TECHNICAL REFERENCE

LANTIME M300

MRS/RPS

2nd September 2019

Meinberg Radio Clocks GmbH & Co. KG
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1 Imprint

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Date: 2019-05-15
2 Important Safety Information

2.1 Important Safety Instructions and Protective Measures

The following safety instructions must be respected in all operating and installation phases of the device. Non-observance of safety instructions, or rather special warnings and operating instructions in product manuals, violates safety standards, manufacturer instructions and proper usage of the device. Meinberg Funkuhren shall not be responsible for any damage arising due to non-observance of these regulations.

Depending on your device or the installed options
some information is not valid for your device.


If a procedure is marked with the following signal words, you may only continue, if you have understood and fulfilled all requirements. In this documentation dangers and indications are classified and illustrated as follows:

DANGER!
The signal word indicates an imminently hazardous situation with a high risk level. This notice draws attention to an operating procedure or similar proceedings, of which a non-observance may result in serious personal injury or death.

WARNING!
The signal word indicates a hazard with a medium risk gradient. This notice draws attention to an operating procedure, a procedure or the like which, if not followed, can lead to serious injuries, possibly resulting in death.

CAUTION!
The signal word indicates a hazard with a low risk gradient. This notice draws attention to an operating procedure, a procedure or the like which, if not followed, can lead to minor injuries.

ATTENTION!
This notice draws attention to an operating procedure, a procedure or the like which, if not followed, can cause damage to the product or loss of important data.
2.2 Used Symbols

The following symbols and pictograms are used in this manual. To illustrate the source of danger, pictograms are used, which can occur in all hazard classes.

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Beschreibung / Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IEC 60417-5031 Direct current</td>
</tr>
<tr>
<td></td>
<td>IEC 60417-5032 Alternating current</td>
</tr>
<tr>
<td></td>
<td>IEC 60417-5017 Earth (ground) terminal</td>
</tr>
<tr>
<td></td>
<td>IEC 60417-5019 Protective earth (ground) terminal</td>
</tr>
<tr>
<td></td>
<td>ISO 7000-0434A Caution</td>
</tr>
<tr>
<td></td>
<td>IEC 60417-6042 Caution, risk of electric shock</td>
</tr>
<tr>
<td></td>
<td>IEC 60417-5041 Caution, hot surface</td>
</tr>
<tr>
<td></td>
<td>IEC 60417-6056 Caution, moving fan blades</td>
</tr>
<tr>
<td></td>
<td>IEC 60417-6172 Disconnection, all power plugs</td>
</tr>
<tr>
<td></td>
<td>IEC 60417-5134 Electrostatic Sensitive Devices</td>
</tr>
<tr>
<td></td>
<td>IEC 60417-6222 Information general</td>
</tr>
<tr>
<td></td>
<td>2012/19/EU This product is handled as a B2B category product. In order to secure a WEEE compliant waste disposal it has to be returned to the manufacturer.</td>
</tr>
</tbody>
</table>
The manuals for a product are included in the scope of delivery of the device on a USB stick. The manuals can also be obtained via the Internet. Enter www.meinbergglobal.com into your browser, then enter the corresponding device name in the search field at the top.

This manual contains important safety instructions for the installation and operation of the device. Please read this manual completely before using the unit.

This device may only be used for the purpose described in this manual. In particular, the given limits of the device must be observed. The safety of the installation in which the unit is integrated is the responsibility of the installer!

Non-observance of these instructions can lead to a reduction in the safety of this device!

Please keep this manual in a safe place.

This manual is intended exclusively for electricians or persons trained by an electrician who are familiar with the applicable national standards and safety rules. Installation, commissioning and operation of this device may only be carried out by qualified personnel.
2.3 Security during Installation

**WARNING!**

Preparing for Commissioning
This built-in unit has been designed and examined according to the requirements of the standard IEC 60950-1 "Information Technology Equipment - Safety".

When the built-in unit is used in a terminal (e.g., housing cabinet), additional requirements according to Standard IEC 60950-1 must be observed and complied with. In particular, the general requirements and the safety of electrical equipment (such as IEC, VDE, DIN, ANSI) as well as the applicable national standards are to be observed.

The device has been developed for use in the industrial sector as well as in residential areas and can only be used in such environments. For environments with higher levels of soiling, additional measures, e.g. Installation in an air-conditioned control cabinet required.

Transport, Unpacking, Installation

If the unit is brought into the operating room from a cold environment, condensation may occur, wait until the unit is temperature-controlled and absolutely dry before operating it.

When unpacking, setting up, and before operating the equipment, be sure to read the information on the hardware installation and the specifications of the equipment. These include, for example, dimensions, electrical characteristics, and necessary ambient and climatic conditions, etc.

The fire protection must be ensured in the installed state.

For mounting, the housing must not be damaged. No holes may be drilled in the housing.

For safety reasons, the device with the highest mass should be installed in the lowest position of the rack. Other devices must be placed from the bottom to the top.

The device must be protected against mechanical stress such as vibration or shock.
Connecting Data Cables
During a thunderstorm, data transmission lines must not be connected or disconnected (risk of lightning).

When wiring the devices, the cables must be connected or disconnected in the order of the arrangement described in the user documentation accompanying the device. Always attach all cables to the plug during connection and removal. Never pull the cable itself. Pulling the cable can cause the cables to disconnect from the plug.

Install the cables in way that they do not constitute a hazard (danger of tripping) and are not damaged, i.e. kinked.

Connecting Power Supply
This equipment is operated at a hazardous voltage. Non-observance of the safety instructions in this manual may result in serious personal injury or property damage.

Before connecting to the power supply, a grounding cable must be connected to the earth connection of the device.

Before operation, check that all cables and lines work properly and are undamaged. Pay particular attention to the facts that the cables do not have kinks or that they are not too short around corners, and no objects are placed on the cables. Also make sure that all connections are secure.

Faulty shielding or cabling will endanger your health (electrical shock) and may destroy other equipment.

Ensure that all necessary safety precautions have been taken. Make all connections to a unit before turning on the power. Observe the safety instructions on the device (see safety symbols).

The metal housing of the device is grounded. It must be ensured that enough air and creepage distances to neighboring voltage-carrying parts are provided during assembly in the control cabinet and no short circuits are caused.

In the case of malfunctions or servicing (e.g. in the event of a damaged housing or power cable or when fluids or foreign objects enter), the current flow can be interrupted. Questions about the house installation, need to be clarified with your house administration.

The power supply should be connected with a short, low-inductance line.
## Important Safety Information

<table>
<thead>
<tr>
<th>AC Power Supply</th>
<th>DC Power Supply</th>
</tr>
</thead>
<tbody>
<tr>
<td>• The device is a device of protection class 1 and may only be connected to a grounded outlet (TN system).</td>
<td></td>
</tr>
<tr>
<td>• For safe operation, the device must be protected by an installation fuse of max. 16 A and equipped with a residual current circuit breaker in accordance with the applicable national standards.</td>
<td></td>
</tr>
<tr>
<td>• The unit must always be disconnected from the mains and not from the appliance.</td>
<td></td>
</tr>
<tr>
<td>• Devices with mains plugs are equipped with a safety-tested mains cable of the country of use and may only be connected to a grounded shockproof socket, otherwise electric shock may occur.</td>
<td></td>
</tr>
<tr>
<td>• Make sure that the mains socket on the appliance or the mains socket of the house installation is freely accessible to the user so that the mains cable can be pulled out of the socket in case of emergency.</td>
<td></td>
</tr>
<tr>
<td>• Outside the assembly group the device must be disconnectable from the power supply in accordance with the provisions of IEC 60950-1 (e.g. by the primary line protection).</td>
<td></td>
</tr>
<tr>
<td>• Installation and disassembly of the power supply plug is only permitted if the assembly group is switched off (e.g. by the primary line protection).</td>
<td></td>
</tr>
<tr>
<td>• The supply lines must be adequately secured and dimensioned.</td>
<td></td>
</tr>
</tbody>
</table>

**Connection Cross Section:**

- 1 mm² – 2.5 mm²
- 17 AWG – 13 AWG

• The device must be supplied with a suitable disconnector (switch). The separation device must be easily accessible, placed near the device and marked as a separation device for the unit.
2.4 Protective Conductor- / Ground-Terminal

ATTENTION!

In order to ensure safe operation and to meet the requirements of IEC 62368-1, the device must be correctly connected to the protective earth conductor via the protective earth connection terminal.

If an external earth connection is provided on the housing, it must be connected to the equipotential bonding rail (grounding rail). The mounting parts (without cable) are not included in the scope of delivery.

Note:
Please use a grounding cable ≥ 1.5 mm²
Always pay attention to a correct crimp connection!
2.5 Safety during Operation

**WARNING!**

**Avoiding Short-Circuits**
Make sure not to get any objects or liquids inside the unit. Electric shock or short circuit could result.

**Ventilation Slots**
Make sure that the ventilation slots are not covered or dusty, as there is a danger of overheating during operation. Disturbances during operation can result.

**Normal Operation**
The normal operation and the observance of the EMC limits (electromagnetic compatibility) are only ensured if the housing cover is properly installed and when the doors are closed (cooling, fire protection, shielding against electrical, magnetic and electromagnetic fields).

**Switch off in fault / service case**
By switching off, the devices are not disconnected from the power supply. In the event of a fault or service case, the devices must be immediately disconnected from all power supplies.

**Follow the steps below:**
- Switch off the device
- Disconnect all power plugs
- Inform the service
- Devices that are connected via one or more uninterruptible power supplies (UPS) remain operational even when the UPS power cord is disconnected. Therefore, you must put the UPS out of operation according to the documentation of the corresponding user documentation.
2.6 Safety during Maintenance

**WARNING!**

When you are expanding the device, use only device parts that are approved for the system. Non-observance may result in injury to the EMC or safety standards and cause malfunction of the device.

If device parts, which are released for the system, are extended or removed there may be a risk of injury in the area of the hands, due to the pull-out forces (approx. 60 N).

The service informs you which device parts may be installed.

The device must not be opened, repairs to the device may only be carried out by the manufacturer or by authorized personnel. Improper repairs can result in considerable danger to the user (electric shock, fire hazard).

Unauthorized opening of the device or of individual parts of the device can also lead to considerable risks for the user and result in a loss of warranty as well as an exclusion of liability.

- Danger due to moving parts - keep away from moving parts.

- Device parts can become very hot during operation. Do not touch these surfaces! If necessary, switch off the unit before installing or removing any equipment, and allow it to cool down.

2.7 Handling Batteries

**CAUTION!**

The lithium battery on the receiver modules has a service life of at least 10 years. If an exchange is necessary, the following notes must be observed:

The device is equipped with a lithium battery. The battery must not be short-circuited or recharged. Replacement of the lithium battery may only be carried out by the manufacturer or authorized personnel.

Risk of explosion if the battery is not replaced correctly. Replace only with the same or equivalent type recommended by the manufacturer.

When disposing used batteries, observe the local regulations for the disposal of hazardous waste.
2.8 Cleaning and Care

ATTENTION!

Do not wet clean the appliance! Penetrating water can cause considerable dangers to the user (e.g., electric shock).

Liquid can destroy the electronics of the device! Liquid penetrates into the housing of the device and can cause a short circuit of the electronics.

Only clean with a soft, dry cloth. Never use solvents or cleaners.

2.9 Prevention of ESD Damage

ATTENTION!

The designation ESD (Electrostatic Sensitive Devices) refers to measures which are used to protect electrostatically endangered components from electrostatic discharge and thus to prevent destruction. Systems and assemblies with electrostatically endangered components usually have the following characteristics:

Indicator for assemblies with electrostatic endangered components
The following measures protect electrostatically endangered components from destruction:

Prepare removal and installation of assemblies
Unload yourself (for example, by touching a grounded object) before touching assemblies.

Ensure that you wear a grounding strap on the wrist when working with such assemblies, which you attach to an unpainted, non-conductive metal part of the system.

Use only tools and devices that are free from static electricity.

Transporting Assemblies
Assemblies may only be touched at the edge. Do not touch any pins or conductors on assemblies.

Installing and Removing Assemblies
Do not touch persons who are not grounded while removing or installing components. This could result in a loss of grounding protection from your electrostatic discharge.

Storing Assemblies
Always keep assemblies in ESD protective covers. These protective covers must be undamaged. ESD protective covers, which are extremely wrinkled or even have holes, no longer protect against electrostatic discharge.

ESD protective covers must not be low-resistance and metallically conductive if a lithium battery is installed on the assembly.
2.10 Return of Electrical and Electronic Equipment

ATTENTION!

WEEE Directive on Waste Electrical and Electronic Equipment 2012/19 / EU
(WEEE Waste Electrical and Electronic Equipment)

Separate Collection
Product Category: According to the device types listed in the WEEE Directive, Appendix 1, this product is classified as an IT and communication device.

This product meets the labeling requirements of the WEEE Directive. The product symbol on the left indicates that this electronic product must not be disposed of in domestic waste.

Return and Collection Systems
For returning your old equipment, please use the country-specific return and collection systems available to you or contact Meinberg.

The withdrawal may be refused in the case of waste equipment which presents a risk to human health or safety due to contamination during use.

Return of used Batteries
Batteries marked with one of the following symbols may not be disposed of together with the household waste according to the EU Directive.
3 Global Information LANTIME M300/MRS

The LANTIME (Local Area Network Time Server) provides a high precision time base to a TCP/IP network (Stratum-1-Server). The NTP (Network Time Protocol) is used to synchronize all NTP clients with the reference. The several LANTIME variants differ from each other by the time reference and output configuration. A GPS or GNSS (GPS, GLONASS, Galileo, BeiDou) receiver, GNS-UC (only GPS and Galileo), a long wave receiver (like DCF77, MSF or WWVB) or an IRIG time code receiver can be integrated as an internal reference as well as a combination of these references (hybrid system). External references are also possible.

The LANTIME system is a set of equipment composed of an integrated GPS receiver, a single-board computer and a power supply, all installed in a metal 19 inch modular chassis and ready to operate. A simplified LINUX operating system is installed on the single-board computers flash disk. Eight push buttons and a display can be used to configure and monitor the time server.

After the network connection has been established the time server can also be configured and monitored remotely from a workstation via TELNET or FTP. An integrated web server enables access to the LANTIME by using an ordinary web browser.
4 Technical Specifications LANTIME Chassis

Protection
Rating: IP20

Power
Consumption: Base configuration: 30 W (max. 50 W – depending on the integrated module options)

Ambient Temperature: 0 ... 50 °C

Storage Temperature: -20 ... 70 °C

Humidity: max. 85% (non-condensing) @ 30 °C

External Ground Connection on the Housing

This connector must be wired to an equipotential bonding bar (earthing bar). Connection is possible on both sides of the housing. The mounting parts (without cable) are included in the scope of delivery.
5 LANTIME M300 - Front connectors

1. The main menu is displayed after switching on the device and having completed the initialization phase. In the main menu the most important status information are displayed. In the top line of the display the operating mode of the reference clock / reference time is shown. Instead of "MRS: sync to GPS" the messages, "MRS: sync to OCX" can appear. In case the antenna connection is interrupted, the following message is shown: "MRS: sync to OCX".

2. By using the 4 arrows and the "ESC", "F1" and "F2" buttons of the keypad you can navigate through each menu in the display. You can always return to the main menu by pressing the "ESC" button several times.
3. 
"Ref. Time"
- Green: the reference clock (e.g. build-in GPS) provides a valid time
- Red: the reference clock does not provide a valid time

"Time Service"
- Green: NTP is synchronized to the reference clock, e.g. GPS
- Red: NTP is not synchronized or switched to the 'local clock'

"Network"
- Green: all monitored network interfaces are connected ('Link up')
- Red: at least one of the monitored network interfaces is faulty

"Alarm"
- Off: no error
- Red: general error

4. To connect a serial terminal use the 9 pin SUBD RS232 connector in the front panel. Via the serial terminal connection it is possible to configure the parameters with a terminal program. To establish a connection between the LANTIME and a PC, use a NULL-MODEM cable. Configure your terminal program with 38400 Baud, 8 Databits, no parity and one Stopbit (8N1). The terminal emulation has to be set to VT100. After connecting to the time server the login message will be displayed. Enter user name and password:

Default User: root; Password: timeserver

5. All devices of the LANTIME M-Series dispose a USB interface, which can be used to plug in a USB Stick. The USB Stick can be deployed for the following tasks:

- to lock the keys on the LC-Display, to prevent unauthorized access
- to save the LANTIME configuration
- to transfer the configuration between several LANTIMES
- to save log files
6 M300 - Rear connectors

1. N/-. L/+.

AD10 PWR

Power

U = 100 V - 240 V

U = 90 V - 254 V

max

I = 1.0A

f = 50 - 60Hz

U = 100 V - 200 V

U = 90 V - 240 V

max

I = 0.6A

LAN 1

LAN 0

10MHz Out

PPS Out

GPS Antenna

Error

CO

NO

NC

COM 1

COM 0

100M

10M

11

9

7

5

4

3

2

1

10

8

6
6.1 AC/DC Power Supply

![Hotplug](image)

Hotplug

It is possible to remove or install a power supply unit from the equipment terminal during operation.

Hints for Hot-Plug compatible Power Supplies

Replacing the power supply unit

1. Interrupt the power supply of the power supply unit by pulling off the protective plug of the power cable.
2. Remove the 5-pin DFK-jack from the power supply after dissolving the two clamping screws (B) with the slot screwdriver.
3. Then loosen the two Torx screws (A) of the power supply that needs to be replaced with the Torx screwdriver (TR8).
4. The dissolved power supply can be removed with the handle (C) now.
5. Put the new power supply in the free slot and secure it with the two previously dissolved Torx fastening screws (A).
6. Connect the 5-pin DFK jack of the power cable to the power supply and put the two slit screws (B) back on.
7. The protective contact plug of the power cable can be reconnected to the power supply.
8. The status LED of the new power supply should now light up and an "OK" status should be displayed in the system's web interface.
Checking Power Status
The status of the power supplies can be viewed in the web interface under "System → Redundant Power Supply" (depending on the equipment, i.e. if one or two power supplies are installed, the web interface displays this status).

Connector Type: 5-pol. DFK

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

Input Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Nominal Value</th>
<th>Maximum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal Voltage Range:</td>
<td>$U_N = 100-240 \text{ V} \sim$</td>
<td>$100-200 \text{ V}$</td>
</tr>
<tr>
<td>Maximum Voltage Range:</td>
<td>$U_N = 90-254 \text{ V} \sim$</td>
<td>$90-240 \text{ V}$</td>
</tr>
<tr>
<td>Nominal Current:</td>
<td>$I_N = 1.0 \text{ A} \sim$</td>
<td>$0.6 \text{ A}$</td>
</tr>
<tr>
<td>Nominal Frequency Range:</td>
<td>$f_N = 50-60Hz$</td>
<td>$f_{\text{max}} = 47-63Hz$</td>
</tr>
</tbody>
</table>

Output Parameter

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum Power:</td>
<td>$P_{\text{max}} = 50 \text{ W}$</td>
</tr>
<tr>
<td>Max. Heat Emission:</td>
<td>$E_{\text{therm}} = 180.00 \text{ kJ/h (170.61 BTU/h)}$</td>
</tr>
</tbody>
</table>

WARNING!
This equipment is operated at a hazardous voltage.

Danger to life due to electrical shock!
- Only qualified personnel (electricians) may connect the device.
- Never work with open terminals and plugs while the power is on.
- All connectors must be protected against touching live parts with a suitable plug housing!

- **Note**: Always ensure safe wiring!
- **Important**: The device must be connected to a proper grounding (PE).
6.2 GPS Antenna

**Cable:** shielded coax

**Cable length:**
- max. 300m to RG58,
- max. 700m to RG213

**Connection type:** BNC female or N-type female

**Input GPS:**
- Antenna circuit
  - 1000 V DC insulated

**Local Oscillator to Converter Frequency:** 10 MHz

**First IF Frequency:** 35.4 MHz

1) these frequencies are transferred via the antenna cable.

**Power Requirements:** 15 V, 100mA (via antenna cable)

---

**WARNING!**

Working on the antenna system during thunderstorms

Danger to life due to electrical shock!
- Do not carry out any work on the antenna system or the antenna cable if there is a risk of a lightning strike.
- Do not carry out any work on the antenna system if the safety distance to free lines and sequential circuits is exceeded.
6.3 RS232 COMx Timestring

**Data transfer:** serial

**Baudrate/framing:** 19200 / 8N1 (default)

**Timestring:** Meinberg Standard (default)

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

**Connection type:** D-SUB female 9pin.

**Cable:**
- data cable (shielded)
- PC connector 1:1
6.4 Error Relay

On the back panel of the device you can find a DFK connector labeled "Error". This relay output is connected to the TTL TIME_SYNC output of the reference clock (GPS, PZF, TCR, ...). If the internal reference clock has been synchronized by its source (GPS, DCF77 or IRIG) the relay will switch to mode "NO". In case of bad antenna signal or the device has been switched off the relay falls back to mode "NC".

Technical Specification

Switching Voltage max.: 125 V DC
140 V AC

Switching Current max.: 1A

Switching Load max.: DC 30 W
AC 60 VA

Switching Current UL/CSA: 0.46 A 140 V AC
0.46 A 65 V DC
1A 30 V DC

Response Time: ca.2ms

WARNING!
This equipment is operated at a hazardous voltage.

Danger to life due to electrical shock!
- Never work with open terminals and plugs while the power is on!
- When working on the connectors of the error relay cable, always remove both sides of the cable from the respective devices!
- Dangerous voltages can occur at the terminal of the fault signal relay! Work on the terminal of the fault signal relay must never be carried out with the signal voltage present!
6.5 Pulse Per Second Input

Input signal: PPS (pulse per second)
Signal level: TTL
Pulse length: \( \geq 5 \mu s \), active high
Connection type: BNC, female
Cable: shielded coax line

6.6 10MHz Frequency Input

Signal input: 10MHz frequency
Signal level: Sine wave (1.5 V_{pp} - 5 V_{pp}) or TTL
Connection type: BNC female
Cable: shielded coaxial line

6.7 Time Code AM (modulated) Input

Signal output: Unbalanced sine wave-signal
Signal level: 600 mV_{ss} / 8 V_{ss} (MARK/SPACE)
  std. 600 Ohm (50 Ohm / 5 kOhm)
Isolation Voltage: 3000 V DC
Connection type: BNC, female
Cable: shielded coax line
6.8 Time Code DCLS (unmodulated) Input

Input signal: Time Code DCLS, pulse-width modulated (e.g. IRIG-B00x)

Isolation voltage: 3750 Vrms
Internal resistance: 330 Ohm
Max. input current: 25 mA
Connection type: BNC female
Cable: shielded coax line

6.9 Pulse Per Second Output

Output signal: PPS (pulse per second)
Signal level: TTL 2.5 V into 50 Ohm
Pulse length: 200 ms
Connection type: BNC, female
Cable: shielded coax line

6.10 10MHz Frequency Output

Output signal: 10MHz frequency
Signal level: TTL, 2.5 V into 50 Ohm
Connector: BNC, female
Cable: shielded coax line
6.11 10/100Base-T Network Port (IEEE 803.2)

Output signal: 100Base-T
Data transmission speed: 10/100 MBit/s
Connection type: 8P8C (RJ45)
Cable: Copper twisted pair, e.g. CAT 5.0
Duplex Modes: Half/Full/Autonegotiation
7 GPS satellite controlled clock with MRS option

LANTIME/MRS is a Multi Reference Source time server. The reference time base, integrated into the LANTIME, consists of a high precision oscillator OCXO HQ. This oscillator can be optionally controlled by the integrated GPS receiver, an external Puls Per Second (PPS input), Standard Frequency Input (10MHz), an IRIG time code receiver, by max. 7 external NTP servers or by a PTP IEEE 1588 Time Stamp Unit (M400, M600 and M900 only). In any case a OCXO oscillator is used as a reference for internal NTP, even if GPS reception or external reference clock are not available. All outputs like serial output, PPS output or 10MHz will be driven by the internal oscillator. The priority which reference clock will discipline the internal OCXO can be set up in a user defined list via the display or the HTTP interface.

7.1 MRS functionality

After power up the system the internal clock module will be free running on an internal oscillator. If the GNSS receiver or one of the external reference sources are available and synchronized then the internal clock will be set once and the internal OCXO will be adjusted. For the first time adjust with an external NTP server the system will wait until the internal NTP has been synchronized and the time offset is below 1 ms (this will take appr. 5 Min). After that the offset to the external NTP server will be calculated and set the internal clock module. The following reference clocks are possible (depending on the expansions):

- GPS / GLONASS / Galileo / BeiDou receiver
- IRIG time code receiver with DCLS or modulated
- Pulse Per Second Input (PPS in)
- up to 7 external NTP server
- PTP IEEE-1588 (M400, M600 and M900 only)
- Pulse Per Second plus serial time string (STR)
- Freq. In.

If more than one reference clock is available and synchronized then the clock with the highest priority will be taken to adjust the internal OCXO. This reference clock will be called master clock. If this master clock is unavailable a different clock with the highest priority will be chosen. If a reference clock with a higher priority than the current master will be available the master clock will be switched to the higher priority.

Each external reference source can be set with a bias (a fix offset), if you know the constant offset (bias) of an external reference source. By default this value is 0 ns. The bias of the internal GNSS receiver can not be set up - indirectly this can be done via the antenna cable length.

Each reference clock can be assigned a specific precision which will reflect the accuracy of the reference clock. This precision value will determine the hold over time when switching to the next reference clock if the current master is not available anymore. If the precision is set to 0 then the next reference clock will be switched at once. If the precision value is greater then 0 the time for switching to the next reference (hold over time) will be calculated by the following formula:

\[
\frac{\text{precision of next reference}}{\text{precision of current master}} \times \text{constant [s]}
\]

The parameter 'constant' depends on the quality of the internal oscillator.

Example: the external PPS with an precision of 100ns is the current master. If this master is no longer available it will switch to the next reference source of the priority order in this case the IRIG input with a precision of 10us. With the formula \((100000ns/100ns)\times11.4\) we get hold over time of 19min. The online display of the MRS status will show the remaining time and the calculated time. The hold over time will be recalculated if the status of the reference clocks will change.
The internal NTP is not requesting the external reference clocks directly. It will see only the internal clock of the GPS/MRS module with its high precision oscillator OCXO. The controlling of the internal OCXO will be done by the GPS/MRS module. All offsets from the internal reference time to the external reference clocks will be send to the GPS/MRS clock. The external NTP server will be configured as "server" at the internal NTP with the option 'noselect' only to get the offsets to the external NTP servers.

The status information of the activated reference clocks will be shown in the display. The state of the master will be marked with '*' or written as text. Also the offset from the reference clock to the internal clock will be displayed.

If an external PTP IEEE1588 grandmaster is available the reference source will be taken prior to the external NTP server. The PTP time stamping unit will be scanned every 10 seconds (independently of the broadcast interval of the PTP master). The external NTP server will be scanned every 64 seconds.

After setting the time offset of the internal clock module the NTP will be restarted. Now only small offset values will be sent to the internal clock module; the fine synchronization mode will start. In the "fine synchronization mode" all offsets greater than 10 ms will be ignored 5 times in a row - after the 5 times the offset will be set.

IMPORTANT: After power up the Lantime/MRS the maximum time difference between internal clock and external NTP server or PTP grandmaster must be lower than 1000s. Otherwise the internal clock must be set manually via LC-Display or synchronized by GPS once.
7.2 GPS Functionality

A Meinberg GPS satellite controlled radio clock is used as a reference time base. The satellite receiver clock has been designed to provide extremely precise time to its user. The clock has been developed for applications where conventional radio controlled clocks can not meet the growing requirements in precision. High precision available 24 hours a day around the whole world is the main feature of the new system which receives its information from the satellites of the Global Positioning System.

The Global Positioning System (GPS) is a satellite-based radio-positioning, navigation, and time-transfer system. It was installed by the United States Department of Defence and provides two levels of accuracy: The Standard Positioning Service (SPS) and the Precise Positioning Service (PPS). While PPS is encrypted and only available for authorized (military) users, SPS has been made available to the general public.

GPS is based on accurately measuring the propagation time of signals transmitted from satellites to the user’s receiver. A nominal constellation of 21 satellites together with 3 active spares in six orbital planes 20000 km over ground provides a minimum of four satellites to be in view 24 hours a day at every point of the globe. Four satellites need to be received simultaneously if both receiver position \((x, y, z)\) and receiver clock offset from GPS system time must be computed. All the satellites are monitored by control stations which determine the exact orbit parameters as well as the clock offset of the satellites’ on-board atomic clocks. These parameters are uploaded to the satellites and become part of a navigation message which is retransmitted by the satellites in order to pass that information to the user’s receiver.

The high precision orbit parameters of a satellite are called ephemeris parameters whereas a reduced precision subset of the ephemeris parameters is called a satellite’s almanac. While ephemeris parameters must be evaluated to compute the receiver’s position and clock offset, almanac parameters are used to check which satellites are in view from a given receiver position at a given time. Each satellite transmits its own set of ephemeris parameters and almanac parameters of all existing satellites.

7.3 GPS Clock Features

The GPS clock module is a 100 mm x 160 mm microprocessor board, and is connected to the antenna/converter unit by a 50 ohm coaxial cable (refer to 'Mounting the Antenna'). DC power to fed to the antenna/downconverter via the antenna cable. An optional antenna splitter is available to operate up to four receivers from a single antenna.

The navigation message coming in from the satellites is decoded by the GPS clock’s microprocessor in order to track the GPS system time with an accuracy of better than 500 ns (or 250 nsec OCXO). Compensation of the RF signal’s propagation delay is done by automatic determination of the receiver’s position on the globe. A correction value computed from the satellites’ navigation messages increases the accuracy of the board’s TCXO or OCXO to \(10^{-9}\) and automatically compensates for the oscillators aging. The last recent value is restored from the battery buffered memory at power-up.

7.4 Time Zone and Daylight Saving

GPS system time differs from the universal time scale (UTC) by the number of leap seconds which have been inserted into the UTC time scale since GPS was initiated in 1980. The current number of leap seconds is part of the navigation message supplied by the satellites, so the internal real time of the GPS is based on UTC time scale. Conversion to local time and annual daylight saving time can be done by the receiver’s microprocessor if the corresponding parameters are set up by the user.
8 Mounting the GPS Antenna

The GPS satellites are not stationary, but circle round the globe with a period of about 12 hours. They can only be received if no building is in the line-of-sight from the antenna to the satellite, so the antenna/downconverter unit must be installed in a location that has as clear a view of the sky as possible. The best reception is achieved when the antenna has a free view of 8° angular elevation above the horizon. If this is not possible, the antenna should be installed with the clearest free view to the equator, because the satellite orbits are located between latitudes 55° North and 55° South. If this is not possible, you may experience difficulty receiving the four satellites necessary to complete the receiver’s position solution.

The antenna/converter unit can be mounted on a wall, or on a pole up to 60 mm in diameter. A 50 cm plastic tube, two wall-mount brackets, and clamps for pole mounting are included. A standard RG58 coaxial cable should be used to connect the antenna/downconverter unit to the receiver. The maximum length of cable between antenna and receiver depends on the attenuation factor of the coaxial cable.

Up to four GPS receivers can be run with one antenna/downconverter unit by using an optional antenna splitter. The total length of an antenna line from antenna to receiver must not be longer than the max. length shown in the table below. The position of the splitter in the antenna line does not matter.

The optional delivered MBG S-PRO protection kit can also be used for outdoor installation (degree of protection: IP55). However, we recommend an indoor installation, as close as possible to the wall where the antenna cable is entering, to minimize the risk of overvoltage damage, for example by lightning.

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**WARNING!**

Antenna mounting without effective anti-fall protection

Danger to life due to fall!
- Pay attention to effective working safety when installing antennas!
- *Never* work without an effective anti-fall equipment!

**WARNING!**

Working on the antenna system during thunderstorms

Danger to life due to electrical shock!
- Do *not* carry out any work on the antenna system or the antenna cable if there is a risk of a lightning strike.
- Do *not* carry out any work on the antenna system if the safety distance to free lines and sequential circuits is exceeded.
8.1 Antenna Cable:

<table>
<thead>
<tr>
<th>Type of cable</th>
<th>diameter Ø [mm]</th>
<th>Attenuation at 100MHz [dB]/100m</th>
<th>max length [m]</th>
</tr>
</thead>
<tbody>
<tr>
<td>RG58/CU</td>
<td>5</td>
<td>17</td>
<td>300 (1)</td>
</tr>
<tr>
<td>RG213</td>
<td>10.5</td>
<td>7</td>
<td>700 (2)</td>
</tr>
</tbody>
</table>

(1) These specifications are made for antenna/converter units produced after January, 2005. The values are typically ones; the exact ones are to find out from the data sheet of the used cable.

8.2 Antenna Short-Circuit

(systems with front display only)

In case of an antenna line short-circuit the following message appears in the display:

ANTENNA SHORT-CIRCUIT
DISCONNECT POWER
!!!

If this message appears the clock has to be disconnected from the mains and the defect eliminated. After that the clock can be powered-up again. The supply voltage for the antenna/converter unit is approx. 18.5 V DC in idle mode and approx. 16 V DC when the GPS antenna is connected.
8.3 Antenna Assembly with Surge Voltage Protection

Optional a surge voltage protector for coaxial lines is available. The shield has to be connected to earth as short as possible by using the included mounting bracket. Normally you connect the antenna converter directly with the antenna cable to the system.
9 WEEE Compliance

Compliance with EU Directive 2011/65/EC (RoHS)

We hereby declare that this product is conform to the European Directive 2011/65/EC, “Restrictions of Hazardous Substances in Electrical and Electronic Equipment”. We ensure that electrical and electronic products sold in the EU do not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs), and polybrominated diphenyl ethers (PBDEs) above the legal threshold.

WEEE status of the product

This product is handled as a B2B (Business to Business) category product. In order to secure a WEEE compliant waste disposal it has to be returned to the manufacturer. Any transportation expenses for returning this product (at its end of life) have to be incurred by the end user, whereas Meinberg will bear the costs for the waste disposal itself.
10 Declaration of Conformity

Konformitätserklärung

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

erklärt in alleiniger Verantwortung, dass das Produkt,
declares under its sole responsibility, that the product
Produktbezeichnung
Product Designation
LANTIME M300/MRS/RPS

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
ETSİ EN 303 413 V1.1.1 (2017-06)

EMV – Richtlinie
EMC – Directive
ETSİ EN 301 489-1 V1.9.2 (2011-09)
DIN EN 61000-6-2:2005
DIN EN 61000-6-3:2007 + A1:2011
DIN EN 55032:2012
DIN EN 55024:2010

Niederspannungsrichtlinie
Low-voltage Directive

RoHS – Richtlinie
RoHS – Directive
DIN EN 50581:2012

Bad Pyrmont, den 2019-05-15

Stephan Meinberg
Production Manager