Table of Contents

1 Imprint .......................... 1

2 Safety Instructions for hot pluggable Modules ......................... 2
   2.1 Additional Safety Hints .................................. 3
   2.2 Supply Voltage ............................................ 3
   2.3 Cabling ...................................................... 4

3 Replacement or Installation of a Hot-pluggable IMS Module .......... 5
   3.1 Important Hints for hot-pluggable IMS Modules ................. 6

4 Meinberg GNS-UC Receiver (GPS and Galileo) ......................... 7
   4.1 Technical Specifications GNS-UC Clock ....................... 8
      4.1.1 Configuration of IMS Modules via Web Interface ......... 10
      4.1.2 Meinberg GPS Antenna/Converter ....................... 11
      4.1.3 Powering up a GNSS Receiver .......................... 14
1 Imprint

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Date: 2020-01-31
2 Safety Instructions for hot pluggable Modules

Check before every maintenance work on the system:

- If a data backup is required?
- Is a backup required, verify the data recovery which is done by this backup.
- Make sure to avoid any static discharge while working - use a grounding cable and/or antistatic gloves during installation and removal of hot pluggable components.
- If you are replacing a hot pluggable power supply, unplug the power cable prior to removing the module from the case.
- Never open a power supply. In power supplies dangerous voltages can still remain even after disconnection from the power supply. Always send power supplies back to the manufacturer for maintenance.

Exchange of hot-swap components

- Ensure that components which will be replaced during operation, always be treated with the utmost care. Avoid contact with live components.
- Electrostatic discharge can damage electronic components. For this reason, ensure protection against electrostatic discharges by wearing anti-static shoes while working with the system.
- Take care when removing and installing the hot-plug modules. Always work with the utmost caution. Touch the modules only at the edges.
- Place the module out of the box or after removal from the system with the component side to the top on a grounded and static-free surface.
- Storage of an IMS module must be done in a dry place.
- Installation or removal from hot-swap components only by authorized personnel!
2.1 Additional Safety Hints

This manual contains important information for the installation and operation of this device as well as for your safety. Make sure to read carefully before installing and commissioning the device.

Certain operating conditions may require the observance of additional safety regulations not covered by this manual. Nonobservance of this manual will lead to a significant abatement of the security provided by this device. Security of the facility where this product is integrated lies in the responsibility of the installer.

The device must be used only for purpose named in this manual, any other use especially operation above the limits specified in this document is considered as improper use.

Keep all documents provided with the device for later reference.

This manual is exclusively for qualified electricians or by a qualified electrician trained personnel who are familiar with the applicable national standards and specifications, in particular for the construction of high voltage devices.

2.2 Supply Voltage

WARNING!
This device is powered by a dangerous voltage. Nonobservance of the safety instructions of this manual may lead to serious damage to persons and property and to danger to life! Installation, commissioning, maintenance and operation of this device are to be carried out by qualified personnel only.

The general safety instructions and standards (e.g. IEC, DIN, VDE, EN) for installation and work with high voltage equipment as well as the respective national standards and laws must be observed.

NONOBSERVANCE MAY LEAD TO SERIOUS DAMAGE TO PERSONS AND PROPERTY AND TO DANGER TO LIFE!

The device may not be opened. Repair services may only be carried out by the manufacturer.

Supply lines for this device must be equipped via an appropriate switch that must be mounted close to the device and must be marked as a mains switch for the device.

To ensure safe operation supply mains connected to this device must be equipped with a fuse and a fault-current circuit breaker according to the applicable national standards for safe operation.

The device must be connected to a protective earth with low grounding resistance according to the applicable national rules.
2.3 Cabling

WARNING!
DANGER TO LIFE BY ELECTRICAL SHOCK! NO LIVE WORKING!
Wiring or any other work done the connectors particularly when connectors are opened may never be carried out when the installation is energized. All connectors must be covered to prevent from accidental contact to life parts.

ALWAYS ENSURE A PROPER INSTALLATION!
3 Replacement or Installation of a Hot-pluggable IMS Module

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.

Please use a Torx screwdriver (T8 x 60) for removal and installation of the module.

1. Follow the safety instructions at the beginning of this manual!

1. Remove the two marked Torx screws from the module holder plate or the cover plate of the empty slot.

2. (Only for an already built-in module)
   Pull the module carefully out of the holding rail. Note that the module is firmly anchored in the connector block of the housing. You need a certain amount of force to release the module from this link. Once the connection to the connector block of the system’s backplane is loosened, the module can be easily pulled out.

3. When installing the new IMS module, please ensure that the board is correctly inserted into the two guide rails of the system housing. Non-observance can cause damage to the module and the chassis. Make sure that the module is securely locked into the connector block before you fasten the two screws.

4. Now you can put the installed module into operation.

Attachment points of an 1U IMS system
3.1 Important Hints for hot-pluggable IMS Modules

The following points should be strictly observed when replacing IMS modules during operation. Not all IMS modules are fully hot-pluggable. Of course, it is not possible to replace a power supply unit of a non-redundant system without first having installed a second power source in operational mode.

The following applies to the individual IMS slots:

**PWR:** "hot swappable" If you operate your system with only one power supply, a second power supply must be installed before removing/replacing it to keep your system functioning.

**I/O, ESI and MRI Slots:** "hot swappable".

**CLK1, CLK2:** "hot swappable" After the exchange or the installation of a clock module a rescan of the reference clocks (Rescan RefClocks) must be executed in the web interface menu "System".

**CPU** not "hot swappable" The central management unit must be disconnected from mains before replacement.

**RSC/SPT** not "hot swappable" The RSC switching card must be disconnected from the mains before the replacement.
4 Meinberg GNS-UC Receiver (GPS and Galileo)

IMS-GNS181-UC - GPS/Galileo based Time Synchronization for Stationary and Mobile Applications using Meinberg Antenna/Converter Technology

The IMS-GNS181-UC unit has a special receiver concept which is able to capture GPS and Galileo signals using a standard Meinberg antenna/converter unit. The configuration supports to select one of these to be used exclusively or the combination of the sources.

The receiver is capable of operating during high speed movement and delivers reliable and highly precise synchronization solutions in stationary installations and on fast moving vehicles, such as aircraft, ships or trucks.

The variety of inputs/outputs makes this receiver the first choice for a broad range of applications, including time and frequency synchronization tasks and the measurement of asynchronous time events.

The IMS-GNS181-UC with its integrated GNSS receiver provides accurate time with ultimate precision both in stationary and mobile environments by supporting long antenna cables because of the Meinberg antenna/ converter technology.

Key Features

- 2 RS-232 interfaces (4 optional)
- 10 MHz reference frequency output
- Pulses per second and per minute
- 4 Programmable pulse outputs (option)
- Frequency Synthesizer
- 2 Time capture inputs

Description

The IMS-GNS181-UC offers satellite based time synchronization at the highest accuracy standards for fixed or mobile applications. It is suitable to be deployed in data centers or on board of cars, trucks, aircrafts, ships and other moving platforms. The satellite receiver can determine its position even at a maximum acceleration of up to 4 g, at a maximum speed of 500 m/s and at an altitude of up to 18,000 meters.

The IMS-GNS181-UC is used to manage high accurate timing and measurement tasks. The board is able to generate fixed and programmable standard frequencies with very high accuracy and stability. Various oscillator options allow to meet different requirements concerning the accuracy of the outputs in the most cost efficient way. The pulse generator of the GNS181-UC generates pulses per second and per minute. As an option four programmable outputs are available. The pulses are synchronized to the UTC second.

The module provides two inputs for measurement of asynchronous time events. These capture events can be read via a serial interface. The board uses a binary interface protocol to receive configuration parameters and exchange status information with external equipment via its RS232 interfaces.

MRS capability

The oscillator of the GNS181-UC can be disciplined by an external reference source (e.g. 1PPS, 10MHz, IRIG, PPS + String).
### 4.1 Technical Specifications GNS-UC Clock

<table>
<thead>
<tr>
<th>Type of receiver:</th>
<th>72 channel receiver</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GPS/Galileo</td>
</tr>
<tr>
<td>Frequency band:</td>
<td></td>
</tr>
<tr>
<td>GPS:</td>
<td>L1C/A</td>
</tr>
<tr>
<td>Galileo:</td>
<td>E1B/C</td>
</tr>
<tr>
<td>Accuracy of Pulses:</td>
<td>Dependant on oscillator option</td>
</tr>
<tr>
<td></td>
<td>$&lt; +100 \text{nsec}$ (TCXO, OCXO-LQ)</td>
</tr>
<tr>
<td></td>
<td>$&lt; +50 \text{ns}$ (OCXO-SQ, -MQ, -HQ, -DHQ)</td>
</tr>
<tr>
<td>Synchronization Time:</td>
<td>Max. 1 minute in normal operation mode, approx. 12 minutes after a cold start</td>
</tr>
<tr>
<td>Antenna Cable:</td>
<td>coaxial antenna cable – shielded data line</td>
</tr>
<tr>
<td>Cable Length:</td>
<td>max. 300m (RG58 coax-cable)</td>
</tr>
<tr>
<td>Type of Connector:</td>
<td>female BNC connector</td>
</tr>
<tr>
<td>Power Requirements:</td>
<td>15 V, 100 mA (via antenna cable)</td>
</tr>
<tr>
<td>Figure right:</td>
<td>GNSS Receiver and GNSS with XHE-SPI Connector (optional)</td>
</tr>
</tbody>
</table>

#### 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 ...)
- **Fail**
  - red: time has not synchronized
Pin Assignment of the DSUB9 Connectors (male):

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

Option "multiref"
Reference signal via 9-pin DSUB connector
(PPS + String Mode)

Pin 1: PPS
Pin 2: String *

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

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® Rubidium expansion chassis.
4.1.1 Configuration of IMS Modules via Web Interface

This chapter shows how to configure a IMS clock module, for example a GNSS receiver.

4.1.1.1 Clock

On this page of the web interface, configurations can be made on the respective installed reference clocks or the changeover card.

![Status & Configuration](image)

Depending on the design of the system, which means whether it is a single reference clock or a system with two installed remote clocks and a changeover card, the web interface builds up accordingly. This also applies to the type of reference clock and its options. In case of a redundant receiver configuration the common settings for "IRIG In/Out", "Serial Ports", "Time Zone", "Enable Outputs", "Programmable Pulses" and "Synthesizers" appears into the "Switch Card" menu.

![Clock Configuration](image)

Figure: Menu "Clock → Status & Configuration → Misc" - selection of the satellite navigation system

A detailed overview of all other settings can be found in the current LANTIME firmware manual: "Web Interface → Documentation & Support" or on our manual download page:

https://www.meinbergglobal.com/english/docs/

Date: 31st January 2020

IMS-GNS181-UC Setup Guide
4.1.2 Meinberg GPS Antenna/Converter

4.1.2.1 Introduction

The Meinberg GPS antenna/converter unit combines a standard GPS patch antenna with a frequency converter which translates the original 1.5 GHz signal received from the GPS satellites to an intermediate frequency, so a standard coaxial cable type like RG58 can be used for antenna cable lengths up to 300 meters (1000 ft). If a low-loss cable type like RG213 is used then even 700 meters (2300 ft) between receiver and antenna are possible without requirement for an additional amplifier.

Surge protectors are optionally available and should be used in the antenna line to protect the receiver from high voltages spikes e.g. due to lightning strikes close to the antenna. The antenna/converter unit is remotely powered by the connected GPS receiver via the antenna cable, so no external power supply is required near the location of the antenna if a coaxial cable is used.

If more than a single GPS receiver are to be operated then a GPS antenna splitter can be used to distribute the GPS signal from a single antenna. The GPS antenna splitter provides 4 outputs and can be cascaded to supply even more than 4 receivers with the GPS signal.

Alternatively there is also a GPS Optical Antenna Link (GOAL) available which uses a fiber optic connection between the antenna and the receiver which allows for a length up to 2000 meters (6500 ft), and provides a high level of insulation and surge protection due to the optical transmission. Since the fiber optic connection is unable to provide the antenna with DC current, an extra power supply is required in this case at the location of the antenna.

Due to the specific requirements for remote powering and frequency conversion the Meinberg GPS equipment is not necessarily compatible with GPS equipment from 3rd party manufacturers.
4.1.2.2 Mounting and Installation of the GPS Antenna

Proper installation of the GPS antenna/converter unit is illustrated in the figure below:

Figure: GPS Antenna mounted on a pole with a free view of the sky. The optional surge protector keeps high voltage strikes through the antenna cable away from the receiver.

Mounting material (plastic pole and holders, clamps for wall or pole mounting) is shipped with all Meinberg GPS antennae for easy installation. A standard RG58 antenna cable of 20 meters length is included by default. If a different cable length is required then this can be ordered accordingly.

Surge protectors should be installed indoors, directly where the antenna cable comes in. The optionally delivered protection kit is not for outdoor usage. The ground lead should be kept as short as possible and has to be connected to building’s ground rod.

Up to four GPS receivers can be fed by a single antenna/down-converter unit by using an antenna splitter which can optionally be cascaded. The total length of an antenna cable from the antenna to each receiver must not exceed the specified maximum length according to the cable type. The position of the splitter in the antenna line does not matter.
**Note:**
If the antenna cable is assembled locally instead of using a cable shipped with the GPS receiver it has to be made sure that the connectors have been soldered and assembled properly, and that there is no short-circuit in the cable or in one of the connectors. Otherwise GPS reception may be degraded, or the GPS receiver can even be damaged. Mount the antenna at a distance of at least 50 cm from other antennas.

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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!

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**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.
4.1.3 Powering up a GNSS Receiver

If both the antenna and the power supply have been connected the system is ready to operate. Depending on the type of oscillator installed in the receiver it takes about 10 seconds (OCXO-LQ) until 3 minutes (OCXO-MQ / HQ) until the oscillator has warmed up and reached the required frequency accuracy.

If the receiver has some valid almanac data in its battery buffered memory and the receiver’s position has not changed significantly since its last operation the receiver can determine which satellites are in view. Only a single satellite needs to be received to synchronize and generate output pulses, so synchronization can be achieved at least one minute (OCXO-LQ) until 10 minutes (OCXO-MQ / HQ) after power-up. After 20 minutes of operation the OCXO is fully adjusted and the generated frequencies are within the specified tolerances.

If the receiver position has changed by some hundred kilometers since last operation, the expected satellites may not be in view after power-up. In this case the receiver switches to Warm Boot mode where it starts scanning for all possible satellites one after the other. Once the receiver can track at least 4 satellites at the same time it updates its own position and switches to Normal Operation.

If no valid data can be found in the battery buffered memory, e.g. because the battery has been disconnected or replaced, the receiver has to scan for satellites and collect the current almanac and ephemeris data first. This mode is called Cold Boot, and it takes at least 12 minutes until all required data have been collected. The reason is that the satellites send all data repeatedly once every 12 minutes. After data collection is complete the receiver switches to Warm Boot mode to scan for more satellites, and finally enters Normal Operation.

In the default configuration neither pulse and synthesizer outputs, nor the serial ports are enabled after power-up until synchronization has been achieved. However, it is possible to configure some or all of those outputs to be enabled immediately after power-up.

If the system starts up in a new environment (e.g. receiver position has changed or new power supply has been installed) it can take some minutes until the oscillator’s output frequency has been adjusted properly. In this case the accuracy of the output frequency and pulses is also reduced until the receiver’s control loops have settled again.

On the frontpanel ("Reference Time → Info GPS → GPS Satellites") as well as via the Web GUI ("Clock → Receiver Information") you can check the number of satellites that are in view (i.e. above the horizon) and considered good (i.e. are healthy and can be tracked).