The Synchronization Experts.

MANUAL

GPS183SV

Eurocard

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Meinberg Funkuhren GmbH & Co. KG

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1 Imprint

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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.

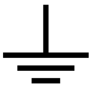
3.4 Generally Applicable Symbols

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

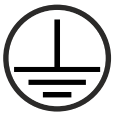
The presence of the "ESD" symbol is indicative of a risk of product damage caused by electrostatic discharge.

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

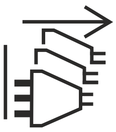
Alternating Current (AC) *(symbol definition IEC 60417-5032)*



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 warnings affixed to the device 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 device 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.

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

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

Ensure that all plug connections are secure.

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

- Pull the power supply plug out of the power source, then disconnect the cable from 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.

4.5 Safety when Maintaining and Cleaning the Device

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

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

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

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

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

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

4.6 Battery Safety

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

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

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

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

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

5 Important Product Information

5.1 CE Marking

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

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

These directives are listed in the EU Declaration of Conformity, appended to this manual as Chapter **13**.

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 **14**.

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 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!

<u>Do not</u> dispose of the product or batteries via the household waste. Inquire with your local waste disposal company or authority on how to best dispose of the product or battery if necessary.

This product is considered to be a "**B2B**" product for the purposes of the WEEE Directive and is also classified as "**IT and Telecommunications Equipment**" in accordance with Annex I of the Directive.

It can be returned to Meinberg for disposal. Any transportation expenses for returning this product (at end-of-life) must be covered by the end user, while Meinberg will bear the costs for the waste disposal itself. If you wish for Meinberg to handle disposal for you, please get in touch with us. Otherwise, please use the return and collection systems provided within your country to ensure that your device is disposed of in a compliant fashion to protect the environment and conserve valuable resources.

Disposal of Batteries

Please consult your local waste disposal regulations for information on the correct disposal of batteries as hazardous waste.

6 Introduction

This manual is a systematically structured guide that provides with a detailed description of all of your Meinberg product's functions and is designed to assist you with the set-up of your Meinberg product.

Each of the chapters addresses a specific topic such as how the GPS183SV operates in general, how to correctly install it, and the key technical specifications of the device. This Setup guide also describes the main configuration operations needed to quickly get your product up and running.

The GPS183SV is used to synchronize devices that are directly connected to it and can be customized during production with a variety of signal outputs for a wide range of applications. Output options for the GPS183SV include time code, frequency, and pulse signals as well as relay outputs for signalling the synchronization and power supply status of the GPS183SV. The management software **Meinberg Device Manager** can be used to configure or monitor the status of the GPS183SV via a serial RS-232 connection.

The Meinberg Device Manager software and associated manual can be downloaded free to charge from the Meinberg website:

https://www.meinbergglobal.com/english/sw/mbg-devman.htm

7 GPS Features

The GPS is using the "Standard Positioning Service" SPS. Navigation messages coming in from the satellites are decoded by the GPS microprocessor in order to track the GPS system time. Compensation of the RF signal´s propagation delay is done by automatic determination of the receiver´s geographical position. A correction value computed from the satellites´ navigation messages increases the accuracy of the board´s oven controlled master oscillator (OCXO) and automatically compensates the OCXO´s aging. The last state of this value is restored from the battery buffered memory at power-up.

The GPS has several different optional outputs, including four progammable pulses, modulated / unmodulated timecode and max. four RS232 COM ports, depending on the hardware configuation. Additionally, you can get the GPS with different oscillators (e.g. OCXO- LQ/SQ/MQ/HQ/DHQ or Rubidium) to cover all levels of accuracy requirements.

You can review and change the hard- and software configuration options of the clock with the GPSMON32 application(see corresponding section in this manual).

7.1 Time Zones and Daylight Saving Time

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

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

7.2 Pulse and Frequency Outputs

The pulse generator of GPS183SV generates pulses once per second (P_SEC) and once per minute (P_MIN). Additionally, master frequencies of 10 MHz, 1 MHz and 100 kHz are derived from the OCXO. All the pulses are available with TTL level at the rear connector.

Frequency Outputs (optional)
The included synthesizer generates a frequency from 1/8 Hz up to 10 MHz synchronous to the internal timing frame. The phase of this output can be shifted from -360° to +360° for frequencies less than 10 kHz. Both frequency and phase can be setup from the front panel or using the serial port COM0. Synthesizer output is available at the rear connector as sine-wave output (F_SYNTH_SIN), with TTL level (F_SYNTH) and via an open drain output (F_SYNTH_OD). The open drain output can be used to drive an optocoupler when a low frequency is generated.

In the default mode of operation, pulse outputs and the synthesizer output are disabled until the receiver has synchronized after power-up. However, the system can be configured to enable those outputs immediately after power-up. An additional TTL output (TIME_SYN) reflects the state of synchronization. This output switches to TTL HIGH level when synchronization has been achieved and returns to TTL LOW level if not a single satellite can be received or the receiver is forced to another mode of operation by the user.

7.3 Time Capture Inputs

Two time capture inputs called User Capture 0 and 1 are provided at the rear connector (CAP0 and CAP1) to measure asynchronous time events. A falling TTL slope at one of these inputs lets the microprocessor save the current real time in its capture buffer. From the buffer, capture events are transmitted via COM0 or COM1 and displayed on LCD. The capture buffer can hold more than 500 events, so either a burst of events with intervals down to less than 1.5 msec can be recorded or a continuous stream of events at a lower rate depending on the transmission speed of COM0 or COM1 can be measured.

The format of the output string is ASCII, see the technical specifications at the end of this document for details. If the capture buffer is full a message "** capture buffer full" is transmitted, if the interval between two captures is too short the warning "** capture overrun" is being sent.

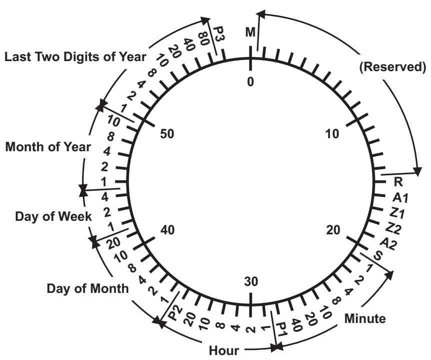
7.4 Asynchronous Serial Ports (optional 4x COM)

Four asynchronous serial RS-232 interfaces (COM0 ... COM3) are available to the user. By default, automatic transmission of a time string via the serial ports is disabled until the receiver has synchronized. However, it is possible to change the device configuration so that serial time strings are always transmitted immediately after power-up.

Transmission speeds, framings and mode of operation can be configured separately using the setup menu. COM0 is compatible with other radio remote clocks made by Meinberg. It sends the time string either once per second, once per minute or on request with ASCII ’?’ only. Also the interfaces can be configured to transmit capture data either automatically when available or on request. The format of the output strings is ASCII, see the technical specifications at the end of this document for details.

7.5 DCF77 Emulation

The clock generates TTL level time marks (active HIGH) which are compatible with the time marks spread by the German long wave transmitter DCF77. This long wave transmitter installed in Mainflingen near Frankfurt/Germany transmits the reference time of the Federal Republic of Germany: time of day, date of month and day of week in BCD coded second pulses. Once every minute the complete time information is transmitted. However, the generates time marks representing its local time as configured by the user, including announcement of changes in daylight saving and announcement of leap seconds. The coding sheme is given below:



M	Start of Minute (0.1 s)	
R	RF Transmission via Secondary Antenna	
A1	Announcement of a Change in Daylight Saving Time	
Z1, Z2	Time Zone Identification	
	Z1, Z2 = 0, 1:	Daylight Saving Time Disabled
	Z1, Z2 = 1, 0:	Daylight Saving Time Enabled
A2	Announcement of a Leap Second	
S	Start of Time Code Information	
P1, P2, P3	Even Parity Bits	

Time marks start at the beginning of new second. If a binary "0" is to be transmitted, the length of the corresponding time mark is 100 msec, if a binary "1" is transmitted, the time mark has a length of 200 msec. The information on the current date and time as well as some parity and status bits can be decoded from the time marks of the 15th up to the 58th second every minute. The absence of any time mark at the 59th second of a minute signals that a new minute will begin with the next time mark. The DCF emulation output is enabled immediately after power-up.

7.6 Programmable pulse

At the male connector Typ VG96 there are four programmable TTL outputs (Prog Pulse 0-3), which are arbitrarily programmable.

7.7 Time Code (Option)

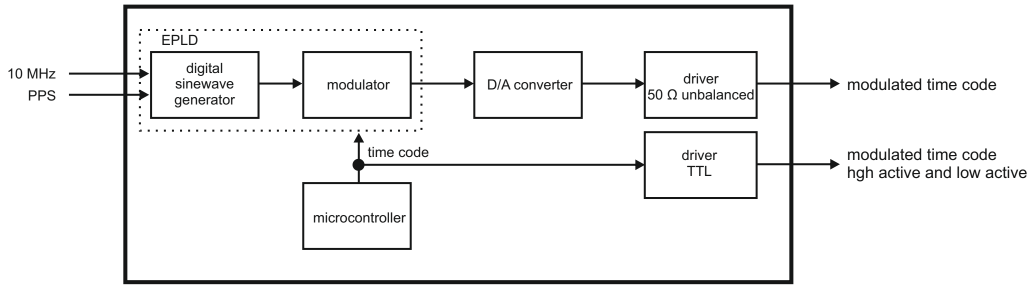
7.7.1 Abstract of Time Code

The transmission of coded timing signals began to take on widespread importance in the early 1950´s. Especially the US missile and space programs were the forces behind the development of these time codes, which were used for the correlation of data. The definition of time code formats was completely arbitrary and left to the individual ideas of each design engineer. Hundreds of different time codes were formed, some of which were standardized by the "Inter Range Instrumentation Group" (IRIG) in the early 60´s.

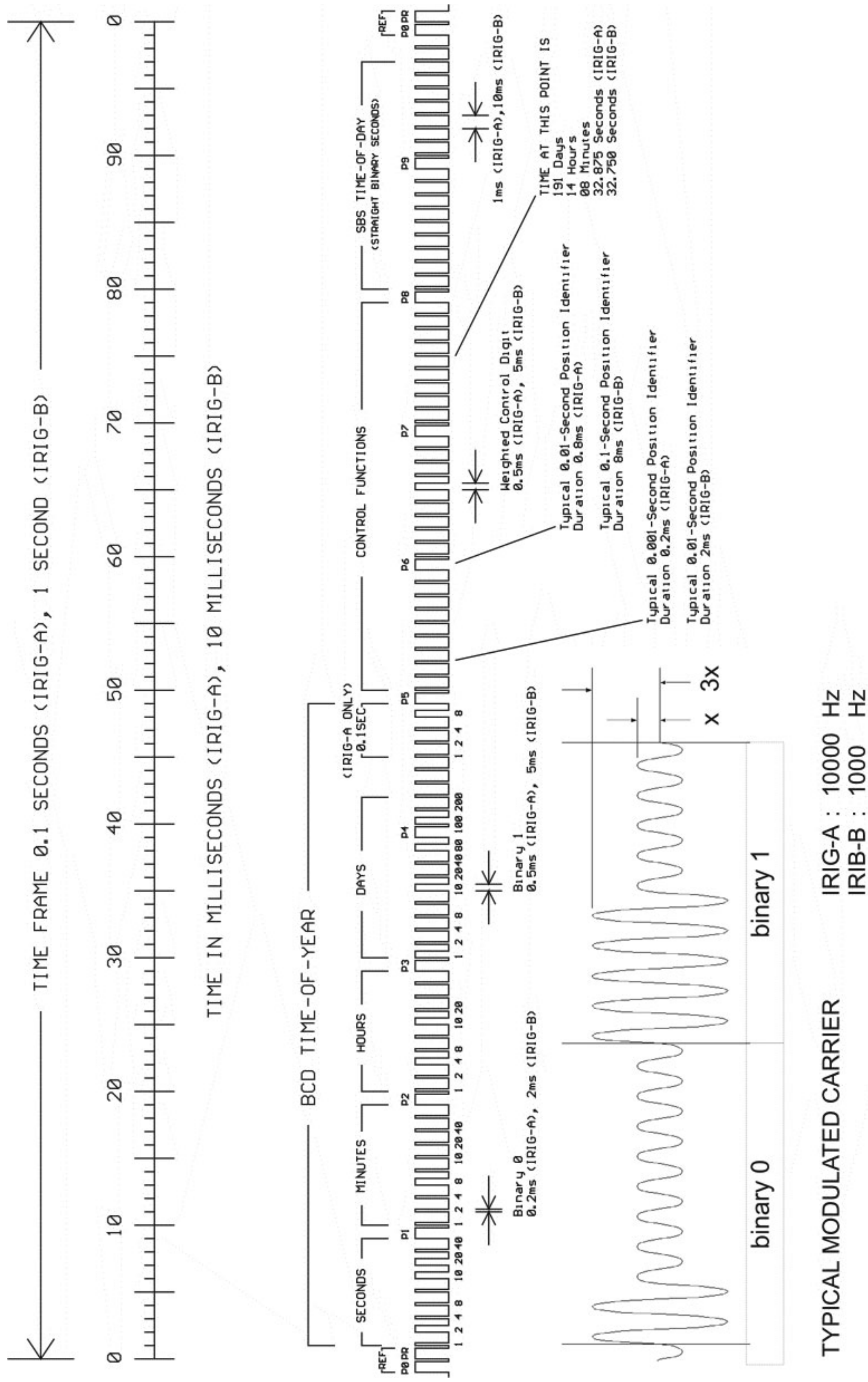
Except these "IRIG Time Codes", other formats like NASA36, XR3 or 2137 are still in use. The board GPS183SV however generates the IRIG-B, AFNOR NFS 87-500 code as well as IEEE1344 code which is an IRIG-B123 coded extended by information for time zone, leap second and date. Other formats may be available on request.

A modulated IRIG-B (3 V_{pp} into 50W) and an unmodulated DC level shift IRIG-B (TTL) signal are available at the VG64 male connector of the module.

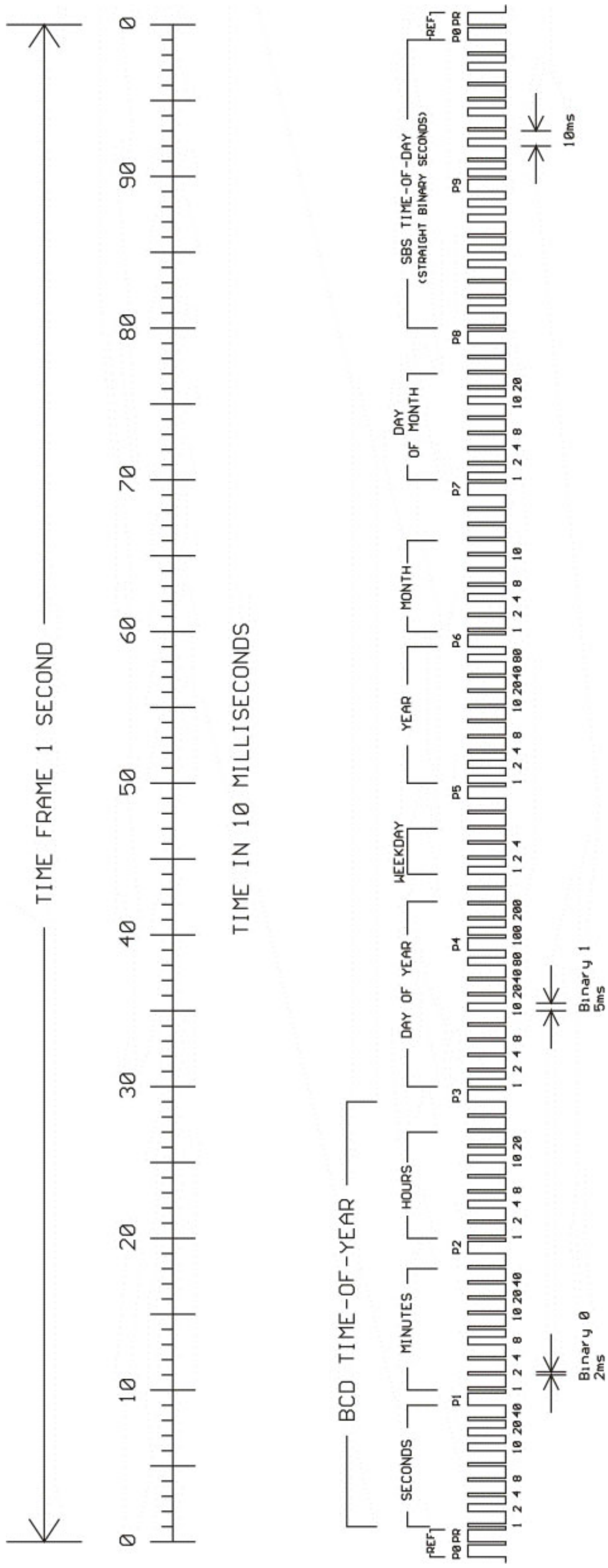
7.7.2 Block Diagram Time Code



7.7.3 Time Code Format According to IRIG Standard



7.7.4 Time Code Format According to AFNOR Standard



7.7.5 Structure of CF Segment in IEEE1344 Code

Bit No.	Designation	Description
49	Position Identifier P5	
50	Year BCD encoded 1	
51	Year BCD encoded 2	Low nibble of BCD-encoded year
52	Year BCD encoded 4	
53	Year BCD encoded 8	
54	empty, always zero	
55	Year BCD encoded 10	
56	Year BCD encoded 20	High nibble of BCD-encoded year
57	Year BCD encoded 40	
58	Year BCD encoded 80	
59	Position Identifier P6	
60	LSP - Leap Second Pending	Set until 59s before LS insertion
61	LS - Leap Second	0 = Add leap second, 1 = Remove leap second 1.)
62	DSP - Daylight Saving Pending	Set until 59s before Daylight Saving Time changeover
63	DST - Daylight Saving Time	Set during Daylight Saving Time
64	Timezone Offset Sign	Sign of TZ offset 0 = "+", 1 = "-"
65	TZ Offset binary encoded 1	
66	TZ Offset binary encoded 2	Offset between IRIG time and UTC time.
67	TZ Offset binary encoded 4	Encoded IRIG time plus TZ offset equals UTC at all times!
68	TZ Offset binary encoded 8	
69	Position Identifier P7	
70	TZ Offset 0.5 hour	Set if additional half-hour offset
71	TFOM Time figure of merit	
72	TFOM Time figure of merit	TFOM represents approximate clock error 2.)
73	TFOM Time figure of merit	0x00 = Clock synchronized, 0x0F = Clock in free-run mode
74	TFOM Time figure of merit	
75	PARITY	Parity of all preceding bits

1.) Current firmware only supports insertion of leap seconds!
2.) TFOM is set to 0 if clock has been able to synchronize since power up. The firmware does not support other codes.

For more information, please refer to the time code specifications.

7.7.6 Generated Time Codes

Besides the amplitude modulated sine wave signal, the board also provides unmodulated DC-Level Shift TTL output in parallel. Thus six time codes are available.

a)	B002:	100 pps, DCLS signal, no carrier BCD time-of-year
b)	B122:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year
c)	B003:	100 pps, DCLS signal, no carrier BCD time-of-year, SBS time-of-day
d)	B123:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, SBS time-of-day
e)	B006:	100 pps, DCLS Signal, no carrier BCD time-of-year, Year
f)	B126:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, Year
g)	B007:	100 pps, DCLS Signal, no carrier BCD time-of-year, Year, SBS time-of-day
h)	B127:	100 pps, AM sine wave signal, 1 kHz carrier frequency BCD time-of-year, Year, SBS time-of-day
i)	AFNOR:	Code according to NFS-87500, 100 pps, wave signal, 1kHz carrier frequency, BCD time-of-year, complete date, SBS time-of-day, Signal level according to NFS-87500
j)	IEEE1344:	Code according to IEEE1344-1995, 100 pps, AM sine wave signal, 1kHz carrier frequency, BCD time-of-year, SBS time-of-day, IEEE1344 extensions for date, timezone, daylight saving and leap second in control functions (CF) segment. (also see table 'Assignment of CF segment in IEEE1344 mode')
k)	C37.118	Like IEEE1344 - with turned sign bit for UTC-Offset

7.7.7 Selection of Generated Time Code

The time code to be generated can be selected by Menu Setup IRIG-settings or by the used Monitorprogram (except Lantime models). DC-Level Shift Codes (PWM-signal) B00x and modulated sine wave carrier B12x are always generated simultaneously. Both signals are provided at the VG64-Connector, i.e. if code B132 is selected also code B002 is available. This applies for the codes AFNOR NFS 87-500 and IEEE1344 as well.

The TFOM field in IEEE1344 code is set dependent on the 'already synced' character ('#') which is sent in the serial time telegram. This character is set, whenever the preconnected clock was not able to synchronize after power up reset. The 'time figure of merit' (TFOM) field is set as follows.

Clock synchronized once after power up:	TFOM = 0000
Clock not synchronized after power up:	TFOM = 1111

For testing purposes the output of TFOM in IEEE1344 mode can be disabled. The segment is set to all zeros then.

7.7.8 Outputs

The module GPS183SV provides modulated (AM) and unmodulated (DCLS) outputs. The format of the time-codes is illustrated in the diagramms "IRIG-" and "AFNOR standard-format".

7.7.8.1 AM - Sine Wave Output

The carrier frequency depends on the code and has a value of 1 kHz (IRIG-B). The signal amplitude is 3 Vpp (MARK) and 1 Vpp (SPACE) into 50 Ohm. The encoding is made by the number of MARK-amplitudes during ten carrier waves. The following agreements are valid:

a)	binary "0":	2 MARK-amplitudes, 8 SPACE-amplitudes
b)	binary "1":	5 MARK-amplitudes, 5 SPACE-amplitudes
c)	position-identifier:	8 MARK-amplitudes, 2 SPACE-amplitudes

7.7.8.2 PWM DC Output

The pulse width DCLS signals shown in the diagramms "IRIG" and "AFNOR standard format" are coexistent to the modulated output and is available at the VG connector pin 13a with TTL level.

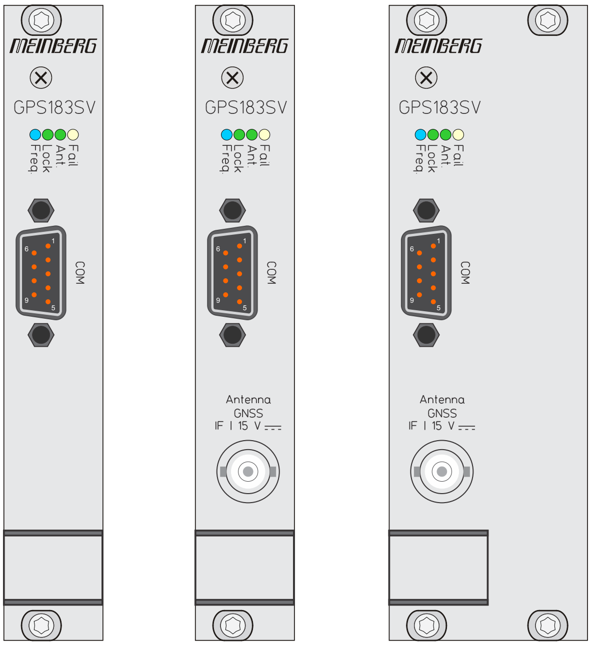
7.7.9 Technical Data

Outputs: Unbalanced AM-sine wave-signal:
3 V_{pp} (MARK) / 1 V_{pp} (SPACE) into 50 Ohm

DCLS signal: TTL

8 Installation

8.1 The Front Panel Layout

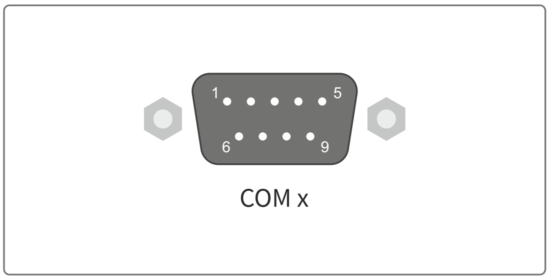


1. Serial Interface COM0, 9-Pin DSUB Male Connector (Chapter **8.1.1**)

2. Status LEDs: Init/Nav./Ant/Fail (Chapter **8.1.2**)

3. Option: GPS Antenna, BNC, Female (Chapter **8.1.3**)

8.1.1 RS-232 COMx Time String Output



Data Transfer Mode: Serial I/O

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

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

Time String Formats:
Meinberg Standard *(Default)*
Meinberg GPS
SAT
NMEA RMC
NMEA GGA
NMEA ZDA
NMEA RMC GGA *(RMC followed by GGA)*
Uni Erlangen
Computime
Sysplex 1
SPA
RACAL
ION
ION Blanked
IRIG-J-1
6021

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

Connector Type: D-Sub, Male, 9-Pin

Cable Type: Standard RS-232 Cable (Shielded)

Information:

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

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

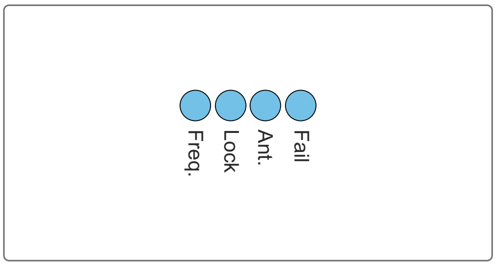
8.1.2 Status LEDs

"*Fail*" LED: Synchronization status

"*Ant.*" LED: Antenna status

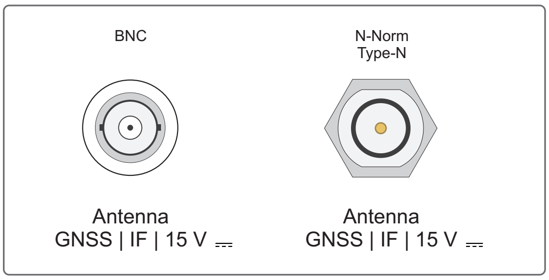
"*Lock*" LED: Geolocation status

"*Freq.*" LED: Initialization status of clock



LED	Colors	Description
Fail	Red	The clock can identify no way to successfully synchronize.
Ant.	Green	The antenna is correctly connected, there is no fault detected in the connection, and the clock is synchronized with the GPS reference.
	Red	The antenna is faulty or not correctly connected.
	Red/yellow (flashing)	The clock is in "**Holdover Mode**"; it is controlled solely via the internal oscillator and has not yet been synchronized to the GPS reference since the device was last started.
	Green/yellow (flashing)	The clock is in "**Holdover Mode**"; it is controlled solely via the internal oscillator, but has been synchronized at least once to the GPS reference since the device was last started.
Lock	Off	The GPS receiver has not yet determined its position (or has been unable to).
	Green	The GPS receiver has successfully determined its position.
Freq.	Blue	The internal firmware is initializing.
	Off	The initialization of the internal firmware is complete but the oscillator is not yet locked to its phase reference.
	Green	The initialization of the clock's firmware is completed and the oscillator is locked to its phase reference.

8.1.3 Antenna Input: GPS Reference Clock



Antenna Input

Receiver Type:	GPS 12-Channel GPS C/A Code Receiver
Mixing Frequency (Reference Clock to Antenna) (GPS Converter):	10 MHz [1]
Intermediate Frequency Antenna (GPS Converter) to Reference Clock:	35.4 MHz [1]
	1) These frequencies are transferred via the antenna cable
Power Supply:	15 V, 100 mA (provided via antenna cable)
Connector Type:	BNC, Female/Type-N, Female
Cable Type:	Coaxial Cable, Shielded
Cable Length:	Max. 300 m (RG58) Max. 700 m (RG213)

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.

8.2 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.

8.2.1 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.

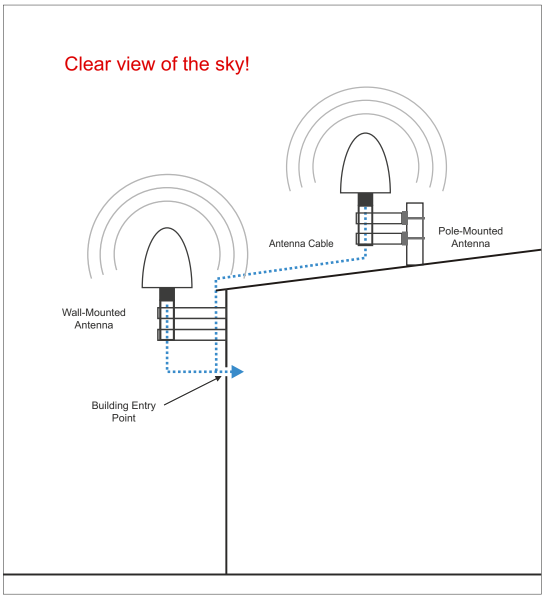


Fig. 1: Ideal Positioning

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.

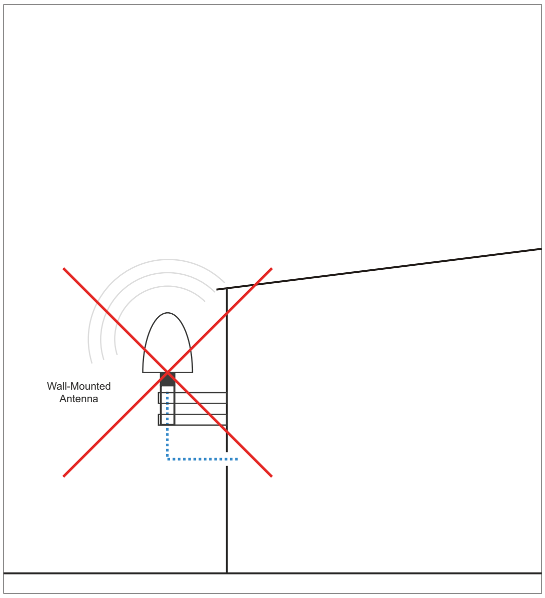


Fig. 2: Poor positioning of a wall-mounted antenna

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 55^{th} north and 55^{th} 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.

8.2.2 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.

8.2.3 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.

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

The propagation of the signal from the antenna to the receiver (reference clock) can incur a certain delay. This delay can be compensated for with Meinberg Device Manager Software.

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

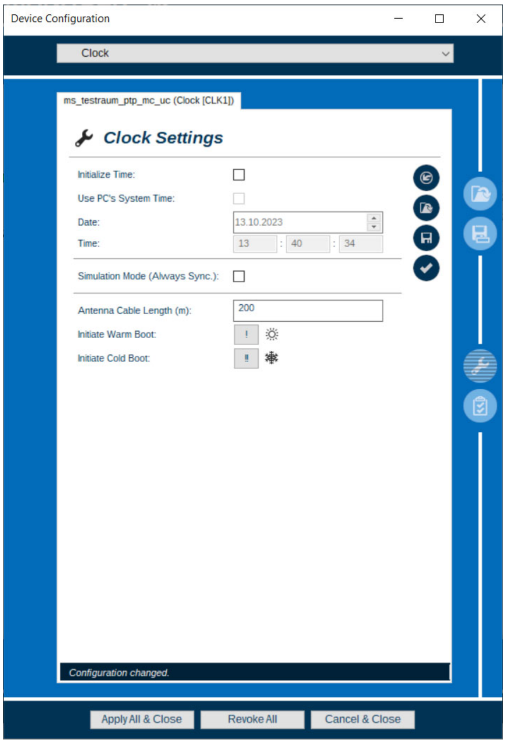


Illustration: "Clock" menu in Meinberg Device Manager

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

8.2.4 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 safe zone (e.g., formed by a lightning rod) positioned above the antenna. This increases the likelihood of lightning being 'caught' by the lightning rod, allowing surge currents to be safely passed from the lightning rod along a grounding conductor to ground.

Electrical Bonding

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.

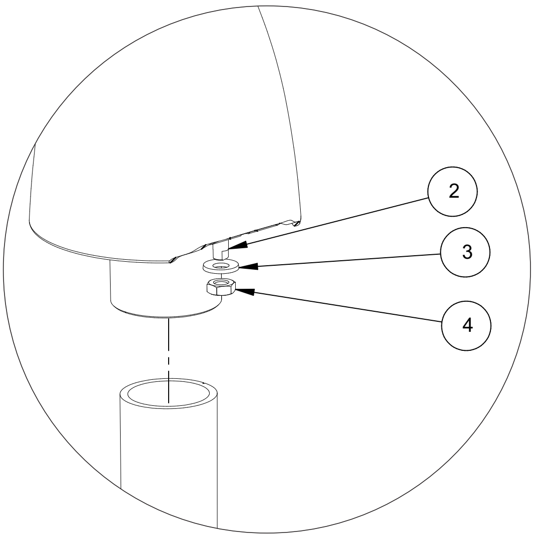
To this end, the following elements should be connected and integrated into a bonding system:

- 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 drawings below 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

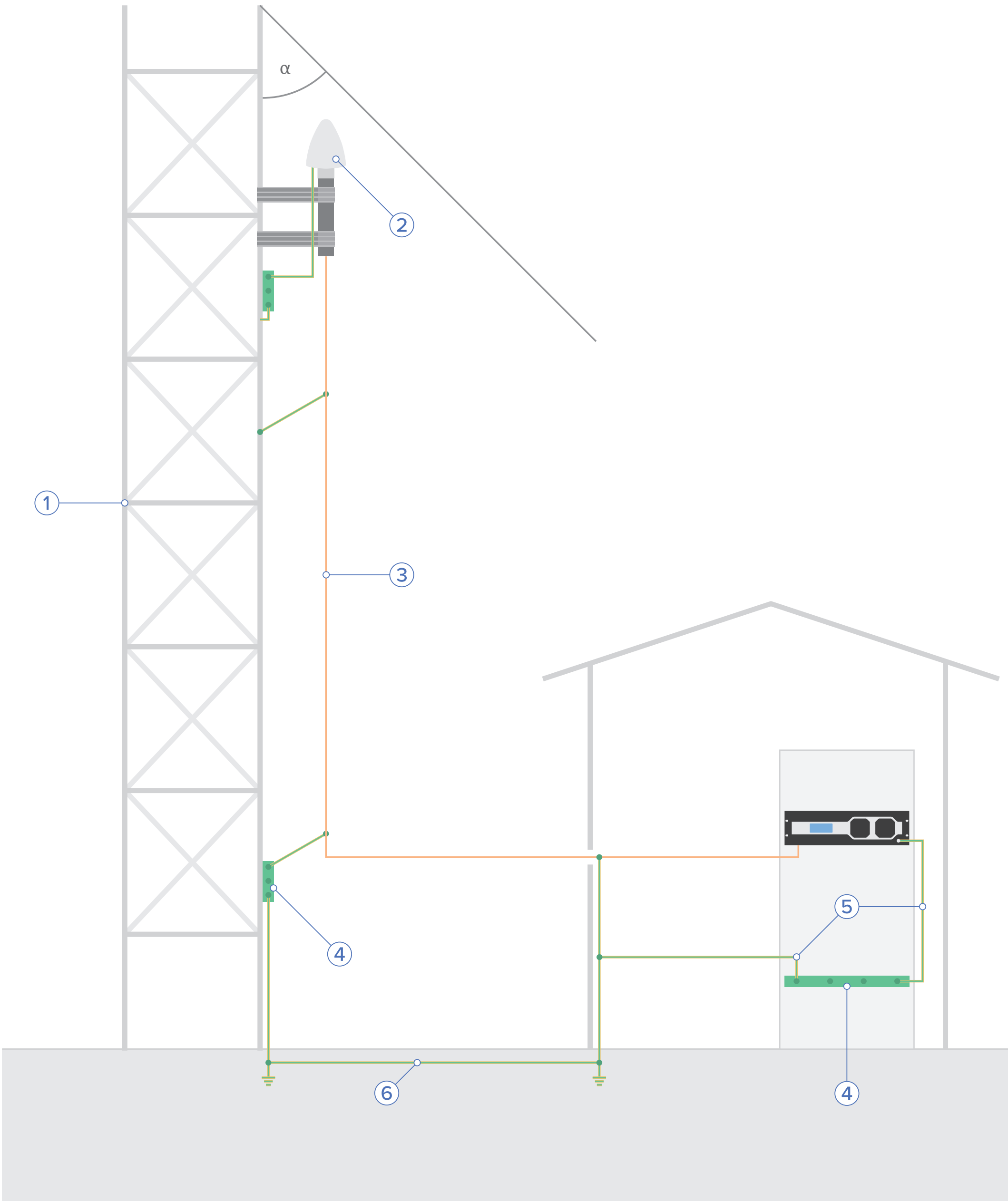


Fig. 5: Installation on a Pole

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

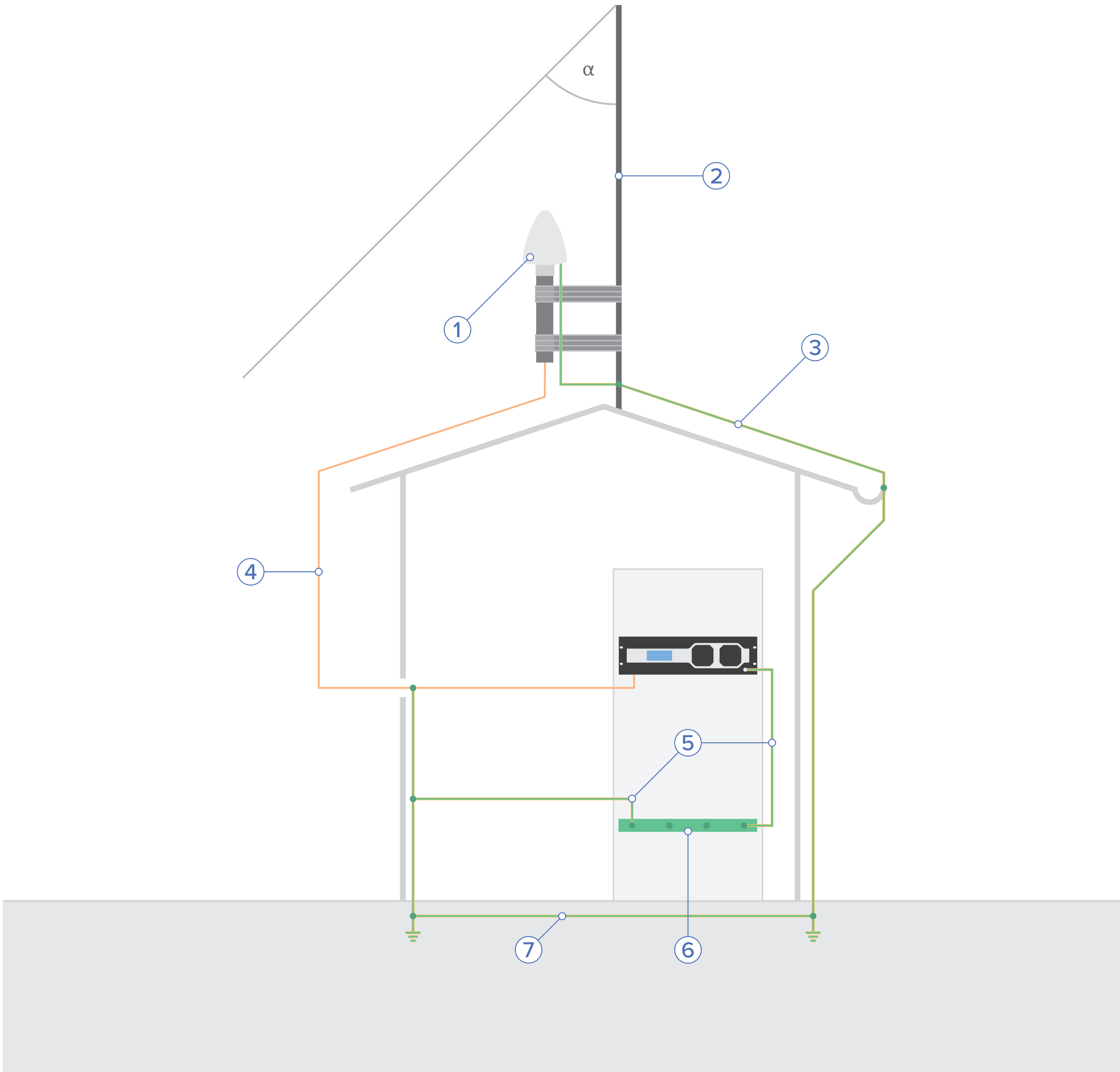


Fig. 6: Roof Installation

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.

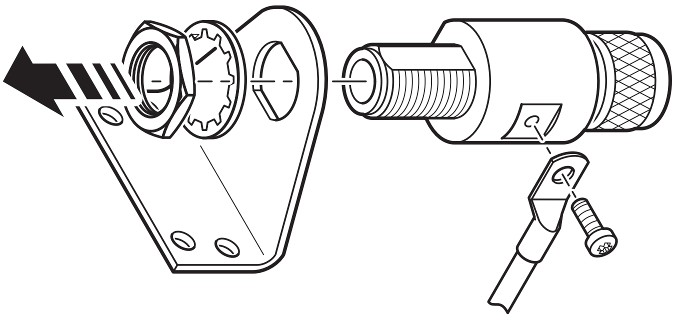


Fig. 7: Installation of the Surge Protector

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

8.3 Power Supply

The power supply used with a GPS183SV has to provide only one output of +5V. The output voltage should be well regulated because drifting supply voltages reduce the short time accuracy of the generated frequencies and timing pulses. The power supply lines should have low resistance and must be connected using both pins a, b and c of the rear connector.

8.4 Powering Up the System

If both the antenna and the power supply have been connected the system is ready to operate. About 10 seconds after power-up the receiver´s (OCXO-LQ) until 3 minutes (OCXO-MQ / HQ) has warmed up and operates with the required accuracy. If the receiver finds valid almanac and ephemeris data in its battery buffered memory and the receiver´s position has not changed significantly since its last operation the receiver can find out which satellites are in view now. Only a single satellite needs to be received to synchronize and generate output pulses, so synchronization can be achieved maximally one minute after power-up (OCXO-LQ) until 10 minutes (OCXO-MQ / HQ) . After 20 minutes of operation the OCXO is full adjusted and the generated frequencies are within the specified tolerances.

If the receiver position has changed by some hundred kilometers since last operation, the satellites´ real elevation and doppler might not match those values expected by the receiver thus forcing the receiver to start scanning for satellites. This mode is called **Warm Boot** because the receiver can obtain ID numbers of existing satellites from the valid almanac. When the receiver has found four satellites in view it can update its new position and switch to **Normal Operation**. If the almanac has been lost because the battery had been disconnected the receiver has to scan for a satellite and read in the current almanacs. This mode is called **Cold Boot**. It takes 12 minutes until the new almanac is complete and the system switches to **Warm Boot** mode scanning for other satellites.

In the default mode of operation, neither pulse and synthesizer outputs nor the serial ports will be 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) it can take some minutes until the OCXO´s output frequency has been adjusted. Up to that time accuracy of frequency drops to 10^{-8} reducing the accuracy of pulses to +-5μs.

9 Using Meinberg Device Manager to Configure and Monitor the GPS183SV

9.1 Introduction to Meinberg Device Manager

The software **Meinberg Device Manager** is used to configure the GPS183SV and to monitor its status.

The current version of Meinberg Device Manager can be downloaded free of charge for Windows, either as an executable installer or as a portable ZIP archive, and is also available for a variety of Linux distributions.

To enable the GPS183SV to be correctly detected, configured, and monitored, **Version 7.3** or better of Meinberg Device Manager is required.

The software can be downloaded at:

https://www.meinbergglobal.com/english/sw/mbg-devman.htm

Documentation

A comprehensive user guide for Meinberg Device Manager is also available to download and contains detailed information on all of the configuration and system monitoring options provided by the software for the GPS183SV. The manual can be downloaded in PDF format under the following link:

https://www.meinbergglobal.com/download/docs/manuals/english/meinberg-device-manager.pdf

9.2 Configuring the GPS183SV

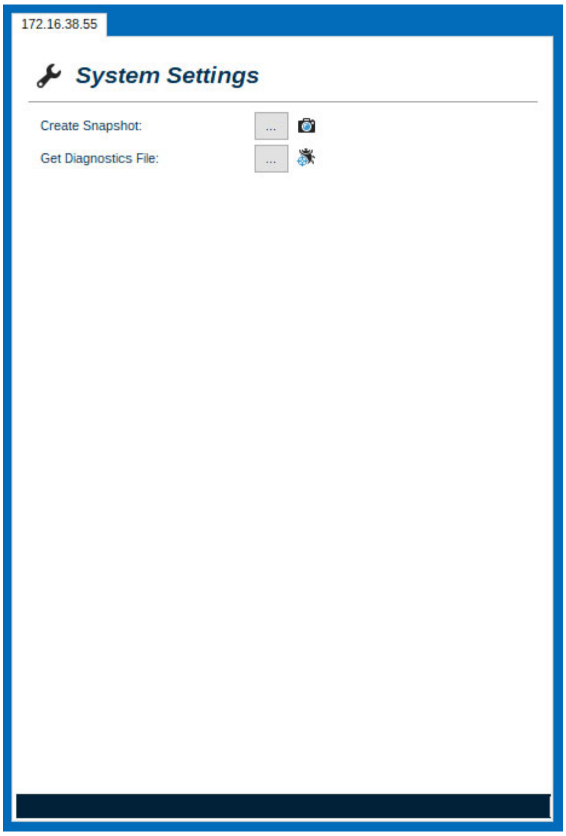
This chapter describes the initial set-up process of a GPS183SV using Meinberg Device Manager.

9.2.1 "System" Section

The "**System**" section can be used to perform basic operations such as the generation of a diagnostic file.

1. To do this, select the device listed on the start page of Meinberg Device Manager.

2. Select it by clicking on it once, then click on "**Configure Device(s)**".



Create Snapshot

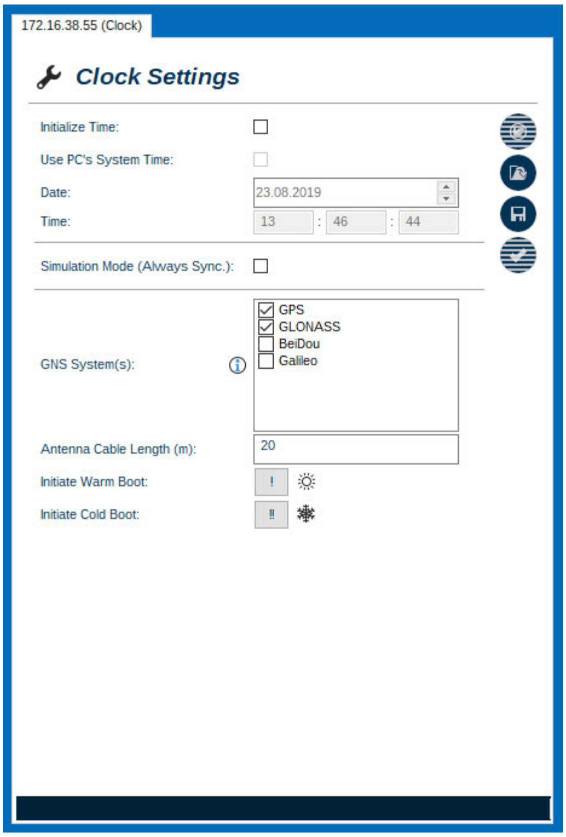
Meinberg Device Manager exports all configuration and status information into text files.
This allows you to save this text file containing the current configuration of your device (ZIP archive). If necessary, this file can be sent to Meinberg's Technical Support team.

Get Diagnostics File

Saves the configuration as a diagnostic file (*tar.gz* format). If necessary, this file can be sent to Meinberg's Technical Support team.

9.2.2 “Clock” Section

The following settings can be configured in the "Clock" section:



Initialize Time: Allows the date and time to be modified manually.

Use PC’s System Time: When enabled, the local PC’s clock will be used once as a reference to set the local clock of your Meinberg system.

Date: Allows the date to be specified in the format `dd.mm.YYYY`.

Time: Allows the time to be specified in the format `HH:ii:ss`.

Simulation Mode: Allows the system to be used without a connected antenna. The synchronization status in this case is ’forged’ so that all system processes assume that the clock is synchronized.

GNS System: Allows the satellite system or a combination of systems to be selected with GNS receivers.

Antenna Cable Length: Allows signal propagation times to be compensated for. The propagation delay inherent in the cable is affected by the length of the cable (approx. 5 ns/m).

Initiate Warm Boot: Forces the receiver to "warm boot", whereby the lock on all detected satellites is cleared and the receiver tries anew to lock onto satelites using the saved almanac data.

Initiate Cold Boot: Forces the receiver to "cold boot", whereby the lock on all detected satellites is cleared and all almanac data is erased. The receiver then locks onto one satellite and downloads the almanac again.

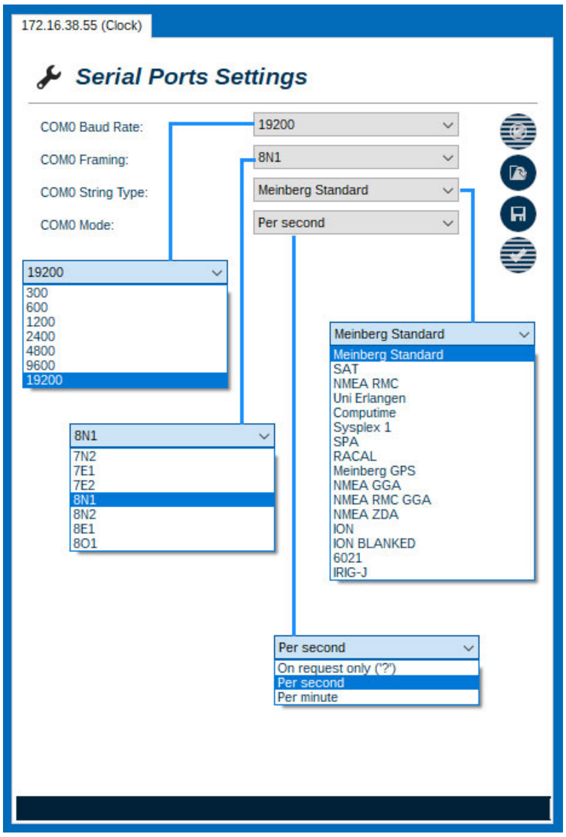
Information:

The system may under certain circumstances automatically perform a warm or cold boot. For example, this might happen if the receiver no longer has enough satellites ’in view’ or the almanac is older than three weeks.

9.2.3 "Serial Ports" Section

The available serial interfaces on the selected module or device can be displayed and configured in the "**Serial Ports**" section.

The following settings can be configured in the "**Serial Ports**" section:



Baud Rate: The baud rate is the data transmission rate for serial time strings.

Framing: The framing represents the format in which the data is transmitted.

String Type: You can select from a a large number of different time string types. These are output as ASCII code sequences and can be displayed on the serial terminal of the start page.

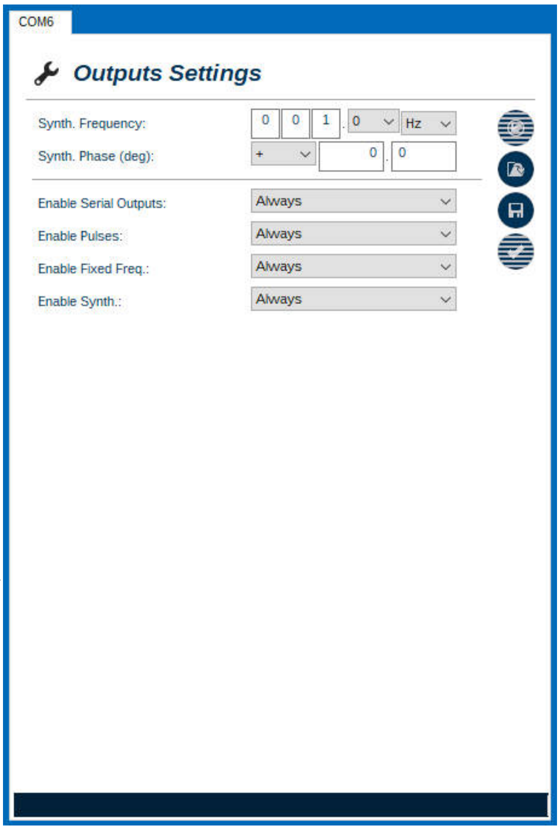
Mode: This is used to select how frequently the time string as configured above should be output or whether it should only be output on request ("?" sent to the RxD pin of the serial interface).

9.2.4 "Outputs" Section

The IRIG time codes that can be output by the system can be configured here. This section can also be used to set the frequency and phase of the synthesizer and define the conditions under which the output signals are enabled.

The various time code formats are described in Chapter **11.6**, "**Time String Formats**".

The following options are configurable in the "**Outputs**" section:



Synth. Frequency: The output frequency of the integrated synthesizer is configured here.

Please Note: If a frequency of *0 Hz* is set, the synthesizer is disabled.

Synth. Phase (deg): The phase of the integrated synthesizer can be specified here in order to control the timing of the zero-crossings.

Please Note: Higher phase offsets will cause the delay in the output signal to be increased. If a frequency of more than *10 kHz* is set, the phase cannot be modified.

Enable *[Signal Type]*: Serial Outputs, Pulses, Fixed Freq., Synthesizer

Always: The signal output is enabled immediately upon device startup.
If Sync: The signal output is only enabled once the receiver has synchronized for the first time.

9.2.5 “Time Zone” Section

This section is used to configure the time zone and summertime/wintertime adjustments (*Daylight Saving Time, DST*). The internal time zone of the system and for NTP is always UTC.

These parameters affect the serial outputs.

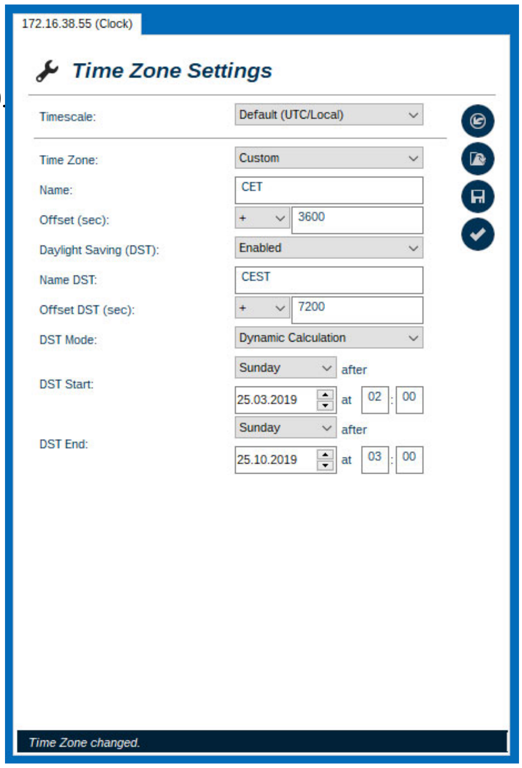
Note Regarding Configuration:
Some systems provide multiple timescale options such as GPS or TAI. In this case you will not be able to customize the time zone, as UTC or local will be set as the fixed timescale as appropriate.

Timescale:

GPS
GPS system time with the epoch January 1, 1980. A monotonic timescale without leap seconds. Incorporates the leap seconds from between 1970 and 1980.

UTC
Coordinated Universal Time (includes leap seconds, which are continuously amended)

TAI
International Atomic Time with the epoch January 1, 1970. A monotonic timescale without leap seconds. Offset relative to GPS time: 19 seconds.



The parameters for the UTC, CET/CEST, and EET/EEST time zones are fixed and cannot be modified. However, you can define a custom profile for a time zone and customize all of the parameters of this.

Name: The time zone name can be assigned any desired name.

Offset (sec): The offset defines the difference relative to UTC time. You can select a positive or negative value for this offset.

Daylight Saving (DST): This can be used to enable or disable Daylight Saving Time.

Name DST: The specific summertime nomenclature can be specified here.

Offset DST (sec): An offset must also be configured for summertime.

DST Mode: It is also possible to specify a weekday on which the summertime starts and ends.

Dynamic Calculation: Daylight Saving Time is applied or removed on the configured day of week, either on or after the configured date. (Example of CEST: First Sunday on or after March 25 and October 25). As such, the configuration only needs to be performed once and the appropriate date is calculated automatically each year.

Fixed Date: Daylight Saving Time is applied or removed on the configured date and needs to be reconfigured each year.

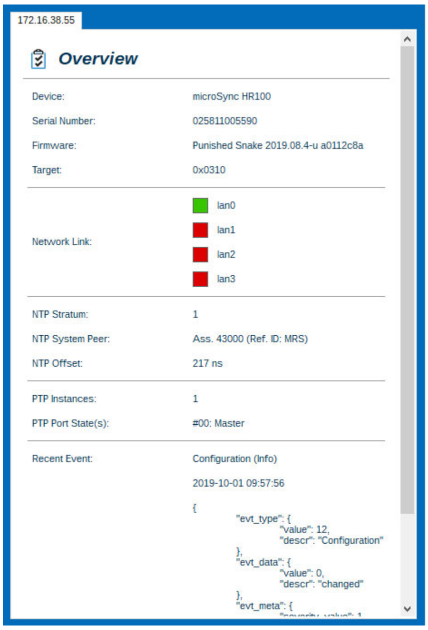
DST Start: The application of Daylight Saving Time can be customized depending on the location of the module or system.

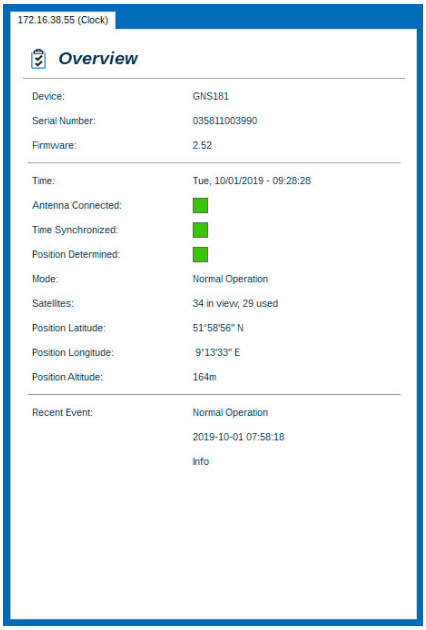
DST End: The end of Daylight Saving Time can be customized depending on the location of the module or system.

9.3 Monitoring the GPS183SV

Once you have successfully logged into the GPS183SV, you can display the status of the device. The Dashboard shows all relevant system information:

9.3.1 “Overview” Section





Device: The specific system name.

Serial Number: The serial number of the device (please always specify when contacting Technical Support).

Firmware: The current firmware version.

Time: The current local time (with time zone offset) of the GPS183SV.

Antenna Connected:
Green: The antenna is correctly connected and exhibits no faults.
Red: The antenna is not connected or is faulty.

Time Synchronized:
Green: The clock is synchronized.
Red: The clock is not synchronized.

Position Determined:
Green: The receiver has been able to successfully determine its position.
Red: The receiver has not (yet) been able to determine its position.

Mode: The current operating mode of the integrated GPS receiver:
Normal Operation: The clock is currently receiving and using the satellites needed to determine its position.
Cold Boot: The clock is searching for a GPS satellite and is downloading all almanac data from it.
Warm Boot: The clock is searching for GPS satellites based on the available almanac data.

Satellites: The number of visible satellites and satellites in use.

Position Latitude: The latitude of the identified location.

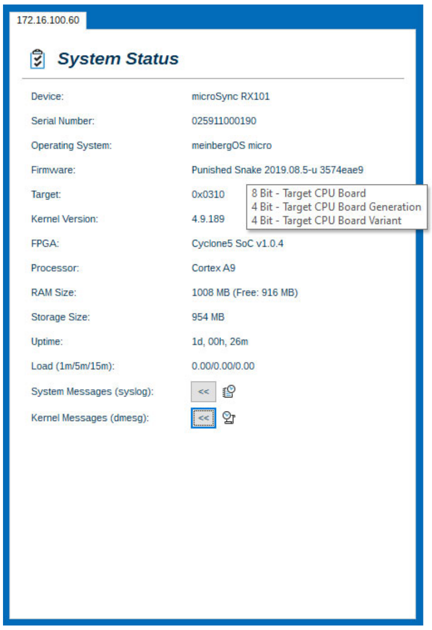
Position Longitude: The longitude of the identified location.

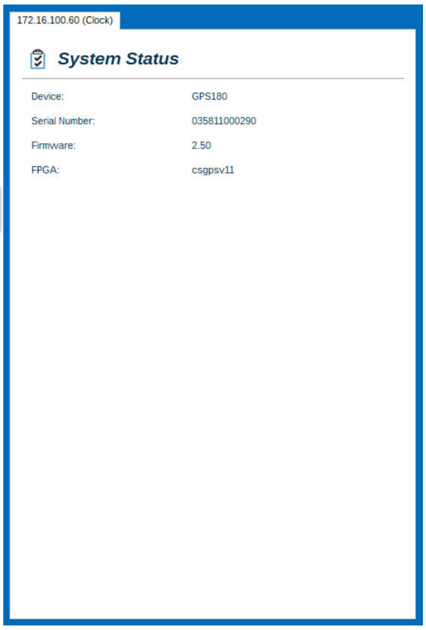
Position Altitude: The altitude of the identified location.

Position Altitude: The altitude of the identified location.

Recent Event: The most recent event shown in an XML structure.

9.3.2 “System” Section

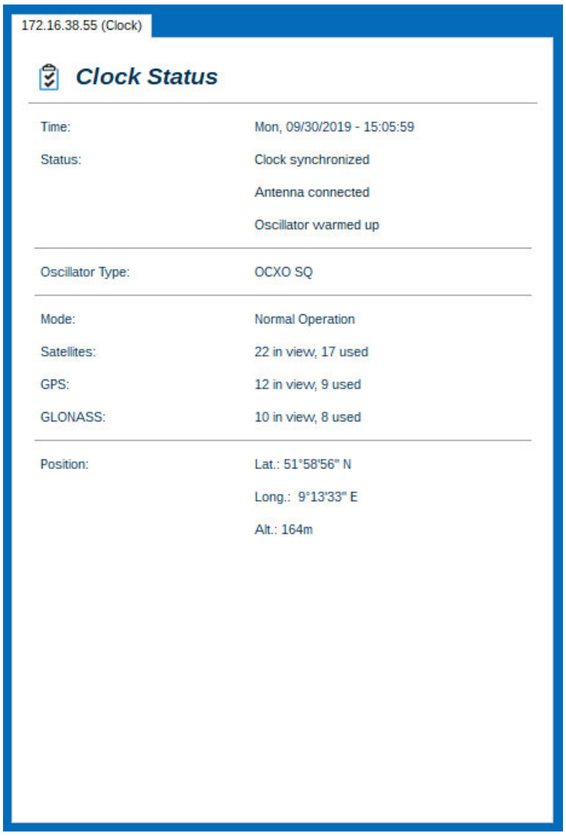




In addition to the information displayed under the "Overview" section, this section also shows the FPGA version, firmware version, serial number, and product designation.

9.3.3 “Clock” Section

The Clock Status section provides important status information about your receiver module. For example, you can see the synchronization status of your receiver, the satellite constellations currently in use, and the number of satellites that are visible and/or in use.



Time: Displays the current system time.

Status: Displays various states for your receiver, including the synchronization, antenna connection, and oscillator status.

Oscillator Type: Displays the type of oscillator that is installed.

Mode: The current mode of the integrated receiver e.g., Normal Operation, Cold Boot, Warm Boot.

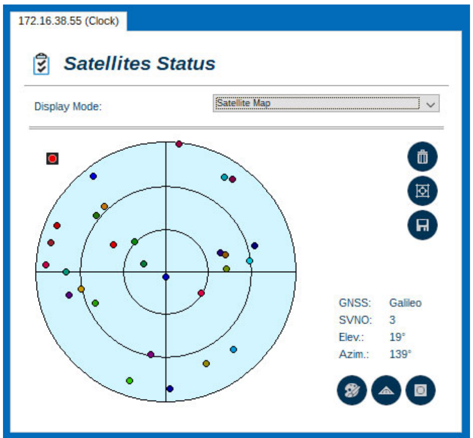
Satellites: The total number of available satellites and the total number of GNSS systems used for synchronization.

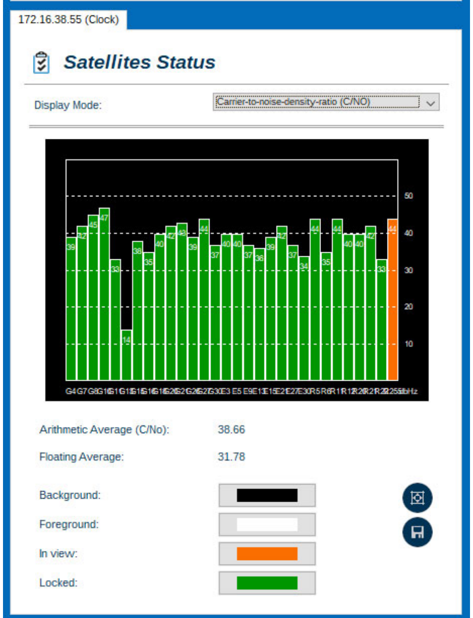
Position: The current location of the receiver.

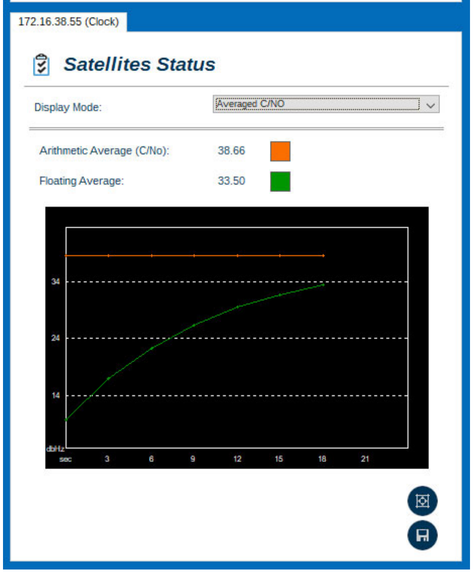
9.3.4 “Satellites” Section

The "Satellites" section allows the visibility and quality of the detected satellites to be monitored and analyzed.

This can be presented in various ways that can be selected as needed.







Satellite List

A list of all detected satellites sorted by satellite system.

GNSS: This column lists the satellites of the previously selected systems.

SVNO: ID number of the satellite.

Last Status: Shows the last known status of the satellite.

Last Locked: Shows the time when the receiver last locked onto this satellite.

Satellite Map

Detailed information about each of the satellites can be displayed here by hovering with the mouse cursor over the points (representing satellites) on the Satellite Orbit Map.

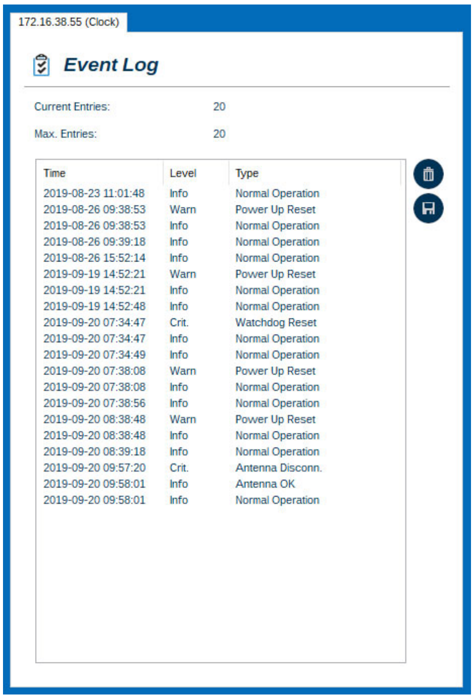
Carrier-to-Noise Density Ratio

This section shows the signal quality *(Carrier-to-Noise Density Ratio, C/NO)* of all available satellites in the form of a bar chart. The height of each of the bars indicates the reception of quality of each of the satellites.

Averaged C/NO

The average quality of the satellites in the coordinate system (x = seconds, y = dBhz as unit for C/NO Carrier-to-Noise Density).

9.3.5 "Event Log" Section



This section is used to log system events and identify any changes.

Clear Event Log – Deletes all displayed event logs.

Save Event Log – Saves event logs as a text file.

Current Entries:
The number of event log entries currently displayed.

Max. Entries:
Displays the maximum number of event log entries.

Event Log

Time: Shows the local date & time (of the receiver) at which the events were generated.

Level: Display the event log level:

Info	Events of a purely informational nature (e.g., antenna OK)
Crit	Critical events (e.g., antenna disconnected)
Error	Error events (e.g., warm boot triggered)
Warn	Warning events (e.g. power-up, reset)

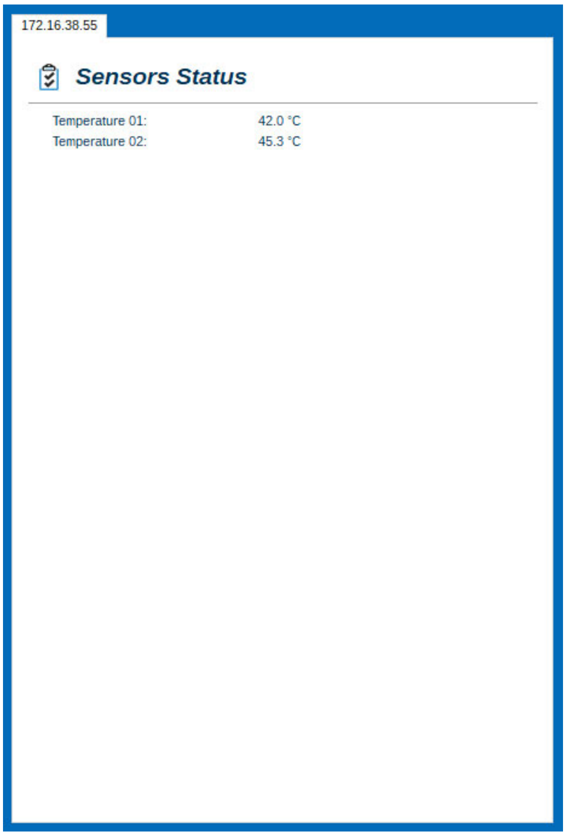
Type: Display the type of generated event.

9.3.6 “Sensors” Section

This section allows the sensors integrated into the system to be monitored.

Temperature 01:
Displays the temperature measured at Sensor 01.

Temperature 02:
Displays the temperature measured at Sensor 02.



10 Configuration and Monitoring Using GPSMON32

The program GPSMON32 was developed by Meinberg until 2017 and offered for download for programming and monitoring Meinberg products.. The software was supported on Windows 7, Windows Vista, Windows 9x, Windows 2000, Windows XP, and Windows NT.

Meinberg ceased development of GPSMON32 in 2010 and ended official support in 2017. GPSMON32 was succeeded from that point by the newer Meinberg Device Manager, which provides many more features and is still in active development.

Meinberg strongly recommends using the newer, more developed, and free Meinberg Device Manager to manage and monitor your GPS183SV. Even so, GPSMON32 remains available to download on the Meinberg software download page as a goodwill gesture for end users who are working with older operating systems or who may be familiar with or prefer the operating style of GPSMON32.

https://www.meinbergglobal.com/english/sw/#gpsmon

Important!

Meinberg no longer supports the use of GPSMON32 for configuring and monitoring your GPS183SV.

Before submitting a support request, please first install the free Meinberg Device Manager software to find out if that will solve your problem.

Meinberg provides no guarantee that GPSMON32 will work correctly on any specific operating system, PC configuration, or with any specific Meinberg product. This applies in particular to PC operating systems (especially Windows 8, Windows 10, and Windows 11), PC configurations, and Meinberg products that were developed after the end of support for GPSMON32.

11 Technical Appendix

11.1 Technical Specifications: GPS Receiver

Receiver Type:	12-Channel GPS C/A Code Receiver	
Antenna Type:	GPSANTv2 Antenna	
Operating Voltage of Antenna:	15 V DC, Short-Proof Power supply over antenna cable	
Time to Synchronization:	Max. 1 Minute if receiver position is known and almanac is valid, approx. 12 minutes if no valid data stored ("Cold Boot" mode)	
Pulse Outputs:	Pulse-per-Minute (PPM) Pulse-per-Second (PPS)	
Frequency Synthesizer:	1/8 Hz – 10 MHz:	Base accuracy = System accuracy
	1/8 Hz – 10 kHz:	Phase synchronicity with pulse-per-second
	10 kHz – 10 MHz:	Frequency deviation < 0.0047 Hz
Pulse Accuracy:	**Following synchronization and within first 20 minutes of operation:** Better than ±2 μs (with OCXO-SQ/MQ/HQ/DHQ)	
	Following synchronization and after 20 minutes of operation: Better than ±50 μs (with OCXO-SQ/MQ/HQ/DHQ)	
Serial Interfaces:	2 asynchronous serial interfaces (RS-232)	
	Baud Rate:	300 – 19200
	Framing Options:	7N2, 7E1, 7E2, 8N1, 8N2, 8E1, 8O1
Default Setting:	COM0:	19200, 8N1 Meinberg Standard string, transmission once per second
	COM1:	19200, 8N1 Meinberg Standard string, transmission once per second
HF Connector:	Coaxial BNC Connector, Female, for GPS Antenna	
Ambient Temperature:	**Operation:**	0 to 50 °C
	Storage:	–20 to 70 °C
Supported Relative Humidity:	Max. 85 % (non-condensing) at 30 °C	

Pin Assignment GPS183

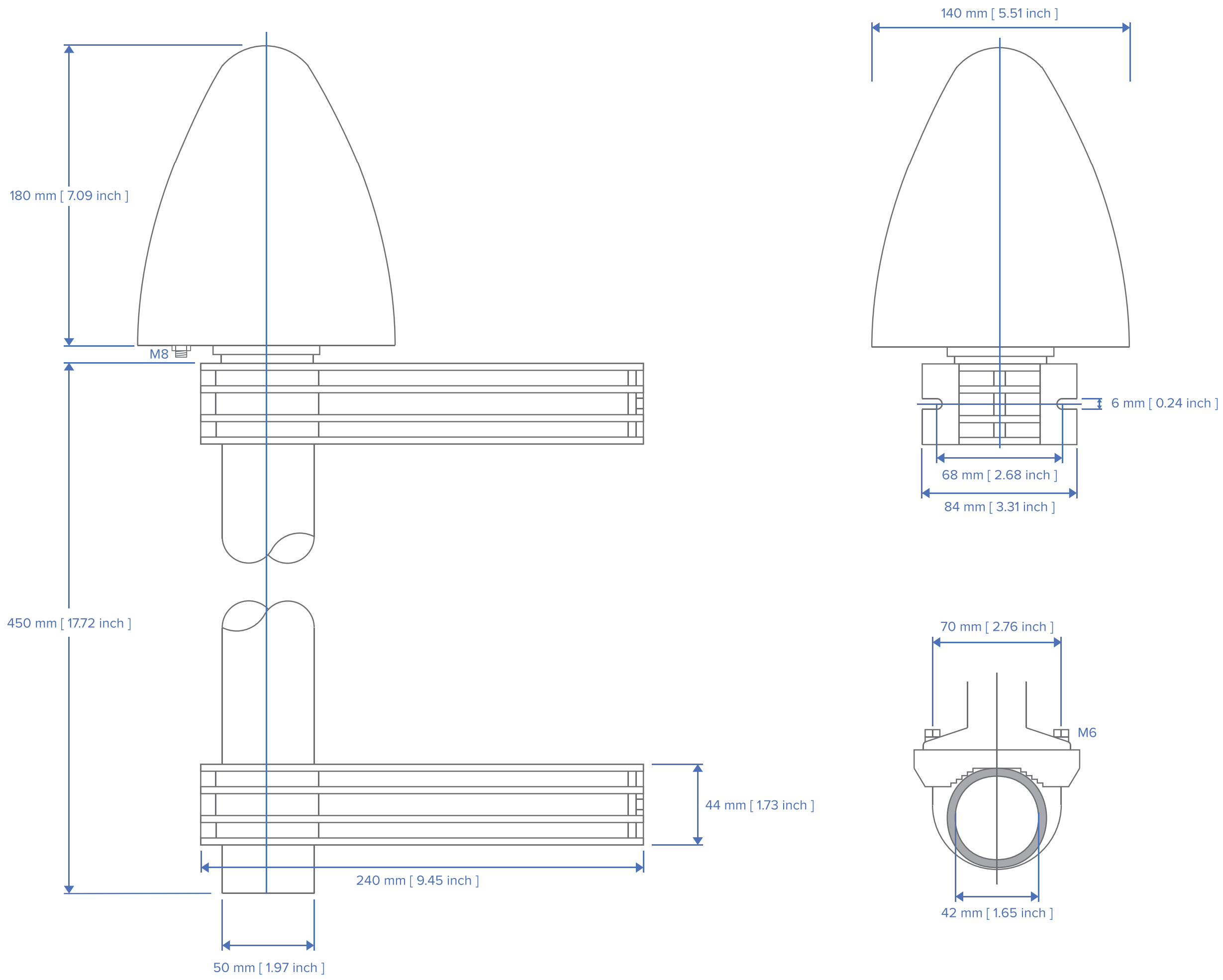
	a	b	c
1	VCC in (+5 V)	VCC in (+5 V)	VCC in (+ 5V)
2	VCC in (+12 V)	VCC in (+12 V)	VCC in (+12 V)
3	VDD in (TCXO/OCXO)	VDD in (TCXO/OCXO)	VDD in (TCXO/OCXO)
4	Reserved (FrequAdjust out)	PPS IMS out	PROG PULSE3 out
5	FIXED FREQUENCY out *	GND	10 MHz IMS in
6	PPS IMS in	PPS HvQ in	PPS out
7	TIME CODE DCLS IMS in	GND	PPS2 in
8	EXT-CLK in / PPS-RUB in		PPM out
9	10 MHz SINE out		PPS RUB out
10	DNC **	HvQ-RS422-A Rx+	PROG PULSE0 out
11	DNC **	HvQ-RS422-B Rx–	PROG PULSE1 out
12	10 MHz TTL out		PROG PULSE2 out
13	TIME CODE DCLS out		SPI-EXT-!CS in
14	TIME CODE AM out	GND	COM4 RxD in
15	COM2 RxD in		SPI-EXT-MISO out
16	COM2 TxD out		SPI-EXT-MOSI in
17	COM3 RxD in		DCF MARK out
18	COM3 TxD out		Reserved (Vref/TxD2 TTL)
19	GND		TIMESYNC out
20	GND	GND	SPI-EXT-SCL in
21	GND		F_SYNTH TTL out
22	GND	GND	F_SYNTH_OD out
23	GND		F_SYNTH_SIN out
24	GND		COM1 TxD out
25	GND	Slot_ID0	COM4 TxD out
26	GND	Slot_ID1	COM0 TxD out
27	GND	Slot_ID2	CAP1 in
28	GND	Slot_ID3	CAP0 in
29	GND	+USB	COM1 RxD in
30	GND	–USB	COM0 RxD in
31	GND	GND	GND
32	GND	GND	GND
*Not with TCXO oscillators / **Do Not Connect			
The assignments marked in blue are optional			
IMS Systems only			
Only receivers with XHS-SPI interface (IMS systems)			
Connector: 96-pin DIN 41612 connector			

11.2 Technical Specifications: Oscillators

	TCXO	OCXO-LQ	OCXO-SQ	OCXO-MQ	OCXO-HQ	OCXO-DHQ
Short-Term Stability (where t = 1 second)	2×10^{-9}	1×10^{-9}	5×10^{-10}	2×10^{-10}	5×10^{-12}	2×10^{-12}
Pulse-per-Second Accuracy	$< \pm$ 100 ns	$< \pm$ 100 ns	$< \pm$ 50 ns	$< \pm$ 50 ns	$< \pm$ 50 ns	$< \pm$ 50 ns
Phase Noise	1 Hz: -60 dBc/Hz 10 Hz: -90 dBc/Hz 100 Hz: -120 dBc/Hz 1kHz: -130 dBc/Hz	1 Hz: -60 dBc/Hz 10 Hz: -90 dBc/Hz 100 Hz: -120 dBc/Hz 1kHz: -130 dBc/Hz	1 Hz: -70 dBc/Hz 10 Hz: -105 dBc/Hz 100 Hz: -125 dBc/Hz 1kHz: -140 dBc/Hz	1 Hz: -75 dBc/Hz 10 Hz: -110 dBc/Hz 100 Hz: -130 dBc/Hz 1kHz: -140 dBc/Hz	1 Hz: -85 dBc/Hz 10 Hz: -115 dBc/Hz 100 Hz: -130 dBc/Hz 1kHz: -140 dBc/Hz	1 Hz: -80 dBc/Hz 10 Hz: -110 dBc/Hz 100 Hz: -125 dBc/Hz 1kHz: -135 dBc/Hz
Frequency Accuracy in Free-Run Mode (1 Day)	$\pm 1 \times 10^{-7}$ ± 1 Hz	$\pm 2 \times 10^{-8}$ ± 0.2 Hz	$\pm 5 \times 10^{-9}$ ± 50 mHz	$\pm 1.5 \times 10^{-9}$ ± 15 mHz	$\pm 5 \times 10^{-10}$ ± 5 mHz	$\pm 1 \times 10^{-10}$ ± 1 mHz
Frequency Accuracy in Free-Run Mode (1 Year)	$\pm 1 \times 10^{-6}$ ± 10 Hz	$\pm 4 \times 10^{-7}$ ± 4 Hz	$\pm 2 \times 10^{-7}$ ± 2 Hz	$\pm 1 \times 10^{-7}$ ± 1 Hz	$\pm 5 \times 10^{-8}$ ± 0.5 Hz	$\pm 1 \times 10^{-8}$ ± 0.1 Hz
Frequency Accuracy with GPS Synchronization	$\pm 1 \times 10^{-11}$	$\pm 1 \times 10^{-11}$	$\pm 1 \times 10^{-11}$	$\pm 5 \times 10^{-12}$	$\pm 1 \times 10^{-12}$	$\pm 1 \times 10^{-12}$
Time-of-Day Accuracy in Free-Run Mode (1 Day)	± 4.3 ms	± 865 µs	± 220 µs	± 65 µs	± 22 µs	± 4.5 µs
Time-of-Day Accuracy in Free-Run Mode (7 Days)	± 128 ms	± 32 ms	± 9.2 ms	± 2.9 ms	± 1.0 ms	± 204 µs
Time-of-Day Accuracy in Free-Run Mode (30 Days)	± 1.1 s	± 330 ms	± 120 ms	± 44 ms	± 16 ms	± 3.3 ms
Time-of-Day Accuracy in Free-Run Mode (1 Year)	± 16 s	± 6.3 s	± 4.7 s	± 1.6 s	± 788 ms	± 158 ms
Temperature-Dependent Drift in Free-Run Mode	$\pm 1 \times 10^{-6}$ (–20 to 70 °C)	$\pm 2 \times 10^{-7}$ (0 to 60 °C)	$\pm 1 \times 10^{-7}$ (–10 to 70 °C)	$\pm 5 \times 10^{-8}$ (–20 to 70 °C)	$\pm 1 \times 10^{-8}$ (5 to 70 °C)	$\pm 2 \times 10^{-10}$ (5 to 70 °C)

11.3 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 ± 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

11.4 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

11.5 How Satellite Navigation Works

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

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

Satellite Systems

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

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

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

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

11.5.1 Time Zones and Daylight Saving Time

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

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

11.6 Time String Formats

11.6.1 Meinberg Standard Time String

The Meinberg Standard Time String is a sequence of 32 ASCII characters starting with the `<STX>` (Start-of-Text) character and ending with the `<ETX>` (End-of-Text) character. The format is as follows:

`<STX>D:`*`dd.mm.yy`*`;`*`T:w`*`;`*`U:hh.mm.ss`*`;`*`uvxy`*`<ETX>`

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

`<STX>`	Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second		
`dd.mm.yy`	The date:		
	`dd`	Day of Month	(01–31)
	`mm`	Month	(01–12)
	`yy`	Year of the Century	(00–99)
`w`	The day of the week		(1–7, 1 = Monday)
`hh.mm.ss`	The time:		
	`hh`	Hours	(00–23)
	`mm`	Minutes	(00–59)
	`ss`	Seconds	(00–59, or 60 during leap second)
`uv`	Clock status characters (depending on clock type):		
	u:	‘`#`’	GPS: Clock is in free-run mode (no exact synchronization) PZF: Time frame not synchronized DCF77: Clock has not synchronized since last reset
	‘ ‘	(space, 20h) GPS: Clock is synchronized (base accuracy is reached) PZF: Time frame is synchronized DCF77: Clock has synchronized since last reset	
	v:	‘`*`’ GPS: Receiver has not checked its position PZF/DCF77: Clock currently running off XTAL	
	‘ ‘	(space, 20h) GPS: Receiver has determined its position PZF/DCF77: Clock is synchronized with transmitter	
`x`	Time zone indicator:		
	‘`U`’	UTC	Universal Time Coordinated, formerly GMT
	‘ ‘	CET	European Standard Time, daylight saving disabled
	‘`S`’	(CEST) European	Summertime, daylight saving enabled
`y`	Announcement of clock jump during last hour before jump enters effect:		
		‘`!`’	Announcement of start or end of Daylight Saving Time
		‘`A`’	Announcement of leap second insertion
		‘ ‘	(Space, 20h) nothing announced
`<ETX>`	End-of-Text, ASCII code 03h		

11.6.2 Meinberg GPS Time String

The Meinberg GPS Time String is a sequence of 36 ASCII characters starting with the <STX> (Start-of-Text) character and ending with the <ETX> (End-of-Text) character. Unlike the Meinberg Standard Time String, the Meinberg GPS Time String does not carry any local time zone or UTC data; it simply carries the direct GPS time without any conversion into UTC. The format is as follows:

<STX>D:*dd.mm.yy;T:w;U:hh.mm.ss;uvGy;lll*<ETX>

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

<STX> Start-of-Text, ASCII code 02h

dd.mm.yy The date:

dd	Day of Month	(01–31)
mm	Month	(01–12)
yy	Year of the Century	(00–99)

w the day of the week (1–7, 1 = Monday)

hh.mm.ss the current time:

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

uv Clock status characters:

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

G 'GPS time' time zone indicator

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

'A'	Announcement of leap second insertion
' '	(Space, 20h) nothing announced

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

<ETX> End-of-Text, ASCII code 03h

11.6.3 Meinberg Capture String

The Meinberg Capture String is a sequence of 31 ASCII characters terminated by a `<CR><LF>` (Carriage Return/Line Feed) sequence. The format is as follows:

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

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

`x`	0 or 1 corresponding on the number of the capture input		
`<SP>`	Space, ASCII code 20h		
`dd.mm.yy`	Capture date:		
	`dd`	Day of Month	(01–31)
	`mm`	Month	(01–12)
	`yy`	Year of the Century	(00–99)
`hh:mm:ss.fffffff`	Capture time:		
	`hh`	Hours	(00–23)
	`mm`	Minutes	(00–59)
	`ss`	Seconds	(00–59, or 60 during leap second)
	`fffffff`	Fractions of second, 7 digits	
`<CR>`	Carriage Return, ASCII code 0Dh		
`<LF>`	Line Feed, ASCII code 0Ah		

11.6.4 ATIS Time String

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

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

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

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

11.6.5 SAT Time String

The SAT Time String is a sequence of 29 ASCII characters starting with the `<STX>` (start-of-text) character and ending with the `<ETX>` (end-of-text) character. The format is as follows:

`<STX>`*dd.mm.yy/w/hh:mm:ssxxxxuv*`<ETX>`

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

`<STX>`	Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second		
`dd.mm.yy`	The date:		
	dd	Day of Month	(01–31)
	mm	Month	(01–12)
	yy	Year of the Century	(00–99)
`w`	The day of the week	(1–7, 1 = Monday)	
`hh:mm:ss`	The time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
`xxxx`	Time zone indicator:		
	'UTC'	Universal Time Coordinated, formerly GMT	
	'CET'	European Standard Time, daylight saving disabled	
	'CEST'	European Summertime, daylight saving enabled	
`u`	Clock status characters:		
	'#'	Clock has not synchronized since last reset	
	' '	(Space, 20h) Clock has synchronized since last reset	
`v`	Announcement of clock jump during last hour before jump enters effect:		
	'!'	Announcement of start or end of Daylight Saving Time	
	' '	(Space, 20h) nothing announced	
`<CR>`	Carriage Return, ASCII code 0Dh		
`<LF>`	Line Feed, ASCII code 0Ah		
`<ETX>`	End-of-Text, ASCII code 03h		

11.6.6 Uni Erlangen String (NTP)

The Uni Erlangen String (NTP) of a GPS clock is a sequence of 66 ASCII characters starting with the <STX> (start-of-text) character and ending with the <ETX> (end-of-text) character. The format is as follows:

<STX>*dd.mm.yy; w; hh:mm:ss; voo:oo; acdfg i;bbb.bbbbn lll.lllle hhhhm*<ETX>

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

<STX> Start-of-Text, ASCII code 02h sent with one-bit accuracy at the change of each second

dd.mm.yy The date:

dd	Day of Month	(01–31)
mm	Month	(01–12)
yy	Year of Century	(00–99)

w Day of the week (1–7, 1 = Monday)

hh.mm.ss The time:

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

v -/+ sign of the offset of local timezone relative to UTC

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

ac Clock status characters:

a:	'#'	Clock has not synchronized since reset
	' '	(Space, 20h) Clock has synchronized since reset
c:	'*'	GPS receiver has not checked its position
	' '	(Space, 20h) GPS receiver has determined its position

d Time zone indicator:

'S'	CEST	European Summertime, Daylight Saving Time enabled
' '	CET	European Standard Time, Daylight Saving Time disabled

f Announcement of clock jump during last hour before jump enters effect:

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

g Announcement of clock jump during last hour before jump enters effect:

'A'	Announcement of leap second insertion
' '	(Space, 20h) nothing announced

i Leap second insertion

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

bbb.bbbb Geographical latitude of receiver position in degrees
Leading characters padded by Space characters (20h)

`n` Latitudinal hemisphere, with the following characters possible:
- 'N' North of Equator
- 'S' South of Equator

`lll.llll` Geographical longitude of receiver position in degrees
Leading characters padded by Space characters (20h)

`e` Longitudinal hemisphere, with the following characters possible:
- 'E' East of Greenwich Meridian
- 'W' West of Greenwich Meridian

`hhhh` Altitude above WGS84 ellipsoid in meters
Leading characters padded by Space characters (20h)

`<ETX>` End-of-Text, ASCII code 03h

11.6.7 NMEA 0183 String (RMC)

The NMEA 0183 RMC String is a sequence of 65 ASCII characters starting with the string '$GPRMC' and ending with the characters `<CR>` (Carriage Return) and `<LF>` (Line Feed). The format is as follows:

`$GPRMC,`*`hhmmss.ff,A,bbbb.bb,n,lllll.ll,e,0.0,0.0,ddmmyy,0.0,a*hh`*`<CR><LF>`

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

`$`	Start character, ASCII code 24h sent with one-bit accuracy at the change of each second		
`GP`	Talker ID, in this case "GP" for GPS		
`RMC`	Message type ID, in this case "RMC"		
`hhmmss.ss`	The time:		
	`hh`	Hours	(00–23)
	`mm`	Minutes	(00–59)
	`ss`	Seconds	(00–59, or 60 during leap second)
	`ff`	Fractions of Seconds	(1/10 ; 1/100)
`A`	Status (A = Time Data Valid, V = Time Data not Valid)		
`bbbb.bb`	Geographical latitude of receiver position in degrees Leading characters padded by space characters (ASCII code 20h)		
`n`	Latitudinal hemisphere, with the following characters possible:		
	"`N`"	North of Equator	
	"`S`"	South of Equator	
`lllll.ll`	Geographical longitude of receiver position in degrees Leading characters padded by space characters (ASCII code 20h)		
`e`	Longitudinal hemisphere, with following characters possible:		
	"`E`"	East of Greenwich Meridian	
	"`W`"	West of Greenwich Meridian	
`0.0,0.0`	Speed over the ground in knots and track angle in degrees. With a Meinberg GPS clock, these values are always 0.0, With GNS clocks, the values are calculated by the receiver for mobile applications		
`ddmmyy`	The date:		
	`dd`	Day of Month	(01–31)
	`mm`	Month	(01–12)
	`yy`	Year of the Century	(00–99)
`a`	Magnetic Variation E/W		
`hh`	Checksum (XOR of all characters except "`$`" and "`*`")		
`<CR>`	Carriage Return, ASCII code 0Dh		
`<LF>`	Line Feed, ASCII code 0Ah		

11.6.8 NMEA 0183 String (GGA)

The NMEA 0193 GGA String is a sequence of characters starting with the string "$GPGGA" and ending with the characters <CR> (Carriage Return) and <LF> (Line Feed). The format is as follows:

```
$GPGGA,hhmmss.ff,bbbb.bbbbb,n,lllll.ll,e,A,vv,hhh.h,aaa.a,M,
ggg.g,M,,0*cs<CR><LF>
```

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

`$`	Start character, ASCII code 24h sent with one-bit accuracy at the change of each second
`GP`	Talker ID, in this case "GP" for GPS
`GGA`	Message type ID, in this case "GGA"
`hhmmss.ss`	The time: *hh* Hours (00–23) *mm* Minutes (00–59) *ss* Seconds (00–59, or 60 while leap second) *ff* Fractions of Seconds (1/10 ; 1/100)
`bbbb.bbbbb`	Geographical latitude of receiver position in degrees Leading characters padded by space characters (ASCII code 20h)
`n`	Latitudinal hemisphere, with the following characters possible: "N" North of Equator "S" South of Equator
`lllll.lllll`	Geographical longitude of receiver position in degrees Leading characters padded by space characters (20h)
`e`	Longitudinal hemisphere, with following characters possible: "E" East of Greenwich Meridian "W" West of Greenwich Meridian
`A`	Position fixed (1 = yes, 0 = no)
`vv`	Number of satellites used (0–12)
`hhh.h`	HDOP (Horizontal Dilution of Precision)
`aaa.h`	Mean Sea Level Altitude (MSL Altitude = WGS84 Altitude - Geoid Separation)
`M`	Meters (unit as fixed value)
`ggg.g`	Geoid Separation (WGS84 Altitude - MSL Altitude)
`M`	Meters (unit as fixed value)
`cs`	Checksum (XOR of all characters except "$" and "*")
`<CR>`	Carriage Return, ASCII code 0Dh
`<LF>`	Line Feed, ASCII code 0Ah

11.6.9 NMEA 0183 String (ZDA)

The NMEA 0183 ZDA String is a sequence of 38 ASCII characters starting with the string "$GPZDA" and ending with the characters <CR> (Carriage Return) and <LF> (Line Feed). The format is:

$GPZDA,*hhmmss.ss*,*dd*,*mm*,*yyyy*,*HH*,*II***cs*<CR><LF>

ZDA - Time and Date: UTC, day, month, year, and local time zone.

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

$	Start character, ASCII Code 24h sent with one-bit accuracy at change of second		
hhmmss.ss	UTC time:		
	hh	Hours	(00–23)
	mm	Minutes	(00–59)
	ss	Seconds	(00–59, or 60 during leap second)
HH,II	The local time zone (offset to UTC):		
	HH	Hours	(00–±13)
	II	Minutes	(00–59)
dd,mm,yy	The date:		
	dd	Day of Month	(01–31)
	mm	Month	(01–12)
	yyyy	Year	(0000–9999)
cs	Checksum (XOR of all characters except "$" and "*")		
<CR>	Carriage Return, ASCII code 0Dh		
<LF>	Line Feed, ASCII code 0Ah		

11.6.10 ABB SPA Time String

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

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

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

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

11.6.11 Computime Time String

The Computime time string is a sequence of 24 ASCII characters, starting with the character `T` and terminated with the character `<LF>` (Line Feed, ASCII code 0Ah). The format is as follows:

`T:`*`yy:mm:dd:ww:hh:mm:ss`*`<CR><LF>`

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

`T`	Start character Sent with 1-bit accuracy at the start of the second.		
`yy:mm:dd`	The current date:		
	`yy`	Year without century	(00–99)
	`mm`	Month	(01–12)
	`dd`	Day of the month	(01–31)
	`ww`	Day of the week	(1–7, 1 = Monday)
`hh:mm:ss`	The current time:		
	`hh`	Hours	(00–23)
	`mm`	Minutes	(00–59)
	`ss`	Seconds	(00–59, or 60 during leap second)
`<CR>`	Carriage Return (ASCII code 0Dh)		
`<LF>`	Line Feed (ASCII code 0Ah)		

11.6.12 RACAL Standard Time String

The RACAL Standard Time String is a sequence of 16 ASCII characters started by a `X` character and terminated by the `<CR>` (Carriage Return, ASCII code 0Dh) character. The format is as follows:

`XGU`*yymmddhhmmss*`<CR>`

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

`X`	Start character, ASCII code 58h Sent with one-bit accuracy at the change of each second		
`G`	Control character, ASCII code 47h		
`U`	Control character, ASCII code 55h		
`yymmdd`	Current date:		
	`yy`	Year of Century	(00–99)
	`mm`	Month	(01–12)
	`dd`	Day of Month	(01–31)
`hh:mm:ss`	Current time:		
	`hh`	Hours	(00–23)
	`mm`	Minutes	(00–59)
	`ss`	Seconds	(00–59, or 60 during leap second)
`<CR>`	Carriage Return, ASCII code 0Dh		

11.6.13 SYSPLEX-1 Time String

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

> **Important!**
>
> To ensure that the time string can be correctly output and displayed through any given terminal program, a singular "C" (not include quotation marks) must be input.

The format is:

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

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

`<SOH>`	Start-of-Header, ASCII code 01h sent with one-bit accuracy at the change of each second			
`ddd`	Day of Year		(001–366)	
`hh:mm:ss`	Current time:			
	`hh`	Hours	(00–23)	
	`mm`	Minutes	(00–59)	
	`ss`	Seconds	(00–59, or 60 during leap second)	
	`q`	Quality Indicator	Space (ASCII code 20h)	Time Sync (GPS Lock)
			"?" (ASCII code 3Fh)	No Time Sync (GPS Fail)
`<CR>`	Carriage Return (ASCII code 0Dh)			
`<LF>`	Line Feed (ASCII code 0Ah)			

11.6.14 ION Time String

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

`<SOH>`*`ddd:hh:mm:ssq`*`<CR><LF>`

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

`<SOH>`	Start of Header (ASCII code 01h) sent with one-bit accuracy at the change of each second			
`ddd`	Day of Year		(001–366)	
`hh:mm:ss`	Current time:			
	`hh`	Hours	(00–23)	
	`mm`	Minutes	(00–59)	
	`ss`	Seconds	(00–59, or 60 while leap second)	
	`q`	Quality		
		Indicator	Space (ASCII code 20h)	Time Sync (GPS Lock)
			"?" (ASCII code 3Fh)	No Time Sync (GPS Fail)
`<CR>`	Carriage Return (ASCII code 0Dh)			
`<LF>`	Line Feed (ASCII code 0Ah)			

11.6.15 ION Blanked Time String

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

<SOH>ddd:hh:mm:ssq<CR><LF>

Important!

The blanking interval of is 2 minutes and 30 seconds long and is added every 5 minutes.

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

<SOH>	Start of Header (ASCII code 01h) sent with one-bit accuracy at the change of each second			
ddd	Day of Year		(001–366)	
hh:mm:ss	Current time:			
	hh	Hours	(00–23)	
	mm	Minutes	(00–59)	
	ss	Seconds	(00–59, or 60 while leap second)	
	q	Quality Indicator	Space (ASCII code 20h)	Time Sync (GPS Lock)
			"?" (ASCII code 3Fh)	No Time Sync (GPS Fail)
<CR>	Carriage Return (ASCII code 0Dh)			
<LF>	Line Feed (ASCII code 0Ah)			

11.6.16 IRIG-J Timecode

The IRIG-J timecode consists of a string of ASCII characters sent in "701" format, i.e.,:

- 1 Start Bit
- 7 Data Bits
- 1 Parity Bit (odd)
- 1 Stop Bit

The on-time marker of the string is the leading edge of the start bit. The timecode consists of 15 characters, sent once per second at a baud rate of 300 or greater. The format is as follows:

`<SOH>`*`DDD:HH:MM:SS`*`<CR><LF>`

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

`<SOH>`	"Start of Header" (ASCII code 01h)
`DDD`	Day of the year (ordinal date, 1–366)
`HH`, `MM`, `SS`	Time of the start bit, specified in hours (`HH`), minutes (`MM`), seconds (`SS`)
`<CR>`	"Carriage Return" (ASCII code 0Dh)
`<LF>`	"Line Feed" (ASCII code 0Ah)

11.6.17 6021 Time String

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

It is broadly identical to the **Freelance Time String** (see Chapter **11.6.18**), but with a different order to the termination sequence.

The format is as follows:

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

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

`<STX>` Start-of-Text, ASCII code 02h

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

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

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

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

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

`hhmmss` Current time:

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

`ddmmyy` Current date:

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

`<LF>` Line Feed (ASCII code 0Ah)

`<CR>` Carriage Return (ASCII code 0Dh)

`<ETX>` End-of-Text (ASCII code 03h)

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

11.6.18 Freelance Time String

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

It is broadly identical to the **6021 Time String** (see Chapter **11.6.17**), but with a different order to the termination sequence.

The format is as follows:

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

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

`<STX>` Start-of-Text, ASCII code 02h

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

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

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

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

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

`hhmmss` Current time:

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

`ddmmyy` Current date:

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

`<CR>` Carriage Return (ASCII code 0Dh)

`<LF>` Line Feed (ASCII code 0Ah)

`<ETX>` End-of-Text (ASCII code 03h)

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

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

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

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

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

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

11.6.20 CISCO ASCII Time String

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

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

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

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

11.6.21 NTP Type 4 Time String

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

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

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

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

11.7 Programmable Pulse Signal Types

Meinberg systems with programmable pulse outputs provide the following signal options; the actual range of available signal options will vary from system to system:

Idle

Selecting "**Idle**" disables that specific output.

Timer

In "**Timer**" mode, the output simulates a timer with a fixed daily schedule. It is possible to configure three switch-on and three switch-off days for each day and each output. In order to set a timer, both the switch-on time ("**ON**") and the corresponding switch-off time ("**OFF**") must be set. If the switch-on time is later than the switch-off time, the switching scheduler will interpret this to mean that the switch-off time is on the next day, which will keep the signal enabled through midnight.

Thus, if a program was set with a switch-on time of *23:45:00* and a switch-off time of *0:30:00*, this would cause the output to be enabled on day *n* at 11:45 p.m., and then to be disabled on day *n+1* at 12:30 a.m. If any of these three programs are to be left disabled, simply enter the same times into the **ON** and **OFF** fields. The "**Signal**" selector specifies the active state for the timer periods. Selecting "*Normal*" will put the output in a low state outside of switch-on periods and in a high state during switch-on periods ("active high"). Conversely, selecting "*Inverted*" will place the output in a high state outside of switch-on periods and in a low state during switch-on periods ("active low").

Single Shot

"**Single Shot**" mode generates a single pulse of defined length once per day. The time of day when the pulse is to be generated can be set via the "**Time**" value. The value "**Length**" allows the pulse length to be set in 10 ms increments and may be any value in the range of *10 ms* to *10 s*. Entries that are not multiples of 10 ms will be rounded down.

Cyclic Pulse

"**Cyclic Pulse**" mode is used to generate cyclically repeating pulses. The time between two pulses is defined, and this value must always be provided in hours, minutes, and seconds. It is important to note that the pulse train is always synchronized with 0:00.00 local time, so that the first pulse on any given day will always be output at midnight, and is repeated at the specified cycle interval henceforth. Thus, if a cycle duration of *2 s* is specified, this will result in pulses being triggered at 0:00.00, 0:00.02, 0:00.04 and so on. While it is possible to set any cycle time between 0 and 24 hours, these repetitions are usually only useful if the time between pulses is always the same. For example, if a cycle time of *1:45.00* is set, this will output pulses at intervals of 6300 seconds. However, between the last pulse of any given day and the pulse at midnight on the following day, there will be an interval of just 4500 seconds.

Pulse Per Second, Per Min, Per Hour

These modes generate pulses of defined length once per second, once per minute, or once per hour. The configuration options for all three modes are the same. The value "**Pulse Length**" specifies the length of the pulse and can be between *10 ms* and *10 s*.

DCF77 Marks

In "**DCF77 Marks**" mode the selected output simulates the time string transmitted by the German DCF77 time code transmitter. The output pulses are the 100 ms and 200 ms pulses (logical 0/1) typical for the DCF77 code. The absence of the 59-second marker is used to signal the start of a new minute.

DCF77-like M59

Sends a 500 ms pulse at the 59-second mark.

The "**Timeout**" field can be used to enter how many minutes the system should wait while in free-run mode before DCF77 simulation is suspended. Entering *0* here will disable the timeout function, so that the DCF77 simulation will continue running perpetually until manually disabled.

Position OK, Time Sync, All Sync

There are three different modes available for outputting the synchronization status of the clock. The "**Position OK**" mode outputs a signal through the output whenever the GPS receiver is receiving enough satellites to determine its position.

In "**Time Sync**" mode, a signal is only passed through the output as long as the clock's internal timebase is synchronized to GPS Time. The "**All Sync**" mode requires both of the above states to be true—for a signal to be passed through the output, there must be sufficient satellites for positioning, and the internal timebase must be synchronized to GPS Time.

DCLS Time Code

DC level shift time code. The time code output here is configured in the "**Clock → IRIG Settings**" section of the Web Interface.

1 MHz Frequency, 5 MHz Frequency, 10 MHz Frequency

This mode is used to output a fixed frequency of 1, 5, or 10 MHz respectively, using a PPS signal as an absolute phase reference (i.e., the falling edge of the signal is synchronized with the rising edge of the PPS signal).

Synthesizer Frequency

This mode is used to output a custom frequency, which is defined using the "**Clock → Synthesizer**" section of the Web Interface.

PTTI 1PPS

This mode is used to pass a PPS signal of 20 μs length through the output.

12 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.

13 Declaration of Conformity for Operation in the European Union

EU-Konformitätserklärung
Doc ID: GPS183SV - Eurocard-May 21, 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*	**GPS183SV - Eurocard**

auf das sich diese Erklärung bezieht, mit den folgenden Normen und Richtlinien übereinstimmt:
to which this declaration relates is in conformity with the following standards and provisions of the directives:

RED – Richtlinie *RED Directive* 2014/53/EU	ETSI EN 303 413 V1.2.1 (2021-04)
EMV – Richtlinie *EMC Directive* 2014/30/EU	ETSI EN 301 489-1 V2.2.3 (2019-11) ETSI EN 301 489-19 V2.2.1 (2022-09) DIN EN IEC 61000-6-2:2019 DIN EN IEC 61000-6-3:2021 DIN EN 55032:2015/AC:2016/A11:2020/A1:2020 DIN EN 55035:2017/A11:2020
Niederspannungsrichtlinie *Low Voltage Directive* 2014/35/EU	DIN EN IEC 62368-1:2020/A11:2020
RoHS – Richtlinie *RoHS Directive* 2011/65/EU + 2015/863/EU	DIN EN IEC 63000:2018

Bad Pyrmont, den May 21, 2024

MEINBERG
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Lange Wand 9
31812 Bad Pyrmont

Aron Meinberg
Quality Management

14 Declaration of Conformity for Operation in the United Kingdom

UK Declaration of Conformity

Doc ID: GPS183SV - Eurocard-May 21, 2024

Manufacturer

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

declares that the product

Product Designation **GPS183SV - Eurocard**

to which this declaration relates, is in conformity with the following standards and provisions of the following regulations under British law:

Radio Equipment Regulations 2017 (as amended) *SI 2017/1206*	ETSI EN 303 413 V1.2.1 (2021-04)
Electromagnetic Compatibility Regulations 2016 (as amended) *SI 2016/1091*	ETSI EN 301 489-1 V2.2.3 (2019-11) ETSI EN 301 489-19 V2.2.1 (2022-09) EN IEC 61000-6-2:2019 EN IEC 61000-6-3:2021 EN 55032:2015/AC:2016/A11:2020/A1:2020 EN 55035:2017/A11:2020
Electrical Equipment (Safety) Regulations 2016 (as amended) *SI 2016/1101*	EN IEC 62368-1:2020/A11:2020
The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012 (as amended) *SI 2012/3032*	EN IEC 63000:2018

Bad Pyrmont, Germany, dated May 21, 2024

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