

The Synchronization Experts.



## MANUAL

## **GPS180PEX**

Satellite controlled Radio Clock

21st October 2020

Meinberg Funkuhren GmbH & Co. KG

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## 1 Imprint

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## 2 Important Safety Information

## 2.1 Important Safety Instructions and Protective Measures

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



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

# CE

The device satisfies the requirements of the following EU regulations: EMC-Directive, Low Voltage Directive, RoHS Directive and – if applicable – the Radio Equipment Directive.

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



### DANGER!

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



### WARNING!

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



### CAUTION!

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



### ATTENTION!

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

## 2.2 Used Symbols

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

Symbol	Beschreibung / Description
	IEC 60417-5031
	Gleichstrom / Direct current
$\sim$	IEC 60417-5032
	Wechselstrom / Alternating current
	IEC 60417-5017
	Erdungsanschluss / Earth (ground) terminal
$\bigcirc$	IEC 60417-5019
	Schutzleiteranschluss / Protective earth (ground) terminal
$\wedge$	ISO 7000-0434A
	Vorsicht / Caution
$\wedge$	IEC 60417-6042
$\overline{1}$	Vorsicht, Risiko eines elektrischen Schlages / Caution, risk of electric shock
	IEC 60417-5041
<u>\m\</u>	Vorsicht, heiße Oberfläche / Caution, hot surface
	IEC 60417-6056
<u>/86/</u>	Vorsicht, Gefährlich sich bewegende Teile / Caution, moving fan blades
	IEC 60417-6172
	Trennen Sie alle Netzstecker / Disconnection, all power plugs
	IEC 60417-5134
	Elektrostatisch gefährdete Bauteile / Electrostatic Sensitive Devices
	IEC 60417-6222
	Information generell / Information general
	2012/19/EU
	Dieses Produkt fällt unter die B2B Kategorie. Zur Entsorgung muss es an den
	Hersteller übergeben werden.
	This product is handled as a B2B category product. In order to secure a WEEE
	compliant waste disposal it has to be returned to the manufacturer.

The manuals for a product are included in the scope of delivery of the device on a USB stick. The manuals can also be obtained via the Internet. Enter www.meinbergglobal.com into your browser, then enter the corresponding device name in the search field at the top.



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

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

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

Please keep this manual in a safe place.

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

## 2.3 Security during Installation



### WARNING!

### Preparing for Commissioning

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

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

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

### Transport, Unpacking, Installation

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

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

The fire protection must be ensured in the installed state.

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

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

The device must be protected against mechanical stress such as vibration or shock.

### Connecting Data Cables

During a thunderstorm, data transmission lines must not be connected or disconnected (risk of lightning).

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

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

### Connecting Power Supply

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

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

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

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

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

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

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

The power supply should be connected with a short, low-inductance line.

## 2.4 Safety during Operation



### WARNING!

### Avoiding Short-Circuits

Make sure not to get any objects or liquids inside the unit. Electric shock or short circuit could result.

### Ventilation Slots

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

### Normal Operation

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



### Switch off in fault / service case

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

#### Follow the steps below:

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

## 2.5 Safety during Maintenance



## WARNING!

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

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

The service informs you which device parts may be installed.

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

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



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

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

## 2.6 Handling Batteries



### CAUTION!

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

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

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

When disposing used batteries, observe the local regulations for the disposal of hazardous waste.

## 2.7 Cleaning and Care



## ATTENTION!

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

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

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

## 2.8 Prevention of ESD Damage



### ATTENTION!

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



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

Prepare removal and installation of assemblies

Unload yourself (for example, by touching a grounded object) before touching assemblies.

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

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

Transporting Assemblies

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

#### Installing and Removing Assemblies

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

#### Storing Assemblies

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

ESD protective covers must not be low-resistance and metallically conductive if a lithium battery is installed on the assembly.

## 2.9 Return of Electrical and Electronic Equipment



## ATTENTION!

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

### Separate Collection

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



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

#### Return and Collection Systems

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

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

### Return of used Batteries

Batteries marked with one of the following symbols may not be disposed of together with the household waste according to the EU Directive.

## **3** General information

The satellite clocks made by Meinberg have been designed to provide extremely precise time to their users. The clocks have been developed for applications where conventional radio clocks can't meet the growing requirements in precision. High precision available 24 hours a day around the whole world is the main feature of the new system which receives its information from the satellites of the Global Positioning System.

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

GPS is based on accurately measuring the propagation time of signals transmitted from satellites to the user's receiver. A nominal constellation of 24 satellites together with some active spares in six orbital planes 20,000 km over ground provides a minimum of four satellites to be in view 24 hours a day at every point of the globe. Four satellites need to be received simultaneously if both receiver position (x, y, z) and receiver clock offset from GPS system time must be computed. All the satellites are monitored by control stations which determine the exact orbit parameters as well as the clock offset of the satellites' on-board atomic clocks. These parameters are uploaded to the satellites and become part of a navigation message which is retransmitted by the satellites in order to pass that information to the user's receiver.

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

## 4 Blockdiagramm GPS180PEX



## 5 Master oscillator

By default the GPS180PEX is equipped with a TCXO (Temperature Compensated Xtal Oscillator) as master oscillator to provide a good time accuracy and frequency stability. As long as an input signal is supplied the frequency of the oscillator is adjusted from the input signal, and if the input signal is disconnected afterwards the card can still provide accurate time for a certain holdover interval. Optionally the card can be ordered with an OCXO (Oven Controlled Xtal Oscillator) which provides even better frequency stability, and thus provides more accuracy over a longer holdover interval than the TCXO.

All internal timing as well as the output signals are derived from the oscillator. The last known good oscillator adjustment value is stored in non-volatile memory, and is used as default after power-up.

The oscillator's 10 MHz output frequency is also available with TTL level via at a ribbon cable connector.



Figure: GNS181PEX with TCXO Oscillator

## 6 **GPS180PEX** Features

The board GPS180PEX is designed as a "low profile" board for computers with PCI Express interface. The rear slot cover integrates the antenna connector, a BNC connector for modulated time codes, two status LEDs and a 9pin SUB-D male connector. The card can be equipped with the delivered low profile cover. The I/O signals, available over a D-Sub plugs (RS-232 – PPS, PPM), are not available in this case.

The antenna/converter unit is connected to the receiver by a  $50\Omega$  coaxial cable with length up to 300m (when using RG58 cable). Power is supplied to the unit DC insulated across the antenna cable. Optionally, an over voltage protection and an antenna distributor are available. The antenna distributor can be used to operate up to 4 Meinberg GPS receivers using a single antenna/converter unit.

The navigation message coming in from the satellites is decoded by satellite clock's microprocessor in order to track the GPS system time with an accuracy of better than 250nsec. Compensation of the RF signal's propagation delay is done by automatic determination of the receiver's position on the globe. A correction value computed from the satellites' navigation messages increases the accuracy of the board's temperature compensated master oscillator (TCXO) to +/- 5E-9 and automatically compensates the TCXO's aging. The last recent value is restored from the nonvolatile memory at power-up. Optionally, the clock is also available with a higher precision time base.

## 6.1 Time zone and daylight saving

GPS system time differs from the universal time scale (UTC) by the number of leap seconds which have been inserted into the UTC time scale after GPS has been initiated in 1980. The current number of leap seconds is part of the navigation message supplied by the satellites, so the satellite clock's internal real time is based on UTC. Conversion to local time including handling of daylight saving year by year can be done by the receiver's microprocessor. For Germany, the local time zone is UTC + 3600 sec for standard time and UTC + 7200 sec if daylight saving is in effect.

The clock's microprocessor determines the times for start and end of daylight saving time by a simple algorithm e. g. for Germany:

Start of DST is on the first Sunday after March, 25th, at 2 o'clock standard time. End of DST is on the first Sunday after October, 25th, at 3 o'clock daylight time.

The monitoring software shipped with the board can be used to configure the time zone and daylight savings parameters easily. Switching to daylight saving time is inhibited if for both start and end of daylight saving the parameters are exactly the same.

The timecode (IRIG, AFNOR, IEEE) generated by GPS180PEX is available with these settings or with UTC as reference. This can be set by the monitor program.

## 6.2 Serial interfaces

The radio clock provides two serial interfaces COM0 (standard port) and COM1 (MultiRef port), by default only COM0 is provided on the slot bracket of the card. Optionally also the COM1 can be led out over this D-Sub connector. To do this, the 10-pin socket on the ribbon cable must be switched to the other tub connector (MultiRef-Port).

By default, the configured telegram is only sent after the system is switched on and after the receiver has synchronized. However, the GPS180PEX can be configured with the help of the monitor program so that the telegram is output immediately after power-on.

Transmission speed, framing and mode of operation can be configured individually for each port. Both of the ports can be configured to transmit either time strings (once per second, once per minute, or on request with ASCII "?" only), or to transmit capture strings (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.

## **6.3** Time capture inputs

The board provides two time capture inputs called User Capture 0 and 1 (CAP0 and CAP1) which can be mapped to pins at the 9 pin connector at the rear panel. These inputs can be used 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, an ASCII string per capture event can be transmitted via COM1 or displayed using the monitoring program. 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 COM1 can be measured. The format of the output string is described in the technical specifications at the end of this document. 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 via COM1.

## 6.4 Pulse and frequency outputs

The pulse generator of the clock GPS180PEX contains three independent channels (PPO0, PPO1, PPO2). These TTL outputs can be mapped to pins at the 9-pin connector at the rear slot cover by using a DIP switch. The pulse generator is able to provide a multitude of different pulses, which are configured with the monitor program. The active state of each channel is invertible, the pulse duration settable between 10 msec and 10 sec in steps of 10 msec. In the default mode of operation the pulse outputs are disabled until the receiver has synchronized after power-up. However, the system can be configured to enable those outputs immediately after power-up.

### Synthesizer

The programmable pulse outputs are able to 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  $-360^{\circ}$  to  $+360^{\circ}$  for frequencies less than 10 kHz.

The following modes can be configured for each channel independently:

Timer mode:	Three on- and off-times per day per channel programmable		
Cyclic mode:	Generation of periodically repeated pulses. A cycle time of two seconds would generate a pulse at 0:00:00, 0:00:02, 0:00:04 etc.		
DCF77-Simulation mode:	The corresponding output simulates the DCF77 time telegram. The time marks are representing the local time as configured by the user.		
Single Shot Mode:	A single pulse of programmable length is generated once a day at a programmable point of time		
Per Sec., Per Min. Per Hr. modes:	Pulses each second, minute or hour		
Synthesizer	Frequency output 1/8 Hz up to 10 MHz		
Time Codes	Generation of Time Codes as described in chapter "Time Codes"		
Status:	<ul> <li>One of three status messages can be emitted:</li> <li>'position OK': The output is switched on if the receiver was able to compute its position</li> <li>'time sync': The output is switched on if the internal timing is synchronous to the GNSS-system</li> <li>'all sync': Logical AND of the above status messages. The output is active if position is calculated AND the timing is synchronized</li> </ul>		
Idle-mode: The output is inactive		nactive	

The default configuration for the pulse outputs is:

PPO0:	Pulse each second (PPS), active HIGH, pulse duration 200 msec
PPO1:	Pulse each minute (PPM), active HIGH, pulse duration 200 msec
PPO2:	DCF77 Simulation

A TTL level master frequency of 10 MHz is derived from the TCXO. By default, this frequency is available only at the 5 pin contact strip of the board.

## 6.5 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:



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 Connectors and LEDs in the rear slot cover





The coaxial antenna connector, two status LEDs and a 9 pin sub D connector can be found in the rear slot cover. (see figure). The upper, green LED (LOCK) is turned on when after power-up the receiver has acquired at least four satellites and has computed its position. In normal operation the receiver position is updated continuously as long as at least four satellites can be received.

The lower, red LED (FAIL) is turned on after power-up until the receiver has synchronized or if a severe error occurs during operation.

The 9 pin sub D connector is wired to the GPS180PEX's serial port COM0. Pin assignment can be seen from the figure beside. This port can not be used as serial port for the computer. Instead, it can be uses to send out Meinberg's standard time string to an external device.

A DIP switch on the board can be used to wire some TTL inputs or outputs (0..5V) to some connector pins. In this case, absolute care must be taken if another device is connected to the port, because voltage levels of -12V through +12V (as commonly used with RS-232 po rts) at TTL inputs or outputs may damage the radio clock.

## 7.1 Output of standard port signals

On delivery, the standard port is connected to the 9-pin connector on the front panel and the signals of the serial interface are led out. If another signal is to be led out, the corresponding switch of the **DIP 1 block** must be switched to ON. The table below shows the pin assignment of the connector and the assignment of the individual switches in the **DIP 1 block**.



Please note that pin 1, pin 4 and pin 7 of the 9-pin connector can be used for two different signals, but only one of the respective DIP switches can be set to the ON position:

DIP 2 block	DIP 1 block	Switch position
1 2 3 4 5 6 7 8 9 10	1 2 3 4 5 6 7 8 9 10	

N 1
N
l
I

The graphic shows all DIP switches on position "OFF". Please use the DIP-Schalter 1 on the right.

Those signals which do not have a lever of the DIP switch assigned are always available at the connector:

9pin D-SUB	Signal	Signal Level	DIP-Switch	
1	VCC out	+5 V	1	DIP 8 must be OFF
1	PPO_0 (PPS) out	RS232	8	DIP 1 must be OFF
2	RxD 0 in	RS232	-	
3	TxD 0 out	RS232	-	
4	PPO_1 (PPM) out	TTL	5	DIP 10 must be OFF
4	10 MHz out	TTL	10	DIP 5 must be OFF
5	GND	-	-	
6	CAP 0 in	TTL	2	
7	CAP 1 in	TTL	3	DIP 7 must be OFF
7	IRIG DC out	TTL into 50 ohm	7	DIP 3 must be OFF
8	PPO_0 (PPS) out	TTL	4	
9	PPO_2 (DCF) out	TTL	9	DIP 6 must be OFF
9	PPO_3 (DCF) out	TTL	6	DIP 9 must be OFF

## Standard Port

The default settings of the programmable pulse outputs of the GPS180PEX are set as follows:

PPO\_0: PPS Out - Pulse Per SecondPPO\_1: PPM Out - Pulse Per MinutePPO\_2: DCF Out - DCF77 SimulationPPO\_3: DCF Out - DCF77 Simulation

The following output signals can be selected using the supplied monitor program: Idle, Timer, Single Shot, Cyclic Pulse, Pulse Per Second, Pulse Per Minute, Pulse Per Hour, DCF77 Marks, Position OK, Time Sync, All Sync, DCLS Time Code and Synthesizer Frequency.

A detailed description of these signals can be found in the technical appendix of this manual.

## 7.2 Output of MultiRef-Port signals

### Connection of ribbon cable

To route the signals of the "MultiRef" port out on the 9-pin connector, the assembled ribbon cable must be plugged into the MuliRef tub connector.

If another signal is to be led out, the corresponding switch of the **DIP 2 block** must be switched to ON. The table below shows the pin assignment of the connector and the assignment of the individual switches in the **DIP 2 block**.



Please note that pin 4, pin 7 and pin 9 of the 9-pin connector can be used for two different signals, but only one of the respective DIP switches can be set to the ON position:



 Pin 4:
 DIP 5 or DIP 10 ON

 Pin 7:
 DIP 3 or DIP 7 ON

 Pin 9:
 DIP 6 or DIP 9 ON

The graphic shows all DIP switches on position "OFF". Please use the DIP 2 block on the left.

### D-SUB pin assignment

The following list shows the pin assignment and the necessary DIL-switch positions for the respective signals Some signals are only output when the specified DIL switch is set to "ON":

## **Multiref Port**

9pin D-SUB	Signal	Signal Level	DIP-Switch	
1	VCC out	+5V	1	
2	RxD1 in	RS232	-	
3	TxD1 out	RS232	-	
4	PPO_1 (PPM) out	TTL	5	DIP 10 must be OFF
4	10MHz out	TTL	10	DIP 5 must be OFF
5	GND	-	-	
6	CAP0 in	TTL	2	
7	PPS in	TTL	7	DIP 3 must be OFF
7	CAP1 in	TTL	3	DIP 7 must be OFF
8	PPO_0 (PPS) out	TTL	4	
9	10 MHz in	TTL	6	DIP 9 must be OFF
9	PPO_2 (DCF) out	TTL	9	DIP 6 must be OFF

## 7.3 PIN-assignment 10 pin. tub connector

### Connection of ribbon cable

The signals of the "Standard Port" are provided via a D-SUB connector which is led out in the slot bracket. The ribbon cable is included in the scope of delivery of the GPS180PEX.

If the cable (e.g. for the MultiRef port) is assembled by the user, one end of the ribbon cable must be connected to a 10-pin tub connector.



### pin assignment 10-pin tub connector

The following table lists the pin assignment of the tub connectors and helps you to assemble own cables.

## MultiRef + Standard-Port

PIN	MultiRef Port	Standard Port
1	GND	GND
2	PP2_Out	DCF_OUT/PP2_OUT
3	PP1_OUT/10 MHz Out	PP1_OUT/10 MHz Out
4	PP0_OUT	PP0_OUT
5	TxD1	TxD0
6	PPS_IN/USRCAP1_IN	USRCAP1_IN/TC-DCLS_OUT
7	RxD1	RxD0
8	USRCAP0_IN	USRCAP0_IN
9	+5 V / 10 MHz In	+5 V /PP0-RS232_OUT
10	TC_IN	N/C

## 8 Installation GPS Antenna



#### WARNING!

Antenna mounting without effective anti-fall protection

#### Danger to life due to fall!

- Pay attention to effective working safety when installing antennas!
- <u>Never</u> work without an effective anti-fall equipment!

### WARNING!

Working on the antenna system during thunderstorms



#### Danger to life due to electrical shock!

- Do <u>not</u> carry out any work on the antenna system or the antenna cable if there is a risk of a lightning strike.
- Do <u>not</u> carry out any work on the antenna system if the safety distance to free lines and sequential circuits is exceeded.

## Selection of the Antenna location

To receive enough satellites, select a location that allows an unobstructed view of the sky, otherwise there may be problems with the synchronization of the system. There should be no obstacle in the line of sight between the antenna and the satellites. In addition, the antenna must not be installed under high-voltage lines or other electrical light or electric circuits.

#### Installation conditions for optimal operation:

- $\bullet$  Free view from  $8^\circ$  above the horizon or
- Free view towards equator (if free view of 8° not possible) or
- Clear view between 55th southern and 55th northern latitude (satellite orbits).

If all of these views are restricted, complications can arise, because four satellites have to be located to calculate a new position.

## Antenna Mounting

### 1.

Mount the antenna at a distance of 50 cm from other antennas to a vertical pole up to 60 mm outer diameter or on a wall with the mounting kit included in the scope of delivery.

Now connect the antenna cable to the N-Norm connector of the antenna.  $\label{eq:Norm}$ 



Make sure that the maximum cable length is kept when installing the antenna cable between the antenna and receiver. This depends on the type of cable used (H155, RG58) and its attenuation factor.

## 2.

High voltage peaks (e.g. caused by lightning strikes) can be transmitted via the antenna cable and may cause damage to the receiver. The receiver is protected against these effects by using the MBG S-PRO surge protection.

Being installed in a waterproof housing, the MBG S-PRO is also suitable for outdoor installation. Meinberg recommends the indoor installation, as soon as possible after the antenna cable enters the building to minimize the risk of overvoltage damage, e.g. due to lightning strikes.



## 3.

To ground the antenna cable, connect the surge protection with a grounding cable to a equipotential bonding rail (see figure).

After installation, connect the other end of the antenna cable to the socket of the surge protection.



### 4.

The next step is to connect the supplied coaxial cable between the surge protector and receiver.



## Antenna splitter option

Several receivers can be connected to one antenna via the antenna splitter. Make sure, that the total length of a route going from the antenna via the splitter to the receiver, does not exceed the maximum cable length. The splitter may be installed at any position between the surge protector and the receiver.



## Compensation the signal propagation time of the antenna cable

The connected receiver must compensate the signal propagation time of the antenna cable, therefore you need to enter the length of the antenna cable in meters or the compensation time in nanoseconds into the settings of your receiver.

### Antenna Cable Length (m):

The receiving satellite signal is delayed by the used coaxial cable.

Cable	Delay	Usage
RG58U	5 ns/m	for GPS180 and GNS-UC
H155	4 ns/m	for GNS180 and GNM

By entering the cable length (from antenna to receiver), the system calculates the delay time and compensates it automatically. The default value of 20 m is preconfigured at delivery.

For other coaxial cable types please use the option **"by delay**". The delay must be calculated by yourself by using the information in the data sheet of the respective coaxial cable.

## 9 Powering up the system

### Installing the GPS180PEX in your computer

The computer has to be turned off and its case must be opened. The radio clock can be installed in any PCI Express slot not used yet. The rear plane must be removed before the board can be plugged in carefully. The computer's case should be closed again and the antenna can be connected to the coaxial plug at the clock's rear slot cover. After the computer has been restarted, the monitor software can be run in order to check the clock's configuration. The computer's case should be closed again and the algain and the antenna must be connected to the appropriate connector.

Every PCI Express board is a plug&play board. After power-up, the computer's BIOS assigns resources like I/O ports and interrupt numbers to the board, the user does not need to take care of the assignments. The programs shipped with the board retrieve the settings from the BIOS.

After the board has been mounted and the antenna has been connected, the system is ready to operate. About 10 seconds after power-up the receiver's TCXO 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 at least one minute after power-up. After 20 minutes of operation the TCXO has achieved its final accuracy 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 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 TCXO's output frequency has been adjusted. Up to that time accuracy of frequency drops to 10-8 reducing the accuracy of pulses to  $+-2\mu$ s.

## **10** Firmware updates

Whenever the on-board software must be upgraded or modified, the new firmware can be downloaded to the internal flash memory via the radio clock's serial port COM0. There is no need to open the computer case and insert a new EPROM.

A loader program shipped together with the file containing the image of the new firmware sends the new firmware from one of the computer's serial ports to the clock's serial port COM0. The contents of the program memory will not be modified until the loader program has sent the command to erase the flash memory. The system will be ready to operate again after the computer has been turned off and then on again.

## 11 Technical Specifications GPS180PEX

RECEIVER:	Twelve channel C/A code receiver with external antenna/converter unit		
ANTENNA:	Antenna/converter unit with remote power supply refer to chapter "Technical specifications of antenna"		
POWER SUPPLY FOR ANTENNA:	15 VDC, continuous short circuit protection, automatic recovery Isolation voltage 1000 VDC, provided via antenna cable		
ANTENNA INPUT:	Antenna circuit dc-insulated; dielectric strength: 1000V Length of cable: refer to chapter "Mounting the Antenna		
TIME TO SYNCHRONIZATION:	one minute with known receiver position and valid almanac 12 minutes if invalid battery buffered memory		
PULSE OUTPUTS:	three programmable outputs, TTL level Default settings: active only ,if sync' PPO_0: change of second (PPS) pulse duration 200 msec valid on rising edge PPO_1: change of minute (PPM) pulse duration 200 msec valid on rising edge PPO_2: DCF77 simulation		
	Synthesizer1/8 Hz to 10 MHz1/8 Hz to 10 kHz1/8 Hz to 10 kHz10 kHz to 10 MHzfrequency deviation < 0.0047 Hz		
ACCURACY OF PULSES:	better than +/- 2 $\mu$ sec during the first 20 minutes of operation better than +/- 100 nsec after synchronization and 20 minutes of operation better than +/- 50nsec with optional OCXO MQ/HQ (see oscillator options)		
TIME CAPTURE INPUTS:	triggered on falling TTL slope Interval of events: 1.5msec min., Resolution: 100ns		
FREQUENCY OUTPUTS:	10 MHz (TTL level)		
SYSTEM BUS INTERFACE:	Single lane (x1) PCI Express (PCIe) Interface compatible to PCI Express specifications r1.0a		
DATA FORMAT:	Binary, byte serial		
SERIAL PORTS:	2 asynchronous serial ports (RS-232) Baud Rate: 300 up to 19200 Framing: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1		
	default setting:		

	COM0: COM1:	19200, 8N1 Meinberg Standard time string, per second 9600, 8N1 Canture string, automatically
TIME CODE OUTPUTS:	Unbalanced modulate 3V <sub>PP</sub> (MARK), 1V <sub>PP</sub> (S	ed sine wave signal: PACE) into 50 ohm
	DCLS-signal: TTL in	nto 50 ohm, active-high or -low, selected by jumper
	optionally optical our optical power: optical connector:	tput(instead of modulated sine wave): typ. 15μW ST-connector for GI 50/125μm or GI 62,5/125μm gradient fiber
POWER REQUIREMENT:	+3.3 V: +12 V: power supplies provid	257 mA 230 mA ded by PCI Express interface
PHYSICAL DIMENSION:	low profile expansion	board (69 x 150 mm)
RF CONNECTOR:	female coaxial BNC-	connectors for antenna and modulated time code
AMBIENT TEMPERATURE:	0 50°C	
HUMIDITY:	85% max.	

### ACCURACY OF FREQUENCY AND PULSE OUTPUTS:

Oscillator Option	TCXO (standard)	ΟΟΧΟ LQ	OCXO MQ	осхо но
short term stability ( $\tau = 1$ sec)	2E-9	1E-9	2E-10	5E-12
accuracy of PPS (pulse per second)	< +/- 100 nsec	< +/- 100 nsec	< +/- 50 ns	< +/- 50 ns
phase noise	1 Hz -60 dBc/Hz 10 Hz -90 dBc/Hz 100 Hz -120 dBc/Hz 1 kHz -130 dBc/Hz	1 Hz -60 dBc/Hz 10 Hz -90 dBc/Hz 100 Hz -120 dBc/Hz 1 kHz -130 dBc/Hz	1Hz -75dBc/Hz 10Hz -110dBc/Hz 100Hz -130dBc/Hz 1kHz -140dBc/Hz	1Hz < -85dBc/Hz 10Hz < -115dBc/Hz 100Hz < -130dBc/Hz 1kHz < -140dBc/Hz
accuracy free run, one day	+/- 1E-7 +/- 1 Hz (Note 1)	+/- 2E-8 +/- 0,2 Hz (Note 1)	+/- 1,5E-9 +/- 15mHz (Note1)	+/- 5E-10 +/- 5mHz (Note1)
accuracy free run, one year	+/- 1E-6 +/- 10 Hz (Note 1)	+/- 4E-7 +/- 4 Hz (Note 1)	+/- 1E-7 +/- 1Hz (Note1)	+/- 5E-8 +/- 0.5Hz (Note1)
accuracy GPS-synchronous averaged 24 h	+/- 1E-11	+/- 1E-11	+/- 5E-12	+/- 1E-12
accuracy of time free run, one day	+/- 4.3 msec	+/- 865 μs	+/- 65 μs	+/- 22 μs
accuracy of time free run, one year	+/- 16 sec	+/- 6.3 sec	+/- 1.6 s	+/- 788 ms
temperature dependant drift, free run	+/- 1E-6 (-2070°C)	+/- 2 * 10 -7 (060°C)	+/- 5E-8 (-2070°C)	+/- 1E-8 (570°C)

Note 1:

The accuracy in Hertz is based on the standard frequency of 10 MHz.

For example: Accuracy of TCXO (free run one day) is +/- 1E-7 \* 10 MHz = +/- 1 Hz

The given values for the accuracy of frequency and time (not short term accuracy) are only valid for a constant ambient temperature ! A minimum time of 24h of GPS-synchronicity is required before free run starts.

GPS180PEX

## 12 Technical appendix GPS180PEX

## 12.1 Time codes

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 GPS170PEX 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. If desired other formats are available.

### 12.1.1 The time code generator

The board GPS180PEX generates modulated and un-modulated timecodes. Modulated signals are transmitting the information by varying the amplitude of a sine wave carrier, un-modulated timecodes are transmitted by pulse duration modulation of a DC-signal (TTL in case of GPS180PEX), see chapter "IRIG standard format" for details.

The sine wave carrier needed for modulated signals is generated in a digital way by a programmable logic device on the board. The frequency of this signal is derived from the main oscillator of GPS180PEX, which is disciplined by the satellite system.

This leads to a sine wave carrier with high accuracy. Transmission of date is synchronized by the PPS (pulse per second) derived from the satellite system. The modulated time code has an amplitude of  $3V_{PP}$  (MARK) and  $1V_{PP}$  (SPACE) into 50  $\Omega$ . The number of MARK-amplitudes within ten periods of the carrier defines the coding:

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

The DC-signal has the following pulse durations accordingly:

a) binary "0" : 2 msec b) binary "1" : 5 msec

c) position-identifier : 8 msec



## 12.1.2 IRIG Standard Format

## 12.1.3 AFNOR Standard Format



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 up to 59s before LS insertion
61	LS – Leap Second	$0 = add \ leap \ second, \ 1 = delete \ leap \ second \ _{1,j}$
62	DSP - Daylight Saving Pending	set up to 59s before daylight saving 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 from IRIG time to 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	time figure of merit represents approximated clock error. $\ensuremath{\scriptscriptstyle 2)}$
73	TFOM Time figure of merit	0x00 = clock locked, 0x0F = clock failed
74	TFOM Time figure of merit	
75	PARITY	parity on all preceding bits incl. IRIG-B time

## 12.1.4 Assignment of CF Segment in IEEE1344 Code

1.) current firmware does not support leap deletion of leap seconds

2.) TFOM is cleared, when clock is synchronized first after power up. see chapter Selection of generated timecode

### 12.1.5 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

### 12.1.6 Selection of time code

The selection of timecode is done by the monitor software.

The unmodulated time code can be delivered as an active-high (default) or activelow signal by setting a jumper on the board GPS180PEX into the appropriate position:



## 12.2 Time Strings

### 12.2.1 Format of the 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:

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

<st)< th=""><th>&lt;&gt;</th><th>Start-Of-Te</th><th colspan="3">-Text, ASCII Code 02h</th></st)<>	<>	Start-Of-Te	-Text, ASCII Code 02h		
dd mr		the current	dato:	j at change of second	
uu.mi	n.yy	dd mm yy the century	day of month month year of (0099)	(0131) (0112)	
W		the day of the week		(17, 1 = Monday)	
hh.mr	n.ss	the current	time:		
		hh mm ss	hours minutes seconds	(0023) (0059) (0059, or 60 while leap second)	
uv	clock st	tatus charact	ters (depending on	clock type):	
	u:	'#'	GPS: clock is rur PZF: time frame	nning free (without exact synchr.) not synchronized	
			DCF77: clock ha (space, 20h) CPS: clock is su	s not synchronized after reset	
			PZF: time frame DCF77: clock ha	is synchronized s synchronized after reset	
	V:	(*)	GPS: receiver has not checked its position		
			(space, 20h)		
			GPS: receiver ha	s determined its position	
			PZF/DCF//: clo	ck is syncronized with transmitter	
х	time zo	ne indicator:			
		'U' ' '	UTC CET 'S'	Universal Time Coordinated, formerly GMT European Standard Time, daylight saving disabled (CEST) European Summertime, daylight saving enabled	
y	anounc	ement of dis	continuity of time, '!' 'A'	enabled during last hour before discontinuity comes in effect: announcement of start or end of daylight saving time announcement of leap second insertion (space, 20h) nothing announced	

### 12.2.2 Format of the 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:

### <STX>dd.mm.yy/w/hh:mm:ssxxxuv<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></stx>	Start-Of-Text sending with	t, ASCII Code 02h one bit accuracy at ch	ange of second		
dd mm uu	the current date:				
uu	dd	day of month	(0131)		
	mm	month	(0112)		
	uu	uear of the centuru	(0099)		
	W	the day of the week	(17, 1 = Monday)		
hh:mm:ss	the current ti	me:			
	hh	hours	(0023)		
	mm	minutes	(0059)		
	SS	seconds	(0059, or 60 while leap second)		
xxxx	time zone indicator:				
	'UTC' Universal Time Coordinated, formerly GMT				
	'CET'	European Standard 7	Fime, daylight saving disabled		
	'CEST'	European Summertim	ne, daylight saving enabled		
u	clock status characters:				
	'#'	clock has not synchro	onized after reset		
		(space, 20h) clock ha	s synchronized after reset		
v	anouncement	of discontinuity of tim	e, enabled during last hour		
	before discontinuity comes in effect:				
	<u>'!'</u>	announcement of star	t or end of daylight saving time		
		(space, 20h) nothing	announced		
<cr></cr>	Carriage Return, ASCII Code 0Dh				
<lf></lf>	Line Feed, ASCII Code 0Ah				
<etx></etx>	End-Of-Text, ASCII Code 03h				

### 12.2.3 Format of the NMEA 0183 String (RMC)

The NMEA String is a sequence of 65 ASCII characters starting with the '\$GPRMC' character and ending with the characters CR (carriage return) and LF (line-feed). The format is:

### \$GPRMC,hhmmss.ss,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 numbers or letters where as the other characters are part of the time string. The groups of characters as defined below:

\$	Start character, ASCII Code 24h sending with one bit accuracy at change of second		
hhmmss.ss	the curr hh mm ss ss	rent time: hours minutes seconds seconds	(0023) (0059) (0059, or 60 while leap second) (1/10 ; 1/100)
А	Status	(A = time data	valid, $V =$ time data not valid)
bbbb.bb	latitude leading	of receiver positi signs are replac	tion in degrees ed by a space character (20h)
n	latitude 'N' 'S'	, the following cl north of equator south d. equato	haracters are possible: r r
шш.п	longitude of receiver position in degrees leading signs are replaced by a space character (20h)		
e	longitud 'E' 'W'	le, the following east of Greenwi west of Greenw	characters are possible: ch ich
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, in case of a GNS clock the values will be calculated by the receiver in mobile applications		
ddmmyy	the curr dd mm yy	rent date: day of month month year of the century	(0131) (0112) (0099)
a	magnetic variation		
hh	checksum (EXOR over all characters except '\$' and '*')		
<cr></cr>	Carriage Return, ASCII Code 0Dh		
<lf></lf>	Line Feed, ASCII Code 0Ah		

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Date: 21st October 2020

### 12.2.4 Format of the Uni Erlangen String (NTP)

The time string Uni Erlangen (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:

### <STX>tt.mm.jj; w; hh:mm:ss; voo:oo; acdfg i;bbb.bbbbn lll.lllle hhhhm<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></stx>	Start-( sendin	Start-Of-Text, ASCII Code 02h sending with one bit occuracy at change of second		
dd.mm.yy	the cur dd mm yy w	rrent date: day of month month year of the century the day of	(0131) (0112) (0099)	
		the week	(17, 1 = Monday)	
hh.mm.ss	the cur hh mm ss	rrent time: hours minutes seconds	(0023) (0059) (0059, or 60 while leap second)	
v	sign of	the offset of loc	al timezone related to UTC	
00:00	offset o	of local timezone	related to UTC in hours and minutes	
ac	clock s a:	tatus characters: '#'	: clock has not synchronized after reset (space, 20h) clock has synchronized after reset	
	C:	1*1	GPS receiver has not checked its position (space, 20h) GPS receiver has determined its position	
d	time zo 'S'	one indicator: CEST CET	European Summertime, daylight saving enabled European Standard Time, daylight saving disabled	
f	anounc before '!'	anouncement of discontinuity of time, enabled during last hour before discontinuity comes in effect: '!' announcement of start or end of daylight saving time ' ' (space, 20h) nothing announced		
g	anounc before 'A'	anouncement of discontinuity of time, enabled during last hour before discontinuity comes in effect: 'A' announcement of leap second insertion ' (space, 20h) nothing announced		
i	leap se 'L'	<pre>leap second insertion 'L' leap second is actually inserted       (active only in 60th sec.) ' ' (space, 20h) no leap second is inserted</pre>		
bbb.bbbb	latitud leading	latitude of receiver position in degrees leading signs are replaced by a space character (20h)		
n	latitud 'N'	latitude, the following characters are possible:		

	'S' south d. equator
uu.uuu	longitude of receiver position in degrees leading signs are replaced by a space character (20h)
e	longitude, the following characters are possible: 'E' east of Greenwich 'W' west of Greenwich
hhhh	altitude above WGS84 ellipsoid in meters leading signs are replaced by a space character (20h)
<etx></etx>	End-Of-Text, ASCII Code 03h

### 12.2.5 Format of the Computime Time String

The Computime time string is a sequence of 24 ASCII characters starting with the T character and ending with the LF (line feed, ASCII Code 0Ah) character. The format is:

### 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 part of the time string. The groups of characters as defined below:

Т	Start o sendin	character g with one bit accuracy	J at change of second
yy:mm:dd	the cur yy mm dd ww	rrent date: year of the century month day of month the day of the week	(0099) (0112) (0131) (0107, 01 = monday)
hh:mm:ss	the cu hh mm ss	rrent time: hours minutes seconds	(0023) (0059) (0059, or 60 while leap second)
<cr></cr>	Carria	ge Return, ASCII Code	0Dh

<LF> Line Feed, ASCII Code 0Ah

### 12.2.6 Format of the SYSPLEX-1 Time String

The SYSPLEX1 time string is a sequence of 16 ASCII characters starting with the SOH (Start of Header) ASCII controll character and ending with the LF (line feed, ASCII Code 0Ah) character.

### Please note:

To receive the Timestring on a selected terminal correctly you have to send a " C " (once, without quotation marks).

The format is:

### <SOH>ddd: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:

<s0h></s0h>	Start sendi	of Header (ASCII on ng with one bit acc	control character) curacy at change of second
ddd	day o	f year	(001366)
hh:mm:ss	the cu hh mm ss q	urrent time: hours minutes seconds Quality indicator	(0023) (0059) (0059, or 60 while leap second) (space) Time Sync (GPS lock) (?) no Time Sync (GPS fail)

- <CR> Carriage-return (ASCII code 0Dh)
- <LF> Line-Feed (ASCII code 0Ah)

### 12.2.7 Format of the Meinberg Capture String

The Meinberg Capture String is a sequence of 31 ASCII characters terminated by a CR/LF (Carriage Return/-Line Feed) combination. The format is:

### CH*x\_tt.mm.jj\_hh:mm:ss.fffffff* <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:

x _	0 or 1 corresponding on the number of the capture input ASCII space 20h		
dd.mm.yy th	e capture date	:	
33	dd .	day of month	(0131)
	mm	month	(0112)
	уу	year of the century	(0099)
hh:mm:ss.ffff	fff the capture	time:	
	hh	hours	(0023)
	mm	minutes	(0059)
	SS	seconds	(0059, or 60 while leap second)
	fffffff	fractions of second, 7	digits
<cr></cr>	Carriage Retu	rn, ASCII Code 0Dh	

<LF> Line Feed, ASCII Code 0Ah

### 12.2.8 Format of the SPA Time String

The ABB SPA Time String is a sequence of 32 ASCII characters starting with the characters ">900WD" and ending with the  $\langle CR \rangle$  (Carriage Return) character. The format is:

### >900WD:jj-mm-tt\_hh.mm;ss.fff:cc<CR>

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:

jj-mm-tt	the current date:		
	jj	year of the century	(0099)
	mm	month	(0112)
	tt	day of month	(0131)
	_	Space	(ASCII-code 20h)
hh.mm;ss.fff	the current time	:	
	hh	hours	(0023)
	mm	minutes	(0059)
	SS	seconds	(0059, or 60 while leap second)
	fff	milliseconds	(000999)
сс	Checksum. EXC displayed as a	CLUSIVE-OR result of HEX byte (2 ASCII cha	the previous characters, aracters 09 or AF)

<CR> Carriage Return ASCII Code 0Dh

### 12.2.9 Format of the RACAL standard Time String

The RACAL standard Time String is a sequence of 16 ASCII characters terminated by a X (58h) character and ending with the CR (Carriage Return, ASCII Code 0Dh) character. The format is:

### <X><G><U>yymmddhhmmss<CR>

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:

<x></x>	Control chan sending with accuracy at	racter h one bit change of second	code 58h
<g></g>	Control cha	racter	code 47h
<u></u>	Control character		code 55h
yymmdd	the current yy mm dd	date: year of the century month day of month	(0099) (0112) (0131)
hh:mm:ss	the current hh mm ss	time: hours minutes seconds	(0023) (0059) (0059, or 60 while leap second)

<CR> Carriage Return, ASCII code 0Dh

### 12.2.10 Format of the Meinberg GPS Time String

The Meinberg Standard 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. Contrary to the Meinberg Standard Telegram the Meinberg GPS Timestring carries no local timezone or UTC but the direct GPS time without conversion into UTC. The format is:

### <STX>D:tt.mm.jj;T:w;U:hh.mm.ss;uvGy;lll<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></stx>	Start-	-Of-Text (ASCI	l code 02h)
tt.mm.jj	the cu tt mm jj	irrent date: day of month month year of the century	(0131) (0112) (0099)
W	the da	ay of the week	(17, 1 = monday)
hh.mm.ss	the cu hh mm ss	urrent time: hours minutes seconds	(0023) (0059) (0059, or 60 while leap second)
uv	clock <i>u</i> :	status characto '#' ' '	ers: clock is running free (without exact synchr.) (space, 20h) clock is synchronous (base accuracy is reached)
	<i>V</i> :	1*1	receiver has not checked its position (space, 20h) receiver has determined its position
G	time zone indicator 'GPS-Time'		
у	anouncement of discontinuity of time, enabled during last hour before discontinuity comes in effect: 'A' announcement of leap second insertion '' (space, 20h) nothing announced		
111	number of leap seconds between UTC and GPS-Time (UTC = GPS-Time + number of leap seconds)		
<etx></etx>	End-Of-Text, (ASCII Code 03h)		

## 12.2.11 Format of the NMEA 0183 String (GGA)

The NMEA (GGA) String is a sequence of characters starting with the '\$GPRMC' character and ending with the characters CR (carriage return) and LF (line-feed). The format is:

### \$GPGGA,hhmmss.ss,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 numbers or letters where as the other characters are part of the time string. The groups of characters as defined below:

\$	Start character, ASCII Code 24h sending with one bit accuracy at change of second		
hhmmss.ss	the curr hh mm ss ss	ent time: hours minutes seconds fractions of seconds	(0023) (0059) (0059, or 60 while leap second) (1/10 ; 1/100)
A	Status	(A = time data) (V = time data)	valid) not valid)
bbbb.bbbbb	latitude leading	of receiver posit signs are replac	tion in degrees ed by a space character (20h)
n	latitude, the following characters are possible: 'N' north of equator 'S' south d. equator		
UUUL.UUU	longitude of receiver position in degrees leading signs are replaced by a space character (20h)		
e	longitud 'E' 'W'	le, the following east of Greenwi west of Greenwi	characters are possible: ch ich
A	Position fix $(1 = yes, 0 = no)$		
VV	Satellites used (012)		
hhh.h	HDOP (Horizontal Dilution of Precision)		
aaa.h	Mean Sea Level altitude (MSL = altitude of WGS84 - Geoid Separation)		
М	Units, meters (fixed value)		
ggg.g	Geoid Separation (altitude of WGS84 - MSL)		
М	Units, meters (fixed value)		
CS	checksum (EXOR over all characters except '\$' and '*')		
<cr></cr>	Carriage Return, ASCII Code 0Dh		
<lf></lf>	Line Feed, ASCII Code 0Ah		

## 12.2.12 Format of the NMEA 0183 String (GGA)

The NMEA (GGA) String is a sequence of characters starting with the '\$GPRMC' character and ending with the characters CR (carriage return) and LF (line-feed). The format is:

### \$GPGGA,hhmmss.ss,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 numbers or letters where as the other characters are part of the time string. The groups of characters as defined below:

\$	Start character, ASCII Code 24h sending with one bit accuracy at change of second		
hhmmss.ss	the curr hh mm ss ss	ent time: hours minutes seconds fractions of seconds	(0023) (0059) (0059, or 60 while leap second) (1/10 ; 1/100)
A	Status	(A = time data) (V = time data)	valid) not valid)
bbbb.bbbbb	latitude of receiver position in degrees leading signs are replaced by a space character (20h)		
n	latitude, the following characters are possible: 'N' north of equator 'S' south d. equator		
	longitude of receiver position in degrees leading signs are replaced by a space character (20h)		
e	longitud 'E' 'W'	le, the following east of Greenwi west of Greenwi	characters are possible: ch ich
A	Position fix $(1 = yes, 0 = no)$		
VV	Satellites used (012)		
hhh.h	HDOP (Horizontal Dilution of Precision)		
aaa.h	Mean Sea Level altitude (MSL = altitude of WGS84 - Geoid Separation)		
М	Units, meters (fixed value)		
ggg.g	Geoid Separation (altitude of WGS84 - MSL)		
М	Units, meters (fixed value)		
CS	checksum (EXOR over all characters except '\$' and '*')		
<cr></cr>	Carriage Return, ASCII Code 0Dh		
<lf></lf>	Line Feed, ASCII Code 0Ah		

## 12.2.13 Format of the NMEA 0183 String (ZDA)

The NMEA String is a sequence of 38 ASCII characters starting with the **'\$GPZDA'** character 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 timezone.

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

\$	Start character, ASCII Code 24h sending with one bit accuracy at change of second			
hhmmss.ss	the current UTC time:			
	hh	hours	(0023)	
	mm	minutes	(0059)	
	SS	seconds	(0059 or 60 while leap second)	
HH,II	the local timezone (offset to UTC):			
	HH	hours	(00±13)	
	II	minutes	(0059)	
dd,mm,yy	the current date:			
	dd	day of month	(0131)	
	mm	month	(0112)	
	уууу	year	(00009999)	
CS	checksum (EXOR over all characters except '\$' and '*')			
<cr></cr>	Carriage Return, ASCII Code 0Dh			
<lf></lf>	Line Feed, ASCII Code 0Ah			

<S0H>

### 12.2.14 Format of the ION Time String

The ION time string is a sequence of 16 ASCII characters starting with the SOH (Start of Header) ASCII controll character and ending with the LF (line feed, ASCII Code 0Ah) character. The format is:

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

Start of Header (ASCII control character)

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:

(	sendi	ng with one bit acc	suracy at change of second
ddd	day o	f year	(001366)
hh:mm:ss	the cu hh mm ss q	urrent time: hours minutes seconds Quality	(0023) (0059) (0059, or 60 while leap second)
		indicator	(space) Time Sync (GPS lock) (?) no Time Sync (GPS fail)

- <CR> Carriage-return (ASCII code 0Dh)
- <LF> Line-Feed (ASCII code 0Ah)

## 12.3 Programmable Pulse Outputs

Each of the programmable outputs is shown on a seperate tab in the tab control **PORT 1** ... **PORT 4**. The settings for the respective output are loaded whenever a new tab is selected. Changed settings must be sent by clicking the Send button before selecting the next tab. All changes will be lost otherwise.

### Mode

This field selects the operation mode of an output. Available modes are Timer, Single Shot, Cyclic Pulse, Per Sec, Per Min, Per Hour, DCF77 Marks, Position OK, Time Sync, All Sync and Idle. Selectable are only those modes which are supported by the connected clock.

### Inverted

The outputs home position can be selected using the "Inverted" drop down box. Please pay attention to the fact, that an output cannot be at high level in case of brown-out or system reset of course.

### Timer Mode

This mode simulates a programmable day assigned timer. Three turn-off and turn-on times are programmable for each output. If you want to program a switchtime, enter the turn-on time into the "On Time" entry field and the turn-off time that belongs to it into the "Off Time" field below. Thus the example on the previous page shows switching times from 10.50 to 11.00, 13.00 to 14.00 and 23.45 to 23.50. A turn-on time later than the turn-off time would cause a switch program running over midnight. For example a program "On Time" 10.45.00, "Off Time" 9.30.00 would cause an active ouput from 10.45 to 9.30 ( the next day! ). If one or more of the three switching times are unused just enter the same time into the fields "On Time" and "Off Time". In this case the switch time does not affect the output. As already mentioned, the outputs home position is selected using the Normal/Inverted button.

### Cyclic Pulse Mode

Cyclic mode is used for generating periodically repeated pulses.

The value in field "Cycle" determines the time between two consecutive pulses (2 sec in example above). This cycle time must be entered as hours, minutes and seconds. The pulse train is synchronized at 0:00 o"clock local time, so the first pulse of a day always occurs at midnight. A cycle time of 2 seconds for example, would cause pulses at 0:00:00, 0:00:02, 0:00:04 etc. Basically it is possible to enter any cycle time between 0 and 24 hours, however usually a cycle times that cause a constant distance between all consecutive pulses make sense. For example a cycle time of 1 hour 45 minutes would cause a pulse every 6300 seconds (starting from 0 o"clock). The appearing distance between the last pulse of a day and the first pulse of the next day (0:00:00 o"clock) would be only 4500 sec. The value in entry field "Cycle" turns red, when entering a time that causes this asymmetry.

The field "Single Shot Time" determines the pulse duration which can vary in steps of 10 msec between 10 msec and 10 sec (= 10000 msec). The program truncates steps smaller than 10 msec. If a pulse duration longer than the cycle time is entered, the output remains activated after the first pulse that occurs. The home position (inactive state) is selected by the Normal/Inverted button.

### DCF77 Marks

In "DCF77 marks" mode the selected output simulates the telegram as transmitted by german time code transmitter DCF77. The generated time code is related to the local time zone.

If you want DCF simulation to be disabled when the clock is in free running mode, you can enter the delay (given in minutes) for deactivating the DCF-Simulation in the entry field "Timeout". DCF Simulation is never suspended, if the delay value is zero.

### Single Shot Mode / Per Sec / Per Min / Per Hour

#### Single Shot Mode

Selecting Singls Shot generates a single pulse of defined length once per day. You can enter the time when the pulse is generated in field "Event Time". The value in field "Pulse Length" determines the pulse duration. The pulse duration can vary from 10 msec to 10 sec in steps of 10 msec.

### Per Sec. Per Min. Per Hour. Modes

These modes generate pulses of defined length once per second, once per minute or once per hour. "Single Shot Time" determines the pulse duration (10 msec...10 sec). The respective output remains in active state, when selecting a pulse duration longer than 990ms in pulse per sec mode.

### Status Output (Position OK, Time Sync, All Sync)

Three different modes are selectable for output of the clocks synchronization state. The Mode "Position OK" activates the output when the receiver has sufficient satellites in view to calculate its position. In "Time Sync" mode the respective output is activated when the clocks internal timebase is synchronized to the GNSS timing. The "All Sync" Mode performs a logical AND operation of the both states previously mentioned, i.e. the output is activated if the position can be calculated AND the internal timebase is synchronized to the GNSS timing.

### DCLS Time Code

The "Time Code" mode allows the output of an unmodulated IRIG-B or AFNOR signal on the programmable pulse output. Basically it can only be supported by radio clocks that have an internal timecode generator option. The timecode signal on the programmable pulse output will always be the same as that selected for the regular timecode output. This setting can be made in the IRIG-Output menu.

#### Synthesizer

If the connected clock is equipped with a programmable synthesizer, its frequency and phase-angle can be set here. The phase value is neglected if the frequency is above 10kHz, it is impossible to enter a phase value then. When range "Hz" is selected, the only valid fractional digits are 0, 4, 5, 7, 8, and 9 or .1/8, .1/4, .1/3, .2/3.

#### IRIG-Output Settings

If a programmable IRIG Output is provided by the radioclock, it's settings can be changed here. This window can only be activated for radioclocks with on board IRIG generator.

### Idle Mode

Selecting "Idle" deactivates the output.

## 12.4 PCI Express (PCIe)

The main technical inovation of PCI Express is a serial data transmission compared to the parallel interfaces of other computer bus systems like ISA, PCI and PCI-X.

PCI Express defines a serial point-to-point connection, the so-called Link:



The data transfer within a Link is done via Lanes, representing one wire pair for sending and one wire pair for receiving data:



This design leads to a full duplex connection clocked with 2.5 GHz capable of transfering a data volume of 250 MB/s per lane in each direction. Higher bandwith is implemented by using multiple lanes silmutaneously. A PCI Express x16 slot for example uses sixteen lanes providing a data volume of 4 GB/s. For comparison: when using conventional PCI the maximum data transfer rate is 133 MB/s, PCI-X allows 1 GB/s but only in one direction respectively.

## 12.5 Content of the USB stick

The included USB stick contains a driver program that keeps the computer's system time synchronous to the received time. If the delivered stick doesn't include a driver program for the operating system used, it can be downloaded from:

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



On the USB stick there is a file called "readme.txt", which helps installing the driver correctly.

## 13 Technical Appendix - GPS Antenna + Accessories

Physical Dimensions:



## Specifications:

Power supply:	15 V, 100 mA (provided via	antenna cable)
Receive frequency:	1575.42 MHz	
Bandwidth:	9 MHz	
Frequencies:	Mixed frequency IF frequency:	10 MHz 35.4 MHz
Connector:	N-Norm female connector	
Form factor:	ABS plastic case for outdo	or installation
Protection class:	IP66	
Humidity:	95%	
Temperature range:	-40 °C to +85 °C (-40 to 1	185 °F)
Weight:	1.6 kg (3.53 lbs) incl. mour	nting kit

## 13.1 Antenna Cable:

Cable type	Cable (mm/in) Ø	Attenuation at 100 MHz (db)/100m/328ft	max. Cable lenght (m/ft)	used for receiver type
RG58/CU	5/0.2	17	300/984	GPS/GNS-UC/PZF
RG213	10,3/0.41	7	700/2297	GPS/GNS-UC
H155	5,4/0,21	9,1	70/230	GNM/GNS
H2010 Ultraflex	7,3/0,29	5,8	150/492	GNM/GNS

Further values can be found in the data sheet of the cable used.

## 13.2 Antenna Short-Circuit

(Only for assembly groups with front display)

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



If this message appears the clock has to be disconnected from the mains and the defect eliminated. After that the clock can be powered-up again. The supply voltage for the antenna/converter unit is approx. 15 V DC when the antenna is connected.

## 13.3 Technical Specifications - MBG S-PRO surge protection

Attachment plug with replaceable gas discharge tube for coaxial signal interfaces. Connection: N connector female/female. The MBG S-PRO set includes a surge voltage protector (Phoenix CN-UB-280DC-BB), a pre-assembled coax cable and a mounting bracket.

The surge voltage protector for coaxial lines has to be installed in the antenna line. The shield has to be connected to earth as short as possible. CN-UB-280DC-BB is equipped with two type-N female connectors. It has no dedicated input/output polarity or prefered mounting orientation.



Phoenix CN-UB-280DC-BB

Features:

- High RF Performance
- Multiple Strike Capability
- 20 kA Surge Protection
- Bi-directional Protection

Mounting type Type Direction of action	Connection-specific intermediate Attachment plug Line-Shield/Earth Ground	plugging
Maximum continuous operating voltage	UC (wire-ground) 195 V AC	280 V DC
Nominal current	In	5 A (25 °C)
Operating effective current	IC at UC	$\leq$ 1 $\mu$ A
Nominal discharge current	In (8/20) $\mu$ s (Core-Earth) In (8/20) $\mu$ s (Core-Shield)	20 kA 20 kA
Total surge current	(8/20) μs (10/350) μs	20 kA 2,5 kA

Max. discharge current	I <sub>max</sub> (8/20) $\mu$ s maximum (Core-Shield)	20 kA
Nominal pulse current	Ian (10/1000)µs (Core-Shield)	100 A
Impulse discharge current	(10/350) $\mu$ s, peak value limp	2,5 kA
Output voltage limitation	at 1 kV/ $\mu$ s (Core-Earth) spike at 1 kV/ $\mu$ s (Core-Earth) spike	$\leq$ 900 V $\leq$ 900 V
Response time	tA (Core-Earth) tA (Core-GND)	$\leq$ 100 ns $\leq$ 100 ns
Input attenuation	aE, asym.	typ. 0.1 dB ( $\leq$ 1.2 GHz) typ. 0.2 dB ( $\leq$ 2.2 GHz)
Cut-off frequency	fg (3 dB), asym. (shield) in 50 Ohm sys	tem > 3 GHz
Standing wave ratio	SWR in a 50 $\Omega$ system	typ. 1.1 (≤ 2 GHz)
Permissible HF power	$P_{max}$ at VSWR = xx (50 ohm system)	700 W (VSWR = 1.1) 200 W (VSWR = $\infty$ )
Capacity	(Core-Earth) asymmetrical (shield)	typ. 1,5 pF typ. 1,5 pF
Surge current resistance	(conductor–ground)	C1 - 1 kV/500 A C2 - 10 kV/5 kA C3 - 100 A D1 - 2,5 kA
Ambient temperature	(operation)	-40 °C 80 °C
Altitude	$\leq$ 2000 m (above sea level)	
Degree of protection	IP55	
Housing material	Nickel-plated brass Color nickel	
Dimensions	Height 25 mm, Width 25 mm, Depth 67	mm
Connection data	IN OUT	N-Connector 50 Ohm N-Connector Buchse N-Connector Buchse
Standards/regulations	IEC 61643-21 2000 + A1:2008 EN 61643-21 2001 + A1:2009	

Source: PHOENIXCONTACT.COM Surge Voltage Protector - CN-UB-280DC-BB

## 13.3.1 MBG S-PRO - Physical Dimensions



13.3.2 Installation and Grounding



## 14 RoHS and WEEE

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

We hereby declare that this product is conform to the European Directive 2011/65/EU and its delegated directive 2015/863/EU "Restrictions of Hazardous Substances in Electrical and Electronic Equipment". We ensure that electrical and electronic products sold in the EU do not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBBs), and polybrominated diphenyl ethers (PBDEs), Bis (2-ethylhexyl)phthalat (DEHP), Benzylbutylphthalat (BBP), Dibutylphthalat (DBP), Diisobutylphthalat (DIBP), above the legal threshold.



## WEEE status of the product

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



## **15 EU Declaration of Conformity**

## Konformitätserklärung Doc ID: GPS180PEX-2020-10-21

Hersteller	Meinberg Funkuhren GmbH & Co. KG
Manufacturer	Lange Wand 9, D-31812 Bad Pyrmont
erklärt in alleiniger Verantwor	tung, dass das Produkt,
declares under its sole respons	sibility, that the product
Produktbezeichnung Product Designation	GPS180PEX
auf das sich diese Erklärung b	ezieht, mit den folgenden Normen und Richtlinier
to which this declaration relat	es is in conformity with the following standards a
RED – Richtlinie	ETSI EN 300 440-1 V1.6.1 (2010-08)
<i>RED – Directive</i>	ETSI EN 300 440-2 V1.4.1 (2010-08)
2014/53/EU	
EMV – Richtlinie EMC – Directive	ETSI EN 301 489-1 V1.9.2 (2011-09) DIN EN 61000-6-2:2005 DIN EN 61000-6-3:2007 + A1:2011

übereinstimmt: nd provisions of the directives:

RED – Richtlinie <i>RED – Directive</i>	ETSI EN 300 440-1 V1.6.1 (2010-08) ETSI EN 300 440-2 V1.4.1 (2010-08)
2014/53/EU	
EMV – Richtlinie	ETSI EN 301 489-1 V1.9.2 (2011-09)
EMC – Directive	DIN EN 61000-6-2:2005
2014/30/EU	DIN EN 01000-0-3:2007 + A1:2011 DIN EN 55032:2012
2017/30/20	DIN EN 55024:2010
Niederspannungsrichtlinie Low-voltage Directive	DIN EN 60950-1:2006 + A11:2009 + A1:2010 + A12:2011 + AC:2011 + A2:2013
2014/35/EU	
RoHS – Richtlinie RoHS – Directive	DIN EN 50581:2012
2011/65/EU + 2015/863/EU	

Bad Pyrmont, den 2020-10-21

5 lleinlerg Stephan Meinberg

Production Manager