



Operating manual

GPS satellite receiver for world wide application



Versions:

Article Number	Auxiliary Voltage	Interface
111.9024.45	H1: AC/DC 88V...264V	D2: RS485
111.9024.46	H2: DC 18V...72V	D2: RS485
111.9024.47	H1: AC/DC 88V...264V	D1: RS232
111.9024.48	H2: AC 18V...72V	D1: RS232



Note:

Please note that this operating manual cannot describe the latest version of the device in all cases. For example, if you download a more recent firmware version from the internet, the following description may no longer be accurate in every point.

In this case, either contact us directly or refer to the most recent version of the operating manual, available on our website (www.a-eberle.de).

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GPS RECEIVER WITH SIMULATED DCF77 OUTPUT

1. General Information

The Global Positioning System (GPS) is a satellite system developed in the USA and based on the NAVSTAR satellites made by Rockwell. With this system, it is possible to receive exact time information anywhere in the world, anytime.

To meet these requirements, it was necessary to position a total of 24 satellites in 6 almost circular orbits. The satellites' orbits are inclined at 55° to the equator with an orbital period of about twelve hours – corresponding to an orbital altitude of 20,183 km. These satellites are now in operation. Each satellite has a mass of about 430 kg and contains a transmitter, a receiver, an antenna, an atomic clock for maximum accuracy and a control system for the satellite's functions. The principal applications of the GPS system are for fixing positions and as an aid to navigation.

2. Operating Principles

Once the GPS system is switched on, it first has to receive and evaluate valid data from the satellites in its line of sight. This start-up phase may take as little as 2 – 3 minutes if reception conditions are favourable. However, as long as half an hour may be needed if there is a poor line of sight to the horizon. This start-up phase is also influenced by the configuration the satellites are in at any particular time. It is impossible to fix a position or obtain time information with fewer than three satellites. The red LED "GPS IS WORKING..." flashes while the satellite signals are being received. When the unit subsequently commences continuous operation, this light-emitting diode only flashes when the number of satellites being received falls below three.

It is simple to set up the system and the procedure does not require any particular specialist knowledge. The daylight saving time changes (start and finish) and the time zone can be set using slide switches.

3. Installation and Start-up

3.1 Generals

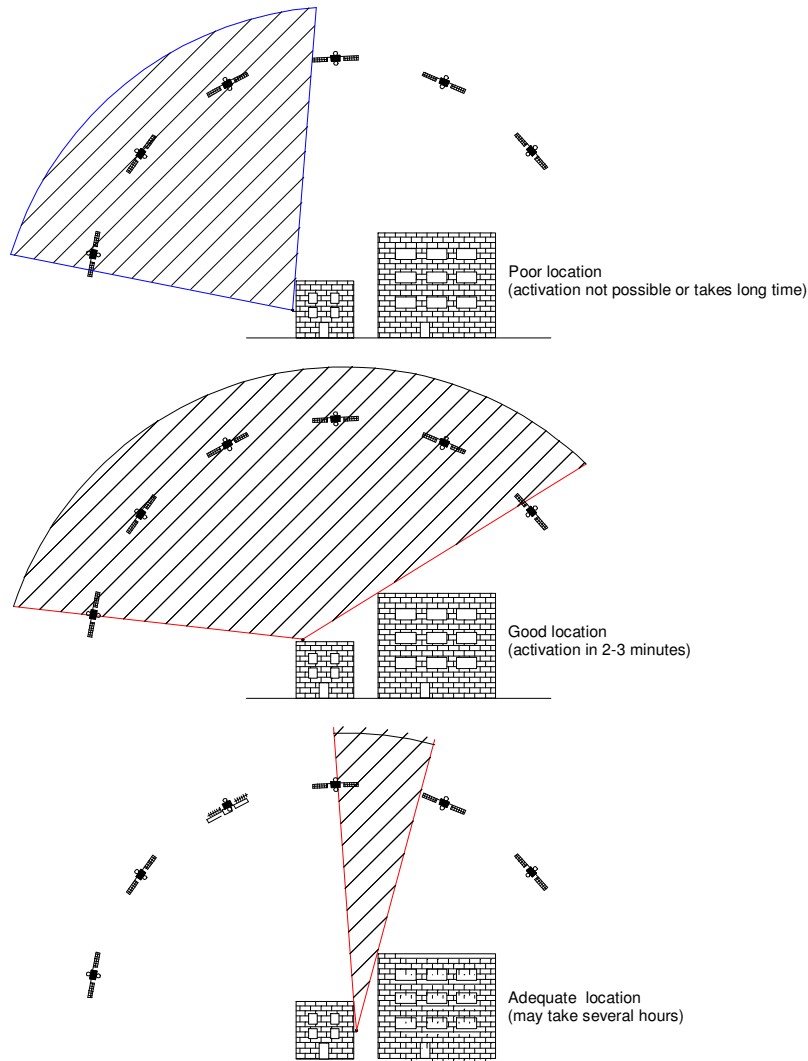
The high frequency of the GPS signal (approx. 1.5 GHz) means an outdoor aerial is always necessary for receiving GPS satellite data. The antenna must not have any directional characteristics because it needs to receive data from all directions. Consequently, boosting the reception characteristics of the antenna by shaping it mechanically as in the case of a parabolic antenna, for example, is not a viable option.

This means the signal magnitude at the antenna output is below the general background noise level. An extremely low-noise pre-amplifier is therefore connected to the antenna input to make it possible to evaluate the signals.

The antenna should have a clear "line of sight" to the entire horizon to guarantee that the GPS reception will be as continuous as possible. The start-up phase may take a long time if the reception arc is obstructed by objects or buildings, depending on the configuration of the satellites. As a result, the antenna should be set up where the maximum possible clear line of sight to the horizon is guaranteed. In general, the more of the sky you can see from the installation site, the quicker the GPS clock will be radio-synchronized and the longer it will remain so.

3.2 Installation site for the antenna

The GPS antenna is located in the control unit housing when the unit is delivered. Please observe the instructions below if the reception conditions make it necessary to install the antenna separately. The length of the antenna cable is about 5 m.



3.3 Installing the antenna cable

Do not route the antenna lead adjacent to other HF, control or power current cables. Interference from these cables could disrupt GPS reception because of the extremely low power of the received signal. Take particular care when routing the antenna cable.

Please observe the following points:

- Do not get the antenna plug dirty and do not damage it. Protect it with plastic foil before pulling the cable through a wall, for example.
- Do not bend the antenna cable around sharp corners.
- Do not exceed the bending radius.
- Do not squash the antenna cable and do not damage the insulation.



Caution!

Extremely powerful voltage or current spikes may occur when outdoor antennas are used during thunderstorms. These spikes represent a risk of severe or even irreparable damage not only to the unit connected directly to the antenna but also to other down-circuit units.

The unit should be incorporated into the building's lightning protection system in order to avoid suffering costly damage and concomitant costs.

The lightning protection system may only be installed by qualified professionals.

4. Electronic connection, DCF- output, Data protocol

Consistent with the products in the REGSys™ range, the GPS receiver is available in two variations for different voltage supplies. (See: Technical Data)

- ▶ It is connected using the terminals marked L, N and PE. Only an electrician is allowed to do this.

The GPS receiver allocates three different output signals.

- **DCF Pulse Output at RS232 Level:**

A DCF signal, at RS232 level, is output at the DCF and GND terminals. To synchronise, for example, a REG-D™ per GPS, the GND terminals must be connected to the GND, and the DFC terminal must be connected to the RXD of a RS232 interface controller. The settings needed for synchronisation are described in the user manual of the corresponding device.

- **DCF Pulse Output at RS485 Level (Timebus)**

A DCF signal, at RS485 level, is output at the DCF-EA+ and DCF-EA- terminals. To synchronise, for example, a PQI-DA™ via GPS, the devices must be connected as follows:

GPS Radio Clock	PQI-DA
DCF-EA+	"A" to connection X6, No. 47
DCF-EA-	"B" to connection X6, No. 48
GND	"GND" to connection X6, No. 50

The settings needed for synchronisation are described in the user manual of the corresponding device.

Termination of the bus should be carried out as described in the user manual of the particular device, and is not dependent on the connection of a GPS radio clock to the bus.

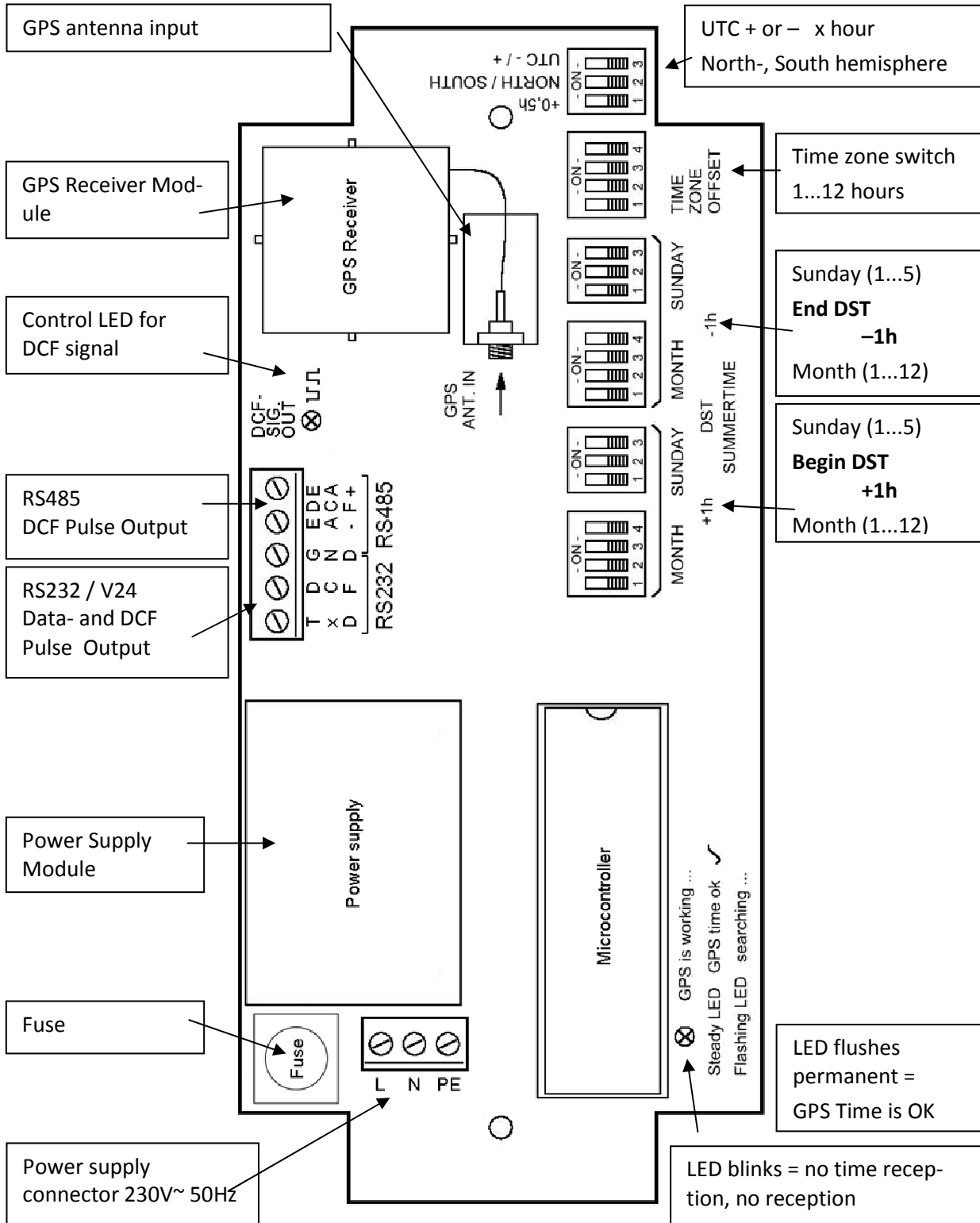
- **DCF Pulse Output at RS485 Level (Timebus)**

A DCF signal, at RS485 level, is output at the DCF-EA+ and DCF-EA- terminals. To synchronise, for example, a PQI-D™ per GPS, the DCF-EA+ terminals must be connected to the "Time in A", and the DCF-EA- terminal must be connected to the "Time in B" of the PQI-D. The settings needed for synchronisation are described in the user manual of the corresponding device.

- **Data Protocol at RS232 Level:**

A data protocol for a serial RS-232 port is transmitted via the terminals TxD and GND. The contents of the data are time, day of the week and date. The data format of interface is set at 9600 baud rate, 8 bits, 1 stop bits, Parity odd.

4.1 Overview of GPS electronic



4.2 Overview 111.9024.45



Auxiliary Voltage

H1: AC/DC 88V...264V
Europlug

Interface

D2: RS485
EA + / gn
EA - / ws
GND / br

Cable Lengths

GPS - Antenne: 5m
Auxiliary Voltage: 2,5m
RS485: 5m (max.1200m)



4.3 Overview 111.9024.46



Auxiliary Voltage

H2: DC 18V...72V
 + / br
 - / bl

Interface

D2: RS485
 EA + / gn
 EA - / ws
 GND / br

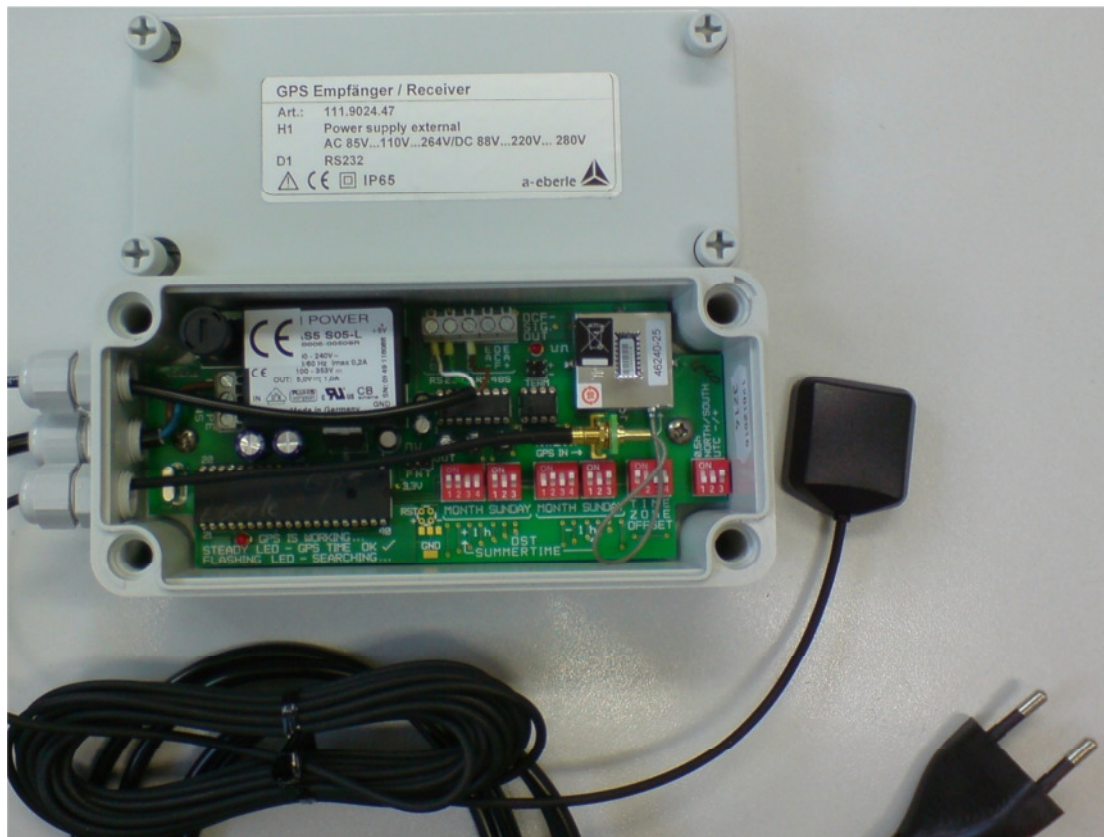
Cable Lengths

GPS - Antenne: 5m
 Auxiliary Voltage: 2,5m
 RS485: 5m (max.1200m)



We take care of it.

4.4 Overview 111.9024.47



Auxiliary Voltage

H1: AC/DC 88V-264V
Europlug

Interface

D2: RS232

SUB-D Plug

Pin2: RXD (DCF)
Pin3: TXD
Pin5: GND
Pin7: RTS

Adapter

RXD / gn
TXD / sw
RTS / rt
GND / ws

Cable Lengths

GPS - Antenne: 5m
Auxiliary Voltage: 2,5m
RS232: 5m (max.15m)



4.5 Overview 111.9024.48



Auxiliary Voltage

H2: DC 18V...72V

+ / br

- / bl

Interface

D2: RS232

SUB-D Plug

Pin2: RXD (DCF)

Pin3: TXD

Pin5: GND

Pin7: RTS

Adapter

RXD / gn

TXD / sw

RTS / rt

GND / ws

Cable Lengths

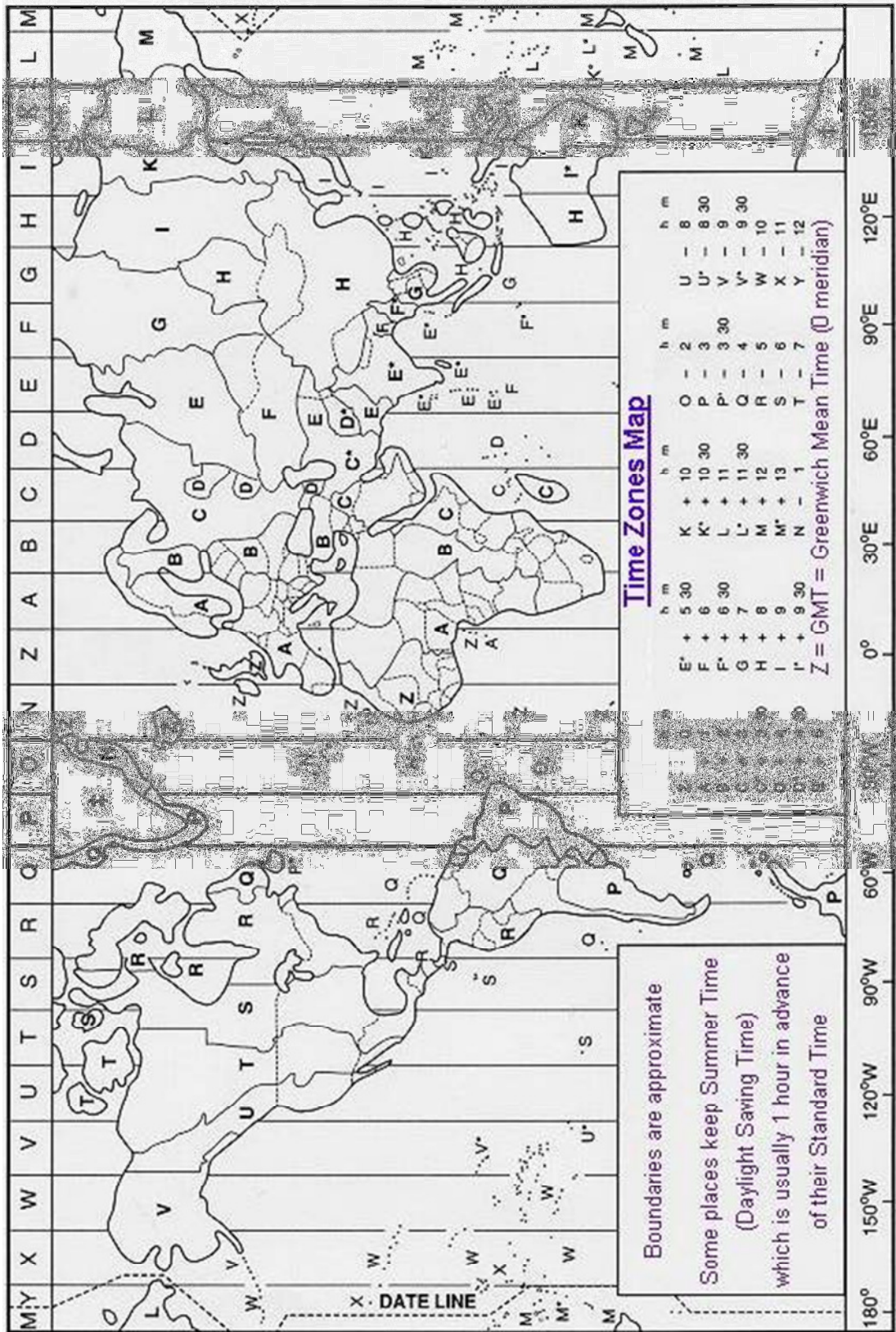
GPS - Antenne: 5m

Auxiliary Voltage: 2,5m

RS232: 5m (max.15m)



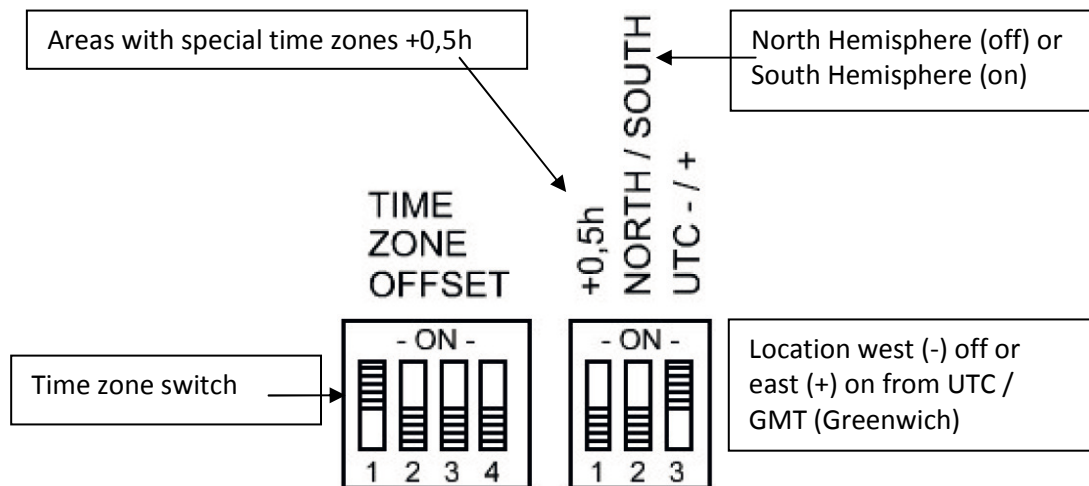
5. Time zone map



6. Setting up the system

6.1 Setting of time zone

The time zone setting is made using the DIP switches marked **TIME ZONE**.



The reference time zone (time zone 0) is UTC (Prime Meridian or Greenwich Mean Time).

The unit is supplied set up for the time zone +1 (Central European Time).

Refer to the map of the world to determine the time zone corresponding to your location and set the switches in accordance with the table below.

Use the TIME $-/+$ DIP switch to specify whether you are east or west of the Prime Meridian. The default setting is east.

In some countries, the time difference to the adjacent time zone is only half an hour rather than a full hour (refer to the map of the world). The **0.5 h switch** must be set to **ON** if the GPS receiver is used in any of these countries. The switch is set to OFF when the unit is delivered.

DIP switch setting TIME ZONE

Time zone	switch 1	switch 2	switch 3	switch 4
0	OFF	OFF	OFF	OFF
1	ON	OFF	OFF	OFF
2	OFF	ON	OFF	OFF
3	ON	ON	OFF	OFF
4	OFF	OFF	ON	OFF
5	ON	OFF	ON	OFF
6	OFF	ON	ON	OFF
7	ON	ON	ON	OFF
8	OFF	OFF	OFF	ON
9	ON	OFF	OFF	ON

We take care of it.

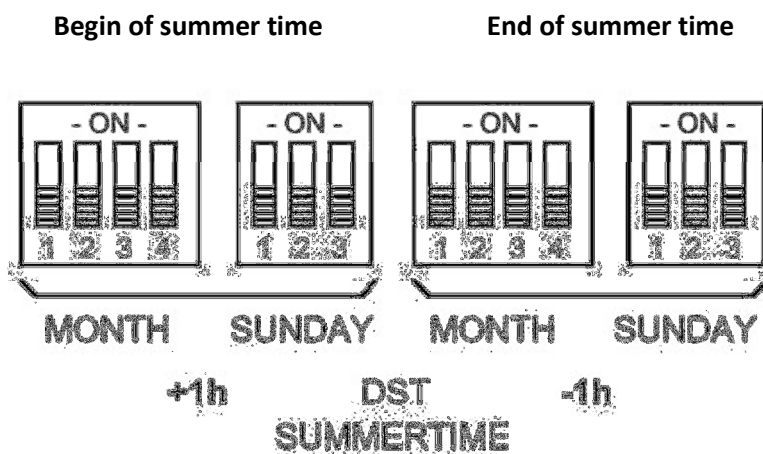
Time zone	switch 1	switch 2	switch 3	switch 4
10	OFF	ON	OFF	ON
11	ON	ON	OFF	ON
12	OFF	OFF	ON	ON
Fault 13	ON	OFF	ON	ON
Fault 14	OFF	ON	ON	ON
Fault 15	ON	ON	ON	ON

If the DIP switches are set to a fault in relation to the time zone setting, the values for the data output will be arithmetically correct.

If the time zone switches have been **incorrectly** set, the data output values will be mathematically correct. This means that there will be time shift outputs of 13, 14 or even 15 hours.

6.2 Setting the Daylight Saving Time Changes

The summer/winter daylight saving time changes are set up using the following DIP switches.



*DST = Daylight saving time / Summer time

Use the NORTH/SOUTH switch to specify whether you are in the southern or the northern hemisphere. The northern hemisphere is set when the unit is delivered.

Set the switch to OFF for the northern hemisphere; set the switch to ON for the southern hemisphere.

The start and finish of summer time is set as shown in the coding table below.

The switches marked MONTH are used for setting the month of the change and the switches marked SUNDAY are used for specifying on which Sunday in that month the change falls (1st to 4th Sunday or last Sunday in the month). BEGIN indicates the switches for the start of summer time and END indicates the end of summer time.

+1h for beginning of summer time and **-1h** for end of summer time

Setting summer time changeover

Setting the MONTH DIP switches

Month	switch 1	switch 2	switch 3	switch 4
no time changeover	OFF	OFF	OFF	OFF
January	ON	OFF	OFF	OFF
February	OFF	ON	OFF	OFF
March	ON	ON	OFF	OFF
April	OFF	OFF	ON	OFF
May	ON	OFF	ON	OFF
June	OFF	ON	ON	OFF
July	ON	ON	ON	OFF
August	OFF	OFF	OFF	ON
September	ON	OFF	OFF	ON
October	OFF	ON	OFF	ON
November	ON	ON	OFF	ON
December	OFF	OFF	ON	ON
Fault	ON	OFF	ON	ON
Fault	OFF	ON	ON	ON
Fault	ON	ON	ON	ON

Setting the Sunday DIP switches

Sunday in month	switch 1	switch 2	switch 3
no time changeover	OFF	OFF	OFF
First	ON	OFF	OFF
Second	OFF	ON	OFF
Third	ON	ON	OFF
Fourth	OFF	OFF	ON
Fifth or last	ON	OFF	ON

No change is made for summer time if the DIP switches are set to fault.

If the DIP switch has been **incorrectly** set at **+1h** or **-1h**, there will be no time change.

6.3 Setting example for Germany

- Please take the time zone from the time zone map
- Please set the DIP switches according to the setting table

Germany is located in the time zone 1 and north hemisphere. The time difference to UTC-time is positive = +1 hour. The summer time changeover takes place at the last Sunday in March. The end of summer time takes place at the last Sunday in October.

Step 1:

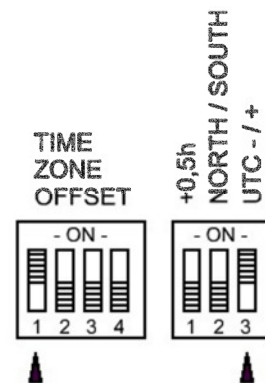
Setting of time zone

DIP switch 1 of TIME ZONE OFFSET to ON (UTC +1 hour)

Step 2:

Setting of time difference (+/-)

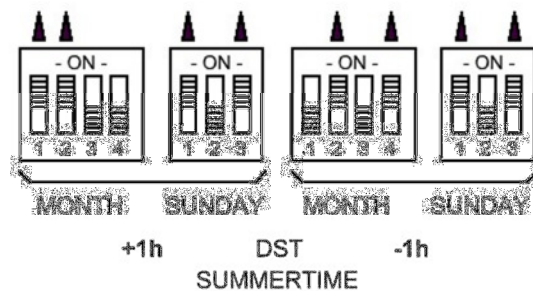
DIP switch of UTC -/+ to ON.
DIP switch NORTH/SOUTH to OFF



Step 3:

Setting of summer time begin

DIP switch 1 and 2 of MONTH +1 to ON (Month March)
DIP switch 1 and 3 of SUNDAY to ON (last Sunday)



Step 4:

Setting of summer time end

DIP switch 2 and 4 of MONTH -1 to ON (Month October)
DIP switch 1 and 3 of SUNDAY to ON (last Sunday)

*DST = Daylight saving time / Summer time

7. RS232 data protocol

Technical Data: Baudrate: 9600Baud
 Data bits: 8
 Stop bits: 1
 Parity: odd
 Handshake: none

Data transmission of time, day of the week and date takes place each second.

If the GPS time receiver has failure or no GPS time signal reception, the data transmission is blocked.

The data transmission takes place in three steps:

1. transmit a control character (STX)
2. transmit time, day of the week and date.
3. transmit a final character ETX

STX	time	day of the week	Date	ETX
02	12:34:56	7	31.01.06	03

Day of the week 1 = Monday..... 7 = Sunday

STX	02 _{hex}	ETX	03 _{hex}
(:)	3A _{hex}	(.)	2E _{hex}

8. Technical data

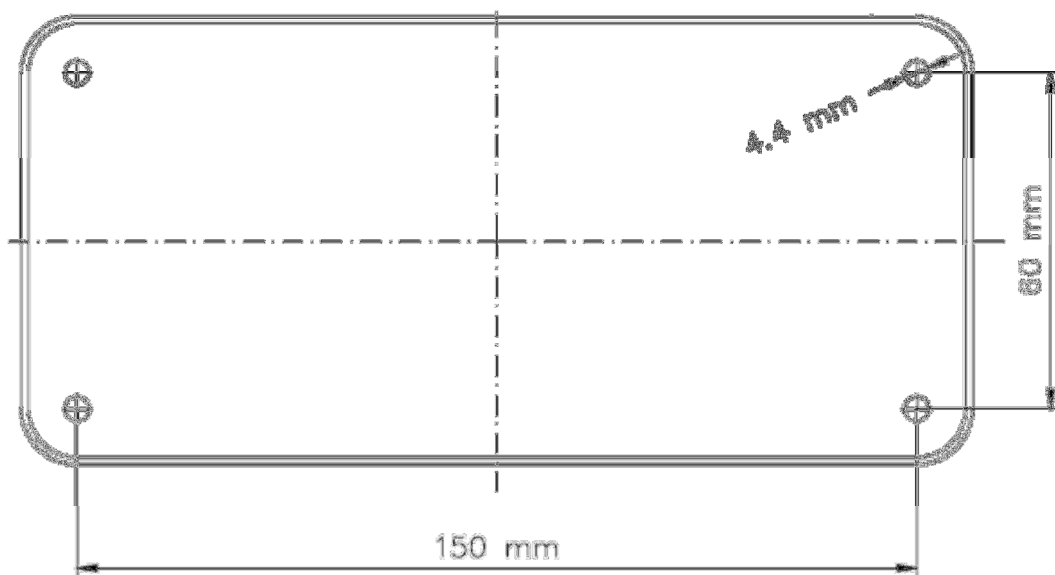
GPS-time receiver	
Output pulse	100 / 200ms
Phase position output pulse	positive or negative
Power	approx. 3VA
Weight incl. active antenna	approx. 650g
Antenna with magnetic clamp	
— Cable length	5 Meters
— Cable diameter	3 mm
— Connector diameter	5 mm
Maximum cable length	
— RS232 Interface → Device	15 Meters (RS232 Specification)
— RS485 Interface → Device	1200 Meters (RS485 Specification)
— Cable entry points	PG 7
— Max. clamp wire diameter	1,5 mm ²
Case	Polycarbonate plastic case
Index of protection	IP65
Dimensions W x H x D (incl. PG screw joints)	195 x 80 x 65 mm
Operating temperature	-25 up to +65°C

GPS-time receiver – Feature H1	
Operating voltage	AC 85V ... <u>110V</u> ... 264V DC 88V ... <u>220V</u> ... 280V
GPS-time receiver – Feature H2	
Operating voltage	DC 18V ... <u>60V</u> ... 72V
GPS-time receiver – Feature D1	
Interface DCF77 Signal	RS 485
GPS-time receiver – Feature D2	
Interface DCF77 Signal	RS 232

Versions:

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111.9024.47	H1: AC/DC 88V...264V	D1: RS232
111.9024.48	H2: AC 18V...72V	D1: RS232

9. Drilling Template



10. Regulations, norms, guidelines

The appliance is equivalent the following norms;

- EN 60950-1:2001 about security of appliances of information technology and general requirement.
- EN 61000-6-1:2001 about electromagnetic compatibility
- EN 61000-6-3:2001 EMV special basic norm for the house use and similar applications.



This product meets the EG Guidelines

- 73/23/EWG dated 29.04.2004 (low voltage guidelines)
- 89/336/EWG dated 23.04.2004 (EMV-guideline including amended guideline 92/31/ EWG)
- 93/68/EWG dated 22.07.1993 (labelling guideline)

11. Trouble shooting ... what to do if?

Power supply line

Please deal with cable to power input carefully. The cable should not be bended or broken.

Damage: If the power supply line is damaged, please disconnect the line and exchange to new one. If the case is damaged, please send the complete device to the manufacturer.

Protect against water!

The GPS time receiver is not to be used in the water or in the humid area. Especially not under the power supply of 230V/AC at the device.

The connected DCF clock doesn't get the correct time.

- Please check the cable connections to the clock?
- The polarity of the connection cable is correctly (GND and DCF SIG)?
Please check the signal level of GPS output positive or negative?
- Output LED blinks in second tact? If not please replace an antenna correctly.
 - If yes, there will be a DCF signal output.
 - If no, then check if the GPS antenna is connected and in the correct position. If the GPS antenna is not connected, then a DCF signal output is not possible. (for more information see points 3.1 and 3.2: 'Antenna installation location')

LED „GPS is working“ blinks?

Please be patient for a while. Until the GPS catches the time signal from the GPS satellites, it takes some minutes, depending on the location.

- Check the antenna location
- Possibly search for a better location.
- Is it possible that the antenna is being blocked by metallic objects?

After the time reception, this LED flushes permanently.

Time reception problem? See under point 3.2 "Installation site for the antenna".

If you have still problem with the device, please disconnect the power supply and wait for min. 1 minute. After that please re-start the device again.

12. Warning and security hints

Please understand:

The device is inspected before the delivery and is fully functional. Sometimes, the “no function” doesn’t come from the technical defect, for example the interference at the location of an antenna or not suitable place and so on.

Before you send the device for repairing, please check the function of the GPS at the different location.

Risk of abuse:

The incalculable risks can cause because of not proper uses and is therefore prohibited.

Especially, the case can be opened and the operating characteristics can be changed only in voltage free condition.

(please see the illustration under point 6 “ setting up the system)

Device changing or modifying

Please do not change the device itself. You will lose the guarantee.

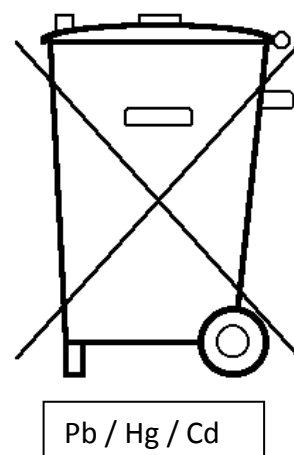
You also have your contribution to environmental protection!

Marking of electrical and electronic equipment in accordance with WEEE 2002/96/EC

Electrical equipment shall not exceed the household garbage.

After the battery changing, you are legally obligated to return the used batteries or accumulators.

A disposal of the waste is prohibited



Creates batteries are marked with a sign, that describes the ban on the disposal of household garbage. The chemical symbol of the crucial heavy metals is also indicated.

Pb stands for lead, Hg for mercury and Cd for cadmium. Your used batteries or accumulators have to return to the public gatherings (public legal disposal makers), who are obliged to withdraw. You meet a significant contribution to the environment!

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Software - Version:

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