INSTRUCTION MANUAL

Wireless Time Distribution WTD 868-T-V2

Manufacturer's Certificate   C E

STANDARDS

The WTD 868-T-V2 time signal transmitter was developed and produced in accordance with the EU guideline 1999 / 5 / EWG

Notes to the Instruction Manual

1. The information contained in this instruction manual can be changed at any time without prior notice. The current version is available for downloading under www.mobatime.com.
2. This instruction manual was compiled with the utmost care to provide all the details regarding the use of this product. However, should you have any queries, or find any errors in the instructions, please contact us.
3. We will not accept any liability for any damages resulting, directly or indirectly, from the use of this instruction manual.
4. Please read these instructions carefully and only use the product when all the instructions on installing and operating have been correctly understood.
5. Installation may only be carried out by qualified personnel.
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Contents

1 Introduction

The WTD 868-T-V2 is an HF transmitter for the wireless synchronisation of analogue and digital radio-controlled slave clocks.

(WTD = Wireless Time Distribution, 868 = Frequency band 868 MHz, T = Transmitter).

The transmitter can be synchronised (NTP), and supplied (Power over Ethernet PoE) from a local network (LAN). The transmitter can, however, also be supplied from an external direct current supply, and synchronised with a time signal receiver (DCF/HBG/MSF/GPS). Should the WTD 868-T-V2 serve as a radio interface for a master clock (ETC, CTC, MTC), it can be synchronised from its DCF output.

The transmitter is completely compatible with the NF S87-500 standard of the French Standards Association (AFNOR). The standard includes a description of the time code format for wireless time distribution.

2 Hardware Description
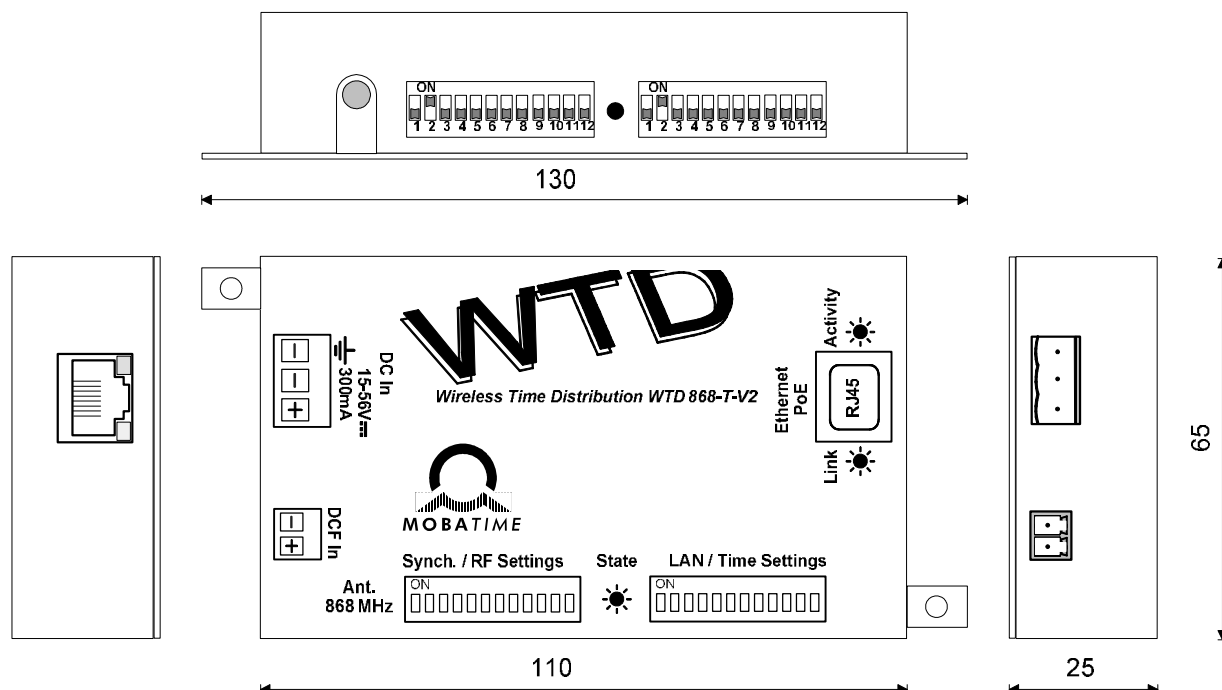
2.1 Connections

2.1.1 LAN Ethernet 10Mbit/s
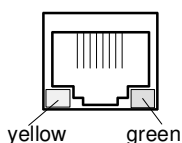
yellow   green

RJ 45 plug for 10BaseT cable

Integrated LEDs:

Yellow: Connection (shows connection to LAN)
Green: Activity (signalises sending / receipt of data packets)

The RJ 45 plug is PoE capable (Power over Ethernet). The WTD 868-T-V2 can thus be supplied directly from the LAN. Either with phantom power or via the connections 4,5 and 7,8 (protected against polarity reversal).

2.1.2 Time signal input DCF In

Active current loop input for DCF time code from the time signal receiver DCF 450(0) / MSF 450(0), HBG 450(0) / GPS 4500 (receiver type adjustable) or from the master clock (e.g. ETC, CTC, MTS, MTC).

2.1.3 Power supply input DC In

This connection (DC in: - / +) can be used to supply the WTD 868-T-V2 from an external direct power supply, if no PoE (Power over Ethernet) is available.

If an external switching power supply unit is used, it must fulfill the following specifications:

- 24 VDC, max. 15VA
- Certified with EN/IEC 60950-1 (e. g. CE, GS, UL)

An earth connection enables the signal ground (-) of the WTD 868-T-V2 to be connected electrically to the earthing potential. This connection can be especially useful in the case of difficult DCF reception to clear the fault (Follow the specifications for the receiver). Take a power supply 24V= / 48V= max. 300mA.
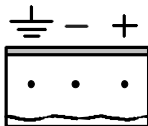
Electrical characteristics DC in: 15..56 V=, current consumption <100 mA @48 V=, respectively <300 mA @15 V=.

When synchronising with a DCF, HBG or MSF time signal receiver, the input voltage should not be lower than 20 V= (Follow the specifications for the receiver).

When synchronising with a GPS 4500 time signal receiver, the common supply voltage of 40 V= may not be exceeded and the current consumption of the receiver should be observed when selecting the power supply (Follow the specifications for the receiver).

2.1.4 Status LED

If there is power on the WTD 868-T-V2, the LED (status: wait for synchronisation) will appear. As soon as the interface is synchronised, the status LED will go out. During transmission activity, the LED lights up briefly (the periodicity of the flashing depends on the transmitter address set). After 1 hour without synchronisation, the LED will light permanently.

Operating modes / Status LED displays

LED	Cause / Remedy
Lights permanently	- Power on after startup - or after 1 hour without synchronisation ➔ Status: wait for synchronisation
Doesn't light up	Normal operation when synchronisation is OK.
Brief, periodical light up	During **transmission activity**, the LED lights up briefly (the periodicity of the flashing depends on the transmitter address set).

3 Synchronisation

3.1 DCF Time Signal

The WTD 868-T-V2 can function as a DCF synchronised radio-controlled master clock. In addition, the transmitter can be synchronised directly from a time signal receiver (DCF 450(0) / MSF 450(0) / HBG 450(0) / GPS 4500).

Should an existing master clock (e.g. MTC, CTC, MTS, ETC) be augmented by the WTD 868-T-V2 wireless time distribution capability, the transmitter can be synchronised from the DCF output of the master clock.

3.2 NTP Server

The WTD 868-T-V2 reads NTP packets (Network Time Protocol) of a time server on the LAN. As the transmitter only needs Multicast messages from a time server, no specific IP address has to be programmed. Only the last part of the Multicast IP address has to be selected by means of DIP switches. The time server provides the packet on the following Multicast IP address (administratively scoped IPv4 multicast address):

239.192.54.nnn   (nnn = 1..15, selectable with switches 1 to 4)

The interval, in which the time server emits NTP packets, can be freely selected (e.g. twice a minute).

3.3 Time Acceptance

For the first synchronisation, the WTD 868-T-V2 requires two valid packets. Later 4 valid packets are required to change the time on the transmitter. This number of packets is defined, in order to prevent the acceptance of wrong time information.

3.4 Loss of Synchronisation

In the case of a loss in synchronisation, the transmitter will continue to function for an hour on the internal quartz accuracy. After that time distribution will stop.

3.5 Accuracy

The transmitted time has an accuracy of +/-20ms.

3.6 Time Zone Entry

Internally, the WTD 868-T-V2 functions with coordinated universal time (UTC). In addition, the transmitter converts the time information received according to the time source to UTC (NTP and GPS time are per definition UTC and do not require any conversion). In order to be able to emit local time, the WTD 868-T-V2 requires a time zone entry for calculating local time offsets. The offset is added to the coordinated universal time.

3.6.1 Standard time zone table

The transmitter provides a time zone table with 59 standard entries. The desired entry can be selected with the switches 5 to 10 of the LAN/time settings switch.

If a standard entry is used, switch 11 of the LAN/time settings switch must be in the OFF position.

3.6.2   Time Zone Server

It is possible to run a time zone server within the LAN (e.g. Little Time Server LTS), which provides the WTD 868-T-V2 with up to 15 different time zone entries. The suitable entry can be selected with the configuration switches 5 to 10 of the LAN/time settings switch.

The time zone server must use the same IP multicast address as the time server for distributing the time zone packets. The time zone server normally functions at the same time as the NTP time server.

If a time zone entry of a time zone server is used, **switch 11** of the LAN/time settings switch must be in the ON position.

4 Configuration

4.1 Configuration switch

The WTD 868-T-V2 has 2x12 switches, enabling the operation mode to be configured. It is recommended that settings be carried out on the equipment with the power turned off. Most settings are binary weighted (see following tables and examples):

4.1.1 Synch. / RF settings switch

Switch 1..2:   Selecting the time source:

0: NTP (synchronisation from NTP multicast server)
1: DCF 77 / HBG (local time)
2: MSF
3: GPS (GPS 4500 time signal receiver) DCF 77 (DCF)

Switch 3..6:   Setting the transmitter address (0..11).

The selected transmitter address determines the frequency with which the time messages are transmitted. The periodicity is determined as follows:

Addresses:	Periodicity:
0	1.250 s
1	1.750 s
2	2.250 s
3	2.750 s
4	3.250 s
5	4.250 s
6	4.750 s
7	5.750 s
8	7.250 s
9	10.250 s
10	28.250 s
11	59.750 s

For most installations an address selection between 0 and 9 is recommended. The addresses 12 – 15 can not be used.

Switch 7..8:   Selecting the transmitter power:

0: 0 mW
1: 125 mW
2: 500 mW
(3: 500 mW)

The selection of the transmitter power should be as low as possible and is to be determined by trials in installing. If need be the fitting of further transmitters or repeaters is necessary.

Switch 9..11:	Reserved (no function).	
Switch 12:	Sets the transmitter in initial mode (Init-Bit is set within the transmitted time message).	
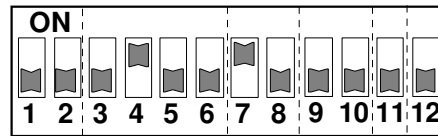
Configuration example:

1..2:	Time source NTP
3..6:	Transmitter address 2 (sends every 2.250 seconds)
7..8:	Transmitter power 125 mW
12:	Normal mode (Initial mode switched off)

Switch:	Status:	Function:
1	Off	Select time source. Significance 0
	On	Select time source. Significance 1
2	Off	Select time source. Significance 0
	On	Select time source. Significance 2
3	Off	Select transmitter address. Significance 0
	On	Select transmitter address. Significance 1
4	Off	Select transmitter address. Significance 0
	On	Select transmitter address. Significance 2
5	Off	Select transmitter address. Significance 0
	On	Select transmitter address. Significance 4
6	Off	Select transmitter address. Significance 0
	On	Select transmitter address. Significance 8
7	Off	Select transmitter power. Significance 0
	On	Select transmitter power. Significance 1
8	Off	Select transmitter power. Significance 0
	On	Select transmitter power. Significance 2
9	Off	Spare
	On	Spare
10	Off	Spare
	On	Spare
11	Off	Spare
	On	Spare
12	Off	Transmitter in normal mode
	On	Transmitter in initial mode

4.1.2 LAN / Time Settings Switch

Switch 1..4: Select the IP multicast address used for distributing the NTP packets from the time server. The address is as follows: **239.192.54**.nnn (nnn = 1..15, 0 = reserved).

If a time zone server is used, the same IP multicast address as the time server must be used for distributing time zone entries.

Switch 5..10: Select from 1 of 59 standard time zone entries. Invalid settings (> 59) lead to emission of UTC time.

If a time zone server is used, the switches are for selecting 1 of 15 time zone entries. Invalid settings (0 or > 15) lead to emission of UTC time.

Switch 11: Defines whether a time zone server automatically provides the WTD 868-T-V2 with a time zone entry.

Switch 12: Forces MOBATime radio-controlled movements to run on the 12:00 position (e.g. for maintenance purposes).

Note: This order is not issued by the WTD interfaces WTD 868-RU and –RD.
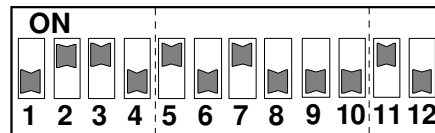
Configuration example:

1..4: IP multicast address 239.192.54.6
5..10: Time zone entry 5
11: Time zone entry from time zone server

Switch:	Status:	Function:
1	Off	Select IP multicast address. Significance 0
	On	Select IP multicast address. Significance 1
2	Off	Select IP multicast address. Significance 0
	On	Select IP multicast address. Significance 2
3	Off	Select IP multicast address. Significance 0
	On	Select IP multicast address. Significance 4
4	Off	Select IP multicast address. Significance 0
	On	Select IP multicast address. Significance 8
5	Off	Select time zone entry. Significance 0
	On	Select time zone entry. Significance 1
6	Off	Select time zone entry. Significance 0
	On	Select time zone entry. Significance 2
7	Off	Select time zone entry. Significance 0
	On	Select time zone entry. Significance 4
8	Off	Select time zone entry. Significance 0
	On	Select time zone entry. Significance 8
9	Off	Select time zone entry. Significance 0
	On	Select time zone entry. Significance 16
10	Off	Select time zone entry. Significance 0
	On	Select time zone entry. Significance 32
11	Off	Use time zone entry from standard table
	On	Use time zone entry from time zone server
12	Off	Slave clocks in normal mode
	On	Slave clocks to 12:00 position

5 Installation

5.1 Instructions

1 Each WTD 868-T-V2 has its own unique MAC address imprinted on the casing. The location of the installed transmitter, and its MAC address should be noted and kept, so that the equipment can always be identified.

Die MAC address has the following hexadecimal number format (6 Byte):

00-16-91-nn-nn-nn (nn = individual)

2 Carry out the desired configuration on the switches 1 to 12 (Synch. / RF settings and LAN / time settings).

3 Power alternative 1 (Power over Ethernet + NTP synchronisation):

Connect the WTD 868-T-V2 to the Ethernet cable. PoE capable equipment must be connected on the LAN connection to the transmitter (e.g. a PoE-Switch or a PoE-mains power adapter – injector). Proceed to no. 7.

4 NTP synchronisation:

Connect the WTD 868-T-V2 to the Ethernet cable. Proceed to no. 6.

5 DCF/HBG/MSF/GPS synchronisation:

Connect time signal receiver to DCF input of the transmitter (Follow the installation instructions of the corresponding receiver!).

6 Power alternative 2 (external DC power)

Connect an external direct power supply 24V= / 48V= max. 300mA to the DC input of the WTD 868-T-V2.

7 Check function:

- Status LED lights and shows availability of power.
- The yellow link LED appears and shows LAN connection.
- The green activity LED flashes on receipt of Ethernet packets.
- If the WTD 868-T-V2 can be synchronised, the status LED flashes during the period of transmission and displays time signal emission.

6 Internet Group Management Protocol (IGMP)

6.1 Use

Several networks are often connected to each other through routers. It is possible that the time/time zone server and the WTD 868-T-V2 do not belong to the same network. The WTD 868-T-V2, therefore, reports periodically its interest in receiving multicast addressed (specific address: 239.192.54.nnn) packets to adjacent multicast routers. The protocol for reporting the IP multicast group membership to the router is called an Internet Group Management Protocol (IGMP). As long as a router receives WTD 868-T-V2 membership reports, it will pass on all packets directed to the specified multicast address to the WTD 868-T-V2. IGMP Version 2 is employed for compatibility reasons.

The protocol is transmitted automatically every 3 minutes to the following dummy IP address:

1.255.255.253

Warning:

The IP address stated may not be used by any other equipment in the network!

7 Standard Time Zone Table

Time zone entries in the standard time zone table (version 9.0).

Time zone	City / State	UTC Offset	DST Change	Standard → DST	DST → Standard
00	UTC (GMT), Monrovia, Casablanca	0	No		
01	London, Dublin, Edinburgh, Lisbon	0	Yes	Last Sun. Mar. (01:00)	Last Sun. Oct. (02:00)
02	Brussels, Amsterdam, Berlin, Bern, Copenhagen, Madrid, Oslo, Paris, Rome, Stockholm, Vienna, Belgrade, Bratislava, Budapest, Liubliana, Prague, Sarajevo, Sofia, Vilnius, Warsaw, Zagreb	+1	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
03	Athens, Istanbul, Minsk, Helsinki, Riga, Tallinn, Kaliningrad	+2	Yes	Last Sun. Mar. (03:00)	Last Sun. Oct. (04:00)
04	Bucharest, Romania	+2	Yes	Last Sun. Mar. (03:00)	Last Sun. Oct. (04:00)
05	Cairo, Pretoria, Harare	+2	No		
06	Dhaka	+6	Yes	Wed. 31. Mar. (22:59) (2010)	Sun. 31. Oct. (23:59) (2010)
07	Tel Aviv	+2	Yes	Last Fri. Mar. (02:00)	2nd Sun. Oct. (02:00) (2010)
08	Kuwait City	+3	No		
09	Moscow, St. Petersburg, Volgograd	+3	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
10	Tehran	+3.5	Yes	Sun. 21. Mar. (00:00) (2010)	Tue. 21. Sep. (00:00) (2010)
11	Abu Dhabi, Muscat, Tbilisi	+4	No		
12	Kabul	+4.5	No		
13	Yekaterinburg, Russia	+5	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
14	Tashkent	+5	No		
15	Mumbai, Calcutta, Madras, New Delhi, Colombo	+5.5	No		
16	Astana, Thimphu	+6	No		
17	Bangkok, Hanoi, Jakarta	+7	No		
18	Beijing, Chongqing, Hong kong, Singapore, Taipei, Urumqi	+8	No		
19	Tokyo, Osaka, Sapporo, Seoul	+9	No		
20	Yakutsk, Russia	+9	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
21	South Australia: Adelaide	+9.5	Yes	1st Sun. Oct (02:00)	1st Sun. Apr. (03:00)
22	Northern Territory: Darwin	+9.5	No		
23	Queensland: Brisbane, Guam, Port Moresby	+10	No		
24	NSW, Victoria: Sydney, Canberra, Melbourne	+10	Yes	1st Sun. Oct. (02.00)	1st Sun. Apr. (03:00)
25	Tasmania: Hobart	+10	Yes	1st Sun. Oct. (02:00)	1st Sun. Apr. (03:00)
26	Vladivostok	+10	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
27	Solomon Is., New Caledonia	+11	No		

		UTC	DST	Standard → DST	DST → Standard
28	Auckland, Wellington	+12	Yes	Last Sun. Sep. (02:00)	1st Sun. Apr. (03:00)
29	Marshall Is.	+12	No		
30	Azores	-1	Yes	Last Sun. Mar. (00:00)	Last Sun. Oct. (01:00)
31	Middle Atlantic	-2	No		
32	Brasilia	-3	Yes	3rd Sun. Oct. (00:00)	3rd Sun. Feb. (00:00) (2010)
33	Buenos Aires	-3	No		
34	Newfoundland, Labrador	-3.5	Yes	2nd Sun. Mar. (00:01)	1st Sun. Nov. (00:01)
35	Atlantic Time (Canada)	-4	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
36	La Paz	-4	No		
37	Bogota, Lima, Quito	-5	No		
38	New York, Eastern Time (US & Canada)	-5	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
39	Chicago, Central Time (US & Canada)	-6	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
40	Tegucigalpa, Honduras	-6	No		
41	Phoenix, Arizona	-7	No		
42	Denver, Mountain Time	-7	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
43	Los Angeles, Pacific Time	-8	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
44	Anchorage, Alaska (US)	-9	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
45	Honolulu, Hawaii (US)	-10	No		
46	Midway Islands (US)	-11	No		
47	Mexico City, Mexico	-6	Yes	1st Sun. Apr. (02:00)	Last Sun. Oct. (02:00)
48	Samara, Russia	+4	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
49	Novosibirsk, Russia	+6	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
50	Krasnoyarsk, Russia	+7	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
51	Irkutsk, Russia	+8	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
52	Magadan, Russia	+11	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
53	Anadyr, Russia	+12	Yes	Last Sun. Mar. (02:00)	Last Sun. Oct. (03:00)
54	Ittoqqortoormiit, Greenland	-1	Yes	Last Sun. Mar. (00:00)	Last Sun. Oct. (01:00)
55	Nuuk, Greenland	-3	Yes	Last Sat. Mar. (22:00)	Last Sat. Oct. (23:00)
56	Qaanaaq, Greenland	-4	Yes	2nd Sun. Mar. (02:00)	1st Sun. Nov. (02:00)
57	Western Australia: Perth	+8	No		
58	Caracas	-4.5	No		
59	CET standard time	+1	No		
60	Santiago, Chile	-4	Yes	2nd Sun. Oct. (00:00)	2nd Sun. Mar. (00:00)
61	Chile, Easter Island	-6	Yes	2nd Sat. Oct. (22:00)	2nd Sat. Mar. (22:00)
62	Baku	+4	Yes	Last Sun. Mar. (04:00)	Last Sun. Oct. (05:00)
63	Islamabad, Karachi, Pakistan	+5	Yes	Thu. 15. Apr. (00:00) (2010)	Sun. 31. Oct. (00:00) (2010)
64	Apia, Samoa	-11	Yes	Last Sun. Sep. (00:00)	First Sun. Apr. (00:00) (2011)

Legend:

UTC:	Universal Time Coordinate, equivalent to GMT
DST:	Daylight Saving Time
DST Change:	Daylight Saving Time changeover
Standard → DST:	Time change from Standard time (Winter time) to Summer time
DST → Standard:	Time change from Summer time to Standard time (Winter time)

Example:

2nd last Sun. Mar. (02:00)	Switch over on the penultimate Sunday in March at 02.00 hours local time.

Attention! The Time Zone Table is usually updated every year. The current table is available for download under the following address: *www.mobatime.com* ➔ *Customer Area* ➔ *Customer Support* ➔ *Support Resources* ➔ *Software Tools* ➔ *Time Zone Table*. In case your device is equipped with a newer version than shown in this manual, the current time zone settings should be checked.

8   Technical Details

Ethernet connection:	10Mbit/s
Transmission:	Operating frequency: 869.525 MHz Modulation: FSK, +/-25 kHz Transmitting power: P_{max} = 500 mW @50 Ohm
Synchronisation:	Over LAN, via Network Time Protocol (NTP), UTC
	Synchronisation input (active current loop) for DCF77, HBG, MSF long wave time signal receivers, or for GPS 4500 satellite time signal receivers
Power supply:	DC input: 15..56 V=, or PoE: 48 V= (Phantom / Pins 4,5 and 7,8)
	Exception: Not all DCF receivers can be supplied with 15 V=.
	Spring clip (plug DC in) for earth connection
Current consumption:	<100 mA @48 V= / <300 mA @15 V=
Antenna:	SMA plug (female) for angled λ/4 antenna
Time keeping:	Autonomous operation on quartz basis over 1 hr
Accuracy:	+/-20 ms (synchronised)
Configuration:	2 x 12 DIP Switch
Display elements:	1 x status LED
Temperature range:	0..50 °C, 10-90% relative humidity, without condensation
Casing:	Stainless steel, bottom 1 mm, top 0.5 mm, printed. Ears for wall mounting
Dimensions:	130 x 65 x 25 mm (l x w x h), Weight: ca. 300 g

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