

Technical Information  
Operating Instructions  
**GPS167PC**

## **Impressum**

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October 30, 2001

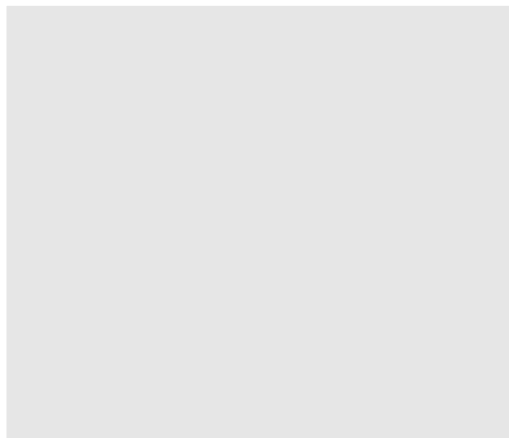
# Table of Contents

Impressum .....	2
Driver Diskette for DOS/Windows .....	4
General Information .....	5
GPS167PC Features .....	6
Time Zone and Daylight Saving.....	6
Asynchronous Serial Ports.....	7
Time Capture Inputs .....	7
Pulse and Frequency Outputs .....	7
DCF77 Emulation .....	8
Connectors and LEDs in the Rear Slot Cover .....	9
Installing the Radio Clock.....	9
Setting The Port Base Address .....	9
Configuring the 9 pin Connector .....	11
Mounting the Board .....	11
Mounting the Antenna .....	11
Powering Up the System .....	12
Files on the Diskette shipped with the Board .....	13
Support for other Operating Systems.....	13
Copying the distributed Software to the Hard Disk.....	13
Using PCPSINFO.EXE .....	14
The resident driver for DOS/Windows .....	17
Controlling the Resident Driver .....	18
Firmware Updates .....	18
Replacing the Lithium Battery .....	19
CE Label .....	19

## Table of Contents (continued)

Technical Specifications GPS167PC .....	21
Technical Specifications of Antenna .....	23
Assembly with CN-UB/E (CN-UB-280DC) .....	24
Format of the Meinberg Standard Time String .....	25
Format of the Meinberg Capture String .....	26
Assignment of the 5 Pin Jumper Block .....	26
Component Layout GPS167PC .....	27

### Driver Diskette for DOS/Windows



## **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 20000 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.

## GPS167PC Features

The hardware of GPS167PC is a plug-in board designed for computers with standard ISA bus architecture. The rear slot cover integrates the antenna connector, two status LEDs, and a 9 pin sub-D female connector.

The antenna/converter unit is connected to the receiver by a 50 ohm coaxial cable with length up to 200m. Power is supplied to the unit DC insulated across the antenna cable. Optionally, an overvoltage 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 automatical 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  $\pm 5 \cdot 10^{-9}$  and automatically compensates the TCXO's aging. The last recent value is restored from the non-volatile memory at power-up. Optionally, the clock is also available with a higher precision time base.

A monitoring software shipped with the board can be used to check the clock's status and configure some operational parameters.

## 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.

## **Asynchronous Serial Ports**

Two asynchronous serial interfaces (RS232) called COM0 and COM1 are available to the user. Only COM0 is available at the rear panel slot cover, COM1 must use another submin-D connector which can optionally be connected to the 5 pin jumper block on the board. The monitoring program can be used to configure the outputs. In the default mode of operation, the serial outputs are disabled until the receiver has synchronized after power-up. However, they can be configured to be enabled immediately after power-up. Transmission speed, framing and mode of operation can be configured individually for each port. Both of the ports can be configured to transmit either the Meinberg standard time string (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.

## **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.

## **Pulse and Frequency Outputs**

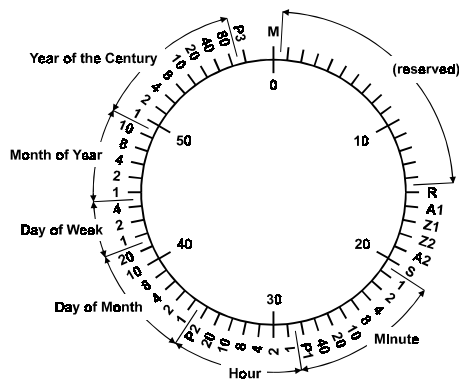
The pulse generator of GPS167PC generates TTL level pulses once per second (P\_SEC) and once per minute (P\_MIN). A DIL switch on the board can be set up to map one or both of the pulses to pins at the 9-pin connector at the rear slot cover.

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

In the default mode of operation, the pulse outputs are disabled until the receiver has synchronized after power-up. However, the monitoring program can be used to enable these outputs immediately after power-up.

## DCF77 Emulation

The GPS167PC satellite controlled 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 clock 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 scheme is given below:

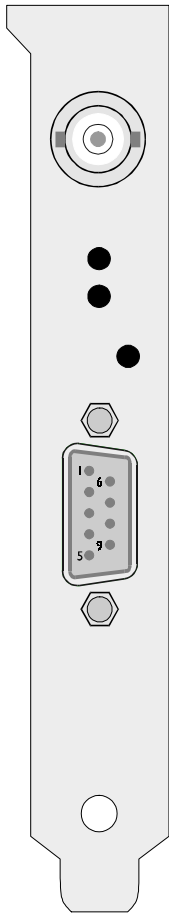


M	Start of Minute (0)
R	RF Transmission via secondary antenna (0)
A1	Announcement of a change in daylight saving
Z1, Z2	Time zone identification
	Z1,Z2 = 0,1: Daylight saving disabled
	Z1,Z2 = 1,0: Daylight saving enabled
A2	Announcement of a leap second
S	Start of time code information (1)
P1, P2, P3	Even parity bits

Time marks start at the beginning of a 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.



## 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 GPS167PC'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 used to send out Meinberg's standard time string to an external device. A DIL 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 ports) at TTL inputs or outputs may damage the radio clock.**

Behind the little hole in the slot cover there is a push button which is needed if the clock's firmware shall be updated. See the chapter about firmware updates for details.

## Installing the Radio Clock

Before the clock can be installed in the computer, some configuration may be required if the desired settings differ from the default settings.

## Setting The Port Base Address

Programs can read data from or write data to the board using 2 I/O ports from a block of four addresses. The base I/O address can be set up in a wide range using the DIL switch on the board. When being shipped, the board's address is set to 300h corresponding to the default address used by the utility software. If one of the levers 8, 9, or

10 of the DIL switch is set to the ON position, the radio clock GPS167PC can generate cyclic hardware interrupts on the PC's corresponding interrupt line. However, if the clock is operated using the software shipped with the board, all of the interrupt switches should remain in the OFF position because the software shipped with the board does **not** use any hardware interrupt.

SW	IRQ
8	3
9	4
10	7

In most cases the board can be installed without modifications. If another board uses I/O in the range 300h to 303h (e. g. networks boards are often configured with this address), the clock's base address must be changed. Lever 1 of the DIL switch is assigned to the PC's address line A2, lever 7 is assigned to A8, A9 is hard wired to logical "1". Any switch in the ON position ties the corresponding address line to logical "0". Some common port base addresses and the corresponding DIL switch settings are shown in the table below:

Use the table shown below to see the DIL switch settings and corresponding I/O addresses.

Port	SW1	2	3	4	5	6	7	Port	SW1	2	3	4	5	6	7
200	x	x	x	x	x	x	x	32C	-	-	x	-	x	x	-
204	-	x	x	x	x	x	x	330	x	x	-	-	x	x	-
208	x	-	x	x	x	x	x	334	-	x	-	-	x	x	-
20C	-	-	x	x	x	x	x	338	x	-	-	-	x	x	-
210	x	x	-	x	x	x	x	33C	-	-	-	-	x	x	-
214	-	x	-	x	x	x	x	340	x	x	x	x	-	x	-
218	x	-	-	x	x	x	x	344	-	x	x	x	-	x	-
21C	-	-	-	x	x	x	x	348	x	-	x	x	-	x	-
300	x	x	x	x	x	x	-	34C	-	-	x	x	-	x	-
304	-	x	x	x	x	x	-	350	x	x	-	x	-	x	-
308	x	-	x	x	x	x	-	354	-	x	-	x	-	x	-
30C	-	-	x	x	x	x	-	358	x	-	-	x	-	x	-
310	x	x	-	x	x	x	-	35C	-	-	-	x	-	x	-
314	-	x	-	x	x	x	-	360	x	x	x	-	-	x	-
318	x	-	-	x	x	x	-	364	-	x	x	-	-	x	-
31C	-	-	-	x	x	x	-	368	x	-	x	-	-	x	-
320	x	x	x	-	x	x	-	36C	-	-	x	-	-	x	-
324	-	x	x	-	x	x	-	370	x	x	-	-	-	x	-
328	x	-	x	-	x	x	-	374	-	x	-	-	-	x	-

'x' —> switch in pos. **ON**

'-' —> switch in pos. **OFF**

## Configuring the 9 pin Connector

By default only the signals needed for the serial port COM0 are mapped to the pins of the connector. Whenever one of the additional signals shall be used, the signal must be mapped to a pin by putting the appropriate lever of switch DIL2 in the **ON** position. The table below shows the pin assignments for the connector and the DIL switch lever assigned to each of the signals. Care must be taken when mapping a signal to Pin 4 of the connector. Only one of the switch levers 5 or 10 may be put in the ON position to connect the pulse per minute or the 10MHz standard frequency to the jack. Those signals which do not have a lever of the DIL switch assigned are always available at the connector:

Pin	Signal	DIL2
1	+5V	1
2	RxD	-
3	TxD	-
4	P_MIN	5
4	10MHz	10
5	GND	-
6	CAP0	2
7	CAP1	3
8	P_SEC	4
9	DCF_OUT	6

## Mounting the Board

The computer has to be turned off and its case must be opened. The radio clock can be installed in any ISA slot not used yet. The rear slot cover must be removed before the board can be carefully plugged in. 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.

## Mounting the Antenna

The GPS satellites are not stationary but circle round the globe in a period of about 12 hours. They can only be received if no building is in the line-of-sight from the antenna to the satellite, so the antenna/converter unit must be installed in a location from which as much of the sky as possible can be seen. The unit can be mounted using a pole with a diameter up to 60 mm. A standard coaxial cable with 50 ohms impedance (e.g. RG58) should be used to connect the antenna/converter unit to the receiver. Cable thinner than RG58 should be avoided due to its higher DC resistance and RF attenuation. When using the optional antenna diplexer the total length of one antenna line

between antenna, diplexer and receiver must not be longer than 200m. If a cable with less attenuation is used its length may be increased accordingly.

## Powering Up the System

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  $\pm 2\mu\text{s}$ .

## **Files on the Diskette shipped with the Board**

DATEIEN.TXT	this list of files in German language
LIESMICH.TXT	last changes/modifications in German language
FILES.TXT	this list of files in English
README.TXT	last changes/modifications in English
@6AAC.ADF	Adapter Description File (required for PS31 only)
PCPSINFO.EXE	shows continuously the board's status
PCPSDRV.COM	resident driver, keeps computer time synchronized with board time
DRV.EXE	temporarily disables the resident driver
DISP.EXE	enables or disables the permanent date/time window
POSXY.EXE	positions the permanent date/time window on the screen
COLOR.EXE	sets the screen attribute of the permanent date/time window

## **Support for other Operating Systems**

Drivers for the operating systems listed below are optionally available:

**IBM OS/2 v2.1 and above**

**Novell NetWare v3.11 and above**

**Microsoft Windows NT v3.51 and above**

## **Copying the distributed Software to the Hard Disk**

When the computer has come up after power on the utility programs should be copied from the shipped diskette to a subdirectory on the hard disk. Assume the current drive is C: and the new subdirectory is to be created on the current drive, create that subdirectory (e.g. called MEINBERG) using the command

**MD \MEINBERG**

from the DOS command line. Make the new subdirectory the current one using the command

**CD \MEINBERG**

If the utility diskette is inserted in drive A: use the following command to copy the files and subdirectories from the diskette to the hard disk:

```
XCOPY A:*. * /S
```

## **Using PCPSINFO.EXE**

After the board has been installed in the computer the program **PCPSINFO.EXE** should be run in order to see if the board has been properly installed. This program can display its messages in English or in German language and the date and time in formats used in the USA, the UK, or Germany. The default language and formats used are derived from the DOS country code at startup. If automatic language detection does not yield the desired result, you can force a language and date/time format using a command line parameter or by pressing a function key when the program is running. The command syntax is shown below:

```
PCPSINFO [P:xxx] [C:xx] [MONO] [?]
```

Usage of the command line parameters is described below:

- P:xxx** This parameter is only needed for clocks with ISA bus, if the I/O port base address does not match the default I/O address (300 hex). If a clock with PCI bus or Micro-channel bus is installed then the program will automatically retrieve the I/O address from the computer's BIOS.
- C:xx** Country code override. The default country code to be used is derived from the COUNTRY=.... entry in the CONFIG.SYS file.  
xx may be set to 49 (Germany, 24h clock, dd.mm.yy), 44 (U.K, 12h clock, dd/mm/yy) or 1 (USA, 12h clock, mm-dd-yy).
- MONO** Force monochrome display even if color display installed. May increase the readability on LC displays often used with laptops.
- ?** Displays a message how to setup port address and how to use the program. Output can be redirected to printer ( append ">LPT1" to the command line) or file (append ">filename").

All the command line parameters are optional. In most cases the program is started simply by entering **PCPSINFO**. If the board can installed successfully, the screen displays information similar to figure shown below:

```

Heinberg PC31/PS31 Info Display v2.8                               16.03.98
Resident Driver                                                  11:25:21
Software rev.: PCPSDRV v3.3 (c) Heinberg 1997
User Int.:      61h      Date/Time read:  Mon, 03-16-98 11:25:21.50 AM
BUSY Flag:     OFF      Tick Reload:   182
DISP Flag:     ON       Tick Counter:  131
Set RTC direct: NO

Reference Time
Eprom ID:      GPS167PC v2.07 (c) Heinberg 1997
S/N:          09000470    Date/Time:   Mon, 03-16-98 11:25:21.51 AM
I/O Port:     300h      Last sync.:  Mon, 03-16-98 11:25:00.00 AM
COM0:         19200,0N1,1 sec  Capture:     N/A
COM1:         9600,0N1,1 sec   Status:      * NORMAL OPERATION (9/9 S0x)
                                           * Time is synchronized
                                           * Receiver pos. has been determined
                                           * Daylight saving disabled
Position:     N 51°59'01", E 9°13'35", 245m

Alt-X Exit  Alt-H Help  F1 Sprache  F3 Board Time  F5 Time Zone

```

The upper part of the screen shows information about the resident driver (if the driver has been installed). These information include the **ID string of the resident driver** with the driver revision number, the **number of the software interrupt** used to control the resident driver and the **last recent date/time** the driver has read from the board. The number of the user interrupt is determined automatically when the resident driver is installed. It is not affected by the hardware interrupt configured by jumpers.

The **BUSY flag** controls the driver's right to access the board. If the flag is set to **OFF** the driver is allowed to access the board, if it is **ON**, access is inhibited. This flag can be changed from the command line using the utility DRV.EXE or by pressing the **key B** in PCPSINFO. The flag **DISP** affects the resident driver's feature displaying the permanent date/time window on the screen (upper right corner in the screenshot above). It can be altered using the utility DISP.EXE from the command line or by pressing the **key D**. The flag **Set RTC direct** enables the driver to write directly to the computer's real time clock. This feature is required in some special environments only; see the description of PCPSDRV.COM below. The **Tick Counter** counts the times the driver has been activated by the computer's periodic timer tick interrupt. If this counter is down to zero, the computer's system time is set and the counter is reloaded to the **Tick Reload** value. The tick reload is derived from the update cycle parameter given in the command line when PCPSDRV.COM is installed. The system timer generates 18.2 interrupt per second, so the reload value in the figure above (182) corresponds to an update cycle of 10 seconds.

The lower part of the screen gives information about the radio clock installed in the computer: The **Eprom's ID string** resp. the **type of the board**, and the **clock's serial number** and **port base address**, and the settings of the clock's serial ports. The serial parameters can be set up by menu if the **key F4** is being hit.

The field labeled **Date/Time:** displays the board's current date and time. If the **key F3** is pressed the user can modify the board's date and time, should the need arise. The line **Last Sync:** shows the time last synchronization with the GPS satellites has been

achieved. The field labeled **Capture:** show the time of the last trigger pulse at one of the clock's capture inputs, if available.

The clock's current status is shown in the field **Status:**. The first line shows the mode of operation and the number of satellites which can be used. By default, the mode should read **Normal Operation**. The indicator (8/9 SVs) says that currently 8 out of 9 satellites in view can be received. The next lines display whether time synchronization has been achieved, whether the receiver position has been computed, and whether daylight saving is currently in effect or not.

**Time zone and daylight saving parameters** can be viewed or modified by a dialog window which comes up if the key **F5** is pressed. The example below shows the settings used in Germany:

```
----- Set the radio clock's time zone -----
Time Zone:
  Standard time:  UTC +3600  sec
  Daylight time:  UTC +7200  sec

DST Start:      Sun after 25.03.  02 o'clock
DST End:        Sun after 25.10.  03 o'clock

Enter to set param.  ← ↑ → ↓      ESC Abort
```

The German standard time (MEZ) is computed by adding 1 hour (3600 sec) to UTC. While daylight saving is active, two hours (7200 sec) must be added to UTC to get German daylight time (MESZ). Every year, daylight saving starts at the first Sunday after March, 25, at 2 o'clock, it ends at the first Sunday after October, 25, at 3 o'clock. The parameters shown in the dialog are saved on the radio clock board if the ENTER key is pressed to close the dialog.

Pressing both the keys **Alt** and **X** simultaneously lets this program terminate.



## The resident driver for DOS/Windows

The resident driver PCPSDRV.COM runs with DOS version 2.11 or greater, Windows 3.x, or Windows 9x. It uses only about 1500 bytes of memory and periodically synchronizes the computer's system time to the board time. Additionally, the driver is able to display the board's time continuously in a window on the text screen. This feature can be enabled and controlled by some of the utility programs (see next chapter).

In order to avoid conflicts accessing the board the driver should not be installed or be temporarily disabled using the utility DRV.EXE if user-written software accesses the board.

If the driver has to be installed every boot time, it should be called from the AUTOEXEC.BAT which should reside in the root directory of the boot drive. Assuming the driver file can be found in the directory MEINBERG on drive C:, a command line like that shown below should be added to the AUTOEXEC.BAT using any text editor:

**C:\MEINBERG\PCPSDRV [port] [U:xxxx] [I] [R]**

The parameter **port** is only needed for clocks with ISA bus, if the I/O port base address does not match the default I/O address (300 hex). If a clock with PCI bus or Microchannel bus is installed then the program will automatically retrieve the I/O address from the computer's BIOS.

The optional parameter **U:xxxx** can be used to set the time span to be used for the periodical update of the system time. Valid numbers for xxxx are 1 to 3600 (seconds). If this parameter is omitted the time span defaults to 1800 seconds (= 30 minutes).

By default the driver will adjust the computer's system time only if the clock has synchronized at least once after power-up (Status: Synchronized after last Reset). If the clock is installed in an environment where the RF signal can not be received properly the parameter **I** may be given on the command line to let the driver ignore that status flag and adjust system time even if the clock has not synchronized after power-up.

The last parameter **R** tells the resident driver to set the real time clock in AT compatible computers directly. This is only required if the DOS/BIOS interrupts which modify the computer's time are redirected by other applications as on Novell Netware 2.xx file servers. In the default case this parameter should not be used in order to minimize the execution time of the resident driver.

## Controlling the Resident Driver

If the resident driver **PCPSDRV.COM** has been installed, some of the utility programs can be used to control the way it works. The programs described below show a few help lines when they are called without command line parameters.

**DRV.EXE** temporarily disables the resident driver's access to the board.  
Command: DRV ON or DRV OFF  
Default: enabled

**DISP.EXE** enables or disables the date/time window on the screen.  
Command: DISP ON or DISP OFF  
Default: disabled

**COLOR.EXE** sets up the screen attribute of the date/time window  
Command: COLOR fg bg  
with fg and bg the color numbers of the foreground/background  
Default: white characters on black

**POSXY.EXE** sets up the screen position of the date/time window.  
Command: POSXY column row  
Default: upper right corner of the screen

Using these utilities, you can enable or disable the date/time window only when special applications are run.

## 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.

If the button behind a hole in the rear slot cover is pressed for approximately 2 seconds, a bootstrap loader is activated and waits for instructions from the serial port COM0. 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 bootstrap loader does not depend on the contents of the flash memory, so if the update procedure is interrupted, it can easily be repeated.

The contents of the program memory will not be modified until the loader program has sent the command to erase the flash memory. So if the button has been pressed accidentally, the system will be ready to operate again after the computer has been turned off and on again.

## **Replacing the Lithium Battery**

The life time of the lithium battery on the board is at least 10 years. If the need arises to replace the battery, the following should be noted:

### **ATTENTION!**

**Danger of explosion in case of inadequate replacement of the lithium battery. Only identical batteries or batteries recommended by the manufacturer must be used for replacement. The waste battery must be disposed as proposed by the manufacturer of the battery.**

## **CE Label**



This device conforms to the directive 89/336/EEG on the approximation of the laws of the Member States of the European Community relating to electromagnetic compatibility.



## Technical Specifications GPS167PC

RECEIVER:	Five 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"
ANTENNA INPUT:	Antenna circuit dc-insulated; dielectric strength: 1000V <sub>DC</sub> Length of cable: refer to chapter "Mounting the Antenna"
TIME TO SYNCHRO- NIZATION:	one minute with known receiver position and valid almanac 12 minutes if invalid battery buffered memory
PULSE OUTPUTS:	change of second (P_SEC, TTL level) change of minute (P_MIN, TTL level)
ACCURACY OF PULSES:	better than $\pm 250$ nsec after synchronization and 20 minutes of operation better than $\pm 2$ $\mu$ sec during the first 20 minutes of operation
TIME CAPTURE INPUTS:	triggered on falling TTL slope Interval of events: 1.5msec min. Resolution: 100ns
FREQUENCY OUTPUTS:	10 MHz (TTL level)
STANDARD ACCURACY OF FREQUENCY:	$\pm 5 \cdot 10^{-9}$

ACCURACY OF  
FREQUENCY

OPTION OCXO:	after sync. and 20 min of operation	$\pm 1 \cdot 10^{-9}$
	during first 20 minutes of operation	$\pm 2 \cdot 10^{-8}$
	Accuracy of quartz	
	one day, free-running	$\pm 2 \cdot 10^{-8}$
	one year, free-running	$\pm 5 \cdot 10^{-7}$
	Short term stability	
	$\leq 10$ sec, GPS controlled	$\pm 1 \cdot 10^{-9}$
	$\leq 10$ sec, free running	$\pm 3 \cdot 10^{-9}$
	Temperature drift	
	free running	$\pm 2 \cdot 10^{-7}$
	SSB phase noise	
	10 kHz beside carrier	-101 dB/Hz
	1 kHz beside carrier	-76 dB/Hz
	100 Hz beside carrier	-60 dB/Hz

SERIAL PORTS: 2 asynchronous serial ports (RS-232)

Baud Rate: 300 up to 19200  
Framing: 7N2, 7E1, 7E2, 8N1, 8N2, 8E1  
default setting: COM0: 19200, 8N1  
COM1: 9600, 8N1

POWER

REQUIREMENTS: 5V  $\pm$  5%, @280mA  
12V  $\pm$  5%, @180mA

RF CONNECTOR: coaxial BNC

AMBIENT

TEMPERATURE: 0 ... 60°C

HUMIDITY: 85% max.

## Technical Specifications of Antenna

ANTENNA: dielectrical patch antenna, 25 x 25mm  
receive frequency: 1575.42 MHz  
bandwidth: 9 MHz

CONVERTER: local oscillator to converter frequency: 10 MHz  
first IF frequency: 35.4 MHz

### POWER

REQUIREMENTS: 12V ... 18V, @ 100mA (provided via antenna cable)

CONNECTOR: coax type N, female

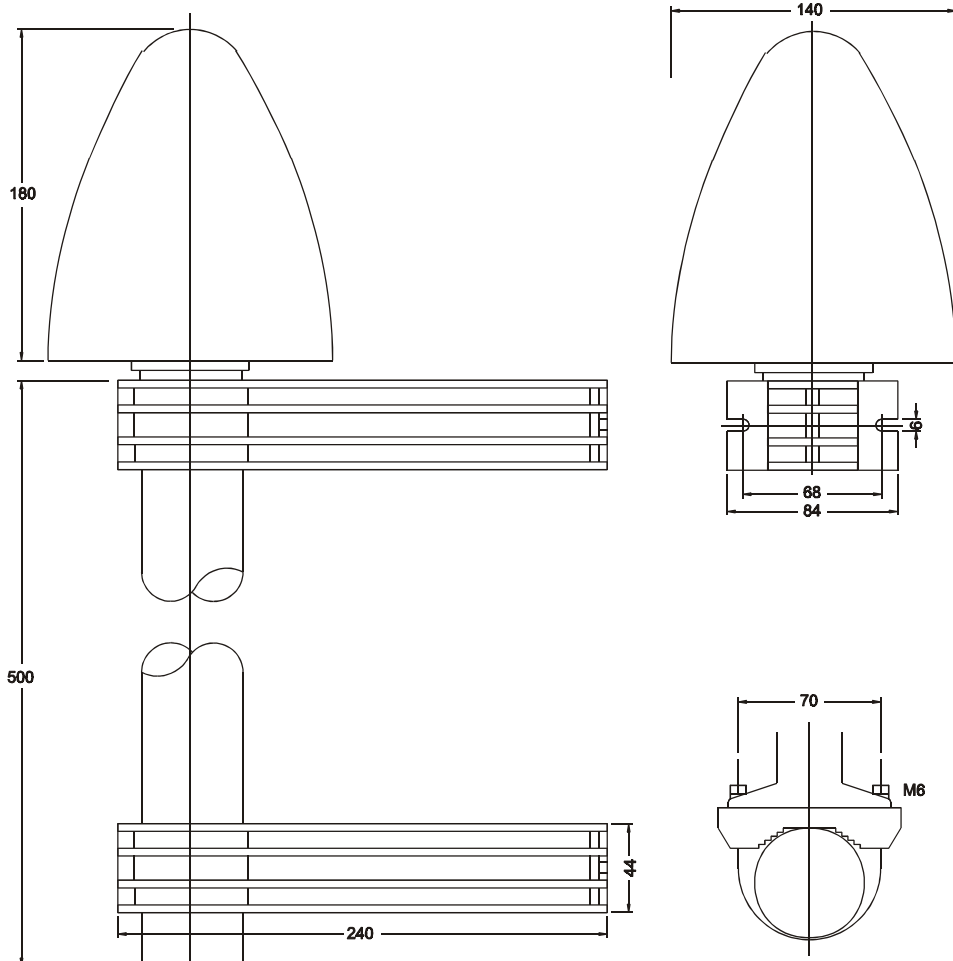
### AMBIENT

TEMPERATURE: -25 ... +65°C

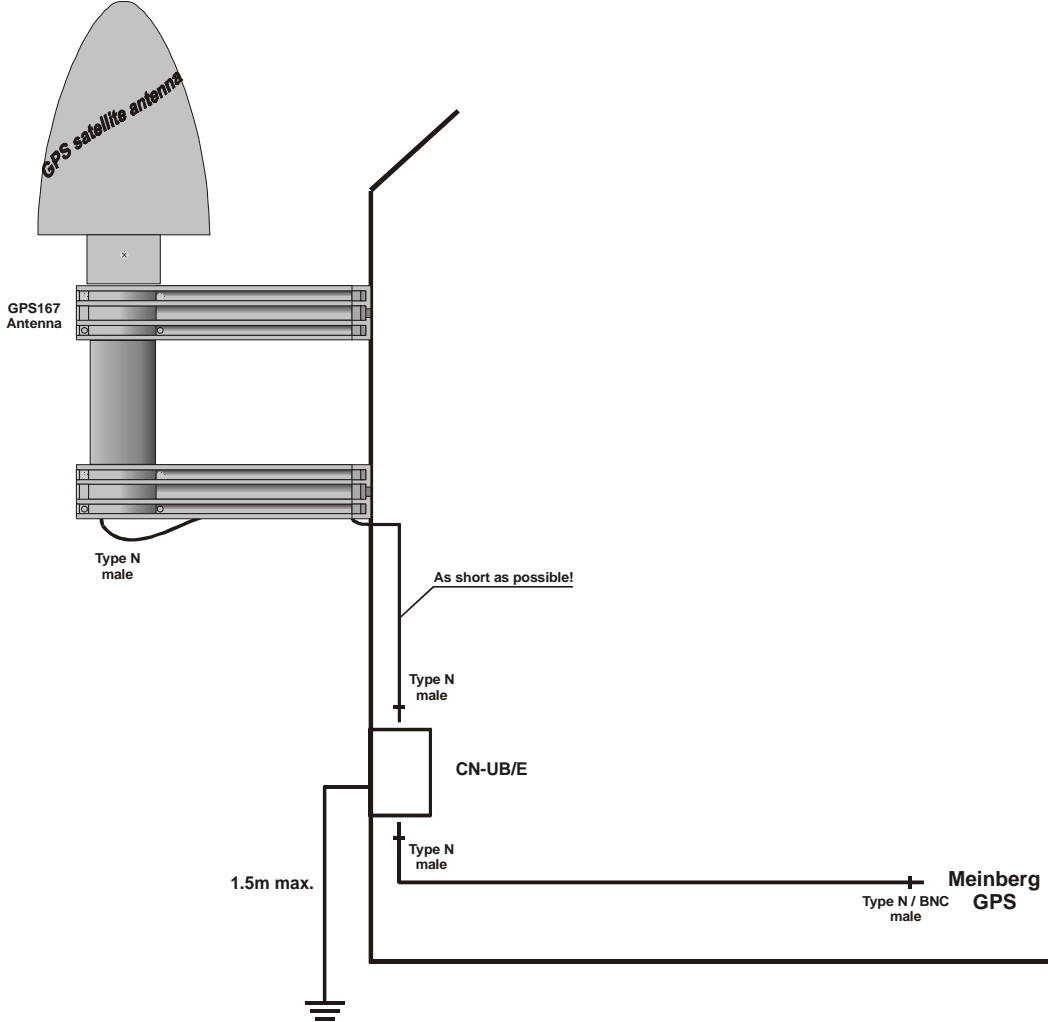
HOUSING: ABS plastic case for outdoor installation (IP56)

### PHYSICAL

#### DIMENSION:



# Assembly with CN-UB/E (CN-UB-280DC)





## 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:

<STX> Start-Of-Text (ASCII code 02h)

*dd.mm.yy* the current date:

*dd* day of month (01..31)

*mm* month (01..12)

*yy* year of the century (00..99)

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

*hh.mm.ss* the current time:

*hh* hours (00..23)

*mm* minutes (00..59)

*ss* seconds (00..59, or 60 while leap second)

*uv* clock status characters:

*u*: ‘#’ clock has not synchronized after reset  
‘ ‘ (space, 20h) clock has synchronized after reset

*v*: different for DCF77 or GPS receivers:

‘\*’ DCF77 clock currently runs on XTAL  
GPS receiver has not checked its position

‘ ‘ (space, 20h) DCF77 clock is sync'd with transmitter  
GPS receiver has determined its position

*x* time zone indicator:

‘U’ UTC Universal Time Coordinated, formerly GMT  
‘ ‘ MEZ European Standard Time, daylight saving disabled  
‘S’ MESZ European Summertime, daylight saving enabled

*y* announcement of discontinuity of time, enabled during last hour before discontinuity comes in effect:

‘!’ announcement of start or end of daylight saving time

‘A’ announcement of leap second insertion

‘ ‘ (space, 20h) nothing announced

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

## 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:

**CHx\_tt.mm.jj\_hh:mm:ss.ffffff<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*    the capture date:

*dd*    day of month            (01..31)  
    *mm*    month                    (01..12)  
    *yy*    year of the century        (00..99)

*hh:mm:ss.ffffff*    the capture time:

*hh*    hours                    (00..23)  
    *mm*    minutes                    (00..59)  
    *ss*    seconds                    (00..59, or 60 while leap second)  
    *ffffff*    fractions of second, 7 digits

<CR>        Carriage Return, ASCII code 0Dh

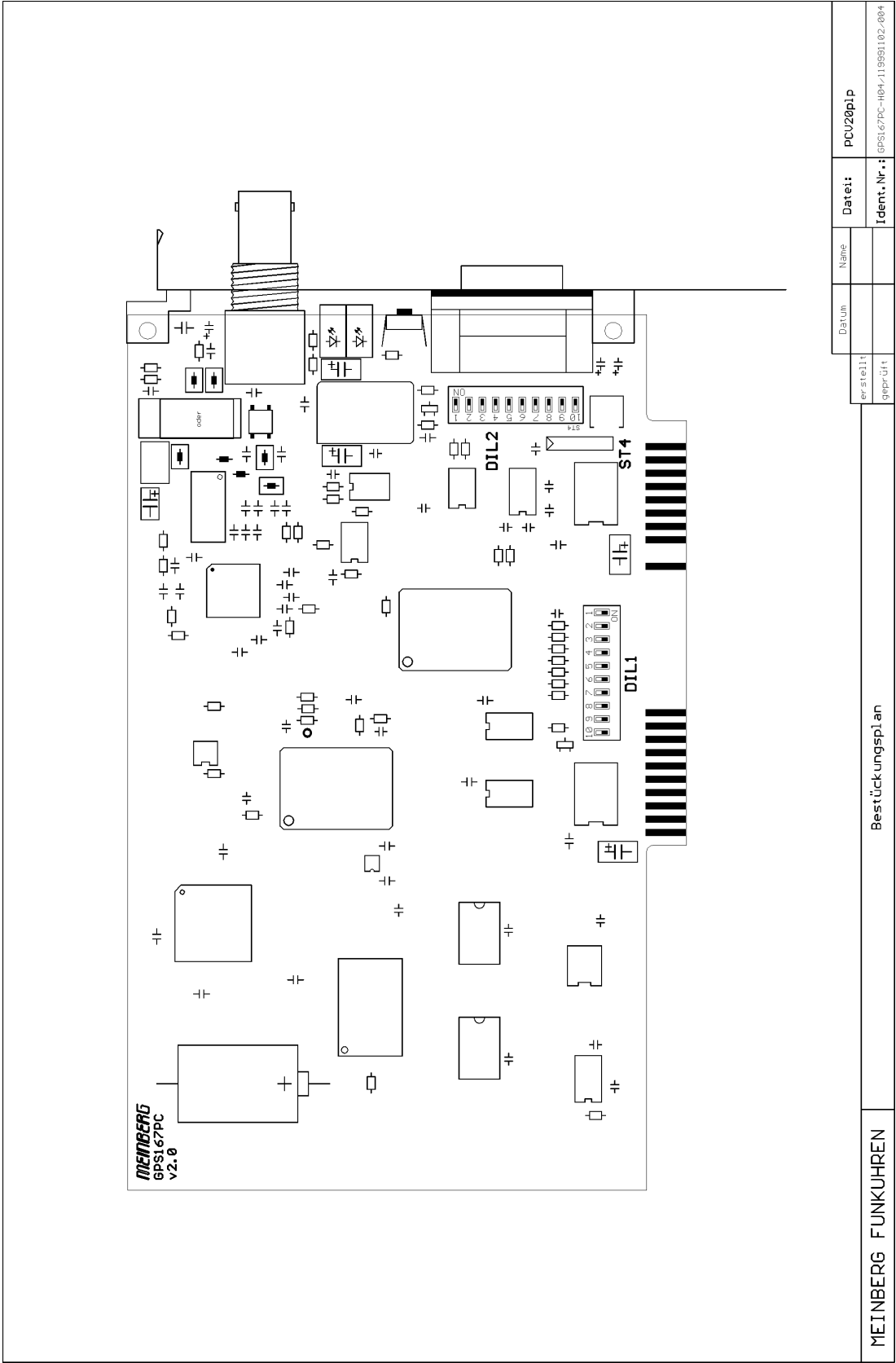
<LF>        Line Feed, ASCII code 0Ah

## Assignment of the 5 Pin Jumper Block

The jumper block can be used to access the 10 MHz frequency output and the serial port COM1. Pin 5 is located near the board's bus connector:

Pin	Signal
1	10 MHz out
2	GND
3	RxD1 in
4	TxD1 out
5	GND

# Component Layout GPS167PC



MEINBERG FUNKUHREN		Bestückungsplan	
Datum	Name	Datei:	PCU20p1.p
erstellt		Ident. Nr.:	GPS167PC-H04/19891102.004
geprüft			

