

Technical Description

GPS-Clock as 8 Bit ISA PC-Board
6038



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1 Brief Information Model 6038

The **hopf** system 6038 is a further development of the DCF77 radio controlled clock 6036. The measurements are the same as the standard format for a short 8-bit ISA bus board. The following construction features were particularly focused on:

- potential free antenna circuit
- no line loss caused by insertion of the indirect lightning protection
- antenna cable up to 150 m by simple looping in of an amplifier into the antenna cable without its own power supply
- downwards compatible with the board 6036 (I/O range)
- simple access to the clock data via the I/O range incl. milliseconds
- no replugging of jumpers required! All address and mode settings are carried out by the software included in the delivery.
- back-up clock function with maintenance free memory element
- TTL pulse outputs
- interrupt operation with freely programmable cyclic interrupt variable from 10-65536 milliseconds (ideal for measuring purposes)
- GPS reception analysis function
- RS232 interface equipped for the synchronisation of remote computers
- Variable pulse breadth adjustment for DCF77-simulation
- Synchronisation with one or several satellites possible

included software:

- service programme for the setting of all parameters in the clock board
- DOS synchronisation programme
- Windows 3.x, 95 synchronisation programme

Included options:

- programmable protection mechanism for software producers (Dongle)
- software driver for Windows NTTM

2 Introduction

The well-proved **hopf** radio controlled / crystal clock systems have been extended by the GPS¹ reception unit which guarantees high precision running of the clock anywhere in the world.

The time basis is synchronised by the global satellite navigation system GPS. At a height of about 20.000 km, satellites circle on different orbits and angles around the earth twice a day (see picture in the appendix GPS). On board each satellite there is a high precision atomic clock (precision min. $1 \times 10E-12$). The GPS reception unit receives the orbit position and a GPS-world time from as many satellites as possible. From these data first the position of the receiver is determined. Once the position has been calculated the travel time of the transmission-information from the individual satellites can be worked out. The accuracy of the time depends above all on how accurately the position is calculated.

The world time UTC² is calculated by subtracting the leap second from the GPS-world time (GPS-UTC). At present (1994) the world time is 8 seconds slower than the GPS-UTC. The difference changes with the insertion of leap seconds. By means of the system key pad or serial interface the difference to UTC and the regional time changeover for summer- / winter time can be entered for any location in the world, which offers the local time for further use at high precision.

Different well-proved ways of communication like:

- 8-Bit ISA-Bus interface via Dual-Port RAM
- serial RS232 interface
- PPS-pulse

are available. Also a DCF77-simulation of the local or UTC-time is integrated so that all **hopf** DCF77 radio controlled clocks can be controlled from here.

3 Starting the Radio Clock Circuit Board 6038

When installing the radio controlled clock the computer and all the connected devices should be switched off. Open the computer housing, plug the radio controlled clock into a vacant extension space (8-bit ISA slot), connect the antenna and the clock is ready for operation.

After installation you have to control that there is no contact to any other board plugged in.

3.1 Antenna Installation

To guarantee a GPS-reception as constant as possible, the antenna must have free "view" of the whole horizon. The antenna is dimensioned so that it covers satellites over 10° above the horizon. It requires the reception of 4 satellites to evaluate the position and time (3D mode). If the view to a part of the sky is blocked by buildings, the GPS-receiver cannot evaluate the exact time. It will wait until 4 satellites have moved into the free range of view. This can take up to four hours in case of an unfavourable satellite constellation. Therefore the antenna should be placed at the highest possible point on the roof (see drawing in the appendix). The quality of the received satellites can be supervised by the programme "**SERVICE.EXE**" (see below).

¹ GPS = Global positioning system

² UTC = Universal time coordinated

3.2 Coaxial Cable Installation

The antenna is connected to the base device by means of a coaxial cable included in the delivery. The cable is connected to the antenna with a coaxial coupling at the plate foot of the antenna. This coupling can be disconnected for cable laying purposes. Loosen the screw at the antenna foot plate and lift the antenna plate (see drawing in the appendix).



Please note : Do not lay the cable next to other HF-, control- or power cables.

The leakage from these cables could disturb the reception because of the very small reception power.

The cable is connected to the clock device at the BNC connector of the unit. The standard length of the antenna cable is max. 25 m (**hopf** special cable up to 70 m). If the cable is longer (up to 150 m) a GPS power amplifier must be looped into the antenna cable.



Please note : Utmost care is required when laying the antenna cable.

Please make sure that :

- the bending diameter must not be less than 10 cm in any place
- the casing of the cable must not be damaged
- the cable must not be crimped

Previously mounted BNC connectors are also a problem. Please do not remove the protection until the cable has been laid.

3.3 Reception Frequencies

The satellites broadcast two frequencies:

L1 at 1.575,42 MHz
and L2 at 1.227,60 MHz

The frequency L1 has been assigned for civil use.

The received power is about -160 dB. The antenna contains a pre-amplifier which boosts the received satellite frequency by +20 dB.

4 Setting by Means of SERVICE. EXE

The programme "SERVICE.EXE" serves to supply the radio controlled clock with initialising data and to check the clock functions. The programme comes in with the following menu.

```
SERVICE programm for GPS-radio board      6 0 3 8

meaning of the procedures                    start by key
-----
Time and Date ..... 1
Initialisation of the radio board ..... 2
Changing the hardware address of the radio board ..... 3
Mode for data output and DCF-simulation ..... 4
Set the parameter-byte of the RS 232 interface ..... 5
Set the telegramm-byte 1 of the RS 232 interface ..... 6
Set the telegramm-byte 2 of the RS 232 interface ..... 7
Show change over date, radio bit, DCF-sim. Eval.-Mode .... 8
Reset the radio board ..... 9

Exit programm ..... Esc

(c) hopf Elektronik GmbH                    Version: 3.00, 18.12.98
```

4.1 Time, Date, Status Information and Reception Quality

Under point 1 time, date and the internal clock status can be checked. The position data and the reception quality can be checked in mode 2 in menu point 4 only. It may therefore be necessary to switch the clock to mode 2, 3, or 4 during the installation phase. Independent from the mode the following display appears.

Structure of display in mode 1 - 6036 compatible

```
base address = Hex : 0280      millisecond : 293
-----
Zone      hour   minute  second day of week daymonth  year
-----
Local     15     5      41      1      1      4      96
UTC       13     5      41      1      1      4      96
Lo/ST    14     5      41      1      1      4      96
-----
                        Status information of the transmission
B7      B6      B5      B4      B3      B2      B1      B0
1       1       0       0       1       0       0       0
radio   time  leap sec.  ST      DST      ann.    free    free
-----
key word = 21845 reception for 10 minutes
-----
end by pressing key ...
-----
```


Supervising the reception quality**Structure of display mode 2 from main menu 4**

```

base address = Hex : 0280                      milliseconds : 293
-----
zone      hour      minute   second   day of week  day      month     year
-----
ST/WT     15         5        41       1         1        4         96
-----
data of position:      latitude : +51.16587 longitude: -7.3456
difference time        UTC/Local: +01 hour 00 minutes
Max Sat.: 7           Revision number : 1.1 date : 01.04.96
Sat.-No.: S/N:       05/137  17/043  15/080  25/065  32/090  00/000
-----
Status information of the Transmission
B7      B6      B5      B4      B3      B2      B1      B0
1       1       0       0       1       0       0       0
radio   time leap second. ST      DST      ann      free     free
-----
key word = 21845                      reception for 10 minutes
-----
end by pressing key ..
-----

```

In the setting 3D of the time evaluation 4 satellites within the view of the antenna are required to synchronise the system with the time. At best 9-10 satellites are within the view of the antenna, while 6 satellites can be received parallel. Mode 2 menu item 4 allow control of the number of satellites within the view and which satellites can be received, also a relative measure of the reception power is transmitted.

The time evaluation can also be done in the position fixed mode which requires only one satellite for synchronisation (see chapter 0).

The entry "**Max Sat.**" states the number of visible satellites. Six satellites can be received. The entry "**Sat.:No/S-N**" states the satellite-pseudo-random-number.

The satellites are not numbered 1, 2, 3, etc. but named after the pseudo-random-number of the satellite broadcasting its information. In case of a satellite failure a spare satellite can be activated under the same number. The figure after the slash indicates the signal/noise ratio. It can vary between 0-255.

After the first installation it may take up to 4 hours before satellite data are at hand. It depends on the start information received by the system (see programming time, position etc.) and on the antenna position e.g. half the view range to the sky.

In the above screen there are 7 satellites in the theoretical view range, of which e.g. satellite 05 is received by the GPS-receiver with a relative signal/noise ratio of 137 and satellite 17 with 43.

The values of a bad signal/noise ratio lie within 10-30

The values of a sufficient signal/noise ratio lie within 30-70

The values of a good signal/noise ratio lie within 70 and higher

4.2 Initialising the GPS Reception Unit

To speed up the initial synchronisation the service programme can be used to set the time, date and the position data at the place of use. If required also the points of changeover for summer and daylight saving time must be entered. The respective selection menu for initialising pops up when the menu item 2 "initialising clock board" is called up.

Keep the following sequence when setting start values in the system.

1. input of the approximately position data
2. input of the difference time UTC-local
3. input of the actual local time
4. input of changeover points daylight saving and standard time
5. release a reset of the clock after the next minute-change

After the programme has been called up, menu point 2 is used to initialise the GPS-reception unit.

The following selection menu is shown:

meaning of the procedures	start by key
Set time and date	1
Set position data	2
Set difference time UTC - Local	3
Set change over daylight saving and standard time	4
Set time out DCF77 simulation and sync.- bit	5
Set Evaluation Mode 3-D / Position fix	6
Back to the main menu	Esc

after pressing the according key the data can be entered and transferred to the clock.

4.2.1 Setting Time and Date

This menu point is used to set the valid time information. The calculation of daylight saving and standard time will be done automatically in case of programmed changeover points (look at pt. Setting Points of Changeover) and is shown after the next complete minute changeover.

key >1< set the time.

The entry dialogue appears where the time, day of the week and date data must be entered plausibly. When the entry is complete the data are transferred to the clock and taken over into the internal crystal clock after another check.

On the next minute change the entered data are loaded into the back-up clock. After every reset or voltage failure the data are read from there. If the voltage failure takes longer than 3 days the values of the back-up clock become invalid.

Menu point 1 in the main menu serves to check the entry.

4.2.2 Setting the Position Data

This function serves to enter the geographical position of the system. This function is helpful for the first installation but not necessary; it shortens the re-initialisation of the GPS-receiver. The following dialogue appears after menu point 2 of the initialising menu has been selected:

```
set position data:
actual geographical latitude: (+ means north, - means south)
    degree (+89 to -89)      =      +51
    degree (0 to 59)        =      12

actual geographical longitude: (+ means east, - means west)
    degree (+179 to -179)   =      +007
    degree (0 to 59)       =      39
```

All entries are taken over by the entry key.

Latitudes and longitudes are entered in degrees and minutes. The entry must include the sign.:

Latitude:	+	northern hemisphere	Longitude:	+	east 0°
	-	southern hemisphere		-	west 0°

Once the entry is complete the data are checked and transferred to the clock. A reset will be released in the clock so that the reception process can start with the new data.

After the successful transfer the following message appears:

```
transfer position data latitude = : 51:12
transfer position data longitude = : 7:34
ready !, end by key ...
```

For a faster synchronisation the GPS-receiver only needs the entry of a rough position. For the above example the following entry would suffice.

```
+ 50°00
+ 007°00
```

4.2.3 Setting the Difference Local/UTC

The difference between local time and UTC is entered under point 3 in the initialising menu.

The entered value refers to the difference between UTC and local ST-time (ST=standard).

As the local ST-time does not have a summer / daylight saving time changeover the difference between UTC and local ST-time stays constant.

The difference between UTC and local time (with summer / daylight saving time changeover) is calculated by the clock board depending on the entered changeover points of time.

The difference time is requested in hours and minutes, the hours being entered with sign.

+	for time zones east of the longitude 0°
-	for time zones west of the longitude 0°



Please note : After enter a new value, the UTC-time will be calculated new. In this case the clock status is set to zero and time and date must be entered again.

4.2.4 Points of Changeover

Points of changeover for changing the local time from summer to daylight saving time can be set under pt. 4 of the menu "initialising the clock board".

If no summer / daylight saving time changeover of the local time is wanted, all data positions must show "0".

Requested are the following: day of the week (values 1-7 according to the days Monday to Sunday), the week in the month of the changeover (e.g. 1st week in the month of the changeover, values between 1-5), the month, hour and minute of the respective changeover.

Any plausible time on the hour within the value range in the programme menu is permissible as point of changeover but the minute digits must show the value "0".

When the entry is completed the data are transferred to the clock, and after another check stored in a fail-safe memory.

On the next minute change the clock calculates from these values the exact date of changeover. These values are calculated automatically for the subsequent years.

The entered values can be checked under menu item 8 of the main menu "view points of changeover, radio bit, DCF77-sim, evaluation mode".



Please note : Minute entries other than 0 do not result in correct changeovers.

4.2.5 Setting DCF77-Simulation and Sync-bit

This function under pt. 5 of the initialising menu can be used to delay the changeover of the status information "radio reception" and the output of the DCF77-simulation in case of changes into crystal operation by the stated time factor (2-254 minutes). If this value is set to 255, the information "radio" is permanently transferred or the DCF77-simulation is not switched off (permanent DCF77-simulation).



Please note : Take over of the value 255 takes approx. 3 minutes.

The possibility to delay the switch-off of the DCF77-simulation and radio bit serves to bridge small reception gaps, where the clock module 6870 does not fall short of the required accuracy due to its internal control.

Example:

If an accuracy of more than 1 msec is required, the second pulse produced at the output must not deviate from the absolute time mark by more than ± 1 msec. In case of a maximum crystal drift (0.1 ppm) in free-running situation, this value would be reached after $1000/0,1 = 10.000$ seconds. A signalling of the crystal operation would be necessary after 166 minutes.

Width of the DCF77-Simulation pulses

The transmitter DCF77 broadcasts a data string, which transmits the time information with one bit per second. The lowering of the amplitude for 100 or 200 msec codes the digital information (0/1).

Due to the narrow band nature of their antennas, some strange makes of radio controlled clocks distort the duration of the lowering, so that the respective receiver connected on load side must be set to a different pulse length. The value for the high pulse can be adjusted in the range of 140-230 msec and the low-pulse in the range of 50-130 msec so that those receivers can run safely with the DCF77-simulation.

4.2.6 Time Decoding 3D / Position fix

The accuracy of the time evaluation depends on how accurately the position of the operational location is calculated. At least the reception of 4 satellites is necessary in the 3D evaluation mode. From the calculated position the transit time of the signal to several satellites is found and the second marker is produced from the average transit times. The **3D** evaluation mode allows the second marker to have an accuracy of $\pm 1 \mu\text{sec}$.

In case of a fixed position quite often a less substantial evaluation of the second marker suffices e.g. up to some milliseconds. In the position-fix mode the accuracy depends mainly on the precise entry of the position of the location of the installation. The calculation of the second marker starts with one satellite and the entered position already. An entry of the position to ± 1 minute degree achieves an accuracy of the second marker better than $\pm 20 \mu\text{sec}$. An entry even more precise can achieve the value $\pm 1 \mu\text{sec}$.

The position-fix mode has the advantage that the clock synchronises with only one received satellite. The antenna may be installed somewhere where less than $\frac{1}{4}$ of the sky is visible.

Often it is possible to install the antenna indoors at the window (short cable, no lightning protection). If 4 received satellites are visible in this mode, the evaluation jumps automatically into the 3D mode and calculates the exact position improving the accuracy to $\pm 5 \mu\text{sec}$ for one satellite.

The following entry sequence set the modes

selection picture

```
Set mode of the GPS Evaluation
```

```
1 = 3 D Evaluation
2 = Position Fixed
```

```
MODE (1-2) =
```

Entering "1" or "2" switches the evaluation to the according mode. The entry can be checked in the main menu under pt. 8. The line

```
Mode of GPS Evaluation:
```

shows the set mode:

```
3-D Evaluation
Position Fixed
```

4.3 Hardware Setting Base Address

The address of the board in the I/O range of the computer is not set by means of jumpers but can be changed using the software "**SERVICE.EXE**". For this operation jumper 2 must be disconnected.

Connecting jumper J2 returns the board to its basic setting (Address \$280). "**SERVICE.EXE**" searches the I/O range for the clock board during the start.

When the programme has been called up the hardware address can be changed by means of menu point 3. The following note appears:

Warning: This function will change the hardware address of your clock board. Before you start make sure which address range is still free in your computer.

The clock board can be addressed in steps of Hex 40 addresses in the I/O range of the computer between Hex 200 to Hex 1FFF.

The factory preset of base address \$280 can be restored automatically by plugging J2 in (see manual of the board 6038)

[Return] for change address or [ESC] for abort!

In case of return the address can be entered as hexadecimal value. The programme checks automatically whether the entered address is valid and does not transfer any addresses but plausible ones ranging from \$200 to \$1FC0 in steps of \$40 into the clock.

example : (\$200, \$240, \$280, \$2C0, \$300 ... \$1F00, \$1F40, \$1F80, \$1FC0)



Please note : A reset is necessary after changing the hardware address. The service software have to be started again. The programme does not check the new address range for addresses which may be used by other adapter boards.

When the base address is selected the data are transferred to the clock board and stored in a fail-safe memory.

4.4 Setting the Output Mode and DCF77-Simulation

The board 6038 can operate in 4 different modes. The modes differ in their information at disposal in the I/O range of the board (see pt. time, date and status information). For more information about the programming of the clock board and the data at disposal please see appendix "**programming manual**".

In mode 1 **6036 compatible** all available information are downward compatible to the DCF77 clock board 6036 (factory preset).

This setting is meant for customers using their own software to synchronise their computer based on the DCF77 clock board 6036 and also for the use of the driver programme "**FUNKINST**" and "**HOPFTIME**" with the command line parameter "**u**" and "**m**".

In the modes 2-4 the position-, receiver- and the status information are found in the I/O range (base address +\$10 to base address +\$3F).

The address range (base address to base address +\$0F) contains the time and date information as BCD or binary values compatible with the clock board 6036. If you are using the **hopf** clock drivers "**FUNKINST**" or "**HOPFTIME**" you can operate without the command line parameters "**u**" and "**m**", because the according time information appears at base address to base address +\$0F.

- mode 2 time information local time
- mode 3 time information UTC time
- mode 4 time information local time (standard time only)

example : If you intend to synchronise your computer with UTC the parameter "**u**" can be omitted if the board is switched over to mode 3.

The address range (base address + \$30 to base address + \$3F) is compatible with the clock board 6036 in all modes.

After selecting menu item 4 in the service programme the following menu appears:

Attention: Change output mode!
First read the paragraph "set output mode" in your manual of the clock board before changing the settings.

```
key [ 1 ] mode 1 -->    compatible with clock board 6036 local time,
                        UTC, local time (standard time only)
key [ 2 ] mode 2 -->    local time with position data and status in
                        formation
key [ 3 ] mode 3 -->    UTC (Universal Time Coordinated),
                        with position data and status information
key [ 4 ] mode 4 -->    Local Time (standard time only)
                        position- and status information
```

your choice 1/2/3/4, or Esc for end !

Esc for end !

After the selection of the mode you will be asked to enter the time base for the DCF77-simulation integrated in the board. This signal can be used for the synchronisation of other DCF77 receivers (in TTL level, active low). The output is made at the 9 pole SUB D female connector (please see the description of the board panel).

Here comes a translation.

```
DCF77-Simulation

key [ 1 ] local time as time base for the DCF77-simulation

key [ 2 ] UTC as base for the DCF77-simulation

Esc for end !
```

When the time base is selected the data are transferred to the clock board where it is stored in a fail-safe memory there.

4.5 Setting the Parameterbyte for the Serial Interface

see appendix **serial interface**

4.6 Setting the Modebyte for the Serial Interface

see appendix **serial interface**

4.7 Show Points of Changeover, Radio Bit, DCF77-Sim and Evaluation Mode

Under point 8 of the main menu the programmed points of change over can be checked.

Attention: New values will be calculated by the clock at the next minute change. In case of setting new values this function should not be used before the next minute change.

Additionally the information about the time out of the radio bit and the DCF77-Simulation are made.

The following display appears:

```
change over to daylight saving time: month 03, hour 02
time      02:00:00 day of week 07 date 29.03.96 worked out
```

```
change over to standard time: month 10, hour 03
time      03:00:00 day of week 07 date 23.10.96 active
```

```
time out radio bit after 2 minutes
time out DCF77-simulation after 2 minutes
DCF77-simulation length of Hi-Bit 200 milliseconds
DCF77-simulation length of Lo-Bit 100 milliseconds
```

```
You must wait at least one minute until the new change over points have
been calculated by the radio controlled clock !
press any key...
```

here you can control the change over date and it's status. Also you can control the date, the time and the day of the week.



Please note : During the output of the points of changeover the time data are invisible for about 5 seconds. Synchronisation processes running in the background may contain wrong data.

4.8 Activate Reset of the Clock Board

Menu item 9 of the service programme can be used to activate a reset in the clock. All previously altered settings in the clock remain.



Please note : Errors may occur during the synchronisation process (FUNKINST.EXE, HOPFTIME.EXE or other clock drivers already active) because for about 2 seconds after a reset the I/O range of the clock board is faded out (all data positions \$FF).

5 LED on the Front Panel

The synchronisation status can also be checked by means of the LED on the front panel.

If the LED flashes at second intervals it means:

the clock is in crystal operation

If the LED is lit permanently:

radio operation

6 Output pulses

The following pulses are available at the 9-pole SUB-D connector:

second pulse	length	100 milliseconds
minute pulse	length	1 second
hour pulse	length	1 second
24 h pulse	length	1 second

the signals are delivered in TTL-Level active low (Connection diagram See appendix).

7 Files on the Disc

The supplied system disc for the clock board contains the following files:

- DOS_DRV\Funkinst.exe DOS synchronisation process
- WIN31x\Hopftime.exe Windows 3.x synchronisation process
- WIN95\SyncProc.exe Windows 95/98 synchronisation process
- WINNT\HopfServ.exe Windows NT synchronisation process
- SERVICE_D.EXE service programme for diagnostic purposes (german)
- SERVICE_E.EXE service programme for diagnostic purposes (english)
- IRQEXAPL.PAS example programme to make an IRQ

8 Error during the Reception Process

The reception display in mode 2 of the menu 4 "mode for the data output and DCF77-simulation" can be used to recognise errors in the reception system.

The display screen: time, date, status information in the service programme, can detect errors in the reception system.

example 1

After the first installation no satellite appears on display even after several hours.

Possible causes:

- the antenna has no sufficient "view" to the horizon
- the antenna cable is broken
- the antenna cable is not connected
- the antenna is broken
- the lightning protection is broken

example 2

7 satellites are within the view range, but only up to 2 appear on display.

Possible errors :

- the view range of the antenna to the sky is too small.

example 3

9 satellites appear in the view range, 6 are recorded but the system does not synchronise because the signal/noise ratios are all between 10-25.

Possible causes:

- the cable is too long
- the BNC connectors are badly assembled
- the cable is crimped or bent
- the cable has the wrong impedance

example 4

The system has been working faultlessly. Seven satellites appear within the view range but none are received, the system has not had any reception for several days.

Possible causes:

- the cable is damaged
- lightning has struck and the lightning protection is damaged
- the antenna is damaged
- the receiver is broken
- the voltage supply has a defect

Failure Cause ISA bus

If your service programme has the following message: "**no clock board found**" although the board is in the computer, or some data positions in the menu "**view time, date**" have faulty values please check the following:

- if the board is placed correctly into the ISA-bus plug-in position
- if there is a possible address conflict with other hardware
- if the contact surfaces of the board are soiled

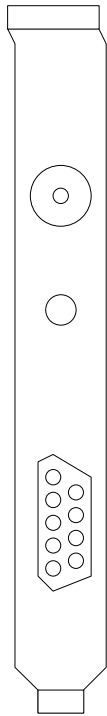
If the computer bios-setup allows the choice to run the ISA-bus either synchronously or asynchronously the bus must be switched explicitly to asynchronous mode. The IOCHRDY signal is needed for an error-free data transmission.

9 Delivery Condition

The clock board 6038 is delivered with the following settings:

- mode 1 - 6036 compatible
- local time as basis for the DCF77 pulse output
- base address \$280 (+\$40 = \$2BF)
- jumper 2 connected (no alteration of address possible)

10 Description of the Front Panel of the Board



BNC-antenna connector

LED crystal/ radio operation

SUB-D connector 9-pole

pin	allocation	pin	allocation
1	day pulse	6	DCF77 pulse out
2	hour pulse	7	RS232 RxD
3	minute pulse	8	RS232 TxD
4	second pulse	9	1 kHz
5	GND		



Please note : The standard interface cable can't be used while employing the serial interface.

11 Technical Data

operating voltage:	5 V DC PC-voltage
power consumption:	450 mA
crystal accuracy:	± 0.02 ppm after GPS control and constant temperature
back-up clock accuracy:	± 25 ppm at 25° C
back-up clock buffering maintenance free:	3 days

Technical Data GPS-receiver

type of receiver:	6 channel phase-tracking-receiver
evaluation:	L1 frequency 1.575,42 MHz, C/A-Code
sensitivity:	-143 dB
synchronisation time cold start:	30 min. - 4 h. (first installation without position data)
warm start:	ca. 2 min. (voltage failure < 3 days)
accuracy of the PPS-pulse:	± 1 microsecond (95%)
temperature range:	0 ... 60° C

Technical Data Antenna

type of antenna:	micro-strip-antenna
mid-frequency:	1.575,42 MHz
band width:	10 MHz

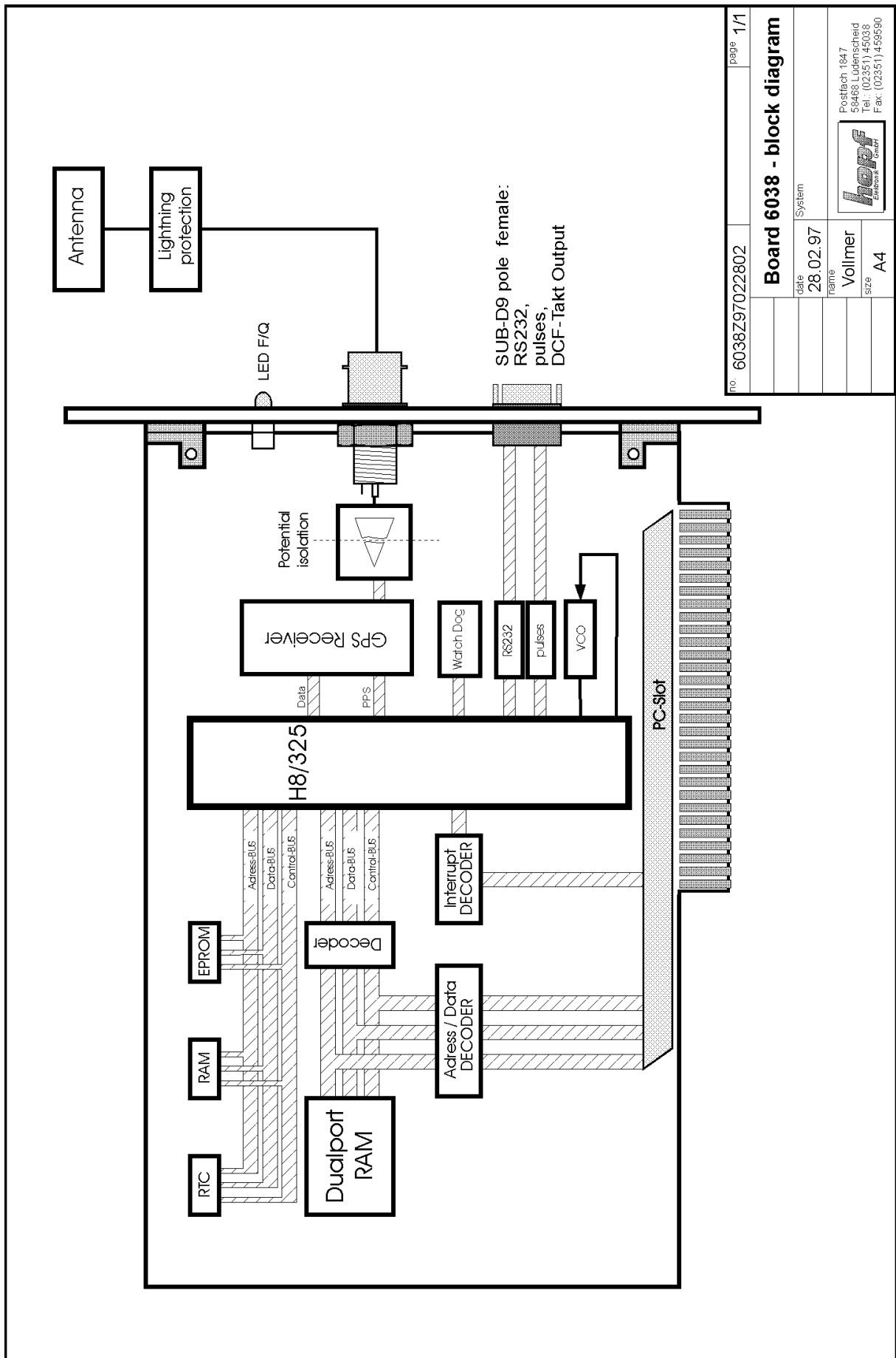
antenna amplifier


voltage supply:	+5 V DC ± 0,5 V (via antenna cable)
impedance:	50 Ohm
power amplifier:	20 dB
length of cable:	max. 25 m - with hopf special. cable 70 m max. 150 m with power amplifier
temperature range:	-30° C to +85° C

Special requirements: Hard- and software alterations according to customer specifications are possible.



Please note : The **hopf** company withhold the right to hard- and software alterations at any time.



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Board 6038 - block diagram			
date	28.02.97	System	
name	Vollmer		
size	A4		
			
Postfach 1847 58468 Ludenscheid Tel.: (02351) 45038 Fax: (02351) 459590			