Appendix

GPS Satellite Radio Controlled Clock
6841

System without keypad and display

hopf Elektronik

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1 Set-up of the Base System via Remote Software

All the required settings in a clock board without key-board and display are carried out by means of the supplied service software (**GPS_6841.EXE**) via the serial interfaces.

The simulated DCF77-pulse is indicated by the LED on the front panel.

1.1.1 System Requirements for the Remote Software

The program requires a PC/notebook with a free serial interface and the operating system Microsoft Windows from 3.x, 95, NT. One free serial interface (COM 1 or COM 2) is always used for the data traffic with the **hopf** system 6841 GPS. Before the transmission of data the software checks if there is a COM connection free.

1.1.2 Installation of the Remote Software

The software is supplied on a 3.5 " disc and should be copied onto the remote computer. A serial interface cable (X-modem) must be connected between computer and the GPS system.

The software automatically looks for the first free COM-port (1-2) and shows the connection in the main window of the program.

> **Example : "program connected with COM 2"**

The remote software replaces keyboard and display. All the required settings of the clock system are transferred to the clock via data string. The program resembles the Window standard.
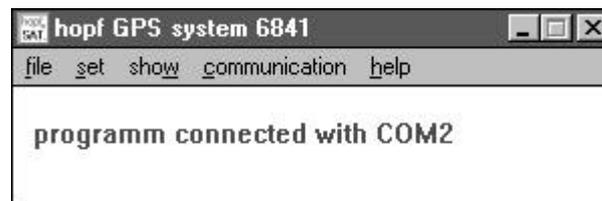
The main window of the program contains all the known elements e.g. pull-down menu, switches etc. You can use either a mouse or the keyboard of your computer to handle the software.

We advise first-time users of the windows program to teach themselves the function by means of the windows teaching program. Start the teaching program in the program manager under the menu help. You'll find further instructions in your Microsoft Windows users manual or directly under "help" of your program manager.

1.1.3 What you should know

In case of an initial installation (file **GPS_INIT.INI** must not be there) **GPS_6841.EXE** sets the transmission parameter in the computer to the following values for the communication with the GPS system.

- baudrate 9600 baud
- data bit 8
- stop bit 1
- parity no

These values must also be activated in the clock system (as supplied). You can activate this status by connecting jumper 2 on the 6841 (see block wiring diagram in the appendix).

If the parameter in the GPS system are altered the setting of the COM port of your computer must also be changed. For this reason changed parameters are saved in a text file so that they are available when the program is called up again.

You can find the file in the same directory as the program **GPS_6841.EXE** and it is called:

> **GPS_INIT.INI**

If necessary this file can be edited manually. It is important that the settings of the values must correspond with the values of the GPS system.

structure of file:

> **[serial Parameter]**
> **String=COM1:9600,N,8,1**

only the parameter part of the entry **String=** may be altered

example:

old	**COM1:9600,N,8,1**
new	**COM1:19200,E,7,2**

When the file is saved and **GPS_INIT.EXE** is restarted the program works with the new settings.

In case of doubt you can delete the file **GPS_INIT.INI**. The program then starts with the above standard settings.

2 Functions of the Remote Software

The functions of the software are divided into (SET) initialising, (SHOW) supervision and (COMMUNICATION). In this present version the output of values by a printer has not yet been established (FILE..PRINT).

2.1 Initialising of the GPS-Receiver

Setting start values in the GPS system during the set-up speeds up the synchronisation of the clock. Entering start values is not absolutely necessary, but the first radio reception may take up to 4 hours without initialising.

Setting the system with start values should follow this sequence:

- entry of the current local time
- entry of the position data
- entry of the difference time UTC/local
- entry of the parameter for the serial interfaces.
- release reset of the GPS system

All the individual points of the program are explained below.

2.1.1 Setting the Time and Date

Many countries change their time (standard / daylight saving) during the course of the year. This function serves to set the time valid for the location and the information daylight saving / standard time.

In countries without timezone changeover the time must always be set as standard time.

You'll find the function set-time under the menu **"set"** and the entry **"time/date"**. The menu is subdivided into **"standard"** and **"daylight saving"**. Select the entry corresponding with the current timezone. The program automatically takes over the time set in the computer into the editing field of the dialogue.

When the clock data and possible alterations have been checked, start the transmission to the clock with the **"send"** switch. The status field **"transmit buffer"** shows the data string sent to the clock. In case of a successful transmission the same data string is shown in the **"receive buffer"**.

2.1.2 Setting the Points of Changeover

This function is used to enter the points of time, calculated from month and hour, when the changeover from daylight saving to standard time takes place. The stated hour is calculated for the last Sunday of the stated month.

The entry of naughts for all parameter is required when a changeover is not wanted (e.g. in countries which do not have a standard / daylight saving time changeover).

You'll find the function set-points of changeover under the menu **"set"** and the entry **"change over date"**. The program shows the set data of the daylight saving or standard time changeover.

2.1.3 Setting the Difference Local-UTC

This function is used to enter the time difference between local time and UTC .

Most countries choose the time difference in full hours, but they could enter differences up to 12:59 in steps of minutes.

e.g. West 05:00; East 11:30; West 08.27.

You'll find the function **"set difference time"** under the menu **"set"** and the entry **"difference local/UTC"**. Enter the current data into the field for hour and minute by using the scroll bar. Click the right field for the direction (West/East).

When the data are entered start the transmission to the clock by using the **"send"** switch. The status field **"transmit buffer"** displays the data string transmitted to the clock. The same data string's are shown in the **"receive buffer"** if the transmission was successful.

2.1.4 Setting the Position Data

Here the geographic position of the system is entered. This function is helpful during first installation but not necessary. It shortens the initialising period of the GPS-receiver.

The values for the latitude and longitude of the position are entered in degrees, minutes and 1/100minute.

Additionally the following information must be entered for the latitude:

North	= northern hemisphere
South	= southern hemisphere
<u>example :</u>	**North 51°12,36**

The entry of the longitude requires the information

East =	east of the 0 meridian
West	= west of the 0 meridian
<u>example :</u>	**East 007°37,84**

A fast synchronisation of the GPS receiver requires the entry of rough position only. The following entry would suffice for the position in the above examples:

North 50°00,00

East 007°00,00

You'll find the **"set-position"** function under the menu **"set"** and the entry **"position"**. Enter the current data into the fields using degree, minutes and 1/100 min. for latitude and longitudes by using the scroll bar. Click at the right field for latitude (north/ south) and longitude (West /east).

When the data are entered start the transmission to the clock by using the **"send"** switch. The status field " **transmit buffer"** shows the data string which is transmitted to the clock. When the transmission is successful the same data string appears in the "receive buffer".

2.1.5 Setting the Reception Mode Position fixed or 3D-Decoding

The accuracy of the time decoding depends on the precise calculation of the position of the location. This calculation requires at least 4 satellites (**3D**-decoding). The position is used to calculate the signal delay times to several satellites, from the average of which the second marker is produced. In this **3D** decoding mode the second marker has an accuracy of ± 1 μsec.

In many cases of a fixed position an inferior decoding of the second marker suffices e.g. up to some milliseconds. In the position-fixed mode the accuracy depends mainly on the accuracy of the entered position of the location. The calculation of the second marker already starts with one satellite and the entered position. If the position is entered very accurately, ± 1 minute degree, the accuracy of the second marker is better than ± 20 μsec. An even more precise entry can achieve a value of 1 μsec.

The position-fixed mode has the advantage that the clock synchronises with one satellite. The antenna can be installed in a place from where less than ¼ of the sky is visible.

In many cases it is possible to place the antenna at the window (short cable, no lightning protection). If in this mode there are 4 satellites the decoding automatically jumps to 3D mode and calculates the exact position, increasing the accuracy to ± 5 μsec. for one satellite. The remote software still shows position-fixed however.

In the **"set"** pull down menu the reception mode can be set under **"mode of reception"**. The windows **"receive quality"** appears. The set mode can also be seen in the **"show"** pull down menu **"quality of receiving"** (see also pt. reception quality).

2.1.6 Setting the Parameter for DCF77-Simulation and Sync-Bit

By means of this function it is possible to ignore short interruptions unless they exceed a preset length. Error messages or even system failures occur only when the interruption of the receptions takes longer than the set time.

Here the duration of the pulses for high- and low bit may be set for the DCF77-simulation. This setting may be needed when radio controlled clocks of some makes - due to the antennas of some makes- falsifiy the duration of the pulses and the simulation must adjust to it. The standard values (which also apply to **hopf** clocks) are 100 msec. for low-pulses and 200 msec. for high-pulses.

You will find the "DCF77-Simulation and setting the sync-bit" function under the menu **"set"** and the entry **"DCF77-simulation and sync.-bit"**. The program shows you the set values of the points of changeover of the daylight saving and standard time.

2.1.7 Reset

This function is used to release a hardware reset of the clock system. The reset is activated by the menu **"set"** and the entry **"reset clock"**. Using the **"send"** switch releases a reset in the clock. This action is confirmed by **"reset activated"** in the **"receive buffer".**

2.1.8 Data Security

All the entry data of points 4.1.1 - 4.1.5 are checked for plausibility and then stored in a voltage fail-safe EEPROM. To check the values a **program reset** or a **master reset** is carried out so that the stored values in the EEPROM are reread into the working memory.

2.2 Supervising the GPS-Receiver

You can use this function to have the internal clock data displayed.

2.2.1 Time and Date

The function **"show time"** is activated by **"show"** and the entry **"time/date"**. The menu point is divided into **"local"** and **"UTC"** time. A window with the according information appears. The time is requested in intervals of 200 msec. anew.

2.2.2 Points of Changeover

The function to show the points of changeover is activated by the menu point **"show"** and the entry **"change over date"**. The menu point is devided into **"standard"** and **"daylight saving"**. A window appears showing the hour and month of both points of changeover.

2.2.3 Difference Local-UTC

The function to show the difference time is activated by the menu point **"show"** and the entry **"difference UTC/Local"**. A window appears with the according information.

The data are requested once and then displayed.

2.2.4 DCF77 Simulation and Sync-Bit

This menu point serves to display the length of the DCF77-Simulation, the length of the high- and low-pulses and the delay time of the synchronisation status.

2.2.5 Position

This function is used to display the entered position or the one updated by GPS. Up to 2 decimal points of the position minute are shown.

The function to show the position is activated by the point **"show"** and the entry **"position"**. A window appears with the according information. The position data are requested once and then displayed.

2.2.6 Reception Quality

4 satellites within the view of the antenna are needed to synchronise the system with UTC. At best, 9-10 satellites are within the view of the antenna, while 6 satellites can be received parallel.

By means of the menu **show quality of receiving** the number of visible satellites are indicated, which satellites are being received and a relative measure for the reception quality. This function is particularly useful during the installation of the system. The following picture is shown when this menu point is selected:
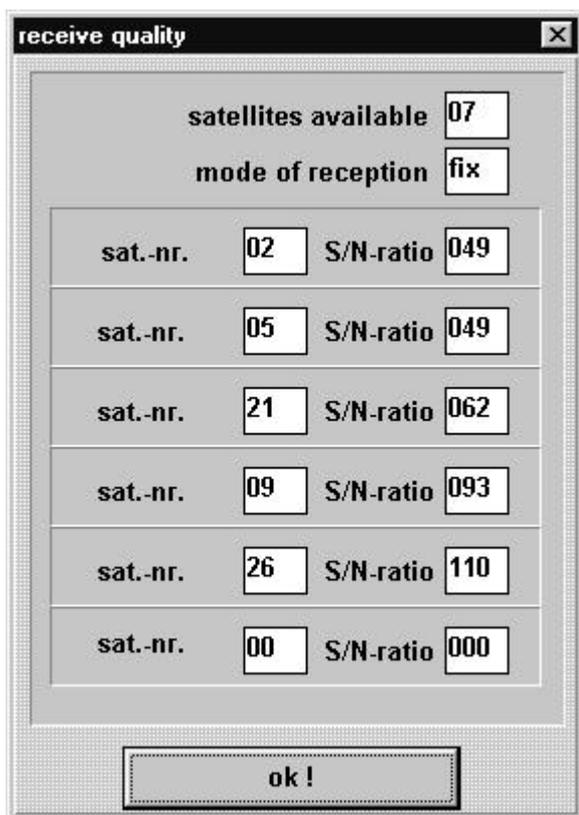
Under **satellites available** the number of satellites are shown which, in the ideal antenna position, are visible for this area.

Six satellites can be received and shown.

The numbers in the fields **sat.-no.** is 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 in the fields **S/N-ratio** indicate the signal/noise ratio. It can vary between 0 - 255.

After the first installation it may take up to 1 hour before anything is written into the display. It depends on the start information received by the system (see programming time, position etc.) and on the antenna position e.g. half the visible range to the sky.

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 - 140**

2.2.7 Error Interpretation

Errors in the reception system can be recognised by means of the display picture of the satellites.

Example 1

No satellite appears in the display even after several hours after the first installation.

Possible faults:

- the antenna cable has a defect
- the antenna cable is not connected
- the antenna has a defect
- the lightning protection has a defect

Example 2

There are 7 satellites in the visible range, but only up to 2 appear on the display.

Fault

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

Example 3

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

Possible faults:

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

Example 4

The system has run perfectly so far. 7 satellites appear in the view range, none are tracked, the system has been running without reception for several days.

Possible faults:

- the cable has been damaged
- a flash of lightning has occurred and the lightning protection has a defect
- the antenna has a defect
- the receiver has a defect
- the voltage supply has a defect

3 *Configuration of the Serial Interfaces*

The clock is equipped with two serial interfaces with handshake lines, which can be set independently. Data can be exchanged via the RS232c (V.24) and RS422 (V.11) signal level. These interfaces can be used for the transmission of time data strings to other computers. As a standard time data string the **hopf** 6021, 5500, 5050, Siemens MADAM S and Leitch Timecode Generator data strings are supported by control signals. Customer specific data strings are available on request. For each channel the following settings can be set separately by serial interface.

> *Please note :*   The setting applies to the according **connected interface**

You will find the setting for baudrate, data bit, stop bit and parity by clicking the menus **communication** and **serial parameter.** The interface-parameter dialogue appears.

After the entry confirm by pressing the **OK** key, which causes the new parameter to be transferred to the clock. When the data are accepted a dialogue window appears with the according statement:

serial parameter

    change from: **PAR: 09600,8,N,1,N**

             to: PAR: 19200,7,N,2,Y

which completes the setting. At the same time the new parameter are set in the remote computer when the transmission has been successfully completed. In case of problems with the transmission a statement indicating so appears in a dialogue window:

    GPS-System did not accept serial parameter

In this case please refer to possible errors.

4 Configuration of the Data String (Modebyte)

The time information received via satellite can be put out via the interface in different data strings stating the internal clock status. This enables the user to synchronise connected computers with the atom accurate time. The required point of time of the output, the string structure and the used control characters can be chosen by entering the according **modebyte dialogue**.

You will find the set-function for the **modebyte 1** by selecting the menu point **communication** and **mode byte 1**. The following modebyte dialogue appears:

```
mode byte 1 settings                                          [X]
┌─control character────────────┐   ┌──────────────┐
│  ⊙ enable STX/ETX            │   │      OK      │
│                              │   └──────────────┘
│  ○ ETX on the second change  │   ┌──────────────┐
│    (only if STX/ETX enabled) │   │    cancel    │
│                              │   └──────────────┘
├─forerun──────────────────────┤   ┌time and date output──┐
│  ○ second forward run        │   │  ○ time only         │
│                              │   │  ⊙ time and date     │
├─structure of data string─────┤   ├transmission point of time┐
│  ⊙ 6021 kompatible           │   │  ⊙ every second      │
│  ○ 5500 kompatible           │   │  ○ on the minute change │
│  ○ 5050 kompatible           │   │  ○ on the hour change │
│  ○ MADAM S kompatible        │   │  ○ on request only   │
└──────────────────────────────┘   └──────────────────────┘
```

Start the transmission with the OK button. When the data have been accepted the dialogue window shows:

> **mode byte configuration**
> **change from: MOD:1,0,1,1,0,0,0,0**
> **to: MOD:1,1,1,1,1,0,0,0**

which completes the setting. In case of problems with the transmission there will be a statement in the dialogue window after 15 seconds:

> **GPS-System did not accept serial parameter**

In this case please refer to possible errors.

Below the possible settings are described.

4.1 Second Advance of Serial Output with Modebyte 1

switch	second advance
on	with second advance
off	without second advance

4.2 Control Character ETX as On-Time-Mark with Modebyte 1

When this setting has been activated and also the transmission with control characters (STX/ETX) has been selected, the final character ETX is transmitted on the marker of the next second change.

switch	ETX on the second change control character must be selected
on	with ETX on second change
off	without ETX on second change

4.3 Choice of Data String with Modebyte 1

switch	string structure
on	data string 6021
off	data string 5500
off	data string 5050
off	data string MADAM S

(only one choice possible)

4.4 Data String Structure Time or Time/Date with Modebyte 1

This setting is not available in data string MADAM S and Leitch Timecode Generator.

Switch	time and date output
on	output time only
off	output time/ date

4.5 Send with Control Character STX/ETX with Modebyte 1

This setting is not available in data string Leitch Timecode Generator.

Switch	enable STX/ETX
on	with control character
off	without control character

4.6 Synchronisation Point with Modebyte 1

switch	transmission point of time
on	transmission every second
off	transmission on the minute change
off	transmission on the hour change
off	transmission on request only

(only one choice possible !)

4.7 Local or UTC Time with Modebyte 2

You will find the set-function for the **modebyte 2** by selecting the menu **communication** and **mode byte 2**. The following modebyte dialogue appears:
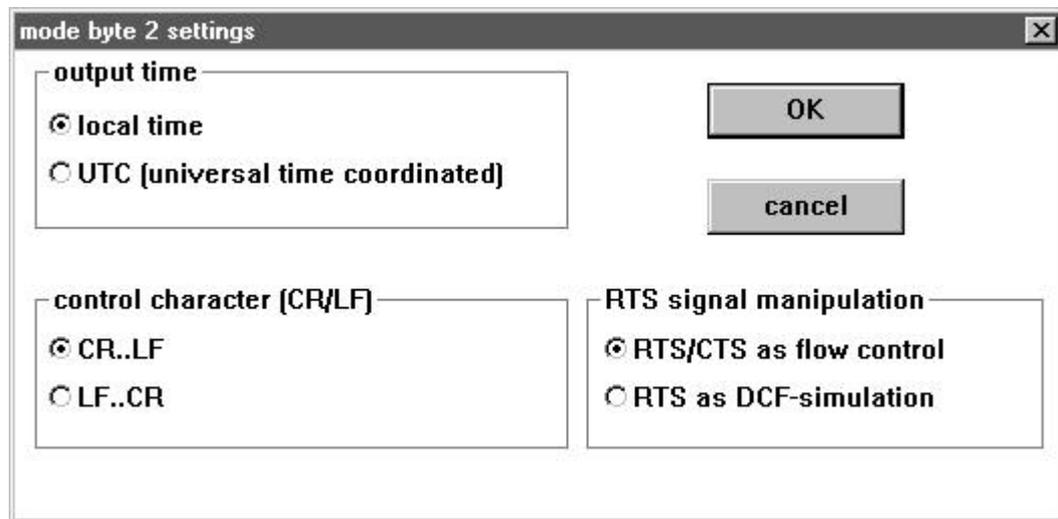
Start the transmission to the clock with the OK button. If the data have been accepted the dialogue window shows the following message:

mode byte configuration
    change from: MO1:1,0,1,1,0,0,0,0
                to: MO1:1,1,1,1,1,0,0,0

which completes the setting. If any problems should occur in the transmission the dialogue window informs after approx. 15 seconds:

GPS - System did not accept serial parameter

In this case please refer to pt.: possible errors.

Below the possible settings are described.

4.8 UTC or Local Time in Output String with Modebyte 2

switch	output time
on	Local Time
off	UTC - Time

(only one choice possible !)

4.9 Exchange Control Characters CR and LF with Modebyte 2

switch	control character CR/LF
on	CR...LF
off	LF...CR

(one setting only)!

4.10 Control Line RTS as DCF77-Simulation with Modebyte 2

this function is not in use at the moment.

switch	RTS signal manipulation
on	Hardware handshake
off	DCF77-Simulation

(only one choice possible !)

4.11 Possible Errors during Transmission with GPS-6841.EXE

- Please check if the connection cable PC-clock has a defect. There must be a connection between the signals.

PC	clock
TxD	RxD
RxD	TxD
GND	GND

- Bridge the signals RTS/CTS at the clock system (necessary only if hardware handshake has been activated).
- Please check if the connection cable is connected to the interface (COM1 or COM2) stated by GPS_INIT.

Please also refer to pt.: **What you should know** .