Technical Description

Programming Manual

6870

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INHALT ***Seite***

1 Service Functions of the Serial Interface

Remote functions are required for the installation of the clock from a remote computer. To do so various data strings for the setting of time, date, points of changeover (daylight saving / standard time) position data, difference time local-UTC and decoding of the GPS reception quality are transmitted. It is also possible to parameter the serial interface. The program GPS_6870 (included in the delivery of the clock) uses the functions described below.

The remote functions are implemented in interface 1 only.

When the remote function is activated the standard data traffic on the interface is interrupted for about 15 seconds.

The control characters STX and ETX cannot be excluded from the transmitted remote string, they are always part of the remote data strings.

The start of a communication between clock and computer is always activated by the computer. The respective data string is structured as follows:

STX (command) [status] [data] CR LF ETX

The STX (Hex 02) and the CR (Hex 0D), LF (Hex 0A) and ETX (Hex 03) at the end of the string form the core of the transmission.

The command field contains four ASCII-characters which indicate the function.

The following commands are possible:

TIM:	for time and date
COS:	for setting points of changeover
DIF:	for difference time local-UTC
POS:	for position data
SAT:	for reception quality
RES:	for reset of the clock system
IMP:	for the configuration of the optical coupler outputs
DCF:	for the DCF77 simulation and the sync.-bit
PAR:	for parameterbyte of interface 1
PA1:	for parameterbyte of interface 2
MOD:	for modebyte 1 of interface 1
MO1:	for modebyte 2 of interface 1
MO2:	for modebyte 1 of interface 2
MO3:	for modebyte 2 of interface 2
SYB:	for the systembyte
VER:	for version information

The fields ***status*** and ***data*** are optional and depend on the command or on the requested function.

The **TIM** command is always transmitted with a status. The status indicates whether a time information or a point of changeover is part of the data string. The other commands are transmitted without status.

2 Time Functions

2.1 The Statusbyte and Structure of the Data String in the TIM Command

The statusbyte consists of two ASCII nibbles. The value range of each nibble can be Hex 30-39 or Hex 41-46 (00-FF). Once the two characters are received they are converted into binary values.

example :

The two ASCII characters "4" and "2" (Hex 34 and 32) are received and the ASCII conversion results in the following byte:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	1	0	0	0	0	1	0

Depending on whether the clock receives or transmits a **TIM** command the statusbyte has the following meaning:

Bits in the transmitted statusbyte (from the clock system):

Bit 7 = 1,	Bit 6 = 1	clock is radio synchronous with crystal control
Bit 7 = 1,	Bit 6 = 0	clock is radio synchronous without crystal control
Bit 7 = 0,	Bit 6 = 1	clock is in crystal operation (valid time)it)
Bit 7 = 0,	Bit 6 = 0	clock has no valid time
Bit 5 = 1		announcement of a leap second on the next hour change
Bit 4 = 1		standard time/local time
Bit 3 = 1		daylight saving time (only when operating with changeover)
Bit 4 = 0,	Bit 3 = 0	UTC-time (Universal Time Co-ordinated)
Bit 2 = 1		daylight saving / standard time - standard time / daylight saving - changeover on the next hour change
Bit 0 = 1		only in case of changeover: changeover is done
Bit 0 = 0		points of changeover still active

Meaning of the bits in the received statusbyte:

Bit 7	no meaning
Bit 6 = 1	must always be set
Bit 5 = 1	clock is to insert a leap second on the next hour change (please note: for diagnostic purposes only)
Bit 4 = 0/1	UTC / Local Time
Bit 3 = 0	no meaning
Bit 2	no meaning
Bit 1	no meaning
Bit 0	no meaning

During transmission the data field in the TIM data string contains the current settings of the clock. During reception the latest times are entered. If the data field is missing during reception the received status is scanned for requested clock data and the transmission of respective data are released by the clock at the next possible point of time.

The data are transformed and received as ASCII values in BCD. Received data are checked for plausibility by the clock. The clock recognises invalid data like e.g. day=32 in the data string and ignores the whole string. The day of the week nibble must always be stated 1 = Monday ... 7 = Sunday.

Structure of the data field in the string:

character no.:	meaning	value (value range)
1	comma	$2C
2	hour tens	$30-32
3	hour unit	$30-39
4	comma	$2C
5	minute tens	$30-35
6	minute unit	$30-39
7	comma	$2C
8	second tens	$30-35
9	second unit	$30-39
10	comma	$2C
11	day tens	$30-33
12	day unit	$30-39
13	comma	$2C
14	month tens	$30-31
15	month unit	$30-39
16	comma	$2C
17	year tens	$30-39
18	year unit	$30-39
19	comma	$2C
20	day of the week	$31-37

2.2 Setting the Time

Statusbyte (Hex)	meaning
48	setting local time

Example data string setting local time 12:34:56 clock, Sunday 07.08.99

STX TIM: 48,12,34,56,07,08,99,7 CR LF ETX

After the data are taken over the clock answers with the new time data string:

STX TIM: 48,12,34,56,07,08,99,7 CR LF ETX

2.3 Requesting the Time

Statusbyte (Hex)	meaning
40	requesting UTC (world time)
48	requesting local time

Example data string for requesting the time:

STX TIM: 40 CR LF ETX

At the next possible point of time the clock answers with the current world time:

example: STX TIM: 40,10,34,56,07,08,99,7 CR LF ETX

It is 10:34:56 h, Sunday 07.08.99 world time

2.4 Setting the Point of Changeover

Here the points of changeover are entered when the time is changed during the course of the year to daylight saving or standard time The transmission contains hour and month separately for **daylight saving** and **standard time**. The changeover always takes place on the first or the last Sunday of the stated month and on the stated hour. If bit 0 in the status is set the changeover is done on the first Sunday of the month (status 4B and 53). If bit 0 =0 the changeover is done on the last Sunday of the month (status 4A and 52).

Hinweis : Naughts are entered for all the digits for countries which do not have or want a changeover.

Structure of Data String:

character no.	value (value range)	meaning
1	4A or 4B	status summer point of changeover
2	00-23	hour when time is changed to daylight saving time
3	01-12	month when time is changed to daylight saving time
4	52or 53	status point of changeover
5	00-23	hour when time is changed to standard time
6	01-12	month when time is changed to standard time

example setting points of changeover:

STX COS: 4A,02,03,52,03,10 CR LF ETX

As soon as the clock has received the data string it answers with the new points of changeover:

STX COS: 4A,02,03,52,03,10 CR LF ETX

The changeover to daylight saving time always takes place at 02:00h on the last Sunday in March.The changeover to standard time is at 03:00 on the last Sunday in October.

2.5 Requesting the Points of Changeover

Requesting the example data string for the winter points of changeover

STX COS: CR LF ETX

As soon as possible the clock answers with the current points of changeover

example: STX COS:4A,02,03,52,03,10 CR LF ETX

The changeover to daylight saving time is at 02:00 on the last Sunday in March. The changeover to standard time is at 03:00 on the last Sunday in October.

2.6 Difference Time UTC - Local

Use the DIF command to set or request the difference between local time and UTC. The data field for this command looks as follows:

meaning	value range (Hex)
direction +/-	2B, 2D
hour tens	30-32
hour unit	30-39
comma	2C
minute tens	30-35
minute unit	30-39

The difference time must not exceed ± 12 hours.

Example data string setting the difference between local time and UTC to - 1 hour

STX DIF: -01,00 CR LF ETX

The current difference is requested by the following data string:

STX DIF: CR LF ETX

Once it has received the data string it answers with the new difference time:

STX DIF: +02,00 CR LF ETX

3 Initialising Functions of the Receiver

3.1 Setting the Position Data

The position data for the respective location of the clock system are set or requested by this data string.

Structure of the data string:

character no.	meaning	ASCII	value (value range)
1	longitude West/East	W, E	$57, 45
2	colon :	$3A	
3	degree hundreds	0,1	$30, 31
4	degree tens	0-8	$30-37
5	degree unit	0-9	$30-39
6	comma	,	$2C
7	minute tens	0-5	$30-35
8	minute unit	0-9	$30-39
9	comma	,	$2C
10	minute a hundredth	0-9	$30-39
11	minute a thousandth	0-9	$30-39
12	comma	,	$2C
13	latitude North/South	N, S	$4E,53
14	colon :	$3A	
15	degree tens	0-8	$30-38
16	degree unit	0-9	$30-39
17	comma	,	$2C
18	minute tens	0-5	$30-35
19	minute unit	0-9	$30-39
20	comma	,	$2C
21	minute hundredth	0-9	$30-39
22	minute thousandth	0-9	$30-39

Example data string for setting the position data:

STX POS: E:007,33,34,N:53,12,21 CR LF ETX

3.2 Setting Decoding Mode Position Fixed 3D and GPS-Reception Quality

The following data string is used to set the decoding mode position fixed or 3D decoding:

STX SAT: 0 CR LF ETX setting decoding to ***Position Fixed***
STX SAT: 1 CR LF ETX setting decoding to ***3D***

The clock answers with the data strings described below.

The data string

STX SAT: CR LF ETX

asks for the current satellite data without change of the decoding mode.

The clock answers with the number of traced satellites and a relative value for the signal/noise ratio. This value may range between 0..255, values larger than 50 representing a good reception.

The data field is structured as follows:

character no.	meaning	ASCII	value (value range)
1	ident.of satellite track	T	53
2	colon :	3A	
3	number of traced sat .	0-9	30-39
4	comma	,	2C
5	Ident. of sat.	S	53
6	colon :	3A	
7	tens sat.-no.	0-9	30-39
8	unit sat.-no.	0-9	30-39
9	slash	/	2F
10	hundreds SN-ratio	0-9	30-32
11	tens SN-ratio	0-9	30-39
12	unit SN-ratio	0-9	30-39
13	comma	,	2C
:			
:			
55	identifier mode	M	
56	colon :		
57	mode 0, 1	30, 31	

Position 5 to 13 is repeated for 6 satellites!

Position 57 indicates the decoding mode.

0 = decoding with Position Fixed
1 = decoding with 3D

Example of a transmitted answer with satellite data:

STX SAT: 08,S:07/143,S:12/145,S:23/034,S:14/145,S:03/123,S:19/047, M:1 CR LF ETX

3.3 Starting Reset of the Clock System

The following data string is used to start a reset (masterreset):

STX RES: CR LF ETX

The clock uses with the following data string,

STX RES: CR LF ETX

to indicate that the command is carried out.

4 Configuration of the Serial Interface

4.1 Parameterbyte of the serial Interface

For setting the baud rate etc. please refer to pt.1.2 of this manual. The serial interfaces are parametered by the following string:

character no.	meaning	ASCII	value (value range)
1	baudrate tenthousands	0-1	30-31
2	baudrate thousands	0-9	30-39
3	baudrate hundreds	0-9	30-39
4	baudrate tens	0	30
5	baudrate unit	0	30
6	comma	,	2c
7	paritybit	N,E,O	4e,45,4f
8	comma	,	2c
9	data bit	7,8	37,38
10	comma	,	2c
11	stop bit	1,2	30,31

Possible baudrates including leading naughts are:

- 19200
- 09600
- 04800
- 02400
- 01200
- 00600
- 00300
- 00150

Example data string of setting the parameter :

STX PAR:09600,N,8,1 CR LF ETX

This string sets the serial interface 1 to the following setting:

9600 baud, no parity, 8 data bits, 1 stop bit

STX PA1:09600,N,8,1 CR LF ETX

this string sets the serial interface 2 to the following setting:

9600 baud, no parity, 8 data bits, 1 stop bit

4.2 Modebyte 1 of the serial interface

Modebyte 1 sets operating modes. Every bit represents a switch which is either on = 1 or off = 0. The meaning of the bit position is as follows:

Bit 8	**output of time information**
off	UTC time
on	local time

Bit 7	**second advance**
off	with second advance
on	without second advance

Bit 6	**transmission with control characters**
off	with control characters
on	without control characters

Bit 5	**ETX on the second change** only if 'with control characters' was selected
off	with ETX on the second change
on	without ETX on the second change

Bit 4	**control characters CR/LF**
off	LF/CR
on	CR/LF

Bit 3	**free**
off	
on	

Bit 2	**Bit 1**	**point of transmission**
off	off	transmission every second
off	on	transmission on the minute change
on	off	transmission on the hour change
on	on	transmission on request only

character no.	meaning	ASCII	value (value range)
1	Bit 8	0-1	30-31
2	comma	,	2c
3	Bit 7	0-1	30-31
4	comma	,	2c
5	Bit 6	0-1	30-31
6	comma	,	2c
7	Bit 5	0-1	30-31
8	comma	,	2c
9	Bit 4	0-1	30-31
10	comma	,	2c
11	Bit 3	0-1	30-31
12	comma	,	2c
13	Bit 2	0-1	30-31
14	comma	,	2c
15	Bit 1	0-1	30-31

Example data string modebyte 1 for setting serial interface 1:

STX MOD:1,1,0,1,1,0,0,0,CR LF ETX

Example data string modebyte 1 for setting serial interface 2:

STX MO2:1,1,0,1,1,0,0,0,CR LF ETX

This string sets the following transmission mode:

- transmission every second
- transmission without control characters
- transmission without ETX as on-time marker
- transmission sequence of control characters CR/LF
- transmission without second advance
- output local time

4.3 Modebyte 2 of the Serial Interfaces

Modebyte 2 sets the transmission string; every bit represents a switch, which knows either the status on=1 or off=0. Meaning of the individual bit positions:

Bit 3	Bit 2	Bit 1	Bit 0	String
off	off	off	off	standard 6021 compatible date and time
off	off	off	on	standard 6021 compatible time only
off	off	on	off	DCF77 slave
off	off	on	on	Siemens Sinec H1
off	on	off	off	Siemens MADAM S
off	on	off	on	IBM Sysplex Timer
off	on	on	off	standard 6021 compatible with year 2000
off	on	on	on	T-string
on	off	off	off	ABB_T_string
on	off	off	on	NGTS-string
on	off	on	off	master/slave-string
on	off	on	on	SPT-string
on	on	off	off	at present standard 6021 compatible date and time
on	on	off	on	at present standard 6021 compatible date and time
on	on	on	off	at present standard 6021 compatible date and time
on	on	on	on	at present standard 6021 compatible date and time

character no.	meaning	ASCII	value (value range)
1	Bit 7	0-1	30-31
2	comma	,	2c
3	Bit 6	0-1	30-31
4	comma	,	2c
5	Bit 5	0-1	30-31
6	comma	,	2c
7	Bit 4	0-1	30-31
8	comma	,	2c
9	Bit 3	0-1	30-31
10	comma	,	2c
11	Bit 2	0-1	30-31
12	comma	,	2c
13	Bit 1	0-1	30-31
14	Bit 0	0-1	30-31

example string for setting modebyte 2 for serial interface 1:

STX MO1:0,0,0,0,0,0,0,0,CR LF ETX

example string for setting modebyte 2 for serial interface 2:

STX MO3:0,0,0,0,0,0,0,0,CR LF ETX

This string sets the following transmission mode:

Transmission standard string 6021 compatible

5 Optical Coupler Configuration

The **IMP**-command is used to configure the optical couplers. The data string which is to be transmitted consists of the identifier nibble of the optical coupler, the statusbyte and 3 further bytes to set the pulse.

Structure of data string: IMP:o,st,ho,mi,se,im

command	description	value range
IMP:	pulse command	4 ASCII Bytes
o	corresponding optical coupler	1 Byte hex 31-33
st	statusbyte	2 Bytes (see status)
ho	value for the hour	2 Bytes ASCII 00-23
mi	value for the minute	2 Bytes ASCII 00-59
se	value for the second	2 Byte ASCII 00-59
im	value for the pulse length	2 Byte ASCII 00-FF

5.1 Structure of the Statusbyte

The statusbyte sets the output mode of the optical couplers. At present the statusbyte uses the lower 4 bits (0-3) only. The higher bits must always be set to 0.

Bit 7-4	Bit 3	Bit 2	Bit 1	Bit 0	meaning
0	x	x	0	0	mode 1: output DCF77-simulation
0	x	x	0	1	mode 2: output status radio/crystal operation
0	x	x	1	0	mode 3: output system o.k.
0	x	0	1	1	mode 4: cyclic output
0	x	1	1	1	mode 5: single pulse
0	0	x	x	x	not inverted output
0	1	x	x	x	inverted output (only mode 1, 4 and 5)

5.2 Pulses

Depending on the set mode in the statusbyte the 3 bytes for the pulse times and the 3 bytes for the date are decoded.

5.2.1 Cyclic Output Mode 4

In this setting only **one value** in one of the 3 time bytes (**ho, mi, se**) can be set with one of the following values. The bytes dy, mo, and yr must be set to 00:

ho = 0, 1, 2, 3, 4, 6, 8, 12, 24
mi = 0, 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30
se = 0, 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30

Also the pulse length in the last byte must be set in steps of 10msec.

The example data string: IMP:2,0B,00,15,00,64,00,00,00

sets at the optical coupler 2 an inverted pulse of 1 second and a cycle of 15 minutes.

5.2.2 Single Pulse Mode 5

This operating mode requires a logical value in the three time bytes and a the length must be set in steps of 10 msec in the pulse byte. If the bytes dy, mo, yr are set to naught the pulse is sent once every day.

The example data string: IMP:1,07,23,59,59,64,00,00,00

sets at the optical coupler 1 a daily pulse of 1 second at 23:59:59 .

If the bytes dy, mo, yr are filled with a date the pulse is sent on those days only. The date is checked for plausibility first.

The example data string: IMP:1,07,23,59,59,64,29,02,00

sets at the optical coupler 1 a pulse of 1 second on 29. Feb. 2000 at 23:59:59 .

6 DCF77 Simulation and Sync-Bit Settings

This data string configures the DCF77-simulation and the radio bit.

structure of string: CF:mi,hi,lo,sy

command	description	value range
DCF:	DCF77 Sim and radio bit	4 ASCII Bytes
mi	entered minutes of DCF77 switch off	2 Byte ASCII 00-FF
hi	pulse length DCF77 Highbit	2 Bytes ASCII
lo	pulse length DCF77 Lowbit	2 Bytes ASCII
sy	delay in minutes of sync.bit switch off	2 Bytes ASCII 00-FF

The length of the DCF77 pulse entered must not exceed the following span:

DCF77 Highpulse: 140-230
DCF77 Lowpulse: 50-130

The example data string:

DCF:3C,C8,64,3F

sets the switch off of the DCF77-simulation (optical coupler and antenna output) in case of a disturbed reception to 60 minutes, the pulse length highbit to 200msec and lowbit to 100msec. The syc.bit is also switched off after 60 minutes.

7 Remote Software for a Personal Computer

There is a software available under MS Windows 3.x or higher for the remote control of the clock system.

This programme is used to carry out all the above described functions from a PC or laptop.To be able to do so the computer must be connected to the clock system via a free serial interface.

The software includes the following functions:

- entry of clock data (time, date)
- entry of position data
- checking for plausibility of the entered data
- creating and transmission of the above data string to the clock system
- monitoring the process by decoding and display of the answer data string
- setting of the optical couplers
- storing of all settings in a set-up file
- print-out of all settings
- monitoring of the previously set output data strings

8 Pin Assignment of the Serial Interfaces

Interface Signal at the 9-pole SUB-D connector

Pin no.:	name of signal
1	
2	RxD Receive Data
3	TxD Transmit Data
4	
5	GND Ground
6	
7	
8	
9	

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