Technical Description

Serial Interface

6036

Safety information

The safety regulations and technical data are important for the smooth running of the devices and the protection of people and equipment. Strict compliance with these regulations is required. In case of non-compliance with these regulations the guarantee and warranty claims for the device and possible consequential damage expire.

Safety of the Devices

The production of this device follows the latest technological standards and safety regulations.

The device must not be assembled by anyone but trained personnel. Please make sure that all the connected cables are laid and fixed properly. The device is to be run with the supply voltage stated on the identification plate only.

Only trained personnel or specialists may operate the device.

Repair on opened devices must not be carried out by anyone but specially trained staff or by the ***hopf*** company.

If the maintenance work requires the opening of a device or if a fuse needs changing the device must be separated from all voltage supplies.

If there are reasons to believe that the operational safety can no longer be guaranteed the device must be taken out of service and labelled accordingly. The safety may be impaired when the device does not operate properly or if it is obviously damaged.

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Serial Interface of the Radio Controlled Clock Board 6036

- the option ***serial interface*** must be listed in your order, otherwise the functions described below are not implemented in the clock board.

The radio controlled clock 6036 is equipped with one serial interface in the RS232c (V.24) format. This interface can be used to transmit time data strings to other computers.

The management of the data transmission is handled completely by the clock board 6036 and does not load your computer. The ***hopf*** 6021, 5500, 5050 and some other strings are supported as time data strings. The interface cannot be used as PC-interface (COM1-COMx).

1 Configuration of the Serial Interface

The interface can be parameterized by the enclosed software **"SERVICE.EXE"**. The different settings are transmitted to the clock board in two configuration bytes, where the bit positions represent switches.

The first byte serves to select the stopbits, the data bits, parity bits and the baudrate In the service programme this byte is called parameter byte and it is transmitted to the clock.

In own programmes the following transmission handling must be observed to supply the new setting to the clock (base= base address of the clock board).

no.	process	value (HEX)	port address
1.	control code parameter byte	30	base +37
2.	write new value	0..FF	base +30

The second byte selects the data string which sets the type of synchronization, decides on the time zone and carries out some other settings.

In the service program this byte is called telegram byte and is transmitted to the clock. In own programmes the following transmission handling must be observed to supply a new setting for the structure of the data string to the clock.

no.	process	value (HEX)	port address (HEX)
1.	control code data string byte	31	base +37
2.	write new value	0..FF	base +30

2 Structure of the Configuration Byte

All the values must be read as hexadecimal values. If the switch position is to be set to "on", the according bit must be set to 1.

Below the calculation table for the transmitted values:

bit position	8	7	6	5	4	3	2	1	
value	80	40	20	10	8	4	2	1	
	1								80
		0							0
			1						20
				0					0
					0				0
						1			4
							1		2
								0	0

Total value for the transmission to the clock : A6

3 Structure of the Parameter Byte

3.1 Setting the Output Time

bitposition	1	meaning
	on	UTC
	off	CET/CEST

3.2 Setting the Word Length

bitposition	2	meaning
	on	8 data bit
	off	7 data bit

3.3 Setting the Parity Mode of the Transmission

bitposition	3	4	Bedeutung
	on	on	no Parity
	on	off	no Parity
	off	on	parity even
	off	off	parity odd

3.4 Setting the Stop-Bits

bitposition	5	meaning
	on	1 stopbit
	off	2 stopbit

3.5 Setting the Baudrate

bitposition	6	7	8	baudrate/bd
	on	on	on	150 baud
	on	on	off	300 baud
	on	off	on	600 baud
	on	off	off	1200 baud
	off	on	on	2400 baud
	off	on	off	4800 baud
	off	off	on	9600 baud
	off	off	off	19200 baud

4 The Putout Data String (telegram byte)

The received time can be put out in a data string stating the internal status of the clock via the interface. This enables the user to synchronize connected computer systems with the official time of the Federal Republic. The output point of time, the string stucture and the control characters can be selected by means of the **telegram byte.**

4.1 Output with Second Advance

bitposition	1	second advance
	on	switched on
	off	switched off

4.2 Synchronization with ETX on the Second Change

bitposition	2	ETX on the second change only if "with control char." has been activated
	on	with ETX
	off	without ETX

4.3 Selection of Data Strings

bitposition	3	4	data string structure
	off	off	data string 6021 see pt.7
	on	off	data string 5500 see pt. 8
	off	on	data string 5050 see pt.9
	on	on	data string MADAM-S see pt.10

4.4 Data String Structure Time or Time/Date

bitposition	5	time or time with date
	on	output time only
	off	output time and date

4.5 Data String Structure with/without Control Characters

bitposition	6	control character STX/ETX
	on	transmit with control characters
	off	transmit without control characters

4.6 Synchronization Point of Time

bitposition	7	8	transmission point of time
	on	on	transmit every second
	on	off	transmit on the minute change
	off	on	transmit on the hour change
	off	off	transmit on request only

5 Data Format of the Serial Transmission

The data are transmitted in ASCII as BCD values using the following special characters:

$20 = space
$0D = CR (carriage return)
$0A = LF (line feed)
$02 = STX (start of text)
$03 = ETX (end of text)

Please note : Status bytes are to be decoded seperately (see data string structure).

6 Serial Requests

The user can release the data string output using a control character.

These control characters are:

ASCII "U" - for time
ASCII "D" - for time/date
ASCII "G" - for UTC-time/date

The systems answers with the according data string within 1 msec. Often this is to fast for the requesting computer, it is therefore possible to delay the answer in 10msec. steps in case of a request via software. The requesting computer sends the small letters "u, d, g" together with a two-digit multiplication factor to the clock to delay the transmission of the data string.

The multiplication factor is interpreted as hexadecimal value by the clock.

Example:

The computer sends **ASCII u05** (Hex 75,30,35)
After 50 milliseconds the clock answers with the data string time only.

The computer sends **ASCII gFF** (Hex 67,46,46)
After 2550 milliseconds the clock sends the data string UTC time/date

If the output 'MADAM-S compatible' is set the out put can be activated with the data string

:ZSYS:
or **:WILA:**

Here the systems answers with the output string MADAM-S on the next second change.

6.1 The data string 6021

6.1.1 Data string 6021 time and date (standard)

The control characters STX and ETX are transmitted only if in the data string byte the output "with control characters" has been set. Otherwise there are no control characters. In case of the setting ETX delayed the last character (ETX) is transmitted exactly on the next second change.

character no.	meaning	
1	STX (start of text)	
2	status (internal clock status)	; see 7.3
3	day of the week (1=Monday ... 7=Sunday)	; see 7.3
	for UTC time bit 3 is set to 1 in the day of the week	
4	hour tens digit	
5	hour unit digit	
6	minute tens digit	
7	minute unit digit	
8	second tens digit	
9	second unit digit	
10	day tens digit	
11	day unit digit	
12	month tens digit	
13	month unit digit	
14	year tens digit	
15	year unit digit	
16	LF (line feed)	
17	CR (carriage return)	
18	ETX (end of text)	

6.1.2 Data string 6021 time only

The control characters STX and ETX are transmitted only if in the data string byte the output "with control characters" has been set. Otherwise there are no control characters. In case of the setting ETX delayed the last character (ETX) is transmitted exactly on the next second change.

character no.	meaning
1	STX (start of text)
2	hour tens digit
3	hour unit digit
4	minute tensdigit
5	minute unit digit
6	second tens digit
7	second unit digit
8	LF (line feed)
9	CR (carriage return)
10	ETX (end of text)

6.1.3 Data string 6021 status and day of the week nibble

The second and the third ASCII-character contain the status and the day of the week. The status is decoded binarily Structure of these characters :

	b3	b2	b1	b0	meaning
status nibble:	x	x	x	0	no annoucement hour
	x	x	x	1	announcement(ST-WT-ST)
	x	x	0	x	wintertime (WT)
	x	x	1	x	summertime (ST)
	0	0	x	x	time / date invalid
	0	1	x	x	crystal operation
	1	0	x	x	radio operation
	1	1	x	x	radio operation (high accuracy)
day of the week nibble:	0	x	x	x	CEST / CET
	1	x	x	x	UTC - time
	x	0	0	1	Monday
	x	0	1	0	Tuesday
	x	0	1	1	Wednesday
	x	1	0	0	Thursday
	x	1	0	1	Friday
	x	1	1	0	Saturday
	x	1	1	1	Sunday

6.1.4 Example of transmitted data string 7001/6021

(STX)E3123456030196(LF)(CR)(ETX)

radio operation (high accuracy)
summer time, no annoucement
It is Wednesday 03.01.96 - 12:34:56 h.
( ) - ASCII-control characters e.g. (STX)

6.2 The data string 5500

6.2.1 Data string 5500 time and date

The control characters STX and ETX are transmitted only if in the data string byte the output "with control characters" has been set. Otherwise there are no control characters. In case of the setting ETX delayed the last character (ETX) is transmitted exactly on the next second change.

character no.	meaning	
1	STX (start of text)	
2	status (internal clock status)	; see 8.3
3	space	
4	hour tens digit	
5	hour unit digit	
6	minute tens digit	
7	minute unit digit	
8	second tens digit	
9	second unit digit	
10	space	
11	day tens digit	
12	day unit digit	
13	month tens digit	
14	month unit digit	
15	year tens digit	
16	year unit digit	
17	space	
18	day of the week	; see 8.3
19	CR (carriage return)	
20	LF (line feed)	
21	ETX (end of text)	

6.2.2 Data string 5500 time only

The control characters STX and ETX are transmitted only if in the data string byte the output "with control characters" has been set. Otherwise there are no control characters. In case of the setting ETX delayed the last character (ETX) is transmitted exactly on the next second change.

character no.	meaning
1	STX (start of text)
2	hour tens digit
3	hour unit digit
4	minute tens digit
5	minute unit digit
6	second tens digit
7	second unit digit
8	CR (carriage return)
9	LF (line feed)
10	ETX (end of text)

6.2.3 Data string 5500 status and day of the week nibble

	b3	b2	b1	b0	meaning
status nibble:	x	x	x	0	radio operation
	x	x	x	1	crystal operation
	x	x	0	x	no announcement WT-ST-WT
	x	x	1	x	announcement WT-ST-WT
	x	0	x	x	winter time
	x	1	x	x	summer time
	1	0	0	x	UTC
day of the week nibble:	x	0	0	1	Monday
	x	0	1	0	Tuesday
	x	0	1	1	Wednesday
	x	1	0	0	Thursday
	x	1	0	1	Friday
	x	1	1	0	Saturday
	x	1	1	1	Sunday

6.2.4 Example of a transmitted data string 5500

(STX)3 123456 030196 3(CR)(LF)(ETX)

crystal operation, no announcement, winter time
It is Wednesday 03.01.96 - 12:34:56 h

6.3 The data string 5050

6.3.1 Data string 5050 time and date

The control characters STX and ETX are transmitted only if in the data string byte the output "with control characters" has been set. Otherwise there are no control characters. In case of the setting ETX delayed the last character (ETX) is transmitted exactly on the next second change.

character no.	meaning	
1	STX (start of text)	
2	hour tens digit	
3	hour unit digit	
4	space	
5	minute tens digit	
6	minute unit digit	
7	space	
8	second tens digit	
9	second unit digit	
10	space	
11	day tens digit	
12	day unit digit	
13	space	
14	month tens digit	
15	month unit digit	
16	space	
17	year tens digit	
18	year unit digit	
19	space	
20	status: internal clock status	; see 9.3
21	day of the week	; see 9.3
22	space	
23	CR (carriage return)	
24	LF (line feed)	
25	ETX (end of text)	

6.3.2 Data string 5050 time only

character no.	meaning
1	STX (start of text)
2	hour tens digit
3	hour unit digit
4	space
5	minute tens digit
6	minute unit digit
7	space
8	second tens digit
9	second unit digit
10	space
11	CR (carriage return)
12	LF (line feed)
13	ETX (end of text)

6.3.3 Data string 5050 status and day of the week nibble

	b3	b2	b1	b0	meaning
status nibble:	x	x	x	0	radio operation
	x	x	x	1	crystal operation
	x	x	1	x	announcement (WT - ST - WT)
	x	x	0	x	no announcement (WT - ST - WT)
	x	0	x	x	CET (UTC + 1h)
	x	1	x	x	CEST (UTC + 2h)
	1	0	0	x	UTC
day of the week nibble:	x	0	0	1	Monday
	x	0	1	0	Tuesday
	x	0	1	1	Wednesday
	x	1	0	0	Thursday
	x	1	0	1	Friday
	x	1	1	0	Saturday
	x	1	1	1	Sunday

6.3.4 Example of a transmitted data string 5050

(STX) 12 34 56 03 01 96 03 (CR)(LF)(ETX)

radio operation, no annoucement, winter time
It is Wednesday 03.01.96 - 12:34:56 h

6.4 The data string MADAM-S

The structure depends on the request string. When the superior computer (PROMEA-MX) requests with the string:

:ZSYS:

the clock answers with the following data string:

character no.	meaning		value (value range)	
1	STX	(start of text)	$02	
2	:	colon	$3A	
3	Z	ASCII Z	$5A	
4	S	ASCII S	$53	
5	Y	ASCII Y	$59	
6	S	ASCII S	$53	
7	:	colon	$3A	
8	status of the changeover		$00, 01, 7F	; see 10.2
9	time scale identification		$30-33	
10	day of the week		$31-37	
11	tens - year		$30-39	
12	unit year		$30-39	
13	tens month		$30-31	
14	unit month		$30-39	
15	tens day		$30-33	
16	unit day		$30-39	
17	tens hour		$30-32	
18	unit hour		$30-39	
19	tens minute		$30-35	
20	unit- minute		$30-39	
21	tens second		$30-35	
22	unit second		$30-39	
23	CR	(carriage return)	$0D	
24	LF	(line feed)	$0A	
25	ETX	(end of text)	$03	

When the superior computer (PROMEA-MX) requests using the string

:WILA:

the clock answers with the following data string

character no.	meaning		value (value range)	
1	STX	(start of text)	$02	
2	:	colon	$3A	
3	W	ASCII W	$57	
4	I	ASCII I	$49	
5	L	ASCII L	$4C	
6	A	ASCII A	$41	
7	:	colon	$3A	
8	status		$00, 01, 7F	; see 10.2
9	time scale ident.		$30-33	
10	day of the week		$31-37	
11	tens year		$30-39	
12	unit year		$30-39	
13	tens month		$30-31	
14	unit month		$30-39	
15	tens day		$30-33	
16	unit day		$30-39	
17	tens hour		$30-32	
18	unit hour		$30-39	
19	tens minute		$30-35	
20	unit minute		$30-39	
21	tens second		$30-35	
22	unit second		$30-39	
23	CR	(carriage Return)	$0D	
24	LF	(line feed)	$0A	
25	ETX	(end of text)	$03	

6.4.1 Required setting in case of output MADAM-S

The synchronization process in case of output MADAM-S requires the following setting on the board 6036:

- output on the minute change
- output with second advance
- output ETX on the second change

6.4.2 Data string MADAM-S status nibble

Announcement of a changeover (8. byte of the transmission)

This byte can have the following values

Nul	(Hex 00)	no announcement
SOH	(Hex 01)	announcement changeover summer-/wintertime winter-/summertime
DEL	(Hex 7F)	no radio time available

time scale ident. (9. Byte of the transmission)

ASCII 0 (Hex 30)	wintertime
ASCII 1 (Hex 31)	summer time + annoucement
ASCII 3 (Hex 33)	summer time

The day of the week nibble can have the values

ASCII 1 (Hex 31 ⇔ MO) to ASCII 7 (Hex 37 ⇔ SU)

In case of an invalid time the byte with ASCII 0 (Hex 30) is transmitted.

6.5 Data output for time-code-generator of the Leitch company

The devices request data/time by means of the ASCII character "T" = Hex 54. After the request the date and time (incl. milliseconds) are stored temporarily and put out on the serial output line in a data string with 31 ASCII - characters.

Data string structure:

character no.	meaning	value (value range)
1	tens hour	$30-32
2	unit hour	$30-39
3	" : " colon	$3A
4	tens minute	$30-35
5	unit minute	$30-39
6	" : " colon	$3A
7	tens second	$30-35
8	unit second	$30-39
9	" . " point	$2E
10	100th millisecond	$30-39
11	tens millisecond	$30-39
12	unit millisecond	$30-39
13	space	$20
14	tens day	$30-32
15	unit day	$30-39
16	" / " slash	$2F
17	tens month	$30-31
18	unit month	$30-39
19	" / " slash	$2F
20	tens year	$30-39
21	unit year	$30-39
22	space	$20
23	100th curr. day of year	$30-33
24	tens curr. day of year	$30-39
25	unit curr. day of year	$30-39
26	space	$20
27	day of the week	$31-37
28	space	$20
29	status	$30-33, 41-46
30	CR (carriage return)	$0D
31	LF (line feed)	$0A

A valid time is shown by Bit 4 = 1 and Bit 3 = 0 in the status byte.

Please note : Required DIP-switch settings: output on request only, string 6021, without ETX on the second change.

The second advance and output UTC can be preselected by means of the data string byte.

6.6 Data String for NTP (Network Time Protocol)

NTP or also xNTP is a batch of programmes to synchronise different computers and operating systems with network support. It is the standard for the Internet Protokoll TCP/IP (RFC-1305). Source code and documentation are available as freeware in the internet under the following address:

http://www.eecis.udel.edu/~ntp/index.html

Binary files for the IBM operating system AIX are avialble on the following internet page:

http://www.hopf-time.com

NTP supports the ***hopf*** standard protocol as described under pt.. **"Datentelegramm (data string) 6870/6021"**. The following settings in the clock are required:

transmission parameter:	9600 baud 8 databit parity no 1 stop bit
transmission mode:	data string 6870/6021 UTC as time basis with second advance with control characters (STX...ETX) LF..CR with ETX on the second change (On Time Marker) output time and date transmission every second

7 Setting the Clock via Serial Interface

Time and date can also be set via serial interface. The following data string is needed.

character no.	meaning	value (value range)
1	"S" (setting the time)	$53
2	first hour digit	$30-32
3	second hour digit	$30-39
4	first minute digit	$30-35
5	second minute digit	$30-39
6	first second digit	$30-35
7	second second digit	$30-39
8	first day digit	$30-33
9	second day digit	$30-39
10	first month digit	$30-31
11	second month digit	$30-39
12	first year digit	$30-39
13	second year digit	$30-39
14	day of the week	$31-37
15	CR (carriage return)	$0D

Alternatively a status information can be transmitted in position 15 and 16, which internally sets the clock status to summer or winter time. In this case the 17. signal must be the carriage return.

15	status high nibble	$34 or 35
16	status low nibble	$30 or 38
17	CR (carriage return)	$0D

meaning of the status byte:

hex 48 = winter time
hex 50 = summer time

Example of a transmission:

>S1234560708942CR< for Tuesday 07.08.94, 12:34:56
>S123456070894250CR< for Tuesday 07.08.94, 12:34:56 summer time

8 Execute Reset of the Clock

Sending the according statusbyte can make the clock initialize itself.

no.	meaning	ASCII	value(HEX)
1.	activate reset	"r"	72
2.	carriage return	CR	0D

9 Master/Slave Operation of the Clock

The clock can change from master to slave operation due to sending the according statusbyte.

This mechanism enables the user to implement clock chains working with one antenna.

The first clock becomes master and receives the time via an antenna signal. This clock generates a **1 Hz DCF-pulse synchronization pulse** which can be used to synchronize further clocks (slaves).

Master operation means that the clock board is synchronized by the antenna signal. This requires the connection of an antenna or an antenna amplifier output to the BNC-connector of the board.

In the **slave operation** the clock is synchronized by 1Hz DCF-pulses via the 9-pole sub-D-connector.

The service programme can be used to change from master to slave operation. The following data string switches the board to master operation:

no.	meaning	ASCII	value(HEX)
1.	master- /slave manipulation	"M"	$4D
2.	status high nibble	"0"	$30
3.	status low nibble	"0"	$30
4.	carriage return	CR	$0D

The following data string switches the clock board to slave operation:

no.	meaning	ASCII	value(HEX)
1.	master- /slave manipulation	"M"	$4D
2.	status high nibble	"8"	$38
3.	status low nibble	"0"	$30
4.	carriage return	CR	$0D

10 Alignment of the Antenna

Sending the ASCII character "A" (Hex 41) followed by a *carriage return* (Hex 0D) activates the special function **"alignment of the antenna "** in the clock.

During the mode "alignment of the antenna" the DCF-reception is switched off. The clock leaves this function automatically after three minutes and changes to the normal reception mode. Sending a reset command (see above) finishes the "alignment of the antenna" mode at once.

Alternatively the alignment of the antenna can also be started with the control character ASCII "a" (Hex61) followed by a *carriage return* (Hex 0D). The receiver then puts out internal values about the reception quality via the serial interface.

The values show the present position of the DCF-dip. The output is carried out continuously without a break in an ASCII data string of 3 byte length.

Structure of the data string of the antenna values

no.	meaning	value(HEX)
1.	EOT, ENQ	$04, $05
2.	ASCII 0..F	$30-39, $41-46
3.	ASCII 0..F	$30-39, $41-46

On every internal second change an ENQ (Hex05) instead of an EOT (Hex04) is transmitted as a start signal. This signal can be used to synchronize the output. The two following values must be read as hex values (00-ff) and must be changed to a shortinteger after an ASCII correction (value range -128 to +127). This represents the incoming DCF-signal.

To show it on the screen every incoming value must be added to the previous one and becomes the new Y-position of the screen co-ordinates. The screen output should be synchronized on the second change (start character Hex 05).

The output of the antenna values can be stopped with the transmission of ASCII "e" (Hex65) followed by a *carriage return* (Hex0D) or a reset command (see above).

Alignment of the antenna with Windows software

A software is available which shows the antenna values under Windows using the above handling. It is a great help when installing antennas in difficult reception situations. When operating this software the default-setting of the serial parameter must be set in the clock board.