Industriefunkuhren

hopf Elektronik GmbH

Technical Manual

Serial Interface Board

Model 7201/7221

ENGLISH

Version: 25.01 - 30.08.2016

Valid for Devices **7201/7221** with FIRMWARE Version: **25.00**

hopf Elektronik GmbH
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Version number (Firmware / Manual)

THE FIRST TWO DIGITS OF THE VERSION NUMBER OF THE TECHNICAL MANUAL AND THE FIRST TWO DIGITS OF THE FIRMWARE VERSION MUST **COMPLY WITH EACH OTHER**. THEY INDICATE THE FUNCTIONAL CORRELATION BETWEEN DEVICE AND TECHNICAL MANUAL.

THE DIGITS AFTER THE POINT IN THE VERSION NUMBER INDICATE CORRECTIONS IN THE FIRMWARE / MANUAL THAT ARE OF NO SIGNIFICANCE FOR THE FUNCTION.

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Symbols and Characters

Operational Reliability
Disregard may cause damages to persons or material.

Functionality
Disregard may impact function of system/device.

Information
Notes and Information.

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Safety regulations

The safety regulations and observance of the technical data serve to ensure trouble-free operation of the device and protection of persons and material. It is therefore of utmost importance to observe and compliance with these regulations.

If these are not complied with, then no claims may be made under the terms of the warranty. No liability will be assumed for any ensuing damage.

Safety of the device

This device has been manufactured in accordance with the latest technological standards and approved safety regulations

The device should only be put into operation by trained and qualified staff. Care must be taken that all cable connections are laid and fixed in position correctly. The device should only be operated with the voltage supply indicated on the identification label.

The device should only be operated by qualified staff or employees who have received specific instruction.

If a device must be opened for repair, this should only be carried out by employees with appropriate qualifications or by ***hopf*** Elektronik GmbH.

Before a device is opened or a fuse is changed all power supplies must be disconnected.

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.

CE-Conformity

This device fulfils the requirements of the EU directive 2014/30/EU "Electromagnetic Compatibility" and 2014/35/EU "Low Voltage Equipment".

Therefore the device bears the CE identification marking
(CE = Communautés Européennes = European communities)

The CE indicates to the controlling bodies that the product complies with the requirements of the EU directive - especially with regard to protection of health and safety for the operator and the user - and may be released for sale within the common markets.

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1 General

There is an Interface board with two different explanations available for the system 7000 and 7001:

- Interface board 7201
- Interface board 7221

1.1 Interface Board 7201

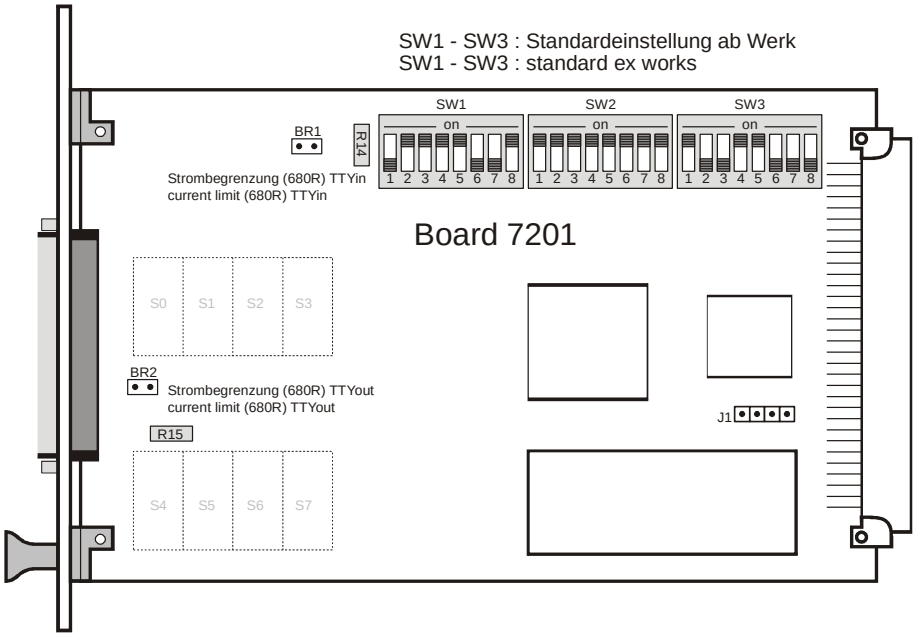
1.1.1 Functional Description

The microprocessor of the interface board 7201 receives the time information via the ***hopf*** 7001 system bus. The received time can be put out via one of three interfaces. There is a DIP-switch to set cyclic data outputs (e.g. data output every minute).

Baud rate, word length as well as the number of stop bits and parity mode can also be set by means of a DIP-switch. It is possible to set various data strings as output data strings by means of a DIP-switch.

1.1.2 Specifications

- Data output via: RS232c (V.24), RS422c (V.11), TTY (20 mA passive)
- Baud rate :150 - 19200 baud, TTY (max. 9600 baud, recommended: max. 2400 baud)
- Various output strings can be set by means of DIP-Switch (e.g. output UTC time).
- Indication of internal clock status in the status byte of the data string.
- Potential separate RS232c- and RS422 interface



SW1
1 Ausgabe UTC / MEZ
2 Wortlänge 8 Bit / 7 Bit
3, 4 Parity
5 Stop-Bit
6-8 Baudrate

SW1
1 output UTC / CET
2 word length 8 Bit / 7 Bit
3, 4 paritybit
5 stopbit
6-8 baud rate

SW2
1..5 Datenstring
6 Senden mit Steuerzeichen
7, 8 Sendezeitpunkt

SW2
1..5 data string
6 send with control character
7, 8 point of transmit

SW3
1 RS232 u. RS422 / TTY
2 CTS Handshake
3 RTS (Sek.Imp. / Steuerltg. für RS232)
4, 5 Sekundenvorlauf / ETX zum
6 UTC / Standardzeit
7 Polarität des Impulseingangs
8 CR/LF-Umschaltung

SW3
1 RS232 u. RS422 / TTY
2 CTS handshake
3 RTS (sec. pulse / ctrl. line for RS232)
4, 5 second advance, ETX at second change
6 UTC / standard time
7 polarity of the pulse
8 CR/LF-switching

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1.1.3 Hardware-configuration - Board 7201

1.1.3.1 Choice of Interface

The radio clock is equipped with 3 serial interfaces:

RS232c (V.24), RS422 (V.11), TTY (20mA-passive)

If a cyclic data output is preset the data string appears at all serial exits. The request for data via the RxD lines can come from only one entry. It is possible to configure the board especially for this case by means of DIP-Switch 3 push button 1 between entry TTY or RS232/RS422.

DIP-Switch 3 push button1

on serial input RS232c and RS422 active
off serial input TTY active

The RS232- and RS422 interfaces are equipped with a potential separation.

A series resistance (680 Ohm) to limit the current can be looped into the TTY- interface. For this purpose bridge BR1 for the input and BR2 for the output must be opened (see position diagram in the appendix).

1.1.3.2 Handshakelines (only with RS232c)

The RS232c-interface of the board is equipped with the standard handshake lines which can be used or deactivated depending on the use. DIP-Switch 3 push button 2 selects the use.

DIP-Switch 3 push button 2

on RTS ⇨ CTS Handshake active
off RTS ⇨ CTS Handshake inactive

The RS232 control line RTS can also be used as second pulse. For this purpose the handshake switch must be activated.

DIP-Switch 3 push button 3

on RTS as second pulse with RS232c level
off RTS as control line for RS232c

When operating the board via RS422/TTY-interface DIP-Switch 3 push button 2 must be in the **off** position.

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1.1.4 Pin Assignment - Board 7201

1.1.4.1 RS232c-Interface

25-pole Sub-D-connector in the front panel pin no.	Signal name	96-pole VG-strip pin no.:
2	TxD (transmit data)	2a
3	RxD (receive data)	3a
4	RTS (ready to send)	4a
5	CTS (clear to send)	5a
7	0 Volt (GND)	7a

1.1.4.2 TTY-Interface (passive)

25-pole Sub-D-connector in the front panel pin no.	Signal name	96-pole VG-strip pin no.:
7	0 Volt (GND)	7a
9	+ output	9a
10	– output	10a
24	+ input	11c
25	– input	12c

1.1.4.3 RS422-Interface

25-pole Sub-D-connector in the front panel pin no.	Signal name	96-pole VG-strip pin no.:
7	0 V (GND)	7a
11	RS422 (V.11) -TxD [L]	11a
12	RS422 (V.11) +TxD [H]	12a
22	RS422 (V.11) -RxD [L]	9c
23	RS422 (V.11) +RxD [H]	10c

[L] **RS422 (V.11) low active**
[H] **RS422 (V.11) high active**

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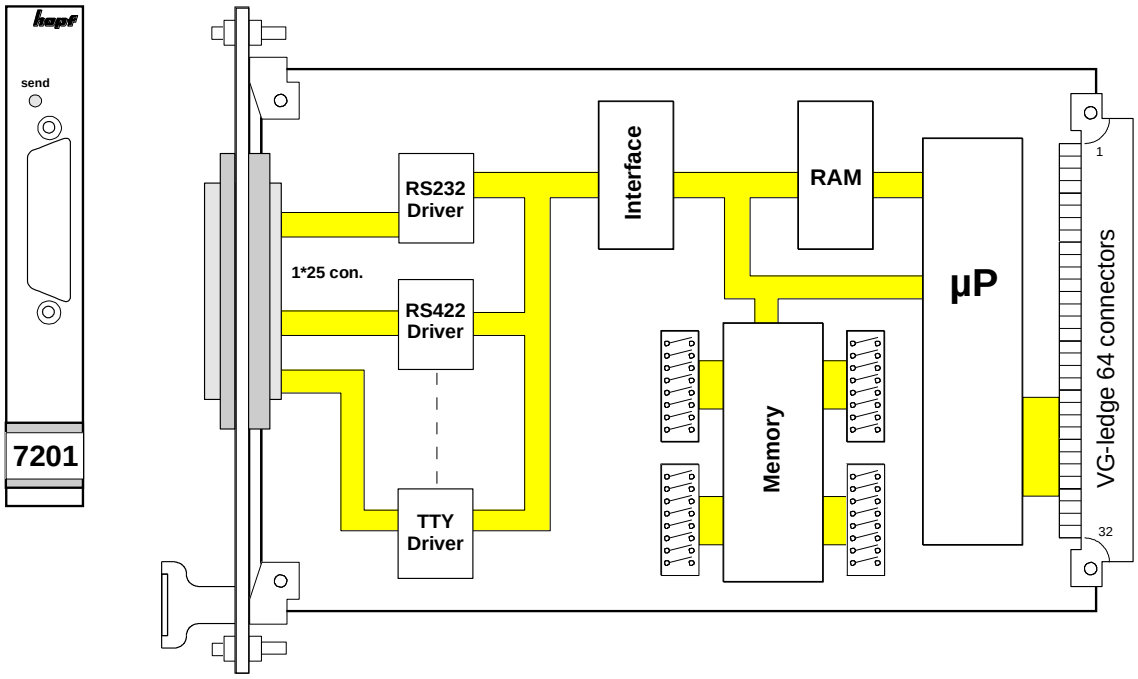
1.1.5 Technical Data - Board 7201

Voltage supply:	+ 5 V DC ± 5%
Current consumption:	approx. 300 mA
Interfaces:	TTY-passive / RS232c / RS422
Data-format:	ASCII
MTBF:	> 600 000 h
Extras:	Hard- and software alterations according to customer specifications are possible.

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

1.1.6 Block Diagram - Board 7201



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1.2 Interface Board 7221

1.2.1 Functional Description

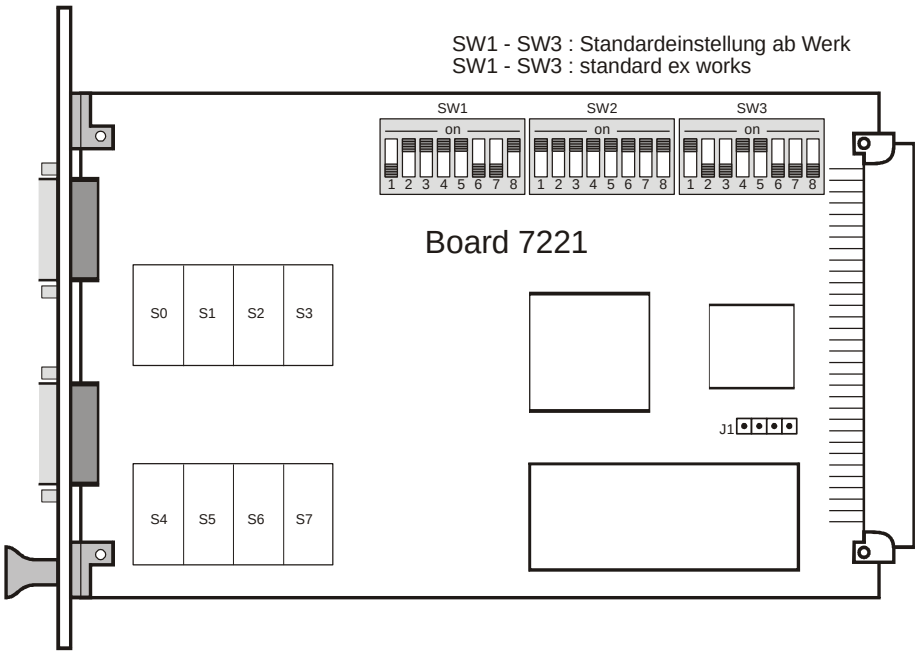
The microprocessor of the interface board 7221 receives the time information via the ***hopf*** 7001 system bus.

The received time is put out via 8 interfaces. It is possible to set cyclic data outputs (e.g. every minute data output) by means of a DIP-switch. Baud rate, word length as well as the number of stop bits and parity mode can also be set by means of a DIP-switch.

It is possible to set various data strings as output data strings by means of a DIP-switch.

1.2.2 Specifications

- Data output via: RS232c (V.24), RS422c (V.11)
- Baud rate: 150 - 19200 Baud
- Various output strings can be set by DIP-switch (e.g. output of UTC-time)
- Indication of internal clock status in the status byte of the data string.
- Two potential separate RS232- and RS422 interfaces (S0 and S7).



SW1
1 Ausgabe UTC / MEZ
2 Wortlänge 8 Bit / 7 Bit
3, 4 Parity
5 Stop-Bit
6-8 Baudrate

SW1
1 output UTC / CET
2 word length 8 Bit / 7 Bit
3, 4 paritybit
5 stopbit
6-8 baud rate

SW2
1..5 Datenstring
6 Senden mit Steuerzeichen
7, 8 Sendezeitpunkt

SW2
1..5 data string
6 send with control character
7, 8 point of transmit

SW3
1 RS232 u. RS422 / TTY
2 CTS Handshake
3 RTS (Sek.Imp. / Steuerltg. für RS232)
4, 5 Sekundenvorlauf / ETX zum
6 UTC / Standardzeit
7 Polarität des Impulseingangs
8 CR/LF-Umschaltung

SW3
1 RS232 u. RS422 / TTY
2 CTS handshake
3 RTS (sec. pulse / ctrl. line for RS232)
4, 5 second advance, ETX at second change
6 UTC / standard time
7 polarity of the pulse
8 CR/LF-switching

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1.2.3 Hardware-configuration - Board 7221

1.2.3.1 Choice of Interface

The radio clock is equipped with 8 serial interfaces. Every interface connector (S0-S7) has the standard interface formats:

RS232c (V.24), RS422 (V.11)

The RS232- and RS422 interfaces of S0 and S7 are equipped with potential separation. S0 can also operate with the handshake lines RTS/CTS.

The interface S0 has a serial input where time data can be requested using ASCII control characters. Optionally it is possible to equip the interface S7 with a serial input at a later date.

S1-S6/7 can be used only as outputs. When the cyclic output is set the data string appears at all the serial outputs (S0-S7). Data request via the RxD line at interface S0 may be carried out only via RS232 or RS422.

1.2.3.2 Handshakelines (only at RS232c and S0)

The RS232c-interface of the interface S0 is equipped with the standard handshake lines. These handshake lines can be - depending on the purpose - either used or deactivated. Selection by DIP-Switch 3 switch 2.

DIP-Switch 3 switch 2

on RTS ⇔ CTS handshake active
off RTS ⇔ CTS handshake inactive)

The RS232 control line RTS can also be used as second pulse. To do so **DIP-Switch 3 switch 2 must be on** (handshake-switch inactive).

DIP-Switch 3 switch 3

on RTS as second pulse with RS232 level
off RTS as control line for RS232

When operating the board at the interfaces S1-S7 DIP-Switch 3 switch 2 must be in position **off**.

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1.2.4 Pin Assignment - Board 7221

1.2.4.1 The Interface S0

The interface S0 is also connected to the VG-strip. The assignment is listed below:

9-pole SUB-D connector in the front panel pin no.	signal name	96-pole VG-strip pin no.:
1	GND	7 a
2	RxD (receive data) RS232c	3 a
3	CTS (clear to sent) RS232c	5 a
4	I + (input) RS422	9 c
5	I + (output) RS422	11 a
6	TxD (transmit data) RS232c	2 a
7	RTS (ready to sent) RS32c	4 a
8	I - (input) RS422	10 c
9	I - (output) RS422	12 a

1.2.4.2 The Interfaces S1-S7

9-pole SUB-D connector in the front panel pin no.	signal name	
1	GND	
5	I + (output) RS422	
6	TxD (transmit data) RS232c	
9	I - (output) RS422	

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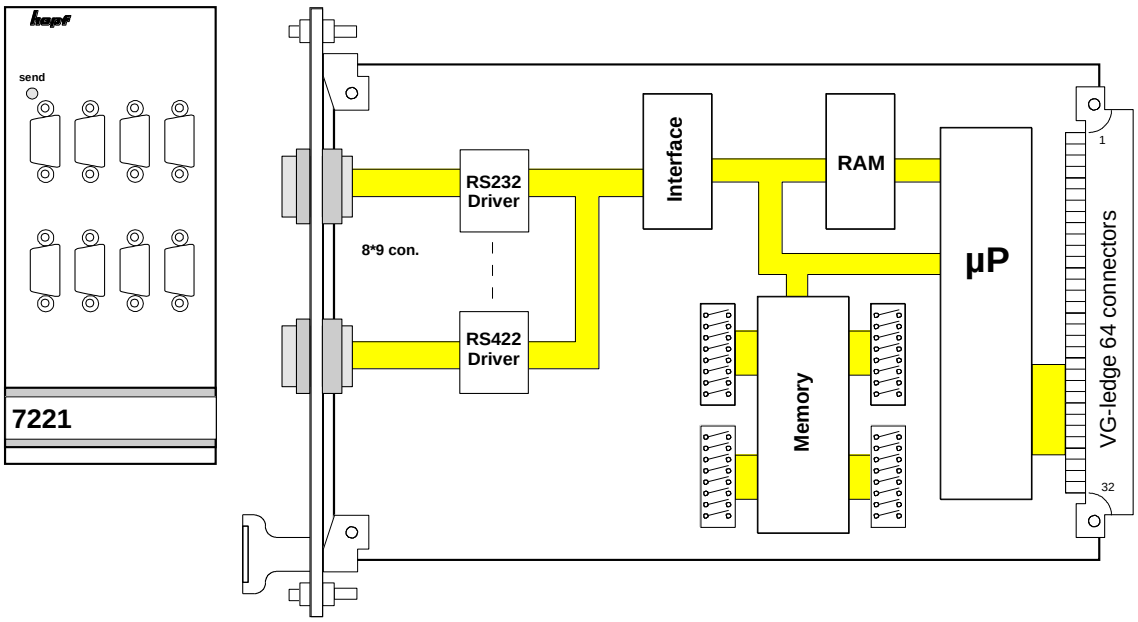
1.2.5 Technical Data - Board 7221

Voltage supply:	+ 5 V DC ± 5%
Current consumption:	approx. 450 mA
Interfaces:	RS232c / RS422
Data-format:	ASCII
MTBF:	> 450 000 h
Extras:	Hard- and software alterations according to customer specifications are possible.

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

1.2.6 Block Diagram - Board 7221



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2 The transmitted Data Strings

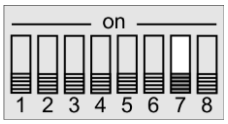
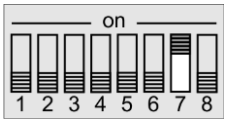
The board 7201 supports different data strings for the output.

2.1 Data String Selection

All data strings are separated in two blocks. First the data string block must be chosen and after that the desired data string.

2.1.1 Data String Block

DIP-Switch SW3 Pos. 7 selects the data string block.

DIP-Switch SW3 Pos. 7	Data String Block
	Data String Block A (default)
	Data String Block B

In case of the data string ABB-SPA the DIP-Switch SW3 Pos. 7 is used for the function "transmission point of second string". The block selection has no function in the mode ABB-SPA.

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2.1.2 Data Strings

Possible settings by means of DIP-switch SW2 Pos 1 to 5.

Data String Block A (DIP-Switch SW3 Pos. 7 = off)					
DIP-Switch SW2					
Pos. 1	**Pos. 2**	**Pos. 3**	**Pos. 4**	**Pos. 5**	**Data String**
on	on	on	on	on	***hopf*** Standard string (6021) - default
on	on	on	on	off	***hopf*** Standard string time only
on	on	on	off	on	***hopf*** 5500
on	on	on	off	off	***hopf*** 5500 time only
on	on	off	on	on	H&B 5050 (PCZ77)
on	on	off	on	off	H&B 5050 time only
on	on	off	off	on	***hopf*** 2000 - 4-digit year output
on	on	off	off	off	***hopf*** 2000 - 4-digit year output, time only
on	off	on	on	on	***hopf*** date / time
on	off	on	on	off	SINEC H1 Extended
on	off	on	off	on	MADAM S
on	off	on	off	off	SINEC H1
on	off	off	on	on	***hopf*** DCF-Slave-String
on	off	off	on	off	T-String
on	off	off	off	on	***hopf*** UTC-Slave
on	off	off	off	off	IBM Sysplex Timer 1+2
off	on	on	on	on	Sicomp M
off	on	on	on	off	H&B
off	on	on	off	on	***hopf*** Master/Slave-String
off	on	on	off	off	ABB 23RC20
off	on	off	on	on	ABB-SPA
off	on	off	on	off	***hopf*** Time Capture
off	on	off	off	on	MDR 2000
off	on	off	off	off	***hopf*** Clock-Mouse
off	off	on	on	on	***hopf*** Clock-Mouse with <o><CR>
off	off	on	on	off	DCF77 pulse output
off	off	on	off	on	NMEA - GPRMC
off	off	on	off	off	DA55
off	off	off	on	on	OMS Synchro
off	off	off	on	off	CCTV
off	off	off	off	on	ABB Master Clock
off	off	off	off	off	IRIG J1x

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Data String Block B (DIP-Switch SW3 Pos. 7 = on)					
DIP-Switch SW2					
Pos. 1	Pos. 2	Pos. 3	Pos. 4	Pos. 5	Data String
on	on	on	on	on	BEXBACH
on	on	on	on	off	NGTS
on	on	on	off	on	SAT 1703
on	on	on	off	off	ION 7550
on	on	off	on	on	free (***hopf*** Standard string 6021 at present)
on	on	off	on	off	free (***hopf*** Standard string 6021 at present)
on	on	off	off	on	free (***hopf*** Standard string 6021 at present)
on	on	off	off	off	free (***hopf*** Standard string 6021 at present)
on	off	on	on	on	free (***hopf*** Standard string 6021 at present)
on	off	on	on	off	free (***hopf*** Standard string 6021 at present)
on	off	on	off	on	free (***hopf*** Standard string 6021 at present)
on	off	on	off	off	free (***hopf*** Standard string 6021 at present)
on	off	off	on	on	free (***hopf*** Standard string 6021 at present)
on	off	off	on	off	free (***hopf*** Standard string 6021 at present)
on	off	off	off	on	free (***hopf*** Standard string 6021 at present)
on	off	off	off	off	free (***hopf*** Standard string 6021 at present)
off	on	on	on	on	free (***hopf*** Standard string 6021 at present)
off	on	on	on	off	free (***hopf*** Standard string 6021 at present)
off	on	on	off	on	free (***hopf*** Standard string 6021 at present)
off	on	on	off	off	free (***hopf*** Standard string 6021 at present)
off	on	off	on	on	ABB-SPA
off	on	off	on	off	data string with microsecond
off	on	off	off	on	free (***hopf*** Standard string 6021 at present)
off	on	off	off	off	free (***hopf*** Standard string 6021 at present)
off	off	on	on	on	free (***hopf*** Standard string 6021 at present)
off	off	on	on	off	free (***hopf*** Standard string 6021 at present)
off	off	on	off	on	free (***hopf*** Standard string 6021 at present)
off	off	on	off	off	free (***hopf*** Standard string 6021 at present)
off	off	off	on	on	free (***hopf*** Standard string 6021 at present)
off	off	off	on	off	free (***hopf*** Standard string 6021 at present)
off	off	off	off	on	free (***hopf*** Standard string 6021 at present)
off	off	off	off	off	free (***hopf*** Standard string 6021 at present)

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2.2 Transmission with Control Characters

SW2 pos. 6		control character STX/ETX	
on		transmission with control characters	Standard
off		transmission without control characters	

When the pulse output DCF77 is set the switches **Pos 6-8** in **DIP-Switch 2** Have a different meaning (see ***chapter 3.24***)

2.3 Transmission Point for the Data String

SW2 pos. 7	SW2 pos. 8	transmission point of time	
on	on	transmission every second	Standard
on	off	transmission on the minute change	
off	on	transmission on the hour change	
off	off	transmission on request	

When the pulse output DCF77 is set the switches **Pos 6-8** in **DIP-Switch 2** Have a different meaning (see ***chapter 3.24***)

2.4 Transmission Delay

SW3 pos. 4	SW3 pos. 5	advance delay	ETX	transmission	
on	on	Off	immediately	off	Standard
on	off	On	immediately	off	
off	on	On	on sec.-change	off	
off	off	On	on sec.-change	on	

2.5 Data Format of the Serial Transmission

The data are transmitted in the ASCII format 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)

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2.6 Serial Request

The user can start the data string output using control characters. These control characters are:

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

The system answers within 1 msec. with the according data string.

This is often too fast for the requesting computer. It is therefore possible to delay the answer in 10 msec. steps on request of the necessary software. To delay the transmission of the data string the small letters "u, d, g" are transmitted to the clock by the requesting computer with a two digit multiplication factor.

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

Example:

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

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

In case of the set output "MADAM-S compatible" the output can be activated only by the following character sequences

:ZSYS:
or **:WILA:**

The system answers here on the next second change.
In case of the set output "Sysplex Timer" the output can be activated only by ASCII **"C".**

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2.7 Selection of the Transmission Format by means of DIP-switch SW1

DIP-switch SW1 is used to set the baud rate, the word length, parity-mode and the stop-bits for the data transfer. The selected configuration applies to all 3 existing interfaces.

The different settings of the Dip-switches you can see in the location plan.

2.7.1 Output Local Time, Standard Time or UTC

The time basis for the output string can be selected by means of switch 1 / SW1 and switch 6 / SW3. Normally the local time is selected as time basis. But this time changes by one hour if changeovers from winter to summer time were programmed on the location. If time leaps are to be avoided standard time or UTC should be selected as time basis.

The standard time differs from the local summer time by minus 1 hour. The time progresses continuously through the year. In case of the setting UTC the global time (previously GMT) is used as time basis, which also progresses continuously through the year. Depending on the place of installation the time difference may vary by ± 12 hours.

SW1 pos. 1	time	meaning	
on	UTC	SW3 / switch 6 = off	
on	standard	SW3 / switch 6 = on	
off	local		Standard

2.7.2 Setting the Word Length

SW1 pos. 2	meaning	
on	8 data bit	Standard
off	7 data bit	

2.7.3 Setting the Parity-Mode of the Transmission

SW1 pos. 3	SW1 pos. 4	meaning	
on	on	no parity bit	Standard
on	off	no parity bit	
off	on	parity even	
off	off	parity odd	

2.7.4 Setting the Stop Bits

SW1 pos. 5	meaning	
on	1 stop bit	Standard
off	2 stop bit	

2.7.5 Setting the Baud rate

SW1 pos. 6	SW1 pos. 7	SW1 pos. 8	baud rate	
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	Standard
off	off	off	19200 baud	

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3 Structure of Data Strings

3.1 *hopf* Standard String (6021)

3.1.1 *hopf* Standard String - time and date (standard)

The control characters STX and ETX cannot be transmitted unless the output has been set "with control characters" at DIP-switch 2 (DIP-switch 2 switch 6 = on). Otherwise these control characters are left out. The setting "ETX delayed" transmits the last character (ETX) exactly on the next second change.

Character no.	Meaning
1	STX (start of text)
2	status (internal clock status)
3	day of the week (1=Monday ... 7=Sunday) 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)

3.1.2 *hopf* Standard String - time only

The control characters STX and ETX cannot be transmitted unless the output has been set "with control characters" at DIP-switch 2 (DIP-switch 2 switch 6 = on). Otherwise these control characters are left out. The setting "ETX delayed" transmits the last character (ETX) 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	LF (line feed)
9	CR (carriage return)
10	ETX (end of text)

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3.1.3 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 announcement hour
	x	x	x	1		announcement(ST-WT-ST)
	x	x	0	x		standard time (WT)
	x	x	1	x		daylight saving time (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

3.1.4 Example of transmitted Data String

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

Radio operation (high accuracy)
Daylight saving time, no announcement
It is Wednesday 03.01.96 - 12:34:56 h.
( ) - ASCII-control characters e.g. (STX)

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3.2 *hopf* 5500

3.2.1 *hopf* 5500 - Time and Date

The control characters STX and ETX cannot be transmitted unless the output has been set "with control characters" at DIP-switch 2 (DIP-switch 2 switch 6 = on). Otherwise these control characters are left out. The setting "ETX delayed" transmits the last character (ETX) exactly on the next second change.

Character no.	Meaning
1	STX (start of text)
2	status (internal clock status)
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
19	CR (carriage return)
20	LF (line feed)
21	ETX (end of text)

3.2.2 *hopf* 5500 - Time only

The control characters STX and ETX cannot be transmitted unless the output has been set "with control characters" at DIP-switch 2 (DIP-switch 2 switch 6 = on). Otherwise these control characters are left out. The setting "ETX delayed" transmits the last character (ETX) 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)

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3.2.3 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		standard time
	x	1	x	x		daylight saving 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

3.2.4 Example of a transmitted Data String

(STX)1 123456 030196 3(CR)(LF)(ETX)

Crystal operation, no announcement, standard time
It is Wednesday 03.01.96 - 12:34:56 h

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3.3 H&B 5050 (PCZ77)

3.3.1 H&B 5050 - Time and Date

The control characters STX and ETX cannot be transmitted unless the output has been set "with control characters" at DIP-switch 2 (DIP-switch 2 switch 6 = on). Otherwise these control characters are left out. The setting "ETX delayed" transmits the last character (ETX) 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
21	day of the week
22	space
23	CR (carriage return)
24	LF (line feed)
25	ETX (end of text)

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3.3.2 H&B 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)

3.3.3 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

3.3.4 Example of a transmitted Data String

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

Radio operation, no announcement, standard time
It is Wednesday 03.01.96 - 12:34:56 h

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3.4 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
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

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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
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

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3.4.1 Required setting in case of output MADAM-S

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

- output on the minute change
- output with second advance
- output ETX on the second change
- output with control characters
- output CR/LF

3.4.2 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
	daylight saving time / standard time
	standard time / daylight saving time
DEL (Hex 7F)	no radio time available

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

ASCII 0 (Hex 30)	standard time
ASCII 1 (Hex 31)	daylight saving time + announcement
ASCII 3 (Hex 33)	daylight saving time

The day of the week nibble can have the values

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

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

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3.5 SINEC H1

The control characters STX and ETX cannot be transmitted unless the output has been set "with control characters" at DIP-switch 2 (DIP-switch 2 switch 6 = on). Otherwise these control characters are left out. The setting "ETX delayed" transmits the last character (ETX) exactly on the next second change.

Character no.	Meaning	Value (value range)
1	STX (start of text)	$02
2	"D" ASCII D	$44
3	":" colon	$3A
4	tens day	$30-33
5	unit day	$30-39
6	"." point	$2E
7	tens month	$30-31
8	unit month	$30-39
9	"." point	$2E
10	tens year	$30-39
11	unit year	$30-39
12	";" semicolon	$3B
13	"T" ASCII T	$54
14	":" colon	$3A
15	day of the week	$31-37
16	";" semicolon	$3B
17	"U" ASCII U	$55
18	":" colon	$3A
19	tens hour	$30-32
20	unit hour	$30-39
21	"." point	$2E
22	tens minute	$30-35
23	unit minutes	$30-39
24	"." point	$2E
25	tens second	$30-36
26	unit second	$30-39
27	";" semicolon	$3B
28	"#" or space	$23 / $20
29	"*" or space	$2A / $20
30	"S" or space	$53 / $20
31	"!" or space	$21 / $20
32	ETX (end of text)	$03

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3.5.1 Status

The characters 28 - 31 in the data string SINEC H1 tell the synchronisation status of the clock.

The characters mean the following:

Character no. 28 =	"#"	no radio synchronisation after reset, time invalid
	Space	radio synchronisation after reset, clock in crystal operation
Character no. 29 =	"*"	time from internal crystal in the clock
	Space	time by radio reception
Character no. 30 =	"S"	daylight saving time
	Space	standard time
Character no. 31 =	"!"	announcement of a W/S or S/W changeover
	Space	no announcement

3.5.2 Example of a transmitted Data String

(STX)D:03.01.96;T:3;U:12.34.56; _ _ _ _ (ETX) (_) = space

Radio operation, no announcement, standard time
It is Wednesday 03.01.96 - 12:34:56 h

3.5.3 String request

The data string SINEC H1 can also send by request. The time of output will be set to "send only by request" and the string will be requested with the ASCII character "?".

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3.6 *hopf* DCF-Slave

This data string is used for the synchronisation of *hopf* DCF-Slave systems. It is the same string as the data string 7001/6021, there is only a difference in the status byte.

Character no.	Meaning	Value (value range)
1	STX (start of text)	$02
2	status	$30-39, $41-46
3	day of the week	$31-37
4	tens hour	$30-32
5	unit hour	$30-39
6	tens minute	$30-35
7	unit minute	$30-39
8	tens second	$30-36
9	unit second	$30-39
10	tens day	$30-33
11	unit day	$30-39
12	tens month	$30-31
13	unit month	$30-39
14	tens year	$30-39
15	unit year	$30-39
16	LF (line feed)	$0A
17	CR (carriage return)	$0D
18	ETX (end of text)	$03

3.6.1 Status and Day of the Week Nibble

	b3	b2	b1	b0		meaning
status nibble:	x	x	x	0		no announcement hour
	x	x	x	1		announcement (ST-WT-ST)
	x	x	0	x		standard time (WT)
	x	x	1	x		daylight saving time (ST)
	x	0	x	x		no announcement second
	x	1	x	x		announcement second
	0	x	x	x		crystal operation
	1	x	x	x		radio operation
day of the week nibble:	0	0	0	1		Monday
	0	0	1	0		Tuesday
	0	0	1	1		Wednesday
	0	1	0	0		Thursday
	0	1	0	1		Friday
	0	1	1	0		Saturday
	0	1	1	1		Sunday

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3.6.2 Example of a transmitted Data String

(STX)83123456030196(LF)(CR)(ETX)

Radio operation, no announcement, standard time
It is Wednesday 03.01.96 - 12:34:56 h

3.6.3 Set-up

To synchronise the ***hopf*** Slave-systems the following setting are kept:

- output every minute
- output second advanced
- ETX at second change; selectable: data string at the beginning or at the end of the 59. second.
- UTC or local time
- word length 8 Bit
- parity no
- baud rate 9600

Use these settings for an optimal regulation of the time base into the slave-systems.

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3.7 *hopf* UTC-Slave

This string is used when *hopf* clock systems are to run completely on UTC time. The difference time is included in the transmission of the string to calculate the local time. If the local time is positive compared to the UTC time the top bit is set into the "tens hour".

e.g. CET + 1 h compared to UTC, the value 81 is transmitted in the hours.

Character no.	Meaning	Value (value range)
1	STX (start of text)	$02
2	Status	$30-39, $41-46
3	day of the week	$39, $41-46
4	tens hour	$30-32
5	unit hour	$30-39
6	tens minute	$30-35
7	unit minute	$30-39
8	tens second	$30-36
9	unit second	$30-39
10	tens day	$30-33
11	unit day	$30-39
12	tens month	$30-31
13	unit month	$30-39
14	tens year	$30-39
15	unit year	$30-39
16	tens difference hour	$30,31,38,39
17	unit difference hour	$30-39
18	tens difference minute	$30-35
19	unit difference minute	$30-39
20	LF (line feed)	$0A
21	CR (carriage return)	$0D
22	ETX (end of text)	$03

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3.7.1 Status and Day of the Week Nibble

	b3	b2	b1	b0		meaning
status nibble:	x	x	x	0		no announcement hour
	x	x	x	1		announcement (ST-WT-ST)
	x	x	0	x		standard time (WT)
	x	x	1	x		daylight saving time (ST)
	x	0	x	x		no announcement second
	x	1	x	x		announcement second
	0	x	x	x		crystal operation
	1	x	x	x		radio operation
day of the week nibble:	1	0	0	1		Monday
	1	0	1	0		Tuesday
	1	0	1	1		Wednesday
	1	1	0	0		Thursday
	1	1	0	1		Friday
	1	1	1	0		Saturday
	1	1	1	1		Sunday

3.7.2 Setting

The following setting are kept to synchronise the ***hopf*** slave-systems:

- output every minute
- output second advance
- ETX on the second change; selectable: data string at the beginning or at the end of the 59. second.
- UTC or local time
- word length 8 bit
- no parity
- baud rate 9600

This setting guarantees the best control of the time base in the slave systems.

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3.8 Data String T-String

The T-String will sent minutely in the sixtieth second to the Slave-clocks. He contains the complete information of a full minute. After sending "LF" the data string will be processed internal and the millisecond counter will set to "1".

Character no.	Meaning	Value (value range)
1	"T" ASCII T	$54
2	":" colon	$3A
3	tens year	$30-39
4	unit year	$30-39
5	":" colon	$3A
6	tens month	$30-31
7	unit month	$30-39
8	":" colon	$3A
9	tens day	$30-33
10	unit day	$30-39
11	":" colon	$3A
12	tens day of the week	$30
13	unit day of the week	$31-37
14	":" colon	$3A
15	tens hour	$30-32
16	unit hour	$30-39
17	":" colon	$3A
18	tens minute	$30-35
19	unit minute	$30-39
20	":" colon	$3A
21	tens second	$30-36
22	unit second	$30-39
23	CR (carriage return)	$0D
24	LF (line feed)	$0A

3.8.1 Example of a transmitted Data String

T:96:01:03:03:12:34:56(CR)(LF)

It is Wednesday 03.01.96 - 12:34:56 h

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3.9 *hopf* Date / Time

3.9.1 *hopf* Date / Time - date and time

The control characters STX and ETX cannot be transmitted unless the output has been set "with control characters" at DIP-switch 2 (DIP-switch 2 switch 6 = on). Otherwise these control characters are left out. The setting "ETX delayed" transmits the last character (ETX) exactly on the next second change.

Character no.	Meaning
1	STX (start of text)
2	year tens digit
3	year unit digit
4	month tens digit
5	month unit digit
6	day tens digit
7	day unit digit
8	hour tens digit
9	hour unit digit
10	minute tens digit
11	minute unit digit
12	second tens digit
13	second unit digit
14	ETX (end of text)

3.9.2 Example of transmitted Data String

(STX) 960103123456 (ETX)

Daylight saving time, no announcement
It is Wednesday 03.01.96 - 12:34:56 h.
( ) - ASCII-control characters e.g. (STX)

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3.10 SINEC H1 Extended

The control characters STX and ETX are transmitted only if the output is set "with control characters". 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.

The data string SINEC H1 can also transmitted on request (Set-up: "Transmission on Request"). The data string can be requested by **"?"**.

Character no.	Meaning	Value (value range)
1	STX (start of text)	$02
2	"D" ASCII D	$44
3	":" colon	$3A
4	tens day	$30-33
5	unit day	$30-39
6	"." point	$2E
7	tens month	$30-31
8	unit month	$30-39
9	"." point	$2E
10	tens year	$30-39
11	unit year	$30-39
12	";" semicolon	$3B
13	"T" ASCII T	$54
14	":" colon	$3A
15	day of the week	$31-37
16	";" semicolon	$3B
17	"U" ASCII U	$55
18	":" colon	$3A
19	tens hours	$30-32
20	unit hours	$30-39
21	"." point	$2E
22	tens minute	$30-35
23	unit minute	$30-39
24	"." point	$2E
25	tens seconds	$30-36
26	unit seconds	$30-39
27	";" semicolon	$3B
28	"#" or space	$23 / $20
29	"*" or space	$2A / $20
30	"S", "U" or space	$53 / $55 / $20
31	"!", "A" or space	$21 / $41 / $20
32	ETX (end of text)	$03

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3.10.1 Status

The characters 28-31 in the data string SINEC H1 Extended give information about the synchronisation status of the clock.

Meaning of the following:

Character no.:28 =	"#"	no radio synchronisation after reset, time invalid
	Space	radio synchronisation after reset, clock at least in crystal operation
Character no.: 29 =	"*"	time from the internal crystal
	Space	time from radio reception
Character no.: 30 =	"S"	daylight saving time
	"U"	UTC (see chapter 2.7.1)
	Space	standard time
Character no.: 31 =	"!"	announcement of a W/S or S/W changeover
	"A"	announcement of a leap second
	Space	no announcement

3.10.2 Example of a Transmitted Data String

(STX)D:03.01.96;T:3;U:12.34.56; _ _ _ _ (ETX) (_) = Space

Radio operation, no announcement, standard time
It is Wednesday 03.01.96 - 12:34:56 h

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3.11 *hopf* 2000 - 4-Digit Year Output

3.11.1 *hopf* 2000 with a 4 Digit Year Output

The control characters STX and ETX cannot be transmitted unless the output has been set "with control characters" at DIP-switch 2 (DIP-switch 2 switch 6 = on). Otherwise these control characters are left out. The setting "ETX delayed" transmits the last character (ETX) exactly on the next second change.

Character no.	Meaning
1	STX (start of text)
2	status (internal clock status)
3	day of the week (1=Monday ... 7=Sunday) 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 thousand digit
15	year hundred digit
16	year tens digit
17	year unit digit
18	LF (line feed)
19	CR (carriage return)
20	ETX (end of text)

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3.11.2 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 announcement hour
	x	x	x	1		announcement (ST-WT-ST)
	x	x	0	x		standard time (WT)
	x	x	1	x		daylight saving time (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

3.11.3 Example of transmitted Data String

(STX)E312345603011996(LF)(CR)(ETX)

Radio operation (high accuracy)
Daylight saving time, no announcement
It is Wednesday 03.01.1996 - 12:34:56 h.
( ) - ASCII-control characters e.g. (STX)

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3.12 IBM Sysplex Timer Model 1+2

This protocol is used for the synchronization of an IBM 9037 Sysplex Timer. The 9037 expects the time at its input every second.

The following settings are required:

- baud rate 9600
- 8 data bit
- parity odd
- 1 stop bit
- sending on request without advance and without control characters

While starting the Sysplex Timer the ASCII-sign **"C"** is sent to the connected radio controlled clock. The listed protocol in the table is automatically given out every second by that.

The setting UTC or local time is optional.

Character no.	Meaning	Value (value range)
1	SOH (start of header)	$02
2	hundreds current day of the year	$30-33
3	tens current year	$30-39
4	unit current year	$30-39
5	":" colon	$3A
6	tens hour	$30-32
7	unit hour	$30-39
8	":" colon	$3A
9	tens minute	$30-35
10	unit minute	$30-39
11	":" colon	$3A
12	tens second	$30-35
13	unit second	$30-39
14	Quality Identifier	$20, 41, 42, 43, 58
15	CR (carriage return)	$0D
16	LF (line feed)	$0A

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3.12.1 Status

The 14th character informs about the synchronisation status of the clock. Possible values and their meaning are listed below.

"?"	=	question mark	=	no radio controlled time
" "	=	space	=	radio controlled time at hand
"A"	=	Hex 41	=	crystal operation for more than 20 minutes
"B"	=	Hex 42	=	crystal operation for more than 41 minutes
"C"	=	Hex 43	=	crystal operation for more than 416 minutes
"X"	=	Hex 58	=	crystal operation for more than 4160 minutes

3.12.2 Example of a transmitted Data String

(SOH)050:12:34:56 _ (CR) (LF) (_) = Space

Radio operation, 12:34:56 h, 50th day of the year

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3.13 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 Protocol 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

NTP supports the ***hopf*** standard string (6021) described under ***chapter 3.1*** . The following adjustments must be made on the board 7201:

Parameter of transmission:

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

Mode of transmission:

- Data String 7001/6021
- UTC as time base
- second in advance = on
- control character (STX...ETX) enabled
- with ETX as On Time Mark
- Output time and date
- output every second

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3.14 TimeServ for the Operating System Windows NT

The synchronization of a Computer running Windows NT version 3.51 and higher is done with the same string as described under pt. **"Sysplex Timer"**.

The Dip-Switch setting on the board 7201 must match the following items:

- telegram Sysplex Timer
- transmission every second
- baud rate 9600
- 8 data bit
- no parity
- 1 stop bit
- without second advance
- transmission without control characters
- output UTC

To install TimeServ on the WinNT-computer you need the program files which can be found on the Microsoft Windows NT Recource Kit CD. The newest version of the program is although available free of charge on the Microsoft Internet site:

ftp://ftp.microsoft.com/bussys/winnt/winnt-public/reskit/nt40

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3.15 Sicomp M

The following string is used for the synchronisation of Sicomp M systems. The string is set-up by DIP-Switch 2+3.

The following parameters are chosen for the data transmission:

- baud rate 9600
- 8 data bit
- parity odd
- 1 stop bit
- Output every minute

The control characters STX and ETX are only transmitted, if the output by DIP-switch 2 is set to "with control characters". In the other case these control character are omitted. By the settings "ETX delayed" the last character (ETX) is transmitted exactly on the next second change.

Structure of the data string

Character no.	Meaning	Value (value range)
1	STX	$02
2	" : " colon	$3A
3	" 3 " DCF77-code	$33
4	" 4 " DCF77-code	$34
5	" : " colon	$3A
6	tens year	$30-39
7	unit year	$30-39
8	tens month	$30-31
9	unit month	$30-39
10	tens day of the week	$30
11	unit day of the week	$31-37
12	tens day	$30-33
13	unit day	$30-39
14	tens hour	$30-32
15	unit hour	$30-39
16	tens minute	$30-35
17	unit minute	$30-39
18	tens second	$30-36
19	unit second	$30-39
20	status	$32-35, $43
21	error status	$31-39, $41-46
22	CR (carriage return)	$0D
23	LF (line feed)	$0A
24	ETX (end of text)	$03

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3.15.1 Status

The status is built up with 4 bits and the following valency:

b3 = 1	Announcement switching second
b2 = 1	standard time (CET)
b1 = 1	daylight saving time (CEST)
b0 = 1	Announcement time zone switch-over

In case of radio reception the error counter is set to 1 and runs max. to F ($31-39, $41-46). It indicates the time how long the radio reception has been interrupted.

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3.16 H&B

In this data string the time, date and a status byte are transmitted in the following order:

Character no.	Meaning
1	tens hour
2	unit hour
3	space
4	tens minute
5	unit minute
6	space
7	tens second
8	unit second
9	space
10	tens day
11	unit day
12	space
13	tens month
14	unit month
15	space
16	tens year
17	unit year
18	space
19	status: internal clock status
20	day of the week
21	CR (carriage return)
22	LF (line feed)

The transmission takes place with one second advance. The last character "line feed" takes place at the next second change and the values are set valid. The switches SW3 pos. 4 and 5 must be set appropriate.

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3.16.1 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 (ST-WT-ST)
	x	x	0	x		no announcement (ST-WT-ST)
	x	0	x	x		MEZ (UTC + 1h)
	x	1	x	x		MESZ (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

3.16.2 Example of a transmitted Data String

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

Crystal operation, no announcement, standard time
It is Wednesday 03.01.96 - 12:34:56 h.

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3.17 *hopf* Master/Slave

This Master/Slave string can be used to synchronise slave systems with the time data of the master system up to an accuracy of ± 0.5 msec. It differs from the DCF-slave-string in as much as the UTC time is included in the transmission.

The difference time is transmitted in hours and minutes following the year. The transmission is done in BCD. The difference time may be up to ± 11.59 h.

The sign is shown as the highest bit in the hours.

logic "1" = local time before UTC
logic "0" = local time after UTC

Example:

90.00 difference time + 10.00 h.
01.30 difference time – 01.30 h.

Structure of the data string

Character no.	Meaning	Value (value range)
1	STX (start of text)	$02
2	status	$30-39,$41-46
3	day of the week	$31-37
4	tens hour	$30-32
5	unit hour	$30-39
6	tens minute	$30-35
7	unit minute	$30-39
8	tens second	$30-36
9	unit second	$30-39
10	tens day	$30-33
11	unit day	$30-39
12	tens month	$30-31
13	unit month	$30-39
14	tens year	$30-39
15	unit year	$30-39
16	tens diff.time a. sign hour	$30-31,$38-39
17	unit diff.time a. sign hour	$30-39
18	tens diff. time minutes	$30-35
19	unit diff. time minutes	$30-39
20	LF (line feed)	$0A
21	CR (carriage Return)	$0D
22	ETX (end of text)	$03

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3.17.1 Status and Day of the Week Nibble

	b3	b2	b1	b0		meaning
status nibble:	x	x	x	0		no announcement hour
	x	x	x	1		announcement (ST-WT-ST)
	x	x	0	x		standard time (WT)
	x	x	1	x		daylight saving time(ST)
	x	0	x	x		no announcement leap second
	x	1	x	x		announcement leap second
	0	x	x	x		crystal operation
	1	x	x	x		radio operation
day of the week nibble	0	0	0	1		Monday
	0	0	1	0		Tuesday
	0	0	1	1		Wednesday
	0	1	0	0		Thursday
	0	1	0	1		Friday
	0	1	1	0		Saturday
	0	1	1	1		Sunday

3.17.2 Example of a Transmitted Data String

(STX)831234560301968230(LF)(CR)(ETX)

Radio operation, no announcement, standard time
It is Wednesday 03.01.96 - 12:34:56 h
The difference to UTC is +2.30 hours

3.17.3 Settings

The following settings are required for the synchronisation of the ***hopf*** slave-systems:

- output every minute
- output second advance
- ETX on the second change; selectable: data string at the beginning or at the end of the 59. second.
- 9600 baud, 8 bit, 1 stop bit, no parity

This setting guarantees the best control of the time basis in the slave systems.

In case of master/slave-string these settings are fixed independently of the actual DIP-switch settings.

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3.18 *hopf* Time Capture (Board 7201 only)

The output of the data string can only be activated via the pulse input of the 25-pole SUB-D connector. For this either the 5 or the 24 Volt input must be connected to a suitable source of signal. The polarity of the pulse input can be selected by the DIP switch 3 switch 7.

DIP switch block 3

switch 7	meaning
on	falling edge releases measuring
off	rising edge releases measuring

If the *hopf* Time Capture is set the pulse input must be wired-up. Otherwise there may be malfunctions in the data output (open input).

wiring of the pulse input	
pin 16	+ 24 Volt
pin 17	GND
pin 18	+ 5 Volt

A signal edge at the input releases an intermediate measuring of time. Up to 20 measurings at short intervals (200 µsec) are possible. The values are stored in a FIFO memory precisely to the microsecond and putout in consecutive order on the serial data line. If the memory is full the subsequent measurings are ignored until the present data are putout via the serial interface.

The accuracy of the measuring depends on the synchronisation status of the clock system. To avoid faulty measurings they should not be carried out during synchronisation (see pt. synchronisation of the clock system 7001 - status byte of the output data string)

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The data are putout in the following string:

Character no.:	Meaning	Value (value range)
1	STX (start of text)	$02
2	status	$30-39, $41-46
3	day of the week	$31-37
4	" " space	$20
5	tens hour	$30-32
6	unit hour	$30-39
7	":" colon	$3A
8	tens minute	$30-35
9	unit minute	$30-39
10	":" colon	$3A
11	tens second	$30-35
12	unit second	$30-39
13	":" colon	$3A
14	hundred digit millisecond	$30-39
15	tens millisecond	$30-39
16	unit millisecond	$30-39
17	"." point	$2E
18	hundred digit microsecond	$30-39
19	tens microsecond	$30-39
20	unit microsecond	$30-39
21	"." point	$2E
22	tens day	$30-33
23	unit day	$30-39
24	"." point	$2E
25	tens month	$30-31
26	unit month	$30-39
27	"." point	$2E
28	thousand digit year	$31, $32
29	hundred digit year	$30, $39
30	tens year	$30-39
31	unit year	$30-39
32	LF (line feed)	$0A
33	CR (carriage return)	$0D
34	ETX (end of text)	$03

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3.19 ABB 23RC20

This data string is pre-set as follows:

- 8 data bit
- parity even
- 1 stop bit

The baud rate should be 2400 baud but a different rate can be selected.

The data string is started 2 seconds after every minute change. The content of the data string is the time on the next minute change. The data are put out coded binarily.

Structure of the data string

Character no.:	Meaning	Value (value range)
1	status	$00-FF
2	second	$00
3	minute	$00-3B
4	hour	$00-17
5	day	$01-1F
6	month	$01-0C
7	year	$00-63

3.19.1 Status

Bit	meaning
Bit 0 = 1	synchronous with Mainflingen
Bit 1 = 1	not synchronous with Mainflingen
Bit 2 = 1	no reception for more than 5 minutes, but less than 2.5h
Bit 3 = 1	no reception for more than 2.5h
Bit 4 =	no meaning
Bit 5 = 1	announcement daylight saving / standard time or standard / daylight saving time on the next hour change
Bit 6 = 1	daylight saving time (=0: standard time)
Bit 7 =	no meaning

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3.20 ABB-SPA Seconds-Clock

The date and time data string fades over the seconds data string when the output time is the same. In case of the setting "without checksum" the ASCII characters for XX are transmitted instead of the checksum. The putout milliseconds state the (calculated) transmission time of the last character of the string.

Altered Function of the Dip-switch SW3:

***SW3* switch 3**		**separator**
off		dot between day and hour
on		space between day and hour

***SW3* switch 4**		**checksum**
off		with checksum
on		no checksum with ASCII character (XX)

***SW3* switch 5**	***SW3* switch 6**	**output point of time/date string**
off	off	6 and 18 o'clock
off	on	every hour
on	off	every 30 minutes
on	on	every minute

***SW3* switch 7**	***SW3* switch 8**	**output point of seconds string**
off	off	every minute
off	on	every 30 seconds
on	off	every 10 seconds
on	on	every second

Only the output of the local time or UTC time is possible in the Data String ABB-SPA. The output of local standard time is not possible.

Altered Function of the Dip-switch SW1:

***SW1* switch 1**		**time output**
off		local time
on		UTC

3.20.1 Seconds String

Character no.:	Meaning	Value (value range)
1	ASCII-character >	$3E
2	ASCII-character 9	$39
3	ASCII-character 0	$30
4	ASCII-character 0	$30
5	ASCII-character W	$57
6	ASCII-character T	$54
7	ASCII-character :	$3A
8	tens second	$30-36
9	unit second	$30-39
10	ASCII-character .	$2E

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11	1/10 second	$30-39
12	1/100 second	$30-39
13	1/1000 second	$30-39
14	ASCII-character :	$3A
15	checksum H-nibble	$30-3F, $58
16	checksum L-nibble	$30-3F, $58
17	CR (carriage return)	$0D

3.20.2 Time Data String Date and Time

Character no.:	Meaning	Value (value range)
1	ASCII-character >	$3E
2	ASCII-character 9	$39
3	ASCII-character 0	$30
4	ASCII-character 0	$30
5	ASCII-character W	$57
6	ASCII-character D	$54
7	ASCII-character :	$3A
8	tens year	$30-39
9	unit year	$30-39
10	ASCII-character -	$2D
11	tens month	$30-31
12	unit month	$30-39
13	ASCII-character -	$2D
14	tens day	$30-33
15	unit day	$30-39
16	ASCII-character .	$2E
17	tens hour	$30-32
18	unit hour	$30-39
19	ASCII-character .	$2E
20	tens minute	$30-35
21	unit minute	$30-39
22	ASCII-character ;	$3B
23	tens second	$30-36
24	unit second	$30-39
25	ASCII-character .	$2E
26	1/10 second	$30-39
27	1/100 second	$30-39
28	1/1000 second	$30-39
29	ASCII-character :	$3A
30	checksum H-nibble	$30-3F, $58
31	checksum L-nibble	$30-3F, $58
32	CR (carriage return)	$0D

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3.21 MDR 2000

This data string serves to synchronise the Atis tape recorders MDR 2000 and MDD500.

The parameter for the serial interface must be set as follows:

- baud rate: 9600 Baud
- data format: 7 Bit
- 2 stop bits
- parity: even
- handshake: no
- control characters: yes
- sequence for CR / LF: SW3 switch 8 off
- synchronisation: every minute, local time, without time advance, output immediately

SW3 switches 4 and 5 are excluded. Delay of transmission and advance cannot be altered.

Structure of the data string

Character no.:	Meaning	Value (value range)
1	ADR. Recorder transmission head	$7F
2	0 ——— " ———	$30
3	0 ——— " ———	$30
4	S ——— " ———	$53
5	A ——— " ———	$41
6	status	$30-39, 41-46
7	tens year	$30-39
8	unit year	$30-39
9	tens month	$30-31
10	unit month	$30-39
11	tens day	$30-33
12	unit day	$30-39
13	tens hour	$30-32
14	unit hour	$30-39
15	tens minute	$30-35
16	unit minute	$30-39
17	tens second	$30-36
18	unit second	$30-39
19	day of the week	$31-37
20	checksum H-Nibble	$30-39, 41-46
21	checksum L-Nibble	$30-39, 41-46
22	reception address	$7F
23	CR (carriage return)	$0D

A checksum controls the transmitted data string. It is made up by adding all the transmitted ASCII characters from 1-20. The low byte of the sum is transmitted (modulo 256).

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3.21.1 Status

The status contains the following information

	b3	b2	b1	b0		meaning
status nibble:	x	x	x	0		no announcement hour
	x	x	x	1		announcement (ST-WT-ST)
	x	x	0	x		standard time(WT)
	x	x	1	x		daylight saving time (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)

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3.22 *hopf* Clockmouse

This data string can be used when the driver software for the clock-mouse is installed. Windows 3.x and Windows 95 computers can be synchronised by means of this software.

The parameter for the serial interface must be set as follows:

- baud rate: 300 Baud
- data format: 7 Bit
- 2 stop bits
- parity: even
- handshake: no
- control characters : yes
- sequence for CR / LF: SW3 switch 8 off
- synchronisation: on request, local time, without advance, output immediately

Structure of the data string

Character no:	Meaning
1	tens hour
2	unit hour
3	tens minutes
4	unit minutes
5	tens seconds
6	unit seconds
7	day of the week
8	tens day
9	unit day
10	tens month
11	unit month
12	tens year
13	unit year
14	status 1
15	status 2
16	CR (carriage return)

The data string is requested cyclically by the driver software.

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3.22.1 Status

The status information consists of 4bit each, meaning the following

Status 1

B3	meaning
1	announcement of leap second

B2	B1	meaning
1	0	standard /wintertime
0	1	daylight saving time

B0	meaning
1	announcement of changeover standard/daylight saving/ standard time

Status 2

B3	meaning
1	battery voltage too low always 0, because there is no battery

B2	meaning
1	reception interrupted always 0, because reception runs permanently

B1	meaning
1	radio reception

B0	meaning
1	valid time at hand

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3.23 *hopf* Clockmouse with <o><CR>

This data string has the same structure as the Clockmouse data string. Merely at the beginning of the string an "o" followed by "CR" is sent. This data string is necessary when a system transmits the string "o<CR>" to the board 7201 and this string is expected back as an echo with a time string.

The parameter for the serial interface must be set as follows:

- baud rate: 300 Baud
- data format: 7 Bit
- 2 stop bits
- parity: even
- handshake: no
- control character: yes
- sequence for CR / LF: SW3 switch 8 off
- synchronisation: on request, local time, without advance, output immediately

Structure of the data string

Character no.:	Meaning	Value (value range)
1	o	$6F
2	CR (carriage return)	$0D
3	tens hour	$30-32
4	unit hour	$30-39
5	tens minute	$30-35
6	unit minute	$30-39
7	tens second	$30-35
8	unit second	$30-39
9	day of the week	$31-37
10	tens day	$30-33
11	unit day	$30-39
12	tens month	$31-32
13	unit month	$30-39
14	tens year	$30-39
15	unit year	$30-39
16	status 1	$30-39, 41-46
17	status 2	$30-39, 41-46
18	CR (carriage return)	$0D

The structure of the status corresponds with the one of the Clockmouse data string without leading <o><CR> (see 3.22.1).

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3.24 DCF77-pulse output

In this setting the DCF77-pulse is put out at the interfaces RS232, RS422 and TTY.

The DCF77-data string puts out the complete time information minute, hour, day of the week and date.

Every second of a minute a particular time information is transmitted, except for the 59th second. The missing signal in this second indicates an imminent minute change in the next second.

At the beginning of every second a pulse is put out for 100 or 200ms. The initial edge of the pulse marks the exact beginning of the second.

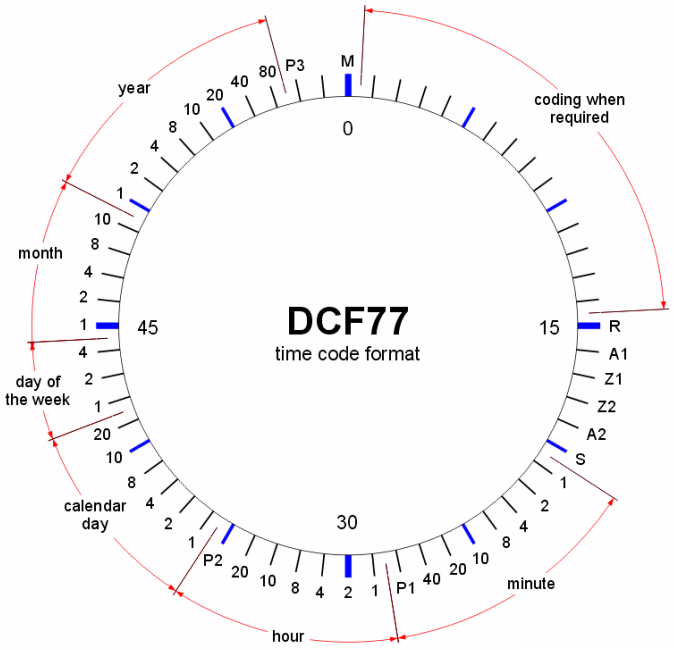
The duration of the second markers of 100 and 200 ms (binary 0 and 1) are transformed into a BCD-Code to decode the transmitted data string.

The time data string is divided into 3 different groups, each followed by a parity check:

- P1 = number of minutes
- P2 = number of hours
- P3 = current day of the year , the day of the week and the year

The binary ones of a group are determined and increased to an even number by the parity bit. When a valid time information (CEST) is transmitted the 17th second marker takes 200ms. One hour before the changeovers from CEST to CET or vice versa the 16th second marker takes 200ms.

The coding is shown below:



M	minute marker (0.1 s)
R	in the simulation this bit is permanently set to logic "0". In the transmitted data string via the DCF77 transmitter this bit becomes logic "1" when a spare antenna is used for the radiation.
A1	announcement of an imminent change over from CET to CEST or vice versa.
Z1, Z2	time zone bits
A2	announcement of a leap second
S	initial bit of the coded time information
P1, P2, P3	check bits

DCF77 : D = German, C = Long wave signal, F = Frankfurt, 77 = frequency

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The following switches on SW2 have changed functions.

Time base

The switch POS 8 is used to select the time base for the structure of the DCF77 data string, the choice being either UTC or local time.

Switch 8		Timebase
off		local time is put out in the DCF77-data string
on		UTC is put out in the DCF77-data string

Output Mode

The switch POS 7 is used to decide if the DCF77 pulse is put out permanently or only if the base system is radio synchronous.

Switch 7		Output Mode
off		output only if the base system is radio synchronous
on		output when the time of the base system is valid

Fault Mode

The DCF77-data string is not put out when the base system does not have a plausible time or if it is not radio synchronous (setting POS 7 – "off").

The output levels of the different interfaces remain in the rest position. This could also simulate a faulty line to the connected device.

POS 6 decides if an un-decodable pulse is putout in case of a fault.

Switch 6		Time Base
off		a constant 2 Hz-pulse is put out in case of a fault
on		the output levels go to rest position in case of a fault

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3.25 NMEA - GPRMC

The full NMEA data string GPRMC contains the position-, rate- and time data (UTC) calculated by the GPS receiver. The different information are separated in the data string by a comma. Only a comma is set if an information is not available.

The transmitted data string contains only the time information in UTC.

```
$GPRMC,hhmmss.ss,A,,,,,,DDMMYY,,*HH<CR><LF>
```

Structure of the data string

Character no.:	Meaning	Value (value range)
1	$ string start	$24
2	G	$47
3	P	$50
4	R	$52
5	M	$4D
6	C	$43
7	, comma as separation	$2C
8	tens hour UTC-time	$30-32
9	unit hour	$30-39
10	tens minute	$30-35
11	unit minute	$30-39
12	tens second	$30-35
13	unit second	$30-39
14	. point as separation	$2E
15	tenth second	$30-39
16	hundredth second	$30-39
17	, comma as separation	$2C
18	A	$41
19	, comma as separation	$2C
20	, comma as separation	$2C
21	, comma as separation	$2C
22	, comma as separation	$2C
23	, comma as separation	$2C
24	, comma as separation	$2C
25	, comma as separation	$2C
26	tens day	$30-33
27	unit day	$30-39
28	tens month	$30-31
29	unit month	$30-39
30	tens year	$30-39
31	unit year	$30-39
32	, comma as separation	$2C
33	, comma as separation	$2C
34	* string limitation	$2A
35	tens checksum	$30-39
36	unit checksum	$30-39
37	CR (carriage return)	$0D
38	LF (line feed)	$0A

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The checksum will be calculated from the XOR function of all transmitted ASCI characters between $ … *

All information will be transmitted as ASCI characters with 8 bit word length, 1 stop bit and no parity.

The following settings must be done on the board:

- baud rate = 4800 baud
- word length = 8 bit
- stop bit = 1
- parity = no parity
- transmission point = every second
- forerun off
- ETX immediately
- transmission delay off
- time base = UTC

The following DIP switch setting is necessary:

Pos.	1	2	3	4	5	6	7	8
SW1	off	on	on	on	off	off	on	off
SW2	off	off	on	off	on	on	on	on
SW3	on	off	off	off	off	off	off	off

If Setting Datastring to NMEA DIP-Switch 3 has other meaning as standard.

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3.26 DA55

Structure of the data string

Character no.:	Meaning	Value (value range)
1	tens hour	$30-32
2	unit hour	$30-39
3	tens minute	$30-35
4	unit minute	$30-39
5	tens second	$30-35
6	unit second	$30-39
7	day of the week	$31-37
8	tens day	$30-33
9	unit day	$30-39
10	tens month	$30-31
11	unit month	$30-39
12	tens year	$30-39
13	unit year	$30-39
14	Status Byte 1	$30-3F
15	Status Byte 2	$30-3F
16	CR (carriage return)	$0D

Status Bytes in Data String DA55

The 14th and 15th ASCII character contain status information. The status is decoded binary.

Structure of these Characters:

The status bytes consist of 7 bits (see settings further down). In Status byte 1 and 2 the status bits **b6**, **b5** and **b4** always have the same value:

- **b6** = 0
- **b5** = 1
- **b4** = 1

That means: 1. Nibble always = 3

Status 1. characters:

B3	meaning
1	announcement of leap second

B2	B1	meaning
1	0	standard- or wintertime
0	1	daylight saving time

B0	meaning
1	announcement of changeover standard-/daylight saving-/standard time

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Status 2. characters:

B3	meaning
1	battery voltage too low, **is always set to 0**
0	battery voltage is fine

B2	meaning
1	there is no valid time nor reception
0	this value is set by the first successful reception

B1	meaning
1	clock is radio synchronous
0	clock is not radio synchronous

B0	meaning
1	there is a valid time
0	there is no valid time

All information are transmitted as ASCII characters with 7 bit word length, 2 stop bits and parity bit (even).

The following settings must be done on the board:

- baud rate = 300 baud
- word length = 7 bit
- stop bit = 2
- parity = even parity
- transmission point = every second
- forerun = off
- ETX = immediately
- transmission delay = off
- time base = local

The following dip switch setting is necessary:

Pos.	1	2	3	4	5	6	7	8
SW1	off	off	off	on	off	on	on	off
SW2	**off**	**off**	**on**	**off**	**off**	**on**	**on**	**on**
SW3	off	off	off	on	on	off	off	on

When SW2 is set as described above, the settings of SW1 and SW3 are automatically corrected to the described values by internal software filter.

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3.27 OMS Synchro

Structure of the data string

Character no.:	Meaning	Value (value range)
1	"\" start character	$5c
2	"G" source: GPS	$47
3	tens hour	$30-32
4	unit hour	$30-39
5	tens minute	$30-35
6	unit minute	$30-39
7	tens second	$30-35
8	unit second	$30-39
9	"2" thousands year	$32
10	"0" hundred year	$30
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	"0"	$30
18	unit day of the week	$30-36 (0=Su, 1=Mo … 6=Sa)
19	checksum: high nibble	$30-3F
20	checksum: low nibble	$30-3F

The following settings must be done on the board:

- baud rate = 9600 Baud
- word length = 8 Bit
- stop bit = 2
- parity = no Parity
- transmission point = every hour
- forerun = off
- transmission delay = off
- time base = UTC / local time

The following dip switch setting is necessary:

Pos.	1	2	3	4	5	6	7	8
SW1	on[1] off[2]	on	on	on	off	off	off	on
SW2	**off**	**off**	**off**	**on**	**on**	**on**	**off**	**on**
SW3	on	off	off	off	on	off	off	on

When SW2 is set as described above, the settings of SW1 (without switch 1) and SW3 (without switch 4 [must be off]) are automatically corrected to the described values by internal software filter.

[1] UTC time
[2] local time

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3.28 IRIG J-1x

IRIG J-12..J-18 Data String

- J-12: 300Bd
- J-13: 600Bd
- J-14: 1200Bd
- J-15: 2400Bd
- J-16: 4800Bd
- J-17: 9600Bd
- J-18: 19200Bd

Structure of the data string

Character no.:	Meaning	Value (value range)
1	SOH	$01
2	hundred day of the year	$30-33
3	tens day of the year	$30-39
4	unit day of the year	$30-39
5	":" colon	$3A
6	tens hour	$30-32
7	unit hour	$30-39
8	":" colon	$3A
9	tens minute	$30-35
10	unit minute	$30-39
11	":" colon	$3A
12	tens second	$30-35
13	unit second	$30-39
14	Carriage Return	$0D
15	Line feed	$0A

3.28.1 Example of a transmitted Data String

(SOH)034:12:34:56 (CR)(LF)

It is the 34th day of the year - 12:34:56 o'clock

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3.29 CCTV

Structure of the data string

Character no.:	Meaning	Value (value range)
1	"0" start character command	$30
2	"M" command "Master"	$4D
3	"a" command end	$61
4	tens hour	$30-32
5	unit hour	$30-39
6	"," comma	$2C
7	tens minute	$30-35
8	unit minute	$30-39
9	"," comma	$2C
10	tens second	$30-35
11	unit second	$30-39
12	"," comma	$2C
13	"0" start character command	$30
14	"X" end of string	$58
15	carriage return	$0D

The following settings must be done on the board:

- baud rate = 1200 or 4800 Baud
- word length = 8 Bit
- stop bit = 1
- parity = no Parity
- transmission point = every minute
- forerun = off
- transmission delay = off
- time base = UTC / local time

The following dip switch setting is necessary:

Pos.	1	2	3	4	5	6	7	8
SW1	off	on	on	on	on	on[3] off[4]	off [1] on [2]	off
SW2	**off**	**off**	**off**	**on**	**off**	**on**	**on**	**off**
SW3	on	off	off	on	on	off	off	off

[3] 1200 Baud
[4] 4800 Baud

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3.30 ABB Master-Clock

Structure of the data string

Character no.:	Meaning	Value (value range)
1	DEL -Character	$7F
2	"*" asterisk	$2A
3	"*" asterisk	$2A
4	"*" asterisk	$2A
5	tens year	$30-39
6	unit year	$30-39
7	":" colon	$3A
8	tens month	$30-31
9	unit month	$30-39
10	":" colon	$3A
11	tens day	$30-33
12	unit day	$30-39
13	":" colon	$3A
14	tens day of the week	$30
15	unit day of the week	$31-37 (1=Mo … 7=So)
16	":" colon	$3A
17	tens hour	$30-32
18	unit hour	$30-39
19	":" colon	$3A
20	tens minute	$30-35
21	unit minute	$30-39
22	"*" asterisk	$2A
22	tens second	$30-35
23	unit second	$30-39
24	Carriage Return	$0D
25	Line feed	$0A
26	DEL -Character	$7F

The following settings must be done on the board:

- baud rate = 4800 Baud
- word length = 7 Bit
- stop bit = 1
- parity = odd
- transmission point = every minute
- forerun = off
- transmission delay = off
- time base = local time

The following DIP-switch setting is necessary:

Pos.	1	2	3	4	5	6	7	8
SW1	off	off	off	off	on	off	on	off
SW2	**off**	**off**	**off**	**off**	**on**	**on**	**on**	**off**
SW3	on	off	off	on	on	off	off	off

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3.31 BEXBACH

The structure of the data string BEXBACH is compatible to the SINEC H1 data string with the exception of character 21 and 24 witch are changed to ":" colons (see ***chapter 3.5 SINEC H1***).

Character no.	Meaning	Value (value range)
1	STX (start of text)	$02
2	"D" ASCII D	$44
3	":" colon	$3A
4	tens day	$30-33
5	unit day	$30-39
6	"." point	$2E
7	tens month	$30-31
8	unit month	$30-39
9	"." point	$2E
10	tens year	$30-39
11	unit year	$30-39
12	";" semicolon	$3B
13	"T" ASCII T	$54
14	":" colon	$3A
15	day of the week	$31-37
16	";" semicolon	$3B
17	"U" ASCII U	$55
18	":" colon	$3A
19	tens hour	$30-32
20	unit hour	$30-39
21	":" colon	$3A
22	tens minute	$30-35
23	unit minutes	$30-39
24	":" colon	$3A
25	tens second	$30-36
26	unit second	$30-39
27	";" semicolon	$3B
28	"#" or space	$23 / $20
29	"*" or space	$2A / $20
30	"S" or space	$53 / $20
31	"!" or space	$21 / $20
32	ETX (end of text)	$03

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3.31.1 Status

The characters 28 - 31 in the data string BEXBACH tell the synchronisation status of the clock.

The characters mean the following:

Character no. 28 =	"#"	no radio synchronisation after reset, time invalid
	Space	radio synchronisation after reset, clock in crystal operation
Character no. 29 =	"*"	time from internal crystal in the clock
	Space	time by radio reception
Character no. 30 =	"S"	daylight saving time
	Space	standard time
Character no. 31 =	"!"	announcement of a W/S or S/W changeover
	Space	no announcement

3.31.2 Example of a transmitted Data String

(STX)D:03.01.96;T:3;U:12:34:56; _ _ _ _ (ETX) (_) = space

Radio operation, no announcement, standard time
It is Wednesday 03.01.96 - 12:34:56 h

3.31.3 String request

The data string BEXBACH can also send by request. The time of output will be set to "send only by request" and the string will be requested with the ASCII character "?".

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3.32 Data String NGTS-String

The following parameters are pre-configured on serial interface **COM0** (delivery status):

		fixed	variable
Baud rate:	9600 baud		x
Data bits:	8		x
Stop bit(s):	1		x
Parity:	no		x
point of transmission:	every minute		x
second forerun:	yes		x
control character:	without function		
CR/LF:	CR ⇨ LF		x

The NGTS string can be transmitted with all modes (e.g.. **forerun** or **"last control character on the second change"**).

In the standard mode this string is transmitted every minute in the 59th second with the data of the next minute change.

3.32.1 Structure of Data String

character no.:	meaning	value (value range)
1	"T" ASCII T	$54
2	10er year	$30-39
3	1er year	$30-39
4	10er month	$30-31
5	1er month	$30-39
6	10er day	$30-33
7	1er day	$30-39
8	1er day of the week	$31-37
9	10er hour	$30-32
10	1er hour	$30-39
11	10er minute	$30-35
12	1er minute	$30-39
13	status (0, 1)	$30-31 (30 ⇨ Local Time, 31 ⇨ UTC)
14	status (0, 1)	$30-31 (31 ⇨GPS synchronous)
15	CR (carriage return)	$0D
16	LF (line feed)	$0A

3.32.2 Example of Data String

`T0401293123401`(CR)(LF)

It is Wednesday 29.01.04 - 12:34 o'clock
Local time
The clock is synchronised by GPS.

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3.33 SAT 1703 Time String

All modes can be transmitted with the SAT 1703 Time String (e.g. with forerun or end character at second change).

The SAT 1703 Time String can also be sent on request. The point of transmission will be set to "transmission on request". The SAT 1703 Time String can be requested with ASCII-character **"?"**.

3.33.1 Specified Settings

Automatic:	**no**
Required:	**no**
Blocked:	**no**

3.33.2 Structure

Character No.	Meaning		Hex-Value
1	STX (start of text)		$02
2	tens day		$30-33
3	unit day		$30-39
4	"."		$2E
5	tens month		$30-31
6	unit month		$30-39
7	"."		$2E
8	tens year		$30-39
9	unit year		$30-39
10	"/"		$2F
11	unit day of the week		$31-37
12	"/"		$2F
13	tens hours		$30-32
14	unit hours		$30-39
15	":"		$3A
16	tens minutes		$30-35
17	unit minutes		$30-39
18	":"		$3A
19	tens seconds		$30-35
20	unit seconds		$30-39
21	"M" or "M" or "U"	(Standard time, Daylight saving time or UTC)	$4D, $4D, $55
22	"E" or "E" or "T"		$45, $45, $54
23	"Z" or "S" or "C"		$5A, $53, $43
24	" " or "Z" or " "		$20, $5A, $20
25	" " ($20 ⇨ synchronous) or "*" ($2A ⇨ not synchronous)		$20 $2A
26	" " ($20 ⇨ no announcement) or "!" ($21 ⇨ announcement of a DST or standard time changeover)		$20 $21
27	CR (carriage return)		$0D
28	LF (line feed)		$0A
29	ETX		$03

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3.33.3 Status

The characters 21-26 in the SAT 1703 Time String indicate the synchronisation status of the clock.

The characters mean the following:

Character no. 21-24 =	"MESZ"	Central European Summertime (Daylight Saving Time)
	"MEZ "	Central European Time (standard time / winter time)
	"UTC "	Coordinated Universal Time
Character no. 25 =	"*"	time from internal crystal in the clock
	" " (space)	time by radio reception
Character no. 26 =	"!"	announcement of a DST or standard time changeover
	" " (space)	no announcement

3.33.4 Example

(STX)18.07.02/4/02:34:45UTC___(CR)(LF)(ETX)

- It is Thursday 18.07.02 - 02:34:45 o'clock UTC
- The clock is synchronous

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3.34 Data String ION 7550

3.34.1 Specified Settings

Table 1: Interface Parameter

Preset:	The following parameters are preset for the data string output (delivery status): • Baud rate: 9600 Baud • Data bits: 8 • Stop bit(s): 1 • Parity: no • Point of transmission: every second • Second forerun: no • Control character: yes • CR/LF: CR ⇨ LF
Required:	-
Free adjustable:	All parameter are free adjustable.

Warning: The accuracy specified in the data string is only achieved when the board is inserted into a GPS system with a time-out (≤ 2 min).

3.34.2 Data String Structure

Table 2: Data String Structure

Character No.	Meaning	Hex-Value
1	SOH (start of header)	$01
2	Hundredth day of year	$30-33
3	Tens day of the year	$30-39
4	Units day of the year	$30-39
5	":"	$3A
6	Tens hours	$30-32
7	Units hours	$30-39
8	":"	$3A
9	Tens minutes	$30-35
10	Units minutes	$30-39
11	":"	$3A
12	Tens seconds	$30-35
13	Units seconds	$30-39
14	Indication of accuracy (table 3)	$23, $2A , $2E , $3F
15	CR (carriage return)	$0D
16	LF (line feed)	$0A

Table 3: Indication of Accuracy

Character			
ASCII	**HEX**	**Description**	**Meaning**
?	$3F	Question mark	Accuracy > 100 µsec
#	$23	Number sign	Accuracy < 100 µsec
*****	$2A	Asterisk	Accuracy < 10 µsec
.	$2E	Point	Accuracy < 1 µsec

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Table 4: Duration of Accuracy Level by Loss of Synchronisation

Accuracy level	Accuracy	Max. Duration until next level	Accuracy Change
0	< 1 µs	Approx 1 minute	**.** ⇨ *****
1	< 10 µs	Approx 3 minutes	***** ⇨ **#**
2	< 100 µs	Approx 27 minutes	**#** ⇨ **?**
3	> 100 µs		**?**

Table 5: Duration of Accuracy Level in Case of Synchronisation

Accuracy level	Accuracy	Duration until next level
1 - 4	> 1 ms	Quartz operation until synchronisation
0	< 1 µs	Radio, with quartz control until loss of synchronisation

3.34.3 Data String Example

(SOH)303:12:34:56*(CR)(LF)

- It is the 303rd day of year,
- 12:34:56 o'clock,
- the accuracy is better than 10 µsec

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