Industriefunkuhren

hopf Elektronik GmbH

Technical Manual

Interface Board

Model 7245

ENGLISH

Version: 07.02 – 18.01.2017

Valid for Devices 7245 with FIRMWARE Version: **07.xx**

hopf Elektronik GmbH
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Version number (Firmware / Description)

THE FIRST TWO DIGITS OF THE VERSION NUMBER OF THE TECHNICAL DESCRIPTION AND THE FIRST TWO DIGITS OF THE FIRMWARE VERSION MUST **COMPLY WITH EACH OTHER**.

THE DIGITS AFTER THE DECIMAL POINT IN THE VERSION NUMBER INDICATE CORRECTIONS OF ONLY MINIMAL IMPORTANCE IN THE FIRMWARE / DESCRIPTION AND 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 technical data serve to ensure trouble-free operation of the devices and protection of persons and equipment. It is therefore of utmost importance to observe and comply with these regulations. If these are not complied with, then no claims may be made under the terms of the warranty and 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 labeled accordingly. The safety may be impaired when the device does not operate properly or if it is obviously damaged. Contact your local ***hopf*** Elektronik GmbH representative for required action.

CE-Konformität

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=Communauté Européenne)

CE = Communautes Europeénnes = 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 In General

1.1 Specifications

- data output via : RS232c (V.24), RS422 (V.11)
- baud rate : 150 - 19200 baud
- different output strings can be set by DIP-switch (e.g. output of UTC time)
- specification of the internal clock status in the status byte of the data string
- potential separation between the output ports (S1-S4)

1.2 Description of Function

The micro-processor of the interface board 7245 contains the time information via the ***hopf*** 7001 system bus.

The received time is put out via the 4 potential free interfaces. Cyclic data outputs (e.g. data output every minute) can be set by means of a DIP-switch. Baud rate, word length and also the number of stop bits and the parity mode can be set by means of a DIP-switch.

And it is also possible to set different data strings as output data strings by means of a DIP-switch.

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2 Hardware Configuration of the Board 7245

2.1 Selection of Interface

The interface board is equipped with 4 potential separate interfaces. Each interface (S1-S4) has the standardised interface formats:

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

The interface S1 can be operated with the handshake line RTS/CTS. It has a serial input where time data can be requested with the ASCII control character.

S2-S4 can be used as outputs only. In case of a set cyclic data output the data string appears at all serial outputs (S1-S4). The request of data via the RxD lines can occur at the interface S1 via RS232c or RS422 only.

2.2 Handshakelines (exclusively RS232c at S1 only)

The RS232c-interfac of the interface S1 is equipped with the standardised handshake lines. Depending on the use these handshake lines can either be used or deactivated by means of the DIP-switch 3 push button 2.

DIP-switch 3 push button 2

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

It is also possible to use the RS232 control line RTS as a second pulse, in which case **DIP-switch 3 push button 2 must be on (handshake switch active).**

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 at the interfaces S2-S4 DIP-switch 3 push button 2 must be in the **off** position.

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2.3 Pin Allocation

2.3.1 Interface S1

The S1 interface can be operated with the handshake lines RTS / CTS. It has a serial input to obtain time data via ASCII control characters.

The **request** of data via the RxD line can only be done at **interface S1** via RS232c or RS422.

9 pole SUB-D female connector		
Pin-No.	**Assignment**	
1	GND	interface GND
2	TxD	RS232C potential isolated
3	RxD	
4	RxD+	RS422 potential isolated
5	RxD-	
6	RTS	RS232C handshake potential isolated
7	CTS	
8	TxD-	RS422 potential getrennt
9	TxD+	

TxD+ / RxD+: High active
TxD- / RxD-: Low active

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2.3.2 Interfaces S2, S4

S2 and S4 can only be used as outputs. When selected for cyclic data output the data string appears on all serial outputs (S1-S4).

9 pole SUB-D female connector		
Pin-No.	**Assignment**	
1	GND	Interface GND
2	TxD	RS232C potential isolated
3		not assigned
4		not assigned
5		not assigned
6		not assigned
7		not assigned
8	TxD-	RS422 potential isolated
9	TxD+	

TxD+ / RxD+: High aktiv
TxD- / RxD-: Low aktiv

2.3.3 Interface S3

Interface S3 is same like interfaces S2 and S4, however it has one additional RxD input.

At present RxD input at S3 is not operated.

9 pole SUB-D female connector		
Pin-No.	**Assignment**	
1	GND	Interface GND
2	TxD	RS232C potential getrennt
3	RxD	
4	RxD+	RS422 potential getrennt
5	RxD-	
6		not assigned
7		not assigned
8	TxD-	RS422 potential getrennt
9	TxD+	

TxD+ / RxD+: High aktiv
TxD- / RxD-: Low aktiv

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2.3.4 Pulse Output via S5

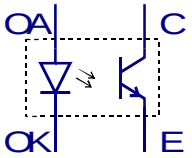
4 potential free minute pulses can be tapped about the connector S5. The pulse duration is 1 second. The potential isolation is via optocouplers.

The connector is assigned at follows::

9 pole SUB-D female connector	
Pin-No.	**Signal description**
1	OK1 C
2	OK2 C
3	OK3 C
4	OK4 C
5	not assigned
6	OK1 E
7	OK2 E
8	OK3 E
9	OK4 E

Contact: E = Emitter of the output transistor

C = Collector of the output transistor



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2.4 Selection of Transmission Format with DIP-Switch SW1

DIP-switch SW1 is used to set the baud rate, word length, parity mode and stop bits for the data transfer.

The selected configuration applies to all 4 existing interfaces.

2.4.1 Output UTC or CEST/CET

switch 1	meaning
on	output UTC via interface
off	CEST/CET via interface

2.4.2 Setting the Word Length

switch 2	meaning
on	8-data bit
off	7-data bit

2.4.3 Setting the Parity-Mode of the Transmission

switch 3	switch 4	meaning
on	on	no parity bit
on	off	no parity bit
off	on	parity even
off	off	parity odd

2.4.4 Setting the Stop bits

switch 5	meaning
on	1 stop bit
off	2 stop bit

2.4.5 Setting the Baud Rate

switch 6	switch 7	switch 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
off	off	off	19200 Baud

in case of pulse output these switches have a different meaning

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3 Data String Output

3.1 Settings for the Data String Output

The time information can be put out via the interfaces in different data strings including the internal clock status. This enables the user to synchronise his computer system with the atom precise time. It is possible to choose particular output points of time, the string structure and control characters by means of the DIP-switch SW2.

Possible Settings with DIP-switch SW2 (see diagram in the appendix)

switch 1	second advance
on	switched on
off	switched off

switch 2	ETX on the second change only when "with control characters" has been activated
on	with ETX on the second change
off	without ETX on the second change

SW2 pos. 3	SW2 pos. 4	SW3 pos. 4	SW3 pos. 5	output of the data string
off	off	off	off	pulse output
off	on	off	off	data string NMEA
on	off	off	off	MIC-P mains frequency (with 7515 only)
on	on	off	off	Contronic P (PCZ77 / 5050 H&B)
off	off	on	off	data string Atis 31
off	on	on	off	DCF77-simulation
on	off	on	off	data string UTC-slave
on	on	on	off	data string 2000
off	off	off	on	data string data / time
off	on	off	on	data string DCF-slave
on	off	off	on	data string SINEC H1
on	on	off	on	data string T-string
off	off	on	on	data string 7001/6021 (standard)
off	on	on	on	data string 5050
on	off	on	on	data string 5500
on	on	on	on	data string MADAM S

switch 5	time or time and date
on	output time only
off	output time and date

switch 6	control characters STX/ETX
on	transmission with control characters
off	transmission without control characters

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

in case of pulse output these switches have a different meaning

3.1.1 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)

In case of all data strings with the control characters **"CR"** and **"LF"** the output can be changed by means of DIP-switch 3 push button 8=on.

3.1.2 Serial Requests

The user can start the output of the standard ***hopf*** data strings 7001 / 6021 / 5500 / 5050 by entering a control character, which are as follows:

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 in case of requests via software. To delay the transmission the requesting computer transmits a small letter "u,d,g" with a two-digit multiplication factor to the clock.

The clock interprets the multiplication factor as a hexa-decimal value.

example :

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

The computer transmits **ASCII gFF** (Hex 67, 46, 46)
After 2250 milliseconds the clock transmits the data string UTC time/date.

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3.2 Data String 7001/6021

3.2.1 Data String 7001/6021 Time and Date (Standard)

The control characters STX and ETX are transmitted only if the output "with control characters" has been set at DIP-switch 2 (DIP-switch 2 push button 6 = on). 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 3.2.3
3	day of the week (1=Monday...7=Sunday)	; see 3.2.3
	In case of UTC-time bit 3 in the day of the week is set to 1	
4	tens hour	
5	unit hour	
6	tens minute	
7	unit minute	
8	tens seconds	
9	unit seconds	
10	tens day	
11	unit day	
12	tens month	
13	unit month	
14	tens year	
15	unit year	
16	LF (line feed)	; see 3.1.1
17	CR (carriage return)	; see 3.1.1
18	ETX (end of text)	

3.2.2 Data String 7001/6021 Time only

The control characters STX and ETX are transmitted only if the output "with control characters" has been set at DIP-switch 2 (DIP-switch 2 push button 6 = on). 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	tens hour	
3	unit hour	
4	tens minutes	
5	unit minutes	
6	tens seconds	
7	unit seconds	
8	LF (line feed)	; see 3.1.1
9	CR (carriage return)	; see 3.1.1
10	ETX (end of text)	

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3.2.3 Data String 7001/6021 Status- and Day of the Week Nibble

The second and the third ASCII characters 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 (DS-ST-DS)
	x	x	0	x	standard time (ST)
	x	x	1	x	daylight saving time (DS)
	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

3.2.4 Example of a Transmitted Data String 7001/6021

(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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3.3 Data String 5500

3.3.1 Data String 5500 Time and Date

The control characters STX and ETX are transmitted only if the output "with control characters" has been set at DIP-switch 2 (DIP-switch 2 push button 6 = on). 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 3.3.3
3	space	
4	tens hour	
5	unit hour	
6	tens minute	
7	unit minute	
8	tens seconds	
9	unit seconds	
10	space	
11	tens day	
12	unit day	
13	tens month	
14	unit month	
15	tens year	
16	unit year	
17	space	
18	day of the week	; see 3.3.3
19	CR (carriage return)	; see 3.1.1
20	LF (line feed)	; see 3.1.1
21	ETX (end of text)	

3.3.2 Data String 5500 Time only

The control characters STX and ETX are transmitted only if the output "with control characters" has been set at DIP-switch 2 (DIP-switch 2 push button 6 = on). 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	tens hour	
3	unit hour	
4	tens minutes	
5	unit minutes	
6	tens seconds	
7	unit seconds	
8	CR (carriage return)	; see 3.1.1
9	LF (line feed)	; see 3.1.1
10	ETX (end of text)	

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3.3.3 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 ST-DS-ST
	x	x	1	x	announcement ST-DS-ST
	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

3.3.4 Example of a Transmitted Data String 5500

(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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3.4 Data String 5050

3.4.1 Data String 5050 Time and Date

The control characters STX and ETX are transmitted only if the output "with control characters" has been set at DIP-switch 2 (DIP-switch 2 push button 6 = on). 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	tens hour	
3	unit hour	
4	space	
5	tens minute	
6	unit minute	
7	space	
8	tens seconds	
9	unit seconds	
10	space	
11	tens day	
12	unit day	
13	space	
14	tens month	
15	unit month	
16	space	
17	tens year	
18	unit year	
19	space	
20	status: internal clock status	; see 3.4.3
21	day of the week	; see 3.4.3
22	space	
23	CR (carriage return)	; see 3.1.1
24	LF (line feed)	; see 3.1.1
25	ETX (end of text)	

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3.4.2 Data String 5050 Time only

character no.	meaning	
1	STX (start of text)	
2	tens hour	
3	unit hour	
4	space	
5	tens minute	
6	unit minute	
7	space	
8	tens seconds	
9	unit seconds	
10	space	
11	CR (carriage return)	; see 3.1.1
12	LF (line feed)	; see 3.1.1
13	ETX (end of text)	

3.4.3 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 (ST-DS-ST)
	x	x	0	x	no announcement (ST-DS-ST)
	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

3.4.4 Example of a Transmitted Data String 5050

(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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3.5 Data String MADAM-S

The structure of the data string depends on the request string. If the superior computer (PROMEA-MX) requests with the following 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 3.5.2
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	; see 3.1.1
23	LF (line feed)	$0A	; see 3.1.1
24	ETX (end of text)	$03	

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If 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 3.5.2
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	; see 3.1.1
23	LF (line feed)	$0A	; see 3.1.1
24	ETX (end of text)	$03	

3.5.1 Required Setting for Output MADAM-S

The synchronisation mechanism for the out put MADAM-S requires the following setting on the board 7245:

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

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3.5.2 Status in the Data String MADAM-S

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

time scale identification (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 ASCII 1 (Hex 31 ⇔ MO) to ASCII 7 (Hex 37 ⇔ SO). In case of an invalid time the byte is transmitted with ASCII 0 (Hex 30).

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3.6 Data String SINEC H1

The control characters STX and ETX are transmitted only if the output "with control characters" has been set at DIP-switch 2 (DIP-switch 2 push button 6 = on). 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	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	; see 3.6.1
29	"*" or space	$2A / $20	; see 3.6.1
30	"S" or space	$53 / $20	; see 3.6.1
31	"!" or space	$21 / $20	; see 3.6.1
32	ETX (end of text)	$03	

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3.6.1 Status in the Data String SINEC H1

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

meaning 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 of the clock
	space	time from radio reception
character no.: 30 =	"S"	daylight saving time
	space	standard time
character no.: 31 =	"!"	announcement of a ST/DS or DS/ST changeover
	space	no announcement

3.6.2 Example of a Transmitted Data String SINEC H1

(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

3.6.3 String Request

The SINEC H1 data string can also be transmitted on request by setting the output point of time to "transmission on request only" and requesting the string with the ASCII character "?"

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3.7 Data String DCF-Slave

The following data string is used to synchronise ***hopf*** DCF-slave systems. The only difference to the standard data string 7001 / 6021 is the status byte.

character no.	meaning	value (value range)	
1	STX (start of text)	$02	
2	status	$30-39, $41-46	; see 3.7.1
3	day of the week	$31-37	; see 3.7.1
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	CR (carriage Return)	$0D	; see 3.1.1
17	LF (line feed)	$0A	; see 3.1.1
18	ETX (end of text)	$03	

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3.7.1 Status in the Data String DCF-Slave

	b3	b2	b1	b0	meaning
status nibble:	x	x	x	0	no announcement hour
	x	x	x	1	announcement (DS-ST-DS)
	x	x	0	x	standard time (ST)
	x	x	1	x	daylight saving time(DS)
	x	0	x	x	no announcement leap second
	x	1	x	x	announcement leap second
	0	x	x	x	radio operation
	1	x	x	x	radio operation (high accuracy)
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

3.7.2 Example of a Transmitted Data String DCF-Slave

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

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

3.7.3 Setting

The following setting is required for the synchronisation of the ***hopf*** slave systems:

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

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

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3.8 Data String UTC-Slave

This string is used when the ***hopf*** clock system is to run completely on UTC-time.

The difference time is included in the string to calculate the local time. If the local time is positive compared to the UTC time, the top bit is set in the tens-hour.

e.g. CET + 1h 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	; see 3.8.1
3	day of the week	$39, $41-46	; see 3.8.1
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 hours	$ 30, 31, 38, 39	
17	unit difference hours	$ 30-39	
18	tens difference minutes	$ 30-35	
19	unit difference minutes	$ 30-39	
20	LF (line feed)	$0A	; see 3.1.1
21	CR (carriage Return)	$0D	; see 3.1.1
22	ETX (end of text)	$03	

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3.8.1 Status in the Data String UTC-Slave

	b3	b2	b1	b0	meaning
status nibble:	x	x	x	0	no announcement hour
	x	x	x	1	announcement (DS-ST-DS)
	x	x	0	x	standard time (ST)
	x	x	1	x	daylight saving time(DS)
	x	0	x	x	no announcement leap second
	x	1	x	x	announcement leap second
	0	x	x	x	radio operation
	1	x	x	x	radio operation (high accuracy)
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

3.8.2 Setting

The following setting is required for the synchronisation of the ***hopf*** slave systems:

- output every minute
- output second advance
- ETX on the second change
- UTC or local time
- word length 8 bit
- parity no
- baud rate 9600

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

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3.9 Data String T-String

The T-string is transmitted to the synchronous clocks in the 60th second every minute. It contains the complete time information of the full minute. After the transmission of "LF" the data string is worked on internally and the millisecond counter is set to "1".

The output of the year can be changed to 4 digits by setting switch 5 of DIP-switch 2 **off**. Usually the switch is **on**.

character no.	meaning	value (value range)	
1	"T" ASCII T	$54	
2	":" colon	$3A	
3	thousands year	$31,32 *	
4	hundreds year	$30,39 *	
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	
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	":" colon	$3A	
23	tens seconds	$30-36	
24	unit seconds	$30-39	
25	CR (carriage return)	$0D	; see 3.1.1
26	LF (line feed)	$0A	; see 3.1.1

* These information will only be shown in case of an 4-digit output of the year.

3.9.1 Example of a Transmitted Data String T-String

T:1996:01:03:03:12:34:56(CR)(LF)

It is Wednesday 03.01.96 - 12:34:56h

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3.10 Data String Data/Time

3.10.1 Data String Date/Time - Date and Time

The control characters STX and ETX are transmitted only if the output "with control characters" was set at DIP-switch 2 (DIP-switch 2 push button 6 = on). Otherwise these control characters are omitted. In case of the setting "ETX delayed" the last characters (ETX) is transmitted on the next second change.

character no.	meaning
1	STX (start of text)
2	tens year
3	unit year
4	tens month
5	unit month
6	tens day
7	unit day
8	tens hour
9	unit hours
10	tens minutes
11	unit minutes
12	tens seconds
13	unit seconds
14	ETX (end of text)

3.10.2 Data String Date/Time - Time only

The control characters STX and ETX are transmitted only if the output "with control characters" was set at DIP-switch 2 (DIP-switch 2 push button 6 = on). Otherwise these control characters are omitted. In case of the setting "ETX delayed" the last characters (ETX) is transmitted on the next second change.

character no.	meaning
1	STX (start of text)
2	tens hours
3	unit hours
4	tens minutes
5	unit minutes
6	tens seconds
7	unit seconds
8	ETX (end of text)

3.10.3 Example of a Transmitted Data String Date/Time

(STX) 960103123456 (ETX)

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

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3.11 Data String 2000

3.11.1 Data String 2000 Time and Date with 4 Digits for the Year

The control characters STX and ETX are transmitted only if the output "with control characters" was set at DIP-switch 2 (DIP-switch 2 push button 6 = on). Otherwise these control characters are omitted. In case of the setting "ETX delayed" the last characters (ETX) is transmitted on the next second change.

character no.	meaning	
1	STX (start of text)	
2	Status (internal status of the clock)	; see 3.11.2
3	day of the week (1=Monday ... 7=Sunday)	; see 3.11.2
	In case of UTC time bit 3 is set to 1 in the day of the week	
4	tens hour	
5	unit hour	
6	tens minutes	
7	unit minutes	
8	tens seconds	
9	unit seconds	
10	tens day	
11	unit day	
12	tens month	
13	unit month	
14	thousands year	
15	hundreds year	
16	tens year	
17	unit year	
18	LF (line feed)	; see 3.1.1
19	CR (carriage return)	; see 3.1.1
20	ETX (end of text)	

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3.11.2 Data String 2000 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. The structure of these characters:

	b3	b2	b1	b0	meaning
status nibble:	x	x	x	0	no announcement hour
	x	x	x	1	announcement (DS-ST-DS)
	x	x	0	x	standard time (ST)
	x	x	1	x	daylight saving time (DS)
	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 a Transmitted Data String 2000

(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 Data String NMEA

This data string contains the time information in the NMEA-Format[1] 0183. The structure matches the one of the standardised string ZDA-Time & Date with the following content:

UTC, day, month, year, local time zone.

The following parameter have been fixed for the data transmission

baud rate = 4800
data bits = 8
parity = no
stop bits = 1

The string structure contains the time information and also the identification information. For this time basis ZQ is selected as identifier and ZDA as string identifier.

The information is transmitted between the ASCII-character "$" and the ASCII-character "*". The checksum is transmitted after the "*". The checksum is calculated in one byte by making an EXOR of all characters in the data string between "$" and "*". The hexadecimal values of the top and bottom 4 bits of the checksum are transformed into ASCII characters and transmitted, while the binary values A-F are transformed into ASCII-characters "A"-"F" (41h - 46h).

[1] NMEA = National Marine Electronics Association

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String Structure :

character no.:	meaning	
1	"$" string start	
2	"Z" identifier time basis crystal	
3	"Q"	
4	"Z" identifier content of data time information	
5	"D"	
6	"A"	
7	"," comma as character to separate information	
8	tens hours UTC-time	
9	unit hours	
10	tens minutes	
11	unit minutes	
12	tens seconds	
13	unit seconds	
14	"," comma as character to separate information	
15	tens day UTC -date	
16	unit day	
17	"," comma as character to separate information	
18	tens month	
19	unit month	
20	"," Comma as character to separate information	
21	thousands digit year	
22	hundreds digit year	
23	tens year	
24	unit year	
25	"," comma as character to separate information	
26	"+" or "-" sign for local time zone	
27	tens hours (local time zone difference hours)	
28	unit hours	
29	"," comma as character to separate information	
30	tens minutes (local time zone difference minutes)	
31	unit minutes	
32	"*" string limit	
33	Checksum Bit 7-4	
34	Checksum Bit 3-0	
35	CR (carriage return)	; see 3.1.1
36	LF (line feed)	; see 3.1.1

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3.13 Structure of Data String MIC-P

The control characters STX and ETX are transmitted only if the output was set "with control characters"; otherwise these characters are missed out. The setting "ETX delayed" causes the last character (ETX) to be transmitted on the next second change.

character no.:	meaning	value (value range)	
1	(STX) Start of Text	$02	
2	”R” ident. mains time	$52	
3	”:” separator	$3A	
4	tens - hour	$30-32	
5	unit - hour	$30-39	
6	”:” separator	$3A	
7	tens - minute	$30-35	
8	unit - minute	$30-39	
9	”:” separator	$3A	
10	tens - second	$30-35	
11	unit - second	$30-39	
12	(LF) line feed	$0A	; see 3.1.1
13	(CR) carriage return	$0D	; see 3.1.1
14	”D” ident. time difference	$44	
15	”:” separator	$3A	
16	+/- sign of difference	$2B/2D	
17	hundreds - second	$30-39	
18	tens - second	$30-39	
19	unit - second	$30-39	
20	”:” separator	$2D	
21	1/10 second	$30-39	
22	1/100 second	$30-39	
23	1/1000 second	$30-39	
24	(LF) line feed	$0A	; see 3.1.1
25	(CR) carriage return	$0D	; see 3.1.1
26	”F” ident. frequency	$46	
27	”:”separator	$3A	
28	tens - frequency	$30-39	
29	unit - frequency	$30-39	
30	”:” separator	$2D	
31	1/10 frequency	$30-39	
32	1/100 frequency	$30-39	
33	1/1000 frequency	$30-39	
34	(LF) line feed	$0A	; see 3.1.1
35	(CR) carriage return	$0D	; see 3.1.1
36	(ETX) End of Text	$03	

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3.13.1 Example of a transmitted data string MIC-P

(STX)R:12:34:56(CR)(LF)D+000.123(CR)(LF)F:50.002(CR)(LF)(ETX)

It is 12:34:56 mains time
difference to system time = + 000,123 second
current frequency = 50,002 Hz
( ) ASCII-control characters e.g. (STX)

3.13.2 Difference Time for Data String MIC-P

The difference time is limited to a maximum of ± 999:999

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3.14 Data String Contronic P

This data string is compatible to the serial data string of the board 6830. The internal designation of the "Hartmann und Braun" radio controlled clock is **PCZ 77**.

The following parameter have been fixed for the data transmission:

- baud rate: 1200
- word length: 7 Bit
- parity: even
- stop bit: 1
- handshake: no
- string output: every minute
- one second forerun
- control character: <CR> <LF>
- end character: to the minute change

3.14.1 Data String Contronic P Time/Date

character no.:	meaning	value
1	tens hour	$30-32
2	unit hour	$30-39
3	space	$20
4	tens minute	$30-35
5	unit minute	$30-39
6	space	$20
7	tens second	$30-35
8	unit second	$30-39
9	space	$20
10	tens day	$30-33
11	unit day	$30-39
12	space	$20
13	tens month	$30-31
14	unit month	$30-39
15	space	$20
16	tens year	$30-39
17	unit year	$30-39
18	space	$20
19	status	$30-39, $41-46
20	day of the week	$31-37
21	CR (carriage return)	$0D
22	LF (Line Feed)	$0A

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3.14.2 Data String Contronic P 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-DS-ST)
	x	x	0	x	no announcement
	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

3.14.3 Example of a Transmitted Data String Contronic P

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

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

3.14.4 Data String Contronic P Time only

character no.:	meaning	value
1	tens hour	$30-32
2	unit hour	$30-39
3	space	$20
4	tens minute	$30-35
5	unit minute	$30-39
6	space	$20
7	tens second	$30-35
8	unit second	$30-39
9	space	$20
10	CR (carriage return)	$0D
11	LF (Line Feed)	$0A

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3.15 Data String Atis 31

The Atis 31 data string can be put out cyclically as well as on request. The date/time data string is the only cyclic one. The checksum is made up by adding "in bytes" all ASCII characters, from the beginning of the string until the output of the checksum.

3.15.1 Data String Atis 31 Time and Date

character no.:	meaning	value (value range)
1	receiving address	$7F
2	sender identification	$30
3	data string sequence number	$30
4	"S" command-Code	$53
5	"A" command-specification	$41
6	status	$30-39, $41-46 ; see 3.15.3
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	$30-35
18	unit second	$30-39
19	day of the week (1=Mo ... 7=Sunday)	$31-37
20	checksum MSB	$30-39, $41-46
21	checksum LSB	$30-39, $41-46
22	receiving address	$7F
23	CR (carriage return)	$0D

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3.15.2 Data String Atis 31 Time only

character no.:	meaning	value (value range)
1	receiving address	$7F
2	sender identification	$30
3	data string sequence number	$30
4	"0" command-code	$30
5	"T" command-specification	$54
6	status	$30-39, $41-46 ; see 3.15.3
7	tens hour	$30-32
8	unit hour	$30-39
9	tens minute	$30-35
10	unit minute	$30-39
11	tens second	$30-35
12	unit second	$30-39
13	checksum MSB	$30-39, $41-46
14	checksum LSB	$30-39, $41-46
15	receiving address	$7F
16	CR (carriage return)	$0D

3.15.3 Data String Atis 31 Status nibble

The 6th ASCII character contains the status. 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 (DS-ST-DS)
	x	x	0	x	standard time (ST)
	x	x	1	x	daylight saving time (DS)
	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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3.15.4 Transmission on Request

The start strings for this are:

character no.:	meaning	value (value range)
1	receiving address	$7F
2	sender identification	$30
3	data string sequence number	$30
4	"G" command-Code	$47
5	"D, T" command-specification	$44, $54
6	"6, 7" checksum MSB	$36, $37
7	"9" checksum LSB	$39
8	receiving address	$7E
9	CR (carriage return)	$0D

For request time/date ⇨ position 5 = ASCII "D"
For request time only ⇨ position 5 = ASCII "T"

The checksum is build up by the digits 1 to 5.

i.e. for time/date = $69
for time only = $79

The system answers within 1 msec with the according data string. If a cyclic output is set by means of the jumpers, e.g. every hour, it is still possible to request a data string by control character.

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3.16 Data String for NTP (Network Time Protocol)

NTP or xNTP is a programme batch to synchronise different computers and operating systems or levels 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 protocol as described under **"data string 7001/6021"**. The following settings are required on the clock board:

baud rate:	9600 baud 8 data bit parity no 1 stop bit
transmission mode :	data string 7001/6021 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

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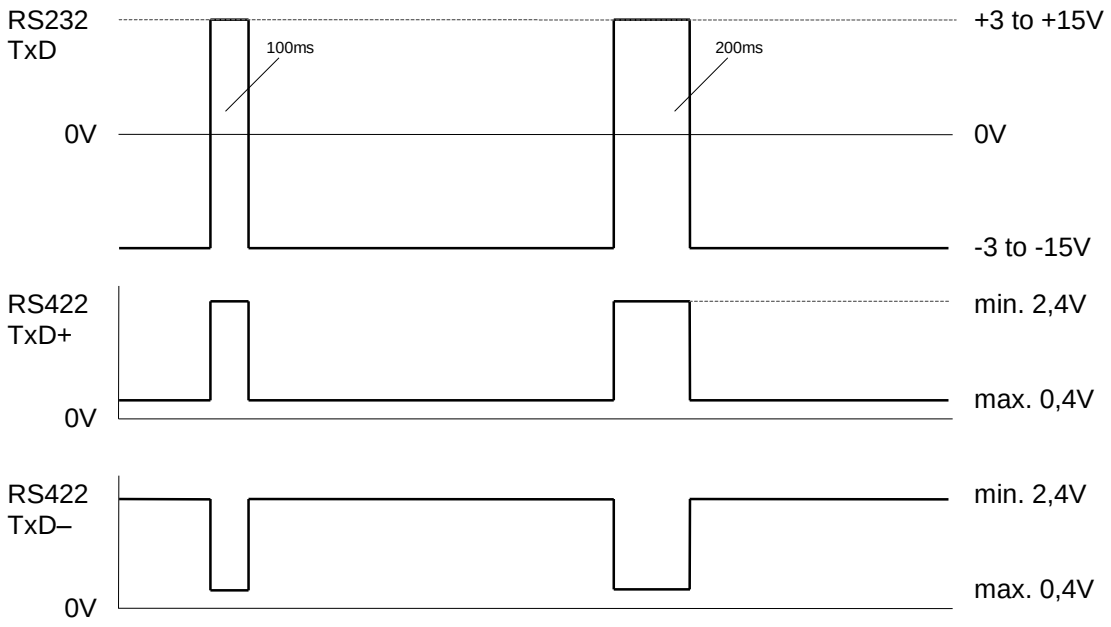
3.17 DCF77-Simulation

In case of this setting the DCF77 pulse is put out at the RS232 and the RS422-interface.

3.17.1 Pulse Display



3.18 Pulse Output

Second-, minute-, hour- or day pulses of different width can be put out instead of the serial data strings.

3.18.1 Selection of the Pulses

The type of pulse is set by means of the switches 7 and 8 at DIP-switch 2.

switch 7	switch 8	pulse
on	on	second pulse
on	off	minute pulse
off	on	hour pulse
off	off	day pulse

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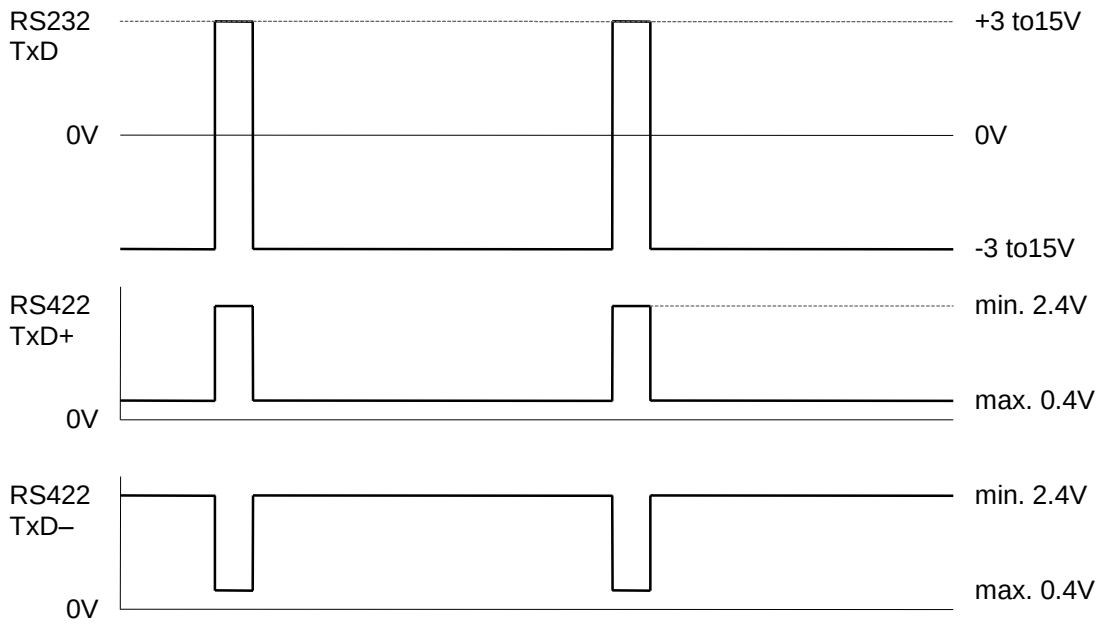
3.18.2 Pulse Duration

The pulse duration can be selected by means of the switches 6, 7 and 8 at DIP-switch 1 as listed below:

switch 6	switch 7	switch 8	pulse
on	on	on	640 msec
on	on	off	320 msec
on	off	on	160 msec
on	off	off	80 msec
off	on	on	40 msec
off	on	off	20 msec
off	off	on	10 msec
off	off	off	5 msec

3.18.3 Pulse Diagram

The pulses are put out at RS232 and RS422.



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4 Technical Data

operating voltage:	+ 5V DC ± 5%
power consumption:	approx. 800 mA
interfaces:	RS232c / RS422 (potential free)
data format:	ASCII
minute pulse optical coupler:	60V / 20mA ohm load
temperature range:	0 ... 70°C
extras:	Hard- and software alterations according to customer specifications are available

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

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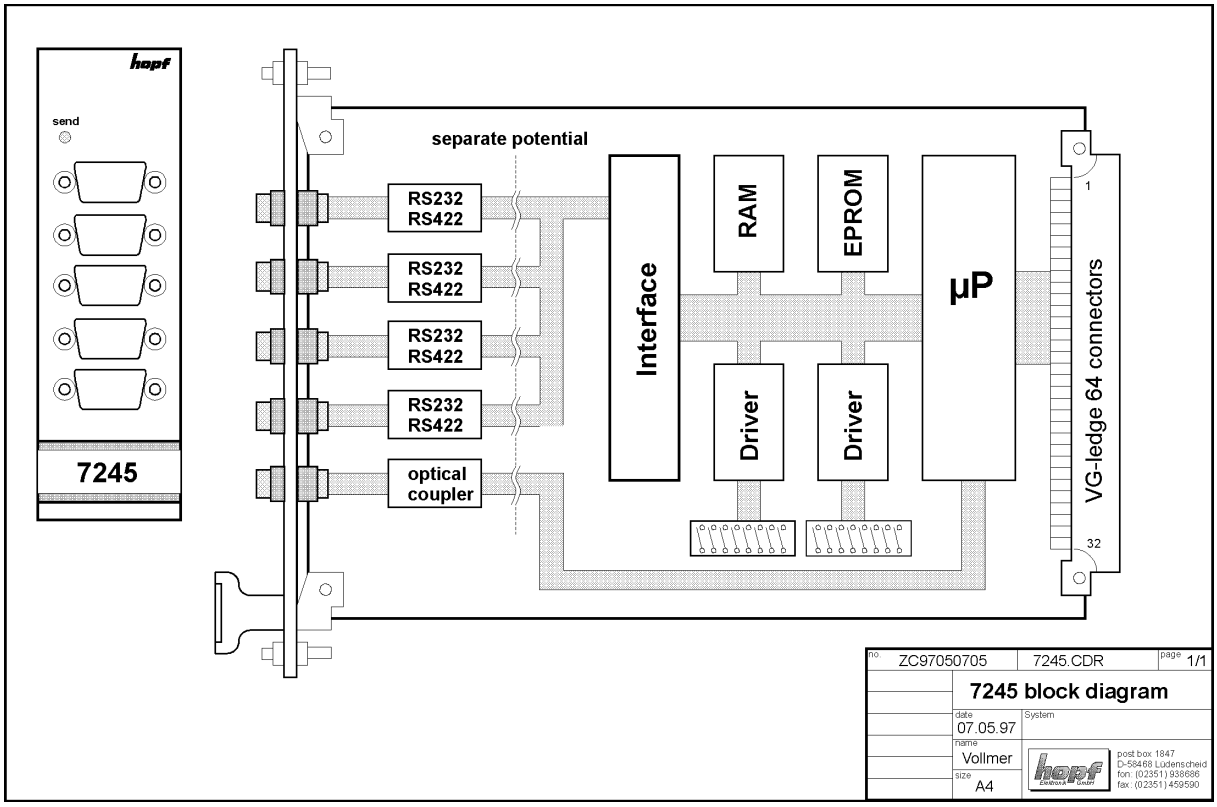

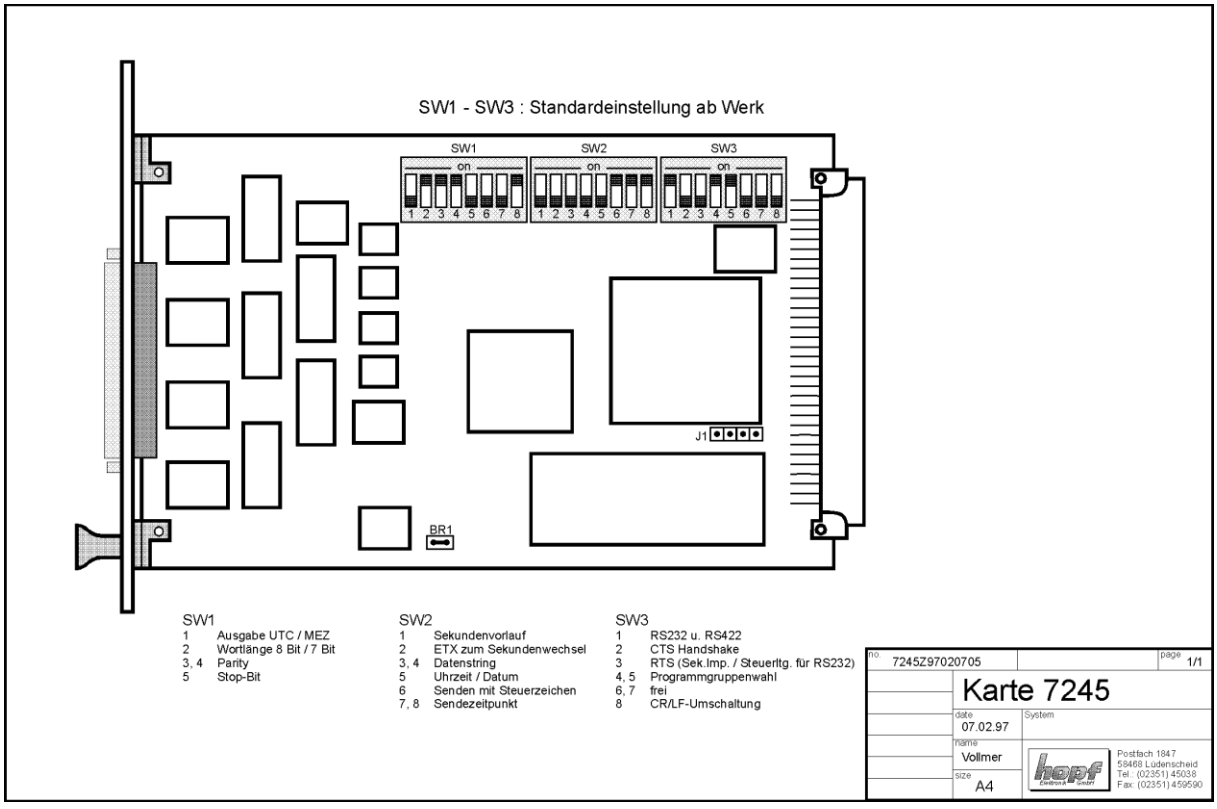

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