Industriefunkuhren

hopf Elektronik GmbH

Technical Manual

Serial Interface Board

Model 7245RC

ENGLISH

Version: 02.02 – 15.06.2010

Valid for Devices 7245RC with FIRMWARE Version: **02.xx**

hopf Elektronik GmbH
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Version Numbers (Firmware / Description)

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

CE

This device fulfils the requirements of the EU directive 89/336/EWG "Electromagnetic compatibility" and 73/23/EWG "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 About the serial interface card 7245RC

Board 7245RC is a serial interface board in eurocard size with a 3U/8HP front panel, designed for a *hopf* clock system 7001RC.

Potential isolated, full-duplex serial interfaces are provided via 9-pole SUB-D female connectors and are available simultaneously in the following formats:

- RS232 (V.24)
- RS422 (V.11)

The interface parameters can be freely set:

- Baud rate: 150-19200
- Data bits: 7 / 8
- Stop bits: 1 / 2
- Parity bit: No / Odd / Even
- Handshake (in RS232)
- Transmission point of time: every second / every minute / on request
- Time base for the output: local / standard / UTC time

Thanks to its hot-plug capability, the Board 7245RC can be removed from the running system 7001RC and re-connected at any point on the system, at any time, without affecting the function of the other system boards.

Board 7245RC is configured via the keyboard of the *hopf* system 7001RC or via the associated *hopf* 7001RC remote software.

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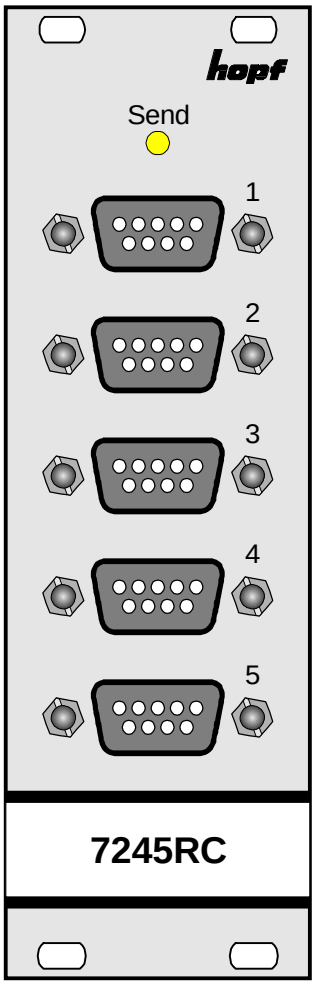
2 RC-Function Board 7245RC Layout

Board 7245RC has a 3U/8HP front panel for 19'' systems, with the following components:

The board 7245RC has only one logical interface, which is issued in different physical formats on four SUB-D connectors.

Therefore it is only possible to give out a particular data string with the same parameters on all outputs (RS232, RS422). Two different data strings can not given out at the same time from a board.

2.1 Front Panel Components



Send LED - Operating condition
(siehe ***Chapter 2.1.1 Send LED***)

S1 9-pole SUB-D female connector
(see ***Chapter 2.1.1 Send LED)***

S2 9-pole SUB-D female connector
(see ***Chapter 2.1.3 Interfaces S2, S4)***

S3 9-pole SUB-D female connector
(see ***Chapter 2.1.4 Interface S3)***

S4 9-pole SUB-D female connector
(see ***Chapter 2.1.3 Interfaces S2, S4)***

S5 9-pole SUB-D female connector
(see ***Chapter 2.1.5 Pulse Output via Connector S5)***

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2.1.1 Send LED

SEND LED	Description
Flashing	Normal operation displaying access to the internal bus. Board 7245RC is installed correctly in the system 7001RC.
Permanently off	Board 7245RC is not ready for operation
Permanently lit	Error on Board 7245RC.

2.1.2 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.

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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2.1.3 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).

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

2.1.4 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.

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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2.1.5 Pulse Output via Connector S5

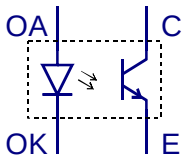
4 potential free minute pulses can be tapped about the plug S5. The pulse duration is 1 second. The potential isolation is via optocouplers.

The connector is assigned at follows::

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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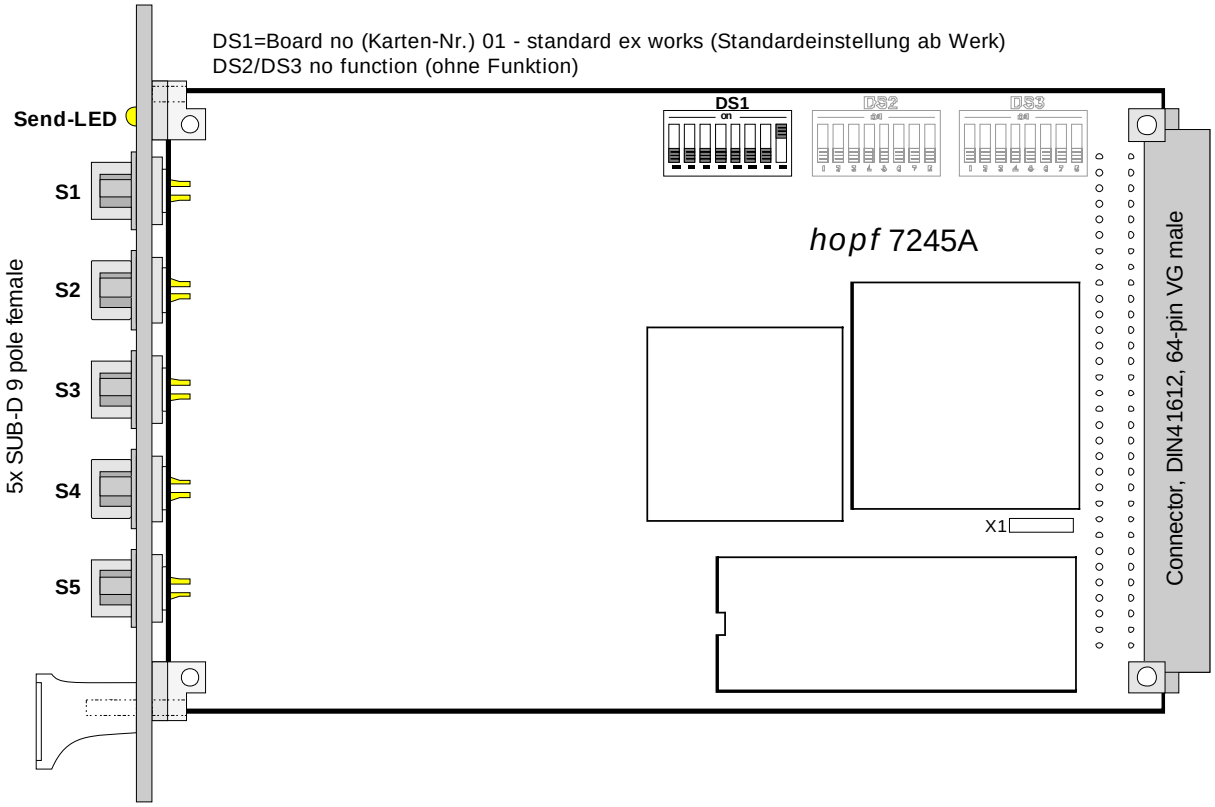
2.2 Assembly Overview



2.3 DIP-Switch

Identification	Function
DS1	DIP-switch: board number for unique identification in the system 7001RC
DS2 / DS3	DIP-switch: without function at present

2.4 Service Connector

Identification	Function
X1	Service connector / for *hopf* Elektronik GmbH only

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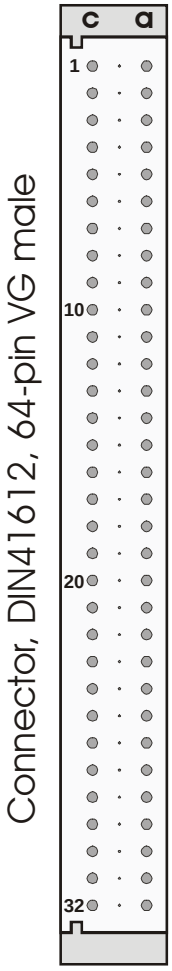
2.5 VG-strip 64-pole (DIN 41612)



Connector, DIN41612, 64-pin VG male

Connector, DIN 41612, 64-pin VG male of the 7245RC				
Pin	**c**		**a**	**Pin**
1				**1**
2				**2**
3				**3**
4				**4**
5				**5**
6				**6**
7				**7**
8				**8**
9				**9**
10				**10**
11				**11**
12				**12**
13				**13**
14				**14**
15				**15**
16				**16**
17				**17**
18				**18**
19				**19**
20				**20**
21	RES / System-Reset			**21**
22				**22**
23	SERI / System-Bus		SCLK / Bus Pulse	**23**
24	KHZB / regulated 1kHz Pulse		PPS / regulated 1Hz Pulse	**24**
25	FROUT		FRIN	**25**
26				**26**
27	AROUT		ARIN	**27**
28				**28**
29				**29**
30				**30**
31	GND		GND	**31**
32	+5V DC		VCC / 5Volt	**32**

Row B not connected!

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3 Implementing the Board 7245RC in the System 7001RC

This Chapter describes the implementation of an additional RC-Function Board in the system 7001RC. Generally, all system boards are implemented and pre-configured with the *hopf* default settings on a newly delivered system 7001RC.

All RC-Function Boards are individually parameterized from the system 7001RC.

Each RC-Function Board is uniquely identified via the board type and an allocated board number (1-31).

The following steps are required for implementation:

- Identification of the board numbers available
- Setting the board number using a DIP-Switch on the Board 7245RC
- Installing the Board 7245RC in the system 7001RC
- Setting the parameters of the Board 7245RC
- Activating the Board 7245RC via the system 7001RC

3.1 Identification of the Board Numbers Available

The board numbers allocated so far can be displayed via the **SHOW ALL ADDED SYSTEM-BOARDS** menu. The board numbers that are not listed for this board type are available for the new board.

Boards that are available in terms of hardware, but which have not yet been activated via the system menu, are **not** listed in the **SHOW ALL ADDED SYSTEM-BOARDS** menu. (The "SEND" LED of these boards does not flash when in operation.)

In order to identify the set board number, these boards must be made available externally, in order to identify the set board number from the DIP switch setting.

3.2 Setting the Board Number

In order to clearly identify the board in the system 7001RC, the board number must be defined via the DS1 DIP switch bank. The board number is set as Hex code on DS1. Switch 8 is the lowest value bit and switch 1 the highest value bit. The inscription on the DIP switch housing serves to identify switches 1-8. Board numbers can be set from 1 to 31, board numbers outside this range are not recognized by the system 7001RC.

Under no circumstances may two boards of the same type with the same board number be installed in one system 7001RC. This leads to undefined errors on both boards.

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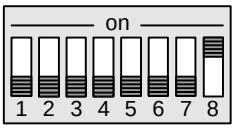
Board 01

DS1



DS1 Pos 4	DS1 Pos 5	DS1 Pos 6	DS1 Pos 7	DS1 Pos 8	Board Number in System 7001RC
off	off	off	off	off	-
off	off	off	off	on	1
off	off	off	on	off	2
off	off	off	on	on	3
off	off	on	off	off	4
off	off	on	off	on	5
off	off	on	on	off	6
off	off	on	on	on	7
off	on	off	off	off	8
off	on	off	off	on	9
off	on	off	on	off	10
off	on	off	on	on	11
off	on	on	off	off	12
off	on	on	off	on	13
off	on	on	on	off	14
off	on	on	on	on	15
on	off	off	off	off	16
on	off	off	off	on	17
on	off	off	on	off	18
on	off	off	on	on	19
on	off	on	off	off	20
on	off	on	off	on	21
on	off	on	on	off	22
on	off	on	on	on	23
on	on	off	off	off	24
on	on	off	off	on	25
on	on	off	on	off	26
on	on	off	on	on	27
on	on	on	off	off	28
on	on	on	off	on	29
on	on	on	on	off	30
on	on	on	on	on	31

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3.3 Installing a New Board 7245RC in the System 7001RC

In order to install a new board 7245RC, a free extension slot (slot with board-connectors and VG-strip installed in the system bus) must be available. This information can be obtained from the assembly drawing supplied.

If a free extension slot is not available, this can usually be retrofitted. Please contact *hopf* Elektronik GmbH.

3.4 Setting the Parameters and Activating the Board 7245RC in the System 7001RC

The following steps are required to activate the board:

To avoid undesirable output behaviour of the board it is first parameterized and then activated by switching it into the monitoring mode.

- In the **BOARD-SETUP** menu, sub-heading **ADD SYSTEM-BOARDS**, log on the newly installed board.
- In the **BOARD-SETUP** menu, sub-heading **SET SYSTEM BOARDS PARAMETER** parameterize the board (***Chapter 4 Administration of Board 7245RC***)
- In the **BOARD-SETUP** menu, sub-heading **SET SYSTEM BOARDS TO MONITORING-MODE OR IDLE-MODE** install the newly implemented board into the monitoring mode.

The menus:
- **ADD SYSTEM-BOARDS** and
- **SET SYSTEM BOARDS TO MONITORING-MODE OR IDLE-MODE**

can be found in the technical manual of the 7001RC System.

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4 Administration of Board 7245RC

The base system 7001RC manual serves as the basis for configuration. The following will cover only the inputting of the values that can be found under menu heading **BOARD-SETUP:4**.

In order for the system 7001RC to accept the newly configured parameters, the configured menu and the following parameter menus in the **SET SYSTEM-BOARDS PARAMETER** menu must be confirmed by pressing the **ENT** key.

4.1 Input Functions for Board 7245RC in the Board Setup Menu

The input and display functions of the board parameters are called up in menu heading **BOARD-SETUP:4**.

with **ENT** key ⇨ Main menu
with **4** key ⇨ Board setup
with **N** key ⇨ Scroll to menu heading:

```
SET SYSTEM-BOARDS PARAMETER  Y/N
```

Select with key **Y**

Search for board to be parameterized with key **N** and select with key **Y**

Example display:

```
PARAMETER BOARD 03 OF 25  7245 NO.:04
STATUS:I/E  BOARDNAME:"SERIAL  " SET>Y/N
```

PARAMETER BOARD 03 OF 25 ⇨ Board **03** of **25** implemented boards

7245 NO: 04 ⇨ Board type **7245RC** with board number **04**

STATUS: M / - ⇨ **M** = Monitoring / **-** = in Operating without Board Error

I / E **I** = without Monitoring / **E** = Board Error

BOARDNAME: "SERIAL" ⇨ **SERIAL** Board name can be freely selected by the customer

The parameter bytes may take on special functions in some versions. These special settings and functions are described in the corresponding data string in ***Chapter 6 Data Strings***.

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4.1.1 Setting Parameter Byte 01

Parameter Byte 01 is shown on the upper line with its currently set values.

```
B.7245 NO.:01   OLD: BYTE 01 >10000110<
BYTE = BIT 7..0 NEW: BYTE 01 >~~~~~~~~<
```

For the purposes of manipulation, the individual bits of the new byte are to be entered on the second line using **"0"** and **"1"**. The complete Parameter Byte must always be recorded and confirmed with the **ENT** key.

The bits of the Parameter Byte are numbered in descending order:

```
BYTE 01 >7 6 5 4 3 2 1 0<
```

The parameter bytes may take on special functions in some versions. These special settings and functions are described in the corresponding data string in ***Chapter 6 Data Strings***.

Parameter Byte 01			
Bit 7	**Parameter Byte 03 Bit 2**		**Time Base of Output**
0	1		UTC time
0	0		Standard time
1	-		Local time
Bit 6			**Number of Data Bits**
0			8 data bits
1			7 data bits
Bit 5	**Bit 4**		**Parity Setting**
0	0		No parity bit
0	1		No parity bit
1	0		Even parity
1	1		Odd parity
Bit 3			**Number of Stop Bits**
0			1 stop bit
1			2 stop bits
Bit 2	**Bit 1**	**Bit 0**	**Baud Rate**
0	0	0	150 Baud
0	0	1	300 Baud
0	1	0	600 Baud
0	1	1	1200 Baud
0	0	0	2400 Baud
1	0	1	4800 Baud
1	1	0	9600 Baud
1	1	1	19200 Baud

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4.1.1.1 Bit 7, Output UTC / Standard / Local

The time base for the output strings is selected with **Parameter Byte 01 (PB 01) Bit 7** and **Parameter Byte 03 (PB 03) Bit 2**.

Local time:
The local time is usually set as the time base. This time leaps forward or back by one hour when there is a summertime- / wintertime-changeover. If this automatic ST/WT changeover shall be suppressed, Standard or UTC time must be selected as the base.

Standard time:
When the setting is Standard time (wintertime), the time offset to local summertime is minus one hour. Standard time runs continuously throughout the whole year.

UTC:
When the setting is UTC, the world time (formerly GMT) is used as the time base. This time base also runs continuously throughout the whole year. The time offset to Standard time can vary by ±12 hours, depending on the installation location in the world.

In general, the status strings in the status winter time are given out without announcement of summer / winter time change over.

PB 01 Bit 7	PB 03 Bit 2	Time Basis of the Output
0	1	**UTC** time (Universal Time Coordinated)
0	0	**Standard** time = (UTC + Difference time)
1	-	**Local** time = (UTC + Difference time + ST hour offset)

4.1.1.2 Bit 6, Setting the Word Length

Bit 6	Number of Data Bits
0	8 data bits
1	7 data bits

4.1.1.3 Bit 5/4, Setting the Parity Mode of the Transmission

Bit 5	Bit 4	Parity Setting
0	0	no parity bit
0	1	no parity bit
1	0	even parity
1	1	odd parity

4.1.1.4 Bit 3, Setting the Stop Bit

Bit 3	Number of Stop Bits
0	1 stop bit
1	2 stop bits

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4.1.1.5 Bit 2-0, Setting the Transmission Speed

Bit 2	Bit 1	Bit 0	Baud rate
0	0	0	150 Baud
0	0	1	300 Baud
0	1	0	600 Baud
0	1	1	1200 Baud
0	0	0	2400 Baud
1	0	1	4800 Baud
1	1	0	9600 Baud
1	1	1	19200 Baud

4.1.2 Setting Parameter Byte 02

Parameter Byte 02 is shown on the upper line with its currently set values.

```
B.7245 NO.:01   OLD: BYTE 02 >00000100<
BYTE = BIT 7..0 NEW: BYTE 02 >~~~~~~~~<
```

For the purposes of manipulation, the individual bits of the new byte are to be entered on the second line using **"0"** and **"1"**. The complete Parameter Byte must always be recorded and confirmed with the **ENT** key.

The bits of the Parameter Byte are numbered in descending order:

```
BYTE 02 >7 6 5 4 3 2 1 0<
```

The parameter bytes may take on special functions in some versions. These special settings and functions are described in the corresponding data string in ***Chapter 6 Data Strings***.

Parameter Byte 02	
Bit 7 - 3	**No function at present**
0	For reasons of compatibility, these bits should always be set to "**0**".
Bit 2	**Control Character STX/ETX**
0	Transmit with control character
1	Transmit without control character
Bit 1 / **Bit 0**	**Transmission Point of Time**
0 / 0	Transmit every second
0 / 1	Transmit at minute change
1 / 0	Transmit at hour change
1 / 1	Transmit on request only

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4.1.2.1 Bit 7 - 3, (no function at present)

Bit 7 - 3	No function at present
0	For reasons of compatibility, these bits should always be set to **"0"**.

4.1.2.2 Bit 2, Control Character STX/ETX

This function defines whether the data string is to be transmitted with or without control character STX/ETX.

Bit 2	Control Character STX/ETX
0	Transmission with control character
1	Transmission without control character

4.1.2.3 Bit 1/0, Data String Transmission Point of Time

This function is used to define the transmission point of time at which the output is to take place.

Bit 1	Bit 0	Data String Transmission Point of Time
0	0	Transmit every second
0	1	Transmit at minute change
1	0	Transmit at hour change
1	1	Transmit on request only

4.1.3 Setting Parameter Byte 03

Parameter Byte 03 is shown on the upper line with its currently set values.

```
B.7245 NO.:01   OLD: BYTE 03 >01100001<
BYTE = BIT 7..0 NEW: BYTE 03 >~~~~~~~~<
```

For the purposes of manipulation, the individual bits of the new byte are to be entered on the second line using **"0"** and **"1"**. The complete Parameter Byte must always be recorded and confirmed with the **ENT** key.

The bits of the Parameter Byte are numbered in descending order:

```
BYTE 03 >7 6 5 4 3 2 1 0<
```

The parameter bytes may take on special functions in some versions. These special settings and functions are described in the corresponding data string in ***Chapter 6 Data Strings***.

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Parameter Byte 03				
Bit 7		**No function at present**		
0		For reasons of compatibility, these bits should always be set to "**0**".		
Bit 6		**Handshake**		
0		inactive		
1		active		
Bit 5		**RTS**		
0		Control line for RS232c (Handshake must be active)		
1		Second pulse with RS232c level (Handshake must be active)		
Bit 4	**Bit 3**	**Forerun**	**Control Character**	**Transmission Delay**
0	0	without	immediate	without
0	1	with	immediate	without
1	0	with	Second change	without
1	1	with	Second change	with
Bit 2	**Parameter Byte 01 Bit 7**	**Time Base of Output**		
0	0	UTC time		
1	0	Standard time		
-	1	Local time		
Bit 1		**No function at present**		
0		For reasons of compatibility, these bits should always be set to "**0**".		
Bit 0		**LF / CR sequence**		
1		LF / CR sequence as in string description		
0		LF / CR sequence opposite to string description		

4.1.3.1 Bit 7, (without Function at Present)

Bit 7	without function at present
0	For compatibility reasons, this bit must always be set to **"0"**.

4.1.3.2 Bit 6, Handshake (only with RS232C)

The RS232c interface of the S1 interface is equipped with standardized handshake lines. These handshake lines can be used or deactivated, depending on the application.

Bit 6	Handshake
0	inactive
1	active (only with RS232C)

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4.1.3.3 Bit 5, Handshake as Second Pulse (RS232C only)

The RS232 control line RTS can also be used optionally as a second pulse output. For this purpose, the handshake must be activated (see ***Chapter 4.1.3.2 Bit 6, Handshake (only with RS232C)***).

Bit 5	RTS as
0	Second pulse with RS232c level
1	Control line for RS232c

4.1.3.4 Bit 4/3, Control Character Transmission Point of Time, Second Forerun, Transmission Delay

Bit 4	Bit 3	Second Forerun	Control Character	Transmission Delay
0	0	without	immediate	without
0	1	with	immediate	without
1	0	with	At second change	without
1	1	with	At second change	with

4.1.3.4.1 Second Forerun

When the second forerun is activated, the data string is transmitted with the time information of the next second. For more information see ***Chapter 5.1 Second Forerun***.

4.1.3.4.2 Control Character at Second Change

When 'Control Character at Second Change' is selected, the control character is not transmitted directly at the end of the data string but at the next second change. For more information see ***Chapter 5.2 Control Character at Second Change***.

4.1.3.4.3 Transmission Delay

With the Transmission Delay setting, the data string is transmitted with a time offset to the second change. For more information see ***Chapter 5.5 Delayed Transmission when Transmitting on Request***.

4.1.3.5 Bit 2, Local Time, Standard Time or UTC Output

See ***Chapter 4.1.1.1 Bit 7, Output UTC / Standard / Local***

4.1.3.6 Bit 1, (without Function at Present)

Bit 7	without function at present
0	For compatibility reasons, this bit must always be set to **"0"**.

4.1.3.7 Bit 0, LF/CR sequence

The sequence of the CR and LF control characters can be inverted with this function for all transmission strings.

Bit 0	LF/CR Sequence
1	LF / CR sequence as in string description
0	LF / CR sequence opposite to string description

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4.1.4 Setting Parameter Byte 04

Parameter Byte 04 is shown on the upper line with its currently set values.

```
B.7245 NO.:01   OLD: BYTE 04 >000000000<
BYTE = BIT 7..0 NEW: BYTE 04 >~~~~~~~~<
```

For the purposes of manipulation, the individual bits of the new byte are to be entered on the second line using **"0"** and **"1"**. The complete Parameter Byte must always be recorded and confirmed with the **ENT** key.

The bits of the Parameter Byte are numbered in descending order:

```
BYTE 04 >7 6 5 4 3 2 1 0<
```

The parameter bytes may take on special functions in some versions. These special settings and functions are described in the corresponding data string in ***Chapter 6 Data Strings***.

4.1.4.1 Bit 7-0, Special, String-Dependent Settings

Special, string-dependent settings are made in Parameter Byte 04.

The settings for Parameter Byte 04 are only explained in the relevant data string descriptions.

4.1.5 Setting Parameter Byte 05, Data String Selection

Parameter Byte 05 is shown on the upper line with its currently set values.

```
B.7245 NO.:01   OLD: BYTE 05 >000000000<
BYTE = BIT 7..0 NEW: BYTE 05 >~~~~~~~~<
```

For the purposes of manipulation, the individual bits of the new byte are to be entered on the second line using **"0"** and **"1"**. The complete Parameter Byte must always be recorded and confirmed with the **ENT** key.

The bits of the Parameter Byte are numbered in descending order:

```
BYTE 05 >7 6 5 4 3 2 1 0<
```

The parameter bytes may take on special functions in some versions. These special settings and functions are described in the corresponding data string in ***Chapter 6 Data Strings***.

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4.1.5.1 Bit 7-0, Data String Overview

The data strings are selected with Parameter Byte 05.

The specification can be found in ***Chapter 6 Data Strings***.

Bits in Parameter Byte 05								Data String Output
7	6	5	4	3	2	1	0	
0	0	0	0	0	0	0	0	*hopf* Standard String (6021)
0	0	0	0	0	0	0	1	*hopf* Standard String time only
0	0	0	0	0	0	1	0	*hopf* 5500
0	0	0	0	0	0	1	1	*hopf* 5500 time
0	0	0	0	0	1	0	0	H&B 5050 date/time
0	0	0	0	0	1	0	1	H&B 5050 time only
0	0	0	0	0	1	1	0	*hopf* 2000 - year output 4-digit
0	0	0	0	0	1	1	1	*hopf* 2000 - year output 4-digit time only
0	0	0	0	1	0	0	0	*hopf* date/time
0	0	0	0	1	0	0	1	*hopf* date/time time only
0	0	0	0	1	0	1	0	MADAM S
0	0	0	0	1	0	1	1	Siemens SINEC H1
0	0	0	0	1	1	0	0	*hopf* DCF77-Slave-String
0	0	0	0	1	1	0	1	*hopf* UTC-Slave-String
0	0	0	0	1	1	1	0	T-String
0	0	0	0	1	1	1	1	T2000-String
0	0	0	1	0	0	0	0	MDR 2000 (Atis 31)
0	0	0	1	0	0	0	1	MDR 2000 (Atis 31 time only)
0	0	0	1	0	0	1	0	Data string not implemented at present
0	0	0	1	0	0	1	1	NMEA (ZDA)
0	0	0	1	0	1	0	0	*hopf* Mains Time B (MIC-P)
0	0	0	1	0	1	0	1	Pulse output
x	x	x	x	x	x	x	x	All other settings without function at present.

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5 Transmission Points of Time - Overview

For the synchronization of several installations, the transmission characteristics of the emitted data strings can be influenced in different ways.

5.1 Second Forerun

The meaning of second forerun is that the transmitted data string contains the time information of the next second. If the second forerun is deactivated, the current time information is always transferred.

Generally, this function is used in combination with "Control Character at Second Change" (see ***Chapter 5.2 Control Character at Second Change***). For example, this combination transmits the information of the 00th second on the 59th second (the forthcoming minute change) and transmits the control character precisely on the 00th second, in order to validate the preceding data (see time chart in ***Chapter 5.6.7 Delayed Transmission when Requesting with ETX***).

5.2 Control Character at Second Change

The control characters are normally transmitted in connection with the data string. If the function "Control Character at Second Change" is activated, the last control character is only transmitted at the next second change. This control character can then validate the previous time information received in the receiver unit, in a similar way to a synchronization pulse. This makes precise synchronization possible.

Generally, the function "Control Character at Second Change" is used in combination with the function "Second Forerun" (see ***Chapter 5.1 Second Forerun***).

See time chart in ***Chapter 5.6.2 Cyclical Transmission with Second Forerun and Control Character at Second Change***.

5.3 Transmission Delay

If the setting "Control Character at Second Change" is selected, the last character of the data string is transmitted directly at the second change and the next data string, which is valid for the following second change, is transmitted immediately thereafter. This can lead to error interpretations on computers with a high processor load. To avoid this, the transmission delay can be activated. The string is not now transmitted at the second change, but after it, with a time delay dependent on the baud rate (see time chart in ***Chapter 5.6.3 Cyclical Transmission with Second Forerun and Delayed Transmission***). The higher is the baud rate, the greater is the time between the second change and the beginning of the data string.

5.4 Transmission on Request

The data string can also be emitted on request by the user. Exception: "Data String Transmission Every Second" setting. The request can be made with the following ASCII characters:

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

The system responds within 3 milliseconds, with the corresponding data string.

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5.5 Delayed Transmission when Transmitting on Request

When transmitting in response to a request, the board 7245RC answers within 3 milliseconds, with the corresponding data string.

This is often too fast for the computer placing the request, however it is possible to:

- Set a fixed response delay (see ***Chapter 5.3 Transmission Delay***).
- Carry out a response delay in steps of 10 msec., by means of a request with the lower case letters "**u, d, g**" and an attached two-digit multiplier.
  The multiplication factor is interpreted by the clock as a hexadecimal value.

Example:

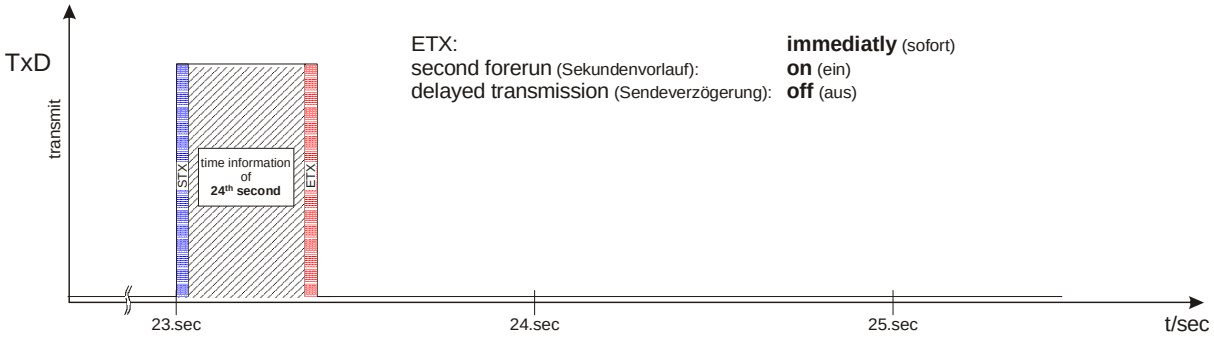
The computer transmits: ASCII **u05** (in Hex 75 30 35)
The clock answers after 50 milliseconds with the 'time only' telegram.

The computer transmits: ASCII **gFF** (in Hex 67 46 46)
After 2550 milliseconds, the clock sends the 'UTC time/date' telegram.

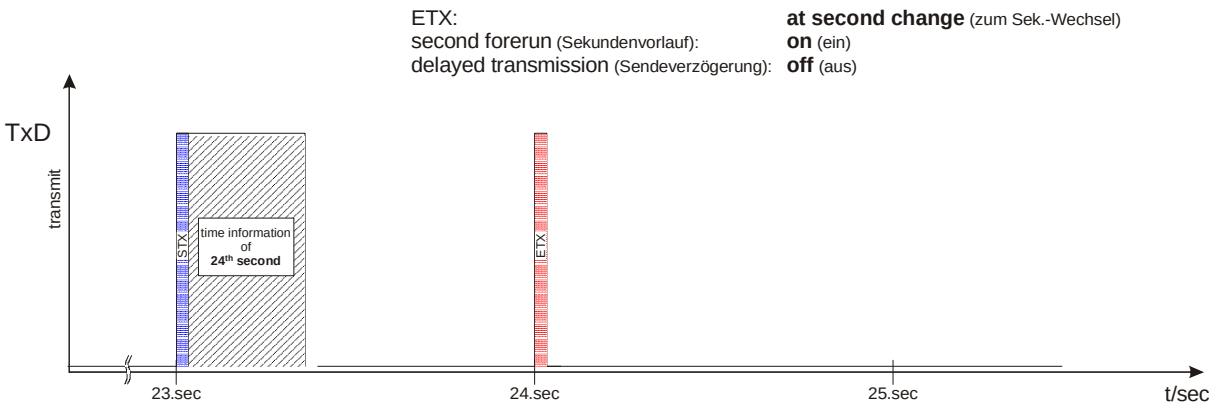
5.6 Time Charts of Transmitted Data Strings

The following charts show the different behaviours of transmitted data strings, dependent on the transmission point of time settings.

5.6.1 Cyclical Transmission with Second Forerun



5.6.2 Cyclical Transmission with Second Forerun and Control Character at Second Change



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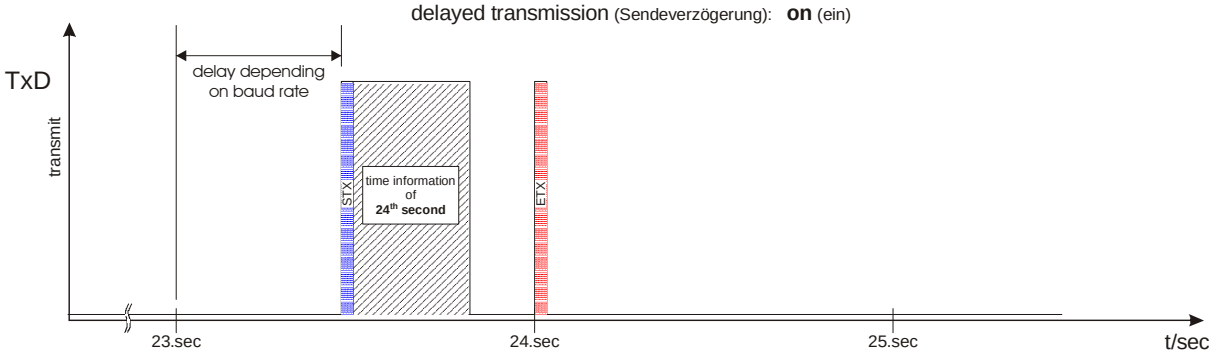
5.6.3 Cyclical Transmission with Second Forerun and Delayed Transmission

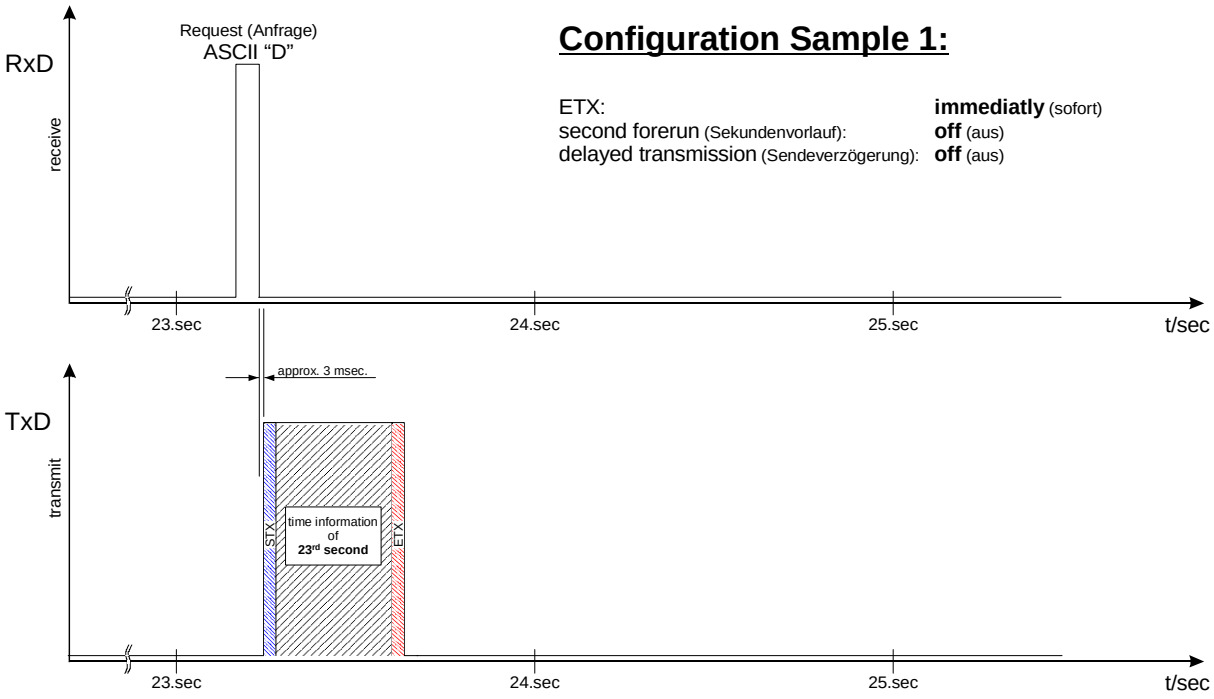
ETX: **at second change** (zum Sek.-Wechsel)
second forerun (Sekundenvorlauf): **on** (ein)
delayed transmission (Sendeverzögerung): **on** (ein)



5.6.4 Transmission on Request without Second Forerun

Configuration Sample 1:

ETX: **immediatly** (sofort)
second forerun (Sekundenvorlauf): **off** (aus)
delayed transmission (Sendeverzögerung): **off** (aus)



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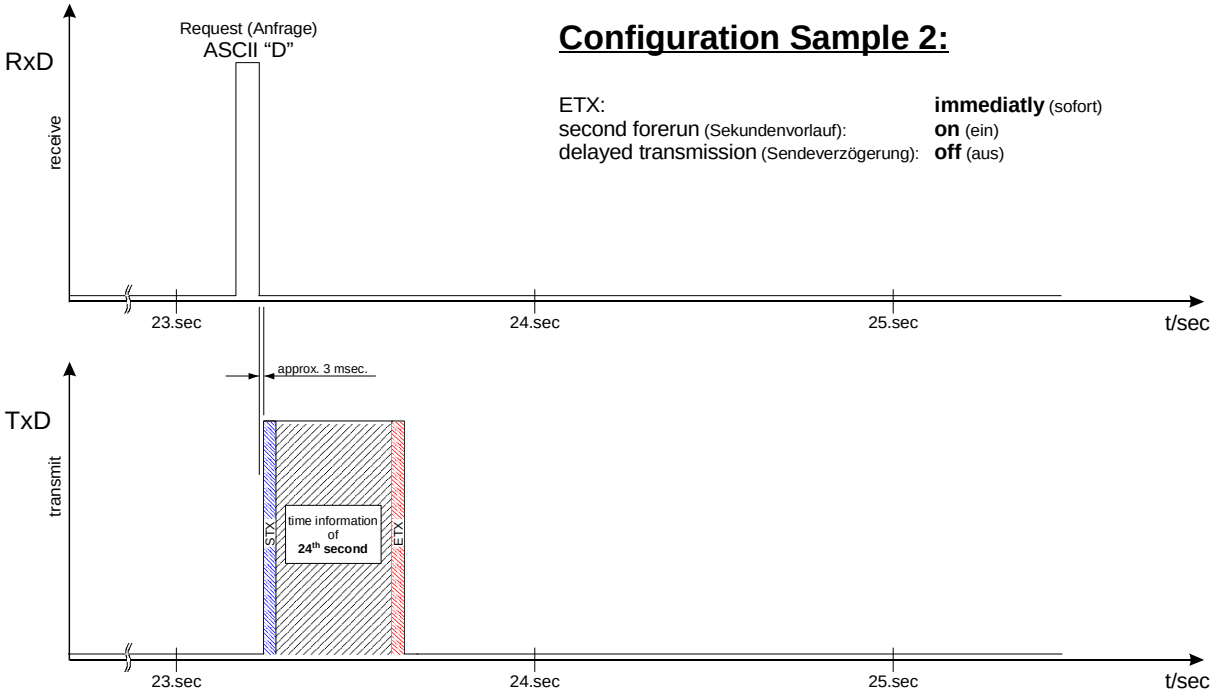
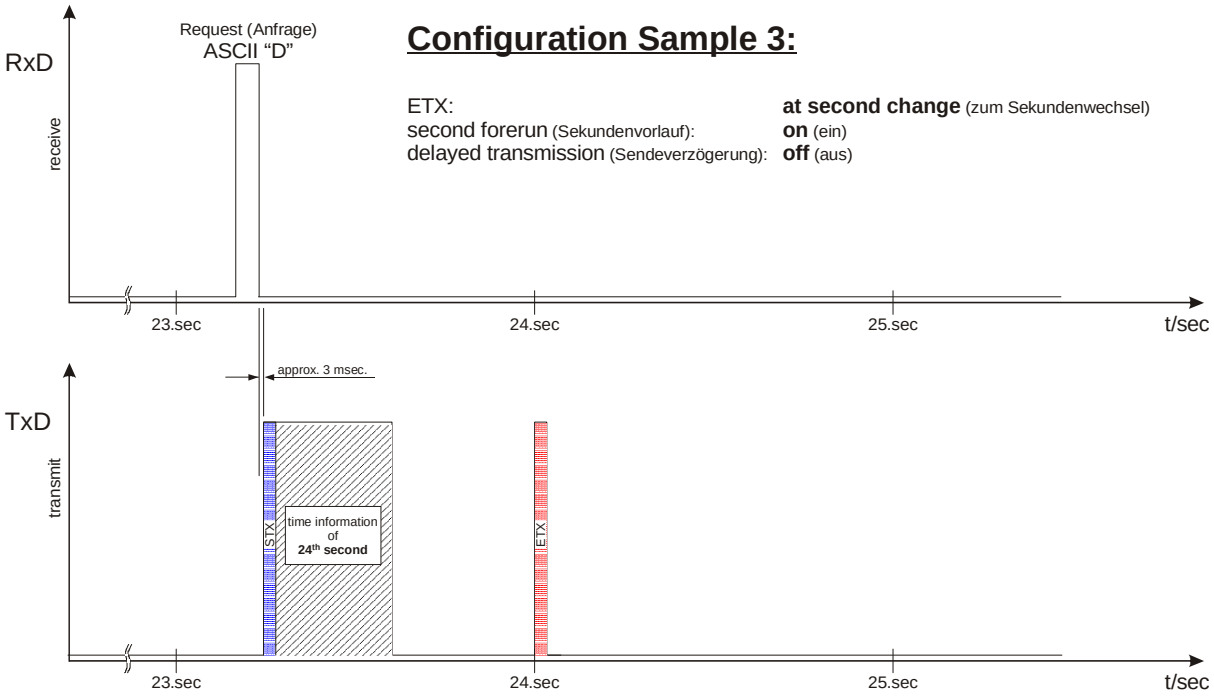
5.6.5 Transmission on Request with Second Forerun



Configuration Sample 2:

ETX: **immediatly** (sofort)
second forerun (Sekundenvorlauf): **on** (ein)
delayed transmission (Sendeverzögerung): **off** (aus)

5.6.6 Transmission on Request with ETX at Second Change



Configuration Sample 3:

ETX: **at second change** (zum Sekundenwechsel)
second forerun (Sekundenvorlauf): **on** (ein)
delayed transmission (Sendeverzögerung): **off** (aus)

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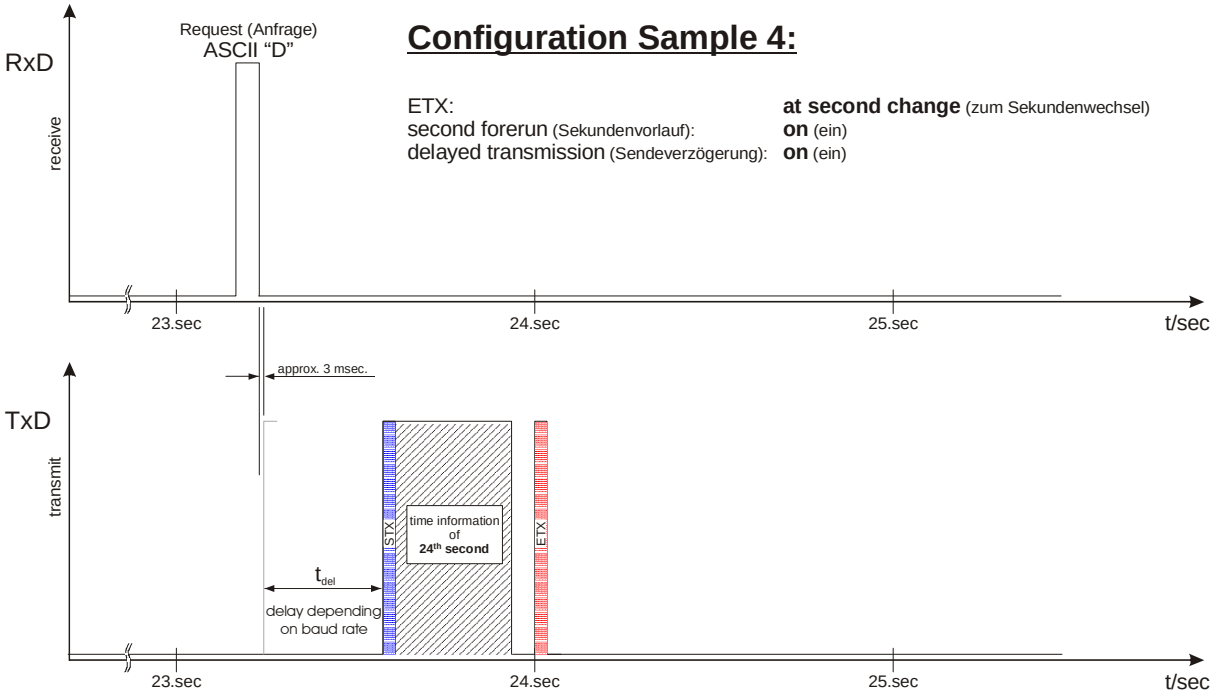
5.6.7 Delayed Transmission when Requesting with ETX at Second Change



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6 Data Strings

This Chapter describes the data strings supported by the board 7245RC.

When "last control character at second change" is set there is a transmission gap of up to 970msec., depending on the baud rate. This should be taken into consideration when programming the time-out on the reception side.

The output of control characters CR and LF can be reversed with **Parameter Byte 03** (see ***chapter 4.1.3.7 Bit 0, LF/CR sequence***).

Possible string-specific settings are specified for all data strings.
These are differentiated as follows:

Automatic:	Automatic string settings are set “automatically“ by the System immediately after the selection of a data string. Customer settings are not required.
Required:	Required string settings must be set by the customer after selection of a data string in the mode byte.
Blocked:	Blocked settings are **not** permissible for a data string. The System does not accept such an input and the data string is transmitted without an error message and with the previously set parameters.

The transmitted data strings are at present compatible with the data strings of the following *hopf* radio-controlled clock boards:

- Board 6020/6021 Standard with control characters
- Board 7200/7201 Standard with control characters
- Board 7220/7221 Standard with control characters
- Board 6840/6841 Standard with control characters
- System 4465 Standard with control characters
- System 6855 Standard with control characters
- System 6870 Standard with control characters

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6.1 *hopf* Standard String (6021)

Below the *hopf* Standard String is described.

This data string can also be given out by user request (see ***chapter 5.4 Transmission on Request***)

6.1.1 Specified Settings

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

6.1.2 Structure

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	status (internal clock status)	$30-39, $41-46
3	day of the week (1=Monday ... 7=Sunday) for UTC time bit 3 is set to 1 in the 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

6.1.3 Structure - Output Time only

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	tens hour	$30-32
3	unit hour	$30-39
4	tens minute	$30-35
5	unit minute	$30-39
6	tens second	$30-36
7	unit second	$30-39
8	LF (line feed)	$0A
9	CR (carriage return)	$0D
10	ETX (end of text)	$03

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6.1.4 Status

The second and the third ASCII-character contain the status and the day of the week. The status is decoded binary.

	b3	b2	b1	b0	Meaning
Status:	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:	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

Status	operation mode	time	announcement ST-WT-ST
0-3	time invalid	summer	
4 = 0100	quartz	winter	no announcement
5 = 0101	quartz	winter	announcement
6 = 0110	quartz	summer	no announcement
7 = 0111	quartz	summer	announcement
5 = 0101	radio	winter	no announcement
6 = 0110	radio	winter	announcement
7 = 0111	radio	summer	no announcement
8 = 1000	radio	summer	announcement
C = 1100	radio with crystal control	winter	no announcement
D = 1101	radio with crystal control	winter	announcement
E = 1110	radio with crystal control	summer	no announcement
F = 1111	radio with crystal control	summer	announcement

6.1.5 Example

(STX)E4123456180702(LF)(CR)(ETX)

- It is Thursday 18.07.2002 - 12:34:56 o'clock.
- radio operation (high accuracy)
- daylight saving time
- no announcement (not available by UTC)
- ( ) - ASCII-control characters e.g. (STX)

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6.2 NTP (Network Time Protocol)

NTP or also xNTP is a batch of programs to synchronize different computers and operating systems with network support. It is the standard for the Internet Protocol TCP/IP (RFC-1305).

The data string must be set in parameter byte 05 as *hopf* standard string (see ***chapter 4.1.5.1***).

Source code and documentation are available as freeware under:

http://www.ntp.org

6.2.1 Specified Settings

Automatic:	**no**
Required:	With the selection of the string the following values are fixed at:: **parameter of transmission:** • baud rate 9600 • 8 data bit • parity no • 1 stop bit **mode of transmission:** • *hopf* Standard String • UTC as time base • output with second advance • control character (STX...ETX) enabled • with control character at second change • output time and date • output every second
Blocked:	**no**

6.2.2 Structure

NTP is according to the *hopf* Standard String (6021), (see ***Chapter 6.1***).

6.2.3 Status

The Status is according to the *hopf* Standard String (6021), (see ***Chapter 6.1.4***).

6.2.4 Example

See ***Chapter 6.1.5*** *hopf* Standard String (6021) with UTC as Time Base (3. ASCII character)

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6.3 *hopf* 5500

Below the data string *hopf* 5500 is described.

This data string can also be given out by user request (see ***chapter 5.4 Transmission on Request***)

6.3.1 Specified Settings

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

6.3.2 Structure - Output Date/Time

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	status (internal clock status)	$30-39,$41-46
3	" " space	$20
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	" " space	$20
11	tens day	$30-33
12	unit day	$30-39
13	tens month	$30-31
14	unit month	$30-39
15	tens year	$30-39
16	unit year	$30-39
17	" " space	$20
18	day of the week	$31-37
19	CR (carriage return)	$0D
20	LF (line feed)	$0A
21	ETX (end of text)	$03

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6.3.3 Structure - Output Time Only

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	tens hour	$30-32
3	unit hour	$30-39
4	tens minute	$30-35
5	unit minute	$30-39
6	tens second	$30-36
7	unit second	$30-39
8	CR (carriage return)	$0D
9	LF (line feed)	$0A
10	ETX (end of text)	$03

6.3.4 Status

	b3	b2	b1	b0	Meaning
Status:	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:	x	0	0	1	Monday
	x	0	1	0	Tuesday
	x	0	1	1	Wednesday
	x	1	0	0	Thursday
	x	1	0	1	Friday
	x	1	1	0	Saturday
	x	1	1	1	Sunday

6.3.5 Example

(STX)1 123456 061102 3(CR)(LF)(ETX)

- It is Wednesday 06.11.02 - 12:34:56 o'clock
- crystal operation
- no announcement
- standard time

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6.4 H&B 5050 (PCZ77)

Below the data string H&B 5050 is described.

This data string can also be given out by user request (see ***chapter 5.4 Transmission on Request***)

6.4.1 Specified Settings

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

6.4.2 Structure - Output Date / Time

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

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6.4.2.1 Structure - Output Time only

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	tens hour	$30-32
3	unit hour	$30-39
4	" " space	$20
5	tens minute	$30-35
6	unit minute	$30-39
7	" " space	$20
8	tens second	$30-36
9	unit second	$30-39
11	" " space	$20
12	CR (carriage return)	$0D
13	LF (line feed)	$0A
14	ETX (end of text)	$03

6.4.3 Status

	b3	b2	b1	b0	Meaning
Status:	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:	x	0	0	1	Monday
	x	0	1	0	Tuesday
	x	0	1	1	Wednesday
	x	1	0	0	Thursday
	x	1	0	1	Friday
	x	1	1	0	Saturday
	x	1	1	1	Sunday

6.4.4 Example

(STX) 12 34 56 06 11 02 03 (CR)(LF)(ETX)

- It is Wednesday 06.11.02 - 12:34:56 o'clock
- radio operation
- standard time
- no announcement ST/WT change over

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6.5 *hopf* 2000 - 4 Digit Year Output

Below the data string *hopf* 2000 - 4 Digit Year Output is described.

This data string can also be given out by user request (see ***chapter 5.4 Transmission on Request***)

6.5.1 Specified Settings

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

6.5.2 Structure

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	status (internal clock status)	$30-39, $41-46
3	day of the week (1=Monday ... 7=Sunday) for UTC time bit 3 is set to 1 in the 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	thousandths year	$31-32
15	hundreds year	$30, $39
16	tens year tens digit	$30-39
17	unit year unit digit	$30-39
18	LF (line feed)	$0A
19	CR (carriage return)	$0D
20	ETX (end of text)	$03

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6.5.3 Status

The second and the third ASCII-character contain the status and the day of the week. The status is decoded binary.

	b3	b2	b1	b0	Meaning
Status:	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:	0	x	x	x	CEST / CET
	1	x	x	x	UTC - time
	x	0	0	1	Monday
	x	0	1	0	Tuesday
	x	0	1	1	Wednesday
	x	1	0	0	Thursday
	x	1	0	1	Friday
	x	1	1	0	Saturday
	x	1	1	1	Sunday

6.5.4 Example

(STX)E412345618072002(LF)(CR)(ETX)

- It is Thursday 18.07.2002 - 12:34:56 o'clock
- radio operation (with crystal control)
- daylight saving time
- no announcement
- ( ) - ASCII-control characters e.g. (STX)

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6.6 *hopf* Date/Time

Below the data string *hopf* Date/Time is described.

6.6.1 Specified Settings

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

6.6.2 Structure - Output Date/Time

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	tens year	$30-39
3	unit year	$30-39
4	tens month	$30-31
5	unit month	$30-39
6	tens day	$30-33
7	unit day	$30-39
8	tens hour	$30-32
9	unit hour	$30-39
10	tens minute	$30-35
11	unit minute	$30-39
12	tens second	$30-36
13	unit second	$30-39
14	ETX (end of text)	$03

6.6.3 Structure - Output Time Only

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	tens hour	$30-32
3	unit hour	$30-39
4	tens minute	$30-35
5	unit minute	$30-39
6	tens second	$30-36
7	unit second	$30-39
8	ETX (end of text)	$03

6.6.4 Status

There is no status contained in the data string *hopf* Date/Time.

6.6.5 Example

(STX) 960103123456 (ETX)

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

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6.7 MADAM-S

Below the data string MADAM-S is described.

6.7.1 Specified Settings

Automatic:	• output of local time
Required:	The synchronisation process in case of output MADAM-S requires the following setting on the board: • output on the minute change • output with second forerun • output ETX on the second change • output with control characters • output CR/LF
Blocked:	**no**

6.7.2 Structure

The structure if the data string depends on the request string (:ZSYS: oder :WILA:).

If cyclic output is enabled the string output is equivalent to ***chapter 6.7.2.1***

6.7.2.1 MADAM-S with Request :ZSYS:

When the superior computer (PROMEA-MX) requests with the string **:ZSYS:** the clock answers with the following data string:

Character No.	Meaning	Hex-Value
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 change over	$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

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Character No.	Meaning	Hex-Value
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
23	LF (line feed)	$0A
24	ETX (end of text)	$03

6.7.2.2 MADAM-S with Request :WILA:

When the superior computer (PROMEA-MX) requests with the string **:WILA:** the clock answers with the following data string:

Character No.	Meaning	Hex-Value
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
23	LF (line feed)	$0A
24	ETX (end of text)	$03

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6.7.3 Status

8. byte of the transmission: announcement of a change over

This byte can have the following values

Nul (Hex 00)	no announcement
SOH (Hex 01)	announcement change over daylight saving time / standard time standard time / daylight saving time
DEL (Hex 7F)	no radio time available

9. byte of the transmission: time scale ident.

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.

6.7.4 Example

(STX):WILA:32040706123456(CR)(LF)(ETX)

- It is Tuesday 06.07.2004 - 12:34:56 o'clock
- daylight saving time, no announcement
- ( ) - ASCII-control characters e.g. (STX)

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6.8 Siemens SINEC H1

Below the data string Siemens SINEC H1 is described.

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 **"?"**.

6.8.1 Specified Settings

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

6.8.2 Structure

Character No.	Meaning	Hex-Value
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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6.8.3 Status

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

Character no.		Meaning
28	#	time invalid
	" " (Space)	time valid (clock at least in crystal operation)
29	"*"	clock in crystal operation
	" " (Space)	clock time by radio reception
30	"S"	daylight saving time (ST)
	" " (Space)	standard time (WT)
31	"!"	announcement of a (ST-WT-ST) change over
	" " (Space)	no announcement

6.8.4 Example

(STX)D:06.11.02;T:3;U:12.34.56; _ _ _ _ **(ETX)** (_) = Space

- It is Wednesday 06.11.02 - 12:34:56 o'clock
- radio operation
- standard time
- no announcement ST/WT change over

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6.9 *hopf* DCF77 Slave-String

This data string is used for the synchronisation of *hopf* DCF77-Slave systems. It is the same string as the standard data string 7001/6021, there is only a difference in the status byte.

6.9.1 Specified Settings

Automatic:	To synchronise the *hopf* Slave-systems the following setting are fixed: • output every minute • output second advanced • ETX at second change; selectable: data string at the beginning or at the end of the 59. second. • local time • word length 8 Bit • parity no • baud rate 9600
Required:	**no**
Blocked:	**no**

These settings guarantee an optimal regulation of the time base in the slave-systems.

When selecting this string all transmission parameters are set automatically. However, the according parameter bytes continue to show the finally selected settings.

6.9.2 Structure

Character No.	Meaning	Hex-Value
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

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6.9.3 Status

	b3	b2	b1	b0	Meaning
Status:	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:	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

6.9.4 Example

(STX)84123456180702(LF)(CR)(ETX)

- It is Thursday 18.07.2002 - 12:34:56 o'clock
- radio operation
- standard time
- no announcement ST/WT change over

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6.10 *hopf* UTC Slave-String

This string is used when *hopf* clock systems are to run completely on UTC time.

6.10.1 Specified Settings

Automatic:	To synchronise the *hopf* Slave-systems the following setting are fixed: • 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 • word length 8 Bit • parity no • baud rate 9600
Required:	**no**
Blocked:	**no**

6.10.2 Structure

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	Hex-Value
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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6.10.3 Status

	b3	b2	b1	b0	Meaning
Status:	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:	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

6.10.4 Example

(STX)8B1234560301968100(LF)(CR)(ETX)

- It is Wednesday 03.01.96 - 12:34:56 o'clock
- radio operation
- standard time
- no announcement ST/WT change over
- difference time is +01:00 h to UTC time

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6.11 T-String

Below the T-String is described.

The T-String can be used with all modes (eg forrun or end character is sent to the second change). The data string can be requested with **"T"**.

6.11.1 Specified Settings

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

6.11.2 Structure

Character No.	Meaning	Hex-Value
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

6.11.3 Status

No status contained in the T-String.

6.11.4 Example

T:02:07:18:04:12:34:56(CR)(LF)

It is Thursday 18.07.2002 - 12:34:56 o'clock

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6.12 T2000-String

The T2000-string is based on the T-string. However, the year number of the T-string is increased to 4 digits. The T-String can be used with all modes (eg forrun or end character is sent to the second change). The data string can be requested with **"T"**.

6.12.1 Specified Settings

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

6.12.2 Structure

Character No.	Meaning	Hex-Value
1	"T" ASCII T	$54
2	":" colon	$3A
3	thousandth 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 second	$30-36
24	unit second	$30-39
25	CR (carriage return)	$0D
26	LF (line feed)	$0A

6.12.3 Status

No Status contained in the T2000-String.

6.12.4 Example

T:2002:07:18:04:12:34:56(CR)(LF)

It is Thursday 18.07.2002 - 12:34:56 o'clock

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6.13 MDR 2000 (Atis 31)

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

The data string can also be issued on request by the user (see Chapter ***5.4 Transmission on Request***)

6.13.1 Specified Settings

Automatic:	• Synchronisation: every minute, without time forerun, output immediately • Time base: local time
Required:	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
Blocked:	**no**

6.13.2 Structure - Output Date/Time

Character No.	Meaning	Hex-Value
1	DEL (ADR. Receiver Header)	$7F
2	"0" ASCII 0	$30
3	"0" ASCII 0	$30
4	"S" ASCII S	$53
5	"A" ASCII 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 (high nibble)	$30-39, 41-46
21	checksum (low nibble)	$30-39, 41-46
22	DEL reception address	$7F
23	CR (carriage return)	$0D

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6.13.3 Structure - Output Time Only

Character No.	Meaning	Hex-Value
1	DEL (ADR. Receiver Header)	$7F
2	"0" ASCII 0	$30
3	"0" ASCII 0	$30
4	"0" ASCII 0 instruction code	$30
5	"T" ASCII T instruction specification	$54
6	status	$30-39, 41-46
7	tens hour	$30-32
8	unit hour	$30-39
9	tens minute	$30-35
10	unit minute	$30-39
11	tens second	$30-36
12	unit second	$30-39
13	checksum (high nibble)	$30-39, 41-46
14	checksum (low nibble)	$30-39, 41-46
15	DEL reception address	$7F
16	CR (carriage return)	$0D

6.13.4 Status

	b3	b2	b1	b0	Meaning
Status:	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)

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).

6.13.5 Example

(DEL)00SA404120715075523E(DEL)(CR)

- It is Tuesday the 07.12.2004 - 15:07:55 o'clock
- crystal operation
- standard time
- no announcement ST/WT change over
- checksum 3E

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6.14 NMEA (ZDA)

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

6.14.1 Specified Settings

Automatic:	The following parameter have been fixed for the data transmission: • baud rate: 4800 baud • word length: 8 bit • 1 stop bit • no parity • transmission point: every second • no forerun • last control character immediatly • no transmission delay • time base: UTC
Required:	**no**
Blocked:	**no**

6.14.2 Structure

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).

Character No.	Meaning	Hex-Value
1	"$" string start	$24
2	"Z" ASCII Z (Identifier time basis crystal)	$5A
3	"Q" ASCII Q	$51
4	"Z" ASCII Z (Identifier content of data time information)	$5A
5	"D" ASCII D	$44
6	"A" ASCII A	$41
7	"," comma	$2C
8	tens hours UTC-time	$30-32
9	unit hours	$30-39
10	tens minutes	$30-35
11	unit minutes	$30-39
12	tens seconds	$30-35
13	unit seconds	$30-39

[1] NMEA = National Marine Electronics Association

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Character No.	Meaning	Hex-Value
14	"," comma	$2C
15	tens day UTC - date	$30-32
16	unit day	$30-39
17	"," comma	$2C
18	tens month	$30-31
19	unit month	$30-39
20	"," comma	$2C
21	thousands digit year	$31-32
22	hundreds digit year	$30, $39
23	tens year	$30-39
24	unit year	$30-39
25	"," comma	$2C
26	"+" or "-" sign for local time zone	$2B, $2D
27	tens hours (local time zone offset hours)	$30-39
28	unit hours	$30-39
29	"," comma	$2C
30	tens minutes (local time zone offset minutes)	$30-39
31	unit minutes	$30-39
32	"*" string limit	$2A
33	tens checksum	$30-39, $41-46
34	unit checksum	$30-39, $41-46
35	CR (carriage return)	$0D
36	LF (line feed)	$0A

6.14.3 Status

No status contained in data string NMEA ZDA.

6.14.4 Example

$ZQZDA,083800,08,12,2004,+01,00*70(CR)(LF)

- It is the 08.12.2004 - 08:38:00 o'clock
- local time zone offset to UTC is +01:00 hour

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6.15 *hopf* Net Time B (MIC-P)

Below the *hopf* Net Time B String (MIC-P) is described.

Output only possible in combination with board 7515RC!

6.15.1 Specified Settings

The network time string is output immediately after the second change.

Automatic:	The following parameter have been fixed for the data transmission: • transmission point: every second • no forerun • ETX: immediatly • no transmission delay
Required:	**no**
Blocked:	**no**

6.15.2 Netfrequency Source Selection with Parameter Byte 04

The source of net time resp. net frequency is fixed by parameter byte 04 bit 4-0. Bit 4 is the most significant bit and bit 0 the least significant one. The board number of the selected board 7515RC, which is the requested source, is indicated.

If a non available board 7515RC is selected by the parameter byte 04 or the complete parameter byte 04 is set to **0**, all values in the data string like net frequency, difference time etc. are set to **0**.

Parameter Byte 04						Board number in System 7001RC
Bit 7 6 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
0	0	0	0	0	1	1
0	0	0	0	1	0	2
0	0	0	0	1	1	3
0	0	0	1	0	0	4
0	0	0	1	0	1	5
0	0	0	1	1	0	6
0	0	0	1	1	1	7
0	0	1	0	0	0	8
0	0	1	0	0	1	9
0	0	1	0	1	0	10
0	0	1	0	1	1	11
0	0	1	1	0	0	12
0	0	1	1	0	1	13
0	0	1	1	1	0	14
0	0	1	1	1	1	15

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Parameter Byte 04						Board number in System 7001RC
Bit 7 6 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	
0	1	0	0	0	0	16
0	1	0	0	0	1	17
0	1	0	0	1	0	18
0	1	0	0	1	1	19
0	1	0	1	0	0	20
0	1	0	1	0	1	21
0	1	0	1	1	0	22
0	1	0	1	1	1	23
0	1	1	0	0	0	24
0	1	1	0	0	1	25
0	1	1	0	1	0	26
0	1	1	0	1	1	27
0	1	1	1	0	0	28
0	1	1	1	0	1	29
0	1	1	1	1	0	30
0	1	1	1	1	1	31

6.15.3 Structure

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	“R“ ident. Net time	$52
3	“:“ colon	$3A
4	tens hour	$30-32
5	unit hour	$30-39
6	“:“ colon	$3A
7	tens minute	$30-35
8	unit minute	$30-39
9	“:“ colon	$3A
10	tens second	$30-35
11	unit second	$30-39
12	LF (line feed)	$0A
13	CR (carriage return)	$0D
14	“D“ ident. difference time	$44
15	“:“ colon	$3A
16	+/- operational sign of difference	$2B/2D
17	hundredth second	$30-39
18	tens second	$30-39
19	unit second	$30-39
20	“:“ colon	$2E
21	1/10 second	$30-39
22	1/100 second	$30-39
23	1/1000 second	$30-39
24	LF (line feed)	$0A
25	CR (carriage return)	$0D
26	“F“ ident. frequency	$46
27	“:“ colon	$3A

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Character No.	Meaning	Hex-Value
28	tens frequency	$30-39
29	unit frequency	$30-39
30	":" colon	$2E
31	1/10 frequency	$30-39
32	1/100 frequency	$30-39
33	1/1000 frequency	$30-39
34	LF (line feed)	$0A
35	CR (carriage return)	$0D
36	ETX (end of text)	$03

The difference time is limited to +/-999:999.

6.15.4 Status

No status contained in data string *hopf* Net time B (MIC-P).

6.15.5 Example

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

- It is 12:34:56 o'clock Net time
- difference to systemtime = +000,123 seconds
- actual frequency = 50,002 Hz

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6.16 Pulse Output

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

6.16.1 Pulse Time in Parameter Byte 02

The pulse is configured with the bits 1 / 0 in the parameter byte 02.

Bit 1	Bit 0	Transmission point of data string
0	0	pulse on second change
0	1	pulse on minute change
1	0	pulse on hour change
1	1	pulse on day change

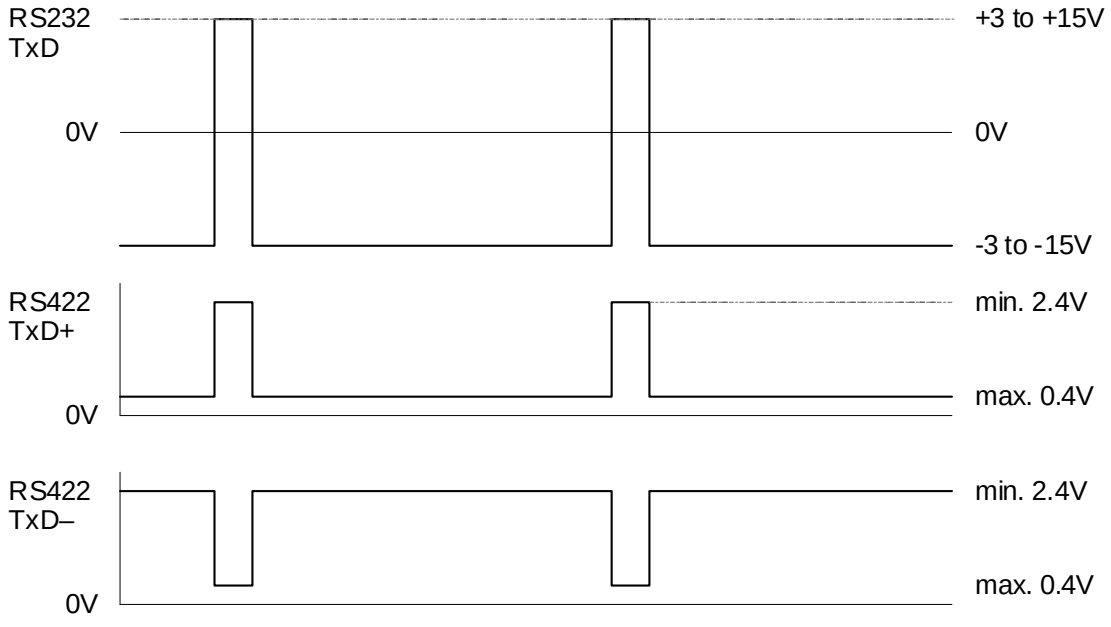
6.16.2 Pulse Duration in Parameter Byte 01

The pulse duration can be set as follows with the bits 0-2 in the parameter byte 01:

P.B. 01 Bit 2	P.B. 01 Bit 1	P.B. 01 Bit 0	Baud rate	pulse length
0	0	0	150 Baud	**640 msec**
0	0	1	300 Baud	**320 msec**
0	1	0	600 Baud	**160 msec**
0	1	1	1200 Baud	**80 msec**
0	0	0	2400 Baud	**40 msec**
1	0	1	4800 Baud	**20 msec**
1	1	0	9600 Baud	**10 msec**
1	1	1	19200 Baud	**5 msec**

6.16.3 Pulse Diagram

The pulses are put out at RS232 and RS422.



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