Industriefunkuhren

hopf Elektronik GmbH

Technical Manual

Serial Interface Board

Model 7201RC/7221RC

ENGLISH

Version: 05.00 – 06.07.2009

Valid for Devices 7201RC/7221RC with FIRMWARE Version: **05.xx**

hopf Elektronik GmbH
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Version number (Firmware / Manual)

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

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

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Symbols and Characters

Operational Reliability

Disregard may cause damages to persons or material.

Functionality

Disregard may impact function of system/device.

Information

Notes and Information.

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Safety regulations

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

If these are not complied with, then no claims may be made under the terms of the warranty 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 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=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 Hardware of Board 7201RC/7221RC

The hardware of Boards 7201RC and 7221RC is different, however their operation is identical.

1.1 Serial Interface Board 7201RC

Board 7201RC is a serial interface board in eurocard size with a 3U/4HP front panel, designed for a ***hopf*** clock system 7001RC.

A potential isolated, full-duplex serial interface is provided via a 25-pole SUB-D female connector and is available simultaneously in the following formats:

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

The serial data string to be emitted can be selected via the system 7001RC, from a variety of pre-programmed data strings.

The interface parameters can be freely set:

- Baud rate: 150-19200
- Data bits: 7 / 8
- Stop bits: 1 / 2
- Parity bit: No / Odd / Even
- Transmission point of time: every second / every minute / on request

The time base for the output can be selected from local, standard or UTC time.

Measurements can be emitted with an accuracy of microseconds, due to a rising or falling signal edge.

Thanks to its hot-plug capability, the Board 7201RC 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 7201RC is configured via the keyboard of the ***hopf*** system 7001RC or via the associated ***hopf*** 7001RC remote software.

Board 7201RC has only *one* logic interface, which is output in various physical formats via a SUB-D female connector.

It is, therefore, only possible to output one specific data string with the same parameterization on all outputs (RS232, RS422, TTY). Two different data strings can not be output by a board at the same time.

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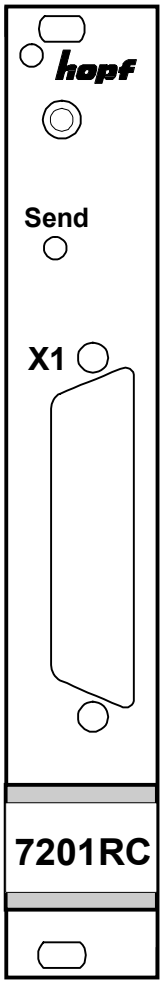
1.1.1 RC-Function Board 7201RC Layout

Board 7201RC has a 3U/4HP front panel for 19'' systems, with the following components:

1.1.1.1 Front Panel Components



Send LED - Operating condition
(see ***Chapter 1.1.1.1.1 Send LED***)

25-pole SUB-D female connector X1
(see ***Chapter 1.1.1.1.2 Pin Assignment of 25-pole SUB-D Female Connector***)

1.1.1.1.1 Send LED

SEND LED	Description
Flashing	Normal operation displaying access to the internal bus. Board 7201RC is installed correctly in the system 7001RC.
Permanently off	Board 7201RC is not ready for operation
Permanently lit	Error on Board 7201RC.

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1.1.1.1.2 Pin Assignment of 25-pole SUB-D Female Connector

Pin No.	Assignment	
1	not assigned	
2	TxD	**RS232C** potential isolated
3	RxD	
4	RTS	
5	CTS	
6	not assigned	
7	GND_{com}	GND interface
8	not assigned	
9	TxD+	**TTY** (passive) potential isolated
10	TxD-	
11	TxD-	**RS422** potential isolated
12	TxD+	
13	not assigned	

Pin No.	Assignment	
14	not assigned	
15	not assigned	
16	+24V DC	Pulse input 1
17	GND_{imp}	GND pulse
18	+5V DC	Pulse input 2
19	not assigned	
20	not assigned	
21	not assigned	
22	RxD-	**RS422** potential isolated
23	RxD+	
24	RxD+	**TTY** (passive) potential isolated
25	RxD-	

TxD+ / RxD+: High active

TxD- / RxD-: Low active

For the purposes of current limitation, a supplementary resistor (680 Ohm), available on Board 7201RC, can be connected in the TTY-interface. To do this, bridge BR 1 must be open for the input and bridge BR 2 must be open for the output (see ***Chapter 1.1.1.3 Assembly Overview***).

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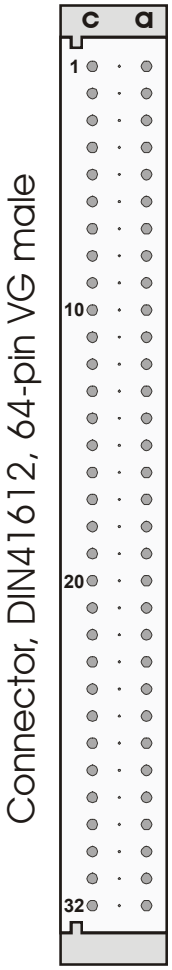
1.1.1.2 VG-strip 64-pole (DIN 41612)



Connector, DIN41612, 64-pin VG male

Connector, DIN 41612, 64-pin VG male of the 7201RC						
Pin	c			a		Pin
1						1
2				TxD	RS232C	2
3				RxD		3
4				RTS		4
5				CTS		5
6						6
7				GND_{com}		7
8						8
9	RxD+	RS422		TxD+	TTY	9
10	RxD-			TxD-		10
11	RxD+	TTY		TxD-	RS422	11
12	RxD-			TxD+		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

TxD+ / RxD+: High active

TxD- / RxD-: Low active

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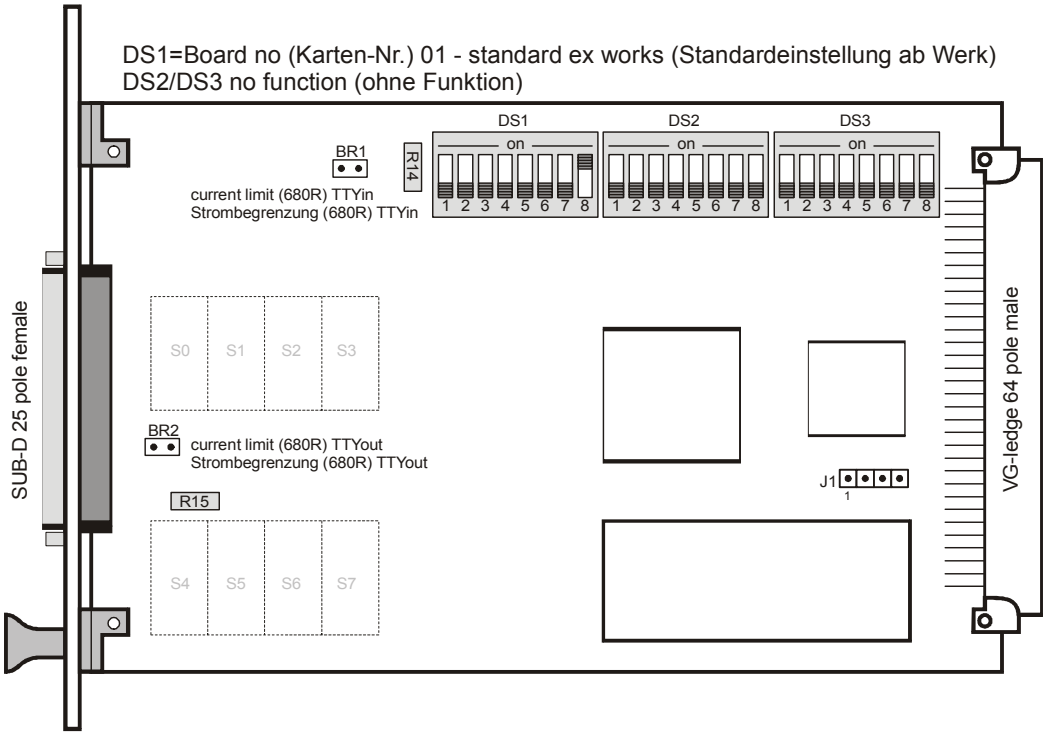
1.1.1.3 Assembly Overview



Identification	Function
DS1	DIP-switch: board number for unique identification in the system 7001RC
DS2 / DS3	DIP-switch: without function at present
J1	Service connector / for ***hopf*** Elektronik GmbH only

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1.2 Serial Interface Board 7221RC with 8 SUB-D Female Connectors

Board 7221RC is a serial interface board in eurocard size with a 3U/16HP front panel, designed for a ***hopf*** clock system 7001RC. A potential isolated serial interface is available via eight 9-pole SUB-D female connectors and is available simultaneously in the following formats:

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

The Board 7221RC only has full-duplex capability on the S0 interface (see ***Chapter 1.2.1.1.2 Assignment of the SUB-D Female Connectors***)

The serial data string to be emitted can be selected via the system 7001RC, from a variety of pre-programmed data strings.

The interface parameters can be freely set:

- Baud rate: 150-19200
- Data bits: 7 / 8
- Stop bits: 1 / 2
- Parity bit: No / Odd / Even
- Transmission point of time: every second / every minute / on request

The time base for the output can be selected from local, standard or UTC time.

Thanks to its hot-plug capability, the Board 7221RC 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 7221RC is configured via the keyboard of the ***hopf*** system 7001RC or via the associated ***hopf*** 7001RC Remote Software.

Board 7221RC has only one logic interface, which is output via eight SUB-D female connectors.

It is, therefore, only possible to output one specific data string with the same parameterization on all outputs (RS232, RS422, TTY). Two different data strings can not be output by a board at the same time.

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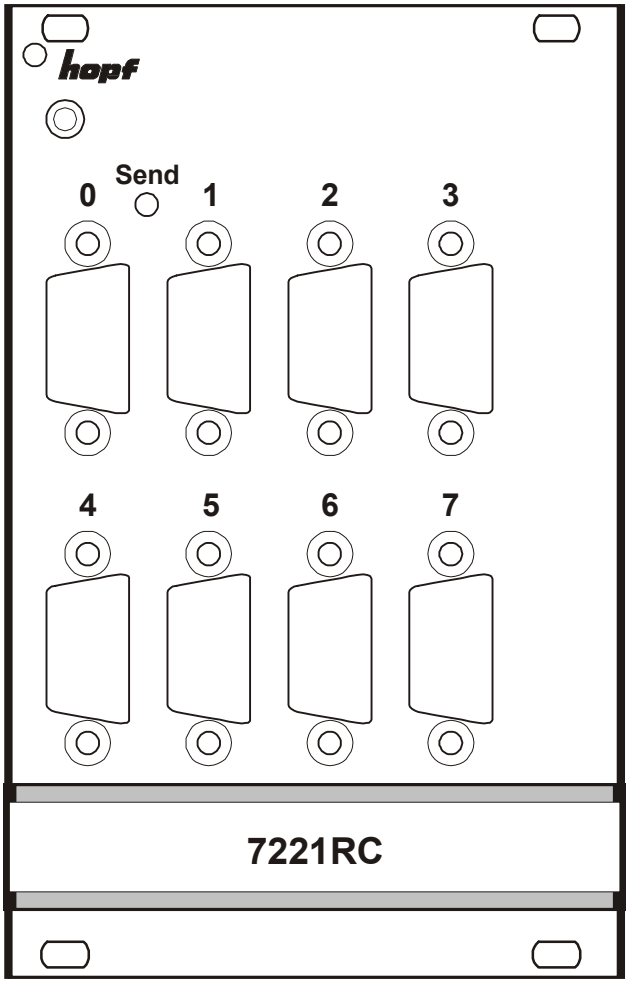
1.2.1 Function Board 7221RC Layout

The Board 7221RC has a 3U/16HP front panel for 19'' systems, with the following components:

1.2.1.1 Front Panel Components



Send LED - Operating Condition
(see ***Chapter 1.2.1.1.1 Send LED***)

8x 9-pole SUB-D fem. connectors 0-7
(see ***Chapter 1.2.1.1.2 Assignment of the SUB-D Female Connectors***)

1.2.1.1.1 Send LED

SEND LED	Description
Flashing	Normal operation displaying access to the internal bus. Board 7221RC is installed correctly in the system 7001RC.
Permanently off	Board 7221RC is not ready for operation
Permanently lit	Error on Board 7221RC.

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1.2.1.1.2 Assignment of the SUB-D Female Connectors

The serial data string is emitted via each of the eight 9-pole SUB-D female connectors on the front panel of the board.

Interface 0

Pin No.	Assignment	Signal Description
1	GND_{com}	**GND** potential isolated
2	RxD	**RS232c** potential isolated
3	CTS	
4	RxD+	**RS422** potential isolated
5	TxD+	
6	TxD	**RS232c** potential isolated
7	RTS	
8	RxD-	**RS422** potential isolated
9	TxD-	

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

Only interface **0** has a serial input, on which time data can be requested in ASCII control characters.

Only interface **0** is equipped with a handshake. Interfaces **1-7** do not have handshake lines.
For this reason, the handshake is to be deactivated when using interfaces **1-7** exclusively, since otherwise no data output will take place.

Interfaces 1-7

Pin No.	Assignment	Signal Description
1	GND_{com}	**GND** potential isolated
2		
3		
4		
5	TxD+	**RS422** potential isolated
6	TxD	**RS232c** potential isolated
7		
8		
9	TxD-	**RS422** potential isolated

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

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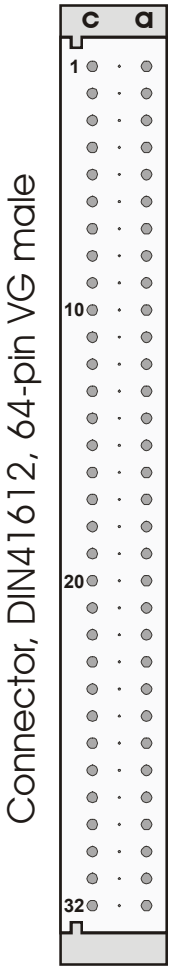
1.2.1.2 VG-strip 64-pole (DIN 41612)



Connector, DIN41612, 64-pin VG male

Connector, DIN 41612, 64-pin VG male of the 7221RC						
Pin	c			a		Pin
1						1
2				TxD	RS232C	2
3				RxD		3
4				RTS		4
5				CTS		5
6						6
7				GND_{com}		7
8						8
9	RxD+	RS422				9
10	RxD-					10
11				TxD-	RS422	11
12				TxD+		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

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

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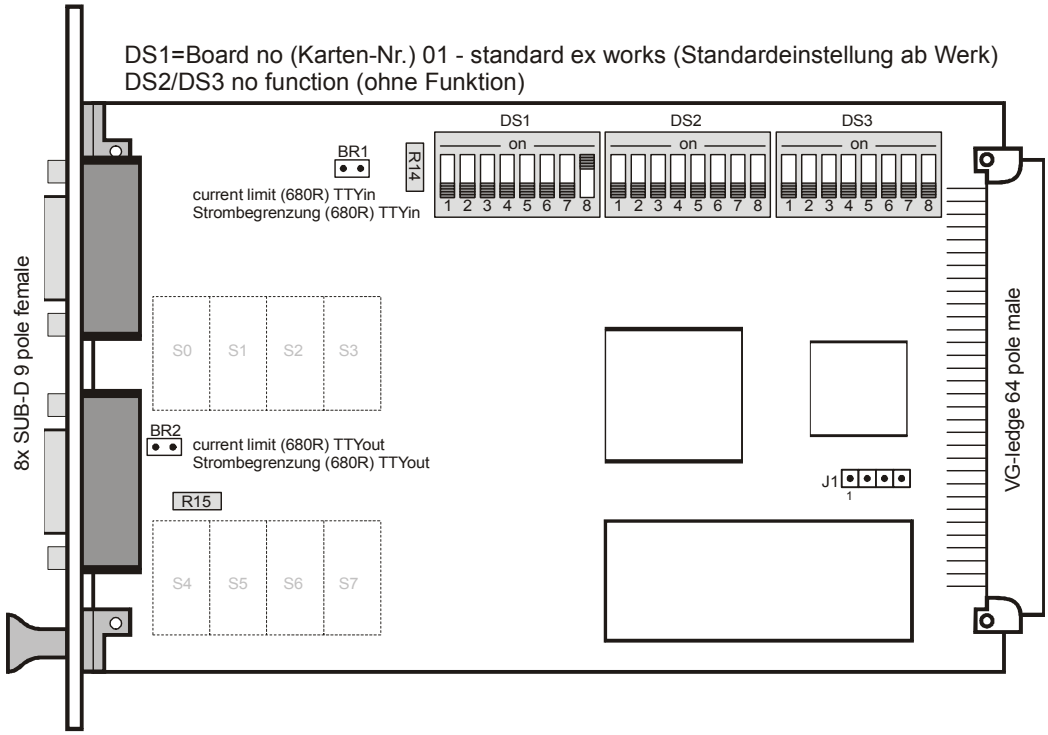
1.2.1.3 Assembly Overview



Description	Function
DS1	DIP-switch: Board number for unique identification in the 7001RC system.
DS2 / DS3	DIP-switch: without function at present
BR1 BR2	Current limitation for TTY
J1	Service connector / for ***hopf*** Elektronik GmbH only

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2 Implementing the Board 7201RC/7221RC 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 7201RC/7221RC
- Installing the Board 7201RC/7221RC in the system 7001RC
- Setting the parameters of the Board 7201RC/7221RC
- Activating the Board 7201RC/7221RC via the system 7001RC

2.1 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.

2.2 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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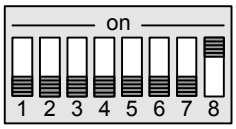
Board 01

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	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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2.3 Installing a New Board 7201RC/7221RC in the System 7001RC

In order to install a new board 7201RC/7221RC, 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.

2.4 Setting the Parameters and Activating the Board 7201RC/7221RC 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 3 Administration of Board 7201RC/7221RC***)
- In the **BOARD-SETUP** menu, sub-heading **SET SYSTEM BOARDS TO MONITOR-ING-MODE OR IDLE-MODE** install the newly implemented board 7201RC/7221RC 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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3 Administration of Board 7201RC/7221RC

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.

3.1 Input Functions for Board 7201RC/7221RC in the System 7001RC

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  7201 NO.:04
STATUS:I/E  BOARDNAME:"SERIEL  " SET>Y/N
```

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

7201 NR.: 04 ⇨ Board type **7201RC** with board number **04**

STATUS: M (I)**/-** (E) ⇨ **M** or **I** = Monitoring **or** No Monitoring

⇨ **E** or **-** = in Operating without Board Error **or** 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 5 Data Strings***.

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3.1.1 Setting Parameter Byte 01

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

```
B.7201 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 >76543210<
```

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 5 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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3.1.1.1 Bit 7, Output UTC / Standard / Local

See ***Chapter 3.1.3.4.3 Transmission Delay***.

3.1.1.2 Bit 6, Setting the Word Length

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

3.1.1.3 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

3.1.1.4 Bit 3, Setting the Stop Bit

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

3.1.1.5 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

3.1.2 Setting Parameter Byte 02

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

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.

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

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 5 Data Strings***.

Parameter Byte 02		
Bit 7, 6, 5, 4, 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

On the 'DCF77-pulse output' setting, **Bits 0 - 2** in **Parameter Byte 02** have a different meaning (see ***Chapter 5.23 DCF77-Pulse Output***)

3.1.2.1 Bits 7, 6, 5, 4 & 3 (no function at present)

Bits 7, 6, 5 , 4 and 3 are without function at present.
For reasons of compatibility, these bits should always be set to "0".

3.1.2.2 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

3.1.2.3 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

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3.1.3 Setting Parameter Byte 03

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

```
B.7201 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 5 Data Strings***.

Parameter Byte 03				
Bit 7		**Request possible at interface:**		
0		RS232c and RS422		
1		TTY (with board 7201RC only)		
Bit 6		**Handshake**		
0		Active		
1		Inactive		
Bit 5		**RTS as**		
0		Second pulse with RS232c level		
1		Control line for RS232c		
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**		
1	0	UTC time		
0	0	Standard time		
-	1	Local time		
Bit 1		**Falling / rising edge for *hopf* Time Capture**		
0		Falling edge triggers measurement		
1		Rising edge triggers measurement		
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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3.1.3.1 Bit 7, Interface Selection for Serial Request

Board 7201RC is equipped with 3 serial interfaces:

- RS232c (V.24)
- RS422 (V.11)
- TTY (passive) (with board 7201RC only).

When cyclical data output is set (see ***Chapter 3.1.2.3 Bit 1/0, Data String Transmission Point of Time***) the data string is present at all serial outputs.

The request of data via the RxD lines may only take place via one input. The board 7201RC can be configured for this purpose via parameter byte 03 bit 7 between input TTY or RS232/RS422.

Bit 7	Request possible at interface:
0	RS232c and RS422
1	TTY (with board 7201RC only)

The TTY interface is not available on board **7221RC**, for this reason Bit 7 is to be set to 0.
Request is possible on RS232c and RS422.

3.1.3.2 Bit 6, Handshake (only with RS232C)

The RS232c interface of boards 7201RC/7221RC is equipped with standardized handshake lines. These handshake lines can be used or deactivated, depending on the application.

Bit 6	Handshake
0	Active (only with RS232C)
1	Inactive

No handshake is available when operating the board **7201RC** via RS422 / TTY interface and must therefore be deactivated, since otherwise data output does not take place.

On board **7221RC**, only interface **0** is equipped with handshake. Interfaces **1-7** do not have handshake lines. For this reason, the handshake should be set to inactive when using interfaces **1-7** exclusively, since otherwise data output does not take place.

3.1.3.3 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 3.1.3.2 Bit 6, Handshake (only with RS232C)***).

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

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3.1.3.4 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

3.1.3.4.1 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 4.1 Second Forerun***.

3.1.3.4.2 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 4.2 Control Character at Second Change***.

3.1.3.4.3 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 4.5 Delayed Transmission when Transmitting on Request***.

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

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

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.

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.

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.

P.Byte 01 Bit 7	P.Byte 03 Bit 2	Time Base of Output
0	1	**UTC** Time (Universal Time Coordinated)
0	0	**Standard** Time = (UTC + Time Offset)
1	-	**Local** Time = (UTC + Time Offset + Hour Offset)

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3.1.3.6 Bit 1, Falling / Rising Edge for *hopf* Time Capture

Only with board 7201RC.

The output of the ***hopf*** Time Capture String can only be triggered via the pulse input with rising or falling edge (see ***Chapter 5.19 hopf Time Capture (only Board 7201RC)***).

Bit 1	Function
0	Falling edge triggers measurement
1	Rising edge triggers measurement

3.1.3.7 Bit 0, LF/CR sequence

The sequence of the CR and LF control characters can be inverted with this function for all transmission strings, with the exception of the "Slave Data 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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3.1.4 Setting Parameter Byte 04

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

```
B.7201 NO.:01   OLD: BYTE 04 >00000000<
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 >76543210<
```

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 5 Data Strings***.

3.1.4.1 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.

3.1.5 Setting Parameter Byte 05, Data String Selection

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

```
B.7201 NO.:01   OLD: BYTE 05 >00000000<
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 >76543210<
```

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 5 Data Strings***.

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3.1.5.1 Bit 7-0, Data String Overview

The data strings are selected with Parameter Byte 05. The specification can be found in ***Chapter 5 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	5050 date/time
0	0	0	0	0	1	0	1	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	IBM Sysplex Timer Model 1+2
0	0	0	1	0	0	0	1	Sicomp M
0	0	0	1	0	0	1	0	***hopf*** Master/Slave-String
0	0	0	1	0	0	1	1	ABB 23RC20
0	0	0	1	0	1	0	0	ABB-SPA Second Clock
0	0	0	1	0	1	0	1	***hopf*** Time Capture (only with board 7201RC)
0	0	0	1	0	1	1	0	MDR 2000
0	0	0	1	0	1	1	1	***hopf*** Clockmouse
0	0	0	1	1	0	0	0	***hopf*** Clockmouse with 'o' 'CR'
0	0	0	1	1	0	0	1	DCF77-Pulse Output
0	0	0	1	1	0	1	0	NMEA (GPRMC)
0	0	0	1	1	0	1	1	NMEA (ZDA)
0	0	0	1	1	1	0	0	DA55-String
0	0	0	1	1	1	0	1	***hopf*** Mains Time A
0	0	0	1	1	1	1	0	***hopf*** Mains Time B (MIC-P)
0	0	0	1	1	1	1	1	***hopf*** Multi-frequency A / KIA
0	0	1	0	0	0	0	0	***hopf*** Multi-frequency B
0	0	1	0	0	0	0	1	SICOMP-70-MX
0	0	1	0	0	0	1	0	H&B Contronic P (PCZ77)
0	0	1	0	0	0	1	1	SAT 1703 Time String
0	0	1	0	0	1	0	0	SINEC H1 Extended
0	0	1	0	0	1	0	1	MODBUS String
0	0	1	0	0	1	1	0	DCF - BKW String
0	0	1	0	0	1	1	1	String 40
0	0	1	0	1	0	0	0	String 41
0	0	1	0	1	0	0	1	String 42
0	0	1	0	1	0	1	0	String 43
X	X	X	X	X	X	X	X	All other settings without function at present.

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3.1.6 Setting Parameter Byte 06

Parameter Byte 06 is shown on the upper line with its currently set values.

```
B.7201 NO.:01   OLD: BYTE 06 >00000000<
BYTE = BIT 7..0 NEW: BYTE 06 >~~~~~~~~<
```

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 06 >76543210<
```

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 5 Data Strings***.

Parameter Byte 06	
Bit 7-0	**No function at present**
0	For reasons of compatibility, these bits should always be set to **"0"**.

3.1.6.1 Bit 7-0, (no function at present)

Bits 7-0 are without function at present.
For reasons of compatibility, these bits should always be set to **"0"**.

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4 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.

4.1 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 4.2 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 4.6.7 Delayed Transmission when Requesting with ETX***).

4.2 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 4.1 Second Forerun***). See time chart in ***Chapter 4.6.2 Cyclical Transmission with Second Forerun and Control Character at Second Change***.

4.3 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 4.6.3 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.

4.4 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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4.5 Delayed Transmission when Transmitting on Request

When transmitting in response to a request, the board 7201RC / 7221RC 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 4.3 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.

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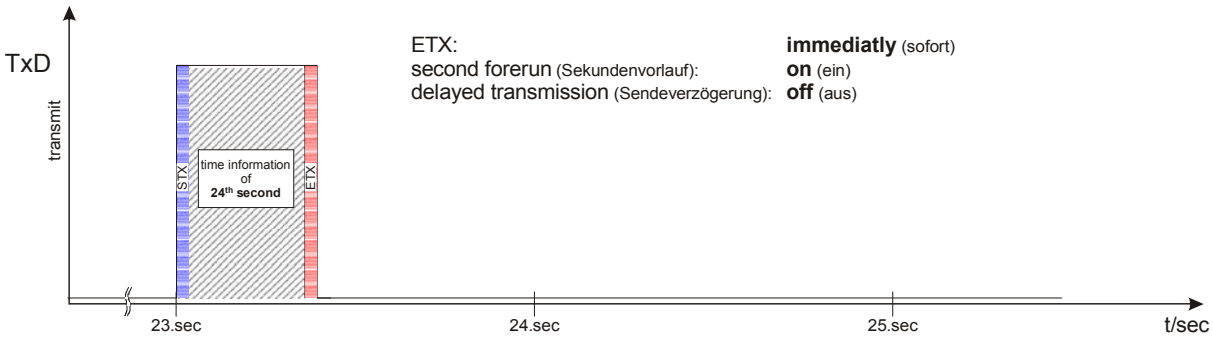
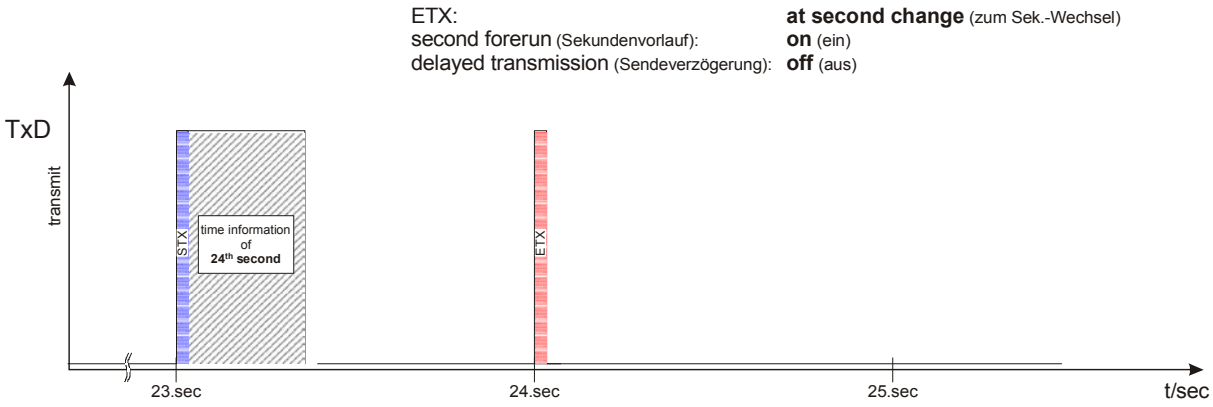
4.6 Time Charts of Transmitted Data Strings

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

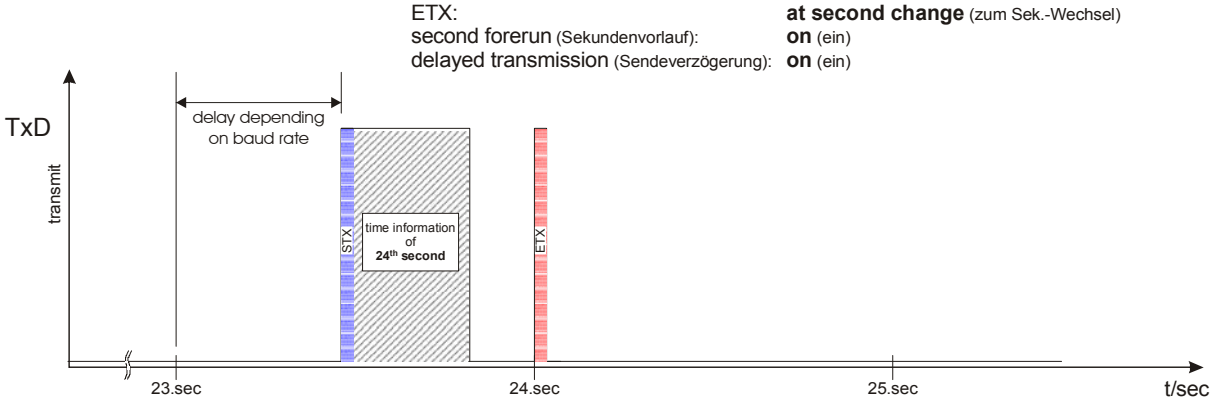
4.6.1 Cyclical Transmission with Second Forerun



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



4.6.3 Cyclical Transmission with Second Forerun and Delayed Transmission



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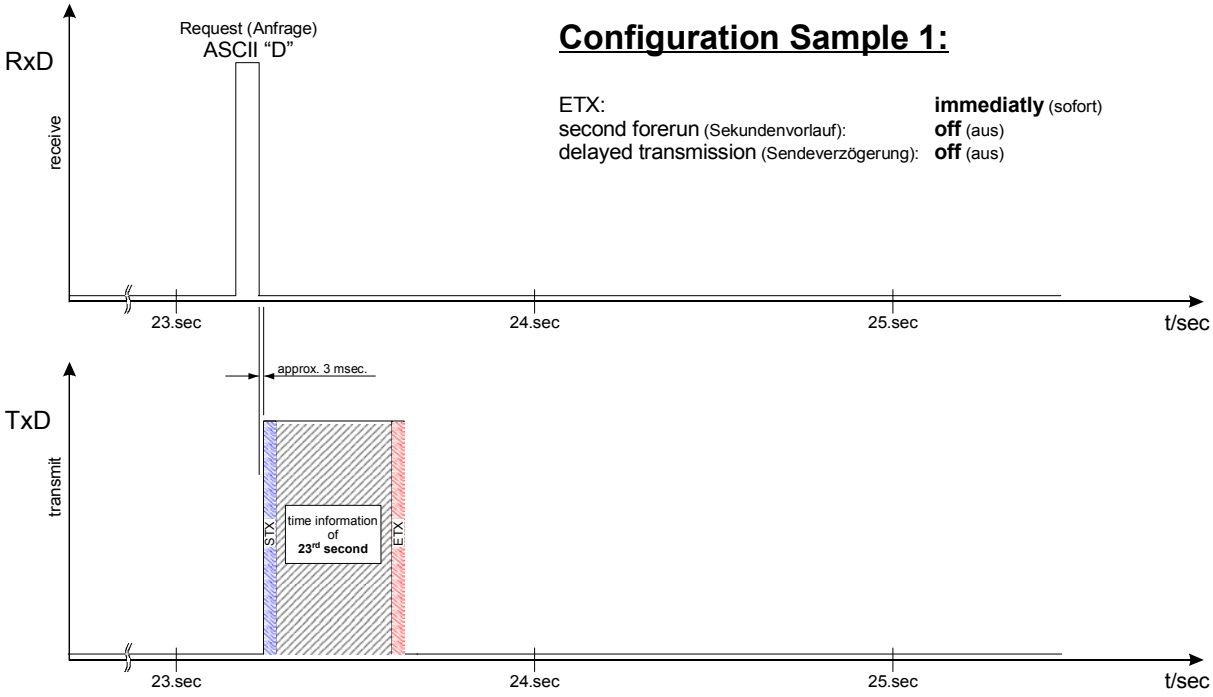
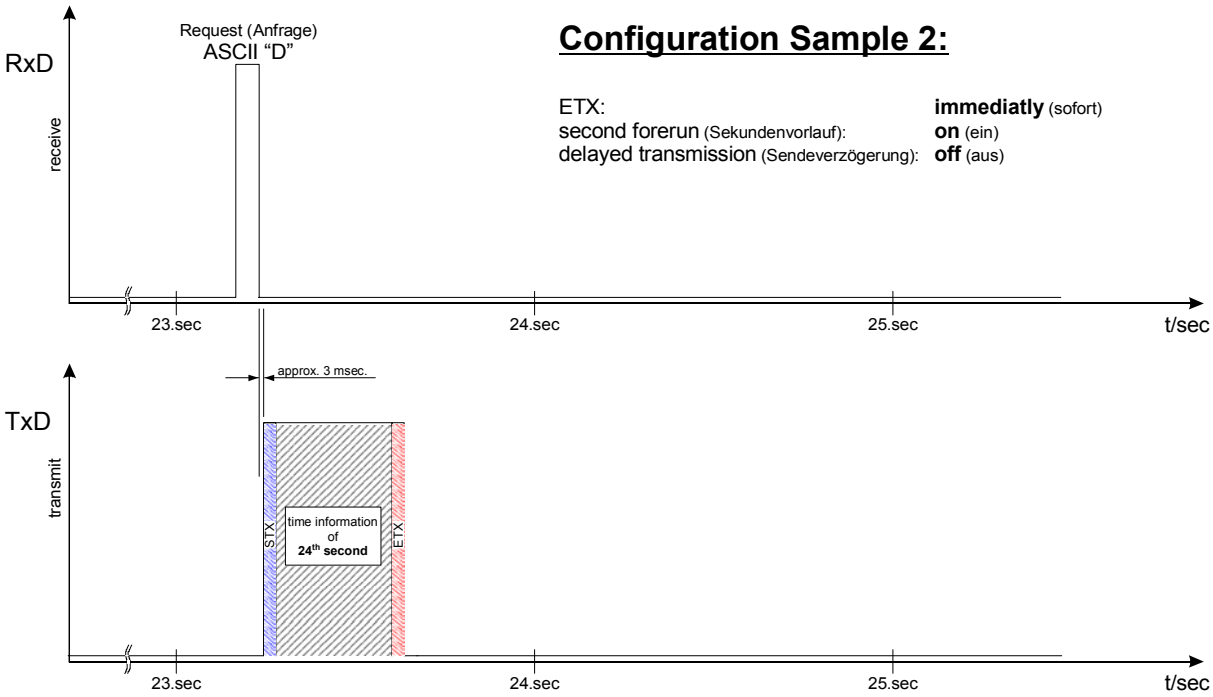
4.6.4 Transmission on Request without Second Forerun



Configuration Sample 1:

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

4.6.5 Transmission on Request with Second Forerun



Configuration Sample 2:

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

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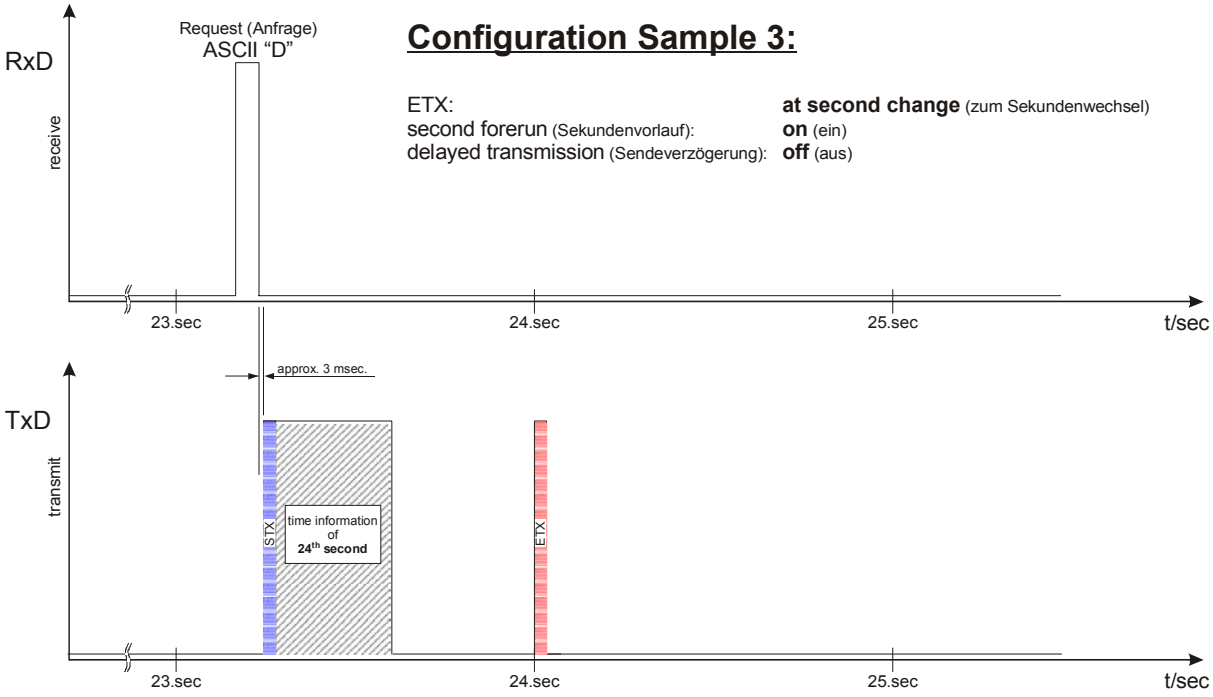
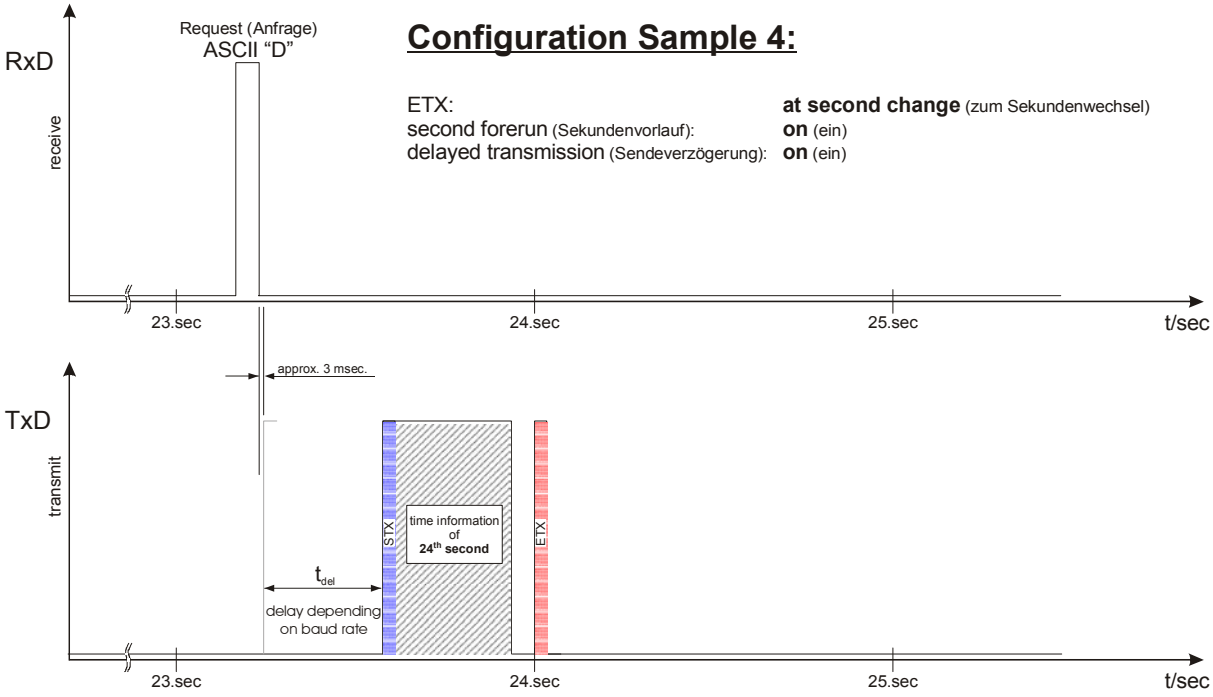
4.6.6 Transmission on Request with ETX at Second Change



Configuration Sample 3:

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

4.6.7 Delayed Transmission when Requesting with ETX at Second Change



Configuration Sample 4:

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

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5 Data Strings

5.1 *hopf* Standard String

Below the *hopf* Standard String is described.

5.1.1 Specified Settings

No specified setting for this data string is necessary.

5.1.2 Structure

5.1.2.1 *hopf* Standard String - Output Date/Time

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

5.1.2.2 *hopf* Standard String - 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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5.1.3 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

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

5.1.4 Example

(STX)E3123456061102(LF)(CR)(ETX)

- It is Wednesday 06.11.02 - 12:34:56 o'clock.
- radio operation (high accuracy)
- daylight saving time
- no announcement
- ( ) - ASCII-control characters e.g. (STX)

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5.2 NTP (Network Time Protocol)

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

http://www.ntp.org

5.2.1 Specified Settings

parameter of transmission:

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

mode of transmission:

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

5.2.2 Structure

NTP is according to the ***hopf*** Standard String (see ***Chapter 5.1***).

5.2.3 Status

The Status is according to the ***hopf*** Standard String (see ***Chapter 5.1.3***).

5.2.4 Example

(STX)EB123456061102(LF)(CR)(ETX)

- It is Wednesday 06.11.2002 - 12:34:56 o'clock.
- radio operation (high accuracy)
- UTC
- no announcement for ST/WT change over (nonexistent in case of UTC)
- ( ) - ASCII control character e.g. (STX)

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5.3 *hopf* 5500

Below the data string *hopf* 5500 is described.

5.3.1 Specified Settings

No specified setting for this data string is necessary.

5.3.2 Structure

5.3.2.1 *hopf* 5500 - 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

5.3.2.2 *hopf* 5500 - 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

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5.3.3 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

5.3.4 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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5.4 5050 Date / Time

Below the data string 5050 Date / Time is described.

5.4.1 Specified Settings

No specified setting for this data string is necessary.

5.4.2 Structure 5050 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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5.4.2.1 Structure 5050 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

5.4.3 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

5.4.4 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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5.5 *hopf* 2000 - 4 Digit Year Output

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

5.5.1 Specified Settings

No specified setting for this data string is necessary.

5.5.2 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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5.5.3 Status

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

	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

5.5.4 Example

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

- It is Wednesday 03.01.1996 - 12:34:56 o'clock
- radio operation (high accuracy)
- daylight saving time
- no announcement
- ( ) - ASCII-control characters e.g. (STX)

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5.6 *hopf* Date/Time

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

5.6.1 Specified Settings

No specified setting for this data string is necessary.

5.6.2 Structure

5.6.2.1 Data String Date/Time - 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

5.6.2.2 Data String Date/Time - 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

5.6.3 Status

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

5.6.4 Example

(STX) 960103123456 (ETX)

- It is Wednesday 03.01.96 - 12:34:56 o'clock
- ( ) - ASCII-control characters e.g. (STX)

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5.7 MADAM-S

Below the data string MADAM-S is described.

5.7.1 Specified Settings

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

5.7.2 Structure

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

5.7.2.1 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
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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5.7.2.2 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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5.7.3 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.

5.7.4 Example

(STX):WILA:NUL32040706123456(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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5.8 Siemens SINEC H1

Below the data string Siemens SINEC H1 is described.

String request

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

5.8.1 Specified Settings

No specified setting for this data string is necessary.

5.8.2 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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5.8.3 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

5.8.4 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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5.9 *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.

5.9.1 Specified Settings

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

These settings guarantees 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.

5.9.2 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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5.9.3 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

5.9.4 Example

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

- It is Wednesday 03.01.96 - 12:34:56 o'clock
- radio operation
- standard time
- no announcement ST/WT change over

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5.10 *hopf* UTC Slave-String

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

5.10.1 Specified Settings

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

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

This setting guarantees the best control 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.

5.10.2 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

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Character No.	Meaning	Hex-Value
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

5.10.3 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

5.10.4 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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5.11 T-String

Below the T-String is described.

5.11.1 Specified Settings

No specified setting for this data string is necessary.

5.11.2 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

5.11.3 Status

No status contained in the T-String.

5.11.4 Example

T:02:11:06:03:12:34:56(CR)(LF)

It is Wednesday 06.11.02 - 12:34:56 o'clock

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5.12 T2000-String

The T2000-string is based on the T-string. However, the year number of the T-string is increased to 4 digits.

5.12.1 Specified Settings

No specified setting for this data string is necessary.

5.12.2 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

5.12.3 Status

No Status contained in the T2000-String.

5.12.4 Example

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

It is Wednesday 03.01.1996 - 12:34:56 o'clock

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5.13 IBM Sysplex Timer Model 1+2

This protocol is used for the synchronization of an IBM 9037 Sysplex Timer.

5.13.1 Specified Settings

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

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

The setting UTC or local time is optional.

5.13.2 Structure

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

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5.13.3 Status

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

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

5.13.4 Example

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

- It is 12:34:56 o'clock
- radio operation
- 50th day of the year

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5.14 TimeServ for Windows NT PCs

The synchronization of a Computer running Windows NT version 3.51 and higher is done with these data string.

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

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

5.14.1 Specified Settings

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

5.14.2 Structure

The data string is the same described in ***Chapter 5.13 IBM Sysplex Timer Model 1+2***.

5.14.3 Status

See ***Chapter 5.13.3 Status*** IBM Sysplex Timer.

5.14.4 Example

See ***Chapter 5.13.4 Example*** IBM Sysplex Timer.

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5.15 Sicomp M

The following string is used for the synchronisation of Sicomp M systems.

5.15.1 Specified Settings

The following parameters are chosen for the data transmission:

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

5.15.2 Structure

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

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5.15.3 Status

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

	b3	b2	b1	b0	Meaning
Status:	x	x	x	0	No announcement of (ST-WT-ST) changeover
	x	x	x	1	No announcement of (ST-WT-ST) changeover
	x	0	1	x	Daylight saving time (summer time, ST)
	x	1	0	x	Standard time (winter time, WT)
	0	x	x	x	No announcement of the leap second
	1	x	x	x	Announcement of the leap second

The 4 bit in the high nibble have no function and are set to 0.

In case of radio reception the error counter is set to 1 and runs max. to F ($31-39, $41-46).

It indicates the time in minutes how long the radio reception has been interrupted.

5.15.4 Example

(STX):34:0412030812345641(CR)(LF)(ETX)

- It is Wednesday 08.12.2004 - 12:34:56 o'clock
- radio operation
- standard time
- no announcement time zone change over
- no announcement leap second

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5.16 *hopf* Master/Slave-String

The ***hopf*** Master/Slave-String can be used to synchronise slave systems with the time data of the master system up to an accuracy of ± 0.5 msec. It differs from the ***hopf*** DCF77-slave-string in as much as the UTC time is included in the transmission.

The ***hopf*** Master/Slave-String transmits:

- the full time information (hour, minute, second),
- the date (day, month, year [2 digits]),
- the difference time local to UTC (hour, minute),
- the day of the week,
- and status information (announcement of ST/WT change over, announcement of a leap second and the status of reception of the Master/Slave-String source).

5.16.1 Specified Settings

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

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

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

In case of Master/Slave-String these settings are fixed automatically. Furthermore the according parameter byte shows the last chosen settings.

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5.16.2 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	difference time tens hour / operational sign	$30-31, $38-39
17	difference time unit hour	$30-39
18	difference time tens minutes	$30-35
19	difference time unit minutes	$30-39
20	LF (line feed)	$0A
21	CR (carriage Return)	$0D
22	ETX (end of text)	$03

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

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

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

Example:

Data String	Tens Difference Time	Difference Time
(STX)831234560301960300(LF)(CR)(ETX)	**0000**	- 03:00h
(STX)831234560301961100(LF)(CR)(ETX)	**0001**	- 11:00h
(STX)831234560301968230(LF)(CR)(ETX)	**1000**	+ 02:30h
(STX)831234560301969100(LF)(CR)(ETX)	**1001**	+ 11:00h

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5.16.3 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 leap second
	x	1	x	x	announcement leap second
	0	x	x	x	crystal operation
	1	x	x	x	radio operation
Day of the Week:	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

Status	Operating Mode	Leap Second	Time	Change over ST-WT-ST
0 = 0000	quartz	no announcement	winter	no announcement
1 = 0001	quartz	no announcement	winter	announcement
2 = 0010	quartz	no announcement	summer	no announcement
3 = 0011	quartz	no announcement	summer	announcement
4 = 0100	quartz	announcement	winter	no announcement
5 = 0101	quartz	announcement	winter	announcement
6 = 0110	quartz	announcement	summer	no announcement
7 = 0111	quartz	announcement	summer	announcement
8 = 1000	radio	no announcement	winter	no announcement
9 = 1001	radio	no announcement	winter	announcement
A = 1010	radio	no announcement	summer	no announcement
B = 1011	radio	no announcement	summer	announcement
C = 1100	radio	announcement	winter	no announcement
D = 1101	radio	announcement	winter	announcement
E = 1110	radio	announcement	summer	no announcement
F = 1111	radio	announcement	summer	announcement

5.16.4 Example

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

- It is Wednesday 03.01.1996 - 12:34:56 o'clock
- radio operation
- standard time
- no announcement
- The difference time to UTC is +2.30 h

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5.17 ABB 23RC20

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

5.17.1 Specified Settings

This data string is pre-set as follows:

- 8 data bit
- even parity
- 1 stop bit

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

5.17.2 Structure

Character No.	Meaning	Hex-Value
1	status	$00-FF
2	second	$00
3	minute	$00-3B
4	hour	$00-17
5	day	$01-1F
6	month	$01-0C
7	year	$00-63

5.17.3 Status

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

5.17.4 Example

Because of the binary transmission no data string is displayed here.

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5.18 ABB-SPA Seconds-Clock

The ABB-SPA data string consists of two different data strings: The Time/Date String and the Second Data String. The Time/Date String fades over the seconds data string when the output time is the same.

In case of the setting "without checksum" the ASCII characters for XX are transmitted instead of the checksum. The putout milliseconds state the (calculated) transmission time of the last character of the string.

5.18.1 Specified Settings

Settings parameter byte 04 for data string ABB SPA

Parameter Byte 04	Function
Bit 7	output point of time Second String
Bit 6	
Bit 5	output point of time Time/Date String
Bit 4	
Bit 3	checksum on/off
Bit 2	point or space between day and hour
Bit 1	free
Bit 0	free

Parameter Byte 04		output point of time second string
Bit 7	Bit 6	
1	1	every minute
0	1	every 30 seconds
1	0	every 10 seconds
0	0	every second

Parameter Byte 04		output point of time time/date string
Bit 5	Bit 4	
1	1	6 a.m. and 6 p.m.
0	1	every hour
1	0	every 30 minutes
0	0	every minute

Parameter Byte 04 Bit 3	checksum
1	with checksum
0	without checksum

Parameter Byte 04 Bit 2	separator between day and hour in time/date string
1	dot between day and hour
0	space between day and hour

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5.18.2 Structure

5.18.2.1 ABB-SPA - Date and Time String

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

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5.18.2.2 ABB-SPA - Second String

Character No.	Meaning	Hex-Value
1	">" ASCII-character >	$3E
2	"9" ASCII-character 9	$39
3	"0" ASCII-character 0	$30
4	"0" ASCII-character 0	$30
5	"W" ASCII-character W	$57
6	"T" ASCII-character T	$54
7	":" colon	$3A
8	tens second	$30-36
9	unit second	$30-39
10	"." dot	$2E
11	1/10 second	$30-39
12	1/100 second	$30-39
13	1/1000 second	$30-39
14	":" colon	$3A
15	checksum (high nibble)	$30-3F, $58
16	checksum (low nibble)	$30-3F, $58
17	CR (carriage return)	$0D

5.18.3 Status

No status contained in data string ABB-SPA.

5.18.4 Examples

5.18.4.1 ABB-SPA - Date and Time String

Output with dot between day and second is set.

>900WD:04-12-07.14.27;00.035:37(CR)

- It is the 07.12.2004 - 14:27:00 o'clock,
- 35 thousandth seconds (35 milliseconds),
- checksum: 37

5.18.4.2 ABB-SPA - Second String

>900WT:02.019:10(CR)

- 2 seconds
- 19 thousandth seconds (19 milliseconds).

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5.19 *hopf* Time Capture (only Board 7201RC)

The appearance of 5V and 24V pulses can recorded with an accuracy of microseconds with the ***hopf*** Time Capture String.

The output of the data string can only be activated via the pulse input of the 25-pole SUB-D connector of board 7201RC. For this either the 5 or the 24 Volt input must be connected to a suitable source of signal. The measuring can be activated with the rising or falling edge (see ***Chapter 3.1.3.6 Bit 1, Falling / Rising Edge for hopf Time Capture***).

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

Connection of the pulse input see ***Chapter 1.1.1.1.2 Pin Assignment of 25-pole*** SUB-D .

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

The accuracy of the measuring depends on the synchronisation status of the clock system. To avoid faulty measurings they should not be carried out during synchronisation.

5.19.1 Specified Settings

The transmission point is automatically set to "transmission on request".

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5.19.2 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	" " space	$20
5	tens hour	$30-32
6	unit hour	$30-39
7	":" colon	$3A
8	tens minute	$30-35
9	unit minute	$30-39
10	":" colon	$3A
11	tens second	$30-35
12	unit second	$30-39
13	":" colon	$3A
14	hundred digit millisecond	$30-39
15	tens millisecond	$30-39
16	unit millisecond	$30-39
17	"." point	$2E
18	hundred digit microsecond	$30-39
19	tens microsecond	$30-39
20	unit microsecond	$30-39
21	"." point	$2E
22	tens day	$30-33
23	unit day	$30-39
24	"." point	$2E
25	tens month	$30-31
26	unit month	$30-39
27	"." point	$2E
28	thousand digit year	$31, $32
29	hundred digit year	$30, $39
30	tens year	$30-39
31	unit year	$30-39
32	LF (line feed)	$0A
33	CR (carriage return)	$0D
34	ETX (end of text)	$03

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5.19.3 Status

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

	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

5.19.4 Example

(STX)42_14:47:53:877.818.07.12.2004(LF)(CR)(ETX) "_": Space

One pulse was recorded on:

- Tuesday the 07.12.2004
- at 14:47:53 o'clock
- in the 877. millisecond and 818. microsecond

at the pulse input of the board 7201RC.

Also:

- System in quartz mode
- standard time
- no announcement ST/WT change over

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5.20 MDR 2000

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

5.20.1 Specified Settings

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
- synchronisation: every minute, local time, without time forerun, output immediately

Bit 3 and **bit 4** of **parameter byte 03** are excluded. Delay of transmission and advance cannot be altered.

5.20.2 Structure

Character No.	Meaning	Hex-Value
1	DEL (ADR. Rekorder Sendekopf)	$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	reception address	$7F
23	CR (carriage return)	$0D

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5.20.3 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)
	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).

5.20.4 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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5.21 *hopf* Clockmouse

This data string can be used when the driver software for the clock-mouse is installed. This can be downloaded at the following site:

http://www.rdcs.at

Windows 3.x and Windows 95 computers can be synchronised by means of this software. The data string is requested cyclically by the driver software.

5.21.1 Specified Settings

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

- baud rate: 300 Baud
- data format: 7 Bit
- 2 stop bits
- parity: even
- handshake: no
- control characters : yes
- synchronisation: on request, local time, without forerun, output immediately

5.21.2 Structure

Character No.	Meaning	Hex-Value
1	tens hour	$30-32
2	unit hour	$30-39
3	tens minutes	$30-35
4	unit minutes	$30-39
5	tens seconds	$30-35
6	unit seconds	$30-39
7	day of the week	$31-37
8	tens day	$30-33
9	unit day	$30-39
10	tens month	$30-31
11	unit month	$30-39
12	tens year	$30-39
13	unit year	$30-39
14	status 1	$30-39, 41-46
15	status 2	$30-39, 41-46
16	CR (carriage return)	$0D

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5.21.3 Status

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

Status 1

B3		Meaning
1		announcement of leap second
0		no announcement of leap second
B2	**B1**	**Meaning**
1	0	Standard- or Wintertime
0	1	Daylight saving time or summertime
B0		**Meaning**
1		announcement ST/WT change over
0		no announcement ST/WT change over

Status 2

B3	Meaning
1	battery voltage to low **(always 0)**
0	battery voltage ok
B2	**Meaning**
1	no valid time and no reception
0	this value will be set during the first successful reception
B1	**Meaning**
1	clock is synchronous
0	clock is not synchronous
B0	**Meaning**
1	valid time available
0	no valid time available

5.21.4 Example

153044207120441(CR)

- It is Tuesday the 07.12.2004 - 15:30:44 o'clock
- standard time
- no announcement of leap second
- no announcement ST/WT change over

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5.22 *hopf* Clockmouse with 'o' 'CR'

Below the data string ***hopf*** Clockmouse with 'o' 'CR' is described.

5.22.1 Specified Settings

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

- baud rate: 300 Baud
- data format: 7 Bit
- 2 stop bits
- parity: even
- handshake: no
- control character: yes
- synchronisation: on request, local time, without advance, output immediately

5.22.2 Structure

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

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

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5.22.3 Status

The structure of the status corresponds with the one of the Clockmouse data string without leading <o><CR> (see ***Chapter 5.21.3 Status*** data string ***hopf*** Clockmouse).

5.22.4 Example

o(CR)115415315090421(CR)

- It is Wednesday the 15.09.2004 - 11:54:15 o'clock
- daylight saving time
- no announcement of leap second
- no announcement ST/WT change over

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5.23 DCF77-Pulse Output

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

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

5.23.1 Specified Settings

5.23.1.1 Fault Mode

Bit 2 of parameter byte 2 selects whether a non-valuable pulse (2Hz pulse) is given out or if the output level of the interfaces remain in idle state when the base system is not synchronous. The idle state, however, could also simulate a line break to the connected device.

Parameter Byte 02 Bit 2	Output in case of a fault
1	A continuous 2 Hz pulse is output when a fault is present
0	The output level moves to the idle state when a fault is present

5.23.1.2 Output Mode

Bit 1 of parameter byte 2 is used to set whether the DCF77 pulse is always output or only when the base system is radio synchronous.

Parameter Byte 02 Bit 1	Output mode
1	Output only when the base system is radio synchronous
0	Output on valid base system time

5.23.1.3 Time Base

The selection of the time base for the structure of the DCF77 telegram takes place with bit 0 of parameter byte 2. Selection can be made between UTC and local time.

Parameter Byte 02 Bit 0	Time base
1	Local time output
0	UTC time output

5.23.2 Structure

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

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

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

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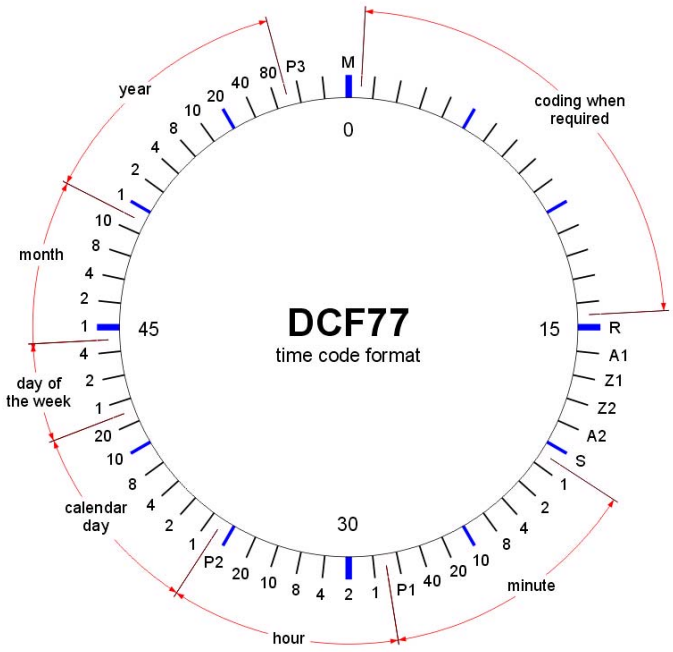
The time data string is divided into 3 different groups, each followed by a parity check:

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

The binary ones of a group are determined and increased to an even number by the parity bit.

When a valid time information (CEST) is transmitted the 17th second marker takes 200ms. One hour before the change overs from CEST to CET or vice versa the 16th second marker takes 200ms.

The coding is shown below:



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

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

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5.24 NMEA (GPRMC)

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

5.24.1 Specified Settings

The settings will be done automatically on the board:

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

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

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5.24.2 Structure

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

All information will be transmitted as ASCII characters.

The checksum will be calculated from the XOR function of all transmitted ASCII characters between **$** and *.

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

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5.24.3 Status

No status contained in data string NMEA GPRMC.

5.24.4 Example

$GPRMC,101640.00,A,,,,,,150904,,*03 (CR)(LF)

- It is the 15.09.2004
- 10:16:40 o'clock and 00 hundredth seconds
- checksum 03

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5.25 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

5.25.1 Specified Settings

The following parameter have been fixed for the data transmission

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

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

5.25.2 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

5.25.3 Status

No status contained in data string NMEA ZDA.

5.25.4 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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5.26 DA55

Below the DA55-String is described.

5.26.1 Specified Settings

The following settings must be done on the board:

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

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

5.26.2 Structure

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

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5.26.3 Status

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

Both status characters are transmitted in ASCII and consist of 7 bit (Hex 37 ⇨ Bin 0110111). For ASCII-coding bits 6, 5, 4 are fixed to "Hex 3 ⇨ Bin 001". Bits 3, 2, 1, 0 can be seen in the status table below:

Status 1. character:

B3		Meaning
1		announcement of leap second
0		no announcement of leap second
B2	**B1**	**Meaning**
1	0	standard- or wintertime
0	1	daylight saving time
B0		**Meaning**
1		announcement of WT/ST/WT change over
0		announcement of WT/ST/WT change over

Status 2. character:

B3	Meaning
1	battery voltage too low, is **always set to 0**
0	battery voltage is fine
B2	**Meaning**
1	there is no valid time nor reception
0	this value is set by the first successful reception
B1	**Meaning**
1	clock is radio synchronous
0	clock is not radio synchronous
B0	**Meaning**
1	there is a valid time
0	there is no valid time

5.26.4 Example

123456705120443(CR)

- It is Sunday 05.12.2004 - 12:34:56 o'clock
- standard time
- no announcement of leap second
- no announcement of ST/WT change over
- system has a valid time an is radio synchronous

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5.27 *hopf* Net Time A

Below the ***hopf*** Net Time A String is described.

Output only possible in combination with board 7515RC!

5.27.1 Specified Settings

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**.

Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Board number in System 7001RC
0	0	0	0	1	1
0	0	0	1	0	2
0	0	0	1	1	3
0	0	1	0	0	4
0	0	1	0	1	5
0	0	1	1	0	6
0	0	1	1	1	7
0	1	0	0	0	8
0	1	0	0	1	9
0	1	0	1	0	10
0	1	0	1	1	11
0	1	1	0	0	12
0	1	1	0	1	13
0	1	1	1	0	14
0	1	1	1	1	15
1	0	0	0	0	16
1	0	0	0	1	17
1	0	0	1	0	18
1	0	0	1	1	19
1	0	1	0	0	20
1	0	1	0	1	21
1	0	1	1	0	22
1	0	1	1	1	23
1	1	0	0	0	24
1	1	0	0	1	25
1	1	0	1	0	26
1	1	0	1	1	27
1	1	1	0	0	28
1	1	1	0	1	29
1	1	1	1	0	30
1	1	1	1	1	31

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5.27.2 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	$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	$30-35
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
17	LF (line feed)	$0A
18	tens frequency	$30-39
19	unit frequency	$30-39
20	1/10 frequency	$30-39
21	1/100 frequency	$30-39
22	1/1000 frequency	$30-39
23	CR (carriage return)	$0D
24	LF (line feed)	$0A
25	tens hour Net time	$30-32
26	unit hour Net time	$30-39
27	tens minute Net time	$30-35
28	unit minute Net time	$30-39
29	tens second Net time	$30-35
30	unit second Net time	$30-39
31	CR (carriage return)	$0D
32	LF (line feed)	$0A
33	sign	$30-31
34	unit hour difference time	$30-39
35	tens minute difference time	$30-35
36	unit minute difference time	$30-39
37	tens second difference time	$30-35
38	unit second difference time	$30-39
39	1/10 difference time	$30-39
40	1/100 difference time	$30-39
41	1/1000 difference time	$30-39
42	CR (carriage return)	$0D
43	LF (line feed)	$0A
44	ETX (end of text)	$03

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The difference time 'system time' - 'Net time' can be either positive or negative. The character no. 33 "sign" in the hour byte indicates whether the value is positive or negative:

Character no. 33 "sign"	Difference time
1	negative
0	positive

The difference time is limited to 00:59:59.999.

5.27.3 Status

The second and the third ASCII characters contain the status and the day of the week. The status is decoded binaurally.

	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	wintertime (WT)
	x	x	1	x	summertime (ST)
	0	0	x	x	time/date invalid
	0	1	x	x	crystal operation
	1	0	x	x	radio operation
	1	1	x	x	radio operation (high accuracy)
Day of the Week	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

5.27.4 Example

(STX)C3123456030196(CR)(LF)49998(CR)(LF)123456(CR)(LF)100000123(CR)(LF)(ETX)

negative difference

- It is Wednesday 03.01.96 - 12:34:56 o'clock
- radio operation (high accuracy)
- wintertime
- no announcement ST/WT change over
- actual frequency = 49,998 Hz
- Net time = 12:34:56
- difference time (system-Net time) = -123 milliseconds
- ( ) ASCII-control characters e.g. (STX)

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5.28 *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!

5.28.1 Specified Settings

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**.

Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Board number in System 7001RC
0	0	0	0	1	1
0	0	0	1	0	2
0	0	0	1	1	3
0	0	1	0	0	4
0	0	1	0	1	5
0	0	1	1	0	6
0	0	1	1	1	7
0	1	0	0	0	8
0	1	0	0	1	9
0	1	0	1	0	10
0	1	0	1	1	11
0	1	1	0	0	12
0	1	1	0	1	13
0	1	1	1	0	14
0	1	1	1	1	15
1	0	0	0	0	16
1	0	0	0	1	17
1	0	0	1	0	18
1	0	0	1	1	19
1	0	1	0	0	20
1	0	1	0	1	21
1	0	1	1	0	22
1	0	1	1	1	23
1	1	0	0	0	24
1	1	0	0	1	25
1	1	0	1	0	26
1	1	0	1	1	27
1	1	1	0	0	28
1	1	1	0	1	29
1	1	1	1	0	30
1	1	1	1	1	31

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5.28.2 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
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.

5.28.3 Status

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

5.28.4 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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5.29 *hopf* Multi Frequency A / KIA

Below the ***hopf*** Multi frequency A string is described.

Output only possible in combination with board 7515RC!

The net frequencies of the board 7515RC **1-9** can be put out by the data string ***hopf*** Multi frequency A / KIA.
Boards with higher numbers are ignored by the output.

5.29.1 Specified Settings

The setting of mode byte 04 is omitted, because the data string KIA contains **all** available frequencies.

5.29.2 Structure

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	“S“ ASCII S (ident. system time/date)	$53
3	Status (high nibble)	$30-39, $41-46
4	Status (low nibble)	$30-39, $41-46
5	tens hour	$30-32
6	unit hour	$30-39
7	tens minute	$30-35
8	unit minute	$30-39
9	tens second	$30-35
10	unit second	$30-39
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	LF (line feed)	$0A
18	CR (carriage return)	$0D
Depending on connected boards 7515RC the string (character 19-28) will be repeated up to 9 times:		
19	“F“ ident. frequency	$46
20	mains no.	$31-39
21	tens frequency	$30-39
22	unit frequency	$30-39
23	“.“ point	$2E
24	1/10 frequency	$30-39
25	1/100 frequency	$30-39
26	1/1000 frequency	$30-39
27	LF (line feed)	$0A
28	CR (carriage return)	$0D
last character	ETX (end of text)	$03

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5.29.3 Status

High nibble: B7-B4

Low nibble: B3-B0

B7	B6	System time
0	0	invalid
0	1	crystal operation
1	0	radio operation
1	1	radio operation (high accuracy)
B5		**Leap second**
1		announcement of leap second
0		no announcement of leap second
B4	**B3**	**Daylight Saving Time / Standard Time**
1	0	standard time
0	1	daylight saving time
B2		**ST/WT Change over**
1		announcement of ST/WT change over
0		no announcement of ST/WT change over
B1		**Control of Leap second**
1		leap second has been done at the last hour
0		leap second hasn't been done at the last hour
B0		**Control of ST/WT Change over**
1		ST/WT change over has been done at the last hour
0		ST/WT change over hasn't been done at the last hour

5.29.4 Example

(STX)SC8123456180904(LF)(CR)F150.021(LF)(CR)(ETX)

- It is the 18.09.2004 - 12:34:56 o'clock
- radio operating (high accuracy)
- summer time
- no announcement of leap second
- no announcement of ST/WT change over
- no leap second has been done in the last hour
- no ST/WT change over has been done in the last hour
- measuring value: 50.021Hz
  (measured by board no. 1 of 7515RC)

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5.30 *hopf* Multi Frequency B

The ***hopf*** Multi frequency B string puts out the net frequencies and net difference time of all implemented net frequency boards 7515RC in the system 7001RC. The string is build up and sent immediately after filtering from the internal data bus.

This string contains:

- the ID of the board 7515RC
- the respective measured net frequencies
- the difference time, build up by the net frequency clock and the system clock.

Output only possible in combination with board 7515RC!

5.30.1 Specified Settings

The baud rate is fixed to 9600 baud.

5.30.2 Structure

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	tens ID number of board 7515RC	$30-33
3	unit ID number of board 7515RC	$30-39
4	“,“ comma	$2C
5	tens frequency	$30-39
6	unit frequency	$30-39
7	tenth frequency	$30-39
8	hundredth frequency	$30-39
9	thousandth frequency	$30-39
10	“,“ comma	$2C
11	+/- difference time sign	$2B/2D
12	tens second difference time	$30-39
13	unit second difference time	$30-39
14	tenth second difference time	$30-39
15	hundredth second difference time	$30-39
16	thousandth second difference time	$30-39
17	“*“ separator	$2A
18	tens checksum	$30-39
19	unit checksum	$30-39
20	CR (carriage return)	$0D
21	LF (line feed)	$0A
22	ETX (end of text)	$03

The checksum will be calculated from the XOR function of all transmitted ASCII characters between "STX" and character no. 17 "*****" (excluded). The calculated checksum will be transmitted in ASCII in the characters no. 18 and 19.

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5.30.3 Status

No status contained in the ***hopf*** Multi Frequency B string.

5.30.4 Example

(STX)03,50230,+08236*23(CR)(LF)(ETX)

- 7515RC board no. 03
- frequency = 50,230 Hz
- difference time = +08,236 seconds
- checksum = 23

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5.31 SICOMP-70-MX

Below the serial data string SICOMP-70-MX is described.

5.31.1 Specified Settings

The following parameters are chosen for the data string SICOMP-70-MX:

- Output at minute change (59th second)
- Output with second advance
- Output with control character
- Output CR/LF

5.31.2 Structure

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	Status (1. character)	$00, $01, $7F
3	Status (2. character)	$30-33
4	Day of the week (1=Monday ... 7=Sunday / 0=invalid time)	$31-37
5	tens year	$30-39
6	unit year	$30-39
7	tens month	$30-31
8	unit month	$30-39
9	tens day	$30-33
10	unit day	$30-39
11	tens hour	$30-32
12	unit hour	$30-39
13	tens minute	$30-35
14	unit minute	$30-39
15	tens second	$30-35
16	unit second	$30-39
17	CR (carriage return)	$0D
18	LF (line feed	$0A
19	ETX (end of text)	$03
20	redundancy check by DIN66219	$00-7F

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5.31.3 Redundancy Check Character

The redundancy check character is composed of a XOR calculation from character no. 2 (Status 1) up to character no. 19 (<ETX>). Afterwards the redundancy check character is carried forward in character no. 20 and binary evaluated.

5.31.4 Status

1. Character:

Status 1 in ASCII	Meaning
<DEL>	**Output whenever the external radio signal fails (or is disturbed).** (System Status crystal operation respectively time/date invalid)
<NUL>	**no changeover** (output only when status radio synchronous)
<SOH>	**Advance notice of changeover on the hour** (output only when status radio synchronous)

2. Character:

Status 2 in ASCII	Meaning
0	**CET**
1	**CEST A (first hour 02-03 o'clock)** hour before ST⇨WT changeover (announcement bit is active)
2	**CEST B (second hour 02-03 o'clock)** hour after ST⇨WT changeover (twice-transisted hour)
3	**CEST**

5.31.5 Example

(STX)(NUL)04070322162500(CR)(LF)(ETX)(ACK)

- radio operation
- no announcement of ST-WT changeover
- winter time (CET)
- it is Thursday 22.03.2007 - 16:25:00 o'clock
- with binary redundancy check $06 = ASCII (ACK)

Displayed in ASCII
( ) ASCII control character e.g. (STX) = binary $02

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5.32 H&B Contronic P (PCZ77)

Below the data string Contronic P (PCZ77) is described.

5.32.1 Specified Settings

No specified setting for this data string is necessary.

5.32.2 H&B Contronic P (PCZ77) - Structure

Character No.	Meaning	Hex-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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5.32.3 Status

	b3	b2	b1	b0	meaning
Status nibble:	x	x	x	0	radio operation
	x	x	x	1	crystal operation
	x	x	1	x	announcement (WT-ST-WT)
	x	x	0	x	no announcement (WT-ST-WT)
	0	0	x	x	MEZ (UTC + 1h)
	0	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

5.32.4 Example

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

- It is Wednesday the 06.11.02 - 12:34:36h
- radio operation
- standard time
- no announcement of ST-WT changeover

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5.33 SAT 1703 Time String

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

5.33.1 Specified Settings

No specified setting for this data string is necessary.

5.33.2 SAT 1703 Time String - Structure

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

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5.33.3 Status

Character no.		Meaning
21... 24	MEZ	Central European Time (Standard Time / Wintertime)
	MESZ	Central European Summertime (Daylight Saving Time)
	UTC	Coordinated Universal Time
25	"*"	Time not radio controlled
	" " (Space)	Time radio controlled
26	" " (Space)	No announcement
	"!"	Announcement of (WT-ST-WT) changeover

5.33.4 Example

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

- It is Thursday 18.07.2002 - 02:34:45h in UTC
- The clock is radio controlled
- No announcement of ST-WT changeover

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5.34 SINEC H1 Extended

The data string SINEC H1 Extended can 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 **"?"**.

5.34.1 SINEC H1 Extended - 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", "U" or space	$53 / $55 / $20
31	"!", "A" or space	$21 / $41 / $20
32	ETX (end of text)	$03

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5.34.1.1 Status

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

Character no.		Meaning
28	#	Time invalid
	" " (Space)	Time valid (clock in crystal operation)
29	"*"	Clock in crystal operation
	" " (Space)	Clock in radio operation
30	"S"	Daylight saving time (ST)
	" " (Space)	Standard time (WT)
	"U"	UTC
31	"!"	Announcement of (ST-WT-ST) changeover
	"A"	Announcement of a leap second
	" " (Space)	No announcement of a leap second

5.34.1.2 Example of a transmitted Data String

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

- It is Wednesday 03.01.96 - 12:34:56h
- The clock is radio controlled
- Standard time
- No announcement of ST-WT changeover

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5.35 MODBUS String

The MODBUS string output is implemented in the **RTU Transmission Mode**.

5.35.1 Specified Settings

Sending **ETX at second change** with **second advance** is not supported by the **MODBUS string output**.

Configuring the **parity** it is necessary to check the number of **stop bits** and adjust as follow:

Parity	Stop bits
odd / even	1
no	2

5.35.2 MODBUS String - Structure

Character No.	Meaning	Decimal Value	Hex-Value
1	Address Slave (Broadcast)	00	$00
2	Mode/Status	70	$46
3	Byte-Count	08	$08
4	Milliseconds (ms Low Byte)	00-99	$00 - 63
5	Deci-seconds (ms High Byte)	00-09	$00 - 09
6	Seconds	00-59, (60)	$00 - 3B, (3C)
7	Minutes	00-59	$00 - 3B
8	Hours	00-23	$00 - 17
9	Day	01-31	$01 - 1F
10	Month	01-12	$01 - 0C
11	Year	00-99	$00 - 63
12	CRC (Checksum, Low Byte)	00-255	$00 - FF
13	CRC (Checksum, High Byte)	00-255	$00 - FF

5.35.3 Example

13 characters is the length of the data string. The values are transmitted binaurally:

00460801001B2C0F020A0735B8

- Date: 02.10.07
- Time: 15:44:27,001h
- CRC - Checksum: $B835

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5.36 DCF - BKW String

5.36.1 Specified Settings

No specified setting for this data string is necessary.

5.36.2 DCF - BKW String - Structure

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 hours	$30-32
9	unit hours	$30-39
10	tens minute	$30-35
11	unit minutes	$30-39
12	tens second	$30-35
13	unit second	$30-39
14	unit day of the week	$31-37
15	CR (carriage return)	$0D
16	LF (line feed)	$0A
17	ETX (end of text)	$03

5.36.3 Example

(STX)0906261109005(CR)(LF)(ETX)

- Date: 2009-06-26 (June, 26th 2009)
- Time: 11:09:00
- Day of the week: 05 (Friday)

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6 Technical Data

6.1 7201RC

General	
Measurements:	Eurocard 160 x 100 mm (3U / 4HP)
MTBF:	> 600,000 hours
Weight:	Approx. 0.3kg

Environment Conditions		
Temperature:	Operating:	0°C ... +55°C
	Storage:	-20°C ... +75°C
Humidity:		Max. 95%, not condensed

Operating Voltage	
Internal system voltage:	5V DC ± 5% (via system bus)
Typical / max. power consumption:	1.5VA / 2VA

Signal Outputs			
Serial full-duplex interfaces (without handshake)	Via 25-pole SUB-D female connector (**X1**) • RS232 / RS422 / TTY - passive		
Accuracy: **ETX** at second change (Start from **ETX** [rising edge])	**Baud rate** (...,8,N,1)	**Offset**	**Jitter**
	150 Baud	+ 7.74ms	± 3.00ms
	300 Baud	+ 3.40ms	± 1.70ms
	600 Baud	+ 1.76ms	± 0.80ms
	1200 Baud	+ 0.92ms	± 0.43ms
	2400 Baud	+ 0.49ms	± 0.21ms
	4800 Baud	+ 0.29ms	± 0.11ms
	9600 Baud	+ 0.18ms	± 0.05ms
	19200 Baud	+ 0.13ms	± 0.03ms

A max. baud rate of 4800 baud is recommended for using the TTY passive interface.

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6.2 7221RC

General	
Measurements:	Eurocard 160 x 100 mm (3U / 16HP)
MTBF:	> 450,000 hours
Weight:	Approx. 0.4kg

Environment Conditions		
Temperature:	Operating:	0°C ... +55°C
	Storage:	-20°C ... +75°C
Humidity:		Max. 95%, not condensed

Operating Voltage	
Internal system voltage:	5V DC ± 5% (via system bus)
Typical / max. power consumption:	2.2VA / 2.5VA

Signal Outputs			
Serial full-duplex interfaces (without handshake)	via 9-pole SUB-D female connector (**0...7**) • RS232 / RS422		
Accuracy: **ETX** at second change (Start from **ETX** [rising edge])	**Baud rate** (...,8,N,1)	**Offset**	**Jitter**
	150 Baud	+ 7.74ms	± 3.00ms
	300 Baud	+ 3.40ms	± 1.70ms
	600 Baud	+ 1.76ms	± 0.80ms
	1200 Baud	+ 0.92ms	± 0.43ms
	2400 Baud	+ 0.49ms	± 0.21ms
	4800 Baud	+ 0.29ms	± 0.11ms
	9600 Baud	+ 0.18ms	± 0.05ms
	19200 Baud	+ 0.13ms	± 0.03ms

A max. baud rate of 4800 baud is recommended for using the TTY passive interface.

Hardware and software can be modified on request to meet specific customer requirements.

The ***hopf*** Company reserves the right to modify hardware and software at any time.

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