Industriefunkuhren

hopf Elektronik GmbH

Technical Manual

Generator Module for Serial String Output

Model 7639

ENGLISH

Version: 02.00 – 12.12.2017

hopf Elektronik GmbH
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Version number (Firmware / Manual)

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

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

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Symbols and Characters

Operational Reliability

Disregard may cause damages to persons or material.

Functionality

Disregard may impact function of system/device.

Information

Notes and Information.

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Safety regulations

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

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

Safety of the device

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

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

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

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

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

If there are reasons to believe that the operational safety can no longer be guaranteed the device must be taken out of service and labelled accordingly.

The safety may be impaired when the device does not operate properly or if it is obviously damaged.

CE-Conformity

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

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

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

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1 General

The ***hopf*** Module 7639 is a compact generator module for serial string output for the integration into Clock Systems and signal converters. This module converts a system/module internally fed time information into a highly-precise serial data string output. Via 9-pole SUB-D male plug the chosen time string in the interface standards below is available by default:

- RS232
- RS422

Potential separation of the signal output is optionally available ex works.

The required serial data string can be chosen from pre-programmed data strings. Operation of module 7639 is made via **DIP switch** and can be controlled via **remote connection** by using appropriate applications (remote functionality currently not implemented).

A variety of parameters is available for individual adjustment of interface parameters and data string parameters:

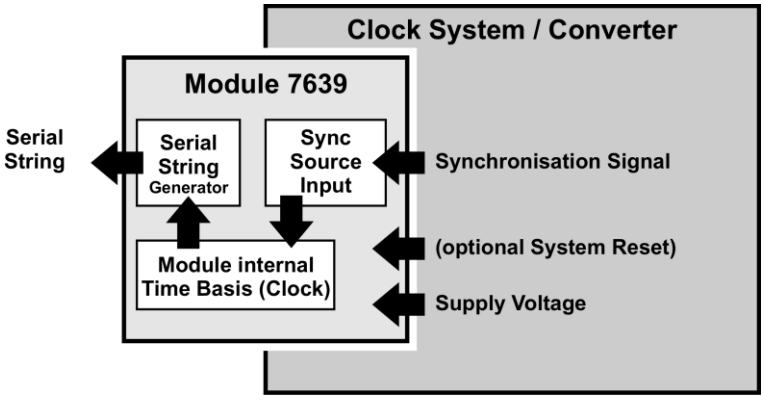
- Baud rate: 300 - 115200 Baud
- Data bits: 7 / 8
- Stop bits: 1 / 2
- Parity bit: No / Odd / Even
- Data string to be issued
- Transmission time: second / minute / hour / on request
- Time base: local time (e.g. CET / CEST), standard time (e.g. CET) and UTC time

Module 7639 has only *one* logical interface issued in various physical formats via SUB-D plug.

Thus, only **one** output data string can be selected in module 7639.

The particular status of module 7639 will be displayed via 2 respectively 3 LEDs (depending on module version) at the front panel. The LEDs enable to recognize visually a successful / interfered synchronization as well as the activity of the 2 signal outputs.

Functional Principle:



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2 Connection Elements of the Module 7639

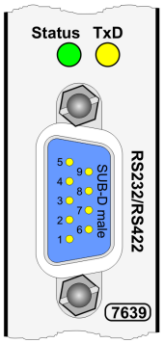
In this chapter you can find the description of connecting elements and LED elements of module 7639.

Connection of power supply and the supply of the synchronization signal are done system-internally.

2.1 Example of Front panels

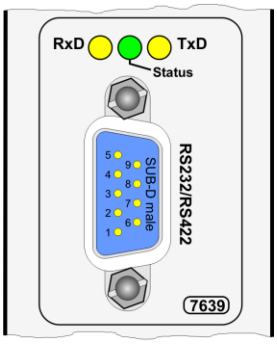
Example 1: module cover with 2 LEDs – TxD/Status

Extract 3U cover with module version 2 LEDs



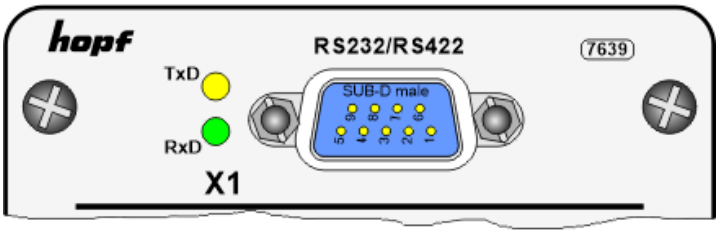
Example 2: module cover with 3 LEDs – RxD/Status/TxD

Extract DIN rail cover with module version 3 LEDs



Example 3: module cover with 2 LEDs – TxD/Status:

Extract 80xxHEPTA cover with module version 2 LEDs



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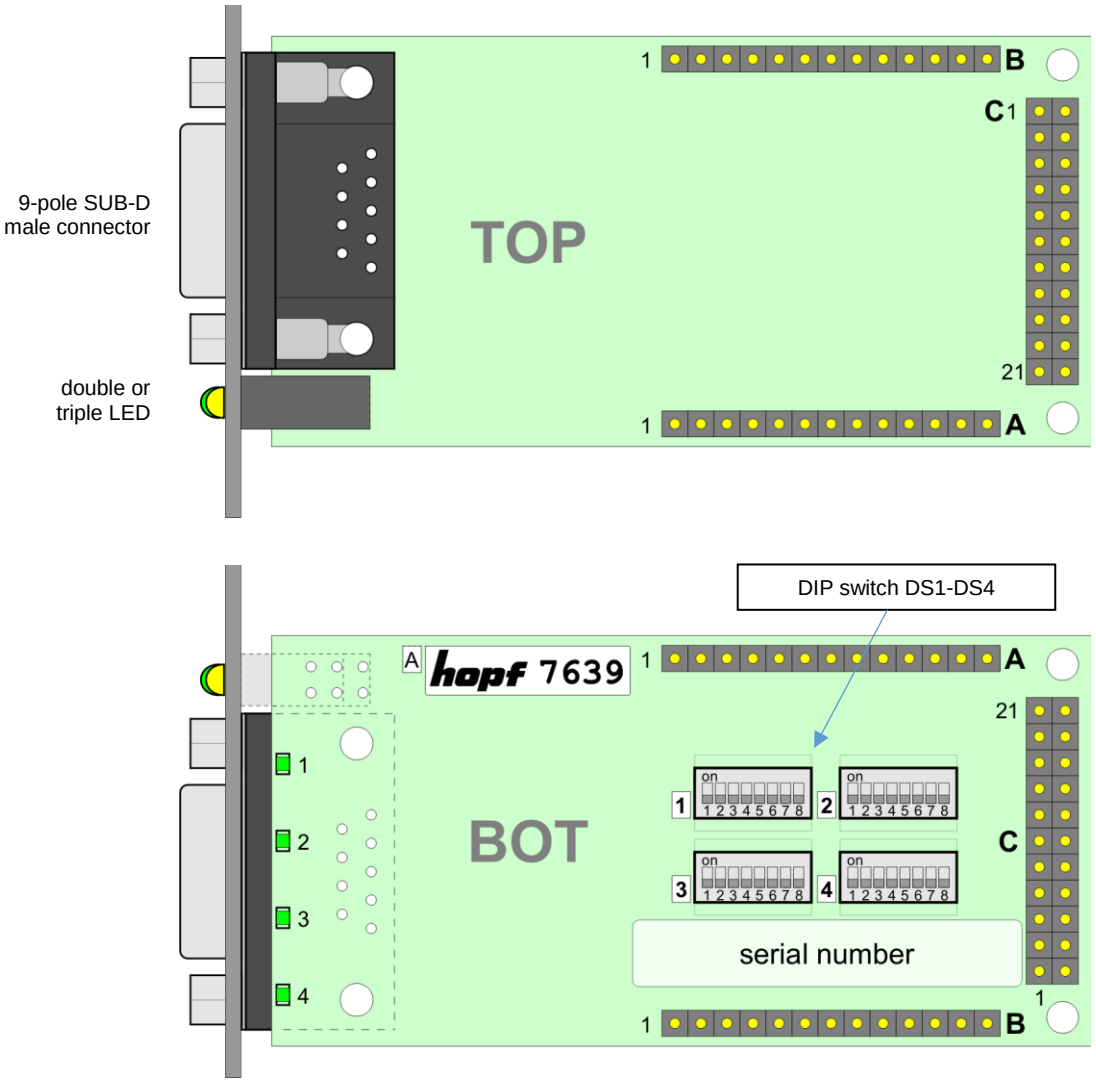
2.2 Components Overview of Module 7639

This chapter describes the arrangement of the module components.



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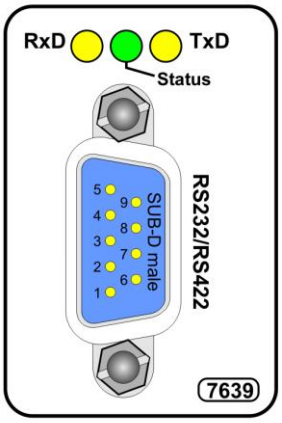
2.3 Description of the Front Panel Elements

Assignment of the 9-pole SUB-D male connector.



Serial-Remote	
LED	**double / triple LED**
RxD	LED gn/ye - reception of serial data
Status	LED green - Sync.-Status
TxD	LED yellow - transmission of serial data
9-pole SUB-D connector	
Pin	**Signal**
1	n.c.
2	RS232c RXD (receive data)
3	RS232c TXD (transmit data)
4	Switching service interface
5	GND
6	RS422 +TxD (high avtive)
7	RS422 -TxD (low avtive)
8	RS422 +RxD (high active)
9	RS422 –RxD (low active)

n.c. = not connected

Pin 4 of the SUB-D plug is currently not in use and **must** remain free!

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2.4 Function of Front Panel LEDs

Depending on the application, the 7639 module is available in different versions (with 2 LEDs or optionally with 3 LEDs).

2.4.1 Module Front Panel with 2 LEDs

TxD - LED yellow	**TxD - meaning**
ON	Transmission serial data
OFF	No activity
RxD - LED green	**RxD - meaning**
ON	Receiving serial data
OFF	No activity

Respectively

TxD - LED yellow	**TxD - meaning**	
ON	Transmission serial data	
OFF	No activity	
Status - LED green	**Status - meaning**	**Status-symbol**
ON	**Sync** (radio-synchronous) with quartz regulation	**SYNC**
Flashes 900ms	**Sync** (radio-synchronous) - SyncOFF timer running	**SYOF**
Flashes 500ms	**Sync** (radio-synchronous) - simulation mode	**SYSI**
Flashes 500ms	**Quartz** - SyncON timer running	**QUON**
Flashes 500ms	**Quartz** - time was set via synchronization source	**QUEX**
Flashes 500ms	**Quartz** - time set manually or after reset	**QUSE**
Flashes 100ms	**No valid time**	**INVA**
OFF	No operating voltage / faulty	---

2.4.2 Module Front Panel with 3 LEDs

TxD - LED yellow	**TxD - meaning**	
ON	Transmission serial data	
OFF	No activity	
Status - LED green	**Status - meaning**	**Status-symbol**
ON	**Sync** (radio-synchronous) with quartz regulation	**SYNC**
Flashes 900ms	**Sync** (radio-synchronous) - SyncOFF timer running	**SYOF**
Flashes 500ms	**Sync** (radio-synchronous) – simulation mode	**SYSI**
Flashes 500ms	**Quartz** - SyncON timer running	**QUON**
Flashes 500ms	**Quartz** - time was set via synchronization source	**QUEX**
Flashes 500ms	**Quartz** - time set manually or after reset	**QUSE**
Flashes 100ms	**No valid time**	**INVA**
OFF	No operating voltage / faulty	---
RxD - LED yellow	**RxD - meaning**	
ON	Receiving serial Data	
OFF	No activity	

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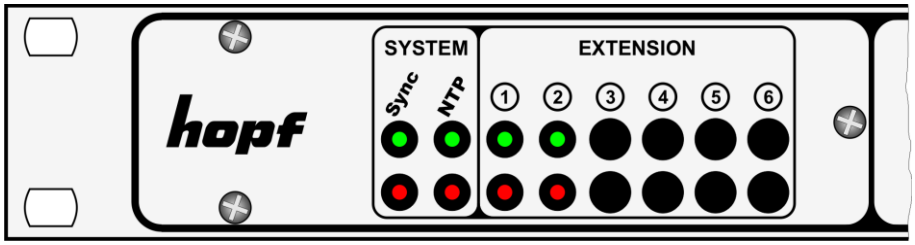
2.4.3 System Front Panel in case of using the Module in 1U Time Server 80xxHEPTA

In 1U Time Server 80xxHEPTA module 7639 additionally indicates its current synchronization status via a pair of extension status LEDs 1-6 on the HEPTA front panel.



The meanings of the LEDs are as follows:

LED RD - Red	LED GN - Green	Status
OFF	ON	**Sync** (radio-synchronous) with quartz regulation
OFF	Flashes	**Sync** (radio-synchronous) - SyncOFF timer running
Flashes	ON	**Sync** (radio-synchronous) - simulation mode
Flashes	Flashes	**Quarz** - SyncON timer running
ON	ON	**Quarz** - time was set via synchronization source
ON	Flashes	**Quarz** - time set manually or after reset
ON	**OFF**	**No valid time**
3Hz	**OFF**	**General Module Error (PCID)**
OFF	**OFF**	**No operating voltage / faulty**

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3 Commissioning

After the parameterization of the module (via DIP switch) has been completed commissioning is carried out by switching-on the basis system or rather the converter.

4 Configuration of the Module

The used synchronization signal and the signal output at the connecting elements need to be configured according to the appropriate application.

Attention: Never work on the open unit when voltage is applied! Danger to life!

ESD The system contains ESD-sensitive components, briefly when touching these elements ESD safety measures needs to be observed.

Using the module in ***hopf*** basis systems the relevant settings are usually carried out at the factory.

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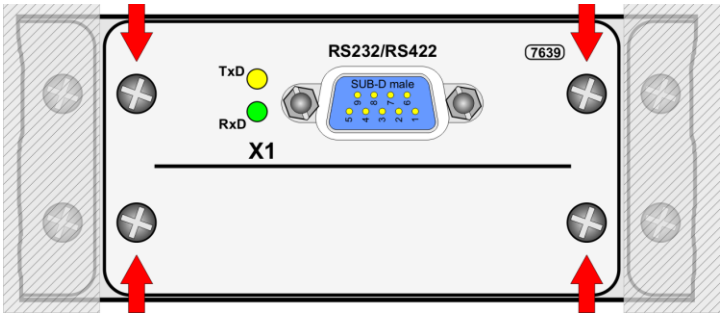
4.1 Access to the Module

For the configuration of the module it needs to be pulled out of the appropriate ***hopf*** basis system / converter and the following steps are to be accomplished:

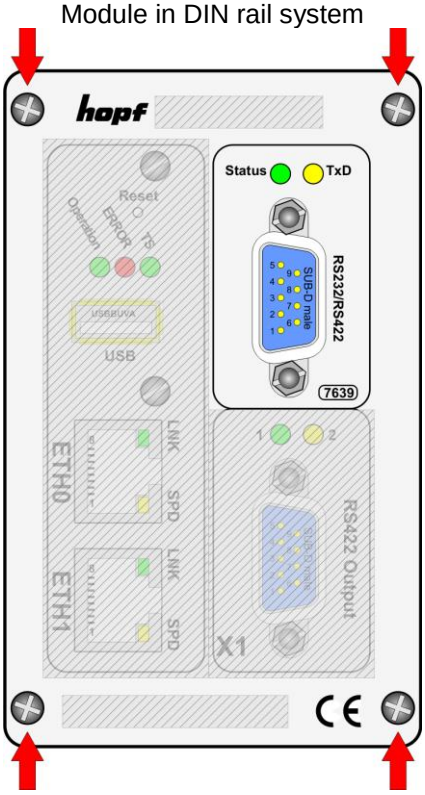
1. Switch-OFF and disconnect the device
2. Loosen the fixing screws of the appropriate module front panel

Module in 3U System

Module in 1U Time Server



Module in DIN rail system



3. Pull the panel with the Module carefully out of the housing. Ensure that no internal connecting cables are severed or get damaged.
4. Configure the component via DIP switch
5. Afterwards insert the component carefully into the housing by considering the connecting cable.
6. Fix the front panel with the screws.

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4.2 DIP switch DS1-DS4

The module configuration can be setup via DIP switch DS1-DS4.

The DIP Switch should only be adjusted carefully with an appropriate tool in order to avoid damage to the switch.

4.2.1 DIP switch DS1 - interface parameter

The standard interface parameters are set via the DIP switch DS1.

4.2.1.1 Setup baud rate

DS1 switch 8	DS1 switch 3	DS1 switch 2	DS1 switch 1	baud rate
OFF	OFF	OFF	OFF	9600 baud
OFF	OFF	OFF	ON	1200 baud
OFF	OFF	ON	OFF	4800 baud
OFF	OFF	ON	ON	9600 baud
OFF	ON	OFF	OFF	19200 baud
OFF	ON	OFF	ON	38400 baud
OFF	ON	ON	OFF	57600 baud
OFF	ON	ON	ON	115200 baud
ON	OFF	OFF	OFF	300 baud
ON	OFF	OFF	ON	600 baud
ON	OFF	ON	OFF	2400 baud
ON	OFF	ON	ON	**Free** currently 9600 baud
ON	ON	OFF	OFF	**Free** currently 9600 baud
ON	ON	OFF	ON	**Free** currently 9600 baud
ON	ON	ON	OFF	**Free** currently 9600 baud
ON	ON	ON	ON	**Free** currently 9600 baud

4.2.1.2 Setup word length

DS1 switch 7	meaning	
OFF	8 data bit	standard
ON	7 data bit	

4.2.1.3 Setup parity mode

DS1 switch 6	DS1 switch 5	meaning	
OFF	OFF	no parity	standard
OFF	ON	no parity	
ON	OFF	parity even	
ON	ON	parity odd	

4.2.1.4 Setup stop bits

SW1 switch 4	meaning	
OFF	1 stop bit	Standard
ON	2 stop bits	

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4.2.2 DIP switch DS2 - Setup data string

4.2.2.1 Output local time, standard time or UTC

Usually, the local time is set as time base for output. This time is going to be adjusted by one hour in case of switching from summer time to winter time and vice versa. In case of standard or UTC time base no time adjustments will take place by activating summer time.

DS2 switch 8	DS2 switch 7	meaning	
OFF	OFF	Local time	Standard
OFF	ON	Standard time	
ON	OFF	UTC	
ON	ON	Local time	

standard time (= winter time) ⇨ UTC + difference time from sync-signal
local time (summer time not active) ⇨ UTC + difference time from sync-signal
local time (summer time active) ⇨ UTC + difference time from sync-signal +1h

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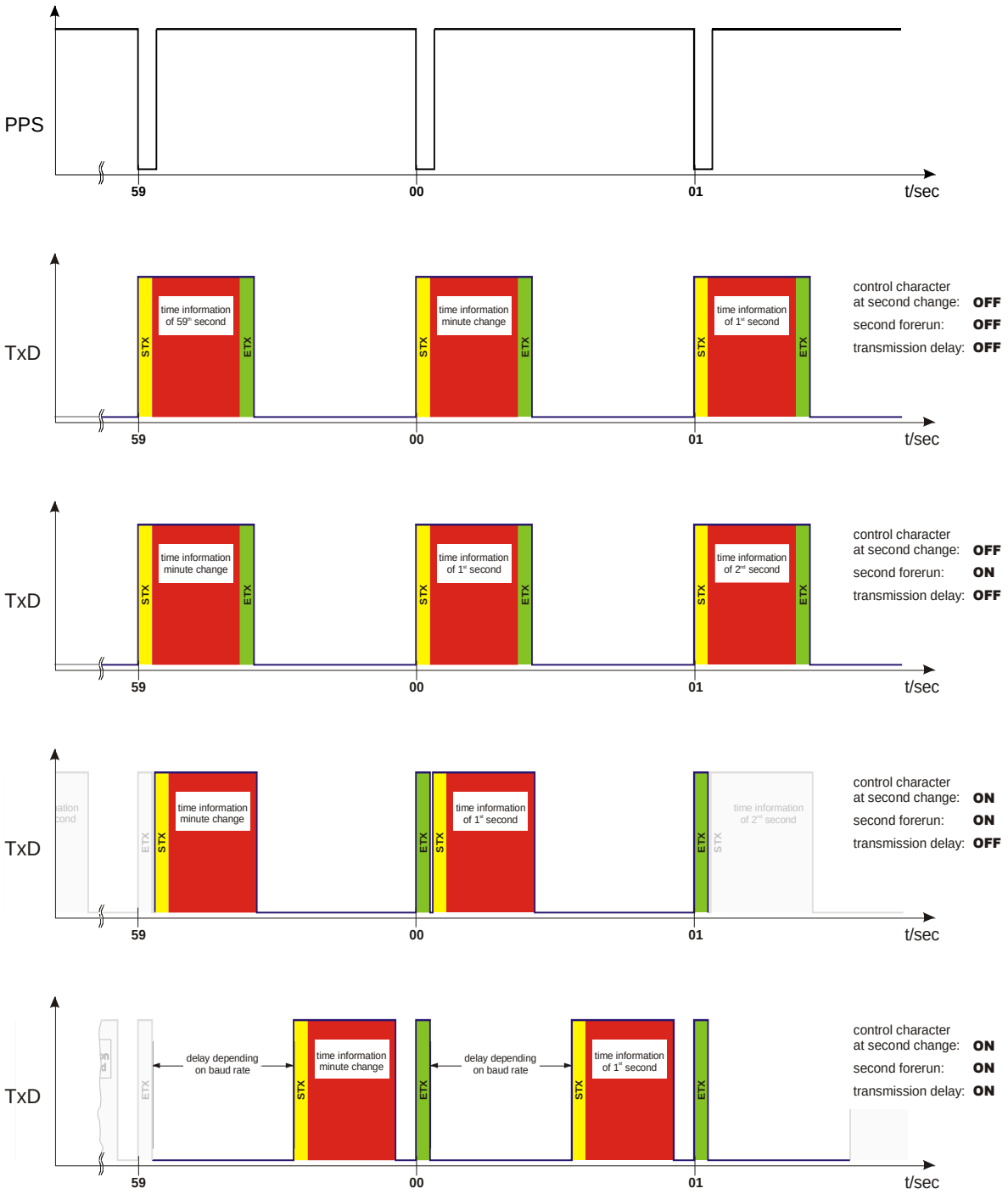
4.2.2.2 Data String Transmission Points of Time

DS2 switch 4	DS2 switch 3	forerun	ETX	Transmission delay	
OFF	OFF	Off	immediately	Off	Standard
OFF	ON	On	immediately	Off	
ON	OFF	On	at second change	Off	
ON	ON	On	at second change	On	



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4.2.2.3 Transmission cycle (every second / minute / hour / on request)

DS2 switch 2	DS2 switch 1	Transmission point	
OFF	OFF	Every second	Standard
OFF	ON	Transmission at minute change	
ON	OFF	Transmission at hour change	
ON	ON	Transmission on request	

4.2.3 DIP switch DS3 - data string configuration

Data string-Block A (DIP switch **DS3 SW 6-8** = OFF)					
DIP-Switch DS3					
SW5	**SW4**	**SW3**	**SW2**	**SW1**	**Data string**
OFF	OFF	OFF	OFF	OFF	***hopf*** Standard string 6021
OFF	OFF	OFF	OFF	ON	***hopf*** String 6021 CR/LF
OFF	OFF	OFF	ON	OFF	SINEC H1 Extended
OFF	OFF	OFF	ON	ON	SAT1703 Time String
OFF	OFF	ON	OFF	OFF	***hopf*** Master/Slave-String
OFF	OFF	ON	OFF	ON	IEC-103 (ASDU Type 6)
OFF	OFF	ON	ON	OFF	5050 H&B (PCZ 77)
OFF	OFF	ON	ON	ON	ION 7550
OFF	ON	OFF	OFF	OFF	Trimble Time String (TSIP)
OFF	ON	OFF	OFF	ON	**Free** currently ***hopf*** Standard string 6021
OFF	ON	OFF	ON	OFF	**Free** currently ***hopf*** Standard string 6021
OFF	ON	OFF	ON	ON	**Free** currently ***hopf*** Standard string 6021
OFF	ON	ON	OFF	OFF	**Free** currently ***hopf*** Standard string 6021
OFF	ON	ON	OFF	ON	**Free** currently ***hopf*** Standard string 6021
OFF	ON	ON	ON	OFF	**Free** currently ***hopf*** Standard string 6021
OFF	ON	ON	ON	ON	**Free** currently ***hopf*** Standard string 6021
ON	OFF	OFF	OFF	OFF	**Free** currently ***hopf*** Standard string 6021
ON	OFF	OFF	OFF	ON	**Free** currently ***hopf*** Standard string 6021
ON	OFF	OFF	ON	OFF	**Free** currently ***hopf*** Standard string 6021
ON	OFF	OFF	ON	ON	**Free** currently ***hopf*** Standard string 6021
…	…	…	…	…	…
ON	ON	ON	ON	ON	**Free** currently ***hopf*** Standard string 6021

If a data string is selected which is not used in the system, the ***hopf*** **Standard string 6021** is always output

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4.2.4 DIP switch DS4 - configuration module 7639

4.2.4.1 Parameterization via DIP switch or via external remote control

DS4 switch 8	meaning	
OFF	Parameterization via DIP switch	Standard
ON	Parameterization via external remote control - only in combination with additional application (currently not implemented)	

4.2.4.2 Service mode reserved for *hopf* Elektronik GmbH

DS4 switch 7	Service mode
OFF	Reserved for ***hopf*** Elektronik GmbH, this setting cannot be changed and must always be **OFF**

4.2.4.3 Additional Configuration of special data string outputs

As required string-specific functions of these DIP switches will be described in the chapter of the related data string.

DS4 switch 6	DS4 switch 5	Point of transmission	
OFF	OFF	Switch for additional configuration of special data string outputs	Standard
OFF	ON	Switch for additional configuration of special data string outputs	
ON	OFF	Switch for additional configuration of special data string outputs	
ON	ON	Switch for additional configuration of special data string outputs	

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4.2.5 Parameterization of the Synchronization Source

Adjustment via: DS4 / SW1-SW4 - Default: No Default-Setting

The Module 7639 can be synchronized by different time information. Using these modules in ***hopf*** basis systems respectively in converters the necessary settings are performed by default (ex works).

Using the module in converter units the settings may be required by the customer.

This selection determines what kind of time information should be evaluated by the module.

DS4				Selection of Sync Source
SW4	SW3	SW2	SW1	
OFF	OFF	OFF	OFF	01: ***hopf*** Binary string with PPS (NTP configuration)
OFF	OFF	OFF	ON	**Free** currently ***hopf*** Binary string with PPS
OFF	OFF	ON	OFF	**Free** currently ***hopf*** Binary string with PPS
OFF	OFF	ON	ON	**Free** currently ***hopf*** Binary string with PPS
OFF	ON	OFF	OFF	**Free** currently ***hopf*** Binary string with PPS
OFF	ON	OFF	ON	**Free** currently ***hopf*** Binary string with PPS
OFF	ON	ON	OFF	**Free** currently ***hopf*** Binary string with PPS
OFF	ON	ON	ON	**Free** currently ***hopf*** Binary string with PPS
ON	OFF	OFF	OFF	**Free** currently ***hopf*** Binary string with PPS
ON	OFF	OFF	ON	**Free** currently ***hopf*** Binary string with PPS
ON	OFF	ON	OFF	**Free** currently ***hopf*** Binary string with PPS
ON	OFF	ON	ON	**Free** currently ***hopf*** Binary string with PPS
ON	ON	OFF	OFF	**Free** currently ***hopf*** Binary string with PPS
ON	ON	OFF	ON	**Free** currently ***hopf*** Binary string with PPS
ON	ON	ON	OFF	**Free** currently ***hopf*** Binary string with PPS
ON	ON	ON	ON	**Free** currently ***hopf*** Binary string with PPS

There is no synchronization of the Module and also no generation of the signal for the output in case of an incorrect setting.

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5 Data Strings

This Chapter describes the data strings supported by this module.

5.1 General Information about Data Output

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

Received data on the serial interface that are not specified in the pertinent data string might disturb and interrupt the cyclic string output.

Possible string-specific settings are specified for all data strings.

required:	Required string settings must be set by the customer after selection of a data string.
pre-set:	After the first selection of the string via Remote, the parameters are set as indicated.
freely adjustable:	These parameters can be set as desired.
fixed:	These parameters are set as and as long as the string is selected.

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5.2 *hopf* Standard String (6021)

Below the *hopf* Standard String is described.

5.2.1 Specified Settings

Required:	**No**
Freely adjustable:	**All**
Pre-set:	**No**

5.2.2 Structure

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	status (internal clock status)	$30-39, $41-46
3	day of the week (1=Monday ... 7=Sunday) for UTC time bit 3 is set to 1 in the day of the week	$31-37
4	tens hour	$30-32
5	unit hour	$30-39
6	tens minute	$30-35
7	unit minute	$30-39
8	tens second	$30-36
9	unit second	$30-39
10	tens day	$30-33
11	unit day	$30-39
12	tens month	$30-31
13	unit month	$30-39
14	tens year	$30-39
15	unit year	$30-39
16	LF (line feed)	$0A
17	CR (carriage return)	$0D
18	ETX (end of text)	$03

5.2.3 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 (DST changeover)
	x	x	0	x		standard time
	x	x	1	x		daylight saving time (DST)
	0	0	x	x		time / date invalid
	0	1	x	x		crystal operation
	1	0	x	x		radio operation
	1	1	x	x		radio operation (high accuracy)

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Day of the Week:	0	x	x	x		CEST / CET
	1	x	x	x		UTC - time
	x	0	0	1		Monday
	x	0	1	0		Tuesday
	x	0	1	1		Wednesday
	x	1	0	0		Thursday
	x	1	0	1		Friday
	x	1	1	0		Saturday
	x	1	1	1		Sunday

Status	operation mode	time	announcement SZ-WZ-SZ
0 = 0000	time invalid	winter	no announcement
1 = 0001	time invalid	winter	announcement
2 = 0010	time invalid	summer	no announcement
3 = 0011	time invalid	summer	announcement
4 = 0100	quartz	winter	no announcement
5 = 0101	quartz	winter	announcement
6 = 0110	quartz	summer	no announcement
7 = 0111	quartz	summer	announcement
8 = 1000	radio	winter	no announcement
9 = 1001	radio	winter	announcement
A = 1010	radio	summer	no announcement
B = 1011	radio	summer	announcement
C = 1100	radio	winter	no announcement
D = 1101	radio	winter	announcement
E = 1110	radio	summer	no announcement
F = 1111	radio	summer	announcement

5.2.4 Example

(STX)E4123456180517(LF)(CR)(ETX)

- It is Thursday 18.05.2017 - 12:34:56 o'clock.
- radio operation (high accuracy)
- daylight saving time
- no announcement of a changeover
- ( ) - ASCII-control characters e.g. (STX)

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5.2.5 Serial Requests with ASCII Characters

The transmission of a data string can also be triggered by the user on enquiry by means of an ASCII character. The following characters trigger the transmission of the standard string:

- ASCII **"D"** - for Time / Date (Local Time)
- ASCII **"G"** - for Time / Date (UTC Time)

The System answers within 1msec. with the corresponding data string.

Since this is often too fast for the requesting computer, it is also possible to realize a response delay in 10msec. steps on request via software. For the delayed transmission of the data string, the requesting computer transmits the lower case letters "**d**, **g**" to the clock with a two position multiplication factor.

The clock interprets the multiplication factor as a hexadecimal value.

Example:

The computer transmits **ASCII gFF** (Hex 67, 46, 46)

The clock transmits the Time / Date (UTC Time) data string after approx. 2550 milliseconds.

5.3 *hopf* String 6021 CR/LF

The ***hopf*** data string 6021 CR/LF is described below. It corresponds to the ***hopf*** Standard string 6021 with the exception of the sequence of the control characters CR / LF.

Required:	**No**
Freely adjustable:	**All**
Pre-set:	**No**

5.3.1 Structure

Character No.	Meaning	Hex-Value
1	STX (start of text)	$02
2	status (internal clock status)	$30-39, $41-46
3	day of the week (1=Monday ... 7=Sunday) for UTC time bit 3 is set to 1 in the day of the week	$31-37
4	tens hour	$30-32
5	unit hour	$30-39
6	tens minute	$30-35
7	unit minute	$30-39
8	tens second	$30-36
9	unit second	$30-39
10	tens day	$30-33
11	unit day	$30-39
12	tens month	$30-31
13	unit month	$30-39
14	tens year	$30-39
15	unit year	$30-39
16	CR (carriage return)	$0D
17	LF (line feed)	$0A
18	ETX (end of text)	$03

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5.4 SINEC H1 Extended

Below the data string SINEC H1 Extended is described.

5.4.1 Specified Settings

Required:	**No**
Freely adjustable:	**All**
Pre-set:	**No**

5.4.2 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", "U" or " " (space)	$53 / $55 / $20
31	"!", "A" or " " (space)	$21 / $41 / $20
32	ETX (end of text)	$03

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5.4.3 Status

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

The characters mean the following:

Character no. 28 =	"#"	no radio synchronisation after reset, time invalid
	" " (space)	radio synchronisation after reset, clock at least in crystal operation
Character no. 29 =	"*"	time from internal crystal in the clock
	" " (space)	time by radio reception
Character no. 30 =	"S"	daylight saving time
	"U"	UTC (Coordinated Universal Time)
	" " (space)	standard time
Character no. 31 =	"!"	announcement of a DST or standard time changeover
	"A"	announcement of a leap second
	" " (space)	no announcement

5.4.4 Example

```
(STX)D:18.05.17;T:4;U:12.34.56; _ _ S _ (ETX)       ( _ ) = Space
```

- It is Thursday 18.05.17 - 12:34:56 o'clock
- radio operation
- summer time (daylight saving time)
- no announcement of a changeover

5.4.5 Serial Requests with ASCII Characters

The data string SINEC H1 Extended can also be sent by request.

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

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5.5 SAT 1703 Time String

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

5.5.1 Specified Settings

Required:	**No**
Freely adjustable:	**All**
Pre-set:	**No**

5.5.2 Structure

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

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5.5.3 Status

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

The characters mean the following:

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

5.5.4 Example

```
(STX)18.05.17/4/02:34:45UTC_ _ _(CR)(LF)(ETX)
```

- It is Thursday 18.05.2017 - 02:34:45 o'clock UTC
- The clock is synchronous

5.5.5 Serial Requests with ASCII Characters

The Data 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 **"?"**.

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5.6 *hopf* Master/Slave-String

The ***hopf*** Master/Slave-String can be used to synchronize slave systems with the time data of the master system.

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
- status information (announcement of DST changeover, announcement of a leap second and the status of reception of the ***hopf*** Master/Slave-String source)

5.6.1 Specified Settings

Required:	The following settings are required for the synchronization of the ***hopf*** slave-systems: • Normally points of time every minute, depending on system also every second • 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

Received data on the serial interface that are not specified in the pertinent data string might disturb and interrupt the cyclic string output.
The receiving synchronization interface should be set to "transmitting on request" for Sub-Master (Slave) Systems.

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5.6.2 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 (time zone offset) is transmitted in hours and minutes following the year. The transmission is done in BCD. The difference time may be up to ± 14.00h.

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 Nibble	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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5.6.3 Status

	b3	b2	b1	b0		Meaning
Status:	x	x	x	0		no announcement hour
	x	x	x	1		announcement (DST changeover)
	x	x	0	x		standard time
	x	x	1	x		daylight saving time (DST)
	x	0	x	x		no announcement leap second
	x	1	x	x		announcement leap second
	0	x	x	x		synchronization status code: INVA / QUSE / QUEX / QUON
	1	x	x	x		synchronization status code: SYOF / SYNC
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	Time	DST changeover	Leap Second
0 = 0000	INVA / QUSE / QUEX / QUON	standard time	no announcement	no announcement
1 = 0001	INVA / QUSE / QUEX / QUON	standard time	announcement	no announcement
2 = 0010	INVA / QUSE / QUEX / QUON	DST	no announcement	no announcement
3 = 0011	INVA / QUSE / QUEX / QUON	DST	announcement	no announcement
4 = 0100	INVA / QUSE / QUEX / QUON	standard time	no announcement	announcement
5 = 0101	INVA / QUSE / QUEX / QUON	standard time	announcement	announcement
6 = 0110	INVA / QUSE / QUEX / QUON	DST	no announcement	announcement
7 = 0111	INVA / QUSE / QUEX / QUON	DST	announcement	announcement
8 = 1000	SYOF / SYNC	standard time	no announcement	no announcement
9 = 1001	SYOF / SYNC	standard time	announcement	no announcement
A = 1010	SYOF / SYNC	DST	no announcement	no announcement
B = 1011	SYOF / SYNC	DST	announcement	no announcement
C = 1100	SYOF / SYNC	standard time	no announcement	announcement
D = 1101	SYOF / SYNC	standard time	announcement	announcement
E = 1110	SYOF / SYNC	DST	no announcement	announcement
F = 1111	SYOF / SYNC	DST	announcement	announcement

DST = daylight saving time

5.6.3.1.1.1 Example

(STX)841234561807028230(LF)(CR)(ETX)

- It is Thursday 18.07.2002 - 12:34:56 o'clock
- synchronization status code: SYNC
- no announcement of a changeover
- The difference time to UTC is +2.30 h

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5.7 IEC-103 (ASDU Type 6)

Reference: IEC60870-5-103

This data string requires the configuration of **Mode Byte 3** (see ***Chapter 5.7.4 Initialization String for IEC-103 (ASDU Type 6)***).

5.7.1 Specified Settings

Required:	• baud rate: 9600 Baud • 8 data bit • 1 stop bit • parity: even • transmission point = every minute • control character at second change: off • second forerun: off • transmission delay: off • Mode byte 3 (address): 0 to 254 ($00-$FE)
Pre-set: **(remote only)**	All **required** parameters & mode byte3 = 254 ($FE)

For mode byte 3, the following 4 settings can be selected via the dip switch 4

DS4 Switch 6	DS4 Switch 5	Initialization	
OFF	OFF	Modebyte3 = 254 (initialization address)	1-254
OFF	ON	Modebyte3 = 127 (initialization address)	1-127
ON	OFF	Modebyte3 = 63 (initialization address)	1-63
ON	ON	Modebyte3 = 0 (initialization)	aus

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5.7.2 Structure

Character No.	Meaning	Hex-Value
1	Start flag	$68
2	Length of Information	$0F
3	Repeated length of Information	$0F
4	Start flag	$68
5	Control field	$44
6	Station address	$FF
7	Frame Type identification	$06
8	Variable structure identifier	$81
9	Cause of transmission	$08
10	Common address of ASDU	$FF
11	Function type	$FF
12	Information number	$00
13	Milliseconds (Low octet)	$0000-$EA5F
14	Milliseconds (High octet)	
15	Minutes (0..59) + MSB = Invalid Flag	$00-3B, $80-$BB
16	Hours (0..23) + MSB = SU Summer time Flag	$00-17, $80-$97
17	Days (1..31)	$01-$1B
18	Months (1..12)	$01-$0C
19	Years (00..99)	$00-$63
20	Checksum (sum of fields 5 to 19 mod 256)	$00-$FF
21	End flag	$16

MSB of minute: 1 = clock is not synchronous (time invalid or quartz)
0 = clock is synchronous

MSB of hour: 1 = daylight saving time
0 = standard time

The seconds are displayed in the value of the milliseconds.

Thus the millisecond value runs from 0 .. 59999 decimal or from 0000 .. EA5F hexadecimal. (If output is set to the minute change this value is always 0)

The checksum is the sum of byte 5 to 19 Modulo 256.

5.7.3 Example

The length of the data string is fixed to 21 characters. All characters including special characters are allowed. Only binaurally values are transmitted.

The transmitted values are given out hexadecimal:

<68><0f><0f><68><44><ff><06><81><08><ff><ff><00><00><00><05><88><11><07><09><fe><16>

- Time is 08:05:00.000 at 17th July 2009
- daylight saving time
- The clock is synchronous.

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5.7.4 Initialization String for IEC-103 (ASDU Type 6)

This initialization string is sent with ascending IEC address every second unless the minute change. The IEC address is continuously repeated from 1 to a selectable value of maximal 254 ($01-$FE). Setting up the IEC address is done in **Mode Byte 3**.

Disable the initialization string:

- Setting the IEC address to **"0"**

or

- Transmission point: every minute

Mode Byte 3 for Initialization String IEC-103

B7	B6	B5	B4	B3	B2	B1	B0	DEZ	HEX	Note
0	0	0	0	0	0	0	0	0	$00	Disabled DS4: SW5=1, SW4=1
0	0	0	0	0	0	0	1	1	$01	
:	:	:	:	:	:	:	:	:		
:	:	:	:	:	:	:	:	:		
0	0	0	0	1	1	1	1	15	$0F	
0	0	0	1	0	0	0	0	16	$10	
0	0	0	1	0	0	0	1	17	$11	
:	:	:	:	:	:	:	:	:	:	
0	0	1	1	1	1	0	1	63	$3F	DS4: SW5=1, SW4=0
:	:	:	:	:	:	:	:	:		
0	1	1	1	1	1	1	1	127	$7F	DS4: SW5=0, SW4=1
:	:	:	:	:	:	:	:	:		
1	1	1	1	1	1	0	0	252	$FC	
1	1	1	1	1	1	0	1	253	$FD	
1	1	1	1	1	1	1	0	254	$FE	Max. Value DS4: SW5=0, SW4=0

Structure IEC-103

Character no.	Meaning	Hex Value
1	Start flag	10
2	Control field	47
3	IEC-Address	$01-$FE
4	Checksum (sum of fields 2 & 3 mod 256)	$00-$FF
5	End flag	16

Example

The length of data string consists of 5 characters. Just binary values are sent.

The hexadecimal values of the transmitted characters are stated:

<10><47>**<01>**<48><<16> (String initializes unit with the address 01)

<10><47>**<02>**<49><<16>

:

<10><47>**<0F>**<56><<16>

<10><47>**<10>**<57><<16>

:

<10><47>**<FE>**<45><<16> (String with maximal valid address)

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5.8 Data String 5050 H&B (PCZ 77)

This data string is compatible with the serial data string of the board 6830.

The "Hartmann and Braun" internal designation of the radio clock is PCZ 77.

5.8.1 Specified Settings

Required: **&** **Pre-set:** **(remote only)**	• baud rate: 1200 Baud • 7 data bit • 1 stop bit • parity: even • transmission point = every minute • control character at second change: on • second forerun: on • transmission delay: off
fixed	---

5.8.2 Structure

Character No.	Meaning	Hex-Value
1	Hour Tens	$30-$32
2	Hour Unit	$30-$39
3	Space	$20
4	Minute Tens	$30-$35
5	Minute Unit	$30-$39
6	Space	$20
7	Second Tens	$30-$35
8	Second Unit	$30-$39
9	Space	$20
10	Days Tens	$30-$33
11	Days Unit	$30-$39
12	Space	$20
13	Month Tens	$30-$31
14	Month Unit	$30-$39
15	Space	$20
16	Years Tens	$30-$39
17	Years Unit	$30-$39
18	Space	$20
19	Status	$30-$39,$41-$46
20	Day oft he week	$31-$37
21	CR (Carriage Return)	$0D
22	LF (Line Feed)	$0A

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5.8.3 Status and Day of the Week Nibble

	b3	b2	b1	b0	Meaning
Status nibble:	x	x	x	0	Radio operation
	x	x	x	1	Quartz operation
	x	x	1	x	Announcement Winter/Summer/Wintertime
	x	x	0	x	No announcement
	x	0	x	x	CET (UTC + 1h)
	x	1	x	x	CEST (UTC + 2h)
	1	0	0	x	UTC
Day of the week nibble:	x	0	0	1	Monday
	x	0	1	0	Tuesday
	x	0	1	1	Wednesday
	x	1	0	0	Thursday
	x	1	0	1	Friday
	x	1	1	0	Saturday
	x	1	1	1	Sunday

5.8.4 Example

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

Radio operation, no announcement, wintertime (standard time)
It is Wednesday 03.01.96 - 12:34:56 o'clock

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5.9 Data String ION 7550

5.9.1 Specified Settings

Table 1: Interface Parameter

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

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

5.9.2 Data String Structure

Table 2: Data String Structure

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

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5.9.3 Status

Table 3: Indication of Accuracy

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

Table 4: Duration of Accuracy Level by Loss of Synchronisation

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

Table 5: Duration of Accuracy Level in Case of Synchronisation

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

5.9.4 Data String Example

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

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

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5.10 Trimble Time String (TSIP)

The Trimble Time String (TSIP) can be used to synchronize slave systems with the time data of the master system.

5.10.1 Specified Settings

Pre-set:	• Point of transmission: every second • Output without second forerun • Output immediately • (no special character) • Last character immediately • UTC time • 9600 Baud, 8 Bit, 1 Stop bit, Parity Odd
Required:	-
Free adjustable:	All parameter (not all have an effect)

5.10.2 Data String Structure

Character No.	Meaning	Hex-Value
1	DLE	$10
2	Packet ID	$8F
3	Sub packet ID	$0B
4	Event Count (0 for GPS)	$00
5	Event Count (0 for GPS)	$00
	Weekly seconds:	
6	Exponent 1. Byte	$00-$FF
7	Exponent 3. Nibble + 1. Nibble Mantissa	$00-$FF
8	Mantissa	$00-$FF
9	Mantissa	$00-$FF
10	Mantissa	$00-$FF
11	Mantissa	$00-$FF
12	Mantissa	$00-$FF
13	Mantissa LSB	$00-$FF
	Date	
14	Day	$01-$1F
15	Month	$01-$0C
16	Year 1. Byte	$00-$FF
17	Year 2. Byte	$00-$FF
18-76	GPS Data (at present all = 0)	$00-$FF
77	DLE	$10
78	ETX	$03

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5.10.3 Day of the Week Seconds

Exponent = h'3FF + Length of the Mantissa in Bits (length of the weekly seconds -1)

Mantissa = Binary places of the normalized weekly seconds.

This means: The first (set) bit of the number is not displayed in the mantissa (since it is ALWAYS 1, except the whole value is 0) and the remaining bits are left-aligned and padded with zeros to the right.

Example:

d'10 (h'0a, b'1010): (length of the mantissa is 3)

Exponent: h'402 mantissa: h'4000000000000 (b'010 0…)

d'65535 (h'FFFF,b'1111 1111 1111 1111): (length of the mantissa is 15)

Exp.:h'40e (h'3ff+h'f)   Mant.:h'FFFE (b'1111 1111 1111 111 0..)

Example in Hex description (not ASCII):

10 8F 0B 00 00 41 0A 49 00 00 00 00 00 13 04 07 E0 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 10 03

Weekly seconds: h'410-3ff=17 +1 = 18 bit h'29200 = d'168448:

Di 22:47:28 Date: 19.04.2016

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6 Technical Data

General

General Data	
Operation	via DIP switches
Installation Position	any position
Protection Type of Board	IP00
Dimensions of Module	multi-layer board 80mm x 40mm
Power Supply	5V DC ± 5% (system internal)
Power Consumption	150mA to 300mA (depending on the module variant and the interface used)
MTBF	> 950,000 hours
Weight	<. 0.05kg

Temperature Range	
Operation	0°C to +50°C
Storage	-20°C to +75°C
Humidity	max. 90%, non condensing

CE Conformity
EMV Directive 2014/30/EU
EN 55022 : 2010 / AC : 2011
EN 61000-3-2 : 2006 / A2 : 2009, EN 61000-3-3 : 2013
EN 55024 : 2010
Low Voltage Directive 2014/35/EU
EN 60950-1 : 2006 / AC : 2011

Potential Isolation (optional)	
Insulation Voltage:	at least 500V DC 1000MΩ

Module - Signal Outputs (standard configuration)	
Full-duplex serial remote interface (without handshake)	Via 9-pole SUB-D (male) connector in the front panel - in level: • RS232 • RS422
Pulse output (optional)	Via 9-pole SUB-D (male) connector in the front panel - in level: • RS232 • RS422

Special production:

Modifications can be made to hardware and software in accordance with customer specifications.

hopf Elektronik GmbH reserves the right to modify hardware and software at any time.

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