

8x00 Product Series

TECHNICAL DOCUMENTATION

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2 Change History

VERSION	DATE	EDITOR	CHANGE DESCRIPTION
01.00	23.09.2021	POM	Creating Document
01.01	28.01.2022	POD	Revision of the safety instructions
01.03	14.11.2022	POM	Formatting revised; Added new extension boards
02.00	18.07.2023	POM	Added boards FG8800M00, FG8802S00, FG8802S01, FG8802S02, FG8802S20, FG8901P06 Added factory default instructions to all boards that have a configuration Added cable housing information to FG8901P01 and FG8901P04 Corrected LED description of all PSU boards Corrected number representation in technical specifications (decimal point and comma for thousands separator) Added supported requests per second for NTP in the technical specifications
03.00	05.08.2024	POM	Added extension boards FG8701G01, FG8701G02, FG8701G03, FG8702G04, FG8702G05, FG8702G06, FG8702G11, FG8702G12, FG8702G13, FG8702G14, FG8702G15, FG8801F02, FG8803S02, FG8803S20 Added base system FG8101G02 Renamed document to be able to refer to FG8101G02 Replaced technical specification with a reference to the product sheet Replaced description of similar board with references to the other board

04.00 28.09.2026 POM

Adapted specifications and descriptions for 2U base systems

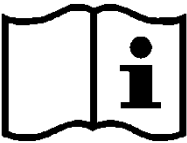
Added the following chapters: Package contents, Airflow,
Dismounting, Disposal, and Appendix

Reworked the Display chapter and updated the menu structures

Performed general editorial improvements and text updates
across the document

3 Preliminary Remarks

This document describes the functions, operation, mounting and commissioning of the products of the 8x00 product series, including the base systems as well as the hot-plug extension boards.

 	WARNING
	Read the instructions completely. This will help you to avoid hazards and errors. The product information contains important information on the intended use, installation and start-up. Keep the product information in a suitable place where it can be accessed for maintenance and repair.

3.1 Conformity data

	CE conformity This device complies with the requirements of the EU Directives 2014/30/EU "Electromagnetic Compatibility" and 2014/35/EU "Low Voltage Directive". For this purpose, the device bears the CE marking (CE = Communautés Européennes = European Communities). The CE indicates to the control authorities that the product complies with the requirements of the EU Directive - in particular with regard to health protection and safety of users and consumers - and may be freely placed on the Community market.
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	UKCA- conformity This device complies with the requirements of the Directives S.I. 2012/3032 "The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012", S.I. 2016/1091 "The Electromagnetic Compatibility Regulations 2016" and S.I. 2016/1101 "The Electrical Equipment (Safety) Regulations 2016". For this purpose, the device bears the UKCA marking The UKCA indicates to the control authorities that the product complies with the requirements of the Directive - in particular with regard to health protection and safety of users and consumers - and may be freely placed on the UK market.
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3.2 Signal words for warnings

This document is not a complete list of all safety measures required for operation of the product. However, it does contain information that you must observe for your personal safety and to prevent damage to property. The instructions are presented as follows, depending on the degree of danger:

 ISO 7000-0434A Allgemeines Warnzeichen Vorsicht / Caution	DANGER The signal word denotes a hazard with a high degree of risk which, if not avoided, will result in death or serious injury. WARNING The signal word indicates a hazard with a medium level of risk which, if not avoided, may result in death or serious injury. CAUTION The signal word indicates a hazard with a low level of risk that, if not avoided, could result in a minor or moderate injury.
 IEC 60417-6042 Vorsicht, Risiko eines elektrischen Schlages / Caution, risk of electric shock	DANGER The signal word indicates a hazard with electrical voltage with a high degree of risk. Danger of Electric Shock!
 IEC 60417-5041 Vorsicht, heiße Oberfläche / Caution, hot surface	CAUTION The signal word indicates a hazard with high device temperatures Risk of burns During operation, high device temperatures may occur depending on the operating parameters and type. Allow the unit to cool down before starting maintenance work.
 IEC 60417-6222 Allgemeine Information, Hilfe / Information, general; help	Note A note in the sense of these instructions is important information about the product or the respective part of the instructions to which special attention is to be drawn.

4 Safety instructions



Note

The product information is intended exclusively for qualified electricians.

This document is not a complete list of all safety measures required for operation of the product. However, it does contain information that you must observe for your personal safety and to avoid damage to property. The notes are presented as follows, depending on the degree of danger:



Note

Assembly, installation, commissioning and repairs of electrical devices may only be carried out by a qualified electrician.

It is essential to observe the safety regulations and generally applicable technical rules relevant to the installation location.

Observe the applicable standards and regulations for system installation.

Prevent malfunctions and thus avoid personal injury and damage to property.



CAUTION

Damage to the device due to overvoltage

Ensure that the power supply is correct.

Take suitable lightning protection measures to ensure that the permitted voltage is not exceeded at the connections.



DANGER

Danger of Electric Shock

The device is operated with dangerous voltages.

It is imperative that you observe the installation instructions for the respective extension boards.

4.1 Intended Use

The equipment may only be operated under the ambient conditions described in the 8x00 product series product sheet.

Correct and safe operation of the product requires proper:

- Transport and storage.
- Installation and assembly.
- Operation and maintenance.

Respect the following safety notes:

- **Dangerous voltages:** When operating electrical equipment, certain parts are inevitably under dangerous voltage.
- **Elevated temperatures:** Electrical equipment may reach elevated temperatures.
- **Risk of severe injury:** If not handled properly, death, serious injury or substantial property damage may result.
- **Grounding first:** The equipment must be grounded at the ground terminal before any other connections are made.
- **Live circuits:** Dangerous voltages may be present in all circuit parts connected to the power supply, even when the device is not actively operating.



Note

The manufacturer accepts no liability for applications that deviate from or go beyond the intended use.

5 Introduction

The 8x00 product series consists of fully modular time reference base systems and hot-plug capable field-replaceable extension boards designed for precise and reliable time synchronization.

These systems offer exceptional performance at extremely competitive prices and are particularly well-suited for critical infrastructure applications.

Supported Time Sources & Protocols:

- **GNSS:** GPS, Galileo, GLONASS, BeiDou, and IRNSS/NavIC
- **Other Protocols & Signals:** NTP, PTP, and various other time sources

6 System description

The 8x00 product series devices are fully modular time reference systems designed to cater to a wide range of applications using field-replaceable, hot-pluggable, mutually independent extension boards. In the following chapters these components are referred to as **extension boards**, while the enclosures into which they are installed are called **base system**. The term **system** refers to the combination of a base system and its installed extension boards.

Each extension board can provide one or more of the following functionalities:

- **Power Supply Unit (PSU):** Converts external power input into an internal voltage level to power the system.
- **Management Controller (MC):** A management core used to monitor and configure the entire system.
- **Time Domain Controller (TDC):** A time source interface. An extension board with this functionality features at least one connector for an external time source and provides a highly accurate time signal to the entire system.
- **Service Provider (SP):** Processes the time signal provided by the TDC(s) to generate the specific time outputs required by the customer.



Note

An extension board can provide more than one functionality.

6.1 Extension board positions



Figure 1

Figure 1 shows the rear panel of a 1U 8x00 product series base system, with labels for the individual extension board positions (POS1 to POS8). Figure 2 lists the functionalities supported on these individual positions:

POS1				POS2				POS3				POS4			
PSU					MC	TDC	SP				SP				SP
POS5				POS6				POS7				POS8			
PSU						TDC	SP				SP				SP

Figure 2

Figure 3 shows the functionalities supported on the individual positions of a 2U 8x00 product series base system.

POS1				POS2				POS3				POS4			
PSU					MC		SP				SP				SP
POS5				POS6				POS7				POS8			
							SP				SP				SP
POS9				POS10				POS11				POS12			
PSU							SP				SP				SP
POS13				POS14				POS15				POS16			
PSU						TDC	SP			TDC	SP				SP

Figure 3



Note

Extension board positions

Extension boards only function correctly when installed in their designated positions. Incorrect positioning of a board will not affect the operation of the rest of the system.

6.2 PSU - Power Supply Unit

Up to two PSUs are supported in a 1U 8x00 product series base system, and up to three PSUs are supported in a 2U 8x00 product series base system. A PSU converts the voltage from its power input connector(s) to the system-internal supply voltage.

If two PSUs are operated in a 1U base system, active 1+1 redundancy with integrated load balancing is achieved. In 2U base systems, at least two PSUs are required for operation. If three PSUs are operated in a 2U base system, active 2+1 redundancy is achieved. In both cases, the backplane automatically balances the load equally across all operational PSUs.

6.3 MC - Management Controller

Each 8x00 base system supports one MC. The MC distributes configurations and updates, and collects the status of the system via the internal management bus. Additionally, the MC displays parts of the collected status information via the base system's display.

6.4 TDC - Time Domain Controller

In the 8x00 product series base systems, up to two TDCs are supported. A TDC processes the time signal received at the corresponding connector(s) of the TDC extension board. It converts this signal to an internal protocol, which is routed to the base system and the remaining extension boards via a TDI (time domain interface).

8x00 product series base systems feature two TDIs; each TDI is routed to all extension boards in the base system.



Note

Boards with TDC functionality cannot synchronize with each other

Most boards with TDC functionality also feature SP functionality. In this case, the SP functionality exclusively uses the time supplied by the TDC functionality of that specific extension board; it cannot use the time from a TDI.

6.5 SP - Service Provider

A 1U 8x00 product series base system supports up to 6 SPs and a 2U 8x00 product series base systems support up to 12 SPs. An SP synchronizes to one of the two TDIs and generates its time output (e.g., NTP) using that time information.

Each SP can process both TDIs of the base system and, depending on its configuration, determines which TDI to synchronize to.

6.6 Minimal configuration

To operate an 8x00 product series device as a time reference system, the following functionalities must be provided at least once by the extension boards installed in the base system: PSU, MC, TDC, and SP.

As mentioned in chapter 6.2 PSU - Power Supply Unit, 2U base systems require at least two PSUs instead of one for basic operation.



Note

The MC functionality is only required for system management (configuration and monitoring) and for displaying data on the base system's display. If the extension board providing MC functionality is removed from the base system or fails, the time outputs of the other extension boards with SP functionality are not affected. This remains true as long as at least one PSU (in 1U base systems) and two PSUs (in 2U base systems), one TDC extension board, and the respective SP extension boards continue to operate within the base system.

6.7 Front cover

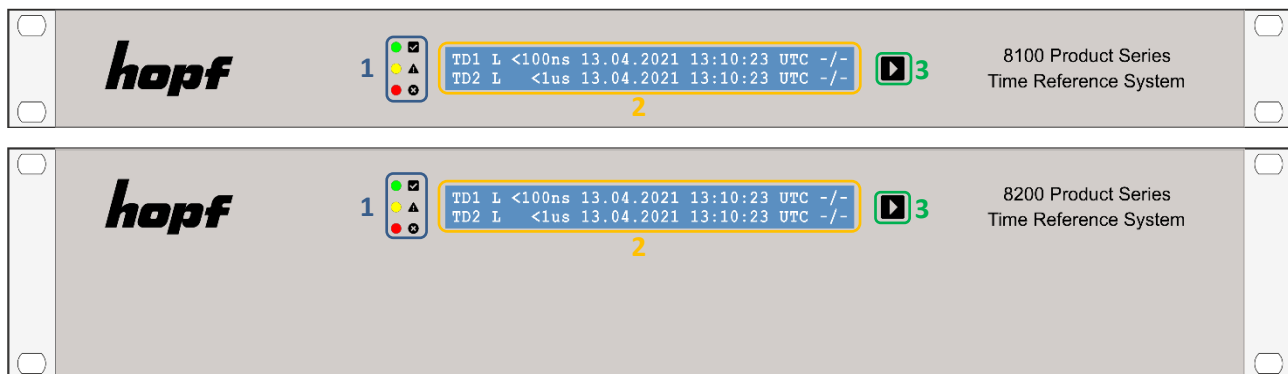


Figure 4

Figure 4 shows the various elements of the front panel of 1U and 2U base systems:

- 1 ... LEDs of the front panel
- 2 ... Display of the front panel
- 3 ... Button of the front panel

6.7.1 LEDs

The LEDs show the current status of the system.

If only the red LED is illuminated, at least one extension board or the base system is operating in an error state.

If only the yellow LED is illuminated, at least one extension board or the base system is operating in warning state, but none of them are in an error state.

If only the green LED is illuminated, neither the base system nor any of the extension boards are operating in an error or warning state.

If all three LEDs are illuminated, no extension board with MC functionality is accessible by the base system (this is the case, for example, while the extension board with MC functionality is booting).

Additionally, during the first 6 seconds following a reboot of the base system, an LED test is executed. During this test, two LEDs are illuminated simultaneously for one second each, in the following sequence: yellow and red, green and red, green and yellow. This sequence is then repeated once.

6.7.2 Button

The button can be used to switch between the different screens on the display.

If the button is pressed briefly (100 to 500ms), the display switches to the next screen.

If the button remains pressed for more than 500ms, the behaviour is determined by the configuration of the base system. In the factory default configuration, an event is triggered every 500ms that simulates a short button press. This way you can quickly scroll through all screens.

6.7.3 Display

Using the display, the article and serial numbers of the base system and the extension boards can be queried, as well as basic information about the individual extension boards.

6.7.3.1 Display state machine

During the first 6 seconds following a reboot of the base system, a display test is performed. During this test, the display backlight flashes on and off, and each of the 40x2 blocks on the display alternates between fully illuminated and empty.

After the display test, the base system screen is displayed for 30 seconds with the backlight turned on. The display then switches to the IDLE screen.

By pressing the button on the front panel, the display switches to the time domain screen. Each subsequent press leads to the next screen in the display state machine. If the button is not pressed for more than 30 seconds, the display automatically reverts to the IDLE screen.

The behaviour described above is the default behaviour and can be changed via the configuration.

State machine:

1. Time domain screen
2. POS1-4 screen
3. POS5-8 screen

4. POS9-12 screen (available in 2U base systems only; otherwise skipped)
5. POS13-16 screen (available in 2U base systems only; otherwise skipped)
6. POSx screen for position x = 1
7. ...
8. POSx screen for position x = 8
9. POSx screens for position x = 9 to 16 (available in 2U base systems only; otherwise skipped)
10. Base system screen



Note

The menu structure operates in a continuous loop. Pressing the button on the "Base system screen" returns the display to the "Time domain screen" (Step 1).

6.7.3.2 IDLE screen



The IDLE screen displays no text and the backlight is turned off. On all other screens, the backlight is turned on.

6.7.3.3 Base system screen



The base system screen displays the article number followed by a hyphen and the serial number of the base system.

6.7.3.4 Time domain screen



The time domain screen displays the current synchronisation state, accuracy, time and date, leap second status and daylight-saving time status of both time domains. The first line

displays the information for time domain 1, while the second line displays the information for time domain 2.

Time domain status:

Length	Description	Example
3	Time domain identifier, either TD1 or TD2	TD1
1	Space	
1	Synchronisation status: L Locked to sync source H Holdover I Not initialized - No communication on this time domain	L
1	Space	
6	Synchronisation accuracy: <100ns Time is within 100ns to UTC <1us Time is within 1us to UTC <10us Time is within 10us to UTC <100us Time is within 100us to UTC <1ms Time is within 1ms to UTC <10ms Time is within 10ms to UTC ≥10ms Time is off more than 10ms to UTC	<100ns
1	Space	
10	Date in the format dd.mm.yyyy dd Day mm Month yyyy Year	16.09.2026
1	Space	
8	Time in the format hh:mm:ss hh Hour mm Minute ss Second	12:00:00
1	Space	

3	Timebase of the displayed time UTC UTC time STD Standard time LOC Local time	UTC
1	Space	
1	Leap second status - No leap second event announced A Positive leap second announced D Negative leap second announced L Current second is a positive leap second	-
1	Slash	/
1	Daylight saving time status - DST not active and not announced D DST is active A DST is announced	-

6.7.3.5 POS1-4 screen

P01: FG8901P01 O/- P02: FG8702G13 O/M
P03: FG8901P01 O/- P04: FG8702G13 O/M

The POS1-4 screen displays the article numbers, board status and management status of the extension boards in positions 1 to 4.

Content per position:

Length	Description	Example
3	Position identifier	P01
1	Colon	:
1	Space	
9	Article number, or hyphen if no extension board is installed in this position	FG8901P01
1	Space	
1	Board status O Ok	O

	W Warning E Error - No extension board detected at this position	
1	Slash	/
1	Monitoring status - Board monitoring not activated for this position M Extension board is monitored and present E Board monitoring is active for this position, but the configured article number is not detected at this position	-
1	Space	
1	Space	

6.7.3.6 POS5-8 screen

Identical to POS1-4 screen, except that it displays the information for positions 5 to 8.

6.7.3.7 POS9-12 screen (only in 2U base systems)

Identical to POS1-4 screen, except that it displays the information for positions 9 to 12.

6.7.3.8 POS13-16 screen (only in 2U base systems)

Identical to POS1-4 screen, except that it displays the information for positions 13 to 16.

6.7.3.9 POSx screens

The POSx screens display status information for the extension boards in position x. For example, the POS1 screen displays the information for the extension board in position 1, and so on.

The content of the status information depends on the article number of the extension board in that position. The details can be found in the following subchapters.

6.7.3.9.1 FG8702D01

```
P02: DCF 1: DCF77 0:192.168.000.001/24
FG8702D01 2: IRG-LS 1:192.168.001.001/24
```

Line 1:

Length	Description	Example
4	Position identifier	P02:
1	Space	
4	Synchronisation source: - No synchronisation source DCF DCF receiver 1 DCF2 DCF receiver 2 TC Time code receiver 1 PTP Time code receiver 2	DCF
1	Space	
2	Fixed string 1:	1:
1	Space	
6	Synchronisation protocol on synchronisation interface 1: - No synchronisation protocol detected DCF77 DCF77 DCF-LS DCF level shift IRG-LS IRIG-B level shift PPS Pulse per second	DCF77
1	Space	
1	Network interface identifier 0 eth0 B Bonding P PRP	0
1	Colon	:
15	IP address of the specified network interface	192.168.000.001
1	Slash	/
2	Network mask of the specified network interface	24

Line 2:

Length	Description	Example
9	Article number of the extension board	FG8702D01
1	Space	
2	Fixed string 2:	2:
1	Space	
6	Synchronisation protocol on synchronisation interface 2: - No synchronisation protocol detected DCF77 DCF77 DCF-LS DCF level shift IRIG-LS IRIG-B level shift PPS Pulse per second	DCF77
1	Space	
2	Fixed string 1: , if the extension board does not use Bonding or PRP, otherwise two spaces	1:
15	IP address of eth1, if the extension board does not use Bonding or PRP, otherwise 15 spaces	192.168.001.001
1	Slash	/
2	Network mask of eth1, if the extension board does not use Bonding or PRP, otherwise two spaces	24

6.7.3.9.2 FG870xGxx

```
P02: R1 1:V33/T19 0:192.168.000.001/24
FG8702G03 1:192.168.001.001/24
```

Line 1:

Length	Description	Example
4	Position identifier	P02:
1	Space	
3	Synchronisation source: - No synchronisation source	R1

	R1 GNSS receiver 1 R2 GNSS receiver 2 NTP NTP PTP PTP	
1	Space	
3	Fixed string 1:V	1:V
2	Number of visible satellites on GNSS receiver 1	33
2	Fixed string /T	/T
2	Number of tracked satellites on GNSS receiver 1	19
1	Space	
1	Network interface identifier 0 eth0 B Bonding P PRP	0
1	Colon	:
15	IP address of the specified network interface	192.168.000.001
1	Slash	/
2	Network mask of the specified network interface	24

Line 2:

Length	Description	Example
9	Article number of the extension board	FG8702G03
1	Space	
3	Fixed string 2:V , if the extension board has two GNSS receivers, otherwise three spaces	2:V
2	Number of visible satellites on GNSS receiver 2, if the extension board has two GNSS receivers, otherwise two spaces	33
2	Fixed string /T , if the extension board has two GNSS receivers, otherwise two spaces	/T

2	Number of tracked satellites on GNSS receiver 2, if the extension board has two GNSS receivers, otherwise two spaces	19
1	Space	
2	Fixed string 1:, if the extension board does not use Bonding or PRP, otherwise two spaces	1:
15	IP address of eth1, if the extension board does not use Bonding or PRP, otherwise 15 spaces	192.168.001.001
1	Slash	/
2	Network mask of eth1, if the extension board does not use Bonding or PRP, otherwise two spaces	24

6.7.3.9.3 FG8800Mxx and FG8801xxx

P02:	0:192.168.000.001/24
FG8800M00	1:192.168.001.001/24

Line 1:

Length	Description	Example
4	Position identifier	P02:
16	16 spaces	
1	Network interface identifier 0 eth0 B Bonding P PRP	0
1	Colon	:
15	IP address of the specified network interface	192.168.000.001
1	Slash	/
2	Network mask of the specified network interface	24

Line 2:

Length	Description	Example
9	Article number of the extension board	FG8800M00

11	11 spaces	
2	Fixed string 1: , if the extension board does not use Bonding or PRP, otherwise two spaces	1:
15	IP address of eth1, if the extension board does not use Bonding or PRP, otherwise 15 spaces	192.168.001.001
1	Slash	/
2	Network mask of eth1, if the extension board does not use Bonding or PRP, otherwise two spaces	24

6.7.3.9.4 FG8802Sxx

```
P03:      X1:IEEE1344 24 X2:IEEE1344 24
FG8802S01 X3:IEEE1344 24 X4:IEEE1344 24
```

Line 1:

Length	Description	Example
4	Position identifier	P03:
6	6 spaces	
3	Fixed string X1:	X1:
11	Configured output protocol on X1	IEEE1344 24
1	Space	
3	Fixed string X1:	X1:
11	Configured output protocol on X2	IEEE1344 24
1	Space	

Line 2:

Length	Description	Example
9	Article number of the extension board	FG8802S01
1	Space	
3	Fixed string X3:	X3:
11	Configured output protocol on X3	IEEE1344 24
1	Space	/

3	Fixed string X4 :	X4:
11	Configured output protocol on X4	IEEE1344 24
1	Space	

6.7.3.9.4.1 Output protocol text format

If output protocol is IRIG-B:

Length	Description	Example
8	AFNOR AFNOR C37118v2 IEEE C37.118v2 C37118v1 IEEE C37.118v1 IEEE1344 IEEE 1344 B000 IRIG-B000 ... B007 IRIG-B007 B120 IRIG-B120 ... B127 IRIG-B127 B220 IRIG-B220 ... B227 IRIG-B227	IEEE1344
1	Space	
2	Output voltage level: 5 5V DC level shift 12 12V DC level shift 24 24V DC level shift AM Amplitude modulated FO Fiber optic output	24

If output protocol is DCF:

Length	Description	Example
6	Fixed string DCF77/	DCF77/

1	Activity L Low active H High active	L
2	2 spaces	
2	Output voltage level: 5 5V DC level shift 12 12V DC level shift 24 24V DC level shift FO Fiber optic output	24

If output protocol is Cyclic Pulse:

Length	Description	Example
2	Period duration	01
1	Period unit s Second m Minute h Hour	s
1	Slash	/
1	Activity L Low active H High active	L
4	4 spaces	
2	Output voltage level: 5 5V DC level shift 12 12V DC level shift 24 24V DC level shift FO Fiber optic output	24

If output is deactivated:

Length	Description	Example
1	Hyphen	-

10	10 spaces	
----	-----------	--

6.7.3.9.5 FG8803Sxx

P01: X1: 115200/8/N/1 S
FG8803S02 X2: 115200/8/N/1 S

Line 1:

Length	Description	Example
4	Position identifier	P03:
7	7 spaces	
3	Fixed string X1:	X1:
26	Configured output protocol on X1	IEEE1344 24

Line 2:

Length	Description	Example
9	Article number of the extension board	FG8803S02
2	2 spaces	
3	Fixed string X2:	X2:
26	Configured output protocol on X3	IEEE1344 24

6.7.3.9.5.1 Output protocol text format

If output is deactivated:

Length	Description	Example
1	Space	
1	Hyphen	-
24	24 spaces	

If output is activated:

Length	Description	Example
1	Space	

6	Baud rate: 150 300 600 1200 2400 4800 9600 19200 38400 57600	115200
1	Slash	/
1	Number of data bits: 7 8	8
1	Slash	/
1	Parity: N No E Even O Odd	N
1	Slash	/
1	Number of stop bits 1 2	1
1	Space	
1	Transmission interval S Every second M Every minute H Every hour R On request	S
11	11 spaces	

6.7.3.9.6 FG8901Pxx

P01:	12.0V 01.0A 12.0W
FG8901P01	54.63°C

Line 1:

Length	Description	Example
4	Position identifier	P01:
19	19 spaces	
4	Output voltage in the format xx.x	12.0:
1	V	V
1	Space	
4	Output current in the format xx.x	01.0
1	A	A
1	Space	
4	Output power in the format xx.x	12.0
1	W	

Line 2:

Length	Description	Example
9	Article number of the extension board	FG8901P01
24	24 spaces	
5	Temperature in the format xx.xx	54.63
2	Fixed string °C	°C

6.7.4 Supported system pages in huma

Device Settings	
General → Status	
General → Action	
General → Config	
Details → Status	
Board Monitoring → Config	

Power Supply → Config	
Key Activation → Status	
Key Activation → Action	
Configuration	
Download → Action	
Upload → Action	
Firmware Update	
Upload → Action	
User Management	
Roles → Config	
Local Users → Action	
Local Users → Config	
Login → Config	
Security Measure	
Profile → Config	
Server → Status	
Server → Action	

7 Package contents

Before starting the installation, verify that the delivery is complete and undamaged. The package includes:

- **Systems ordered with the “-B000” suffix in the article numbers** (indicating that all components are factory-assembled by **hopf**):
 - Base system including all purchased extension boards (including pre-assembled mating connectors for the power supply terminals and screw terminal blocks)
 - Quick Installation Guide
 - Factory Test Report
 - Activation keys in printed form
 - One ST0001H00 per assembled FG8901P01
 - Two ST0001H00 per assembled FG8901P04
- **Components ordered without the “-B000” suffix in the article number** (indicating individual spare parts):
 - **Base systems:**
 - Base system
 - Quick Installation Guide
 - Factory Test Report
 - Activation keys in printed form
 - **FG8901P01:**
 - FG8901P01 board
 - Factory Test Report
 - One pre-assembled mating connector for the power supply terminal block
 - One ST0001H00

- **FG8901P04:**
 - FG8901P04 board
 - Factory Test Report
 - Two ST0001H00
 - Two pre-assembled mating connectors for the power supply terminal blocks
- **All other extension boards:**
 - The respective extension board
 - Factory Test Report
 - One pre-assembled mating connector per two-pole terminal block
 - One pre-assembled mating connector per power supply terminal block

8 System mounting

8x00 product series base systems are designed for installation in a 19" control cabinet. Carry out the following steps for installation:

	CAUTION
	Thermal hazard
	The fans draw cool air into the unit, through the lateral ventilation openings, directing the airflow toward the rear, where it exits through the top and bottom ventilation openings, resulting in the following requirements: • The lateral ventilation openings on the left and right must not be covered. • A minimum of 1U of free space is required above and below the device.
	Failure to comply will restrict airflow, reducing the maximum permissible ambient operating temperature due to insufficient convection or thermal coupling with surrounding equipment. Ensure that appropriate fire protection measures are met in the final installed state.

- Insert the base system into the 19" control cabinet and secure it tightly to the front retaining brackets using four screws.
- The base system must be connected to at least one of the two grounding screws  for potential equalization (the positions of the grounding screws are shown in Figure 5). A grounding cable with a cross-section of at least 1.5mm² must be used.



Figure 5

	CAUTION
	Class I equipment
The system is a protection class I device. To prevent the risk of electric shock, it must be properly grounded.	

8.1 Airflow

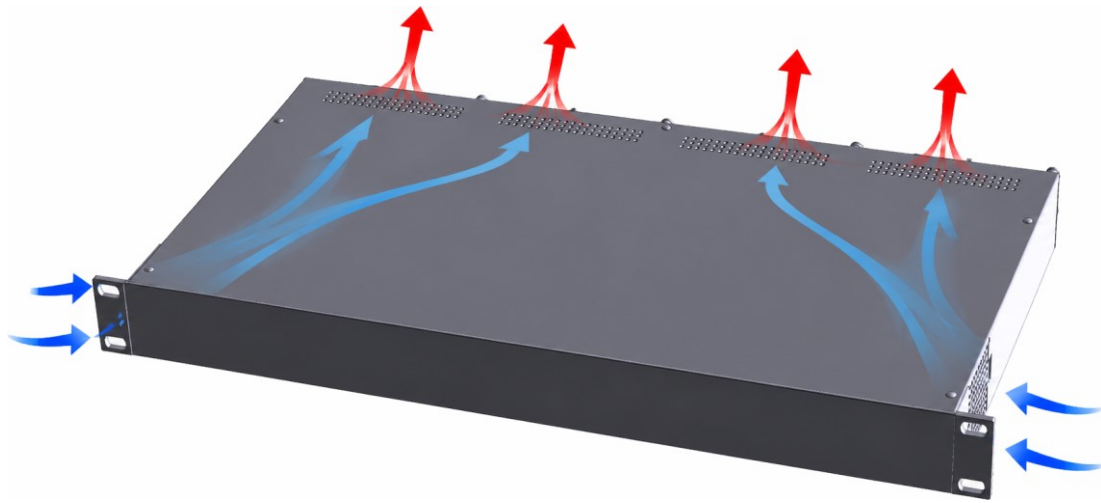


Figure 6

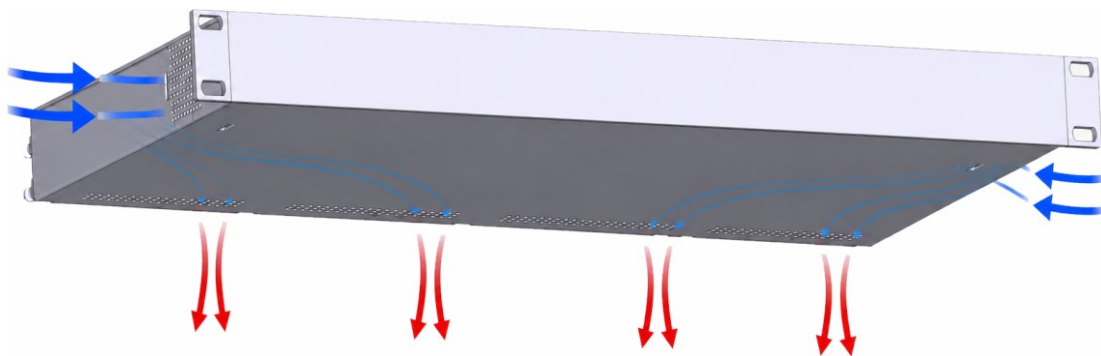


Figure 7

Figure 6 and Figure 7 depict the airflow of the 8x00 product series systems. The fans draw cool air into the unit, directing the airflow toward the rear, where it exits through the top and bottom ventilation openings. Figure 8 shows the required 1U spacing for proper airflow.

These figures illustrate a 1U base system, but the same principle applies to 2U base systems.



Figure 8

**NOTICE****Risk of device damage due to overheating!**

The operating mode of the fans is software-configurable and allows them to be disabled. Disabling the fans is only permitted if the ambient temperature of the device is constantly kept below 35°C during operation.

The internal device temperature is continuously monitored. If the fans are disabled via software and an over-temperature condition occurs, this event will be logged. Operating the device under these conditions voids the warranty and liability.

9 Connection of the power supply lines

The 8x00 product series time reference systems operate using hazardous voltages.

**WARNING****Hazardous Voltage Risk**

Failure to follow the safety instructions in this manual can result in death, serious personal injury, and substantial property damage. Always observe the safety instructions attached to the device.

Observe the following requirements before connecting the device to the power supply:

- **Protective Earthing:** The system must be properly grounded. Details can be found in chapter 8 System mounting.
- **Cable Selection:** Connect the power supply using short, low-inductance cables.
- **Cable Integrity and Routing:** Ensure all supply lines are undamaged and routed properly to prevent mechanical wear or stress.

9.1 Redundant Power Supplies vs. Redundant Power Feeding

All DC-only power supply extension boards in the 8x00 product series feature two connectors for power supply connection - a setup also known as redundant power feeding. The positive and negative input lines of both connectors are interconnected via diodes.

Consequently, an earth fault on one connected power source is forwarded via the redundant power feeding to the other power source. If an earth-fault monitor is used in both power

sources, a fault in one source will trigger the monitor of both sources, thereby reducing redundancy.

If this behaviour is unacceptable, separate redundant power supplies must be used (e.g., two PSU extension boards in a 1U base system or three PSU extension boards in a 2U base system).

10 Available base systems

Currently, the following base systems are available:

- **FG8101G01:** This 1U base system supports all features described above.
- **FG8101G02:** This 1U base system has the restriction that POS6 cannot be used. This is because POS2 is prepared to be equipped with a board that utilizes the space of both POS2 and POS6.
- **FG8201G01:** This 2U base system supports all features described above.

10.1 FG8101G02 restrictions

Due to the fact that POS6 of the FG8101G02 cannot be used, the system has the following restrictions:

- Only one TDC is supported (the one in POS6 cannot be installed).
- Only five SPs are supported (the one in POS6 cannot be installed).

11 Extension boards

11.1 Mounting of extension boards

To mount an extension board, the blind panel of the corresponding position must be removed first. To do this, remove the two captive screws of the blind panel from the base system.



Figure 9

Figure 9 shows a FG8101G01 with the blind panels removed from POS1 and POS2.

Then the extension board must be inserted into the desired position.

For POS2 to POS4, POS6 to POS8 and POS10 to 12 as well as POS14 to POS16 in 2U base systems, the circuit board of the extension board must be inserted between the guides of the corresponding position (see Figure 10)



Figure 10

For POS1 and POS5 in 1U base systems and POS1, POS9 and POS13 in 2U base systems, the board must be placed on the guides of the isolation plate and then inserted into the base system. The guides of the isolation plate on which the board must be placed are marked in Figure 11.



Figure 11



Note

Extension board rotation

In 1U base systems, the extension boards for POS5 to POS8 must be rotated prior to insertion; therefore, the labelling on the extension board cover will be upside down in these positions.

In 2U base systems, the extension boards in POS13 to POS16 must also be inserted rotated.

After the extension board has been inserted into the base system, it must be secured to the base system using the captive screws on its cover before connecting any cables.



Note

Avoid overtightening the screws

Damage to the threads may occur if the maximum torque of 0.5 Nm is exceeded.



CAUTION

Connect cable to extension board

Cables may only be connected to the extension boards after the boards have been fully mounted in the base system. Failure to do so may result in an electric shock or damage to the extension board or the whole system.

11.1.1 Mounting extension boards occupying 2 positions

Some extension boards occupy two vertically adjacent positions. If such an extension board is to be installed in a position requiring normal orientation, the position below must not be occupied by another board. If the extension board is to be installed in a position requiring 180° rotation, the position above must not be occupied by another board. In both cases, the insulation plate between the two positions must be removed.

11.2 Dismounting of extension boards

To remove an extension board from the base system, all cables must first be disconnected from the corresponding extension board.

	CAUTION
	Disconnect cables from extension boards All cables must be disconnected from an extension board before removing it; otherwise, an electric shock or damage to the extension board may occur.

After that, the captive screws of the extension board cover must be unscrewed from the base system, and the extension board can then be pulled out of the base system.

	DANGER
	Electric Shock PSU extension boards must not be pulled out of the base system immediately after disconnecting the power source. Wait at least one minute after disconnecting the power supply before removing the PSU extension board to allow internal capacitors to discharge.

	WARNING
	Risk of Burns During operation, high device temperatures may occur depending on the operating parameters and system configuration. Allow the device to cool down completely before starting maintenance work.

Finally, either a blind panel or another extension board must be installed in the open position of the base system to cover the slot of the dismantled extension board.

11.2.1 Dismounting extension boards occupying two positions

When dismounting an extension board that occupies two positions, follow the steps in chapter 11.2 Dismounting of extension boards. In addition, an isolation plate must be installed between the two positions that were occupied by the extension board.

11.3 Supported extension boards

Different extension boards are supported by the 8x00 product series base systems. The following chapters describe their cover elements, LED states, how to perform a factory default reset, and which **huma** board pages are supported.

Technical specifications of all extension boards can be found in the latest 8x00 product series product sheet.

All extension boards are equipped with status LEDs on their front panels for quick identification of their operating status. The exact functional description of the LEDs can be found in the corresponding subchapter for each extension board.

11.3.1 FG8701G01 - MC, TDC and SP functionality



Figure 12



Note

This extension board cannot be installed to base system FG8101G01.

This extension board can only be installed in POS2 of base system FG8101G02.

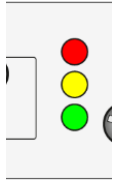
This extension board can be installed to all positions supporting SPs within base system FG8201G01.

The FG8701G01 is a multi-functional extension board supporting MC, TDC and SP functionalities, occupying two positions. Its operating mode depends on its position within the base system.

Hardware Interfaces:

- **Antenna Connector** : Connects a GNSS antenna system. This connector provides a 5 VDC supply voltage for the antenna.
- **Status Connector** : Provides a dry, normally open (NO) contact that can be configured via the device settings.
- **Network Interfaces** : Features two RJ45 ports used for MC, TDC, and SP data communication.

11.3.1.1 Status LEDs

	Red	Fault condition. At least one configured time output is no longer generated.
	Yellow	Warning condition. Configured time outputs are generated, but a problem was detected.
	Green	Normal operation. Full functionality is achieved.
	All Three	Boot process. All three LEDs are illuminated simultaneously during system boot.

11.3.1.2 Factory default

A factory default or reboot of the extension board can be performed via the push button accessible through the 1.5 mm diameter hole on its front panel (located next to the LED symbols).



- **Reboot:** Press and hold the button for 1 to 10 seconds.
- **Factory Default:** Press and hold the button for at least 10 seconds.

11.3.1.3 Supported board pages in huma

The following table lists the supported **huma** board pages of this board.

Board Overview	
General → Status	
General → Action	
General → Config	
Performance → Status	
Network	
General → Status	
General → Action	
General → Config	
Interface → Status	
Interface → Action	

Interface → Config	
Routing → Status	
Routing → Config	
Firewall → Config	
Firewall → Action	
Sync Setting	
General → Status	
General → Action	
General → Config	TDC variant
GNSS → Status	
GNSS → Action	
GNSS → Config	
NTP → Status	
NTP → Action	
NTP → Config	
PTP → Status	
PTP → Config	
Time Service	
General → Status	
General → Config	
NTP → Status	
NTP → Action	
NTP → Config	
PTP → Status	
PTP → Config	
SIMATIC NTP 10s broadcast → Config	
SINEC H1 → Config	
Monitoring	
Events → Config	
Syslog → Config	

Email → Config	
SNMP → Action	
SNMP → Config	
Relay → Config	

11.3.2 FG8701G02 - MC, TDC and SP functionality



Figure 13

	Note
	This extension board cannot be installed to base system FG8101G01.
	This extension board can only be installed in POS2 of base system FG8101G02.
	This extension board can be installed to all positions supporting SPs within base system FG8201G01.

Identical to extension board FG8701G01. The only difference is the integrated GNSS receiver.

11.3.3 FG8701G03 - MC, TDC and SP functionality



Figure 14



Note

This extension board cannot be installed to base system FG8101G01.

This extension board can only be installed in POS2 of base system FG8101G02.

This extension board can be installed to all positions supporting SPs within base system FG8201G01.

Identical to extension board FG8701G01. The only difference is that it is equipped with two GNSS receivers.

GNSS antenna systems can be connected to the antenna connector  **1** and  **2**. Each of these connectors provides a 5VDC supply voltage for the respective GNSS antenna system. Both connectors are independent and feed different GNSS receivers.

11.3.3.1 Supported board pages in huma

This extension board supports the same **huma** board pages as FG8701G01. In addition, it supports the following pages too:

Sync Setting	
GNSS2 → Status	
GNSS2 → Action	
GNSS2 → Config	

11.3.4 FG8702D01 – MC, TDC and SP functionality

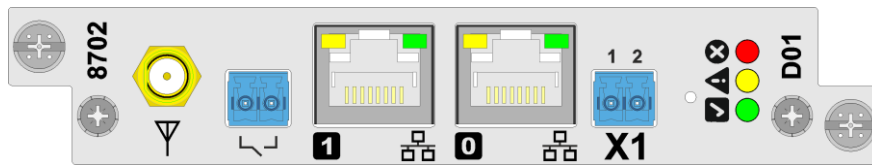


Figure 15

The FG8702D01 is a multi-functional extension board supporting MC, TDC and SP functionalities. Its operating mode depends on its position within the base system.

Hardware Interfaces:

- **Antenna Connector** : Connects a DCF antenna system. This connector provides a 5 VDC supply voltage for the antenna.
- **DC level shift Connector (X1)**: Time sources supplying DCF, IRIG-B, or cyclic pulse in DC level shift, can be connected here as synchronisation sources.
- **Status Connector** : Provides a dry, normally open (NO) contact that can be configured via the device settings.
- **Network Interfaces** : Features two RJ45 ports used for MC, TDC, and SP data communication.

11.3.4.1 Status LEDs

Identical to extension board FG8701G01.

11.3.4.2 Factory default

Identical to extension board FG8701G01.

11.3.4.3 Supported board pages in huma

The following table lists the supported **huma** board pages of this board.

Board Overview	
General → Status	
General → Action	
General → Config	
Performance → Status	
Network	
General → Status	
General → Action	
General → Config	
Interface → Status	
Interface → Action	
Interface → Config	
Routing → Status	
Routing → Config	
Firewall → Config	
Firewall → Action	
Sync Setting	
General → Status	
General → Action	
General → Config	TDC variant
DCF → Status	
DCF → Action	
DCF → Config	
Timecode → Status	
Timecode → Action	
Timecode → Config	
NTP → Status	

NTP → Action	
NTP → Config	
PTP → Status	
PTP → Config	
Time Service	
General → Status	
General → Config	
NTP → Status	
NTP → Action	
NTP → Config	
SIMATIC NTP 10s broadcast → Config	
SINEC H1 → Config	
Monitoring	
Events → Config	
Syslog → Config	
Email → Config	
SNMP → Action	
SNMP → Config	
Relay → Config	

11.3.5 FG8702G01 - MC, TDC and SP functionality

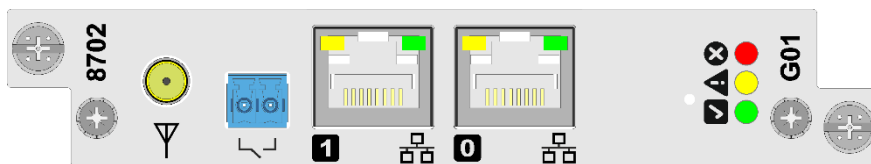


Figure 16

Identical to extension board FG8701G01. The only differences are that this extension board occupies only one position, features a different integrated oscillator type, and utilizes a different GNSS receiver type.

11.3.6 FG8702G02 - MC, TDC and SP functionality

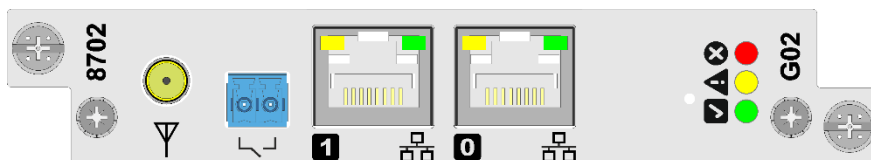


Figure 17

Identical to extension board FG8702G01. The only difference is the integrated oscillator type.

11.3.7 FG8702G03 - MC, TDC and SP functionality

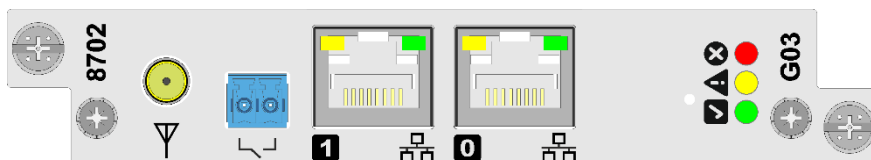


Figure 18

Identical to extension board FG8702G01. The only difference is the integrated oscillator type.

11.3.8 FG8702G04 - MC, TDC and SP functionality

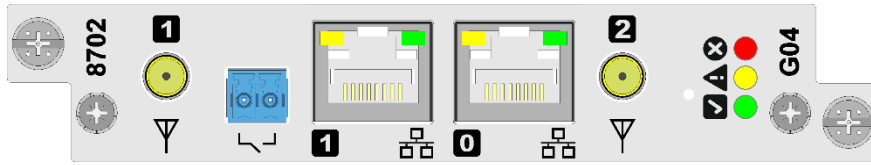


Figure 19

Identical to extension board FG8702G01. The only difference is that it is equipped with a second GNSS receiver.

GNSS antenna systems can be connected to the antenna connector  **1** and  **2**. Each of these connectors provides a 5VDC supply voltage for the respective GNSS antenna system. Both connectors are independent and feed different GNSS receivers.

11.3.8.1 Supported board pages in huma

This extension board supports the same **huma** board pages as FG8701G01. In addition, it supports the following pages too:

Sync Setting	
GNSS2 → Status	
GNSS2 → Action	
GNSS2 → Config	

11.3.9 FG8702G05 - MC, TDC and SP functionality

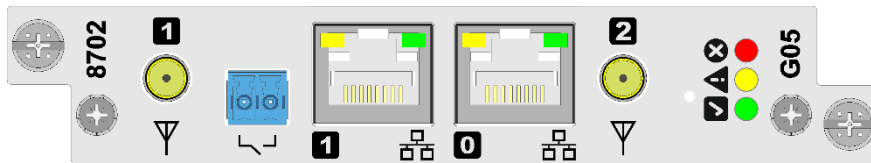


Figure 20

Identical to extension board FG8702G04. The only difference is the integrated oscillator type.

11.3.10 FG8702G06 - MC, TDC and SP functionality

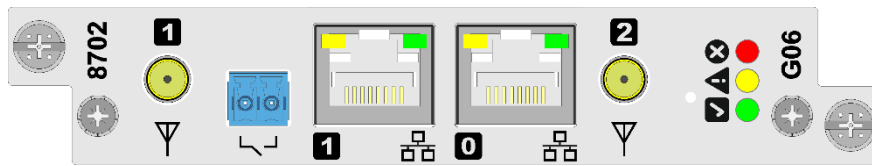


Figure 21

Identical to extension board FG8702G04. The only difference is the integrated oscillator type.

11.3.11 FG8702G11 - MC, TDC and SP functionality

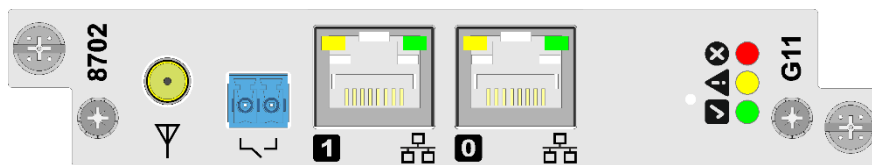


Figure 22

Identical to extension board FG8702G01. The only difference is the integrated GNSS receiver type.

11.3.12 FG8702G12 - MC, TDC and SP functionality

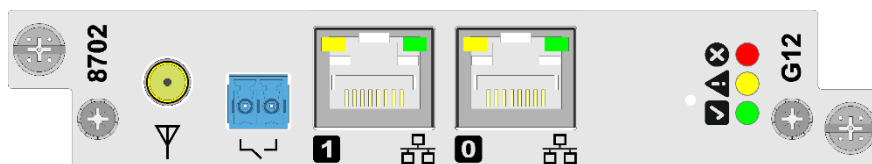


Figure 23

Identical to extension board FG8702G11. The only difference is the integrated oscillator type.

11.3.13 FG8702G13 - MC, TDC and SP functionality

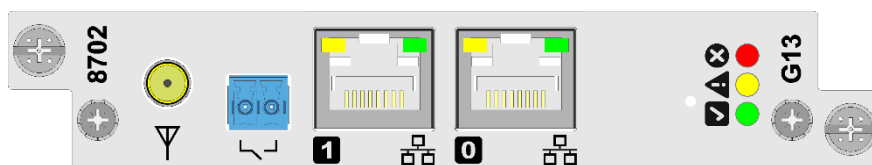


Figure 24

Identical to extension board FG8702G11. The only difference is the integrated oscillator type.

11.3.14 FG8702G14 - MC, TDC and SP functionality

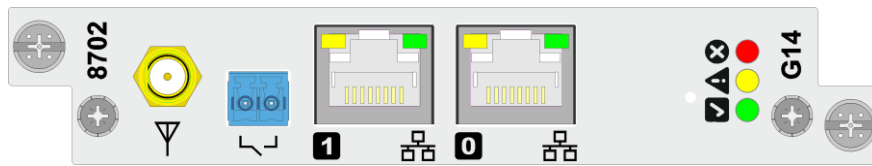


Figure 25

Identical to extension board FG8702G03. The only difference is the integrated GNSS receiver type.

11.3.15 FG8702G15 - MC, TDC and SP functionality

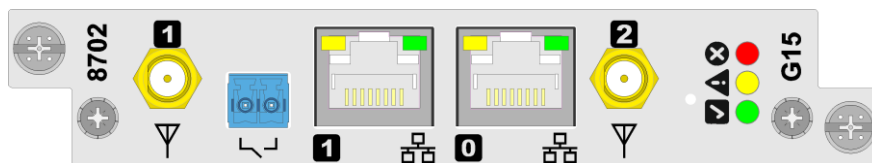


Figure 26

Identical to extension board FG8702G06. The only difference is the integrated GNSS receiver type for  **1**.

11.3.16 FG8800M00 - MC and SP functionality

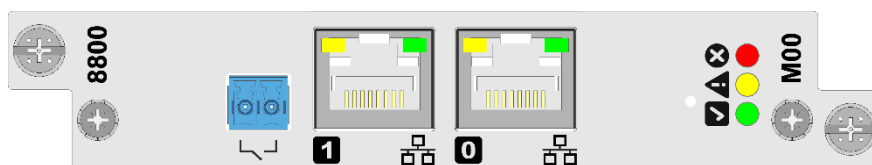


Figure 27

The FG8701G01 is a multi-functional extension board supporting MC and SP functionalities. Its operating mode depends on its position within the base system.

Hardware Interfaces:

- **Status Connector** : Provides a dry, normally open (NO) contact that can be configured via the device settings.
- **Network Interfaces** : Features two RJ45 ports used for MC and SP data communication.

11.3.16.1 Status LEDs

Identical as on board FG8701G01.

11.3.16.2 Factory default

Identical as on board FG8701G01.

11.3.16.3 Supported board pages in huma

The following table lists the supported **huma** board pages of this board.

Board Overview	
General → Status	
General → Action	
General → Config	
Performance → Status	
Network	
General → Status	
General → Action	
General → Config	
Interface → Status	
Interface → Action	
Interface → Config	
Routing → Status	
Routing → Config	
Firewall → Config	
Firewall → Action	
Sync Setting	
General → Status	
General → Action	
General → Config	SP variant
Time Service	
General → Status	

General → Config	
NTP → Status	
NTP → Action	
NTP → Config	
SIMATIC NTP 10s broadcast → Config	
SINEC H1 → Config	
Monitoring	
Events → Config	
Syslog → Config	
Email → Config	
SNMP → Action	
SNMP → Config	
Relay → Config	

11.3.17 FG8800M01 - MC and SP functionality

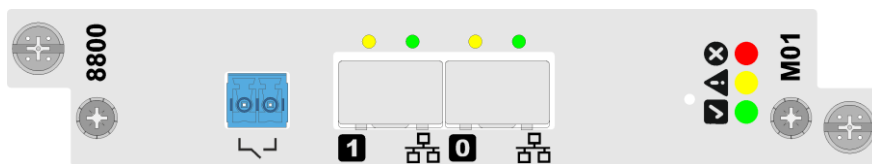


Figure 28

Identical to FG8800M00. The only difference is that it features SFP slots instead of RJ45 ports.

11.3.18 FG8801F02 - SP functionality

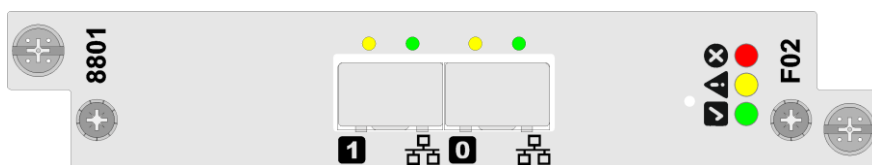


Figure 29

The FG8801F02 extension board supports the SP functionality only.

Hardware Interfaces:

- **Network Interfaces** : Features two SFP slots used for network time distribution communication.

11.3.18.1 Status LEDs

Identical as on board FG8701G01.

11.3.18.2 Factory default

Identical as on board FG8701G01.

11.3.18.3 Supported board pages in huma

The following table lists the supported **huma** board pages of this board.

Board Overview	
General → Status	
General → Action	
General → Config	
Performance → Status	
Network	
General → Status	
General → Action	
General → Config	
Interface → Status	
Interface → Action	
Interface → Config	
Routing → Status	
Routing → Config	
Firewall → Config	
Firewall → Action	
Sync Setting	
General → Status	
General → Action	
General → Config	SP variant
Time Service	
General → Status	
General → Config	
NTP → Status	
NTP → Action	
NTP → Config	
PTP → Status	
PTP → Config	
SIMATIC NTP 10s broadcast → Config	

11.3.19 FG8801N02 - SP functionality

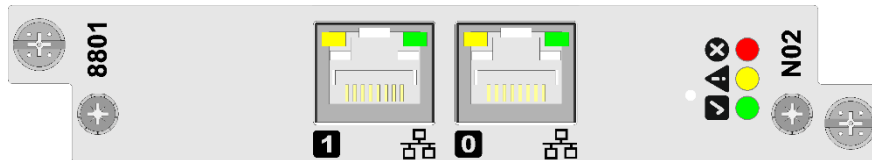


Figure 30

Identical to FG8801F02. The only difference is that it features RJ45 ports instead of SFP slots.

11.3.20 FG8802S00 - SP functionality

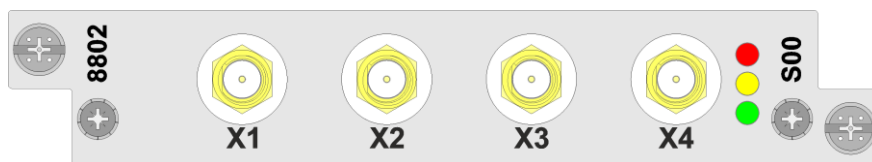


Figure 31

The FG8801F02 extension board supports the SP functionality only.

Hardware Interfaces:

- **SMA interfaces** (X1 to X4): Four SMA connectors used for time distribution in various protocols and signal forms. The four channels X1 to X4 are galvanically isolated from each other. Refer to the 8x00 product series product sheet for detailed information regarding supported protocols and signal levels.

11.3.20.1 Status LEDs

Identical as on board FG8701G01.

11.3.20.2 Factory default

The FG8802S00 is equipped with an internal DIP switch. To perform a factory default reset on this extension board, follow these steps:

1. Dismount the FG8802S00 from the base system.
2. Set both switches of the DIP switch to the ON position.

3. Mount the FG8802S00 into a powered base system.
4. Wait 60 seconds.
5. Dismount the FG8802S00 from the base system.
6. Set both switches of the DIP switch to the OFF position.
7. Mount the FG8802S00 into a powered system.

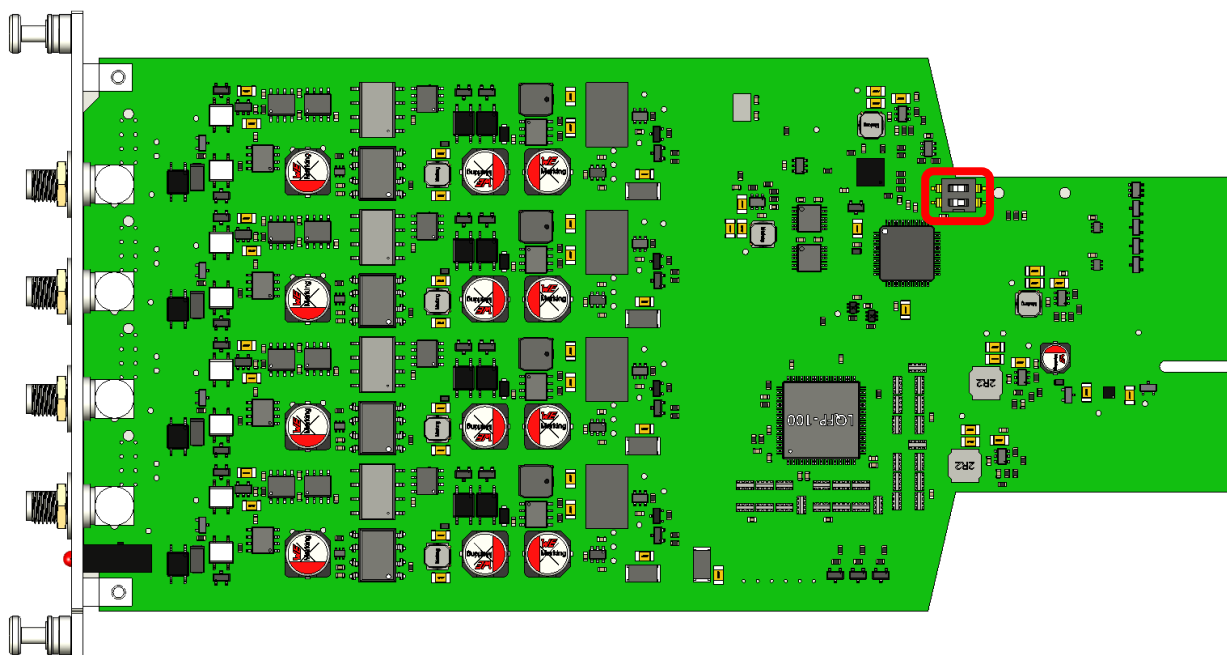


Figure 32

The position of the DIP switch is highlighted in Figure 32.

11.3.20.3 Supported board pages in huma

The following table lists the supported **huma** board pages of this board.

Board Overview	
General ➔ Status	
General ➔ Action	
General ➔ Config	
Sync Setting	
General ➔ Status	
General ➔ Action	
General ➔ Config	SP variant

Time Service	
General → Status	
General → Config	
X1 → Config	
X1 → Action	
X2 → Config	
X2 → Action	
X3 → Config	
X3 → Action	
X4 → Config	
X4 → Action	

11.3.21 FG8802S01 - SP functionality



Figure 33

Identical to FG8802S00. The only difference is that it features BNC connectors instead of SMA connectors.

11.3.22 FG8802S02 - SP functionality

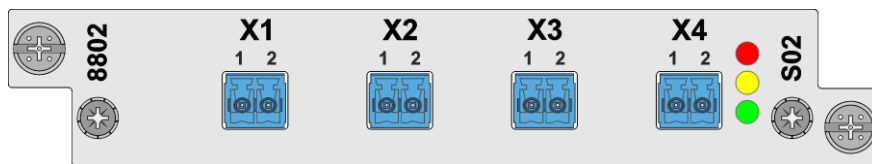


Figure 34

Identical to FG8802S00. The only difference is that it features screw terminals instead of SMA connectors.

Pin Description		
Pin	Signal	Description
1	SIGNAL / +	Channel signal output
2	GND / -	Channel ground reference

11.3.23 FG8802S20 - SP functionality



Figure 35

Identical to FG8802S00. The only difference is that it features ST-type fiber optic ports (820 nm multimode) instead of SMA connectors.

11.3.24 FG8803S02 - SP functionality



Figure 36

The FG8803S02 extension board supports the SP functionality only.

Hardware Interfaces:

- **Serial interfaces** (X1 / X2): Two 9-pin D-Sub 9 connectors used for serial time distribution. Details regarding the supported serial strings and the pinout can be found in appendix chapter 19.1 FG8803Sxx details

11.3.24.1 Status LEDs

Identical as on board FG8701G01.

11.3.24.2 Factory default

Identical as on board FG8701G01.

11.3.24.3 Supported board pages in huma

The following table lists the supported **huma** board pages of this board.

Board Overview	
General → Status	
General → Action	
General → Config	
Sync Setting	
General → Status	
General → Action	
General → Config	SP variant
Time Service	
General → Status	

General → Config	
X1 → Config	
X1 → Action	
X2 → Config	
X2 → Action	

11.3.25 FG8803S20 - SP functionality

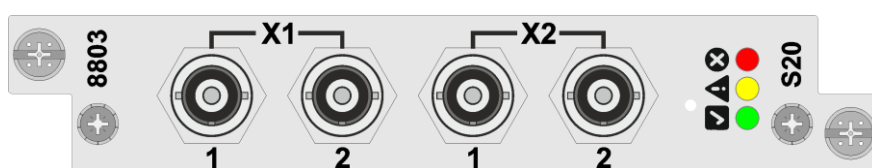


Figure 37

The FG8803S20 extension board supports the SP functionality only.

Hardware Interfaces:

- **Serial interfaces (X1 / X2):** Four ST-type fiber optic ports (820 nm multimode) used for serial time distribution. Details regarding the supported serial strings can be found in appendix chapter 19.1 FG8803Sxx details

11.3.25.1 Connector description

The following table describes the functionality of the four ST-type fiber optic connectors:

X1-1	FG8803S20 channel 1 (X1) RX; this connector is only used when the transmission interval of channel 1 is configured to "Only on request".
X1-2	FG8803S20 channel 1 (X1) TX; the configured serial string is output at this connector.
X2-1	FG8803S20 channel 2 (X2) RX; this connector is only used when the transmission interval of channel 2 is configured to "Only on request".
X2-2	FG8803S20 channel 2 (X2) TX; the configured serial string is output at this connector.

11.3.25.2 Status LEDs

Identical as on board FG8701G01.

11.3.25.3 Factory default

Identical as on board FG8701G01.

11.3.25.4 Supported board pages in huma

Identical as on board FG8803S02.

11.3.26 FG8901P01 - PSU 85-264VAC / 125-250VDC

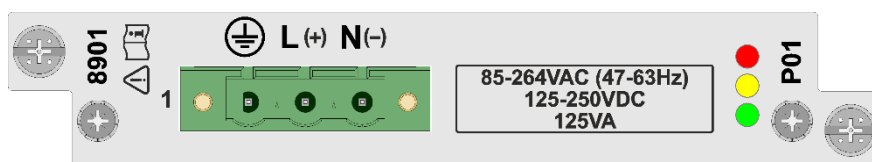


Figure 38

The FG8901P01 is an extension board with PSU functionality.

	WARNING
	Hazardous Voltage and Residual Energy
	The device operates using hazardous voltages. To prevent severe electrical shock or death:
	• Disconnect all power supply lines and plugs before performing any work on the device. • Wait for at least one minute after disconnecting the power supply to allow dangerous residual voltages (stored capacitor charge) to fully discharge.

11.3.26.1 Electrical connection

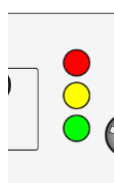
	WARNING Compliance with IEC 62368-1 Requirements Installation, wiring, and disassembly of the power supply connector must only be performed in a de-energized state (e.g., by opening the primary-side circuit breaker). To ensure safe operation, adhere to the following infrastructure requirements: • Overcurrent Protection: The supply lines must be adequately fused and dimensioned according to local regulations. • Conductor Cross-Section: Wire sizes must be between 1 mm² and 2.5 mm² (17 AWG to 13 AWG). • Disconnecting Device: The system must be supplied via a suitable, easily accessible disconnecting device (e.g., a mains switch or protective contact socket) installed near the equipment and clearly marked as the isolating switch for this device.
--	---

	Note This PSU is delivered with the cable housing ST0001H00. Mount the cable housing on the power supply connector, to obtain additional protection against direct contact with the supply voltage and strain relief. The length of the cable housing is 37 mm; keep this in mind when planning the space requirements of the base system
--	--

Power Supply Terminal – 3-Pole Specifications

Conductor cross section	1mm ² - 2.5mm ² (17 AWG - 13 AWG)
-------------------------	---

11.3.26.2 Status LEDs



Red	Fault condition. The PSU has detected an operating fault (e.g., missing supply voltage / defective board).
Yellow	Warning condition. The PSU is working close to its maximum ratings.
Green	Normal operation. The PSU is in full operational readiness.

11.3.26.3 Supported board pages in huma

The following table lists the supported **huma** board pages of this board.

Board Overview	
General → Status	
General → Action	
General → Config	
Details → Status	

11.3.27 FG8901P02 - PSU 18-36VDC



Figure 39

The FG8901P02 is an extension board with PSU functionality.

	CAUTION
	Short Circuit and Thermal Hazard The device operates within a safe low-voltage range (18–36 V DC). However, high short-circuit currents can cause severe burns, arcing, or fire hazards. • Disconnect all power supply lines and plugs before performing any work on the device. • Wait for at least one minute after disconnecting the power supply to allow internal components to fully discharge before handling the board.

11.3.27.1 Electrical connection

	WARNING
	Infrastructure and Overcurrent Protection Requirements Installation, wiring, and disassembly of the power supply connector must only be performed in a de-energized state (e.g., by opening the primary-side circuit breaker). To ensure safe and reliable operation, adhere to the following infrastructure requirements: • Overcurrent Protection: The supply lines must be adequately fused and dimensioned according to local regulations to prevent overheating or fire in the event of a short circuit.

	• Conductor Cross-Section: Wire sizes must be between 1 mm² and 2.5 mm² (17 AWG to 13 AWG). • Disconnecting Device: The system must be supplied via a suitable, easily accessible disconnecting device installed near the equipment and clearly marked as the isolating switch for this device.
--	--

2x Power Supply Terminal – 3-Pole Specifications

Conductor cross section	1mm ² - 2.5mm ² (17 AWG - 13 AWG)
-------------------------	---

11.3.27.2 Status LEDs

Identical as on board FG8901G01.

11.3.27.3 Supported board pages in huma

Identical as on board FG8901G01.

11.3.28 FG8901P03 - PSU 36-76VDC

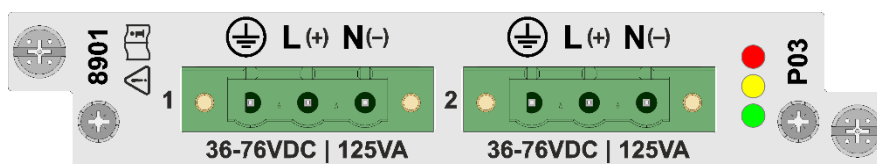


Figure 40

The FG8901P03 is an extension board with PSU functionality.

	WARNING
	Hazardous Voltage and Residual Energy The device operates using hazardous voltages. To prevent severe electrical shock or injury: • Disconnect all power supply lines and plugs before performing any work on the device. • Wait for at least one minute after disconnecting the power supply to allow dangerous residual voltages (stored capacitor charge) to fully discharge.

11.3.28.1 Electrical connection

	WARNING
	Compliance with IEC 62368-1 Requirements Installation, wiring, and disassembly of the power supply connector must only be performed in a de-energized state (e.g., by opening the primary-side circuit breaker). To ensure safe operation, adhere to the following infrastructure requirements: • Overcurrent Protection: The supply lines must be adequately fused and dimensioned according to local regulations. • Conductor Cross-Section: Wire sizes must be between 1 mm² and 2.5 mm² (17 AWG to 13 AWG). • Disconnecting Device: The system must be supplied via a suitable, easily accessible disconnecting device (e.g., a mains switch or protective contact socket) installed near the equipment and clearly marked as the isolating switch for this device.

2x Power Supply Terminal – 3-Pole Specifications

Conductor cross section	1mm ² – 2,5mm ² (17 AWG – 13 AWG)
-------------------------	---

11.3.28.2 Status LEDs

Identical as on board FG8901G01.

11.3.28.3 Supported board pages in huma

Identical as on board FG8901G01.

11.3.29 FG8901P04 - PSU 60-160VDC

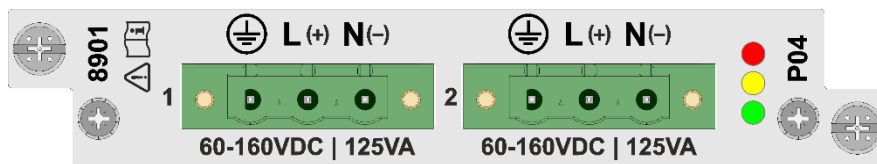


Figure 41

The FG8901P04 is an extension board with PSU functionality.

	WARNING Hazardous Voltage and Residual Energy The device operates using hazardous voltages. To prevent severe electrical shock or death: • Disconnect all power supply lines and plugs before performing any work on the device. • Wait for at least one minute after disconnecting the power supply to allow dangerous residual voltages (stored capacitor charge) to fully discharge.
--	---

11.3.29.1 Electrical connection

	WARNING Compliance with IEC 62368-1 Requirements Installation, wiring, and disassembly of the power supply connector must only be performed in a de-energized state (e.g., by opening the primary-side circuit breaker). To ensure safe operation, adhere to the following infrastructure requirements: • Overcurrent Protection: The supply lines must be adequately fused and dimensioned according to local regulations. • Conductor Cross-Section: Wire sizes must be between 1 mm² and 2.5 mm² (17 AWG to 13 AWG). • Disconnecting Device: The system must be supplied via a suitable, easily accessible disconnecting device (e.g., a mains switch or protective contact socket) installed near the equipment and clearly marked as the isolating switch for this device.
--	---

	Note This PSU is delivered with two cable housings ST0001H00. Mount the cable housings on the power supply connectors, to obtain additional protection against direct contact with the supply voltage and strain relief.
--	--

	The length of the cable housing is 37 mm; keep this in mind when planning the space requirements of the base system
--	---

2x Power Supply Terminal – 3-Pole Specifications

Conductor cross section	1mm ² – 2,5mm ² (17 AWG – 13 AWG)
-------------------------	---

11.3.29.2 Status LEDs

Identical as on board FG8901G01.

11.3.29.3 Supported board pages in huma

Identical as on board FG8901G01.

11.3.30 FG8901P06 - PSU 19-75VDC



Figure 42

The FG8901P06 is an extension board with PSU functionality.

	WARNING Hazardous Voltage and Residual Energy The device operates using hazardous voltages. To prevent severe electrical shock or injury: • Disconnect all power supply lines and plugs before performing any work on the device. • Wait for at least one minute after disconnecting the power supply to allow dangerous residual voltages (stored capacitor charge) to fully discharge.
--	--

11.3.30.1 Electrical connection

	WARNING Compliance with IEC 62368-1 Requirements Installation, wiring, and disassembly of the power supply connector must only be performed in a de-energized state (e.g., by opening the primary-side circuit breaker). To ensure safe operation, adhere to the following infrastructure requirements: • Overcurrent Protection: The supply lines must be adequately fused and dimensioned according to local regulations. • Conductor Cross-Section: Wire sizes must be between 1 mm² and 2.5 mm² (17 AWG to 13 AWG). • Disconnecting Device: The system must be supplied via a suitable, easily accessible disconnecting device (e.g., a mains switch or protective contact socket) installed near the equipment and clearly marked as the isolating switch for this device.
--	---

2x Power Supply Terminal – 3-Pole Specifications

Conductor cross section	1mm ² - 2.5mm ² (17 AWG - 13 AWG)
--------------------------------	---

11.3.30.2 Status LEDs

Identical as on board FG8901G01.

11.3.30.3 Supported board pages in huma

Identical as on board FG8901G01.

12 Commissioning

To put an 8x00 product series device into operation, the following steps must be carried out:

1. **Mount the base system:** Mount the base system as described in chapter 8 System mounting.
2. **Install extension boards:** Install the extension boards into the base system as described in chapter 11.1 Mounting of extension boards (the minimum configuration described in chapter 6.6 Minimal configuration must be met).
3. **Connect the supply voltage:** Connect the power supply lines to the individual PSU extension boards. The supported voltage ranges are printed on each PSU extension board 's front panel.
4. **Wait for boot completion:** Wait until the extension board with MC functionality has booted. The boot status is indicated by the extension boards front panel LEDs. The boot procedure is complete when only a single LED remains active.

Note: Immediately after booting, the red LED will typically be active until valid time synchronization is established.

5. **Retrieve the IPv4 address:** Use the base systems front panel button to switch to the POS2 screen as described in chapter 6.7.3 Display, to read the retrieved the IPv4 address.
6. **Access the web interface:** Open a web browser and navigate to the retrieved IP address (e.g. <https://192.168.0.1> if factory default settings are active).
7. **Log in:** Log in to the hopf unified management application **huma®** to begin system configuration.



Note

Security Note

Change the default credentials immediately after the initial login to secure the system against unauthorized access.

13 Maintenance

The 8x00 product series systems do not require any special or preventive maintenance.

In the event of a system malfunction or error, follow the troubleshooting instructions in the respective chapters of this manual or contact the **hopf** Elektronik GmbH - support team.

14 Troubleshooting

14.1 Procedure

In the event of a device error or malfunction, **hopf** Elektronik GmbH recommends the following troubleshooting procedure:

- **No LEDs active:** If all LEDs on the system remain dark, verify that the supply voltage meets the specifications and ensure the polarity is correct at the corresponding terminals.
- **Red error LED active:** If an extension board indicates a fault via its red LED, open the **huma**® web interface and check the diagnostic menu for the specific extension board. When hovering the mouse cursor over the extension board's position within the graphical system overview in **huma**®, a detailed description of the current operational status and root cause is displayed.

The base system and its extension boards are operating correctly when:

- The operational status signalled by the three LEDs on each extension board's front panel matches the expected states described in the respective extension board chapter.

- Only the green LEDs are active (indicating normal operation without warnings or faults).

15 Dismounting

	WARNING Hazardous Voltage and Residual Energy The device operates using hazardous voltages. To prevent severe electrical shock or death: • Disconnect all power supply lines and plugs before performing any work on the device. • Wait for at least one minute after disconnecting the power supply to allow dangerous residual voltages (stored capacitor charge) to fully discharge.
	CAUTION Risk of Burns – Hot Surfaces Depending on the operating parameters and extension board types, high device temperatures can occur on the housing during operation. Allow the system to cool down completely before starting any handling, maintenance, or replacement work.

If dismounting of an 8x00 product series system is required, perform the following steps in the specified order:

1. **Power down:** Turn off and isolate the power supplies of the PSU extension boards.
2. **Wait for discharge and cooling:** Wait at least one minute to allow dangerous residual voltages to fully discharge and allow the system to cool down.
3. **Disconnect all cables:** Unplug all cables from the extension boards and the grounding cables from the base system.
4. **Remove system from 19" control cabinet:** Remove the four screws fixing the base system in the 19" control cabinet.

16 Repair

Apart from the extension boards only fans of the base system may be exchanged outside a factory of the company **hopf** Elektronik GmbH.

Limit work on the hardware to the necessary extent.



Note

Have defective extension boards replaced only by trained persons.

16.1 Fan replacement

16.1.1 1U base system

Tools needed: Phillips screwdriver PH1

Perform the following steps to replace the fans of a 1U base system:

1. Follow the steps mentioned in chapter 15 Dismounting.
2. Remove all screws fixing the cover of the base system to the rest of the housing (see Figure 43).



Figure 43

3. Lift the cover of the base system and place it in front of the front panel of the base system. The inner surface of the cover must face up (see Figure 44).



Note

Cover grounding cable

The cover must be lifted carefully, as it is connected to the rest of the housing by a grounding cable. If care is not taken when removing the cover, the device may be damaged.



Figure 44

4. Open the cable guide of the fan cable.
5. Unplug the fan from its connector.
6. Remove the defective fan from the base system. Figure 45 illustrates the positions of the cable guide and the plug of the fan.

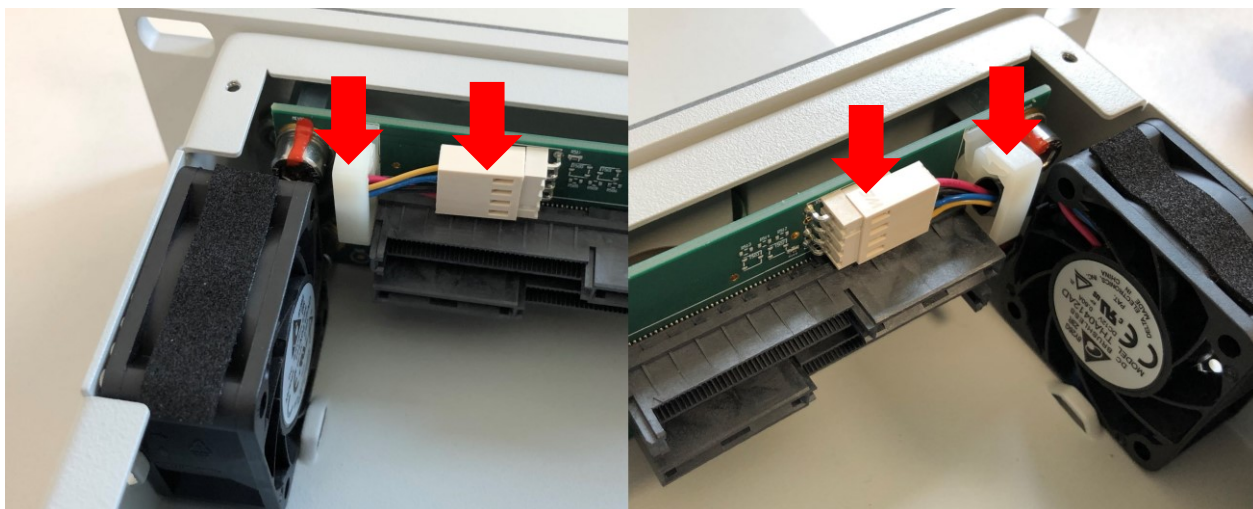


Figure 45

7. Put a new fan into the base system.
8. Lay the fan cable through the cable guide.
9. Plug the cable into the connector of the base system
10. Close the cable guide.
11. Mount the housing cover and secure it with all screws (tighten the screws with a torque of $0.2 \text{ Nm} \pm 0.05 \text{ Nm}$), making sure that the ground cable of the cover is not positioned over the backplane connectors of the surrounding positions.
12. Mount the base system as described in *chapter 8* System mounting.
13. Reconnect all cables to the extension boards.

16.1.2 2U base system

The fan replacement procedure for 2U base systems is the same as for 1U base systems, except that 2U base systems feature more screws mounting the cover to the housing of the base system and have two fans placed on each side.

17 Disposal

Our products are subject to the labelling requirements of the European Union Directive (2012/19/EU) on Waste Electrical and Electronic Equipment (WEEE) and are marked with the WEEE symbol (crossed-out wheeled bin, usually found on the serial number label).

This symbol indicates that our electronic products must not be disposed of with household waste. At the end of their useful life, they must be processed through an authorized recycling collection point or returned to **hopf** Elektronik GmbH for proper disposal.

18 Technical Specifications

Technical specifications of the base system and all extension boards can be found in the latest 8x00 product series product sheet.

19 Appendix

19.1 FG8803Sxx details

19.1.1 Output overview

SP functionality	
Time protocols	See chapter 19.1.3 Supported strings Configurable PPS
Output voltages	RS232, RS485
Maximum output current	RS232: 8mA RS485: 200mA
Connector type	2x 9-pole D-SUB male connector

19.1.2 9-pin D-Sub pinout

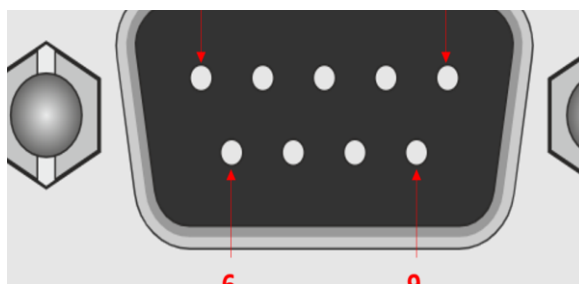


Figure 46

Figure 46 shows the pin numbering of the 9-pole D-Sub male connectors. Their respective functionalities are described in the table below.

Note: In the following table, receive (RX) and transmit (TX) directions are defined from the perspective of this module.

Pin number	Functionality short	Functionality
1	PPS+	RS232 mode: Outputs the PPS signal in RS232 level. RS485 mode: Outputs the positive RS485 signal (PPS+).
2	RS232 RXD	RS232 receive data line
3	RS232 TXD	RS232 transmit data line

4	RS485 PPS-	Negative RS485 PPS signal line (PPS-)
5	GND	Signal ground for RS232 interfaces
6	RS485 TXD+	Positive RS485 transmit data line
7	RS485 TXD-	Negative RS485 transmit data line
8	RS485 RXD+	Positive RS485 receive data line
9	RS485 RXD-	Negative RS485 receive data line

RS232 and RS485 receive signals can be connected to their corresponding pins simultaneously. However, only the signal type configured as the active input modulation will be processed on the respective channel (X1 / X2).



Note

Changed RS422 / RS485 Pin Assignment

Please note that the pin assignment for the **RS422 / RS485 lines (+ and -)** has changed in this product. Compared to previous product generations, the internal wiring of these lines has been **reversed (swapped)**.

Verify the pin assignment of your existing wiring prior to connection to prevent communication failures.

This change applies in comparison to the following (legacy) products:

- 4465
- 6844
- 6855
- 6870
- 6875
- 7001(RC)
- 8024
- 8030HEPTA
- 8030NTS

19.1.3 Supported strings

19.1.3.1 ABB Melody / Freelance (LF / CR), hopf 6021 (LF / CR)

This string can be sent on request. To request this string the character “G” (0x47) must be sent to the channel where this string is configured.

Character no.	Meaning	Hex value
1	STX (start of text)	\$02
2	Status	\$30-\$39, \$41-\$46
3	Day of week 1 → Monday ... 7 → Sunday When the time is output in UTC the following hex values apply 9 → Monday ... F → Sunday	\$31-\$37 \$39, \$41-\$46
4	Ten's hours	\$30-\$32
5	Unit hour	\$30-\$39
6	Ten's minutes	\$30-\$35
7	Unit minutes	\$30-\$39
8	Ten's seconds	\$30-\$35
9	Unit seconds	\$30-\$39
10	Ten's day	\$30-\$33
11	Unit day	\$30-\$39
12	Ten's month	\$30-\$31
13	Unit month	\$30-\$39
14	Ten's year	\$30-\$39
15	Unit year	\$30-\$39

16	LF (line feed)	\$0A
17	CR (carriage return)	\$0D
18	ETX (end of text)	\$03

Status:

Bit 3	Bit 2	Bit 1	Bit 0	Meaning
X	X	X	0	No DST announcement
X	X	X	1	DST announcement
X	X	0	X	Standard time
X	X	1	X	Daylight saving time (DST)
0	0	X	X	The time domain controller has no valid time
0	1	X	X	The time domain controller is operating in crystal mode and the accuracy is worse than or equal 100ns
1	0	X	X	The time domain controller is operating in crystal mode and the accuracy is better than 100ns
1	1	X	X	The time domain controller is locked to a sync source

Recommended settings for ABB-Melody:

Setting	Recommended value
Baud rate	9600
Data bits	8
Stop bit(s)	2
Parity bit	Even
Transmission interval	Every minute (at minute change)
Transmission scheme	Without second forerun / immediate control character

19.1.3.2 ABB Melody / Freelance (CR / LF) / hopf 6021 (CR / LF)

Identical to **ABB Melody / Freelance (LF / CR)**, **hopf 6021 (LF / CR)** only character 16 and 17 are exchanged.

19.1.3.3 hopf Binary

Character no.	Meaning	Hex value
1	STX (start of text)	\$02
2	“.”	\$3A
3	“T”	\$54
4	“I”	\$49
5	“M”	\$49
6	“E”	\$45
7	“.”	\$3A
8	“8”	\$38
9	“0”	\$30
10	“.”	\$3A
11-20	Milliseconds since start of the year as unsigned 40bit value, represented with 10 hex digits	\$30-\$39, \$41-\$46
21	“,”	\$3B
22-25	Year as unsigned 16bit value, represented with 4 hex digits	\$30-\$39, \$41-\$46
26	“,”	\$3B
27	Time zone offset in minutes as signed 16bit value, represented with 4 hex digits	\$30-\$39
28	“,”	\$3B
29-36	4 status bytes, represented with 8 hex digits	\$30-\$39, \$41-\$46
37	“*”	\$2A
38-39	Checksum	\$30-\$39, \$41-\$46
40	CR (carriage return)	\$0D
41	LF (line feed)	\$0A
42	ETX (end of text)	\$03

Status byte 1:

Bit 7	Bit 6	Bit 5	Meaning
0	0	0	Time is invalid
0	0	1	Unused
0	1	0	The time domain controller is operating in crystal mode and the accuracy is worse than 10ms
0	1	1	Unused
1	0	0	The time domain controller is operating in crystal mode and the accuracy is better than or equal 10ms and worse than 100ns
1	0	1	The time domain controller is locked to a sync source (accuracy worse than 100ns)
1	1	0	The time domain controller is operating in crystal mode and the accuracy is better than 1ms
1	1	1	The time domain controller is locked to a sync source (accuracy better than or equal 100ns)
Bit 4			Meaning
0			Standard time
1			Daylight saving time is active
Bit 3			Meaning
0			Daylight saving time change is not announced
1			Daylight saving time change is announced
Bit 2			Meaning
0			Actual year is not a leap year
1			Actual year is a leap year
Bit 1			Meaning
0			Leap second is not announced
1			Leap second is announced
Bit 0			Meaning
0			Actual second is not leap second
1			Actual second is leap second

Status byte 2:

Bit 7	Bit 6	Bit 5	Bit 4	Meaning
0	0	0	0	The time domain controller is operating in crystal mode or has invalid time
0	0	0	1	The time domain controller is locked to sync source
0	0	1	X	unused
0	1	X	X	unused
1	X	X	X	unused

Bit 3 to 0 are unused and set to 0.

Status byte 3:

Bit 7	Meaning
0	The time domain controller is operating in crystal mode or has invalid time
1	The time domain controller is locked to sync source
Bit 6	Meaning
0	unused
1	always
Bit 5	Meaning
0	unused
1	always
Bit 4	Meaning
0	unused
1	always

Status byte 4 plus status byte 3 bit 3-0

Used for time since the system is locked to sync source.

Status byte 3 bit 3 is the MSB and status byte 4 bit 0 is the LSB.

Recommended settings:

Setting	Recommended value
Baud rate	9600
Data bits	8
Stop bit(s)	1
Parity bit	No
Transmission interval	Every second (at second change)
Transmission scheme	Without second forerun / immediate control character

19.1.3.4 hopf Binary v2

Character no.	Meaning	Hex value
1	"\$"	\$24
2	"H"	\$48
3	"B"	\$42
4	"2"	\$32
5-20	Seconds since 00:00 01.01.1970 as unsigned 64bit value, represented with 16 hex digits. Example: 000000006155BC00 (for 30.09.2021 13:30:40)	\$30-\$39, \$41-\$46
21	Leap second state 0 → no leap second announced 1 → positive leap second announced 2 → negative leap second announced 4 → actual second is a positive leap second	\$30-\$32, \$34
22-25	TAI-UTC offset as signed 16bit value, represented with 4 hex digits	\$30-\$39, \$41-\$46
26-33	Total vector error as signed 32bit value represented with 8 hex digits	\$30-\$39, \$41-\$46

34	Synchronization status 0 → invalid time 1 → crystal (holdover) mode 2 → locked to sync source	\$30-\$32
35-38	Time zone offset in minutes, as 16bit value represented with 4 hex digits	\$30-\$39, \$41-\$46
39	Daylight saving time state 0 → standard time (daylight saving time is not active) 1 → daylight saving time is active 2 → daylight saving time is not configured	\$30-\$32
40-43	Daylight saving time offset in minutes that should be added to the standard time while daylight saving time is active, as 16bit value, represented with 4 hex digits	\$30-\$39, \$41-\$46
44-59	Time stamp of the next daylight-saving time state change in seconds since 00:00 01.01.1970, as unsigned 64bit value represented with 16 hex digits	\$30-\$39, \$41-\$46
60	Time source of the time domain controller 0 → atomic clock 1 → GNSS 2 → terrestrial radio 3 → serial time code 4 → PTP 5 → NTP 6 → hand set 7 → other 8 → internal oscillator	\$30-\$38

61-64	Fletcher 16 checksum of all characters, sent before this checksum, represented with 4 hex digits	\$30-\$39, \$41-\$46
65	LF (line feed)	\$0A

Recommended settings:

Setting	Recommended value
Baud rate	115200
Data bits	8
Stop bit(s)	1
Parity bit	No
Transmission interval	Every second (at second change)
Transmission scheme	Without second forerun / immediate control character

19.1.3.5 hopf Master / Slave

Character no.	Meaning	Hex value
1	STX (start of text)	\$02
2	Status	\$30-\$39, \$41-\$46
3	Day of week 1 → Monday ... 7 → Sunday When the time is output in UTC the following hex values apply 9 → Monday ... F → Sunday	\$31-\$37 \$39, \$41-\$46
4	Ten's hours	\$30-\$32

5	Unit hours	\$30-\$39
6	Ten's minutes	\$30-\$35
7	Unit minutes	\$30-\$39
8	Ten's seconds	\$30-\$35
9	Unit seconds	\$30-\$39
10	Ten's day	\$30-\$33
11	Unit day	\$30-\$39
12	Ten's month	\$30-\$31
13	Unit month	\$30-\$39
14	Ten's year	\$30-\$39
15	Unit year	\$30-\$39
16	Difference time ten's hour, including sign 0 → difference time is negative (west), and ten's hour is 0 1 → difference time is negative (west), and ten's hour is 1 8 → difference time is positive (east), and ten's hour is 0 9 → difference time is positive (east), and ten's hour is 1	\$30, \$31, \$38, \$39
17	Difference time unit hours	\$30-\$39
18	Difference time ten's 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

Status:

Bit 3	Bit 2	Bit 1	Bit 0	Meaning
X	X	X	0	No DST announcement

X	X	X	1	DST announcement
X	X	0	X	Standard time
X	X	1	X	Daylight saving time (DST)
X	0	X	X	No leap second announcement
X	1	X	X	Leap second announcement
0		X	X	The time domain controller is not locked to a sync source
1		X	X	The time domain controller is locked to a sync source

Recommended settings:

Setting	Recommended value
Baud rate	9600
Data bits	8
Stop bit(s)	1
Parity bit	No
Transmission interval	Every second (at second change)
Transmission scheme	With second forerun / control character at second change

19.1.3.6 hopf Time Universal

Character no.	Meaning	Hex value
1	STX (start of text)	\$02
2 - 3	Status byte	\$30-\$39, \$41-\$46
4	Ten's hours	\$30-\$32
5	Unit hours	\$30-\$39
6	Ten's minutes	\$30-\$35
7	Unit minutes	\$30-\$39
8	Ten's seconds	\$30-\$35
9	Unit seconds	\$30-\$39
10	Ten's day	\$30-\$33
11	Unit day	\$30-\$39
12	Thousand's year	\$31, \$32
13	Hundred's year	\$30-\$39
14	Ten's year	\$30-\$39
15	Unit year	\$30-\$39
16 -17	Day of week 1 → Monday 7 → Sunday	\$31-\$37
18	Sign of difference time '+', '-'	\$2B, \$2D
19	Difference time ten's hours	\$30, \$31
20	Difference time unit hours	\$30-\$39
21	Difference time ten's minutes	\$30-\$35
22	Difference time unit minutes	\$30-\$39
23-25	"FFFF"	\$46
26	'*'	\$2A
27-28	XOR-Checksum	\$30-\$39, \$41-\$46
29	LF (line feed)	\$0A
30	CR (carriage return)	\$0D
31	ETX (end of text)	\$03

Status byte:

Bit 7	Bit 6	Bit 5	Bit 4	Meaning
0	0	0	0	Time is invalid
0	0	0	1	Unused
0	0	1	0	The time domain controller is operating in crystal mode and accuracy is worse than 10µs
0	0	1	1	The time domain controller is operating in crystal mode and accuracy is better than or equal 10µs
0	1	0	0	The time domain controller is operating in sync mode and the accuracy is worse than 1µs
0	1	0	1	Unused
0	1	1	0	The time domain controller is operating in crystal mode and the accuracy is better than 1µs
0	1	1	1	The time domain controller is locked to a sync source (accuracy better than or equal 1µs)
Bit 3	Bit 2	Bit 1	Bit 0	Meaning
X	X	0	0	Local time DST not active
X	X	0	1	Local time DST active
X	X	1	0	Standard time
X	X	1	1	UTC time
X	0	X	X	DST is not announced
X	1	X	X	DST is announced
0	X	X	X	Leap second is announced
1	X	X	X	Leap second is announced and active at the moment

Recommended settings:

Setting	Recommended value
Baud rate	9600
Data bits	8
Stop bit(s)	1
Parity bit	No
Transmission interval	Every second (at second change)
Transmission scheme	With second forerun / control character at second change

19.1.3.7 IEC-103

If actual second is the change of a minute:

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 ADSU	\$FF
11	Function type	\$FF
12	Information number	\$00
13	Milliseconds (Low octet)	\$0000-\$EA5F
14	Milliseconds (High octet)	
15	Minutes (0 to 59) + MSB = Invalid Flag	\$00-\$3B, \$80-\$BB
16	Hours (0 to 23) + MSB = SU Summer time Flag	\$00-\$17, \$80-\$97

17	Day in Month	\$01-\$1B
18	Month	\$01-\$0C
19	Year since 2000	\$00-\$63
20	Checksum (sum over characters no. 5–19 mod 256)	\$00-\$FF
21	End flag	\$16

Initialization string for IEC-103 (sent every second which is not a minute change):

Character no.	Meaning	Hex value
1	Start flag	\$10
2	Control field	\$47
3	IEC-Address	\$01-\$FE
4	Checksum	\$00-\$FF
5	End flag	\$16

Recommended settings:

Setting	Recommended value
Baud rate	9600
Data bits	8
Stop bit(s)	1
Parity bit	Even
Transmission interval	Every minute (at minute change)
Transmission scheme	Without second forerun / immediate control character

19.1.3.8 SAT 1703

This string can be sent on request. To request this, string the character “?” (0x3F) must be sent to the channel where this string is configured.

Character no.	Meaning	Hex value
1	STX (start of text)	\$02
2	Ten's day	\$30-\$33
3	Unit day	\$30-\$39
4	“.”	\$2E
5	Ten's month	\$30-\$31
6	Unit month	\$30-\$39
7	“.”	\$2E
8	Ten's year	\$30-\$39
9	Unit year	\$30-\$39
10	“/”	\$2F
11	Day of week 1 → Monday ... 7 → Sunday	\$31-\$37
12	“/”	\$2F
13	Ten's hours	\$30-\$32
14	Unit hours	\$30-\$39
15	“.”	\$3A
16	Ten's minutes	\$30-\$35
17	Unit minutes	\$30-\$39
18	“.”	\$3A
19	Ten's seconds	\$30-\$35
20	Unit seconds	\$30-\$39
21	“M” or “M” or “U”	(standard time, \$4D or \$55
22	“E” or “E” or “T”	daylight saving time \$45 or \$54
23	“Z” or “S” or “C”	or UTC) \$43 or \$53 or \$5A

24	“ “ or “Z” or “ “		\$20 or \$5A
25	“ “ when the time domain controller is locked to a sync source “*” when the time domain controller is not locked to a sync source		\$20 or \$2A
26	“ “ when no announcement “!” when switch to or back from DST is announced		\$20 or \$21
27	CR (carriage return)		\$0D
28	LF (line feed)		\$0A
29	ETX (end of text)		\$03

19.1.3.9 SINEC H1 Extended

This string can be sent on request. To request this, string the character “?” (0x3F) must be sent to the channel where the SINEC H1 Extended is configured.

Character no.	Meaning	Hex value
1	STX (start of text)	\$02
2	“D”	\$44
3	“.”	\$3A
4	Ten’s day	\$30-\$33
5	Unit day	\$30-\$39
6	“.”	\$2E
7	Ten’s month	\$30-\$31
8	Unit month	\$30-\$39
9	“.”	\$2E
10	Ten’s year	\$30-\$39
11	Unit year	\$30-\$39
12	“,”	\$3B
13	“T”	\$54

14	“.”	\$3A
15	Day of week 1 → Monday ... 7 → Sunday	\$31-\$37
16	“,”	\$3B
17	“U”	\$55
18	“.”	\$3A
19	Ten's hours	\$30-\$32
20	Unit hours	\$30-\$39
21	“.”	\$2E
22	Ten's minutes	\$30-\$35
23	Unit minutes	\$30-\$39
24	“.”	\$2E
25	Ten's seconds	\$30-\$35
26	Unit seconds	\$30-\$39
27	“,”	\$3B
28	“#” when time domain controller has no valid time “ ” when the time domain controller has a valid time	\$20 or \$23
29	“*” when the time domain controller is operating in crystal mode or has no valid time “ ” when the time domain controller is locked to a sync source	\$20 or \$2A
30	“U” when output time is UTC “ ” when output time is standard time “S” when output time is daylight saving time	\$20 or \$53 or \$55

31	“ “ no announcement “A” leap second announcement “!” DST announcement	\$20 or \$21 or \$41
32	ETX (end of text)	\$03

19.1.3.10 Trimble TSIP

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
	Second in week as little endian	
6	Exponent 1. byte	\$00-\$FF
7	Exponent 3. nibble plus 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 of month	\$01-\$1F
15	Month	\$01-\$0C
16	Year 1. byte	\$00-\$FF
17	Year 2. byte	\$00-\$FF
18 - 76	GPS data (actually all set to 0)	\$00
77	DLE	\$10
78	ETX	\$03

19.1.3.11 ION 7550

This string can be sent on request. To request this, string the character “C” (0x43) or “c” (0x63) must be sent to the channel where this string is configured.

Character no.	Meaning	Hex value
1	SOH (start of header)	\$01
2	Hundredth day of year	\$30-\$39
3	Ten's day of year	\$30-\$39
4	Unit day of year	\$30-\$39
5	“.”	\$3A
6	Ten's hours	\$30-\$32
7	Unit hours	\$30-\$39
8	“.”	\$3A
9	Ten's minutes	\$30-\$35
10	Unit minutes	\$30-\$39
11	“.”	\$3A
12	Ten's seconds	\$30-\$35
13	Unit seconds	\$30-\$39
14	Indication of accuracy	\$23, \$2A, \$2E, \$3F
15	CR (carriage return)	\$0D
16	LF (line feed)	\$0A

Indication of accuracy:

ASCII	Meaning	Hex value
“?”	Accuracy $\geq 100\mu\text{s}$	\$3F
“#”	Accuracy $< 100\mu\text{s}$	\$23
“*”	Accuracy $< 10\mu\text{s}$	\$2A
“.”	Accuracy $< 1\mu\text{s}$	\$2E

19.1.4 Troubleshooting

If an FG8803Sxx extension board reports an error, then **hopf** Elektronik GmbH recommends the following procedure:

- **Analyse active events:** Access the **huma**® web interface of the system in which the FG8803Sxx is installed. Navigate to the Start Page and hover the mouse over the FG8803Sxx. Review the active events listed to identify the root cause of the problem.
- **Event: "X1/X2 is turned off (overcurrent)":** This indicates that a short circuit has been detected on the corresponding connector. To resolve this, clear the short circuit on the external cabling, navigate to the Time Service → X1/X2 → ACTION page in **huma**®, and click the Restart button to reactivate the channel.
- **Event: "X1/X2 is turned off (inaccuracy)":** This indicates that the system's time accuracy is currently insufficient to meet the configuration requirements of the corresponding channel.
 - Verify that the TDC extension boards are properly connected to their configured synchronization source.
 - Check if the status is shown as "locked to sync source".
 - If the synchronization is correct but the failure on the FG8803Sxx persists for more than 5 minutes, reboot the FG8803Sxx.
 - If the error remains active 5 minutes after the reboot, contact **hopf** Elektronik GmbH support.