

1000 Product Series

TECHNICAL DOCUMENTATION

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2 Change History

VERSION	DATE	EDITOR	CHANGE DESCRIPTION
01.00	28.09.2026	POM	Initial document

3 Preliminary Remarks

This document describes the functions, operation, mounting and commissioning of the products of the 1000 product series.

 	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.

	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.

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 1000 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 1000 product series consists of fully modular time reference modules 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 1000 product series systems are fully modular time reference systems designed to cater to a wide range of applications using field-replaceable, mutually independent modules. In the following chapters, **module** refers to an individual device, while **system** denotes the entire assembly built from one or more modules.

Each module can provide one or more of the following functionalities:

- **Management Controller (MC):** A management core used to monitor and configure the entire system, including all installed modules.
- **Time Domain Controller (TDC):** A time source interface. A module 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 to generate the specific time outputs required by the customer.



Note

A module can provide more than one functionality.

6.1 System build up rules

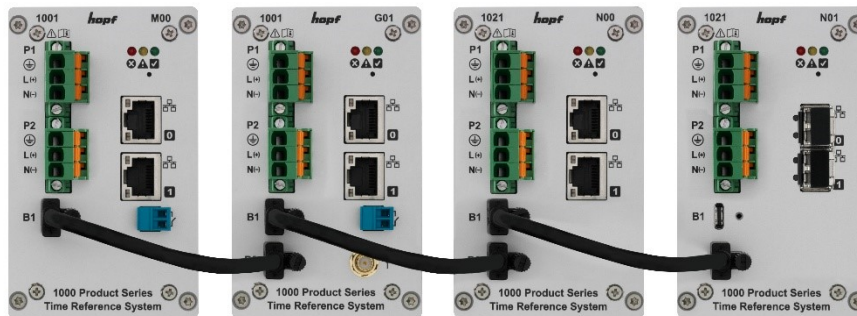


Figure 1

Figure 1 shows a 1000 product series system composed of four modules. A functional system can consist of 1 to 6 modules connected in a daisy-chain topology. Interconnections between modules require the dedicated interconnection cable **KA1000B01**.

To build an operational system, the following build up rules must be fulfilled:

- **Module Interconnection:** The cable KA1000B01 must always connect connector **B1** of one module to connector **B2** of the adjacent module.
- **Chain Termination:** Exactly one module in the system must have an unconnected B2 connector, and exactly one module must have an unconnected B1 connector.
- **Module Indexing:** The module with the unconnected B2 connector is designated as **module#1**. The module connected to B1 of module#1 is **module#2**, the next is **module#3**, and so on.
- **System Size:** A system can contain a maximum of 6 modules.
- **TDC Requirements:** The system must contain **exactly one** module with TDC functionality.
- **MC Requirements:** The system must contain **at least one** module with MC functionality. The primary module managing the system must be **module#1**.
- **TDC/MC Position Coexistence:** If module#1 provides both MC and TDC functionalities, the system is valid. If the TDC functionality is provided by a separate module, it must be positioned as **module#2**.

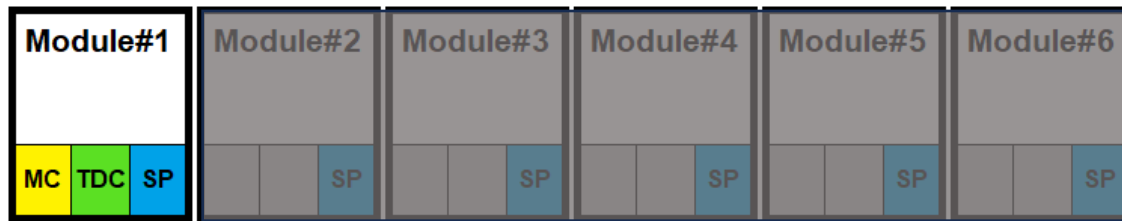


Figure 2

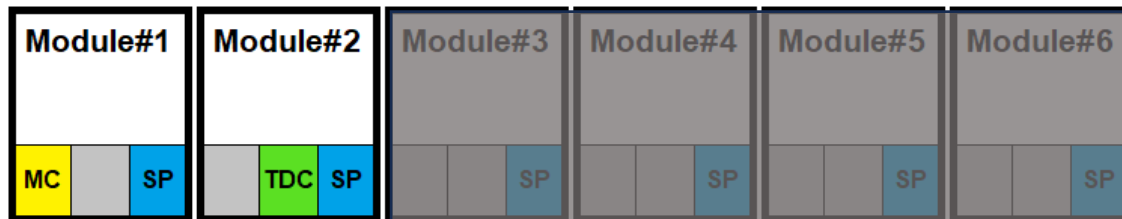


Figure 3

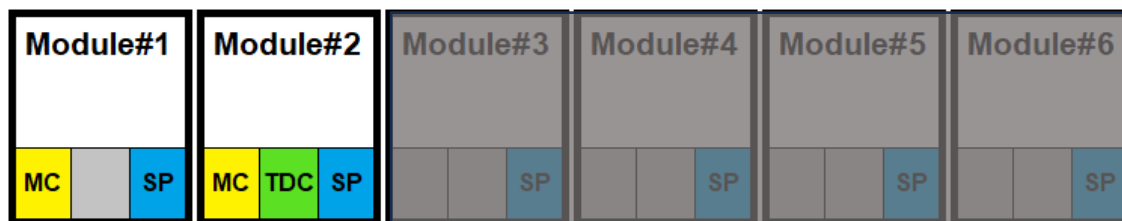


Figure 4

Figure 2, Figure 3 and Figure 4 illustrate correct system configurations.

The greyed-out modules are optional. These optional modules may provide MC and SP functionality, but **must not** support TDC functionality. The SP functionality on module#1 and module#2 is optional.

In the configuration shown in Figure 4, the MC functionality of module#2 is automatically deactivated because the module detects that its B2 connector is connected to another module.

6.2 MC - Management Controller

Each 1000 product series system contains exactly one module with active MC functionality. This module distributes configurations and updates to all other modules and monitors their status via the interconnection cable.

6.3 TDC - Time Domain Controller

A 1000 product series system requires exactly one module with TDC functionality. This module processes the incoming time signals from its external connectors and converts them into an internal protocol, which is distributed then distributed to all other modules via the interconnection cable.

6.4 SP - Service Provider

Modules with SP functionality synchronize with the internal time signal distributed by the TDC module. They use this precision time information to generate the specific time outputs (e.g., NTP) required by the user.

6.5 Minimal configuration

The minimal configuration for a functional 1000 product series system requires all three functionalities (MC, TDC, and SP) to be present. Certain modules natively integrate all three functionalities within a single hardware unit. Operating such a module stand-alone constitutes a complete and operational 1000 product series system.



Note

The MC functionality is only required for system management (configuration and monitoring). If the module providing the MC functionality is disconnected from the system or fails due to a defect, the time outputs of the SP modules are not affected, provided that the TDC module continues to operate within the remaining system.

6.6 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:

- **1000 product series module** (including pre-assembled mating connectors for the power supply terminal)
- **Quick Installation Guide**
- **Factory Test Report**
- **Interconnection cable KA1000B01** (only included with modules *without* TDC functionality)

8 System mounting

1000 product series systems are designed for installation on standard DIN rails. Carry out the following steps for installation:

	CAUTION Thermal hazard The 1000 product series modules dissipate thermal energy through their housing. To ensure sufficient convection and prevent overheating, adhere to the following installation requirements: • Maintain at least 10 mm of free space between a 1000 product series module and adjacent devices. • Maintain at least 25 mm of free space above and below the modules. 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.
--	--

1. **Hook at the bottom:** Place the mounting bracket of the module onto the lower edge of the DIN rail.

2. **Snap into place:** Push the module upward and press it toward the DIN rail until it latches securely into place at the back (see Figure 5)

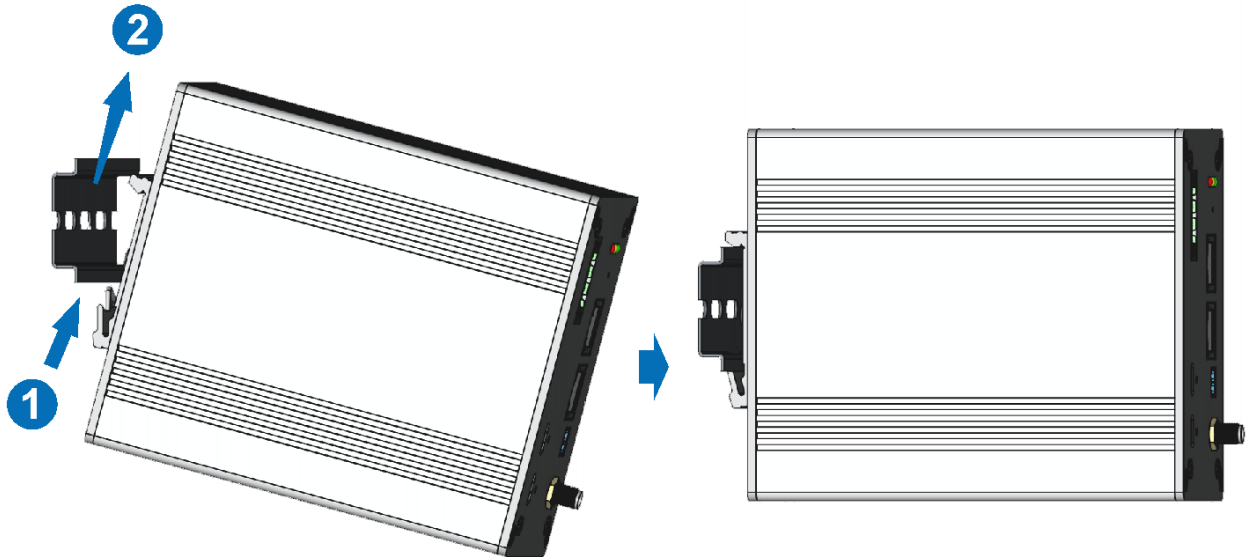


Figure 5

3. **Verify clearances:** Check that all minimum clearance rules specified in the caution box above are fulfilled (see Figure 6).

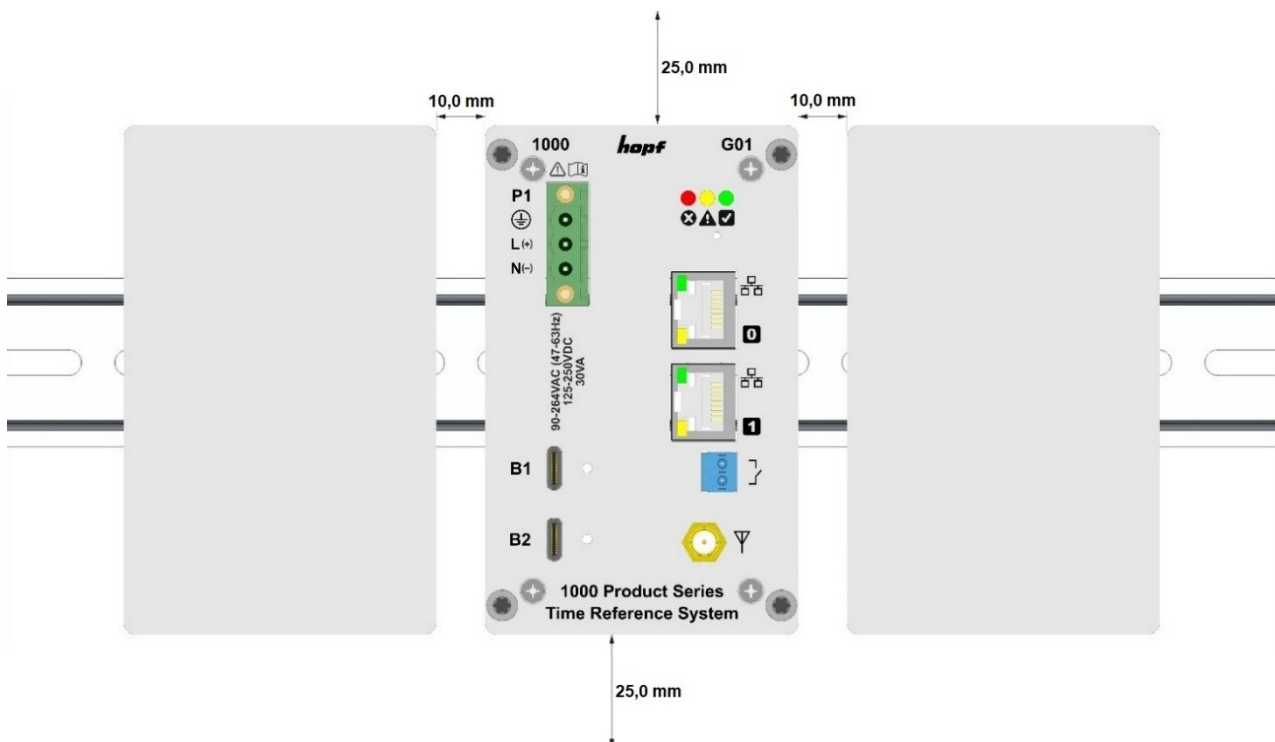


Figure 6

- 4. Interconnect the modules:** Connect the modules using the interconnection cables to build the system assembly (see Figure 7).

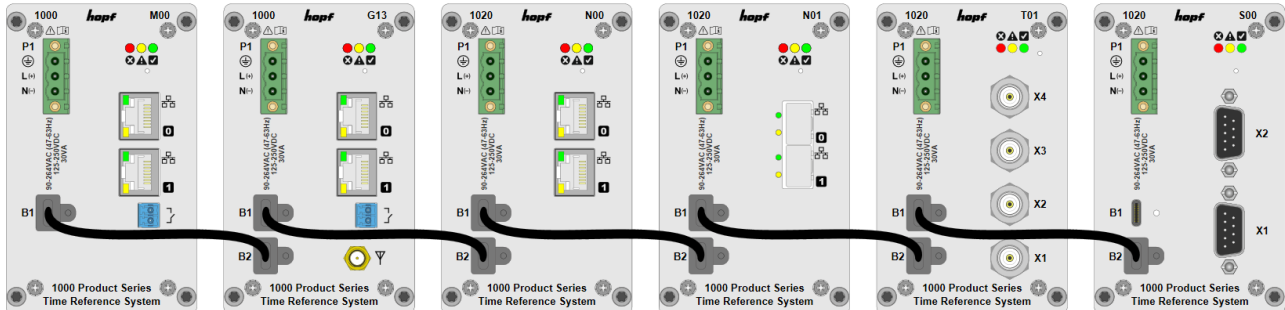


Figure 7

- 5. Connect additional grounding:** The primary method to properly ground a module is to connect a suitable grounding cable to the PE / grounding pin of P1 and P2 (if available). Additionally, the module can be grounded via the pan-head screw located on the rear side.



Figure 8



CAUTION

Class I equipment

The system is a protection class I device. To prevent the risk of electric shock, it **must** only be operated with a properly grounded power connection.

9 Connection of the supply and data lines

The 1000 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 (PE):** When wiring the power supply connector, ensure the grounding (PE) wire is cut longer than the live and neutral wires. This ensures the ground connection remains intact longest in the event of a strain relief failure.
- **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.

10 Supported modules

A variety of modules are available for the 1000 product series. The following chapters describe the interface elements, LED states, factory reset procedures, and the supported **huma**® board pages for each specific module.

For detailed technical specifications of all modules, refer to the latest 1000 product series product sheet.

All modules feature status LEDs on their front panels for quick identification of their operational status. The exact functional descriptions of these LEDs are provided in the respective module chapters.

10.1 FG1000G01 - MC, TDC and SP functionality

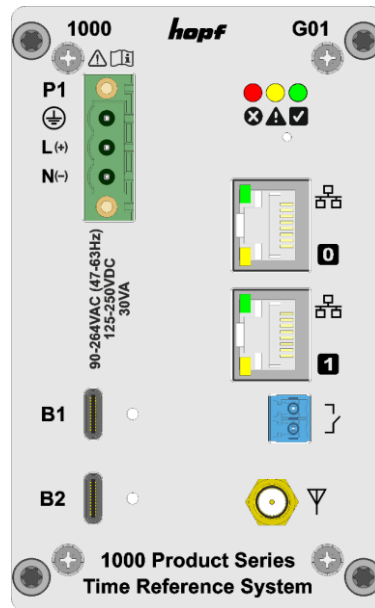


Figure 9

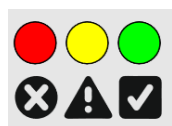
The FG1000G01 is a multi-functional module supporting MC, TDC, and SP functionalities. Its operating mode depends on its position within the 1000 product series system:

- **Positioned at module#1:** Supports MC, TDC, and SP functionalities simultaneously.
- **Positioned at module#2:** Supports only TDC and SP functionalities. In this configuration, a module *without* TDC functionality must be installed at the module#1 position.

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.

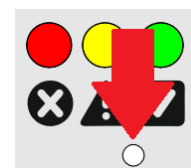
10.1.1 Status LEDs



- | | |
|------------------|--|
| 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. |

10.1.2 Factory default

A factory default or module reboot can be performed via the push button accessible through the 1.5 mm diameter hole on the 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.

10.1.3 Supported board pages in *huma*®

The following table lists the supported *huma*® board pages for this module.

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

10.2 FG1000G02 - MC, TDC and SP functionality

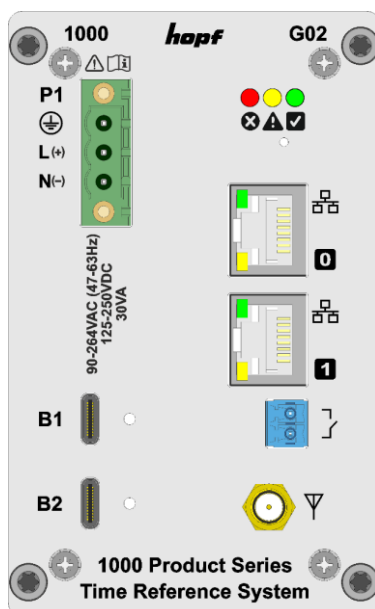


Figure 10

This module is identical to FG1000G01. The only difference is the integrated oscillator type.

10.3 FG1000G03 - MC, TDC and SP functionality

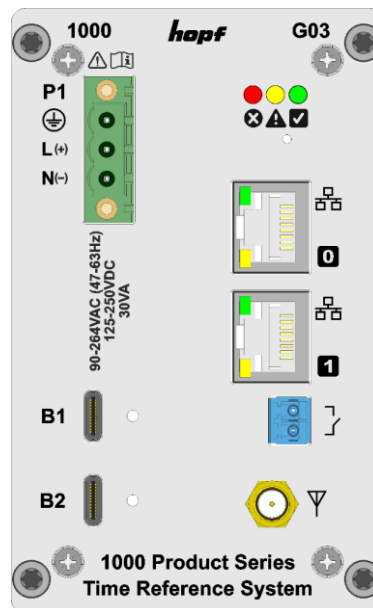


Figure 11

This module is identical to FG1000G01. The only difference is the integrated oscillator type.

10.4 FG1000G11 – MC, TDC and SP functionality

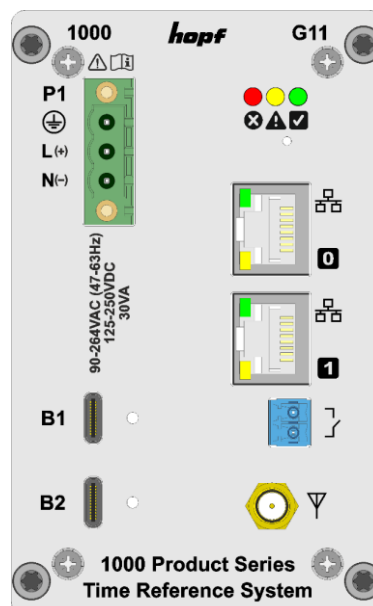


Figure 12

This module is identical to FG1000G01. The only difference is the integrated GNSS receiver.

10.5 FG1000G12 - MC, TDC and SP functionality

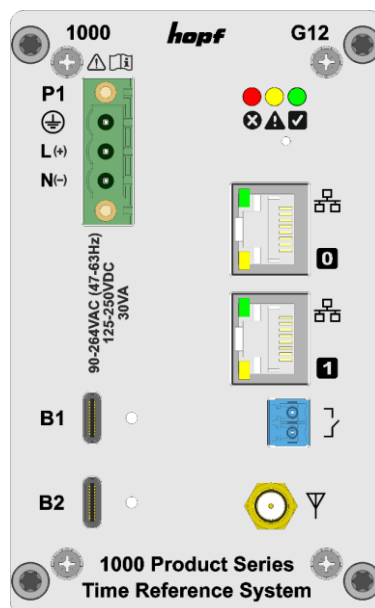


Figure 13

This module is identical to FG1000G01. The only differences are the integrated GNSS receiver and the integrated oscillator type.

10.6 FG1000G13 - MC, TDC and SP functionality

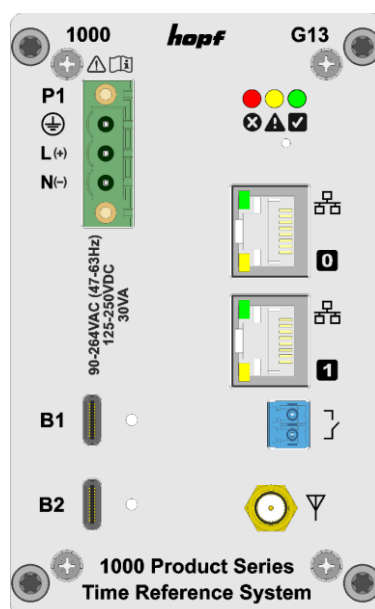


Figure 14

This module is identical to FG1000G01. The only differences are the integrated GNSS receiver and the integrated oscillator type.

10.7 FG1000M00 - MC and SP functionality

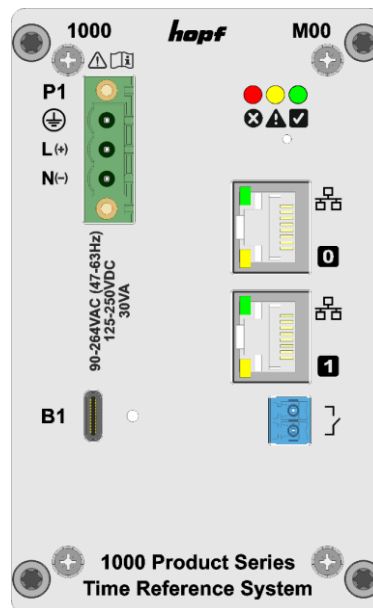


Figure 15

The FG1000M00 is a multi-functional module supporting MC and SP functionalities. It **must only** be operated at the module#1 position. A module with TDC functionality must be installed at the module#2 position, to build a valid and operational 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.

10.7.1 Status LEDs

Identical as on module FG1000G01.

10.7.2 Factory default

Identical as on module FG1000G01.

10.7.3 Supported board pages in *huma*®

The following table lists the supported *huma*® board pages for this module.

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

10.8 FG1001G01 - MC, TDC and SP functionality

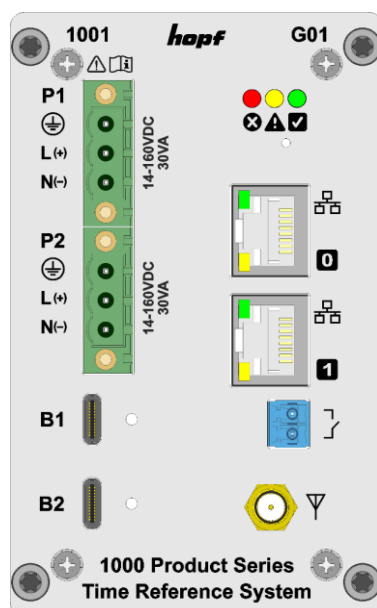


Figure 16

This module is identical to the FG1000G01 module. The only difference is the integrated power supply unit.

10.9 FG1001G02 - MC, TDC and SP functionality

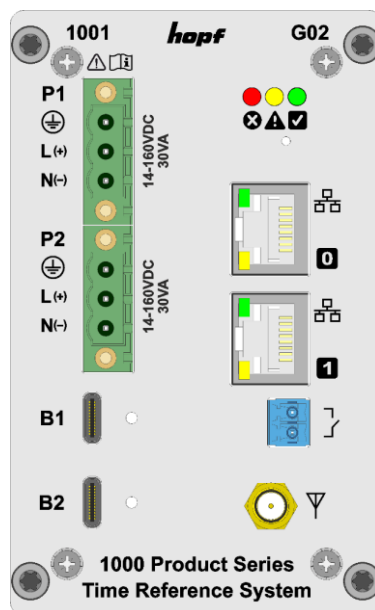


Figure 17

This module is identical to the FG1000G01 module. The only differences are the integrated power supply unit and the integrated oscillator.

10.10 FG1001G03 - MC, TDC and SP functionality

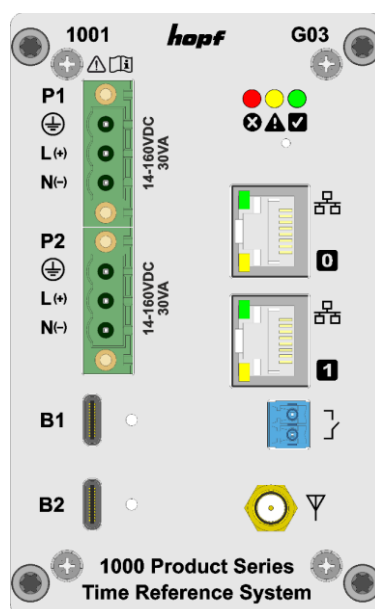


Figure 18

This module is identical to the FG1000G01 module. The only differences are the integrated power supply unit and the integrated oscillator.

10.11 FG1001G11 - MC, TDC and SP functionality

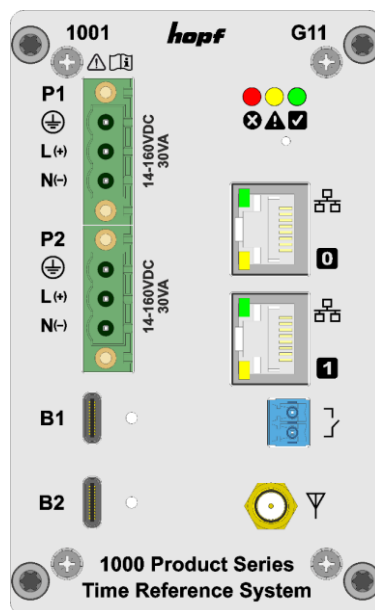


Figure 19

This module is identical to the FG1000G01 module. The only differences are the integrated power supply unit and the integrated GNSS receiver.

10.12 FG1001G12 - MC, TDC and SP functionality

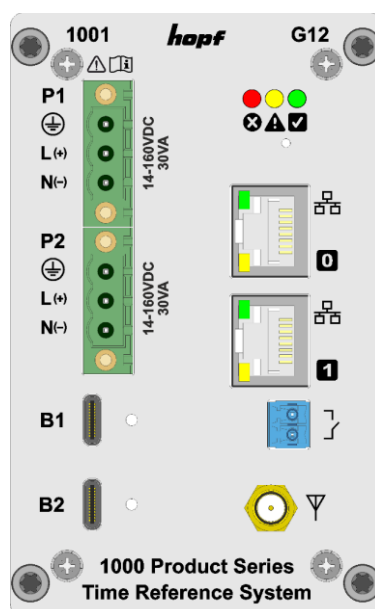


Figure 20

This module is identical to the FG1000G01 module. The only differences are the integrated power supply unit, the integrated GNSS receiver, and the integrated oscillator.

10.13 FG1001G13 - MC, TDC and SP functionality

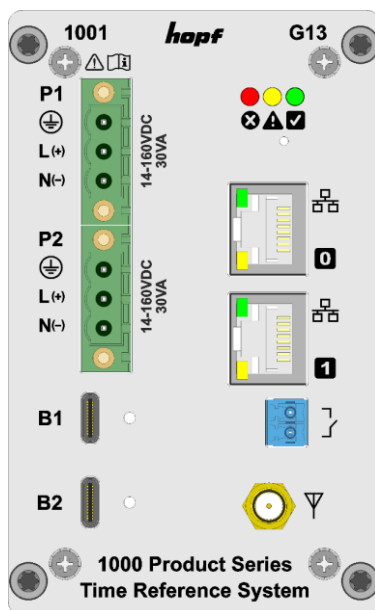


Figure 21

This module is identical to the FG1000G01 module. The only differences are the integrated power supply unit, the integrated GNSS receiver, and the integrated oscillator.

10.14 FG1001M00 - MC and SP functionality

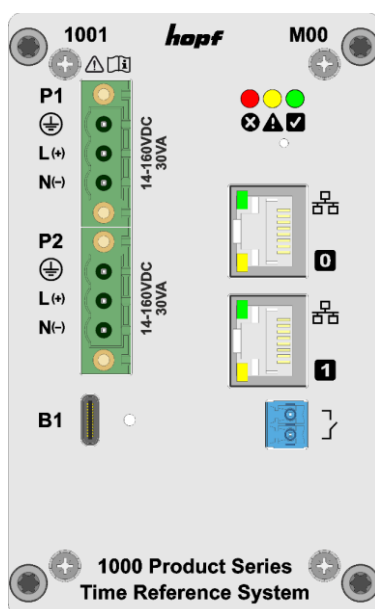


Figure 22

This module is identical to the FG1000M00 module. The only difference is the integrated power supply unit.

10.15 FG1020N00 - SP functionality

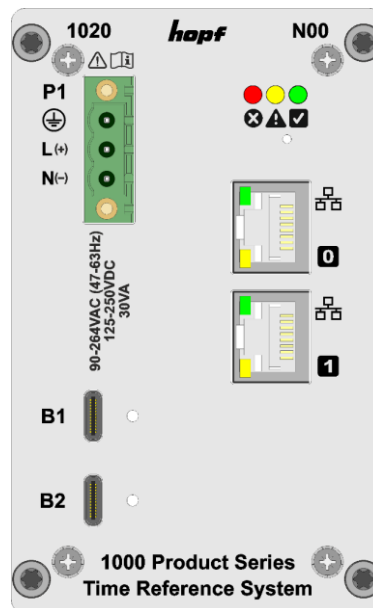


Figure 23

The FG1020N00 module supports the SP functionality only. It may be operated at any position from module#2 to module#6, provided that all other system configuration rules for MC and TDC functionalities are fulfilled.

Hardware Interfaces:

- **Network Interfaces** : Features two RJ45 ports used for network time distribution communication.

10.15.1 Status LEDs

Identical as on module FG1000G01.

10.15.2 Factory default

Identical as on module FG1000G01.

10.15.3 Supported board pages in *huma*®

The following table lists the supported *huma*® board pages for this module.

Board Overview	
General → Status	
General → Action	
General → Config	
Details → Status	
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	
SINEC H1 → Config	

10.16 FG1020N01 - SP functionality

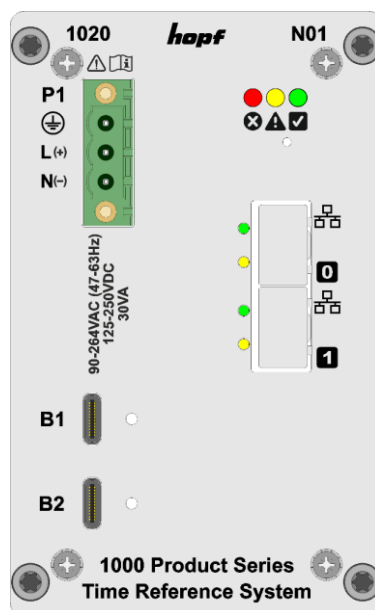


Figure 24

This module is identical to the FG1020N00 module. The only difference is that it features SFP slots instead of RJ45 ports.

10.17 FG1020S00 - SP functionality

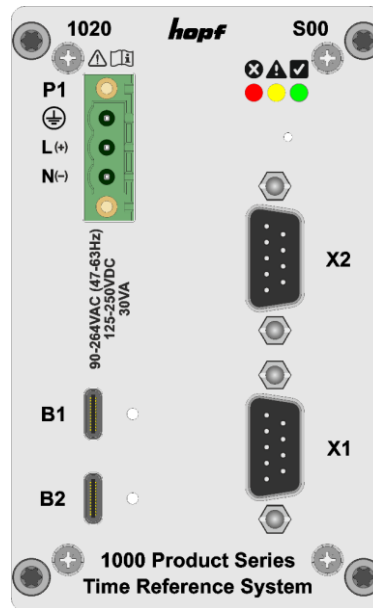


Figure 25

The FG1020S00 module supports the SP functionality only. It may be operated at any position from module#2 to module#6, provided that all other system configuration rules for MC and TDC functionalities are fulfilled.

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 (FG102xSxx details)

10.17.1 Status LEDs

Identical as on module FG1000G01.

10.17.2 Factory default

Identical as on module FG1000G01.

10.17.3 Supported board pages in *huma*®

The following table lists the supported *huma*® board pages for this module.

Board Overview	
General → Status	
General → Action	
General → Config	
Details → Status	
Sync Setting	
General → Status	
General → Action	
General → Config	SP variant
Time Service	
General → Status	
General → Config	
X1 → Config	
X1 → Action	
X2 → Config	
X2 → Action	

10.18 FG1020T00 - SP functionality

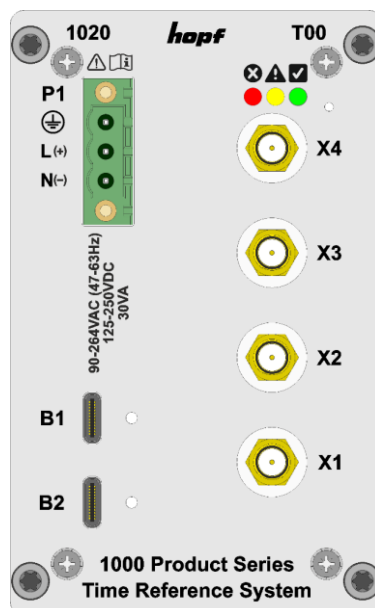


Figure 26

The FG1020T00 module supports the SP functionality only. It may be operated at any position from module#2 to module#6, provided that all other system configuration rules for MC and TDC functionalities are fulfilled.

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 1000 product series product sheet for detailed information regarding supported protocols and signal levels.

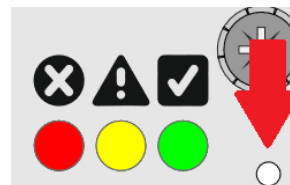
10.18.1 Status LEDs

	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.

10.18.2 Factory default

A factory default or module reboot can be performed via the push button accessible through the 1.5 mm diameter hole on the 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.

10.18.3 Supported board pages in *huma*®

The following table lists the supported *huma*® board pages for this module.

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

10.19 FG1020T01 - SP functionality

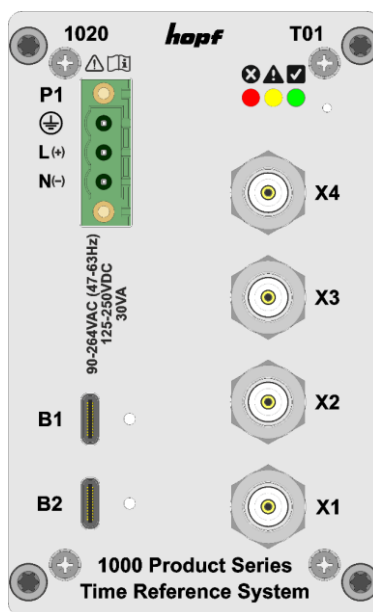


Figure 27

This module is identical to the FG1020T00 module. The only difference is that it features BNC connectors instead of SMA connectors.

10.20 FG1020T02 - SP functionality

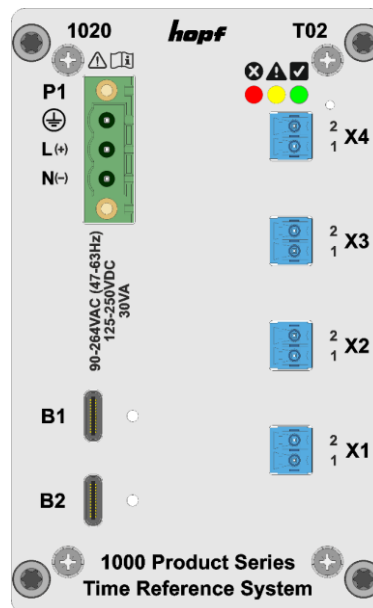


Figure 28

This module is identical to the FG1020T00 module. The only difference is that it features screw terminals instead of SMA connectors.

10.21 FG1020T03 - SP functionality

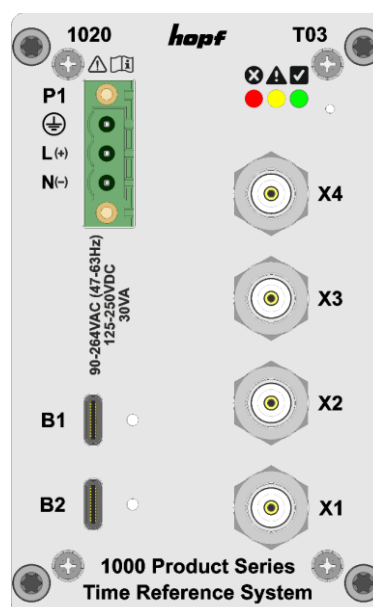


Figure 29

This module is identical to the FG1020T00 module. The only difference is that it features TNC connectors instead of SMA connectors.

10.22 FG1020T04 - SP functionality

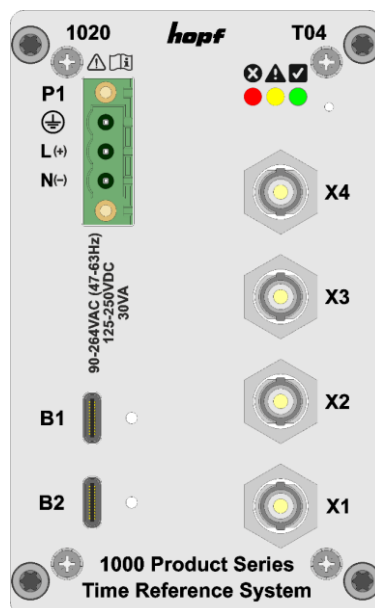


Figure 30

This module is identical to the FG1020T00 module. The only difference is that it features ST-type fiber optic ports (820 nm multimode) instead of SMA connectors.

10.23 FG1021N00 - SP functionality

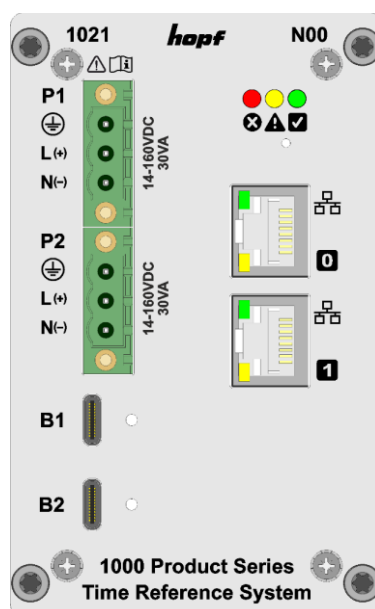


Figure 31

This module is identical to the FG1020N00 module. The only difference is the integrated power supply unit.

10.24 FG1021N01 - SP functionality

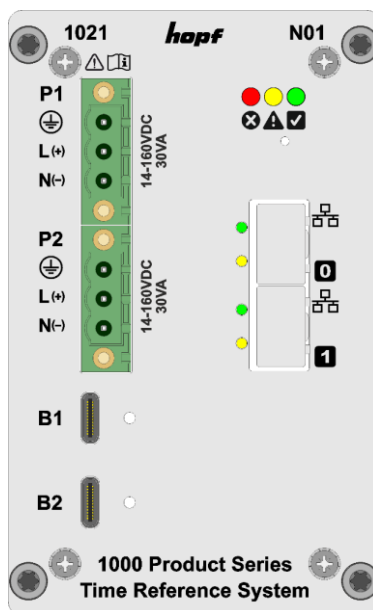


Figure 32

This module is identical to the FG1020N01 module. The only difference is the integrated power supply unit.

10.25 FG1021S00 - SP functionality

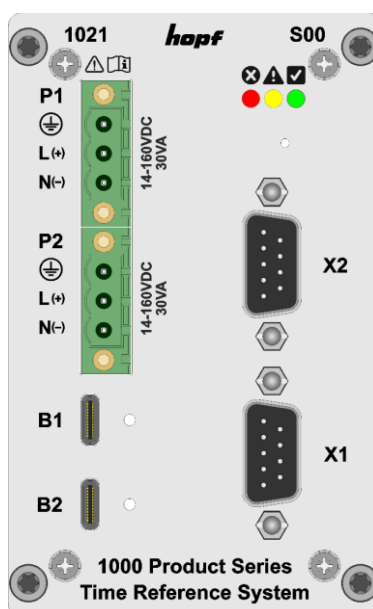


Figure 33

This module is identical to the FG1020S00 module. The only difference is the integrated power supply unit.

10.26 FG1021T00 - SP functionality

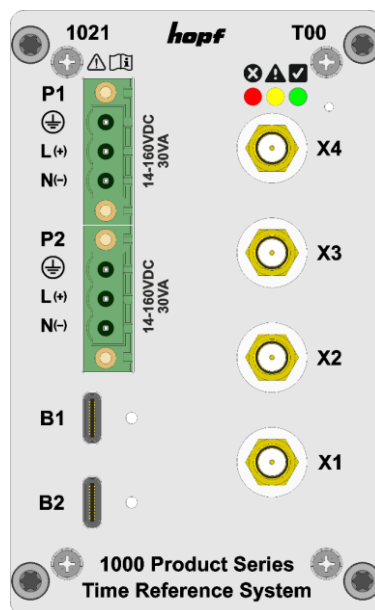


Figure 34

This module is identical to the FG1020T00 module. The only difference is the integrated power supply unit.

10.27 FG1021T01 - SP functionality

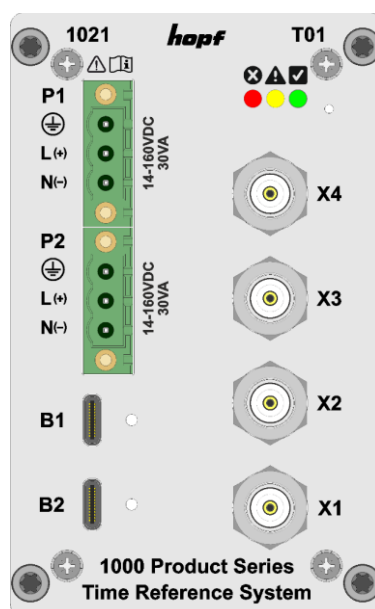


Figure 35

This module is identical to the FG1020T01 module. The only difference is the integrated power supply unit.

10.28 FG1021T02 - SP functionality

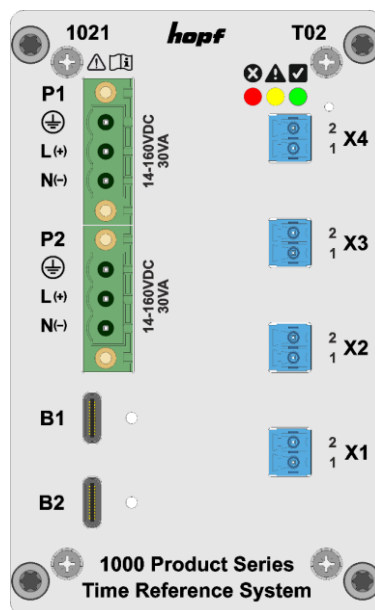


Figure 36

This module is identical to the FG1020T02 module. The only difference is the integrated power supply unit.

10.29 FG1021T03 - SP functionality

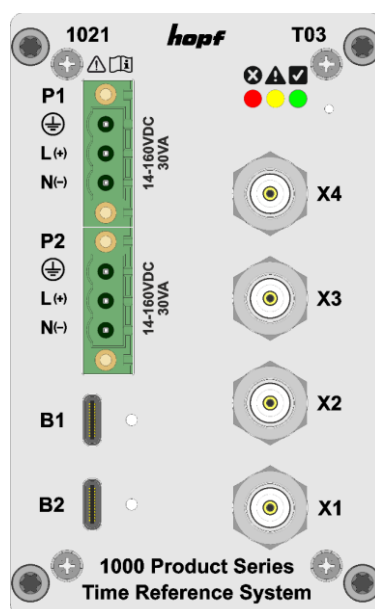


Figure 37

This module is identical to the FG1020T03 module. The only difference is the integrated power supply unit.

10.30 FG1021T04 - SP functionality

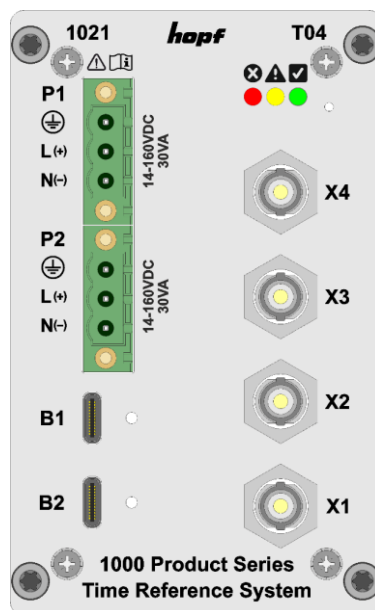


Figure 38

This module is identical to the FG1020T04 module. The only difference is the integrated power supply unit.

11 Power supply

Each module of the 1000 product series features its own internal power supply unit. Two different power supply types are available. The specific supported voltage ranges are printed on the front panel of each module.

	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.

11.1 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 0.5 mm² and 2.5 mm² (20 AWG to 12 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.
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Power Supply Terminal – 3-Pole Specifications

Conductor cross section	0,5mm ² - 2.5mm ² (20 AWG - 12 AWG)
-------------------------	---

12 Commissioning

To put an 1000 product series system into operation, carry out the following steps:

1. **Mount the modules:** Install the modules on the DIN rail as described in chapter 8 System mounting
2. **Connect the supply voltage:** Connect the power supply lines to the individual module power supply units (PSUs). The supported voltage ranges are printed on each module's front panel.

IMPORTANT: The power-up sequence of the modules is critical. Choose one of the following methods:

- **Simultaneous power-up:** Power up all modules at the same time (within a window of ± 2 seconds).

- **Sequential power-up:** Power up the modules in chronological order of their system position. Module#1 must be powered up first, followed by module#2, and so forth.
- 3. **Wait for boot completion:** Wait until the module providing the MC functionality has fully booted. The boot status is indicated by the 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.
- 4. **Establish network connection:** Connect a configuration PC using a network cable (Cat 5e or better) to the eth0 port of module#1.
- 5. **Access the web interface:** Open a web browser and navigate to the default IP address: <https://192.168.0.1>.
Note: If the configured IP address is unknown, perform a factory default reset as described in the respective module chapter to restore the default IP address and credentials.
- 6. **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 1000 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

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

- **No LEDs active:** If all LEDs on a module 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 a module indicates a fault via its red LED, open the **huma**® web interface and check the diagnostic menu for the specific module. Hovering the mouse cursor over the module's position in the graphical system overview within **huma**®, it displays a detailed description of the current operational status and root cause.

The system and its modules are fully operational when:

- The operational status signalled by the three LEDs on each module's front panel matches the expected states described in the respective module chapter.
- The green or yellow LEDs are active (indicating normal or warning states, while a red LED typically indicates a fault or limited functionality).

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.
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	CAUTION Risk of Burns – Hot Surfaces Depending on the operating parameters and module type, high device temperatures can occur on the housing during operation. Allow the device to cool down completely before starting any handling, maintenance, or replacement work.
---	--

If dismounting of a module or the entire system is required, perform the following steps in the specified order:

1. **Power down:** Turn off and isolate the power supply of the module or the entire system.
2. **Wait for discharge and cooling:** Wait at least one minute to allow dangerous residual voltages to fully discharge and allow the device to cool down.
3. **Disconnect all cables:** Unplug all cables from the module or the entire system.
4. **Remove from DIN rail:** Push the module upward and pull it away of the DIN rail.

16 Repair

Modules of the 1000 product series cannot be repaired outside the factory of hopf Elektronik GmbH. If a defect is detected, contact **hopf** Elektronik GmbH support to arrange return shipment and factory repair.

Hardware modifications or interventions must be strictly limited to the tasks explicitly described in this manual (e.g., module replacement).

	WARNING
	Risk of Electric Shock and Fire Hazard Improper repairs or unauthorized opening of a module can cause severe danger to the user, including fatal electric shocks and fire hazards. • Manufacturer Service Only: Repairs to the modules must only be performed by hopf Elektronik GmbH or explicitly authorized personnel. • Warranty Void: Unauthorized opening of a module or any of its subcomponents will immediately void the product warranty and exclude hopf Elektronik GmbH from any liability. • Qualified Personnel: Defective modules must only be replaced by trained and qualified technical personnel.

	CAUTION
	Risk of Burns – Hot Surfaces Depending on the operating parameters and module type, high device temperatures can occur on the housing during operation. Allow the device to cool down completely before starting any handling, maintenance, or replacement work.

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 all modules can be found in the latest 1000 product series product sheet.

19 Appendix

19.1 FG102xSxx 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

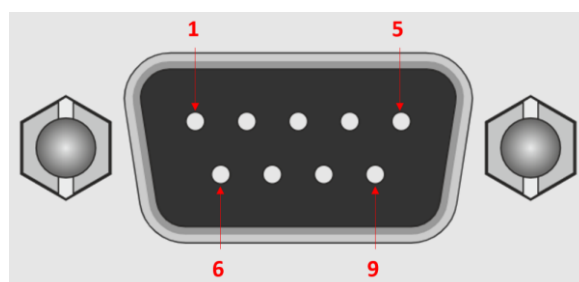


Figure 39

Figure 39 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 FG102xSxx module reports an error, then **hopf** Elektronik GmbH recommends the following procedure:

- **Analyse active events:** Access the **huma**[®] of the of the primary management module (module#1). Navigate to the Start Page and hover the mouse over the FG102xSxx module. 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 modules 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 FG102xSxx module persists for more than 5 minutes, reboot the module.
 - If the error remains active 5 minutes after the reboot, contact **hopf** Elektronik GmbH support.