

8100 Product Series

Modular GNSS

Time Reference Systems

Key Features

- 1U fully modular subrack for 19-inch rack mounting
- LCD information display and LEDs for system status
- Redundant power supply option
- All components are hot-plug capable field-replaceable units (FRU)
- Extended temperature range for reliable operation between -40° and $+70^{\circ}\text{C}$
- GPS, Galileo, GLONASS, and BeiDou time sources for reliable satellite synchronization
- Average accuracy of ± 30 ns to UTC, peak accuracy of ± 100 ns to UTC for demodulated IRIG-B and pulse outputs and ± 1 μs for modulated IRIG-B output
- Synchronization of IEC 61850 compatible devices
- Typical NTP time stamp accuracy < 30 μs
- Precision Time Protocol (PTP) option with peak time stamp accuracy ± 100 ns, support for IEC 61850-9-3:2016 Power Utility Automation Profile, IEEE C37.238-2017 Power Profile
- IEC 62439-3:2016 Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR) option, feature combinable with PTP

The 8100 product series are modular time reference systems supporting the Global Navigation Satellite Systems (GNSS) GPS, Galileo, GLONASS, and BeiDou for precise and reliable time synchronization at highly competitive pricing which is especially well suited for critical infrastructure applications.



The 8100 product series time reference systems have been designed for synchrophasor and substation applications with high requirements in terms of flexibility, availability and the support of a wide variety of time synchronization standards.

The modular system design features easy spare part management and minimum mean time to repair (MTTR) with all parts / extension boards supporting hot-plug capability. The modularity of the system also ensures security of investment if the requirements for the system should change in the future.

The system supports both single and dual / redundant power supplies (PSU) to ensure higher availability. Power supplies are available for DC input voltages 24VDC (18 – 36VDC), 48VDC (36 – 76VDC), 110VDC (60 – 160VDC), 300VDC (200 – 400VDC) and wide range AC/DC input voltages 85 – 264VAC (50Hz / 60Hz) / 125 – 250VDC. The DC voltage power supplies feature redundant power inputs for connection of two power sources to a single power supply. In the version with redundant power supplies, the available power supplies can be combined as required.

Up to six extension slots are available for time domain controller (time signal input from time source), service consumer boards (time signal output / distribution to customer application), and system management boards.

A variety of service consumer boards is available for, among others:

- Network time synchronization using Network Time Protocol (NTP / SNTP), SIMATIC NET SINEC H1 Time Datagram or IEEE 1588™-2019 Precision Time Protocol (PTP) with support for IEC 61850-9-3:2016 profile for power utility automation and IEEE Std C37.238™-2017 power profile
- IRIG-B and DCF77 signal output (demodulated / modulated)
- Programmable cyclic pulse (PPS, PPM, PPH)
- Serial time datagram (e. g. **hopf** Standard, IEC-103, ABB Melody / Freelance, Trimble TSIP, SAT1703 / SICAM RTU)
- Signal distribution via electrical or fiber-optic signal output

Time Signal Reliability

- Reduction of GNSS vulnerability by application of anti-jamming and anti-spoofing technologies at the signal receiver
- Redundant multiple validation of the available synchronization signals for error-free and leap-free timing signal evaluation
- Automatic handling of leap second and week rollover

System Configuration and Monitoring

- huma® web edition, HTTPS web interface
- Integrated event log
- Diagnostics and monitoring via SNMP v2c and v3 read operations (MIB II, **hopf** private enterprise MIB, NTPv4 MIB, PTPBASE MIB, IEEE37.238 MIB, IEC-62439-3 MIB)
- Event notification using SNMP traps, email messaging and / or external SYSLOG server

Enhanced IT/OT Security

- Separation of the diagnostic and operational / productivity network for enhanced security
- Role based access control (RBAC) with support of LDAP and RADIUS authentication according to IEC 62351-8:2020
- Built-in firewall for provision of barrier against network-based intrusions
- Certificate signed configuration files and firmware packages

The 8100 product series time domain controller features evaluation of time signals from multiple satellite systems freely configurable for GPS, Galileo, GLONASS and BeiDou. On receiver and firmware level the time domain controller implements consistency checks and statistical tests on features such as automatic gain control (AGC), clock error, signal quality, signal power, propagation delay and the angle of arrival in order to safeguard error-free and leap-free time signal evaluation. In case of signal loss due to antenna failure or identification of time signal mismatch due to jamming or spoofing attacks the time domain controller clock automatically switches to the integrated oscillator holdover ensuring the oscillator dependent freewheeling accuracy. For enhanced availability redundant time domain controller configurations are supported.

Time domain controller boards are equipped with an integrated management controller which allows easy configuration and monitoring using the **hopf** unified management application **huma® web edition** which features secure access to the system via an intuitive to use state-of-the-art web interface. All field replaceable units integrated into the enclosure can be centrally configured. System configurations may be saved for the whole enclosure or for each individual board separately.

The management controller continuously monitors the health status of all integrated boards and components. It collects diagnostic and statistical data for the integrated event log and for real time notification of critical events to external IT management systems using email messaging, SNMP traps or external SYSLOG server.

The current demand for the convergence of Information Technologies (IT) and Operational Technologies (OT) in critical infrastructure requires to ensure security and reliability in compliance with regulatory requirements. The modular system design of the 8100 product series allows complete separation of operational / productivity network (e.g. process bus for power utility applications) for enhanced security while allowing complete access to diagnostic data and critical events for the IT network management via the integrated management controller. Role based access control according to the most up-to-date standards safeguards secure access to the management controller by authorized staff. The built-in firewall feature adds even increased security against network-based intrusions by limiting access to the minimum necessary network connections and services. All configuration files and firmware update packages may be signed by certificates to ensure authenticity and eligibility for application.

Base System

Enclosures

FG8101G01

8100 product series time reference system

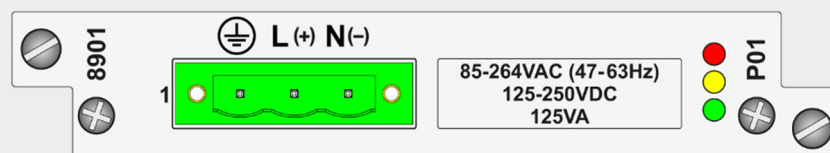
- 19-inch 1U modular subrack according to IEC 60297-3-100:2008
- 2 extension slots for redundant power supply units
- 6 extension slots for time domain controller and service consumer boards

Base System Options

Power Supplies

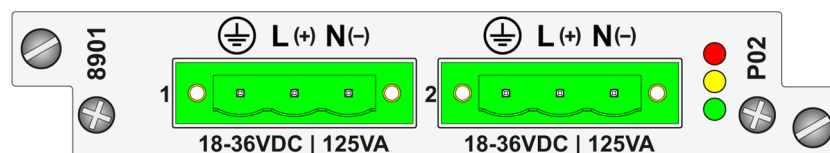
FG8901P01

Power Supply Unit for 8100 product series, hot-plug capable
85 – 264VAC (50Hz / 60Hz) / 125 – 250VDC
single power input for connection to a single power source



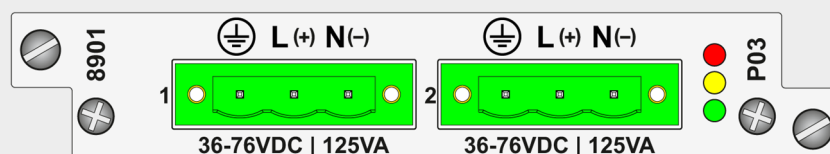
FG8901P02

Power Supply Unit for 8100 product series, hot-plug capable
24VDC (18 – 36VDC)
redundant power inputs for connection of the power sources



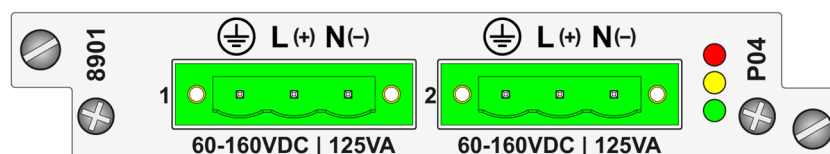
FG8901P03

Power Supply Unit for 8100 product series, hot-plug capable
48VDC (36 – 76VDC)
redundant power inputs for connection of the power sources



FG8901P04

Power Supply Unit for 8100 product series, hot-plug capable
110VDC (60 – 160VDC)
redundant power inputs for connection of the power sources



Time Domain Controller Boards

FG8702G01	<p>Time Domain Controller Board</p> <ul style="list-style-type: none"> ■ 72-channel GNSS receiver for GPS, GLONASS, BeiDou, Galileo with connection via SMA connector (female) ■ Dry contact for alarm / status output ■ VCTCXO oscillator (236,71 μs per day at constant temperature after 2 days of continuous operation) ■ Time server and integrated management controller with 2x ethernet interface 10/100/1000Base-T (RJ45) according to IEEE 802.3 for: <ul style="list-style-type: none"> - Network Time Protocol NTP/SNTP v4.2.x (RFC 5905) - HTTP/HTTPS, SNMP, SNMP Traps, SMTP, Syslog and huma® software (hopf unified management application)
FG8702G02	<p>Time Domain Controller Board</p> <ul style="list-style-type: none"> ■ 72-channel GNSS receiver for GPS, GLONASS, BeiDou, Galileo with connection via SMA connector (female) ■ Dry contact for alarm / status output ■ OCXO oscillator for enhanced freewheeling accuracy (25,9 μs per day after 7 days of continuous operation ($\pm 1^\circ\text{C}$)) ■ Time server and integrated management controller with 2x ethernet interface 10/100/1000Base-T (RJ45) according to IEEE 802.3 for: <ul style="list-style-type: none"> - Network Time Protocol NTP/SNTP v4.2.x (RFC 5905) - HTTP/HTTPS, SNMP, SNMP Traps, SMTP, Syslog and huma® software (hopf unified management application)
FG8702G03	<p>Time Domain Controller Board</p> <ul style="list-style-type: none"> ■ 72-channel GNSS receiver for GPS, GLONASS, BeiDou, Galileo with connection via SMA connector (female) ■ Dry contact for alarm / status output ■ OCXO HPFS oscillator for high precision freewheeling accuracy (4,32 μs per day after 7 days of continuous operation ($\pm 1^\circ\text{C}$)) ■ Time server and integrated management controller with 2x ethernet interface 10/100/1000Base-T (RJ45) according to IEEE 802.3 for: <ul style="list-style-type: none"> - Network Time Protocol NTP/SNTP v4.2.x (RFC 5905) - HTTP/HTTPS, SNMP, SNMP Traps, SMTP, Syslog and huma® software (hopf unified management application)
FG8702G04	<p>Time Domain Controller Board</p> <ul style="list-style-type: none"> ■ Redundant 72-channel GNSS receiver for GPS, GLONASS, BeiDou, Galileo with connection via 2x SMA connector (female) ■ Dry contact for alarm / status output ■ VCTCXO oscillator (236,71 μs per day at constant temperature after 2 days of continuous operation) ■ Time server and integrated management controller with 2x ethernet interface 10/100/1000Base-T (RJ45) according to IEEE 802.3 for: <ul style="list-style-type: none"> - Network Time Protocol NTP/SNTP v4.2.x (RFC 5905) - HTTP/HTTPS, SNMP, SNMP Traps, SMTP, Syslog and huma® software (hopf unified management application)
FG8702G05	<p>Time Domain Controller Board</p> <ul style="list-style-type: none"> ■ Redundant 72-channel GNSS receiver for GPS, GLONASS, BeiDou, Galileo with connection via 2x SMA connector (female) ■ Dry contact for alarm / status output ■ OCXO oscillator for enhanced freewheeling accuracy (25,9 μs per day after 7 days of continuous operation ($\pm 1^\circ\text{C}$)) ■ Time server and integrated management controller with 2x ethernet interface 10/100/1000Base-T (RJ45) according to IEEE 802.3 for: <ul style="list-style-type: none"> - Network Time Protocol NTP/SNTP v4.2.x (RFC 5905) - HTTP/HTTPS, SNMP, SNMP Traps, SMTP, Syslog and huma® software (hopf unified management application)

FG8702G06

Time Domain Controller Board

- Redundant 72-channel GNSS receiver for GPS, GLONASS, BeiDou, Galileo with connection via 2x SMA connector (female)
- Dry contact for alarm / status output
- OCXO HPFS oscillator for high precision freewheeling accuracy (4,32 μ s per day after 7 days of continuous operation ($\pm 1^\circ\text{C}$))
- Time server and integrated management controller with 2x ethernet interface 10/100/1000Base-T (RJ45) according to IEEE 802.3 for:
 - Network Time Protocol NTP/SNTP v4.2.x (RFC 5905)
 - HTTP/HTTPS, SNMP, SNMP Traps, SMTP, Syslog and huma® software (**hopf** unified management application)

Service Consumer Boards

FG8801N02

Service Consumer Board, hot-plug capable

- Time server with 2x ethernet interface 10/100/1000Base-T via 2x RJ45 connector (copper) according to IEEE 802.3 for output of:
 - Network Time Protocol NTP/SNTP v4.2.x (RFC 5905)

FG8801F02

Service Consumer Board, hot-plug capable

- Time server with 2x ethernet interface via 2x SFP transceiver module with LC fiber optic connector according to IEEE 802.3 for output of:
 - Network Time Protocol NTP/SNTP v4.2.x (RFC 5905)

FG8899C01

Service Consumer Board, hot-plug capable

- Output for 5V active / 5V TTL signal via 2x BNC female connector
- Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500

FG8899C02

Service Consumer Board, hot-plug capable

- Output for 5V active / 5V TTL signal via 4x BNC female connector
- Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500

FG8899C03

Service Consumer Board, hot-plug capable

- Output for 5V active / 5V TTL signal via 2x 3-pole pluggable screw terminal
- Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500

FG8899C04

Service Consumer Board, hot-plug capable

- Output for 5V active / 5V TTL signal via 4x 3-pole pluggable screw terminal
- Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500

FG8899C05

Service Consumer Board, hot-plug capable

- Output for 12V active signal via 2x BNC female connector
- Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500

FG8899C06

Service Consumer Board, hot-plug capable

- Output for 12V active signal via 4x BNC female connector
- Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500

FG8899C07	<p>Service Consumer Board, hot-plug capable</p> <ul style="list-style-type: none"> ■ Output for 12V active signal via 2x 3-pole pluggable screw terminal ■ Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500
FG8899C08	<p>Service Consumer Board, hot-plug capable</p> <ul style="list-style-type: none"> ■ Output for 12V active signal via 4x 3-pole pluggable screw terminal ■ Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500
FG8899C09	<p>Service Consumer Board, hot-plug capable</p> <ul style="list-style-type: none"> ■ Output for 24V active signal via 2x BNC female connector ■ Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500
FG8899C10	<p>Service Consumer Board, hot-plug capable</p> <ul style="list-style-type: none"> ■ Output for 24V active signal via 4x BNC female connector ■ Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500
FG8899C11	<p>Service Consumer Board, hot-plug capable</p> <ul style="list-style-type: none"> ■ Output for 24V active signal via 2x 3-pole pluggable screw terminal ■ Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500
FG8899C12	<p>Service Consumer Board, hot-plug capable</p> <ul style="list-style-type: none"> ■ Output for 24V active signal via 4x 3-pole pluggable screw terminal ■ Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500
FG8899C13	<p>Service Consumer Board, hot-plug capable</p> <ul style="list-style-type: none"> ■ Output for modulated IRIG-B signal via 2x BNC female connector, time signal from board signal generator for IRIG-B B12x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500
FG8899C14	<p>Service Consumer Board, hot-plug capable</p> <ul style="list-style-type: none"> ■ Output for modulated IRIG-B signal via 4x BNC female connector, time signal from board signal generator for IRIG-B B12x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500
FG8899C15	<p>Service Consumer Board, hot-plug capable</p> <ul style="list-style-type: none"> ■ Output via 2x fiber optic connector for multimode fiber optic cable, wave length 820nm, connector type ST ■ Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500
FG8899C16	<p>Service Consumer Board, hot-plug capable</p> <ul style="list-style-type: none"> ■ Output via 4x fiber optic connector for multimode fiber optic cable, wave length 820nm, connector type ST ■ Time signal configurable from board time signal generator for PPS, cyclic pulse PPS/PPM/PPH, DCF77, IRIG-B B00x / IEEE 1344 / IEEE C37.118 / AFNOR NF S 87-500
FG8899C17	<p>Service Consumer Board, hot-plug capable</p> <ul style="list-style-type: none"> ■ Output of serial time datagram (hopf Standard, IEC-103, ABB Melody / Freelance, Trimble TSIP, SAT1703 / SICAM RTU) via 1x 9-pole D-SUB connector at 1xRS232 and 1x RS422 signal level

FG8899C18

Service Consumer Board, hot-plug capable

- Output of serial time datagram (**hopf** Standard, IEC-103, ABB Melody / Freelance, Trimble TSIP, SAT1703 / SICAM RTU) via 2x 9-pole D-SUB connector each at 1xRS232 and 1x RS422 signal level

Firmware Activation Options

LI8100A01	<p>Activation key for activation of the following feature for product series 8100:</p> <ul style="list-style-type: none"> ■ Support for Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR) according to IEC 62439-3:2016 for use as Dual Attached Node (DAN) ■ Activation key for one (1) board
LI8100A02	<p>Activation key for activation of the following feature for product series 8100:</p> <ul style="list-style-type: none"> ■ Support for Precision Time Protocol (PTP) according to IEEE Std 1588™-2008 with support for IEEE Standard Profile for use of IEEE 1588™ Precision Time Protocol in Power System Applications (Power Profile v1) according to IEEE Std C37.238™-2011, Profile for Power Utility Automation according to IEC 61850-9-3:2016 and IEEE Standard Profile for use of IEEE 1588™ Precision Time Protocol in Power System Applications (Power Profile v2) according to IEEE Std C37.238™-2017 ■ Activation key for one (1) board
LI8100A03	<p>Activation key for activation of the following feature for product series 8100:</p> <ul style="list-style-type: none"> ■ Support for SIMATIC NET SINEC H1 Time Datagram Protocol ■ Activation key for one (1) board



Rear view of base system equipped with redundant power supplies FG8901P01 and FG8901P04

Applied Standards

Electromagnetic Compatibility

IEC 61000-4-2:2008	Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test
IEC 61000-4-3:2006/A1:2007/A2:2010	Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency, electromagnetic field immunity test
IEC 61000-4-4:2012	Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test
IEC 61000-4-5:2014/A1:2017	Electromagnetic compatibility (EMC) – Part 4-5: Testing and measurement techniques – Surge immunity test
IEC 61000-4-6:2013	Electromagnetic compatibility (EMC) – Part 4-6: Testing and measurement techniques – Immunity to conducted disturbances, induced by radio-frequency fields
IEC 61000-4-11:2004/A1:2017	Electromagnetic compatibility (EMC) – Part 4-11: Testing and measurement techniques – Voltage dips, short interruptions and voltage variations immunity tests
IEC 61000-4-12:2017	Electromagnetic compatibility (EMC) – Part 4-12: Testing and measurement techniques – Ring wave immunity test
IEC 61000-4-17:1999 + A1:2001	Electromagnetic compatibility (EMC) - Part 4-17: Testing and measurement techniques - Ripple on d.c. input power port immunity test
IEC 61000-4-18:2019 + COR1:2019	Electromagnetic compatibility (EMC) - Part 4-18: Testing and measurement techniques - Damped oscillatory wave immunity test
IEC 61000-4-29:2000	Electromagnetic compatibility (EMC) - Part 4-29: Testing and measurement techniques; Voltage dips, short interruptions and voltage variations on d.c. input power port immunity tests
IEC 61000-6-2:2016	Electromagnetic compatibility (EMC). Part 6-2: Generic standards – Immunity for industrial environments
IEC 61000-6-3:2006/A1:2010	Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments
IEC 61000-6-5:2015/COR1:2017	Electromagnetic compatibility (EMC) - Part 6-5: Generic standards - Immunity for equipment used in power station and substation environment
EN 55016 (CISPR 16)	Specification for radio disturbance and immunity measuring apparatus and methods

EN 55032:2012/AC:2013 (CISPR 32:2015)	Electromagnetic compatibility of multimedia equipment – Emission Requirements (150kHz – 30 MHz class B)
--	---

Safety

IEC 62368-1:2014/AC:2015	Audio/video, information and communication technology equipment – Part 1: Safety requirements
--------------------------	---

IEC 60529:1989/A1:1999 /A2:2013	Degrees of protection provided by enclosures (IP Code)
------------------------------------	--

Radio Equipment and GNSS receivers

EN 301 489-1 V2.2.3 (2019-11)	Electromagnetic Compatibility (EMC) standard for radio equipment and services – Part 1: Common technical requirements – Harmonized Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU and the essential requirements of article 6 of Directive 2014/30/EU
----------------------------------	---

EN 301 489-19 V2.1.1 (2019-04)	Electromagnetic Compatibility (EMC) standard for radio equipment and services – Part 19: Specific conditions for Receive Only Mobile Earth Stations (ROMES) operating in the 1,5 GHz band providing data communications and GNSS receivers operating in the RNSS band (ROGNSS) providing positioning, navigation and timing data – Harmonized Standard covering the essential requirements of article 3.1(b) of Directive 2014/53/EU
-----------------------------------	--

EN 303 413 V1.2.1 (2021-04)	Satellite Earth Stations and Systems (SES) – Global Navigation Satellite System (GNSS) receivers – Radio equipment operating in the 1164 MHz to 1300 MHz and 1559 MHz to 1610 MHz frequency bands – Harmonized Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU
--------------------------------	--

Environmental

IEC 60068-2-1:2007	Environmental testing – Part 2-1: Tests – Test A: Cold
--------------------	--

IEC 60068-2-2:2007	Environmental testing – Part 2-2: Tests – Test B: Dry heat
--------------------	--

IEC 60068-2-30:2005	Environmental testing – Part 2-30: Tests – Test Db: Damp heat, cyclic (12 h + 12 h cycle)
---------------------	---

IEC 60255-21-1:1988	Electrical relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment; section 1: Vibration tests (sinusoidal)
---------------------	---

IEC 60255-21-2:1988	Electrical relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment; section 2: Shock and bump tests
IEC 60255-21-3:1993	Electrical relays - Part 21: Vibration, shock, bump and seismic tests on measuring relays and protection equipment; section 3: Seismic tests
IEC 61850-3:2013	Communication networks and systems for power utility automation - Part 3: General requirements
IEEE 1613-2009	Environmental and testing requirements for communications networking devices installed in electric power substations

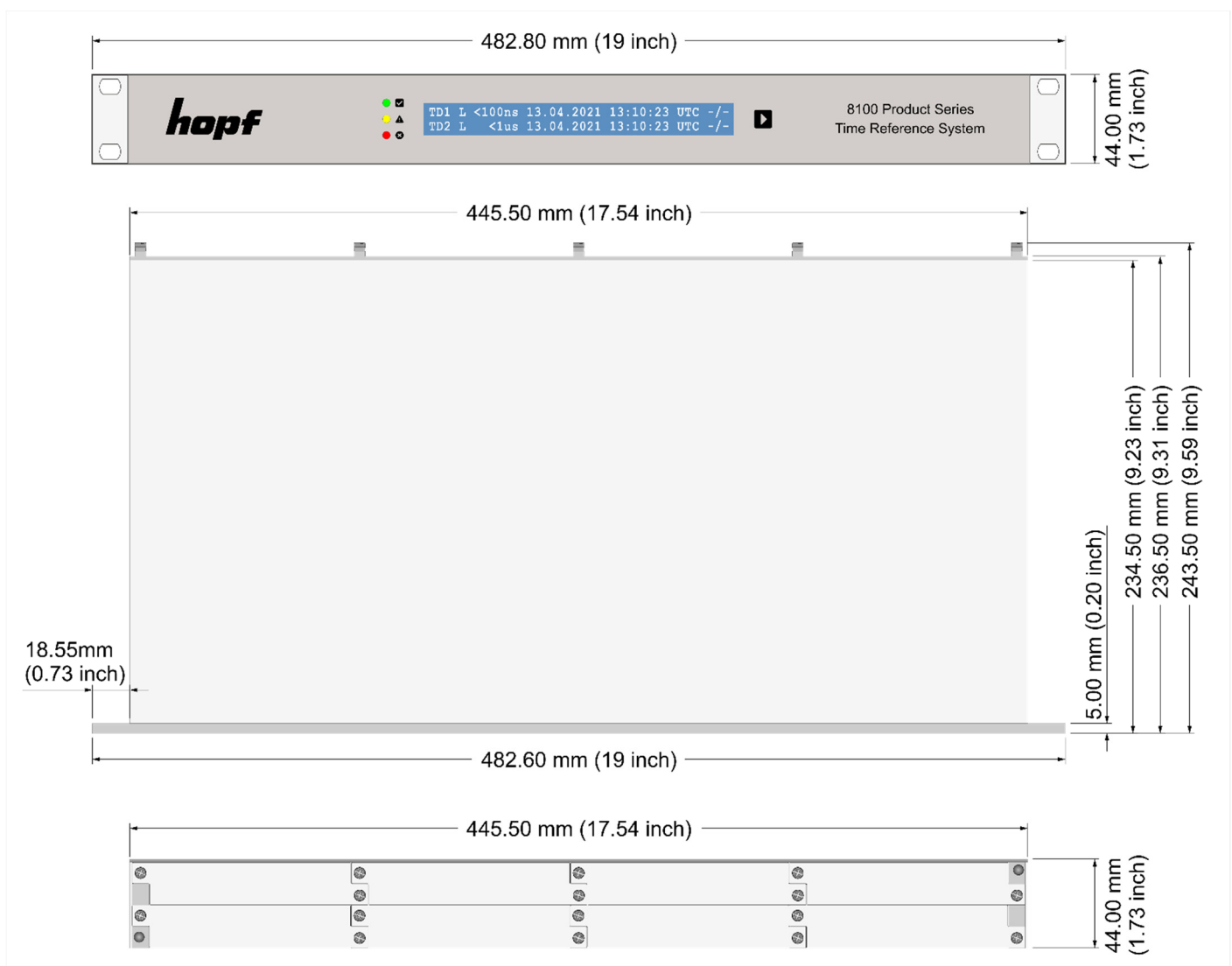
Mechanical

IEC 60297-3-100:2008	Mechanical structures for electronic equipment - Dimensions of mechanical structures of the 482,6 mm (19 in) series - Part 3-100: Basic dimensions of front panels, subracks, chassis, racks and cabinets
----------------------	---

Technical Specifications

Mechanical Data

Housing	19-inch 1U subrack according to IEC 60297-3-100
Dimensions	Width: 482.6 mm (19.00 inch) / 445.5 mm (17.54 inch) Height: 44.00 mm (1.73 inch) Depth: 236.5 mm (9.31 inch) / 243.5 mm (9.59 inch)
Material	metal, powder coated
Color (RAL)	light gray (7035)
Protection Class	IP30 according to DIN EN 60529
Weight	3.5 kg (7.7 lbs) without power supply units and extension boards



Environmental Conditions

Operating Temperature	-40 °C to +70 °C (-40 °F to +158 °F) according to IEC 61850-3 and IEEE 1613
Storage Temperature	-40 °C to +70 °C (-40 °F to +158 °F) according to IEC 61850-3 and IEEE 1613
Operating Altitude	up to 3,000 m (9,843 ft) above sea level according to IEC 61850-3
Relative Humidity	5 to 95 % (non-condensing) at 40 °C (104 °F) according to IEC 61850-3
Operating Environment	Pollution Degree: 2 Overvoltage Category: II

Environmental and Electromagnetic Compatibility Tests

Temperature	IEC 60068-2-1	Severity Level 16h at -40°C
	IEC 60068-2-2	Severity Level 16h at +85°C storage
		Severity Level 16h at +65°C operating
	IEC 60068-2-14	Severity Level -20° to +55°C, 5 cycles
	IEC 60068-2-30	Severity Level +25° to +55°C, 6 cycles, RH 95%
Mechanical Stress	IEC 60068-2-78	Severity Level 240h at +40°C, RH 95%
	IEC 60255-21-1	Severity Level Class 2
	IEC 60255-21-2	Severity Level Class 2
	IEC 60255-21-3	Severity Level Class 2
Electromagnetic Compatibility	IEC 61000-4-2	Severity Level 8kV contact Severity Level 15kV air
	IEC 61000-4-3	Severity Level 10V/m
	IEC 61000-4-4	Severity Level 4kV
	IEC 61000-4-5	Severity Level 2kV line-to-line Severity Level 4kV line-to-earth
	IEC 61000-4-6	Severity Level 10V
	IEC 61000-4-11	Severity Level 30% one period Severity Level 60% 50 periods Severity Level 100% 5 periods Severity Level 100% 50 periods
	IEC 61000-4-12	Severity Level 2,5kV
	IEC 61000-4-17	Severity Level 10%
	IEC 61000-4-18	Severity Level 2,5kV common mode Severity Level 1kV differential mode
	IEC 61000-4-29	Severity Level 30% 0,1sec Severity Level 60% 0,1sec Severity Level 100% 0,05sec

Extension Card Dependent Specifications

FG8901P01	Input Voltage: 85-264VAC 125-250VDC Input Frequency: 47-63Hz for AC input voltage Input Current: max. 1,3A@100VAC max. 0.7A@200VAC
FG8901P02	Input Voltage: 18-36VDC Input Current: max. 5,47A@24VDC
FG8901P03	Input Voltage: 36-76VDC Input Current: max. 2,69A@48VDC

FG8901P04

FG8702G01
FG8702G04

Input Voltage:	60-160VDC
Input Current:	max. 1,1A@110VDC
Ethernet	
Ports	2
Data Rate	10/100/1000Mbps
Connector	RJ45
Status Output	
Dry Contact	
Operating Voltage	0-24VDC
Operating Current	max. 50mA
Boot time	
typ. ≤ 40 seconds depending on the configuration	
Antenna	
Supply Voltage	5V±10%
Current	max. 100mA
Receiver	
GNSS systems	GPS, GLONASS, Beidou, Galileo
Channels	72
Time to first fix	Warm start: <2 s Cold start: <30 s First initialization: <750 s
Sensitivity	Tracking: -166dBm Warm start: -157dBm Cold start: -148dBm
Clock Accuracy	
Internal PPS	±15ns (after 5 minutes GNSS reception with clear sky view)
Holdover	236,71µs per day at constant temperature after 2 days of continuous operation
NTP	
Timestamp Accuracy	typ. <30µs
Identical to FG8702G01 / FG8702G04 except holdover	
Clock Accuracy	
Holdover	25,9µs per day after 7 days of continuous operation (±1°C)
Identical to FG8702G01 / FG8702G04 except holdover	
Clock Accuracy	
Holdover	4,32µs per day after 7 days of continuous operation (±1°C)

FG8702G02
FG8702G05

FG8702G03
FG8702G06

FG8801N02

Ethernet	
Ports	2
Data Rate	10/100/1000Mbps
Connector	RJ45
Status Output	
Dry Contact	
Operating Voltage	0-24VDC
Operating Current	max. 50mA
Boot time	
typ. ≤ 40 seconds depending on the configuration	
Time Accuracy	
Internal time accuracy $\pm 15\text{ns}$ to system internal PPS	
NTP	
Timestamp Accuracy	typ. $< 30\mu\text{s}$
PTP	
Timestamp Accuracy	typ. $< 50\text{ns}$ to system internal PPS

FG8801F02

Ethernet	
Ports	2
Data Rate	dependent on SFP transceiver module
Connector	LC
Status Output	
Dry Contact	
Operating Voltage	0-24VDC
Operating Current	max. 50mA
Boot time	
typ. ≤ 40 seconds depending on the configuration	
Time Accuracy	
Internal time accuracy $\pm 15\text{ns}$ to system internal PPS	
NTP	
Timestamp Accuracy	typ. $< 30\mu\text{s}$
PTP	
Timestamp Accuracy	typ. $< 50\text{ns}$ to system internal PPS



Network Standards and Protocols

General standards and protocols

- IEEE 802.1Q VLANs
- IEEE 802.3 Type 10BASE-T
- IEEE 802.3ab 1000BASE-T
- IEEE 802.3ad Link Aggregation Control Protocol (LACP)
- IEEE 802.3bt Power over Ethernet
- IEC 62439-3:2016 Parallel Redundancy Protocol (PRP) and High-availability Seamless Redundancy (HSR)
- RFC 768 User Datagram Protocol (UDP)
- RFC 791 Internet Protocol, Version 4 (IPv4)
- RFC 792 Internet Control Message Protocol (ICMPv4)
- RFC 793 Transmission Control Protocol (TCP)
- RFC 826 Address Resolution Protocol (ARP)
- RFC 1035 Domain Names (client)
- RFC 1918 Address Allocation for Private Internet
- RFC 4443 Internet Control Message Protocol (ICMPv6)
- RFC 2131 Dynamic Host Configuration Protocol (DHCPv4)
- RFC 3484 Default Address Selection for Internet Protocol version 6 (IPv6)
- RFC 3596 DNS Extensions to Support IP Version 6
- RFC 8200 Internet Protocol, Version 6 (IPv6)
- RFC 8415 Dynamic Host Configuration Protocol for IPv6 (DHCPv6)

Device and Network Management

- RFC 1098 A Simple Network Management Protocol (SNMP)
- RFC 1155 Structure and Identification of Management Information for TCP/IP-based Internets
- RFC 1213 Management Information Base for Network Management of TCP/IP-based internets: MIB-II
- RFC 2578 Structure of Management Information Version 2 (SMIv2)
- RFC 2579 Textual Conventions for SMIv2
- RFC 3411 An Architecture for Describing Simple Network Management Protocol (SNMP) Management Frameworks
- RFC 3412 Message Processing and Dispatching for the Simple Network Management Protocol (SNMP)
- RFC 3413 Simple Network Management Protocol (SNMP) Applications
- RFC 3414 User-based Security Model (USM) for version 3 of the Simple Network Management Protocol (SNMPv3)
- RFC 3418 Management Information Base (MIB) for the Simple Network Management Protocol (SNMP)

- RFC 3584 Coexistence between Version 1, Version 2, and Version 3 of the Internet-standard Network Management Framework
- RFC 4250/4251/5252/4253/4254 The Secure Shell (SSH) Protocol
- RFC 5321 Simple Mail Transfer Protocol
- RFC 5424 The Syslog Protocol
- RFC 7540 Hypertext Transfer Protocol Version 2 (HTTP/2)
- **hopf** Private Enterprise MIB

Security / Authentication

- IEC 62351-8:2020 Power systems management and associated information exchange - Data and communications security - Role-based access control
- IEC 62443-4-2:2019 Security for industrial automation and control systems - Technical security requirements for IACS components
- IEEE 1686-2013 Standard for Intelligent Electronic Devices Cyber Security Capabilities
- RFC 4510/4511/4512/4513/4514/4515/4516/4517/4518/4519/4520 Lightweight Directory Access Protocol (LDAP)
- RFC 2865 Remote Authentication Dial In User Service (RADIUS)
- RFC 2866 RADIUS Accounting

Time Synchronization

- RFC 5905 Network Time Protocol Version 4: Protocol and Algorithms Specification
- RFC 5906 Network Time Protocol Version 4: Autokey Specification
- RFC 5907 Definitions of Managed Objects for Network Time Protocol Version 4 (NTPv4)
- IEEE 1588-2019 Standard for a Precision Clock Synchronization Protocol for Networked Measurement and Control Systems (PTP v2.1)
- IEEE C37.238-2017 Standard Profile for Use of IEEE 1588 Precision Time Protocol in Power System Applications
- IEC 61850-9-3:2016 Communication networks and systems for power utility automation - Precision time protocol profile for power utility automation
- IEEE 60255-118-1:2018-12 Measuring relays and protection equipment - Synchrophasor for power systems – Measurements
- SIMATIC NET SINEC H1 Time Datagram

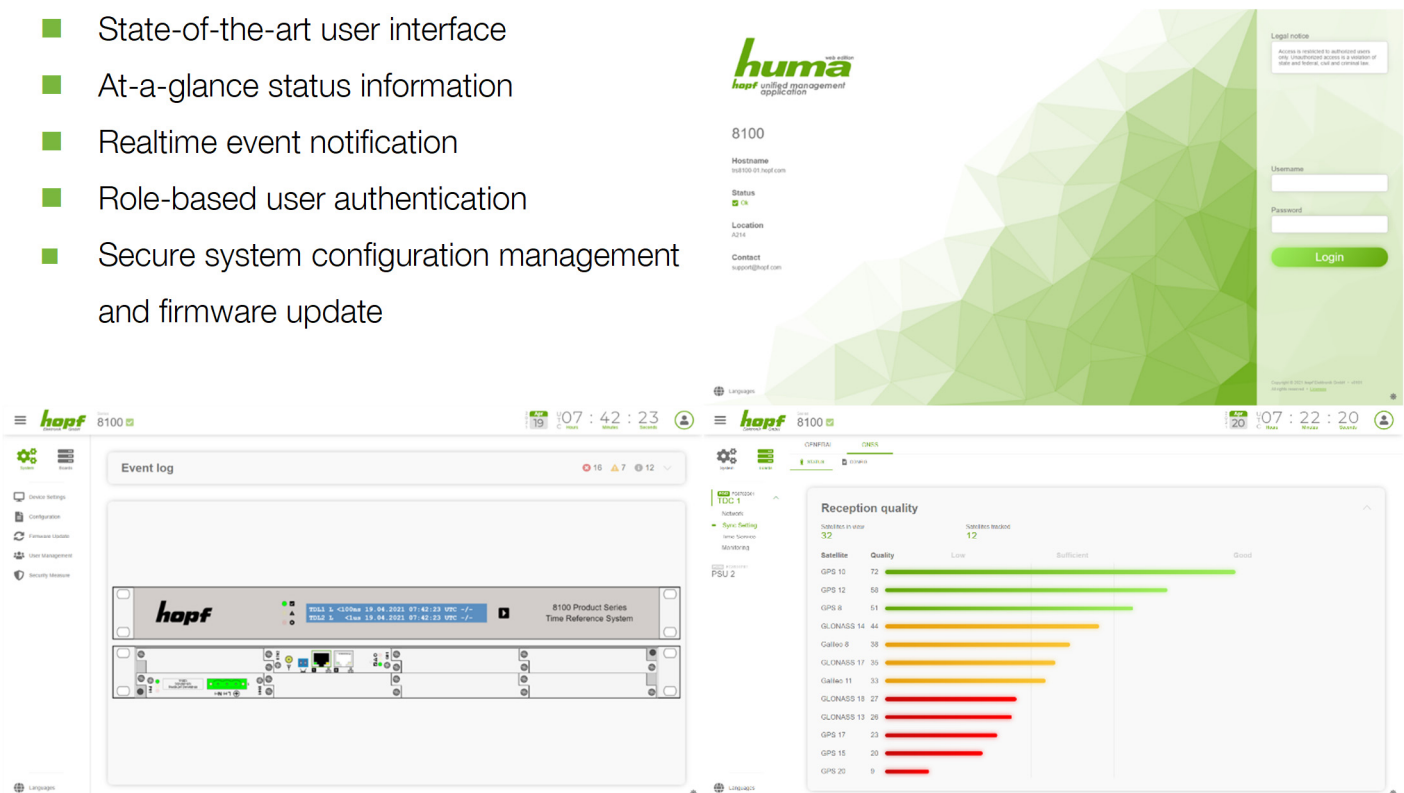
huma® web edition software

huma® web edition – **hopf** unified management application – is the highly flexible, versatile, secure, and easy-to-use system configuration and management software that is integral part of each system's management controller hardware. The software is accessible using the local computer's web browser and network connection.

System requirements

Web browsers	Google Chrome (Version > 89), Microsoft Edge (Version > 89), Mozilla Firefox (Version > 87), Opera (Version > 75), Brave (Version > 1.23)
Browser technology support	HTML5, CSS3, JavaScript enabled, ECMAScript 2016, Local Storage (min. 1MB)

- State-of-the-art user interface
- At-a-glance status information
- Realtime event notification
- Role-based user authentication
- Secure system configuration management and firmware update



Referring to the information in this product sheet: After the editorial deadline of this publication, October 22, 2021, changes may have been made to the product. Subject to changes of structural or design changes, changes to the scope and scale of discounts by the manufacturer during the delivery period as long as the changes or deviations are reasonable under consideration of the interest of the seller to the buyer. Errors and technical data are subject to change without prior notice.

All rights reserved. © **hopf** Elektronik GmbH, Nottebohmstrasse 41, 58511 Luedenscheid, Germany