

## 8100 Product Series

Fully Modular

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  $-40^{\circ}$  and  $+70^{\circ}\text{C}$
- GPS, Galileo, GLONASS, and BeiDou time sources for reliable satellite synchronization
- Average accuracy of  $\pm 30$  ns to UTC, peak accuracy of  $\pm 100$  ns to UTC for demodulated IRIG-B and pulse outputs and  $\pm 1$   $\mu\text{s}$  for modulated IRIG-B output
- Synchronization of IEC 61850 compatible devices
- Typical NTP time stamp accuracy  $< 30$   $\mu\text{s}$
- Precision Time Protocol (PTP) option with peak time stamp accuracy  $\pm 100$  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 fully modular time reference systems that support the Global Navigation Satellite Systems (GNSS) GPS, Galileo, GLONASS, and BeiDou, as well as NTP, PTP and various other time sources for precise and reliable time synchronization at extremely competitive prices and are particularly well suited for critical infrastructure applications.



The 8100 product series time reference systems have been designed for mission critical applications with high requirements in terms of flexibility, availability, security and the support of a wide variety of time synchronization standards commonly used in public infrastructure, railway technology, power utility, digital smart grid, industry automation and data center facilities.

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), wide range DC input voltages 19 – 75VDC 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 boards (time signal input from time source), service provider boards (time signal output / distribution to customer application) and management controller boards.

A variety of time service provider 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 with integrated management controller as well as standalone independent management controller boards allow 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  
FG8101G01-B000

8100 product series time reference system

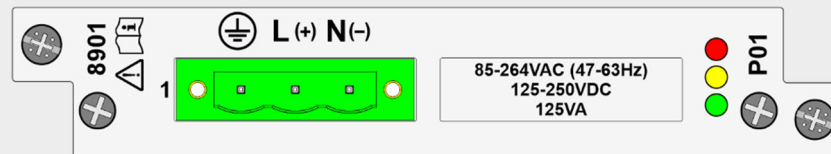
- 19-inch 1U modular subrack according to IEC 60297-3-100:2008
- 2 extension slots for redundant power supply units
- 6 extension slots for time domain controller, service provider and management controller boards

## Base System Options

### Power Supplies

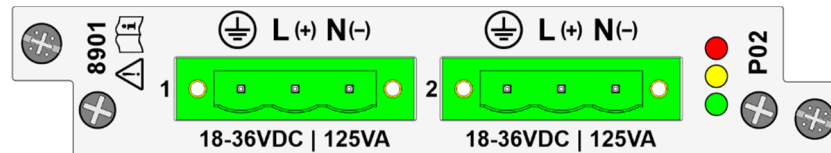
FG8901P01  
FG8901P01-B000

Power Supply Unit for 8x00 product series, hot-plug capable  
85 – 264VAC (50Hz / 60Hz) / 125 – 250VDC  
single power input for connection to a single power source



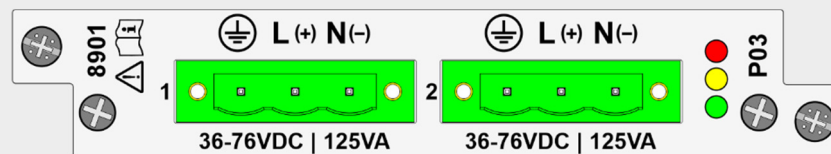
FG8901P02  
FG8901P02-B000

Power Supply Unit for 8x00 product series, hot-plug capable  
24VDC (18 – 36VDC)  
redundant power inputs for connection of the power sources



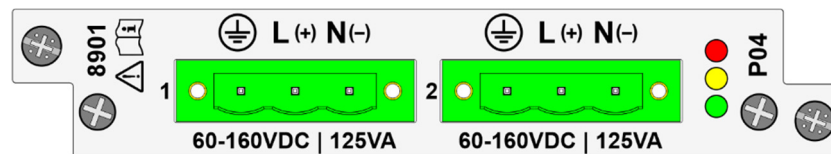
FG8901P03  
FG8901P03-B000

Power Supply Unit for 8x00 product series, hot-plug capable  
48VDC (36 – 76VDC)  
redundant power inputs for connection of the power sources



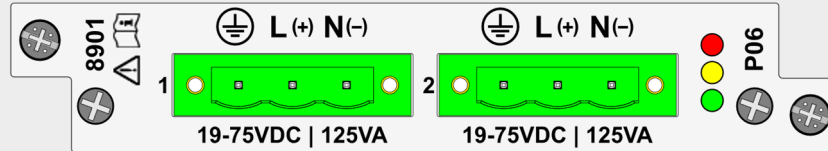
FG8901P04  
FG8901P04-B000

Power Supply Unit for 8x00 product series, hot-plug capable  
110VDC (60 – 160VDC)  
redundant power inputs for connection of the power sources



FG8901P06  
FG8901P06-B000

Power Supply Unit for 8x00 product series, hot-plug capable  
19 – 75VDC  
redundant power inputs for connection of the power sources



## Time Domain Controller Boards

FG8702G01  
FG8702G01-B000

Time Domain Controller Board for product series 8x00, hot-plug capable

- 72-channel GNSS receiver for GPS, GLONASS, BeiDou, Galileo with connection via SMA connector (female)
- Dry contact for alarm / status output
- TCXO oscillator (236,71  $\mu$ s 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:
  - 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  
FG8702G02-B000

Time Domain Controller Board for product series 8x00, hot-plug capable

- 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 stability (25,9  $\mu$ 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)

FG8702G03  
FG8702G03-B000

Time Domain Controller Board for product series 8x00, hot-plug capable

- 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 stability (4,32  $\mu$ 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)

FG8702G04  
FG8702G04-B000

Time Domain Controller Board for product series 8x00, hot-plug capable

- Redundant 72-channel GNSS receiver for GPS, GLONASS, BeiDou, Galileo with connection via 2x SMA connector (female)
- Dry contact for alarm / status output
- TCXO oscillator (236,71  $\mu$ s 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:
  - 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  
FG8702G05-B000

Time Domain Controller Board for product series 8x00, hot-plug capable

- 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 stability (25,9  $\mu$ 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)

FG8702G06  
FG8702G06-B000

Time Domain Controller Board for product series 8x00, hot-plug capable

- 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 stability (4,32  $\mu$ 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)

### Time Service Provider Boards

FG8801N02  
FG8801N02-B000

Time Service Provider Board for product series 8x00, 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  
FG8801F02-B000

Time Service Provider Board for product series 8x00, 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)

FG8802S00  
FG8802S00-B000

Time Service Provider Board for product series 8x00, hot-plug capable

- 4 channel output via 4x SMA connector (female), each channel individually configurable
- Electrical signal output type:
  - DC level shift (DCLS) (pulse width coded without carrier), 5V active / 5V TTL signal level
  - DC level shift (DCLS) (pulse width coded without carrier), 12V active signal level
  - DC level shift (DCLS) (pulse width coded without carrier), 24V active signal level
  - Sine wave carrier (amplitude modulated), 1kHz carrier frequency (only applicable for IRIG-B time signal output)
  - Manchester modulated, 1kHz carrier frequency (only applicable for IRIG-B time signal output)
- Time signal output type:
  - IRIG-B with applicable standards: RCC IRIG STANDARD 200-04, RCC IRIG STANDARD 200-16, IEEE 1344-1995, IEEE C37.118-2005, IEEE C37.118.1-2011, IEEE C37.118.1a-2014, IEEE/IEC 60255-118-1-2018, AFNOR NF S 87-500 (2007)
  - DCF77 (DCLS)
  - Cyclic pulse (DCLS): PPS (pulse per second), PPM (pulse per minute), PPH (pulse per hour)

FG8802S01  
FG8802S01-B000

Time Service Provider Board for product series 8x00, hot-plug capable

- 4 channel output via 4x BNC connector (female), each channel individually configurable
- Electrical signal output type:
  - DC level shift (DCLS) (pulse width coded without carrier), 5V active / 5V TTL signal level
  - DC level shift (DCLS) (pulse width coded without carrier), 12V active signal level
  - DC level shift (DCLS) (pulse width coded without carrier), 24V active signal level
  - Sine wave carrier (amplitude modulated), 1kHz carrier frequency (only applicable for IRIG-B time signal output)
  - Manchester modulated, 1kHz carrier frequency (only applicable for IRIG-B time signal output)
- Time signal output type:
  - IRIG-B with applicable standards: RCC IRIG STANDARD 200-04, RCC IRIG STANDARD 200-16, IEEE 1344-1995, IEEE C37.118-2005, IEEE C37.118.1-2011, IEEE C37.118.1a-2014, IEEE/IEC 60255-118-1-2018, AFNOR NF S 87-500 (2007)
  - DCF77 (DCLS)
  - Cyclic pulse (DCLS): PPS (pulse per second), PPM (pulse per minute), PPH (pulse per hour)

FG8802S02  
FG8802S02-B000

Time Service Provider Board for product series 8x00, hot-plug capable

- 4 channel output via 4x 2-pole pluggable screw terminal, each channel individually configurable
- Electrical signal output type:
  - DC level shift (DCLS) (pulse width coded without carrier), 5V active / 5V TTL signal level
  - DC level shift (DCLS) (pulse width coded without carrier), 12V active signal level
  - DC level shift (DCLS) (pulse width coded without carrier), 24V active signal level
  - Sine wave carrier (amplitude modulated), 1kHz carrier frequency (only applicable for IRIG-B time signal output)
  - Manchester modulated, 1kHz carrier frequency (only applicable for IRIG-B time signal output)
- Time signal output type:
  - IRIG-B with applicable standards: RCC IRIG STANDARD 200-04, RCC IRIG STANDARD 200-16, IEEE 1344-1995, IEEE C37.118-2005, IEEE C37.118.1-2011, IEEE C37.118.1a-2014, IEEE/IEC 60255-118-1-2018, AFNOR NF S 87-500 (2007)
  - DCF77 (DCLS)
  - Cyclic pulse (DCLS): PPS (pulse per second), PPM (pulse per minute), PPH (pulse per hour)

FG8802S03  
FG8802S03-B000

Time Service Provider Board for product series 8x00, hot-plug capable

- 4 channel output via 4x TNC connector (female), each channel individually configurable
- Electrical signal output type:
  - DC level shift (DCLS) (pulse width coded without carrier), 5V active / 5V TTL signal level
  - DC level shift (DCLS) (pulse width coded without carrier), 12V active signal level
  - DC level shift (DCLS) (pulse width coded without carrier), 24V active signal level
  - Sine wave carrier (amplitude modulated), 1kHz carrier frequency (only applicable for IRIG-B time signal output)
  - Manchester modulated, 1kHz carrier frequency (only applicable for IRIG-B time signal output)
- Time signal output type:
  - IRIG-B with applicable standards: RCC IRIG STANDARD 200-04, RCC IRIG STANDARD 200-16, IEEE 1344-1995, IEEE C37.118-2005, IEEE C37.118.1-2011, IEEE C37.118.1a-2014, IEEE/IEC 60255-118-1-2018, AFNOR NF S 87-500 (2007)
  - DCF77 (DCLS)
  - Cyclic pulse (DCLS): PPS (pulse per second), PPM (pulse per minute), PPH (pulse per hour)

FG8802S20  
FG8802S20-B000

Time Service Provider Board for product series 8x00, hot-plug capable

- 4 channel output via 4x fiber optic connector for multimode fiber optic cable, wave length 820nm, connector type ST, each channel individually configurable
- Time signal output type:
  - IRIG-B with applicable standards: RCC IRIG STANDARD 200-04, RCC IRIG STANDARD 200-16, IEEE 1344-1995, IEEE C37.118-2005, IEEE C37.118.1-2011, IEEE C37.118.1a-2014, IEEE/IEC 60255-118-1-2018, AFNOR NF S 87-500 (2007)
  - DCF77
  - Cyclic pulse: PPS (pulse per second), PPM (pulse per minute), PPH (pulse per hour)

FG8803S02  
FG8803S02-B000

Time Service Provider Board for product series 8x00, hot-plug capable

- 2 channel output of serial time datagram via 2x 9-pole D-SUB connector (male), each channel individually configurable
- Electrical signal output type: each channel available at RS232 and RS485 signal level
- Time signal output type: **hopf** standard serial time datagram types, IEC-103, ABB Melody, ABB Freelance, Trimble TSIP, SAT1703 / SICAM RTU, SINEC H1 Extended

FG8803S20  
FG8803S20-B000

Time Service Provider Board for product series 8x00, hot-plug capable

- 2 channel output of serial time datagram via 2x fiber optic connector for multimode fiber optic cable, wave length 820nm, connector type ST, each channel individually configurable
- Time signal output type: **hopf** standard serial time datagram types, IEC-103, ABB Melody, ABB Freelance, Trimble TSIP, SAT1703 / SICAM RTU, SINEC H1 Extended

### Management Controller Boards

FG8800M00  
FG8800M00-B000

Standalone independent Management Controller Board for product series 8x00, hot-plug capable

- Dry contact for alarm / status output
- Management controller with 2x ethernet interface 10/100/1000Base-T via 2x RJ45 connector (copper) according to IEEE 802.3 for output of:
  - HTTP/HTTPS, SNMP, SNMP Traps, SMTP, Syslog and huma® software (**hopf** unified management application)
- Time server for output of:
  - Network Time Protocol NTP/SNTP v4.2.x (RFC 5905)

### Firmware Activation Options

LI8100A01  
LI8100A01-B000

Activation key for activation of the following feature for product series 8x00:

- 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  
 LI8100A02-B000

Activation key for activation of the following feature for product series 8x00:

- Support for Precision Time Protocol (PTP) according to IEEE Std 1588™-2019 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  
 LI8100A03-B000

Activation key for activation of the following feature for product series 8x00:

- Support for SIMATIC NET SINEC H1 Time Datagram Protocol
- Activation key for one (1) board

LI8100A04  
 LI8100A04-B000

Activation key for activation of the following feature for product series 8x00:

- Support for Precision Time Protocol (PTP) according to IEEE Std 1588™-2019 as time source for time domain controller boards
- Activation key for one (1) board

LI8100A05  
 LI8100A05-B000

Activation key for activation of the following feature for product series 8x00:

- Support for Network Time Protocol (NTP/SNTP) according to RFC 5905 as time source for time domain controller boards
- Activation key for one (1) board

Article numbers ending with '-B000' have to be used for purchase orders for systems where all components are intended to be assembled at the **hopf** factory.

Article numbers without the suffix '-B000' are considered spare parts where each component is delivered in individual packaging.



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

## Applied Standards

### Electromagnetic Compatibility

|                                 |   |
|---------------------------------|---|
| IEC 61000-3-2:2018              | Electromagnetic compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current $\leq 16$ A per phase)  |
| IEC 61000-3-3:2013 + A1:2017    | Electromagnetic compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current $\leq 16$ A per phase and not subject to conditional connection |
| IEC 61000-4-2:2008              | Electromagnetic compatibility (EMC) – Part 4-2: Testing and measurement techniques – Electrostatic discharge immunity test  |
| IEC 61000-4-3:2020              | 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 61000-4-11:2020 + COR1:2020 | 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 61000-6-3:2020              | Electromagnetic compatibility (EMC) – Part 6-3: Generic standards – Emission standard for residential, commercial and light-industrial environments   |

|   |   |
|---|---|
| IEC 61000-6-4:2018  | Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for 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 55016-2-1:2014 /A1:2017<br>(CISPR 16-2-1:2014 +A1:2017)                      | Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-1: Methods of measurement of disturbances and immunity - Conducted disturbance measurements |
| EN 55016-2-3:2017 /A1:2019<br>(CISPR 16-2-3:2016 +A1:2019)                      | Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-3: Methods of measurement of disturbances and immunity - Radiated disturbance measurements  |
| EN 55032:2015/AC:2016/A11:2020/A1:2020<br>(CISPR 32:2015 + COR1:2016 + A1:2019) | Electromagnetic compatibility of multimedia equipment – Emission Requirements (150kHz – 30 MHz)   |
| EN 55035:2017<br>(CISPR 35:2016, modified)                                      | Electromagnetic compatibility of multimedia equipment – Immunity requirements   |

### Safety

|                                 |   |
|---------------------------------|---|
| IEC 62368-1:2018                | 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

IEC 63000:2016

Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances

IEEE 1613-2009

Environmental and testing requirements for communications networking devices installed in electric power substations

## Mechanical

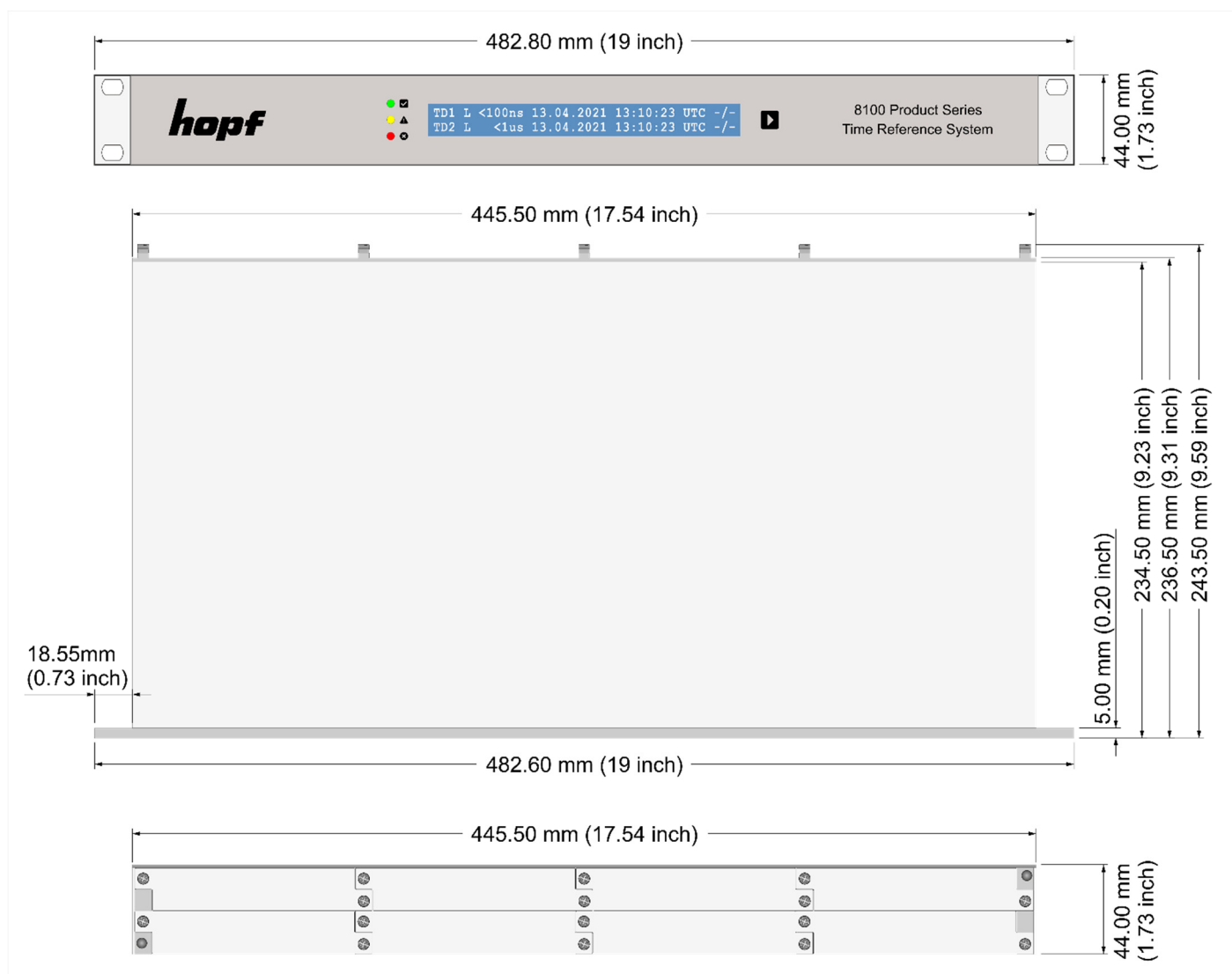
IEC 60297-3-100:2008

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)<br>Height: 44.00 mm (1.73 inch)<br>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 IEC 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 5,000 m (16,404 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<br>Overvoltage Category: II                             |
| Reliability (MTBF)    | 1.850.000h<br>(without display and fan)                                     |

## 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<br>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%   |
|                               | IEC 60068-2-78 | Severity Level 240h at +40°C, RH 95%   |
| Mechanical Stress             | 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 | EN 55032       | Class B  |
|                               | (CISPR 32)     |  |
|                               | IEC 61000-4-2  | Severity Level 4 8kV contact / 15kV air  |
|                               | IEC 61000-4-3  | Severity Level 3 10V/m   |
|                               | IEC 61000-4-4  | Severity Level 4 4kV power connector<br>4kV signal connector                           |
|                               | IEC 61000-4-5  | Severity Level 4 2kV line-to-line<br>4kV line-to-earth                                 |
|                               | IEC 61000-4-6  | Severity Level 3 10V   |
|                               | IEC 61000-4-11 | Severity Level X 30% one period<br>60% 50 periods<br>100% 5 periods<br>100% 50 periods |
|                               | IEC 61000-4-12 | Severity Level 3 1kV line-to-line<br>2,5kV line-to-earth                               |
|                               | IEC 61000-4-17 | Severity Level 3 10%   |
|                               | IEC 61000-4-18 | Severity Level 3 1kV line-to-line<br>2,5kV line-to-earth                               |
|                               | IEC 61000-4-29 | Severity Level X 30% 0,1sec<br>60% 0,1sec<br>100% 0,05sec                              |

### Extension Card Dependent Specifications

|                        |  |
|------------------------|--|
| FG8901P01              | Input Voltage: 85-264VAC<br>125-250VDC<br>Input Frequency: 47-63Hz for AC input voltage<br>Input Current: max. 1,3A@100VAC<br>max. 0,7A@200VAC<br>Reliability (MTBF): 250.000h   |
| FG8901P02              | Input Voltage: 18-36VDC<br>Input Current: max. 5,47A@24VDC<br>Reliability (MTBF): 300.000h   |
| FG8901P03              | Input Voltage: 36-76VDC<br>Input Current: max. 2,69A@48VDC<br>Reliability (MTBF): 300.000h   |
| FG8901P04              | Input Voltage: 60-160VDC<br>Input Current: max. 1,1A@110VDC<br>Reliability (MTBF): 300.000h  |
| FG8901P06              | Input Voltage: 19-75VDC<br>Input Current: max. 5,7A@24VDC<br>Reliability (MTBF): 300.000h  |
| FG8702G01<br>FG8702G04 | <p><b>Ethernet</b></p> Ports 2<br>Data Rate 10/100/1000Mbps<br>Connector RJ45 <p><b>Status Output</b></p> Dry Contact<br>Operating Voltage +/-250VDC<br>Operating Current max. 120mA <p><b>Boot time</b></p> typ. ≤40 seconds depending on the configuration <p><b>Antenna</b></p> Supply Voltage 5V±10%<br>Current max. 100mA <p><b>Receiver</b></p> GNSS systems GPS, GLONASS, Beidou, Galileo<br>Channels 72<br>Time to first fix<br>Warm start: <2 s<br>Cold start: <30 s<br>First initialization: <750 s<br>Sensitivity<br>Tracking: -166dBm<br>Warm start: -157dBm<br>Cold start: -148dBm <p><b>Clock Accuracy</b></p> Internal PPS ±15ns (after 5 minutes GNSS reception with clear sky view)<br>Holdover 236,71µs per day at constant temperature after 2 days of continuous operation <p><b>NTP</b></p> Timestamp Accuracy typ. <30µs<br>Requests per second 25.000 |

|                        |   |
|------------------------|---|
| FG8702G02<br>FG8702G05 | <b>PTP</b><br>Timestamp Accuracy typ. <50ns to system internal PPS<br><br><b>Reliability</b><br>MTBF 1.100.000h   |
| FG8702G03<br>FG8702G06 | Identical to FG8702G01 / FG8702G04 except holdover<br><br><b>Clock Accuracy</b><br>Holdover 25,9µs per day after 7 days of continuous operation (±1°C)  |
| FG8801N02              | <b>Ethernet</b><br>Ports 2<br>Data Rate 10/100/1000Mbps<br>Connector RJ45<br><br><b>Boot time</b><br>typ. ≤40 seconds depending on the configuration<br><br><b>Time Accuracy</b><br>Internal time accuracy ±15ns to system internal PPS<br><br><b>NTP</b><br>Timestamp Accuracy typ. <30µs<br>Requests per second 25.000<br><br><b>PTP</b><br>Timestamp Accuracy typ. <50ns to system internal PPS<br><br><b>Reliability</b><br>MTBF 1.250.000h                   |
| FG8801F02              | <b>Ethernet</b><br>Ports 2<br>Data Rate dependent on SFP transceiver module<br>Connector LC<br><br><b>Boot time</b><br>typ. ≤40 seconds depending on the configuration<br><br><b>Time Accuracy</b><br>Internal time accuracy ±15ns to system internal PPS<br><br><b>NTP</b><br>Timestamp Accuracy typ. <30µs<br>Requests per second 25.000<br><br><b>PTP</b><br>Timestamp Accuracy typ. <50ns to system internal PPS<br><br><b>Reliability</b><br>MTBF 1.250.000h |



FG8800M00

|   |                 |
|---|-----------------|
| <b>Ethernet</b>                                     |                 |
| Ports   | 2               |
| Data Rate   | 10/100/1000Mbps |
| Connector   | RJ45            |
| <b>Status Output</b>                                |                 |
| Dry Contact   |                 |
| Operating Voltage                                   | +/-250VDC       |
| Operating Current                                   | max. 120mA      |
| <b>Boot time</b>                                    |                 |
| typ. ≤40 seconds depending on the configuration     |                 |
| <b>Time Accuracy</b>                                |                 |
| Internal time accuracy ±15ns to system internal PPS |                 |
| <b>NTP</b>  |                 |
| Timestamp Accuracy                                  | typ. <30µs      |
| Requests per second                                 | 25.000          |
| <b>Reliability</b>                                  |                 |
| MTBF  | 1.250.000h      |



## 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)
- 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
- RFC 8915 Network Time Security for the Network Time Protocol

### 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



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