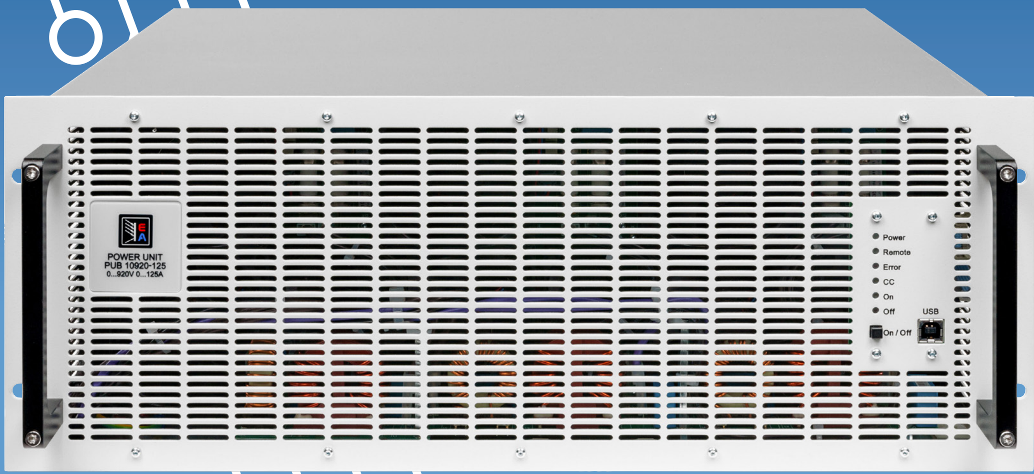
Elektro-Automatik



30 kW

DATASHEET

EA-PU 10000 4U

Programmable DC Power Supply

EA-PU 10000 4U
30 KW

Programmable
DC power supply

Features

- Wide range input: 208 V - 480 V, ±10%, 3ph AC
- Active Power Factor Correction, typical 0.99
- Very high efficiency of up to over 96%
- High performance with up to 30 kW per unit
- Voltages from 0 - 60 V up to 0 - 2000 V
- Currents from 0 - 40 A up to 0 - 1000 A
- Flexible power regulated DC output stages (autoranging)
- Regulation modes CV, CC, CP, CR with fast crossover
- Digital regulation, high resolution with 16bit ADCs and DACs, selection of control speed: Normal, Fast, Slow
- Galvanically isolated Share-Bus for parallel operation of all power classes in the 10000 series
- Master-Slave-Bus for parallel operation of up to 64 units of all power classes in the 10000 series
- Command languages and drivers: SCPI and ModBus, LabVIEW, IVI

Built-in interfaces

- USB
- Ethernet
- Analog
- Master-Slave-Bus
- Share-Bus
- USB Front panel

Optional interfaces

- CAN
- CANopen
- RS232
- Profibus
- EtherCAT
- Profinet, with one or two ports
- Modbus, with one or two ports
- Ethernet, with one or two ports

Software

- EA-Power Control
- EA-Battery Simulator

Options

- Water Cooling in stainless steel

Technical data

General specifications	
AC input	
Voltage, Phases	380 V - 480 V ±10%, 3ph AC (208 V - 240 V ±10%, 3ph AC with derating to 18 kW)
Frequency	45 - 65 Hz
Power factor	ca. 0.99
Leakage current	<10 mA
Phase current	≤56 A @ 400 V AC
Overvoltage category	2
DC output static	
Load regulation CV	≤0.05% FS (0 - 100% load, constant AC input voltage and constant temperature)
Line regulation CV	≤0.01% FS (380 V - 480 V ±10% AC input voltage, constant load and constant temperature)
Stability CV	≤0.02% FS (during 8 h of operation, after 30 minutes warm-up, at constant AC input voltage, load and temperature)
Temperature coefficient CV	≤30ppm/°C (after 30 minutes of warm-up)
Compensation (remote sense)	≤5% $U_{Nominal}$
Load regulation CC	≤0.1% FS (0 - 100% load, constant AC input voltage and constant temperature)
Line regulation CC	≤0.01% FS (380 V - 480 V ±10% AC input voltage, constant load and constant temperature)
Stability CC	≤0.02% FS (during 8 h of operation, after 30 minutes warm-up, at constant AC input voltage, load and temperature)
Temperature coefficient CC	≤50ppm/°C (after 30 minutes of warm-up)
Load regulation CP	≤0.3% FS (0 - 100% load, constant AC input voltage and constant temperature)
Load regulation CR	≤0.3% FS + 0.1% FS current (0 - 100% load, constant AC input voltage and constant temperature)
Protective functions	
OVP	Overvoltage protection, adjustable 0 - 110% $U_{Nominal}$
OCP	Overcurrent protection, adjustable 0 - 110% $I_{Nominal}$
OPP	Overpower protection, adjustable 0 - 110% $P_{Nominal}$
OT	Overtemperature protection (DC output shuts down in case of insufficient cooling)
DC output dynamic	
Rise time 10 - 90% CV	≤10 ms
Fall time 90 - 10% CV	≤10 ms
Rise time 10 - 90% CC	≤2 ms
Fall time 90 - 10% CC	≤2 ms
Insulation	
AC input to DC output	3750 Vrms (1 minute, creepage distance >8 mm)
AC input to case (PE)	2500 Vrms
DC output to case (PE)	Depending on the model, see model tables
DC output to interfaces	1000 V DC (models up to 360 V output), 1500 V DC (models from 500 V output)
Interfaces digital	
Built-in, galvanically isolated	USB, Ethernet (100 MBit), USB front panel, all for communication
Optional, galvanically isolated	CAN, CANopen, RS232, ModBus TCP, Profinet, Profibus, EtherCAT, Ethernet

General specifications	
Interfaces analog	
Built-in, galvanically isolated	15 pole D-Sub
Signal range	0 - 10 V or 0 - 5 V (switchable)
Inputs	U, I, P, R, remote control on/off, DC output on/off, resistance mode on/off
Outputs	Monitor U and I, alarms, reference voltage, DC output status, CV/CC regulation mode
Accuracy U / I / P / R	0 - 10 V: ≤0.2%, 0 - 5 V: ≤0.4%
Device configuration	
Parallel operation	Up to 64 units of any power class in series 10000 start from 5 kW, with Master-Slave-Bus and Share-Bus
Safety and EMC	
Safety	EN 61010-1 IEC 61010-1 UL 61010-1 CSA C22.2 No 61010-1 BS EN 61010-1
EMC	EN 55011, class A CISPR 11, class A FCC 47 CFR part 15B, unintentional radiator, class A EN 61326-1 include tests according to: - EN 61000-4-2 - EN 61000-4-3 - EN 61000-4-4 - EN 61000-4-5 - EN 61000-4-6
Safety protection class	1
Ingress Protection	IP20
Environmental conditions	
Operating temperature	0 - 50 °C (32 - 122 °F)
Storage temperature	-20 - 70 °C (-4 - 158 °F)
Humidity	≤80% relative humidity, non-condensing
Altitude	≤2000 m (≤6,600 ft)
Pollution degree	2
Mechanical construction	
Cooling	Forced air flow from front to rear (temperature controlled fans), optional water cooling
Dimensions (W x H x D)	Enclosure: 19" x 4U x 668 mm (26.3 in)
Weight	50 kg (110 lb)
Weight with water cooling	56 kg (126 lb)

Technical specifications	PU 10060-1000	PU 10080-1000	PU 10200-420	PU 10360-240	PU 10500-180
DC output					
Voltage range	0 - 60 V	0 - 80 V	0 - 200 V	0 - 360 V	0 - 500 V
Ripple in CV (rms)	≤25 mV (BW 300 kHz)	≤25 mV (BW 300 kHz)	≤40 mV (BW 300 kHz)	≤55 mV (BW 300 kHz)	≤70 mV (BW 300 kHz)
Ripple in CV (pp)	≤320 mV (BW 20 MHz)	≤320 mV (BW 20 MHz)	≤300 mV (BW 20 MHz)	≤320 mV (BW 20 MHz)	≤350 mV (BW 20 MHz)
Current range	0 - 1000 A	0 - 1000 A	0 - 420 A	0 - 240 A	0 - 180 A
Power range	0 - 30000 W	0 - 30000 W	0 - 30000 W	0 - 30000 W	0 - 30000 W
Resistance range	0.003 Ω - 5 Ω	0.003 Ω - 5 Ω	0.0165 Ω - 25 Ω	0.05 Ω - 90 Ω	0.08 Ω - 170 Ω
Output capacitance	25380 μF	25380 μF	5400 μF	1800 μF	675 μF
Efficiency sink/source (up to)	95.1% *1	95.5% *1	95.3% *1	95.8% *1	96.5% *1
Insulation					
Negative DC pole <-> PE	±600 V DC	±600 V DC	±1000 V DC	±1000 V DC	±1500 V DC
Positive DC pole <-> PE	+600 V DC	+600 V DC	+1000 V DC	+1000 V DC	+2000 V DC
Article numbers					
Standard	01113000	01113001	01113002	01113003	01113004
Standard + Water Cooling	01443001	01443002	01443003	01443004	01443005

*1 At 100% power and 100% output voltage

Technical specifications	PU 10750-120	PU 10920-125	PU 11000-80	PU 11500-60	PU 12000-40
DC output					
Voltage range	0 - 750 V	0 - 920 V	0 - 1000 V	0 - 1500 V	0 - 2000 V
Ripple in CV (rms)	≤200 mV (BW 300 kHz)	≤250 mV (BW 300 kHz)	≤300 mV (BW 300 kHz)	≤400 mV (BW 300 kHz)	≤500 mV (BW 300 kHz)
Ripple in CV (pp)	≤800 mV (BW 20 MHz)	≤1200 mV (BW 20 MHz)	≤1600 mV (BW 20 MHz)	≤2400 mV (BW 20 MHz)	≤3000 mV (BW 20 MHz)
Current range	0 - 120 A	0 - 125 A	0 - 80 A	0 - 60 A	0 - 40 A
Power range	0 - 30000 W	0 - 30000 W	0 - 30000 W	0 - 30000 W	0 - 30000 W
Resistance range	0.2 Ω - 370 Ω	0.25 Ω - 550 Ω	0.4 Ω - 650 Ω	0.8 Ω - 1500 Ω	1.7 Ω - 2700 Ω
Output capacitance	450 μF	100 μF	200 μF	75 μF	50 μF
Efficiency sink/source (up to)	96.5% *1	96.5% *1	95.8% *1	96.5% *1	96.5% *1
Insulation					
Negative DC pole <-> PE	±1500 V DC	±1500 V DC	±1500 V DC	±1500 V DC	±1500 V DC
Positive DC pole <-> PE	+2000 V DC	+2000 V DC	+2000 V DC	+2000 V DC	+2000 V DC
Article numbers					
Standard	01113005	01113006	01113007	01113008	01113009
Standard + Water Cooling	01443006	01443007	01443008	01443009	01443010

*1 At 100% power and 100% output voltage

General

The DC power supplies in the PU 10000 series from EA Elektro-Automatik convert the energy from the grid into a regulated DC voltage with an efficiency up to over 96%. The PU 10000 series are three phase units which, together with the wide input range, allows use with practically all global mains voltages. The DC voltages and currents are determined by the application and the spectrum ranges from 0 - 60 V to 0 - 2000 V and from 0 - 40 A up to 0 - 1000 A in a single device. The DC supply operates as a flexible output stage with a constant power characteristic (autoranging) with a wide voltage and current range. To achieve higher power and current all units are equipped with a Master-Slave-Bus. This enables up to 64 parallel connected devices to be combined into one system which can provide up to 3840 kW and 64000 A. Such a system works as a single unit and can use different power classes start from 5kW, only the voltage class must remain constant. In this way a user can construct a 150 kW system from two 60 kW 6U and one 30 kW 4U device from the PU 10000 range. Furthermore, typical laboratory functionality is provided. This includes alarm and warning management, various optional industrial interfaces, software solutions and many more functions.

AC connection

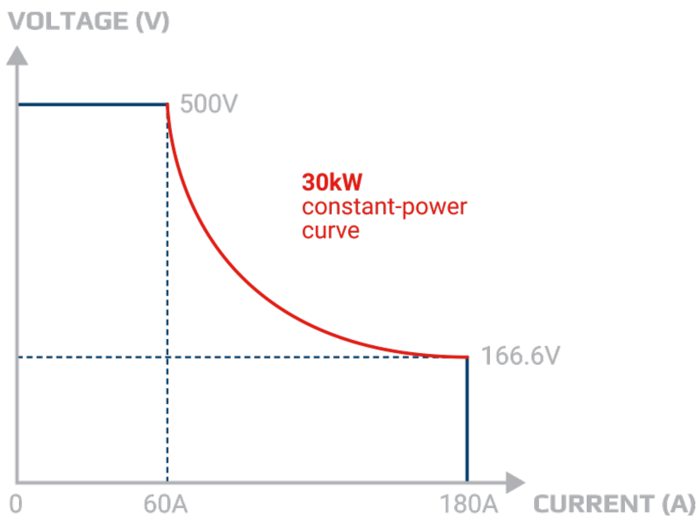
The DC power supplies in the PU 10000 series with 30 kW are equipped with an active PFC which provides a high efficiency at a low energy consumption. Furthermore, the devices in this series provide a wide input voltage range. It reaches with 3-phases from 208 - 240 V (with a derating to 18 kW) and 380 - 480 V. Hence the devices can be operated in the majority of global grids.

DC output

The output of the power supply PU 10000 4U with 30 kW with a DC voltage of 0 - 60 V up to 0 - 2000 V allows currents of 0 - 40 A up to 0 - 1000 A . The flexible output stages (autoranging) provide the user with a wide voltage, current and power range and hence a wider field of working than traditional power supplies.

DC connection

Connection of the DC output is via a copper rail on the back side of the device. If a system with higher performance is required, the devices are simply connected in parallel. With minimal effort devices can be linked with the vertical copper rails. A cover for contact protection is provided.



The principle of autoranging

„Autoranging" is a term when a programmable DC power supply automatically offers a wide output range of both, voltage and current, to maintain full power across a wide operation range. This type of solution allows the use of a single unit to address multiple voltage and current combinations.

Interfaces

As standard, 10000s series devices are fitted with the most important interfaces and ports which are all galvanically isolated from the DC input. There is an analog interface which can be parameterized for input and output, control and monitoring, of 0 - 5 V or 0 - 10 V for voltage, current, power and resistance, assorted inputs and outputs as well as USB and Ethernet ports. Further optional industrial interface for plug & play slot complete the portfolio:

- CAN
- CANopen
- RS232
- Profibus
- EtherCAT
- Profinet, with one or two ports
- Modbus, with one or two ports
- Ethernet, with one or two ports

High performance systems

High power applications can be covered with high power systems of up to 3840 kW. These are achieved by using the DC outputs of multiple PU 10000 devices with vertical copper rails in parallel. Thus, a 19” cabinet with 42 U can provide a system with 300 kW occupying only 0.6 m² (6.5 sqft) of floor space. The Master-Slave-Bus allows for up to 13 cabinets with a maximum of 64 units with 60 kW each to behave as one unit.

Master-Slave-Bus and Share-Bus

If the integrated Master-Slave-Bus and Share-Bus are used, a multi device system behaves as a single device. The Master-Slave-Bus and Share-Bus are simply connected between each device. With the Master-Slave-Bus the system data, such as total power and total current, are collected and shown on the master device. Warnings and alarms of the slave devices are shown clearly in the display. The Share-Bus equal load distribution to the individual devices.

Example representation

In this illustration you can see a fully assembled and wired 240 kW system

Applications

Fuel cell simulation

One of further applications where programmable DC power supplies are used for is the simulation of fuel cells. It allows for optimal definition of these energy storages, as well of components powered by these fuel cells. In every application where reproducible data is required, the use of a simulator is typically first choice. This is mainly due to the various built-in mechanisms for the protection of connected consumers. The overcurrent protection (OCP) can, like a safety fuse, switch off the output and generate an alarm. The voltage can be monitored and can, if over or under limits, trigger various functions, and also generate warnings and alarms. Thus, many integrated functions can be safely performed.

Power supply for electrolysis

Hydrogen is considered as an important energy carrier to counter climate change. It can be used to power cars, trucks and even aircrafts. In addition, hydrogen can be used as an energy carrier for a wide range of industrial processes. Green and therefore climate-neutral hydrogen is produced by electrolysis. The programmable power supplies of the PU 10000 series are ideally suited as energy supply systems for the electrolysis process. Systems of up to 3.84 MW can be set up by parallel connection, either in air-cooled or water-cooled versions. The systems are characterized by good accuracy and dynamics and can be operated in different control modes (CC, CP, CV). In addition, the high efficiency and the excellent reliability of the units help to reduce the production costs of hydrogen production.

Electric car components

The programmable power supplies of the PU 10000 series can be used to test a wide range of components installed in an electric car, such as fuses, relays, traction inverters or DC-DC converters. The integrated function generator allows real load profiles to be mapped and thus realistic test results to be achieved. In addition, the built-in autoranging functionality offers maximum flexibility when testing a wide range of components.

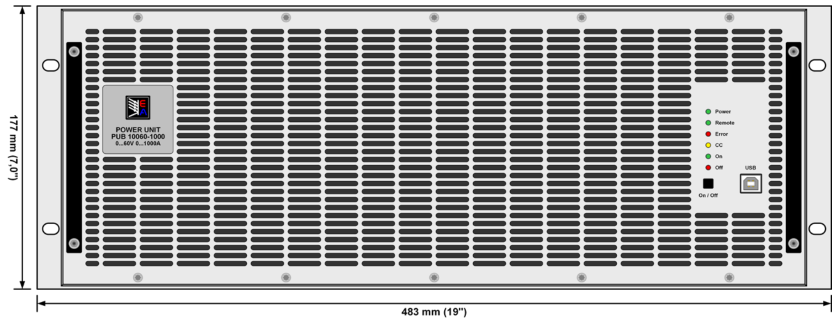
Solar array simulation

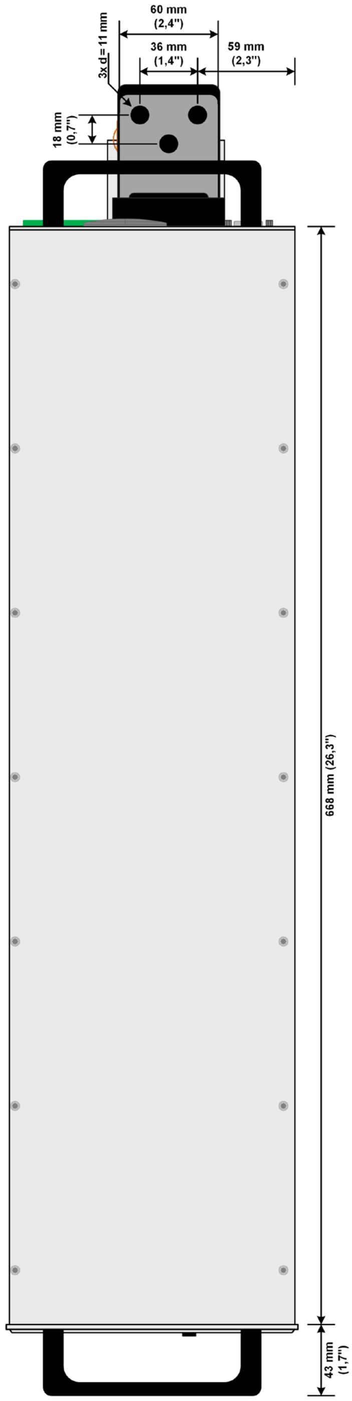
The programmable power supplies of the PU 10000 range are highly suited to use as test systems for PV inverters as they can provide the necessary simulation for solar panels. Users can quickly access simulation models according to EN 50530 or Sandia while it supports diverse solar panel types. Parameters such as irradiation (varying with shadows), panel technology and temperature can be included. Thus the devices can test all the relevant electrical features of a PV inverter including the important efficiency value.
The high resolution of 16-bit technology and a high sampling rate enable the programmable power supply to deliver accurate results which can be documented and saved to an Excel file.

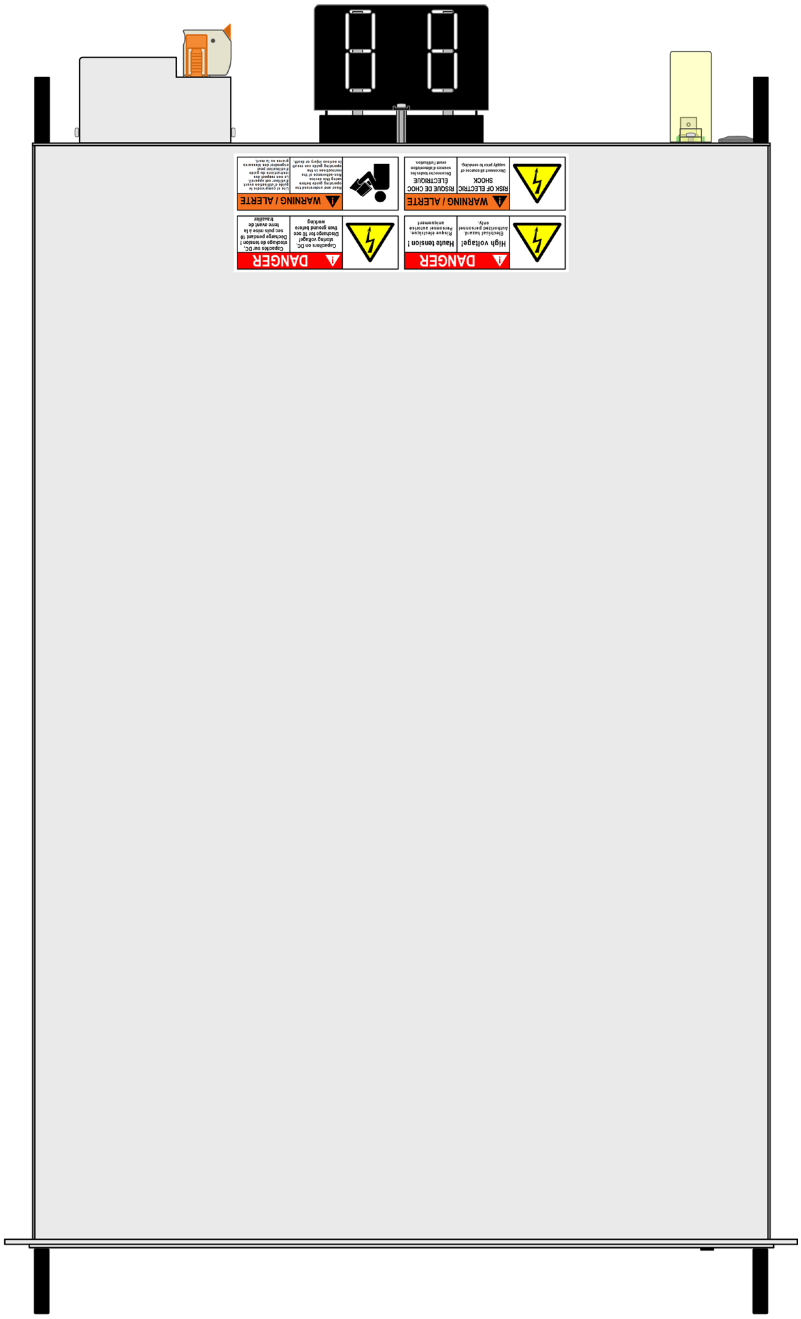
Relay test in the production

Relay manufacturers must carry out assorted tests on their products during production. For these the coils and contacts are provided with exactly defined voltage and current. For the coil tests, important parameters such as operating, holding and decay current, together with the associated voltages must be checked and documented. For the contacts, not only are the current carrying capability and contact resistance important parameters, but also voltage consistency and disconnect threshold indicate much about the product quality. Testing all these is best supported by an automatic test system. A part of such a system can be the devices of the PU 10000 series with their exact, dynamic, controls of voltage, current, power, and resistance, providing optimal values for the best test results. With their diverse interface connections, they can be integrated into any test system and deliver the necessary data without the need for additional measuring equipment.

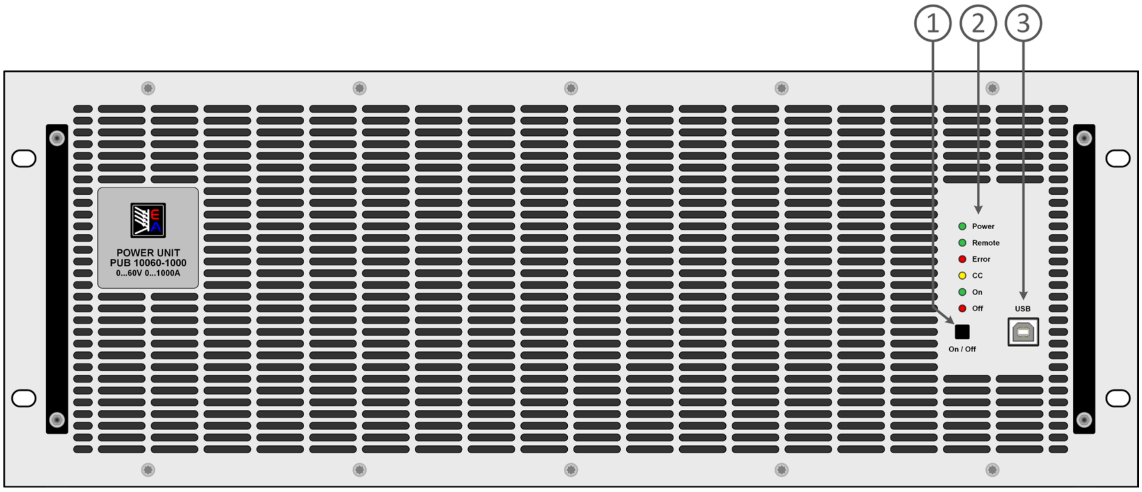
Technical drawings PU 10000 4U ≤200 V





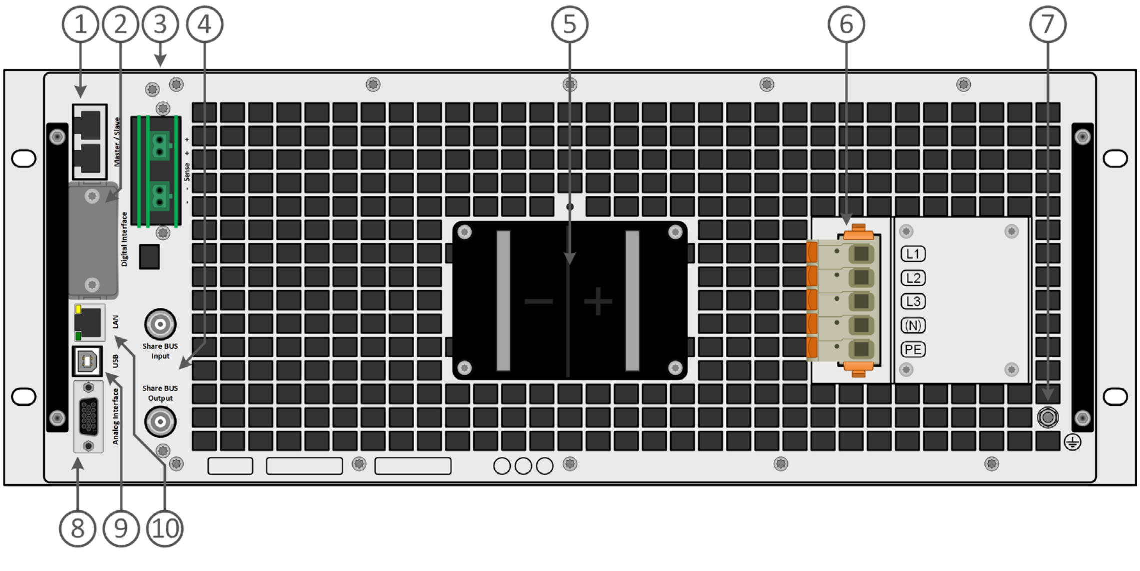


Front panel description PU 10000 4U



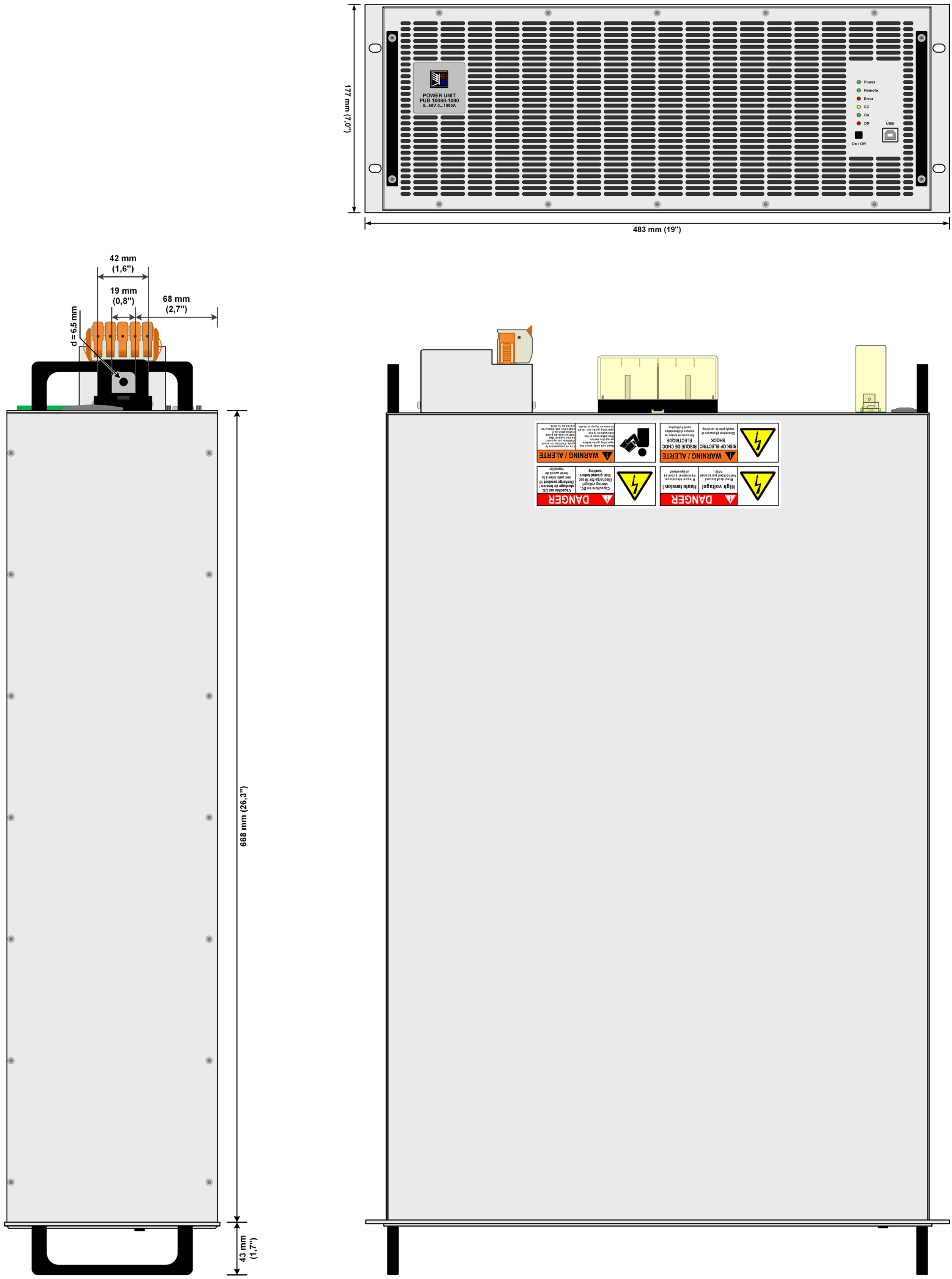
1. On / Off push-button
2. LED status display
3. USB Interface

Rear panel description PU 10000 4U ≤200 V

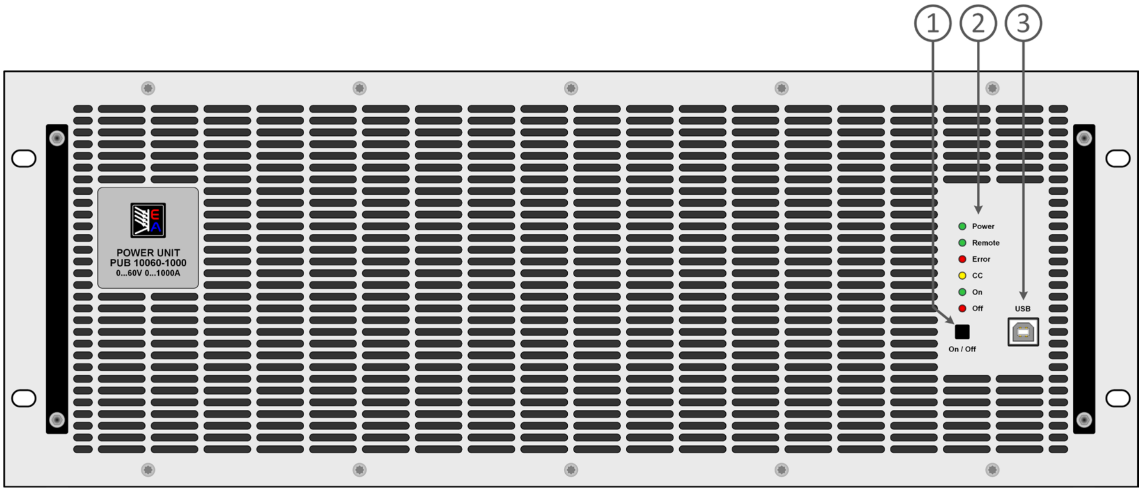


1. Master-Slave-Bus connectors to set up a system for parallel connection
2. Slot for interfaces
3. Remote sense connectors
4. Share-Bus connectors to set up a system for parallel connection
5. DC output connector (copper blades)
6. AC input connector
7. Grounding connection screw (PE)
8. Connector (DB15 female) for isolated analog programming, monitoring and other functions
9. USB interface
10. Ethernet interface

Technical drawings PU 10000 4U >360 V

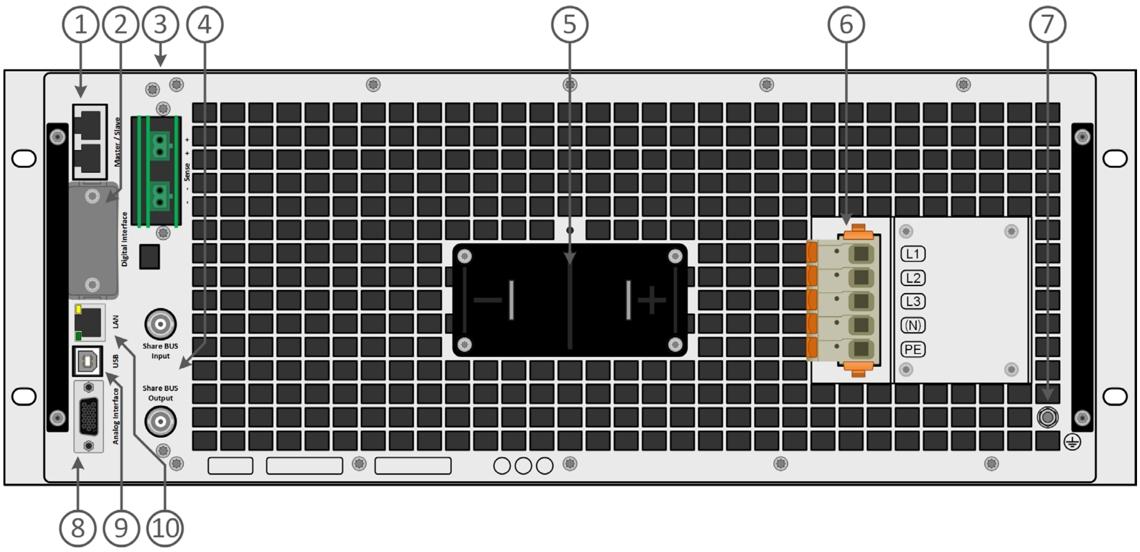


Front panel description PU 10000 4U



1. On / Off push-button
2. LED status display
3. USB Interface

Rear panel description PU 10000 4U ≥360 V

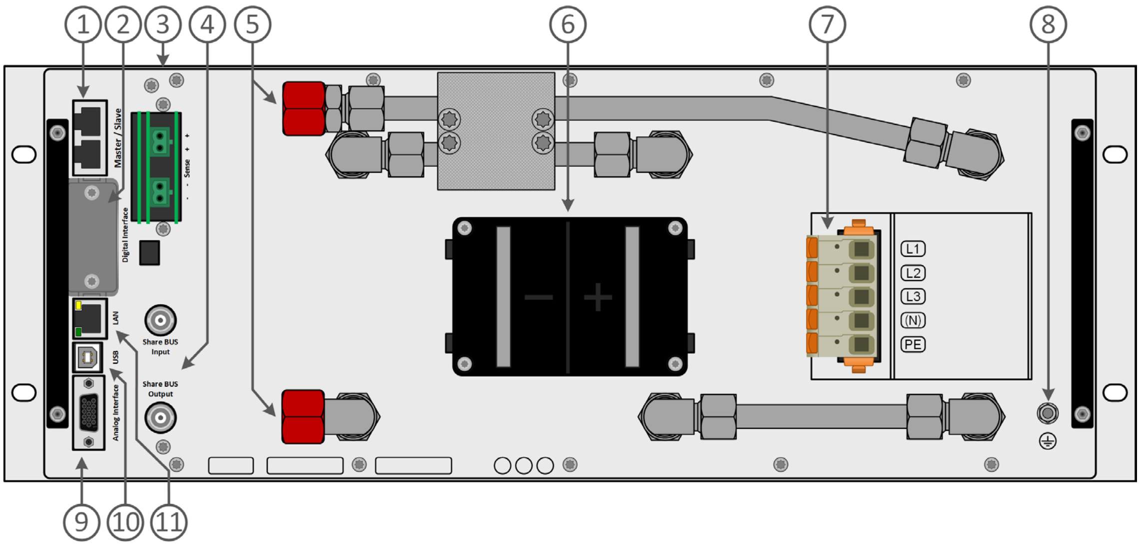


1. Master-Slave-Bus connectors to set up a system for parallel connection
2. Slot for interfaces
3. Remote sense connectors
4. Share-Bus connectors to set up a system for parallel connection
5. DC output connector (copper blades)
6. AC input connector
7. Grounding connection screw (PE)
8. Connector (DB15 female) for isolated analog programming, monitoring and other functions
9. USB interface
10. Ethernet interface

Front panel description PU 10000 4U with Water Cooling option

1. On / Off push-button
2. LED status display
3. USB Interface

Rear panel description PU 10000 4U with Water Cooling option



1. Master-Slave-Bus connectors to set up a system for parallel connection
2. Slot for interfaces
3. Remote sense connectors
4. Share-Bus connectors to set up a system for parallel connection
5. Inlets and outlets for water-cooling
6. DC output terminal (copper blades)
7. AC input connector
8. Grounding connection screw (PE)
9. Connector (DB15 female) for isolated analog programming, monitoring and other functions
10. USB interface
11. Ethernet interface

CALTEST
INSTRUMENTS

Caltest Instruments GmbH
Binzigstrasse 21 | Tel: +49(0)7842-99722-00
D-77876 KAPPELRODECK | Fax: +49(0)7842-99722-29
www.caltest.de | info@caltest.de

EA Elektro-Automatik GmbH & Co. KG
Helmholtzstr. 31-37
41747 Viersen

Phone +49 2162 3785 - 0
Fax +49 2162 1623 - 0
ea1974@elektroautomatik.com

www.elektroautomatik.com

EA Elektro-Automatik Inc.
9845 Via Pasar
San Diego, CA 92126 USA

Phone +1 (858) 836 1300

sales@elektroautomatik.com

www.eapowered.com