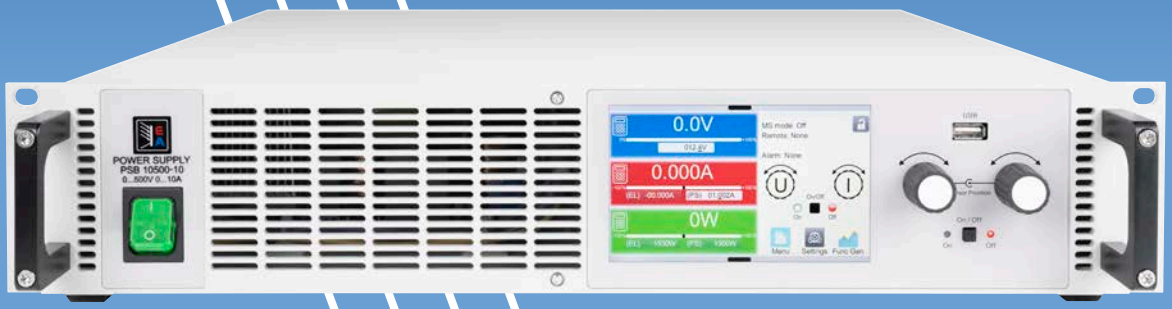
Elektro-Automatik



EA-PSI 10000 2U

Programmable
DC-Power Supply

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EA-PSI 10000 2U
1.5 KW / 3.0 KW

Programmable
DC-Power Supply

Features

- Wide range input, 110 V - 240 V ±10 % 1ph AC
- Active Power-Factor-Correction, typical 0.99
- Very high efficiency up to over 95 %
- Voltage from 0 - 60 V up to 0 - 1500 V
- Currents from 0 - 6 A up to 0 - 120 A
- Flexible power regulated DC output stages (autoranging)
- Regulation mode CV, CC, CP, CR with fast crossover
- Digital regulation, high resolution with 16bit ADCs and DACs, selection of control speed: Normal, Fast, Slow
- Color 5“ TFT display with touch control and intuitive user interface
- 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
- Integrated function generator with predefined curves
- Predefined automotive test procedures for LV123, LV124 and LV148
- Command languages and drivers: SCPI and ModBus, LabVIEW, IVI

Build-in Interfaces

- USB
- Ethernet
- Analog
- USB Host
- Master-Slave-Bus
- Share-Bus

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

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General specifications	
AC-Input	
Voltage, Phases	110 V / 120 V / 208 V / 220 V / 230 V / 240 V ±10%, 1ph AC (110 V / 120 V 1ph with Derating, see model table)
Frequency	45-66 Hz
Power factor	>0.99
Leakage current	< 3.5 mA
Overvoltage category	2
Pollution degree	2
DC-Output static	
Load regulation CV	≤0.05% FS (0 - 100% load, constant input voltage and constant temperature)
Line regulation CV	≤0.01% FS (110 V - 240 V AC ±10% input voltage, constant load and constant temperature)
Stability CV	≤0.02% FS (Over 8hrs interval following 30 minutes warm-up, constant input voltage, load and temperature)
Temperature coefficient CV	≤30ppm/°C (Following 30 minutes warm up)
Compensation (Remote Sense)	≤5% $U_{Nominal}$
Load regulation CC	≤0.1% FS (0 - 100% load, constant input voltage and constant temperature)
Line regulation CC	≤0.01% FS (110 V - 240 V AC ±10% input voltage, constant load and constant temperature)
Stability CC	≤0.02% FS (Over 8hrs interval following 30 minutes warm-up, constant input voltage, load and temperature)
Temperature coefficient CC	≤50ppm/°C (Following 30 minutes warm up)
Load regulation CP	≤0.3% FS (0 - 100% load, constant input voltage and constant temperature)
Load regulation CR	≤0.3% FS + 0.1% FS current (0 - 100% load, constant 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, output shuts down in case of insufficient cooling
DC-Output dynamic	
Rise time 10 - 90% CV	≤20 ms
Fall time 90 - 10% CV	≤20 ms
Rise time 10 - 90% CC	≤10 ms
Fall time 90 - 10% CC	≤10 ms
Display accuracy	
Voltage	≤0.05% FS
Current	≤0.1% FS
Insulation	
AC-Input to DC-Output	3750 Vrms (1 Minute), creepage >8 mm
AC-Input to case (PE)	2500 Vrms
DC-Output to case (PE)	Depending on the model, see model table
DC-Output to Interfaces	1000 V DC (Model up to 360 V output), 1500 V DC (Model from 500 V output)
Interfaces Digital	
Built-in, galvanically isolated	USB, Ethernet (100 MBit) for communication 1x USB Host for data acquisition
Optional, galvanically isolated	CAN, CANopen, RS232, ModBus TCP, Profinet, Profibus, EtherCAT, Ethernet
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, status DC, status CV/CC
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, with Master-Slave-Bus and Share-Bus

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General specifications		
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 B CISPR 11, class B FCC 47 CFR Part 15B, Unintentional Radiator, class B 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	
Storage temperature	-20 - 70 °C	
Humidity	≤80% RH, non-condensing	
Altitude	≤2000 m (≤6600 ft)	
Mechanical construction		
Cooling	Forced air flow from front to rear, temperature controlled fans	
Dimensions (B x H x T)	19" x 2U x 462 mm (Enclosure only, not over all)	
Weight	9,5 kg (21 Lbs) 1500 W unit	12,7 kg (28 Lbs) 3000 W unit

Technical Specifications	PSI 10060-60	PSI 10080-60	PSI 10200-25	PSI 10360-15	PSI 10500-10
DC-Output					
Voltage range	0 - 60 V	0 - 80 V	0 -200 V	0 - 360 V	0 - 500 V
Ripple rms CV	10 mV BW 300 kHz	10 mV BW 300 kHz	30 mV BW 300 kHz	30 mV BW 300 kHz	40 mV BW 300 kHz
Ripple and noise p-p CV	100 mV BW 20 MHz	100 mV BW 20 MHz	300 mV BW 20 MHz	300 mV BW 20 MHz	500 mV BW 20 MHz
Current range	0 - 60 A	0 - 60 A	0 - 25 A	0 - 15 A	0 - 10 A
Power range *1	0 - 1500 W (0 - 1200 W)	0 - 1500 W (0 - 1200 W)	0 - 1500 W (0 - 1200 W)	0 - 1500 W (0 - 1200 W)	0 - 1500 W (0 - 1200 W)
Resistance range	0.04 Ω - 80 Ω	0.04 Ω - 80 Ω	0.25 Ω - 500 Ω	0.8 Ω - 1600 Ω	2 Ω - 3000 Ω
Output capacity	8640 µF	8640 µF	800 µF	330 µF	120 µF
Efficiency up to	94.0% *2	94.0% *2	94.5% *2	94.5% *2	95.0% *2
Isolation					
Negative DC-Pol <-> PE	±1000 V DC	±1000 V DC	±1000 V DC	±1000 V DC	±1500 V DC
Positive DC-Pol <-> PE	+1000 V DC	+1000 V DC	+1000 V DC	+1000 V DC	+2000 V DC
Article number	06230840	06230841	06230842	06230843	06230844

*1 The value in brackets applies to the state of derating (power reduction) for 110 V AC and 120 V AC grid
*2 100% Power and 100% Output voltage

Technical Specifications	PSI 10750-06				
DC-Output					
Voltage range	0 - 750 V				
Ripple rms CV	50 mV BW 300 kHz				
Ripple and noise p-p CV	500 mV BW 20 MHz				
Current range	0 - 6 A				
Power range *1	0 - 1500 W (0 - 1200 W)				
Resistance range	4 Ω - 6000 Ω				
Output capacity	40 µF				
Efficiency up to	95.0% *2				
Isolation					
Negative DC-Pol <-> PE	±1500 V DC				
Positive DC-Pol <-> PE	+2000 V DC				
Article number	06230845				

*1 The value in brackets applies to the state of derating (power reduction) for 110 V AC and 120 V AC grid
*2 100% Power and 100% Output voltage

Technical Specifications	PSI 10060-120	PSI 10080-120	PSI 10200-50	PSI 10360-30	PSI 10500-20
DC-Output					
Voltage range	0 - 60 V	0 - 80 V	0 -200 V	0 - 360 V	0 - 500 V
Ripple rms CV	10 mV BW 300 kHz	10 mV BW 300 kHz	30 mV BW 300 kHz	30 mV BW 300 kHz	40 mV BW 300 kHz
Ripple and noise p-p CV	100 mV BW 20 MHz	100 mV BW 20 MHz	300 mV BW 20 MHz	300 mV BW 20 MHz	500 mV BW 20 MHz
Current range	0 - 120 A	0 - 120 A	0 - 50 A	0 - 30 A	0 - 20 A
Power range *1	0 - 3000 W (0 - 1500 W)	0 - 3000 W (0 - 1500 W)	0 - 3000 W (0 - 1500 W)	0 - 3000 W (0 - 1500 W)	0 - 3000 W (0 - 1500 W)
Resistance range	0.02 Ω - 24 Ω	0.02 Ω - 40 Ω	0.1 Ω - 250 Ω	0.4 Ω -800 Ω	1 Ω - 1500 Ω
Output capacity	17280 µF	17280 µF	1600 µF	660 µF	240 µF
Efficiency up to	94.0% *2	94.0% *2	94.5% *2	94.5% *2	95.0% *2
Isolation					
Negative DC-Pol <-> PE	±1000 V DC	±1000 V DC	±1000 V DC	±1000 V DC	±1500 V DC
Positive DC-Pol <-> PE	+1000 V DC	+1000 V DC	+1000 V DC	+1000 V DC	+2000 V DC
Article number	06230846	06230847	06230848	06230849	06230850

*1 The value in brackets applies to the state of derating (power reduction) for 110 V AC and 120 V AC grid
*2 100% Power and 100% Output voltage

Technical Specifications	PSI 10750-12	PSI 11000-10	PSI 11500-06		
DC-Output					
Voltage range	0 - 750 V	0 - 1000 V	0 - 1500 V		
Ripple rms CV	50 mV BW 300 kHz	100 mV BW 300 kHz	150 mV BW 300 kHz		
Ripple and noise p-p CV	500 mV BW 20 MHz	2000 mV BW 20 MHz	6500 mV BW 20 MHz		
Current range	0 - 12 A	0 - 10 A	0 - 6 A		
Power range *1	0 - 3000 W (0 - 1500 W)	0 - 3000 W (0 - 1500 W)	0 - 3000 W (0 - 1500 W)		
Resistance range	2 Ω - 3000 Ω	3 Ω - 6000 Ω	8 Ω -6000 Ω		
Output capacity	80 µF	60 µF	20 µF		
Efficiency up to	95.0% *2	95.0% *2	95.0% *2		
Isolation					
Negative DC-Pol <-> PE	±1500 V DC	±1500 V DC	±1500 V DC		
Positive DC-Pol <-> PE	+2000 V DC	+2000 V DC	+2000 V DC		
Article number	06230851	06230852	06230853		

*1 The value in brackets applies to the state of derating (power reduction) for 110 V AC and 120 V AC grid
*2 100% Power and 100% Output voltage

General

The DC laboratory power supplies in the PSI 10000 series from EA Elektro-Automatik convert the energy from the grid into a regulated DC voltage with an efficiency of over 96%. The PSI 10000 series includes single and three phase units, which, together with the wide input range, allows use with practically all global mains voltages. The DC voltage and current are directed by the application and the spectrum ranges from 0 - 60 V to 0 - 2000 V and from 0 - 6 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), and a wide voltage, current and power 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 1920 W and 64000 A. Such a system works as a single unit and can use different power classes, only the voltage class must remain constant. In this way a user can construct a 75 kW system from two 30 kW and one 15 kW devices from the PSI 10000 range. Furthermore, typical laboratory functionality is provided. This includes an extensive function generator, alarm and warning management, assorted interfaces and ports, software solutions and many more functions.

AC Connection

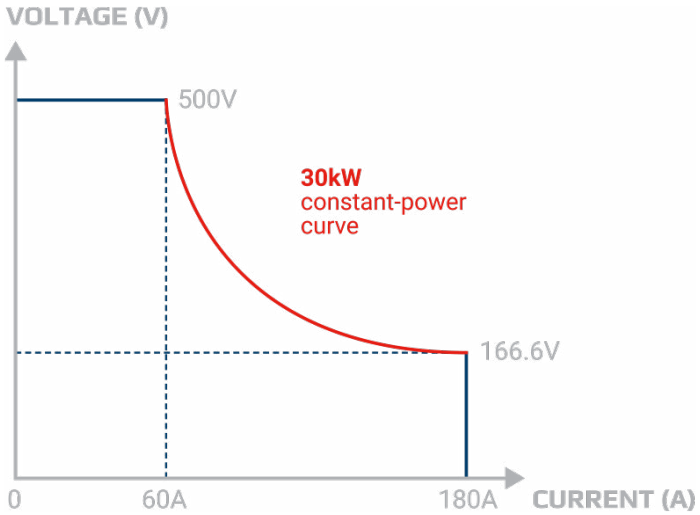
The DC power supplies in the PSI 10000 series are equipped with an active PFC which provides a high efficiency at a low energy consumption. Furthermore, the devices in this series provide a wide input voltage range. This extends from 1-phase 110/120 V up to 240 V AC mains supply and 3-phase 208 V to 380 V, 400 V and 480 V AC mains supply. The devices can be operated in the majority of global mains supply. They adjust automatically, without additional configuration, to the available supply. In a 110/120 V and 208 V AC grid a derating of the output power is set.

DC Output

The output of the bidirectional power supply PSI 10000 with a DC voltage of 0 - 60 V up to 0 - 2000 V allows currents of 0 - 6 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

This description should clarify the availability the voltage and current ranges within the power hyperbole.

Function generator

All models in the PSI 10000 series are equipped with a function generator. This allows curve processes such as sine, triangle, square or trapeze to be simply called up. A ramp function and a arbitrary generator allow voltage and current progression to be freely programmable. Test sequences for repeated tests can be saved and reloaded when needed, that´s saving time. A LUT allows IU and UI reference lines to be stored. For simulation of a photovoltaic system or fuel cells, adaptable tables are provided. With the standard PV characteristic curve (DIN EN 50530) various solar cells and many other technology parameters can be selected and set. In short, the user is supported by a multitude of useful functions.

Interfaces

As standard EA devices are fitted with the most important digital and analogue interfaces and ports which are galvanically isolated. These include an analogue interface which can be parameterised 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. The following options which use a 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

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High performance systems

High power applications can be covered with high power systems of up to 1920 kW. These are achieved by using the outputs of many PSI 10000 devices, changing the copper rails to vertical, and connecting in parallel. Thus, a 19" cabinet with 42 HE can provide a system with 240 kW occupying 0.6 m² floorspace. The master/slave bus enables up to 8 cabinets with a maximum of 64 units of 30 kW each to behave as one unit.

Master-Slave-Bus and Share-Bus

If the integral master-slave bus and share bus are used, a multi device system behaves as a single device. The master-slave bus and the share bus are simply connected to each device. With the master-slave bus the system data such as total power and total current are collected and shown in the master device. Warnings and alarms of the slave devices are shown clearly in the display. The share bus provides an equal load distribution to the individual devices.

Example representation

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

Application

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 PS 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.

Fuel cell simulation

Additional applications include the simulation of batteries as single cells, modules, or packs. These simulations aid in the optimal configuration of energy storage as well as the components to be supplied. Wherever reproducible data are needed a battery simulator is the first choice. Also, the use of a simulator as a power source provides protection for the connected consuming component. The Over-Current-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.

On-board charger test

In an on-board charger test (OBC) the electrical features must be tested under various conditions. This requires a flexible test system which also provides test data. With the sequencing and logging functions of the PSI 10000 devices test procedures allow data to be read out and saved. In this way applications can promptly generate reproducible test results based on dynamic and highly accurate set point and measurement data. To avoid competition between two separate control loops of the device under test (DUT) and the test device, the control frequency of the power supply is adjustable. The modes Normal, Fast and Slow allow the PSI 10000 devices to match the control characteristics of the on board charger.

Solar array simulation

The programmable power supplies of the PSB 10000 range are highly suited to use as test systems for PV inverters as they can provide the necessary simulation for solar cells. Users can readily program simulation models according to EN 50530 or Sandia using diverse solar cell materials. An IU curve can be accurately reproduced, parameters such as irradiation, shadow, temperature, clouds, and rain can be included. Thus, the devices can test all the relevant electrical features of a PV inverter including the particularly important determination of the efficiency. Users can select a static or dynamic Maximum-Power-Point-Tracking (MPPT). The high resolution of 16-bit technology and a sampling rate of 1µs enables the programmable power supply to deliver exact results which can be documented and saved to an Excel file.

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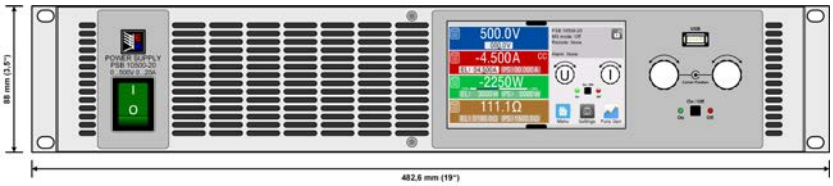
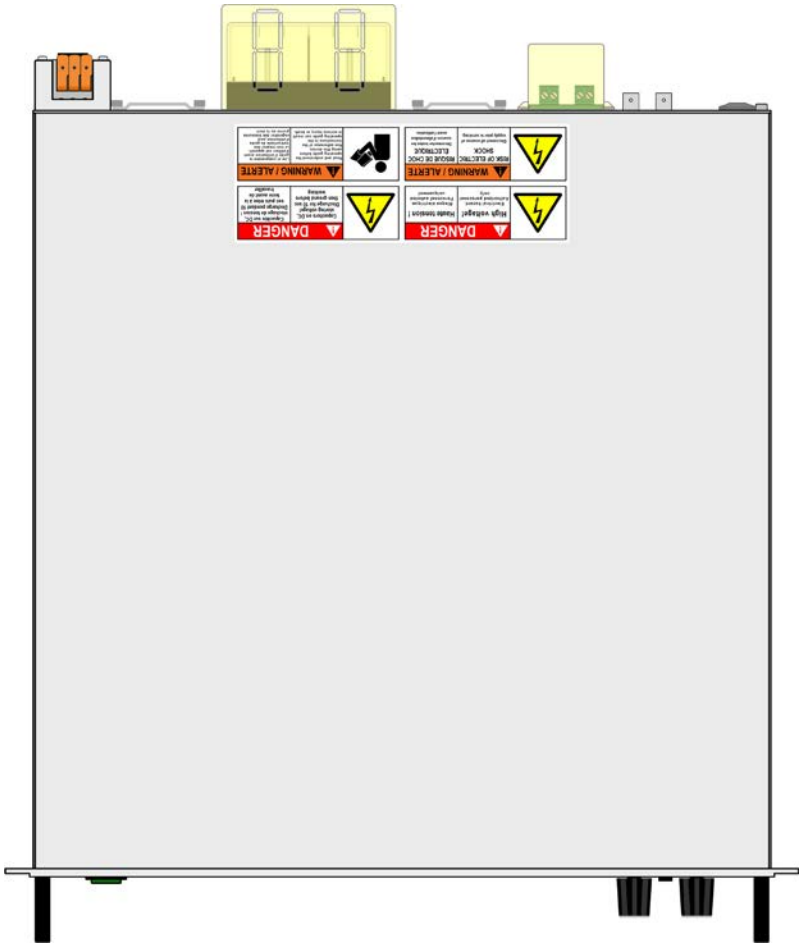
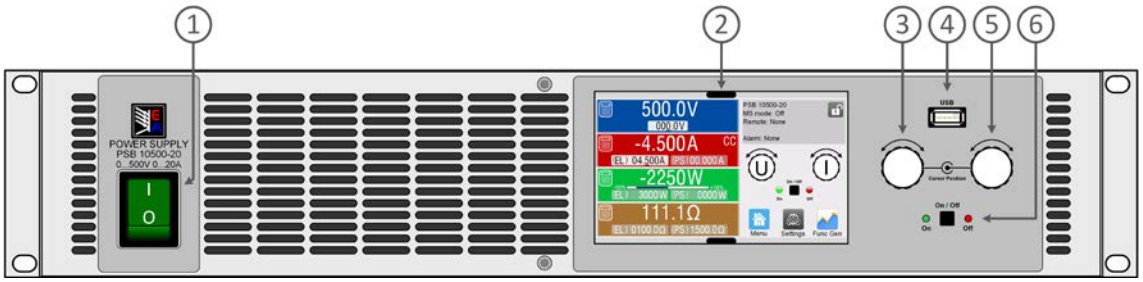
Technical Drawing PSI 10000 2U



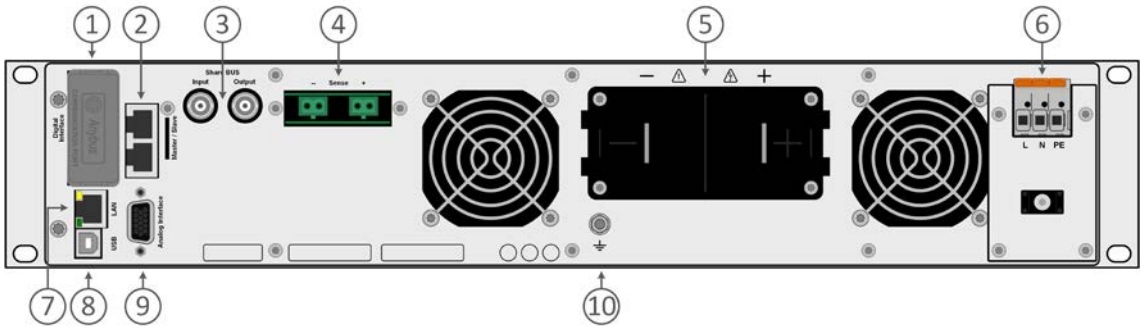


Front Panel Description PSI 10000 2U



1. Main switch
2. TFT Control Interface, interactive operation and display
3. Rotary knob with push-button for settings and control
4. USB Host, use USB-stick for data logging and sequencing
5. Rotary knob with push-button for settings and control
6. On / Off push-button with LED status display

Rear Panel Description PSI 10000 2U



1. Slot for Interfaces
2. Master-Slave-Bus interface to set up a system for parallel connection
3. Share-Bus Interface to set up a system for parallel connection
4. Output voltage Remote Sense input terminal
5. Output terminal, Copper busbar
6. Mains input terminal
7. Ethernet interface
8. USB interface
9. Connector (DB15 Female) for isolated analog program, monitor and other functions
10. Grounding connection screw (PE)

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