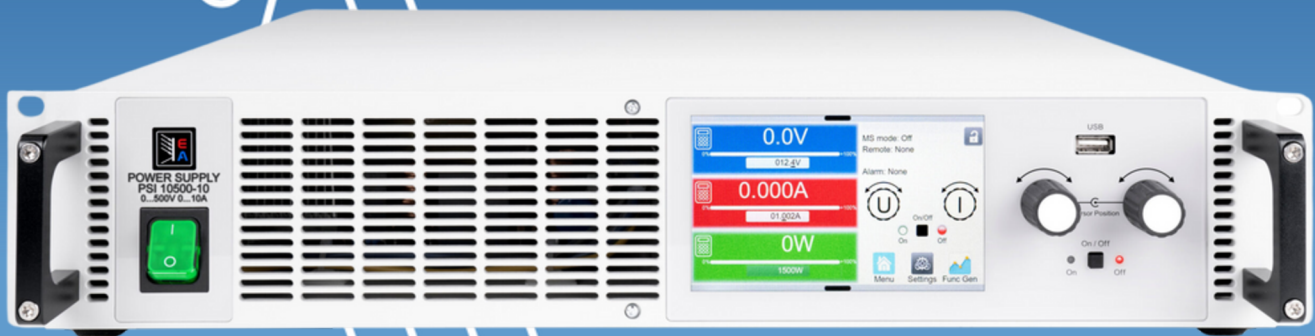




Elektro-Automatik



## PSI 10000 2U

### Compact, High-Efficiency DC Power for Precision Applications

**Wide Autoranging Output:** Supports voltage ranges from 0-60 V to 0-1500 V and currents up to 120 A, delivering full power across diverse applications.

**High Efficiency:** Achieves over 95% efficiency, minimizing energy loss and heat generation.

**Advanced Regulation Modes:** Includes CV, CC, CP, and CR modes with fast crossover for precise control and adaptability.

**Scalable Operation:** Parallel operation of up to 64 units via Master-Slave and Share-Bus, enabling systems up to 1920 kW.

**Intuitive User Interface:** Features a 5" color TFT touchscreen with touch controls for seamless operation and monitoring.

# 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

## Built-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



# SPECIFICATIONS

## AC Input

- **Voltage, Phases:** 110 V / 120 V / 208 V / 220 V / 230 V / 240 V  $\pm 10\%$ , 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:**  $\leq 0.05\%$  FS (0 - 100% load, constant input voltage and constant temperature)
- **Line Regulation CV:**  $\leq 0.01\%$  FS (110 V - 240 V AC +10% input voltage, constant load and constant temperature)
- **Stability CV:**  $\leq 0.02\%$  FS (Over 8hrs interval following 30 minutes warm-up, constant input voltage, load and temperature)
- **Temperature Coefficient CV:**  $\leq 30$ ppm/ $^{\circ}$ C (Following 30 minutes warm up)
- **Compensation (Remote Sense):**  $\leq 5\%$  UNominal
- **Load Regulation CC:**  $\leq 0.1\%$  FS (0 - 100% load, constant input voltage and constant temperature)
- **Line Regulation CC:**  $\leq 0.01\%$  FS (110 V - 240 V AC +10% input voltage, constant load and constant temperature)
- **Stability CC:**  $\leq 0.02\%$  FS (Over 8hrs interval following 30 minutes warm-up, constant input voltage, load and temperature)
- **Temperature Coefficient CC:**  $\leq 50$ ppm/ $^{\circ}$ C (Following 30 minutes warm up)
- **Load Regulation CP:**  $\leq 0.3\%$  FS (0 - 100% load, constant input voltage and constant temperature)
- **Load Regulation CR:**  $\leq 0.3\%$  FS +  $0.1\%$  FS current (0 - 100% load, constant input voltage and constant temperature)

## Protective Functions

- **Overvoltage Protection (OVP):** Adjustable 0 - 110% UNominal
- **Overcurrent Protection (OCP):** Adjustable 0 - 110% INominal
- **Overpower Protection (OPP):** Adjustable 0 - 110% PNominal
- **Overtemperature Protection (OT):** Output shuts down in case of insufficient cooling

## DC Output (Dynamic)

- **Rise time 10 - 90% CV:**  $\leq 20$  ms
- **Fall time 90 - 10% CV:**  $\leq 20$  ms
- **Rise time 10 - 90% CC:**  $\leq 10$  ms
- **Fall time 90 - 10% CC:**  $\leq 10$  ms

## Display Accuracy

- **Voltage:**  $\leq 0.05\%$  FS
- **Current:**  $\leq 0.1\%$  FS

## 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 table
- **DC Output to Interfaces:** 1000 V DC (models up to 360 V rating), 1500 V DC (models from 500 V rating)

## 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:  $\leq 0.2\%$ , 0-5 V:  $\leq 0.4\%$

## Device Configuration

- **Parallel Operation:** Up to 64 units of any power class in the 10000 series, with Master-Slave Bus and Share Bus

## Safety and EMC

- **Safety Standards:** EN 61010-1, IEC 61010-1, UL 61010-1, CSA C22.2 No 61010-1, BS EN 61010-1
- **EMC Compliance:** EN 55011 (Class B), CISPR 11 (Class B), FCC 47 CFR part 15B (Class B), EN 61326-1
- **Includes tests:** EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6
- **Safety Protection Class:** Class 1
- **Ingress Protection:** IP20

## Environmental Conditions

- **Operating Temperature:** 0–50  $^{\circ}$ C (32–122  $^{\circ}$ F)
- **Storage Temperature:** -20–70  $^{\circ}$ C (-4–158  $^{\circ}$ F)
- **Humidity:**  $\leq 80\%$  relative humidity, non-condensing
- **Altitude:**  $\leq 2000$  m ( $\leq 6,600$  ft)
- **Pollution Degree:** 2

## Mechanical Construction

- **Cooling:** Forced air flow from front to rear (temperature-controlled fans)
- **Dimensions (W x H x D):** 19" x 2U x 462 mm (Enclosure only, not over all)
- **Weight:** 1.5 kW unit: 9.5 kg (21 lbs), 3.0 kW unit: 12.7 kg (28 lbs)

## Available Models

Specification	PSI 10060-60	PSI 10080-60	PSI 10200-25	PSI 10360-15	PSI 10500-10	PSI 10750-06	PSI 10060-120
Voltage Range (V)	0 - 60 V	0 - 80 V	0 - 200 V	0 - 360 V	0 - 500 V	0 - 750 V	0 - 60 V
Ripple RMS (CV) (mV BW)	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	50 mV BW 300 kHz	10 mV BW 300 kHz
Ripple Noise (p-p CV) (mV BW)	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	500 mV BW 20 MHz	100 mV BW 20 MHz
Current Range (A)	0 - 60 A	0 - 60 A	0 - 25 A	0 - 15 A	0 - 10 A	0 - 6 A	0 - 120 A
Power Range (W)	0 - 1500 W	0 - 1500 W	0 - 1500 W	0 - 1500 W	0 - 1500 W	0 - 1500 W	0 - 3000 W
Resistance Range (Ω)	0.04 - 80 Ω	0.04 - 80 Ω	0.25 - 500 Ω	0.8 - 1600 Ω	2 - 3000 Ω	4 - 6000 Ω	0.02 - 24 Ω
Output Capacitance (μF)	8640 μF	8640 μF	800 μF	330 μF	120 μF	40 μF	17280 μF
Efficiency (%)	94.0 %	94.0 %	94.5 %	94.5 %	95.0 %	95.0 %	94.0 %

Specification	PSI 10080-120	PSI 10200-50	PSI 10360-30	PSI 10500-20	PSI 10750-12	PSI 11000-10	PSI 11500-06
Voltage Range (V)	0 - 80 V	0 - 200 V	0 - 360 V	0 - 500 V	0 - 750 V	0 - 1000 V	0 - 1500 V
Ripple RMS (CV) (mV BW)	10 mV BW 300 kHz	30 mV BW 300 kHz	30 mV BW 300 kHz	40 mV BW 300 kHz	50 mV BW 300 kHz	100 mV BW 300 kHz	150 mV BW 300 kHz
Ripple Noise (p-p CV) (mV BW)	100 mV BW 20 MHz	300 mV BW 20 MHz	300 mV BW 20 MHz	500 mV BW 20 MHz	500 mV BW 20 MHz	2000 mV BW 20 MHz	6500 mV BW 20 MHz
Current Range (A)	0 - 120 A	0 - 50 A	0 - 30 A	0 - 20 A	0 - 12 A	0 - 10 A	0 - 6 A
Power Range (W)	0 - 3000 W	0 - 3000 W	0 - 3000 W	0 - 3000 W	0 - 3000 W	0 - 3000 W	0 - 3000 W
Resistance Range (Ω)	0.02 - 40 Ω	0.1 - 250 Ω	0.4 - 800 Ω	1 - 1500 Ω	2 - 3000 Ω	3 - 6000 Ω	8 - 6000 Ω
Output Capacitance (μF)	17280 μF	1600 μF	660 μF	240 μF	80 μF	60 μF	20 μF
Efficiency (%)	94.0 %	94.5 %	94.5 %	95.0 %	95.0 %	95.0 %	95.0 %

## General

The PSI 10000 2U series transforms grid energy into regulated DC voltage with efficiency exceeding 96%. Supporting both single-phase and three-phase units, it accommodates a wide input range, ensuring compatibility with virtually all global mains voltages. The devices deliver DC voltage ranges from 0-60 V to 0-2000 V and currents up to 1000 A, functioning as flexible output stages with constant power autoranging. These power supplies are equipped with a master-slave bus, allowing up to 64 parallel units to operate as a single, cohesive system with a combined output of up to 1920 kW and 64,000 A. This modular and scalable design meets the demands of laboratories and industrial applications while offering advanced features like a function generator and comprehensive monitoring capabilities.

## DC Connection

The device's DC output is conveniently connected via a robust copper rail at the rear of the unit. For higher performance systems, multiple devices can be seamlessly linked in parallel using vertical copper rails. Additionally, a protective cover ensures safe operation and easy integration into high-performance setups, making it an excellent choice for scalable applications.

## AC Connection

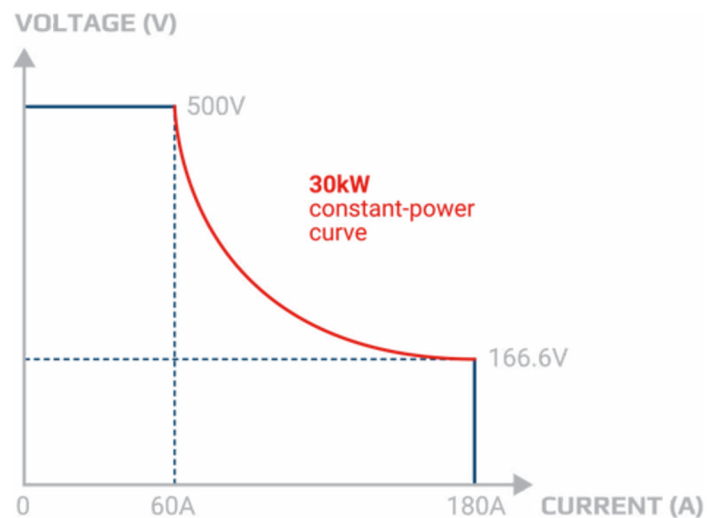
The PSI 10000 2U series features active Power Factor Correction (PFC) for exceptional efficiency and reduced energy consumption. It supports a wide input voltage range from single-phase 110/120 V to 240 V AC and three-phase 208 V to 480 V AC, ensuring compatibility with the majority of global power grids. The devices automatically adapt to the available input without requiring manual adjustments. In grids with lower voltages, such as 110/120 V and 208 V, the system applies automatic derating to match the input capacity, ensuring reliable and safe operation.

## DC Output

The PSI 10000 2U delivers a versatile DC output, offering voltage ranges from 0-60 V up to 0-2000 V and currents from 0-6 A to 0-1000 A. Its flexible autoranging output stages provide an extended operational range, enabling users to handle diverse applications without the need for multiple power supplies. This adaptability ensures greater efficiency and cost-effectiveness for complex testing environments.

## The Principle of Autoranging

Autoranging is a key feature of the PSI 10000 2U series that enhances flexibility and efficiency by dynamically adjusting the output voltage and current to deliver full power across a wide operating range. Unlike traditional fixed-range power supplies, autoranging enables a single device to adapt to diverse applications, eliminating the need for multiple units. This capability ensures that the PSI 10000 2U can handle varying voltage and current requirements while maintaining optimal performance. By offering broader operating ranges, autoranging simplifies system design, reduces equipment costs, and provides engineers with a versatile and reliable solution for complex testing scenarios.



## Integrated Function Generator

The PSI 10000 2U series comes equipped with a built-in function generator, providing the ability to create predefined waveforms such as sine, triangle, square, and trapezoid. Additionally, a ramp function and an arbitrary generator allow for the free programmability of voltage and current profiles, making it ideal for customized testing requirements. Test sequences can be saved and reloaded for repetitive applications, saving time and enhancing efficiency. With integrated features like lookup tables (LUT) for storing IU and UI reference lines, the function generator supports advanced simulations, including photovoltaic systems and fuel cells, adhering to the DIN EN 50530 standard. This versatility makes the PSI 10000 2U an indispensable tool for precise and dynamic testing.

## Interfaces

The PSI 10000 2U series is designed with extensive interface options to ensure seamless integration into a variety of systems. Standard interfaces include USB, Ethernet, and an analog interface, all galvanically isolated for secure communication and control. The analog interface supports flexible parameterization for voltage, current, power, and resistance monitoring, as well as input/output control. Optional plug-and-play interfaces expand connectivity options to include CAN, CANopen, RS232, Profibus, EtherCAT, Profinet (single or dual ports), Modbus (single or dual ports), and Ethernet (single or dual ports). These interfaces enhance the adaptability of the device, making it suitable for both laboratory and industrial environments while supporting modern automation and data acquisition systems.

## High-Performance Systems

The PSI 10000 2U series is designed to meet the demands of high-power applications with scalable system configurations. By connecting multiple devices in parallel, users can create systems delivering up to 1920 kW of power. A single 19-inch cabinet with a height of 42U can house up to 240 kW, occupying just 0.6 m<sup>2</sup> of floor space. This modular design allows engineers to combine units of varying power classes within the same voltage class, enabling tailored solutions for specific needs. The PSI 10000 2U series offers unmatched power density and flexibility, making it an ideal choice for laboratories and industrial applications requiring large-scale power systems.

## Master-Slave-Bus and Share-Bus

The integrated Master-Slave Bus and Share Bus simplify the creation of multi-device systems by ensuring they operate as a single cohesive unit. The Master-Slave Bus consolidates system data such as total power and current, displaying it on the master device while coordinating warnings and alarms from slave devices. The Share Bus ensures balanced load distribution across all connected units, optimizing performance and extending system longevity. This intelligent load management and unified control make the PSI 10000 2U series an efficient and reliable solution for scalable, high-performance systems.



## Example Representation

A fully assembled and operational 240 kW system.

# Applications

## Relay Testing in Production

The PSI 10000 2U series is an essential tool for relay manufacturers, providing precise voltage and current control for testing coils and contacts during production. It accurately measures critical parameters such as operating, holding, and decay currents, ensuring product quality and reliability. For contact testing, the device evaluates current-carrying capacity, contact resistance, voltage consistency, and disconnect thresholds. With its versatile interface options, the PSI 10000 2U integrates seamlessly into automated test systems, delivering consistent, measurable results without the need for additional testing equipment.

## Fuel Cell Simulation

Fuel cell simulation is simplified with the PSI 10000 2U, offering advanced features for precise and repeatable testing. The device enables simulation of single cells, modules, or packs, helping optimize energy storage systems and powered components. Overcurrent and voltage protection mechanisms safeguard connected devices, while adjustable limits generate warnings and alarms for added safety. These features make the PSI 10000 2U an indispensable tool for engineers developing next-generation energy technologies.

## On-Board Charger Test

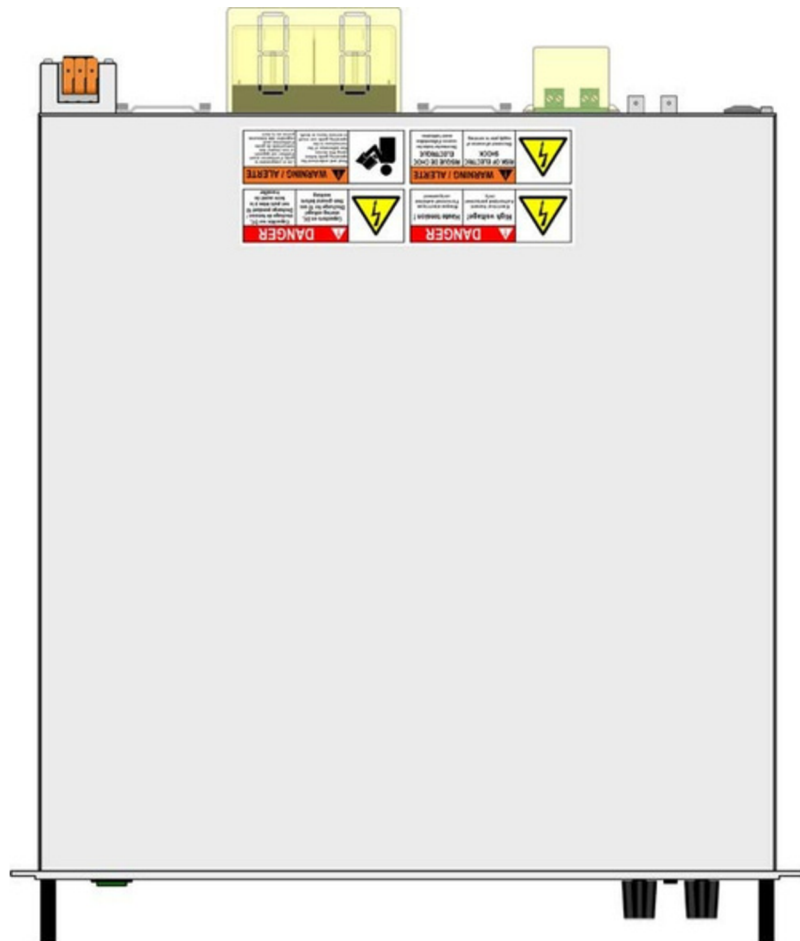
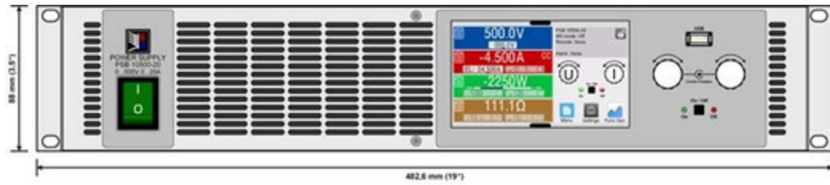
Testing on-board chargers (OBCs) requires precise control and adaptability, both of which are delivered by the PSI 10000 2U series. The device's built-in sequencing and logging features allow engineers to generate reproducible test results and analyze dynamic setpoint data. Adjustable control speeds (Normal, Fast, Slow) prevent conflicts between the power supply and the device under test, ensuring smooth and accurate testing. The PSI 10000 2U's flexibility and advanced monitoring capabilities make it a perfect choice for automotive and electric vehicle applications.

## Solar Array Simulation

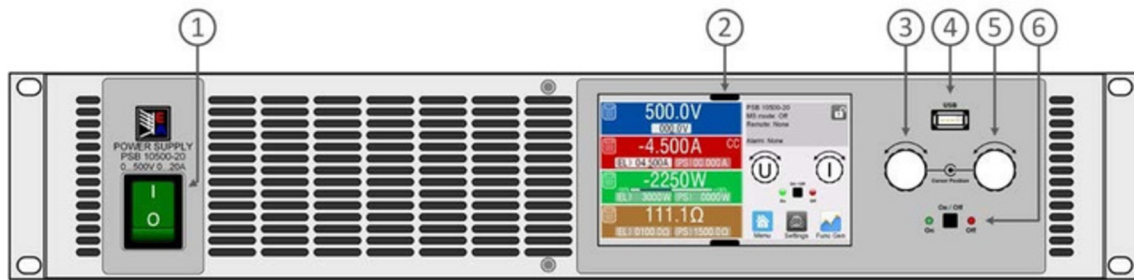
The PSI 10000 2U series is an ideal solution for photovoltaic (PV) inverter testing, offering precise simulation of solar panel behavior. Engineers can create custom IU curves or use standards-based models like EN 50530, simulating conditions such as varying irradiation, shading, and temperature. The device supports both static and dynamic Maximum Power Point Tracking (MPPT) tests, delivering high-resolution results with its 16-bit technology and 1  $\mu$ s sampling rate. These capabilities ensure accurate performance evaluation and efficiency measurement for PV systems, with data easily saved for reporting and analysis.



# Technical Drawing PSI 10000 2U

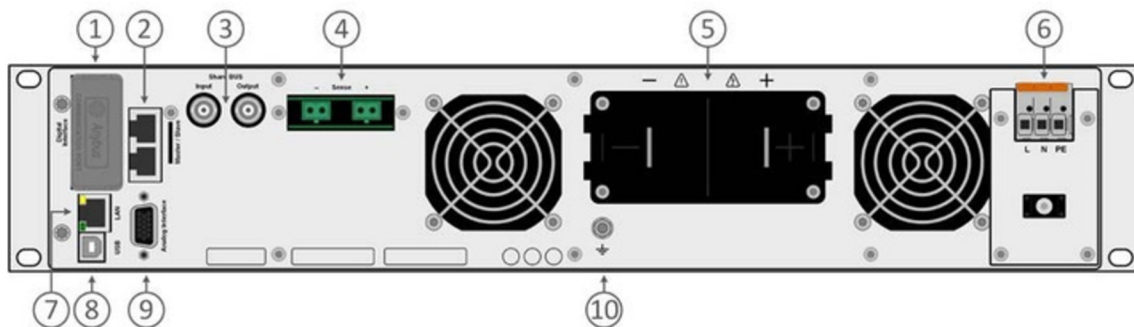


## Front Panel Description PSI 10000 2U



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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