



Elektro-Automatik



## PSB 10000 2U

### Compact, Energy-Efficient Power Testing Solutions for Precision Applications

**Bidirectional Power Capability:** Operates as both a power source and regenerative load, with up to 95% energy recovery, reducing energy costs and heat generation.

**Flexible Autoranging Technology:** Supports a wide range of voltages (up to 1500 V) and currents (up to 120 A) for maximum adaptability across applications.

**Compact and Scalable Design:** Offers up to 3 kW per unit and supports parallel operation of up to 64 units for large-scale testing needs.

**Integrated Function Generator:** Includes pre-programmed waveforms and test sequences to simplify complex testing scenarios.

**User-Friendly Interface and Connectivity:** Features a 5" color touchscreen, USB, Ethernet, and optional industrial communication protocols for seamless system integration.

# EA-PSB 10000 2U 1.5 kW / 3.0 kW

Programmable bidirectional DC  
power supply



## Features

- Wide range input, 110 V - 240 V +10 % 1ph AC
- Active Power-Factor-Correction, typical 0.99
- Bidirectional power supply, 2-quadrants in source and sink
- In load operation, regenerative with energy recovery into the grid
- Very high efficiency up to over 95 %
- Voltage from 0 - 10 V up to 0 - 1500 V
- Currents from 0 - 6 A up to 0 - 120 A
- Flexible power regulated DC input/output stages (autoranging)
- Regulation mode CV, CC, CP, CR with fast crossover
- Digital regulation, high resolution with 16bit ADCs and DACs
- 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
- Integrated battery test mode, battery and fuel cell simulation
- Photovoltaics test mode, MPPT, EN 50530
- 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
- EA - Battery Simulator



# 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 (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:  $\leq 0.2\%$ , 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 452 mm
- **Weight:** 1500W unit: 9.5 kg (21 lb), 3000 W unit: 12.7 kg (28 lbs)

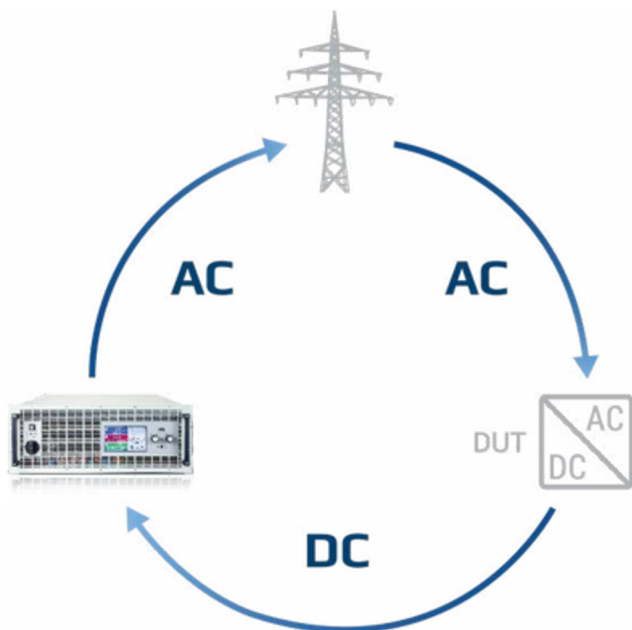
## Available Models

SKU	Power (W)	Voltage (V)	Current (A)	Output Capacity	Resistance Range	Umin for Imax	Ripple in CV (rms)	Ripple in CV (pp)	Efficiency
PSB 10010-120	1200 W	10 V	120 A	17280 $\mu$ F	0.02 $\Omega$ - 24 $\Omega$	0.8 V	10 mV (BW 300 kHz)	100 mV (BW 20 MHz)	93.00%
PSB 10010-60	600 W	10 V	60 A	8640 $\mu$ F	0.04 $\Omega$ - 80 $\Omega$	0.8 V	10 mV (BW 300 kHz)	100 mV (BW 20 MHz)	93.00%
PSB 10060-120	3000 W	60 V	120 A	800 $\mu$ F	0.02 $\Omega$ - 24 $\Omega$	0.8 V	10 mV (BW 300 kHz)	100 mV (BW 20 MHz)	94.00%
PSB 10060-60	1500 W	60 V	60 A	8640 $\mu$ F	0.04 $\Omega$ - 80 $\Omega$	0.8 V	10 mV (BW 300 kHz)	100 mV (BW 20 MHz)	94.00%
PSB 10080-120	3000 W	80 V	120 A	800 $\mu$ F	0.02 $\Omega$ - 40 $\Omega$	0.8 V	10 mV (BW 300 kHz)	100 mV (BW 20 MHz)	94.00%
PSB 10080-60	1500 W	80 V	60 A	8640 $\mu$ F	0.04 $\Omega$ - 80 $\Omega$	0.8 V	10 mV (BW 300 kHz)	100 mV (BW 20 MHz)	94.00%
PSB 10200-25	1500 W	200 V	25 A	800 $\mu$ F	0.25 $\Omega$ - 500 $\Omega$	2 V	30 mV (BW 300 kHz)	300 mV (BW 20 MHz)	94.50%
PSB 10200-50	3000 W	200 V	50 A	1600 $\mu$ F	0.1 $\Omega$ - 250 $\Omega$	2 V	30 mV (BW 300 kHz)	300 mV (BW 20 MHz)	94.50%
PSB 10360-15	1500 W	360 V	15 A	330 $\mu$ F	0.08 $\Omega$ - 1600 $\Omega$	2 V	30 mV (BW 300 kHz)	300 mV (BW 20 MHz)	94.50%
PSB 10360-30	3000 W	360 V	30 A	660 $\mu$ F	0.4 $\Omega$ - 800 $\Omega$	2 V	30 mV (BW 300 kHz)	300 mV (BW 20 MHz)	94.50%
PSB 10500-10	1500 W	500 V	10 A	120 $\mu$ F	2 $\Omega$ - 3000 $\Omega$	2.5 V	40 mV (BW 300 kHz)	500 mV (BW 20 MHz)	95.00%
PSB 10500-20	3000 W	500 V	20 A	240 $\mu$ F	1 $\Omega$ - 1500 $\Omega$	2.5 V	40 mV (BW 300 kHz)	500 mV (BW 20 MHz)	95.00%
PSB 10750-06	1500 W	750 V	6 A	40 $\mu$ F	4 $\Omega$ - 6000 $\Omega$	2.5 V	50 mV (BW 300 kHz)	500 mV (BW 20 MHz)	95.00%
PSB 10750-12	3000 W	750 V	12 A	80 $\mu$ F	2 $\Omega$ - 3000 $\Omega$	2.5 V	50 mV (BW 300 kHz)	500 mV (BW 20 MHz)	95.00%
PSB 11000-10	3000 W	1000 V	10 A	60 $\mu$ F	3 $\Omega$ - 6000 $\Omega$	4 V	100 mV (BW 300 kHz)	2000 mV (BW 20 MHz)	95.00%
PSB 11500-06	3000 W	1500 V	6 A	20 $\mu$ F	8 $\Omega$ - 6000 $\Omega$	4.2 V	150 mV (BW 300 kHz)	6500 mV (BW 20 MHz)	95.00%



## General

The bidirectional DC power supplies of the PSB 10000 series by EA Elektro-Automatik are highly versatile two-quadrant devices capable of functioning as both a power supply and an electronic load. In load mode, these devices are regenerative, feeding energy back into the grid with an efficiency of up to 96%, significantly reducing operational costs and heat generation. Designed for global compatibility, the PSB 10000 series supports a wide range of DC voltages and currents, from 0–10 V to 0–2000 V and 0–6 A to 0–1000 A, all within a single device. The flexible autoranging output stages ensure seamless adaptation to varied applications, while the master-slave bus enables up to 64 devices to be combined into a single, scalable system delivering up to 1920 kW and 64,000 A. This series also incorporates robust laboratory functionality, such as an integrated function generator, comprehensive alarm and warning systems, and versatile software options for seamless operation.



## The Principle of Energy Recovering

The PSB 10000 series leverages advanced bidirectional technology to optimize energy flow. During operation, the device under test (DUT) draws energy from the mains, converts it to DC, and supplies it to the EA device. This bidirectional power supply then regenerates the DC energy into an AC current, efficiently feeding it back into the grid. This process ensures minimal energy loss, reducing both electricity costs and heat output, while supporting a wide range of testing and simulation applications with exceptional reliability and precision.

## AC Connection

The PSB 10000 series is equipped with an active power factor correction (PFC) system, ensuring high energy efficiency and low energy consumption. These devices are compatible with a wide range of global input voltages, spanning single-phase 110 V to 240 V AC and three-phase 208 V to 480 V AC supplies. Automatic adjustment to the available mains voltage eliminates the need for manual configuration, allowing for effortless integration into diverse power environments. In lower-voltage grids, such as 110 V or 120 V, automatic output derating ensures optimal performance without compromising reliability.

## Energy Recovering

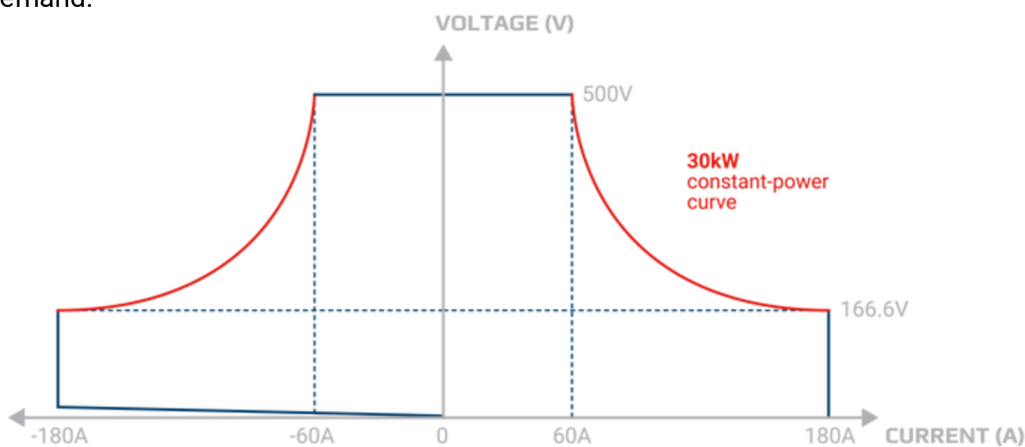
The PSB 10000 series stands out with its regenerative energy recovery system, which allows energy consumed in load mode to be efficiently fed back into the mains supply at up to 96% efficiency. Unlike conventional systems that dissipate energy as heat, these devices minimize energy waste, significantly reducing operational costs. This also results in less heat production, lowering cooling requirements and associated costs, making the PSB 10000 series an economical and environmentally friendly solution for high-performance testing applications.

## DC Output

The PSB 10000 series offers a wide range of DC output capabilities, providing voltages from 0–10 V to 0–2000 V and currents from 0–6 A to 0–1000 A, depending on the model. These bidirectional devices operate as two-quadrant systems, allowing them to supply or absorb power as needed. The flexible autoranging output stages ensure a broad operational spectrum, allowing users to work efficiently across various voltage, current, and power ranges. This adaptability makes the PSB 10000 series suitable for diverse applications, from precision lab experiments to large-scale industrial operations, with the reliability and flexibility engineers demand.

## DC Connection

The DC connections in the PSB 10000 series are designed for efficiency and scalability, utilizing robust copper busbars for reliable energy transfer. These connections are located at the rear of the device, allowing for seamless integration into test setups. For higher power requirements, multiple devices can be connected in parallel using vertical copper rails with minimal effort. To ensure operator safety, protective covers are provided for all exposed contacts, ensuring a secure and efficient testing environment.



## The Principle of Autoranging

The autoranging technology in the PSB 10000 series enhances its adaptability by automatically optimizing the voltage and current ranges to maintain full power across a wide operational spectrum. This flexibility allows a single device to handle a variety of voltage-current combinations, replacing the need for multiple fixed-range units. By maximizing the operational range without compromising efficiency, the PSB 10000 series provides engineers with a cost-effective and versatile solution for complex testing scenarios.

## Integrated Function Generator

The PSB 10000 series is equipped with an integrated function generator, allowing users to simulate real-world conditions with predefined waveforms, including sine, triangle, square, and trapezoidal curves. Additional features, such as ramp functions and arbitrary waveform programming, enable precise customization for specialized tests. The devices also support test sequence storage, allowing users to save and reload recurring procedures, significantly improving workflow efficiency. For applications such as solar and fuel cell simulations, pre-programmed PV characteristics compliant with DIN EN 50530 are available, further expanding the series' versatility.

## Interfaces

The PSB 10000 series includes a comprehensive set of digital and analog interfaces, ensuring seamless integration into diverse testing environments. Standard USB, Ethernet, and analog ports are galvanically isolated for safe operation and accurate communication. The series also supports optional industrial protocols, including CAN, CANopen, RS232, EtherCAT, Profinet, and Modbus, providing robust connectivity for automated and industrial systems. These versatile interfaces, coupled with intuitive configuration options, ensure the PSB 10000 series meets the demands of modern engineering and testing applications.

## High-Performance Systems

The PSB 10000 series is designed to meet the needs of high-power applications, with scalable solutions that support up to 1920 kW of power. By connecting multiple units in parallel using vertical copper rails, the system can deliver exceptional performance while occupying minimal floor space. For example, a single 19-inch rack can accommodate up to 240 kW in a compact and efficient configuration. The modular design and compatibility across different power classes allow engineers to build systems tailored to their specific requirements, ensuring flexibility and efficiency in demanding environments.

## Master-Slave-Bus and Share-Bus

The PSB 10000 series incorporates an advanced Master-Slave bus and Share bus to ensure seamless operation in multi-device systems. These buses allow up to 64 units to function as a single, unified device, simplifying control and monitoring. The Master-Slave bus consolidates data such as total power and current on the master device's display, while also providing clear visibility of warnings and alarms from slave units. The Share bus ensures equal load distribution across connected devices, optimizing performance and reliability. This intelligent system architecture enhances scalability and efficiency, making the PSB 10000 series a reliable choice for high-power applications.



## Example Representation

A fully assembled and operational 240 kW system.

# Applications

## Battery Testing for Electromobility

The PSB 10000 series is ideal for testing the electrical characteristics of batteries, covering a wide range of applications from cell, module, and pack tests to State-of-Health (SOH) evaluations and End-of-Line (EOL) testing. Its ability to deliver accurate and reproducible voltage and current measurements, coupled with its flexibility and reliability, makes it suitable for both automated test systems and integrated battery test setups. The series' efficiency of up to 96% ensures cost-effective operation, meeting the rigorous demands of modern battery testing.

## Battery Simulation

The battery simulation capabilities of the PSB 10000 series enable it to replicate the behavior of single cells, modules, or packs, supporting the development of optimized energy storage systems and components. Integrated safety features, such as overcurrent protection (OCP) and alarms, safeguard the connected devices during operation. The series provides precise, reproducible data, making it a dependable tool for applications requiring simulation of real-world battery performance.

## Fuel Cell Testing

The PSB 10000 series supports the testing of fuel cells, stacks, and complete systems, delivering highly accurate and reproducible results. With its ability to simulate various electrical modes, the series is well-suited for evaluating resistance, performance, and operational lifespan. Its regenerative energy recovery and scalability via parallel operation ensure that even high-current testing scenarios are handled with precision and efficiency, while keeping costs under control.

## On-board Charger Test

The PSB 10000 series provides a flexible and efficient solution for testing on-board chargers (OBCs) under diverse conditions. Its sequencing and logging capabilities allow users to generate and store reproducible test results, while adjustable voltage regulation speeds (Normal, Fast, Slow) ensure compatibility with the control loops of devices under test (DUTs). This adaptability makes the PSB 10000 series a reliable choice for accurate and dynamic OBC performance analysis.

## Solar Array Simulation

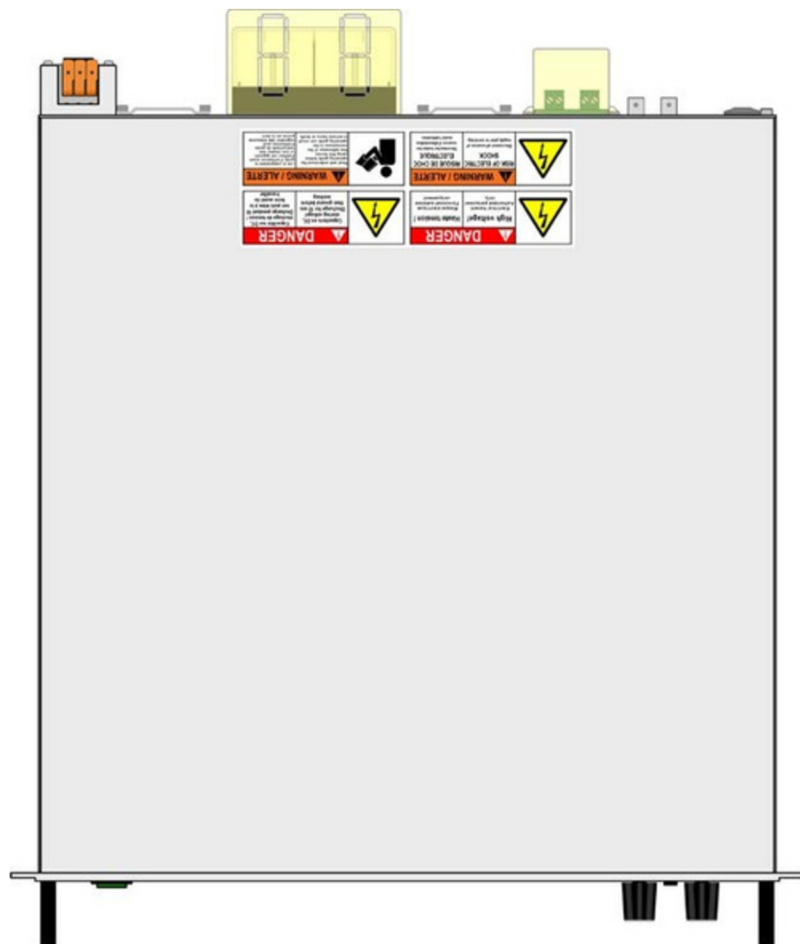
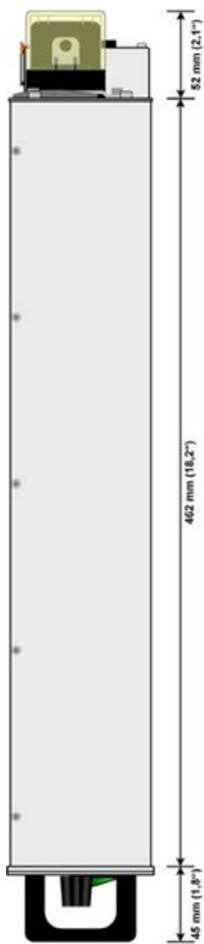
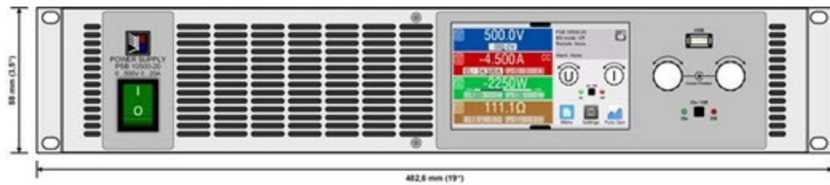
The PSB 10000 series excels in solar array simulation, providing advanced tools to test PV inverters under realistic conditions. Built-in support for standards like EN 50530 and Sandia ensures compatibility with a variety of solar panel types, while customizable parameters such as irradiation, shadow, temperature, and weather conditions enable comprehensive performance evaluations. Its high-resolution 16-bit technology delivers precise results, which can be saved for detailed analysis and reporting.

## Battery Recycling

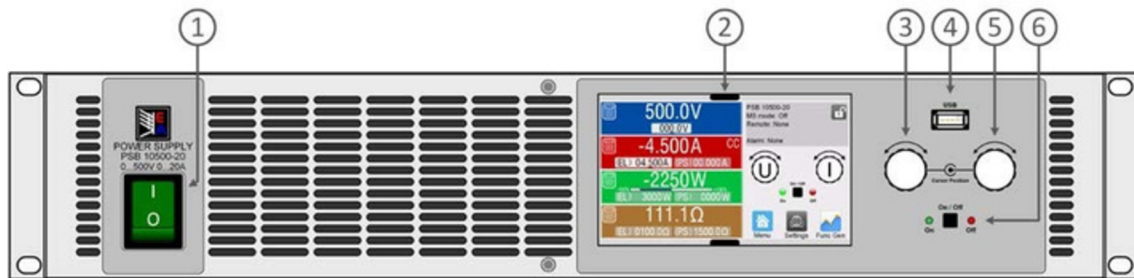
The PSB 10000 series simplifies the process of battery recycling by enabling thorough evaluations of State-of-Health (SOH) and supporting total discharge with high efficiency. Its autoranging technology ensures maximum discharge, even at low voltages, while its energy recovery system minimizes costs by feeding up to 96% of the energy back into the grid. This cost-effective and environmentally friendly approach makes the PSB 10000 series an indispensable tool in battery recycling workflows.



# Technical Drawing PSB 10000 2U

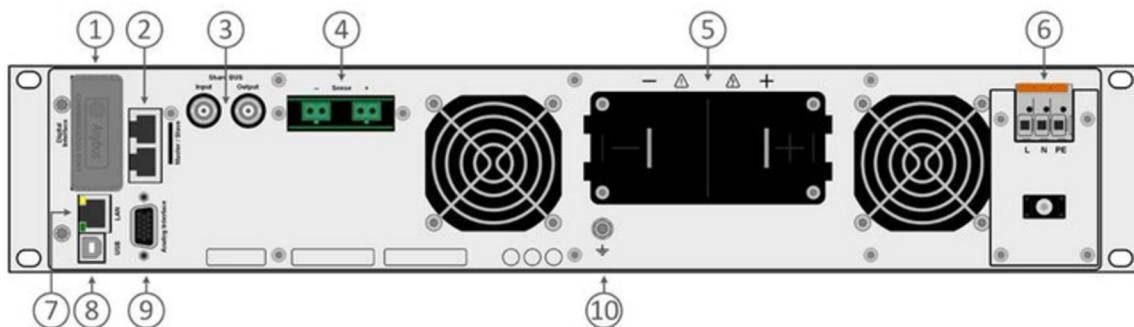


## Front Panel Description PSB 10000 2U



1. Power switch
2. TFT control interface, interactive operation and display
3. Rotary knob with push-button action, for settings and control
4. USB host, uses USB sticks for data logging and sequencing
5. Rotary knob with push-button action, for settings and control
6. On / Off push-button with LED status display

## Rear Panel Description PSB 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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