

EA-PSB 10000 30 kW



Programmable bidirectional DC power supplies



EA-PSB 10750-120



- Wide range 342...528 V AC supply for operation on 380 V, 400 V or 480 V grids
- US 208 V models available
- Bidirectional device - power supply and electronic load in one
- Energy recovery with high efficiency
- Power rating: 30 kW (15 kW*) per device, expandable up to 1920 kW
- Voltage ratings: 60 V up to 2000 V
- Current ratings: 40 A up to 1000 A
- Flexible, power regulated DC<->AC stage
- Various protection circuits (OVP, OCP, OPP, OTP)
- 5" TFT touch panel with display for values, status and notifications
- Remote sensing with automatic detection
- Galvanically isolated interfaces (USB, Ethernet, analog, slot)
- Integrated function generator
- Battery test, MPP tracking simulation, PV simulation according to EN 50530
- Optional, digital interface modules
- SCPI and ModBus command set
- LabView VIs and control software for Windows

General

The new bidirectional power supplies of series EA-PSB 10000 offer much power in a small space: **30 kW in only 4 units of height (4U)**. Compared to series EA-PSB 9000 3U it saves a space of 2U or one third, when considering the 30 kW of rated power.

It also incorporates two devices in one: a power supply (source) and an electronic load (sink) with energy recovery. Based on these two features the devices offer the functionality of two-quadrants operation as standard. The internal electronic load achieves a high voltage dynamics by discharging unavoidable capacities on the DC terminal. For a connected source, the devices are full electronic loads with energy recovery, also ideal for bigger systems with a total power of up to **1920 kilowatts**.

In source operation mode the device becomes a flexible, autoranging power supply like those of series EA-PSI 9000 3U. It incorporates the advantages of both device types into one and at the same time it eliminates the disadvantages of separate units regarding weight, space requirement, costs and effort to implement them into custom test software.

* US 208 V models

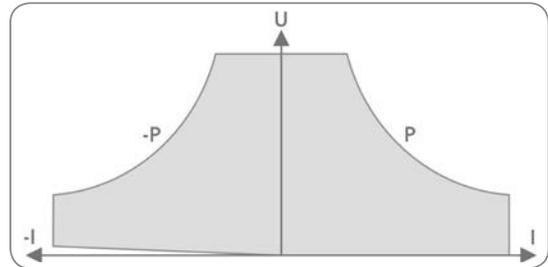
EA-PSB 10000 30 kW

AC supply

All models are provided with an active Power Factor Correction (PFC) circuit and are designed for operation on a three-phase supply with typical worldwide ratings between 380 V and 480 V AC. But also regions where only 208 V three-phase is available are covered by the US 208 V models. During load operation, the device recovers the consumed DC energy and feeds it back into the local power network. This helps saving a lot of energy costs.

Autorangeing power stage

All models are equipped with a flexible autorangeing bidirectional power stage which provides a higher output voltage at lower output current or a higher output current at lower output voltage, always limited to the max. rated output power. The same applies for sink mode operation. The power set value is adjustable with these models. Therefore, a wide range of applications can already be covered by the use of just one unit.



DC output/input

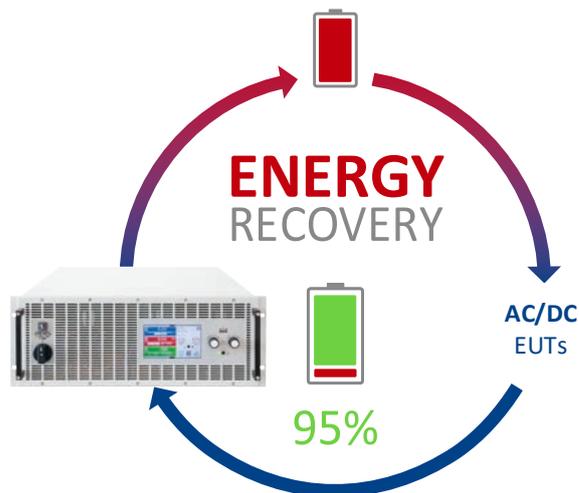
DC voltages between 0...60 V and 0 ...**2000 V**, current ratings between 0...40 A and 0...**1000 A** are available, all along with a power rating of 0...30kW for all standard models, while the US 208 V models are rated with 0...15 kW. The DC terminal is located on the rear panel.

Source-sink operation

One salient feature of these devices is the coalescence of an electronic load, also called sink, and a power supply, also called source, into one unit. It means, the device cannot only arbitrarily operate as sink or source, the switchover between these two operating modes occurs without interruption and time loss. This is also called two-quadrants operation.

Energy recovery

The most important feature of these devices is that the AC input while connected to the grid is also used as output for the recovery of the supplied DC energy during load operation, which is converted with an efficiency of up to 95.5%. This way of energy recovery helps to lower costs and can avoid expensive cooling systems, such as they are required for conventional electronic loads which only convert energy into heat. Principle view.



Master-slave

All models feature a digital master-slave bus by default. It can be used to connect up to 64 units of identical models in parallel operation to a bigger system with total formation of the actual value of voltage, current and power. This allows for a total power of up to **1920 kilowatts**.

The configuration of the master-slave system is either completely done on the control panels of the units or by remote control via any of digital communication interfaces. Handling of the master unit is possibly by manual or remote control (any interface).



EA-PSB 10000 30 kW

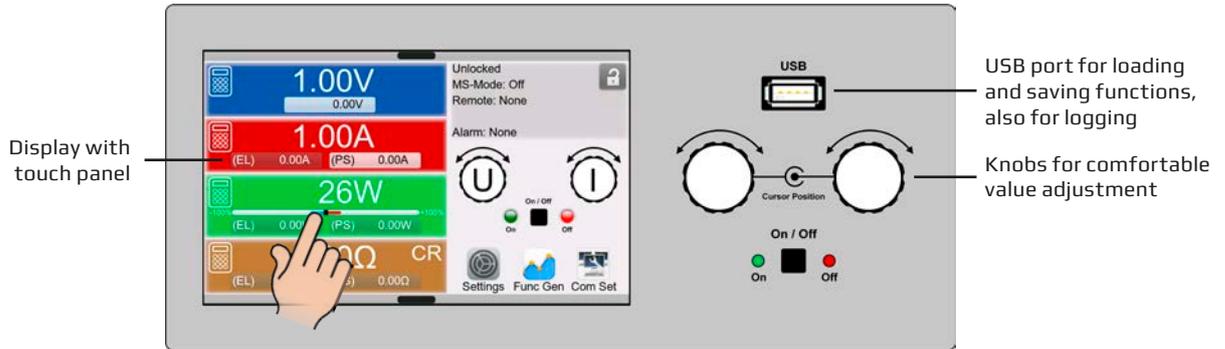


Display and control panel

Set values and actual values of input & output voltage / current / power are clearly represented on the 5" graphic display. The color TFT screen is touch sensitive and can be intuitively used to control all functions of the device with just a finger tip.

Set values of voltage, current, power or resistance can be adjusted using the rotary knobs or entered directly via a numeric pad.

To prevent unintentional operations, all operation controls can be locked.



Multilingual screen



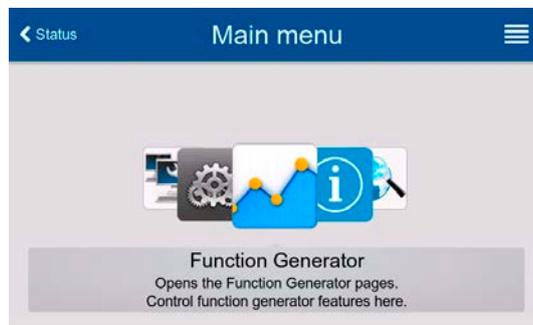
German



Chinese



Russian

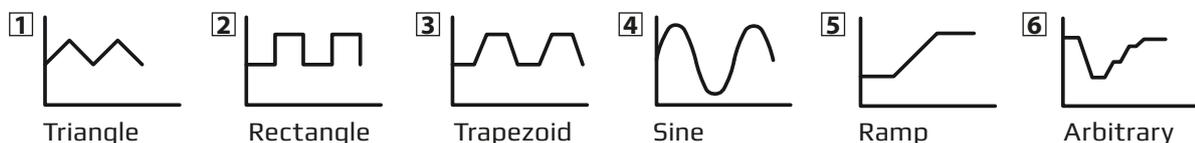


English

Function generator

All models of this series include a software based function generator which can generate typical functions, as displayed in the figure below, and apply them to either the voltage or the current. The generator can be completely configured and controlled by using the touch panel on the front of the device, or by remote control via one of the digital interfaces.

The predefined functions offer all necessary parameters to the user, such as Y offset, time / frequency or amplitude, for full configuration ability.



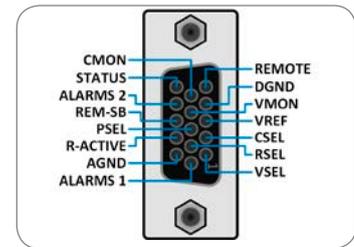
EA-PSB 10000 30 kW

Additionally to the standard functions, which are all based upon a so-called arbitrary generator, this generator is accessible for the creation and execution of complex sets of function runs, separated into up to 99 sequence points. Those can be used for testing purposes in development and production. The sequence points can be loaded from and saved to a standard USB stick via the USB port on the front panel, making it easy to change between different test sequences.

There is furthermore an XY generator, which is used to generate functions such as IU. It's defined by the user in form of tables (CSV file) and then loaded from USB stick. For photovoltaics related tests, a standard PV curve can be generated and run from user-adjustable key parameters, including an extended version according to the european norm **EN 50530**.

Analog interface

There is a galvanically isolated analog interface terminal, located on the rear of the device. It offers analog inputs to set voltage, current, power and resistance from 0...100% through control voltages of 0 V...10 V or 0 V...5 V. To monitor the output voltage and current, there are analog outputs with 0 V...10 V or 0 V...5 V. Also, several inputs and outputs are available for controlling and monitoring the device status.



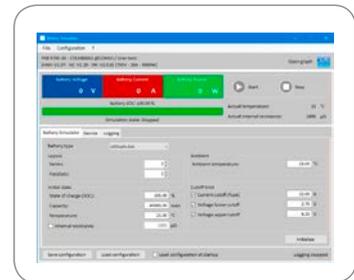
Control software

Included with the devices is a control software for Windows PCs, called **EA Power Control** (see page 146), which allows for the remote control of multiple identical or even different types of devices. It has a clear interface for all set and actual values, a direct input mode for SCPI and ModBus RTU commands, a firmware update feature and the semi-automatic table control named "Sequencing".

Further features which can be unlocked by a purchasable license:

- Graphical visualization of the actual values
- **Multi Control** - an app to control up to 20 units at once, including Sequencing and Function Generator
- Full function generator configuration and control with function like standard PV, PV **EN 50530**, **Sandia**, **SAS**, **battery test** and **MPP tracking**

There is furthermore an optionally available, USB dongle licensed battery simulation software for Windows PCs, the **EA Battery Simulator**. In combination with one or multiple EA-PSB 10000 devices and within their ratings it can simulate standard lead-acid (AGM) and lithium-ion batteries in series or parallel connection for a wide variety of battery related tests. The user can adjust typical battery parameters for the test profile. Once the test has started, it runs automatically. The combination of a power supply and this software covers a wide range of battery voltages and also charging/discharging currents and helps to eliminate the requirement for multiple different test equipments and softwares. Also see page 148.



Water-cooling

While standard water-cooling systems use an air flow-through engaged by fans in order to cool internal electronic components like an auxiliary power supply, this series premieres a new water-cooling system where no additional heat is exhausted anymore. All internal heat is dissipated into the water. This can help to cut down on additional, expensive exhaust systems for cabinets or rooms. Also, this option will be available for all voltage classes.

Options

- Digital interface modules for RS232, CAN, CANopen, ModBus TCP, Profibus, Profinet or EtherCAT. The interface slot is located on the rear panel, making it easy for the user to plug in a new interface or to replace an existing one (also see page 144)
- Water-cooling (also see page 150)
- Grid protection & supervision module EA-ENS2 (only for 400 V supply, also see page 151)



EA-PSB 10000 30 kW



Technical Data	Series EA-PSB 10000 4U
AC: Supply	
- Voltage / Phases	Standard models: 380 / 400 / 480 V, $\pm 10\%$, 3ph US 208 V models: 208 V, $\pm 10\%$, 3ph
- Frequency	45...66 Hz
- Power factor	>0.99
DC: Voltage	
- Accuracy	$\leq 0.05\%$ of rated value
- Load regulation 0-100%	$\leq 0.05\%$ of rated value
- Line regulation $\pm 10\% \Delta U_{AC}$	$\leq 0.02\%$ of rated value
- Regulation 10-100% load	≤ 1.5 ms
- Slew rate 10-90% (source mode)	Max. 30 ms
- Overvoltage protection	Adjustable, 0...110% U_{Nom}
DC: Current	
- Accuracy	$\leq 0.1\%$ of rated value
- Load regulation 1-100% ΔU_{DC}	$\leq 0.15\%$ of rated value
- Slew rate (sink) 10-90%	≤ 1 ms
DC: Power	
- Accuracy	$\leq 0.3\%$ of rated value
DC: Resistance	
- Accuracy	$\leq 0.3\%$ of max. resistance + 0.1% of rated current
Protection	OT, OVP, OPP, PF, OCP, SF ⁽²⁾
Insulation	
- DC output to enclosure (PE)	Depending on model, see tables
Degree of pollution	2
Protection class	1
Display / control panel	Graphics color display with touch panel
Digital interfaces	
- Built-in	1x USB and 1x Ethernet (100 MBit) for communication, galvanically isolated 1x USB type A for USB stick (data recording etc.)
- Slot	1x for retrofittable plug-in modules (CAN, CANopen, RS232, ModBus TCP, Profinet, Profibus, EtherCAT)
Analog interface	Built-in, 15 pole D-Sub (female), galvanically isolated
- Signal range	0...5 V or 0...10 V (switchable)
- Inputs	U, I, P, R, remote control on-off, DC output on-off, resistance mode on-off
- Outputs	U, I, alarms, reference voltage, status
- Accuracy U / I / P / R	0...10 V: $\leq 0.2\%$ 0...5 V: $\leq 0.4\%$
Parallel operation	Yes, with master-slave bus, up to 64 units
Standards	EN 61010-1:2011-07, EN 50160:2011-02 Grid class 2 EN 61000-6-2:2016-05, EN 61000-6-3:2011-09 Class B
Cooling	Air (temperature-controlled fans), optional: water
Operation temperature	0...50 °C (32...133 °F)
Storage temperature	-20...70 °C (-4...158 °F)
Relative humidity	$\leq 80\%$, non-condensing
Operation altitude	≤ 2000 m (1.242 mi)
Dimensions (W x H x D) ⁽¹⁾	19" x 4U x 670 mm (26.4")

(1) Enclosure only, not overall
(2) See page 157

EA-PSB 10000 30 kW

Technical Data	PSB 10060-1000 4U	PSB 10080-1000 4U	PSB 10200-420 4U
Rated voltage & range	0...60 V	0...80 V	0...200 V
- Ripple (source mode) ⁽¹⁾	≤480 mV _{pp} / ≤37 mV _{RMS}	≤480 mV _{pp} / ≤37 mV _{RMS}	≤450 mV _{pp} / ≤60 mV _{RMS}
Insulation			
- Negative DC <-> PE	±500 V DC	±500 V DC	±725 V DC
- Positive DC <-> PE	+600 V DC	+600 V DC	+1000 V DC
Rated current & range	0...1000 A	0...1000 A	0...420 A
Rated power	0...30 kW (0...15 kW ⁽⁴⁾)	0...30 kW (0...15 kW ⁽⁴⁾)	0...30 kW (0...15 kW ⁽⁴⁾)
Efficiency ⁽⁵⁾	Up to 94%	Up to 94%	Up to 94.2%
Weight ⁽²⁾	≈ 50 kg (110 lb)	≈ 50 kg (110 lb)	≈ 50 kg (110 lb)
Ordering number (standard)	30000800	30000801	30000802
Ordering number (WC) ⁽³⁾	30000820	30000821	30000822
Ordering number (US208V)	30008800	30008801	30008802
Ordering number (US208V+WC) ⁽³⁾	30008820	30008821	30008822

Technical Data	PSB 10360-240 4U	PSB 10500-180 4U	PSB 10750-120 4U
Rated voltage & range	0...360 V	0...500 V	0...750 V
- Ripple (source mode) ⁽¹⁾	≤480 mV _{pp} / ≤83 mV _{RMS}	≤525 mV _{pp} / ≤105 mV _{RMS}	≤1200 mV _{pp} / ≤300 mV _{RMS}
Insulation			
- Negative DC <-> PE	±1500 V DC	±1500 V DC	±1500 V DC
- Positive DC <-> PE	+2000 V DC	+2000 V DC	+2000 V DC
Rated current & range	0...240 A	0...180 A	0...120 A
Rated power	0...30 kW (0...15 kW ⁽⁴⁾)	0...30 kW (0...15 kW ⁽⁴⁾)	0...30 kW (0...15 kW ⁽⁴⁾)
Efficiency ⁽⁵⁾	Up to 94.6%	Up to 95.3%	Up to 95.5%
Weight ⁽²⁾	≈ 50 kg (110 lb)	≈ 50 kg (110 lb)	≈ 50 kg (110 lb)
Ordering number (standard)	30000803	30000804	30000805
Ordering number (WC) ⁽³⁾	30000823	30000824	30000825
Ordering number (US208V)	30008803	30008804	30008805
Ordering number (US208V+WC) ⁽³⁾	30008823	30008824	30008825

Technical Data	PSB 11000-80 4U	PSB 11500-60 4U	PSB 12000-40 4U
Rated voltage & range	0...1000 V	0...1500 V	0...2000 V
- Ripple (source mode) ⁽¹⁾	≤2400 mV _{pp} / ≤450 mV _{RMS}	≤3600 mV _{pp} / ≤600 mV _{RMS}	≤3600 mV _{pp} / ≤600 mV _{RMS}
Insulation			
- Negative DC <-> PE	±1500 V DC	±1500 V DC	±1500 V DC
- Positive DC <-> PE	+2000 V DC	+2000 V DC	+2000 V DC
Rated current & range	0...80 A	0...60 A	0...40 A
Rated power	0...30 kW (0...15 kW ⁽⁴⁾)	0...30 kW (0...15 kW ⁽⁴⁾)	0...30 kW (0...15 kW ⁽⁴⁾)
Efficiency ⁽⁵⁾	Up to 94.6%	Up to 95.3%	Up to 95.5%
Weight ⁽²⁾	≈ 50 kg (110 lb)	≈ 50 kg (110 lb)	≈ 50 kg (110 lb)
Ordering number (standard)	30000806	30000807	30000808
Ordering number (WC) ⁽³⁾	30000826	30000827	30000828
Ordering number (US208V)	30008806	30008807	30008808
Ordering number (US208V+WC) ⁽³⁾	30008826	30008827	30008828

(1) RMS value: measured at LF with BWL 300 kHz, PP value: measured at HF with BWL 20MHz

(2) Weight of the standard version, models with option(s) may vary

(3) WC = water-cooling

(4) US 208 V models

(5) Both directions, i. e. source and sink mode

