EA-PSB 9000 3U 2.5 kW - 15 kW

Programmable bidirectional DC power supplies

EA-PSB 91500-30 3U

U I P R OVP OCP OPP OTP

19“ MS USB Option: IFAB IEEE WC

- For 208 V or wide range 342...528 V AC supply
- Bidirectional device - power supply and electronic load in one
- Energy recovery with high efficiency
- Power ratings: 2.5 kW, 5 kW, 7.5 kW, 10 kW or 15 kW, expandable up to 540 kW
- Voltage ratings: 60 V up to 1500 V
- Current ratings: 20 A up to 360 A
- Flexible, power regulated DC<->AC stage
- Various protection circuits (OVP, OCP, OPP, OTP)
- Intuitive TFT touch panel with display for values, status and notifications
- Remote sensing with automatic detection
- Galvanically isolated analog interface and USB port
- Integrated function generator
- Battery test, MPP tracking simulation
- Optional, digital interface modules
- SCPI command set and ModBus RTU (optionally: ModBus TCP) support
- LabView VIs and control software for Windows

General

The microprocessor-controlled, bidirectional power supplies of series EA-PSB 9000 3U incorporate 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 the unavoidable capacitance on the DC terminal. For a connected source, the devices are full electronic loads with energy recovery feature, such as the devices from series EA-ELR 9000.
In source operation mode the device becomes a flexible, autoranging power supply like those of series EA-PSI 9000. 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.

AC supply

All models are provided with an active Power Factor Correction (PFC) circuit and are designed for operation on a two- or three-phase supply with typical ratings between 380 V and 480 V AC. During load operation, the device regenerates the consumed DC energy and feeds it back into the local power network. This can help saving a lot of energy costs.

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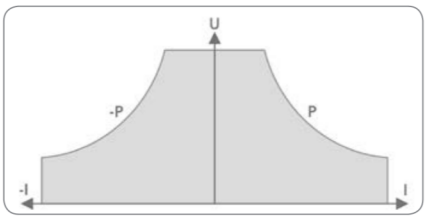
Autoranging power stage

All models are equipped with a flexible autoranging 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

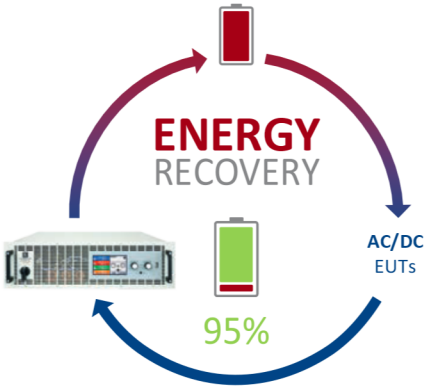
DC voltages between 0...60 V and 0...1500 V, current ratings between 0...20 A and 0...360 A and power ratings of 0...5 kW, 0...10 kW or 0...15 kW are available. The DC terminal is located on the rear panel.

Source-sink operation

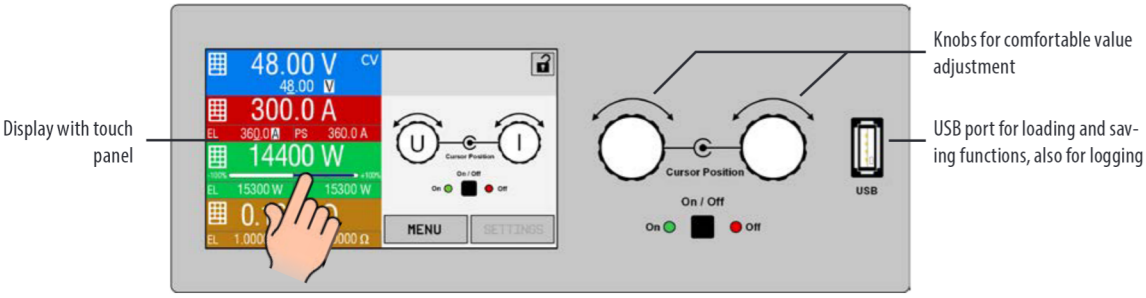
One salient feature of these devices is the coalescence of an electronic load, also called sink, and a power supply, also called source, into one unit. It means, the device cannot only arbitrarily operate as sink or source, the switchover between these two operating modes occurs without interruption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

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%. 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. The figure on the right illustrates the principle.



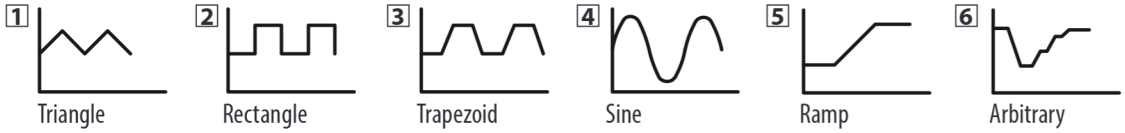
Display and control panel



Set values and actual values of input & output voltage / current / power are clearly represented on the 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.

Function generator

All models of this series include a true 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.



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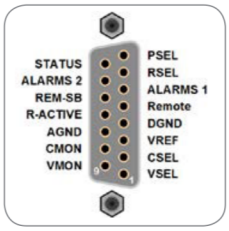
Additionally to the standard functions, which are all based upon a so-called arbitrary generator, this generator is accessible for the creation and execution of complex sets of function runs, separated into up to 99 sequence points. Those can be used for testing purposes in development and production. 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.

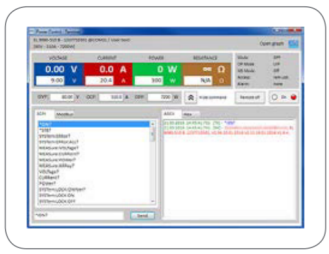
Master-slave

All models feature a digital master-slave bus by default. It can be used to connect up to 36 units of identical models in parallel operation to a bigger system with totals formation of the actual value of voltage, current and power. 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).

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

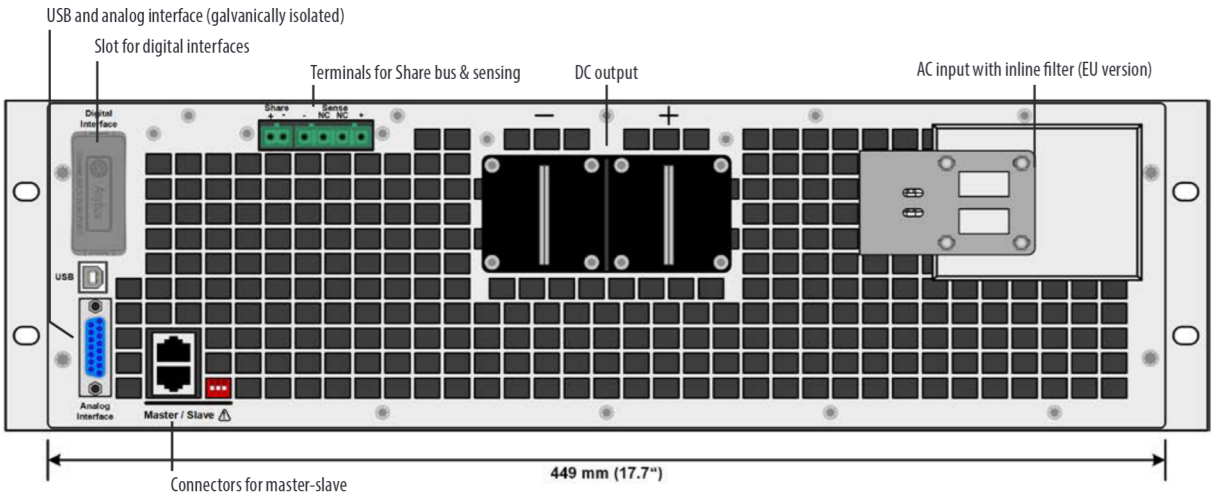
Included with the device is a control software for Windows PCs, which allows for the remote control of multiple identical or even different types of devices. It has a clear interface for all set and actual values, a direct input mode for SCPI and ModBus RTU commands, a firmware update feature and the semi-automatic table control named “Sequencing”. Further features which can be unlocked by a purchasable license:

- Graphical visualization of the actual values
- Support for full remote configuration and control of the function generator
- Multi Control - an app to control up to 20 units at once, including Sequencing and Function Generator

Options

- Digital interface modules for RS232, CAN, CANopen, ModBus TCP, Profibus, Profinet, EtherCAT or Ethernet. The interface slot is located on the rear panel (standard models only), making it easy for the user to plug in a new interface or to replace an existing one. The interface will be automatically detected by the device and requires no or only little configuration. See page 116.
- Three-way interface (3W) with a rigid GPIB port installed instead of the default slot for retrofittable interface modules
- Water cooling (upon request, also see page 121)

Rear view of standard model



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Technical Data	Series PSB 9000 3U	
AC: Supply		
- Voltage	Standard models: 342...528 V, 2ph/3ph US208V models: 188...229 V, 2ph/3ph	
- Frequency	45...66 Hz	
- Power factor	>0.99	
DC: Voltage		
- Accuracy	<0.1% of rated value	
- Load regulation 0-100%	<0.05% of rated value	
- Line regulation ±10% ΔU_{AC}	<0.02% of rated value	
- Regulation 10-100% load	<2 ms	
- Slew rate 10-90% (source mode)	Max. 30 ms	
- Overvoltage protection	Adjustable, 0...110% U_{Nom}	
DC: Current		
- Accuracy	<0.2% of rated value	
- Load regulation 1-100% ΔU_{DC}	<0.15% of rated value	
- Slew rate (sink) 10-90%	≤1 ms	
DC: Power		
- Accuracy	<1% of rated value	
DC: Resistance		
- Accuracy	≤1% of max. resistance + 0.3% of rated current	
Protection	OT, OVP, OPP, PF, OCP (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 type B for communication, 1x GPIB (optional with option 3W)	
- Slot	1x for retrofittable plug-in modules (not with option 3W)	
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: <0.2%	0...5 V: <0.4%
Parallel operation	Yes, with master-slave bus, up to 36 units	
Standards	EN 61010-1:2001-07, EN 50160:2011-02 Grid class 2, EN 61000-6-2:2016-05, EN 61000-6-3:2011-09 Class B	
Cooling	Temperature-controlled fans (optional: water)	
Operation temperature	0...50 °C	
Storage temperature	-20...70 °C	
Relative humidity	<80%, non-condensing	
Operation altitude	<2000 m (1.242 mi)	
Dimensions (W x H x D) (1	19" x 3U x 669 mm (26.4")	

(1 Enclosure only, not overall
(2 See page 126

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Technical Data	PSB 9060-120 3U	PSB 9080-120 3U	PSB 9200-70 3U	PSB 9360-40 3U	PSB 9500-30 3U
Rated voltage & range	0...60 V	0...80 V	0...200 V	0...360 V	0...500 V
- Ripple (source) [1]	<200 mV_{PP} / <16 mV_{RMS}	<200 mV_{PP} / <16 mV_{RMS}	<300 mV_{PP} / <40 mV_{RMS}	<320 mV_{PP} / <55 mV_{RMS}	<350 mV_{PP} / <70 mV_{RMS}
Insulation (neg. DC pole to PE)	±400 V DC	±400 V DC	±725 V DC	±725 V DC	±1500 V DC
Insulation (pos. DC pole to PE)	±400 V DC	±400 V DC	±1000 V DC	±1000 V DC	±1800 V DC
Rated current & range	0...120 A	0...120 A	0...70 A	0...40 A	0...30 A
Rated power (standard model)	0...5000 W	0...5000 W	0...5000 W	0...5000 W	0...5000 W
Rated power (US 208 V model)	0...2500 W	0...2500 W	0...2500 W	0...2500 W	0...2500 W
Efficiency	≈95%	≈95%	≈95%	≈95%	≈95%
Weight [2]	≈18 kg (39.7 lb)	≈18 kg (39.7 lb)	≈18 kg (39.7 lb)	≈18 kg (39.7 lb)	≈18 kg (39.7 lb)
Ordering nr. (standard model)	30000319	30000301	30000302	30000303	30000304
Ordering nr. (US 208 V model)	30008319	30008301	30008302	30008303	30008304

Technical Data	PSB 9750-20 3U	PSB 9060-240 3U	PSB 9080-240 3U	PSB 9200-140 3U	PSB 9360-80 3U
Rated voltage & range	0...750 V	0...60 V	0...80 V	0...200 V	0...360 V
- Ripple (source) [1]	<800 mV_{PP} / <200 mV_{RMS}	<320 mV_{PP} / <25 mV_{RMS}	<320 mV_{PP} / <25 mV_{RMS}	<300 mV_{PP} / <40 mV_{RMS}	<320 mV_{PP} / <55 mV_{RMS}
Insulation (neg. DC pole to PE)	±1500 V DC	±400 V DC	±400 V DC	±725 V DC	±725 V DC
Insulation (pos. DC pole to PE)	±1800 V DC	±400 V DC	±400 V DC	±1000 V DC	±1000 V DC
Rated current & range	0...20 A	0...240 A	0...240 A	0...140 A	0...80 A
Rated power (standard model)	0...5000 W	0...10000 W	0...10000 W	0...10000 W	0...10000 W
Rated power (US 208 V model)	0...2500 W	0...5000 W	0...5000 W	0...5000 W	0...5000 W
Efficiency	≈95%	≈95%	≈95%	≈95%	≈95%
Weight [2]	≈18 kg (39.7 lb)	≈25 kg (55.1 lb)	≈25 kg (55.1 lb)	≈25 kg (55.1 lb)	≈25 kg (55.1 lb)
Ordering nr. (standard model)	30000305	30000320	30000306	30000307	30000308
Ordering nr. (US 208 V model)	30008305	30008320	30008306	30008307	30008308

Technical Data	PSB 9500-60 3U	PSB 9750-40 3U	PSB 9060-360 3U	PSB 9080-360 3U	PSB 9200-210 3U
Rated voltage & range	0...500 V	0...750 V	0...60 V	0...80 V	0...200 V
- Ripple (source) [1]	<350 mV_{PP} / <70 mV_{RMS}	<800 mV_{PP} / <200 mV_{RMS}	<320 mV_{PP} / <25 mV_{RMS}	<320 mV_{PP} / <25 mV_{RMS}	<300 mV_{PP} / <40 mV_{RMS}
Insulation (neg. DC pole to PE)	±1500 V DC	±1500 V DC	±400 V DC	±400 V DC	±725 V DC
Insulation (pos. DC pole to PE)	±1800 V DC	±1800 V DC	±400 V DC	±400 V DC	±1000 V DC
Rated current & range	0...60 A	0...40 A	0...360 A	0...360 A	0...210 A
Rated power (standard model)	0...10000 W	0...10000 W	0...15000 W	0...15000 W	0...15000 W
Rated power (US 208 V model)	0...5000 W	0...5000 W	0...7500 W	0...7500 W	0...7500 W
Efficiency	≈95%	≈95%	≈95%	≈95%	≈95%
Weight [2]	≈25 kg (55.1 lb)	≈25 kg (55.1 lb)	≈32 kg (70.5 lb)	≈32 kg (70.5 lb)	≈32 kg (70.5 lb)
Ordering nr. (standard model)	30000309	30000310	30000321	30000312	30000313
Ordering nr. (US 208 V model)	30008309	30008310	30008321	30008312	30008313

Technical Data	PSB 9360-120 3U	PSB 9500-90 3U	PSB 9750-60 3U	PSB 91000-40 3U	PSB 91500-30 3U
Rated voltage & range	0...360 V	0...500 V	0...750 V	0...1000 V	0...1500 V
- Ripple (source) [1]	<320 mV_{PP} / <55 mV_{RMS}	<350 mV_{PP} / <70 mV_{RMS}	<800 mV_{PP} / <200 mV_{RMS}	<1600 mV_{PP} / <300 mV_{RMS}	<2400 mV_{PP} / <400 mV_{RMS}
Insulation (neg. DC pole to PE)	±725 V DC	±1500 V DC	±1500 V DC	±1500 V DC	±1500 V DC
Insulation (pos. DC pole to PE)	±1000 V DC	±1800 V DC	±1800 V DC	±1800 V DC	±1800 V DC
Rated current & range	0...120 A	0...90 A	0...60 A	0...40 A	0...30 A
Rated power (standard model)	0...15000 W	0...15000 W	0...15000 W	0...15000 W	0...15000 W
Rated power (US 208 V model)	0...7500 W	0...7500 W	0...7500 W	0...7500 W	0...7500 W
Efficiency	≈95%	≈95%	≈95%	≈95%	≈95%
Weight [2]	≈32 kg (70.5 lb)	≈32 kg (70.5 lb)	≈32 kg (70.5 lb)	≈32 kg (70.5 lb)	≈32 kg (70.5 lb)
Ordering nr. (standard model)	30000314	30000315	30000316	30000317	30000318
Ordering nr. (US 208 V model)	30008314	30008315	30008316	30008317	30008318

(1 RMS value: measured at LF with BWL 300 kHz, PP value: measured at HF with BWL 20MHz
(2 Weight of the base version, models with option(s) may vary
(3 Ordering number of the EU version, US models or such with option(s) installed have different ordering numbers