



Elektro-Automatik



**DATASHEET - preliminary**

# EA-PSB 20000 Triple series

3-Channel Programmable  
Bidirectional DC Power Supply

EA-PSB 20000 Triple 4U

EA-PSB 20000 Triple 4U water-cooled

# EA-PSB 20000 Triple

## 3-Channel Programmable Bidirectional DC Power Supply



### Overview

- EA-PSB 20000 Triple series is the most compact multi-channel bidirectional high power DC source enabling multiple tests with a single device.
- A triple-channel power supply reduces the need for additional equipment. This not only lowers capital expenditure but also simplifies the testing setup, allowing engineers to focus on critical tasks without managing multiple devices.
- With three independent channels, customers can conduct parallel testing on different components or subsystems, such as motors, inverters, and on-board chargers, within the same test setup. This reduces the time needed to validate each component individually.
- The occupation of rack space is reduced by more than 50% when using triple devices instead of single output devices.
- By enabling more efficient testing and reducing the time required for validation and integration, a triple-channel power supply helps customers accelerate their development process. This is particularly important in fast-moving industries like automotive and renewable energy, where being first to market can be a significant competitive advantage.
- Operational expenses are significantly lower due to high energy recovery (up to greater than 96%) when used in bidirectional mode. Both operational and HVAC energy cost savings are realized.

### Features

- Worldwide Input Voltage: 208 V - 480 V, +/- 10%, 3ph AC
- Active Power Factor Correction, typical 0.99
- Very high efficiency of over 96% in regenerative with energy recovery back to the grid
- Voltages from 0 - 60 V up to 0 - 920 V
- High performance with up to 10 kW per channel
- Currents from 0 - 40 A up to 0 - 340 A per channel
- 3 Independent, fully isolated and bidirectional DC output/input stages, with autoranging
- Galvanically isolated Share-Bus for parallel operation
- 3 Built-in high speed control interfaces with 1 ms communication speed

### Built-in interfaces

- USB
- Ethernet (1 Gbit/s)
- EtherCAT
- CAN FD
- Master-Aux-Bus
- Share-Bus
- USB Host on front panel
- Digital In/Out

### Software

- EA Power Control
- EA Battery Simulator

### Options

- Water Cooling in stainless steel

## Technical data

### General specifications

#### AC input

Voltage, Phases	Range 1: 208 V, $\pm 10\%$ , 3ph AC Range 2: 380 - 480 V, $\pm 10\%$ , 3ph AC
Frequency	45 - 66 Hz
Power factor	ca. 0.99
Overvoltage category	II

#### DC output static

Load regulation CV	$\leq 0.05\%$ FS (0 - 100% load, constant output voltage and constant temperature)
Line regulation CV	$\leq 0.01\%$ FS (208 V - 480 V AC $\pm 10\%$ supply voltage, constant load and constant temperature)
Stability CV	$\leq 0.02\%$ FS (during 8 h of operation, after 30 minutes warm-up, at constant output voltage, load and temperature)
Temperature coefficient CV	$\leq 30$ ppm/ $^{\circ}\text{C}$ (after 30 minutes of warm-up)
Compensation (remote sense)	$\leq 5\%$ $U_{\text{Nominal}}$
Load regulation CC	$\leq 0.1\%$ FS (0 - 100% load, constant output voltage and constant temperature)
Line regulation CC	$\leq 0.01\%$ FS (208 V - 480 V AC $\pm 10\%$ supply voltage, constant load and constant temperature)
Stability CC	$\leq 0.02\%$ FS (during 8 h of operation, after 30 minutes warm-up, at constant output voltage, load and temperature)
Temperature coefficient CC	$\leq 50$ ppm/ $^{\circ}\text{C}$ (after 30 minutes of warm-up)
Load regulation CP	$\leq 0.3\%$ FS (0 - 100% load, constant output voltage and constant temperature)
Load regulation CR	$\leq 0.3\%$ FS + 0.1% FS current (0 - 100% load, constant output voltage and constant temperature)

#### Protective functions

OVP	Overvoltage protection, adjustable 0 - 110% $U_{\text{Nominal}}$
OCP	Overcurrent protection, adjustable 0 - 110% $I_{\text{Nominal}}$
OPP	Overpower protection, adjustable 0 - 110% $P_{\text{Nominal}}$
OT	Overtemperature protection (DC output shuts down in case of insufficient cooling)

#### DC output dynamic

Rise time 10 - 90% CV	$\leq 10$ ms
Fall time 90 - 10% CV	$\leq 10$ ms
Rise time 10 - 90% CC	$\leq 2$ ms
Fall time 90 - 10% CC	$\leq 2$ 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) *1
AC input to case (PE)	2500 Vrms
DC output to case (PE)	Depending on the model, see model tables
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 (1 GBit), EtherCAT, CAN FD all for communication,
Communication speed	$\leq 1$ ms
Front galvanically isolated	USB-host, for data acquisition

#### Interfaces analog

Built-in, galvanically isolated	16 pole
Inputs	3x independent, user-configurable
Outputs	3x independent, as dry contact

<b>General specifications</b>	
<b>Device configuration</b>	
Parallel operation with Share bus	PSB 20000 Triple series: up to 8 units of this series
<b>Safety and EMC</b>	
Safety	EN 61010-1 IEC 61010-1 UL 61010-1 CSA C22.2 No 61010-1 BS EN 61010-1
EMC	EN 55011, class A, group 1 CISPR 11, class A, group 1 FCC 47 CFR part 15B, unintentional radiator, class A EN 61326-1 including tests according to: - EN 61000-4-2 - EN 61000-4-3 - EN 61000-4-4 - EN 61000-4-5 - EN 61000-4-6
Appliance class	I
Ingress protection	IP20
<b>Environmental conditions</b>	
Operating temperature	0 - 50 °C (32 - 122 °F)
Storage temperature	-20 - 70 °C (-4 - 158 °F)
Humidity	≤80% relative humidity, non-condensing
Altitud	≤2000 m (≤6,600 ft)
Pollution degree	2
<b>Mechanical construction</b>	
Cooling	Forced air flow from front to rear (temperature-controlled fans), optional water cooling
Dimensions (W x H x D)	Enclosure: 483 mm (19 in) x 177 mm (4U) x 668 mm (26.3 in) Overall depth: min. 802 mm (min. 31.6 in)
Weight	50 kg (110 lb)
Weight with water cooling	56 kg (126 lb)

## Technical data EA-PSB 20000 Triple 4U

Technical specifications	PSB 20060-340 Triple	PSB 20080-340 Triple	PSB 20200-140 Triple	PSB 20360-80 Triple
<b>DC output per channel</b>				
Number of channels	3	3	3	3
Total device power range	0 – 30000 W	0 – 30000 W	0 – 30000 W	0 – 30000 W
Voltage range	0 - 60 V	0 - 80 V	0 - 200 V	0 - 360 V
Current range	0 - 340 A	0 - 340 A	0 - 140 A	0 - 80 A
Efficiency sink/source (up to)	95.1%	95.5%	95.3%	95.8%
Article number	30334401	30334402	30334403	30334404
Article number water cooled	30354401	30354402	30354403	30354404

Technical specifications	PSB 20500-60 Triple	PSB 20920-40 Triple		
<b>DC output per channel</b>				
Number of channels	3	3		
Total device power range	0 – 30000 W	0 – 30000 W		
Voltage range	0 - 500 V	0 - 920 V		
Current range	0 - 60 A	0 - 40 A		
Efficiency sink/source (up to)	96.5%	96.5%		
Article number	30334405	30334407		
Article number water cooled	30354405	30354407		

## General

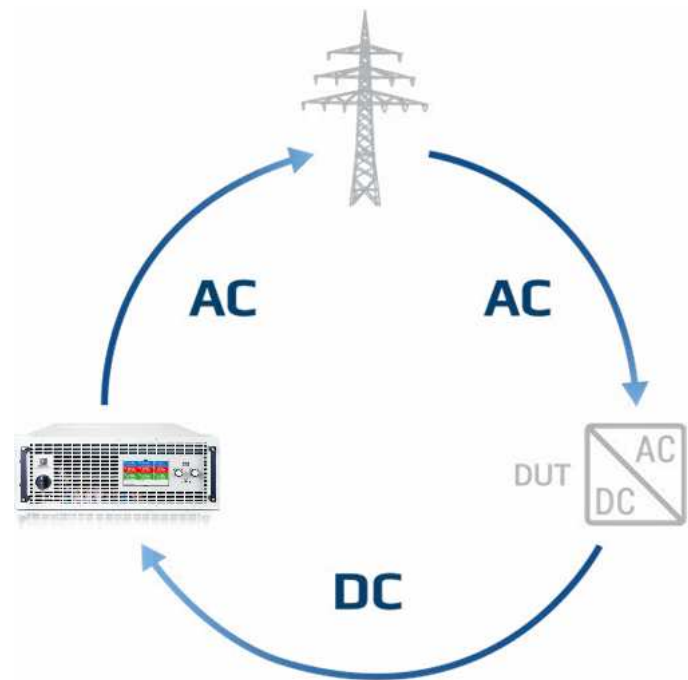
The bidirectional DC laboratory power supplies in the PSB 20000 Triple series from EA Elektro-Automatik are two quadrant devices which can perform the function of a power supply (source) as well as that of an electronic load (sink). In sink mode the device is regenerative and feeds the energy back into the local grid with an efficiency of up to 96%. The DC voltages and currents are determined by the application and the spectrum ranges from 0 - 60 V to 0 - 920 V and from 0 - 40 A up to 0 - 340 A per channel in a single device. The DC supply operates as a flexible output stage with a constant power characteristic (autoranging) with a wide voltage and current range. To achieve higher power and current all units are equipped with a master-slave bus. This enables up to 8 parallel connected devices to be combined into one system which can provide up to 240 kW and 8160 A. Furthermore, typical laboratory functionality is provided. This includes an extensive function generator, alarm and warning management, various industrial communication interfaces, software solutions and many more functions.

## AC connection

The DC power supplies in the PSB 20000 Triple 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. It reaches from 208 V to 380/400/480 V. Hence the devices can be operated in the majority of global grids. They adjust automatically, without additional configuration, to the available grid voltage. In a 208 V AC grid a derating of the DC output power is automatically set.

## Energy recovery

The energy consumed in load mode is fed back into the connected grid with an efficiency of up to 96%. As the energy is not converted to heat as in other loads, the energy costs are reduced. In addition, the devices generate less heat requiring less cost intensive air conditioning. One device can already be sufficient for a while range of applications, reducing investment and installation costs.



## The principle of energy recovery

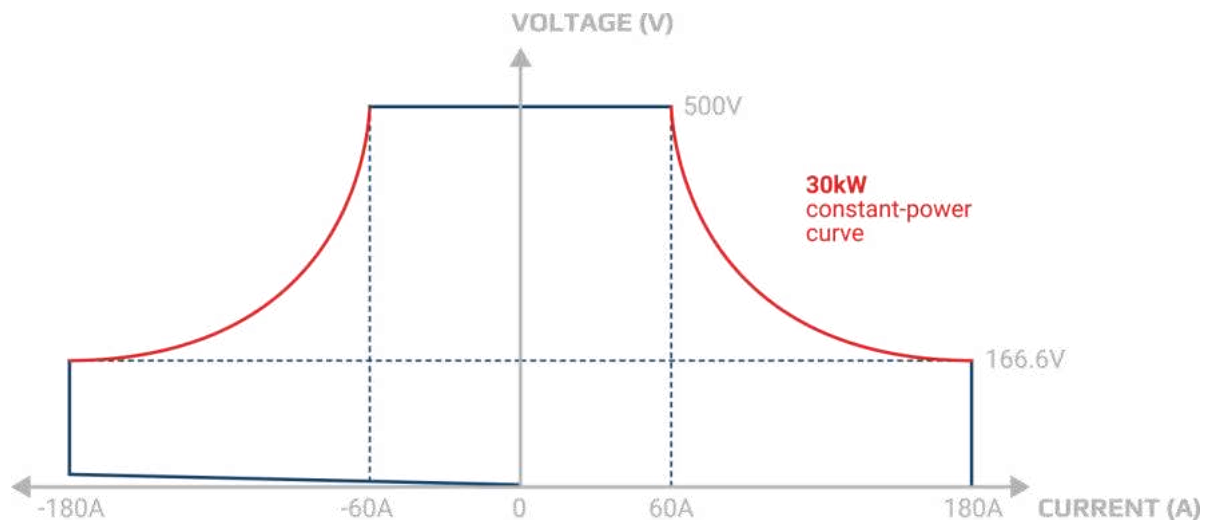
The figure above demonstrates, based on a typical application, how a „device under test“ consumes energy from the mains, converts it to DC and feeds that into an EA device. The bidirectional power supply PSB 20000 Triple series converts this energy back into an AC current and feeds it back into the grid.

## DC output

The DC output of the power supplies in series PSB 20000 Triple 4U is rated for DC voltages of 0 - 60 V up to 0 - 920 V and allowing currents of 0 - 40 A up to 0 - 340 A per channel. 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 done via copper blades 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 copper rails. A cover for contact protection is provided.



## The principle of autoranging

„Autoranging“ is a term used when a programmable DC power supply automatically offers a wider output range of both, voltage and current, to maintain full power across a wide operation range. This type of solution allows the use of a single unit to address multiple voltage and current combinations.

## Function generator

All models in the PSB 20000 Triple series are equipped with a function generator. This allows waveforms such as sine, triangle, square or trapezoid to be simply called up and applied to either the voltage or the current. 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, which saves time. For simulation of a photovoltaics system or fuel cells, adaptable tables are provided. With the integrated and adjustable PV characteristics curve DIN EN 50530 various solar modules can be defined and entire day trend progression can be simulated.

Conclusion: the user is supported by a multitude of useful functions.

## Interfaces

As standard PSB 20000 Triple series devices are fitted with the most important interfaces and ports which are all galvanically isolated from the AC input and DC output.

Communication Interfaces are:

- 100 Mbit EtherCAT (2x In/Out, 1x Master)
- Gbit Ethernet
- 5 Mbit CAN FD
- USB

## High performance systems

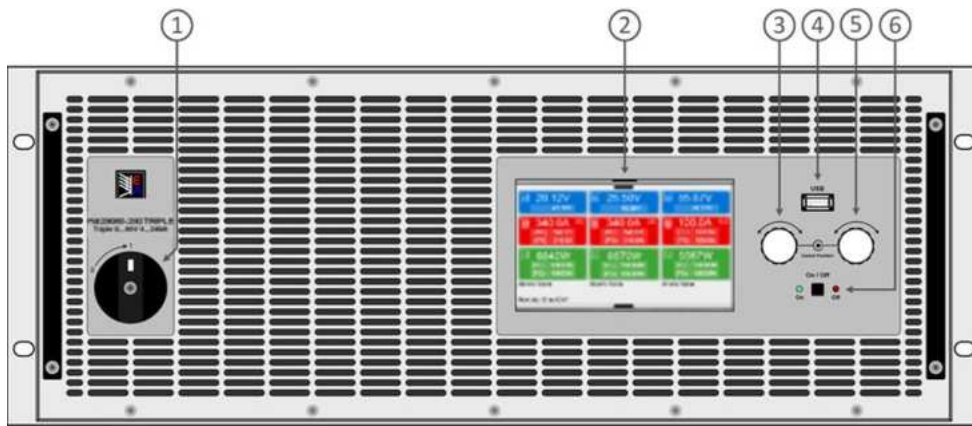
High power applications can be covered with high power systems of up to 240 kW. This is achieved by connecting the DC terminals of multiple PSB 20000 Triple 4U devices with copper rails in parallel. Thus, a 19" cabinet with 42 U can provide a system with 240 kW occupying only 0.6 m<sup>2</sup> (6.5 sqft) of floor space. The master-slave bus allows for up to 8 units with 30 kW each to behave as one unit.

## Master-slave bus and Share bus

When the integrated master-slave bus and Share bus are used, a multi device system behaves as a single device. The buses are simply connected between each device. With the master-slave bus the system data, such as total power and total current, are collected and displayed on the master unit. Warnings and alarms of the slave devices are also clearly displayed. The Share bus cares for a balanced load distribution between the individual units.

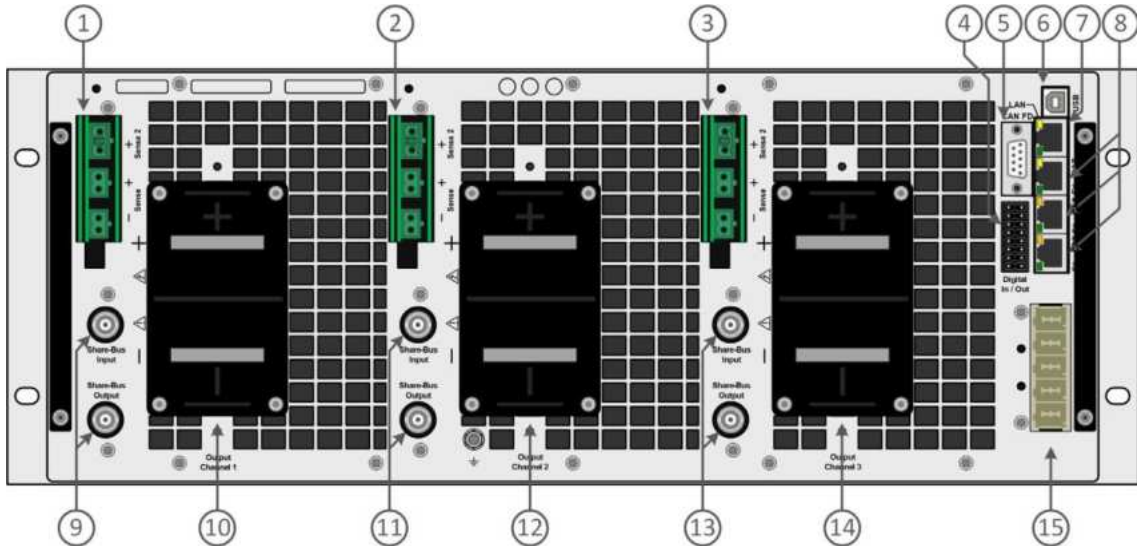


## Front panel description PSB 20000 Triple 4U $\leq 200$ V



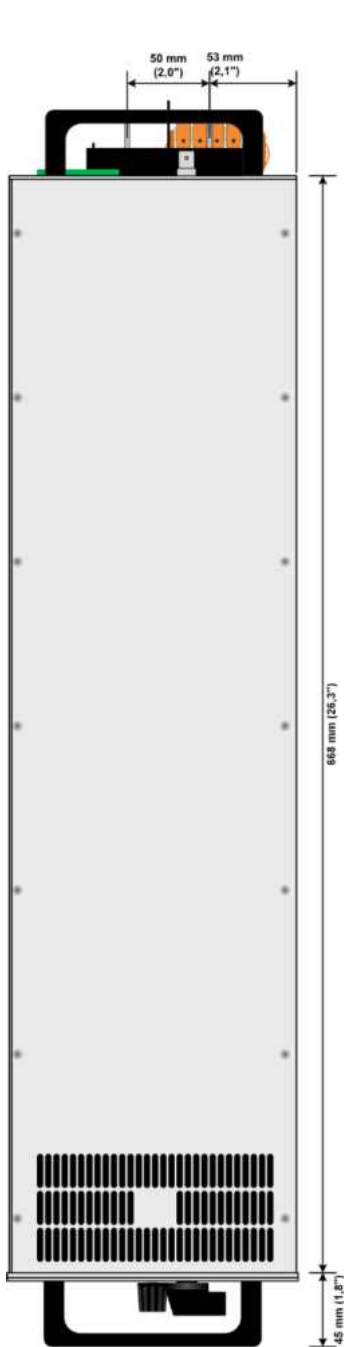
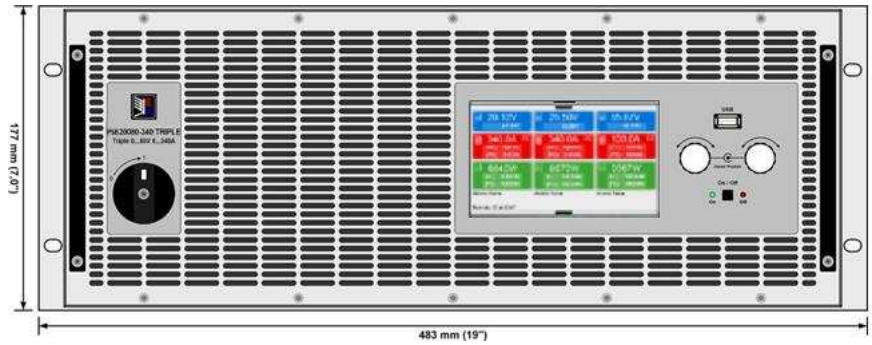
1. Power switch
2. TFT control interface, interactive operation and display
3. Rotary knob with push-button action, for settings and control
4. USB host, uses USB sticks for data logging and sequencing
5. Rotary knob with push-button action, for settings and control
6. On / Off push-button with LED status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

## Rear panel description PSB 20000 Triple 4U $\leq 200$ V

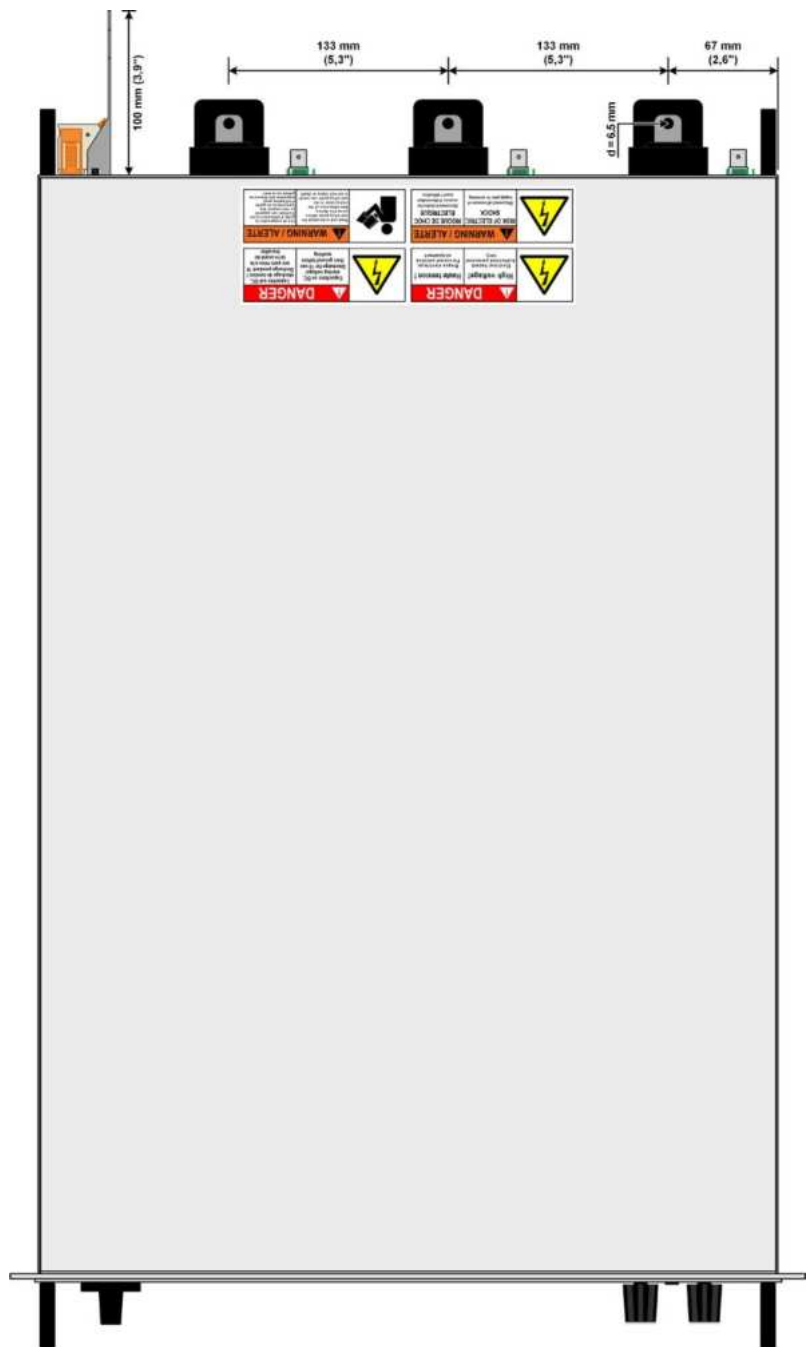


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|--|---|
| <ol style="list-style-type: none"> <li>2. Remote sense connectors Channel 1</li> <li>3. Remote sense connectors Channel 2</li> <li>4. Remote sense connectors Channel 3</li> <li>5. Digital In/Out (16 pole connector)</li> <li>6. CAN FD interface</li> <li>7. USB interface</li> <li>8. Ethernet interface</li> <li>9. EtherCAT ports</li> </ol> | <ol style="list-style-type: none"> <li>10. Share-Bus connectors Channel 1</li> <li>11. DC output connector (copper blades) Channel 1</li> <li>12. Share-Bus connectors Channel 2</li> <li>13. DC output connector (copper blades) Channel 2</li> <li>14. Share-Bus connectors Channel 3</li> <li>15. DC output connector (copper blades) Channel 3</li> <li>16. AC input connector</li> </ol> |
|--|---|

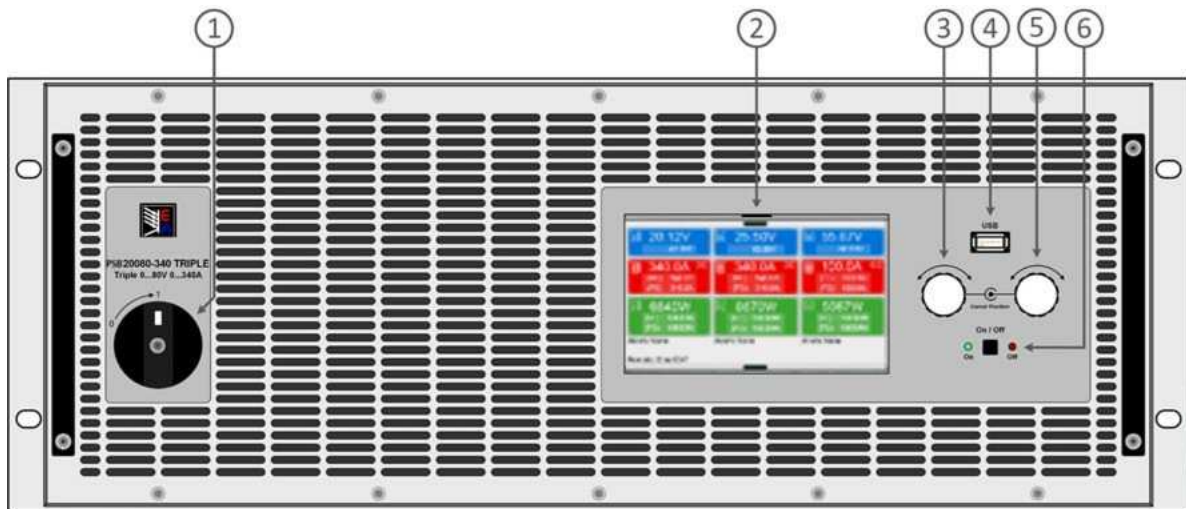
# Technical drawings PSB 20000 Triple 4U $\geq 360$ V



(side view of standard version shown)

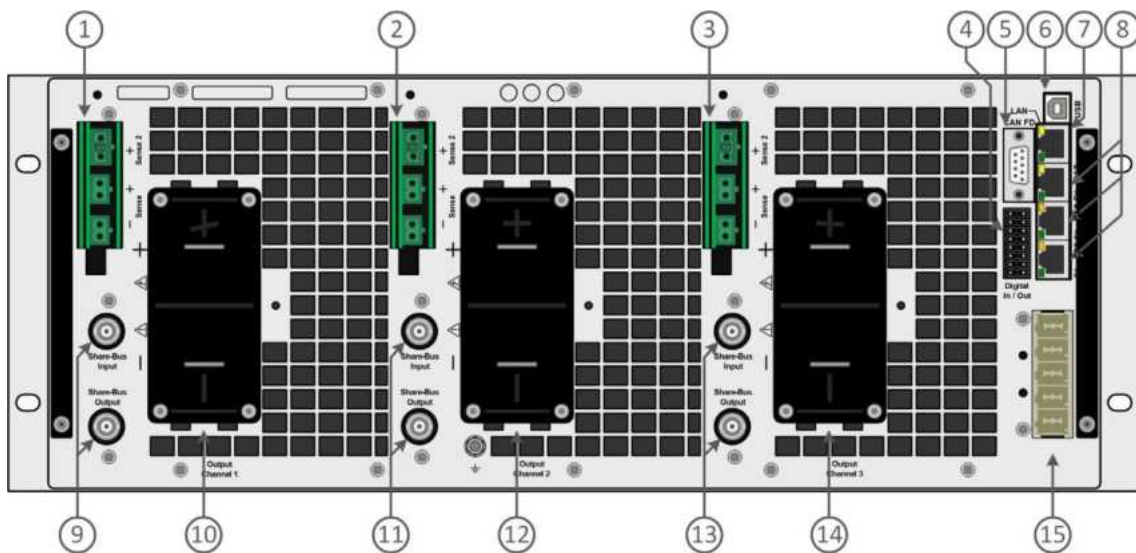


## Front panel description PSB 20000 Triple 4U



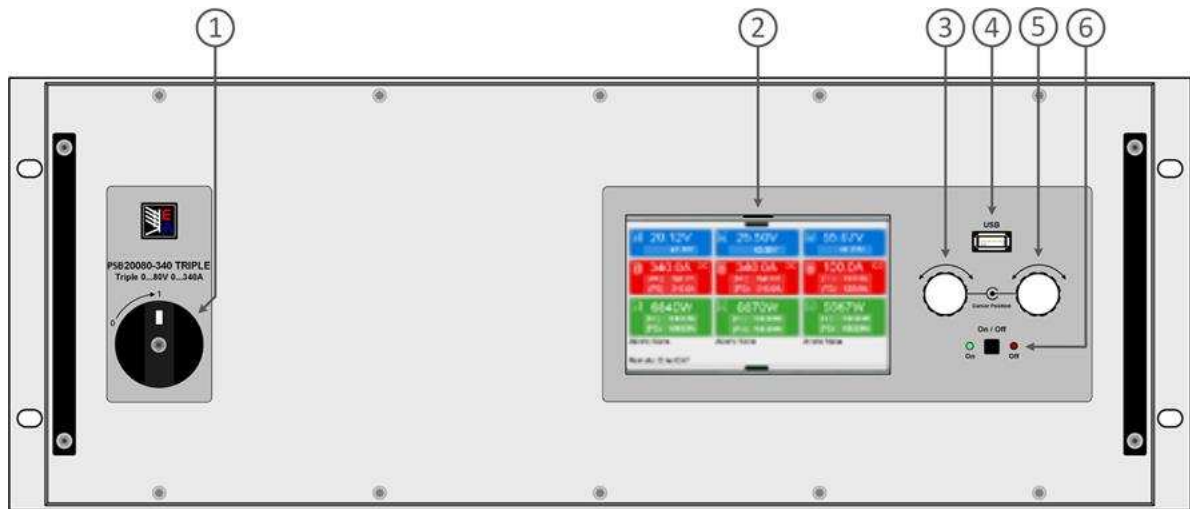
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## Rear panel description PSB 20000 Triple 4U $\geq 360$ V



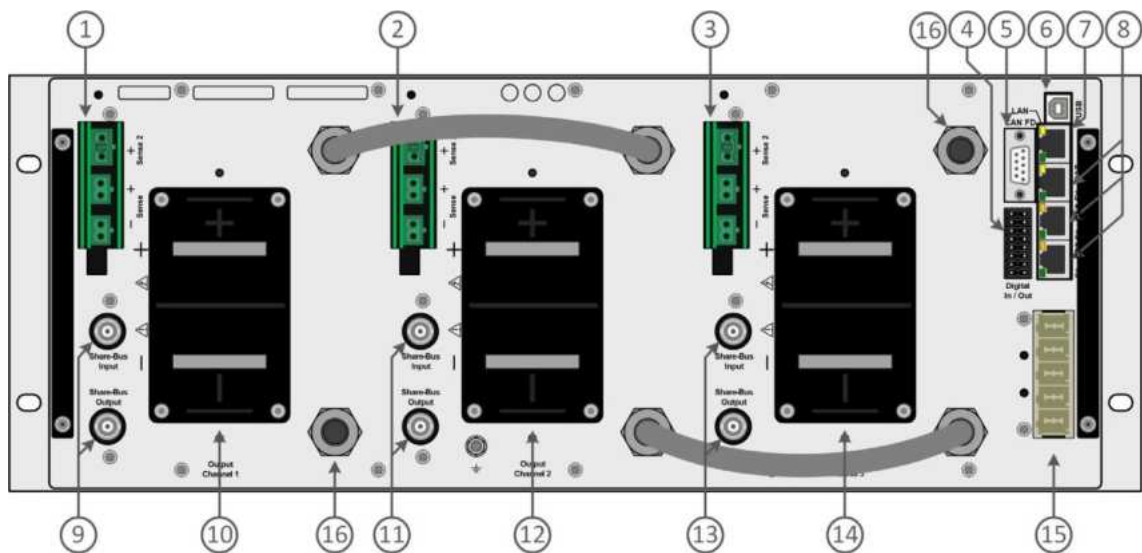
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|--|--|

## Front panel description PSB 2000 Triple 4U WC (water cooling option)



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 2000 Triple 4U WC (water cooling option)



- |  |  |
|--|--|
| <ol style="list-style-type: none"> <li>1. Remote sense connectors Channel 1</li> <li>2. Remote sense connectors Channel 2</li> <li>3. Remote sense connectors Channel 3</li> <li>4. Digital In/Out (16 pole connector)</li> <li>5. CAN FD interface</li> <li>6. USB interface</li> <li>7. Ethernet interface</li> <li>8. EtherCAT ports</li> </ol> | <ol style="list-style-type: none"> <li>9. Share-Bus connectors Channel 1</li> <li>10. DC output connector (copper blades) Channel 1</li> <li>11. Share-Bus connectors Channel 2</li> <li>12. DC output connector (copper blades) Channel 2</li> <li>13. Share-Bus connectors Channel 3</li> <li>14. DC output connector (copper blades) Channel 3</li> <li>15. AC input connector</li> <li>16. Water inlet/outlet</li> </ol> |
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