DATASHEET

EA-PS 10000 4U

Programmable DC Power Supply
EA-PSB 10000 4U
30 KW
Programmable
DC Power Supply

Features
- Wide range input, 208 V - 480 V ±10 % 3ph AC
- Active Power Factor Correction, typical 0.99
- Very high efficiency up to over 96 %
- High performance of 30 kW per unit
- Voltage from 0 - 60 V up to 0 - 2000 V
- Currents from 0 - 40 A up to 0 - 1000 A
- Flexible power regulated DC output stages (autoranging)
- Regulation mode CV, CC, CP 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
- Command languages and drivers: SCPI and ModBus, LabVIEW, IVI

Build-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

Options
- Water Cooling in stainless steel
### General specifications

#### AC Input
- **Voltage, Phases**: 208 V / 380 V / 400 V / 480 V ±10%, 3ph AC (208 V 3ph AC with Derating to 18 kW)
- **Frequency**: 45-66 Hz
- **Power factor**: >0.99
- **Leakage current**: <10 mA
- **Overvoltage category**: 2
- **Pollution degree**: 2

#### DC Output static
- **Load regulation CV**: ≤0.05% FS (0 - 100% load, constant input voltage and constant temperature)
- **Line regulation CV**: ≤0.01% FS (208 V - 480 V AC ±10% input voltage, constant load and constant temperature)
- **Stability CV**: ≤0.02% FS (Over 8hrs interval following 30 minutes warm-up, constant input voltage, load and temperature)
- **Temperature coefficient CV**: ≤30ppm/°C (Following 30 minutes warm up)
- **Compensation (Remote Sense)**: ≤5% \(U_{\text{nominal}}\)
- **Load regulation CC**: ≤0.1% FS (0 - 100% load, constant input voltage and constant temperature)
- **Line regulation CC**: ≤0.01% FS (208 V - 480 V AC ±10% input voltage, constant load and constant temperature)
- **Stability CC**: ≤0.02% FS (Over 8hrs interval following 30 minutes warm-up, constant input voltage, load and temperature)
- **Temperature coefficient CC**: ≤50ppm/°C (Following 30 minutes warm up)
- **Load regulation CP**: ≤0.3% FS (0 - 100% load, constant input voltage and constant temperature)
- **Load regulation CR**: ≤0.3% FS + 0.1% FS current (0 - 100% load, constant input 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, output shuts down in case of insufficient cooling

#### DC Output dynamic
- **Rise time 10 - 90% CV**: ≤20 ms
- **Fall time 90 - 10% CV**: ≤20 ms
- **Rise time 10 - 90% CC**: ≤10 ms
- **Fall time 90 - 10% CC**: ≤10 ms

#### Display accuracy
- **Voltage**: ≤0.05% FS
- **Current**: ≤0.1% FS

#### Insulation
- **AC Input to DC Output**: 3750 Vrms (1 Minute), creepage >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, galvatically isolated**: USB, Ethernet (100 MBit) for communication
  1x USB Host for data acquisition
- **Optional, galvatically isolated**: CAN, CANopen, RS232, ModBus TCP, Profinet, Profibus, EtherCAT, Ethernet

#### Interfaces analog
- **Built-in, galvatically isolated**: 15-pole D-Sub
- **Signal range**: 0 - 10 V or 0 - 5 V (switchable)
- **Inputs**: U, I, P, remote control on/off, DC output on/off
- **Outputs**: Monitor U and I, alarms, reference voltage, status DC output, status CV/CC
- **Accuracy U / I / P**: 0 - 10 V ±0.2%, 0 - 5 V ±0.4%

#### Device configuration
- **Parallel operation**: Up to 64 units of any power class in series 10000, with Master-Slave-Bus and Share-Bus
## General specifications

### Safety and EMC

| Safety | EN 61010-1  
          IEC 61010-1  
          UL 61010-1  
          CSA C22.2 No 61010-1  
          BS EN 61010-1 |
|-----------------|----------------------------------|
| EN 55011, class B  
CISPR 11, class B  
FCC 47 CFR Part 15B, Unintentional Radiator, class B  
EN 61326-1 include tests according to:  
- EN 61000-4-2  
- EN 61000-4-3  
- EN 61000-4-4  
- EN 61000-4-5  
- EN 61000-4-6 |
| Safety protection class | 1 |
| Ingress Protection | IP20 |

### Environmental conditions

| Operating temperature | 0 - 50 °C |
| Storage temperature | -20 - 70 °C |
| Humidity | ≤80% RH, non-condensing |
| Altitude | ≤2000 m (≤6600 ft) |

### Mechanical construction

| Cooling | Forced air flow from front to rear, temperature controlled fans |
| Dimensions (B x H x T) | 19” x 4U x 668 mm (Enclosure only, not over all) |
| Weight | 50.0 kg (110 Lbs) |
| Weight with water cooling | 56.0 kg (126 Lbs) |
### Technical Specifications

<table>
<thead>
<tr>
<th>DC-Output</th>
<th>PS 10060-1000</th>
<th>PS 10080-1000</th>
<th>PS 10200-420</th>
<th>PS 10360-240</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage range</td>
<td>0 - 60 V</td>
<td>0 - 80 V</td>
<td>0 - 200 V</td>
<td>0 - 360 V</td>
</tr>
<tr>
<td>Ripple rms CV</td>
<td>≤25 mV BW 300 kHz</td>
<td>≤25 mV BW 300 kHz</td>
<td>≤40 mV BW 300 kHz</td>
<td>≤55 mV BW 300 kHz</td>
</tr>
<tr>
<td>Ripple and noise p-p CV</td>
<td>≤320 mV BW 20 MHz</td>
<td>≤320 mV BW 20 MHz</td>
<td>≤300 mV BW 20 MHz</td>
<td>≤320 mV BW 20 MHz</td>
</tr>
<tr>
<td>Current range</td>
<td>0 - 1000 A</td>
<td>0 - 1000 A</td>
<td>0 - 420 A</td>
<td>0 - 240 A</td>
</tr>
<tr>
<td>Power range</td>
<td>0 - 30000 W</td>
<td>0 - 30000 W</td>
<td>0 - 30000 W</td>
<td>0 - 30000 W</td>
</tr>
<tr>
<td>Output capacity</td>
<td>25380 μF</td>
<td>25380 μF</td>
<td>5400 μF</td>
<td>1800 μF</td>
</tr>
<tr>
<td>Efficiency up to</td>
<td>95.1% *1</td>
<td>95.5% *1</td>
<td>95.3% *1</td>
<td>95.8% *1</td>
</tr>
</tbody>
</table>

### Isolation

<table>
<thead>
<tr>
<th>Negative DC-Pol &lt;-&gt; PE</th>
<th>PS 10060-1000</th>
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<th>PS 10360-240</th>
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<tr>
<td>Positive DC-Pol &lt;-&gt; PE</td>
<td>PS 10060-1000</td>
<td>PS 10080-1000</td>
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<td>PS 10360-240</td>
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</tbody>
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| Article number Standard | 06230800 | 06230801 | 06230802 | 06230803 |
| Article number Water cooling | 06250800 | 06250801 | 06250802 | 06250803 |

*1 At 100% Power and 100% Output voltage

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<table>
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<tr>
<th>DC-Output</th>
<th>PS 10500-180</th>
<th>PS 10750-120</th>
<th>PS 10920-125</th>
<th>PS 11000-80</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voltage range</td>
<td>0 - 500 V</td>
<td>0 - 750 V</td>
<td>0 - 920 V</td>
<td>0 - 1000 V</td>
</tr>
<tr>
<td>Ripple rms CV</td>
<td>≤70 mV BW 300 kHz</td>
<td>≤200 mV BW 300 kHz</td>
<td>≤200 mV BW 300 kHz</td>
<td>≤300 mV BW 300 kHz</td>
</tr>
<tr>
<td>Ripple and noise p-p CV</td>
<td>≤350 mV BW 20 MHz</td>
<td>≤800 mV BW 20 MHz</td>
<td>≤800 mV BW 20 MHz</td>
<td>≤1600 mV BW 20 MHz</td>
</tr>
<tr>
<td>Current range</td>
<td>0 - 180 A</td>
<td>0 - 120 A</td>
<td>0 - 125 A</td>
<td>0 - 80 A</td>
</tr>
<tr>
<td>Power range</td>
<td>0 - 30000 W</td>
<td>0 - 30000 W</td>
<td>0 - 30000 W</td>
<td>0 - 30000 W</td>
</tr>
<tr>
<td>Output capacity</td>
<td>675 μF</td>
<td>450 μF</td>
<td>100 μF</td>
<td>200 μF</td>
</tr>
<tr>
<td>Efficiency up to</td>
<td>96.5% *1</td>
<td>96.5% *1</td>
<td>96.5% *1</td>
<td>95.8% *1</td>
</tr>
</tbody>
</table>

### Isolation

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| Article number Standard | 06230804 | 06230805 | 06230809 | 06230806 |
| Article number Water cooling | 06250804 | 06250805 | 06250806 | 06250806 |

*1 At 100% Power and 100% Output voltage
### Technical Specifications

<table>
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<tr>
<th></th>
<th>PS 11500-60</th>
<th>PS 12000-40</th>
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<tr>
<td><strong>DC-Output</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Voltage range</td>
<td>0 - 1500 V</td>
<td>0 - 2000 V</td>
</tr>
<tr>
<td>Ripple rms CV</td>
<td>≤400 mV BW 300 kHz</td>
<td>≤400 mV BW 300 kHz</td>
</tr>
<tr>
<td>Ripple and noise p-p CV</td>
<td>≤2400 mV BW 20 MHz</td>
<td>≤2400 mV BW 20 MHz</td>
</tr>
<tr>
<td>Current range</td>
<td>0 - 60 A</td>
<td>0 - 40 A</td>
</tr>
<tr>
<td>Power range</td>
<td>0 - 30000 W</td>
<td>0 - 30000 W</td>
</tr>
<tr>
<td>Output capacity</td>
<td>75 μF</td>
<td>50 μF</td>
</tr>
<tr>
<td>Efficiency up to</td>
<td>96.5% *1</td>
<td>96.5% *1</td>
</tr>
<tr>
<td><strong>Isolation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Negative DC-Pol &lt;-&gt; PE</td>
<td>±1500 V DC</td>
<td>±1500 V DC</td>
</tr>
<tr>
<td>Positive DC-Pol &lt;-&gt; PE</td>
<td>+2000 V DC</td>
<td>+2000 V DC</td>
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<tr>
<td><strong>Article number</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Article number Standard</td>
<td>06230807</td>
<td>06230808</td>
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<td>06250807</td>
<td>06250808</td>
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*1 At 100% Power and 100% Output voltage
General

The DC laboratory power supplies in the PS 10000 series from EA Elektro-Automatik convert the energy from the grid into a regulated DC voltage with an efficiency of over 96%. The PS 10000 series includes single and three phase units, which, together with the wide input range, allows use with practically all global mains voltages. The DC voltage and current are directed by the application and the spectrum ranges from 0 - 60 V to 0 - 2000 V and from 0 - 6 A up to 0 - 1000 A in a single device. The DC supply operates as a flexible output stage with a constant power characteristic (autoranging), and a wide voltage, current and power range. To achieve higher power and current all units are equipped with a master-slave bus. This enables up to 64 parallel connected devices to be combined into one system which can provide up to 1920 W and 64000 A. Such a system works as a single unit and can use different power classes, only the voltage class must remain constant. In this way a user can construct a 75 kW system from two 30 kW and one 15 kW devices from the PS 10000 range. Furthermore, typical laboratory functionality is provided. This includes an extensive function generator, alarm and warning management, assorted interfaces and ports, software solutions and many more functions.

AC Connection

The DC power supplies in the PS 10000 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. This extends from 1-phase 110/120 V up to 240 V AC mains supply and 3-phase 208 V to 380 V, 400 V and 480 V AC mains supply. The devices can be operated in the majority of global mains supply. They adjust automatically, without additional configuration, to the available supply. In a 110/120 V and 208 V AC grid a derating of the output power is set.
DC Output
The output of the power supply PS 10000 with a DC voltage of 0 - 60 V up to 0 - 2000 V allows currents of 0 - 6 A up to 0 - 1000 A. 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 via a copper rail 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 vertical copper rails. A cover for contact protection is provided.

The principle of autoranging
„Autoranging“ is a term when a programmable DC Power Supply automatically offers a wide 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.

Interfaces
As standard EA devices are fitted with the most important digital and analogue interfaces and ports which are galvanically isolated. These include an analogue interface which can be parameterised for input and output, control and monitoring, of 0 - 5 V or 0 - 10 V for voltage, current, power and resistance, assorted inputs and outputs as well as USB and ethernet ports. The following options which use a Plug & Play slot, complete the portfolio:
- CAN
- CANopen
- RS232
- Profibus
- EtherCAT
- Profinet, with one or two ports
- Modbus, with one or two ports
- Ethernet, with one or two ports
High performance systems
High power applications can be covered with high power systems of up to 1920 kW. These are achieved by using the outputs of many PS 10000 devices, changing the copper rails to vertical, and connecting in parallel. Thus, a 19" cabinet with 42 U can provide a system with 240 kW occupying 0.6 m² floorspace. The master/slave bus enables up to 8 cabinets with a maximum of 64 units of 30 kW each to behave as one unit.

Master-Slave-Bus and Share-Bus
If the integral master-slave bus and share bus are used, a multi device system behaves as a single device. The master-slave bus and the share bus are simply connected to each device. With the master-slave bus the system data such as total power and total current are collected and shown in the master device. Warnings and alarms of the slave devices are shown clearly in the display. The share bus provides an equal load distribution to the individual devices.

Example representation
In this illustration you can see a fully assembled and wired 240 kW system
Application

Relay test in the production
Relay manufacturers must carry out assorted tests on their products during production. For these the coils and contacts are provided with exactly defined voltage and current. For the coil tests, important parameters such as operating, holding and decay current, together with the associated voltages must be checked and documented. For the contacts, not only are the current carrying capability and contact resistance important parameters, but also voltage consistency and disconnect threshold indicate much about the product quality. Testing all these is best supported by an automatic test system. A part of such a system can be the devices of the PS 10000 series with their exact, dynamic, controls of voltage, current, power, and resistance, providing optimal values for the best test results. With their diverse interface connections, they can be integrated into any test system and deliver the necessary data without the need for additional measuring equipment.

On-board charger test
In an on-board charger test (OBC) the electrical features must be tested under various conditions. This requires a flexible test system which also provides test data. With the sequencing and logging functions of the PS 10000 devices test procedures allow data to be exported and saved. In this way applications can promptly generate reproducible test results based on dynamic and highly accurate set point and measurement data. To avoid competition between two separate control loops of the device under test (DUT) and the test device, the control frequency of the power supply is adjustable. The modes Normal, Fast and Slow allow the PS 10000 devices to match the control characteristics of the on-board charger.
Front Panel Description PS 10000 4U

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 PS 10000 4U ≤200 V

1. Master-Slave-Bus interface to set up a system for parallel connection
2. Slot for Interfaces
3. Output voltage Remote Sense input terminal
4. Share-Bus Interface to set up a system for parallel connection
5. Output terminal, Copper busbar
6. Mains input terminal
7. Grounding connection screw (PE)
8. Connector (DB15 Female) for isolated analog program, monitor and other functions
9. USB interface
10. Ethernet interface
Technical Drawing PS 10000 4U ≥360 V
Front Panel Description PS 10000 4U

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 PS 10000 4U >360 V

1. Master-Slave-Bus interface to set up a system for parallel connection
2. Slot for Interfaces
3. Output voltage Remote Sense input terminal
4. Share-Bus Interface to set up a system for parallel connection
5. Output terminal, Copper busbar
6. Mains input terminal
7. Grounding connection screw (PE)
8. Connector (DB15 Female) for isolated analog program, monitor and other functions
9. USB interface
10. Ethernet interface
Front Panel Description PS 10000 4U Water Cooling Option

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 PS 10000 4U Water Cooling Option

1. Master-Slave-Bus interface to set up a system for parallel connection
2. Slot for Interfaces
3. Output voltage Remote Sense input terminal
4. Share-Bus Interface to set up a system for parallel connection
5. Output terminal, Copper busbar
6. Mains input terminal
7. Grounding connection screw (PE)
8. Connector (DB15 Female) for isolated analog program, monitor and other functions
9. USB interface
10. Ethernet interface