

PSI 9000 3U Series

3.3 kW to 150 kW



High Performance
Programmable DC
Power Sources

INTEPRO
SYSTEMS

THE POWER TEST EXPERTS

PSI 9000 3U Series

3.3 kW to 150 kW



Product Overview

The PSI 9000 Series of high performance programmable DC power sources are FPGA controlled and come standard with several advanced features. User-friendly, interactive menu navigation makes the use of this equipment remarkably easy to program.



PSI 9000 3U

User and process profiles can be edited, saved and archived so that the reproducibility of a test or other application is improved.

A single 3U chassis houses up to 15kW of DC power and can be paralleled up to 150kW. Each chassis features a controller which allows the flexibility of separating into individual sources or paralleling for high power applications.

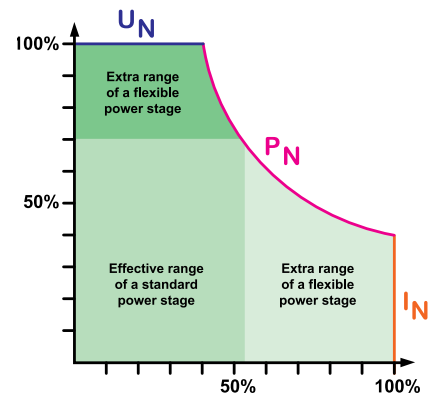
Power

All models feature a flexible Auto-Ranging output stage which provides higher output current at reduced voltages so the source maintains maximum output power across a wide range of voltage operation.

Traditional DC sources offer a square operation curve meaning the source maintains maximum rated current at less than full scale voltage. A traditional 5kW DC source with a voltage range of 600V provides 10A. At 200V the source still offers 10A so only 2kW is actually delivered to the unit under test.

Auto-Ranging addresses this issue by automatically increasing the output current at reduced voltages. Take the PSI 9500-30 which is 5kW as an example. At 600V the source offers 10A. At 200V the source provides 25A which means the source maintains a 5kW output rating.

Auto-Range is especially useful when testing products that require varied input voltages while maintaining regulated output power. This feature often results in a single chassis solutions versus buying multiple sources to address low and high voltage / current requirements.



Featured Benefits

- *Auto-ranging output*
- *High efficiency up to 95.5%*
- *Output power ratings: 0-3.3kW, 0-5kW, 0-10kW and 0-15kW in a single 3U chassis*
- *Expandable to 150kW and 5,100A*
- *Output voltages: 0...40 V up to 0...1500 V*
- *Output currents: 0...30 A up to 0...510 A*
- *Flexible, power regulated output stage*
- *Various protection circuits (OVP, OCP, OPP, OTP)*
- *Intuitive TFT touch panel with display for values, status and notifications*
- *Integrated true function generator*
- *Remote sensing with automatic detection*
- *Galvanically isolated, analog interface with:*
 - *U / I / P programmable via 0...10 V or 0...5 V*
 - *U / I monitoring via 0...10 V or 0...5 V*
- *Photovoltaic array simulation*
- *Internal resistance simulation and regulation*
- *Temperature controlled fans for cooling*
- *Fuel cell simulation*
- *USB port integrated*
- *Optional, digital interface modules or alternatively installed IEEE/GPIB port*
- *SCPI command language supported*

Protective Features

For protection of the equipment connected, it is possible to set an overvoltage protection threshold (OVP), as well as one for overcurrent (OCP) and overpower (OPP).

As soon as one of these thresholds is reached for any reason, the DC output will be immediately shut off and a status signal will be generated on the display and via the interfaces.

There is furthermore an overtemperature protection, which will shut off the DC output if the device overheats.

Remote Sensing

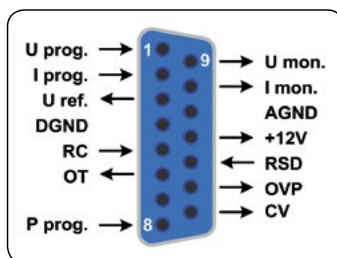
The standard sensing input can be connected directly to the load in order to compensate voltage drops along the power cables up to a certain level. If the sensing input is connected to the load, the power supply will adjust the output voltage automatically to make ensure the accurate required voltage is available at the load.

Display & Controls

Set values and actual values of output voltage, output current and output power are clearly represented on the graphic display. The LCD display is touch sensitive and can be intuitively used to control all functions of the device with just a finger.

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

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

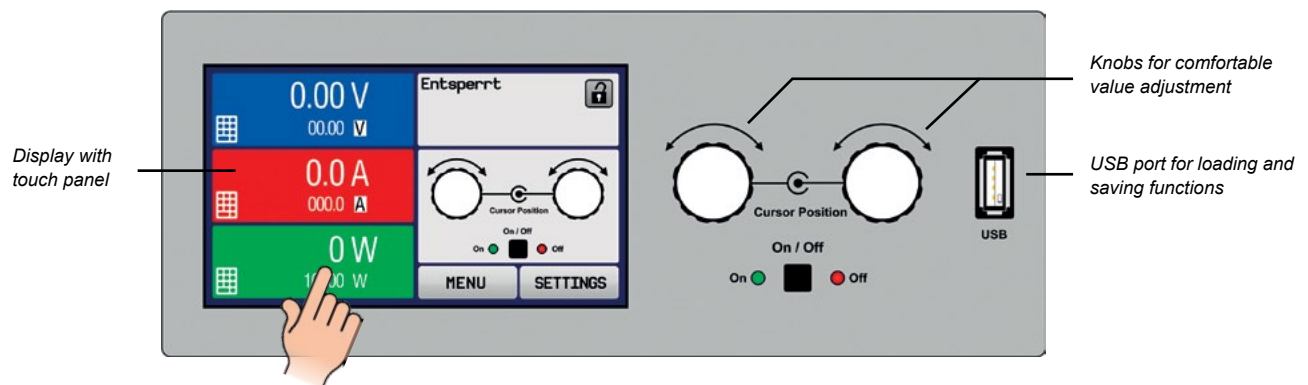


Analog Interface

There is a galvanically isolated analog interface terminal, located on the rear of the device. It offers analog inputs to set voltage, current and power 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 voltage ranges of 0 V...10 V or 0 V...5 V. Also, several inputs and outputs are available for controlling and monitoring the device status.

Display and Control Panel



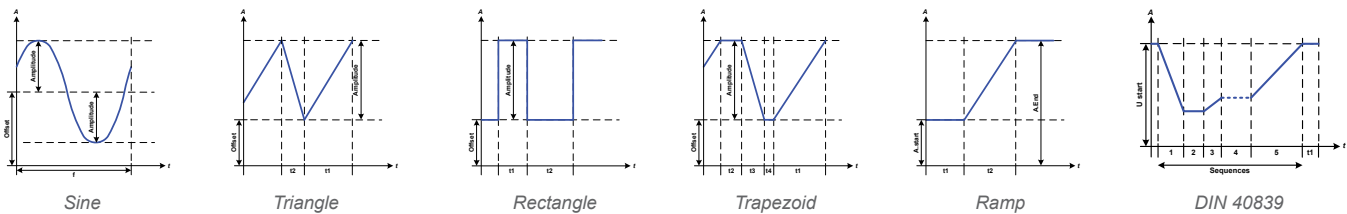
Function Generator

All models within this series is based on 4096 data points and generates typical functions, as displayed in the figures below, and applies them to either the output voltage or the output 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.

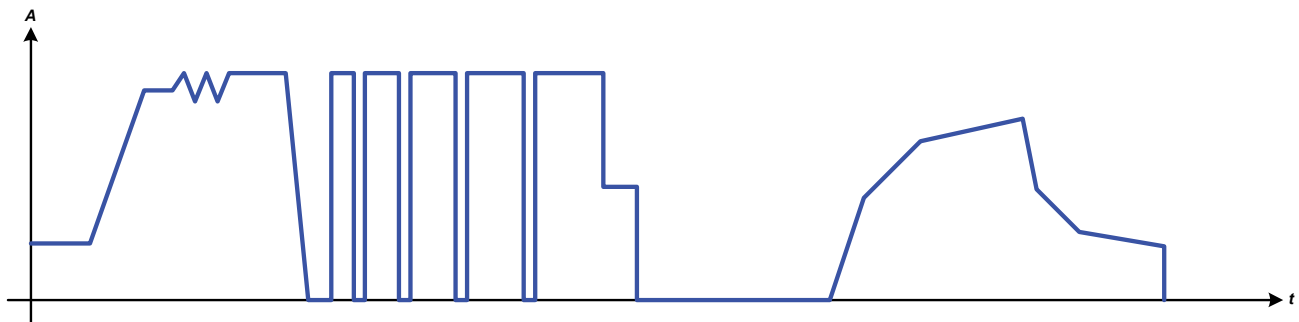
The predefined functions offer all necessary parameters to the user, such as Y offset, time / frequency or amplitude, for full configuration ability.

Additionally to the standard functions, which are all based upon a so-called arbitrary generator, this base generator is accessible for the creation and execution of complex sets of functions, separated into up to 100 sequences. Those can be used for testing purposes in development and production.

The sequences can be loaded from and saved to a standard USB flash drive via the USB port on the front panel, making it easy to change between different test sequences.



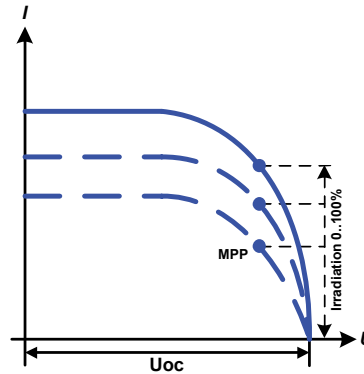
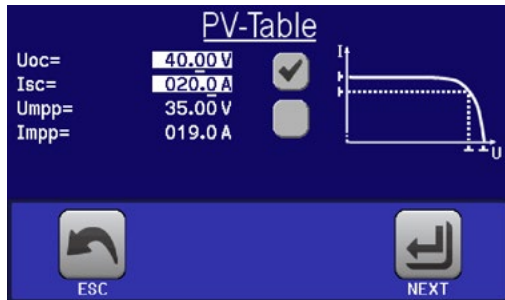
The figure below shows a fictional example of a complex function of 40 sequences, as it can be realized with the arbitrary generator. The function can be created on the device or externally and then loaded or saved:



There is furthermore a XY generator, which is used to generate other functions like UI or IU, which are defined by the user in form of tables (CSV file) and then loaded from USB drive.

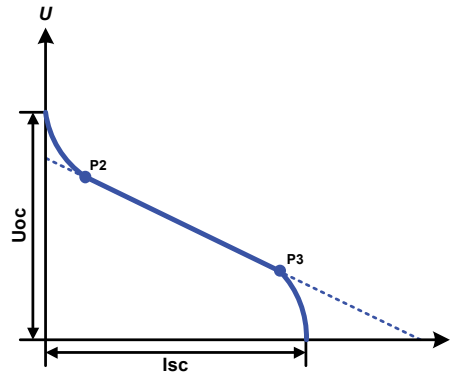
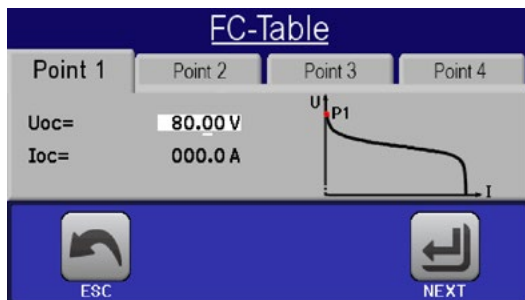
Photovoltaic Solar Array Simulation

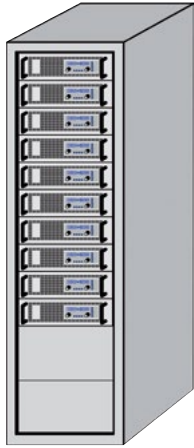
The PSI is an ideal solution for simulating static or dynamic irradiance levels of solar array. The high accuracy irradiance curve is based on 16,400 data points and adjustable in 1% increments. I_{sc} , U_{oc} , MPP and I_{mpp} are user programmable.



Fuel Cell Simulation

An embedded Fuel Cell table function is used to simulate the characteristics of voltage and current of a fuel cell. Simply define slope points and the data is automatically calculated then transferred to the function generator and output from the DC source.





Parallel for High Power

Chassis can be paralled up to 150kW. Intepro offers turn-key integrated solutions in chassis up to 42U and allow installation of auxilary equipment such as DC loads, DMM's and oscilloscope. Contact Intepro with your system configuration requirements.

Supervision Features

All models offer supervision features for voltage and current steps. The supervision is configurable to monitor voltage or current over- and undershooting. As a reaction, the device can generate a notification of selectable type:

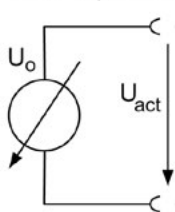
- Signals are displayed only; even if the fault is still active, without affecting the output.
- Warnings remain active and must be acknowledged after the fault is removed.
- Alarms will shut off the output instantly and can also be signaled acoustically.

Programmable Impedance

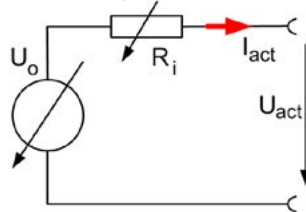
Alnternal resistance control provides a means to virtually simulate an internal resistance which is in series to the voltage source and thus also in series to the load. According to Ohm's Law, this causes an voltage drop, which will result in a difference between adjusted output voltage and the actual output voltage.

The adjustable resistance range is generally defined between 0 and 30 * UNOM / INOM of the particular model. The voltage setting in dependency of the resistance set value and the output current is done by calculation of the microcontroller and thus will be significantly slower the other controllers inside the control circuit.

U//P Operation



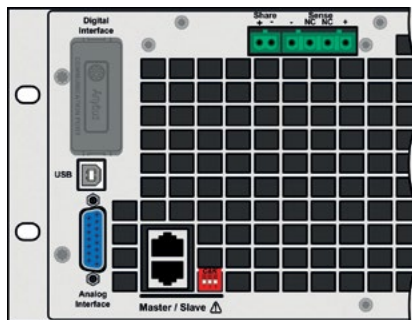
U//R Operation



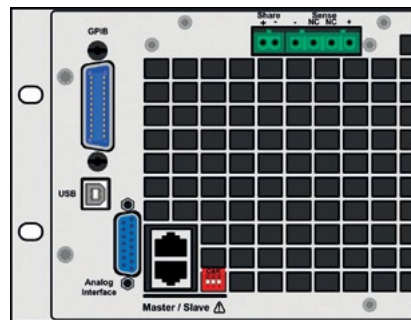
$$U_{Set} = U_0 - I_{Act} * R_{Set} \quad \left| \begin{matrix} P_{Set}, I_{Set} \end{matrix} \right.$$

Options

- Digital interface modules for RS232, CANopen, Modbus TCP, Profibus, Profinet/IO, Devicenet 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.
- Three-way interface (3W) with a rigid GPIB port installed instead of the default slot for retrofittable interface modules.
- High Speed ramping*
- Water Cooling **
- High Speed Ramping increases voltage slew rates by as much as 20x. Contact Intepro for details.



Rear connectors of the standard models



Rear connectors of models with option 3W

* Not available for all voltages - please quote for availability

** Generally available for models up to 200 V, for other models upon request

Technical Data	Series PSI 9000 3U
Input AC	
- Voltage standard	208VL-L; +/- 10%, 400VL-L; +/- 10%, 480VL-L; +/- 10%
- Frequency	45...66 Hz
- Power factor	>0.99
Output voltage DC	
- Accuracy	<0.1%
- Load regulation 0-100%	<0.05%
- Line regulation $\pm 10\% \Delta U_{AC}$	<0.02%
- Regulation 10-100% load	<2 ms
- Overvoltage protection	adjustable, 0...110% U_{Nom}
- No load discharge time on DC off	100% U auf / to <60 V: weniger als 10 s / less than 10 s
Output current	
- Accuracy	<0.2%
- Load regulation 0-100% ΔU_{DC}	<0.15%
- Line regulation $\pm 10\% \Delta U_{AC}$	<0.05%
Output power	
- Accuracy	<1%
Overvoltage category	2
Protection	OT, OVP, OPP, PF, OCP ⁽¹⁾
Isolation	
- Input to enclosure	2500 V DC
- Input to output	2500 V DC
- Output to enclosure (PE)	Depending on model, see tables
Pollution degree	2
Protection class	1
Display and panel	Graphics 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 (standard models only)
Analog interface	built-in, 15-pole D-Sub, female
- Input range	0...5 V or 0...10 V (switchable)
- Accuracy U / I	0...10 V: <0.2% 0...5 V: <0.4%
- Programming resolution	see tables below
Series operation	Possible, but depending on the isolation of DC- against PE
Parallel operation	Yes, with true master-slave, up to 10 units
Standards	EN 61326, IEC 1010, EN 61010 EMC TÜV approved according to IEC 61000-6-2:2005, IEC 61000-6-3:2006 Class B
Cooling	Fans (optional: water)
Operation temperature	0...50 °C
Storage temperature	-20...70 °C
Relative humidity	<80%, n.c.
Operation altitude	<2000 m
Dimensions (W H D) ⁽²⁾	19" 3 HE / 3U 609 mm

(1 See page 13

(2 Enclosure only, not overall

Technical Data	PSI 9040-170 3U	PSI 9080-170 3U	PSI 9200-70 3U	PSI 9360-40 3U
Output voltage DC	0...40 V	0...80 V	0...200 V	0...360 V
- Ripple ⁽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}
-Sensing compensation	~1 V	~2 V	~5 V	~7.5 V
Isolation				
- Negative output <-> PE	±400 V DC	±400 V DC	±400 V DC	±400 V DC
- Positive output <-> PE	±400 V DC	±400 V DC	±600 V DC	±600 V DC
Output current	0...170 A	0...170 A	0...70 A	0...40 A
- Ripple ⁽¹⁾	<80 mA _{RMS}	<80 mA _{RMS}	<22 mA _{RMS}	<18 mA _{RMS}
Output power	0...3300 W	0...5000 W	0...5000 W	0...5000 W
Efficiency	~93%	~93%	~95%	~93%
Max Rise time 10-90%	15msec max	15msec max	15msec max	15msec max
Programming resolution U	≤2 mV	≤4 mV	≤9 mV	≤15 mV
Programming accuracy U	≤40 mV	≤80 mV	≤200 mV	≤360 mV
Programming resolution I	≤7 mA	≤7 mA	≤3 mA	≤2 mA
Programming accuracy I	≤340 mA	≤340 mA	≤140 mA	≤80 mA
Weight ⁽²⁾	~17 kg	~17 kg	~17 kg	~17 kg
Article number ⁽³⁾	06230350	06230351	06230352	06230353

Technical Data	PSI 9500-30 3U	PSI 9750-20 3U	PSI 9040-340 3U	PSI 9040-510 3U
Output voltage DC	0...500 V	0...750 V	0...40 V	0...40 V
- Ripple ⁽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}
-Sensing compensation	~10 V	~15 V	~1 V	~1 V
Isolation				
- Negative output <-> PE	±725 V DC	±725 V DC	±400 V DC	±400 V DC
- Positive output <-> PE	±1000 V DC	±1000 V DC	±400 V DC	±400 V DC
Output current	0...30 A	0...20 A	0...340 A	0...510 A
- Ripple ⁽¹⁾	<16 mA _{RMS}	<16 mA _{RMS}	<160 mA _{RMS}	<120 mA _{RMS}
Output power	0...5000 W	0...5000 W	0...6600 W	0...10000 W
Efficiency	~95.5%	~94%	~93%	~93%
Programming resolution U	≤21 mV	≤31 mV	≤2 mV	≤2 mV
Programming accuracy U	≤500 mV	≤750 mV	≤40 mV	≤40 mV
Programming resolution I	≤2 mA	≤1 mA	≤14 mA	≤21 mA
Programming accuracy I	≤60 mA	≤40 mA	≤680 mA	≤1.1 A
Weight ⁽²⁾	~17 kg	~17 kg	~24 kg	~30 kg
Article number ⁽³⁾	06230354	06230355	06230356	06230363

Technical Data	PSI 9080-340 3U	PSI 9200-140 3U	PSI 9360-80 3U	PSI 9500-60 3U
Output voltage DC	0...80 V	0...200 V	0...360 V	0...500 V
- Ripple ⁽¹⁾	<320 mV _{PP} <25 mV _{RMS}	<300 mV _{PP} <40 mV _{RMS}	<320 mV _{PP} <55 mV _{RMS}	<350 mV _{PP} <70 mV _{RMS}
-Sensing compensation	~ 2 V	~ 5 V	~ 7.5 V	~ 10 V
Isolation				
- Negative output <-> PE	±400 V DC	±400 V DC	±400 V DC	±725 V DC
- Positive output <-> PE	±400 V DC	±600 V DC	±600 V DC	±1000 V DC
Output current	0...340 A	0...140 A	0...80 A	0...60 A
- Ripple ⁽¹⁾	<160 mA _{RMS}	<44 mA _{RMS}	<35 mA _{RMS}	<32 mA _{RMS}
Output power	0...10000 W	0...10000 W	0...10000 W	0...10000 W
Efficiency	~93%	~95%	~93%	~95%
Programming resolution U	≤4 mV	≤9 mV	≤15 mV	≤21 mV
Programming accuracy U	≤80 mV	≤200 mV	≤350 mV	≤500 mV
Programming resolution I	≤14 mA	≤6 mA	≤4 mA	≤3 mA
Programming accuracy I	≤680 mA	≤280 mA	≤160 mA	≤120 mA
Weight ⁽²⁾	~24 kg	~24 kg	~24 kg	~24 kg
Article number ⁽³⁾	06230357	06230358	06230359	06230360

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

(2) Weight of standard version, models with options may vary

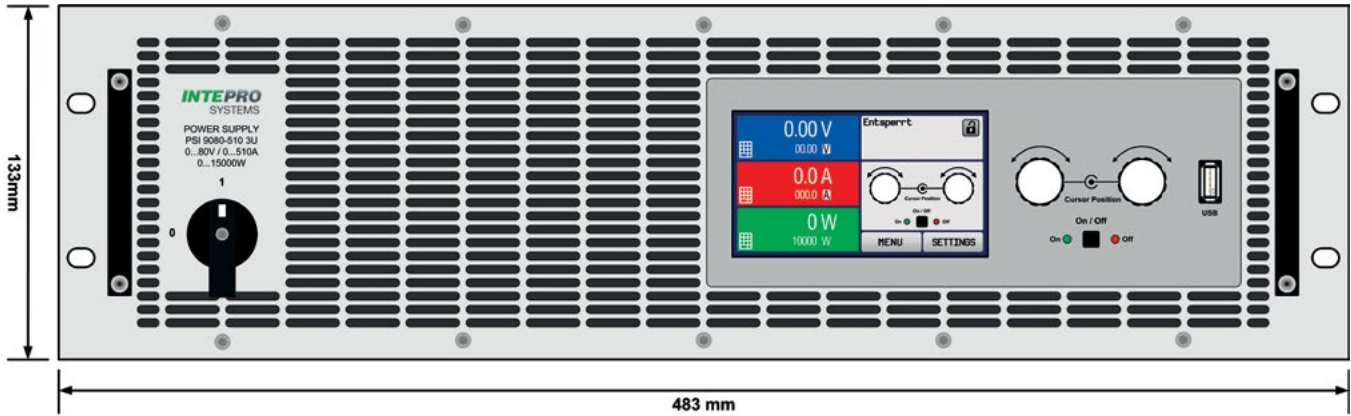
(3) Article number of the standard version, models with option 3W installed have different article numbers

Technical Data	PSI 9750-40 3U	PSI 91000-30 3U	PSI 9080-510 3U	PSI 9200-210 3U
Output voltage DC	0...750 V	0...1000 V	0...80 V	0...200 V
- Ripple ⁽¹⁾	<800 mV _{PP} <200 mV _{RMS}	<1600 mV _{PP} <350 mV _{RMS}	<320 mV _{PP} <25 mV _{RMS}	<300 mV _{PP} <40 mV _{RMS}
-Sensing compensation	~15 V	~20 V	~2.5 V	~6 V
Isolation				
- Negative output <-> PE	±725 V DC	±725 V DC	±400 V DC	±400 V DC
- Positive output <-> PE	±1000 V DC	±1000 V DC	±400 V DC	±600 V DC
Output current	0...40 A	0...30 A	0...510 A	0...210 A
- Ripple ⁽¹⁾	<32 mA _{RMS}	<22 mA _{RMS}	<240 mA _{RMS}	<66 mA _{RMS}
Output power	0...10000 W	0...10000 W	0...15000 W	0...15000 W
Efficiency	~94%	~95%	~93%	~95%
Programming resolution U	≤31 mV	≤41 mV	≤4 mV	≤9 mV
Programming accuracy U	≤750 mV	≤1 V	≤80 mV	≤200 mV
Programming resolution I	≤2 mA	≤2 mA	≤21 mA	≤9 mA
Programming accuracy I	≤80 mA	≤60 mA	≤1.1 A	≤420 mA
Weight ⁽²⁾	~24 kg	~24 kg	~30 kg	~30 kg

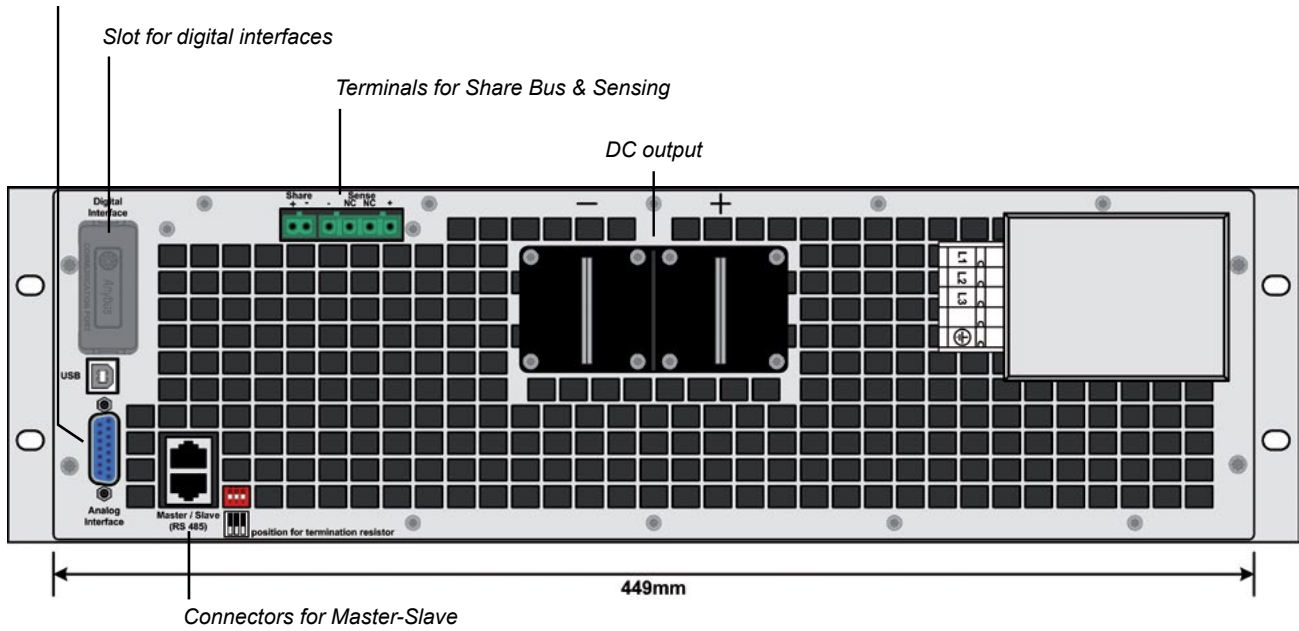
Technical Data	PSI 9360-120 3U	PSI 9500-90 3U	PSI 9750-60 3U	PSI 91500-30 3U
Output voltage DC	0...360 V	0...500 V	0...750 V	0...1500 V
- Ripple ⁽¹⁾	<320 mV _{PP} <55 mV _{RMS}	<350 mV _{PP} <70 mV _{RMS}	<800 mV _{PP} <200 mV _{RMS}	<2400 mV _{PP} <400 mV _{RMS}
-Sensing compensation	~7.5 V	~10 V	~15 V	~30 V
Isolation				
- Negative output <-> PE	±400 V DC	±725 V DC	±725 V DC	±725 V DC
- Positive output <-> PE	±600 V DC	±1000 V DC	±1000 V DC	±1500 V DC
Output current	0...120 A	0...90 A	0...60 A	0...30 A
- Ripple ⁽¹⁾	<50 mA _{RMS}	<48 mA _{RMS}	<48 mA _{RMS}	<26 mA _{RMS}
Output power	0...15000 W	0...15000 W	0...15000 W	0...15000 W
Efficiency	~93%	~95%	~94%	~95%
Programming resolution U	≤15 mV	≤21 mV	≤31 mV	≤61 mV
Programming accuracy U	≤350 mV	≤500 mV	≤750 mV	≤1.5 V
Programming resolution I	≤5 mA	≤4 mA	≤3 mA	≤2 mA
Programming accuracy I	≤240 mA	≤180 mA	≤120 mA	≤60 mA
Weight ⁽²⁾	~30 kg	~30 kg	~30 kg	~30 kg

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

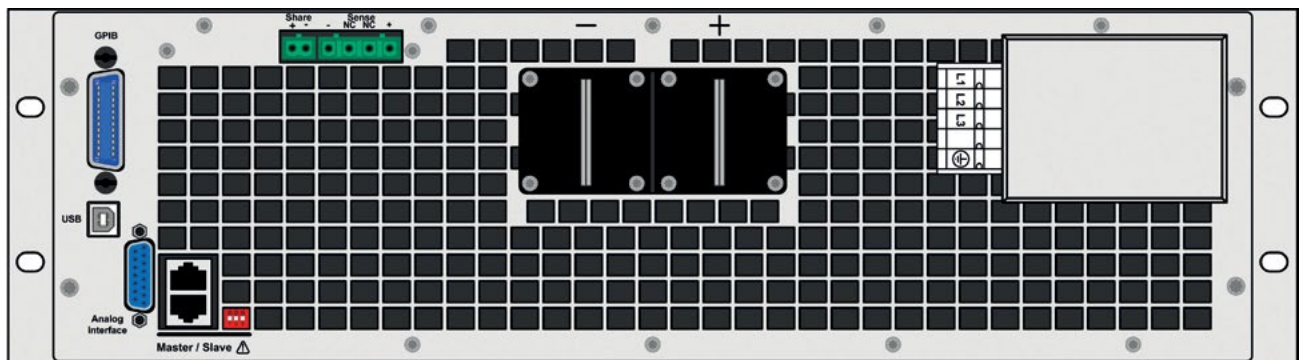
(2) Weight of standard version, models with options may vary



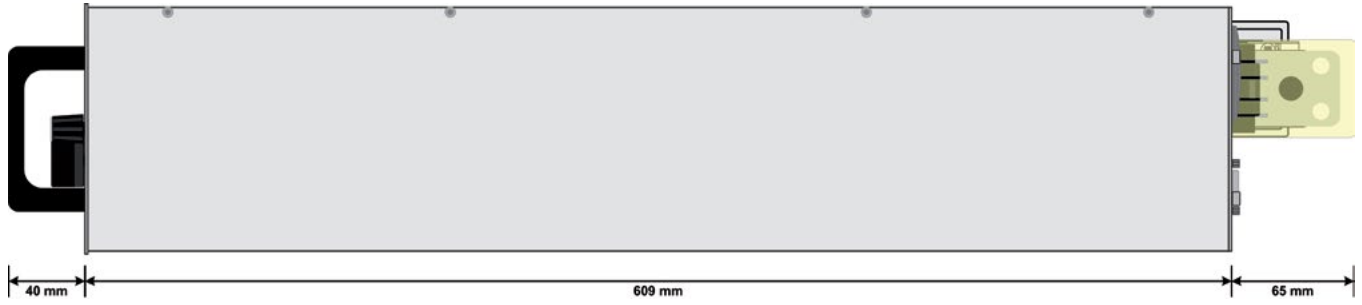
USB and analog interface



Rear view of base model



Rear view with option 3W



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