

# EA-ELR 9000 3.1 kW - 10.5 kW



## Programmable electronic DC loads with energy recovery



EA-ELR 9200-210



- For 208 V ( $\pm 10\%$ ) or 230 V AC supply
- Energy recovery of the supplied DC energy into the local grid
- Galvanically isolated DC input
- Input power ratings: up to 9.3 kW per unit, expandable to 297 kW
- Input voltages: up to 1500 V
- Input currents: up to 510 A per unit
- FPGA based digital control
- Multilingual TFT touch panel
- User profiles, true function generator
- Galvanically isolated analog and USB interface
- Extra USB port on the front for USB stick
- Optional, digital, plug & play interfaces or alternatively installed GPIB port
- SCPI command set and ModBus support

### General

Series EA-ELR 9000 offers electronic DC loads with energy recovery, along with a good selection of voltage, current and power ratings for a multitude of applications. These devices incorporate the four common regulation modes constant voltage (CV), constant current (CC), constant power (CP) and constant resistance (CR). The FPGA based control circuit provides additional features, such as a function generator and a table based regulation circuit for the simulation of non-linear internal resistances.

The energy recovery function converts the supplied DC energy into a synchronous sine current and feeds it back into the local grid, eliminating the usual heat dissipation to a minimum and saving energy costs at the same time. The large color TFT touch panel offers a different and intuitive kind of manual operation, compared to electronic load series of other manufacturers.

Response times for the control via analog or digital interfaces have been improved by the FPGA controlled hardware.

In parallel operation of multiple devices, a master-slave bus is used to connect the units to a bigger system where the actual values are totaled and the set values distributed.

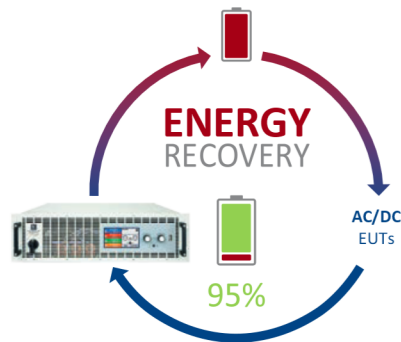
### Power ratings, voltages, currents

The available voltage range portfolio goes from models with 0...80 V DC up to models with 0...1500 V DC. Input currents up to 510 A with only one unit are available. The series offers three power classes with 3.1 kW, 6.2 kW or 9.3 kW (**US models** for 208 V) respectively 3.5 kW, 7 kW or 10.5 kW (**EU models** for 230 V) in only 3U for single devices, which can be extended up to 297 kW in cabinets for a significantly high total current.

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## Supply

The US models are designed to run on 208 V (L-L) two- or three-phase supply while the EU models require one to three phases with 230 V (L-N).



## Energy recovery

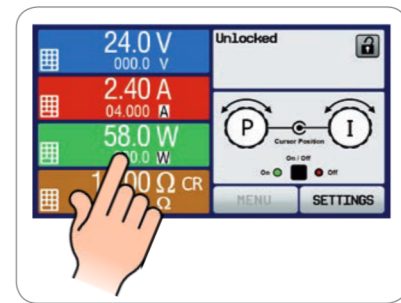
The most important feature of these electronic loads is that the AC input, i.e. grid connection, is also used as output for the recovery of the supplied DC energy, which will be converted with an efficiency of up to 95%. This way of energy recovery helps to lower energy costs and avoids expensive cooling systems, such as they are required for conventional electronic loads which convert the DC input energy into heat. Principle view:

Operation of these recovering loads in terms of electricity generation is not intended. Grid protection devices which can supervise the feedback of energy into the public grid are available on the market for optional installation and are installed to achieve additional safety of persons and equipment, especially when running the so-called isolated operation. However, such devices usually require the N conductor.

Regardless of whether the user has installed such a supervision unit or not, the devices feature a simple and non-redundant switch-off function that supervises AC voltage and frequency and will automatically switch off the power stages in case upper or lower limits are exceeded.

## Handling (HMI)

Manual operation is done with a Gorilla glass touch panel, two rotary knobs and a pushbutton. The large color display shows all relevant set values and actual values at a glance. The whole setup is also done with the human-machine interface, as well as the configuration of functions (square, triangle, sine) etc. The display is multilingual (German, English, Russian, Chinese).



## Function generator and table control

A special feature is the comfortable, FPGA based, digital function and arbitrary generator. It enables to control and run user-customizable load profiles and can generate sine, square, saw tooth and ramp functions in arbitrary order. With a freely programmable, digital value table of 3276 points, which is embedded in the control circuit, the devices can reproduce non-linear internal resistances, such as those of batteries or LED chains. For purposes of testing all kinds of batteries, such as for example constant current or constant resistance discharging, the devices offer a battery test mode.

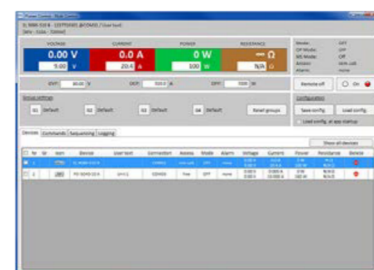
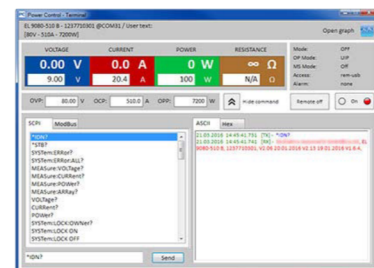
## Remote control & connectivity

For remote control, there are by default two interface ports (1x analog, 1x USB) available on the rear of the devices, which can also be extended by optional, pluggable and retrofittable, digital interface modules (dedicated slot). Alternatively to the interface modules slot, all models can be equipped with a three-way interface (option 3W, see below), which then offers 1x GPIB/IEEE488, 1x USB and 1x Analog on the rear side of the device.

For the implementation into the LabView IDE we offer ready-to-use components (VIs) to be used with the interface types USB, RS232, GPIB and Ethernet. Other IDEs and interfaces are supported by documentation about the communication protocol.

Windows users can profit from the free software "EA Power Control". It offers a feature called "Sequencing", where the device is controlled through a semi-automatic table in CSV format. This table represents a simple test procedure and can be created and edited in MS Excel or other CSV editors and then imported into the software tool.

This software also allows for the control of up to 20 units at once with an optional feature called "Multi Control" (licensed, not free of charge). See page 118 for more information.



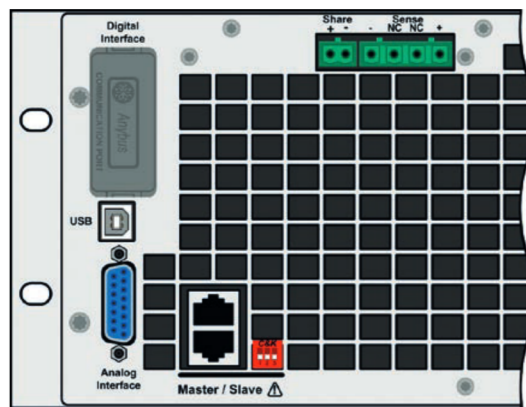
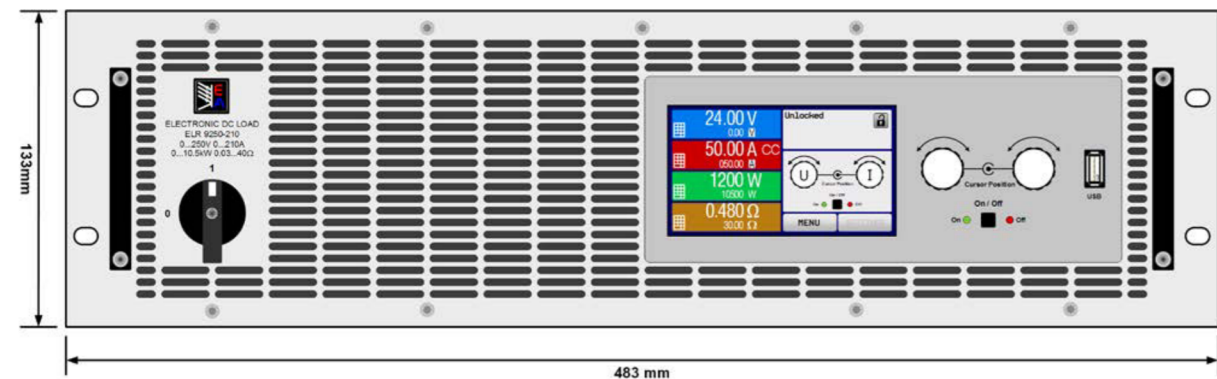
## Options

- Pluggable and retrofittable, digital interface modules for CAN, CANopen, Ethernet, Profibus, ProfiNet, RS232, EtherCAT or ModBus TCP. See page 116.
- Three-way interface (3W) with a rigid GPIB port installed instead of the default slot for retrofittable interface modules
- Grid protection & supervision module ENS2 (only compatible to the EU models)

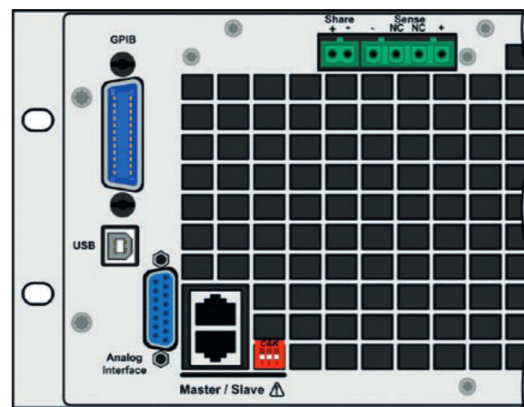
# EA-ELR 9000 3.1 kW - 10.5 kW



## Product views



Rear connectors of the standard models



Rear connectors of models with option 3W

Model	Power		Voltage	Current	Resistance	Efficiency	Weight	Ordering number	
	US model	EU model						US model	EU model
EA-ELR 9080-170	0...3.1 kW	0...3.5 kW	0...80 V	0...170 A	0.01...12 Ω	92.5%	17 kg (37.5 lb)	33208401	33200401
EA-ELR 9250-70	0...3.1 kW	0...3.5 kW	0...250 V	0...70 A	0.09...120 Ω	93.5%	17 kg (37.5 lb)	33208402	33200402
EA-ELR 9500-30	0...3.1 kW	0...3.5 kW	0...500 V	0...30 A	0.42...480 Ω	94.5%	17 kg (37.5 lb)	33208403	33200403
EA-ELR 9750-22	0...3.1 kW	0...3.5 kW	0...750 V	0...22 A	0.8...1100 Ω	94.5%	17 kg (37.5 lb)	33208404	33200404
EA-ELR 9080-340	0...6.2 kW	0...7 kW	0...80 V	0...340 A	0.005...6 Ω	92.5%	24 kg (52.9 lb)	33208405	33200405
EA-ELR 9250-140	0...6.2 kW	0...7 kW	0...250 V	0...140 A	0.04...60 Ω	93.5%	24 kg (52.9 lb)	33208406	33200406
EA-ELR 9500-60	0...6.2 kW	0...7 kW	0...500 V	0...60 A	0.21...240 Ω	94.5%	24 kg (52.9 lb)	33208407	33200407
EA-ELR 9750-44	0...6.2 kW	0...7 kW	0...750 V	0...44 A	0.43...550 Ω	94.5%	24 kg (52.9 lb)	33208408	33200408
EA-ELR 91000-30	0...6.2 kW	0...7 kW	0...1000 V	0...30 A	0.83...950 Ω	94.5%	24 kg (52.9 lb)	33208409	33200409
EA-ELR 9080-510	0...9.3 kW	0...10.5 kW	0...80 V	0...510 A	0.003...4 Ω	92.5%	31 kg (68.3 lb)	33208410	33200410
EA-ELR 9250-210	0...9.3 kW	0...10.5 kW	0...250 V	0...210 A	0.03...40 Ω	93.5%	31 kg (68.3 lb)	33208411	33200411
EA-ELR 9500-90	0...9.3 kW	0...10.5 kW	0...500 V	0...90 A	0.14...160 Ω	94.5%	31 kg (68.3 lb)	33208412	33200412
EA-ELR 9750-66	0...9.3 kW	0...10.5 kW	0...750 V	0...66 A	0.29...360 Ω	94.5%	31 kg (68.3 lb)	33208413	33200413
EA-ELR 91500-30	0...9.3 kW	0...10.5 kW	0...1500 V	0...30 A	1.2...1450 Ω	94.5%	31 kg (68.3 lb)	33208414	33200414

(1) Ordering number of the standard model, models with option 3W installed have different ordering numbers

# EA-ELR 9000 3.1 kW - 10.5 kW

Technical Data	Series EA-ELR 9000	
AC: Supply		
- Voltage (US models)	US models: 208 V (L-L), $\pm 10\%$ , 45...66 Hz, 2ph-3ph EU models: 230 V (L-N), $-15\%/+10\%$ , 45...66 Hz, 1ph-3ph	
- Frequency	45...66 Hz	
DC: Voltage		
- Accuracy	<0.3% of rated value	
DC: Current		
- Accuracy	<0.4% of rated value	
- Load regulation 1-100% $\Delta U_{DC}$	<0.15% of rated value	
- Slew rate 10-90%	$\leq 300 \mu s$	
DC: Power		
- Accuracy	<1.5% of rated value	
DC: Resistance		
- Accuracy	$\leq 1\%$ of max. resistance + 0.3% of rated current	
Display / control panel	Graphics display with touch panel	
Protection	OT, OVP, OCP, OPP, PF <sup>(1)</sup>	
Degree of pollution	2	
Protection class	1	
Digital interfaces		
- Built-in	1x USB type B for communication, optional: 1x GPIB (option 3W)	
- Slot	1x for retrofittable plug-in modules (standard models only)	
Analog interface	Built-in, galvanically isolated	
- Signal range	0...5 V or 0...10 V (switchable)	
- Inputs	U, I, P, R, remote control on-off, DC input on-off, resistance mode on-off	
- Output	U, I, overvoltage, alarms, reference voltage	
- Accuracy U / I / P / R	0...10 V: <0.2%	0...5 V: <0.4%
Parallel operation	Yes, with true master-slave, up to 32 units	
Standards	EN 60950:2006 + A11:2009 + A1:2010 + A12:2011 + AC:2011 + A2:2013 EN 61000-6-3:2011-09, EN 61000-6-4:2011-09 Radiation Class B EN 50160:2011-02 Grid Class 2	
Cooling	Temperature-controlled fans	
Ambient temperature	0...50 °C	
Storage temperature	-20...70 °C	
Terminals on rear		
- DC input	Screw terminal	
- Share Bus & Sense	Plug connector 2 pole & 4 pole	
- Analog interface	Sub-D connector 15 pole	
- Digital interfaces	Module socket 50 pole or GPIB 24pole, USB	
Dimensions (W x H x D)	19" x 3U x 609 mm (24")	

(1) See page 126

