



EA-ELR 9000 3.5 KW - 10.5 KW

能量回馈式直流电子负载 / ELECTRONIC LOAD WITH ENERGY RECOVERY



EA-ELR 9200-210

- ▶ 可供1相, 2相或3相输入电压使用
- ▶ 可将直流电量返回到本地或公共电网
- ▶ 直流输入端为电隔离结构
- ▶ 每台产品的输入功率高达10.5 kW
还可扩展至105 kW或更高
- ▶ 输入电压高达1500 V
- ▶ 每台产品的输入电流能高达510 A
- ▶ 基于FPGA/DSP数字控制
- ▶ 多语言TFT触摸屏
- ▶ 用户配置文档, 真实函数发生器
- ▶ 内置模拟接口与USB接口
- ▶ 并联用主-从总线
- ▶ 前板有额外的USB端口, 适合使用外置U盘
- ▶ 可选数字式即插即用型接口, 或安装IEEE/GPIB端口
- ▶ 支持SCPI指令语言
- ▶ 可选自动隔离设备⁽¹⁾

概述

新一系列的直流电子负载具有能量返回(即: 返回市电)功能, 称为EA-ELR 9000, 其电压、电流与功率级别也都是新的, 适用于多种用途。

这些产品具有四个常用调节模式: 恒压、恒流、恒功率和恒阻。基于FPGA的控制电路带来了更多新的功能, 如函数发生器, 模拟非线性内阻的基于表格格式的调整电路。

能量返回功能可使产生的直流电同步转化成正弦波电流, 然后返回给当地或公共电网。这不仅摆脱了以前的热耗散, 同时还节省了用电成本。产品上的巨大蓝色触摸屏提供一个不同于其他产品的手动操作。

经模拟或数字接口进行控制的反应时间已由DSP控制软件得到很好的改善。

多台产品并联操作时, 可经主从总线将这数台产品连到一个更大的系统上, 此时实际值会被累加, 设定值则会被均衡分布。

- ▶ For 1-, 2- or 3-phase supply
- ▶ Energy recovery of the supplied DC energy into the local or public grid
- ▶ Galvanically isolated DC input
- ▶ Input power ratings up to 10.5 kW per unit
Expandable to 105 kW or more
- ▶ Input voltages up to 1500 V
- ▶ Input currents up to 510 A per unit
- ▶ FPGA/DSP based digital control
- ▶ Multilingual TFT touch panel
- ▶ User profiles, true function generator
- ▶ Analog interface and USB interface built-in
- ▶ Master-slave bus for parallel connection
- ▶ Extra USB port on the front for USB stick
- ▶ Optional, digital, plug & play interfaces or alternatively installed IEEE/GPIB port
- ▶ SCPI command language supported
- ▶ Optional automatic isolation unit ⁽¹⁾

General

The new series of electronic DC loads with energy recovery, called EA-ELR 9000, offers new voltage, current and power ratings for a multitude of applications.

These devices incorporate the four common regulation modes constant voltage, constant current, constant power and constant resistance. The FPGA based control circuit provides additional features like a function generator, 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 or public grid. This eliminates the usual heat dissipation to a minimum and saves energy costs at the same time. The large blue LCD touch panel offers a different and intuitive kind of manual operation, compared to other devices.

Response times for the control via analog or digital interfaces have been improved by the DSP 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 totalled and the set values distributed.



功率、电压和电流等级

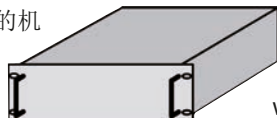
本系列有0...80 V DC至0...1500 V DC输出电压的产品型号，还有一款输入电流高达510 A的型号。本系列有三个功率级别，分别为3.5 kW，7 kW或10.5 kW，单机外壳仅3U高。还可组合到机柜内扩展高达105 kW（或更大）的功率，并形成更大的总电流。按照客户要求能组成更大功率的系统。

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 3.5 kW, 7 kW or 10.5 kW in only 3U for single devices, which can be extended up to 105 kW (or higher) in cabinets for a significantly high total current. Upon request, even higher total power can be realised.

机械结构

所有型号都安装于一个3U高，19"宽，609 mm深的机架式外壳内，适合各种尺寸的19"机柜，如42U，也适合大功率的系统设计。



Construction

All models are built in 19" wide rack enclosures with 3U height and 609 mm depth, which makes them ideal for use in 19" cabinets of various sizes, for example 42U, and for the design of systems with very high power.

供电

3.5 kW的型号配230 V的单相电使用，7 kW的则需两相电，10.5 kW的则需三相电（230 V + N）供电。

Supply

Models with 3.5 kW are intended for use with 1-phase mains supplies of 230 V. Models with 7 kW require a 2-phase resp. models with 10.5 kW power require a 3-phase supply (230 V + N).

可选择给电网装一监控设备（AIU, ENS），该设备可拆卸且为模块式。

The grid connection can be equipped with a supervision unit (AIU, ENS) which is optionally available, retrofittable and modular.

如选择安装“ENS2”，电网将变成三相电（L1, L2, L3, N, PE）。

With option „ENS2“ installed, the grid connection will become three-phase (L1, L2, L3, N, PE) for every model.

能量返回

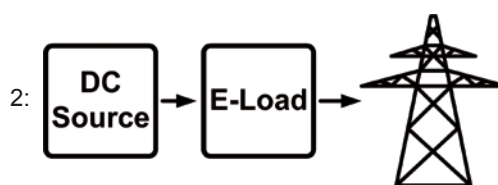
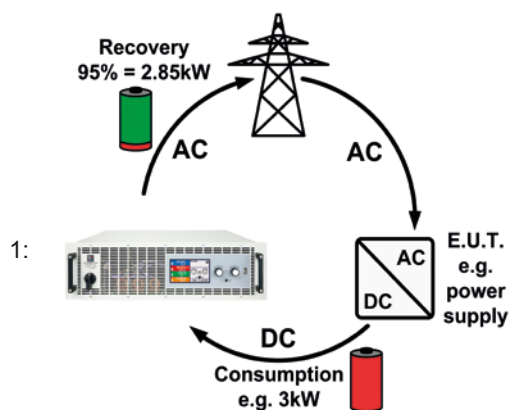
本负载最主要的特点是其AC输入端，即电网连接端，它也可用作直流电返回的输出端，转换效率接近93%。这种能量转换方式有助于降低用电成本，且避免使用昂贵的制冷系统，因为普通电子负载使用过程中会将直流输入电量转化成热量，从而需要制冷系统进行冷却。

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 approximately 93%. 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.

下面为两种电量转换的基本原理示意图：

Principle view of two ways of energy recovery:



如果这类回馈式负载执行发电的操作，按照当地供电公司的规定，可能要求安装一个额外的监控设备（AIU, ENS）。

For the operation of these feeding back loads in terms of power generation it might be required to install an additional supervision unit (AIU, ENS), according to provisions of the local energy supplying companies.

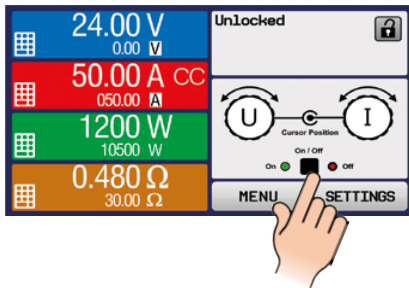
不管用户是否装有此类监控设备，我们产品配有一简易无冗余关闭功能，遇到电网连线突然断开时会关闭产品。本产品可监控AC电压和频率，当超过功率上限或下限时会自动关闭功率模块。

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



操作 (HMI)

手动操作通过电阻式触摸屏、两个旋钮与一个按钮来完成。大的蓝色显示器一次性显示所有设定与实际值。通过人机界面可完成整个设置，包括函数（方形，三角形，正弦形）的配置等。



Operation (HMI)

Manual operation is done with a resistive touch panel, two rotary knobs and a push-button. The large blue 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 the configuration of functions (square, triangle, sine) etc.

函数发生器与表格控制

本产品还具有基于FPGA的数字函数与任意发生器。它可控制和运行用户定制的负载配置文档，并产生任意顺序的正弦、方形、锯齿形以及跳跃型函数。

通过可自由编程的4096点数值表，能实时嵌入到控制电路中，然后可重现非线性内阻，就像电池或LED灯条中的内阻。

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-customisable load profiles and can generate sine, square, saw tooth and ramp functions in arbitrary order.

With a freely programmable, digital value table of 4096 points, which is embedded in the control circuit, the devices can reproduce non-linear internal resistances, such as those of batteries or LED chains.

远程控制 & 连接

进行远程控制时，可使用产品后板默认配置的两个接口卡端口（1x analog, 1x USB）与一个模拟接口。这些端口还可装上插拔式数字接口模块（指定插槽）进行扩展。

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).

另外，本系列所有型号还配有一个三位接口（3W功率，见下面描述），它为产品提供了1x IEEE, 1x USB与1x Analog接口。

Alternatively, all models can be equipped with a three-way interface (option 3 W, see below), which then offers 1x GPIB/IEEE, 1x USB and 1x Analog on the rear side of the device.

产品前方还有一个USB端口，用来插U盘，方便上传与保存函数和用户配置文档。

Another USB port, located on the front side, is intended for USB flash drives in order to load and save functions and user profiles.

应用到LabView IDE时，我们给USB, RS232或Ethernet常用接口提供即用版(VIs)。通过通讯协议文档还可支持其它IDE与接口。可上传和存储文档。

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

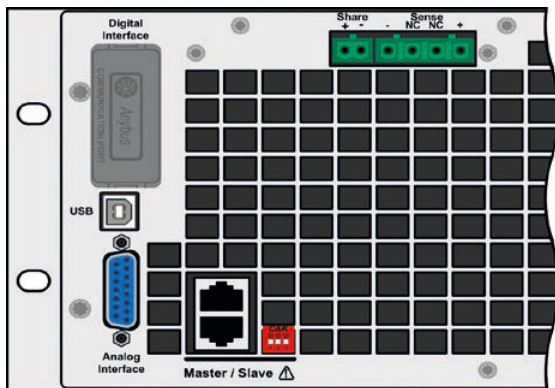
选项

- 可插拔式数字接口模块，如CANopen, Ethernet (1个或2个端口)，Profibus, ProfiNET (1个或2个端口)，RS232, DeviceNet与ModBus-TCP。请见122页。
- 还可安装带固定GPIB端口的三位接口（3W），而非接口模块用的默认插槽
- 自动隔离设备，三相供电 (AIU / ENS, 见124页)
- 预配置的机柜（见第128页）

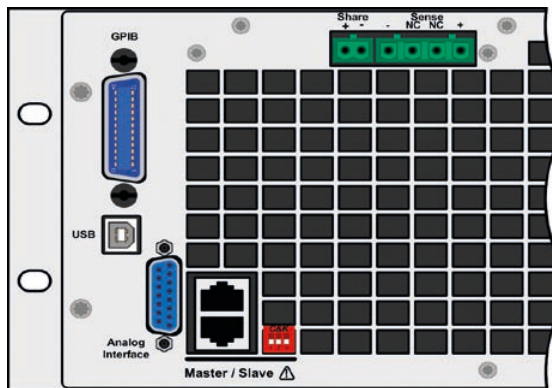


Options

- Pluggable and retrofittable, digital interface modules for CANopen, Ethernet (1 or 2 ports), Profibus, ProfiNet (1 or 2 ports), RS232, DeviceNet and ModBus-TCP. See page 122.
- Three-way interface (3 W) with a rigid GPIB port installed instead of the default slot for retrofittable interface modules.
- Automatic isolation unit, 3-phase (AIU / ENS, see page 124)
- Preconfigured cabinets (see page 128)



可标准型号后板所配端子 /
Rear connectors of the standard models



带选项功能型号后板所配端子 /
Rear connectors of models with option 3 W



技术参数	Technical Data	Series EA-ELR 9000 / 系列
AC输入	AC input	
- 1相电的输入电压	- Input voltage 1-phase models	230 V L->N, +10%/-15%, 45...66 Hz
- 2&3相电的输入电压	- Input voltage 2&3-phase models	400 V L->L, +10%/-15%, 45...66 Hz
- 功率因素校正	- Power factor correction (PFC)	>0.99
DC输入：电流	DC input: Current	
- 精确度	- Accuracy	<0.4%
- 0-100% ΔU_{DC} 的稳定度	- Stability at 0-100% ΔU_{DC}	<0.15%
- $\pm 10\%$ ΔU_{Mains} 的稳定度	- Stability at $\pm 10\%$ ΔU_{Mains}	<0.05%
- 负载10-90%调整时的反应时间	- Response time 10-90% load step	<1.5 ms
DC输入：电压	DC input: Voltage	
- 精确度	- Accuracy	<0.3%
- 0-100% Last 的稳定度	- Stability at 0-100% load	<0.05%
- $\pm 10\%$ ΔU_{Mains} 的稳定度	- Stability at $\pm 10\%$ ΔU_{Mains}	<0.02%
DC输入：功率	DC input: Power	
- 精确度	- Accuracy	<1.5%
- 0-100% ΔU_{DC} 的稳定度	- Stability at 0-100% ΔU_{DC}	<0.3%
- $\pm 10\%$ ΔU_{Mains} 的稳定度	- Stability at $\pm 10\%$ ΔU_{Mains}	<0.05%
DC输入：内阻	DC input: Resistance	
- 精确度	- Accuracy	<2%
- 0-100% ΔU_{DC} 的稳定度	- Stability at 0-100% ΔU_{DC}	<0.02%
- $\pm 10\%$ ΔU_{Mains} 的稳定度	- Stability at $\pm 10\%$ ΔU_{Mains}	<0.05%
显示器与面板	Display and panel	带触摸屏的图形显示器 / Graphics display with touch panel
数字接口	Digital interfaces	
- 内置型	- Built-in	1x 通讯用A型USB / 1x USB type B for communication 1x GPIB (带3 W可选功能 / 1x GPIB (optional with option 3 W)
- 插槽型	- Slot	1x 可更换的插入式模块 / 1x for retrofittable plug-in modules: RS232, RS485/422, CANopen, Profibus, Profinet, Ethernet
模拟接口	Analog interface	
- U / I / P / R 设定输入脚	- Setting inputs U / I / P	0...10 V / 0...5 V
- U / I 控制输出脚	- Monitoring outputs U / I	0...10 V / 0...5 V
- 控制信号	- Control signals	远程开-关, 输入开-关 / Remote on-off, Input on-off
- 状态信号	- Status signals	过压 / Overvoltage, 过温 / Overtemperature
- 参考电压	- Reference voltage	10 V / 5 V
制冷	Cooling	温控风扇 / Temperature controlled fans
- 工作温度	- Operation temperature	0...50°C
- 储存温度	- Storage temperature	-20...70°C
后板上的连接端	Terminals on rear panel	
- 负载输入	- Load input	螺丝端 / Screw terminal
- 共享总线 & 感测端	- Share Bus & Sense	2针插头连接器 / Plug connector 2 pole & 4 pole
- 模拟接口	- Analog interface	15针Sub-D型连接器 / Sub-D connector 15 pole 50针模块插座或24针GPIB接口, 以及USB/
- 数字接口	- Digital interface	Module socket 50 pole or GPIB 24 pole, USB

型号 / Model	功率 Power	电压 Voltage	电流 Current	阻值 Resistance	效率 Efficiency	宽 / 深 ⁽¹⁾ Width / Depth ⁽¹⁾	高 Height	重量 Weight	产品编号 ⁽²⁾ Article number ⁽²⁾
EA-ELR 9080-170	0...3.5 kW	0...80 V	0...170 A	0.01...12 Ω	92.5%	19" / 609 mm	3U	17 kg	33200401
EA-ELR 9250-70	0...3.5 kW	0...250 V	0...70 A	0.09...120 Ω	93.5%	19" / 609 mm	3U	17 kg	33200402
EA-ELR 9500-30	0...3.5 kW	0...500 V	0...30 A	0.42...480 Ω	94.5%	19" / 609 mm	3U	17 kg	33200403
EA-ELR 9750-22	0...3.5 kW	0...750 V	0...22 A	0.8...1100 Ω	94.5%	19" / 609 mm	3U	17 kg	33200404
EA-ELR 9080-340	0...7 kW	0...80 V	0...340 A	0.005...6 Ω	92.5%	19" / 609 mm	3U	24 kg	33200405
EA-ELR 9250-140	0...7 kW	0...250 V	0...140 A	0.04...60 Ω	93.5%	19" / 609 mm	3U	24 kg	33200406
EA-ELR 9500-60	0...7 kW	0...500 V	0...60 A	0.21...240 Ω	94.5%	19" / 609 mm	3U	24 kg	33200407
EA-ELR 9750-44	0...7 kW	0...750 V	0...44 A	0.43...550 Ω	94.5%	19" / 609 mm	3U	24 kg	33200408
EA-ELR 91000-30	0...7 kW	0...1000 V	0...30 A	0.83...950 Ω	94.5%	19" / 609 mm	3U	24 kg	33200409
EA-ELR 9080-510	0...10.5 kW	0...80 V	0...510 A	0.003...4 Ω	92.5%	19" / 609 mm	3U	31 kg	33200410
EA-ELR 9250-210	0...10.5 kW	0...250 V	0...210 A	0.03...40 Ω	93.5%	19" / 609 mm	3U	31 kg	33200411
EA-ELR 9500-90	0...10.5 kW	0...500 V	0...90 A	0.14...160 Ω	94.5%	19" / 609 mm	3U	31 kg	33200412
EA-ELR 9750-66	0...10.5 kW	0...750 V	0...66 A	0.29...360 Ω	94.5%	19" / 609 mm	3U	31 kg	33200413
EA-ELR 91500-30	0...10.5 kW	0...1500 V	0...30 A	1.2...1450 Ω	94.5%	19" / 609 mm	3U	31 kg	33200414

(1) 仅为外壳尺寸 / Enclosure only

(2) 标准型号的产品编码, 带3 W选项功能的编码则会不同 / Article number of the standard version, models with option 3 W installed have different article numbers.

