



EA-ELR 9000 3.5KW - 10.5KW

能量反馈式直流电子负载 / ELECTRONIC LOAD WITH ENERGY RECOVERY

U
I
P
R
OVP
OPC
OPP
OTP

19"

L

USB

MS

ABCC



EA-ELR 9080-170

- 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10.5kW
还可扩展至105kW或更高
- 输入电压高达1500V
- 每台产品的输入电流能高达510A
- 基于FPGA/DSP数字控制
- 多语言触摸屏
- 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
- 可选自动隔离设备⁽¹⁾

- 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 10.5kW per unit
Expandable to 105kW or more
- Input voltages up to 1500V
- Input currents up to 510A per unit
- FPGA/DSP based digital control
- Multi-language touchpanel
- 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
- Optional automatic isolation unit ⁽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。

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.

1) 前德文术语名: ENS

1) Former german name: ENS

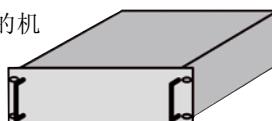


功率、电压和电流等级

本系列有0...80V DC至0...1500V DC输出电压的产品型号，还有一款输入电流高达510A的型号。本系列有三个功率级别，分别为3.5kW, 7kW或10.5kW，单机外壳仅3U高。还可组合到机柜内扩展高达105kW（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。

机械结构

所有型号都安装于一个3U高，19“宽，609mm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。



供电

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

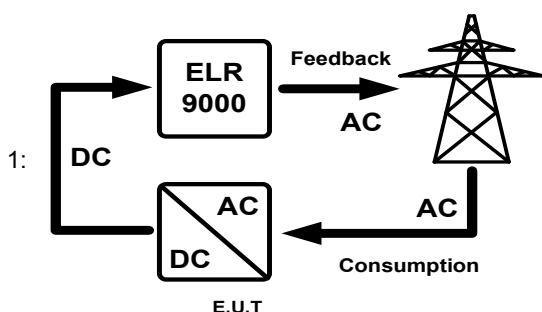
可选择给电网装一监控设备（AIU, ENS），该设备可拆卸且为模块式。

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

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。

下面为两种电量转换的基本原理示意图：



如果对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）。

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。

Power ratings, voltages, currents

The available voltage range portfolio goes from models with 0...80V DC up to models with 0...1500V DC. Input currents up to 510A with only one unit are available. The series offers three power classes with 3.5kW, 7kW or 10.5kW in only 3U for single devices, which can be extended up to 105kW (or higher) in cabinets for a significantly high total current. Upon request, even higher total power can be realised.

Construction

All models are built in 19“ wide rack enclosures with 3U height and 609mm 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.

Supply

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

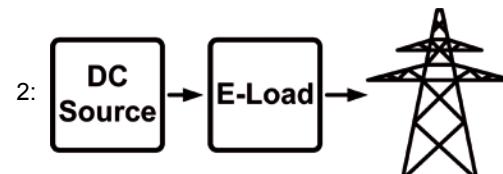
The grid connection can be equipped with a supervision unit (AIU, ENS) which is optionally available, retrofittable and modular.

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

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.

Principle view of two ways of energy recovery:



For the operation of these backfeeding 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.

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.

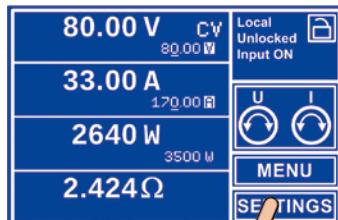


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操作 (HMI)

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 pushbutton. 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

本产品还具有一基于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4096个点的数值表，可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。

连接

本产品默认配有两个内置USB端口与一个模拟接口。产品后方的USB端口用于数字式远程控制本产品，前方的A型USB端口用来插U盘，可上传和存储文档。

产品后端还有一个接口模块插槽。关于它的详细信息，请参考122页。

远程控制

产品后板有两个接口卡插槽（一个插模拟接口，一个插USB），通过可插拔式数字接口模块还能扩展出更多。

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。

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。
- 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)



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

Connectivity

By default, two USB ports and an analog interface are built-in. The USB port on the rear is used for digital remote control of the device, the front side port of type A is for USB flash drives in order to load and save profiles.

There is furthermore a slot for interface modules on the rear side. See page 122 for more information.

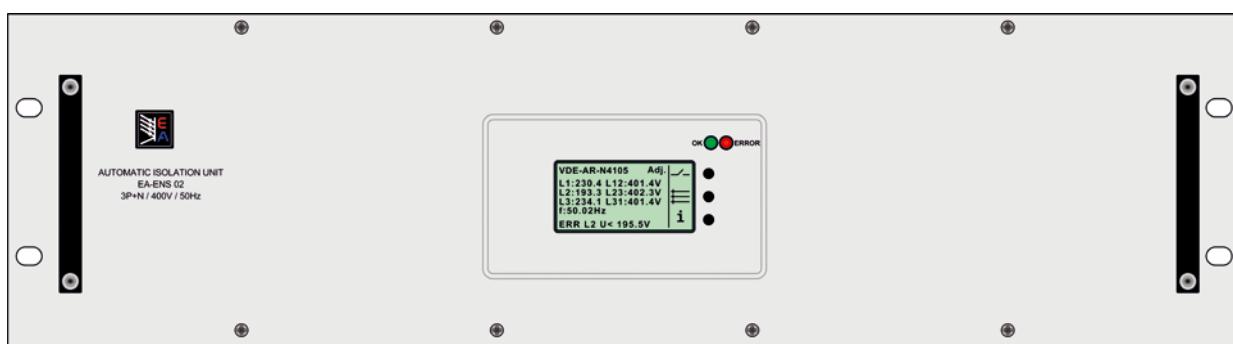
Remote control

There are 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.

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.

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.
- Automatic isolation unit, 3-phase (AIU / ENS, see page 124)
- Preconfigured cabinets (see page 128)



可选ENS2模块前视图，适合高3U、宽19“的ELR 9000外壳 /
Front view of optional ENS2-Module, matching the ELR 9000 enclosure in height (3U) and width (19“)

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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	230V L->N, +10%/-15%, 47..63Hz
- 2&3相电的输入电压	- Input voltage 2&3-phase models	400V L->L, +10%/-15%, 47..63Hz
- 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} 的稳定性	- Stability at 0-100% ΔU _{DC}	<0.15%
- ±10% ΔU _{Mains} 的稳定性	- Stability at ±10% ΔU _{Mains}	<0.05%
- 负载10-90%调整时的反应时间	- Response time 10-90% load step	<1.5ms
DC输入: 电压	DC input: Voltage	
- 精确度	- Accuracy	<0.3%
- 0-100% Last的稳定性	- Stability at 0-100% load	<0.05%
- ±10% ΔU _{Mains} 的稳定性	- Stability at ±10% ΔU _{Mains}	<0.02%
- 300kHz-20MHz的纹波	- Ripple 300kHz-20MHz	取决于电压源的阻值 / Depends on the voltage source impedance
DC输入: 功率	DC input: Power	
- 精确度	- Accuracy	<1.5%
- 0-100% ΔU _{DC} 的稳定性	- Stability at 0-100% ΔU _{DC}	<0.3%
- ±10% ΔU _{Mains} 的稳定性	- Stability at ±10% ΔU _{Mains}	<0.05%
DC输入: 内阻	DC input: Resistance	
- 精确度	- Accuracy	<2%
- 0-100% ΔU _{DC} 的稳定性	- Stability at 0-100% ΔU _{DC}	<0.02%
- ±10% ΔU _{Mains} 的稳定性	- Stability at ±10% ΔU _{Mains}	<0.05%
显示器	Display	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 U盘用A型USB / 1x USB type A for USB flash drives
- 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 / R	0...10V / 0...5V
- U / I 控制输出脚	- Monitoring outputs U / I	0...10V / 0...5V
- 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	10V / 5V
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	- Share Bus	2针插头连接器 / Plug connector 2 pole
- 感测端	- Sense	4针插头连接器 / Plug connector 4 pole
- 模拟接口	- Analog interface	15针Sub-D型连接器 / Sub-D connector 15 pole
- 数字接口	- Digital interface	50针模块插座/ Module socket 50 pole

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

(1) 仅为外壳尺寸 / Enclosure only

(2) HF纹波 0Hz - 20MHz / HF ripple 0Hz - 20MHz