EA-ELR 9000 3.5KW - 10.5KW
能量回馈式电子负载 / ELECTRONIC LOAD WITH ENERGY RECOVERY

EA-ELR 9080-510

- 可供1相或3相输入电压使用
- 可将直流能量返回到公共电网
- 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200kW或更高
- 输入电压高达1500V
- 输入电流高达510A
- 基于FPGA/DSP的数控
- 多语言触摸屏
- 用户配置文档，数据记录，真实函数发生器
- 内置模拟接口与USB接口
- 并联用共享总线
- 前板有额外的USB端口，适合使用外置U盘
- 多款可选数字式即插即用型接口
- 可选自动隔离设备(1

- **For 1-phase or 3-phase supply**
- **Energy recovery of the supplied DC energy into the public grid**
- **Galvanically isolated DC input**
- **Input power ratings up to 10.5kW per unit Expandable to 200kW or more**
- **Input voltages up to 1500V**
- **Input currents up to 510A per unit**
- **FPGA/DSP based digital control**
- **Multi-language touchpanel**
- **User profiles, data logging, true function generator**
- **Analog interface and USB interface built-in**
- **Share bus for parallel connection**
- **Extra USB port on the front for USB stick**
- **Optional, digital, plug & play interfaces**
- **Optional automatic isolation unit (1**

新一系列EA-ELR 9000直流电子负载具有能量返回（即：返回市电）功能，提供新的额定电压、电流与功率，适用于多种用途。它具有四个常用的调节模式：恒压、恒流、恒功率和恒阻。基于 FPGA的控制电路提供了更多新功能，如函数发生器，控制动态负载配置文件的基于表格格式的调整电路，或非线性内阻的模拟。

能量返回功能可对直流源输出来的能量进行转化成同步电流，然后供给当地或公共电网。大的蓝色触摸屏提供一个不同于其他产品的直观的手动操作面板。

经模拟或数字接口的控制反应时间因DSP控制软件得到很好的改善和提高。

并联操作时，“Share bus系统”可用于单机与单机之间平衡电流的分布。

A new series of electronic DC loads with energy recovery (i.e. mains backfeed), called EA-ELR 9000, offers new voltages, currents and power ratings for a multitude of applications. These loads 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 gemerator, a table based regulation circuit for the control of dynamic load profiles or the simulation of non-linear internal resistances.

The energy recovery function converts the supplied DC energy into a synchronous since current and feeds it back into the local or public grid. The big blue LCD touch panel offers a different and intuitive kind of manual handling compared to other devices.

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

During parallel operation, a „Share bus“ is used to balance the load current between the single units

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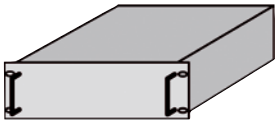
功率、电压和电流等级
本系列有0...80V DC至0...1500V DC输出电压的产品型号，还有一款输入电流高达510A的型号。本系列有三个功率级别，分别为3.5kW，7kW或10.5kW，单机的外壳仅3U高。还可组合到机柜内扩展高达200kW的功率，形成更大的总电流。按照客户要求能组成更大功率的系统。



Power ratings, voltages, current
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 200kW in cabinets, for an correspondingly high total current. Upon request even higher total power can be realised.

机械结构
所有型号都为3U高，19“宽，595mm深的机架式外壳，适合各种尺寸的19“机柜，如42U，以及大功率的系统设计。

Mechanics
All models are built in 19“ wide rack enclosures with 3U height and 595mm depth, what makes them ideal for the use in 19“ cabinets of various sizes, for example 42U, and for the design of systems with very high total power.

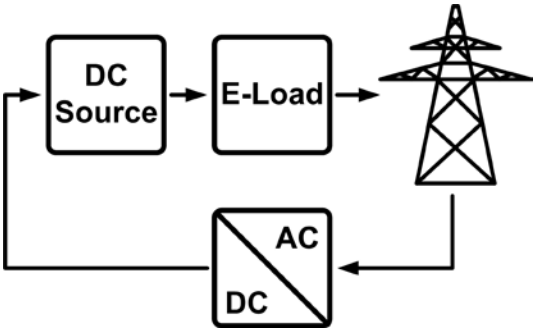
供电
3.5kW的型号适合230V的单相电使用，而7kW或10.5kW则需400V的三相电供电。
可选择给电网装一控制器（AIU，ENS），可拆卸且为模块式。如选择安装“ENS”，电网将变成三相电（L1，L2，L3，N，PE），供给每一台型号。

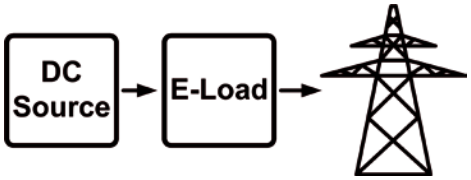
Supply
Models with 3.5kW are intend for the use on 1-phase mains supply with 230V, models with 7kW or 10.5kW power required a 3-phase connection with 400V.
The grid connection can be equipped a supervision unit (AIU, ENS) which is optionally available, retrofittable and modular. With option „ENS“ installed, 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，即电网连接，它也可用作直流电反馈的输出，其转换效率接近93%。这种能量转换方式可帮助降低能耗成本，且能避免使用普通电子负载将直流因输入能量转化成热量而需要配备昂贵的制冷系统。

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 backfeed of the supplied DC energy, which will be converted with an efficiency of approximately 93%. This way of energy recovery help to lower energy costs and avoids expensive cooling systems, as required for conventional electronic loads, which convert the DC input energy into heat.
Principle view of two ways of energy recovery:

下面为两种能量转换的基本原则示意图：





若涉及发电而操作这类回馈式负载，按照一些严格的供电公司的规定，可能需要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，如遇电网连线突然断开，我们的负载产品有一个简单无冗余的关闭功能可关闭产品。它可监控AC电压和频率，并当遇到超过功率上限或下限时能自动关闭功率模块。

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 responsible 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.

提示：此页出现的所有品名，参数和图纸 都为初步定义，如有变动。
Note: All names, values and drawings on this page are preliminary and subject to change

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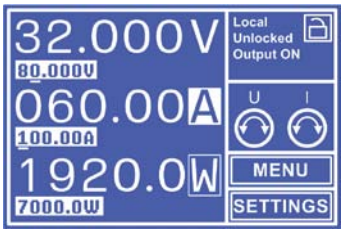
操作
手动操作通过电阻式触摸屏，两个旋钮与一个按钮来完成。大的蓝色显示器一次性显示所有设定与实际值。经过人机界面，函数（方形，三角形，正弦形）等配置可完成整个设置。



Handling (HMI)
The manuelle operation is done with a resistive touchpanel, two rotary knobs and a pushbutton. The big blue display shows all relevant set and actual values at one 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
它还有一特征，就是配有一个基于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，并产生正弦，方形，锯齿形以及跳跃函数，且带外差式正弦波调制。

通过4096个点的数值表，可实时嵌入到控制电路中，然后重复产生非线性内阻，就像电池或LED灯串链中的内阻。

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, sawtooth and ramp functions, also with heterodyned sine wave modulation.
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, like the ones of batteries or LED chains.

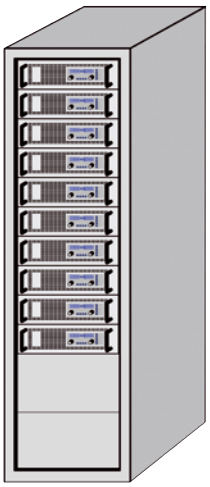
连接
本产品默认配有两个USB端口，以及一个内置模拟接口。产品后方的USB端口用于数字式远程控制本产品，前方的A型USB端口用来插U盘，从而上传和存储文档。也可以将记录下的数据存储为CSV格式文档。
产品后端还有一个接口模块插槽。关于它的详细信息，请参考121页。按客户需求还可提供其他类未列出的接口卡。

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 sticks, in order to load and save profiles. It will also be possible to log data into CSV files with it.
There is furthermore a slot for interface modules on the rear side. See page 138 for more information. Other interface types than listed are available upon request.

远程控制
产品上还有几个接口卡插槽（一个模拟，一个USB），通过可插拔式数字接口模块进行扩展，如：RS232，RS485，CANopen，Ethernet，Profibus 。
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。

Remote control
There are several interface ports (1x analog, 1x USB) available on the devices, which can also be extended by optional, pluggable and retrofittable, digital interface modules für RS232, RS485, CANopen, Ethernet, Profibus and others.
For the implementation into the LabView IDE we offer ready-to-use components (VIs) for 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/IP，Profibus，ProfiNET，RS232或RS485/422。请见121页。按需开可供其它接口。
- 自动隔离设备 (AIU)
- 可预先配置的机柜（见第126页）



Options
- Pluggable and retofittable, digital interface modules for CANopen, Ethernet/IP, Profibus, ProfiNET, RS232 or RS485/422. See page 138. Other interfaces upon request.
- Automatic isolation unit (AIU)
- Preconfigured cabinets (see page 160)

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技术参数	Technical Data	EA-ELR 9000
AC输入	**AC input**	
- Spannung 1-phasige Modelle	- Input voltage 1-phase models	230V +15%/-10%, 47...53Hz, L+N
- Spannung 2&3-phasige Modelle	- Input voltage 2&3-phase models	400V +15%/-10%, 47...53Hz, L1+L2+L3+N
- Leistungsfaktorkorrektur	- Power factor correction (PFC)	>0.99
DC输入：电流	**DC input: Current**	
- 精确度	- Accuracy	<0.2%
- 0-100% ΔU_{DC}的稳定度	- Stability at 0-100% ΔU_{DC}	<0.15%
- ±10% ΔU_{Netz}的稳定度	- 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	<0.2%
- 0-100% Last的稳定度	- Stability at 0-100% load	<0.05%
- ±10% ΔU_{Netz}的稳定度	- 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	<0.5%
- 0-100% ΔU_{DC}的稳定度	- Stability at 0-100% ΔU_{DC}	<0.3%
- ±10% ΔU_{Netz}的稳定度	- Stability at ±10% ΔU_{Mains}	<0.05%
DC输入：内阻	**DC input: Resistance**	
- 精确度	- Accuracy	<2%
- 0-100% ΔU_{DC}的稳定度	- Stability at 0-100% ΔU_{DC}	<电流范围的0.3% / <0.3% of current range
- ±10% ΔU_{Netz}的稳定度	- 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 sticks
- 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**	
- 设定 U / I / P / R输入	- Setting inputs U / I / P / R	0...10V
- 控制 U / I 输出	- Monitoring outputs U / I	0...10V
- 控制信号	- Control signals	远程开关，输入开关，R模式开关 / Remote on-off, Input on-off, R mode on-off
- 状态信号	- Status signals	过压 / Overvoltage, 过温 / Overtemperature
- 参考电压	- Reference voltage	10V
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

			电流 / Current							
	功率	电压	范围	纹波[2]	阻值	效率	宽 / 深[1]	高	重量	产品编号
Modell / Model	**Power**	**Voltage**	**Range**	**Ripple[2]**	**Resistance**	**Efficiency**	**Width / Depth[1]**	**Height**	**Weight**	**Article number**
EA-ELR 9080-170	0...3500W	0...80V	0...170A	<700mA$_{PP}$	0.01...12Ω	92.5%	19“ / 595mm	3U	19.5kg	33200401
EA-ELR 9250-70	0...3500W	0...250V	0...70A	<500mA$_{PP}$	0.09...120Ω	93.5%	19“ / 595mm	3U	19.5kg	33200402
EA-ELR 9500-30	0...3500W	0...500V	0...30A	<400mA$_{PP}$	0.42...480Ω	94.5%	19“ / 595mm	3U	19.5kg	33200403
EA-ELR 9750-22	0...3500W	0...750V	0...22A	<350mA$_{PP}$	0.85...1100Ω	94.5%	19“ / 595mm	3U	19.5kg	33200404
EA-ELR 9080-340	0...7000W	0...80V	0...340A	<800mA$_{PP}$	0.005...6Ω	92.5%	19“ / 595mm	3U	25.5kg	33200405
EA-ELR 9250-140	0...7000W	0...250V	0...140A	<550mA$_{PP}$	0.04...60Ω	93.5%	19“ / 595mm	3U	25.5kg	33200406
EA-ELR 9500-60	0...7000W	0...500V	0...60A	<450mA$_{PP}$	0.21...240Ω	94.5%	19“ / 595mm	3U	25.5kg	33200407
EA-ELR 9750-44	0...7000W	0...750V	0...44A	<700mA$_{PP}$	0.43...550Ω	94.5%	19“ / 595mm	3U	25.5kg	33200408
EA-ELR 91000-30	0...7000W	0...1000V	0...30A	<700mA$_{PP}$	0.83...950Ω	94.5%	19“ / 595mm	3U	25.5kg	33200409
EA-ELR 9080-510	0...10500W	0...80V	0...510A	<700mA$_{PP}$	0.003...4Ω	92.5%	19“ / 595mm	3U	33kg	33200410
EA-ELR 9250-210	0...10500W	0...250V	0...210A	<700mA$_{PP}$	0.03...40Ω	93.5%	19“ / 595mm	3U	33kg	33200411
EA-ELR 9500-90	0...10500W	0...500V	0...90A	<700mA$_{PP}$	0.14...160Ω	94.5%	19“ / 595mm	3U	33kg	33200412
EA-ELR 9750-66	0...10500W	0...750V	0...66A	<700mA$_{PP}$	0.29...360Ω	94.5%	19“ / 595mm	3U	33kg	33200413
EA-ELR 91500-30	0...10500W	0...1500V	0...30A	<700mA$_{PP}$	1.25...1450Ω	94.5%	19“ / 595mm	3U	33kg	33200414

(1 仅为外壳尺寸 / Enclosure only
(2 HF纹波 0Hz - 20MHz / HF ripple 0Hz - 20MHz

EA-IF-AB 系列 / EA-IF-AB SERIES
数字接口模块 / DIGITAL INTERFACE MODULES

EA-IF-AB Interfaces

- 可更换，安装简易（即插即用型）
- 通过产品上的设置菜单可简便地完成配置
- 电隔离耐压高达**2500V**

基本信息
目前已开发的以及后续新款，用于可编程电源或电子负载上的EA接口卡都为可插拔式的数字模块。

支持**LabView**与编程语言
我们给RS232, RS485与Ethernet接口卡提供即用的 LabView-VIs。
通讯协议是完全开放的，存储在文件内。可将其整合到任何一种虚拟编程语言中。

其它接口类型
按需求，还可将其它类型接口卡应用到产品软件中，如：ModBUS-RTU, DeviceNET, Bluetooth, ProfiNET 2-Port, Ethernet/IP 2-Port。

软件和驱动
随接口卡会附有一张光盘，里面存储一些文档和软件。该软件分为Windows软件包***EasySoft***（也可见63页）与LabView兼容版VIs。两个软件仅限制于与普通接口USB，RS232/485 或 Ethernet-以太网的使用。

型号概览

RS232
- EA-IF-AB-RS232　　产品编号：35400101
- 转换速度：最大115200 Bd
- D-sub型公座，9针，配调制解调器连线

RS485/422
- EA-IF-AB-RS485　　产品编号：35400102
- 转换速度：最大10MBit/s
- 传输距离长达1200m
- 可转换至RS422的功能
- 1x Sub-D型母座，9针

- **Retrofittable, simple installation (plug'n'play)**
- **Easy configuration via a setup menu on the device**
- **Galvanic isolation up to 2500V**

General
The EA interfaces are pluggable, digital modules for current and upcoming series of programmable power supplies or electronic loads.

Support for LabView and programming languages
For the interfaces RS232, RS485 and Ethernet we provide ready-to-use LabView VIs.
The communication protocol is open and included in the documentation. Thus it can be integrated in virtually any programming language.

Other interface types
Upon request, further interface types can be implemented into the software of the devices: ModBUS-RTU, DeviceNET, Bluetooth, ProfiNET 2 port, Ethernet/IP 2 port.

Software and drivers
The interface cards are delivered with a tools CD that includes documentation and software. The software is divided into the Windows software suite ***EasySoft*** (also see page 67) and LabView compatible VIs. Both software are limited to the use with common interfaces like USB, RS232/485 or Ethernet.

Model overview

RS232
- EA-IF-AB-RS232　　Art.No. 35400101
- Transfer speed: max. 115200 Bd
- D-sub, male, 9-pole for null modem cable

RS485/422
- EA-IF-AB-RS485　　Art.No. 35400102
- Transfer speed: max. 10MBit/s
- For transmission over distances of up to 1200m
- Switchable to RS422 functionality
- 1x D-Sub socket, female, 9-pole

EA-IF-AB 系列 / EA-IF-AB SERIES
数字接口模块 / DIGITAL INTERFACE MODULES

CANopen
- EA-IF-AB-CAN 产品编号：35400100
- 转换速度：最大1MBit/s
- 全CANopen-Slave
- Auto-Baud
- 最大32 TPDO 与 32 RPDO
- 含EDS (电子数据表)文档
- 1x Sub-D型公座，9针

Profibus
- EA-IF-AB-PBUS 产品编号：35400103
- 转换速度：最大12MBit/s
- 全DPV1-Slave
- 含GSD-Datei (Generic Station Device)文档
- 1x Sub-D型母座，9针

ProfiNET
- EA-IF-AB-PNET 产品编号：35400105
- 转换速度：最大100MBit/s，全双向
- PROFINET IO通讯
- 多达两个APIs (含API0)
- 多达32767个ADIs
- 多达256个字节，实时I/O
- 1x RJ45插座，8针

Ethernet/IP
- EA-IF-AB-ETH1 产品编号：35400104
- 转换速度：最大10/100MBit/s
- CIP-参数对象
- 多达65535个ADIs
- 透明插座
- 1x RJ45插座，8针

CANopen
- EA-IF-AB-CAN Art.Nr. 35400100
- Transfer speed: max. 1MBit/s
- Full CANopen slave
- Auto-baud
- Max. 32 TPDO and 32 RPDO
- EDS (Electronic Data Sheet) included
- 1x D-Sub socket, male, 9-pole

Profibus
- EA-IF-AB-PBUS Art.No. 35400103
- Transfer speed: max. 12MBit/s
- Full DPV1 slave
- GSD (Generic Station Device) file included
- 1x D-Sub socket, female, 9-pole

ProfiNET
- EA-IF-AB-PNET Art.No. 35400105
- Transfer speed: 100MBit/s, full duplex
- PROFINET IO communication
- Up to two APIs (incl. API0)
- Up to 32767 ADIs
- Up to 256 Bytes realtime I/O
- 1x RJ45 socket, 8-pole

Ethernet/IP
- EA-IF-AB-ETH1 Art.No. 35400104
- Transfer speed: 10/100MBit/s
- CIP parameter objects
- Up to 65535 ADIs
- Transparent socket
- 1x RJ45 socket, 8-pole