EA-EL 9000 B 1.2 kW - 14.4 kW

可编程直流电子负载
Programmable Electronic DC loads

EA-EL 9080-510 B 3U

U | I | P | R | OVP | OCP | OPP | OTP | 19" | MS | USB | Option: | IFAB | IEEE | WC

- 输入功率级别：1.2 kW...14.4 kW，还可扩展至机柜系统，功率高达72 kW
- 输入电压：0...80 V至0...750 V
- 输入电流：每台高达1020 A
- 基于FPGA的控制电路
- 多语言彩色触摸屏
- 用户配置文档，真实函数发生器
- 多个可调保护功能：OVP, OCP, OPP
- 操作模式：CV, CC, CP, CR
- 电隔离接口（模拟与USB端口）
- 并联用主-从总线
- 支持SCPI & ModBus RTU
- LabView VIs与远程控制软件(Windows)

- **Input power ratings: 1.2 kW...14.4 kW, expandable in cabinets up to 72 kW**
- **Input voltages: 0...80 V up to 0...750 V**
- **Input currents: up to 1020 A per unit**
- **FPGA based control circuit**
- **Multilingual colour touch panel**
- **User profiles, true function generator**
- **Adjustable protections: OVP, OCP, OPP**
- **Operation modes: CV, CC, CP, CR**
- **Galvanically isolated interfaces (analog and USB)**
- **Master-slave bus for parallel connection**
- **SCPI & ModBus RTU supported**
- **LabView VIs and remote control software (Windows)**

概要

EA-EL 9000 B系列是一款新的小型电子负载，它将取代之前的EA-EL 9000 A系列，供应新的电压、电流与功率级别，适用于众多应用。
所有型号都有四种操作模式：恒压（CV），恒流（CC），恒功率(CP)和恒阻(CR)。基于FPGA的控制电路具有很多有趣的特征，比如：真实函数发生器，它可使用表格做成的函数模拟非线性内阻。

与之前的EA-EL 9000 A系列相比，其功率损耗与高度之间的比例得到很大地提升。所有型号都只为3U高，而每台产品消耗的直流功率可达7.2 kW，6U型号则为两倍。

General

The new series of compact electronic DC loads, called EA-EL 9000 B, replaces the former series EA-EL 9000 A and offers new voltage, current and power ratings for a multitude of applications.
All models support the four common regulation modes constant voltage (CV), constant current (CC), constant power (CP) and constant resistance (CR). The FPGA based control circuit provides interesting features, such as a function generator with a table based function for the simulation of non-linear internal resistances.

The ratio between power consumption and height of the devices has been significantly increased compared to the former series EA-EL 9000 A. The new models with 3U of height are capable of consuming DC power of up to 7.2 kW per unit and the 6U models even twice as much.

EA-EL 9000 B 1.2 kW - 14.4 kW

大的彩色TFT触摸屏可以让用户直观地手动操作，就像现在流行的智能手机或者平板电脑那样操作。
经模拟或数字接口控制产品时的响应时间已大大提高，全归因于FPGA处理器控制的硬件。
多台产品并联时，可以使用主-从总线，将这些产品连接起来，组成更大的系统。此系统的实际输出值会被汇总，而设定值会均衡分布。

功率等级、电压和电流

本系列有0...80 V DC至0...750 V DC输出电压的多个型号，单台机器的输入电流就高达1020A。单个型号的功率级别有很多，因此多台本系列型号装入机柜后，可扩展至144 kW(见138页），从而获得更大的总电流。

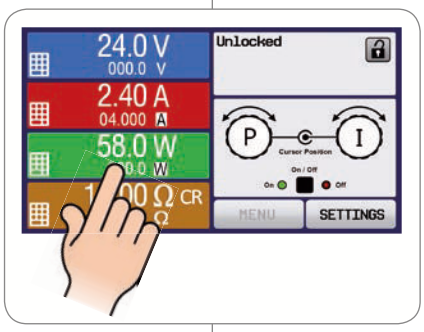
结构

本系列所有型号都组装在一个19“宽，3U或6U高，460 mm深的柜式外壳内，可以简便地装入不同尺寸的19“机柜，比如42U，以组成更高的功率。还可将不同的设备安装到机柜系统，比如：电子负载与电源一起，这样可以组成一个大功率的供电-吸收电的系统。

操作面板（HMI）

手动操作通过TFT触摸屏、两个旋钮与一个按钮来完成。大的彩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。

还提供多语言显示（德文，英文，俄文，中文）。



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3276个有效点数自由编程的数值表，能实时嵌入到控制电路中，然后可重现非线性内阻，如：电池或LED灯条中的内阻。

The large colour TFT touch panel offers an intuitive kind of manual operation, such as it is prolific nowadays with smartphones or tablet computers. 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 link the units to a bigger system where the actual values are totalled 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...750 V DC. Input currents up to 1020 A with only one unit are available. The series offers various power classes amongst the single models, which can be extended up to 144 kW in cabinets (see from page 138) for a significantly higher total current.

Construction

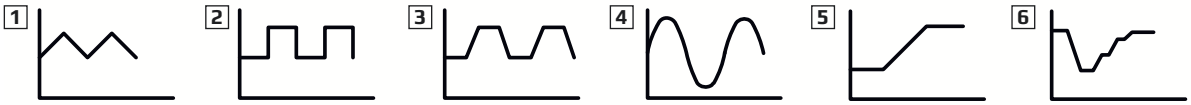
All models are built in 19“ wide rack enclosures with 3U or 6U of height and 460 mm of depth, which makes them ideal for use in 19“ cabinets of various sizes, for example 42U, and for the design of systems with very high power. It is furthermore possible to build cabinet systems with mixed equipment, i.e. electronic loads and power supplies, in order to achieve the source-sink principle with high power ratings.

Handling (HMI)

Manual operation is done with a TFT touch panel, two rotary knobs and a pushbutton. The large colour 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.
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 controlling and running 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 3276 effective points, which is embedded in the control circuit, the devices can reproduce non-linear internal resistances, such as those of batteries or LED chains.



三角形 *Triangle* | 矩形 *Rectangle* | 梯形 *Trapezoid* | 正弦 *Sine* | 阶跃 *Ramp* | DIN 40839

Share-Bus-共享总线

产品后板有一个模拟连接端子叫“Share Bus”，用来均衡多台类似产品并联时的电流，如：本系列的负载产品与EA-ELR 9000系列并联。
还可通过此端子连接EA-PSI 9000，EA-PS 9000与EA-PSE 9000系列电源，以便组建两象限系统。该系统专门利用源-沉原理进行测试用途。

Share Bus

The so-called „Share Bus“ is an analog connection at the rear of the devices and is used to balance current across multiple similar units in parallel connection, such as with loads of this series and series EA-ELR 9000.
It can also be used to build a two-quadrants system in connection with power supplies of series EA-PSI 9000, EA-PS 9000 and EA-PSE 9000. This system is dedicated for testing purposes using the source-sink principle.

EA-EL 9000 B 1.2 kW - 14.4 kW

功率降额

EA-EL 9000 B系列产品具有热降额功能，可避免产品在最大功率下运行时过热。
环境温度越低，冷却状况越好，负载可吸收的功率就越大。功率降额后可持续吸收的功率是在21°C室温条件下定义的，并当温度上升时会快速减少。

电池测试

本产品还有一电池测试模式，可以通过恒流或恒阻放电来测试各类电池。它会显示累计的测试时间(Ah)与消耗的容量 (Wh)。

EA Power Control测试期间，由电脑记录的数据，可以CSV格式导出Excel表。后续可在MS Exce或类似工具下进行分析，甚至能创建可视化的放电图。
关于更详细的设置，还可设定一可调极限值，当电池电压低时停止测试，或者停止可调最大测试期。

远程控制 & 连接

本产品后板标配有两个接口（1x 模拟，1x USB），可经其进行远程控制。还可选择一插拔式数字接口模块（插到指定插槽）进行扩展。

如要应用到LabView IDE，我们还提供即用的组建（VIs），能与USB，RS232，GPIB以及以太网接口一起使用。其它IDE与接口类型则需通讯协议才能支持。
Windows用户还可使用“EA Power Control”免费软件。它具有“排序”功能，通过CSV格式的半自动化表格控制产品。此表能代表简易的测试程序，可在MS Excel或其它CSV编辑器下创建与编写，然后导入软件工具内。
该软件利用“**多功能控制**”特性（需注册码，非免费），可一次性监控多达20台产品。更多信息见136页。

Power derating

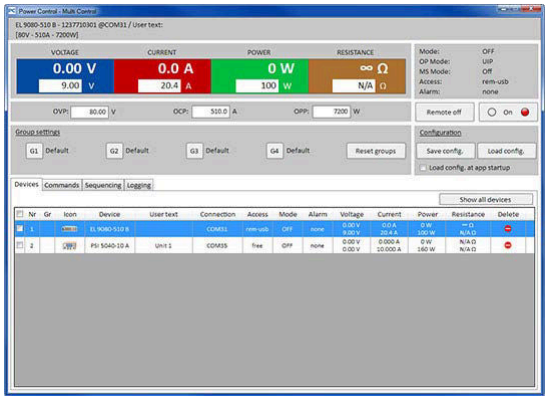
The devices of the EA-EL 9000 B series are equipped with thermal derating in order to avoid overheating when operating in the maximum power range. The lower the ambient temperature and the better the cooling, the higher the power that the load can take. The nominal intake power before the derating starts is defined at 21°C ambient temperature.

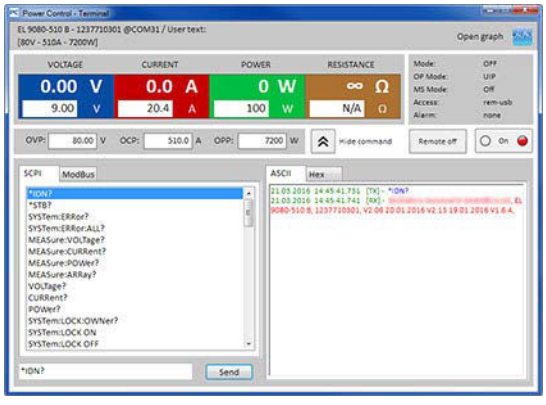
Battery test

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. This show extra values for elapsed testing time and consumed capacity (Ah).
Data recorded by the PC during tests with, for example, EA Power Control can be exported as Excel table in CSV format and analysed later in MS Excel or similar tools and even visualised as a discharge diagram.
For more detailed setup, there is also an adjustable threshold to stop the battery test on low battery voltage, as well an adjustable maximum test period.

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).
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 136 for more information.





可选项

- 可插拔、可替换的数字接口模块，适合CAN，CANopen，Ethernet (1个或2个端口)，Profibus，ProfiNet I/O (1个或2个端口)，RS232，EtherCAT 或 ModBus TCP。可参见第134页。
- 可插拔带规定GPIB端口的三路接口（3W），可替代接口模块的默认插槽
- 水冷（按需可供，也可参考页面145）

Options

- Pluggable and retrofittable, digital interface modules for CAN, CANopen, Ethernet (1 or 2 ports), Profibus, ProfiNet I/O (1 or 2 ports), RS232, EtherCAT orModBus TCP. See page 134.
- Three-way interface (3W) with a rigid GPIB port installed instead of the default slot for retrofittable interface modules
- Water cooling (upon request, also see page 145)

EA-EL 9000 B 1.2 kW - 14.4 kW

技术参数	Technical Data	Series EA-EL 9000 B / 系列	
交流：供电	AC: Supply		
- 电压	- Voltage	90...264 V	
- 频率	- Frequency	45...66 Hz	
- 功率损耗	- Power consumption	3 HE / 3 U: 最大 / max. 130 W	6 HE / 6 U: 最大 / max. 260 W
直流：电压	DC: Voltage		
- 精确度	- Accuracy	<额定值的0.1% / <0.1% of rated value	
直流：电流	DC: Current		
- 精确度	- Accuracy	<额定值的0.2% / <0.2% of rated value	
- 1-100% ΔU_{DC}的负载调整率	- Load regulation 1-100% ΔU_{DC}	<额定值的0.1% / <0.1% of rated value	
- 10-90%上升时间	- Rise time 10-90%	<50 µs	
直流：功率	DC: Power		
- 精确度	- Accuracy	<额定值的0.5% / <0.5% of rated value	
直流：内阻	DC: Resistance		
- 精确度	- Accuracy	≤最大电阻的1% + 额定电流的0.3% / ≤1% of max. resistance + 0.3% of nominal current	
保护功能	Protection	OT, OVP, OPP, PF, OCP (2	
显示器与面板	Display and panel	TFT触摸屏彩色显示器 / Graphics display with TFT touch panel	
数字接口	Digital interfaces		
- 内置	- Built in	1x 通讯用B类USB端口 / 1x USB type B for communication	
- 插槽	- Slot	1x 更换内置模块用 / 1x for retrofittable plug-in modules	
模拟接口	Analog interface	内置15极D-Sub母插，电隔离 / Built in, 15-pole D-Sub (female), galvanically isolated	
- 信号范围	- Signal range	0...5 V 或 0...10 V (可转换) / 0...5 V or 0...10 V (switchable)	
- 输入脚	- Inputs	U, I, P, R, 远程开-关，直流输入开-关，内阻模式开-关 / U, I, P, R, Remote on-off, DC input on-off, resistance mode on-off	
- 输出脚	- Output	U, I, 过压，报警，参考电压 / U, I, Overvoltage, alarms, reference voltage	
- U / I / P / R精确度	- Accuracy U / I / P / R	0...10 V: <0.2%	0...5 V: <0.4%
制冷方式	Cooling	温控风扇（可选：水冷） / Temperature controlled fans (optional: water)	
工作温度	Ambient temperature	0...50 °C	
储存温度	Storage temperature	-20...70 °C	
相对湿度	Relative humidity	<80%, 无凝露 / non-condensing	
工作高度	Operation altitude	<2000 m	
后板端子	Terminals on rear panel		
- 直流输入	- DC input	螺丝端 / Screw terminal	
- 共享总线 & 感测	- Share Bus & Sense	2极&4极插式连接器 / Plug connector 2 pole & 4 pole	
- 模拟接口	- Analog interface	15极Sub-D连接器 / Sub-D connector 15 pole	
- 数字接口	- Digital interfaces	模块插座 / Module socket 主-从 / Master-Slave (2x RJ45), USB	
尺寸 (1 (宽 x 高 x 深)	Dimensions (1 (W x H x D)	19" x 3 HE/U x 464 mm	19" x 6 HE/U x 464 mm

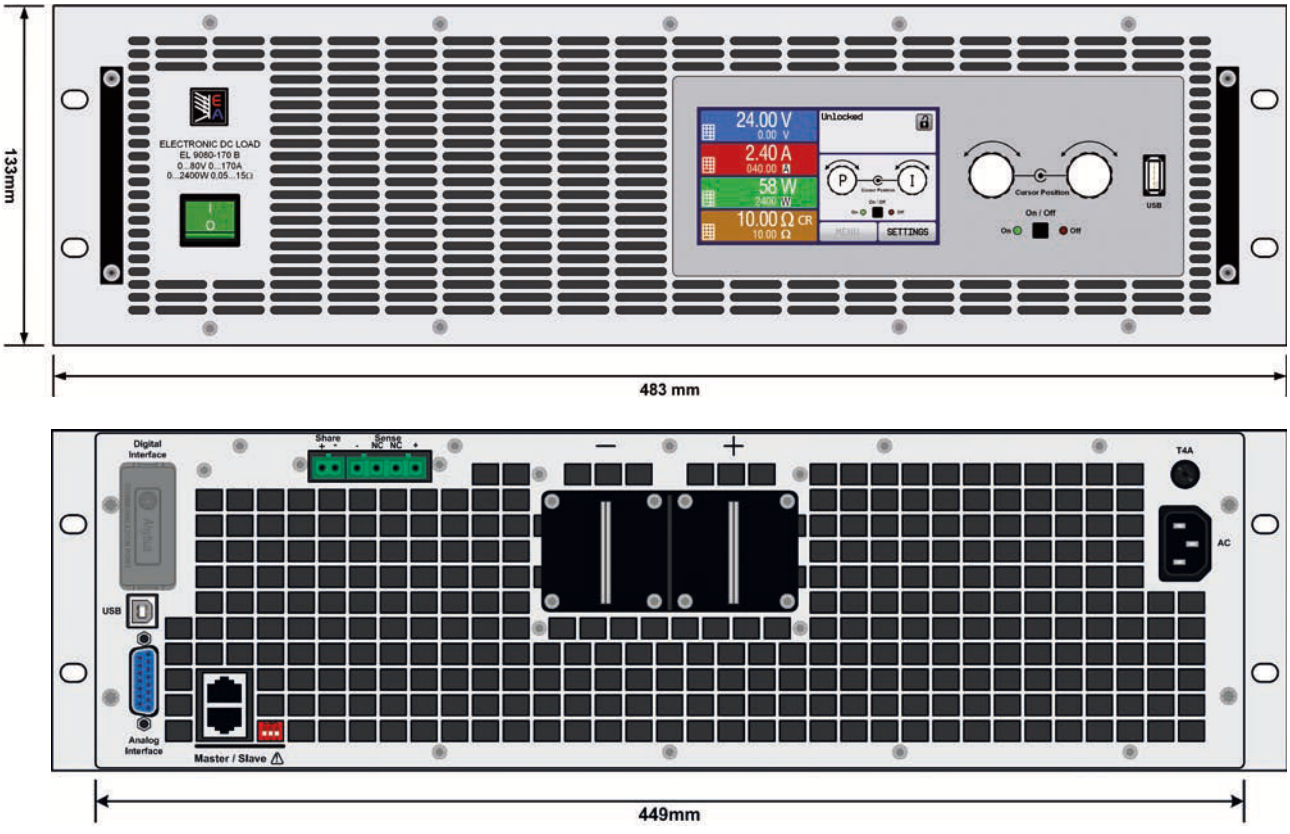
(1 仅为外壳尺寸 / Enclosure only
(2 见第146页 / See page 146

EA-EL 9000 B 1.2 kW - 14.4 kW

型号 Model	功率 Power	功率 @ 21°C Power @ 21°C	电压 Voltage	电流 Current	内阻 Resistance	I_{Max}时U_{Min} (2 U_{Min} for I_{Max} (2	重量 Weight	高度 Height	订购编号 (1 Ordering number (1
EA-EL 9080-170 B	0...2400 W	1500 W	0...80 V	0...170 A	0.045...15 Ω	~2.2 V	~ 9 kg	3 HE / 3 U	33200260
EA-EL 9200-70 B	0...2000 W	1500 W	0...200 V	0...70 A	0.25...85 Ω	~2 V	~ 9 kg	3 HE / 3 U	33200261
EA-EL 9360-40 B	0...1800 W	1500 W	0...360 V	0...40 A	0.8...270 Ω	~2 V	~ 9 kg	3 HE / 3 U	33200262
EA-EL 9500-30 B	0...1200 W	1200 W	0...500 V	0...30 A	1.5...500 Ω	~6.5 V	~ 9 kg	3 HE / 3 U	33200263
EA-EL 9750-20 B	0...1200 W	1200 W	0...750 V	0...20 A	3.5...1100 Ω	~5.5 V	~ 9 kg	3 HE / 3 U	33200264
EA-EL 9080-340 B	0...4800 W	3000 W	0...80 V	0...340 A	0.023...7.5 Ω	~2.2 V	~ 13 kg	3 HE / 3 U	33200265
EA-EL 9200-140 B	0...4000 W	3000 W	0...200 V	0...140 A	0.13...43 Ω	~2 V	~ 13 kg	3 HE / 3 U	33200266
EA-EL 9360-80 B	0...3600 W	3000 W	0...360 V	0...80 A	0.4...135 Ω	~2 V	~ 13 kg	3 HE / 3 U	33200267
EA-EL 9500-60 B	0...2400 W	2400 W	0...500 V	0...60 A	0.75...250 Ω	~6.5 V	~ 13 kg	3 HE / 3 U	33200268
EA-EL 9750-40 B	0...2400 W	2400 W	0...750 V	0...40 A	1.75...550 Ω	~5.5 V	~ 13 kg	3 HE / 3 U	33200269
EA-EL 9080-510 B	0...7200 W	4500 W	0...80 V	0...510 A	0.015...5 Ω	~2.2 V	~ 17 kg	3 HE / 3 U	33200270
EA-EL 9200-210 B	0...6000 W	4500 W	0...200 V	0...210 A	0.08...28 Ω	~2 V	~ 17 kg	3 HE / 3 U	33200271
EA-EL 9360-120 B	0...5400 W	4500 W	0...360 V	0...120 A	0.27...90 Ω	~2 V	~ 17 kg	3 HE / 3 U	33200272
EA-EL 9500-90 B	0...3600 W	3600 W	0...500 V	0...90 A	0.5...167 Ω	~6.5 V	~ 17 kg	3 HE / 3 U	33200273
EA-EL 9750-60 B	0...3600 W	3600 W	0...750 V	0...60 A	1.2...360 Ω	~5.5 V	~ 17 kg	3 HE / 3 U	33200274
EA-EL 9080-1020 B	0...14400 W	9000 W	0...80 V	0...1020 A	0.0075...2.5 Ω	~2.2 V	~ 33 kg	6 HE / 6 U	33200275
EA-EL 9200-420 B	0...12000 W	9000 W	0...200 V	0...420 A	0.04...14 Ω	~2 V	~ 33 kg	6 HE / 6 U	33200276
EA-EL 9360-240 B	0...10800 W	9000 W	0...360 V	0...240 A	0.14...45 Ω	~2 V	~ 33 kg	6 HE / 6 U	33200277
EA-EL 9500-180 B	0...7200 W	7200 W	0...500 V	0...180 A	0.25...88 Ω	~6.5 V	~ 33 kg	6 HE / 6 U	33200278
EA-EL 9750-120 B	0...7200 W	7200 W	0...750 V	0...120 A	0.6...180 Ω	~5.5 V	~ 33 kg	6 HE / 6 U	33200279

(1 为标准版的订购编号，带3W选项的则为不同编号 / Ordering number of the standard version, models with option 3W installed have different ordering numbers
(2 用最小直流输入电压供给负载以获得最大输入电流 / Minimum DC input voltage to supply for the load to achieve the max. input current

3U版本的产品视图 Views of 3U version



EA-EL 9000 B SLAVE 7.2 kW

Slave-Lasten für Serie EA-EL 9000 B
Slave loads for series EA-EL 9000 B

EA-EL 9080-510 B Slave

一般信息

EA-EL 9000 B Slave系列可以快速匹配EA-EL 9000 B系列选定型号，来扩大功率。其目的就是，通过并联与主-从操作，最多组合16台，从而获得一个高达115 kW的直流电子负载系统。所有技术规格都与EA-EL 9000 B系列一模一样，除了几个连接端子外。

操作与配置

扩展后的控制面板精简到剩下几个必要部件。为配合手动操作、状态指示与配置，配有少数几个LED灯，一个按钮，以及一个USB端口。本系列经前板USB端口可通过软件配置，比如EA Power Control（见 136页）。

主-从系统

主-从系统的配置简易又快捷。将从机模块与主机装在一起，比如在一19"机柜内。将产品连至交流供电端，并联他们的直流输出（连线或铜条），再经主-从总线与共享总线连接起来。主机上的操作仅为启动主从操作，然后整个系统将按照通电的机器数量自己配置，并准备好供用户使用或者软件操作。

General

The so-called "slave module" of series EA-EL 9000 B Slave are available for quick and cost saving power extension select models of series EA-EL 9000 B. Their purpose is to run in parallel connection and master-slave operation of up to 16 units in total, in order to achieve electronic DC load systems with power ratings of up to 115 kW. All technical specifications are identical to EA-EL 9000 B series, except for the available connectors.

Handling and configuration

The extensive control panel, as usual with regular electronic load models, has been reduced to the absolute necessary. For manual handling, status indication and configuration it offers a few LEDs, a pushbutton and an USB port. The devices are configured with software through the front USB port, for example with EA Power Control (see page 136).

Master-slave system

Configuring a master-slave system is very quick and easy. The slave modules and the master unit are installed together, for example in a 19" cabinet. Then they are connected to the AC supply and paralleled on their DC inputs (cables or copper bars), plus also linked via master-slave bus and Share bus. The only thing to do on the master is to enable master-slave and the system will self-configure to the number of powered units and represent itself to the user or a control software accordingly.

型号	最大功率	功率 @ 21°C	电压	电流	适用于	高度	重量	订购编号
Model	Power max.	Power @ 21°C	Voltage	Current	Suitable for	Height	Weight	Ordering number
EA-EL 9080-510 B Slave	0...7200 W	4500 W	0...80 V	0...510 A	EA-EL 9080-510 B	3 HE / 3 U	~ 17 kg	33290270
EA-EL 9200-210 B Slave	0...6000 W	4500 W	0...200 V	0...210 A	EA-EL 9200-210 B	3 HE / 3 U	~ 17 kg	33290271
EA-EL 9360-120 B Slave	0...5400 W	4500 W	0...360 V	0...120 A	EA-EL 9360-120 B	3 HE / 3 U	~ 17 kg	33290272
EA-EL 9500-90 B Slave	0...3600 W	3600 W	0...500 V	0...90 A	EA-EL 9500-90 B	3 HE / 3 U	~ 17 kg	33290273
EA-EL 9750-60 B Slave	0...3600 W	3600 W	0...750 V	0...60 A	EA-EL 9750-60 B	3 HE / 3 U	~ 17 kg	33290274