

# EA-EL 9000 B 2Q 600 W - 2400 W

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



EA-EL 9500-30 B 2Q 2U



- 两象限模块
- 输入功率级别：0...600 W至0...2400 W
- 输入电压：0...80 V至0...750 V
- 输入电流：每台高达170 A
- 基于FPGA的控制电路
- 带LED状态灯的控制面板
- 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
- 可选：
  - 数字式、即插即用型接口
- 支持SCPI & ModBus RTU协议
- LabView VIs与远程控制软件(Windows)

### 概要

专为所谓的“两象限操作”而设计的EA-EL 9000 B 2Q系列电子负载，可以结合EA-PS 9000, EA-PSI 90000与EA-PSE 9000系列一起操作。该负载系列特别关注输出电压改变时的动态变化。

将电子负载直接连到电源输出端就可来实现。负载还要连到共享总线上，这样可由兼容的电源设备控制。

默认情况下，本负载产品的配置为，以全功率、全电流和最小电压运行，可独立运行，也可在主-从模式下运行。其他参数则经远程控制进行配置，例如使用软件EAPC软件（也可见136）。

- Two-quadrants module
- Power ratings: 0...600 W up to 0...2400 W
- Input voltages: 0...80 V up to 0...750 V
- Input currents: up to 170 A per unit
- FPGA based control circuit
- Control panel with status LEDs
- Adjustable protections: OVP, OCP, OPP
- Operation modes: CV, CC, CP, CR
- Galvanically isolated interfaces (analog and USB)
- Master-slave bus for parallel connection
- Optional:
  - Digital, plug & play interfaces
- SCPI & ModBus RTU supported
- LabView VIs and remote control software (Windows)

### General

The series EA-EL 9000 B 2Q offers electronic load which are designed for the so-called “two-quadrants operation” in combination with the series EA-PS 9000, EA-PSI 9000 and EA-PSE 9000. The electronic loads care for an improved dynamics regarding output voltage changes.

This is achieved by connecting the electronic loads directly to the output of a power supply. The loads are furthermore connected on the so-called Share bus, so they can be controlled by a compatible power supply device. By default the devices are configured to run with full power and current and minimal voltage, stand-alone or in master-slave. Other parameters can be configured via remote control, for example with the software EA Power Control (also see page 136).



## 两象限操作

两象限操作（2Q, 2QO）具有广泛的应用。例如，减速电机的再生能量可以被消耗掉。从而保护电机以及电源，防止过压。另一个例子就是，各种类型的电池或其他储能设备的最终测试或其特性的模拟。电池可以使用2Q系统进行充放电。

当与电源并联运行时，可以实现极短的时间内快速下降电压。它通过对电源产品的输出电容放电，形成动态的电压进程来实现。

## 功率等级、电压和电流

EA-EL 9000B 2Q新负载系列为模块式产品，可以组成一个或两个功率级。有0...80 V DC至0...750 V不同的DC输出电压，单机输入电流就高达170A。从而可以匹配本公司不同额定电压与电流的实验室电源系列。此兼容性能使EA-EL 9000 B 2Q系列与EA-S 9000, EA-PSI 9000与EA-PSE 9000系列电源组合使用。

## 结构

所有型号都组装在一个19"宽，2U高，460 mm深的柜式外壳内，可以很简便地配进不同尺寸的19"机柜，比如42U，以组成更高的功率。

还可将不同的设备混合安装到机柜系统，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。

## 控制面板

本系列最初可经共享总线由电源控制。对于特殊应用可选择接口设置所有参数。

产品状态由多个彩色LED灯指示出来。前板的USB端口用来快速访问直流输入相关的参数，如：设定值（电流/功率等），以及保护极限值（OCP, OPP等）。

## Share-Bus-共享总线

产品后板有一个模拟连接端子叫“Share Bus”，用来将与EA-S 9000, EA-PSI 9000与EA-PSE 9000系列电源连接起来，组成两象限系统。该系统专门利用源-沉原理进行测试用途。

这个共享总线端子还可用来均衡多台负载产品并联时的电流，以获得提升的功率。

## 功率降额

如EA-EL 9000 B HP系列一样，缩写“HP”表示“大功率”。本系列在环境温度30°C以下时达到额定功率。在此之上，所有型号基于热降额，根据环境温度具体数据，来降低输入功率。

## Two-quadrants operation

There is wide application spectrum for the two-quadrants operation (2Q, 2QO). For example, the regenerated energy of decelerating motor could be consumed. This protects the motor as well as the power supply against overvoltage. Another example is the end tests of various types of batteries or other kinds of energy storage devices or simulation of their characteristics. A battery can be charged and discharged with a system using 2Q.

When running the loads in parallel to a power supply it can achieve very short voltage fall times. This is done by loads discharging the typical output capacitor of power supplies, resulting in dynamic voltage progression.

## Power ratings, voltages, currents

The electronic loads of the new series EA-EL 9000 B 2Q are modular and can be equipped with one or two power stages. The available voltage range portfolio offers five different voltage from 0...80 V DC up to 0...750 V DC. Input currents up to 170 A with only one unit are available. This adapts the rated voltages and currents to the laboratory power supply series of the company. This compatibility enables combination of series EA-EL 9000 B 2Q with power supply series EA-PS 9000, EA-PSI 9000 and EA-PSE 9000.

## Construction

All models are built in 19" wide rack enclosures with 2U of height and approx. 460 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.

It is also possible to assemble cabinet systems with mixed equipment, i.e. electronic loads and power supplies, in order to achieve the source-sink principle with high power ratings.

## Control panel

The devices of this series are primarily controlled via the Share bus from a power supply. For special applications the optional available interfaces offer to set up all parameters.

The device status is indicated with several coloured LEDs. The front USB port is used for easy and quick access to all DC input related parameters, such as set values (current / power etc.), as well as protections (OCP, OPP etc.).

## Share Bus

The „Share Bus“ is an analog connection at the rear of the devices and is used to build a two-quadrants system in connection with compatible power supplies of series EA-PSI 9000, EA-PS 9000 or EA-PSE 9000. Such a system is ideal for all testing purposes requiring the source-sink principle.

This Share bus is furthermore used to balance the current across multiple identical load units in parallel connection to gain power uprating.

## Power derating

Like with series EA-EL 9000 B HP, where the abbreviation “HP” in the series name stands for “High Power”, this series achieves its rated power up to an ambient temperature of 30°C. Above that point, all models of this series will reduce the input power based upon a thermal derating which depends on the ambient temperature.





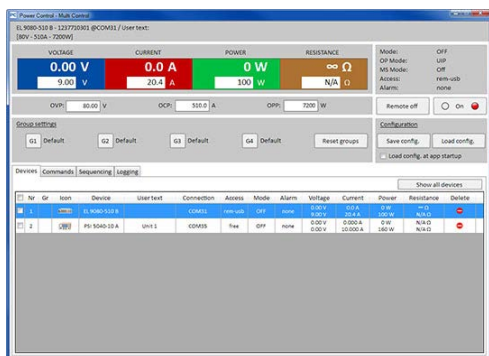
## 远程控制 & 连接

经内置USB接口或多款可选数字接口的其中一款可以监控、控制和配置本系列负载(见134页)。它还有一个可以控制与监控的标准模拟接口。所有接口都有直流输入隔离开来。

如要应用到LabView IDE, 我们还提供即用的组建(VIs), 能与USB, RS232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。



## 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。

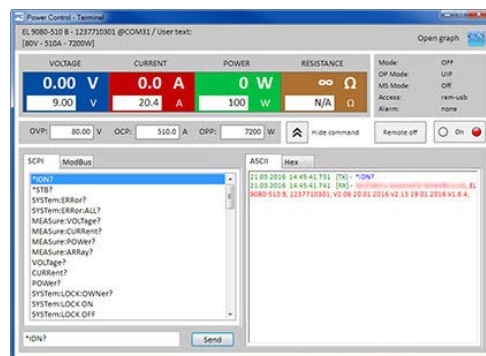
## Remote control & connectivity

Monitoring, control and configuration of these load devices can either be done using the built-in USB interface or via one of various optional digital interfaces (see page 134). There is furthermore a standard analog interface for control and monitoring. All interfaces are galvanically isolated from the DC input.

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

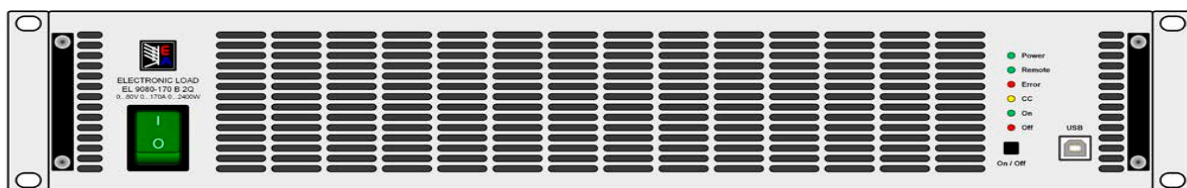
Windows users can profit from the free software “EA Power Control”. It offers a feature called “Sequencing”, where the device is controlled through a table in CSV format to achieve automatic test runs. This table represents simple to complex test procedure and can be created and edited in MS Excel or 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.



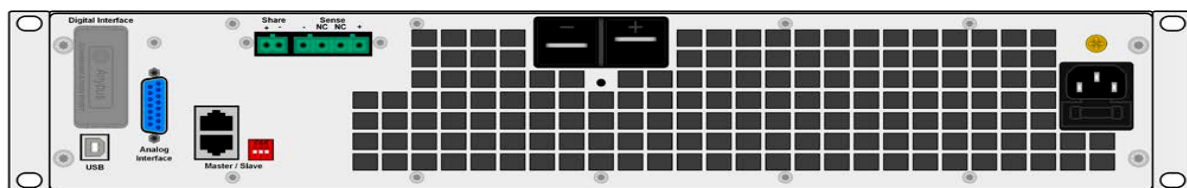
## Options

- Pluggable and retrofittable, digital interface modules for CAN, CANopen, Ethernet (1 or 2 ports), Profibus, ProfiNet I/O (1 or 2 ports), RS232, EtherCAT or ModBus TCP. See page 134.



前视图

Front view



后视图

Rear view





| 技术参数                            | Technical Data                           | Series EA-EL 9000 B 2Q / 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                      | 最大 / max. 80 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% $\Delta U_{DC}$ 的负载调整率 | - Load regulation 1-100% $\Delta U_{DC}$ | <额定值的0.1% / <0.1% of rated value                                                                                      |
| - 10-90% 上升时间                   | - Rise time 10-90%                       | <50 $\mu$ s                                                                                                           |
| 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                               | $\leq$ 最大阻值的1% + 额定电流的0.3% / $\leq$ 1% of max. resistance + 0.3% of rated current                                     |
| 显示器与控制面板                        | Display and control panel                | LED状态灯与按钮 / Status LEDs and pushbutton                                                                                |
| 数字接口                            | Digital interfaces                       | 2x 通讯用B类USB端口 / 2x 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连接器, 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%                                                                                   |
| 兼容性                             | 2Q compatible power supply series        | EA-PSI 9000 2U, EA-PSI 9000 3U, EA-PS 9000 1U, EA-PS 9000 2U, EA-PS 9000 3U, EA-PSE 9000, EA-PSB 9000, EA-PSI 9000 WR |
| 制冷方式                            | Cooling                                  | 温控风扇 / Temperature controlled fans                                                                                    |
| 工作温度                            | Ambient temperature                      | 0...50 $^{\circ}$ C                                                                                                   |
| 储存温度                            | Storage temperature                      | -20...70 $^{\circ}$ C                                                                                                 |
| 后板端子                            | Terminals on rear                        |                                                                                                                       |
| - 负载输入                          | - Load 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针Sub-D连接器 / Sub-D connector 15 pole                                                                                 |
| - 数字接口                          | - Digital interfaces                     | 模块插座 / Module socket<br>主-从 / Master-Slave (2x RJ45), USB                                                             |
| 尺寸 <sup>(1)</sup> (宽 x 高 x 深)   | Dimensions <sup>(1)</sup> (W x H x D)    | 19" x 2 HE/U x 464 mm                                                                                                 |

(1 仅为外壳尺寸 / Enclosure only)

| 型号                  | 功率         | 功率 @ 40 $^{\circ}$ C    | 电压        | 电流        | 内阻                  | 重量      | 订购编号            |
|---------------------|------------|-------------------------|-----------|-----------|---------------------|---------|-----------------|
| Model               | Power      | Power @ 40 $^{\circ}$ C | Voltage   | Current   | Resistance          | Weight  | Ordering number |
| EA-EL 9080-85 B 2Q  | 0...1200 W | 0...1000 W              | 0...80 V  | 0...85 A  | 0.08...30 $\Omega$  | ~ 9 kg  | 33200710        |
| EA-EL 9200-35 B 2Q  | 0...1000 W | 0...1000 W              | 0...200 V | 0...35 A  | 0.44...200 $\Omega$ | ~ 9 kg  | 33200711        |
| EA-EL 9360-20 B 2Q  | 0...900 W  | 0...900 W               | 0...360 V | 0...20 A  | 1.4...600 $\Omega$  | ~ 9 kg  | 33200712        |
| EA-EL 9500-15 B 2Q  | 0...600 W  | 0...600 W               | 0...500 V | 0...15 A  | 2.5...1200 $\Omega$ | ~ 9 kg  | 33200713        |
| EA-EL 9750-10 B 2Q  | 0...600 W  | 0...600 W               | 0...750 V | 0...10 A  | 6...2500 $\Omega$   | ~ 9 kg  | 33200714        |
| EA-EL 9080-170 B 2Q | 0...2400 W | 0...2000 W              | 0...80 V  | 0...170 A | 0.04...15 $\Omega$  | ~ 13 kg | 33200715        |
| EA-EL 9200-70 B 2Q  | 0...2000 W | 0...2000 W              | 0...200 V | 0...70 A  | 0.22...100 $\Omega$ | ~ 13 kg | 33200716        |
| EA-EL 9360-40 B 2Q  | 0...1800 W | 0...1800 W              | 0...360 V | 0...40 A  | 0.7...300 $\Omega$  | ~ 13 kg | 33200717        |
| EA-EL 9500-30 B 2Q  | 0...1200 W | 0...1200 W              | 0...500 V | 0...30 A  | 1.25...600 $\Omega$ | ~ 13 kg | 33200718        |
| EA-EL 9750-20 B 2Q  | 0...1200 W | 0...1200 W              | 0...750 V | 0...20 A  | 3...1250 $\Omega$   | ~ 13 kg | 33200719        |

