

EA-EL 9000 T 400 W - 600 W

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



EA-EL 9080-45 T



Option: LAN

- 输入功率级别: 0...400 W, 0...500 W至0...600 W
- 输入电压: 0...80 V, 0...200 V, 0...500 V
- 输入电流: 0...5 A, 0...18 A, 0...45 A
- 多语言彩色触摸屏
- 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
- 标配USB端口
- 可选以太网接口, 模拟接口
- 支持SCPI & ModBus RTU
- 带控制软件(Windows)
- LabView VIs

概要

EA-EL 9000 T系列是一款新的小型电子负载, 供有三款塔式型号, 适合实验室、学校日常的众多应用。小额定功率型号可以执行多种测试, 既节省成本, 也节省空间。

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)。控制电路的核心部件是一个微处理器, 它具有很多有趣的特征, 比如: 配通用函数的真实函数发生器, 如: 正弦波, 方波或三角波, 还有一个任意函数。彩色TFT触摸屏可以让用户直观地进行手动操作, 就像现在流行的智能手机或者平板电脑那样操作。

跟旧系列电子负载相比, 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ARM处理器控制的硬件。

- Input power ratings: 0...400 W, 0...500 W, 0...600 W
- Input voltages: 0...80 V, 0...200 V, 0...500 V
- Input currents: 0...8 A, 0...18 A, 0...45 A
- Multilingual colour touch panel
- True function generator
- Adjustable protections: OVP, OCP, OPP
- Operation modes: CV, CC, CP, CR
- USB port as standard
- Ethernet & analog interface optional
- SCPI & ModBus RTU supported
- Control software (Windows)
- LabView VIs

General

The new series of compact electronic DC loads, called EA-EL 9000 T, offers three tower models for the daily application in research laboratories and even schools. Lower power ratings allow for a multitude of test applications while being cost effective and space saving.

All models support the four regulation modes constant voltage (CV), constant current (CC), constant power (CP) and constant resistance (CR). The core of the control circuit is a fast microprocessor which provides interesting features, such as a true function generator with common functions like sine wave, rectangle or triangle, but also an arbitrary function. The colour TFT touch panel offers an intuitive kind of manual operation, like it is prolific with smartphones or tablet computers.

Response times during the control of the devices via analog or digital interface have been improved by an ARM processor controlled hardware, compared to older electronic load series.



本系列标配有一个USB端口，用户可以选择安装以太网与模拟接口。所有接口都电隔离。通过公共协议SCPI和ModBus-RTU以及即用型LabView组件，简化了针对各种定制应用程序的远程控制和应用。

功率等级、电压和电流

本系列有0...80 V, 0...200 V或0...500 V输入电压, 0...5A, 0...18 A或0...45A输入电流的产品型号。输出功率有三个级别，分别为固定功率400W, 500W或600W。

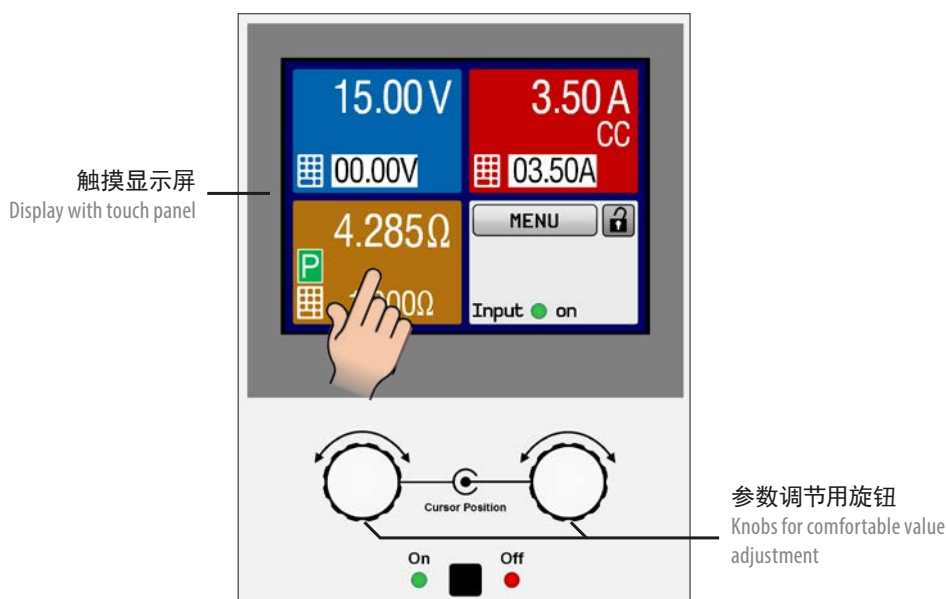
显示器与操作

An USB port is standard with this series, Ethernet and analog interfaces can be optionally retrofitted by the user. All interfaces are galvanically isolated. Remote control and implementation into custom applications for every purpose is simplified by the common protocols SCPI and ModBus RTU, as well as by ready-to-use LabView components.

Power ratings, voltages, currents

Available are models with inputs voltages of 0...80 V, 0...200 V or 0...500 V and input currents of 0...8 A, 0...18 A or 0...45 A. The series offers three power classes with 400 W, 500 W or 600 W steady power.

Display and handling



设定与实际输入电压、电流与功率都清晰显示于彩屏上。彩色的TFT屏幕为敏感点触式，用一个手指就能控制所有功能。

通过旋钮或者数字键盘，可直接输入或调节设定电压、电流、功率或内阻。若想防止意外操作，可锁定所有操作键。

Set values and actual values of input voltage, current and power are clearly represented on the graphic display. The colour TFT screen is touch sensitive and can be intuitively used to control all functions of the device with just a finger.

Set values of voltage, current, power or resistance can be adjusted using the rotary knobs or entered directly via a numeric pad.

To prevent unintentional operations, all operation controls can be locked.

多语言控制面板



英文 / English



中文 / Chinese



俄文 / Russian



德文 / German

Multi-language control panel





函数发生器

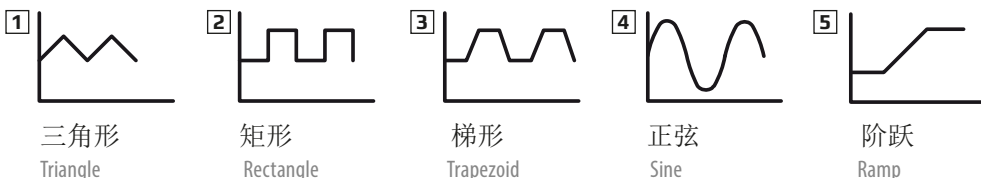
本系列所有型号都具有可形成如下典型函数的真实函数发生器，并能将它们应用于输入电压或输入电流上。发生器可通过前板的触摸屏进行全面的设置，或经某一数字接口进行远程控制。

预设函数会为用户提供所有必须的参数，如Y偏差值，时间/频率或幅度，整套配置完成。

Function generator

All models within this series include a function generator which can generate typical functions, as displayed in the figures below, and apply them to either the input voltage or the input current. The generator can be completely configured and controlled by using the touch panel on the front of the device, or by remote control via one of the digital interfaces.

The predefined functions offer all necessary parameters to the user, such as Y offset, time / frequency or amplitude, for full configuration ability.

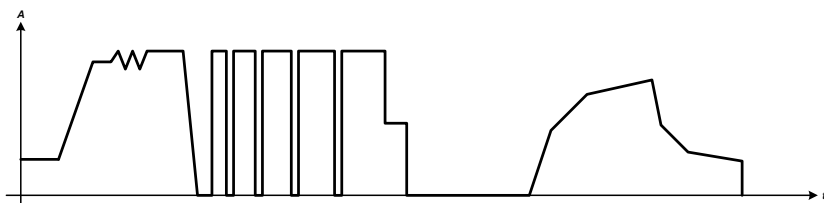


除了基于任意发生器产生的标准函数外，它还可形成某些复杂的函数，并能分成多达99组序列。这些可用于研发和生产的测试。

通过前板的USB端口可将这些序列上载使用或存储于标准U盘上，这样方便更换不同的测试序列。下图是任意发生器可实现的由40个序列组成的复杂曲线，仅为虚构范例。可以在产品外或者于产品上创建函数，然后上载或保存：

Additionally to the standard functions, which are all based upon a so-called arbitrary generator, this base generator is accessible for the creation and execution of complex sets of functions, separated into up to 99 sequences. These can be used for testing purposes in development and production.

The sequences can be loaded from and saved to a standard USB flash drive via the USB port on the front panel, making it easy to change between different test sequences. Below is a depiction of a fictional example of a complex function (40 sequences) as it can be realised with the arbitrary generator. The function can be created on the device or externally and then loaded or saved:



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 Excel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。

功率降额

EA-EL 9000 T系列产品具有热降额功能，当产品在最大功率下运行时避免过热。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25°C室温条件下定义的，并当温度上升时会快速减少。

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. It counts values for elapsed testing time and consumed capacity (Ah) and energy (Wh).

Data recorded by the PC during tests with 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.

Power derating

The devices of the EA-EL 9000 T 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 25°C ambient temperature.



远程控制 & 连接

本产品后板默认有一个USB端口，可经其进行远程控制。另外还有一个选择，用户可插上一块装有USB、以太网与模拟接口电子板的三路系统。

产品前板还有一个USB端口，可以插U盘，以便上传与保存函数和用户配置文档。

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。

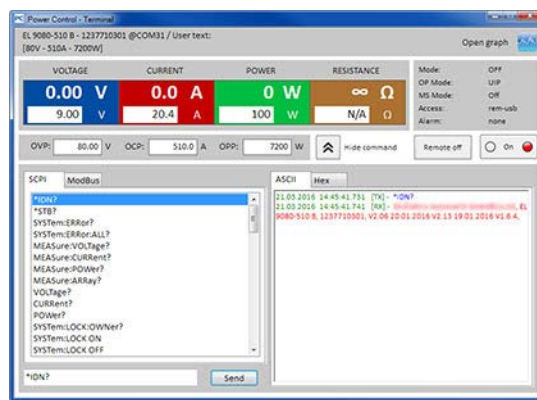
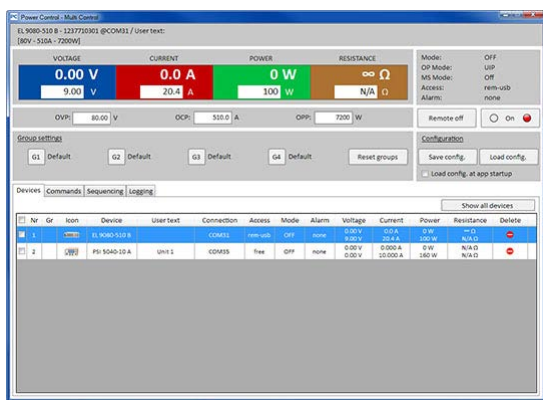
Remote control & connectivity

For remote control, there is by default an USB interface port available on the rear of the devices. As an option, a 3-way system can installed by the user simply by plugging an electronic board, which hold an USB, an Ethernet and an analog interface.

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

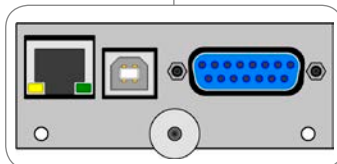
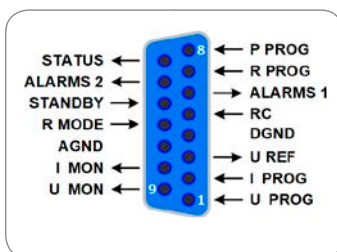
Windows users can profit from the free software “EA Power Control”. It offers a feature called “Sequencing”, where the device is controlled through a semi-automatic table in CSV format. This table represents a simple test procedure and can be created and edited in MS Excel or other CSV editors and then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



可选模拟接口

还可选择在产品后板上装一电隔离模拟接口。它具有一模拟输入脚，接上0 V...10 V或0 V...5 V电压，可设置0...100%的输出电压、电流、功率与内阻。要监控输出电压与电流，可给模拟输出脚接上0 V...10 V或0 V...5 V来完成。此外，还有几个输入脚和输出脚，可用来控制和监控产品状态。



可选项

- 带USB、以太网与模拟端口的可拆装接口模块

Optional analog interface

A galvanically isolated analog interface can be installed optionally and subsequently, located on the rear of the device. It offers analog inputs to set voltage, current, power and resistance from 0...100% through control voltages of 0 V...10 V or 0 V...5 V. To monitor the DC input voltage and current there are analog outputs with 0 V...10 V or 0 V...5 V. Also, several inputs and outputs are available for controlling and monitoring the device status.

Options

- Retrofittable interface module with USB, Ethernet and analog port





技术参数	Technical Data	Series EA-EL 9000 T / 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. 40 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 μ 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	$\leq$ 最大电阻的1% + 额定电流的0.3% / $\leq 1\%$ of max. resistance + 0.3% of nominal current
显示器与控制面板	Display and control panel	TFT触摸屏彩色显示器 / Graphics display with TFT touch panel
数字接口	Digital interfaces	
- 标配	- As standard	1x B类USB端口（通讯用） / 1x USB type B (for communication) 1x A类USB端口（存储设备用） / 1x USB type A (for storage device)
- 选配	- Optionally available	1x Ethernet (未分开，总是跟USB与模拟接口结合在一起) / 1x Ethernet (not separate, always in combination with USB and analog interface)
模拟接口（可选）	Analog interface (optional)	15针D-Sub母插，电隔离 / 15-pole D-Sub, galvanically isolated
- 信号范围	- Signal range	0...5 V 或 0...10 V (可切换) / 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	- Outputs	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 / Temperature controlled fan
工作温度	Ambient temperature	0...50 $^{\circ}$ C
储存温度	Storage temperature	-20...70 $^{\circ}$ C
前板端子类型	Terminals on front	
- 负载输入	- Load input	前板，插拔式 & 螺丝端子 / Frontside, plug & screw terminal
- 远程感测	- Remote sensing	夹线端子 / Clamp terminal
- 数字接口	- Digital interfaces	USB (A型)
后板端子类型	Terminals on rear	
- 模拟接口	- Analog interface	可选 / optional: 15针Sub-D连接器 / Sub-D connector 15 pole
- 数字接口	- Digital interfaces	内置：USB (B型)，可选（以太网） / Built-in: USB (type B), optional: Ethernet
机械结构	Mechanics	
- 尺寸 (宽x高x深) ⁽¹⁾	- Dimensions (W x H x D) ⁽¹⁾	92 x 239 x 352 mm
- 重量	- Weight	~ 7 kg

(1) 仅为机身尺寸 / Body only

型号	功率	功率 @ 40 $^{\circ}$ C	电压	电流	内阻	I_{Max} 时 U_{Min} ⁽¹⁾	订购编号
Model	Power	Power @ 40 $^{\circ}$ C	Voltage	Current	Resistance	U_{Min} for I_{Max} ⁽¹⁾	Ordering number
EL 9080-45 T	600 W	550 W	0...80 V	0...45 A	0.12...40 Ω	~ 2.2 V	33210511
EL 9200-18 T	500 W	500 W	0...200 V	0...18 A	1...340 Ω	~ 2 V	33210512
EL 9500-08 T	400 W	400 W	0...500 V	0...8 A	6...2000 Ω	~ 6.5 V	33210513

(1) 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



产品图片

Product views

