ALx 系列

直流电子负载 • 风冷、线性MOSFET拓扑架构、宽量程操作范围

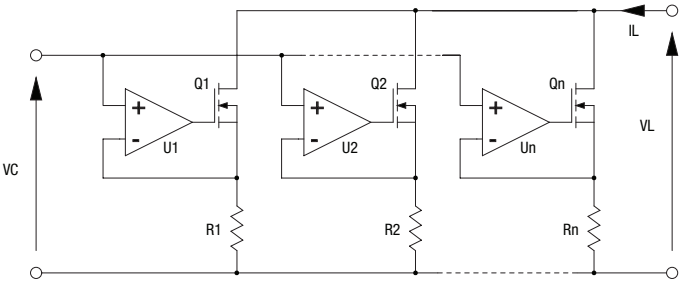
概况

ALx系列麦格纳负载使用传统的线性MOSFET的耗散原件，使该系列产品能够在型号的最大额定功率内达到极宽的电压-电流操作范围。ALx系列产品使用与高密度可编程直流电源相同的热管理创新技术，其稳定冷却性能可保证产品在50°C的工作温度下满功率持续运行，具有较长的使用寿命。

技术

ALx系列使用MOSFET进行功率耗散，产品级别在全功率运行领域居行业领先地位。ALx系列通过在线性区域运行的MOSFET，实现对产品整个额定电压/电流的满功率和全部控制。

特意选择MOSFET是基于它可在线性区运行的能力，且将它用作电子开关时，能将安全运行线图完好控制在最大功率定额下。ALx系列麦格纳负载的控制电路在闭合环路运行，以实现线性响应。每个MOSFET设备产生VC/Rn所定义的负载电流。闭路放大器可帮助多个MOSFET均等共享负载电流。



主要特点

- MagnaLINK™分布式DSP架构
- 16位数字化编程和显示器分辨率
- SCPI远程编程API
- 多种控制模式，包括：电压、电流、功率、电阻和分路调节器
- 宽泛的电压-电流-功率运行曲线图
- 集成的前置和后置USB全面控制接口，RS485和双MagnaLINK™接口，且适用LXI TCP/IP以太网和IEEE-488通用接口总线GPIB
- 数字化即插即用主从式操作
- 可编程保护限值
- 可配置的外部模拟-数字用户输入/输出
- 在美国设计并生产

型号

型号	最大功率	最大电压	最大电流	封装类型	最小电压
ALx1.25-200-300	1.25 kW	200 Vdc	300 Adc	机架安装	2.5 Vdc
ALx1.25-500-125	1.25 kW	500 Vdc	125 Adc	机架安装	6.0 Vdc
ALx1.25-1000-37.5	1.25 kW	1000 Vdc	37.5 Adc	机架安装	7.5 Vdc
ALx2.5-200-600	2.5 kW	200 Vdc	600 Adc	机架安装	2.5 Vdc
ALx2.5-500-250	2.5 kW	500 Vdc	250 Adc	机架安装	6.0 Vdc
ALx2.5-1000-75	2.5 kW	1000 Vdc	75 Adc	机架安装	7.5 Vdc
ALx5-200-1200	5 kW	200 Vdc	1200 Adc	落地式	2.5 Vdc
ALx5-500-500	5 kW	500 Vdc	500 Adc	落地式	6.0 Vdc
ALx5-1000-150	5 kW	1000 Vdc	150 Adc	落地式	7.5 Vdc
ALx7.5-200-1800	7.5 kW	200 Vdc	1800 Adc	落地式	2.5 Vdc
ALx7.5-500-750	7.5 kW	500 Vdc	750 Adc	落地式	6.0 Vdc
ALx7.5-1000-225	7.5 kW	1000 Vdc	225 Adc	落地式	7.5 Vdc
ALx10-200-2400	10 kW	200 Vdc	2400 Adc	落地式	2.5 Vdc
ALx10-500-1000	10 kW	500 Vdc	1000 Adc	落地式	6.0 Vdc
ALx10-1000-300	10 kW	1000 Vdc	300 Adc	落地式	7.5 Vdc
ALx12.5-200-3000	12.5 kW	200 Vdc	3000 Adc	落地式	2.5 Vdc
ALx12.5-500-1250	12.5 kW	500 Vdc	1250 Adc	落地式	6.0 Vdc
ALx12.5-1000-375	12.5 kW	1000 Vdc	375 Adc	落地式	7.5 Vdc
ALx15-200-3600	15 kW	200 Vdc	3600 Adc	落地式	2.5 Vdc
ALx15-500-1500	15 kW	500 Vdc	1500 Adc	落地式	6.0 Vdc
ALx15-1000-450	15 kW	1000 Vdc	450 Adc	落地式	7.5 Vdc
ALx17.5-200-4200	17.5 kW	200 Vdc	4200 Adc	落地式	2.5 Vdc
ALx17.5-500-1750	17.5 kW	500 Vdc	1750 Adc	落地式	6.0 Vdc
ALx17.5-1000-525	17.5 kW	1000 Vdc	525 Adc	落地式	7.5 Vdc
ALx20-200-4800	20 kW	200 Vdc	4800 Adc	落地式	2.5 Vdc
ALx20-500-2000	20 kW	500 Vdc	2000 Adc	落地式	6.0 Vdc
ALx20-1000-600	20 kW	1000 Vdc	600 Adc	落地式	7.5 Vdc

规格

电源规格

交流输入电压 1.25 kW 至 2.5 kW 型号	85 至 265 Vac (UI: Universal Input) 1Φ, 2-wire + ground
交流输入电压 5 kW 至 20 kW 型号	120 Vac (120SP: 运行范围 108 至 132 Vac) 240 Vac (240SP: 运行范围 216 至 264 Vac) 1Φ, 2-wire + ground
交流输入频率	45-66 Hz
交流输入隔离	±1500 Vac, 最大输入接地电压
直流输入隔离	±1500 Vdc, 对地最大输出电压

编程规格

分辨率 (所有型号)	16位, 0.0015%
精度	电压: 满量程额定电压 的 ±0.1% 电流: 满量程额定电流 的 ±0.2% 功率: 满量程额定功率的 ±0.3% 电阻: 满量程额定电阻的 ±0.3%
上升/下降时间 最大	电压模式: 100 ms, 10% 至 90% 最大额定电压的 电压模式: 560 µs, 10% 至 90% 最大额定电流的 功率模式: 35 ms, 10% 至 90% 最大额定功率的 电阻模式: 40 ms, 10% 至 90% 最大额定电阻的
跳闸设置范围	过压: 最大额定电压的 10% 至 110% 欠压: 最大额定电压的 0% 至 110% 过流: 最大额定电流的 10% 至 110% 过功率: 最大额定功率的 10% 至 110%

通信规格

通信接口 (标配)	USB 主机 (前置) :B类型 USB 主机 (后置) :B类型 RS485 (后置): RJ-45 MagnaLINK™: RJ-25 x 2 外部用户输入/输出: 标准形母口
通信接口 (选件)	LXI 以太网 (后置): RJ-45 通用接口总线 (后置): IEEE-488

外部用户输入/输出规格

数字输入	5 V, 10 kΩ 阻抗
数字监测信号	5 V, 32 mA 电容
数字参考信号	5 V 输出, 20 mA 电容
模拟采样率	2 kHz
模拟编程输入	0-10 V
模拟编程阻抗	10 kΩ
模拟编程分辨率	12 位, 0.025%
模拟监测信号	0-10 V, 3 mA 电容
模拟监测阻抗	0.005 Ω
模拟监测精度	最大额定值的 0.05%
模拟参考信号	10 V, 20 mA 电容

物理规格

功率	机架单位	尺寸	重量
1.25 kW	3U	5.25" **高** x 19" **宽** x 24" **深** (13.34 x 48.26 x 60.96 cm)	40 lbs (18.1 kg)
2.5 kW	3U	5.25" **高** x 19" **宽** x 24" **深** (13.34 x 48.26 x 60.96 cm)	65 lbs (29.5 kg)
5 kW	12U 机柜	30.7" 高 x 24" 宽 x 31.5" 深 (78.0 x 61.0 x 80.0 cm)	255 lbs (115.7 kg)
7.5 kW	12U 机柜	30.7" 高 x 24" 宽 x 31.5" 深 (78.0 x 61.0 x 80.0 cm)	320 lbs (145.2 kg)
10 kW	12U 机柜	30.7" 高 x 24" 宽 x 31.5" 深 (78.0 x 61.0 x 80.0 cm)	385 lbs (174.6 kg)
12.5 kW	24U 机柜	58.25" 高 x 24" 宽 x 31.5" 深 (148.0 x 61.0 x 80.0 cm)	500 lbs (226.8 kg)
15 kW	24U 机柜	58.25" 高 x 24" 宽 x 31.5" 深 (148.0 x 61.0 x 80.0 cm)	565 lbs (256.3 kg)
17.5 kW	24U 机柜	58.25" 高 x 24" 宽 x 31.5" 深 (148.0 x 61.0 x 80.0 cm)	630 lbs (285.8 kg)
20 kW	24U 机柜	58.25" 高 x 24" 宽 x 31.5" 深 (148.0 x 61.0 x 80.0 cm)	695 lbs (315.3 kg)

交流输入规格

环境工作温度	0°C 至 50°C
储存温度	-25°C 至 +85°C
湿度	不凝结相对湿度高达95%
气流	前置进风口，后置出风口

适用法规

EMC	欧盟测试和测量产品EMC指令, 2014/30/EU
安全性	遵守 EN61010-1:2010-02
CE 标志	通过
RoHS 认证	通过

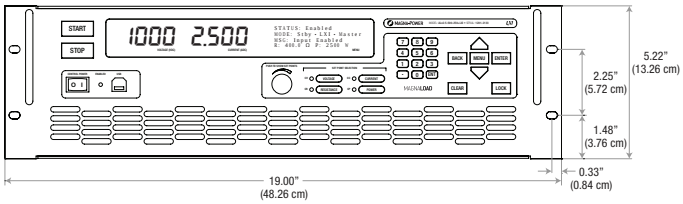
ALx系列型号订购指南

ALx 系列

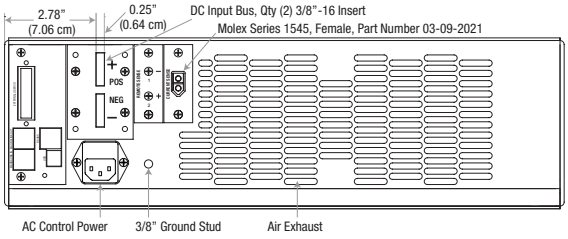
直流电子负载 • 风冷、线性MOSFET拓扑架构、宽量程操作范围

产品图

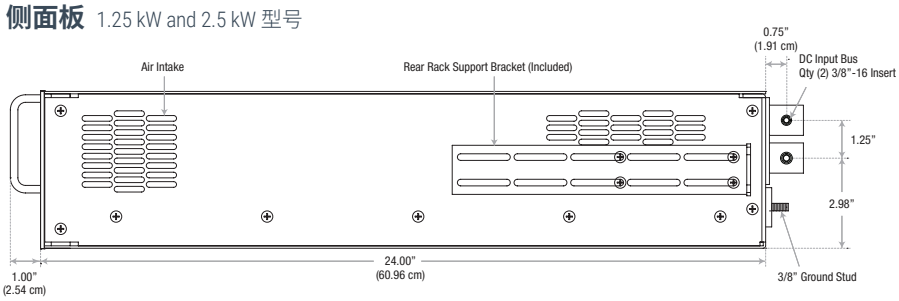
前面板 1.25 kW and 2.5 kW 型号



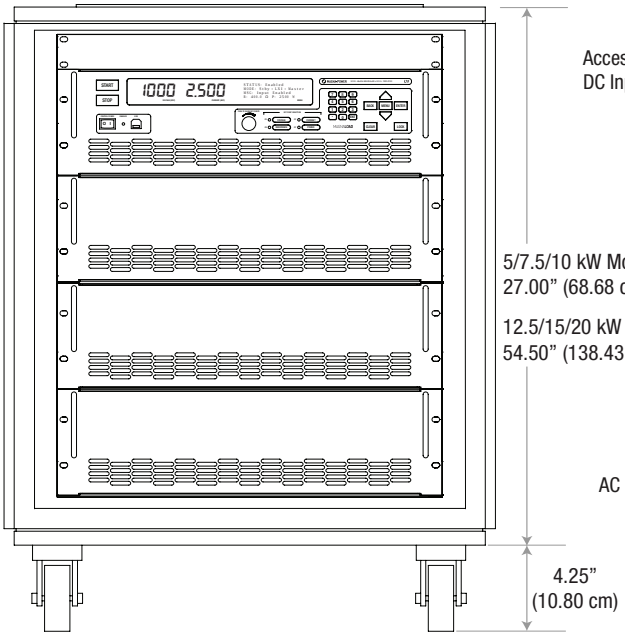
后面板 1.25 kW and 2.5 kW 型号



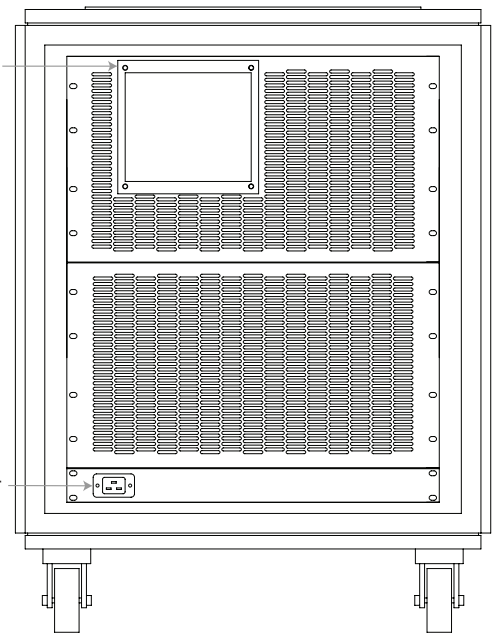
侧面板 1.25 kW and 2.5 kW 型号



正面 5 kW to 20 kW 型号



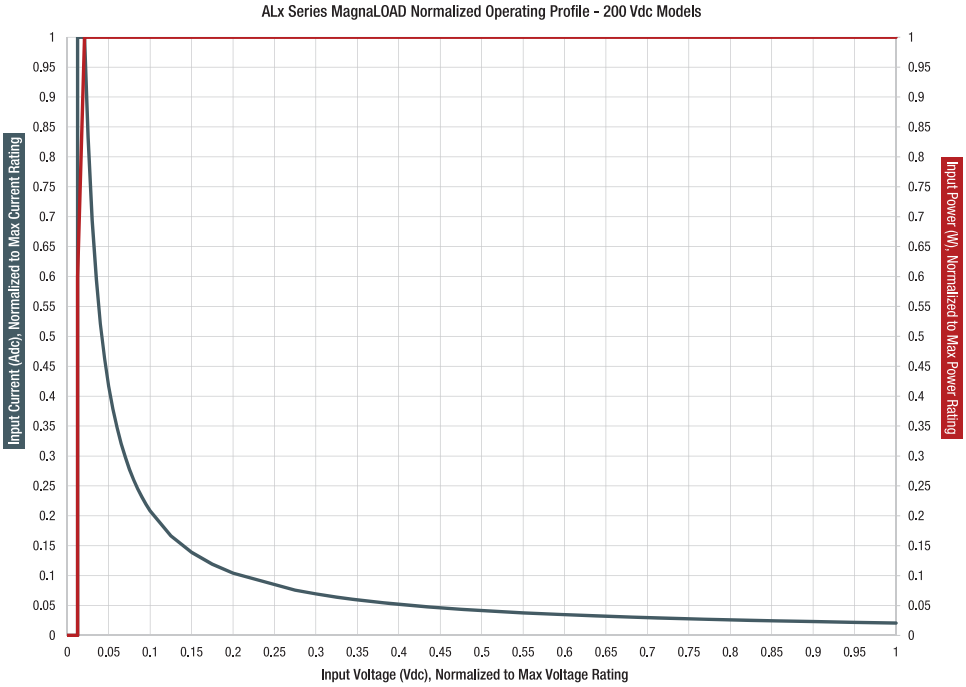
背面 5 kW to 20 kW 型号



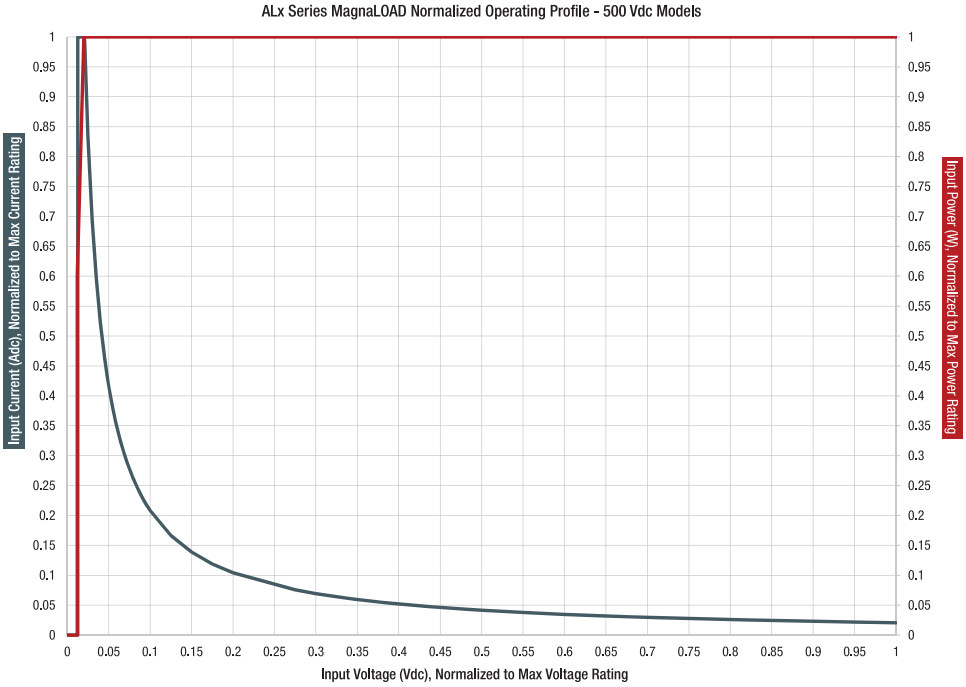
工作曲线

Alx系列仅使用线性单元散热，具有麦格纳负载产品中最宽的运行曲线。该运行曲线图适用所有ALx系列型号，产品的最大电压、电流和功率归一化。

200 Vdc ALx 系列 型号

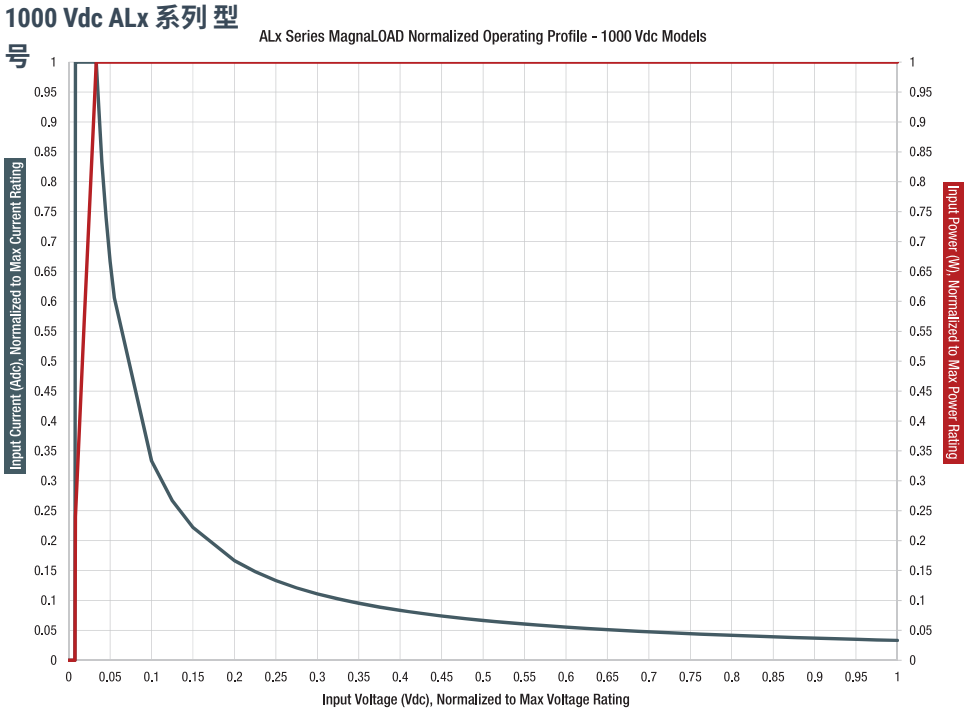


500 Vdc ALx 系列 型号



工作曲线, 继续

1000 Vdc ALx 系列 型号



MagnaLOAD 总览

MagnaLINK™ 分布式数控

麦格纳公司的MagnaLINK™使用德州仪器的分布式DSP，为麦格纳直流电子负载的内部功率处理过程提供控制。该技术遵循麦格纳公司内部重要的开发周期，为其电子负载和电源全程提供统一的数控平台，其具备多种特点，包括全数控回路、可调控制增益、程控转换速率、数字主从控制及许多先进的控制技术。

所有麦格纳负载均具有以下界面：

· 前面板旋钮，小键盘和菜单系统

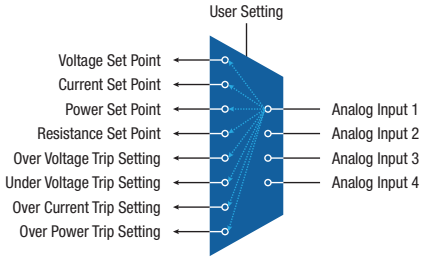
· 25针可配置外部用户接口，包括高速模拟输入

· 前置USB，后置USB和后置RS-485，或可选以太网接口

当处于待机或诊断故障时，直流输入总线将通过切换装置断开连接。

最后，通过专用的+5V互锁输入管脚，以及与之连接的所有有此+5V互锁功能设备，外部的紧急停止系统可通过外部接点轻松实现整合控制。

可配置的外部用户I/O接口



除前面板和计算机控制外，所有麦格纳负载均有标准的25针D形接口，用于外部用户输入/输出控制接口。该接口提供：

· 8个数字输出

· 4 个数字输入

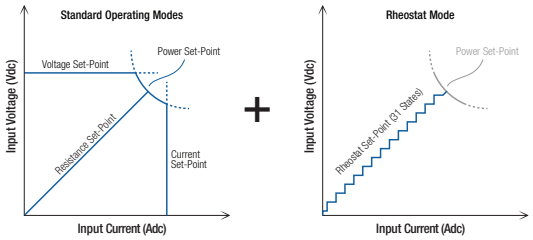
· 4 个模拟输出

· 4 个模拟输入

所有模拟-数字输入/输出端口均可配置，用户可选择他们想控制并监测的参数。可配置输入/输出方案降低了复杂性，简化了PLC集成，并允许不同界面同时控制参数。

麦格纳负载的可配置模拟量输入，可通过PLC和外部D/A转化器在0-10V编程。

灵活的操作模式



为适合各种直流电源，所有麦格纳负载均具有多种可配置控制模式，包括：

· 电压模式

· 电流模式

· 功率模式

· 电阻模式

· 分路调节器模式

· 可变电阻器模式（仅适用ARx系列和WRx系列）

在编程设定值的选定模式中，其参数均倾向于直流调节。使用麦格纳负载的设定值和跳闸设置，产品既可配置为超过极限值出现障碍时跳闸，也可配置于跨越到不同的调控状态。

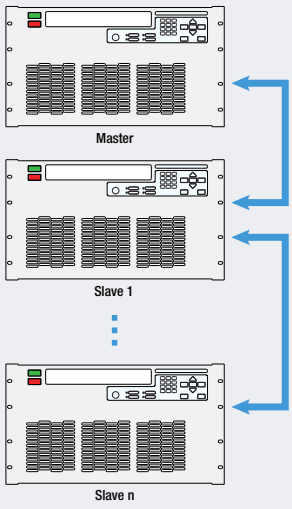
分路调节器模式使麦格纳负载成为高速智能制动电阻器，仅在指定电压超过用户定义的某个百分比时才接入直流输入，同时限制分流电流达到编程设定值。

数字主从控制：卓越的扩展性

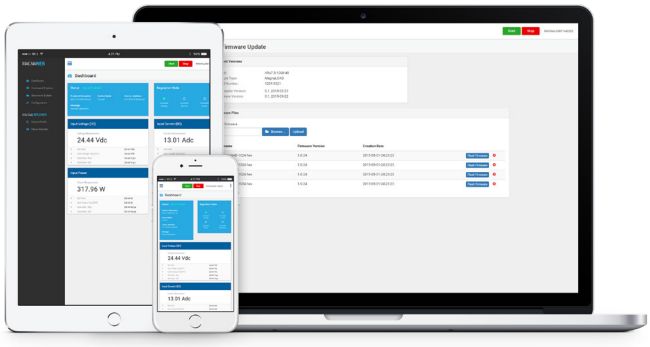
所有麦格纳负载均配有标准的MagnaLINK™输入和MagnaLINK™输出端口，实现即插即用的数字主从式控制。仅需将主设备的MagnaLINK™输出与从设备的MagnaLINK™输入相连。

此外，通过MagnaWEB软件，产品将作为基于通用控制端口之上的功率单元，自动配置为主从式运行。缓冲式数字化MagnaLINK™是指许多麦格纳负载可在主从运行中呈菊花链方式连接。主从式麦格纳负载单元可将各类测量集成在一个显示板上。

前部扩展性成就了内部MagnaLINK™协议的开发。在主从运行配置下，主控制器控制所有从控制器的数字目标。通过此数字主从式策略，一眼便可看出该单元是完全独立的运作产品，还是主从式产品。



MagnaWEB 软件接口



麦格纳电子设备公司提供的的下一代软件接口—MagnaWEB，以麦格纳负载的程控和测量回读控制为目的、提供了直观且人性化的网络浏览器。几乎所有麦格纳负载的可用功能都可通过MagnaWEB软件进行控制和监测，只要产品安装了此通信接口。

MagnaWEB使用服务器-客户的软件模式，几乎任何设备和操作系统均可访问麦格纳负载。在Windows系统本地安装并运行MagnaWEB软件，然后使用网络浏览器，可找到连接至麦格纳负载的服务器，上述操作也可以在台式机、平板电脑或智能手机等多种设备上进行。

广泛的编程支持

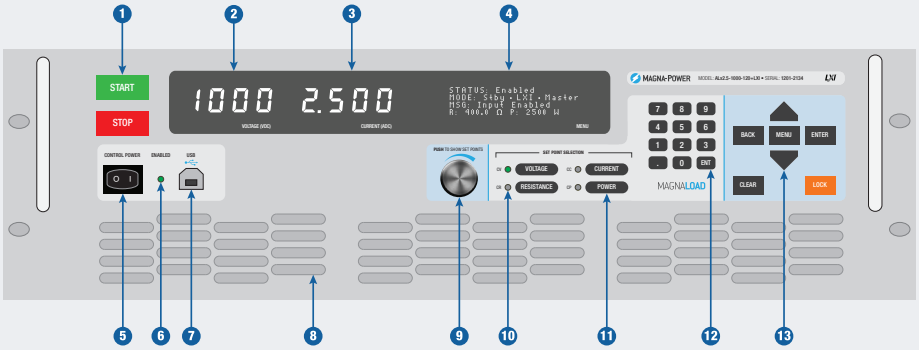
所有麦格纳直流电子负载均有专用的美国国家仪器虚拟仪器™驱动程序、可互换虚拟仪器（IVI）驱动器，并且支持各种可编程仪器标准命令（SCPI）。这些编程接口可实现对麦格纳负载的全面控制、测量和监测。麦格纳负载的所有可用通信接口均适用于这些驱动程序和命令集，包括：USB、RS-485、LXI TCP/IP以太网和IEEE-488通用接口总线GPIB。

如下面的基本代码所示，SCPI指令通过最基本的双向端接通信，使用了最简单的ASCII文本格式和参数，为客户提供了最简单的通信格式。指令编程可达50种，详细说明请参见产品系列的说明书。

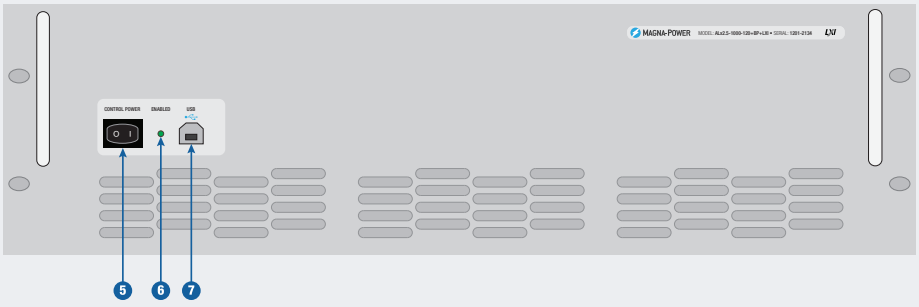
使用SCPI命令集的Python编程示例如下：

```
import serial
conn = serial.Serial(port='COM8', baudrate=115200)
conn.write('*IDN?\n')
print conn.readline()
conn.write('VOLT 1000\n')
conn.write('CURR 2.5\n')
conn.write('INP:START\n')
conn.write('MEAS:ALL?\n')
print conn.readline()
```

MagnaLOAD 前面板-标准



MagnaLOAD 前面板 空白面板（+BP）



1 START：启动电源输出
STOP：断开电源输出

2 电压测量值显示

3 电流测量值显示

4 行字符显示板：呈现菜单系统、运行 状态与模式、带诊断码的产品信息，电阻测量显示和功能测量显示

5 控制电源开关，可在不使用直流总线时给控制电路通电

6 LED指示灯：表明直流输出打开

7 完全控制（主机）的前面板USB 接口

8 进风口，有集成电扇

9 铝制数字编码器按钮，用于编程设定值

10 LED指示器，显示麦格纳负载的当前调控状态，包括：恒定电压（CV）、恒定电流（CC）、恒定功率（CP）、或者恒定电阻（CR）

11 照明选择器按钮：通过数字编码器按钮和数字键盘按钮，调整设定值

12 MENU：进入4行显示版的菜单系统
BACK：返回菜单上一级
ENTER：选择突出显示的菜单项
CLEAR：将产品移出故障状态中
LOCK：前面板锁定

程控电源和负载不断创新

麦格纳电子设备公司在美国设计并生产稳定可靠的程控直流电源产品和程控直流电子负载。制定与产品质量、规格和控制相关的行业标准。公司在电力电子方面具有丰富的经验，体现在其1.25 kW ~2000 kW产品，及产品线、优质服务和卓越声誉上。当今，你会发现麦格纳的标准产品为全球成千上万的客户提供服务、致力于电动汽车制造、为开发变频器模拟太阳能阵列、为粒子加速器操纵磁铁、为雷达系统供电、为机车研发驱动牵引控制器等方面的服务，或在很多大学里进行前沿能源的科学研究。

概要

公司成立
1981

总发货功率
350+ 兆瓦

总部及生产地点
美国 新泽西州 弗莱明顿市

场地规模
73,500 兆瓦

垂直整合 美国制造

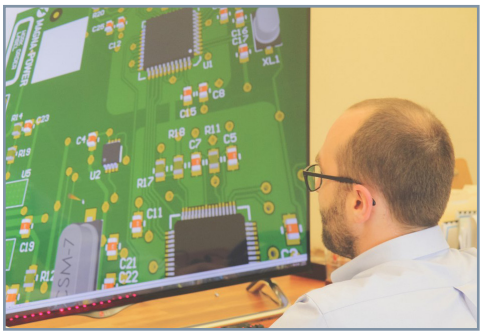
麦格纳的产品按照公司的资源垂直整合及设计方案在美国生产。公司总部位于新泽西州佛莱明顿市，公司场地面积达73,500平方英尺。公司总部承担了全部的工程设计、生产制造和北美的产品服务。

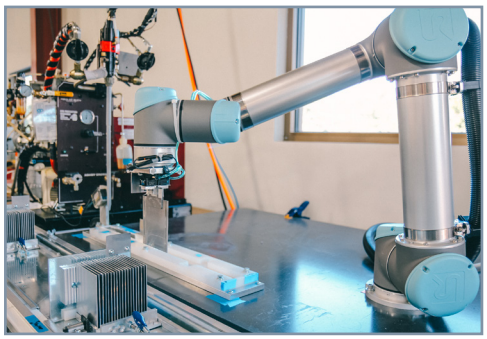
麦格纳产品在制造过程中资源垂直整合，以实现对客户订购产品的质量、成本和生产周期的控制。随着公司发展，更多运营流程纳入公司内部管理。

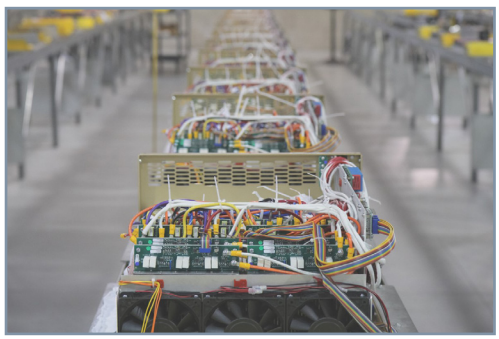
垂直整合资源使麦格纳电子设备公司能够生产各式复杂的电力电子产品，同时保持行业领先的发货周期。产线设计工程团队和制造团队协同工作，有力地促进了两个团队之间的密切合作，保证生产过程连续性，并持续提高产品性能。

内部运营流程

- 研发
- 磁学绕组
- 磁芯冲切
- 整片金属铸造
- EDM和CNC加工
- 电缆束
- 粉末涂敷
- 自动化风冷和水冷式散热设备生产
- 表面贴装与金属孔印刷电路板组装
- 产品组装、测试与老化







Electronic Loads — A New Generation

DC electronic loads have been available for electronic testing applications for several decades. Today's products range from switched resistors, high speed active loads utilizing power semiconductors, and regenerative loads that return power to the utility. Each technology group has found their way into various applications. This article describes some advantages and disadvantages of the technology alternatives and presents a newly developed, hybrid circuit topology offering some unique performance features.

Switched Resistive Loads

The oldest generation of electronic loads is based on switching of resistive components. Depending on the power level, resistors are commonly constructed from steel plates, nichrome wire, or metal film resistors. Switched resistor loads have the lowest cost per watt, but the poorest performance in terms of dynamic response, programmability, and protection.

Figure 1 shows two circuits that are commonly used with resistive switching. The two configurations differ in their ability to select the desired resistor combination versus the ability to dissipate power.

Figure 1a, binary switching, provides the most accurate resistance selection per quantity of components. Resistor R2 has twice the resistance as resistor R1, R3 has twice the resistance as R2, and so forth. This circuit is often used in low power applications to obtain digital to analog conversion where power is not a consideration. Power varies as the square of applied voltage and as a load, binary switching exhibits poor performance in terms of power dissipation at lower voltage levels. Binary switching is the best choice for applications when the applied voltage is fixed.

Figure 1b, optimized power switching, allows resistors to be placed in series or parallel offering better power dissipation performance over a wider range of applied voltage. The disadvantage, when compared to binary switching, is that optimized power switching has a lower selection of available resistor settings per number of components. With three switches, maximum rated power dissipation can be achieved at half and full rated voltage. Other resistor configurations are also possible by modulating resistor on-states with the available switches.

In DC systems and when using contractors for the switching devices, performance is usually limited by the contractor DC current rating. For cost reasons, an AC contractors are commonly used for switching resistor elements, but with these devices, switching is restricted to low voltages were arcing can be minimized. This limitation prohibits the use of contactor-based switching for dynamic-load applications. In addition, use of DC contactors, while available, are rarely used because of cost and size constraints. Utilizing power semiconductors as the switching elements eliminate the constraint imposed by AC contactors, but are rarely used in favor of MOSFET load technologies.

Most electronic loads using resistive elements are fabricated by end users wanting high-power, low-cost solutions for their testing needs, sacrificing dynamic loading and programmable protection capabilities.

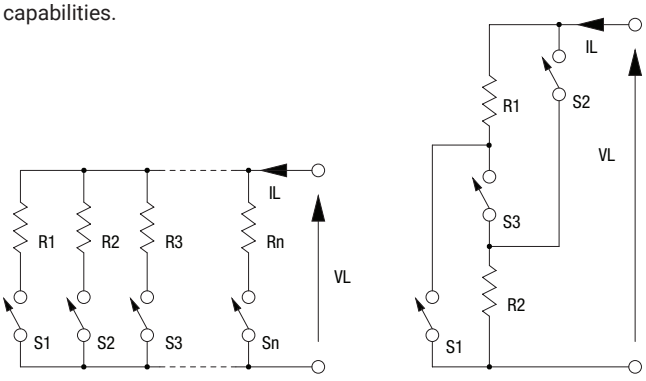


Figure 1. (left) Binary switching and (right) Optimized power switching

MOSFET Loads

Metal Oxide Field Effect Transistors, MOSFETs, loads can be deployed as state-of-the-art electronic loads to address the limitations of resistor-based loads. As illustrated in Figure 2, these electronic loads use semiconductor devices, operated in the linear region, to allow full power and full control over the entire VA rating of the product. MOSFETs have to be specifically rated to operate in the linear region and have safe operating curves well below the maximum power rating when used as an electronic switch.[1-2] Circuitry for MOSFET loads requires each stage to be controlled in a closed loop to linearize the response. As shown in the figure, each device produces a load current defined by VC/Rn. Closed loop amplifiers enable multiple MOSFETs to share load current equally. In addition, MOSFET loads have a fast dynamic response.

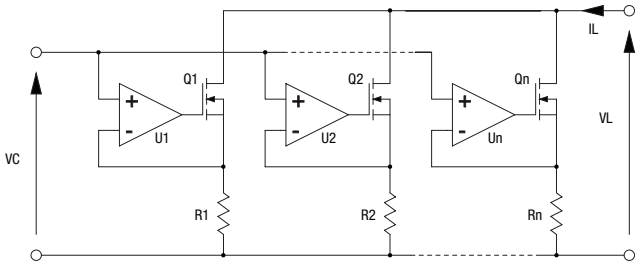


Figure 2. MOSFET Load

The reliability of MOSFET loads depends on the allowed power dissipated per device, current sharing, and cooling design. Water cooling is commonly used to enhance cooling performance and enable higher power loads.

MOSFET loads come at a cost premium over switched resistor loads.

Regenerative Loads

In the past decade, regenerative loads started appearing as a viable product. A regenerative load is, in a simplified sense, an AC to DC power supply with power circuitry reversed to allow current flow in the reverse direction. Response times are similar to that of DC power supplies and special circuitry is needed to stop operation in the event that the power mains voltage is disrupted for any reason. Regenerative loads can be compared to solar inverters as far as performance with exception to the DC range of operation. Like switched resistor loads, obtaining maximum power operation over a wide voltage range requires special circuitry rated at maximum voltage and maximum current; such performance demands can greatly increase the cost as compared to a conventional switching power supply.

The major benefit of regenerative loads is that energy used for testing can be recovered. Some regenerative loads are designed to operate as both a source and sink. These products, regenerative power supplies, must have a dual set of electronic switches.

Using regenerative loads in pulse current applications is not recommended because any pulse current at the input must flow through the unit and appear on the power mains. The economics of regenerative loads must be evaluated in terms of capital equipment costs versus energy savings.

Active Resistive Loads

Active Resistive loads are a blend between switched resistor loads and MOSFET loads. The advantage of resistive loads is cost per watt of dissipating power and the advantage of MOSFET loads is speed of performance and the ability of dissipating power over a wide range of control. Figure 3 shows the basic concept of an Active Resistive load [3]. As illustrated, a critical part of the design is that resistors are placed in series with MOSFETs. MOSFETs are a voltage to current, transconductance, devices. Voltage perturbations resulting from resistors switching are compensated with reverse voltage perturbations across the MOSFETs. Amplifiers, used to share current between devices, do not need to respond

quickly to these voltage changes because of the profile of MOSFET devices when operated as a transconductance device. A constant gate voltage in the device's active region provides nearly a constant current.

The range of maximum power loading, like in resistive loads, depends on the number of resistors, number of switches, and applied voltage. To compromise between the number of dissipative elements and range of maximum power loading, both resistor configurations as described in Figure 1a and 1b, are applied. Careful design of the cooling system can enable maximum power output over half-rated to full-rated voltage. With sufficient number of resistor switching states, power dissipation can be shared with an 80% to 20% ratio for resistor to MOSFET power dissipation, respectively.

Below half-rated voltage and as described previously, maximum power dissipation varies as the square of applied voltage. Having a series MOSFET connection enables a broader profile for lower voltage applications. This requires the resistor elements to be shorted. If the maximum power is limited to 20% of the total using the MOSFET section of the load, this part of the load can provide a 20% maximum power profile. While this is not ideal, it is an effective compromise when considering the cost benefit.

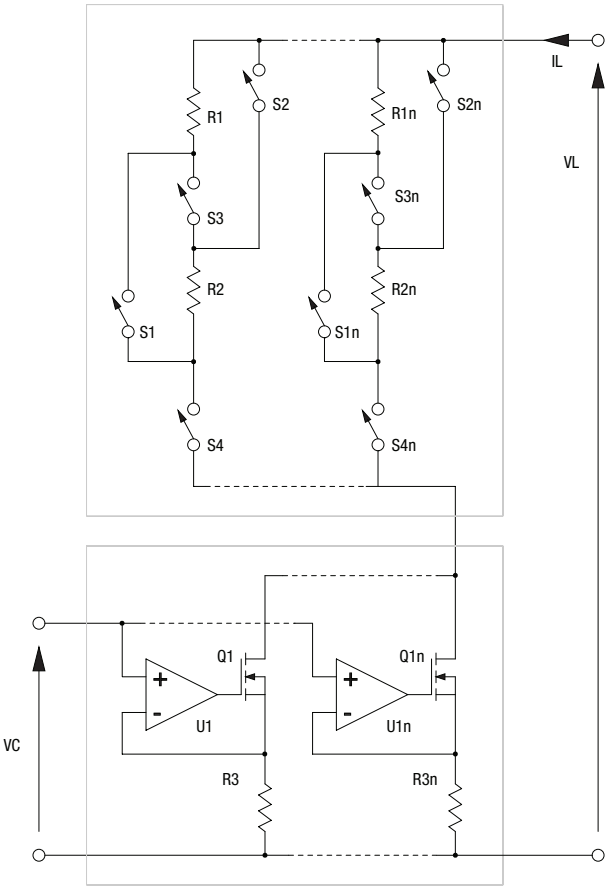


Figure 3. Active Resistance Technology electronic load

With the MOSFET section of the load shorted, the electronic load becomes a purely resistive and the load is operated in rheostat mode. While this could be considered a downgraded load, there are many applications where a purely resistive profile, with no closed loop control, is desirable. The dynamically switched resistor states eliminate the possibility of two closed loops, that of the source and load, to operate against one another. Bandwidth for step changes resistance depends on the speed of the resistor switches. The Active Resistive load can provide 80% of the load's power rating over a range of half-rated to full-rated voltage.

Figure 4 illustrates the load profiles of MOSFET, resistive, and active resistive operation.

Robustness is a key characteristic of Active Resistive loads. Current limiting is constantly enabled with a series connected resistor. A sudden demand change in current will cause the MOSFETs to saturate protecting the devices from exceeding their safe operating area.

Balancing power between the resistors and MOSFETs presents one of the key challenges for effective Active Resistance load operation. The MOSFETs must have a range of voltage to offset the voltages produced by the switching resistors. Load voltage and current must constantly be monitored to provide resistor state changes along with analog control of the MOSFETs. High speed digital signal processors (DSP's) are required to make such calculations to ensure proper operation. Step load responses require feed forward compensation to force a change in resistance prior to changing load current with the MOSFETs. If step changes in resistance are made quickly and MOSFETs are made to respond soon after, MOSFET safe operating area limitations can be maintained for reliable operation.

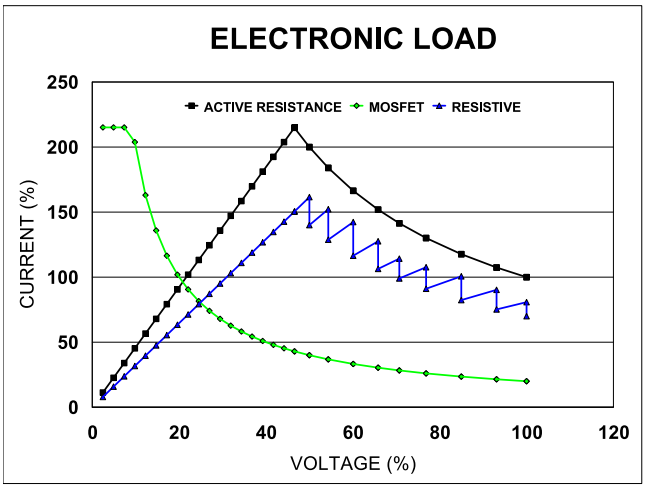


Figure 4. Active Resistance current voltage (IV) load profiles

Conclusion

This article provides an overview of electronic loads currently available, namely: switched resistance, MOSFET, regenerative, and newly introduced hybrid, Active Resistance. Each load topology has advantages and disadvantages, ranging from cost, speed of operation, to loading as a function of applied voltage. The Active Resistance topology has characteristics of switched resistance and MOSFET loads combined as well as operating independently of others.

References

[1] Sattar and V. Tsukanov, "MOSFETs Withstand Stress of Linear-Mode Operation," Power Electronics Technology, 2007, pp. 34-39.

[2] J. Dodge, "How to Make Linear Mode Work," Bodo's Power Systems, December 2007.

[3] I. Pitel, G. Pitel, and A. Pitel, "Electronic Loads," U.S. Patent No. 9,429,629.

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