

## **Programmable DC Power Supplies Are Scalable To 10 MW**

[Magna-Power Electronics'](#) ML series of 500-kW and 1-MW water-cooled programmable dc power supplies combines the company's signature robust current-fed power processing topology with a state-of-the-art water-cooled design to achieve a nearly fourfold increase in power density compared to Magna-Power's air-cooled high-power solutions (see the figure).

The ML series spans 38 models at 500-kW and 1-MW power levels, with voltage ratings as high as 6000-Vdc (floating) and current ratings as high as 5000 Adc. Power levels up to 10 MW are achieved using multiple products configured for high-performance master-slave parallel operation, wherein the master directly controls the gate drivers of slave units. The master-slave technique ensures a single control loop in the system and consistent performance as the system scales.

The ML series uses 250-kW power stages. When compared to alternative solutions that parallel many smaller modules, these larger power stages provide significantly reduced design and integration complexity, parts count, switching devices (and potential points of failure), all while offering a substantially lower cost point, says the vendor.

In addition, the ML series incorporates Magna-Power's harmonic neutralizer technology, which consists of specially wound magnetic components designed to passively cancel strings of harmonics to lower total harmonic distortion and increase power factor. The 500-kW models incorporate a 12-pulse harmonic neutralizer, while the 1000-kW models incorporate a 24-pulse harmonic neutralizer.

With its scalable air-cooled 150-kW and 250-kW MT series, Magna-Power has offered megawatt-scale programmable dc power supply solutions for decades. However, key applications have been driving demand for even higher power with a significantly reduced physical size, including electrolysis and fuel cells, powering radar systems, electrification across all modes of transportation, and aerospace.

A Standard Commands for Programmable Instrumentation (SCPI) command set is supported for control from virtually any programming language, including Python. In addition, an IVI driver is included for the Visual Studio programming environment along with a dedicated National Instruments LabVIEW and LabWindows driver. The ML series comes with a serial interface with an optional LXI TCP/IP Ethernet (+LXI) interface.

Additional options include

- High isolation output (+ISO): Expands the output isolation to allow floating or series operation beyond the standard  $\pm 1500$ -Vdc rating.
- Integrated blocking diode (+BD): Provides an internally heatsinked protection diode, designed specifically for battery and capacitor charging applications.
- High slew rate output (+HS): Provides high-speed programmed voltage and current changes.

Standard protection features on the ML series power supplies include a dedicated interlock emergency stop input, programmable overvoltage trip and overcurrent trip settings, thermal protection, fuse fault, ac line fault, and analog input programming line fault. In addition, when in standby or fault condition, a three-phase contactor provides a mechanical break between the power supply's power processing circuit and the ac mains, providing the user with confidence in safe operating conditions.

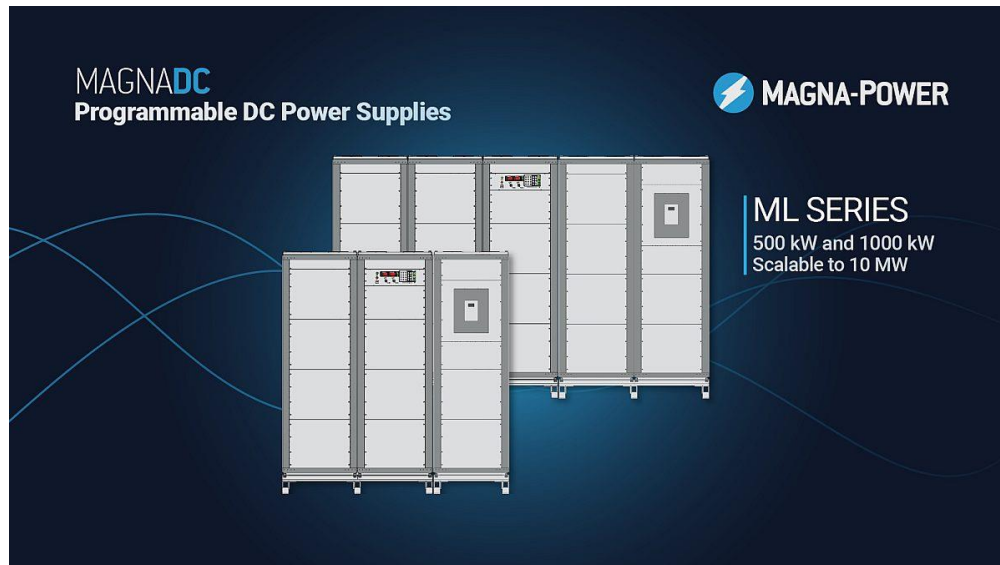
The ML series is manufactured by Magna-Power in Flemington, New Jersey, at its vertically integrated purpose-built factory. Key manufacturing and facility developments were required to support the introduction of the ML series.

Each power electronics stage is mounted on a dedicated high-heat-transfer aluminum chill plate with press-fit copper tubes, ensuring manufacturability and serviceability. These stages slide into the rack enclosure on rails, secured and interconnected with a wire harness.

Magnetic components are wound with chill plates around the transformer core, while a precisely tuned water distribution manifold ensures adequate flow to each stage. An integrated solenoid prevents water flow until internal temperatures reach a set value to minimize condensation.

Magna-Power developed all-new reconfigurable switched-resistance water-cooled loads, with capabilities up to 10 kV and 1 MW+, to support testing and burn-in of the company's wide array of product ratings. Installation of a new 1-MW cooling tower with associated cooling loops is currently underway to provide closed-loop chilled water for testing needs.

The ML series is now available directly from Magna-Power. For more information see the ML series [page](#) or contact [Magna-Power](#).



*Figure. The ML series of water-cooled programmable dc power supplies offers 500-kW and 1-MW models, significantly increasing power density and reducing size for high-power applications. The series features 38 models with ratings up to 6000 Vdc (floating) and 5000 A dc, designed to address requirements for electrolysis and fuel cells, high-power radar, vehicle electrification, and other applications. Multiple units can be configured for master-slave parallel, achieving combined ratings up to 10 MW.*