Magna-Power Electronics Programmable DC Power Supplies

Technology and Feature Overview

Innovative and Scalable

Magna-Power Electronics programmable DC power supplies combine the best of DC power processing with microprocessor embedded control. A combination of high and medium frequency power processing technologies improves response, shrinks package size, and reduces cost. All Magna-Power Electronics DC power supplies are current-fed and are more tolerant to abusive loads than conventional switching power supplies. This technology allows the power supply to operate under short-circuit conditions, open-circuit conditions and everything in between.

The programmable DC power supplies offer both master/slave parallel and series operation. This enables two or more power supplies to be placed in parallel for increased output current or in series for increased output voltage, within the unit's isolation limits. With master/slave operation, power supplies operate at near equal voltage and current. The process of master/slaving power supplies is plug & play with the use of Magna-Power Electronics UID47 option, which can be added at any time.

All supplies can operate as a voltage source or current source depending on the control settings and load conditions. If the power supply is operating as a voltage source and the load increases to a point beyond the current command setting, the power supply automatically crosses over to current mode control and operates as a current source at that setting.

Designed for Safety

Magna-Power Electronics programmable DC power supplies have extensive diagnostic functions—all of which, when activated, take command to shut down the system. Diagnostic functions include phase loss, excessive thermal conditions, over voltage trip, over current trip, fuse clearing, and program line. Program line monitors externally applied analog set point signals to insure they are within the specified range. Upon a diagnostic fault condition, main power is disconnected and the diagnostic condition is latched into memory. Pressing the clear key clears the memory. All diagnostic functions can be monitored through the rear connector and software. Furthermore, control functions can also be set through the rear connector to allow simultaneous control of one or more power supplies.

The power supplies have three levels of over voltage/current protection: shutdown of controlling insulated gate bipolar transistors (IGBTs), disconnect of main power and input fuses. After an over voltage/current trip condition, the supply fault must be cleared.

Isolated External I/O for Automation

Using the rear isolated 37-pin I/O connector, the programmable power supplies can be completely controlled and monitored using external signals. The voltage, current, over voltage and over current set points are set by applying a 0-10V analog signal. Each diagnostic condition is given a designated pin, which reads +5V when high. Reference +5V and +10V signals are provided, eliminating the need for external voltage signals and allowing the use of dry contacts. Also, the power supply features a normally closed external interlock, which when enabled, allows the power supply to be tied in with other emergency stop equipment. All these pins are isolated to earth-ground as standard—no additional isolation equipment or options necessary.

Fully Programmable

The Magna-Power Electronics programmable DC power supplies can be programmed and monitored using three possible sources:

- Stepless front panel programming knobs
- External analog/digital signals
- Computer interface through included software, LabVIEW, or other programming environemnt

The power supply can be programmed to have its control functions accessible from the front panel, rear connector, RS232 (standard), LXI TCP/IP Ethernet (+LXI), IEEE 488 GPIB (+GPIB), USB Edgeport (+USB), or RS485DSS (+RS485) communications. The included IVI driver enables programming in a variety of software environments, including: Visual C++, Visual C#, Visual Basic .NET, Visual Basic 6.0, LabVIEW, LabWindows/CVI, MATLAB, Measure Foundry, and Agilent VEE Pro. Basic programming requirements are satisfied by the instrument's supported Standard Commands for Programmable Instruments (SCPI). Sensing can be established at the output terminal of the power supply or through a rear remote sense terminals for sensing at the load. Even calibration has been simplified with front panel access to digital calibration potentiometers.

Attention to Power Quality

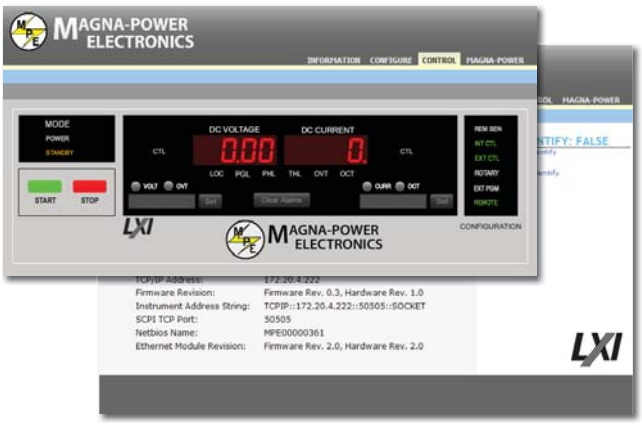
All Magna-Power Electronics power supplies contain circuitry to work harmoniously with other power equipment. Step-start contactors are used to keep inrush current below full scale operating current. Filter components lower current harmonic content emanating from the power supply and increase power factor to levels beyond 90%. Every power supply is tested at 90% to 125% nominal line to insure satisfactory operation even under the worst line voltage conditions.

Electronic Output Stage

The novel electronic output stage (XR/TS/MS Series) utilizes near constant power loading under all conditions via an electronic bleed resistance. This electronic bleeder means stability under all operating conditions and faster fall times, without affecting the overall system efficiency.

Higher Quality Power Processing

LXI TCP/IP Ethernet Interace Option (+LXI)



LXI is an instrumentation platform based on industry standard Ethernet technology designed to provide modularity, flexibility and performance to small- and medium-sized systems. Certified to the LXI Standard (Class C), Magna-Power Electronics +LXI option includes an embedded web-server, allowing web browser power supply control and monitoring from virtually anywhere and a universal IVI driver.

Remote Interface Software

The Remote Interface Software ships with all power supplies. The software provides the user with an easy and intuitive method to operate a Magna-Power Electronics power supply with computer control. The Remote Interface Software has six windows: Virtual Control Panel, Command Panel, Register Panel, Calibration Panel, Firmware Panel, and Modulation Panel.

Key Product Line Features:

Magna-Power Electronics has designed its products from the ground up to provide synergy across the entire product line. The following are some the company's programmable DC power supplies key features:

- **Industry leading power density**
  Rack-mount space is always at a premium. Magna-Power Electronics power supplies are continuously refined with new technology and devices to drive down size and increase power density.
- **High accuracy programming**
  ±0.075% full scale programming accuracy on all models and programming interfaces.
- **High power factor: > 0.92 on all 3Φ models:**
  Attention to AC power quality and input inductance enables a high power factor, consistent across all 3Φ input voltages.
- **Standard 37-pin isolated I/O and RS232**
- **Multiple front panel types for flexibility**
- **Extensive programming interface options**
- **CE Mark safety and EMI/EMC certification**
- **Made in USA**
  All products are designed and manufactured at Magna-Power Electronics vertically integrated headquarters in Flemington, NJ USA

Protective Diagnostic Features:

- Over-voltage protection (OVT) (*Programmable*)
- Over-current protection (OCT) (*Programmable*)
- Over-temperature protection (THL)
- Interlock fault (LOC)
- Fuse fault (FUSE)
- Phase loss alarm (PHL)
- Analog programming line voltage fault (PGM LN)
- Remote sense lead detection (REM SEN)

MT Series VI: 100 kW to 2000 kW+

MT Series VI 100 kW and 150 kW Module

MT Series VI 250 kW Module

Product Name:	MT Series VI
Number of Models:	65
Power Levels:	100 kW to 2000 kW+
Voltage Range:	Models from 0-16 Vdc to 0-4000 Vdc
Current Range:	Models from 0-24 Adc to 0-24000 Adc
Enclosure	Floor Standing Cabinet

Overview

Magna-Power Electronics MT Series VI uses the same reliable current-fed power processing technology and controls as the rest of the programmable DC power supply product line, but with larger high-power modules: individual 100 kW, 150 kW and 250 kW power supplies. As an added safety measure, all MT Series VI units include an input AC breaker rated for full power. The independent IGBT-based MT Series VI units are among the largest standard switch-mode power supplies on the market, minimizing the number of switching components when comparing to smaller module sizes. Scaling in the multi-megawatts is accomplished using the UID47 device, which provides master/slave control: one power supply takes command over the remaining units, for true system operation.

250 kW modules come standard with an embedded 12-pulse harmonic neutralizer, ensuring low total harmonic distortion (THD). Even higher quality AC waveforms are available with an external additional 500 kW 24-pulse or 1000 kW 48-pulse harmonic neutralizers, designed and manufactured exclusively for Magna-Power Electronics products (Page 29).

All MT Series VI power supplies come standard with isolated 37-pin external I/O, RS232, Remote Interface Software, IVI drivers for integration into a variety of programming environment Three front panel types are available (Page 22) for maximum application flexibility. The A Version provides front panel control and calibration, start and stop buttons, and a digital display for voltage and current. The D Version front panel adds a 10-key digital front panel entry, memory sequencing, and modulation capabilities for non-linear output profile emulation.

Available Options

- Harmonic Neutralizer
- High Isolation Output (+ISO)
- High Slew Rate Output (+HS)
- IEEE 488.2 GPIB Interface (+GPIB)
- LXI TCP/IP Ethernet Interface (+LXI)
- Photvoltaic Power Profile Emulation (+PPPE)
- RS-485DSS Interface (External) (+RS485)
- UID47: Universal Interface Device (+UID)
- USB Edgeport Interface (External) (+USB)

Innovative High-Power Switch-Mode Technology

MT Series VI Specifications

Input Specifications	
Nominal Voltage **3 phase, 3 wire + ground**	380 Vac, 3Φ (operating range 342 - 418 Vac) 415 Vac, 3Φ (operating range 373 - 456 Vac) 440 Vac, 3Φ (operating range 396 - 484 Vac) 480 Vac, 3Φ (operating range 432 - 528 Vac)
Frequency	50 Hz (operating range 45 - 55 Hz) 60 Hz (operating range 54 - 66 Hz)
Power Factor	> 92% at maximum power: 100 kW and 150 kW modules > 96% at maximum power: 250 kW modules

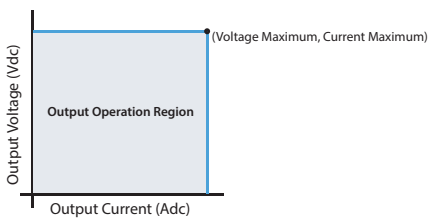
Output Specifications	
Ripple	(See Model Charts)
Line Regulation	Voltage Mode: ± 0.004% of full scale Current Mode: ± 0.02% of full scale
Load Regulation	Voltage Mode: ± 0.01% of full scale Current Mode: ± 0.04% of full scale
Load Transient Response	2 ms to recover within ±1% of regulated output, with a 50% to 100% or 100% to 50% step load change
Efficiency	≥ 90% at full load (See Model Charts)
Stability	± 0.10% for 8 hrs. after 30 min. warmup
Isolation	User inputs and outputs: referenced to earth ground Maximum input voltage to ground: ±2500 Vac Maximum output voltage to ground: ±1000 Vdc for models less than or equal to 1000 Vdc ±4000 Vdc for models greater than 1000 Vdc
Maximum Slew Rate	Standard Models: 100 ms for output voltage change from 0 to 63% 100 ms for output current change from 0 to 63% With High Slew Rate Option (+HS): 4 ms for output voltage change from 0 to 63% 8 ms for output current change from 0 to 63%
Bandwidth	Standard Models: 3 Hz for remote analog voltage programming 2 Hz for remote analog current programming With High Slew Rate Option (+HS): 60 Hz for remote analog voltage programming 45 Hz for remote analog current programming

Note: Specifications are subject to change without notice. For three-phase configurations, input specifications are line-to-line. Unless otherwise noted, input voltages and currents are specified for three-phase configurations.

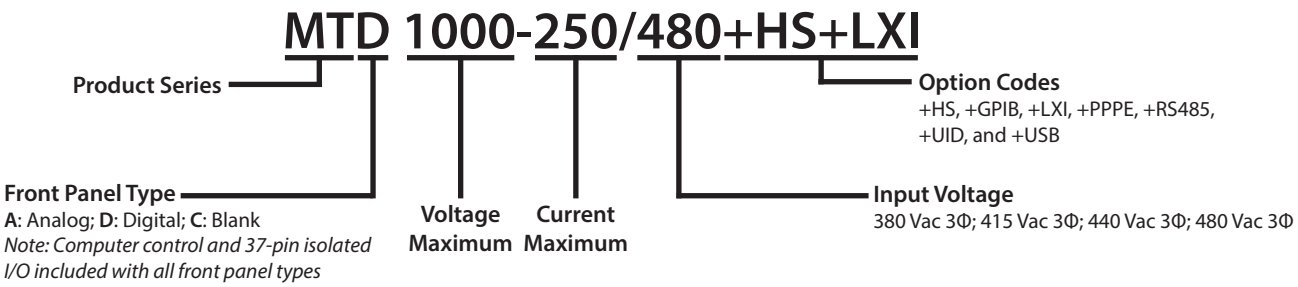
Physical Specifications		
Power	**Size (H" x W" x D")**	**Weight**
100 kW	62.5 x 48 x 31.5 in (158.8 x 121.9 x 80.0 cm)	1600 lbs (725.8 kg)
150 kW	62.5 x 48 x 31.5 in (158.8 x 121.9 x 80.0 cm)	2100 lbs (952.5 kg)
250 kW	62.5 x 72 x 31.5 in (158.8 x 182.9 x 80.0 cm)	3300 lbs (1496.9 kg)
500 kW	62.5 x 144 x 31.5 in (158.8 x 365.8 x 80.0 cm)	6600 lbs (2993.7 kg)
750 kW	62.5 x 216 x 31.5 in (158.8 x 548.7 x 80.0 cm)	9900 lbs (4490.6 kg)
1000 kW	62.5 x 288 x 31.5 in (158.8 x 731.6 x 80.0 cm)	13200 lbs (5987.4 kg)

Control Specifications	
Voltage Programming Accuracy	± 0.075% of full scale voltage
OVT Programming Accuracy	± 0.075% of full scale voltage
Current Programming Accuracy	± 0.075% of full scale current
OCT Programming Accuracy	± 0.075% of full scale current
Voltage Readback Accuracy	± 0.2% of full scale voltage
Current Readback Accuracy	± 0.2% of full scale current
External Analog Programming and Monitoring Levels	0 - 10 Vdc
External Analog Output Impedances	Voltage output monitoring: 100 Ω Current output monitoring: 100 Ω +10 Vdc reference: 1 Ω
External Digital Programming and Monitoring Limits	Input: 0 to 5 Vdc, 10k input inpedance Output: 0 to 5 Vdc, 5 mA drive capacity
Remote Sense Limits	3% maximum voltage drop from output to load
Period Programming Limits	Minimum period: 10 ms Maximum period: 9997 sec

Environmental Specifications	
Ambient Operating Temperature	0 °C to 50 °C
Storage Temperature	-25 °C to 85 °C
Humidity	Relative humidity up to 95% non-condensing
Temperature Coefficient	0.04 % / °C of maximum output voltage 0.06 % / °C of maximum output current
Air Flow	Front and rear intake, top exhaust



MT Series VI Models



Models Chart

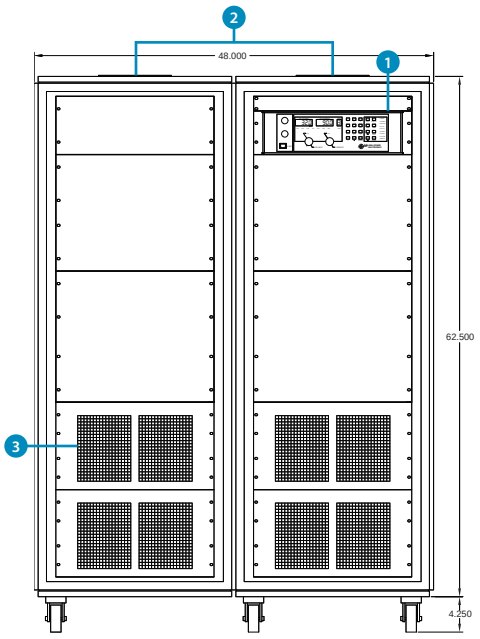
The following chart details the available standard MT Series VI models. The Current Maximum (Adc) column is separated by the available power levels. To determine the appropriate model, first select your output Voltage Maximum (Vdc) to find appropriate row. Next, select one desired current maximum from the row that contains your desired voltage maximum. Non-standard voltage and current configurations are available. Configurations above 1000 kW are also available. Please contact your local sales partner for more information.

	100 kW	150 kW	250 kW	500 kW*	750 kW*	1000 kW*		
Voltage Maximum (Vdc)	**Current Maximum (Adc)**						**Ripple (mVrms)**	**Efficiency (%)**
16	6000	N/A	N/A	N/A	N/A	N/A	35	90
20	5000	N/A	N/A	N/A	N/A	N/A	40	90
25	N/A	6000	N/A	N/A	N/A	N/A	40	90
32	3000	4500	N/A	N/A	N/A	N/A	40	90
40	2500	3750	6000	12000	18000	24000	40	91
50	2000	3000	5000	10000	15000	20000	50	91
80	1250	1850	3000	6000	9000	12000	60	91
100	1000	1500	2500	5000	7500	10000	60	91
125	800	1200	2000	4000	6000	8000	100	91
160	620	160	1500	3000	4500	6000	120	91
200	500	750	1250	2500	3750	5000	125	91
250	400	600	1000	2000	3000	4000	130	92
375	270	400	660	1320	1980	2640	170	92
400	250	375	625	1250	1875	2500	180	92
500	200	300	500	1000	1500	2000	220	92
600	160	240	400	800	1200	1600	250	92
800	120	180	300	600	900	1200	300	92
1000	100	150	250	500	750	1000	400	92
1250	80	120	200	400	600	800	500	92
1600	62	90	150	300	450	600	600	92
2000	50	75	125	250	375	500	800	92
2500	40	60	100	200	300	400	900	92
3000	32	48	80	160	240	320	1000	92
4000	24	36	60	120	180	240	1100	92
	Input Current (Aac)							
380/415 Vac, 3Φ	191	287	478	956	1434	1912		
440/480 Vac, 3Φ	165	248	413	826	1239	1652		

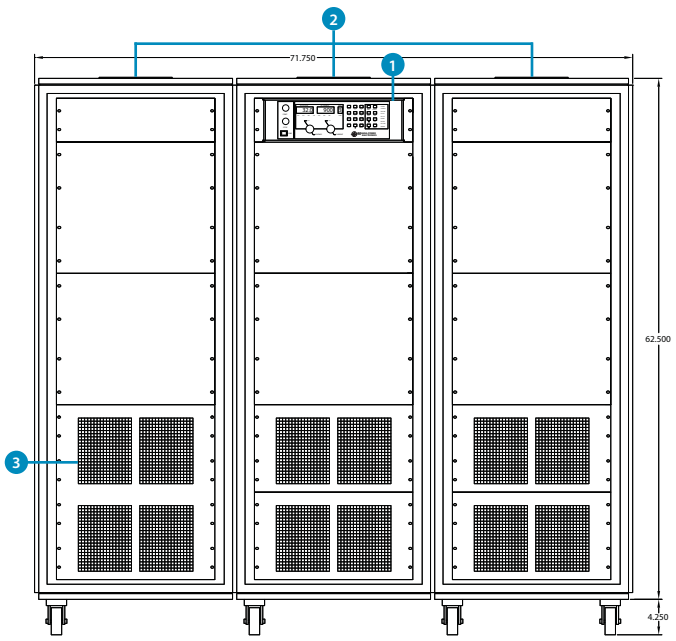
Note: Power levels marked with an asterisk (*) and above 1000 kW are achieved by master/slave paralleling 250 kW modules. Ripple specified for standard models. For models with the High Slew Rate Output Option (+HS), refer to the table on the option page.

MT Series VI Models

Front View* (100 kW and 150 kW)

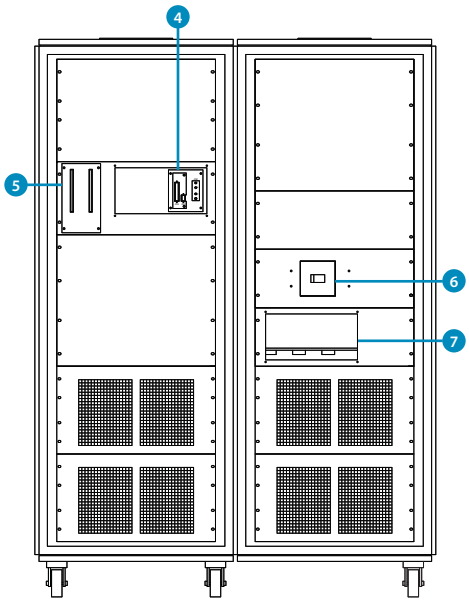


Front View (250 kW)

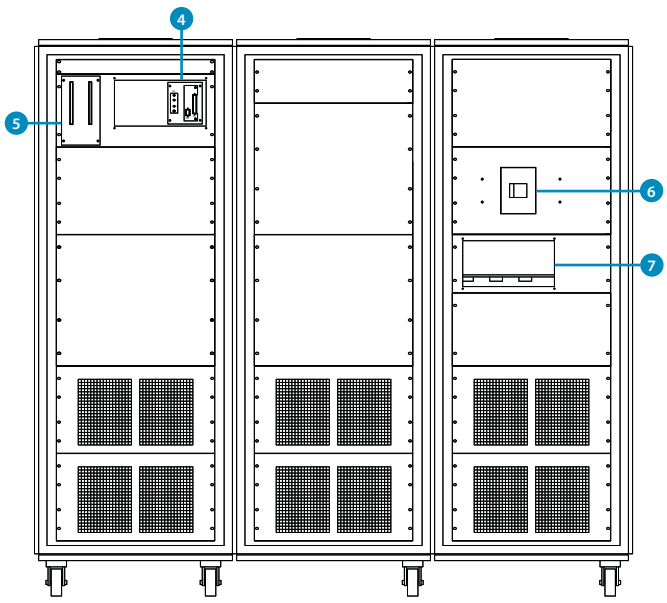


1. Front Panel Controller
2. Air Exhaust Fans
3. Air Intake
4. Connections for External Control
5. DC Output Bus (See Details Below)
6. Input AC Breaker
7. Input AC Power Entry Qty (4) 3/8-16 1.5" Studs

Rear View (100 kW and 150 kW)



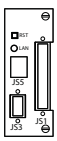
Rear View (250 kW)



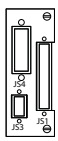
* Note: 150 kW model pictured in diagram. 100 kW models will have the front panel on the left side.

External Controls and DC Output Bus Connections

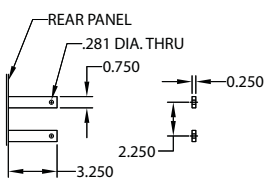
Optional (+LXI) Interface



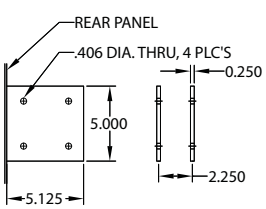
Optional (+GPIB) Interface



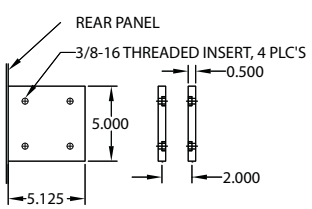
High Voltage Output Bus:
Models 1250 Vdc+



Medium Voltage Output Bus:
Models 80 Vdc to 1000 Vdc



Low Voltage Output Bus:
Models 50 Vdc and below

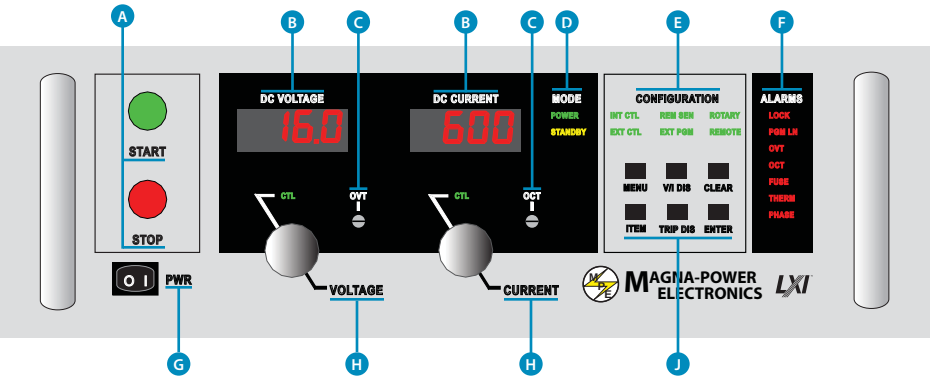


Front Panel Types (TS/MS/MT Series)

This section details the various front panel types available for the TS Series, MS Series, and MT Series power supplies. For the XR Series front panels, refer to its diagram page.

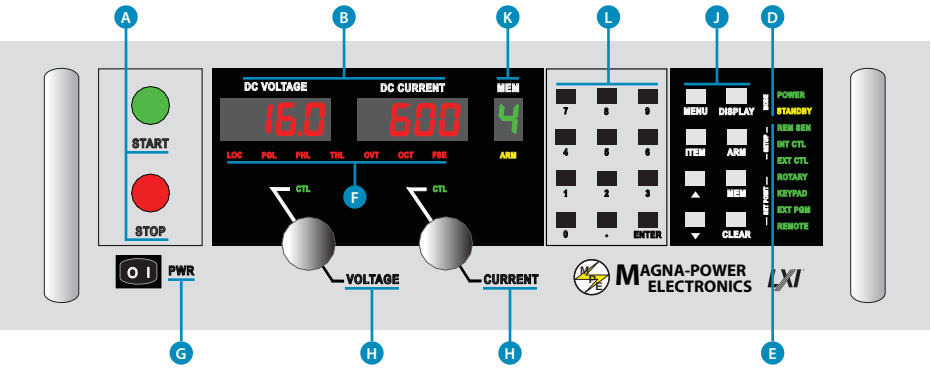
A Version Front Panel

The A Version front panel provides a digital display with rotary front panel input, isolated 37-pin analog/digital I/O, and a RS232 computer interface.



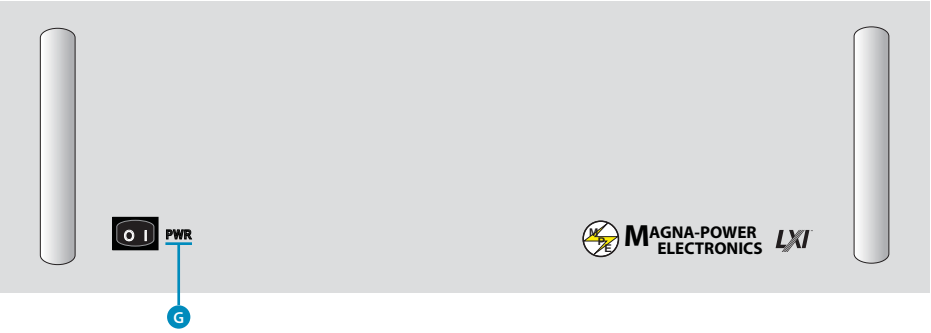
D Version Front Panel

In addition to the features of the A Version front panel, the D Version front panel provides digital 10-key entry, auto-sequencing with memory capability, and modulation for non-linear power profile emulation.



C Version Front Panel

The C Version front panel is blank, providing on a switch to enable control power. All control must be performed by the provided isolated 37-pin analog/digital I/O or through a computer interface.



- **A** Engages and disengages main power
- **B** Meters display output voltage, output current, voltage set point, current set point, over voltage trip, and over current trip
- **C** Over voltage trip and over current trip setting potentiometers
- **D** MODE
  POWER: Indicates power output
  STANDBY: Indicates control power only
- **E** CONFIGURATION
  REM SEN: Remote sense enabled
  INT CTL: Front panel start/stop/clear enabled
  EXT CTL: External start/stop/clear enabled
  ROTARY: Front panel control
  EXT PGM: External voltage/current control
  REMOTE: Computer control
- **F** DIAGNOSTIC ALARMS
  LOCK: Interlock
  PGM LN: External input voltage beyond limits
  OVT: Over-voltage protection has tripped
  OCT: Over-current protection has tripped
  THERM: Indicates over-temperature condition
  PHASE: Indicates under-voltage AC input
- **G** Power switch energized control circuits without engaging main power
- **H** Stepless rotary knob to set voltage/current
- **J** FUNCTION KEYS
  MENU: Selects function
  ITEM: Selects item within function
  V/I DIS: Displays voltage/current settings
  TRIP DIS: Displays OVT and OCT settings
  CLEAR: Clears setting or resets fault
  ENTER: Selects item
  MEM: Sets the memory location
- **K** Memory location indicator, used for auto-sequencing applications
- **L** Digital input keypad

Low Voltage High Current Units

Magna-Power Electronics offers a range of standard low voltage high current units based on TS Series IV and MS Series IV that do not fit in these series' standard power envelopes. All of the product options are available for these models.

Model	Voltage Maximum (Vdc)	Current Maximum (Adc)	Power (kW)	Ripple (mVrms)	Efficiency (%)	Size	Input Current (Aac)		
							208/240 Vac	380/415 Vac	440/480 Vac
TS5-1800	5	1800	9.0	50	86	6U	38	22	18
TS8-1200	8	1200	9.6	40	86	6U	38	22	18
TS10-1000	10	1000	10.0	40	86	6U	38	22	18
TS5-2700	5	2700	13.5	50	86	9U	57	33	27
TSA10-1800	10	1800	18.0	40	86	6U	72	42	36
TSA10-2700	10	2700	27.0	40	86	9U	108	63	48
MS5-2700	5	2700	13.5	50	86	18U Cabinet	57	30	27
MS5-3600	5	3600	18.0	50	86	18U Cabinet	76	40	36
MS5-4500	5	4500	22.5	50	86	30U Cabinet	95	50	45
MS10-2700	10	2700	27.0	40	86	18U Cabinet	108	62	54
MS10-3600	10	3600	36.0	40	86	18U Cabinet	144	84	72
MS10-4500	10	4500	45.0	40	86	30U Cabinet	180	106	90

Product Options

Performance and Packaging Options

Magna-Power Electronics programmable DC power supplies are designed to be as versatile and expandable as possible. A variety of options are available allowing the product to deviate from its standard specifications. This section provides an overview of the available performance and packaging options and products supported.

Cabinet and Integration

Option Code:	**+CAB1, +CAB2, +CAB3**
Products Supported:	**XR Series, TS Series**

Cabinet and integration services are offered for the rack-mount programmable DC power supply products. Cabinets are supplied with fans rated to installed products. Key features of the cabinet and integration option are as follows:

- Reliable Premier Metal (+CAB1, +CAB2) and Hoffman® (+CAB3) cabinets
- Casters installed, including (2) locking casters
- Special circuitry for product integration with cabinet fans
- Installation and testing as a complete system

Cabinet and Integration Specifications

Cabinet Option	Dimensions (H" x W" x D")	Rack Units
Cabinet 1 (+CAB1)	38.75" x 22" x 31"	18U
Cabinet 2 (+CAB2)	49.25" x 22" x 31"	24U
Cabinet 3 (+CAB3)	67" x 24" x 31.5"	30U

High Isolation Output

Option Code:	**+ISO**
Products Supported:	**TS Series, MS Series, MT Series**

Certain applications require floating the output voltage to values beyond the power supply's standard isolation rating. Magna-Power Electronics High Isolation Output option (+ISO) enables any TS Series, MS Series, or MT Series model with a peak output voltage rating of 250 Vdc through 1000 Vdc to be rated for a higher voltage output isolation. Improved isolation is achieved by a novel output stage with improved controller isolation. In addition to being able to float the power supply to a higher output voltage, this option also enables lower voltage units to connected series up to the higher isolation rating.

The table below provides the output isolation rating for all available configurations, where Vo is the unit's rated maximum output voltage.

Output Isolation Specifications

Product	Isolation, models 1000 Vdc and below	Isolation, models 1000 Vdc and below with +ISO option	Isolation, model above 1000 Vdc
XR Series	1000 Vdc	N/A	N/A
TS Series	1000 Vdc	± (2000 Vdc + Vo/2)	± (2000 Vdc + Vo/2)
MS Series	1000 Vdc	± (2000 Vdc + Vo/2)	± (2000 Vdc + Vo/2)
MT Series	1000 Vdc	4000 Vdc	4000 Vdc

High Slew Rate Output

Option Code:	**+HS**
Products Supported:	**XR Series, TS Series, MS Series, MT Series**

The high slew rate option solves several limitations inherent in switching power supply design. Rapid voltage transitions require internal electronics to supply the energy to charge and discharge output capacitors. Peak currents internal to the power supply define slew rate; utilizing less capacitance enables voltage transitions in shorter time periods. Additionally, less capacitance reduces requirements for discharge demands during open circuit conditions.

The standard output stage Magna-Power Electronics power supplies has been designed to provide the lowest possible output ripple voltage within the constraints of available components, size, and cost. Part of the output stage consists of a bank of aluminum electrolytic capacitors which has the desired electrical properties to provide this function. These components require bleed resistors to discharge any voltage when the power supply has no load and is disabled. While the presence of these components and the resulting performance are normally industry accepted, there are applications where lower output capacitance is extremely desirable and higher ripple voltage is acceptable. To meet this need, a high-slew rate option is available which has an output stage consisting of low capacitance film and aluminum electrolytic capacitors. Applications for the high-slew rate option include battery charging, photovoltaic emulation, power waveform generation, and medium speed power pulsing. These applications all benefit from higher bandwidth and in many cases, can tolerate the increased ripple voltage of this option.

Slew Rate Specifications

	Slew rate standard	Slew rate with +HS option
Voltage	100 ms	4 ms
Current	100 ms	8 ms

UID47: Universal Interface Device

Option Code:	**+UID**
Products Supported:	**XR Series, TS Series, MS Series, MT Series**

Magna-Power Electronics UID47 is a general purpose device for connection to Magna-Power Electronics' power supplies. The device contains the necessary circuitry for configuring power supplies for master/slave parallel or series operation.

Master/slave parallel operation allows two or more power supplies to equally share output current when connected together. Master/slave series operation allows two or more power supplies to equally share output voltage when connected together. In either operation mode, the master unit will command the slave units to the proper voltage and current. Each unit will display its own individual voltage and current. Installation requires setting jumpers, placing included 37-conductor cables between the UID47 and power supplies, and wiring the power supply outputs in either parallel or series.

The UID47 can be used as an interface for connecting control and monitoring lines to external circuitry. It also contains an area on the printed circuit board for interconnecting wires and placing components for specific user applications.

Key features of the UID47 option are as follows:

- Compatible with all Magna-Power Electronics power supplies
- Interface for series and parallel master/slave operation
- User configurable screw terminal connector
- Pad area for custom circuitry
- (2) 6-foot 37-pin cables included

Water Cooling

Option Code:	**+WC**
Products Supported:	**TS Series, MS Series**

Water cooling is available for Magna-Power Electronics TS Series and MS Series power supplies typically for use in corrosive environments, such as electroplating applications or in densely packaged system cabinets, where heat removal by air cooling presents a problem.

Water cooling is accomplished with chill plates and an integrated central heat exchanger. The chill plates provides a thermal conduction path for heat sensitive components and the central heat exchanger removes heat from air internal to the enclosure. Water cooled TS Series models have enclosures without vent holes and are basically sealed the unit from the environment. An internal solenoid valve enables water flow when the chill plate reaches 60 degrees celcius. Operation of the solenoid prevents internal condensation.

Water Cooling Specifications			
	5 kW - 15 kW Models	**20 kW to 30 kW Models**	**45 kW to 75 kW Models**
Inlet Coolant Temperature	25°C	25°C max	25°C max
Flow Rate (Min)	1.5 GPM	3.0 GPM	4.5 GPM
Pressure (Max)	80 psi	80 psi	80 psi
Inlet/Outlet Pipe Size	1/4" NPT male	1/2" NPT male	1/2" NPT male

Each 15 kW module has a 1/4" NPT female inlet and outlet for water flow. For models greater than 15 kW, external plumbing interconnects power supply modules. A minimum of 2.50" is recommended behind the enclosure for this hardware and user connections. For systems requiring more than one power supply, plumbing connections must be paralleled; that is, water should not flow from one power supply into another.

Product Options

Communication Interface Options

All Magna-Power Electronics programmable DC power supplies come standard with RS232 serial interface and 37-pin isolated analog/digital I/O. Additional available interface options are available, as detailed in this section.

IEEE 488 GPIB

Option Code:	+GPIB
Products Supported:	XR Series, TS Series, MS Series, MT Series

The IEEE 488 interface, sometimes called the General Purpose Interface Bus (GPIB), is a general purpose digital interface system that can be used to transfer data between two or more devices. It is particularly well-uited for interconnecting computers and instruments. Some of its key features are:

- Up to 15 devices may be connected to one bus
- Total bus length may be up to 20 m and the distance between devices may be up to 2 m
- Communication is digital (as opposed to analog) and messages are sent one byte (8 bits) at a time
- Message transactions are hardware handshaked
- Data rates may be up to 1 Mbyte/sec

USB Edgeport

Option Code:	+USB
Products Supported:	XR Series, TS Series, MS Series, MT Series

Edgeport USB-to-serial converters offer instant I/O expansion for peripheral device connectivity. An out-of-the-box (external) alternative to PCI cards, Edgeport makes it easy to add serial port to a PC, server or thin client in minutes without opening the chassis, reconfiguring or rebooting the system.

The USB Edgeport device plugs directly into the back of the power supply, creating a seamless USB interface. Feature-rich design, reliability and unmatched operating system support make Edgeport USB-to-serial converters ideal for mission-critical enterprise applications. USB cable included along with associated drivers on the Magna-Power Electronics software CD.

LXI TCP/IP Ethernet

Option Code:	+LXI
Products Supported:	XR Series, TS Series, MS Series, MT Series

Certified to the LXI Standard (Class C), the TCP/IP Ethernet option includes an embedded web-server, allowing web browser power supply control and monitoring from virtually anywhere. LXI is an instrumentation platform based on industry standard Ethernet technology designed to provide modularity, flexibility, and performance to small- and medium-sized systems.

LXI's advantages are exemplified in its compact, flexible package providing high-speed I/O and reliable measurements. The Magna-Power Electronics LXI TCP/IP Ethernet option includes an embedded web-server, allowing web browser power supply control and monitoring from virtually anywhere.

RS-485DSS

Option Code:	+RS485
Products Supported:	XR Series, TS Series, MS Series, MT Series

The 485DSS allows non-addressable, "dumb" RS-232 devices to be connected on an addressable RS-485 network. The master node controls all communications to connected devices. By distributing the switching intelligence along the RS-485 network, wiring cost savings are substantial compared to a single switched "star" configuration.

Devices can either be polled by the master node or request access to the bus through a RS-232 handshake line. This provides a versatile system for interconnecting devices that are designed for point to point communications. Because the units communicate using standard RS-485 signals, RS-232 devices can form their own network or be added to an existing system. Up to 32 nodes at up to 4000 feet can be on one bus without a repeater, and the 485DSS's addressing scheme allows up to 256 units on a single network with repeaters.

Harmonic Neutralizer

Magna-Power Electronics Harmonic Neutralizers eliminate families of harmonic components by multiplying the number of input phases with specially wound magnetic components. These transformers, in combination with equally loaded, high-power DC power supplies, offer a cost-effective solution to maintaining power quality at acceptable levels. Harmonic Neutralizers are packaged in cabinetry designed to be integrated with multiple MT Series VI installations.

Why Neutralize Harmonics?

Input current harmonics are a by-product of nearly all power supplies. Power can only be delivered to the load if the frequency and phase of the voltage and current match. For a three phase power supply using a three phase input rectifier, the input current has a theoretical spectrum of 6n±1 where n is an integer incrementing from 1; this is known as a 6-pulse waveform. This means that a power supply with a three phase input rectifier will produce input currents at 1, 5, 7, 11, 13, 17, 19 ... times the fundamental frequency. The theoretical magnitude decays as the reciprocal of the harmonic component. The 5th and 7th harmonic components have magnitudes of 20% and 14% of the fundamental component, respectively.

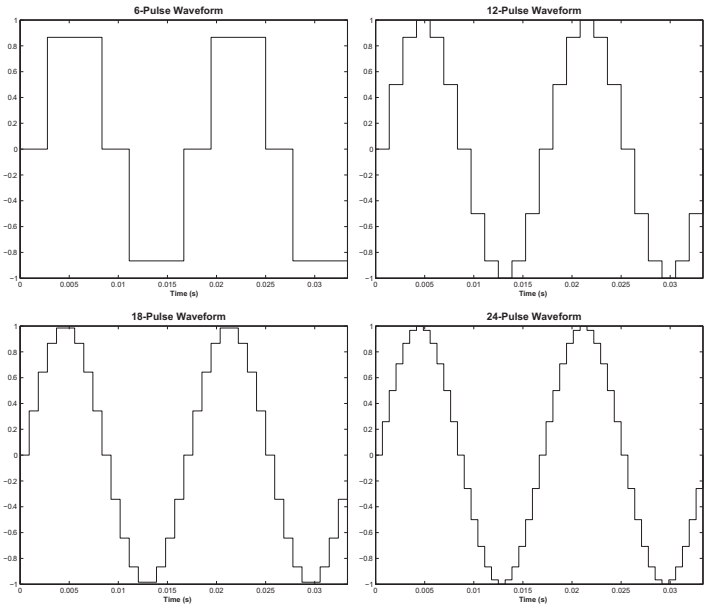
Harmonics currents in power systems can find unusual paths and can cause problems if the magnitude is significant and there are loads sensitive to harmonic frequencies. For example, lighting ballasts have series connected capacitors and inductors which can be excited by harmonic currents. IEEE has introduced standard, IEEE 519, which defines recommended limits. Implementing this standard requires a knowledge of the power system and other loads producing harmonics. Unfortunately, the standard can allow the same power supply to possibly exceed limits in one application and not in another. In the same respect, a power supply may or may not can cause a harmonic related problem with or without meeting IEEE 519. The best solution to minimize the risk of a harmonic problem is to eliminate the harmonic current at the source.

Models and Ratings

Model	Power Modules	Power (kW)	Pulse No.	Weight (lbs)	Size (H"x W"x D")
HN200-12	2 x 100 kW	200	12	935	62.5 x 24 x 31.5
HN300-12	2 x 150 kW	300	12	1602	62.5 x 24 x 31.5
HN400-12	4 x 100 kW	400	12	1670	62.5 x 24 x 31.5
HN450-18	3 x 150 kW	450	18	1982	62.5 x 24 x 31.5
HN500-24	2 x 250 kW	500	24	3003	62.5 x 24 x 31.5
HN600-12	4 x 150 kW	600	12	3003	62.5 x 24 x 31.5
HN1000-48	4 x 250 kW	1000	48	9012	62.5 x 72 x 31.5

AC Harmonic Waveforms

The following figures are representative of expected AC current waveforms for the various pulses available from Magna-Power Electronics power supplies. As standard, models 2 kW through 150 kW produce 6-pulse waveforms, while 250 kW models produce 12-pulse waveforms. Magna-Power Electronics Harmonic Neutralizers suppress families of harmonics by increasing the number of power phases. It can be used when multiple power supplies are used in series or parallel and are equally loaded. Harmonic Neutralizers can produce 12-pulse, 18-pulse, 24-pulse, or 48-pulse waveforms which have harmonic current components on the order of 12n±1, 18n±1, 24n±1, or 48n±1, respectively. The following figures show the theoretical difference for waveforms with a different number of pulses. Harmonic Neutralizers are protected with appropriate sized primary-side circuit breakers.



Size Diagrams