

## MDX 500 FEATURES



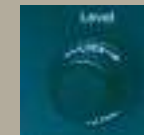
### Status LEDs

Indicate present system status.



### Digital Meter

Display, setpoint or output power, voltage, or current.



### Level

Adjusts the output setpoint.



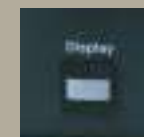
### Output Stop & Start

Turn output on and off.



### Regulation Switches

Select the power regulation mode.



### Display

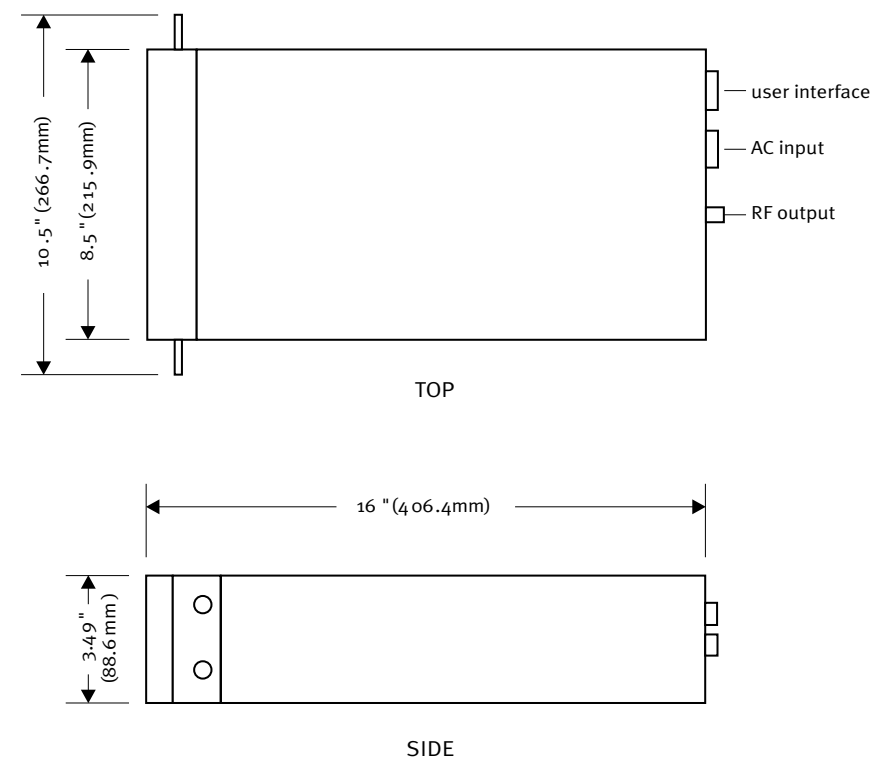
Selects displayed parameter.



## SPECIFICATIONS

PHYSICAL	
<b>Size</b>	Single: 88.63 mm (H) x 215.9 mm (W) x 406.4 mm (D) 3.5" (H) x 8.5"(W) x 16"(D) Dual: 88.63 mm (H) x 482.6 mm (W) x 406.4 mm (D) 3.5" (H) x 19"(W) x 16"(D)
<b>Weight</b>	Single: 5.57 kg (12.25 lb) Dual: 11.14 kg (25 lb)
<b>Power Output Cable</b>	RG-8U coaxial cable Discrete cables, optional
<b>Power Output Connector</b>	UHF style "N" type, optional SHV style, optional

## DIMENSIONS



DISCOVER THE POWER OF **AE** ADVANCED ENERGY®

© Advanced Energy Industries, Inc. 2000.  
 All rights reserved. Printed in USA.  
 SL-MDX5-230-01 2.5M 04/00

**California**  
 T: 408.263.8784  
 F: 408.263.8992

**New Jersey**  
 T: 856.627.6100  
 F: 856.627.6159

**United Kingdom**  
 T: 44.1869.320022  
 F: 44.1869.325004

**Germany**  
 T: 49.711.77927-0  
 F: 49.711.7778700

**Korea**  
 T: 82.3427052100  
 F: 82.3427052766

**Japan**  
 T: 81.3.32351511  
 F: 81.3.32353580

**Taiwan**  
 T: 886.2.82215599  
 F: 886.2.82215050

**Advanced Energy Industries, Inc.**  
 1625 Sharp Point Drive  
 Fort Collins, Colorado 80525  
 800.446.9167  
 970.221.4670  
 970.221.5583 (fax)  
[support@aei.com](mailto:support@aei.com)  
[www.advanced-energy.com](http://www.advanced-energy.com)

**MDX DC**  
500 W



**MDX LOW-POWER 500 W**  
 used for continuous hard use  
 in small-scale vacuum  
 environments.



**MDX LOW-POWER 500 W**

The MDX 500 is intended for continuous hard use in a vacuum environment. It is a leading performer in basic magnetron sputtering, dc sputtering with RF bias, and dc-biased RF sputtering. Its small size makes it well suited for laboratory systems and small-scale production environments.

**MDX drives use a high-frequency conversion technique to provide tight regulation, high conversion efficiency, and low stored energy at the output.**

The MDX 500 provides exceptional accuracy and repeatability in a conveniently small and affordable package.

**FEATURES**

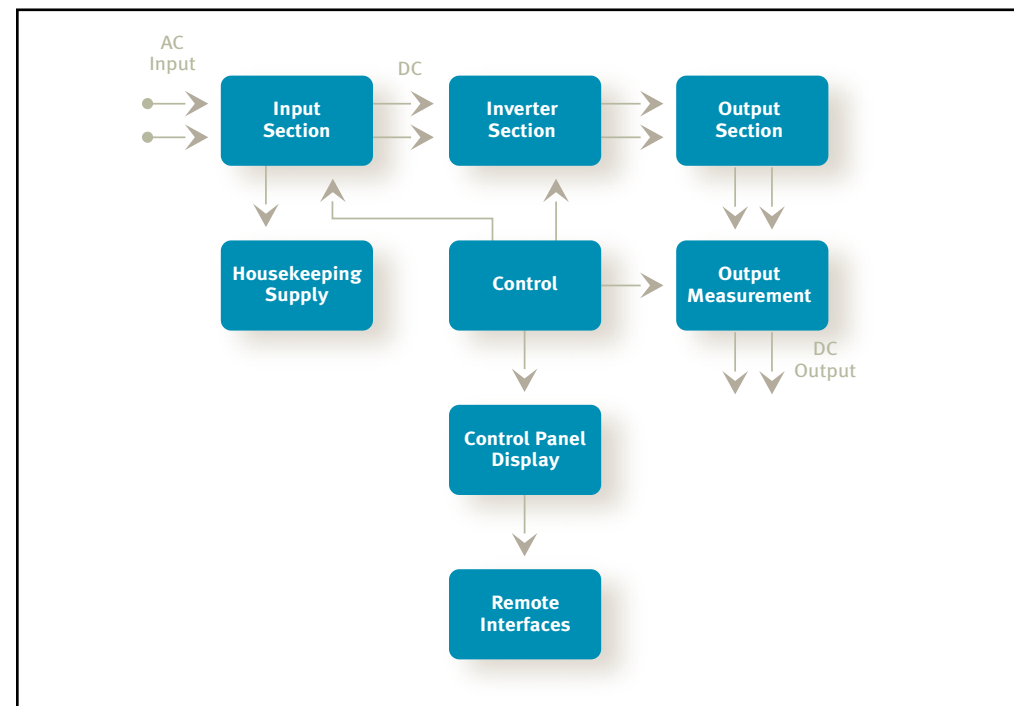
Advanced Energy® switchmode conversion modules achieve high efficiency from line to load. The high-frequency method ensures a rapid response to plasma load changes. The design reduces stored energy at the output by several orders of magnitude. The fast response time virtually eliminates line-induced surges and noise spikes.

Arc-Out™ suppression circuitry provides multi-level suppression and quenching of different types of arcs in the magnetron environment. An added advantage is that Arc-Out reduces target burn-in time and material loss. This feature also prevents dumping of energy into hot spots by sensing a change in current and immediately shutting the power off. Start-up is controlled so that hot spots cool before power is turned back on, preventing renewed arcing.

The MDX 500 can be used as a power, current, or voltage source, depending on the method of output regulation selected. The setpoint level is set with a locking potentiometer to ensure repeatability from run to run. The MDX 500 can be controlled either from the front panel or from the optional analog/digital User port.

By configuring three ramp switches on the rear panel, you can select fast ramp or some combination of 0.1, 1, or 10 seconds (the ramp times are additive).

The contactor hold function causes the contactor to remain closed after the first ramp start. Contactor hold shortens the time needed for the output to reach setpoint on subsequent runs.



**Several MDX 500 models meet strict CE standards for safety, immunity, and emissions.**

**User I/O Access**

Many of the functions that are available from the control panel are also available through the user interface: turning output on and off; specifying the method of output regulation; completing the system interlock string; specifying the output setpoint; and monitoring output parameters and status.

**Built-in Protection**

The MDX 500 has complete internal protection for all overload conditions. Three separate pins on the User port and a front panel indicator are provided for safety-related inputs such as vacuum, water, and auxiliary (user specified) interlocks.

**Compliance Certifications**

Several CE-compliant MDX 500 models are available. These models meet the requirements of EN50081-2 (emissions), EN50082-2 (immunity), and EN50178 (safety). They also meet the requirements of the German safety standard, DIN VDE0160.

**Reliability and Serviceability**

Advanced Energy Industries, Inc., has used great care in selecting components and designing the MDX family of power supplies, making them among the most reliable and quality-oriented systems available. All parts and labor carry our standard one-year warranty. When a unit does require service, its small size makes removal and handling easy. These features, combined with responsive factory support, give you superior productivity over the long life of the unit.

**FUNCTIONAL SPECIFICATIONS**

**Meters**

The MDX 500 has a digital meter that displays the actual output in Watts, Volts, or Amps, or the Setpoint level in the selected mode of regulation.

**Controls**

Output Stop & Start switches turn output on and off; Regulation selects the method of output regulation; the Level knob adjusts the output setpoint; Display cycles through the display parameters.

**Status Indications**

Arc occurred; Setpoint has been reached; Output is on; Interlock conditions have been satisfied; Plasma is present; either on/off control or setpoint control or both are under Remote control.

**Remote Operation (Analog/Digital)**

The 25-pin analog/digital I/O port provides lines for controlling output on/off, regulation mode, setpoint, and three interlocks. It is also possible to monitor the setpoint and actual output levels, and to determine whether output is on and if the unit is at setpoint. The analog signals can be either 0 to 5 V or 0 to 10 V.

**SPECIFICATIONS**

ELECTRICAL	
<b>Input Voltage</b>	90 to 132 Vac (50 to 60 Hz), 1 phase 180 to 265 Vac (50 to 60 Hz), 1 phase
<b>Input Current</b>	10 A at 120 Vac at 500 W 6.3 A at 230 Vac at 500 W Power factor = 0.55
<b>Output Power</b>	0 to 600 V at 0 to 1 A, 500 W (maximum of 500 W) 0 to 1200 V at 0 to 0.5 A, 2000 W (maximum of 500 W)
<b>Output Voltage/Current</b>	0 to 500 W
<b>Regulation</b>	Power, current, and voltage
<b>Ripple</b>	Switching: 2% p-p (100 kHz) Line: 1% p-p (100/120 Hz)
<b>Ramp Timer</b>	0.1, 1.0, or 10 second, selectable at the rear panel
<b>Output Display Accuracy</b>	Within 2% of actual output level or 0.2% of maximum rated output level, whichever is greater
<b>Methods of Control</b>	Local or analog/digital remote Factory set to 0 to 10 V 0 to 5 V, optional

ENVIRONMENTAL	
<b>Ambient Operating Temperature</b>	Storage: minimum -25°C (-13°F), maximum 55°C (131° F) Operating: minimum 0°C (32°F), maximum 40°C (104° F) Transportation: minimum -25°C (-13°F), maximum 55°C (131° F)
<b>Coolant Temperature</b>	Air (gas) minimum 0°C (32°F), maximum 35°C (95°F)
<b>Humidity</b>	15 to 85% relative humidity, no condensing or icing
<b>Atmospheric Pressure</b>	Storage and operation: 800 mbar minimum Transportation: 600 mbar minimum



## MDX DC 1 kW & 1.5 kW Series

- Tight regulation
- Superior arc control
- Low stored output energy



## Benefits

- Tight regulation
- Improved yield
- Reduced target burn-in time
- High reliability
- Easy maintenance and replacement

## Features

- Low stored output energy
- Low ripple
- Adjustable arc suppression time
- High efficiency
- Compact design
- Voltage, current, and power regulation modes
- Front panel and analog interface control
- Full range of protection features

*Tight regulation, superior arc quenching, and low stored output energy make MDX Series DC power supplies an industry leader. Intended for continuous hard use in a vacuum environment, these rugged power supplies are most commonly used as DC magnetron sputtering drives. They also offer tight regulation as bias supplies in RF sputtering and etching systems. Their compact design makes them the primary choice for laboratory systems.*

The design of the MDX 1 kW and 1.5 kW models is a scaled version of the industry standard MDX 10 kW model. This allows processes defined with any MDX unit to be scaled up or down without surprises. These magnetron drives use a high-frequency conversion technique to provide excellent regulation, high conversion efficiency, and low stored energy at the output.

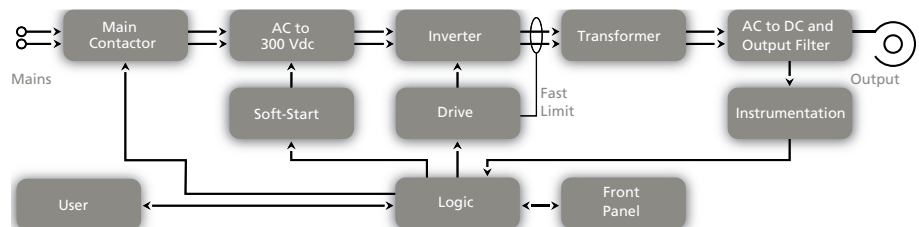
## Features

Advanced Energy® switchmode conversion modules provide over 90% efficiency from line to load. The high-frequency method used gives a 20 msec response to plasma load changes. The design reduces the stored energy at the output by several orders of magnitude. Line-induced surges and noise spikes are virtually eliminated.

The MDX series features 1 kW and 1.5 kW units. Each model comes in two configurations to suit either standard Z or low Z applications. The standard Z version has a “soft” 1500 V striking voltage; the low Z units produce an 800 V striking voltage. This is a significant aid to low-pressure ignition and plasma stabilization. The standard Z unit supplies 1 kW at 1000 V and 1 A; the low Z unit supplies 1.5 kW at 500 V and 3 A.

These features give an added advantage when developing methods for sputtering hard-to-deposit materials at high rates:

- Very low ripple
- Adjustable arc suppression time



Arc-Out™ suppression circuitry provides multi-level suppression and quenching of different types of arcs in the magnetron environment. This, in conjunction with the low stored energy at the output, has been shown to produce better yields than other supplies when depositing aluminum. Arc-Out circuitry also reduces target burn-in time and material loss.

Output power may be regulated in constant voltage, constant current, or constant power modes. You can control the MDX from either the front panel or an analog interface connector. Power can be set to ramp up in seconds or minutes.

The internal logic checks for proper circuit operation while supervising all operating parameters. Instrumentation and status readings are displayed by means of front panel digital meters and LED indicators. This enables you to monitor a variety of parameters, including power, voltage, current, ramp time, at set point, output on, interlock status, and arcing indication. Full analog interfacing enables control and data logging. The analog interface can be used for remote control, status indication, remote off, interlocking, and data logging of key parameters. It provides complete access to all operating parameters, status indication, output control functions, and set point data.

MDX magnetron drives have complete internal protection for over-voltage, over-current, and over-power conditions, as well as for short and open circuits. They feature input connections for safety interlocks such as vacuum, water, and system.

MDX magnetron drives are among the most reliable available. When a unit does require service, its small size makes removal and handling easy. Its modular construction enables replacements to be completed in minutes. These features, combined with the rapid response of our expert staff, ensure superior productivity over a long unit life.

## Functional Specifications

Dual digital meters display power, current, and voltage, as well as ramp time and set points. The left meter automatically displays the appropriate measurement for the regulation mode selected. The right meter is used with the right display switches to display actual and set point values as desired. The ramp time may be entered in seconds or minutes. The meters have 0.1% resolution and 2% reading accuracy.

MDX 1 kW and 1.5 kW models feature a master circuit breaker, an input power switch, output on/off switches, and an output regulation switch for selecting power, current, or voltage regulation. The right display switches

are used to select the value displayed on the right meter. The ramp adjust sets or modifies ramp time and the level knob adjusts the output set point. Switches that enable remote control are located on the rear panel.

LED messages indicate that an arc has occurred, the MDX unit is at set point, a ramp is in progress, plasma is present, output is on, and that water, vacuum, and aux (user specified) interlock conditions have been satisfied.

A 25-pin, sub-miniature D connector on the rear panel enables control and data logging. Analog signals are 0 to 5 V in and out. Digital signals are 0 to 15 V CMOS compatible. Three switches on the rear panel are used to select whether the ramp time is programmed in seconds or minutes, whether the MDX is under remote or local control, and whether the output is turned on from the front panel or from a remote source.



### Left and Right Meters

Display output, voltage, current, and power (left) and either actual values or set points (right).



### Ramp Adjust Knob

Sets and adjusts ramp time.



### Right Display Switches

Select the parameter or set point value to be displayed on the right meter.



### Level Knob

Sets and adjusts output level.



### Output Switches

Turn output on and off.



### Regulation Switches

Select output regulation method.

## Specifications

Electrical	MDX 1 kW	MDX 1.5 kW
Regulation	0.2%	
Ripple	5% at 50 kHz	
Ramp Timer	1 to 10 sec or 1 to 10 min	
Load Mismatch	Continuous operation into any load mismatch. Automatic limiting occurs when current, voltage, or power exceeds preset limits.	
Power Output	1000 W	1500 W
Output Voltage	1000 V, 1300 V	500 V, 750 V
Ignition Voltage	1500 V	800 V, 1200 V
Input Power	115 VAC, 50/60 Hz $\pm$ 10%, 16 A max 208/220 VAC, 50/60 Hz $\pm$ 10%, 8.9 A	208/220 VAC, 50/60 Hz $\pm$ 10%, 13.4 A
Power Factor	0.6	

Physical	MDX 1 kW	MDX 1.5 kW
Dimensions	175.3 mm (H) x 266.7 mm (W) x 400 mm (D); 6.9" (H) x 10.5" (W) x 15.75" (D)	
Weight	8.6 kg (19 lb)	
Power Output Connector	UHF or terminal block (6-32 screw)	

Environmental	MDX 1 kW	MDX 1.5 kW
Ambient Operating Temperature	0 to 40°C (32 to 104°F); max value of average over 24 h: 35°C (95°F)	
Coolant Type	Air (gas)	
Coolant Temperature	0 to 35°C (32 to 95°F)	
Humidity	15 to 85% relative humidity, no condensing or icing	
Atmospheric Pressure	800 mbar min (approx. 2000 m above sea level)	

## Dimensional Drawing

