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AE ADVANCED ENERGY®

MDX Series DC Magnetron Drives, 5 kW to 80 kW of Output Power.

Typical Applications. These supplies are intended for continuous hard use in a vacuum environment. They are most commonly used as dc magnetron sputtering drives where tight regulation, superior arc quenching, and low stored output energy make them the industry leader. They are also used as high-power bias supplies in hard-coat systems and RF sputter and etch systems.

Theory of Design. The MDX magnetron drives use a high-frequency conversion technique to provide very good regulation, high conversion efficiency, and low stored energy at the output. Their size is 1/10 that of supplies with the same power rating from other manufacturers. Microprocessor control and a modular design provide ease of use, maintenance, and repair.

Features. Advanced Energy® switchmode conversion modules achieve over 90% efficiency from line to load. The high-frequency method ensures a 5- μ s 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.

Each MDX unit is provided with a three-tap impedance-matching transformer for user convenience. The units are available in high, standard, and low Z transformer configurations. Load impedances requiring voltages of from 400 V to 1250 V can be accommodated with proper unit and tap selection. Strike voltage is 1800 V in all ranges. Full rated power is supplied throughout a tap range.

These magnetron drives have ARC-OUT™ arc-suppression circuitry. This circuitry provides multilevel 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 drop in impedance and immediately shutting the power off. Start-up is controlled so that hot spots cool before power is turned back on, preventing renewed arcing.

Output power may be regulated in constant voltage, constant current, or constant power modes. Control can be initiated from the front panel, an analog interface connector, or an RS-232 port. Setpoint levels are maintained in nonvolatile

memory for use in recovering from run interruptions and for ensuring repeatability from run to run.

Optional Feature. ARC-CHECK™ is a state-of-the-art companion to ARC-OUT arc-suppression circuitry. This feature eliminates continuous low-impedance conditions. An automatic, controlled burst of high energy melts flakes in milliseconds and restores load impedance. Software-controlled timing eliminates prolonged overpowering and protects valuable system components.

Microprocessor Advantages. The internal microprocessor checks for proper circuit operation while supervising all operating parameters. System diagnostics run when the unit is turned on and messages are displayed as errors occur. In addition, a nonvolatile memory retains the most recent power supply settings and conditions, accumulated target life, and running time of the drive.

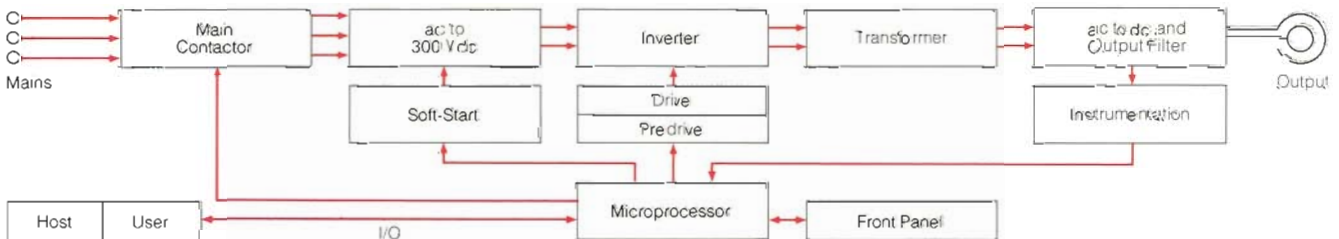
Instrumentation and status readings are taken and interpreted by the computer, then displayed on digital front panel displays and LED indicators. Power, voltage, current, ramp time, run time, target selection, target life, interlock status, and many others are shown.

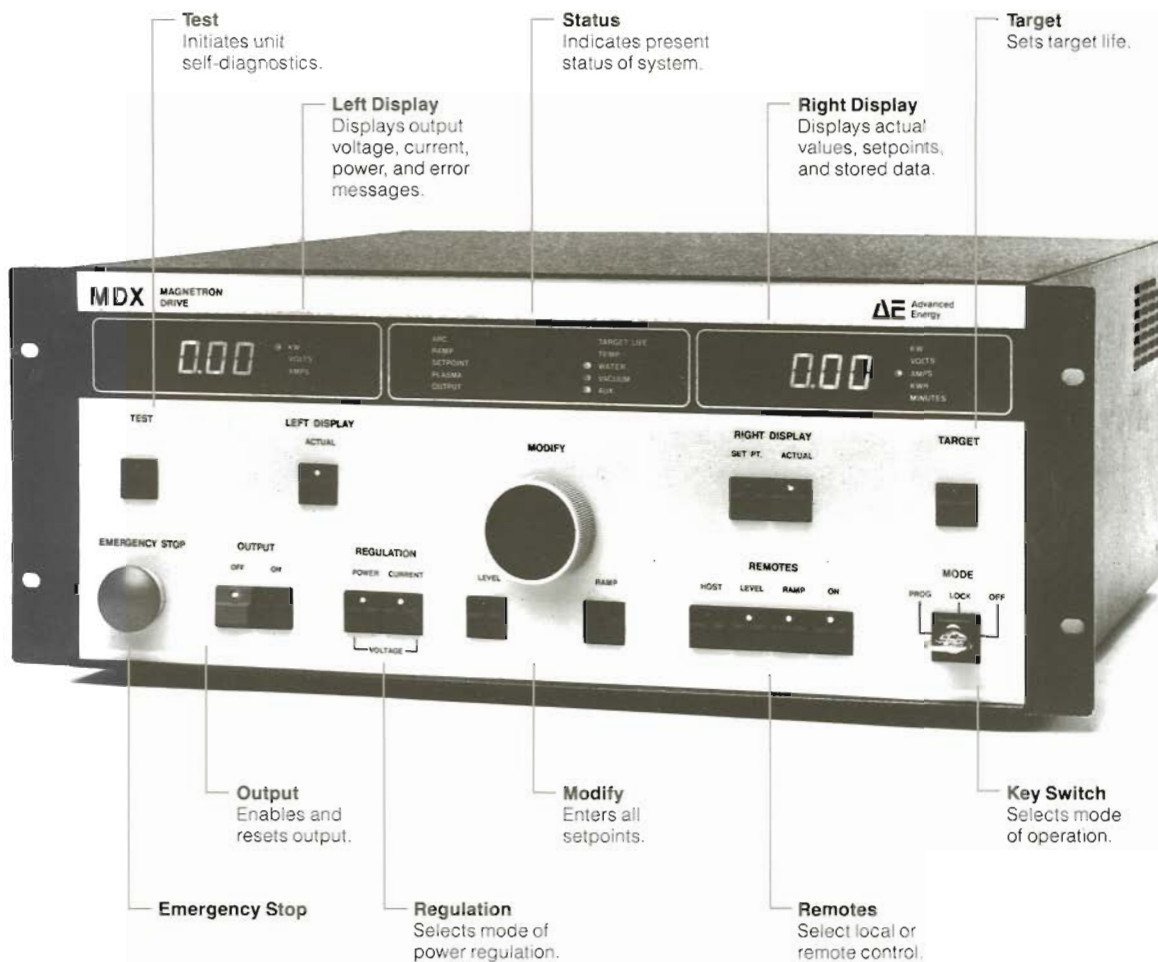
User I/O Access. Full analog and RS-232 interfacing is provided for control and data-logging purposes. The analog interface can be used for remote control, status indication, remote emergency off, interlocking, and data logging of key parameters. The RS-232 port provides complete access to all operating parameters, control functions, and data stored in memory.

Built-in Protection. The MDX series has complete internal protection for overvoltage, current limit, and power limit, as well as short and open output protection. A key switch limits access to parameter changing. User connections are included for safety such as vacuum, water, and system interlock inputs.

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 1-year warranty.

When a unit does require service, its small size makes removal and handling easy. Its modular construction allows replacements to be made in minutes, using only a screwdriver. These features, combined with responsive factory support, give you superior productivity over the long life of the unit.





Functional Specifications

Monitors. Dual digital displays show power, current, and voltage, as well as target life, ramp time, setpoint, and diagnostic messages. LEDs indicate the proper units for the parameter selected. These meters have 0.1% resolution and provide a reading with an accuracy of $\pm 2\%$.

Controls. MODE key switch for selecting programming or set-up mode (PROG), restricted-operation mode (LOCK), or disabled mode (OFF); power OUTPUT ON and OUTPUT OFF switches; REGULATION mode-selection switches; MODIFY program knob and selection switches; DISPLAY selection switches; TARGET switch for modifying data; TEST switch; and REMOTES mode-selection switches.

Status Indication. ARC occurred; RAMP is complete; unit is at regulation SETPOINT; PLASMA is present; OUTPUT is enabled; TARGET LIFE has ended; TEMP. of unit is too high; and WATER, VACUUM, and AUX. interlocks are OK.

Alarm. A behind-the-panel speaker alerts the operator

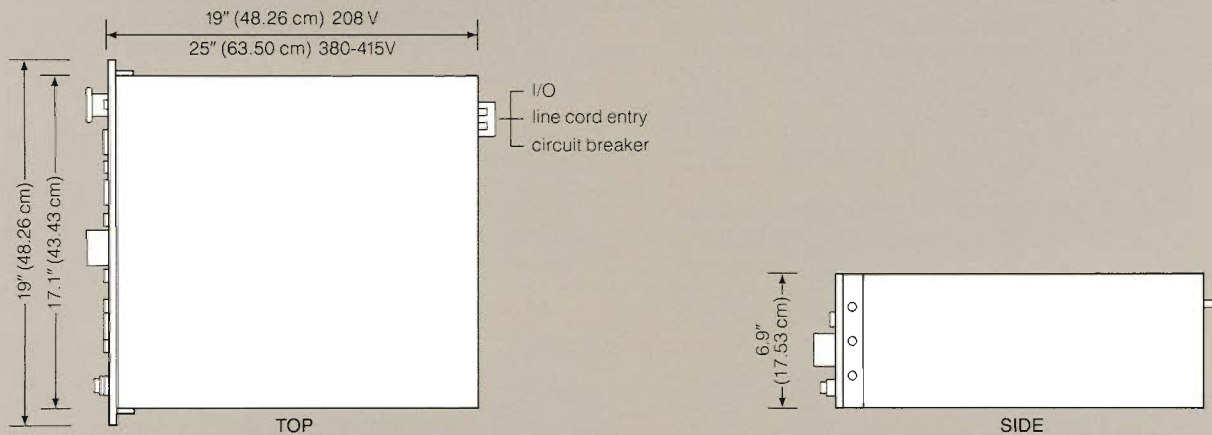
when any of the status lights flash, when an error in panel programming is made, or when a diagnostic message is presented.

Remote Operation (Analog). A user connector (37-pin "D") is provided on the rear panel for interface and control. Analog signals are 0-5 V in and out. Digital signals are 0-15 V, CMOS compatible. The following signals are passed through: OUTPUT ENABLED; AT SETPOINT; TARGET SELECT (3 BIT); AUX, WATER, and VACUUM INTERLOCK; REMOTE OFF/RESET; E-STOP RESTORE; ARC; END OF TARGET LIFE; CURRENT/POWER/VOLTAGE REGULATE SELECT; REMOTE ON; OUTPUT VOLTAGE/CURRENT/POWER; RAMP TIME/TARGET LIFE REMAINING; PROGRAM LEVEL; and RAMP/LEVEL ADJUST.

Remote Operation (RS-232). A user RS-232 (25-pin "D") connector is provided on the rear panel. The following signals are used to communicate all unit functions and parameters: DATA COMMON, TxD, RxD, and DSR.

Physical Specifications

Power Output	From 5 kW to 80 kW, in 5-kW increments.
Regulation	0.25% in all modes: power, current, voltage.
Ripple	5-kW unit is 5% rms at 50 kHz; all others are 1% rms at 100 kHz.
Voltage Taps	Low Z (400-500 V, 500-640 V, 640-800 V); Standard Z (500-600 V, 600-800 V, 800-1000 V); High Z (600-775 V, 775-1000 V, 1000-1250 V).
Ignition Voltage	1550 V.
Ramp Timer	0 to 99.0 minutes, programmable.
Run Timer	Continuous or 0 to 99.0 minutes, programmable.
Load Mismatch	Continuous operation into any load mismatch. Automatic limiting occurs when current, voltage, or power exceed factory-set limits.
Input Voltage	208 V \pm 10%, 3 phase, 50/60 Hz regardless of phase rotation. 380 V \pm 10%, 3 phase, 50/60 Hz regardless of phase rotation. 415 V \pm 10%, 3 phase, 50/60 Hz regardless of phase rotation.
Cooling	Forced air; maximum ambient temperature is 45°C, 92% relative humidity, noncondensing. Free airflow must be provided.
Power Output Connector	"UHF" type (mating connector supplied).
Weight	208 V: 5-kW chassis = 55 lb., 10-kW chassis = 71 lb.; 380-415 V: 5-kW chassis = 65 lb., 10-kW chassis = 80 lb.; 8 chassis maximum configuration.



5600004 Rev. C In the interest of providing even better equipment, Advanced Energy Industries, Inc., reserves the right to make changes in design and specifications without notice or obligation.



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