

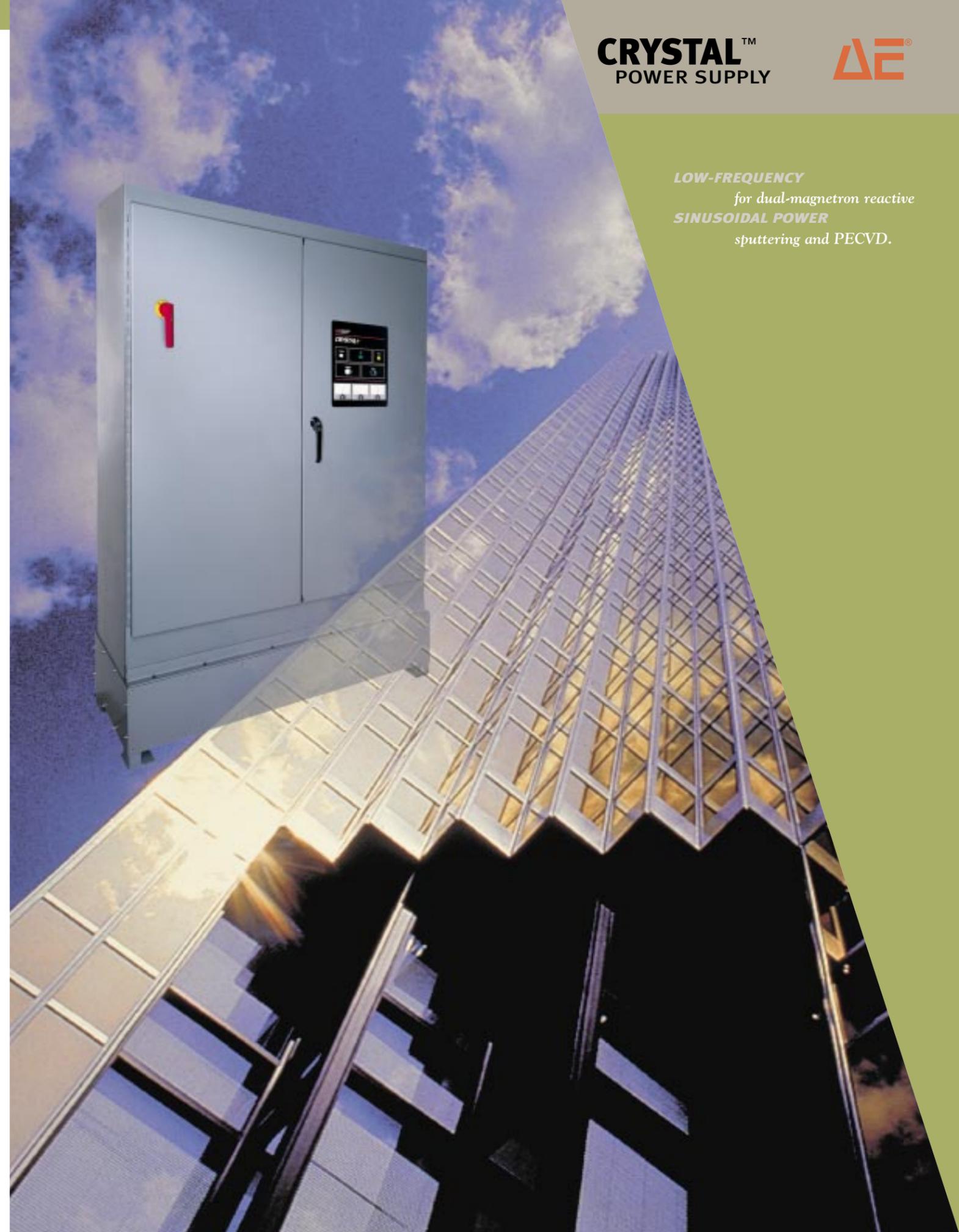


**SPECIFICATIONS**

PHYSICAL	
<b>Size</b>	213 cm (H) x 152 cm (W) x 76 cm (D); 84" (H) x 60" (W) x 30" (D)
<b>Weight</b>	1220 kg (2700 lb)
<b>Connector/Cables</b>	
<b>Input &amp; Output Connectors</b>	Compression lugs
<b>User Port Connector</b>	48-pin Wieland
<b>Host Port Connector</b>	Duplex fiber optic: RS-485, Profibus
<b>Coolant Connectors</b>	1 inch NPT female

ELECTRICAL	
<b>Input Power</b>	
<b>Voltage</b>	400/480 V <sub>rms</sub> ±10%
<b>Frequency</b>	50/60 Hz
<b>Current</b>	325 A <sub>rms</sub> @ 180 kW, 400 V <sub>rms</sub> 270 A <sub>rms</sub> @ 180 kW, 480 V <sub>rms</sub>
<b>Efficiency</b>	≥90% at full power nominal
<b>Power Factor</b>	≥0.95
<b>Output Power</b>	
<b>Frequency</b>	40 kHz to 60 kHz nominal at full power, up to 80 kHz at minimum power
<b>Maximum Current</b>	600 A <sub>rms</sub>
<b>Maximum Voltage</b>	1460 V <sub>rms</sub>
<b>Voltage Range</b>	300 V to 1460 V via internal load match transformer with user-selectable taps, each with a minimum of 2 to 1 range
<b>Maximum Power</b>	180 kW

ENVIRONMENTAL	
<b>Operating Ambient Temperature</b>	5°C to 45°C (41°F to 113°F)
<b>Water Cooling Temperature</b>	15°C to 40°C (59°F to 104°F)
<b>Water Cooling Flow Volume</b>	53 lpm (14 gpm)
<b>Humidity</b>	5% to 85% relative humidity (noncondensing)



**LOW-FREQUENCY**  
for dual-magnetron reactive  
**SINUSOIDAL POWER**  
sputtering and PECVD.



**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)

© Advanced Energy Industries, Inc. 2001  
All rights reserved. Printed in U.S.A.  
SL-CRYS-230-01 1M 05/01

<b>California</b>	<b>New Jersey</b>	<b>United Kingdom</b>	<b>Germany</b>	<b>Korea</b>	<b>Japan</b>	<b>Taiwan</b>	<b>China</b>
T: 408.263.8784	T: 856.627.6100	T: 44.1869.320022	T: 49.711.779270	T: 82.31.705.2100	T: 81.3.32351511	T: 886.2.82215599	T: 86.755.3867986
F: 408.263.8992	F: 856.627.6159	F: 44.1869.325004	F: 49.711.7778700	F: 82.31.705.2766	F: 81.3.32353580	F: 886.2.82215050	F: 86.755.3867984

**LOW-FREQUENCY SINUSOIDAL POWER**

Advanced Energy's (AE) Crystal™ power supplies are ideally suited for large area glass coating applications such as architectural, automotive, anti-reflective, and mirrors. They provide wide range, low-frequency sinusoidal process power for dual-magnetron sputtering applications and are currently available in 180 kW power levels with other power levels soon to follow (120 kW, 60 kW). AE's Crystal power supply is the only ac high power supply whose topology is designed specifically for use in a plasma environment. Incorporating knowledge gained from over two decades of plasma power experience, AE includes features in its Crystal design that enable you to obtain higher yields, fewer defects, and better film quality.

**Inherent in the Crystal supply's topology is the ability to remain stable through the majority of plasma conditions. It is optimized for stability while running process plasma at high power. For example, operating on planar silicon at a constant power level but with significant voltage and current change, the Crystal supply is able to provide stable power because its resonant circuit automatically compensates for plasma variations.**

**BENEFITS**

**Increased Throughput**

The Crystal supply increases overall throughput in three ways. First, the Crystal supply is able to recover from arc fluctuations due to the speed of the arc handling and control loops. The rapid response of the Crystal supply's arc management enables operation at higher powers without arc induced instabilities. In addition, the Crystal supply's topology is designed for stable

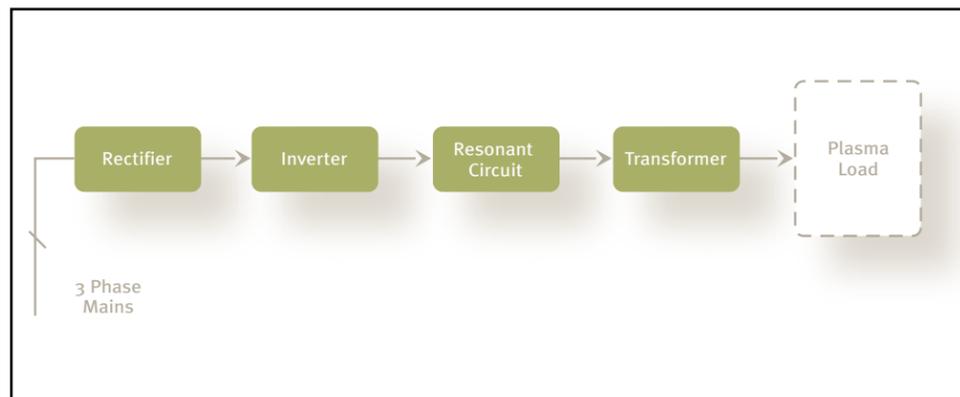
operation at high power, enabling fast compensation for plasma variations. This enables the Crystal supply to deliver full requested power to the cathodes with virtually no losses. In fact, there have been several cases where the deposition rate of the Crystal supply has been up to 50% higher than that of a competitive supply at the same requested power.

**Higher Yield**

The Crystal power supply produces higher yield through its advanced arc handling and low stored energy that reduce arc damage such as inclusions, pitting, and arc tracks. In addition, the speed of the arc response prevents banding. The Crystal power supply's superior performance also allows for quality film to be deposited from what would normally be considered a nonworking target. Finally, fast response to setpoint changes when used with an integrated control system enables high deposition rates in the transition zone.

**Reduced Process Downtime**

The Crystal supply is able to work with thicker targets requiring a higher initial voltage. This ability can extend the process run time before target change. In this scenario, the arc handling also enhances the ability to decrease process downtime because it allows successful running of previously inoperable targets. If a changeover in the process run at a position is required, the Crystal supply is a single box solution that needs no external changes to be able to run the new process.



**Crystal resonant supplies provide immediate benefits for dual-magnetron sputtering, with low arc energy and fast control loop response.**

**More Flexibility**

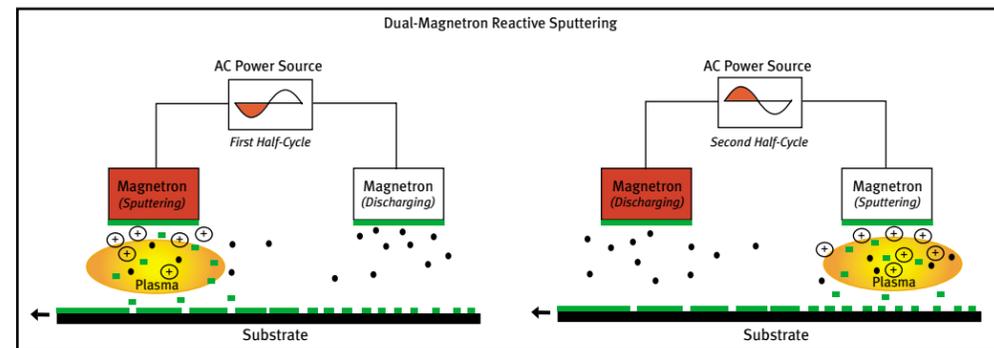
The Crystal power supply's unique adjustable parameters, when combined with the inherent stability of the topology, enable the unit to operate in high power reactive processes without the need for external components such as filters and ignition circuits. Therefore, it is a one-box solution for your system requirements.



**The Crystal supply's adjustable parameters and stable topology let you run either in the transition mode where a higher voltage is required (left) or in the fully poisoned mode where higher current is required (right).**

**FEATURES**

- High power capability at 180 kW
- Wide tap range for extended target life (maximum 600 A, 1460 V)
- High efficiency and less energy consumption results in low cost of ownership
- Low stored energy and superior arc handling minimizes arc damage



**In reactive sputtering applications, the Crystal supply allows the negative magnetron (cathode) to attract positive ions from the plasma that sputter material from the magnetron's target to the substrate. Simultaneously, the positive magnetron (anode) attracts electrons to discharge its target surface. The oscillating voltage of a dual-magnetron sputtering arrangement ensures that poisoning of both targets is controlled, and that both targets remain virtually arc-free throughout the process.**

- Regulation on power, current, or voltage delivered to the load
- Power output matched to the load through an internal load-matching transformer that provides impedance matching through mechanical changing of the transformer taps
- Dual-floating output configuration
- Control flexibility with three control options, including the power supply's own remote operator control panel, the User port interface for PLC control, and the Host port interface (RS-232/485, Profibus, etc.)
- Industrial cabinet can withstand harsh factory environments
- Water cooled, with low water requirement

**APPLICATIONS**

The Crystal platform contributes to improved efficiency and cost-effectiveness by helping to reduce arcing and to increase throughput and film quality as well as to maximize target utilization. These benefits can be obtained on all types of dual-magnetron systems such as planar and rotatable. Some of the processes where results have already been proven are Si<sub>3</sub>N<sub>4</sub>, ZnO, SiO<sub>2</sub>, SnO<sub>2</sub>, TiO<sub>2</sub>, and Al<sub>2</sub>O<sub>3</sub>.

The Crystal platform is valuable in such applications as:

- Glass coating—architectural, automotive, mirror, and anti-reflective
- Web coating—food packaging, decorative, anti-reflective, and capacitor, etc.
- Other industrial applications—automotive and industrial coatings on plastic