

CRYSTAL® AC POWER
SUPPLIES: 60, 100, 120, 150,
AND 180 KW

Mid-frequency sinusoidal power for dual-
magnetron reactive sputtering and PECVD

CRYSTAL[®] AC POWER SUPPLIES

Precise power control is essential for high-density, uniform, reactively sputtered films. The Crystal[®] power supply offers process engineers and operators a repeatable method for improving throughput and yield with quick yet stable power, fast arc detection, and low arc energy. With power granularity from 60 to 180 kW, it is certain to match the demands of your low-e coating applications.

Benefits

- Optimized process stability and yield
- Enhanced flexibility
- Increased throughput
- Reduced cost of ownership
- World-class service, support, and training

Features

- 60 kW, 100 kW, 120 kW, 150 kW, and 180 kW models
- Lowest stored energy in the industry (1 mJ per kW)
- Fastest arc detection and response in the industry (microsecond scale)
- Wide output impedance range
- Suitable for all processes (ZnO, SnO₂, TiO₂, Al₂O₃, Si₃N₄, Si, SiO₂)
- Single-box solution—no hardware or setting changes required when changing sputtering materials
- Wide tap range (2:1 voltage range at full power on single tap)
- Multiple taps with high strike (> 3000 V)
- Power, current, and voltage regulation modes
- Control and interface flexibility

Optimized Process Stability and Yield

Exceptional Stability at High Power Levels

The Crystal power supply's LCC resonant topology delivers exceptionally stable AC power, resulting in high-quality films with excellent flatness, reduced pinholes, and better packing density, even for challenging materials such as SiO₂, Si₃N₄, TiO₂, and ZnO.

Low Arc Damage

The Crystal power supply optimizes yield by minimizing arc damage in three key ways:

- **Fastest arc handling and recovery in the industry (microsecond scale)**—Sophisticated arc management technology suppresses arcs before they can cause banding and prevents target material "blow outs" that result in macro- and micro-particle inclusions.
- **Lowest stored energy in the industry (1 mJ per kW—five times lower than the competition)**—Crystal power supplies store very little energy, which reduces residual arc energy to an absolute minimum.
- **Stable power-delivery performance during heavy arcing conditions**—Crystal power supplies optimize film quality and uniformity by maintaining stability through the most challenging process conditions.

Industry-Leading Repeatability and Accuracy

Full microprocessor control and precise power measurement, plus high power-delivery stability ensure the highest accuracy and the best run-to-run repeatability of any supply on the market.

Enhanced Flexibility

Crystal power supplies offer a wide output impedance range and a stable resonant network design, enabling them to run processes from full reactive to full metallic. They suit most any target material and typically require no hardware or setting adjustments when changing materials. For control flexibility, the Crystal platform offers numerous options: a remote control panel, user port, and multiple host port interfaces.

Increased Throughput

Reduced Process Interruptions

Competing AC power supplies become overwhelmed by arcing and can't maintain stable power delivery as the target ages. This necessitates frequent process shut downs for target cleaning or replacement. However, with a robust LCC resonant topology and the fastest arc handling in the industry, Crystal power supplies maintain extremely stable power delivery, enabling far greater target utilization and thus significantly reducing process downtime for target replacement. The Crystal platform's wide output impedance range also enables the use of thicker targets, which extends productive manufacturing time between replacements even further.

Superior Process Stability

The Crystal power supply's ability to deliver remarkably stable AC power helps create the ideal process conditions for highly efficient production of consistent, defect-free films.

Faster, Simpler Setup

The Crystal platform does not require extra equipment such as matching networks or igniters. This increases production time by eliminating the need for setting or equipment adjustments while changing process materials. The Crystal power supply's ability to condition targets quickly and effectively further increases productivity.

Higher Deposition Rates

Unique capabilities, such as microsecond-speed arc handling, a wide output range, and the ability to create an extremely stable process, allow Crystal power supplies to deliver full requested power into any process material for enhanced deposition rates.

Reduced Cost of Ownership

Lower Consumable Costs

Excellent power-delivery stability produces superior film quality and uniformity. Crystal power supplies enable the use of economical, lower-grade target materials with no negative effects on film quality. The Crystal power supply also significantly increases target utilization, giving you more use out of every target you buy. These two factors dramatically reduce the amount you spend on consumables.

Lower Facility Costs

The high-efficiency Crystal design generates less heat, which enables these rugged power supplies to consume less cooling water and tolerate higher water temperatures than competing power supplies. This lowers facility costs and increases flexibility by enabling the Crystal power supply to stand up to a variety of conditions, including harsh industrial environments.

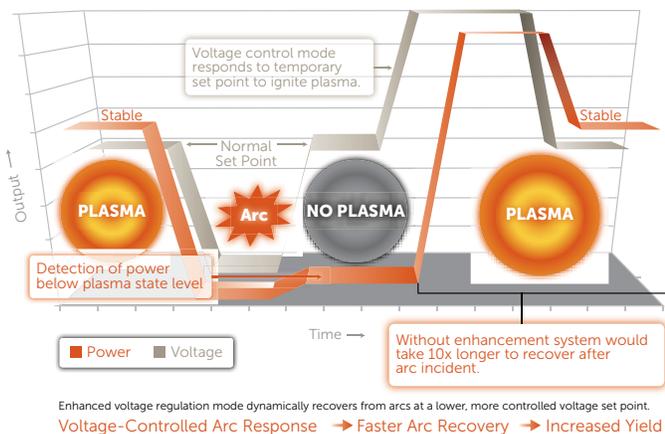
World-Class Service, Support, and Training

Advanced Energy's global service and support help you increase productivity and achieve a higher return on your capital equipment investments. Our product support, educational programs, and advanced process consulting help optimize tool uptime and yield. As your global support partner, we offer industry-leading product knowledge and applications expertise.

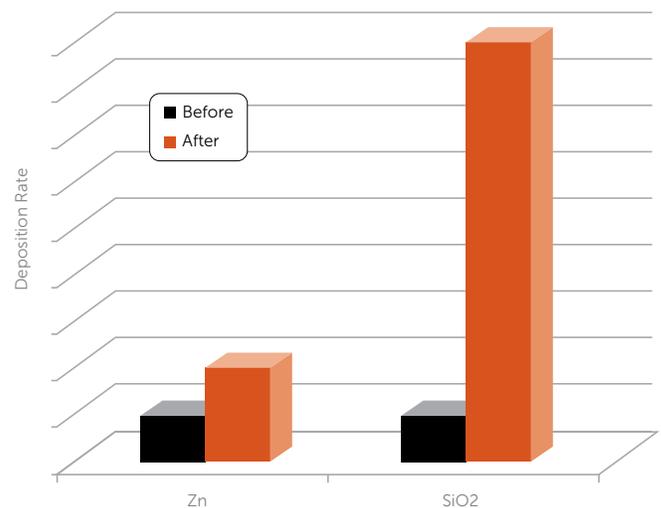
Our optional training and documentation program for process engineers, tool maintenance personnel, and process tool users includes instruction from experienced AE engineers, as well as documentation covering Crystal power supply installation, setup, troubleshooting, and on-site repair.

AE DIFFERENTIATION: VOLTAGE-CONTROL ARC RECOVERY Fast and Controlled Response in Voltage Mode

Voltage-Control Mode: Arc Response (Graphic Representation)



Productivity Gains With Embedded Voltage Control



Specifications

Physical	60 kW	100 kW	120 kW	150 kW	180 kW
Size	See drawing and table on next page.				
Weight	680.4 kg (1500 lb)	907 kg (2000 lb)		1180 kg (2601 lb)	
Mounting	Floor mounted				
Connectors					
Input Power	Ring lugs (if applicable, depending on your unit configuration), safety ground connection provided				
Output Power	Output terminals				
User Port	37-pin, sub-miniature D, male			48-pin, modular, Wieland®	
Host Port	9-pin, female, subminiature-D connector				
Coolant	Two 1" NPT, female				

Electrical	60 kW	100 kW	120 kW	150 kW	180 kW
Engine	LCC resonant inverter x 1	LCC resonant inverter x 2		LCC resonant inverter x 3	
Input Power					
Source Voltage	480 V _{RMS} ±10% (per IEC 38)	400 or 480 V _{RMS} ±10%, 3 Φ			
Source Frequency	47 to 63 Hz				
Source Current	95 A at 480 VAC input low line and 60 kW output	160 A at 480 VAC input low line and 100 kW output 190 A at 400 VAC input low line and 100 kW output	190 A at 480 VAC input low line and 120 kW output 230 A at 400 VAC input low line and 120 kW output	240 A at 480 VAC input low line and 150 kW output 290 A at 400 VAC input low line and 150 kW output	280 A at 480 VAC input low line and 180 kW output 340 A at 400 VAC input low line and 180 kW output
Efficiency at Full Power	≥ 90% typical	≥ 88% typical		≥ 90% typical	
Input Power Factor	≥ 0.95				
Output Power					
Max Power	60 kW (90 kVA)	100 kW (180 kVA)	120 kW (180 kVA)	150 kW (270 kVA)	180 kW (270 kVA)
Regulation Modes	Power, current, or voltage				
Frequency	40 to 60 kHz typical at full power, up to 100 kHz at minimum power				
Maximum Current	220 A _{RMS} —single tap	467 A _{RMS} output at lowest tap		700 A _{RMS} output at lowest tap	
Maximum Voltage	1100 V _{RMS}	1460 V _{RMS} at highest tap			
Protection	The power supply protects itself against short circuits, open circuits, arcs, and suddenly opening loads.				
Stored (Arc) Energy	1 mJ per kW				
Arc Response	µsec detect and shutdown (shutdown: 100 to 5000 µsec); programmable re-ramp				

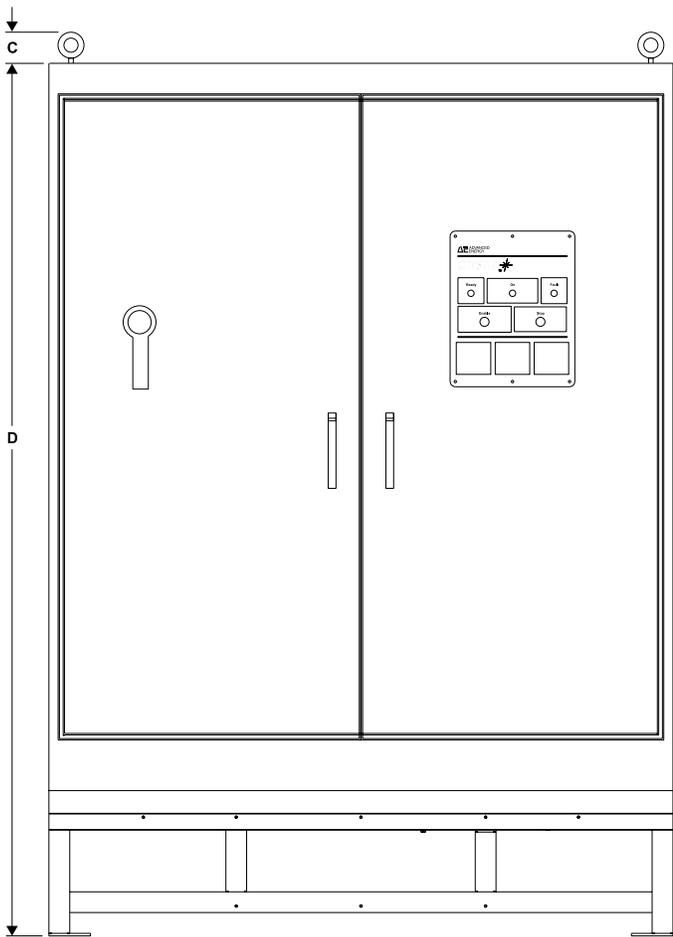
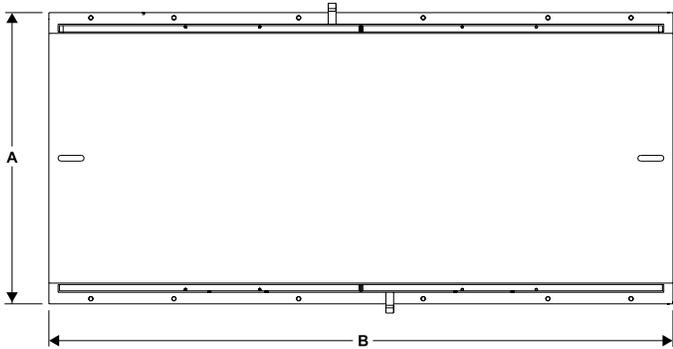
I/O Control	60 kW	100 kW	120 kW	150 kW	180 kW
Analog Interface Options	24 V ISO user card				
Serial Communications Options	ASCII, Profibus				

Cooling	60 kW	100 kW	120 kW	150 kW	180 kW
Medium	Air and Water				
Water Inlet Temperature	+10 to +40°C (+50 to +104°F)				
Min Water Flow Rate	34 lpm (9 gpm); The power supply shuts off at flow levels ≤ 34 lpm (9 gpm).	42 lpm (11 gpm); The power supply shuts off at flow levels ≤ 42 lpm (11 gpm).		53 lpm (14 gpm); The power supply shuts off at flow levels ≤ 53 (14 gpm).	

Environmental	60 kW	100 kW	120 kW	150 kW	180 kW
Operating Temperature	+5 to +40°C (+41 to +104°F)				
Relative Humidity	10 to 85%, non-condensing, +2 to +25 gpm ³				
Air Pressure	80 to 106 kPa (800 to 1060 mbar); ~2000 m (6562') above sea level				

Dimensions	60 kW	100 kW	120 kW	150 kW	180 kW
A	72.4 cm (28.5")	76.84 cm (30.25")	76.84 cm (30.25")	76.84 cm (30.25")	76.84 cm (30.25")
B	59.7 cm (23.5")	120.65 cm (47.5")	120.65 cm (47.5")	120.65 cm (47.5")	152.4 cm (60")
C	8.26 cm (3.25")				
D	201.3 cm (79.25")	201.3 cm (79.25")	201.3 cm (79.25")	201.3 cm (79.25")	213.36 (84")

Dimensional Drawing





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