



Crystal® AC Power
Supplies: 60, 120,
and 180 kW

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

Benefits

Optimized process stability and yield

Enhanced flexibility

Increased throughput

Reduced cost of ownership

World-class service, support, and training

Features

60 kW, 120 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

The Advanced Energy® (AE®) Crystal® resonant-circuit power supply is ideally suited for large-area glass coating, such as architectural, automotive, anti-reflective, and mirror applications. The Crystal platform is available in 60, 120, and 180 kW power levels, providing wide-range, mid-frequency sinusoidal process power for dual-magnetron sputtering. Designed specifically for use in a plasma environment, the Crystal power supply produces stable, low-arc energy and compensates for plasma variations—increasing throughput and film quality while maximizing target utilization.

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 superb film quality, with excellent flatness, reduced pinholes, and better packing density, even for challenging materials such as SiO₂, Si₃N₄, TiO₂, and ZnO.

Extremely 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—5 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.

Optimized for demanding plasma applications, Crystal® power supplies minimize power deviations and arc damage in reactive sputtering and PECVD, enabling superior results at the high power levels required for challenging materials such as SiO₂, Si₃N₄, TiO₂, and ZnO.

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 when you are 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, set-up, troubleshooting, and on-site repair.

Specifications

| Physical | Crystal® 60 Power Supplies | Crystal® 120 Power Supplies | Crystal® 180 Power Supplies |
|-------------------|--|-----------------------------|-----------------------------|
| 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 | Fiber-optic connector | | |
| Coolant | Two 1" NPT, female | | |

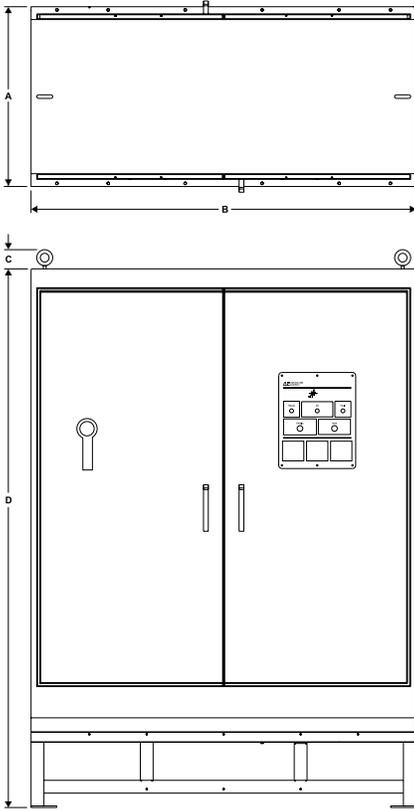
| Electrical | Crystal® 60 Power Supplies | Crystal® 120 Power Supplies | Crystal® 180 Power Supplies |
|--------------------------|---|--|--|
| Engine | LCC resonant inverter x 1 | LCC resonant inverter x 2 | LCC resonant inverter x 3 |
| Input Power | | | |
| Source Voltage | 480 V _{RMS} ±10% (per IEC 38) | 400 or 480 V _{RMS} ±10%, 3 Φ | |
| Source Frequency | 47 to 63 Hz | | |
| Source Current | 105 A at 480 VAC input and 60 kW output | 210 A at 480 VAC input and 120 kW output 240 A at 400 VAC input and 120 kW output | 270 A at 480 VAC input and 180 kW output 325 A at 400 VAC input and 180 kW output |
| Efficiency at Full Power | ≥ 90% typical | | |
| Input Power Factor | ≥ 0.95 | | |
| Output Power | | | |
| Max Power | 60 kW (90 kVA) | 120 kW (180 kVA) | 180 kW (270 kVA) |
| Regulation Modes | Power, current, or voltage | | |
| Frequency | 40 to 60 kHz nominal at full power, up to 80 kHz at minimum power | | |
| Maximum Current | 220 A _{RMS} —single tap | 466 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 | Crystal® 60 Power Supplies | Crystal® 120 Power Supplies | Crystal® 180 Power Supplies |
|-------------------------------|----------------------------|-----------------------------|-----------------------------|
| Analog Interface Options | 24 V ISO user card | | |
| Serial Communications Options | AE Bus, Profibus | | |

| Cooling | Crystal® 60 Power Supplies | Crystal® 120 Power Supplies | Crystal® 180 Power Supplies |
|-------------------------|---|---|---|
| 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 lpm (14 gpm). |

| Environmental | Crystal® 60 Power Supplies | Crystal® 120 Power Supplies | Crystal® 180 Power Supplies |
|-----------------------|---|-----------------------------|-----------------------------|
| 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 | | |

Dimensional Drawing



| Dimensions | Crystal® 60 Power Supplies | Crystal® 120 Power Supplies | Crystal® 180 Power Supplies |
|------------|----------------------------|-----------------------------|-----------------------------|
| A | 72.4 cm (28.5") | 76.84 cm (30.25") | 76.84 cm (30.25") |
| B | 59.7 cm (23.5") | 120.65 cm (47.5") | 152.4 cm (60") |
| C | 8.26 cm (3.25") | 8.26 cm (3.25") | 8.26 cm (3.25") |
| D | 201.3 cm (79.25") | 210.3 cm (79.25") | 213.36 (84") |

For more information on Crystal power supplies, visit:
www.advanced-energy.com/en/Crystal_High_Power_Systems.html

To view AE's comprehensive power systems portfolio, visit:
www.advanced-energy.com/en/Power_Systems.html

To view AE's complete product portfolio, visit:
www.advanced-energy.com/en/Products.html

Specifications are subject to change without notice.



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