

# High Precision Power Supplies and Switches for Research and Industry

From kilowatts to Megawatts

## Today's Power... Tomorrow's Physics

- Precision Cryogenic Magnet Power Supplies
  - Multichannel
  - Quench Detection
  - Quench Protection
- Precision Extraction & Injection Power Supplies
- High Voltage Modulators
- High Frequency Inverters
- Solid-State Power Conversion Products
- High Power & High Voltage SCR and Rectifier Assemblies



**Applied Power Systems**

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### *The Driving Force in Power Electronics*

Applied Power Systems specializes in advanced power conversion products and are leaders in the design and manufacture of power electronics control, high power semiconductor packaging and thermal management.

For over 15 years, APS has been providing the world's leading manufacturers and research labs with high quality, high precision, reliable power products. With power products ranging from basic SCR assemblies to complex power systems up to 4MW, all APS products are designed and built to last for years of maintenance free operation.

APS is a high-tech company focused exclusively on power electronics, providing innovative, leading-edge, quality engineered products. Our technical expertise and practical experience allow us to develop and produce power electronic products that satisfy the most demanding requirements and withstand the harshest environments.

### *Working with the Best*

APS has had the pleasure of working with some of the most respected companies and laboratories around the world, supplying them with cutting edge power solutions including:

- ABB
- Bechtel
- Brookhaven National Lab
- CERN
- Curtiss Wright
- General Atomics
- General Dynamics – Electric Boat Division
- Knolls Atomic Power Lab (KAPL)
- Lockheed Martin
- Max-Planck-Institut für Plasmaphysik
- National Oilwell Varco
- Northrup Grumman
- Oak Ridge National Lab
- Omron
- Sandia National Lab
- University of Texas – Center for Electromechanics

**Whether your needs are  
for a basic power semiconductor assembly  
or a fully programmable, high precision  
power system,  
contact APS and join  
this distinguished list.**

# High Precision Power Supplies



## MAGPS Series

Designed for years of unattended operation, this series of power supplies is field-proven as a reliable, cost effective solution for powering and controlling cryogenic magnets.

Each MAGPS power supply is designed and built for the specific characteristics of the corresponding magnet(s). APS engineers work closely with customers and physicists to attain the best practical solution.

All power supplies feature simple controls, ease of use, and modular construction for simplified troubleshooting and maintenance.

The topology and controls designed in this series of power supplies offer the highest precision and repeatability available in the industry across the full power spectrum.

## Superconducting Magnet Power Supplies

Air and liquid cooled high precision power supplies designed specifically to power, control and protect LTS and HTS cryogenic magnets. Precision to 25ppm output stability and repeatability.

The MAGPS Series are high performance, programmable DC power sources that employ modular, stackable linear output amplifier stages to provide over +/- 2000 amps DC output current. The optional internal magnet Quench Detection module (QDM) automatically activates when it senses a magnet quench and executes a controlled disconnect and crowbar of the PS output, while performing fail-safe energy extraction of magnet power into its' internal quench protection circuit.

## Features

- Precision, programmable DC Current source
- Extremely stable low noise linear output
- Internal multi tap Quench Detection Module option (QDM)
- Tapped user-settable energy extraction levels from 100KJoule to over 1MJoule
- Complete fault detection diagnostics suite
- Solid state output disconnect switch
- Automatic voltage triggered output crowbar
- Isolated remote control interface
- Flexible design allows simple integration with PLC or Lab specific controls
- Local front panel and remote controls
- Fused AC inputs
- Integrated Soft start
- Thermal interlocks on all power components
- Air or Liquid Cooled versions available
- Airflow fault / Flow fault detection / protection
- Access panel interlocks

## Recent Projects

BNL NSLSII: Air cooled, Bipolar 450A, 600VDC <50mV p-p ripple; <50 ppm class performance

IPP/PPPL: Liquid cooled Bipolar 260kW, +/- 2200A, 230V, 1% current regulation; 500 ppm class performance

BNL ELENIS: Bipolar 1100A, 220VDC, 50ppm class performance

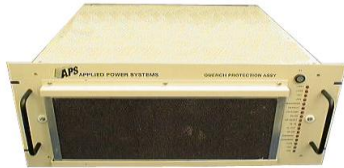
BNL OCTAL Steering: 8 Bipolar outputs; +/- 400A, 200V, 50ppm class performance

ORNL SNS HV Modulator: 50kV 4kA HV Pulse Modulator

KAPL DPM: 4MW Bipolar output; +/-2800A

BNL EBIS: Bipolar 925A, 180V, slews from 0 – 925A; settling time <= 25mS; 25ppm class performance

# Quench Detection and Protection



## QPA Series for Cryogenic Magnets

The QPA series of quench protection assemblies are designed to provide complete protection of superconducting magnets and their associated power sources in the event of a magnet quench fault.

These completely self-contained units include the magnet quench detection circuit, protection switch, energy load dump resistor and an SCR Crowbar for safe shutdown of the magnet power supply.

Upon detecting a power supply overvoltage or when customer supplied quench activation signal is received, the QPA activates a fast IGBT switch to perform a controlled energy dump into a load dump resistor.

When performing fail-safe energy extraction of the stored magnet energy into the internal multi-tap load dump resistor, the QPA simultaneously initiates a crowbar of the magnet power supply output for a safe and orderly shutdown.

## Features

- Complete Fail-safe magnet quench protection
- Solid state switch utilizing high speed IGBT
- Automatic voltage triggered crowbar of magnet power supply
- Internal load dump resistor
- Tapped user settable energy extraction levels from 30kJoule to over 1MJoule
- Complete fault detection diagnostics
- Local and remote triggers
- Local front panel indicators
- Isolated remote control interface
- Fused AC input
- DC overcurrent fault shutdown
- DC overvoltage fault shutdown
- Thermal interlocks on all power components
- Airflow fault detection

***“NOT JUST MAGNET POWER – TOTAL  
MAGNET PROTECTION”***

# Rack Mount Power Supplies and Amplifiers

## APS-HV Series

This rack mounted, precision power supply series is designed for ease of use and long life. The HV series has an isolated output for positive or negative operation.

Output voltage is adjustable from 0 – 100% and is available in regulated and unregulated versions. The HV power supplies mount in a standard 19" rack.

APS-HV18 1800VDC @ 1A  
APS-HV09 900VDC @ 2A  
APS-HV04 450VDC @ 4A



Contact Applied Power Systems to discuss Your power requirements

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## APS20-160 BiPolar Linear Amplifier

This latest addition to the APS family of power supplies is a high precision linear amplifier that converts to and turns an ordinary DC unipolar voltage source into a precise 4 Quadrant power source with zero crossover distortion.

Designed to control beam positioning magnets, this class AB linear amplifier is rated at 160A @ 25V. Its output contains less than 5mV p-p voltage ripple. Used in conjunction with an "off the shelf" unipolar voltage source, the APS20 produces a precision four quadrant output capable of sourcing +/- 160A with a compliance of +/- 25 volts into a load.

An external user supplied DCCT may be connected to the 9 pin D-Sub connector, to configure the APS20 as a precise (+/- 20ppm) 4 quadrant current source. The small signal response range for the precise outer current loop can be selected via dip switch setting to range from 1kHz to 5kHz.

Air cooled and housed in a 3U rack mount enclosure, the APS20 is easily configured for new or existing applications. As with all APS power products, all critical components are monitored and protected against failures due to overvoltage, overcurrent or over temperature. The front panel displays indicate output voltage and current, heatsink temperature, fuse failure and fault status.