

- **3-Axis 700A Precision Gradient Amplifier System**
- **1500 VDC (OEM adjustable down to 800V)**
- **100% Digital D-SERIES™ Technology**
- **Hi-Speed, Single Fiber-Optic Digital Command**
- **Universal Utility Access**

Description

The DA1500-1 Gradient Amplifier from Performance Controls, Inc. (PCI) is a three-axis pulse width modulated amplifier system. The internal DC power supply output voltage can be configured by the OEM and is protected by a redundant hardware/software interlock. The DA1500-1's exceptionally low output noise, high bandwidth and rock-solid stability make it ideally suited for demanding power amplifier tasks found in laboratory and medical applications.

PCI's new D-SERIES™ technology is the foundation for the DA1500-1's many powerful features. Coupled with PCI's new InSight™ software toolkit, D-SERIES™ technology gives systems engineers, sequence developers, and field service technicians unprecedented insight and capability for maximizing system performance, lowering overall system costs, and ensuring maximum system uptime.



Applications

- MRI magnetic field gradient control
- Particle beam magnetic steering control
- Any inductive load requiring precise control of large currents across a wide frequency range

Features and Benefits

D-SERIES™ Technology
(see separate data sheet)

100% digital amplifier architecture, enabling: Power Utilization Monitor, Advanced System Diagnostics, Integrated Digital Storage Oscilloscope, Sequence Development Assistant, and others.

Hi-Speed Fiber Digital Command

Single high-speed fiber-optic cable for all 3 axes of command and synchronization. Delivers maximum performance, economy, flexibility, and ease of system integration.

Selectable Bus Voltage

User-selectable output bus voltages for optimized voltage/current matching to load requirements.

Universal Utility Access

Water and electrical utilities (power, load) can enter at the cabinet top or back, in any combination, user-selectable. Provides maximum flexibility for accommodating diverse installation requirements.

InSight™ Software Toolkit
(see separate data sheet)

Single, easy-to-use graphical user interface for simple control of all amplifier functions.

Specifications

Parameter	Value
Internal AC/DC Power Supply	
AC line voltage, 3 phase	380-480 VAC +/-10% at 50-60 Hz
AC line phase current (max continuous, at low line)	80 A RMS
Internal AC line fuses, fast acting	125 A
AC line filter with transient voltage suppression	Yes
Input power (max continuous)	48 kVA
Input power (max at 20 kW gradient coil limited)	~48 kVA
Power factor (typical)	>0.9
Output power (max continuous)	40 kW
Output power to load (max, load and waveform dependent)	~20 kW, single or combined axes
DC Bus Voltage and Amplifier Output Current	
OEM-selectable bus voltage, with software and hardware interlocks	Yes
Current loop compensation (tuning) independent of the DC bus voltage setting	Yes. Once tuned, no adjustment is required.
Bus Voltage Setting (Volts)	Axis Output Current (A RMS) / (A Peak)*
1500	190 / 700
1400	220 / 700
1300	230 / 700
1200	240 / 700
1100	270 / 700
1000	300 / 700
900	300 / 700
800	300 / 700
* Maximum peak current pulse duration is 20 msec and is application and environmental conditions dependent. Contact PCI for additional information.	
Load Specifications	
Inductance range	100 μ H to 1 mH (contact PCI for extended range)
Resistance range	0.04 Ω to 1.0 Ω (contact PCI for extended range)
Maximum capacitance, output to ground	0.2 μ F
Maximum capacitance, output to output	0.2 μ F
Advanced Digital Amplifier Architecture	
100% digital control loop, from command input to load output	Yes
Current command delay (software adjustable, each axis)	0 to 40 μ sec range 40 nsec resolution for digital command 1 μ sec resolution for analog command
Gain (software adjustable)	\pm 50 A/V to \pm 120 A/V (default setting: +70 A/V)
Bandwidth (typical, load dependent)	DC to >7 kHz
RMS output current noise (typical)	<200 μ A RMS, 0.5 Hz – 50 Hz <2.0 mA RMS, 10 Hz – 1 kHz
Settling time to +/- 0.25% (typical)	<200 μ sec
Command Inputs	
Digital high-speed fiber-optic	One fiber for 3 commands and synchronization

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Parameter	Value
Three analog inputs with integrated high performance ADC's	+/- 10V differential +/- 5V each signal of complementary pair 20 bit ADC's
Communication Ports	
Ethernet, CAN Bus, USB, Bluetooth, RS-232, Fiber-optic I/O	Supported
Mechanical	
Enclosure outer dimensions:	
• Width	26 inch 660 mm
• Depth	37 inch 940 mm
• Height	74 inch 1880 mm
Weight (no seismic anchors and no coolant)	495 kg +/- 5 kg 1091 lb +/- 11 lb
Environmental	
Operating temperature, ambient	+50 to +95 °F +10 to +35 °C
Storage temperature, ambient	-22 to +158 °F -30 to +70 °C
Relative humidity, non-condensing	< 70%
Thermal Management - Water Cooling	
Components cooled by water	Power semiconductors mounted to high performance water-cooled heat sinks
Water heat load (typical for 3 X 150 Arms, 0.1Ω load)	~ 18 kW with a 1500V DC supply
Thermal Management - Air Cooling	
Active control prevents/minimizes condensation	System tolerates and protects against condensation damage; includes dew point detection and alarm
Air heat load (typical for 3 X 150 Arms, 0.1Ω load)	~ 4 kW with a 1500V DC supply
Universal Utility Access	
OEM-selectable utility service entry options:	Electrical connections via front and/or top panels
• Water and electrical (power, load) enter at top	Yes - allows installation flush with wall
• Water and electrical (power, load) enter at back	Yes
• Water enters at top and electrical enters at back	Yes
• Water enters at back and electrical enters at top	Yes
Command, Control, and Communication Connections	
Location of all command and communication connections	Front of cabinet (top entry optional, consult PCI)
Front panel DC bus and amplifier enable/disable switch	Yes (multi-purpose switch)
Field Replaceable Units (FRU)	
All FRUs serviced via front panels; rear or side access not required	Yes
Lightweight FRU's for single person servicing	<20 kg (<44 lb) for all FRU's

Certifications and Standards

The DA1500-1 complies with the following certifications and standards.

- IEC 60601-1, Edition 3.1, CB Report
- IEC 60601-1, Edition 3, CB Report
- IEC 60601-1, Edition 2; am1; am2

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- EN60601-1:2006/A11:2011/A1:2013/A12:2014
- ANSI/AAMI ES60601-1: A1:2012, C1:2009/(R)2012 and A2:2010/(R)2012
- CSA, CAN/CSA-C22.2 NO. 60601-1:14
- EN50581:2012, RoHS (Europe)
- GB/T 26572-2011, RoHS (China)

D-SERIES™ and InSight™

The DA1500-1 incorporates all the powerful capabilities of D-SERIES™ technology from PCI. Many of these capabilities are easily accessed using PCI's InSight™ software toolkit. The 100% digital control loop architecture found in all D-SERIES™ gradient amplifier systems enables industry-leading features such as:

- High-speed fiber-optic digital command interface
- High-resolution adjustable command time delay (independent control for each axis)
- Advanced System Diagnostics
- Sequence Development Assistant
- Amplifier Replicator
- Guided field software updates
- ... and many more

For more information on D-SERIES™ and InSight™ please refer to their respective data sheets.

Options and Customizations

PCI offers the following standard options for the DA1500-1. Beyond the options described below, PCI is able to provide customizations to meet your special requirements and welcomes your inquiries.

Seismic Anchors

The seismic anchors consist of two angle brackets mounted to the underside of the cabinet. The vertical surface of each bracket has a standardized hole pattern for bolting to a mating bracket (not provided) which is bolted to the floor.

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Performance Controls, Inc. (PCI) designs and manufactures high performance PWM (pulse width modulated) amplifiers and motor drives. We specialize in amplifiers characterized by high precision, high power, wide bandwidth, and ruggedized construction. You can select from one of our standard products, have a product customized, or work with us to develop a custom solution that exactly satisfies your application.

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PCI has a policy of continuous improvement and therefore reserves the right to update this information without notice to correct mistakes or to reflect specification changes. Please contact PCI to ask questions about this product or to confirm its specifications.

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