

- **3-Axis 900A Precision Gradient Amplifier System**
- **2100 VDC High Performance Power Supply**
- **100% Digital D-SERIES™ Technology**
- **Hi-Speed, Single Fiber Digital Command**
- **Rear Panel Utility Access**

## Description

The QDCM2100D Gradient Amplifier from Performance Controls, Inc. (PCI) is a three-axis pulse width modulated amplifier system. It is rated at 2100 V / 900 Apk / 375 ARMS / 60 kW and offers unrivaled power for the industry's most precise and demanding gradient control applications. The QDCM2100D'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 makes its debut with the QDCM2100D; it is the foundation for many new 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 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.

**Digitally Adjustable Current Command Delay**

User-selectable high-resolution command delay offers independent control for each axis; delay up to 40 usec with 40 nsec delay resolution.

**InSight™ Software Toolkit**  
(see separate data sheet)

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

# Model QDCM2100D

## Specifications

Parameter	Value
<b>Internal AC/DC Power Supply</b>	
AC line voltage, 3 phase	380-480 VAC +/-10% at 50-60 Hz
AC line phase current (max continuous, at low line)	120 A RMS
Internal AC line fuses, fast acting	150 A
AC line filter with transient voltage suppression	Yes
Input power (max continuous)	71 kVA
Input power (max at 20 kW gradient coil limited)	~40 kVA
Power factor (typical)	>0.9
Output power (max continuous)	60 kW
Output power to load (max, load and waveform dependent)	~45 kW, single or combined axes
<b>DC Bus Voltage and Amplifier Output Current, Per Axis</b>	
Bus voltage	2100 VDC
Output current, continuous RMS	375 A
Output current, peak (>25 msec)	900 A
<b>Load Specifications</b>	
Inductance range	100 $\mu$ H to 1 mH (contact PCI for extended range)
Resistance range	0 $\Omega$ to 1 $\Omega$ (contact PCI for extended range)
Maximum capacitance, output to ground	0.2 $\mu$ F
Maximum capacitance, output to output	0.2 $\mu$ F
<b>Advanced Digital Amplifier Architecture</b>	
100% digital control loop, from command input to load output	Yes
Current command delay (software adjustable, each axis)	0 to 40 $\mu$ sec; 40 nsec adjustment resolution
Gain (software adjustable)	$\pm$ 50 A/V to $\pm$ 120 A/V (default setting: +90 A/V)
Bandwidth (typical, load dependent)	DC to >15 kHz
RMS output current noise (typical)	<200 $\mu$ A RMS, 0.5 Hz – 50 Hz <2.0 mA RMS, 10 Hz – 1 kHz
Settling time to +/- 0.25% (typical)	<200 $\mu$ sec
<b>Command Inputs</b>	
Hi-speed digital fiber	One fiber for all three axes and synchronization
Three analog inputs with integrated high performance ADC's	+/- 10V differential +/- 5V each signal of complementary pair 20 bit ADC's
<b>Communication Ports</b>	
Ethernet, CAN Bus, USB, Bluetooth, RS-232	Supported
<b>Mechanical</b>	
Enclosure outer dimensions:	
• Width	31 inch   790 mm
• Depth	40 inch   1016 mm
• Height	74 inch   1880 mm
Weight (no seismic anchors and no coolant)	<760 kg
<b>Environmental</b>	
Operating temperature, ambient	+50 to +95 °F   +10 to +35 °C

# Model QDCM2100D

Parameter	Value
Storage temperature, ambient	-22 to +158 °F   -30 to +70 °C
Relative humidity, non-condensing	< 70%
<b>Thermal Management - Water Cooling</b>	
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)	<17 kW
<b>Thermal Management - Air Cooling</b>	
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)	<1.8 kW
<b>Utility Access</b>	
Water and electrical (power, load) enter at back	Yes
<b>Command and Communication Connections</b>	
Command and communication connections enter at back	Yes
<b>Field Replaceable Units (FRU)</b>	
Multiple FRUs help maintain maximum up-time	Yes
Lightweight FRUs for single person servicing	<22 kg for all FRUs

## Certifications and Standards

The QDCM2100D complies with the following certifications and standards.

- UL/CSA Approved, ANSI/AAMI ES60601-1:2005/©2012, CSA CAN/CSA-C22.2 NO. 60601-1:14
- EN60601-1:2006/A11:2011/A1:2013/A12:2014
- IEC60601-1, Edition 3, 3.1, CB Report
- EN50581:2012, RoHS (Europe)
- GB/T 26572-2011, RoHS (China)

## D-SERIES™ and InSight™

The QDCM2100D 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 QDCM2100D. 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.

*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.*

**Performance Controls, Inc.  
151 Domorah Drive  
Montgomeryville, PA 18936  
USA  
Tel: +1 215-619-4920  
www.pcipa.com**

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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