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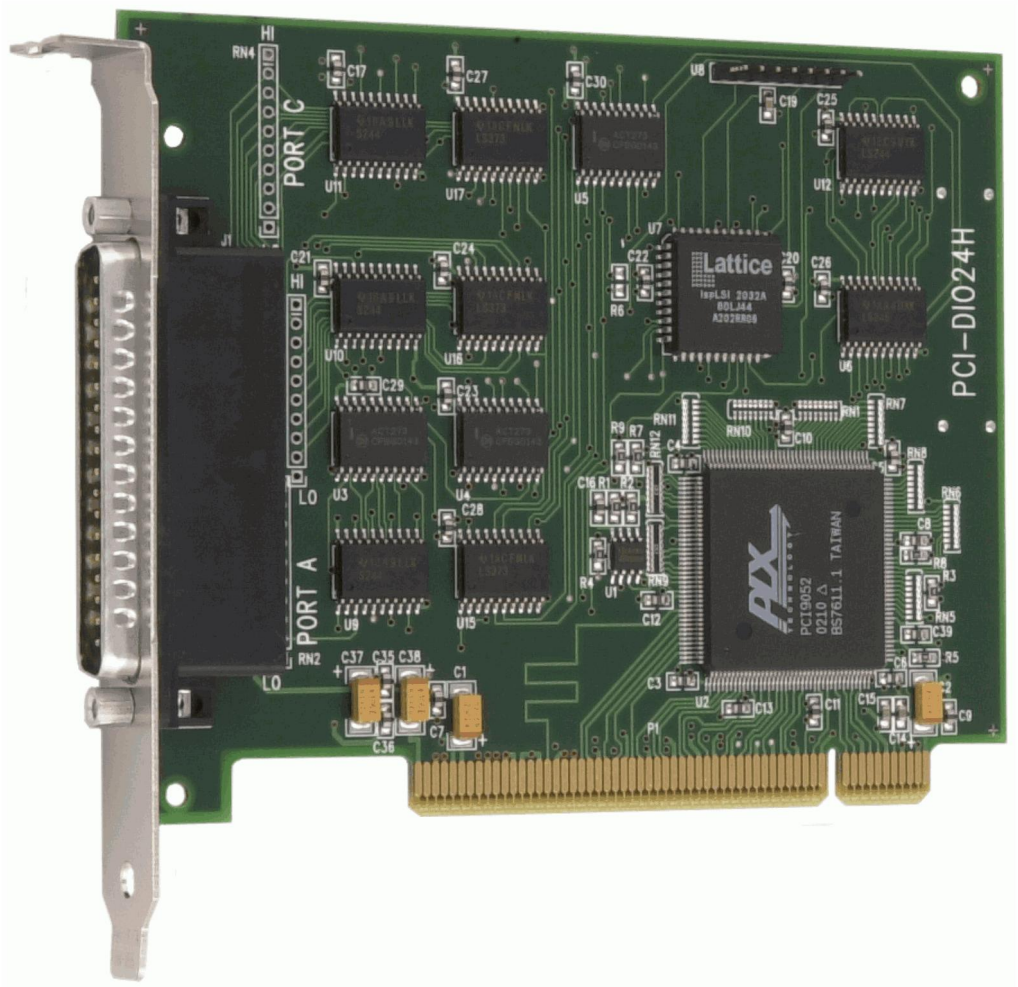
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PCI-DIO24H

24-bit, High-output drive digital I/O board

User's Guide



MEASUREMENT COMPUTING™

PCI-DIO24H

Digital I/O

User's Guide



Document Revision 3, May, 2009
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About this User's Guide

What you will learn from this user's guide

This user's guide explains how to install, configure, and use the PCI-DIO24H so that you get the most out of the digital I/O features.

This user's guide also refers you to related documents available on our web site, and to technical support resources.

Conventions in this user's guide

For more information on …

Text presented in a box signifies additional information and helpful hints related to the subject matter you are reading.

Caution! Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

<#:#> Angle brackets that enclose numbers separated by a colon signify a range of numbers, such as those assigned to registers, bit settings, etc.

bold text **Bold** text is used for the names of objects on the screen, such as buttons, text boxes, and check boxes. For example:
1. Insert the disk or CD and click the **OK** button.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase. For example:
The *Insta*Cal installation procedure is explained in the *Quick Start Guide*.
Never touch the exposed pins or circuit connections on the board.

Where to find more information

For additional information relevant to the operation of your hardware, refer to the *Documents* subdirectory where you installed the MCC DAQ software (C:\Program Files\Measurement Computing\DAQ by default), or search for your device on our website at www.mccdaq.com.

If you need to program at the register level in your application, refer to the *Register Map for the PCI-DIO24, PCI-DIO24H, PCI-DIO24/S, and PCI-DIO24/LP*. This document is available on our website at www.mccdaq.com/registermaps/RegMapPCI-DIO24X.pdf.

Introducing the PCI-DIO24H

This manual explains how to install and use the PCI-DIO24H board. The PCI-DIO24H is a high output drive, logic-level digital I/O board designed for the PCI-bus.

The PCI-DIO24H provides 24-bits of digital I/O in three eight-bit ports (Port A, Port B, and Port C) based on an 82C55 mode 0 emulation. Port C can be further divided into two four-bit ports (Port C-HI and Port C-LO). You can configure each port independently for either input or output.

All digital inputs are LSTTL. The output signals are buffered high output drive TTL. The digital output drivers are 74S244 chips that can sink 64 mA and source 15 mA. The input buffers are 74LS373 chips and have standard high input impedance of the 74LS series devices.

All 24 I/O lines are accessible through the board's 37-pin connector.

82C55 Mode 0 programming supported

The PCI-DIO24H supports 82C55 Mode 0 programming only.

Software features

For information on the features of *Insta*Cal and the other software included with your PCI-DIO24H, refer to the *Quick Start Guide* that shipped with your device. The *Quick Start Guide* is also available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Check www.mccdaq.com/download.htm for the latest software version or versions of the software supported under less commonly used operating systems.

Installing the PCI-DIO24H

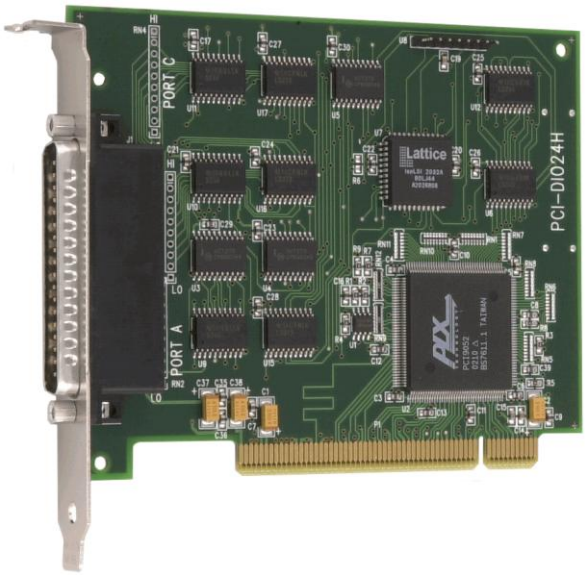
What comes with your PCI-DIO24H shipment?

The following items are shipped with the PCI-DIO24H.

Hardware

The following items should be included with your shipment.

- PCI-DIO24H board

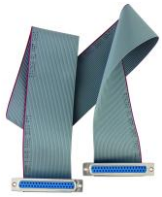


Additional documentation

In addition to this hardware user's guide, you should also receive the *Quick Start Guide* (available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf). This booklet supplies a brief description of the software you received with your PCI-DIO24H and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

Optional components

- Cables



C37FF-x



C37FFS-x

- Signal termination and conditioning accessories

  MCC provides signal termination products for use with the PCI-DIO24H. Refer to the "Field wiring and signal termination" section on page 11 for a complete list of compatible accessory products.

Unpacking the PCI-DIO24H

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the PCI-DIO24H from its packaging, ground yourself using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge.

If any components are missing or damaged, notify Measurement Computing Corporation immediately by phone, fax, or e-mail:

- Phone: 508-946-5100 and follow the instructions for reaching Tech Support.
- Fax: 508-946-9500 to the attention of Tech Support
- Email: techsupport@mccdaq.com

Installing the software

Refer to the *Quick Start Guide* for instructions on installing the software on the *Measurement Computing Data Acquisition Software CD*. This booklet is available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Installing the PCI-DIO24H

The PCI-DIO24H board is completely plug-and-play, with no switches or jumpers to set. Configuration is controlled by your system's BIOS. To install your board, follow the steps below.

Install the MCC DAQ software before you install your board

The driver needed to run your board is installed with the MCC DAQ software. Therefore, you need to install the MCC DAQ software before you install your board. Refer to the *Quick Start Guide* for instructions on installing the software.

1. Turn your computer off, open it up, and insert your board into an available PCI slot.
2. Close your computer and turn it on.

   If you are using an operating system with support for plug-and-play (such as Windows 2000 or Windows XP), a dialog box opens as the system loads, indicating that new hardware has been detected. If the information file for this board is not already loaded onto your PC, you are prompted for the disk containing this file. The *Measurement Computing Data Acquisition Software* CD supplied with your board contains this file. If required, insert the disk or CD and click **OK**.
3. To test your installation and configure your board, run the *Insta*Cal utility installed in the previous section. Refer to the *Quick Start Guide* that came with your board for information on how to initially set up and load *Insta*Cal.

Configuring the hardware

All hardware configuration options on the PCI-DIO24H are software controlled.

Connecting the board for I/O operations

Connectors, cables – main I/O connector

The table below lists the board connector type, applicable cables, and compatible accessory products for the PCI-DIO24H.

Board connectors, cables, and accessory equipment

Connector type	37-pin D-type
Compatible cables	▪ C37FF-x unshielded ribbon cable. x = length in feet. (see Figure 2) ▪ C37FFS-x shielded round cable. x = length in feet. (see Figure 3)
Compatible accessory products with the C37FF-x or C37FFS-x cable	SCB-37 CIO-MINI37 CIO-MINI37-VERT CIO-ERB08 CIO-SERB08 CIO-ERB24 CIO-SPADE50 SSR-RACK08 SSR-RACK24

Pin out – main I/O connector

The I/O connector is a 37-pin, male D-type connector accessible from the rear of the computer through the expansion backplate. The signals available are direct connections to the digital I/O chips as well as the computer's internal power supplies. The pin out is identical to the CIO-DIO24, except that –5 VDC is not brought out. The PCI-DIO24H board's I/O connector is shown in Figure 1.

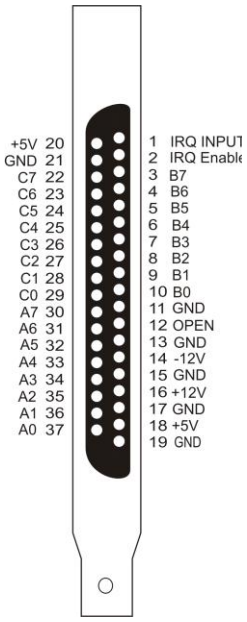


Figure 1. PCI-DIO24H board connector pin out

Information on signal connections

General information regarding signal connection and configuration is available in the *Guide to Signal Connections*. This document is available on our web site at www.mccdaq.com/signals/signals.pdf.

Cabling

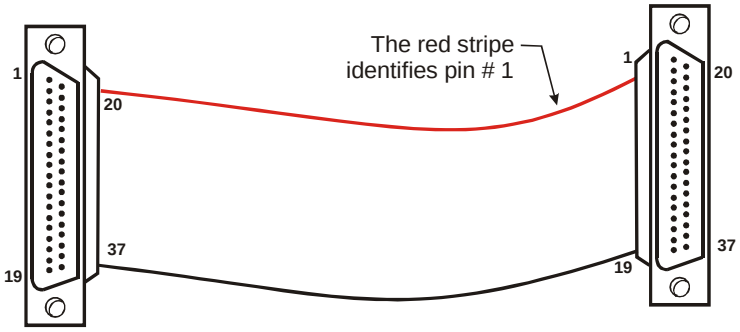


Figure 2. C37FF-x cable

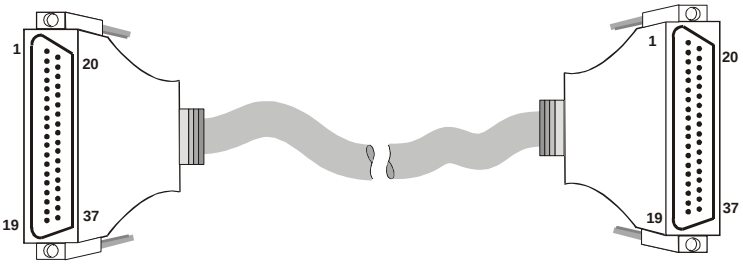


Figure 3. C37FFS-x cable

Field wiring and signal termination

You can connect the PCI-DIO24H to the following termination boards using the C37FF-x or C37FFS-x cable:

- SCB-37 — 37-conductor, shielded signal connection/screw terminal box that provides two independent 37-pin connections.
- CIO-MINI37 — 4 x 4, 37-pin screw terminal board.
- CIO-MINI37-VERT — 37-pin screw terminal accessory with vertical 37-pin male D connector.
- CIO-SPADE50 — 16" X 4" termination panel which mates with both 37-pin and 50-pin connectors.

Details on these products are available on our web site at
www.mccdaq.com/products/screw_terminal_bnc.aspx.

The following relay racks and accessory boards can be used with the PCI-DIO24H:

- SSR-RACK24 — 24-position solid state relay rack..
- SSR-RACK08 — Eight-channel solid state relay rack.
- CIO-ERB08 — Eight-channel electromechanical relay accessory for digital I/O boards.
- CIO-SERB08 — Eight Form C and ten socketed relay accessory for digital I/O boards.
- CIO-ERB24 — 24-channel electromechanical relay accessory for digital I/O boards.

Details on these products are available on our web site at www.mccdaq.com/products/signal_conditioning.aspx.

Functional Details

PCI-DIO24H Block diagram

PCI-DIO24H functions are illustrated in the block diagram shown here.

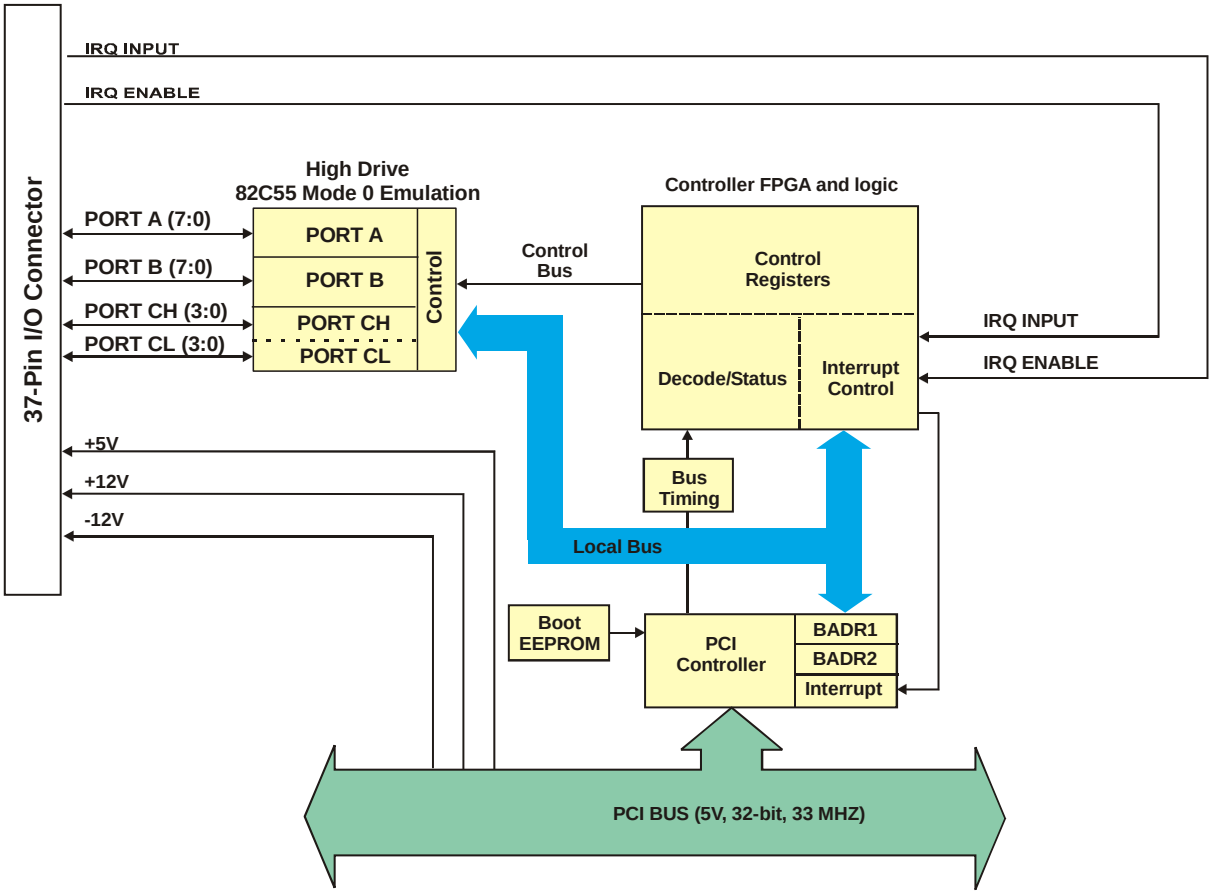


Figure 4. Functional block diagram

DIO signals

The PCI-DIO24H signals are buffered (high output drive) TTL. Voltages and currents associated with external devices are usually far greater than can be supplied from a PCI-DIO24H.

Caution! Direct connections to high-current/high voltage devices will damage the board.

The emulated 82C55 mode 0 circuit initializes all ports as inputs on power-up and reset. The state of the digital I/O lines is not defined as either logic high or logic low when in input mode. Input devices connected to the PCI-DIO24 board may detect either a high or a low and therefore may be turned off or on at power-up.

Signal level control

All I/O bits are set to a high impedance input mode on power up and reset. To prevent unwanted signal levels, and to drive all inputs on the device you are controlling to a known state after power up or reset, install pull-up or pull-down resistors.

A pull-up resistor pulls all digital pins up to +5 V (high logic level). A pull-down resistor pulls all digital pins down to 0 V (low logic level).

The PCI-DIO24H has open locations where you can install a 2.2 KΩ, eight-resistor single inline package (SIP) resistor network for each port. The SIP is made up of eight 2.2 KΩ resistors. One side of each resistor is connected to a single common point and brought out to a pin. The common line is marked with a dot or line at one end of the SIP. The remaining resistor ends are brought out to the other eight pins (see Figure 5).

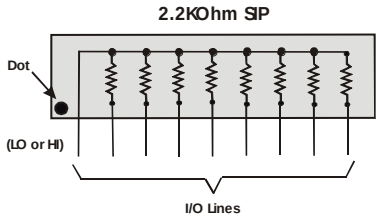


Figure 5. Eight-resistor SIP schematic

Install the SIP on the PCI-DIO24H board at the locations labeled **PORT A**, **PORT B** and **PORT C** (adjacent to the 37-pin connector). Figure 6 shows a schematic of an SIP installed in both the pull-up and pull-down positions.

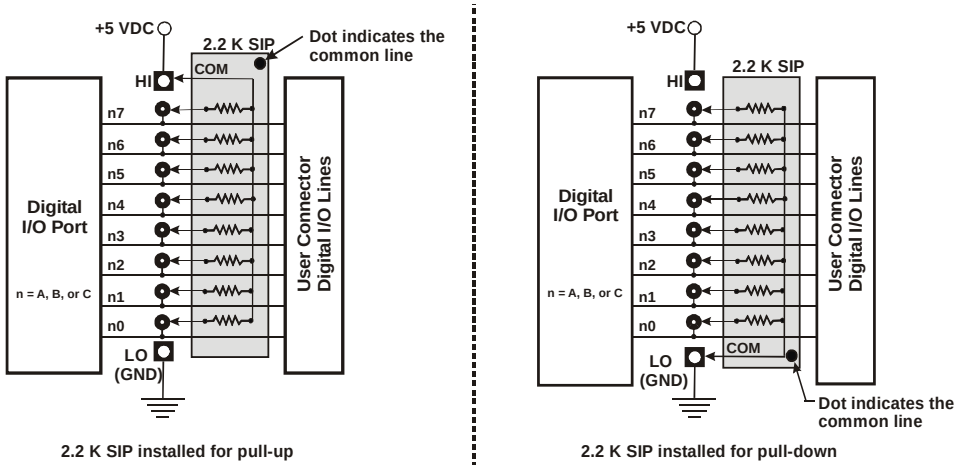


Figure 6. Pull-up and pull-down resistor SIP schematic

When installed, the SIP establishes either a high or low logic level at each of the eight I/O lines on the port. At each board location, A, B, and C, there are 10 holes in a line. The hole on one end is marked "HI" and is connected to +5V. The other end is marked "LO" and is connected to GND. The eight holes in the middle connect to eight lines of the port, A, B or C.

To pull-up lines, orient the SIP with the common pin (dot) toward the HI end; to pull-down, install the resistor with the common pin in the LO hole.

Note:

We recommend using 2.2KΩ SIPs (MCC part number SP-K2.29C). Use a different value only if necessary.

Specifications

Typical for 25 °C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

Power consumption

Table 1. Power consumption specifications

+5V operating	625 mA typical, 960 mA max

Digital input / output

Table 2. Digital input / output specifications

Digital type	8255 mode 0 emulation
Output:	74S244
Input:	74LS373
Configuration	2 banks of 8, 2 banks of 4, programmable by bank as input or output
Number of channels	24 I/O
Output high	2.4 volts min @ -15 mA
Output low	0.5 volts max @ 64 mA
Input high	2.0 volts min, 7 volts absolute max
Input low	0.8 volts max, -0.5 volts absolute min
Power-up / reset state	Input mode (high impedance)
Interrupts	INTA# - mapped to IRQn via PCI BIOS at boot-time
Interrupt enable	External (IR ENABLE, active low, disabled by default through internal resistor to TTL high) and programmable through PCI9052: 0 = disabled 1 = enabled (default)
Interrupt sources	External source (IR INPUT), polarity programmable through PCI9052; 1 = active high 0 = active low (default)

Environmental

Table 3. Environmental specifications

Operating temperature range	0 to 50 °C
Storage temperature range	-20 to 70 °C
Humidity	0 to 90% non-condensing

Main connector and pin out

Table 4. Board connector, cables, and accessory equipment

Connector type	37-pin D-type
Compatible cables	C37FF-x unshielded ribbon cable. x = length in feet. C37FFS-x shielded round cable. x = length in feet.
Compatible accessory products (with the C37FF-x or C37FFS-x cable)	SCB-37 CIO-MINI37 CIO-MINI37-VERT CIO-ERB08 CIO-SERB08 CIO-ERB24 CIO-SPADE50 SSR-RACK08 SSR-RACK24

Table 5. Connector pin out

Pin	Signal Name	Pin	Signal Name
1	IRQ INPUT	20	+5V
2	IRQ ENABLE	21	GND
3	Port B7	22	Port C7
4	Port B6	23	Port C6
5	Port B5	24	Port C5
6	Port B4	25	Port C4
7	Port B3	26	Port C3
8	Port B2	27	Port C2
9	Port B1	28	Port C1
10	Port B0	29	Port C0
11	GND	30	Port A7
12	OPEN	31	Port A6
13	GND	32	Port A5
14	-12V	33	Port A4
15	GND	34	Port A3
16	+12V	35	Port A2
17	GND	36	Port A1
18	+5V	37	Port A0
19	GND		

CE Declaration of Conformity

Manufacturer:	Measurement Computing Corporation
Address:	10 Commerce Way Suite 1008 Norton, MA 02766 USA
Category:	Electrical equipment for measurement, control and laboratory use.

Measurement Computing Corporation declares under sole responsibility that the product

PCI-DIO24H

to which this declaration relates is in conformity with the relevant provisions of the following standards or other documents:

EC EMC Directive 2004/108/EC: General Requirements, EN 61326-1:2006 (IEC 61326-1:2005).

Emissions:

- EN 55011 (2007) / CISPR 11(2003): Radiated emissions: Group 1, Class A
- EN 55011 (2007) / CISPR 11(2003): Conducted emissions: Group 1, Class A

Immunity: EN 61326-1:2006, Table 3.

- IEC 61000-4-2 (2001): Electrostatic Discharge immunity.
- IEC 61000-4-3 (2002): Radiated Electromagnetic Field immunity.
- IEC 61000-4-4 (2004): Electric Fast Transient Burst Immunity.
- IEC 61000-4-5 (2001): Surge Immunity.
- IEC 61000-4-6 (2003): Radio Frequency Common Mode Immunity.
- IEC 61000-4-11 (2004): Voltage Interrupts.

To maintain compliance to the standards of this declaration, the following conditions must be met.

- The host computer, peripheral equipment, power sources, and expansion hardware must be CE compliant.
- All I/O cables must be shielded, with the shields connected to ground.
- I/O cables must be less than 3 meters (9.75 feet) in length.
- The host computer must be properly grounded.
- Equipment must be operated in a controlled electromagnetic environment as defined by Standards EN 61326-1:2006, or IEC 61326-1:2005.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in March, 2009. Test records are outlined in Chomerics Test Report #EMI5299.09.

We hereby declare that the equipment specified conforms to the above Directives and Standards.



Carl Haapaoja, Director of Quality Assurance

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