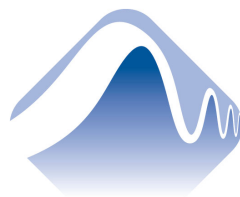


PCI-DIO24

24-bit, Logic-level Digital I/O Board

User's Guide



**MEASUREMENT
COMPUTING™**

Document Revision 2, June, 2006

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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-DIO24 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 *InstaCal*® 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

The following electronic documents provide information that is relevant to the operation of the PCI-DIO24.

- MCC's *Specifications: PCI-DIO24* (the PDF version of the Electrical Specification Chapter in this guide) is available on our web site at www.mccdaq.com/pdfs/PCI-DIO24.pdf.
- MCC's *Quick Start Guide* is available on our web site at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.
- MCC's *Guide to Signal Connections* is available on our web site at www.mccdaq.com/signals/signals.pdf.
- MCC's *Universal Library User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.
- MCC's *Universal Library Function Reference* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-functions.pdf.
- MCC's *Universal Library for LabVIEW™ User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/SM-UL-LabVIEW.pdf.

PCI-DIO24 User's Guide (this document) is also available on our web site at www.mccdaq.com/PDFmanuals/PCI-DIO24.pdf.

Introducing the PCI-DIO24

This manual explains how to install, configure and use the PCI-DIO24 digital I/O board.

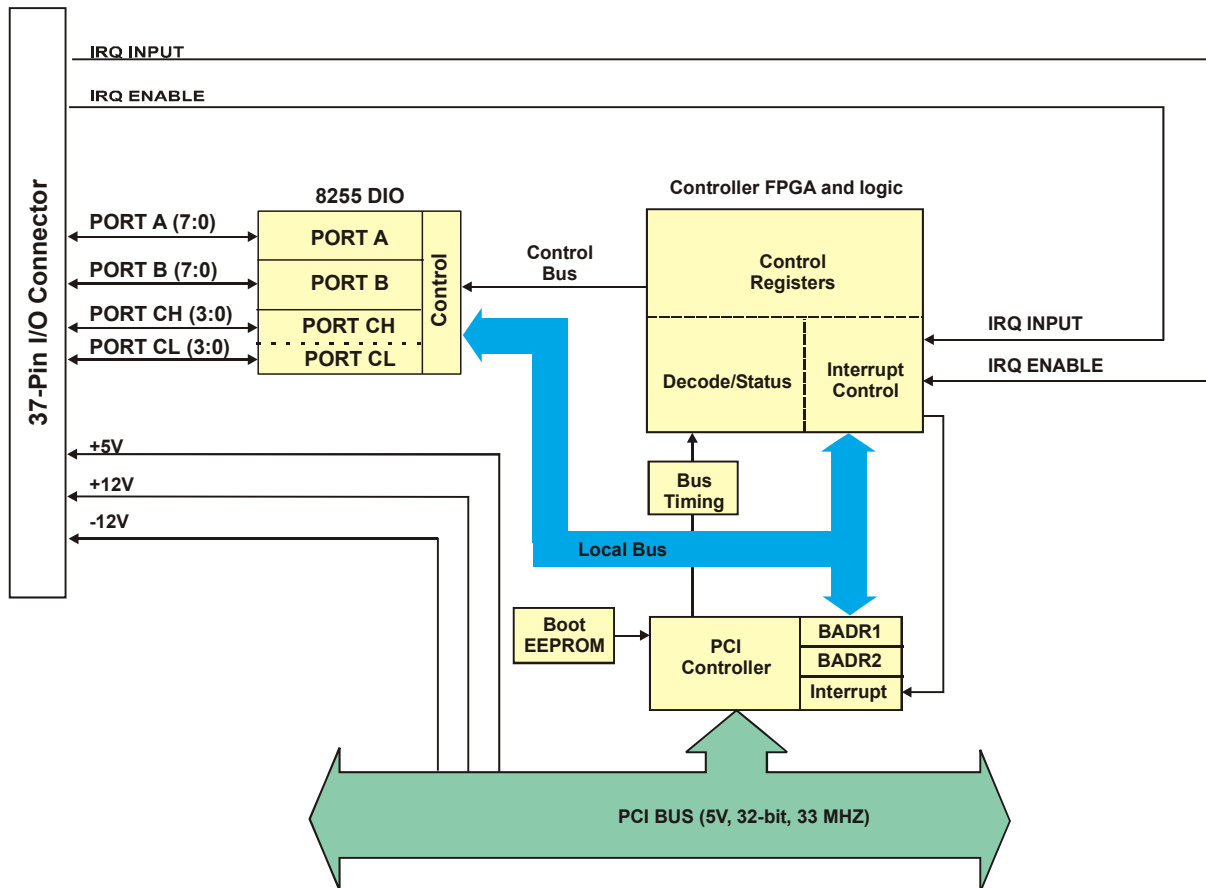
The PCI-DIO24 provides 24 lines of digital I/O. An on-board, industry standard 82C55 programmable peripheral interface chip provides the 24 digital I/O lines in three eight-bit ports (Port A, Port B, and Port C). Port C can be further divided into two four-bit ports (Port C-HI and Port C-LO). You can configure each port independently for either input or output. All 24 I/O lines are accessible through the board's 37-pin connector. The I/O pins of an 82C55 are bi-directional CMOS TTL level.

82C55 mode 1 or mode 2 operation

This user's guide provides information on I/O configuration of the 82C55 in mode 0. To use the 82C55 in modes 1 or 2, refer to the *82C55A CMOS Programmable Interface* datasheet. This document is available on our web site at www.mccdaq.com/82C55.

PCI-DIO24 block diagram

PCI-DIO24 functions are illustrated in the block diagram shown here.



Software features

For information on the features of *InstaCal* and the other software included with your PCI-DIO24, 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.

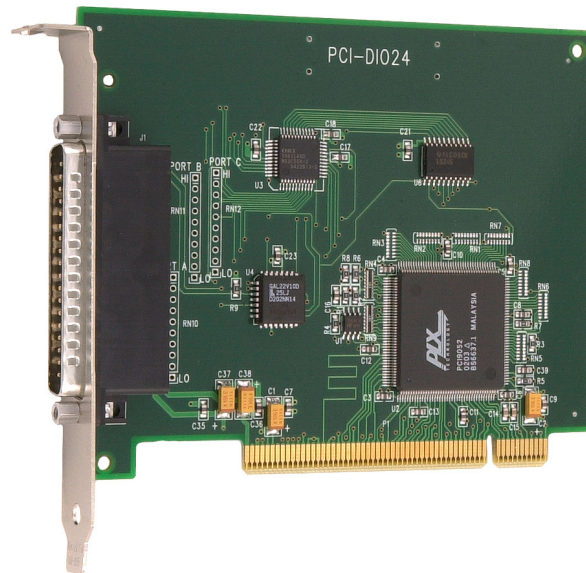
Installing the PCI-DIO24

What comes with your PCI-DIO24 shipment?

The following items are shipped with the PCI-DIO24.

Hardware

- PCI-DIO24



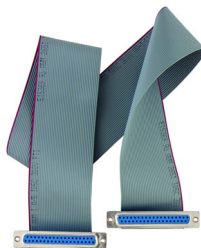
Additional documentation

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-DIO24 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

Optional components

If you ordered any of the following products with your board, they should be included with your shipment.

- Cables



C37FF-x



C37FFS-x

- Signal termination and conditioning accessories
MCC provides signal termination products for use with the PCI-DIO24. Refer to the "[Field wiring and signal termination](#)" section on page 2-4 for a complete list of compatible accessory products.

Unpacking the PCI-DIO24

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the PCI-DIO24 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 hardware

The PCI-DIO24 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 pops up 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 will be prompted for the disk containing this file. The MCC DAQ software contains this file. If required, insert the *Measurement Computing Data Acquisition Software CD* and click **OK**.

3. To test your installation and configure your board, run the *InstaCal* 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 *InstaCal*.

Configuring the hardware

All hardware configuration options on the PCI-DIO24 are software controlled.

Connecting the board for I/O operations

Connectors, cables – main I/O connector

Table 2-1 lists the board connector type, applicable cables, and compatible accessory products for the PCI-DIO24.

Table 2-1. 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 2-2) C37FFS-x cable shielded round cable. x = length in feet. (see Figure 2-3)
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-DIO24 board's I/O connector is shown in Figure 2-1.

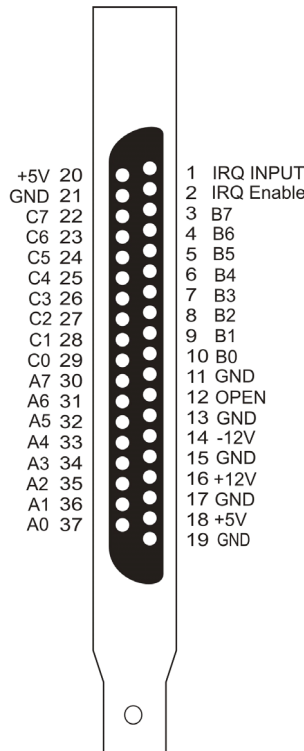


Figure 2-1. PCI-DIO24 board connector pin out

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.

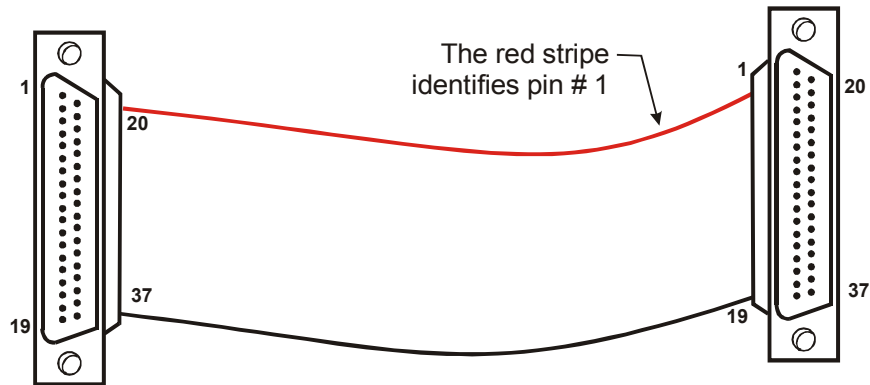
Cabling

Figure 2-2. C37FF-x cable

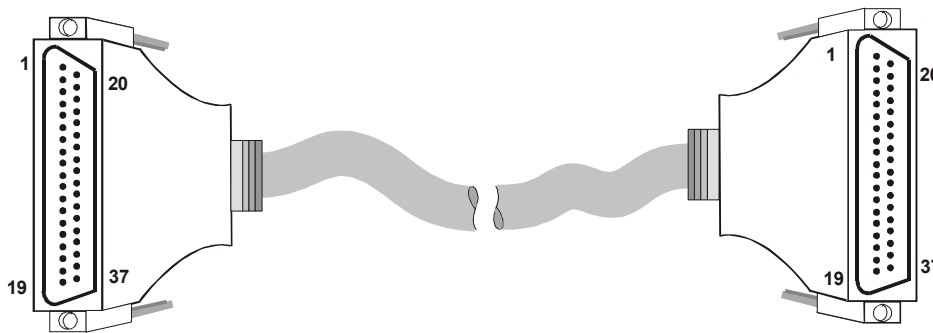


Figure 2-3. C37FFS-x cable

Field wiring and signal termination

You can use the following MCC screw terminal boards and relay racks with the PCI-DIO24 board 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. Details on this product are available at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=196&pf_id=1166.
- CIO-MINI37 — 4 x 4, 37-pin screw terminal board. Details on this product are available at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=255.
- CIO-MINI37-VERT — 37-pin screw terminal accessory with vertical 37-pin male D connector. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=256.
- CIO-SPADE50 — 16" X 4" termination panel which mates with both 37-pin and 50-pin connectors. Details on this product are available on our web site at www.mccdaq.com/pdfs/screw.pdf.
- SSR-RACK24 — 24-position solid state relay rack. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=122&pf_id=1193.
- SSR-RACK08 — Eight-channel solid state relay rack. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=122&pf_id=620

- CIO-ERB08 — Eight-channel electromechanical relay accessory for digital I/O boards. Details on this product are available on our web site at www.mccdaq.com/cbicalog/cbiproduct.asp?dept_id=123&pf_id=241.
- CIO-SERB08 — Eight Form C and ten socketed relay accessory for digital I/O boards. Details on this product are available on our web site at www.mccdaq.com/cbicalog/cbiproduct.asp?dept_id=123&pf_id=680.
- CIO-ERB24 — 24-channel electromechanical relay accessory for digital I/O boards. Details on this product are available on our web site at www.mccdaq.com/cbicalog/cbiproduct.asp?dept_id=123&pf_id=241.

Programming and Developing Applications

After following the installation instructions in Chapter 2, your board should now be installed and ready for use.

Programming languages

Measurement Computing's Universal Library™ provides access to board functions from a variety of Windows programming languages. If you are planning to write programs, or would like to run the example programs for Visual Basic® or any other language, please refer to the *Universal Library User's Guide* (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf).

Packaged applications programs

Many packaged application programs, such as SoftWIRE® and HP-VEE™ now have drivers for your board. If the package you own does not have drivers for the board, please fax or e-mail the package name and the revision number from the install disks. We will research the package for you and advise how to obtain drivers.

Some application drivers are included with the Universal Library package, but not with the application package. If you have purchased an application package directly from the software vendor, you may need to purchase our Universal Library and drivers. Please contact us 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

Register-level programming

You should use the Universal Library or one of the packaged application programs mentioned above to control your board. Only experienced programmers should try register-level programming.

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 at www.mccdaq.com/registermaps/RegMapPCI-DIO24X.pdf.

Functional Details

DIO signals

All digital outputs and inputs on the PCI-DIO24 are CMOS TTL. Voltages and currents associated with external devices are usually far greater than can be supplied from a PCI-DIO24.

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

The 82C55 digital I/O chip 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-DIO24 has open locations where you can install a 2.2 K Ω , eight-resistor single inline package (SIP) resistor network for each port. The SIP is made up of eight 2.2 K Ω 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 4-1).

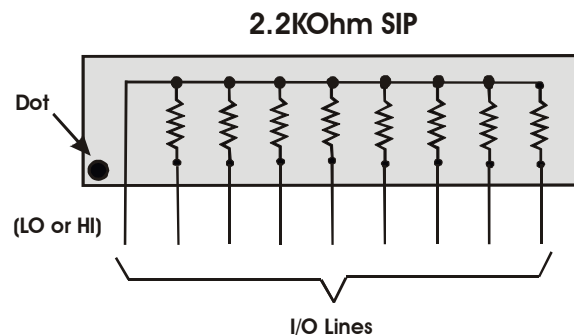


Figure 4-1. Eight-resistor SIP schematic

Install the SIP on the PCI-DIO24 board at the locations labeled PORT A, PORT B and PORT C (adjacent to the 37-pin connector). Figure 4-2 shows a schematic of an SIP installed in both the pull-up and pull-down positions.

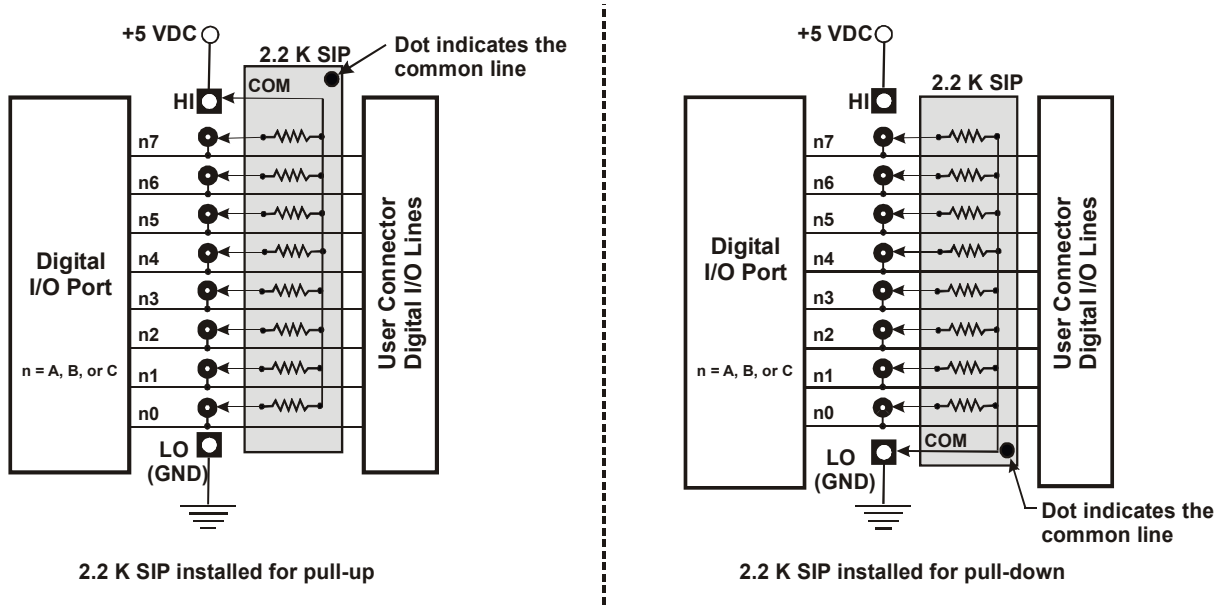


Figure 4-2. Pull-up and pull-down resistor SIP schematic

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	240 typical, 350 max
---------------	----------------------

Digital input / output

Table 2. Digital input / output specifications

Digital type	82C55
Configuration	2 banks of 8, 2 banks of 4, programmable by bank as input or output
Number of channels	24 I/O
Output high	3.7 volts min @ -2.5 mA
Output low	0.4 volts max @ 2.5 mA
Input high	2.2 volts min, 5.3 volts absolute max
Input low	0.8 volts max, -0.3 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 cable 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-DIO24

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

EU EMC Directive 89/336/EEC: Electromagnetic Compatibility, EN 61326 (1997) Amendment 1 (1998)

Emissions: Group 1, Class A

- EN 55011 (1990)/CISPR 11: Radiated and Conducted emissions.

Immunity: EN61326, Annex A

- IEC 61000-4-2 (1995): Electrostatic Discharge immunity, Criteria C.
- IEC 61000-4-3 (1995): Radiated Electromagnetic Field immunity Criteria A.
- IEC 61000-4-8 (1994): Power Frequency Magnetic Field immunity Criteria A.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in February, 2006. Test records are outlined in Chomerics Test Report #EMI4445.06.

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



Carl Haapaoja, Director of Quality Assurance

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