PCI-PDISO16

Digital Input Board

User's Guide

Document Revision 4, October, 2003

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Lifetime Harsh Environment Warranty™

Any product manufactured by Measurement Computing Corp. that is damaged (even due to misuse) may be replaced for only 50% of the current list price. I/O boards face some tough operating conditions—some more severe than the boards are designed to withstand. When a board becomes damaged, just return the unit with an order for its replacement at only 50% of the current list price. We don't need to profit from your misfortune. By the way, we honor this warranty for any manufacturer's board that we have a replacement for.

Table of Contents

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-PDISO16 so that you get the most out of its digital input features.

This user's guide also refers you to related documents available on our web site, and to technical support resources that can also help you get the most out of these boards.

Conventions in this user's guide

The following conventions are used in this manual to convey special information.

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 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 *Software Installation Manual*.
- *Never* touch the exposed pins or circuit connections on the board.

Where to find more information

The following electronic documents provide information that can help you get the most out of the PCI-PDISO16 board.

- MCC's *Guide to Signal Connections* is available on our web site at www.mccdaq.com/signals/signals.pdf.
- MCC's *Register Map for the PCI-PDISO16* is available on our web site at www.mccdaq.com/registermaps/RegMapPCI-PDISO16.pdf.
- MCC's *Specifications: PCI-PDISO16* (the PDF version of Chapter 5 in this guide) is available on our web site at www.mccadq.com/pdfs/PCI-PDISO16.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

This user's manual is also available on our web site at www.mccdaq.com/PDFmanuals/PCI-PDISO16.pdf.

Introducing the PCI-PDISO16

This manual explains how to install and use the PCI-PDISO16 board. The PCI-PDISO16 is a 16-channel isolated-input and relay output digital interface board for PCI-compatible computers. The board is designed for applications where high voltages need to be sensed or controlled.

The PCI-PDISO16 board provides 16 digital inputs and 16 Form C relay outputs.

The 16 individual, optically isolated (500V) inputs can be read back as two 8-bit bytes. The inputs are not polarity sensitive, and can be driven by either AC (50 to 1000 Hz) or DC at levels up to 28 Volts. Each input channel has a software-enabled low-pass filter with a time constant of 5 ms (200 Hz).

The 16 outputs are dry contact, Form-C electromechanical relays. The relays are controlled by writing to two eight-bit ports. The state of the relays can be determined by reading the same two ports.

The PCI-PDISO16 board is completely plug-and-play, with no switches or jumpers to set.

Software features – *Insta*Cal™ and Universal Library™

PCI-PDISO16 boards ship with the *Insta*Cal™ software configuration utility package. *Insta*Cal is a complete installation, calibration, and test program for data acquisition and control boards. Complete with extensive error checking, *Insta*Cal guides you through the installation and setup of your data acquisition board, and creates the board configuration file for use by your program or application software package. The procedure for installing *Insta*Cal is explained in the *Software Installation Manual* (available on our web site at www.mccdaq.com/PDFmanuals/sm-installation.pdf).

The optional Universal Library™ fully supports the PCI-PDISO16 boards. The Universal Library is a complete set of I/O libraries and drivers for all MCC boards and for all Windows-based languages. When using the Universal Library, you can switch boards or even programming languages, and the syntax remains constant.

Installing the Board

This section contains instructions on the installation and configuration of your PCI-PDISO16 board, and includes cabling and accessory equipment.

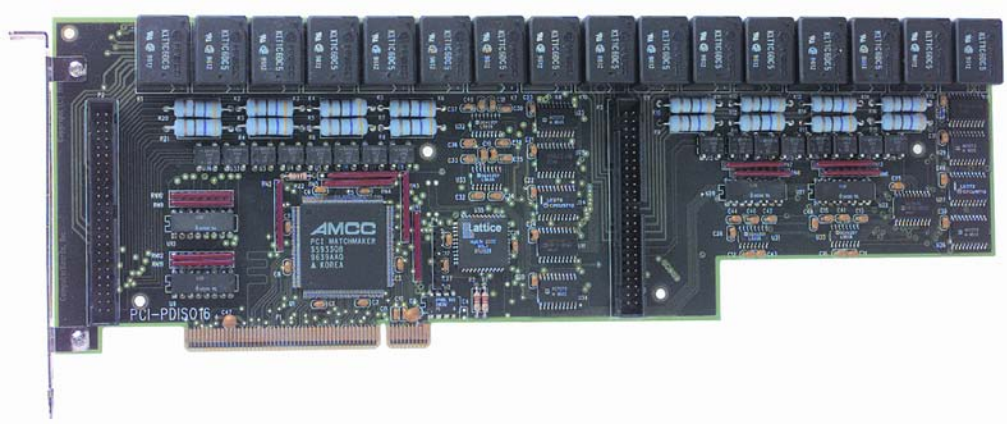
What is included with your board

As you unpack your board shipment, verify that the following components are included.

Standard shipment

The following items should be included with your shipment:

- PCI-PDISO16 board (shown with protective cover removed – it is recommended that this cover be left in place during use)



- *Insta*Cal installation CD.

  If you ordered the optional Universal Library, use that CD to install both *Insta*Cal and the Universal Library.

- MCC's *Software Installation Manual*

Optional components

If you ordered any of the following products with your PCI-PDISO16 board, they should be included with your shipment.

Universal Library

- Universal Library™ Data Acquisition and Control Programming Tools (*Insta*Cal installation package is included on the CD)
- *Universal Library User's Guide* and *Universal Library Function Reference*.

Cables

C50FF-*x*

C50-37F-*x*

For more information on these MCC cables, refer to the "Connecting the board for I/O operations" section on page 2-10.

Accessories

MCC provides signal termination products for use with the PCI-PDISO16. Refer to the "Field wiring and signal termination accessories" section for a complete list of compatible accessory products.

If any items are missing or damaged, contact Measurement Computing Corp. 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@measurementcomputing.com

Unpacking the board

Each PCI-PDISO16 board is shipped in an antistatic container to prevent damage by an electrostatic discharge. To avoid such damage, perform the following procedure when unpacking and handling your board:

1. Before opening the antistatic container, ground yourself with a wrist-grounding strap or by holding onto a grounded object (such as the computer chassis).
2. Touch the antistatic container to the computer chassis before removing the board from the container.
3. Remove the board from the container. *Never* touch the exposed pins or circuit connections on the board.

Installing the software

We recommended that you install the *Insta*Cal software included with your board *before* you install the hardware. If you ordered the Universal Library software, install that software instead. *Insta*Cal is installed at the same time as the Universal Library.

Installing the software first ensures that the information required for proper board detection is installed and available at boot up. The procedure for installing *Insta*Cal is explained in the *Software Installation Manual* included with your board (and also available on our web site at www.mccdaq.com/PDFmanuals/sm-installation.pdf).

If you ordered the Universal Library…
If you ordered the optional Universal Library, use that CD to install both *Insta*Cal and the Universal Library.

Installing the hardware

The PCI-PDISO16 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:

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 (play (such as Windows 95 or Windows 2000), a dialog box displays 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 *Insta*Cal software 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 you installed in the previous section. Refer to the *Software Installation Manual* that came with your board (www.mccdaq.com/PDFmanuals/sm-installation.pdf) for information on how to initially set up and load *Insta*Cal.

Configuring the hardware
All hardware configuration options on the PCI-PDISO16 are software controlled. You can select some of the configuration options using *Insta*Cal. Once configured, any program that uses the Universal Library will initialize the hardware according to these selections.

Connecting the board for I/O operations

Connectors, cables – main I/O connector

Table 2-1 lists the board connectors, applicable cables and compatible accessory boards.

Table 2-1. Board Connectors, Cables, Accessory Equipment

Connector type	50-pin IDC type
Compatible cables	C50FF-*x*: 50-pin IDC female to female cable. *x* = length in feet.
	C50-37F-*x*: 50-pin IDC to 37-pin female D connector (adaptor cable for connecting to a PCI-PDISO8 compatible interface). *x* = length in feet.
Compatible accessory products (using C50FF-*x* cable)	CIO-MINI50 CIO-TERM100 SCB-50
Compatible accessory products (using C50-37F-*x* cable)	CIO-MINI37 CIO-TERMINAL SCB-37

The PCI-PDISO16 board has two 50-pin connectors for signal I/O connections, identified here as Port A and Port B. Port A is located adjacent to the main I/O connector bracket at the left side of the board, and is labeled **P2**. Port B is located towards the middle-right side of the board, and is labeled **P3**. Figure 2-1 shows the location of the board's port connectors and relays.

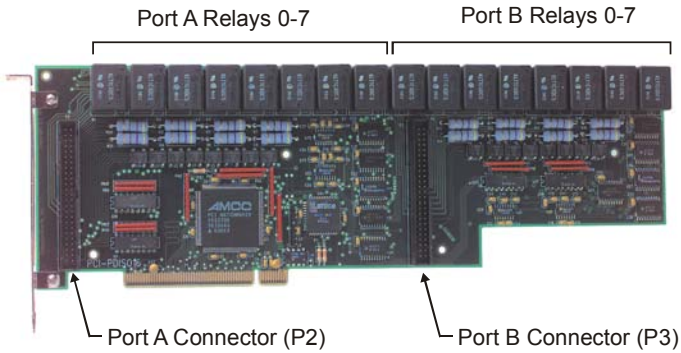


Figure 2-1. Port A and Port B locations

The pinout for the Port A connector is defined in Table 2-2. The pinout for the Port B connector is defined in Table 2-3.

Pinout – I/O connector

Table 2-2.
Port A connector pinout

Signal Name	Pin		Pin	Signal Name
NC	50		49	NC
NC	48		47	NC
NC	46		45	NC
NC	44		43	NC
NC	42		41	NC
RELAY 6 (NC)	40		39	RELAY 5 (NC)
RELAY 7 (NC)	38		37	RELAY 0 (NO)
RELAY 0 (C)	36		35	RELAY 0 (NC)
RELAY 1 (NO)	34		33	RELAY 1 (C)
RELAY 1 (NC)	32		31	RELAY 2 (NO)
RELAY 2 (C)	30		29	RELAY 2 (NC)
RELAY 3 (NO)	28		27	RELAY 3 (C)
RELAY 3 (NC)	26		25	RELAY 4 (NO)
RELAY 4 (C)	24		23	RELAY 4 (NC)
RELAY 5 (NO)	22		21	RELAY 5 (C)
RELAY 6 (NO)	20		19	RELAY 6 (C)
RELAY 7 (NO)	18		17	RELAY 7 (C)
INPUT 0	16		15	INPUT 0
INPUT 1	14		13	INPUT 1
INPUT 2	12		11	INPUT 2
INPUT 3	10		9	INPUT 3
INPUT 4	8		7	INPUT 4
INPUT 5	6		5	INPUT 5
INPUT 6	4		3	INPUT 6
INPUT 7	2		1	INPUT 7

PCI slot ↓

Table 2-3. Port B connector pinout

Signal Name	Pin		Pin	Signal Name
NC	50	••	49	NC
NC	48	••	47	NC
NC	46	••	45	NC
NC	44	••	43	NC
NC	42	••	41	NC
RELAY 6 (NC)	40	••	39	RELAY 5 (NC)
RELAY 7 (NC)	38	••	37	RELAY 0 (NO)
RELAY 0 (C)	36	••	35	RELAY 0 (NC)
RELAY 1 (NO)	34	••	33	RELAY 1 (C)
RELAY 1 (NC)	32	••	31	RELAY 2 (NO)
RELAY 2 (C)	30	••	29	RELAY 2 (NC)
RELAY 3 (NO)	28	••	27	RELAY 3 (C)
RELAY 3 (NC)	26	••	25	RELAY 4 (NO)
RELAY 4 (C)	24	••	23	RELAY 4 (NC)
RELAY 5 (NO)	22	••	21	RELAY 5 (C)
RELAY 6 (NO)	20	••	19	RELAY 6 (C)
RELAY 7 (NO)	18	••	17	RELAY 7 (C)
INPUT 0	16	••	15	INPUT 0
INPUT 1	14	••	13	INPUT 1
INPUT 2	12	••	11	INPUT 2
INPUT 3	10	••	9	INPUT 3
INPUT 4	8	••	7	INPUT 4
INPUT 5	6	••	5	INPUT 5
INPUT 6	4	••	3	INPUT 6
INPUT 7	2	••	1	INPUT 7

PCI slot ↓

Caution! High voltages are present on the PCI-PDISO16 board when you connect high voltage inputs or outputs to the board's connector. **Use extreme caution!** Never handle the PCI-PDISO16 board when signals are connected to the board through the connector. **Do not remove the protective plates on the PCI-PDISO16 board.**

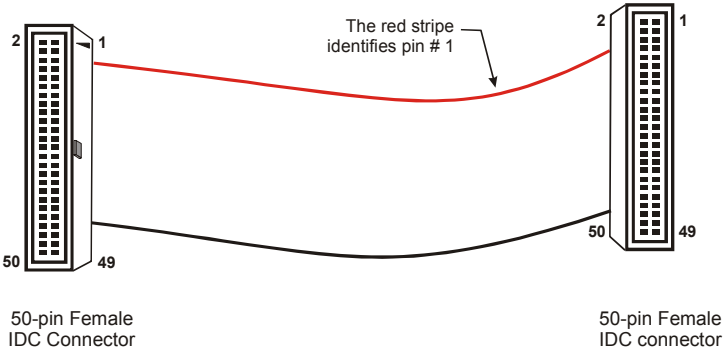


Figure 2-2. C50FF-*x* cable

Details on this cable are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=104&pf_id=136.

PCI-PDISO8 compatibility

For connections to a PCI-PDISO8 compatible interface, use a C50-37F-*x* adaptor cable. This cable converts the PCI-PDISO16 board's connector to a PDIS08-compatible D connector. Two adaptor cables are required if more than eight relays are used. Pin assignments for the C50-37F-*x* cable are shown in Figure 2-3. Details on this cable are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=104&pf_id=116.

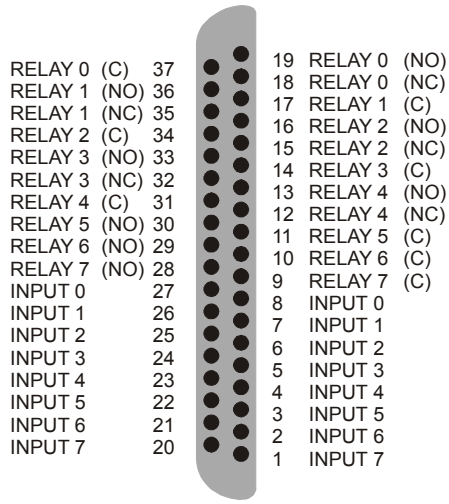


Figure 2-3. C50-37F-*x* pin-out

Note
The RELAY 5, 6 and 7 NC terminals on the PCI-PDISO16 board's 50-pin I/O connector (pin 38, 39 and 40) are not accessible when using the C50-37F-*x* adaptor cable.

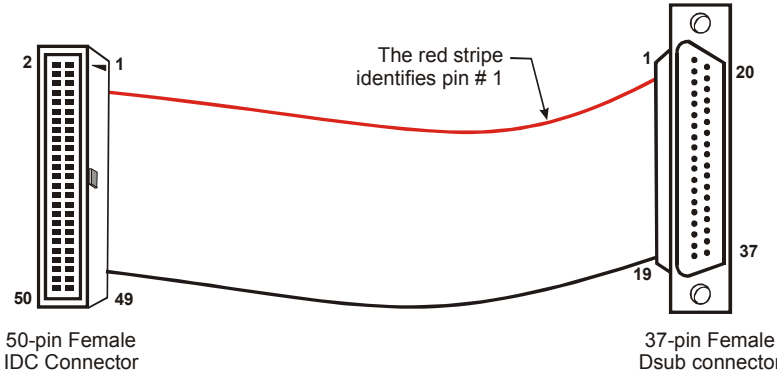


Figure 2-4. C50-37F-*x* adaptor cable

Field wiring and signal termination accessories

You can use the following screw terminal boards to terminate field signals and route them into the PCI-PDISO16 using the C50FF-*x* cable:

- **CIO-MINI50** – 50-pin screw terminal board. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=258.
- **CIO-TERM100** – 100-pin screw terminal board. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=258.
- **SCB-50** – 50 conductor, shielded signal connection/screw terminal box provides two independent 50-pin connections. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=196&pf_id=1168.

You can use the following screw terminal boards to terminate field signals and route them into the PCI-PDISO16 using the C50-37F-*x* cable:

- **CIO-MINI37** – 37-pin screw terminal board. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=255.
- **CIO-TERMINAL** – 37-pin screw terminal board with on-board prototype area. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=282.
- **SCB-37** – 37 conductor, shielded signal connection/screw terminal box provides two independent 37-pin connections. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=196&pf_id=1166.

Caution! Do not use the CIO-MINI50 screw terminal board if your field voltages are greater than 24 volts. The CIO-MINI50 does not have shields to protect users from accidental contact with hazardous high voltage signals. Construct a safe, fully insulated cable to carry your signals directly from your equipment to the PCI-PDISO16 connector. If you use a screw terminal board, ensure that it is fully enclosed in an insulated, protected box.

Additional signal conditioning is not required

The PCI-PDISO16 is designed with signal conditioning installed. Most accessory boards are intended to provide signal conditioning or easy-to-access signal termination. In general, the PCI-PDISO16 does not require additional signal conditioning.

Chapter 3

Programming and Developing Applications

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 http://www.measurementcomputing.com/PDFmanuals/sm-ul-user-guide.pdf).

Packaged applications programs

Measurement Computing's Universal Library™ provides complete access to PCI-PDISO16 board functions from the full range 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, refer to the *Universal Library User's Guide*. This document is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.

Many packaged application programs, such as SoftWIRE®, Labtech Notebook™, 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@measurementcomputing.com

Register-level programming

You should use the Universal Library or one of the packaged application programs listed on page 3-1 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-PDISO16* (available at www.measurementcomputing.com/registermaps/RegMapPCI-PDISO16.pdf).

Functional Description

Basic architecture

The PCI-PDISO16 provides isolated input channels and relay output channels on each connector. The block diagram shown in Figure 4-1 illustrates the board's functionality.

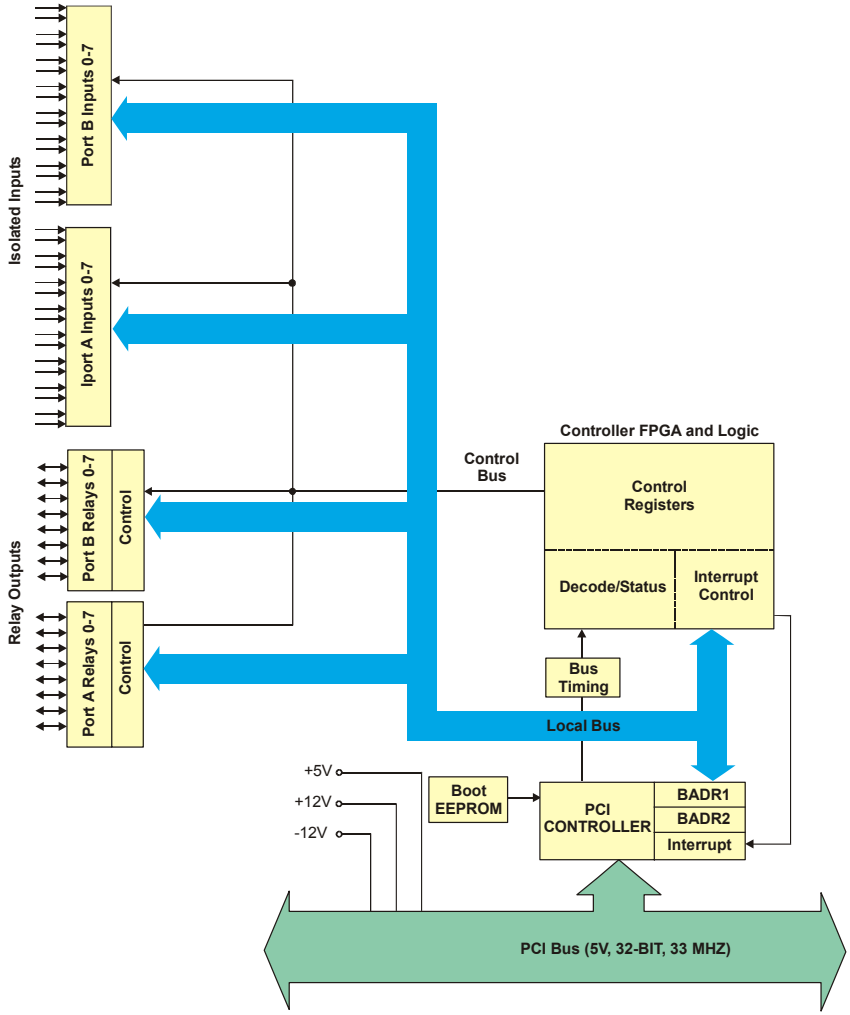


Figure 4-1. Block Diagram – PCI-PDISO16

Isolated inputs

The PCI-PDISO16 board has eight isolated input channels. A schematic of a single channel is shown in Figure 4-2. The signals are routed through a bridge rectifier so that the inputs are not polarity sensitive.

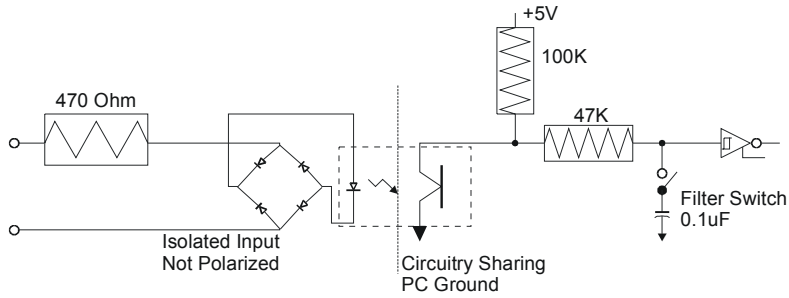


Figure 4-2. Isolated input channel - simplified schematic

Extending the input range

To extend the input range beyond the 5-28V specified, add an external resistor. Figure 4-3 shows the resistor and the equations used to calculate resistor values for a given V_{in}.

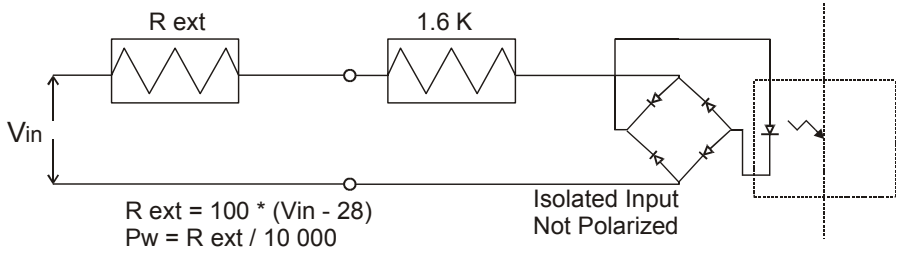


Figure 4-3. Input voltage range extender resistor

Digital I/O Techniques
For more information about digital I/O techniques, refer to the *Guide to Signal Connections*. This document is available on our web site at http://www.measurementcomputing.com/signals/.

Form C relay outputs

Figure 4-4 shows the schematic for a Form C relay contact.

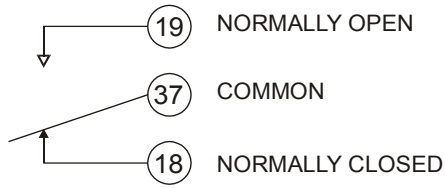


Figure 4-4. Form C Relay Contacts

The Form C relay has a Common (C), Normally Open (NO) and Normally Closed (NC) contact.

- When a 0 is written to the output, the relay is not energized, and the common and NC are in contact.
- When a 1 is written to the output, the relay is energized and the common and NO are in contact.

Specifications

Typical for 25°C unless otherwise specified.

Relay Specifications

Number	16
Contact Configuration	16 Form C
Contact Rating	6A @ 120VAC or 28VDC resistive
Contact Type	Gold overlay silver
Contact Resistance	100 milliohms max
Operate Time	20 milliseconds
Release Time	10 milliseconds max
Vibration	10 to 55 Hz (Dual amplitude 1.5mm)
Shock	10G (11 milliseconds)
Dielectric Isolation	500V (1 minute)
Life Expectancy	10 million mechanical operations, min

Isolated Inputs

Number	16
Voltage Range	DC: ±28V
	AC: ±28V (50-1000Hz)
Input 'High' Level	>5V min (positive or negative input voltage - not TTL compatible)
Input 'Low' Level	<2.5V max (positive or negative input voltage)
Isolation	500V
Resistance	1.6k Ohms min
Response	w/o filter: 20 µS
	w/ filter: 5 mS
Filters	Time constant: 5ms (200Hz)
	Filter control: Each input individually programmable
	Power-up /reset: Filters off

Power Consumption

Icc:	All relays off	0.7A typical
	All relays on	2.0A typical

Environmental

Operating temperature range	0 to 70°C
Storage temperature range	-40 to 100°C
Humidity	0 to 90% non-condensing

Main Connector and Pin out

Connector type	50-pin IDC type
Compatible cables	C50FF-*x*: 50-pin IDC female to female cable. *x* = length in feet.
	C50-37F-*x*: 50-pin IDC to 37-pin female D connector (adaptor cable for connecting to a PCI-PDISO8 compatible interface). *x* = length in feet.
Compatible accessory products (using C50FF-x cable)	CIO-MINI50 CIO-TERM100 SCB-50
Compatible accessory products (using C50-37F-x cable)	CIO-MINI37 CIO-TERMINAL SCB-37

Note that the PCI-PDISO16 board has two 50-pin connectors, identified here as Port A and Port B. Port A is located adjacent to the main I/O connector bracket at the left side of the board, and is labeled **P2**. Port B is located towards the middle-right side of the board, and is labeled **P3**.

Table 5-1. Port A (P2) connector pin out

Pin	Signal Name	Pin	Signal Name
50	NC	49	NC
48	NC	47	NC
46	NC	45	NC
44	NC	43	NC
42	NC	41	NC
40	RELAY 6 (NC)	39	RELAY 5 (NC)
38	RELAY 7 (NC)	37	RELAY 0 (NO)
36	RELAY 0 (C)	35	RELAY 0 (NC)
34	RELAY 1 (NO)	33	RELAY 1 (C)
32	RELAY 1 (NC)	31	RELAY 2 (NO)
30	RELAY 2 (C)	29	RELAY 2 (NC)
28	RELAY 3 (NO)	27	RELAY 3 (C)
26	RELAY 3 (NC)	25	RELAY 4 (NO)
24	RELAY 4 (C)	23	RELAY 4 (NC)
22	RELAY 5 (NO)	21	RELAY 5 (C)
20	RELAY 6 (NO)	19	RELAY 6 (C)
18	RELAY 7 (NO)	17	RELAY 7 (C)
16	INPUT 0	15	INPUT 0
14	INPUT 1	13	INPUT 1
12	INPUT 2	11	INPUT 2
10	INPUT 3	9	INPUT 3
8	INPUT 4	7	INPUT 4
6	INPUT 5	5	INPUT 5
4	INPUT 6	3	INPUT 6
2	INPUT 7	1	INPUT 7

Table 5-2. Port B (P3) connector pin out

Pin	Signal Name	Pin	Signal Name
50	NC	49	NC
48	NC	47	NC
46	NC	45	NC
44	NC	43	NC
42	NC	41	NC
40	RELAY 6 (NC)	39	RELAY 5 (NC)
38	RELAY 7 (NC)	37	RELAY 0 (NO)
36	RELAY 0 (C)	35	RELAY 0 (NC)
34	RELAY 1 (NO)	33	RELAY 1 (C)
32	RELAY 1 (NC)	31	RELAY 2 (NO)
30	RELAY 2 (C)	29	RELAY 2 (NC)
28	RELAY 3 (NO)	27	RELAY 3 (C)
26	RELAY 3 (NC)	25	RELAY 4 (NO)
24	RELAY 4 (C)	23	RELAY 4 (NC)
22	RELAY 5 (NO)	21	RELAY 5 (C)
20	RELAY 6 (NO)	19	RELAY 6 (C)
18	RELAY 7 (NO)	17	RELAY 7 (C)
16	INPUT 0	15	INPUT 0
14	INPUT 1	13	INPUT 1
12	INPUT 2	11	INPUT 2
10	INPUT 3	9	INPUT 3
8	INPUT 4	7	INPUT 4
6	INPUT 5	5	INPUT 5
4	INPUT 6	3	INPUT 6
2	INPUT 7	1	INPUT 7

EC Declaration of Conformity

We, Measurement Computing Corporation, declare under sole responsibility that the product

PCI-PDISO16		High output digital I/O board
Part Number		*Description*

to which this declaration relates, meets the essential requirements, is in conformity with, and CE marking has been applied according to the relevant EC Directives listed below using the relevant section of the following EC standards and other informative documents:

- EU EMC Directive 89/336/EEC: Essential requirements relating to electromagnetic compatibility.
- EN 55022 Class B (1995): Radiated and conducted emission requirements for information technology equipment.
- ENV 50204 (1995): Radio-frequency electromagnetic field immunity.
- EN 55024 (1998): EC generic immunity requirements.
- EN 50082-1 (1997): EC generic immunity requirements.
- EN 61000-4-2 (1995): Electrostatic discharge immunity.
- EN 61000-4-3 (1997) ENV 50204 (1996): RF immunity.
- EN 61000-4-4 (1995): Electric fast transient burst immunity.
- EN 61000-4-5 (1995): Surge immunity.
- EN 61000-4-6 (1996): Radio frequency common mode immunity.
- EN 61000-4-8 (1994): Power frequency magnetic field immunity.
- EN 61000-4-11 (1994): Voltage dip and interrupt immunity.

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