PCI-PDISO16

Isolated Input and Relay Output Interface Board

User's Guide

MEASUREMENT COMPUTING™

PCI-PDISO16

Isolated Input and Relay Output Interface Board

User's Guide

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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

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

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

- MCC's *Specifications: PCI-PDISO16* (the PDF version of the *Specifications* chapter in this guide) is available on our web site at www.mccdaq.com/pdfs/Specs/PCI-PDISO16-spec.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.

User's Guide (this document) is also available on our web site at www.mccdaq.com/PDFmanuals/PCI-PDISO16.pdf.

Register-level programming

You should use the Universal Library 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.mccdaq.com/registermaps/RegMapPCI-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

For information on the features of *Insta*Cal and the other software included with your PCI-PDISO16, 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.

PCI-PDISO16 block diagram

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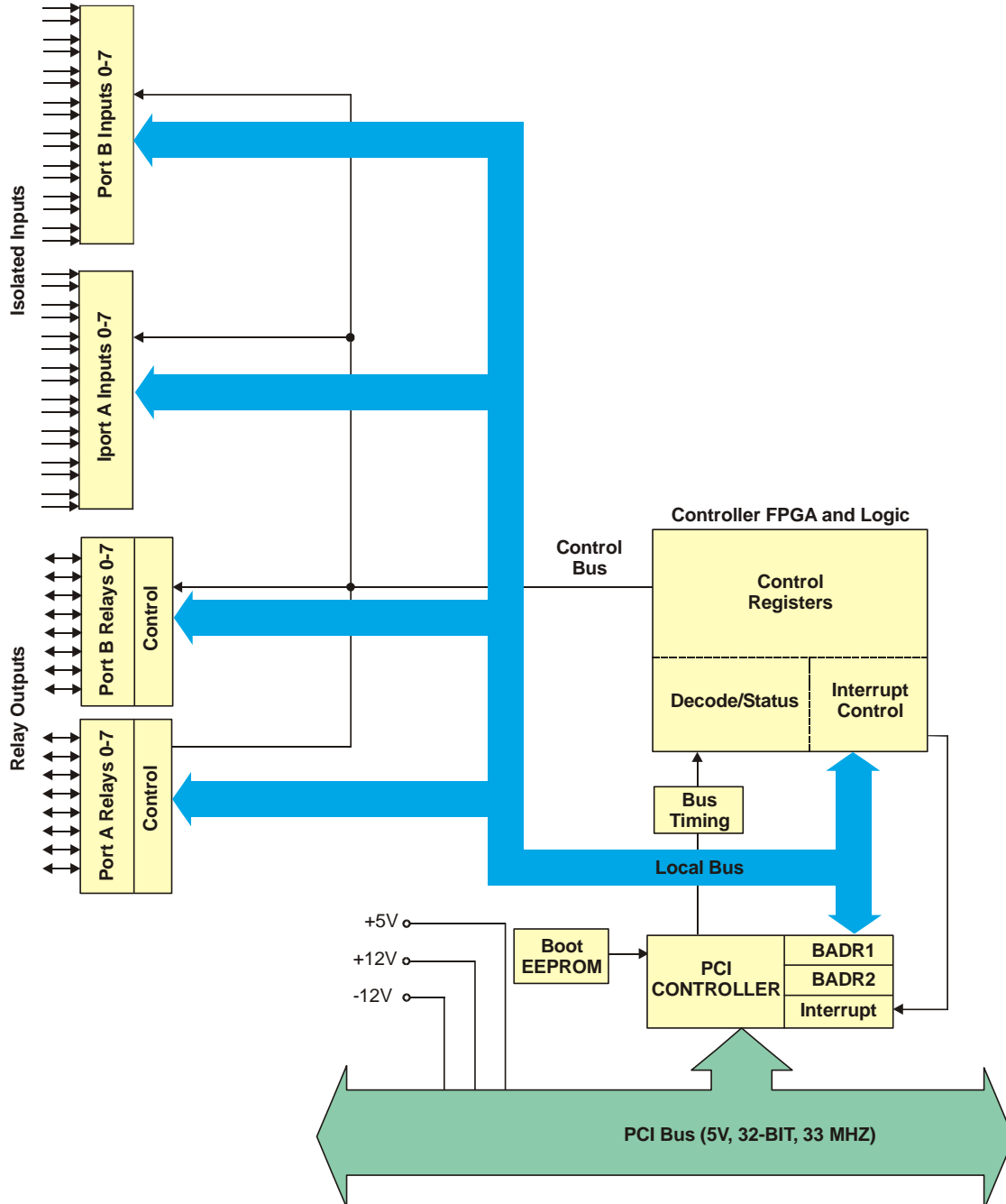
Figure 1. PCI-PDISO16 functional block diagram

Installing the PCI-PDISO16

What comes with your PCI-PDISO16 shipment?

As you unpack your PCI-PDISO16, verify that the following components are included.

Hardware

▪ PCI-PDISO16 (shown here with the protective cover removed – it is recommended that this cover be left in place during use)
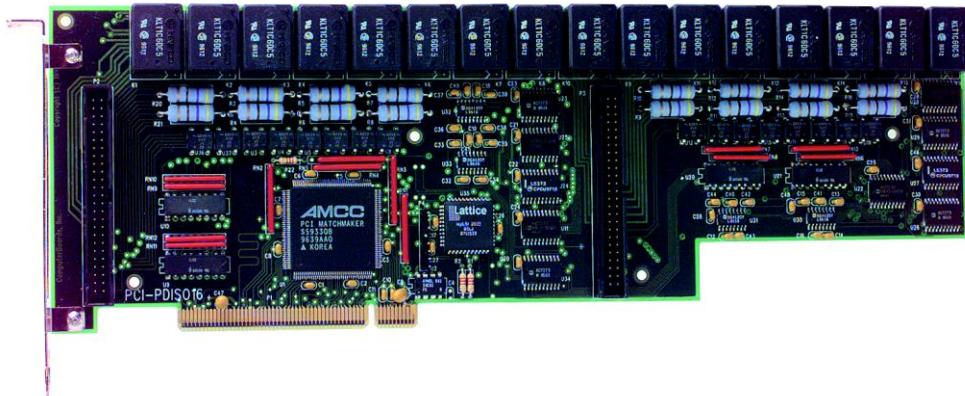
Optional components

▪ Cables

C50FF-x   **C50-37F-x**

▪ Signal conditioning accessories

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

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-PDISO16 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

Unpacking the board

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the PCI-PDISO16 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-PDISO16 board is completely plug-and-play. There are no switches or jumpers to set on the board. 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.

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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 *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-PDISO16 are software controlled. You can select some of the configuration options using *Insta*Cal. Once selected, 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

The table below lists the board connectors, applicable cables and compatible accessory boards.

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 that are labeled on the board as **P2** and **P3**. P2 is located adjacent to the main I/O connector bracket at the left side of the board. P3 is located towards the middle-right side of the board. Figure 2 shows the location of the board connectors and relays.
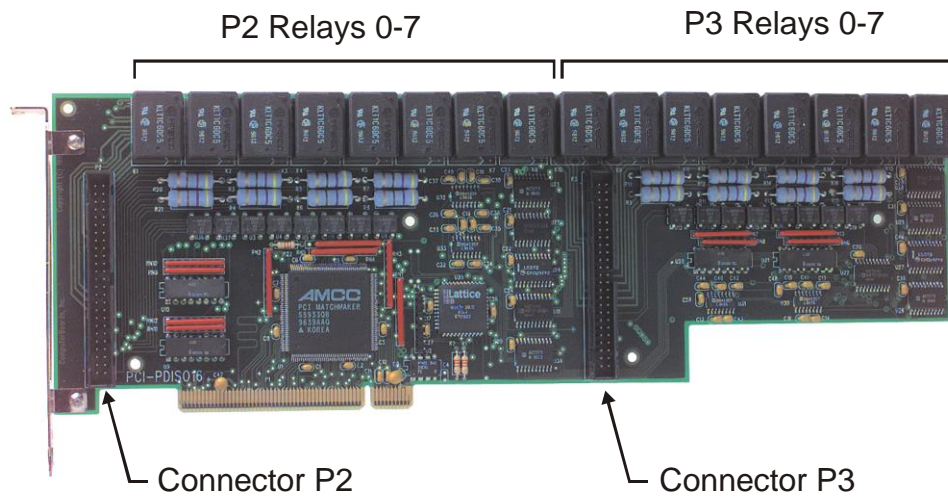

Figure 2. Connector and relay locations

The pin out for connector P2 and connector P3 are shown below.

Pin out – I/O connector

Connector P2 pin out

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 ↓

Connector P3 pin out

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.**
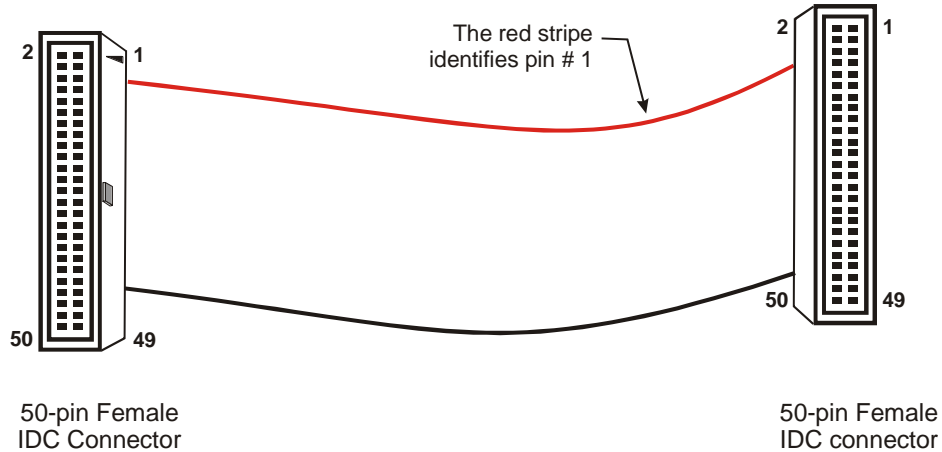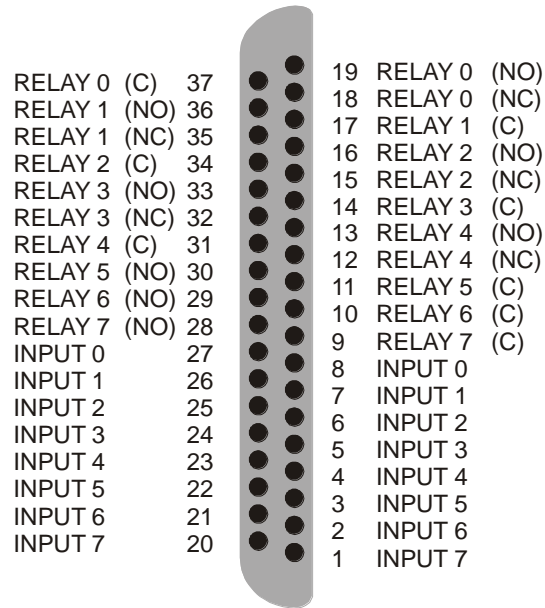
Figure 3. C50FF-x cable

Details on this cable are available on our web site at www.mccdaq.com/products/accessories.aspx.

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 4.

RELAY 0	(C)	37		19	RELAY 0	(NO)
RELAY 1	(NO)	36		18	RELAY 0	(NC)
RELAY 1	(NC)	35		17	RELAY 1	(C)
RELAY 2	(C)	34		16	RELAY 2	(NO)
RELAY 3	(NO)	33		15	RELAY 2	(NC)
RELAY 3	(NC)	32		14	RELAY 3	(C)
RELAY 4	(C)	31		13	RELAY 4	(NO)
RELAY 5	(NO)	30		12	RELAY 4	(NC)
RELAY 6	(NO)	29		11	RELAY 5	(C)
RELAY 7	(NO)	28		10	RELAY 6	(C)
INPUT 0		27		9	RELAY 7	(C)
INPUT 1		26		8	INPUT 0	
INPUT 2		25		7	INPUT 1	
INPUT 3		24		6	INPUT 2	
INPUT 4		23		5	INPUT 3	
INPUT 5		22		4	INPUT 4	
INPUT 6		21		3	INPUT 5	
INPUT 7		20		2	INPUT 6	
				1	INPUT 7	

(NO) = Normally Open, (C) = Common, (NC) = Normally Closed

Figure 4. C50-37F-x adaptor cable pin out

Details on this cable are available on our web site at www.mccdaq.com/products/accessories.aspx.

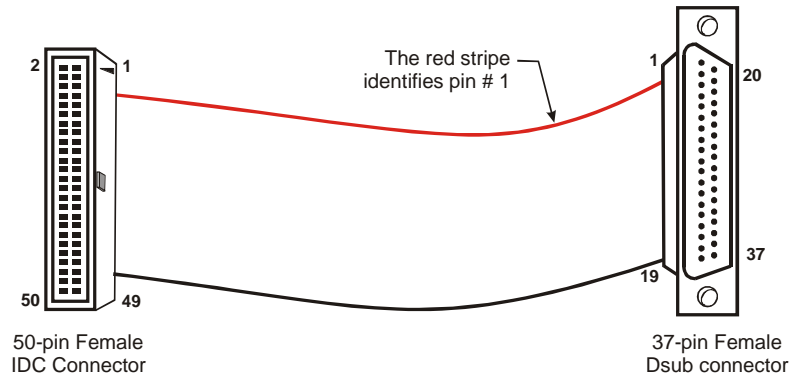| **Note** |
| --- |
| The RELAY 5, 6 and 7 NC terminals on the PCI-PDISO16 board's 50-pin I/O connector (pin 38, 39 and 40) are not accessible when using the C50-37F-x adaptor cable. |

Figure 5. C50-37F-x adaptor cable

Field wiring and signal termination

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.
- CIO-TERM100 – 100-pin screw terminal board.
- SCB-50 – 50 conductor, shielded signal connection/screw terminal box provides two independent 50-pin connections.

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

- CIO-MINI37 – 37-pin screw terminal board.
- CIO-TERMINAL – 37-pin screw terminal board with on-board prototype area.
- SCB-37 – 37 conductor, shielded signal connection/screw terminal box providing two independent 37-pin connections.

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

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.

Functional Description

Isolated inputs

The PCI-PDISO16 board has eight isolated input channels. A schematic of a single channel is shown in Figure 6. The signals are routed through a bridge rectifier so that the inputs are not polarity sensitive.
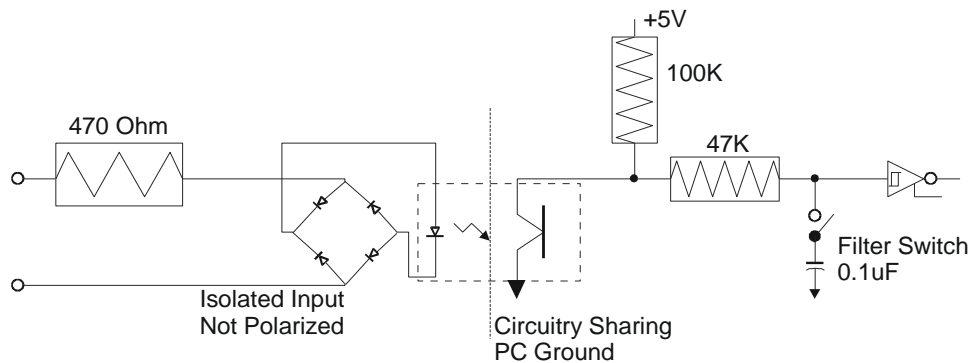
Figure 6. Isolated input channel - simplified schematic

Extending the input range

To extend the input range beyond the 5-28V specified, add an external resistor. Figure 7 shows the resistor and the equations used to calculate resistor values for a given V_{in}.

$$R\ ext = 100 * (Vin - 28)$$
$$Pw = R\ ext / 10\ 000$$
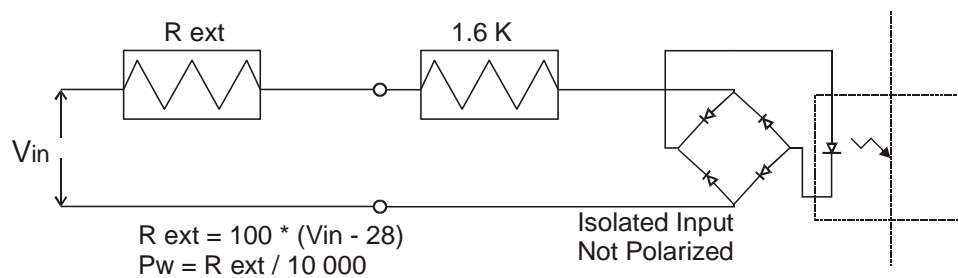
Figure 7. Input voltage range extender resistor

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 www.mccdaq.com/signals/signals.pdf.

Form C relay outputs

The Form C relay has a Common (C), Normally Open (NO) and Normally Closed (NC) contact; see Figure 8.

Figure 8. Form C relay contacts

- 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.

Specifications in *italic text* are guaranteed by design.

Relay specifications

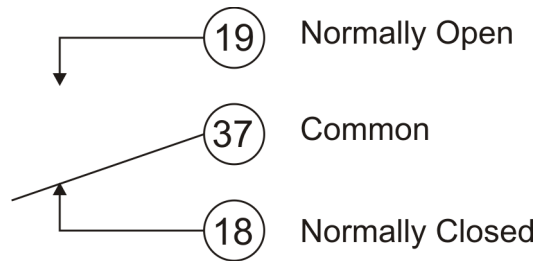Table 1. Relay specifications

Number	16
Contact Configuration	16 Form C
Contact Rating	*6A @ 120VAC or 28VDC resistive (see connector ratings below)*
Contact Resistance	100 milliohms max
Operate Time	*20 milliseconds*
Release Time	*10 milliseconds max*
Vibration	*10 to 55 Hz (Dual amplitude 1.5mm)*
Shock	*10 G (11 milliseconds)*
Dielectric Isolation	*500 V (1 minute)*
Life Expectancy	*10 million mechanical operations, min*
Power on RESET state	Not energized. NC in contact to Common.

Isolated inputs

Table 2. Isolated input specifications

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

Power consumption

Table 3. Power consumption specifications

+5 V power	All relays off	0.7 A typical
	All relays on	2.0 A typical

Environmental

Table 4. Environmental specifications

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

Table 5. Main connector specifications

Connector type	50-pin header
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 the C50FF-x cable)	CIO-MINI50 CIO-TERM100 SCB-50
Compatible accessory products (using the C50-37F-x cable)	CIO-MINI37 CIO-TERMINAL SCB-37
Max current	3 A

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

Table 6. 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 7. 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

CE Declaration of Conformity

Manufacturer:	Measurement Computing Corporation
Address:	10 Commerce Way
	Suite 1008
	Norton, MA 02766
	USA

Category: Information technology equipment.

Measurement Computing Corporation declares under sole responsibility that the product

PCI-PDISO16

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: Electromagnetic Compatibility, EN 61326-1:2006 (IEC 61326-1:2005)

Emissions: Group 1, Class B

- EN55022 (1995)/CISPR 22: Radiated and Conducted emissions.

Immunity: EN61326-1:2006, (IEC 61326-1:2005)

- EN61000-4-2 (2001): Electrostatic Discharge immunity.
- EN61000-4-3 (2002): Radiated Electromagnetic Field immunity.
- EN61000-4-4 (2004): Electric Fast Transient Burst immunity.
- EN61000-4-5 (2001): Surge immunity.
- EN61000-4-6 (2003): Radio Frequency Common Mode immunity.
- EN61000-4-11 (2004): Voltage Dip and Interrupt immunity.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in September, 2001. Test records are outlined in Chomerics Test Report #EMI3053.01. Further testing was conducted by Chomerics Test Services, Woburn, MA. 01801, USA in December, 2008. Test records are outlined in Chomerics Test report #EMI5241.08.

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

Carl Haapaoja, Director of Quality Assurance