

PCle-DIO96H

High-Density, Logic-Level, Digital I/O

User's Guide

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About this User's Guide

This user's guide describes the Measurement Computing PCIe-DIO96H data acquisition device and lists device specifications.

Conventions in this user's guide

For more information

Text presented in a box signifies additional information related to the subject matter.

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

bold text **Bold** text is used for the names of objects on a screen, such as buttons, text boxes, and check boxes.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase.

Where to find more information

Additional information about PCIe-DIO96H hardware is available on our website at www.mccdaq.com. You can also contact Measurement Computing Corporation with specific questions.

- Knowledgebase: kb.mccdaq.com
- Tech support form: www.mccdaq.com/support/support_form.aspx
- Email: techsupport@mccdaq.com
- Phone: 508-946-5100 and follow the instructions for reaching Tech Support

If you need to program at the register level in your application, refer to the *Register Map for the PCIe-DIO96H*. This document is available on our website at www.mccdaq.com/registermaps/RegMapPCIe-DIO96H.pdf.

Introducing the PCIe-DIO96H

Overview: PCIe-DIO96H features

This manual explains how to install and use the PCIe-DIO96H board. The PCIe-DIO96H is a high-density, logic-level digital I/O board designed for PCI Express (PCIe) bus.

The PCIe-DIO96H is fully compatible with software written for the PCI-DIO96H and USB-DIO96H.

The PCIe-DIO96H provides 96 digital I/O lines in four independent port groups. Each digital port group is divided into two 8-bit ports and two 4-bit ports. The PCIe-DIO96H emulates an 82C55 chip in Mode zero. You can configure each port independently for either input or output.

The PCIe-DIO96H outputs are high-drive TTL that can source 15 mA and sink 64 mA. Additional buffering is typically not required to drive external devices. The board has two individual slow blow fuses rated at 1 amp that provide protection for the +5 V User Outputs. A spare fuse is provided.

Each digital port has an associated 10 k resistor network. The board is shipped with each port configured in the pull-up state. You can change the port configuration with software. On power up and reset the configuration of each port is read from EEPROM.

Digital I/O lines are accessed through a 100-pin high-density connector.

The PCIe-DIO96H board is completely plug-and-play, with no jumpers or switches to set. All board addresses are set by the board's plug-and-play software. Board configuration is controlled by your system's BIOS.

Power is provided by the computer's internal 5 V Molex connector.

Functional block diagram

PCIe-DIO96H functions are illustrated in the block diagram shown here.

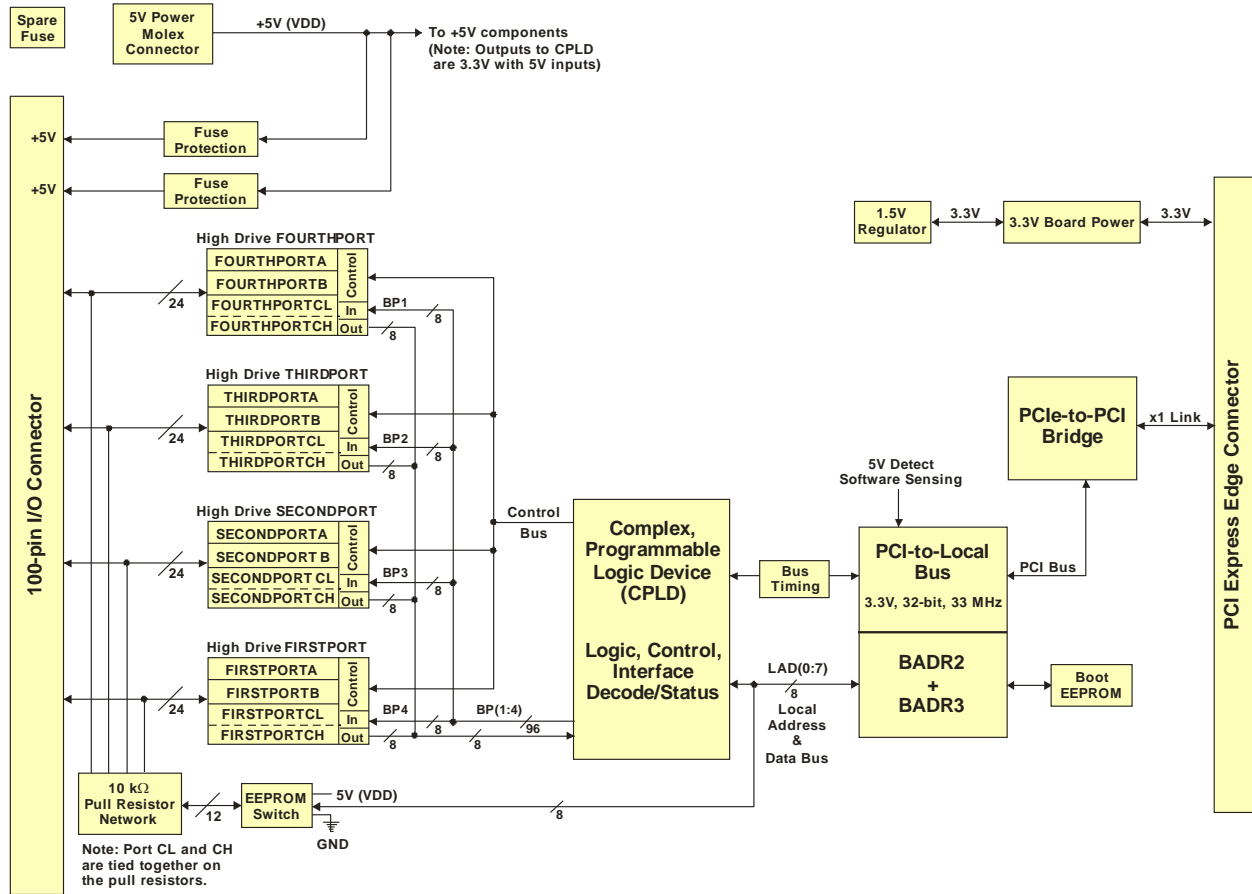


Figure 1. PCIe-DIO96H functional block diagram

Installing the PCIe-DIO96H

What comes with your shipment?

The following items are shipped with the PCIe-DIO96H:

Hardware

- PCIe-DIO96H

Software

- MCC DAQ CD

Documentation

- MCC DAQ Quick Start

This booklet provides an overview of the MCC DAQ software you received with the device, and includes information about installing the software. Please read this booklet completely before installing any software or hardware.

Optional components

- C100FF-x cable
- Signal termination and conditioning accessories

Measurement Computing provides signal termination products for use with the PCIe-DIO96H. Refer to the section "Field wiring and signal termination" on page 12 for compatible accessory products.

Unpacking the PCIe-DIO96H

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the PCIe-DIO96H 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, contact us immediately using one of the following methods:

- Knowledgebase: kb.mccdaq.com
- Tech support form: www.mccdaq.com/support/support_form.aspx
- Email: techsupport@mccdaq.com
- Phone: 508-946-5100 and follow the instructions for reaching Tech Support

For international customers, contact your local distributor. Refer to the International Distributors section on our website at www.mccdaq.com/International.

Installing the software

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

Installing the hardware

The PCIe-DIO96H is completely plug-and-play. There are no switches or jumpers to set on the board. Configuration is controlled by your system's BIOS. Perform the steps to install your board..

Install the MCC DAQ software before you install your board

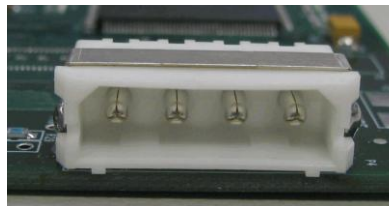
The driver needed to run your board is installed with the MCC DAQ software. Therefore, you need to install the MCC DAQ software before you install your board. Refer to the *Quick Start Guide* for instructions on installing the software.

1. Power off and unplug the computer, and remove the cover to expose the expansion slots.
2. Touch any metal part of the computer to discharge static electricity that may be present. Static electricity can damage the board.
3. Insert the PCIe-DIO96H into an unused x1 PCIe expansion slot.

The PCIe-DIO96H is designed to install into an x1 slot. However, you can also install the board into an unused x4, x8, or x16 PCIe slot.

Caution! Ensure that you install the board into a PCI Express slot. Installing the PCIe-DIO96H into a non-PCIe slot can damage both the board and the computer's motherboard.

4. Connect the board's external power connector to one of the computer's four-pin Molex power connectors. The board's Molex power connections are shown here.



PC +5V
PC Ground
PC Ground
No Connect

Caution! Using an external power supply is not recommended. If external power is used, ensure that the power supply ground or common is at the same ground potential as the computer power supply.

5. Close your computer and turn it on.
A dialog box opens as the system loads, indicating that new hardware has been detected. The information file for this board should have already been loaded onto your PC when you installed the *Measurement Computing Data Acquisition Software* CD supplied with your board, and should be detected automatically by Windows. If you have not installed this software, cancel the dialog and install it now.
6. Run *InstaCal* to test your installation and to configure the pull direction of the digital port resistors.
Refer to the *Quick Start Guide* that came with your board for information on how to initially set up *InstaCal*.

Signal connections

The table below lists the board I/O connector, applicable cables and compatible accessory boards.

Board connectors, cables, accessory equipment

Connector type	100-pin, high-density keyed connector	
Compatible cable	C100FF-x (Figure 2)	
Compatible accessory products with the C100FF-x cable	CIO-MINI50* CIO-SPADE50* CIO-TERM100 SCB-50 * two devices are required	CIO-ERB24 CIO-SERB24/FD CIO-ERB48 CIO-SERB48 SSR-RACK24 SSR-RACK48

The PCIe-DIO96H has a 100-pin, high-density Robinson-Nugent male connector. You can use the C100FF-x cable to split the 100 I/O lines into two 50-pin cables (see Figure 2 on page 11).

Board connector pins 1 to 50 are mapped directly to pins 1 to 50 on the C100FF-x cable's first 50-pin connector. Pins 51 to 100 are mapped directly to pins 1 to 50 on the second 50-pin connector (pin 51 is mapped to pin 1, and pin 100 is mapped to pin 50.) A sample C100FF-x cable configuration is shown in Figure 3 on page 11.

Information on signal connections

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

Caution! When connecting a cable to the board's I/O connector, make sure that the arrow indicating pin 1 on the board connector lines up with the arrow indicating pin 1 on the cable connector. Incorrectly connected cables can damage the board and the I/O controller.

Connector pinout

Main I/O connector pinout

Signal name	Pin		Pin	Signal name
GND	100	••	50	GND
+5V User Output*	99	••	49	+5V User Output*
THIRDPORTC Bit 0	98	••	48	FIRSTPORTC Bit 0
THIRDPORTC Bit 1	97	••	47	FIRSTPORTC Bit 1
THIRDPORTC Bit 2	96	••	46	FIRSTPORTC Bit 2
THIRDPORTC Bit 3	95	••	45	FIRSTPORTC Bit 3
THIRDPORTC Bit 4	94	••	44	FIRSTPORTC Bit 4
THIRDPORTC Bit 5	93	••	43	FIRSTPORTC Bit 5
THIRDPORTC Bit 6	92	••	42	FIRSTPORTC Bit 6
THIRDPORTC Bit 7	91	••	41	FIRSTPORTC Bit 7
THIRDPORTB Bit 0	90	••	40	FIRSTPORTB Bit 0
THIRDPORTB Bit 1	89	••	39	FIRSTPORTB Bit 1
THIRDPORTB Bit 2	88	••	38	FIRSTPORTB Bit 2
THIRDPORTB Bit 3	87	••	37	FIRSTPORTB Bit 3
THIRDPORTB Bit 4	86	••	36	FIRSTPORTB Bit 4
THIRDPORTB Bit 5	85	••	35	FIRSTPORTB Bit 5
THIRDPORTB Bit 6	84	••	34	FIRSTPORTB Bit 6
THIRDPORTB Bit 7	83	••	33	FIRSTPORTB Bit 7
THIRDPORTA Bit 0	82	••	32	FIRSTPORTA Bit 0
THIRDPORTA Bit 1	81	••	31	FIRSTPORTA Bit 1
THIRDPORTA Bit 2	80	••	30	FIRSTPORTA Bit 2
THIRDPORTA Bit 3	79	••	29	FIRSTPORTA Bit 3
THIRDPORTA Bit 4	78	••	28	FIRSTPORTA Bit 4
THIRDPORTA Bit 5	77	••	27	FIRSTPORTA Bit 5
THIRDPORTA Bit 6	76	••	26	FIRSTPORTA Bit 6
THIRDPORTA Bit 7	75	••	25	FIRSTPORTA Bit 7
FOURTHPORTC Bit 0	74	••	24	SECONDPORTC Bit 0
FOURTHPORTC Bit 1	73	••	23	SECONDPORTC Bit 1
FOURTHPORTC Bit 2	72	••	22	SECONDPORTC Bit 2
FOURTHPORTC Bit 3	71	••	21	SECONDPORTC Bit 3
FOURTHPORTC Bit 4	70	••	20	SECONDPORTC Bit 4
FOURTHPORTC Bit 5	69	••	19	SECONDPORTC Bit 5
FOURTHPORTC Bit 6	68	••	18	SECONDPORTC Bit 6
FOURTHPORTC Bit 7	67	••	17	SECONDPORTC Bit 7
FOURTHPORTB Bit 0	66	••	16	SECONDPORTB Bit 0
FOURTHPORTB Bit 1	65	••	15	SECONDPORTB Bit 1
FOURTHPORTB Bit 2	64	••	14	SECONDPORTB Bit 2
FOURTHPORTB Bit 3	63	••	13	SECONDPORTB Bit 3
FOURTHPORTB Bit 4	62	••	12	SECONDPORTB Bit 4
FOURTHPORTB Bit 5	61	••	11	SECONDPORTB Bit 5
FOURTHPORTB Bit 6	60	••	10	SECONDPORTB Bit 6
FOURTHPORTB Bit 7	59	••	9	SECONDPORTB Bit 7
FOURTHPORTA Bit 0	58	••	8	SECONDPORTA Bit 0
FOURTHPORTA Bit 1	57	••	7	SECONDPORTA Bit 1
FOURTHPORTA Bit 2	56	••	6	SECONDPORTA Bit 2
FOURTHPORTA Bit 3	55	••	5	SECONDPORTA Bit 3
FOURTHPORTA Bit 4	54	••	4	SECONDPORTA Bit 4
FOURTHPORTA Bit 5	53	••	3	SECONDPORTA Bit 5
FOURTHPORTA Bit 6	52	••	2	SECONDPORTA Bit 6
FOURTHPORTA Bit 7	51	••	1	SECONDPORTA Bit 7

PCIe slot ↓

* The board has two individual slow blow fuses rated at 1 A. One fuse protects the +5V User Output at pin 49, and one fuse protects the +5V User Output at pin 99.

Cabling

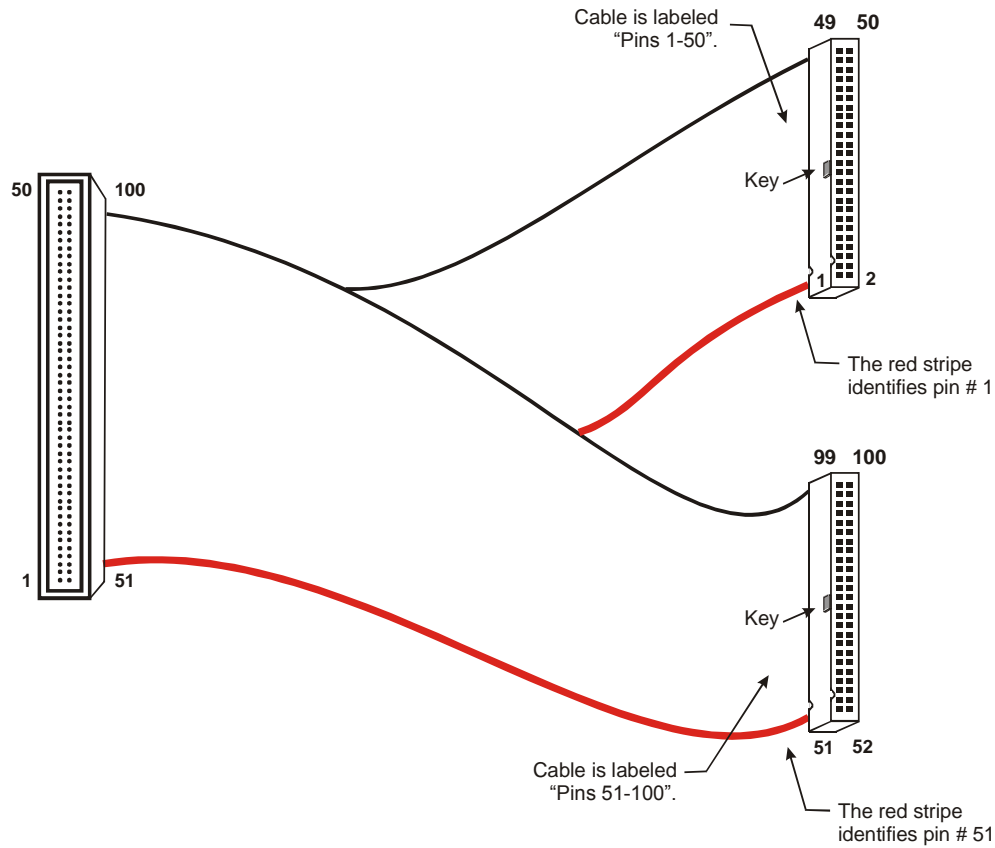


Figure 2. C100FF-x cable

Caution! When connecting the cable to the board's I/O connector, make sure that the arrow indicating pin 1 on the board connector lines up with the arrow indicating pin 1 on the cable connector. Incorrectly connected cables can damage the board and the I/O controller.

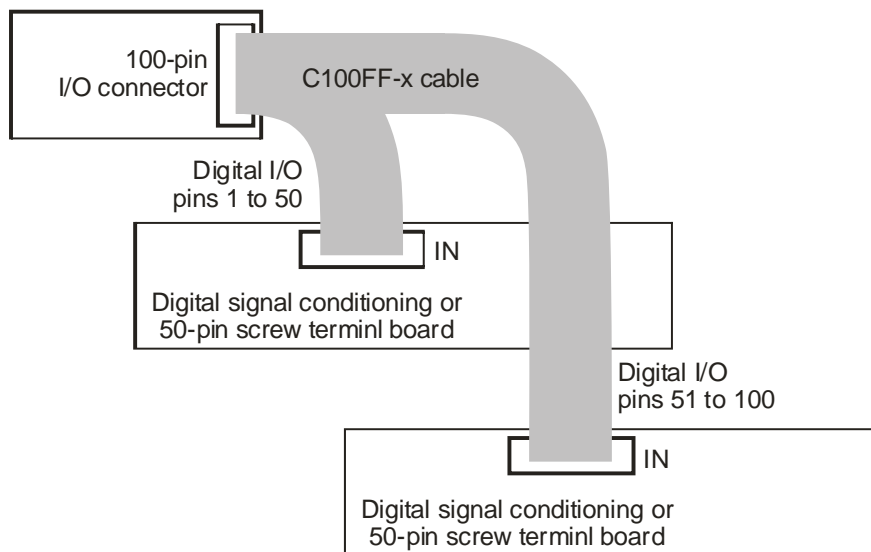


Figure 3. C100FF-x cable configuration

Field wiring and signal termination

You can use the following screw terminal boards to terminate field signals and route them into the PCIe-DIO96H using the C100FF-x cable.

- CIO-MINI50 – 50-pin screw terminal board.
- CIO-TERM100 – 100-pin screw terminal board (two 50-pin IDC connectors).
- CIO-SPADE50 — 16" × 4" termination panel which mates with both 37-pin and 50-pin connectors.
- SCB-50 – 50 conductor, shielded signal connection/screw terminal box provides two independent 50-pin connections.
- CIO-ERB24 – 24 Form C relays, 6 A relay accessory board for digital signal conditioning.
- CIO-SERB24/FD – 24 Form C relays, 10 A, fault detecting relay accessory board with socketed and field-replaceable relays.
- CIO-ERB48 – 48 Form C relays, 6 A, relay, 50-pin accessory board for digital signal conditioning.
- CIO-SERB48 – 48 Form C relays, 10 A relay accessory board with socketed and field-replaceable relays.
- SSR-RACK24 – 24-channel, solid-state relay mounting rack for digital signal conditioning.
- SSR-RACK48 – 48-channel, solid-state relay mounting rack with quad-format modules.

Details on these products are available on our website.

For additional information about digital interfacing

Detailed information regarding digital interfacing is contained in MCC's *Guide to DAQ Signal Connections*. This document is available on our website at www.measurementcomputing.com/signals/signals.pdf.

Functional Details

CIO-ERB24 and SSR-RACK24 daisy chain configuration

Many relay and solid-state relay (SSR) racks provide only 24-bits of digital I/O. You can configure the CIO-ERB24 relay output board and SSR-RACK24 I/O module rack in a daisy chain configuration to use all of the digital I/O bits provided by the PCIe-DIO96H board. An example of the daisy chain configuration scheme for each board is shown below.

The PCIe-DIO96H board provides digital I/O in a group of 96 bits. Each of the C100FF-x cable's 50-pin connectors provides 48 bits. To use all of the board's 96 digital I/O bits to control relays and/or SSRs, configure the daisy chain as shown in Figure 4.

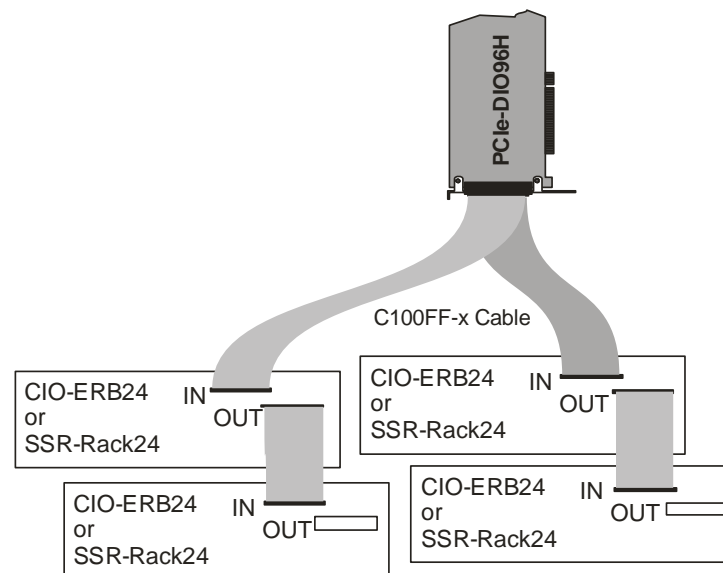


Figure 4. PCIe-DIO96H to C100FF-x to relay rack daisy chain cabling

The 24 digital I/O bits on pins 1-24 control the first relay board on the chain. The 24 digital I/O bits on pins 25-50 control the second relay/SSR board on the daisy chain and so on, for up to 100 pins.

82C55 emulation (mode 0)

The PCIe-DIO96H emulates the 82C55 chip (mode 0). The 82C55 emulation initializes all ports as inputs on power-up and reset. A TTL input is a high impedance input. If you connect another TTL input device to the output, it could be turned on or off every time the board is reset.

To establish a consistent TTL level at power-up, configure each port resistor with *InstaCal* for either pull-up or pull-down.

Whenever an 82C55 emulation is powered on or reset, all pins are set to high-impedance input. Based on standard TTL functionality, these inputs typically float high, and may have enough drive current to turn on external devices. Consequently, if you have output devices such as solid state relays, they may be switched on whenever the computer is powered on or reset. To prevent unwanted switching, and to drive all outputs to a known state after power on or reset, configure each port resistor with *InstaCal*.

Unconnected inputs are forced to the pull direction

Unconnected inputs will float in the pull direction that is configured for the port with *InstaCal* (either up/high or down/low).

Replacing a fuse

The PCIe-DIO96H has two individual 1 amp slow blow fuses. One fuse is connected to the +5V User Output at pin 49, and is labeled **F1** on the board. The second fuse is connected to the +5V User Output at pin 99, and is labeled **F2** on the board. A spare fuse is installed on the board at location **F3**. All fuses are secured to the board with clips for convenient replacement.

A fuse will blow during operation if amperage exceeds 1 amp. If you need to replace a fuse, perform the following procedure.

1. Pry the center of the fuse from the fuse holder clip.
2. Insert the replacement fuse into the fuse holder clip.

Fuse specifications

Refer to the information below to purchase additional fuses, (or an equivalent), if required:

- Manufacturer: Littelfuse®
- Series: 452 Slo-Blo®
- Part number: 0452001. (Include the period as part of the item number.)
- 1 amp, 125 volts, 0.225 Ω
- <http://www.littelfuse.com/part/0452001..html>

Specifications

All specifications are subject to change without notice.

Typical for 25 °C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

Digital input/output

Table 1. Digital I/O specifications

Parameter	Specification
Digital type	8255 emulation, Mode 0
Output	74ABT244
Input	74LV373A
Configuration	8 banks of 8, 8 banks of 4, programmable by bank as input or output
Number of I/O	96
<i>Output high</i>	<i>2.0 volts min @ -15 mA</i>
<i>Output low</i>	<i>0.55 volts max @ 64 mA</i>
<i>Input high</i>	<i>2.0 volts min, 5.5 volts absolute max</i>
<i>Input low</i>	<i>0.8 volts max, -0.5 volts absolute min</i>
Power-up / reset state	Input mode (10 k Ω impedance from pull-up or pull-down)
Pull-up/pull-down resistors	EEPROM stored; software programmable driven by 74ACT244 through 10 k Ω bussed resistor networks (shipped in the pull-up state)

Power consumption

Table 2. Power consumption specifications

Parameter	Specification
+3.3 V operating (bus)	484 mA max (405 mA typ)
+5 V operating (Molex)	1.74 A max (54 mA typ no load)
+5 V user output (Molex)	1 A max per +5 V user output (pins 49 and 99, protected with 1 A slow blow fuse)
+5 V user output Fuse	1 A Littelfuse ® Slo-Blo ® Fuse P/N: 0452001 or equivalent

Environmental

Table 3. Environmental specifications

Parameter	Specification
<i>Operating temperature range</i>	<i>0 °C to 50 °C</i>
<i>Storage temperature range</i>	<i>-35 °C to 80 °C</i>
<i>Humidity</i>	<i>0% to 90% non-condensing</i>

Mechanical

Table 4. Mechanical specifications

Parameter	Specification
Dimensions (L × W × H)	167.6 × 106.6 × 14.48 mm (6.60 × 4.20 × 0.57 in.)

Bus

Table 5. Bus specifications

Parameter	Specification
Bus type	PCI Express 1.0a
Bus width	x1 lane PCI Express

Signal connector

Table 6. Signal connector specifications

Parameter	Specification	
Connector type	100-pin, high-density	
Compatible cables	C100FF-x	
Compatible accessory products	CIO-MINI50 (two devices are required) CIO-TERM100 SCB-50 CIO-ERB24 CIO-SERB24	CIO-ERB48 CIO-SERB48 SSR-RACK24 SSR-RACK48

Table 7. Signal connector pinout

Pin	Signal name	Pin	Signal name
100	GND	50	GND
99	+5V User Output (Note 1)	49	+5V User Output (Note 1)
98	THIRDPORC Bit 0	48	FIRSTPORC Bit 0
97	THIRDPORC Bit 1	47	FIRSTPORC Bit 1
96	THIRDPORC Bit 2	46	FIRSTPORC Bit 2
95	THIRDPORC Bit 3	45	FIRSTPORC Bit 3
94	THIRDPORC Bit 4	44	FIRSTPORC Bit 4
93	THIRDPORC Bit 5	43	FIRSTPORC Bit 5
92	THIRDPORC Bit 6	42	FIRSTPORC Bit 6
91	THIRDPORC Bit 7	41	FIRSTPORC Bit 7
90	THIRDPORC Bit 0	40	FIRSTPORC Bit 0
89	THIRDPORC Bit 1	39	FIRSTPORC Bit 1
88	THIRDPORC Bit 2	38	FIRSTPORC Bit 2
87	THIRDPORC Bit 3	37	FIRSTPORC Bit 3
86	THIRDPORC Bit 4	36	FIRSTPORC Bit 4
85	THIRDPORC Bit 5	35	FIRSTPORC Bit 5
84	THIRDPORC Bit 6	34	FIRSTPORC Bit 6
83	THIRDPORC Bit 7	33	FIRSTPORC Bit 7
82	THIRDPORC Bit 0	32	FIRSTPORC Bit 0
81	THIRDPORC Bit 1	31	FIRSTPORC Bit 1
80	THIRDPORC Bit 2	30	FIRSTPORC Bit 2
78	THIRDPORC Bit 3	29	FIRSTPORC Bit 3
78	THIRDPORC Bit 4	28	FIRSTPORC Bit 4
77	THIRDPORC Bit 5	27	FIRSTPORC Bit 5
76	THIRDPORC Bit 6	26	FIRSTPORC Bit 6
75	THIRDPORC Bit 7	25	FIRSTPORC Bit 7
74	FOURTHPORC Bit 0	24	SECONDPORC Bit 0
73	FOURTHPORC Bit 1	23	SECONDPORC Bit 1
72	FOURTHPORC Bit 2	22	SECONDPORC Bit 2
71	FOURTHPORC Bit 3	21	SECONDPORC Bit 3
70	FOURTHPORC Bit 4	20	SECONDPORC Bit 4
69	FOURTHPORC Bit 5	19	SECONDPORC Bit 5
68	FOURTHPORC Bit 6	18	SECONDPORC Bit 6
67	FOURTHPORC Bit 7	17	SECONDPORC Bit 7
66	FOURTHPORC Bit 0	16	SECONDPORC Bit 0
65	FOURTHPORC Bit 1	15	SECONDPORC Bit 1
64	FOURTHPORC Bit 2	14	SECONDPORC Bit 2
63	FOURTHPORC Bit 3	13	SECONDPORC Bit 3
62	FOURTHPORC Bit 4	12	SECONDPORC Bit 4
61	FOURTHPORC Bit 5	11	SECONDPORC Bit 5
60	FOURTHPORC Bit 6	10	SECONDPORC Bit 6
59	FOURTHPORC Bit 7	9	SECONDPORC Bit 7
58	FOURTHPORTA Bit 0	8	SECONDPORC Bit 0
57	FOURTHPORTA Bit 1	7	SECONDPORC Bit 1
56	FOURTHPORTA Bit 2	6	SECONDPORC Bit 2
55	FOURTHPORTA Bit 3	5	SECONDPORC Bit 3
54	FOURTHPORTA Bit 4	4	SECONDPORC Bit 4
53	FOURTHPORTA Bit 5	3	SECONDPORC Bit 5
52	FOURTHPORTA Bit 6	2	SECONDPORC Bit 6
51	FOURTHPORTA Bit 7	1	SECONDPORC Bit 7

Note 1: Protected by individual slow blow fuses rated at 1 A.

CE Declaration of Conformity
According to ISO/IEC 17050-1:2010

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

Product Category: Electrical equipment for measurement, control and laboratory use.

Measurement Computing Corporation declares under sole responsibility that the product

PCIe-DIO96H

Complies with the essential requirements of the following applicable European Directives:

Electromagnetic Compatibility (EMC) Directive 2004/108/EC
Low Voltage Directive 2006/95/EC
RoHS Directive 2011/65/EU

Conformity is assessed in accordance to the following standards:

EMC:

Emissions:

- EN 61326-1:2006 (IEC 61326-1:2005), Class A
- EN 55011: 2007 (IEC CISPR 11:2003), Group 1, Class A

Immunity:

- EN 61326-1:2006 (IEC 61326-1:2005), Controlled EM Environments
- EN 61000-4-2:2001 (IEC 61000-4-2:2001)
- EN 61000-4-3 :2002 (IEC61000-4-3:2002)
- EN 61000-4-4 :2004 (IEC61000-4-4:2004)
- EN 61000-4-5 :2001 (IEC61000-4-5:2001)
- EN 61000-4-6 :2007 (IEC61000-4-6:2003)
- EN 61000-4-11:2004 (IEC61000-4-11:2004)

Safety:

- EN610101-1 (IEC61010-1)

Environmental Affairs:

Articles manufactured on or after the Date of Issue of this Declaration of Conformity do not contain any of the restricted substances in concentrations/applications not permitted by the RoHS Directive.



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