

# PCle-DIO24

Digital Input/Output

## User's Guide

## Trademark and Copyright Information

Measurement Computing Corporation, InstaCal, Universal Library, and the Measurement Computing logo are either trademarks or registered trademarks of Measurement Computing Corporation. Refer to the Copyrights & Trademarks section on [mccdaq.com/legal](http://mccdaq.com/legal) for more information about Measurement Computing trademarks. Other product and company names mentioned herein are trademarks or trade names of their respective companies.

© 2018 Measurement Computing Corporation. All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form by any means, electronic, mechanical, by photocopying, recording, or otherwise without the prior written permission of Measurement Computing Corporation.

### **Notice**

Measurement Computing Corporation does not authorize any Measurement Computing Corporation product for use in life support systems and/or devices without prior written consent from Measurement Computing Corporation. Life support devices/systems are devices or systems that, a) are intended for surgical implantation into the body, or b) support or sustain life and whose failure to perform can be reasonably expected to result in injury. Measurement Computing Corporation products are not designed with the components required, and are not subject to the testing required to ensure a level of reliability suitable for the treatment and diagnosis of people.

---

# Table of Contents

<b>Preface</b>	
<b>About this User's Guide .....</b>	<b>4</b>
What you will learn from this user's guide .....	4
Conventions in this user's guide .....	4
Where to find more information .....	4
<b>Chapter 1</b>	
<b>Introducing the PCIe-DIO24 .....</b>	<b>5</b>
Functional block diagram .....	6
<b>Chapter 2</b>	
<b>Installing the PCIe-DIO24 .....</b>	<b>7</b>
Unpacking.....	7
Installing the software .....	7
Installing the hardware .....	7
Signal connections.....	8
Connector pinout.....	8
Cabling.....	9
Field wiring and signal termination .....	9
<b>Chapter 3</b>	
<b>Functional Details .....</b>	<b>10</b>
82C55 emulation.....	10
Replacing a fuse.....	10
Fuse specifications.....	10
Logic level switch.....	10
<b>Chapter 4</b>	
<b>Specifications .....</b>	<b>11</b>
Digital input/output.....	11
Power consumption .....	11
Environmental .....	12
Mechanical .....	12
Bus.....	12
Signal connector .....	12
<b>Declaration of Conformity .....</b>	<b>14</b>

---

## About this User's Guide

### What you will learn from this user's guide

This user's guide describes the Measurement Computing PCIe-DIO24 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-DIO24 hardware is available on our website at [www.mccdaq.com](http://www.mccdaq.com). You can also contact Measurement Computing Corporation with specific questions.

- Knowledgebase: [kb.mccdaq.com](http://kb.mccdaq.com)
- Tech support form: [www.mccdaq.com/support/support\\_form.aspx](http://www.mccdaq.com/support/support_form.aspx)
- Email: [techsupport@mccdaq.com](mailto: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](http://www.mccdaq.com/International).

If you need to program at the register level in your application, refer to the *Register Map for the PCIe-DIO24* on our website at [www.mccdaq.com/registermaps/RegMapPCIe-DIO24.pdf](http://www.mccdaq.com/registermaps/RegMapPCIe-DIO24.pdf).

---

## Introducing the PCIe-DIO24

This manual explains how to install and use the PCIe-DIO24 board. The PCIe-DIO24 is a digital I/O board designed for the PCI Express (PCIe) bus.

The PCIe-DIO24 provides 24 lines of digital I/O with selectable 3.3 V and 5 V logic levels. The 24 DIO lines are organized into three groups of 8-bits each (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). The direction of each port is independently configurable with software for either input or output. Digital outputs are HC logic and can source and sink 2.5 mA.

The PCIe-DIO24 has a 10 k resistor network associated with each digital port. You can configure each port for pull-up or pull-down with software. On power up and reset the configuration of each port is read from EEPROM. The board is shipped with each port configured in the pull-up state.

### **82C55 support for mode 0 only**

The PCIe-DIO24 emulates the 82C55 Programmable Peripheral Interface (PPI) chip. The PCIe-DIO24 hardware, Universal Library software, and Windows driver support mode 0 only.

Digital I/O lines are accessible through a 37-pin D-type connector. The board has two individual slow blow fuses rated at 0.375 amp to protect the +V<sub>DIO</sub> and +12V outputs on the connector. One spare fuse is provided.

Software programs written with the Universal Library for the USB-DIO24/37, PCI-DIO24 and CIO-DIO24 devices are fully compatible with the PCIe-DIO24.

Power is provided by the PCI Express slot. The PCIe-DIO24 board is completely plug-and-play. All board addresses are set by the board's plug-and-play software. Board configuration is controlled by the system BIOS.

# Functional block diagram

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

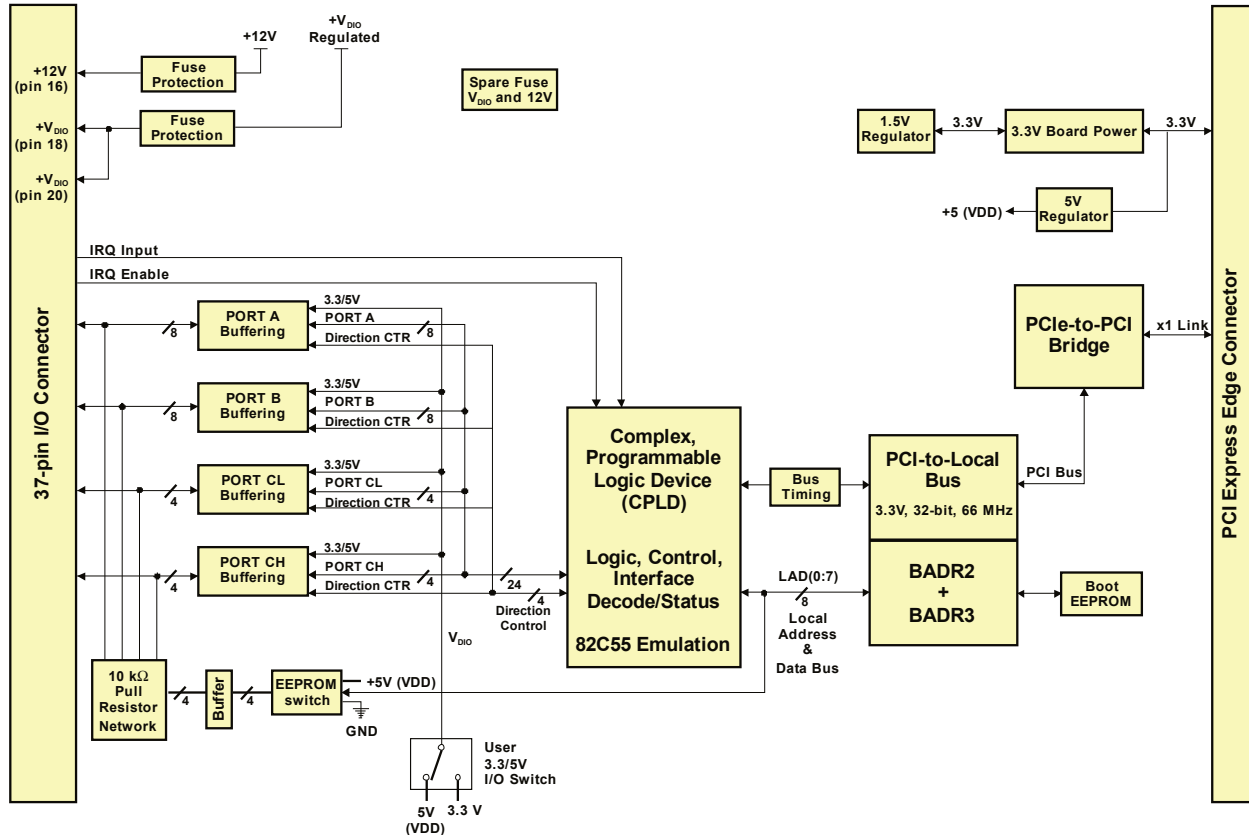


Figure 1. PCIe-DIO24 functional block diagram

# Installing the PCIe-DIO24

## Unpacking

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

Contact us immediately if any components are missing or damaged.

## Installing the software

Refer to the MCC DAQ Quick Start and the PCIe-DIO24 product page on our website for information about the software supported by the device.

### **Install the software before you install your device**

The driver needed to run the PCIe-DIO24 is installed with the software. Therefore, you need to install the software package you plan to use before you install the hardware.

## Installing the hardware

The PCIe-DIO24 is completely plug-and-play. Configuration is controlled by your system's BIOS. To install your board, follow the steps below.

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-DIO24 into an unused x1 PCIe expansion slot.

The PCIe-DIO24 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 PCIe slot. Installing the PCIe-DIO24 into a non-PCIe slot can damage both the board and the computer motherboard.

4. 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 MCC DAQ software, and should be detected automatically by Windows. If you have not installed this software, cancel the dialog and install it now.
5. Run InstaCal to test your installation and to configure the pull direction of the digital port resistors.  
Refer to the MCC DAQ Quick Start 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	37-pin D-type	
Compatible cables	C37FF-x unshielded ribbon cable. x = length in feet. (see Figure 3) C37FFS-x cable shielded round cable. x = length in feet. (see Figure 4)	
Compatible accessory products (with the C37FF-x or C37FFS-x cable)	SCB-37 CIO-MINI37 CIO-MINI37-VERT CIO-ERB08	CIO-SERB08 CIO-ERB24 SSR-RACK08 SSR-RACK24

### Connector pinout

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 logic level switch sets the logic level for either 3.3V or 5V; refer to page 10 for switch information.

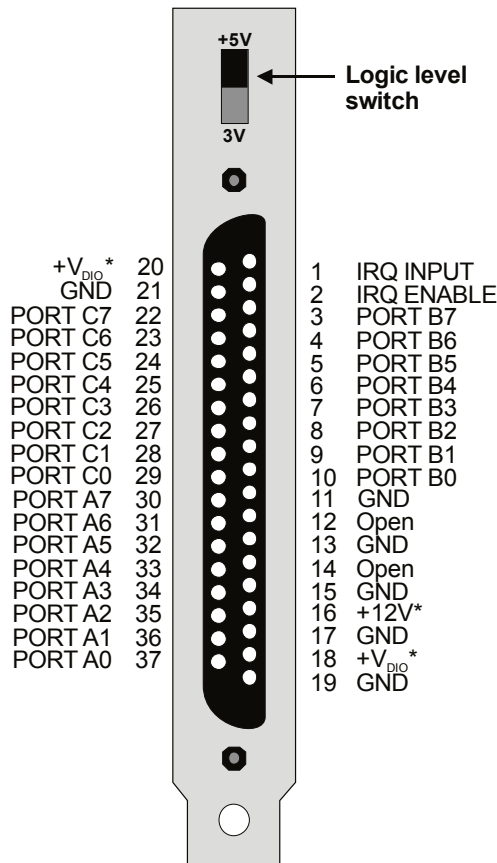


Figure 2. I/O connector

\* The board has two individual slow blow fuses rated at 1 A. One fuse protects the 12V output at pin 16, and one fuse protects both +V<sub>DIO</sub> outputs at pin 18 and pin 20.



## Cabling

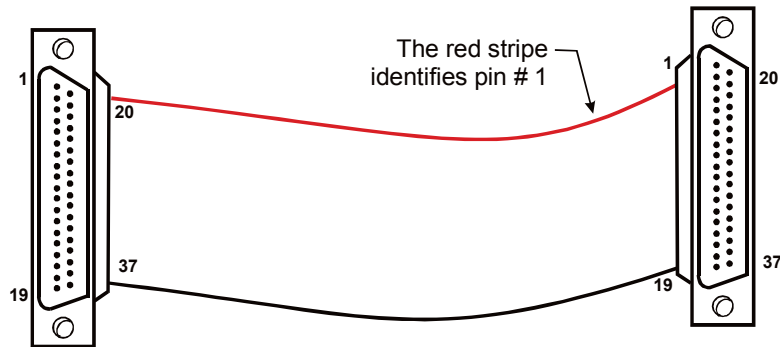


Figure 3. C37FF-x cable

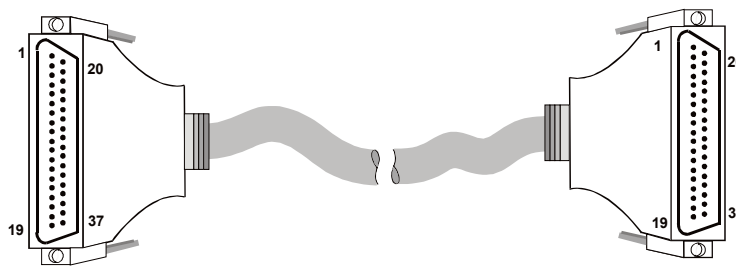


Figure 4. C37FFS-x cable

## Field wiring and signal termination

You can use the following MCC screw terminal boards and relay racks with the PCIe-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.
- 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.
- 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 website](#).

### More information about digital interfacing

Detailed information regarding digital interfacing is contained in the *Guide to DAQ Signal Connections* on our website at [www.mccdaq.com/support/DAQ-Signal-Connections.aspx](http://www.mccdaq.com/support/DAQ-Signal-Connections.aspx).

## Functional Details

### 82C55 emulation

The PCIe-DIO24 emulates the 82C55 Programmable Peripheral Interface (PPI) chip. The PCIe-DIO24 hardware, Universal Library software, and Windows driver support mode 0 only.

Whenever the board 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 float 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-DIO24 has two individual 0.375 amp slow blow fuses. One fuse is connected to the 12V output at pin 16, and is labeled **F7** on the board. The second fuse is connected to both +V<sub>DIO</sub> outputs at pin 18 and pin 20, and is labeled **F6** on the board. A spare fuse is installed on the board at location **F4**. All fuses are secured to the board with clips for convenient replacement.

A fuse will blow during operation if amperage exceeds 0.375 amp. If you need to replace a fuse, perform the following procedure.

1. Hold the center of the blown fuse and pry it 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, if required:

- Manufacturer: Littelfuse®
- Type: 452 Series NANO<sup>2</sup>® Slo-Blo<sup>®</sup> Subminiature Surface Mount Fuse
- Part number: 0452.375
- 0.375 amp, 125 volts, 1.2 Ω

### Logic level switch

Use switch S1 to set the logic level for either 3.3V or 5V (default). The switch is located above the I/O connector (see Figure 2 on page 8).



Figure 5. Logic level select switch

## Specifications

All specifications are subject to change without notice.  
Typical for 25 °C unless otherwise specified.

### Digital input/output

Table 1. Digital I/O specifications

Parameter	Specification	
Digital type	82C55 Emulation (mode 0 only)	
Configuration	2 banks of 8, 2 banks of 4, programmable by bank as input or output	
Output	Ports A and B: 74HC245A Port C: 74HC126	
Input	Ports A and B: 74HC245A Port C: 74HC125	
Number of channels	24 I/O	
Switch state	Board silk screen reference: S1 – Default +5V	
Output high	3.3 V	2.8 volts min @ -2.5 mA
Output low		0.3 volts max @ 2.5 mA
Input high		2.6 volts min, 3.6 volts absolute max
Input low		1.3 volts max, -0.5 volts absolute min
Output high	5 V	4.5 volts min @ -2.5 mA
Output low		0.3 volts max @ 2.5 mA
Input high		2.6 volts min, 5.5 volts absolute max
Input low		1.3 volts max, -0.5 volts absolute min
Power-up /reset state	Input mode (10 kΩ impedance from pull-up or pull-down)	
Pull-up/pull-down resistors	EEPROM stored; software programmable driven by 74ACT244 through 10 kΩ bussed resistor networks (shipped in the pull-up state)	
Interrupt enable	External (IRQ ENABLE, active low, disabled by default through internal resistor to TTL high) and programmable through PCI9030; 0 = disabled, 1 = enabled (default)	
Interrupt sources	External source (IRQ INPUT), polarity programmable through PCI9030; 1 = active high, 0 = active low (default)	

### Power consumption

Table 2. Power consumption specifications

Parameter	Specification
+3.3 V operating	515 mA typ
+3.3 V with 5 V I/O	520 mA typ
+V <sub>DIO</sub> User output	125 mA max @ +5V; 375 mA max @ +3.3 V
Fuses	+V <sub>DIO</sub> User output and +12 V: Littelfuse 0.375A NANO <sup>2</sup> ® Slo-Blo <sup>®</sup> Subminiature Surface Mount Fuse; art number <a href="#">0452.375</a>

## Environmental

Table 3. Environmental specifications

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

## Mechanical

Table 4. Environmental specifications

Parameter	Specification
Dimensions (L × W × H)	167.4 × 111.2 × 18.72 mm (6.60 × 4.38 × 0.74 in.)

## Bus

Table 5. Bus specifications

Parameter	Specification
Bus Type	PCI Express 1.1
Bus Width	x1 lane PCI Express

## Signal connector

Table 6. Main connector specifications

Parameter	Specification	
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	
Compatible accessory products with S1 in the +5 V position(with the C37FF-x or C37FFS-x cable)	CIO-ERB08 CIO-SERB08 CIO-ERB24	SSR-RACK08 SSR-RACK24

Table 7. Signal connector pinout

Pin	Signal Name	Pin	Signal Name
1	IRQ INPUT	20	+V <sub>DIO</sub> (Note 1)
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	OPEN	33	Port A4
15	GND	34	Port A3
16	+12V (Note 1)	35	Port A2
17	GND	36	Port A1
18	+V <sub>DIO</sub> (Note 1)	37	Port A0
19	GND		

**Note 1:** Protected by slow blow fuses rated at 0.375 A. One fuse protects pin 16 (+12V), and the second fuse protects pin 18 (+V<sub>DIO</sub>) and pin 20 (+V<sub>DIO</sub>).

**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.  
Date and Place of Issue: September 12, 2014, Norton, Massachusetts USA

Measurement Computing Corporation declares under sole responsibility that the product

**PCIe-DIO24**

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.



Carl Haapaoja, Director of Quality Assurance

**Measurement Computing Corporation**  
**10 Commerce Way**  
**Norton, Massachusetts 02766**  
**(508) 946-5100**  
**Fax: (508) 946-9500**  
**E-mail: [info@mccdaq.com](mailto:info@mccdaq.com)**  
**[www.mccdaq.com](http://www.mccdaq.com)**

**NI Hungary Kft**  
**H-4031 Debrecen, Hátar út 1/A, Hungary**  
**Phone: +36 (52) 515400**  
**Fax: +36 (52) 515414**  
**<http://hungary.ni.com/debrecen>**