

# PCI-DIO24H

24-bit, High-Output Drive, Digital I/O

## 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.

© 2019 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         |
| Register map .....                               | 4         |
| <b>Chapter 1</b>                                 |           |
| <b>Introducing the PCI-DIO24H.....</b>           | <b>5</b>  |
| Functional block diagram .....                   | 5         |
| <b>Chapter 2</b>                                 |           |
| <b>Installing the PCI-DIO24H.....</b>            | <b>6</b>  |
| Unpacking.....                                   | 6         |
| Installing the software .....                    | 6         |
| Installing the hardware .....                    | 6         |
| Configuring the hardware.....                    | 6         |
| Signal connections.....                          | 7         |
| Connector pinout.....                            | 7         |
| Cabling.....                                     | 8         |
| Field wiring and signal termination .....        | 8         |
| <b>Chapter 3</b>                                 |           |
| <b>Functional Details .....</b>                  | <b>9</b>  |
| DIO signals .....                                | 9         |
| Signal level control.....                        | 9         |
| <b>Chapter 4</b>                                 |           |
| <b>Specifications .....</b>                      | <b>11</b> |
| Power consumption .....                          | 11        |
| Digital I/O.....                                 | 11        |
| Environmental .....                              | 11        |
| Signal connector .....                           | 12        |
| <b>Declaration of Conformity .....</b>           | <b>13</b> |

---

## About this User's Guide

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

This user's guide describes the Measurement Computing PCI-DIO24H data acquisition device and lists device specifications.

### Conventions in this user's guide

**For more information**

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.

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

*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 the PCI-DIO24H is available on our website at [www.mccdaq.com](http://www.mccdaq.com). You can also contact Measurement Computing Corporation by phone, fax, or email 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).

For additional information relevant to the operation of your hardware, refer to the *Documents* subdirectory where you installed the MCC DAQ software (C:\Program Files\Measurement Computing\DAQ by default), or search for your device on our website at [www.mccdaq.com](http://www.mccdaq.com).

### Register map

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 on our website at [www.mccdaq.com/registermaps/RegMapPCI-DIO24X.pdf](http://www.mccdaq.com/registermaps/RegMapPCI-DIO24X.pdf).

# Introducing the PCI-DIO24H

This manual explains how to install and use the PCI-DIO24H board. The PCI-DIO24H is a high output drive, logic-level digital I/O board designed for the PCI-bus.

The PCI-DIO24H provides 24-bits of digital I/O in three eight-bit ports (Port A, Port B, and Port C) based on an 82C55 mode 0 emulation. 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 digital inputs are LSTTL. The output signals are buffered high output drive TTL. The digital output drivers are 74S244 chips that can sink 64 mA and source 15 mA. The input buffers are 74LS373 chips and have standard high input impedance of the 74LS series devices.

All 24 I/O lines are accessible through the board's 37-pin connector.

**82C55 Mode 0 programming supported**

The PCI-DIO24H supports 82C55 Mode 0 programming only.

## Functional block diagram

PCI-DIO24H functions are illustrated in the block diagram shown here.

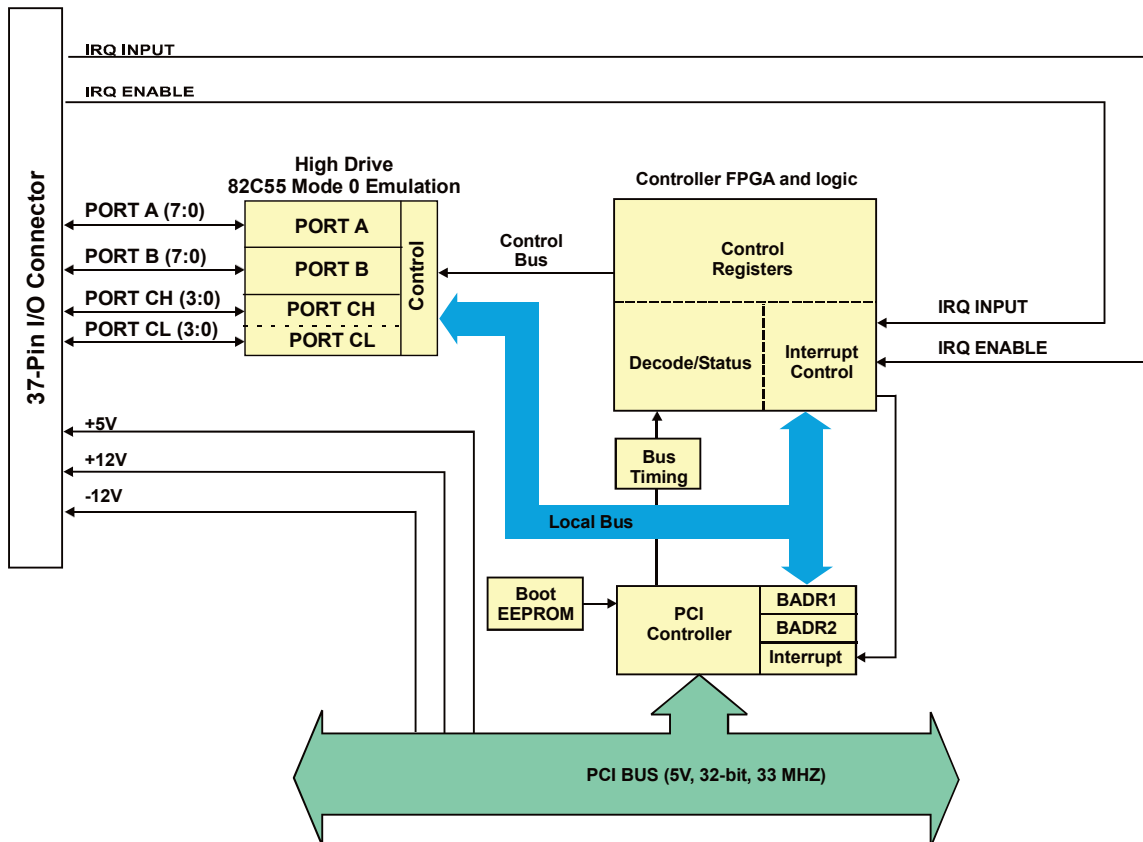


Figure 1. Functional block diagram

## Installing the PCI-DIO24H

### 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 PCI-DIO24H product page on our website for information about the software supported by the PCI-DIO24H.

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

The driver needed to run the PCI-DIO24H 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 PCI-DIO24H board is completely plug-and-play, with no switches or jumpers to set. Configuration is controlled by your system's BIOS. Perform the following procedure 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.

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.

When connected for the first time, a **Found New Hardware** dialog opens when the operating system detects the device. When the dialog closes, the installation is complete. If you have not installed the MCC DAQ software, cancel the dialog and install it now.

3. To test your installation and configure your board, run the InstaCal utility installed with MCC DAQ software. Refer to the Quick Start Guide for information on how to initially set up and load InstaCal.

### Configuring the hardware

All hardware configuration options on the PCI-DIO24H are software controlled.

## Signal connections

The table below lists the board connector type, applicable cables, and compatible products for the PCI-DIO24H.

Board connectors, cables, and accessory equipment

|  |  |
|--|--|
| Connector type   | 37-pin D-type  |
| Compatible cables  | <ul style="list-style-type: none"> <li>■ C37FF-x unshielded ribbon cable. x = length in feet. (see Figure 3)</li> <li>■ C37FFS-x shielded round cable. x = length in feet. (see Figure 4)</li> </ul> |
| Compatible accessory products (with the C37FF-x or C37FFS-x cable) | SCB-37<br>CIO-MINI37<br>CIO-MINI37-VERT<br>CIO-ERB08<br>CIO-SERB08<br>CIO-ERB24<br>CIO-SPADE50<br>SSR-RACK08<br>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 pin out is identical to the CIO-DIO24, except that -5 VDC is not brought out. The PCI-DIO24H board's I/O connector is shown in Figure 2.

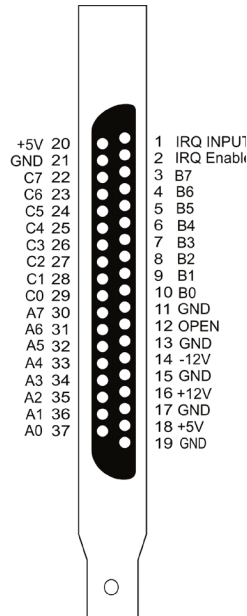


Figure 2. PCI-DIO24H board connector pinout

#### Information on signal connections

General information regarding signal connection and configuration is available 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).

## Cabling

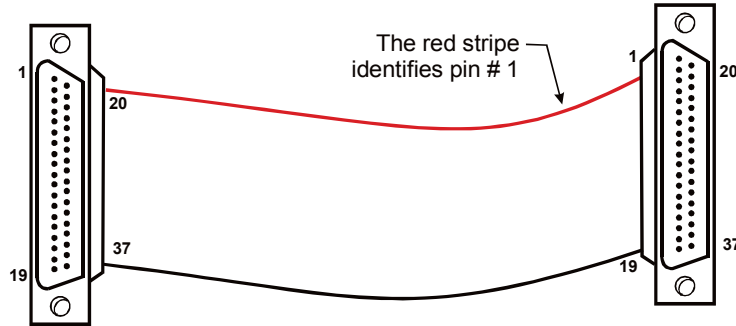


Figure 3. C37FF-x cable

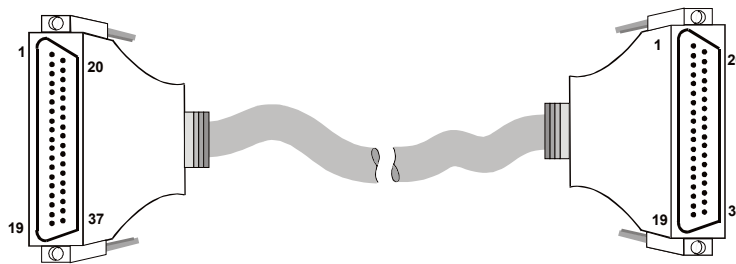


Figure 4. C37FFS-x cable

## Field wiring and signal termination

You can connect the PCI-DIO24H to the following termination boards 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.
- CIO-SPADE50 — 16" X 4" termination panel which mates with both 37-pin and 50-pin connectors.

Details on these products are available on our website.

The following relay racks and accessory boards can be used with the PCI-DIO24H:

- 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.



## Functional Details

### DIO signals

The PCI-DIO24H signals are buffered (high output drive) TTL. Voltages and currents associated with external devices are usually far greater than can be supplied from a PCI-DIO24H.

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

The emulated 82C55 mode 0 circuit 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-DIO24H has open locations where you can install a 2.2 K $\Omega$ , eight-resistor single inline package (SIP) resistor network for each port. The SIP is made up of eight 2.2 K $\Omega$  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 5).

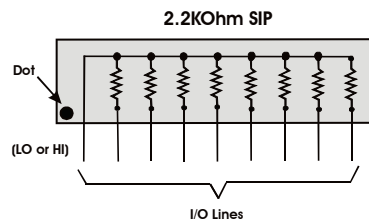


Figure 5. Eight-resistor SIP schematic

Install the SIP on the PCI-DIO24H board at the locations labeled **PORT A**, **PORT B** and **PORT C** (adjacent to the 37-pin connector). Figure 6 shows a schematic of an SIP installed in both the pull-up and pull-down positions.

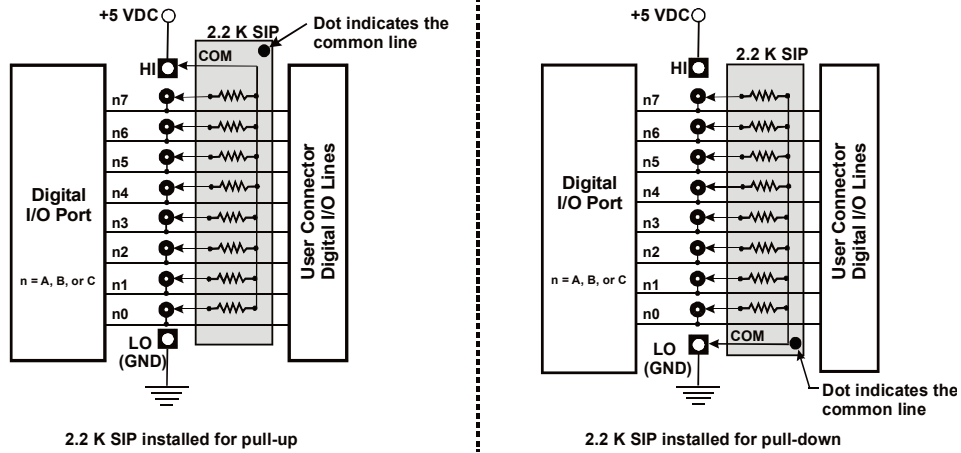


Figure 6. Pull-up and pull-down resistor SIP schematic

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

All specifications are subject to change without notice.

Typical for 25 °C unless otherwise specified.

### Power consumption

Table 1. Power consumption specifications

| Parameter     | Specification              |
|---------------|----------------------------|
| +5V operating | 625 mA typical, 960 mA max |

### Digital I/O

Table 2. DIO specifications

| Parameter              | Specification  |
|------------------------|--|
| Digital type           | 8255 mode 0 emulation  |
| Output                 | 74S244   |
| Input                  | 74LS373  |
| Configuration          | 2 banks of 8, 2 banks of 4, programmable by bank as input or output  |
| Number of channels     | 24 I/O   |
| Output high            | 2.4 volts min @ -15 mA   |
| Output low             | 0.5 volts max @ 64 mA  |
| Input high             | 2.0 volts min, 7 volts absolute max  |
| Input low              | 0.8 volts max, -0.5 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:<br>0 = disabled<br>1 = enabled (default) |
| Interrupt sources      | External source (IR INPUT), polarity programmable through PCI9052:<br>1 = active high<br>0 = active low (default)  |

### Environmental

Table 3. Environmental specifications

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

## Signal connector

Table 4. Signal connector specifications

| Parameter  | Specification  |
|--|--|
| Connector type   | 37-pin D-type  |
| Compatible cables  | C37FF-x unshielded ribbon cable. x = length in feet.<br>C37FFS-x shielded round cable. x = length in feet.                 |
| Compatible accessory products (with the C37FF-x or C37FFS-x cable) | SCB-37<br>CIO-MINI37<br>CIO-MINI37-VERT<br>CIO-ERB08<br>CIO-SERB08<br>CIO-ERB24<br>CIO-SPADE50<br>SSR-RACK08<br>SSR-RACK24 |

Table 5. Connector pinout

| 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  
Norton, MA 02766  
USA  
Category: Electrical equipment for measurement, control and laboratory use.

Measurement Computing Corporation declares under sole responsibility that the product

## PCI-DIO24H

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: General Requirements, EN 61326-1:2006 (IEC 61326-1:2005).

Emissions:

- EN 55011 (2007) / CISPR 11(2003): Radiated emissions: Group 1, Class A
- EN 55011 (2007) / CISPR 11(2003): Conducted emissions: Group 1, Class A

Immunity: EN 61326-1:2006, Table 3.

- IEC 61000-4-2 (2001): Electrostatic Discharge immunity.
- IEC 61000-4-3 (2002): Radiated Electromagnetic Field immunity.
- IEC 61000-4-4 (2004): Electric Fast Transient Burst Immunity.
- IEC 61000-4-5 (2001): Surge Immunity.
- IEC 61000-4-6 (2003): Radio Frequency Common Mode Immunity.
- IEC 61000-4-11 (2004): Voltage Interrupts.

To maintain compliance to the standards of this declaration, the following conditions must be met.

- The host computer, peripheral equipment, power sources, and expansion hardware must be CE compliant.
- All I/O cables must be shielded, with the shields connected to ground.
- I/O cables must be less than 3 meters (9.75 feet) in length.
- The host computer must be properly grounded.
- Equipment must be operated in a controlled electromagnetic environment as defined by Standards EN 61326-1:2006, or IEC 61326-1:2005.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in March, 2009. Test records are outlined in Chomerics Test Report #EMI5299.09.

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



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>**