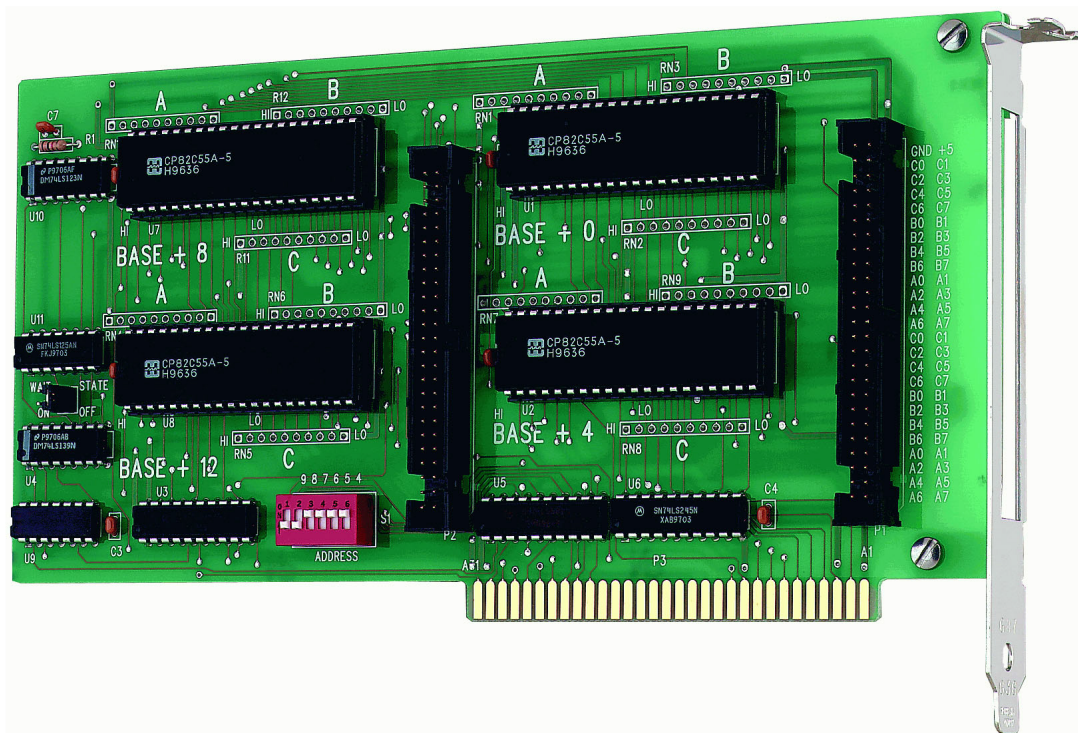


# CIO-DIO96

96 Digital I/O bits, TTL Level, Four 82C55 Chips

## User's Guide



# **CIO-DIO96**

## **Digital Input/Output Board**

### **User's Guide**



**MEASUREMENT  
COMPUTING™**

Document Revision 1A, December, 2006  
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## About this User's Guide

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

This user's guide describes the Measurement Computing CIO-DIO96 data acquisition board 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 CIO-DIO96 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).

# Introducing the CIO-DIO96

## Overview: CIO-DIO96 features

The CIO-DIO96 is a 96-bit digital I/O board with four 82C55 parallel-interface chips. The board provides the 96 bits in 24-bit groups based on the 82C55 specification.

Each 82C55 chip controls 24 CMOS/TTL-compatible digital I/O pins. Each 24-bit group is divided into three eight-bit ports, or two 8-bit ports and two 4-bit ports. Each port is programmable for input or output.

All I/O bits are set to input mode (high impedance) on power up and reset. Locations are available for installing pull-up or pull-down resistors.

All signals pass through a 50-pin connector.

## Software features

For information on the features of *InstaCal* and the other software included with your CIO-DIO96, 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](http://www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf).

Check [www.mccdaq.com/download.htm](http://www.mccdaq.com/download.htm) for the latest software version.

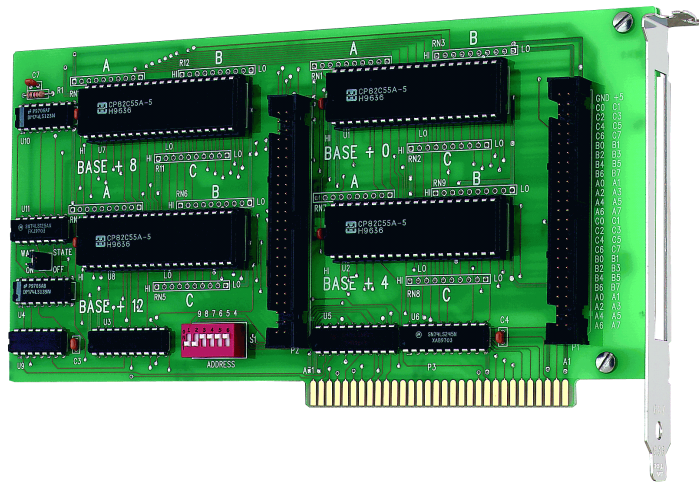
## Installing the CIO-DIO96

### What comes with your CIO-DIO96 shipment?

The following items are shipped with the CIO-DIO96.

#### Hardware

- CIO-DIO96

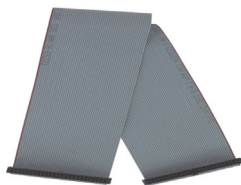


#### Additional documentation

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](http://www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf)). This booklet supplies a brief description of the software you received with your CIO-DIO96 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

### Optional components

- Cables



C50FF-x

- Signal termination and conditioning accessories  
MCC provides signal conditioning and termination products for use with the CIO-DIO96. Refer to [Field wiring, signal termination, and conditioning](#) on page 13 for a complete list of compatible accessory products.



## Unpacking the CIO-DIO96

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the CIO-DIO96 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](mailto: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](http://www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf).

## Configuring the base address switch

The CIO-DIO96 employs the PC bus for power, communications and data transfer. As such, it draws power from the PC, monitors the address lines and control signals, responds to its I/O address, and receives and places data on the eight data lines.

The CIO-DIO96 has one bank of base address-select switches, and one wait-state jumper. Verify their settings before installing the board in your computer.

### Base address switch

The easiest way to set the base address is to let *InstaCal* show you the correct settings. However, if you are already familiar with setting ISA base addresses, you may use the base address switch description below to guide your base address selection.

The base address is the starting location that software writes to when communicating with the CIO-DIO96. A set of DIP switches is used to set the base address. By placing the switch down, the CIO-DIO96 address decode logic is instructed to respond to that address bit. A complete address is constructed by calculating the HEX or decimal number which corresponds to all the address bits the board has been instructed to respond to.

The board is shipped with the base address set to 300 hex (see Figure 1). Unless there is already a board in your system that uses address 300 hex (768 decimal), leave the switches as they were set at the factory.



Figure 1. Base address switch

In the default configuration, addresses 9 and 8 are *down*, and all others are *up*. Address 9 = 200 hex (512 decimal), and address 8 = 100 hex (256 decimal). When added together they equal 300 hex (768 decimal).

**Disregard the numbers printed on the switch**

When setting the base address, refer to the numbers printed in white on the printed circuit board.

## PC I/O Address Summary

| Hex Range | Function                 | Hex Range | Function         |
|-----------|--------------------------|-----------|------------------|
| 000-00F   | 8237 DMA #1              | 2C0-2CF   | EGA              |
| 020-021   | 8259 PIC #1              | 2D0-2DF   | EGA              |
| 040-043   | 8253 TIMER               | 2E0-2E7   | GPIB (AT)        |
| 060-063   | 8255 PPI (XT)            | 2E8-2EF   | SERIAL PORT      |
| 060-064   | 8742 CONTROLLER (AT)     | 2F8-2FF   | SERIAL PORT      |
| 070-071   | CMOS RAM & NMI MASK (AT) | 300-30F   | PROTOTYPE CARD   |
| 080-08F   | DMA PAGE REGISTERS       | 310-31F   | PROTOTYPE CARD   |
| 0A0-0A1   | 8259 PIC #2 (AT)         | 320-32F   | HARD DISK (XT)   |
| 0A0-0AF   | NMI MASK (XT)            | 378-37F   | PARALLEL PRINTER |
| 0C0-0DF   | 8237 #2 (AT)             | 380-38F   | SDLC             |
| 0F0-0FF   | 80287 NUMERIC CO-P (AT)  | 3A0-3AF   | SDLC             |
| 1F0-1FF   | HARD DISK (AT)           | 3B0-3BB   | MDA              |
| 200-20F   | GAME CONTROL             | 3BC-3BF   | PARALLEL PRINTER |
| 210-21F   | EXPANSION UNIT (XT)      | 3C0-3CF   | EGA              |
| 238-23B   | BUS MOUSE                | 3D0-3DF   | CGA              |
| 23C-23F   | ALT BUS MOUSE            | 3E8-3EF   | SERIAL PORT      |
| 270-27F   | PARALLEL PRINTER         | 3F0-3F7   | FLOPPY DISK      |
| 2B0-2BF   | EGA                      | 3F8-3FF   | SERIAL PORT      |

You can set the base address switch to any address in the range of 000-3F8. If you are not using IBM prototyping cards or another board which occupies these addresses, 300-31Fh are also free to use.

Addresses not specifically listed, such as 390-39Fh, are not reserved and may be available. Check your computer for other boards which may use I/O addresses.

**Wait state jumper**

The CIO-DIO96 board has a wait state jumper which you can set to enable an on-board wait state generator. A wait state is an extra delay injected into the processor's clock via the bus. This delay slows down the processor when the processor addresses the CIO-DIO96 board, so that signals from slow devices (chips) are valid.

The jumper is shown in Figure 2 configured for OFF (wait state is disabled).

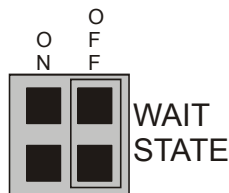


Figure 2. Wait state jumper

The wait state generator is only active when the CIO-DIO96 is being accessed. Your PC will not be slowed down in general by using the wait state.

Because all PC expansion board buses are slowed to either 8 MHz or 10 MHz, the wait state generally is not required. If you experience sporadic failures, try enabling the wait state generator.

## Installing the CIO-DIO96

After you configure the base address, you can install the CIO-DIO96 into your computer. 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.

1. Turn your computer off, open it up, and insert your board into an available ISA slot.
2. Close your computer and turn it on.
3. To test your installation and configure your board, run the *InstaCal* utility you installed in the previous section. Refer to the *Quick Start Guide* that came with your board [www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf](http://www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf) for information on how to initially set up and load *InstaCal*.

## Connecting the board for I/O operations

### Connectors, cables – main I/O connector

The table below lists the board connector, applicable cables, and compatible accessory products.

Board connector, cables, and accessory equipment

|  |  |
|--|--|
| Connector type                                       | (2) 50-pin shrouded male header connectors: P1 and P2  |
| Compatible cables                                    | C50FF-x  |
| Compatible accessory products with the C50FF-x cable | CIO-TERM100-pin<br>CIO-SPADE50<br>CIO-MINI50<br>SSR-RACK24, SSR-RACK48<br>CIO-ERB24, CIO-ERB48 |

### Pinout – main I/O connectors

The CIO-DIO96 connector has two standard 50-pin header connectors (P1 and P2) that are accessible through the PC/AT expansion bracket.

Connect FIRSTPORT and SECONDPORT signals to connector P1. Connect THIRDPORT and FOURTHPORT signals to connector P2.

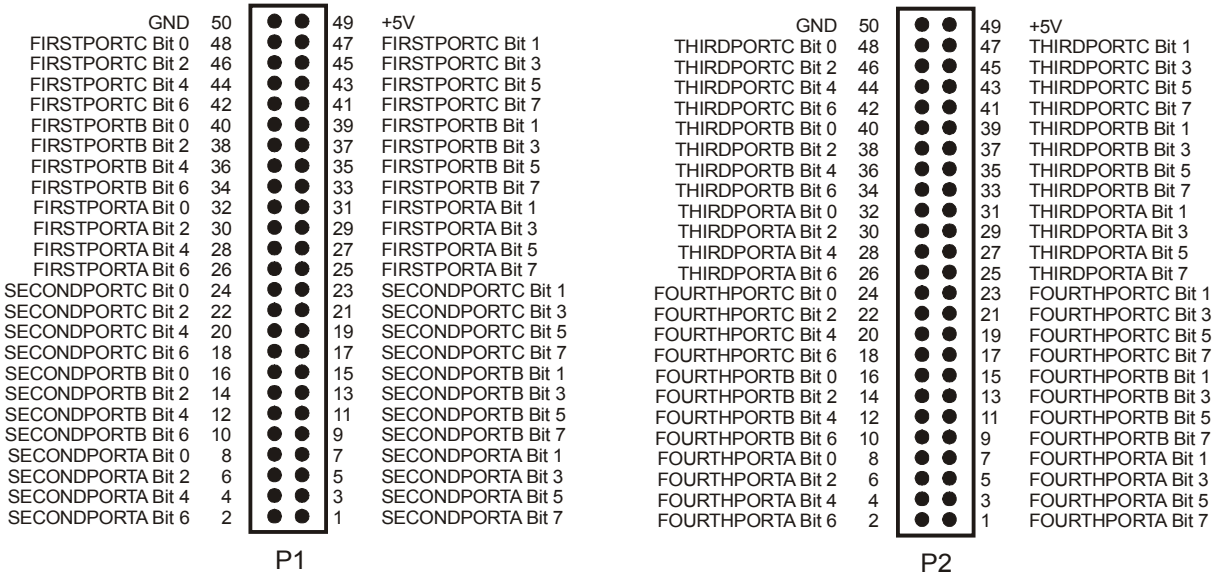


Figure 3. P1 AND P2 pin out

All the digital inputs and outputs are TTL. Under normal operating conditions, the voltages on the I/O pins range from near 0 volts for the low state, to near 5 volts for the high state. The voltages and currents of external devices usually exceed these values. Because of this, external relays are usually employed to handle higher current and voltage loads.

In addition to load matching, digital signal sources often need to be filtered or "de-bounced". Refer to the *Guide to Signal Connections* for information on digital interfacing. This document is available at [www.mccdaq.com/signals/signals.pdf](http://www.mccdaq.com/signals/signals.pdf)

### Cabling

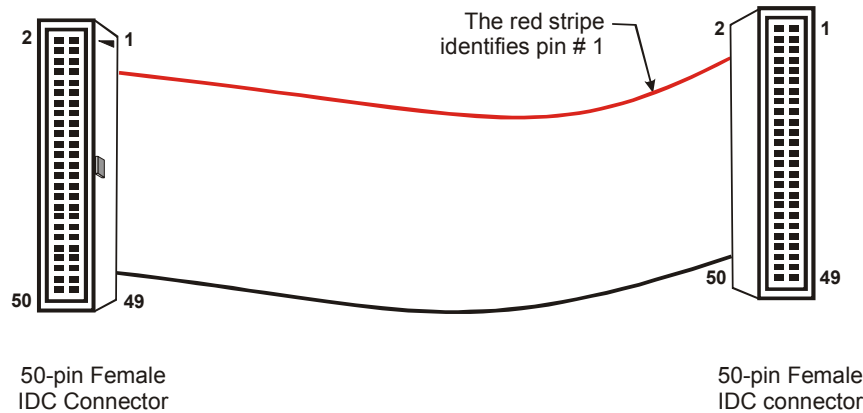


Figure 4. C50FF-x cable

## Field wiring, signal termination, and conditioning

You can use the following cabling, screw termination, and signal conditioning products with the CIO-DIO96.

- CIO-TERM100 – 100-pin screw terminal board (daisy-chained 50-pin IDC connectors)
- CIO-SPADE50 – 16" X 4" termination panel which mates with both 37-pin and 50-pin connectors.
- CIO-MINI50 – 50-pin screw terminal board.
- 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.
- CIO-ERB24 – 24 Form C relays, 6 Amp relay accessory board for digital signal conditioning.
- CIO-ERB48 – 48 Form C relays, 6 Amp, relay, 50-pin accessory board for digital signal conditioning.

### Information on signal connections

General information regarding signal connection and configuration is available in the *Guide to Signal Connections*. This document is available on our web site at [www.mccdaq.com/signals/signals.pdf](http://www.mccdaq.com/signals/signals.pdf).

# Functional Details

## Signal level control

The digital I/O bits on the CIO-DIO96 are 8255 CMOS TTL. The 82C55 digital I/O chip 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 82C55 it could be turned ON or OFF every time the 82C55 is reset.

All I/O bits are set to input mode on power up and reset. If you are using the board to control items that must be OFF on reset, install pull-down resistors. The CIO-DIO96 has open locations where you can install Single Inline Packages (SIP) resistor networks in either pull-up or pull-down configurations.

You can install pull-up and pull-down resistor SIP packs at each port. The positions are labeled **RN1** through **RN6** on the board. When installed, the SIP establishes either a high or low logic level at each of the I/O lines on the port.

To safeguard against unwanted signal levels, the devices being controlled by the CIO-DIO96 board should be tied low or high as required by a 2.2K  $\Omega$  resistor. In a 2.2K eight-resistor SIP pack, one side of all of the resistors is connected to a single common point and brought out to a pin. The common line, usually marked with a dot or line, is at one end of the SIP. The remaining resistor ends are brought out to the other eight pins (refer to Figure 5).

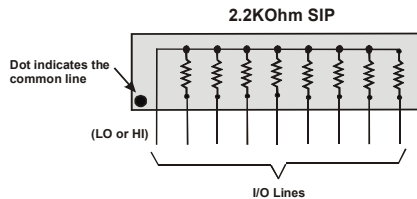


Figure 5. Eight-resistor SIP schematic

Figure 6 shows a schematic of an SIP installed in both the pull-up and pull-down positions. Each port provides 10 holes in a line. The end labeled **HI** connects to +5V. The end marked **LO** connects to GND. The eight holes in the middle (n0 –n7) connect to the eight lines of the Port, A, B or C.

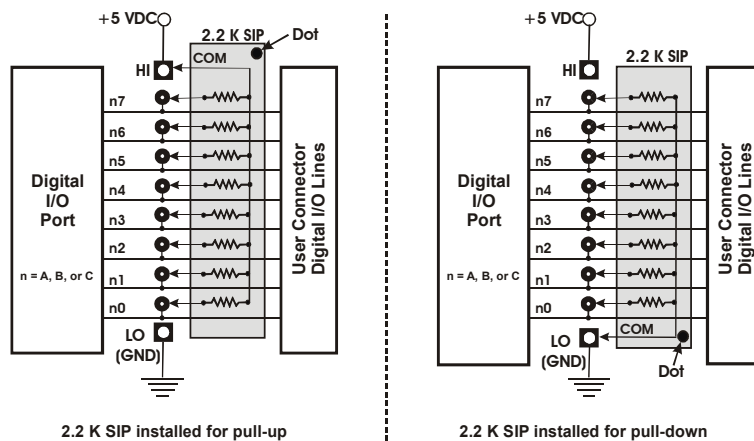


Figure 6. Pull-up and pull-down resistor SIPs schematic

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.

When installing pull-up and pull-down resistor SIP packs, we recommend using 2.2K, eight-resistor Single Inline Packages (MCC part number SP-K2.29C). Use a different value only if necessary.

#### Unconnected inputs float

Unconnected inputs typically float high, but not reliably. If you are using a CIO-DIO48H for input and have unconnected inputs, ignore the data from those lines. You do not have to terminate input lines. Unconnected lines will not affect the performance of connected lines. Mask out any unconnected bits in software.

## Digital I/O Isolation

To provide external signal conditioning and isolation, you can connect the CIO-DIO96 to a CIO-ERB24 or SSR-RACK24. The CIO-ERB24 provides 24 Form C electromechanical relays. The SSR-RACK24 is a mounting rack for 24 solid-state relays.

The CIO-DIO96 provides digital I/O in groups of 48-bits. 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 CIO-DIO96 board. An example of this configuration scheme is shown below.

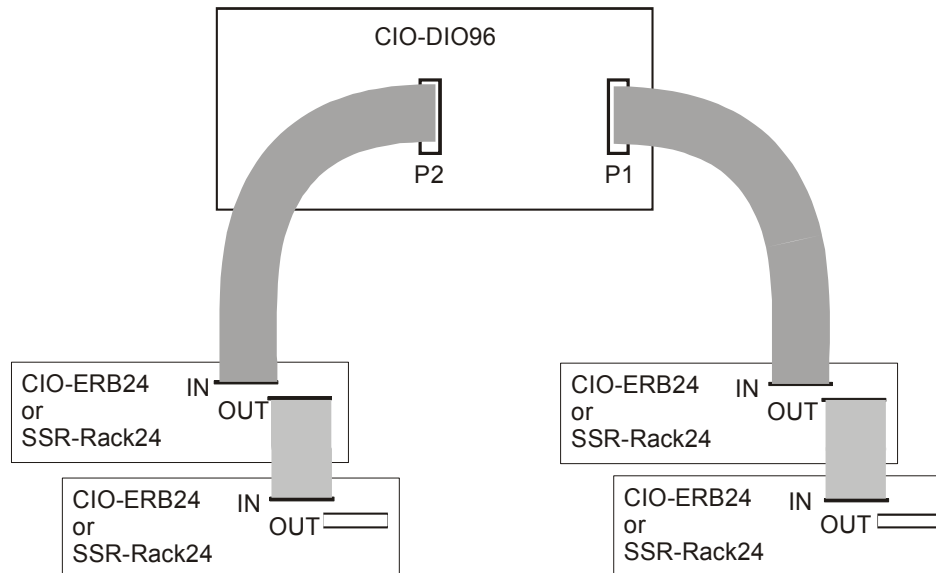


Figure 7. CIO-DIO96 to CIO-ERB24 or SSR-RACK24 daisy chain

The 24 digital I/O bits on pins 25 to 48 (base address +0 through +2) control the first relay board. The 24 digital I/O bits on pins 1 to 24 control the second relay/SSR board on the daisy chain.

Use the C50FF-x cable for interconnections. You can also use SSR-RACK48 or the CIO-ERB48 series relay boards.

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# Programming and Developing Applications

After following the installation instructions in Chapter 2, your board should now be installed and ready for use. In general there may be no correspondence among registers for different boards. Software written at the register level for other models will not function correctly with your board.

## 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 [www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf](http://www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf)).

## Packaged applications programs

Many packaged application programs now have drivers for your board. If the package you own does not have drivers for your 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@mccdaq.com](mailto:techsupport@mccdaq.com)

## Register-level programming

You should use the Universal Library or one of the packaged application programs mentioned above 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 CIO-DIO48, CIO-DIO48H, CIO-DIO96, and CIO-DIO192*. This document is available on our website at [www.mccdaq.com/registermaps/RegMapCIO-DIO-Series.pdf](http://www.mccdaq.com/registermaps/RegMapCIO-DIO-Series.pdf).



## Specifications

Typical for 25 °C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

### Digital input / output

Table 1. DIO specifications

|                        |   |
|------------------------|---|
| Digital type           | 82C55   |
| Configuration          | 8 banks of 8, 8 banks of 4, programmable by bank as input or output |
| Number of channels     | 96 I/O  |
| Output high            | 3.0 volts min @ -2.5mA  |
| Output low             | 0.4 volts max @ 2.5mA   |
| Input high             | 2.0 volts min, 5.5 volts absolute max                               |
| Input low              | 0.8 volts max, -0.5 volts absolute min                              |
| Power-up / reset state | Input mode (high impedance)   |

### Power consumption

Table 2. Power consumption specifications

|               |                           |
|---------------|---------------------------|
| +5V quiescent | 60 mA typical, 205 mA max |
|---------------|---------------------------|

### Environmental

Table 3. Environmental specifications

|                                    |                         |
|------------------------------------|-------------------------|
| <i>Operating temperature range</i> | 0 to 50 °C              |
| <i>Storage temperature range</i>   | -40 to +100 °C          |
| <i>Humidity</i>                    | 0 to 90% non-condensing |

### Main connectors and pin out

Table 4. Connector specifications

|  |  |
|--|--|
| Connector type                                 | (2) 50-pin shrouded male header connectors: P1 and P2                                      |
| Compatible cables                              | C50FF-x  |
| Compatible accessory products with the C50FF-x | CIO-TERM100<br>CIO-SPADE50<br>CIO-MINI50<br>SSR-RACK24, SSR-RACK48<br>CIO-ERB24, CIO-ERB48 |

Table 5. P1 pin out

| Pin | Signal name       | Pin | Signal name       |
|-----|-------------------|-----|-------------------|
| 50  | GND               | 49  | +5V               |
| 48  | FIRSTPORTC Bit 0  | 47  | FIRSTPORTC Bit 1  |
| 46  | FIRSTPORTC Bit 2  | 45  | FIRSTPORTC Bit 3  |
| 44  | FIRSTPORTC Bit 4  | 43  | FIRSTPORTC Bit 5  |
| 42  | FIRSTPORTC Bit 6  | 41  | FIRSTPORTC Bit 7  |
| 40  | FIRSTPORTB Bit 0  | 39  | FIRSTPORTB Bit 1  |
| 38  | FIRSTPORTB Bit 2  | 37  | FIRSTPORTB Bit 3  |
| 36  | FIRSTPORTB Bit 4  | 35  | FIRSTPORTB Bit 5  |
| 34  | FIRSTPORTB Bit 6  | 33  | FIRSTPORTB Bit 7  |
| 32  | FIRSTPORTA Bit 0  | 31  | FIRSTPORTA Bit 1  |
| 30  | FIRSTPORTA Bit 2  | 29  | FIRSTPORTA Bit 3  |
| 28  | FIRSTPORTA Bit 4  | 27  | FIRSTPORTA Bit 5  |
| 26  | FIRSTPORTA Bit 6  | 25  | FIRSTPORTA Bit 7  |
| 24  | SECONDPORC Bit 0  | 23  | SECONDPORC Bit 1  |
| 22  | SECONDPORC Bit 2  | 21  | SECONDPORC Bit 3  |
| 20  | SECONDPORC Bit 4  | 19  | SECONDPORC Bit 5  |
| 18  | SECONDPORC Bit 6  | 17  | SECONDPORC Bit 7  |
| 16  | SECONDPORB Bit 0  | 15  | SECONDPORB Bit 1  |
| 14  | SECONDPORB Bit 2  | 13  | SECONDPORB Bit 3  |
| 12  | SECONDPORB Bit 4  | 11  | SECONDPORB Bit 5  |
| 10  | SECONDPORB Bit 6  | 9   | SECONDPORB Bit 7  |
| 8   | SECONDPORTA Bit 0 | 7   | SECONDPORTA Bit 1 |
| 6   | SECONDPORTA Bit 2 | 5   | SECONDPORTA Bit 3 |
| 4   | SECONDPORTA Bit 4 | 3   | SECONDPORTA Bit 5 |
| 2   | SECONDPORTA Bit 6 | 1   | SECONDPORTA Bit 7 |

Table 6. P2 pin out

| Pin | Signal name       | Pin | Signal name       |
|-----|-------------------|-----|-------------------|
| 50  | GND               | 49  | +5V               |
| 48  | THIRDPORC Bit 0   | 47  | THIRDPORC Bit 1   |
| 46  | THIRDPORC Bit 2   | 45  | THIRDPORC Bit 3   |
| 44  | THIRDPORC Bit 4   | 43  | THIRDPORC Bit 5   |
| 42  | THIRDPORC Bit 6   | 41  | THIRDPORC Bit 7   |
| 40  | THIRDPORB Bit 0   | 39  | THIRDPORB Bit 1   |
| 38  | THIRDPORB Bit 2   | 37  | THIRDPORB Bit 3   |
| 36  | THIRDPORB Bit 4   | 35  | THIRDPORB Bit 5   |
| 34  | THIRDPORB Bit 6   | 33  | THIRDPORB Bit 7   |
| 32  | THIRDPORTA Bit 0  | 31  | THIRDPORTA Bit 1  |
| 30  | THIRDPORTA Bit 2  | 29  | THIRDPORTA Bit 3  |
| 28  | THIRDPORTA Bit 4  | 27  | THIRDPORTA Bit 5  |
| 26  | THIRDPORTA Bit 6  | 25  | THIRDPORTA Bit 7  |
| 24  | FOURTHPORC Bit 0  | 23  | FOURTHPORC Bit 1  |
| 22  | FOURTHPORC Bit 2  | 21  | FOURTHPORC Bit 3  |
| 20  | FOURTHPORC Bit 4  | 19  | FOURTHPORC Bit 5  |
| 18  | FOURTHPORC Bit 6  | 17  | FOURTHPORC Bit 7  |
| 16  | FOURTHPORB Bit 0  | 15  | FOURTHPORB Bit 1  |
| 14  | FOURTHPORB Bit 2  | 13  | FOURTHPORB Bit 3  |
| 12  | FOURTHPORB Bit 4  | 11  | FOURTHPORB Bit 5  |
| 10  | FOURTHPORB Bit 6  | 9   | FOURTHPORB Bit 7  |
| 8   | FOURTHPORTA Bit 0 | 7   | FOURTHPORTA Bit 1 |
| 6   | FOURTHPORTA Bit 2 | 5   | FOURTHPORTA Bit 3 |
| 4   | FOURTHPORTA Bit 4 | 3   | FOURTHPORTA Bit 5 |
| 2   | FOURTHPORTA Bit 6 | 1   | FOURTHPORTA Bit 7 |

# CE Declaration of Conformity

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

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

Measurement Computing Corporation declares under sole responsibility that the product

## **CIO-DIO96**

to which this declaration relates is in conformity with the relevant provisions of the following standards or other documents:

EU EMC Directive 89/336/EEC: Electromagnetic Compatibility, EN55022 (1987), EN50082-1

Emissions: Group 1, Class B

- EN55022 (1987): Radiated and Conducted emissions.

Immunity: EN50082-1

- IEC 801-2 (1987): Electrostatic Discharge immunity, Criteria B.
- IEC 801-3 (1984): Radiated Electromagnetic Field immunity Criteria A.
- IEC 801-4 (1988): Electric Fast Transient Burst immunity Criteria B.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in December, 1995. Test records are outlined in Chomerics Test Report #EMI0168B.95.

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



Carl Haapaoja, Director of Quality Assurance

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