

**CIO-RELAY08**  
**CIO-RELAY16**  
**CIO-RELAY24**  
**CIO-RELAY32**  
**(standard and /M versions)**

**User's Guide**



**MEASUREMENT  
COMPUTING™**

Revision 6A

August, 2001

## 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.

© 2001 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>1 INTRODUCTION</b> .....	1
<b>2 INSTALLATION</b> .....	2
2.1 SOFTWARE INSTALLATION .....	2
<b>3 HARDWARE INSTALLATION</b> .....	3
3.1 Mercury (/M) board special considerations .....	3
3.2 BASE ADDRESS .....	3
3.3 WAIT STATE .....	4
<b>4 PROGRAMMING</b> .....	5
4.1 DIRECT I/O REGISTER PROGRAMMING .....	5
4.2 PROGRAMMING NOTES .....	6
4.3 DETAILED RELAY CONTROL I/O MAP .....	6
<b>5 CONNECTING TO RELAYS</b> .....	8
5.1 I/O CONNECTOR DIAGRAMS .....	8
5.2 FORM C RELAYS (standard versions) .....	10
5.3 FORM A RELAYS (/M versions) .....	10
<b>6 SPECIFICATIONS</b> .....	12
6.1.1 CIO-RELAY08, 16, 24 and 32 (standard versions) .....	12
6.1.2 MERCURY WETTED (/M) VERSIONS .....	12

This page is blank.

# 1 INTRODUCTION

The CIO-RELAY16 is a 16-channel relay interface board for ISA bus computers. The board provides 16, Form-C (SPDT) relays. The CIO-RELAY08 board is identical to the RELAY16 board except that only eight relays are installed. The CIO-RELAY32 is two CIO-RELAY16s on a single board while the CIO-RELAY24 is a CIO-RELAY32 with only 24 relays installed.

The /M versions (e. g. CIO-RELAY16/M or CIO-RELAY08/M) are identical to the standard versions, but use Mercury wetted relays. They offer quicker switching times, less contact bounce and lower on-resistance than the standard models. The CIO-RELAY16 family has been designed for control applications where a few points of high voltage (or current) need to be controlled.

## **WARNING!**

*High voltages will be present on the CIO-RELAY16 family boards when high voltage is connected to the CIO-RELAY16 connector. Use extreme caution! Never handle the CIO-RELAY16 when signals are connected to the board through the connector.*

## **DO NOT REMOVE THE PROTECTIVE PLATES FROM THE CIO-RELAY16!**

The CIO-RELAY16 family are digital I/O boards with relay-based signal conditioning installed. Most accessory boards are intended to provide signal conditioning or easy to access signal termination. In general, the CIO-RELAY16 will not require additional signal conditioning.

## **WARNING**

We STRONGLY recommend that under no circumstance should a screw terminal board be used to connect high voltages to the CIO-RELAY16 series board. The CIO-RELAY16 is intended to control high voltages. If you use a screw terminal board you will expose yourself and others to those high voltage signals.

We recommend that you construct a safe cable to carry your signals directly from your equipment to the CIO-RELAY16 connector.

**NOTE:** The Mercury wetted boards must be mounted in the computer such that they will remain within 30 degrees of vertical.

***Installation of these boards in most tower computer cases will require the tower be rested on its side for proper operation of the mercury relays.***

## 2 INSTALLATION

The installation and operation of all four CIO-RELAY series boards is very similar. Throughout this manual we use CIO-RELAY as a generic designation for the CIO-RELAY08, CIO-RELAY16, CIO-RELAY24, and CIO-RELAY32. When required, due to the differences in the boards, the specific board name is used. The CIO-RELAY boards are easy to use. These procedure will help you quickly and easily setup, install and test your board. We assume you already know how to open the PC and install expansion boards. If you are unfamiliar or uncomfortable with board installation, please refer to your computer's documentation.

*We recommend you perform the software installation described in the following sections prior to installing the board in your computer. The InstaCal™ operations below will show you how to properly set the switches and jumpers on the board prior to physically installing the board in your computer.*

---

---

### 2.1 SOFTWARE INSTALLATION

The board has a variety of switches and jumpers to set before installing the board in your computer. The simplest way to configure your board is to use the *InstaCal*™ program provided on the CD (or floppy disk) .

*InstaCal* will show you all available options, how to configure the various switches and jumpers (as applicable) to match your application requirements. It will create a configuration file that your application software (and the Universal Library) will refer to so the software you use will automatically have access to the exact configuration of the board.

Please refer to the *Extended Software Installation Manual* regarding the installation and operation of *InstaCal*. The following hard copy information is provided as a matter of completeness, and will allow you to set the hardware configuration of the board if you do not have immediate access to *InstaCal* and/or your computer.

# 3 HARDWARE INSTALLATION

## 3.1 MERCURY (/M) BOARD SPECIAL CONSIDERATIONS

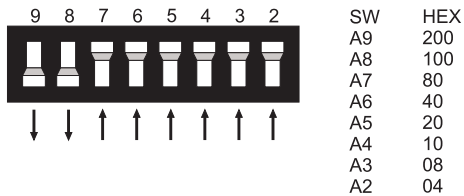
The Mercury wetted boards must be mounted in the computer such that they will remain within 30 degrees of vertical.

*NOTE: Installation of these boards in most tower computer cases will require the tower be rested on its side for proper operation of the mercury relays.*

## 3.2 BASE ADDRESS

The base address switch controls the I/O location where the CPU can access the registers of the CIO-RELAY board. The factory default is 300h (768D). If you have a board installed at address 300h, you will have to choose a new address from those available on your computer. You may use the list of PC I/O address assignments found on the following page and add notes about the boards you have installed in your computer. Choose a new base address from those available and set the switch using the guide below.

*NOTE: The switch shown below in Figure 3-1 is for the CIO-RELAY08 and CIO-RELAY16 boards. Since the CIO-RELAY32 and CIO-RELAY24 board require four I/O addresses, their base address switch does not provide switch #2. All other settings are identical.*



If address 300h is available on your computer, we recommend that you select it for your board. The software examples are written for base = 300h.

BASE ADDRESS SWITCH - Address 300H shown here.

Figure 3-1. Base Address Switches -

Table 3-1. PC I/O Addresses

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

### **3.3 WAIT STATE**

There is a wait state jumper on CIO-RELAY series boards. The factory default is wait state disabled. You will probably never need the wait state because PC expansion slot busses are limited to 8 or 10 MHz.

If you were to get intermittent operation from your CIO-RELAY board, you can try enabling the wait state to see if that solves the problem.



## 4 PROGRAMMING

The CIO-RELAY boards are easy to program. From one to four eight-bit registers are written to control relays or can be read to determine the state of relays.

In addition to direct I/O programming, the boards are fully supported by the powerful Universal Library program as well as most third-party application programs.

---

---

### 4.1 DIRECT I/O REGISTER PROGRAMMING

The CIO-RELAY family uses between one and four I/O addresses. Each address controls eight relays. Relays are controlled by writing to these register(s). The address map of the CIO-RELAY boards is shown below.

BASE ADDRESS	Relays 0-7	Read/Write (All CIO-RELAY boards)
BASE + 1	Relays 8-15	Read/Write (CIO-RELAY16, -24, -32)
BASE + 2	Relays 16-23	Read/Write (CIO-RELAY24, -32)
BASE + 3	Relays 24-31	Read/Write (CIO-RELAY32 only)

The registers are written to and read from as a single, 8-bit byte. Each bit controls an output to a relay (write) or represents the state of a relay (read).

All registers are read left to right. The leftmost bit (the eighth bit) being the most significant bit. Following this format, bit seven (OP7) of BASE + 0 corresponds to relay number 7 and bit 0 to relay number 0.

To construct a control word, use Table 4.1 for bit weights.

Table 4-1. Bit Weights

<b>BIT POSITION</b>	<b>DECIMAL VALUE</b>	<b>HEX VALUE</b>
0	1	1
1	2	2
2	4	4
3	8	8
4	16	10
5	32	20
6	64	40
7	128	80

For example, to assemble the control byte that will turn on relays 0, 1, 3, 5, and 7, we see in Table 4-2 that we need to write HEX AB or decimal 171.

Table 4-2. Sample Coding to Turn ON Relays 0, 1, 3, 5, & 7

RELAY	HEX	ON=1	WEIGHT	DECIMAL	ON=1	WEIGHT
OP7	80	1	80	128	1	128
OP6	40	0	0	64	0	0
OP5	20	1	20	32	1	32
OP4	10	0	0	16	0	0
OP3	8	1	8	8	1	8
OP2	4	0	0	4	0	0
OP1	2	1	2	2	1	2
OP0	1	1	1	1	1	1

Totals

AB

171

---



---

## 4.2 PROGRAMMING NOTES

WRITE = CONTROL: Write a byte to the register to control the relays. *A one in the relay bit position turns the relay on.*

READ = STATUS: Read the status of the relay control register. A one in the relay bit position indicates the relay is on.

ON & OFF for FORM C RELAYS:

ON means that FORM C relay common terminal is in contact with the Normally Open contact.

OFF means that FORM C relay common terminal is in contact with the normally closed contact.

---



---

## 4.3 DETAILED RELAY CONTROL I/O MAP

The following section provides a detailed description of the register map and relay control registers.

**Base Address +0** (applicable to all CIO-RELAY series boards).

RELAY	OP7	OP6	OP5	OP4	OP3	OP2	OP1	OP0
<b>BIT No.</b>	7	6	5	4	3	2	1	0
<b>HEX Value</b>	80	40	20	10	8	4	2	1
<b>DECIMAL</b>	128	64	32	16	8	4	2	1

**Base Address + 1** (applicable to CIO-RELAY16, -24, and -32 only).

<u>RELAY</u>	<u>OP15</u>	<u>OP14</u>	<u>OP13</u>	<u>OP12</u>	<u>OP11</u>	<u>OP10</u>	<u>OP9</u>	<u>OP8</u>
<b>BIT No.</b>	7	6	5	4	3	2	1	0
<b>HEX Value</b>	80	40	20	10	8	4	2	1
<b>DECIMAL</b>	128	64	32	16	8	4	2	1

**Base Address + 2** (applicable to CIO-RELAY24, and -32 only).

<u>RELAY</u>	<u>OP23</u>	<u>OP22</u>	<u>OP21</u>	<u>OP20</u>	<u>OP19</u>	<u>OP18</u>	<u>OP17</u>	<u>OP16</u>
<b>BIT No.</b>	7	6	5	4	3	2	1	0
<b>HEX Value</b>	80	40	20	10	8	4	2	1
<b>DECIMAL</b>	128	64	32	16	8	4	2	1

**Base Address + 3** (applicable to CIO-RELAY32 only).

<u>RELAY</u>	<u>OP31</u>	<u>OP30</u>	<u>OP29</u>	<u>OP28</u>	<u>OP27</u>	<u>OP26</u>	<u>OP25</u>	<u>OP24</u>
<b>BIT No.</b>	7	6	5	4	3	2	1	0
<b>HEX Value</b>	80	40	20	10	8	4	2	1
<b>DECIMAL</b>	128	64	32	16	8	4	2	1

## 5 CONNECTING TO RELAYS

### 5.1 I/O CONNECTOR DIAGRAMS

The CIO-RELAY08 and CIO-RELAY16 boards use a single 50-pin connector for signal interfacing. The CIO-RELAY24 and CIO-RELAY32 use two, 50-pin connectors. The pin-outs of the connectors are shown in Figures 5-1 through 5-4.

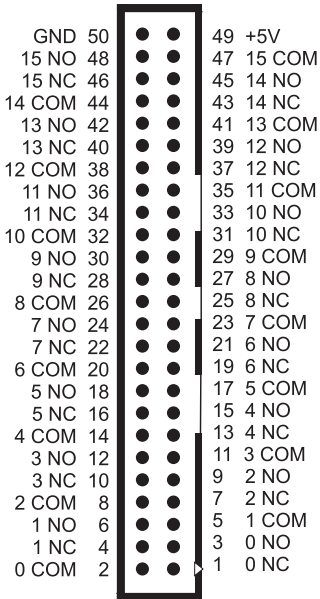


Figure 5-1. CIO-RELAY08 & 16 Connector

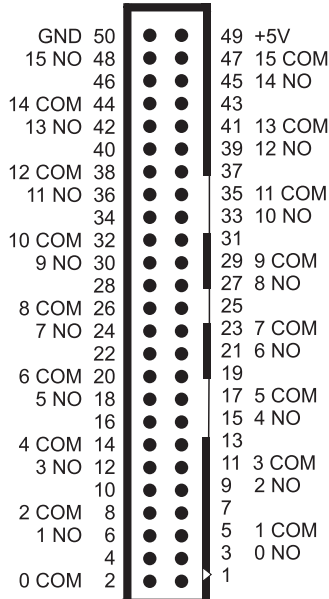


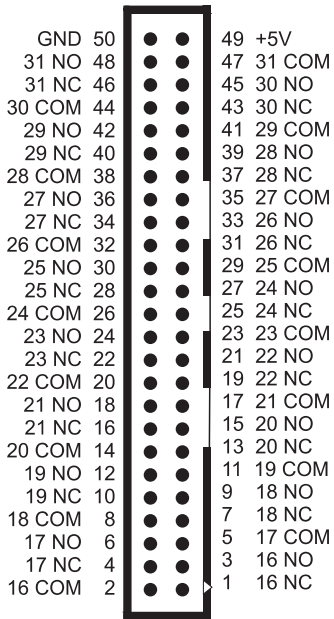
Figure 5-2. CIO-RELAY08/M & 16/M Connector

PINS corresponding to relays 8 through 15 are not connected on the RELAY08 version (Figure 5-1). Note that the form A relays used on the /M versions have **NO** and **COM** connections only (Figure 5-2).

### **WARNING!**

*High voltages will be present on the CIO-RELAY boards when you have connected high voltage inputs or outputs to the CIO-RELAY connector. Use extreme caution! Never handle the CIO-RELAY board when high voltage signals are connected to it.*

**DO NOT REMOVE THE PROTECTIVE PLATES FROM THE BOARD .**



CIO-RELAY24 & 32  
Connector

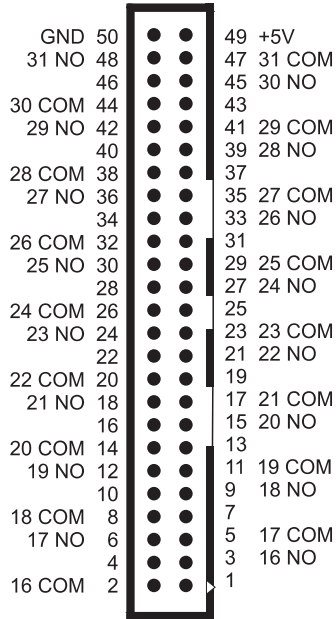


Figure  
5-3.

Figure 5-4. CIO-RELAY24/M & 32M  
Connector

The CIO-RELAY24 & 32 connector (Figure 5-3) is the center of the board.

The connector for relays 0 through 15 is closest to the computer back-plate.

**The Form-A relays of the /M versions have NO and COM connections only (Figure 5-4).**

NOTE: Pins for relays 24 through 31 are open on the CIO-RELAY24 & -24/M versions.

## WARNING!

*High voltages will be present on the CIO-RELAY boards when you have connected high voltage inputs or outputs to the CIO-RELAY connector. Use extreme caution! Never handle the CIO-RELAY board when HV signals are connected to the board.*

***DO NOT REMOVE THE PROTECTIVE PLATES FROM THE BOARD.***

---

---

## 5.2 FORM C RELAYS (STANDARD VERSIONS)

Figure 5-5 is the schematic for a Form-C relay as used on the standard CIO-RELAY08, -16, -24 and -32 boards.

The Form-C relay has a COMMON (COM), a normally open (NO), and a normally closed (NC) contact. When a 0 is written to an output (OPn), the common and NC are in contact. When a “1” is written to an output (OPn), the common and NO are in contact.

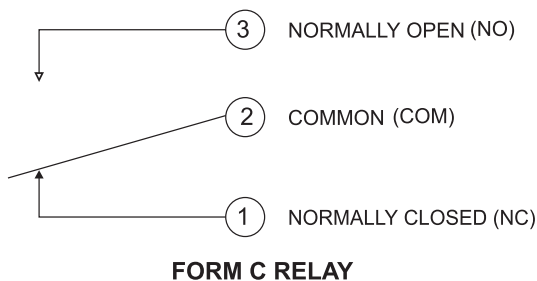


Figure 5-5. Form C Relay

---

---

## 5.3 FORM A RELAYS (/M VERSIONS)

Figure 5-6 is the schematic for a Form-A relay as used on mercury wetted (/M) models.

A Form-A relay has COMMON (COM) and normally open (NO) connections. When a “0” is written to the output, the common and NO are disconnected. When a “1” is written to the output (OPn), the common and NO are in contact.



Figure 5-6. Form A Relay

## 6 SPECIFICATIONS

### 6.1.1 CIO-RELAY08, 16, 24 and 32 (standard versions)

#### POWER CONSUMPTION

+5V supply                      510 mA typical plus 22 mA per active (on) relay

#### GENERAL SPECIFICATIONS

Number	8, 16, 24, or 32
Contact arrangement	Form C (SPDT)
Contact rating	3A @ 120VAC or 28VDC resistive
Contact type	Gold-overlaid silver
Contact resistance	100 milliohms max.
Operate time	20 milliseconds
Release time	10 milliseconds max.
Life expectancy	10 million mechanical operations minimum

#### ENVIRONMENTAL

Vibration	10 to 55 Hz (Dual amplitude 1.5mm)
Shock	10G (11 milliseconds)
Dielectric isolation	500V (1 minute)
Life Expectancy	1 Million Operations Electrical 100,000 Operations @ Full Load

### 6.1.2 MERCURY WETTED (/M) VERSIONS

#### POWER CONSUMPTION

CIO-RELAY                      510 mA + (22 mA per activated relay max)

#### GENERAL SPECIFICATIONS

Number	8 /16
Contact arrangement	Form A (SPST)
Contact rating	50 Watts @ 1 Amp or 500VDC resistive
Contact type	Mercury wetted
Contact resistance	50 milliohms max.
Operate time	2 milliseconds
Release time	2 milliseconds max.
Dielectric isolation	500V (1 minute)
Life Expectancy	107 Operations (Full Load)

## ENVIRONMENTAL

Operating temperature	0 to 70 °C
Storage temperature	-40 to 100 °C
Humidity	0 to 90% non-condensing
Weight	8 oz.

**NOTE:** The Mercury wetted boards must be mounted in the computer such that they will remain within 30 degrees of vertical.

***Installation of these boards in most tower computer cases will require the tower be rested on its side for proper operation of the mercury relays.***



For Your Notes

For Your Notes

## EC Declaration of Conformity

We, Measurement Computing Corp., declare under sole responsibility that the product:

CIO-RELAY##                      8, 16, 24 or 32 channel relay board

---

Part Number	Description
-------------	-------------

to which this declaration relates, meets the essential requirements, is in conformity with, and CE marking has been applied according to the relevant EC Directives listed below using the relevant section of the following EC standards and other normative documents:

**EU EMC Directive 89/336/EEC:** Essential requirements relating to electromagnetic compatibility.

**EU 55022 Class B:** Limits and methods of measurements of radio interference characteristics of information technology equipment.

**EN 50082-1:** EC generic immunity requirements.

**IEC 801-2:** Electrostatic discharge requirements for industrial process measurement and control equipment.

**IEC 801-3:** Radiated electromagnetic field requirements for industrial process measurements and control equipment.

**IEC 801-4:** Electrically fast transients for industrial process measurement and control equipment.

Carl Haapaoja, Director of Quality Assurance

**Measurement Computing Corporation**  
**16 Commerce Boulevard,**  
**Middleboro, Massachusetts 02346**  
**(508) 946-5100**

**Fax: (508) 946-9500**

**E-mail: [info@measurementcomputing.com](mailto:info@measurementcomputing.com)**  
**[www.measurementcomputing.com](http://www.measurementcomputing.com)**