

User's Guide

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CIO-RELAY08
CIO-RELAY16
CIO-RELAY24
CIO-RELAY32

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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 designed for applications that require fewer relays and is identical to the RELAY16 board except that only 8 relays are installed. The CIO-RELAY32 is two CIO-RELAY16s on a single board while the CIO-RELAY24 is are CIO-RELAY32 with eight of the relays not installed.

The /M versions (e.g. CIO-RELAY16/M and CIO-RELAY08/M) are identical to the standard versions, but use Mercury wetted relays and offer quicker switch 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!

1.1 ACCESSORIES

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.

We 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.

6.2 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 @ 1Amp 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	10 ⁷ 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.

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. This quick start 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**TM 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 Install the *InstaCal*TM software

Windows 95, 98 and NT users install InstaCAL by running the SETUP.EXE program included on your InstaCAL floppies or CD.

Windows 3.x and DOS users install the program by running the INSTALL.EXE program supplied on your InstaCAL disk.

These installation routines will create all required folders/directories and unpack the various pieces of compressed software. Simply run install and follow the on-screen instructions. Remember where the installed files are placed, as you will need to access them in the next step (the default location is on your main hard drive in a directory or folder named C:\CB).

2.2 Run *InstaCal*TM

To run *InstaCal*TM in the various forms of Windows, find the file named InstaCal.exe using your file management system and double click your mouse on it. In DOS simply type *instacal* and press the *Enter* key.

Once running, *InstaCal*TM provides four sub-menus (plus exit).

1. Select **Install** (either highlight it and hit enter or double click your mouse on it).
2. Select **Board #0** (select another number if Board #0 is already installed)
3. Select **Board Type**
4. Move through the selections and highlight the particular board you are installing (e.g. CIO-RELAY08 or CIO-RELAY16/M).
Either double click on the board or hit enter.
5. The board's default settings are then displayed. The board's defaults are:

 BASE ADDRESS: 300H (768 Decimal)
 WAIT STATE OFF
6. You are now ready to install the board in your computer. Open your PC (after turning off the power) and install the board. After the board is installed and the computer is closed up, turn the power back on.
7. Run *InstaCal*TM again, and at the main menu select **Test**.
 - a. Select the board you just installed
 - b. Select **Internal Test**
 - c. The internal control registers of the board will then be tested. If this test is successful, your board is installed correctly. If not, you likely have a base address conflict, or have the base address switch set incorrectly. Please refer to the next chapter for more information regarding selecting and setting the base address.
 - d. If the **Internal Test** is completed successfully, you may want to check that the I/O pins are working correctly. To check this select **External Test** and follow the instruction provided. This will require the use of an ohmmeter.

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

POWER CONSUMPTION

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

GENERAL SPECIFICATIONS

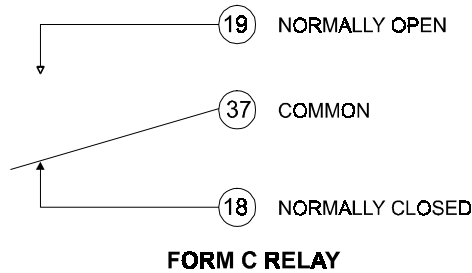
Number	8, 16, 24, or 32
Contact arrangement	Form C (SPDT)
Contact rating	3A @ 120V A.C or 28V D.C. resistive
Contact type	Gold overlay silver
Contact resistance	100 milliohms max.
Operate time	20 milliseconds
Release time	10 milliseconds max.
Life expectancy	10 million mechanical operations min.

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

5.2 FORM C RELAYS (standard versions)

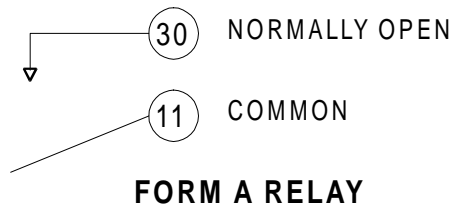
Shown here is the schematic for a form C relay as used on the standard CIO-RELAY08, 16, 24 and 32.



The form C relay has a COMMON, normally open (NO) and normally closed (NC) contact. When a 0 is written to the output, the common and NC are in contact. When a 1 is written to the output the common and NO are in contact.

5.3 FORM A RELAYS (/M versions)

Shown here is the schematic for a form A relay as used on mercury wetted (/M) models.



The form A relay has COMMON 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 the common and NO are in contact.

3 HARDWARE INSTALLATION

3.1 Mercury whetted (/M) board special considerations

The Mercury whetted boards must be mounted in the computer such that they will remain within 30 degrees of vertical. Note that installation of these boards in most tower computer cases will require the tower be rested on its side for proper operation.

3.2 BASE ADDRESS

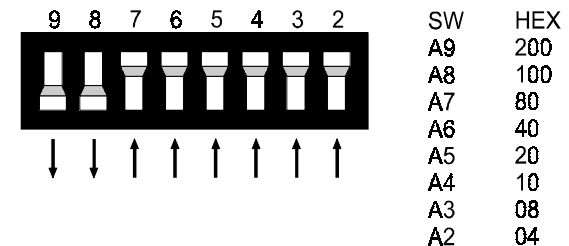
The base address switch controls the I/O location where the CPU can access the registers of the CIO-RELAY board.

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. *Please note that the switch shown below is for the CIO-RELAY08 and CIO-RELAY16 boards. Since the CIO-RELAY32 and CIO-RELAY24 board require 4 I/O address, 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.

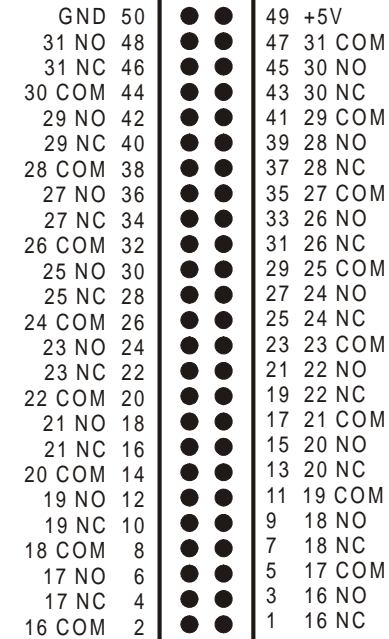
HEX RANGE	FUNCTION	HEX RANGE	FUNCTION
000-00F	8237 DMA #1	2C0-2CF	EGA
020-021	8259 PIC #1	2D0-2DF	EGA
040-043	8253 TIMER	2E0-2E7	GPIB (AT)
060-063	8255 PPI (XT)	2E8-2EF	SERIAL PORT
060-064	8742 CONTROLLER (AT)	2F8-2FF	SERIAL PORT
070-071	CMOS RAM & NMI MASK (AT)	300-30F	PROTOTYPE CARD
080-08F	DMA PAGE 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

TABLE OF I/O ADDRESS

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 may try enabling the wait state to see if that solves the problem.



CIO-RELAY24 and CIO-RELAY32 Connector

This connector is the center of the board. The connector for relays 0 through 15 is the connector that is closest to the computer back-plate. PINS corresponding to relays 24 through 31 are not connected on the RELAY24 version.

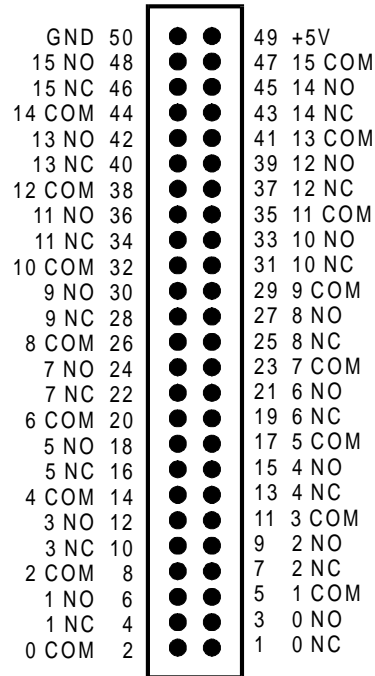
The form A relays used on the /M versions have NO and COM connections only!

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 when signals are connected to the board.! DO NOT REMOVE THE PROTECTIVE PLATES FROM THE CIO-RELAY.

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 connector are shown here.



CIO-RELAY08 and CIO-RELAY16 Connector

PINS corresponding to relays 8 through 15 are not connected on the RELAY08 version. **The form A relays used on the /M versions have NO and COM connections only!**

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 when signals are connected to the board.! **DO NOT REMOVE THE PROTECTIVE PLATES FROM THE CIO-RELAY.**

The CIO-RELAY boards are easy to program. Eight bit registers located at the base address and the base address plus an offset 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 8 relays and the relays are controlled by writing to these registers. The base address maps of the CIO-RELAY boards are shown below.

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

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

All registers are read left to right. The leftmost bit being the most significant bit. Following this format bit 7 of BASE+0 corresponds to relay 7 and bit 0 to relay 0.

To construct a control word, use the following table:

BIT POSITION	DECIMAL VALUE	HEX VALUE
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 can see from the chart below we need to write decimal 171 (hex AB):

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
			1			1
			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 is in contact with the Normally Open contact. Off means that FORM C relay common 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
BIT No.	7	6	5	4	3	2	1	0
HEX Value	80	40	20	10	8	4	2	1
DECIMAL	128	64	32	16	8	4	2	1

Base Address +1 (RELAY16, 24 and 32 only)

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

Base Address +2 (RELAY24 and 32 only)

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

Base Address +1 (RELAY32 only)

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