CIO-PDISO8

User's Manual

Revision 6
October, 2000

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1.0 INTRODUCTION

1.1 DESCRIPTION

The CIO-PDISO8 has eight channels of isolated inputs and eight channels of relay outputs. The CIO-PDISO8 is designed for applications where high voltage points are sensed and/or controlled.

WARNING!

High voltages will be present on the CIO-PDISO8 board when you have connected high voltage inputs or outputs to the CIO-PDISO8 connector. Use extreme caution! Never handle the CIO-PDISO8 when signals are connected to the board through the connector.

DO NOT REMOVE THE PROTECTIVE PLATES FROM THE CIO-PDISO8.

Outputs are from eight electromechanical relays. Five relays have FORM C configuration and three are FORM A normally-open configuration. The relays are controlled by writing to one, 8-bit port. The state of the relay control register may be read back from the same port.

The eight inputs are optically-isolated (500V) and can be read back as a single byte. The inputs are not polarity sensitive and may be driven by either AC (50 - 1000 Hz) or DC Each input has a switchable low-pass filter with a time constant of 5 ms (200 Hz).

The CIO-PDISO8 is fully supported by the Universal Library and many third party packages such as HP Vee.

1.2 ACCESSORIES

The CIO-PDISO8 is a combination digital I/O board with signal conditioning installed. Most accessory boards are intended to provide signal conditioning or easy to access signal termination. In general, the CIO-PDISO8 with not require additional signal conditioning.

WARNING

We recommend NOT using screw terminal boards with the CIO-PDISO8. The CIO-PDISO8 is intended to sense and 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-PDISO8 connector.

2.0 SOFTWARE INSTALLATION

Before you open your computer and install the board, install and run *Insta*Cal, the installation, calibration and test utility included with your board. *Insta*Cal will guide you through switch and jumper settings for your board. Detailed information regarding these settings can be found below. Refer to the *Software Installation Manual* for *Insta*Cal installation instructions.

3.0 HARDWARE INSTALLATION

3.1 BASE ADDRESS

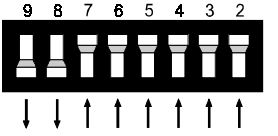
The base address switch sets the starting I/O location where the CPU can access the registers of the CIO-PDISO8.

The factory default is 300h (768 decimal).

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 elsewhere in this manual 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 in Figure 3-1.

If 300h is available on your computer, use it for the CIO-PDISO8.



SW	HEX
A9	200
A8	100
A7	80
A6	40
A5	20
A4	10
A3	08
A2	04

BASE ADDRESS SWITCH - Address 300H shown here.

Figure 3-1. Base Address Switch

3.2 WAIT STATE

There is a wait state jumper on the CIO-PDISO8. 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 get intermittent operation, try enabling the wait state to see if that solves the problem.

3.3 AC INPUT FILTER

The inputs are eight optically-isolated inputs are not polarity sensitive and may be driven by an AC (50-1000 Hz) or DC signal. Each input has a switchable low-pass R-C filter having a time constant of 5 ms (200Hz).

The switch which control the input filters is shown in Figure 3.2. The filters must be used for AC inputs and should be used for DC inputs.

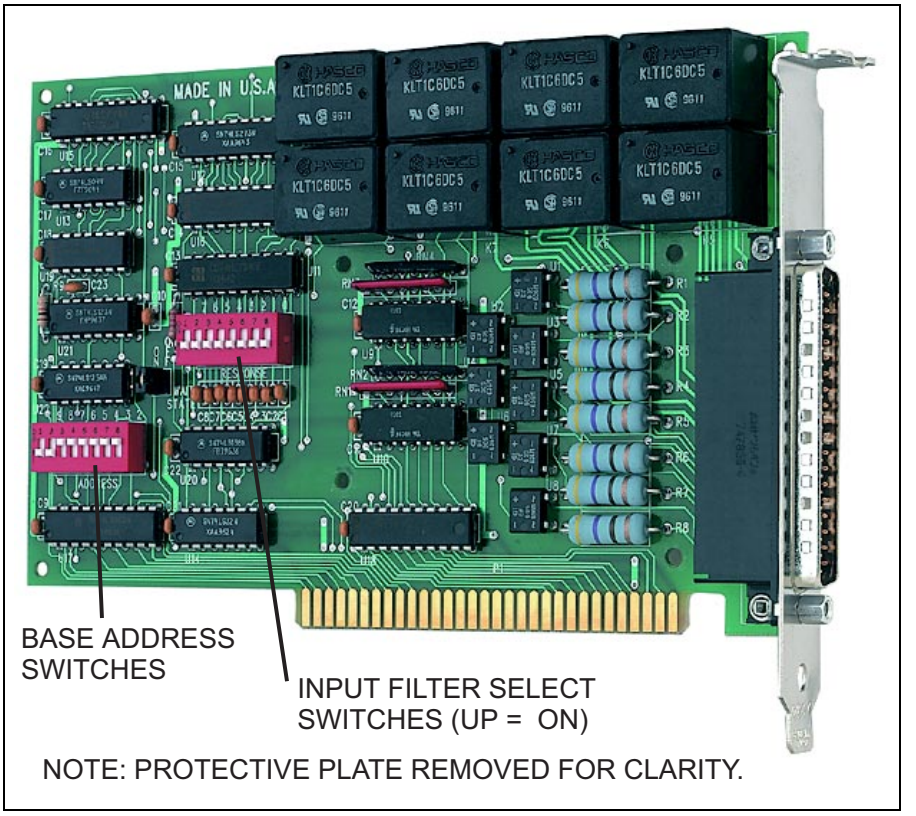


Figure 3-2. Board Switch Locations

Unless you have reason to turn off a filter, we recommend it be left on (switch up). With the filter on, an AC voltage within the specified frequency range present on the input produces a constant high signal to the opto-isolator.

Your CIO-PDISO8 is set up and can be installed in the computer.

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4.0 PROGRAMMING

The CIO-PDISO8 is easy to program. Two eight-bit registers located at the base address (relay output) and base+1 (isolated inputs) are written to or read from to control relays, read back the state of relays, or sense inputs.

BASE ADDRESS	Relay Output	Read/Write
BASE + 1	Isolated Inputs	Read Only
BASE + 2	Not Used	
BASE + 3	Not Used	

Although the CIO-PDISO8 decodes to four addresses, two of those are not used. This conforms to the design of the original PDISO-8, of which the CIO-PDISO8 is a true clone.

The registers are written to and read from as a single eight-bit byte. Each bit controls and output or represents the state of a device or input.
Both 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 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

For example, to assemble a control byte to turn on relays 0, 1, 3, 5, and 7:

RELAY	HEX	ON=1	WEIGHT	DECIMAL	ON=1	WEIGHT
RELAY 7	80	1	80	128	1	128
RELAY 6	40	0	0	64	0	0
RELAY 5	20	1	20	32	1	32
RELAY 4	10	0	0	16	0	0
RELAY 3	8	1	8	8	1	8
RELAY 2	4	0	0	4	0	0
RELAY 1	2	1	2	2	1	2
RELAY 0	1	1	1	1	1	1
			AB			171

If the relay status byte is read back, it is in the same format.

The isolated inputs are read in this format as well. To disassemble the byte and determine the state of the isolated inputs or the relay read-back register, perform the following operation in software:

INPUT/RELAY	HEX	DECIMAL
INPUT 7 / RELAY 7	80	128
INPUT 6 / RELAY 6	40	64
INPUT 5 / RELAY 5	20	32
INPUT 4 / RELAY 4	10	16
INPUT 3 / RELAY 3	8	8
INPUT 2 / RELAY 2	4	4
INPUT 1 / RELAY 1	2	2
INPUT 0 / RELAY 0	1	1

Perform an AND operation for each bit to see if it is on. In this example the variable INPBYTE% is the isolated input byte read from BASE+1. This example is in Microsoft Basic.

```
INPBYTE% = INP(BADR+1)
INP7% = INPBYTE% AND &H80
IF INP7% = 1 THEN ISOINP$ = "ON" ELSE ISOINP$ = "OFF"
```

The code above shows how to set the variable INP7% to either 1 or 0. It can then be used in your program. The variable ISOINP$ can be used as part of your on-screen display.

4.1 OUTPUT REGISTER

The output register is located at the board's base address.

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.

ON & OFF FOR FORM A RELAYS:
On means that FORM A relay common is in contact with the normally open contact. Off means that FORM A common is not in contact with anything.

RELAY	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
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

4.2 INPUT REGISTER

The isolated-inputs register is located at the CIO-PDISO8 base address + 1.

WRITE = NO FUNCTION

READ = STATUS: Read the status of the isolated inputs. A one in the input bit position indicates that a voltage is present at the input.

INPUT #	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**0**
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

5.0 ELECTRONICS AND INTERFACING

This short, simple introduction to the electronics most often needed by digital I/O board users covers a few key concepts. They are:

- Connector diagram.
- FORM C relay outputs.
- FORM A relay outputs.
- Isolated inputs.
- Adding a resistor to expand the range of the isolated inputs.
- Voltage dividers.

5.1 CONNECTOR DIAGRAM

The CIO-PDISO8 use a single 37-pin connector for signal interfacing The pin-outs of the connector are shown below in Figure 5-1. Note that INPUTnA and INPUTnB are the two connections to a single input channel, NOT separate inputs.

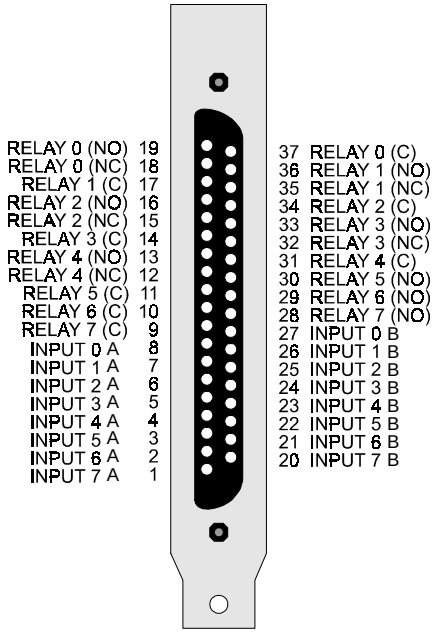

Figure 5-1. Connector Pin-Out

WARNING!

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5.2 FORM C RELAY OUTPUTS

Figure 5-2 is the schematic for a form C relay, like those connected at RELAY 0 through RELAY 4.

A 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.

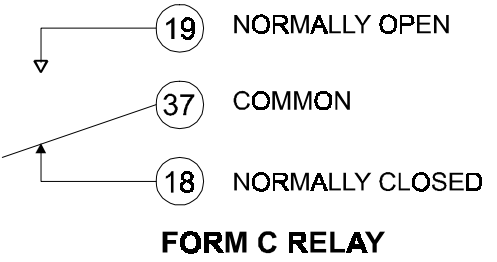

Figure 5-2. Form C Relay

5.3 FORM A RELAY OUTPUTS

Figure 5-3 is the schematic for a form A relay, like those connected at RELAY 5 through RELAY 7.

A form A relay has a COMMON and a normally open (NO) contact.

When a 0 is written to the output, the common and NO are NOT in contact. When a 1 is written to the output the common and NO are in contact.

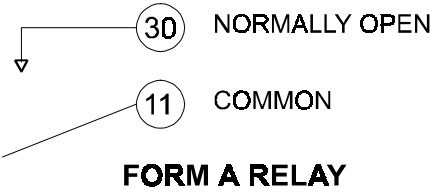

Figure 5-3. Form A relay

The form A and form C relays on the CIO-PDISO8 are the same part. Only the connections to the relay poles differ.

5.4 ISOLATED INPUTS

There are 8 isolated input channels. The schematic of a single channel is shown in Figure 5-4.

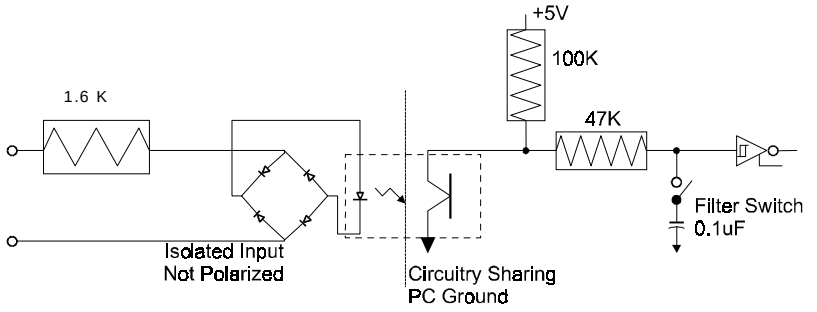

Figure 5-4. Input channel schematic

The signals are routed through a bridge rectifier so that the inputs are not polarity sensitive.

5.5 EXTENDING THE INPUT RANGE

It is possible to extend the input range beyond the 5 to 28V specified by adding an external resistor.

Figure 5-5 shows the added resistor and the equations used to calculate resistor values for a given Vin.

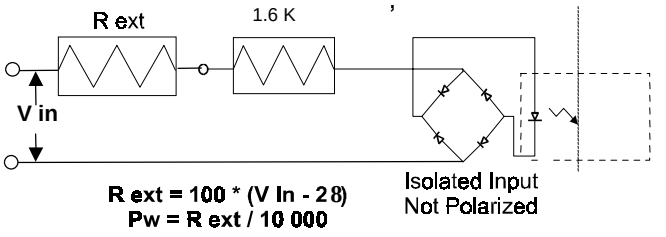

Figure 5-5. Range-extending resistor

5.6 VOLTAGE DIVIDERS

If you wish to measure a signal which varies over a range greater than the input range of an input, a voltage divider can drop the voltage of the input signal to the level the digital input can measure.

A voltage divider takes advantage of Ohm's law, which states,

> Voltage = Current * Resistance

and Kirchoff's law which states,

> The sum of the voltage drops around a circuit will be equal to the voltage drop for the entire circuit.

Thus, any variation in the voltage drop for the circuit as a whole will have a proportional variation in all the voltage drops in the circuit.

In a voltage divider, the voltage across one of the resistors in a circuit is proportional to the voltage across the total resistance in the circuit.

The trick to using a voltage divider is to choose two resistors with the proper proportions relative to the full scale of the digital input and the maximum signal voltage.

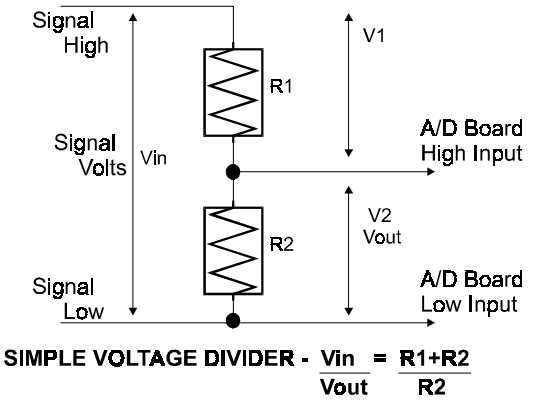

Figure 5-6. Voltage Divider

Dropping the voltage proportionally is called attenuation. The formula for attenuation is:

$$2 = \frac{10K + 10K}{10K}$$

For example, if the signal varies between 0 and 20 volts and you wish to measure that with an analog input with a full scale range of 0 to 10 volts, the Attenuation is 2:1 or just 2.

$$R1 = (A-1) * R2$$

For a given attenuation, pick a handy resistor and call it R2, the use this formula to calculate R1.

For Attenuation of 5:1 or less, no resistor should be less than 10K.
For Attenuation of greater than 5:1, no resistor should be < 1K.

6.0 SPECIFICATIONS

Power Consumption

+5V	
All relays off	0.20 A typical
All relays on	0.70 A typical

Relay Specifications

Relays	8
Contact Configuration	5 Form C, SPDT (Relays 0 - 4) and 3 Form A, SPST, NO, Relays 5 - 7)
Contact Rating (resistive load)	7 A / 30VDC or 10 A / 125VAC
Contact Resistance	50 milliohms
Coil Resistance	70 ohms
Isolation:	
Between open contacts	750VAC, 50/60HZ, 1 min.
Between coil and contacts	1500VAC, 50/60HZ, 1 min.
Operate Time	10 milliseconds max.
Release Time	5 milliseconds max.
Vibration	10 to 55Hz (Dual amplitude 1.5mm)
Shock	10 G (11 milliseconds)
Insulation Resistance	100 Mohms min. (500V @ 1 min.)
Life Expectancy:	
Mechanical	10^7 mechanical operations, min.
Electrical	100,000 min at full load

Isolated Inputs

Number	8
Type	Non-polarized, opto-isolated (Not TTL compatible)
Voltage Range	
DC	5-28V
AC	5-28V (50-1000 Hz)
Isolation	500V
Resistance	1.6 KOhms min.
Response	
Without filter	20 µs
With filter	5 ms
Filters Time constant	5 ms; each input switch- selectable

Connector

Connector type	37-pin D type (male)
Current Rating	2 A

Environmental

Operating temperature range	0 to 50°C
Storage temperature range	–20 to 70°C
Humidity	0 to 90% non-condensing
Weight	8 oz.
Size	3-7/8" (99mm) tall excluding gold fingers 6-1/2" (164mm) long

EC Declaration of Conformity

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

CIO-PDISO8	8 Channel relay/isolated input 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.

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