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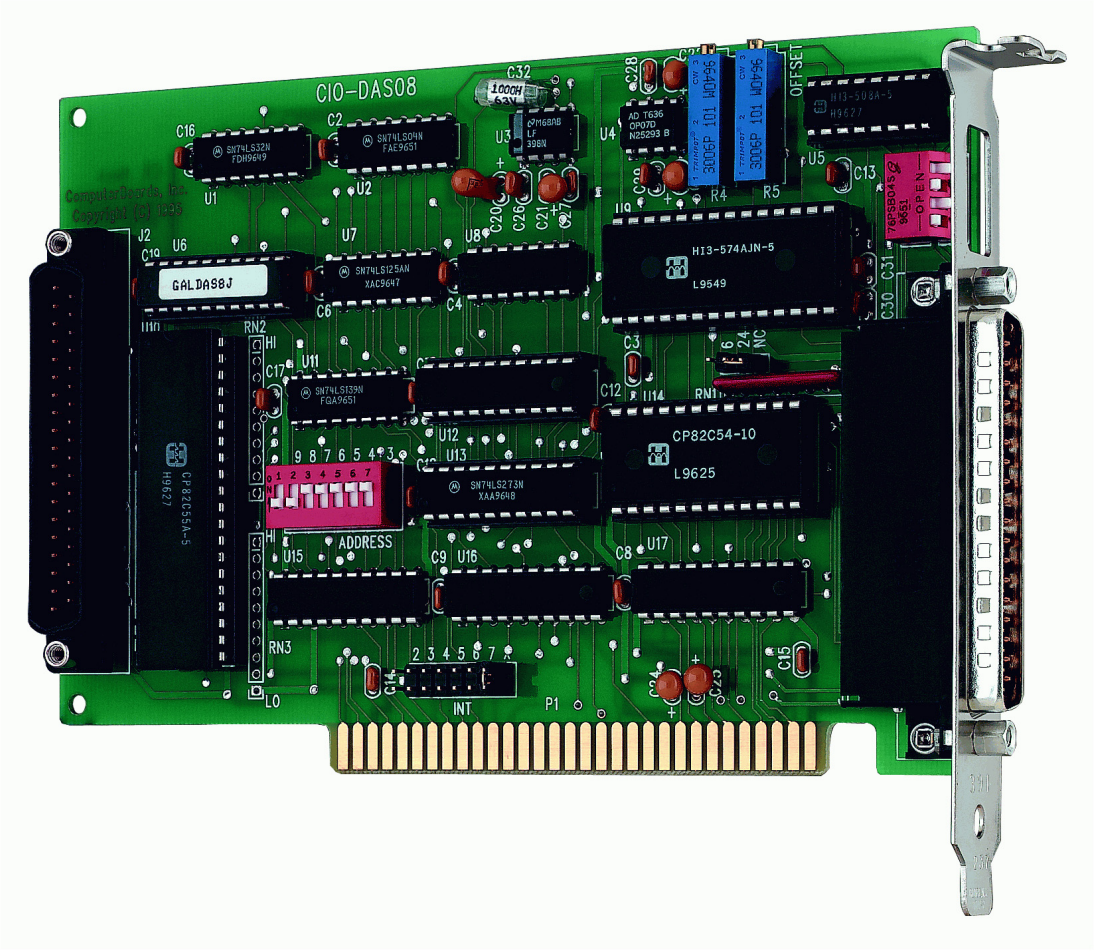
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CIO-DAS08

Eight 12-bit Single-ended Analog Inputs, 31 Digital I/O

User's Guide



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CIO-DAS08

Multifunction Analog and Digital I/O board

User's Guide



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Table of Contents

Preface
About this User's Guide 6
What you will learn from this user's guide 6
Conventions in this user's guide 6
Where to find more information 6

Chapter 1
Introducing the CIO-DAS08 7
Overview: CIO-DAS08 features 7
Software features 7

Chapter 2
Installing the CIO-DAS08 8
What comes with your CIO-DAS08 shipment? 8
Hardware 8
Optional components 8
Additional documentation 8
Configuring the CIO-DAS08 9
Base address 10
Interrupt level 11
Clock source 11
Analog input range 12
Installing the CIO-DAS08 12
Connecting the board for I/O operations 13
Connectors, cables – I/O connectors 13
Cabling 14
Field wiring, signal termination, and conditioning 15

Chapter 3
Programming and Developing Applications 16
Programming languages 16
Packaged applications programs 16
Register-level programming 16

Chapter 4
Specifications 17
Analog input 17
Digital Input / Output 17
Counters 18
Power consumption 18
Environmental 18
Main connectors and pin out 19
Analog connector J1 pin out 19
Digital connector J2 pin out 19

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About this User's Guide

What you will learn from this user's guide

This user's guide explains how to install, configure, and use the CIO-DAS08 so that you get the most out of its analog input and digital I/O features.

This user's guide also refers you to related documents available on our web site, and to technical support resources.

Conventions in this user's guide

For more information on …

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.

<#:#> Angle brackets that enclose numbers separated by a colon signify a range of numbers, such as those assigned to registers, bit settings, etc.

bold text **Bold** text is used for the names of objects on the screen, such as buttons, text boxes, and check boxes. For example:
1. Insert the disk or CD and click the **OK** button.

italic text *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase. For example:
The *Insta*Cal installation procedure is explained in the *Quick Start Guide*.
Never touch the exposed pins or circuit connections on the board.

Where to find more information

The following electronic documents provide helpful information relevant to the operation of the CIO-DAS08.

- MCC's *Specifications: CIO-DAS08* (the PDF version of the *Specifications* chapter in this guide) is available on our web site at www.mccdaq.com/pdfs/CIO-DAS08.pdf.
- MCC's *Quick Start Guide* is available on our web site at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.
- MCC's *Guide to Signal Connections* is available on our web site at www.mccdaq.com/signals/signals.pdf.
- MCC's *Universal Library User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf.
- MCC's *Universal Library Function Reference* is available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-functions.pdf.
- MCC's *Universal Library for LabVIEW™ User's Guide* is available on our web site at www.mccdaq.com/PDFmanuals/SM-UL-LabVIEW.pdf.

CIO-DAS08 User's Guide (this document) is also available on our web site at www.mccdaq.com/PDFmanuals/CIO-DAS08.pdf.

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Introducing the CIO-DAS08

Overview: CIO-DAS08 features

The CIO-DAS08 is a multifunction analog and digital I/O board supported under popular Microsoft® Windows® operating systems.

The CIO-DAS08 provides eight single-ended channels of 12-bit analog input, three 16-bit down counter channels, three digital input, four digital output, and 24 digital I/O lines.

The analog input range and polarity are selectable with an on-board switch. Bipolar input ranges are ±10 V and ±5 V. The Unipolar input range is 0 to +10 V.

You select the base address with onboard dip switches. The interrupt level and pacer source are jumper-selectable. You can set the pacer source to use the internal PC clock or an external clock.

The CIO-DAS08 has a 37-pin analog connector and an onboard 37-pin digital connector.

Four digital output bits and three digital input bits are provided on the board's main connector. A 37-pin connector mounted on the board provides 24 digital I/O bits based on the 82C55 specification. The 24 bits are configured as two eight-bit ports and two four-bit ports. Each of these ports may be individually programmed as input or output.

Software features

For information on the features of *Insta*Cal and the other software included with your CIO-DAS08, 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.

Check www.mccdaq.com/download.htm for the latest software version.

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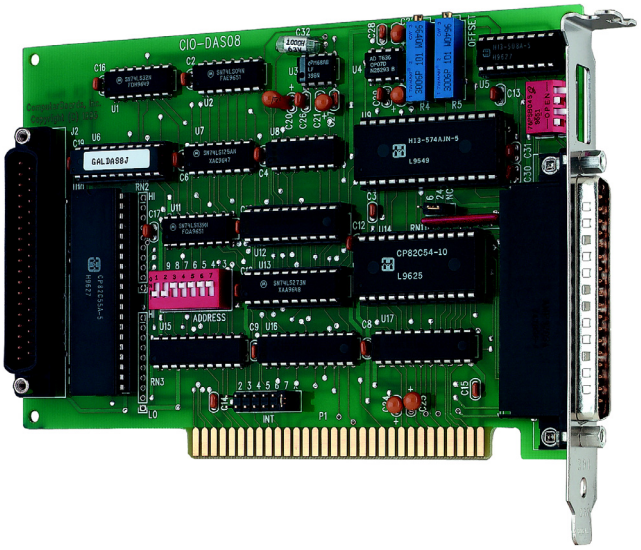
Installing the CIO-DAS08

What comes with your CIO-DAS08 shipment?

The following items are shipped with the CIO-DAS08.

Hardware

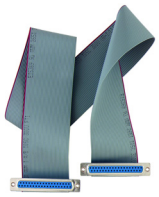
- CIO-DAS08



Optional components

You can also order the following MCC products to use with your CIO-DAS08.

- Cables



C37FF-x



BP-37

- Signal termination and conditioning accessories

  MCC provides signal conditioning and termination products for use with the CIO-DAS08. Refer to Field wiring, signal termination, and conditioning on page 15 for a complete list of compatible accessory products.

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). This booklet supplies a brief description of the software you received with your CIO-DAS08 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

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Configuring the CIO-DAS08

The CIO-DAS08 has two sets of switches and two jumpers that should be set before installing the board in the PC. Mounted on the board is a bank of DIP switches for setting the base address, a jumper for setting the interrupt level and a jumper for setting the pacer source to either the internal PC Clock source or an external clock. A bank of four switches on the connector bracket is used for setting the analog input range.

The *Insta*Cal calibration and test program included with the CIO-DAS08 will show you how to configure the board. Run *Insta*Cal before you open your computer and install the board.

The location of each switch and jumper on the CIO-DAS08 is shown in Figure 1.

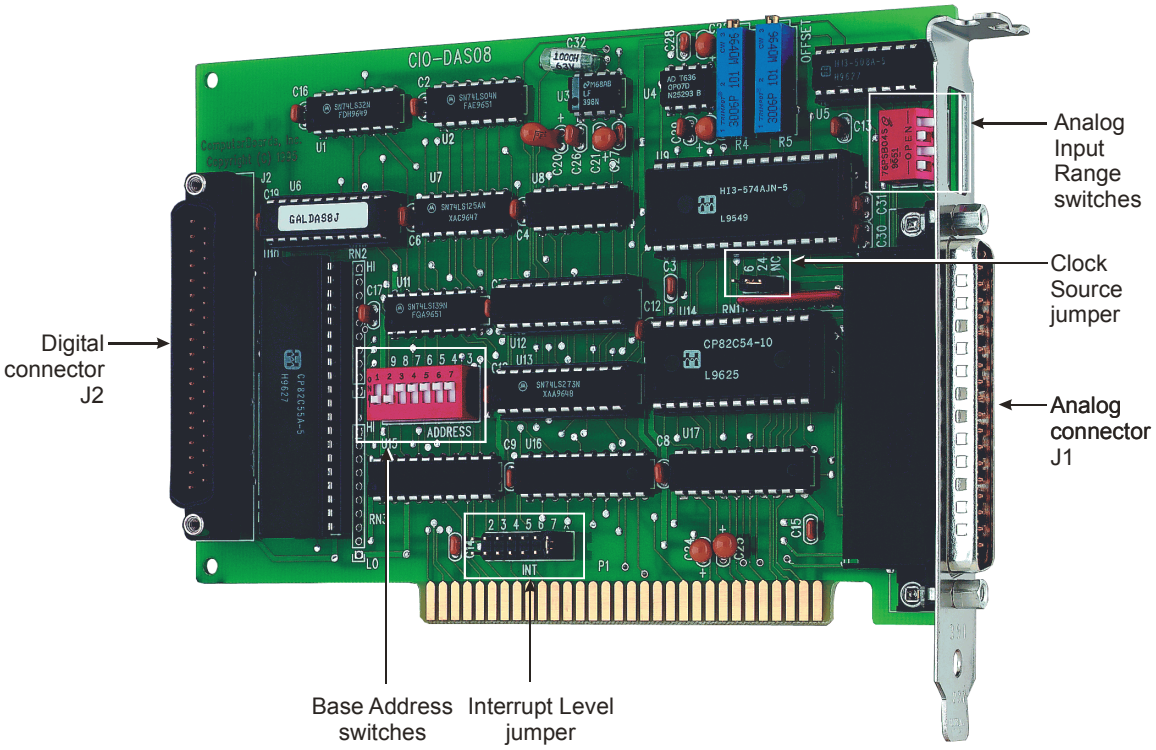


Figure 1. Switch and jumper locations

The CIO-DAS08 is shipped with the factory-default settings listed in the table below.

Factory-configured default settings

Switch/jumper	Description	Default setting
Base address DIP switches	Sets the base address	300h (768 decimal)
Interrupt level jumper	Sets the interrupt level	"X" position (no interrupt level set)
Clock source jumper	Sets the pacer source as the internal PC clock or an external clock	"24/NC" position (external source)
Analog input range and gain	Sets the analog input range and gain	±5V

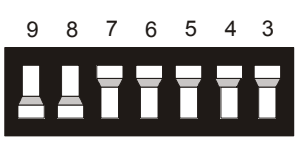
Review the following information to change the default configuration of a jumper or switch.

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Base address

Before you install the CIO-DAS08 in your computer, set the base address by using the dip switches labeled **ADDRESS** located on the board. The easiest way to set the base address switch is to let *Insta*Cal show you the correct settings. However, if are already familiar with setting ISA base addresses, you may use the base address switch description below to guide your base address selection.

Unless there is already another board in your system using address 300 hex (768 decimal), leave the switches as they are set at the factory. The example shown in Figure 2 shows the settings for the factory-default base address of 300 hex.



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

Figure 2. Base address switches (300h shown)

In the default configuration shown in Figure 2, 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).

A complete address is constructed by calculating the hexadecimal number which corresponds to all the address bits the CIO-DAS08 can respond to. The range of base addresses is 000h to 3F0h. Certain address are used by the PC, others are free and may be used by the CIO-DAS08 and other expansion boards. Refer to the following table.

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 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)	3B0-3BB	SDLC
1F0-1FF	HARD DISK (AT)	3BC-3BF	MDA
200-20F	GAME CONTROL	3C0-3CF	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

The CIO-DAS08 base switch can be set for an address in the span of 000-3F0h, so it should not be hard to find a free address area. If you are not using IBM prototyping cards, or some other board which occupies these addresses, then 300-31F HEX are free to use. Addresses not specifically listed — such as 390-39Fh — are free.

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Interrupt level

Set the interrupt jumper only if your software requires it. If you do set the interrupt jumper, check your PC's current configuration for interrupt conflicts. Do not use IR2 in PC/AT class machines (or higher).

Use the jumper block labeled **INT** above the PC bus interface (gold pins) to set the interrupt. The board is shipped with the jumper in the "**X**" position, which means that no interrupt level is set (Figure 3).

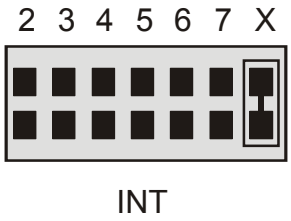


Figure 3. Interrupt level select jumper (no interrupt level set)

To pace conversions through hardware (either the on-board pacer or an external clock), move this jumper to another position. The CIO-DAS08 can use interrupt levels 2 through 7. Refer to the following table for some typical interrupt assignments on a computer. The levels most often available are 5 and 7.

Hardware interrupt assignments

Name	Description	Name	Description
NMI	Parity	IRQ8	Real Time Clock (AT)
IRQ0	Timer	IRQ9	RE-directed to IRQ2
(AT)			
IRQ1	Keyboard	IRQ10	Unassigned
IRQ2	Reserved (XT)	IRQ11	Unassigned
	INT 8-15 (AT)		
IRQ3	COM OR SDLC	IRQ12	Unassigned
IRQ4	COM OR SDLC	IRQ13	80287 MUNERIC CO-P
IRQ5	Hard Disk (XT)	IRQ14	Hard Disk
	LPT (AT)		
IRQ6	Floppy Disk	IRQ15	Unassigned
IRQ7	LPT	**Note**: IRQ8-15 are AT only	

Clock source

With revision 4 and higher hardware, you can use the on-board pacer clock to trigger A/D conversions by setting the clock source jumper (labeled **J** on the board) to the **6/24** position. This setting routes the pacer output (pin 6) to the interrupt input (pin 24). By default, this jumper is configured as not connected (NC). Refer to Figure 4.

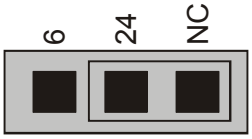


Figure 4. Clock source jumper (default setting)

Note: to pace conversions with the on-board pacer, you must also select a hardware interrupt by configuring the interrupt level select jumper (discussed above).

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Analog input range

Configure the signal polarity and the analog input range setting using the four dip switches accessible through the CIO-DAS08 connector bracket (Figure 5). These switches set the input range for the analog inputs.

Available bipolar input ranges are ±10 V and ±5 V. The Unipolar input range is 0 to +10 V.

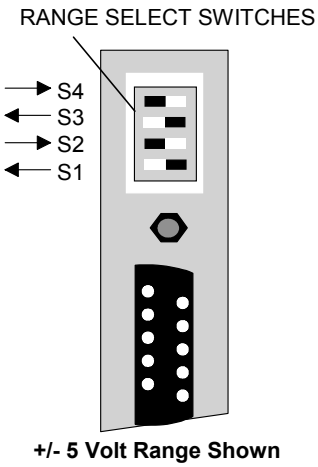


Figure 5. Range select switches

The CIO-DAS08 is shipped with the analog input range configured for ±5 volts. To change the range, refer to Figure 5 and the table below to determine the correct positions of switches S1 through S4 for the range and gain you want to set. You do not have to turn off the PC power or disconnect signals to change these switch settings.

Range Switch Settings

Range	S1	S2	S3	S4	Gain	Resolution
±5 V	Left	Right	Left	Right	1	2.44 mV / bit
±10 V	Right	Left	Left	Right	0.5	4.88 mV / bit
0-10 V	Left	Right	Right	Left	1	2.44 mV / bit

Positions other than those shown in the table are not valid.

Installing the CIO-DAS08

After configuring the board, install the CIO-DAS08 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 *Insta*Cal 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 for information on how to initially set up and load *Insta*Cal.

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Connecting the board for I/O operations

Connectors, cables – I/O connectors

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

Board connector, cables, and accessory equipment

Connector type	Analog connector (J1): 37-pin male "D" connector
	Digital connector (J2): 37-pin male "D" connector
Compatible cables with analog connector J1	C37FF-x C37-FFS-x
Compatible cables with digital connector J2	BP-37
Compatible accessory products with the C37FF-x cable, C37FFS-x cable, and the BP-37 cable	CIO-MINI37 CIO-TERMINAL CIO-SPADE50 CIO-EXP16 CIO-EXP32

Pin out – Analog connector (J1)

The analog connector (J1) is a 37-pin, type D connector that is accessible from the rear of the PC through the expansion backplate (see Figure 6).

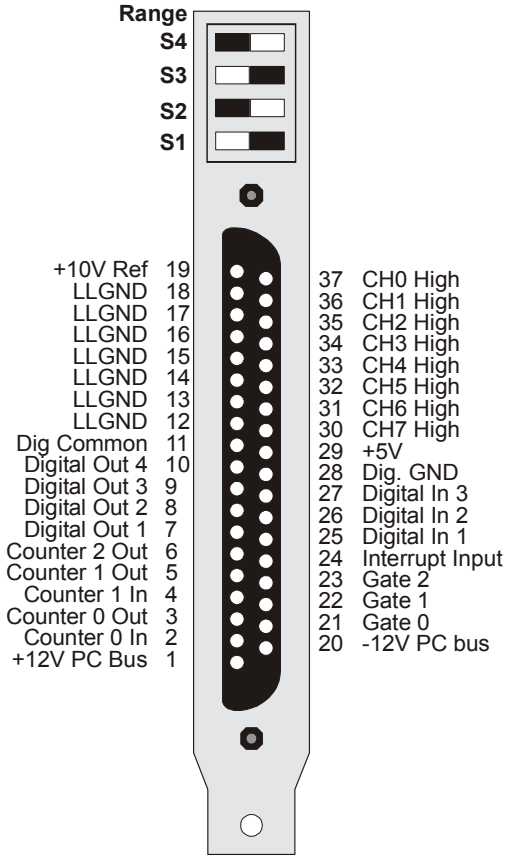


Figure 6. 37-pin analog connector

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Pin out – Digital connector (J2)

The digital connector (J2) is a 37-pin, type D connector that is mounted on the CIO-DAS08 board (see Figure 7). This connector is identical to the CIO-DIO24 connector, except that the Interrupt Input and Interrupt Enable pins are not provided. These are no-connect pins (NC) on the CIO-DAS08. The CIO-DAS08 has an interrupt input pin at pin 24 on the analog connector J1.

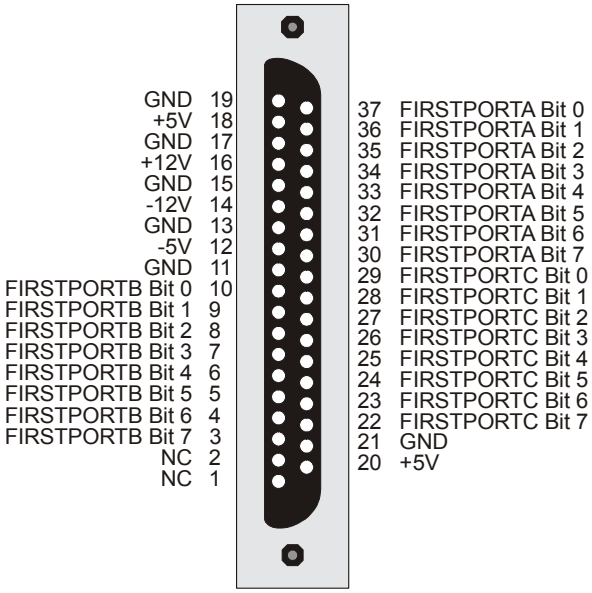


Figure 7. 37-pin digital connector

Use a BP-37 backplate and cable assembly to bring signals from the digital connector to the backplate. BP-37 terminates with a 37-pin male backplate connector. You can run a standard C37FF-2 cable alongside the analog connector (J1) through the gap in the expansion slot backplate.

Cabling

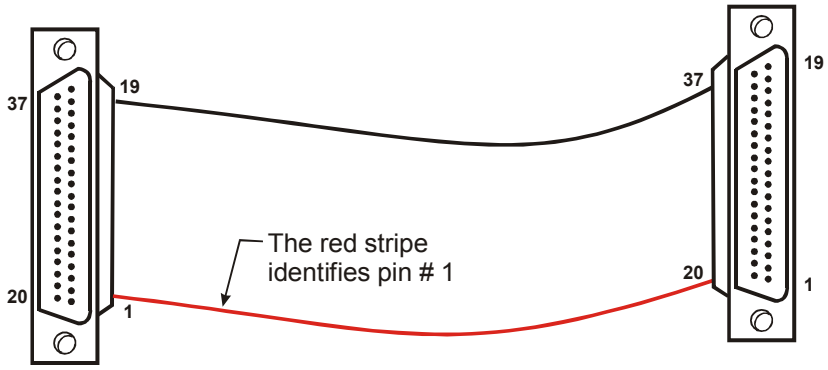


Figure 8. C37FF-x cable

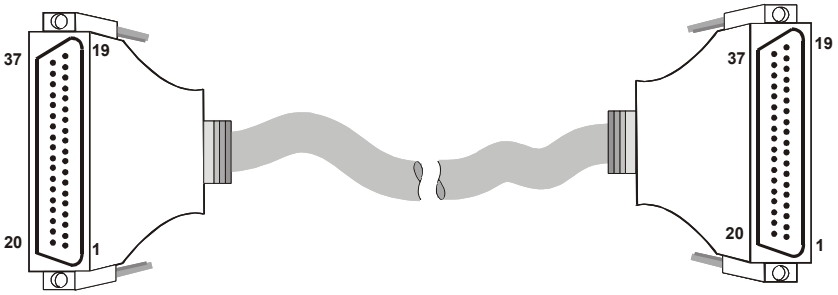


Figure 9. C37FFS-x cable

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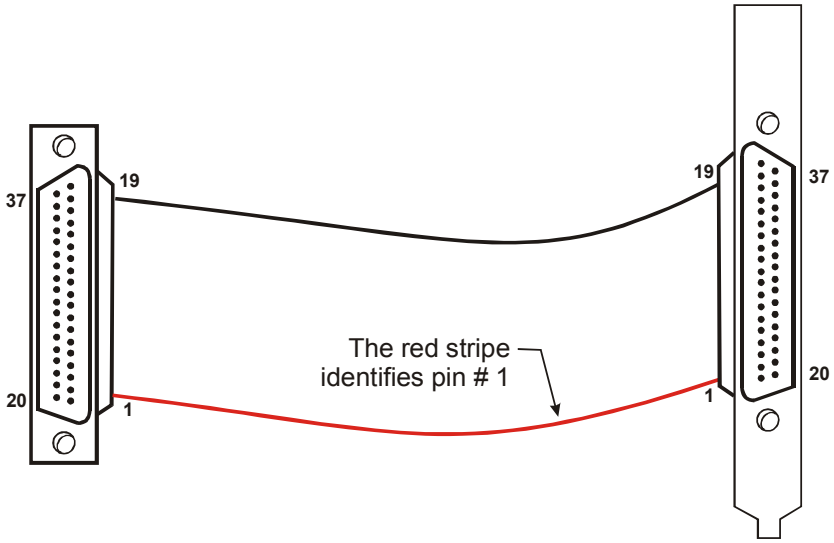


Figure 10. BP-37 cable

Field wiring, signal termination, and conditioning

You can use the following screw termination and signal conditioning products with the C37FF-x or C37FFS cable.

- **CIO-MINI37** – 37-pin screw terminal board. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=255.
- **CIO-TERMINAL** – 37-pin screw terminal board with on-board prototyping area. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=282.
- **CIO-SPADE50** — 16" x 4" termination panel which mates with both 37-pin and 50-pin connectors. Details on this product are available on our web site at www.mccdaq.com/pdfs/screw.pdf
- **BP-37** – Backplate with 37-pin male connector/cable. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=103&pf_id=1.
- **CIO-EXP16** – 16-channel analog multiplexer board with on-board CJC sensor. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=126&pf_id=249.
- **CIO-EXP32** – 32-channel analog multiplexer board with an on-board CJC sensor and 2 gain amps. Details are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=126&pf_id=250.

Information on signal connections

General information regarding signal connection and configuration is available in the *Guide to Signal Connections* (available at www.mccdaq.com/signals/signals.pdf).

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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).

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

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-DAS08*. This document is available on our website at www.mccdaq.com/registermaps/RegMapCIO-DAS08.pdf.

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Specifications

Typical for 25 °C unless otherwise specified.
Specifications in *italic* text are guaranteed by design.

Analog input

Table 1. Analog input specifications

Parameter	Specification			
A/D converter type	*AD574*			
Resolution	12-bits			
Number of channels	8 single-ended			
Input ranges	±10 V, ±5 V, 0 to +10 V, switch selectable			
Polarity	Unipolar/Bipolar, switch selectable			
A/D pacing	Software polled (typically through ISR paced by on-board counter)			
A/D trigger sources	External polled digital input trigger (Digital In 1)			
Data transfer	Software polled (typically through ISR paced by on-board counter)			
DMA	None			
A/D conversion time	*25 µs*			
Throughput	20 kHz, PC dependent			
Accuracy	±0.01% of reading ±1 LSB			
Differential linearity error	±1 LSB			
Integral linearity error	±0.5 LSB			
No missing codes guaranteed	*12-bits*			
Gain drift (A/D specs)	*±25 ppm/°C*			
Zero drift (A/D specs)	*±10 µV/°C*			
Common Mode Range	±10 V			
CMRR	72 dB			
Input leakage current (@ 25 °C)	*100 nA*			
Input impedance	*10 Meg Ohms min*			
Absolute maximum input voltage	*±35 V*			
Noise Distribution (Rate = 1 to 20 kHz)		Avg % ± 2 bins	Avg % ± 1 bin	Avg # bins
	Bipolar (10 V)	100%	100%	3 bins
	Bipolar (5 V)	100%	100%	3 bins
	Unipolar (10 V)	100%	100%	3 bins

Digital Input / Output

Table 2. Digital input/output specifications (main connector – J1)

Digital type (main connector J1)	*Output: 74LS273* *Input: 74LS244*
Configuration	*4 fixed output bits, 3 fixed input bits*
Number of channels	*4 out, 3 in*
Output high	*2.7 volts min @ -0.4 mA*
Output low	*0.4 volts max @ 8 mA*
Input high	*2.0 volts min, 7 volts absolute max*
Input low	*0.8 volts max, -0.5 volts absolute min*
Output power-up / reset state	

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Table 3. Digital input/output specifications (digital connector – J2)

Digital type (digital I/O connector J2)	*82C55*
Configuration	*2 banks of 8, 2 banks of 4, programmable by bank as input or output*
Number of channels	*24 I/O*
Output high	*3.0 volts min @ -2.5 mA*
Output low	*0.4 volts max @ 2.5 mA*
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)*

Table 4. Interrupt specifications

Interrupts	2 - 7, jumper selectable
Interrupt enable	Programmable
Interrupt sources	External (Interrupt In), rising edge; on-board counter, jumper selectable

Counters

Table 5. Counter specifications

Counter type	*82C54*
Configuration	3 down counters, 16-bits each
Counter 0 — Independent, user configurable	Source: User connector (Counter 0 In) Gate: User connector (Gate 0) Output: User connector (Counter 0 Out)
Counter 1 — Independent, user configurable	Source: User connector (Counter 1 In) Gate: User connector (Gate 1) Output: User connector (Counter 1 Out)
Counter 2 — Independent, user configurable	Source: PC SysClk via divide by 2 circuit Gate: User connector (Gate 2) Output: User connector (Counter 2 Out)
Clock input frequency	*10 MHz max*
High pulse width (clock input)	*30 ns min*
Low pulse width (clock input)	*50 ns min*
Gate width high	*50 ns min*
Gate width low	*50 ns min*
Input low voltage	*0.8 V max*
Input high voltage	*2.0 V min*
Output low voltage	*0.4 V max*
Output high voltage	*3.0 V min*

Power consumption

Table 6. Power consumption specifications

Parameter	**Specification**
+5V	250 mA typical, 312 mA max
+12V	15 mA typical, 21 mA max
-12V	25 mA typical, 35 mA max

Environmental

Table 7. Environmental specifications

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

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Main connectors and pin out

Table 8. Connector specifications

Connector type	Analog connector (J1): 37-pin male "D" connector
	Digital connector (J2): 37-pin male "D" connector
Compatible cables with analog connector J1	C37FF-x C37-FFS-x
Compatible cables with digital connector J2	BP-37
Compatible accessory products with the C37FF-x cable, C37FFS-x cable, and the BP-37 cable	CIO-MINI37 CIO-TERMINAL CIO-SPADE50 CIO-EXP16 CIO-EXP32

Analog connector J1 pin out

Table 9. Analog connector J1 pin out

Pin	Signal Name	Pin	Signal Name
1	+12V PC Bus	20	-12V PC Bus
2	Counter 0 In	21	Gate 0
3	Counter 0 Out	22	Gate 1
4	Counter 1 In	23	Gate 3
5	Counter 1 Out	24	Interrupt Input
6	Counter 2 Out	25	Digital In 1
7	Digital Out 1	26	Digital In 2
8	Digital Out 2	27	Digital In 3
9	Digital Out 3	28	Dig GND
10	Digital Out 4	29	+5V
11	Dig Common	30	CH7 High
12	LLGND	31	CH6 High
13	LLGND	32	CH5 High
14	LLGND	33	CH4 High
15	LLGND	34	CH3 High
16	LLGND	35	CH2 High
17	LLGND	36	CH1 High
18	LLGND	37	CH0 High
19	+10V Ref		

Digital connector J2 pin out

Table 10. Digital connector J2 pin out

Pin	Signal Name	Pin	Signal Name
1	NC	20	+5V
2	NC	21	GND
3	FIRSPORTB Bit 7	22	FIRSPORTC Bit 7
4	FIRSPORTB Bit 6	23	FIRSPORTC Bit 6
5	FIRSPORTB Bit 5	24	FIRSPORTC Bit 5
6	FIRSPORTB Bit 4	25	FIRSPORTC Bit 4
7	FIRSPORTB Bit 3	26	FIRSPORTC Bit 3
8	FIRSPORTB Bit 2	27	FIRSPORTC Bit 2
9	FIRSPORTB Bit 1	28	FIRSPORTC Bit 1
10	FIRSPORTB Bit 0	29	FIRSPORTC Bit 0
11	GND	30	FIRSPORTA Bit 7
12	-5V	31	FIRSPORTA Bit 6
13	GND	32	FIRSPORTA Bit 5
14	-12V	33	FIRSPORTA Bit 4
15	GND	34	FIRSPORTA Bit 3
16	+12V	35	FIRSPORTA Bit 2
17	GND	36	FIRSPORTA Bit 1
18	+5V	37	FIRSPORTA Bit 0
19	GND		

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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-DAS08

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 A.
- IEC 801-3 (1984): Radiated Electromagnetic Field immunity Criteria A.
- IEC 801-4 (1988): Electric Fast Transient Burst immunity Criteria A.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in November, 1995. Test records are outlined in Chomerics Test Report #EMI0168A.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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Measurement Computing Corporation
10 Commerce Way
Suite 1008
Norton, Massachusetts 02766
(508) 946-5100
Fax: (508) 946-9500
E-mail: info@mccdaq.com
www.mccdaq.com

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