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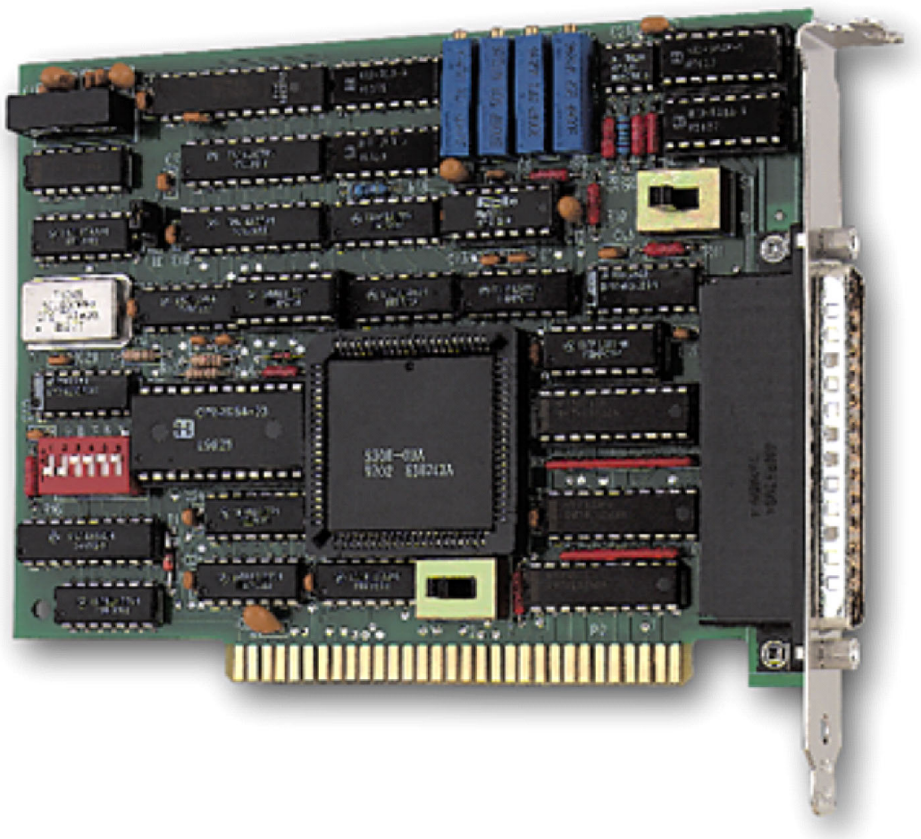
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CIO-DAS16/Jr

16 Single-ended/Eight Differential Analog Inputs
Eight Digital I/O, Three 16-bit Down Counters

User's Guide



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CIO-DAS16/Jr

Multifunction Analog and Digital I/O board

User's Guide



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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-DAS16/Jr 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-DAS16/Jr.

- MCC's *Specifications: CIO-DAS16/Jr* (the PDF version of the *Specifications* chapter in this guide) is available on our web site at www mccdaq.com/pdfs/CIO-DAS16Jr.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-DAS16/Jr User's Guide (this document) is also available on our web site at www mccdaq.com/PDFmanuals/CIO-DAS16Jr.pdf.

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Introducing the CIO-DAS16/Jr

Overview: CIO-DAS16/Jr features

The CIO-DAS16/Jr board is supported under popular Microsoft® Windows® operating systems.

The CIO-DAS16/Jr provides 16 single-ended or 8 differential channels of 12-bit analog input, three 16-bit counter channels, and eight digital I/O channels.

Analog input ranges are software selectable for Bipolar or Unipolar polarity. Bipolar input ranges are ±10 V, ±5 V, ±2.5 V, ±1.25 V, and ±0.625 V. Unipolar input ranges are 0 to 10 V, 0 to 5 V, 0 to 2.5 V, 0 to 1.25 V, and 0 to 0.625 V. Analog input ranges are software programmable.

The analog input mode is switch-selectable for single-ended or differential mode. The DMA level is switch-selectable for either 1 or 3. The frequency of the source applied to the on-board pacer is jumper-selectable for either 1 MHz or 10 MHz. The base address is selectable via on-board dip switches.

All user interface signals pass through a 37-pin connector.

Software features

For information on the features of *Insta*Cal and the other software included with your CIO-DAS16/Jr, 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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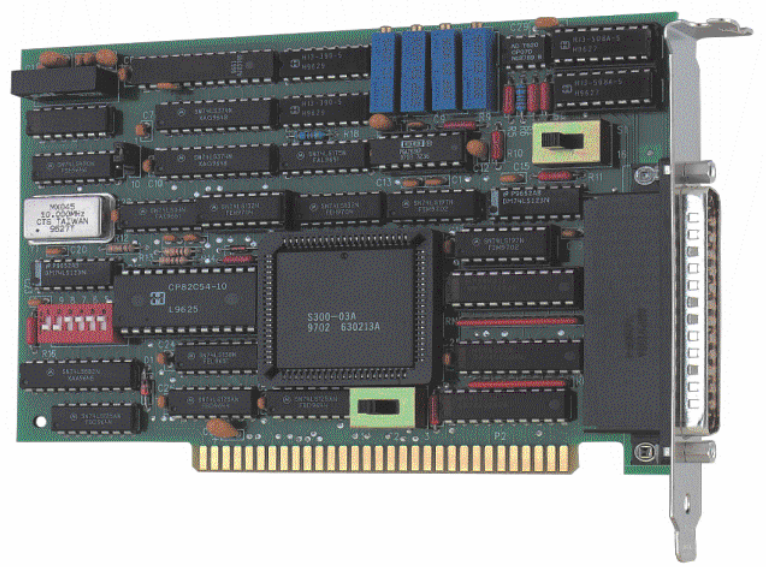
Installing the CIO-DAS16/Jr

What comes with your CIO-DAS16/Jr shipment?

The following items are shipped with the CIO-DAS16/Jr.

Hardware

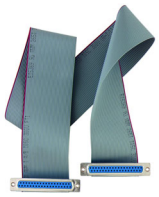
- CIO-DAS16/Jr



Optional components

You can also order the following MCC products to use with your CIO-DAS16/Jr.

- Cables



C37FF-x



C37FFS-x



C-EXP2DAS16-10

- Signal termination and conditioning accessories

  MCC provides signal conditioning and termination products for use with the CIO-DAS16/Jr. Refer to Field wiring, signal termination, and conditioning on page 13 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-DAS16/Jr 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-DAS16/Jr

The CIO-DAS16/Jr has one bank of base address-select switches, a DMA level select switch, an 8/16 analog channel select switch, and one XTAL jumper which you must set before installing the board in your computer. The *Insta*Cal calibration and test program included with the CIO-DAS16/Jr will show you how to set the switches. Run *Insta*Cal before you open your computer and install the board.

The location of each switch and jumper on the CIO-DAS16/Jr is shown in Figure 1.

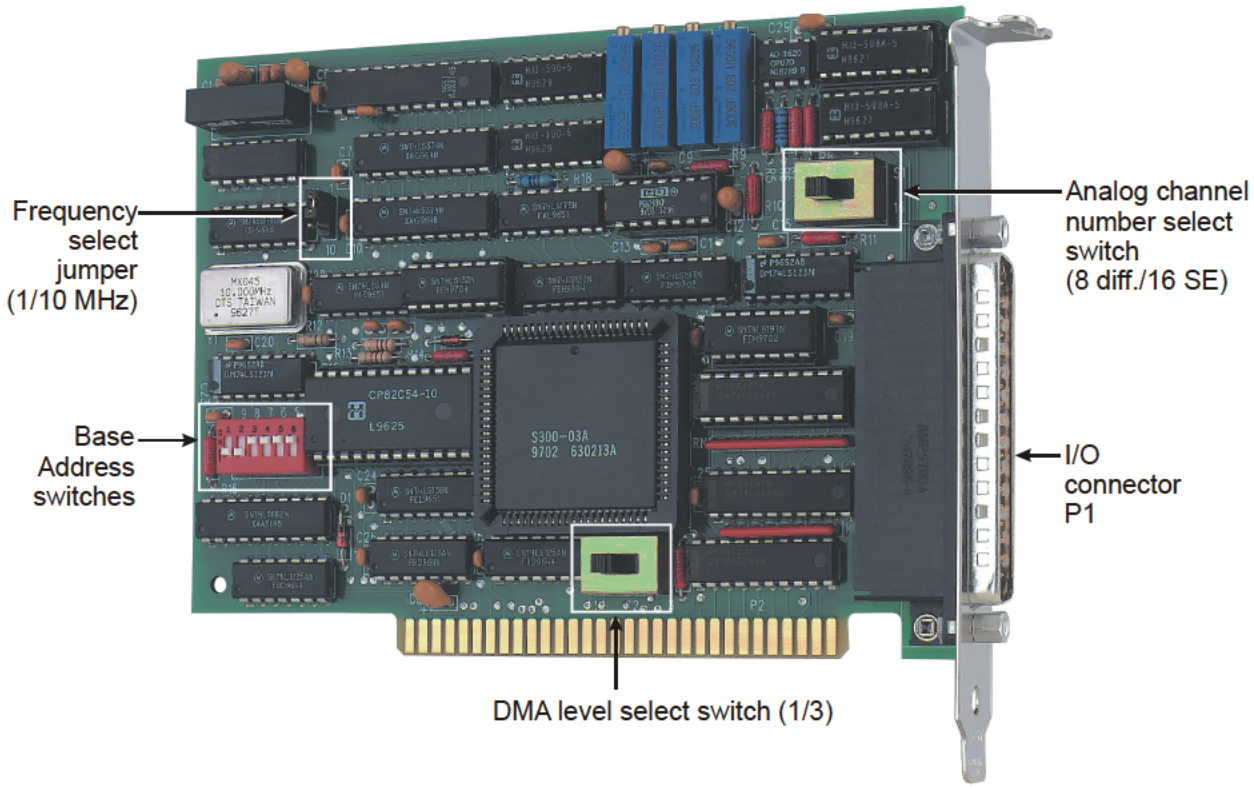


Figure 1. Switch and jumper locations

The CIO-DAS16/Jr is shipped with the factory-default settings listed in the table below.

Factory-configured default settings

Switch/jumper	Description	Default setting
Base address switches	DIP switch for setting the base address	300h (768 decimal)
Frequency select jumper	Selects the frequency of the source applied to the on-board pacer to be 1 MHz or 10 MHz	1 MHz
Analog channel number select switch	Configures the analog inputs for 8 differential or 16 single-ended channels	8 (differential)
DMA level-select switch	Selects the DMA level to be 1 or 3	Level 1

Before installing the CIO-DAS16/Jr in the computer, verify that the board is configured with the settings that you want. Review the following information to change the default configuration of a jumper or switch.

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Base address switch

The board is shipped with the base address set to 300 hex. 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. In the example shown in Figure 2, the board is set for base address 300 hex (768 decimal).

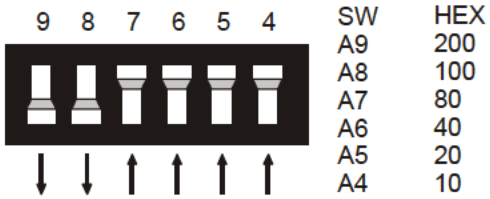


Figure 2. Base address switch

Frequency select jumper

Use the frequency select jumper to set the frequency of the source applied to the on-board pacer to either 1 MHz (default) or 10 MHz.

The frequency select jumper is incorporated in the board design because the original DAS-16, designed in 1984, had a 1 MHz crystal. When MetraByte redesigned the DAS-16 and added the faster 10 MHz crystal, a jumper was provided to maintain compatibility with older software. The CIO-DAS16/Jr has a select jumper because the DAS-16 has the jumper. Older software may require that you set the 1 MHz setting for this jumper.

Use the 10 MHz setting for any new software development to achieve better resolution setting pacer frequencies.

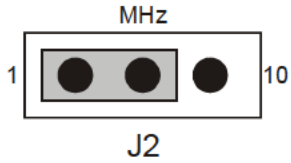


Figure 3. Frequency select jumper

Analog channel number select switch

Use the analog input mode-select switch to configure the board for eight differential (default) or 16 single-ended inputs. Using differential inputs allows up to 10 volts of common mode (ground loop) rejection.

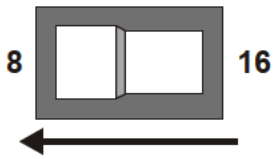


Figure 4. Analog channel number select switch

DMA level select switch

Use the direct memory access (DMA) level-select switch to set the DMA level to either 1 (default) or level 3. Unless you have another board in your system using DMA level 1, leave the DMA level-select switch at the level 1 position (Figure 5).

Some network boards use DMA, and so do some IEEE-488 interface boards. If you suspect a conflict with another board in the system, change this switch to DMA level 3.

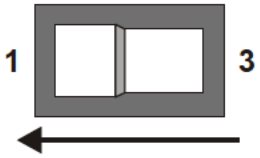


Figure 5. DMA level select switch

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Installing the CIO-DAS16/Jr

After configuring the board, install the CIO-DAS16/Jr 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.

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	37-pin male "D" connector
Compatible cables	C37FF-x C37FFS-x C-EXP2DAS16-10 DFCON-37 (D-connector, D-shell, and termination pins to construct your own cable)
Compatible accessory products with the C37FF-x cable or C37FFS-x cable	CIO-MINI37 CIO-TERMINAL CIO-SSH16 ISO-RACK16
Compatible accessory products with the C-EXP2DAS16-10 cable	CIO-EXP16 CIO-EXP32

Pinout – main I/O connector

The CIO-DAS16/Jr analog connector is a 37-pin D type connector accessible from the rear of the PC through the expansion backplate (Figure 6). With the exception of the missing D/A signals, the signals available are identical to the DAS-16.

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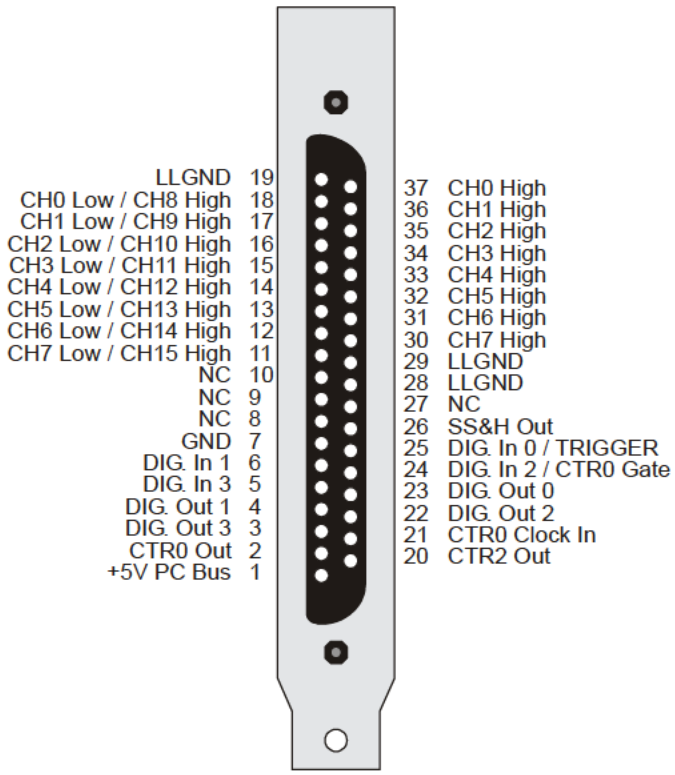


Figure 6. 37-pin analog connector

Cabling

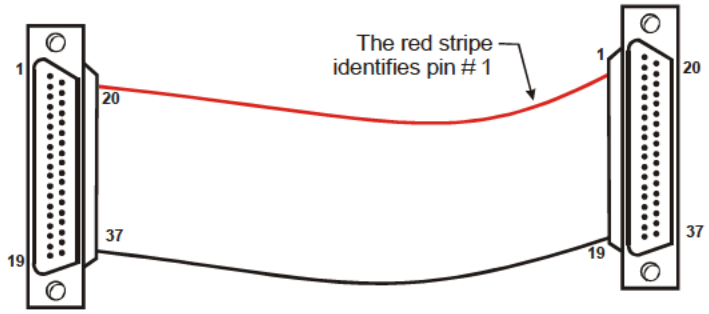


Figure 7. C37FF-x cable

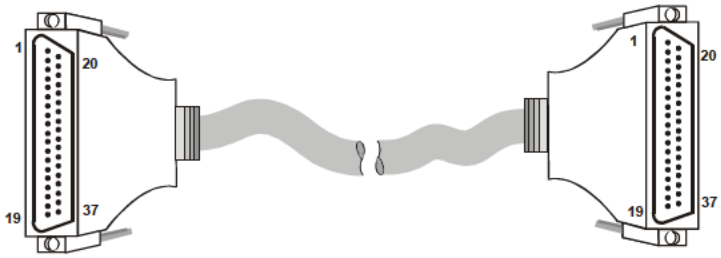


Figure 8. C37FFS-x cable

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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 are available on our web site at www mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=282.
- CIO-SSH16 – 16-channel sample & hold front end board (four channels installed). Details are available on our web site at www mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=125&pf_id=278.
- ISO-RACK16 – Isolated 16-channel, 5B module rack for analog signal conditioning and expansion. Details are available on our web site at www mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=127&pf_id=450.

You can use the following expansion multiplexer boards with the C-EXP2DAS16-10 cable.

- 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.
- 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.

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-DAS16/Jr*. This document is available on our website at http://www mccdaq.com/registermaps/RegMapCIO-DAS16Jr.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	*AD7800*
Resolution	12 bits
Number of channels	8 differential or 16 single-ended, switch selectable
Input ranges	±10 V, ±5 V, ±2.5 V, ±1.25 V, ±0.625 V, 0 to 10 V, 0 to 5 V, 0 to 2.5 V, 0 to 1.25 V, 0 to 0.625 V, fully programmable
Polarity	Unipolar/Bipolar, software selectable
A/D pacing	Programmable: ▪ internal counter or external source (DIG. IN 0 / TRIGGER, rising edge), or ▪ software polled
A/D trigger sources	External polled gate trigger (DIG. IN 0 / TRIGGER, active high)
A/D triggering modes	Digital: Gated pacer, software polled. (Gate must be disabled by software after trigger event.)
Data transfer	Interrupt, DMA or software polled
DMA	Channel 1 or 3
A/D conversion time	*3 µs*
Throughput	120 kHz typical, PC dependant
Absolute accuracy	0.01% of reading ±1 LSB
Differential linearity error	±1 LSB
Integral linearity error	±1 LSB
Differential linearity error	±1 LSB
No missing codes guaranteed	*12-bits*
Gain drift (A/D specs)	*±25 ppm/°C*
Zero drift (A/D specs)	*±10ppm/°C*
Common mode range	±10 V
CMRR @ 60 Hz	-72 dB
Input leakage current (@ 25 °C)	*200 nA*
Input impedance	*10 Meg Ohms min*
Absolute maximum input voltage	*±35 V*

Table 2. Noise distribution (Rate = 1-100 kHz)

Range	Average % ±2 bins	Average % ±1 bin	Average # bins
Bipolar (10 V)	98%	86%	8 bins
Bipolar (5 V)	97%	86%	9 bins
Bipolar (2.5 V)	97%	82%	8 bins
Bipolar (1.25 V)	95%	73%	9 bins
Unipolar (10 V)	95%	79%	9 bins
Unipolar (5 V)	96%	80%	9 bins
Unipolar (2.5 V)	92%	70%	10 bins
Unipolar (1.25 V)	89%	68%	11 bins

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Digital input/output

Table 3. Digital input/output specifications

Digital type	FPGA
Configuration	4 bits as input , 4 bits as output
Number of channels	4 input, 4 output
Input low voltage	0.8 V max
Input high voltage	2.0 V min
Output low voltage (IOL = 4 mA)	0.32 V max
Output high voltage (IOH = -4 mA)	3.86 V min
Absolute maximum input voltage	-0.5V, +5.5V
Interrupts	2 through 7, programmable
Interrupt enable	Programmable
Interrupt sources	A/D End-of-conversion, DMA terminal count

Counters

Table 4. Counter specifications

Counter type	82C54
Configuration	82C54 device. 3 down counters, 16-bits each
Counter 0 — Independent, available to user	Source: 100 kHz on board clock or external (CTR 0 Clock In) Gate: External (CTR 0 Gate) Output: Available at the user connector (CTR 0 Out)
Counter 1 — ADC Pacer Lower Divider	Source: 1 or 10 MHz oscillator, jumper-selectable Gate: Tied to Counter 2 gate, programmable source: internal or external (DIG. IN 0 / TRIGGER) Output: Chained to Counter 2 Clock
Counter 2 — ADC Pacer Upper Divider	Source: Counter 1 Output. Gate: Tied to Counter 1 gate, programmable source: internal or external (DIG. IN 0 / TRIGGER) Output: ADC Pacer clock, available at user connector (CTR 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
Crystal oscillator	▪ Frequency: 10 MHz ▪ Frequency accuracy: 100 ppm

Power consumption

Table 5. Power consumption specifications

Parameter	Specification
+5 V	680 mA typical, 850 mA max

Environmental

Table 6. 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 connector and pin out

Table 7. Connector specifications

Connector type	37-pin male "D" connector
Compatible cables	C37FF-x C37FFS-x C-EXP2DAS16-10 DFCON-37 (D-connector, D-shell, and termination pins to construct your own cable)
Compatible accessory products with the C37FF-x cable or C37FFS-x cable	CIO-MINI37 CIO-TERMINAL CIO-SSH16 ISO-RACK16
Compatible accessory products with the C-EXP2DAS16-10 cable	CIO-EXP16 CIO-EXP32

Table 8. Connector pin out

Pin	Signal Name	Pin	Signal Name
1	+5V PC Bus	20	CTR2 Out
2	Ctr0 Out	21	CTR0 Clock In
3	Dig. Out 3	22	Dig. Out 2
4	Dig. Out 1	23	Dig. Out 0
5	Dig. In 3	24	Dig. In 2 /CTR0 Gate
6	Dig. In 1	25	Dig. In 0 / TRIGGER
7	GND	26	SS&H Out
8	NC	27	NC
9	NC	28	LLGND
10	NC	29	LLGND
11	CH7 Low / CH15 High	30	CH7 High
12	CH6 Low / CH14 High	31	CH6 High
13	CH5 Low / CH13 High	32	CH5 High
14	CH4 Low / CH12 High	33	CH4 High
15	CH3 Low / CH11 High	34	CH3 High
16	CH2 Low / CH10 High	35	CH2 High
17	CH1 Low / CH9 High	36	CH1 High
18	CH0 Low / CH8 High	37	CH0 High
19	LLGND		

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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-DAS16/Jr

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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