ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

Artisan Technology Group
(217) 352-9330 | sales@artisantg.com | artisantg.com

Full-service, independent repair center
with experienced engineers and technicians on staff.

We buy your excess, underutilized, and idle equipment
along with credit for buybacks and trade-ins.

Custom engineering
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

Expert team | Trust guarantee | 100% satisfaction

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Measurement Computing / ComputerBoards CIO-DAS16* at our website: *Click HERE*

CIO-DAS16

CIO-DAS16/F

USER'S MANUAL



Revision 8
October, 2000

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

LIFETIME WARRANTY

Every hardware product manufactured by Measurement Computing Corp. is warranted against defects in materials or workmanship for the life of the product, to the original purchaser. Any products found to be defective will be repaired or replaced promptly.

LIFETIME HARSH ENVIRONMENT WARRANTY™

Any Measurement Computing Corp. product which is damaged due to misuse may be replaced for only 50% of the current price. I/O boards face some harsh environments, some harsher than the boards are designed to withstand. When that happens, just return the board with an order for its replacement at only 50% of the list price. Measurement Computing Corp. does not need to profit from your misfortune. By the way, we will honor this warranty for any other manufacture's board that we have a replacement for!

30 DAY MONEY-BACK GUARANTEE

Any Measurement Computing Corp. product may be returned within 30 days of purchase for a full refund of the price paid for the product being returned. If you are not satisfied, or chose the wrong product by mistake, you do not have to keep it. Please call for a RMA number first. No credits or returns accepted without a copy of the original invoice. Some software products are subject to a repackaging fee.

These warranties are in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular application. The remedies provided herein are the buyer's sole and exclusive remedies. Neither Measurement Computing Corp., nor its employees shall be liable for any direct or indirect, special, incidental or consequential damage arising from the use of its products, even if Measurement Computing Corp. has been notified in advance of the possibility of such damages.

MEGA-FIFO, the CIO prefix to data acquisition board model numbers, the PCM prefix to data acquisition board model numbers, PCM-DAS08, PCM-D24C3, PCM-DAC02, PCM-COM422, PCM-COM485, PCM-DMM, PCM-DAS16D/12, PCM-DAS16S/12, PCM-DAS16D/16, PCM-DAS16S/16, PCI-DAS6402/16, Universal Library, *Insta*Cal, *Harsh Environment Warranty* and Measurement Computing Corp. are registered trademarks of Measurement Computing Corp.

IBM, PC, and PC/AT are trademarks of International Business Machines Corp. Windows is a trademark of Microsoft Corp. All other trademarks are the property of their respective owners.

Information furnished by Measurement Computing Corp. is believed to be accurate and reliable. However, no responsibility is assumed by Measurement Computing Corp. neither for its use; nor for any infringements of patents or other rights of third parties, which may result from its use. No license is granted by implication or otherwise under any patent or copyrights of Measurement Computing Corp.

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 Corp.

Notice

Measurement Computing Corp. does not authorize any Measurement Computing Corp. product for use in life support systems and/or devices without the written approval of the President of Measurement Computing Corp. Life support devices/systems are devices or systems which, 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 Corp. 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.

© Copyright 2000 Measurement Computing Corp.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

TABLE OF CONTENTS

1 INSTALLATION 1
1.1 BASE ADDRESS 1
1.2 MODIFYING THE CIO-DAS16 FOR ODD ADDRESSES 2
1.3 DMA LEVEL SELECT 2
1.4 1/10 MHz XTAL JUMPER 2
1.5 8/16 CHANNEL SELECT 2
1.6 D/A CONVERTER REFERENCE JUMPER BLOCK 3
1.7 RANGE SWITCH SETTING 3
2 SIGNAL CONNECTION 5
2.1 CONNECTOR DIAGRAM 5
2.2 ANALOG INPUTS 6
2.3 ANALOG OUTPUTS 8
2.4 DIGITAL OUTPUTS & INPUTS 8
3 **ANALOG CONNECTIONS** 9
3.1 ANALOG INPUTS 9
3.2 SINGLE-ENDED AND DIFFERENTIAL INPUTS 9
3.3 WIRING CONFIGURATIONS 13
4 CIO-DAS16 CONTROL & DATA REGISTERS 18
4.1 INTRODUCTION 19
4.2 A/D DATA & CHANNEL REGISTERS 19
4.3 CHANNEL MUX SCAN LIMITS REGISTER 20
4.4 4-BIT DIGITAL I/O REGISTERS 20
4.5 D/A REGISTERS 21
4.6 STATUS REGISTER 22
4.7 DMA, INTERRUPT & TRIGGER CONTROL 23
4.8 PACER CLOCK CONTROL REGISTER 23
4.9 BASE + 11 - RESERVED REGISTER 24
4.10 PACER CLOCK DATA & CONTROL REGISTERS 24
4.11 24-LINE DIGITAL I/O REGISTERS 25
5 SPECIFICATIONS 28

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

This page intentionally left blank.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1 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.

There are two versions of this board, the CIO-DAS16 and the CIO-DAS16/F. The only difference between the two is maximum sampling rate for the A/D. They will both be referred to as the CIO-DAS16 except where this distinction applies.

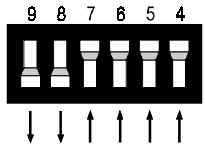
The CIO-DAS16 has one bank of switches, two single function switches and four jumper blocks which must be set before installation of the board inside your computer.

1.1 BASE ADDRESS

After a base address is chosen, a diagram of the switch setting is drawn on the PC screen. Set the switches on your base address switch as shown on Figure 1-1. Unless there is already a board in your system which uses address 300 hex (768 decimal) then you can leave the switches as they are set at the factory.

In the diagram, the CIO-DAS16 is set for base address 300h. That means the DAS-16 compatible section of the board is at 300h and the PIO-12 compatible section of the board is at 310h (784 Decimal).

When the 4 addresses of the 8255 digital I/O (PIO-12) are in use, the CIO-DAS16 occupies 20 consecutive addresses and is addressable on 32 address boundaries. Address boundaries of 32 are 300h, 320h, 340h, 360h, etc.



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

BASE ADDRESS SWITCH - Address 300H shown here.

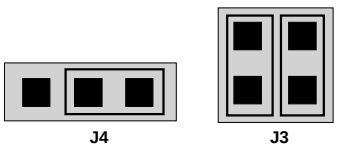
Figure 1-1. Base Address Switches

Because the MetraByte DAS-16 occupies only 16 addresses, it is addressable at 300h, 310h, 320h, 330h etc. If you have written software that assumes the DAS-16 base address is on a 16 address boundary and it is too much trouble to change the address in software, the CIO-DAS16 can be made to occupy only 16 addresses and address on 16 address boundaries.

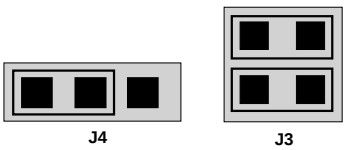
If you want to address the CIO-DAS16 on a 16 boundary address, such as 310h, 330h, 350h etc., you will not be able to use the additional 24 digital I/O lines on the rear connector.

1.2 MODIFYING THE CIO-DAS16 FOR COMPATIBLE ADDRESSES

There are two jumpers on the CIO-DAS16, J3 and J4, which disable or enable the 8255. The jumpers must be configured as a pair, according to either the (A) or (B) configuration in Figure 1-2.



(A)CIO-DAS16 POSITION
PIO-12 is active at Base Address + 16
Board will address at 300H, 320H, 340H, etc.



(B) DAS 16 POSITION
PIO-12 is not active at any address.
Board will address at 300H, 310H, 320H, etc.

CIO-DAS16 PIO-12 KNOCK OUT JUMPERS - The CIO-DAS16 is shipped in the (A) configuration. It should be left this way unless you want to use odd addressess, such as 310H, 330H, 350H, etc. In the (B) configuration, the 24 digital lines of the 8255 are not usable.

Figure 1-2. Odd Address Jumpers

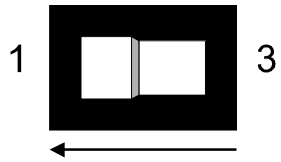
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.3 DMA LEVEL SELECT

What kind of computer are you installing the board in? If it is an old XT then there are only two DMA levels available and level 3 is probably used by the hard disk controller in your XT computer. Set the DMA level switch to the level 1 position (Figure 1-3).

If you have an AT or 386 type computer the hard disk controller is not at level 1 or 3 so either level may be used.

There are other boards that use DMA levels. Some network boards and some IEEE-488 interface boards do also. If you have other boards in your computer with DMA level switches on them, they must have a different level setting.



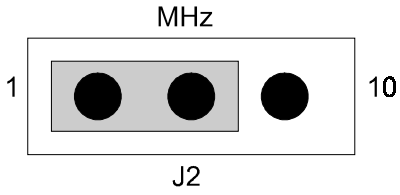
DMA LEVEL SELECT - DMA Level 1 Is selected.

Figure 1-3. DMA Level Select Switch

1.4 1/10 MHZ XTAL JUMPER

The 1/10 MHz XTAL jumper selects the frequency of the source applied to the on-board pacer. This pacer is used to pace the A/D start conversion trigger.

This jumper is on the board 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 has the jumper because the DAS-16 has the jumper and some software needs the jumper to be in the 1 MHz position and some software requires the 10 MHz position.



XTAL JUMPER - Default 1MHz shown.

Figure 1-4. 1 or 10 MHz Xtal Jumper

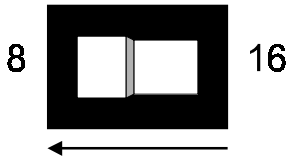
The CIO-DAS16 is shipped with the jumper in the 1 MHz position.

Some older 3rd party software programs require that the jumper be in the 1 MHz position. Please refer to the software program user's manual for guidance. Other programs, such as Labtech Notebook, have a 1 or 10 MHz choice in the set-up menu.

1.5 8/16 CHANNEL SELECT

The analog inputs of the CIO-DAS16 may be configured as 8 differential or 16 single-ended. Using single-ended inputs means you have more separate analog input channels available to connect signals. Using differential inputs allows up to 10 volts of common mode (ground loop) rejection and can be more noise immune.

The CIO-DAS16 comes from the factory configured for 8 differential inputs so the 8/16 switch is in the position shown here. Set it for the type and number of inputs you desire.



8/16 CHANNEL SELECT - 8 Differential inputs selected.

Figure 1-5. 8 /16 Channel Select Switch

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

1.6 D/A CONVERTER REFERENCE JUMPER BLOCK

There is a jumper block with 10 pins (2 rows of 5 each) located top center on the board. This block allows you to use the on-board precision voltage reference or an external voltage to provide reference to either or both of the digital-to-analog converters.

If you choose to use the on-board voltage reference rather than an external voltage, two D/A reference input pins, 10 and 26, on the 37-pin connector are not needed as reference inputs.

The 'S' jumper in this block is used to place a synchronizing signal on pin 26 so that the CIO-SSH16 external accessory Simultaneous Sample & Hold board can be used.

If the on-board D/A reference is used, the jumpers are set in the I1 and I0 positions (Figure 1-6). The board is configured this way at the factory. The SS&H output is not connected. If an external reference is desired, move the blocks to X0 and X1. If using a CIO-SSH16 board, leave the blocks on I0 and I1 and place a block on SS&H. To avoid possible damage in the event of a bad connection, do not install jumper S unless you intend to connect a CIO-SSH16 board. There is a spare shorting block on one of the 'S' pins.

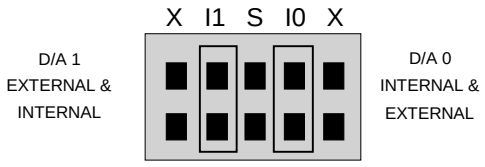
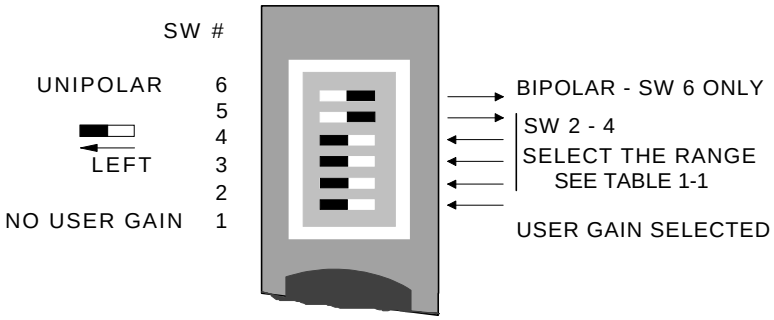


Figure 1-6. Ref. Volt and SS&H Jumpers

1.7 RANGE SWITCH SETTING

A bank of six dip switches accessible through the CIO-DAS16 connector bracket control the UNIPOLAR/BIPOLAR analog input range (Figure 1-7).



The factory setting of +/- 5V shown.

Figure 1-7. Range Select Switches

These switches control the analog input range values of all channels. You can use Table 1-1 and Figure 1-7, or use the *Insta*Cal program to determine the correct positions of switches S1 through S6 for the range you desire.

.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table 1-1. Range Select Switch Positions

S1	S2	S3	S4	S5	GAIN	BIPOLAR S6=RIGHT	UNIPOLAR S6=LEFT	RESOLUTION
L	L	L	L	L	0.5	+/- 10V	N/A	4.88mV / bit
L	L	L	L	R	1	+/- 5V	0 to 10V	2.44mV / bit
L	L	L	R	R	2	+/- 2.5V	0 to 5V	1.22mV / bit
L	L	R	L	R	5	+/- 1V	0 to 2 V	0.488mV / bit
L	R	L	L	R	10	+/- 0.5V	0 to 1V	0.244mV / bit
R	L	L	L	L	0.5 < USER < 20			SEE EQUATION

In the above table R = right and L = left.

S6, the top switch, controls a relay that switches the range between unipolar and bipolar.

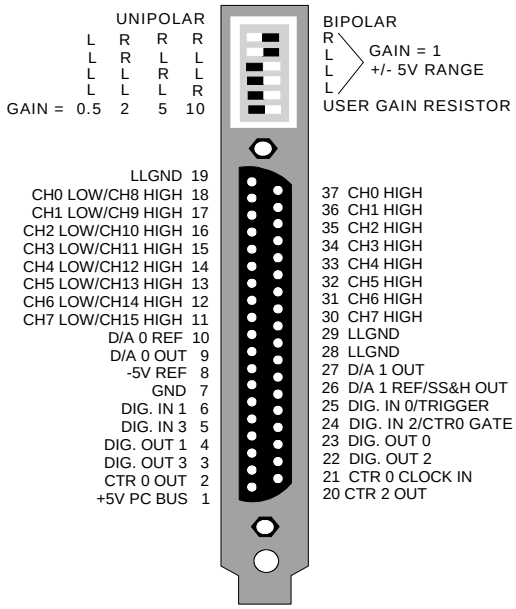
Set the switches as desired or leave them at the factory setting of +/- 5 volts.

It is not necessary to turn off the PC power or disconnect signals when changing these switch settings.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2.1 CONNECTOR DIAGRAM

The CIO-DAS16 analog connector is a 37-pin, D-type connector accessible from the rear of the PC through the expansion backplate (Figure 2-1). The signals available are identical to the DAS-16, or optionally, an additional signal, SS&H OUT, may be accessed at pin 26.



CIO-DAS16 ANALOG CONNECTOR - The CIO-DAS16 analog connector can be accessed from the rear of the computer through the expansion backplate.

Figure 2-1. Analog Connector

If frequent changes to signal connections or signal conditioning is required, please refer to the information on one of the following:

- CIO-TERMINAL screw terminal board
- CIO-EXP16, 16-channel analog multiplexer
- CIO-SSH16 16-channel simultaneous sample & hold board
- ISO-RACK16, 16-module 5B isolation module interface rack

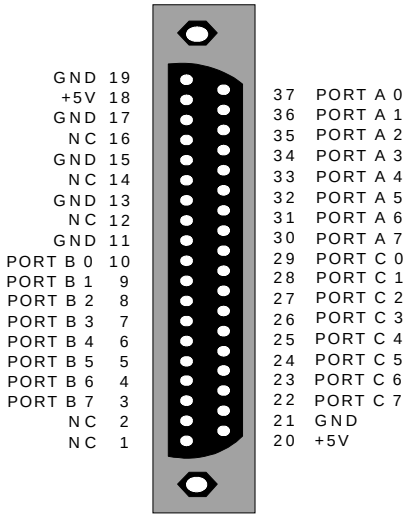
The CIO-DAS16 digital connector is identical to the CIO-DIO24 connector except for the −12V and +12V power signals and interrupt input brought out on the CIO-DIO24. These are no-connect pins on the CIO-DAS16.

The digital connector is mounted at the rear of the CIO-DAS16 and will accept a 37-pin, D-type female connector such as those on the C73FF-2, two-foot cable with connectors.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

A BP-37 will bring the signals to a backplate with a 37 pin male connector mounted in it.

A standard C37FF-2 may be run alongside the analog connector through the gap in the expansion slot backplate, or may be connected to the BP-37.



CIO-DAS16 DIGITAL CONNECTOR - The connector is mounted at the rear of the CIO-DAS 16.

Figure 2-2. Digital Connector

2.2 ANALOG INPUTS

Analog inputs to the CIO-DAS16 can be connected in three different configurations:

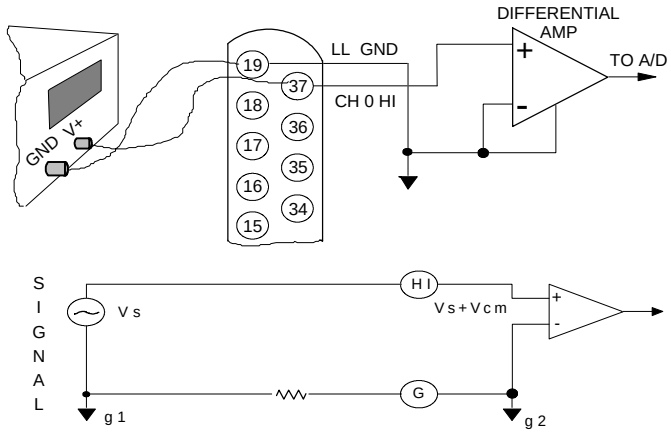
- Single-Ended
- Floating Differential
- Differential.

WARNING - PLEASE READ

Measure the voltage between the ground signal at the signal source and the PC. Using a voltmeter, place the red probe on the PC ground and the black probe on the signal ground. If there is more than 10 volts (AC or DC), do not connect the CIO-DAS16 to this signal source because you will not be able to make any reading. If more than 30 volts, DO NOT connect this signal to the CIO-DAS16 because it will damage the board and possibly the computer. **Voltages over 24V can be hazardous. Use great care when measuring voltages.**

SINGLE-ENDED

A single-ended input has two wires connected to the CIO-DAS16; a channel high (CH# HI) and a Low Level Ground (LLGND). The LLGND signal must be the same ground the PC is on. The CH# HI is the voltage signal source.



SIGNAL ENDED INPUT - A channel high (CH 0 HI) and a low level ground (LLGND) are connected to the CIO-DAS16.

Figure 2-3. Single-Ended Input Configuration

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

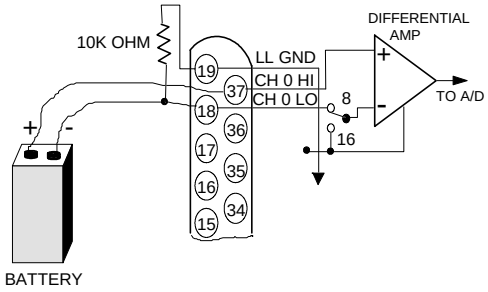
FLOATING DIFFERENTIAL

A floating differential input is two wires from the signal source and a 10K ground reference resistor installed at the CIO-DAS16 input. The two signals from the signal source are Signal High (CH# HI) and Signal Low (CH# LO) (Figure 2-4).

The reference resistor is connected between the CIO-DAS16 CH# LO and LLGND pins.

A floating differential hookup is useful when the signal source is floating with respect to ground, such as a battery, 4-20 mA transmitter or the lead lengths are long or subject to EMI.

The floating differential input will reject up to 10V of EMI.



CIO-DAS16 FLOATING DIFFERENTIAL - The two signals from the signal source are Signal High (CH 0 HI) and Signal Low (CH 0 LO).

Figure 2-4. Floating Differential Input

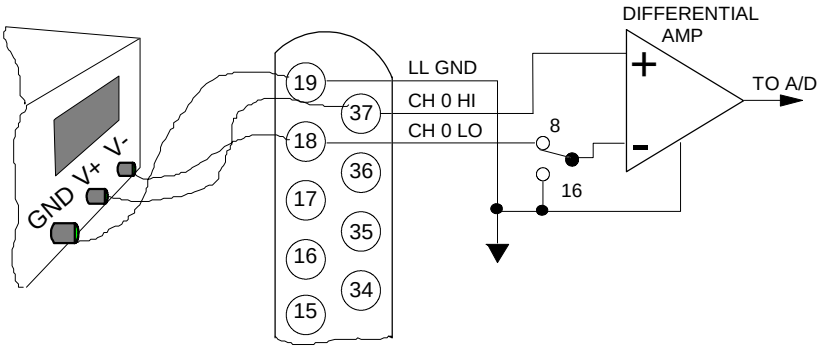
WARNING!

Verify that the signal source is floating. Check it with a voltmeter before risking the CIO-DAS16 and PC!

DIFFERENTIAL

A differential signal has three wires from the signal source. The signals are Signal High (CH# HI), Signal Low (CH# LO) and Signal Ground (LLGND) (Figure 2-5).

A differential connection allows you to connect the CIO-DAS16 to a signal source with a ground that is different from the PC ground, but less than 10V difference, and still make a true measurement of the signal between CH# HI and CH# LO.



CIO-DAS16 DIFFERENTIAL - The signals are Signal High (CH 0 HI), Signal Low (CH 0 LO), and Signal Ground (LLGND).

Figure 2-5. Differential Input

EXAMPLE:

A laboratory instrument with its own wall plug. There are sometimes voltages in wall GND between outlets.

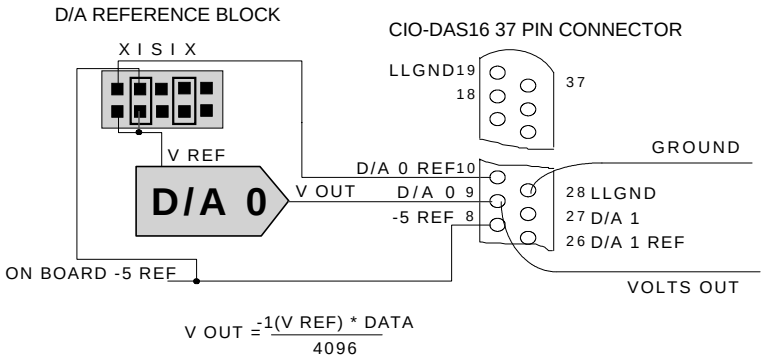
Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

2.3 ANALOG OUTPUTS

Analog outputs are voltage outputs which can be connected to any device which will record, display or be controlled by a voltage.

The CIO-DAS16 analog outputs are 4 quadrant multiplying DACs. This means that they accept an input voltage reference and provide an output voltage which is inverse to the reference voltage and proportional to the digital value in the output register.

For example, the supplied reference of -5V provides a +5V output when the value in the output register is 4095 (full scale at 12 bits of resolution). It provides a value of 2.5V when the value in the output register is 2048 (Figure 2-6).



CIO-DAS16 D/A CONVERTER SIGNAL CONNECTION - Jumper blocks for internal Vref shown installed. The on-board -5V reference is internally jumped. Both DACs will have a range of 0 to 5 volts. This is the factory default configuration.

Figure 2-6. Analog Output Configuration

2.4 DIGITAL OUTPUTS & INPUTS

All the digital outputs and inputs on the CIO-DAS16 are TTL level. TTL is an electronics industry term, short for Transistor Transistor Logic, that describes a standard for digital signals which are either at 0V or 5V (nominal). The binary logic inside the PC is all TTL or LSTTL (Low power Schotky TTL).

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.1 ANALOG INPUTS

Although complete coverage of this topic is well beyond the scope of this manual, the following section provides some explanations and helpful hints regarding these analog input connections. This section is intended to help you achieve the optimum performance from your CIO-DAS16/F series board.

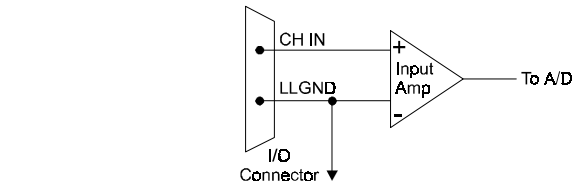
You should have a basic understanding of Single-Ended/Differential inputs and system grounding/isolation. If you are already comfortable with these concepts you may wish to skip to the next section (on wiring configurations).

3.2 SINGLE-ENDED AND DIFFERENTIAL INPUTS

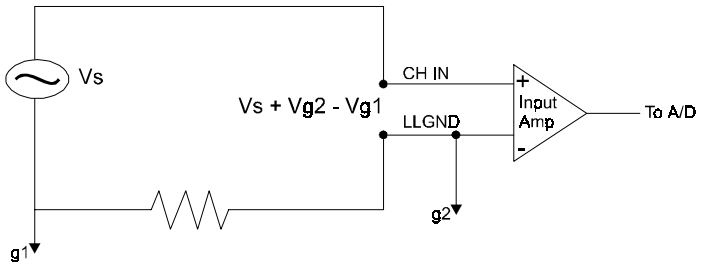
The CIO-DAS16/F provides either eight differential or 16 single-ended input channels. The concepts of single-ended and differential inputs are discussed in the following section.

Single-Ended Inputs

A single-ended input measures the voltage between the input signal and ground. In this case, in single-ended mode the CIO-DAS16/F measures the voltage between the input channel and LLGND. The single-ended input configuration requires only one physical connection (wire) per channel and allows the CIO-DAS16/F to monitor more channels than the (2-wire) differential configuration using the same connector and onboard multiplexor. However, since the CIO-DAS16/F is measuring the input voltage relative to its own low level ground, single-ended inputs are more susceptible to both EMI (Electro Magnetic Interference) and any ground noise at the signal source. Figure 3-1 shows the single-ended input configuration.



SINGLE-ENDED INPUT



SINGLE-ENDED INPUT WITH COMMON MODE VOLTAGE - Any voltage differential between grounds g1 and g2 shows up as an error signal at the input amplifier.

Figure 3-1. Single-Ended Input Configuration

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Differential Inputs

Differential inputs measure the voltage between two distinct input signals. Within a certain range (referred to as the common mode range), the measurement is almost independent of signal source to CIO-DAS16/F ground variations. A differential input is also much more immune to EMI than a single-ended one. Most EMI noise induced in one lead is also induced in the other, the input only measures the difference between the two leads, and the EMI common to both is ignored. This effect is a major reason there is twisted pair wire as the twisting assures that both wires are subject to virtually identical external influence. Figure 3-2 below shows a typical differential input configuration.

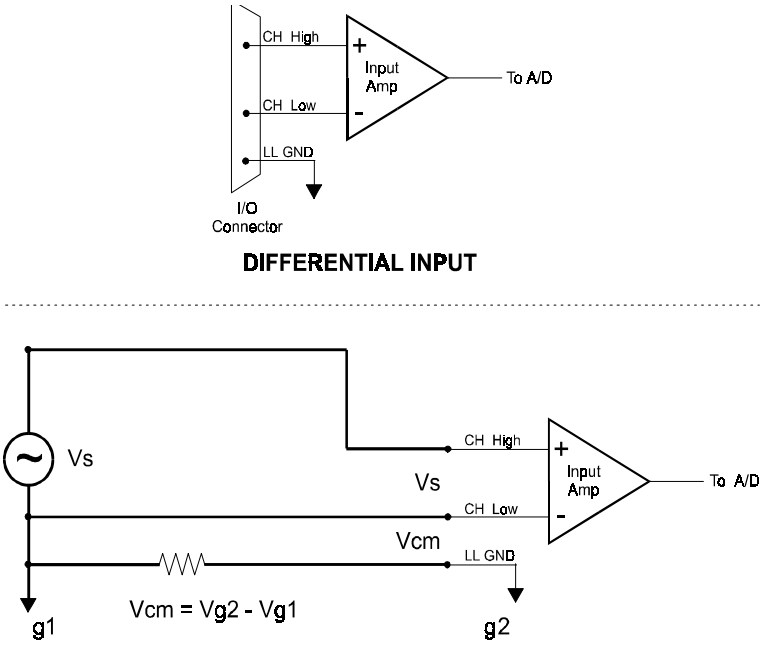


Figure 3-2. Differential Input Configuration

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Before moving on to the discussion of grounding and isolation, it is important to explain the concepts of common mode, and common mode range (CM Range). Common mode voltage is depicted in Figure 3-2 as Vcm. Though differential inputs measure the voltage between two signals, without (almost) respect to the either signal's voltages relative to ground, there is a limit to how far away from ground either signal can go. Though the CIO-DAS16/F has differential inputs, it will not measure the difference between 100V and 101V as 1 Volt (in fact the 100V would destroy the board!). This limitation or common mode range is depicted graphically in Figure 3-3. The CIO-DAS16/F common mode range is +/- 10 Volts. Even in differential mode, no input signal can be measured if it is more than 10V from the board's low level ground (LLGND).

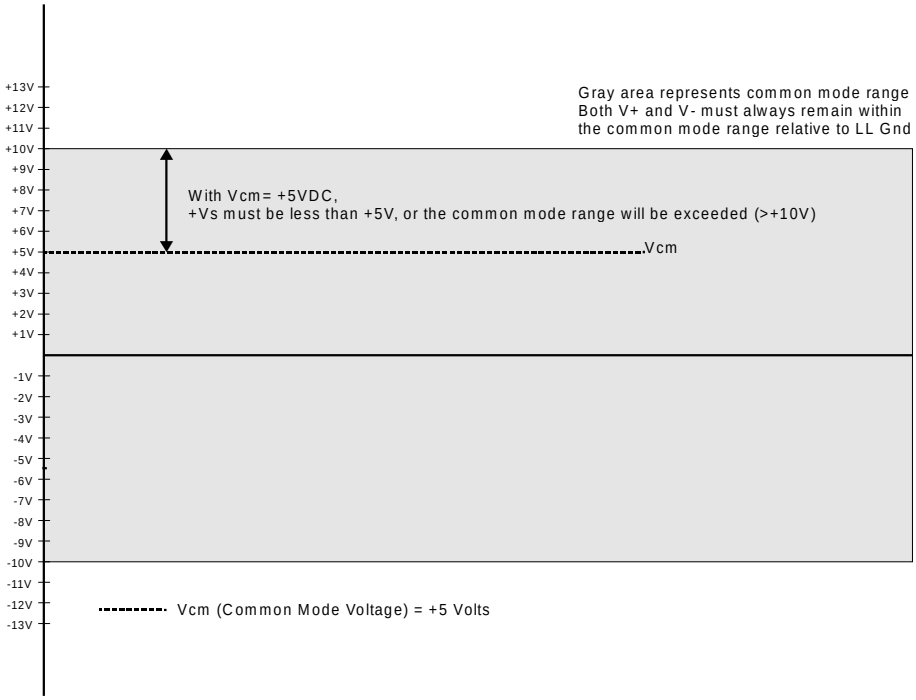


Figure 3-3. Common Mode Range Diagram

System Grounds and Isolation

There are three scenarios possible when connecting your signal source to your CIO-DAS16/F board.

1. The CIO-DAS16/F and the signal source may have the same (or common) ground. This signal source may be connected directly to the CIO-DAS16/F.
2. The CIO-DAS16/F and the signal source may have an offset voltage between their grounds (AC and/or DC). This offset it commonly referred to a common mode voltage. Depending on the magnitude of this voltage, it may or may not be possible to connect the CIO-DAS16/F directly to your signal source. We will discuss this topic further in a later section.
3. The CIO-DAS16/F and the signal source may already have isolated grounds. This signal source may be connected directly to the CIO-DAS16/F.

Which system do you have?

Perform the following test: Using a battery powered voltmeter[1], measure the voltage (AC and DC) between the ground signal at your signal source and at your PC. Place one voltmeter probe on the PC ground and the other on the signal source ground. Measure both the AC and DC Voltages.

[1] *If you do not have access to a voltmeter, skip the experiment and take a look at the following three sections. You may be able to identify your system type from the descriptions provided.*

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

If both AC and DC readings are 0.00 volts, you may have a system with common grounds. However, since voltmeters will average out high frequency signals, there is no guarantee. Please refer to the section below titled Common Grounds.

If you measure reasonably stable AC and DC voltages, your system has an offset voltage between the grounds category. This offset is referred to as a Common Mode Voltage. Please be careful to read the following warning and then proceed to the section describing Common Mode systems.

WARNING

> If either the AC or DC voltage is greater than 10 volts, do not connect the CIO-DAS16/F to this signal source. You are beyond the boards usable common mode range and will need to either adjust your grounding system or add special Isolation signal conditioning to take useful measurements. A ground offset voltage of more than 30 volts will likely damage the CIO-DAS16/F board and possibly your computer. Note that an offset voltage much greater than 24 volts will not only damage your electronics, but it may also be hazardous to your health. *In this case you will need to either reconfigure your system to reduce the ground differentials, or install special electrical isolation signal conditioning.*

If you cannot obtain a reasonably stable DC voltage measurement between the grounds, or the voltage drifts around considerably, the two grounds are most likely isolated. The easiest way to check for isolation is to change your voltmeter to it's ohm scale and measure the resistance between the two grounds. It is recommended that you turn both systems off prior to taking this resistance measurement. If the measured resistance is more than 100 Kohm, it's a fairly safe bet that your system has electrically isolated grounds.

Systems with Common Grounds

In the simplest (but perhaps least likely) case, your signal source will have the same ground as the CIO-DAS16/F. This would typically occur when providing power or excitation to your signal source directly from the CIO-DAS16/F. There may be other common ground configurations, but it is important to note that any voltage between the CIO-DAS16/F ground and your signal ground is a potential error voltage if you set up your system based on a common ground assumption.

As a safe rule of thumb, if your signal source or sensor is not connected directly to an LLGND pin on your CIO-DAS16/F, it's best to assume that you do not have a common ground even if your voltmeter measured 0.0 Volts. Configure your system as if there is ground offset voltage between the source and the CIO-DAS16/F. This is especially true if you are using either the CIO-DAS1402/16 or the CIO-DAS1402/12 at high gains, since ground potentials in the sub millivolt range will be large enough to cause A/D errors, yet will not likely be measured by your handheld voltmeter.

Systems with Common Mode (ground offset) Voltages

The most frequently encountered grounding scenario involves grounds that are somehow connected, but have AC and/or DC offset voltages between the CIO-DAS16/F and signal source grounds. This offset voltage my be AC, DC or both and may be caused by a wide array of phenomena including EMI pickup, resistive voltage drops in ground wiring and connections, etc. Ground offset voltage is a more appropriate term to describe this type of system, but since our goal is to keep things simple, and help you make appropriate connections, we'll use the phrase *Common Mode*.

Small Common Mode Voltages

If the voltage between the signal source ground and CIO-DAS16/F ground is small, the combination of the ground voltage and input signal will not exceed the CIO-DAS800's +/-10V common mode range, (i.e. the voltage between grounds, added to the maximum input voltage, stays within +/-10V), This input is compatible with the CIO-DAS16/F and the system may be connected without additional signal conditioning. Fortunately, most systems will fall in this category and have a small voltage differential between grounds.

Large Common Mode Voltages

If the ground differential is large enough, the CIO-DAS800's +/- 10V common mode range will be exceeded (i.e. the voltage between CIO-DAS16/F and signal source grounds, added to the maximum input voltage you're trying to measure exceeds +/-10V). In this case the CIO-DAS16/F cannot be directly connected to the signal source. You will need to

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

change your system grounding configuration or add isolation signal conditioning. (Please look at our ISO-RACK and ISO-5B-series products to add electrical isolation, or give our technical support group a call to discuss other options).

NOTE

Relying on the earth prong of a 120VAC for signal ground connections is not advised.. Different ground plugs may have large and potentially even dangerous voltage differentials. Remember that the ground pins on 120VAC outlets on different sides of the room may only be connected in the basement. This leaves the possibility that the "ground" pins may have a significant voltage differential (especially if the two 120 VAC outlets happen to be on different phases!)

CIO-DAS16/F and Signal Source Having Isolated Grounds

Some signal sources will already be electrically isolated from the CIO-DAS16/F. The diagram below shows a typical isolated ground system. These signal sources are often battery powered, or are fairly expensive pieces of equipment (since isolation is not an inexpensive proposition), isolated ground systems provide excellent performance, but require some extra effort during connections to assure optimum performance is obtained. Please refer to the following sections for further details

3.3 WIRING CONFIGURATIONS

Combining all the grounding and input type possibilities provides us with the following potential connection configurations. The combinations along with our recommendations on usage are shown in Table 3-1 below.

Table 3-1. Input Type Recommendations

GROUND CATEGORY	INPUT CONFIGURATION	OUR VIEW
Common Ground	Single-Ended Inputs	Recommended
Common Ground	Differential Inputs	Acceptable
Common Mode Voltage < +/-10V	Single-Ended Inputs	Not Recommended
Common Mode Voltage < +/-10V	Differential Inputs	Recommended
Common Mode Voltage > +/- 10V	Single-Ended Inputs	Unacceptable without adding Isolation
Common Mode Voltage > +/-10V	Differential Inputs	Unacceptable without adding Isolation
Already Isolated Grounds	Single-ended Inputs	Acceptable
Already Isolated Grounds	Differential Inputs	Recommended

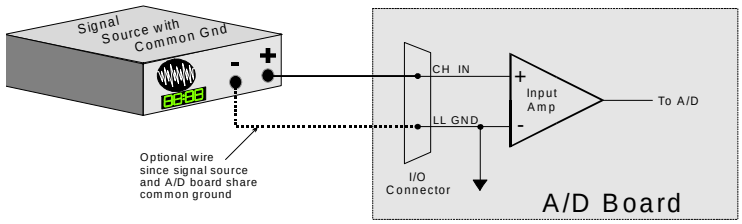
The following sections depicts recommended input wiring schemes for each of the eight possible input configuration/grounding combinations.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.3.1 Common Ground / Single-Ended Inputs

Single-ended is the recommended configuration for common ground connections. However, if some of your inputs are common ground and some are not, we recommend you use the differential mode. There is no performance penalty (other than loss of channels) for using a differential input to measure a common ground signal source. However the reverse is not true. Figure 3-4 below shows a recommended connection diagram for a common ground / single-ended input system.

NOTE: For simplicity, the input multiplexer is not shown in the following diagrams.

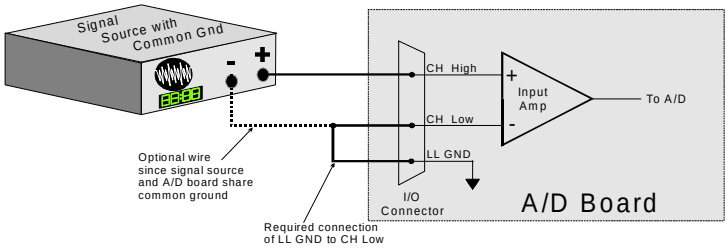


Signal source and A/D board sharing common ground connected to single-ended input.

- Figure 3-4. Single-Ended Input

3.3.2 Common Ground / Differential Inputs

The use of differential inputs to monitor a signal source with a common ground is a acceptable configuration though it requires more wiring and offers fewer channels than selecting a single-ended configuration. Figure 3-5 shows the recommended connections in this configuration.



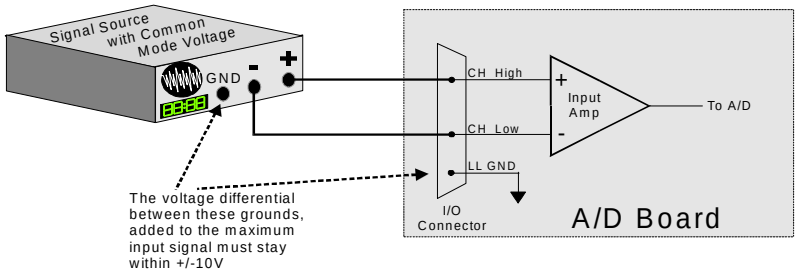
Signal source and A/D board sharing common ground connected to differential input.

Figure 3-5. Common Ground - Differential Input

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.3.3 Common Mode Voltage < +/-10V/Single-Ended Inputs

This is not a recommended configuration. In fact, the phrase common mode has no meaning in a single-ended system and this case would be better described as a system with offset grounds. Anyway, you are welcome to try this configuration, no system damage should occur and depending on the overall accuracy you require, you may receive acceptable results.

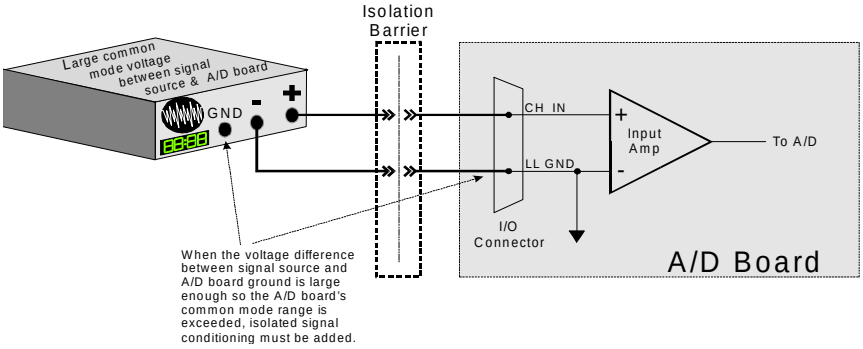


Signal source and A/D board with common mode voltage connected to a differential input.

Figure 3-6. Common Mode Voltage < +/-10V/Single-Ended Inputs

3.3.4 Common Mode Voltage < +/-10V/Differential Inputs

Systems with varying ground potentials should always be monitored in the differential mode. Care is required to assure that the sum of the input signal and the ground differential (referred to as the common mode voltage) does not exceed the common mode range of the A/D board (+/-10V on the CIO-DAS16/F). Figure 3-7 shows recommended connections in this configuration.



System with a Large Common Mode Voltage, Connected to a Single-Ended Input

Figure 3-7. Common Mode Voltage < +/-10V/Differential Inputs

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.3.5 Common Mode Voltage > +/-10V

The CIO-DAS16/F will not directly monitor signals with common mode voltages greater than +/-10V. You will either need to alter the system ground configuration to reduce the overall common mode voltage, or add isolated signal conditioning between the source and your board (Figure 3-8).

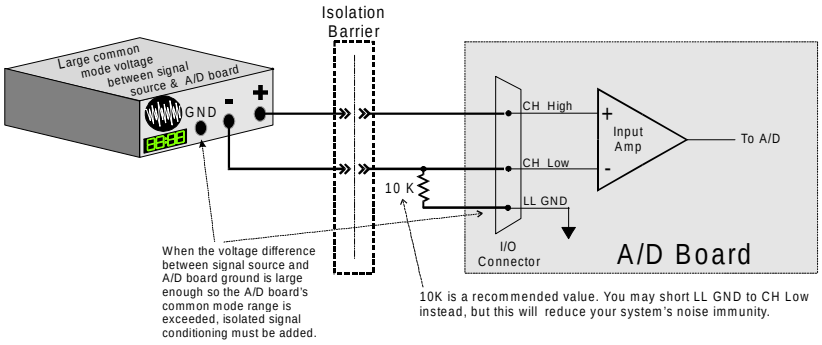


Figure 3-8. Common Mode Voltage > +/-10V - Differential Input

3.3.6 Isolated Grounds / Single-Ended Inputs

Single-ended inputs can be used to monitor isolated inputs, though the use of the differential mode will increase you system's noise immunity. Figure 3-9 shows the recommended connections is this configuration.

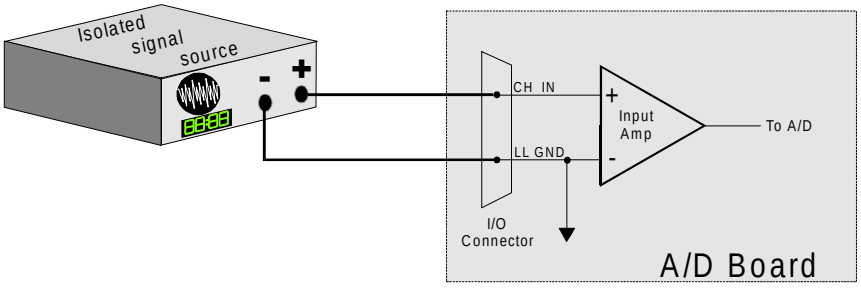


Figure 3-9. Isolated Grounds / Single-Ended Inputs

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

3.3.7 Isolated Grounds / Differential Inputs

Optimum performance with isolated signal sources is assured with the use of the differential input setting. Figure 3-10 below shows the recommend connections is this configuration..

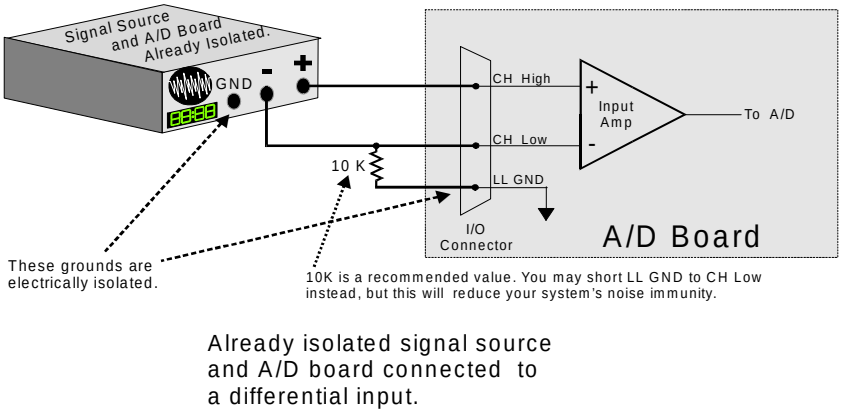


Figure 3-10. Isolated Grounds/Differential Inputs

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

4 CIO-DAS16 CONTROL & DATA REGISTERS

4.1 INTRODUCTION

The CIO-DAS16 is controlled and monitored by writing to and reading from 20 consecutive 8-bit I/O addresses (registers). The first address, or BASE ADDRESS, is determined by setting a bank of switches on the board.

Register manipulation is best done by experienced programmers since most of the CIO-DAS16 functions are implemented in easy-to-use Universal Library™ routines.

The register descriptions all follow the format:

7	6	5	4	3	2	1	0
A/D9	A/D10	A/D11	A/D12 LSB	CH8	CH4	CH2	CH1

The numbers along the top row are the bit positions within the 8-bit byte and the numbers and symbols in the bottom row are the functions associated with that bit.

To write to or read from a register in decimal or HEX, the following weights apply (Table 4-1):

Table 4-1. Register Bit Weights

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

To write control or data to a register, the individual bits must be set to 0 or 1 then combined to form a byte.

The method of programming required to set/read bits from bytes is beyond the scope of this manual.

In summary form, the registers and their function are listed on Table 4-2. Within each register are eight bits which may constitute a byte of data or eight individual bit read/write functions.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Table 4-2. Register Summary

ADDRESS	READ FUNCTION	WRITE FUNCTION
BASE	A/D Bits 9 - 12 (LSB) & Channel #	Start A/D Function
BASE + 1	A/D Bits 1 (MSB) - 8	None
BASE + 2	Channel MUX Read	Channel MUX Set
BASE + 3	Digital 4 Bit Input	Digital 4 Bit Output
BASE + 4	None	D/A 0 Bits 9-12 (LSB)
BASE + 5	None	D/A 0 Bits 1(MSB)-8
BASE + 6	None	D/A 1 Bits 9-12 (LSB)
BASE + 7	None	D/A 1 Bits 1(MSB) - 8
BASE + 8	Status EOC, UNI/BIP etc.	Interrupt Reset
BASE + 9	DMA, Interrupt & Trigger Control	Set DMA, INT etc
BASE + 10	Pacer clock control register.	None
BASE + 11	Reserved for future use.	
BASE + 12	Counter 0 Data	Counter 0 Data
BASE + 13	CTR 1 Data - A/D Pacer Clock	CTR 1 Data - A/D Pacer
BASE + 14	CTR 2 Data - A/D Pacer Clock	CTR 2 Data - A/D Pacer
BASE + 15	None. No read back on 8254	Pacer Clock Control (8254)
BASE + 16	Port A Input of 8255	Port A Output
BASE + 17	Port B Input	Port B Output
BASE + 18	Port C Input	Port C Output
BASE + 19	None - No read back on 8255	Configure 8255

4.2 A/D DATA & CHANNEL REGISTERS

BASE ADDRESS

7	6	5	4	3	2	1	0
A/D9	A/D10	A/D11	A/D12 LSB	CH8	CH4	CH2	CH1

A read/write register.

READ:

On read, it contains two types of data. The least significant four digits of the analog input data and the channel number which the current data was taken from.

These four bits of analog input data must be combined with the eight bits of analog input data in BASE + 1, forming a complete 12-bit number. The data is in the format 0 = minus full scale. 4095 = +FS.

The channel number is binary-coded. The weights are shown in Table 4-1. For example, if the current channel were five, then bits CH4 and CH1 would be high and CH8 and CH2 would be low.

WRITE:

Writing any data to the register causes an immediate A/D conversion.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

BASE ADDRESS +1

7	6	5	4	3	2	1	0
A/D1 MSB	A/D 2	A/D3	A/D4	A/D5	A/D6	A/D7	A/D8

A Read-only register.

On read, the most significant A/D byte is read.

4.3 CHANNEL MUX SCAN LIMITS REGISTER

BASE ADDRESS +2

7	6	5	4	3	2	1	0
CH H8	CH H4	CH H2	CH H1	CH L8	CH L4	CH L2	CH L1

A read and write register.

READ:

The current channel scan limits are read as one byte. The high channel number scan limit is in the most significant four bits. The low channel scan limit is in the least significant four bits.

WRITE:

The channel scan limits desired are written as one byte. The high channel number scan limit is in the most significant four bits. The low channel scan limit is in the least significant four bits.

That is one way of looking at this register, and probably the most sensible way. In fact, the bits 3-0 contain the starting channel number and bits 7-4 contain the ending channel number. If you wanted to scan channels 1, 2, 3 in that order, you could do so by placing the 3 in bits 7-4 and the 1 in bits 3-0.

NOTE

Every write to this register sets the current A/D channel MUX setting to the number in bits 0-3. See BASE + 8.

4.4 FOUR-BIT DIGITAL I/O REGISTERS

BASE ADDRESS +3

7	6	5	4	3	2	1	0
1	0	0	0	D13	D12, CTR 0 GATE	DI1	DI0, TRIG

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

READ:

The signals present at the inputs are read as one byte, the digital input data being contained in the four least significant bits. The pins 25 (digital input 0) and 24 (digital input 2) digital inputs have two functions each.

The TRIG function of digital input 0 may be used to hold off the first sample of an A/D set by holding it low (0V) until you are ready to take samples, which are then paced by the 82C54. It can also be used as the source of an external start conversion pulse, synchronizing A/D conversions to some external event.

BASE ADDRESS +3

7	6	5	4	3	2	1	0
X	X	X	X	DO3	DO2	DO1	DO0

WRITE:

The upper four bits are ignored. The lower four bits are latched TTL outputs. Once written, the state of the inputs cannot be read back because a read back would read the separate digital input lines (see above).

NOTE

The digital lines 0 to 4, pins 3, 4, 5, 6, 22, 23, 24, and 25 of the analog connector should not be used as ON/OFF Digital I/O. Read on.

The digital inputs have multiple functions as described above. The digital outputs are also used by the CIO-EXP family of multiplexer expansion boards. The original DAS-16 design had insufficient number of digital I/O, so we added a PIO-12 compatible 24-line 8255 to the design. We suggest that you use these lines for ON/OFF digital functions, keeping the 4-bit ports on the analog connector free.

4.5 D/A REGISTERS

D/A 0 REGISTERS

BASE ADDRESS +4

7	6	5	4	3	2	1	0
D/A9	D/A10	D/A11	D/A12 LSB	X	X	X	X

BASE ADDRESS+5

7	6	5	4	3	2	1	0
D/A1	D/A2	D/A3	D/A4	D/A5	D/A6	D/A7	D/A8

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

D/A 1 REGISTERS

BASE ADDRESS +6

7	6	5	4	3	2	1	0
D/A9	D/A10	D/A11	D/A12	X	X	X	X

BASE ADDRESS +7

7	6	5	4	3	2	1	0
D/A1	D/A2	D/A3	D/A4	D/A5	D/A6	D/A7	D/A8

WRITE ONLY:

Each 12-bit D/A output line has two registers. The first contains the four least significant bits of the data and four bits that don't matter. The second register contains the eight most significant bits of the data.

The D/A will be updated when the eight most significant bits (upper register) are written. In this way, the lower four bits can be written with no effect on the D/A output until the remainder of the data is written to the upper eight bits.

4.6 STATUS REGISTER

BASE ADDRESS + 8

7	6	5	4	3	2	1	0
EOC	U/B	MUX	INT	CH8	CH4	CH2	CH1

A read mostly, one-function-write register.

READ:

EOC = 1, the A/D converter is busy. EOC = 0, it is free.

U/B = 1, the amplifier is in Unipolar mode. U/B = 0, is bipolar.

MUX = 1, Channels are configured 16 single ended. MUX = 0, 8 differential.

INT = 1, an external pulse has been received. INT = 0, the flip-flop is ready to receive a pulse..

There is a flip-flop on the TRIGGER input (pin 25) which will latch a pulse as short as 200 ns. After being triggered, this flip-flop must be reset by a write to this register. Your interrupt service routine must do this before another interrupt trigger can be received.

CH8, CH4, CH2 and CH1 make up a binary number between 0 and 15 indicating the channel number that the MUX is currently set to. It is valid only when EOC = 0. The channel MUX increments shortly after EOC = 1 so may be in a state of transition when EOC = 1. The binary weight of each bit is shown in Table 4-1.

WRITE:

A write of any data to this register resets the flip-flop on the pin 25 input and sets the INT bit to 0.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

4.7 DMA, INTERRUPT & TRIGGER CONTROL

BASE ADDRESS + 9

7	6	5	4	3	2	1	0
INTE	IR4	IR2	IR1	Don't Care	DMA	TS1	TS0

A read and write register.

READ OR WRITE:

INTE = 1, Interrupts are enabled. An interrupt generated will be placed on the PC bus interrupt level selected by IR4, IR2, and IR1. When INTE = 0, interrupts are disabled.

IR4, IR2, and IR1 are bits in a binary number between 0 and 7 which map interrupts onto the PC bus interrupt levels 2 to 7. Interrupts 0 and 1 can not be asserted by the CIO-DAS16.

When DMA = 1, DMA transfers are enabled. When DMA = 0, DMA transfers are disabled. Note that a DMA request can be asserted only on the DMA request level selected by the DMA switch on the board. Before this bit is set to 1, the PC's 8237 (or appropriate) DMA controller chip must be set up.

TS1 & TS0 control the source of the A/D start conversion trigger according to Table 4-3 below.

Table 4-3. Start Conversion Trigger Source - Control Bit Coding

TS1	**TS0**	Action
0	X	Software triggered A/D only
1	0	Start on rising TRIGGER (Digital input 0, Pin 25)
1	1	Start on Pacer Clock Pulse (CTR 2 OUT, no external access)

4.8 PACER CLOCK CONTROL REGISTER

BASE ADDRESS +10

7	6	5	4	3	2	1	0
X	X	X	X	X	X	CTR0	TRIG0

Write only

When CTR0 = 1, an on-board 100 KHz clock signal is ANDed with the COUNTER 0 CLOCK INPUT (pin 21). A high on pin 21 will allow pulses from the on-board source into the 8254 Counter 0 input.

When CTR0 = 0, the input to 82C54 Counter 0 is entirely dependent on pulses at pin 21, COUNTER 0 CLOCK INPUT.

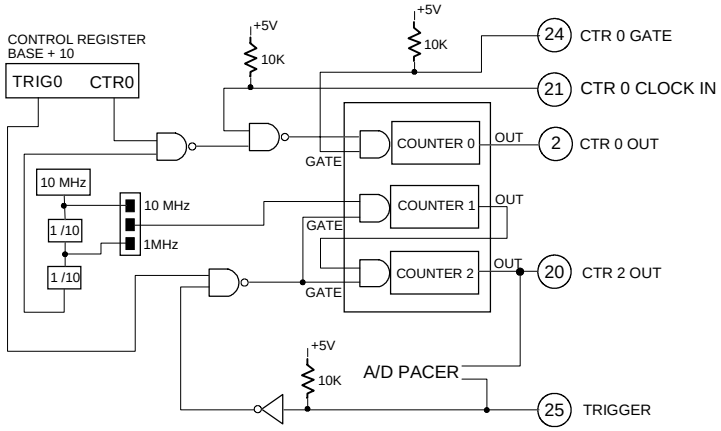
TRIG0 = 1. The TRIGGER input at pin 25 is ANDed with TRIG0 which controls gating of the on-board pacer clock (82C54). When TRIG0 = 1, the on-board pacer clock can be gated off (disabled) by pulling pin 25 low. The input at pin 25 is pulled up and will always be high unless pulled low externally.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

When TRIG0 = 0, the external trigger at pin 25 has no effect on the GATEs of counter 1 and 2.

See Figure 4-1 for a block diagram of the Pacer Clock logic.

Figure 4-1. Pacer Clock and Control Logic



4.9 BASE + 11 - RESERVED REGISTER

BASE ADDRESS + 11

This address is reserved for use as a programmable gain register in other DAS16 family boards.

4.10 PACER CLOCK DATA & CONTROL REGISTERS

8254 COUNTER 0 DATA

BASE ADDRESS +12

7	6	5	4	3	2	1	0
D7	D6	D5	D4	D3	D2	D1	D0

8254 COUNTER 1 DATA

BASE ADDRESS +13

7	6	5	4	3	2	1	0
D7	D6	D5	D4	D3	D2	D1	D0

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

82C54 COUNTER 2 DATA

BASE ADDRESS +14

7	6	5	4	3	2	1	0
D7	D6	D5	D4	D3	D2	D1	D0

The three 82C54 counter/timer data registers may be written to and read from. Because each counter can count to 65,535, loading or reading the counter data must be a multi-step process. The operation of the 82C54 is explained in the Intel 82C54 data sheet.

82C54 COUNTER CONTROL

BASE ADDRESS +15

7	6	5	4	3	2	1	0
D7	D6	D5	D4	D3	D2	D1	D0

This register controls the operation and loading/reading of the counters. The configuration of the 82C54 codes which control the 82C54 chip is explained in the Intel 82C54 data sheet.

4.11 24-LINE DIGITAL I/O REGISTERS

PORT A DATA

BASE ADDRESS +16

7	6	5	4	3	2	1	0
A7	A6	A5	A4	A3	A2	A1	A0

PORT B DATA

BASE ADDRESS +17

7	6	5	4	3	2	1	0
B7	B6	B5	B4	B3	B2	B1	B0

Ports A and B may be programmed as input or output. Each is written to and read from in bytes, although for control and monitoring purposes the individual bits are used.

Bit set/reset and bit read functions require that unwanted bits be masked out of reads and ORed into writes.

PORT C DATA

BASE ADDRESS +18

7	6	5	4	3	2	1	0
C7	C6	C5	C4	C3	C2	C1	C0
CH3	CH2	CH1	CH0	CL3	CL2	CL1	CL0

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Port C may be used as one 8-bit port of either input or output, or it may be split into two 4-bit ports which can be independently input or output. The notation for the upper 4-bit port is CH3 to CH0, and for the lower, CL3 to CL0.

Although it may be split, every read and write to port C carries eight bits of data so unwanted information must be ANDed out of reads, and writes must be ORed with the current status of the other port.

OUTPUT PORTS:

In 8255 mode 0 configuration, ports configured for output, hold the output data written to them. The output byte may be read back by reading a port configured for output.

INPUT PORTS:

In 8255 mode 0 configuration, ports configured for input, read the state of the input lines at the moment, transitions are not latched.

8255 CONTROL REGISTER

BASE ADDRESS +19

7	6	5	4	3	2	1	0
MS	M3	M2	A	CH	M1	B	CL
	Group A				Group B		

The 8255 can be programmed to operate in Input/Output (mode 0), Strobed Input/Output (mode 1) or Bi-Directional Bus (mode 2).

When the PC is powered up or RESET, the 8255 is reset. This places all 24 lines in Input mode and no further programming is needed to use the 24 lines as TTL inputs.

To program the 8255 for other modes, the following control code byte must be assembled into an 8-bit byte.

M3	M2	GROUP A FUNCTION	
0	1	Mode 0	Input/Output
0	1	Mode 1	Strobed Input/Output
1	X	Mode 2	Bi-Directional Bus

MS = Mode Set. 1 = mode set active. M1 = 0 is mode 0 for group B. Input / Output. M1 = 1 is mode 1 for group B. Strobed Input / Output

A	B	CL	CH	INDEPENDENT FUNCTION
1	1	1	1	Input
0	0	0	0	Output

The Ports A, B, C High, and C Low may be independently programmed for input or output.

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

The two groups of ports, group A and group B, may be independently programmed in one of several modes. The most commonly used mode is mode 0, input / output mode. The codes for programming the 82C55 in this mode are shown in Table 4-4. D7 is always 1 and D6, D5 & D2 are always 0.

Table 4- 4. Programming Codes for 82C55 in Mode 0, Input/Output Mode

D4	D3	D1	D0	HEX	DEC	A	CH	B	CL
0	0	0	0	80	128	OUT	OUT	OUT	OUT
0	0	0	1	81	129	OUT	OUT	OUT	IN
0	0	1	0	82	130	OUT	OUT	IN	OUT
0	0	1	1	83	131	OUT	OUT	IN	IN
0	1	0	0	88	136	OUT	IN	OUT	OUT
0	1	0	1	89	137	OUT	IN	OUT	IN
0	1	1	0	8A	138	OUT	IN	IN	OUT
0	1	1	1	8B	139	OUT	IN	IN	IN
1	0	0	0	90	144	IN	OUT	OUT	OUT
1	0	0	1	91	145	IN	OUT	OUT	IN
1	0	1	0	92	146	IN	OUT	IN	OUT
1	0	1	1	93	147	IN	OUT	IN	IN
1	1	0	0	98	152	IN	IN	OUT	OUT
1	1	0	1	99	153	IN	IN	OUT	IN
1	1	1	0	9A	154	IN	IN	IN	OUT
1	1	1	1	9B	155	IN	IN	IN	IN

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

5 SPECIFICATIONS

Power consumption

+5V:	780 mA typical, 975 mA max
+12V:	20 mA typical, 25 mA max
-12V:	27 mA typical, 34 mA max

Analog input section

A/D converter type	
CIO-DAS16	AD674
CIO-DAS16/F	AD774
Resolution	12 bits
Number of channels	8 differential or 16 single-ended, switch selectable
Input Ranges	±10V, ±5V, ±2.5V, ±1V, ±0.5V, 0 to 10V, 0 to 5V, 0 to 2V, 0 to 1V and user settable through resistor selection
Polarity	Unipolar/Bipolar, switch 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, switch selectable
A/D conversion time	
CIO-DAS16	15 µs
CIO-DAS16/F	8.5 µs
Throughput	
CIO-DAS16	50 kHz min
CIO-DAS16/F	100 kHz min
Accuracy	0.01% of reading ±1 LSB
Differential Linearity error	±1 LSB
Integral Linearity error	±1 LSB
No missing codes guaranteed	12 bits
Gain drift (A/D specs)	±25 ppm/°C
Zero drift (A/D specs)	±10µV/°C
Common Mode Range	±10V
CMRR @ 60Hz	72 dB
Input leakage current (@25 Deg C)	25 µA
Input impedance	50 Meg Ohms min
Absolute maximum input voltage	±35V

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Analog Output

D/A converter type	MX7548
Resolution	12 bits
Number of channels	2
Output Ranges	0 to 5V using on-board reference, ±10V range using external reference (Vout max = –1 * VRef)
Offset error	Adjustable to 0 with potentiometer
Gain error	Adjustable to 0 with potentiometer
Differential non linearity	±1LSB max
Integral non linearity	±1LSB max
Monotonicity	±0.5 LSB
D/A Gain drift	±5 ppm/°C max
D/A pacing	Software paced
D/A trigger modes	Software
Data transfer	Software
Throughput	System dependent
Settling time (output current to ±½LSB)	1µs max
Slew Rate (OP07)	0.3V/µs
Current Drive	±5 mA
Output short-circuit duration	25 mA indefinite
Output coupling	DC
Output impedance	0.1 Ohms max
Miscellaneous	Double buffered output latches

Digital Input / Output

Digital Type (main connector)	
Output:	74LS374
Input:	74S244
Configuration	4 bits as input, 4 bits as output
Number of channels	8
Output High	2.4 volts min @ –2.6 mA
Output Low	0.5 volts max @ 24 mA
Input High	2.0 volts min, 7 volts absolute max
Input Low	0.8 volts max, –0.5 volts absolute min
Digital Type (Digital I/O connector)	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
Interrupts	2 - 7, software selectable
Interrupt enable	Programmable
Interrupt sources	A/D End-of-conversion, DMA terminal count

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Counter section

Counter type	82C54
Configuration	82C54 device. 3 down-counters, 16 bits each

Counter 0 - Independent user counter

- Source: Internal 100 kHz or external (CTR 0 Clock In), software selectable
- Gate: External (Dig In 2 / CTR 0 Gate), software enabled
- Output: Available at 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: external (Dig In 0 / Trigger) or internal
- Output: Chained to Counter 2 Clock.

Counter 2 - ADC Pacer Upper Divider

- Source: Counter 1 Output.
- Gate: Tied to Counter 1 gate, programmable source (external or internal).
- Output: ADC start convert, 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	0.8V max
Input high voltage	2.0V min
Output low voltage	0.4V max
Output high voltage	3.0V min

Environmental

Operating temperature range	0 to 50°C
Storage temperature range	-20 to 70°C
Humidity	0 to 95% non-condensing

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

EC Declaration of Conformity

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

Part Number	Description
CIO-DAS16/F	

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

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Measurement Computing Corporation
16 Commerce Boulevard,
Middleboro, Massachusetts 02346
(508) 946-5100
Fax: (508) 946-9500
E-mail: info@measurementcomputing.com
www. measurementcomputing.com

Artisan Technology Group - Quality Instrumentation ... Guaranteed | (888) 88-SOURCE | www.artisantg.com

Artisan Technology Group is an independent supplier of quality pre-owned equipment

Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP