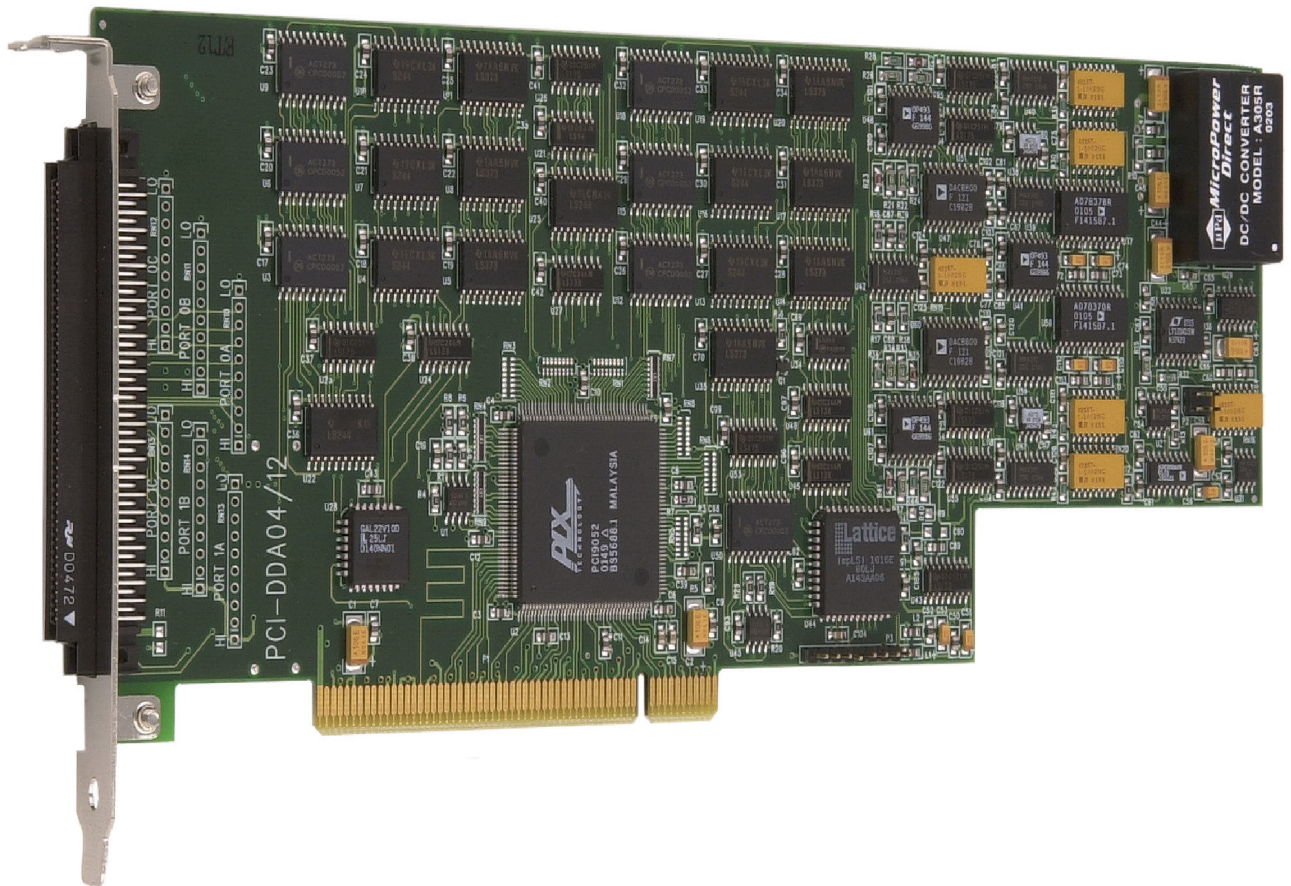


# PCI-DDA04/12

Analog Output and Digital I/O Board

## User's Guide



# PCI-DDA04/12

## Analog Output and Digital I/O

### User's Guide



**MEASUREMENT  
COMPUTING™**

Document Revision 2, July, 2006

© Copyright 2006, Measurement Computing Corporation

Your new Measurement Computing product comes with a fantastic extra —

## Management committed to your satisfaction!

Refer to [www.mccdaq.com/execteam.html](http://www.mccdaq.com/execteam.html) for the names, titles, and contact information of each key executive at Measurement Computing.

Thank you for choosing a Measurement Computing product—and congratulations! You own the finest, and you can now enjoy the protection of the most comprehensive warranties and unmatched phone tech support. It's the embodiment of our two missions:

- To offer the highest-quality, computer-based data acquisition, control, and GPIB hardware and software available—at the best possible price.
- To offer our customers superior post-sale support—FREE. Whether providing unrivaled telephone technical and sales support on our latest product offerings, or continuing that same first-rate support on older products and operating systems, we're committed to you!

**Lifetime warranty:** Every hardware product manufactured by Measurement Computing Corporation is warranted against defects in materials or workmanship for the life of the product. Products found defective are repaired or replaced promptly.

**Lifetime Harsh Environment Warranty®:** We will replace any product manufactured by Measurement Computing Corporation that is damaged (even due to misuse) for only 50% of the current list price. I/O boards face some tough operating conditions—some more severe than the boards are designed to withstand. When a board becomes damaged, just return the unit with an order for its replacement at only 50% of the current list price. We don't need to profit from your misfortune. By the way, we honor this warranty for any manufacturer's board that we have a replacement for.

**30 Day Money Back Guarantee:** You may return any Measurement Computing Corporation product 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 an 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 Corporation, 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 Corporation has been notified in advance of the possibility of such damages.*

### **Trademark and Copyright Information**

TracerDAQ, Universal Library, Harsh Environment Warranty, Measurement Computing Corporation, and the Measurement Computing logo are either trademarks or registered trademarks of Measurement Computing Corporation.

Windows, Microsoft, and Visual Studio are either trademarks or registered trademarks of Microsoft Corporation

LabVIEW is a trademark of National Instruments.

CompactFlash is a registered trademark of SanDisk Corporation.

All other trademarks are the property of their respective owners.

Information furnished by Measurement Computing Corporation is believed to be accurate and reliable. However, no responsibility is assumed by Measurement Computing Corporation 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 Corporation.

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 Corporation.

#### **Notice**

Measurement Computing Corporation does not authorize any Measurement Computing Corporation product for use in life support systems and/or devices without prior written consent from Measurement Computing Corporation. 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 Corporation 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.

---

# Table of Contents

## Preface

<b>About this User's Guide .....</b>	<b>v</b>
What you will learn from this user's guide .....	v
Conventions in this user's guide .....	v
Where to find more information .....	v

## Chapter 1

<b>Introducing the PCI-DDA04/12.....</b>	<b>1-1</b>
Overview: PCI-DDA04/12 features .....	1-1
Software features .....	1-1
PCI-DDA04/12 block diagram .....	1-2

## Chapter 2

<b>Installing the PCI-DDA04/12.....</b>	<b>2-1</b>
What comes with your PCI-DDA04/12 shipment? .....	2-1
Hardware .....	2-1
Additional documentation.....	2-1
Optional components .....	2-1
Unpacking the PCI-DDA04/12 .....	2-2
Installing the software .....	2-2
Installing the PCI-DDA04/12.....	2-2
Connecting the board for I/O operations .....	2-2
Connectors, cables – main I/O connector .....	2-2
Pin out – main I/O connector.....	2-3
Field wiring, signal termination and conditioning .....	2-4

## Chapter 3

<b>Programming and Developing Applications .....</b>	<b>3-1</b>
Programming languages .....	3-1
Packaged applications programs .....	3-1
Register-level programming .....	3-1

## Chapter 4

<b>Functional Details .....</b>	<b>4-1</b>
Analog connections .....	4-1
Digital connections .....	4-1
Pull up and pull down resistors .....	4-1

## Chapter 5

<b>Calibrating the PCI-DDA04/12.....</b>	<b>5-1</b>
Self-calibrating .....	5-1
Calibration configuration.....	5-1
"In-system" calibration .....	5-2

## Chapter 6

<b>Specifications.....</b>	<b>6-1</b>
Power consumption .....	6-1
Analog output .....	6-1
Digital input / output .....	6-2
Environmental .....	6-2
Main connector and pin out.....	6-2

---

## 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 PCI-DDA04/12 so that you get the most out of its analog output 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 *InstaCal* 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 information relevant to the operation of the PCI-DDA04/12.

- MCC's *Specifications: PCI-DDA04/12* (the PDF version of the *Specifications* chapter in this guide) is available on our web site at [www.mccdaq.com/pdfs/PCI-DDA04-12.pdf](http://www.mccdaq.com/pdfs/PCI-DDA04-12.pdf).
- MCC's *Quick Start Guide* is available on our web site at [www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf](http://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](http://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](http://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](http://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](http://www.mccdaq.com/PDFmanuals/SM-UL-LabVIEW.pdf).

*PCI-DDA04/12 User's Guide* (this document) is also available on our web site at [www.mccdaq.com/PDFmanuals/PCI-DDA04-12.pdf](http://www.mccdaq.com/PDFmanuals/PCI-DDA04-12.pdf).

---

# Introducing the PCI-DDA04/12

## Overview: PCI-DDA04/12 features

This manual explains how to install and use the PCI-DDA04/12 board. The PCI-DDA04/12 provides four channels of 12-bit analog output and 48-bits of digital I/O.

The D/A converters can be independently configured for either Bipolar or Unipolar. Bipolar ranges are  $\pm 10$  V,  $\pm 5$  V, and  $\pm 2.5$  V. Unipolar ranges are 0 to 10 V, 0 to 5 V, and 0 to 2.5 V. The outputs may be updated individually or simultaneously. The range settings are software-selectable.

The digital I/O ports are configured as two 82C55 mode 0 emulations. Each group is divided into three 8-bit ports — Port A, Port B, and Port C. Port C can be split into two four-bit ports — Port C-HI and Port C-LO. Each of these ports may be individually programmed as input or output. The digital outputs are capable of sinking 64 mA and sourcing 15 mA utilizing standard "S" logic.

The PCI interface uses the PLX 9052 chip, which is a slave-only device. The PCI interface for the analog output is configured in a 16-bit, multiplexed address/data bus, I/O access mode. The PCI interface for the digital I/O is configured in an 8-bit, multiplexed address/data bus, I/O access mode to be register-compatible with the PCI-DIO48H and PCI-DIO96H boards.

The PCI-DDA04/12 board is completely plug-and-play, with no jumpers or switches to set. All board addresses are set by the board's plug-and-play software. Board configuration is controlled by your system's BIOS.

## Software features

For information on the features of *InstaCal* and the other software included with your PCI-DDA04/12, 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](http://www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf).

Check [www.mccdaq.com/download.htm](http://www.mccdaq.com/download.htm) for the latest software version or versions of the software supported under less commonly used operating systems.

## PCI-DDA04/12 block diagram

PCI-DDA04/12 functions are illustrated in the block diagram shown here.

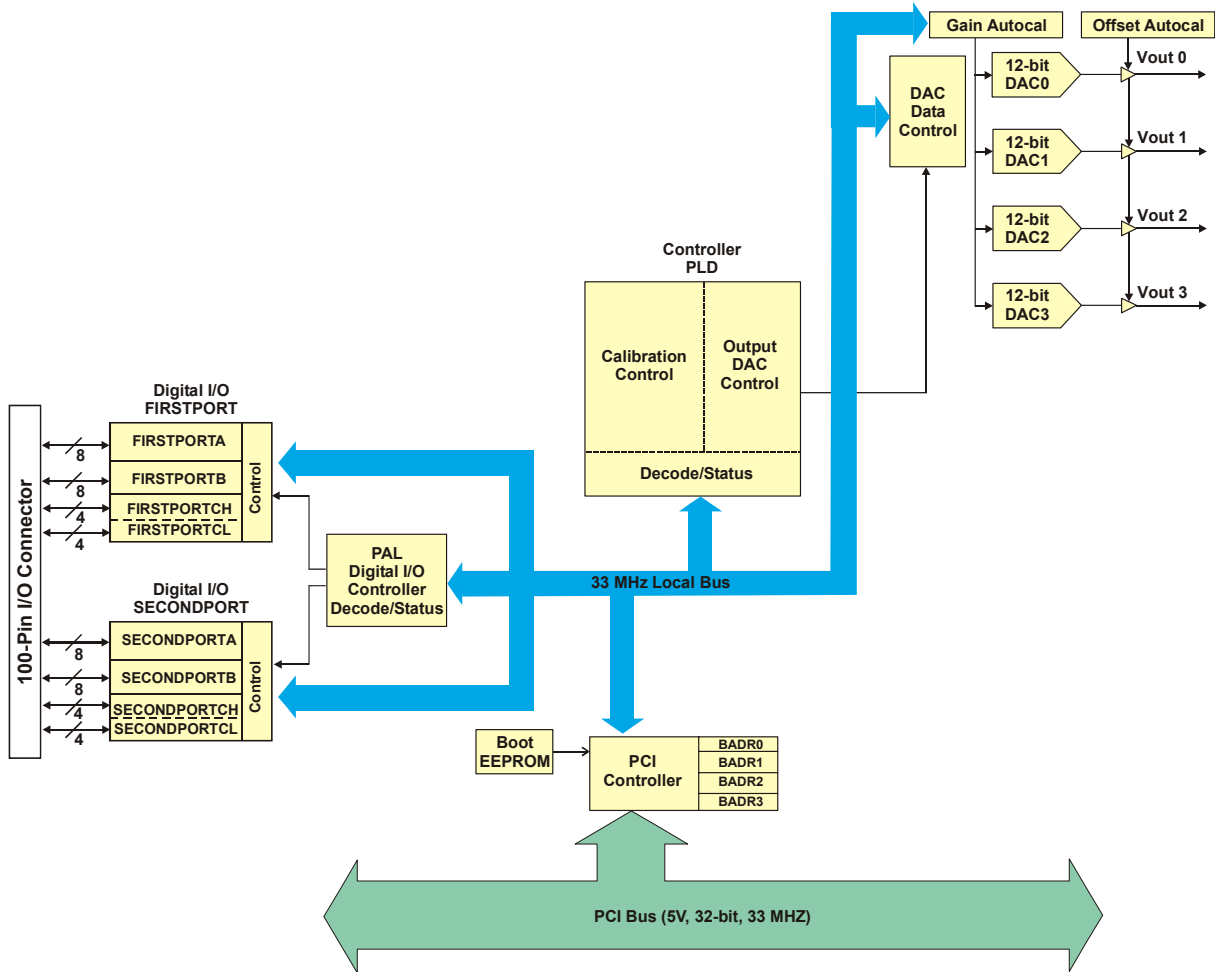


Figure 1-1. PCI-DDA04/12 functional block diagram



---

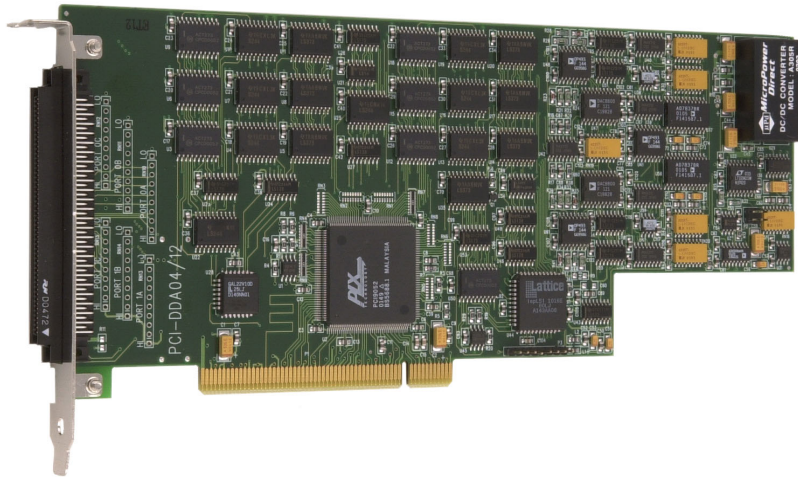
# Installing the PCI-DDA04/12

## What comes with your PCI-DDA04/12 shipment?

The following items are shipped with the PCI-DDA04/12.

### Hardware

- PCI-DDA04/12

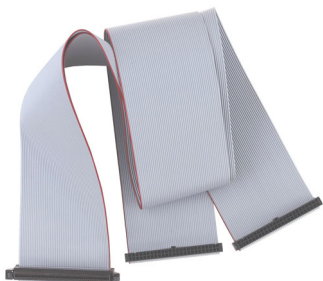


### Additional documentation

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](http://www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf)). This booklet supplies a brief description of the software you received with your PCI-DDA04/12 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

### Optional components

- C100FF-x cable



- Signal termination and conditioning accessories  
MCC provides signal termination products for use with the PCI-DDA04/12. Refer to [Field wiring, signal termination and conditioning](#) on page 2-4 for a complete list of compatible accessory products.

## Unpacking the PCI-DDA04/12

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the PCI-DDA04/12 from its packaging, ground yourself using a wrist strap or by simply touching the computer chassis or other grounded object to eliminate any stored static charge.

If any components are missing or damaged, notify Measurement Computing Corporation immediately 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](mailto:techsupport@mccdaq.com)

## Installing the software

Refer to the *Quick Start Guide* for instructions on installing the software on the *Measurement Computing Data Acquisition Software CD*. This booklet is available in PDF at [www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf](http://www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf).

## Installing the PCI-DDA04/12

The PCI-DDA04/12 board is completely plug-and-play. There are no switches or jumpers to set. Configuration is controlled by your system's BIOS. To install your board, 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 PCI slot.
2. Close your computer and turn it on.

If you are using an operating system with support for plug-and-play (such as Windows 2000 or Windows XP), a dialog box pops up as the system loads indicating that new hardware has been detected. If the information file for this board is not already loaded onto your PC, you will be prompted for the disk containing this file. The MCC DAQ software contains this file. If required, insert the *Measurement Computing Data Acquisition Software CD* and click **OK**.

3. To test your installation and configure your board, run the *InstaCal* 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](http://www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf) for information on how to initially set up and load *InstaCal*.

## Connecting the board for I/O operations

### Connectors, cables – main I/O connector

Table 2-1 lists the board connectors, applicable cables and compatible accessory boards.

Table 2-1. Board connectors, cables, accessory equipment

Connector type	100-pin, high density connector
Compatible cables	C100FF-x unshielded ribbon cable (x = length in feet)

Compatible accessory products with the C100FF-x cable	SCB-50 CIO-TERM100 CIO-MINI50 (two required)
---	--

The PCI-DDA04/12 uses a single 100-pin high density connector on the back plate of the board to bring out all required digital and analog lines and grounds.

### Pin out – main I/O connector

Table 2-2. I/O connector pin out

Signal name	Pin		Pin	Signal name
Digital Ground	100	••	50	Digital Ground
+5V	99	••	49	NC
FIRSTPORTC Bit 0	98	••	48	NC
FIRSTPORTC Bit 1	97	••	47	NC
FIRSTPORTC Bit 2	96	••	46	NC
FIRSTPORTC Bit 3	95	••	45	NC
FIRSTPORTC Bit 4	94	••	44	NC
FIRSTPORTC Bit 5	93	••	43	NC
FIRSTPORTC Bit 6	92	••	42	NC
FIRSTPORTC Bit 7	91	••	41	NC
FIRSTPORTB Bit 0	90	••	40	NC
FIRSTPORTB Bit 1	89	••	39	NC
FIRSTPORTB Bit 2	88	••	38	NC
FIRSTPORTB Bit 3	87	••	37	NC
FIRSTPORTB Bit 4	86	••	36	NC
FIRSTPORTB Bit 5	85	••	35	NC
FIRSTPORTB Bit 6	84	••	34	NC
FIRSTPORTB Bit 7	83	••	33	NC
FIRSTPORTA Bit 0	82	••	32	NC
FIRSTPORTA Bit 1	81	••	31	NC
FIRSTPORTA Bit 2	80	••	30	NC
FIRSTPORTA Bit 3	79	••	29	NC
FIRSTPORTA Bit 4	78	••	28	NC
FIRSTPORTA Bit 5	77	••	27	NC
FIRSTPORTA Bit 6	76	••	26	NC
FIRSTPORTA Bit 7	75	••	25	NC
SECONDPORTC Bit 0	74	••	24	NC
SECONDPORTC Bit 1	73	••	23	NC
SECONDPORTC Bit 2	72	••	22	NC
SECONDPORTC Bit 3	71	••	21	NC
SECONDPORTC Bit 4	70	••	20	NC
SECONDPORTC Bit 5	69	••	19	NC
SECONDPORTC Bit 6	68	••	18	NC
SECONDPORTC Bit 7	67	••	17	NC
SECONDPORTB Bit 0	66	••	16	NC
SECONDPORTB Bit 1	65	••	15	NC
SECONDPORTB Bit 2	64	••	14	NC
SECONDPORTB Bit 3	63	••	13	NC
SECONDPORTB Bit 4	62	••	12	NC
SECONDPORTB Bit 5	61	••	11	NC
SECONDPORTB Bit 6	60	••	10	NC
SECONDPORTB Bit 7	59	••	9	NC
SECONDPORTA Bit 0	58	••	8	Analog Ground
SECONDPORTA Bit 1	57	••	7	Vout 3
SECONDPORTA Bit 2	56	••	6	Analog Ground
SECONDPORTA Bit 3	55	••	5	Vout 2
SECONDPORTA Bit 4	54	••	4	Analog Ground
SECONDPORTA Bit 5	53	••	3	Vout 1
SECONDPORTA Bit 6	52	••	2	Analog Ground
SECONDPORTA Bit 7	51	••	1	Vout 0
	PCI slot ↓			

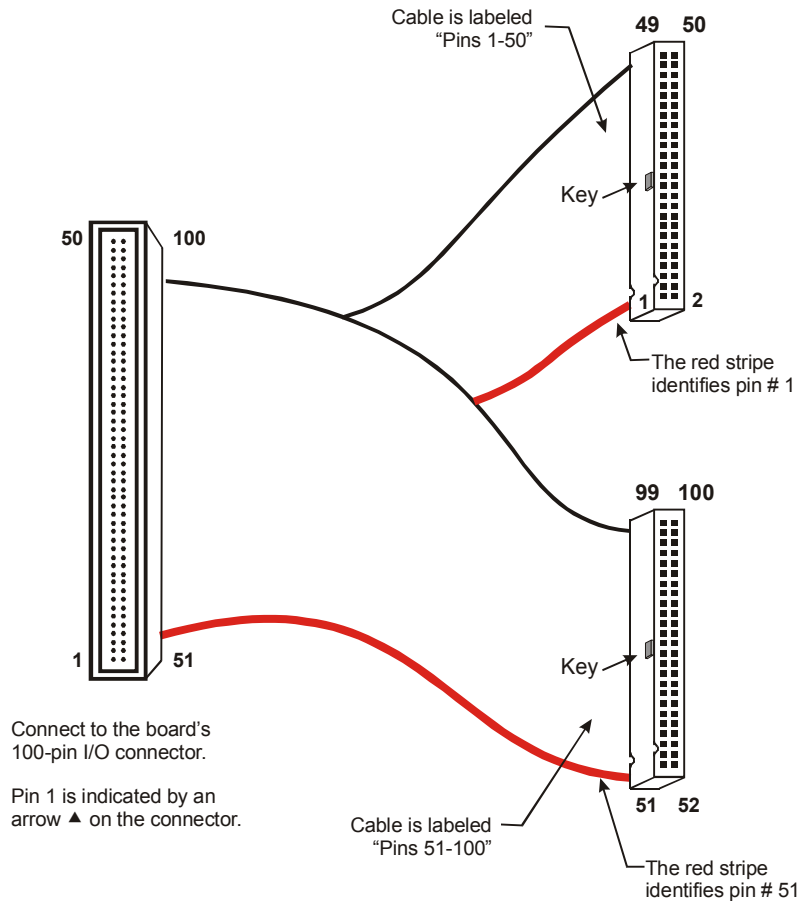


Figure 2-1. C100FF-x cable

Details on the C100FF-x cable are available on our web site at [www.mccdaq.com/cbicatalog/cbiproduct.asp?dept\\_id=104&pf\\_id=21](http://www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=104&pf_id=21).

#### Information on signal connections

General information regarding signal connection and configuration is available in the *Guide to Signal Connections*. This document is available on our web site at [www.mccdaq.com/signals/signals.pdf](http://www.mccdaq.com/signals/signals.pdf).

### Field wiring, signal termination and conditioning

You can use the following screw terminal boards to terminate field signals and route them into the PCI-DDA04/12 using the C100FF-x cable:

- SCB-50 – 50 conductor, shielded signal connection/screw terminal box provides two independent 50-pin connections. Details on this product are available on our web site at [www.mccdaq.com/cbicatalog/cbiproduct.asp?dept\\_id=196&pf\\_id=1168](http://www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=196&pf_id=1168).
- CIO-TERM100 – 100-pin screw terminal board (daisy-chained 50-pin IDC connectors). Details on this product are available on our web site at [www.mccdaq.com/cbicatalog/cbiproduct.asp?dept\\_id=102&pf\\_id=281](http://www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=281).
- CIO-MINI50 – 50-pin screw terminal board. Two boards are required. Details on this product are available on our web site at [www.mccdaq.com/cbicatalog/cbiproduct.asp?dept\\_id=102&pf\\_id=258](http://www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=258).

---

# Programming and Developing Applications

After following the installation instructions in Chapter 2, your board should now be installed and ready for use.

## 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](http://www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf)).

## Packaged applications programs

Many packaged application programs, such as SoftWIRE® and HP-VEE™, 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](mailto: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 PCI-DDA0x/12 Series*. This document is available at on our web site at [www.mccdaq.com/registermaps/RegMapPCI-DDA0x-12.pdf](http://www.mccdaq.com/registermaps/RegMapPCI-DDA0x-12.pdf).

---

## Functional Details

### Analog connections

The analog output connections on the PCI-DDA04/12 series are two-wire hookups. One wire connects to the signal labeled **Vout #**, where # is the channel number from 0 to 3. The other wire connects to the associated analog ground. The I/O connector pin out is shown in Table 2-2 on page 2-3.

Analog ranges are software-selectable for  $\pm 10$  V,  $\pm 5$  V,  $\pm 2.5$  V, 0 to 10 V, 0 to 5 V, and 0 to 2.5 V. Each port may be reconfigured easily and quickly.

### Digital connections

The PCI-DDA04/12 emulates two 82C55 chips, but offers much higher drive capability than the 82C55. The board emulates only Mode 0 of the 82C55 (no strobed I/O or bi-directional I/O bits). The PCI-DDA04/12 is completely plug-and-play, without any onboard user configurable switches or jumpers. The 48 CMOS/TTL compatible digital I/O lines are configured in four banks of eight and four banks of four. You can configure each bank for input or output.

All of the digital outputs/inputs on the PCI-DDA04/12 connector are TTL-compatible. TTL is an electronics industry term, short for Transistor Transistor Logic, a standard for digital signals which are either at near 0V or near 5V. The outputs are capable of sinking 64 mA or sourcing 15 mA. All I/O is brought out to the 100-pin connector, which also allows connection to the computer's +5 volt and ground.

#### Unconnected inputs float

Unconnected inputs typically float high, but not reliably. If you are using a PCI-DDA04/12 board for input and have unconnected inputs, ignore the data from those lines. You do not have to terminate input lines. Unconnected lines will not affect the performance of connected lines. Ensure that you mask out any unconnected bits in software.

### Pull up and pull down resistors

Whenever the board is powered-on or reset, all ports are set to input mode. To drive all outputs to a known state after power on or reset, pull all pins either high or low through a 2.2 K $\Omega$  resistor.

- The pull-up resistor pulls the input to a high state (+5V). Its resistance of 2200 ohms draws only 2 mA of the 64 mA available from the output.
- A 2200 ohm pull-down resistor does the same task, except that the line is pulled low when the board is in the input mode, and uses only 2 mA of the 15 mA available output provided by the board.

The PCI-DDA04/12 board has open positions for up to six Single Inline Package (SIPs) resistors. The locations are marked Port 0A, 0B, and 0C, and Port 1A, 1B, and 1C, and are adjacent to the I/O connector. Port 0*n* corresponds to FIRSTPORT*n*, and Port 1*n* corresponds to SECONDPORT*n*.

The SIP resistors provide either pull-up or pull-down action for each eight-line port, depending on their orientation in the port positions on the board.

The SIP is made up of eight 2.2 K $\Omega$  resistors. One side of each resistor is connected to a single common point and brought out to a pin. The common line is marked with a dot or line at one end of the SIP. The remaining resistor ends are brought out to the other eight pins (refer to Figure 4-1).

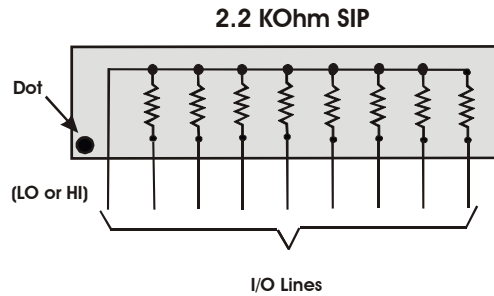


Figure 4-1. Eight-Resistor SIP Schematic

You can install the SIP as either pull-up or pull-down. At each location there are 10 holes in a line. One end of the line is +5V, the other end is GND. They are marked **HI** and **LO** respectively. The eight holes in the middle are connected to the eight lines of a port.

- For a pull-up function per port, mount the SIP with the common pin (marked with a dot or line) in the **HI** position.
- For a pull-down function per port, mount the SIP with the common pin in the **LO** position.

When installing pull-up and pull-down resistor SIP packs, we recommend using a 2.2 K, eight-resistor SIP (MCC part number SP-K2.29C). You can substitute individual 2.2 k $\Omega$  resistors for the resistor SIPs, if required.

# Calibrating the PCI-DDA04/12

## Self-calibrating

The PCI-DDA04/12 is shipped fully-calibrated from the factory. Calibration coefficients are stored in nonvolatile RAM. When using the Universal Library, the calibration factors are read from nonvolatile RAM and are automatically written to the calibration DACs each time you select a different DAC range.

You can recalibrate with respect to the factory-measured voltage standards by selecting the "Calibrate" option in *InstaCal*. *InstaCal* calibrates each channel at all six ranges. Each channel takes less than a minute to calibrate.

## Calibration configuration

The PCI-DDA04/12 provides self-calibration of the analog source and measure systems. This eliminates the need for external equipment and user adjustments. The analog output circuits are calibrated for both gain and offset. Gain calibration of the analog output is performed via DAC reference adjustments. Offset adjustments for the analog output is made in the output buffer section.

PCI-DDA04/12 calibration circuitry is shown in Figure 5-1.

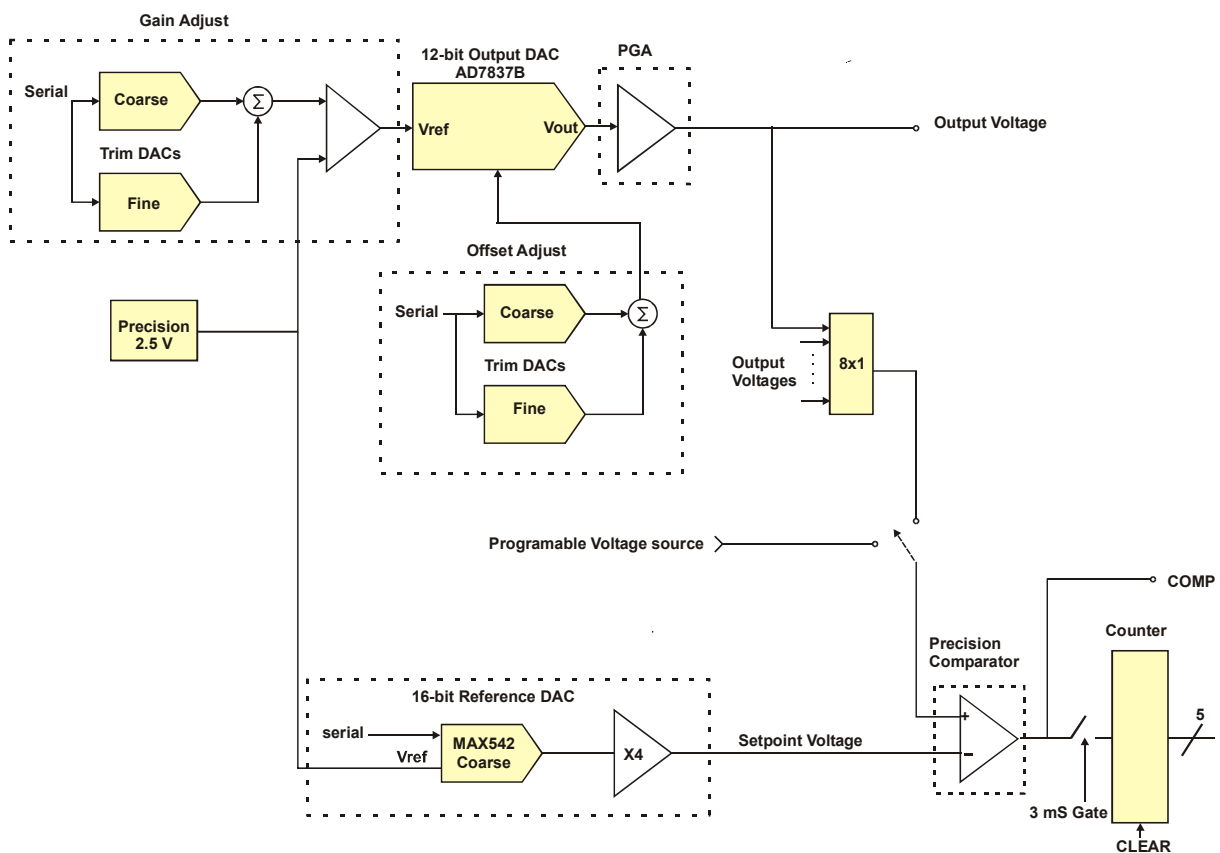


Figure 5-1. Calibration block diagram



## "In-system" calibration

The PCI-DDA04/12 is calibrated at the factory for the correct voltages at the I/O connector. For more precise application of voltages at the "system end", we can provide a version of *InstaCal* that allows you to calibrate the board within your system for correct voltages at your field connection. This calibration lets you remove the effects of voltage drops caused by IR loss in the cable and connector for resistances up to 1  $\Omega$ . This calibration also allows you to zero out errors in any external signal conditioning up to approximately  $\pm 10$  mV.

In most applications, the version of *InstaCal* that ships with the board provides the accuracy specified. If your application has unusual requirements, such as long cables, etc., you may need the "in-system version" to achieve this accuracy.

Contact technical support by phone, fax, or e-mail for details regarding the "in-system" calibration feature. For international customers, contact your local distributor where you purchased the board.

- 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](mailto:techsupport@mccdaq.com)

## Specifications

Typical for 25 °C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

### Power consumption

Table 1. Power consumption specifications

+5 V operating	1.5 A typical, 2.4 A max
+12 V	12 mA typical, 24 mA max
-12 V	8 mA typical, 12 mA max

### Analog output

Table 2. Analog output specifications

D/A converter type	AD7837B
Resolution	12-bits
Number of channels	4
Output ranges	$\pm 10$ V, $\pm 5$ V, $\pm 2.5$ V, 0 to 10 V, 0 to 5 V, 0 to 2.5 V. Each channel independently programmable.
Data transfer	Programmed I/O
Offset error (calibrated)	$\pm(300 \mu\text{V} + \frac{1}{4} \text{LSB})$
Gain error (calibrated)	$\pm(300 \mu\text{V} + \frac{1}{4} \text{LSB})$
Differential nonlinearity	$\pm 1$ LSB max
Integral nonlinearity	$\pm 1$ LSB max
Monotonicity	12-bits
D/A gain drift	$\pm 2$ ppm/°C
D/A offset drift	$\pm 5 \mu\text{V}/^\circ\text{C}$
Throughput	PC dependent
Settling time (20V step to $\pm \frac{1}{2}$ LSB)	6 $\mu\text{s}$ typ, 10 $\mu\text{s}$ max
Slew rate	5 V/ $\mu\text{s}$
Current drive	$\pm 5$ mA
Output short-circuit duration	25 mA indefinite
Output coupling	DC
Output impedance	0.1 Ohms max
Miscellaneous	<ul style="list-style-type: none"> <li>▪ Double buffered output latches</li> <li>▪ Update DACs individually or simultaneously (software selectable)</li> <li>▪ Power up and reset, all DAC's cleared to 0 volts, <math>\pm 210</math> mV</li> </ul>

## Digital input / output

Table 3. Digital I/O specifications

Digital type (main connector)	82C55 mode 0 emulation
	Output: 74S244
	Input: 74LS373
Configuration	4 banks of 8, 4 banks of 4, programmable by bank as input or output
Number of channels	48 I/O
Output high	2.4 volts min @ -15 mA
Output low	0.5 volts max @ 64 mA
Input high	2.0 volts min, 7 volts absolute max
Input low	0.8 volts max, -0.5 volts absolute min
Power-up / reset state	Input mode (high impedance)

## Environmental

Table 4. Environmental specifications

Operating temperature range	0 to 70 °C
Storage temperature range	-40 to 100 °C
Humidity	0 to 90% non-condensing

## Main connector and pin out

Table 5. Board connectors, cables, accessory equipment

Connector type	100-pin, high density connector
Compatible cables	C100FF-x unshielded ribbon cable (x = length in feet)
Compatible accessory products with the C100FF-x cable	CIO-TERM100 CIO-MINI50 (two required)

Table 6. I/O connector pin out

Pin	Signal Name	Pin	Signal Name
1	Vout 0	51	SECONDPORTA Bit 7
2	Analog Ground	52	SECONDPORTA Bit 6
3	Vout 1	53	SECONDPORTA Bit 5
4	Analog Ground	54	SECONDPORTA Bit 4
5	Vout 2	55	SECONDPORTA Bit 3
6	Analog Ground	56	SECONDPORTA Bit 2
7	Vout 3	57	SECONDPORTA Bit 1
8	Analog Ground	58	SECONDPORTA Bit 0
9	NC	59	SECONDPORTB Bit 7
10	NC	60	SECONDPORTB Bit 6
11	NC	61	SECONDPORTB Bit 5
12	NC	62	SECONDPORTB Bit 4
13	NC	63	SECONDPORTB Bit 3
14	NC	64	SECONDPORTB Bit 2
15	NC	65	SECONDPORTB Bit 1
16	NC	66	SECONDPORTB Bit 0
17	NC	67	SECONDPORTC Bit 7
18	NC	68	SECONDPORTC Bit 6
19	NC	69	SECONDPORTC Bit 5
20	NC	70	SECONDPORTC Bit 4
21	NC	71	SECONDPORTC Bit 3
22	NC	72	SECONDPORTC Bit 2
23	NC	73	SECONDPORTC Bit 1
24	NC	74	SECONDPORTC Bit 0
25	NC	75	FIRSTPORTA Bit 7
26	NC	76	FIRSTPORTA Bit 6
27	NC	77	FIRSTPORTA Bit 5
28	NC	78	FIRSTPORTA Bit 4
29	NC	79	FIRSTPORTA Bit 3
30	NC	80	FIRSTPORTA Bit 2
31	NC	81	FIRSTPORTA Bit 1
32	NC	82	FIRSTPORTA Bit 0
33	NC	83	FIRSTPORTB Bit 7
34	NC	84	FIRSTPORTB Bit 6
35	NC	85	FIRSTPORTB Bit 5
36	NC	86	FIRSTPORTB Bit 4
37	NC	87	FIRSTPORTB Bit 3
38	NC	88	FIRSTPORTB Bit 2
39	NC	89	FIRSTPORTB Bit 1
40	NC	90	FIRSTPORTB Bit 0
41	NC	91	FIRSTPORTC Bit 7
42	NC	92	FIRSTPORTC Bit 6
43	NC	93	FIRSTPORTC Bit 5
44	NC	94	FIRSTPORTC Bit 4
45	NC	95	FIRSTPORTC Bit 3
46	NC	96	FIRSTPORTC Bit 2
47	NC	97	FIRSTPORTC Bit 1
48	NC	98	FIRSTPORTC Bit 0
49	NC	99	+5V
50	Digital Ground	100	Digital Ground

# 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

## PCI-DDA04/12

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 (1995), EN55024 (1998)

Emissions: Group 1, Class B

- EN55022 (1995): Radiated and Conducted emissions.

Immunity: EN55024

- EN61000-4-2 (1995): Electrostatic Discharge immunity, Criteria A.
- EN61000-4-3 (1997): Radiated Electromagnetic Field immunity Criteria A.
- EN61000-4-4 (1995): Electric Fast Transient Burst immunity Criteria A.
- EN61000-4-5 (1995): Surge immunity Criteria A.
- EN61000-4-6 (1996): Radio Frequency Common Mode immunity Criteria A.
- EN61000-4-8 (1994): Power Frequency Magnetic Field immunity Criteria A.
- EN61000-4-11 (1994): Voltage Dip and Interrupt immunity Criteria A.

Declaration of Conformity based on tests conducted by Chomerics Test Services, Woburn, MA 01801, USA in September, 2001. Test records are outlined in Chomerics Test Report #EMI3053.01.

We hereby declare that the equipment specified conforms to the above Directives and Standards.



Carl Haapaoja, Director of Quality Assurance

**Measurement Computing Corporation**  
**10 Commerce Way**  
**Suite 1008**  
**Norton, Massachusetts 02766**  
**(508) 946-5100**  
**Fax: (508) 946-9500**  
**E-mail: [info@mccdag.com](mailto:info@mccdag.com)**  
**[www.mccdag.com](http://www.mccdag.com)**