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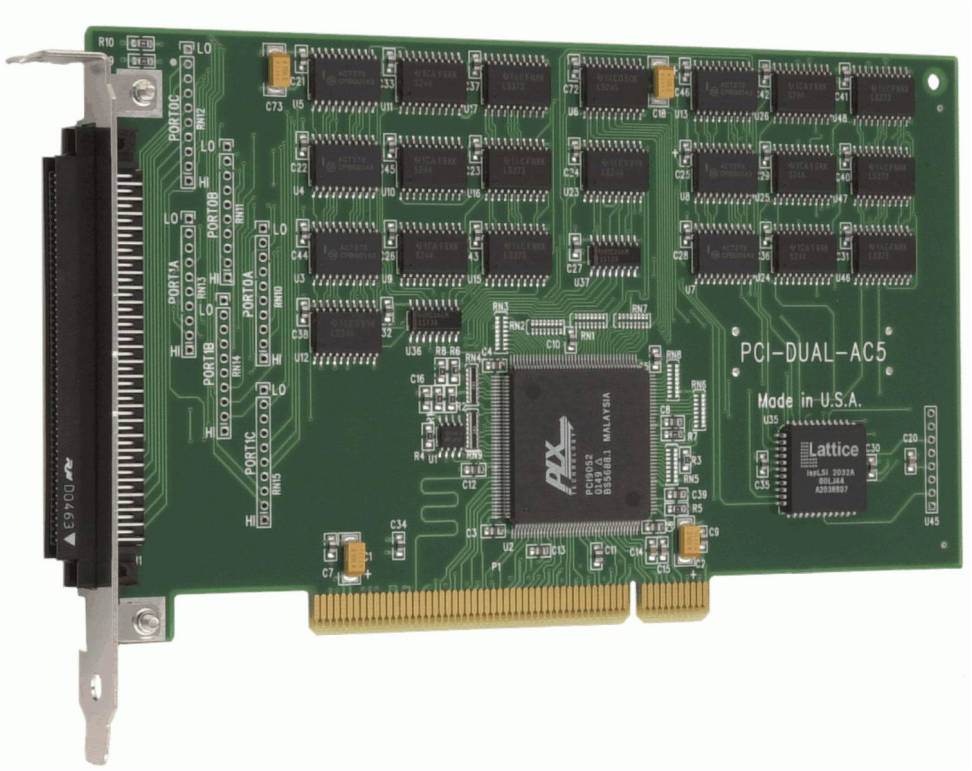
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Find the *Measurement Computing PCI-DUAL-AC5* at our website: *Click HERE*

PCI-DUAL-AC5

High Output Digital I/O

User's Guide



MEASUREMENT COMPUTING™

PCI-DUAL-AC5

High Output Digital I/O

User's Guide



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Table of Contents

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

Chapter 1
Introducing the PCI-DUAL-AC5 7
Overview: PCI-DUAL-AC5 features 7
Software features 7

Chapter 2
Installing the PCI-DUAL-AC5 8
What comes with your PCI-DUAL-AC5 shipment? 8
Hardware 8
Additional documentation 8
Optional components 8
Unpacking the board 9
Installing the software 9
Installing the PCI-DUAL-AC5 9
Connecting the board for I/O operations 10
Connectors, cables – main I/O connector 10
Pinout – main I/O connector 10
Field wiring and signal termination 11

Chapter 3
Functional Details 13
PCI-DUAL-AC5 block diagram 13
PCI-DUAL-AC5 to SSR-PB24 rack connections 14
82C55 emulation 14
Pull-up and pull-down resistors 15
TTL to solid state relays 16

Chapter 4
Specifications 17
Power consumption 17
Digital Input / Output 17
Environmental 17
Mechanical 17
Main connector and pin out 17

Declaration of Conformity 19

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-DUAL-AC5 board so that you get the most out of its 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.

Shaded caution statements present information to help you avoid injuring yourself and others, damaging your hardware, or losing your data.

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

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

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

Where to find more information

For additional information relevant to the operation of your hardware, refer to the *Documents* subdirectory where you installed the MCC DAQ software (C:\Program Files\Measurement Computing\DAQ by default), or search for your device on our website at www.mccdaq.com.

If you need to program at the register level in your application, refer to the *Register Map for the PCI-DUAL-AC5*. This document is available on our website at www.mccdaq.com/registermaps/RegMapPCI-DUAL-AC5.pdf.

Introducing the PCI-DUAL-AC5

Overview: PCI-DUAL-AC5 features

The PCI-DUAL-AC5 is a 48-bit, high output, digital I/O board for PCI-compatible computers. Primarily designed as a direct interface to the industry-standard SSR-PB24 rack, the board is also highly useful as a general purpose digital I/O board.

The 48-bits of digital I/O are organized into two 24-bit groups based on an 82C55 mode 0 emulation (no strobed I/O or bi-directional I/O bits). Each 24-bit group is divided into three eight-bit ports labeled PORTA, PORTB and PORTC. PORTC can be split into two four-bit nibbles — Port C-HI and Port C-LO. Each of these ports may be individually programmed as input or output.

All inputs and outputs are TTL compatible. The digital output drivers are 74S244 chips that can sink 64 mA and source 15 mA. The input buffers are 74LS373 chips and have standard high input impedance of the 74LS series devices. All I/O is brought out to a 100-pin connector, which also allows connection to the PC's +5 Volt and Ground.

On power up and reset, all I/O bits are set to input mode. If you are using the board to control items that must be OFF on reset, install pull-down resistors. Each board is equipped with open locations where you can install SIP resistor networks for either pull-up or pull-down.

The PCI-DUAL-AC5 board is completely plug-and-play, with no jumpers or switches to set. All board addresses and interrupt sources 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 *Insta*Cal and the other software included with your PCI-DUAL-AC5, refer to the *Quick Start Guide* that shipped with your device. The *Quick Start Guide* is also available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf.

Check www.mccdaq.com/download.htm for the latest software version or versions of the software supported under less commonly used operating systems.

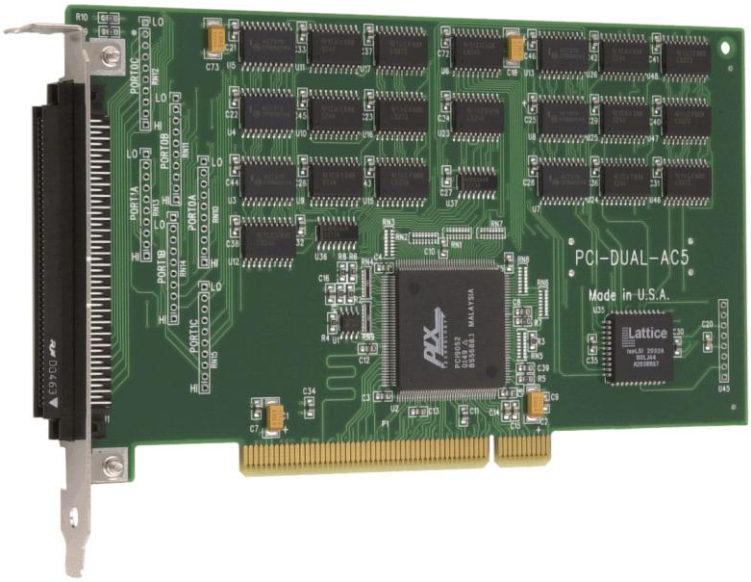
Installing the PCI-DUAL-AC5

What comes with your PCI-DUAL-AC5 shipment?

The following items are shipped with the PCI-DUAL-AC5.

Hardware

- PCI-DUAL-AC5



Additional documentation

In addition to this hardware user's guide, you should also receive the *Quick Start Guide* (available in PDF at www.mccdaq.com/PDFmanuals/DAQ-Software-Quick-Start.pdf). This booklet supplies a brief description of the software you received with your PCI-DUAL-AC5 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

Optional components

- Cables



C100FE-x C100FF-x

- Signal termination and conditioning accessories

  MCC provides signal conditioning and termination products for use with the PCI-DUAL-AC5. Refer to Field wiring and signal termination on page 11 for a complete list of compatible accessory products.

Unpacking the board

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the PCI-DUAL-AC5 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

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.

Installing the PCI-DUAL-AC5

The PCI-DUAL-AC5 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 *Insta*Cal utility installed in the previous section. Refer to the *Quick Start Guide* that came with your board for information on how to initially set up and load *Insta*Cal.

Connecting the board for I/O operations

Connectors, cables – main I/O connector

The table below lists board connectors, cables, and compatible accessory products for the PCI-DUAL-AC5.

Board connector, cables, and accessory equipment

Connector type	100-pin high-density Robinson-Nugent
Compatible cables	▪ C100FE-x ▪ C100FF-x
Compatible accessory product with the C100FE-x cable	SSR-PB24 (two required)
Compatible accessory products with the C100FF-x cable	▪ CIO-MINI50 (two required) ▪ CIO-SPADE50 (two required) ▪ CIO-TERM100 ▪ SCB-50

The PCI-DUAL-AC5 connector is accessible through the PCI slot expansion bracket. The connector is a standard 100-pin header connector. If you are connecting to the SSR-PB24 or equivalent, we recommend using the C100FE-x series cable, which splits the 100-pins into two edge-connectors which you can then connect to two SSR-PB24 racks.

If you need direct access to the digital I/O, use the C100FF-x cable to connect two CIO-MINI50s, an SCB-50 or a CIO-TERM100. These combinations bring all I/O connections out to the screw terminals.

Pinout – main I/O connector

The I/O connector for the board is a 100-pin header connector accessible from the rear of the PC through the expansion backplate. See Figure 1 for pin assignments.

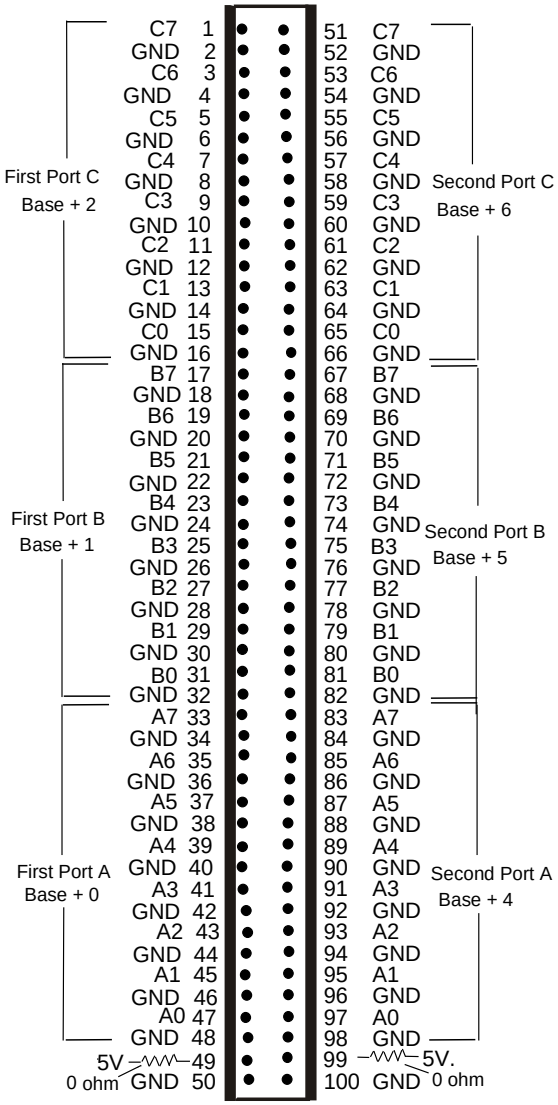


Figure 1. I/O connector pinout

The connector accepts 100-pin connectors, such as on the C100FE-2, a 2-foot cable with two edge-connectors, or the C-100FF-2, a two-foot cable with two 50-pin header connectors.

Field wiring and signal termination

You can use the following screw terminal boards to terminate field signals and route them into the PCI-DUAL-AC5 using the C100FF-x cable.

- CIO-MINI50 – 50-pin universal screw terminal board. Two boards are required.
- CIO-SPADE50 — 16" x 4" termination panel which mates with both 37-pin and 50-pin connectors. Two boards are required.
- CIO-TERM100 – 100-pin screw terminal board (daisy-chained 50-pin IDC connectors). Two boards are required.
- SCB-50 – 50 conductor, shielded signal connection/screw terminal box provides two independent 50-pin connections.

Details on these products are available on our web site at www.mccdaq.com/products/screw_terminal_bnc.aspx.

You can use the following relay mounting rack with the C100FE-x cable to provide digital signal conditioning.

- SSR-PB24 – 24 channel solid-state relay mounting and interface rack. The PCI-DUAL-AC5 supports up to two SSR-PB24 boards (one cable required per SSR-PB24).

Details on this product is available on our web site at www.mccdaq.com/products/signal_conditioning.aspx.

Information on signal connections

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

Functional Details

PCI-DUAL-AC5 block diagram

PCI-DUAL-AC5 functions are illustrated in the block diagram shown here.

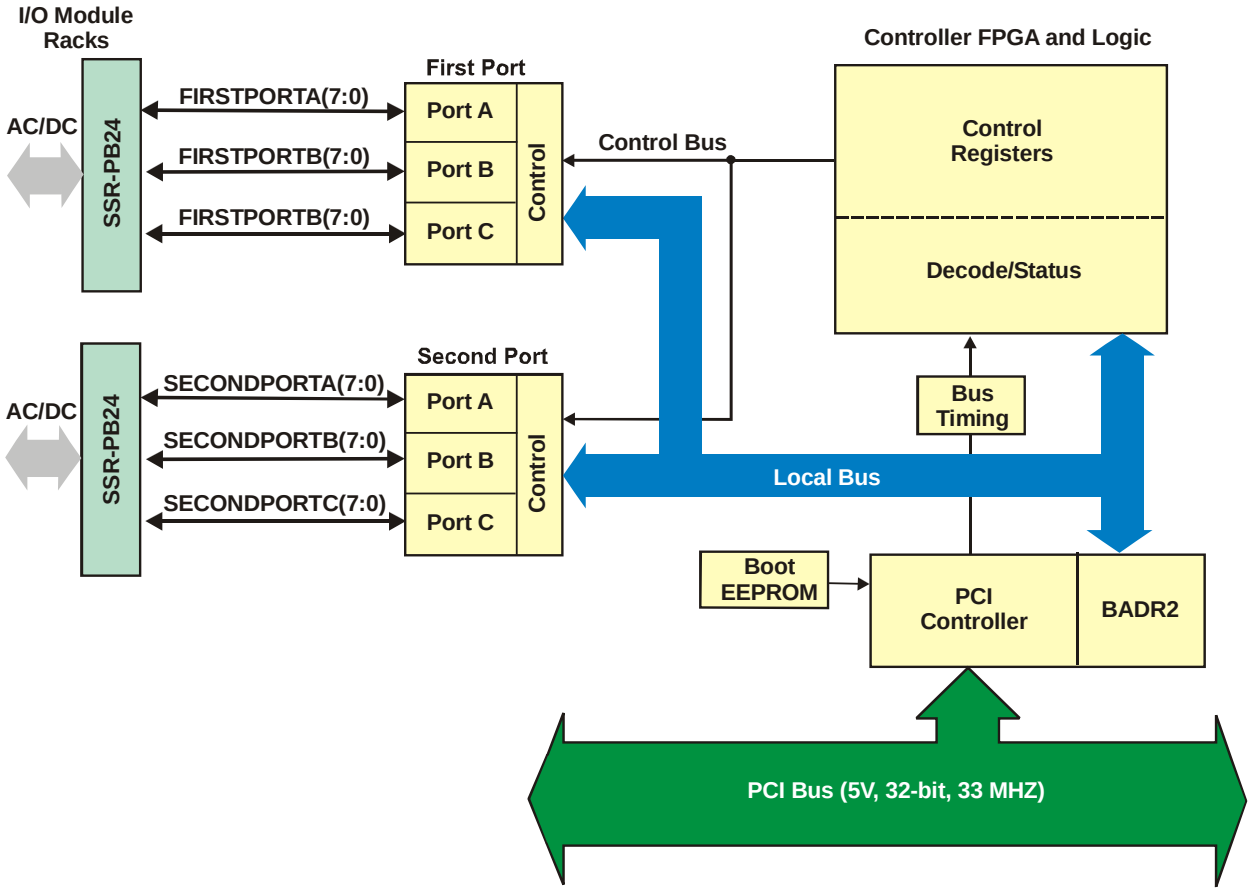


Figure 2. Functional block diagram

PCI-DUAL-AC5 to SSR-PB24 rack connections

The PCI-DUAL-AC5 board provides 48 bits of digital I/O. However, most popular relay and SSR boards provide 24-bits of I/O. The PCI-DUAL-AC5 uses a dual-leg cable, C100FE-x to monitor and control SSRs on two SSR-PB24 racks. The configuration is shown in Figure 3.

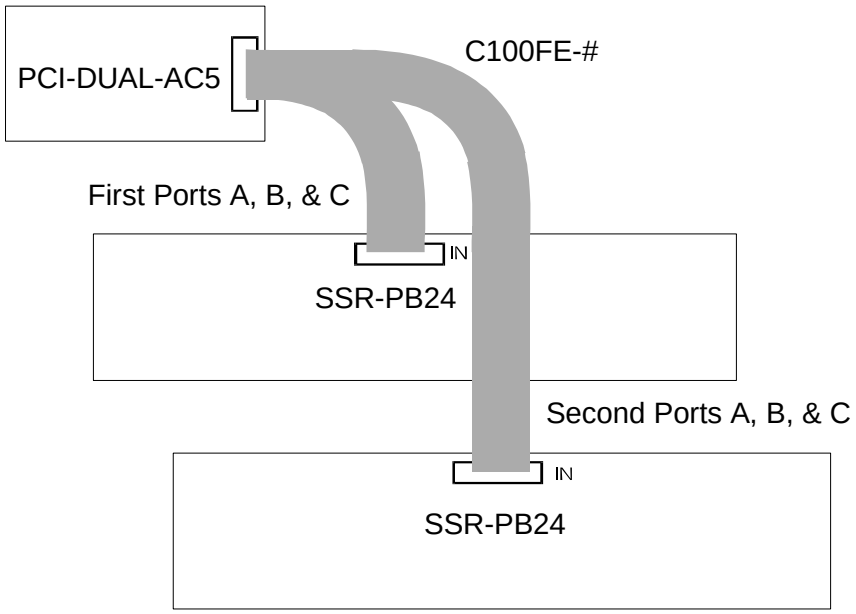


Figure 3. PCI-DUAL-AC5 to SSR-PB24 cabling

The 24-bits of digital I/O on PCI-DUAL-AC5 connector pins 1-48 (base address +0 through +2) control the first relay rack. The 24-bits of digital I/O on pins 51-98 (base address +4 through +6) control the second SSR rack.

Figure 1 is a pin translation of pins 51 thru 100 of the C100FE-x or C100FF-x cable to the cable's second 50-pin connector. The first 50 pins are a one-to-one relationship to the first 50-pin connector.

82C55 emulation

The PCI-DUAL-AC5 board emulates the 82C55 chip. The 82C55 emulation initializes all ports as inputs on power-up and reset. A TTL input is a high impedance input. If you connect another TTL input device to the output, it could be turned *on* or *off* every time the board is reset.

To establish a consistent TTL level at power-up, use resistors tied to either +5V (pull-up) or ground (pull-down). There are open locations for pull-up and pull-down resistor packs on the board.

Whenever an 82C55 emulation is powered on or reset, all pins are set to high-impedance input. Based on standard TTL functionality, these inputs will typically float high, and may have enough drive current to turn on external devices.

Consequently, if you have output devices such as solid state relays, they may be switched on whenever the computer is powered on or reset. To prevent unwanted switching, and 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 resistor.

Pull-up and pull-down resistors

TTL inputs usually, but not reliably, float high. The direction they float is dependent on the characteristics of the circuit and is unpredictable. This means that if devices such as solid state relays, are driven by digital I/O pins, they can be switched on whenever the computer is powered-on or is reset. To prevent unwanted switching at power-on or reset, force all digital I/O pins to a known state by pulling all pins either high or low through a 2.2 K ohm resistor tied to either 5V or GND.

The pull-up resistor pulls the input to a high state (+5V) when the board is in input mode, as it would be on power-up or reset. A 2.2 K ohm resistor draws only 2 mA. A grounded 2.2 K ohm pull-down resistor pulls the I/O line low when the board is in input mode.

The SIP is made up of eight 2.2 K ohm 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).

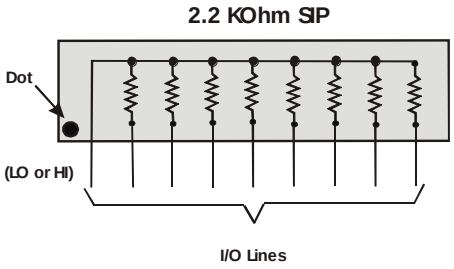


Figure 4. Eight-resistor SIP Schematic

The PCI-DUAL-AC5 board has open locations where you can install a 2.2 K ohm, eight-resistor single inline package (SIP) resistor network for each port. The locations are adjacent to the I/O connector and are marked **PORT0A**, **PORT0B**, and **PORT0C**, and **PORT1A**, **PORT1B**, and **PORT1C**. PORT0*n* is associated with FIRSTPORT, and PORT1*n* is associated with SECONDPORT.

When installed, the SIP establishes either a high or low logic level at each of the eight I/O lines on the port. At each board location, A, B, and C, there are 10 holes in a line. The hole on one end is marked "HI" and is connected to +5V. The other end is marked "LO" and is connected to GND. The eight holes in the middle connect to eight lines of the port, A, B or C.

To pull-up lines, orient the SIP with the common pin (dot) toward the HI end; to pull-down, install the resistor with the common pin in the LO end.

Figure 5 shows a schematic of an SIP installed in both the pull-up and pull-down positions.

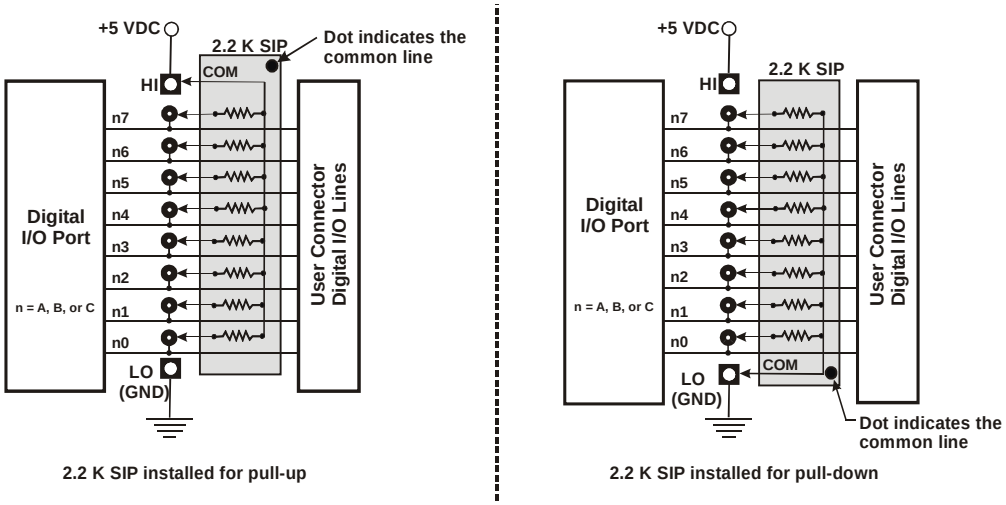


Figure 5. Pull-up and pull-down resistor SIP schematic

We recommend using 2.2 K ohm SIPs (MCC part number SP-K2.29C). Use a different value only if necessary.

Unconnected inputs float

Unconnected inputs typically float high, but not reliably. If you are using a PCI-DUAL-AC5 board for input and have unconnected inputs, ignore the data from those lines. You do not have to terminate input lines, and unconnected lines will not affect the performance of connected lines. Ensure that you mask out any unconnected bits in software.

TTL to solid state relays

Many applications require digital outputs to switch AC and DC voltage motors on and off or to monitor AC and high DC voltages. These AC and high DC voltages cannot be controlled or read directly by the TTL digital lines of a PCI-DUAL-AC5.

Solid State Relays (SSRs) allow control and monitoring of AC and high DC voltages and provide 750 V isolation. SSRs are the recommended method of interfacing to AC and high DC signals.

The most convenient way to use solid state relays and a PCI-DUAL-AC5 board is to purchase a solid state relay rack. The rack recommended for use with the PCI-DUAL-AC5 board is the **SSR-PB24** from Measurement Computing Corporation. Details on this product is available on our web site at www.mccdaq.com/products/signal_conditioning.aspx.

Specifications

Typical for 25 °C unless otherwise specified.

Specifications in *italic text* are guaranteed by design

Power consumption

Table 1. Power consumption specifications

+5V Operating	1.13 A typical, 1.80 A max

Digital Input / Output

Table 2. Digital I/O specifications

Digital type (main connector)	8255 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)
Miscellaneous	*Locations provided for installation of pull-up or pull-down resistors*

Environmental

Table 3. Environmental specifications

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

Mechanical

Table 4. Mechanical specifications

Card dimensions	174.8 mm (L) x 106.7 mm (W) x 21.6 mm (H)
	6.88" (L) x 4.2" (W) x 0.85" (H)

Main connector and pin out

Table 5. Main connector specifications

Connector type	100-pin high density
Compatible cables	C100FE-x cable C100FF-x cable
Compatible accessory products with the C100FE-x cable	SSR-PB24 (2)
Compatible accessory products with the C100FF-x cable	CIO-MINI50 (2) CIO-SPADE50 (2) CIO-TERM100 (1) SCB-50 (1)

Table 6. Main connector pin out

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

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-DUAL-AC5

to which this declaration relates is in conformity with the relevant provisions of the following standards or other documents:

EC EMC Directive 2004/108/EC: General Requirements, EN 61326-1:2006 (IEC 61326-1:2005).

Emissions:

- EN 55011 (2007) / CISPR 11(2003): Radiated emissions: Group 1, Class A
- EN 55011 (2007) / CISPR 11(2003): Conducted emissions: Group 1, Class A

Immunity: EN 61326-1:2006, Table 3.

- IEC 61000-4-2 (2001): Electrostatic Discharge immunity.
- IEC 61000-4-3 (2002): Radiated Electromagnetic Field immunity.
- IEC 61000-4-4 (2004): Electric Fast Transient Burst Immunity.
- IEC 61000-4-5 (2001): Surge Immunity.
- IEC 61000-4-6 (2003): Radio Frequency Common Mode Immunity.
- IEC 61000-4-11 (2004): Voltage Interrupts.
-
- To maintain compliance to the standards of this declaration, the following conditions must be met.
-
- The host computer, peripheral equipment, power sources, and expansion hardware must be CE compliant.
- All I/O cables must be shielded, with the shields connected to ground.
- I/O cables must be less than 3 meters (9.75 feet) in length.
- The host computer must be properly grounded.
- Equipment must be operated in a controlled electromagnetic environment as defined by Standards EN 61326-1:2006, or IEC 61326-1:2005.

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. Further testing was conducted by Chomerics Test Services, Woburn, MA. 01801, USA in January, 2009. Test records are outlined in Chomerics Test report #EMI5243.09.

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



Carl Haapaoja, Director of Quality Assurance

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