PCI-CTR10

9513-Based Counter/Timer Board

User's Guide

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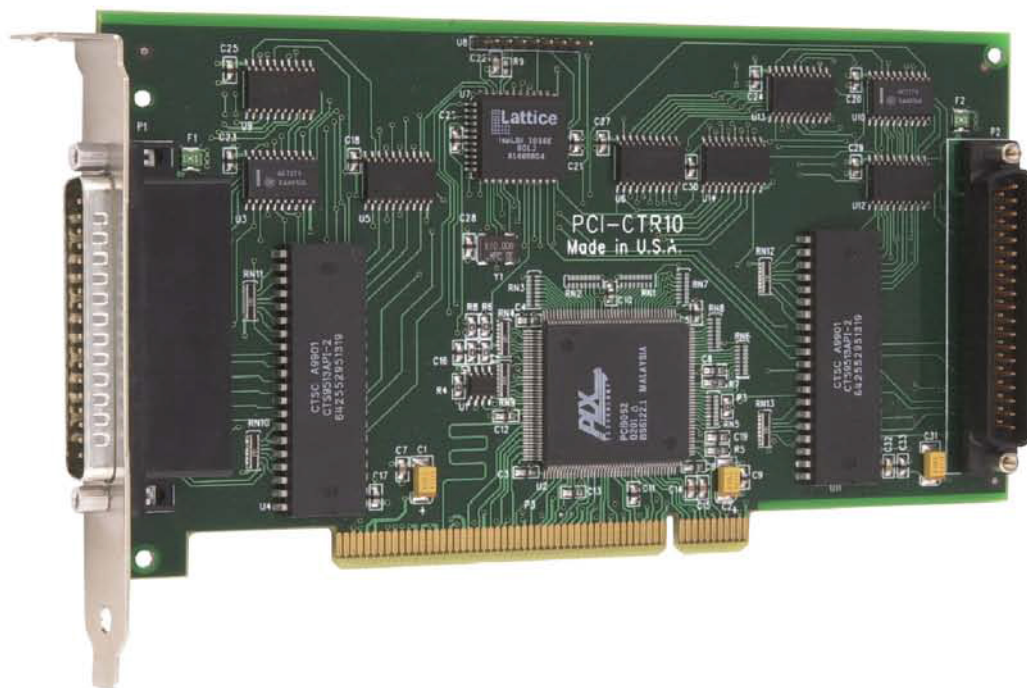
PCI-CTR10

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Table of Contents

About this User's Guide

What you will learn from this user's guide

This user's guide describes the Measurement Computing PCI-CTR10 data acquisition board and lists hardware specifications.

Conventions in this user's guide

For more information

Text presented in a box signifies additional information related to the subject matter.

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

bold text   **Bold** text is used for the names of objects on a screen, such as buttons, text boxes, and check boxes.

italic text   *Italic* text is used for the names of manuals and help topic titles, and to emphasize a word or phrase.

Where to find more information

Additional information about PCI-CTR10 hardware is available on our website at www.mccdaq.com. You can also contact Measurement Computing Corporation with specific questions.

- Knowledgebase: kb.mccdaq.com
- Tech support form: www.mccdaq.com/support/support_form.aspx
- Email: techsupport@mccdaq.com
- Phone: 508-946-5100 and follow the instructions for reaching Tech Support

For international customers, contact your local distributor. Refer to the International Distributors section on our website at www.mccdaq.com/International.

Introducing the PCI-CTR10

The PCI-CTR10 is a high-performance, low-cost counter/timer board for PCI bus-compatible computers.

The PCI-CTR10 is based on the 9513 counter/timer device. The PCI-CTR10 has two 9513 devices installed. Each 9513 has five independent 16-bit counters (65,536 counts). An input source, count register, load register, hold register, alarm register, output, and gate are associated with each counter.

The 9513 is software-programmable for event counting, pulse and frequency measurement, alarm comparisons, and other input functions. The 9513 can generate frequencies with either complex duty cycles, or with one-shot and continuous-output modes. You can chain up to five 9513 devices together using software to enable a 32-, 48-, 64-, or 80-bit counter that does not require hardware connections. The gate source and gating functions are software-programmable.

An eight-bit, high-current digital output port provides logic-level control, and can be used to switch solid state relays. An eight-bit digital input port can be used to sense contact closures. The 9513 device also provides access to the PCI bus interrupts.

For more information on the 9513 counter/timer, refer to the 9513 data sheet. This document is available at www.mccdaq.com/PDFmanuals/9513A.pdf.

Software features

For information on the features of *Insta*Cal and the other software included with your PCI-CTR10, 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.

PCI-CTR10 block diagram

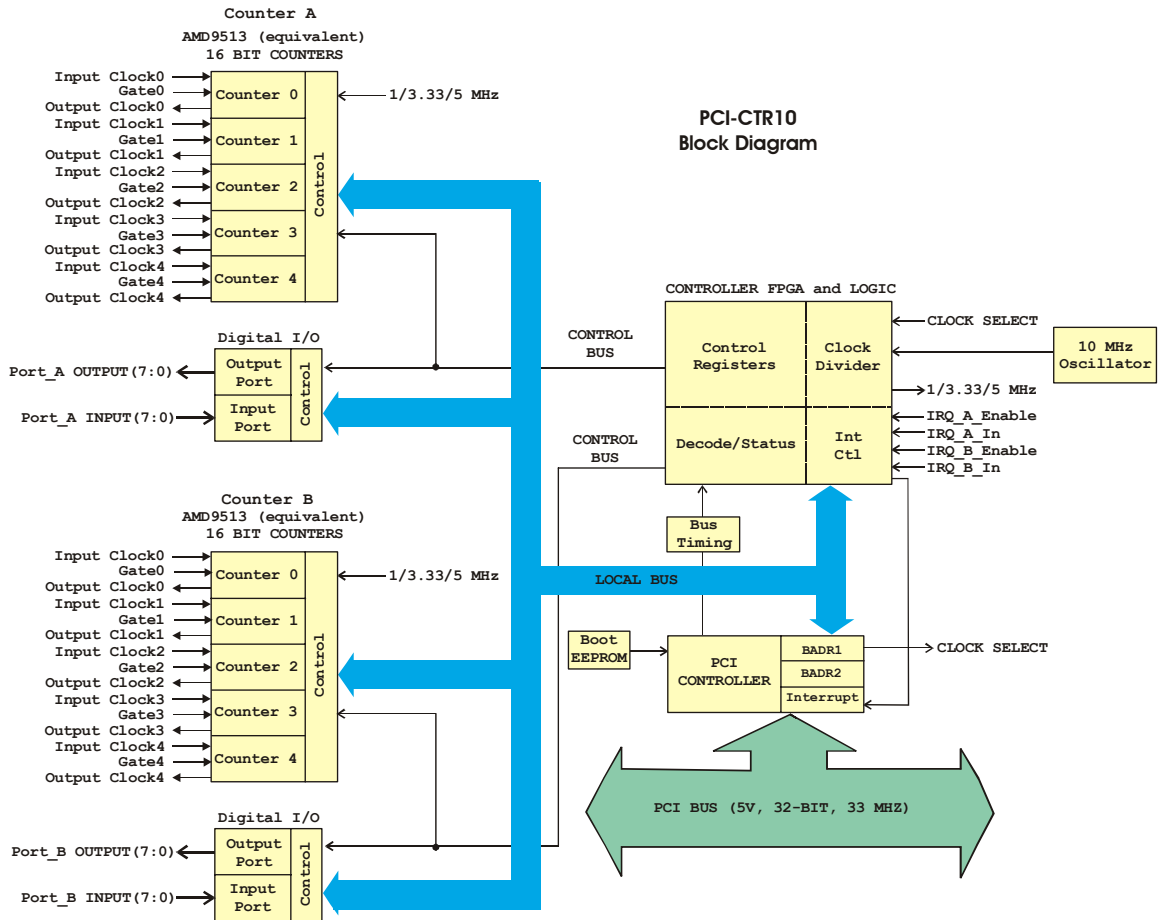PCI-CTR10 functions are illustrated in the block diagram shown here.

Figure 1-1. PCI-CTR10 functional block diagram

Installing the PCI-CTR10

What comes with your PCI-CTR10 shipment?

The following items are shipped with the PCI-CTR10.

Hardware

▪ PCI-CTR10

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-CTR10 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

Optional components

▪ Cables
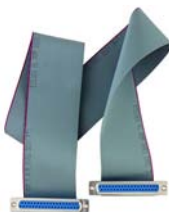
C37FF-x   C37FFS-x

▪ Signal termination and conditioning accessories

MCC provides signal termination and signal conditioning products for use with the PCI-CTR10. Refer to Field wiring, signal termination and conditioning for a complete list of compatible accessory products.

Unpacking the PCI-CTR10

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the PCI-CTR10 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-CTR10

The PCI-CTR10 board is completely plug-and-play, with 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 locate two adjacent PCI expansion slots.

2. From the rear of the computer, place the PCI-CTR10 in the left hand of the two empty slots, so that the empty slot is on the component side of the PCI-CTR10. Cabling is easier when there is an empty slot on the component side of the board.

3. 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 opens 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 are prompted for the disk containing this file. The *Measurement Computing Data Acquisition Software* CD supplied with your board contains this file. If required, insert the disk or CD and click **OK**.

To test your installation and configure your board, run the *Insta*Cal utility you installed in the previous section. Refer to the *Quick Start Guide* that came with your board 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

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

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

Connector type	▪ P1: 37-pin shielded, D-type, right angle ▪ P2: 37-pin unshielded, D-type, straight
Compatible cables	C37FF-x, unshielded ribbon cable (Figure 2-2)
	C37FFS-x, shielded round cable (Figure 2-3)
Compatible accessory products	CIO-MINI37
	CIO-MINI37-VERT
	CIO-TERMINAL
	SCB-37
	BP-37/P (Note 1)
Note 1: The BP-37/P is required to cable all CTR B signals from connector P2 to the PC bulkhead.	

Pinout – main I/O connector

The PCI-CTR10 has two male, 37-pin D-type connector - **P1** and **P2** (see Figure 2-1.) Digital input, digital output and interrupt signals from the 9513 are all accessible on these connectors.

The signals on both connectors are identical. The second 9513 device on the PCI-CTR10 is accessible via connector P2 at the rear of the board, and is wired identically to the 9513 device on connector P1.
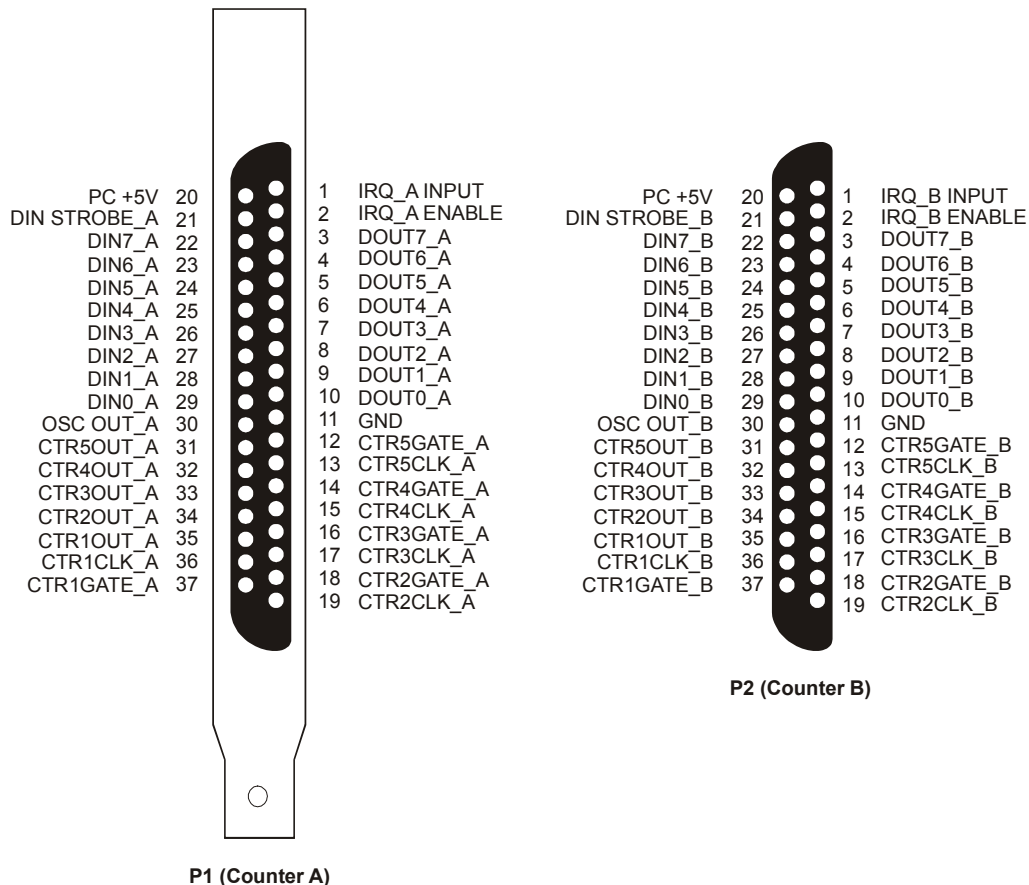

P1 (Counter A)

P2 (Counter B)

Figure 2-1. Board connectors P1 and P2

Information on signal connections

For general information regarding digital I/O techniques, including signal conditioning and low pass filters, refer to the *Guide to Signal Connections*. This document is available on our web site at www.mccdaq.com/signals/signals.pdf).
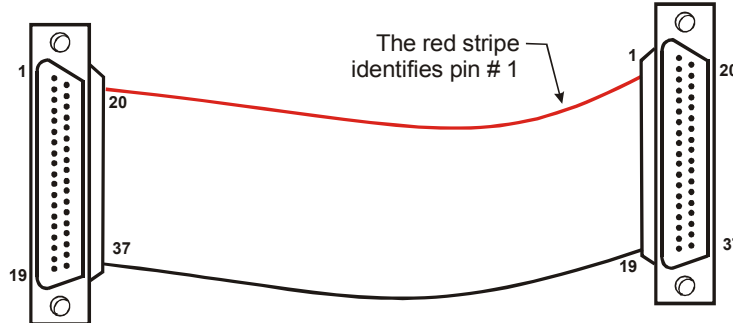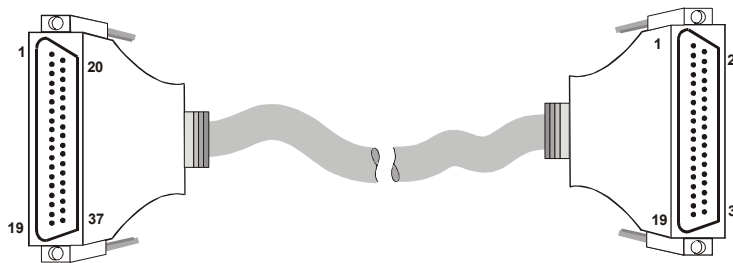

Figure 2-2. C37FF-x cable

Figure 2-3. C37FFS-x cable

Field wiring, signal termination and conditioning

You can use the following MCC screw terminal boards and relay racks with the PCI-CTR10 board using the C37FF-*x* or C37FFS-x cable.

▪ **SCB37 —** 37-conductor, shielded signal connection/screw terminal box that provides two independent 37-pin connections. Details on this product are available at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=196&pf_id=1166.
▪ **CIO-MINI37 —** 4 x 4, 37-pin screw terminal board. Details on this product are available at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=255.
▪ **CIO-MINI37-VERT** — 37-pin screw terminal accessory with vertical 37-pin male D connector. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=256.
▪ **CIO-TERMINAL —** 16 X 4 universal screw terminal board with on-board prototype area and circuitry. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=282.
▪ **BP-37/P—** PCI backplate with 37-pin connector/cable. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=103&pf_id=1520.

Programming and software applications

Programming languages

Measurement Computing's Universal Library™ provides access to board functions from a variety of Windows programming languages. If you are planning to write programs, or would like to run the example programs for Visual Basic® or any other language, please refer to the *Universal Library User's Guide* (available on our web site at www.mccdaq.com/PDFmanuals/sm-ul-user-guide.pdf).

Packaged applications programs

Many packaged application programs, 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

Register-level programming

We recommend that you use the Universal Library or one of the packaged application programs mentioned above for controlling your board. Only experienced programmers should attempt register level-programming.

If you must use register-level programming in your application, refer to the *Register Map for the PCI-CTR10*. This document is available on our web site at www.mccdaq.com/registermaps/RegMapPCI-CTR10.pdf

Specifications

Typical for 25 °C unless otherwise specified.

Specifications in *italic text* are guaranteed by design.

Counters

Refer to CTS9513-2 data sheet for complete 9513 specifications and operating modes. The SAVE command for the CTS9513 device does not behave predictably when using clocks which are not synchronous with the logic timing. If the SAVE command must be used, we strongly recommend that the 3.3 MHz clock derived from the 33 MHz PCI clock be selected as the clock source. The CTS9513-2 data sheet is available on our web site at www.mccdaq.com/PDFmanuals/9513A.pdf.

Table 1. Counter specifications

Parameter	Conditions
Counter type	CTS9513
Configuration	Two 9513 devices. Five up/down counters per 9513, 16-bits each.
Compatibility	5V/TTL
Each 9513 device is programmable for:	
Clock source	Software selectable: External: ▪ Counter 1-5 clock inputs ▪ Counter 1-5 gate inputs Internal: ▪ Terminal count of previous counter ▪ X2 clock frequency scaler
Gate	Software selectable source: External: ▪ Active high or low level or edge, counter 1 – 5 gate input ▪ Active high level previous gate or next gate ▪ All external gate signals (CTRnGATE) individually pulled up through 10K resistors to +5V. Internal: ▪ Active high previous counter terminal count ▪ No gating.
Output	Software selectable: ▪ Always low ▪ High pulse on terminal count ▪ Low pulse on terminal count ▪ Toggle on terminal count ▪ Inactive, high impedance at user connector counter # output.
Osc Out	Software selectable source: ▪ Counter # input ▪ Gate # input ▪ Prescaled clock source (X2 clock frequency scaler) Software selectable divider: ▪ Division by 1-16 Software selectable enable: ▪ On or low impedance to ground.
Clock input frequency	6.8 MHz max (145 nS min period)
X2 clock input sources	Software selectable: ▪ 1.0 MHz (10 MHz Xtal divided by 10) ▪ 5.0 MHz (10 MHz Xtal divided by 2) ▪ 3.3 MHz (33 MHz PCI clock divided by 10)

Parameter	Conditions
X2 clock frequency scaler	BCD scaling (X2 divided by 10, 100, 1000 or 10000) or Binary scaling (X2 divided by 16, 256, 4096 or 65536)
High pulse width (clock input)	*70 ns min*
Low pulse width (clock input)	*70 ns min*
Gate width high	*145 ns min*
Gate width low	*145 ns min*
Input low voltage	*-0.5 V min, 0.8 V max*
Input high voltage	*2.2 V min, Vcc max*
Output low voltage @ Ill = 3.2 mA	*0.4 V max*
Output high voltage @ IIH = -200 μA	*2.4 V min*
Crystal oscillator frequency	10 MHz
Frequency accuracy	50 ppm
Data transfer	Programmed I/O, interrupt
Power-up / reset state	CTRnOUT_x: low impedance OSCOUT_x: enabled

Digital input / output

Table 2. Digital I/O specifications

Digital type	Discrete, 5V/TTL compatible
	Output:74ACT273
	Input: 74LS373
Number of I/O	8 input, 8 output per 37-pin D connector
Configuration, per connector	1 bank of 8 as output, 1 bank of 8 as strobed input
Input high voltage	*2.0 V min, 7.0 V absolute max*
Input low voltage	*0.8 V max, –0.5 V absolute min*
Output high voltage	*3.94 volts min @ -24 mA (Vcc = 4.5 V)*
Output low voltage	*0.36 volts max @ 24 mA (Vcc = 4.5 V)*
Data transfer	Programmed I/O
Power-up / reset state	Digital outputs power on and Reset to TTL low
Din Strobe	Active low latch enable input, internally pulled high through 10 Kohm resistor
Din Strobe pulse width high/low	15 nS min
Data setup to Din Strobe	*5 nS min*
Data hold from Din Strobe	*20 nS min*

Interrupts

Table 3. Interrupt specifications

Number of user interrupts	Two
PCI interrupt	PCI INTA# - mapped to IRQn via PCI BIOS at boot-time
Interrupt enables	External: IRQ_A ENABLE, IRQ_B ENABLE, active low, disabled by default through internal resistor to TTL high) and programmable through PCI9052-1; 0 = disabled 1 = enabled (default)
Interrupt sources	External: IRQ_A IN, IRQ_B IN, polarity programmable through PCI9052-1; 1 = active high 0 = active low (default)
	IRQ_A IN maps to PLX 9052 LINT1
	IRQ_B IN maps to PLX 9052 LINT2

Power consumption

Table 4. Power consumption specifications

+5V	550 mA typical, 800 mA max. Does not include power consumed through the I/O connector.
+5V available at each I/O connector	1A max, protected with a resettable fuse
Resettable fuse	Raychem type *miniSMDC110*. ▪ Hold Current: 1.1 A max ▪ Series resistance 0.21 Ohms max.

Environmental

Table 5. Environmental specifications

Operating Temperature Range	0 to 55°C
Storage Temperature Range	-20 to 70°C
Humidity	0 to 90% non-condensing

Mechanical

Table 6. Mechanical specifications

Card dimensions	PCI half card: 174.4 mm(L) x 106.7 mm(W) x11.65 mm(H)
Form factor	PCI 5V keying. Compatible with 5V, 32-bit. 33 MHz back planes

Main connector and pin out

The P1 connector is compatible with the CIO-CTR05 and the PCI-CTR05. Both P1 and P2 are compatible with the CIO-CTR10.

Table 7. Main connector specifications

Connector types	P1: 37-pin shielded D-type, right angle.
	P2: 37-pin unshielded D-type, straight.
Compatible Cables	C37FF-x, unshielded ribbon cable.
	C37FFS-x, shielded round cable
Compatible accessory products	BP37/P (Note 1) CIO-MINI37 CIO-MINI37-VERT CIO-TERMINAL SCB-37

Note 1:   BP37/P is required in order to cable all CTR B signals from P2 to the PC bulkhead.

Table 8. P1 pin out (Counter A)

Pin	Signal Name
1	IRQ_A INPUT
2	IRQ_A ENABLE
3	DOUT7_A
4	DOUT6_A
5	DOUT5_A
6	DOUT4_A
7	DOUT3_A
8	DOUT2_A
9	DOUT1_A
10	DOUT0_A
11	GND
12	CTR5GATE_A
13	CTR5CLK_A
14	CTR4GATE_A
15	CTR4CLK_A
16	CTR3GATE_A
17	CTR3CLK_A
18	CTR2GATE_A
19	CTR2CLK_A
20	PC +5V
21	DIN STROBE_A
22	DIN7_A
23	DIN6_A
24	DIN5_A
25	DIN4_A
26	DIN3_A
27	DIN2_A
28	DIN1_A
29	DIN0_A
30	OSC OUT_A
31	CTR5OUT_A
32	CTR4OUT_A
33	CTR3OUT_A
34	CTR2OUT_A
35	CTR1OUT_A
36	CTR1CLK_A
37	CTR1GATE_A

Table 9. P2 pin out (Counter B)

Pin	Signal Name
1	IRQ_B INPUT
2	IRQ_B ENABLE
3	DOUT7_B
4	DOUT6_B
5	DOUT5_B
6	DOUT4_B
7	DOUT3_B
8	DOUT2_B
9	DOUT1_B
10	DOUT0_B
11	GND
12	CTR5GATE_B
13	CTR5CLK_B
14	CTR4GATE_B
15	CTR4CLK_B
16	CTR3GATE_B
17	CTR3CLK_B
18	CTR2GATE_B
19	CTR2CLK_B
20	PC +5V
21	DIN STROBE_B
22	DIN7_B
23	DIN6_B
24	DIN5_B
25	DIN4_B
26	DIN3_B
27	DIN2_B
28	DIN1_B
29	DIN0_B
30	OSC OUT_B
31	CTR5OUT_B
32	CTR4OUT_B
33	CTR3OUT_B
34	CTR2OUT_B
35	CTR1OUT_B
36	CTR1CLK_B
37	CTR1GATE_B

$C\epsilon$ 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-CTR10

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