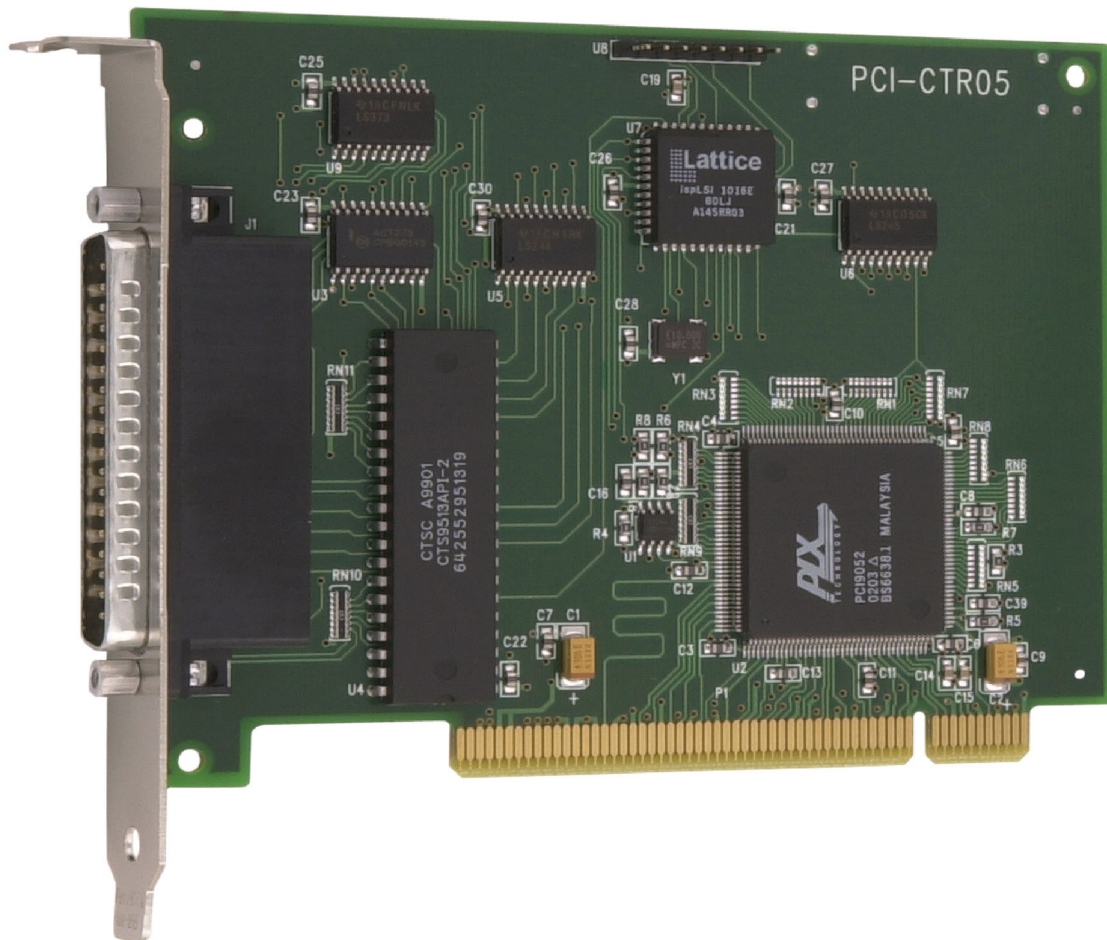


# PCI-CTR05

9513-Based Counter/Timer Board

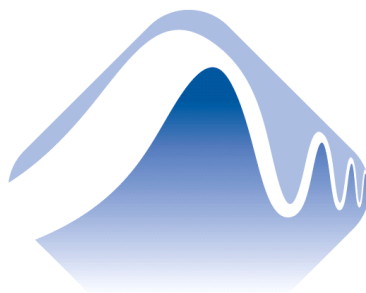
## User's Guide



# PCI-CTR05

## 9513-Based Counter/Timer

### User's Guide



**MEASUREMENT  
COMPUTING™**

Document Revision 5, June, 2006

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## About this User's Guide

### What you will learn from this user's guide

This user's guide explains how to install, configure, and use the PCI-CTR05 so that you get the most out of it's counter 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 helpful information relevant to the operation of the PCI-CTR05

- MCC's *Specifications: PCI-CTR05* (the PDF version of the *Specifications* chapter in this guide) is available on our web site at [www.mccdaq.com/pdfs/PCI-CTR05.pdf](http://www.mccdaq.com/pdfs/PCI-CTR05.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-CTR05 User's Guide* (this document) is also available on our web site at [www.mccdaq.com/PDFmanuals/PCI-CTR05.pdf](http://www.mccdaq.com/PDFmanuals/PCI-CTR05.pdf).

#### Rev 2 hardware specifications

The specifications for hardware up to revision 2 are available on our web site at [www.mccdaq.com/pdfs/PCI-CTR05r2\\_spec2.pdf](http://www.mccdaq.com/pdfs/PCI-CTR05r2_spec2.pdf).

---

## Introducing the PCI-CTR05

The PCI-CTR05 is a high-performance, low-cost counter/timer board for PCI bus-compatible computers.

The PCI-CTR05 is based on the 9513 counter/timer device. The PCI-CTR05 has one 9513 counter/timer device. The 9513 device has five independent 16-bit counters (65,536 counts). Each counter has an input source, count register, load register, hold register, alarm register, output, and gate 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 counters 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 and other TTL level signals. The PCI-CTR05 also provides access to the PCI bus interrupt assigned to the board.

The PCI-CTR05 board (rev. 3 and later) is compatible with either 3.3 V or 5 V PCI signaling environments.

**Compatibility with 3.3 V signaling only applies to boards at hardware revision 3 and later**

Hardware revisions up to rev 2 support 5 V PCI signaling environments only.

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](http://www.mccdaq.com/PDFmanuals/9513A.pdf).

## Software features

For information on the features of *InstaCal* and the other software included with your PCI-CTR05, 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-CTR05 block diagram

PCI-CTR05 functions are illustrated in the block diagram shown here

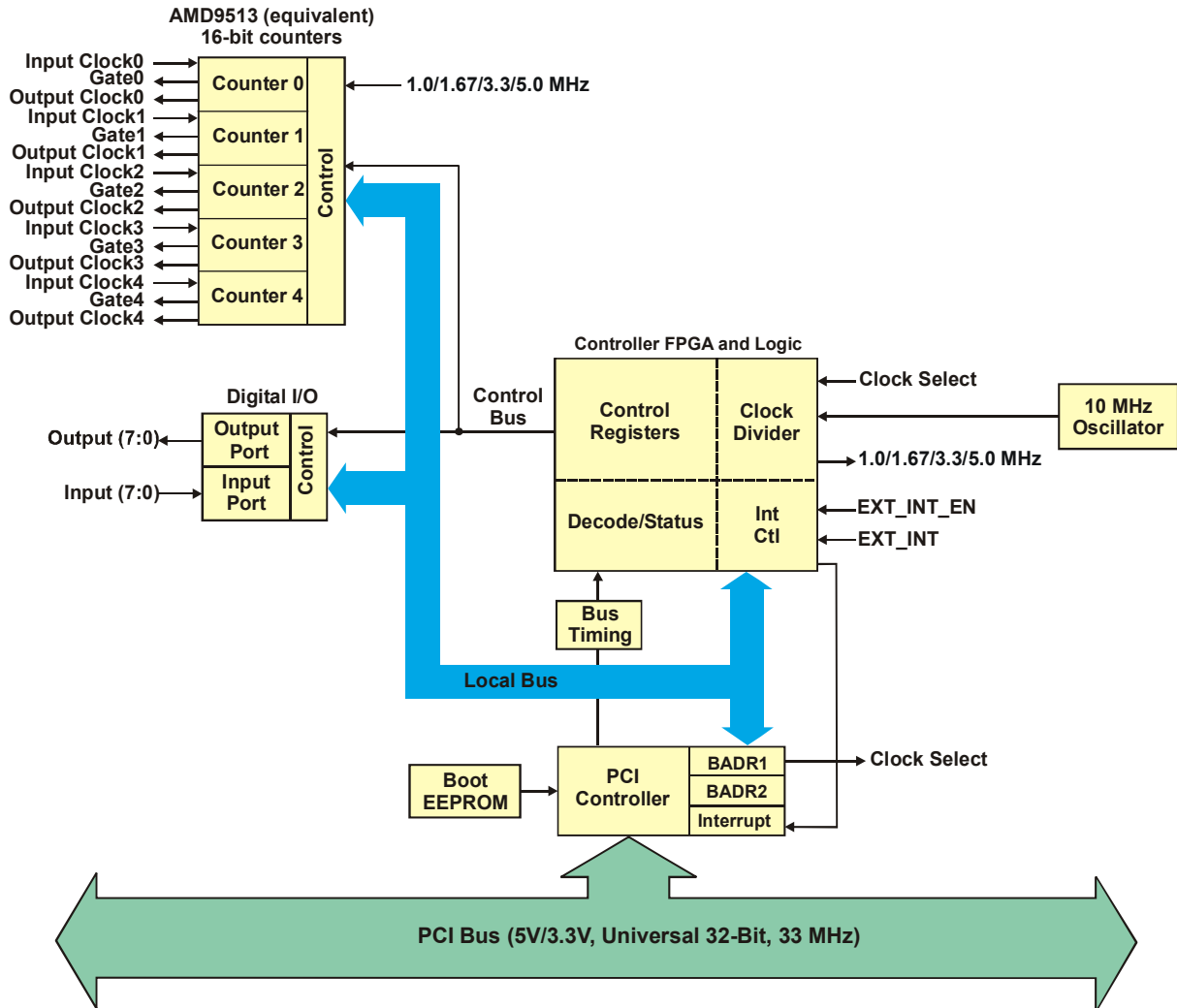


Figure 1-1. PCI-CTR05 functional block diagram



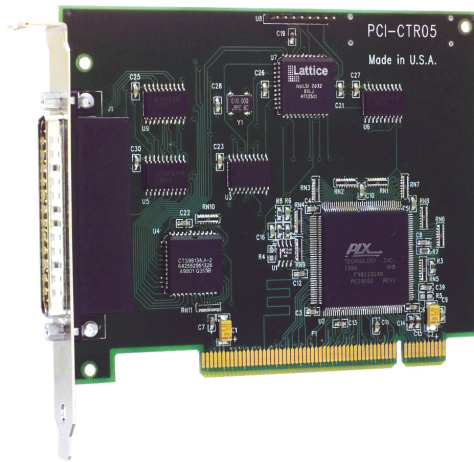
# Installing the PCI-CTR05

## What comes with your PCI-CTR05 shipment?

As you unpack your board, make sure that the following components are included.

### Hardware

- PCI-CTR05

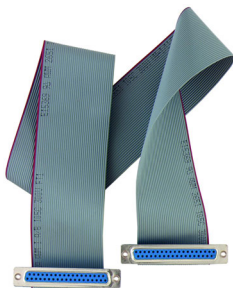


### Additional documentation

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-CTR05 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-CTR05. Refer to [Field wiring, signal termination and conditioning](#) for a complete list of compatible accessory products.

## Unpacking the PCI-CTR05

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the PCI-CTR05 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-CTR05

The PCI-CTR05 board is completely plug-and-play. There are no switches or jumpers to set on the board. 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 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**.

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/sm-installation.pdf](http://www.mccdaq.com/PDFmanuals/sm-installation.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	37-pin shielded D-type, right angle (J1 – see Figure 2-1)
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

### Pinout – main I/O connector

The board connector is a male, 37-pin D-type connector (J1). Digital input, digital output, interrupt, and signals from the 9513 are all accessible on this connector.

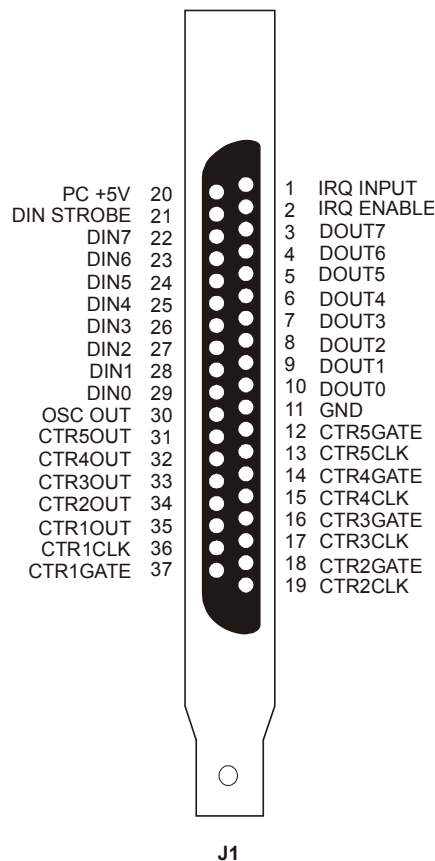


Figure 2-1. Board connector J1

#### 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](http://www.mccdaq.com/signals/signals.pdf).

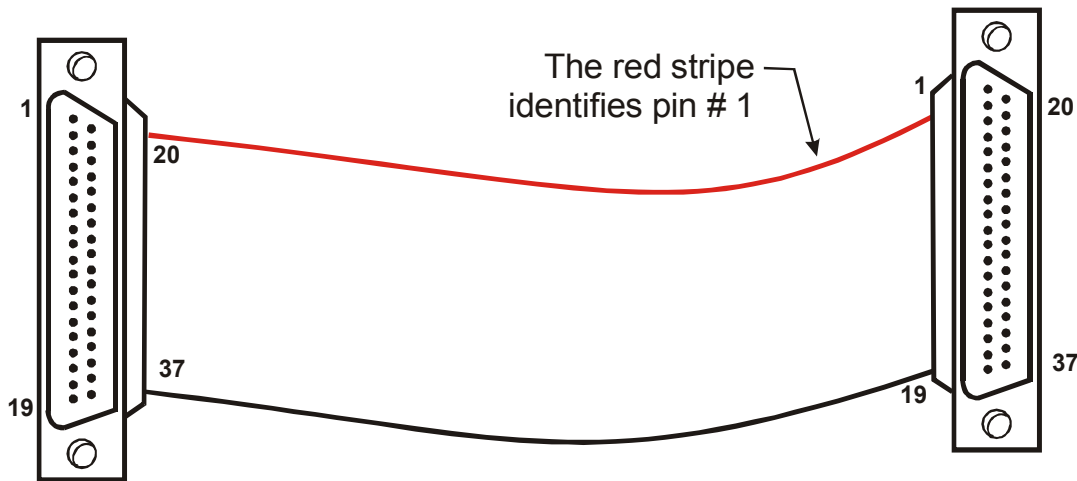


Figure 2-2. C37FF-x cable

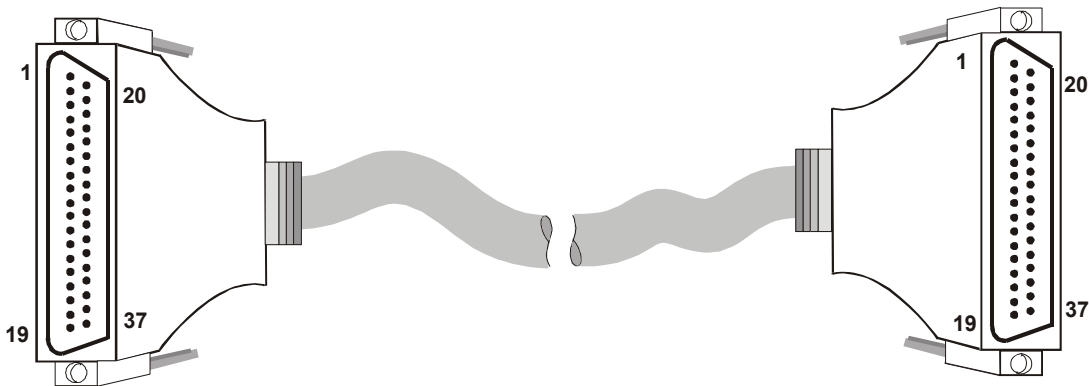


Figure 2-3. C37FFS-x cable

## Field wiring, signal termination and conditioning

You can use the following MCC screw terminal boards with the PCI-CTR05 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](http://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](http://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](http://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](http://www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=282).

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

## Packaged application 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

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-CTR05*. This document is available on our web site at [www.mccdaq.com/registermaps/RegMapPCI-CTR05.pdf](http://www.mccdaq.com/registermaps/RegMapPCI-CTR05.pdf).

## Specifications

**The counter frequency sources and 3.3 V compatibility apply to hardware manufactured at revision 3 and later**

The clock input frequency sources and compatibility with a 3.3 V signaling environment that are listed in this specification apply to hardware built at revision 3 and later.

**Typical for 25 °C unless otherwise specified.**

**Specifications in *italic text* are guaranteed by design.**

### Digital input / output

Table 1. Digital I/O specifications

Digital type	Discrete, 5V/TTL compatible
	Output: 74ACT273
	Input: 74LS373
Number of I/O	8 input, 8 output
Configuration	1 bank of 8 as output, 1 bank of 8 as strobed input
<i>Input high voltage</i>	<i>2.0 V min, 7.0 V absolute max</i>
<i>Input low voltage</i>	<i>0.8 V max, -0.5 V absolute min</i>
<i>Output high voltage</i>	<i>3.94 volts min @ -24 mA (Vcc = 4.5 V)</i>
<i>Output low voltage</i>	<i>0.36 volts max @ 24 mA (Vcc = 4.5 V)</i>
Data transfer	Programmed I/O
Power-up / reset state	Digital outputs 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
<i>Data setup to Din strobe</i>	<i>5 nS min</i>
<i>Data hold from Din strobe</i>	<i>20 nS min</i>

### Interrupt

Table 2. Interrupt specifications

Number of user interrupts	One
PCI interrupt	PCI INTA# - mapped to IRQn via PCI BIOS at boot-time
Interrupt enables	External: IRQ ENABLE, active low, disabled by default through internal resistor to TTL high) and programmable through PCI9030-AA60PI. 0 = disabled 1 = enabled (default)
Interrupt sources	External: IRQ IN, polarity programmable through PCI9030-AA60PI. 1 = active high 0 = active low (default) IRQ IN maps to PLX 9030 LINT1.

## Counter

Refer to the 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. The CTS9513-2 data sheet is available on our web site at [www.mccdaq.com/PDFmanuals/9513A.pdf](http://www.mccdaq.com/PDFmanuals/9513A.pdf).

Table 3. Counter specifications

Parameter	Conditions
Counter type	9513
Configuration	One 9513 device. Five up/down counters, 16-bits each.
Compatibility	5V/TTL
The 9513 device is programmable for:	
Clock source	Software selectable: External: <ul style="list-style-type: none"> <li>▪ Counter 1-5 clock inputs</li> <li>▪ Counter 1-5 gate inputs</li> </ul> Internal: <ul style="list-style-type: none"> <li>▪ Terminal count of previous counter</li> <li>▪ X2 clock frequency scaler</li> </ul>
Gate:	Software selectable source: External (default logic high): <ul style="list-style-type: none"> <li>▪ Active high or low level or edge, counter 1 – 5 gate input</li> <li>▪ Active high level previous gate or next gate</li> <li>▪ All external gate signals (CTR<sub>x</sub>GATE) individually pulled up through 10K resistors to +5V.</li> </ul> Internal: <ul style="list-style-type: none"> <li>▪ Active high previous counter terminal count</li> <li>▪ No gating.</li> </ul>
Output:	Software selectable: <ul style="list-style-type: none"> <li>▪ Always low</li> <li>▪ High pulse on terminal count</li> <li>▪ Low pulse on terminal count</li> <li>▪ Toggle on terminal count</li> <li>▪ Inactive, high impedance at user connector counter # output.</li> </ul>
Osc Out	Software selectable source: <ul style="list-style-type: none"> <li>▪ Counter # input</li> <li>▪ Gate # input</li> <li>▪ Prescaled clock source (X2 clock frequency scaler)</li> </ul> Software selectable divider: <ul style="list-style-type: none"> <li>▪ Division by 1-16</li> </ul> Software selectable enable: <ul style="list-style-type: none"> <li>▪ On or low impedance to ground.</li> </ul>
Clock input frequency	6.8 MHz max (145 nS min period)
X2 clock input sources	Software selectable: <ul style="list-style-type: none"> <li>▪ 1.0 MHz (10 MHz Xtal divided by 10)</li> <li>▪ 5.0 MHz (10 MHz Xtal divided by 2)</li> <li>▪ 3.3 MHz (33 MHz PCI clock divided by 10)</li> <li>▪ 1.67 MHz (33 MHz PCI clock divided by 20)</li> </ul>
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

Parameter	Conditions
Input low voltage	-0.5 V min, 0.8V max
Input high voltage	2.2 V min, Vcc max
Output low voltage @ III=3.2 mA	0.4 V max
Output high voltage @ IIH= -200 uA	2.4 V min
Crystal oscillator frequency	10 MHz
Frequency accuracy	50 ppm

## Power consumption

Table 4. Power consumption specifications

+5 V	307 mA typical, 549 mA max. Does not include power consumed through the I/O connector.
+5 V available at connector	1 A 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	132.3 mm (L) x 106.7 mm (W) x 11.65 mm (H)
Form factor	Universal PCI keying. Compatible with either 3.3 V or 5 V PCI signaling environments.

## Main connector and pin out

Main connector J1 is compatible with the CIO-CTR05 and the CIO-CTR10.

Table 7. Main connector specifications

Connector type	37 pin shielded D-type, right angle
Compatible cables	<ul style="list-style-type: none"> <li>▪ C37FF-x, unshielded ribbon cable</li> <li>▪ C37FFS-x, shielded round cable</li> </ul>
Compatible accessory products	CIO-MINI37 CIO-MINI37-VERT CIO-TERMINAL SCB-37



## J1 pin out

Table 8. Main connector J1 pin out

Pin	Signal Name
1	IRQ INPUT
2	IRQ ENABLE
3	DOUT7
4	DOUT6
5	DOUT5
6	DOUT4
7	DOUT3
8	DOUT2
9	DOUT1
10	DOUT0
11	GND
12	CTR5GATE
13	CTR5CLK
14	CTR4GATE
15	CTR4CLK
16	CTR3GATE
17	CTR3CLK
18	CTR2GATE
19	CTR2CLK
20	PC +5V
21	DIN STROBE
22	DIN7
23	DIN6
24	DIN5
25	DIN4
26	DIN3
27	DIN2
28	DIN1
29	DIN0
30	OSC OUT
31	CTR5OUT
32	CTR4OUT
33	CTR3OUT
34	CTR2OUT
35	CTR1OUT
36	CTR1CLK
37	CTR1GATE

# 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-CTR05

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.



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