PCI-CTR20HD

9513-Based Counter/Timer Board

User's Guide

PCI-CTR20HD

MEASUREMENT COMPUTING
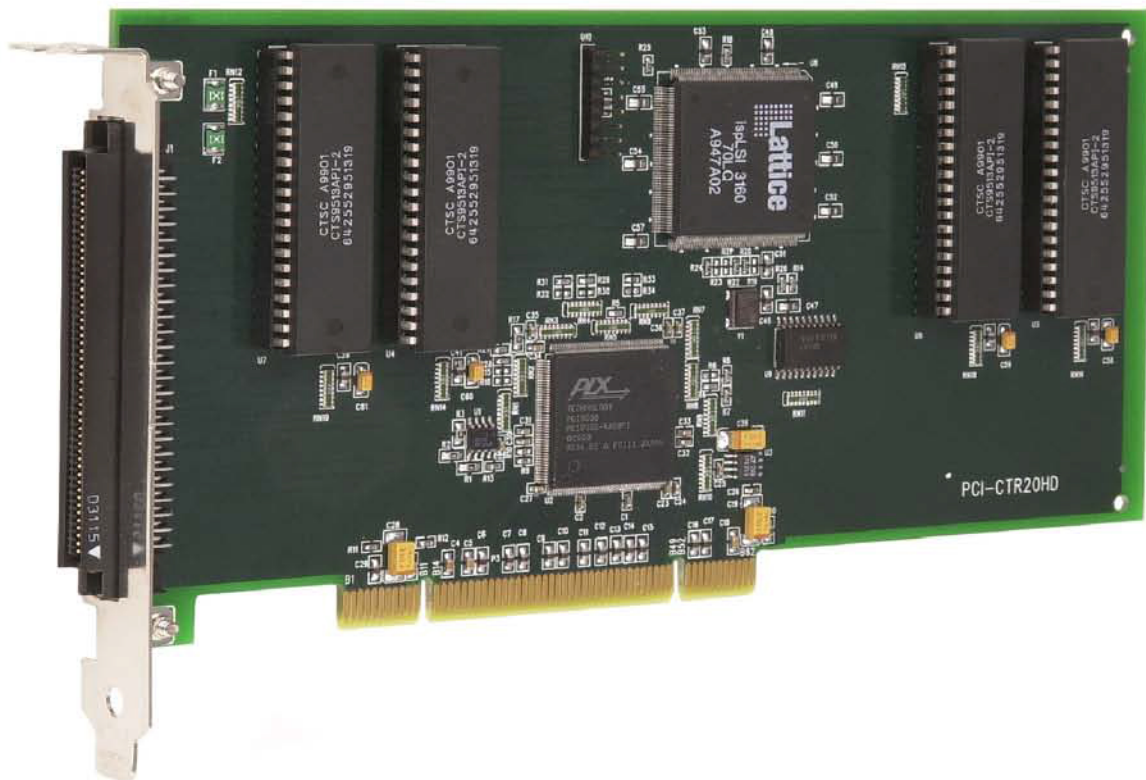
PCI-CTR20HD

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User's Guide

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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-CTR20HD 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-CTR20HD 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-CTR20HD board

Overview: PCI-CTR20HD features

This manual explains how to install and use the PCI-CTR20HD board. The PCI-CTR20HD is a high-performance, low-cost counter/timer board for PCI bus-compatible computers. This board can be used in such applications as data acquisition, system timing, industrial process control, and laser systems.

The PCI-CTR20HD board is equipped with four 9513-based counter/timer devices. Each 9513 device has five 16-bit independent up-down counters (65,536 counts). An input source, dual count register, load register, hold register, alarm register, output, and gate are associated with each counter. All are selectable via software.

You can configure the 9513 counter/timer device with software to perform event counting, pulse and frequency measurements, watchdog timing, alarm comparisons, and other input functions. The 9513 counter/timer can generate frequencies with either complex duty cycles or with one-shot and continuous-output modes.

Up to five counters can be chained together using software to enable a 32-, 48-, 64-, or 80-bit counter. No hardware connections are required. The internal/external counter source, gate source, and gating functions are software-programmable. The 9513 device also provides access to one PCI bus interrupt. This interrupt has two user inputs.

Detailed information about the 9513 counter/timer device is available from the *CTS9513-2 5 Chan 16 bit 20MHz Counter/Timer* data sheet. The information in this data sheet will help you maximize the performance of your PCI-CTR20HD board. This document is available from our web site at www.mccdaq.com/PDFs/manuals/9513A.pdf.

Software features

For information on the features of *Insta*Cal and the other software included with your PCI-CTR20HD, 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-CTR20HD block diagram

PCI-CTR20HD functions are illustrated in the block diagram shown here.
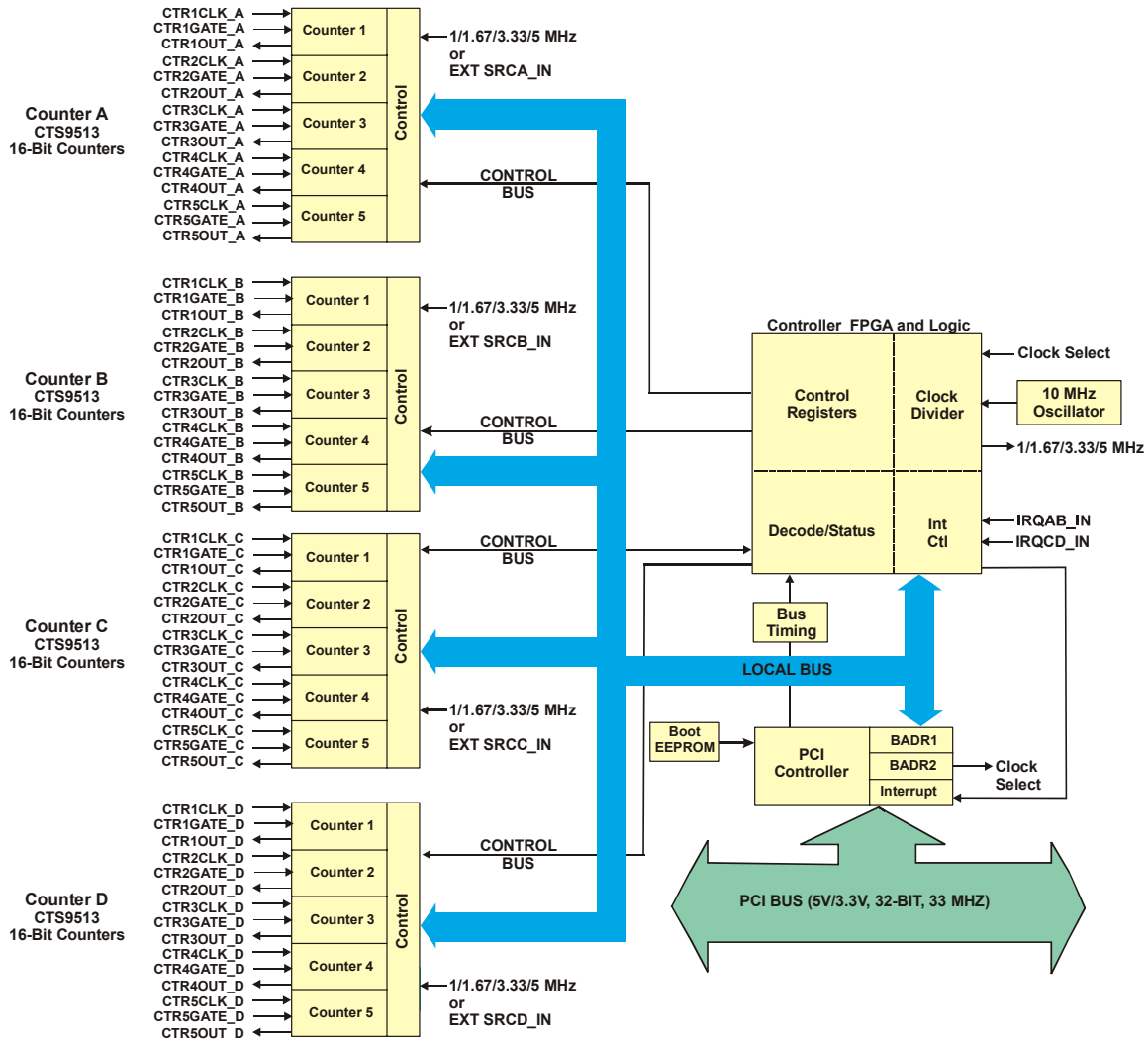
Figure 1-1. PCI-CTR20HD functional block diagram

Installing the PCI-CTR20HD

What comes with your PCI-CTR20HD shipment?

The following items are shipped with the PCI-CTR20HD.

Hardware

▪ PCI-CTR20HD
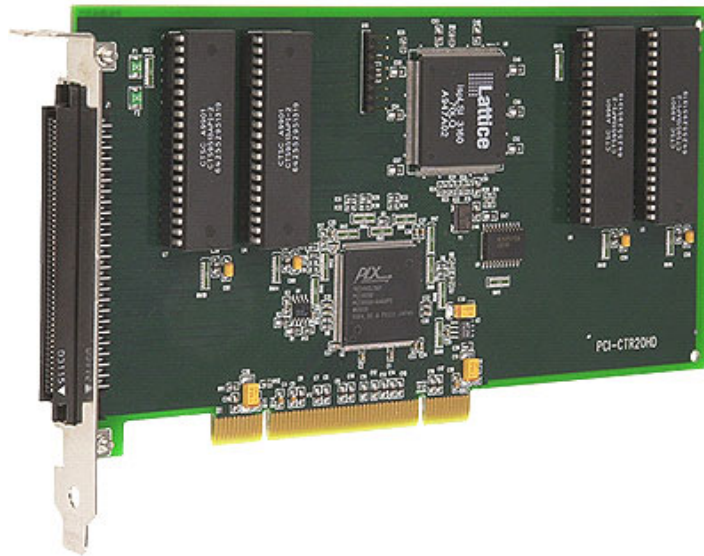
Additional documentation

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-DDA04/16 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware.

Optional components

▪ C100FF-x cable
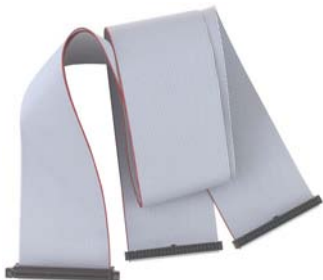
▪ Signal termination and conditioning accessories

MCC provides signal termination products for use with the PCI-DDA08/16. Refer to Field wiring, signal termination and conditioning on page 2-5 for a complete list of compatible accessory products.

Unpacking the PCI-CTR20HD

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the PCI-DDA02/12 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

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-CTR20HD

The PCI-CTR20HD 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 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 for information on how to initially set up and load *Insta*Cal.

Configuring the PCI-CTR20HD

All hardware configuration options on the PCI-CTR20HD are software-controlled. You can select some of the configuration options using *Insta*Cal, such as the frequency of the clock input source for each chip. Once selected, any program that uses the Universal Library initializes the hardware according to these selections.

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 products for the PCI-CTR20HD.

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

Connector type	J1: 100 pin high density unshielded
Compatible cables (optional)	C100FF-x, unshielded ribbon cable (Figure 2-2). x = length in feet
Compatible accessory products (optional)	CIO-MINI50 or CIO-MINI50/DST CIO-TERM100 or CIO-TERM100/DST CIO-SPADE50 SCB-50

Pinout – main I/O connector

The PCI-CTR20HD board's main I/O connector is a 100-pin high density connector labeled **J1** on the board. Pins 1-50 provide connections for counters A and B. Pins 51-100 provide connections for counters C and D. The pin names for the I/O connector are defined in **Error! Reference source not found.**.

Table 2-2. J1 connector pin out

Counter C, D				Counter A, B
Signal Name	**Pin**		**Pin**	**Signal Name**
GND	100	••	50	GND
PC +5V	99	••	49	PC +5V
OSC OUT_D	98	••	48	OSC OUT_B
EXT SRCD_IN	97	••	47	EXT SRCB_IN
GND	96	••	46	GND
CTR5GATE_D	95	••	45	CTR5GATE_B
CTR5OUT_D	94	••	44	CTR5OUT_B
CTR5CLK_D	93	••	43	CTR5CLK_B
GND	92	••	42	GND
CTR4GATE_D	91	••	41	CTR4GATE_B
CTR4OUT_D	90	••	40	CTR4OUT_B
CTR4CLK_D	89	••	39	CTR4CLK_B
GND	88	••	38	GND
CTR3GATE_D	87	••	37	CTR3GATE_B
CTR3OUT_D	86	••	36	CTR3OUT_B
CTR3CLK_D	85	••	35	CTR3CLK_B
GND	84	••	34	GND
CTR2GATE_D	83	••	33	CTR2GATE_B
CTR2OUT_D	82	••	32	CTR2OUT_B
CTR2CLK_D	81	••	31	CTR2CLK_B
GND	80	••	30	GND
CTR1GATE_D	79	••	29	CTR1GATE_B
CTR1OUT_D	78	••	28	CTR1OUT_B
CTR1CLK_D	77	••	27	CTR1CLK_B
IRQCD_IN	76	••	26	IRQAB_IN
PC +5V	75	••	25	PC +5V
GND	74	••	24	GND
PC +5V	73	••	23	PC +5V
OSC OUT_C	72	••	22	OSC OUT_A
EXT SRCC_IN	71	••	21	EXT SRCA_IN
GND	70	••	20	GND
CTR5GATE_C	69	••	19	CTR5GATE_A
CTR5OUT_C	68	••	18	CTR5OUT_A
CTR5CLK_C	67	••	17	CTR5CLK_A
GND	66	••	16	GND
CTR4GATE_C	65	••	15	CTR4GATE_A
CTR4OUT_C	64	••	14	CTR4OUT_A
CTR4CLK_C	63	••	13	CTR4CLK_A
GND	62	••	12	GND
CTR3GATE_C	61	••	11	CTR3GATE_A
CTR3OUT_C	60	••	10	CTR3OUT_A
CTR3CLK_C	59	••	9	CTR3CLK_A
GND	58	••	8	GND
CTR2GATE_C	57	••	7	CTR2GATE_A
CTR2OUT_C	56	••	6	CTR2OUT_A
CTR2CLK_C	55	••	5	CTR2CLK_A
GND	54	••	4	GND
CTR1GATE_C	53	••	3	CTR1GATE_A
CTR1OUT_C	52	••	2	CTR1OUT_A
CTR1CLK_C	51	••	1	CTR1CLK_A

PCI slot ↓

Cabling

Use a C100FF-x 100-pin cable to connect signals to the CTR20HD board. This cable consists of two 50-pin ribbon cables that are joined together at a 100-pin high density header connector (Figure 2-2.)
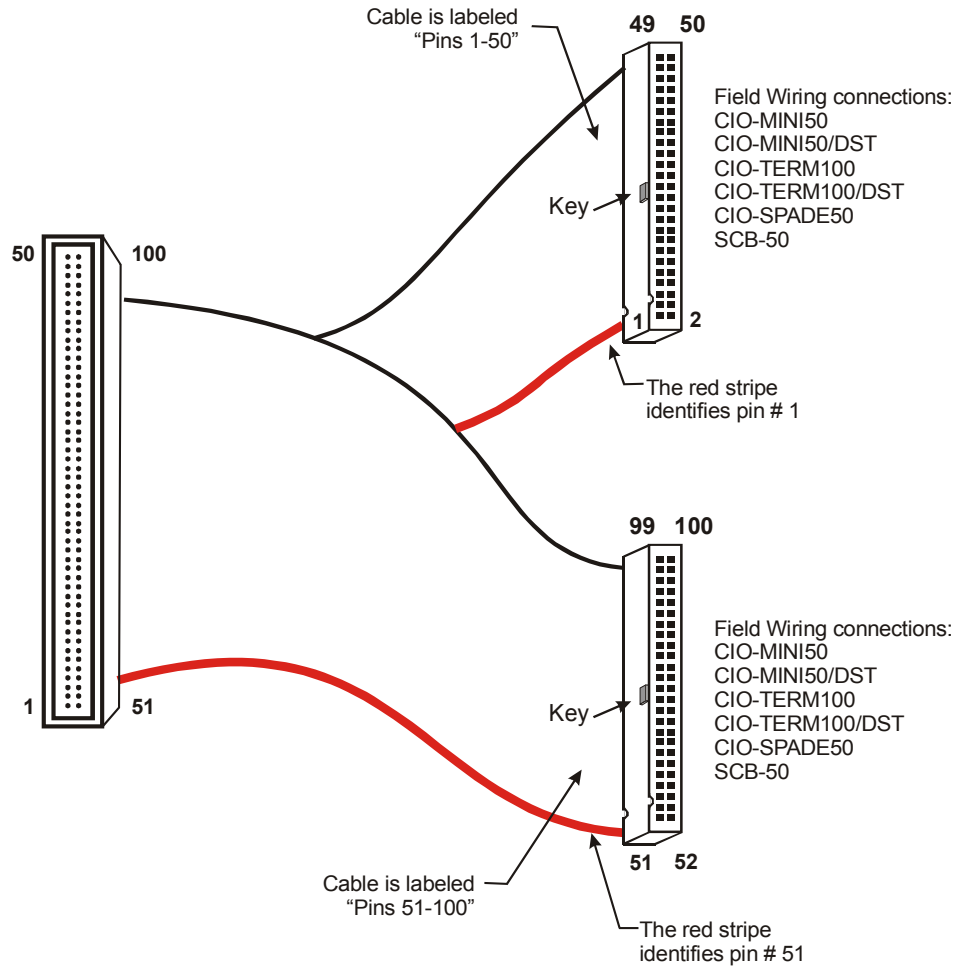

Figure 2-2. C100FF-x cable

Field wiring, signal termination and conditioning

You can use the following MCC screw terminal boards to terminate field signals and route them into the PCI-CTR20HD board using the C100FF-x cable:

- 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.
- CIO-MINI50/DST – 50-pin screw terminal board with detachable screw terminals. 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=720.
- 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.
- CIO-TERM100/DST – 100-pin screw terminal board with detachable screw terminals (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=721.

- CIO-SPADE50 – 50-pin screw terminal board with spade lug terminals. Two boards are required. Details on this product are available from our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=102&pf_id=275.
- SCB-50 – 50 conductor, shielded signal connection/screw terminal box that provides two independent 50-pin connections. Only one box is required. Details on this product are available on our web site at www.mccdaq.com/cbicatalog/cbiproduct.asp?dept_id=196&pf_id=1168.

Programming and software applications

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 need to program at the register level in your application, refer to the *Register Map for the PCI-CTR20HD*. This document is available on our website at www.mccdaq.com/registermaps/RegMapPCI-CTR20HD.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	9513
Configuration	Four 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 (CTRxGATEn) individually pulled up through 10 K 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 #1-5 input Gate #1-5 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: (each counter individually) External (max = 7.0 MHz) EXT SRCA_IN, EXT SRCB_IN, EXT SRCC_IN, EXT SRCD_IN 1.0 MHz (10MHz Xtal divided by 10) 5.0 MHz (10MHz Xtal divided by 2) 3.33 MHz (33 MHz PCI clock divided by 10) 1.67 MHz (33 MHz PCI clock divided by 20)

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

Interrupts

Table 2. Interrupt specifications

Number of user interrupt inputs	Two
PCI Interrupt	PCI INTA# - mapped to IRQn via PCI BIOS at boot-time
Interrupt enable	External: Programmable through PLX-9030; 0 = disabled (default) 1 = enabled
Interrupt sources	External: IRQAB_IN, IRQCD_ IN, polarity programmable through PLX-9030; 1 = active high 0 = active low (default) IRQAB_IN and IRQCD_IN pulled up through 10K resistor to +5V
	IRQAB_IN maps to PLX 9030 LINT1
	IRQCD_IN maps to PLX 9030 LINT2

Power consumption

Table 3. Power consumption specifications

+5V	1 A typical, 1.2 A max. Does not include power consumed through the I/O connector.
+5V available at each I/O connector	1 A max, protected with a resettable fuse
Resettable fuse	Type: Raychem *miniSMDC110.* Hold Current: 1.1 A max Series resistance: 0.21 Ω max

Environmental

Table 4. Environmental specifications

Operating temperature range	0 to 55 °C
Storage temperature range	-20 to 70 °C
Humidity	0 to 90% non-condensing

Mechanical

Table 5. Mechanical specifications

Card dimensions	202.8 mm (L) x 106.7 mm (W) x14.48 mm (H)
Form factor	Universal PCI keying. Compatible with 3.3V/5V 32-bit, 33 MHz back planes

Main connector and pin out

Table 6. Main connector specifications

Connector type	J1: 100-pin high density unshielded
Compatible cables	C100FF-x, unshielded ribbon cable
Compatible accessory products	CIO-MINI50 CIO-SPADE50 CIO-TERM100 SCB-50

Table 7. J1 pin out

Counter C, D		Counter A, B	
Pin	Signal Name	Pin	Signal Name
100	GND	50	GND
99	PC +5V	49	PC +5V
98	OSC OUT_D	48	OSC OUT_B
97	EXT SRCD_IN	47	EXT SRCB_IN
96	GND	46	GND
95	CTR5GATE_D	45	CTR5GATE_B
94	CTR5OUT_D	44	CTR5OUT_B
93	CTR5CLK_D	43	CTR5CLK_B
92	GND	42	GND
91	CTR4GATE_D	41	CTR4GATE_B
90	CTR4OUT_D	40	CTR4OUT_B
89	CTR4CLK_D	39	CTR4CLK_B
88	GND	38	GND
87	CTR3GATE_D	37	CTR3GATE_B
86	CTR3OUT_D	36	CTR3OUT_B
85	CTR3CLK_D	35	CTR3CLK_B
84	GND	34	GND
83	CTR2GATE_D	33	CTR2GATE_B
82	CTR2OUT_D	32	CTR2OUT_B
81	CTR2CLK_D	31	CTR2CLK_B
80	GND	30	GND
79	CTR1GATE_D	29	CTR1GATE_B
78	CTR1OUT_D	28	CTR1OUT_B
77	CTR1CLK_D	27	CTR1CLK_B
76	IRQCD_IN	26	IRQAB_IN
75	PC +5V	25	PC +5V
74	GND	24	GND
73	PC +5V	23	PC +5V
72	OSC OUT_C	22	OSC OUT_A
71	EXT SRCC_IN	21	EXT SRCA_IN
70	GND	20	GND
69	CTR5GATE_C	19	CTR5GATE_A
68	CTR5OUT_C	18	CTR5OUT_A
67	CTR5CLK_C	17	CTR5CLK_A
66	GND	16	GND
65	CTR4GATE_C	15	CTR4GATE_A
64	CTR4OUT_C	14	CTR4OUT_A
63	CTR4CLK_C	13	CTR4CLK_A
62	GND	12	GND
61	CTR3GATE_C	11	CTR3GATE_A
60	CTR3OUT_C	10	CTR3OUT_A
59	CTR3CLK_C	9	CTR3CLK_A
58	GND	8	GND
57	CTR2GATE_C	7	CTR2GATE_A

4-4

Counter C, D		Counter A, B	
56	CTR2OUT_C	6	CTR2OUT_A
55	CTR2CLK_C	5	CTR2CLK_A
54	GND	4	GND
53	CTR1GATE_C	3	CTR1GATE_A
52	CTR1OUT_C	2	CTR1OUT_A
51	CTR1CLK_C	*1*	CTR1CLK_A

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-CTR20HD

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

Carl Haapaoja, Director of Quality Assurance