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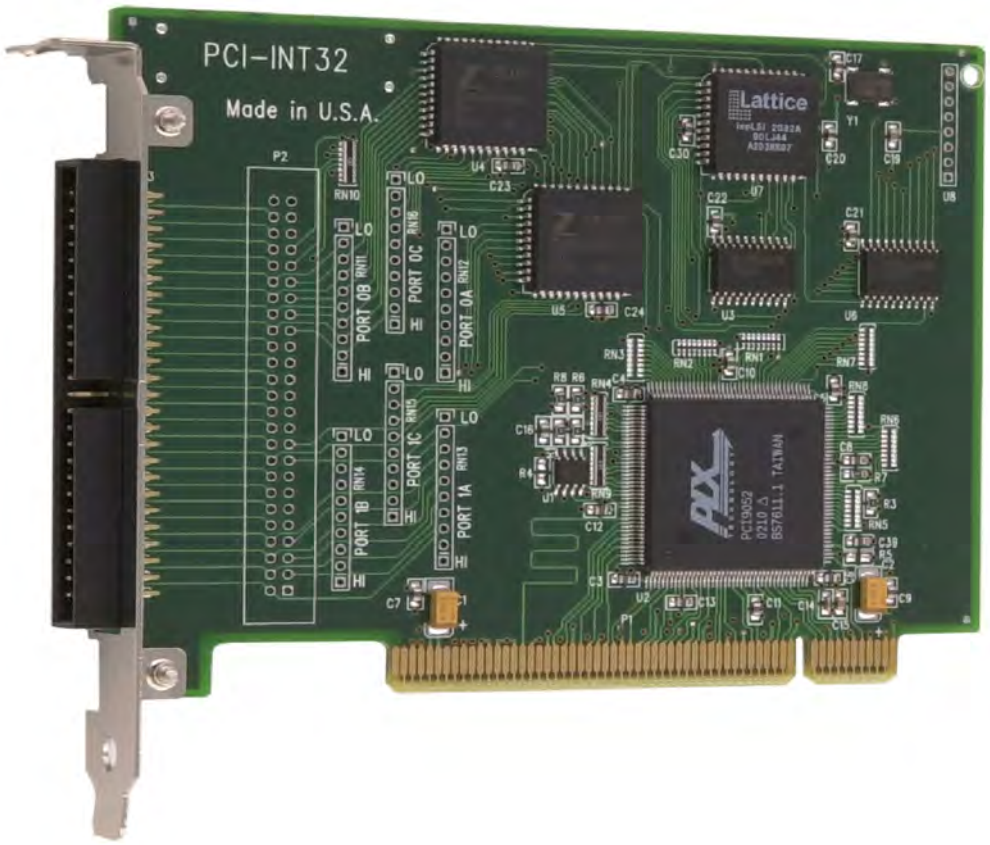
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PCI-INT32

Interrupt/Counter Board

32 Vector Interrupts, 40 Bits Digital I/O, and Six 16-bit Counters

User's Guide



MEASUREMENT COMPUTING™

PCI-INT32

Interrupt/Counter Board

User's Guide



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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-INT32 so that you get the most out of the board's interrupt and 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 *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

Additional information about PCI-INT32 hardware is available on our website at www.mccdaq.com. You can also contact Measurement Computing Corporation with specific questions.

- Knowledgebase: kb.mccdaq.com
- 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

Introducing the PCI-INT32

The PCI-INT32 is intended to be used in conjunction with the ZILOG *Z8036/Z8536 Product Specification*. This document is available on our web site at www.mccdaq.com/PDFmanuals/Z8536.pdf.

The PCI-INT32 can accept up to 32 vector interrupts and output an interrupt to the PC. The board has a pair of Z8536 I/O chips interfaced to the PCI bus. Each Z8536 accepts up to 16 independent inputs that can be used to generate interrupts from bit patterns or individual bit states or transitions. The interrupt outputs from two X8536 chips can be ANDed using software.

Many other functions can be performed by the PCI-INT32 including digital pattern recognition, counting with six 16-bit counters, and up to 40 bits of digital I/O.

The 16-bit counters can be set up independently or chained together in groups of three.

The I/O pins of the Z8536 are TTL levels. All I/O lines are accessible through a 50-pin header connector. Connections to the board typically use the C50FF-# cable and the CIO-MINI50 terminal board.

Software features

For information on the features of *Insta*Cal and the other software included with your PCI-INT32, 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-INT32

What comes with your PCI-INT32 shipment?

Hardware

- PCI-INT32

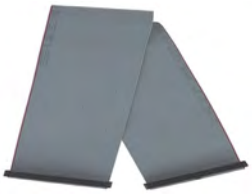


Additional documentation

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-DIO96 and information regarding installation of that software. Please read this booklet completely before installing any software or hardware..

Optional components

- Cables



C500FF-x

- Signal termination and conditioning accessories

  MCC provides signal termination and signal conditioning products for use with the PCI-INT32. Refer to the Field wiring, signal termination and conditioning section for a complete list of compatible accessory products.

Unpacking the PCI-INT32

As with any electronic device, you should take care while handling to avoid damage from static electricity. Before removing the PCI-INT32 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-INT32

The PCI-INT32 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 insert your board into an available PCI slot.
2. Close your computer and turn it on.

   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

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

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

Connector type	50-pin, high-density IDC header connector
Compatible cables	C50FF-*x* (Figure 2-1)
Compatible accessory products	CIO-MINI50

The PCI-INT32 I/O connector is a 50-pin header type connector accessible from the rear of the PC through the expansion backplate. The signals available are direct connections to the Z8536 digital I/O chips.

Signal name	Pin		Pin	Signal name	
GND	50	••	49	+5V	
C3 OUT C0	48	••	47	C1 C3 IN	
C3 TRIG C2	46	••	45	C3 C3 GATE	
INT INPUT	44	••	43	INT ENABLE	
NC	42	••	41	NC	
C2 OUT B0	40	••	39	B1 C2 IN	**First Z8536**
C2 TRIG B2	38	••	37	B3 C2 GATE	
C1 OUT B4	36	••	35	B5 C1 IN	**BADR + 0, 1, 2**
C1 TRIG B6	34	••	33	B7 C1 GATE	
A0	32	••	31	A1	
A2	30	••	29	A3	
A4	28	••	27	A5	
A6	26	••	25	A7	
C3 OUT C0	24	••	23	C1 C3 IN	
C3 TRIG C2	22	••	21	C3 C3 GATE	
2.5 MHz OUT	20	••	19	5 MHz	
INTA OUT	18	••	17	INTB OUT	**Second Z8536**
C2 OUT B0	16	••	15	B1 C2 IN	
C2 TRIG B2	14	••	13	B3 C2 GATE	**BADR + 4, 5, 6**
C1 OUT B4	12	••	11	B5 C1 IN	
C1 TRIG B6	10	••	9	B7 C1 GATE	
A0	8	••	7	A1	
A2	6	••	5	A3	
A4	4	••	3	A5	
A6	2	••	1	A7	

Figure 2-1. PCI-INT32 board I/O connector

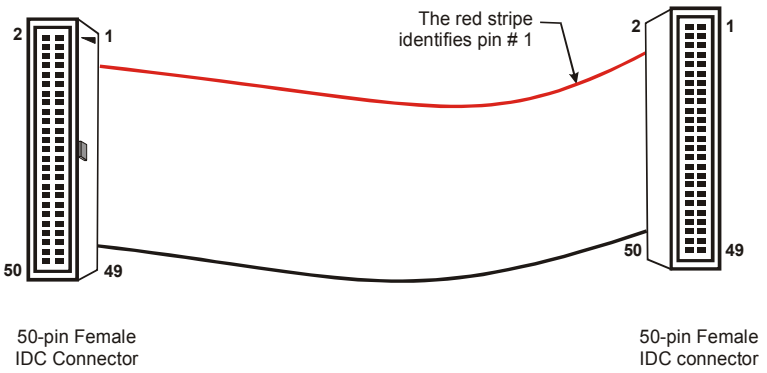


Figure 2-1. C50FF-x cable

Field wiring and signal termination accessories

You can use the CIO-MINI50 (50-pin screw terminal board) to terminate field signals and route them into the PCI-INT32 using the C50FF-*x* cable.

For additional information about digital interfacing…

Detailed information regarding digital interfacing is contained in MCC's *Guide to Signal Connections*. This document is available on our web site at www.mccdaq.com/signals/signals.pdf.

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.*

Packaged applications programs

Many packaged application programs, such as SoftWIRE®, Labtech Notebook™, 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

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-INT32*. This document is available on our web site at www.mccdaq.com/registermaps/RegMapPCI-INT32.pdf.

Functional Details

PCI-INT32 block diagram

PCI-DIO96 functions are illustrated in the block diagram shown here.

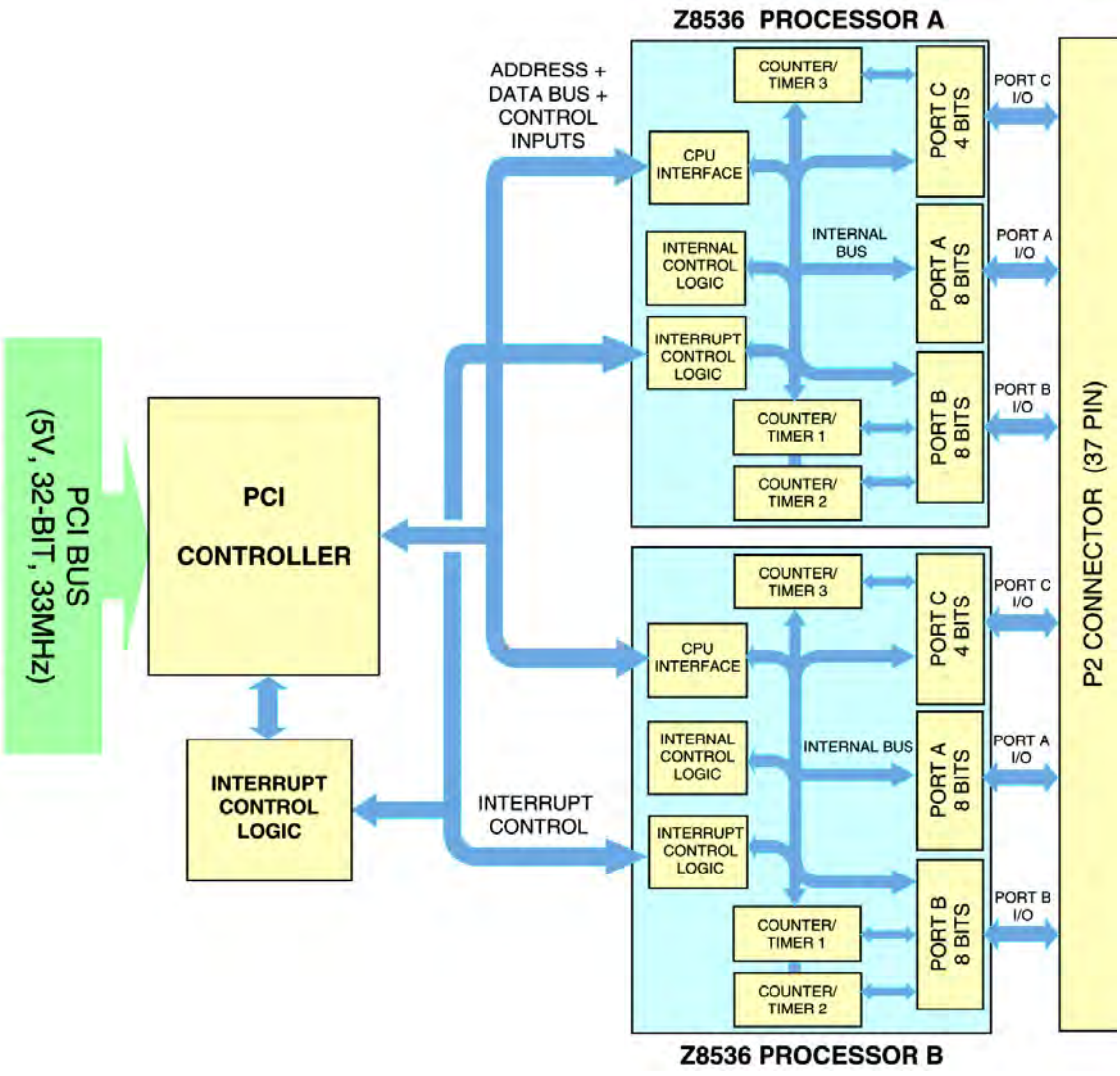


Figure 4-1. PCI-INT32 functional block diagram

DIO signals

All digital outputs and inputs on the PCI-INT32 connector are TTL (Transistor-Transistor-Logic). TTL is an electronics industry term which describes a standard for digital signals which are either at 0 V or 5 V (nominal).

Under normal operating conditions, the voltages on the Z8536 pins range from near 0 volts for the low state to near 5.0 volts for the high state. The current handling capability of these inputs / outputs is limited to a few milliamps. This is typical of TTL devices.

Caution! The voltages and currents associated with external devices range from less than a hundred mA at a few volts for a small flash light bulb to 50 Amps at 220 volts for a large electric range. Attempting to connect either of these devices directly to the PCI-INT32 would destroy the I/O chip.

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).

IMPORTANT

The Z8536 digital I/O chip 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 Z8536 it will probably be turned ON every time the Z8536 is reset, or, it might be turned OFF instead. Remember, and Z8536 which is reset is in INPUT mode.

It cannot be stated often enough to those unfamiliar with the Z8536 — whenever the Z8536 is powered on or reset, all pins are set to high impedance input.

Output devices such as solid state relays 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 pins either high or low with a pull-up or pull-down resistor.

Pull-up/down resistors

When the Z8536 digital I/O chip is powered-on or reset, the control register is set to a known state. When used as an output device to control other TTL input devices, the Z8536 applies a voltage level of 0 V for low and 2.5 V to 5 V for high. The device being controlled responds to the output voltage level of the Z8536 chip.

The concept of voltage level of a Z8536 chip in input mode is meaningless. Do not connect a volt meter to the floating input of a Z8536. It will show you nothing of meaning. In input mode, the Z8536 is in 'high Z' or high impedance. If your Z8536 was connected to another input chip (the device you are controlling), the inputs of that chip are left floating whenever the Z8536 is in the input mode. If the inputs of the device you are controlling are allowed to float, they may float up or down. The direction they float is dependent on the characteristics of the circuit and is unpredictable. This is why it often appears that the Z8536 has gone 'high' after power up. The result is that the controlled device gets turned on. That is why you need pull up/down resistors.Figure 4-2 shows a Z8536 digital output with a pull-up resistor attached.

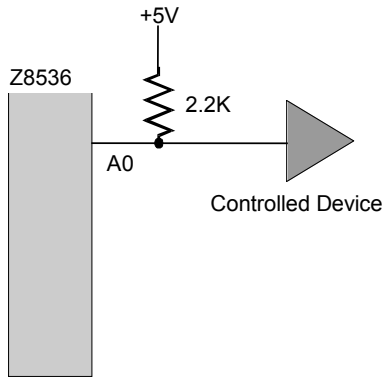


Figure 4-2. Z8536 digital output with pull-up resistor

The pull-up resistor provides a reference to +5V, while its value of 2,200 Ω allows only a little current to flow through the circuit.

If the Z8536 is reset and enters high impedance input, the line is pulled high. At that point, both the Z8536 AND the device being controlled will sense a high signal. If the Z8536 is in output mode, the Z8536 has more than enough power to override the pull-up resistor's high signal and drive the line to 0 volts (nominal).

With a pull-down resistor installed, the line is pulled low when the Z8536 is reset. The Z8536 has more than enough power to drive the line high.

To safeguard against unwanted signal levels, all devices that are controlled by the Z8536 chip should be tied low or high as required by a 2.2K Ω resistor. Open positions are located on the board to install resistor Single Inline Packages (SIP). The positions are marked A, B, and C and are adjacent to the Z8536.

The SIP is made up of eight 2.2 K 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 4-3).

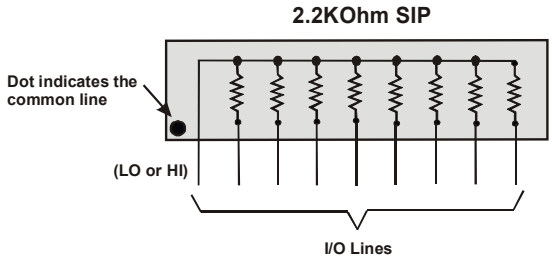


Figure 4-3. Eight-resistor SIP schematic

Figure 4-4 shows a schematic of an SIP installed in both the pull-up and pull-down positions.

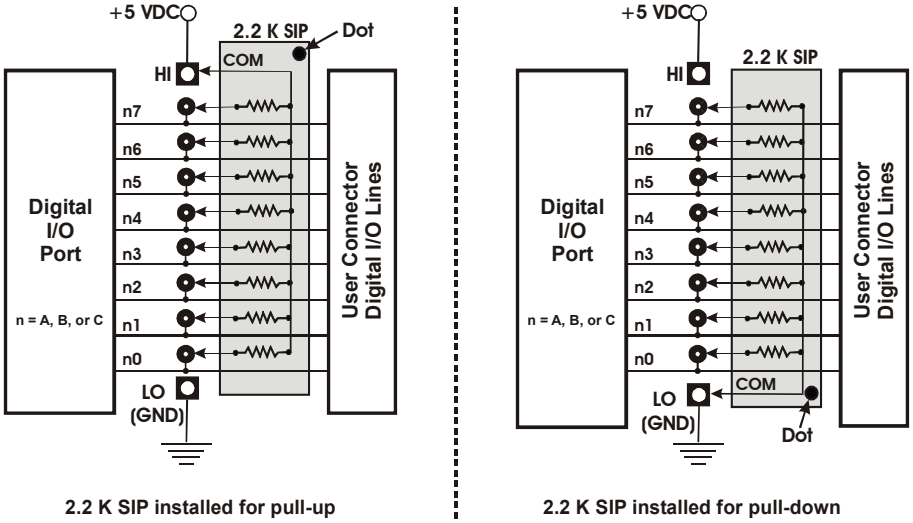


Figure 4-4. Pull-up and pull-down resistor SIP schematic

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 hole.

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

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	620 mA typical, 925 mA max

Counter/timer and parallel I/O

Table 2. Counter/timer and parallel I/O specifications

Device	Zilog Z85C36 (2)
Output high	2.4 volts minimum @ -250 uA
Output low	0.5 volts maximum @ +3.2 mA
Input high	2.0 volts minimum, 7 volts absolute max
Input low	0.8 volts maximum, -0.3 volts absolute min
Power-up / reset state	Input mode (high impedance)
Configured as digital input/output ports:	
Digital configuration	4 banks of 8 (Ports A and B), 2 banks of 4 (Port C), programmable by bit or bank as input or output
Number of channels	40 I/O
Configured as counter/timers: (Port A is a digital I/O port only)	
Counter type	Zilog Z85C36
Counter configuration	Six 16-bit counter/timers (Port B - High and Low nibble - and Port C) All Trigger (C1-C3 TRIG), Source (C1-C3 IN), Gate (C1-C3 GATE), and Output (C1-C3 OUT) for each chip are available at the user connector.
Clock input frequency	3 MHz max
High pulse width (clock input)	150 ns min
Low pulse width (clock input)	150 ns min
Trigger pulse width (high, low)	130 ns min

Interrupts

The Z8536 is programmable to generate interrupts based on bit change, pattern recognition, level or edge triggered, whether configured as a digital I/O port or counter port. Refer to the ZILOG *Z8036/Z8536 Product Specification* for further options. This document is available on our web site at www.mccdaq.com/PDFmanuals/Z8536.pdf.

Table 3. Interrupt specifications

Interrupts	INTA# - mapped to IRQn via PCI BIOS at boot-time
Interrupt enable	Programmable (enabled by default) and external (INT ENABLE), active low (pulled high through resistor).
Interrupt sources	Programmable: 8536A interrupt output, 8536B interrupt output, 8536A OR'ed with 8536B, external (INT INPUT, active low) or None.
Interrupt output	Buffered output for each chip available at user connector (INTA OUT, INTB OUT).
Interrupt priority	Programmable: No priority or 8536A interrupt has priority over 8536B interrupt.

Environmental

Table 4. Environmental specifications

Operating temperature range	0 to 50 °C
Storage temperature range	-20 to 70°C
Humidity	0 to 90% non-condensing

Main connector and pin out

Table 5. Main connector specifications

Connector type	50-pin, high-density IDC header connector
Compatible cables	C50FF-x
Compatible accessory products	CIO-MINI50

Table 6. Main connector pin out

Signal name	Pin		Pin	Signal name	
GND	50		49	+5V	
C3 OUT C0	48		47	C1 C3 IN	
C3 TRIG C2	46		45	C3 C3 GATE	
INT INPUT	44		43	INT ENABLE	
NC	42		41	NC	
C2 OUT B0	40		39	B1 C2 IN	**First Z8536**
C2 TRIG B2	38		37	B3 C2 GATE	
C1 OUT B4	36		35	B5 C1 IN	**BADR + 0, 1, 2**
C1 TRIG B6	34		33	B7 C1 GATE	
A0	32		31	A1	
A2	30		29	A3	
A4	28		27	A5	
A6	26		25	A7	
C3 OUT C0	24		23	C1 C3 IN	
C3 TRIG C2	22		21	C3 C3 GATE	
2.5 MHz OUT	20		19	5 MHz	
INTA OUT	18		17	INTB OUT	**Second Z8536**
C2 OUT B0	16		15	B1 C2 IN	
C2 TRIG B2	14		13	B3 C2 GATE	**BADR + 4, 5, 6**
C1 OUT B4	12		11	B5 C1 IN	
C1 TRIG B6	10		9	B7 C1 GATE	
A0	8		7	A1	
A2	6		5	A3	
A4	4		3	A5	
A6	2		1	A7	

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-INT32

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

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