PowerDAQ™ PD2-DIO

PCI Digital I/O Board User Manual

High Performance Digital I/O boards for PCI Bus

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Contacting United Electronic Industries

✉ Address:

Ten Dexter Avenue

Watertown, Massachusetts 02472

U.S.A.

☎ Support:

Telephone: (617) 924-1155

Fax: (617) 924-1441

💻Internet Access:

Support support@ueidaq.com

Web site http://www.powerdaq.com

FTP site ftp://ftp.powerdaq.com

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How to Use This Manual

Introduction

This manual describes the PowerDAQ™ PD2-DIO series Digital Input/Output boards. The following boards are supported:

- PD2-DIO-64
- PD2-DIO-128

Who Should Read This Book?

This manual has been designed to benefit the user of PowerDAQ™ PD2-DIO boards. To use PowerDAQ™ PD2-DIO, it is assumed that you have basic PC skills, and that you are familiar with Microsoft Windows NT/2000 and/or 95/98 operating environments.

Organization of This Manual

The PowerDAQ™ PD2-DIO User Manual is organized as follows:

Chapter 1 - Introduction

This chapter gives you an overview of PowerDAQ™ PD2-DIO's features the various models available and what you need to get started.

Chapter 2 - Installation and Configuration

This chapter explains how to install and configure your PowerDAQ™ PD2-DIO board.

Chapter 3 - Architecture

This chapter discusses the internal structure and subsystems of your PowerDAQ™ PD2-DIO board.

Chapter 4 - Interconnections

This chapter describes the I/O connections to your PowerDAQ™ PD2-DIO board.

Appendix A - Specifications

This chapter lists the PowerDAQ™ PD2-DIO hardware specifications.

Appendix B - Accessories

This appendix lists the PowerDAQ™ PD2-DIO accessories products.

Appendix C - Common Questions and Support

This appendix contains a list of commonly asked questions and their answers relating to usage and special features of your PowerDAQ™ PD2-DIO board. Should you require assistance while installing or using PowerDAQ™ PD2-DIO, support service details are also listed.

Appendix D - Warranty

This appendix contains a detailed explanation of PowerDAQ™ PD2-DIO's warranty.

Glossary

The Glossary contains an alphabetical list and description of terms used in this manual.

Index

The Index alphabetically lists topics covered in this manual.

Conventions Used in This Manual

These are the main conventions used to help you get the most out of this manual:

Tips are designed to highlight quick ways to get the job done, or good ideas you might not discover on your own.

Notes alert you to important information.

CAUTION! Caution advises you of precautions to take to avoid injury, data loss, or system crash.

Text formatted in **bold** typeface may also represent type that should be entered verbatim or a command, as in the following example:

You can instruct users how to run setup using a command such as **setup.exe**.

Feedback

We are interested in any feedback you might have concerning our products and manuals. A Reader Evaluation form is available on the last page of the manual.

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1

Introduction

1

Introduction

This chapter describes the basic features of the PowerDAQ™ PD2-DIO boards.

About the PowerDAQ™ PD2-DIO board

Thank you for purchasing a PowerDAQ™ PD2-DIO board. The PowerDAQ™ PD2-DIO board was designed from the ground-up to overcome the problems associated with previous ISA-based DIO boards.

The associated PowerDAQ™ PD2-DIO software has been written specifically for these products, uses advanced software design.

Overview

The new PowerDAQ Digital IO board (PD2-DIO), which is designed to save money, shortens “time to market” and design out the flaws of 8255 based DIO boards. The PD2-DIO is feature rich; no longer do you have to design external circuitry for start-up states, work against problems associated with the 8255 and relays or have a separate mechanism for generating interrupts. Additionally it features ESD protected inputs and automatic short detection on power-up. The PD2-DIO has it all and more and is the lowest cost of ownership board on the market.

The PowerDAQ digital input/output boards are configured as 64 or 128 lines. The PD2-DIO uses 16-bit line drivers, (not 8255 devices) which allow you to configure the start up states in groups of 16-bit ports. The on-board DSP/PCI interface allows you to use three 24-bit counter timers, four high speed IRQ lines and two high speed ESSI ports.

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Features

The major features of the PowerDAQ™ PD2-DIO board are:

- 24-bit 66 MHz Motorola 56301 DSP (Digital Signal Processor)
- "Bus Master Ready" PCI Bus Host PC Interface (PCI 2.1 Compliant)
- 64/128 lines (5 V/TTL) static I/O in 16-bit ports;
- Generate interrupts on any line;
- Four Separate High speed IRQ lines (100 ns);
- No legacy '8255' based devices;
- Ideal for solid state relays;
- User-defined power-up state in groups of 16-bit ports (High, Low, Tri-stated);
- Two Enhanced Synchronous Serial Interfaces (ESSI);
- Three 24-bit counter timers;
- Detects incorrect "shorts" wiring;
- High Speed Digital Streaming to Disk * (Optional);
- Port scan list;
- Software:
  PowerDAQ for Windows95/98/NT/2000
  Visual C++, VB, Delphi, C++ Builder
  Drivers for: LabVIEW®
  HP VEE®
  LabWindows/CVI®
  TestPoint®
  DASYLab®
  DiaDem®

Note For the full list of specifications, *see Appendix A: Specifications.*

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PD2-DIO Applications

PD2-DIO board provides a wide range of powerful features with allows using this board in a wide range of end-customer applications. The most common applications are:

Electro-mechanical relays controlled applications

Solid-state relays applications

Alarm System sensors

Digital streaming applications

Digital motion control and close-loop applications

Note The easiest way to expand the possibilities of PD2-DIO board is use the PD2-MF, PD2-MFS, PD2-AO series on the same PC

1

PowerDAQ™ PD2-DIO Models

PowerDAQ™ PD2-DIO model numbers are derived from the following:

PD2-[Type Of Board]-[Channels]-[Speed]/[Resolution][Gain]

The types of boards are:

- MF Multifunction
- AO Analog Output
- DIO Digital Input /Output
- CTM Counter Timer

Models	DIO Features
PD2-DIO-64	64 DI or DO (SW selectable in banks of 16)
PD2-DIO-128	128 DI or DO (SW selectable in banks of 16)

Table 1: PowerDAQ™ PD2-DIO Models

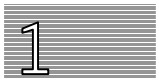
Furthermore, all DIO boards have the following additional features:

- ESSI Two high-speed serial interfaces
- IRQ's Four IRQ/Clock lines
- Counter Timers Three 24-bit (33MHz Internal/16.5 MHz External)

Getting Started

To get your PowerDAQ™ PD2-DIO board up and running, ensure that you have the following:

- A computer with PCI slots and the BIOS compliant to PCI
- Specifications 2.1 or greater. S*ee Appendix C: Common Questions and Support.*
- PowerDAQ™ PD2-DIO PCI board with user manual.
- PowerDAQ™ PD2-DIO Software for Windows 95/98 or Windows NT/2000.
- The PowerDAQ™ PD2-DIO PCI bus interface must be mechanically keyed as 32 bit, 5V power and signaling.
- Minimum 16MB RAM for Windows95 and 32MB for Windows NT/98



2

Installation and Configuration

Installation and Configuration

This chapter describes the hardware and software installation and configuration of the PowerDAQ™ PD2-DIO board.

Unpacking

Your PowerDAQ™ PD2-DIO board is wrapped in an anti-static bag to protect against electrostatic charges that might damage the board. To avoid damage, proceed as follows:

1. Ground yourself with a grounded wrist strap or grounded source.
2. Discharge the static electricity by taking the board in the antistatic bag and touching the metal part of your PC.
3. Remove the board from the antistatic bag. We suggest you save the bag.
4. Inspect the board for any damage. If any damage is found, notify your distributor to return the board to the manufacturer. *See Appendix C: Common Questions and Support.*

Note The PowerDAQ™ PD2-DIO boards contain sensitive electronic components. Please make sure the proper grounding and electrostatic conditions are used.

Hardware

You can install you PowerDAQ™ PD2-DIO board in any PCI slot. We recommend you use the first available slot and complete the following instructions:

1. Turn off your PC.
2. Remove the cover and make sure you have clear access to the PCI slots.
3. Connect all desired cables to the DIO board and put them through the hole in the PCI bracket of the PD2-DIO board.
4. Insert the PowerDAQ™ PD2-DIO board into a PCI slot. (If the PCI slots have not been used for a long time, insert the PowerDAQ™ PD2-DIO board, then remove it and clean the edge connector with alcohol. After this has been done, replace the bard back into the slot.)
5. Screw the bracket and replace the cover.

6. Turn the PC on.

The PowerDAQ™ PD2-DIO board is now installed. All configuration requirements are all set via software.

Installing Multiple Boards

You can install multiple PowerDAQ™ PD2-DIO boards in one PC. You are limited to the number of PCI slots in your PC.

Software

PowerDAQ™ PD2-DIO software is supplied for Windows 95/98 and Windows NT/2000 or greater.

Installation

From the CD, run the **SETUP.exe** program. The setup program will take you through the installation process. If you downloaded the PowerDAQ™ SDK software from the web you just need to run the file downloaded and follow the setup instructions.

As the installation process modifies your Windows registry, you must only install or uninstall the software using the appropriate programs.

Note Never delete the UEI PowerDAQ software from you PC directly. Always use Uninstall program from PowerDAQ folder or Control Panel/Add-Remove Programs applet.

Note Once the installation is complete, the PC must be rebooted for the proper operation.

Note Windows NT users must be logged in as an administrator or have equivalent access.

Base address, DMA, Interrupt settings

The PowerDAQ™ PD2-DIO boards are configured automatically by the PCI bus on power up. You do not have to set any base address, DMA channels or interrupt levels.

Diagnostics

In order to confirm board operation, install the PowerDAQ SDK (software development kit) which installs a PowerDAQ application control panel, that will display the board configuration.

To access the PowerDAQ™ control panel, select **START** > **Settings** > **Control Panel** and the PowerDAQ™ icon will be displayed.

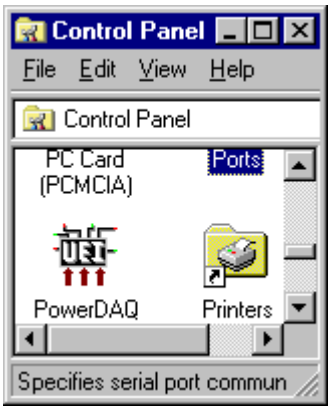


Figure 1: Use the PowerDAQ™ ICON for quick diagnostics

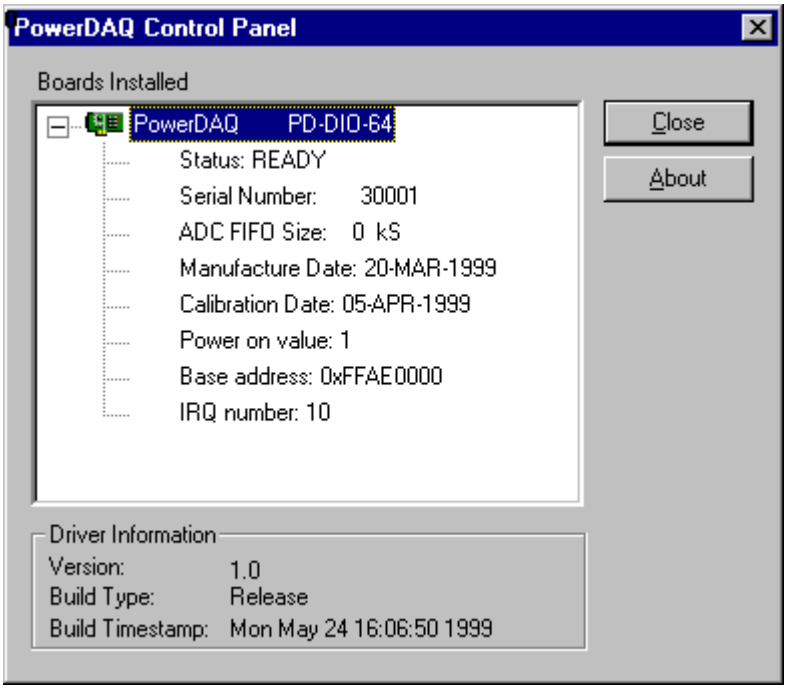


Figure 2: PowerDAQ™ control panel application showing PD2-DIO-64 board installed

Please refer to the PowerDAQ™ PD2-DIO software manual for a complete set of demonstration programs and the programming of the PowerDAQ™ PD2-DIO DLL.

All PowerDAQ™ PD2-DIO manuals are supplied in electronic Adobe Acrobat PDF format. If you require the PDF reader, this can be downloaded from the Internet at no cost from **www.adobe.com**

Accessories

PowerDAQ™ PD2-DIO boards are supplied with a large range of accessories:

- Cables
- Screw terminal panels
- Complete kits
- J1/J2 high-density digital connectors
- J3/J4 high-speed twisted pair connectors
- OEM distribution panel

Cables

Note The PowerDAQ™ PD2-DIO boards are supplied with one/two cables, depends of the board type (PD2-DIO-64/PD2-DIO-128).

The J1/J2 connectors use a 100-way 1-meter high-density IDC cable (PN PD2-DIO-CBL-100).

The J3 connector uses a 16-way 18” twisted pair cable to connect IRQ/Counter lines to the screw terminal or user board. (PN PD-CBL-16).

The J4 connector uses a 26-way 18” twisted pair cable to connect ESSI lines to the screw terminal or user board. (PN PD2-DIO-CBL-26).

Custom cables are available. Please contact your distributor or the factory.

Screw Terminal Panels

The PD2-DIO-STP-64 is a 64-channel screw terminal panel, which also includes connections for the counter timers, high speed IRQ and ESSI ports.

Custom terminal panels are available. Please contact your distributor or the factory.

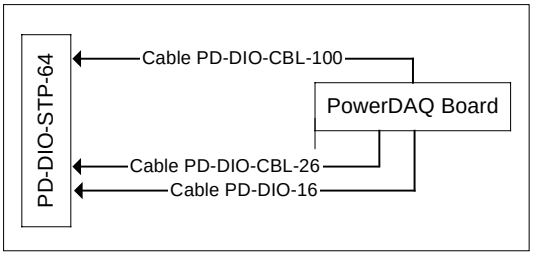


Figure 3: PD2-DIO-STP-64 Wiring Diagram

Complete kits

We have included the PD2-DIO-CBL-100, PD2-DIO-CBL-26, PD-CBL-16 and the PD2-DIO-STP-64 into a complete kit. The product is available by ordering PN PD-STP-64-KIT.

J1/J2 Connector

If you wish to develop you own custom cable, you can purchase the connector and metal high-density IDC header from your distributor or the factory. The part number is PD-ADM.

The manufacturer is Adam Technologies, Inc.

Telephone: 908-688-5000

Fax: 908-688-5001.

The manufacturers' part number for the connector is HBHR-A-100-VSG and the high-density IDC header HFCS-100-SG.

OEM Header Distribution Connector

The PD2-DIO-CONN distributes the 64 I/O's lines into four sets 16 I/O lines via a 50-pin industry standard IDC connector. These connectors can attach directly into standard relay boards.

For 128 lines, you can connect two PD2-DIO-STP-64 or PD2-DIO-CONN devices. Each connects to 64 lines via the high-density 100-pin ribbon cable (PD2-DIO-CBL-100).

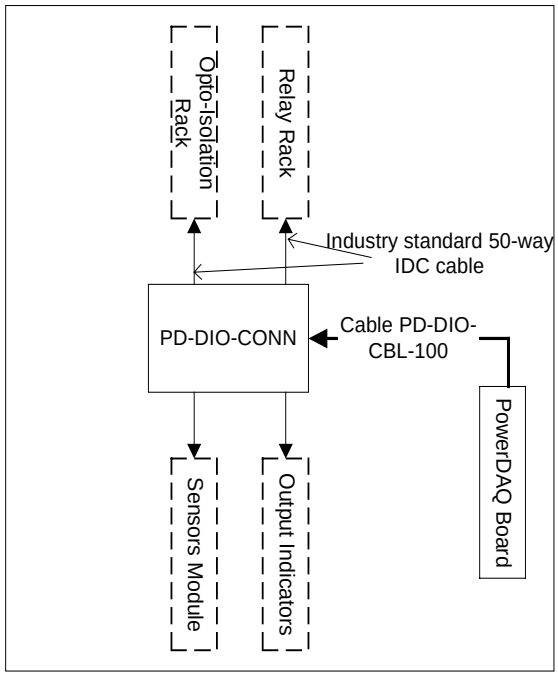


Figure 4: PD2-DIO-CONN wiring diagram

Custom terminal panels are available. Please contact your distributor or the factory.

3

Architecture

Architecture

This chapter describes the functional operation of the PowerDAQ™ PD2-DIO boards.

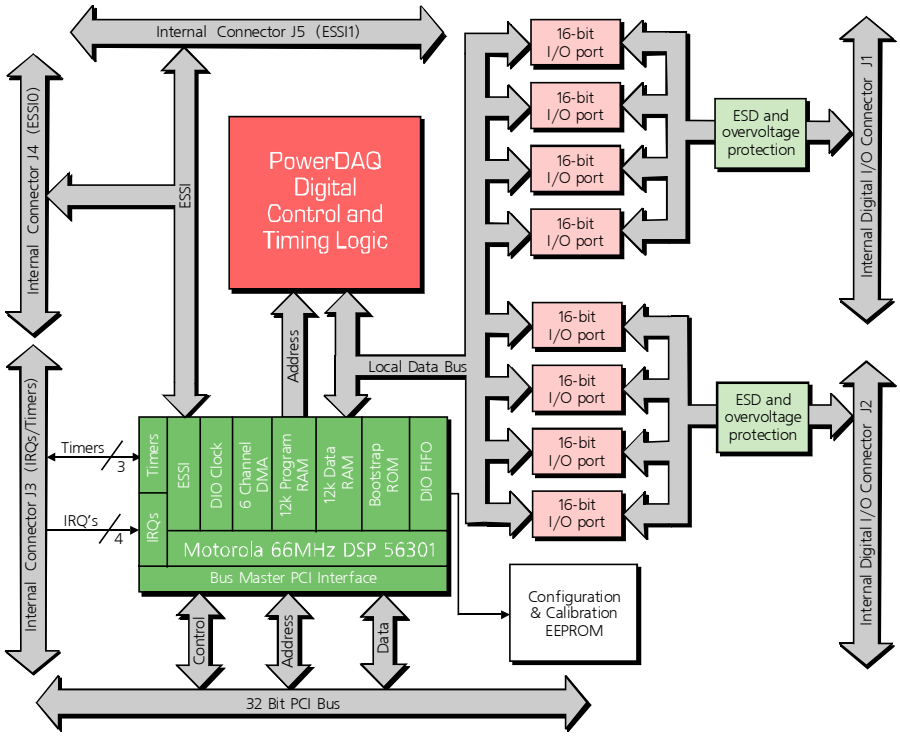


Figure 5: Block Diagram of the PowerDAQ™ PD2-DIO boards

Functional Overview

Digital Input and Output Subsystem (DIO)

The PowerDAQ digital input/output boards are configured as 64 or 128 lines. The PD2-DIO uses 16-bit line drivers, (not 8255 devices) which allow you to configure the start up states in groups of 16-bit ports.

The DIO subsystem also includes input modes, channel queue, trigger and clocking control.

Interrupt generation: You can configure the digital inputs to generate an interrupt on any change of state on any line. This is software configurable.

The digital I/O lines are capable of sinking up to 24 mA. This will support standard SSR and other devices.

Input Mode

Single Update

The PowerDAQ™ PD2-DIO boards operate with either a single-update or streaming input configuration. Single-update inputs/output mode allows performing direct read/write access to any of the 16-bit ports of the PD2-DIO board. The update frequency is limited by 1K guaranteed for the single update mode.

Note Single Update mode is easiest way for most of DIO applications such as Relay Control or Sensor Read. S*ee Appendix C: Common Questions and Support.*

High-speed streaming mode

For advanced applications, the PD2-DIO board and software provides a high-speed operation mode called streaming I/O. With this mode inputs and outputs can be updated at maximum aggregate speed rate up to 2.2MS/s. The channel list provided for this kind of operation allows simultaneous input and output operations (and single update at the same time).

Pattern Generation Mode

In addition to the streaming mode, the PD2-DIO board provides a special Pattern Generation mode when the user pattern is loaded into DSP memory (up to 2K Samples) and continuously streamed out with update rate from 2Hz to 2.2 MHz without any gaps.

Channel List

The Channel List is a powerful feature of the PD2-DIO board. The Channel list can contain continuous channel numbers, up to the number of ports available on the DIO board used. For example, the PD2-DIO-128, ports 2 and 3 can be specified as input streaming channels 5,6 and 7 as output streaming channels and channels 0,1 and 4 can be accessed directly using single update mode commands.

Enhanced Serial Interfaces (ESSI)

Note The PowerDAQ™ PD2-DIO software supports this feature in release 2.x of the DIO driver.

The Motorola 56301 DSP contains 2 High Speed Enhanced serial interfaces called ESSIs. The PowerDAQ DIO board allows access depending upon the board's operational mode. Each ESSI port contains three transmitters and one receiver and has a maximum operational speed of 15 Mbit/s. In the combination with the PD2-DIO software, the ESSI subsystem can be used for High-Speed communication tasks.

Counter/Timer Subsystem

Depending on your PowerDAQ™ PD2-DIO operation mode, the board can support up to the three DSP based 24-bit counter/timers with maximum count rate up to the 33 MHz for internal base clock and 16.5 MHz for the external clock. The minimum count rate is 2 Hz for the internal clock and has no low limits for the external clock.

The software informs you which counter/timers are available.

Each timer can use internal or external clocking and can interrupt the DSP56301 after a specified number of events (clocks) or can signal an external device after counting internal events. Each timer can also be used to trigger DMA transfers after a specified number of events (clocks) occurred. Each timer connects to the external world through one bi-directional pin TIO which is 7kV ESD protected. When TIO is configured as input, the timer functions as an external event counter or can measure external pulse width/signal period. When TIO is used as output the timer is functioning as either a timer, a watchdog or a Pulse Width Modulator.

Some common timer/counter/output functions which microprocessors require are:

- Real time clock,
- Event counter
- Digital one-shot
- Programmable rate generator
- Square wave generator
- Binary rate multiplier
- Complex digital wave form generator
- Complex motor control

Counters

1. Each counter is a 24-bit count-up counter
2. After power-up, the count value and output of all counters are set to zero
3. Each counter must be programmed before it can be used
4. Unused counters need not to be programmed

5. Counters are programmed by using the PowerDAQ™ PD2-DIO SDK
6. Each counter is fully independent of the others. Each counter may operate in a different mode

DSP Processor

All PowerDAQ™ PD2-DIO boards are based on the Motorola 56301 DSP. This is a 24-bit 66 MHz processor with an integrated PCI interface. The PCI interface implements the PCI Local Bus Specifications so the board is fully configured (base address, interrupt)

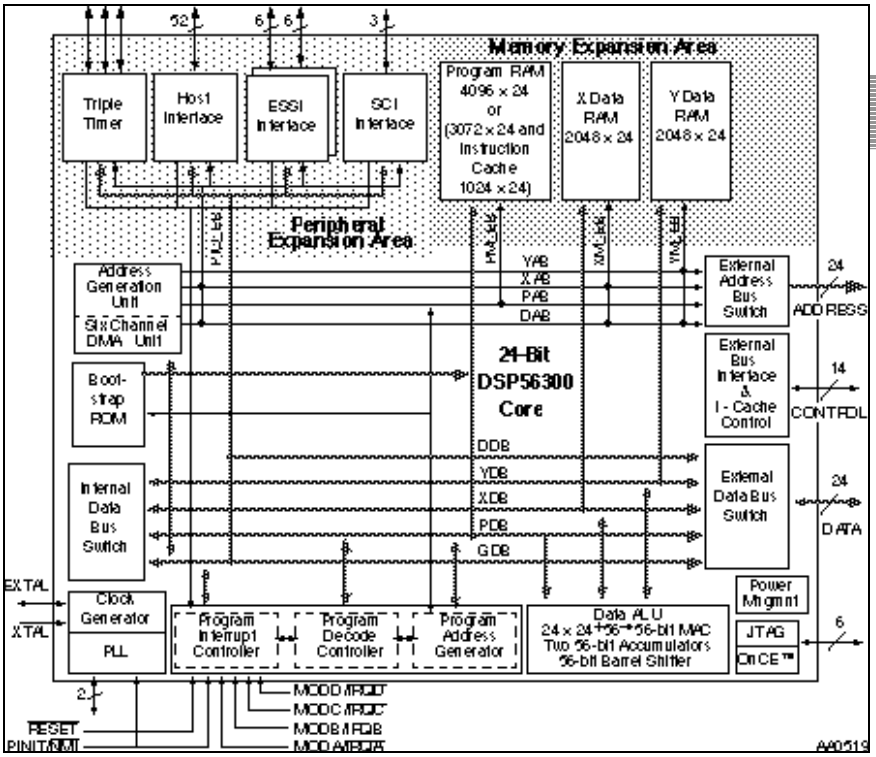


Figure 6: Motorola 56301 architecture

When the PowerDAQ™ PD2-DIO software is loaded, the PowerDAQ™ PD2-DIO firmware is downloaded to the DSP via the PCI bus. This firmware contains all the code necessary to communicate with the board subsystems and the host PC driver.

Note The drivers from the PowerDAQ web site always contains the latest versions of the DSP firmware

Note Custom programming of the DSP is not available with the standard PowerDAQ™ PD2-DIO product. However, should you require DSP processing, please consult the factory.

PCI Bus Interface

The PowerDAQ™ PD2-DIO boards communicate via the PCI bus. The PCI bus interface is embedded in the Motorola 56301 DSP. On power up, the host PC automatically configures the boards base address and interrupt resources.

PowerDAQ™ PD2-DIO board provide unique “Bus-Master Ready” PCI communication interface.

Timing and Control

The PowerDAQ™ PD2-DIO clocking and triggering features are extensive and can be configured in various different ways.

Digital I/O Clocking

Clocking comprises of two input signals:

1. DI Clock In – used to clock digital input channels in channel list.
2. DO Clock In – used to clock digital output channels in channel list.

You must load the channel list prior to starting the acquisition.

Clocking can be controlled by:

- Software Strobe
- Internal Clock (DSP)
- External Clock

Universal External Interrupt/Clocks Inputs

Note You can only use these lines for Digital Input and/or Digital Output Clocking OR Triggering

Triggering is configured as follows:

Use the IRQx pin to supply your external trigger source.

Trigger modes:

- Start trigger
- Stop trigger

Synchronizing two or more boards

Note Using the PowerDAQ™ PD2-DIO control panel application, please ensure the software driver recognizes the two or more PowerDAQ™ PD2-DIO boards. Custom synchronization cables are required.

Internal wiring requirements:

The PowerDAQ™ PD2-DIO J3 internal connector has a TMRx Clock Output pin. You can connect this pin to the TMRx pin of the next board you wish to synchronize acquisition.

Synchronizing Digital Input and Digital Output

Using the TMRx pin of J3 connector, you can trigger the digital input and analog output simultaneously.

4

Interconnections

Interconnections

Connectors

The PowerDAQ™ PD2-DIO boards have four connectors:

- 100-contact high-density IDC header DIO connector (J1/J2)
- 26-way header ESSI connector (J4, separated into two connectors – J4/J5)
- 14-way header for counter/timers/IRQx lines

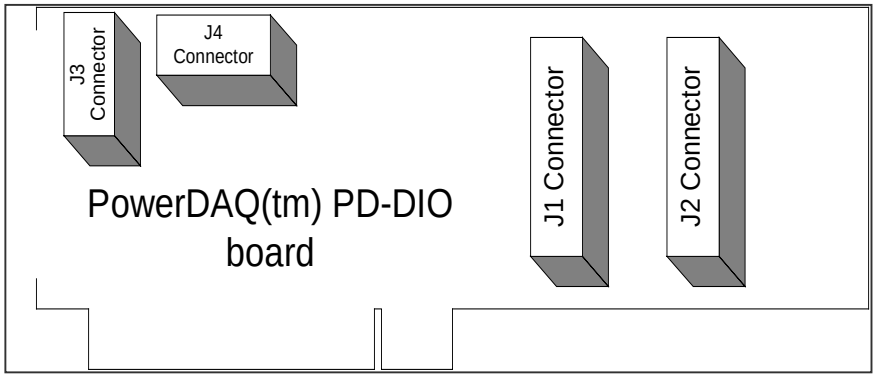


Figure 7: PowerDAQ™ PD2-DIO Connectors

Note For manufacturers part numbers, *see Appendix A: Specifications*.

J1 Connector

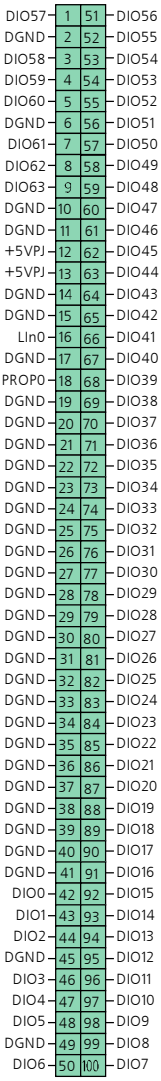


Figure 8: Connector pin assignment for the J1

J2 Connector

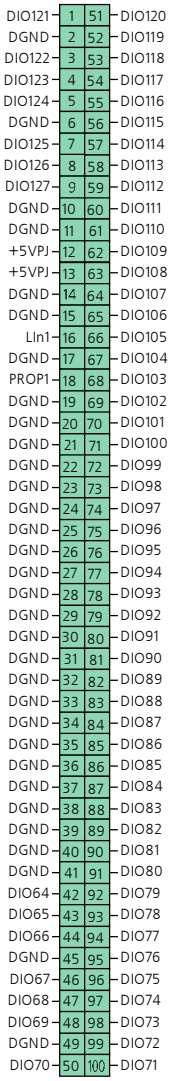


Figure 9: Connector pin assignment for the J2

J4/J5 ESSI Connector

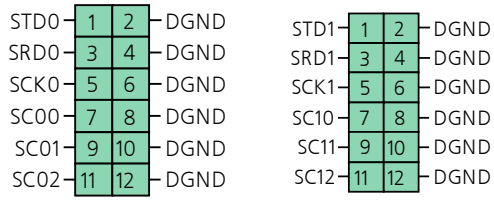


Figure 10: Connector Pin Assignments for J4/5

Note

J4/J5 Connector was designed to use either 26-way IDC header for both ports or one 12-way IDC header for the single port operations. For the combined J4/J5 port the pin numbering is follows – 1..12 – ESSI0 (J4), 13..14 – N/C, 15..26 – ESSI1(J5).

4

J3 Counter/Timers/IRQx Connector

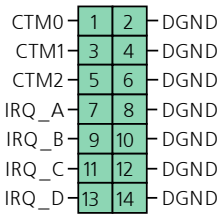


Figure 11: Connector Pin Assignment for the J3

Appendix A: Specifications

PD2-DIO specifications:

All external I/O on the PowerDAQ DIO boards are 7 kV ESD protected and +/- 35v Overshoot/Undershoot protected.

IO subsystem

64 lines of digital I/O in four 16-bit ports or 128 lines of digital I/O in eight 16-bit ports

DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

The Following Conditions Apply:
T_A = –40°C to +85°C

Symbol	Parameter	Test conditions	Min	Typ	Max	Units
VIH	Input HIGH Level	Guaranteed Logic HIGH Level	2.0			V
VIL	Input LOW Level	Guaranteed Logic LOW Level			0.8	V
IIH	Input HIGH Current	Vi = 5V			+/-1	µA
IIL	Input LOW Current	Vi = GND			+/-1	µA
IOZH	3-State Output Current	Vo = 2.7 V			+/-1	µA
IOZL	3-State Output Current	Vo = 0.5 V			+/-1	µA
IOS	Short Circuit Current	Vo = GND*	-80	-140	-250	mA
VH	Input Hysteresis			100		mV

OUTPUT DRIVE CHARACTERISTICS

Symbol	Parameter	Test conditions	Min	Typ	Max	Units
IO	Output DRIVE Current	Vo = 2.5V	-50		-180	mA
VOH	Output HIGH Voltage	IOH = -3 mA		3.5	4.8	V
VOH	Output HIGH Voltage	IOH = -15 mA		3.5	4.7	V
VOH	Output HIGH Voltage	IOH = -32 mA **	2.0	3.0		V
VOL	Output LOW Voltage	IOH = 64 mA		0.2	0.55	V
IOFF	I/O Power Off Leakage	Vi/o <= 4.5 V ***			+/-1	µA

Note

* Not more than one output should be tested at a time. The duration of the test should not exceed one second.

** The duration of the condition cannot exceed one second.

*** The test limit for this parameter is ± 5µA at T_A = –55°C.

AC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE (****)

The following conditions apply:

T_A = –40°C to +85°C

Propagation Delay	**16 nS max**
Output Enable Delay	**16 nS max**
Output Disable Delay	**16 nS max**
Setup Time	**4.0 nS min**
Latch pulse Width	**10 nS min**
Maximum I/O frequency	**15 MHz**

Note

(****) For a single 16-bit port only. All AC characteristics are specified only as hardware based and some software limitations apply. For example, all delays will be extended by 10

ms for PC-based commands and 200 ns for DSP-based patterns. The input I/O frequency is limited by the driver/firmware used. Gap-free output frequency is limited by 2.2 MS/s (with optional software).

DSP – based subsystems

There are three DSP-based subsystems available on the PowerDAQ DIO boards:

- Counter/timers
- High-speed interrupts
- ESSI ports

DC ELECTRICAL CHARACTERISTICS FOR DSP-BASED SUBSYSTEMS

The following conditions apply:
T_A = –40°C to +85°C

Symbol	Parameter	Test conditions	Min	Typ	Max	Units
VIH	Input HIGH Level	Guaranteed Logic HIGH Level	2.0		6.0	V
VIL	Input LOW Level	Guaranteed Logic LOW Level	-0.3		0.8	V
IIH	Input HIGH Current		-10		+10	µA
IIL	Input LOW Current		-10		+10	µA
IOZ	3-State Output Current		-10		+10	µA
IO	Output DRIVE Current		-3 (VOH)		3 (VOL)	mA
VOH	Output HIGH Voltage	IOH = -3 mA	2.4			V
VOH	Output LOW Voltage	IOH = 3 mA			0.4	V

Counter/timers

- External Event Counter
- Input Width Measurement
- Input Period Measurement
- Event Capture
- Pulse Width Modulation (PWM)
- Watchdog Pulse
- Watchdog Toggle

Note The external clock frequency should be less than the internal operating frequency divided by 4 (I.e. 16.33/20.00 MHz for 66/80 MHz DSPs).

COUNTER/TIMER SPECIFICATIONS:

The following conditions apply:
T_A = –40°C to +100°C; C load = 50pF + 2 TTL loads

Symbol	Parameter	Min	Typ	Max	Units
480	TIO low	32.5			ns
481	TIO high	32.5			ns
482	Timer setup time	9.0		15.15	ns
483	Fast timer-based interrupt time (from CLKOUT rising edge to first interrupt instruction execution)	156			ns
484	CLKOUT rising edge to TIO assertion	11.1			ns
485	CLKOUT rising edge to TIO deassertion	11.1			ns

Note The maximum timer frequency of 16.33 MHz for external clock and 33 MHz for internal clock (66 MHz DSP core). TIO assumes timer I/O pin, CLKOUT – DSP clock. The minimum pulse width is 20 ns for an external clock/event.

HIGH SPEED INTERRUPT SPECIFICATIONS

Symbol	Parameter	Min	Typ	Max	Units
	DSP IRQx response time (from CLKOUT rising edge to first interrupt instruction execution)	200			ns
	IRQx to host PC interrupt IRQx response time	0.5	5		ms
	DSP-based IRQx to output pattern first port write time	250			ns

ESSI SPECIFICATIONS

The Motorola 56301 DSP contains 2 fast Enhanced serial interfaces called ESSIs. The PowerDAQ DIO board allows access to one or both of them depending upon the board's operational mode. Each ESSI port contains three transmitters and one receiver and has a maximum operational speed of 15 Mbit/s (*).

Symbol	Parameter	Min	Typ	Max	Units
430	Clock cycle	60.6			ns
431-1	Internal clock high period	20.3			ns
431-2	External clock high period	22.7			ns

Note Please check on the availability of driver/firmware with ESSI/High speed IRQ support.

Appendix B: Accessories

Overview

The PowerDAQ™ PD2-DIO boards can connect to a variety of stand-alone or 19" rack-mount accessory panels. A complete range of cables and options are available.

If you require a custom accessory, please contact the factory.

Cables: (PD-CBL-xx)

The J1/J2 connectors use a 100-way 1-meter high-density IDC cable (PN **PD2-DIO-CBL-100**).

The J3 connector uses a 16-way 18" twisted pair cable to connect IRQ/Counter lines to the screw terminal board. (PN **PD-CBL-16**).

The J4 connector uses a 26-way 18" twisted pair cable to connect ESSI lines to the screw terminal board. (PN **PD2-DIO-CBL-26**).

Screw Terminal Panels: (PD2-DIO-STP-xx)

The PD2-DIO-STP-64 is a 64-channel screw terminal panel, which also includes connections to the counter timers, high speed IRQ and ESSI ports.

Custom terminal panels are available. Please contact your distributor or the factory.

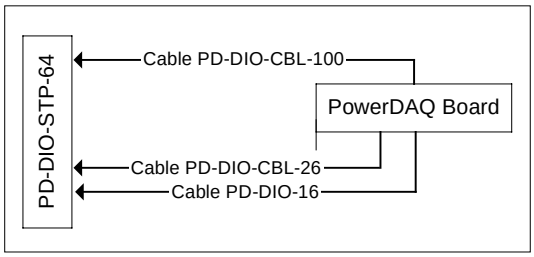


Figure 4: PD2-DIO-STP-64 Wiring Diagram

OEM Header Distribution Connector: (PD2-DIO-CONN)

The PD2-DIO-CONN distributes the 64 I/O's lines into four sets 16 I/O lines via a 50-pin industry standard IDC connector. These connectors can attach directly into standard relay boards.

For 128 lines, you can connect two PD2-DIO-STP-64 or PD2-DIO-CONN devices. Each connects to 64 lines via the high-density 100-pin ribbon cable (PD2-DIO-CBL-100).

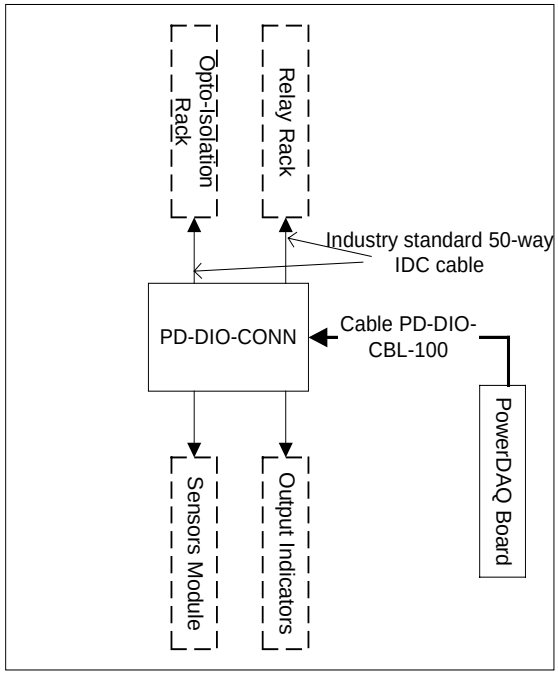


Figure 4: PD2-DIO-CONN wiring diagram

Custom terminal panels are available. Please contact your distributor or the factory.

Dimensions:

The following table contains the dimensions of the PowerDAQ™ PD2-DIO and accessory products.

Accessory	Dimensions (W x L x H)
PD2-DIO-xx	4.2”x8.6”x0.5”
PD2-DIO-STP-64	4.4”x7.1”x2.1”
PD2-DIO-CONN	4.4”x7.1”x2.1”

Table 2: Dimensions of PowerDAQ™ PD2-DIO accessory products

Kits:

All accessories are offered in complete kit form. See ordering information.

If you require a custom accessory, please contact the factory.

C

Appendix C: Common Questions and Support

Q What is PCI Specification 2.1?

A *The PCI LocalBus is a high-performance bus that provides a processor-independent data path between the CPU and high-speed peripherals. PCI is a robust interconnect mechanism designed specifically to accommodate multiple high performance peripherals for graphics, full motion video, SCSI, LAN, etc.*

The PCI Local Bus Specifications, Rev 2.1 includes the protocol, electrical, mechanical and configuration specification for the PCI Local Bus components and expansion boards.

The Rev 2.1 was published June 1, 1995 by the PCI Special Interest Group.PO Box 14070,Portland,OR 97214. Web site: www.pcisig.com

Calibration Questions

Q How often should I calibrate my board?

A *The PD2-DIO series board does not required any calibration procedure.*

Service and Support

If you have technical problems using PowerDAQ™ PD2-DIO, our Technical Support department can be reached by:

C

Telephone: (617) 924 1155

Fax: (617) 924 1441

Email: support@powerdaq.com

Web Site: www.powerdaq.com

For the most efficient service, please be available at your computer and be prepared to answer several questions listed on the following page when you call for technical support. This information helps us identify specific system and configuration-related problems.

C

Technical Support Form

Photocopy this form and update it each time you make changes to your software or hardware. Completing this form accurately before contacting us for technical support helps our application engineers answer your questions more efficiently.

What is the name and version number of the product?

_____

What version of Windows are you using? _____

What programming language and version?

_____

Is the board set at factory configuration? _____

Have you run the board diagnostics? What were the results?

_____

Did the system ever work ? If so, what changed (moved location, installed other boards, software etc..)

_____

Have you run the sample programs? What were the results?

_____

Have you verified that all your connections are made properly and are secure?

_____

Have you been able to isolate the source of your problem: input or output device, board, software?

_____

What other boards or applications are installed in your system?

_____

How much RAM do you have? _____

What size hard disk are you using? _____

How fast is your CPU? _____

How fast is your host data bus?

_____

If you are on a network, what type of network are you using and approximately how many users are on the network?

_____

Please specify whether or not the problem occurred more than once

_____

D

Appendix D: Warranty

Overview

IBM, IBM PC/XT/AT and IBM PS/2 are trademarks of International Business Machine Corporation.

BASIC is a trademark of Dartmouth College.

Microsoft is a trademark of Microsoft Corporation.

LabVIEW, LabWindows/CVI is a trademark of National Instruments Corporation

All PowerDAQ™ PD2-DIO boards have received CE Mark certification according to the following:

- EN55011
- EN50082-1

Life Support Policy

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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to effect its safety or effectiveness.

United Electronics, Industries, inc. warrants that the products furnished under this agreement will be free from material defects for a period of one year from the date of shipment. The customer shall provide notice to United Electronics Industries of such defect within one week after the Customer's discovery of such defect. The sole obligation and liability of Untied Electronic Industries under this warranty shall be to repair or replace, at its option, without cost to the Customer, the product or part which is so defective and as to which such notice is given.

Upon request by United Electronics Industries, the product or part claimed to be defective shall immediately be returned at the customer's expense to United Electronics Industries.

There shall be no warranty or liability for any products or parts which have been subject to misuses, accident, negligence, failure or electrical power or modification by the Customer without United Electronics Industries' approval. Final determination of warranty eligibility shall be made by United Electronics Industries. If a warranty claim is considered invalid for any reason, the Customer will be charged for services performed and expenses incurred by United Electronics Industries in handling and shipping the return item.

As to replacement parts supplied or repairs made during the original warranty period, the warranty period of the replacement or repaired part shall terminate with the termination of the warranty period with respect to the original product or part.

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Glossary

A

Asynchronous

(1) Hardware - A property of an event that occurs at an arbitrary time, without synchronization to a reference clock.

(2) Software - A property of a function that begins an operation and returns prior to the completion or termination of the operation.

B

Background Acquisition

Data is acquired by a DAQ system while another program or processing routine is running without apparent interruption.

Base Address

A memory address that serves as the starting address for programmable registers. All other addresses are located by adding to the base address.

Bit

One binary digit, either 0 or 1.

Block-Mode

A high-speed data transfer in which the address of the data is sent followed by a specified number of back-to-back data words.

Burst-Mode

A high-speed data transfer in which the address of the data is sent followed by back-to-back data words while a physical signal is asserted.

Bus

The group of conductors that interconnect individual circuitry in a computer. Typically, a bus is the expansion vehicle to which I/O or other devices are connected. Examples of PC buses are the AT PCI Bus.

Bus Master

A type of a plug-in board or controller with the ability to read and write devices on the computer bus.

Byte — Eight related bits of data, an eight-bit binary number. Also used to denote the amount of memory required to store one byte of data.

C

Cache — High-speed processor memory that buffers commonly used instructions or data to increase processing throughput.

Channel List — A variable length list of 1 to 8 channels/ports

Control Register(s) — Registers containing control bits to initiate control signals to various onboard subsystems.

Code Generator — A software program, controlled from an intuitive user interface that creates syntactically correct high-level source code in languages such as C or Basic.

Component Software — An application that contains one or more component objects that can freely interact with other component software. Examples include OLE-enabled applications such as Microsoft Visual Basic and OLE Controls for virtual instrumentation in Component Works.

Counter/Timer — A circuit that counts external pulses or clock pulses (timing), such as the Intel 8254 device.

Coupling — The manner in which a signal is connected from one location to another.

Crosstalk — An unwanted signal on one channel due to an input on a different channel.

Current Sinking — The ability of a DAQ board to dissipate current for analog or digital output signals.

Current Sourcing — The ability of a DAQ board to supply current for analog or digital output signals.

D

DAQ	Data Acquisition (1) Collecting and measuring electrical signals from sensors, transducers, and test probes or fixtures and inputting them to a computer for processing; (2) Collecting and measuring the same kinds of electrical signals with A/D and/or DIO boards plugged into a PC, and possibly generating control signals with D/A and/or DIO boards in the same PC.
dB	Decibel The unit for expressing a logarithmic measure of the ratio of two signal levels: dB=20log10 V1/V2, for signals in volts.
DIO	Digital input/output.
DLL	Dynamic Link Library A software module in Microsoft Windows containing executable code and data that can be called or used by Windows applications or other DLLs. Functions and data in a DLL are loaded and linked at run time when they are referenced by a Windows application or other DLLs.
DMA	Direct Memory Access: A method by which data can be transferred to/from computer memory from/to a device or memory on the bus while the processor does something else. DMA is the fastest method of transferring data to/from computer memory.
Drivers	Software that controls a specific hardware device, such as DAQ boards.
DSP	Digital signal processing.
Dual-Access Memory	Memory that can be sequentially accessed by more than one controller or processor but not simultaneously accessed. Also known as shared memory.
Dual-Ported Memory	Memory that can be simultaneously accessed by more than one controller or processor.

Dynamic Range — The ratio of the largest signal level a circuit can handle to the smallest signal level it can handle (usually taken to be the noise level), normally expressed indB.

E

EEPROM — Electrically Erasable Programmable Read-Only Memory ROM that can be erased with an electrical signal and reprogrammed.

Encoder — A device that converts linear or rotary displacement into digital or pulse signals. The most popular type of encoder is the optical encoder, which uses a rotating disk with alternating opaque areas, a light source, and a photo detector.

EPROM — Erasable Programmable Read-Only Memory: ROM that can be erased (usually by ultraviolet light exposure) and reprogrammed.

Events — Signals or interrupts generated by a device to notify another device of an asynchronous event. The contents of events are device-dependent.

External Trigger — A voltage pulse from an external source that triggers an event such as digital input latch signal.

F

FIFO — First-In First-Out Memory Buffer: The first data stored is the first data sent to the acceptor.

Fixed-Point — A format for processing or storing numbers as digital integers.

Floating-Point — A format for processing or storing numbers in scientific exponential notation (digits multiplied by a power of 10).

Function — A set of software instructions executed by a single line of code that may have input

and/or output parameters and returns a value when executed.

G

GUI — Graphical User Interface: An intuitive, easy-to-use means of communicating information to and from a computer program by means of graphical screen displays. GUIs can resemble the front panels of instruments or other objects associated with a computer program.

H

Handler — A device driver that is installed as part of the operating system of the computer.

Hardware — The physical components of a computer system, such as the circuit boards, plug-in boards, chassis, enclosures, peripherals, cables, and so on.

I

IMD — Intermodulation Distortion: The ratio, in dB, of the total rms signal level of harmonic sum and difference distortion products, to the overall rms signal level. The test signal is two sine waves added together according to the following standards:

Input Impedance — The measured resistance and capacitance between the input terminals of a circuit.

Input Offset Current — The difference in the input bias currents of the two inputs of an instrumentation amplifier.

Integral Control — A control action that eliminates the offset inherent in proportional control.

Interpreter — A software utility that executes source code from a high-level language such as Basic, C or Pascal, by reading one line at a time and

executing the specified operation. See also Compiler.

Interrupt — A computer signal indicating that the CPU should suspend its current task to service a designated activity.

I/O — Input/Output: The transfer of data to/from a computer system involving communications channels, operator interface devices, and/or data acquisition and control interfaces.

IPC — Interprocess Communication Protocol by which processes can pass messages. Messages can be either blocks of data and information packets, or instructions and requests for pro-cess(es) to perform actions. A process can send messages to itself, other processes on the same machine, or processes located anywhere on the network.

Isolation Voltage — The voltage that an isolated circuit can normally withstand, usually specified from input to input and/or from any input to the amplifier output, or to the computer bus.

K

k — Kilo, the standard metric prefix for 1,000, or 103, used with units of measure such as volts, hertz, and meters.

K — Kilo, the prefix for 1,024, or 210, used with B in quantifying data or computer memory.

kbytes/s — A unit for data transfer that means 1,000 or 103 bytes/s.

L

Linearity — The adherence of device response to the equation R = KS, where R =response, S = stimulus, and K = a constant.

LSB — Least significant bit.

M

M — (1) mega, the standard metric prefix for 1 million or 106, when used with units of measure such as volts and hertz;

(2) mega, the prefix for 1,048,576, or 220, when used with B to quantify data or computer memory.

Mbytes/s — A unit for data transfer that means 1 million or 106 bytes/s.

MMI — Man-Machine Interface, also Human-Machine Interface: The means by which an operator interacts with an industrial automation system; often a GUI.

Multitasking — A property of an operating system in which several processes can be run simultaneously.

N

Noise — An undesirable electrical signal. Noise comes from external sources such as the AC power line, motors, generators, transformers, fluorescent lights, soldering irons, CRT displays, computers, electrical storms, welders, radio transmitters, and internal sources such as semiconductors, resistors, and capacitors.

O

OLE — Object Linking and Embedding: A set of system services that provides a means for applications to interact and interoperate. Based on the underlying Component Object Model, OLE is object-enabling system software. Through OLE Automation, an application can dynamically identify and use the services of other applications, to build powerful solutions using packaged software. OLE also makes it possible to create compound documents consisting of multiple

	sources of information from different applications.
OLE Controls	See ActiveX Controls.
Operating System	Base-level software that controls a computer, runs programs, interacts with users, and communicates with installed hardware or peripheral devices.
Optical Isolation	The technique of using an optoelectric transmitter and receiver to transfer data without electrical continuity, to eliminate high-potential differences and transients.
Output Settling Time	The amount of time required for the analog output voltage to reach its final value within specified limits.
Output Slew Rate	The maximum rate of change of analog output voltage from one level to another.
Overhead	The amount of computer processing resources, such as time and/or memory, required to accomplish a task.

P

Paging	A technique used for extending the address range of a device to point into a larger address space
PCI	Peripheral Component Interconnect: A high-performance expansion bus architecture originally developed by Intel to replace ISA and EISA. It is achieving widespread acceptance as a standard for PCs and work-stations; it offers a theoretical maximum transfer rate of 132 Mbytes/s.
PID Control	A three-term control mechanism combining proportional, integral, and derivative control actions. Also see proportional control, integral control, and derivative control.
Pipeline	A high-performance processor structure in which the completion of an instruction is broken into its elements so that several

	elements can be processed simultaneously from different instructions.
PLC	Programmable logic controller: A highly reliable special-purpose computer used in industrial monitoring and control applications. PLCs typically have proprietary programming and networking protocols, and special-purpose digital and analog I/O ports.
Plug and Play ISA	A specification prepared by Microsoft, Intel, and other PC-related companies that will result in PCs with plug-in boards that can be fully configured in software, without jumpers or switches on the boards.
Port	A communications connection on a computer or a remote controller.
Postriggering	The technique used on a DAQ board to acquire a programmed number of samples after trigger conditions are met.
Potentiometer	An electrical device the resistance of which can be manually adjusted; used for manual adjustment of electrical circuits and as a transducer for linear or rotary position.
Pretriggering	The technique used on a DAQ board to keep a continuous buffer filled with data, so that when the trigger conditions are met, the sample includes the data leading up to the trigger condition.
Programmed I/O	The standard method a CPU uses to access an I/O device-- each byte of data is read or written by the CPU.
Propagation Delay	The amount of time required for a signal to pass through a circuit. Proportional
Control	A control action with an output that is to be proportional to the deviation of the controlled variable from a desired set point.
Protocol	The exact sequence of bits, characters and control codes used to transfer data between

	computers and peripherals through a communications channel, such as the GPIB.

Q

Quantization Error	The inherent uncertainty in digitizing an analog value due to the finite resolution of the conversion process.

R

Real Time	A property of an event or system in which data is processed as it is acquired in-stead of being accumulated and processed at a later time.
Resource Locking	A technique whereby a device is signaled not to use its local memory while the memory is in use from the bus.
Ribbon Cable	A flat cable in which the conductors are side by side.
RTD	Resistance Temperature Detector: A metallic probe that measures temperature based upon its coefficient of resistivity.

S

SE	Single-Ended: A term used to describe an analog input that is measured with respect to a common ground.
Self-Calibrating	DAQ board that calibrates its own A/D and D/A circuits with and external reference source.
Sensor	A device that responds to a physical stimulus (heat, light, sound, pressure, motion, flow, and so on), and produces a corresponding electrical signal.
S/H	Sample-and-Hold: A circuit that acquires and stores an analog voltage/digital value on a capacitor for a short period of time.

SNR Signal-to-Noise Ratio**:** The ratio of the overall rms signal level to the rms noise level, expressed in dB.

Software Trigger A programmed event that triggers an event such as data acquisition.

SPDT Single-Pole Double Throw: A property of a switch in which one terminal can be connected to one of two other terminals.

SSH Simultaneous Sampling and Hold: A property of a system in which each input or output channel is digitized or updated at the same instant.

S/s Samples per second; used to express the rate at which a DAQ board samples an analog signal.

Strain Gauge A sensor whose resistance is a function of the applied force.

Subroutine A set of software instructions executed by a single line of code that may have input and/or output parameters.

Synchronous A property of a function that begins an operation and returns only when the operation is complete.

T

TCP/IP A set of standard protocols for communicating across a single network or interconnected set of networks. The Internet Protocol (IP) for the low-level service of taking data and packaging of components, and Transmission Control Protocol (TCP) for high-reliability data transmissions.

THD Total Harmonic Distortion: The ratio of the total rms signal due to harmonic distortion to the overall rms signal, in dB or percent.

THD+N Signal-to-THD Plus Noise: The ratio in decibels of the overall rms signal to the rms

	signal of harmonic distortion plus noise introduced.
Thermistor	A semiconductor sensor that exhibits a repeatable change in electrical resistance as a function of temperature. Most thermistors exhibit a negative temperature coefficient.
Thermocouple	A temperature sensor created by joining two dissimilar metals. The junction produces a small voltage as a function of the temperature.
Throughput Rate	The data, measured in bytes/s, for a given continuous operation.
Transducer	A device that responds to a physical stimulus (heat, light, sound, pressure, motion, flow, and so on), and produces a corresponding electrical signal.
Transfer Rate	The rate, measured in bytes/s, at which data is moved from source to destination after software initialization and set up operations; the maximum rate at which the hardware can operate.

U

Unipolar	A signal range that is always positive (for example, 0 to +10 V).

Z

Zero-Overhead Looping	The ability of a high-performance processor to repeat instructions without requiring time to branch to the beginning of the instructions.
Zero-Wait-State Memory	Memory fast enough that the processor does not have to wait during any reads and writes to the memory.

Reader Evaluation

Index

Reader Evaluation

We are committed to improving the quality of our documentation, in order to serve you better. Your feedback will help us in the effort. Thanks for taking the time to fill out and return this form.

☐ Is the manual well organized? Yes No

☐ Can you find information easily? Yes No

☐ Were you able to install the PD2-DIO boards? Yes No

☐ Did you find any technical errors? Yes No

☐ Is the manual size appropriate? Yes No

☐ Are the design, type style, and layout attractive? Yes No

☐ Is the quality of illustrations satisfactory? Yes No

☐ Is the quality of illustrations satisfactory? Yes No

☐ Is the quality of illustrations satisfactory? Yes No

☐ Is the quality of illustrations satisfactory? Yes No

How would you rate this manual? ☐ Excellent ☐ Good ☐ Fair ☐ Poor

Why?_____

_____

Suggested improvements: _____

_____

Other Comments: _____

_____

_____

Your background (optional)

Your application: _____