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PCI-/cPCI-/LPCI-/LPCIe-723X Series

32-CH Isolated Digital I/O Card

User's Manual

Manual Rev. 4.05

Revision Date: June 24, 2008

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Recycled Paper

Advance Technologies; Automate the World.

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Product Model	
Environment	OS: M/B: CPU: Chipset: BIOS:

Please give a detailed description of the problem(s):

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1 Introduction

This manual lists and describes the components of the PCI-723X family products, which includes:

- PCI-7230: Isolated 16-CH DI and 16-CH DO Card
- PCI-7233: Isolated 32-CH DI Card with COS detection
- PCI-7234: Isolated 32-CH DO Card
- PCI-7234P: Isolated 32-CH DO Card with Source Current Transistor
- cPCI-7230: Isolated 16-CH DI and 16-CH DO Module for 3U CompactPCI
- LPCI-7230: Isolated 16-CH DI and 16-CH DO Card for low-profile PCI
- LPCIe-7230: Isolated 16-CH DI and 16-CH DO Card for low-profile PCI Express

These products have high isolation voltage with either 32 DI or 32 DO channels. The high isolation voltage protects the user's computer against damage caused by accidental contact with high external voltage and eliminates troublesome ground loops.

The PCI-7230/cPCI-7230/LPCI-7230/LPCIe-7230 provides 16 isolated inputs and 16 isolated outputs. The PCI-7230/cPCI-7230 isolated I/O channels are isolated to 5000 Vrms, and LPCI/LPCIe-7230 isolated I/O channels are isolated to 2500 Vrms (excluding cables).

The PCI-7233 provides 32 isolated digital input channels with COS (change-of-state detection).

The PCI-7234/7234P provides 32 isolated digital output (Darlington transistor) channels. The isolation voltage is high up to 5,000 Vrms (excluding cables), both channel-to-channel and channel-to-computer. (PCI-7234 is sink current DO card, PCI-7234P is source current DO card).

The PCI-7230/7233/7234 use ASIC PCI controller to interface the board to the PCI bus. The ASIC fully implement the PCI local bus specification Rev 2.1. All bus relative configurations, such as base memory address and interrupt assignment, are automatically controlled by BIOS software. It does not need any user interaction and

pre-study for the configurations. This removes the burden of searching for a conflict-free configuration, which can be very time-consuming and difficult with some other bus standards.

1.1 Features

PCI-7230, cPCI-7230, LPCI-7230, and LPCIe-7230 Features

- Supports a 32-bit 5 V PCI bus (PCI-7230)
- 3U Eurocard form factor, CompactPCI Compliant (PICMG 2.0 Rev 2.1) (cPCI-7230)
- Support a 32-bit 3.3 V or 5 V PCI bus (LPCI-7230)
- x1 lane PCI Express Interface (LPCIe-7230)
- 16 isolated Digital Input Channels
- 16 isolated Digital Output Channels
- High output driving capability
- 5000 Vrms high voltage isolation (for PCI-7230 and cPCI-7230), 2500 Vrms high voltage isolation (for LPCI-7230 and LPCIe-7230)
- Two external interrupt sources
- 500 mA max@ 100% duty, for one of the eight transistor devices ON
- Up to 24V voltage protection for isolated input
- 37-pin D-type connector (for PCI-7230)
- 50-pin SCSI-II type connector (for cPCI-7230, LPCI-7230, and LPCIe-7230)

PCI-7233 Features

- 32 Isolated Digital Input Channels
- 5000 Vrms high voltage isolation
- Up to 24 V voltage protection for isolated input
- Interrupt is generated by COS (change-of-state) detection
- Dual interrupt trigger
- 37-pin D-type connector

PCI-7234/7234P Features

- 32 Isolated Digital Output Channels
- High output driving capability
- 500 mA max@ 100% duty, for one of the eight transistor devices ON (PCI-7234: sink current, PCI-7234P: source current)
- 5,000 Vrms high voltage isolation
- 37-pin D-type connector

1.2 PCI-7230/cPCI-7230/LPCI-7230/LPCIe-7230 Specifications

Isolated Digital I/O (DIO)

- Optical Isolated Input Channel
- Numbers of Channel: 16 digital inputs
- Input Voltage: up to 24Vdc
  - Logic “L”: 0 to 1.5 V
  - Logic “H”: 5 to 24 V
- Input resistance:1.2 KΩ @ 0.5 W
- Isolated voltage: 5000 Vrms (for PCI-7230 and cPCI-7230), 2500 Vrms (for LPCI-7230 and LPCIe-7230)
- Throughput:10 KHz
- Optical Isolated Output channel:
  - Numbers of Channel: 16 digital outputs
  - Output type: Darlington transistors
  - Output Voltage: open collector 5 V_{DC} (min.), up to 35 V_{DC} (max.)
- Sink Current:
  - 500 mA max @ 100% duty, for one of the eight transistor devices ON
  - 370 mA @ duty 10% for all transistors devices ON
  - 130 mA @ duty 50% for all transistors devices ON

(Note: the pulse width is 25 ms for one duty cycle.)

- Throughput: 10 KHz
- Interrupt sources: Channel 0 and channel 1 of digital input channels

General Specifications

- Connector:
  - 37-pin D-type connector for PCI-7230
  - 50-pin SCSI-II type connector for cPCI-7230, LPCI-7230, and LPCIe-7230
- Operating Temperature: 0 to 60°C
- Storage Temperature: -20 to 80°C
- Humidity: 5 to 95%, non-condensing
- Power Consumption:
  - PCI-7230: +5V @ 150 mA (typical)

(Note: Requires external power)

  - cPCI-7230: +5V @ 270 mA (typical)
  - LPCI-7230: +5 V @ 150 mA (typical)
  - LPCIe-7230: +3.3 V @ 279 mA (typical)
    +12 V @ 133 mA (typical)
- Dimension: Compact size, not including connectors
  - PCI-7230: 153mm(L) X 107mm(H)
  - cPCI-7230: 160 mm(L) X 100 mm(H)
  - LPCI-7230: 120 mm(L) X 65 mm(H)
  - LPCIe-7230: 119.9 mm(L) x 68.9 mm(H)

1.3 PCI-7233 Specifications

Isolated Digital Input

Optical Isolated Input

- Numbers of Channel: 32 digital inputs
- Input Voltage: up to 24Vdc
  - Logic “L”: 0 to 1.5V
  - Logic “H”: 5 to 24V
- Input resistance:1.2 KΩ @ 0.5W
- Isolated voltage: 5000Vrms
- Throughput: 10KHz
- Dual-interrupt sources:
  - Change-of-state (COS) on any 16 DI lines of LSB
  - Change-of-state (COS) on any 16 DI lines of MSB

General Specifications

- Connector: 37-pin D-type connector
- Operating Temperature: 0°C to 60°C
- Storage Temperature: -20°C to 80°C
- Humidity: 5 to 95%, non-condensing
- Power Consumption: +5V @ 300 mA
- Dimension: Compact size only 158 mm x 107 mm

1.4 PCI-7234/7234P Specifications

Isolated Digital Output

- Numbers of Channel: 32 digital output
  - Output type: Darlington transistors
  - Output Voltage: open collector 5 V_{DC} (min.), up to 35 V_{DC} (max.)
- Sink Current: (PCI-7234)
  - 500 mA max @ 100% duty, for one of the eight transistors ON
  - 500 mA @ duty 20% for all transistors devices ON

(Note: the pulse width is 25ms for one duty cycle)

- Source Current:(PCI-7234P)
  - 500 mA max @ 100% duty, for one of the eight transistors ON
  - 260 mA @ duty 10% for all transistors devices ON

(Note: the pulse width is 25 ms for one duty cycle)

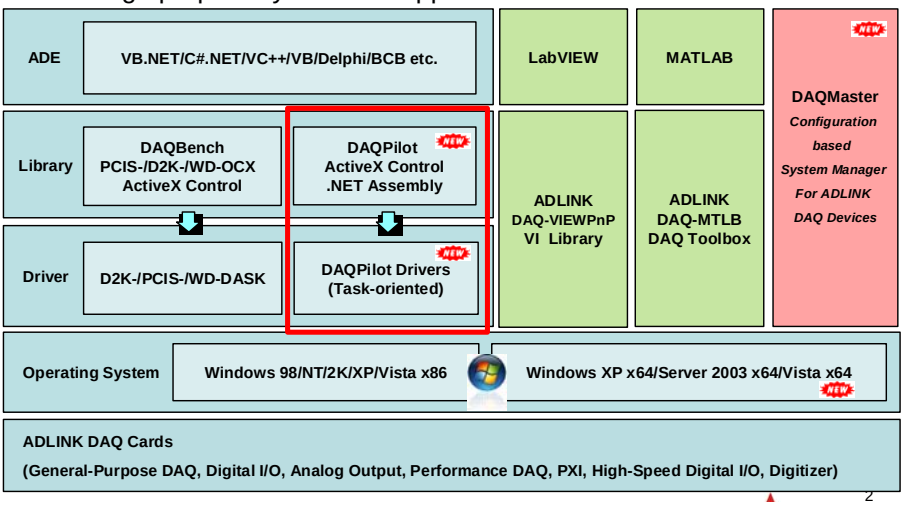
- Isolated voltage:
  - 5000 Vrms
- Throughput:
  - 10 KHz

General Specifications

- Connector: 37-pin D-type connector
- Operating Temperature: 0 to 60°C
- Storage Temperature: -20 to 80°C
- Humidity: 5 to 95%, non-condensing
- Power Consumption: +5V @ 180 mA (typical, with internal DC-DC power)
- Dimensions: 175 mm(H) x 107 mm(L)

1.5 Software Support

ADLINK Technology Inc., a leading provider of high-performance, high-quality data acquisition cards and platforms, delivers robust software support for its comprehensive line of DAQ cards with varying form factors including PCI Express®, PCI, CompactPCI, and PXI. ADLINK offers support not only for mainstream Windows and Linux OS, but also for third-party applications including Lab-VIEW® and MATLAB®. In addition, ADLINK also provides ActiveX componentware for measurement and SCADA/HMI, and break-through proprietary software applications.



Windows Drivers

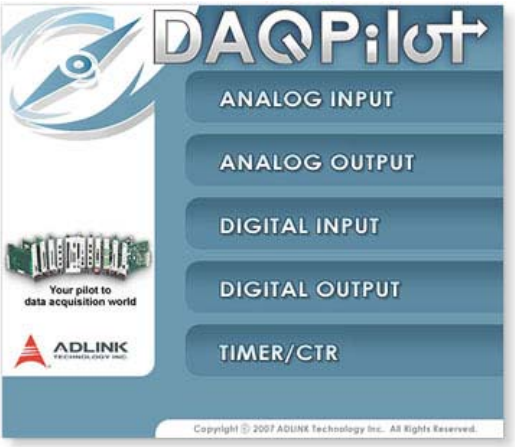
ADLINK Task-oriented DAQ Driver/SDK and Wizard for Windows

DAQPilot provides one interface for all ADLINK DAQ products via

- DAQPilot API
- DAQPilot ActiveX Control
- DAQPilot .Net Assembly,

DAQPilot (Download and install from the DAQPilot product page: http://www.adlinktech.com/TM/DAQPilot.html

- Save development time
- Shorten learning curve



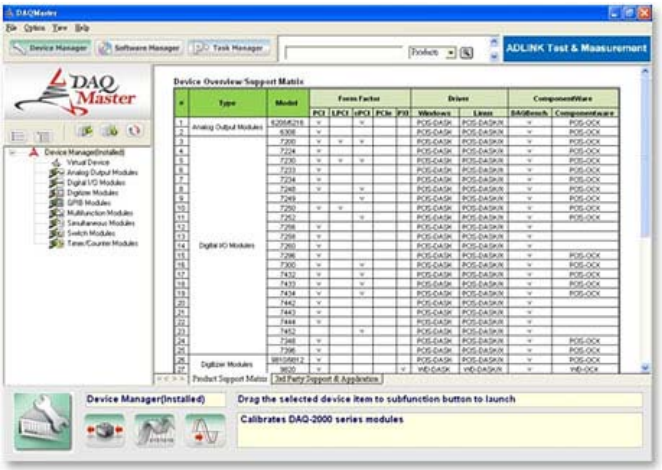
DAQPilot is a driver and SDK with a graphics-driven interface for various ADE. DAQPilot comes as ADLINK's commitment to provide full support to its comprehensive line of data acquisition products. DAQPilot is designed for the beginners as well as experienced programmers. Moreover, because DAQPilot can finish a DAQ task in minutes, it is suitable for programmers aiming to

immediately program ADLINK DAQ modules and integrate tasks to their own DAQ applications.

Note: ADLINK strongly recommend all users to install the new-generation ADLINK Driver – DAQPilot instead legacy DASK drivers. For those users who have been using the legacy ADLINK DASK Drivers or are not able to connect to the internet, you still can get the latest update from ADLINK all-in-one CD.

Configuration-Based Device Manager for ADLINK DAQ Cards

- DAQMaster (.\Utility)



The ADLINK DAQMaster is a smart device manager that enables access to ADLINK data acquisition and test and measurement products. DAQMaster delivers an all-in-one configurations, user can get a full support matrix to well configure ADLINK Test and Measurement products.

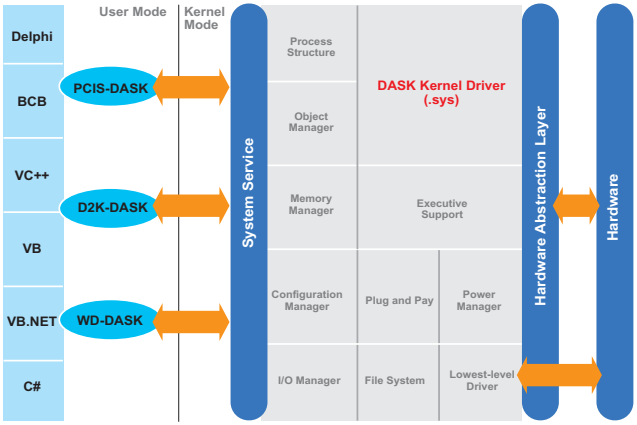
DAQMaster enables you to:

- Manage ADLINK devices and interfaces
- Manage ADLINK installed software
- Manage ADLINK DAQPilot tasks



ADLINK Legacy DAQ Card Drivers and SDK for Windows

- PCIS-DASK (.\Software Package\PCIS-DASK)
- D2K-DASK (.\Software Package\D2K-DASK)
- WD-DASK (.\Software Package\WD-DASK)



ADLINK's DASK are advanced 32-bit kernel drivers for customized DAQ application development. DASK enables users to perform detailed operations and achieve superior performance and reliability from their data acquisition system. DASK kernel drivers now support Windows Vista.

- PCIS-DASK for NuDAQ PCI/cPCI Series
- D2K-DASK for DAQ-2000 and PXI-2000 Series
- WD-DASK for High-speed Waveform Digitizer

DASK also supports the following:

- Supports Windows Vista 32- or 64-bit editions
- Supports AMD64 and Intel x86-64 architectures
- Digitally-signed for Windows Vista 64-bit Edition
- Utilizes WOW64 subsystem to ensure that 32-bit applications run normally on 64-bit Editions of Windows XP, Windows 2003 Server, and Windows Vista without modification.

More information about Windows Vista Support, please visit http://www.adlinktech.com/TM/VistaSupport.html.

Note: Please use PCIS-DASK with the LPCI-7230 and LPCIe-7230

Linux Drivers

Linux Drivers for ADLINK DAQ Cards



Drivers are available on the ADLINK website:

- PCIS-DASK/X
- D2K-DASK/X
- WD-DASK/X

ADLINK's DASK/X drivers are intended for developing customized data acquisition applications under Linux environments. The DASK/X drivers provide common APIs for ADLINK's extensive family of PCI, CompactPCI, and PXI plug-in data acquisition cards, and utilize the full capabilities of these cards under Linux environment.

- PCIS-DASK/X for NuDAQ PCI/cPCI Series
- D2K-DASK/X for DAQ-2000 and PXI-2000 Series
- WD-DASK/X for ADLINK High-speed Waveform Digitizer

More information about Linux drivers, please visit http://www.adlinktech.com/TM/linux_daq.html

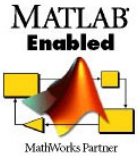
Note: Please use PCIS-DASK/X with the LPCI-7230 and LPCIe-7230

Third-party Software Support

MATLAB® Data Acquisition Toolbox Adapter for ADLINK DAQ Cards

- DAQ-MTLB for MATLAB® (.\Software Package\DAQ-MTLB)

The DAQ-MTLB for MATLAB® integrates ADLINK components with MATLAB® Data Acquisition Toolbox and enables users to control a wide range of ADLINK DAQ cards directly from the advanced MATLAB® environment.

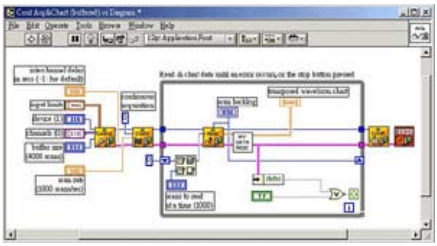


- Directly control scores of ADLINK DAQ cards that come in different form factors including PCI Express®, PCI, cPCI, and PXI
- Compliant with MATLAB DAQ Toolbox 2.2 or higher (now at R2007a)
- Critical updates and support are available as ADLINK is now a MathWorks Connections Program partner
- ADLINK offers the only MATLAB® adapter for high-speed digitizers with up to 65 MHz sampling rate and 14-bit resolution

More information, please visit http://www.adlinktech.com/TM/DAQ-MTLB.html

LabVIEW™ Data Acquisition VI Set for ADLINK DAQ Cards

- DAQ Cards DAQ-LVIEW PnP for LabVIEW™ (.\Software Package\DAQ-LVIEW PnP)



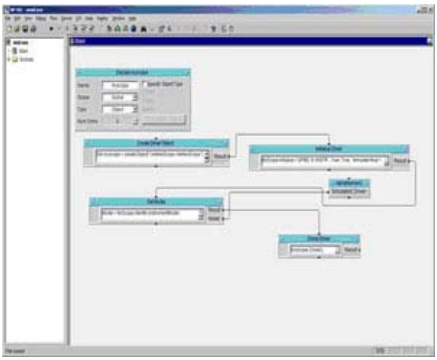
The DAQ-LVIEW PnP is a set of LabView Virtual Instruments (Vis) that is fully-compatible with National Instrument's DAQ VIs. Based on the virtual instruments concept, DAQ-LVIEW PnP provides four additional tool panels in LabView, including analog input, analog output, digital I/O, and timer/counter.

The DAQ-LVIEW PnP is designed and verified for LabVIEW 7.0, and is compatible with LabVIEW 6.5, 7.1, 8.0, 8.2 and 8.5.

More information, please visit http://www.adlinktech.com/TM/lab-view-pnp.html

VEE™ Interface for ADLINK DAQ Cards

- PCIS-VEE (.\Software Package\PCIS-VEE)
- D2K-VEE (.\Software Package\D2K-VEE)



Agilent VEE™ is a popular visual programming environment for data acquisition that includes data analysis and control. VEE provides a visual programming interface that allows users to create programs by connecting objects such as acquisition routines, buttons and displays in a flow diagram. For users that are familiar with Agilent VEE, ADLINK has released the PCIS-VEE and D2K-VEE for seamless integration of the following NuDAQ data acquisition cards to the VEE environment:

- PCIS-VEE.

  VEE for ADLINK NuDAQ Series DAQ cards

  6208, 6308, 7200, 7230, 7233, 7234, 7250, 7252, 7248, 7249, 7296, 7300, 7396, 7432, 7433, 7434, 9111, 9112, 9113, 9114, 9118, 9812

- D2K-VEE.

  VEE for DAQ-2000 Series DAQ cards

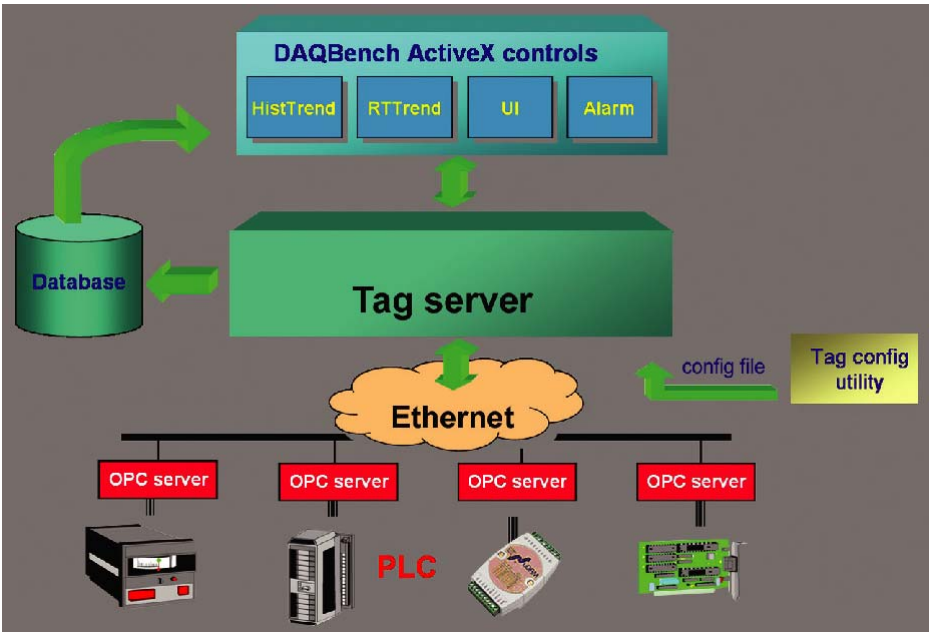
  2010, 2005, 2006, 2204, 2205, 2206, 2501, 2502

The ADLINK PCIS-VEE and D2K-VEE drivers are designed and verified for Agilent VEE 4.5 environment.

Componentware/ActiveX Control

32-Bit ActiveX Controls for Measurement and SCADA/HMI

DAQBench (.\Software Package\DAQBench)

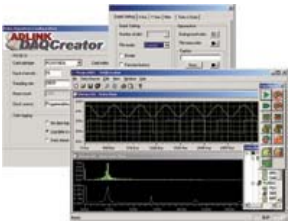


DAQBench is a specialized ActiveX control package designed for 32-bit measurement and SCADA/HMI applications. DAQBench leverages the power of the latest Microsoft ActiveX technology - the standard for code interchangeability and integration under various Windows platform. With DAQBench, programmers can take advantage of their familiarity with development environments such as Visual Basic, Visual C++, Delphi, and Borland C++ Builder to build their own applications.

Applications for Test and Measurement

Smart & Easy-to-Use Data Acquisition System Creator

DAQCreator (.\Software Package\DAQCreator)



DAQCreator is an out-of-the-box data acquisition software for acquiring, displaying, analyzing, and storing data from ADLINK DAQ cards. Equipped with a smart wizard and intuitive panels, users can easily configure data acquisition settings, change the appearance of data display, perform FFT to acquired data, and store data to a hard disk drive. Another remarkable feature of DAQCreator is the 40 MB/s stream-to-disk data throughput made possible through combination with advanced SCSI technology. DAQCreator delivers a cost-effective solution for high-speed data logging applications.

Get latest ADLINK Software Solutions from ADLINK Web site: http://www.adlinktech.com/TM/software-product.html

Note: All company names appearing herein are trademarks or trade names of their respective owners.

Note: Windows Vista is either a registered trademark or trademark of Microsoft Corporation in the United States and/or other countries.

2 Installation

This chapter describes the configurations of the PCI-/cPCI-/LPCI-/LPCIe-723X Series. The PCI-/cPCI-/LPCI-/LPCIe-723X Series is Plug and Play and can easily be installed onto any PC system with PCI slots.

2.1 What You Have

- This User's Manual
- PCI-/cPCI-/LPCI-/LPCIe-723X Series Isolated Digital I/O Card
- ADLINK CD
- Software Installation Guide

If any of these items are missing or damaged, please contact the dealer from whom the product was purchased. Save the shipping materials and carton for future storage or shipping purposes.

2.2 Unpacking

Your PCI-/cPCI-/LPCI-/LPCIe-723X Series card contains sensitive electronic components that can be easily damaged by static electricity.

The card should be placed on a grounded anti-static mat. The operator should wear an anti-static wristband, grounded at the same point as the anti-static mat. Inspect the card module carton for obvious damage. Shipping and handling may cause damage to the module. Ensure that there are no shipping and handing damages on the module before processing.

After opening the card module carton, extract the system module and place it only on a grounded anti-static surface component side up.

Again, inspect the module for damage. Press down on all socketed ICs to make sure they are properly seated. Do this only with the module placed on a firm flat surface.

Note:	Do not apply power to the card if it has been damaged.

2.3 Hardware Installation Outline

PCI configuration

The PCI cards (or CompactPCI cards) are equipped with a Plug and Play PCI controller, it can request base addresses and interrupt in accordance with the PCI standard. The system BIOS will install the system resource based on the PCI cards' configuration registers and system parameters (which are set by system BIOS). Interrupt assignment and memory usage (I/O port locations) of the PCI cards can be assigned by system BIOS only. These system resource assignments are done on a board-by-board basis. It is not recommended that the system resource be assigned by any other method.

PCI slot selection

The PCI card can be inserted into any PCI slot without any configuration for system resource.

Installation Procedures

1. Turn off the computer.
2. Turn off all accessories (printer, modem, monitor, etc.) connected to your computer.
3. Remove the computer cover.
4. Select a 32-bit PCI slot. PCI slots are shorter than ISA or EISA slots, and usually white or ivory in color.
5. Before handling the PCI cards, discharge any static buildup on your body by touching the metal case of the computer. Hold the edge and do not touch the components.
6. Position the board into the selected PCI slot.
7. Secure the card in place at the rear panel of the system.

2.4 Device Installation for Windows Systems

Once Windows Vista/XP/2003/2000 has started, the Plug and Play function of Windows system will find the new NuDAQ/NuIPC cards. If this is the first time installing NuDAQ/NuIPC cards on your Windows system, you will be prompted to enter the device information source. Please refer to the “Software Installation Guide” for instructions on installing the device.

2.5 Connector Pin Assignment

PCI-7230 Pin Assignment

The pin assignment of the 37 pins D-type connector CN2, which is an isolated DIO signal connector, shown below:

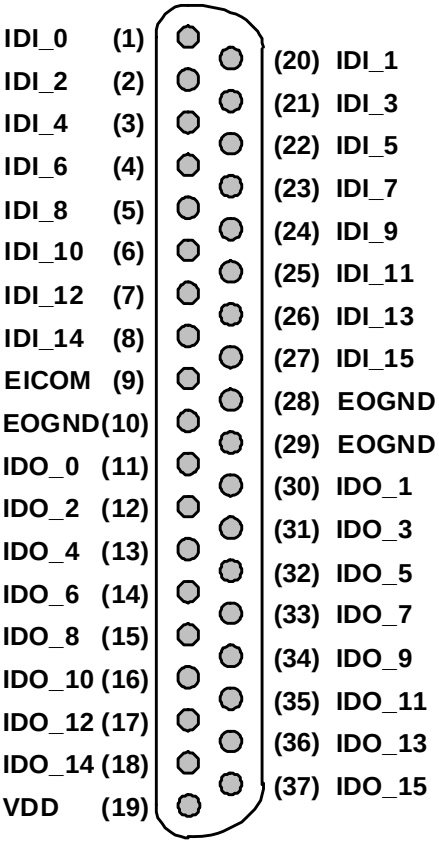


Figure 2-1: PCI-7230 Pin Assignment

Legend:

IDI_n: Isolated digital input channel #n.

IDO_n: Isolated digital output channel #n.

EICOM: Common Ground or Common power of isolated input channels.

EOGND: Ground return path of isolated output channels.

VDD: Power supply of isolated output channels.

Note:	The VDD must be supplied by an external power supply of 5 to 35VDC.

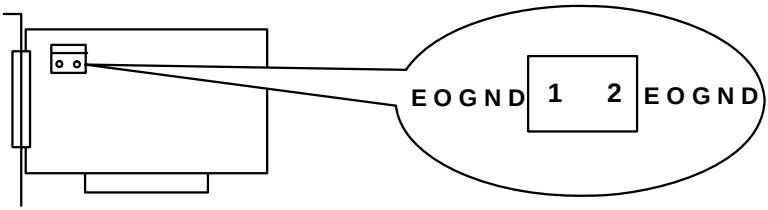


Figure 2-2: PCI-7230 Onboard Power and Ground terminal

cPCI-7230 Pin Assignment

The pin assignment of the cPCI-7230's 50 pins SCSI-II type connector CN1 is shown in the following diagram.

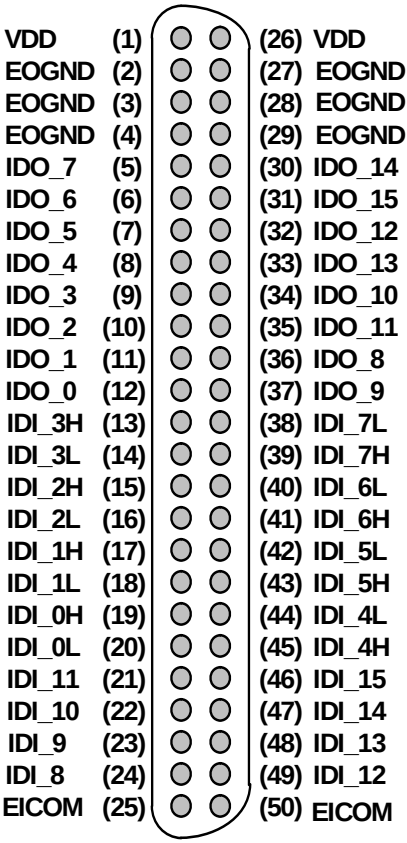


Figure 2-3: cPCI-7230 Pin Assignment

Legend:

IDI_n: Isolated digital input channel #n.

IDO_n: Isolated digital output channel #n.

EICOM: Common ground or common power of isolated input channels #8 to 15.

IDI_nH: High input of isolated differential DI channel #n.

IDI_nL: Low input of isolated differential DI channel #n.

EOGND: Ground return path of isolated output channels.

VDD: Power input signal for fly-wheel diode of DO channels.

LPCI/LPCIe-7230 Pin Assignment

The pin assignment of the LPCI-7230's 50 pins SCSI-II type connector CN1 is shown in the following diagram.

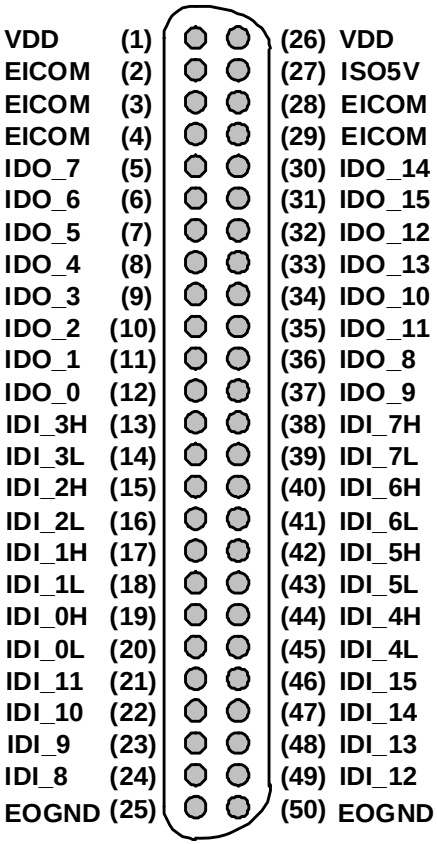


Figure 2-4: LPCI/LPCIe-7230 Pin Assignment

Legend:

IDI_n: Isolated digital input channel #n.

IDO_n: Isolated digital output channel #n.

EICOM: Common ground or common power of isolated input channels #8 to 15.

IDI_nH: High input of isolated differential DI channel #n.

IDI_nL: Low input of isolated differential DI channel #n.

EOGND: Ground return path of isolated output channels.

VDD: Power input signal for fly-wheel diode of DO channels.

ISO5V: Isolatied power output 5V.

PCI-7233 Pin Assignment

The pin assignment of the 37 pins D-type connector CN1 is illustrated below:

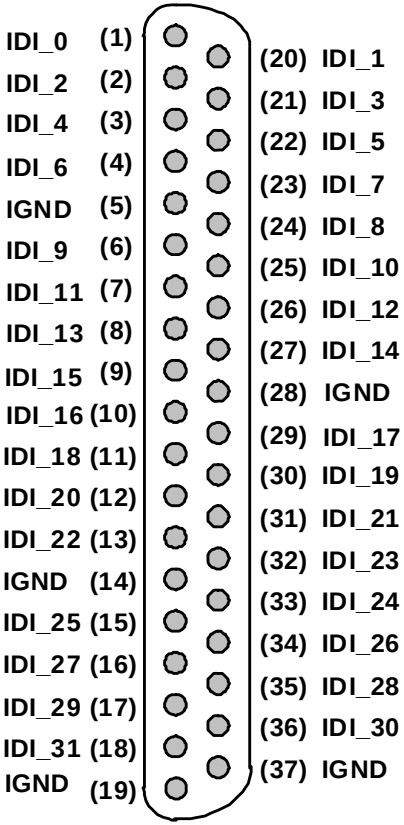


Figure 2-5: PCI-7233 Pin Assignment

Legend:

IDI_n: Isolated digital input channel n.

I.GND: Isolated common ground.

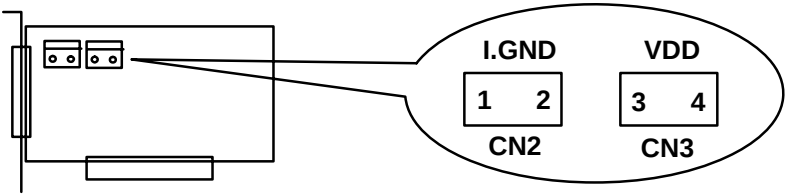


Figure 2-6: PCI-7233 Onboard Power and Ground terminal

PCI-7234 Pin Assignment

The pin assignment of the 37 pins D-type connector CN1, which is an isolated DIO signal connector, is shown below.

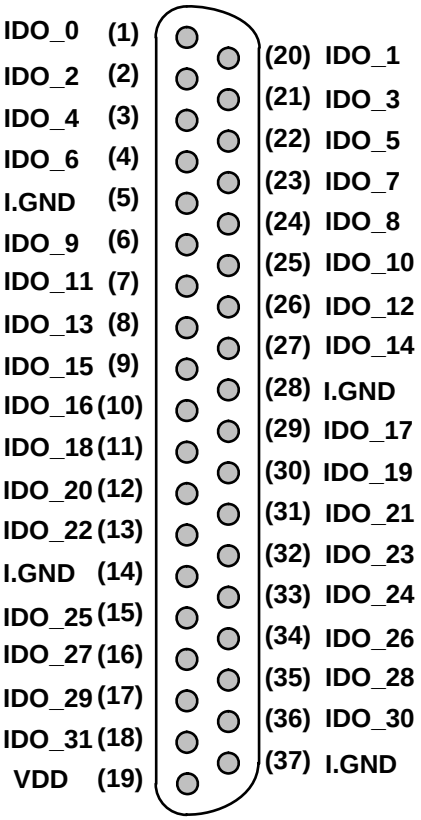


Figure 2-7: PCI-7234 Pin Assignment

Legend:

IDO_n: Isolated digital output signal channel n.

I.GND: Isolated Ground for all isolated output channels.

VDD: Power input signal for fly-wheel diode of DO channels.

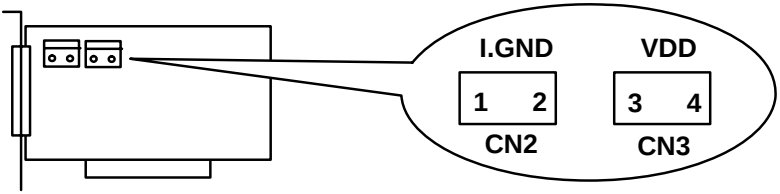


Figure 2-8: PCI-7234 Onboard Power and Ground terminal

PCI-7234P Pin Assignment

The pin assignment of the 37 pins D-type connector CN1, which is an isolated DIO signal connector, as shown below:

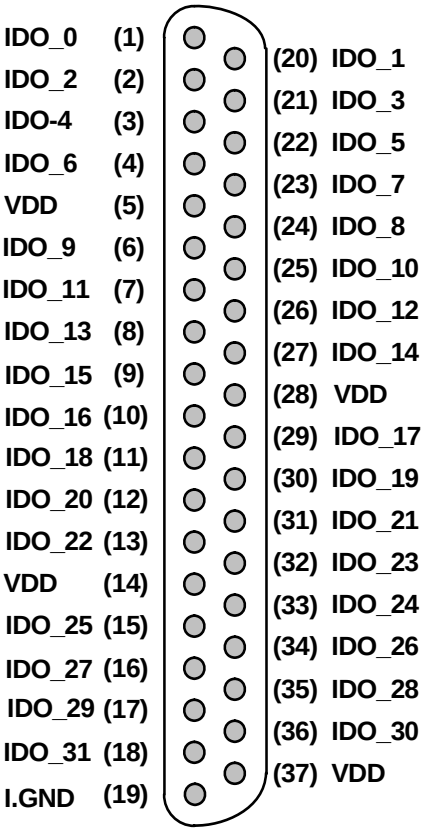


Figure 2-9: PCI-7234P Pin Assignment

Legend:

IDO_n: Isolated digital output signal channel n.

I.GND: Isolated ground for isolated output channels.

VDD: External power supply for IDO source drivers.

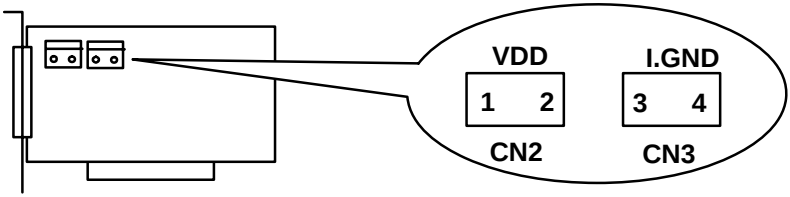


Figure 2-10: PCI-7234P Onboard Power and Ground terminal

2.6 Termination Board Connection

The 723X boards are equipped with a DB-37 or a 50-pin SCSI-II female connector. Available termination boards include:

ACLD-9137-01:

General-Purpose termination board with a 37-pin D-sub male connector.

DIN-37D-01:

Termination board with a 37-pin D-sub connector and DIN-Rail mounting (including one 1-meter ACL-10137 cable).

DIN-50S-01:

Termination board with a 50-pin SCSI-II connector and DIN-Rail mounting (including one 1-meter ACL-10250 cable)

3 Register Format

The registers format is described in this chapter. This information is quite useful for programmers who wish to handle the card by low-level programming. However, it is recommended that the user has a deeper understanding of the PCI interface before starting any low-level programming. This chapter can also assist users in using the software driver to manipulate this card.

3.1 PCI PnP Registers

This PCI card functions as a 32-bit PCI target device to any master on the PCI bus. There are three types of registers: PCI Configuration Registers (PCR), Local Configuration Registers (LCR), and PCI-723X registers.

The PCR, which is compliant with the PCI-bus specifications, is initialized and controlled by the Plug and Play PCI BIOS. Users can study the PCI BIOS specification to understand the operation of the PCR. Please contact the PCISIG for specifications of the PCI interface.

The PCI bus controller PCI 9052 is provided by PLX technology Inc. (www.plxtech.com). For further detail on the LCR, please visit PLX technology's website to download the relative information. Users are not required to understand the details of the LCR if using the software library. The PCI PnP BIOS assigns the base address of the LCR to offset 14h of PCR.

The PCI-723X registers are shown in the next section. The base address, which is also assigned by the PCI PnP BIOS, is located at offset 18h of PCR. Therefore, users can read the 18h of PCR to find the base address by using the BIOS function call.

Do not try to modify the base address and interrupt assigned by the PCI PnP BIOS as it may cause resource conflict within your system.

3.2 I/O Registers Format

The PCI-7230/cPCI-7230/LPCI-7230/LPCIe-7230 requires one 32-bit address in the PC I/O address space. Table 3.1 shows the I/O address of each register with respect to the base address.

Address	Write	Read
Base (0 - 1)	Isolated DO	Isolated DI

Table 3-1: I/O Address Map of PCI-7230/cPCI-7230/LPCI-7230/LPCIe-7230

The PCI-7233 requires one 32-bit address in the PC I/O address space. Table 3.2 shows the address.

Address	Write	Read
Base (0 - 3)	--	Isolated DI

Table 3-2: I/O Address Map of PCI-7233

The PCI-7234/7234P requires one 32-bit address in the PC I/O address space. Table 3.3 shows the address.

Address	Write	Read
Base (0 - 3)	Isolated DO	--

Table 3-3: I/O Address Map of PCI-7234/7234P

CAUTION:



All the I/O ports above are 32-bit width.

8-bit or 16-bit I/O access is NOT allowed.

3.3 Digital Input Register

There is a total of 16 and 32 digital input channels on the PCI-7230/cPCI-7230/LPCI-7230/LPCIe-7230 and PCI-7233 respectively. Each bit corresponds to a signal on the digital input channel. IDI_16 to IDI_31 are only available on PCI-7233.

Address: BASE + 0 to BASE + 3

Attribute: read only

Data Format:

Bit	7	6	5	4	3	2	1	0
Base + 0	IDI_7	IDI_6	IDI_5	IDI_4	IDI_3	IDI_2	IDI_1	IDI_0
Base + 1	IDI_15	IDI_14	IDI_13	IDI_12	IDI_11	IDI_10	IDI_9	IDI_8
Base + 2	IDI_23	IDI_22	IDI_21	IDI_20	IDI_19	IDI_18	IDI_17	IDI_16
Base + 3	IDI_31	IDI_30	IDI_29	IDI_28	IDI_27	IDI_26	IDI_25	IDI_24

Table 3-4: Digital Input Register

Legend:

IDI_n: Isolated Digital Input CH n.

3.4 Digital Output Register

There is a total of 16 and 32 digital output channels on the PCI-7230/cPCI-7230/LPCI-7230/LPCIe-7230 and PCI-7234/7234P respectively. Each bit corresponds to a signal on the digital output channel. IDO_16 to IDO_31 are only available on PCI-7234/7234P.

Address: BASE + 0 to BASE + 3

Attribute: write only

Data Format:

Bit	7	6	5	4	3	2	1	0
Base + 0	IDO_7	IDO_6	IDO_5	IDO_4	IDO_3	IDO_2	IDO_1	IDO_0
Base + 1	IDO_15	IDO_14	IDO_13	IDO_12	IDO_11	IDO_10	IDO_9	IDO_8
Base + 2	IDO_23	IDO_22	IDO_21	IDO_20	IDO_19	IDO_18	IDO_17	IDO_16
Base + 3	IDO_31	IDO_30	IDO_29	IDO_28	IDO_27	IDO_26	IDO_28	IDO_24

Table 3-5: Digital Output Register

Legend:

IDO_n: Isolated Digital Output CH n.

4 Operation Theory

4.1 Isolated Digital Input Circuits

The isolated digital output is an open collector transistor output. The input can accept voltages of up to 24 V. The input resisters on PCI-7230/7233, cPCI-7230 and LPCI-7230/LPCIe-7230 are 1.2 KΩ. The connection between outside signal and PCI-7230/7233, cPCI-7230 and LPCI-7230/LPCIe-7230 are shown below.

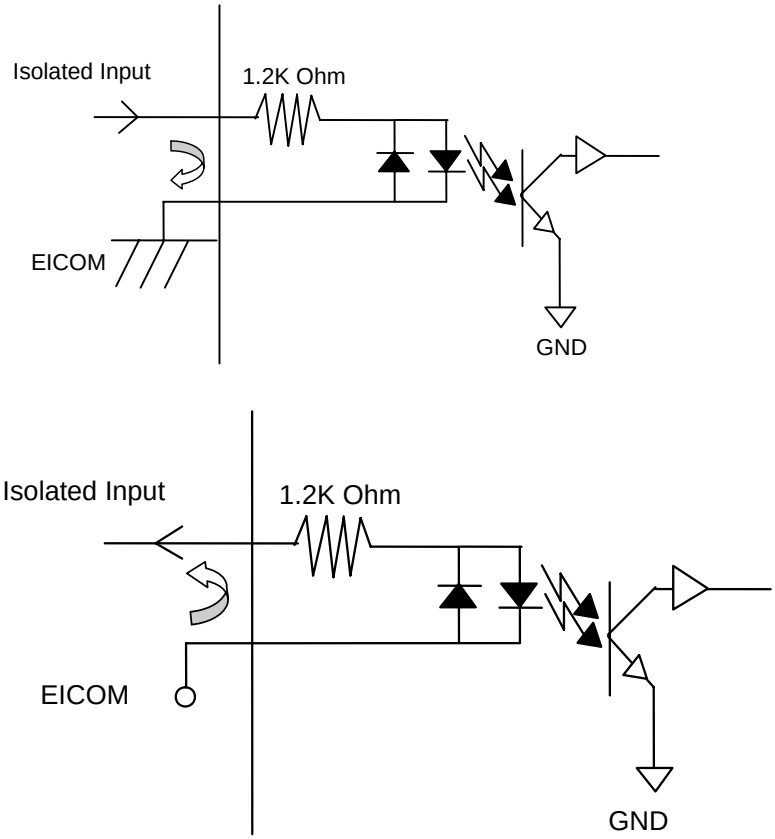


Figure 4-1: Input circuits of 7230 and 7233 series

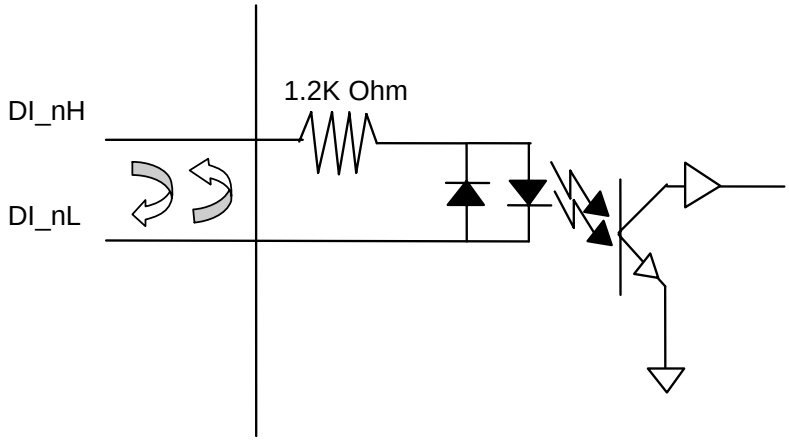


Table 4-1: Differential Input circuits of cPCI-7230/LPCI-7230/LPCIe-7230

4.2 Isolated Digital Output Circuits

On the 7230/7234 series, an external voltage source, minimum 5V, maximum 35 VDC, is necessary to power the internal isolated circuits. It is connected with the VDD pin, When the isolated digital output goes to high, the sink current will be from VDD.

On the 7230/7234 series, the VDD pin is used as a “fly-wheel” diode, which can protect the driver if the loading is inductance loading such as relay, motor, or solenoid.

The VDD must connect to the external power to form a fly-wheel current loop.

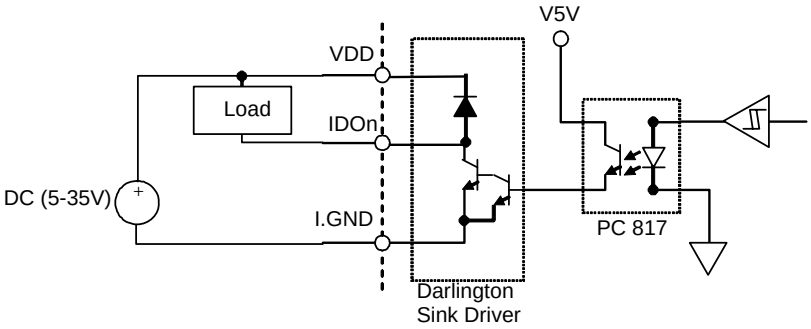


Figure 4-2: Isolate output circuits of PCI-7234 (sink current)

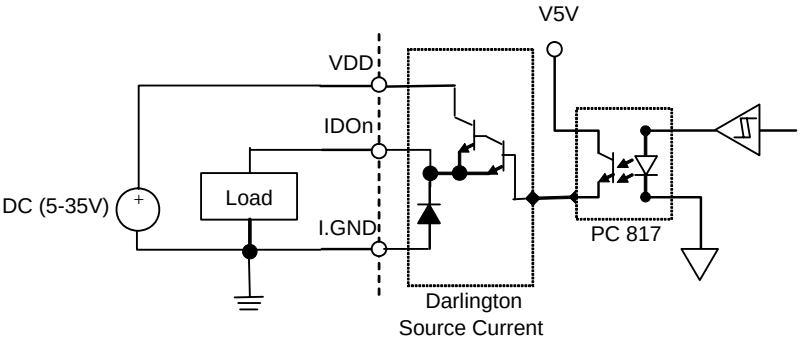


Figure 4-3: Isolate output circuits of PCI-7234P (source current)

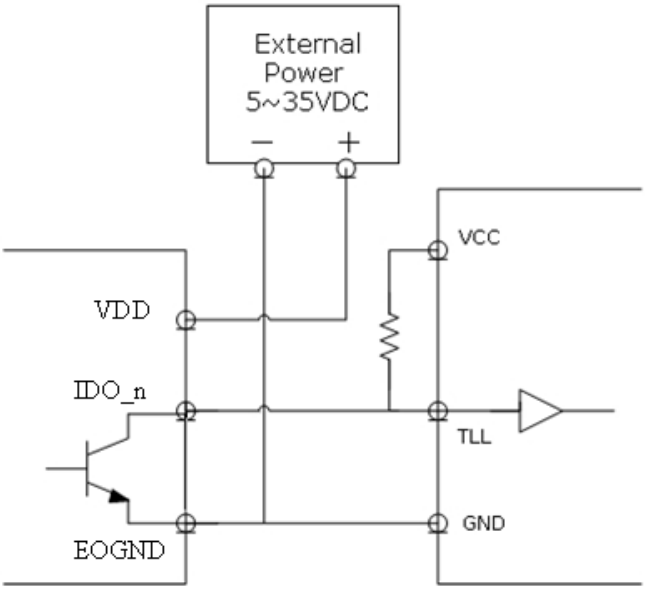


Figure 4-4: Isolation Output to TTL Input connection

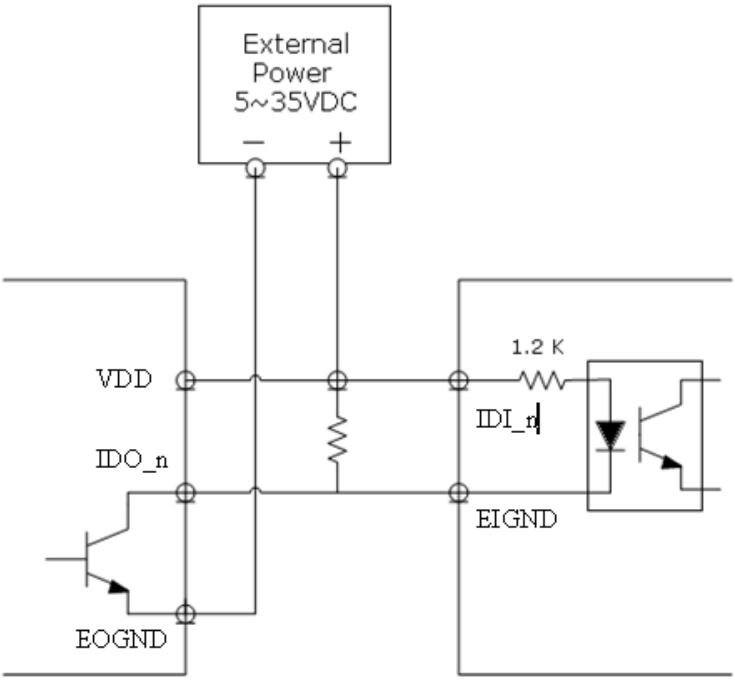


Figure 4-5: Isolation Output to Isolation Input connection

4.3 Change of State Detection

What is COS?

The COS (Change of State) occurs when the input state (logic level) is changed from low to high or from high to low. The COS detection circuit is used to detect the edge of level change. In the PCI-7233 card, the COS detection circuit is applied to all 32 channels input channels. If any channel is changed, the COS detection circuit generates an interrupt request signal.

Structure of COS detection and Dual Interrupt System

The dual interrupt system is used in PCI-7233. Dual interrupt occurs when the hardware can generate two interrupt request signals at the same time and the software can service these two requests with ISR. Note that dual interrupt does not mean the card occupies two IRQ levels. The two interrupt request signals (INT1 and INT2) come from COS detection output signal #1 and #2. The INT1 is inserted when any channel from 0 to 15 is changed. The INT2 is inserted when any channel between 16 to 31 is changed. The interrupt system is illustrated below.

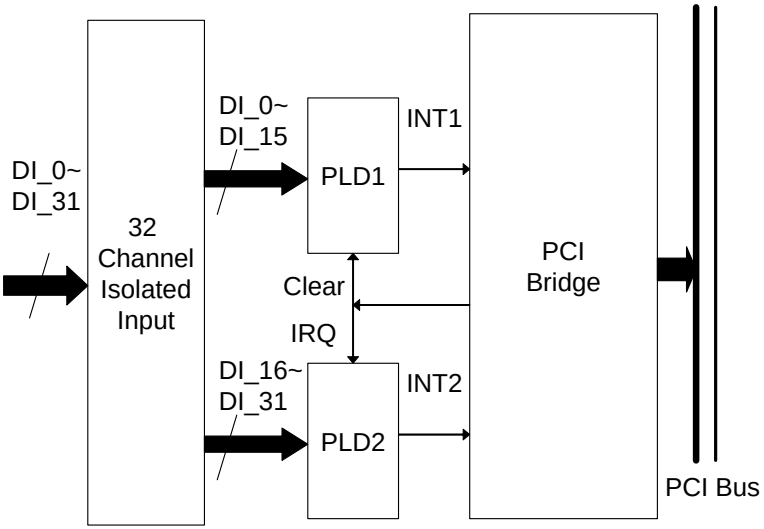


Figure 4-6: Dual Interrupt System of PCI-7233

COS Detection

The following timing is an example of the COS detection. Every DI signal's edge change can be detected. All the DI channels edge will be 'OR' together to generate the INT1 or INT2 IRQ signals.

If INT1 or INT2 irq Signals generate, the signal will be latch its state. The user can use the "_7233_CLR_IRQ" function to clear, INT1, or INT2 IRQ signal state.

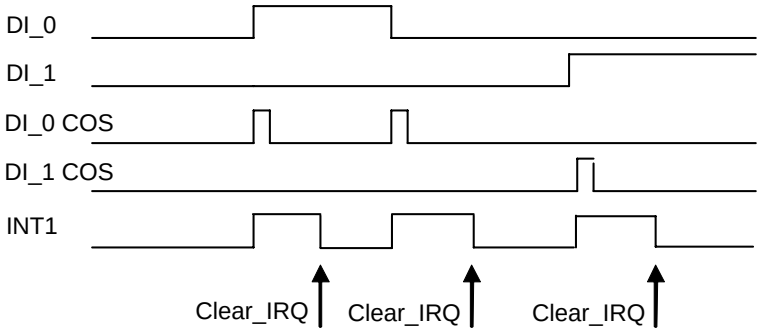


Figure 4-7: Example of COS detection

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