PCI-/cPCI-/LPCI-/ LPCIe-725X Series

8-CH Relay Output &
8-CH Isolated Digital Input Cards

User's Manual

Manual Rev. 2.03

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Recycled Paper

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1 Introduction

The PCI-7250/7251, cPCI-7252, LPCI-7250 and LPCIe-7250 8-CH Relay Output & 8-CH Isolated Digital Input Cards are basic Digital I/O cards for PCI bus compliant computers used in industrial applications.

This PCI-7250/7251 provide 8 relay actuators and 8 opto-isolated digital inputs. Of the eight relays, four are Form C (R0~R3) and four are Form A (R4~R7). The cPCI-7252 provides 8 relay actuators and 16 opto-isolated digital inputs; all relays are Form C. The LPCI-7250 and LPCIe-7250 provide 8 relay actuators and 8 opto-isolated digital inputs; all relays are Form C. They are very suited for constant ON/OFF control devices. For convenience the above models will be referred to as PCI-725X in this manual.

All digital input channels are isolated and suitable applications in noisy environment. For identical non-polarized opto-isolated digital input channels, switching can be carried out using AC-filtered or non-AC-filtered channels.

PCI-7250 is equipped with LEDs to reflect the status of each relay output. When a relay is energized, its corresponding LED will turn ON, otherwise it is OFF.

The relay outputs and digital inputs are controlled by two bytes of I/O addresses. When a bit is read or written, its output status will be controlled, or its input status will be monitored. The I/O signals are routed through to a 37-pin D-type or a 50-pin SCSI-II connector.

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1.1 Features

The PCI-725X Relay Actuator and D/I cards provide the following advanced features:

- 32-bit PCI-Bus, Plug and Play (PCI-7250, LPCI-7250)
- 32-bit CompactPCI® Bus, Plug and Play (cPCI-7252)
- 8 relay actuator outputs
- 8 opto-isolated digital inputs (PCI-7250, LPCI-7250, LPCIe-7250)
- x1 lane PCI Express Interface (LPCIe-7250)
- 16 opto-isolated digital inputs (cPCI-7252)
- Onboard LED indicators to show energized relays
- Jumper selectable AC-filter/non-AC-filter input signals
- On-board relay driving circuits
- On-board digital input signal conditioning circuits

Note: PCI-7251 is the extension module of the PCI-7250. Each PCI-7251 card provides an additional 8 relay outputs and 8 photo isolated inputs. Up to three PCI-7251 cards can be attached to one PCI-7250 card to provide 32 relay outputs and 32 photo isolated inputs.

1.2 Applications

- Industrial ON/OFF control
- External high power relay driving signal switching
- Laboratory automation
- Industrial automation
- Switch contact status sensing, limit switch monitoring,
- Useful with A/D and D/A cards to implement a data acquisition & control system

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1.3 Specifications

Digital input

Input channels	8 for PCI-7250, PCI-7251, LPCI-7250 and LPCIe-7250 16 for cPCI-7252
Photo-coupler	PC-814 (for PCI-7250, PCI-7251 and cPCI-7252) PC3H4 (for LPCI-7250 and LPCIe-7250)
Input current	10 mA rated 60 mA max for isolated input
Input Voltage	Up-to 24 VDC or 24 VAC 50-1,000 Hz Logic Low: 0-1.5 V Logic High 5-24 V
Input impedance	2.2 KΩ
Input mode	Isolation AC-filter/ Non-AC-filter
Isolated voltage	5000 Vrms channel-to-system (PCI-7250,PCI-7251 and cPCI-7252) 2500 Vrms channel-to-system (LPCI-7250, LPCIe-7250)

Table 1-1: Digital Input Specifications

Relay Output

Output channels	8
Relay type	4 SPDT (From C) & 4 SPST (Form A) for PCI-7250 and PCI-7251 8 SPDT (From C) for cPCI-7252, LPCI-7250, and LPCIe-7250
Contact rating	PCI-7250/7251, cPCI-7252 ▶ AC: 120 V @ 0.5 A ▶ DC: 24 V @ 1 A LPCI-7250, LPCIe-7250 ▶ DC: 30 V @ 2 A
Breakdown voltage	1000 V AC/DC min..
Release time	8msec typical
Operate time	8msec typical
Contact resistance	100 mΩ
Insulation resistance	1,000 MΩ min.

Table 1-2: Relay Output Specifications

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Life expectancy	PCI-7250/7251, cPCI-7252: ▶ >5x10^5 operations @ 1 A, 24 VDC ▶ >2x10^5 operations @ 0.5 A, 120 VAC LPCI-7250/LPCIe-7250: ▶ >10^5 operations @ 2 A, 30 VDC ▶ >5x10^5 operations @ 1 A, 30 VDC
LED indicators	Monitor ON/OFF status of each relay
Coil Voltage	+5V, 33 mA for each relay, total 0.264 A
Power supply of Relay	+5 V from the PCI-Bus (PCI-7250/7251, cPCI-7252, LPCI-7250) +5 V from PWM switcher output (LPCIe-7250)

Table 1-2: Relay Output Specifications

General Specifications

Dimensions	▶ 162mm x 107mm for PCI-7250 ▶ 141mm x 102mm for PCI-7251 ▶ 160mm x 100mm for cPCI-7252 ▶ 120mm x 65mm for LPCI-7250 ▶ 120 mm x 69 mm for LPCIe-7250
Bus	32-bit PCI bus
Operating temperature	0 - 60ºC (Operating)
Storage temperature	-20ºC - 80ºC (Operating)
Humidity	5 to 90% non-condensing

Table 1-3: General Specifications

Power Consumption

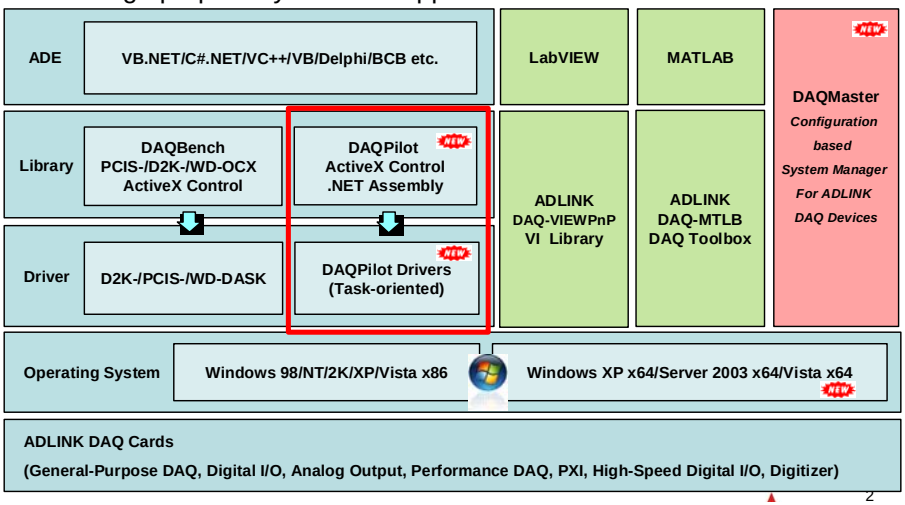
Power Consumption	Note: No relay is energized
PCI-7250	+5V @ 140mA
PCI-7251	+5V @ 125mA
cPCI-7252	+5V @ 120mA
LPCI-7250	+5V @ 200mA
LPCIe-7250	+3.3V @ 280 mA +12 V @ 180 mA

Table 1-4: Power Consumption Specifications

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1.4 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 LabVIEW® and MATLAB®. In addition, ADLINK also provides ActiveX componentware for measurement and SCADA/HMI, and break-through proprietary software applications.



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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

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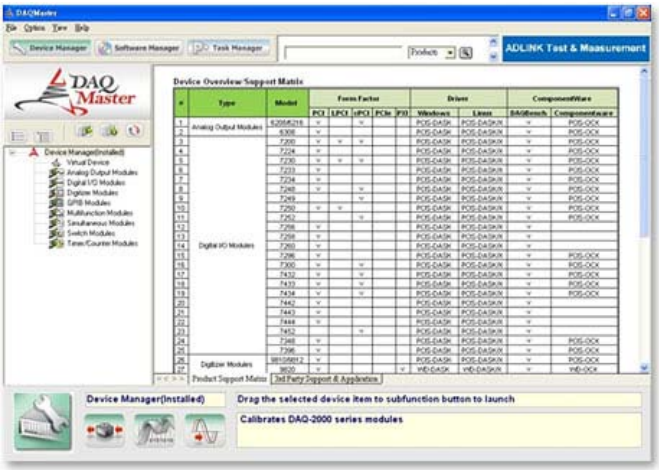
immediately program ADLINK DAQ modules and integrate tasks to their own DAQ applications.

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.

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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

DAQPilot
Task-oriented DAQ driver

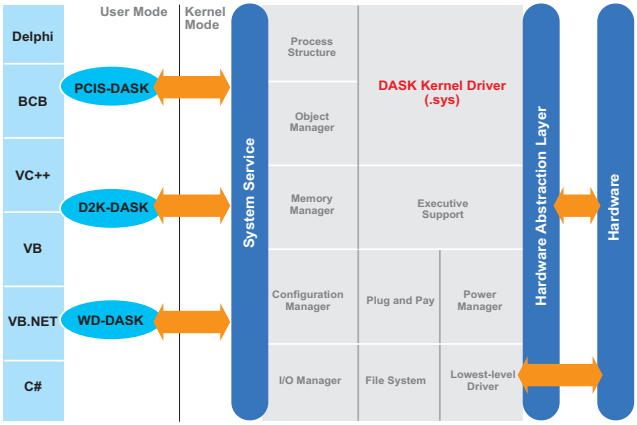
DAQ Master
Configuration-based device manager

ADLINK TECHNOLOGY INC.
www.adlinktech.com/TM

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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.

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

Note: Please use PCIS-DASK with the LPCI-7250 and LPCIe-7250

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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-7250 and LPCIe-7250

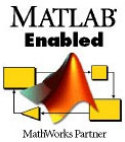
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Third-party Software Support

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.



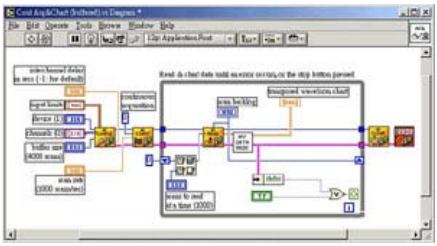
- Directly control scores of ADLINK DAQ cards that come in different form factors including PCI Express®, PCI, cPCI, and PXI
- Compliant with MATLAB DAQ Toolbox 2.2 or higher (now at R2007a)
- Critical updates and support are available as ADLINK is now a MathWorks Connections Program partner
- ADLINK 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

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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.

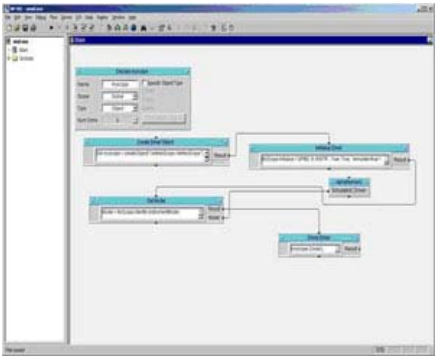
The DAQ-LVIEW PnP is designed and verified for LabVIEW 7.0, and is compatible with LabVIEW 6.5, 7.1, 8.0, 8.2 and 8.5.

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

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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

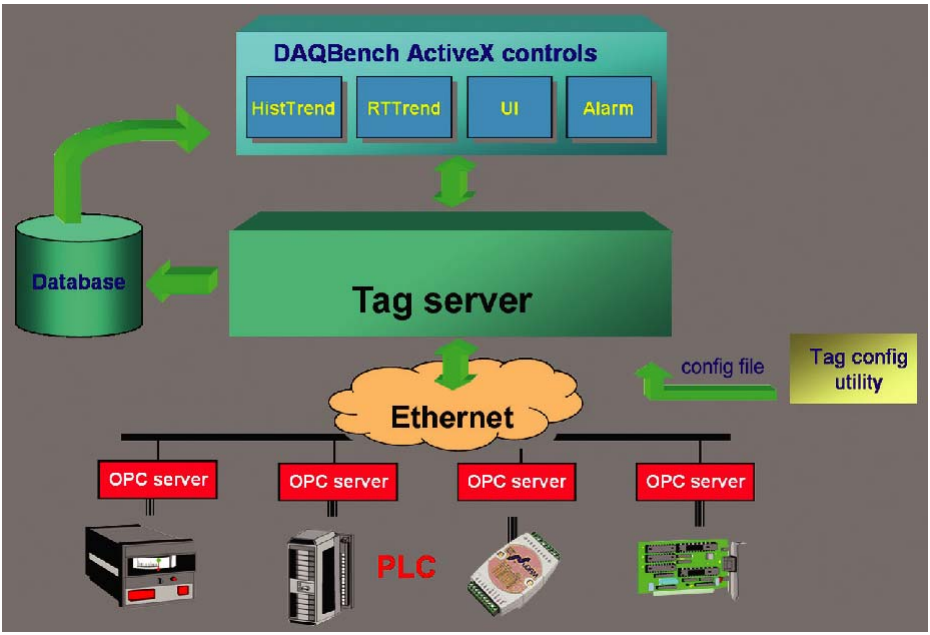
The ADLINK PCIS-VEE and D2K-VEE drivers are designed and verified for Agilent VEE 4.5 environment.

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Componentware/ActiveX Control

32-Bit ActiveX Controls for Measurement and SCADA/HMI

DAQBench (.\Software Package\DAQBench)



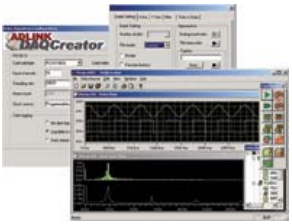
DAQBench is a specialized ActiveX control package designed for 32-bit measurement and SCADA/HMI applications. DAQBench leverages the power of the latest Microsoft ActiveX technology - the standard for code interchangeability and integration under various Windows platform. With DAQBench, programmers can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

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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

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

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2 Installation

This chapter describes how to install and setup the 725X cards. Jumper settings for the digital input channel configurations (AC-filter or Non-AC-filter) and the signal definitions of the 37-pins connectors are also specified.

2.1 Unpacking Checklist

Check the shipping carton for any damage. If the shipping carton and contents are damaged, notify the dealer for a replacement. Retain the shipping carton and packing materials for inspection by the dealer. Obtain authorization before returning any product to ADLINK.

Check the following items are included in the package, if there are any items missing, please contact your dealer:

Included Items

- PCI-7250 (or PCI-7251, cPCI-7252, LPCI-7250, LPCIe-7250) Relay Actuator & Isolated D/I Card
- ADLINK CD (for PCI-7250, cPCI-7252, LPCI-7250, and LPCIe-7250)
- Software Installation Guide
- This User's Manual

Note: The packaging of OEM versions with non-standard configuration, functionality, or package may vary according to different configuration requests.

CAUTION: The boards must be protected from static discharge and physical shock. Never remove any of the socketed parts except at a static-free workstation. Use the anti-static bag shipped with the product to handle the board. Wear a grounded wrist strap when servicing

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2.2 PCB Layout

PCI-7250 PCB Layout

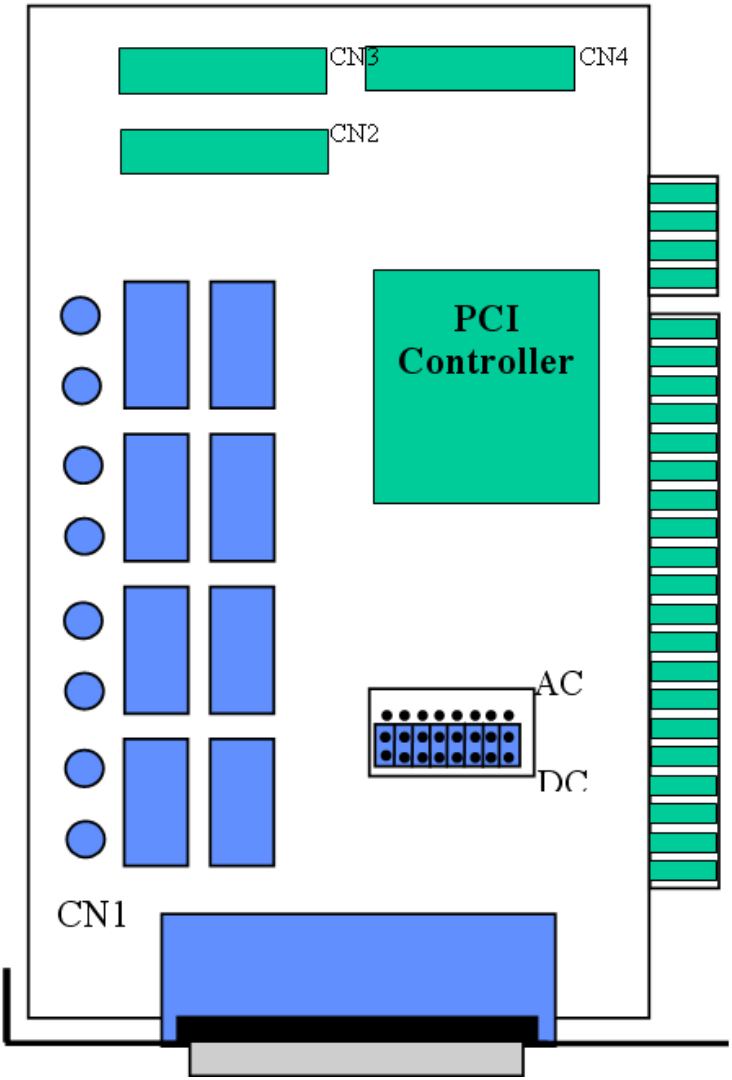


Figure 2-1: PCI-7250 Layout

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cPCI-7252 PCB Layout

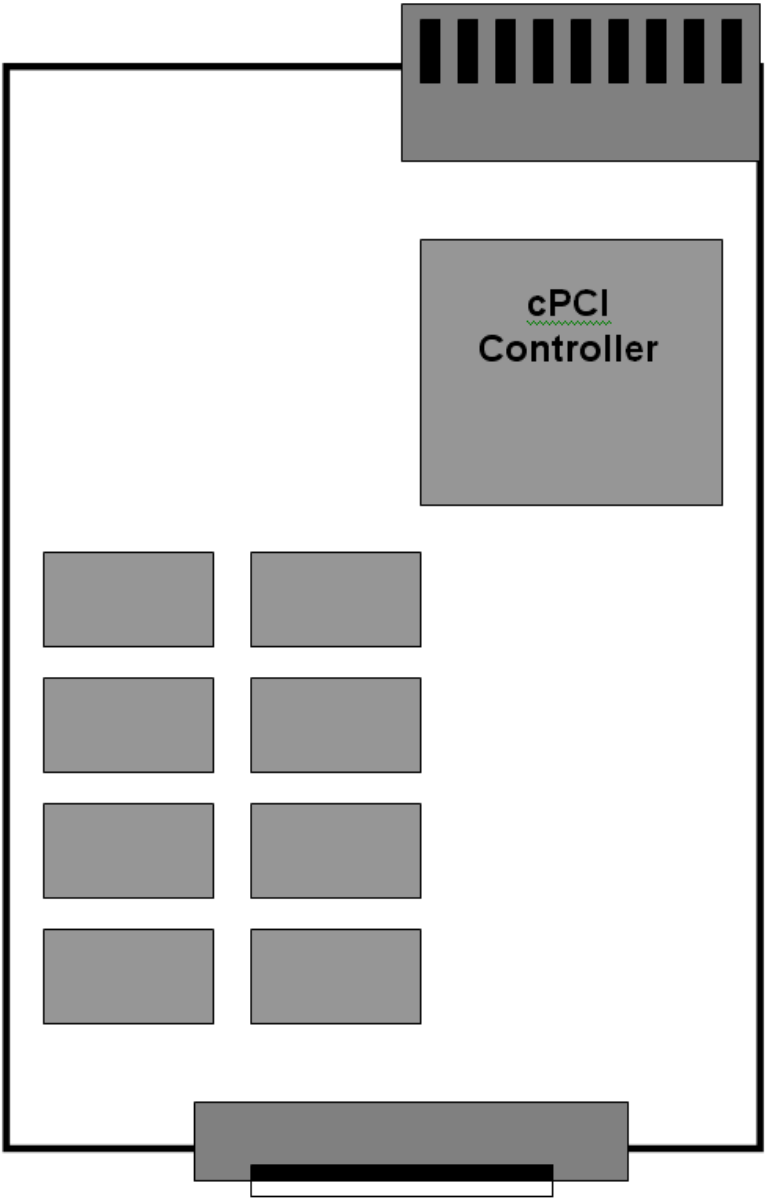


Figure 2-2: cPCI-7252 Layout

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LPCI-7250 PCB Layout

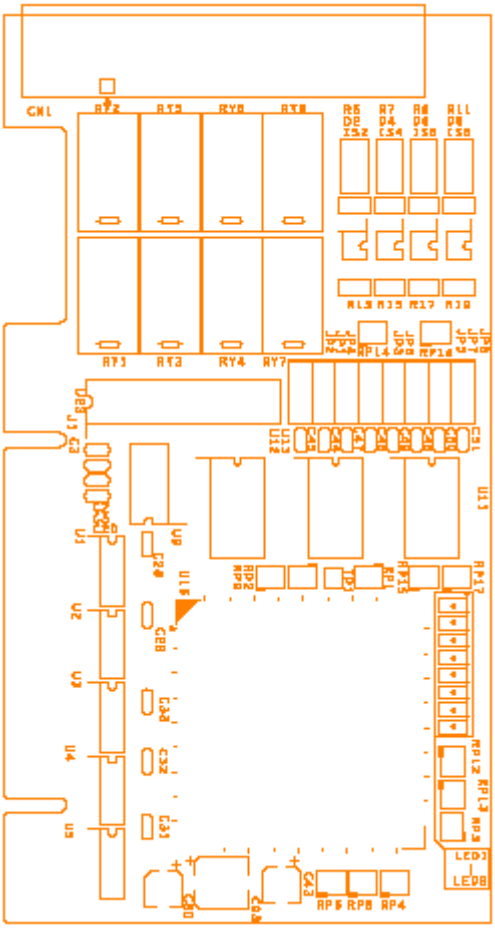


Figure 2-3: LPCI-7250 PCB Layout

LPCIe-7250 PCB Layout

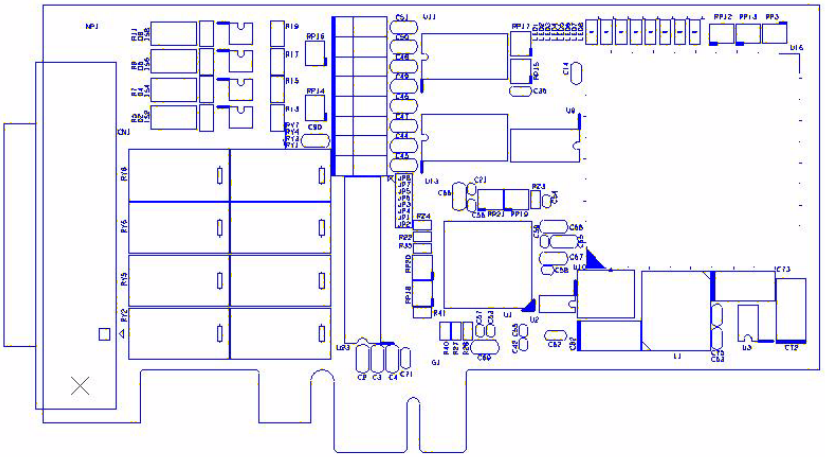


Figure 2-4: LPCIe-7250 PCB Layout

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2.3 Input Signal Jumper Setting

Note: This section is for PCI-7250, PCI-7251, LPCI-7250, and LPCIe-7250 only.

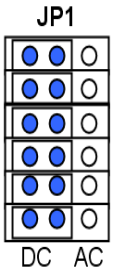
There are 8 jumpers (JP1 to JP8) on the PCI-7250, PCI-7251, LPCI-7250 and LPCIe-7250; each associated with one digital input to configure that channel as either AC-Filtered or Non-AC-Filtered. Digital input channels and corresponding jumpers are listed in the table below

JUMPER	INPUT SIGNAL
JP1	DI0
JP2	DI1
JP3	DI2
JP4	DI3
JP5	DI4
JP6	DI5
JP7	DI6
JP8	DI7

Table 2-1: Jumpers and DI Channels

The default setting for the input signal selection is Non-AC-Filter (DC signal input), which is shown as below:

JP1



Input Signal Selection	Non-AC-Filter (DC Signal)	AC-Filter (AC Signal)
Jumper JP1 - JP8	2-3	1-2

Table 2-2: Input Signal Selection Jumper Settings

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2.4 Hardware Installation Outline

PCI Configuration

PCI cards (or CompactPCI cards) are equipped with plug and play PCI controllers which can request base addresses and interrupts according to the PCI standard. The system BIOS will assign the system resources based on the PCI card configuration registers and system parameters (which are set by the system BIOS). Interrupt assignment and memory usage (I/O port locations) can only be assigned by the system BIOS. These system resource assignments are done on a board-by-board basis. It is not suggested to assign the system resource by any other methods.

PCI Slot Selection

The PCI card can be inserted into any PCI slot without any configuration of the system resources. The CompactPCI card can also be inserted into any CompactPCI I/O slot.

Installation Procedures

1. Turn off your computer
2. Turn off all accessories (printer, modem, monitor, etc.) connected to your computer.
3. Remove the cover from your computer.
4. Setup jumpers on the PCI or CompactPCI card.
5. Select a 32-bit PCI slot. PCI slot are shorter than ISA or EISA slots, and are usually white or ivory.
6. 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.
7. Position the board into the PCI slot you selected.
8. Secure the card in place at the rear panel of the system.

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2.5 Device Installation for Windows Systems

Once Windows Vista/XP/2003/2000 has started, the Plug and Play functions of the Windows system will find and locate the new NuDAQ/NuIPC card. If this is the first time a NuDAQ/NuIPC card is installed in your Windows system, you will be prompted to input the device information source. Please refer to the “Software Installation Guide” for installation procedures for the device drivers.

2.6 Connector Pin Assignments

PCI-7250/51 Pin Assignment

The PCI-7250 card comes equipped with a 37-pin D type connector (CN1) accessible from the rear of the card. The pin assignment of the D type connector is shown in below.

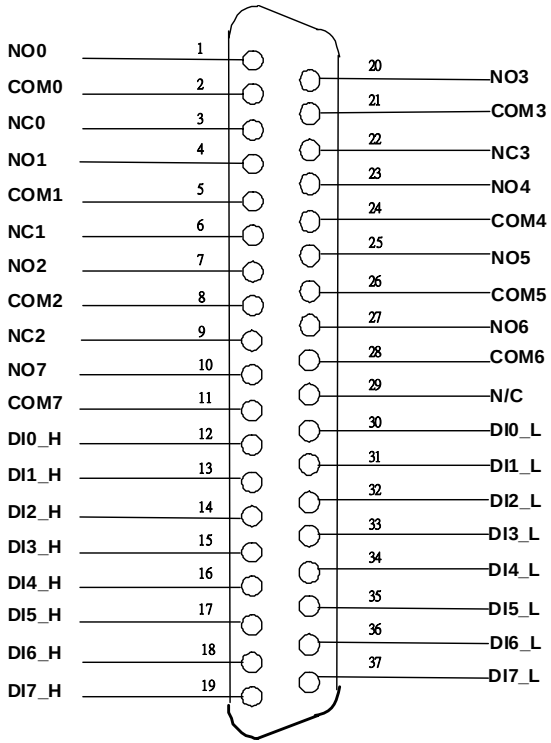


Figure 2-5: CN1 - D Type Connector

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Legend	
Din:	Digital input low, channel n (input signal Is not polarity sensitive)
NC n:	Normal close pin of relay n
NO n:	Normal open pin of relay n
COM n:	Common pin of relay n
N/C:	No connection

Table 2-3: CN1 - PCI-7250/51 Pin Assignment

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cPCI-7252 Pin Assignment

Signal	Pin	Pin	Signal
IGND	1	26	IGND
DI8	2	27	DI12
DI9	3	28	DI13
DI10	4	29	DI14
DI11	5	30	DI15
DI0L	6	31	DI4H
DI0H	7	32	DI4L
DI1L	8	33	DI5H
DI1H	9	34	DI5L
D2IL	10	35	DI6H
DI2H	11	36	DI6L
DI3L	12	37	DI7H
DI3H	13	38	DI7L
NO0	14	39	NO5
NO1	15	40	NO4
COM0	16	41	COM5
COM1	17	42	COM4
NC0	18	43	NC5
NC1	19	44	NC4
NO2	20	45	NO7
NO3	21	46	NO6
COM2	22	47	COM7
COM3	23	48	COM6
NC2	24	49	NC7
NC3	25	50	NC6

Table 2-4: CN1 - cPCI-7252 Pin Assignment

Legend	
Din:	Digital input channel n
IGND:	Ground of DIn signals
DinH:	Digital input channel n with positive polarity
DinL:	Digital input channel n with negative polarity
NC n:	Normal close pin of relay n
NO n:	Normal open pin of relay n
COM n:	Common pin of relay n

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LPCI/LPCIe-7250 CN1 Pin Assignment

Signal	Pin	Pin	Signal
NO0	1	26	NO4
COM0	2	27	COM4
NC0	3	28	NC4
NO1	4	29	NO5
COM1	5	30	COM5
NC1	6	31	NC5
NO2	7	32	NO6
COM2	8	33	COM6
NC2	9	34	NC6
NO3	10	35	NO7
COM3	11	36	COM7
NC3	12	37	NC7
N/C	13	38	N/C
N/C	14	39	N/C
N/C	15	40	N/C
N/C	16	41	N/C
N/C	17	42	N/C
IDI_0H	18	43	IDI_0L
IDI_1H	19	44	IDI_1L
IDI_2H	20	45	IDI_2L
IDI_3H	21	46	IDI_3L
IDI_4H	22	47	IDI_4L
IDI_5H	23	48	IDI_5L
IDI_6H	24	49	IDI_6L
IDI_7H	25	50	IDI_7L

Table 2-5: LPCI/LPCIe-7250 CN1 Pin Assignment

Legend	
Din:	Digital input channel n
IGND:	Ground of DIn signals
DinH:	Digital input channel n with positive polarity
DinL:	Digital input channel n with negative polarity
NC n:	Normal close pin of relay n
NO n:	Normal open pin of relay n
COM n:	Common pin of relay n

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2.7 PCI-7250 and PCI-7251 Connection

There are 8-relay outputs and 8-isolation inputs on both the PCI-7250 and PCI-7251. The PCI-7251 is used as an expansion for the PCI-7250. The operations of the PCI-7251 are the same as that of the PCI-7250. There can be at most 3 PCI-7251 expansion boards to one PCI-7250. Therefore, the PCI-7250 can control up to 32 relays and detect 32 input signals.

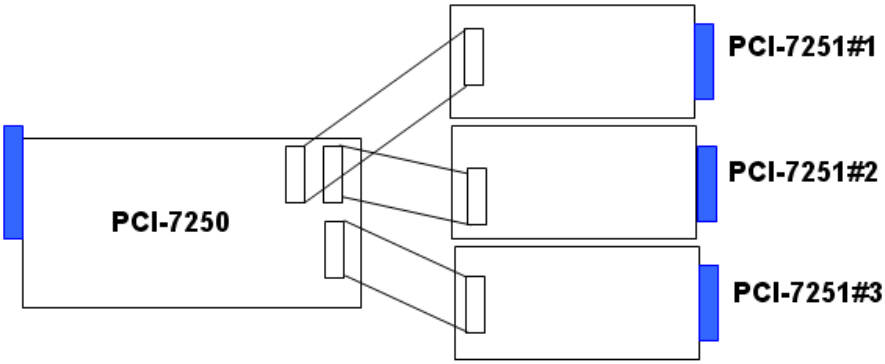


Figure 2-6: Connection between PCI-7250 and PCI-7251

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3 Registers

Detailed descriptions of the registers are specified in this chapter. This information is useful for programmers who wish to control the card with low-level programming. However, we suggest users fully understand the PCI interface before starting any low-level programming. In addition, the contents of this chapter will also help users understand how to use the software drivers to configure 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 725X registers.

The PCR, which is PCI-bus specification compliant, is initialized and controlled by the Plug and Play (PnP) PCI BIOS. Users may obtain more information on the PCI BIOS specification to better understand the operation of the PCR. Please contact PCISIG to acquire PCI interface specifications.

The PCI bus controller PCI-9050 is provided by PLX Technology Inc. (www.plxtech.com). For more information about the LCR, please visit PLX Technology's web site to download relative information. It is not necessary for users to fully understand the details of the LCR if the software library provided is used. The PCI PnP BIOS assigns the base address of the LCR. The assigned address is located at an offset of 14h from the PCR.

The 725X registers are discussed in the next section. The base address, which is also assigned by the PCI PnP BIOS, is located at an offset of 18h from the PCR. Therefore, users can read the address 18h from the PCR to obtain its base address by using the BIOS function call. Do not attempt to modify the base address and interrupt that have been assigned by the PCI PnP BIOS, it may cause resource conflicts with your system.

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3.2 I/O Address Map

All 725X registers are 8 bits long. Users can access these registers using 8-bit I/O instructions. Using these registers will allow the relays and status of the inputs to be controlled. The following table shows the registers address map, including descriptions and their offset addresses relative to the base address. If the PCI-7251 expansion boards are not installed, corresponding registers have no significance.

Offset	Write	Read	Board
0	Relay Output	Output readback	PCI-7250
1	Not used	Isolation Input	
2	Relay Output	Output readback	PCI-7251 #1
3	Not used	Isolation Input	
4	Relay Output	Output readback	PCI-7251 #2
5	Not used	Isolation Input	
6	Relay Output	Output readback	PCI-7251 #3
7	Not used	Isolation Input	

Table 3-1: PCI-7250 Address Map with PCI-7251 Installed

Offset	Write	Read	Board
0	Relay Output	Isolation Input	cPCI-7252
1	Not used	Not used	
2	Not used	Output readback	

Table 3-2: cPCI-7252 Address Map

Offset	Write	Read	Board
0	Relay Output	Output readback	LPCI-7250/ LPCIe-7250
1	Not used	Isolation Input	

Table 3-3: LPCI/LPCIe-7250 Address Map

3.3 Relay Output and Readback Registers

There are 8 relays on each PCI-7250/7251, LPCI-7250, LPCIe-7250, and cPCI-7252 board. Each relay is controlled by one bit in the control register. Bit value ‘0’ means the relay is not energized.

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The normal open signal line is ‘open’. Bit value ‘1’ means the relay is energized and the normal open signal line is now closed.

The initial bit values of the control register are all ‘0’ and the status of the relay can be readback from the readback register. If the relay is open, the corresponding bit value read is ‘0’. If the relay is closed, the bit value read is ‘1’.

Bit	7	6	5	4	3	2	1	0
Relay Output	DO7	DO6	DO5	DO4	DO3	DO2	DO1	DO0
Output Readback	RB7	RB6	RB5	RB4	RB3	RB2	RB1	RB0

Table 3-4: Data Format of Relay Output and Readback Status Registers

3.4 Isolation Input Registers

There are 8 isolated input channels on the PCI-7250 / 7251 board. The status of the 8 channels can be read from the isolation input register. Each bit corresponds to each channel. Bit value “1” means input voltage is high and “0” means input voltage is low.

Bit	7	6	5	4	3	2	1	0
Iso. Input	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0
Bit	15	14	13	12	11	10	9	8
Iso. Input	DI15	DI14	DI13	DI12	DI11	DI10	DI9	DI8

Table 3-5: Relay Output

Note: Bits 8-15 are for cPCI-7252 only

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4 Operation Theory

4.1 Using Relay Output

The PCI-7250/7251 contains two types of relays: Form C and Form A. Relays R0 - R3 are form C relays, and R4 - R7 are plain form A type. Note that the LPCI-7250, LPCIe-7250, and cPCI-7252 contain Form C relays only. The differences between these two types of relays are:

1. Form C Relay: (R0 - R3)

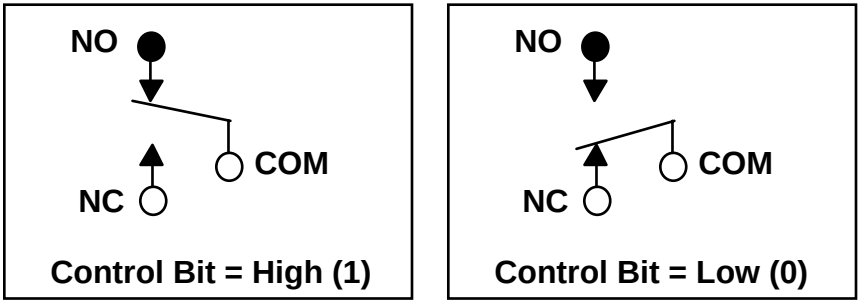


Figure 4-1: Form C Relay

Form C type relays have three contacts: NC (Normal Close), NO (Normal Open), and COM (Common). The COM post, located at the middle, must make contact with either the NO post or NC post. When the control bit is high (1), there is contact between the COM post and NO post. If the control bit is low (0), there is contact between the COM post and NC post.

In normal power-up and reset, the relay is in **low** status.

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2. Form A Relay: (R4 - R7)

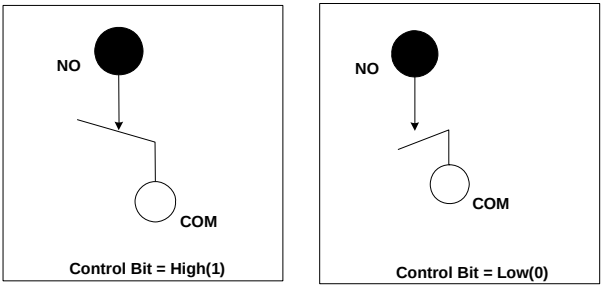


Figure 4-2: Form A Relay

Form A relay only has two contacts: NO (Normal Open) and COM (Common). The COM post can make contact either with the NO post or not. When the control bit is high (1), the COM post and NO post are contacted. If the control bit is low (0), the COM post and NO post does not make contact.

In normal power-up and reset, the relay is in **low** status.

The relay output contacts are rated at a maximum of 0.5 at 120 VAC (resistive), 1 A 24 VDC, or 0.3 A 60 VDC. You should reduce these ratings for inductive loads. For more information on relay contact, please refer to the Appendix.

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4.2 Using Isolated Input

The PCI-7250 (or PCI-7251) contains 8 identical opto-isolated control input channels. The circuit diagram of the differential input channel is shown below.

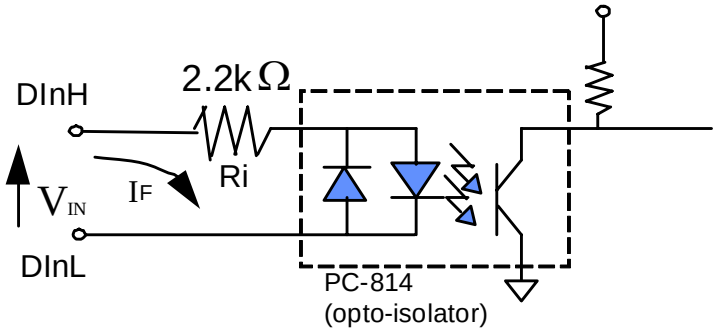


Figure 4-3: PCI-7250 Differential Input Circuit

The digital input is first routed through a photo-coupler (PC-814), which is shown in the following diagram.

The cPCI-7252 contains 16 identical opto-isolated control input channels. The circuit diagram of the differential input signals of channel number 0-7 are the same as of the PCI-7250. While the input signals for channel numbers 8-15 are isolated inputs, the connection is not polarity sensitive whether AC or DC voltage is used.

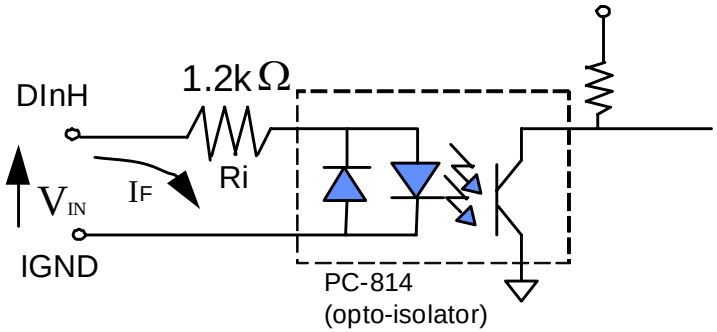


Figure 4-4: cPCI-7252 Isolated Input Circuit

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The LPCI-7250 and LPCIe-7250 contain 8 identical opto-isolated control input channels through PC3H4 photo-coupler. The circuit is shown as the following diagram:

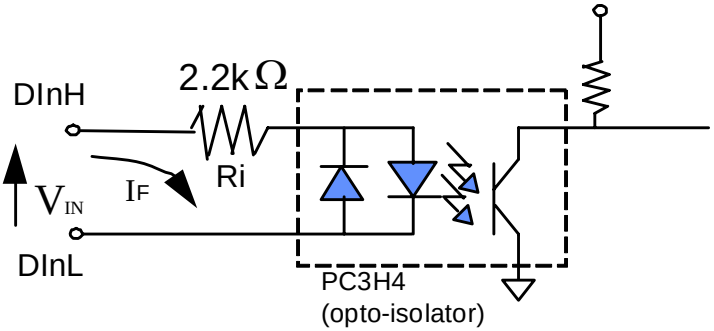


Figure 4-5: LPCI/LPCIe-7250 Differential Input Circuit

In addition, a single-pole filter with a time constant of about 5ms is used to filter AC inputs passing through.

The normal input voltage range for an active high state is 3 to 24 VAC or DC. The normal input range can be extended by changing the resister (Ri) to limit the current (IF) through the PC-814 (opto-isolator to about 10 mA). The exact resister value to replace the original resister Ri (1.2 KΩ) can be calculated by the following formula.

```
Vin = IF x Ri
Pw = Vin x IF
```

For example, if the input voltage is 110V, then the Ri should be replace by

```
Ri = 110 (V) / 0.01 (A)  = 11 KΩ
Pw = 110 (V) X 0.01 (A)  = 1.1 W
```

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Appendix

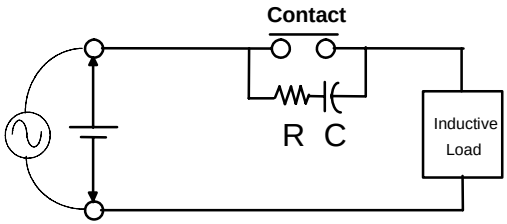
Relay Contact Protection Circuits

The contacts are the most important elements of a relay construction, Contact performance conspicuously influenced by contact material, and voltage and current values applied to the contacts.

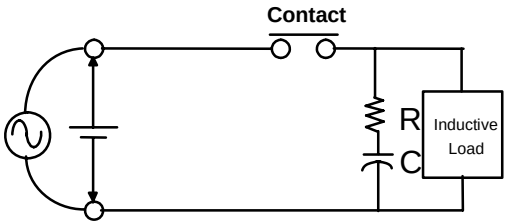
Another important issue is contact protection; the right contact protection circuit can suppress the counter EMF to a low level. However, note that incorrect use will result in an adverse effect. Typical contact protection circuits are given below:

RC Circuit

This circuit is suitable for DC applications. If the load is a timer, leakage current flow through the RC circuit may cause faulty operation.



The circuit below is suitable for both DC and AC applications. If the load is a relay or solenoid, the release time is lengthened. Effective when connected to both contacts if the power supply voltage is 24V or 48V and the voltage cross the load is 100 to 200V.



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Device Selection:

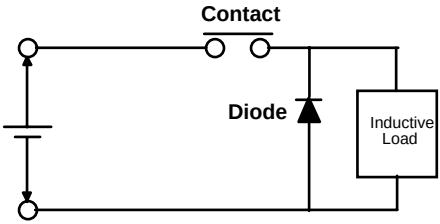
As a guide in selecting R and C,

- R: 0.5 to 1Ω per 1V contact voltage
- C: 0.5 to 1μF per 1A contact current

Values vary depending on the properties of the capacitor C acting to suppress the discharge the moment the contacts open. Resistor R acts to limit the current when the power is turned on. Test to confirm. Use a capacitor with a breakdown voltage of 200 to 300V. Use AC type capacitors (non-polarized) for AC circuits.

Diode Circuit

This circuit is suitable for DC applications. The diode connected in parallel causes the energy stored in the coil to flow to the coil in the form of current and dissipates it as joule heat at the resistive component of the inductive load. This circuit further delays the release time compared to the RC circuit.



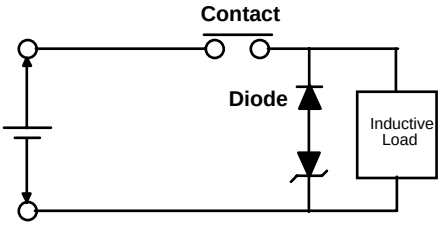
Device Selection:

Use a diode with a reverse breakdown voltage of at least 10 times the circuit voltage and a forward current at least as large as the load current.

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Diode & Zener diode Circuit

This circuit is also suitable for DC application. Effective when the release time i in the diode circuit is too long.

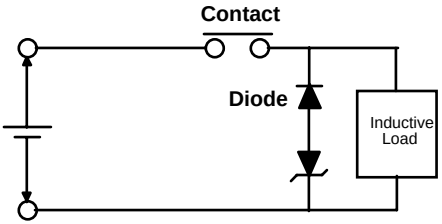


Device Selection:

Use a zener diode with a zener voltage about the same as the power supply voltage.

Varistor Circuit

This circuit is also suitable for both AC & DC applications. Using the stable voltage characteristics of the varistor, this circuit prevents excessively high voltages from being applied across the contacts. This circuit also slightly delays the release time. Effective when connected to both contacts if the power supply voltage is 24V or 48V and the voltage cross the load is 100 to 200V.



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