

PCI-7224/7248/7296

24 / 48 / 96-bit Parallel

Digital I/O Card

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How to Use This Guide

This manual is designed to help you use the PCI-7248/96. It describes how to modify and control various functions on the PCI-7248/96 card to meet your requirements. It is divided into three chapters:

- Chapter 1, "Introduction," gives an overview of the product features, applications, and specifications.
- Chapter 2, "Installation," describes how to install the PCI-7248/96. The layout of PCI-7248/96 are shown, the jumper settings, the connectors specifications, and the notes for installation are described.
- Chapter 3, "Operation Theorem" describes more details about the versatile functions, including DIO, timer / counter, and interrupt systems.
- Chapter 4, "Software Library" specifies the software library of C language under DOS environment that makes you can operate the functions on this card easily.

Introduction

The PCI-7248 and PCI-7296 are multi-functions digital I/O board used for industrial PC with PCI bus. The PCI cards are plug and play therefore it is not necessary to set any jumper for matching the PC environment. PCI-7248 is a 48-bit Parallel DIO card and PCI-7296 is an 96-bit parallel DIO card.

The PCI-7248 emulates two industry standard mode zero configuration of 8255 Programmable Peripheral Interface (PPI) chips. The PCI-7296 emulates four PPI chips. These two cards are compatible not only on hardware connectors but also on software programming. This manual is used to lead users to know how to operate these two cards.

Every PPI connector offers 3 ports: PA, PB, and PC. The PC can also be subdivided into 2 nibble-wide (4-bit) ports - PC Upper and PC Low. Two and four 50-pin male ribbon connectors come equipped with the PCI-7248 and PCI-7296. Each connector is corresponding to one PPI chip with 24 DIO points.

The PCI-7248/96 is programmed using the ADLink's software library. The programming of these PCI cards is as easy as AT bus add-on cards.

1.1 Features

The PCI-7248/96 Multi-functions Digital I/O Boards provide the following advanced features:

1.1.1 Digital I/O Ports

- 48 or 96 TTL/DTL compatible digital I/O lines
- Emulates two/four industry standard mode 0 of 8255 PPI
- Buffered circuits for higher driving
- Direct interface with OPTO-22 compatible I/O module
- Output status readback

1.1.2 Timer / Counter and Interrupt System

- A 32 bits timer to generate watchdog timer interrupt
- A 16 bits event counter to generate event interrupt
- Programmable interrupt source
- Dual interrupt system

1.1.3 Miscellenous

- Provide 12V and 5V power supply on OPTO-22 connectors
- On board resettable fuses to protect power supply for external devices

1.2 Applications

- Programmable mixed digital input & output
- Industrial monitoring and control
- Digital I/O control
- Contact closure, switch / keyboard monitoring
- Connects with OPTO-22 compatible modules
- Useful with A/D and D/A to implement a data acquisition & control system

1.3 Specifications

I/O channels	48-bit for PCI-7248 96-bit for PCI-7296
Input Signal	Logic High Voltage :2.0 V to 5.25V Logic Low Voltage : 0.0 V to 0.80V Logic High Current : 20.0 uA Logic Low Current : -0.2 mA
Output Signal	Logic High Voltage : Minimum 2.4 V Logic Low Voltage : Maximum 0.5V Logic High Current : -15.0 mA Logic Low Current : 24.0 mA
Operating Temperature	0° ~ 60° C
Storage Temperature	-20° ~ 80° C
Humidity	5% ~ 95% non-condensing
I/O Connectors	50-pin male ribbon cable connector
Bus	PCI bus
IRQ Level	Set by Plug and Play BIOS
I/O port address	Set by Plug and Play BIOS
Power Consumption (without external devices)	PCI-7248 : 450mA @5VDC (Typical) 540mA @5VDC (Maximum) PCI-7296 : 600mA @5VDC (Typical) 750mA @5VDC (Maximum)
Transfer Rate	500 K bytes/sec (Typical)
Size	PCI-7248 : 147mm x 98.8mm PCI-7296 : 165mm x 98.8 mm

2

Installation

This chapter describes how to install the PCI-7248 or PCI-7296. At first, the contents in the package and unpacking information that you should be careful are described.

2.1 What You Have

In addition to this *User's Manual*, the package includes the following items:

- PCI-7248 48-bits Parallel Digital I/O Card
or
- PCI-7296 96-bits Parallel Digital I/O Card
- Manual & Software Utility CD

If any of these items is missing or damaged, contact the dealer from whom you purchased the product. Save the shipping materials and carton in case you want to ship or store the product in the future.

2.2 Unpacking

Your PCI-7248/96 card contains sensitive electronic components that can be easily damaged by static electricity.

The card should be done on a grounded anti-static mat. The operator should be wearing 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 your module. Be sure there are no shipping and handling damages on the module before processing.

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

Note : DO NOT APPLY POWER TO THE CARD IF IT HAS BEEN DAMAGED.

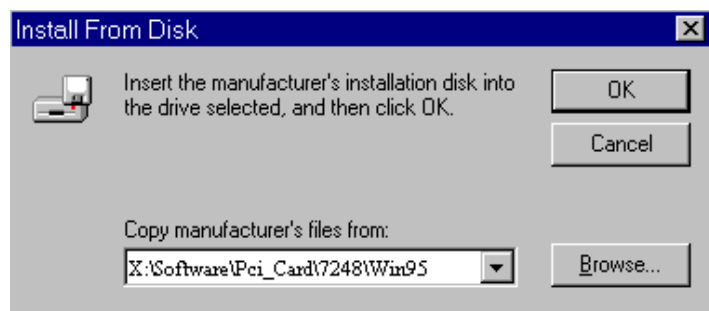
You are now ready to install your ACL-7248/96.

2.3 Device Installation for Windows 95

While you first plug PCI-7248/96 card and enter Windows 95, the system will detect this device automatically and show the following dialog box that prompts you to select the device information source.



Choose the default option “*Driver from disk provided by hardware manufacturer*” and then a dialog box is shown to prompt you give the path of installation disk.



Place ADLink’s “Manual & Software Utility” CD into the appropriate CD driver. Type “X:\Software\ NuDAQPCI \7248\Win95” or “X:\Software\ NuDAQPCI \7296\Win95” (these directory includes PCI-7248/96 device information files “7248.inf”, “7296.inf”) in the input field (**X indicates the CD ROM driver**) and then click OK. The system will start the installation of PCI-7248/96.

2.4 PCI-7248 Layout

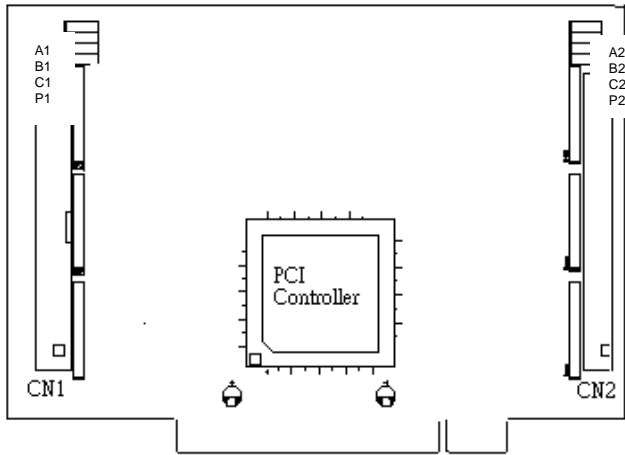


Figure 2.1 PCI-7248 Layout

2.5 PCI-7296 Layout

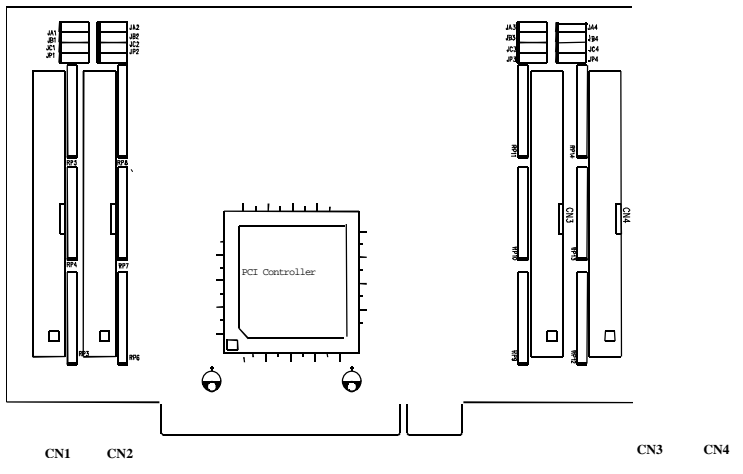


Figure 2.4 PCI-7296 Layout

2.6 Connector Pin Assignment

The I/O ports of PCI-7248/96 emulate the mode 0 configuration of the 8255 general purpose programmable peripheral interface. This card comes equipped with two/four 50-pin male IDC connectors that interface with OPTO-22. Figure 2.5 shows the circuits and pin assignment of PCL-7248/96's connectors (CN1~CN4).

Note : The pin assignment of the CN1 ~ CN4 connectors are identical.

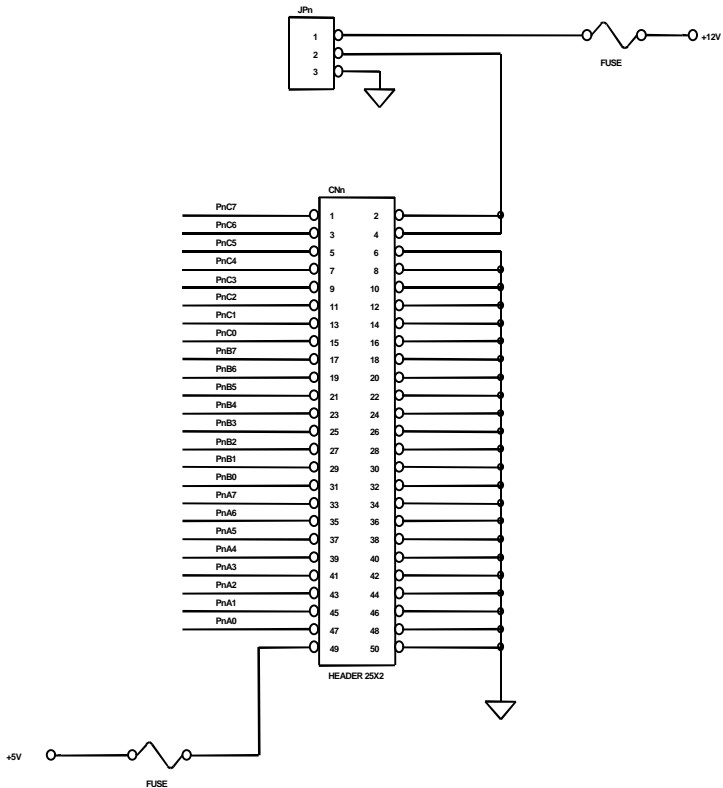


Figure 2.5 Connectors Pin Assignment Power Signals

The DIO pin names are specified as PnXb, where

- n : means the connector reference number n=1~4.
- X : means the port name, X= 'A' , 'B' or 'C'
- b : means the bit number of a port, b=0~7

For example, P1C4 means bit 4 of port C on connector CN1.

**Note : The power supply pins are protected by resettable fuses.
Refer to section 3.4 for details of the power supply.**

2.7 Jumper Description

The PCI-7248/96 DIO cards are 'plug and play' cards using PCI bus. It is not necessary to setup the card configurations to fit the computer system's hardware configurations. However, to fit users' versatile operation environment, there are still a few jumpers to set the power on state of ports and the usage of the +12V output pins.

2.7.1 Power on State of Ports

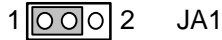
For every port on the PCI-7248/96 cards, the power on state is set as input, therefore, the voltage could be pulled high, pulled low, or floating. It is dependent on the jumpers setting. Table 2.6 lists the reference number of the jumpers and the corresponding port names.

Jumper	Port Name	Remarks
JA1	P1A (Port A of CN1)	for both PCI-7248/7296
JB1	P1B (Port B of CN1)	for both PCI-7248/7296
JC1	P1C (Port C of CN1)	for both PCI-7248/7296
JA2	P2A (Port A of CN2)	for both PCI-7248/7296
JB2	P2B (Port B of CN2)	for both PCI-7248/7296
JC2	P2C (Port C of CN2)	for both PCI-7248/7296
JA3	P3A (Port A of CN3)	for PCI-7296 only
JB3	P3B (Port B of CN3)	for PCI-7296 only
JC3	P3C (Port C of CN3)	for PCI-7296 only
JA4	P4A (Port A of CN4)	for PCI-7296 only
JB4	P4B (Port B of CN4)	for PCI-7296 only
JC4	P4C (Port C of CN4)	for PCI-7296 only

Table 2.6 Jumpers and Port names list

The physical meaning of all the jumpers are identical. The power on state of each port can be set independently. The default is to pull all signals high. The following diagram use JA1 as an example to show the possible configurations.

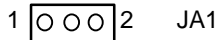
1. Port A of CN1 are power on pulled 'H'.



2. Port A of CN1 are power on pulled 'L'.



3. Port A of CN1 are power on floating. (The jumper is removed)



2.7.2 12V Power Supply Configuration

The pin 2 and pin 4 of the CN1 ~ CN4 50-pin OPTO-22 connectors can be configured as 12V power supply or ground. Please refer to Figure 2.5 for the 12 volts power supply circuits. JP1~JP4 set the 12V power of CN1~CN4 respectively. The default configuration is short to ground. The following diagram shows the setting of JP2, shorting the pin 2 and pin 4 of CN2 to ground.



2.8 PCI-7248/7296 Installation Outline

2.8.1 Hardware configuration :

PCI-7248/7296 has plug and play component, the card can requests an interrupt via a system call. The system BIOS responds with an interrupt assignment based on the PCI-7248/7296's configuration registers and on known system parameters(which are set by system BIOS). Interrupts assigned are a function of the system, the system BIOS, the installed driver and the installed PCI boards.

Memory usage (I/O port locations) of the PCI-7248/7296 is also assigned by system BIOS. The address assignment is done on a board-by-board basis for all PCI-7248s in the system.

2.8.2 PCI slot selection

Your computer will probably have both PCI and ISA slots. Do not force the PCI-7248 into a PC/AT slot.

2.8.3 Installation Procedures

1. Turn off your computer
2. Turn off all accessories (printer, modem, monitor, etc.) connected to computer.
3. Remove the cover from your computer.
4. Select a 32-bit PCI expansion slot. PCI slots are shorter than ISA or EISA slots and are usually white or ivory.

Caution !! Don't put PCI-7248/7296 card into ISA or EISA slot.

5. Before handling the PCI-7248/7296, 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 PCI slot you selected.
7. Secure the card in place at the rear panel of the system unit using screw removed from the slot.

2.8.4 Running the 7248UTIL.EXE or 7296UTIL.EXE

A testing program is included in this utility, you can check if your PCI-7248/7296 can work properly. Refer Section 5.2 for further detailed information.

3

Registers and Operation Theorem

In this chapter, a register format and primitive digital I/O operations of 7248 series products will be specified. The operation theorem of the digital I/O, timer, interrupt are introduced. Before programming or applying the PCI-7248/96 cards to your applications, please go through this chapter to understand the features of the functions.

3.1 I/O Port Base Address

The PCI-7248 products function as a 32-bit PCI target device to any master on the PCI bus. There are three types of registers on the PCI-7248: PCI Configuration Registers (PCR), Local Configuration Registers (LCR) and PCI-7248 registers.

The PCR which conforms the PCI-bus specifications is initialized and controlled by the system plug & play PCI BIOS. Please refer to the PCI BIOS specification to understand how to get information from the PCRs.

The LCR is specified by the PCI bus controller PLX-9050. It is not necessary for users to understand the details of the LCR if you use the software library. The base address of the LCR is assigned by the PCI p&p BIOS. The assigned address is located at offset 14h of PCR. Please refer to the PCI-9050's data sheet for the detail operation of the LCR and also the register format of the PCR.

The registers of 7248 series are shown in the Table 3.1. The base address of these registers is also assigned by the PCI p&p BIOS. The assigned base address is stored at offset 18h of PCR. Therefore, users can read the PCR to know the base address by using the BIOS function call. Note that the PCI-7248 registers are all 8 bits. The users can access these registers by 8 bits I/O instructions only.

3.2 Registers Map

Table 3.1 shows the registers' description and offset address relative to the base address. Please refer to the following sections for more detail of every registers.

Offset	Write	Read	Boards
0x00	P1A	P1A	PCI-7224 PCI-7248 PCI-7296
0x01	P1B	P1B	
0x02	P1C	P1C	
0x03	P1Ctrl	No used	
0x04	P2A	P2A	PCI-7248 PCI-7296
0x05	P2B	P2B	
0x06	P2C	P2C	
0x07	P2Ctrl	No used	
0x08	P3A	P3A	PCI-7296
0x09	P3B	P3B	
0x0A	P3C	P3C	
0x0B	P3Ctrl	No used	
0x0C	P4A	P4A	
0x0D	P4B	P4B	
0x0E	P4C	P4C	
0x0F	P4Ctrl	No used	
0x10	Timer/Counter #0	Timer/Counter #0	PCI-7224 PCI-7248 PCI-7296
0x11	Timer/Counter #1	Timer/Counter #1	
0x12	Timer/Counter #2	Timer/Counter #2	
0x13	Timer/Counter Mode Control	Timer/Counter Mode Status	
0x20	ISC: Interrupt Source Control	No used	
0x30	Clear Interrupt	No used	

3.1 Digital I/O Ports

3.1.1 Introduction

The 7224/7248/7296 products can emulate one/ two / four mode 0 configuration of 8255 programmable peripheral interface (PPI) chips. There are 24 DIO signals for every PPI. The PCI-7248 and PCI-7296 has 48 and 96 DIO signals respectively.

3.1.2 8255 Mode 0

The basic functions of 8255 mode 0 are :

- Two 8-bit I/O ports - port A (PA) and port B (PB)
- Two nibble-wide (4-bit) ports C - PC upper and PC lower
- Any port can be used as either input or output
- Outputs are latched whereas inputs are buffered
- 16 different input / output configurations are available

3.1.3 Special Function of the DIO Signals

Two I/O signals (PC0 and PC3) of CN1 and CN2 can be used to generate hardware interrupt. Refer to the 'interrupt system' section for details about the interrupt control. In addition, the P1C4 signals can be used as input signal of event counter.

3.1.4 Digital I/O Port Programming

Users can write the digital output value to or read back the digital signal level from the PPI ports by using the software library. Here we define the port name in Table 3.1.1. These port names are used both in software library and all through this manual. Although there are four 8255 PPIs in PCI-7296 and only two 8255 PPIs in PCI-7248, the programming for PCI-7224 / 48 / 96 are fully compatible.

Connector numbers	CN1	CN2	CN3	CN4
Port Names	P1A	P2A	P3A	P4A
	P1B	P2B	P3B	P4B
	P1C	P2C	P3C	P4C
	P1CTRL	P2CTRL	P3CTRL	P4CTRL

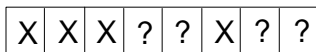
Table 3.1.1 I/O Port Names

There are four ports on every 8255 PPI, including port A,B,C and the control port. PA,PB and PC could be write or read but the control port is write only. Refer to section 4.3 for details about programming of DIO ports.

3.1.5 Control Word

The *control word* written in the control port is used to setup PA, PB and PC as input or output port. Fig 3.1 shows the format of the control word. Table 3.1.2 shows the 16 possible control word and the respective I/O configurations .

D7 D6 D5 D4 D3 D2 D1 D0



1/0 : Input/Output of Port C low nibble

1/0 : Input/Output of Port B

1/0 : Input/Output of Port C high nibble

1/0 : Input/Output of Port A

X : don't care

Figure 3.1 Control Word Format

Control Word	D 4	D 3	D 1	D 0	PORT A	PORT C UPPER	PORT B	PORT C LOWER
00H	0	0	0	0	O/P	O/P	O/P	O/P
01H	0	0	0	1	O/P	O/P	O/P	I/P
02H	0	0	1	0	O/P	O/P	I/P	O/P
03H	0	0	1	1	O/P	O/P	I/P	I/P
08H	0	1	0	0	O/P	I/P	O/P	O/P
09H	0	1	0	1	O/P	I/P	O/P	I/P
0AH	0	1	1	0	O/P	I/P	I/P	O/P
0BH	0	1	1	1	O/P	I/P	I/P	I/P
10H	1	0	0	0	I/P	O/P	O/P	O/P
11H	1	0	0	1	I/P	O/P	O/P	I/P
12H	1	0	1	0	I/P	O/P	I/P	O/P
13H	1	0	1	1	I/P	O/P	I/P	I/P
18H	1	1	0	0	I/P	I/P	O/P	O/P
19H	1	1	0	1	I/P	I/P	O/P	I/P
1AH	1	1	1	0	I/P	I/P	I/P	O/P
1BH*	1	1	1	1	I/P	I/P	I/P	I/P

Table 3.1.2 Summary of control word (D0 - D4).

(* power on default configuration)

3.1.6 Power On Configuration

The default configuration after *power on*, *hardware reset* or *software reset* is to set all ports as input ports, therefore the users won't worry about damaging the external devices when system is power on. In addition, the default signal level can be pulled high or pulled low by setting the jumpers. Refer to section 2.6 for setting the power on state of the DIO ports.

3.1.7 Note for Output Data

Be careful about the initial condition of digital output signals. If user set the control word as output port after power on, the previous uncertain output value will be put on the output pins immediately. Therefore, **BE SURE TO SET A SAFE OUTPUT VALUE BEFORE SETTING ANY PORT AS OUTPUT.**

3.2 8254 Timer / Counter Operation

3.2.1 Introduction

One 8254 programmable timer/counter chip is installed in PCI-7248/7296. There are three counters in one 8254 chip and 6 possible operation modes for each counter. The block diagram of the timer /counter system is shown in Figure 3.2.

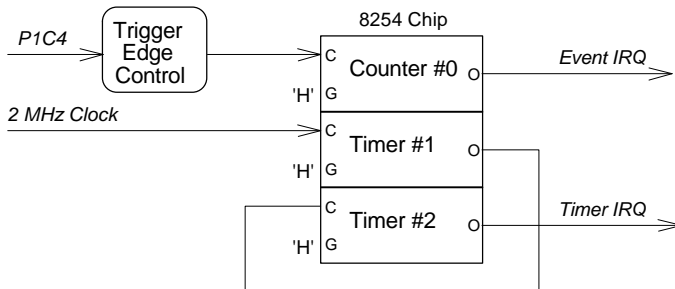


Figure 3.2 Timer / counter system of PCI-7248/96.

The timer #1 and timer #2 of the 8254 chip are cascaded as a 32-bits programmable timer. In software library, the timer #1 and #2 are always set as mode 2 (rate generator).

In software library, the counter #0 is used as an event counter, that is, interrupt on terminal count of 8254 mode 0 . Please refer to section 4.4 for programming the timer / counter functions.

3.2.2 Cascaded 32 bits Timer

The input clock frequency of the cascaded timers is 2M Hz. The output of the timer is send to the interrupt system (refer to section 3.3). Therefore, the maximum and minimum watchdog timer interrupt frequency is $(2M \text{ Hz})/(2^*2)=(500K \text{ Hz})$ and $(2M \text{ Hz})/(65535*65535)$ respectively.

3.2.3 Event Counter and Edge Control

The counter #0 of the 8254 chip can be used as event counter. The input of counter #0 is PC4 of CN1 (P1C4). The counter clock trigger direction (H to L or Lto H) is programmable. The gate control is always enable. The output is send to interrupt system which named as event IRQ. If counter #0 is set as 8254 mode 0, the event counter IRQ will generate when the counter value is counting down to zero.

3.3 Interrupt System

3.3.1 System Architecture

The PCL-7248/96's interrupt system is a powerful and flexible system which is suitable for many applications. The system is a **Dual Interrupt System**. The dual interrupt means the hardware can generate two interrupt request signals in the same time and the software can service these two request signals by ISR. Note that the dual interrupt do not mean the card occupy two IRQ levels.

The two interrupt request signals (INT1 and INT2) are comes from digital input signals or the timer / counter output. An interrupt sources multiplexer (MUX) is used to select the IRQ sources. Fig 3.3.1 shows the interrupt system.

3.3.2 IRQ Level Setting

There is only one IRQ level is used by this card, although it is a dual interrupt system. This card uses INT #A interrupt request signal to PCI bus. The mother board circuits will transfer INT #A to one of the AT

bus IRQ levels. The IRQ level is set by the PCI plug and play BIOS and saved in the PCI controller. It is not necessary for users to set the IRQ level. Users can get the IRQ level setting by software library. Refer the section 4.5.

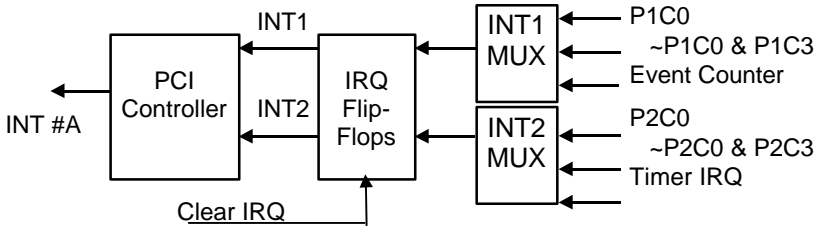


Fig 3.3.1 Dual Interrupt System of PCI-7248/96

3.3.3 Dual Interrupt System

The PCI controller of PCI-7248/96 can receive two hardware IRQ sources. However, a PCI controller can generate only one IRQ to PCI bus, the two IRQ sources must be distinguished by ISR of the application software if the two IRQ are all used.

The application software can use the “get_PCI72_irq_status” function to distinguish which interrupt is inserted. After servicing an IRQ signal, users must check if another IRQ is also asserted, then clear current IRQ to allow the next IRQ coming in.

The two IRQs are named as INT1 and INT2. INT1 comes from P1C0, P1C3 or the event counter interrupt. INT2 comes from P2C0, P2C3 or the timer interrupt. The sources of INT1 and INT2 is selectable by the Interrupt Source Control (ISC) Register.

3.3.4 Interrupt Source Control

There are four bits to control the IRQ sources of INT1 and INT2. The Table 3.3.1 shows the selection of the IRQ sources and the interrupt trigger conditions.

If the application need only one IRQ, you can disable one of the IRQ sources by software. If your application do not need any IRQ source, you can disable all the two interrupts. However, the PCI BIOS still assign a IRQ level to the PCI card and occupy the PC resource, if you

only disable the IRQ sources without change the initial condition of the PCI controller.

It is not suggested to re-design the initial condition of the PCI card by users' own application software. If users want to disable the IRQ level, user can use the ADLink's utility 'INIT7296.EXE' to change power on interrupt setting.

The table 3.3.4 shows the register format of the ISC (address offset 0x20). This register is read only. The 4 LSBs are used to control the source of INT1 and INT2.

INT1	D3	D2	D1	D0	IRQ Sources	IRQ Trigger Condition
Disable	X	X	0	0	INT1 disable	--
Mode 1	X	X	0	1	~P1C0	falling edge of P1C0
Mode 2	X	X	1	0	P1C0 OR ~P1C3	(see following)
Mode 3	X	X	1	1	Event Counter	Counter count down to 0

INT2	D3	D2	D1	D0	IRQ Sources	IRQ Trigger Condition
Disable	0	0	X	X	INT2 disable	--
Mode 1	0	1	X	X	~P2C0	falling edge of P2C0
Mode 2	1	0	X	X	P2C0 OR ~P2C3	(see following)
Mode 3	1	1	X	X	Timer Output	Timer count down to 0

Table 3.3.1 ISC register format

When the IRQ sources is set as "P1C0 OR ~P1C3", the IRQ trigger conditions are summarized in table 3.3.2,

P1/2C0	P1/2C3	IRQ Trigger Condition
High	X	PC0='H' disable all IRQ
X	Low	PC3='L' disable all IRQ
Low	1->0	PC3 falling edge trigger when PC0=L
0->1	High	PC0 rising edge trigger when PC3=H

Table 3.3.2 IRQ Trigger conditions

Because the P1/P2C0 and P1/P2C3 are external signals, the applications can utilize the combination of the four signals to generate a proper IRQ.

3.4 12V and 5V Power Supply

The OPTO-22 compatible connectors provide external devices the +12 volts and +5 volts power supply. To avoid short or overload of the power supply, the **resetable fuses** are added on all the power supply signals. Refer to Figure 2.5.

The maximum current for 5 volts on every connector is 0.5 A. If the load current is larger than 0.5 A, the resistance of fuse will increase because of the temperature rising. The rising resistance will cause the power supply drop and reduce current. If the overload or short condition is removed, the fuse will get to normal condition. It is not necessary to repair or re-install the fuse.

The maximum current of 12 volts for all the four connectors is also 0.5 A. The action of the fuse is the same as which used for +5V power. The limitation is more restrictive than 5V power supply because the PCI bus can not provide large current.

4

C/C++ Software Libraries

In this chapter, the PCI-7248 and PCI-7296 software libraries for DOS and Windows 95 are described.

4.1 Installation

4.1.1 Installation

The PCI-7248/96's Software Library supplied with PCI-7248/96 includes a utility software, C-language library and some demonstration programs which can help you reduce programming work.

◆ **MS-DOS Software Installation**

1. Turn your PC's power switch on
2. Put the ADLink's "Manual & Software Utility" CD into the appropriate CD driver
3. Type the commands(X indicates the CD ROM driver) under DOS environment:

For PCI-7248:

```
X:\> CD Software\Pci_Card\7248\DOS
```

```
X:\ Software\Pci_Card\7248\DOS> SETUP
```

For PCI-7296:

```
X:\> CD Software\Pci_Card\7296\DOS
```

```
X:\ Software\Pci_Card\7296\DOS> SETUP
```

4. An installation completed message will be shown on the screen.

After installation, all the files of *PCI-7248/96 Library & Utility for DOS* are stored in C:\ADLink\7248\DOS or C:\ADLink\7296\DOS directory.

◆ **Windows 95 Software Installation**

1. Turn your PC's power switch on and enter Windows 95
2. Put the ADLink's "Manual & Software Utility" CD into the appropriate CD driver.
3. If Windows 95 is loaded, choose Run from the Start menu.
4. Type **X:\Software\Pci_Card\7248\Win95\Setup.exe** or **X:\Software\Pci_Card\7296\Win95\Setup.exe** in the Run dialog box. (X indicates the CD ROM driver).

Setup first displays a Welcome dialog box. Please click Next button to go on installation.

After a welcome dialog box, Setup prompts the following dialog box for you to specify the destination directory. The default path is C:\7248w95 or C:\7296w95. If you want to install *PCI-7248/96 DLL for Windows 95* in another directory, please click Browse button to change the destination directory.



Then you can click Next to begin installing *PCI-7248/96 DLL for Windows 95*.

After you complete the installation of PCI-7248/96 Software, PCI-7248/96's DLL (7248.DLL or 7296.DLL) is copied to Windows System directory (default is C:\WINDOWS\SYSTEM for Win-95) and the driver files (W95_7248.VXD or W95_7296.VXD and PCIW95.VXD) are also copied to the appropriate directory.

4.2 Running Testing Utility (7296UTIL.EXE or 7248UTIL.EXE)

After finishing the DOS installation, you can execute the utility by typing as follows :

```
C> cd \7296\DOS\UTIL (or cd \7248\DOS\UTIL)
```

```
C> 7296UTIL (or 7248UTIL)
```

4.3 Software Driver Naming Convention

The functions of PCI-7248's or PCI-7296's software drivers are using full-names to represent the functions' real meaning. The naming convention rules are :

In DOS Environment :

`_{hardware_model}_{action_name}`. e.g. `_7248_Initial()`.

In order to recognize the difference between DOS library and Windows 95 library, A capital "W" is put on the head of each function name of the Windows 95 DLL driver. e.g. `W_7248_Initial()`.

There are 5 functions provided by PCI-7248 software drivers. The detail descriptions of each function are specified in the following sections. The functions prototype and some useful constants are defined in `Acl_pci.h`.

4.4 _7248/96_Initial

@ Description

The PCI-7248 or PCI-7296 cards are initialized by this function. The software library could be used to control multiple PCI-7248 cards. Because PCI-7248 is in PCI bus architecture and meets the plug and play specifications, the **IRQ** and **I/O address** are assigned by system BIOS directly.

@ Syntax

PCI-7248:

C/C++ (DOS, Windows 95)

U16 W_7248_Initial (U16 *existCards, PCI_INFO *pciInfo)

Visual Basic (Windows 95)

W_7248_Initial (existCards As Integer, pciInfo As PCI_INFO) As Integer

PCI-7296:

C/C++ (DOS, Windows 95)

U16 W_7296_Initial (U16 *existCards, PCI_INFO *pciInfo)

Visual Basic (Windows 95)

W_7296_Initial (existCards As Integer, pciInfo As PCI_INFO) As Integer

@ Argument

existCards : The numbers of installed PCI-7248/7296 cards. The returned value shows how many PCI-7248/7296 cards are installed in your system.

pciinfo: It is a structure to memorize the PCI bus plug and play initialization information which is decided by p&p BIOS. The PCI_INFO structure is defined in ACL.PCI.H The base I/O address and the interrupt channel number is stored in pciinfo which is for reference.

@ Return Code

ERR_NoError
ERR_PCIBiosNotExist

4.5 _7248/96_DI

@ Description

This function is used to read 8-bit digital inputs data from digital input port. You can get the 8 bits data from _7248_DI by using this function.

The written data and read in data is 8 bits data. Each data is mapped to a signal as the table below.

D7	D6	D5	D4	D3	D2	D1	D0
PA7	PA6	PA5	PA4	PA3	PA2	PA1	PA0
PB7	PB6	PB5	PB4	PB3	PB2	PB1	PB0
PC7	PC6	PC5	PC4	PC3	PC2	PC1	PC0

@ Syntax

PCI-7248:

C/C++ (DOS)

U16 _7248_DI (U16 cardNo, U16 channelPort, U8 *diData)

C/C++ (Windows 95)

U16 W_7248_DI (U16 cardNo, U16 channelPort, U16 *diData)

Visual Basic (Windows 95)

W_7248_DI (ByVal cardNo As Integer, ByVal channelPort As Integer, diData As Integer) As Integer

PCI-7296:

C/C++ (DOS)

U16 _7296_DI (U16 cardNo, U16 channelPort, U8 *diData)

C/C++ (Windows 95)

U16 W_7296_DI (U16 cardNo, U16 channelPort, U16 *diData)

Visual Basic (Windows 95)

W_7296_DI (ByVal cardNo As Integer, ByVal channelPort As Integer, diData As Integer) As Integer

@ Argument

cardNo : card number to select board

channelPort : port of each channel

PCI_CH0_PA : CH1's Port A

PCI_CH0_PB : CH1's Port B

PCI_CH0_PC : CH1's Port C

PCI_CH0_PCU : CH1's Port C Upper Nibble

PCI_CH0_PCL : CH1's Port C Low Nibble

PCI_CH1_PA : CH2's Port A

PCI_CH1_PB : CH2's Port B

PCI_CH1_PC : CH2's Port C

PCI_CH1_PCU : CH2's Port C Upper Nibble
PCI_CH1_PCL : CH2's Port C Low Nibble
PCI_CH2_PA : CH2's Port A
PCI_CH2_PB : CH2's Port B
PCI_CH2_PC : CH2's Port C
PCI_CH2_PCU : CH2's Port C Upper Nibble
PCI_CH2_PCL : CH2's Port C Low Nibble
PCI_CH3_PA : CH3's Port A
PCI_CH3_PB : CH3's Port B
PCI_CH3_PC : CH3's Port C
PCI_CH3_PCU : CH3's Port C Upper Nibble
PCI_CH3_PCL : CH3's Port C Low Nibble

Note : CH2 and CH3 are only available for PCI-7296 card only.

diData : return 8-bit value from digital port.

@ Return Code

ERR_NoError

4.6 _7248/96_DO

@ Description

This function is used to write data to digital output ports. There are 6 digital output ports (P1A, P1B, P1C, P2A, P2B, P2C) could be configure as digital output channel on the PCI-7248,

@ Syntax

PCI-7248:

C/C++ (DOS)

U16 _7248_DO (U16 cardNo, U16 channelPort, U8 doData)

C/C++ (Windows 95)

U16 W_7248_DO (U16 cardNo, U16 channelPort, U16 doData)

Visual Basic (Windows 95)

W_7248_DO (ByVal cardNo As Integer, ByVal channelPort As Integer, ByVal doData As Integer) As Integer

PCI-7296:

C/C++ (DOS)

U16 _7248_DO (U16 cardNo, U16 channelPort, U8 doData)

C/C++ (Windows 95)

U16 W_7248_DO (U16 cardNo, U16 channelPort, U16 doData)

Visual Basic (Windows 95)

W_7248_DO (ByVal cardNo As Integer, ByVal channelPort As Integer, ByVal doData As Integer) As Integer

@ Argument

cardNo : card number to select board channelPort :

channelPort : port of each channel

PCI_CH0_PA : CH1's Port A

PCI_CH0_PB : CH1's Port B

PCI_CH0_PC : CH1's Port C

PCI_CH0_PCU : CH1's Port C Upper Nibble

PCI_CH0_PCL : CH1's Port C Low Nibble

PCI_CH1_PA : CH2's Port A

PCI_CH1_PB : CH2's Port B

PCI_CH1_PC : CH2's Port C

PCI_CH1_PCU : CH2's Port C Upper Nibble

PCI_CH1_PCL : CH2's Port C Low Nibble

PCI_CH2_PA : CH2's Port A

PCI_CH2_PB : CH2's Port B

PCI_CH2_PC : CH2's Port C

PCI_CH2_PCU : CH2's Port C Upper Nibble

PCI_CH2_PCL : CH2's Port C Low Nibble
PCI_CH3_PA : CH3's Port A
PCI_CH3_PB : CH3's Port B
PCI_CH3_PC : CH3's Port C
PCI_CH3_PCU : CH3's Port C Upper Nibble
PCI_CH3_PCL : CH3's Port C Low Nibble

Note : CH2 and CH3 are only available for PCI-7296 card only.

doData : value will be written to digital output port

@ **Return Code**

ERR_NoError

4.7 _7248/96_Config_Port

@ **Description**

This function is used to configure the Input or Output of each Port. Each I/O Port of PCI-7248 is either input or output, so it has to configure as input or output before I/O operations are applied.

@ **Syntax**

PCI-7248:

C/C++ (DOS, Windows 95)

U16 W_7248_Config_Port (U16 cardNo, U16 channelPort, U16 direction)

Visual Basic (Windows 95)

W_7248_Config_Port (ByVal cardNo As Integer, ByVal channelPort As Integer, ByVal direction As Integer) As Integer

PCI-7296:

C/C++ (DOS, Windows 95)

U16 W_7296_Config_Port (U16 cardNo, U16 channelPort, U16 direction)

Visual Basic (Windows 95)

W_7296_Config_Port (ByVal cardNo As Integer, ByVal channelPort As Integer, ByVal direction As Integer) As Integer

@ **Argument**

cardNo : card number to select board channelPort :

channelPort : port of each channel

PCI_CH0_PA : CH1's Port A
PCI_CH0_PB : CH1's Port B
PCI_CH0_PC : CH1's Port C
PCI_CH0_PCU : CH1's Port C Upper Nibble
PCI_CH0_PCL : CH1's Port C Low Nibble
PCI_CH1_PA : CH2's Port A
PCI_CH1_PB : CH2's Port B
PCI_CH1_PC : CH2's Port C
PCI_CH1_PCU : CH2's Port C Upper Nibble
PCI_CH1_PCL : CH2's Port C Low Nibble
PCI_CH2_PA : CH2's Port A
PCI_CH2_PB : CH2's Port B
PCI_CH2_PC : CH2's Port C
PCI_CH2_PCU : CH2's Port C Upper Nibble
PCI_CH2_PCL : CH2's Port C Low Nibble
PCI_CH3_PA : CH3's Port A
PCI_CH3_PB : CH3's Port B
PCI_CH3_PC : CH3's Port C
PCI_CH3_PCU : CH3's Port C Upper Nibble
PCI_CH3_PCL : CH3's Port C Low Nibble

Note : CH2 and CH3 are only available for PCI-7296 card only.

direction : port I/O direction

INPUT_PORT : the port is configure as INPUT

OUTPUT_PORT : the port is configure as OUTUT

@ **Return Code**

ERR_NoError

4.8 _7248/96_Software_Reset

@ **Description**

This function is used to reset the I/O port configuration. After reset PCI-7248/96, all the ports will be set as input ports. Note that this function can not re-start the PCI bus and all the hardware setting won't be change either.

@ **Syntax**

PCI-7248:

C/C++ (DOS, Windows 95)

U16 W_7248_Software_Reset (U16 cardNo)

Visual Basic (Windows 95)

W_7248_Software_Reset (ByVal cardNo As Integer) As Integer

PCI-7296:

C/C++ (DOS, Windows 95)

U16 W_7296_Software_Reset (U16 cardNo)

Visual Basic (Windows 95)

W_7296_Software_Reset (ByVal cardNo As Integer) As Integer

@ **Argument**

cardNo : card number which the DIO will be reset.

@ **Return Code**

ERR_NoError

4.9 _7248/96_INT_Start

@ **Description**

This function is only available in Windows 95 driver. This function is used to initialize and start up the interrupt control. Please refer to section 3.3 for detailed description of interrupt system. After calling this function, every time an interrupt request signal generated, a software event is signaled. So that in your program, you can use wait operation to wait for the event. When the event is signaled, it means an interrupt is generated. Please refer to the sample program 7248int.c or 7296int.c.

@ **Syntax**

PCI-7248:

C/C++ (DOS, Windows 95)

void W_7248_INT_Start (U16 cardNo, U16 c1, U16 c2, U16 ctrlValue, HANDLE *hIntEvent)

Visual Basic (Windows 95)

W_7248_INT_Start (ByVal cardNo As Integer, ByVal c1 As Integer, ByVal c2 As Integer, ByVal ctrlValue As Integer, hIntEvent As Long)

PCI-7296:

C/C++ (DOS, Windows 95)

```
void W_7296_INT_Start (U16 cardNo, U16 c1, U16 c2, U16
    ctrlValue, HANDLE *hIntEvent)
```

Visual Basic (Windows 95)

```
W_7296_INT_Start (ByVal cardNo As Integer, ByVal c1 As Integer,
    ByVal c2 As Integer, ByVal ctrlValue As Integer, hIntEvent
    As Long)
```

@ Argument

cardNo : card number which the DIO will be reset.

c1 : If the interrupt source is set as internal timer source, this value is the frequency divider of Timer#1.

c2 : If the interrupt source is set as internal timer source, this value is the frequency divider of Timer#2.

ctrlValue: the value for INT mode setting. The value can be set for INT1 is INT1_OFF, INT1_P1C0, INT1_P1C3C0, or INT1_EVENT_IRQ. The value can be set for INT2 is INT2_OFF, INT2_P2C0, INT2_P2C3C0, or INT2_TIMER_IRQ. Please refer to section 3.3.4 for detailed description.

hIntEvent : the handle of the event for interrupt signals.

@ Return Code

ERR_NoError

4.10_7248/96_INT_Stop

@ Description

This function is only available in Windows 95 driver. This function is used to disable the interrupt signal generation.

@ Syntax

PCI-7248:

C/C++ (DOS, Windows 95)

```
void W_7248_INT_Stop (U16 cardNo)
```

Visual Basic (Windows 95)

```
W_7248_INT_Stop (ByVal cardNo As Integer)
```

PCI-7296:

C/C++ (DOS, Windows 95)

```
void W_7296_INT_Stop (U16 cardNo)
```


Visual Basic (Windows 95)

W_7296_INT_Stop (ByVal cardNo As Integer)

@ Argument

cardNo : card number which the DIO will be reset.

@ Return Code

ERR_NoError

Product Warranty/Service

Seller warrants that equipment furnished will be free from defects in material and workmanship for a period of one year from the confirmed date of purchase of the original buyer and that upon written notice of any such defect, Seller will, at its option, repair or replace the defective item under the terms of this warranty, subject to the provisions and specific exclusions listed herein.

This warranty shall not apply to equipment that has been previously repaired or altered outside our plant in any way as to, in the judgment of the manufacturer, affect its reliability. Nor will it apply if the equipment has been used in a manner exceeding its specifications or if the serial number has been removed.

Seller does not assume any liability for consequential damages as a result from our products uses, and in any event our liability shall not exceed the original selling price of the equipment.

The equipment warranty shall constitute the sole and exclusive remedy of any Buyer of Seller equipment and the sole and exclusive liability of the Seller, its successors or assigns, in connection with equipment purchased and in lieu of all other warranties expressed implied or statutory, including, but not limited to, any implied warranty of merchant ability or fitness and all other obligations or liabilities of seller, its successors or assigns.

The equipment must be returned postage-prepaid. Package it securely and insure it. You will be charged for parts and labor if you lack proof of date of purchase, or if the warranty period is expired.