



# PCI-P16R16 Series Cards

## User Manual

Isolated Digital Input/Output Cards

Version 3.0, Mar. 2015

### SUPPORT

This manual relates to the following boards: PCI-P8R8, PCI-P8R8U, PCI-P16R16, PCI-P16R16U, PCI-P16C16, PCI-P16POR16, PEX-P8POR8i and PEX-P16POR16i.

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We will respond to you within 2 working days.






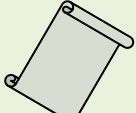

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## Packing List

The shipping package should contain the following items:

	<p>One of the following PCI cards:</p> <p>PCI-P8R8 PEX-P8POR8i PCI-P8R8U</p>	<p>PCI-P16R16 PCI-P16R16U PCI-P16C16 PCI-P16POR16 PEX-P16POR16i</p>
	<p>One CA-4002 D-sub connector</p>	<p>Two CA-4002 D-sub Connectors</p>
	<p>-</p>	<p>One CA-4037W Cable</p>
	<p>One printed Quick Start Guide</p>	
	<p>One Software Utility CD</p>	



**Note:**

***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 need to ship or store the product in the future.***

## Related Information

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- For more information related to individual cards, refer to the Product Page on the ICP DAS website for the respective device.

PCI-P16POR16/PEX-P16POR16i/PEX-P8POR8i:

[http://www.icpdas.com/root/product/solutions/pc\\_based\\_io\\_board/pci/pci-p16por16.html](http://www.icpdas.com/root/product/solutions/pc_based_io_board/pci/pci-p16por16.html)

PCI-P16C16:

[http://www.icpdas.com/root/product/solutions/pc\\_based\\_io\\_board/pci/pci-p16c16.html](http://www.icpdas.com/root/product/solutions/pc_based_io_board/pci/pci-p16c16.html)

PCI- PCI-P8R8/P8R8U/P16R16/P16R16U/:

[http://www.icpdas.com/root/product/solutions/pc\\_based\\_io\\_board/pci/pci-p8r8.html](http://www.icpdas.com/root/product/solutions/pc_based_io_board/pci/pci-p8r8.html)

- More information related to the Hardware Manual, Datasheet and QuickStart of PCI-P16R16 Series cards can be found in the \NAPDOS\PCI\PCI-P16R16\Manual\ folder on the companion CD, or can be downloaded from:  
<http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pci-p16r16/manual/>
- The drivers for use with **Windows NT/95/98 and 32-bit version of Windows** can be found in the \NAPDOS\PCI\PCI-P16R16\DLL\_OCX\ folder on the companion CD, or can be downloaded from:  
[http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pci-p16r16/dll\\_ocx/](http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pci-p16r16/dll_ocx/)
- The User Manual for the Classic Driver for PCI-P16R16 Series Cards can be found in the \NAPDOS\PCI\PCI-P16R16\Manual\ folder on the companion CD, or can be downloaded from:  
<http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pci-p16r16/manual/>
- More information related to the **UniDAQ SDK Driver for 64-bit version of Windows** can be found in the \NAPDOS\PCI\UniDAQ\ folder on the companion CD, or can be downloaded from:  
<http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/unidaq/>

# 1. Introduction

The following is an overview of the PCI-P8R8/P16R16, PCI-P16C16, PCI-P8POR8/P16POR16 and PEX-P8POR8i/P16POR16i Series cards, including the number and type of input and output channels.

Model	Isolated Digital Input	Output Type
<b>PCI-P8R8</b> <b>PCI-P8R8U</b>	8 channels	8 Relay Output channels
<b>PCI-P16R16</b> <b>PCI-P16R16U</b>	16 channels	16 Relay Output channels
<b>PCI-P16C16</b>	16 channels	16 Open Collector Output channels
<b>PEX-P8POR8i</b>	8 channels	8 PhotoMOS-Relay Output channels
<b>PCI-P16POR16</b>	16 channels	16 PhotoMOS-Relay Output channels
<b>PEX-P16POR16i</b>	16 channels	16 PhotoMOS-Relay Output channels

## ➤ PCI-P8R8U/P16R16U, PCI-P8R8/PCI-P16R16

The PCI-P8R8U/P16R16U universal PCI card supports 3.3 V/5 V PCI bus while the PCI-P8R8/P16R16 supports 5 V PCI bus and Plug and Play functionality so that the I/O address is automatically assigned rather than needing to be set manually. These cards contain 8/16 photo-coupler Digital Input channels that provide 5000 V<sub>rms</sub> isolation protection, allowing the input signals to be completely floated so as to prevent ground loops. They are also equipped with 8/16 Relay Output channels that can be used to control the ON/OFF state of external devices, drive external relays or small power switches, or activate alarms, etc.

## ➤ PCI-P16C16

The PCI-P16C16 is a 5 VPCI card that supports Plug and Play functionality so that the I/O resources are automatically assigned from the BIOS. This card contains 16 optically-isolated Digital Input channels and 16 open collector (Sink, NPN) Digital Output channels. The Digital Input channels provide 5000 V<sub>rms</sub> isolation protection that allows the input signals to be completely floated so as to prevent ground loops and isolates the host computer from potentially damaging voltage spikes. The open collector Digital Output channels are typically used for alarm and warning notifications, control of signal Output, control of external circuits that require a higher voltage level, and signal transmission applications, etc. The PCI-P16C16 contains a single DB-37 connector and a single 40-pin box header, and is shipped with a 40-pin to DB-37 flat cable for easy wiring.

### ➤ **PCI-P16POR16 and PEX-P8POR8i/P16POR16i**

The PCI-P16POR16 card supports the 5 V PCI bus, while the PEX-P8POR8i/P16POR16i supports the PCI Express bus. Each contains 8 or 16 optically-isolated Digital Input channels and 8 or 16 PhotoMOS Relay Output channels. Both the isolated Digital Input channels and the PhotoMOS Relay Output channels use a short optical transmission path to transfer an electronic signal between elements of a circuit and keep them electrically isolated. The Digital Input channels provide 5000  $V_{rms}$  isolation protection, allowing the input signals to be completely floated so as to cut down ground loops, and isolating the Host computer from potentially damaging voltage spikes. The PhotoMOS Relay channels are used where it is necessary to control a circuit using a low-power signal with complete electrical isolation between the control and controlled circuits, or where several circuits must be controlled by a single signal.

PCI-P16POR16 and PEX-P8POR8i/P16POR16i cards can be used for a variety of applications, such as controlling the ON/OFF state of external devices, driving external relays or small power switches, activating alarms, contact closure, or sensing external voltages or switches, etc. The cards can be installed in either a PCI or PCI Express slot, and support true Plug and Play functionality, with two DB-37 connectors provided for easy wiring.

## 1.1 Features

The following is an overview of the features provided by PCI-P16R16 Series cards.

Model	PCI-P8R8	PCI-P8R8U	PCI-P16R16	PCI-P16R16U	PCI-P16C16
Bus Type	5 V PCI	Universal PCI	5 V PCI	Universal PCI	5 V PCI
Common Features	<ul style="list-style-type: none"> <li>Optically-isolated Digital Input</li> <li>AC/DC Digitally-signed Input</li> <li>AC Digital Input with Filter configurable via Jumper Settings</li> </ul>				
Input Channels	8		16		16
Input Type	Optically-isolated Digital Input				
Output Channels	8		16		16
Output Type	Relay Output				Transistor (Open Collector)
LED Indicators	-		-		External Power Status

Model	PCI-P16POR16	PEX-P8POR8i	PEX-P16POR16i
Bus Type	5 V PCI	PCI Express x1	
Common Features	<ul style="list-style-type: none"><li>Optically-isolated Digital Input</li><li>AC/DC Digitally-signed Input</li><li>AC Digital Input with Filter configurable via Jumper Settings</li></ul>		
Input Channels	16	8	16
Input Type	Optically-isolated Digital Input		
Output Channels	16	8	16
Output Type	PhotoMOS Relay		
LED Indicators	Output Status		



## 1.3 Specifications

The following is an overview of the specifications for the various models in the PCI-P16R16 Series.

### 1.3.1 PCI-P8R8/P8R8U/P16R16/P16R16U

Model		PCI-P8R8	PCI-P8R8U	PCI-P16R16	PCI-P16R16U
Digital Input					
Isolation Voltage		5000 V <sub>rms</sub> (Photo-coupler)			
Channels		8		16	
Input	Logic 1	AC/DC +5 ~ +24 V (AC 50 Hz ~ 1 kHz)			
Voltage	Logic 0	AC/DC 0 ~ +1 V			
Response Speed		Without Filter: 50 kHz (Typical) With Filter: 0.455 kHz (Typical)			
Relay Output					
Channels		8		16	
Relay Type		4 SPDT, 4 SPST		8 SPDT, 8 SPST	
Contact Rating		AC:120 V@ 0.5 A, DC: 24 V@ 1 A			
Operating Time		5 ms (Typical)			
Release Time		10 ms (Typical)			
Insulation Resistance		1000 MΩ @ 500 V <sub>DC</sub>			
Lifetime		Mechanical: 5000000 ops. Electrical: 100000 ops.			
General					
Bus Type		5 V PCI, 32-bit, 33 MHz	3.3 V/5 V Universal PCI, 32-bit, 33 MHz	5 V PCI, 32-bit, 33 MHz	3.3 V/5 V Universal PCI, 32-bit, 33 MHz
Data Bus		16-bit			
Card ID		No	Yes (4-bit)	No	Yes (4-bit)
I/O Connector		Female DB-37 x 1		Female DB-37 x 1 40-pin Box Header x 1	
Dimensions (L x W x D)		183 mm x 105 mm x 22 mm			
Power Consumption		500 mA @ +5 V		800 mA @ +5 V	
Operating Temperature		0 ~ 60 °C			
Storage Temperature		-20 ~ 70 °C			
Humidity		5 ~ 85% RH, Non-condensing			

## 1.3.2 PCI-P16C16

Model		PCI-P16C16
<b>Digital Input</b>		
Isolation Voltage		5000 V <sub>rms</sub> (Photo-coupler)
Channels		16
Input Voltage	Logic 1	AC/DC +5 ~ +24 V (AC 50 Hz ~ 1 kHz)
	Logic 0	AC/DC 0 ~ +1 V
Response Speed		Without Filter: 50 kHz (Typical) With Filter: 0.455 kHz (Typical)
<b>Digital Output</b>		
Isolation Voltage		3750 V <sub>rms</sub>
Channels		16
Compatibility		Transistor (Open Collector)
Output Capability		DC: 600 mA/+30 V for one channel @ 100% duty
Response Speed		1 kHz (Typical)
<b>General</b>		
Bus Type		5 V PCI, 32-bit, 33 MHz
Data Bus		16-bit
Card ID		No
I/O Connector		Female DB-37 x 1 40-pin Box Header x 1
Dimensions (L x W x D)		183 mm x 105 mm x 22 mm
Power Consumption		800 mA @ +5 V
Operating Temperature		0 ~ 60 °C
Storage Temperature		-20 ~ 70 °C
Humidity		5 ~ 85% RH, Non-condensing

### 1.3.3 PCI-P16POR16 and PEX-P8POR8i/P16POR16i

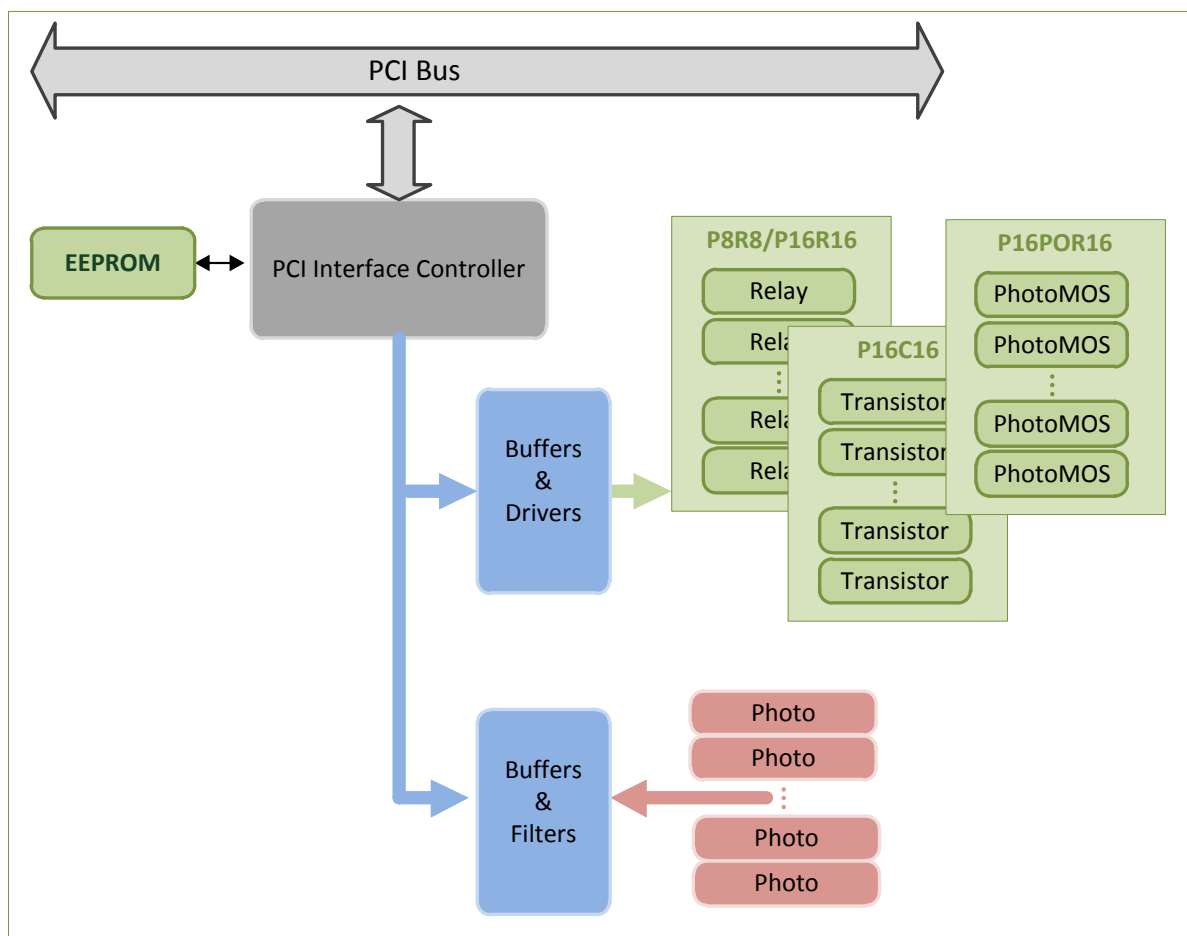
Model		PCI-P16POR16	PEX-P8POR8i	PEX-P16POR16i
Digital Input				
Isolation Voltage		5000 V <sub>rms</sub> (Photo-coupler)	2000 V <sub>DC</sub> (Photo-coupler)	
Channels		16	8	16
Input Voltage	Logic 1	AC/DC +5 ~ +24 V (AC 50 Hz ~ 1 kHz)		
	Logic 0	AC/DC 0 ~ +1 V		
Input Impedance		-	-	1.2 KΩ, 0.5 W
Response Speed		Without Filter: 50 kHz (Typical) With Filter: 0.455 kHz (Typical)		
Relay Output				
Channels		16	8	16
Relay Type		PhotoMOS Relay (Form A)		
Contact Rating		Load Voltage: 300 V (AC peak or DC) Load Current: 130 mA		
Operating Time		0.7 ms (Typical)		
Release Time		0.05 ms (Typical)		
Insulation Resistance		1000 MΩ @ 500 V <sub>DC</sub>		
Electrical Endurance (Resistive load)		Long Life and No Spike		
Special				
LED Indicators		Output Status		
General				
Bus Type		5 V PCI, 32-bit, 33 MHz	PCI Express x1	
Data Bus		16-bit		
Card ID		No	Yes (4-bit)	
I/O Connector		Female DB-37 x 1 40-pin Box Header x 1	Female DB-37 x 1	Female DB-37 x 1 40-pin Box Header x 1
Dimensions (L x W x D)		183 mm x 105 mm x 22 mm	118 mm x 113 mm x 22 mm	173 mm x 113 mm x 22 mm
Power Consumption		800 mA @ +5 V		
Operating Temperature		0 ~ 60 °C		
Storage Temperature		-20 ~ 70 °C		
Humidity		5 ~ 85% RH, Non-condensing		

## 1.4 Applications

- Factory Automation
- Laboratory Automation
- Communication Switching
- Security Control
- Product Testing
- Energy Management

## 1.5 Block Diagram

The following is the block diagram for PCI-P16R16 Series cards.

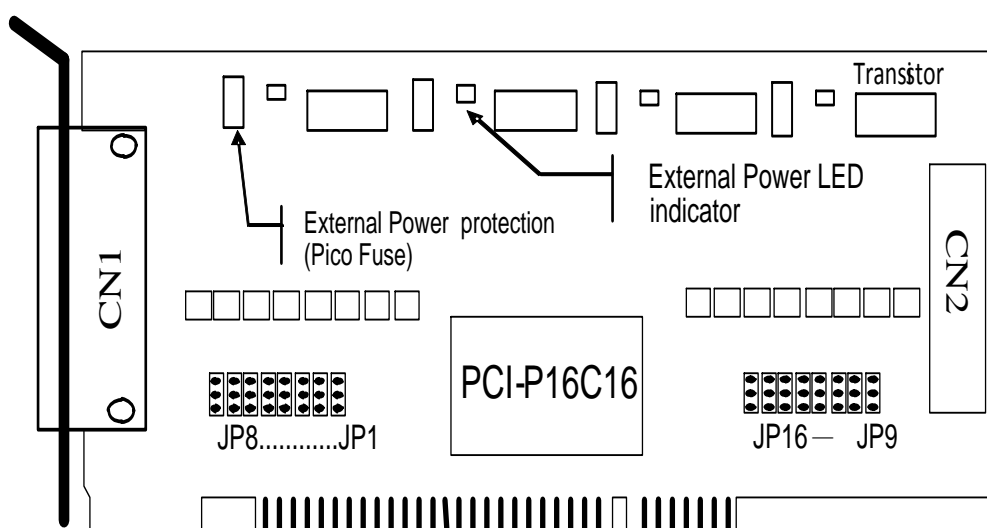


## 2 Hardware Configuration

### 2.1 Board Layout

The following is an overview of the board layout for each of the PCI-P16R16 Series cards.

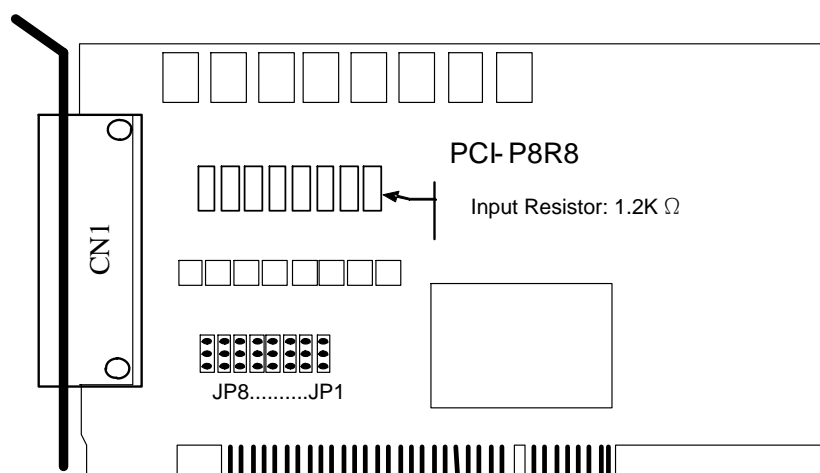
#### 2.1.1 PCI-P16C16



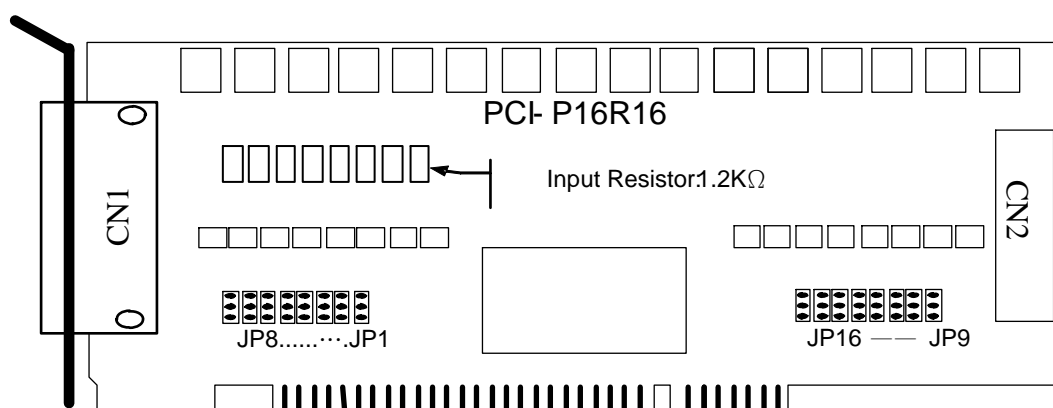
<b>CN1</b>	The Connector for Digital I/O channels 0 to 7 on PCI-P16C16 Series Cards	Refer to <a href="#">Section 2.4.2 Pin Assignments</a>
<b>JP1 - JP8</b>	Used to select whether the input signals for Digital Input channels 0 to 7 on CN1 are set to AC or DC	Refer to <a href="#">Section 2.2 Jumper Settings</a>
<b>CN2</b>	The Connector for Digital I/O channels 8 to 15 on PCI-P16C16 Series Cards	Refer to <a href="#">Section 2.4.2 Pin Assignments</a>
<b>JP9 – JP16</b>	Used to select whether the input signals for Digital Input channels 8 to 15 on CN2 are set to AC or DC	Refer to <a href="#">Section 2.2 Jumper Settings</a>

## 2.1.2 PCI-P8R8/PCI-P16R16

### ➤ PCI-P8R8



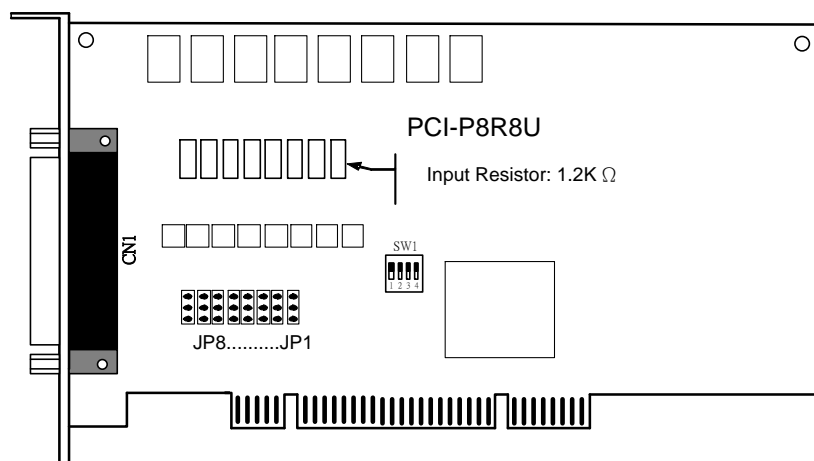
### ➤ PCI-P16R16



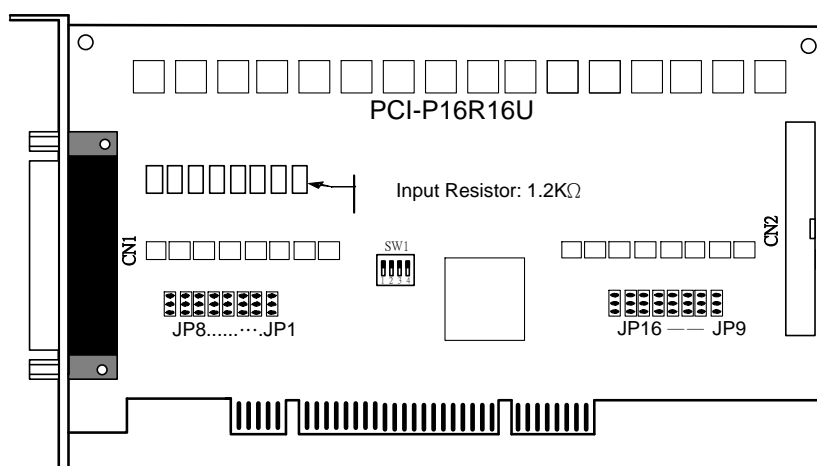
<b>CN1</b>	The Connector for Digital I/O channels 0 to 7 on PCI-P8R8/P16R16 Series Cards	Refer to <a href="#">Section 2.4.1 Pin Assignments</a>
<b>JP1 - JP8</b>	Used to select whether the input signals for Digital Input channels 0 to 7 on CN1 are set to AC or DC	Refer to <a href="#">Section 2.2 Jumper Settings</a>
<b>CN2</b>	The Connector for Digital I/O channels 8 to 15 on PCI-P16R16 Series Cards	Refer to <a href="#">Section 2.4.1 Pin Assignments</a>
<b>JP9 – JP16</b>	Used to select whether the input signals for Digital Input channels 8 to 15 on CN2 are set to AC or DC	Refer to <a href="#">Section 2.2 Jumper Settings</a>

## 2.1.3 PCI-P8R8U/P16R16U

### ➤ PCI-P8R8U

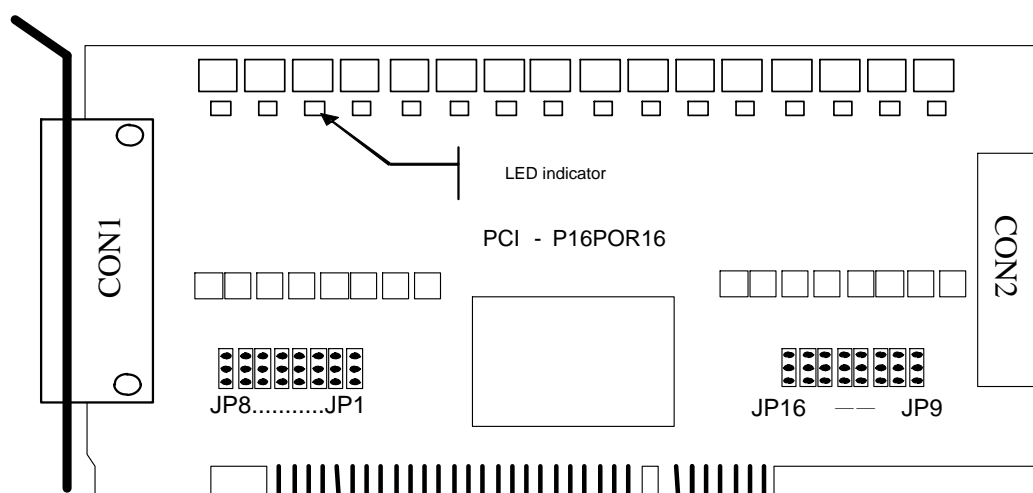


### ➤ PCI-P16R16U



<b>CN1</b>	The Connector for Digital I/O channels 0 to 7 on PCI-P8R8U/P16R16U Series Cards	Refer to <a href="#">Section 2.4.1 Pin Assignments</a>
<b>JP1 - JP8</b>	Used to select whether the input signals for Digital Input channels 0 to 7 on CN1 are set to AC or DC	Refer to <a href="#">Section 2.2 Jumper Settings</a>
<b>CN2</b>	The Connector for Digital I/O channels 8 to 15 on PCI-P16R16U Series Cards	Refer to <a href="#">Section 2.4.1 Pin Assignments</a>
<b>JP9 – JP16</b>	Used to select whether the input signals for Digital Input channels 8 to 15 on CN2 are set to AC or DC	Refer to <a href="#">Section 2.2 Jumper Settings</a>
<b>SW1</b>	The Card ID DIP Switch	Refer to <a href="#">Section 2.3 Card ID Switch (SW1)</a>

## 2.1.4 PCI-P16POR16

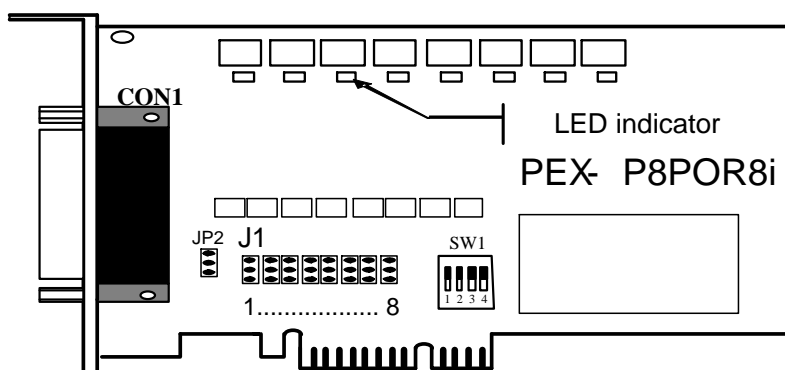


<b>CON1</b>	The Connector for Digital I/O channels 0 to 7 on PCI-P16POR16 Series Cards	Refer to <a href="#">Section 2.4.3 Pin Assignments</a>
<b>JP1 - JP8</b>	Used to select whether the input signals for Digital Input channels 0 to 7 on CN1 are set to AC or DC	Refer to <a href="#">Section 2.2 Jumper Settings</a>
<b>CON2</b>	The Connector for Digital I/O channels 8 to 15 on PCI-P16POR16 Series Cards	Refer to <a href="#">Section 2.4.3 Pin Assignments</a>
<b>JP9 – JP16</b>	Used to select whether the input signals for Digital Input channels 8 to 15 on CN2 are set to AC or DC	Refer to <a href="#">Section 2.2 Jumper Settings</a>

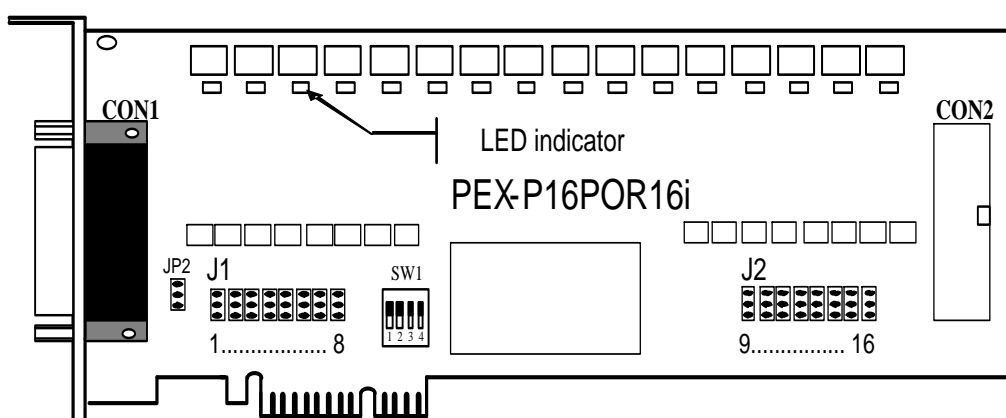


## 2.1.5 PEX-P8POR8i/PEX-P16POR16i

### ➤ PEX-P8POR8i



### ➤ PEX-P16POR16i



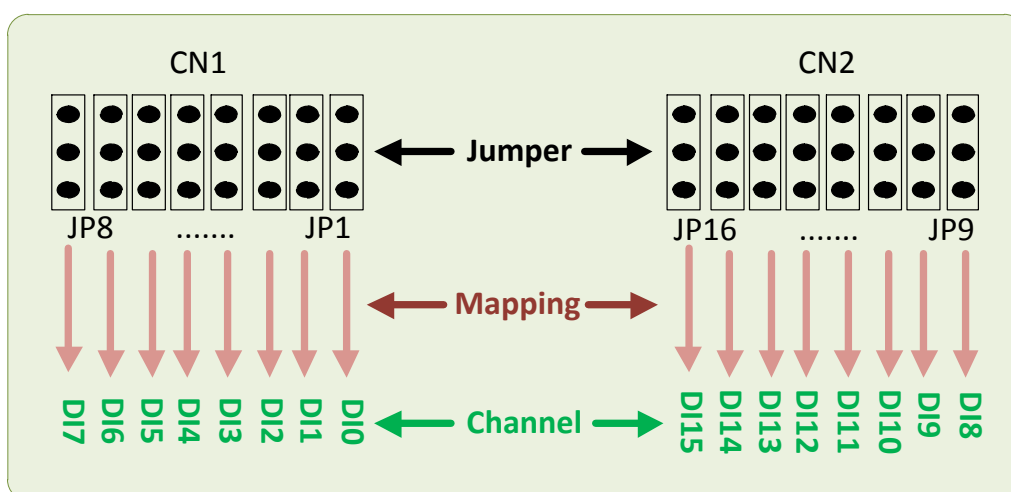
<b>CON1</b>	The Connector for Digital I/O channels 0 to 7 on PEX-P8POR8i/P16POR16i Series Cards	Refer to <a href="#">Section 2.4.3 Pin Assignments</a>
<b>J1</b>	Used to select whether the input signals for Digital Input channels 0 to 7 on CON1 are set to AC or DC	Refer to <a href="#">Section 2.2 Jumper Settings</a>
<b>CON2</b>	The Connector for Digital I/O channels 8 to 15 on PCI-P16R16i Series Cards	Refer to <a href="#">Section 2.4.3 Pin Assignments</a>
<b>J2</b>	Used to select whether the input signals for Digital Input channels 8 to 15 on CN2 are set to AC or DC	Refer to <a href="#">Section 2.2 Jumper Settings</a>
<b>JP2</b>	Used to set the Ground Isolation Protection	Refer to <a href="#">Section 2.2 Jumper Settings</a>
<b>SW1</b>	The Card ID DIP Switch	Refer to <a href="#">Section 2.3 Card ID Switch (SW1)</a>

## 2.2 Jumper Settings

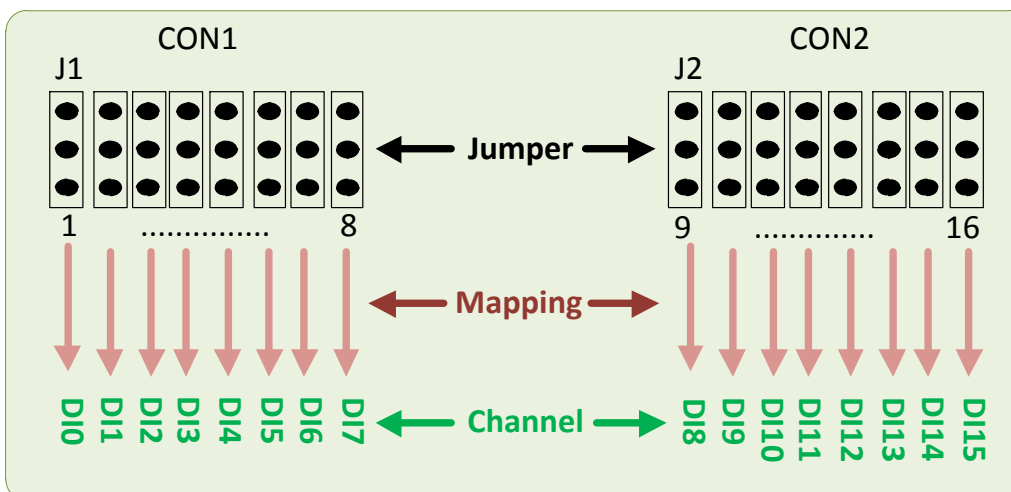
### 2.2.1 Input Signal Type

The configuration for the I/O card can be adjusted simply by setting the position of the jumpers on the card. Each Digital Input channel can be configured as a single-pole, RC filter with a time constant of 1.2 ms by setting the respective jumper. The Figures shown below provides an overview of the mapping for each Digital Input channel and the corresponding jumper position.

- Jumper Settings for CN1 and CN2 on PCI-P8R8/P16R16, PCI-P8R8U/P16R16U, PCI-P16C16 and PCI-P16POR16 Series cards:



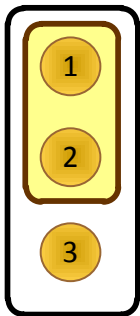
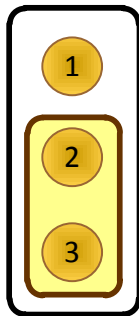
- Jumper Settings for CON1 and CON2 on PEX-P8POR8i/P16POR16i Series cards:



➤ Jumper Mapping for the Digital Input Channels on PCI and PEX Series cards:

Jumper		Channel		Jumper		Channel	
PCI Series	PEX Series			PCI Series	PEX Series		
JP1	J1	1	DI0	JP9	J2	9	DI8
JP2		2	DI1	JP10		10	DI9
JP3		3	DI2	JP11		11	DI10
JP4		4	DI3	JP12		12	DI11
JP5		5	DI4	JP13		13	DI12
JP6		6	DI5	JP14		14	DI13
JP7		7	DI6	JP15		15	DI14
JP8		8	DI7	JP16		16	DI15

The following illustrates the jumper positions used to select the Digital Input type:

Without Filter For DC Signals (Default)	With AC Filter For AC Signals
	

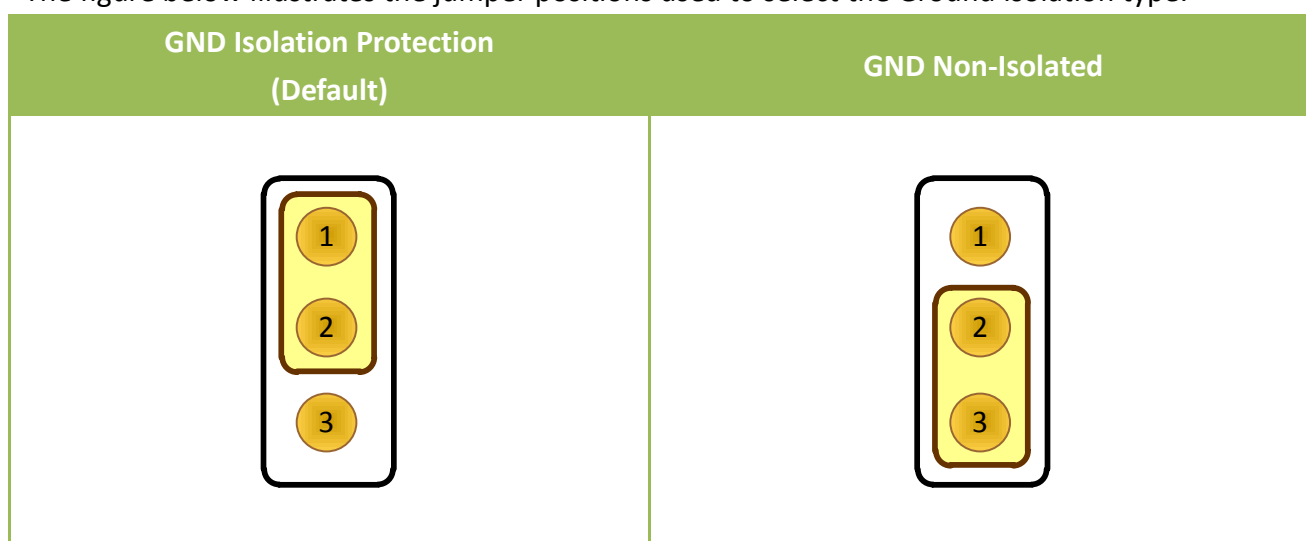
If **AC Input Signals** are to be used, ensure that the **AC FILTER** is activated by connecting pins 2 and 3 of the corresponding jumpers. When using **DC input signals**, activating the **AC FILTER** is optional. If the signal response for the DC input is less than 20  $\mu$ s, the AC Filter can be set to OFF. If a slow response is desired (about 5 to 10 ms) in order to reject noise or contact bouncing, connect pins 2 and 3 to activate the **AC FILTER**. The default position is “Without Filter For DC Signals”.

## 2.2.2 JP2: Ground Isolation Protection Jumper

Jumper JP2 is used to select whether the ground protection is configured as isolated or non-isolated.

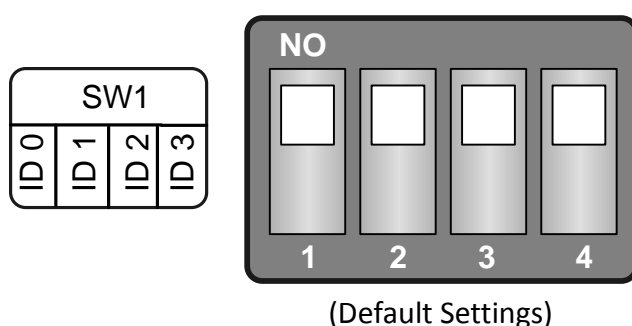
**Note that this feature is only available on PEX-P8POR8i/P16POR16i Series cards.** Ground isolation protection can be enabled by connecting pins 1 and 2 on Jumper JP2, which is the default position, as shown in the figure below. However, if the ground is to be non-isolated, then pins 2 and 3 on Jumper JP2 should be connected.

The figure below illustrates the jumper positions used to select the Ground Isolation type:



## 2.3 Card ID Switch (SW1)

The PEX-P8POR8i/P16POR16i and PCI-P8R8U/P16R16U Series cards includes an onboard Card ID DIP Switch (SW1) that enables the card to be recognized via software if two or more cards are installed in the same computer. The default Card ID is 0x0 in hexadecimal format. For more detailed information regarding the positions of the SW1 DIP Switch for the different Card ID settings, refer to the table below. **Note that the Card ID Switch is only available on PEX-P8POR8i/P16POR16i and PCI-P8R8U/P16R16U Series cards.**



Card ID (Hex)	1 ID0	2 ID1	3 ID2	4 ID3
(*) 0x0	ON	ON	ON	ON
0x1	OFF	ON	ON	ON
0x2	ON	OFF	ON	ON
0x3	OFF	OFF	ON	ON
0x4	ON	ON	OFF	ON
0x5	OFF	ON	OFF	ON
0x6	ON	OFF	OFF	ON
0x7	OFF	OFF	OFF	ON
0x8	ON	ON	ON	OFF
0x9	OFF	ON	ON	OFF
0xA	ON	OFF	ON	OFF
0xB	OFF	OFF	ON	OFF
0xC	ON	ON	OFF	OFF
0xD	OFF	ON	OFF	OFF
0xE	ON	OFF	OFF	OFF
0xF	OFF	OFF	OFF	OFF

(\*) Default Settings; OFF → 1; ON → 0

## 2.4 Pin Assignments

The following is an overview of the pin assignments for PCI-P16R16 Series cards.

### 2.4.1 PCI-P8R8/P8R8U/P16R16/P16R16U

Pin Assignment <b>CN2</b>	Pin Assignment <b>CN1</b>	Terminal No.	Pin Assignment <b>CN1</b>	Pin Assignment <b>CN2</b>	Pin Assignment	Terminal No.	Pin Assignment
NO_8	NO_0	01	20 NO_3	NO_11	NO_8	01	NO_11
COM_8	COM_0	02	21 COM_3	COM_11	COM_8	03	COM_11
NC_8	NC_0	03	22 NC_3	NC_11	NC_8	05	NC_11
NO_9	NO_1	04	23 NO_4	NO_12	NO_9	07	NO_12
COM_9	COM_1	05	24 COM_4	COM_12	COM_9	09	COM_12
NC_9	NC_1	06	25 NO_5	NO_13	NC_9	11	NO_13
NO_10	NO_2	07	26 COM_5	COM_13	NO_10	13	COM_13
COM_10	COM_2	08	27 NO_6	NO_14	COM_10	15	NO_14
NC_10	NC_2	09	28 COM_6	COM_14	NC_10	17	COM_14
NO_15	NO_7	10	29 GND	GND	NO_15	19	GND
COM_15	COM_7	11	30 DIB_0	DIB_8	COM_15	21	DIB_8
DIA_0	DIA_0	12	31 DIB_1	DIB_9	DIA_8	23	DIB_9
DIA_1	DIA_1	13	32 DIB_2	DIB_10	DIA_9	25	DIB_10
DIA_2	DIA_2	14	33 DIB_3	DIB_11	DIA_10	27	DIB_11
DIA_3	DIA_3	15	34 DIB_4	DIB_12	DIA_11	29	DIB_12
DIA_4	DIA_4	16	35 DIB_5	DIB_13	DIA_12	31	DIB_13
DIA_5	DIA_5	17	36 DIB_6	DIB_14	DIA_13	33	DIB_14
DIA_6	DIA_6	18	37 DIB_7	DIB_15	DIA_14	35	DIB_15
DIA_7	DIA_7	19			DIA_15	37	N/A
					N/A	39	N/A

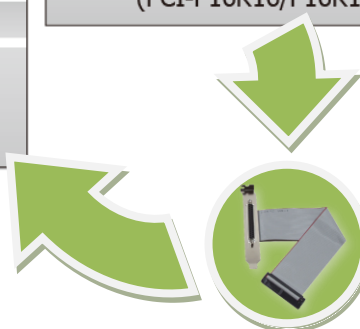
CN2 (40-pin box header)  
(PCI-P16R16/P16R16U only)

CN1 (Female DB-37)



#### Notes:

<b>NO:</b> Normally Open	<b>DIA:</b> Digital Input (Point A)
<b>COM:</b> Common	<b>DIB:</b> Digital Input (Point B)
<b>NC:</b> Normally Closed	



**Extension Cable (CA-4037W):**  
Conversion from DB-40-pin to DB-37-pin

## 2.4.2 PCI-P16C16

Pin Assignment CN2	Pin Assignment CN1	Terminal No.	Pin Assignment CN1	Pin Assignment CN2
OUT_8	OUT_0	01		
OUT_9	OUT_1	02	20	Ext. Power 1
OUT_10	OUT_2	03	21	Ext. Power1
OUT_11	OUT_3	04	22	GND_1
OUT_12	OUT_4	05	23	GND_1
OUT_13	OUT_5	06	24	Ext. Power2
OUT_14	OUT_6	07	25	Ext. Power2
OUT_15	OUT_7	08	26	GND_2
N/A	N/A	09	27	GND_2
N/A	N/A	10	28	N/A
N/A	N/A	11	29	N/A
DIA_8	DIA_0	12	30	DIB_0
DIA_9	DIA_1	13	31	DIB_1
DIA_10	DIA_2	14	32	DIB_2
DIA_11	DIA_3	15	33	DIB_3
DIA_12	DIA_4	16	34	DIB_4
DIA_13	DIA_5	17	35	DIB_5
DIA_14	DIA_6	18	36	DIB_6
DIA_15	DIA_7	19	37	DIB_7

Diagram of a female DB-37 connector with pins numbered 01 to 37.

CN1(Female DB-37)

Pin Assignment	Terminal No.	Pin Assignment
DO_8	01	02 Ext. Power3
DO_9	03	04 Ext. Power3
DO_10	05	06 GND3
DO_11	07	08 GND3
DO_12	09	10 Ext. Power4
DO_13	11	12 Ext. Power4
DO_14	13	14 GND4
DO_15	15	16 GND4
N/A	17	18 N/A
N/A	19	20 N/A
N/A	21	22 DIB_8
DIA_8	23	24 DIB_9
DIA_9	25	26 DIB_10
DIA_10	27	28 DIB_11
DIA_11	29	30 DIB_12
DIA_12	31	32 DIB_13
DIA_13	33	34 DIB_14
DIA_14	35	36 DIB_15
DIA_15	37	38 N/A
N/A	39	40 N/A

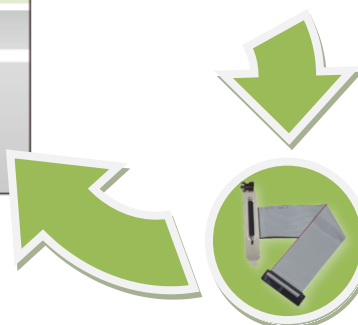
Diagram of a 40-pin box header with pins numbered 01 to 40.

CN2(40-pin box header)



### Notes:

<b>Ext. Power:</b>	External Power Input
<b>GND:</b>	External Power Ground
<b>OUT:</b>	Open Collector Output
<b>DIA:</b>	Digital Input (Point A)
<b>DIB:</b>	Digital Input (Point B)



**Extension Cable (CA-4037W):**  
Conversion from DB-40-pin to DB-37-pin

## 2.4.3 PCI-P16POR16 and PEX-P8POR8i/P16POR16i

Pin Assignment <b>CON2</b>	Pin Assignment <b>CON1</b>	Terminal No.	Pin Assignment <b>CON1</b>	Pin Assignment <b>CON2</b>
NO_8	NO_0	01	20	CM_0
NO_9	NO_1	02	21	CM_1
NO_10	NO_2	03	22	CM_2
NO_11	NO_3	04	23	CM_3
NO_12	NO_4	05	24	CM_4
NO_13	NO_5	06	25	CM_5
NO_14	NO_6	07	26	CM_6
NO_15	NO_7	08	27	CM_7
N/A	N/A	09	28	N/A
N/A	N/A	10	29	GND
N/A	N/A	11	30	DIB_0
DIA_8	DIA_0	12	31	DIB_1
DIA_9	DIA_1	13	32	DIB_2
DIA_10	DIA_2	14	33	DIB_3
DIA_11	DIA_3	15	34	DIB_4
DIA_12	DIA_4	16	35	DIB_5
DIA_13	DIA_5	17	36	DIB_6
DIA_14	DIA_6	18	37	DIB_7
DIA_15	DIA_7	19		

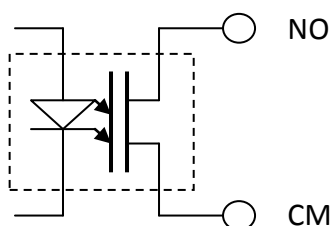
Pin Assignment	Terminal No.	Pin Assignment
NO_8	01	02
NO_9	03	04
NO_10	05	06
NO_11	07	08
NO_12	09	10
NO_13	11	12
NO_14	13	14
NO_15	15	16
N/A	17	18
N/A	19	20
N/A	21	22
DIA_8	23	24
DIA_9	25	26
DIA_10	27	28
DIA_11	29	30
DIA_12	31	32
DIA_13	33	34
DIA_14	35	36
DIA_15	37	38
N/A	39	40

CON2 (40-pin box header)  
(PCI-P16POR16/PEX-P16POR16i only)

CON1 (Female DB-37)



### Notes:



**DIA:** Digital Input  
(Point A)

**DIB:** Digital Input  
(Point B)

**Extension Cable (CA-4037W):**  
Conversion from DB-40-pin to DB-37-pin



## 3 Hardware Applications

Model	Input	Output
PCI-P8R8/P8R8U	Optical Isolation	Relay
PCI-P16R16/P16R16U	Optical Isolation	Relay
PCI-P16C16	Optical Isolation	Transistor (Open Collector)
PCI-P16POR16	Optical Isolation	PhotoMOS Relay
PEX-P8POR8i	Optical Isolation	PhotoMOS Relay
PEX-P16POR16i	Optical Isolation	PhotoMOS Relay

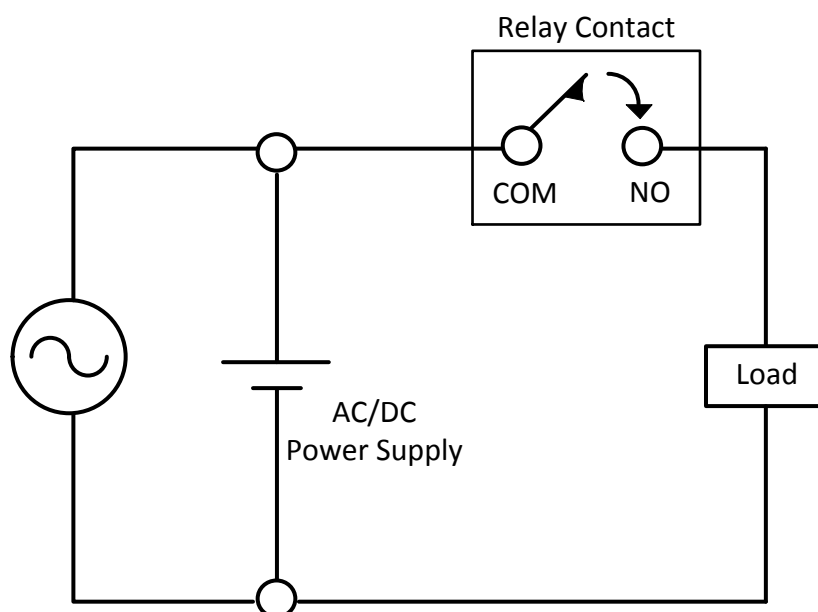
### 3.1 Relay Output

#### For PCI-P8R8/P16R16 and PCI-P8R8U/P16R16U Series Cards Only

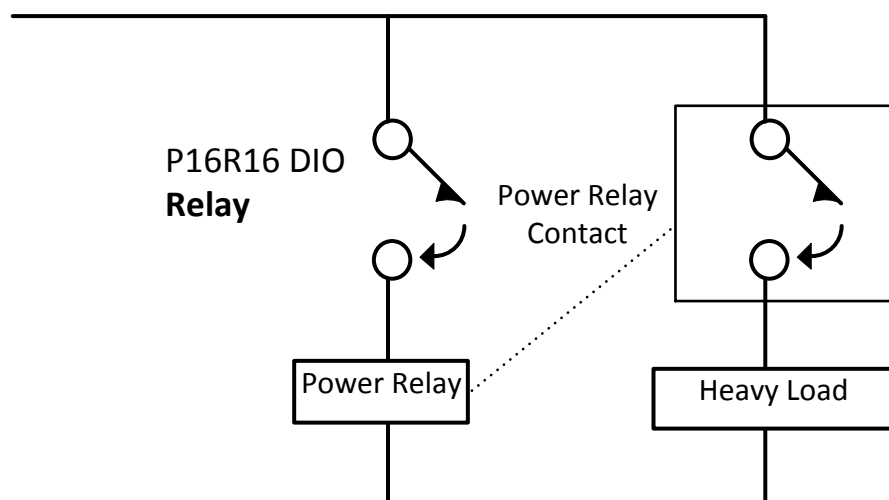
Whenever data is written to the output control register, the Relays will switch to either **Normally Closed (NC)** or **Normally Open (NO)**, as specified by the control code. A “1” in the control register will energize the corresponding Relay, which will then switch from **Common (COM)** to NO. A “0” in the control register will turn off the corresponding Relay, which will then be switched from COM to NC. The control register will be set to NC mode when the board is first powered-on. Hardware reset signal or a programmable reset signal will also switch the Relay to NC.

The following figures illustrate how to use the Relay.

- Basic Relay Circuitry: (Current Rating < 0.3A):



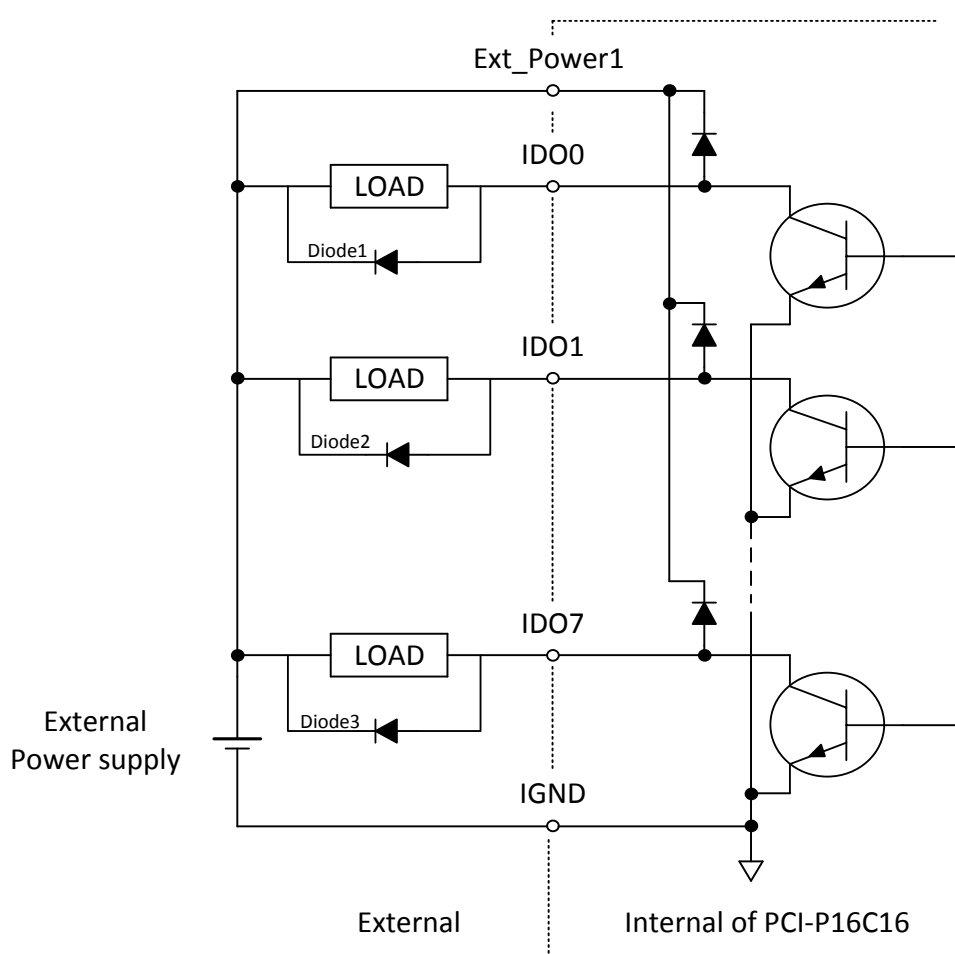
- The Relay Circuit for Heavy Load Applications (Current Rating > 0.3 A):



## 3.2 Open Collector Output

### For PCI-P16C16 Series Cards Only

PCI-P16C16 Series cards provide 16 open collector output channels with 4 channels per common power. Each common power is designed to include fuse protection and LED status indicators.

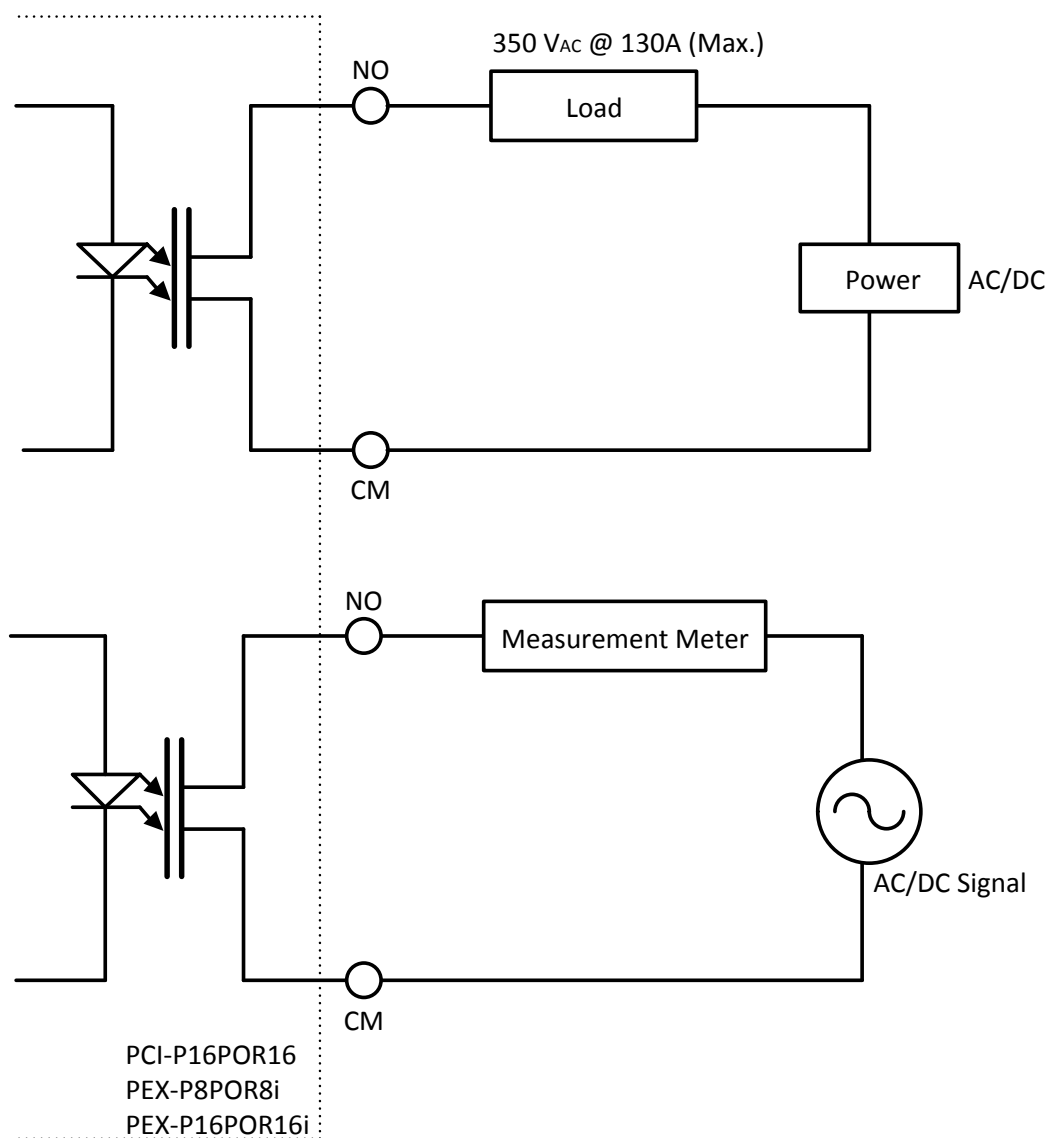


(Recommend : It Is necessary to connect a diode1 (..3..) . In the External Device end as means of preventing damage form the counter emf . If your Device Is Inductive Load , Ex. Relay ...)

## 3.3 PhotoMOS Relay Output

### For PEX-P8POR8i/P16POR16i and PCI-P16POR16 Series Cards Only

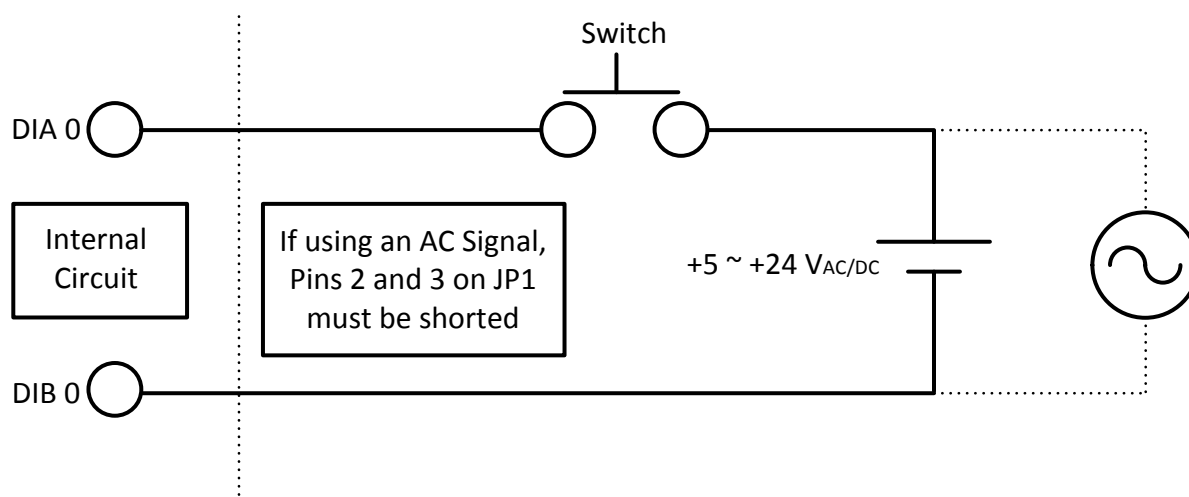
The PEX-P8POR8i/P16POR16i and PCI-P16POR16 Series cards contain 8/16 normally open, Form A PhotoMOS Relay Output channels. The cards can be used to help to eliminate ground-loop problems and isolate the computer from potentially damaging voltage spikes. PEX-P8POR8i/P16POR16i and PCI-P16POR16 Series cards can be used to switch loads of up to 350 V<sub>AC</sub> at 130 mA.



## 3.4 Isolated Input

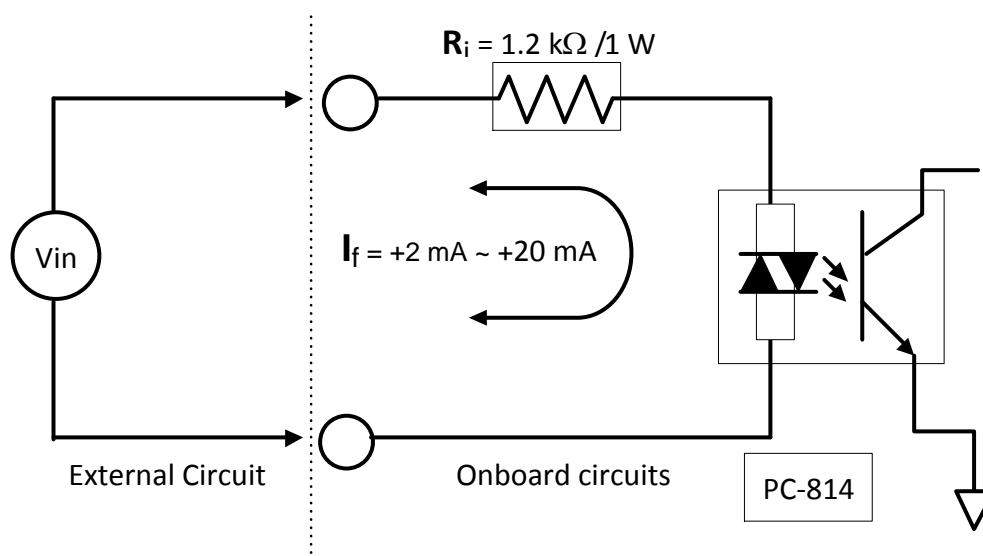
### For PCI-P8R8/P16R16, PCI-P16C16, PCI-P16POR16 and PEX-P8POR8i/P16POR16i Series Cards

The status of the Digital Input for the photo-couple (isolation input) can be determined by reading the isolation input register. The figure below is an illustration of a basic Digital Input circuit.



Although the normal input voltage range is from +5 to +24 V<sub>AC</sub> or V<sub>DC</sub>, it can still be increased to a larger range by integrating a suitable external resistor. The following figure shows how to connect to a larger input. Note that the input current should be limited to between +2 mA and +20 mA, as too large an input current will burn the internal resistor **R<sub>i</sub>**, while too low an input current will not be strong enough to activate the photo-coupler isolator.

To ensure that the circuit will operate as expected, first calculate the input voltage and the current, and then replace **R<sub>i</sub>** with a suitable resistor.



The following is an example of how to calculate an approximate value for the resistor:

If  $V_{in} = 120 \text{ V}$  and the photo-coupler turn-on voltage is ignored, the calculation will be as follows:

$$\begin{aligned} V_{in} &= 120 \text{ (V)}, I_f = 10 \text{ (mA)}, R_i = V_{in} / I_f \\ V_{in} / I_f &= R_i \\ 120 \text{ (V)} / 0.01 \text{ (A)} &= 12000 \text{ (}\Omega\text{)} \end{aligned}$$

If resistor  $R_i$  is replaced with a  $12 \text{ k}\Omega$  resistor, the power consumption for  $R_i$  can be calculated as follows:

$$\begin{aligned} P &= I^2 R_{ex} \\ &= (10 \text{ mA})^2 * 12 \text{ k}\Omega \\ &= 1.2 \text{ W} \end{aligned}$$

Therefore, the power consumption will be **1.2 W**, although choosing **1.5 or 2 W** would be better. Thus, a **12 kΩ/2 W** resistor can be used to replace resistor  $R_i$ .

## 4 Hardware Installation



### Note:

It is recommended that the driver is installed before installing the hardware as the computer may need to be restarted once the driver is installed in certain operating systems, such as Windows 2000 or Windows XP, etc. Installing the driver first helps reduce the time required for installation and restarting the computer.

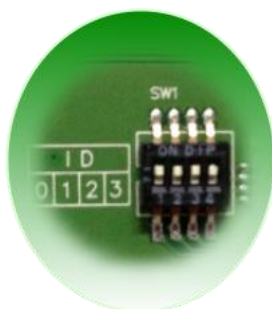
To install the PCI-P16R16 Series cards, follow the procedure described below:

Step 1: Install the driver for the DAQ card on your computer.



For detailed information about installing the driver, refer to **Chapter 5 Software Installation**.

Step 2: For PEX-P8POR8i/P16POR16i and PCI-P8R8U/P16R16U Series cards, configure the Card ID using the DIP Switch (SW1). This step can be skipped for other cards.



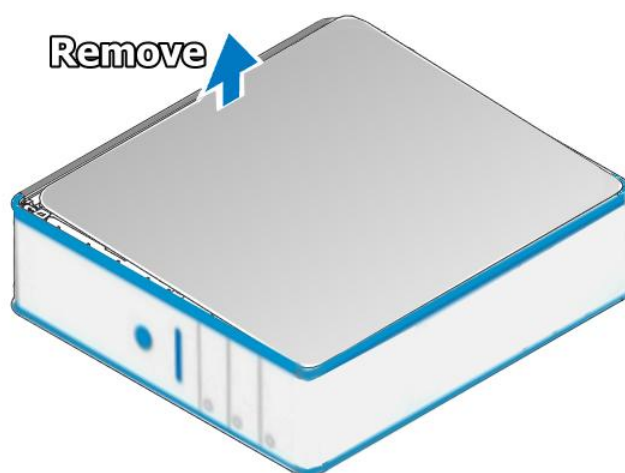
For detailed information about the Card ID, refer to **Section 2.3 Card ID Switch (SW1)**.

**Note:** The Card ID function is only supported on PEX-P8POR8i/P16POR16i and PCI-P8R8U/P16R16U Series cards.

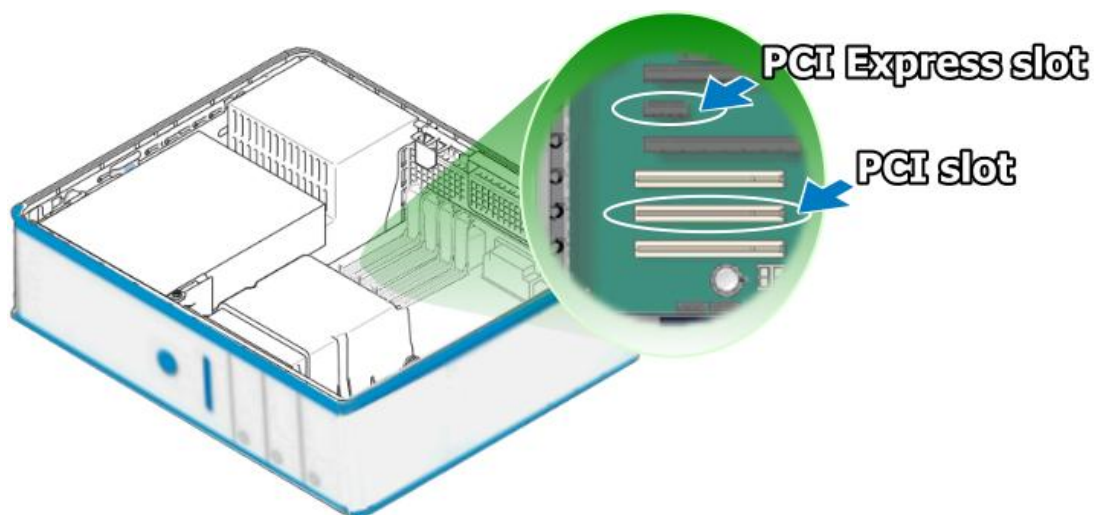


Step 3: Shut down and switch off the power to the computer, and then disconnect the power supply.

Step 4: Remove the cover from the computer.

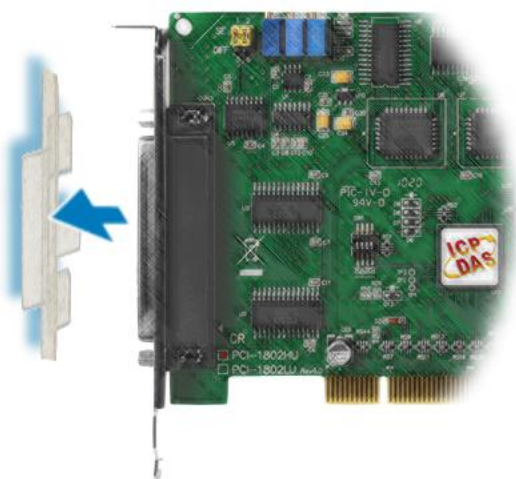
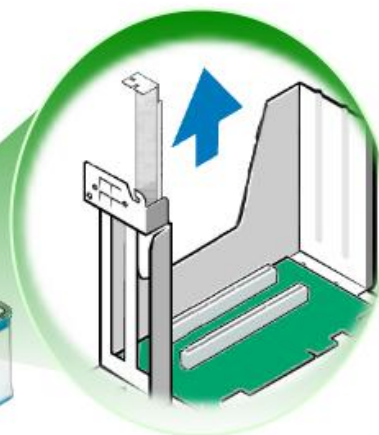
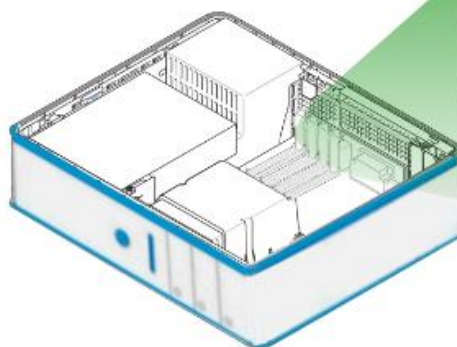


Step 5: Select a vacant PCI/PCI Express slot.



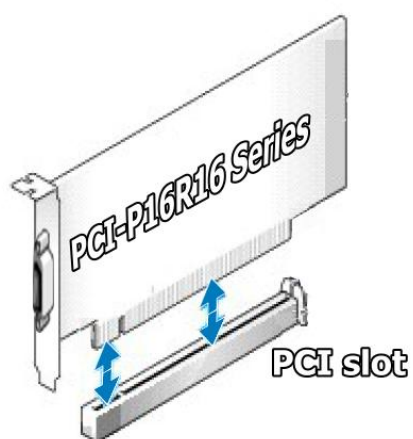


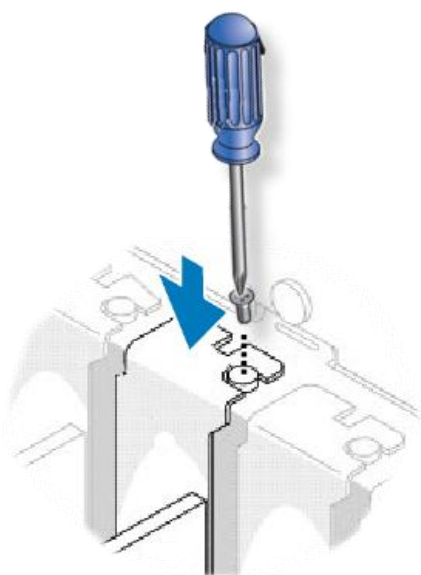
Step 6: Unscrew and remove the PCI/PCI Express slot cover from the computer case.



Step 7: Remove the connector cover form the DAQ card.

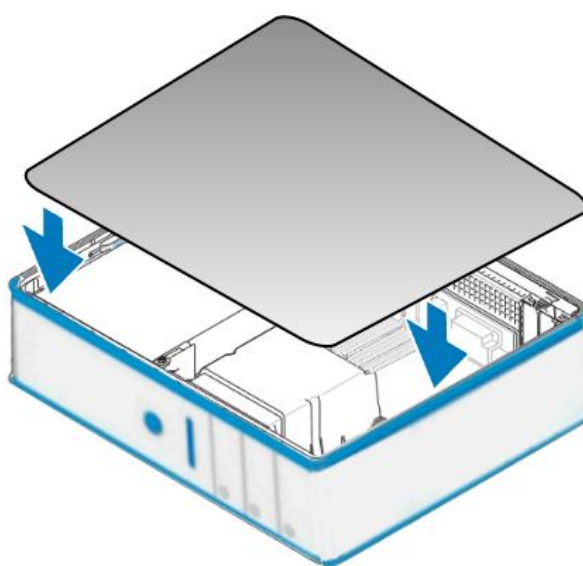
Step 8: Carefully insert the DAQ card into the PCI/PCI Express slot by gently pushing down on both sides of the card until it slides into the PCI connector.





Step 9: Confirm that the card is correctly inserted in the motherboard, and then secure the DAQ card in place using the retaining screw that was removed in Step 6.

Step 10: Replace the covers on the computer.



Step 11: Re-attach any cables, insert the power cord and then switch on the power to the computer.



Once the computer reboots, follow any message prompts that may be displayed to complete the Plug and Play installation procedure. Refer to **Chapter 5 Software Installation** for more information.

## 5 Software Installation

This chapter provides a detailed description of the process for installing the driver for the PCI-P16R16 Series card as well as how to verify whether the PCI-P16R16 Series card was properly installed. PCI-P16R16 Series cards can be used on DOS, Linux and Windows 2000 and 32-/64-bit version of Windows XP/2003/Vista/7/8 based systems, and the drivers are fully Plug and Play compliant for easy installation.

### 5.1 Obtaining/Installing the Driver Installer Package

The driver installation package for PCI-P16R16 Series cards can be found on the companion CD-ROM, or can be obtained from the ICP DAS FTP web site. Install the appropriate driver for your operating system. The location and website addresses for the installation package are indicated below.

#### ➤ UniDAQ Driver/SDK

Operating System	Windows 2000, 32/64-bit Windows XP, 32/64-bit Windows 2003, 32/64-bit Windows Vista, 32/64-bit Windows 7, 32/64-bit Windows 2008, and 32/64-bit Windows 8
Driver Name	UniDAQ Driver/SDK (unidaq_win_setup_XXXX.exe)
CD-ROM	CD:\\ NAPDOS\\PCI\\UniDAQ\\DLL\\Driver\\
Web site	<a href="http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/unidaq/dll/driver/">http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/unidaq/dll/driver/</a>
Installing Procedure	<p>Please follow the following steps to setup software:</p> <p><b>Step 1:</b> Double click the <b>UniDAQ_Win_Steupxxx.exe</b> to setup it.</p> <p><b>Step 2:</b> When the Setup Wizard screen is displayed, click the <b>Next&gt;</b> button.</p> <p><b>Step 3:</b> When the Information screen is displayed, click the <b>Next&gt;</b> button.</p>

**Installation  
Procedure**

**Step 4:** Select the folder where the drivers are to install. The **default path is C:\ICPDAS\UniDAQ**. But if you wish to install the drivers to a different location , click the “**Browse...**” button and select the relevant folder and then click the **Next>** button.

**Step 5:** When the Select Components screen is displayed, check PCI-1002 series board on the list, then click the **Next>** button.

**Step 6:** When the Select Additional Tasks screen is displayed, click the **Next>** button.

**Step 7:** When the Download Information screen is displayed, click the **Next>** button.

**Step 8:** Select the item “**Yes, restart the computer now**”, press the **Finish** button. System will reboot.

For more detailed information about how to install the UniDAQ driver, refer to “Section 2.2 Install UniDAQ Driver DLL” of the UniDAQ Software Manual, which can be found in the \NAPDOS\PCI\UniDAQ\Manual\ folder on the companion CD, or can be downloaded from:

<http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/unidaq/manual/>

➤ **PCI-P16R16 Series Classic Driver**

<b>Operating System</b>	Windows 95/98/ME, Windows NT, Windows 2000, 32-bit Windows XP, 32-bit Windows 2003, 32-bit Windows Vista, 32-bit Windows 7 and 32-bit Windows 8
<b>Driver Name</b>	<b>PCI-P16R16 Series Classic Driver</b> The name of the driver depending on the platform being used. The setup files for the relevant operating system can be found in the <b>Win98, WinNT or Win2K_XP_7</b> folders.
<b>CD-ROM</b>	CD:\NAPDOS\PCI\PCI-P16R16\DLL_OXC\
<b>Web site</b>	<a href="http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pci-p16r16/dll_ocx/">http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pci-p16r16/dll_ocx/</a>
<b>Installing Procedure</b>	<p>Please follow the following steps to setup software:</p> <p><b>Step 1:</b> Double click the <b>PCI-P16R16 Series Classic Driver</b> to setup it.</p> <p><b>Step 2:</b> When the Setup Wizard screen is displayed, click the <b>Next&gt;</b> button.</p> <p><b>Step 3:</b> Select the folder where the drivers are to install. The <b>default path is C:\DAQPro\PCI-P16R16_Winxxx</b>. But if you wish to install the drivers to a different location , click the <b>“Browse...”</b> button and select the relevant folder and then click the <b>Next&gt;</b> button.</p> <p><b>Step 4:</b> Select the item <b>“No, I will restart my computer later”</b>, press the <b>Finish</b> button.</p> <p>For detailed information about how to install the Classic Driver for PCI-P16R16 Series cards, refer to the PCI-P16R16 Series Classic Driver DLL Software, which can be found in the \NAPDOS\PCI\PCI-P16R16\Manual\ folder on the companion CD, or can be downloaded from:  <a href="http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pci-p16r16/manual/">http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pci-p16r16/manual/</a> </p>

➤ **Linux Driver**

<b>Operating System</b>	Linux Kernel 2.4.x/2.6.x/3.12.x
<b>Driver Name</b>	lxpci.tar.gz
<b>CD-ROM</b>	CD:\\NAPDOS\\Linux\\
<b>Web site</b>	<a href="http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/linux/">http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/linux/</a>
<b>Installing Procedure</b>	For detailed information about how to install the Linux driver, refer to the readme.txt file that can be found in the \\NAPDOS\\Linux\\ folder on the companion CD.

## 5.2 Plug and Play Driver Installation

Switch off the computer and install the PCI-P16R16 Series card(s). Turn on the computer and Windows 98/ME/2000 or 32/64-bit Windows XP/2003/Vista/7/8 should automatically detect any new PCI device(s) and then ask for the location of the driver files for the new hardware.

If a problem is encountered during installation, refer to the **PCI-P16R16\_Pnp\_Driver\_Installation** file, which can be found in the \\NAPDOS\\PCI\\PCI-P16R16\\Manual\\ folder on the companion CD, or can be downloaded from the ICP DAS FTP website at:

<http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pci-p16r16/Manual/>

## 5.3 Verifying the Installation

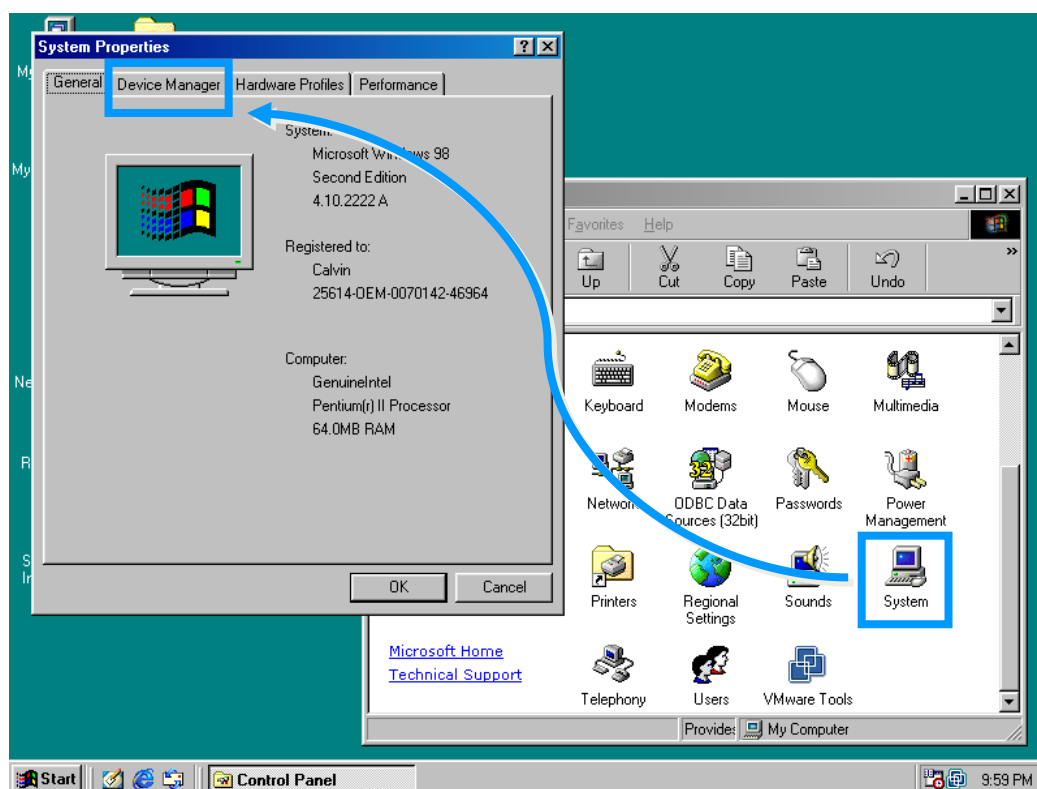
To verify that the driver was correctly installed, use the Windows **Device Manager** to view and update the device drivers installed on the computer, and to ensure that the hardware is operating correctly. The following is a description of how access the Device Manager in each of the major versions of Windows. Refer to the appropriate description for the specific operating system to verify the installation.

### 5.3.1 Accessing Windows Device Manager

#### ■ Windows 95/98/ME

**Step 1:** Either right-click the “**My Computer**” icon on the desktop and then click “**Properties**”, or open the “**Control Panel**” and double-click the “**System**” icon to open the System Properties dialog box.

**Step 2:** In the **System Properties** dialog box, click the “**Device Manager**” tab.

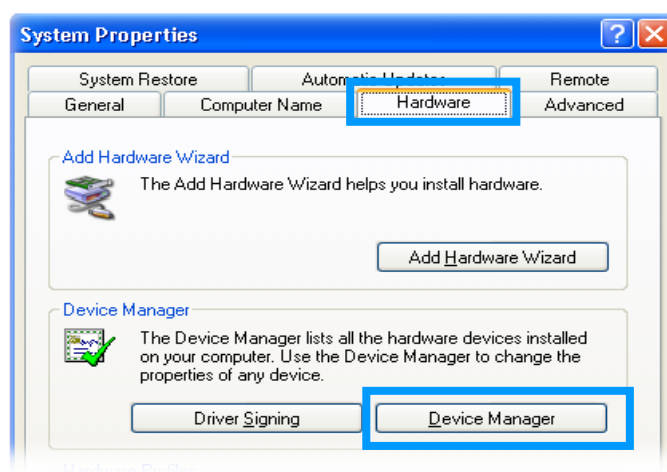


## ■ Windows 2000/XP

**Step 1:** Click the **“Start”** button and then point to **“Settings”** and click **“Control Panel”**.

Double-click the **“System”** icon to open the **“System Properties”** dialog box.

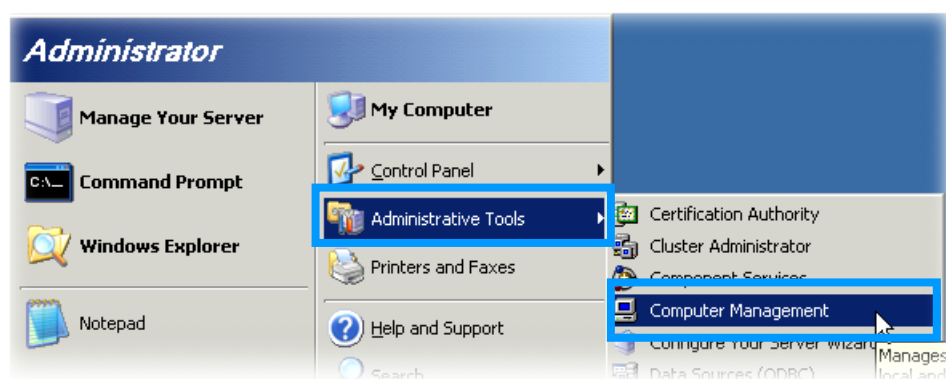
**Step 2:** Click the **“Hardware”** tab and then click the **“Device Manager”** button.



## ■ Windows Server 2003

**Step 1:** Click the **“Start”** button and point to **“Administrative Tools”**, and then click the **“Computer Management”** option.

**Step 2:** Expand the **“System Tools”** item in the console tree, and then click **“Device Manager”**.





## ■ Windows Vista/7

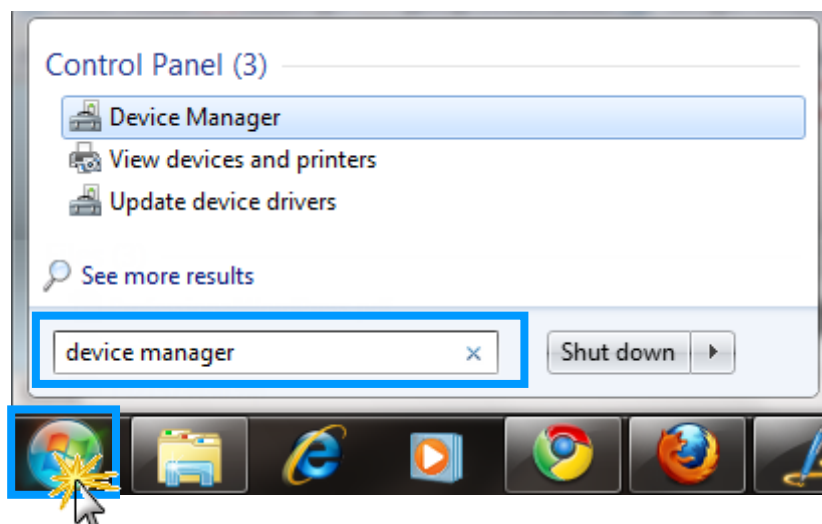
**Step 1:** Click the “Start” button, and then click “Control Panel”.


**Step 2:** Click “System and Maintenance”, and then click “Device Manager”.

Alternatively,

**Step 1:** Click the “Start” button.

**Step 2:** In the **Search field**, type **Device Manager** and then press Enter.



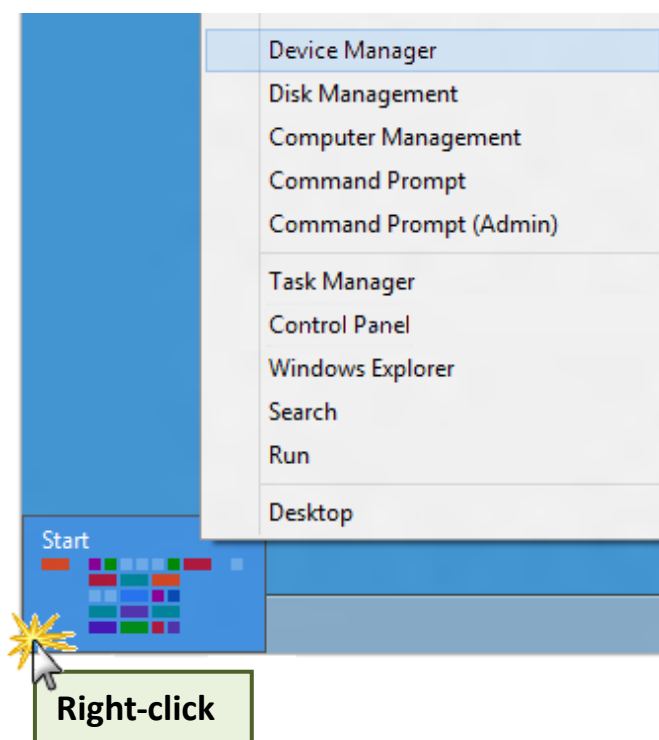
 **Note that Administrator privileges are required for this operation. If you are prompted for an administrator password or confirmation, enter the password or provide confirmation by clicking the “Yes” button in the User Account Control message.**

## ■ Windows 8

**Step 1:** To display the **Start screen icon** from the desktop view, hover the mouse cursor over the **bottom-left corner** of screen.

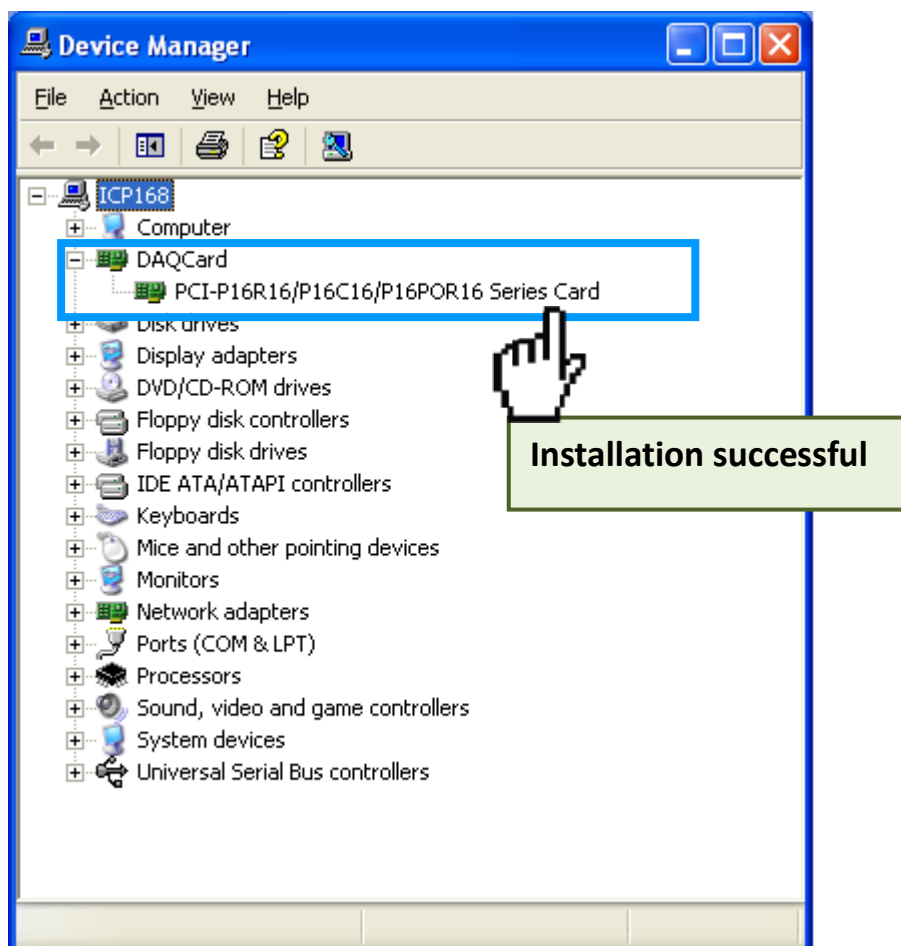
**Step 2:** **Right-click** the Start screen icon and then click “Device Manager”.

Alternatively, press [Windows Key] +[X] to open the Start Menu, and then select Device Manager from the options list.



### 5.3.2 Check the Installation

Check that the PCI-P16R16 Series card is correctly listed in the Device Manager, as illustrated below.



## 6 Testing the PCI-P16R16 Series Card

This chapter provides detailed information about the “Self-Test” process, which is used to confirm that the PCI-P16R16 Series card is operating correctly. Before beginning the “Self-Test” process, ensure that both the hardware and driver installation procedures are fully completed. For detailed information about the hardware and driver installation, refer to **Chapter 4 Hardware Installation** and **Chapter 5 Software Installation**.

### 6.1 Self-Test Wiring

The following is a description of how to configure the wiring in order to perform the “Self-Test” procedures for the Digital Input and Digital Output. Refer to the appropriate descriptions for PCI-P16R16 Series cards in Sections 6.1.1 to 6.1.3 for more detailed information.

Before beginning the “Self-Test” procedure, ensure that the following items are available:

☒ A CA-3710 Cable

(Optional, Website: [http://www.icpdas.com/products/Accessories/cable/cable\\_selection.htm](http://www.icpdas.com/products/Accessories/cable/cable_selection.htm))

☒ A DN-37 Terminal Board

(Optional, Website:

[http://www.icpdas.com/root/product/solutions/pc\\_based\\_io\\_board/daughter\\_boards/dn-37.html](http://www.icpdas.com/root/product/solutions/pc_based_io_board/daughter_boards/dn-37.html))

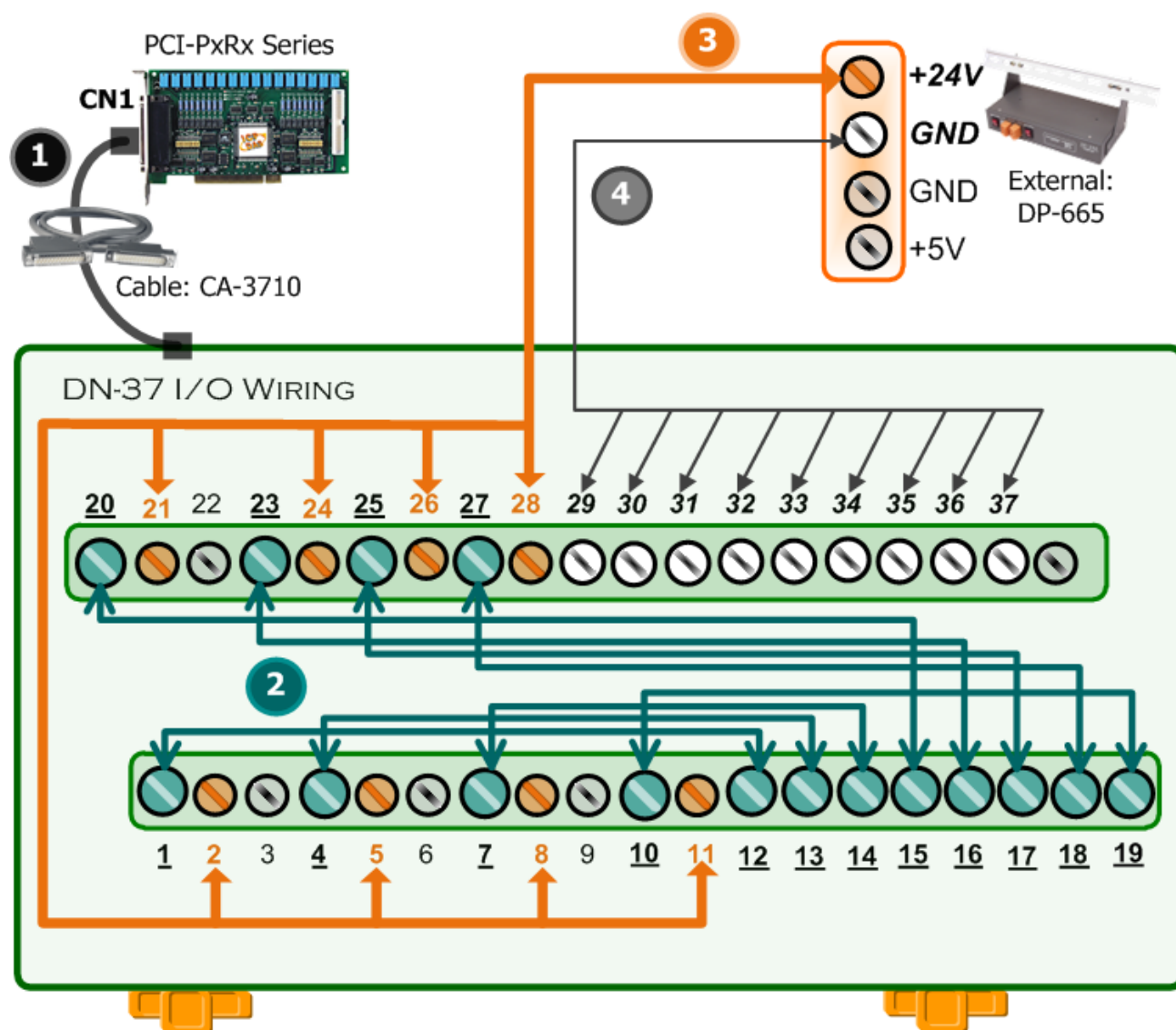
☒ An External power supply device, such as the DP-665

(Optional, Website:

[http://www.icpdas.com/root/product/solutions/accessories/power\\_supply/dp-665.html](http://www.icpdas.com/root/product/solutions/accessories/power_supply/dp-665.html))

## 6.1.1 PCI-P8R8/P8R8U/P16R16/P16R16U Test Wiring

- Step 1:** Connect the DN-37 to the CN1 connector on the board using the CA-3710 cable.
- Step 2:** Connect the **NO(0...7) pins** to the **DIA(0...7) pins**.  
(i.e., connect Pin1/4/7/20/23/25/27/10 to Pin12/13/14/15/16/17/18/19)
- Step 3:** Connect the **External Power Supply (+24 V)** to the **COM0...COM7 pins**  
(Pin2/5/8/21/24/26/28/11) .
- Step 4:** Connect the **External Power Supply GND** to the **DIB0...DIB7 pins**(Pin30/31/32/33/34/35/36/37).  
Connect the **External Power Supply GND** to the **GND pin** (Pin29).



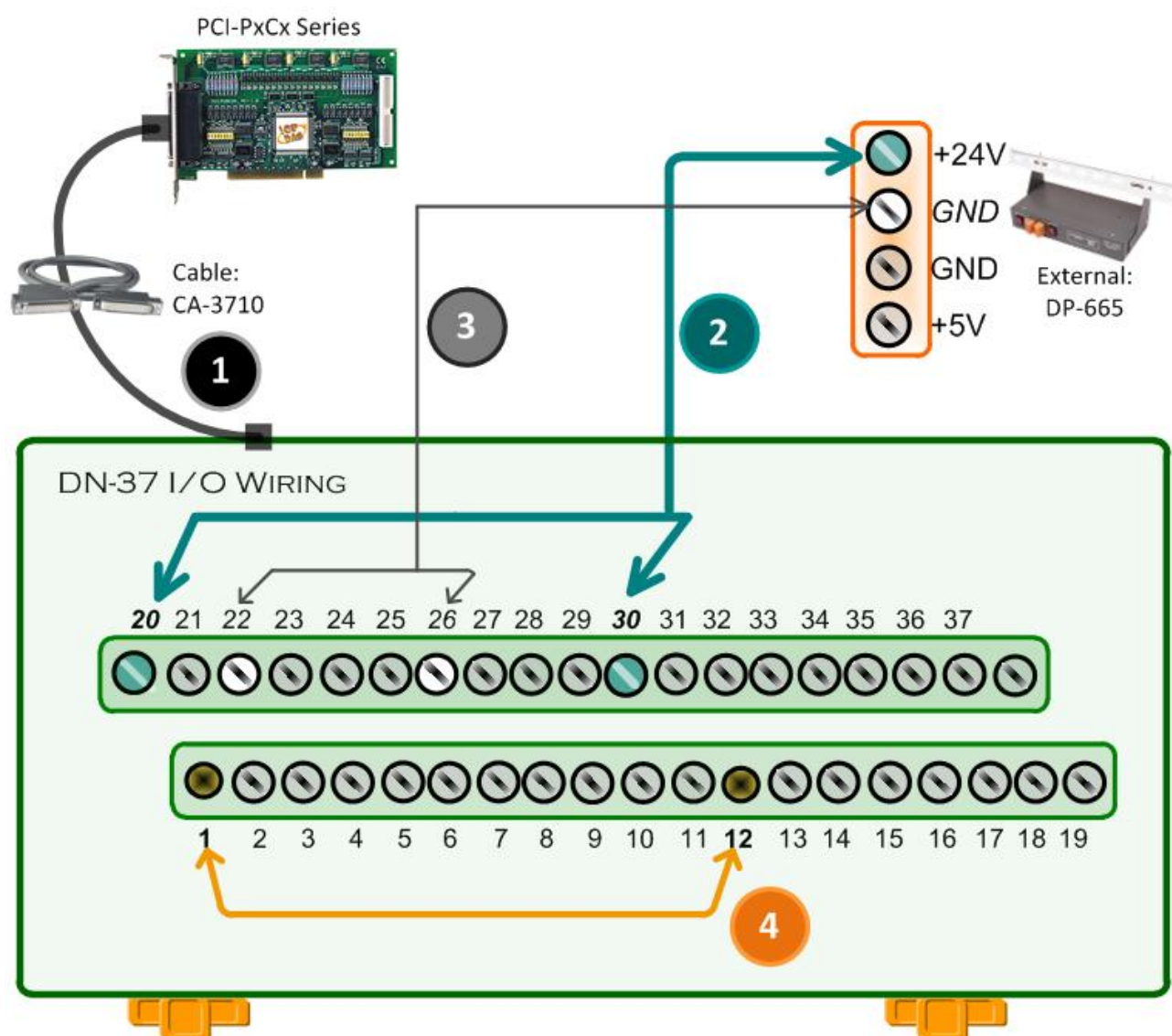
## 6.1.2 PCI-P16C16 Test Wiring

**Step 1:** Connect the DN-37 to the CN1 connector on the board using the CA-3710 cable.

**Step 2:** Connect the **External Power Supply (+24 V)** to the **CON1.Ext.Power1 pin (Pin20)** and the **CON1.DIB0 pin (Pin30)**.

**Step 3:** Connect the **External Power Supply GND** to the **CON1.GND1 pin (Pin22)** and **CON1.GND2 pin (Pin26)**.

**Step 4:** Connect the **CON1.OUT0 pin (Pin1)** to the **CON1.DIA0 pin (Pin12)**.



### 6.1.3 PCI-P16POR16 and PEX-P8POR8i/P16POR16i Test Wiring

**Step 1:** Connect the DN-37 to the **CON1** connector on board using the CA-3710 cable.

**Step 2:** Connect the **NO(0...7)** pins to the **DIA(0...7)** pins.

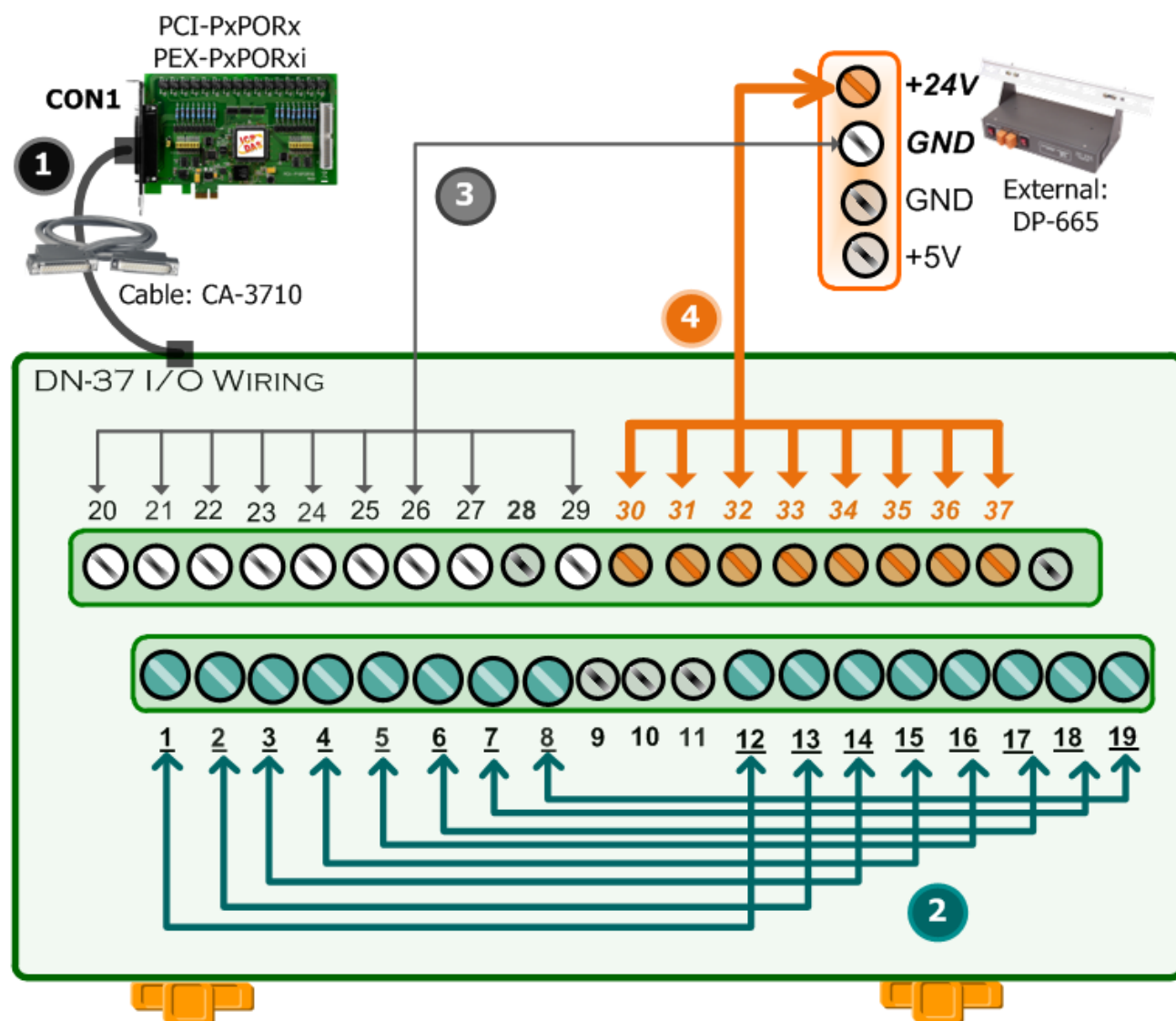
(i.e., connect Pin1/2/3/4/5/6/7/8 to Pin12/13/14/15/16/17/18/19)

**Step 3:** Connect the **External Power Supply GND** to the **CM0...CM7 pins** (Pin20/21/22/23/24/25/26/27).

Connect the **External Power Supply GND** to the **GND pin** (Pin29).

**Step 4:** Connect the **External Power Supply (+24 V)** to the **DIB0...DIB7 pins**

(Pin30/31/32/33/34/35/36/37).



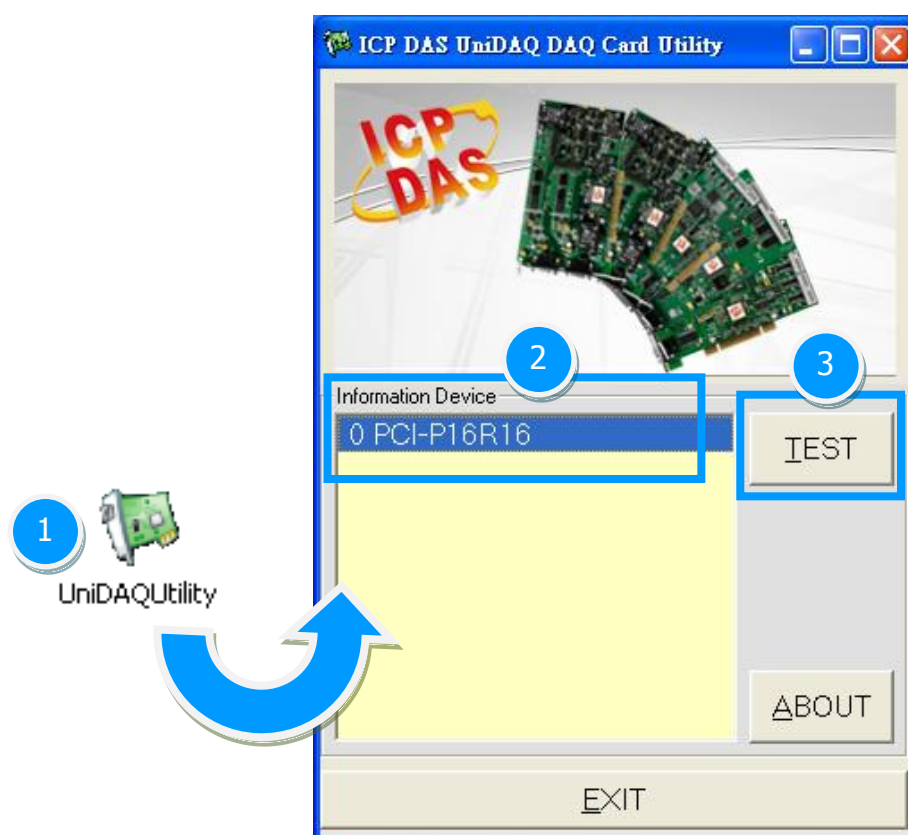
## 6.2 Execute the Test Program

After installation, the UniDAQ Utility will be located in the default folder (C:\ICPDAS\UniDAQ\Driver\). Use the procedure described below to perform the “Self-Test”.

**Step 1:** In Windows XP, click the “**Start**” button point to “**All Programs**” and then click the “**ICPDAS**” folder. Point to “**UniDAQ Development Kits**” and then click the “**UniDAQ Utility**” to execute the UniDAQ Utility Program.

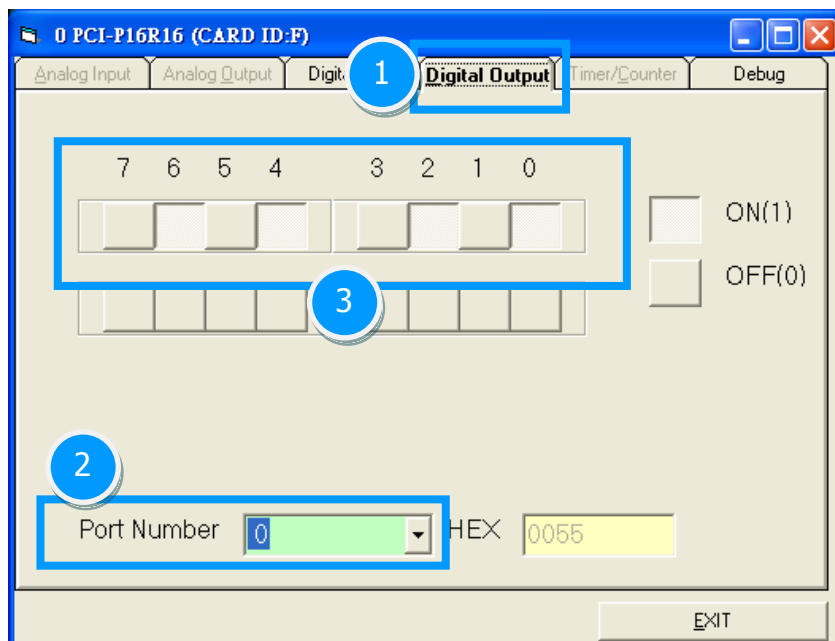
**Step 2:** Confirm the PCI-P16R16 Series card has been successfully installed in the Host system. Note that the device numbers start from 0.

**Step 3:** Click the “**TEST**” button to start the test.

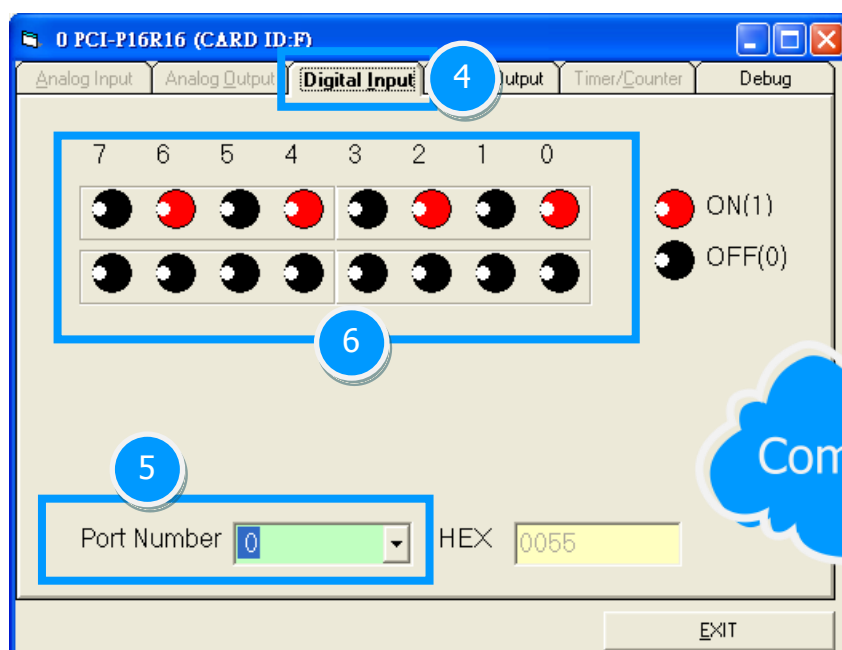


**Step 4:** Check the results of the **Digital Input/Output** functions test result.

1. Click the **“Digital Output”** tab.
2. Select **“Port0”** from the **“Port Number”** drop-down menu.
3. Checkmark in **channels 0, 2, 4 and 6**.



4. Click the **“Digital Input”** tab.
5. Select **“Port0”** from the **“Port Number”** drop-down menu.
6. The corresponding DI indicators will turn **red** when the corresponding DO channels 0, 2, 4 and 6 are **ON**.





## 7 I/O Control Registers

### 7.1 Determining the I/O Address

During the power-on stage, the Plug and Play BIOS will assign an appropriate I/O address to each PCI-P16R16 Series card installed in the system. Each card includes four fixed ID numbers that are used to identify the card, and are indicated below:

Model	PCI-P8R8 PCI-P8R8U PEX-P8POR8i	PCI-P16R16 PCI-P16R16U PCI-P16C16 PCI-P16POR16 PEX-P16POR16i
Vendor ID	0x1234	0x1234
Device ID	0x0808	0x1616
Sub-Vendor ID	0x0000	0x0000
Sub-Device ID	0x0000	0x0000

#### 7.1.1 PIO\_PISO Utility

The **PIO\_PISO Utility** is a useful tool that is applicable to all **PIO/PISO Series cards**. The Utility can be used to detect all ICPDAS I/O cards installed in the system and display detailed information for the card. Detail of how to identify the ICPDAS PCI-P16R16 Series card based on the **Sub-vendor, Sub-device and Sub-Aux ID** information are provided in the table in Section 7.1 above. The Utility is also useful for testing whether the Plug and Play driver functions for the PIO or PISO Series card were successfully initialized when the computer was booted up. If the card is not detected correctly, install the card into a different PCI slot and reboot the computer.

The PIO\_PISO Utility can be used to obtain the following information:

- A list of all PIO/PISO cards currently installed in the system
- A list of all resources allocated to each PIO/PISO card
- A list of the wSlotBus and wSlotDevice information that can be used for identification of specific PIO/PISO cards

## ➤ For Windows Operating Systems

The installation files for the **PIO\_PISO Utility for Windows** can be obtained from:



CD:\NAPDOS\PCI\Utility\Win32\PIO\_PISO



[http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/utility/win32/pio\\_piso/](http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/utility/win32/pio_piso/)

After executing the Utility, detailed information for all PIO/PISO cards that are installed in the system will be displayed, as illustrated below:

ICP DAS PCI Base I/O Card Utility[Ver 2.48.8.1202]

Please select one of the device to show the detail information.

S	Ven ID	Dev ID	SubVen	SubDev	AUX	BoardName(Version)
=	=====	=====	=====	=====	=====	=====
	0x1234	0x1616	0xC1A2	0x0823	0x00	PCI-P16R16 series

**Detail Information**

Board Name

System(OS) Win XP Service Pack 2

**Bus Information**

BAR 0

BAR 1

BAR 2

BAR 3

**Locating/Resource**

Bus#:

Device#:

Address:

IRQ#:

Manual R/W Port Address(HEX)

Address Value

Width

☒ 8

☐ 16

Write

Read

MISC Setting

☐ Show Unknow Device

Save Log

EXIT

## ➤ For DOS

The installation files for the **PIO\_PISO Utility for DOS** can be obtained from:



CD:\NAPDOS\PCI\Utility\DOS\



<http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/utility/dos/>

The following is the source code for the PIO\_PISO DOS program:

```
/* ----- */
/* Detect all PIO_PISO series cards installed in this system */
/* Step 1: Install all PIO_PISO cards into the PC */
/* Step 2: Run the PIO_PISO.EXE */
/* ----- */

#include "PIO.H"

WORD wBase,wlrq;
WORD wBase2,wlrq2;

int main()
{
    int i,j,j1,j2,j3,j4,k,jj,dd,j11,j22,j33,j44;
    WORD wBoards,wRetVal;
    WORD wSubVendor,wSubDevice,wSubAux,wSlotBus,wSlotDevice;
    char c;
    float ok,err;

    clrscr();
    wRetVal=PIO_DriverInit(&wBoards,0xff,0xff,0xff); /*for PIO-PISO */
    printf("\nThrere are %d PIO_PISO Cards in this PC",wBoards);
    if (wBoards==0 ) exit(0);

    printf("\n-----");
    for(i=0; i<wBoards; i++)
    {
        PIO_GetConfigAddressSpace(i,&wBase,&wlrq,&wSubVendor,
                                &wSubDevice,&wSubAux,&wSlotBus,&wSlotDevice);

        printf("\nCard_%d:wBase=%x,wlrq=%x,subID=[%x,%x,%x],
                SlotID=[%x,%x]",i,wBase,wlrq,wSubVendor,wSubDevice,
                wSubAux,wSlotBus,wSlotDevice);

        printf(" --> ");
        ShowPioPiso(wSubVendor,wSubDevice,wSubAux);
    }

    PIO_DriverClose();
}
```

## 7.2 I/O Address Mapping

The first 16 double words of the configuration space for a PCI device are referred to as the device's configuration region. Within these 16 (0-15) double words, the double words 04, 05, 06, 07, 08 and 09 are referred to as Base Address0, Base Address1, Base Address2, Base Address3, Base Address4 and Base Address5. More detailed information about these 16 double words can be found by referring to the book **Plug & Play System Architecture** (Tom Shanley-MindShare Inc., Addison-Wesley Publishing Company, 1995).

These Base Addresses are utilized as control registers and/or I/O registers for many data acquisition boards. On PCI-P16R16 Series cards, Base Address2 is utilized as the base address for the Digital Input and Digital Output.

The address of each register can be determined by simply adding the offset value to the base address of the corresponding section. More detailed descriptions of each register can be found in the following sections and also in the PCI-P16R16 Series Classic Driver software manual, can be downloaded from: <http://ftp.icpdas.com/pub/cd/iocard/pci/napdos/pci/pci-p16r16/manual/>. The following is an overview of the registers for PCI-P16R16 Series cards and their function:

### ➤ BAR 2: DI/DO Register

Bar No.	Offset	Register Function Script		
		Name	Operation	Access
<b>2</b> <b>(DIO)</b>	0x00	DI Port	R	16-bit
	0x00	DO Port	W	16-bit
	0x0C	Read DO Readback	R	16-bit
	0x3C	Read Card ID	R	16-bit



**Note:** For detailed information related to the program code used to read the configuration space (Base Addresses 0 to 5) information for PCI-P16R16 Series cards, refer to [Appendix A2. Configuration Address Space Program Code](#).

## 7.2.1 Digital Input/Digital Output

The following is a sample of the code used to access the Digital Input/Output functions on PCI-P16R16 Series cards:

```
// DIO functions for PCI-P16R16/P16R16U/P16C16/P16POR16 and PEX-P16POR16i Series cards
```

```
void    P16R16_DO(WORD BaseAddr, WORD wOutData)
{
    outport (BaseAddr, wOutData);
}
```

```
WORD    P16R16_DI(WORD BaseAddr)
{
    DigitalIn=inportb(BaseAddr);
}
```

```
// DIO functions for PCI-P8R8/P8R8U and PEX-P8POR8i Series cards
```

```
void    P8R8_DO(WORD BaseAddr, WORD wOutData)
{
    outportb(BaseAddr, wOutData);
}
```

```
UCHAR   P8R8_DI(WORD BaseAddr)
{
    DigitalIn=inportb(BaseAddr);
}
```



**Note:** For detailed information related to the Digital I/O program code used for PCI-P16R16 Series cards, refer to [Appendix A1. Digital I/O Functions Program Code](#).

## 7.2.2 DO Readback Register

The DO Readback register is used to read the Digital Output value and the format is as follows:

➤ **(Read) BaseAddr +0x0C**

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
------	------	------	------	------	------	------	------

The following is a sample of the code used to read the Digital Output:

```
// DO Readback function for PEX-P8POR8i and PEX-P16POR16i Series cards
```

```
DigitalIn=inportb(BaseAddr+0x0C);
```

**Note that the DO Readback function is only supported by PEX-P8POR8i/P16POR16i Series cards (Version 1.0 or above).**

## 7.2.3 Card ID Register

The Card ID register is used to read the Card ID that was set using DIP Switch SW1 (See [Section 2.3](#) for more details), and the format is as follows:

➤ **(Read) BaseAddr +0x3C**

x	x	x	x	Bit3	Bit2	Bit1	Bit0
---	---	---	---	------	------	------	------

The following is a sample of the code used to read the Card ID:

```
// Card ID function for PEX-P8POR8i/P16POR16i and PCI-P8R8U/P16R16U Series cards
```

```
*wID=inportb(BaseAddr+ 0x3C)&0x000f;
```

**Note that the Card ID function is only supported by PEX-P8POR8i/P16POR16i (Version 1.0 or above) and PCI-P8R8U/P16R16U Series cards.**

## 8 Demo Programs

PCI-P16R16 Series card provides Digital Input/Output demo programs, together with the source code for the library, that can be used in either a Windows or a DOS environment, based on a variety of programming languages, including TC/BC/MSC (DOS), Borland C++, Delphi, Visual Basic, Visual C, VB.NET 2005, and C#.NET2005, etc. (Windows).

Detailed information about the demo programs is provided below.

Sample Program	UniDAQ SDK/Driver	PCI-P16R16 Series Class Driver	DOS
TC	-	-	✓
BC	-	-	✓
MSC	-	-	✓
Borland C++ Builder 3	-	✓	-
Borland C++ Builder 6			-
Delphi 3	-	✓	-
Delphi 6	✓	-	-
Visual Basic 6	✓	✓	-
Visual C++ 6	✓	✓	-
VB.NET 2005 (32-bit)	✓	✓	-
VB.NET 2005 (64-bit)	✓	-	-
C#.NET 2005 (32-bit)	✓	✓	-
C#.NET 2005 (64-bit)	✓	-	-
VC.NET 2005 (32-bit)	✓	-	-
VC.NET 2005 (64-bit)	✓	-	-
MATLAB	✓	-	-
LabVIEW	✓	✓	-

# Appendix

## A1. Digital I/O Functions Program Code

- The code used to access the Digital Input/Output functions for PCI-P8R8/P8R8U and PCI-P16R16/P16R16U Series cards is as follows:

```
#define WORD    unsigned int
#define UCHAR   unsigned char

void    P16R16_DO(WORD BaseAddr, WORD wOutData)
{
    output(BaseAddr,wOutData);
}

WORD    P16R16_DI(WORD BaseAddr)
{
    WORD DigitalIn;
    DigitalIn=inport(BaseAddr);
    return DigitalIn;
}

void    P8R8_DO(WORD BaseAddr, WORD wOutData)
{
    outportb(BaseAddr,wOutData);
}

UCHAR   P8R8_DI(WORD BaseAddr)
{
    UCHAR DigitalIn;
    DigitalIn=inportb(BaseAddr);
    return DigitalIn;
}
```



## A2. Configuration Address Space Program Code

- The following code can be used to read the six base addresses for PCI-P16R16 and PCI-P8R8. This code is based on the PCI **Plug and Play** mechanism 2.

```
/******  
/* Reading the configuration address space for PCI card */  
/******  
WORD   GetAddress(void)  
{  
    DWORD   dConfigAddress,dBaseAddress;  
    WORD     HiWord,LoWord;  
    WORD     ReturnCode;  
    UCHAR    Bus,Device,Function,WhichLong;  
    WORD     VendorID,DeviceID;  
    WORD     wIrqNumber;  
  
    wTotalBoards=0;   /* Initial number of boards number is 0 */  
    Bus=0;  
    for(Bus=0; Bus<10;  Bus++)  
    {  
        Function=0;  
        WhichLong=1;  
        for(Device=0;  Device<32;  Device++)  
        {  
            WhichLong=0;  
            WriteAddress(Bus,Device,Function,WhichLong);  
            VendorID=inport(0xcfc);  
            DeviceID=inport(0xcfe);  
  
            if( VendorID==0x1234 && DeviceID==0x1616 )  
            { /*----- PCI-P16R16 -----*/  
                WhichLong=4;    // Base Address 0  
                WriteAddress(Bus,Device,Function,WhichLong);  
                dBaseAddress=_inpd(0xcfc);  
                wBaseAddr0=(WORD)(dBaseAddress&0xfffe);  
                wConfigSpace[wTotalBoards][0]=wBaseAddr0;
```

```
/*-----*/
WhichLong=5; /* Base Address 1 */
WriteAddress(Bus,Device,Function,WhichLong);
dBaseAddress=_inpd(0xcfc);
wBaseAddr1=(WORD)(dBaseAddress&0xfffe);
wConfigSpace[wTotalBoards][1]=wBaseAddr1;

/*-----*/
WhichLong=6; /* Base Address 2 */
WriteAddress(Bus,Device,Function,WhichLong);
dBaseAddress=_inpd(0xcfc);
wBaseAddr2=(WORD)(dBaseAddress&0xfffe);
wConfigSpace[wTotalBoards][2]=wBaseAddr2;

/*-----*/
WhichLong=7; /* Base Address 3 */
WriteAddress(Bus,Device,Function,WhichLong);
dBaseAddress=_inpd(0xcfc);
wBaseAddr3=(WORD)(dBaseAddress&0xfffe);
wConfigSpace[wTotalBoards][3]=wBaseAddr3;

/*-----*/
WhichLong=8; /* Base Address 4 */
WriteAddress(Bus,Device,Function,WhichLong);
dBaseAddress=_inpd(0xcfc);
wBaseAddr4=(WORD)(dBaseAddress&0xfffe);
wConfigSpace[wTotalBoards][4]=wBaseAddr4;

/*-----*/
WhichLong=9; /* Base Address 5 */
WriteAddress(Bus,Device,Function,WhichLong);
dBaseAddress=_inpd(0xcfc);
wBaseAddr5=(WORD)(dBaseAddress&0xfffe);
wConfigSpace[wTotalBoards][5]=wBaseAddr5;

/*----- Store the Board Type Name ID -----*/
wConfigSpace[wTotalBoards][6]=TYPE_P16R16;
```

```
/*-----*/
    wTotalBoards++; /* Increment number of boards */
    wGetAddress=1;
}

if( VendorID==0x1234 && DeviceID==0x0808 )
{ /*----- PCI-P8R8 -----*/
    WhichLong=4; /* Base Address 0 */
    WriteAddress(Bus,Device,Function,WhichLong);
    dBaseAddress=_inpd(0xcfc);
    wBaseAddr0=(WORD)(dBaseAddress&0xfffe);
    wConfigSpace[wTotalBoards][0]=wBaseAddr0;

    /*-----*/
    WhichLong=5; /* Base Address 1 */
    WriteAddress(Bus,Device,Function,WhichLong);
    dBaseAddress=_inpd(0xcfc);
    wBaseAddr1=(WORD)(dBaseAddress&0xfffe);
    wConfigSpace[wTotalBoards][1]=wBaseAddr1;

    /*-----*/
    WhichLong=6; /* Base Address 2 */
    WriteAddress(Bus,Device,Function,WhichLong);
    dBaseAddress=_inpd(0xcfc);
    wBaseAddr2=(WORD)(dBaseAddress&0xfffe);
    wConfigSpace[wTotalBoards][2]=wBaseAddr2;

    /*-----*/
    WhichLong=7; /* Base Address 3 */
    WriteAddress(Bus,Device,Function,WhichLong);
    dBaseAddress=_inpd(0xcfc);
    wBaseAddr3=(WORD)(dBaseAddress&0xfffe);
    wConfigSpace[wTotalBoards][3]=wBaseAddr3;

    /*-----*/
    WhichLong=8; /* Base Address 4 */
    WriteAddress(Bus,Device,Function,WhichLong);
    dBaseAddress=_inpd(0xcfc);
    wBaseAddr4=(WORD)(dBaseAddress&0xfffe);
    wConfigSpace[wTotalBoards][4]=wBaseAddr4;
```

```

/*-----*/
WhichLong=9; /* Base Address 5 */
WriteAddress(Bus,Device,Function,WhichLong);
dBaseAddress=_inpd(0xcfc);
wBaseAddr5=(WORD)(dBaseAddress&0xfffe);
wConfigSpace[wTotalBoards][5]=wBaseAddr5;

/*----- Store the Board Type Name ID -----*/
wConfigSpace[wTotalBoards][6]=TYPE_P8R8;

wTotalBoards++; /* Increment the number of boards */
wGetAddress=1;
    }
}
}
if( wTotalBoards>16 )
    return( NotFoundBoard );
else
    return( NoError );
}

void WriteAddress(UCHAR bBus, UCHAR bDevice, UCHAR bFunction, UCHAR bWhichLong)
{
    DWORD    dOutData;
    WORD     HiWord,LoWord;
    UCHAR    HiByte,LoByte;

    HiWord=0x8000|bBus;
    HiByte=(bDevice<<3)|bFunction;
    LoByte=(bWhichLong<<2) & 0xfc;
    LoWord=( (WORD)HiByte<<8 )|LoByte;
    dOutData=( (DWORD)HiWord<<16 ) | LoWord;
    _outpd(0xcf8,dOutData);
}

```