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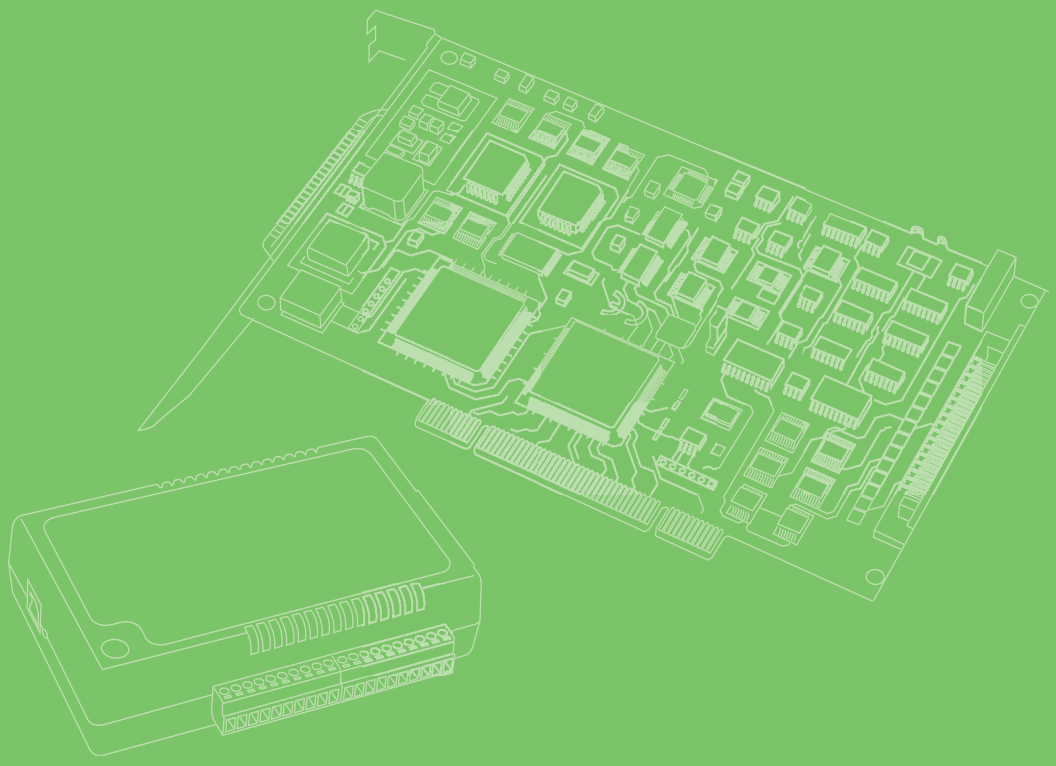
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User Manual

PCI-1761

8-ch Relay & 8-ch Isolated Digital Input PCI Card

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3. If your product is diagnosed as defective, obtain an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.
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5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

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Declaration of Conformity

CE

This product has passed the CE test for environmental specifications. Test conditions for passing included the equipment being operated within an industrial enclosure. In order to protect the product from being damaged by ESD (Electrostatic Discharge) and EMI leakage, we strongly recommend the use of CE-compliant industrial enclosure products.

Technical Support and Assistance

1. Visit the Advantech web site at www.advantech.com/support where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (operating system, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

Warnings, Cautions and Notes

Warning! *Warnings indicate conditions, which if not observed, can cause personal injury!*



Caution! *Cautions are included to help you avoid damaging hardware or losing data. e.g.*



There is a danger of a new battery exploding if it is incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Note! *Notes provide optional additional information.*



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Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
15. The power cord or plug is damaged.
16. Liquid has penetrated into the equipment.
17. The equipment has been exposed to moisture.
18. The equipment does not work well, or you cannot get it to work according to the user's manual.
19. The equipment has been dropped and damaged.
20. The equipment has obvious signs of breakage.
21. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.
22. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
23. The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

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Chapter 1

Overview

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1.1 Introduction

Thank you for buying the Advantech PCI-1761. The Advantech PCI-1761 is a 8-channel relay actuator and 8-channel isolated digital input card for the PCI bus. Its eight on-board SPDT relays are ideal for applications such as device ON/OFF control or small power switched. For easy monitoring, each relay is equipped with one red LED to show its ON/OFF status.

The PCI-1761's eight optically-isolated digital input channels are ideal for digital input in noisy environments or with floating potentials. The following sections of this chapter will provide further information about features, installation guide, together with some brief information on software and accessories for the PCI-1761 card.

1.2 Features

- 8 relay output channels and 8 isolated digital input channels
- LED indicators to show activated relays
- 4 Form A-type and 4 Form C-type relay output channels
- Output status read-back
- Keep relay output values when hot system reset
- High-voltage isolation on input channels (2,500 V_{DC})
- High ESD protection (2,000 V_{DC})
- High over-voltage protection (70 V_{DC})
- Wide input range (10 ~ 50 V_{DC})
- Interrupt handling capability
- Board ID

The Advantech PCI-1761 offers the following main features:

Robust Protection

The PCI-1761 digital input channels feature a robust isolation protection for industrial, lab and machinery automation applications. It durably withstands voltage up to 2,500 V_{DC}, preventing your host system from any incidental harms. If connected to an external input source with surge-protection, the PCI-1761 can offer up to a maximum of 2,000 V_{DC} ESD (Electrostatic Discharge) protection. Even with an input voltage rising up to 70 V_{DC}, the PCI-1761 can still manage to work properly albeit only for short period of time.

Wide Input Range

The PCI-1761 has a wide range of input voltage from 10 to 50 V_{DC}, and it is suitable for most industrial applications with 12 V_{DC}, 24 V_{DC} and 48 V_{DC} input voltage.

Reset Protection Fulfills Requirement for Industrial Applications

When the system has undergone a hot reset (i.e. without turning off the system power), the PCI-1761 can either retain outputs values of each channel, or return to its default configuration as open status, depending on its on-board jumper setting. This function protects the system from wrong operations during unexpected system resets.

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Plug-and-Play Functionality

The PCI-1761 is a Plug-and-Play device, which fully complies with PCI Specification Rev 2.2. During card installation, there is no need to set jumpers or DIP switches. Instead, all bus-related configurations such as base I/O address and interrupt are automatically done by the Plug-and-Play function.

Board ID

The PCI-1761 has a built-in DIP Switch that helps define each card's ID when multiple PCI-1761 cards have been installed on the same PC chassis. The board ID setting function is very useful when users build their system with multiple PCI-1761 cards. With correct Board ID settings, you can easily identify and access each card during hardware configuration and software programming.

1.3 Applications

- Industrial On/Off control
- Switch status sensing
- Digital I/O control
- Industrial and lab automation
- SMT/PCB machinery
- Semi-conductor machinery
- PC-based Industrial Machinery
- Testing & Measurement
- Laboratory & Education
- External relay driving

1.4 Installation Guide

Before you install your PCI-1761 card, please make sure you have the following necessary components:

- PCI-1761 card
- PCI-1761 User's Manual
- Driver software - Advantech DLL drivers (included in the companion CD-ROM)
- Wiring cable - PCL-10137 (optional)
- Wiring board - ADAM-3937 (optional)
- Personal computer or workstation with a PCI interface (running Windows 8 (desktop mode), 7 and XP)
- Application software - DAQ Navi, LabView or other 3rd-party software

After you get the necessary components and maybe some of the accessories for enhanced operation of your Multifunction card, you can then begin the Installation procedures.

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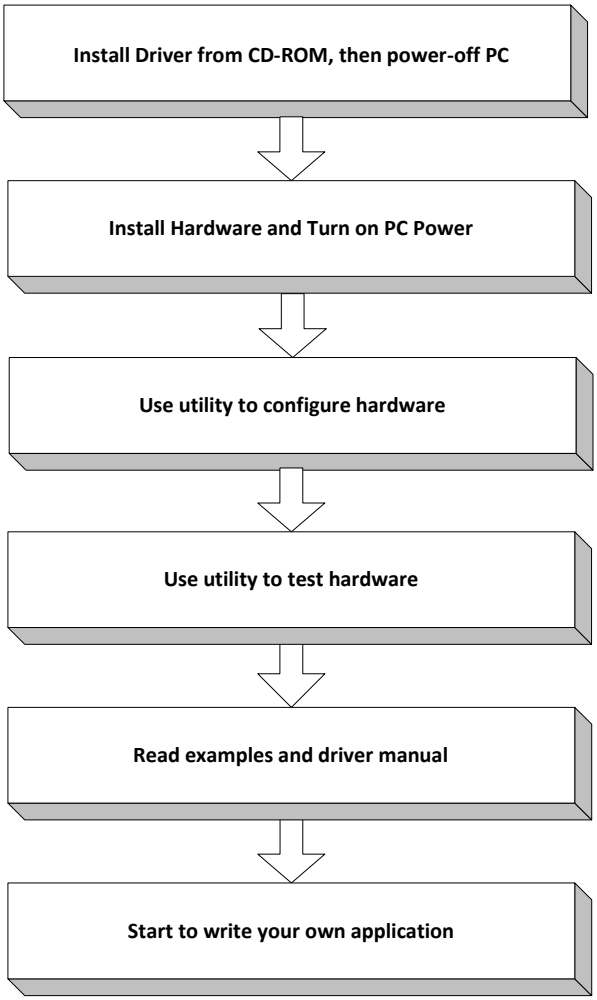


Figure 1.1 Installation Flow Chart

1.5 Software Overview

Advantech offers a rich set of DLL drivers, third-party driver support and application software to help fully exploit the functions of your PCI-1761 card:

- Device Drivers (on the companion DVD-ROM)
- LabVIEW driver
- Advantech DAQ NAVi
- Datalogger

Programming choices for DA&C cards:

You may use Advantech application software such as Advantech Device Drivers. On the other hand, advanced users can use register-level programming, although this is not recommended due to its laborious and time-consuming nature.

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DAQNavi Software

Advantech DAQNavi software includes device drivers and SDK which features a complete I/O function library to help boost your application performance. This software is included in the companion DVD-ROM at no extra charge and comes with all Advantech DA&C cards. The Advantech DAQNavi software for Windows XP/7/8 (desktop mode) works seamlessly with development tools such as Visual Studio .Net, Visual C++, Visual Basic and Borland Delphi.

1.6 Accessories

Advantech offers a complete set of accessory products to support the PCI-1761 card. These accessories include:

Wiring Cable

The PCL-10137 shielded cable is specially designed for PCI-1761 cards to provide high resistance to noise. To achieve a better signal quality, the signal wires are twisted in such a way as to form a "twisted-pair cable", reducing cross-talk and noise from other signal sources. Furthermore, its analog and digital lines are separately sheathed and shielded to neutralize EMI/EMC problems.

Wiring Boards

The ADAM-3937 is a 37-pin D-type wiring terminal module for DIN-rail mounting. This terminal module can be readily connected to the Advantech PC-Lab cards and allow easy yet reliable access to individual pin connections for the PCI-1761 card.

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Chapter 2

Installation

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2.1 Unpacking

After receiving your PCI-1761 package, please inspect ita contents first. The package should contain the following items:

- PCI-1761 card
- Companion CD-ROM (DLL driver included)
- Startup Manual

2.2 Switch and Jumper Settings

The PCI-1761 card has one function switch settings.

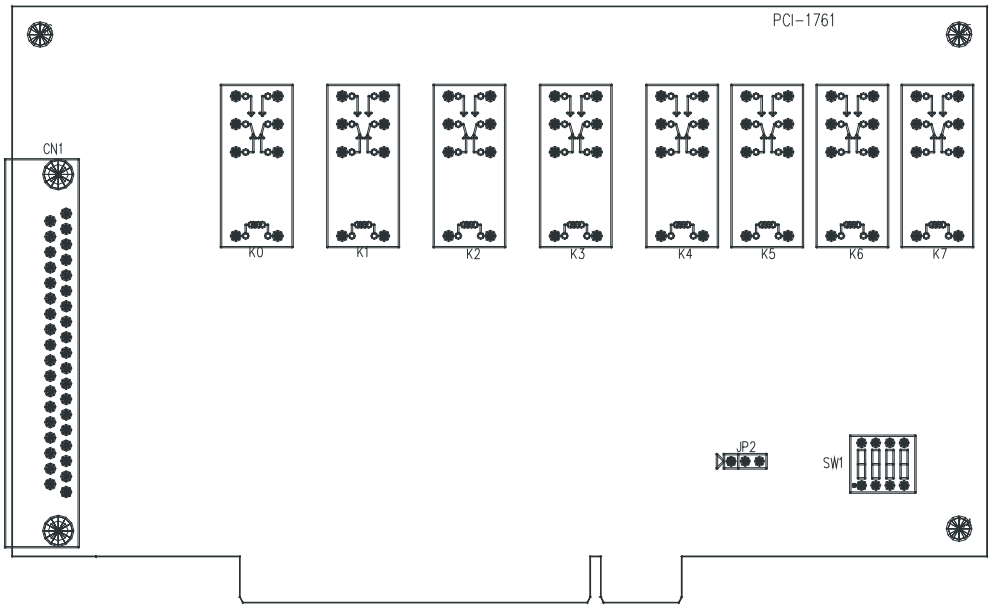


Figure 2.1 Card Connector, Jumper and Switch Locations

Table 2.1: Summary of Jumper Settings

Names of Jumpers	Function Description	
JP2		Keep last status after hot reset
		Default configuration

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Board ID (SW1)

The PCI-1761 has a built-in DIP switch (SW1), which is used to define each card's board ID. When there are multiple cards on the same chassis, this board ID switch is useful for identifying each card's device number.

After setting each PCI-1761, you can identify each card in system with different device numbers. The default value of board ID is 0 and if you need to adjust it to other value, please set the SW1 by referring to Table 2.2.

Table 2.2: Board ID Setting (SW1)

SW1	Position 1	Position 2	Position 3	Position 4
Board ID	**ID3**	**ID2**	**ID1**	**ID1**
0	ON	ON	ON	ON
1	ON	ON	ON	OFF
2	ON	ON	OFF	ON
3	ON	ON	OFF	OFF
4	ON	OFF	ON	ON
5	ON	OFF	ON	OFF
6	ON	OFF	OFF	ON
7	ON	OFF	OFF	OFF
8	OFF	ON	ON	ON
9	OFF	ON	ON	OFF
10	OFF	ON	OFF	ON
11	OFF	ON	OFF	OFF
12	OFF	OFF	ON	ON
13	OFF	OFF	ON	OFF
14	OFF	OFF	OFF	ON
15	OFF	OFF	OFF	OFF

Default Setting is 0

Setting the Time to Reset the Relay Outputs

Some users will want the capability of clearing each relay output when the system (or PC) issues a reset signal on the PCI bus. Some users will want to clear their relays only as part of system power-on. The PCI-1761 satisfies both these needs by providing jumper JP2. Depending on the application, this capability may allow relay outputs to be "OFF" without requiring a complete shutdown of processes controlled by the card.

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2.3 I/O Connectors

Pin Assignments

Figure 2-2 shows the pin assignments for the 37-pin I/O connector on the PCI-1761

Description of pin use:

IDI*n*A* (*n*=0 ~ 7):

Isolated digital input A

IDI*n*B* (*n*=0 ~ 7):

Isolated digital input B

R*n*_NO(*n*=0 ~ 7):

Normally Open pin of relay output

R*n*_NC(*n*=0 ~ 7):

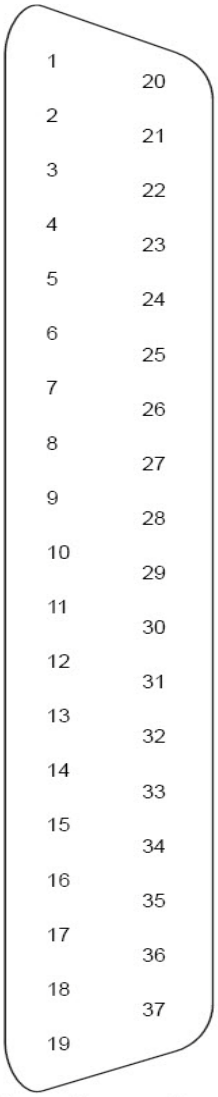
Normally Close pin of relay output

R*n*_COM(*n*=0 ~ 7):

Common pin of relay output

Note:

Isolated Digital Input is bidiretional.



R0_NO	1	20	R3_NO
R0_COM	2	21	R3_COM
R0_NC	3	22	R3_NC
R1_NO	4	23	R4_NO
R1_COM	5	24	R4_COM
R1_NC	6	25	R5_NO
R2_NO	7	26	R5_COM
R2_COM	8	27	R6_NO
R2_NC	9	28	R6_COM
R7_NO	10	29	N/A
R7_COM	11	30	IDI 0B
IDI 0A	12	31	IDI 1B
IDI 1A	13	32	IDI 2B
IDI 2A	14	33	IDI 3B
IDI 3A	15	34	IDI 4B
IDI 4A	16	35	IDI 5B
IDI 5A	17	36	IDI 6B
IDI 6A	18	37	IDI 7B
IDI 7A	19		

Figure 2.2 I/O Connector Pin Assignments

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2.4 Hardware Installation

After the device driver installation is completed, you can now go on to install the PCI-1761 card in any PCI slot on your computer. But it is suggested that you should refer to the computer user manual or related documentation if you have any doubt. Please follow the steps below to install the card on your system.

1. Turn off your computer and unplug the power cord and cables. TURN OFF your computer before installing or removing any components on the computer.
2. Remove the cover of your computer.
3. Remove the slot cover on the back panel of your computer.
4. Touch the metal part on the surface of your computer to neutralize the static electricity that might be on your body.
5. Insert the 1761 card into a PCI slot. Hold the card only by its edges and carefully align it with the slot. Insert the card firmly into place. Use of excessive force must be avoided, otherwise the card might be damaged.
6. Fasten the bracket of the PCI card on the back panel rail of the computer with screws.
7. Connect appropriate accessories (37-pin cable, wiring terminals, etc. if necessary) to the PCI card.
8. Replace the cover of your computer chassis. Re-connect the cables you removed in step 2.
9. Plug in the power cord and turn on the computer .

After your card is properly installed on your system, you can now configure your device using the Device Installation Program that has itself already been installed on your system during driver setup. A complete device installation procedure should include device setup, configuration and testing. The following sections will guide you through the Setup, Configuration and Testing of your device.

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2.5 Device Setup & Configuration

The Advantech Navigator program is a utility that allows you to set up, configure and test your device, and later stores your settings on the system registry. These settings will be used when you call the APIs of Advantech Device Drivers.

Setting Up the Device

1. To install the I/O device for your card, you must first run the Advantech Navigator program (by accessing Start/Programs/Advantech Automation/DAQNavi/ Advantech Navigator).
2. You can then view the device(s) already installed on your system (if any) on the Installed Devices list box. If the software and hardware installation are completed, you will see PCI-1761 card in the Installed Devices list.

Configuring the Device

3. Please go to the Device Setting to configure your device. you can configure the ID0 ~ ID7 Interrupt trigger mode either as Rising Edge or Falling Edge.

For more detailed information, please refer to the DAQNavi SDK Manual or the User Interface Manual in the Advantech Navigator.

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Chapter 3

Signal Connections

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3.1 Overview

Maintaining signal connections is one of the most important factors in ensuring that your application system is sending and receiving data correctly. A good signal connection can avoid unnecessary and costly damage to your PC and other hardware devices. This chapter provides useful information about how to connect input and output signals to the PCI-1761 via the I/O connector.

3.2 Isolated Digital Input Connections

The PCI-1761 has 8 isolated digital input channels designated IDI0~IDI7. Each of isolated digital input channel accepts 10~50 V_{DC} voltage inputs, and accept bi-directional input. It means that you can apply positive or negative voltage to an isolated input pin (Vin). The figure below shows how to connect an external input source to one of the card's isolated input channels.

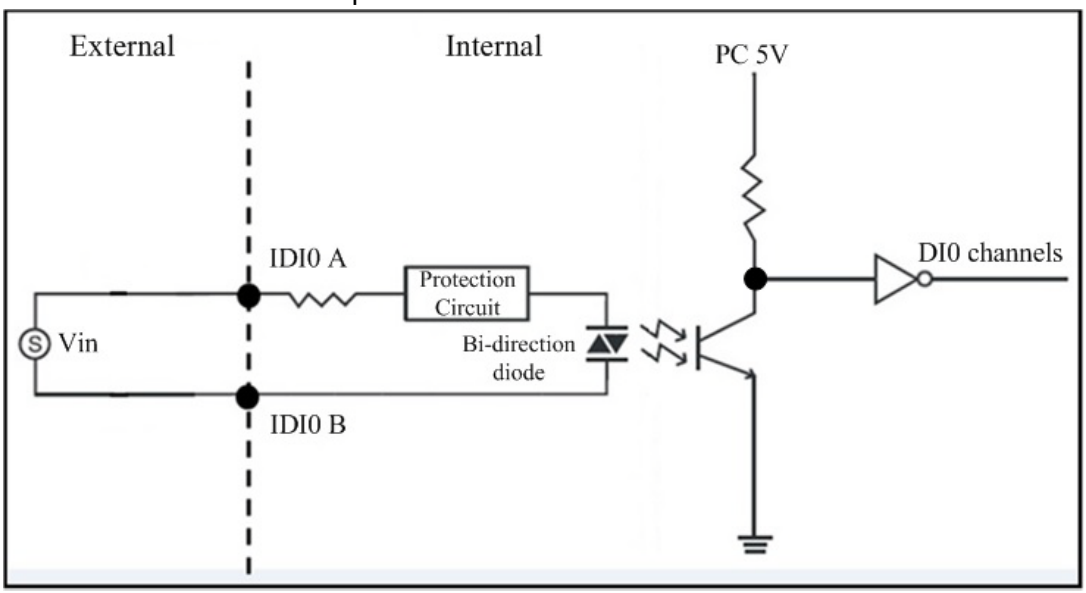


Figure 3.1 Isolated Digital Input Connections

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3.3 Relay Connections

After power on, the initial relay output status of PCI-1761 is shown as below:

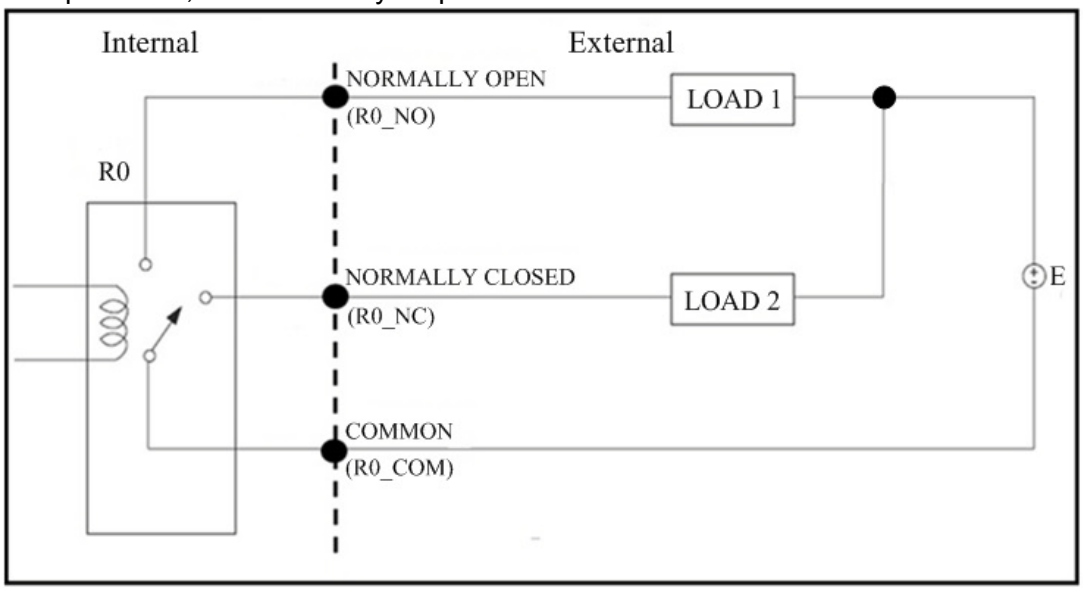


Figure 3.2 Relay Output Connection

A write operation to I/O address, BASE +0, will change the output status of each relay. For example, if Bit 0 of BASE +0 is set "1" (logic high), relay 0, K0, will switch from position "NORMALLY CLOSED", R0_NC, to position "NORMALLY OPEN", R0_NO. This means that LOAD2 will be de-energized, while LOAD1 is energized.

To summarize, the "COMMON" line connect to the "NORMALLY CLOSED" line, if the corresponding bit is set as 0 (power-on initial status). Otherwise, if the corresponding bit is set as 1, then the "COMMON" line will connect to the "NORMALLY OPEN" line.

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Appendix A

Specifications

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A.1 Specifications

Table A.1: Isolated Digital Input	
Number of Input Channel	8
Interrupt Inputs	8 (IDI0~IDI7)
Optical Isolation	2500 V_{DC}
Optical isolator response time	100μs
Input Resistance	5.7KΩ @1W
Over-voltage Protect	70 V_{DC}
Input Voltage	V_{IH} (max.)=50 V_{DC}
	V_{IH} (min.)=10 V_{DC}
	V_{IL} (max.)=3 V_{DC}
Input Current	1.6 mA @ 10 V_{DC} (typical)
	1.9 mA @ 12 V_{DC} (typical)
	4.1 mA @ 24 V_{DC} (typical)
	8.5 mA @ 48 V_{DC} (typical)
	8.9 mA @ 50 V_{DC} (typical)

Table A.2: Relay Output		
Number of Output Channel		8
Relay Type		4 x Form C, and 4 x Form A
Contact Rating (resistive)		2A@250V_{AC}, 2A@30V_{DC}
Max. Switching Power		500VA, 60W
Max. Switching Voltage		400V_{AC}, 300V_{DC}
Resistance		100 mΩ max.
Breakdown Voltage	Between Coil and Contacts	5000V_{AC}
	Between Open Contacts	1000V_{AC}
	Between Adjacent Contacts	2500V_{AC}
Operating Time		Typical. 7 ms, Max. 15 ms
Releasing time		Typical. 2 ms, Max. 6ms
Life Expectancy		2 x 10^5 cycles min. @ 2A/250V_{AC}

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Table A.3: General Specifications		
I/O Connector Type	1 x DB37 female connector	
Dimensions	175 mm x 100 mm (6.9" x 3.9")	
Power Consumption	+5V @ 220 mA (typical) +5V @ 750 mA (max.)	
Temperature	Operating	0 ~ +60°C (32 ~ 140°F)
	Storage	-20 ~ +70°C (-4 ~158°F)
Relative Humidity	5 - 95 % RH non-condensing	
Certifications	CE/FCC	

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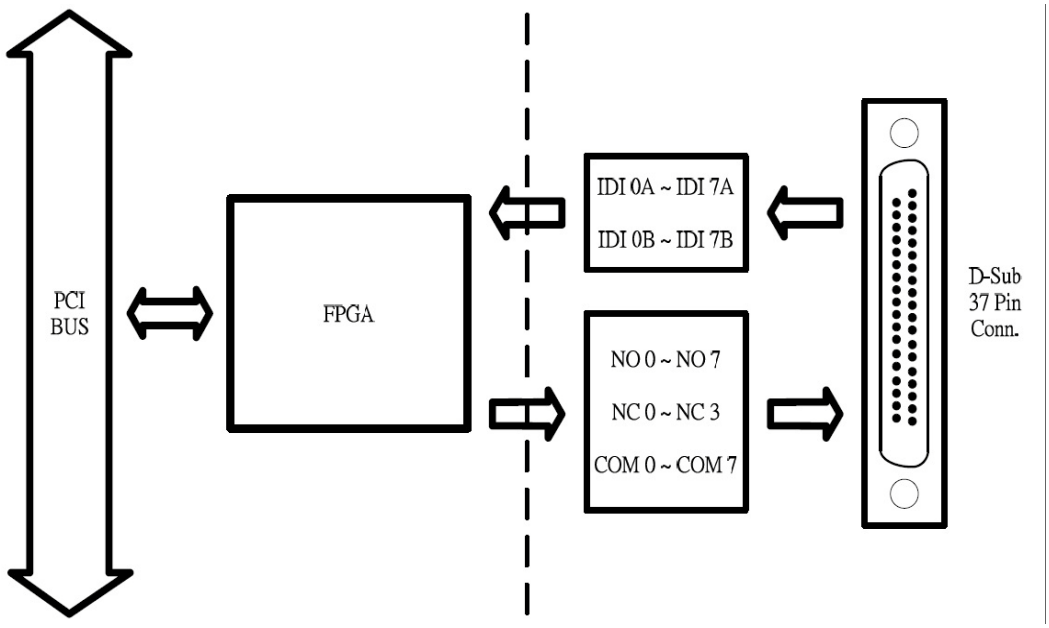
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Appendix B

Block Diagram

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B.1 Block Diagram



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Appendix C

Register Structure and Format

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C.1 Overview

The PCI-1761 is delivered with an easy-to-use driver for user programming under the Windows and Linux operating systems. We advise users to program the PCI-1761using the driver provided by Advantech to avoid the complexity of low-level programming by register. The most important consideration in programming the PCI-1761 the register level is to understand the function of the card's registers. The information in the following sections is provided only for users who would like to do their own low-level programming.

C.2 I/O Port Address Map

The PCI-1761 requires 32 consecutive addresses in the PC's I/O space. The address of each register is specified as an offset from the card's base address. For example, BASE+0 is the card's base address and BASE+7 is the base address plus seven bytes. Table C-1 shows the function of each register of the PCI-1761 or driver and its address relative to the card's base address.

Table C.1: Register Functions

Base Addr, + Hex		7	6	5	4	3	2	1	0
0H	R	Relay Output Status							
		RS7	RS6	RS5	RS4	RS3	RS2	RS1	RS0
	W	Relay Output							
		RO7	RO6	RO5	RO4	RO3	RO2	RO1	RO0
1H	R	Isolated Digital Input							
		IDI7	IDI	IDI5	IDI4	IDI3	IDI2	IDI1	IDI0
	W	N/A							
2H	R	Board ID Register							
						BD3	BD2	BD1	BD0
	W	N/A							
3H	R	Interrupt Enable Status							
		IDI7EN	IDI6EN	IDI5EN	IDI4EN	IDI3EN	IDI2EN	IDI1EN	IDI0EN
	W	Interrupt Enable Register							
		IDI7EN	IDI6EN	IDI5EN	IDI4EN	IDI3EN	IDI2EN	IDI1EN	IDI0EN
4H	R	Interrupt Triggering Status							
		IDI7RF	IDI6RF	IDI5RF	IDI4RF	IDI3RF	IDI2RF	IDI1RF	IDI0RF
	W	Interrupt Triggering Register							
		IDI7RF	IDI6RF	IDI5RF	IDI4RF	IDI3RF	IDI2RF	IDI1RF	IDI0RF
5H	R	Interrupt Flag							
		IDI7F	IDI6F	IDI5F	IDI4F	IDI3F	IDI2F	IDI1F	IDI0F
	W	Interrupt Clear Register							
		IDI7CLR	IDI6CLR	IDI5CLR	IDI4CLR	IDI3CLR	IDI2CLR	IDI1CLR	IDI0CLR

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C.3 C.3 Relay I/O Registers - BASE+0H

The PCI-1761 offers 8-ch relay actuators. These I/O channels use the input and output ports at addresses **BASE+0H.**

Table C.2: Register for Relay Output Status

Read	Relay Output Status							
Bit #	7	6	5	4	3	2	1	0
BASE +0H	RS7	RS6	RS5	RS4	RS3	RS2	RS1	RS0

Table C.3: Register for Relay Output

Write	Relay Output							
Bit #	7	6	5	4	3	2	1	0
BASE +0H	RO7	RO6	RO5	RO4	RO3	RO2	RO1	RO0

Note! *The default configuration of the digital output channels is a logic 0. This avoids damaging external devices during system start-up or reset since the power on status is set to the default value.*

C.4 Isolated Digital Input Registers - BASE+1H

The PCI-1761 offers 8-ch isolated digital input channels. These channels use the input ports at addresses **BASE+1H**.

Register for Isolated Digital Input

Read	Isolated Digital Input							
Bit #	7	6	5	4	3	2	1	0
BASE +1H	IDI7	IDI6	IDI5	IDI4	IDI3	IDI2	IDI1	IDI0

C.5 Board ID - BASE+2H

The PCI-1761 offers Board ID register **BASE+2H**. With correct Board ID settings, user can easily identify and access each card during hardware configuration and software programming.

Table C.4: Register for Board ID

Read	Board ID							
Bit #	7	6	5	4	3	2	1	0
BASE +2H					BD3	BD2	BD1	BD0

BD3 ~ DB0 **Board ID**

BD0 LSB of the Board ID

BD3 MSB of the Board ID

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C.6 Interrupt Status Register - BASE+3H/4H/5H

The ***Interrupt Status Register*** control the status of eight interrupt signal sources (IDI0 ~ IDI7).

Table C.5: Register for Interrupt Status

Read	Interrupt Status Register							
Bit #	7	6	5	4	3	2	1	0
BASE +3H	IDI7EN	IDI6EN	IDI5EN	IDI4EN	IDI3EN	IDI2EN	IDI1EN	IDI0EN
BASE +4H	IDI7RF	IDI6RF	IDI5RF	IDI4RF	IDI3RF	IDI2RF	IDI1RF	IDI0RF
BASE +5H	IDI7F	IDI6F	IDI5F	IDI4F	IDI3F	IDI2F	IDI1F	IDI0F

IDI*n*F **Interrupt flag bits (*n* = 0 ~ 7)**

This bit is a flag indicating the status of an interrupt.
User can read this bit to get the status of the interrupt

0 No interrupt
1 Interrupt occurred

IDI*n*EN **Interrupt enable control bits (*n* = 0 ~ 7)**

Read this bit to Enable/Disable the interrupt.

0 Disable
1 Enable

IDI*n*RF **Interrupt triggering control bits (*n* = 0 ~ 7)**

The interrupt can be triggered by a rising edge or falling edge of the interrupt signal, as determined by the value in this bit.

0 Rising edge trigger
1 Falling edge trigger

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C.7 Interrupt Control Register - BASE+3H/4H/5H

The Interrupt Control Register control the status of two interrupt signal sources (IDI0 ~ IDI7). The user can clear the interrupt by writing its corresponding value to the Interrupt Control Register, as shown in below table.

Table C.6: Register for Interrupt Control

Write	Interrupt Control Register							
Bit #	7	6	5	4	3	2	1	0
BASE +3H	IDI7EN	IDI6EN	IDI5EN	IDI4EN	IDI3EN	IDI2EN	IDI1EN	IDI0EN
BASE +4H	IDI7RF	IDI6RF	IDI5RF	IDI4RF	IDI3RF	IDI2RF	IDI1RF	IDI0RF
BASE +5H	IDI7CLR	IDI6CLR	IDI5CLR	IDI4CLR	IDI3CLR	IDI2CLR	IDI1CLR	IDI0CLR

IDI*n*CLR **Interrupt clear control bits (*n* = 0 ~ 7)**

This bit must first be cleared to service the next interrupt.

0 Don't care

1 Clear the interrupt

IDInEN **Interrupt enable control bits (*n* = 0 ~ 7)**

Read this bit to Enable/Disable the interrupt.

0 Disable

1 Enable

IDInRF **Interrupt triggering control bits (n = 0 ~ 7)**

The interrupt can be triggered by a rising edge or falling edge of the interrupt signal, as determined by the value in this bit.

0 Rising edge trigger

1 Falling edge trigger

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