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PCI-1727U

12-ch Analog Output Card with Universal PCI

User Manual

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Product Warranty (2 years)

Advantech warrants to you, the original purchaser, that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which have been subject to misuse, abuse, accident or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

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5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

Declaration of Conformity

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

FCC Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Technical Support and Assistance

Step 1. Visit the Advantech web site at **www.advantech.com/support** where you can find the latest information about the product.

Step 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

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User's Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid 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:

a. The power cord or plug is damaged.

b. Liquid has penetrated into the equipment.

c. The equipment has been exposed to moisture.

d. The equipment does not work well, or you cannot get it to work according to the user's manual.

e. The equipment has been dropped and damaged.

f. The equipment has obvious signs of breakage.

15. 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 DAM-

AGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.

16. 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.

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.

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

1. To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.
2. Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

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CHAPTER 1

Introduction

This chapter contains information on the PCI-1727U and instruction on card configuration in order to match your application and prepare it for installation on your system.

Sections include:

- Features
- Applications
- Installations Guide
- Software Overview
- Device Driver Programming Roadmap
- Accessories

Chapter 1 Introduction

Thank you for being an Advantech PCI-1727U customer. PCI-1727U provides twelve 14-bit analog output channels, and is pin-compatible with the ISA PCL-727 card for easy migration. It supports both +/-10V and 0~ 20mA current loop (sink) output. The card's on board DC-to-DC converter ensures the full 10V analog output is always available.

Each analog output channel has a built-in fuse to protect the circuit, PC and the external devices. PCI-1727U is an ideal, economical solution for the applications which require multiple PID control loops.

In addition to its analog outputs, PCI-1727U provides 16 TTL DI and 16 TTL DO channels that are easily applied with industrial on/off control applications.

1.1 Features

- 12 Analog output channels
- 14-bit resolution
- Multiple voltage output ranges ± 10V output and 0~20mA current loop (sink)
- 16 digital input and 16 digital output channelsTTL compatible
- Board ID
- Calibration
- Retain the latest analog/digital output value after system reset

The Advantech PCI-1727U offers the following main features:

Calibration Function

The PCI-1727U provides a manual calibration function through a utility.

The program helps the user to easily complete the calibration procedures

Flexible Voltage Output Range

The PCI-1727U provides a fixed voltage output range of ± 10V to fulfill your flexible range application requirements. Users can define the specific voltage output range and output data format via the software utility and driver.

Retains the Output Values after System Reset

Users can independently set the 12 outputs to different ranges: ±10V and 0~20mA. All ranges are software selectable. When the system is hot reset (power not shut down), the PCI-1727U can either retain the last analog output values, or return to its default configuration, according to the jumper setting. This practical function eliminates danger caused by miss-operation during unexpected system reset.

BoardID

The PCI-1727U has a built-in DIP Switch that helps define each card's ID when multiple PCI-1727U cards have been installed on the same PC chassis. With correct BoardID settings, you can easily identify and access each card during hardware configuration and software programming.

Note: For detailed specifications of the PCI-1727U, please refer to Appendix A, Specifications.

1.2 Applications

- Process control
- Programmable voltage source
- Programmable current sink
- Servo control
- Multiple loop PID control

1.3 Installation Guide

Before you install your PCI-1727U card, please make sure you have the following necessary components:

- PCI-1727U DA&C card
- PCI-1727U User Manual
- Driver software Advantech DLL drivers (in the companion CD-ROM)
- PC or workstation with a PCI-bus slot (running Windows 2000/XP)

Please refer to Section 1.6 for the relevant wring boards and cables.

Some other optional components are also available for enhanced operation: ActiveDAQ, ActiveDAQ Pro, LabView or other 3rd-party software packages

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 procedure. Figure 1.1 provides a concise flow chart to give users a broad picture of the software and hardware installation procedures:

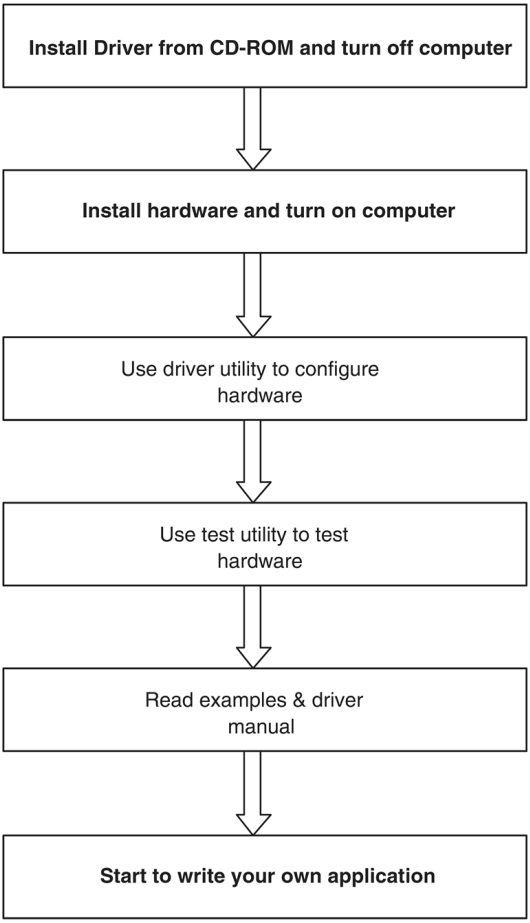


Figure 1.1: Installation Flow Chart

1.4 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-1727U card:

- Device Drivers (on the companion CD-ROM)
- LabVIEW driver
- Advantech ActiveDAQ Pro

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.

Device Drivers

Advantech Device Driver software is included on the companion CDROM at no extra charge. It also comes with all Advantech DA&C cards. Advantech's Device Drivers features a complete I/O function library to help boost your application performance. Advantech Device Drivers for Win 2000/XP works seamlessly with development tools such as Visual C++, Visual Basic, Borland C++ Builder and Borland Delphi.

Register-level Programming

Register-level programming is available for experienced programmers who find it necessary to write code directly at the level of the device register. Since register-level programming requires much effort and time, we recommend that you use the Advantech Device Drivers instead. However, if register-level programming is indispensable, you should refer to the relevant information in *Chapter 4, Register Structure and Format,* or to the example codes included on the companion CD-ROM.

1.5 Device Driver Programming Roadmap

This section will provide a roadmap to demonstrate how to build an application from scratch using Advantech Device Drivers with your favorite development tools such as Visual C++, Visual Basic, Delphi, or C++ Builder. The step-by-step instructions on how to build your own applications using each development tool will be given in the Device Drivers Manual. Moreover, a rich set of example source code is also given for your reference.

1.5.1 Programming Tools

Programmers can develop programs using these development tools:

- Visual C++
- Visual Basic
- Delphi
- C++ Builder

For instructions on how to begin programming in each development tool, Advantech offers a Tutorial Chapter in the Device Drivers Manual for your reference. Please refer to the corresponding sections in this chapter on the Device Drivers Manual to begin your programming efforts. You can also look at the example source code provided for each programming tool, since they can get you very well oriented.

The Device Drivers Manual can be found on the companion CD-ROM. Alternatively, if you have already installed the Device Drivers on your system, The Device Drivers Manual can be readily accessed through the Start button:

Start/Programs/Advantech Automation/Advantech Device Manager /Device Driver's Manual

The example source code can be found under the corresponding installation folder such as the default installation path:

\Program Files\Advantech\ADSAPI\Examples

1.5.2 Programming with Device Drivers Function Library

Advantech Device Drivers offer a rich function library that can be utilized in various application programs. This function library consists of numerous APIs that support many development tools, such as Visual C++, Visual Basic, Delphi and C++ Builder.

1.5.3 Troubleshooting Device Drivers Error

Driver functions will return a status code when they are called to perform a certain task for the application. When a function returns a code that is not zero, it means the function has failed to perform its designated function. To troubleshoot the Device Drivers error, you can pass the error code to DRV_GetErrorMessage function to return the error message. Alternatively, you can refer to the Device Drivers Error Codes Appendix in the Device Drivers Manual for a detailed listing of Error Codes, Error IDs and the Error Messages.

1.6 Accessories

Advantech offers a complete set of accessory products to support the PCI-1727U card. These accessories include:

1.6.1 Wiring Cables

PCL-10137 - The PCL-10137 shielded cable is specially designed for the PCI-1727U cards in order to provide a high resistance to noise. To achieve a better signal quality, the signal wires are twisted to form a “twisted-pair cable”, reducing cross-talk and noise from other signal sources. Its analog and digital lines are separately sheathed and shielded to neutralize EMI/EMC problems.

PCL-10120 - DC-20 pin connectors with flat cable for TTL DIO ports.

1.6.2 Wiring Boards

ADAM-3937 - The ADAM-3937 is a 37-pin D-type wiring terminal module for DIN-rail mounting. This terminal module can be easily connected to the Advantech PC-Lab cards and allows easy yet reliable access to individual pin connections for the PCI-1727U card.

PCLD-880 - The PCLD-880 is a universal screw-terminal board compatible with any of the PC-LabCards which have 37-pin D-type connectors. All the specifications, connectors, pin-assignments, and registry formats are the same. Users can upgrade their system to PCI bus without changing any existing wiring system.

CHAPTER 2

Installation

This chapter contains a package item checklist, proper instructions for unpacking and step-by-step procedures for card installation.

Sections include:

- Unpacking
- Driver Installation
- Hardware Installation
- Device Configuration

Chapter 2 Installation

2.1 Unpacking

After receiving your PCI-1727U package, please inspect its contents first. The package should contain the following items:

- PCI-1727U card
- Companion CD-ROM (Device Drivers included)
- User Manual

The PCI-1727U cards harbor certain electronic components vulnerable to electrostatic discharge (ESD). ESD can easily damage the integrated circuits and certain components if preventive measures are ignored.

Before removing the card from the antistatic plastic bag, you should take the following precautions to ward off possible ESD damage:

Touch the metal part of your computer chassis with your hand to discharge the static electricity accumulated on your body. Alternatively, one can also use a grounding strap.

Touch the anti-static bag to a metal part of your computer chassis before opening the bag.

Take hold of the card only by the metal bracket when removing it out of the bag.

After taking out the card, you should first:

Inspect the card for any possible signs of external damage (loose or damaged components, etc.). If the card is visibly damaged, please notify our service department or our local sales representative immediately. Do not install a damaged card into your system.

Also, pay extra caution to the following aspects during installation:

Avoid physical contact with materials that could hold static electricity such as plastic, vinyl and Styrofoam.

Whenever you handle the card, grasp it only by its edges. DO NOT TOUCH the exposed metal pins of the connector or the electronic components.

Note: Keep the anti-static bag for future use. You might need the original bag to store the card I you have to remove the card from a PC or transport it elsewhere.

2.2 Driver Installation

We recommend you install the driver before you plug the PCI-1727U into your system, since this will guarantee a smooth installation process.

The Advantech Device Drivers Setup program for the PCI-1727U card is included in the companion CD-ROM that is shipped with your DA&C card package. Please follow the steps below to install the driver software:

1. Insert the companion CD-ROM into your CD-ROM drive.
2. The Setup program will be launched automatically if you have the autoplay function enabled on your system. When the Setup Program is launched, the Setup Screen will appear.

Note: If the autoplay function is not enabled on your computer, use Windows Explorer or Windows Run command to execute AUTORUN.EXE on the companion CD-ROM.

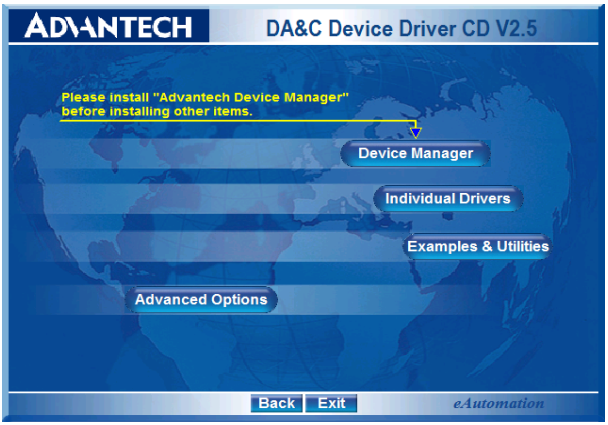


Figure 2.1: Advantech Automation Software Setup

3. First, install the Advantech Device Manager.
4. Select the "**Individual Drivers**" to install the specific device driver then just follow the installation instructions step by step to complete your device driver installation and setup.

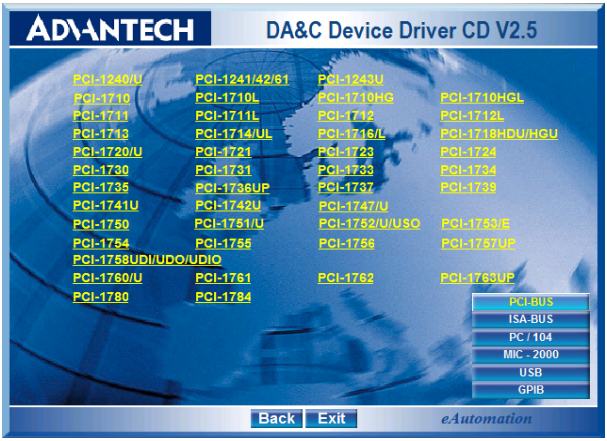


Figure 2.2: Different Options for Driver Setup

For further information on driver-related issues, an online version of the Device Drivers Manual is available by accessing the following path:

Start/Advantech Automation/Device Manager/Device Driver's Manual

2.3 Hardware Installation

Note: Make sure you have installed the driver and Advantech Device Manager before you install the card (please refer to chapter 2.2 Driver Installation)

After the Device Drivers installation is completed you can install the PCI-1727U card into any PCI slot on your computer. 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. However, it is suggested that you refer to the computer's user manual or related documentation if you have any doubts. Please follow the steps below to install the card.

1. Turn off your computer and unplug the power cord and cables.
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 PCI-1727U 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.
6. Fasten the bracket of the PCI card on the back panel rail of the computer with screws.
7. Connect appropriate accessories (50-pin flat 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 ***Advantech Device Manager Program*** that has itself already been installed on your system during driver setup.

2.4 Device Configuration

The ***Advantech Device Manager 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 configure the I/O device for your card, you must first run the setup program by accessing ***Start/Advantech Automation/Device Manager/ Advantech Device Manager*** .
2. You can then view the device(s) already installed on your system. Please click the "**Setup**" button to configure your device.

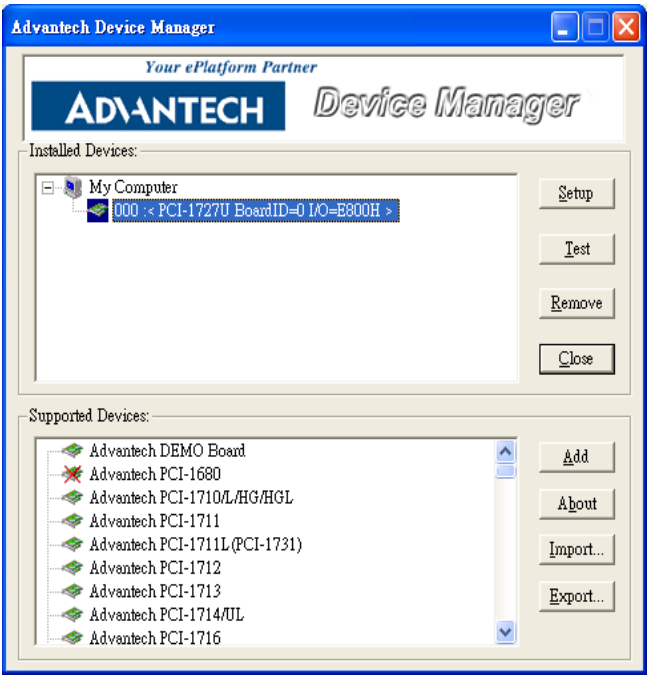


Figure 2.3: The Device Manager Dialog Box

3. On the Device Setting dialog box (Fig. 2-4), you can configure I/O port and interrupt source setting.

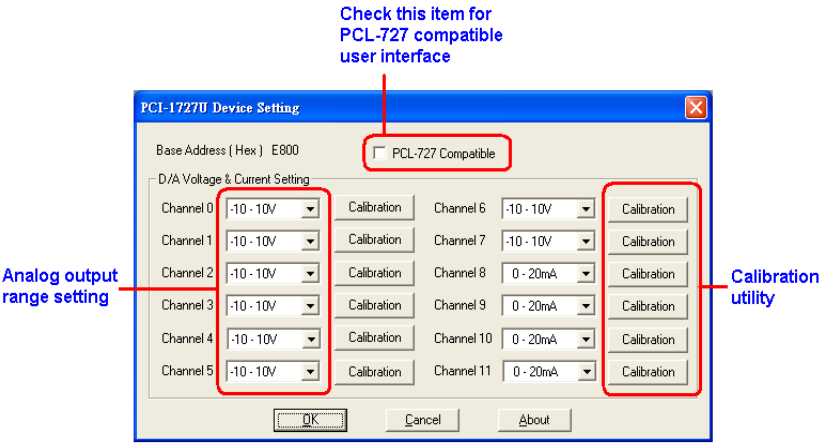


Figure 2.4: The Device Setting Dialog Box

After your card is properly installed and configured, you can click the 'Test' button to test your hardware by using the testing utility.

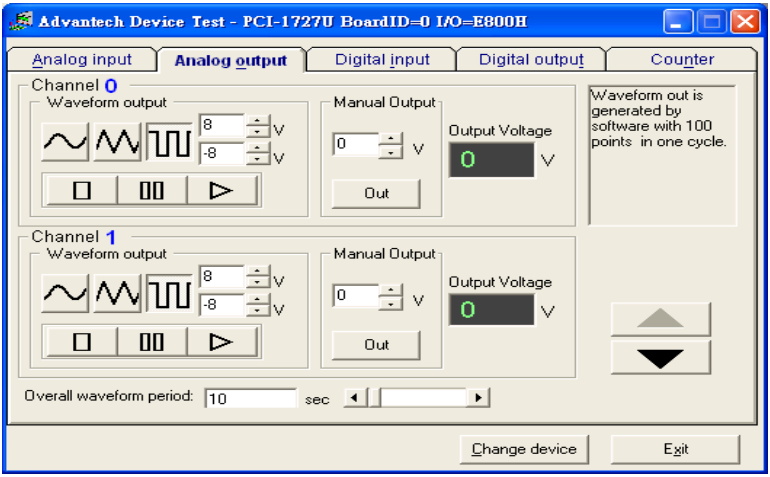


Figure 2.5: Analog Output Test Utility

For more detailed information, please refer to Chapter 2 of the Device Drivers Manual. You can also find rich examples on the CD-ROM to speed up your programming.

CHAPTER 3

Signal Connections

This chapter provides useful information about how to connect input and output signals to the PCI-1727U via the I/O connector.

Sections include:

- Overview
- Switch & Jumper Settings
- Signal Connections

Chapter 3 Signal Connections

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 on how to connect input and output signals to the PCI-1727U via the I/O connector.

3.2 Switch & Jumper Settings

The PCI-1727U card has two function jumper settings.

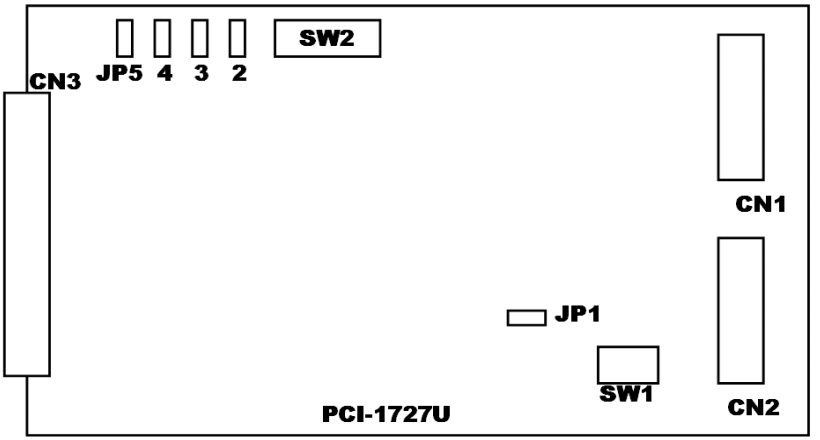
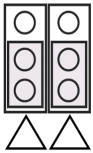
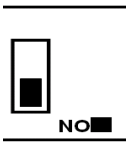
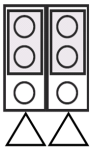
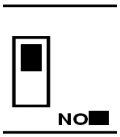


Figure 3.1: Card Connectors, Jumpers & Switches

Location	Descriptiom
CN1	IDC-20 pin connector for digital output channels
CN2	IDC-20 pin connector for digital input channels
CN3	DSub-37 pin connector for analog output channels
JP1	Keep the latest output status/ Restore the default value after system hot reset
SW1	BoardID setting
JP2~5	Voltage/Current mode setting for Ch8~Ch11
SW2	Voltage/Current mode setting for Ch0~Ch7

Table 3.1: Summary of Jumper Settings		
Jumper Name	**Function Description**	
JP1		Retain last status after hot reset
		Default configuration

Table 3.2: Summary of Jumper Settings		
Jumper/Switch	**Setting & Function Description**	
JP2~JP5		Set AO channels to VOLTAGE MODE.
SW2		
JP2~JP5		Set AO channels to CURRENT MODE.
SW2		

Board ID Setting

BD3	BD2	BD1	BD0	Board ID
1	1	1	1	0
1	1	1	0	1
1	1	0	1	2
1	1	0	0	3
1	0	1	1	4
1	0	1	0	5
1	0	0	1	6
1	0	0	0	7
0	1	1	1	8
0	1	1	0	9
0	1	0	1	10
0	1	0	0	11
0	0	1	1	12
0	0	1	0	13
0	0	0	1	14
0	0	0	0	15

Note: On: 1, Off: 0

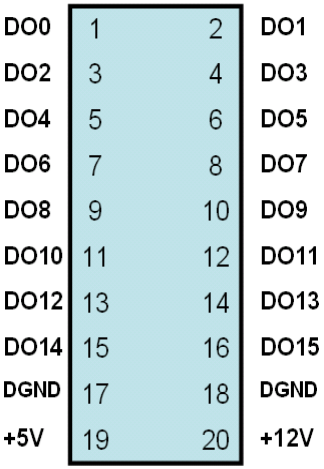
3.3 Signal Connections

Pin Assignment

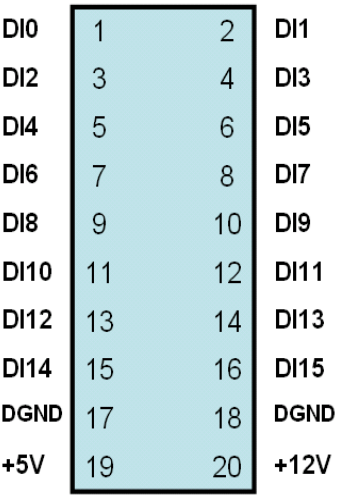
The PCI-1727U is equipped with a 37-pin D-type connector, accessible from the rear plate, and two on-board 20-pin insulation displacement connectors. All connectors accommodate the same type of flat cable, or can be connected to 37-pin D-type connectors through our PCLD-880 industrial wiring kit.

The following figures detail the pin assignments for each connector.

Connector 1 (CN1) - Digital Output



Connector 2 (CN2) – Digital Input



Connector 3(CN3) – D/A output

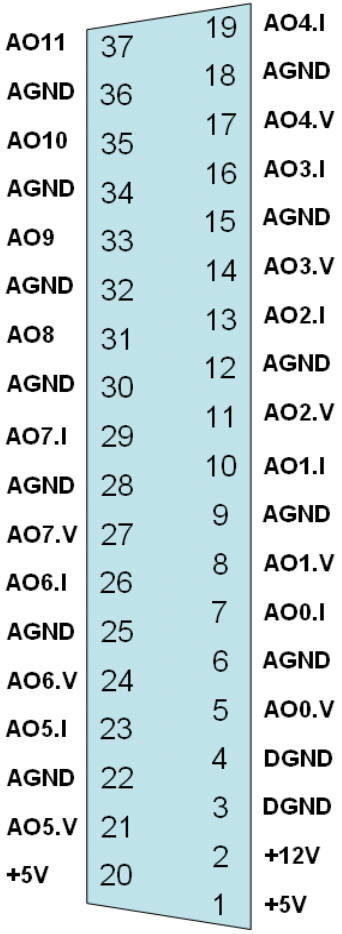
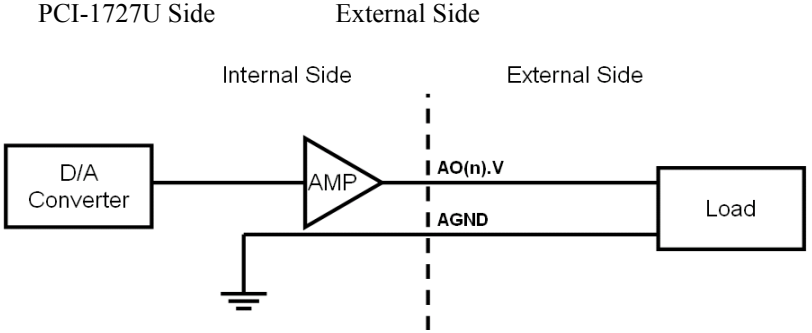


Table 3.3: I/O Connection Signal Description			
Signal	**Ref.**	**Direction**	**Description**
DO <0~15>	DGND	Output	Digital output channel 0~15.
DI <0~15>	DGND	Input	Digital input channel 0~15.
AO <0~15> , V/I	AGND	Output	Analog input channel 0~15. "**V**" stands for voltage output; "**I**" stands for current loop. Voltage output and current loop share the same pin at AO8/9/10/11, selectable by jumpers.
+5V	DGND/ AGND	Output	+5V DC power
+12V	DGND/ AGND	Output	+12V DC power
DGND	-	-	Digital ground.
AGND	-	-	Analog ground.

Voltage Output Connections

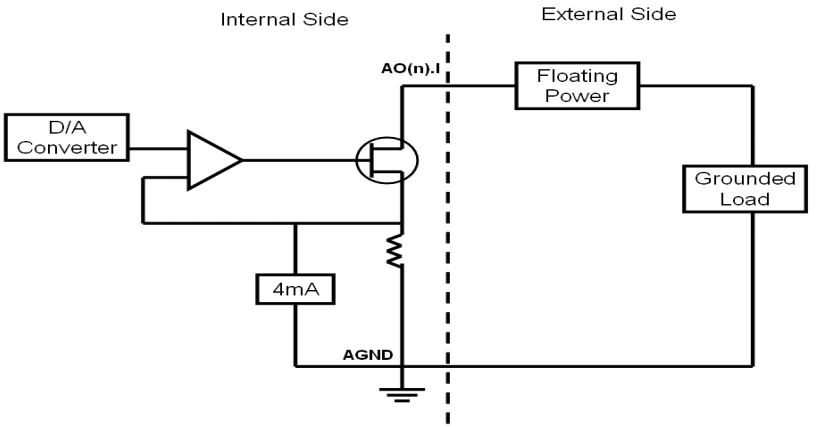
The PCI-1727U supports 12 channels of Analog voltage output. There is only one output signal wire for each channel, as the voltage is referenced to the common ground. A standard wiring diagram showing how to connect a voltage output channel with a load as shown below.



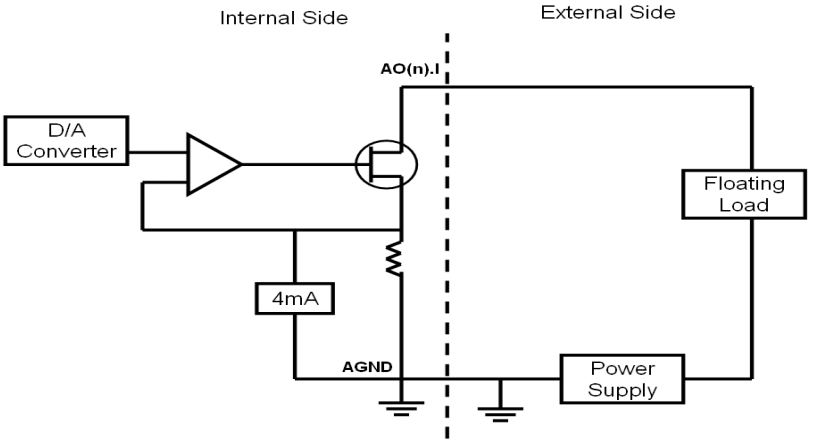
0 to 20 mA Current Output Connections

The PCI-1727U provides 12 channels of 0 to 20 mA current output. The current loop utilizes 0 to 5 V (unipolar) voltage output as the driving source. The PCI-1727U's current drive circuit consists of a power FET, and a constant current source. The voltage bias of this current output should be within 8 to 36 V to insure correct operation. An external 24 V power supply is ideal for this application. The PCI-1727U also provides an internal 12 V power source for current loops should this be required. There are three ways of connecting the load:

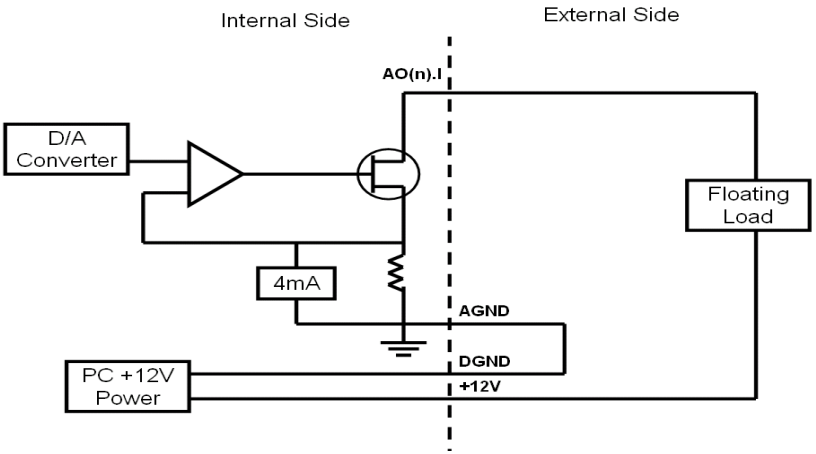
1. Grounded load with a floating supply



2. Floating load with a grounded power supply

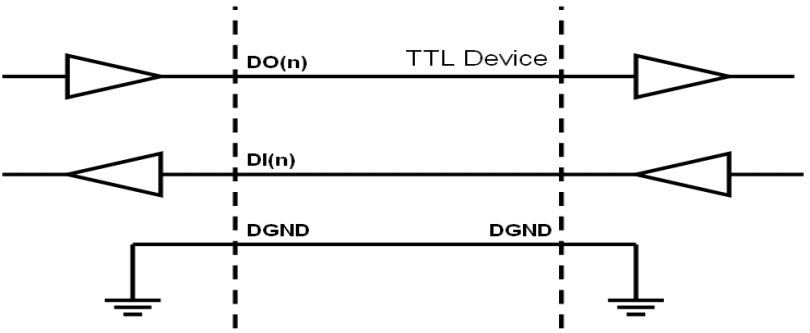


3. Floating load with the internal 12 V supply

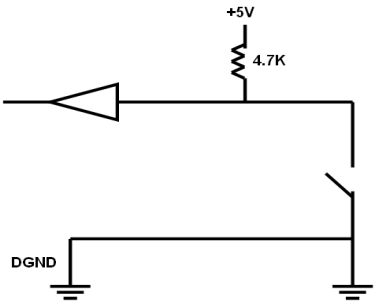


Digital Signal Connections

The PCI-1727U has 16 digital input and 16 digital output channels. The digital I/O levels are TTL compatible. To transmit or receive digital signals to and from other TTL devices, the connection should be as follows.



When the PCI-1727U is used to detect an OPEN/SHORT signal from a switch or relay, a pull-up resistor must be added to ensure the input is tied to a high (+ 5 V) when the contact is open. The following diagram shows this configuration.



Field Wiring Considerations

When the PCI-1727U acquires data from outside, noise in the environment might affect the accuracy of your measurements if preventative measures are not taken. The following is helpful to reduce running signal wire interference between signal sources and the PCI-1727U.

The signal cables must be kept away from strong electromagnetic sources such as power lines, large electric motors, circuit breakers or welding machines, as they may cause strong electromagnetic interference. Keep the analog signal cables away from any video monitor, as it can significantly affect a data acquisition system.

Avoid running cables through any conduit that may contain power lines.

If it is necessary to place a signal cable parallel to a power line with a high voltage or current, try to keep a safe distance between them. Place the signal cable at a right angle to the power line to minimize the effect.

If the cable travels through an area with significant electromagnetic interference, substitute individually shielded, twisted-pair wires as the analog input cable. This type of cable has its signal wires twisted together and shielded with a metal mesh. The metal mesh should only be connected to one point at the signal source ground.

The signals transmitted on the cable will be directly affected by the quality of the cable. In order to ensure better signal quality, we recommend the PCL-10137 shielded cable.

APPENDIX A

Specifications

Appendix A Specifications

Analog Output

- Channel : 12
- Resolution : 14 bits
- Accuracy : +/- 3 LSB
- Output Range : ±10V, 0 – 20mA. (Internal Reference only)
- Current loop excitation voltage : 8V – 36V
- Output current in Vulgate output : 15mA max.
- Throughput : Software Static Update
- Setting time : <= 70μs
- Power on default value : all output range is 0V or 0mA in power on
- Fuse on each channel : 0.1A

Digital Input

- Channel : 16 channel
- Level : TTL compatible
- Logic0 : 0.8V max
- Logic1 : 2.0V min
- Input loading : 0.5V@0.4mA max.(low)
  2.7V@50μA max(high)

Digital Output

- Channel : 16 channel
- Level : TTL compatible
- Logic0 : 0.5V@8mA(sink)
- Logic1 : 2.4V @0.4mA (source)

Power supply

- +5V :250mA typical,500mA max
- +12V:150 mA typical,300mA max
- -12V:100 mA typical,130mA max

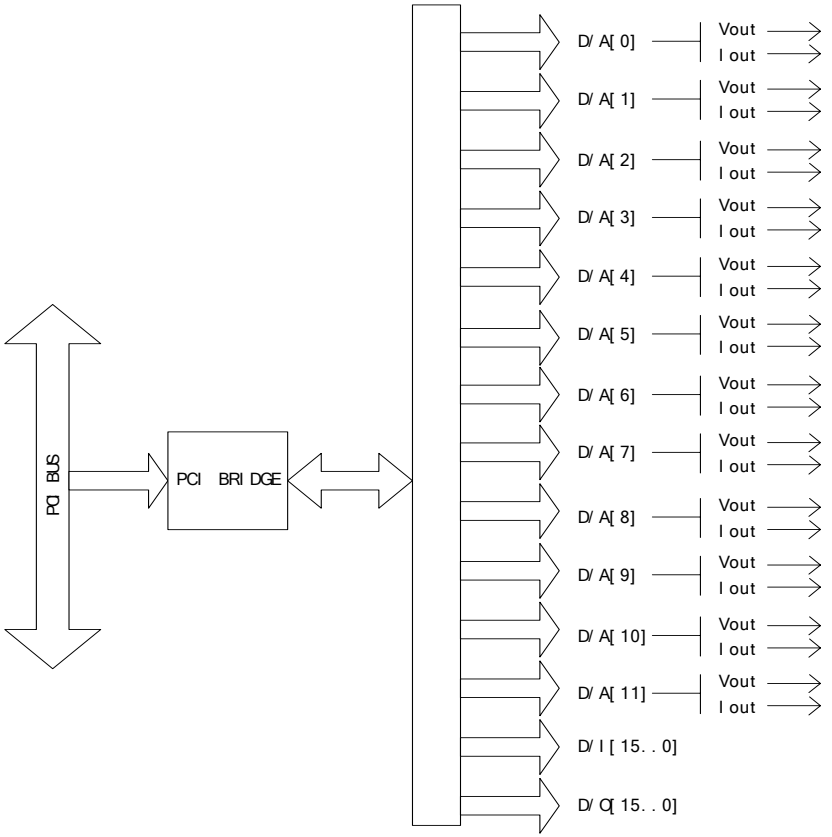
General

- Connector 37-pin D-type female
- Dimension 175×100mm (6.9" ×3.9")
- Operation temperature 0 ~ 50° C (32~149° F)
- Storage temperature -20 ~ 60C ° (-40 ~ 185° F)
- Related humidity 5 ~ 95%, non-condensing

APPENDIX B

Block Diagram

Appendix B Block Diagram



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