PCI-1721

12-bit, 4-channel
Advanced Analog
Output Card

Acknowledgments

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CE notification

The PCI-1721, developed by ADVANTECH CO., LTD., 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.

On-line Technical Support

For technical support and service, please visit our support website at:

http:\\www.advantech.com/support

Note:

✎ Concerning the environment protection, we'd like to reduce the paper using for the user's manual. Starting the page of *Appendix C*, please find the PDF file of the CD-ROM.

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Chapter 1

1. Introduction

Thank you for buying the Advantech PCI-1721. The PCI-1721 is an advanced high-speed analog output card for PCI bus, and each of analog output channels is equipped with a 12-bit, double-buffered DAC.

It features many powerful and unique functions, like waveform output function with 10 MHz maximum update rate, auto-calibration function and Board ID.

The PCI-1721 is an ideal solution for industrial applications where high-speed continuous analog output or even real-time waveform output functions are required.

The following sections of this chapter will provide further information about features of the multifunction cards, a quick start for installation, together with some brief information on software and accessories for the PCI-1721 card.

1.1 Features

- ❑ 10 MHz maximum digital update rate
- ❑ PCI-bus mastering for data transfer
- ❑ Auto calibration function
- ❑ 4 analog output channels with 1K FIFO
- ❑ A 12-bit DAC is equipped for each of analog output channels
- ❑ Real-time waveform output function with internal/external pacer
- ❑ Synchronized output function
- ❑ Flexible output types and output range settings
- ❑ Keeping the output settings and values after system reset
- ❑ 16-ch DIO and one 10MHz 16-bit resolution counter
- ❑ Board ID

The Advantech PCI-1721 offers the following main features:

PCI-Bus Mastering Data Transfer

The PCI-1721 supports *PCI-Bus mastering DMA* for high-speed data transfer and gap-free analog output. By setting aside a block of memory in the PC, the PCI-1721 performs bus-mastering data transfers without CPU intervention, setting the CPU free to perform other more urgent tasks such as data analysis and graphic manipulation. The function allows users to run all I/O functions simultaneously at full speed without losing data.

Auto-calibration Function

The PCI-1721 provides an auto-calibration function by using a calibration utility. The built-in calibration circuitry of the PCI-1721 corrects gain and offset errors in analog output channels thereby eliminating the need for external equipment and user adjustments.

Waveform Analog Output

The PCI-1721 provides four analog output channels. Both of them can perform continuous waveform output. The analog output can be up to 10MS/s for each analog output channel. Or you can load a cyclic waveform into an on-board FIFO, which will continuously output the cyclic waveform. The on-board FIFO of the PCI-1721 can store 2 to 1024 samples of the waveform.

Keeping the Output Settings and Values after system reset

Users can independently set the four outputs to different ranges: 0~+5V, 0~+10V, ±5V, ±10V, 0~20mA or 4~20mA, and all the ranges are software selectable. When the system is hot reset (power not shut down), the PCI-1721 can either retain the last analog output settings and values, or return to its default configuration, depending on jumper setting. This practical function eliminates danger caused by mis-operation during unexpected system reset.

On-board FIFO Memory

The PCI-1721 provides an *on-board FIFO* (First In First Out) memory buffer, storing up to 1K samples for D/A conversion.

Board ID

The PCI-1721 has a built-in DIP Switch that helps define each card's ID when multiple PCI-1721 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-1721 cards. With correct Board ID settings, you can easily identify and access each card during hardware configuration and software programming.

On Board Programmable Timer/Counter

PCI-1721 provides a programmable timer counter for generating pacer trigger for the D/A conversion. The timer/counter chip is 82C54, which includes three 16-bit counters of 10 MHz clock. One counter is used as an event counter for counting events coming from the input channel. The other two are cascaded together to make a 32-bit timer for pacer trigger time base.

Note:

✎ For detailed specifications of the PCI-1721, please refer to *Appendix A, Specifications.*

1.2 Applications

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

1.3 Installation Guide

Before you install your PCI-1721 card, please make sure you have the following necessary components:

- ❑ **PCI-1721 DA&C card**
- ❑ **PCI-1721 User's Manual**
- ❑ **Driver software** Advantech DLL drivers (included in the companion CD-ROM)
- ❑ **Wiring cable** PCL-10168 (optional)
- ❑ **Wiring board** ADAM-3968 (optional)
- ❑ **Computer** Personal computer or workstation with a PCI-bus slot (running Windows 95/98/NT/ 2000)

Some other optional components are also available for enhanced operation:

- ❑ **Application software** ActiveDAQ, GeniDAQ or other third-party software packages (the waveform output function of Analog Output is not included)

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. Figure 1-1 on the next page provides a concise flow chart to give users a broad picture of the software and hardware installation procedures:

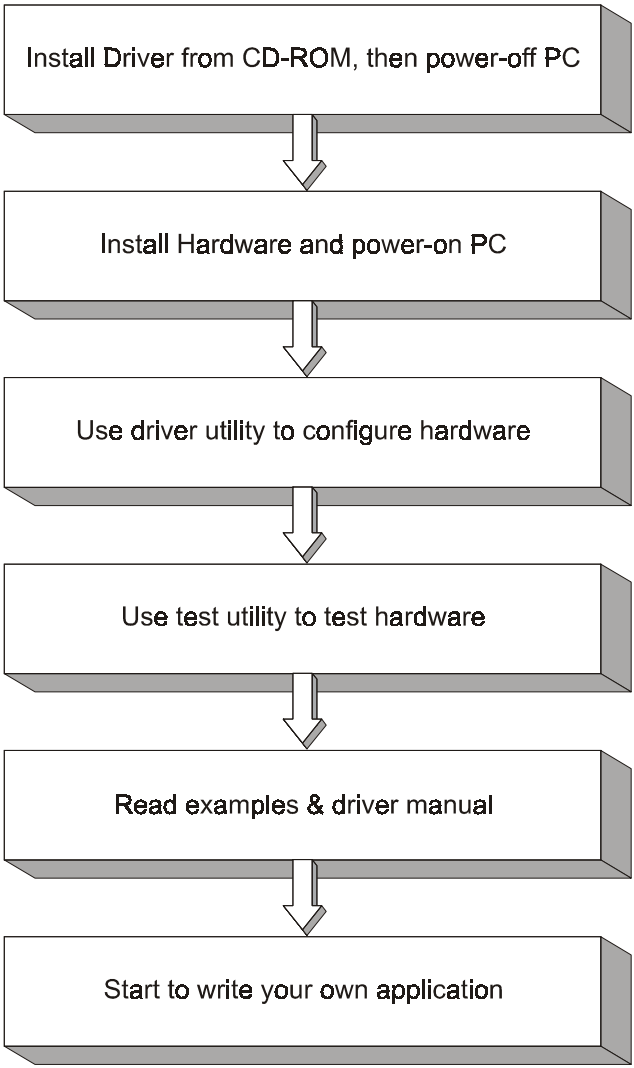

Fig. 1-1 Installation Flow Chart

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-1721 card:

- DLL driver (on the companion CD-ROM)
- LabVIEW driver*
- Advantech ActiveDAQ*
- Advantech GeniDAQ*

Note:

✎ The waveform output function of Analog Output is not included.

Programming choices for DA&C cards: You may use Advantech application software such as Advantech DLL driver. On the other hand, advanced users are allowed another option for register-level programming, although not recommended due to its laborious and time-consuming nature.

DLL Driver

The Advantech DLL Drivers software is included on the companion CD-ROM at no extra charge. It also comes with all the Advantech DA&C cards. Advantech's DLL driver features a complete I/O function library to help boost your application performance. The Advantech DLL driver for Windows 95/98/NT/2000 works seamlessly with development tools such as Visual C++, Visual Basic, Inprise C++ Builder and Inprise Delphi.

Register-level Programming

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

1.5 DLL Driver Programming Roadmap

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

Programming Tools

Programmers can develop application programs with their favorite development tools:

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

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

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

Start/Programs/Advantech Driver for 95 and 98 (or for NT/2000)/ Driver Manual

The example source codes could be found under the corresponding installation folder such as the default installation path:

\Program Files\Advantech\ADSAPI\Examples

For information about using other function groups or other development tools, please refer to the *Creating Windows 95/NT/2000 Application with DLL Driver* chapter and the *Function Overview* chapter on the *DLL Drivers Manual*.

Programming with DLL Driver Function Library

Advanech DLL driver offers a rich function library to 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.

According to their specific functions or services, those APIs can be categorized into several function groups:

- **Analog Output Function Group**
- **Digital Input/Output Function Group**
- **Counter Function Group**
- **Port Function Group (direct I/O)**
- **Event Function Group**

For the usage and parameters of each function, please refer to the *Function Overview* chapter in the *DLL Drivers Manual.*

Troubleshooting DLL Driver 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 DLL driver error, you can pass the error code to *DRV_GetErrorMessage* function to return the error message. Or you can refer to the *DLL Driver Error Codes* Appendix in the *DLL Drivers Manaul* for a detailed listing of the Error Code, Error ID and the Error Message.

1.6 Accessories

Advantech offers a complete set of accessory products to support the PCI-1721 card. These accessories include:

Wiring Cable

- **PCL-10168** The PCL-10168 shielded cable is specially designed for PCI-1721 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

- **ADAM-3968** The ADAM-3968 is a 68-pin SCSI 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-1721 card.

Chapter 2

2. Installation

This chapter gives users a package item checklist, proper instructions about unpacking and step-by-step procedures for both driver and card installation.

2.1 Unpacking

After receiving your PCI-1721 package, please inspect its contents first. The package should contain the following items:

☑ PCI-1721 card

☑ Companion CD-ROM (DLL driver included)

☑ User's Manual

The PCI-1721 card harbors certain electronic components vulnerable to *electrostatic discharge* (ESD). ESD could easily damage the integrated circuits and certain components if preventive measures are not carefully paid attention to.

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

- Touch the metal part of your computer chassis with your hand to discharge static electricity accumulated on your body. Or 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, first you should:

- 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. Avoid installing a damaged card into your system.

Also pay extra caution to the following aspects to ensure proper 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 if you have to remove the card from PC or transport it elsewhere.