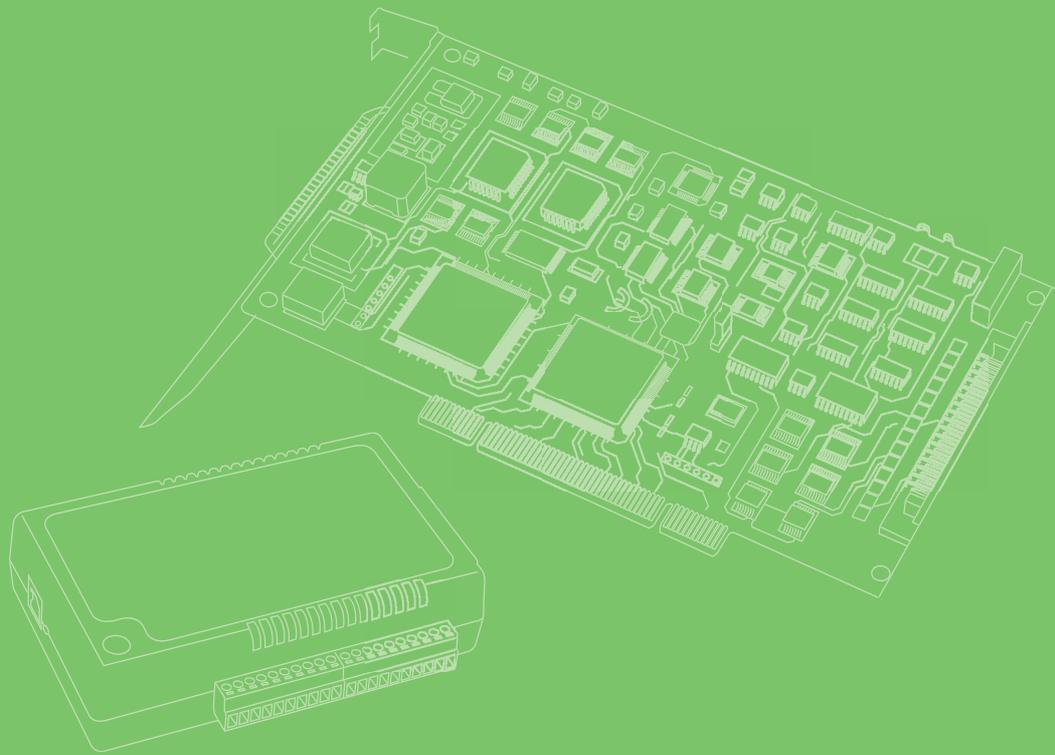


User Manual



PCI-1723

16-bit, 8-ch Analog Output PCI
Card with 16-ch Digital I/O

ADVANTECH

Enabling an Intelligent Planet

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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.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Consult your dealer for more details.

If you think you have a defective product, follow these steps:

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages you get when the problem occurs.
2. Call your dealer and describe the problem. Have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an RMA (return merchandise authorization) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a fully-completed Repair and Replacement Order Card and a photocopy proof of purchase date (such as your sales receipt) in a shippable container. A product returned without proof of the purchase date is not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

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.

Technical Support and Assistance

1. Visit the Advantech web site at <http://support.advantech.com.tw/> 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. 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

Packing List

Before setting up the system, check that the items listed below are included and in good condition. If any item does not accord with the table, Contact your dealer immediately.

- PCI-1723 card
- Startup or User Manual

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 introduces PCI-1723 and its typical applications.

Sections include:

- Features
- Applications
- Installation Guide
- Software Overview
- Roadmap
- Accessories

Thank you for buying the Advantech PCI-1723. The PCI-1723 is a non-isolated multiple channels analog output card for PCI bus, and each analog output channel is equipped with a 16-bit, double-buffered DAC. It features an auto-calibration function and Board ID.

The PCI-1723 is an ideal solution for industrial applications where multiple analog output channels 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-1723 card.

1.1 Features

- Auto calibration function
- A 16-bit DAC is equipped for each of the analog output channels
- Flexible output range: ± 10 V, 0 ~ 20 mA, 4 ~ 20 mA
- Synchronized output function
- Output values kept after system hot reset
- 2-port (16-channel) user-defined digital input/output
- Board ID

PCI-1723 offers the following main features:

Auto-Calibration Function

The PCI-1723 provides an auto-calibration function by using a calibration utility. The built-in calibration circuitry of the PCI-1723 corrects gain and offset errors in analog output channels, thereby eliminating the need for external equipment and user adjustments.

Flexible Voltage Output Range

The PCI-1723 provides a fixed voltage output range of 10V to fulfill your flexible range needed applications. Users can define the specific voltage output range and output data format via the enclosed software utility and driver.

Keeping Output Values After System Reset

Users can independently set the eight outputs to different ranges: 10 V, 0 ~ 20 mA or 4 ~ 20 mA, and all ranges are software selectable. When the system is hot reset (power not shut down), the PCI-1723 can either retain the last analog output values, or return to its default configuration, depending on the jumper setting. This practical function eliminates danger caused by improper operation during unexpected system reset.

BoardID Switch

The PCI-1723 has a built-in DIP switch that helps define each card's ID when multiple PCI-1723 cards have been installed on the same PC chassis. The BoardID setting function is very useful when building a system with multiple PCI-1723 cards. With the correct BoardID settings, you can easily identify and access each card during hardware configuration and software programming.

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-1723 card, please make sure you have the following necessary components:

- PCI-1723 card
- PCI-1723 user manual
- Driver software Advantech DAQNav software (available for download from the Advantech website)
- Personal computer or workstation with a PCI Express interface (running Windows 10, 8 and 7)
- Shielded Cable PCL-10168 (optional)
- Wiring Board ADAM-3968 (optional)

Other optional components are also available for enhanced operation:

- 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 procedure. Figure 1.1 on the next page provides a concise flow chart to give you a broad picture of the software and hardware installation procedures:

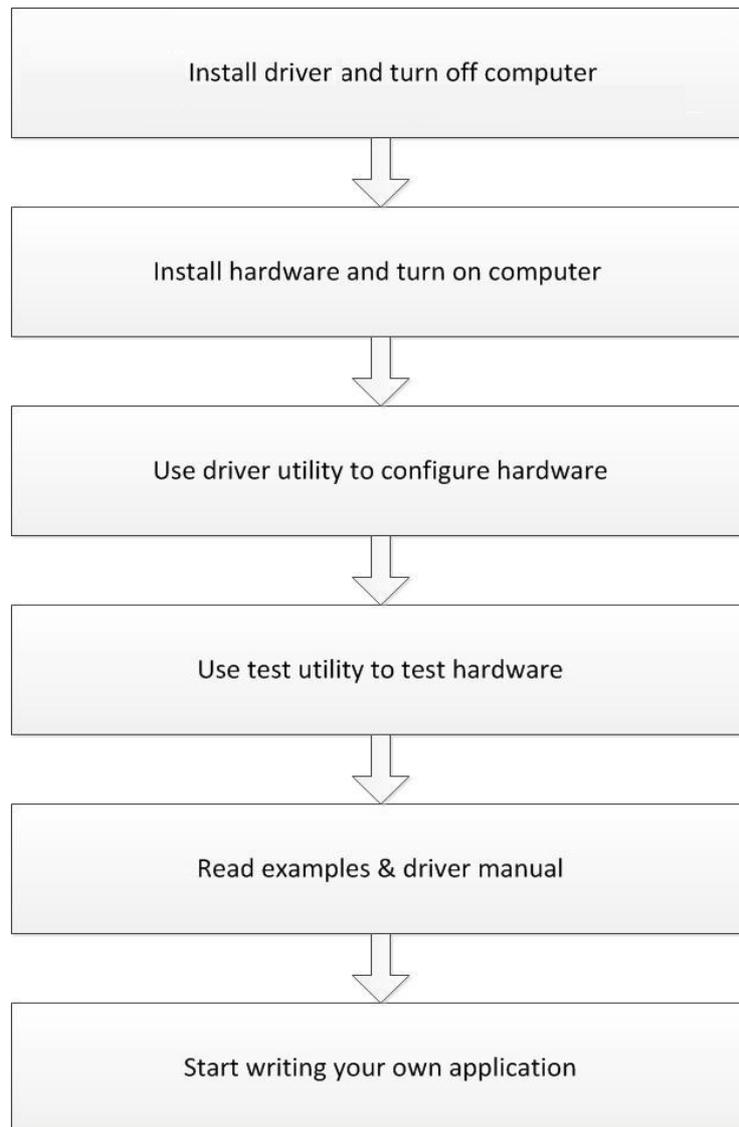


Figure 1.1 Installation Flow Chart

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-1723 card:

- Device Drivers
- Advantech DAQNav

DAQNavi Software

Advantech's DAQNavi software includes device drivers and a software development kit (SDK), which features a comprehensive I/O function library to boost application performance. This software can be downloaded from the Advantech website (at www.advantech.com). The Advantech DAQNavi software for Windows XP/7/8/10 (desktop mode) works seamlessly with most major development tools, including Visual Studio.NET, Visual C++, Visual Basic, and Borland Delphi.

1.5 DAQNav Device Driver Programming Roadmap

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

Programming Tools

Programmers can develop application programs with their favorite development tools:

- Visual Studio.NET
- Visual C++ and Visual Basic
- Delphi
- C++ Builder

For instructions on how to begin programming work in each development tool, Advantech offers a Tutorial Chapter in the *DAQNav SDK Manual* for your reference. Please refer to the corresponding sections in this chapter on the *DAQNav SDK Manual* to begin your programming efforts. You can also look at the example source code provided for each programming tool; examples can help jump-start a project.

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

Start/Programs/Advantech Automation/DAQNav/DAQNav Manuals/DAQNav SDK Manual

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

Advantech\DAQNav\Examples

For information about using other function groups or other development tools, please refer to the Using DAQNav SDK chapter in the DAQNav SDK Manual, or the video tutorials in the Advantech Navigator.

Programming with DAQNav Device Drivers Function Library

Advantech DAQNav 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 Studio.NET, Visual C++, Visual Basic, Delphi and C++ Builder.

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

- Analog Input Function Group
- 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 *Using DAQNav SDK* chapter in the *DAQNav SDK Manual*.

Troubleshooting DAQNav 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, you can check the error code and error description within the Error Control of each function in the DAQNav SDK Manual.

1.6 Accessories

Advantech offers a complete set of accessory products to support the PCI-1723 card. These accessories include:

Wiring Cables

- PCL-10168-1E, 68-pin SCSI Shielded Cable, 1 m
- PCL-10168-2E, 68-pin SCSI Shielded Cable, 2 m

Wiring Boards

- ADAM-3968-AE 68-pin DIN-rail SCSI Wiring Board

Chapter 2

Installation

This chapter provides a packing item checklist, proper instructions for unpacking, and step-by-step procedures for both driver and card installation.

Sections include:

- Unpacking
- Driver Installation
- Hardware Installation
- Device Setup & Configuration

2.1 Unpacking

After receiving your PCI-1723 package, inspect the contents. The package should include the following items:

- PCI-1723 card
- Startup Manual

The PCI-1723 card has 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 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 from 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 attention to the followings to ensure a 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 a PC or transport it elsewhere.*



2.2 Driver Installation

We recommend installing the driver before installing the PCI-1723 card to ensure smooth operation. The Advantech DAQNav Setup program for the PCI-1723 card can be downloaded from the Advantech website.

2.3 Hardware Installation

Note! Make sure you have installed the driver first before you install the card (refer to 2.2 Driver Installation)



After the Device Drivers installation is completed, you can install the PCI-1723 card in your computer. 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 in your system.

1. TURN OFF your computer and unplug the power cord and cables. Do this 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 any static electricity that might be on your body.
5. Insert the PCI-1723 card into the PCI interface. 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. Connect appropriate accessories (DB68 shielded cable, wiring terminals, etc., if necessary) to the card.
7. Replace the cover of your computer chassis. Re-connect the cables you removed in step 1.
8. 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 Navigator* 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.

2.4 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. Take the following PCI-1723 details as an example.

Setting Up the Device

1. To install the I/O device for your card, first run the *Advantech Navigator* program (by accessing *Start/Programs/Advantech Automation/Navigator for DN4*).

- You can then view the device(s) already installed on your system (if any) in the Installed Devices list box. If the software and hardware installation are completed, you will see PCI-1723 card in the Installed Devices list.

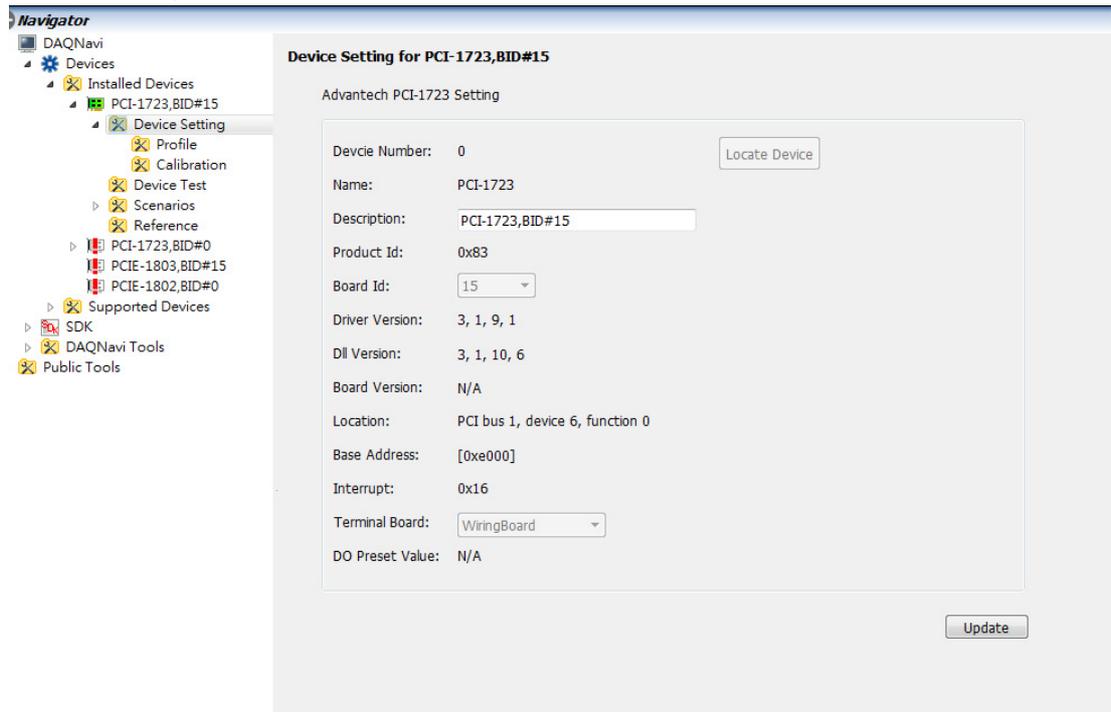


Figure 2.1 PCI-1723 Device Settings

Configuring the Device

- Please go to Device Setting to configure your device. Here you can configure the analog output of PCI-1723.

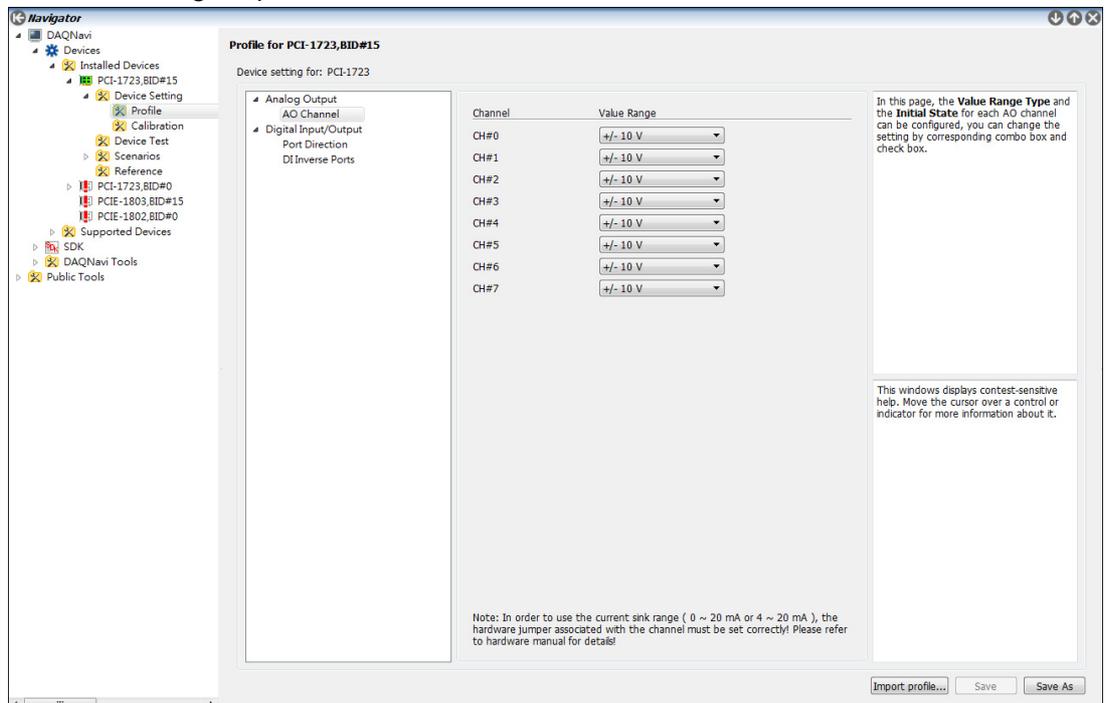


Figure 2.2 The Device Setting Page

- After your card is properly installed and configured, you can go to the *Device Test* page to test the hardware using the testing utility supplied.

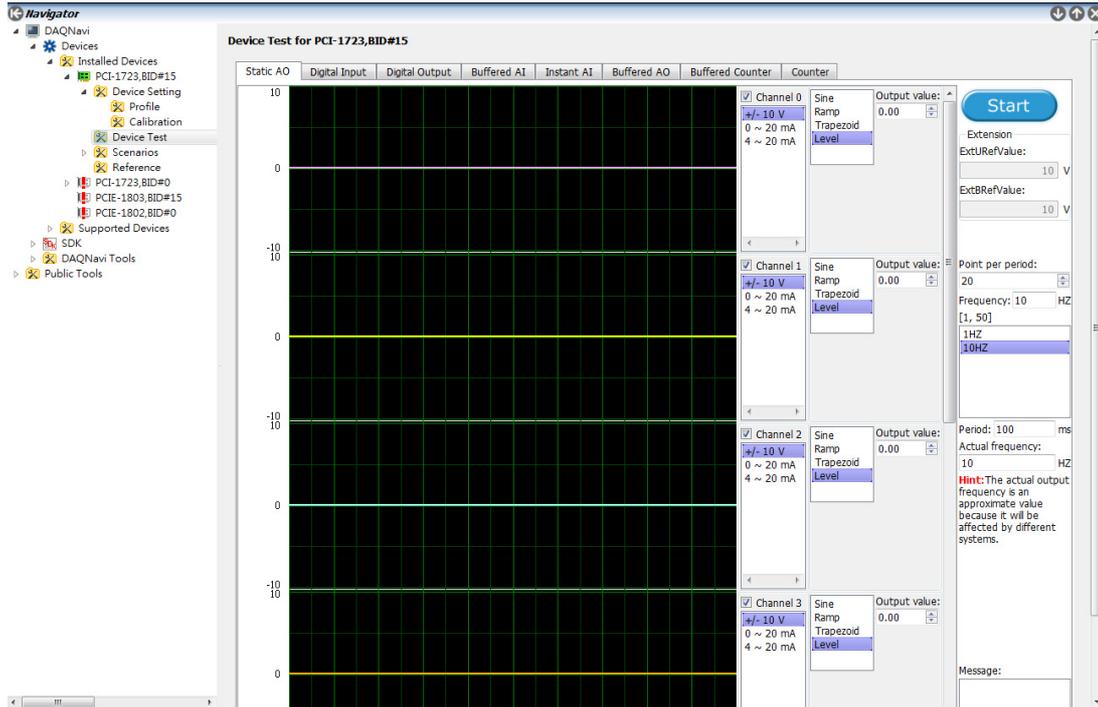


Figure 2.3 PCI-1723 Device Testing

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

Chapter 3

Signal Connections

This chapter provides useful information about how to connect input and output signals to the PCI-1723 card via the I/O connector.

Sections include:

- Overview
- Board ID Settings
- Signal Connections
- Field Wiring Considerations

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-1723 via the I/O connector.

3.2 Switch and Jumper Settings

Please refer to Figure 3.1 for jumper and switch locations on PCI-1723.

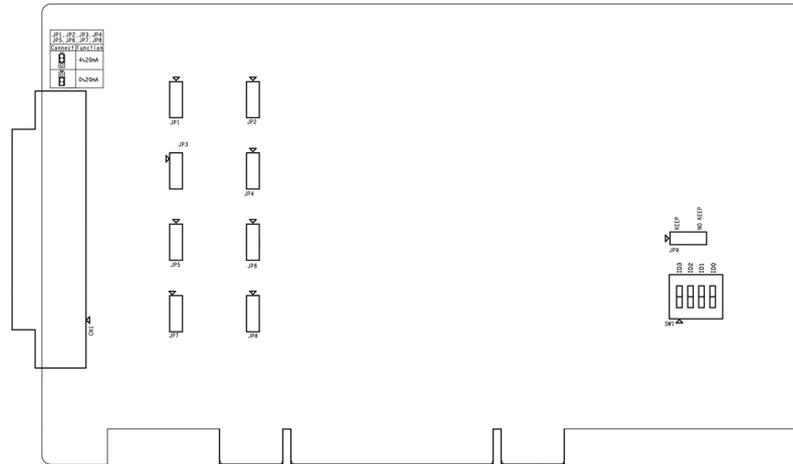


Figure 3.1 Connector and Switch Location

3.2.1 Board ID (SW1)

The PCI-1723 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 used to set each card's device number.

After setting each PCI-1723, 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 another value, please set the SW1 by referring to Table 3.1 below.

Table 3.1: SW1				
1	2	3	4	Board ID
ON	ON	ON	ON	0
ON	ON	ON	OFF	1
ON	ON	OFF	ON	2
ON	ON	OFF	OFF	3
ON	OFF	ON	ON	4
ON	OFF	ON	OFF	5
ON	OFF	OFF	ON	6
ON	OFF	OFF	OFF	7
OFF	ON	ON	ON	8
OFF	ON	ON	OFF	9
OFF	ON	OFF	ON	10
OFF	ON	OFF	OFF	11
OFF	OFF	ON	ON	12
OFF	OFF	ON	OFF	13
OFF	OFF	OFF	ON	14
OFF	OFF	OFF	OFF	15

Default Setting is 0.

3.2.2 Power On Configuration(JP9)

Default configuration after power on, and hardware reset is to set all the analog input and analog output channels to open status (output voltage equals zero) so that external devices will not be damaged when the system starts or resets. When the system is hot reset, then the status of isolated digital output channels are selected by jumper JP9. Table 3.2 shows the possible configurations of jumper JP9.

Table 3.2:	
JP9	Description
(1:2)	Keep last status after hot reset
(2:3)	Not keep last status after hot reset

3.2.3 Current output range jumper

Output range of a channel is configured by a jumper. JP1 through JP8 correspond to analog output channels 0 through 7.

JP1 – JP8	Description
(1:2)	4 ~ 20 mA
(2:3)	0 ~ 20 mA

3.3 Signal Connections

Pin Assignments

The I/O connector on the PCI-1723 is a 68-pin connector that enables you to connect to accessories with the PCL-10168 shielded cable.

Figure 3.2 shows the pin assignments for the 68-pin I/O connector on the PCI-1723, and Table 3.3 shows its I/O connector signal description.

NC	68	34	NC
VOUT0	67	33	VOUT1
AGND	66	32	AGND
IOUT0	65	31	IOUT1
NC	64	30	NC
AGND	63	29	AGND
VOUT2	62	28	VOUT3
AGND	61	27	AGND
IOUT2	60	26	IOUT3
NC	59	25	NC
AGND	58	24	AGND
VOUT4	57	23	VOUT5
AGND	56	22	AGND
IOUT4	55	21	IOUT5
NC	54	20	NC
AGND	53	19	AGND
VOUT6	52	18	VOUT7
AGND	51	17	AGND
IOUT6	50	16	IOUT7
NC	49	15	NC
AGND	48	14	AGND
DIO0	47	13	DIO1
DIO2	46	12	DIO3
DIO4	45	11	DIO5
DIO6	44	10	DIO7
DIO8	43	9	DIO9
DIO10	42	8	DIO11
DIO12	41	7	DIO13
DIO14	40	6	DIO15
DGND	39	5	DGND
NC	38	4	NC
NC	37	3	NC
NC	36	2	NC
+12V	35	1	+5V

Figure 3.2 68-pin I/O Connector Pin Assignments

3.3.1 I/O Connector Signal Description

Pin Name	Type	Pin#	Description
Analog Output			
VOUT0	O	67	Voltage output channel 0
VOUT1	O	33	Voltage output channel 1
VOUT2	O	62	Voltage output channel 2
VOUT3	O	28	Voltage output channel 3
VOUT4	O	57	Voltage output channel 4
VOUT5	O	23	Voltage output channel 5
VOUT6	O	52	Voltage output channel 6
VOUT7	O	18	Voltage output channel 7
IOUT0	O	65	Current output channel 0
IOUT1	O	31	Current output channel 1
IOUT2	O	60	Current output channel 2
IOUT3	O	26	Current output channel 3
IOUT4	O	55	Current output channel 4
IOUT5	O	21	Current output channel 5
IOUT6	O	50	Current output channel 6
IOUT7	O	16	Current output channel 7
Digital Input/Output			
DIO0	I/O	47	Digital input/output channel 0
DIO1	I/O	13	Digital input/output channel 1
DIO2	I/O	46	Digital input/output channel 2
DIO3	I/O	12	Digital input/output channel 3
DIO4	I/O	45	Digital input/output channel 4
DIO5	I/O	11	Digital input/output channel 5
DIO6	I/O	44	Digital input/output channel 6
DIO7	I/O	10	Digital input/output channel 7
DIO8	I/O	43	Digital input/output channel 8
DIO9	I/O	9	Digital input/output channel 9
DIO10	I/O	42	Digital input/output channel 10
DIO11	I/O	8	Digital input/output channel 11
DIO12	I/O	41	Digital input/output channel 12
DIO13	I/O	7	Digital input/output channel 13
DIO14	I/O	40	Digital input/output channel 14
DIO15	I/O	6	Digital input/output channel 15
Power and Ground			
+12V	-	35	+12 V power supply for external use
+5V	-	1	+5 V power supply for external use
AGND	-	14, 17, 19, 22, 24, 27, 29, 32,48, 51, 53, 56, 58, 61, 63, 66	Analog ground
DGND	-	5, 39	Digital ground
Others			
NC	-	2 ~ 4, 15, 20, 25,30, 34,36 ~ 38, 49, 54, 59, 64, 68	No connect

3.3.2 Analog Output Connections

The PCI-1723 provides 8 channels of analog output (AO) signal generation with output ranges of ± 10 V, 0 ~ 20 mA, and 4 ~ 20 mA. The output range of each channel can be configured independently by using dedicated pins or jumper.

3.3.2.1 Voltage Output

For voltage output range (± 10 V), the output configuration is single-ended. Signal connection is shown in below picture, and the minimum load resistance (R_L) is 2 k Ω .

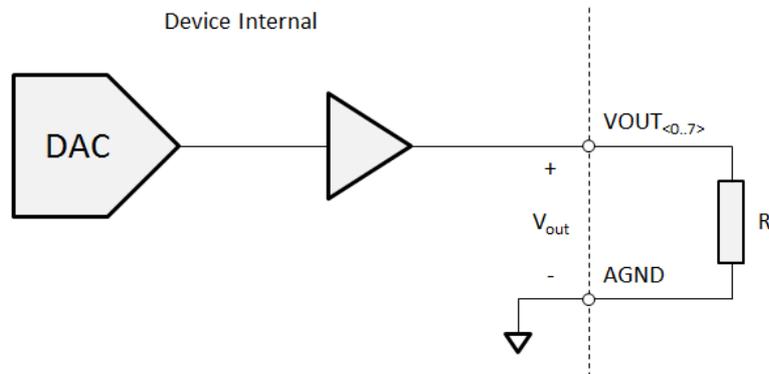


Figure 3.3 Voltage output signal connections

3.3.2.2 Current Output

For current output ranges (0 ~ 20 mA and 4 ~ 20 mA), current flows into the device (sink), and user must provide external power supply to the load. Signal connection is shown in below picture.

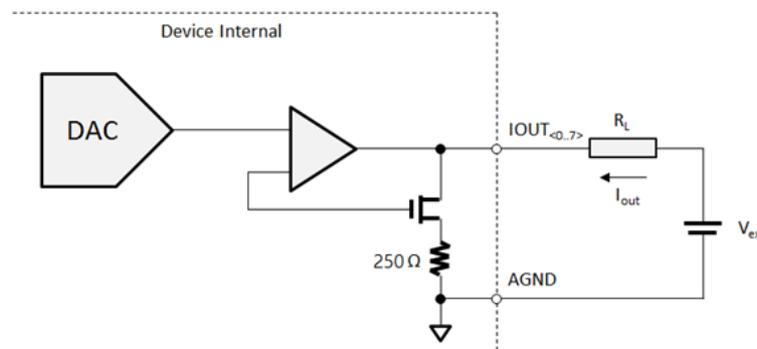


Figure 3.4 Current output signal connection

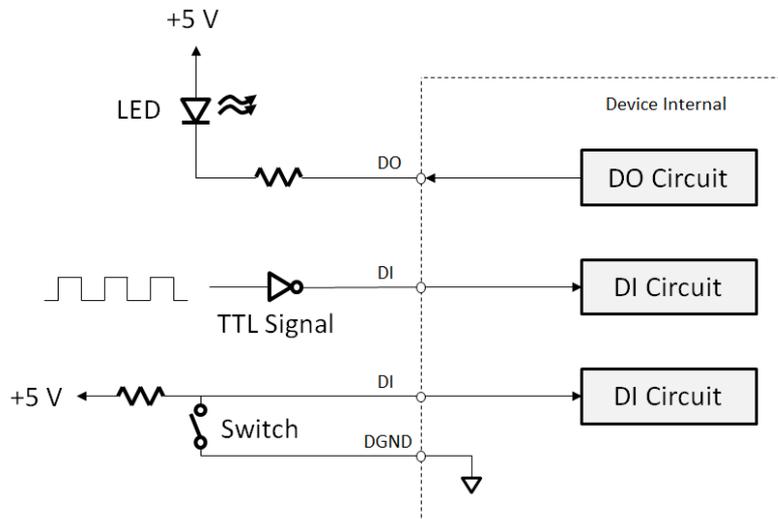
The maximum allowable load resistance (R_L) can be calculated as follows.

$$R_{L,max} = \frac{V_{ext}}{20 \text{ mA}} - 0.250 \text{ k}\Omega$$

where V_{ext} is the external power supply in volts, which must not exceed 40v.

3.3.3 Digital Input/Output Connections

The DI/O signals are referenced to DGND. Figure 3-5 shows digital input and digital output connections. Digital input applications include receiving TTL signals and sensing external device states, such as the state of the switch shown in the figure. Digital output applications include sending TTL signals and driving external devices, such as the LED shown in Figure 3-5.



Caution! Exceeding the maximum input voltage ratings, which are listed in “Appendix A Specifications”, can damage the PCI-1723 and the computer. Advantech is not liable for any damage resulting from such signal connections.



3.4 Field Wiring Considerations

When using a data acquisition device to acquire signals from or generate signals to the outside world, noises and electromagnetic interference from the outside world may significantly affect the results if cautions are not heeded. The following instructions may be helpful to reduce these unwanted effects.

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

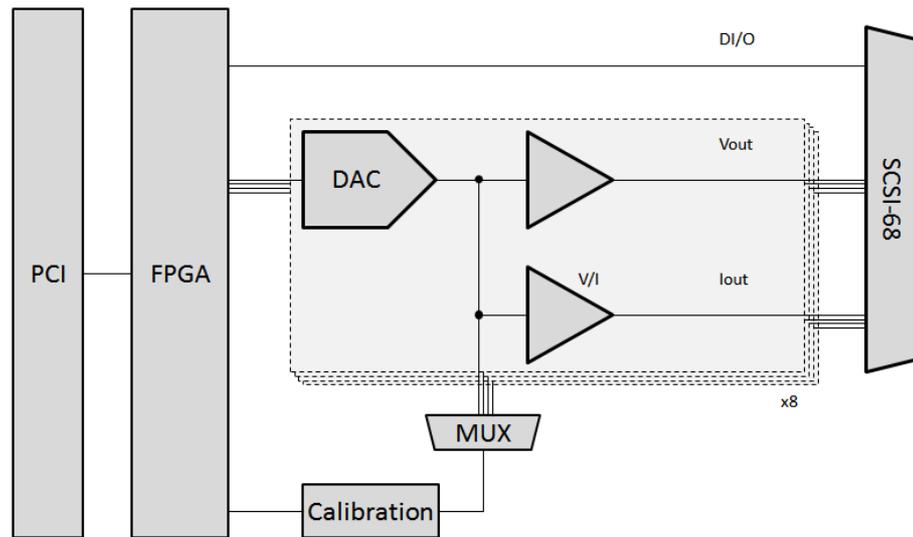
If the cable unavoidably travels through an area with significant electromagnetic interference, a shielded cable with twisted-pair wires should be used.

Try to place the cable at a right angle to the nearby power lines to minimize the undesirable effect.

Appendix **A**

Specifications

A.1 Function Block



A.2 Analog Output

Channels	8, can be enabled/disabled each channel independently by software	
Output configuration	Single-ended	
Output range	± 10 V/0 ~ 20 mA/4 ~ 20 mA (sink) software selectable per channel	
Synchronous output	Yes, can be enabled/disabled by software	
D/A converter (DAC) resolution	16 bits	
Update rates	Static update	
Minimum load for voltage output	2 k Ω	
Maximum external power for current output	40 V	
Internal resistor	250 Ω	
Settling time	100 μ s (within 6 LSB)	
Auto-calibration	Yes	
Voltage output Accuracy	Gain Error	< ± 6 LSB
	Offset Error	< ± 6 LSB
Current output Accuracy	Gain Error	< $\pm 0.1\%$ of FSR (after manual calibration) < $\pm 3\%$ of FSR (without manual calibration)
	Gain Error	< $\pm 0.1\%$ of FSR (after manual calibration) < $\pm 3\%$ of FSR (without manual calibration)

A.3 Digital Input/Output

Channels	16 (shared, 8-channel per group programmable as input or output)	
Input Voltage	Low	0.8 V max.
	High	2 V min.
Output Voltage	Low	0.5 V max. @ 24 mA sink
	High	2.0 V min. @ -15 mA source
Pull-down resistor	100 k Ω	
Maximum input voltage	5.5 V	

A.4 Power Output

+5 V	200 mA max.
+12 V	100 mA max.

A.5 General

I/O Connector Type	68-pin SCSI	
Dimensions	168 × 99 mm ² (6.6 × 3.9 in. ²)	
Power Consumption	Typical	+5 V @ 400mA
	Max.	+5 V @ 820mA
Temperature	Operating	0~60°C (32~140°F)
	Storage	-40 ~ 70°C (-40 ~ 158°F)
Relative Humidity	Operating	10~90%RH non-condensing
	Storage	5~95%RH non-condensing
Certifications	CE/FCC certified	

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Please verify specifications before quoting. This guide is intended for reference purposes only.

All product specifications are subject to change without notice.

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