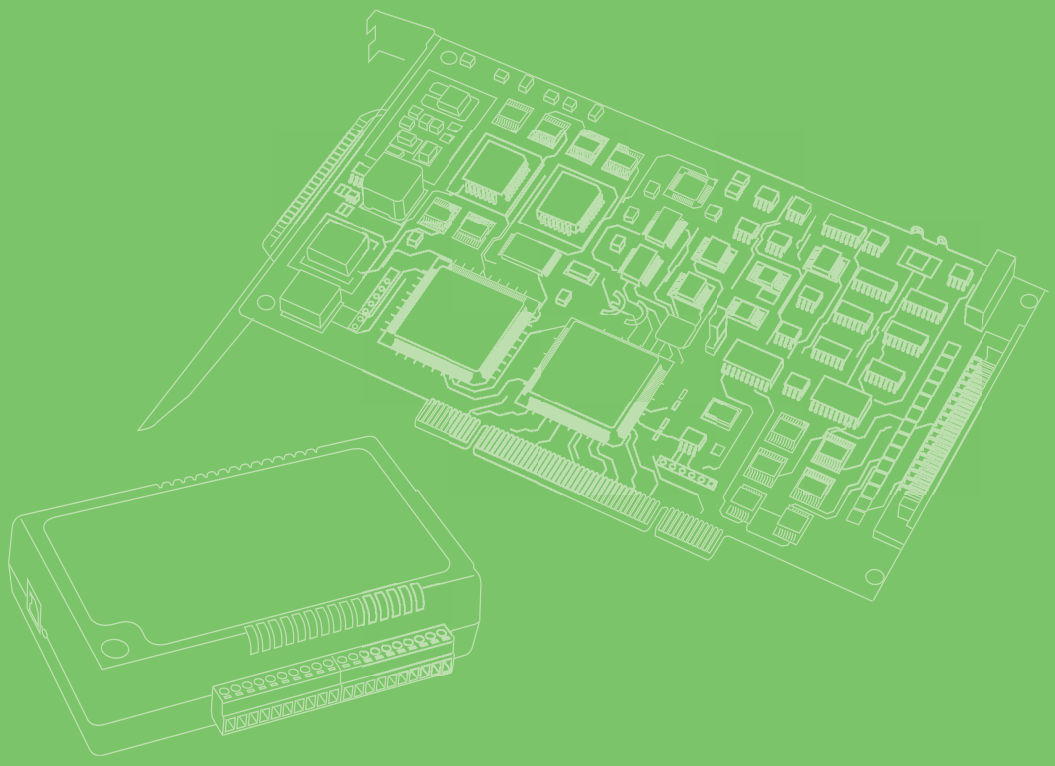

User Manual

PCIE-1758 Series

128-Channel Isolated Digital I/O Card

ADVANTECH

Enabling an Intelligent Planet

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Product Warranty (2 years)

Advantech warrants 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 that have been repaired or altered by persons other than repair personnel authorized by Advantech, or products that 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 customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced free of charge during the warranty period. For out-of-warranty repairs, customers are billed according to the cost of replacement materials, service time, and freight. Please consult your dealer for more details.

If you believe that your product is defective, follow the steps outlined below.

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 displayed when the problem occurs.
2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
3. If your product is diagnosed as defective, obtain an return merchandize authorization (RMA) number from your dealer. This allows us to process your return more quickly.
4. Carefully pack the defective product, a completed Repair and Replacement Order Card, and a proof of purchase date (such as a photocopy of your sales receipt) into a shippable container. Products returned without a proof of purchase date are not eligible for warranty service.
5. Write the RMA number visibly on the outside of the package, then ship the package prepaid to your dealer.

Part No. 2001175810 Edition 1

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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 type of cable is available from Advantech. Please contact your local supplier for ordering information.

FCC Class A

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 such cases, users are required to correct the interference at their own expense.

Technical Support and Assistance

1. Visit the Advantech web site at www.advantech.com/support to obtain the latest product information.
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 calling:
   - 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 with your product and in good condition. If any item does not accord with the table, please contact your dealer immediately.

- 1 x PCIE-1758 Series DAQ card
- 1 x PCIE-1758 Series user manual

Safety Precaution - Static Electricity

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

- To avoid electrical shock, always disconnect the power from the PC chassis before manual handling. Do not touch any internal components, the CPU, or any adapter cards while the PC is powered on.
- Disconnect the power before implementing any configuration changes. A sudden rush of power after connecting a jumper or installing a card may damage sensitive electronic components.

Contents

Chapter 1

Introduction

This chapter introduces the PCIE-1758 series cards and their typical applications.

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

1.1 Introduction

Thank you for buying the Advantech PCIE-1758 series, 128-channel isolated digital input/output card(s). It is a series of data acquisition card with advanced performance based on PCI Express bus architecture. They feature a unique circuit design and completed functions for data acquisition and control. The following sections in this chapter will provide further information about features of PCIE-1758 series, including Quick Start Guide, and brief information on software and accessories.

1.2 Features

- 128-ch isolated DI/O
- Wide input range (10 ~ 30 V_{DC})
- Either +/- voltage input for IDI by group
- Wide output range (5 ~ 40 V_{DC})
- High sink current on isolated output channels (350 mA max./ch)
- High over-voltage protection (70 V_{DC})
- High-voltage isolation (2,500 V_{DC})
- 2,000 VDC ESD protection
- Output status read-out
- Keeps output settings and values after system hot reset
- Interrupt handling capability for IDI channels
- Board ID

PCIE-1758 series provides the following benefits:

Robust Protection

The PCIE-1758 series features a robust isolation protection for applications in industry, lab and machine automation. The PCIE-1758 series can durably withstand a voltage up to 2,500 VDC, preventing your host system from harm.

Wide Input Range

The PCIE-1758 series accepts a wide range of input voltage, from 10 to 30 V_{DC}, and it is suitable for most industrial applications with 12 V_{DC} and 24 V_{DC} input voltage. We are also ready to serve your special needs for specific input voltage ranges. Do not hesitate to ask us about tailoring our standard products to meet your specifications.

Wide Output Range

The PCIE-1758 series also features a wide output voltage range from 5 to 40 V_{DC}, suitable for most industrial applications of 12 V_{DC}/24 V_{DC} output voltage. Similar to the input voltage offer above, we are ready to serve your special needs for specific output voltage range. Do not hesitate to ask us about tailoring our standard products to meet your specifications.

Board ID Setting

The PCIE-1758 series has a built-in DIP switch that defines each card's ID when multiple cards have been installed in the same PC chassis. The board ID setting function is very useful when users build systems with multiple PCIE-1758 series cards. With correct Board ID settings, you can easily identify and access each card during hardware configuration and software programming.

Reset Protection

When the system has undergone a hot reset (i.e., without turning off the system power), the PCIE-1758 series can either retain output 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 incorrect operations during unexpected system resets.

All the above features make PCIE-1758 series cards ideal for industrial applications.

Note! *For detailed specifications of the PCIE-1758 series cards, please refer to Appendix A.*

1.3 Applications

- Industrial ON/OFF control
- Switch status sensing
- BCD interfacing
- Digital I/O control
- Industrial and lab automation

1.4 Installation Guide

Before installing a PCIE-1758 series card, ensure that you have the following necessary components:

- 1 x PCIE-1758 Series DAQ card
- 1 x PCIE-1758 Series user manual
- Advantech DAQNavi driver software
- 1 x PCL-101100S-1E/PCL-101100S-2E/PCL-101100S-3E cable (optional)
- 1 x ADAM-39100-BE wiring board (optional)
- 1 x Personal computer or workstation with a PCI Express bus slot

Other optional components are also available for enhanced operation:

- Advantech DAQ tools, LabView, and other third-party software

After obtaining all necessary components and accessories for enhanced operation, you can begin card installation.

1.5 Software Overview

Advantech offers a comprehensive set of DLL drivers and third-party driver support and application software to fully exploit the functions of PCIE-1758 series cards. These include

- DAQNavi software
- LabView driver
- Advantech DAQ tools

Programming DA&C Cards

Advantech application software, such as Advantech DAQNavi software can be used for programming PCIE-1758 series cards. Advanced users can conduct register-level programming, although this is not recommended due to its laborious and time-consuming nature.

DAQNavi Software

Advantech DAQNavi software includes device drivers and an SDK that features a complete I/O function library to enhance application performance. This software can be downloaded from the Advantech Support Portal (http://support.advantech.com/support/new_default.aspx). Simply search “DAQNavi” to navigate to the download page. The Advantech DAQNavi software for Windows XP/Vista/7 works seamlessly with a range of development tools, including Visual Studio.Net, Visual C++, Visual Basic, and Borland Delphi.

Register-Level Programming

Register-level programming is available for experienced programmers wishing to write code directly at the device register level. Because register-level programming requires substantial time and effort, we recommend that you use the Advantech DAQNavi software instead. However, if register-level programming is unavoidable, contact the technical support team to obtain any information that may be required.

1.6 DAQNavi Device Driver Programming Roadmap

This section provides a roadmap for building an application from the ground up using Advantech DAQNavi device drivers combined with your preferred development tools, such as Visual Studio.Net, Visual C++, Visual Basic, and Borland Delphi. Additionally, step-by-step instructions for building unique applications using each development tool are included in the DAQNavi SDK manual. A comprehensive set of example source codes is also provided for reference.

1.6.1 Programming Tools

Programmers can develop application programs using their preferred development tools. For example,

- Visual Studio.Net
- Visual C++ and Visual Basic
- Borland Delphi

The Tutorial Chapter in the DAQNavi SDK manual provides instructions on how to begin programming using each development tool. Example source codes for each programming tool are also included in this chapter.

The DAQNavi SDK manual is located on the accompanying DVD-ROM. Alternatively, if you have already installed the DAQNavi SDK on your system, the DAQNavi SDK manual can be easily accessed from the Start menu via the following file path:

Start\Programs\Advantech Automation\DAQNavi\DAQNavi Manuals\DAQNavi SDK Manual

The example source codes are located in the corresponding installation folder. The default installation path is as follows:

\Advantech\DAQNavi\Examples

For information about using other function groups or other development tools, refer to the chapter titled “Using DAQNavi SDK” in the DAQNavi SDK manual or to the video tutorials provided in Advantech Navigator.

1.6.2 Programming with DAQNavi Device Drivers Function Library

Advantech DAQNavi device drivers offer a comprehensive function library that can be used for various application programs. This function library consists of numerous APIs that support many development tools, such as Visual Studio.Net, Visual C++, Visual Basic, and Borland Delphi.

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

- Analog Input Function Group
- Analog Output Function Group
- Digital Input/Output Function Group
- Counter Function Group

For information regarding the usage and parameters of each function, refer to “Using DAQNavi SDK” in the DAQNavi SDK manual.

1.6.3 Troubleshooting DAQNavi Device Driver Errors

Driver functions will return a status code when they are called to perform a certain task for the application. Sometimes a function is not successful and an error code is returned. To troubleshoot a device driver error, check the error code and error description in the “Error Control” section for the specific function in the DAQNavi SDK manual.

1.7 Accessories

Advantech offers a complete range of accessories to support PCIE-1758 series cards. These accessories include

Wiring Cables

- **PCL-101100S-1E, PCL-101100S-2E, PCL-101100S-3E**
  PCL-101100S is a 100-pin mini-SCSI shielded cable especially designed for PCIE-1758 series cards. This cable should be used with an ADAM-39100 wiring board.

Wiring Boards

- **ADAM-39100-BE**
  ADAM-39100 is a 100-pin SCSI wiring terminal module with DIN-rail mount.

Chapter 2

Installation

This chapter details the packing list, unpacking instructions, and driver and card installation procedures.

- Unpacking
- Driver Installation
- Hardware Installation

2.1 Unpacking

Upon receiving your PCIE-1758 series product, check that the package contains the following items:

- 1 x PCIE-1758 series DAQ card
- 1 x PCIE-1758 series user manual

PCIE-1758 series cards feature certain electronic components that are vulnerable to electrostatic discharge (ESD). ESD can easily damage the integrated circuits and components if preventive measures are ignored.

Before removing the card from the anti-static plastic bag, take the following precautions to avoid potential damage from ESD:

- Touch the metal part of the computer chassis with your hand to discharge any static electricity accumulated in your body. Alternatively, wear a grounding strap.
- Touch the anti-static bag to a metal part of the computer chassis before opening the bag.
- Hold of the DAQ card by the metal bracket only when removing it from the bag.

After taking out the card

- Inspect the card for any signs of external damage (loose or damaged components, etc.). If the card is visibly damaged, notify the Advantech service department or your local sales representative immediately.
- Do not attempt to install a damaged card in your system.

Additionally, pay extra attention to the following during installation:

- Avoid physical contact with materials that may hold static electricity, such as plastic, vinyl, and styrofoam.
- When handling the card, hold it by its edges only. Do not touch the exposed metal connector pins or any electronic components on the card.

Note! *Retain the anti-static bag for future use. The original bag may be needed to store the card when removing or installing the card on another PC.*

2.2 Driver Installation

Driver installation should be completed before the PCIE-1758 series card is installed in the system to ensure problem-free installation.

The Advantech DAQNavi drivers for PCIE-1758 series cards can be downloaded from the Advantech Support Portal at http://support.advantech.com/support/new_default.aspx

Simply search “PCIE-1758” to navigate to the product page with relevant download links.

2.3 Hardware Installation

Note! *Ensure that all relevant drivers are installed before installing the card (please refer to Chapter 2.2 Driver Installation).*

After the device drivers are installed, the PCIE-1758 series card can be installed in any slot on the computer. However, we recommend that you refer to the computer's user manual or related documentation for guidance. Follow the steps provided below to install the card in your computer.

1. Power off the computer and unplug the power cord and cables before installing or removing any components.
2. Remove the cover of the computer.
3. Remove the slot cover on the back panel of the computer.
4. Touch a metal surface of the computer to neutralize any static electricity that may be in your body.
5. Insert the PCIE-1758 series card into a PCI Express slot. Hold the card by its edges only and carefully align it with the slot. Push the card firmly to insert the card in the slot. Do not use excessive force to avoid damaging the card.
6. Fasten the bracket of the PCI Express card onto the back panel rail of the computer using screws.
7. Connect any additional accessories (100-pin cable, wiring terminals, etc. if necessary) to the PCIE-1758 series card.
8. Replace the cover of the computer chassis. Reconnect the cables removed in Step 2.
9. Plug in the power cord and turn on the computer.

After the PCIE-1758 series card is successfully installed, users can begin configuring their device using the Advantech Navigator program automatically installed during driver setup.

Chapter 3

Signal Connections

This chapter explains how to connect input and output signals to PCIE-1758 series cards via the I/O connector.

- Overview
- Card Layout
- Switch and Jumper 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 PCIE-1758 series cards via the I/O connector.

3.2 Card Layout

Figures 3.1 to 3.3 show the connector, jumper, and switch locations on PCIE-1758 series cards.

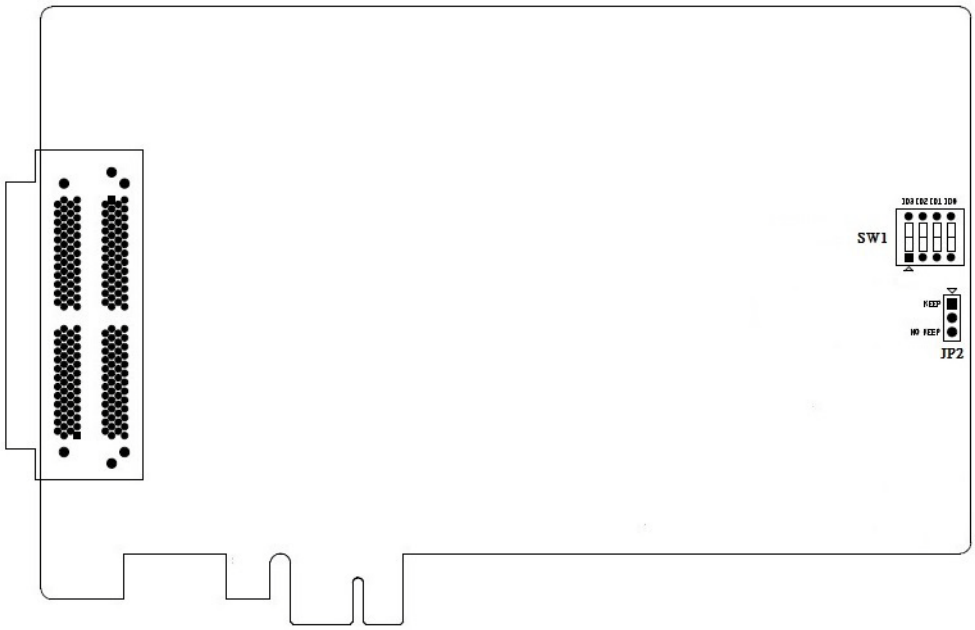


Figure 3.1 PCIE-1758DIO Card Layout

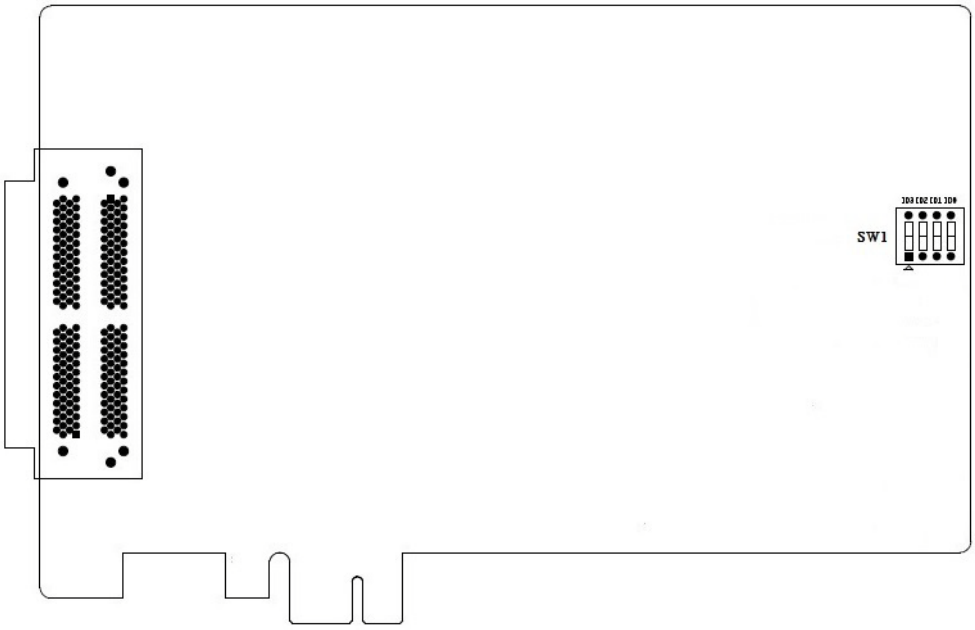


Figure 3.2 PCIE-1758DI Card Layout

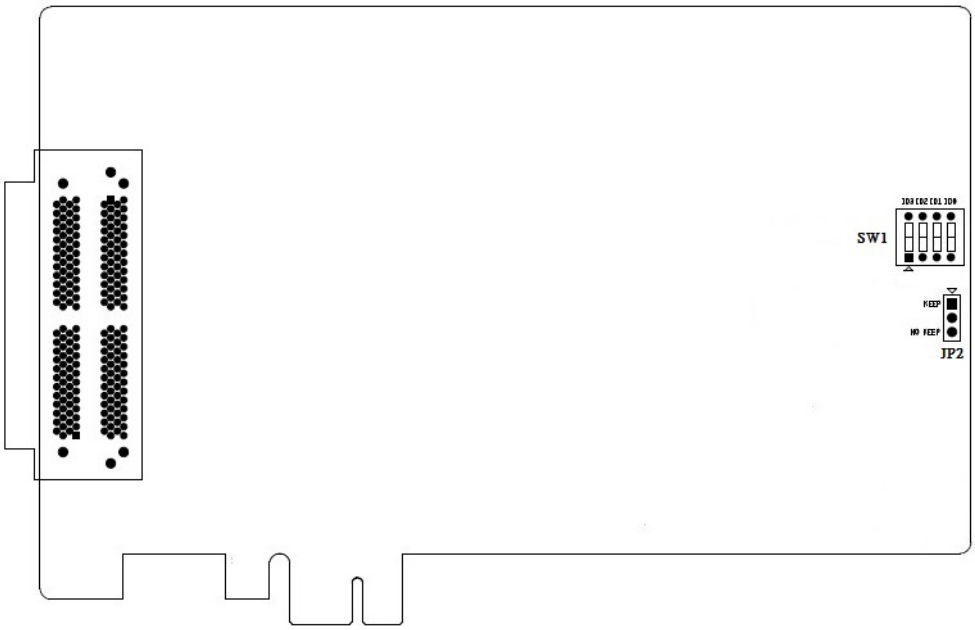


Figure 3.3 PCIE-1758DO Card Layout

3.3 Switch and Jumper Settings

3.3.1 Board ID (SW1)

PCIE-1758 series cards feature a built-in DIP switch (SW1) that is used to define each card's board ID. When multiple cards are installed on the same chassis, the board ID switch is useful for identifying each card's device number. After installing each card, users can differentiate them using their board ID. The available IDs and their corresponding switch combinations are listed in Table 3.1. Refer to this table when changing the ID to a non-zero number.

Table 3.1: Board ID Settings (SW1)

Board ID (dec)	Switch Position			
	1 (ID3)	2 (ID2)	3 (ID1)	4 (ID0)
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

Table 3.1: Board ID Settings (SW1)				
14	OFF	OFF	OFF	ON
15	OFF	OFF	OFF	OFF

Default setting = 0

3.3.2 Power On Configuration (JP2)

The default status of the PCIE-1758 series cards' digital output after a system power on is OPEN to protect external devices from damage. JP2 determines whether the last output value is retained after a hot system reset. Table 3.2 shows the jumper positions for power on configuration.

Table 3.2: Power On Configuration After Hot Resets (JP2)	
JP2	**Power On Configuration After Hot Resets**
	Retain last status after hot reset
	Default configuration (default setting)

3.4 Signal Connections

Pin Assignments

The PCIE-1758 series cards feature two 100-pin connectors that allow users to integrate accessories using a PCL-101100S shielded cable.

Figure 3.4 to 3.6 show the pin assignments of the I/O connectors on the PCIE-1758 series cards. The I/O connector signal descriptions are presented in Table 3.3.

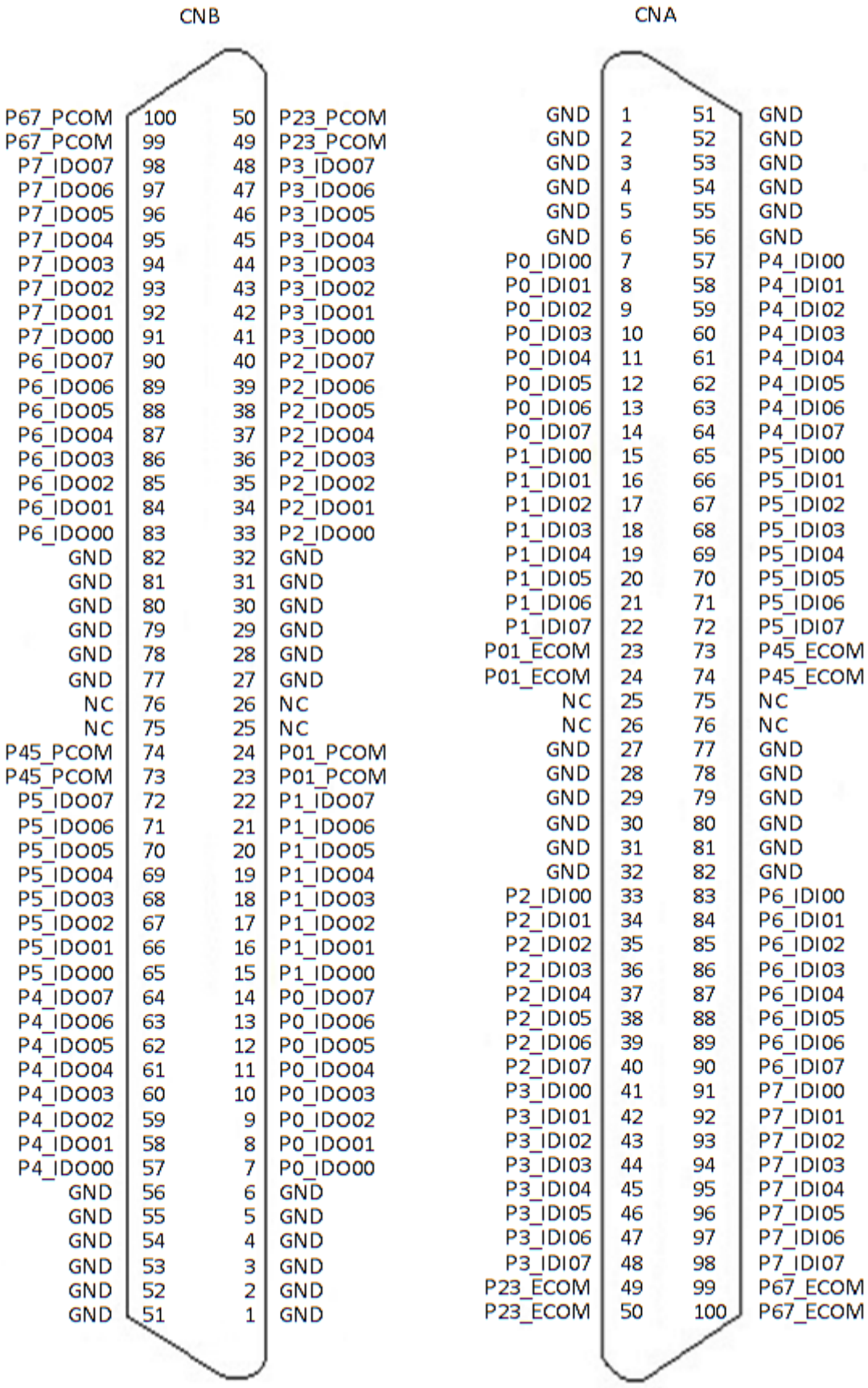


Figure 3.4 PCIE-1758DIO I/O Connector Pin Assignments

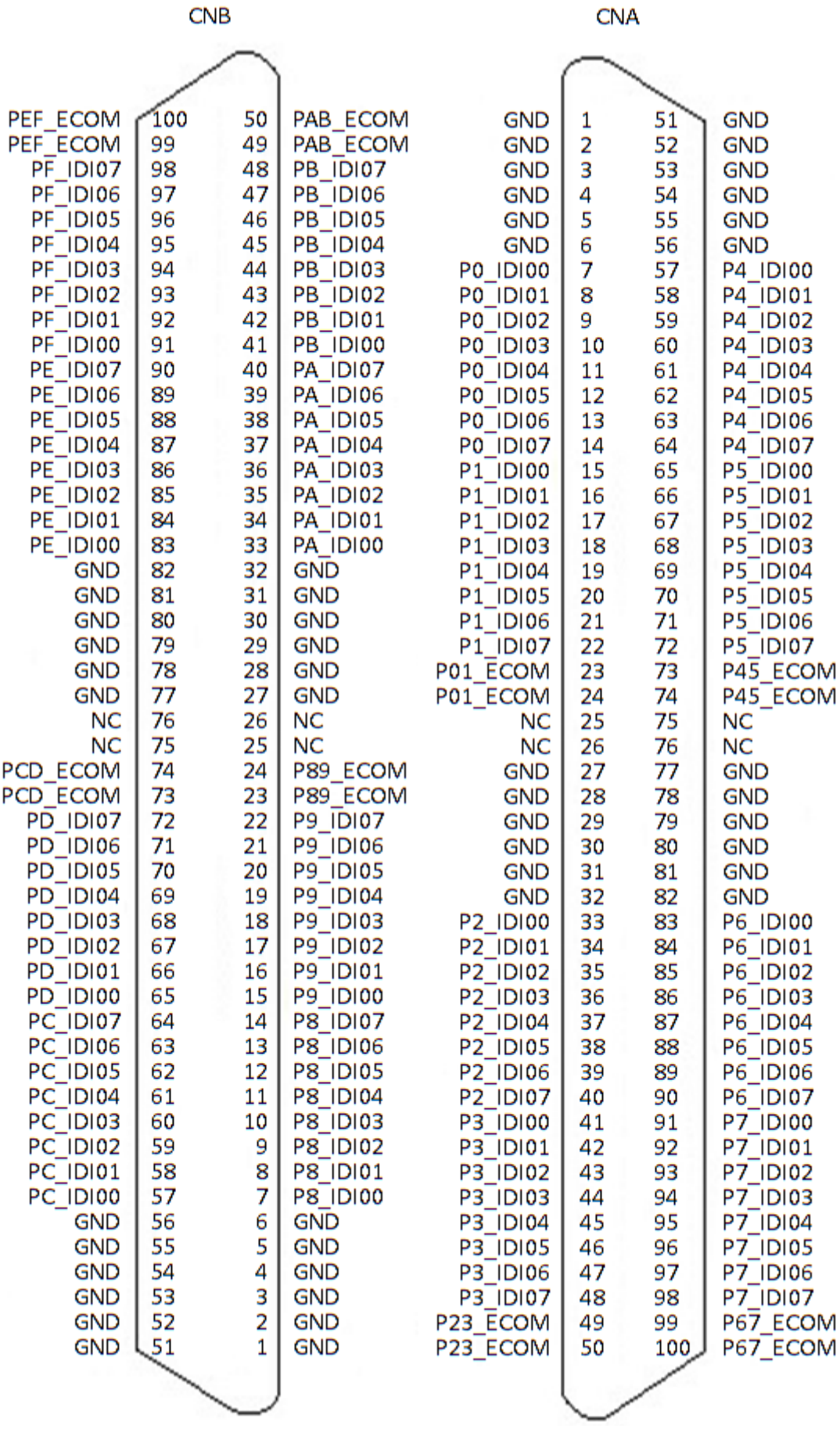


Figure 3.5 PCIE-1758DI I/O Connector Pin Assignments

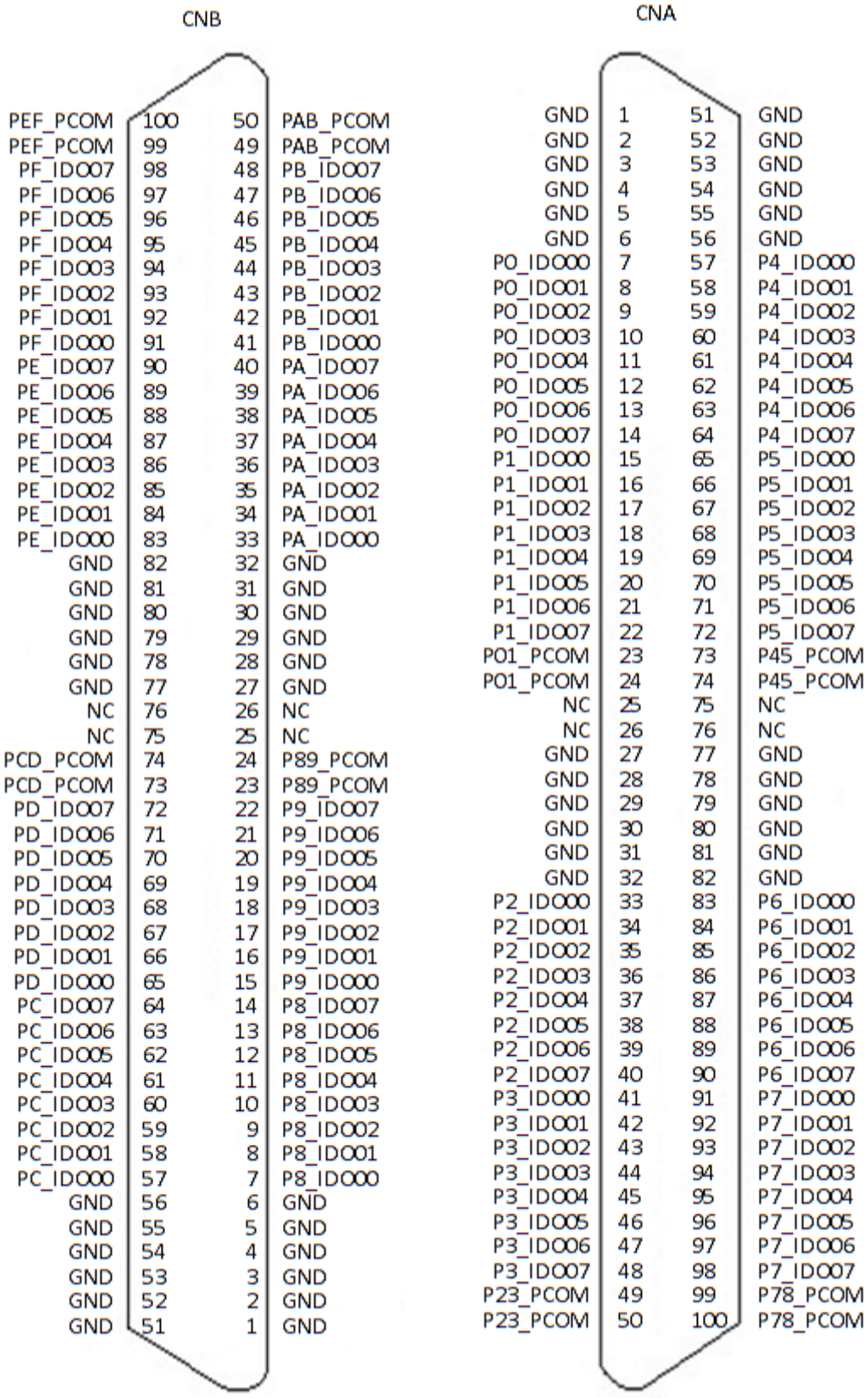


Figure 3.6 PCIE-1758DO I/O Connector Pin Assignments

3.4.1 I/O Connector Pin Definition

Table 3.3: I/O Connector Signal Descriptions

Pin Name	Description
Isolated Digital Input	
Pn_IDI00~07	Isolated digital input of port n (n = 0 ~ 8 for PCIE-1758DIO, 0 ~ F for PCIE-1758DI, hex)
P01_ECOM	Common port of isolated digital input port 0 & port 1
P23_ECOM	Common port of isolated digital input port 2 & port 3
P45_ECOM	Common port of isolated digital input port 4 & port 5
P67_ECOM	Common port of isolated digital input port 6 & port 7
P89_ECOM	Common port of digital input port 8 & port 9
PAB_ECOM	Common port of digital input port A & port B
PCD_ECOM	Common port of digital input port C & port D
PEF_ECOM	Common port of digital input port E & port F
Isolated Digital Output	
Pn_IDO00~07	Isolated digital output of port n (n = 0 ~ 8 for PCIE-1758DIO, 0 ~ F for PCIE-1758DO, hex)
P01_PCOM	Free wheeling common diode for isolated digital output of port 0 & port 1
P23_PCOM	Free wheeling common diode for isolated digital output of port 2 & port 3
P45_PCOM	Free wheeling common diode for isolated digital output of port 4 & port 5
P67_PCOM	Free wheeling common diode for isolated digital output of port 6 & port 7
P89_PCOM	Free wheeling common diode for isolated digital output of port 8 & port 9
PAB_PCOM	Free wheeling common diode for isolated digital output of port A & port B
PCD_PCOM	Free wheeling common diode for isolated digital output of port C & port D
PEF_PCOM	Free wheeling common diode for isolated digital output of port E & port F
GND	Isolated ground

3.4.2 Isolated Digital Input

Each isolated digital input channel accepts bi-directional 10 ~ 30 V_{DC} voltage inputs. This means users can apply positive or negative voltage to an isolated input pin (V_{IN}). Every 16 input channels share one common pin. Figure 3.7 shows how to connect an external input source to one of the card's isolated input channels.

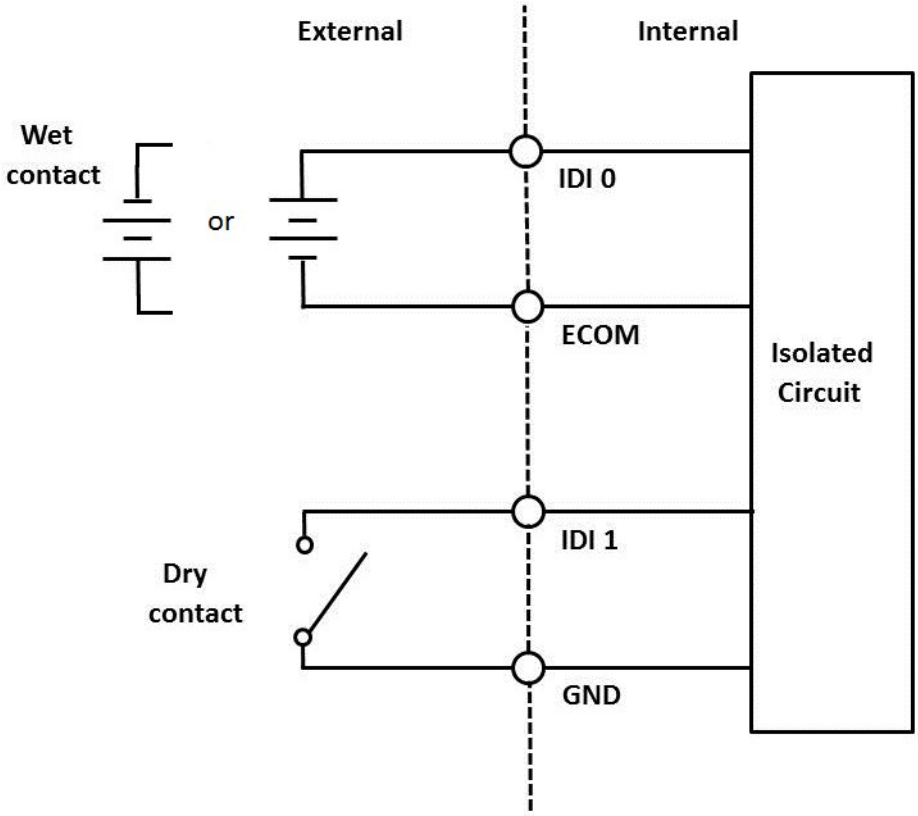


Figure 3.7 Isolated Digital Input Connection

3.4.3 Isolated Digital Output

Each isolated output channel is equipped with a MOSFET, polyswitch (for current protection), and flywheel diode for use with inductive loads and that can be activated by connecting PCOM to V_{DC}. If an external voltage (5 ~ 40 V_{DC}) is applied to an isolated output channel, the current will flow from the external voltage source to the card. The current flowing through each IDO channel should not exceed 350 mA.

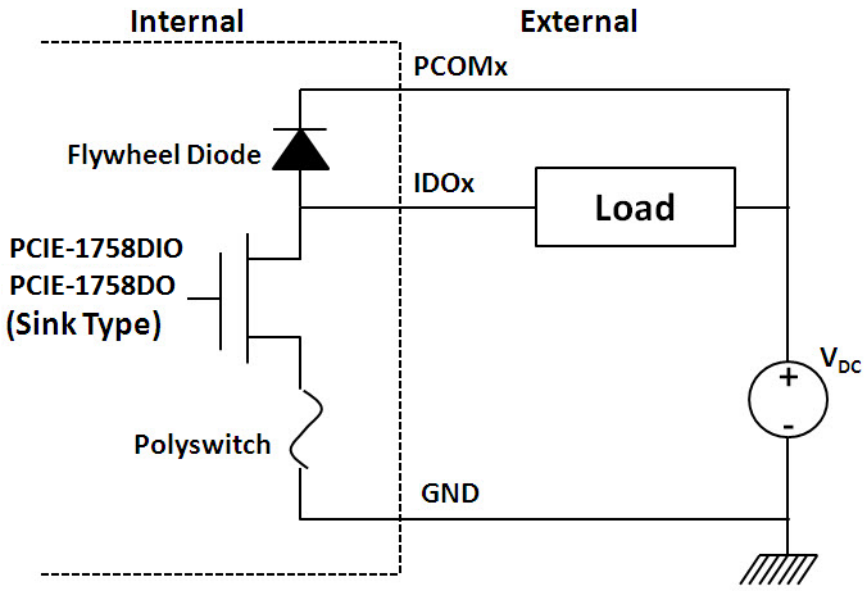


Figure 3.8 Isolated Digital Output Connection

3.5 Field Wiring Considerations

When using PCIE-1758 series cards to acquire data from an outdoor environment, noises in the environment can significantly affect the accuracy of measurements if due cautions are not taken. The following measures can help reduce possible interference on signal wires connecting signal sources to the PCIE-1758 series card.

- Signal cables must be kept away from strong electromagnetic sources, such as power lines, large electric motors, circuit breakers, or welding machines, as these may cause strong electromagnetic interference. Keep analog signal cables away from any video monitors because they can significantly affect data acquisition systems.
- If signal cables are routed through an area with significant electromagnetic interference, users should employ individually shielded, twisted-pair wires as analog input cables. This type of cable features 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.
- Avoid running the signal cables through any conduit that may also contain power lines.
- If the signal cable must be routed parallel to a high-voltage.current power line, try to maintain a safe distance between the two cables. Alternatively, the signal cable can be placed at a right angle to the power line to minimize the undesirable effect.

Appendix A

Specifications

A.1 Isolated Digital Input (PCIE-1758DI & PCIE-1758DIO)

Number of Input Channels	PCIE-1758DI: 128 PCIE-1758DIO: 64	
Interrupt Inputs	PCIE-1758DI: 128 PCIE-1758DIO: 64	
Digital Filter for Inputs	PCIE-1758DI: 128 PCIE-1758DIO: 64	
Optical Isolation	2500 V_{DC}	
Opto-Isolator Response Time	100 µs	
Over-Voltage Protection	70 V_{DC}	
Input Resistance	3.6KΩ@1W	
Input Voltage	VIH (max.)	30 V_{DC}
	VIH (min.)	10 V_{DC}
	VIL (max.)	3 V_{DC}
Input Current	12 V_{DC}: 3.8mA 24 V_{DC}: 7.2mA	

A.2 Digital Filter Time (PCIE-1758DI & PCIE-1758DIO)

Digital Filter Time [sec.] = 2^n/8 x 10^6, n = setting data (0 - 20)

Setting Data (n)	Digital Filter Time	Setting Data (n)	Digital Filter Time
7 (07h)	16µsec	14 (0Eh)	2.048msec
8 (08h)	32µsec	15 (0Fh)	4.096msec
9 (09h)	64µsec	16 (10h)	8.192msec
10 (0Ah)	128µsec	17 (11h)	16.384msec
11 (0Bh)	256µsec	18 (12h)	32.768msec
12 (0Ch)	512µsec	19 (13h)	65.536msec
13 (0Dh)	1.024msec	20 (14h)	131.072msec

A.3 Isolated Digital Output (PCIE-1758DO & PCIE-1758DIO)

Number of Output Channels	PCIE-1758DO: 128 PCIE-1758DIO: 64
Optical Isolation	2500 V_{DC}
Opto-Isolator Response Time	100 µs
Supply Voltage	5 ~ 40 V_{DC}
Sink Current	350mA max./channel @25 °C 250mA max./channel @60 °C

A.4 General

I/O Connector Type	2 x 100-pin mini-SCSI (female)	
Dimensions	168 x 100 mm (6.6 x 3.9 in)	
Temperature	Operating	0 ~ 60 °C (32 ~ 140 ° F) (refer to IEC 68-2-1,2)
	Storage	-20 ~ 70 °C (-4 ~ 158 °F)
Relative Humidity	5 ~ 95% RH non-condensing (refer to IEC 60068-2-3)	
Certification	CE Class A certified	

A.5 Power Consumption

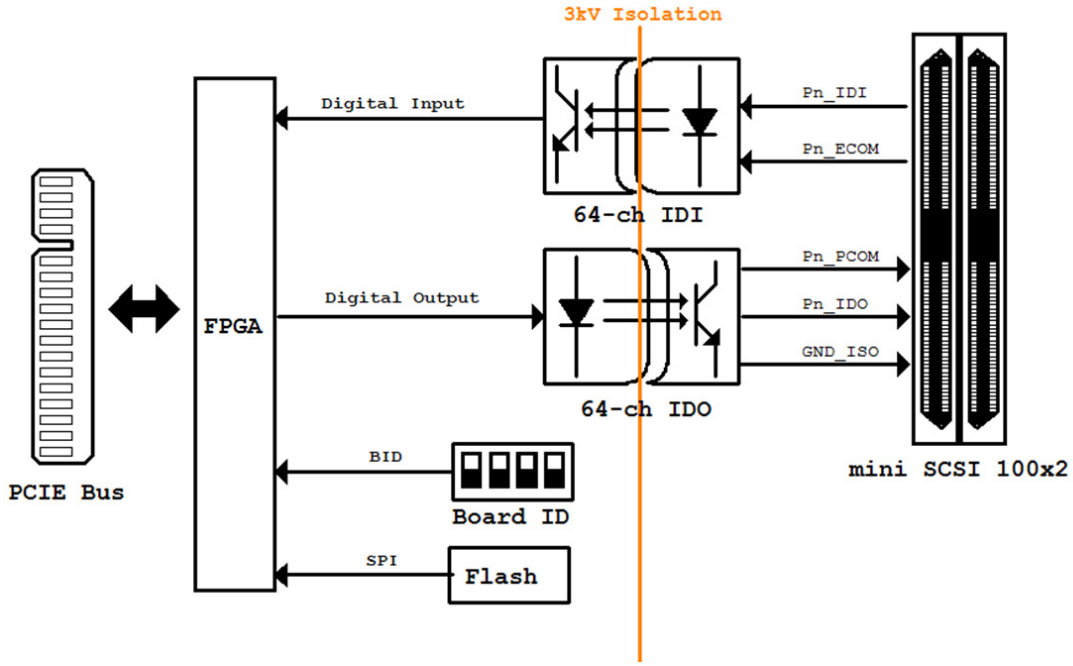
	PCIE-1758DIO	PCIE-1758DI	PCIE-1758DO
Typical	3.3 V@ 250mA 12 V @ 20mA	3.3 V@ 270mA 12 V @ 30mA	3.3 V@ 250mA 12 V @ 25mA
Max.	3.3 V@ 425mA 12 V @ 250mA	3.3 V@ 400mA 12 V @ 260mA	3.3 V@ 450mA 12 V @ 235mA

Appendix B

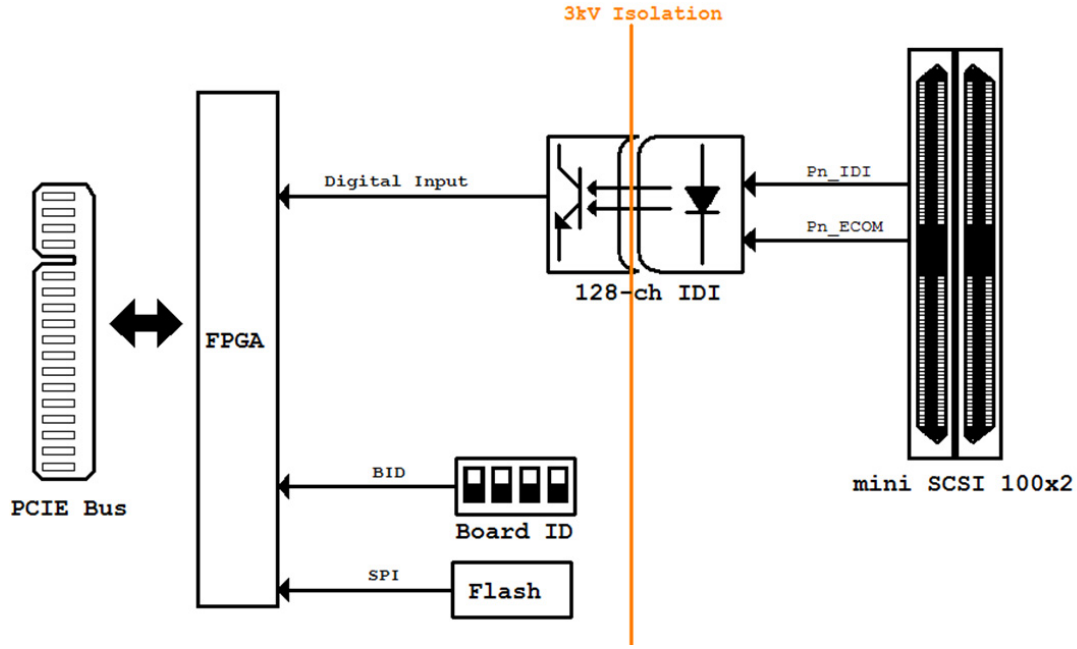
Block Diagrams

B.1 Block Diagrams

PCIE-1758DIO



PCIE-1758DI



PCIE-1758DO

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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.