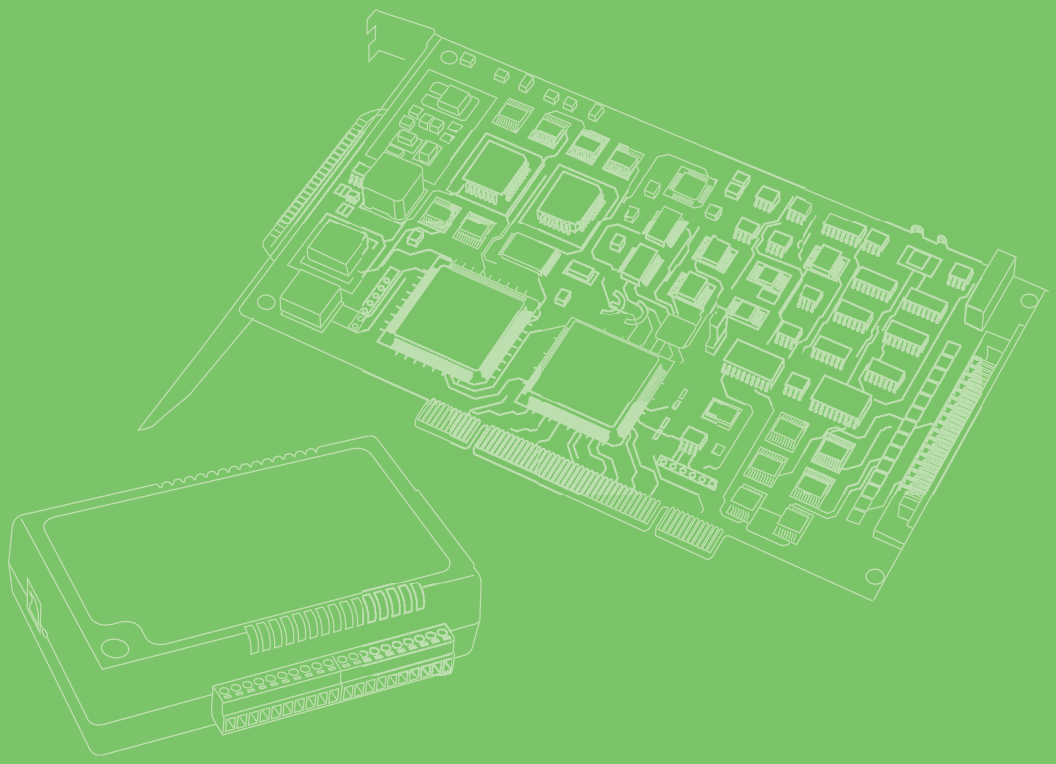

User Manual

PCIE-1760

8-Ch Relay and 8-Ch Isolated Digital Input PCIE Card

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Acknowledgments

Product Warranty (2 years)

Advantech warrants to you, the original purchaser, that this product will be free from defects in materials and workmanship for 2 years from the date of purchase.

This warranty does not apply to products that have been repaired or altered by persons other than repair personnel authorized by Advantech, nor does it apply to products that have been subject to misuse, abuse, accident, or improper installation. Under the terms of this warranty, Advantech assumes no liability for consequences arising from 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. Please consult your dealer for more details.

If you believe that you have a defective product, follow these steps:

1. Collect all the information about the problem encountered (e.g., CPU speed, Advantech products used, other hardware and software used, etc.). Note anything abnormal and list any on-screen messages that appear 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 a return merchandise authorization (RMA) 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 proof of purchase date (e.g., a photocopy of 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 clearly on the outside of the package and ship it prepaid to your dealer.

Part No. 2003E76012 Edition 3

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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 using 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 user 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 or her own expense.

Technical Support and Assistance

1. Visit the Advantech website at www.advantech.com/support for the latest information about this product.
2. Should you require additional assistance, contact your distributor, sales representative, or Advantech's customer service center for technical support. Please have the following information ready before you call:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (OS, 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, please contact your dealer immediately.

- PCIe bus main communication interface board
- Startup 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 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.
- 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.

Contents

Chapter 1

Introduction

1.1 Product Overview

This chapter provides an overview of Advantech industrial data acquisition module for PCIE-1760 — surveying the product lineups, features, drivers, utilities, and accessories. PCIE-1760 are differential digital I/O modules. The function for these models are isolated digital I/O, TTL I/O, solid-state relay (SSR), and counters.

All of the PCIe modules are capable of use in all kinds of PCIe chassis. Detailed instructions and functions will be described in the following sections.

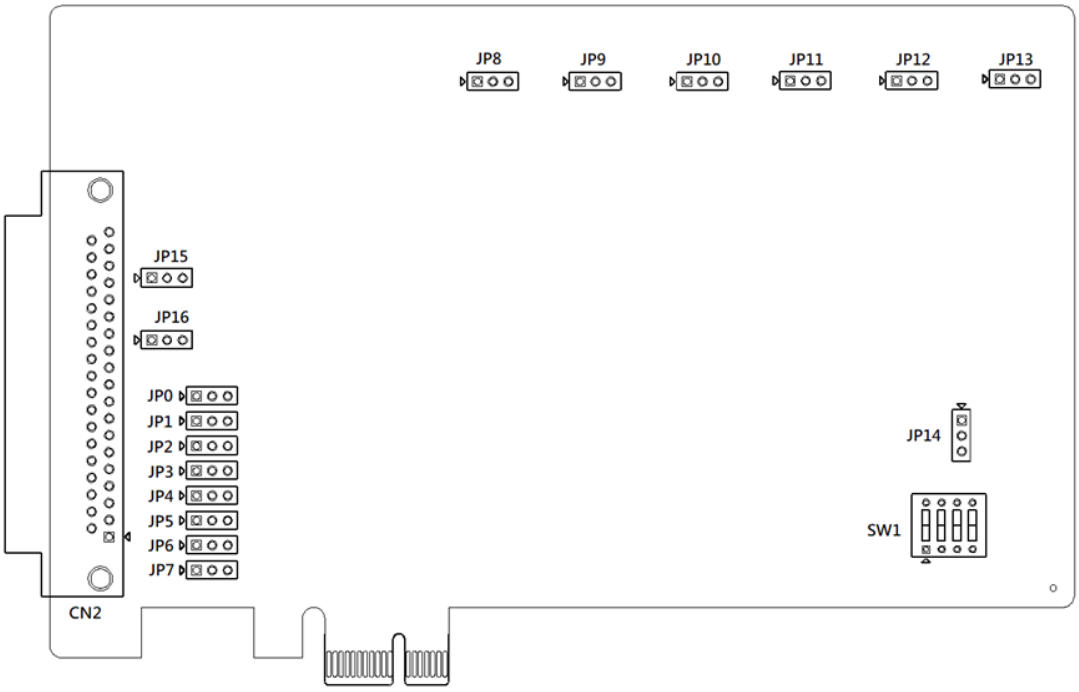


Figure 1.1 PCIE-1760

1.2 Product Features

1.2.1 Board ID

A board ID can be assigned to the PCIe chassis by the rotary switch and slot number.

The board ID will be shown in the software and can be used to distinguish modules.

The number shown around the rotary switch shows if the device is in operation or not. For example, When configured as 0, the board ID is automatically assigned by the device driver software. When configured as a value other than 0, the configured value is used. Do not configure the same value (except for 0) for hardware devices with the same model name. Refer to the device specifications for the configuration of the board ID.

If changed, a new board ID value takes effect only after a cold reset. The number assigned to each PCIe module follows a rule combining the ChassisID and slot number. Refer to section 3.4 for more detailed information.

1.3 Driver Installation

The driver package can be found via the Advantech Support Portal (https://www.advantech.com/support). Search for PCIe on the support portal to find the corresponding driver/SDK package. You'll receive the XNavi installer after the download session finishes.

Execute the installer and it will guide you through the session. You can choose the device and software components you'd like to install in the system (Figure 1.2). After the selection, click on "start" to begin the installation.

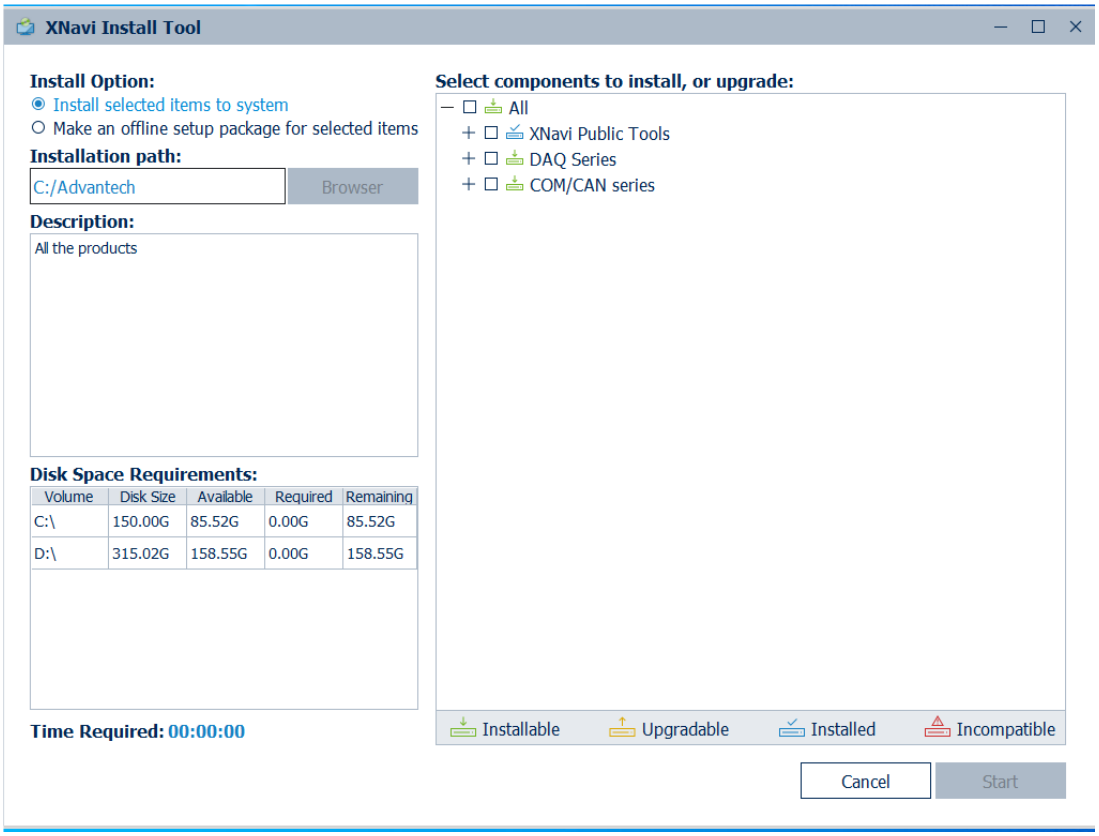


Figure 1.2 XNavi Installer

1.4 Software Utility

Advantech offers device drivers, SDKs, third-party driver support, and application software to help you fully exploit the functions of your PCIe system. All these software packages are available on the Advantech website: http://www.advantech.com/.

The Advantech Navigator is a utility that allows you to set up, configure, and test your device; and later stores your settings in a proprietary database.

1. To set up the I/O device for your card, you should first run the Advantech Navigator program (by accessing Start/Programs/Advantech Automation/XNavi Advantech Navigator). The settings can also be saved.
2. You can then view the device(s) already installed on your system (if any) on the Installed Device tree view. If the software and hardware installation have completed, you will see the PCIe modules in the Installed Devices list.

1.5 Software Development Using DAQNavi SDK

DAQNavi SDK is the software development kit for programming applications with Advantech DAQ products. The necessary runtime DLL, header files, software manual and tutorial videos can be installed via XNavi installer, which can be found under C:\Advantech\DAQNavi (default directory) after finishing installation.

1.6 FPGA Code Update

The FPGA can also be updated via the interface in Navigator. However, it isn't normal to make an FPGA update. Advantech strongly suggests consultation with technical support before starting an FPGA update.

1.7 Hardware Installation

After the device driver installation has completed, you can now continue to install the PCIE-1760 card in any PCI Express slot on your computer. Follow the steps below to install the card on your system.

1. Turn off your computer and unplug the power cord and cables. TURN OFF your computer before installing or removing any components on the computer.
2. Remove the cover of your computer.
3. Remove the slot cover on the back panel of your computer.
4. Touch the metal part on the surface of your computer to neutralize the static electricity that might be on your body.
5. Insert the PCIE-1760 card into a PCI Express slot. Hold the card only by its edges and carefully align it with the slot. Insert the card firmly into place. Use of excessive force must be avoided, otherwise the card might get damaged.
6. Fasten the bracket of the PCI Express card on the back panel of the computer.
7. Connect appropriate accessories to the PCI Express card.
8. Replace the cover of your computer chassis. Re-connect the cables you removed in step 1.
9. Plug in the power cord and turn on the computer.

After the PCIE-1760 card is installed, you can verify whether it is properly installed on your system through the Device Manager:

1. Access the Device Manager through Control Panel/System/Device Manager.
2. The device name of the PCIE-1760 should be listed on the Device Manager tab as follows.

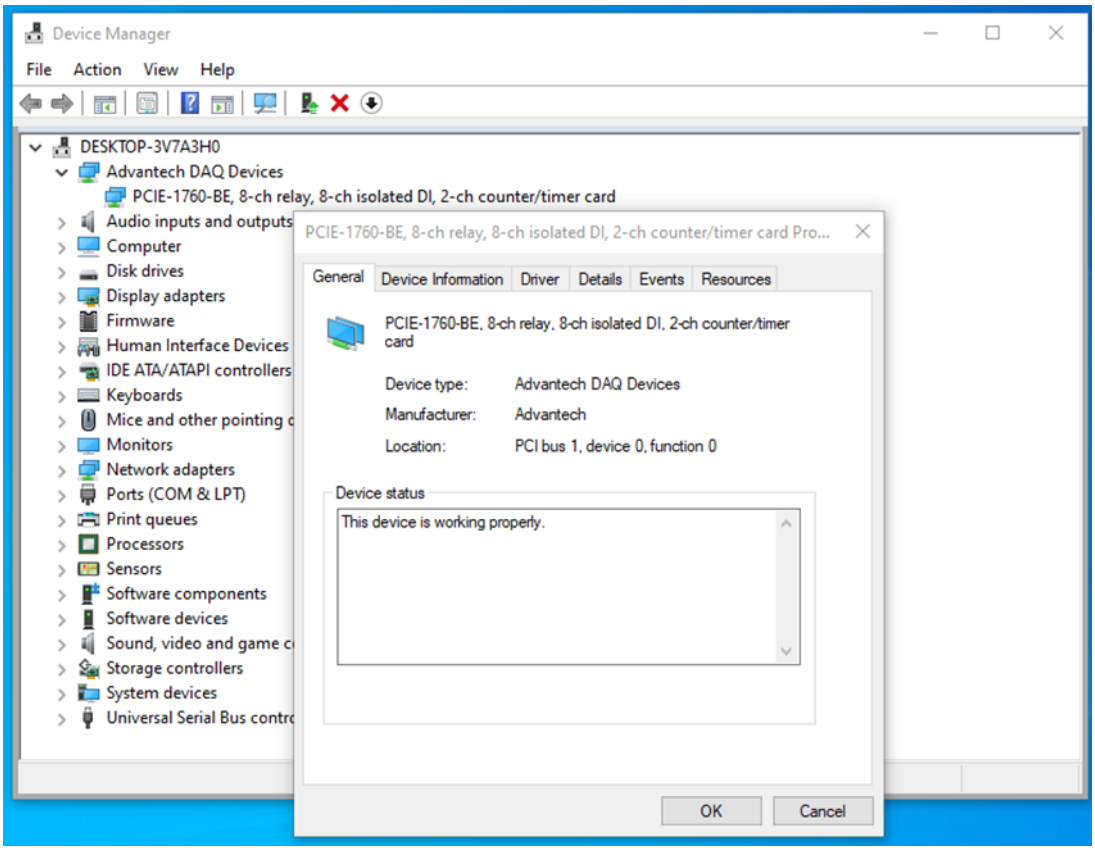


Figure 1.3 Device Manager

Note! *If your card is properly installed, you should see the device name of your card listed on the Device Manager tab. If you do see your device name listed on it but marked with an exclamation sign "!", it means your card has not been correctly installed. In this case, remove the card device from the Device Manager by selecting its device name and press the Remove button. Then go through the driver installation process again.*

After your card is properly installed on your system, you can now configure your device using the Advantech Navigator after you install XNavi on your computer.

1.8 Accessories

All of the following lists the accessories for PCIE-1760

- PCL-10137-1E: 37-pin D-SUB cable, 1 m
- PCL-10137-2E: 37-pin D-SUB cable, 2 m
- PCL-10137-3E: 37-pin D-SUB cable, 3 m
- ADAM-3937-BE: DB37 DIN-rail Wiring Board

Chapter 2

Installation and Field Applications

2.1 Signal Connection and Pin Assignments

2.1.1 Isolated Digital Input Signal Connection

A digital input channel senses the state of the external sensor or switch, and passes it through a galvanic isolator (opto-coupler) to the internal circuit. This prevents the internal components and the host devices (e.g. PC) from damaging when such fault conditions arise. The device supports both wet contact and dry contact configurations for digital input signal connection, which can be configured by onboard jumpers for each channel independently.

For wet contact configuration, an external voltage source is applied between the positive digital input (DI+) terminal and the negative digital input (DI−) terminal through a switch as shown in Figure 2.1. If the switch is closed, circuit loop is formed among the external source, the switch, and the opto-coupler. The current flowing on this loop is sensed by the opto-coupler, and the digital input state is ON. On the other hand, if the switch is open, no current flows through the opto-coupler, and the digital input state is OFF. The voltage of the external source must meet the minimum value of ON state as specified in the device specifications for proper operation.

An external signal source can also be used for a digital input channel. This is shown in Figure 2.1 and Figure 2.2 for wet and dry contact configuration, respectively. The signal source toggles between a high level voltage and a low level voltage, which results in digital input ON and OFF states.

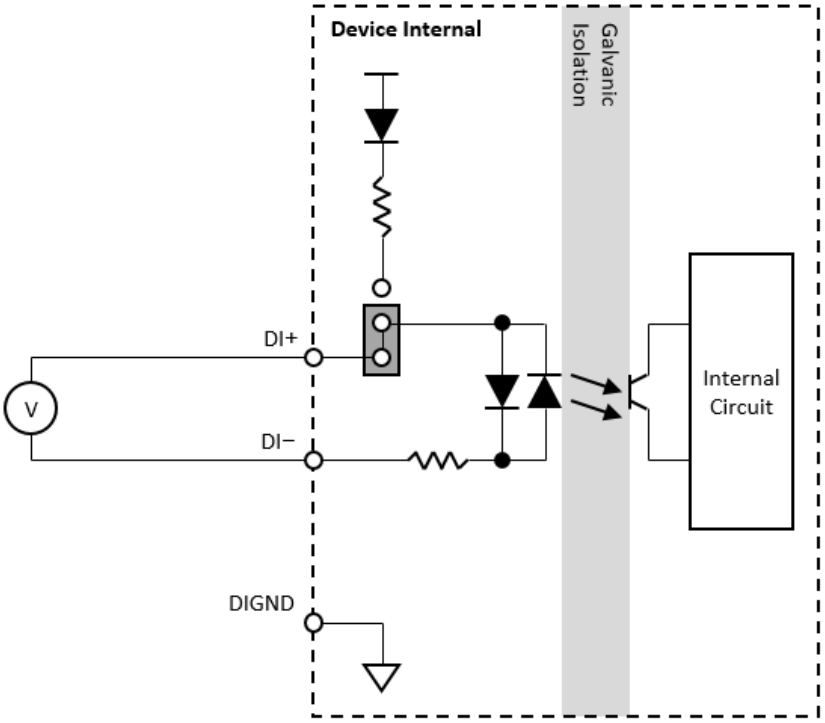


Figure 2.1 Digital input signal connection with wet contact configuration

The input voltage, which is the voltage between the DI+ terminal and the DI− terminal for wet contact configuration and between the DI− terminal and the DIGND terminal for dry contact configuration, must be either higher than the minimum value of ON state or lower than the maximum value of OFF state for a deterministic result. If the input voltage is between these two values, the result is undetermined, which may be ON or OFF. In addition, do not input a voltage higher than the maximum allowable value of ON state or lower than the minimum allowable value of the OFF state, other-

wise the device may be damaged under such circumstance. Refer to the device specifications for ON and OFF state voltage ranges.

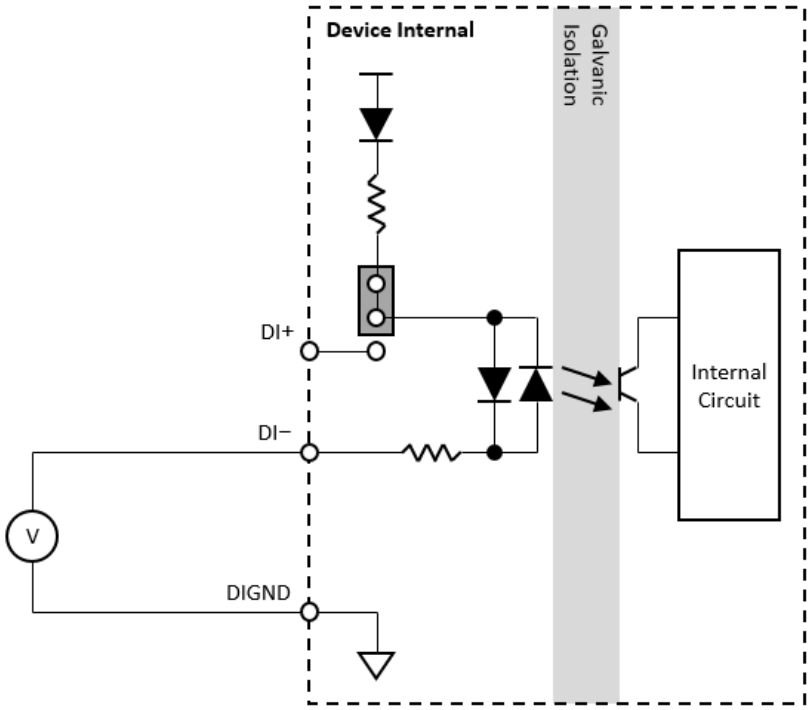


Figure 2.2 Digital input signal connection with dry contact configuration

2.1.2 Relay Output Signal Connection

A relay output channel sends a signal to control the ON/OFF state of a relay. Some of the relays are of Form A (normally open) or Form B (normally closed) type, which is configured by the onboard jumper for each channel independently, and others are of Form C (normally open and normally closed) type. All types are described in detail as follows:

- For Form A type, if the relay is in ON state, the common (COM) terminal is connected to the normally open (NO) terminal; on the other hand, if the relay is in OFF state, the terminals are disconnected from each other.
- For Form C type, if the relay is in OFF state, the COM terminal is connected to the normally NO terminal; on the other hand, if the relay is in ON state, the terminals are disconnected from each other.
- For Form C type, if the relay is in ON state, the COM terminal is connected to the NO terminal, and the normally closed (NC) terminal is disconnected. On the other hand, if the relay is in OFF state, the COM terminal is connected to the NC terminal, and the NO terminal is disconnected.

This is shown in Figure 2.3. The default state is OFF state.

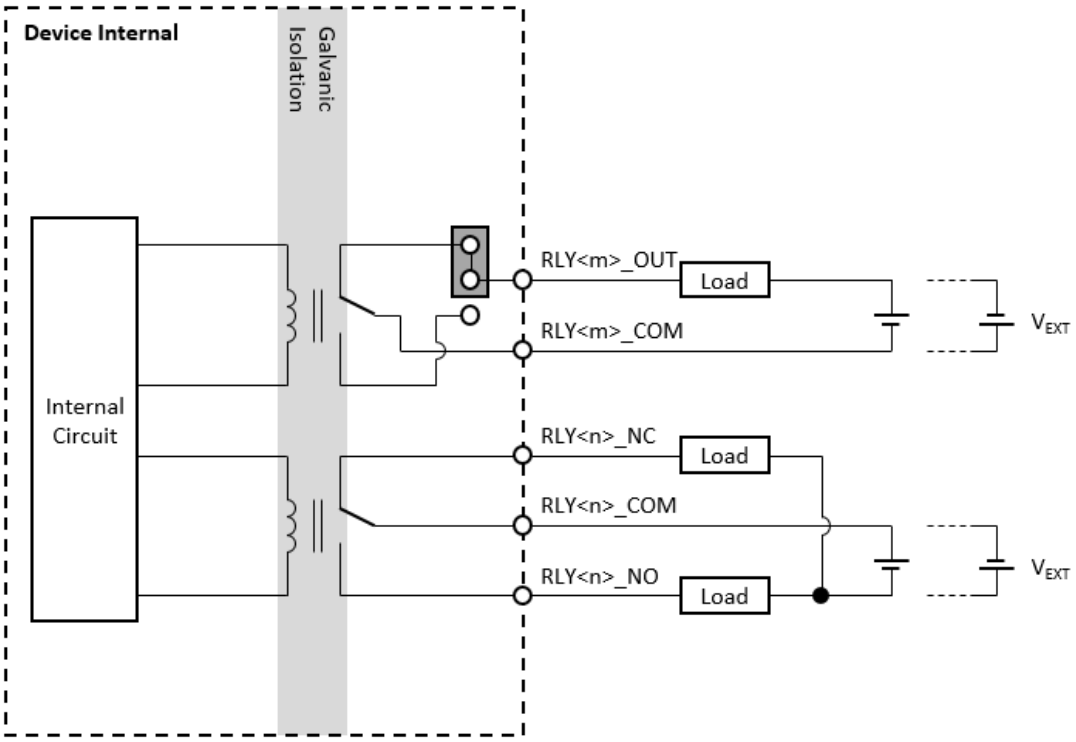


Figure 2.3 Relay output signal connection

The relay is a non-directional component, which means that the external source can be applied in either direction. However, both the load voltage and current must be within the range as specified in the device specifications for proper operation and to prevent the device from damage.

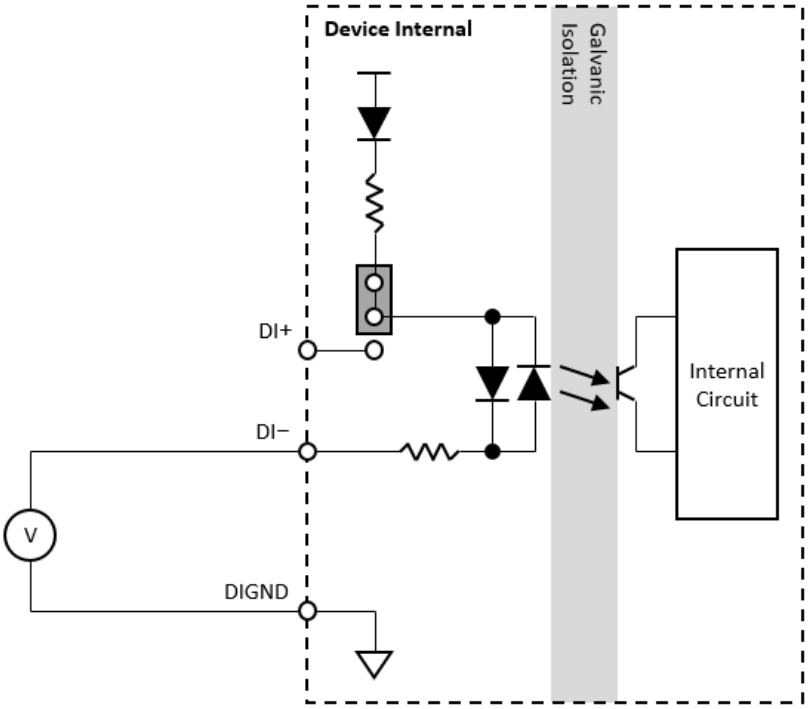


Figure 2.4 Digital input signal connection with dry contact configuration

2.1.3 Counter Signal Connection

Counter Input Connection:

Please refer to “2.1.1 Isolated Digital Input Signal Connection”.

Counter Output Connection:

The type of counter output signal can be TTL or sink, which is selected by an onboard jumper.

When configured as TTL type output, the signal is sent through a galvanic isolator and a logic gate. A voltage logic level is generated between the counter output and the digital ground (DGND) terminal. This is shown in Figure 2.5.

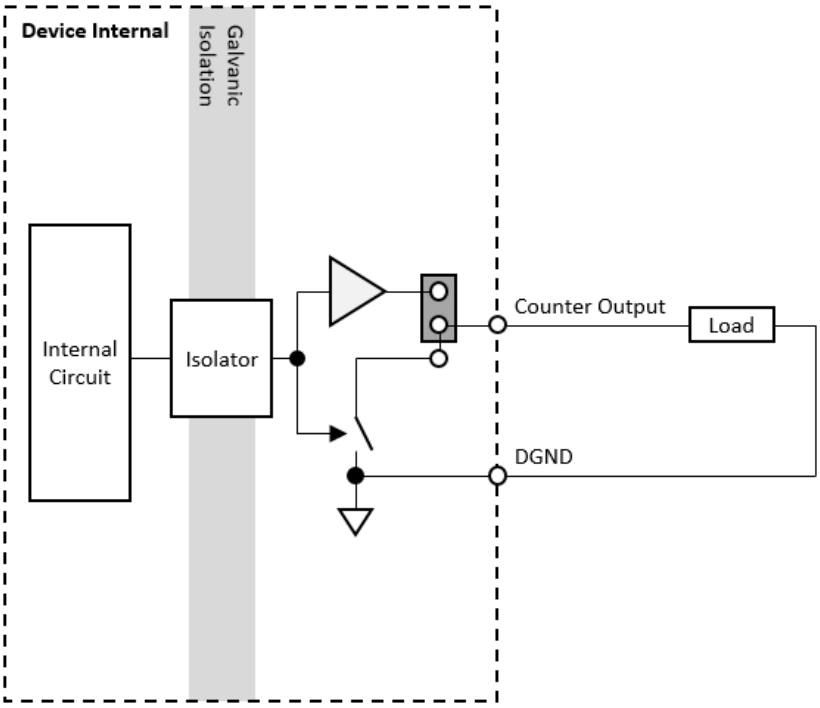


Figure 2.5 TTL type counter output signal connection

When configured as sink type output, the signal is sent through a galvanic isolator to control the ON/OFF state of a switch. The state of the switch then decides if the load is conducting or not. The device supports sink (NPN) type configuration for counter output signal connection. This is shown in Figure 2.6.

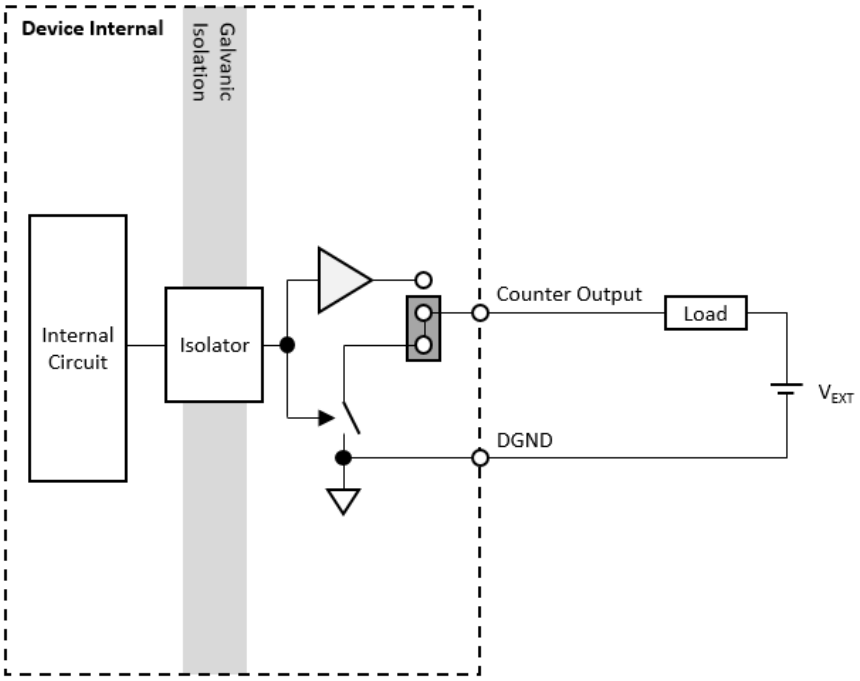


Figure 2.6 Sink type counter output signal connection

2.1.4 Pin Assignment

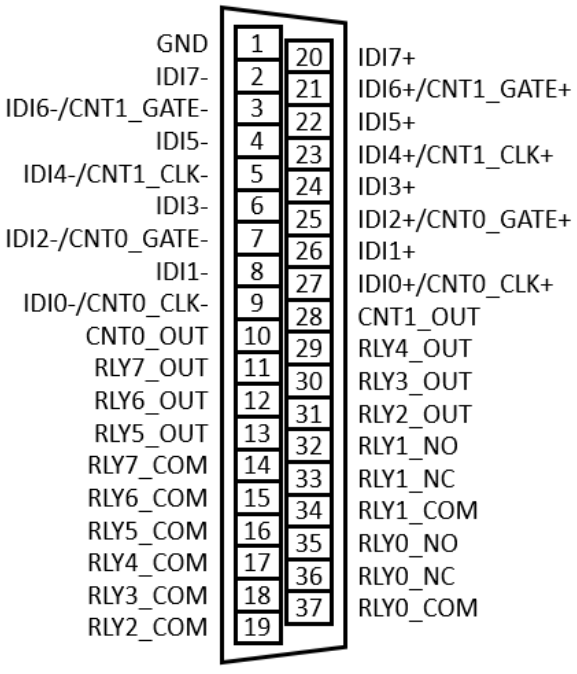
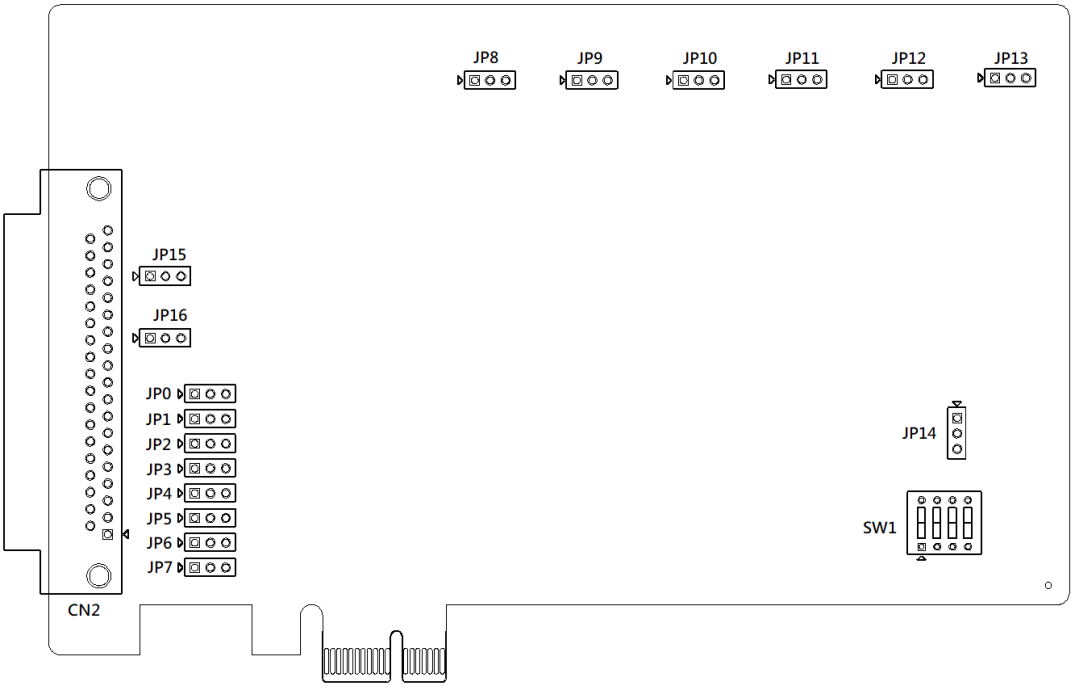


Figure 2.7 Pin assignment of PCIE-1760

Pin Name	Direction	Description	Pin Number
IDI<0..7>+	I	Isolated digital input positive terminals	20 ~ 27
IDI<0..7>-	I	Isolated digital input negative terminals	2 ~ 9
CNT<0..1>_CLK+	I	Counter clock input positive terminals. Shared with IDI+ terminals.	23, 27
CNT<0..1>_CLK-	I	Counter clock input negative terminals. Shared with IDI- terminals.	5, 9
CNT<0..1>_GATE+	I	Counter gate input positive terminals. Shared with IDI+ terminals.	21, 25
CNT<0..1>_GATE-	I	Counter gate input negative terminals. Shared with IDI- terminals.	3, 7
CNT<0..1>_OUT	O	Counter output terminals.	10, 28
GND	-	Ground terminal.	1
RLY<0..1>_NO	O	Relay output normally open terminals.	32, 35
RLY<0..1>_NC	O	Relay output normally close terminals.	33, 36
RLY<2..7>_OUT	O	Relay output terminals. Can be configured as normally close or normally open by on-board jumpers.	11 ~ 13, 29 ~ 31
RLY<0..7>_COM	O	Relay output common terminals.	14 ~ 19, 34, 37

2.1.5 Switch and Jumper Settings



Switch Setting

Board ID	Switch Position			
	1	2	3	4
0*	UP	UP	UP	UP
1	UP	UP	UP	DOWN
2	UP	UP	DOWN	UP
3	UP	UP	DOWN	DOWN
4	UP	DOWN	UP	UP
5	UP	DOWN	UP	DOWN
6	UP	DOWN	DOWN	UP
7	UP	DOWN	DOWN	DOWN
8	DOWN	UP	UP	UP
9	DOWN	UP	UP	DOWN
10	DOWN	UP	DOWN	UP
11	DOWN	UP	DOWN	DOWN
12	DOWN	DOWN	UP	UP
13	DOWN	DOWN	UP	DOWN
14	DOWN	DOWN	DOWN	UP
15	DOWN	DOWN	DOWN	DOWN

*Default setting

Jumper Setting

Digital Input Configuration (JP0 - JP7)

Jumper Setting	Description
	Dry contact*
	Wet contact

*Default setting

Relay Output Configuration (JP8 – JP13)

Jumper Setting	Description
	Form A (normally open)*
	Form B (normally close)

*Default setting

Power-on Configuration (JP14)

Jumper Setting	Description
	Keep last status after hot reset
	Reset to default status after hot reset*

*Default setting

PWM Output Configuration (JP15 – JP16)

Jumper Setting	Description
	Sink (NPN)*
	5V TTL

* Default setting

Chapter 3

Function Details

3.1 Digital Input

Insert an PCIE-1760 module supporting digital input function to perform digital input measurement. The following sections describe the digital input acquisition mechanism. For detailed specifications of the functions, refer to the document of the corresponding PCIE-1760 module.

3.1.1 Digital Input Interrupt

All digital input channels can generate software interrupts (or events) to notice the application about the state change of input signals. Interrupts can occur at rising edge, falling edge, or both edges of the digital input signal as shown in Figure 3.3, Figure 3.4, and Figure 3.5, respectively. The enable/disable interrupt function and the selection of interrupt edges can be configured independently for each digital input channel.

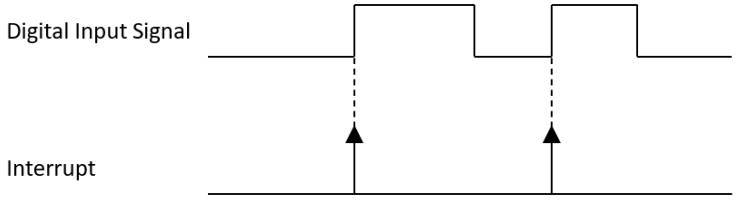


Figure 3.1 Digital input rising edge interrupts

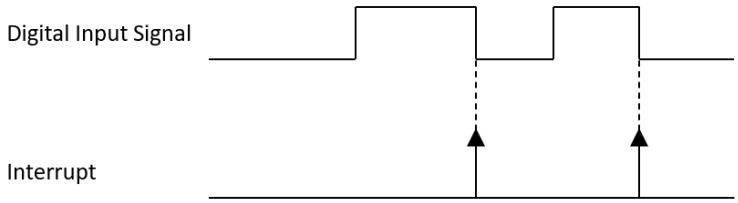


Figure 3.2 Digital input falling edge interrupts

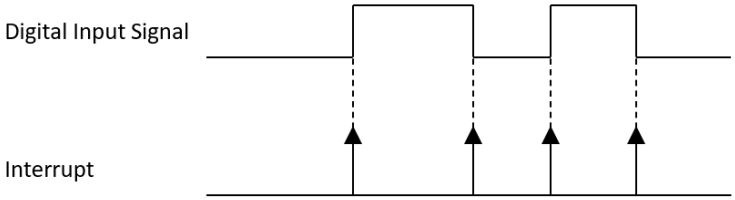


Figure 3.3 Digital input both edges interrupts

3.1.2 Digital Input Pattern Match Interrupt

Digital input channels can also generate an interrupt by detecting a specific pattern.

The pattern can be configured by ports, and each channel can be enabled or disabled the detection independently. For example, if channels 0, 1, 2, 3, 6, and 7 of a digital input port is pattern match detect enabled, and the pattern is “10xx0100” (channel 7 through 0, where x indicates don’t care bit), the pattern match interrupt will be generated as shown in Figure 3.6.

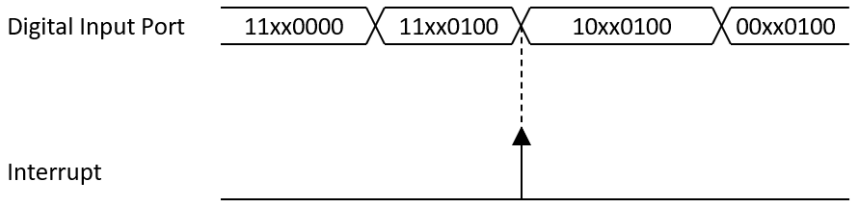


Figure 3.4 Digital input pattern match interrupt for pattern "10xx0100"

3.1.3 Digital Input Debounce Filter

To prevent false interrupts due to noise or bouncing in the signal, the digital input signals can be filtered. If digital input filter is enabled, transient signals with duration smaller than the filter duration will be considered as glitches and will not generate interrupts as shown in Figure 3.7. Digital input debounce filter can be enabled or disabled independently for each channel, and filter duration can be configured by ports (8 channels).

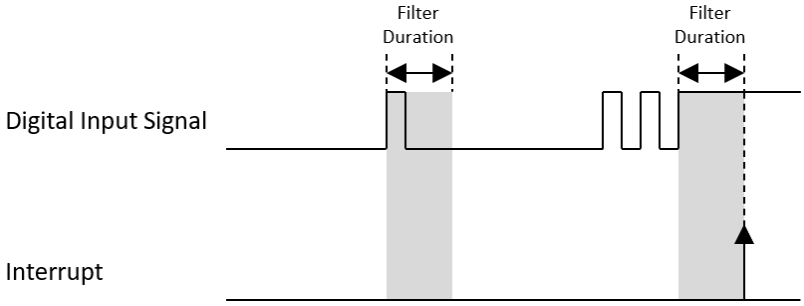


Figure 3.5 Digital input debounce filter

3.1.4 Instant Digital Input Acquisition

With instant digital input acquisition, the software controls the sample timing. Each time the software sends a "read instant digital input sample" command, the state of all digital input channels is sampled as shown in Figure 3.8.

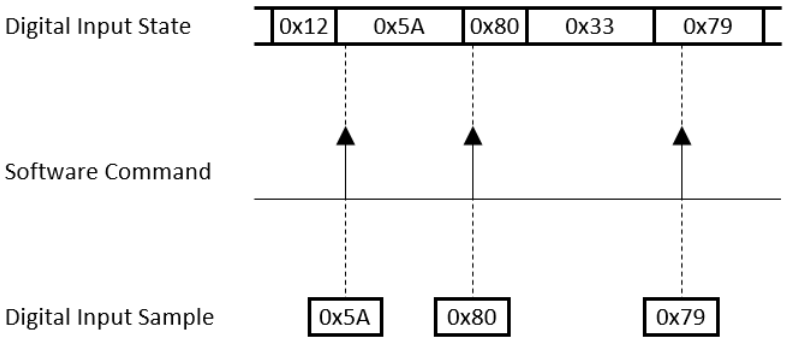


Figure 3.6 Instant digital input acquisition

3.2 Digital Output

Insert an DAQ module supporting digital output function to perform digital output update/generation. The following sections describe the digital output update/generation mechanism. These output functions are applied to TTL digital output, isolated digital output and SSR/Mechanical relay output, i.e. all the digital output modules. For detailed specifications of the functions, refer to the document of the corresponding DAQ module.

3.2.1 Static Digital Output Update

With static digital output update, the digital output state is updated only when the software sends a “write static digital output sample” command. The digital output state remains unchanged at other times. This is shown in Figure 3.19.

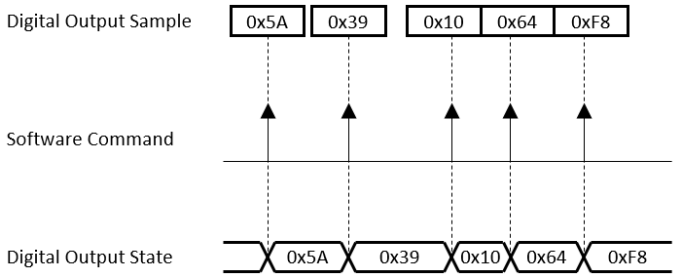


Figure 3.7 Static digital output update

3.3 Counter Output

3.3.1 Event Counting

In event counting mode, the counter counts the number of edges the counter clock signal generates. It can be configured rising edge or falling edge activating, as shown in Figure 3.28 and Figure 3.29, respectively.

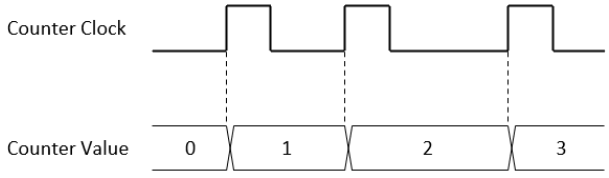


Figure 3.8 Rising edge event counting

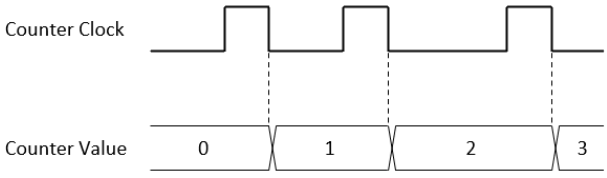


Figure 3.9 Falling edge event counting

Counting may be temporarily paused by the counter gate signal as shown in Figure 3.30.

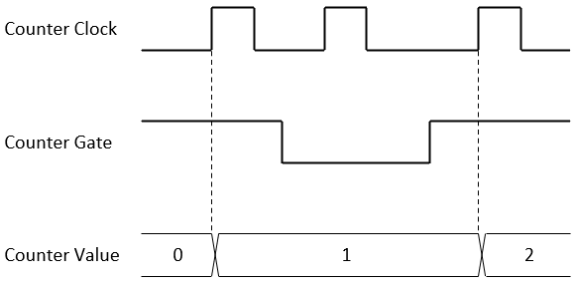


Figure 3.10 Event counting with pause gate

3.3.2 Pulse Width Measurement

In pulse width measurement mode, both the high period and the low period of the counter clock signal are measured. The measured values are updated when a pulse is completed. This is shown in Figure 3.31.

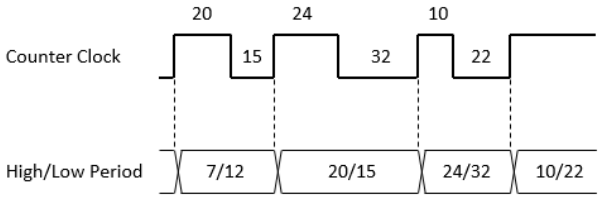


Figure 3.11 Pulse width measurement

3.4 Device Description and Configuration

The Device Description is used to differentiate the modules in the DAQ system. It follows a naming rule that combines chassis ID, model name and slot number.

You can change the description in Navigator, or just leave it as default. The description is used in your own program in order to get control or get a device handler from the device.

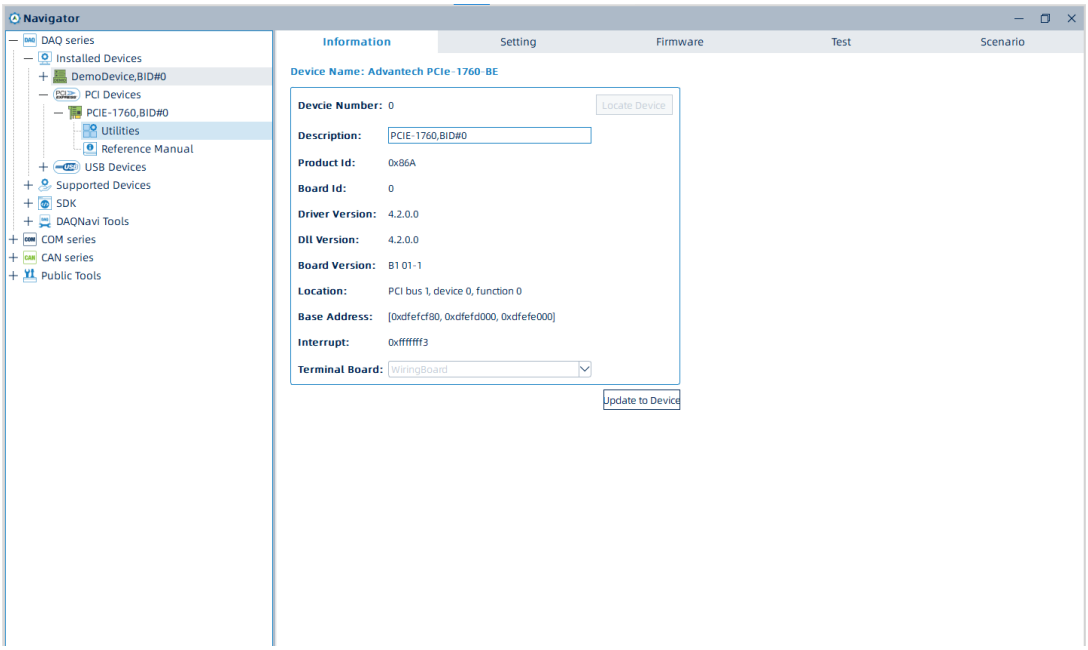


Figure 3.12 Device description shown in Navigator

Appendix A

Specifications

A.1 Isolation Digital Input

Channels		8
Input type		Differential
Wet contact input logic level	OFF state	0 V ~ 3 V
	ON state	10 V ~ 30 V
	Type	Unipolar
Dry contact input logic level	OFF state	Open
	ON state	Connect to GND
	Note	Enabled by on-board jumpers
Wet contact current draw	OFF state	0.8 mA max.
	ON state	2.97 mA min./9.72 mA max.
Input protection voltage		70 V_{DC}
Isolation protection		2,500 V_{DC}
Response time		100 µs max.
Debounce filter		1 µs ~ 255 µs, high/low period set independently, software configurable
Acquisition type		Instant
Interrupt	Edge detection	Rising edge, falling edge, or both edges, software configurable per channel
	Pattern match detection	By port detection, each channel can be enabled or disabled by software independently
State latch		Latch port state when interrupt occurs

A.2 Relay Output

Channels		8
Contact configuration		Form C x 2, Form A/B x 6, selected by jumpers
Rating		30 V_{DC} @ 1 A, 125 V_{AC} @ 0.5 A
Breakdown voltage		1,500 V
Contact resistance		100 mΩ max.
Operate time		5 ms max.
Release time		3.5 ms max.
Life expectancy	Mechanical	1 x 10^8 operations typ.
	Electrical	30 V_{DC} @ 2 A, 125 V_{AC} @ 1 A: 3 x 105 operations min., 30 V_{DC} @ 1 A, 125 V_{AC} @ 0.5 A: 10^6 operations min.
Update type		Static

A.3 Counter

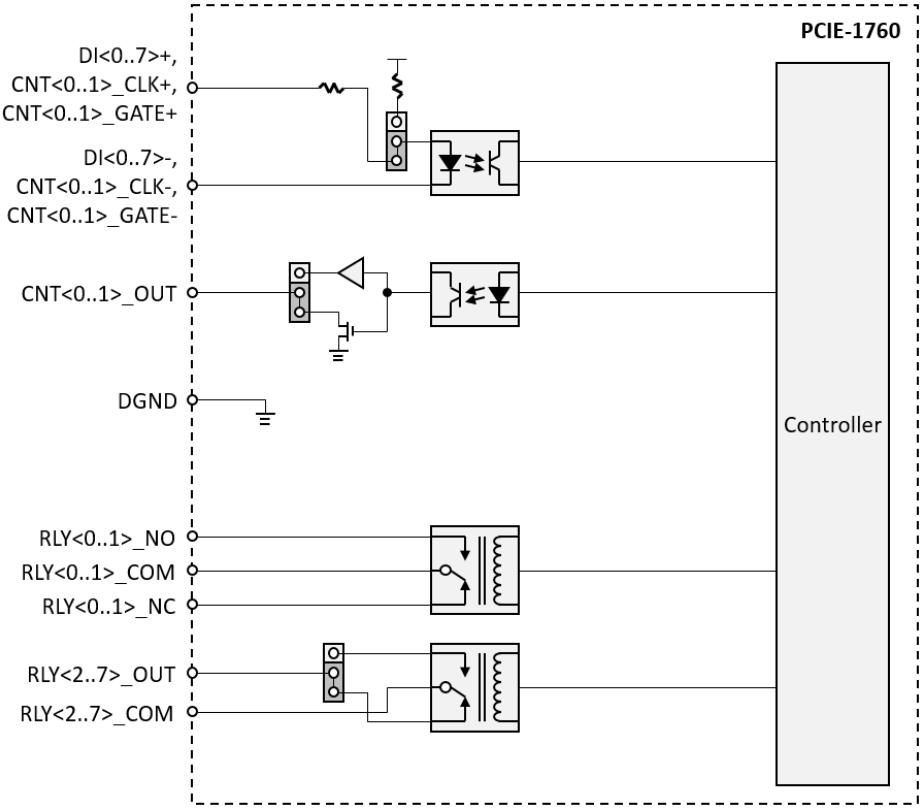
Channels		2
Resolution		32 bits
Input type		Differential (shared with digital input terminals)
Wet contact input logic level	OFF state	0 V ~ 3 V
	ON state	10 V ~ 30 V
	Type	Unipolar
Dry contact input logic level	OFF state	Open
	ON state	Connect to GND
	Note	Enabled by on-board jumpers
Wet contact current draw	OFF state	0.8 mA max.
	ON state	2.97 mA min./9.72 mA max.
Input protection voltage		70 V_{DC}
Isolation protection		2,500 V_{DC}
Debounce filter		1 µs ~ 255 µs, high/low period set independently, software configurable
Output type		Sink (NPN) or 5V TTL, configurable by on-board jumpers
Output logic level	Logic high	4.5 V min. @ 2 mA source/5.5 V max.
	Logic low	0.8 V max.
Output load	Load voltage	+5 V ~ +40 V
	Load current	500 mA max. per channel
Counter measurement function		
Event counting	Input frequency	1 kHz max.
	Clock polarity	Rising edge or falling edge, software configurable
	Gate function	Enabled or disabled, software configurable
	Gate polarity	High active or low active, software configurable
	Measuring type	Instant
Frequency measurement	Measuring method	Counting pulse by system time, period inverse, or auto adaptive, software configurable
	Input frequency	0.1 Hz ~ 1 kHz
	Accuracy	f_{IN}/40 MHz or 50 ppm, whichever is larger
	Measuring type	Instant
Pulse width measurement	Pulse width range	1 ms ~ 1 s
	Pulse width resolution	1 ms
	Accuracy	50 ppm
	Measuring type	Instant
Counter output function		
One shot	External clock source frequency	1 kHz max.
	Delay count	1 ~ 4,294,967,295
	Gate source	None, External (1 kHz max.)
	Gate polarity	Rising edge or falling edge, software configurable
	Generation type	Static

Timer/pulse	Timebase clock frequency	20 kHz
	Timebase clock accuracy	50 ppm
	Output frequency	5e-6 Hz ~ 5 kHz
	Gate function	Enabled or disabled, software configurable
	Gate polarity	High active or low active, software configurable
	Interrupt generation	Enable or disable, software configurable
Pulse width modulation	Timebase clock frequency	20 kHz
	Timebase clock accuracy	50 ppm
	Pulse width	100 µs ~ 214,748 s
	Pulse width resolution	50 µs
	Number of pulses	1 ~ 4,294,967,295 or infinite, software configurable
	Gate function	Enable or disable, software configurable
	Gate polarity	High active or low active, software configurable
	Generation type	Static

A.4 General

Power consumption	+3.3 V	150 mA typ., 750 mA max.
	+12 V	40 mA typ., 80 mA max.
Form factor		PCIe x1
Dimensions		175 x 100 x 18 mm^3 (6.9 x 3.9 x 0.7 in^3)
I/O connector		37-pin D-sub
Operating temperature		0 ~ 60 °C (32 ~ 140 °F)
Storage temperature		-20 ~ 70 °C (-4 ~ 158 °F)
Operating humidity		10% to 90% RH, non-condensing
Storage humidity		5% to 95% RH, non-condensing

A.5 Function Block Diagram



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