User Manual

PCIE-1760

8-ch Isolated Digital Input & 8-ch Relay Output PCI Express Card

ADVANTECH

*e*Automation

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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. Please 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 on screen messages you get 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 RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.

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

Declaration of Conformity

CE

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

CE

This product has passed the CE test for environmental specifications. Test conditions for passing included the equipment being operated within an industrial enclosure. In order to protect the product from being damaged by ESD (Electrostatic Discharge) and EMI leakage, we strongly recommend the use of CE-compliant industrial enclosure products.

FCC Class B

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Technical Support and Assistance

1. Visit the Advantech web site at www.advantech.com/support 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. Please have the following information ready before you call:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (operating system, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

Warnings, Cautions and Notes

Warning! *Warnings indicate conditions, which if not observed, can cause personal injury!*

Caution! *Cautions are included to help you avoid damaging hardware or losing data. e.g.*

There is a danger of a new battery exploding if it is incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.

Document Feedback

To assist us in making improvements to this manual, we would welcome comments and constructive criticism. Please send all such - in writing to: support@advantech.com

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
15. The power cord or plug is damaged.
16. Liquid has penetrated into the equipment.
17. The equipment has been exposed to moisture.

18. The equipment does not work well, or you cannot get it to work according to the user's manual.
19. The equipment has been dropped and damaged.
20. The equipment has obvious signs of breakage.
21. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.
22. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
23. The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

Safety Precaution - Static Electricity

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.Safety Precaution - Static Electricity

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

- 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

Overview

1.1 Introduction

The Advantech PCIE-1760 is a 8-channel isolated digital input and 8-channel relay output card for the PCI Express bus.

The PCIE-1760's isolated digital input channels are ideal for digital input in noisy environments or with floating potentials.Each isolated digital input supports both dry contact and wet contact, designated by jumper settings, so that it can easily interface with other devices. PCIE-1760 relays can serve as ON/OFF control devices or small power switches. For easy monitoring, each relay is equipped with one green LED to reflect its ON/OFF status. Moreover, PCIE-1760 also offers counter input and PWM input/output channels.

The following sections of this chapter will provide further information about features, installation guide, together with some brief information on software and accessories for the PCIE-1760 card.

1.2 Features

PCIE-1760

- 8 opto-isolated digital input channels
- 8 relay actuator output channels
- 2 counter input channels and 2 opto-isolated PWM output channels
- High-voltage isolation on isolated I/O channels (2,500 V_{DC})
- LED indicators to show activated relays
- Jumper selectable dry contact or wet contact for digital input channels
- D-type connector for isolated input and output channels
- High ESD protection (2,000 V_{DC})
- High over-voltage protection (70 V_{DC})
- Wide input range (10 ~ 30 V_{DC})
- Board ID to identify specific card when multiple devices are installed

The Advantech PCIE-1760 offers the following main features:

Robust Protection

The PCIE-1760 digital input channels feature robust isolation protection for industrial, lab and machinery automation applications. It durably withstands voltage up to 2,500 V_{DC}, preventing your host system from any incidental harm. If connected to an external input source with surge-protection, the PCIE-1760 can offer up to a maximum of 2,000 V_{DC} ESD (Electrostatic Discharge) protection. Even with an input voltage rising up to 70 V_{DC}, the PCIE-1760 can still manage to work properly, albeit only for a short period of time.

Plug-and-Play Function

The PCIE-1760 is a Plug-and-Play device, which fully complies with PCI Express Specification Rev V1.0. During card installation, there is no need to set jumpers or DIP switches. Instead, all bus-related configurations such as base I/O address and interrupt are automatically done by the Plug-and-Play function.

Board ID

The PCIE-1760 has a built-in DIP Switch that helps define each card's ID when multiple PCIE-1760 cards have been installed on the same PC chassis. The board ID setting function is very useful when users build their system with multiple PCIE-1760 cards. With correct Board ID settings, you can easily identify and access each card during hardware configuration and software programming.
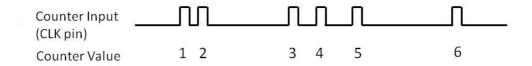
Counter Input and PWM Input/Output

PCIE-1760 offer two counter inputs which can perform event counting, frequency measurement and pulse width measurement.

Counters on PCIE-1760 have a counter value match interrupt function. When this interrupt function is enabled, an interrupt signal will be generated if the counter value reaches a pre-set counter match value. The counter will continue to count until an overflow occurs, then it will go back to its reset value zero and continue the counting process. A user can set each individual counter channel to count either falling edge (high-to-low) or rising edge (low-to-high) signals.

Except measurement functionality, counter input channels can combine with PWM output channels to generate single pulse, pulse train or PWM (pulse-width modulated) output signal. A pulse-width modulated waveform is created when the High and Low periods of a periodic rectangular signal are varied. Using PCIE-1760, user can individually set each PWM channel's High and Low periods for from 2 to (2^{32} -1) units (1 unit = 50 μs), depending on his needs.
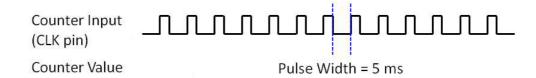
1. Event counter: PCIE-1760 built-in counter can calculate how many pulse are sent into the input channel.
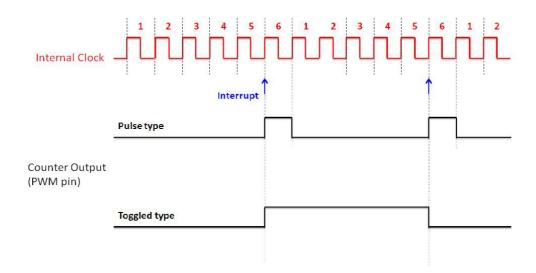

2. Frequency measurement: PCIE-1760 built-in counter can measure the frequency value of the signal connected to counter input.

3. Pulse Width measurement: PCIE-1760 built-in counter can measure the pulse width value of the signal connected to counter input.
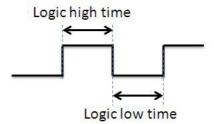

4. Pulse Output with Interrupt: PCIE-1760 counter has internal clock that you can produce periodic output signal with interrupt generated at the same time. PCIE-1760 counter will use internal clock as time base, to fulfill the frequency you want to set. PCIE-1760 supports two output types: pulse and toggled. See figure below as example, the desired frequency is 3 MHz. The internal clock is 20 MHz, so PCIE-1760 will periodically generate output signal and interrupt every 6 pulses of the internal clock. (20 MHz / 3 MHz = 6.67).
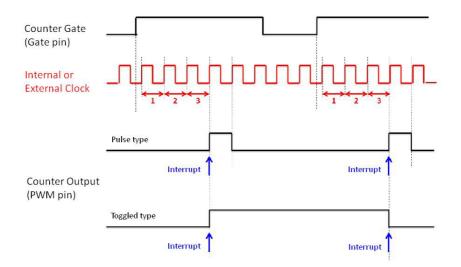

Note! *If the output signal logic high time or logic low time (see figure below) is less than 100 µs, you cannot see the output signal. This is because PCIE-1760 is equipped with photocouple component on PWM output channel, and their response time is not fast enough to make the frequency faster than 20 kHz.*
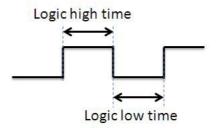
5. Delay Pulse Generation: Using PCIE-1760 internal clock, you can generate a single pulse after a specific period, starting from a trigger signal connecting to counter gate input. For example, if you define the count equals to 3 (as figure below), a single pulse will be generated after 3 pulses of internal clock signals pass, after a trigger signal from counter gate becomes high.
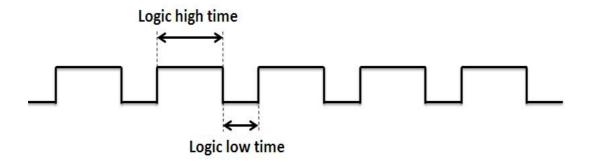

Note! If the output signal logic high time or logic low time (see figure below) is less than 100 µs, you cannot see the output signal. This is because PCIE-1760 is equipped with photocouple component on PWM output channel, and their response time is not fast enough to make the frequency faster than 20 kHz.

6. PWM Output: PCIE-1760 can generate PWM (pulse width modulation) signal which you can configure its logic high time and logic low time as figure below.

Digital Filter for Digital Input Channels

The PCIE-1760 includes a programmable digital filter on each digital input channel to eliminate the unexpected signal or noise from the card's inputs. When the digital filter is enabled, the state of the corresponding input channel will not update immediately until one high/low signal has lasted for a period which is programmed by the user.

Interrupt Function Ensures Faster System Response

The PCIE-1760 provides a "Pattern Match" interrupt function for the digital input channels. It monitors the state of some or all of the input channels and compares it with a pre-set pattern. When the received state matches the pre-set pattern, PCIE-1760 will generate an interrupt signal to the system. The "Change of Input State" interrupt function means PCIE-1760 monitors the state of the input channels. When any input changes its state, the card interrupts the system to handle this event.

> *Note!* For detailed specifications of the PCIE-1760, refer to Appendix A, Specifications.

1.3 Applications

- Industrial ON/OFF control
- Signal switching
- External relay driving
- Digital signal and contact status monitoring
- Industrial and lab automation
- Laboratory & Education

1.4 Installation Guide

Before you install your PCIE-1760 card, please make sure you have the following necessary components:

- PCIE-1760 card
- PCIE-1760 User's Manual
- Advantech driver DAQNavi (included in the CD-ROM)
- Wiring cable PCL-10137 (option)
- Wiring board ADAM-3937 (option)
- Personal computer or workstation with a PCI Express-bus slot

Some other optional components are also available for enhanced operation:

- Application software: Advantech Navigator (Utility) offered by DAQNavi software.

After you get the necessary components and maybe some of the accessories for enhanced operation of your card, you can then begin the Installation procedures.

1.5 Software Overview

Advantech offers device drivers, SDKs, third-party driver support and application software to help fully exploit the functions of your PCIE-1760 card. All these software packages are available on the companion CD-ROM or you can browse Advantech website to get the latest update: http://www.advantech.com/.

1.6   Accessories

Advantech offers a complete set of accessory products to support the PCIE-1760 card. These accessories include:

Wiring Cable

The PCL-10137 shielded cable is specially designed for PCIE-1760 cards to provide high resistance to noise. To achieve 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 digital lines are separately sheathed and shielded to neutralize EMI/EMC problems.

Wiring Boards

The ADAM-3937 is a 37-pin D-type wiring terminal module for DIN-rail mounting. This terminal module can be readily connected to the Advantech cards and allow easy yet reliable access to individual pin connections for the PCIE-1760 card.

Chapter 2

Hardware Installation

2.1 Installation

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

2.2 Unpacking

After receiving your PCIE-1760 package, please inspect its contents first. The package should contain the following items:

- PCIE-1760 card
- Companion CD-ROM
- User's Manual

The PCIE-1760 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.*

2.3 Driver Installation

We recommend you to install the driver before you install the PCIE-1760 card into your system, since this will guarantee a smooth installation process.

The Advantech device driver installation for the PCIE-1760 card is included on the companion CD-ROM that is shipped with your DA&C card package.

2.4 Hardware Installation

Note! *Make sure you have installed the driver first before you install the card.*

After the device driver installation is completed, you can now go on 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 be 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 2.
9. Plug in the power cord and turn on the computer.

Note! *In case you installed the card without installing the Device Drivers first, Win95/98/ME will recognize your card as an "unknown device" after rebooting, and will prompt you to provide the necessary driver. Ignore the prompting messages (just click the Cancel button) and set up the driver according to the steps described in 2.3 Driver Installation.*

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.

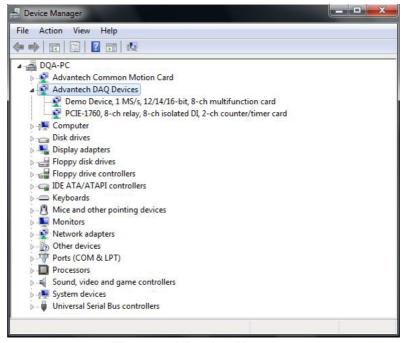2. The device name of the PCIE-1760 should be listed on the Device Manager tab as follows.

Figure 2.1 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 DAQNavi on your computer.

Chapter   3

Signal Connections

3.1 Overview

Maintaining signal connections is one of the most important factors in ensuring that your application system is sending and receiving data correctly. A good signal connection can avoid unnecessary and costly damage to your PC and other hardware devices. This chapter provides useful information about how to connect input and output signals to the PCIE-1760 via the I/O connector.

3.2 Switch and Jumper Settings

Figure 3.1 Card Connector, Jumper and Switches

Table 3.1: Summary of Jumper Settings		
Jumper No.	**Operation**	**Function Description**
JP0	1, 2 pin short	Set DI channel 0 as Dry Contact (default)
	2, 3 pin short	Set DI channel 0 as Wet Contact
JP1	1, 2 pin short	Set DI channel 1 as Dry Contact (default)
	2, 3 pin short	Set DI channel 1 as Wet Contact
JP2	1, 2 pin short	Set DI channel 2 as Dry Contact (default)
	2, 3 pin short	Set DI channel 2 as Wet Contact
JP3	1, 2 pin short	Set DI channel 3 as Dry Contact (default)
	2, 3 pin short	Set DI channel 3 as Wet Contact
JP4	1, 2 pin short	Set DI channel 4 as Dry Contact (default)
	2, 3 pin short	Set DI channel 4 as Wet Contact
JP5	1, 2 pin short	Set DI channel 5 as Dry Contact (default)
	2, 3 pin short	Set DI channel 5 as Wet Contact
JP6	1, 2 pin short	Set DI channel 6 as Dry Contact (default)
	2, 3 pin short	Set DI channel 6 as Wet Contact
JP7	1, 2 pin short	Set DI channel 7 as Dry Contact (default)
	2, 3 pin short	Set DI channel 7 as Wet Contact
JP8	1, 2 pin short	Set relay channel 2 as Normal Open (default)
	2, 3 pin short	Set relay channel 2 as Normal Close
JP9	1, 2 pin short	Set relay channel 3 as Normal Open (default)
	2, 3 pin short	Set relay channel 3 as Normal Close
JP10	1, 2 pin short	Set relay channel 4 as Normal Open (default)
	2, 3 pin short	Set relay channel 4 as Normal Close

Table 3.1: Summary of Jumper Settings

JP11	1, 2 pin short	Set relay channel 5 as Normal Open (default)
	2, 3 pin short	Set relay channel 5 as Normal Close
JP12	1, 2 pin short	Set relay channel 6 as Normal Open (default)
	2, 3 pin short	Set relay channel 6 as Normal Close
JP13	1, 2 pin short	Set relay channel 7 as Normal Open (default)
	2, 3 pin short	Set relay channel 7 as Normal Close
JP14	1, 2 pin short	Output channels will keep last status after system resets
	2, 3 pin short	Output channels will set their values to Low after system resets (default)
JP15	1, 2 pin short	Set PWM output channel 0 voltage level to isolated DO (5-40 V_{DC})
	2, 3 pin short	Set PWM output channel 0 voltage level to 5V/TTL compatible (default)
JP16	1, 2 pin short	Set PWM output channel 1 voltage level to isolated DO (5-40 V_{DC})
	2, 3 pin short	Set PWM output channel 1 voltage level to 5V/TTL compatible (default)

Table 3.2: Board ID setting (SW1)

ID3	ID2	ID1	ID0	Board ID
1	1	1	1	0
1	1	1	0	1
1	1	0	1	2
1	1	0	0	3
1	0	1	1	4
1	0	1	0	5
1	0	0	1	6
1	0	0	0	7
0	1	1	1	8
0	1	1	0	9
0	1	0	1	10
0	1	0	0	11
0	0	1	1	12
0	0	1	0	13
0	0	0	1	14
0	0	0	0	15

Note: On: 1, Off: 0

3.3 Signal Connections

PCIE-1760 Pin Assignments

CN6

Description of pin use:

IGND	1	20	IDI 7+
IDI 7-	2	21	IDI 6+/ GATE 1+
IDI 6-/ GATE 1-	3	22	IDI 5+
IDI 5-	4	23	IDI 4+/ CLK 1+
IDI 4-/ CLK 1-	5	24	IDI 3+
IDI 3-	6	25	IDI 2+/ GATE 0+
IDI 2-/ GATE 0-	7	26	IDI 1+
IDI 1-	8	27	IDI 0+ / CLK 0+
IDI 0- / CLK 0-	9	28	PWM1
PWM0	10	29	R4_OUT
R7_OUT	11	30	R3_OUT
R6_OUT	12	31	R2_OUT
R5_OUT	13	32	R1_NO
R7_COM	14	33	R1_NC
R6_COM	15	34	R1_COM
R5_COM	16	35	R0_NO
R4_COM	17	36	R0_NC
R3_COM	18	37	R0_COM
R2_COM	19		

IDIn+ (n=0 ~ 7):
Isolated digital input +
IDIn- (n=0 ~ 7):
Isolated digital input -
PWMn (n=0~1):
Isolated or TTL digital output (for PWM)
Rn_OUT (n=2~7):
Normally Open/Closed pin of Relay output
Rn_NO (n=0~1):
Normally Open pin of Relay output
Rn_NC (n=0~1):
Normally Close pin of Relay output
Rn_COM (n=0~7):
Common pin of Relay output
GATEn + (n=0~1):
Counter n gate input +
GATEn - (n=0~1):
Counter n gate input -
CLKn + (n=0~1):
Counter n clock input +
CLKn - (n=0~1):
Counter n clock input -

Isolated Digital Input

Each of the 8 isolated digital input channels accepts either dry contact or 10 ~ 30 V_{DC} wet contact inputs as determined by the corresponding jumper settings (see Table 3.1). Dry contact capability allows an input channel to respond to changes in an external circuit (e.g., the closing of a switch in the external circuit) when no voltage is present in the external circuit. Figure 3.2 shows the internal and external circuitry, with both wet and dry contact components connected as an input source for one of the PCIE-1760's isolated digital input channels.

Figure 3.2 Isolated DI Connection
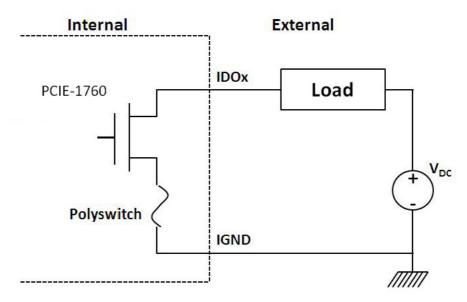
Relay Output

Of the total eight relays, two relays (Channel 0 and 1) are single-pole double-throw (SPDT, Form C) and six relays (Channel 2 to Channel 7) are single-pole single-throw (SPST), which can be set as either normally open (NO) or normally closed (NC) via jumper settings. The following figure illustrates the structures and connections of the relay outputs.

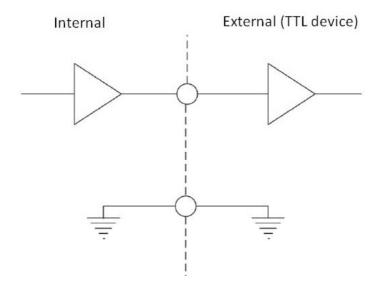**Figure 3.3 Relay Output Connection**

Isolated Digital Output

Each of isolated output channels comes equipped with a MOSFET and a polyswitch (for current protection) for using with inductive loads. 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. Please note that the current through each IDO channel should not exceed 500 mA.

TTL Digital Output

The two isolated output pins for PCIE-1760 can also be configured as TTL digital output using JP15 and JP16. (See Table 3.1) The following figure shows connections to exchange digital signals with other TTL devices.

Appendix A

Specifications

A.1 Specifications

A.1.1 PCIE-1760

Isolated Digital Input

Digital Input Channels	8
Input Voltage	Logic 0: 0 - 3 V_{DC}
	Logic 1: 10 - 30 V_{DC}
Input Current	10 V_{DC} @ 2.97 mA
	12 V_{DC} @ 3.18 mA
	24 V_{DC} @ 6.71 mA
	30 V_{DC} @ 9.73 mA
Input Resistance	3.2KΩ @1W
Interrupt Capable Channels	1 (IDI0)
Opto-Isolator Response	60 µs
Counter Input Channels	2*
Counter Input Frequency Range	up to 1 kHz
Counter Input Internal clock	up to 20 MHz
Digital Input Filter	effective high input period: 1 µs ~ 255 µs (unit: 1 µs)
	effective low input period: 1 µs ~ 255 µs (unit: 1 µs)
Over Voltage Protection	70 V_{DC}
ESD Protection	2000 V_{DC}
Isolation Protection	2500 V_{DC}

> **Note!** * Counter input channel shares some pinouts from isolated digital channels

Relay Output

Relay Output Channels	8
Relay Type	Channel 0 ~ 1: single-pole double-throw (SPDT, Form C)
	Channel 2 ~ 7: single-pole single-throw (SPST)
Output type	Channel 0 ~ 1: Normal-Open (NO) and Normal-Close (NC)
	Channel 2 ~ 7: Normal-Open (NO) or Normal-Close (NC), selectable by jumper
Contact Rating	125 V_{AC} @ 0.5 A, 30 V_{DC} @ 1 A
Contact Resistance	< 100 mΩ initially
Dielectric Strength	Coil to contacts: 1500 Vrms Between open contacts: 1000 Vrms
Operate Time	5 ms (maximum)
Release Time	3.5 ms (maximum)
Life Expectancy	3×10^5 cycles (minimum): 2 A @ 30 V_{DC}, 1 A @ 125 V_{AC}
	10^6 cycles (minimum): 1 A @ 30 V_{DC}, 0.5 A @ 125 V_{AC}

PWM Output

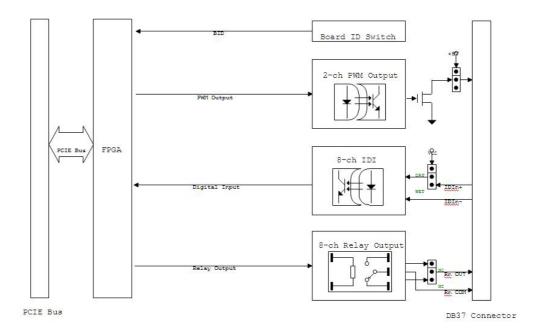| PWM Output Channels	2
PWM Output Type	5V/TTL or Isolated DO (selectable by jumper)
PWM Output Range (TTL)	Logic 0: < 0.8 V_{DC}
	Logic 1: (5 ± 0.5) V_{DC}
PWM Output Current	Sink = 0.5 A, Source = - 2mA
PWM Output Range (Isolated DO)	5 - 40 V_{DC}
PWM Output Frequency	up to 1 kHz
Scaling Resolution	32 bits (50 μs for each step)
PWM High Period	100 μs ~ [(2^{32}-1) x 50] μs, deviation: ± 60 μs
PWM Low Period	100 μs ~ [(2^{32}-1) x 50] μs, deviation: ± 60 μs
Isolation Protection	2500 V_{DC}

General

I/O Connector Type	37-pin D-Sub female	
Dimensions	167.7 mm x 100 mm (6.6" x 3.9")	
Power Consumption	Typical	+3.3 V @ 390 mA +12 V @ 30 mA
	Max.	+3.3 V @ 490 mA +12V @ 60 mA
Temperature	Operation	0~+60°C (32~140°F) (refer to IEC 60068-2-1, 2)
	Storage	-25~+85°C (-4~185°F)
Relative Humidity	5~95%RH non-condensing (refer to IEC 60068-2-3)	
Certification	CE certified	

Appendix B

Block Diagram

B.1 PCIE-1760

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