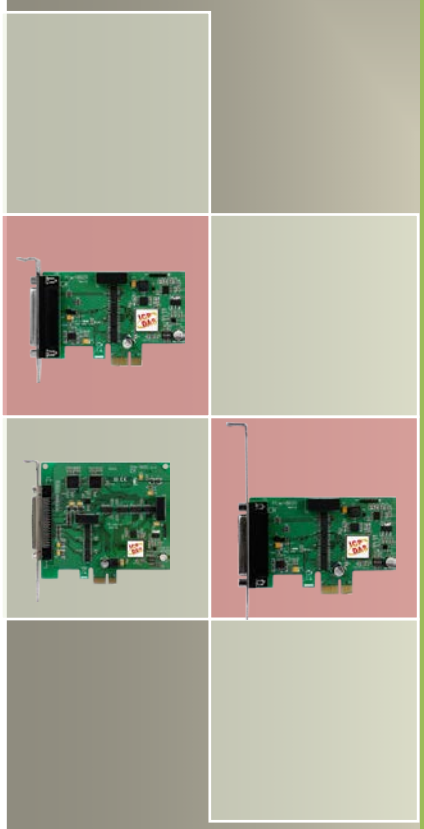

PCIe-LM4 User Manual

24-Bit Precision Load Cell Input Board Version 1.0, Jan. 2020

SUPPORT

This manual relates to the following boards: PCIe-LM4.

WARRANTY

All products manufactured by ICP DAS are warranted against defective materials for a period of one year from the date of delivery to the original purchaser.

WARNING

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CONTACT US

If you have any questions, feel to contact us by email at:
service@icpdas.com or service.icpdas@gmail.com
We will respond to you within 2 working days.

TABLE OF CONTENTS

Packing List

The shipping package should contain the following items:

	One multifunction board:
	PCIe-LM4
	One printed Quick Start Guide

Note:
If any of these items is missing or damaged, contact the dealer from whom you purchased the product. Save the shipping materials and carton in case you need to ship or store the product in the future.

1. Introduction

The PCIe-LM4 is a powerful multifunction board based on the PCI Express. Equipped with four strain gauge input channels, four general analog input channels, a 2-axis motion controller, two analog output channels, sixteen isolated digital input channels and sixteen isolated digital output channels.

The PCIe-LM4 also adds a Card ID switch. Users can set Card ID on a board and recognize the board by the ID via software when using two or more PCIe-LM4 cards in one computer.

These cards support various OS versions, such a Windows 32/64-bit Windows 7/8/10. DLL together with various language sample programs based on Visual C++, Borland Delphi, Borland C++ Builder, Visual Basic, C#.NET, Visual Basic.NET and LabVIEW are provided in order to help users quickly and easily develop their own applications.

1.1 Features

The following is an overview of the general features provided by the PCIe-LM4 board. Refer to Section 1.3 for more details.

■ Interface

- PCI Express x1
- Card ID switch
- Software Calibration

■ Analog Input

- 24-bit AD converter, with up to 15 kHz sampling rate for each channel
- 4-channel differential General Analog Inputs
- 4-channel Load Cell Transducer Inputs

■ Analog Output

- 2-channel 16-bit voltage output
- Voltage output range: +/-10 V, +/-5 V, 0 ~ +10 V, 0 ~ +5 V

■ Motion Control

- 2-asiex Encoder Inputs
- 2-asiex Pulse Outputs

■ Digital I/O

- 16-channel Digital Inputs
- 16-channel Digital Outputs
- 2500 V_{DC} Isolation

1.3 Specifications

The following is an overview of the specifications for the various models in the PCIe-LM4 Series.

Model	PCIe-LM4
Load Cell Transducer	
Channels	4
A/D Converter	24-bit, 67 µs conversion time
Sampling Rate	15 kS/s
Over voltage Protection	Continuous +/-35 Vp-p
Input Impedance	10,000 MΩ/4pF
Trigger Modes	Software
Data Transfer	Polling
Accuracy	0.05 % of FSR ±1 LSB @ 25 °C, ± 10 V
Input Range	±227 mV (For Load Cell Transducer)
Analog Input	
Channels	4 differential
A/D Converter	24-bit, 67 µs conversion time
Sampling Rate	15 kS/s
Over voltage Protection	Continuous +/-35 Vp-p
Input Impedance	10,000 MΩ/4pF
Trigger Modes	Software
Data Transfer	Polling
Accuracy	0.05 % of FSR ±1 LSB @ 25 °C, ± 10 V
Input Range	±10 V, ±5 V, ±2.5 V, ±1.25 V
Analog Output	
Channels	2
Resolution	16-bit
Accuracy	± 10 LSB
Output Range	±5 V, ±10 V
Output Driving	± 5 mA
Slew Rate	2.8 V/µs
Output Impedance	0.1 Ω (Max.)
Operating Mode	Static update, Waveform generation
Output Rate	500 KS/s (Max.)

FIFO Size	512 Samples
Digital Input	
Channels	16
Isolation Voltage	2500 V_{DC}
Compatibility	Sink or Source, Photo coupler isolated channel with common power or ground
Input Voltage	Logic 0: 0 ~1 V/Logic 1: 5~24 V
Response Speed	4 kHz (Typical)
Trigger Mode	Software
Data Transfer	Polling
Digital Output	
Channels	16
Isolation Voltage	2500 V_{DC}
Compatibility	Sink, Open Drain
Output Capability	100 mA/+ 30V for each channel @100% duty
DO Readback	N/A
Operation Mode	Static update
Response Speed	4 kHz (Typical)
Encoder Input	
Channels	2
Mode	CW/CCW, PULSE/DIR
Frequency	12 MHz
Pulse counter	32-bit for each channel
Isolated Voltage	3 kVrms
Pulse Output	
Channels	2
Mode	CW/CCW, PULSE/DIR, A/B PHASE
Frequency	4 MHz
Pulse counter	32-bit for each channel
Isolated Voltage	3 kVrms
General	
Bus Type	PCI Express x1
Data Bus	32-bit
Card ID	Yes (4-bit)
I/O Connector	SCSI VHDCI 68-pin x 2
Dimensions (L x W x D) Unit: mm	187 x 101 x 22

Power Consumption	1 A @ +5 V (Max.)
Operating Temperature	0 ~ 60 °C
Storage Temperature	-20 ~ 70 °C
Humidity	5 ~ 85% RH, Non-condensing

1.4 Applications

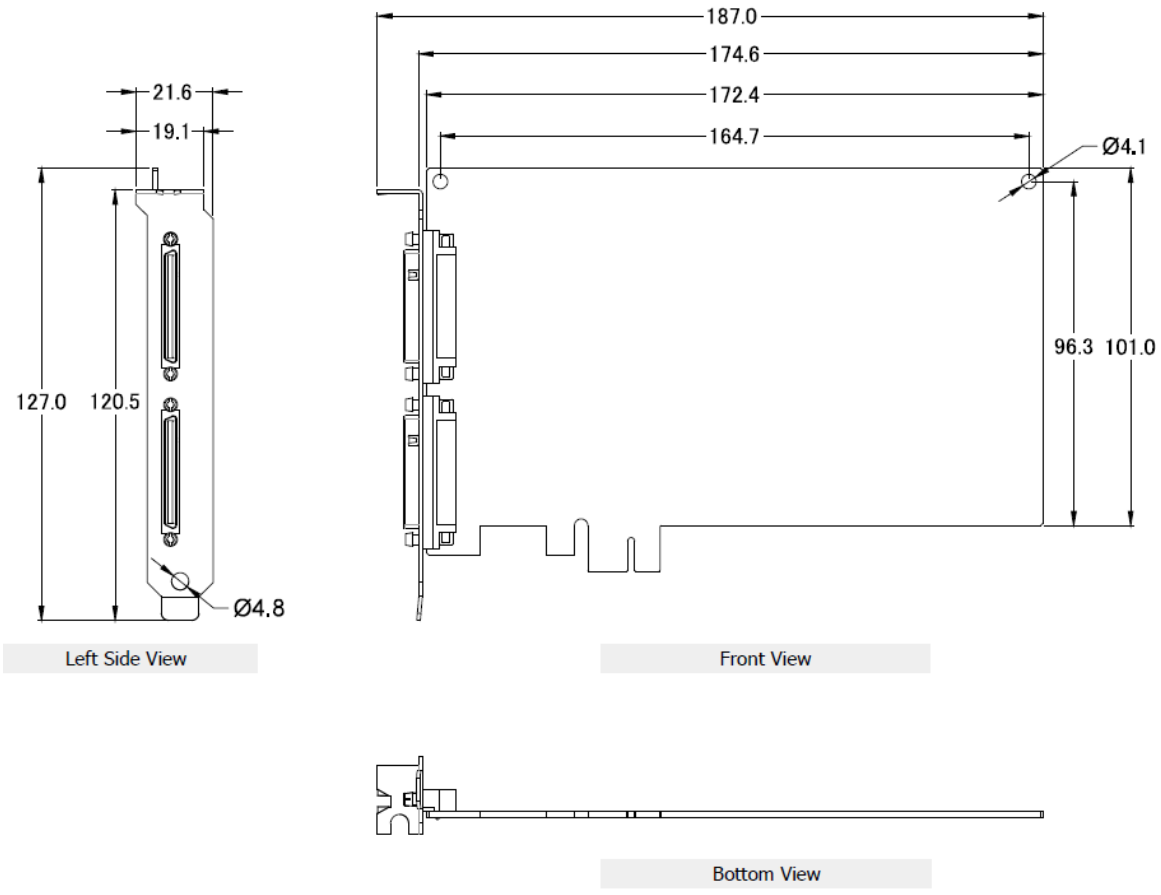
- Signal Analysis
- FFT and Frequency Analysis
- Transient Analysis
- Temperature Monitor
- Vibration Analysis
- Energy Management
- Other Industrial and Laboratory Measurement and Control

2 Hardware Configuration

2.1 Board Layout

The following is an overview of the board layout for each of the PCIe-LM4 Series cards.

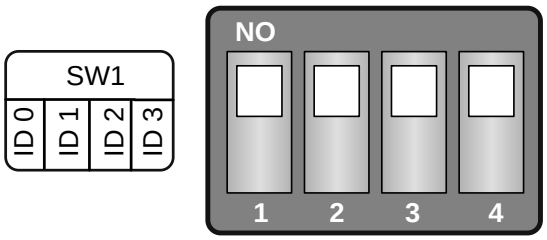
➢ **PCIe-LM4**



CON1	The Connector for Analog input and Analog Output. Refer to Section 2.8 Pin Assignments
CON2	The Connector for Motion control and Digital I/O. Refer to Section 2.8 Pin Assignments

2.2 Card ID Switch (SW1)

The PCIe-LM4 includes an onboard Card ID switch (SW1) that enables the board to be recognized via software if two or more PCIe-8620/8622 boards are installed in the same computer. The default Card ID is 0x0. For more details regarding the SW1 Card ID settings, refer to the table below.



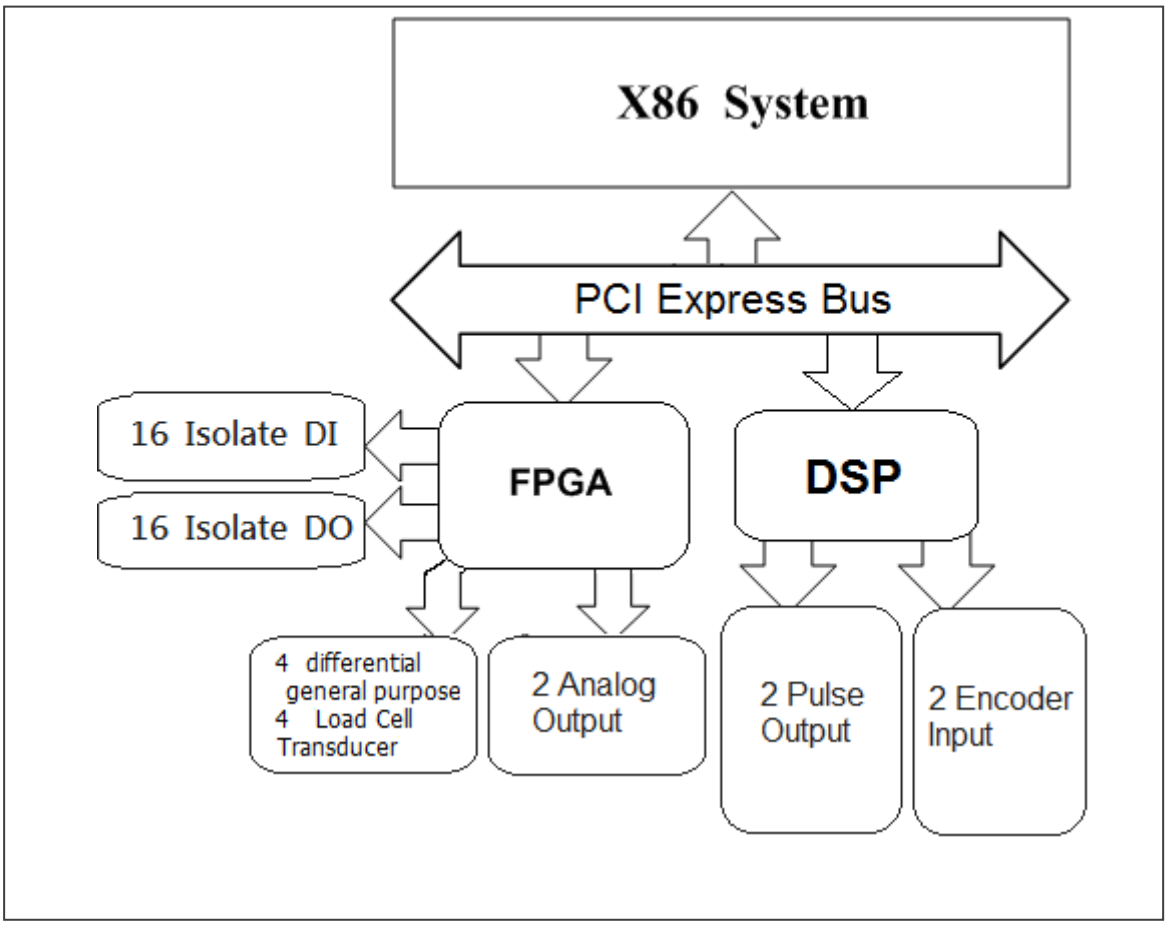
(Default Settings)

Card ID (Hex)	1 ID0	2 ID1	3 ID2	4 ID3
(*) 0x0	ON	ON	ON	ON
0x1	**OFF**	ON	ON	ON
0x2	ON	**OFF**	ON	ON
0x3	**OFF**	**OFF**	ON	ON
0x4	ON	ON	**OFF**	ON
0x5	**OFF**	ON	**OFF**	ON
0x6	ON	**OFF**	**OFF**	ON
0x7	**OFF**	**OFF**	**OFF**	ON
0x8	ON	ON	ON	**OFF**
0x9	**OFF**	ON	ON	**OFF**
0xA	ON	**OFF**	ON	**OFF**
0xB	**OFF**	**OFF**	ON	**OFF**
0xC	ON	ON	**OFF**	**OFF**
0xD	**OFF**	ON	**OFF**	**OFF**
0xE	ON	**OFF**	**OFF**	**OFF**
0xF	**OFF**	**OFF**	**OFF**	**OFF**

(*) Default Settings; OFF → 1; ON → 0

2.3 System Block Diagram

➢ The following is the block diagram for the PCIe-LM4:



2.4 Analog Input

2.4.1 Analog Input Range

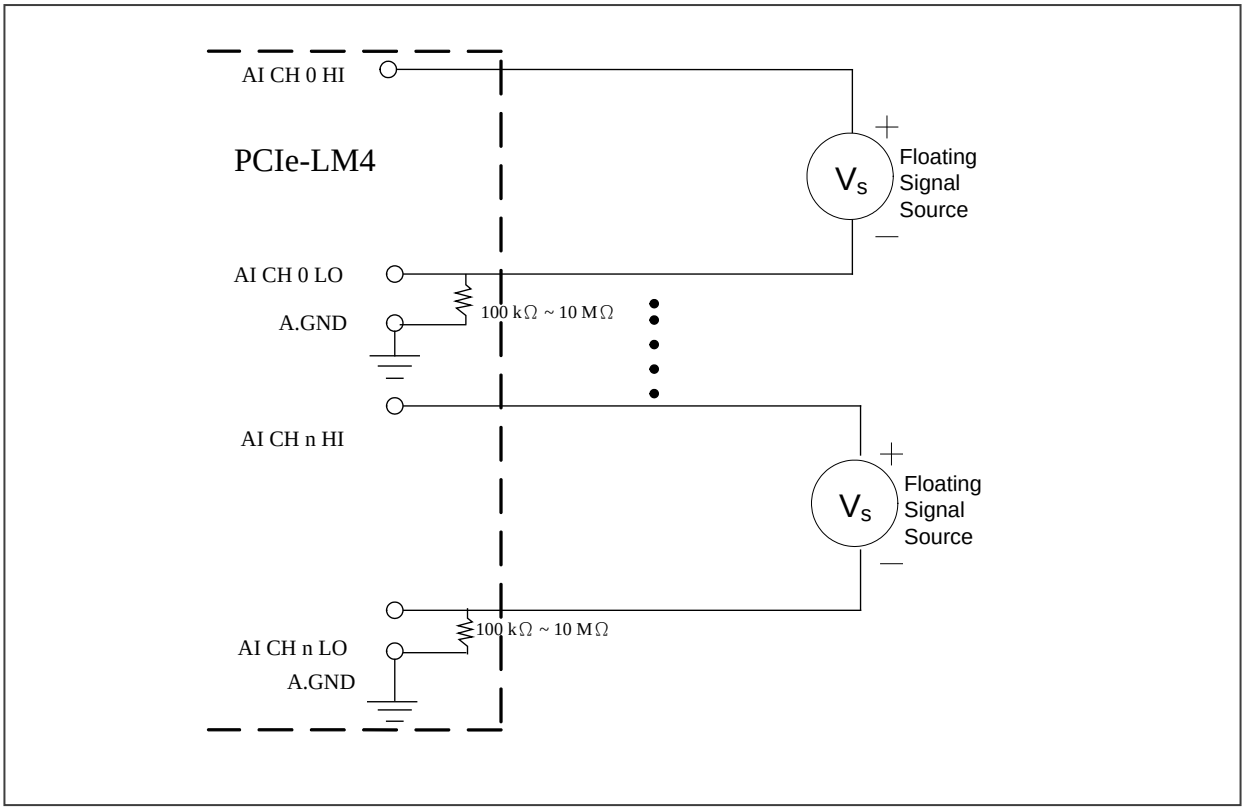
Input Range refers to the set of input voltages that an Analog Input channel can digitize with the specified accuracy. The PGA amplifies or attenuates the AI signal depending on the input range. User can individually program the input range of all channels on PCIe-LM4 board.

Input rage affects the resolution of the PCIe-LM4 for an AI channel Resolution refer to the voltage of one ADC code. 24-bit ADC converts Analog Inputs into one of 16777216 codes – that is, one of 16777216 possible digital values. These values are spread fairly evenly across the input range.

Theory	Input Range	Nominal Resolution
(Max – Min)/16,777,216	-10 V to 10 V	1.192 µV
	-5 V to 5 V	596 nV
	-2.5 V to 2.5 V	298 nV
	-1.25 V to 1.25 V	149 nV
	-227 mV to 227 mV	27 nV

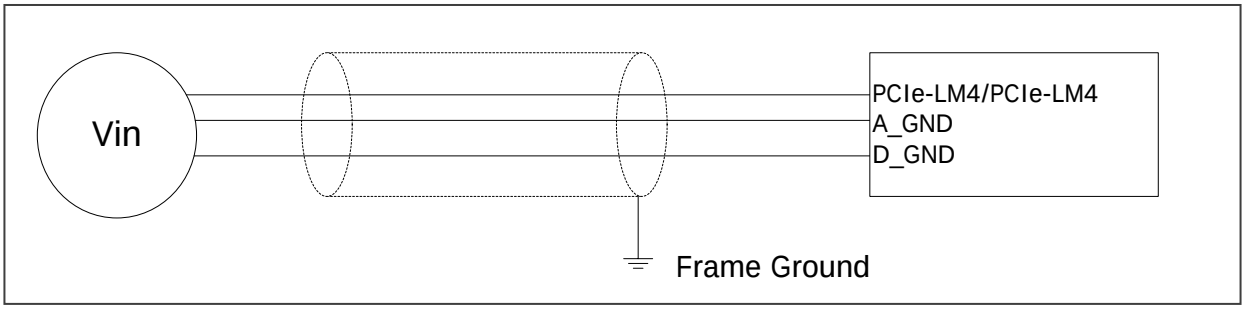
2.4.2 Connecting Analog Input Signals

The PCIe-LM4 Series board can be used to measure differential type Analog Input signals for floating signal source.



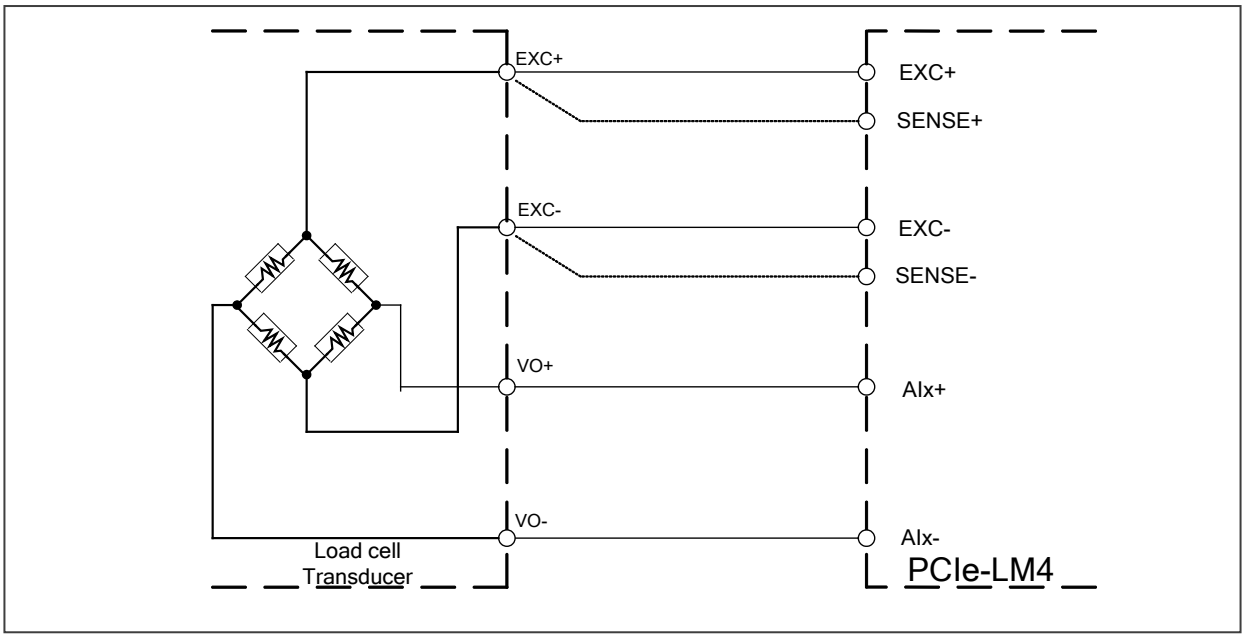
2.4.3 Signal Shielding

Use a single-point connection to the frame ground, rather than the AGND or DGND pins.



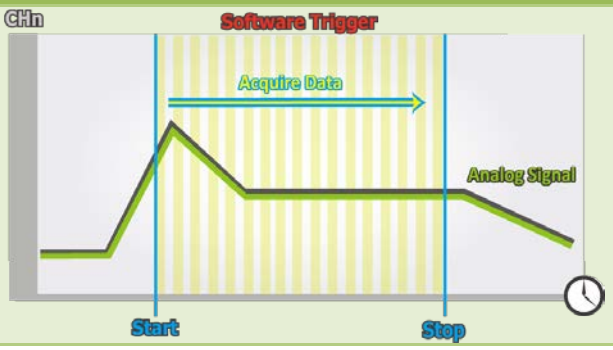
2.4.4 Connecting Load cell inputs Signals

The PCIe-LM4 Series board can be used to measure Load cell transducer Input signals for floating signal source in differential mode.



2.4.5 Analog Input Data Acquisition Methods

The following is an overview of the five trigger modes:

Trigger Mode		Description
Software Trigger		No trigger signal is used and all A/D operations are initiated by software.

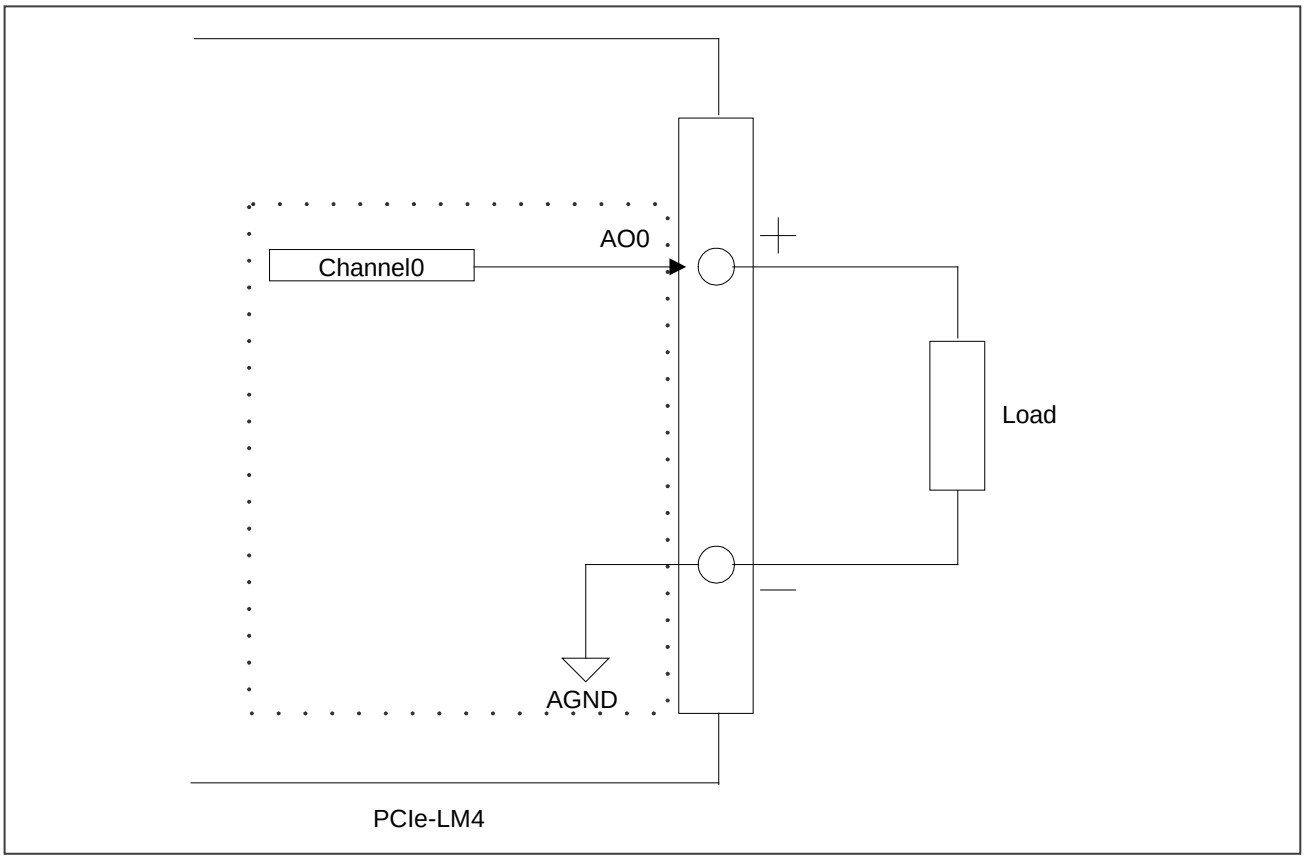
After the clock signal is generated, A/D data will be recorded and saved to the buffer or the FIFO. Two clock sources are provided, a software command and a pacer clock.

The saved data can be transferred to the memory on the PC using either software polling transfer.

2.5 Analog Output

2.5.1 Connection Analog Output Signals

The PCIe-LM4 board provides two DA output channels, AO0 and AO1, and the onboard -5 V (-10 V) reference signal on the PCIe-LM4 may be used to generate a DA output range of 0 V to +5 V (+10 V).



2.6 Digital Input/Output

The DIO signals, DO<0..15> and DI<0..15> are referenced to DI.COM and EXT.GND. The figure shows DI<0..15> configured for Digital Input and DO<0..15> configured for Digital Output.

- Digital Input wiring diagram

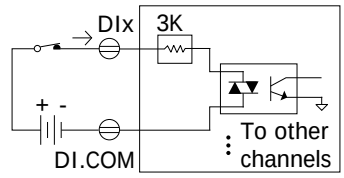
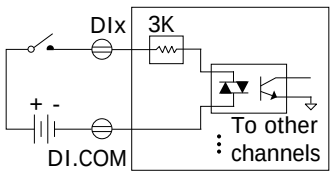
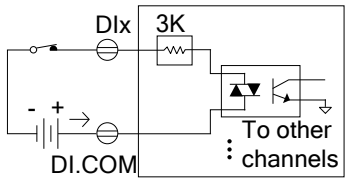
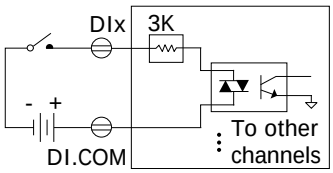
Digital Input/Counter	Readback as 1	Readback as 0
Sink	+10 ~ +30 VDC	OPEN or <4 VDC
		
Source	+10 ~ +30 VDC	OPEN or <4 VDC
		

Figure 1: digital input wiring

- Digital Output wiring diagram

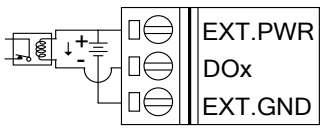
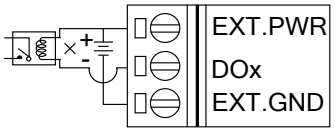
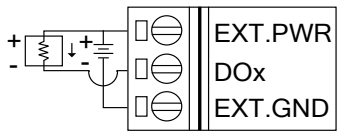
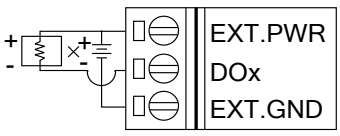
Output Type	ON State Readback as 1	OFF State Readback as 0
Driver Relay		
Resistance Load		

Figure 2: digital output wiring

2.7 Motion Control

2.7.1 Connecting Pulse Output Signals

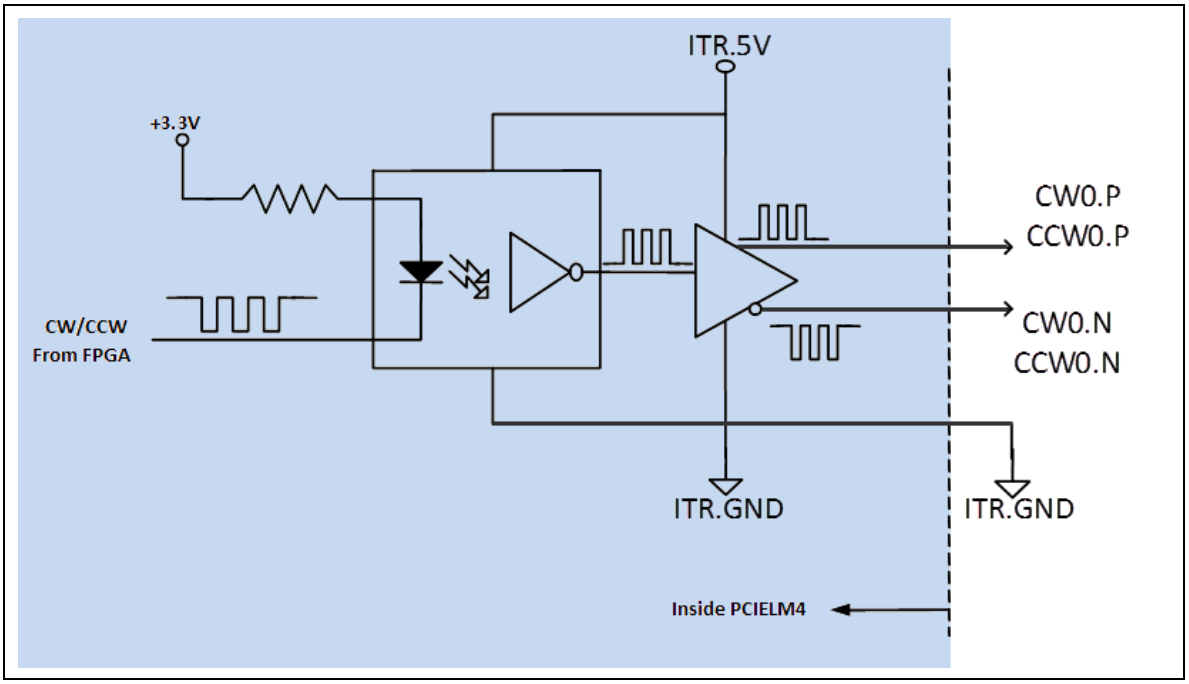


Figure 3: Internal pulse output circuit

- Differential type:

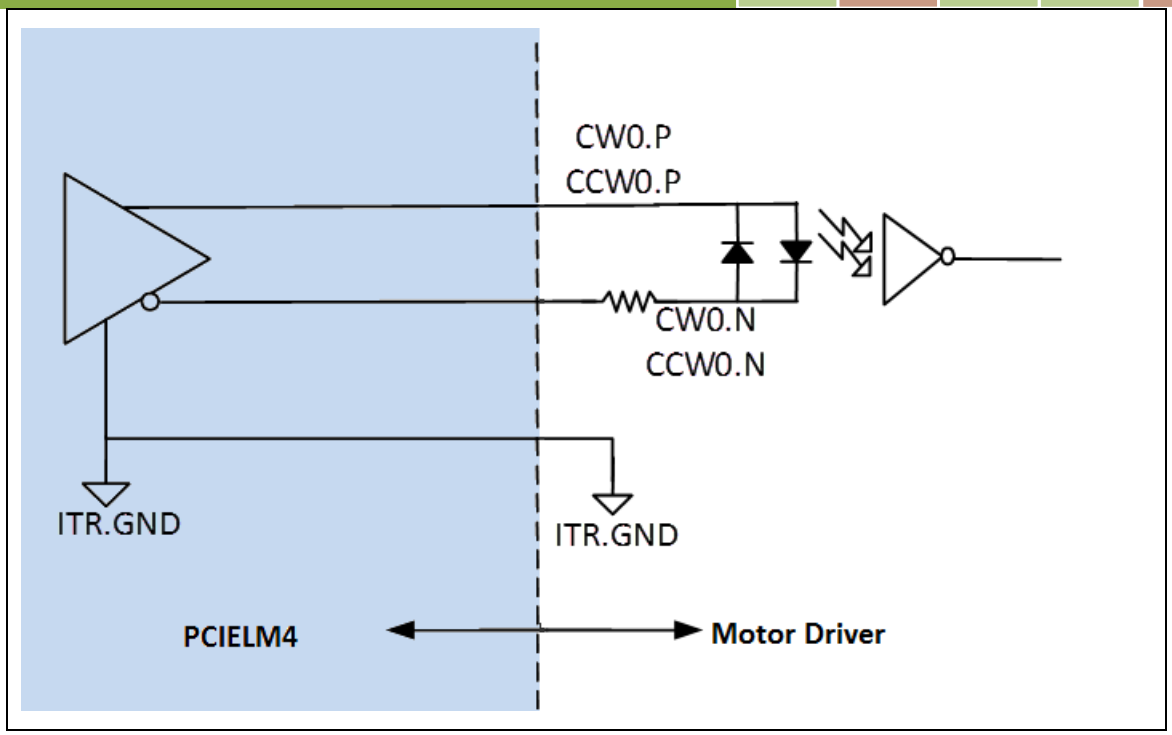


Figure 4: Wiring for differential type pulse output

- Open collector TTL output

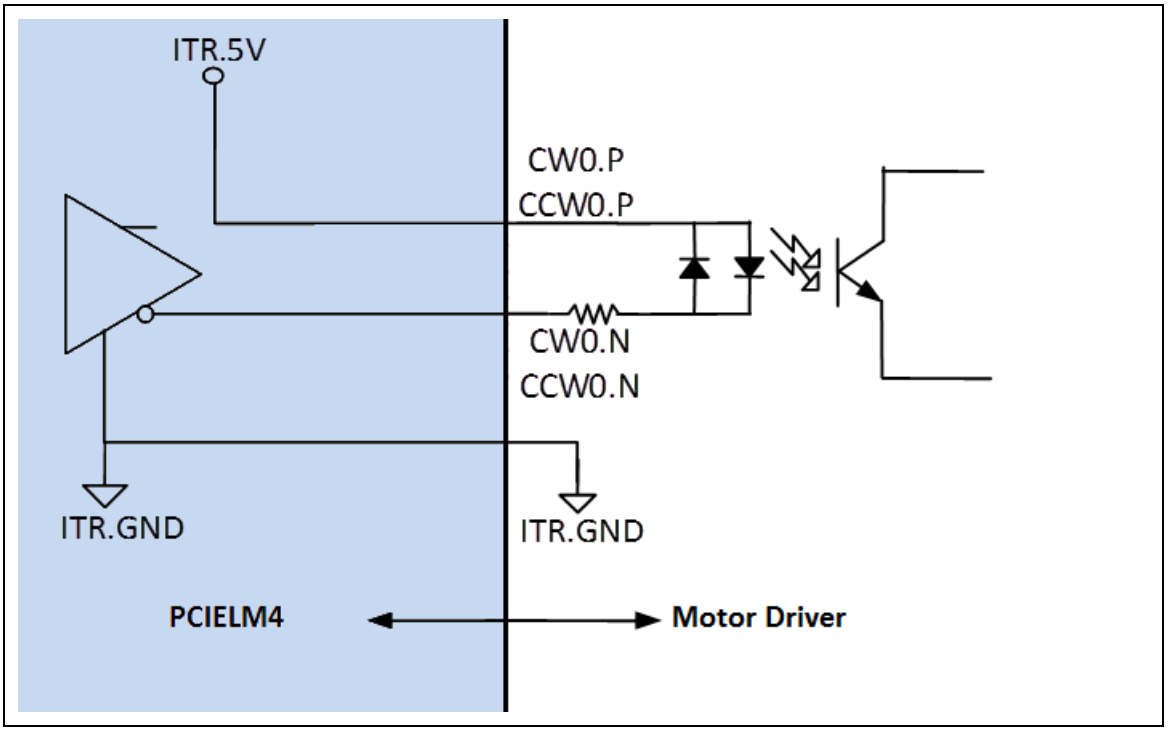


Figure 5: Open collector TTL output

2.7.2 Connecting Encoder Input Signals

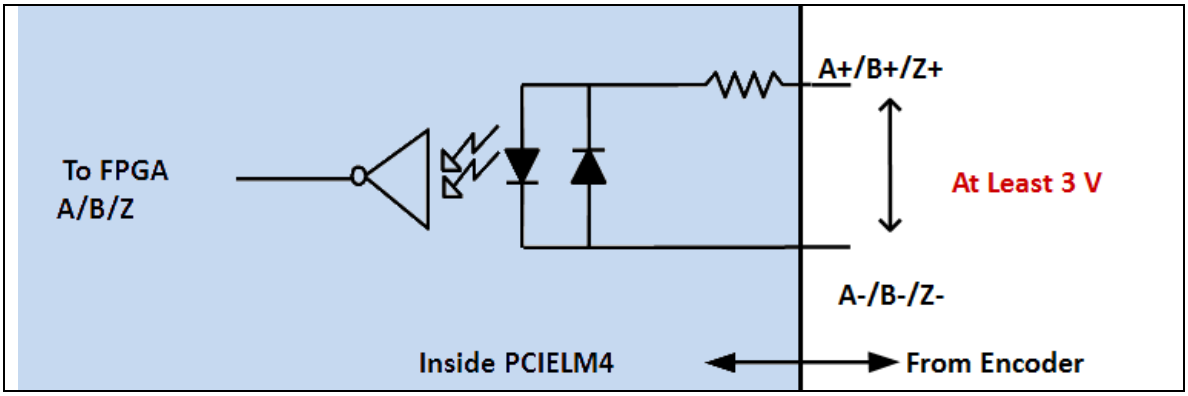


Figure 6: Encoder input signal circuit

- Differential type encoder connection

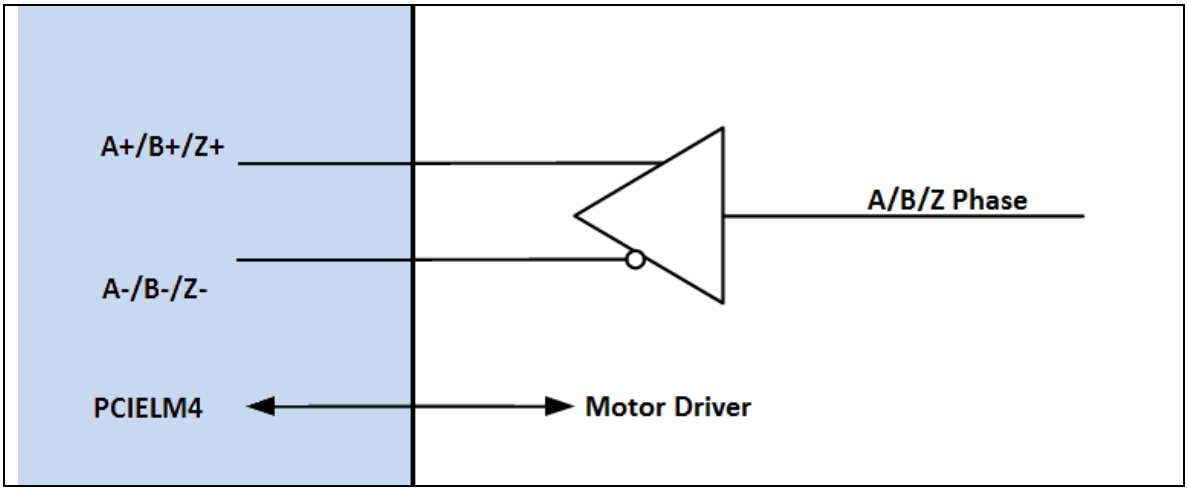


Figure 7: Differential type encoder wiring

- Open collector type encoder wiring:

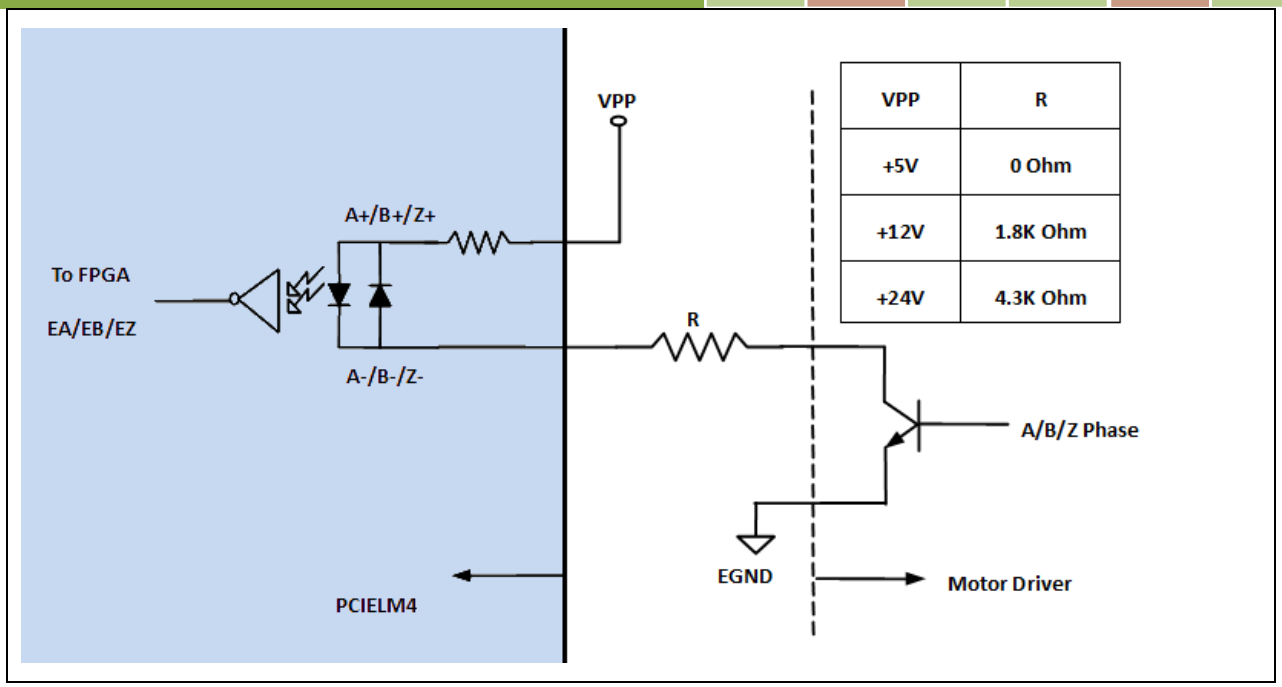


Figure 8: Open collector type encoder wiring

2.8 Pin Assignments

2.8.1 CON1/2 Connector of the PCIe-LM4

Pin Assignment	Terminal No.		Pin Assignment
IO			IO
N.C.	01	35	N.C.
N.C.	02	36	N.C.
N.C.	03	37	N.C.
N.C.	04	38	N.C.
N.C.	05	39	N.C.
AGND	06	40	AGND
AGND	07	41	AGND
AGND	08	42	AGND
AGND	09	43	AGND
VO0	10	44	AGND
AGND	11	45	AGND
VO1	12	46	AGND
AGND	13	47	AGND
AI4+	14	48	AI4-
AI5+	15	49	AI5-
AI6+	16	50	AI6-
AI7+	17	51	AI7-
AGND	18	52	AGND
N.C.	19	53	N.C.
SENSE+	20	54	SENSE-
EXC+	21	55	EXC-
AI3+	22	56	AI3-
N.C.	23	57	N.C.
SENSE+	24	58	SENSE-
EXC+	25	59	EXC-
AI2+	26	60	AI2-
N.C.	27	61	N.C.
SENSE+	28	62	SENSE-
EXC+	29	63	EXC-
AI1+	30	64	AI1-
N.C.	31	65	N.C.
SENSE+	32	66	SENSE-
EXC+	33	67	EXC-
AI0+	34	68	AI0-

CON1

Pin Assignment		Terminal No.		Pin Assignment	
Motion	IO			IO	Motion
N.C.	DI.COM1	01	35	DI.COM1	N.C.
RDY0	DI0	02	36	DI1	INP0
ALM0	DI2	03	37	DI3	SLD0
ORG0	DI4	04	38	DI5	MEL0
PEL0	DI6	05	39	DI7	E.EMG
N.C.	DI.COM2	06	40	DI.COM2	N.C.
RDY1	DI8	07	41	DI9	INP1
ALM1	DI10	08	42	DI11	SLD1
ORG1	DI12	09	43	DI13	MEL1
PEL1	DI14	10	44	DI15	E.LTC0
N.C.	EXT.PWR1	11	45	EXT.GND1	N.C.
E.SVON0	DO0	12	46	DO1	E.ERC0
ALMRST0	DO2	13	47	DO3	CMP0
E.SVON1	DO4	14	48	DO5	E.ERC1
ALMRST1	DO6	15	49	DO7	CMP1
N.C.	EXT.PWR2	16	50	EXT.GND2	N.C.
N.C.	DO8	17	51	DO9	N.C.
N.C.	DO10	18	52	DO11	N.C.
N.C.	DO12	19	53	DO13	N.C.
N.C.	DO14	20	54	DO15	N.C.
N.C.	N.C.	21	55	N.C.	N.C.
N.C.	N.C.	22	56	N.C.	N.C.
A1+	N.C.	23	57	N.C.	A1-
B1+	N.C.	24	58	N.C.	B1-
Z1+	N.C.	25	59	N.C.	Z1-
A2+	N.C.	26	60	N.C.	A2-
B2+	N.C.	27	61	N.C.	B2-
Z2+	N.C.	28	62	N.C.	Z2-
CW0.P	N.C.	29	63	N.C.	CW0.N
CCW0.P	N.C.	30	64	N.C.	CCW0.N
CW1.P	N.C.	31	65	N.C.	CW1.N
CCW1.P	N.C.	32	66	N.C.	CCW1.N
ITR.5V	ITR.5V	33	67	ITR.5V	ITR.5V
ITR.GND	ITR.GND	34	68	ITR.GND	ITR.GND

CON2

2.8.2 I/O Connector Signal Descriptions

Signal Name	Reference	Direction	Description
AI<0..7>+	**AI<0..7>-**	Input	**Analog Input channels 0 to 7.** For Differential measurements, channels 0 to 3 are for load-cell transducer inputs and channels 4 to 7 are for general purpose analog inputs.
EXC+	**EXC-**	Output	Analog outputs for transducer voltage excitation, in selectable ranges of 2.5V or 10V. Connect one excitation source to only one load-cell transducer; sharing a common wiring between transducers will degrade gain accuracy. Up to four 120-ohm load-cells can be connected to one PCIe-LM4. Load-cells with larger impedance can also be used.
SENSE+	**SENSE-**	Input	Remote-sense analog inputs for transducer excitation sensing. Always connect SENSEn+ to EXCn+, SENSEn- to EXCn-, and as close as possible to transducers excitation terminals.
AGND	**-**	-	**Analog Input/Output Ground.** These terminals are reference point for AI measurements and AO<0..1>.
AO<0..1>	**AGND**	Output	**Analog Output channels 0 to 1.** These terminals supply the voltage output of AO channels 0 to 1.
DO<0..15>	**EXT.GND**	Output	Isolated Digital Output.
DI<0..15>	**DGND**	Input	Isolated Digital Inputs.
DI.COM<1..2>	**D_GND**	Input	Isolated Digital Ground
EXT.PWR<1..2>	**EXT.GND <1..2>**	Input	Use in conjunction with DO<1..2> and external power supply, to provide current return path for fly-wheel diodes.
EXT.GND<1..2>	**-**	-	Isolated Digital Ground

Signal Name	Reference	Direction	Description
RDY<0..1>	-	Input	Servo Ready
ALM<0..1>	-	Input	Servo Alarm
ORG<0..1>	-	Input	Origin, Home Signal
PEL<0..1>	-	Input	Positive End Limit
INP<0..1>	-	Input	Servo In-Position
SLD<0..1>	-	Input	Slow Down
MEL<0..1>	-	Input	Minus End Limit
E.EMG	-	Input	Emergency Stop (All axes)
E.LTC0	-	Input	Latch
E.SVON<0..1>	-	Output	Servo On
ALMRST<0..1>	-	Output	Servo Alarm Reset
E.ERC<0..1>	-	Output	Error Counter Clear
CMP<0..1>	-	Output	Compare
A<1..2>+	**A<1..2>-**	Input	Encoder A-Phase
B1<1..2>+	**B<1..2>-**	Input	Encoder B-Phase +
Z<1..2>+	**Z<1..2>-**	Input	Encoder Z-Phase +
CW<0..1>.P	**CW<0..1>.N**	Input	Clockwise Pulse
CCW<0..1>.P	**CCW<0..1>.N**	Input	Counter-Clockwise Pulse
ITR.5V	**ITR.GND**	Output	Internal Power +5 V
ITR.GND	-	Input	Internal Ground

2.8.3 Power Source

The +5 V terminals on the I/O connector supply +5 V referenced to **ITR.GND**. Use these terminals to power external circuitry.

Caution:

Never connect the +5 V power terminals to analog or digital ground or to any other voltage source on PCIe-LM4 or any other device. Doing so can damage the device and the computer. ICP DAS is not liable for damage resulting from such a connection.

3 Hardware Installation

Note:

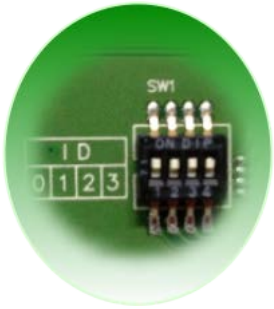
It is recommended that the driver is installed before installing the hardware as the computer may need to be restarted once the driver is installed in certain operating systems, such as Windows 2000 or Windows XP, etc. Installing the driver first helps reduce the time required for installation and restarting the computer.

To install the PCIe-LM4 Series cards, follow the procedure described below:

Step 1: Install the driver for the PCIe-LM4 board on your computer.

For detailed information about installing the driver, refer to Chapter 4 Software Installation.

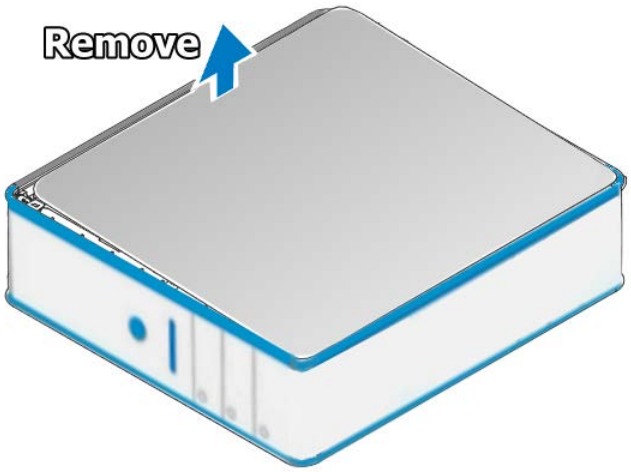
Step 2: Configure the Card ID using the DIP Switch (SW1).



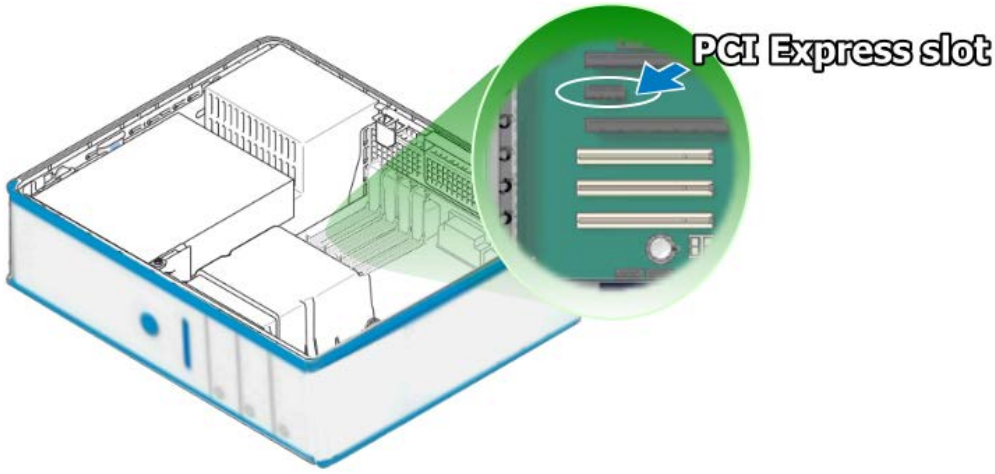
For detailed information about the Card ID, refer to Section 2.2 Card ID Switch (SW1).

Step 3: Shut down and switch off the power to the computer, and then disconnect the power supply.

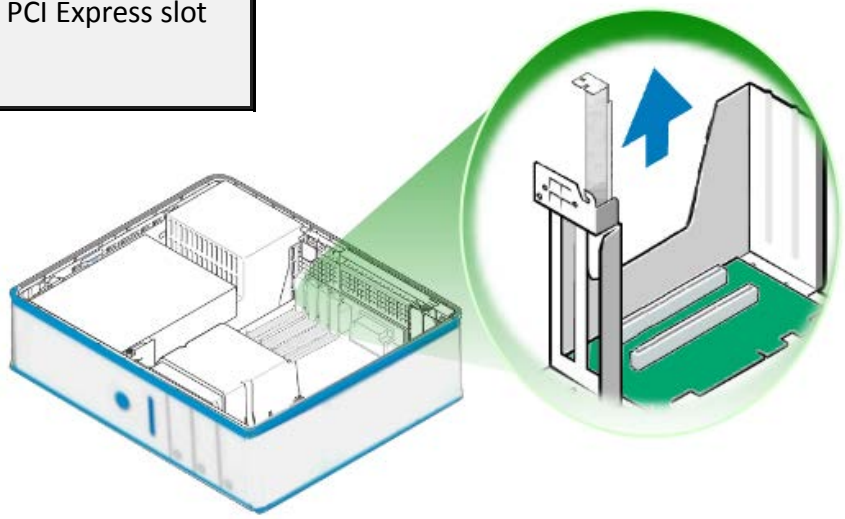
Step 4: Remove the cover from the computer.

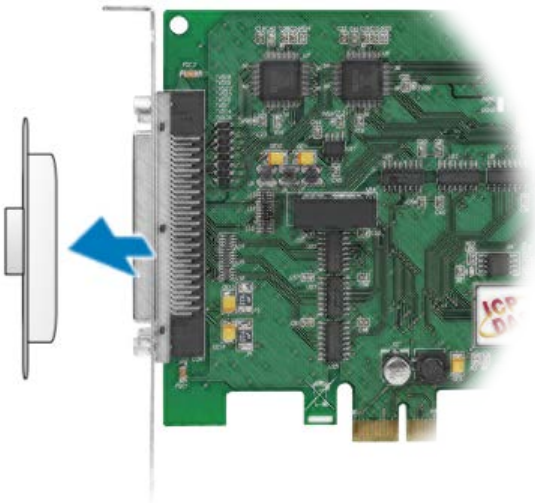


Step 5: Select a vacant PCI Express slot.



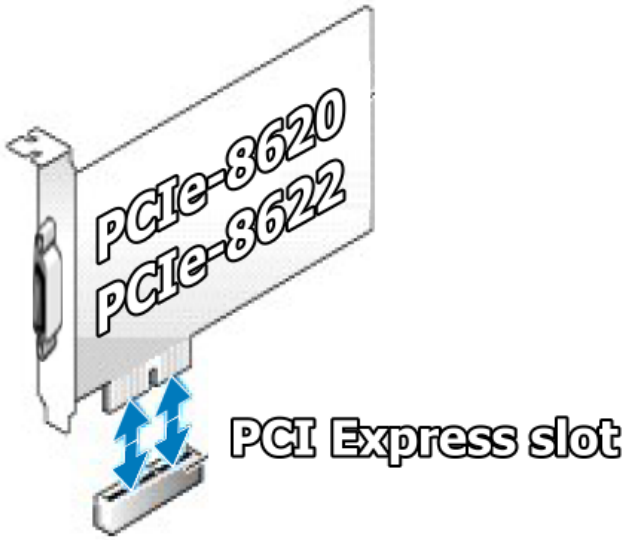
Step 6: Unscrew and remove the PCI Express slot cover from the computer case.

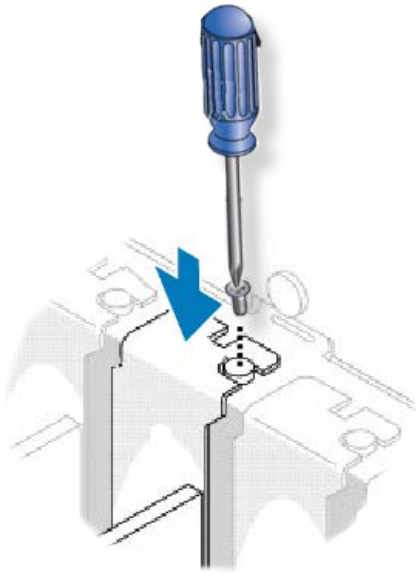




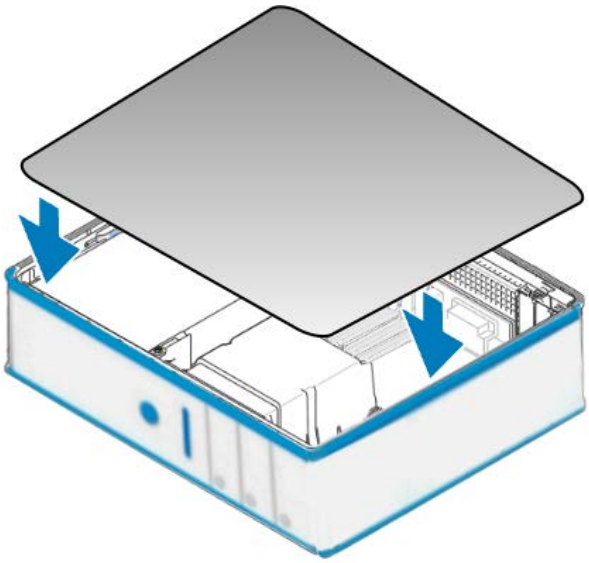
Step 7: Remove the connector cover from the PCIe-LM4 board.

Step 8: Carefully insert the PCIe-LM4 board into the PCI Express slot by gently pushing down on both sides of the card until it slides into the PCI connector.





Step 9: Confirm that the card is correctly inserted in the motherboard, and then secure the PCIe-LM4 board in place using the retaining screw that was removed in Step 6.



Step 10: Replace the covers on the computer.

Step 11: Re-attach any cables, insert the power cord and then switch on the power to the computer.

Once the computer reboots, follow any message prompts that may be displayed to complete the Plug and Play installation procedure. Refer to Chapter 4 Software Installation for more information.

4 Software Installation

This chapter provides a detailed description of the process for installing the driver for the PCIe-862x Series board as well as how to verify whether the PCIe-862x Series board was properly installed. PCIe-862x Series cards can be used on DOS, Linux and Windows 2000 and 32/64-bit versions of Windows XP/2003/2008/7/8 based systems, and the drivers are fully Plug and Play compliant for easy installation.

4.1 Obtaining/Installing the Driver Installer Package

The driver installation package for PCIe-LM4 Series board can be found on the companion CD-ROM, or can be obtained from the ICP DAS FTP web site. Install the appropriate driver for your operating system. The location and website addresses for the installation package are indicated below.

➢ **PCIe-LM4 Driver/SDK**

Operating System	**Windows 2000, 32/64-bit Windows XP, 32/64-bit Windows 2003, 32/64-bit Windows 7, 32/64-bit Windows 2008, and 32/64-bit Windows 8**
Driver Name	**PCIe-LM4 Driver/SDK (pcie-lm4_win_setup_xxxx.exe)**
Web site	http://www.icpdas.com/en/download/index.php?model=PCIe-LM4
Installing Procedure	To install the PCIe-LM4 driver, follow the procedure described below. **Step 1:** Double-click the **PCIe-LM4_Win_Setupxxx.exe** icon to begin the installation process. **Step 2:** When the "Welcome to the ICP DAS PCIe-LM4 Driver Setup Wizard" screen is displayed, click the **"Next>"** button to start the installation.

Installation Procedure	**Step 3:** On the “Information” screen, verify that the DAQ card is included in the list of supported devices, then click the **“Next>”** button. **Step 4:** On the “Select Destination Location” screen, click the **“Next>”** button to install the software in the default folder, **C:\ICPDAS\PCIe-LM4**. **Step 5:** On the “Select Components” screen, verify that the DAQ Card is in the list of device, and then click the **“Next>”** button to continue. **Step 6:** On the “Select Additional Tasks” screen, click the **“Next>”** button to continue. **Step 7:** On the “Download Information” screen, click the **“Next>”** button to continue. **Step 8:** Once the installation has completed, click **“No, I will restart my computer later”**, and then click the **“Finish”** button. For more detailed information about how to install the driver, refer to “Section 2.2 Install PCIe-LM4 Driver DLL” of the Software Manual, which can be downloaded from: http://www.icpdas.com/en/download/index.php?model=PCIe-LM4

4.2 Plug and Play Driver Installation

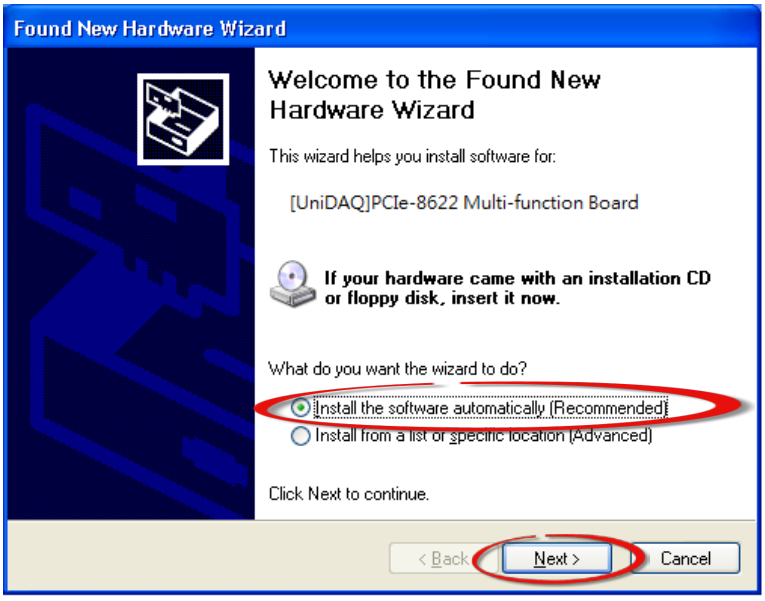
Step 1: Correctly shut down and power off your computer and disconnect the power supply, and then install the PCIe-LM4 Series board into the computer.

For detailed information about the hardware installation of the PCIe-LM4 Series board, refer to Chapter 3 Hardware Installation.

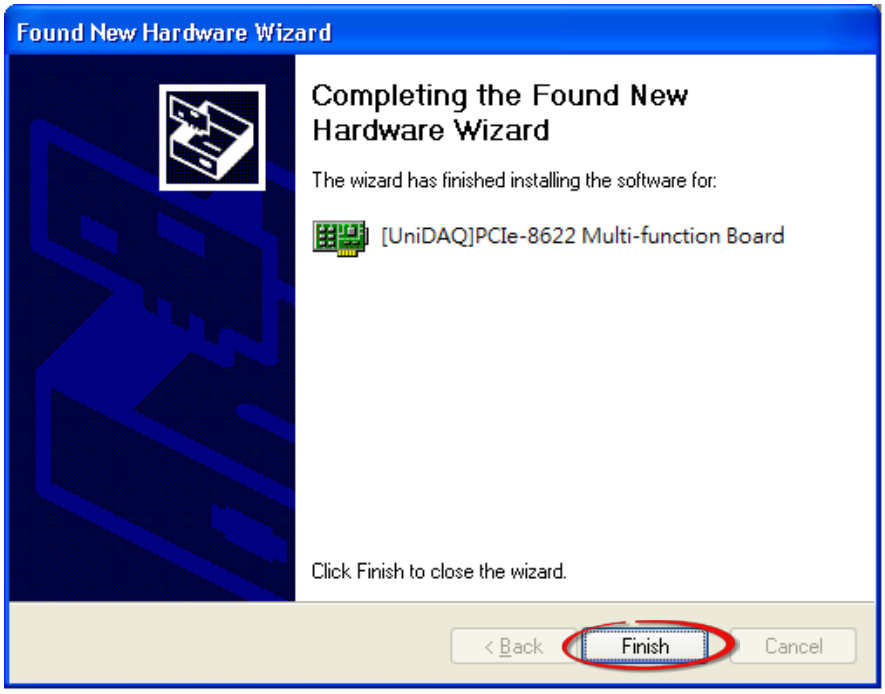
Step 2: Power on the computer and complete the Plug and Play installation**.**

Note: More recent operating systems, such as Windows 7/8/10 will automatically detect the new hardware and install the necessary drivers etc., so Steps 3 to 5 can be skipped.

Step 3: Select **"Install the software automatically [Recommended]"** and click the **"Next>"** button.



Step 4: Click the **"Finish"** button.



Step 5: Windows pops up **"Found New Hardware"** dialog box again.

4.3 Verifying the Installation

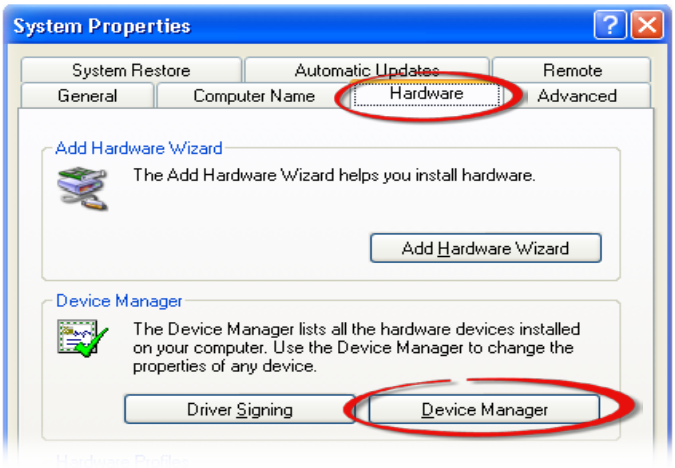
To verify that the driver was correctly installed, use the Windows **Device Manager** to view and update the device drivers installed on the computer, and to ensure that the hardware is operating correctly. The following is a description of how access the Device Manager in each of the major versions of Windows. Refer to the appropriate description for the specific operating system to verify the installation.

4.3.1 Accessing Windows Device Manager

➢ Windows 2000/XP

Step 1: Click the "**Start"** button and then point to "**Settings" and click** "**Control Panel**". Double-click the "**System**" icon to open the **"System Properties"** dialog box.

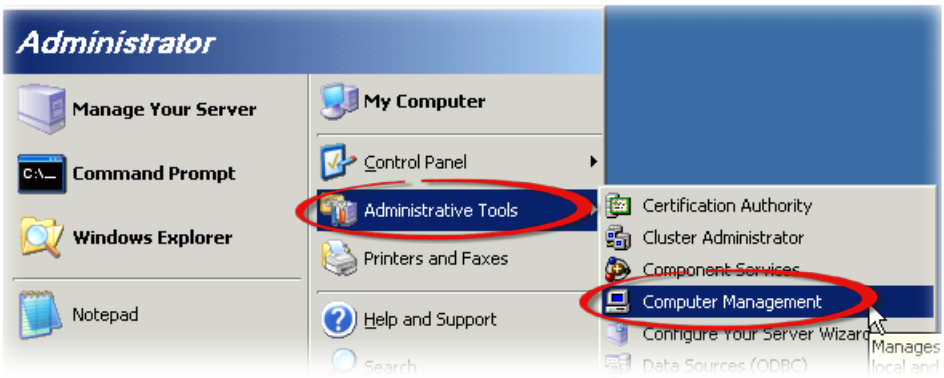
Step 2: Click the "**Hardware**" tab and then click the "**Device Manager**" button.



➢ Windows Server 2003

Step 1: Click the **"Start"** button and point to **"Administrative Tools"**, and then click the **"Computer Management"** option.

Step 2: Expand the **"System Tools"** item in the console tree, and then click **"Device Manager"**.



➢ Windows 7

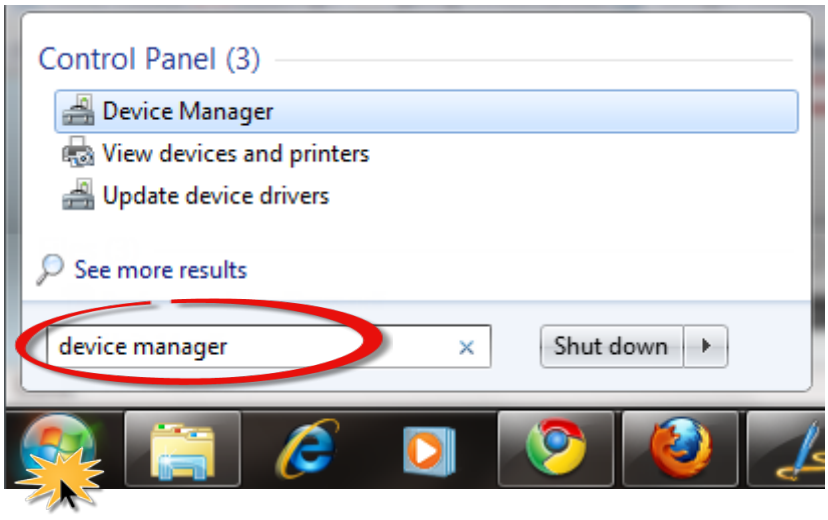
Step 1: Click the **"Start"** button, and then click **"Control Panel"**.

Step 2: Click **"System and Maintenance"**, and then click **"Device Manager"**.

Alternatively,

Step 1: Click the **"Start"** button.

Step 2: In the **Search field,** type **Device Manager** and then press Enter.



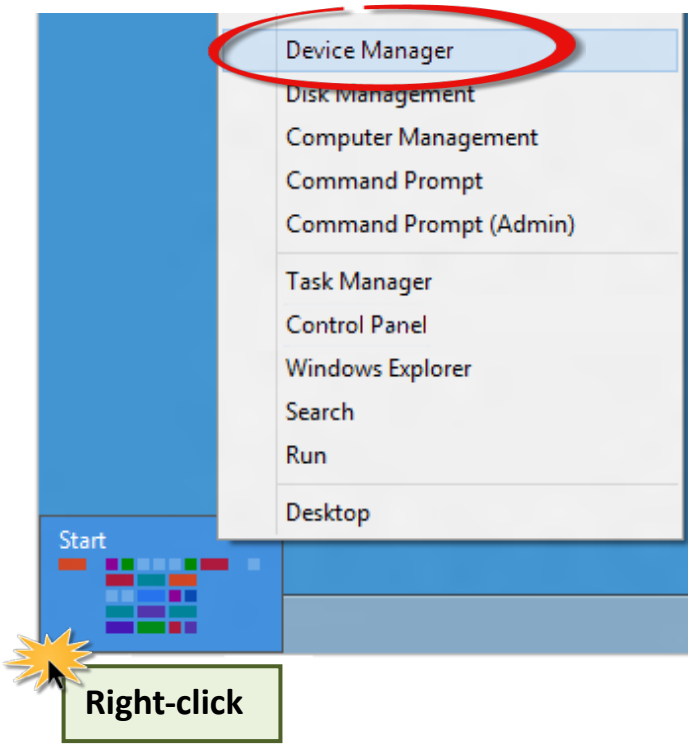
Note that Administrator privileges are required for this operation. If you are prompted for an administrator password or confirmation, enter the password or provide confirmation by clicking the "Yes" button in the User Account Control message.

➢ Windows 8

Step 1: To display the **Start screen icon** from the desktop view, hover the mouse cursor over the **bottom-left corner** of screen.

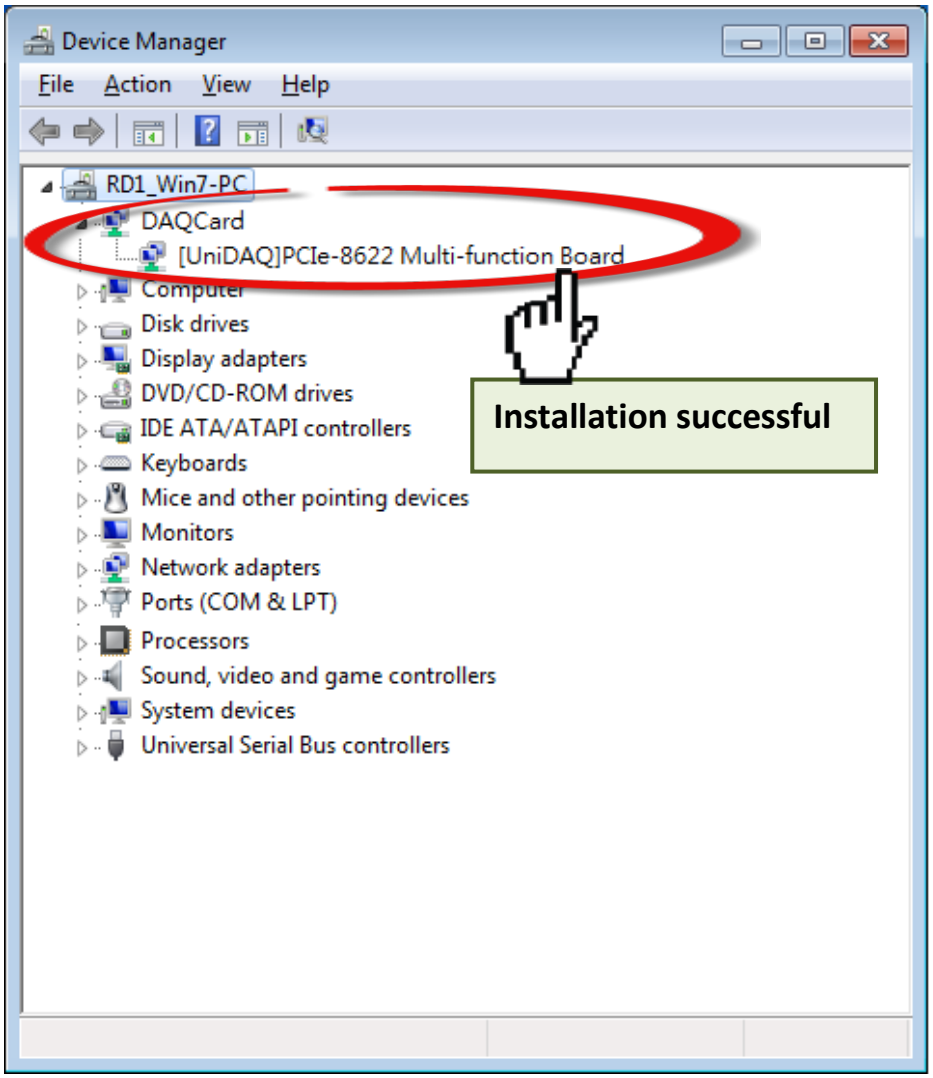
Step 2: **Right-click** the Start screen icon and then click "**Device Manager"**.

Alternatively, press **[Windows Key] +[X]** to open the Start Menu, and then select Device Manager from the options list.



4.3.2 Check the Installation

Check that the PCIe-LM4 Series board is correctly listed in the Device Manager, as illustrated below.



5 Calibration

5.1 Introduction

When shipped from the factory, the PCIe-LM4 Series board is already fully calibrated, including the calibration coefficients that are stored in the onboard EEPROM. For a more precise application of voltages in the field, the procedure described below provides a method that allows the board installed in a specific system to be calibrated so that the correct voltages can be achieved for the field connection. This calibration allows the effects of voltage drops caused by IR loss in the cable and/or the connector to be eliminated.

At first the user has to prepare the equipment for calibration: the precise multi-meter. The calibration procedure will be demonstrated below:

5.2 Step-by-Step Calibration Process

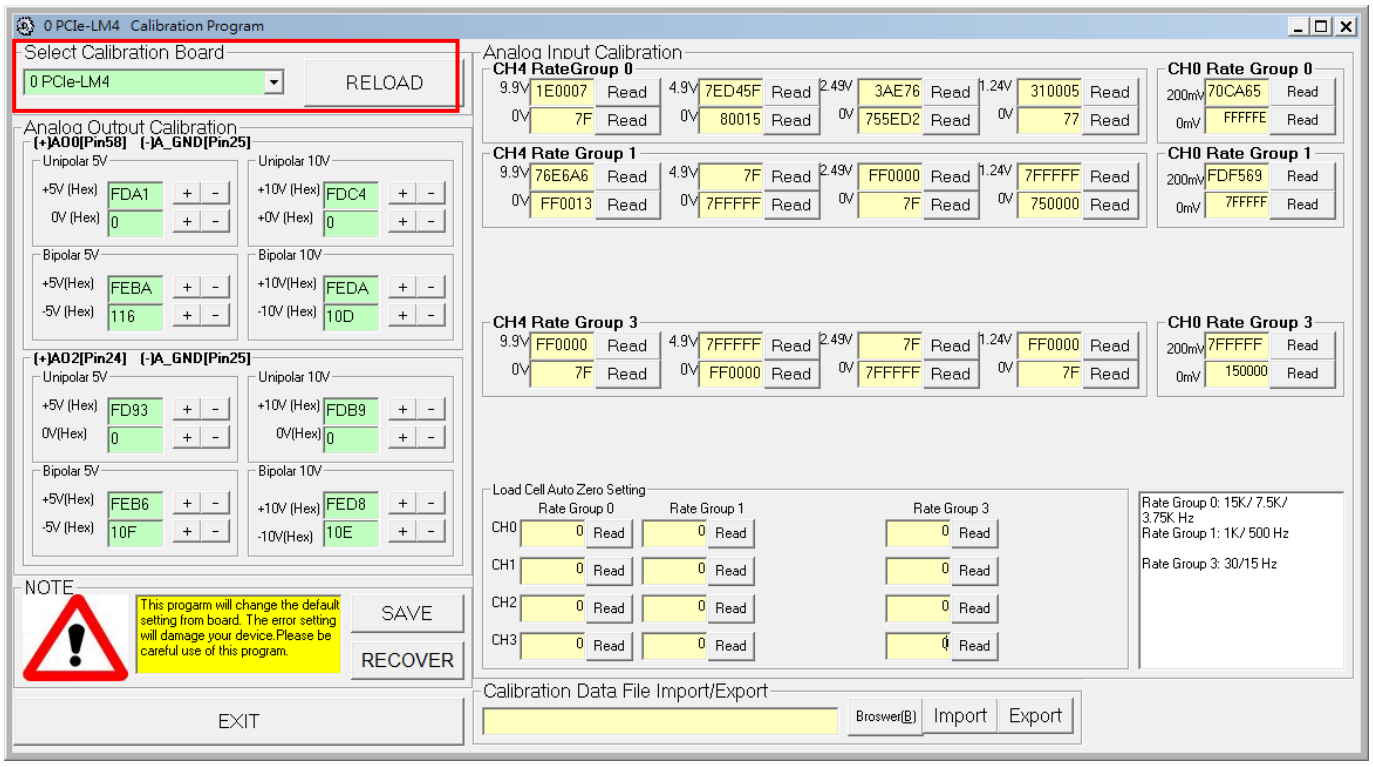
The following is a step-by-step description of the calibration process using the Windows Calibration Program for the PCIe-LM4, which can be downloaded form:
http://www.icpdas.com/en/download/index.php?model=PCIe-LM4

5.2.1 PCIe-LM4 Calibration Step

Step 1: Select calibration board

(1) Select **"0 PCIe-LM4"** from the **"Select Calibration Board"** drop-down menu.

(2) Click the **"RELOAD"** button.

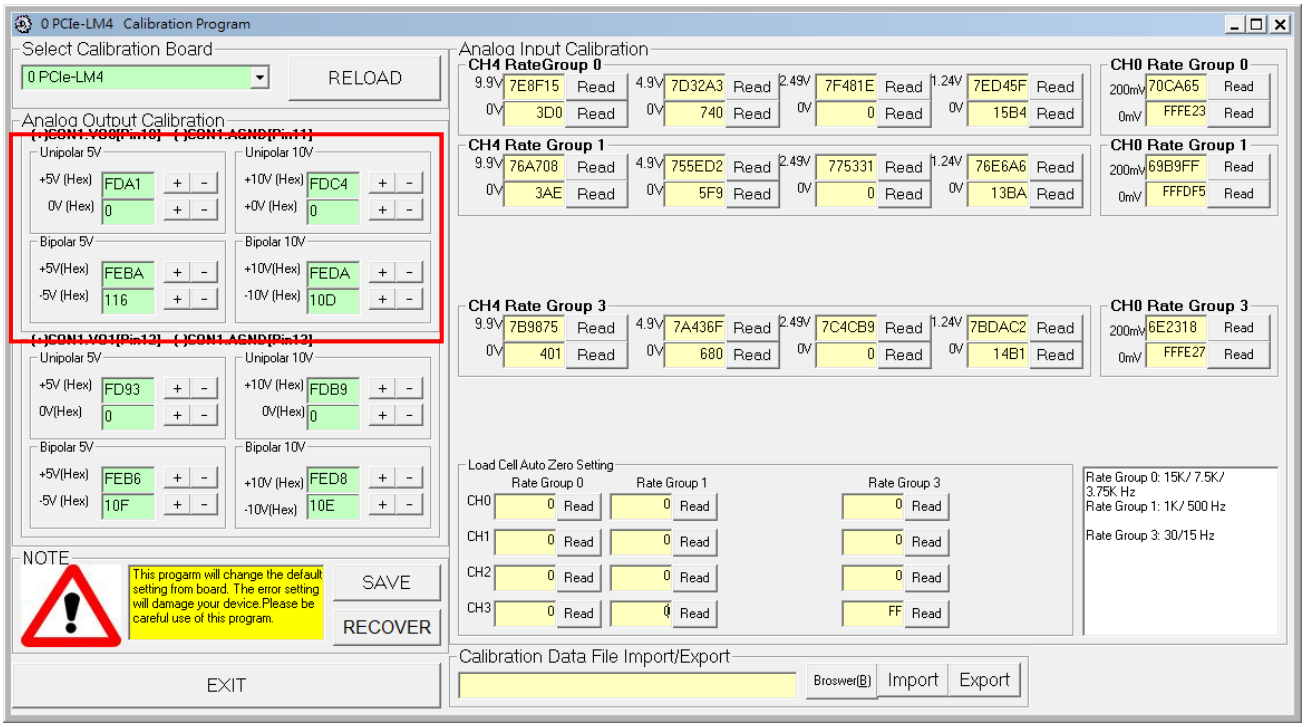


Step 2: Calibrate the Analog Output Channel 0

(1) Connect the meter to measure the voltage from channel 0

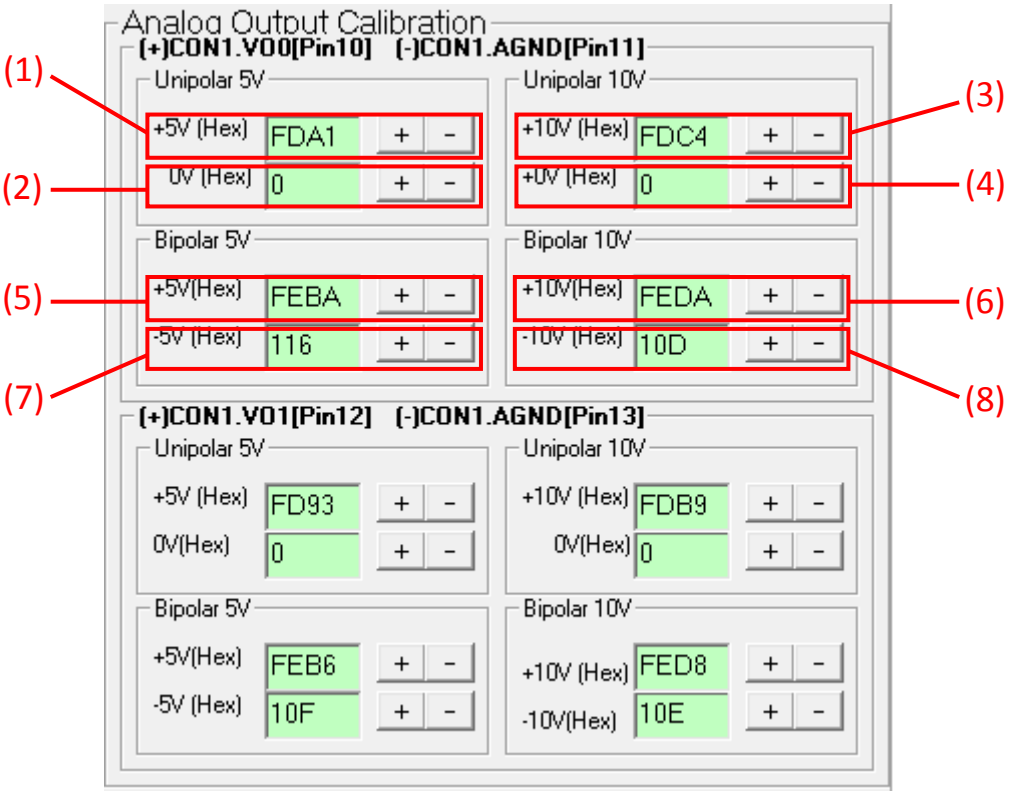
(2) Connect meter(+) to PCIe-LM4.CON1.VO0 (Pin10)

(3) Connect meter(-) to PCIe-LM4.CON1.AGND (Pin11)



Step 3: Calibrate the Unipolar 5 V, Unipolar 10 V, Bipolar 5 V and Bipolar 10 V for Analog Output Channel 0

(1) Use button **"+"** or **"-"** and adjust output voltage to voltage 5 V.
(2) Use button **"+"** or **"-"** and adjust output voltage to voltage 0 V.
(3) Use button **"+"** or **"-"** and adjust output voltage to voltage 10 V.
(4) Use button **"+"** or **"-"** and adjust output voltage to voltage 0 V.
(5) Use button **"+"** or **"-"** and adjust output voltage to voltage 5 V.
(6) Use button **"+"** or **"-"** and adjust output voltage to voltage -5 V.
(7) Use button **"+"** or **"-"** and adjust output voltage to voltage 10 V.
(8) Use button **"+"** or **"-"** and adjust output voltage to voltage -10 V.

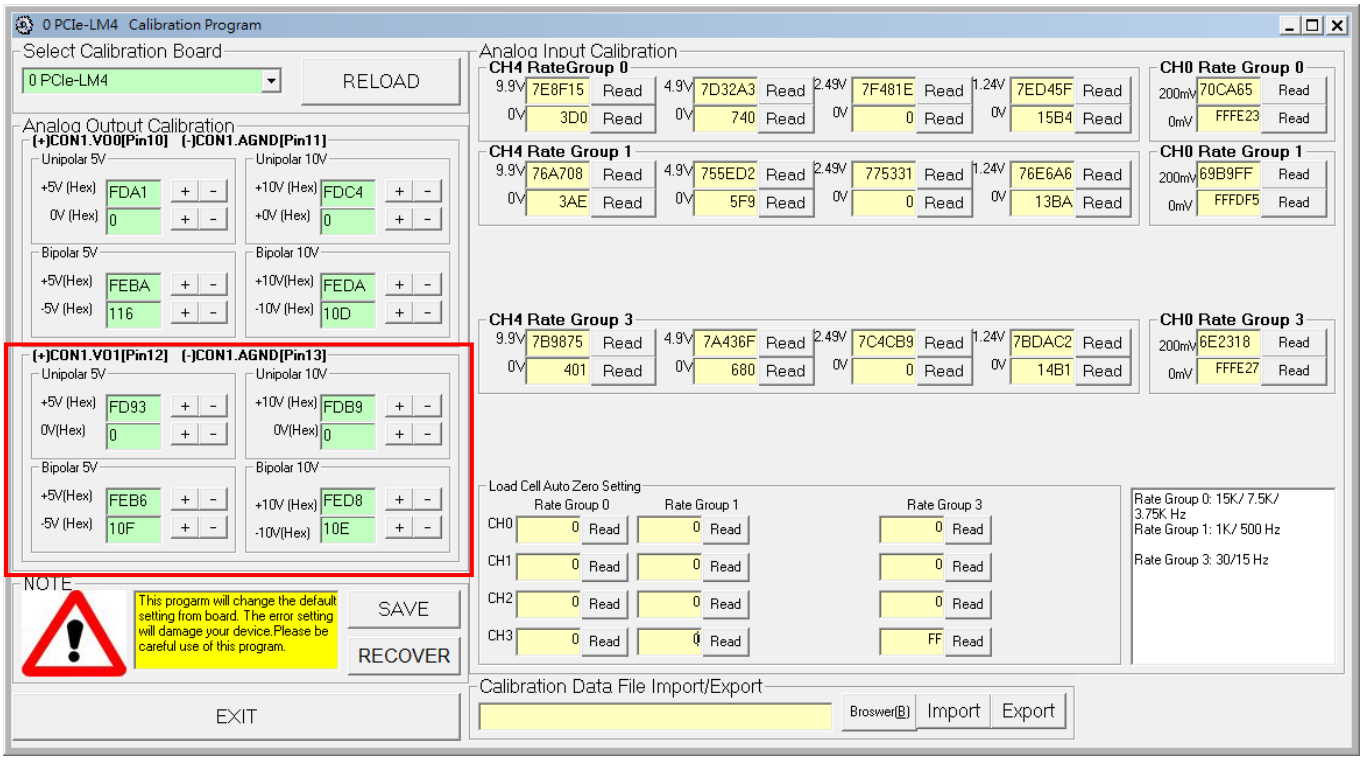


Step 4: Calibrate the Analog Output Channel 1

(1) Connect the meter to measure the voltage from channel 1

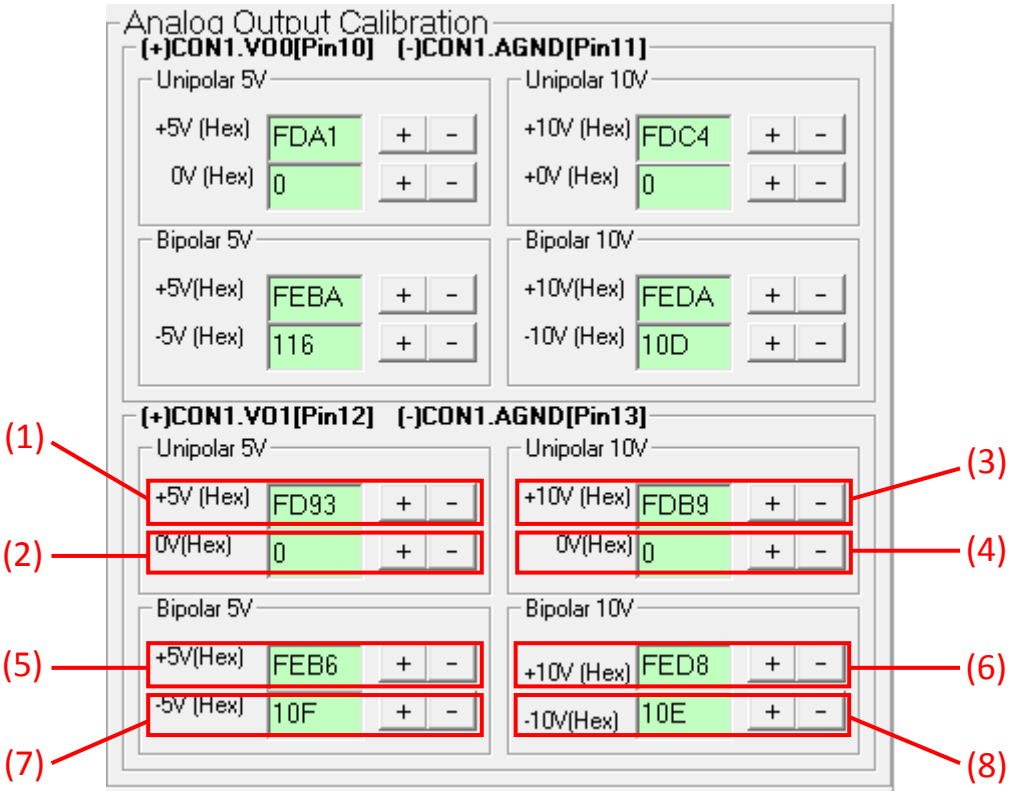
(2) Connect meter(+) to PCIe-LM4.CON1.VO1 (Pin12)

(3) Connect meter(-) to PCIe-LM4.CON1.AGND (Pin13)

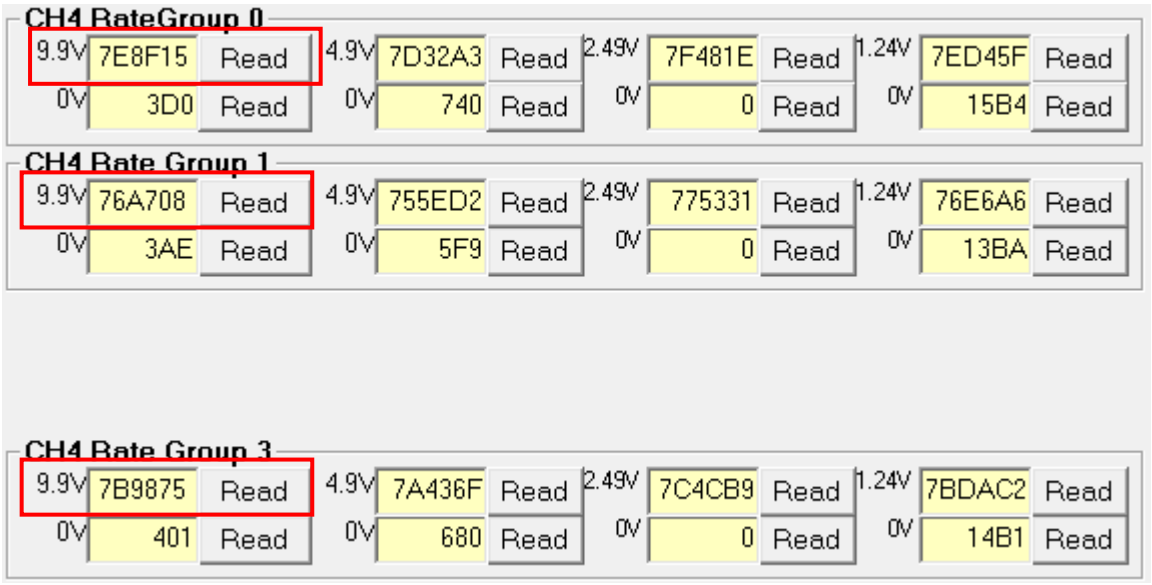


Step 5: Calibrate the Unipolar 5 V, Unipolar 10 V, Bipolar 5 V and Bipolar 10 V for Analog Output Channel 1

(1) Use button **"+"** or **"-"** and adjust output voltage to voltage 5 V.
(2) Use button **"+"** or **"-"** and adjust output voltage to voltage 0 V.
(3) Use button **"+"** or **"-"** and adjust output voltage to voltage 10 V.
(4) Use button **"+"** or **"-"** and adjust output voltage to voltage 0 V.
(5) Use button **"+"** or **"-"** and adjust output voltage to voltage 5 V.
(6) Use button **"+"** or **"-"** and adjust output voltage to voltage -5 V.
(7) Use button **"+"** or **"-"** and adjust output voltage to voltage 10 V.
(8) Use button **"+"** or **"-"** and adjust output voltage to voltage -10 V.

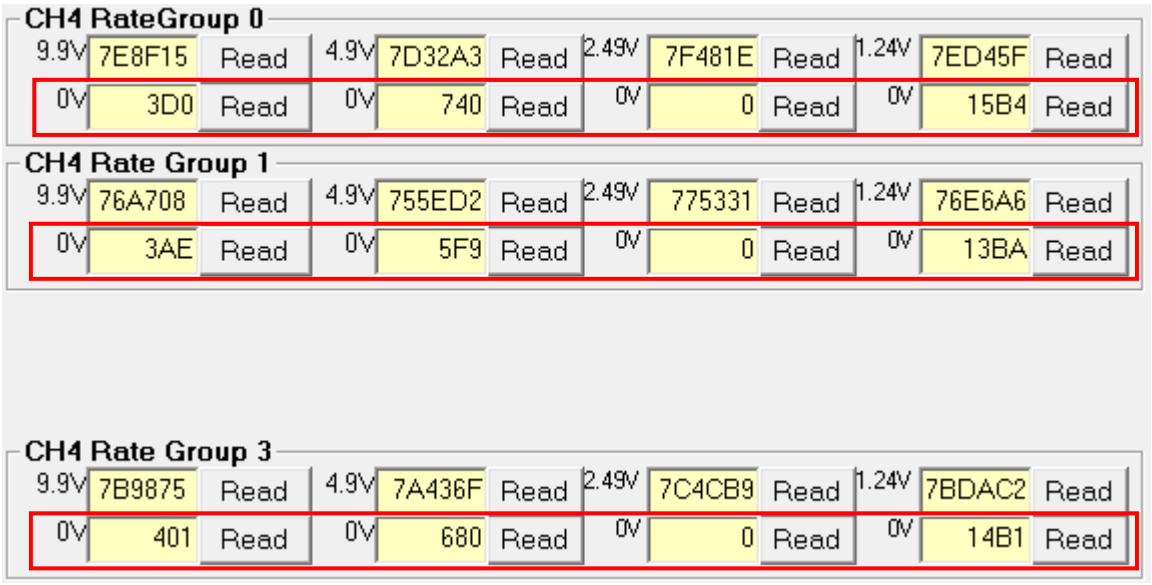


Step 6: Calibrate the Analog Input Channel 4 to 9.9V



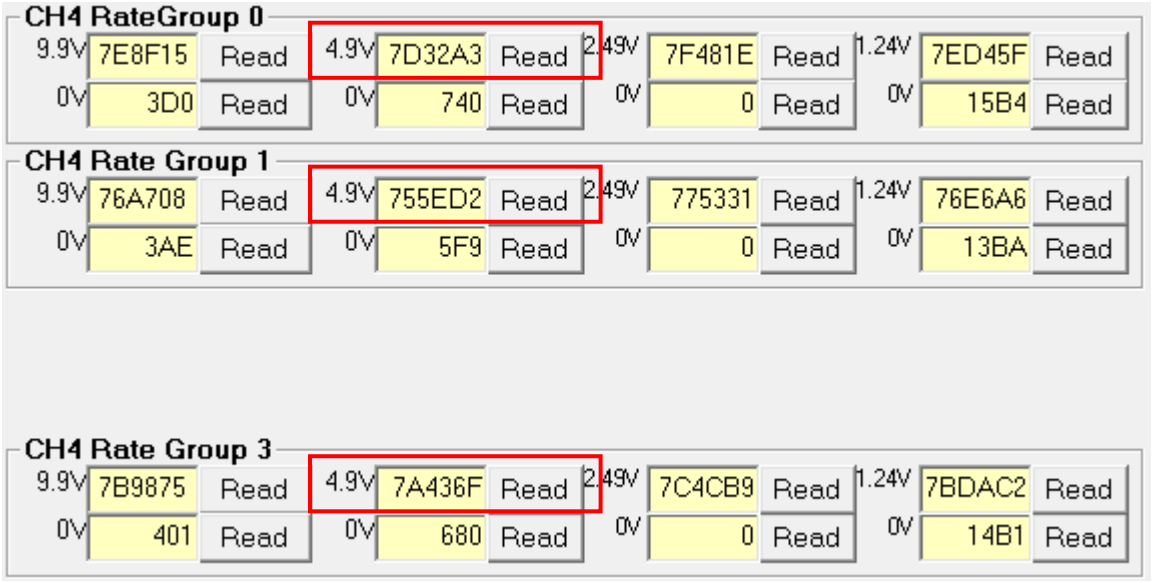
(1) Connect 9.9 V voltage source to PCIe-LM4.CON1.AI4+ (Pin14)
(2) Connect GND source to PCIe-LM4.CON1.A14- (Pin48)
(3) Click CH4 Rate Group 0 **"Read"** button to get hexadecimal value
(4) Click CH4 Rate Group 1 **"Read"** button to get hexadecimal value
(5) Click CH4 Rate Group 3 **"Read"** button to get hexadecimal value

Step 7: Calibrate the Analog Input Channel 4 to 0V



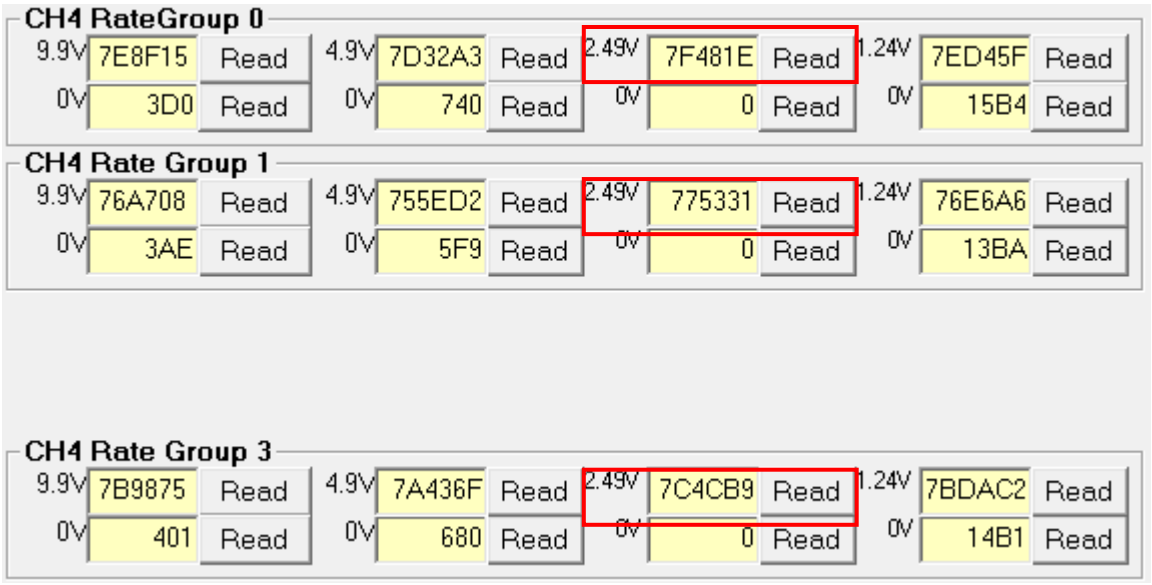
(1) Connect 0 V voltage source to PCIe-LM4.CON1.AI4+ (Pin14)
(2) Connect GND source to PCIe-LM4.CON1.AI4- (Pin48)
(3) Click CH4 Rate Group 0 **"Read"** button to get hexadecimal value
(4) Click CH4 Rate Group 1 **"Read"** button to get hexadecimal value
(5) Click CH4 Rate Group 3 **"Read"** button to get hexadecimal value

Step 8: Calibrate the Analog Input Channel 4 to 4.9V



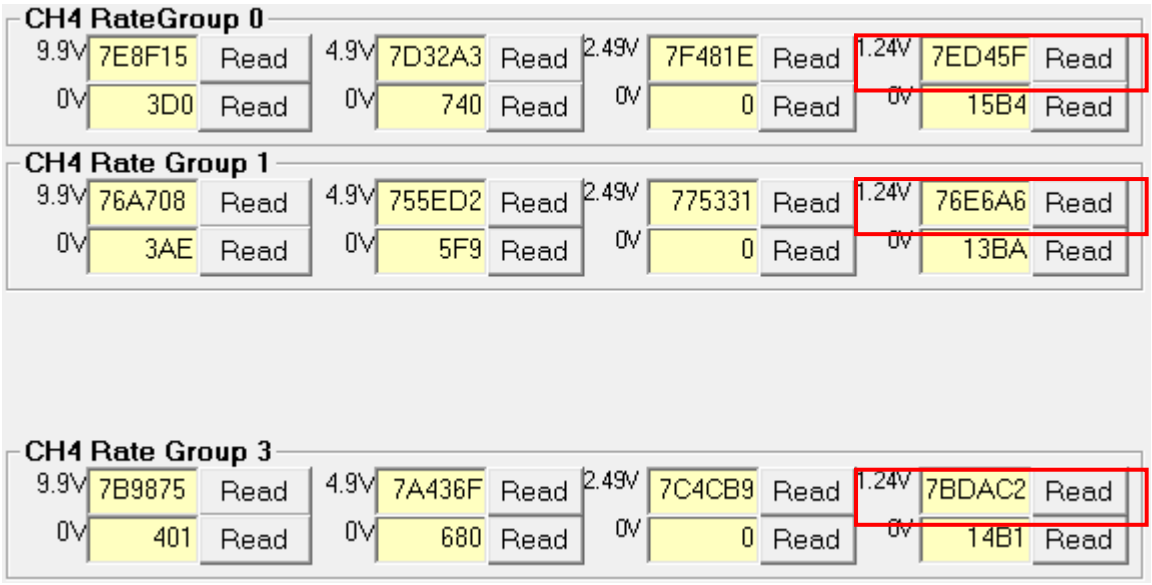
(1) Connect 4.9 V voltage source to PCIe-LM4.CON1.AI4+ (Pin14)
(2) Connect GND source to PCIe-LM4.CON1.AI4- (Pin48)
(3) Click CH4 Rate Group 0 **"Read"** button to get hexadecimal value.
(4) Click CH4 Rate Group 1 **"Read"** button to get hexadecimal value.
(5) Click CH4 Rate Group 2 **"Read"** button to get hexadecimal value.

Step 9: Calibrate the Analog Input Channel 4 to 2.49V



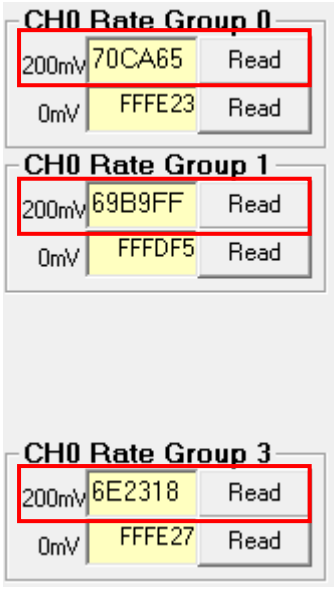
(1) Connect 2.49 V voltage source to PCIe-LM4.CON1.AI4+ (Pin14)
(2) Connect GND source to PCIe-LM4.CON1.AI4- (Pin48)
(3) Click CH4 Rate Group 0 **"Read"** button to get hexadecimal value
(4) Click CH4 Rate Group 1 **"Read"** button to get hexadecimal value
(5) Click CH4 Rate Group 3 **"Read"** button to get hexadecimal value

Step 10: Calibrate the Analog Input Channel 4 to 1.24V



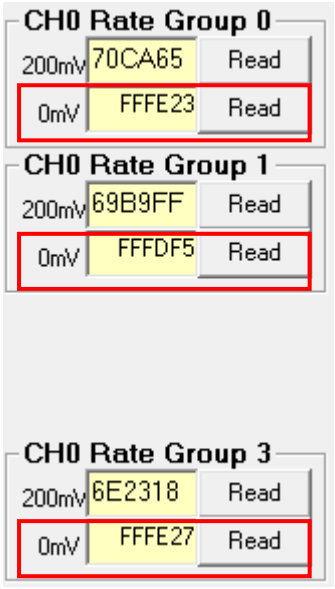
(1) Connect 1.24 V voltage source to PCIe-LM4.CON1.AI4+ (Pin14)
(2) Connect GND source to PCIe-LM4.CON1.AI4- (Pin48)
(3) Click CH4 Rate Group 0 **"Read"** button to get hexadecimal value
(4) Click CH4 Rate Group 1 **"Read"** button to get hexadecimal value
(5) Click CH4 Rate Group 3 **"Read"** button to get hexadecimal value

Step 11: Calibrate the Analog Input Channel 0(Load Cell) to 200 mV



(1) Connect 200 mV Loadcell source to PCIe-LM4.Analog input channel 0(Load Cell),
Note: About signal connection , please refer to Sec. 2.2.4
(2) Click CH0 Rate Group 0**"Read"** button to get hexadecimal value
(3) Click CH0 Rate Group 1**"Read"** button to get hexadecimal value
(4) Click CH0 Rate Group 2**"Read"** button to get hexadecimal value

Step 12: Calibrate the Analog Input Channel 0(Load Cell) to 200 mV



(1) Connect 0 mV Loadcell source to PCIe-LM4.Analog input channel 0(Load Cell),
Note: About signal connection , please refer to Sec. 2.2.4
(2) Click CH0 Rate Group 0**"Read"** button to get hexadecimal value
(3) Click CH0 Rate Group 1**"Read"** button to get hexadecimal value
(4) Click CH0 Rate Group 3**"Read"** button to get hexadecimal value

6 Windows API Function

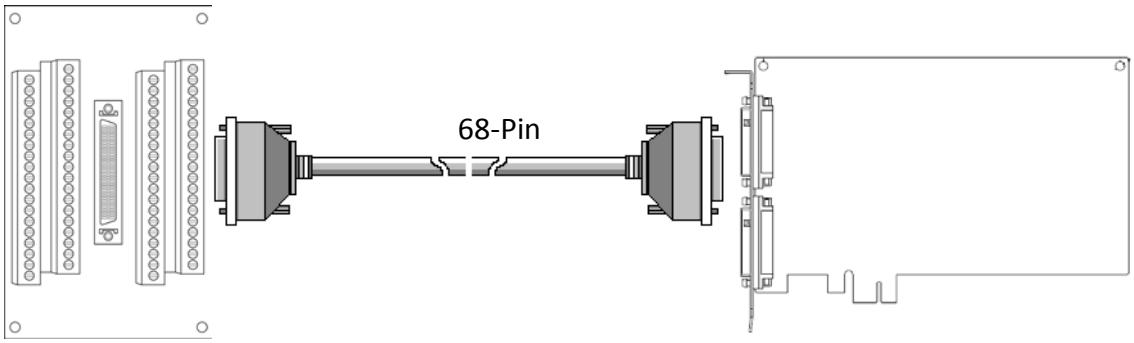
For more details regarding the Windows API Functions for the PCIe-LM4 Series board, refer to UniDAQ SDK User manual, which can be downloaded from:

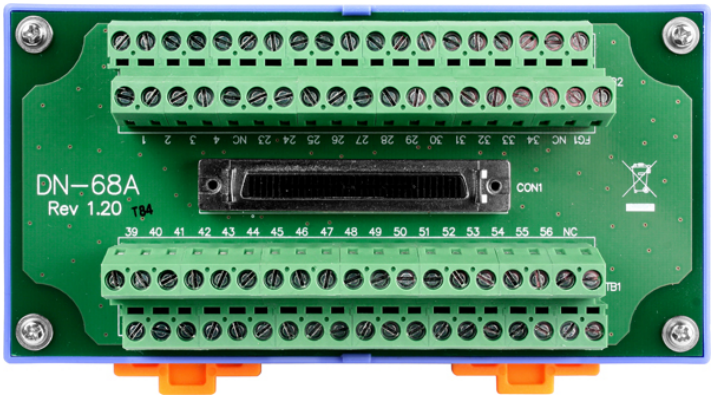
http://www.icpdas.com/en/download/index.php?model=PCIe-LM4

Appendix A: Daughter Boards

DN-68A

The DN-68A is a general-purpose DIN-Rail mountable daughter board containing female 68 pin D-sub I/O Connectors and is designed to allow easy field wiring connections.





Pins 01 to 68 on the DN-68A daughter board are connected to the CON1 connector on the PCIe-LM4 using a 68-pin male-male cable.
The FG on the DN-68A is connected to the shielding wire of the 68-pin cable.

Appendix B: Revision history

This chapter provides revision history information to this document.

The table below shows the revision history.

Revision	Date	Description
1.0	2020.01.08	Initial issue