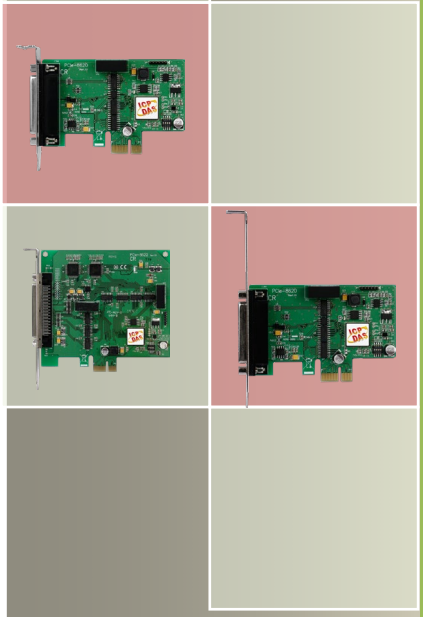

PCI-AD64 User Manual

1 MS/s, 64-ch, 16-bit Analog Input Board Version 1.1, Feb. 2023

SUPPORT

This manual relates to the following boards: PCI-AD64SU.

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

ICP DAS assumes no liability for damages consequent to the use of this product. ICP DAS reserves the right to change this manual at any time without notice. The information furnished by ICP DAS is believed to be accurate and reliable. However, no responsibility is assumed by ICP DAS for its use, nor for any infringements of patents or other rights of third parties resulting from its use.

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CONTACT US

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

TABLE OF CONTENTS

Packing List

The shipping package should contain the following items:

	One Analog Input board:
	PCI-AD64SU
	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

PCI-AD64SU is a high-resolution high channel count analog input card for the Universal PCI bus. Its sampling rate is up to 1 MS/s and 16-bit resolution provides the power needed for most data acquisition applications. PCI-AD64SU provides 64 single-ended, 32 differential analog input channels. It also has built in a 4k-sample FIFO buffer for analog input data.

The PCI-AD64SU also includes an onboard Card ID that enables the board to be recognized via software if two or more PCI-AD64SU cards are installed in the same 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

- Universal PCI (3.3 V/5 V) Interface
- Card ID switch
- Software Calibration

Analog Input

- 64 Single-ended/32 Differential Analog Input Channels
- 16-bit ADC with Max. 1 MS/s Sampling Rate
- 4096-sample Hardware FIFO for Analog Input
- AD Trigger Mode: Software, Pacer
- AD Data Transfer: Polling, Interrupt

1.3 Specifications

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

Model	PCI-AD64SU
Analog Input	
Channels	64 Single-ended/ 32 differential
A/D Converter	16-bit, 10 µs conversion time
Sampling Rate	Fixed channel: 1 MS/s (Max.) Scan channel: 250 kS/s (Max.)
Over voltage Protection	Continuous +/-35 Vp-p
Input Impedance	10,000 MΩ/4pF
Trigger Modes	Software, Pacer
Data Transfer	Polling, Interrupt
Accuracy	0.05 % of FSR ±1 LSB @ 25 °C, ± 10 V
Input Range	±10 V, ±5 V, ±2.5 V
FIFO Size	4096 Samples
General	
Bus Type	3.3 V/5 V Universal PCI, 32-bit, 33 MHz
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	146 x 120.5 x 21.6
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

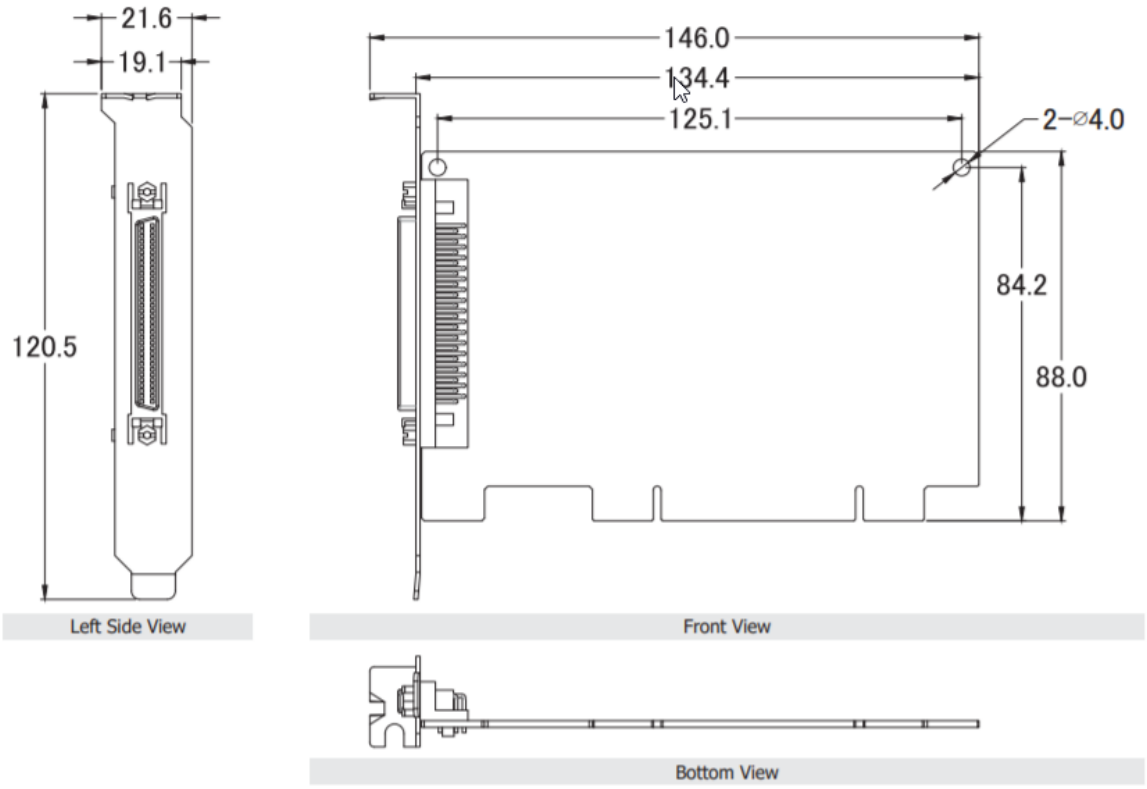
- Signal Analysis
- FFT and Frequency Analysis
- Transient Analysis
- Temperature Monitor
- Vibration Analysis
- Energy Management
- Other Industrial and Laboratory Measurement and Control

2 Hardware Configuration

2.1 Board Layout

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

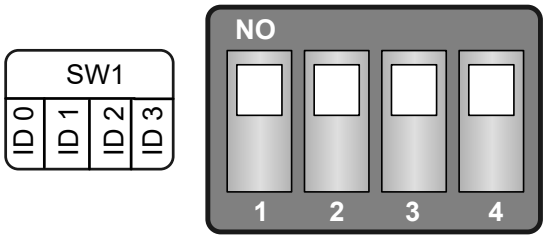
➢ **PCI-AD64SU**



CON1	The Connector for Analog input and Analog Output. Refer to Section 2.8 Pin Assignments

2.2 Card ID Switch (SW1)

The PCI-AD64SU includes an onboard Card ID switch (SW1) that enables the board to be recognized via software if two or more PCI-AD64SU 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.



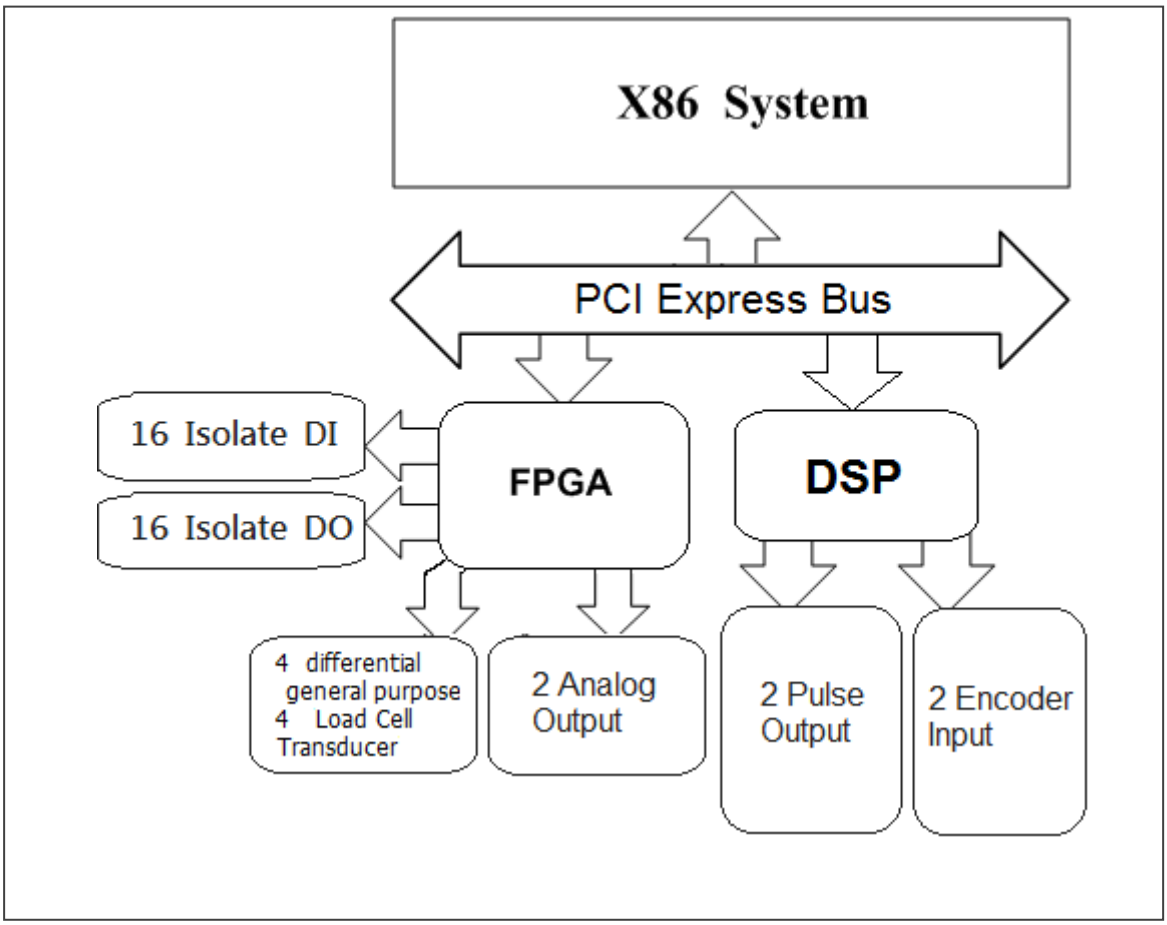
(Default Settings)

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

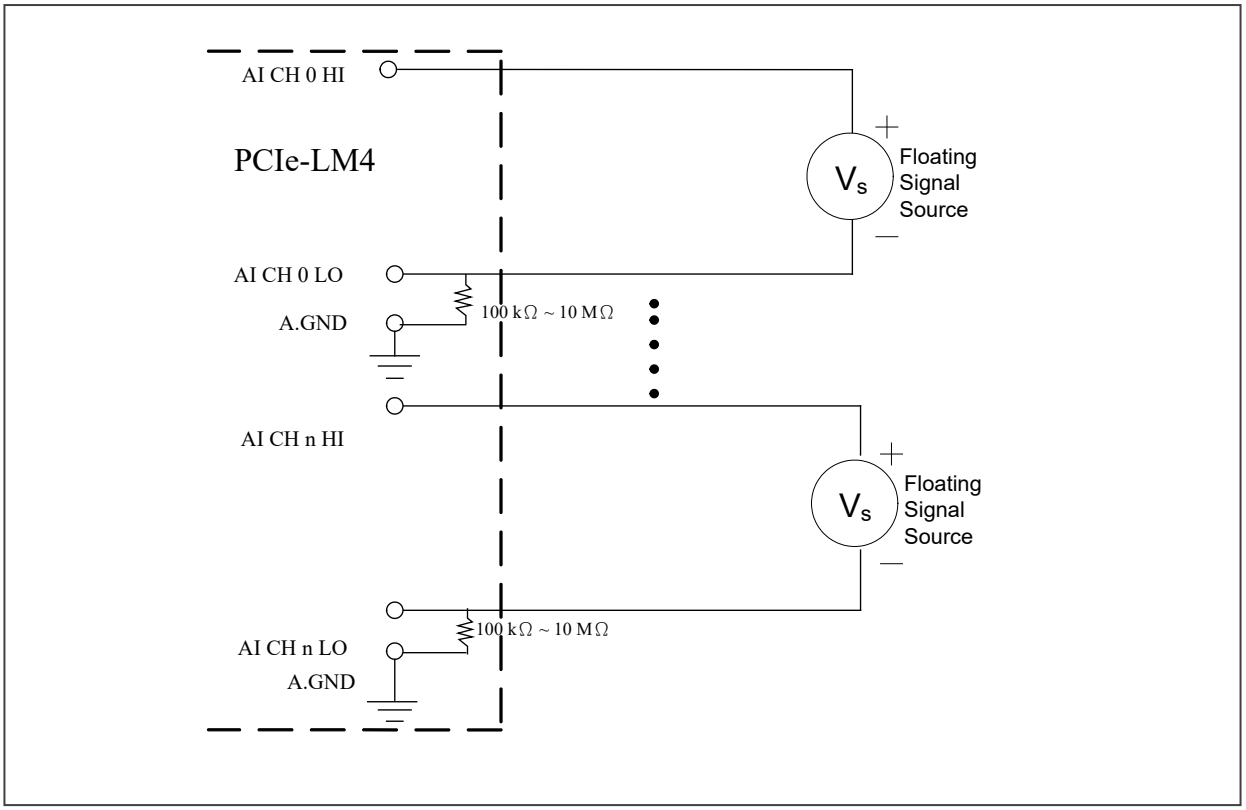
Input Range refers to the set of input voltages that an Analog Input channel can digitize with the specified accuracy. The PGA amplifies or attenuates the AI signal depending on the input range. User can individually program the input range of all channels on PCI-A64SU board.

Input rage affects the resolution of the PCI-A64SU 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)/65536	-10 V to 10 V	0.305 mV
	-5 V to 5 V	0.1525 mV
	-2.5 V to 2.5 V	0.0762 mV

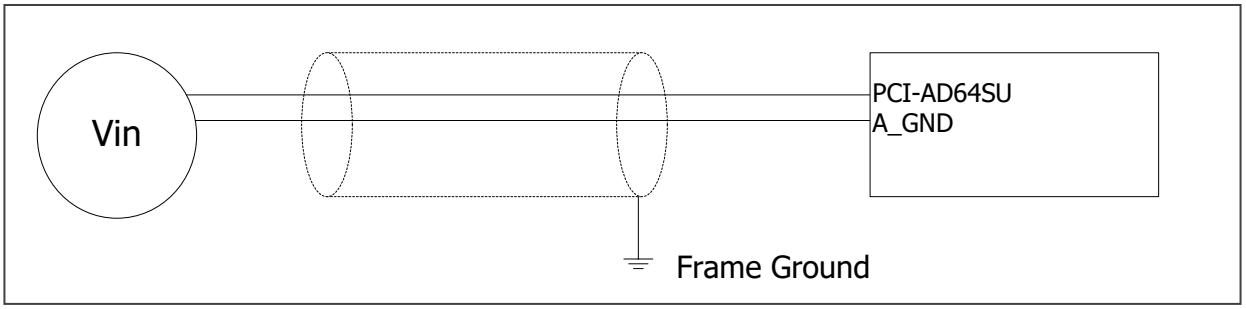
2.4.2 Connecting Analog Input Signals

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



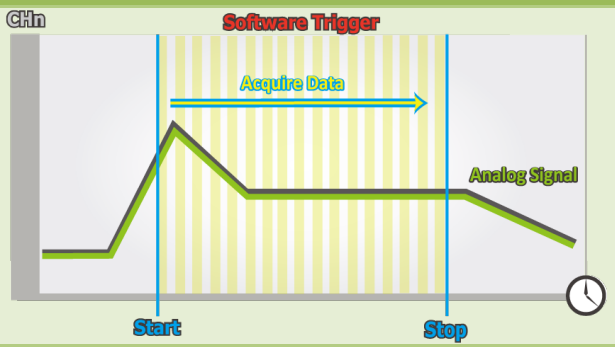
2.4.3 Signal Shielding

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



2.4.4 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 Pin Assignments

2.5.1 CON1 Connector of the PCI-AD64SU

Pin Assignment		Terminal		No.	Pin Assignment	
S.E.	Diff.				Diff.	S.E.
AI00	AI00+	68		34	AI00-	AI01
AI02	AI01+	67		33	AI01-	AI03
AI04	AI02+	66		32	AI02-	AI05
AI06	AI03+	65		31	AI03-	AI07
AI08	AI04+	64		30	AI04-	AI09
AI10	AI05+	63		29	AI05-	AI11
AI12	AI06+	62		28	AI06-	AI13
AI14	AI07+	61		27	AI07-	AI15
AGND		60		26	AGND	
AI16	AI08+	59		25	AI08-	AI17
AI18	AI09+	58		24	AI09-	AI19
AI20	AI10+	57		23	AI10-	AI21
AI22	AI11+	56		22	AI11-	AI23
AI24	AI12+	55		21	AI12-	AI25
AI26	AI13+	54		20	AI13-	AI27
AI28	AI14+	53		19	AI14-	AI29
AI30	AI15+	52		18	AI15-	AI31
AI32	AI16+	51		17	AI16-	AI33
AI34	AI17+	50		16	AI17-	AI35
AI36	AI18+	49		15	AI18-	AI37
AI38	AI19+	48		14	AI19-	AI39
AI40	AI20+	47		13	AI20-	AI41
AI42	AI21+	46		12	AI21-	AI43
AI44	AI22+	45		11	AI22-	AI45
AI46	AI23+	44		10	AI23-	AI47
AGND		43		9	AGND	
AI48	AI24+	42		8	AI24-	AI49
AI50	AI25+	41		7	AI25-	AI51
AI52	AI26+	40		6	AI26-	AI53
AI54	AI27+	39		5	AI27-	AI55
AI56	AI28+	38		4	AI28-	AI57
AI58	AI29+	37		3	AI29-	AI59
AI60	AI30+	36		2	AI30-	AI61
AI62	AI31+	35		1	AI31-	AI63

SCSI 68-pin/DB-68-pin

2.5.2 I/O Connector Signal Descriptions

Signal Name	Reference	Direction	Description
AI<0..31>+	**AI<0..31>-**	Input	**Analog Input channels 0 to 31.** For Differential measurements for general purpose analog inputs.
AI<0..63>+	**AGND**	Input	**Analog Input channels 0 to 63.** For Single-Ended measurements for general purpose analog inputs.
AGND	**-**	-	**Analog Input Ground.** These terminals are reference point for AI measurements.

3 Hardware Installation

Note:

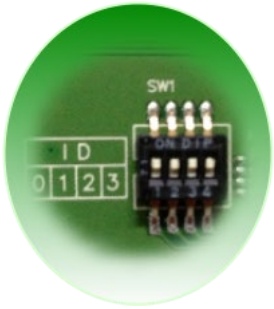
It is recommended that the driver is installed before installing the hardware as the computer may need to be restarted once the driver is installed in certain operating systems, such as Windows 2000 or Windows XP, etc. Installing the driver first helps reduce the time required for installation and restarting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

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

Step 1: Install the driver for the I/O board on your computer.

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

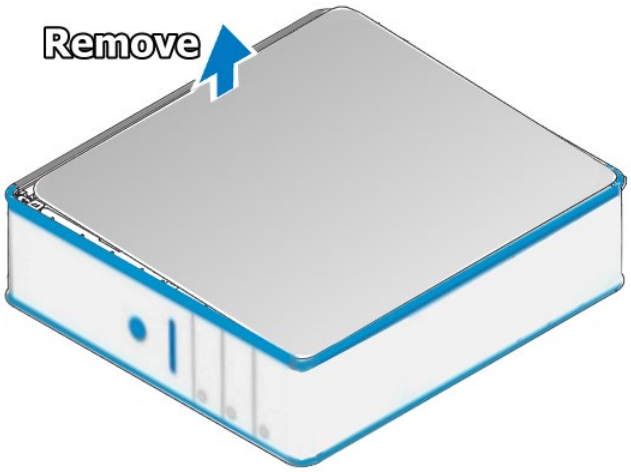
Step 2: Configure the Card ID using the DIP Switch (SW1).



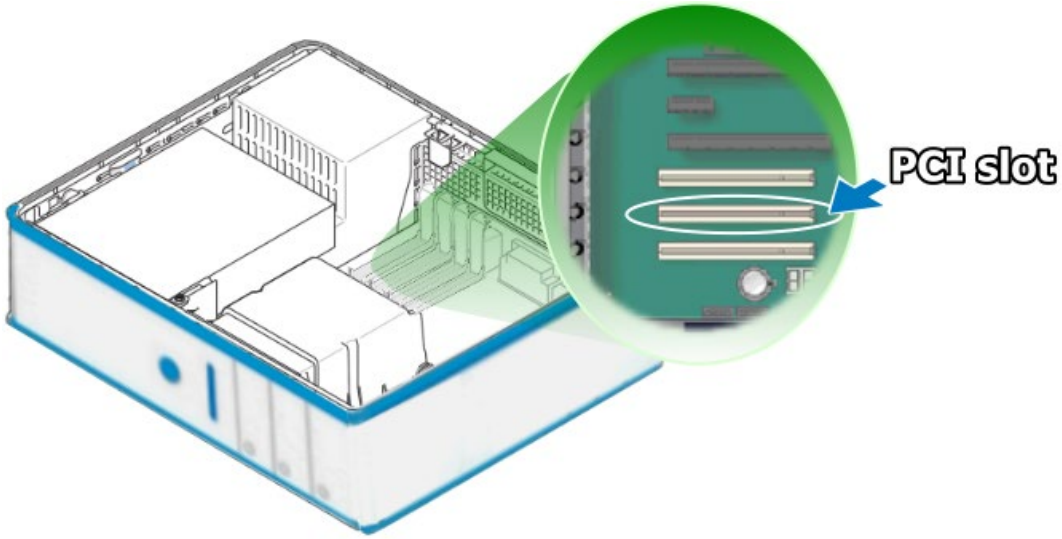
For detailed information about the Card ID, refer to Section 2.2 Card ID Switch (SW1).

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

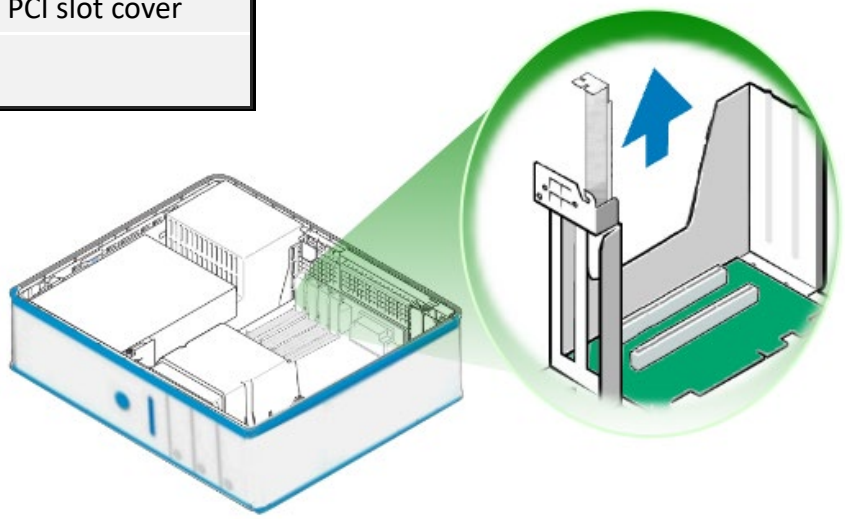
Step 4: Remove the cover from the computer.

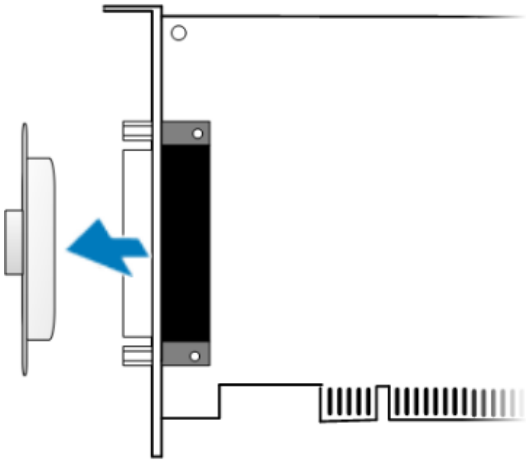


Step 5: Select a vacant PCI slot.



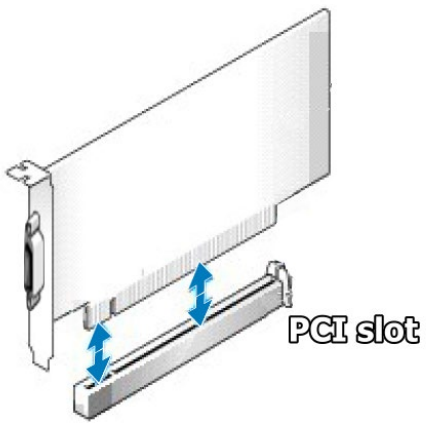
Step 6: Unscrew and remove the PCI slot cover from the computer case.

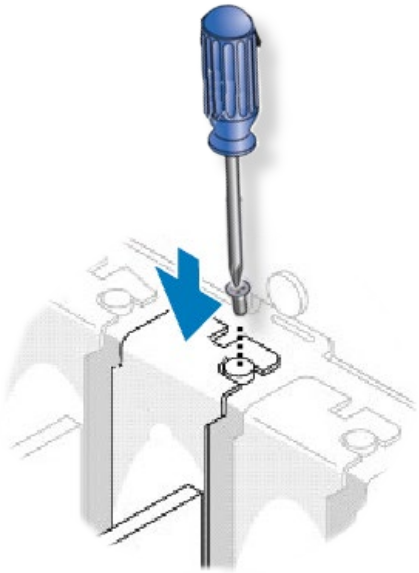




Step 7: Remove the connector cover from the I/O board.

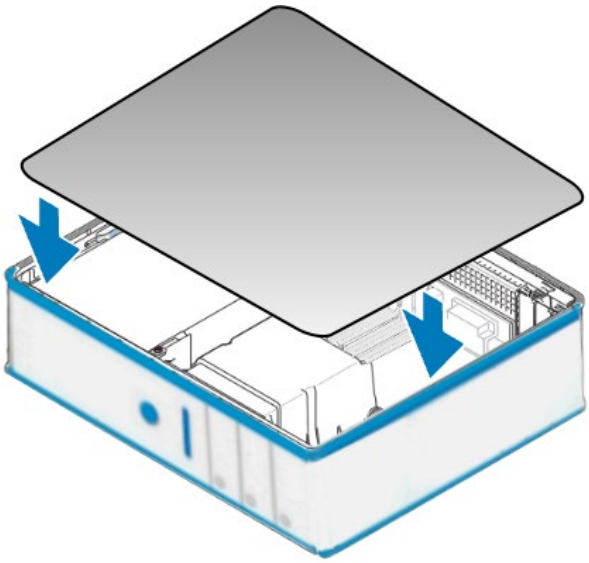
Step 8: Carefully insert the I/O board into the PCI slot by gently pushing down on both sides of the card until it slides into the PCI connector.





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 PCI-AD64SU Series board as well as how to verify whether the PCIe-862x Series board was properly installed. PCI-AD64su Series cards can be used on 32/64-bit versions of Windows 10/11 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 PCI-AD64SU 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.

➢ **UniDAQ Driver/SDK**

Operating System	**32/64-bit Windows 10/11**
Driver Name	**UniDAQ Driver/SDK (UniDAQ_win_setup_xxxx.exe)**
Web site	http://www.icpdas.com/en/download/index.php?model=PCI-AD64SU
Installing Procedure	To install the PCIe-LM4 driver, follow the procedure described below. **Step 1:** Double-click the **UniDAQ_Win_Setupxxx.exe** icon to begin the installation process. **Step 2:** When the "Welcome to the ICP DAS UniDAQ 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\UniDAQ**. **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 UniDAQ Driver DLL” of the Software Manual, which can be downloaded from: http://www.icpdas.com/en/download/index.php?model=PCI-AD64SU

4.2 Plug and Play Driver Installation

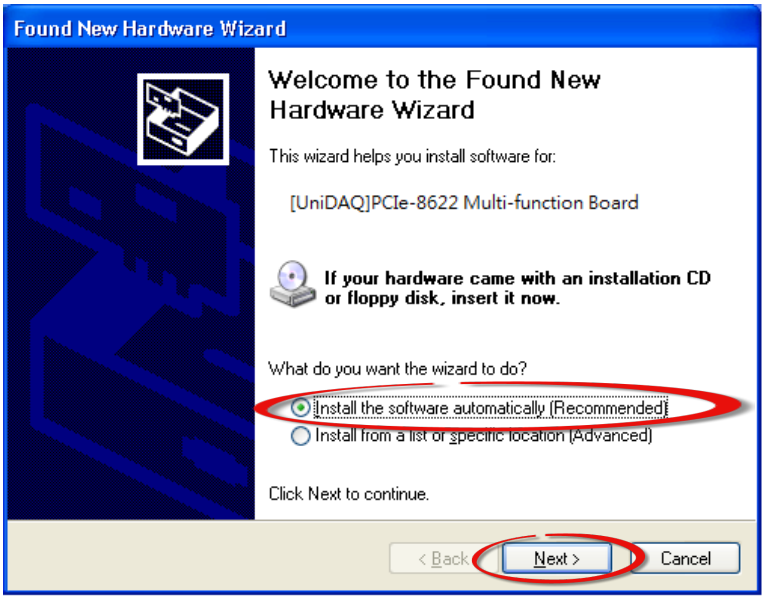
Step 1: Correctly shut down and power off your computer and disconnect the power supply, and then install the PCIe-LM4 Series board into the computer.

For detailed information about the hardware installation of the PCI-AD64SU Series board, refer to Chapter 3 Hardware Installation.

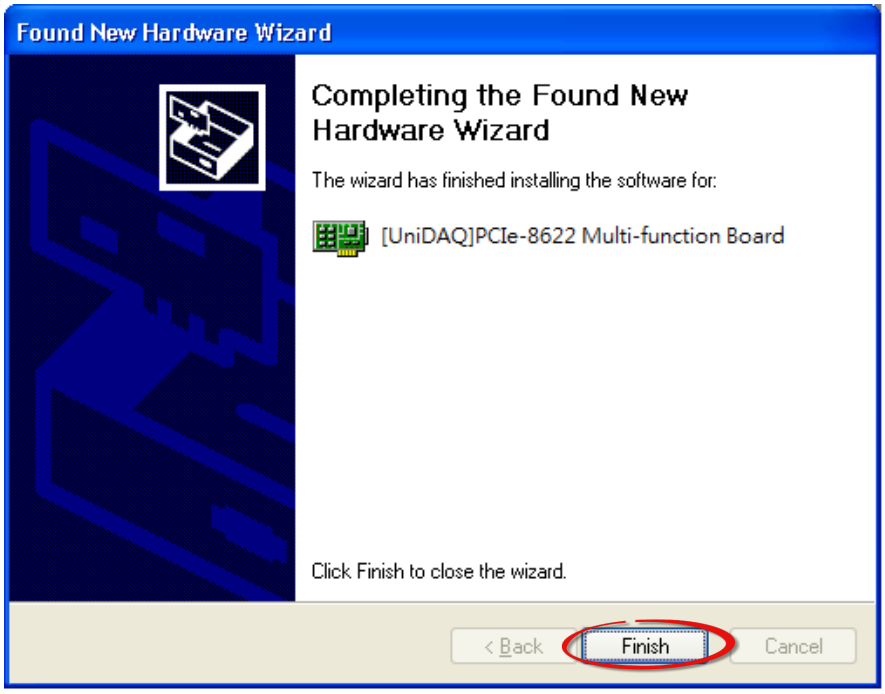
Step 2: Power on the computer and complete the Plug and Play installation**.**

Note: More recent operating systems, such as Windows 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.

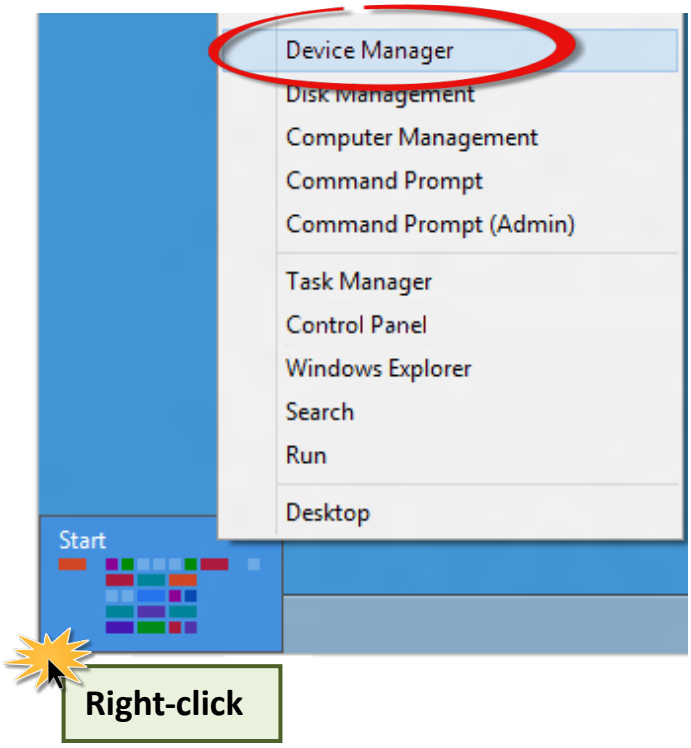
4.3.1 Accessing Windows Device Manager

➢ Windows 10/11

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

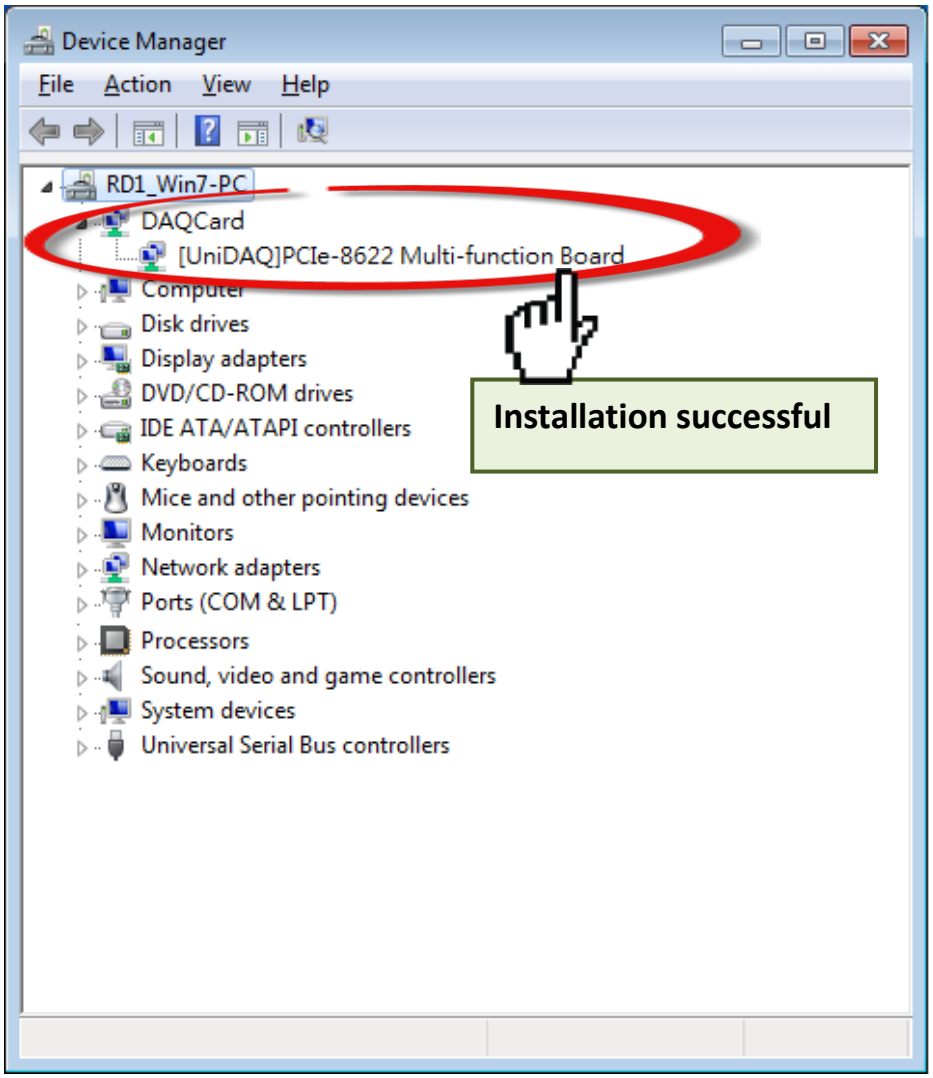
Step 2: **Right-click** the Start screen icon and then click "**Device Manager**".

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 PCI-AD64SU 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

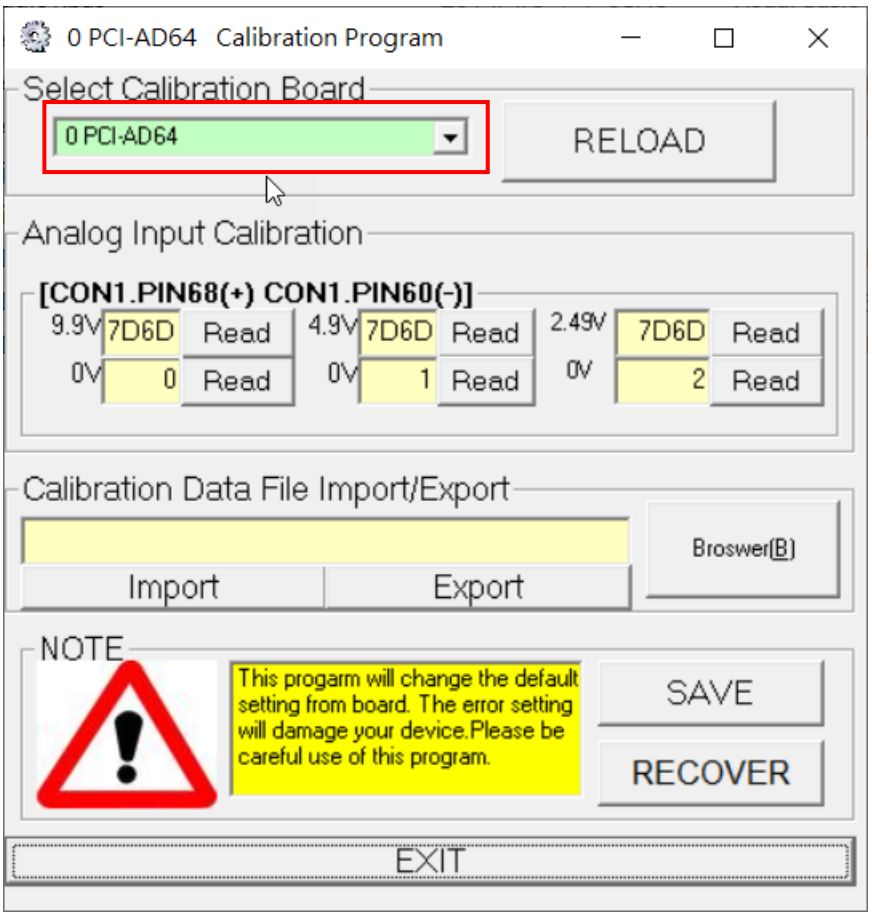
The following is a step-by-step description of the calibration process using the Windows Calibration Program for the PCI-AD64SU, which can be downloaded form: https://www.icpdas.com/en/product/PCI-AD64SU

5.2.1 PCIe-LM4 Calibration Step

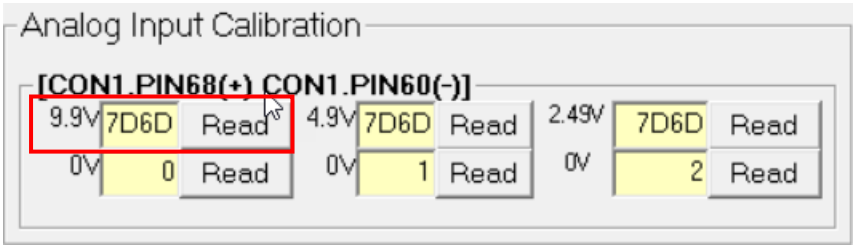
Step 1: Select calibration board

(1) Select **"0 PCI-AD64"** from the **"Select Calibration Board"** drop-down menu.

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

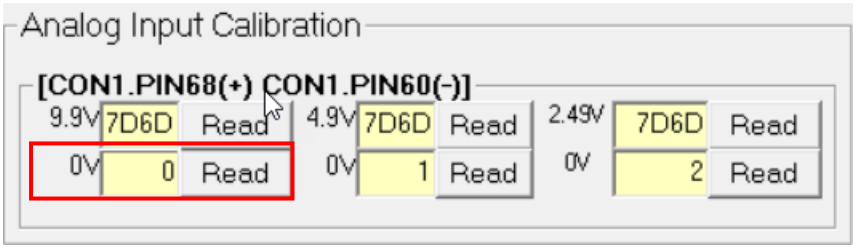


Step 2: Calibrate the Analog Input Channel 0 to 9.9V



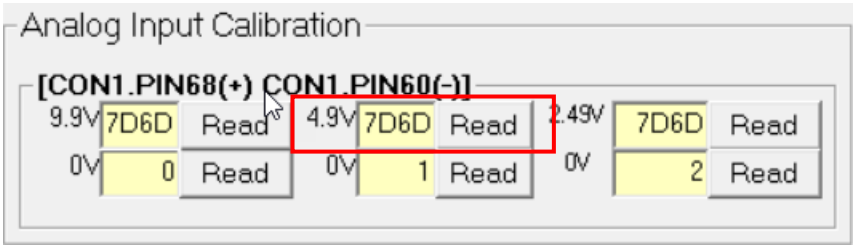
(1) Connect 9.9 V voltage source to PCI-AD64SU.CON1.AI0 (Pin68)
(2) Connect GND source to PCI-AD64SU.CON1.AGND (Pin60)
(3) Click **"Read"** button to get hexadecimal value

Step 3: Calibrate the Analog Input Channel 0 to 0V



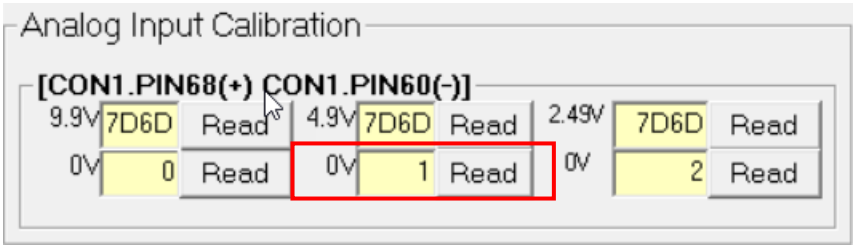
(1) Connect 0 V voltage source to PCI-AD64SU.CON1.AI0 (Pin68)
(2) Connect GND source to PCI-AD64SU.CON1.AGND (Pin60)
(3) Click **"Read"** button to get hexadecimal value

Step 4: Calibrate the Analog Input Channel 0 to 4.9V



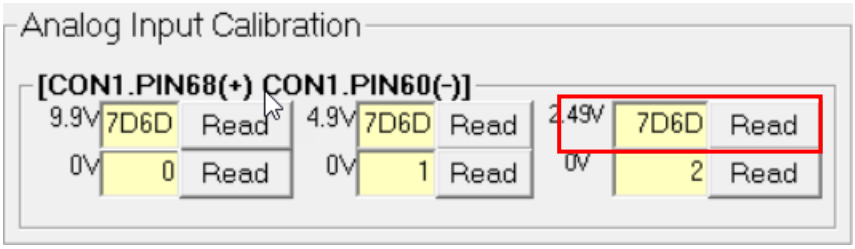
(1) Connect 4.9 V voltage source to PCI-AD64SU.CON1.AI0 (Pin68)
(2) Connect GND source to PCI-AD64SU.CON1.AGND (Pin60)
(3) Click **"Read"** button to get hexadecimal value

Step 5: Calibrate the Analog Input Channel 0 to 0V



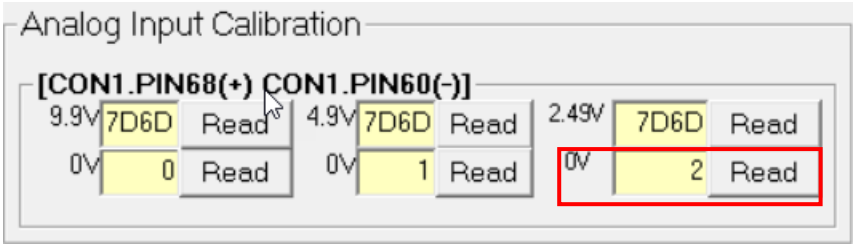
(1) Connect 0 V voltage source to PCI-AD64SU.CON1.AI0 (Pin68)
(2) Connect GND source to PCI-AD64SU.CON1.AGND (Pin60)
(3) Click **"Read"** button to get hexadecimal value

Step 6: Calibrate the Analog Input Channel 0 to 2.49V



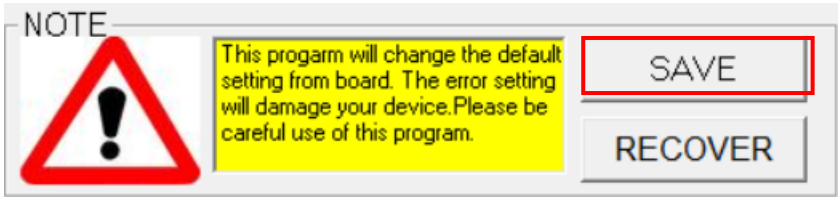
(1) Connect 2.49 V voltage source to PCI-AD64SU.CON1.AI0 (Pin68)
(2) Connect GND source to PCI-AD64SU.CON1.AGND (Pin60)
(3) Click **"Read"** button to get hexadecimal value

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



(1) Connect 0 V voltage source to PCI-AD64SU.CON1.AI0 (Pin68)
(2) Connect GND source to PCI-AD64SU.CON1.AGND (Pin60)
(3) Click **"Read"** button to get hexadecimal value

Step 7: **Store** Calibrate data to board



(1) Click "SAVE" to store the data

6 Windows API Function

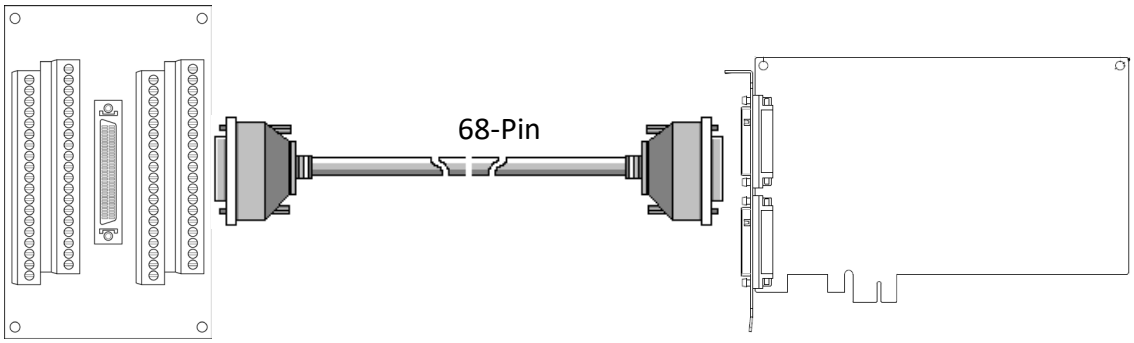
For more details regarding the Windows API Functions for the PCI-AD64SU Series board, refer to UniDAQ SDK User manual, which can be downloaded from:

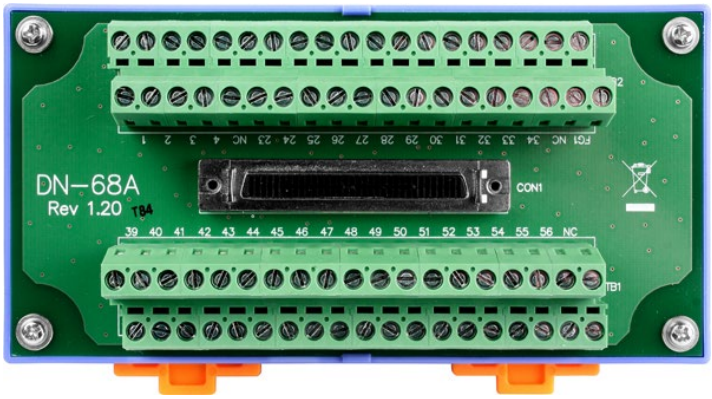
http://www.icpdas.com/en/download/index.php?model=PCI-AD64SU

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 PCI-AD64SU 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	2021.05.18	Initial issue
1.1	2023.02.02	Remvoe Linux and Windows 2000/XP/7/8 suppported.