

PCI Express Industrial I/O Control Board

User's Manual

Copyright

Copyright© 2022 SUNIX Co., Ltd. All Rights Reserved.

No part of this publication may be reproduced, transcribed, stored in a retrieval system, translated into any language, or transmitted in any form or by any means, photocopying, manual, or otherwise, without prior written permission from SUNIX.

Disclaimer

SUNIX shall not be liable for any incidental or consequential damages resulting from the performance or use of this equipment.

SUNIX makes no representations or warranties regarding the contents of this manual. Information in this manual has been carefully checked for reliability; however, no guarantee is given as to the correctness of this content. In the interest of continued product improvement, this company reserves the right to revise the manual or include change in the specifications of the product described within it at any time without notice and without obligation to notify any person of such revision or changes. The information contained in this manual is provided for general use by the customers.

Trademarks

SUNIX is a registered trademark of SUNIX Group.

All other trademarks or registered marks in this manual belong to their respective owners.

Safety Information

1. Keep this User's Manual for future reference.
2. Always read the safety information carefully.
3. Keep this equipment away from direct sunlight, or in humid or damp places.
4. Do not place this equipment in an unstable position, or on vibrating surface before setting it up.
5. Do not use or place this equipment near magnetic fields, televisions, or radios to avoid electronic interface that affects device performance.

Regulatory Compliance

FCC Conditions

This equipment has been tested and found to comply with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- (1) This equipment may not cause harmful interference
- (2) This equipment must accept any interference received, including interference that may cause undesired operation.

Important! Changes or modifications not expressly approved by the manufacturer responsible for compliance could void the user's authority to operate the equipment. Use an approved phone set.

CE

This equipment is in compliance with the requirements of the following regulations: EN 55032: CLASS B and EN55035

WEEE Information

For EU (European Union) member users: According to the WEEE (Waste electrical and electronic equipment) Directive, do not dispose of this product as household waste or commercial waste. Waste electrical and electronic equipment should be appropriately collected and recycled as required by practices established for your country. For information on recycling of this product, please contact your local authorities, your household waste disposal service or the shop where you purchased the product.



Table of Contents

1. INTRODUCTION.....	4
1.1. Overview	5
1.2. Package Checklist	5
1.3. Product Features.....	5
1.4. Product Specifications	7
2. HARDWARE INSTALLATION.....	9
2.1. Hardware Appearance.....	9
2.2. Hardware Installation.....	10
2.3. Connector Installation	11
2.4. Pin Assignment	13
3. DRIVER AND SOFTWARE INSTALLATION	14
3.1. Windows Driver and software Installation	14
3.2. Windows Driver Verify Installation	18
3.3. Windows Driver Uninstallation	19
4. SOFTWARE OPERATION	20
4.1. Overview	21
4.2. Configure Digital Input interface	23
4.3. Configure Digital Output interface	28
4.4. Firmware Upgrade	30
5. APPENDIX.....	32
5.1. Customer Service Information	32

1. Introduction

SUNIX industrial PCI Express I/O Control Board, is designed to meet PCI Express Base Specification Ver2.1. It can be installed in virtually any available PC system and compatible with all major Windows and Linux operating systems.

This board offers independent Digital I/O ports for connecting kinds of serial terminals on the PC based systems. This board is industrial standard which offers a reliable and high performance solution for industrial applications.

The following topics covered in this chapter:

1.1 Overview

1.2 Package Checklist

1.3 Product Features

1.4 Product Specifications

1.1. Overview

SUNIX SDC0FF0I, industrial isolated Digital I/O PCI-Express add-on card, is designed for PC-based IoT Gateway or desktop that enables data acquisition and I/O control in the industrial automation. This board built-in SUNIX Digital-I/O controller, QiuNiu, and as well built with many of SUNIX advanced features and technologies. In addition, SUNIX provides API software and SDK library, allowing users to program under Windows 10/11 and Linux operating systems. The software package includes a dynamic library.dll, as well as C, C# and Python programming language sample codes, making it easier to develop application software.

SUNIX PCI Express Industrial I/O Control Board enriches I/O expandable capacity with cost-efficient design; SDC0FF0I is the best digital I/O communicating solution to enrich your system I/O expandable capacity for lite industrial applications.

1.2. Package Checklist

Please check if the following items are present and in good condition upon opening your package. Contact your vendor if any item is damaged or missing.

- PCI Express Industrial I/O Control Board
- DB44 Male to Female connection cable, 100cm
- DB44 Male DIN-rail wiring board
- User's Manual (This document)

1.3. Product Features

- Designed to meet PCI Express Base Specification Revision 2.1.
- With high reliable SUNIX QiuNiu UART & Digital-I/O controller.
- Plug-n-Play, I/O address and IRQ assigned by system.
- Ultra low power consumption (<1.5W) design for green environment and industrial application.

- High quality electronic components, low impedance and high stability ensure product quality and reliability.
- Support Microsoft Windows 10/11 and Linux with C, C# and Python programming language sample code.
- Certified by CE, FCC, RoHS, and Microsoft approvals.
- Support both standard and Low profile bracket design to meet various of PC chassis.

Digital I/O Interfaces:

- Expands isolated sixteen (16) digital input channels with features for all channels.
 - Support both NPN & PNP devices
 - Support both dry and wet contact connections
 - With digital filter for noise reduction
 - Built-in 32-bit counter for all digital in channels
- Expands isolated sixteen (16) NPN type digital output channels with initial value (Booting & Restart) protection.
- Each channel built-in 2.5KV isolation protection for signal and power, allowing the input signals to be completely floated so as to prevent ground loops.

1. Product Specifications

Board Level

Interface	PCI Express
Controller	SUNIX QiuNiu
BUS	PCI Express Gen1 x 1 (single Lane)
IRQ & IO	Assigned by System
ESD Protection	±15KV IEC61000-4-2 Air Gap Discharge ±8KV IEC61000-4-2 Contact Discharge

Digital Input

Type	NPN & PNP	Channel	16-channel
Dry Contact	Logic Level 0: Open; Logic Level 1: Close to GND	Wet Contact	Logic Level 0: 0 to 3VDC; Logic Level 1: 10 to 50VDC
Input Resistance	10KΩ	Isolation	2500 VDC
Counter	32-bit counter on all channel	Frequency	Input Range 2KHz max.
Digital Filter	Digital filter for noise reduction	Pin Define	DI1~DI16, COM, GND
Interrupt Mode	Event trigger (Rising Edge, Falling Edge, Both modes) & polling for all channels		
PCB Connector	DB44 Female connector		

Digital Output

Type	NPN	Channel	16-channel
Voltage Range	3.5 to 40VDC	Current	500mA per Channel
Isolation	2500 VDC	Pin Define	DO1~DO16, PWR, GND
Initial Protection	Initial Value Setup (Bootling & Restart protection)		
PCB Connector	DB44 Female connector		

Software Support

OS	Windows 10 (X86/X64), Windows 11, Linux
SDK	Library: Supporting C, C++, C# and Python languages. C, C# and Python sample code available

Declaration

Green Product	RoHS, WEEE
---------------	------------

Regulatory

Hardware	CE / FCC / VCCI / BSMI
----------	------------------------

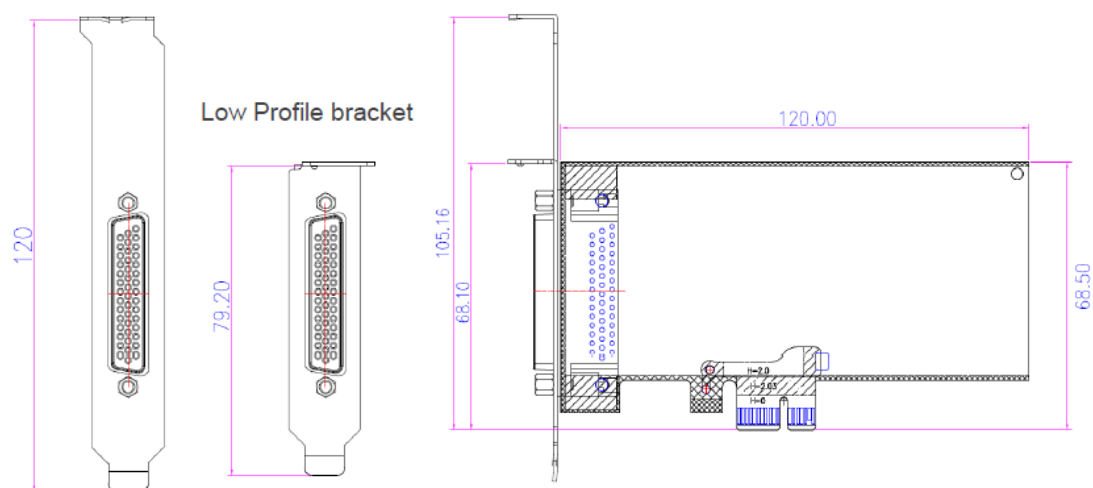
Environment

Operation Temperature	-20 to 70°C (-4 to 158°F)
Operation Humidity	5 to 95% (non-condensing)
Storage Temperature	-20 to 70°C (-4 to 158°F)

Dimension

SDC0FF01	120 x 68.5 mm
Bracket	Standard 120 mm / Low Profile 79.2mm
Bracket Space	1

Standard bracket



2. Hardware Installation

This chapter includes information about hardware installation of SUNIX PCI Express Industrial I/O Control Board, connectors and cables, pin assignment of hardware interfaces, and digital input/out settings.

The following topics covered in this chapter:

2.1 Hardware Appearance

2.2 Hardware Installation

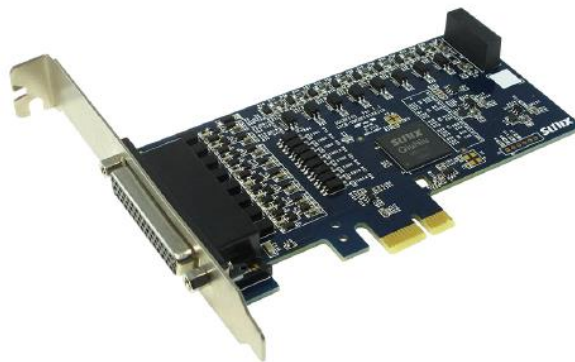
2.3 Connector Installation

2.4 Pin Assignments

2.1. Hardware Appearance

PCI Express Industrial I/O Control Board appearance shown as below.

SDC0FF0I



2.2. Hardware Installation

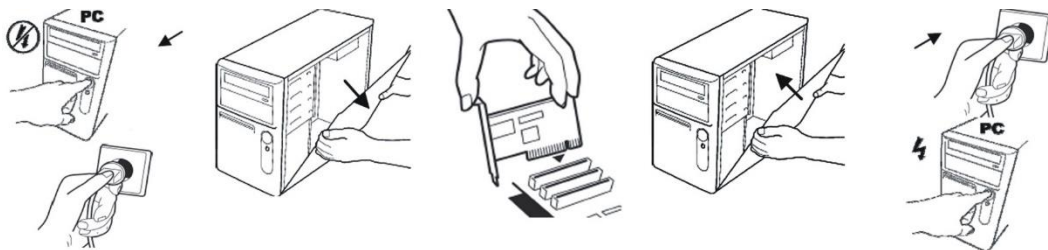
The hardware installation of PCI Express Industrial I/O Control Board is easy to carry out. Before inserting the card into the PCI Express bus, please follow the detailed steps given below to install the board in your computer.



Safety First

To avoid damaging your system and boards, make sure your PC's power is turned off before installing PCI Express card.

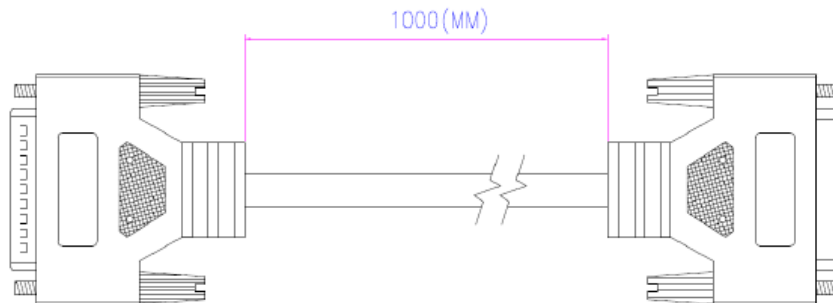
- Step1. Turn your PC's power off, and shut off the power to any peripheral.
- Step2. Remove the power plug from the plug socket.
- Step3. Remove the cover from the computer case.
- Step4. If fitted. Remove the metal cover plate on the rear of a free PCI-E slot.
- Step5. Insert PCI Express Industrial I/O Control Board into the free PCI Express slot and screw it firmly on the bracket side.
- Step6. Place the cover back onto the computer.
- Step7. Insert the plug into the plug socket.



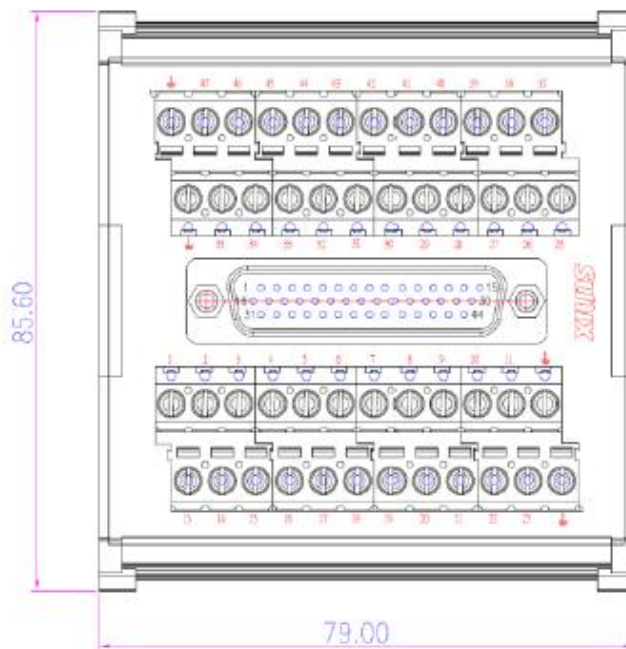
2.3. Connector Installation

This product also contains connection cables and DIN-rail wiring board:

1. DB44 Male to Female connection cable, 100cm



2. DB44 Male DIN-rail wiring board



The chapter demonstrates the assembly of boards, cables and connectors.

Step1. Plug DB44 connection cable to PCI Express Industrial I/O Control Board.

Step2. Fix the DB44 male DIN-rail wiring board on DIN rail mount.

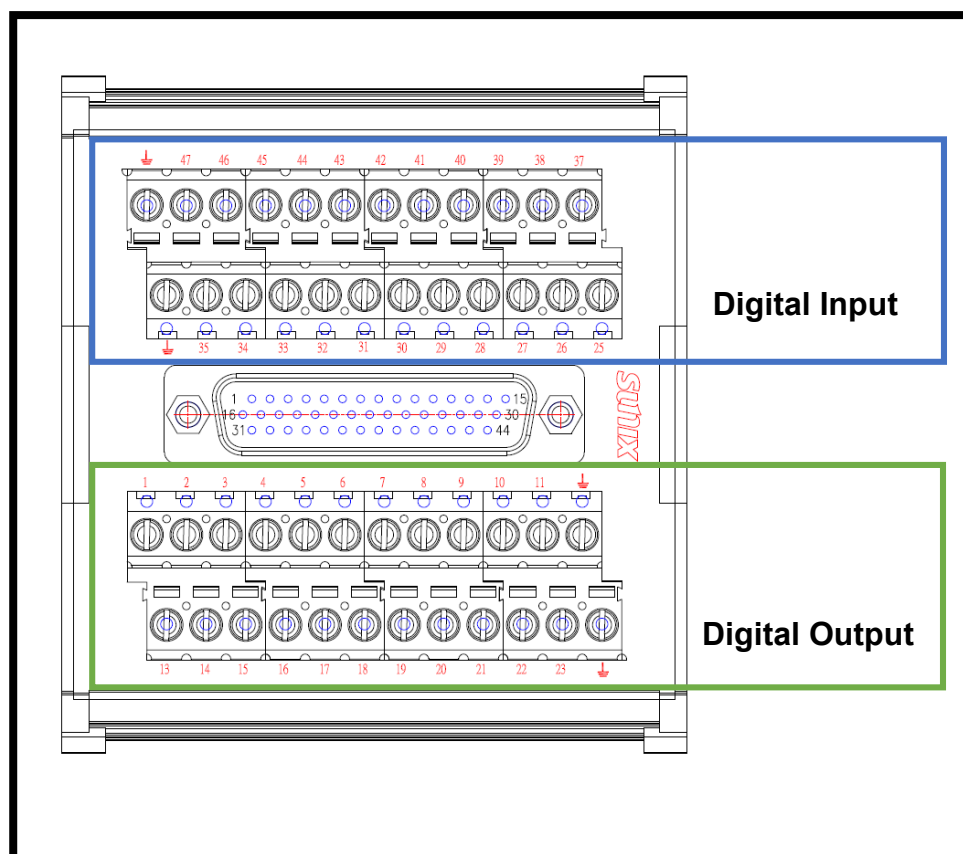
Step3. Please refer to 2.4 Pin Assignment table of Digital in/out terminal block for connecting to your digital control devices.

2.4. Pin Assignment

This chapter provides the pin assignment of PCI Express Industrial I/O Control Board, as well as the pin assignment for the optional accessories.

Digital in/out terminal block Pin Assignment

PIN	Digital Output	PIN	Digital Output	PIN	Digital Input	PIN	Digital Input
1	DO_COM1	13	DO GND1	25	DI_COM1	37	DI_GND1
2	DO_COM2	14	DO_GND2	26	DI_COM2	38	DI_GND2
3	DO_COM3	15	DO_GND3	27	DI_COM3	39	DI_GND3
4	DO_1	16	DO_9	28	DI_1	40	DI_9
5	DO_2	17	DO_10	29	DI_2	41	DI_10
6	DO_3	18	DO_11	30	DI_4	42	DI_11
7	DO_4	19	DO_12	31	DI_5	43	DI_12
8	DO_5	20	DO_13	32	DI_5	44	DI_13
9	DO_6	21	DO_14	33	DI_6	45	DI_14
10	DO_7	22	DO_15	34	DI_7	46	DI_15
11	DO_8	23	DO_16	35	DI_8	47	DI_16
⏏	GND	⏏	GND	⏏	GND	⏏	GND



3. Driver and Software Installation

After installing the PCI Express Industrial I/O Control Board in your system successfully, please follow the step by step software installation guide to confirm how to install appropriate driver and configure the Digital I/O and serial port settings.

The driver and software for PCI Express Industrial I/O Control Board supports Windows 10 operating systems, and you can select your requirement in the following chapter:

The following topics covered in this chapter:

3.1 Windows Driver and software Installation

3.2 Windows Driver Verify Installation

3.3 Windows Driver Uninstallation

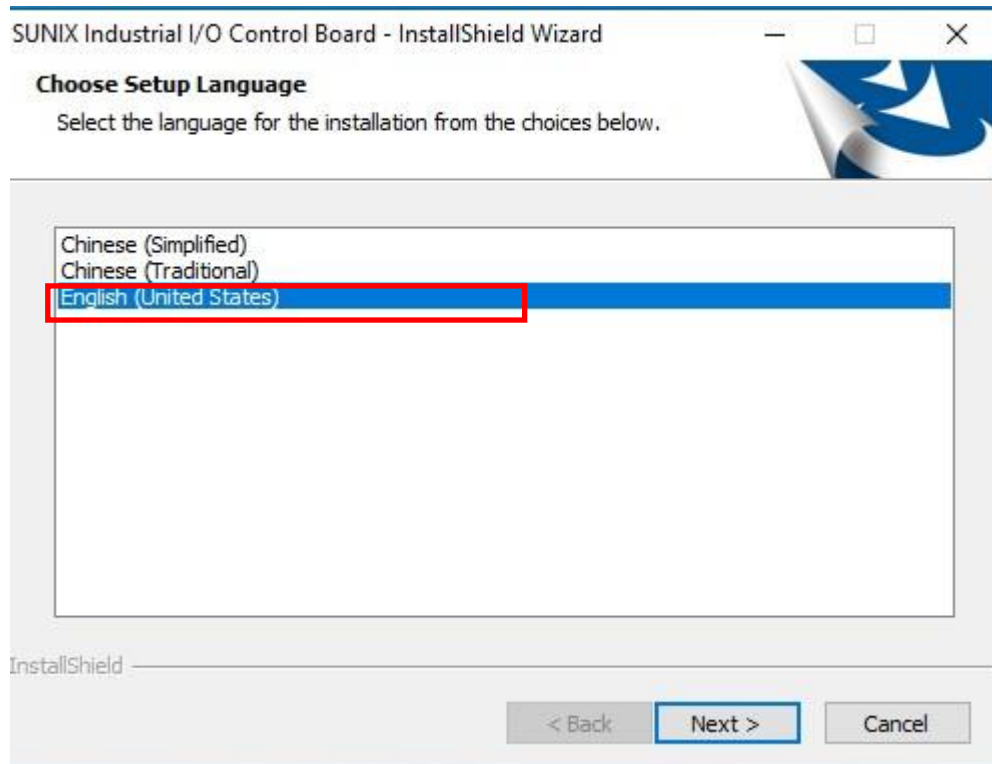
3.1. Windows Driver and software Installation

Please refer to following instructions to install the driver and software for the first time under Windows 10 operation system. Please plug the board in an available PCI Express slot first, before installing the driver.

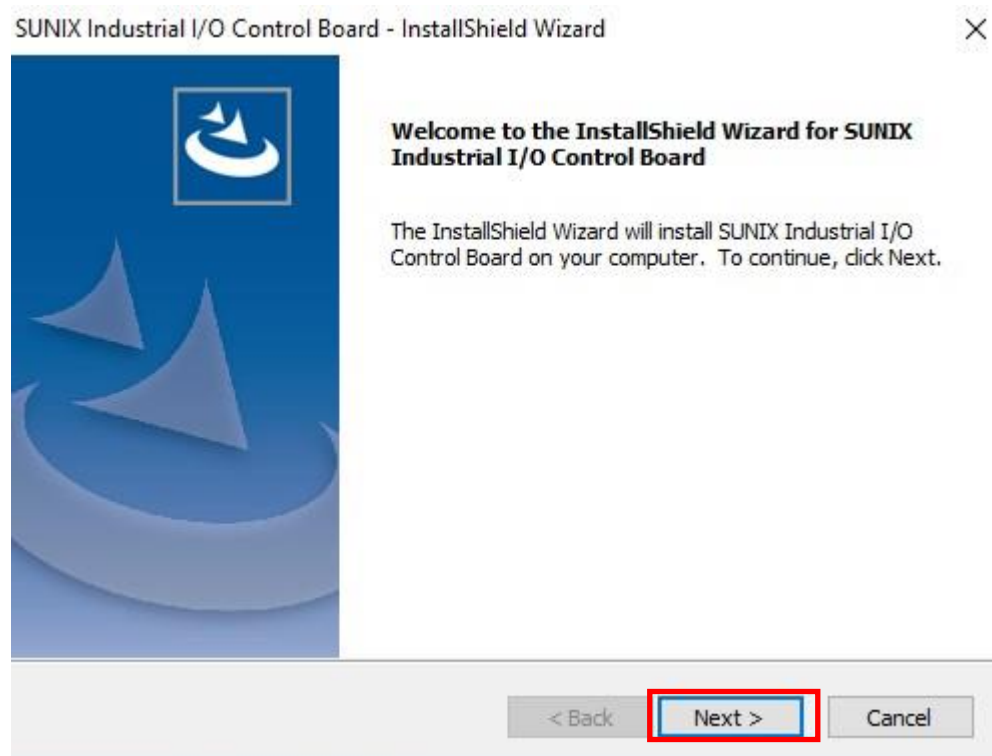
(1) Unzip the software file and Run setup.exe.

Name	Type
 readme.txt	Text Document
 Setup.exe	Application

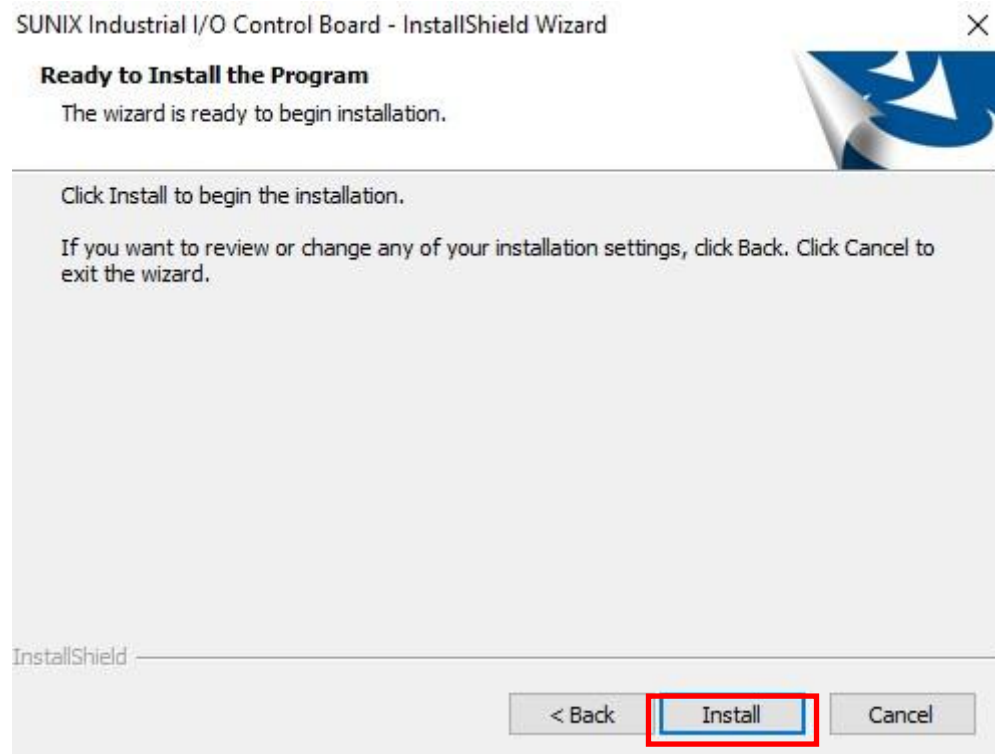
(2) Please select setup language for your operation system.



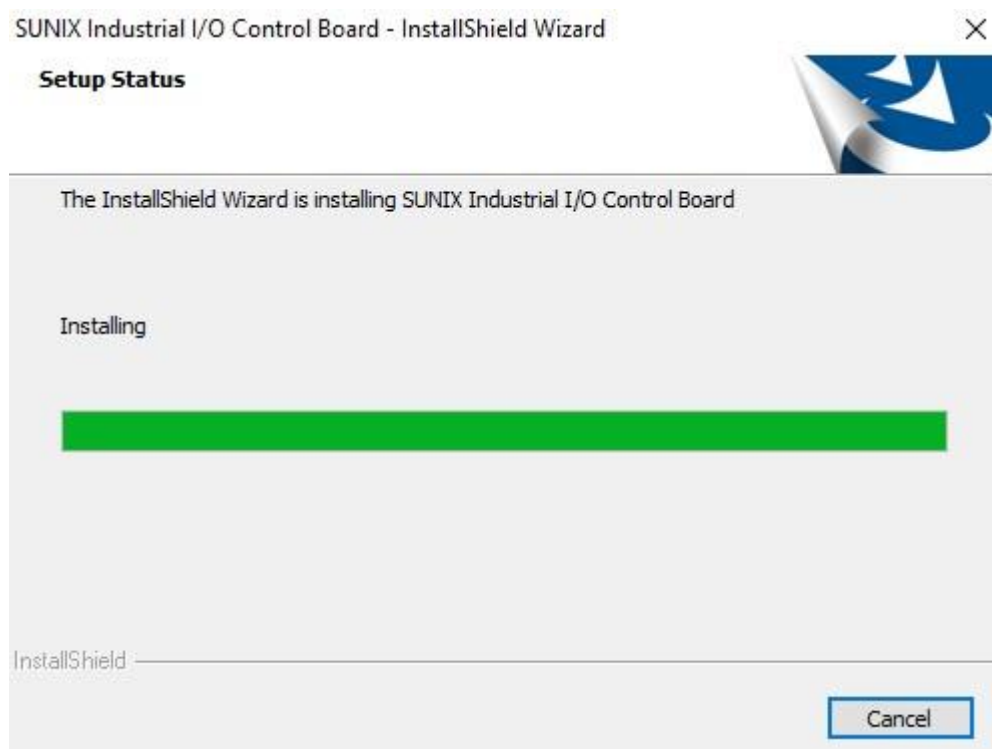
(3) Click “**Next**” to continue installation steps.



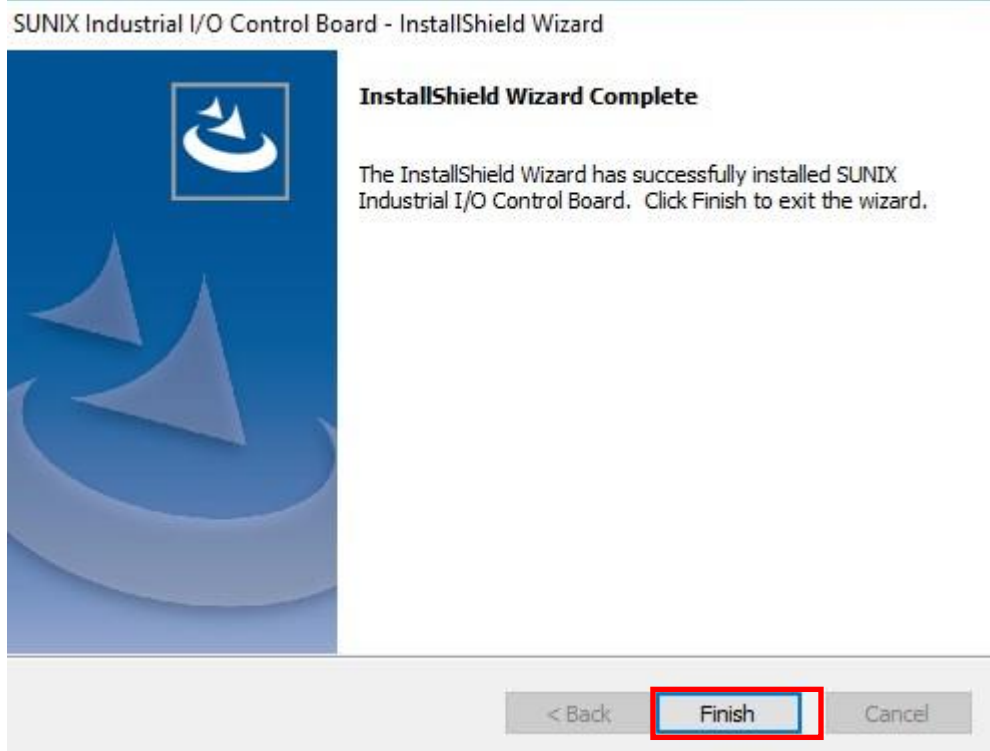
(4) Click "Install" to continue installation steps.



(5) System will install driver and software automatically.



(6) Click "**Finish**" to end installation steps.



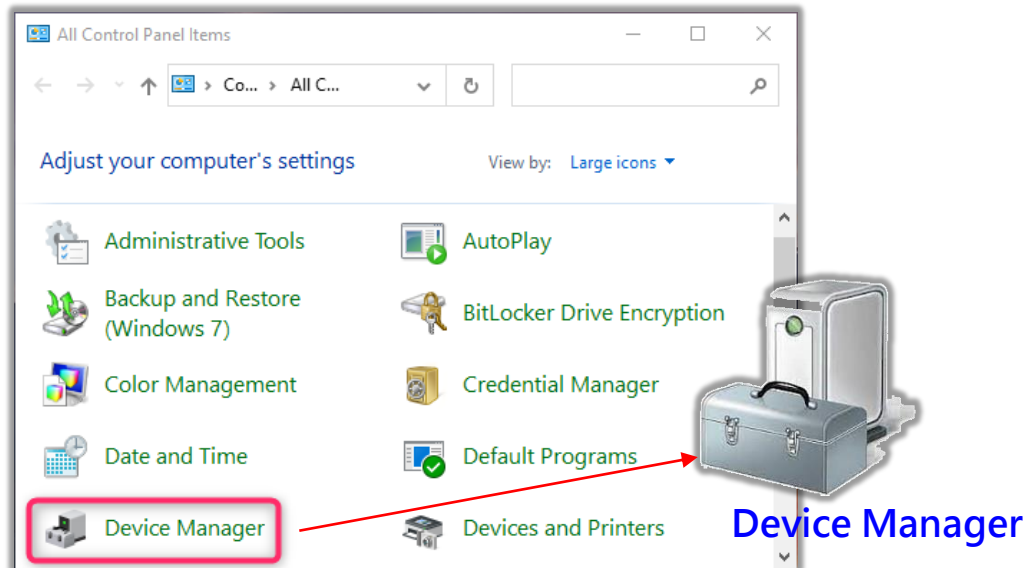
Note: PCI Express Industrial I/O Control Board is certificated by Windows 10 operation system. Please visit SUNIX official website (<http://www.sunix.com>) to download latest driver.

3.2. Windows Driver Verify Installation

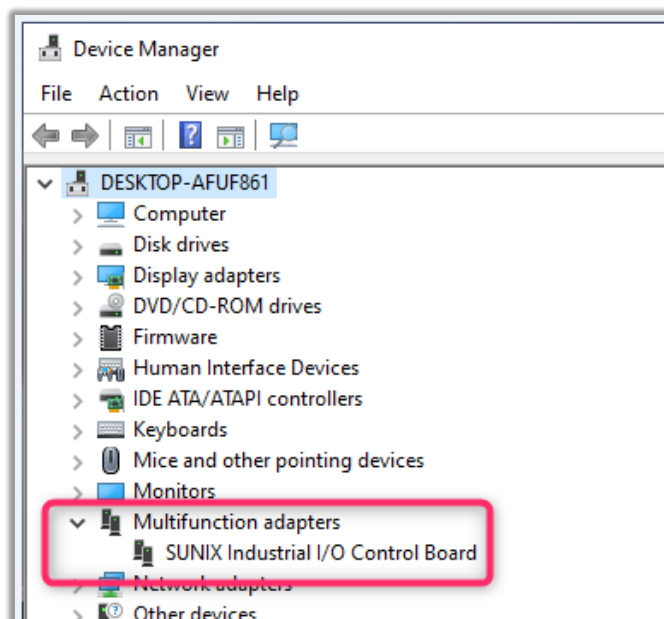
You can use Windows “**Device Manager**” to verify proper installation.

- (1) Select Device Manager in the in the Windows Control Panel.

Controller Panel > All Control Panel Items > Device Manager



- (2) In the Device Manager window, you would read **SUNIX PCI Express Industrial I/O Control Board** under **Multifunction adapters** catalog

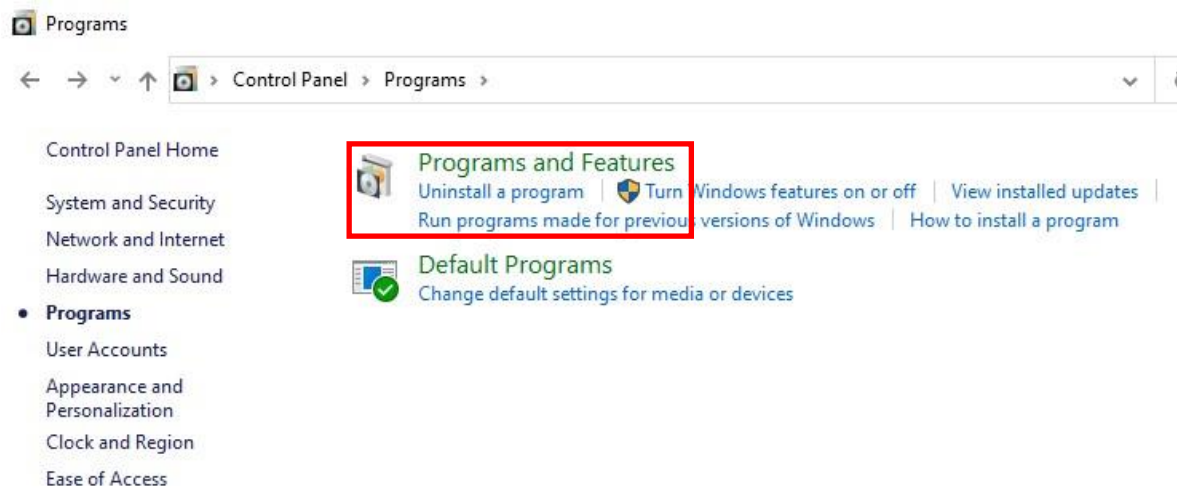


3.3. Windows Driver Uninstallation

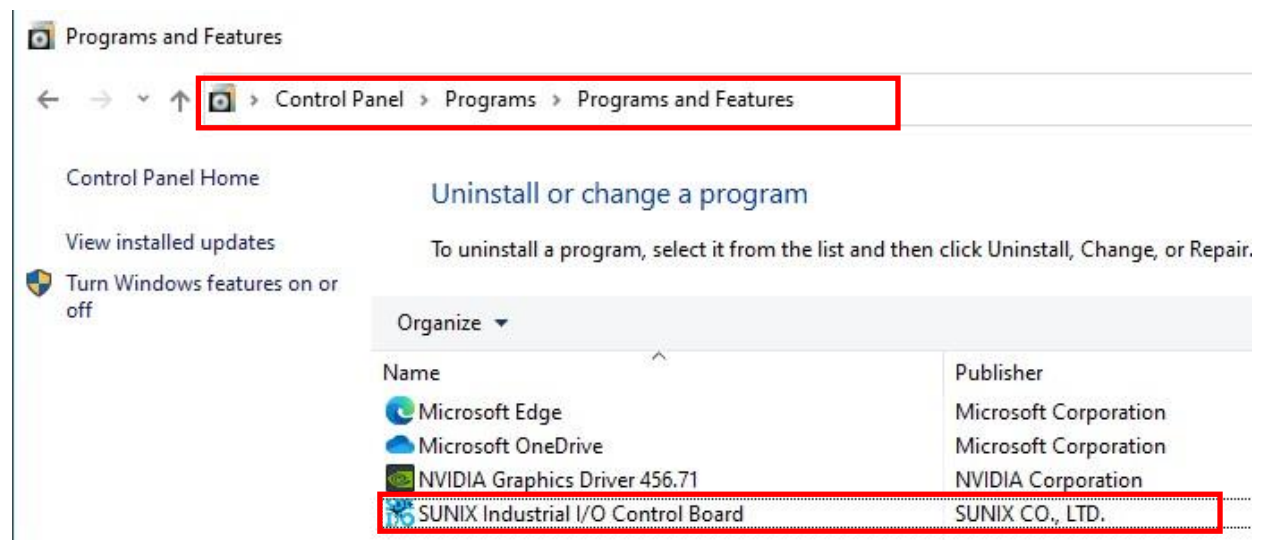
Please refer to following instructions uninstall PCI Express Industrial I/O Control Board driver.

- (1) Click on the “**Programs and Features**” tab in the Windows Control Panel.

Controller Panel > Programs > Programs and Features



- (2) Enter Uninstall or change a program page, and double click “**SUNIX PCI Express Industrial I/O Control Board**” to process uninstallation procedure.



4. Software Operation

This chapter introduces the operation of the I/O Control Manager utility of industrial control board that comes with isolated digital input/output channels and Serial (RS-232/422/485) COM ports interfaces.

The following topics covered in this chapter:

4.1 Overview

4.2 Configure Digital Input interface

4.3 Configure Digital Output interface

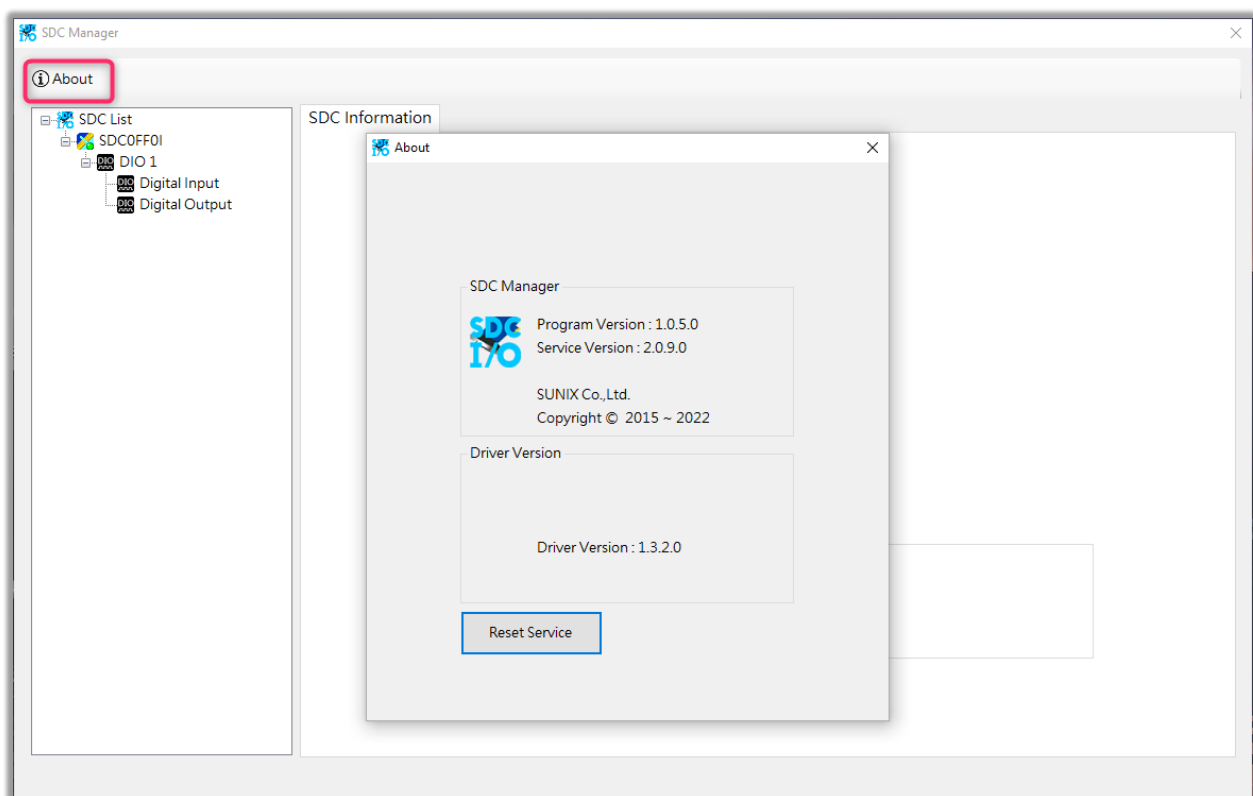
4.4 Configure Serial Interface

4.5 Firmware Upgrade

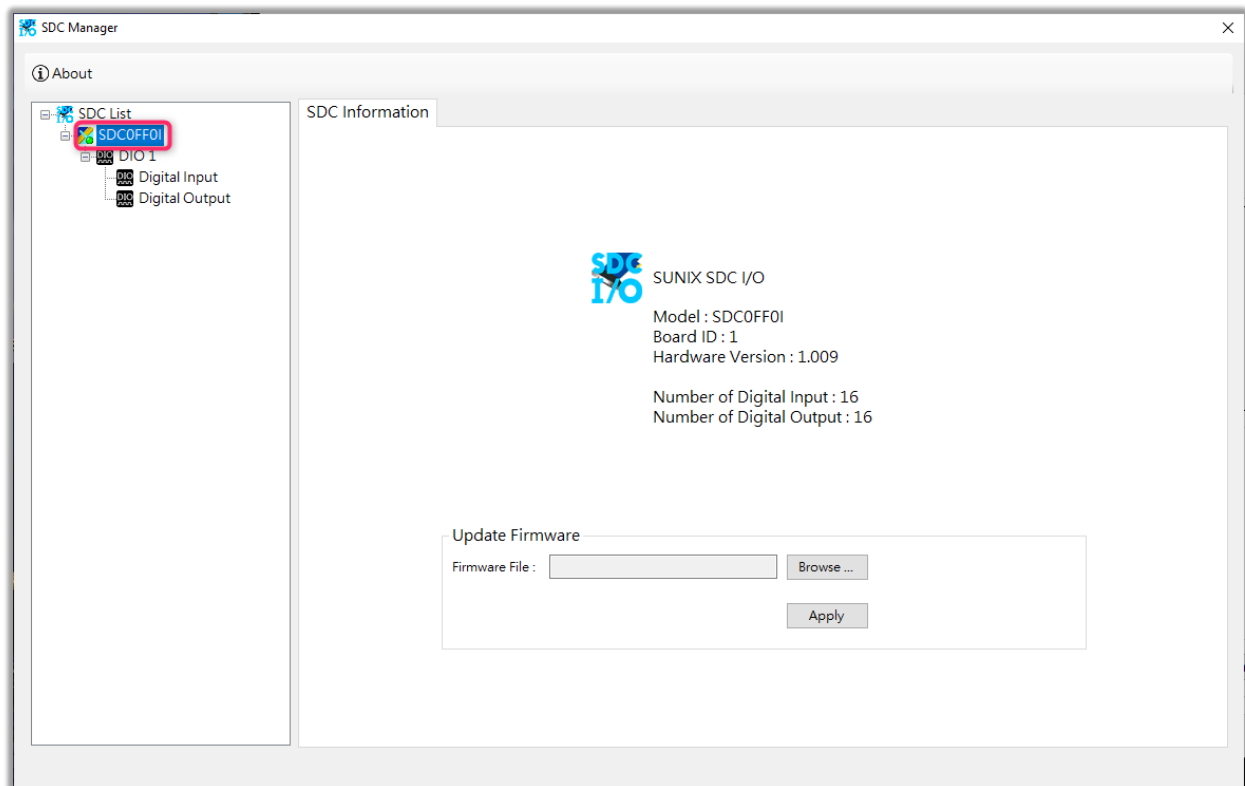
4.1. Overview

The I/O Control Manager utility could be launched after PCI Express Industrial I/O Control Board hardware is installed. Therefore, be sure to install hardware and driver properly at first.

Launch I/O Control Manager utility, and you can read the control panel windows that shows utility version, service version, and driver version information. User can update latest version from Microsoft Store where you download from.

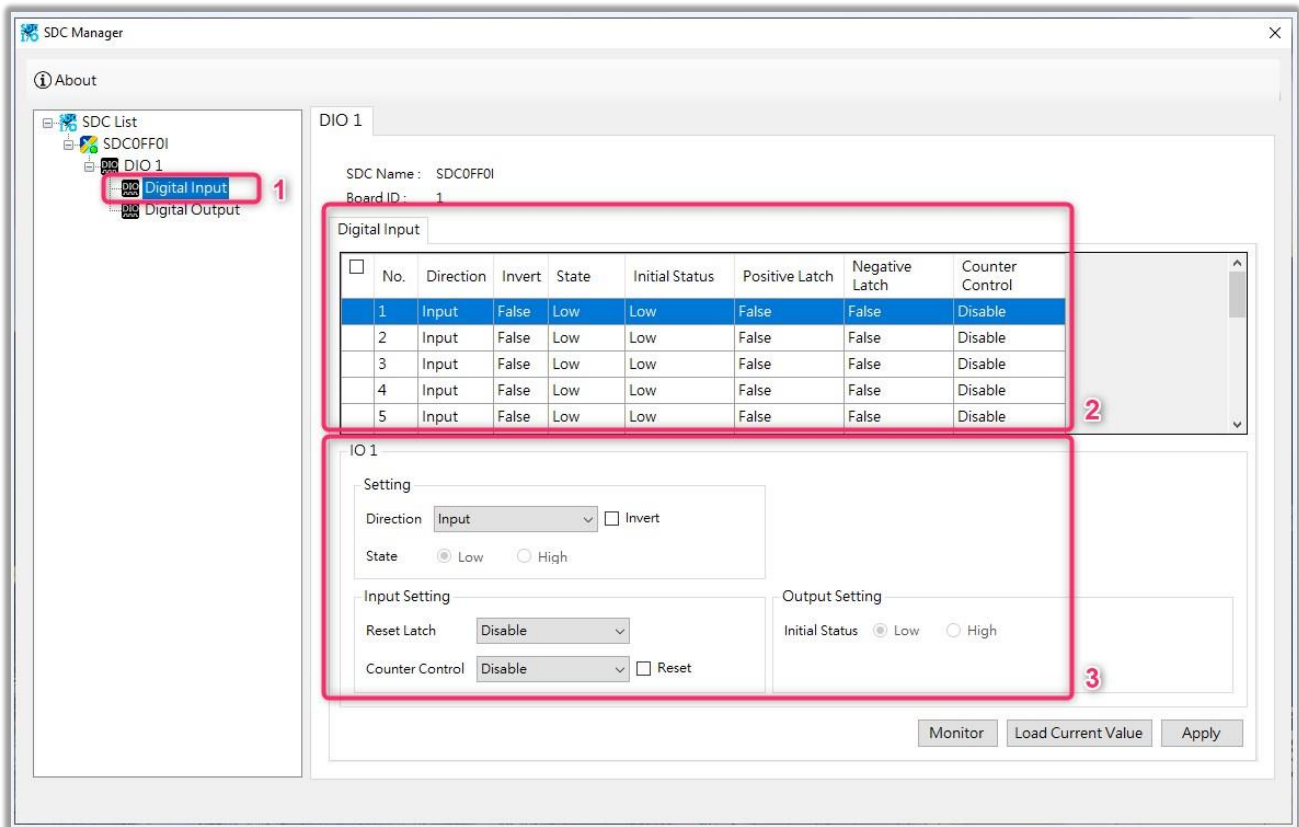


Click I/O Expansion Card catalog, user could read the hardware interfaces support list, including Digital I/O Interface, and Serial Interface. Please note that hardware support list depends on the industrial card that installed in your system. The following screen is an example of one of the industrial control board.



4.2. Configure Digital Input interface

Under Digital I/O interface catalog, select “**Digital Input**” item and you can read control panel as shown as below. If there are any settings changes, be sure to execute the “**Apply**” button to save the settings, or execute “**Default**” button to restore manufactory default settings.



1. Digital Input Interface

Select this item to read Digital Input channel state on the table.

2. Digital Input Channel State List

User can read the state table of the digital input channel and individually set each digital input channel in the control panel.

3. Digital Input Control Panel

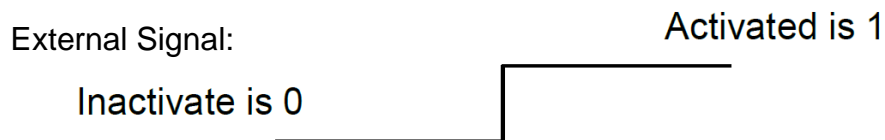
Please refer to following instructions.

<<Digital Input Value Setting>>

A digital input detects if a voltage is above/below a specific threshold. If the voltage is higher than some value, the computer will detect the digital input as **HIGH=1**. If the voltage is lower than some value, the computer will detect the digital input as **LOW=0**.

Standard digital input (default) state: (0:Low, 1:High)

- If the external signal is logic level high, the digital input value is 1.
- if the external signal is logic level low, the digital input value is 0.



Invert Value:

“**Enable**” invert digital input state: (1:Low, 0:High)

- If the external signal is logic level high, the digital input value is 0.
- If the external signal is logic level low, the digital input value is 1.



Direction ☐ Invert

Box State	Settings	Result
Uncheck (Default)	Default Mode	0:Low, 1:High
Check	Invert Mode	1:Low, 0:High

<<Counter Setting>>

Each digital input channel supports a counter feature that counts the number of digital input triggers. The counter value can be increased when a Positive (rising) edge, Negative (falling) edge or both (positive or negative edge) occur.



1). None (Default):

Disable counter feature.

2). Positive edge:

If positive (rising) edge-triggered, counter +1.

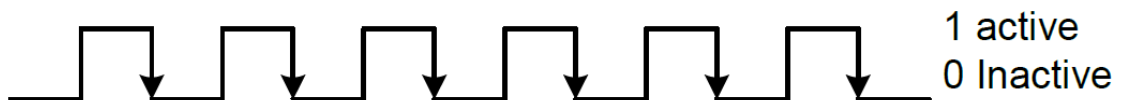
Positive Edge Counter:



3). Negative edge:

If negative (falling) edge-triggered, counter +1.

Negative Edge Counter:



4). Both:

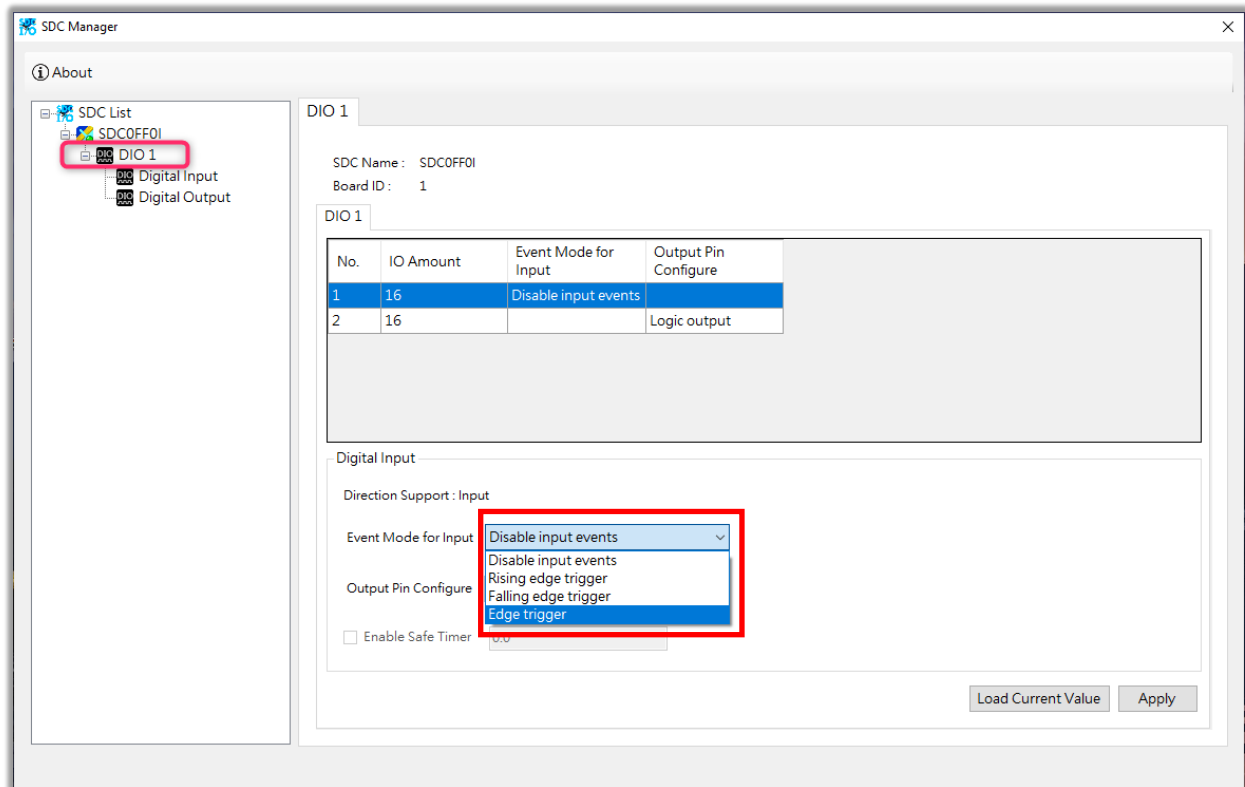
If positive (rising) or negative (falling) edge-triggered, counter +1.

5). Reset Counter:

Clear digital input counter result, value=0.

<<Event Trigger Condition Setting>>

Event Mode settings must be used with the API (Application Programming Interface) and Library. When the event trigger happens, the corresponding action can be performed through the software. User can enable positive (rising) or negative (falling) trigger event.



1). None (Default):

Disable event trigger feature.

2). Positive edge:

Event trigger when positive (rising) edge happens.

3). Negative edge:

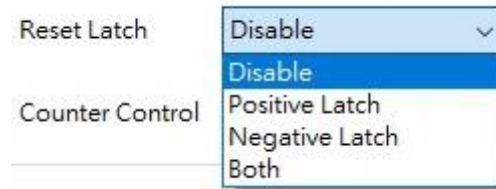
Event trigger when negative (falling) edge happens.

4). Both:

Event trigger when positive (rising) or negative (falling) edge happen.

<<Latch Setting>>

The latch will record the result of whether the digital input state has changed. User can monitor positive and negative latch state in the digital input channel state List table. “**True**” will be displayed if the state has changed, if not it shows “**false**”. Latch default settings is enable.



By clicking “Reset Positive Latch” or “Reset Negative Latch” button to clear the value to default.

1). Reset positive latch:

Clear digital input positive latch result.

If it's **true**, after reset, result back to default **false**.

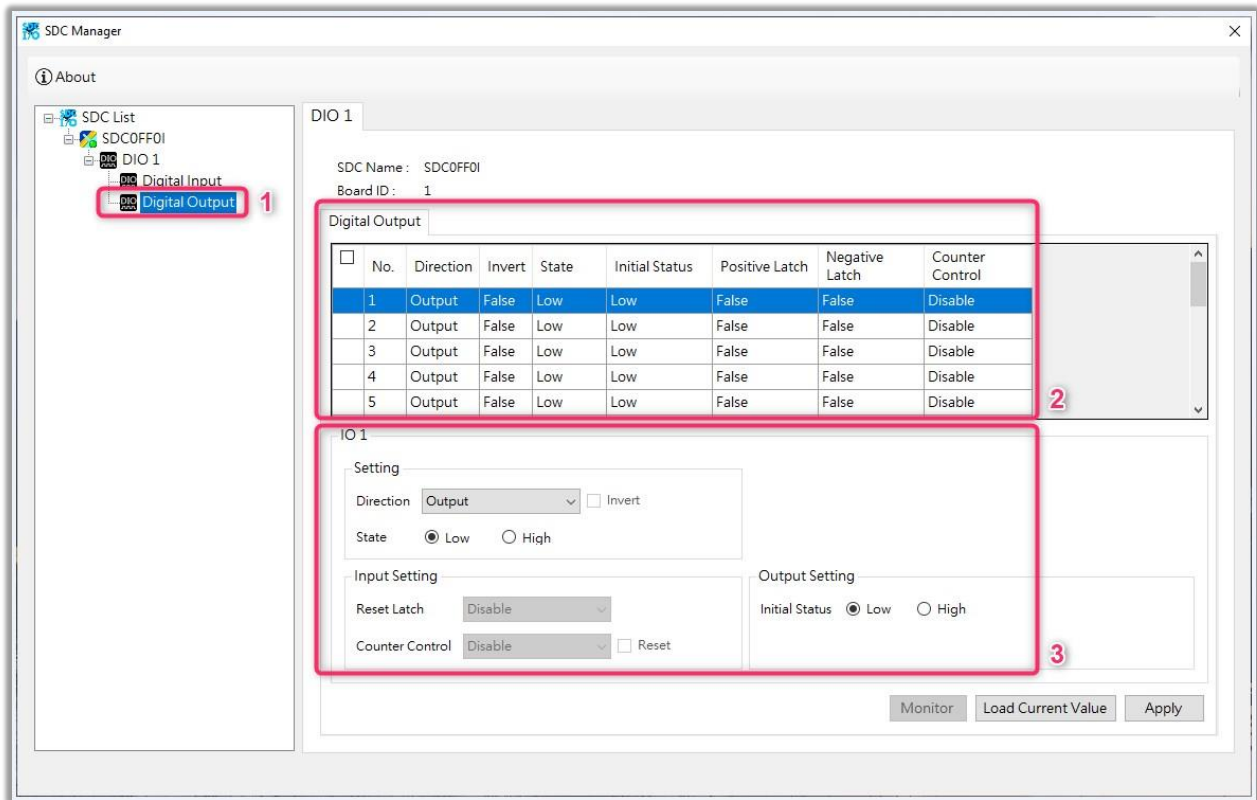
2). Reset negative latch:

Clear digital input negative latch result.

If it's **true**, after reset, result back to default **false**.

4.3. Configure Digital Output interface

Under Digital I/O interface catalog, select “**Digital Output**” item and you can read control panel as shown as below. If there are any settings changes, be sure to execute the “**Apply**” button to save the settings, or execute “**Default**” button to restore manufactory default settings.



1. Digital Output Interface

Select this item to read Digital Output channel state on the table.

2. Digital Output Channel State List

User can read the state table of the digital output channel and individually set each digital output channel in the control panel.

3. Digital Output Control Panel

Please refer to following instructions.

<<Digital Output Value Setting>>

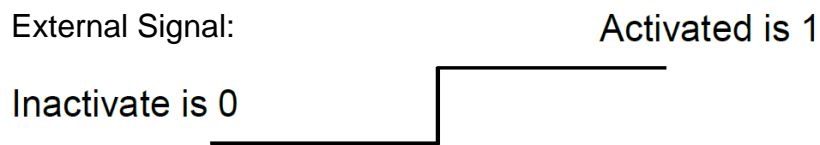
A digital output is the closed or opened circuit to indicate whether the given state is high or low. The digital output hardware design is a NPN (Sink) type.

Initial Status <input checked="" type="radio"/> Low <input type="radio"/> High		Direction <input type="text" value="Output"/> <input type="checkbox"/> Invert
State <input checked="" type="radio"/> Low <input type="radio"/> High		

1). Digital Output Initial State: (Default: 0=Low)

The digital output channel has the function ("High" or "Low" state) during computer boot (before entering the operation system).

Digital Output initial state "**High**" or "**Low**" setting when system booting.



Note: Before turning computer power on, digital out state will be 0=Low.

2). Digital Output Current State: (Default: 0=Low)

Change the current digital output channel state to "**High**" or "**Low**" setting.



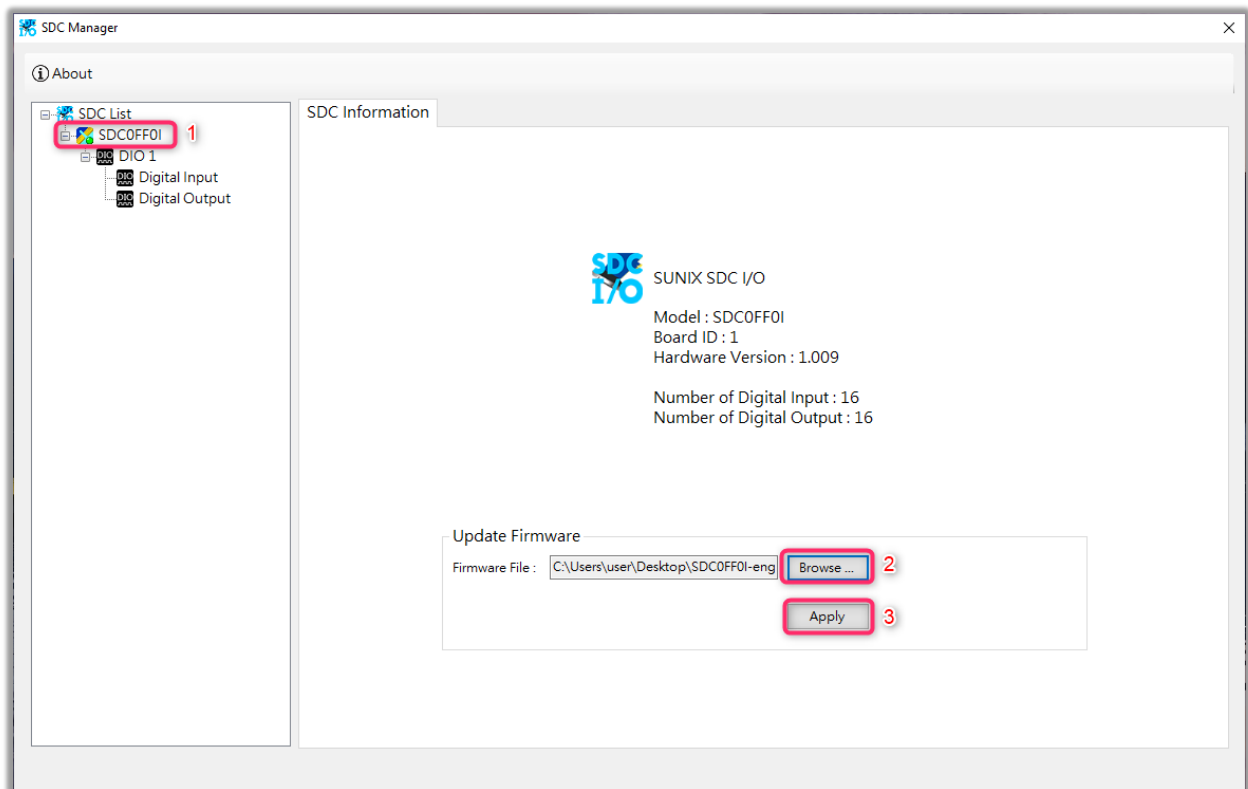
3). Invert Value:

"**Enable**" invert digital output state: (1:Low, 0:High)

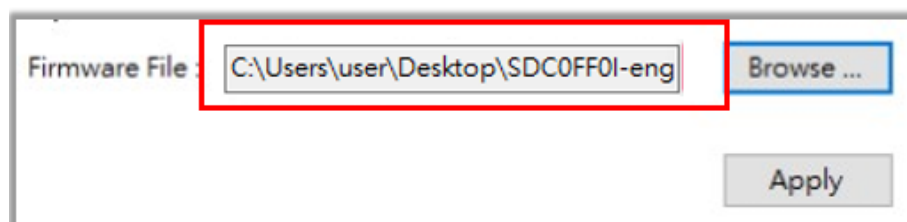
Box State	Settings	Result
Uncheck (Default)	Default Mode	0:Low, 1:High
Check	Invert Mode	1:Low, 0:High

4.4. Firmware Upgrade

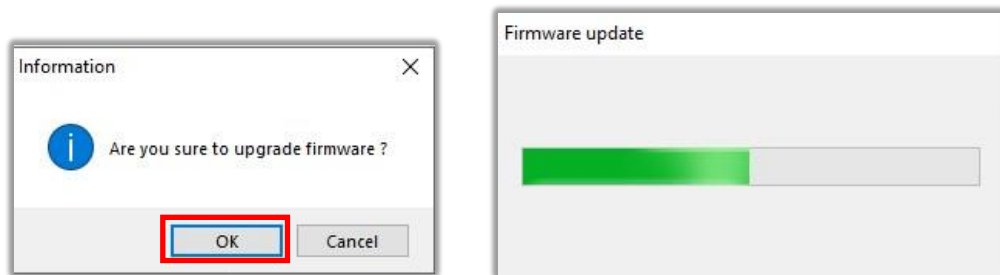
In the main page of I/O Controller Manager utility, user can update the firmware version of the I/O expansion card in the setting options of this page.



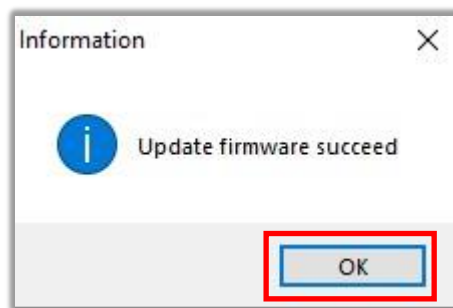
After successfully downloading the latest firmware version, “**Browse**” the file storage path location of the firmware ROM file and click the “**Upgrade**” button to run firmware upgrade process. The latest version of the firmware can be downloaded from the official SUNIX website.



Click “**OK**” to approve firmware upgrade process.



Click “**OK**” to finish firmware upgrade process. To enable new firmware feature, please turn the computer off, and then power it on later. (PC restart is useless)



Note:

- 1). Do NOT turn off or restart your computer while updating the firmware ROM.
- 2). Be sure to power off your computer, after finishing firmware upgrade.

5. Appendix

This chapter introduce technology detail that user came with usually. In addition, you could contact with us for detail technical product information.

In this appendix, we cover the following topics.

6.1 Customer Service Information

5.1. Customer Service Information

Customer satisfaction is our number one concern, and to ensure that customers receive the full benefit of our products, SUNIX services has been set up to provide technical support, driver updates, product information, and user's manual updates.

The following services are provided

E-mail for technical support

..... info@sunix.com

World Wide Web (WWW) Site for product information:

..... <http://www.sunix.com>