USB-2000 Series

USB 2.0 Full-Speed High Performance DAQ module

User's Manual

Revision History

Revision	Date	Description of Change
1.03	Dec 29, 2011	1. Adding information for USB-2084 2. Adding PI API 3. Adding PI related error codes
1.02	Dec 20, 2011	Adding ERR_USBDEV_ERROR_WRITEFILE error code
1.01	Dec 15, 2011	Modify specification of USB-2019
1.00	Oct 31, 2011	First revision

Preface

Warranty

All products manufactured by ICP DAS are under warranty regarding 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 resulting from 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, or for any infringements of patents or other rights of third parties resulting from its use.

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Content

1 Introduction

1.1 Overview

The ICP DAS USB series I/O modules are highly flexible solution for data acquisition. It provides easy USB plug-and-play operation and equips accurate measurement for all kinds of applications of automations. Compared with the traditional PC-based cards like PCI, PC/104 and ISA cards, users can achieve data acquisition easier and quicker via ICP DAS USB series I/O modules. Besides, through ICP DAS USB I/O utility, users can configure and test USB-2019 directly and easily without any coding. The friendly API library is also provided for users to develop own USB application.

1.2 Feature

- Maximum 10KS/s sampling rate
- Wide operating temperature range
- RoHS compliant
- USB 2.0 Full-Speed compliant
- No external power supply (Powered by USB)
- Plug-and-Play without driver installation
- Lockable USB cable
- Support firmware update via USB
- Utility tool for module configuration and I/O testing easily and quickly
- PWR/RUN/ERR LED indicator
- Built-in dual watchdog (hardware/software)
- Providing API Library (VC/VB/BCB/.NET)
- Module supported for Win2000/XP and Win7 (32/64 bit)

1.3 Applications

- Building automation
- Factory automation
- Machine automation
- Data acquisition and control
- Environment monitor
- Laboratory equipment and research

1.4 Specifications

1.4.1 General

Communication	
Interface	USB 2.0 Full-Speed
Watchdog	1 Hardware watchdog (1.6 second) 1 Software watchdog (Programmable)
LED Indicators / Display	
System LED Indicators	3 LED as Power, Run and Error
I/O LED Indicators	1 LED / channel as I/O status for Digital and Pulse I/O
EMS Protection	
ESD (IEC 61000-4-2)	4 kV contact for each terminal 8 kV air for random point
Environment	
Operating Temperature Range	-25 ~ +75℃
Storage Temperature Range	-40 ~ +85℃
Humidity	10 ~ 95% RH, non-condensing

1.4.2 USB-2019

The USB-2019 is an 8-channel universal analog input module. It supports the over-voltage protection of up to 240Vrms. In addition, it has voltage and current input types. It also widely supports thermocouple devices with J, K, T, E, R, S, B, N, C, L, M and $L_{DIN43710}$ types. Moreover, it provides extremely accurate thermocouple measurement and automatically cold-junction compensation for each channel. Finally, it features open wire detection for thermocouple and 4 ~ 20 mA inputs for each channel.

Channels	8 differential	
Input Type	Voltage : ±15 mV, ±50 mV, ±100 mV, ±150 mV, ±500 mV, ±1 V, ±2.5 V, ±5 V, ±10 V	
	Current : ±20 mA, 0 ~ +20 mA, +4 ~ +20 mA (Note : An external resistor is required)	
	Thermocouple : J, K, T, E, R, S, B, N, C, L, M and $L_{DIN43710}$	
Resolution	16 bit	
Accuracy	±0.1% FSR	
Sampling Rate	10 Hz (Total)	
Zero Drift	±20 μV/℃	
Span Drift	±25 ppm/℃	
Common Mode Rejection	86 dB	
Normal Mode Rejection	100 dB	
Input Impedance	Voltage input : > 400 kΩ Current input : 125Ω (External resistor is required)	
Intra-Module Isolation, Field-to-Logic	3000 V_{DC}	
Overvoltage protection	240 V_{rms}	
Individual Channel Configuration	Yes	
Open Wire Detection	Yes (Software programmable)	
Power Consumption	1.45W maximum	
Mechanical		
Dimensions (W×L×H)	Body	33mm × 78mm × 107mm
	CN-1824	29mm × 43mm × 83mm

1.4.3 USB-2084

Channels	4 channel counter type Up/Down 4 channel counter type Dir/Pulse 4 channel counter type A/B Phase 8 channels for counter type Up and Frequency	
Input Type	Up, Frequency, Up/Down, Dir/Pulse, A/B Phase	
Resolution	32 bit	
Input Frequency	500kHz maximum	
Digital Noise Filter	1~32767uS (Software programmable)	
Frequency Accuracy	±0.4%	
Isolated Input Level	On Voltage Level	+4.5V_{DC}~+30V_{DC}
	Off Voltage Level	+1V_{DC} maximum
Non-isolated Input Level	On Voltage Level	+2V_{DC}~+5V_{DC}
	Off Voltage Level	0V_{DC}~+0.8V_{DC}
Intra-Module Isolation, Field-to-Logic	2500 V_{DC}	
Individual Channel Configuration	Yes	
Power Consumption	1.11W maximum	
Mechanical		
Dimensions (W×L×H)	33mm × 102mm × 107mm	

1.5 Product Check List

The package includes the following items:

- One ICP DAS USB I/O module
- One Quick Start Guide
- One USB cable with lockable kit

It is highly recommended to read the Quick Start Guide first before using ICP DAS USB I/O modules. There is some useful information in the Quick Start Guide:

- How to install hardware and use utility

2 Hardware Information

2.1 Module Overview

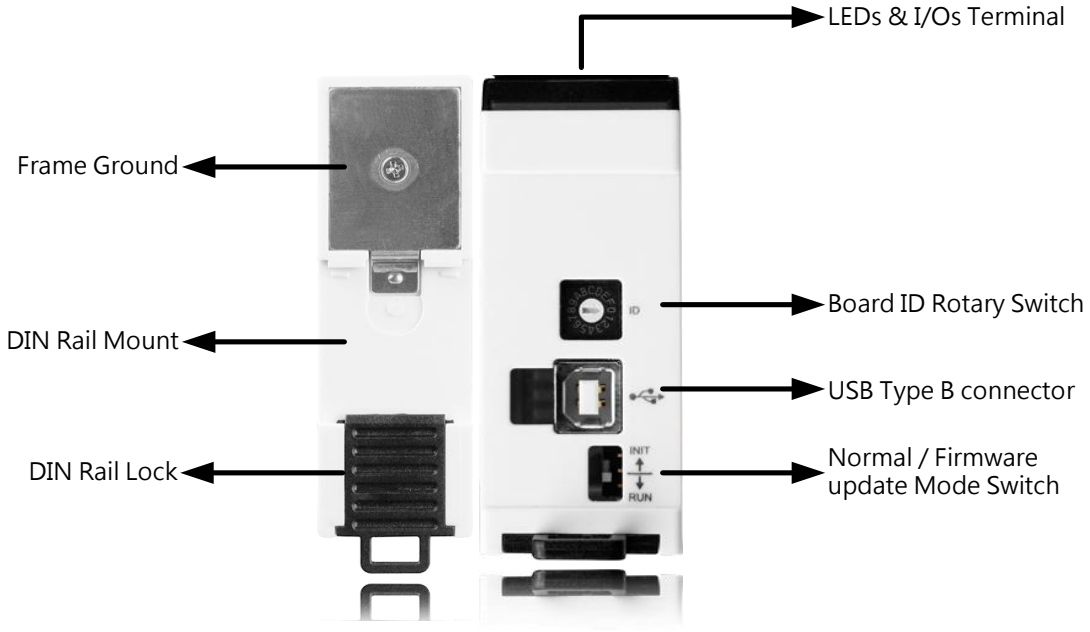


Figure 2-1 Module Overview of the ICP DAS USB I/O

Board ID Rotary Switch	
0	: User defined (Software Programmable)
1 ~ 15	: Fix board ID

Normal / Firmware Update Mode Switch	
INIT	: Firmware update mode
RUN	: Normal mode

2.1.1 USB-2019

2.1.1.1 Body

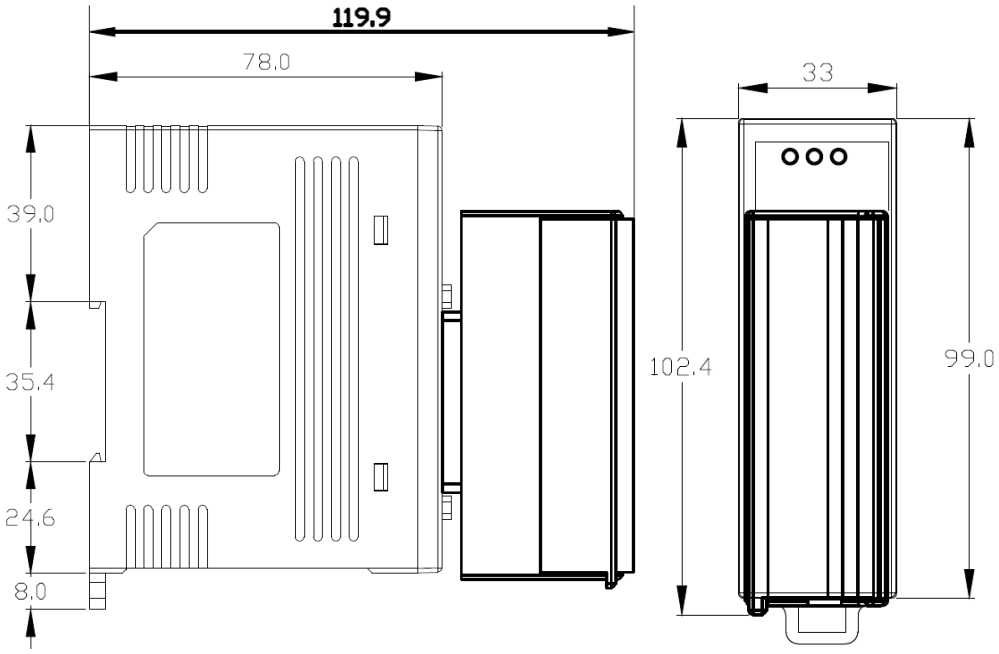


Figure 2-2, Figure 2-3 The USB-2019 left and front side view with CN-1824

2.1.1.2 CN-1824

The CN-1824 is a connector transfers DB-25 connector to 18-pin terminal block to help user to wire. The dimension is shown as follow.

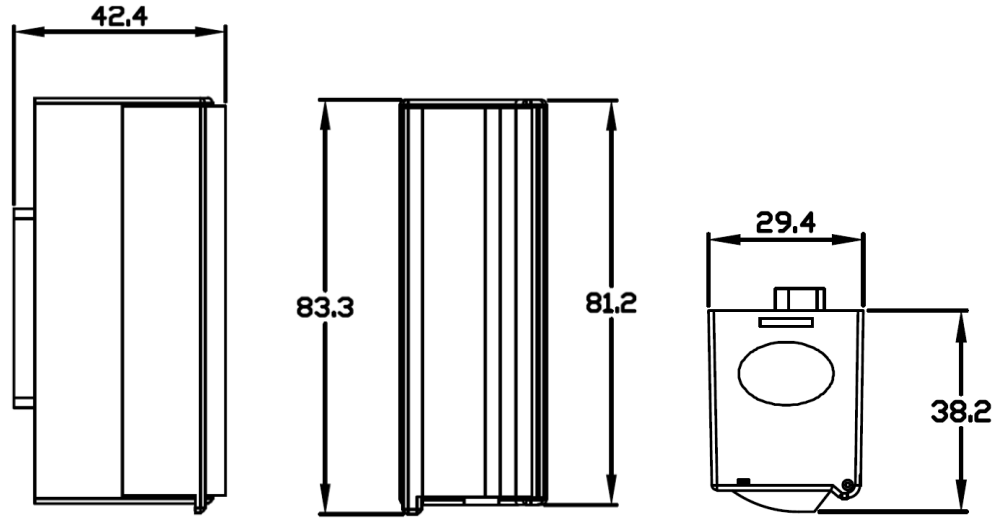


Figure 2-4, Figure 2-5, Figure 2-6 The CN-1824 left, front and top side view

2.1.2 USB-2084

2.1.2.1 Body

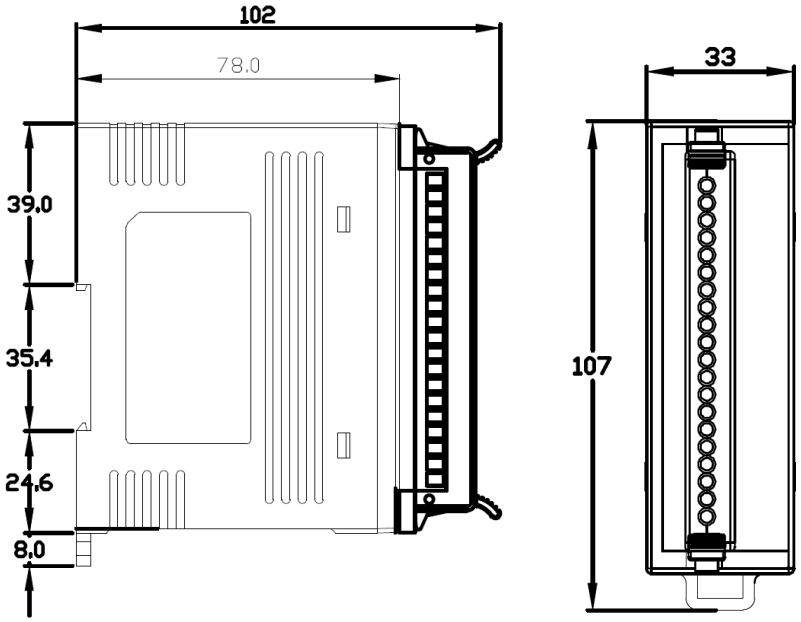


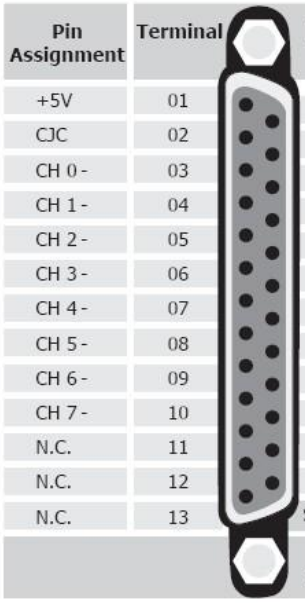
Figure 2-7, Figure 2-8 The USB-2084 left and front side view

2.2 Connector Pin Assignment

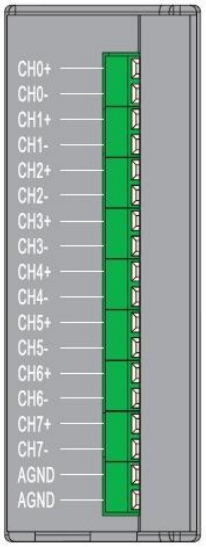
2.2.1 USB-2019

The connector of the USB-2019 is a 25-pin female D-sub connector. It can be connected by either the CN-1824 terminal block or the 25-pin D-sub male connector. The pin assignments of 25-pin female D-sub connect and the CN-1824 are shown in figure 2-9 and 2-10.

Pin Assignment	Terminal No.	Pin Assignment
+5V	01	14 AGND
CJC	02	15 CH 0+
CH 0 -	03	16 CH 1+
CH 1 -	04	17 CH 2+
CH 2 -	05	18 CH 3+
CH 3 -	06	19 CH 4+
CH 4 -	07	20 CH 5+
CH 5 -	08	21 CH 6+
CH 6 -	09	22 CH 7+
CH 7 -	10	23 N.C.
N.C.	11	24 N.C.
N.C.	12	25 N.C.
N.C.	13	Shield F.G.



25-pin Female D-Sub Connector



Pin Assignment Name
CH 0+
CH 0 -
CH 1+
CH 1 -
CH 2+
CH 2 -
CH 3+
CH 3 -
CH 4+
CH 4 -
CH 5+
CH 5 -
CH 6+
CH 6 -
CH 7+
CH 7 -
AGND
AGND

Figure 2-9, Figure 2-10 The pin assignments of 25-pin female D-sub connector and the CN-1824

2.2.2 USB-2084

The connector of the USB-2084 is a 20-pin terminal block. The pin assignment is shown as figure 2-11.

Terminal No.	Pin Assignment
01	C0A+
02	C0A-
03	C0B+
04	C0B-
05	C1A+
06	C1A-
07	C1B+
08	C1B-
09	C2A+
10	C2A-
11	C2B+
12	C2B-
13	C3A+
14	C3A-
15	C3B+
16	C3B-
17	GND
18	GND
19	N.C
20	N.C

Figure 2-11 The pin assignment of 20-pin terminal block of USB-2084

2.3 Connector Symbol Description

2.3.1 USB-2019

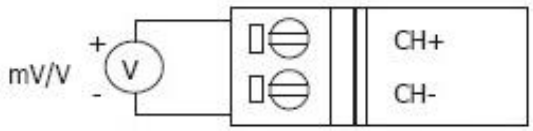
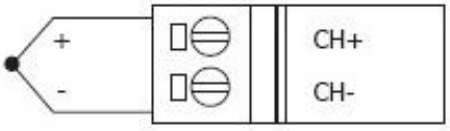
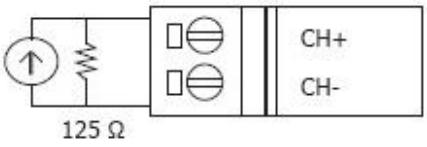
Signal	Direction	Description
AGND	I	Analog input ground
CH<N>+	I	Analog input channel N positive reference.
CH<N>-	I	Analog input channel N negative reference.

2.3.2 USB-2084

Signal	Direction	Description
GND	I	Ground pin for non-isolated connection
CxA+	I	Counter positive signal channel for pair A
CxA-	I	Counter negative signal channel for pair A
CxB+	I	Counter positive signal channel for pair B
CxB-	I	Counter negative signal channel for pair B
N.C	N/A	No connection on this pin

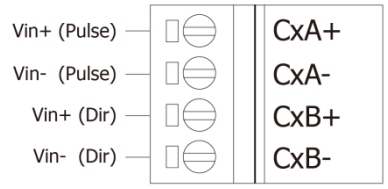
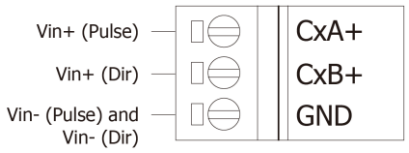
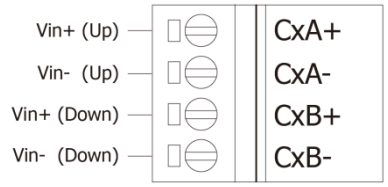
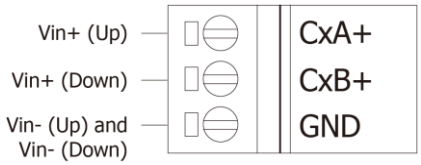
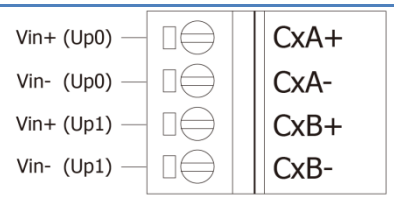
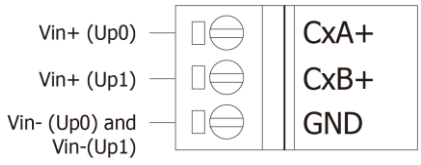
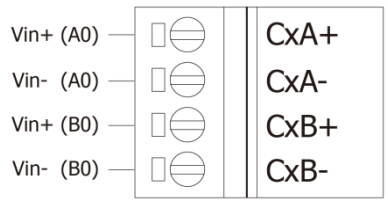
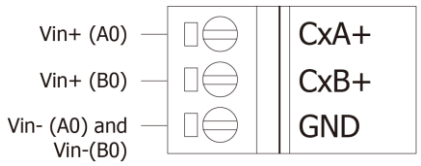
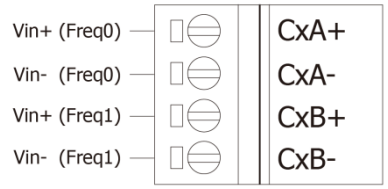
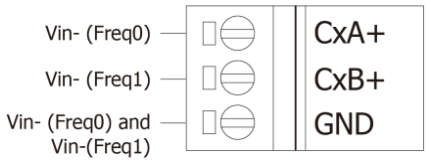
2.4 Wiring

2.4.1 USB-2019

Voltage Input	Thermocouple Input
	
Current Input	
	

Note: When connecting to current source, an external 125Ω resistor is required.

2.4.2 USB-2084

Input Mode	Isolated	Non-isolated
Dir/Pulse		
Up/Down		
Up		
A/B Phase (Quadrant)		
Frequency		

2.5 Hardware Configuration

The ICP DAS USB series I/O modules provide two basic configurations of hardware to configure board ID and enable firmware update functionality.

2.5.1 Board ID

The board ID is used to identify two modules with same product number connected to computer. When two more modules with same product number are connected, each of them must be set to different board ID to prevent conflict and unexpected errors. The board ID can be configured by the rotary switch. The location of the rotary switch is

shown in figure 2-12. The value of board ID can be configured from 1 ~ 15 by hardware, and can be configured from 16 ~ 127 by software when switched to 0.

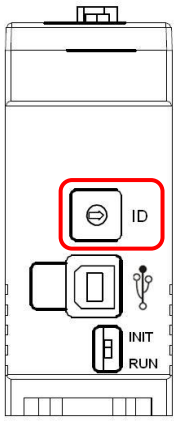


Figure 2-12 The hardware setting for board ID

2.5.2 Firmware Update

The ICP DAS USB series I/O modules provide firmware updateable functionality. Users can update firmware if latest firmware released. The switch setting is shown in figure 2-13. The INIT side of the switch means firmware update mode, run side means normal operation.

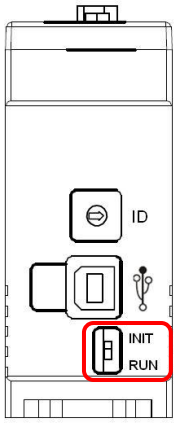
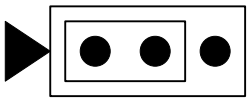
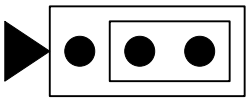


Figure 2-13 The hardware setting for enabling firmware update functionality

2.5.3 USB-2019

2.5.3.1 Hardware Watchdog

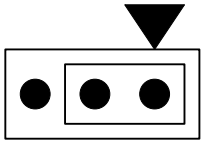
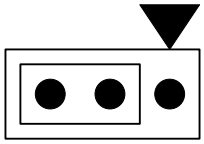
The USB-2019 has a build-in hardware watchdog. It is recommended to enable this functionality. The hardware watchdog can be set by jumper JP1. The watchdog setting is enabled by default.

Jumper	Setting			
JP1	Enable (Default)		Disable	

2.5.4 USB-2084

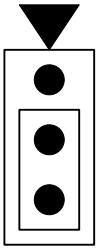
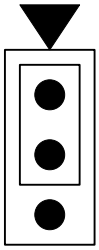
2.5.4.1 Hardware Watchdog

The USB-2084 has build-in hardware watchdog. It is recommended to enable this functionality. The hardware watchdog can be set by jumper JP1. The watchdog setting is enabled by default.

Jumper	Setting			
JP1	Enable (Default)		Disable	

2.5.4.2 Isolated/Non-isolated (TTL)

The USB-2084 has two kind of inputs, isolated and non-isolated (TTL), for different input signals. Users can switch jumper setting on the USB-2084 board for appropriate signal. These jumpers are located within JP4~JP11. The jumper settings are listed in the following table. The isolated input is set by default.

Jumper	Counter	Jumper setting			
JP4	A0	Isolated input (Default)		Non-isolated input (TTL input)	
JP5	B0				
JP6	A1				
JP7	B1				
JP8	A2				
JP9	B2				
JP10	A3				
JP11	B3				

2.6 LED Indicators

The ICP DAS USB series I/O modules have two modes, normal and firmware update, are described in previous section. Each mode has own LED way of indication. The LED indications for two modes are shown below.

2.6.1 Normal Operation

LED Indicators	LED Status	Causes
PWR (Yellow)	Blink	HW WDT triggered
	Solid	Normal Operation
	Off	Power Off
RUN (Green)	Blink	USB Bus Communicating
	Off	USB Bus Idle
ERR (Red)	Blink (Less frequent)	Warning (**Does not** affect the operation)
	Blink	Minor Error (**Does not** affect the operation)
	Solid	Major Error (**Does** affect the operation)
	Off	No Error

2.6.2 Firmware update

LED Indicators	LED Status	Causes
ALL	Blink	Waiting for Firmware to update

3 Installation

3.1 Hardware

3.1.1 Connecting to ICP DAS USB series I/O module

1. Turning on the PC you are preparing to configure ICP DAS USB I/O modules.
2. Connecting the ICP DAS USB series I/O modules to USB port on the PC.
3. Once you first time connect the USB I/O module to PC. There will be few messages in system bar in bottom right side to inform new hardware is detected and installed successfully. After the message is shown as figure 3-2, then the ICP DAS USB series I/O modules are ready to use.

Figure 3-1 The system detects the ICPDAS USB series I/O modules has plugged in

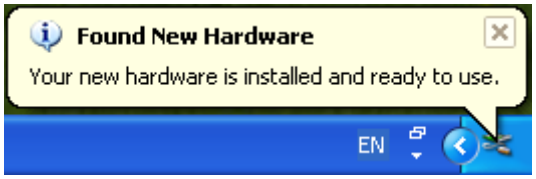


Figure 3-2 The ICPDAS USB series I/O modules are ready to use

3.2 Software

The software installer includes libraries, samples and Utility, and can be found in web site. You can install the package by double clicking the file “ICPDAS USB IO X.X.X.exe”. Then follow the instruction during installation.

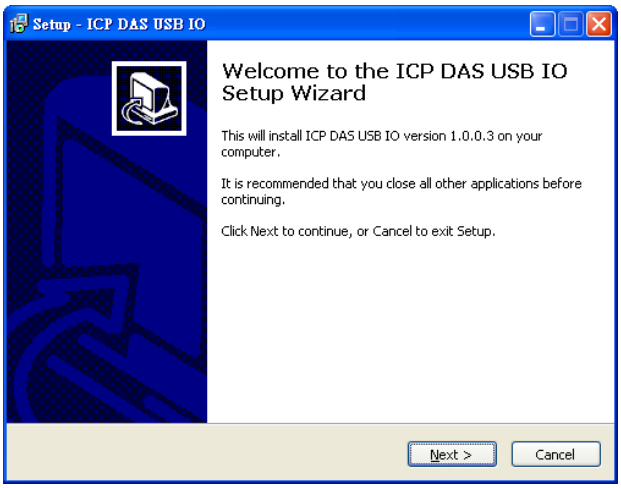


Figure 3-3 The welcome message of the ICP DAS USB series I/O installer

After the installation, the window will indicate the installation has completed as the figure below. Users can check the patch note to see the change or ignore.

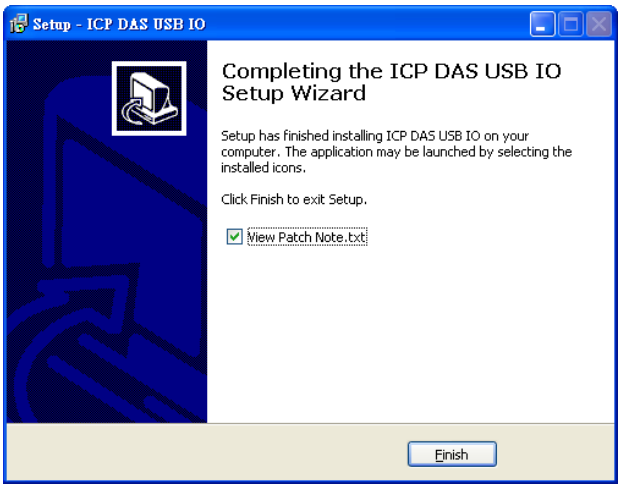


Figure 3-4 The installation has completed

3.2.1 Utility

The USB IO Utility provides a simple way to test and acquire data easily and instantly for all ICP DAS USB series I/O modules without programming. You will find this program in “Start\Programs\ICPDAS\USB IO\USB IO Utility” or the path “C:\ICPDAS\USB IO\USB IO Utility\USB IO Utility.exe”.

When users open USB IO Utility, the all ICP DAS USB series I/O modules connected to PC are listed in “Device List” as figure 3-5. The utility will scan the ICP DAS USB series I/O modules automatically. The module in the “Device List” will be removed when pull-off from PC and added when plug-in to PC.

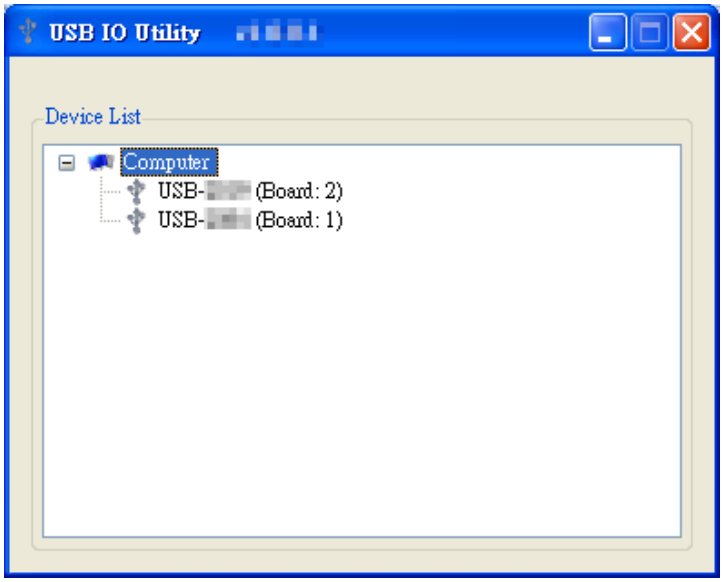


Figure 3-5 USB Utility Device List form

To access the any ICP DAS USB I/O module by double clicking module in “Device List”, then you will see another form comes out. There are several function pages, information and I/O pages, in this form. In the information page, it is used to configure basic system parameters. And in the I/O page, it is used to access real-time data and configuring I/O parameters. In addition, there will be a data log page if module supports this function.

3.2.1.1 Information Page

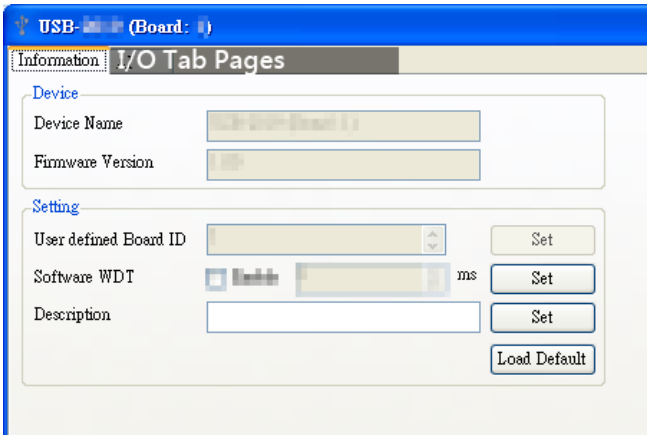


Figure 3-6 The USB I/O Information Page

- **Device Name**

  The name of the opened device.

- **Firmware Version**

  The firmware version of the opened device.

- **User Defined Board ID**

  The board ID of the opened device. The value can configure when switched the board ID to "0" by the rotary switch.

  Note: The valid range of this ID is from 16 ~ 127.

- **Software WDT**

  The software watch dog timer of the opened device. The value enables the functionality to monitor module alive. When enable the watch dog timer, computer and module will send SYNC packet to each other. When communication is failure, software WDT also provides functionality to output safety value if the module has output capability.

  Note: The valid range of this value is 100 ms ~ 30 minute.

- **Description**

  The description of the opened device. This item helps user to identify module.

  Note: The maximum characters of the description are 32.

- **Load Default**

  This function is use for restoring module to default setting (factory setting).

3.2.1.2 Analog Input

In the I/O page of the AI, the real-time value and module configuration can be read or written in this page. The detail of all items in this form will be introduced in this section.

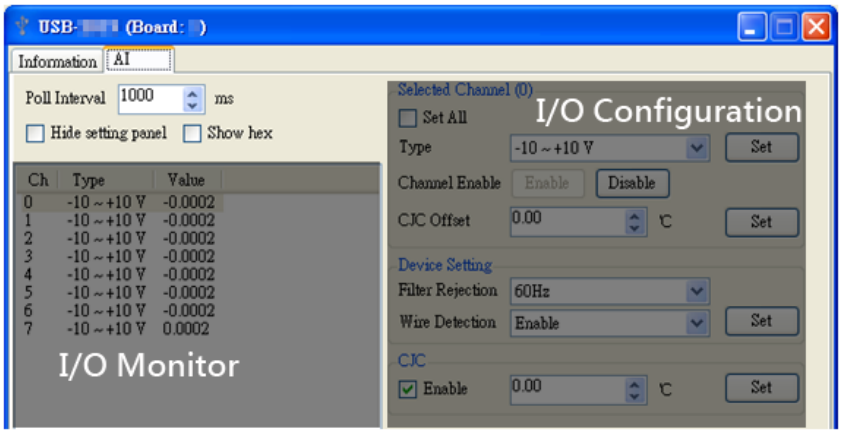


Figure 3-7 USB I/O AI Configuration Page

- **Polling Interval**

  This value is the period to poll data to the USB I/O module.

  Note: The valid value is 100 ~ 5000ms.

- **Hide Setting Panel**

  Hiding the I/O configuration panel.

- **Show Hex**

  Converting the I/O value from decimal to hexadecimal.

- **I/O Monitor Region**

  The I/O related data and configurations will be listed here. Users can select the channel to configure in the "I/O Monitor Region". The setting of this selected channel will show in "I/O configuration region".

- **I/O Configuration Region**

  All I/O related configurations can be set in this region. This region is divided into two parts, channel and module related setting. The channel related setting is in the "Selected Channel". The rest are module related settings.

  - **Set All**

    All channels related setting will follow current selection.

- **Type**

  The ICP DAS USB series I/O modules provide programmable input type for analog input. Users can set different type for each analog input channel. For more detail for type of analog input modules, please refer to Appendix A.1.

- **Channel Enable**

  Enable / Disable channel.

- **Channel CJC Offset**

  Setting the CJC offset for the specific channel. The behavior of the setting is the same as the CJC Offset, but it only affects specific channel.

  Note: The CJC offset can be any in the range of -40.96 to +40.95 °C.

- **Filter Rejection**

  In order to remove the noise from the power supply, some analog input modules feature build-in noise filter. Two filters, 50Hz and 60Hz, are provided to remove noise generated from power source.

- **Wire Detection**

  Enable / Disable the open-wire detection for thermocouple and 4~20 mA.

- **CJC Enable**

  Enable / Disable the CJC (Cold-Junction Compensation).

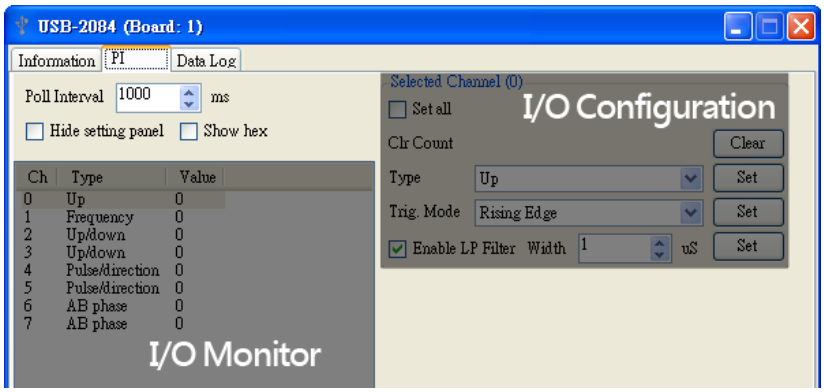
- **CJC Offset**

  Setting the CJC offset value for all AI channels. The offset value is used to add or subtract the reading value. Changing of this value will not affect calibration, but will affect the reading value of temperature type.

  Note: The CJC offset can be any in the range of -40.96 to +40.95 °C.

3.2.1.3 PI

In the I/O page of the PI, the real-time value and module configuration can be read or written in this page. The detail of all items in this form will be introduced in this section.



3-8 USB I/O PI Configuration Page

- **Polling Interval**

  This value is the period to poll data to the USB I/O module.

  Note: The valid value is 100 ~ 5000ms.

- **Hide Setting Panel**

  Hiding the I/O configuration panel.

- **Show Hex**

  Converting the I/O value from decimal to hexadecimal.

- **I/O Monitor Region**

  The I/O related data and configurations will be listed here. Users can select the channel to configure in the "I/O Monitor Region". The setting of this selected channel will show in "I/O configuration region".

- **I/O Configuration Region**

  All I/O related configurations can be set in this region. This region is divided into two parts, channel and module related setting. The channel related setting is in the "Selected Channel". The rest are module related settings.

  - **Set All**

    All channels related setting will follow current selection.

  - **Type**

    The ICP DAS USB series I/O modules provide programmable input type for pulse input. Users can set different type for each pulse input channel. For more detail for type of pulse input modules, please refer to Appendix A.3.

  - **Clr Count**

    Clear counter value for specified channel.

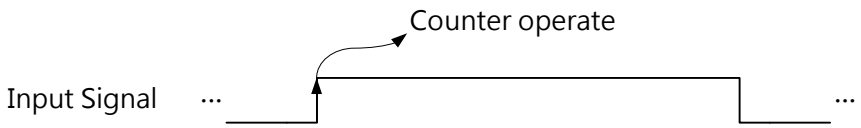
- **Ch. Isolated**

  The USB-2084 has isolated and non-isolated (TTL) inputs. To switch different input, two parts have to set as well. One is jumper JP4~JP10 described in 2.5.4.2, and the other is Ch. Isolated in Utility.

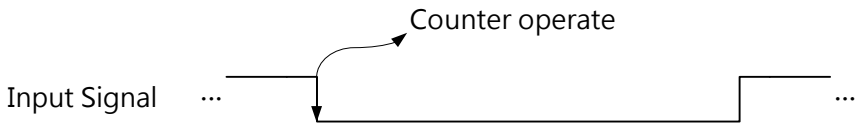
- **Trig. Mode**

  The USB-2084 has rising and falling edge trigger modes. The difference between rising and falling is the timing of counter operation. In rising edge trigger mode, counter will operate when the input signal from low to high level. In contrast, counter will operate when the input signal from high to low level in the falling edge trigger mode.

  Rising edge：



  Falling edge：



- **Enable LP Filter**

  To enable build-in digital low pass filter. The detail of this setting will be introduced in "LP Width" section.

- **LP Width**

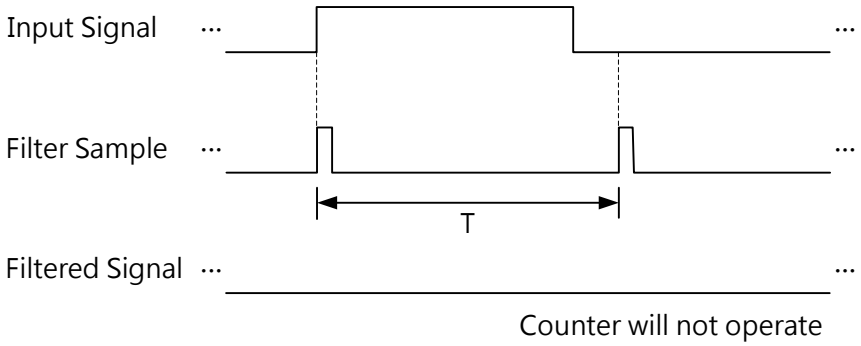
  The USB-2084 has three independent digital noise filters, LP0, LP1 and LP2, to remove noise. 8 counters share these three filters. The following table shows the relationship between filters and counters.

Channel	Low Pass Filter
A0	LP0
B0	LP0
A1	LP1
B1	LP1
A2	LP2
B2	LP2
A3	LP2
B3	LP2

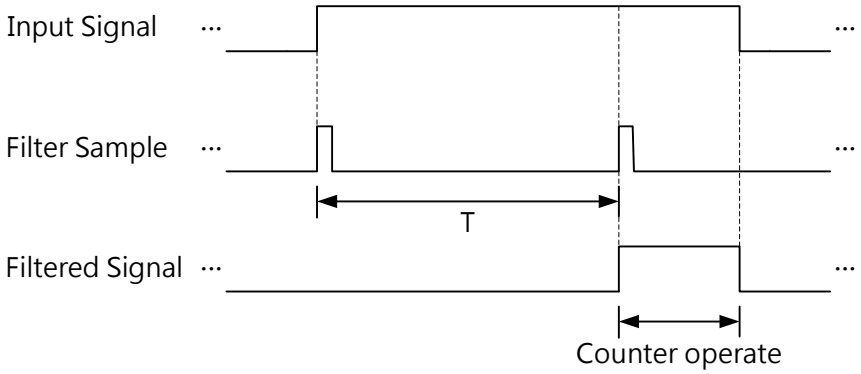
The low pass filter width can be either disable or enable, and the width can be programmed from **1 to 32767 us**.

The basic operation of filter is shown in following figure. The counter will operate when input signal hold on the same level during filter width.

(a) If the high width of the input signal is shorter then T, the counter will not operate. The input signal will be filtered. The time chart is shown as follow.



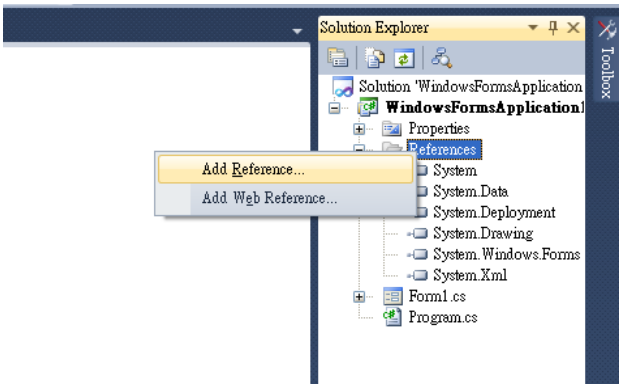
(b) If the high width of the input signal is grater then T, the counter will operate. The time chart is shown as follow.

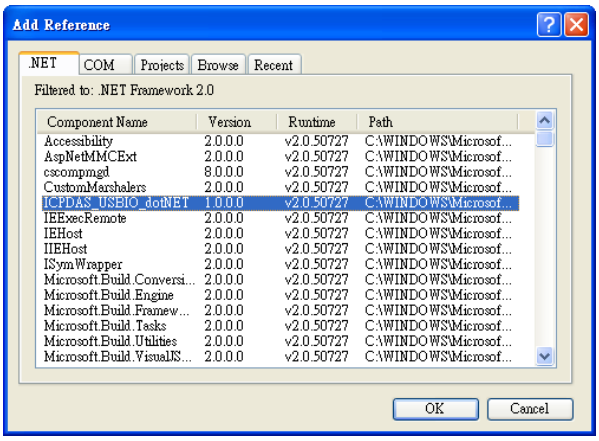


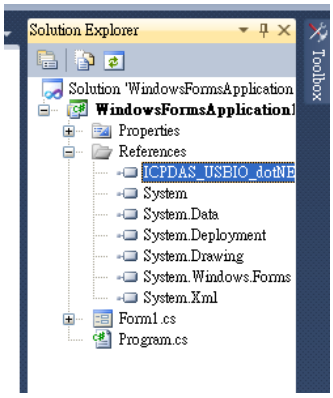
3.2.2 ICP DAS USB I/O Software Integration

The USB I/O libraries are the way to access ICP DAS USB series I/O modules. It supports various IDE like C#/VB.NET/VB/VC/BCB. Users can choose any IDE you familiar with. Before starting up project, you need to do some configuration to integrate the SDK into your IDE. The following section will indicate you how to integrate the SDK into your IDE.

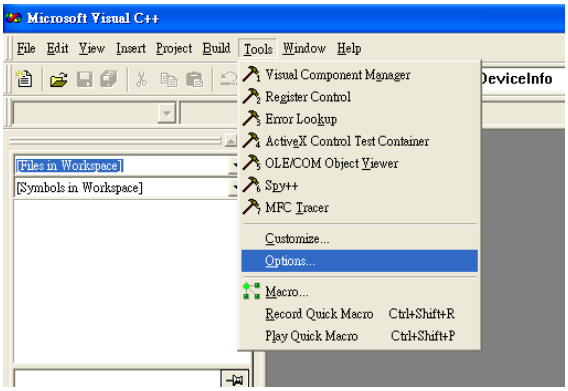
3.2.2.1 .NET

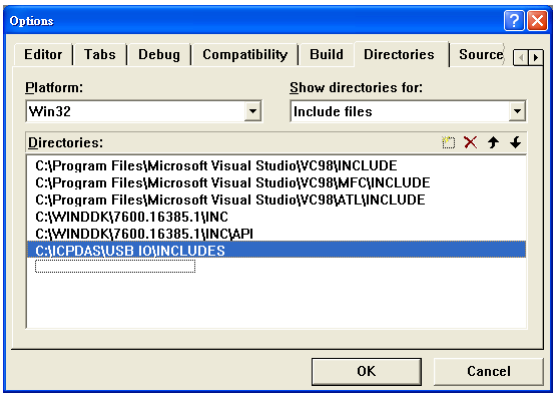


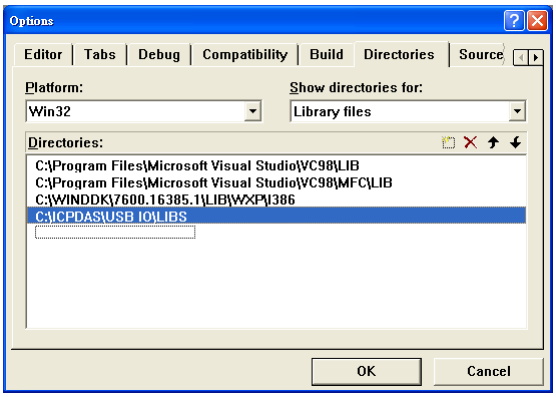




3.2.2.2 VC



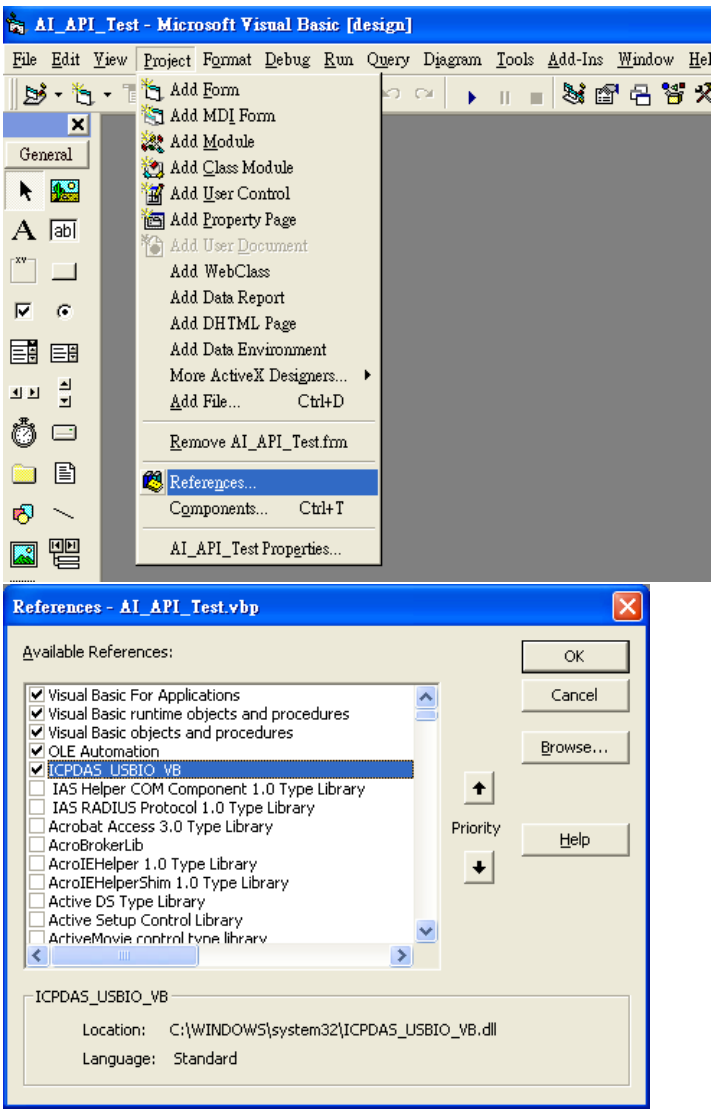




3.2.2.3 BCB

This section is left blank intentionally.

3.2.2.4 VB



3.2.3 Samples

There are several samples to help user to develop project smoothly. The samples can be found in “Start\Programs\ICPDAS\USB IO\Samples” or the path “C:\ICPDAS\USB IO\Samples“.

4 Operation

4.1 Hardware structure

The ICP DAS USB I/O provides various types of input and output. The I/O is handled by embedded controller. The hardware structure is shown in figure 4-1 below.

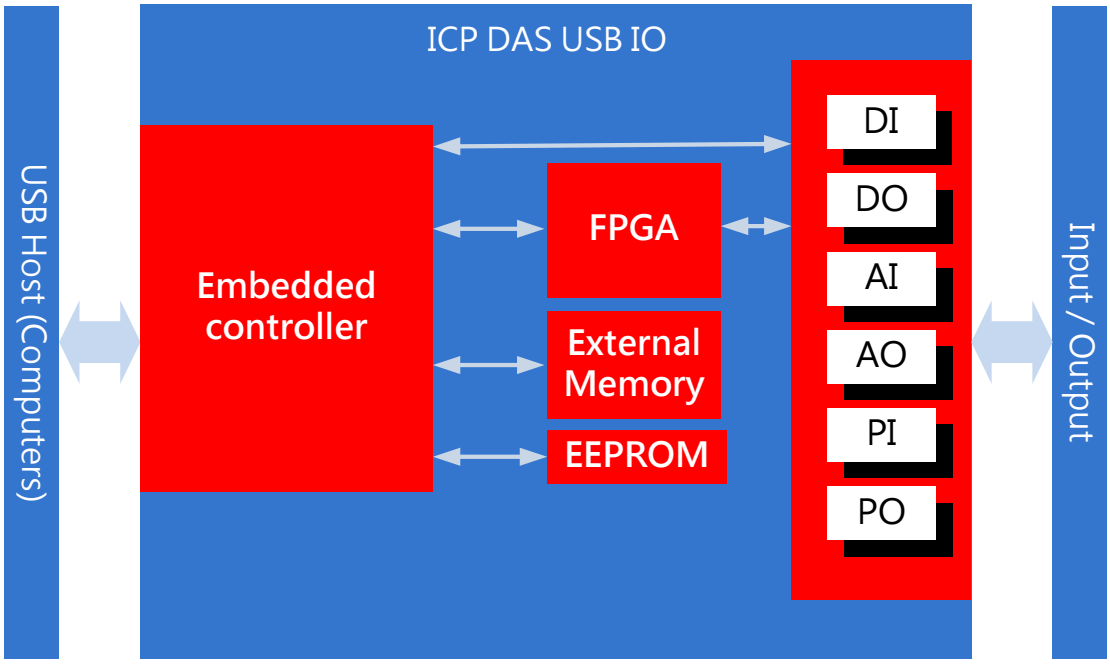


Figure 4-1 Hardware structure of the ICP DAS USB series modules

4.2 Software structure

In the programmer point of view, the ICP DAS provides a class library to user to develop project quickly and easily. The structure of the software is shown in figure 4-2. The methods of USB classes are divided into 4 groups, base, digital I/O, analog I/O and pulse I/O. The figures 4-3~4-7 show an overview to use ICP DAS USB I/O class library.

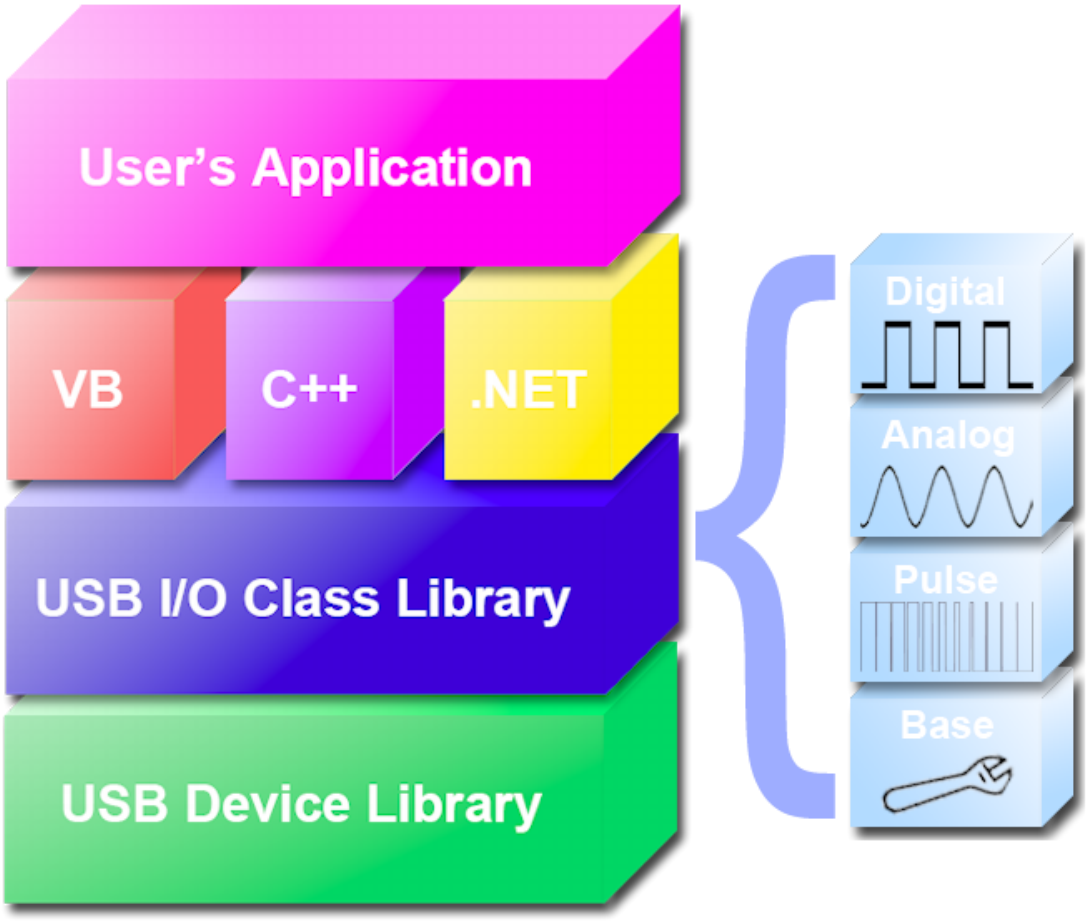


Figure 4-2 The software structure of the ICP DAS USB series I/O modules

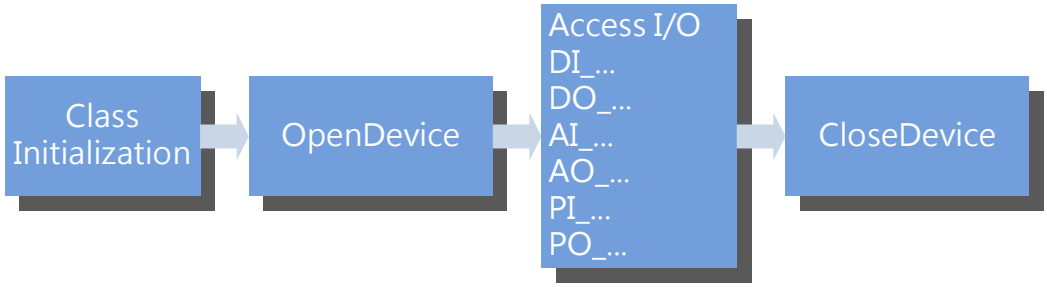


Figure 4-3 The procedure to access the USB I/O

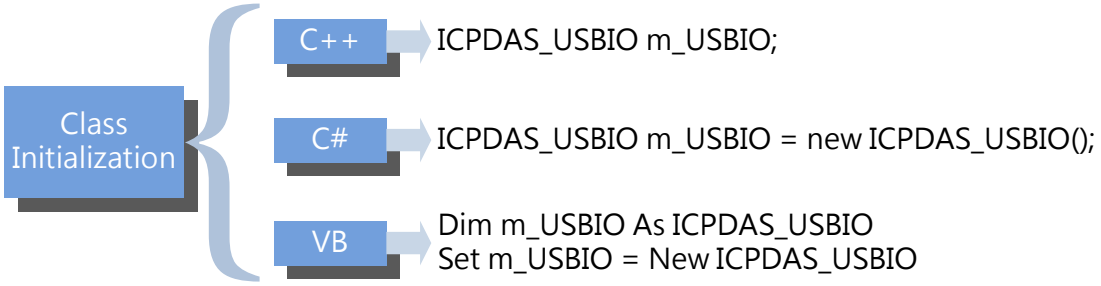


Figure 4-4 Class initialization corresponding code

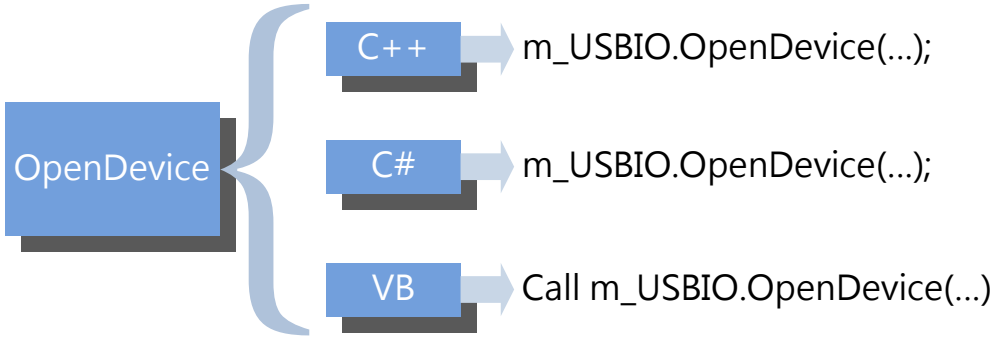


Figure 4-5 Device opening corresponding code

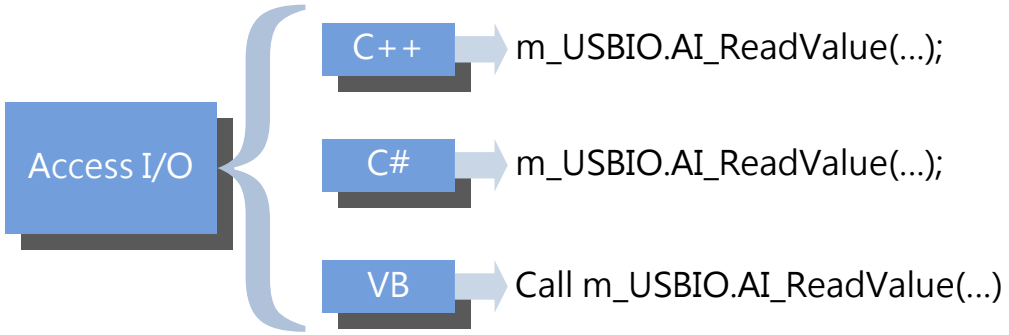


Figure 4-6 Accessing I/O corresponding code

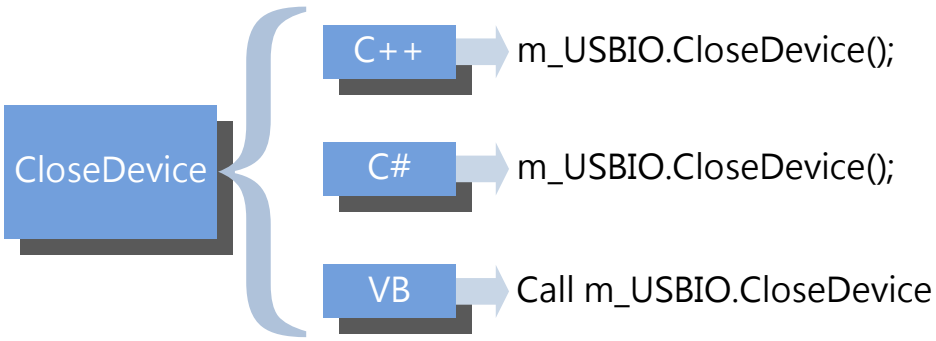


Figure 4-7 Device closing corresponding code

5 ICP DAS USB Class Members

The members of the ICPDAS_USBIO class are divided into constructors, static and public methods. The constructors initialize and create the instance of the ICPDAS_USBIO. Static methods are the ways to identify or scan what USB modules are connected. Public methods are used to access USB modules. The following tables list the members of ICPDAS_USBIO class. The detail of these will be described in the following section.

5.1 Table of Constructors

Name	Description
ICPDAS_USBIO	Initializes a new instance of the ICPDAS_USBIO class.

5.2 Table of Static Methods

Name	Description
ListDevice	List all devices connected with local PC.
ScanDevice	Scan devices connected with local PC

5.3 Table of Public Methods

5.3.1 System

Name	Description
OpenDevice	List all devices connected with local PC.
CloseDevice	Scan devices connected with local PC.
SYNCDevice	Send a synchronization packet to clear software WDT.
SetCommTimeout	Set communication timeout.
GetCommTimeout	Get communication timeout.

5.3.2 Device

Name	Description
RefreshDeviceInfo	Refresh device information.
GetSoftWDTTimeout	Get software WDT timeout.
GetDeviceID	Get ID of the device.
GetFwVer	Get firmware version of the device.
GetDeviceNickName	Get nick name of the device.
GetDeviceSN	Get serial number of the device.
GetSupportIOMask	Get the mask of this device IO distribution.
GetDITotal	Get DI total channel of the device.
GetDOTotal	Get DO total channel of the device.
GetAITotal	Get AI total channel of the device.
GetAOTotal	Get AO total channel of the device.
GetPITotal	Get PI total channel of the device.
GetPOTotal	Get PO total channel of the device.
SetUserDefinedBoardID	Set board ID of this device.
SetDeviceNickName	Set nick name of this device.
SetSoftWDTTimeout	Set software WDT timeout.
LoadDefault	Load default setting.
StopBulk	Stop current bulk process.
RegisterEmergencyPktEventHandle	Register the callback function for emergency event sent from USBIO.

5.3.3 Analog Input

Name	Description
AI_GetTotalSupportType	Analog input function - Get total supported amount.
AI_GetSupportTypeCode	Analog input function - Get supported type code.
AI_GetTypeCode	Analog input function - Get type code.
AI_GetChCJCOffset	Analog input function - Get channel CJC offset.
AI_GetChEnable	Analog input function - Get channel enable/disable.
AI_GetFilterRejection	Analog input function - Get filter rejection.
AI_GetCJCOffset	Analog input function - Get CJC offset.
AI_GetCJCEnable	Analog input function - Get CJC enable.

AI_GetWireDetectEnable	Analog input function - Get wire detect enable.
AI_GetResolution	Analog input function - Get resolution.
AI_ReadValue	Analog input function - Read AI value in double word format. (Overload)
AI_ReadBulkValue	Analog input function - Read bulk AI value (Fast acquire functionality)
AI_ReadCJCValue	Analog input function - Get CJC value.
AI_SetTypeCode	Analog input function - Set type code for specific channel. (Overload)
AI_SetChCJCOffset	Analog input function - Set channel CJC offset for specific channel. (Overload)
AI_SetChEnable	Analog input function - Set channel enable/disable.
AI_SetFilterRejection	Analog input function - Set filter rejection.
AI_SetCJCOffset	Analog input function - Set CJC offset.
AI_SetCJCEnable	Analog input function - Set CJC enable.
AI_SetWireDetectEnable	Analog input function - Set wire detect enable.

5.3.4 Pulse Input

Name	Description
PI_GetTotalSupportType	Pulse input function - Get total supported amount.
PI_GetSupportTypeCode	Pulse input function - Get supported type code.
PI_GetTypeCode	Pulse input function - Get type code.
PI_GetTriggerMode	Pulse input function - Get trigger mode.
PI_GetLPFilterEnable	Pulse input function - Get low-pass filter enable.
PI_GetChIsolatedFlag	Pulse input function - Get channel isolated flag.
PI_GetLPFilterWidth	Pulse input function - Get low-pass filter width.
PI_ReadValue	Pulse input function - Read PI value.
PI_ReadCntValue	Pulse input function - Read the count value of counters
PI_ReadFreqValue	Pulse input function - Read the frequency value of counters
PI_ReadBulkValue	Pulse input function - Get bulk PI value (Fast acquire functionality)
PI_SetTypeCode	Pulse input function - Set type code for specific channel. (Overload)
PI_ClearChCount	Pulse input function - Clear channel count with

	clear mask.
PI_ClearSinglelChCount	Pulse input function - Clear single channel count.
PI_ClearChStatus	Pulse input function - Clear channel status with clear mask.
PI_ClearSinglelChStatus	Pulse input function - Clear single channel status.
PI_SetTriggerMode	Pulse input function - Set trigger mode. (Overload)
PI_SetChIsolatedFlag	Pulse input function - Set channel isolated flag. (Overload)
PI_SetLPFilterEnable	Pulse input function - Set low-pass filter enable. (Overload)
PI_SetLPFilterWidth	Pulse input function - Set low-pass filter width. (Overload)

5.3.5 Other

Name	Description
GetCurrentAccessObj	INTERNAL USE. DO NOT USE THIS METHOD.
SetNormalPktByteArray	INTERNAL USE. DO NOT USE THIS METHOD.
SetActivePktByteArray	INTERNAL USE. DO NOT USE THIS METHOD.
ClearActivePktBuffer	INTERNAL USE. DO NOT USE THIS METHOD.
GetActivePktByteArray	INTERNAL USE. DO NOT USE THIS METHOD.
SetNormalPktEvent	INTERNAL USE. DO NOT USE THIS METHOD.
IsDevMonitorThreadStop	INTERNAL USE. DO NOT USE THIS METHOD.
IsCommWithDevice	INTERNAL USE. DO NOT USE THIS METHOD.
GetLastCmdTime	INTERNAL USE. DO NOT USE THIS METHOD.

5.4 Constructors

5.4.1 ICPDAS_USBIO

Initialize a new instance of the ICPDAS_USBIO class.

Syntax

```
public ICPDAS_USBIO (
    void
)
```

Example

```
ICPDAS_USBIO m_usbIO;


m_usbIO = new ICPDAS_USBIO();
```

5.5 Static Methods

5.5.1 ListDevice

List all devices connected to local PC.

Syntax

```
public byte ListDevice (
    WORD *o_wDID,
    BYTE *o_byBID
)
```

Parameters

*o_wDID

[OUT] An array of device ID for all devices

*o_byBID

[OUT] An array of board ID for all devices

Return Value

Number of devices connected with PC

Example

```
BYTE byNumDevice, byBIDs[127];
WORD wDIDs[127];


byNumDevice = ICPDAS_USBIO.ListDevice(&wDIDs, &byBIDs);
```

5.5.2 ScanDevice

Scanning device connected to PC. This static method just refreshes the list of the ICP DAS USB series I/O modules, it is necessary to call ListDevice() to refresh new list.

Syntax

```
public int ScanDevice (
    void
)
```

Parameters

none

Return Value

Error code

Example

```
ICPDAS_USBIO.ScanDevice();
```

5.6 Public Methods

5.6.1 System

5.6.1.1 OpenDevice

Open USBIO with device ID and board ID. The device ID is defined by the header ICPDAS_USBIO.h or the enumeration in ICPDAS_USBIO.

Syntax

```
public int OpenDevice (
    WORD i_wUSBIO_DID,
    BYTE i_byUSBIO_BID
)
```

Parameters

i_wUSBIO_DID

[IN] Device ID for the specific device to open (Defined in ICPDAS_USBIO.h)

i_byUSBIO_BID

[IN] Board ID for the specific device to open

Return Value

Error code

Example

```
Int iErrCode;
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
iErrCode = m_usbIO.OpenDevice(USB2019, 1);
iErrCode = m_usbIO.CloseDevice();
```

5.6.1.2 CloseDevice

Close device and release resource.

Syntax

```
public int CloseDevice (
    void
)
```

Parameters

none

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;


m_usbIO = new ICPDAS_USBIO();
if (ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   // Some code accessing USB I/O
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.1.3 SYNCDevice

Send synchronization packet to I/O module.

Note 1: The synchronization will be handled by library after calling OpenDevice, the procedure will be closed after calling CloseDevice. User can call this API to send synchronization packet manually, it will not stop the original synchronization procedure handled by library.

Syntax

```
public int SYNCDevice (
    void
)
```

Parameters

none

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;


m_usbIO = new ICPDAS_USBIO();
if (ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   If(ERR_NO_ERR != (iErrCode = m_usbIO.SYNCDevice()))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.1.4 SetCommTimeout

Set the communication timeout between packet send and receive.

Note 1: The timeout value will affect communication. If the timeout is small, it means the communication is timeout after the value passed.

Note 2: The default value when first initial an ICP DAS USB I/O is 100ms.

Syntax

```
public int SetCommTimeout (
    DWORD i_dwCommTimeout
)
```

Parameters

i_dCommTimeout

[IN] The communication timeout in millisecond(ms)

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;


m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR != (iErrCode = m_usbIO.SetCommTimeout(1000)))
   printf( "%d" , iErrCode)
```

5.6.1.5 GetCommTimeout

Get the communication timeout between packet send and receive.

Note 1: The timeout value will affect communication. If the timeout is small, it means the communication is timeout after the value passed.

Note 2: The default value when first initial an ICP DAS USB I/O is 100ms.

Syntax

```
public int GetCommTimeout (
    DWORD* o_dwCommTimeout
)
```

Parameters

o_dCommTimeout

[OUT] The communication timeout in millisecond(ms)

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
DWORD o_dwCommTimeout;

m_usbIO = new ICPDAS_USBIO();
if (ERR_NO_ERR == (iErrCode = m_usbIO.SetCommTimeout(1000)))
  if(ERR_NO_ERR != (iErrCode = m_usbIO. GetCommTimeout (&o_dwCommTimeout)))
    printf( "%d" , iErrCode);
  else
    printf( "%d\n" , o_dwCommTimeout);
```

5.6.2 Device

5.6.2.1 RefreshDeviceInfo

Refresh all information of this device.

Note 1: The RefreshDeviceInfo() will be called automatically when open device.

Note 2: This function will take time to refresh information.

Syntax

```
public int RefreshDeviceInfo (
    void
)
```

Parameters

none

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;


m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != iErrCode = m_usbIO.RefreshDeviceInfo()))
      printf( "%d" , iErrCode)
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.2 GetSoftWDTTimeout

Get the software WDT timeout of I/O module.

Syntax

```
public int GetSoftWDTTimeout (
    DWORD *o_dwSoftWDTTimeout
)
```

Parameters

*o_dwSoftWDTTimeout

[OUT] The software WDT timeout in millisecond(ms)

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
DWORD o_dwSoftWDTTimeout;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != iErrCode = m_usbIO. GetSoftWDTTimeout (&o_dwSoftWDTTimeout)))
      printf( "%d" ,iErrCode);
   else
      printf( "%d\n" , o_dwCommTimeout);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.3 GetDeviceID

Get ID of the device.

Syntax

```
public int GetDeviceID (
    DWORD *o_dwDeviceID
)
```

Parameters

*o_dwDeviceID

[OUT] The device ID

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
DWORD o_dwDeviceID;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. GetDeviceID (&o_dwDeviceID)))
      printf( "%d" , iErrCode);
   else
      printf( "%d" , o_dwDeviceID);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.4 GetFwVer

Get firmware version of the device.

Syntax

```
public int GetDeviceID (
    WORD *o_ wFwVer
)
```

Parameters

*o_wFwVer

[OUT] The firmware version

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
WORD o_wFwVer;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. GetFwVer (&o_wFwVer)))
      printf( "%d" , iErrCode);
   else
      printf( "%d" ,o_wDwVer);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.5 GetDeviceNickName

Get nick name of the device.

Syntax

```
public int GetDeviceNickName (
    BYTE *o_byDeviceNickName
)
```

Parameters

*o_byDeviceNickName

[OUT] The byte array of the nick name of the device

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byDeviceNickName [USBIO_NICKNAME_LENGTH];

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. GetDeviceNickName (o_byDeviceNickName)))
      printf( "%d" , iErrCode);
   else
      printf( "%s" , o_byDeviceNickName);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.6 GetDeviceSN

Get serial number of the device.

Syntax

```
public int GetDeviceSN (
    BYTE *o_byDeviceSN
)
```

Parameters

*o_byDeviceSN

[OUT] The byte array of the serial number of the device

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byDeviceSN [USBIO_SN_LENGTH];

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. GetDeviceSN (o_ byDeviceSN)))
      printf( "%d" , iErrCode);
   else
      printf( "%s" , o_ byDeviceSN);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.7 GetSupportIOMask

Get the mask of this device IO distribution. Each bit of the mask indicates each supported IO type as shown in the following table.

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
N/A	N/A	PI	PO	AI	AO	DI	DO

This mask can help you to identify what types of IO are supported in the device.

Syntax

```
public int GetSupportIOMask (
    BYTE *o_bySupportIOMask
)
```

Parameters

*o_bySupportIOMask

[OUT] The support IO mask of the device

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_bySupportIOMask;


m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. GetSupportIOMask (&o_bySupportIOMask)))
      printf( "%d" , iErrCode);
   else
      printf( "0x%02x" ,o_bySupportIOMask);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.8 GetDITotal

Get DI total number of channels of the device.

Syntax

```
public int GetDITotal (
    BYTE *o_byDITotal
)
```

Parameters

*o_byDITotal

[OUT] The DI total number of channels

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byDITotal;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. GetDITotal (&o_byDITotal)))
      printf( "%d" , iErrCode);
   else
      printf( "%d" ,o_byDITotal);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.9 GetDOTotal

Get DO total number of channels of the device.

Syntax

```
public int GetDOTotal (
    BYTE *o_byDOTotal
)
```

Parameters

*o_byDOTotal

[OUT] The DO total number of channels

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byDOTotal;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. GetDOTotal (&o_byDOTotal)))
      printf( "%d" , iErrCode);
   else
      printf( "%d" ,o_byDOTotal);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.10 GetAITotal

Get AI total number of channels of the device.

Syntax

```
public int GetAITotal (
    BYTE *o_byAITotal
)
```

Parameters

*o_byAITotal

[OUT] The AI total number of channels

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byAITotal;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. GetAITotal (&o_byAITotal)))
      printf( "%d" , iErrCode);
   else
      printf( "%d" ,o_byAITotal);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.11 GetAOTotal

Get AO total number of channels of the device.

Syntax

```
public int GetAOTotal (
    BYTE *o_byAOTotal
)
```

Parameters

*o_byAOTotal

[OUT] The AO total number of channels

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byAOTotal;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. GetAOTotal (&o_byAOTotal)))
      printf( "%d" , iErrCode);
   else
      printf( "%d" ,o_byAOTotal);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.12 GetPITotal

Get PI total number of channels of the device.

Syntax

```
public int GetPITotal (
    BYTE *o_byPITotal
)
```

Parameters

*o_byPITotal

[OUT] The PI total number of channels

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byPITotal;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. GetPITotal (&o_byPITotal)))
      printf( "%d" , iErrCode);
   else
      printf( "%d" ,o_byPITotal);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.13 GetPOTotal

Get PO total number of channels of the device.

Syntax

```
public int GetPOTotal (
    BYTE *o_byPOTotal
)
```

Parameters

*o_byPOTotal

[OUT] The PO total number of channels

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byPOTotal;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. GetPOTotal (&o_byPOTotal)))
      printf( "%d" , iErrCode);
   else
      printf( "%d" ,o_byPOTotal);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.14 SetUserDefinedBoardID

Set board ID of this device. The valid value of the ID is from 16 to 127.

Syntax

```
public int SetUserDefinedBoardID (
    BYTE i_byBID
)
```

Parameters

i_byBID

[IN] The board ID to set

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. SetUserDefinedBoardID (123)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.15 SetDeviceNickName

Set nick name of this device. The maximum number of the character of this device is 32.

Syntax

```
public int SetDeviceNickName (
    BYTE *i_byDeviceNickName
)
```

Parameters

*i_byDeviceNickName

[IN] The byte array of the nick name to set

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte byNickName[USBIO_NICKNAME_LENGTH];

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   sprintf(byNickName,  "Station 1-1-3" );
   if(ERR_NO_ERR != (iErrCode = m_usbIO. SetDeviceNickName (byNickName)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.16 SetSoftWDTTimeout

Set the software WDT timeout.

The minimum value of timeout is 100ms, and maximum is 30 minutes.

Syntax

```
public int SetSoftWDTTimeout (
    DWORD i_dwSoftWDTTimeout
)
```

Parameters

i_dwSoftWDTTimeout

[IN] The software WDT timeout in millisecond(ms)

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;


m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. SetSoftWDTTimeout (1000)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.17 LoadDefault

Load default setting.

Syntax

```
public int LoadDefault (
    void
)
```

Parameters

none

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if (ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   If(ERR_NO_ERR != (iErrCode = m_usbIO.LoadDefault ()))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.18 StopBulk

Stop current bulk process.

Syntax

```
public int LoadDefault (
    void
)
```

Parameters

none

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if (ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   If(ERR_NO_ERR != (iErrCode = m_usbIO.StopBulk ()))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.2.19 RegisterEmergencyPktEventHandle

Register the callback function for emergency event sent from USBIO.

When in callback operation, it will cause the performance in your callback function.

Please reduce execute time in this callback function.

Syntax

```
public int RegisterEmergencyPktEventHandle (
    OnEmergencyPktArriveEvent i_evtHandle
)
```

Parameters

i_evtHandle

[IN] The callback function for emergency event

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Bool m_bEmcyPktArrive;
Byte byEmcyPkt[USBIO_MAX_PACKET_LENGTH];

Void emcypkeEvt(Byte* byData, Byte byLen)
{
   m_ bEmcyPktArrive = true;
   memcpy(byEmcyPkt, byData, byLen);
}

m_usbIO = new ICPDAS_USBIO();
if (ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB20xx, 1)))
{
   If(ERR_NO_ERR != (iErrCode = m_usbIO.RegisterEmergencyPktEventHandle (emcypkeEvt)))
      printf( "%d" , iErrCode);
   while(1)
   {
      // User' s application loop
      If(m_ bEmcyPktArrive)
      {
         // Handle emcy packet
      }
   }
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.3 Analog Input

5.6.3.1 AI_GetTotalSupportType

Analog input function - Get total supported amount.

Syntax

```
public int AI_GetTotalSupportType (
    BYTE *o_byTotalSupportType
)
```

Parameters

*o_byTotalSupportType

[OUT] The number of total support type

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byTotalSupportType;
Byte o_bySupportTypeCode[USBIO_MAX_SUPPORT_TYPE];
Int iIdx;
Bool bRet = true;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_GetTotalSupportType (&o_ byTotalSupportType)))
   {
      printf( "%d" , iErrCode);
      bRet = false;
   }
   if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_GetSupportTypeCode (o_ bySupportTypeCode)))
   {
      printf( "%d" , iErrCode);
      bRet = false;
   }
   If(bRet)
   {
      printf( "%d\n" , o_byTotalSupportType);
      for(iIdx = 0; iIdx < o_byTotalSupportType; iIdx++)
         printf( "%02x\n" , o_bySupportTypeCode[iIdx]);
   }
}
```

5.6.3.2 AI_GetSupportTypeCode

Analog input function - Get supported type code Please refer to Appendix A.1 of user's manual to map AI channels input type.

Syntax

```
public int AI_GetTotalSupportType (
    BYTE *o_bySupportTypeCode
)
```

Parameters

*o_byTotalSupportType

[OUT] The number of total support type

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byTotalSupportType;
Byte o_bySupportTypeCode[USBIO_MAX_SUPPORT_TYPE];
Int iIdx;
Bool bRet = true;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
  if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_GetTotalSupportType (&o_ byTotalSupportType)))
  {
    printf( "%d" , iErrCode);
    bRet = false;
  }
  if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_GetSupportTypeCode (o_ bySupportTypeCode)))
  {
    printf( "%d" , iErrCode);
    bRet = false;
  }
  If(bRet)
  {
    printf( "%d\n" , o_byTotalSupportType);
    for(iIdx = 0; iIdx < o_byTotalSupportType; iIdx++)
      printf( "%02x\n" , o_bySupportTypeCode[iIdx]);
  }
}
```

5.6.3.3 AI_GetTypeCode

Analog input function - Get type code Please refer to user's manual to map AI channels input type. The type code can reference to Appendix A.1.

Syntax

```
public int AI_GetTypeCode (
    BYTE *o_byTypeCode
)
```

Parameters

*o_byTypeCode

[OUT] The byte array of type code

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byTypeCode [USBIO_AI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
  if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_GetTypeCode (o_byTypeCode)))
    printf( "%d" , iErrCode);
  else
  {
    for(iIdx = 0; iIdx < USBIO_AI_MAX_CHANNEL; iIdx++)
      printf( "%02x\n" , o_byTypeCode[iIdx]);
  }
}
```

5.6.3.4 AI_GetChCJCOffset

Analog input function - Get channel CJC offset The valid range of offset is -40.96 ~ +40.95.

Syntax

```
public int AI_GetChCJCOffset (
    float *o_fChCJCOffset
)
```

Parameters

*o_ fChCJCOffset

[OUT] The float array of channel CJC offset

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
float o_fChCJCOffset [USBIO_AI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_GetChCJCOffset (o_fChCJCOffset)))
      printf( "%d" , iErrCode);
   else
   {
      for(iIdx = 0; iIdx < USBIO_AI_MAX_CHANNEL; iIdx++)
         printf( "%.5f\n" , o_fChCJCOffset [iIdx]);
   }
}
```

5.6.3.5 AI_GetChEnable

Analog input function - Get channel enable/disable. Each byte indicates 8 channels enable/disable mask. EX: Byte0 -> Channel0 ~ 7

Syntax

```
public int AI_GetChCJCOffset (
    BYTE *o_byChEnable
)
```

Parameters

*o_byChEnable

[OUT] The byte array of channel enable/disable mask

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byChEnable [(USBIO_AI_MAX_CHANNEL + 7] / 8];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_GetChEnable (o_byChEnable)))
      printf( "%d" , iErrCode);
   else
   {
      for(iIdx = 0; iIdx < (USBIO_AI_MAX_CHANNEL + 7) / 8; iIdx++)
         printf( "%02x\n" , o_byChEnable [iIdx]);
   }
}
```

5.6.3.6 AI_GetFilterRejection

Analog input function - Get filter rejection.

Rejection Setting	Value
60Hz	0
50Hz	1

Syntax

```
public int AI_GetFilterRejection (
    BYTE *o_byFilterRejection
)
```

Parameters

*o_byFilterRejection

[OUT] The filter rejection

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byFilterRejection;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_GetFilterRejection (&o_byFilterRejection)))
      printf( "%d" , iErrCode);
   else
      printf( "%d\n" , o_byFilterRejection);
}
```

5.6.3.7 AI_GetCJCOffset

Analog input function - Get CJC offset The valid range of offset is -40.96 ~ +40.95.

Syntax

```
public int AI_GetCJCOffset (
    float *o_fCJCOffset
)
```

Parameters

*o_fCJCOffset

[OUT] The CJC offset

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
float o_fCJCOffset;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_GetCJCOffset (&o_fCJCOffset)))
      printf( "%d" , iErrCode);
   else
      printf( "%.5f\n" , o_fCJCOffset);
}
```

5.6.3.8 AI_GetCJCEnable

Analog input function - Get CJC enable.

Enable Setting	Value
Disable	0
Enable	1

Syntax

```
public int AI_GetCJCEnable (
    BYTE *o_byCJCEnable
)
```

Parameters

*o_byCJCEnable

[OUT] The CJC enable

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byCJCEnable;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_GetCJCEnable (&o_byCJCEnable)))
      printf( "%d" , iErrCode);
   else
      printf( "%d\n" , o_byCJCEnable);
}
```

5.6.3.9 AI_GetWireDetectEnable

Analog input function - Get wire detect enable.

Enable Setting	Value
Disable	0
Enable	1

Syntax

```
public int AI_GetWireDetectEnable (
    BYTE *o_byWireDetectEnable
)
```

Parameters

*o_byWireDetectEnable

[OUT] The wire detect enable

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byWireDetectEnable;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_GetWireDetectEnable (&o_byWireDetectEnable)))
      printf( "%d" , iErrCode);
   else
      printf( "%d\n" , o_byWireDetectEnable);
}
```

5.6.3.10 AI_GetResolution

Analog input function - Get resolution. Each byte indicates each channel real resolution.

Syntax

```
public int AI_GetResolution (
    BYTE *o_byResolution
)
```

Parameters

*o_byResolution

[OUT] The byte array of resolution for each channel

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byResolution[USBIO_AI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
  if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_GetResolution (o_byResolution)))
    printf( "%d" , iErrCode);
  else
  {
    For(iIdx = 0; iIdx < USBIO_AI_MAX_CHANNEL; iIdx++)
      printf( "%d\n" , o_byResolution[iIdx]);
  }
}
```

5.6.3.11 AI_ReadValue

The class library provides 4 overload methods to read AI value. Two methods, the parameter in float format, will convert raw value to true inside the method. Others will return raw value without having conversion. The overview of these methods is as following table, and will describe in the following section.

Name of Methods
AI_ReadValue (DWORD* o_dwAIValue)
AI_ReadValue (DWORD* o_dwAIValue, BYTE* o_byAIChStatus)
AI_ReadValue (float* o_fAIValue)
AI_ReadValue (float* o_fAIValue, BYTE* o_byAIChStatus)

5.6.3.11.1 AI_ReadValue (DWORD *)

Analog input function - Read AI value in double word (digital) format.

In the digital format, the value represents the value from zero to full scale. Ex: For type -10V ~ +10V, the value 0x0 indicates -10V and 0xFFFF (16bit resolution) indicates +10V.

Please note that, when channel was not in good status, the reading value no longer represents zero to full scale. Different channel status follows the following rule:

- Channel Over

  The reading value represents a sign value X indicates how many value over full scale range. This value can be calculated by following formula:

  Assume current type is -10V ~ +10V with 16 bit resolution and reading value is 0x13E, then we can get the actual value Y is $\mathrm{Y} = \left(1 + \frac{0\mathrm{X13E}}{0\mathrm{xFFFF}}\right) \times \left(10 - (-10)\right) + (-10)$

- Channel Under

  The reading value represents a sign value X indicates how many value under zero scale range. This value can be calculated by following formula:

  Assume current type is -5V ~ +5V with 16 bit resolution and reading value is 0x53E, then we can get the actual value Y is $\mathrm{Y} = \left(0 - \frac{0\mathrm{X53E}}{0\mathrm{xFFFF}}\right) \times \left(5 - (-5)\right) + (-5)$

- Channel Open & Channel Close

  The reading value of these two statuses will be the full scale for channel open and zero scale for channel close.

The overload API for only reading AI value cannot detect the channel status. It only read the AI value but has the most efficiency.

Syntax

```
public int AI_ReadValue (
    DWORD *o_dwAIValue
)
```

Parameters

*o_dwAIValue

[OUT] The raw value of AI value

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
DWORD o_dwAIValue[USBIO_AI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_ReadValue(o_dwAIValue)))
      printf( "%d" , iErrCode);
   else
   {
      For(iIdx = 0; iIdx < USBIO_AI_MAX_CHANNEL; iIdx++)
         printf( "0x%08x\n" , o_dwAIValue[iIdx]);
   }
}
```

5.6.3.11.2 AI_ReadValue (DWORD *, BYTE*)

Analog input function - Read AI value in double word (digital) format.

In the digital format, the value represents the value from zero to full scale. Ex: For type -10V ~ +10V, the value 0x0 indicates -10V and 0xFFFF (16bit resolution) indicates +10V.

Please note that, when channel was not in good status, the reading value no longer represents zero to full scale. Different channel status follows the following rule:

- Channel Over

  The reading value represents a sign value X indicates how many value over full scale range. This value can be calculated by following formula:

  Assume current type is -10V ~ +10V with 16 bit resolution and reading value is 0x13E, then we can get the actual value Y is $\mathrm{Y} = \left(1 + \frac{0\mathrm{X13E}}{0\mathrm{xFFFF}}\right) \times \left(10 - (-10)\right) + (-10)$

- Channel Under

  The reading value represents a sign value X indicates how many value under zero scale range. This value can be calculated by following formula:

  Assume current type is -5V ~ +5V with 16 bit resolution and reading value is 0x53E, then we can get the actual value Y is $\mathrm{Y} = \left(0 - \frac{0\mathrm{X53E}}{0\mathrm{xFFFF}}\right) \times \left(5 - (-5)\right) + (-5)$

- Channel Open & Channel Close

  The reading value of these two statuses will be the full scale for channel open and zero scale for channel close.

Syntax

```
public int AI_ReadValue (
    DWORD *o_dwAIValue
    BYTE* o_byAIChStatus
)
```

Parameters

*o_dwAIValue

[OUT] The raw value of AI value

*o_byAIChStatus

[OUT] The byte array of channel status

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
DWORD o_dwAIValue[USBIO_AI_MAX_CHANNEL];
Byte o_byAIChStatus[USBIO_AI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
  if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_ReadValue(o_dwAIValue, o_byAIChStatus)))
    printf( "%d" , iErrCode);
  else
  {
    For(iIdx = 0; iIdx < USBIO_AI_MAX_CHANNEL; iIdx++)
      printf( "0x%08x,  0x%02x\n" , o_dwAIValue[iIdx], o_byAIChStatus);
  }
}
```

5.6.3.11.3 AI_ReadValue (float *)

Analog input function - Read the real AI value without channel status.

The reading value is calculated, users no need to convert it to real value for current input type. Ex: The reading value is 1.316 in -2.5 ~ +2.5V, the input signal is 1.316V.

Syntax

```
public int AI_ReadValue (
    float *o_fAIValue
)
```

Parameters

*o_fAIValue

[OUT] The true value of AI value

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
float o_fAIValue[USBIO_AI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_ReadValue(o_fAIValue)))
      printf( "%d" , iErrCode);
   else
   {
      For(iIdx = 0; iIdx < USBIO_AI_MAX_CHANNEL; iIdx++)
         printf( "%.5f\n" , o_dwAIValue[iIdx]);
   }
}
```

5.6.3.11.4 AI_ReadValue (float *, BYTE*)

Analog input function - Read the real AI value with channel status.

Syntax

```
public int AI_ReadValue (
    float *o_fAIValue
    BYTE* o_byAIChStatus
)
```

Parameters

*o_fAIValue

[OUT] The true value of AI value

*o_byAIChStatus

[OUT] The byte array of channel status

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
float o_fAIValue[USBIO_AI_MAX_CHANNEL];
Byte o_byAIChStatus[USBIO_AI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_ReadValue(o_fAIValue, o_byAIChStatus)))
      printf( "%d" , iErrCode);
   else
   {
      For(iIdx = 0; iIdx < USBIO_AI_MAX_CHANNEL; iIdx++)
         printf( "%.5f,   0x%02x\n" , o_fAIValue[iIdx], o_byAIChStatus);
   }
}
```

5.6.3.12 AI_ReadBulkValue

Analog input function – Trigger reading bulk AI value (Fast acquire functionality).

When in callback operation, it will cause the performance in your callback function. Please reduce execute time in this callback function.

The detail of operation is described as follow. When call this API, the AI module operation will be changed from normal to fast acquire mode. In fast acquire mode, AI module follow the parameter of API setting to acquire data.

The API has block and non-block operation. In block operation, user’ s application needs to wait until API finishing all procedure. In contrast with block mode, non-block provides a flexible way for user. In non-block operation, user’ s application can proceed to own other code. To enable non-block operation, it is important to declare a callback function and pass it through last parameter. For block operation, just pass a NULL definition in last parameter.

Due to the USB 2.0 Full-speed transfer rate capability, the maximum sample rate is 10 KHz.

Syntax

```
public int AI_ReadBulkValue (
    BYTE i_byStartCh,
    BYTE i_byChTotal,
    DWORD i_dwSampleWidth,
    Float i_fSampleRate,
    DWORD i_dwBufferWidth,
    DWORD *o_dwDataBuffer,
    OnBulkValueFinishEvent i_CBFunc
)
```

Parameters

i_byStartCh

[IN] The starting acquire channel

i_byChTotal

[IN] The total channels to acquire

i_dwSampleWidth

[IN] The sampling width (ms)

i_fSampleRate

[IN] The sampling rate (Hz). 10KHz maximum.

i_dwBufferWidth

[IN] The width of the buffer for single channel

*o_dwDataBuffer

[OUT] The 2-dimension buffer array to store

i_CBFunc

[IN] Block operation – NULL

[IN] Non-block operation - The address of callback function.

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
// To read 0~1 channel for 100ms in 5 KHz sample rate each channel in non-block operation
// So we have the following variable declaration
#define SampleRate 5000
#define BufferWidth 500; // 5000(Hz) * 0.1(100ms)
DWORD m_dwBuffer[2][BufferWidth];

Void BulkFinishCallback(DWORD dwCount)
{
   // Callback function to handle data
}

Int main()
{
   m_usbIO = new ICPDAS_USBIO();
   if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
   {
      if(ERR_NO_ERR != (iErrCode = m_usbIO. AI_ReadBulkValue(0,
                                                2,
                                                100,
                                                SampleRate,
                                                BufferWidth
                                                m_dwBuffer,
                                                BulkFinishCallback)))
         printf( "%d" , iErrCode);

      while(1) {Sleep(1);}
   }
}
```

5.6.3.13 AI_ReadCJCValue

Analog input function - Read the current CJC value on the module.

Syntax

```
public int AI_ReadCJCValue (
    float *o_fCJCValue
)
```

Parameters

*o_fCJCValue

[OUT] The CJC value

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
float o_fCJCValue;
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_ReadCJCValue(o_fCJCValue)))
      printf( "%d" , iErrCode);
   else
      printf( "%.5f\n" , o_fCJCValue);
}
```

5.6.3.14 AI_SetTypeCode

The class has two overload methods for setting type code. One provides specifying channel to set, another for all channel. Please refer to user's manual for analog input type code. These two overload methods are listed as following table and described in following section. The corresponding type code can be found in Appendix A.1.

Name of Methods
AI_SetTypeCode (BYTE i_byChToSet, BYTE i_byTypeCode)
AI_SetTypeCode (BYTE *i_byTypeCodes)

5.6.3.14.1 AI_SetTypeCode (BYTE, BYTE)

Analog input function - Set type code for specific channel. The type code can reference to Appendix A.1.

Syntax

```
public int AI_SetTypeCode (
    BYTE i_byChToSet,
    BYTE i_byTypeCode
)
```

Parameters

i_byChToSet

[IN] The specific channel to set

i_byTypeCode

[IN] The type code for the specific channel

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;


m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_SetTypeCode(0, 0x10)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.3.14.2 AI_SetTypeCode (BYTE*)

Analog input function - Set type code for all channels. The type code can reference to Appendix A.1.

Syntax

```
public int AI_SetTypeCode (
    BYTE *i_byTypeCodes
)
```

Parameters

*i_byTypeCodes

[IN] The byte array of type code to set

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte m_byChTypeCode[USBIO_AI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   For(iIdx = 0; iIdx < USBIO_AI_MAX_CHANNEL; iIdx)
      m_byChTypeCode[iIdx] = 0x10;
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_SetTypeCode(m_byChTypeCode)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.3.15 AI_SetChCJCOffset

The class has two overload methods for setting channel CJC offset. One provides specifying channel to set, another for all channel. The valid range of offset is -40.96 ~ +40.95. These two overload methods are listed as following table and described in following section.

Name of Methods
AI_SetChCJCOffset (BYTE i_byChToSet, float i_fChCJCOffset)
AI_SetChCJCOffset (float *i_fChCJCOffsets)

5.6.3.15.1 AI_SetChCJCOffset (BYTE, float)

Analog input function - Set channel CJC offset for specific channel.

Syntax

```
public int AI_SetTypeCode (
    BYTE i_byChToSet,
    float i_fChCJCOffset
)
```

Parameters

i_byChToSet

[IN] The specific channel to set

i_fChCJCOffset

[IN] The CJC offset for the specific channel

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_SetChCJCOffset(0, 1.354)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.3.15.2 AI_SetChCJCOffset (float*)

Analog input function - Set channel CJC offset for specific channel.

Syntax

```
public int AI_SetTypeCode (
    float* i_fChCJCOffset
)
```

Parameters

*i_fChCJCOffset

[IN] The float array of channel CJC offset to set

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
float m_fChCJCOffset[USBIO_AI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   For(iIdx = 0; iIdx < USBIO_AI_MAX_CHANNEL; iIdx)
      m_fChCJCOffset[iIdx] = 1.358;
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_SetChCJCOffset(m_fChCJCOffset)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.3.16 AI_SetChEnable

Analog input function - Set channel enable/disable. Each byte indicates 8 channels enable/disable mask. Ex: Byte0 -> Channel0 ~ 7

Syntax

```
public int AI_SetChEnable (
    BYTE *i_byChEnable
)
```

Parameters

*i_byChEnable

[IN] The byte array of channel enable/disable mask

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte m_byChEnable[(USBIO_AI_MAX_CHANNEL + 7) / 8];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   For(iIdx = 0; iIdx <( USBIO_AI_MAX_CHANNEL + 7) / 8; iIdx)
      m_byChEnable [iIdx] = 0x5A;
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_SetChEnable(m_byChEnable)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.3.17 AI_SetFilterRejection

Analog input function - Set filter rejection.

Rejection Setting	Value
60Hz	0
50Hz	1

Syntax

```
public int AI_SetFilterRejection (
    BYTE i_byFilterRejection
)
```

Parameters

i_byFilterRejection

[IN] The filter rejection

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;


m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_SetFilterRejection(0)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.3.18 AI_SetCJCOffset

Analog input function - Set CJC offset. The valid range of offset is -40.96 ~ +40.95.

Syntax

```
public int AI_SetCJCOffset (
    float i_fCJCOffset
)
```

Parameters

i_fCJCOffset

[IN] The CJC offset

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_SetCJCOffset(-20.81)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.3.19 AI_SetCJCEnable

Analog input function - Set CJC enable.

Enable Setting	Value
Disable	0
Enable	1

Syntax

```
public int AI_SetCJCOffset (
    BYTE i_byCJCEnable
)
```

Parameters

i_byCJCEnable

[IN] The CJC enable

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;


m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_SetCJCEnable(1)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.3.20 AI_SetWireDetectEnable

Analog input function - Set wire detect enable.

Enable Setting	Value
Disable	0
Enable	1

Syntax

```
public int AI_SetCJCOffset (
    BYTE i_byWireDetectEnable
)
```

Parameters

i_byWireDetectEnable

[IN] The wire detect enable

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2019, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.AI_SetWireDetectEnable(0)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4 Pulse Input

5.6.4.1 PI_GetTotalSupportType

Pulse input function - Get total supported amount.

Syntax

```
public int PI_GetTotalSupportType (
    BYTE * o_byTotalSupportType
)
```

Parameters

* o_byTotalSupportType

    [OUT] The number of total support type

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byTotalSupportType;
Byte o_bySupportTypeCode[USBIO_MAX_SUPPORT_TYPE];
Int iIdx;
Bool bRet = true;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
  if(ERR_NO_ERR != (iErrCode = m_usbIO. PI_GetTotalSupportType (&o_ byTotalSupportType)))
  {
    printf( "%d" , iErrCode);
    bRet = false;
  }
  if(ERR_NO_ERR != (iErrCode = m_usbIO. PI_GetSupportTypeCode (o_ bySupportTypeCode)))
  {
    printf( "%d" , iErrCode);
    bRet = false;
  }
  If(bRet)
  {
    printf( "%d\n" , o_byTotalSupportType);
    for(iIdx = 0; iIdx < o_byTotalSupportType; iIdx++)
      printf( "%02x\n" , o_bySupportTypeCode[iIdx]);
  }
}
```

5.6.4.2 PI_GetSupportTypeCode

Pulse input function - Get supported type code. Please refer to Appendix A.3 of user's manual to map PI channels input type.

Syntax

```
public int PI_GetTotalSupportType (
    BYTE *o_bySupportTypeCode
)
```

Parameters

*o_byTotalSupportType

[OUT] The number of total support type

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byTotalSupportType;
Byte o_bySupportTypeCode[USBIO_MAX_SUPPORT_TYPE];
Int iIdx;
Bool bRet = true;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
  if(ERR_NO_ERR != (iErrCode = m_usbIO. PI_GetTotalSupportType (&o_ byTotalSupportType)))
  {
    printf( "%d" , iErrCode);
    bRet = false;
  }
  if(ERR_NO_ERR != (iErrCode = m_usbIO. PI_GetSupportTypeCode (o_ bySupportTypeCode)))
  {
    printf( "%d" , iErrCode);
    bRet = false;
  }
  If(bRet)
  {
    printf( "%d\n" , o_byTotalSupportType);
    for(iIdx = 0; iIdx < o_byTotalSupportType; iIdx++)
      printf( "%02x\n" , o_bySupportTypeCode[iIdx]);
  }
}
```

5.6.4.3 PI_GetTypeCode

Pulse input function - Get type code. Please refer to user's manual to map PI channels input type. The type code can reference to Appendix A.3.

Syntax

```
public int PI_GetTypeCode (
    BYTE *o_byTypeCode
)
```

Parameters

*o_byTypeCode

[OUT] The byte array of type code

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byTypeCode [USBIO_PI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. PI_GetTypeCode (o_byTypeCode)))
      printf( "%d" , iErrCode);
   else
   {
      for(iIdx = 0; iIdx < USBIO_PI_MAX_CHANNEL; iIdx++)
         printf( "%02x\n" , o_byTypeCode[iIdx]);
   }
}
```

5.6.4.4 PI_GetTriggerMode

Pulse input function - Get trigger mode

Trigger Mode	Code
Falling edge	0
Rising edge	1
Both edge	2 & 3

Syntax

```
public int PI_GetTriggerMode (
    BYTE *o_byTriggerMode
)
```

Parameters

*o_byTriggerMode

[OUT] The byte array of trigger mode

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byTriggerMode [USBIO_PI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. PI_GetTriggerMode (o_byTriggerMode)))
      printf( "%d" , iErrCode);
   else
   {
      for(iIdx = 0; iIdx < USBIO_PI_MAX_CHANNEL; iIdx++)
         printf( "%02x\n" , o_byTriggerMode [iIdx]);
   }
}
```

5.6.4.5 PI_GetChIsolatedFlag

Pulse input function - Get channel isolated flag. Each byte indicates 8 channels flag. EX: Byte0 -> Channel0 ~ 7.

Syntax

```
public int PI_GetChIsolatedFlag (
    BYTE *o_byChIsolatedFlag
)
```

Parameters

*o_byChIsolatedFlag

[OUT] The byte arrays of channel isolated flag

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byChIsolatedFlag [(USBIO_PI_MAX_CHANNEL + 7) / 8];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_GetChIsolatedFlag(o_byChIsolatedFlag)))
      printf( "%d" , iErrCode);
   else
   {
      for(iIdx = 0; iIdx < (USBIO_PI_MAX_CHANNEL + 7) / 8; iIdx++)
         printf( "%02x\n" , o_byChIsolatedFlag[iIdx]);
   }
}
```

5.6.4.6 PI_GetLPFilterEnable

Pulse input function - Get low-pass filter enable. Each byte indicates 8 channels enable/disable mask. EX: Byte0 -> Channel0 ~ 7.

Syntax

```
public int PI_GetLPFilterEnable (
    BYTE * o_byLPFilterEnable
)
```

Parameters

* o_byLPFilterEnable

    [OUT] The byte array of the low-pass filter enable mask

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte o_byLPFilterEnable [(USBIO_PI_MAX_CHANNEL + 7) / 8];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_GetLPFilterEnable(o_byLPFilterEnable)))
      printf( "%d" , iErrCode);
   else
   {
      for(iIdx = 0; iIdx < (USBIO_PI_MAX_CHANNEL + 7) / 8; iIdx++)
         printf( "%02x\n" , o_byLPFilterEnable[iIdx]);
   }
}
```

5.6.4.7 PI_GetLPFilterWidth

Pulse input function - Get low-pass filter width. The unit of the width is uS. The maximum value of width is 32767uS.

Note: Each channel does not use own low-pass filter width. Please refer to following table to see what low-pass filter width is referred to.

Channel Index	Set
0 & 1	0
2 & 3	1
4, 5, 6, 7	2

Syntax

```
public int PI_GetLPFilterWidth (
    WORD *o_wLPFilterWidth
)
```

Parameters

*o_wLPFilterWidth

[OUT] The byte array of the low-pass filter width in uS

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
WORD o_wLPFilterWidth [USBIO_PI_MAX_CHANNEL];
Int iIdx;


m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_GetLPFilterWidth(o_wLPFilterWidth)))
      printf( "%d" , iErrCode);
   else
   {
      for(iIdx = 0; iIdx < USBIO_PI_MAX_CHANNEL; iIdx++)
         printf( "%d\n" , o_wLPFilterWidth[iIdx]);
   }
}
```

5.6.4.8 PI_ReadValue

Pulse input function - Get PI value in double-word format. This method provides two formats in a function call.

NOTE: If the type of the channel is frequency, users have to convert these 4 bytes into float format.

Syntax

```
public int PI_ReadValue (
    DWORD *o_dwPIValue
    BYTE *o_byChStatus
)
```

Parameters

*o_dwPIValue

[OUT] The byte array of the PI channel counter value

*o_byChStatus

[OUT] The byte array of the channel status

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
DWORD o_dwPIValue[USBIO_PI_MAX_CHANNEL];
BYTE o_byChStatus[USBIO_PI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. PI_ReadValue(o_dwPIValue, o_byChStatus)))
      printf( "%d" , iErrCode);
   else
   {
      for(iIdx = 0; iIdx < USBIO_PI_MAX_CHANNEL; iIdx++)
         printf( "%d\n" , o_dwPIValue[iIdx]);
   }
}
```

5.6.4.9 PI_ReadCntValue

Pulse input function - Read PI value in double-word format. This method reads the all counter value of channels.

NOTE: If the channel is in the type of frequency. The value of the related channel of the o_dwCntValue will be 0, and the value of the related channels of o_byChStatus will indicate the type not support.

Syntax

```
public int PI_ReadValue (
    DWORD *o_dwCntValue
    BYTE *o_byChStatus
)
```

Parameters

*o_dwCntValue

[OUT] The unsigned long array of the PI channel counter value

*o_byChStatus

[OUT] The byte array of the channel status

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
DWORD o_dwCntValue[USBIO_PI_MAX_CHANNEL];
BYTE o_byChStatus[USBIO_PI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. PI_ReadCntValue(o_dwCntValue, o_byChStatus)))
      printf( "%d" , iErrCode);
   else
   {
      for(iIdx = 0; iIdx < USBIO_PI_MAX_CHANNEL; iIdx++)
         printf( "%d\n" , o_dwCntValue[iIdx]);
   }
}
```

5.6.4.10 PI_ReadFreqValue

Pulse input function - Read the frequency value. This method reads the all frequency value of channels.

NOTE: If the channel is not in the type of frequency. The value of the related channel of the o_dwCntValue will be -1, and the value of the related channels of o_byChStatus will indicate the type not support.

Syntax

```
public int PI_ReadValue (
    float *o_fFreqValue
    BYTE *o_byChStatus
)
```

Parameters

*o_fFreqValue

[OUT] The float array of the PI channel frequency value

*o_byChStatus

[OUT] The byte array of the channel status

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
float o_fFreqValue[USBIO_PI_MAX_CHANNEL];
BYTE o_byChStatus[USBIO_PI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO. PI_ReadValue(o_fFreqValue, o_byChStatus)))
      printf( "%d" , iErrCode);
   else
   {
      for(iIdx = 0; iIdx < USBIO_PI_MAX_CHANNEL; iIdx++)
         printf( "%f\n" , o_fFreqValue[iIdx]);
   }
}
```

5.6.4.11 PI_ReadBulkValue

Analog input function – Trigger reading bulk PI value (Fast acquire functionality).

When in callback operation, it will cause the performance in your callback function. Please reduce execute time in this callback function.

The detail of operation is described as follow. When call this API, the PI module operation will be changed from normal to fast acquire mode. In fast acquire mode, PI module follow the parameter of API setting to acquire data.

The API has block and non-block operation. In block operation, user’ s application needs to wait until API finishing all procedure. In contrast with block mode, non-block provides a flexible way for user. In non-block operation, user’ s application can proceed to own other code. To enable non-block operation, it is important to declare a callback function and pass it through last parameter. For block operation, just pass a NULL definition in last parameter.

Due to the USB 2.0 Full-speed transfer rate capability, the maximum sample rate is 10 KHz.

Syntax

```
public int PI_ReadBulkValue (
    BYTE i_byStartCh,
    BYTE i_byChTotal,
    DWORD i_dwSampleWidth,
    Float i_fSampleRate,
    DWORD i_dwBufferWidth,
    DWORD *o_dwDataBuffer,
    OnBulkValueFinishEvent i_CBFunc
)
```

Parameters

i_byStartCh

[IN] The starting acquire channel

i_byChTotal

[IN] The total channels to acquire

i_dwSampleWidth

[IN] The sampling width (ms)

i_fSampleRate

[IN] The sampling rate (Hz). 10KHz maximum.

i_dwBufferWidth

[IN] The width of the buffer for single channel

*o_dwDataBuffer

[OUT] The 2-dimension buffer array to store

i_CBFunc

[IN] Block operation – NULL

[IN] Non-block operation - The address of callback function.

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
// To read 0~1 channel for 100ms in 5 KHz sample rate each channel in non-block operation
// So we have the following variable declaration
#define SampleRate 5000
#define BufferWidth 500; // 5000(Hz) * 0.1(100ms)
DWORD m_dwBuffer[2][BufferWidth];

Void BulkFinishCallback(DWORD dwCount)
{
   // Callback function to handle data
}

Int main()
{
   m_usbIO = new ICPDAS_USBIO();
   if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
   {
      if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_ReadBulkValue(0,
                                                            2,
                                                            100,
                                                            SampleRate,
                                                            BufferWidth
                                                            m_dwBuffer,
                                                            BulkFinishCallback)))
         printf( "%d" , iErrCode);

      while(1) {Sleep(1);}
   }
}
```

5.6.4.12 PI_SetTypeCode

The class has two overload methods for setting type code. One provides specifying channel to set, another for all channels. Please refer to user's manual for pulse input type code. These two overload methods are listed as following table and described in following section. The corresponding type code can be found in Appendix A.3.

Name of Methods
PI_SetTypeCode (BYTE i_byChToSet, BYTE i_byTypeCode)
PI_SetTypeCode (BYTE *i_byTypeCodes)

5.6.4.12.1 PI_SetTypeCode (BYTE, BYTE)

Pulse input function - Set type code for specific channel. The type code can reference to Appendix A.3.

Syntax

```
public int PI_SetTypeCode (
    BYTE i_byChToSet,
    BYTE i_byTypeCode
)
```

Parameters

i_byChToSet

[IN] The specific channel to set

i_byTypeCode

[IN] The type code for the specific channel

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;


m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_SetTypeCode(0, 0x10)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.12.2 PI_SetTypeCode (BYTE*)

Analog input function - Set type code for all channels. The type code can reference to Appendix A.3.

Syntax

```
public int PI_SetTypeCode (
    BYTE *i_byTypeCodes
)
```

Parameters

*i_byTypeCodes

[IN] The byte array of type code to set

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte m_byChTypeCode[USBIO_PI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   For(iIdx = 0; iIdx < USBIO_PI_MAX_CHANNEL; iIdx)
      m_byChTypeCode[iIdx] = 0x50;
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_SetTypeCode(m_byChTypeCode)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.13 PI_ClearChCount

Pulse input function - Clear channel count with clear mask. Each byte indicates 8 channels clear mask, set for channel clear. Ex: Byte0 -> Channel0 ~ 7

Syntax

```
public int PI_ClearChCount (
    BYTE *i_byClrMask
)
```

Parameters

*i_byClrMask

[IN] The byte array of channel count clear mask

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte m_byChClrMask[(USBIO_PI_MAX_CHANNEL + 7) / 8];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   For(iIdx = 0; iIdx <( USBIO_PI_MAX_CHANNEL + 7) / 8; iIdx)
      m_byChClrMask[iIdx] = 0x5A;
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_ClearChCount(m_byChClrMask)))
      printf(  "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.14 PI_ClearSingleChCount

Pulse input function - Clear specific channel count.

Syntax

```
public int PI_ClearSingleChCount (
    BYTE i_byChToClr
)
```

Parameters

i_byChToClr

[IN] The channel index for clearing

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_ClearSingleChCount(7)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.15 PI_ClearChStatus

Pulse input function - Clear channel status with clear mask. Each byte indicates 8 channels clear mask, set for channel clear. Ex: Byte0 -> Channel0 ~ 7

Syntax

```
public int PI_ClearChStatus(
    BYTE *i_byClrMask
)
```

Parameters

*i_byClrMask

[IN] The byte array of channel status clear mask

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte m_byChClrMask[(USBIO_PI_MAX_CHANNEL + 7) / 8];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   For(iIdx = 0; iIdx <( USBIO_PI_MAX_CHANNEL + 7) / 8; iIdx)
      m_byChClrMask[iIdx] = 0x5A;
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_ClearChStatus(m_byChClrMask)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.16 PI_ClearSingleChStatus

Pulse input function - Clear specific channel status.

Syntax

```
public int PI_ClearSingleChStatus(
    BYTE i_byChToClr
)
```

Parameters

i_byChToClr

[IN] The channel index for clearing

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_ClearSingleChStatus(7)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.17 PI_SetTriggerMode

The class has two overload methods for setting trigger mode. One provides specifying channel to set, another for all channels.

The trigger mode is shown as following table.

Trigger Mode	Code
Falling edge	0
Rising edge	1
Both edge	2 & 3

These two overload methods are listed as following table and described in following section.

Name of Methods
PI_SetTriggerMode (BYTE i_byChToSet, BYTE i_byTypeCode)
PI_SetTriggerMode (BYTE *i_byTypeCodes)

5.6.4.17.1 PI_SetTriggerMode (BYTE, BYTE)

Pulse input function - Set trigger mode to specific channel.

Syntax

```
public int PI_SetTriggerMode (
    BYTE i_byChToSet,
    BYTE i_byTriggerMode
)
```

Parameters

i_byChToSet

[IN] The specific channel to set

i_byTriggerMode

[IN] The type code for the specific channel

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_SetTriggerMode(0, 0x1)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.17.2 PI_SetTriggerMode (BYTE*)

Pulse input function - Set trigger mode to all channel.

Syntax

```
public int PI_SetTriggerMode (
    BYTE *i_byTriggerMode
)
```

Parameters

*i_byTriggerMode

[IN] The byte array of trigger mode to set

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte m_byChTriggerMode[USBIO_PI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   For(iIdx = 0; iIdx < USBIO_PI_MAX_CHANNEL; iIdx)
      m_byChTriggerMode[iIdx] = 0x2;
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_SetTriggerMode(m_byChTriggerMode)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.18 PI_SetChIsolatedFlag

The class has two overload methods for setting channel isolated flag. One provides specifying channel to set, the other for all channels. Set 1 for setting channel to isolated. The parameter of the method for all channels is constructed in byte array for all channel isolated flag, ex: Byte0 -> Channel0 ~ 7.

These two overload methods are listed as following table and described in following section.

Name of Methods
PI_SetChIsolatedFlag (BYTE i_byChToSet, BOOL i_bChIsolatedFlag)
PI_SetChIsolatedFlag (BYTE *i_byChIsolatedFlags)

5.6.4.18.1 PI_SetChIsolatedFlag (BYTE, BOOL)

Pulse input function - Set channel isolated flag.

Syntax

```
public int PI_SetChIsolatedFlag (
    BYTE i_byChToSet,
    BOOL i_bChIsolatedFlag
)
```

Parameters

i_byChToSet

[IN] The specific channel to set

i_bChIsolatedFlag

[IN] The isolated flag for the specific channel

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_SetChIsolatedFlag(5, 0x1)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.18.2 PI_SetChIsolatedFlag (BYTE*)

Pulse input function - Set channel isolated flag to all channels.

Syntax

```
public int PI_SetChIsolatedFlag (
    BYTE *i_byChIsolatedFlags
)
```

Parameters

*i_byChIsolatedFlags

[IN] The byte arrays of channel isolated flag.

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte m_byChIsolatedFlags[(USBIO_PI_MAX_CHANNEL + 7) / 8];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   For(iIdx = 0; iIdx < (USBIO_PI_MAX_CHANNEL + 7) / 8; iIdx)
      m_byChIsolatedFlag[iIdx] = 0x5a;
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_SetChIsolatedFlag(m_byChIsolatedFlag)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.19 PI_SetLPFilterEnable

The class has two overload methods for setting trigger mode. One provides specifying channel to set, another for all channels. Set 1 to enable low-pass filter. The parameter of the method for all channels is a byte array for all channel enable mask, ex: Byte0 -> Channel0 ~ 7.

These two overload methods are listed as following table and described in following section.

Name of Methods
PI_SetLPFilterEnable (BYTE i_byChToSet, BOOL i_bLPFilterEnable)
PI_SetLPFilterEnable (BYTE *i_byLPFilterEnable)

5.6.4.19.1 PI_SetLPFilterEnable (BYTE, BOOL)

Pulse input function - Set low-pass filter enable to specific channel.

Syntax

```
public int PI_SetLPFilterEnable (
    BYTE i_byChToSet,
    BOOL i_bLPFilterEnable
)
```

Parameters

i_byChToSet

[IN] The specific channel to set

i_bLPFilterEnable

[IN] The enable flag for the specific channel

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_SetLPFilterEnable(5, 0x1)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.19.2 PI_SetLPFilterEnable (BYTE*)

Pulse input function - Set low-pass filter enable to all channel.

Syntax

```
public int PI_SetLPFilterEnable (
    BYTE *i_byLPFilterEnable
)
```

Parameters

*i_byLPFilterEnable

[IN] The byte array of low-pass filter enable mask.

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte m_byLPFilterEnable[(USBIO_PI_MAX_CHANNEL + 7) / 8];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   For(iIdx = 0; iIdx < (USBIO_PI_MAX_CHANNEL + 7) / 8; iIdx)
      m_byLPFilterEnable[iIdx] = 0x5a;
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_SetLPFilterEnable(m_byLPFilterEnable)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.20 PI_SetLPFilterWidth

The class has two overload methods for setting trigger mode. One provides specifying channel to set, another for all channels. The low-pass filter width is for filtering noise or bouncing. The unit of the filter width is uS.

These two overload methods are listed as following table and described in following section.

Name of Methods
PI_SetLPFilterWidth (BYTE i_byChToSet, WORD i_wLPFilterWidth)
PI_SetLPFilterWidth (WORD *i_wLPFilterWidths)

5.6.4.20.1 PI_SetLPFilterEnable (BYTE, WORD)

Pulse input function - Set low-pass filter width

Syntax

```
public int PI_SetLPFilterWidth (
    BYTE i_byChToSet,
    BOOL i_wLPFilterWidth
)
```

Parameters

i_byChToSet

[IN] The specific channel to set

i_wLPFilterWidth

[IN] The low-pass filter width. (uS)

Return Value

Error code

Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_SetLPFilterWidth(5, 10000)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

5.6.4.20.2 PI_SetLPFilterEnable (BYTE*)

Pulse input function - Set low-pass filter enable to all channel.

Syntax

```
public int PI_SetLPFilterEnable (
    BYTE *i_byLPFilterEnable
)
```

Parameters

*i_byLPFilterEnable

[IN] The byte array of low-pass filter enable mask.

Return Value

Error code

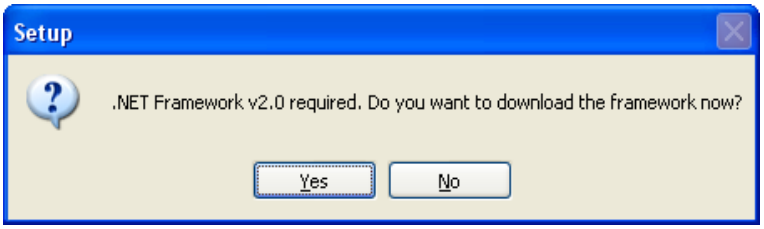
Example

```
Int iErrCode
ICPDAS_USBIO m_usbIO;
Byte m_byLPFilterWidth[USBIO_PI_MAX_CHANNEL];
Int iIdx;

m_usbIO = new ICPDAS_USBIO();
if(ERR_NO_ERR == (iErrCode = m_usbIO.OpenDevice(USB2084, 1)))
{
   For(iIdx = 0; iIdx < USBIO_PI_MAX_CHANNEL; iIdx)
      m_byLPFilterEnable[iIdx] = 20000;
   if(ERR_NO_ERR != (iErrCode = m_usbIO.PI_SetLPFilterWidth(m_byLPFilterWidth)))
      printf( "%d" , iErrCode);
   iErrCode = m_usbIO.CloseDevice();
}
```

6 Troubleshooting

1. **Cannot install ICP DAS USB I/O package with the message like the following figure.**



Because the ICP DAS USB I/O requires .NET Framework v2.0, the package will automatically detect the .NET Framework v2.0 installed as well or not. Users can click "Yes" to download and install the .NET Framework v2.0 via internet. If users can not access internet, the other way is install .NET Framework v2.0 in the folder "net_framework " in the root path of the CD.

2. **Returning timeout error code (65792) when access USB I/O.**

There are some possible reasons:

- The USB module connected to USB hub not local USB port on computer. This will cause the time for communication increased. To prevent this error, users can increase the time of communication timeout.
  (Note: We strongly recommended connecting USB modules to local USB port on computer to prevent unexpected problem.)
- Module is failure caused by unknown reason. You can refer to LED indicators section.

Appendix A

A.1 Analog Input Type Code

Code	Input Type	Code	Input Type
0x00	-15 mV ~ +15 mV	0x17	Type L TC, -200 ~ +800°C
0x01	-50 mV ~ + 50 mV	0x18	Type M TC, -200 ~ +100°C
0x02	-100 mV ~ +100 mV	0x19	Type $L_{DIN43710}$ TC, -200 ~ +900°C
0x03	-500 mV ~ +500 mV	0x1A	0 ~ +20 mA
0x04	-1 V ~ +1 V	0x1B	-150 V ~ +150 V
0x05	-2.5 V ~ +2.5 V	0x1C	-50 V ~ +50 V
0x06	-20 mA ~ +20 mA	0x20	Pt 100, α=.00385, -100 ~ +100°C
0x07	+4 mA ~ +20 mA	0x21	Pt 100, α=.00385, 0 ~ +100°C
0x08	-10 V ~ +10 V	0x22	Pt 100, α=.00385, 0 ~ +200°C
0x09	-5 V ~ +5 V	0x23	Pt 100, α=.00385, 0 ~ +600°C
0x0A	-1 V ~ +1 V	0x24	Pt 100, α=.003916, -100 ~ +100°C
0x0B	-500 mV ~ +500 mV	0x25	Pt 100, α=.003916, 0 ~ +100°C
0x0C	-150 mV ~ +150 mV	0x26	Pt 100, α=.003916, 0 ~ +200°C
0x0D	-20 mA ~ +20 mA	0x27	Pt 100, α=.003916, 0 ~ +600°C
0x0E	Type J TC, -210 ~ +760°C	0x28	Nickel 120, -80 ~ +100°C
0x0F	Type K TC, -210 ~ +1372°C	0x29	Nickel 120, 0 ~ +100°C
0x10	Type T TC, -270 ~ +400°C	0x2A	Pt 1000, α=.00392, -200 ~ +600°C
0x11	Type E TC, -270 ~ +1000°C	0x2B	Cu 100, α=.00421, -20 ~ +150°C
0x12	Type R TC, 0 ~ +1768°C	0x2C	Cu 100, α=.00427, 0 ~ +200°C
0x13	Type S TC, 0 ~ +1768°C	0x2D	Cu 1000, α=.00421, -20 ~ +150°C
0x14	Type B TC, 0 ~ +1820°C	0x2E	Pt 100, α=.00385, -200 ~ +200°C
0x15	Type N TC, -270 ~ +1300°C	0x2F	Pt 100, α=.003916, -200 ~ +200°C
0x16	Type C TC, 0 ~ +2320°C		

A.2 Analog Output Type Code

Code	Input Type
0x30	0 ~ +20 mA
0x31	0 ~ +20 mA
0x32	0 V ~ +10 V
0x33	-10 V ~ +10 V
0x34	0 V ~ +5 V
0x35	-5 V ~ +5 V

A.3 Pulse Input Type Code

Code	Input Type
0x50	Up counter
0x51	Frequency
0x52	Counter with battery backup
0x53	Encoder
0x54	Up/Down counter
0x55	Pulse/Direction counter
0x56	AB phase

A.4 Channel Status

Code	Input Type
0x00	Good
0x01	Over Range / Overflow
0x02	Under Range / Underflow
0x03	Open
0x04	Close
0x05	Type Not Supported

Appendix B

B.1 Error Codes

The error codes are divided into three parts, device, DEV-library and IO-library. Each part means different error code returned by device, DEV-library and IO-library. The error codes are described in the table.

Constant/Value	Description
ERR_NO_ERR 0x00000000, 0	The operation completed successfully.
ERR_DEV_ILLEGAL_FUNC 0x00000001, 1	The function is invalid.
ERR_ DEV_ILLEGAL_INDEX 0x00000002, 2	The index is invalid.
ERR_DEV_ILLEGAL_LENGTH 0x00000003, 3	The length is invalid.
ERR_DEV_ILLEGAL_PARAMETER 0x00000004, 4	The parameter is invalid.
ERR_DEV_ILLEGAL_MAPTABSIZE 0x00000005, 5	The size of mapping table is invalid.
ERR_DEV_ILLEGAL_MAPTABINDEX 0x00000006, 6	The index in mapping table is invalid.
ERR_ DEV_READONLY 0x00000007, 7	The index is read only.
ERR_ DEV_WRITEONLY 0x00000008, 8	The index is written only.
ERR_ DEV_BUFFERFULL 0x00000009, 9	The buffer in transceiver is full.
ERR_ DEV_LTTIMEOUT 0x0000000A, 10	The operation of large transfer has timeout.
ERR_ DEV_LTMODEFAIL 0x0000000B, 11	The current mode is not in large transfer mode.
ERR_ DEV_LTPKGLOST	The large transfer packet is lost.

0x0000000C, 12	
ERR_ DEV_LTINDEXNOTMACH 0x0000000D, 13	The offset index is not match while operating in large transfer.
ERR_ DEV_LTNOTFINISH 0x0000000E, 14	Another large transfer is operating.
ERR_DEV_DO_RELATED_ERR 0x00004000~0x000047FFF	The digital output related error in this region.
ERR_DEV_DI_RELATED_ERR 0x00004800~0x00004FFF	The digital input related error in this region.
ERR_DEV_AO_RELATED_ERR 0x00005000~0x000057FF	The analog output related error in this region.
ERR_DEV_AI_RELATED_ERR 0x00005800~0x00005FFF	The analog input related error in this region.
ERR_DEV_PO_RELATED_ERR 0x00006000~0x000067FF	The pulse output related error in this region.
ERR_DEV_PI_RELATED_ERR 0x00006800~0x00006FFF	The pulse input related error in this region.
ERR_USBDEV_INVALID_DEV 0x00010000, 65536	The handle of device is invalid.
ERR_USBDEV_DEV_OPENED 0x00010001, 65537	The device has been opened by class library.
ERR_USBDEV_DEVNOTEXISTS 0x00010002, 65538	The class library cannot find the device.
ERR_USBDEV_GETDEVINFO 0x00010003, 65539	An error was made to scan device.
ERR_USBDEV_ERROR_PKTSIZE 0x00010004, 65540	The packet size is invalid.
ERR_USBDEV_ERROR_WRITEFILE 0x00010004, 65541	An error occurs while writing packet to module.
ERR_USBIO_COMM_TIMEOUT 0x00010100, 65792	The communication between computer and device has been timeout.
ERR_USBIO_DEV_OPENED 0x00010101, 65793	The device has been opened by class library.
ERR_USBIO_DEV_NOTOPEN 0x00010102, 65794	The device has not opened for operating.
ERR_USBIO_INVALID_RESP 0x00010103, 65795	The data returned by device is invalid.

ERR_USBIO_IO_NOTSUPPORT 0x00010104, 65796	The method is not supported.
ERR_USBIO_PARA_ERROR 0x00010105, 65797	The parameter of method is invalid.
ERR_USBIO_BULKVALUE_ERR 0x00010106, 65798	An error occurs while getting bulk value.
ERR_USBIO_GETDEVINFO 0x00010107, 65799	An error occur while getting device information while device opening procedure.