USB-2000 Series

USB 2.0 Full-Speed High Performance DAQ module

User's Manual

Revision History

Revision	Date	Description of Change
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.

Copyright

Trademark

The names used for identification only may be registered trademarks of their respective companies.

Content

1 Introduction

1.1 Overview

ICP DAS USB series I/O modules are highly flexible solution to acquire or output data. User can build up own PC-based control, laboratory research, testing and so on by applying ICP DAS USB series modules. The advantages of ICP DAS USB I/O modules are small size, portable, USB bus powered and various input type to help user build up own project easily and quickly in different field and application.

Compare with traditional PC I/O card, it is waste of time to open chassis and configure I/O board. In ICP DAS USB I/O, you will enjoy the simply controlling I/O in the efficient way. ICP DAS USB I/O equips USB bus powered feature, one cable to access I/O and provide power without additional power wiring. ICP DAS USB I/O is a small size module. You can use these I/O modules in wide range application, ex: fan-less control or measurement, automatically testing with BOX-PC…etc. ICP DAS USB I/O provides 10kS/s data acquisition functionality. User can apply this to real-time demanded application, ex: noise measurement.

1.2 Feature

- Wide Operating Temperature Range
- USB 2.0 Full-Speed
- USB Bus Powered
- Lockable USB cable
- Driver free
- 10KS/s for analog and pulse input measurement
- SDK to develop project easily
- All-In-One Utility

1.3 Applications

- Automation
- Measurement and testing
- Laboratory 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	
Mechanical		
Dimensions (W×L×H)	Body	33mm × 78mm × 107mm
	CN-1824	29mm × 43mm × 83mm
Environment		
Operating Temperature Range	-25 ~ +75℃	
Storage Temperature Range	-40 ~ +85℃	
Humidity	10 ~ 95% RH, non-condensing	

1.4.2 Analog Input

1.4.2.1 USB-2019

USB-2019 is a universal analog input module with 8 differential channels and compatible with USB 2.0 full-speed. It equips small size, portable, USB bus powered, various input type features to help user build up own project easily and quickly.

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)
Intra-Module Isolation, Field-to-Logic	3000 V_{DC}
Overvoltage protection	240 V_{rms}
Individual Channel Configuration	Yes
Open Wire Detection	Yes (Software programmable)

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 USB I/O modules. The following useful information will be given in the Quick Start Guide:

- How to install hardware and use utility

2 Hardware Information

2.1 Module Overview

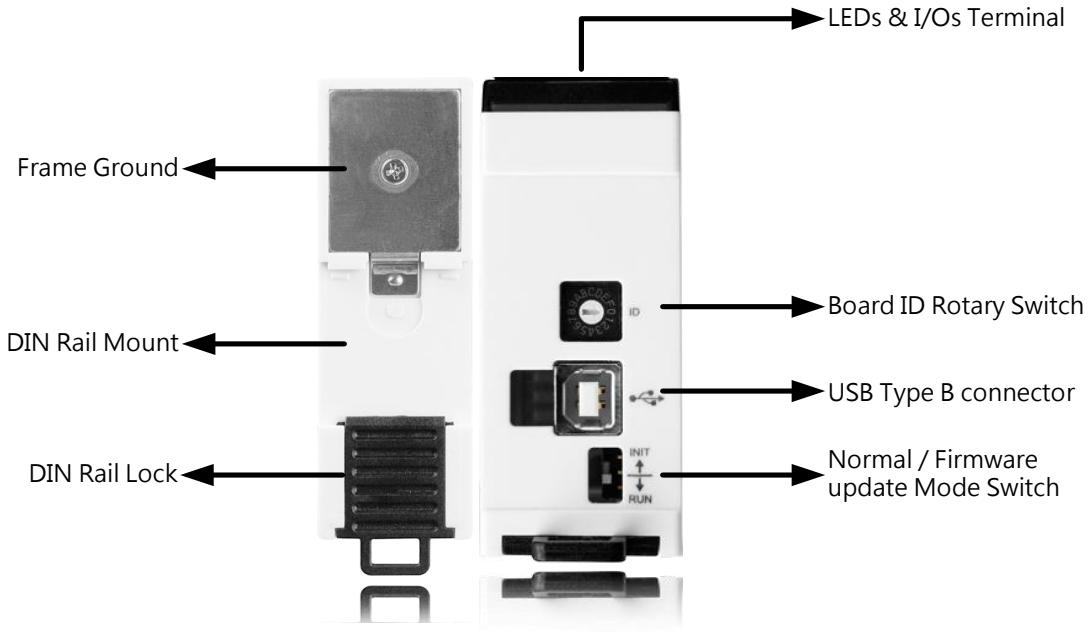


Figure 2-1 Module Overview of ICP DAS USB I/O

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

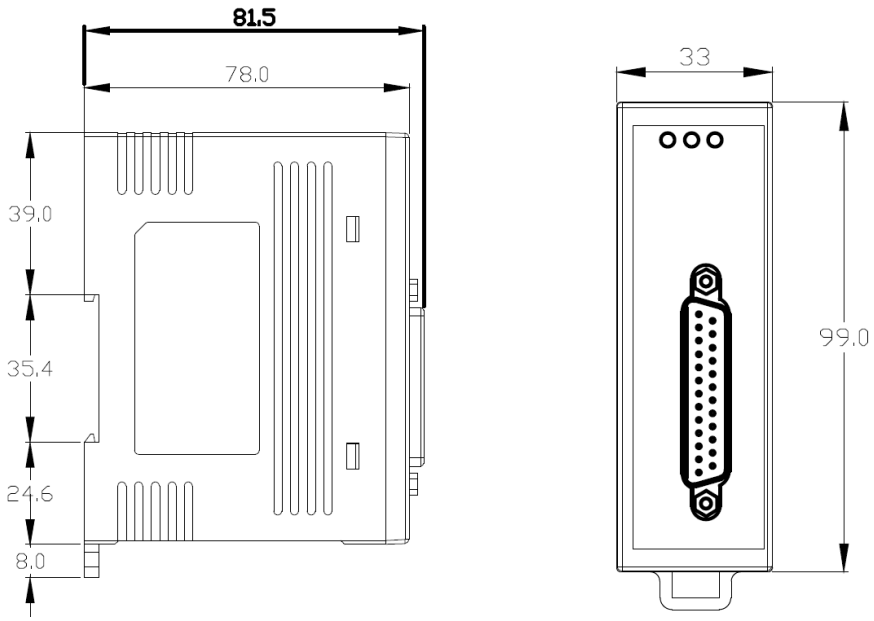


Figure 2-2, Figure 2-3 USB-2019 left side and front view without CN-1824

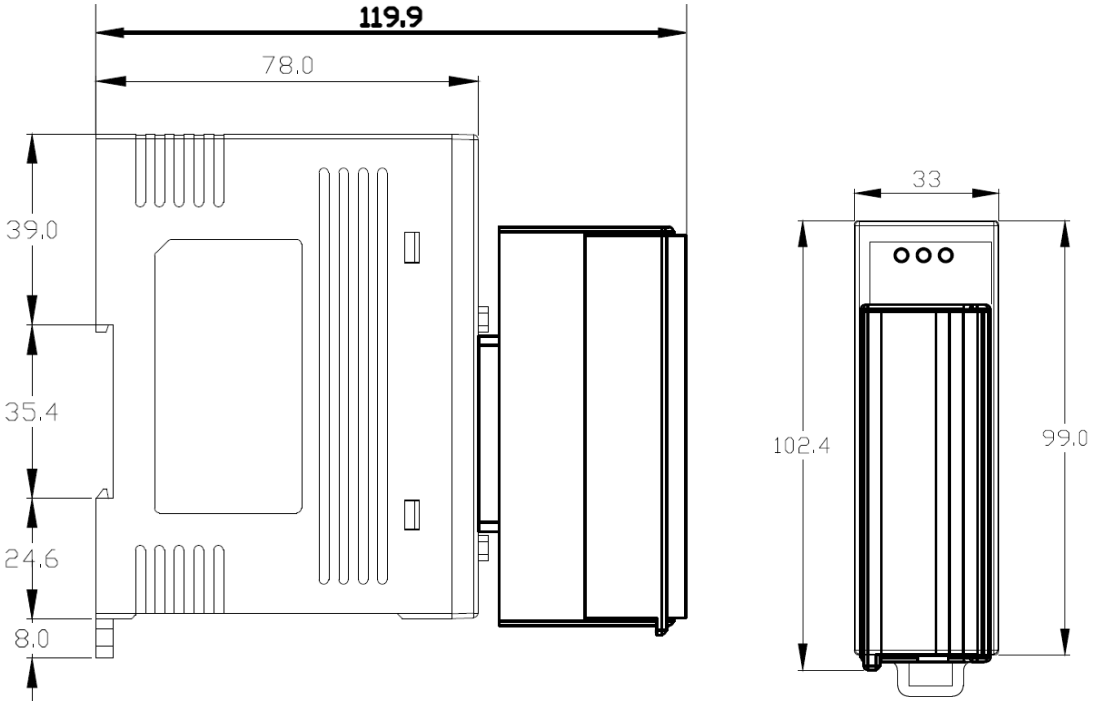


Figure 2-4, Figure 2-5 USB-2019 left side and front view with CN-1824

2.1.2 CN-1824

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

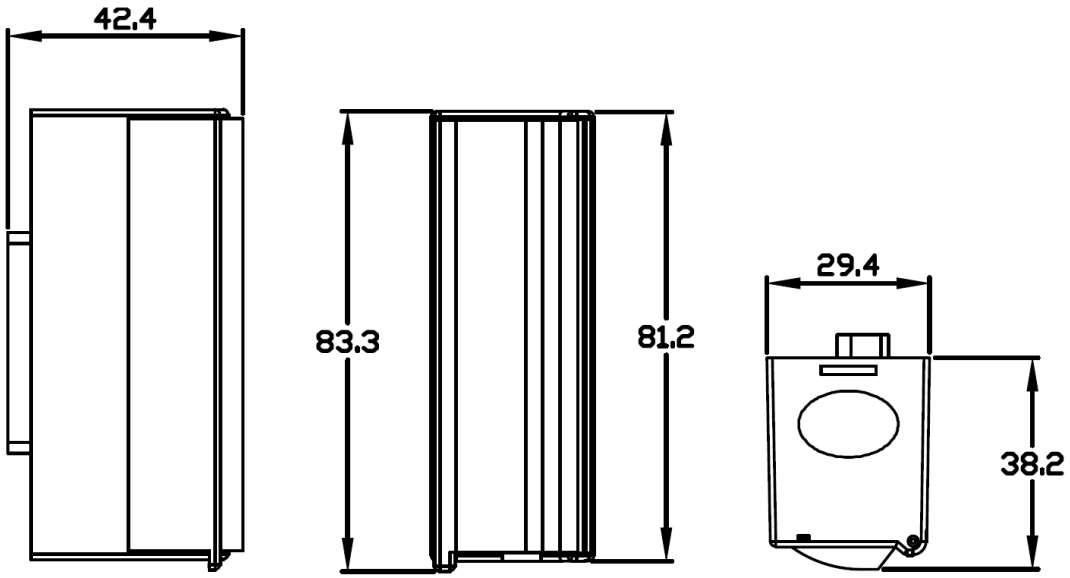


Figure 2-6, Figure 2-7, Figure 2-8 The CN-1824 left side, front and top view

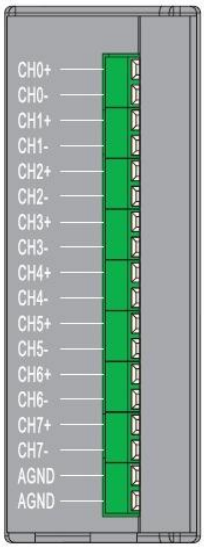
2.2 Connector Pin Assignment

2.2.1 USB-2019

The connector of USB-2019 analog input side is a 25-pin female D-sub connector, and it can be connected by CN-1824 terminal block or 25-pin D-sub male connector. The pin assignment of 25-pin female D-sub connect and 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 Pin assignment of 25-pin female D-sub connector and CN-1824

2.3 Connector Symbol Description

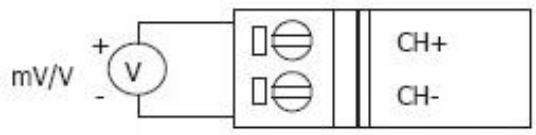
2.3.1 USB-2019

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.

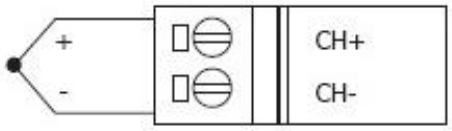
2.4 Wiring

2.4.1 USB-2019

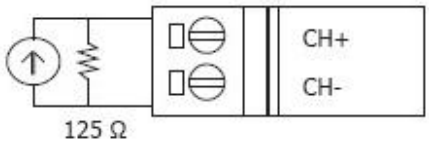
Voltage Input



Thermocouple Input



Current Input



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

2.5 Hardware Configuration

ICP DAS USB module provides two basic hardware configurations for each module to configure board ID and enable firmware update.

2.5.1 Board ID

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

shown in figure 2-11. The value of ID can be configured from 1 ~ 15 by hardware, and can be configured from 16 ~ 127 by software when switch to 0.

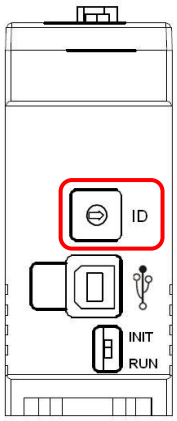


Figure 2-11 Hardware setting for board ID

2.5.2 Firmware Update

ICP DAS USB modules provide updatable functionality. User can switch to firmware update mode when latest firmware released. The switch setting is shown in figure 2-12. Switch to INIT. to enable firmware update functionality.

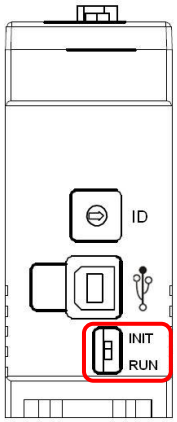


Figure 2-12 Hardware setting for enabling firmware update functionality

2.6 LED Indicators

ICP DAS USB modules have two modes, normal and firmware update, as previous section mentioned. Each mode has own LED indication. The LED status for these two modes is 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 Connect to ICP DAS USB I/O series module

1. Turn on the PC you are preparing to configure and program.
2. Connect ICP DAS USB I/O module to USB 2.0 port or higher on PC by using cable inside the box.
3. Once you first time connect USB I/O module to PC, there will be few message in system bar in bottom right side to inform new hardware is detect and installed successfully. After the message shown as figure 3-2, then USB I/O module is ready to use.

Figure 3-1 System detect ICPDAS USB module plug in

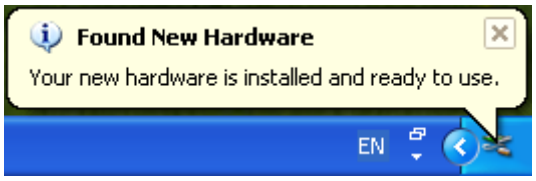


Figure 3-2 Device is ready to use

3.2 Software

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

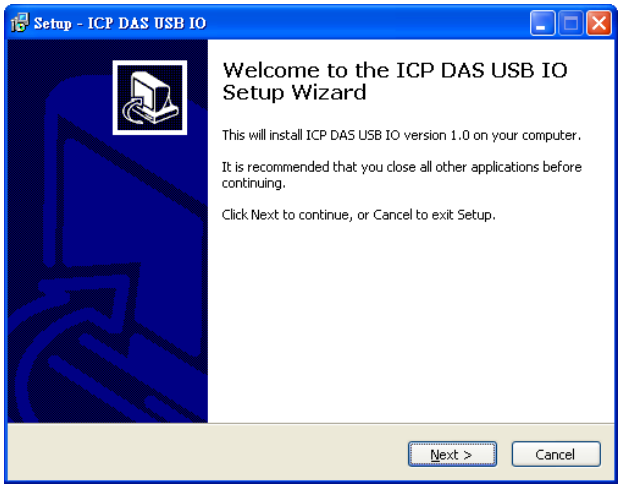


Figure 3-3 The welcome message of ICP DAS USB I/O software installer

After the installation process, the window will indicate the installation has completed as the figure below.

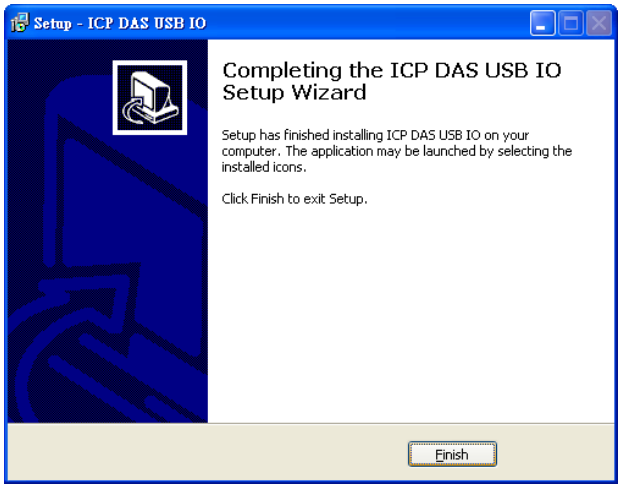
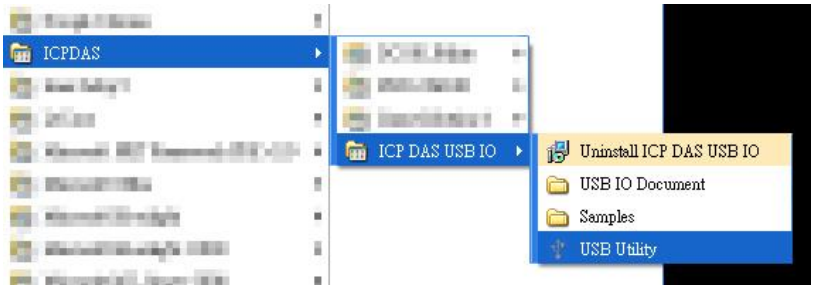


Figure 3-4 The installation is complete

3.2.1 Utility

USB-2K Utility provides a simple way to easily test and instant acquire data for all ICP DAS USB I/O series modules without programming. You can find this program in the "Start\Programs\ICPDAS\ICP DAS USB IO\USB Utility".



Once the utility open, the all ICP DAS USB I/O modules connected to PC are listed in "Device List" tree view of device list form as figure 3-5. The utility will scan ICP DAS USB IO modules automatically, the module in the list view will be removed when pull off and added when plug in.

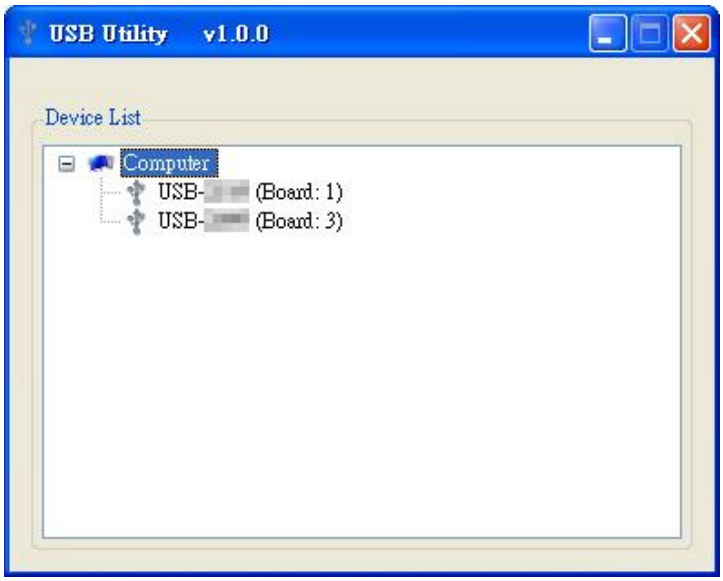


Figure 3-5 USB Utility Device List form

To access ICP DAS USB I/O module by double clicking module in device list, then you will see another form come out. There are several function pages, information to configure basic system parameters, I/O access (DI/O, AI/O, PI/O) to monitor real-time data and configure I/O parameters and data log (if module supports this function), in this form.

3.2.1.1 Information Page

In "Information" page, the detail of all items in this page will be introduced as follow:

- **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 be configured when switch the 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 used to enable the check of module alive. When enable the watch dog timer, computer and module will send SYNC packet each other. The period to send is a quarter of this WDT value. This value also provides the module has output capability to enable safety value output when communication is failure.

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

- **Description**

  The description of the opened device. This item used to help user identify module. For example: Name the description to "LAB1-CTL". So, this message help user to know what this module used for.

  Note: The maximum characters of description are 32.

- **Load Default**

  This function helps user to restore module to factory default setting.

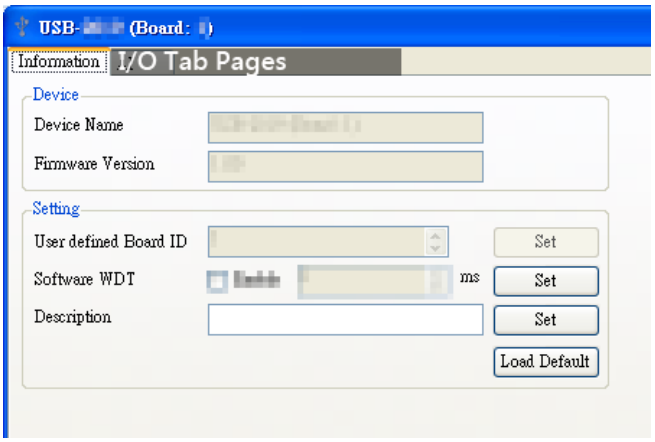


Figure 3-6 USB I/O Information Page

3.2.1.2 AI Page

In "IO" page, the real-time value and module configuration can be read or written in this page. The detail of all of item in this form will be introduced as follow.

- **Polling Interval**

  This value is the period of polling data from USB I/O module.

  Note: The range of this value is 100 ~ 5000ms.

- **Hide Setting Panel**

  This checkbox used to hide the I/O configuration panel when user only wants to take care of I/O data.

- **Show Hex**

  This checkbox use to convert the I/O value from decimal to hexadecimal.

- **I/O Monitor Region**

  The I/O related data and configuration will be listed here. User can select the channel to configure corresponding setting in I/O configuration region. The setting of this selected channel will show in I/O configuration.

- **I/O Configuration Region**

  All AI related configuration can be set in this region. This region is divided to part, channel and module related setting. The channel related setting is in "Selected Channel" group box. The rest of group boxes are module related setting.

  - **Set All**

    Channel related setting will be followed by currently selection.

  - **Type**

    ICP DAS USB I/O modules provide programmable input type on analog input. You can set different type for each analog input channel. Selecting the type in the combo box you want.

    For more detail on input type of analog input modules, please refer to "Appendix B".

  - **Channel Enable**

    Enable / Disable channel.

  - **Channel CJC Offset**

    Set the CJC offset of the specified channel individually. This feature behaves the same as the CJC Offset, except that it only affects a single channel. By default, this offset value is zero.

    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, analog input modules feature build-in filter. Two filters with different frequencies are provided to remove noise generated from different power source.

- **Wire Detection**

  Enable / Disable the open-wire detection for thermocouple measurement.

- **CJC Enable**

  Enable / Disable the CJC (Cold-junction compensation).

- **CJC Offset**

  Set the CJC offset value for all AI channels. The offset value is used to add or subtract a temperature measured by the CJC sensor. By default, this offset value is zero. Change of this value does not affect calibration, but will affect the displayed temperature. If an offset error is occurring with the CJC sensor, this feature may be used to reduce or eliminate that error.

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

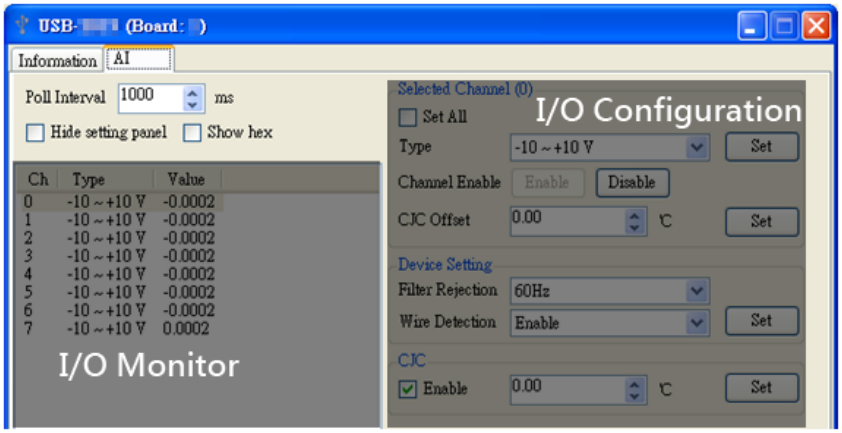


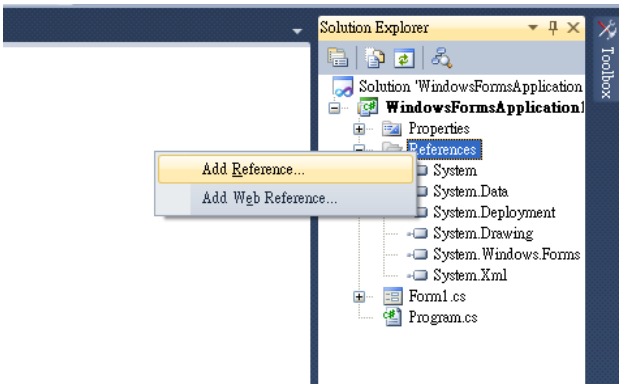
Figure 3-7 USB I/O AI Configuration Page

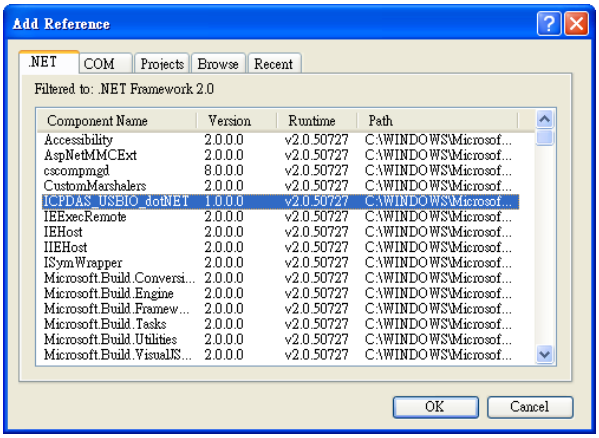
3.2.2 ICP DAS USB I/O SDK Integration

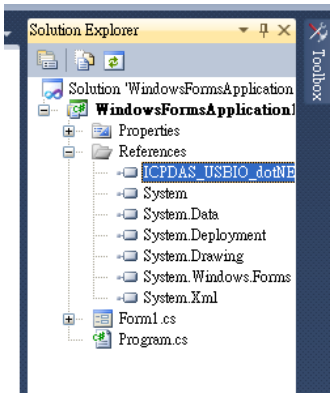
The SDK is the way to access ICP DAS USB I/O modules. The SDK supports various IDE like C#.NET/VB.NET/VB/VC/BCB. You can choose what IDE you familiar with. Before starting up your own project, you need to do some configuration to integrate the SDK into your IDE. The following section will indicate you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

Another way to start your own application is copying sample project folder then developing your project.

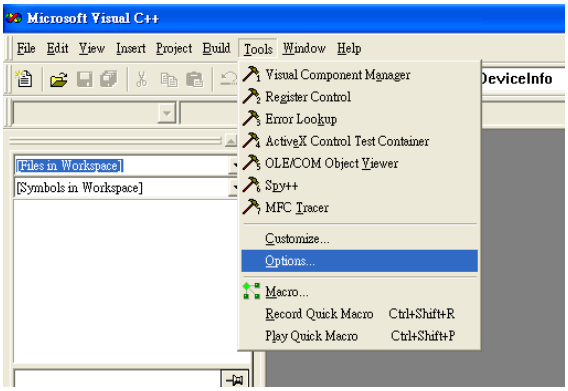
3.2.2.1 .NET

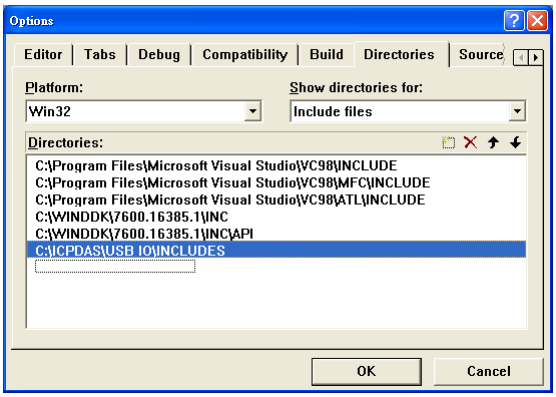


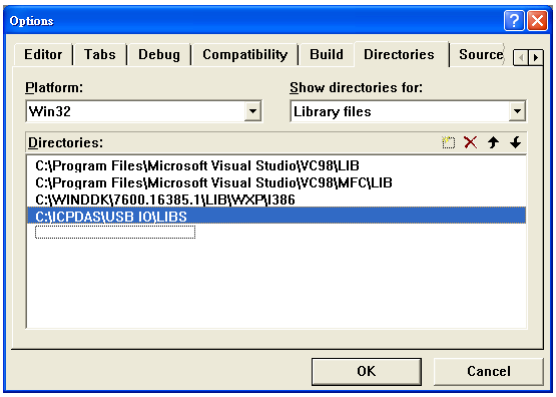




3.2.2.2 VC



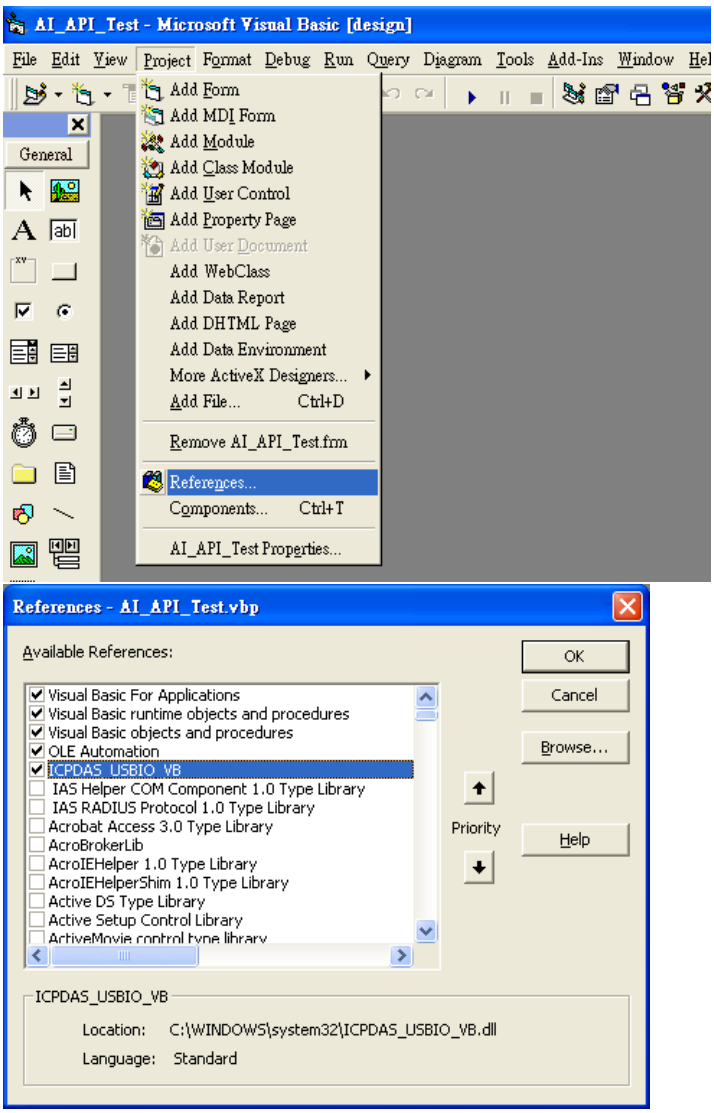




3.2.2.3 BCB

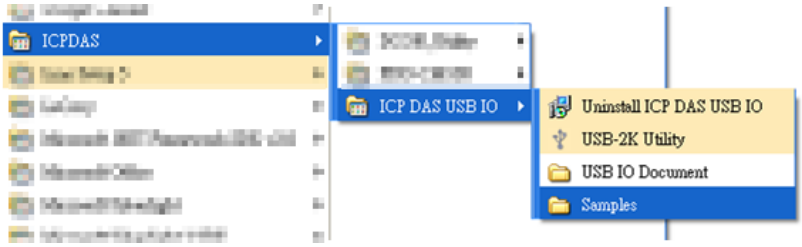
This section is left blank intentionally.

3.2.2.4 VB



3.2.3 Samples

The package also provides samples to help user to develop own project smoothly. The samples can be found in “Start\Programs\ICPDAS\ICP DAS USB IO\Samples” as following figure. Another window will come out, and all samples will be listed in the window.



4 Operation

4.1 Hardware structure

ICP DAS USB I/O provides various types of input and output for user’ s application. ICP DAS USB I/O has two solution, one is compact I/O another is multi-function. The I/O controller is handled by embedded controller. This controller uses GPIO or FPGA to control read or write I/O. The hardware structure is shown in figure 4-1 below.

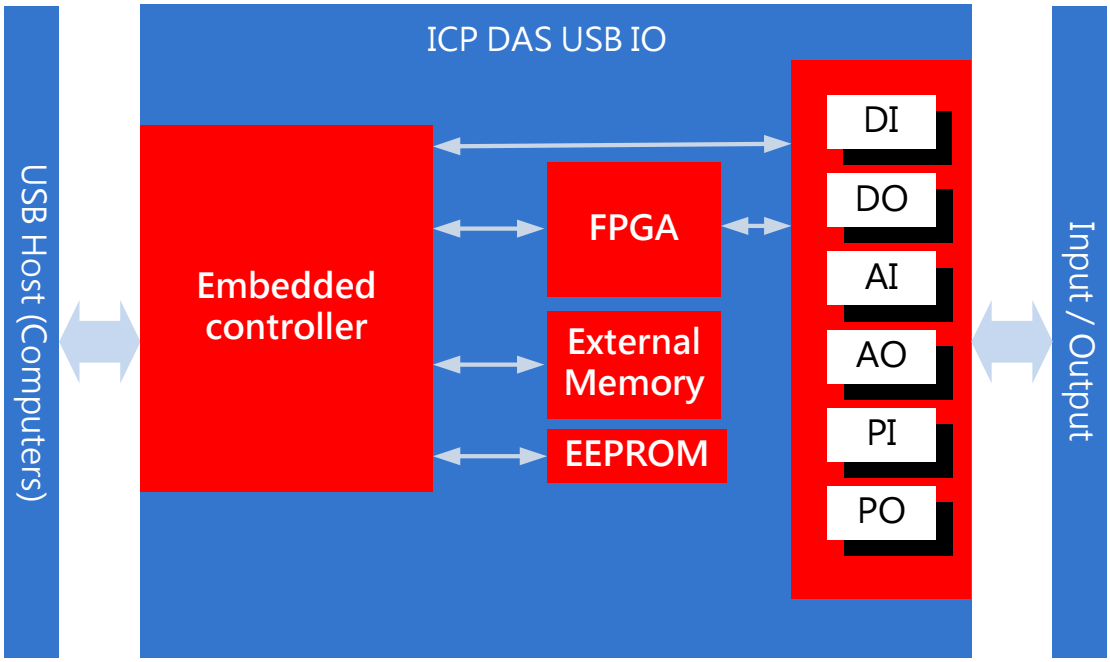


Figure 4-1 Hardware structure of ICP DAS USB series module

4.2 Software structure

In programmer side, ICP DAS provides a class library to develop your own project quickly and easily. The structure of ICP DAS USB I/O software is shown in figure 4-2 below. The methods of USB class are divided into 4 group, base, digital I/O, analog I/O and pulse I/O. To access USB I/O, there are only 2 steps, class initialization and opening device, in your own program.

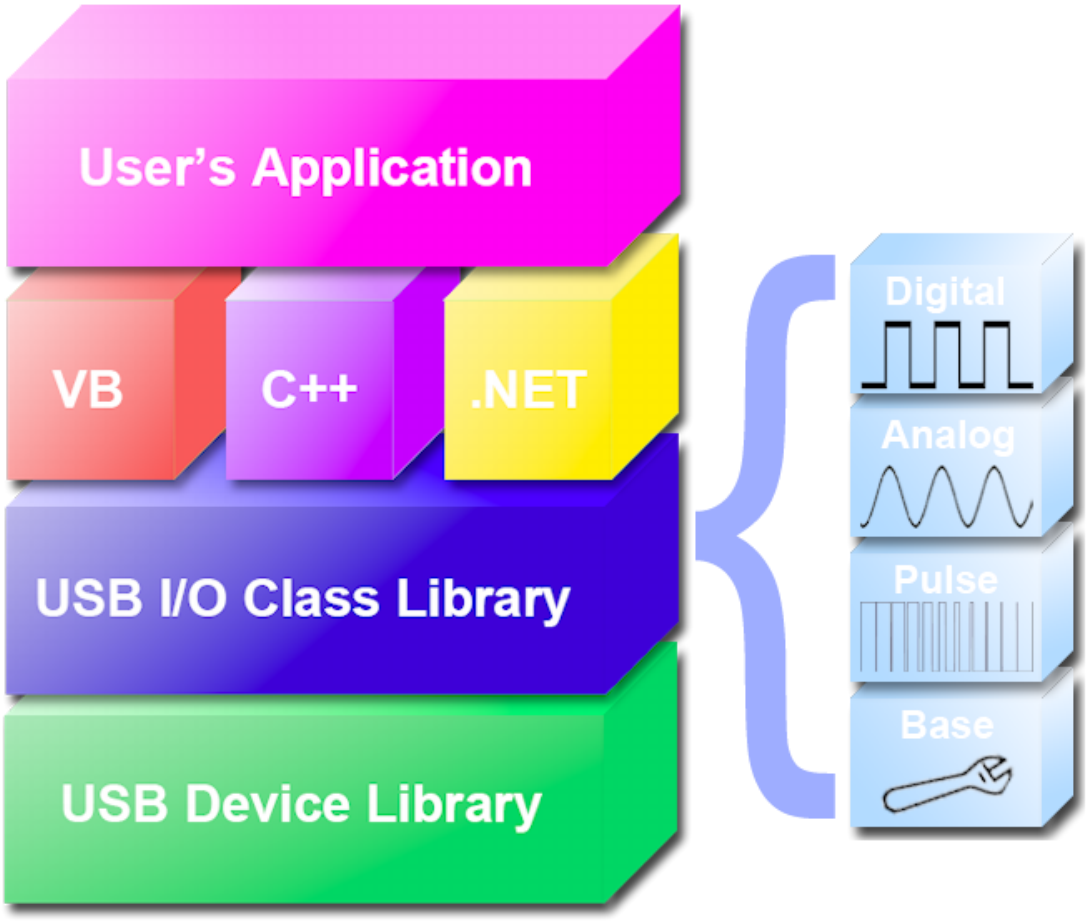


Figure 4-2 Software structure of ICP DAS USB series module

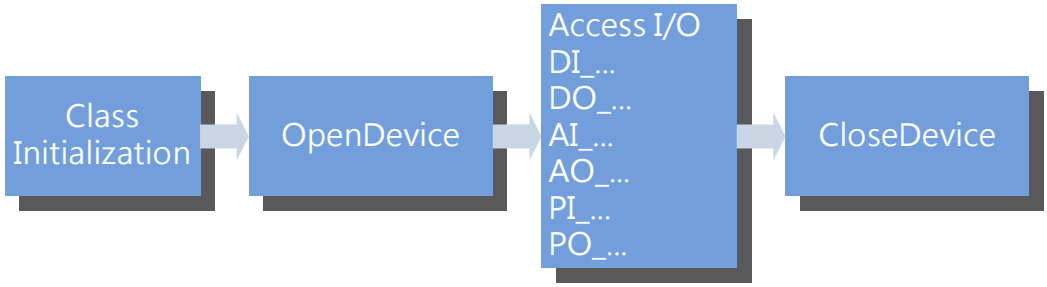


Figure 4-3 The procedure to access USB I/O

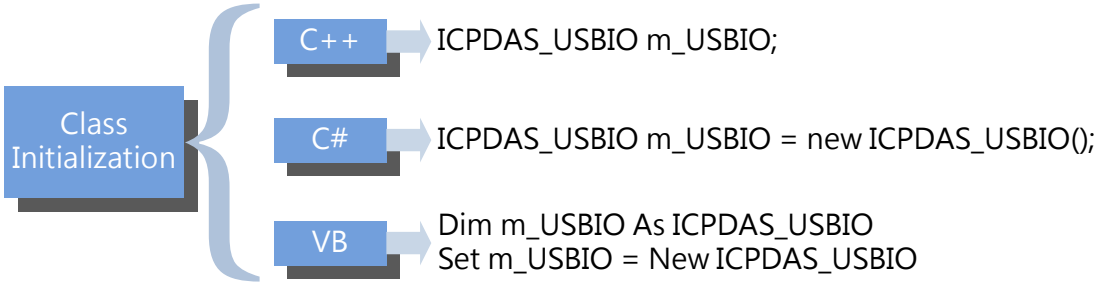


Figure 4-4 Class initialization corresponding code

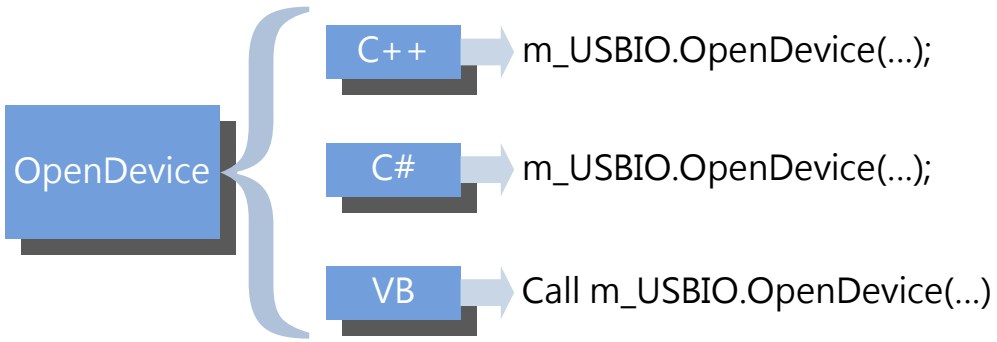


Figure 4-5 Device opening corresponding code

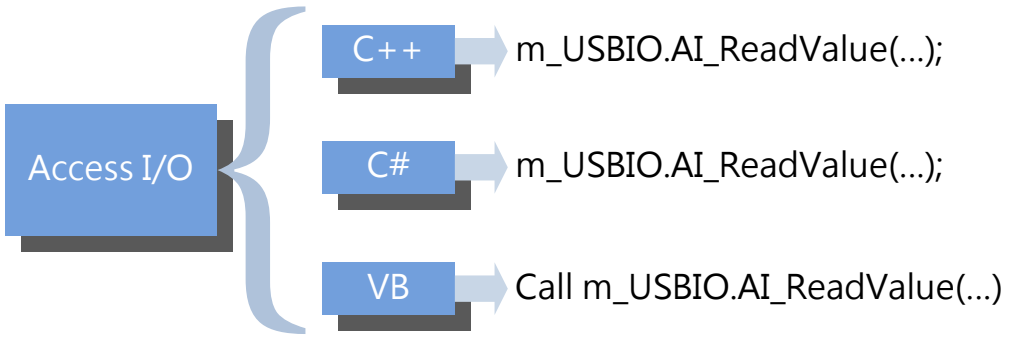


Figure 4-6 Accessing I/O corresponding code

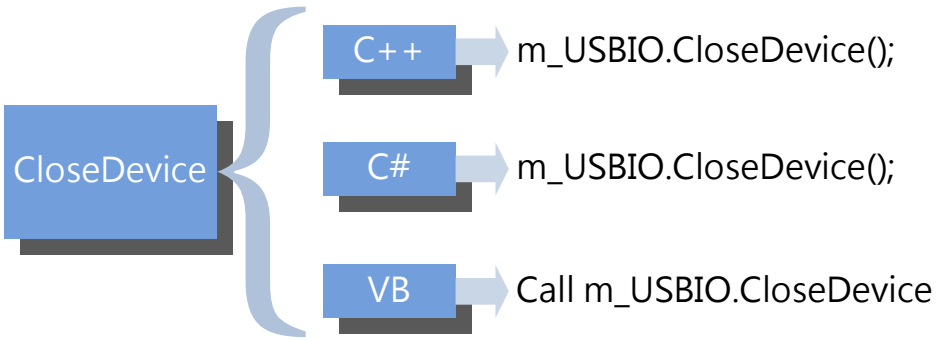


Figure 4-7 Device closing corresponding code

5 ICP DAS USB Class Members

The members of ICPDAS_USBIO are divided into 3 parts are constructors, static and public methods. Constructors are initializations to create instance of the ICPDAS_USBIO class. Static methods are the ways to identify or scan what ICP DAS USB modules plugged in. Public methods are the core to access ICP DAS USB modules. It provides the functionalities of system, device, digital, analog, pulse input or output.

The following tables list the members of ICPDAS_USBIO class. The detail of these methods will be described in the following chapter.

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_GetLPFilterWidth	Pulse input function - Get low-pass filter width.
PI_ReadValue	Pulse input function - Get PI value.
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 specific channel count.
PI_ClearAllChCount	Pulse input function - Clear all channel count.
PI_SetTriggerMode	Pulse input function - Set trigger mode. (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 with 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

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

Name of Methods
AI_SetTypeCode (BYTEi_byChToSet, BYTEi_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 (BYTEi_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

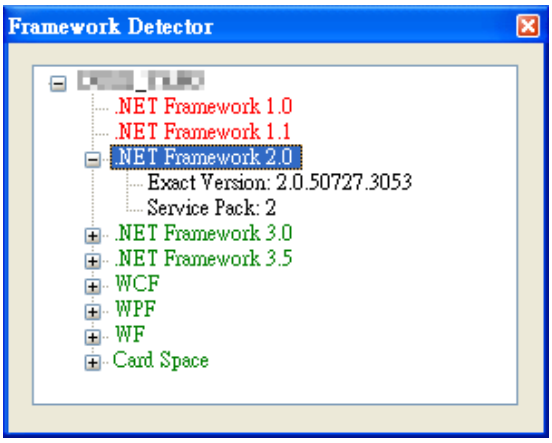
```
Int iErrCode
ICPDAS_USBIO m_usbIO;


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();
}
```

6 Troubleshooting

1. **Cannot open USB-2K Utility.**

   USB-2K Utility is written by .NET under .NET Framework 2.0. It is necessary to have .NET framework 2.0 installed in your computer. The installation package will check .NET framework 2.0 installed as well or not, and the installer will direct you to download appropriate file from internet you need. Also, you can use "FrameworkDetect.exe" to check what versions are installed in your computer. It is free and public software and can be downloaded from internet easily.



2. **Returning timeout error code (65792) after calling set methods or read value.**

   There are some possible reasons as follow:

   - USB modules connected to USB hub not local USB port on computer, and communication timeout is too low to communicate.
     (Note: We strong 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
0x02	Under Range
0x03	Open
0x04	Close

Appendix B

B.1 Error Codes

The error codes of class library have three parts of region, device, DEV-library and IO-library. Each region means different error code returned by device, DEV-library and IO-library. In the device error code region, it includes basic error and IO related error codes. And in the DEV-library and IO-library, there are specified error codes defined what error is to help user debug and program. The error codes are described in the following 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 0x0000000C, 12	The large transfer packet is lost.
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_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	The data returned by device is invalid.

0x00010103, 65795	
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 occur while getting bulk value.
ERR_USBIO_GETDEVINFO 0x00010107, 65799	An error occur while getting device information while device opening procedure.