USB-1000 Series Multifunctional Data Acquisition Devices

User 's Manual

Rev: B

Smacq Technologies. Co., Ltd
Smacq.com
Smacq.cn

Statement

Copyright

Trademark information

Smacq It is a registered trademark of Smacq Technologies. Co., Ltd.
The other products and company names mentioned in this document are trademarks or business names of their respective companies.

Other statements

- The information provided in this document may be modified and updated in subsequent versions without prior notice.
- Smacq Technologies. Co., Ltd. does not provide any express or implied warranties with respect to this document and the information contained therein, including but limited to implied warranties of the marketability and suitability for a particular purpose of the product.
- Smacq Technologies. Co., Ltd. shall not be liable for any errors or inaccurate descriptions that may be contained in this document, or for any incidental or consequential damages resulting from the information and functions provided in the manual, or from the use of this document.
- Smacq Technologies. Co., Ltd. reserves the right to change product specifications, prices, and decide whether to discontinue production.

Contact us

If you have any questions or need assistance while using this product or this document, please contact us via:

Phone: (86-10) 52482802
E-mail: service@smacq.com
Website: http://www.smacq.com
http://www.smacq.cn

Safety requirements

Warning: Only connect voltage within the specified range. If the voltage exceeds the specified range, it may cause equipment damage and even affect personal safety. The voltage range that can be connected to each port is detailed in the product specification section.

Warning: Do not attempt to operate the device in any other way not mentioned in this document. Incorrect operation of equipment may pose a danger. When the equipment is damaged, the internal security protection mechanism will also be affected.

Warning: Do not attempt to replace device components or modify the device using other methods not mentioned in this document. Do not repair the product yourself when it malfunctions.

Warning: Do not use the equipment in environments where explosions may occur or in the presence of flammable smoke. If necessary for such environments, please place the device in a suitable enclosure.

Warning: During the operation of the warning device, all chassis covers and filling panels must be closed.

Warning: For equipment with exhaust vents, do not insert foreign objects into the vents or block the air flow through the vents.

Measurement category

Warning: This device can only be used in measurement category I (CAT I). Do not use this device to connect signals or perform measurements in measurement categories II/III/IV.

Measurement category description

Measurement Category I (CAT I) refers to measurements taken on circuits that are not directly connected to the main power supply. For example, measuring circuits that are not derived from the main power source, especially circuits derived from protected (internal) main power sources. In the latter case, the instantaneous stress will change. Therefore, users should understand the instantaneous tolerance of the device.

Measurement Category II (CAT II) refers to measurements taken on circuits directly connected to low-voltage equipment. For example, measuring household appliances, portable tools, and similar devices.

Measurement Category III (CAT III) refers to measurements conducted in building equipment. For example, measurements are taken on distribution boards, circuit breakers, circuits (including cables, busbars, junction boxes, switches, sockets) in fixed equipment, as well as industrial equipment and certain other devices (such as fixed motors permanently connected to fixed installations).

Measurement category IV (CAT IV) refers to measurements taken at the source of low-voltage equipment. For example, measurements taken on electricity meters, primary over Current protection equipment, and pulse control units.

Environment

Temperature	
Operation	0°C~55°C
Storage	-40°C~85°C
Humidity	
Operation	5% RH~95% RH, non-condensing
Storage	5% RH~95% RH, non-condensing
Pollution level	2
Highest altitude	2000m

Pollution level description

Pollution level 1: No pollution, or only dry non-conductive pollution occurs. This pollution level has no impact. For example, a clean room or an air-conditioned office environment.

Pollution level 2: Generally only dry non-conductive pollution occurs. Sometimes temporary conduction may occur due to condensation. For example: general indoor environment.

Pollution level 3: Conductive pollution occurs, or dry non-conductive pollution becomes conductive due to condensation. For example, an outdoor environment with a canopy.

Pollution Level 4: Permanent conductive pollution caused by conductive dust, rainwater, or snow. For example: outdoor places.

Recycling precautions

Warning: Some substances contained in this product may be harmful to the environment or human health. To avoid releasing harmful substances into the environment or endangering human health, it is recommended to recycle this product using appropriate methods to ensure that most materials can be reused or recycled correctly. For information on handling or recycling, please contact local professional organizations.

CONTENT

1. Getting Started

This chapter describes the basic functions of USB-1000 Series Data Acquisition Device, as well as product specifications and precautions in the process of product unpacking.

1.1. Product introduction

USB-1000 Series data acquisition device is the multifunctional data acquisition device based on high-speed USB2.0 interface. When connected to the computer, it can be used for continuous high-speed signal acquisition and control signal output.

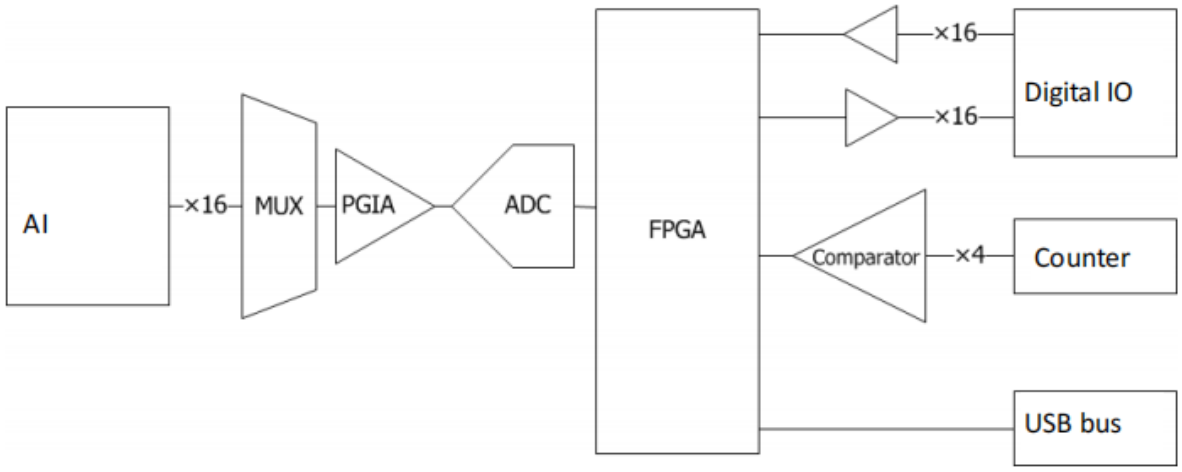
USB-1000 series of data acquisition devices can measure analog and digital signals continuously and save the data to the computer hard drive without interruption. It can also provide digital signal output controlled by a computer.

USB-1000 series data acquisition device supports operating in Windows OS, providing standard DLLs and support for mainstream development languages including VC++, VB, C#, LabVIEW, and MATLAB.

Key Features

- Easy to use and Low cost
- High speed USB interface, Plug and Play, USB powered
- 12-bit analog input resolution, support continuous uninterrupted acquisition
- Analog input supports up to 16-channel and up to 500kS/s/Ch
- Analog input mode supports Difference and Single end
- Analog input range supports 0-10V or ±5V
- Digital I/O supports 16-channel digital input and 16-channel digital output
- Supports 4-channel counter

1.2. Function Diagram



USB-1000 series data acquisition device functions schematic

1.3. Product specifications

The following product specification parameters, unless otherwise stated, are acquired at the temperature of 25°C and the humidity of 40%, while the device is turned on for 20 minutes.

Series USB-1000 parameters list

Analog input

Channel	USB-1252A: 16-CH Single End / 8-CH Difference
ADC type	SAR
Resolution	12-Bit
Sampling rate (Use channel equal allocation)	USB-1252A: Single-channel 500kS/s, Multiple-channel 200kS/s
Timing resolution	20ns
Channel synchronization	No
Range	±5V / 0-10V
Input coupling mode	DC
Input impedance	1GΩ (Power on)
Analog input max voltage	±15V
FIFO buffer	16k sampling point
Analog input mode	Continuous mode and limited number acquisition mode

Analog input accuracy

Range (V)	Random noise (μV rms)	Full range absolute accuracy (mV)
NRSE 0-10	0.15	2.8
NRSE ±5V	0.3	3
DIFF 0-10	0.2	3
DIFF ±5V	0.4	4

Digital I/O

Channel	USB-1252A: 16-DI, 16-DO
Ground reference	DGND
Digital input voltage	High level: 3.3~5V Low level: 0~0.5V
Digital output voltage	High level: 3.0-3.4V Low level: 0~0.1V
Digital output power-on status	Low level
Channel synchronization	Yes

Counter

Channel	USB-1252A: 4-CT
Resolution	32-bit
Counter Measurement	Edge count
Counter direction	Rising edge count
Input frequency(MAX)	1Mhz

Calibration

Warm-up time	No less than 20Minutes (Recommended)
Calibration interval	1 year (Recommended)

Bus interface

USB	USB 2.0 High Speed interface

Power supply requirements

USB interface power supply	4.75~5.25V
Typical current without load	300mA

Physical properties

Size (mm)	Without connectors: 150*96*28 Connectors included: 150*112*28
Weight (g)	Without connectors: about 185g Connectors included: about 230g
I/O connectors	Bolt terminals
Bolt terminal connection	16~28 AWG
USB connectors	USB Type-B

2. Product unpacking and packing list

2.1. Product unboxing

To prevent electrostatic discharge (ESD) from damaging the device, please note the following:

- Please wear a grounding wristband or touch a grounded object first to ensure being grounded.
- Before removing the equipment from the packaging, please first connect the anti-static packaging to the grounded object.
- Do not touch the exposed pins of the connector.
- Place your device in anti-static packaging when you are not using the device.

2.2. Check the packing list

After unpacking the product, follow the packing list in the box, check the host and each attachment individually to ensure that the items in the box are consistent with the packing list.

If you find that any item is missing, please get in touch with us for help as soon as possible.
If you find that the product comes in damaged after unpacking, please get in touch with us as soon as possible. Do not install damaged equipment on your devices.

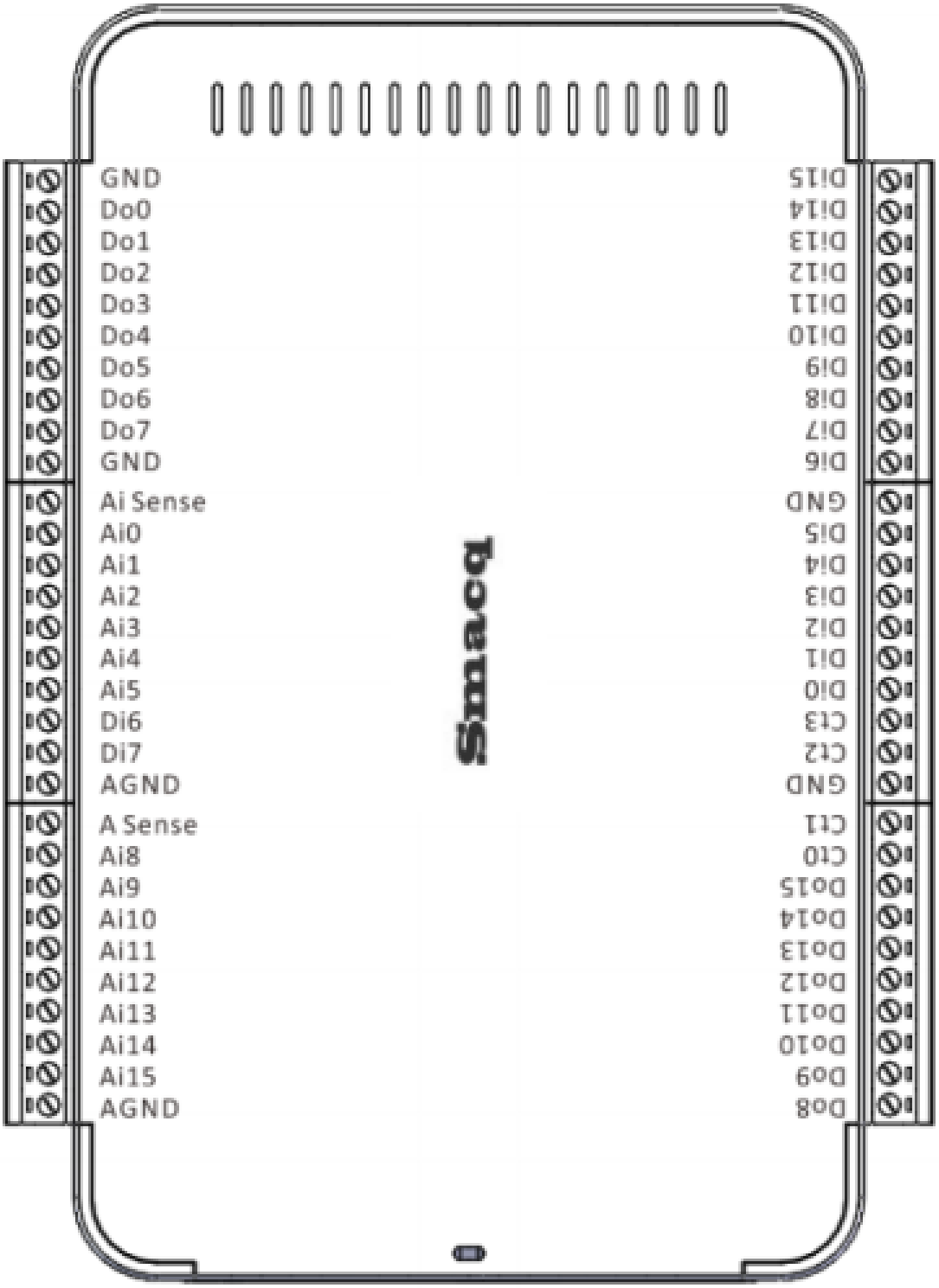
2.3. Packing list

Name	Specification Description	Quantity
USB-1000 Series	USB-1000 Series Multifunctional Data Acquisition Devices	1
Include Attachments		
USB Cable	USB cable/black/1.5 meters	1
Wiring Terminals	10Pin/Green/3.81mm/pitch terminal block	6

3. Installation

This chapter describes signal connection and drive installation of USB-1000 series.

3.1. Connector signal pins distribution



USB-1000 series signal pins distribution

1252A Signal pin allocation list

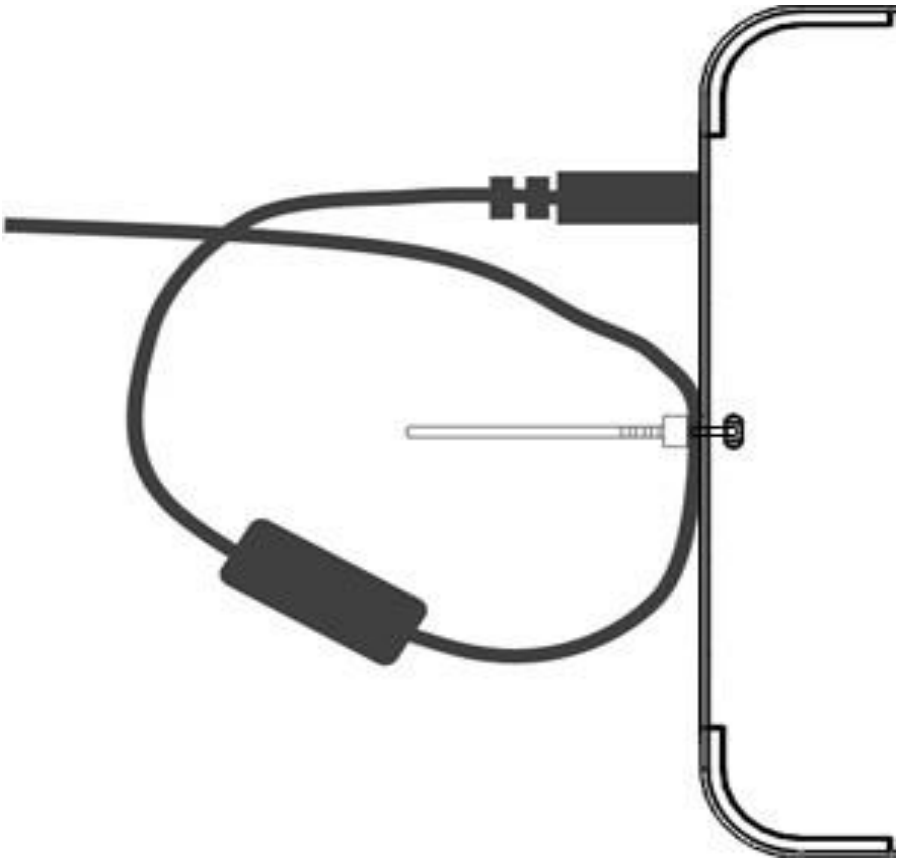
Signal name	NOTE(Single end)	NOTE(Difference)
AI0	Analog input 0	Analog input 0 +
AI1	Analog input 1	Analog input 0 -
AI2	Analog input 2	Analog input 1 +
AI3	Analog input 3	Analog input 1 -
AI4	Analog input 4	Analog input 2 +
AI5	Analog input 5	Analog input 2 -
AI6	Analog input 6	Analog input 3 +
AI7	Analog input 7	Analog input 3 -
AI8	Analog input 8	Analog input 4 +
AI9	Analog input 9	Analog input 4 -
AI10	Analog input 10	Analog input 5 +
AI11	Analog input 11	Analog input 5 -
AI12	Analog input 12	Analog input 6 +
AI13	Analog input 13	Analog input 6 -
AI14	Analog input 14	Analog input 7 +
AI15	Analog input 15	Analog input 7 -

Signal name	NOTE
DI 0	Digital input 0
DI 1	Digital input 1
DI 2	Digital input 2
DI 3	Digital input 3
DI 4	Digital input 4
DI 5	Digital input 5
DI 6	Digital input 6
DI 7	Digital input 7
DI 8	Digital input 8
DI 9	Digital input 9
DI 10	Digital input 10
DI 11	Digital input 11
DI 12	Digital input 12
DI 13	Digital input 13
DI 14	Digital input 14
DI 15	Digital input 15
CT0	Counter input 0
CT1	Counter input 1
CT2	Counter input 2
CT3	Counter input 3

Signal name	NOTE
DO 0	Digital output 0
DO 1	Digital output 1
DO 2	Digital output 2
DO 3	Digital output 3
DO 4	Digital output 4
DO 5	Digital output 5
DO 6	Digital output 6
DO 7	Digital output 7
DO 8	Digital output 8
DO 9	Digital output 9
DO 10	Digital output 10
DO 11	Digital output 11
DO 12	Digital output 12
DO 13	Digital output 13
DO 14	Digital output 14
DO 15	Digital output 15
AISENSE	Analog input reference
AGND	Simulated ground
DGND	Digital ground

3.2. USB cable reinforcement design

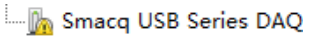
USB cable connectors are prone to be pulled off during operation. USB-1000 series data acquisition devices provide a cable reinforcement design, with which a strap can be used to fix the USB cable to the device to prevent the accidents.



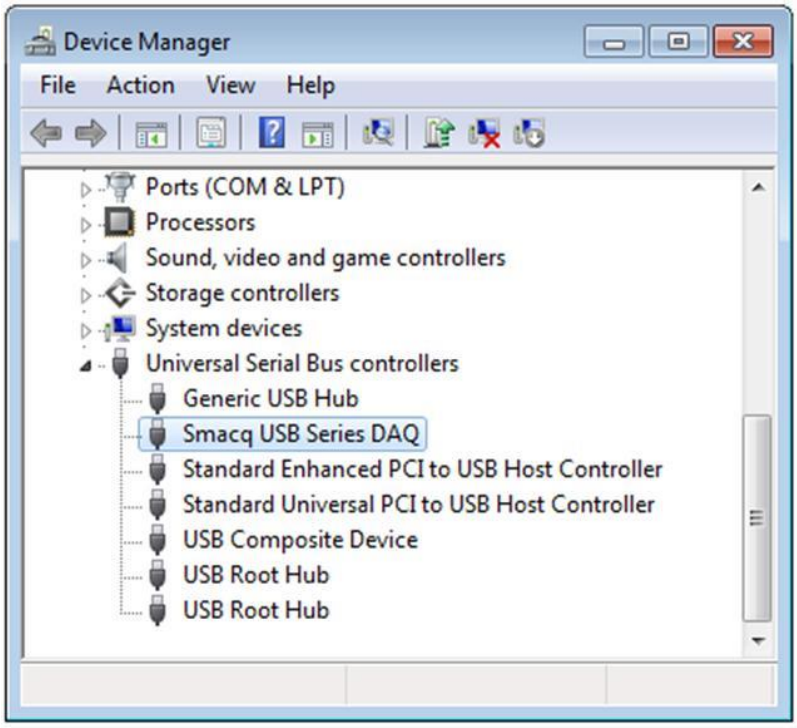
USB cable reinforcement design

3.3. Drive installation

Smacq USB-1000 series data acquisition device support Microsoft Windows XP, Windows 7, Windows 8/8.1, and Windows 10, including all the 32-bit and 64-bit versions. To install the driver for USB-1000devices, you need to turn off driver signature enforcement first. Here is an example step-by-step tutorial on how to install the driver in Windows 7.

1. Connect your USB-1000card to the computer and launch the Device Manager in Windows.
2. There should be a device with an exclamation point. 

3. Right-click it, select "Update driver".
4. In the pop-up dialog box, select "Browse my computer for driver software"
5. And then select "Let me pick from a list of device drivers on my computer"
6. Click on "Next" and then select "Have disk"
7. Click Browse in the pop-up dialog box, then enter the \USB-3000 Series DAQ \driver folder in the CD-ROM, then enter the "win7" folder, then the 32-bit operating system enters the "x86" folder, the 64-bit operating system enters the "x64" folder, select the "susb.inf" file, and then click "Open". (The drivers of Windows8/8.1 and Windows10 are the same as those of Windows7, using the same file.)
8. Then in the dialogue of "Install from disk", click on "Yes".
9. Click "Next", if the Windows security warning pops up, you need to select "Install this driver software anyway" to finish the installation.
10. After these steps, the operating system will start installing the driver, which usually takes about 30 seconds. After the driver is installed, the exclamation point in Device Manager will disappear.

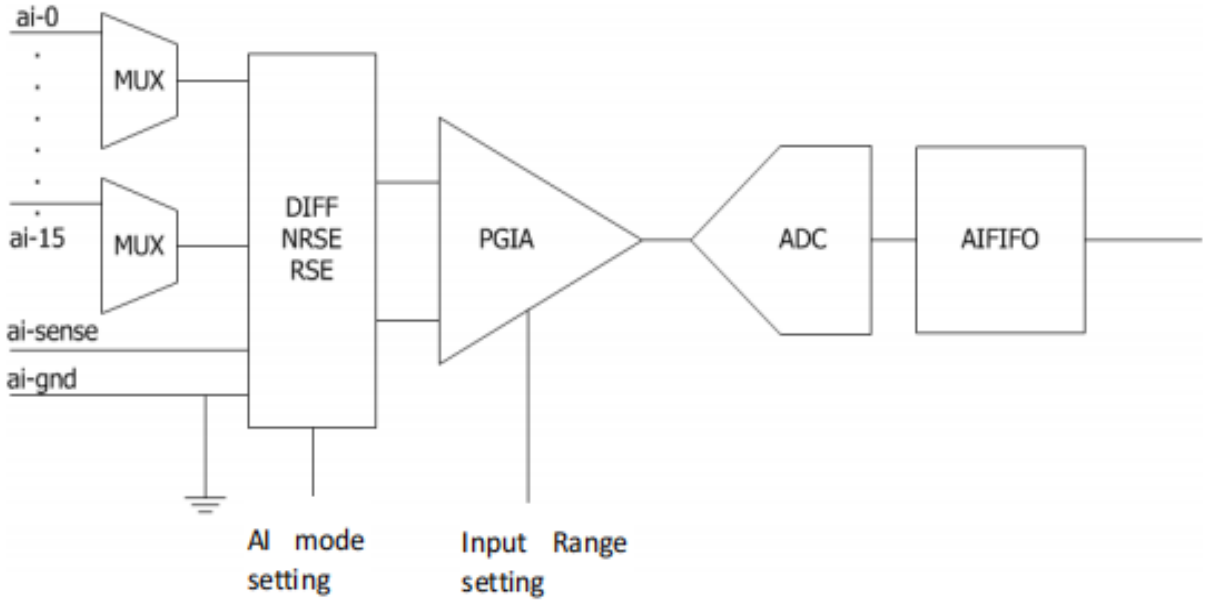


Device Manager after the driver is correctly installed

4. Analog Input (AI)

This chapter describes measuring the relevant content of analog input signals on USB-1000 series data acquisition cards. AI here is short for Analog Input.

4.1. Circuit diagram



Analog input circuit

4.2. Input Range Description

● Single-Ended Mode

For single-ended input mode, positive input is connected to Aix, and negative input to AGND or AI-sense. Its input range can be set to 0~10V or ±5V via the software.

● Differential Mode

For DIFF Mode, positive input is connected to AI+, and negative input to AI-. Its input range can be set to 0~10V or ±5V via the software.

The voltage from AI+ and AI- can vary in the range of -10V~10V. The actually measured voltage value is the difference of voltage between AI+ pin and AI- pin.

When the input range is set to 0~10V, voltage range that can be measured in differential mode shall meet the following conditions:
The voltages from both AI+ and AI- are in the range of -10V~10V, and the voltage in the range of $0V \geq (AI+) - (AI-) \leq 10V$ can be measured correctly.

When the range is set to -5V~5V, voltage range that can be measured in differential mode shall meet the following conditions:
The voltages from both AI+ and AI- are in the range of -10V~10V, and the voltage in the range of $-5V \geq (AI+) - (AI-) \leq 5V$ can be measured correctly.

4.3. Description on Multi-Channel Scanning

● Sampling rate

In multi-channel scanning applications, the PGIA will need enough settling time in switching channels. In such case, the sampling rate can be set to 200kS/s at maximum.

Setting sampling rate higher than actually required sampling rate should be avoided, as lower sampling rate makes the PGIA having more sufficient settling time, so that the accuracy of data acquisition can be improved.

● Input Ranges

The input range of the DAQ device should be set uniformly. In multi-channel scanning applications, all the channels shall have a same range.

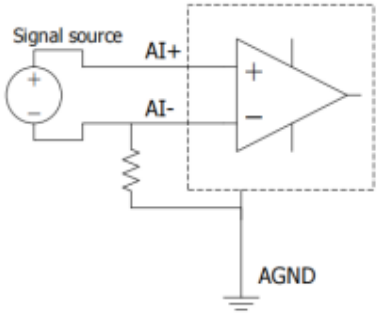
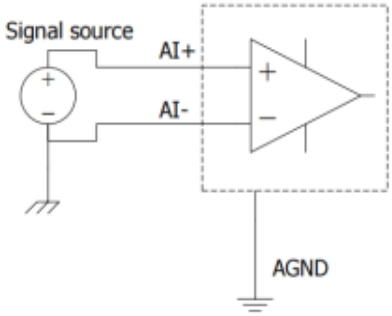
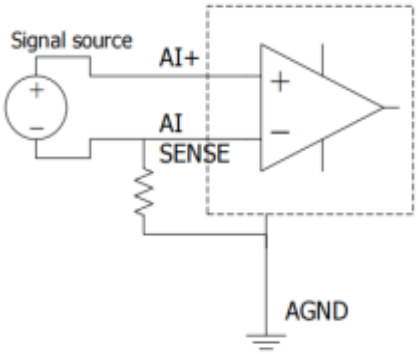
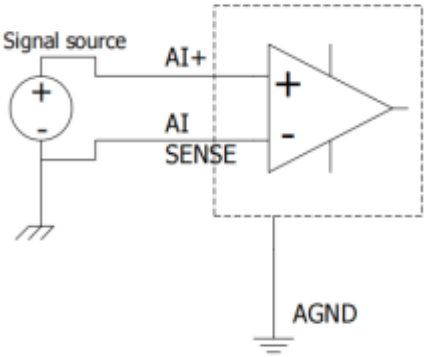
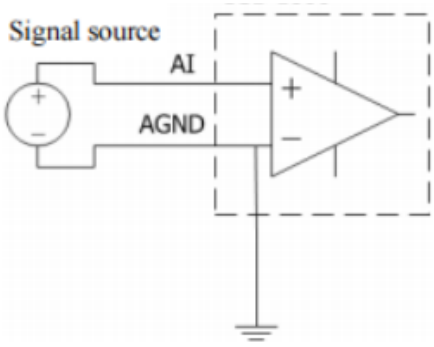
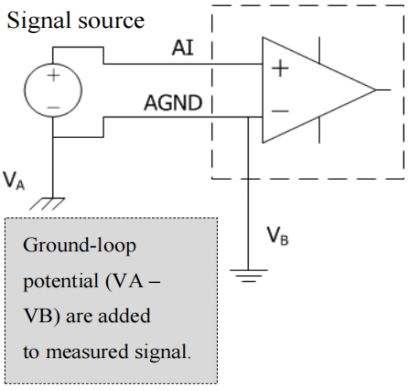
● Trigger Sources

When USB-1000 series DAQ acquires signals via analog input, its trigger source can be set to trigger by software or trigger by the rising edge or falling edge of digital IO input channel DIN0 port.

4.4. Signal Connection Mode

USB-1000 series data acquisition devices support analog input acquisition connection methods of non-grounding reference single-ended input (NRSE), differential input (DIFF),referenced Single-ended(RSE).

The recommended connection methods for floating-ground and grounding signal sources list

Input mode	**Floating grounded signal source (Not connected to GND of the building)**	**Grounded signal source**
Example	● Ungrounded thermocouples ● Signals that are isolated ● Battery-powered devices	● Signals that are not isolated
DIFF		
NRSE		
RSE		

4.5. Floating grounded signal source

A floating grounded signal source is not connected in any way to the building ground system but, it has an isolated ground-reference point. Common floating grounded signal sources are transformers, thermocouples, battery equipment, optical isolate, and isolation amplifier output. An instrument or device with isolated output is a floating-ground signal source.

Attention When measuring the floating grounded signal source, it is important to connect the negative end of the signal source directly or indirectly through the resistor to the AGND.

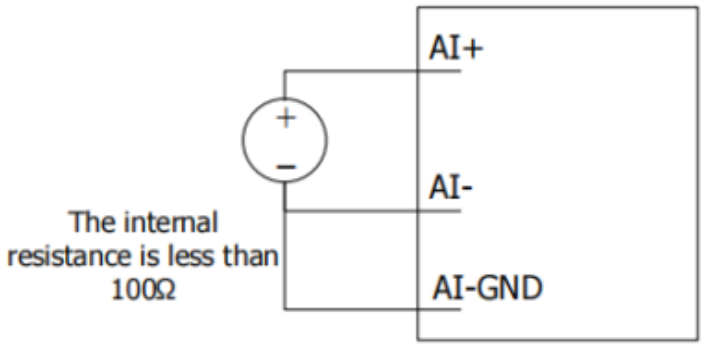
● Using differential mode (DIFF) connection

When any of the following conditions are true, a differential mode should be used to connect the floating signal:

- Analog input AI+ and AI- are all valid signals.
- Low input signal voltage while higher accuracy demanded
- The cable length of the connection signal to the acquisition device exceeds 3 Meters
- The input signal requires a separate ground-reference point or a return signal
- There is obvious noise in the environment of the connection wire

Differential connection mode can reduce noise interference and improve the common-mode suppression ability of acquisition device.

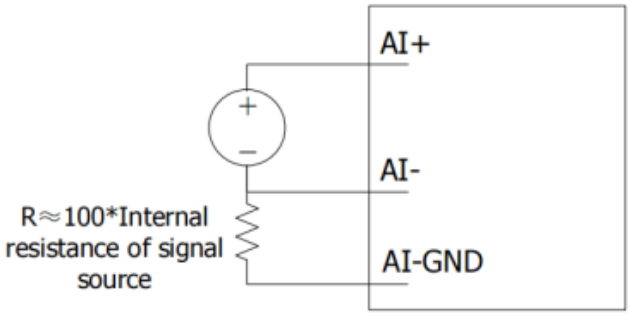
For a floating signal source with less than 100ΩF internal resistance, you can directly connect the negative end of the signal to AI- and AGND ports and connect the positive end of the signal to AI+ ports, as shown below.



Differential input mode for direct connection

However, for a floating signal source with large internal resistance, the above connection will lead to the imbalance of differential signal, and the common-mode noise will be coupled to the signal of AI+ while not to AI-, so that the common-mode noise will appear in the measured results.

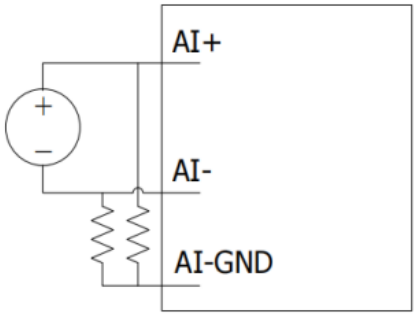
Therefore, for such a signal source, you can use a bias resistor approximately 100 times the internal resistance of the signal source to connect to AI- and AGND ports.
This can make the differential signal close to equilibrium, hence couple the same amount of noise at both ends of the signal to enable better common-mode noise suppression.



Differential input mode with single bias resistor

For a floating signal source with a large internal resistance, you can use the differential input mode with two bias resistors. The fully balanced bias resistor connection in this way can provide a slightly better noise suppression, but it can reduce the load on the signal source and result in gain errors.

For example, suppose the internal resistance of the signal source is 2kΩ, and two equilibrium resistors are 100kΩ each, then the signal source load is 200kΩ, which results in a 1% gain error.

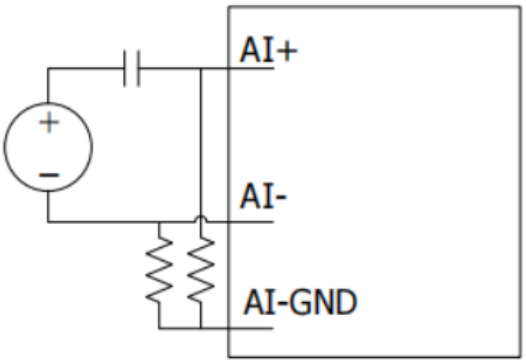


Balanced bias resistor differential input mode

For AC-coupled floating signal sources, a resistor is required to provide DC loops for the positive input of instrument amplifier, AI+.

If the AC coupled float signal source has a smaller internal resistance, the AI+ and AGND connection resistance values should be generally set as 100kΩ to 1MΩ. Hence, it does not aggravate the load of the signal source, nor does it generate an offset voltage due to the bias current of the instrument amplifier. In this case, you can directly connect AI- and AGND.

If the internal resistance of the AC coupled floating source signal is large, the differential input mode utilizing the equilibrium bias resistor described earlier should be used, and it is important to note the gain error that may be caused by the equilibrium bias resistor.



Differential input method for AC coupled floating signal source

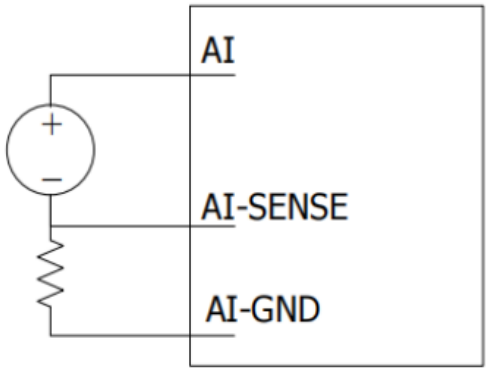
● Non-grounded reference single-ended mode (NRSE) connection

When both the following conditions are true, you can connect the float signal using a non-grounded reference single-end mode:

- The input signal voltage is higher than 1V
- The length of the cable connecting signals to the acquisition device is lower than 3 meters

If the signal does not meet the above conditions, it is recommended to use a differential mode connection to ensure better signal integrity. In single-ended mode, the electrostatic noise and electromagnetic noise of the coupled input signal connection are more than that in differential mode.

Non-grounded reference single-ended mode (NRSE) connection methods.
Note that the resistance value setting of the grounded resistance is consistent with the that in difference mode.



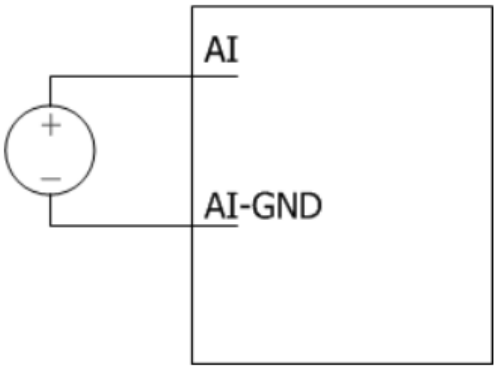
Floating-grounded signal source NRSE input

● Reference single-ended mode (RSE) connection

When conditions are true, you can connect the float signal using a reference single-end mode:

- The input signal voltage is higher than 1V
- The length of the cable connecting signals to the acquisition device is lower than 3 meters
- The input signal can share a common reference AGND with other signal

If the signal does not meet the above conditions, it is recommended to use a differential mode connection to ensure better signal integrity. In single-ended mode, the electrostatic noise and electromagnetic noise of the coupled input signal connection are more than that in differential mode.



Floating-grounded signal source RSE input

4.6. Grounded Signal Source

The grounded signal source is a signal source connected to the building ground. If the computer is connected to the same power supply as the signal source, the source is already connected to a common ground point relative to the device. Instruments and equipment connected to the building power supply system while with non-isolated outputs belong to this type of signal source.

The potential difference between devices connected to the power supply system of the same building is usually 1mV to 100mV, but the potential difference may be larger if the distribution line is not properly connected. If the measurement method is improper, the potential difference may cause measurement errors. Follow the connection guide for the grounded signal source below to reduce the grounded potential difference of the measured signal.

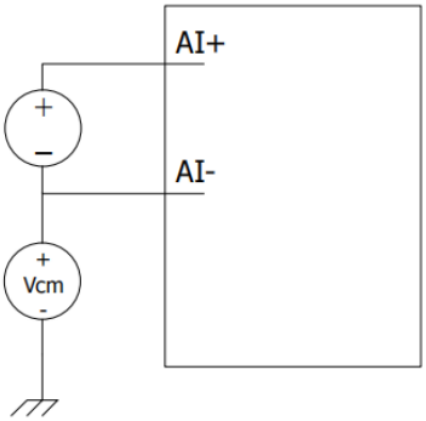
● Use a differential mode (DIFF)

Differential mode connection should be used when any of the following conditions is true:

- Analog input AI+ and AI- are all valid signals.
- Low input signal voltage while high accuracy demanded
- The cable connecting the signal to the acquisition device exceeds 3 meters
- The input signal requires a separate reference location or a return signal
- There is obvious noise in the environment of the signal wire

Differential connection mode can reduce noise interference and improve the common-mode suppression of the acquisition device. Differential connection allows the input signal to float within the common-mode operating range of the instrument amplifier.

Shows how to use differential mode to connect the grounded signal source



Grounded signal source DIFF input

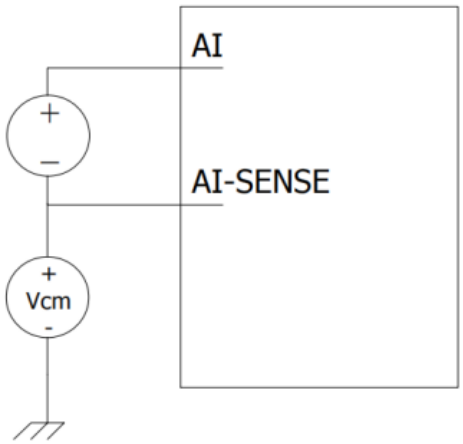
● Use a non-grounded reference single-ended mode (NRSE)

When all of the following conditions are true, you can connect the float signal using a non-grounded reference single-ended mode:

- The input signal voltage is higher than 1V
- The cable connecting the signal to the acquisition device is less than 3 meters
- The input signal shares a reference point whose voltage is not AGND.

If the signal does not meet the above conditions, it is recommended to use a differential mode connection to ensure better signal integrity. In single-ended mode, the electrostatic noise and electromagnetic noise of the coupled input signal connection are more than that in the difference mode.

The grounded signal source (NRSE) connection in non-grounded reference single-ended mode.



Grounded signal source NRSE input

● Using Referenced Single-Ended (RSE)

For grounded signal sources, differential mode (DIFF) or Non-Referenced Single-Ended (NRSE) connections may be used under permitting conditions. If RSE mode is used for connecting the signal, potential difference may exist between the ground of the signal source and the ground of the DAQ device.

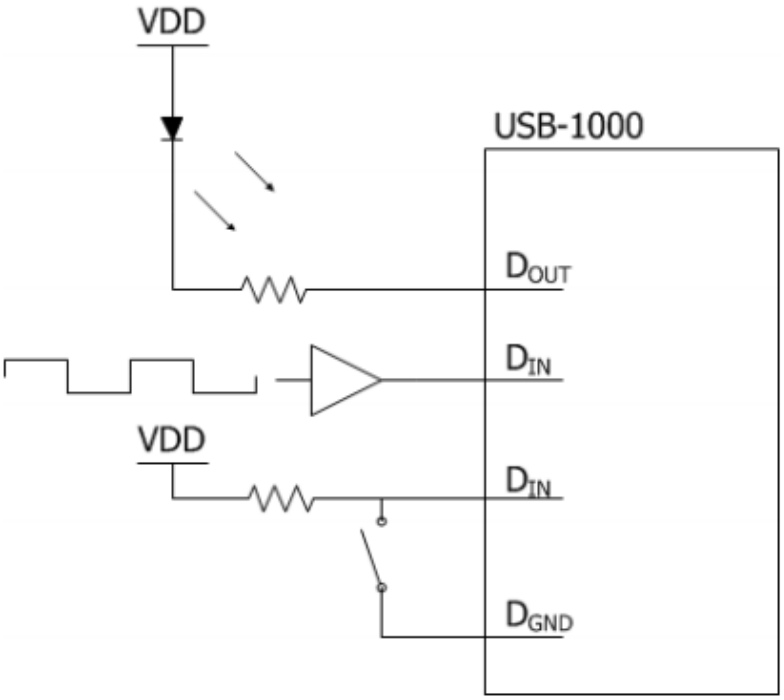
5. Digital I/O

This chapter introduces the digital I/O signal acquisition on USB-1000 series data acquisition cards. 16-channel digital input and 16-channel digital output, DGND is digital I/O reference grounded signal.

The digital input DIN channel is compatible with 0~5V level signal. 2~5V is determined as high level, and 0~0.5V as low level.
Digital output DOUT channels output high level of 3.3V, and output low level of 0V.

5.1. Digital signal connect

When using digital output DOUT signals, it is desirable to use low-level driving mode as much as possible for the purpose of reducing the power burden of the digital output channels of your DAQ device.



Digital I/O signal connection

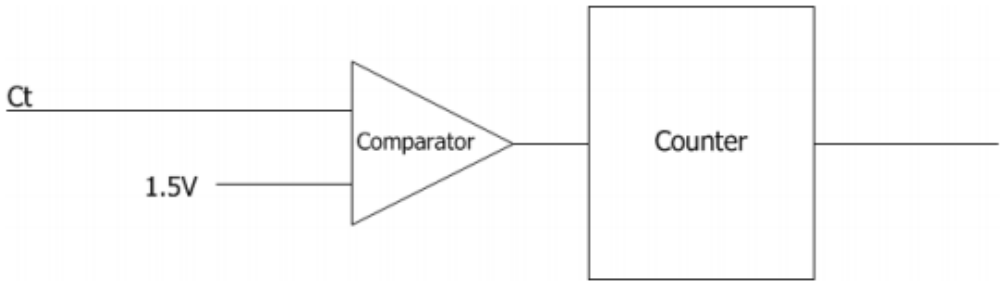
6. Counter

6.1. Overview

USB-1000 series DAQ device has 4 counter channels, with input signal voltage up to 5V. GND is the ground-reference signal of counter channels. The counter can be configured as any of the following three functions:

- Event counter
- Period measurement
- Positive pulse width measurement
- Negative pulse width measurement

Since the counter channel is added with a comparator,USB-1000 series DAQ devices can be used to count or measure the periods of sine waves.



Counter Block Diagram

6.2. Event counter

In event counter applications, the counter channel of the DAQ device is used as an event counter. You can configure the counter to count rising or falling edges of the Ct port.

You can configure the event counter counting up, but not counting down, that is, the value of the event counter is accumulated in the order 0, 1, 2, 3, 4, and 5 depending on the number of pulses received.

6.3. Period/Positive/Negative Pulse Width Measurement

You can configure the counter channel of the DAQ device to measure period/positive pulse width/negative pulse width via the software.

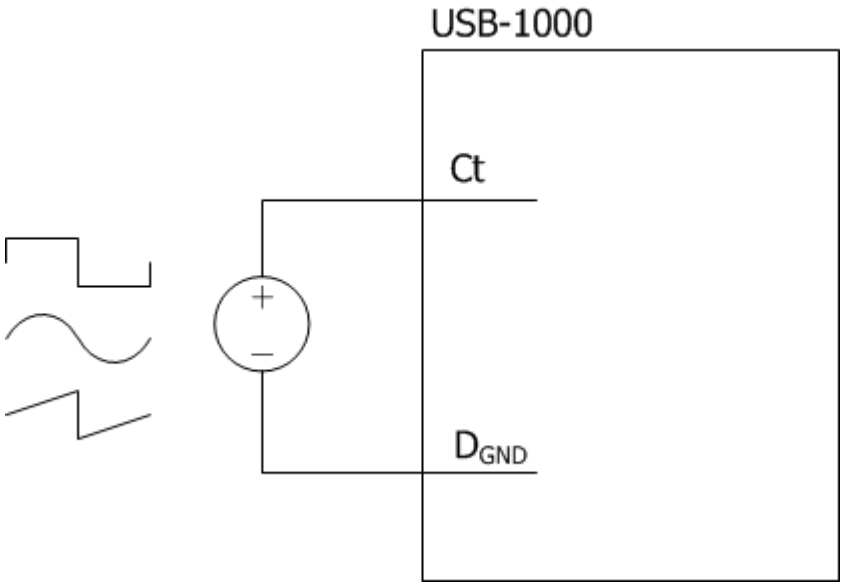
In period measurement applications, the DAQ device measures the period between two rising edges from the comparator and save it in the results of the corresponding counter channel, with a time accuracy of 40ns.

In positive pulse width measurements, the DAQ device measures the period between one rising edge and the following falling edge from the comparator and save it in the results of the corresponding counter channel, with a time accuracy of 40ns.

In negative pulse width measurements, the DAQ device measures the period between one falling edge and the following rising edge from the comparator and save it in the results of the corresponding counter channel, with a time accuracy of 40ns.

6.4. Connecting Counter Signals

The connection diagram for counter channel signal.



Counter Signal Connection

7. Programming Instructions

Via a standard dynamic link library usb-1000.dll, developers can interact with the USB-1000 series DAQ device and control all the functions of the DAQ device.

This chapter gives a detailed description on all the functions provided by library usb-1000.dll. The call formats of all these functions can be found in the file usb-1000.h. Refer to reference routines for detailed controlling and calling programs.

Attention: All functions in this document use C/C++ function models. If using other language for application development of, you need to note the difference between the data type of the other development language with that of C/C++, otherwise it will lead to errors.

7.1. Basic functions

FindUSBDAQ()
int_stdcall FindUSBDAQ()
Find the USB-1000 series DAQ device connected to the computer.

parameters	Note
Return value	the number of USB-1000 series DAQ devices connected to the computer.

OpenDevice()
int_stdcall OpenDevice(int DevIndex)
Turn on the specified device.

parameters	Note
DevIndex	the index number of the DAQ device, 0 is the number of the first device.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

CloseDevice()
void_stdcall CloseDevice(int DevIndex)
Turn off the specified device.

parameters	Note
DevIndex	the index number of the DAQ device, 0 is the number of the first device.

ResetDevice()
int_stdcall ResetDevice(int DevIndex)
Reset the specified device.

parameters	Note
DevIndex	the index number of the DAQ device, 0 is the number of the first device.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

7.2. Analog Input Related Functions

SetUSB1AiRange()

int_stdcall SetUSB1AiRange(int DevIndex, float Range)

Set AI channel range of the DAQ device.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
Range	AI channel range of the DAQ device, you can configure it to 10 or 5. 10 indicates 0~10V, 5 indicates -5~5V.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

SetSampleRate()

int_stdcall SetSampleRate(int DevIndex, unsigned int SampleRate)

Set the sampling rate of AI channel of the DAQ device.

When the USB-1000 series DAQ device works in multiple AI channels, the sampling rate per channel = the set sampling rate/the number of channels used. For example, given the set sampling rate is 200kS/s, and 4 channels are used, then the sampling rate of each channel is 50kS/s.

The minimum time resolution of sampling period is 20ns. Therefore, the optimal sampling period will be achieved when the sampling period is set to integral multiple of 20ns.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
SampleRate	Sampling rate, in S/s,for example, to set the sampling rate as 1kS/s, you need to configure SampleRate to 1000.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

SetChanMode()

int_stdcall SetChanMode(int DevIndex, unsigned char ChanMode)

Set channel mode to differential (DIFF) or Non-Referenced Single-Ended(NRSE) or Referenced Single-Ended(RSE).

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
ChanMode	0 indicates DIFF; 1 indicates NRSE; 3 indicates RSE, others invalid.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

SetChanSel()

int_stdcall SetChanSel(int DevIndex, unsigned short ChSel)

Set the channel to be selected.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
ChSel	The channel to be selected. The binary bits of this parameter correspond to AI channels ai0~ai15 from low to high. 1 indicates enabled, 0 indicates unused. For example, to select ai0 and ai1, you need to configure ChSel to 0x0003; to select ai0 and ai2, you need to configure ChSel to 0x0005.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

Attention: If the analog channel is configured as DIFF, only channels ai0~ai7 can be selected. Otherwise it will result in an error.

SetSoftTrig()
int_stdcall SetSoftTrig(int DevIndex, unsigned char Trig)
Set software trigger.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
Trig	The software trigger switch, 0 indicates Off, 1 indicates On.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

7.3. Digital IO Related Functions

SetDioOut()
int_stdcall SetDioOut(int DevIndex, unsigned int DioOut)
Set the value of digital IO output channel DOUT.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
DioOut	The value of digital IO output channel DOUT. The least 16 bits of DioOut correspond to the 16 channels of digital IO output channel DOUT.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

7.4. Counter Related Functions

SetCounter()
int_stdcall SetCounter(int DevIndex, unsigned char CtrNum, unsigned char CtrMode, unsigned char CtrEdge)
Set counter function.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
CtrNum	The index number of counter channels. 0~3 correspond to Ct0~Ct3. If 0x0f is set, it indicates 4 counters operating simultaneously.
CtrMode	Counter operating mode. 0 indicates Event Counter mode. 1 indicates period measurement; 2 indicates positive pulse width measurement; 3 indicates negative pulse width measurement.
CtrEdge	When working in Event Counter mode, 1 indicates counting rising edges, and 2 indicates counting falling edges.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

StartCounter()
int_stdcall StartCounter(int DevIndex, unsigned char CtrNum, unsigned char OnOff)
Counter switch, it starts or stops the counter.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
CtrNum	The index number of counter channels. 0~3 correspond to Ct0~Ct3. If 0x0f is set, it indicates 4 counters operating simultaneously.
OnOff	1 indicates starting the counter; 0 indicates stopping the counter.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

ClearCounter()
int_stdcall ClearCounter(int DevIndex, unsigned char CtrNum)
Return the counter to zero.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
CtrNum	The index number of counter channels. 0~3 correspond to Ct0~Ct3. If 0x0f is set, it indicates 4 counters operating simultaneously.34
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

7.5. Read Data Control Functions

StartRead()
int_stdcall StartRead(int DevIndex)
Start reading. This function enables a thread to automatically read the data in the DAQ device hardware FIFO and save it in computer software FIFO.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

StopRead()
int_stdcall StopRead(int DevIndex)
Stop reading. This function disables the reading thread enabled by the function "StartRead()".

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

GetAiChans()
int_stdcall GetAiChans(int DevIndex, unsigned long Num, unsigned short ChSel, float *Ai, long TimeOut)
Users read the sampling data of AI channels stored in the software FIFO. For continuous sampling, simply repeatedly call this function to get the continuous sampling waveforms.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
Num	The analog sampling number in this reading, indicating the sampling number to be read per channel.
ChSel	The channel to be selected. The binary bits of this parameter correspond to AI channels ai0~ai15 from low to high. 1 indicates enabled, 0 indicates unused. For example, to select ai0 and ai1, you need to configure ChSel to 0x0003; to select ai0 and ai2,you need to configure ChSel to 0x0005.
*Ai	The pointer to AI data array.
TimOut	Timeout setting. If software FIFO does not acquire enough sampling number 35 (Num) within the specified time, this function will exit and return a timeout error code.
Return value	When it returns a non-negative number, it indicates that the remaining space of the software FIFO contains integers from 0 to 2000000; when it returns a negative number, it indicates an error. Refer to section 7.7 Error Codes for others.

GetDioIn()

unsigned int_stdcall GetDioIn(int DevIndex)

Read the value of digital IO channel DIN.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
Return value	It returns the value of digital IO channel DIN, the least 16 bits correspond to the values of DIN0~DIN15.

GetCounter()

unsigned int_stdcall GetCounter(int DevIndex, unsigned char CtrNum)

Read the value of the event counter.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
CtrNum	The index number of the counter channel. 0~3 correspond to Ct0~Ct3.
Return value	The value of the event counter.

GetCtrTime()

double_stdcall GetCtrTime(int DevIndex, unsigned char CtrNum)

Read the measured value in period/positive pulse width/negative pulse width measurement, in us.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
CtrNum	The index number of counter channels. 0~3 correspond to Ct0~Ct3.
Return value	The measured value in period/positive pulse width/negative pulse width measurement, in us.

ClearBufs()

int_stdcall ClearBufs(int DevIndex)

Clear the AI buffer, containing software FIFO and hardware FIFO.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

TransDioIn()

int_stdcall TransDioIn(int DevIndex, unsigned char TransDioSwitch)

Start separately transmitting digital port data, including DIN data and counter data. You need to call this function first if you only need to transmit the digital input (DIN) channel data or counter data. If you have already started simulation acquisition, you can obtain correct DIN data and counter value without calling this function. Refer to routines of digital IO and counter respectively for detailed use method.

parameters	Note
DevIndex	The index number of the DAQ device, 0 is the number of the first device.
TransDioSwitch	Data transmission switch, 1 for On, 0 for Off.
Return value	0 indicates error free. Refer to section 7.7 *Error Codes* for others.

7.6. Error Code

If a negative is returned in function operation, it means that an operation error occurred. Refer to Table 4 below for detailed error codes.

Table4. Error Codes

Error Code	Description
-1	No USB-1000 series DAQ device connected to the computer is found.
-2	Index of DAQ device out of bound.
-3	DAQ device firmware error.
-4	DAQ device closed.
-5	Transmission data error.
-6	The computer does not have enough memory.
-7	Timeout.

8. After sales service and warranty

Smacq Technologies. Co., Ltd. promises that its products are under warranty. If the product malfunctions during normal use, we will provide free repair or replacement of parts for the user. For detailed warranty instructions, please refer to the warranty instructions inside the packaging box.

Except for the warranties mentioned in this manual and warranty instructions, our company does not provide any other express or implied warranties, including but not limited to any implied warranties regarding the merchant ability and fitness for a particular purpose of the product.

For more technical support and service details, or if you have any questions while using this product and this document, please feel free to contact us:

Phone: (86-10) 52482802
E-mail: service@smacq.com
Website: http://www.smacq.com
http://www.smacq.cn

9. Ordering Information

Main Equipment

Model	Notes
USB-1252A	16-AI(Single-500kSa/s, Multipath-200kSa/s), 4-CT, 16-DI, 16-DO

Standard accessories

Model	Notes
USB Cable	USB connection cable, 1.5 meters, USB-A type to USB-B type
TB10-3.81	10-bit, 3.81mm pitch terminal block

Optional accessories

Model	Notes
SDIN	35mm DIN rail mounting bracket
CHF-100B	Current sensor, 100A, DC~20kHz, output ±4v
CHV-600VD	Voltage sensor, 600V, DC~20kHz, isolated Diff-input, output ±5v

10. Document Revision History

Date	Edition	Remarks
2016.08.30	Rev: A	First release
2017.09.25	Rev: B	Update USB-1252A model information