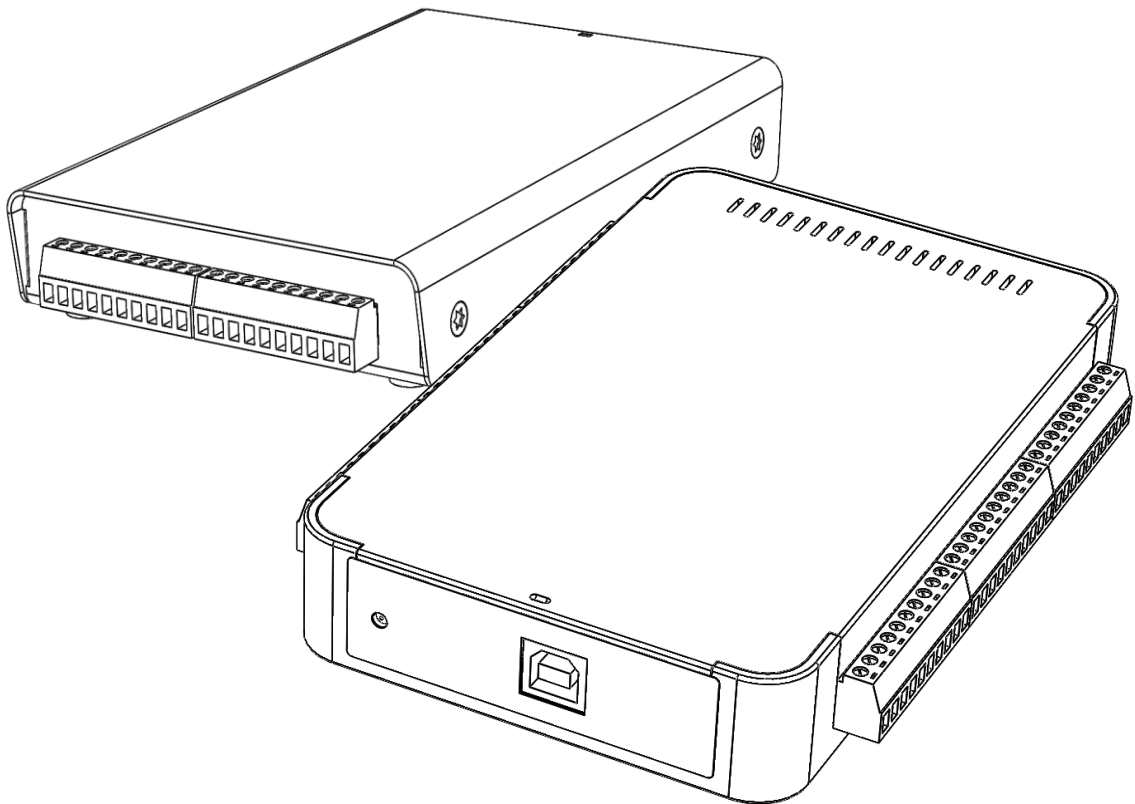


USB-1000 Series Multi-Function Data Acquisition Devices

USB-1252/USB-1252A

User Manual

Rev: C



Smacq

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1. Product Overview

1.1. Overview

The new USB-1000 series multi-function data acquisition (DAQ) device provides a new option for convenience and quick start of data acquisition application. Its exquisite shape provides super portable and very flexible installation.

USB-1000 series DAQ devices provide 12-bit, up to 500kS/s sampling rate, and up to 16 analog signal acquisition channels. You can set the range as 0~10V or $\pm 5V$ via software.

With 16 digital input/output channels and 4 counter channels, USB-1000 series DAQ device offers you the flexibility to build automatic control system of any size.

1.2. Block Diagram

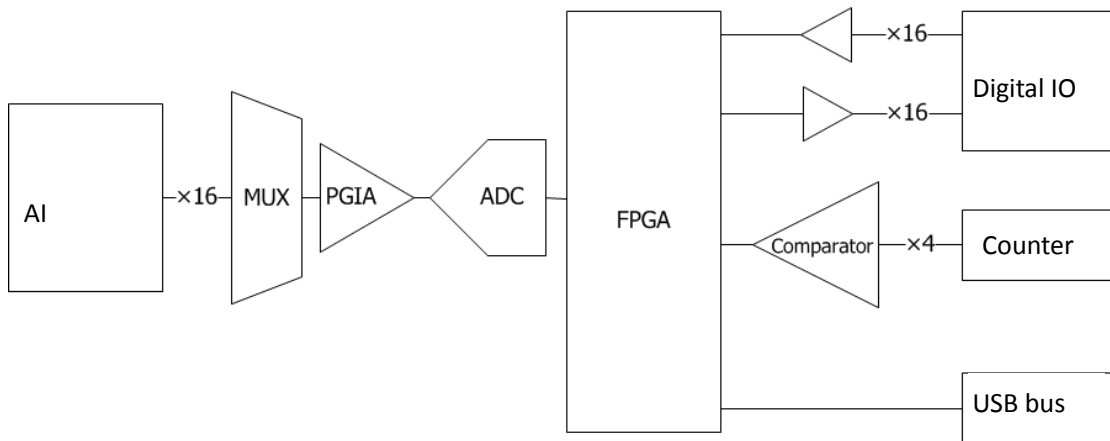


Figure 1. Block Diagram of USB-1000 series DAQ device

1.3. Product Features

- 12-bit analog input (AI) resolution.
- Up to 500kS/s analog input (AI) sampling rate. (Up to 200kS/s with multiple channels enabled.)
- Sampling period configurable by steps of 20ns.
- Up to 16 single-ended AI channels or 8 differential AI channels configurable via software.

- 0~10V or $\pm 5V$ configurable via software.
- Onboard 16K sampling point FIFO buffer.
- Up to 16 digital input (DI) channels and 16 digital output (DO) channels.
- Up to four 32-bit counter channels.
- LabVIEW, Visual Studio and MATLAB development support.

1.4. Product Specifications

The following product specifications, unless otherwise stated, are measured at the temperature of 25 °C and the humidity of 40%.

Analog Input

Number of AI Channels	16 single-ended channels or 8 differential channels configurable via software.
Synchronous Sampling	No
AI Resolution	12-bit
Converter Type	SAR
Sampling Rate	Single-channel acquisition: 500kS/s maximum Multiple-channel acquisition: 200kS/s maximum
Timing Resolution	20ns
AI FIFO Buffer	16k sampling point
Range	0~10V or -5~5V configurable via software.
Safe Voltage	$\pm 15V$, the DAQ device may be damaged if the input voltage exceeds this safe voltage.
Input Impedance	>1G Ω (Power On)
Input Coupling Mode	DC
Trigger Mode	Software trigger
System Noise	NRSE 0~10V range: 0.15mVrms NRSE $\pm 5V$ range: 0.3mVrms DIFF 0~10V range: 0.2mVrms DIFF $\pm 5V$ range: 0.4mVrms
Absolute Accuracy	NRSE 0~10V range: 2.8mV NRSE $\pm 5V$ range: 3mV DIFF 0~10V range: 3mV DIFF $\pm 5V$ range: 4mV

Digital IO

Number of DO Channels	16
High Level Output Voltage	3.0~3.4V
Low Level Output Voltage	0~0.1V
Number of DI Channels	16
Low Level Input Voltage	3.3~5V
High Level Input Voltage	0~0.5V

Counter

Number Of Counters	4
Resolution	32-bit
Counter Measurement	Edge Count,
Counting Direction	Count Up
Maximum Input Frequency	1MHz

Bus Interface

USB Interface Specification	USB 2.0 High-Speed Interface
USB Interface Connector	USB Series Type-B Connector

Power Requirements

USB Bus Power Supply	4.75~5.25VDC
Current Consumption	About 300mA

Other Specifications

Dimensions (mm)	Without Connector: 156*102*26 With Connector:161*102*26
Weight	About 420g
Analog Channel Signal Connector	10-PIN Screw Terminal Connector
Digital IO and Counter Connector	40-PIN IDC Connector
Operating Environment	0 ℃ ~55 ℃ 5%RH~90%RH, Non-Condensing
Storage Environment	-40 ℃ ~85 ℃

	5%RH~90%RH, Non-Condensing
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2. Description on Appearance and Signal Connection

2.1. Appearance

USB-1000 series DAQ device uses metal shielding enclosure, with AI signals connected with plug-in screw terminal connectors, digital IO signals and counter signals connected with 40-PIN IDC connectors, and USB communication interface connected with USB series type-B connector. Figure 2 shows the overall appearance and dimensions (in mm) of the product.

Sensors generate electrical signals to measure physical phenomena, such as temperature, force, sound, or light. Strain gauges, thermocouples, thermistors, angular encoders, linear encoders, and resistance temperature detectors (RTDs) are commonly used sensors.

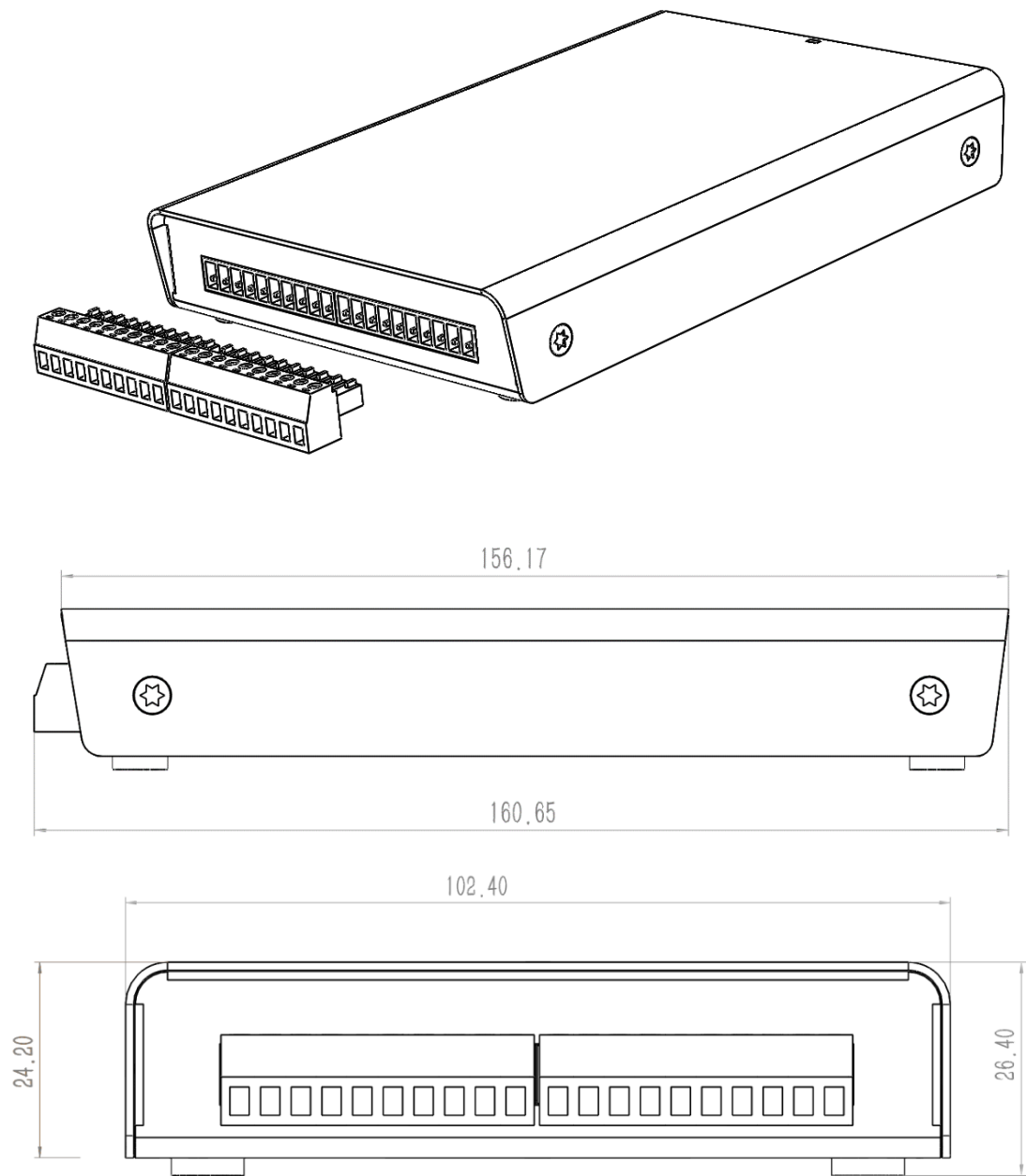


Figure 2. External View of USB-1252 DAQ Device

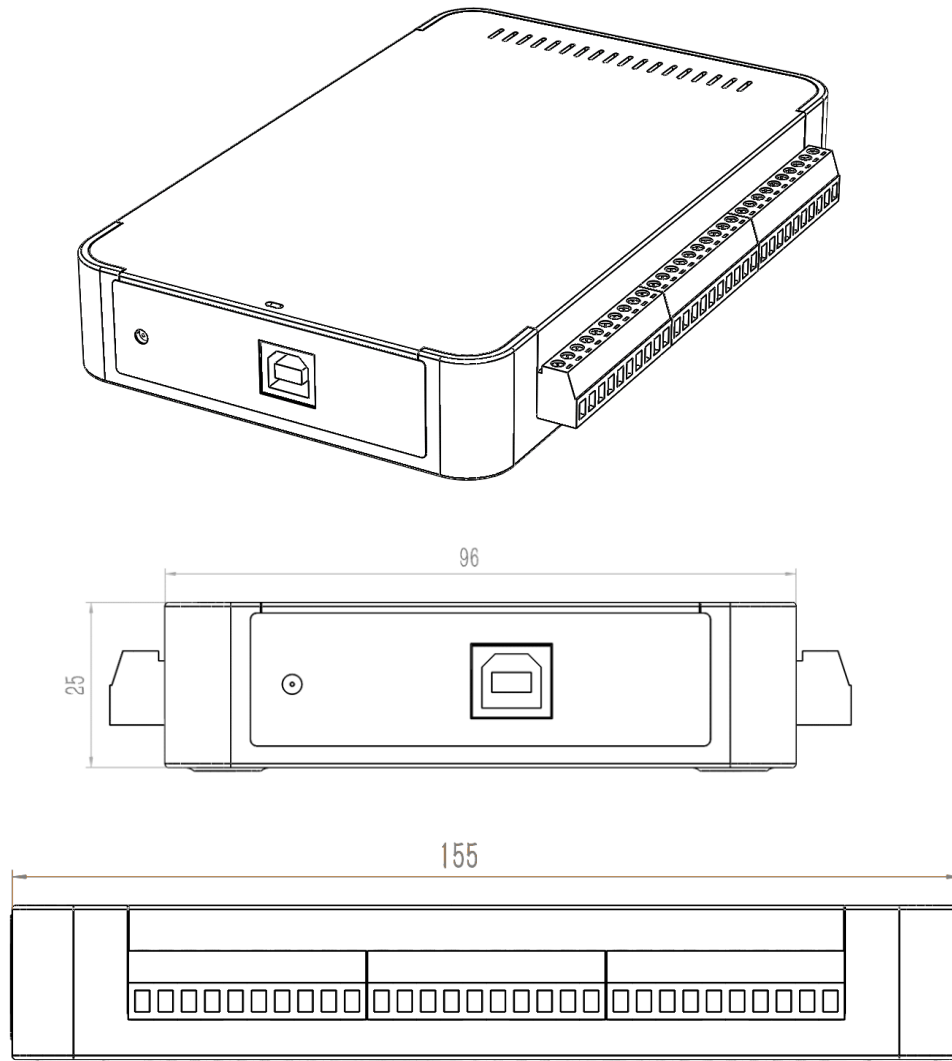


Figure 3. External View of USB-1252A DAQ Device

2.2. Signal Connection

Connecting Analog Input Signal

The screw terminal connector, located in front of the DAQ device, is used for connecting AI signals. Figure 3 and Table 1 show its pin distribution and corresponding signals. Unused AI channels should be grounded so as to reduce system noise and achieve higher stability.

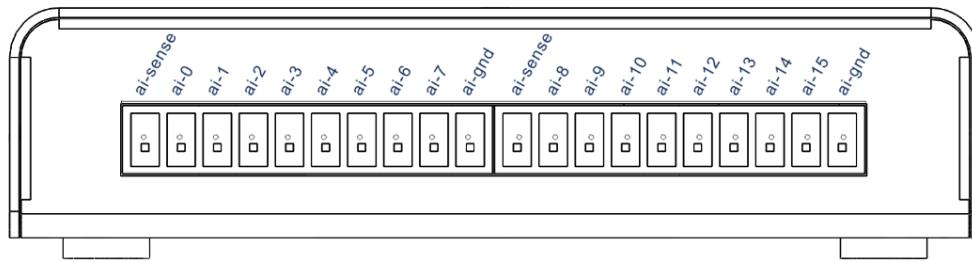


Figure 4. Pin Distribution and Corresponding Signals of Screw Terminal Connector

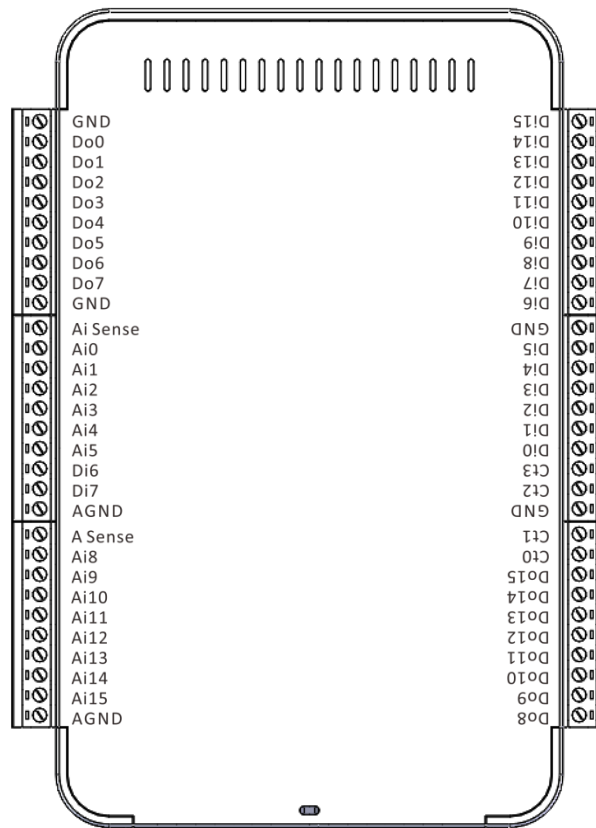


Figure 5. Pin Distribution and Corresponding Signals of Screw Terminal Connector

Table 1 Mapping of Pins and Signals of Screw Terminal

Name	Description
ai-sense	Reference end input for Non-Referenced Single-Ended (NRSE) signal
ai-gnd	Analog ground
ai-0	AI channel, ai0 for single ended, and ai0+ for differential

ai-1	AI channel, ai1 for single ended, and ai0- for differential
ai-2	AI channel, ai2 for single ended, and ai1+ for differential
ai-3	AI channel, ai3 for single ended, and ai1- for differential
ai-4	AI channel, ai4 for single ended, and ai2+ for differential
ai-5	AI channel, ai5 for single ended, and ai2- for differential
ai-6	AI channel, ai6 for single ended, and ai3+ for differential
ai-7	AI channel, ai7 for single ended, and ai3- for differential
ai-8	AI channel, ai8 for single ended, and ai4+ for differential
ai-9	AI channel, ai9 for single ended, and ai4- for differential
ai-10	AI channel, ai10 for single ended, and ai5+ for differential
ai-11	AI channel, ai11 for single ended, and ai5- for differential
ai-12	AI channel, ai12 for single ended, and ai6+ for differential
ai-13	AI channel, ai13 for single ended, and ai6- for differential
ai-14	AI channel, ai14 for single ended, and ai7+ for differential
ai-15	AI channel, ai15 for single ended, and ai7- for differential

Connecting Digital IO Signals and Counter

The IDC connector, located at the back of the DAQ device, is used for connecting digital IO signals and counter signals. Figure 4 and Table 2 show its pin distribution and corresponding signals.

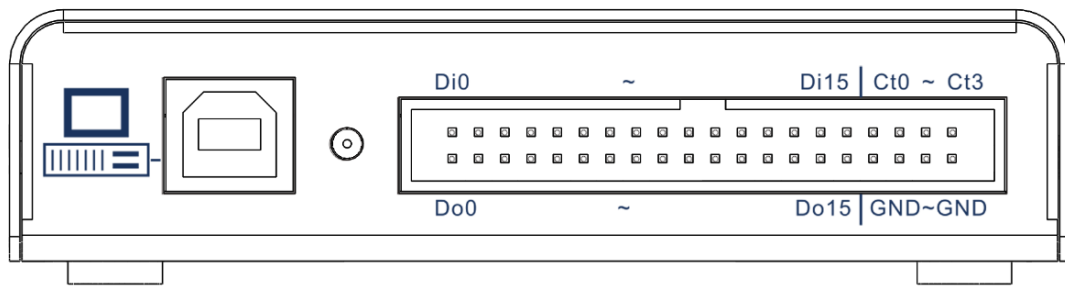


Figure 6. Pin Distribution and Corresponding Signals of IDC Connector

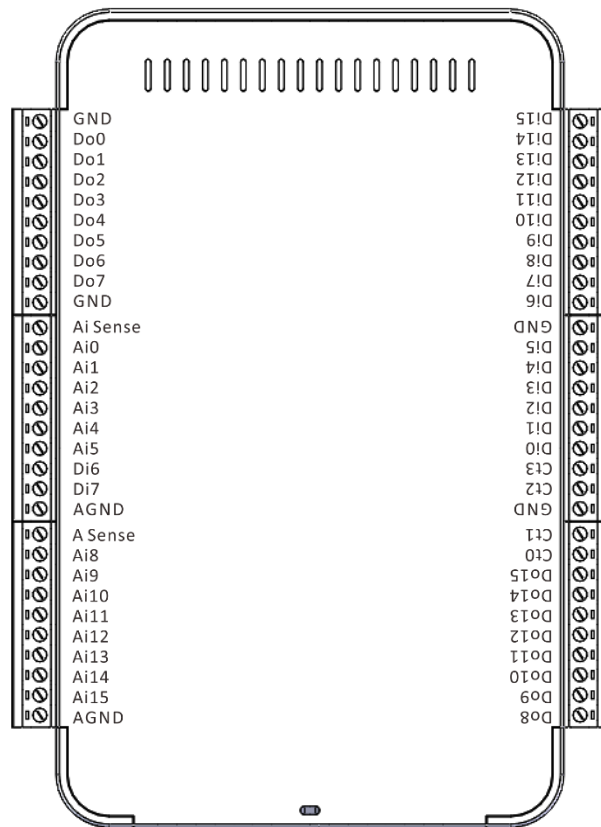


Figure 7. Pin Distribution and Corresponding Signals of Screw Terminal Connector

Table 2 Mapping of Pins and Signals of Screw Terminal

Name	Reference	Direction	Description
Di0~Di15	GND	Input	DI channels
Do0~Do15	GND	Output	DO channels
Ct0~Ct3	GND	Input	Counter channels
GND			Digital ground

2.3. USB Cable Reinforcement

To prevent USB connectors from falling off accidentally, a binding band is provided to be used to fix the USB cable to the body of the USB-1000 series DAQ devices. Refer to Figure 5 for installation.

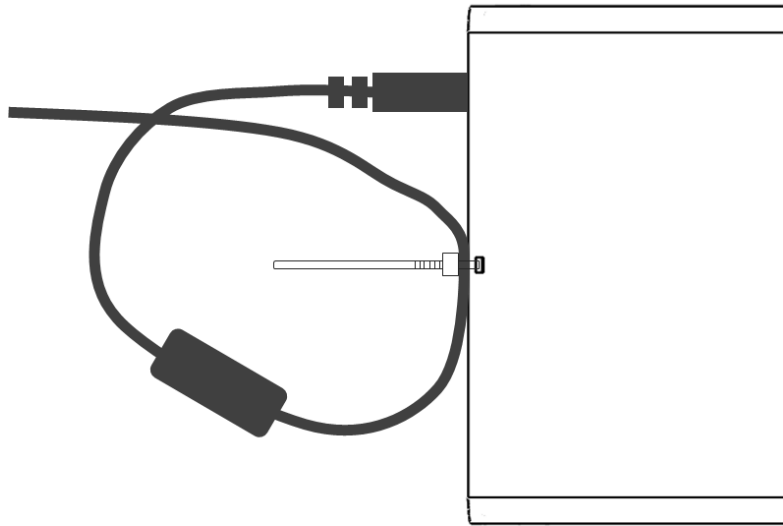


Figure 8. USB Cable Reinforcement


3. Installation and Testing

3.1. Driver Installation

If you intend to use USB-1000 series DAQ device on a PC running Windows, you need to install the driver to make the OS recognize the DAQ device.

Here we take Windows7 operating system as an example. The driver installation steps are as follows: (for Windows8, Windows8.1 and Windows10 operating systems, it is required to disable the driver signature authentication during booting. For Windows XP operating system, it can be used directly without any other settings.)

- 1) Open the **Device Manager** of the Windows operating system.
- 2) Right click on the device with an exclamation point

 **Smacq USB Series DAQ** , and select **Update Driver Software....**

- 3) In the pop-up dialog box, select **Browse my computer for driver software.**

- 4) Then, choose **Select from a list of device drivers on my computer**.
- 5) Keep the default and click **Next**, and then click **Have Disk**.
- 6) In the pop-up dialog box, click **Browse**, go to the `\USB-1000 Series DAQ\driver` folder in the ResourceCD, find the *Win7* folder, and then go to the *x86* folder for 32-bit operating system and *x64* folder for 64-bit operating system, and finally select the *gusb.inf* file, and click **Open**. (Windows8, Windows8.1, and Windows10 use the same driver file as Windows7.)
- 7) Click **OK** in the **Install from Disk** dialog box.
- 8) Click **Next**. If a Windows security warning dialog box appears, you need to choose the second option **Always install this driver software**.
- 9) The system starts the installation, which will take about 30 seconds. Upon the driver installation is completed, you can see that the exclamation point in the **Device Manager** disappears, as shown in Figure 6.



Figure 9. Device Manager Display with Driver Correctly Installed

3.2. Hardware Installation

For connection of testing signals, refer to detailed description on connections of AI, digital IO and counter in the subsequent sections.

After installing the driver and correctly connecting signals, you can run any one of the routines of the USB-1000 series DAQ device in the ResourceCD. The acquired signals will be shown.

4. Analog Input

4.1. Overview

With 16 AI channels, USB-1000 series DAQ device can be configured as 16 single-ended input channels or 8 differential input channels. Figure 7 shows the block diagram of analog input function of the USB-1000 series DAQ device.

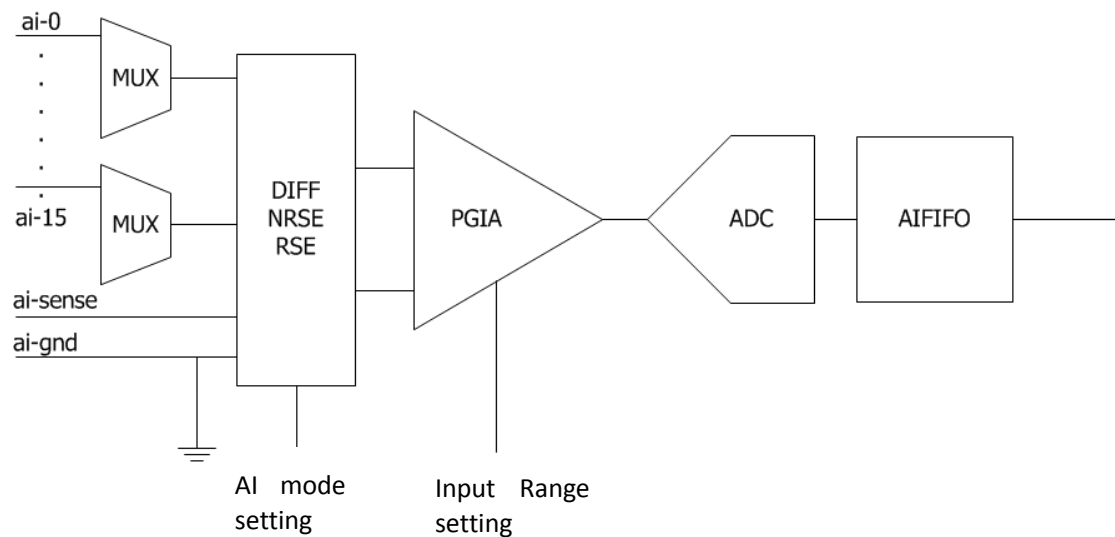


Figure 10. Block Diagram Of Analog Input

The AI block diagram of the USB-1000 series DAQ device includes the following main components:

MUX: A multiplexer, routing and inputting the signal from the desired channel to the instrumentation amplifier.

AI mode setting: Set AI to differential input (DIFF), Referenced Single-Ended (RSE), or Non-Referenced Single-Ended (NRSE). Refer to Section 4.2 for detailed description on these modes.

PGIA: Programmable gain instrumentation amplifier, used for setting input ranges.

ADC: An analog to digital converter.

AIFIFO: Data buffer FIFO.

4.2. Input Range Description

Single-Ended Mode

For single-ended input mode, positive input is connected to ai-n, and negative input to ai-gnd or ai-sense. Its input range can be set to 0~10V or $\pm 5V$ 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 $\pm 5V$ 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.

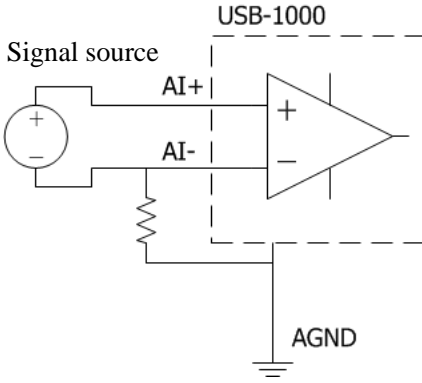
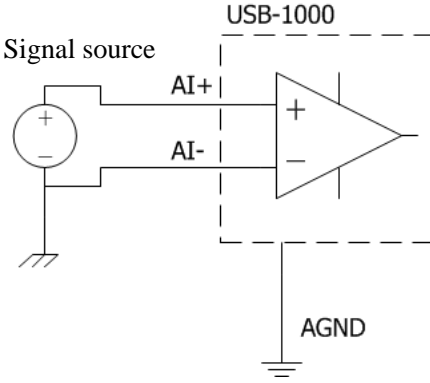
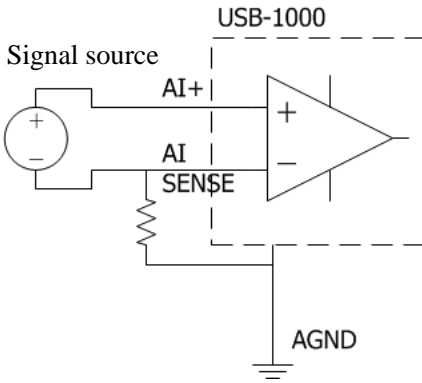
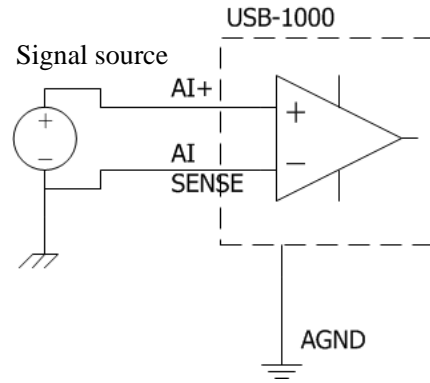
4.4. Trigger Sources

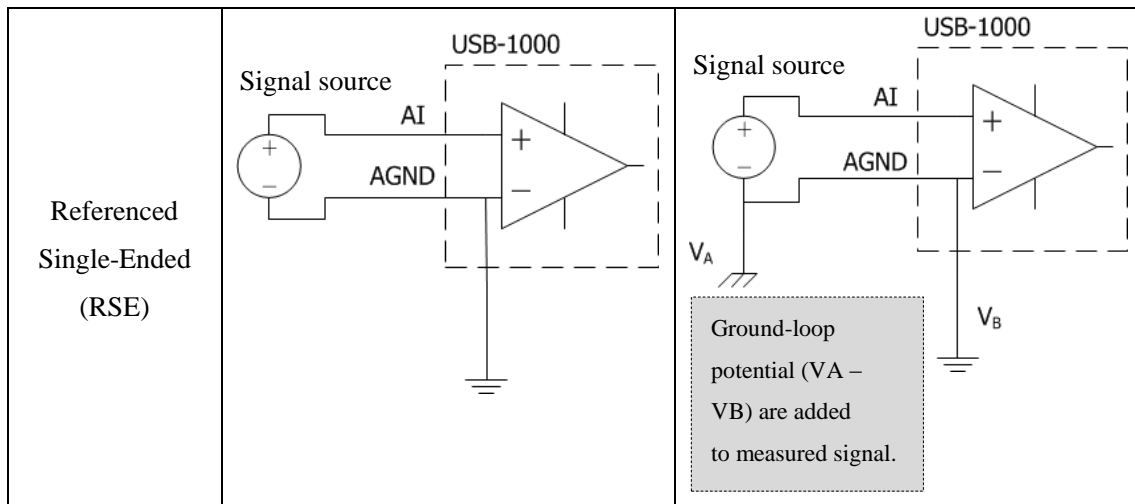
When USB-1000 series DAQ acquires signals via analog input, its trigger source can be set to trigger by software or trigger by the rising edge or falling edge of digital IO input channel D_{IN}0 port.

4.5. Analog Input Mode

The AI channel of USB-1000 series DAQ device can be configured as Referenced Single-Ended (RSE), Non-Referenced Single-Ended (NRSE) or Differential Input (DIFF) mode. Table 3 shows the recommended analog input modes for floating signal source and ground-referenced signal source.

Table 3 Analog Input Mode

Analog Input Mode	Floating Signal Sources (Not connected to the building ground)	Ground-Referenced Signal source
Example	<ul style="list-style-type: none"> ● Ungrounded thermocouple ● Isolated output signal ● Battery-powered devices 	<ul style="list-style-type: none"> ● Non-isolated output signal
Differential Input (DIFF)		
Non-Referenced Single-Ended (NRSE)		



4.6. Floating Signal Source

A floating signal source is not connected in any way to the building ground system, and instead it has an isolated ground-reference point. Some examples of floating signal sources are outputs of transformers, thermocouples, battery-powered devices, optical isolators, and isolation amplifiers. An instrument or device that has an isolated output is a floating signal source.



When measuring a floating signal, make sure the negative input is directly connected to the AGND, or indirectly through a resistor connected to the AGND.

Using Differential Connections for Floating Signal Source

Use DIFF mode for connections of floating signal sources when any of the following conditions are met:

- Two analog input channels, AI+ and AI-, are available for the signal.
- The input signal is low level and a high accuracy is required.
- The leads connecting the signal to the DAQ device are greater than 3m.
- The input signal requires a separate ground-reference point or return signal.
- The signal leads travel through noisy environments.

DIFF signal connections reduce noise pickup and increase common-mode noise rejection.

For floating signal source with impedance less than 100Ω , it is allowable to connect the negative side of the signal to AI- and AI-GND, and connect the positive side of the signal to AI+, as shown in Figure 8 below.

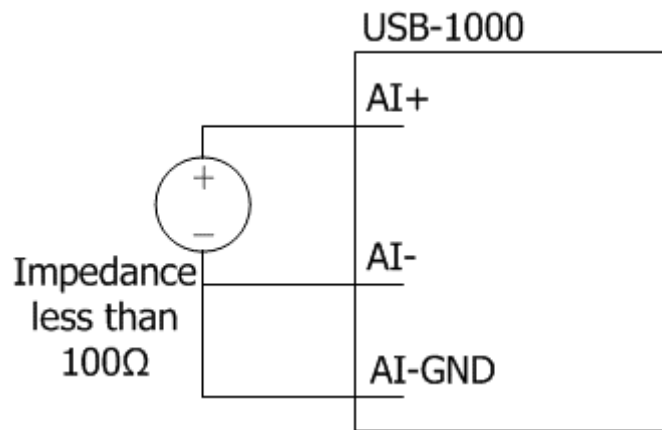


Figure 11 Differential Connection for Floating Signal Sources without Bias Resistor

However, for floating signal source with larger impedance, this connection leaves the DIFF signal off balance. Common-mode noise will couple onto AI+ signal instead of AI- signal. Such, common-mode noise will appear in your measured data. In this case, connect AI- port and AI-GND port through a bias resistor that is about 100 times the equivalent source impedance, as shown in Figure 9. In such way, the resistor puts the differential signal nearly in balance, so that about the same amount of noise couples onto both ends of the signal, yielding better rejection of common mode noise.

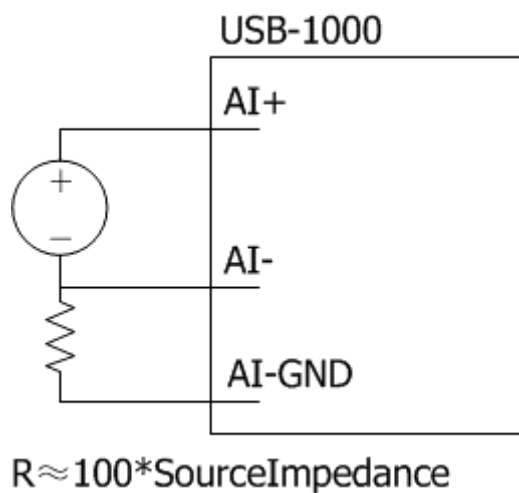


Figure 12. Differential Connections for Floating Signal Source with Single Bias Resistor

However, for floating signal source with larger impedance, you can also use DIFF Mode using two bias resistors, as shown in Figure 10. This fully balanced bias resistor connection offers

slightly better noise rejection, but it has the disadvantage of loading the signal source down and introducing gain error. If, for example, the source impedance is $2\text{ k}\Omega$ and each of the two resistors is $100\text{ k}\Omega$, the signal source load is $200\text{ k}\Omega$ and it produces a -1% gain error.

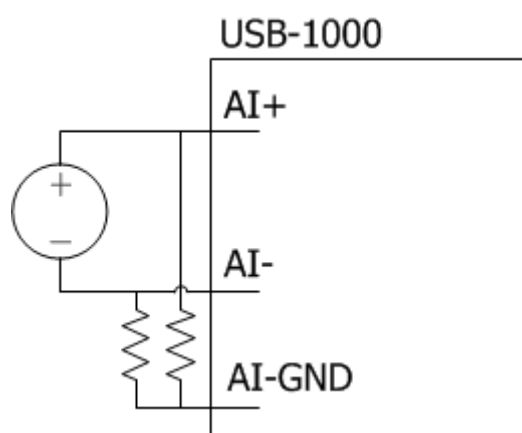


Figure 13. Differential Connections for Floating Signal Sources with Balanced Bias Resistors

If the floating source is AC coupled, the PGIA needs a resistor to provide DC circuit for the positive input AI+, as shown in Figure 11.

If this AC coupled floating signal source has low impedance, choose a resistor between $100\text{ k}\Omega$ to $1\text{ M}\Omega$ that will neither significantly load the source nor produce offset voltage as a result of bias current of PGIA. In this case, connect the AI- directly to AI-GND.

If this AC coupled floating source has high impedance, use the previously described Differential Connection with Balanced Bias Resistors. Be aware that there is some gain error resulting from balanced bias resistors.

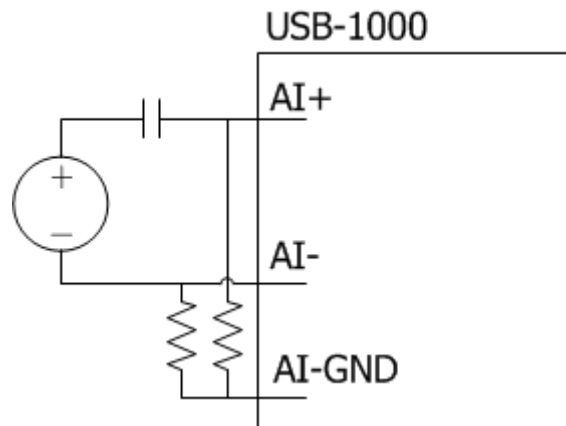


Figure 14. Differential Connections for AC Coupled Floating Sources

Using Non-Referenced Single-Ended (NRSE) Connections for Floating Signal Sources

Use NRSE mode for connections of floating signals when all of the following conditions are met:

- The input signal is high level (greater than 1V).
- The leads connecting the signal to the DAQ device are lower than 3m.

DIFF input connections are recommended for greater signal integrity for any input signal that does not meet the preceding conditions. In the single-ended modes, more electrostatic and magnetic noise couples into the signal connections than in DIFF configurations.

Figure 12 shows the connection diagram of floating signal sources in NRSE mode. The impedance value setting of its ground resistor is determined based on the same criterion as that in DIFF mode.

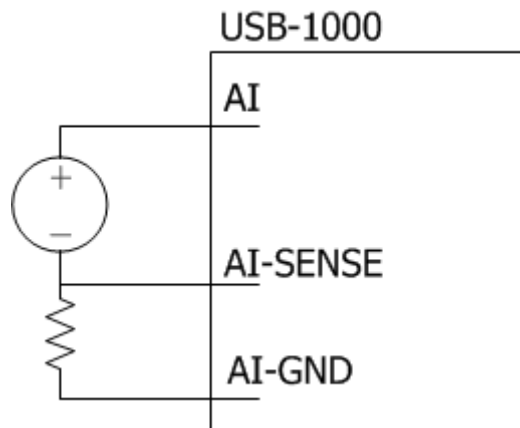


Figure 15. NRSE Connections for Floating Signal Sources

Using Referenced Single-Ended (RSE) Connections for Floating Signal Sources

Use RSE mode for connections of signals when all of the following conditions are met:

- The input signal can share a common reference point AGND with other signal using RSE connection.
- The input signal is high level (greater than 1V).
- The leads connecting the signal to the DAQ device are less than 3m.

DIFF input connections are recommended for greater signal integrity for any input signal that does not meet the preceding conditions. In the single-ended modes, more electrostatic and magnetic noise couples into the signal connections than in DIFF configurations.

Figure 13 shows the connection diagram in of floating signal sources in RSE mode.

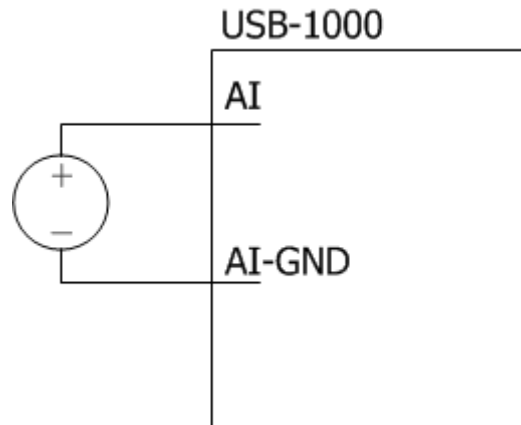


Figure 16. RSE Connections for Floating Signal Sources

4.7. Ground-Referenced Signal Source

A ground signal source is a signal source connected to the building system ground. It is already connected to a common ground point with respect to the device, assuming that the computer is plugged into the same power system as the signal source. Non-isolated outputs of instruments and devices that plug into the building power system fall into this category.

The difference in ground potential between two instruments connected to the same building power system is typically between 1 and 100 mV, but the difference can be much higher if power distribution circuits are improperly connected. If a grounded signal source is incorrectly measured, this difference can appear as measurement error. Follow the connection instructions for grounded signal sources to eliminate this ground potential difference from the measured signal.

Using Differential Connections for Ground-Referenced Signal Source

Use DIFF mode for connections of grounded signal sources when any of the following conditions are met:

- Two analog input channels, AI+ and AI-, are available for the signal.
- The input signal is low level and a high accuracy is required.
- The leads connecting the signal to the DAQ device are greater than 3m.
- The input signal requires a separate ground-reference point or return signal.
- The signal leads travel through noisy environments.

DIFF signal connections reduce noise pickup and increase common-mode noise rejection. DIFF connections also allow input signals to float within the common-mode limits of the PGIA.

Figure 14 shows the connection diagram of grounded signal sources in DIFF mode.

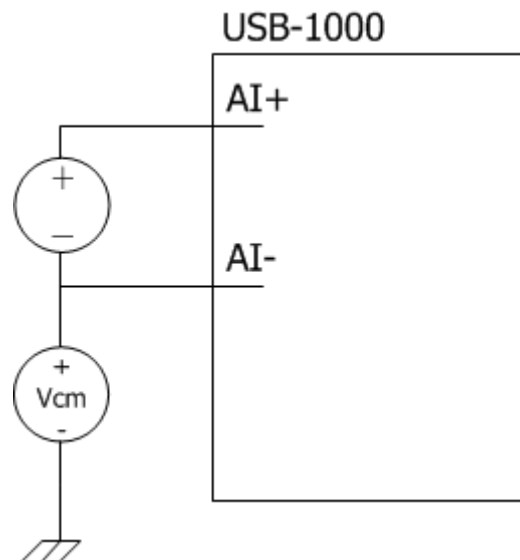


Figure 17. Differential Connections for Ground-Referenced Signal Sources

Using Non-Referenced Single-Ended (NRSE) for Ground-Referenced Signal Sources

Use NRSE mode for the connection of floating signals when all of the following conditions are met:

- The input signal is high level (greater than 1V).
- The leads connecting the signal to the DAQ device are lower than 3m.
- The input signal can share a reference point with voltage which is not AI GND.

DIFF input connections are recommended for greater signal integrity for any input signal that does not meet the preceding conditions. In the single-ended modes, more electrostatic and magnetic noise couples into the signal connections than in DIFF configurations.

Figure 15 shows the connection diagram of grounded signal source in NRSE mode.

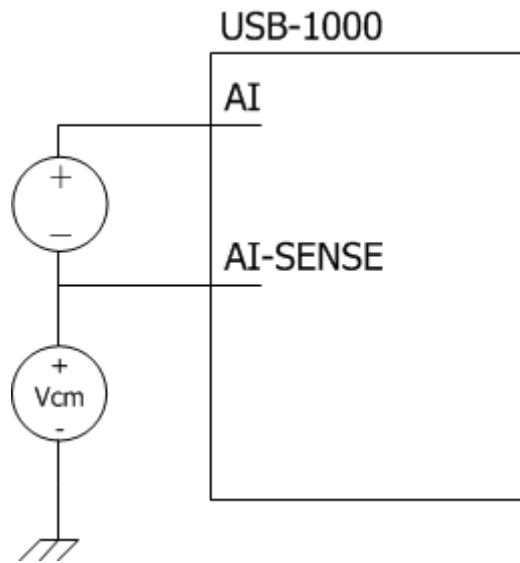


Figure 18. NRSE Connections for Ground-Referenced Signal Sources

Using Referenced Single-Ended (RSE) for Ground-Referenced Signal Sources

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. This difference may produce measurement errors, as described in Table 3.

5. Digital IO

5.1. Overview

The USB-1000 series DAQ device contains 16 digital input D_{IN} channels and 16 digital output D_{OUT} channels. GND is the ground-reference signal of digital IO port.

The digital input D_{IN} channel is compatible with 0~5V level signal. 2~5V is determined as high level, and 0~0.5V as low level.

Digital output D_{OUT} channels output high level of 3.3V, and output low level of 0V.

5.2. Connecting Digital I/O Signal

Figure 16 shows the connection diagram of digital I/O signals. When using digital output D_{OUT}

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.

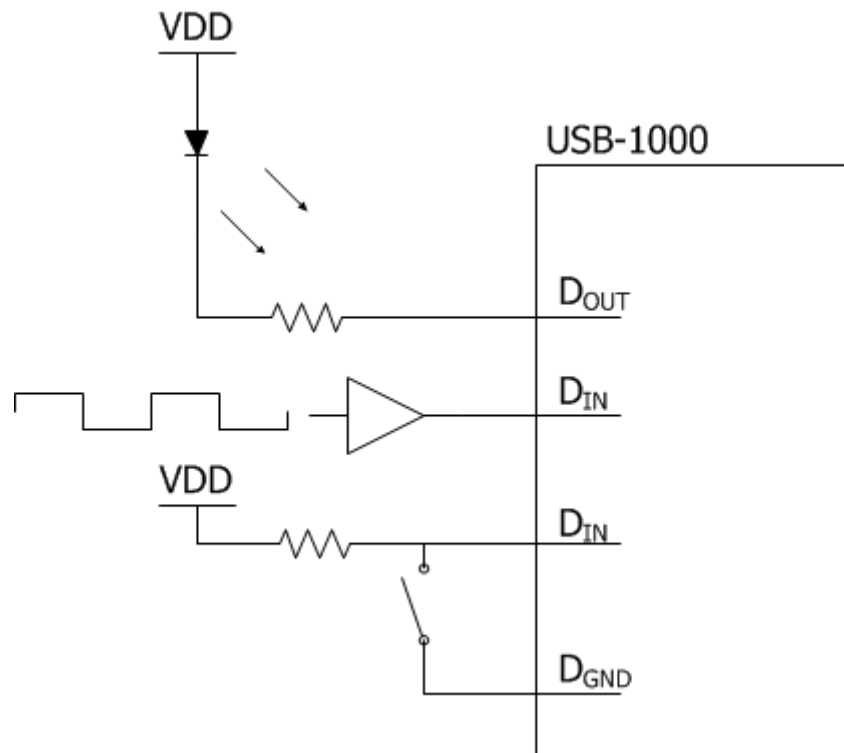


Figure 19. Digital I/O Signal Connection

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

Figure17 shows the block diagram of the counter function of USB-1000 series DAQ devices. 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.

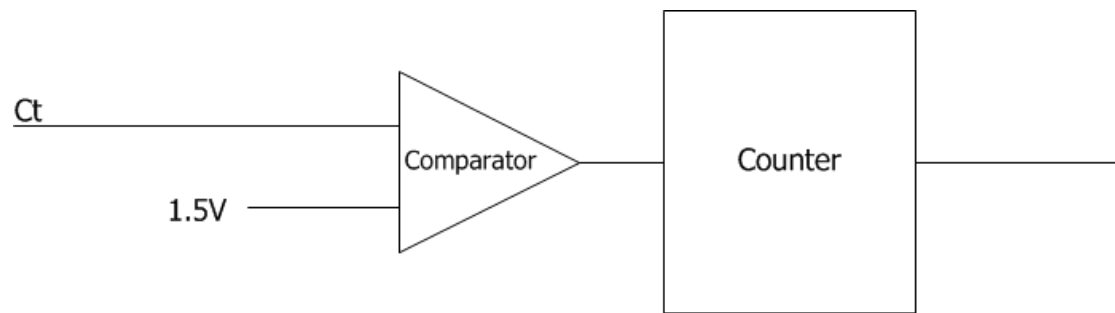


Figure 20. Counter Block Diagram

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

Figure 18 shows the connection diagram for counter channel signal.

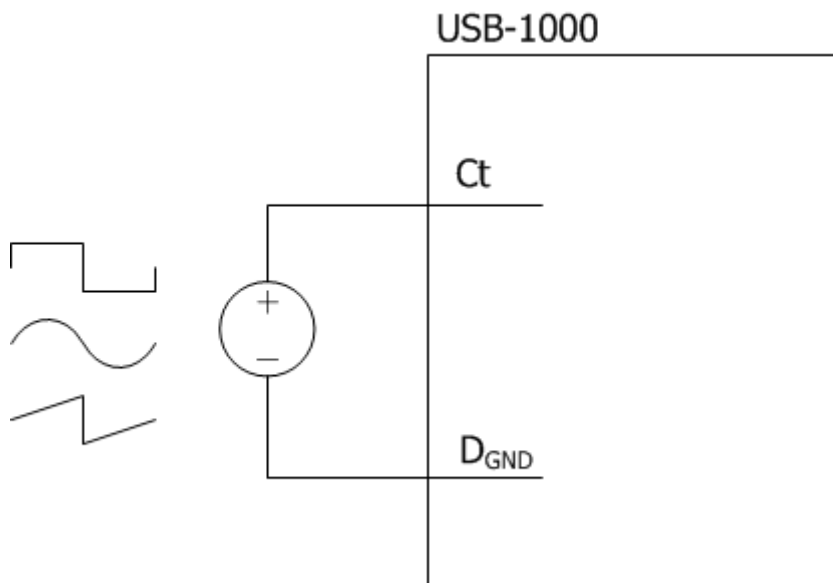


Figure 21. Counter Signal Connection

7. Programming Instructions

7.1. Overview

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.



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.

7.2. Basic functions

FindUSBDAQ()

[int_stdcall](#) FindUSBDAQ()

Find the USB-1000 series DAQ device connected to the computer.

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:

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:

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:

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.

7.3. Analog Input Related Functions

SetUSB1AiRange()

`int_stdcall` SetUSB1AiRange(`int` DevIndex, `float` Range)

Set AI channel range of the DAQ device.

Parameters:

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, and 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, unsignedint SampleRate)`

Set the sampling rate of AI channel of the DAQ device. When the USB-1000 series DAQ device works in multiple AI channels, it operates in scanning mode. Therefore, 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:

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, unsignedchar ChanMode)`

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

Parameters:

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:

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.



If the analog channel is configured as DIFF, only channels ai0~ai7 can be selected. Otherwise it will result in an error. **Note:** When measuring a floating signal source, be sure to connect the negative lead of the signal source directly or through a resistor to AGND.

SetSoftTrig()

`int_stdcall SetSoftTrig(int DevIndex, unsigned char Trig)`

Set software trigger.

Parameters:

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.

7.4. Digital IO Related Functions

SetDioOut()

`int_stdcall SetDioOut(int DevIndex, unsignedint DioOut)`

Set the value of digital IO output channel D_{OUT}.

Parameters:

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.

7.5. Counter Related Functions

SetCounter()

`int_stdcall SetCounter(int DevIndex, unsigned char CtrNum, unsigned char CtrMode, unsigned char CtrEdge)`

Set counter function.

Parameters:

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:

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:

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.

Return value:

0 indicates error free. Refer to section 7.7 *Error Codes* for others.

7.6. 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:

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:

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:

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.

TimeOut, Timeout setting. If software FIFO does not acquire enough sampling number

(Num) within the specified time, this function will exit and return a timeout error code.

Return value:

When it returns a nonnegative 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 D_{IN}.

Parameters:

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 D_{IN}, the least 16 bits correspond to the values of D_{IN}0~D_{IN}15.

GetCounter()

`unsigned int_stdcall GetCounter(int DevIndex, unsigned char CtrNum)`

Read the value of the event counter.

Parameters:

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:

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:

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

Parameters:

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.

7.7. 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	Reading thread is not started.

7.8. Instructions for LabVIEW Developer

LabVIEW developers can also control the DAQ device by calling the dynamic link library. Meanwhile, the series of sub-vi we provide contains all the functions mentioned above. Besides, we also provide sample code routines for the purpose of illustrating these functions. All these files can be found in the ResourceCD.

7.9. Instructions for MATLAB Developer

MATLAB developers can also control the DAQ device by calling the dynamic link library. Meanwhile, the series of M files we provide contains all the functions mentioned above. Besides, we also provide sample code for the purpose of illustrating these functions. All these files can be found in the ResourceCD.

8. Ordering Information

Host computer

Model	Description
USB-1252A	12-bit resolution, 16 channels, sampling rate up to 500kS/s

Supplied Accessories

Model	Description
USB-A-B	USB cable, 1.5m, USB-A to USB-B types
TB10-3.81	Screw Terminal connector, 10-bit, 3.81mm pitch

Optional Accessories

Model	Description
SDIN	35mm DIN rail installing support

9. Service and Warranty

Smacq Technologies, Inc. warrants that, if failure of this product appears under normal operation during the warranty period, the Company will repair or replace parts without charges. Refer to the *Limited Warranty* in the package box for details.

In addition to what are covered in this Manual and the *Limited Warranty*, our Company does not provide any other warranties, either express or implied, including but not limited to any implied warranties about tradability and applicability of special applications of this product.

To get more technical support and service details, or if you have any questions in using this product and this Document, please do not hesitate to contact us:

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10. Revision History

Date	Version	Remarks
8/30/2016	Rev: A	First release.