User Manual

iDAQ-817, iDAQ-821

Analog Input and output Industrial DAQ Modules

ADVANTECH

Enabling an Intelligent Planet

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Product Warranty (2 years)

Advantech warrants the original purchaser that each of its products will be free from defects in materials and workmanship for two years from the date of purchase.

This warranty does not apply to any products that have been repaired or altered by persons other than repair personnel authorized by Advantech, or products that have been subject to misuse, abuse, accident, or improper installation. Advantech assumes no liability under the terms of this warranty as a consequence of such events.

Because of Advantech's high quality-control standards and rigorous testing, most customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced free of charge during the warranty period. For out-of-warranty repairs, customers will be billed according to the cost of replacement materials, service time, and freight. Please consult your dealer for more details.

If you believe your product is defective, follow the steps outlined below.

1. Collect all the information about the problem encountered. (For example, CPU speed, Advantech products used, other hardware and software used, etc.) Note anything abnormal and list any onscreen messages displayed when the problem occurs.

2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.

3. If your product is diagnosed as defective, obtain a return merchandise authorization (RMA) number from your dealer. This allows us to process your return more quickly.

4. Carefully pack the defective product, a completed Repair and Replacement Order Card, and a proof of purchase date (such as a photocopy of your sales receipt) into a shippable container. Products returned without a proof of purchase date are not eligible for warranty service.

5. Write the RMA number clearly on the outside of the package and ship the package prepaid to your dealer.

Declaration of Conformity

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This type of cable is available from Advantech. Please contact your local supplier for ordering information.

Test conditions for passing also include the equipment being operated within an industrial enclosure. In order to protect the product from damage caused by electrostatic discharge (ESD) and EMI leakage, we strongly recommend the use of CE-compliant industrial enclosure products.

FCC Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference. In this event, users are required to correct the interference at their own expense.

Technical Support and Assistance

1. Visit the Advantech website at www.advantech.com/support to obtain the latest product information.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before calling:
   – Product name and serial number
   – Description of your peripheral attachments
   – Description of your software (operating system, version, application software, etc.)
   – A complete description of the problem
   – The exact wording of any error messages

Warnings, Cautions, and Notes

Warning! *Warnings indicate conditions that if not observed can cause personal injury!*

Caution! *Cautions are included to help prevent hardware damage and data losses. For example,*

"Batteries are at risk of exploding if incorrectly installed. Do not attempt to recharge, force open, or heat the battery. Replace the battery only with the same or equivalent type as recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions."

Note! *Notes provide additional optional information.*

Document Feedback

To assist us with improving this manual, we welcome all comments and constructive criticism. Please send all such feedback in writing to support@advantech.com.

Packing List

Before system installation, check that the items listed below are included and in good condition. If any item does not accord with the list, contact your dealer immediately.

iDAQ-817
- iDAQ-817 x 1
- 10-pin terminal block x 2
- Startup Manual x 1

iDAQ-821
- iDAQ-821 x 1
- 10-pin terminal block x 1
- Startup Manual x 1

Safety Instructions

1. Read these safety instructions carefully.
2. Retain this user manual for future reference.
3. Disconnect the equipment from all power outlets before cleaning. Use only a damp cloth for cleaning. Do not use liquid or spray detergents.
4. For pluggable equipment, the power outlet socket must be located near the equipment and easily accessible.
5. Protect the equipment from humidity.
6. Place the equipment on a reliable surface during installation. Dropping or letting the equipment fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. Do not cover the openings.
8. Ensure that the voltage of the power source is correct before connecting the equipment to a power outlet.
9. Position the power cord away from high-traffic areas. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage from transient overvoltage.
12. Never pour liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If any of the following occurs, have the equipment checked by service personnel:
    – The power cord or plug is damaged.
    – Liquid has penetrated the equipment.
    – The equipment has been exposed to moisture.
    – The equipment is malfunctioning, or does not operate according to the user manual.
    – The equipment has been dropped and damaged.
    – The equipment show obvious signs of breakage.
15. Do not leave the equipment in an environment with a storage temperature of below -20 °C (-4 °F) or above 60 °C (140 °F) as this may damage the components. The equipment should be kept in a controlled environment.
16. CAUTION: Batteries are at risk of exploding if incorrectly replaced. Replace only with the same or equivalent type as recommended by the manufacturer. Discard used batteries according to the manufacturer's instructions.
17. In accordance with IEC 704-1:1982 specifications, the sound pressure level at the operator's position does not exceed 70 dB (A).

DISCLAIMER: These instructions are provided according to IEC 704-1 standards. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Wichtige Sicherheishinweise

1. Bitte lesen sie Sich diese Hinweise sorgfältig durch.

2. Heben Sie diese Anleitung für den späteren Gebrauch auf.

3. Vor jedem Reinigen ist das Gerät vom Stromnetz zu trennen. Verwenden Sie Keine Flüssig-oder Aerosolreiniger. Am besten dient ein angefeuchtetes Tuch zur Reinigung.

4. Die NetzanschluBsteckdose soll nahe dem Gerät angebracht und leicht zugänglich sein.

5. Das Gerät ist vor Feuchtigkeit zu schützen.

6. Bei der Aufstellung des Gerätes ist auf sicheren Stand zu achten. Ein Kippen oder Fallen könnte Verletzungen hervorrufen.

7. Die Belüftungsöffnungen dienen zur Luftzirkulation die das Gerät vor über-hitzung schützt. Sorgen Sie dafür, daB diese Öffnungen nicht abgedeckt werden.

8. Beachten Sie beim. AnschluB an das Stromnetz die AnschluBwerte.

9. Verlegen Sie die NetzanschluBleitung so, daB niemand darüber fallen kann. Es sollte auch nichts auf der Leitung abgestellt werden.

10. Alle Hinweise und Warnungen die sich am Geräten befinden sind zu beachten.

11. Wird das Gerät über einen längeren Zeitraum nicht benutzt, sollten Sie es vom Stromnetz trennen. Somit wird im Falle einer Überspannung eine Beschädigung vermieden.

12. Durch die Lüftungsöffnungen dürfen niemals Gegenstände oder Flüssigkeiten in das Gerät gelangen. Dies könnte einen Brand bzw. elektrischen Schlag aus-lösen.

13. Öffnen Sie niemals das Gerät. Das Gerät darf aus Gründen der elektrischen Sicherheit nur von authorisiertem Servicepersonal geöffnet werden.

14. Wenn folgende Situationen auftreten ist das Gerät vom Stromnetz zu trennen und von einer qualifizierten Servicestelle zu überprüfen:
    – Netzkabel oder Netzstecker sind beschädigt.
    – Flüssigkeit ist in das Gerät eingedrungen.
    – Das Gerät war Feuchtigkeit ausgesetzt.
    – Wenn das Gerät nicht der Bedienungsanleitung entsprechend funktioniert oder Sie mit Hilfe dieser Anleitung keine Verbesserung erzielen.
    – Das Gerät ist gefallen und/oder das Gehäuse ist beschädigt.
    – Wenn das Gerät deutliche Anzeichen eines Defektes aufweist.

15. VOSICHT: Explisionsgefahr bei unsachgemaben Austausch der Batterie.Ersatz nur durch densellben order einem vom Hersteller empfohlene-mahnlichen Typ. Entsorgung gebrauchter Batterien navh Angaben des Herstellers.

16. ACHTUNG: Es besteht die Explosionsgefahr, falls die Batterie auf nicht fach-männische Weise gewechselt wird. Verfangen Sie die Batterie nur gleicher oder entsprechender Type, wie vom Hersteller empfohlen. Entsorgen Sie Batterien nach Anweisung des Herstellers.

17. Der arbeitsplatzbezogene Schalldruckpegel nach DIN 45 635 Teil 1000 beträgt 70dB(A) oder weiger.

Haftungsausschluss: Die Bedienungsanleitungen wurden entsprechend der IEC-704-1 erstellt. Advantech lehnt jegliche Verantwortung für die Richtigkeit der in die-sem Zusammenhang getätigten Aussagen ab.

Safety Precautions - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

■ To avoid electrical shock, always disconnect the power from the PC chassis before manual handling. Do not touch any components on the CPU card or other cards while the PC is powered on.

■ Disconnect the power before making any configuration changes. A sudden rush of power after connecting a jumper or installing a card may damage sensitive electronic components.

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Chapter 1

Start Using iDAQ-817/821

1.1 Overview

This chapter provides an overview of Advantech industrial data acquisition (iDAQ) modules for iDAQ-817 and iDAQ-821, ranging the product lineups, features and accessories.

iDAQ-817 is an 8-channel analog input module. It features a maximum sampling rate of 200kS/s multiplexing, high common-mode voltage 275 V_{DC}, input isolation, and low-pass filter. It's suitable for generic test and measurement use.

iDAQ-821 is a 4-channel analog output module. It features maximum update rates of 10 kS/s/ch, output isolation and analog output fail-safe. It's suitable for most basic DC output and device control scenarios.
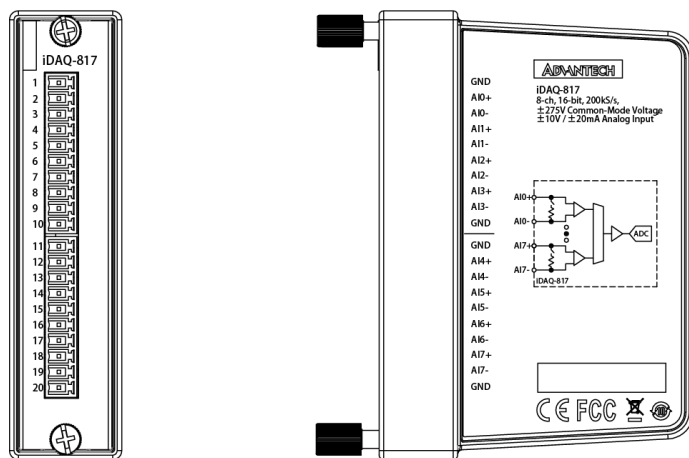
1.2 Product Overview
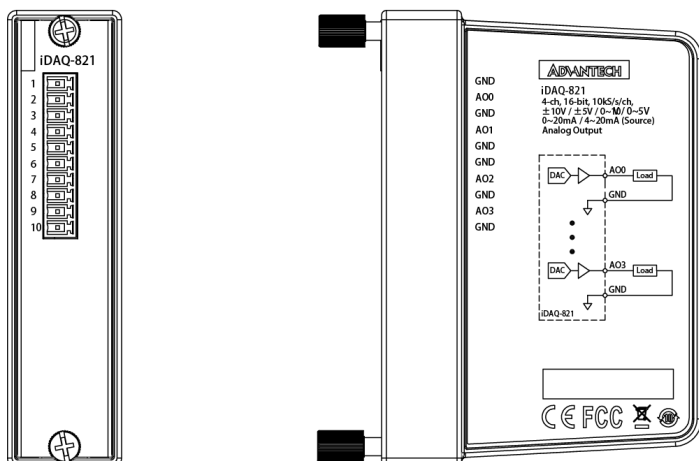
iDAQ-817

Figure 1.1 Overview of iDAQ-817

iDAQ-821

Figure 1.2 Overview of iDAQ-821

1.3 Product Features

1.3.1 Power Input

The power input of all the iDAQ I/O modules come from iDAQ chassis via the DB 15-pin connector. The iDAQ I/O modules are powered on when the power of iDAQ chassis is connected.

1.3.2 BoardID

A board ID (BID) can be assigned to the iDAQ chassis by the rotary switch and slot number. The board ID will be shown in the software and can be used to distinguish modules. The number shown around the rotary switch is in hexadecimal format. For example, "A" represents 10 in decimal format, and "F" represents 15 in decimal format. The number assigned to each iDAQ module follows a rule combining the ChassisID and slot number. Refer to section 3.3 for detailed information.

1.3.3 Plug and Play Device

The iDAQ modules are hot-swappable in the iDAQ chassis. The modules will be recognized instantly in the software (Installed Devices list) when they are plugged into the iDAQ slots and they can be removed as soon as they are disabled in the software. Therefore, it's strongly recommended to operate these actions whilst the system is in idle mode not data acquisition mode.

1.4 Driver Installation

The driver package could be found on Advantech Support Portal (https://www.advantech.com/support). Search for iDAQ on the support portal, then the corresponding driver/SDK package can be found. You'll get the XNavi installer after the download session finishes.

Execute the installer, then it will guide you through the session. You can choose the device and software components you'd like to install in the system (Figure 1.3). After the selection, click on "start" to begin the installation.
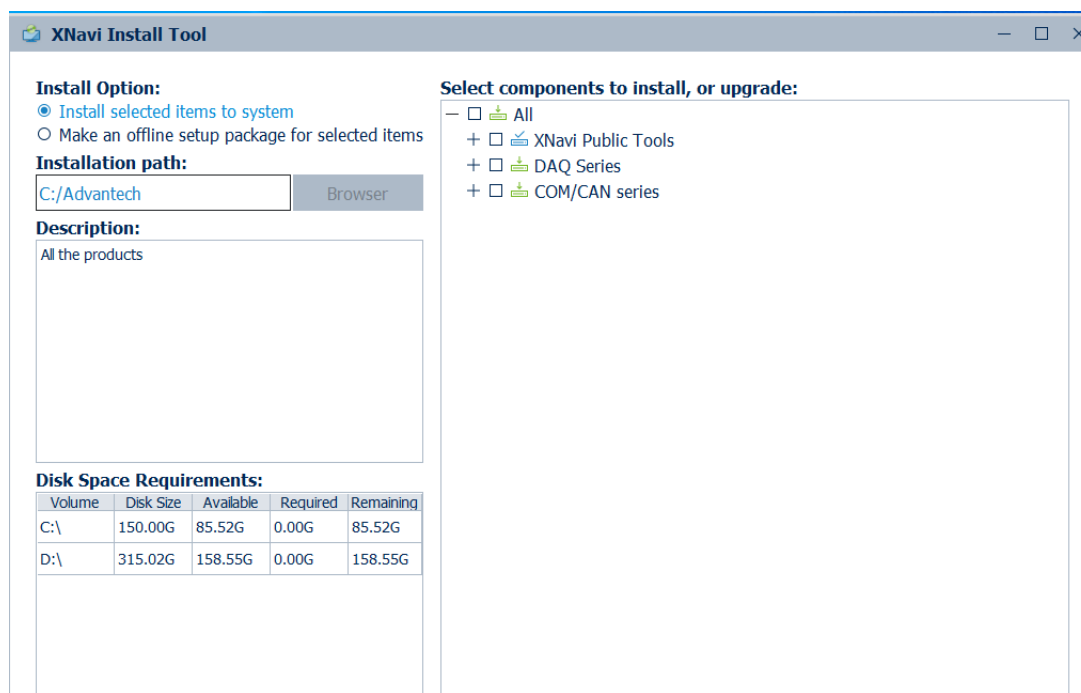
Figure 1.3 XNavi Installation Interface

1.5 Software Utility

Advantech offers device drivers, SDKs, third-party driver support and application software to help fully exploit the functions of your iDAQ system. All these software packages are available on the Advantech website: http://www.advantech.com/.

The Advantech Navigator is a utility that allows you to set up, configure and test your device, and later store your settings in a proprietary database.

1. To set up the I/O device, you could first run the Advantech Navigator program (by accessing Start/Programs/Advantech Automation/DAQNavi/Advantech Navigator). The settings could also be saved.

2. You can then view the device(s) already installed on your system (if any) on the Installed Device tree view. Once the software and hardware installation have completed, you will see the iDAQ modules in the Installed Devices list.

1.6 Software Development Using DAQNavi SDK

DAQNavi SDK is the software development kit for programming applications with Advantech DAQ products. The necessary runtime DLL, header files, software manual and tutorial videos could be installed via XNavi installer. They could be found under C:\Advantech\DAQNavi (default directory) after the finishing the installation.

1.7 Application Software DAQNavi MCM

DAQNavi MCM is an application software focusing on high-speed data acquisition, data monitoring and network access. It provides a graphical interface for users to achieve DAQ configuration, data pre-processing, feature extraction, user-defined formula calculation and output settings to upload data. All the settings could also be saved to a project file for further parameter management. On top of that, the data logging function is also available in DAQNavi/MCM. All the data could be saved not only in local storage, but also in remote storage.

By introducing the DAQNavi/MCM, the DAQ system could become an IoT-solution-ready edge device. For more information, please search for DAQNavi/MCM on the Advantech Support Portal (https://www.advantech.com/support).

1.8 FPGA Code Update

The FPGA could also be updated via the interface in Navigator. However, it isn't normal to move on to an FPGA update. Advantech strongly suggests you to consult your technical support before starting an FPGA update.

1.9 Ordering Information

iDAQ-817-AE   8-ch, 16-bit, 200 kS/s, AI iDAQ module

iDAQ-821-AE   4-ch, 16-bit, 10 kS/s/ch AO iDAQ module

Chapter 2

Installation Guide

2.1 Initial Unpacking Check

Before you install your iDAQ modules, please make sure you have the following necessary components when unpacking the package:

- DAQ modules*1
- Startup manual*1
- Terminal blocks

If anything in the packing list is missing, please contact your local support for further assistance.

2.2 Installation

Below are the steps to insert the iDAQ modules into the iDAQ chassis.

1. Insert the module follow the guide rail to the end
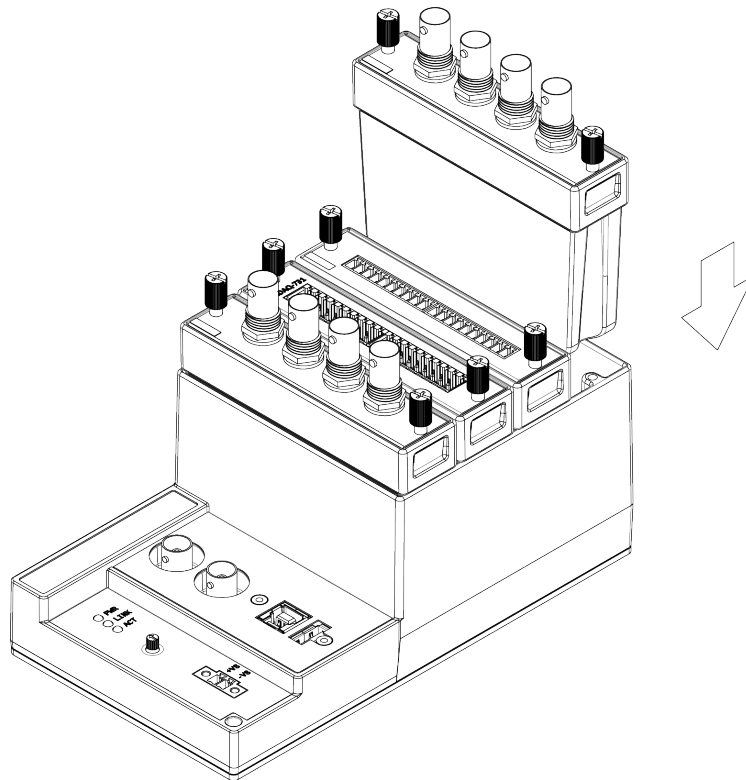2. Screw the two thumb screws tight onto the chassis

Figure 2.1 iDAQ Module Install into iDAQ Chassis

2.3 Signal Connection and Pin Assignment

2.3.1 Analog Input Connection

An analog input channel measures the voltage or current of the external sensor or source, converts the value into a digital form of data by an analog-to-digital converter (ADC), and passes it through a galvanic isolator to the internal circuit. Figure 2.2 shows the analog input signal connection.
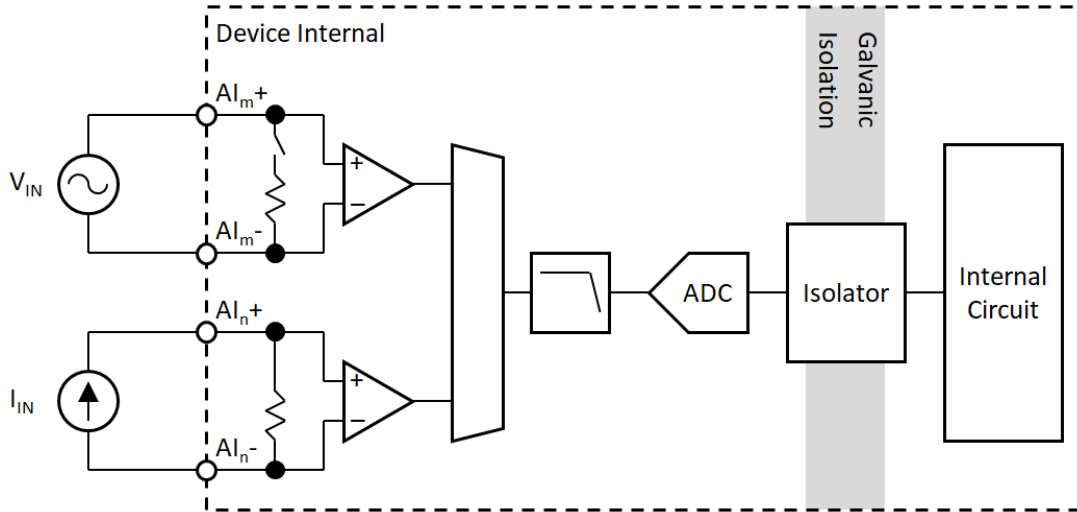

Figure 2.2 Analog input signal connection.

The analog input channels accept differential type signals, hence the external sensors or sources should be connected to both the positive and the negative analog input terminals.

Each channel can be configured independently by software to measure voltage or current. When measuring a current, a precision resistor is connected between both input terminals to convert the current value into a voltage value. When measuring a voltage, on the other hand, the precision resistor is disconnected.

Every channel is equipped with a high common-mode voltage amplifier that can withstand high common-mode input voltage as shown in Figure 2.3. This is quite suitable for applications which measure voltages with high common-mode such as battery cell voltage monitoring, high-voltage current sensing, or power-supply current monitoring. For other analog input measurement devices without this feature, the device will be damaged by the high common-mode input voltage. Refer to Appendix A Specifications for the maximum common-mode voltage value the device can accept.
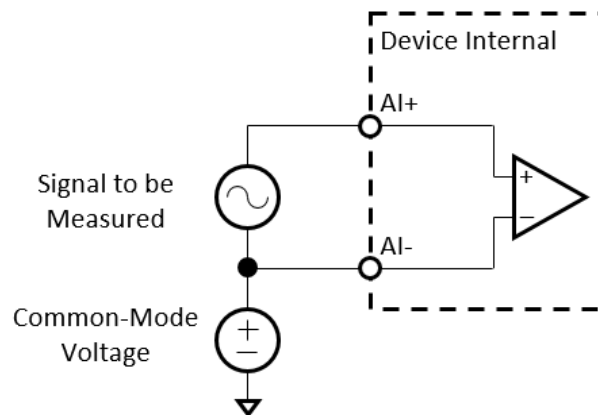

Figure 2.3 Common-mode input voltage.

There is only one ADC in the device. An analog multiplexer selects one of the analog input channels at a time to be measured by the ADC. Therefore, the sample rate of the ADC is shared by all enabled channels. Refer to Appendix A Specifications for the sample rate supported. The ADC is of successive approximation register (SAR) type.

A low-pass filter is placed in front of the ADC. This filter removes high frequency noise in the input signal before entering the ADC, which can increase signal-to-noise ratio (SNR) performance. It also avoids alias generation due to ADC conversion.

The device is equipped with a galvanic isolator, which can withstand a large continuous voltage between external side and internal side. This prevents internal circuit from damaging when such fault condition happens.

2.3.2 Analog Output Connection

For an analog output channel to work, a digital form of data is sent to the digital-to-analog converter (DAC) through a galvanic isolator. The DAC then outputs the corresponding voltage or current to the external load. Figure 2.4 shows the analog output signal connection.
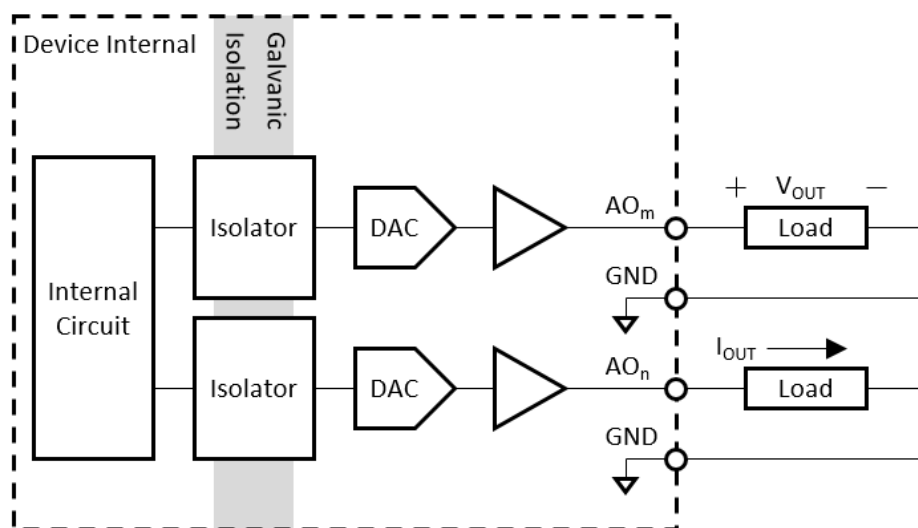

Figure 2.4 Analog output signal connection.

The analog output channels are of single-ended type, hence the negative terminal of the external loads should be connected to GND pin.

Each channel can be configured independently by software to output multiple ranges of voltage or current. User should ensure the load value is within the range as specified in Appendix A Specifications, otherwise the output voltage or current may not reach the specified value due to limitation of output driving capability.

The device is equipped with a galvanic isolator, which can withstand a large continuous voltage between external side and internal side. This prevents internal circuit from damaging when such fault condition happens.
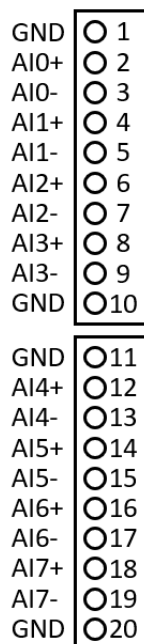
2.3.3   Pin Assignment

iDAQ-817

GND ◯ 1
AI0+ ◯ 2
AI0- ◯ 3
AI1+ ◯ 4
AI1- ◯ 5
AI2+ ◯ 6
AI2- ◯ 7
AI3+ ◯ 8
AI3- ◯ 9
GND ◯10

GND ◯11
AI4+ ◯12
AI4- ◯13
AI5+ ◯14
AI5- ◯15
AI6+ ◯16
AI6- ◯17
AI7+ ◯18
AI7- ◯19
GND ◯20

Figure 2.5 Pin Assignment for iDAQ-817

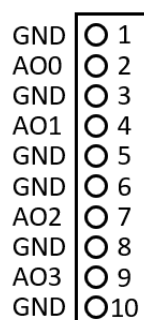| Table 2.1: Pin Assignment for iDAQ-817		
Pin Name	**Description**	**Pin Number**
AI<n>+	Analog input n positive terminal, n = 0~7	2, 4, 6, … , 18
AI<n>-	Analog input n negative terminal, n = 0~7	3, 5, 7, … , 19
GND	Ground	1, 10, 11, 20

iDAQ-821

GND ◯ 1
AO0 ◯ 2
GND ◯ 3
AO1 ◯ 4
GND ◯ 5
GND ◯ 6
AO2 ◯ 7
GND ◯ 8
AO3 ◯ 9
GND ◯10

Figure 2.6 Pin Assignment for iDAQ-821

Table 2.2: Pin Assignment for iDAQ-821		
Pin Name	Description	Pin Number
AO0	Analog output 0	2
AO1	Analog output 1	4
AO2	Analog output 2	7
AO3	Analog output 3	9
GND	Ground	1, 3, 5, 6, 8, 10

Chapter **3**

Function Details

3.1 Function Details

The iDAQ system relys on the chassis module as a platform to bring all the signals together in order to achieve functions including synchronization, data streaming, and timing control. This chapter describes all the functions that the iDAQ system provides and how they work.

3.2 Analog Input

Insert an iDAQ module supporting analog input to perform analog input measurement. The following sections describe the analog input acquisition mechanisms. For detailed specifications of the analog input functions, please refer to the document for the individual iDAQ module.

3.2.1 Instant Analog Input Acquisition

With instant analog input acquisition, the software controls the sample timing. The analog-to-digital converter (ADC) is continuously converting analog input signals by its maximum allowable conversion rate. Each time the software sends a "read instant analog input sample" command, the most recent conversion result is sampled as shown in Figure 3.1.
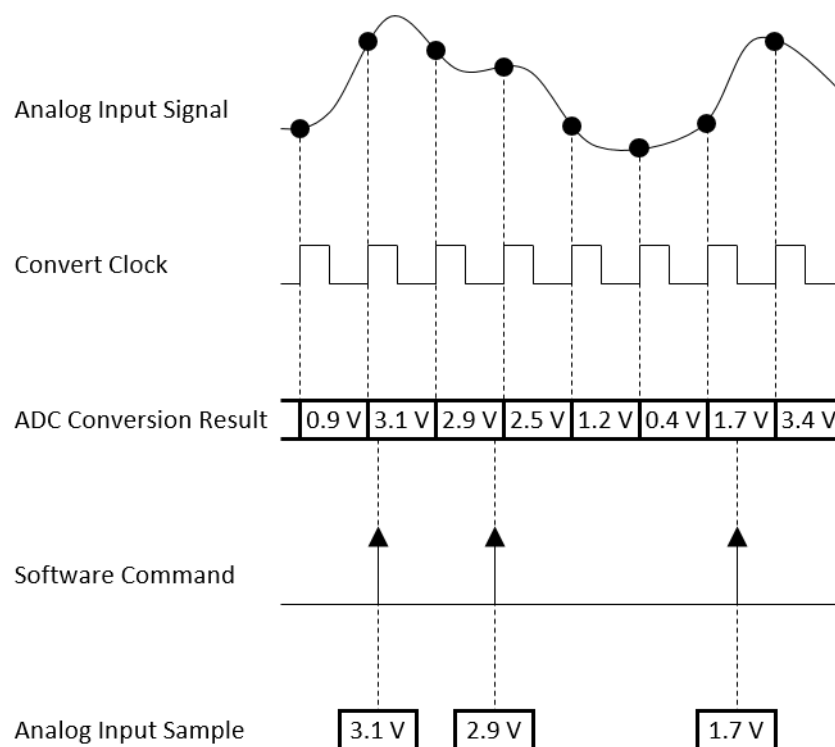
Figure 3.1 Instant analog input acquisition.

3.2.2 Buffered Analog Input Acquisition

With buffered analog input acquisition, the ADC conversion rate and the duration of the acquisition is controlled by hardware timing signals. All conversion results are sampled and stored in the buffer memory before sending back to the host computer as shown in Figure 3.2.
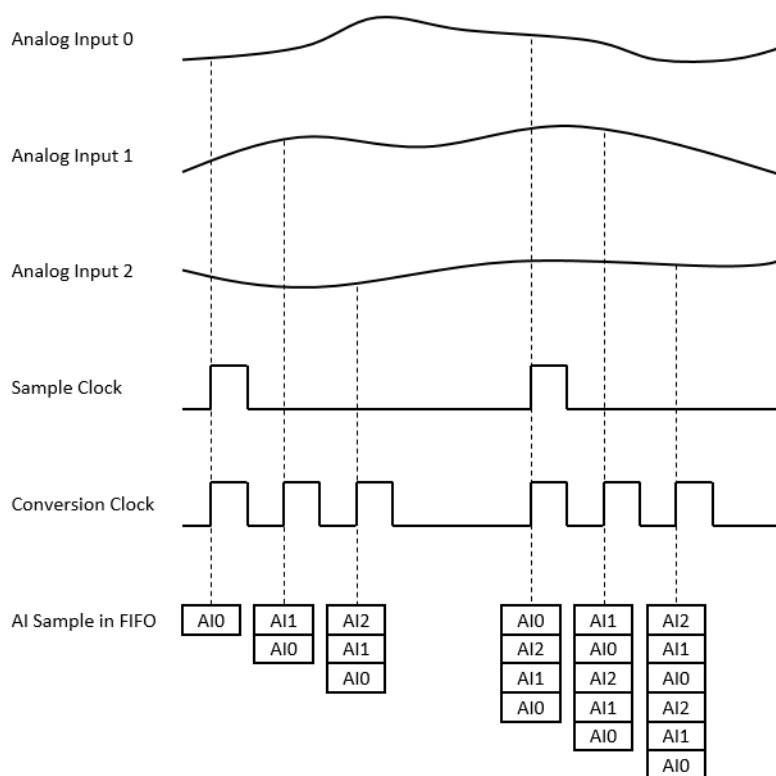
Figure 3.2 Buffered analog input acquisition.

The start and stop mechanism of the data acquisition are controlled by the start trigger and stop trigger respectively. When configuration is completed, the acquisition engine of the iDAQ chassis is at standby state. After receiving a start trigger, acquisition becomes active and each rising edge of the sample clock acquires one analog input sample. The acquisition active period lasts until a stop trigger is received, which ends the acquisition. This is shown in Figure 3.3.
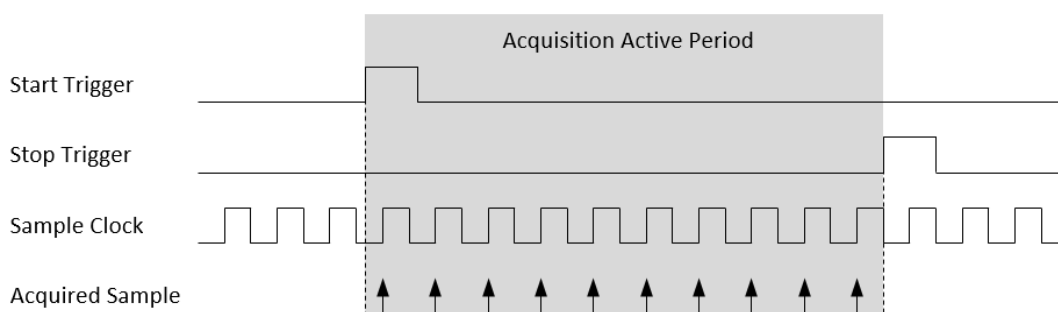

Figure 3.3 Start and stop triggers of the analog input acquisition.

The start and stop of data acquisition can also be delayed in the number of samples after receiving the corresponding trigger signal. As shown in Figure 3.4, the start of acquisition is delayed by 3 samples after receiving a start trigger, and the stop of acquisition is delayed by 2 samples after receiving a stop trigger.
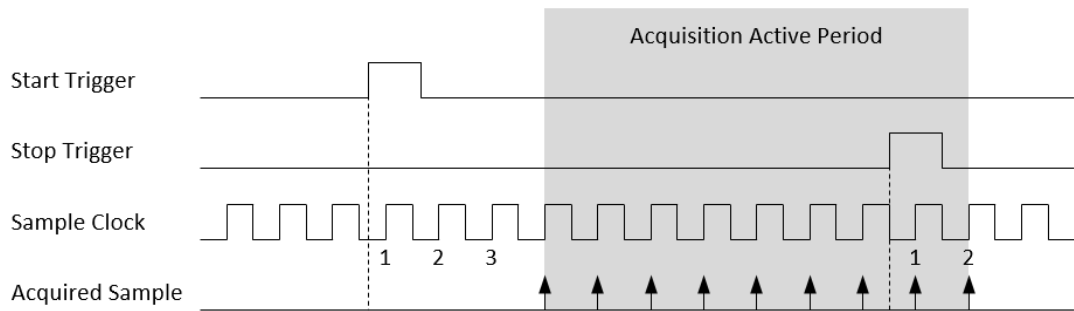
Figure 3.4 Start and stop of the analog input acquisition with delay.

Buffered analog input acquisition has several advantages over instant analog input acquisition:

■ The start and stop time of acquisition (or duration of the acquisition) can be precisely controlled by hardware trigger signals.

■ The ADC conversion rate is configurable and the sample rate can be much higher by using hardware sample clock signals.

■ Time between samples is deterministic.

3.2.3 High Common-Mode Amplifier

Each channel is equipped with a high common-mode voltage amplifier that can withstand high common-mode input voltage. Common-mode input voltage (VCM) is the ground voltage difference between the source and the device as shown in Figure 3.5.
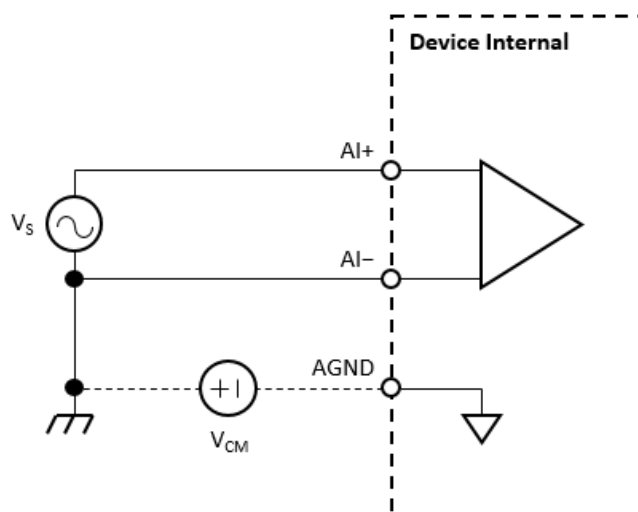

Figure 3.5 Common-mode input voltage.

This is suitable for applications which measure voltages with high common-modes such as battery cell voltage monitoring, high-voltage current sensing, or power-supply current monitoring. For other analog input measurement devices without this feature, the device will be damaged due to the high common-mode input voltage. Refer to the device specifications for the maximum allowable common-mode voltage.

3.2.4 Analog Input Low-pass Filter

The low-pass filter removes high frequency noise of the input signal and the noise that is added by the high common-mode voltage amplifier. It can also act as an anti-aliasing filter which avoids alias generation due to ADC conversion.

3.2.5 Analog Multiplexer

The analog multiplexer routes one of the analog input channels at a time (one for single-ended configuration, and two for differential configuration) to the PGIA and ADC to be measured. This mechanism is called channel scanning. It realizes multiple channel measurement using only one ADC at a cost of sharing ADC sample rate among all scanned channels.

User can select a range of channels to be scanned. The selected channels will be scanned by the order of channel number. After the last channel is scanned, the next channel will be the first channel. For example, if channels 3, 4, 5, 6, and 7 are selected, the scanning sequence is channel 3, 4, 5, 6, 7, 3, 4, 5, 6, 7, 3, etc.

3.2.6 Analog Input Isolation

The analog input circuitry is equipped with a galvanic isolator, which can withstand a large continuous voltage between external side and internal side. This prevents the internal components and the host devices (e.g. PC) from damaging when such fault condition happens.

3.3 Analog Output

Insert an iDAQ module supporting analog output function to perform analog output update/generation. The following sections describe the analog output update/generation mechanism. They all apply to iDAQ-821.

3.3.1 Static Analog Output Update

With static analog output update, the analog output voltage or current is updated only when the software sends a "write static analog output sample" command. The analog output voltage or current remains unchanged at other times. This is shown in Figure 3.6.
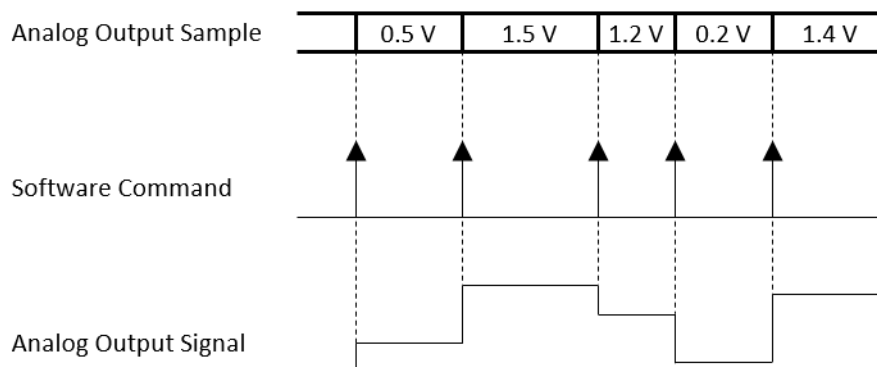

Figure 3.6 Static analog output update

3.3.2 Buffered Analog Output Waveform Generation

With buffered analog output waveform generation, the DAC conversion rate and the duration of the generation is controlled by hardware timing signals. The analog output waveform to be generated are first programmed and stored in the buffer memory in a digital form. The digital values are converted to analog voltage or current one by one for each sample clock as shown in Figure 3.7.
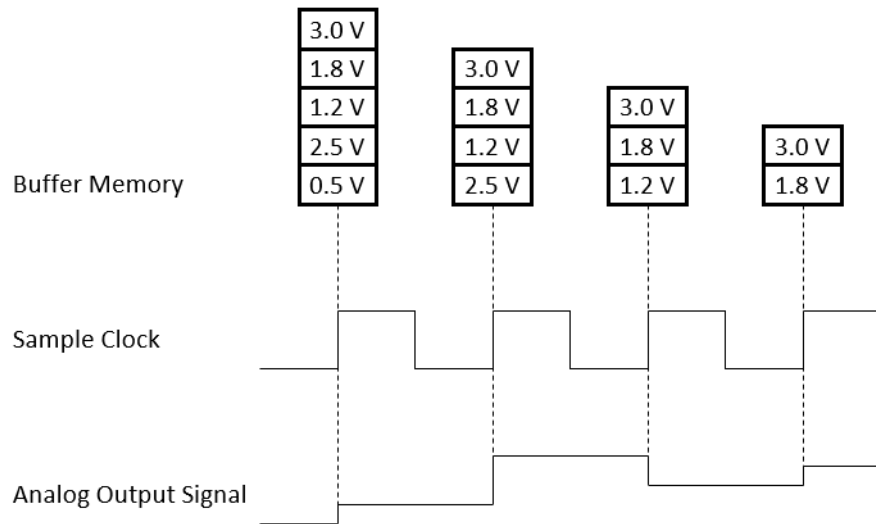
Figure 3.7 Buffered analog output waveform generation

The start and stop of the generation are controlled by the start trigger and stop trigger, respectively. When configuration is completed, the acquisition engine of the iDAQ chassis is at standby state. After receiving a start trigger, generation becomes active and each rising edge of the sample clock converts one analog output sample. The generation active period lasts until a stop trigger is received, which ends the generation. This is shown in Figure 3.8.
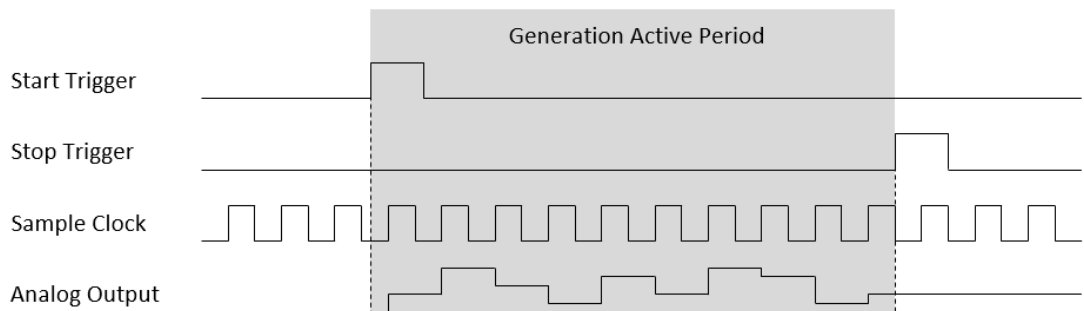

Figure 3.8 Start and stop of the analog output waveform generation

The start and stop of generation can also be delayed in number of samples after receiving the corresponding trigger signal. As shown in Figure 3.9, the start of generation is delayed by 3 samples after receiving a start trigger, and the stop of generation is delayed by 2 samples after receiving a stop trigger.
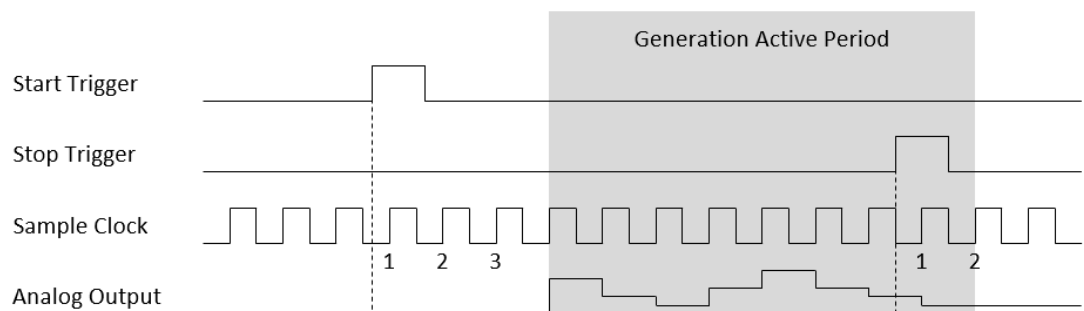

Figure 3.9 Start and stop of the analog output waveform generation with delay.

Buffered analog output waveform generation has several advantages over static analog output update:

- The start and stop time of generation (or duration of the generation) can be precisely controlled by hardware trigger signals.
- DAC conversion rate is configurable, and update rate can be much higher by using hardware sample clock signal.
- Time between samples is deterministic.

3.3.3 Analog Output Isolation

Each channel is equipped with a galvanic isolator, which can withstand a large continuous voltage between external side and internal side. This prevents the internal components and the host devices (e.g. PC) from damaging when such fault condition happens.

3.3.4 Analog Output Fail-safe Function

When upstream communication is disconnected, the value of the analog output channels cannot be controlled by the software anymore and will keep at the last value before disconnection. This may cause harmful operation for the external devices which is begin controlled by the analog output channels.

The analog output fail-safe function can be enabled to solve this problem. If enabled, the value of the analog output channels will be automatically set to the pre-programmed fail-safe values when disconnection occurs. After reconnection, the value can again be controlled by the software.

3.4 Device Description and Configuration

The Device Description is used to differentiate the modules in the iDAQ system. It's given following a naming rule of combining chassis ID, model name and slot number. You can change the description in Navigator, or just leave it as default. The description is used in your own program, in order to get control or device handler from the device.
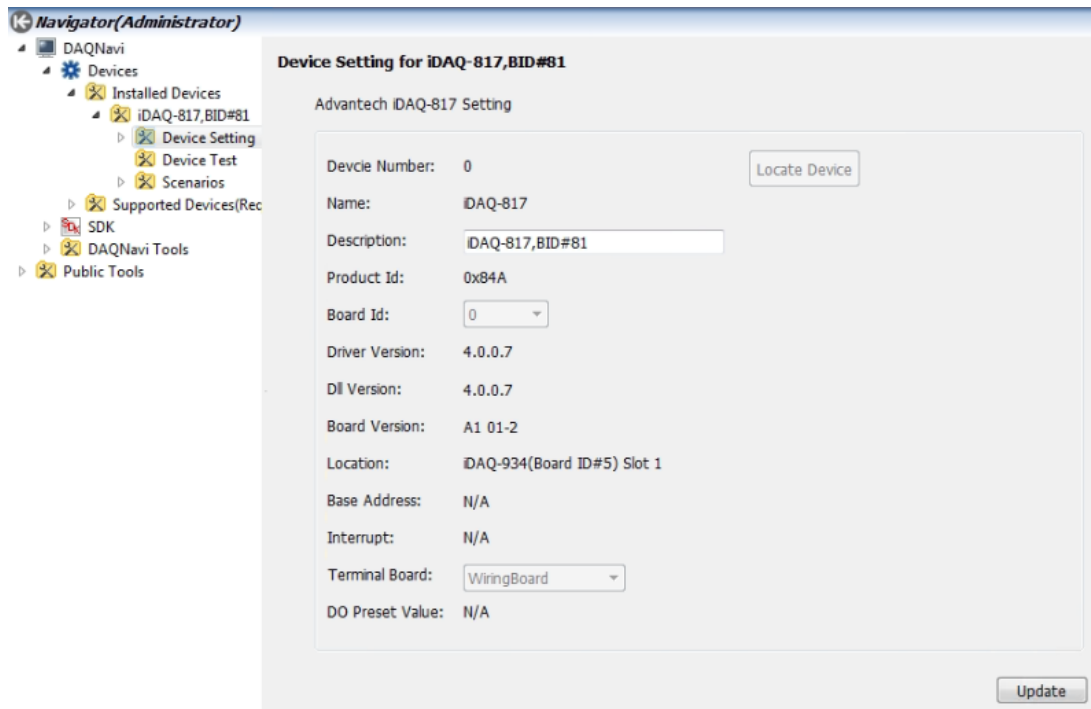
Figure 3.10 Device description shown in Navigator

3.5 Field Application Notes

Here are some notes related to field applications. They are mainly about the considerations of safety, especially the output function in some machine-controlling scenarios.

3.5.1 DAC Code Change Glitch

When the output voltage or current of an analog output channel changes, glitches may be observed. This is a normal phenomenon due to released charges of the DAC. The largest glitches occur when the most significant bit of the DAC code changes.

To preserve the slew rate and settling time specifications, no further signal conditioning is applied in the device. If the glitches are unacceptable, an external low-pass deglitching filter can be used to reduce the glitches. However, users should verify that the frequency response and distortion of the signal due to the deglitching filter can still meet the requirement of the applications.

3.5.2 Output Status When Changing Range

When analog output range changes, the output voltage or current will reset to 0 and stay until another software command changes it. This prevents unexpected voltage or current change when changing output range.

Appendix A

Specifications

A.1 Analog Input (iDAQ-817)

- **Channels:** 8 differential
- **Analog-to-digital converter (ADC) resolution:** 16 bits
- **Analog-to-digital converter (ADC) type:** Successive approximation (SAR)
- **Input range:** ±10 V or ±20 mA, each channel can be configured independently by software
- **Input common-mode voltage range:** ±275 V max.
- **Input coupling:** DC
- **Input impedance**
  - **Differential, voltage measurement:** 800 kΩ
  - **Common-mode, voltage measurement:** 200 kΩ
  - **Current measurement:** 500 Ω
- **Isolation protection:** 600 V_{RMS}
- **Operation mode:** Instant or buffered, software configurable
- **Buffered output**
  - **Sample rate:** (200 / n) kHz max., where n is the number of enabled channels, software configurable
  - **Convert clock rate:** 200 kHz
  - **Internal data buffer (FIFO) size:** 512 samples
- **Absolute accuracy**
  - **Voltage input**

    Operating temperature within: ±5°C of last

    auto-calibration temperature: ±0.01% of full-scale range max.

    Over full operating temperature range: ±0.05% of full-scale range max.

  - **Current input**

    Operating temperature within: ±5°C of last

    auto-calibration temperature: ±0.1% of full-scale range max.

    Over full operating temperature range: ±0.5% of full-scale range max.
- **Temperature drift**
  - **Offset drift:** 25 ppm/°C
  - **Gain drift:** 15 ppm/°C
- **Bandwidth (-3dB):** 78 kHz
- **DC performance**
  - **Idle channel noise:** 0.34 mV_{RMS} /0.7A_{RMS}
  - **Effective resolution:** 15.8 bits
- **AC performance**
  - **Signal-to-noise ratio (SNR):** 86 dB
  - **Total harmonic distortion (THD):** -98 dB
  - **Total harmonic distortion plus noise (THD+N):** -86 dB
  - **Effective number of bits (ENOB):** 14.0 bits
  - **Spurious-free dynamic range (SFDR):** 103 dB
 - **Crosstalk:** -85 dB

A.2 Analog Output (iDAQ-821)

- **Channels:** 4
- **Digital-to-analog converter (DAC) resolution:** 16 bits
- **Output range:** 0 ~ +5 V, 0 ~ +10 V, ±5 V, ±10 V, 0 ~ 20 mA, 4 ~ 20 mA, software selectable per channel
- **Output coupling:** DC
- **Current output type:** Source
- **Output load**
  - **Voltage output:** 1 kΩ min.
  - **Current output:** 520 Ω max.
- **Output impedance**
  - **Voltage output:** 0.06 Ω typ.
  - **Current output:** 100 MΩ typ.
- **Isolation protection:** 600 V_{RMS}
- **Power-on output state:** 0 V
- **Operation mode:** Static or buffered, software configurable
- **Buffered output**
  - **Update rate:** 10 kHz max. per channel, software configurable
  - **Internal data buffer (FIFO) size:** 512 samples
- **Absolute accuracy**
  - **Voltage output**
    Operating temperature: within ±5°C of last
    Auto-calibration temperature: ±0.01% of full-scale range max.
    Over full operating temperature range: ±0.05% of full-scale range max.
  - **Current output**
    Operating temperature: within ±5°C of last
    Auto-calibration temperature: ±0.1% of full-scale range max.
    Over full operating temperature range: ±0.5% of full-scale range max.
  - **Power-on glitch:** 1.1 V, 0.4 ms
- **Temperature drift**
  - **Offset drift:** 25 ppm/°C
  - **Gain drift:** 15 ppm/°C
- **Output slew rate:** 1 V/μs
- **Settling time:** 100μs (to ±0.01% of FSR, voltage output)
- **DC performance**
  - **Output noise:** 0.2 mV_{RMS} @ bandwidth of 100 kHz
  - **Effective resolution:** 16 bits
  - **Channel-to-channel DC crosstalk:** 20 μV, measured channel at midscale, adjacent channel at full scale

A.3 General

- **Power consumption from chassis**
  - **iDAQ-817:** 1,000 mW typ./1,250 mW max.
  - **iDAQ-821:** 675 mW typ./ 2,900 mW max.
- **Module dimensions:** 100 x 80 x 25 mm (3.94 x 3.15 x 0.98 in.)
- **Operating temperature:** -20 °C to 60 °C (-4 °F to 140 °F)
- **Storage temperature:** -40 °C to 70 °C (-40 °F to 158 °F)
- **Operating humidity:** 10% to 90% RH, non-condensing
- **Storage humidity:** 5% to 95% RH, non-condensing
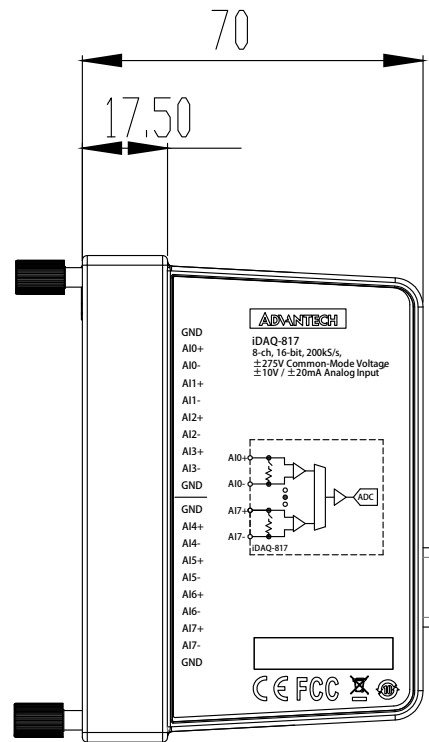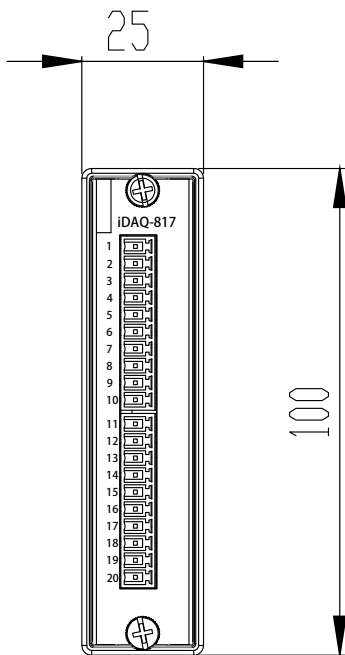- **Vibration:** $5G_{RMS}$
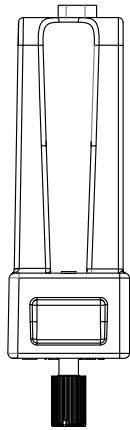- **Shock:** 30G

A.4 Function Block

iDAQ-817
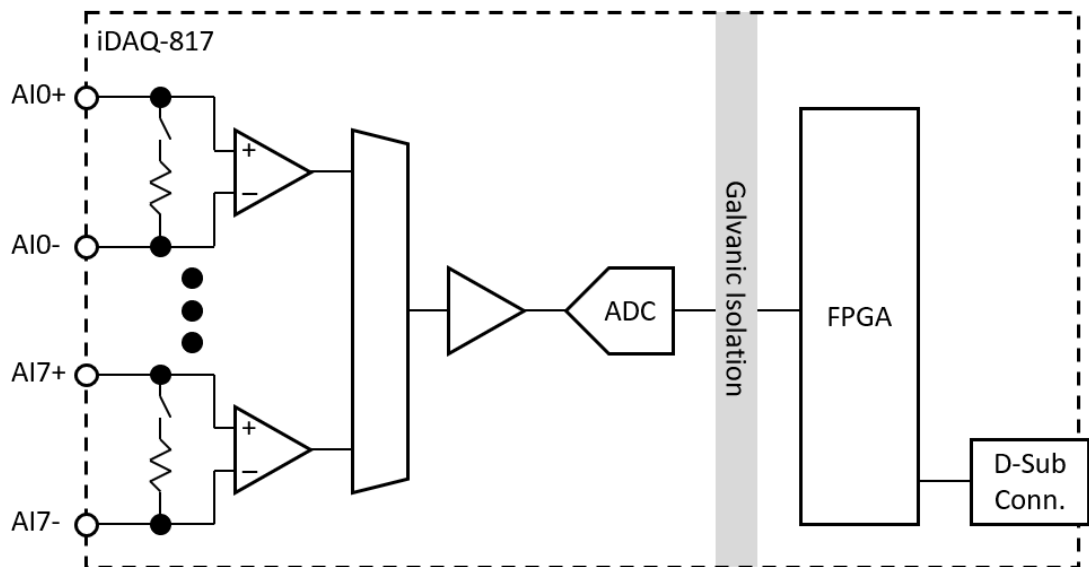
iDAQ-821
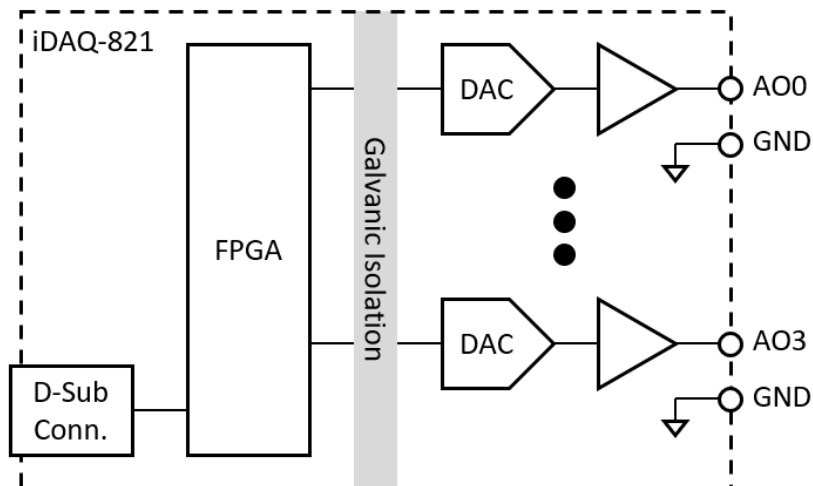
Appendix B

System Dimensions

B.1 System Dimensions

Enabling an Intelligent Planet

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