User Manual

MIC-1816

DAQ Embedded Automation Computer with Intel® Core™ i3-6100U/Celeron® 3955U Processor

ADVANTECH

Enabling an Intelligent Planet

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1. Collect all 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 merchandize 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. Then 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.

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 such cases, 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

Safety Precaution - 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 all power before implementing any configuration changes. The sudden rush of power after connecting a jumper or installing a card may damage sensitive electronic components.

Safety Instructions

1. Read these safety instructions carefully.
2. Retain this user manual for future reference.
3. Disconnect the equipment from any AC outlet 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 any 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 one of the following occurs, have the equipment checked by authorized 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 shows 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. ATTENTION: Danger d'explosion si la batterie est mal remplace. Remplacer uniquement par le meme type ou equivalent recommandé par le fabricant. Jeter les piles usagées selon les instructions du fabricant.
18. 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 in accordance with IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

Contents

Chapter 1

Overview

This chapter provides an overview of the MIC-1816 specifications.

- Introduction
- Safety Precautions
- Accessories
- System Layout
- Platform Specifications

1.1 Introduction

The MIC-1816 is a standalone automation controller that features an integrated data acquisition module with signal conditioning, 2 serial communication ports, 24 programmable digital I/O lines, 16 analog inputs, and 2 analog outputs for real-time monitoring and data collection applications. The built-in terminal block enables direct connection with the sensor signal line, saving installation space and eliminating unnecessary wiring. With support for multiple drivers, networking interfaces, and operating systems, including Windows 10/7 and embedded Linux, MIC-1816 has the versatile functionality and configuration flexibility to be easily deployed in a wide range of industrial automation environments.

1.2 Safety Precautions

The following sections provide instructions for making each connection. In most cases, users will simply need to connect a standard cable.

Warning! *Always disconnect the power cord from the chassis before manual handling. Do not make any connection while the system is powered on. A sudden rush of power may damage sensitive electronic components. The chassis should only be opened by experienced technicians.*

Warning! *Toujours débrancher le cordon d'alimentation de votre boîtier lorsque vous êtes travailler. Ne branchez pas lorsque l'appareil est allumé. Un afflux soudain de puissance peut endommager les composants électroniques sensibles. Seulement connu personnel de l'électronique devraient ouvrir le châssis.*

Caution! *Before touching MIC-1816, users should take precautions to remove any static electrical charge that may be in their bodies. Modern electronic devices are very sensitive to static electrical charges. Use a grounding wrist strap at all times when handling the device. Place all electronic components on a static-dissipative surface or in a static-shielded bag.*

Caution! *Toujours à la terre pour éliminer toute charge d'électricité statique avant toucher MIC-1816. Appareils électroniques modernes sont très sensibles à charges d'électricité statique. Utilisez un bracelet antistatique à tout moment. Placez tous composants électroniques sur une surface antistatique ou dans un statique-sac blindé.*

Caution! *Equipment is intended for installation in Restricted Access Location.*

Caution! *Les matériels sont destinés à être installés dans des EMPLACEMENTS À ACCÈS RESTREINT*

1.3 Accessories

The MIC-1816 controller should be shipped with the following accessories:

■ Terminal blocks: 1 x 2-pin, 1 x 16-pin, 1 x 24-pin, 3 x 10-pin

If any of the above items are missing or damaged, contact your distributor or sales representative immediately.

1.4 Optional Accessories

■ 1960099348N001   Table mount kit
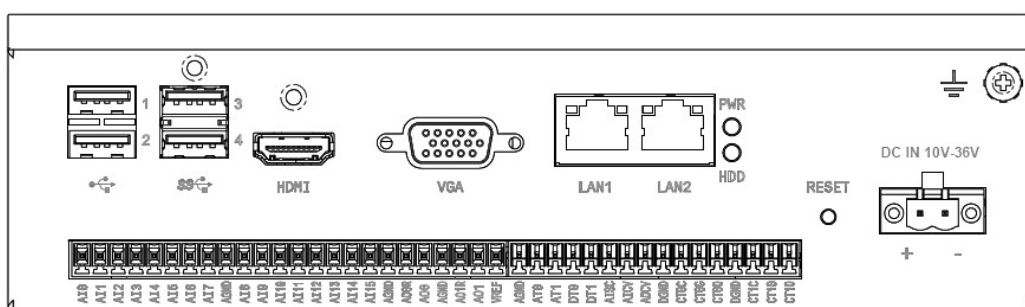
1.5 System Layout
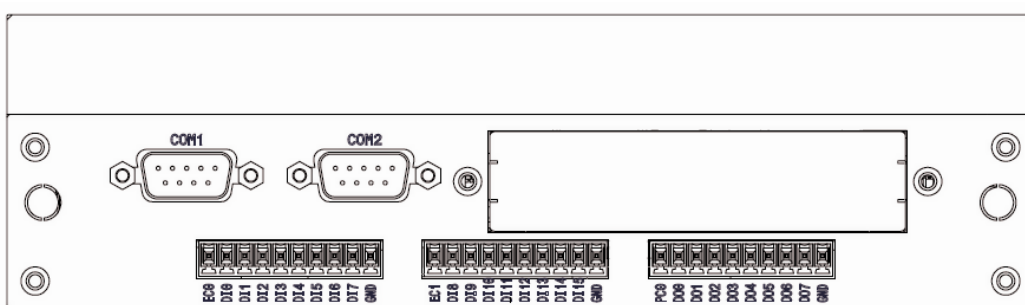

Figure 1.1 MIC-1816 Front Panel

Figure 1.2 MIC-1816 Rear Panel

1.6 Platform Specifications

■ **Processor:** 6th Generation Intel® Core™ CPU
  – MIC-1816-U0A1E: Intel®Celeron® 3955U 2.0 GHz dual-core CPU
  – MIC-1816-U3A1E: Intel® Core™ i3 6100U 2.3 GHz dual-core CPU
■ **Serial Ports**
  – 2 x RS-232 via COM1/COM2

1.7 LAN: Gigabit Ethernet

- LAN1: Intel i219
- LAN2: Intel i210

> *Note!* *Both LAN1 and LAN2 support EtherCAT*

1.8 Power Supply

The MIC-1816 comes with a 2-pin phoenix connector that carries 10~36V$_{DC}$ external power input. You can connect your DC power to the MIC-1816 through this connector.

1.9 USB Ports

The USB interface supports plug-and-play functionality, which allows devices to be connected/disconnected without powering off the computer. MIC-1816 features four USB ports (2 x USB 3.0, 2 x USB 2.0) that support plug-and-play functionality and hot swapping for up to 127 external devices. The USB interface complies with USB EHCI, Revision 2.0 specifications. The USB interface can be disabled via the system BIOS utility.

1.10 HDMI

MIC-1816 is equipped with an HDMI port that supports full HD resolution output to two independent displays. MIC-1816 can also be equipped with a DisplayPort upon request.

Chapter 2

Initial Setup

This chapter explains the initial setup and how to connect the input and output signals.

- Chassis Grounding
- Power Supply
- SSD Installation
- Table Mount Installation
- DAQ Setup and Configuration
- Signal Connections
- I/O Signal Descriptions

2.1 Chassis Grounding

MIC-1816 provides EMI protection and a stable grounding base with an easy-to-connect chassis grounding point, as shown in Figure 2.1.
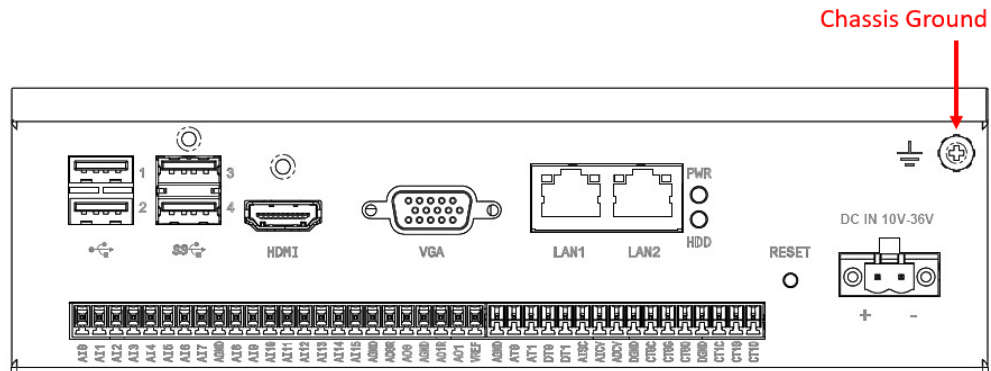

Figure 2.1 Chassis Grounding Connection

2.2 Power Supply

Connect the MIC-1816 to a 10~36 V_{DC} power source, such as a power adapter.

2.3 Storage Installation

Follow the instructions below to install a solid state drive. Please follow these steps carefully. (Note: The system is not compatible with a 12 V Storage. Only install Storage with a power input of less than 12 V.)

1. Undo the 4 x affixing screws and remove the rear cover.
2. Remove the 4 x Storage screws in the rear cover.
3. Connect the SATA/power cable.
4. Replace the rear cover and secure in place with 4 x screws.

Note! *MIC-1816 features only one SATA slot.*
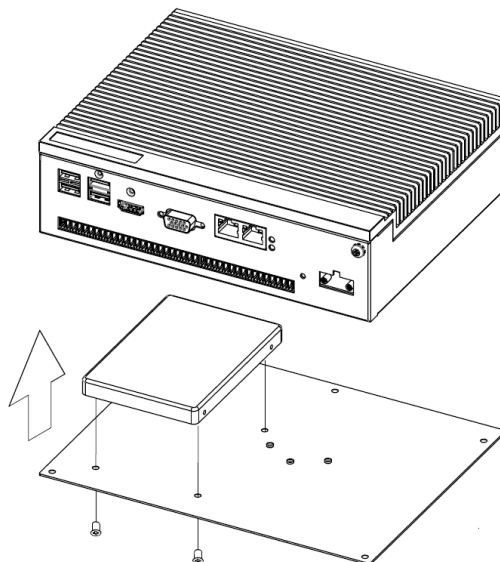
2.4   Table Mount Installation

MIC-1816 provides an optional table mount kit for flexible deployment. Follow the instructions below for installation. To avoid overheating, the extruded heat sink must be installed on top of the system.

1. Undo the 4 x affixing screws of the rear cover.
2. Position the table mount in place, align the screw holes with those in the rear cover. Secure the mount to the system using 4 x screws.
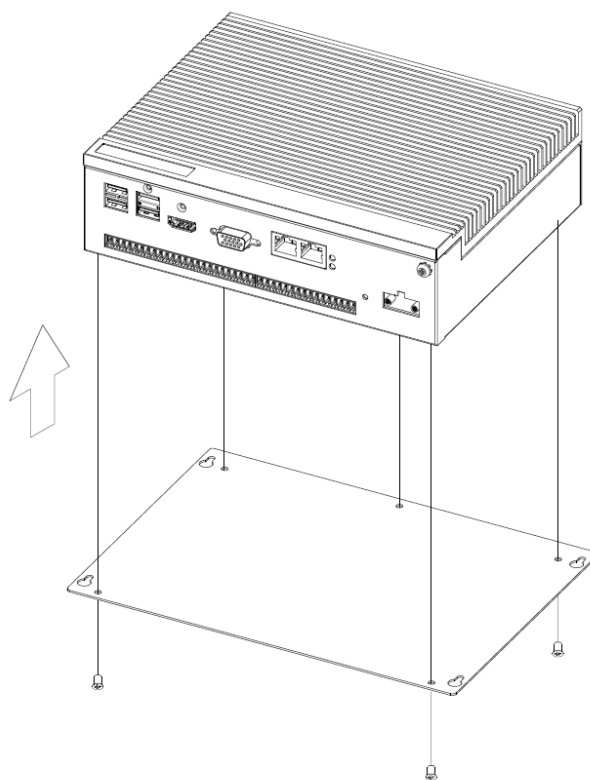
Optional Table Mount

Part Number: 1960099348N001

Dimensions: 220 x 156 mm (8.66 x 6.14 in.)

2.5   iDoor Module Installation

1.   Unscrew the bottom plate and back cover.
2.   Unscrew the iDoor cover from the back cover assembly.
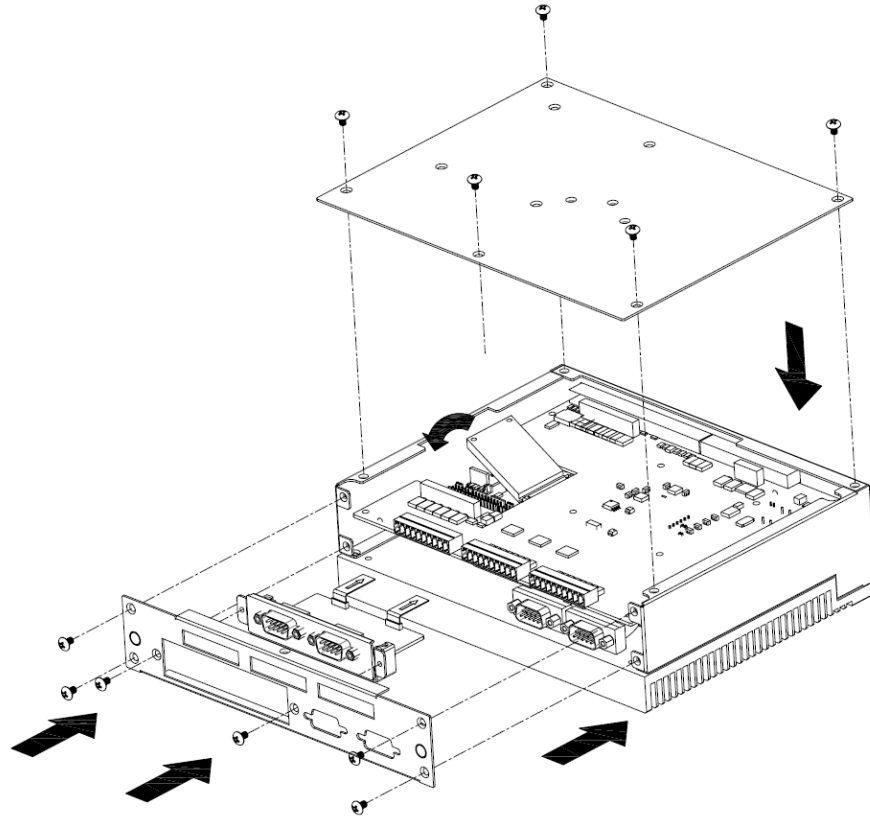3.   Insert the mini PCIe card into the mPCIe slot.
4.   Plug the cable to connect the mini PCIe card and iDoor IO module.
5.   Screw the IO module with the back cover.
6.   Screw the back cover and bottom plate back to complete the assembly.

2.6   DAQ Setup and Configuration

MIC-1816 features a built-in MIOE-3816 DAQ card. The Advantech Navigator program is a utility for setting up, configuring, and testing MIOE-3816. The system settings are stored on the system registry and used when Advantech device driver APIs are called.

2.6.1   Device Setup

1.   To install the I/O device for the MIOE-3816 DAQ card, first run the Advantech Navigator program (by accessing Start/Programs/Advantech Automation/ DAQNavi/Advantech Navigator).
2.   Users can then view the device(s) already installed (if any) via the Installed Devices list. After the software and hardware installation are complete, the MIOE-3816 card should be included in the Installed Devices list.
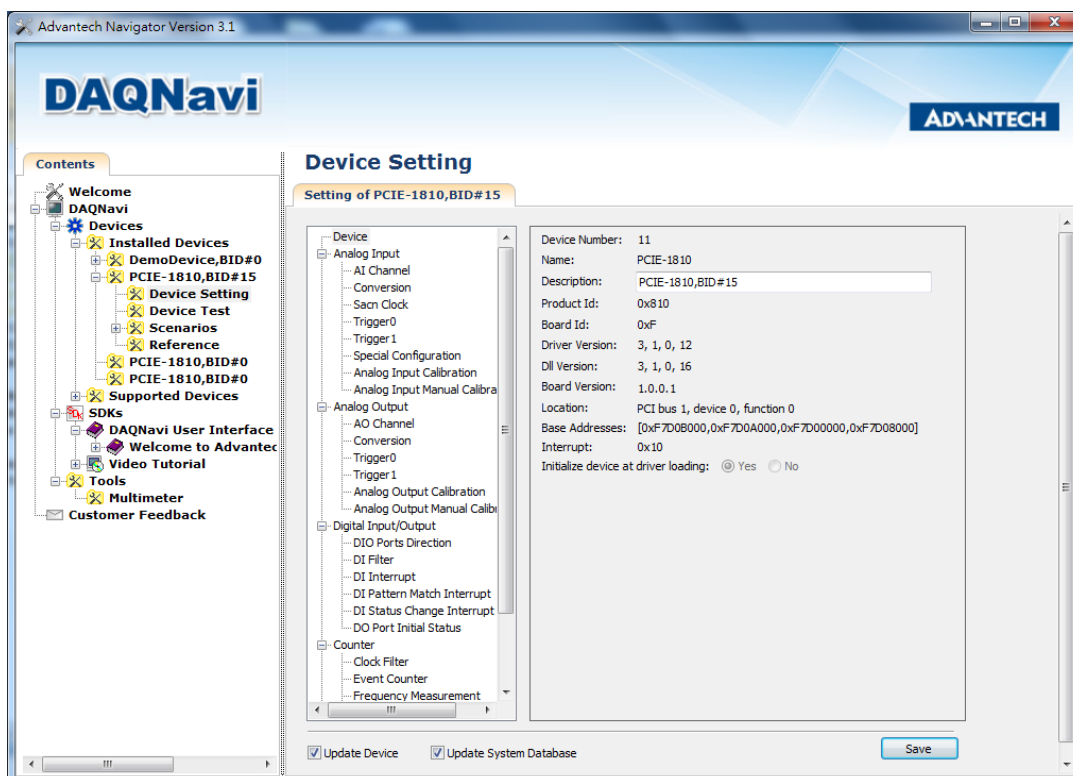
Figure 2.2 MIOE-3816 Device Setting

2.6.2 Device Configuration

1. Please go to the Device Setting to configure your device. Here you can configure not only the analog Input/Output of MIOE-3816 but also digital Input/Output.

Figure 2.3 Device Setting Page

2. After the card is installed and configured, navigate to the Device Test page to test the hardware using the testing utility provided.

Figure 2.4 Device Testing Page

For detailed information related to the software and settings, please refer to the Advantech Navigator.

2.7 DAQ Function Block

Figure 2.5 MIC-1816 DAQ Function Block

2.8 I/O Connector Signal Description

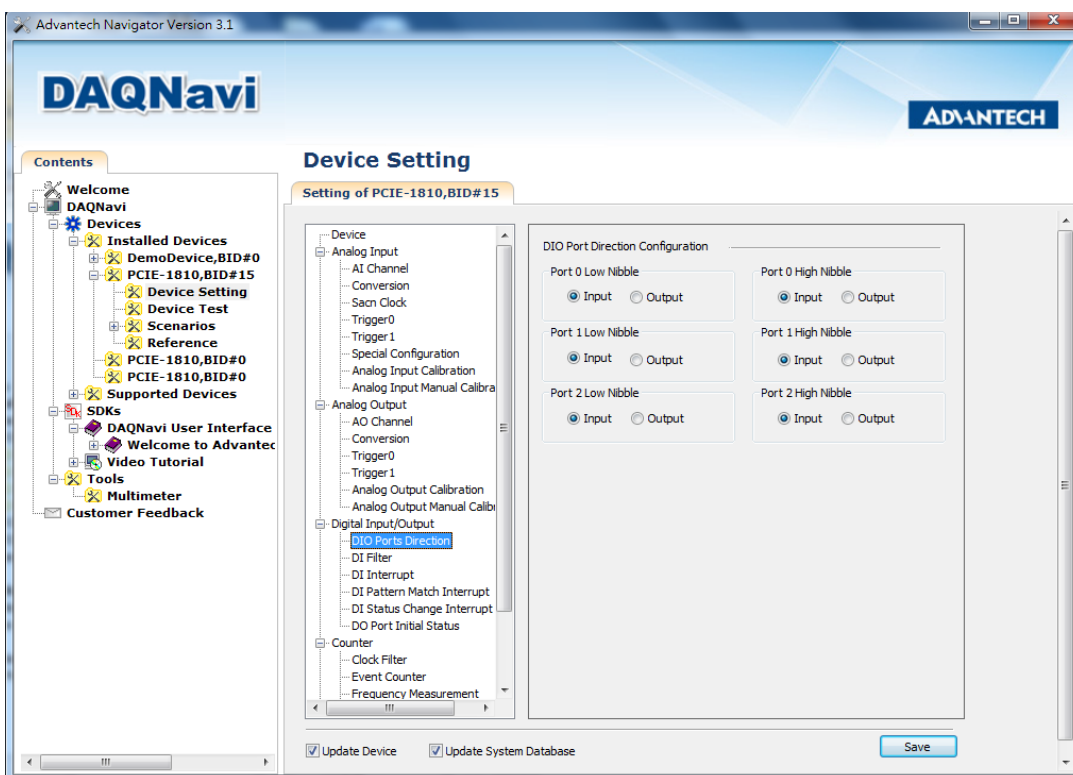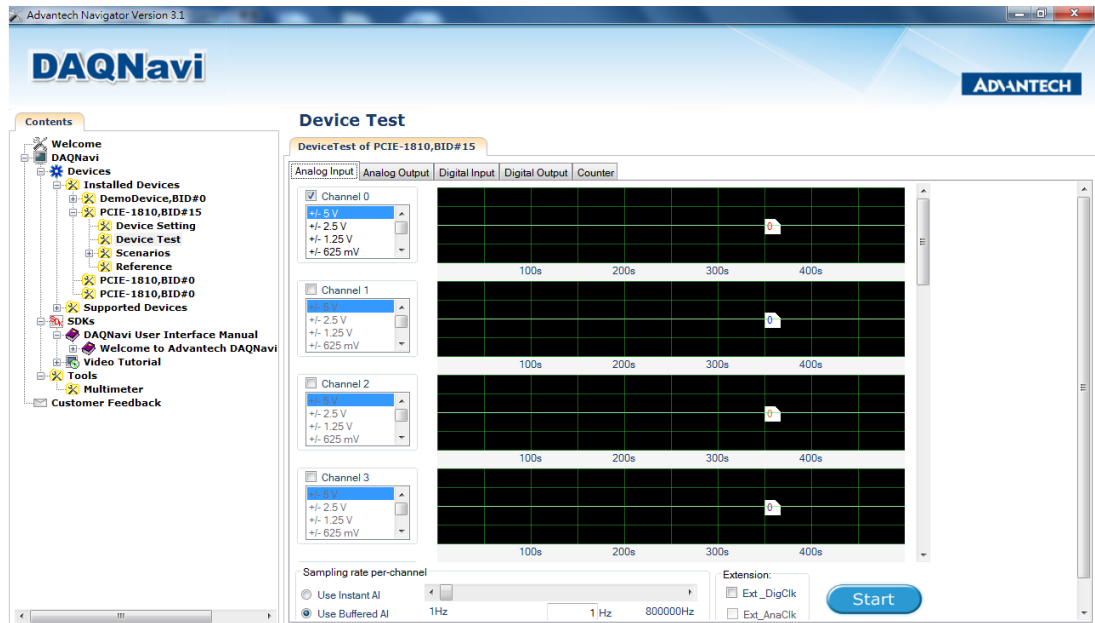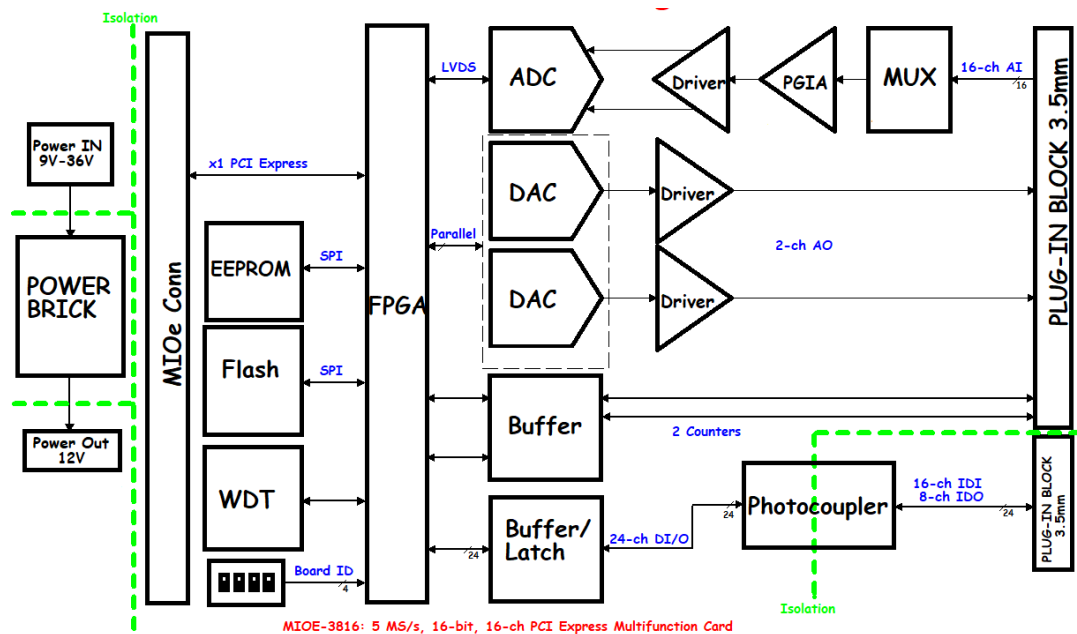Refer to Figures 1.1 and 1.2 regarding the pin assignments for the terminal blocks. The I/O connector signal descriptions are provided in Table 2.1.

Table 2.1: I/O Signal Descriptions			
Signal Name	**Reference**	**Direction**	**Pin Description**
AI[15:0]	AGND	Input	**AI Channels 0 to 15.** Each channel pair, AI[i+1:i](i=0,2,4…14), can be configured as either two single-ended inputs or one differential input.
AGND	-	-	**Analog Ground.** These pins are the reference points for single-ended measurements and the bias current return point for differential measurement. The ground references (AGND and DGND) are connected on MIC-1816.
ATRG0(AT0) ATRG1(AT1)	AGND	Input	**Analog Threshold Trigger.** These pins are the analog threshold trigger input.
DTRG0(DT0) DTRG1(DT1)	DGND	Input	**Digital Trigger.** These pins are the digital input. The left pins are used to start or stop a data acquisition. **Analog Threshold Trigger** and **Digital Trigger** are used to execute a specific data acquisition mode – an acquisition which consists of one or more scans. A data acquisition behavior needs a stop trigger signal while the pin is used to stop the function. The active edge of the start and stop function can be programmed as rising or falling.
AI_SCAN(AISC)	DGND	Input	**AI Scan Clock.** This pin is used to initiate a set of data acquisition. The card samples the AI signals of every channel in the scan list once for every AI Scan Clock.
AI_CONV(AICV)	DGND	Input	**AI Conversion Clock.** This pin initiates a single AI conversion on a single channel. A scan (controlled by the AI Scan Clock) consists of one or more conversions.
AO0_REF(AO0R) AO1_REF(AO1R)	AGND	Input	**AO Channel 0/1 External Reference.** This is the external reference input for the analog output channel 0/1.
AO0_OUT(AO0) AO1_OUT(AO1)	AGND	Output	**AO Channels 0/1.** This pin supplies the voltage output of analog output channel 0/1.
AO_CONV(AOCV)	DGND	Input	**AO Convert Clock.** This pin is for initiating AO conversion. Each sample updates the output of all DACs. Users can specify an internal or external source for AO Convert Clock.
DI(0~15)	EC	Input	**Isolated digital input.** Refer to signal connection for the actual connection with ECOM.
EC	--		Common pin for connecting external signal and digital input.

DO(0~7)	DGND	Output	Isolated digital output. Refer to signal connection for the actual connection with PC and DGND.
PC	--		Connection to unload the back EMF.
DGND	-	-	**Digital Ground.** This pin supplies the reference for the digital channels at the I/O connector as well as the 5 V and 12 V DC supply. The ground references (AGND and DGND) are connected on MIC-1816.
CNT0.CLK(CT0C) CNT1.CLK(CT1C)	DGND	Input	**Counter 0/1 External Clock Input.** The clock input of counters can be either external (up to 10MHz) or internal (20MHz), as set by software.
CNT0.OUT(CT0O) CNT1.OUT(CT1O)	DGND	Output	Counter 0/1 Output
CNT0.GATE(CT0G) CNT1.GATE(CT1G)	DGND	Input	Counter 0/1 Gate Control
+12V	DGND	Output	**+12V DC Source.** This pin provides 12 V DC power supply for external use (0.1A maximum).
+5V	DGND	Output	**+5V DC Source.** This pin provides 5 V DC power supply for external use (0.3A maximum).

MIC-1816 supports either 16 single-ended or 8 differential analog inputs.

2.8.1 Single-Ended Channel Connections

Single-ended connections use only one signal wire per channel. The voltage on the line references the common ground on the card. Signal sources without a local ground are called "floating" sources. A single-ended channel can be easily connected to a floating signal source. The standard wiring configuration is shown below.
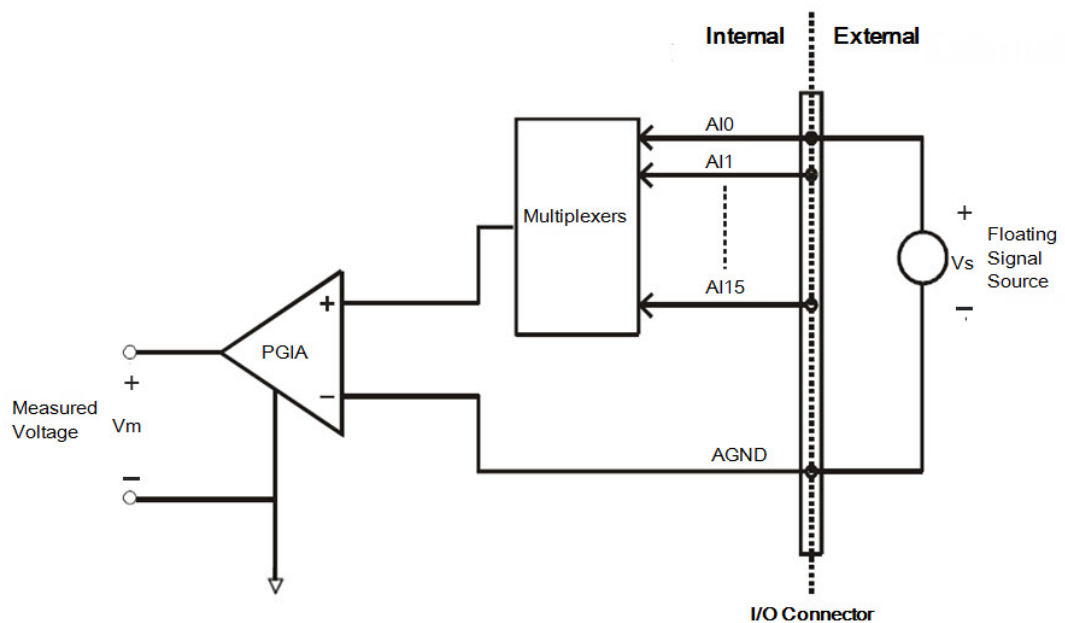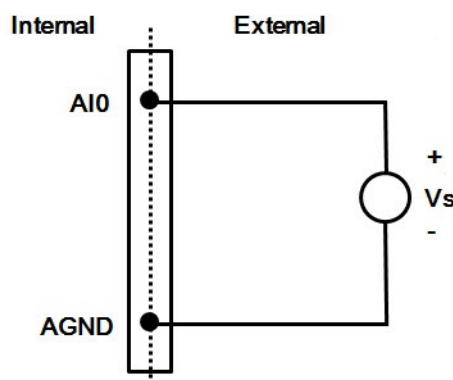
Figure 2.6 Single-Ended Input Channel Connections

Single-ended connections should only be used in the following situations:

■ All input signals share a common reference point (AGND)
■ The wire connecting the signals to the device is less than 3 m in length

2.8.2 Differential Channel Connections

The differential input channels operate with two signal wires for each channel, and the voltage difference between both signal wires is measured. On MIC-1816, when all channels are configured for differential input, up to 8 analog channels are available.

If one side of the signal source is connected to a local ground, the signal source is ground-referenced. Therefore, the ground of the signal source and the ground of the card will not be at exactly the same voltage. The difference between the ground voltages forms a common-mode voltage (Vcm).

To avoid the ground loop noise effect caused by common-mode voltages, connect the signal ground to the low input. Figure 2.7 shows a differential channel connection between a ground reference signal source and input channel on MIC-1816. With this connection, the PGIA rejects a common-mode voltage between the signal source and the MIC-1816 ground, denoted as Vcm in Figure 2.7.
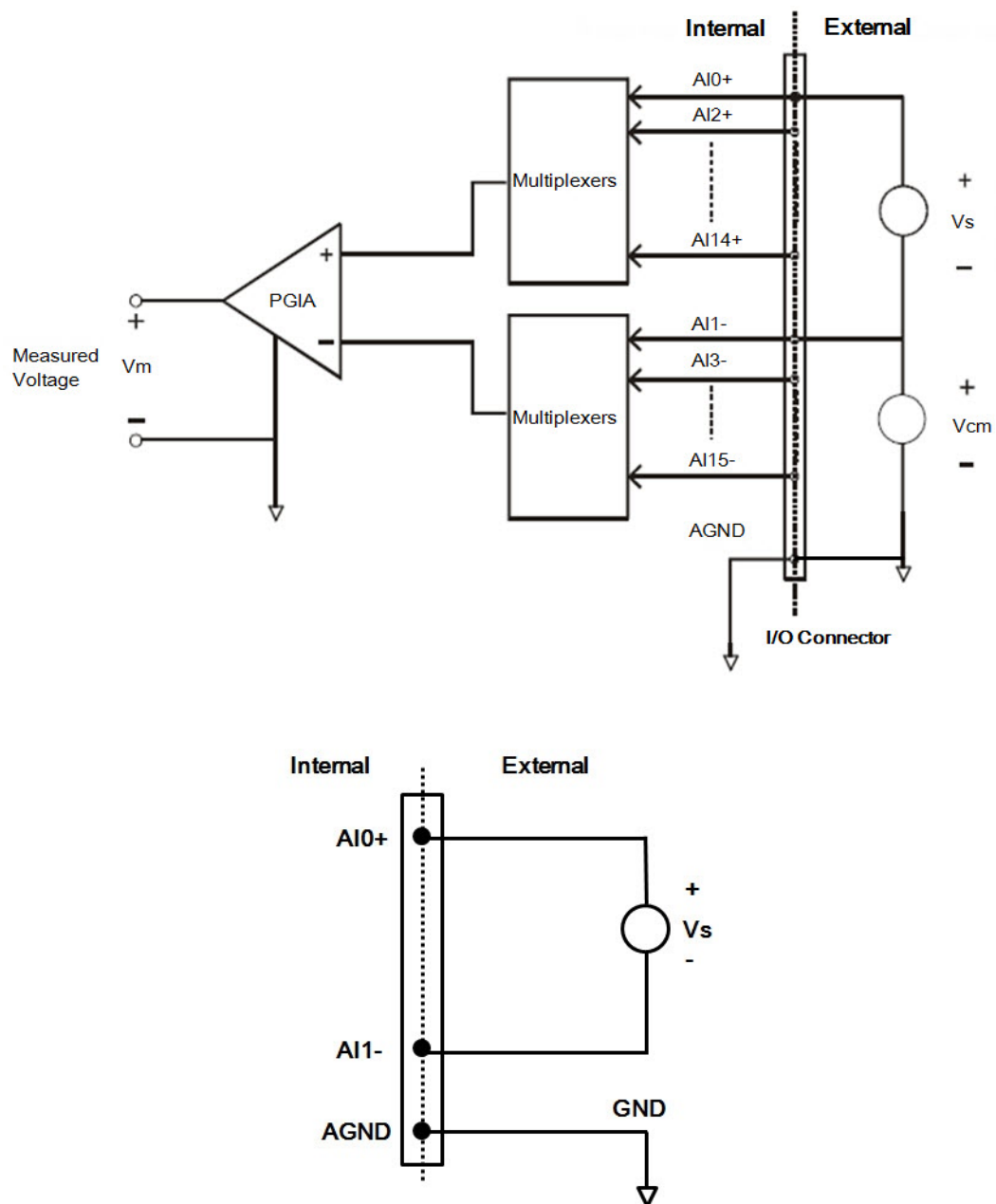
Figure 2.7 Differential Input Channel Connections

If a floating signal source is connected to the differential input channel, the signal source may exceed the common-mode signal range of the PGIA, and the PGIA will be saturated with erroneous voltage readings. Therefore, users must reference the signal source against the AGND.

Figure 2.8 shows a differential channel connection between a floating signal source and an input channel on MIC-1816. Each side of the floating signal source is connected through a resistor to the AGND. This connection can reject the common-mode voltage between the signal source and the MIC-1816 ground.
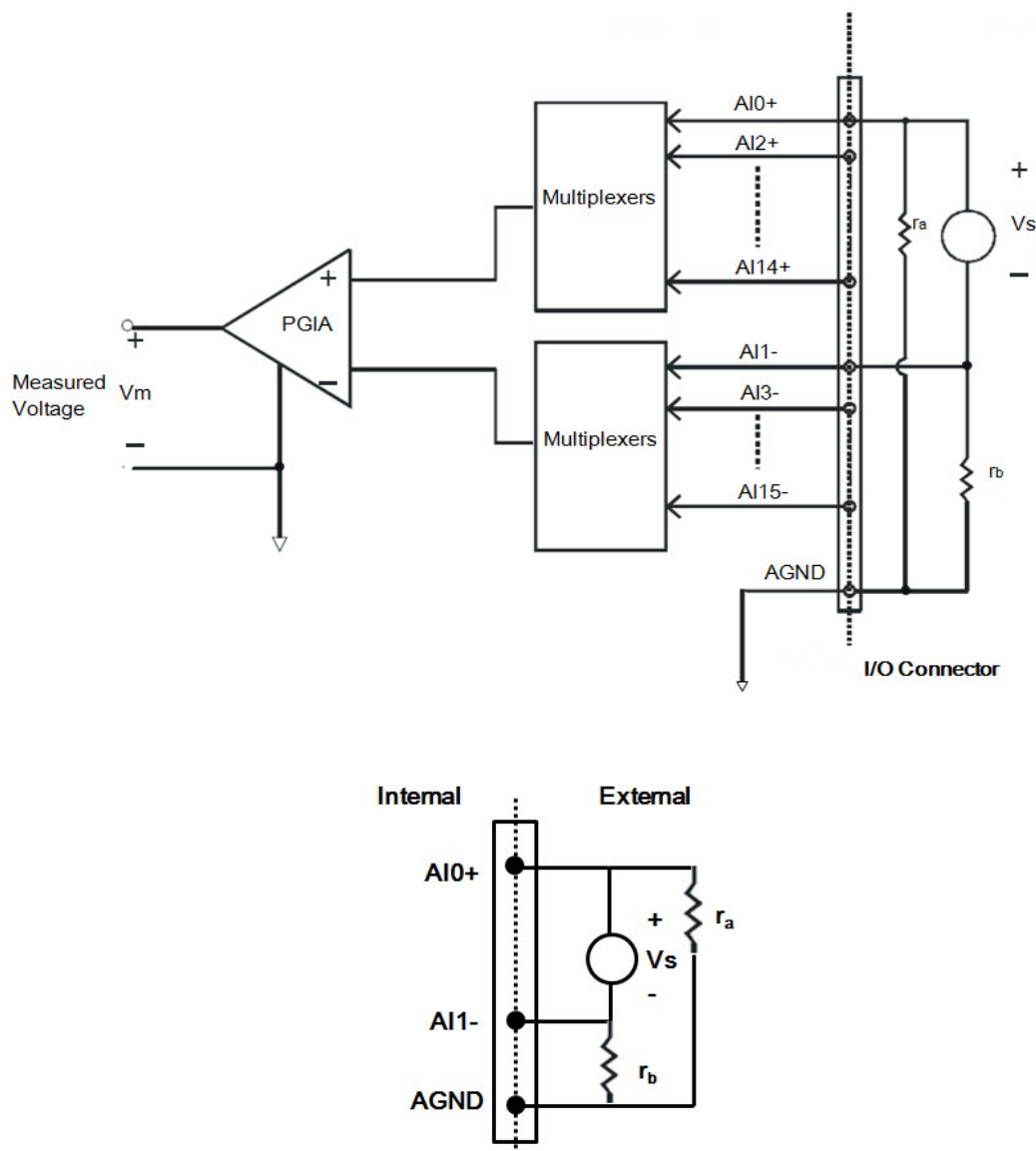

Figure 2.8 Floating Signal Source

However, the disadvantage of this connection is that the source is loaded with the series combination (sum) of the two resistors. For ra and rb, for example, if the input impedance rs is 1k Ohm, and each of the two resistors is 100k Ohm, then the resistors load the signal source with 200 Ohm (100 Ohm + 100 Ohm), resulting in a 0.5% gain error. Below is a simplified representation of the circuit and calculating process.
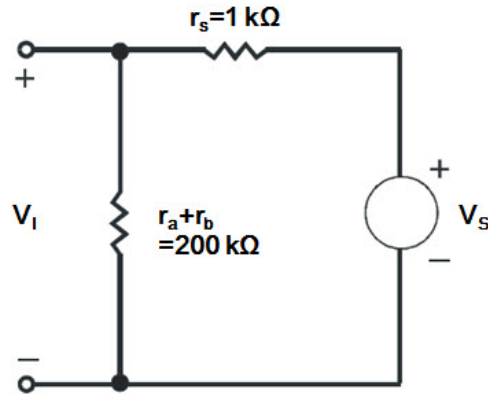
V_S: ideal signal source

V_I: measured signal source

r_s: output impedance of signal source

r_a, r_b: series-wound resistors

$$V_I = \frac{r_a + r_b}{r_s + r_a + r_b} V_S = \frac{200}{1 + 200} V_S = \frac{200}{201} V_S \qquad \text{Gain error} = \frac{V_I - V_S}{V_S} = -\frac{1}{201} = -0.5\%$$

2.8.3 AI Sample Clock Source Connections

Internal AI Sample Clock

The internal AI sample clock uses a 100 MHz time base. Conversions start on the rising edge of the counter output. Users can set the clock source as internal and specify the sampling frequency via software in order to pace operations. The minimum frequency is 0.024 S/s, the maximum frequency is 1 MS/s. According to the sampling theory (Nyquist Theorem), users must specify a frequency that is at least twice as fast as the input's highest frequency component to achieve valid sampling. For example, to accurately sample a 20 kHz signal, a sampling frequency of at least 40 kHz must be specified. This can avoid an error condition often know as aliasing, in which high frequency input components appear erroneously as lower frequencies when sampling.

External AI Sample Clock

The external AI sample clock is useful for pacing acquisitions at rates not available with the internal AI sample clock, or pacing at uneven intervals. Connect an external AI sample clock to screw terminal AI_CLK on the screw terminal board. Conversions will start on the rising edge of the external AI sample clock input signal. Use software to set the clock source as external. The sampling frequency is always limited to a maximum of 10 MHz for the external AI sample clock input signal.
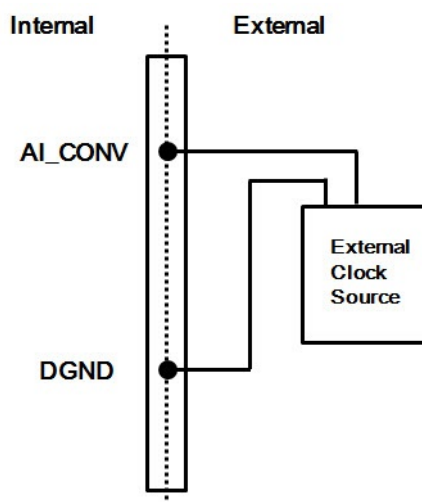
Figure 2.9 External Clock Source Connection

2.8.4 Trigger Source Connections

External Digital (TTL) Trigger

For analog input operations, an external digital trigger event occurs when the MIC-1816 detects either a rising or falling edge on the external AI TTL trigger input signal from screw terminals DTRG0 and DTRG1 on the screw terminal board. The trigger signal is TTL compatible.
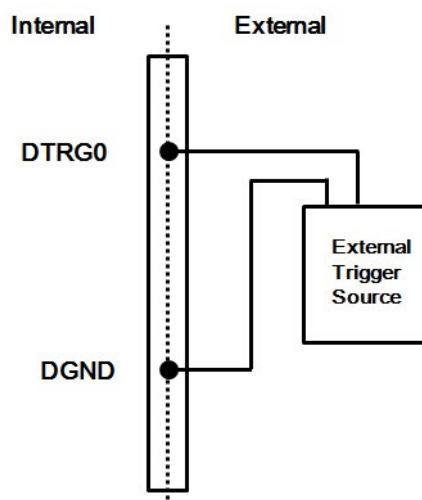

Figure 2.10 External Digital Trigger Source Connection

Analog Threshold Trigger

For analog input operations, an analog trigger event occurs when the MIC-1816 detects a transition from above a threshold level to below a threshold level (falling edge), or a transition from below a threshold level to above a threshold level (rising edge). Users should connect analog signals from an external device or analog output channel on board to external input signals ATRG0 and ATRG1. For MIC-1816, the threshold level is set using a dedicated 16-bit DAC. The threshold level can be programmed by writing a voltage value to this DAC using software. The voltage value can range from -10 V to 10 V.
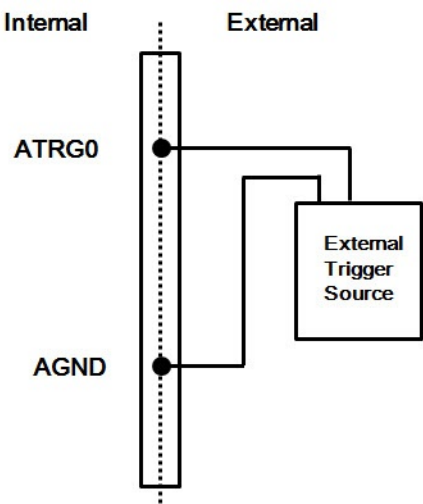

Figure 2.11 External Analog Trigger Source Connection

2.8.5 Measurement Type Selection

MIC-1816/MIC-1810 provides both current and voltage measurement for customers to choose from. To configure this, you should follow the below steps:

1. Unscrew the bottom plate
2. Sets the measurement type on SW2401 (Voltage: OFF, Current: ON)
3. Sets the channel to differential in software if current measurement mode is selected
4. Sets corresponding value ranges according to the switch setting

Table 2.2: SW2401	
	OFF, Voltage Measurement Mode (Default)
	ON, Current Measurement Mode

		Switch & Channel No.		
Switch No.	**Channel**	**Switch No.**	**Channel**
1	CH0 & CH1	5	CH8 & CH9
2	CH2 & CH3	6	CH10 & CH11
3	CH4 & CH5	7	CH12 & CH13
4	CH6 & CH7	8	CH14 & CH15

2.8.6 Analog Output Connection

MIC-1816 provides two AO output channels. The internal precision -5 V or -10 V reference can be used to generate 0 ~ 5 V or 0 ~ 10 V analog output. Use an external reference for other analog output ranges. The maximum reference input voltage is 10 V and the maximum output scaling is 10 V. Loading current for analog outputs must not exceed 5 mA.

Figure 2.12 shows the configuration of analog output and external reference input connections on MIC-1816.
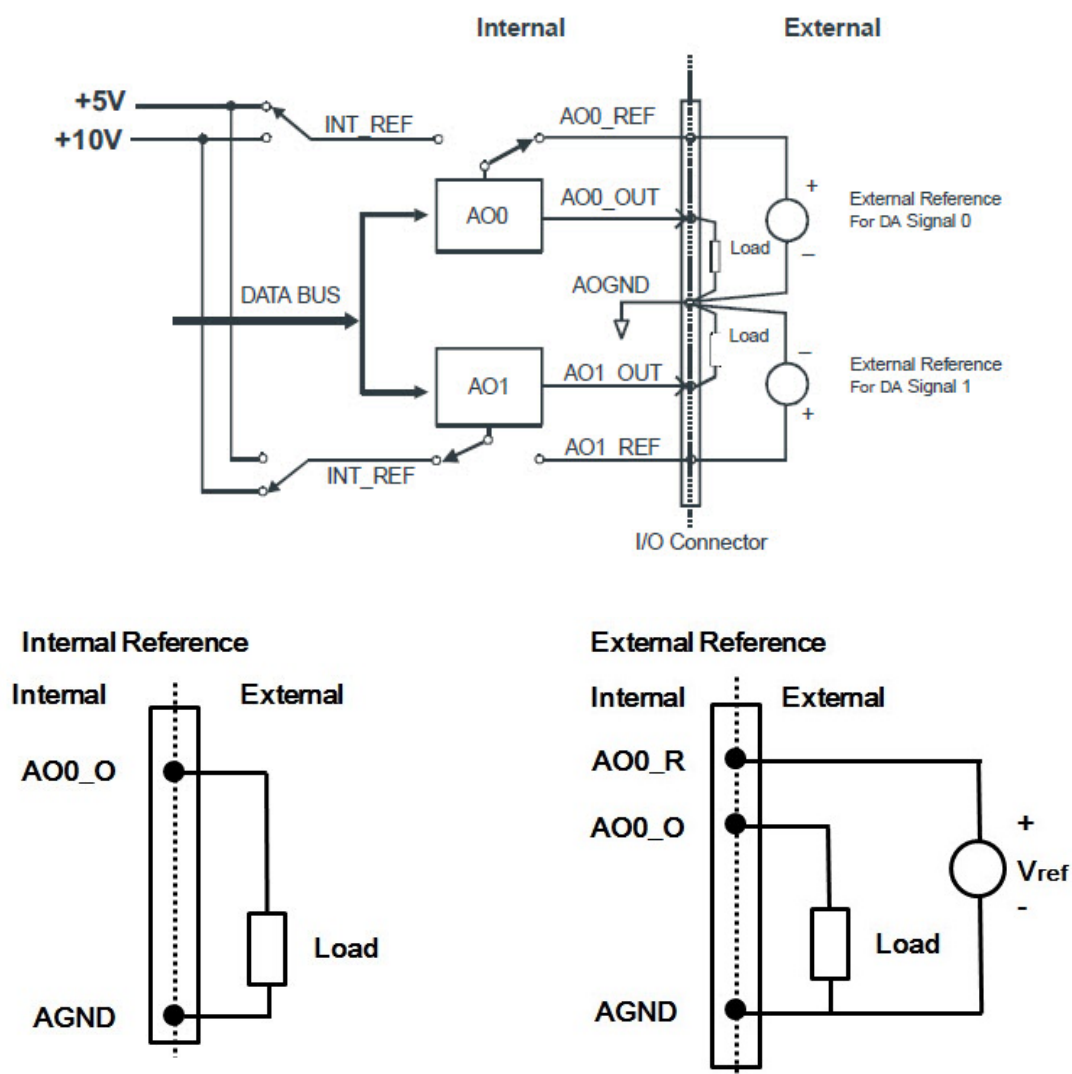

Figure 2.12 Analog Output Connections

2.8.7 AO Sample Clock Source Connections

Internal AO Output Clock

The internal AO output clock applies a 100 MHz time base divided by a 32-bit counter. Conversions start on the rising edges of counter output. The clock source and clock frequency can be specified via software to pace the analog output operation. The maximum frequency is 3.030303MS/s.

External AO Output Clock

The external AO output clock can be used for pacing analog output operations at rates not available with the internal AO output clock, or for pacing at uneven intervals. Connect an external AO output clock to the pin. Conversions will begin on the input signal's rising edge. The clock source can be set as external via software. The maximum input clock frequency is 3MS/s.
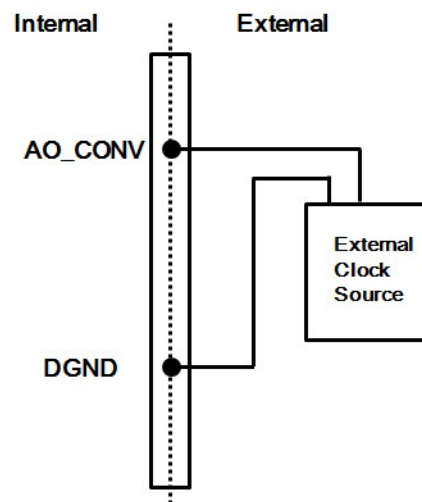
Figure 2.13 External Clock Source Connection

2.8.8 AO Trigger Source Connections

External Digital (TTL) Trigger

MIC-1816 supports the use of an external digital (TTL) trigger to activate AO conversions for continuous output mode. An external digital trigger event occurs when MIC-1816 detects either a rising or falling edge on the external AO TTL trigger input signal from the pin of connector. Users can define the trigger source type as rising edge or falling edge via software. The trigger signal is TTL compatible.

Figure 2.14 External Digital Trigger Source Connection

Analog Threshold Trigger

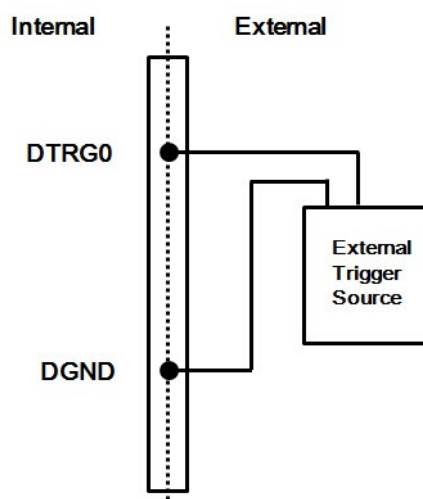For analog input operations, an analog trigger event occurs when MIC-1816 detects a transition from above a threshold level to below a threshold level (falling edge), or a transition from below a threshold level to above a threshold level (rising edge). Users should connect analog signals from an external device or analog output channel on board to external input signals ATRG0 and ATRG1. For MIC-1816, the threshold level is set using a dedicated 16-bit DAC. The threshold level can be programmed by writing a voltage value to this DAC using software. The voltage value can range from -10 V to 10 V.
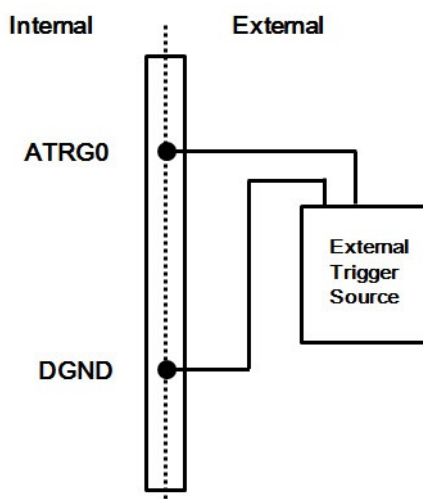
Figure 2.15 External Analog Trigger Source Connection

2.8.9 Digital Signal Connections

MIC-1816 features 16 isolated digital input channels and 8 isolated digital output channels.

Isolated Digital Input

MIC-1816 provides both wet and dry contact connections. Figure 2.16 describes the connection.

Figure 2.16 Isolated Digital Input

Isolated Digital Output

MIC-1810 provides NPN connection for digital output. Figure 2.17 describes the connection. If there's inductive load connected, the PCOM should be connected in order to protect the internal output circuit from damaging.

Figure 2.17 Isolated Digital Output

Appendix A

Specifications

A.1 Analog Input

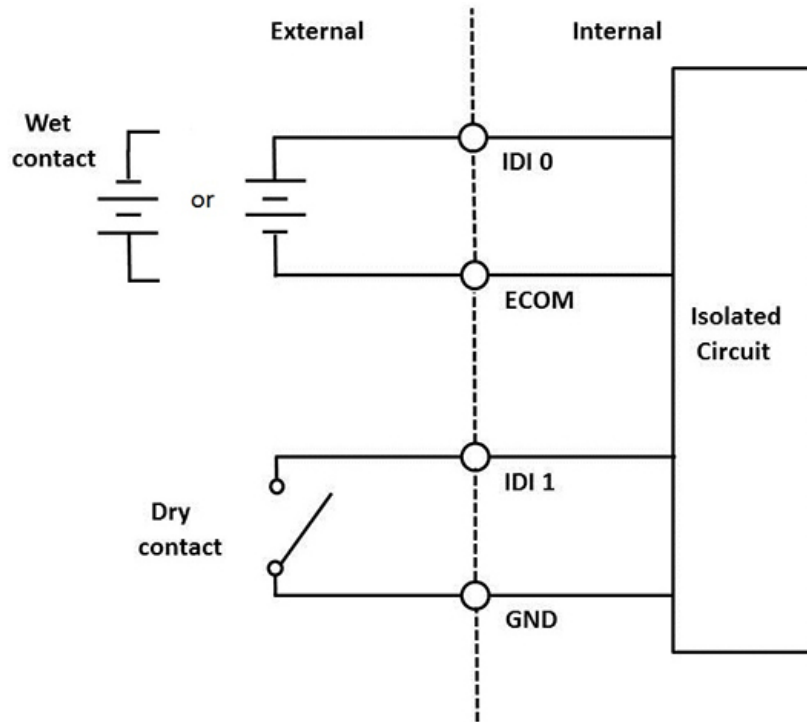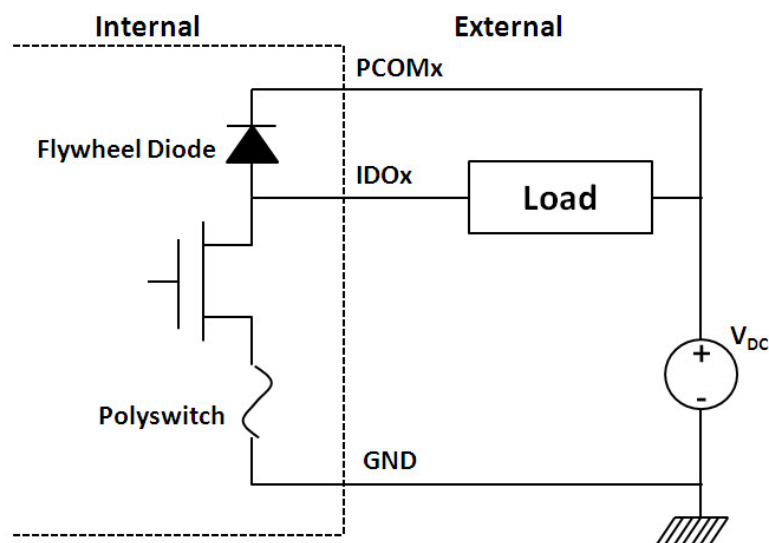| Channels	16 single ended/8 differential				
Resolution	16 bit				
Build-in memory	4K samples				
Sampling Rate	Single Channel	5 MS/s			
	Multi Channel	1 MS/s			
	Unipolar/Bipolar Mixed	250 KS/s			
Input Range and Gain List	Gain	0.5	1	2	4	8
	Unipolar	NA	0 ~ 10	0 ~ 5	0 ~ 2.5	0 ~ 1.25
	Bipolar	±10/ 0~20mA/ 4~20mA	±5	±2.5	±1.25	±0.625
Drift	Gain	0.5	1	2	4	8
	Zero	25 ppm/°C				
	Span	15 ppm/°C				
Input Signal Bandwidth (-3dB)	Gain	0.5	1	2	4	8
	BW (MHz)	4.4	4.4	4.4	3.3	1.7
Max. Input Voltage	± 15 V				
Input Impedance	1G Ω / 2pF				
Clock Source	Software or external				
Trigger Mode	Start, Delay Start, Stop, Delay Stop				
Accuracy	DC	INLE: ± 2 LSB (with manual adjustment)				
		DNLE: ± 1 LSB (with manual adjustment)				
		Offset error: ± 0 LSB (with manual adjustment)				
		Gain	0.5	1	2	4	8
		Gain Error (%FSR)	0.0075 (Voltage) 0.03 (Current)	0.0075	0.0075	0.008	0.008
		Channel Type	Single ended/differential				
	AC	SINAD: 81 dB				
		ENOB: 13 bits				
External Digital Trigger	Low: 0.8 V max.; High: 2.0 V min.				
	Min. Pulse Width: 50 ns				
External Analog Trigger	Range: -10 ~ 10 V				
	Resolution: 16 bit (0.3 mV/step)				

Bipolar Range	Unipolar Range	±1 LSB for Full-Scale Step
±10 V	NA	1.04 us
±5 V	0~ 10 V	1.04 us
±2.5 V	0~ 5 V	1.04 us
±1.25 V	0~ 2.5 V	4 us
±0.625 V	0~ 1.25 V	5 us

A.2 Analog Output

Channels	2		
Resolution	16 bit		
Memory Size	4K samples		
Update Rate	3 MS/s		
Output Range	Internal Reference	0 ~ 5 V, 0 ~ 10 V, ±5 V, ±10 V	
	External Reference	Reference Input	Maximum Range
	Unipolar	-10V ≤ x ≤10V	0 ~ x V
	Bipolar		-x V ~ x V
Accuracy	Relative	±1 LSB	
	Differential Non-Linearity	±1 LSB (monotonic)	
Slew Rate	20 V/us		
Gain Error	Adjustable to zero (manual calibration)		
Drift	30 ppm/ °C		
Driving Capability	5 mA		
Update Mode	Static update, waveform		
Output Impedance	max. 0.1 Ω		
Capacitive Load	Max. 500 pF		

A.3 Isolated Digital Input

Channels	16

Input Voltage Level	Wet Contact:
	  Low: 0~3V_{DC}
	  High: 10~30V_{DC}
	Dry Contact:
	  Low: Connect to GND
	  High: Open

Input Impedance	3 kΩ
Isolation Protection	2500V_{DC}
Response Time	100μs

A.4 Isolated Digital Output

Channels	8
Output Voltage	5~40V_{DC}
Output Type	Sink (NPN)
Sink Current	350mA max./channel @ 25°C 250mA max./channel @ 60°C
Isolation Protection	2500V_{DC}
Response Time	100μs

A.5 Counter/Timer

Counter Chip	N/A	
Channels	2 channels (independent)	
Resolution	32 bit	
Compatibility	TTL level	
Base Clock	Internal 20 MHz or external clock (10 MHz max.) selected by software	
Input Frequency	Max. 10 MHz	
Clock Input	Low	0.8 V max.
	High	2.0 V min.
Gate Input	Low	0.8 V max.
	High	2.0 V min.
Counter Output	Low	0.8 V max. @ +15 mA
	High	2.0 V min. @ -15 mA
Error in Advanced Functions	Frequency Measurement	0.1% when input signal frequency ≥ 40 KHz
	Pulse Width Measurement	0.1% when input signal frequency ≤ 40 KHz
	Pulse Output	within 2% when output frequency > 1 MHz
	PWM Output	within 2% when output frequency > 1 MHz

A.6 System

- **Processor:** Generation 6 Intel Core U-series
  - MIC-1816-U0A1E: Celeron 3955U1 2.0 GHz, dual-core, two threads
  - MIC-1816-U3A1E*: i3 6100U 2.3 GHz, dual-core, four threads
- **L3 Cache**
  - MIC-1816-U0A1E: 2MB
  - MIC-1816-U3A1E*: 3MB
- **I/O interface of Platform Controller Hub**
  - Integrated Serial ATA Host Controller
    Data transfer rates up to 6.0 Gb/s (600 MB/s)
    Integrated AHCI controller
  - USB
    xHCI Host Controller, supporting 2 SuperSpeed USB 3.0 ports
    One EHCI Host Controllers, supporting 2 HighSpeed USB 2.0 ports
    Supports wake-up from sleeping states S1, S3
    Supports legacy Keyboard/Mouse software
  - Power Management
    Full support of ACPI C-states as implemented by the following processor
    Cstates: — C0, C1, C1E, C3, C6, C7, C8, C9, C10
  - Enhanced Intel SpeedStep® Technology
- **System Memory Support****
  - Non-ECC, DDR3L/DDR3L-RS and LPDDR3 memory with dual SO-DIMM up to 16GB
  - DDR3L/DDR3L-RS I/O Voltage of 1.35V
    1333 MT/s (PC3-10600), 1600 MT/s (PC3-12800)
  - 64-bit wide channels

– Intel® Fast Memory Access (Intel® FMA):
Just-in-Time Command Scheduling
Command Overlap
Out-of-Order Scheduling

■ **Integrated Graphics Controller**

– Contains a generation 9 graphics core architecture (Intel® HD Graphics 620/520/510 (Celeron))
– Intel® QuickSync & Clear Video Technology HD Support
– Full Hardware Accelerated Video Decode: AVC/VC1/MPEG2/HEVC/VP8/JPEG.
– OpenGL4.4 and OpenCL2.1 support
– DirectX 12, DirectX 11.3, DirectX 11.2, DirectX 11.1, DirectX 10, DirectX 9 support
– Support Extend, Clone and Collage mode with multi-display device
– Dual Display: Any two combination between: VGA, LVDS***, HDMI (from Rear I/O line)
– Triple Display: VGA+HDMI+ LVDS***
– Integrated Dual-channel LVDS*** support resolution up to 1920x1200 at 60 Hz
– Analog RGB display (VGA) output up to resolution 1920 x 1200 with 60 Hz, or 2048 x 1152 @ 60Hz with reduced blanking.
– HDMI interface supports the HDMI 1.4a specification with audio up to 4096x2160 at 24 Hz (Supporting 4K display required two DDR channels of same size).

■ **Gigabit Ethernet**

– Port 1: Integrated Intel 100 Series Chipset (MAC) + i219 GbE (PHY)
Integrated ASF Management Controller
10/100/1000 BASE-T IEEE 802.3 specification conformance
Supports the Energy Efficient Ethernet (EEE) IEEE802.3az specification
Supports up to 9 KB jumbo frames (full duplex)
802.1as/1588 conformance
– Port 2: i210 Gigabit Ethernet Controller
Flow Control Support compliant with the 802.3X Specification
Compliant with the 1 Gb/s IEEE 802.3 802.3u 802.3ab Specifications
Magic Packet* wake-up enabled with unique MAC address
Supports IEEE 1588

■ **BIOS**

– AMI UEFI 128 Mbit

* The Core i3 isn't standard product of MIC-1800. Please contact Advantech if this is needed.

** MIC-1800 series use DDR3 4GB in default. Customization is available.

*** LVDS is inside the MIC-1800 system.

A.7 General

- ■ **Electrical**
  - – Power Input: 10-36VDC
  - – Power Consumption: Typ. 11W @ 24V, Max. 50W @24V
  - – RTC Battery:
    Typical Voltage: 3.0 V
    Normal discharge capacity: 210 mAh
- ■ **Environment**
  - – Operating Temperature: -20 ~ 60 °C (-4 ~140 °F) @ 5 ~ 85% RH with 0.7m/s air flow -20~60 °C
  - – Storage Temperature: -20 ~ 80 °C (-4 ~ 176 °F)
  - – Storage Humidity: 5 ~ 95% RH, non-condensing
  - – Random Vibration: 1Grms, 1hr per axis w/SSD equipped (IEC60068-2-64)
  - – Shock: 1G, 11ms (IEC60068-2-27)
- ■ **Mechanical**
  - – System Dimension: 200 x 156 x 58 mm (7.87" x 6.14" x 2.28")
  - – Weight: 2.41kg (5.3lb)

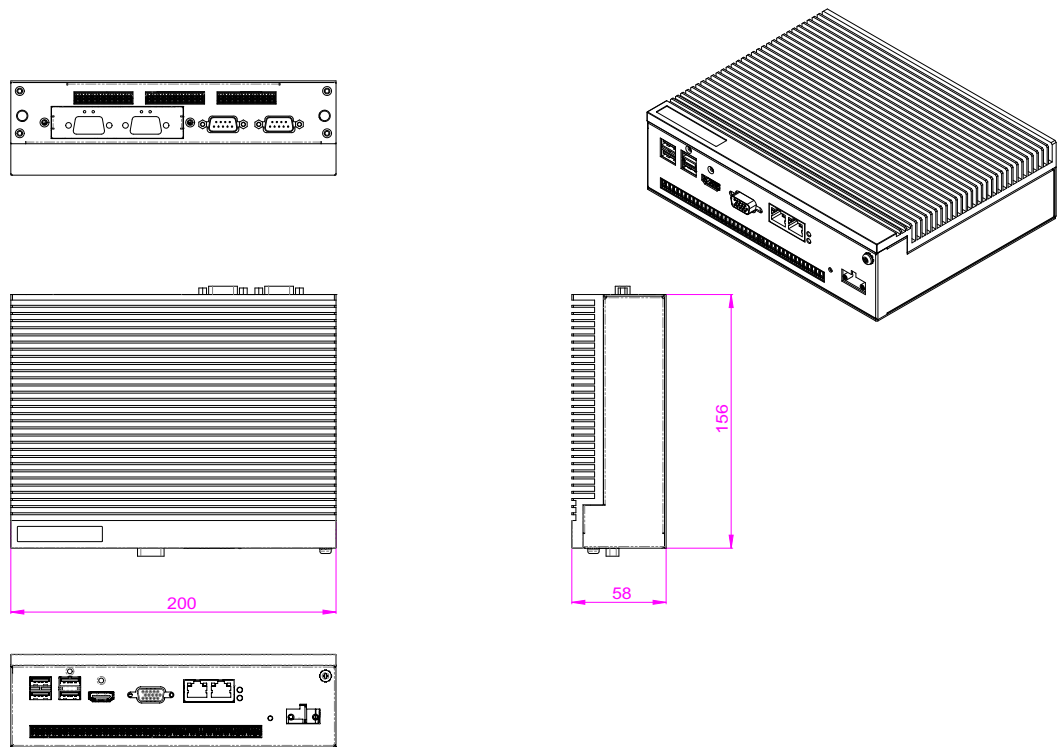# Appendix B

System Dimensions

B.1 System Dimensions
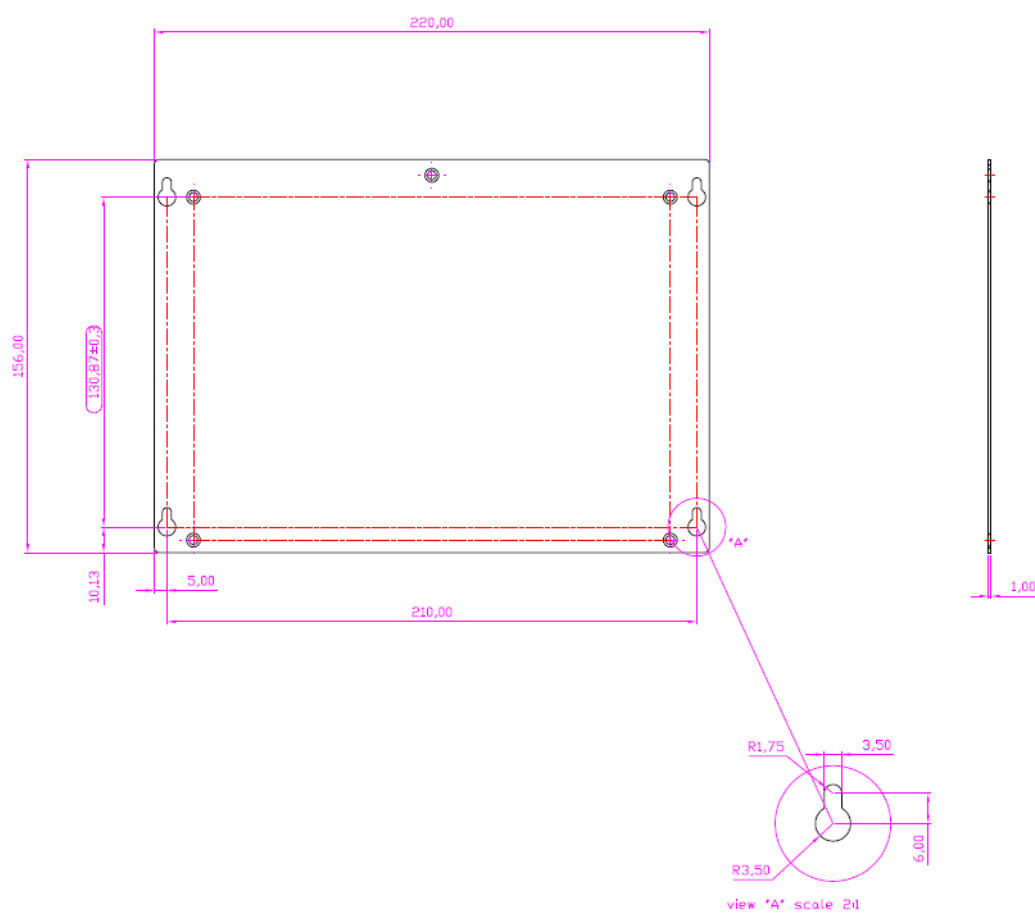

Figure B.1 System Dimensions

B.2 Table Mount Kit

Figure B.2 Table Mount Kit

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