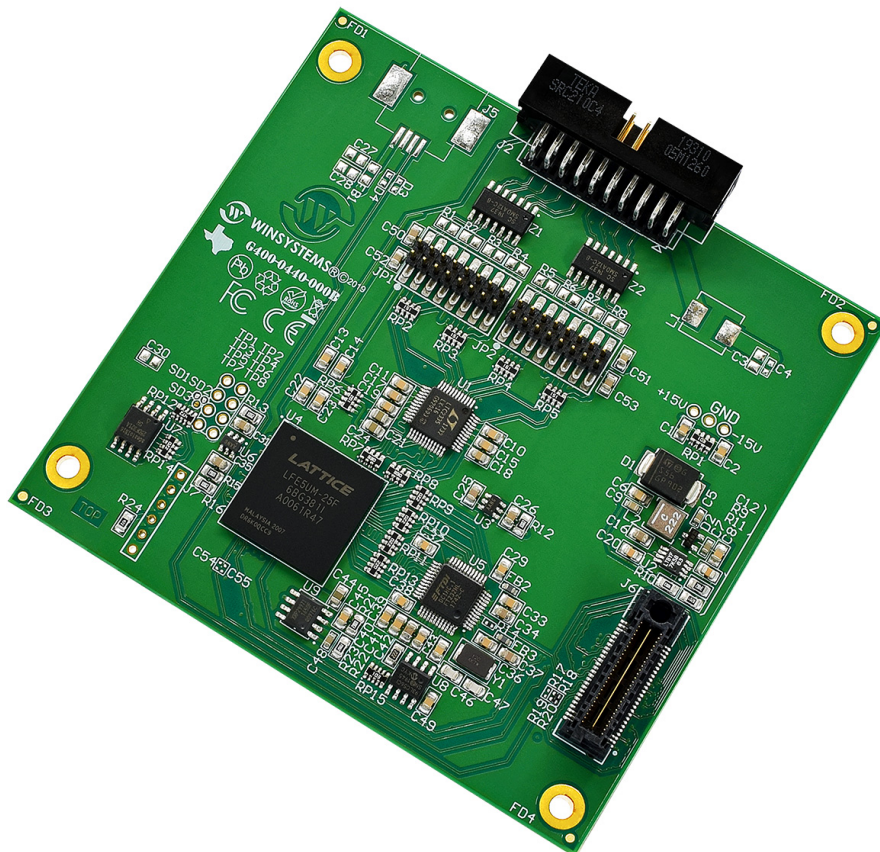# WINSYSTEMS®

PX1-I440-ADC

Industrial Analog to Digital Data Acquisition Module

Product Manual

Revision History

Document Version	Last Updated Date	Brief Description of Change
v1.0	7/24/20	Initial release
v2.0	9/30/2020	New pictures, pinouts, and connectors updated to reflect updated board design

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Table of Contents

1. Before You Begin

Review the warnings in this section and the best practice recommendations (see "Best Practices" on page 11) when using and handling the WINSYSTEMS PX1-I440-ADC. Following these recommendations provides an optimal user experience and prevents damage. Read through this document and become familiar with the PX1-I440-ADC before proceeding.

> FAILING TO COMPLY WITH THESE BEST PRACTICES MAY DAMAGE THE PX1-I440-ADC AND VOID YOUR WARRANTY.

1.1 Warnings

Only qualified personnel should configure and install the PX1-I440-ADC. While observing best practices, pay particular attention to the following:.

> **Avoid Electrostatic Discharge (ESD)**
> Only handle the circuit board and other bare electronics when electrostatic discharge (ESD) protection is in place. Having a wrist strap and a fully grounded workstation is the minimum ESD protection required before the ESD seal on the product bag is broken.

2. Introduction

This manual provides configuration and usage information for the PX1-I440-ADC. If you still have questions, contact Technical Support at (817) 274-7553, Monday through Friday, between 8 AM and 5 PM Central Standard Time (CST).

Refer to the WINSYSTEMS website at http://www.winsystems.com/ for other accessories (including cable drawings and pinouts) that can be used with your PX1-I440-ADC.

3. Functionality

The PX1-I440-ADC is an industrial data acquisition module for embedded systems with PCIe/104 OneBank™ expansion. This module features eight differential analog-to-digital converter (ADC) inputs based on Analog Devices' LTC2335-16 ADC. Analog to digital inputs terminate to a single 16-pin box header. The PX1-I440-ADC provides flexible voltage ranges from 0 V to 5 V, 0 V to 5.12 V, ±5 V, ±5.12 V, 0 V to 10 V, 0 V to 10.24 V, ±10 V, and ±10.24 V.

The PX1-I440-ADC-420 configuration includes precision resistors on board for measuring 4-20 mA current loop inputs from a variety of sensors.

Customized populations are available for OEM clients that need a mix of 4-20 mA and voltage inputs.

4.   Features

The PX1-I440-ADC provides the following features.

Analog Inputs (ADC)

*   16-bit, Linear Technology LTC2335-16 analog-to-digital converter

    PX1-I440-ADC

    –   8x single-ended inputs or differential inputs with following ranges:

    0 V to 5 V

    0 V to 5.12 V

    ±5 V

    ±5.12 V

    0 V to 10 V

    0 V to 10.24 V

    ±10 V

    ±10.24 V

    PX1-I440-ADC-420

    –   8x single-ended inputs or differential inputs with 4 mA to 20 mA

Power

*   +5 VDC @ 200 mA power input via OneBank connector

Industrial Operating Temperature

*   -40 to +85°C (-40 to +185°F)

5. Specifications

The PX1-I440-ADC adheres to the following specifications and requirements.
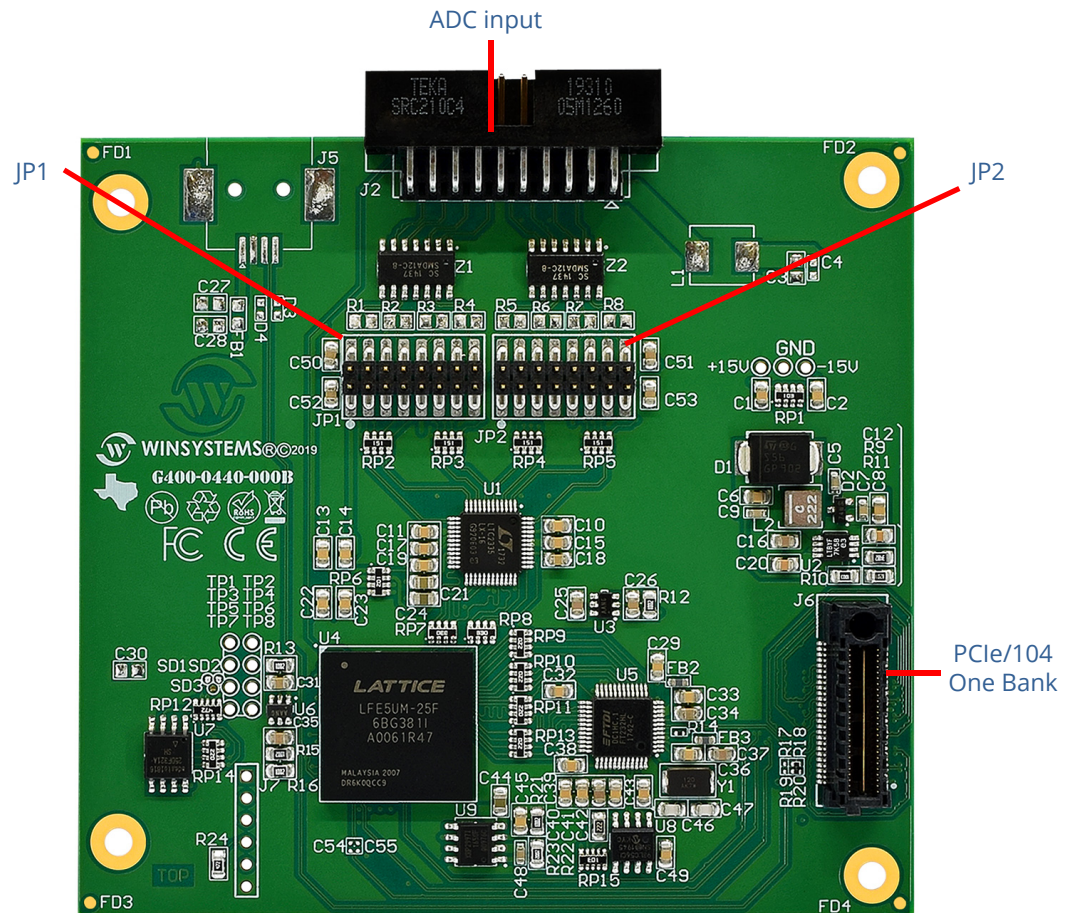
Table 1: PX1-I440-ADC specifications

Feature	Specification
Electrical	
V_{CC}	+5 V via OneBank connector
Models	PX1-I440-ADC, PX1-I440-ADC-420
Mechanical	
Dimensions	3.55 x 3.775 in. (90 x 96 mm)
Weight	0.1 oz (100 g)
PCB thickness	0.078 in. (1.98 mm)
Environmental	
Temperature	-40 to +85°C (-40 to +185°F)
Humidity (RH)	5% to 95% non-condensing
Mean time between failure (MTBF) [a]	760,641 hours, 86.83 years
RoHS compliant	Yes
Operating Systems	
Windows 10, Linux	

a. A MTBF measurement is based on a statistical sample and is not intended to predict any one specific unit's reliability; thus MTBF is not, and should not be construed as, a warranty measurement.

6. Configuration

This section describes the PX1-I440-ADC components and configuration.

6.1 Component Layout

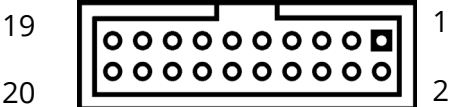| Item	Description	Reference
J2	ADC Input	page 8
J6	PCIe/104 One Bank Top Connector	page 9
J101	PCIe/104 One Bank Bottom Connector	page 10
JP1, JP2	Voltage Test jumpers	page 8

6.2   Connectors

6.2.1   J2 - ADC Input Header

The ADC Input header provides eight channels of analog to digital inputs as well as a a sample clock rate. This clock is free running, but does reset at the start of a conversion command.

Layout and Pin Reference

Pin	Name	Pin	Name
1	IN0_P	2	IN0_N
3	IN1_P	4	IN1_N
5	IN2_P	6	IN2_N
7	IN3_P	8	IN3_N
9	IN4_P	10	IN4_N
11	IN5_P	12	IN5_N
13	IN6_P	14	IN6_N
15	IN7_P	16	IN7_N
17	SYNC	18	GND
19	N.C.	20	GND

Connector

• TEKA Shrouded Right angle, 0.1" pitch SRC210C425M126-0

Matching Connector

• TE Connectivity 1658622-4, 0.1" pitch

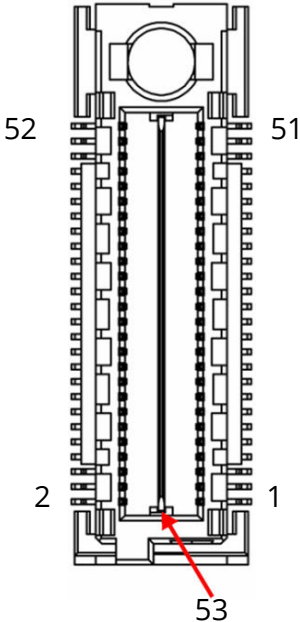### 6.2.2   JP1 and JP2 Voltage Test Jumpers

JP1 and JP2 are test jumpers that input on-board voltages to the ADC pins. This is to allow software testing to verify that the ADC and software are working as intended.

NOTE DO NOT provide ADC inputs on connectors J2 or J3 when using onboard jumpers at JP1 or JP2.

6.2.3 J6 - OneBank Top Connector

Purpose: OneBank expansion interface top connection to additional expansion modules.

Layout and Pin Reference

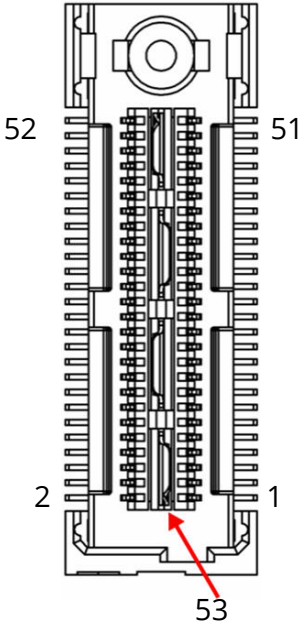| Diagram	Pin	Name	Pin	Name
	1	USB_0C#	2	PR_RST#
	3	3.3 V	4	3.3 V
	5	USB_1p	6	USB_0p
	7	USB_1n	8	USB_0n
	9	GND	10	GND
	11	PEx1_1Tp	12	PEx1_0Tp
	13	PEx1_1Tn	14	PEx1_0Tn
	15	GND	16	GND
	17	PEx1_2Tp	18	PEx1_3Tp
	19	PEx1_2Tn	20	PEx1_3Tn
	21	GND	22	GND
	23	PEx1_1Rp	24	PEx1_0Rp
	25	PEx1_1Rn	26	PEx1_0Rn
	27	GND	28	GND
	29	PEx1_2Rp	30	PEx1_3Rp
	31	PEx1_2Rn	32	PEx1_3Rn
	33	GND	34	GND
	35	PEx1_1CLKp	36	PEx1_0CLKp
	37	PEx1_1CLKn	38	PEx1_0CLKn
	39	+5 V_SB	40	+5 V_SB
	41	PEx1_2CLKp	42	PEx1_3CLKp
	43	PEx1_2CLKn	44	PEx1_3CLKn
	45	DIR	46	PWRGOOD
	47	SMB_DAT	48	RESERVED
	49	SMB_CLK	50	RESERVED
	51	SMB_ALERT	52	PSON#
	33	+5 V		

Connector

- Samtec ASP-129637-13

6.2.4   J101 - OneBank Bottom Connector

Purpose: OneBank expansion interface bottom connection to host computer.

Layout and Pin Reference

Diagram	Pin	Name	Pin	Name
	1	USB_0C#	2	PR_RST#
	3	3.3 V	4	3.3 V
	5	USB_1p	6	USB_0p
	7	USB_1n	8	USB_0n
	9	GND	10	GND
	11	PEx1_1Tp	12	PEx1_0Tp
	13	PEx1_1Tn	14	PEx1_0Tn
	15	GND	16	GND
	17	PEx1_2Tp	18	PEx1_3Tp
	19	PEx1_2Tn	20	PEx1_3Tn
	21	GND	22	GND
	23	PEx1_1Rp	24	PEx1_0Rp
	25	PEx1_1Rn	26	PEx1_0Rn
	27	GND	28	GND
	29	PEx1_2Rp	30	PEx1_3Rp
	31	PEx1_2Rn	32	PEx1_3Rn
	33	GND	34	GND
	35	PEx1_1CLKp	36	PEx1_0CLKp
	37	PEx1_1CLKn	38	PEx1_0CLKn
	39	+5 V_SB	40	+5 V_SB
	41	PEx1_2CLKp	42	PEx1_3CLKp
	43	PEx1_2CLKn	44	PEx1_3CLKn
	45	DIR	46	PWRGOOD
	47	SMB_DAT	48	RESERVED
	49	SMB_CLK	50	RESERVED
	51	SMB_ALERT	52	PSON#
	33	+5 V		

Connector

- Samtec ASP-129637-13

7.   Software Drivers

Go to www.winsystems.com for information on available software drivers.

Appendix A. Best Practices

The following paragraphs outline the best practices for operating the PX1-I440-ADC in a safe, effective manner, that does not damage the board. Read this section carefully.

Power Supply

Avoid Electrostatic Discharge (ESD)
Only handle the circuit board and other bare electronics when electrostatic discharge (ESD) protection is in place. Having a wrist strap and a fully grounded workstation is the minimum ESD protection required before the ESD seal on the product bag is broken.

Power Supply Budget

Evaluate your power supply budget. It is usually good practice to budget twice the typical power requirement for all of your devices.

Zero-load Power Supply

Use a zero-load power supply whenever possible. A zero-load power supply does not require a minimum power load to regulate. If a zero-load power supply is not appropriate for your application, then verify that the embedded system's typical load is not lower than the power supply's minimum load. If the embedded system does not draw enough power to meet the power supply's minimum load, then the power supply does not regulate properly and can cause damage to the PX1-I440-ADC.

Use Proper Power Connections (Voltage)
When verifying the voltage, measure it at the power connector on the PX1-I440-ADC. Measuring it at the power supply does not account for voltage drop through the wire and connectors.

The PX1-I440-ADC requires 5 V to operate. Verify the power connections. Incorrect voltages can cause catastrophic damage.

The PX1-I440-ADC accepts 5 V via the PCIe OneBank connector.

Power Harness

Minimize the length of the power harness. This reduces the amount of voltage drop between the power supply and the PX1-I440-ADC.

Gauge Wire

Use the largest gauge wire that you can. Most connector manufacturers have a maximum gauge wire they recommend for their pins.

Contact Points

WINSYSTEMS boards mostly use connectors with gold finish contacts. Gold finish contacts are used exclusively on high-speed connections. Power and lower speed peripheral connectors may use a tin finish as an alternative contact surface. It is critical that the contact material in the mating connectors is matched properly (gold to gold and tin to tin). Contact areas made with dissimilar metals can cause oxidation/corrosion, resulting in unreliable connections.

Pin Contacts

Often the pin contacts used in cabling are not given enough attention. The ideal choice for a pin contact would include a design similar to Molex or Trifurcon designs, which provide three distinct points to maximize the contact area and improve connection integrity in high shock and vibration applications.

Power Down

Make sure that power has been removed from the system before making or breaking any connections.

Power Supply OFF—Always turn off the power supply before connecting to the I/O Module. Do not hot-plug the PX1-I440-ADC on a host platform that is already powered.

I/O Connections OFF—Turn off all I/O connections before connecting them to the PX1-I440-ADC or any other I/O cards. Connecting hot signals can cause damage whether the embedded system is powered or not.

Mounting and Protecting the I/O Module

To avoid damage, mount the PX1-I440-ADC properly. Standoff kits are available and recommended for use with the PX1-I440-ADC.

Placing the PX1-I440-ADC on mounting standoffs—Be careful when placing the PX1-I440-ADC on the mounting standoffs. Sliding the board around until the standoffs are visible from the top can cause component damage on the bottom of the board.

Do not bend or flex the PX1-I440-ADC—Bending or flexing can cause irreparable damage. Embedded computer modules are especially sensitive to flexing or bending around ball grid array (BGA) devices. BGA devices are extremely rigid by design, and flexing or bending the embedded computer module can cause the BGA to tear away from the printed circuit board.

Mounting holes—The mounting holes are plated on the top, bottom, and through the barrel of the hole. The mounting holes are connected to the embedded computer module's ground plane.

- Never use a drill or any other tool in an attempt to make the holes larger.

- Never use screws with oversized heads. The head could come in contact with nearby components causing a short or physical damage.

- Never use self-tapping screws; they compromise the walls of the mounting hole.

- Never use oversized screws that cut into the walls of the mounting holes.

- Always use all of the mounting holes. By using all of the mounting holes, you provide the support the embedded computer module needs to prevent bending or flexing.

Plug or unplug connectors only on fully mounted boards—Never plug or unplug connectors on a board that is not fully mounted. Many of the connectors fit rather tightly and the force needed to plug or unplug them could cause the embedded computer module to be flexed.

Avoid cutting the PX1-I440-ADC—Never use star washers or any fastening hardware that cut into the PX1-I440-ADC.

Avoid over-tightening of mounting hardware—Causing the area around the mounting holes to compress could damage interlayer traces around the mounting holes.

Use appropriate tools—Always use tools that are appropriate for working with small hardware. Large tools can damage components around the mounting holes.

Avoid conductive surfaces—Never allow the embedded computer module to be placed on a conductive surface. Many embedded systems use a battery to back up the clock-calendar and CMOS memory. A conductive surface such as a metal bench can short the battery causing premature failure.

Adding PCIe104 One Bank to your Stack

Be careful when adding PCIe104 One Bank boards to your stack—Never allow the power to be turned on when a PCIe104 One Bank board has been improperly plugged onto the stack.

Conformal Coating

Applying conformal coating to a WINSYSTEMS product does not in itself void the product warranty, if it is properly removed prior to return. Coating can change thermal characteristics and impedes our ability to

test, diagnose, and repair products. Any coated product sent to WINSYSTEMS for repair will be returned at customer expense and no service will be performed.

Operations/Product Manuals

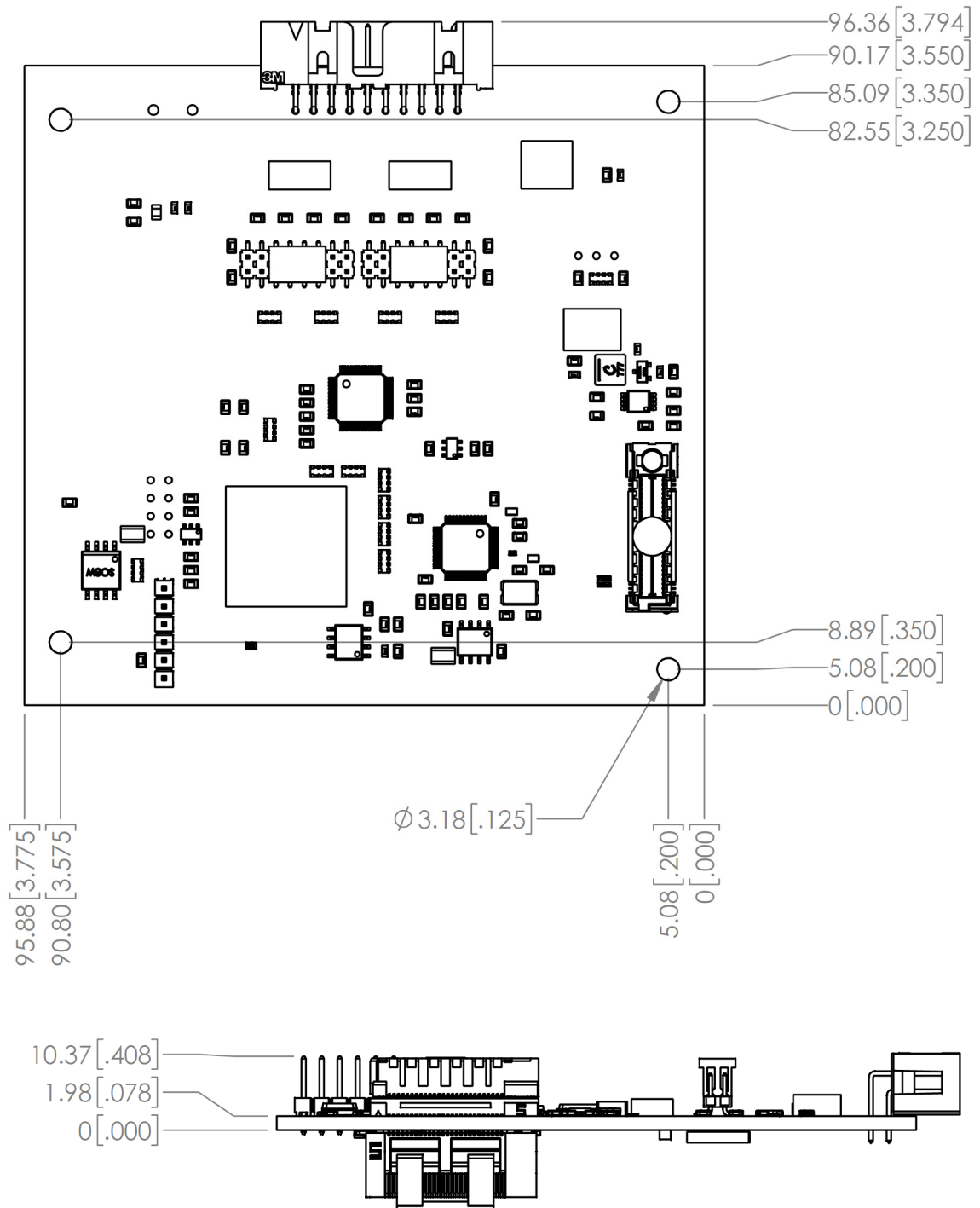Every WINSYSTEMS product has an Operations manual or Product manual.

Periodic updates—Operations/product manuals are updated often. Periodically check the WINSYSTEMS website (http://www.winsystems.com) for revisions.

Check pinouts—Always check the pinout and connector locations in the manual before plugging in a cable. Many I/O modules have identical headers for different functions and plugging a cable into the wrong header can have disastrous results.

Contact an Applications Engineer—If a diagram or chart in a manual does not seem to match your system, or if you have additional questions, contact a WINSYSTEMS Applications Engineer at +1-817-274-7553.

Appendix B. Mechanical Drawings

The mechanical drawings for the PX1-I440-ADC are shown below.

Appendix C. Warranty Information

WINSYSTEMS warrants that for a period of two (2) years from the date of shipment, any Products and Software purchased or licensed hereunder which have been developed or manufactured by WINSYSTEMS shall be free of any defects and shall perform substantially in accordance with WINSYSTEMS' specifications therefor. With respect to any Products or Software purchased or licensed hereunder which have been developed or manufactured by others, WINSYSTEMS shall transfer and assign to Customer any warranty of such manufacturer or developer held by WINSYSTEMS, provided that the warranty, if any, may be assigned. The sole obligation of WINSYSTEMS for any breach of warranty contained herein shall be, at its option, either (i) to repair or replace at its expense any materially defective Products or Software, or (ii) to take back such Products and Software and refund the Customer the purchase price and any license fees paid for the same. Customer shall pay all freight, duty, broker's fees, insurance, charges and other fees and charges for the return of any Products or Software to WINSYSTEMS under this warranty. WINSYSTEMS shall pay freight and insurance charges for any repaired or replaced Products or Software thereafter delivered to Customer within the United States. All fees and costs for shipment outside of the United States shall be paid by Customer. The foregoing warranty shall not apply to any Products or Software which have been subject to abuse, misuse, vandalism, accident, alteration, neglect, unauthorized repair or improper installation.

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Warranty Service

1. To obtain service under this warranty, obtain a return authorization number. In the United States, contact the WINSYSTEMS Service Center for a return authorization number. Outside the United States, contact your local sales agent for a return authorization number.
2. You must send the product postage prepaid and insured. You must enclose the products in an anti-static bag to protect from damage by static electricity. WINSYSTEMS is not responsible for damage to the product due to static electricity.