PCIe-833x Series

PCIe-8332/PCIe-8334/PCIe-8338

PCIe EtherCAT
Master Motion Controller

User's Manual

Manual Rev.: 1.1

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Leading EDGE COMPUTING

Revision History

Revision	Release Date	Description of Change(s)
1.0	Apr. 10, 2019	Initial Release
1.1	May 28, 2019	Errata resolved

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Preface

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Conventions

Take note of the following conventions used throughout this manual to make sure that users perform certain tasks and instructions properly.



Additional information, aids, and tips that help users perform tasks.



Information to prevent ***minor*** physical injury, component damage, data loss, and/or program corruption when trying to complete a task.



Information to prevent ***serious*** physical injury, component damage, data loss, and/or program corruption when trying to complete a specific task.

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1 Introduction

ADLINK's PCIe-833x Series is a fully in-house developed ARM-based EtherCAT motion controller, supporting up to 64 synchronized axes and over 10,000 points simultaneously. The PCIe-833x Series features dedicated isolated emergency stop input (EMG), and configurable isolated high-speed digital input as not only generic sensor input but also pulse input with up to 1MHz input frequency. Maximum jitter performance is provided in the minimal cycle of 250μs to improve motion and I/O synchronous control in vertical automation applications such as semiconductor, electrical manufacturing systems, and others.

The PCIe-833x Series provides an out-of-shell application-ready function library (APS Function Library) to support multi-dimensional, highly synchronized, time-deterministic event triggering motion & I/O control. The broad AVL of EtherCAT 3rd party slaves enhances user design with ADLINK APS function library with flexible implementation in preferred 3rd party slaves. ADLINK's MotionCreatorPro 2™ motion control utility is fully supported in Microsoft® Windows™ environments, allowing users to complete motion, EtherCAT, and I/O configuration and function evaluation.

The PCIe-833x Series, as shown, uses one digital signal processor (ARM) from Xilinx SoC as its main computing unit and integrates high speed large volume Field Programmable Gate

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Array (FPGA) to provide high speed pulsar input, emergency stop input (EMG) as well as 2/4 digital input and digital output.a

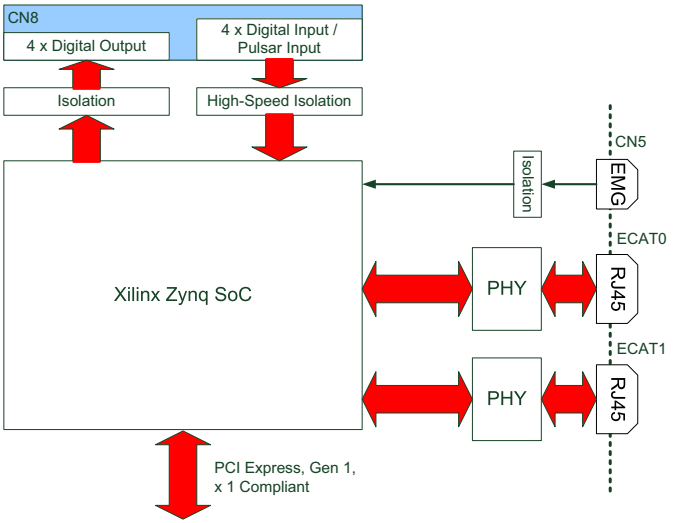


Figure 1-1: PCIe-833x Series Block Diagram

MotionCreatorPro 2™

Graphical motion control interface enables Windows-based motion control software development for EtherCAT configuration, motion control, and I/O status monitoring. Allows completioon of hardware installation and wiring in real-time signal feedback as well as step-by-step single-axis manipulation, saving development time and cost.

Windows Programming Libraries

A Windows coding environment supporting Microsoft C#, Microsoft .NET framework based VB.NET, VC, NET and Visual Studio C++ 6.0. Sample programs are provided.

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EtherCAT Topology

EtherCAT supports virtually all conncetivity topologies, inculding line, tree, star, and daisy-chain, making pure bus or line topology with hundreds of nodes possible, with none of the limitations that normally arise from cascading switches or hubs.

In system connection, the combination of lines with branches or drop lines is beneficial, since the ports necessary to create branches are directly integrated in multiple I/O modules, requiring no additional switches or active infrastructure components.

Additional flexibility is enabled for supported cable types. Inexpensive industrial Ethernet cable can be used between two nodes up to 100m apart in 100BASE-TX mode. The Power over EtherCAT option (compatible with IEEE 802.3af) enables connection of devices such as sensors with a single line. Fiber optics (such as 100BASE-FX) can also be used, for example for a node distance exceeding 100 m.

Up to 65,535 devices can be connected to EtherCAT, making network expansion is virtually unlimited, while normal Ethernet arbitrary changes between physical layers are allowed.

1.1 Features

- PCI Express® x 1 compliant
- Motion control of 16/32/64 axes & 10,000 I/O points via EtherCAT
- EtherCAT cycle time up to 250μs
- Broad AVL of EtherCAT slaves
- Point-table functions for contouring applications
- Support for up to 16D linear interpolations, 3D circular and 3D spiral interpolation
- Switchable card ID

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1.2 Specifications

	PCIe-8332	PCIe-8334	PCIe-8338
System			
Axes supported (max.)	16	32	64
Processor	Xilinx Zynq SoC		
Memory	128MB DDR x 2		
EtherCAT Communication			
EtherCAT Master Cycle Time	250/500/1000/2000/4000µs (configurable)		
Communication Fault Detection	Yes		
Max. I/O Points	10,000		
I/O Interface			
Digital Output Channel	4		
Digital Output Type	Sinking		
Digital Output Voltage	24Vdc ±10%		
Digital Output Current	90mA		
Digital Output Isolation Voltage	2500Vrms		
Digital Input Channel	4 (2CH can be configured as Pulsar Input)		
Digital Input Type	Sourcing		
Digital Input Voltage	24Vdc ±10%		
Digital Input Current	50mA for DI0, DI1 15mA for DI2, DI3 (Pulse)		
Digital Input Isolation Voltage	2500Vrms		
Pulsar Input Frequency	1MHz		
Pulsar Input Mode	CW/CCW; 1x/2x/4x AB phase		
EMG (Emergency Stop) Input	Yes		
EMG Input Type	COM		
EMG Input Voltage	24Vdc ±10%		
EMG Input Current	50mA		
Power Consumption			
Slot power supply (input)	+12 VDC ±5%, 500 mA (max)		

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	PCIe-8332	PCIe-8334	PCIe-8338
Physical/Environmental			
Dimensions	100.36 mm x 151.90 mm (H x L)		
Operating Temperature	0˚C to 50˚C		
Storage Temperature	-20°C to 80°C		
Humidity	5% to 85% (non-condensing)		
Safety	EN 55022/24, CLASS B		
Motion			
Speed Profile Planning	Trapezoidal curve and S-curve		
Point-to-Point Move	Yes		
Linear Interpolation	2-16		
Circular Interpolation	16	32	64
Spiral Interpolation	16	32	64
Helical Interpolation	16	32	64
Home Return	User customization (Refer to zero-position, limit switch, EZ signals from Servo Drive)		
Continuous Motion			
Point Table	2x50 path length buffer for advance point table (64/32/16)x100 path length buffer for PT/PVT point table		
Advanced Motion			
Gantry	3 synchronous sets		
EGearing	3 synchronous sets		
Interrupt	Motion status event / error alarm / in position / emergency stop		
Diagnostic	Profile Sampling		
	Motion Status		
	Motion I/O Status		
	Watch Dog Timer (WDT)		

NOTE:

Due to limitations in microprocessor power, the maximum number of EPS-7002 cards accommodated in one EPS-9905 chassis is 2.

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1.3 Supported Software

OS/Programming Library

The PCIe-833x Series supports Windows 10 64/32-bit OS and provides DLL files for easy application development by users.

APS Functions

The PCIe-833x Series is fully compliant with the APS (Automation Product Software) function library, independent of programming languages and operating systems (OS). A complete detailed listing of functions can be found in the APS Function Library User Manual.

MotionCreatorPro 2

MotionCreatorPro 2™ is a user interface exclusively developed for ADLINK motion control products in a standard Windows environment. It provides easy card and axis parameter setup, and a Setup Wizard guides users through hardware installation and wiring as well as single-axis manipulation in minutes. MotionCreatorPro 2™ not only effectively reduces development time but also enables concurrent validation of overall mechanism and electric design with all single axis and interpolation motion operation pages.

For more information, please see the ADLINK document MotionCreatorPro 2 User's Manual.

1.4 Available Terminal Board

ADLINK's optional DIN-37D terminal board (P/N 91-14025-1020) for the PCIe-833x Series provides DI/O I/O connectability, via ADLINK cable ACL-10137-1MM, with generic application sensors and actuators.

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1.5 Exterior Profile

NOTE:

All dimensions shown are in millimeters (mm) unless otherwise stated.

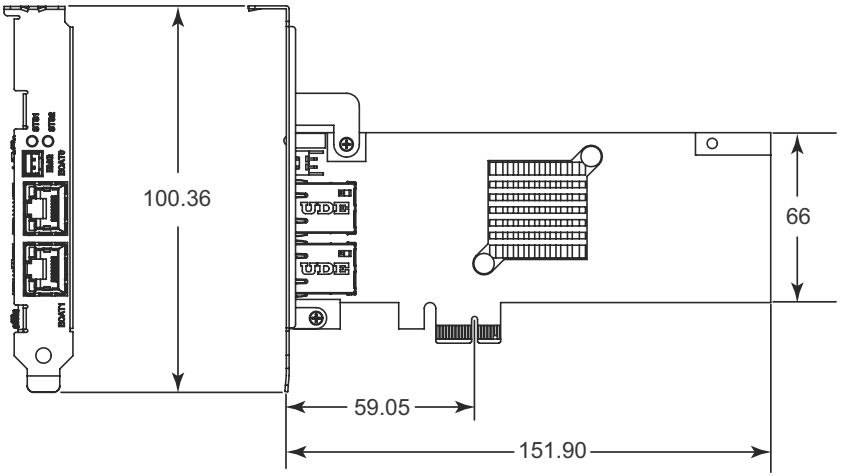


Figure 1-2: PCB Layout

NOTE:

SW5 Card ID switch is located on the PCB rear side and is thus not shown in the Figure

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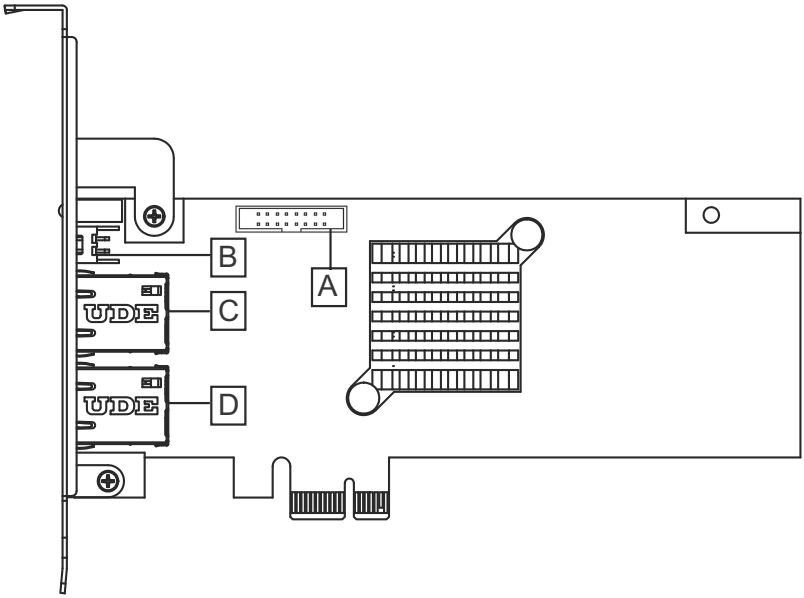


Figure 1-3: PCB Connectors

	Location	Connector	Details
A	CN8	16-pin Box Header	8CH isolated digital I/O
B	EMG (CN5)	2-pin	Emergency stop signal input
C	ECAT0	RJ45	Basic EtherCAT communication
D	ECAT1	RJ45	Advanced EtherCAT communication
(not shown)	SW5	DIP switch	Card ID setup (0 to 15)

Table 1-1: PCB Connector Legend

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1.5.1 I/O Indicators

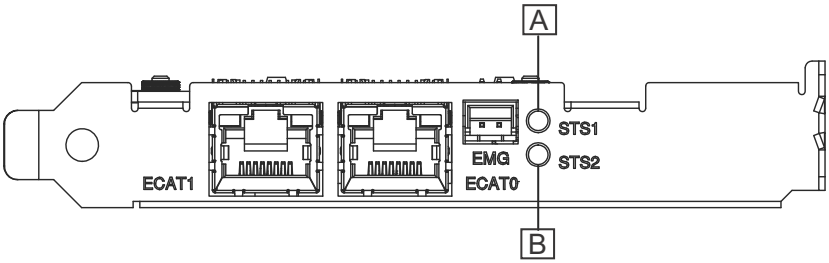


Figure 1-4: I/O Indicators

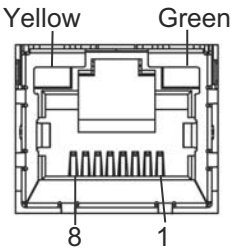
	Indicator	Color	Function
A	STS1	Green	Lit when SoftMotion™ initializes
B	STS2	Red	Lit when emergency occurs

Table 1-2: I/O Indicator Legend

1.6 I/O Connectors

1.6.1 EtherCAT Connector

ECAT0 & ECAT1 (reserved)



Pin	Signal
1	TX+

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Pin	Signal
2	TX-
3	RX+
4	NC
5	NC
6	RX-
7	NC
8	NC

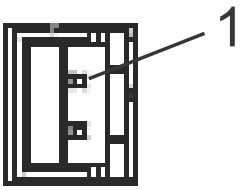
Table 1-3: EtherCAT Connector Pin Assignments

	Function	Display	Indication
Yellow	Activity	Unlit	No Activity
		Flashing	Activity
Green	Link	Unlit	OFF
		Lit	ON

Table 1-4: EtherCAT Connector LED Legend

1.6.2 EMG Connector

CN5



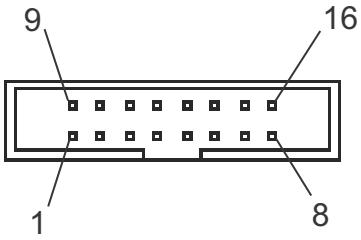
Pin	Name	Function
1	COM	Common ground or power
2	EMG	Emergency signal

Table 1-5: EMG Connector Pin Assignments

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1.6.3 DI/O Connector

CN8: General Digital Output and Digital Input (/Pulsar Input)



Pin	Name	I/O	Function
1	E24V_	--	Isolation power Input, +24V
2	EGND_	--	Ext. power ground
3	DI0	I	Digital Input 0
4	DI1	I	Digital Input 1
5	PA_5V	I	5V Pulser A signal input
6	PB_5V	I	5V Pulser B signal input
7	DI2/PCOM_5V	I/--	Digital Input 2/ Pulser common
8	DI3/PCOM_5V	I/--	Digital Input 3/ Pulser common
9	EGND_	--	Ext. power ground
10	DO0	O	Digital Output 0
11	DO1	O	Digital Output 1
12	DO2	O	Digital Output 2
13	DO3	O	Digital Output 3
14	DICOM1	--	Isolation power Input, +24V
15	DICOM2	--	Isolation power Input, +24V
16	EGND_	--	Ext. power ground

Table 1-6: DI/O Connector Pin Assignments

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2 Getting Started

2.1 Package Contents

The package includes the following items:

- PCIe-833x Series card
- IDE 16p – DSUB 37p flat cable
- Product warranty card


NOTE:

The terminal board is an optional accessory and is not included in the PCIe-833x Series package.

If any of these items are missing or damaged, contact the dealer. Save the shipping materials and carton to ship or store the product in the future.

2.2 PCIe-833x Series Hardware Installation

Hardware Configuration

The PCIe-833x Series employs PCI Express Gen 2, the x1 Bus System BIOS can autoconfigure memory and IRQ channel. The terminal board DIN-37D provides connection to various sensors, actuators, and pulsar devices through the extension cable.

PCIe Slot Selection

The PCIe-833x Series can be installed in any PCIe slot.

Installation Procedures

1. Please read this manual carefully and set up the signal I/O in the proper mode.
2. Turn off power to the computer and all relevant terminal boards, and install the PCIe-833x Series in any available PCIe x1/x4/x8 slot. The slot is normally black. Ensure

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that proper ESD (electrostatic discharge) protection measures are in place.

3. Connect the DIN-37D terminal board to the PCIe-833x Series (if applicable) with DSUB 37p cable.
4. Connect the EtherCAT type servo drive and I/O with Ethernet cables (CAT5e is recommended).
5. Set up the servo or stepper drive with physical limit switch, zero-positioning, and any essential drive signals.
6. Turn on system power including computer power, relevant terminal board power, and 24VDC power.
7. Configure EtherCAT communication parameters via MotionCreatorPro 2™ and 3rd party utility as needed.
8. Verify all I/O signals and servo operations via MotionCreatorPro 2™.



- Please ground the shielding end of the power terminal to reduce risk of electric shock and ensure product operation of electric appliances.
- Please disconnect the motor drive from its load before using the card for the first time. Do not connect the motor drive to any mechanical devices before completion of the installation and fine tuning of the control system. Connect the system only after the board is adjusted and the drive parameters can control the motor.

Troubleshooting:

If the computer fails to power up normally or the motion control system operates abnormally after system installation, follow the steps listed for troubleshooting. If the problem persists, please contact your dealer for technical services.

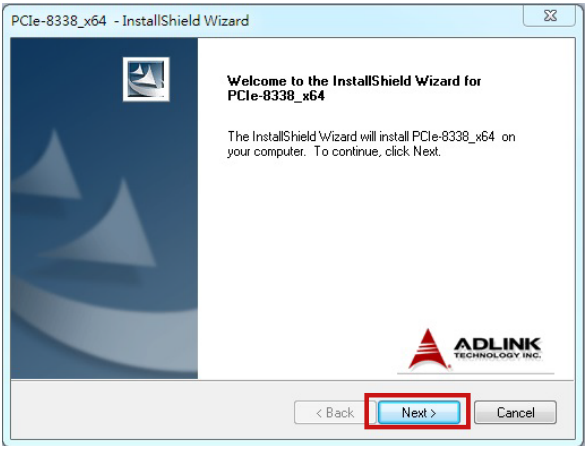
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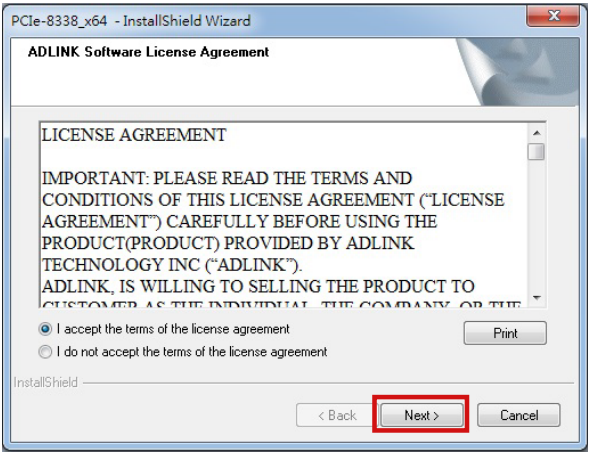
Problem	Possible Solve
The card does not appear in Windows Device Manager after its driver has been installed	Turn off the computer and ensure the card is properly mounted in the PCIe slot; ensure the driver is properly installed in Windows Control Panel's **Add/remove programs**
MotionCreatorPro 2™ will not launch after driver installation.	Ensure .NET framework v3.5 or later has been installed.
The No Signal indicator in MotionCreatorPro 2™ appears after the motor is connected and the motor will not function	Ensure 24VDC power is provided, Ethernet cable connection is in place among EtherCAT devices, and that physical servo I/O signals are connected properly
EtherCAT slaves (incl. servo/ stepper drive or I/O) in MotionCreatorPro 2™ will not connect	Ensure all Ethernet cables connect all EtherCAT slave devices properly and every slave device is turned on for connection. The CAT5e cable is recommended for best impedance matching.
When using the MotionCreatorPro2™ all the control indicators of the drive light correctly but the drive warns	Ensure correctness of the axis parameter setup, alarm logic (ALM), and the EMG loop configuration
Value of output command differs from the encoder feedback value.	Ensure feedback signal (CW/CCW, 1xAB, 2xAB, 4xAB) settings comply with that of the drive
During motion control, the motor only moves in one direction rather than two	Ensure signal patterns (CW/CCW, OUT/ DIR) comply with that of the motor drive

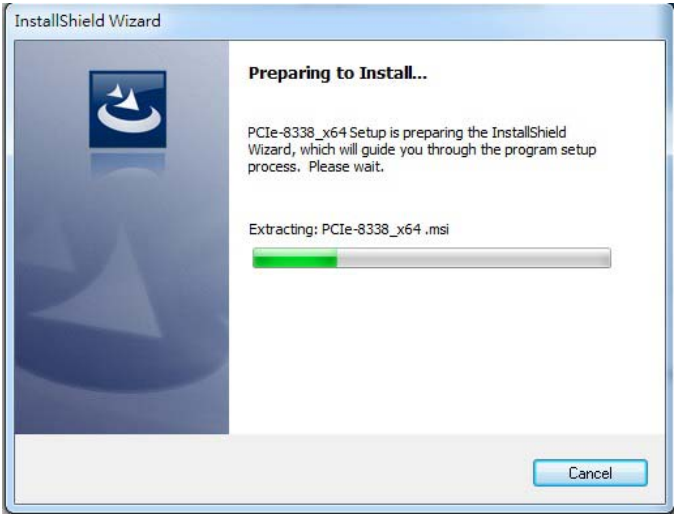
2.3 Software Driver Installation

1. Download the PCIe-833x Series WDM file from ADLINK and run. Installation executes automatically.
2. Select Next as prompted to complete installation.

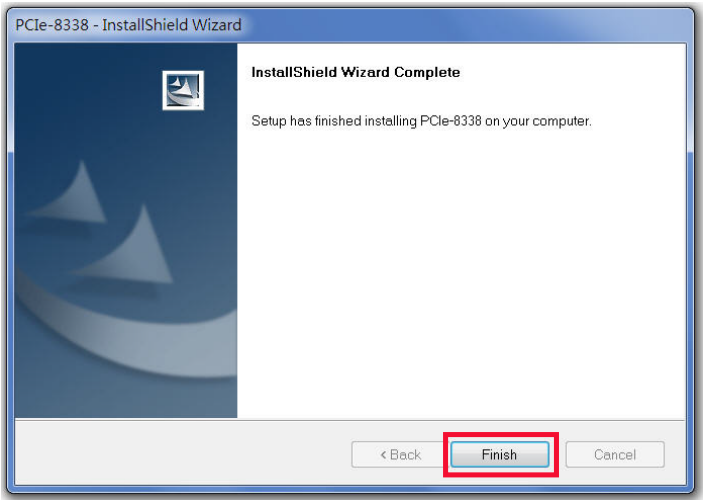
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PCIe-8338_x64 - InstallShield Wizard
Welcome to the InstallShield Wizard for PCIe-8338_x64
The InstallShield Wizard will install PCIe-8338_x64 on your computer. To continue, click Next.
ADLINK TECHNOLOGY INC.
< Back
Next >
Cancel


PCIe-8338_x64 - InstallShield Wizard
ADLINK Software License Agreement
LICENSE AGREEMENT
IMPORTANT: PLEASE READ THE TERMS AND CONDITIONS OF THIS LICENSE AGREEMENT ("LICENSE AGREEMENT") CAREFULLY BEFORE USING THE PRODUCT(PRODUCT) PROVIDED BY ADLINK TECHNOLOGY INC ("ADLINK").
ADLINK, IS WILLING TO SELLING THE PRODUCT TO
I accept the terms of the license agreement
I do not accept the terms of the license agreement
Print
InstallShield
< Back
Next >
Cancel



3. After installation is complete, select Finish.



4. Ensure the Windows Device Manager lists the PCIe-833x Series correctly.
5. Restart the computer now, or later, as desired.

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NOTE:

Please download the latest installation software from ADLINK's official website to maintain an optimum operating environment.
http://www.adlinktech.com/Motion-Control/index.php

2.4 SW5 Card Index Selection

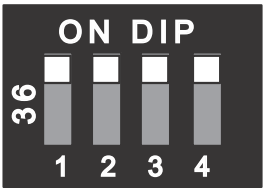


Figure 2-1: SW5 Switch

The SW5 switch is used to set the card index. For example, if the switch is set to 1-0-0-0 (ON-OFF-OFF-OFF), card ID is 1. The index value can be from 0 to 15. Details are as follows.

Card ID	Switch Setting (ON=1)
0	0000
1	1000
2	0100
3	1100
4	0010
5	1010
6	0110
7	1110
8	0001
9	1001
10	0101
11	1101
12	0011
13	1011

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Card ID	Switch Setting (ON=1)
14	0111
15	1111

Table 2-1: SW5 Card Index

2.5 IDE 16p to DSUB 37p Bus

An IDE cable connecting IDE 16-pin to DSUB 37-pin, it allows the PCIe-833x Series to support Px extension 4CH digital input and 4CH digital output.

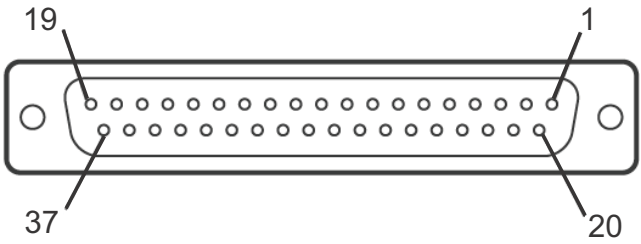


Figure 2-2: DSUB 37-pin Connector

Pin	Name	Pin	Name
1	N/A	20	N/A
2	N/A	21	N/A
3	N/A	22	N/A
4	N/A	23	N/A
5	N/A	24	N/A
6	E24V_	25	EGND
7	EGND	26	DO0
8	DI0	27	DO1
9	DI1	28	DO2
10	PA_5V	29	DO3
11	PB_5V	30	DICOM1
12	DI2/PCOM_5V	31	DICOM2

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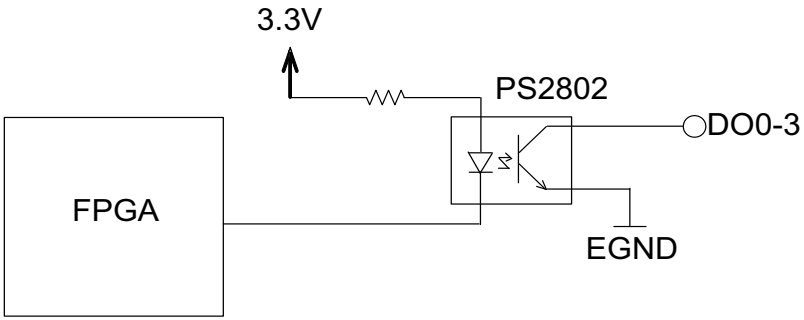
Pin	Name	Pin	Name
13	DI3/PCOM_5V	32	EGND
14	N/A	33	N/A
15	N/A	34	N/A
16	N/A	35	N/A
17	N/A	36	N/A
18	N/A	37	N/A
19	N/A		

Table 2-2: DSUB 37-pin Connector Pin Assignments

2.6 Signal Connection

2.6.1 General Digital Output

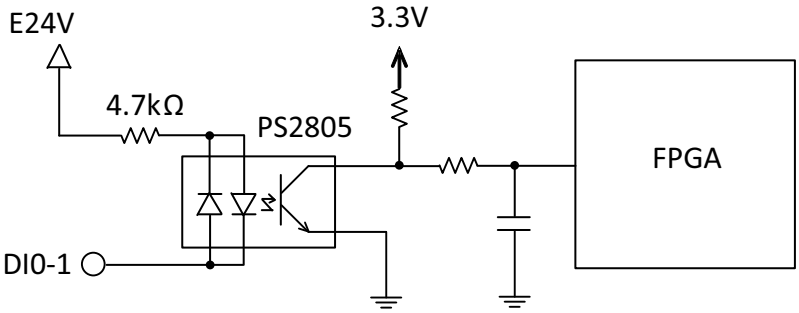
PCIe-833x Series provides 4 isolated digital output channels to connect 24VDC actuators such as electronic vacuums, valves and others. Sample signal wiring is shown.



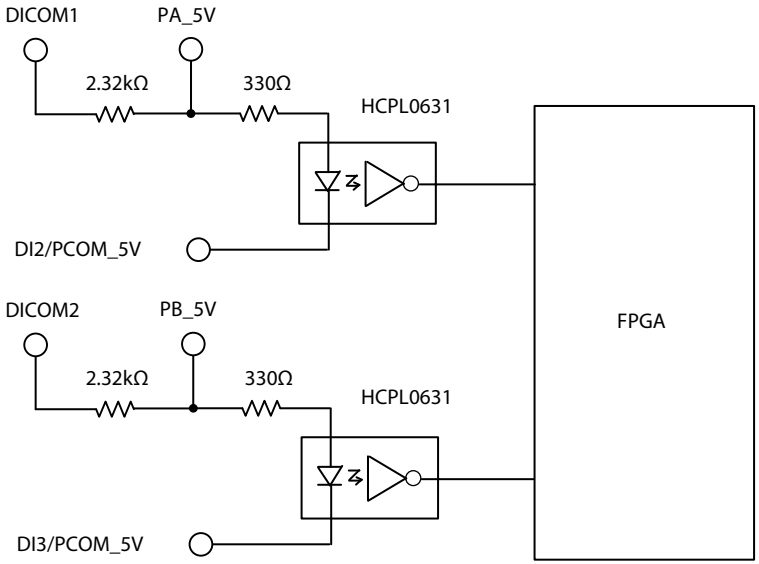
2.6.2 General Digital Input & Pulsar Input

The PCIe-833x Series provides 4 isolated digital input channels to connect 24VDC sensors, in which the first two channels are configured for pulsar input. An example signal wiring is shown.

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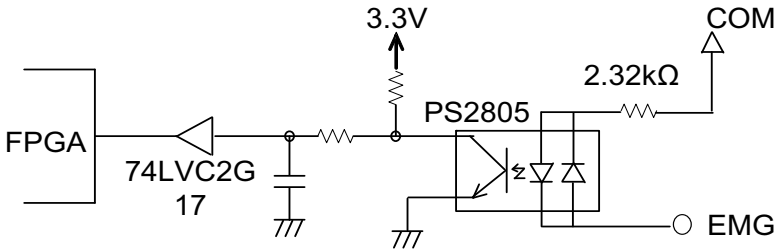
Connection of a pulsar device with 5V power supply (if selected) is shown. The pulsar input frequency supports up to 1MHz in variant input modes that include CW/CCW mode and 1x/2x/4x AB phase modes.



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2.6.3 Emergency Stop Input (EMG)

The EMG signal identifies emergency stop input occurrence results in all motion functions forced to stop, while EtherCAT communication is retained for status monitoring.



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Important Safety Instructions

For user safety, please read and follow all instructions, Warnings, Cautions, and Notes marked in this manual and on the associated device before handling/operating the device, to avoid injury or damage.

S'il vous plaît prêter attention stricte à tous les avertissements et mises en garde figurant sur l'appareil , pour éviter des blessures ou des dommages.

- Read these safety instructions carefully
- Keep the User's Manual for future reference
- Read the Specifications section of this manual for detailed information on the recommended operating environment
- The device can be operated at an ambient temperature of 50ºC
- When installing/mounting or uninstalling/removing device; or when removal of a chassis cover is required for user servicing (See "Getting Started" on page 13.):
  - Turn off power and unplug any power cords/cables
  - Reinstall all chassis covers before restoring power
- To avoid electrical shock and/or damage to device:
  - Keep device away from water or liquid sources
  - Keep device away from high heat or humidity
  - Keep device properly ventilated (do not block or cover ventilation openings)
  - Always use recommended voltage and power source settings
  - Always install and operate device near an easily accessible electrical outlet
  - Secure the power cord (do not place any object on/over the power cord)
  - Only install/attach and operate device on stable surfaces and/or recommended mountings
- If the device will not be used for long periods of time, turn off and unplug from its power source

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- Never attempt to repair the device, which should only be serviced by qualified technical personnel using suitable tools
- A Lithium-type battery may be provided for uninterrupted backup or emergency power.



Risk of explosion if battery is replaced with one of an incorrect type; please dispose of used batteries appropriately.
Risque d'explosion si la pile est remplacée par une autre de type incorrect. Veuillez jeter les piles usagées de façon appropriée.

- The device must be serviced by authorized technicians when:
  - The power cord or plug is damaged
  - Liquid has entered the device interior
  - The device has been exposed to high humidity and/or moisture
  - The device is not functioning or does not function according to the User's Manual
  - The device has been dropped and/or damaged and/or shows obvious signs of breakage
- Disconnect the power supply cord before loosening the thumbscrews and always fasten the thumbscrews with a screwdriver before starting the system up
- It is recommended that the device be installed only in a server room or computer room where access is:
  - Restricted to qualified service personnel or users familiar with restrictions applied to the location, reasons therefor, and any precautions required
  - Only afforded by the use of a tool or lock and key, or other means of security, and controlled by the authority responsible for the location

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	**BURN HAZARD** Touching this surface could result in bodily injury. To reduce risk, allow the surface to cool before touching. ***RISQUE DE BRÛLURES*** *Ne touchez pas cette surface, cela pourrait entraîner des blessures.* *Pour éviter tout danger, laissez la surface refroidir avant de la toucher.*

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Getting Service

Ask an Expert: http://askanexpert.adlinktech.com

ADLINK Technology, Inc.
9F, No.166 Jian Yi Road, Zhonghe District
New Taipei City 235, Taiwan
Tel: +886-2-8226-5877
Fax: +886-2-8226-5717
Email: service@adlinktech.com

Ampro ADLINK Technology, Inc.
5215 Hellyer Avenue, #110
San Jose, CA 95138, USA
Tel: +1-408-360-0200
Toll Free: +1-800-966-5200 (USA only)
Fax: +1-408-360-0222
Email: info@adlinktech.com

ADLINK Technology (China) Co., Ltd.
300 Fang Chun Rd., Zhangjiang Hi-Tech Park
Pudong New Area, Shanghai, 201203 China
Tel: +86-21-5132-8988
Fax: +86-21-5132-3588
Email: market@adlinktech.com

LiPPERT ADLINK Technology GmbH
Hans-Thoma-Strasse 11
D-68163 Mannheim, Germany
Tel: +49-621-43214-0
Fax: +49-621 43214-30
Email: emea@adlinktech.com

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