PCI-1220U

**2-axis Universal PCI Stepping/
Pulse-type Servo Motor Control
Card**

User Manual

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CE notification

The PCI-1220U, developed by ADVANTECH CO., LTD., has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

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Product Warranty (2 years)

Advantech warrants to you, 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 which have been repaired or altered by persons other than repair personnel authorized by Advantech, or which 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.

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If you think you have a defective product, follow these steps:

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 you get 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 an RMA (return merchandize authorization) number from your dealer. This allows us to process your return more quickly.

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

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

Technical Support and Assistance

Step 1. Visit the Advantech web site at **www.advantech.com/support** where you can find the latest information about the product.

Step 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 you call:
- 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

Packing List

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

• PCI-1220U

• Companion CD-ROM (DLL driver included)

• User Manual

Safety Precaution - Static Electricity

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

1. To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.

2. Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

Contents

Introduction

This chapter introduces PCI-1220U and lists features and specifications.

Chapter 1 Introduction

PCI-1220U 2-axis Stepping/Pulse-type Servo Motor Control Card is designed for general-purpose motion applications. The card simplifies stepping and pulse-type servo motor control.

The cards' intelligent NOVA MCX312 motion ASIC builds in a variety of motion control functions, such as 2-axis linear interpolation, 2-axis circular interpolation, T/S-curve acceleration/deceleration rate and more.

PCI-1220U performs motion control functions without processor load during driving. For advanced applications, we supply Windows DLL drivers and user-friendly examples to decrease your programming load. Moreover, through a free bundled motion utility, you can complete configuration and diagnosis easily.

1.1 Features

PCI-1220U provides users with the most requested motor control functions as seen below:

- Independent 2-axis motion control
- Support hand wheel and jog function
- 2-axis linear interpolation function
- 2-axis circular interpolation function
- Continuous interpolation function
- Programmable T/S-curve acceleration and deceleration
- Up to 4MPPS pulse output for each axis
- Two pulse output types: Up/Down or Pulse/Direction
- Up to 1 MHz encoder input for each axis
- Two encoder pulse input types: A/B phase or Up/Down
- Position management and software limit switch function
- BoardID Switch
- Free Motion Utility bundled for configuration and diagnosis
- "Go home" functions
- Universal PCI Bus for both 3.3 and 5 V PCI slots

The Advantech PCI-1220U offers the following main features:

Individual Control for 2 Axes

Each of the axes has identical capabilities, and is controlled by the same method of operation with constant speed, trapezoidal or S-curve driving.

Programmable T/S-curve Acceleration and Deceleration

Each of four axes can be preset individually with S-curve or trapezoidal acceleration/deceleration rates. When using S-curve acceleration to control driving speed, output pulse is generated in parabolic-shaped acceleration or deceleration curves, and the triangular curve phenomenon will not occur through the NOVA MCX-312-motion ASIC design concept.

Linear and Circular Interpolation

Two axes can be used to execute linear interpolation driving and circular arc interpolation control. The interpolation speed range is from 1 PPS to 4 MPPS.

Powerful Position Management Function

Each axis is equipped with a 32-bit logical position counter and a 32-bit real position counter. The logical position counter counts the axis' pulse output number and the real position counter is recorded with the feedback pulse from the outside encoder or linear scale.

Speed Control

The speed range of the pulse output is from 1PPS to 4MPPS for constant speed, trapezoidal or S-curve acceleration/deceleration driving. The accuracy of the frequency of the pulse output is less than +/- 0.1% (at CLK=16 MHz). The speed of driving pulse output can be freely changed during the driving.

Continuous Interpolation

Different interpolation methods can be used continuously, for example: Linear interpolation→Circular interpolation→Linear interpolation.

The maximum driving speed of performing continuous interpolation is 2 MPPS.

Constant Vector Speed Control

This function performs a constant vector speed. During the interpolation driving, MCX312 can set a 1.414 times pulse cycle for 2-axis simultaneous pulse output that keeps constant speed during driving.

Compare Register and Software Limit

Each axis has two 32-bit compare registers for logical position counter and real position counter. The comparison result can be read from the status registers. The comparison result can be notified by an interrupt signal. These registers can be also functioned as software limits.

Driving by External Signal

It is possible to control each axis by external signals. The +/- direction fixed pulse driving and continuous driving can be also performed through the external signals. This function is used for JOG or teaching modes, and will share the CPU load.

Input/ Output Signal

Each axis has 2 points of general input signals. Besides, there are ORG and EZ signals for high-speed near-by home search, home search and z-phase search during the home returning. Each axis is with 4 output points for general output.

Servo Motor Feedback Signals

Each axis includes input pins for servo feedback signals such as in-positioning, close loop positioning control and servo alarm.

Interrupt Signals

Interrupt signals can be generated when: (1) the start/finish of a constant speed drive during the trapezoidal driving, (2) the end of driving, and (3) the compare result higher/lower the border-lines of the position counter. An interrupt signal can be also generated during the interpolation driving.

Real Time Monitoring

During the driving, the present status such as logical position, real position, drive speed, acceleration / deceleration, status of accelerating / decelerating and constant driving can be read.

1.2 Applications

- Precise X-Y position control
- Precise rotation control
- Packaging and assembly equipment
- Machine control with up to 2 axes
- Semiconductor pick and place and testing equipment
- Other stepping/pulse-type servo motor applications

1.3 Installation Guide

Before you install your PCI-1220U card, please make sure you have the following necessary components:

- PCI-1220U Motion Card
- PCI-1220U Startup Manual
- Driver Software
  Advantech PCI-1220U DLL drivers (Included in the CD-ROM)
- Motion Utility
  Advantech PCI-1220U Motion Utility (Included in the CD-ROM)
- Personal computer or workstation with a PCI-bus slot

After you have got the necessary components and maybe some accessories for enhanced operation of your Motion card, you can then begin the installation procedure.

1.4 Accessories

Advantech offers a complete set of accessory products to support the PCI-1220U card. These accessories include:

Wiring Cable

• PCL-10152   The PCL-10152 shielded cable is specially designed for PCI-1220U card to provide higher resistance to noise. To achieve a better signal quality, the signal wires are twisted in such away as to form a "twisted-pair cable", reducing cross talk and noise from other signal sources.

Wiring Boards

• ADAM-3952   The ADAM-3952 is a 50-pin SCSI wiring terminal module for DIN-rail mounting. This terminal module can allow easy yet reliable access to individual pin connections for the PCI-1220U card.

Installation

This chapter gives users a package item checklist, proper instructions about unpacking and step-by-step procedures for both driver and card installation.

Chapter 2 Installation

2.1 Unpacking

After receiving your PCI-1220U package, please inspect its contents first. The package should contain the following items:

• PCI-1220U Card

• Companion CD-ROM (DLL driver included)

• User Manual

The PCI-1220U card harbors certain electronic components vulnerable to electrostatic discharge (ESD). ESD could easily damage the integrated circuits and certain components if preventive measures are not carefully paid attention to.

Before removing the card from the antistatic plastic bag, you should take following precautions to ward off possible ESD damage:

• Touch the metal part of your computer chassis with your hand to dis-charge static electricity accumulated on your body. Or one can also use a grounding strap.

• Touch the antistatic bag to a metal part of your computer chassis before opening the bag.

• Take hold of the card only by the metal bracket when removing it out of the bag.

After taking out the card, you should first:

• Inspect the card for any possible signs of external damage (loose or damaged components, etc.). If the card is visibly damaged, please notify our service department or the local sales representative immedi-ately. Avoid installing a damaged card into your system.

Also pay extra caution to the following to ensure proper installation:

• Avoid physical contact with materials that could hold static electricity such as plastic, vinyl and Styrofoam.

• Whenever you handle the card, grasp it only by its edges. DO NOT TOUCH the exposed metal pins of the connector or the electronic com-ponents.

2.2 Driver Installation

We recommend you install the software driver before installing the PCI-1220U module, since this will guarantee a smooth installation process.

The 32-bit DLL driver Setup program for the PCI-1220U module is included on the companion CD-ROM that is shipped with your module package.

For further information on driver-related issues, an online version of the Device Drivers Manual is available by accessing the following path:

Start\Programs\Advantech Automation \Device Manager\Device Driver's Manual

2.3 Installation Instructions

The PCI-1220U can be installed in any PCI slot in the computer. However, refer to the computer user's manual to avoid any mistakes and danger before you follow the installation procedure below:

1. Turn off your computer and any accessories connected to the computer.

   Warning!TURN OFF your computer power supply whenever you install or remove any card, or connect and disconnect cables.

2. Disconnect the power cord and any other cables from the back of the computer.

3. Remove the cover of the computer.

4. Select an empty +3.3/+5V PCI slot. Remove the screw that secures the expansion slot cover to the system unit. Save the screw to secure the interface card retaining bracket.

5. Carefully grasp the upper edge of the PCI-1220U. Align the hole in the retaining bracket with the hole on the expansion slot and align the gold striped edge connector with the expansion slot socket. Press the card into the socket gently but firmly. Make sure the card fits the slot tightly.

6. Secure the PCI-1220U by screwing the mounting bracket to the back panel of the computer.

7. Attach any accessories to the card.

8. Replace the cover of your computer and connect the cables you removed in step 2.

9. Turn the computer power on.

CHAPTER **3**

Signal Connections

This chapter provides useful information about how to connect input and output signals to the PCI-1220U via the I/O connector.

Chapter 3 Signal Connections

3.1 I/O Connector Pin Assignments

The I/O connector on the PCI-1220U is a 50-pin connector that enables you to connect to accessories with the PCL-10152 shielded cable.

Figure 3.1 shows the pin assignments for the 50-pin I/O connector on the PCI-1220U, and Table 3-1 shows its I/O connector signal description.

Note   *The PCL-10152 shielded cable is especially*
             designed for the PCI-1220U to reduce noise in
             the analog signal lines.

3.2 Location of Jumpers and DIP switch

Figure 3.2 shows the names and locations of jumpers and DIP switch on the PCI-1220U. There are ten jumpers, JP1 to JP10 on the PCI-1220U. Please refer to Section 3.4 Output Pulse Definition and Section 3.11 Emergency Stop Input for more information about JP1~4 and JP5 configurations.

BoardID Switch

PCI-1220U has have a built-in DIP switch (SW1), which is used to define each card's unique identifier for the Motion Utility. You can determine the BoardID identifier on the register as shown in Table 3-2. When there are multiple cards on the same chassis, this BoardID setting is useful for identifying each card's device number.

We set the BoardID switch of PCI-1220U to 0 at the factory. If you need to adjust it to another number, set SW1 by referring to Table 3.3.
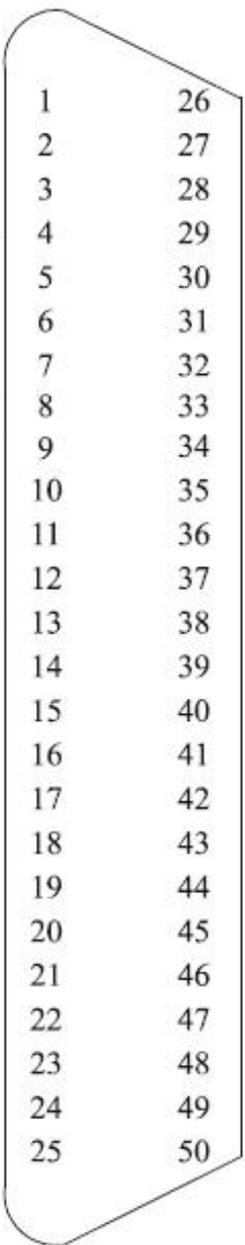
	Pin	Pin	
VEX	1	26	EMG
XLMT+	2	27	XLMT-
XIN0	3	28	XIN1
XORG	4	29	YLMT+
YLMT-	5	30	YIN0
YIN1	6	31	YORG
XINPOS	7	32	XALARM
XECAP	8	33	XECAN
XECBP	9	34	XECBN
XEZ+	10	35	XEZ-
YINPOS	11	36	YALARM
YECAP	12	37	YECAN
YECBP	13	38	YECBN
YEZ+	14	39	YEZ-
XEXOP+	15	40	XEXOP-
YEXOP+	16	41	YEXOP-
GND	17	42	XOUT0
XOUT1	18	43	XOUT2
XOUT3	19	44	XP+P
XP+N	20	45	XP-P
XP-N	21	46	GND
YOUT0	22	47	YOUT1
YOUT2	23	48	YOUT3
YP+P	24	49	YP+N
YP-P	25	50	YP-N

Figure 3.1: I/O Connector Pin Assignments

Table 3.1: I/O Connector Signal Description

Signal Name	Reference	Direction	Description
VEX	-	Input	External Power (12~24VDC)
EMG	-	Input	Emergency Stop (for all axes)
XLMT+	-	Input	+ Direction Limit at X axis
XLMT-	-	Input	- Direction Limit at X axis
XIN0	-	Input	General Input at X axis
XIN1	-	Input	General Input at X axis
XORG	-	Input	Home Signal Input at X axis
YLMT+	-	Input	+ Direction Limit at Y axis
YLMT-	-	Input	- Direction Limit at Y axis
YIN0	-	Input	General Input at Y axis
YIN1	-	Input	General Input at Y axis
YORG	-	Input	Home Signal Input at Y axis
XINPOS	-	Input	In-Position input at X axis
XALARM	-	Input	Servo Error at X axis
XECAP	-	Input	Encoder Phase A at X axis
XECAN	-	Input	Encoder Phase A at X axis
XECBP	-	Input	Encoder Phase B at X axis
XECBN	-	Input	Encoder Phase B at X axis
XEZ+	-	Input	Encoder Phase Z at X axis
XEZ-	-	Input	Encoder Phase Z at X axis
YINPOS	-	Input	In-Position input at Y axis
YALARM	-	Input	Servo Error at Y axis
YECAP	-	Input	Encoder Phase A at Y axis
YECAN	-	Input	Encoder Phase A at Y axis
YECBP	-	Input	Encoder Phase B at Y axis
YECBN	-	Input	Encoder Phase B at Y axis
YEZ+	-	Input	Input Encoder Phase Z at Y axis
YEZ-	-	Input	Encoder Phase Z at Y axis
XEXOP+	-	Input	Jog at the + Direction of X axis
XEXOP-	-	Input	Jog at the - Direction of X axis
YEXOP+	-	Input	Jog at the + Direction of Y axis
YEXOP-	-	Input	Jog at the - Direction of Y axis
GND	-	-	Ground
XOUT0	GND	Output	General Output at X axis (CMP+)

Table 3.1: I/O Connector Signal Description (continued)			
XOUT1	GND	Output	General Output at X axis (CMP-)
XOUT2	GND	Output	General Output at X axis (Server On)
XOUT3	GND	Output	General Output at X axis
XP+P	GND	Output	Output pulse CW/Pulse+ of X-axis
XP+N	GND	Output	Output pulse CW/ Pulse- of X-axis
XP-P	GND	Output	Output pulse CCW/DIR+ of X-axis
XP-N	GND	Output	Output pulse CCW/DIR- of X-axis
GND	-	-	Ground
YOUT0	GND	Output	General Output at Y axis (CMP)
YOUT1	GND	Output	General Output at Y axis
YOUT2	GND	Output	General Output at Y axis (Server on)
YOUT3	GND	Output	General Output at Y axis (Reset)
YP+P	GND	Output	Output pulse CW/Pulse+ of Y-axis
YP+N	GND	Output	Output pulse CW/ Pulse- of Y-axis
YP-P	GND	Output	Output pulse CCW/DIR+ of Y-axis
YP-N	GND	Output	Output pulse CCW/DIR- of Y-axis

Figure 3.2: Location of Jumpers & DIP Switch

Table 3.2: BoardID register				
SW1	**Board ID register**			
Base Add.+12h	3	2	1	0
Abbreviation	BDID3	BDID2	BDID1	BDID

ID0: the least significant bit (LSB) of Board ID

ID3: the most significant bit (MSB) of Board ID

Table 3.3: BoardID setting				
Board ID setting (SW1)				
Board ID (Dec.)	**Switch Position**			
	ID3	ID2	ID1	ID0
*0	●	●	●	●
1	●	●	●	○
:				
14	○	○	○	●
15	○	○	○	○
○= Off	●= On	* = default		

3.3 Output Pulse Definition

The output pulse command of PCI-1220U is from MCX312 chip. The pulse command has two types. One is in Up/Down mode and another is in Pulse/Direction mode. While nP+P is differential from nP+N and

nP-P is differential from nP-N. After system reset, the nP+P and nP-P is low level, and this invert output (nP+N, nP-N) is high level, and the de-fault setting of pulse output mode is Up/Down. User can change the output mode into Pulse/Direction mode by writing specified command system register.
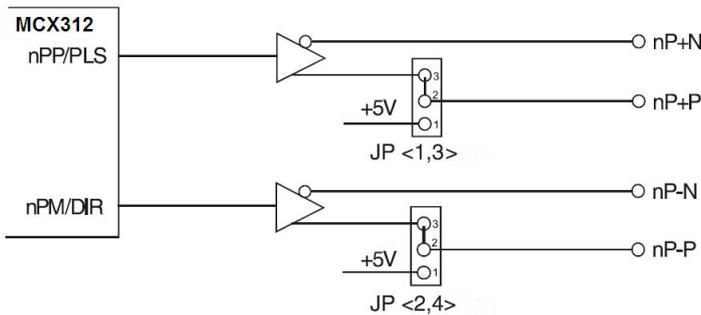
Figure 3.3: Output Signal Loop for Drive Pulses

From the circuit shown above (Figure 3-3), the default output mode is differential output. For single ended output use, user can change jumpers JP1~4 to +5V. Note that you should prevent from the noise interference when using jumpers JP1~4 to output internal +5V to external device.

Table 3.4: JP1~4 Jumpers				
Jumper	JP1	JP2	JP3	JP4
Output Signal	XP+P	XP-P	YP+P	YP-P
IC Output (Line Drive Output)	Pin2 and Pin3 short (Default)			
+5V Output	Pin1 and Pin2 short			

The following figure 3-4 and 3-5 show the examples of input circuitry connection for both photo coupler and motor driver respectively.
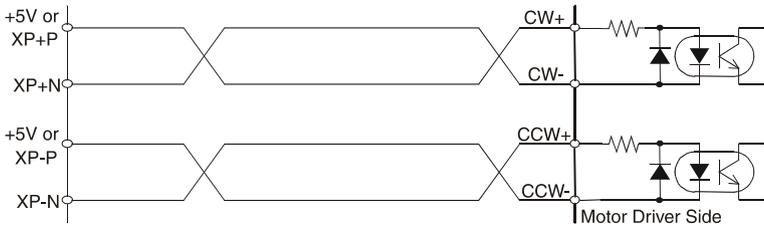
Figure 3.4: Photo Coupler Input Interface
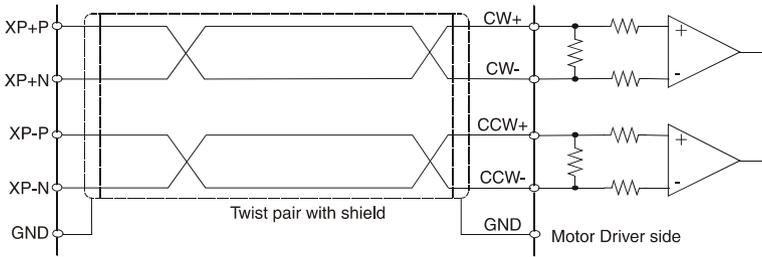
Figure 3.5: Line Driver Input Interface

3.4 General Purposed Output

The general purposed output nOUT3/DSND, nOUT2/ASND, nOUT1/
CMPM, and nOUT0/CMPP are from MCX312, and each output signal is
OFF status after system reset.
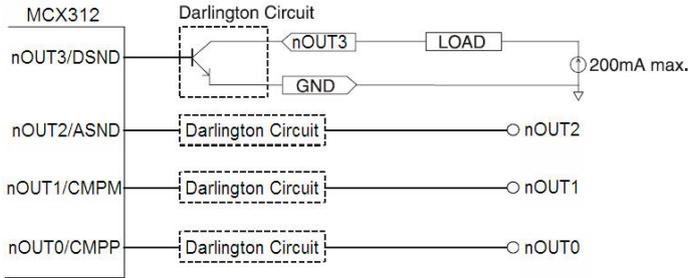
Figure 3.6: General Purpose Output

General purposed output signals used in motor drives can clear error
counter, alarm reset, stimulus off, etc., or select acceleration/deceleration
for driving, position counter, and the status of comparison register as your
output during driving.

3.5 Over Traveling Limit Switch Input

Note: *When the axis/axes is/are about to stop (in the decelera-
tion stage), the axis/axes will not stop totally but keep
moving at a very low speed if you use S-curve accelera-
tion/deceleration to control speed under the* **"Point to
Point"** *and* **"Line Profile(interpolation)"** *drive mode
(positioning operation, specify a target position) on the
conditions below:*

The hardware limit is activated and the **Limited Switch
Operation Mode** *is set to "**Slow Down then Stop**" (WR2/
D2=1).*

The software limit is enabled and activated (WR3/D, 1=1).

The **Limited Switch Function** *of IN1 and IN2 are
enabled (WR1/D5, 3, 1=1).*

Over traveling limit switches are used for system protection. This input signal is connected to the limit input of MCX312 through the connection of photo coupler and RC filter. When the limit switch is applied, the external power VEX DC12~24V will source the photo coupler, and then the nLMTP in MCX312 will be low level. This enables the over traveling function if the desired level of nLMTP is set to low.
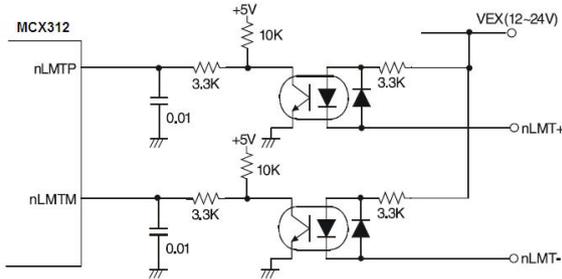
Figure 3.7: Movement Limit Input Signals

The response time of this circuit should take about 0.2 ~ 0.4 msec because of the delay of photo coupled and RC filter. The following figure 3-8 is an example of photo sensor used in the case of over traveling limit switch input. When writing D3 bit of register2 (XWR2) into 0 to set the limit switch is low active in X-axis, the following figure can work normally.
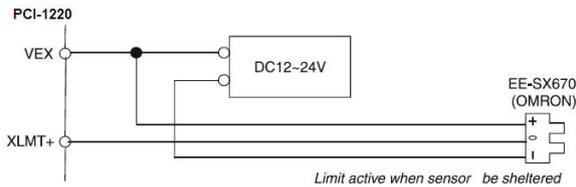
Figure 3.8: Photo Sensor in the Limit Input Signal

3.6 Deceleration/Instantaneous Stop Switch Input

Note: *When the axis/axes is/are about to stop (in the decelera-tion stage), the axis/axes will not stop totally but keep moving at a very low speed if you use S-curve accelera-tion/deceleration to control speed under the "**Point to Point**" and "**Line Profile(interpolation)**" drive mode (positioning operation, specify a target position) on the conditions below:*

*The hardware limit is activated and the **Limited Switch Operation Mode** is set to "**Slow Down then Stop**" (WR2/ D2=1).*

The software limit is enabled and activated (WR3/D, 1=1).

*The **Limited Switch Function** of IN1 and IN2 are enabled (WR1/D5, 3, 1=1).*

There are three input signals (nIN0, nIN1, nORG) that can make the motor drives deceleration or stop. EZ is used in phase Z interface of encoder feedback and nIN0, nIN1 are used as input signals near the origi-nal point. If run mode is active, the output of driving pulse is terminated after those signals are enabled; The deceleration occurs during accelera-tion/deceleration, and it will be stopped immediately during constant drive. All the signals become invalid after reset. For example, when set-ting the D7 and D6 of XWR1 register to 1 and 0 (ORG is low active), the drive will be terminated in the case of the limit switch is on and xORG is low. Furthermore, these input signals can be used as general purposed input because user can get the level by reading the input register status (RR4, RR5).
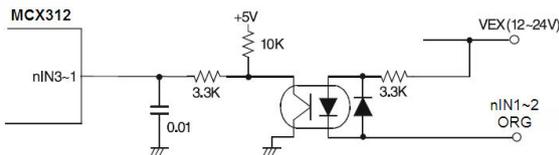
Figure 3.9: Deceleration/Instantaneous Stop Input

The response time of this circuit should take about 0.25 msec because of the delay of photo coupled and RC filter.

3.7 General Purposed Input for Servo Drives

nINPOS is an input signal from servo drives for in-position check, it is active after the servo drives finish a position command. Users can enable/disable this pin. When enable this function, the n-DRV bit in RR0 will change to 0 after servo drives finish the in-position check and nINPOS pin active.

nALARM is an input signal from servo drives for drives alarm output. When servo drives have an abnormal condition, they active this signal to note PCI-1220U to stop output pulses. When enable the nALARM function of PCI-1220U, the D14 bit of RR2 will set to 1 after nALARM active. If PCI-1220U is driving pulses output, the output pulses will stop immediately when nALARM active.
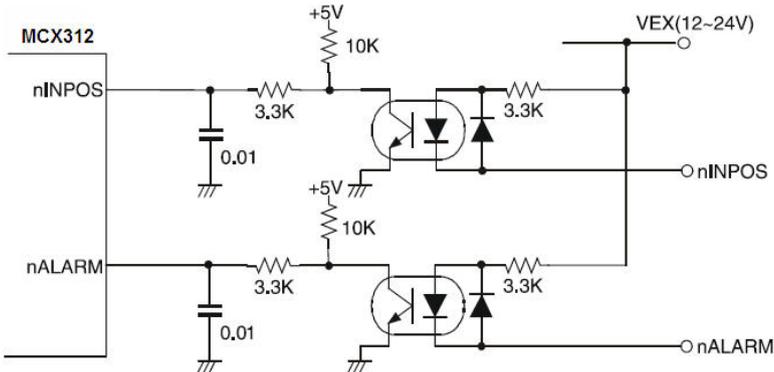
Figure 3.10: Input Signal for Servo Motor

This signal must be supplied from the external source DC12 ~ 24V, and the response time of this circuit should take about 0.25 msec because of the delay of photo coupled and RC filter.

Furthermore, this two signals can be used as general purposed input while user could read the input register 1 and 2 (RR4, RR5) to get the status of this two signal.

3.8 Encoder Input

When feedback the encoder signals, connect nECAP to phase A of encoder output. And nECAN to phase A, nECBP to phase B, nECBN to phase B. nIN0P to phase Z and nIN0N to phase Z. The default setting of position feedback of PCI-1220U is quadrature input. Up/Down pulses feedback is available after setting the input pule mode.

nIN0P/N is used for encoder phase Z signal feedback and also can be used as general purposed input or instantaneous stop input.
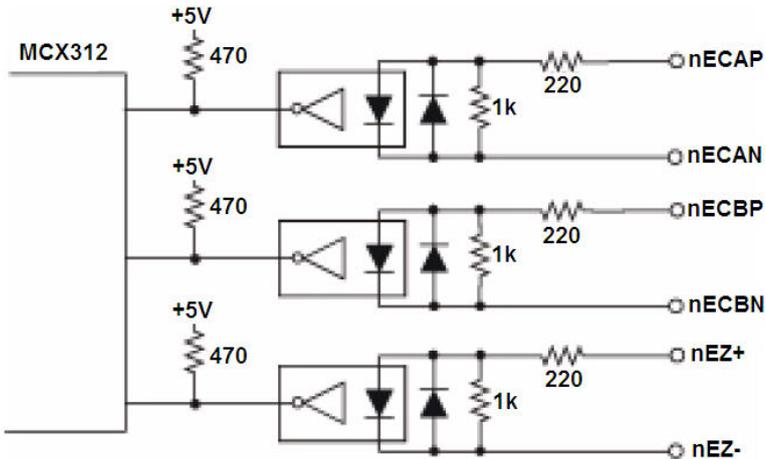
Figure 3.11: Circuit Diagram of Encoder Feedback

From the circuit diagram above, PCI-1220U uses high speed photo coupler for isolation. The encoder output can be differential mode or open-collector mode. When n***P is high and n***N is low, the real feedback signal (n***) to MCX312 is low. The maximum possible A/B phase feedback frequency is about 1 MHz.

The following diagram is an example of the connection for encoder with differential-output linear driver.
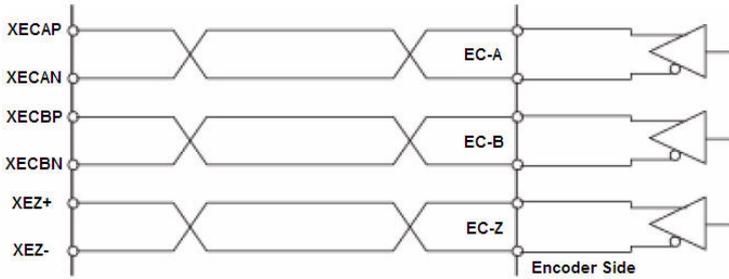
Figure 3.12: Differential-output Line Driver

The following figure is an example of connection for the encoder with open-collector output.
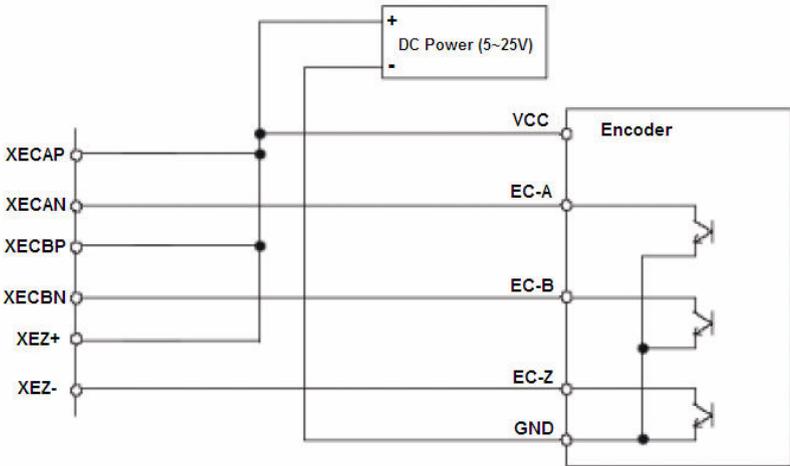
Figure 3.13: Open Collector Output Encoder

3.9 External Pulse Control Input

The pulses output function of MCX312 chip is controlled by register set-
ting or by external pulse command input (nEXOP+, nEXOP-). There are
two output pulse mode for the external control pin. One is fixed pulse out-
put mode, and the other is continuous output mode. In PCI-1220U, it pro-
vides Jog and Hand wheel functions that allow you driving motors
through external Hand wheel or Jog equipment. In Jog mode, it is corre-
sponding to the "Continuous Output Mode," and in Hand wheel mode, it
is corresponding to the "Fixed Pulse Output Mode." These functions are
progressed without CPU involved on host PC. When the input signal is
enabled during fixed pulse drive, the pulse specified will be output. When
continuous output drive is enabled, the drive pulse will be continually
output at the period of signal Low. This signal should be used in combina-
tion with external power DC12 ~ 24V. The response time of circuitry
should take about 10 msec because of the delay of photo
coupled and RC filter.
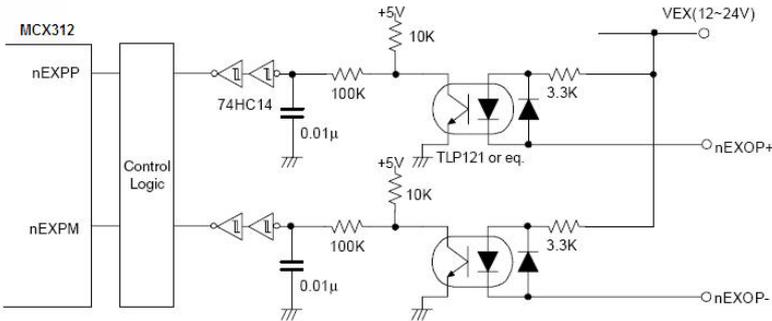
Figure 3.14: External Drive Operation Signals
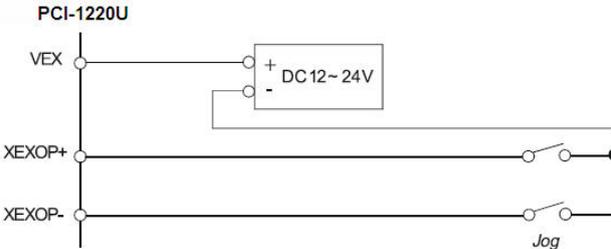
Figure 3.15: Example of Connecting to Jog

3.10 Emergency Stop Input (EMG)

When emergency stop input signal is enabled, the output of the drive pulse for all axes will be stopped, and error bit of main status register will be set to 1. The operation of emergency stop input is positive or negative triggered can be determined by JP5 on the board.
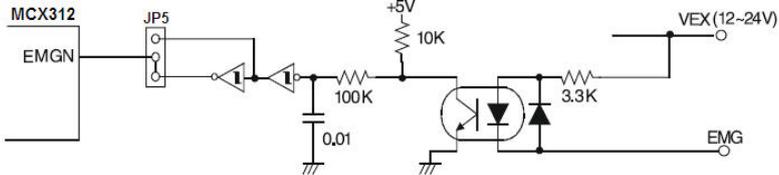
Figure 3.16: Emergency Stop Input Signal

This signal should be used in combination with external power DC12 ~ 24V. The response time of circuitry should take about 0.25 msec because of the delay of photo coupled and RC filter.

Table 3.5: Jumper Settings of JP5	
Jumper	JP5
Emergency stop function enabled when emergency stop signal (EMG) and external GND short	Pin 1 and Pin 2 short (Default)
Emergency stop function enabled when emergency stop signal (EMG) and external GND open	Pin 2 and Pin 3 short

Note   *Please check if EMG and GND are short or not when the card could not work properly.*

3.11 External Power Input (VEX)

External power is necessary for all input signals of each axis. Please apply DC12~24V voltage as your need. Current consumption of each point for input signal is DC12V = 3.3 mA, DC24V = 7 mA.

3.12 Interrupt Setting

When the interrupt occurs from MCX312, the interrupt signal of MCX312 will be changed from high to low. Because the PCI bus interrupt is high level sensitive, the PCI-1220U inverse the signal and latch the signal to adapt the PCI bus INTA. The Fig- 3.17 shows the interrupt structure of the PCI-1220U. We suggest users who want to program their own interrupt service routine (ISR) should follow the procedures:

Step 1: When interrupt occurs. (Hardware)

Step 2: Program will jump to ISR. (Software)

Step 3: In ISR program the first thing have to do is clear interrupt for preventing hanging up the PCI bus.

Step 4: In ISR program the last thing have to do is read nRR3 of MCX312 for accepting next interrupt occurs.
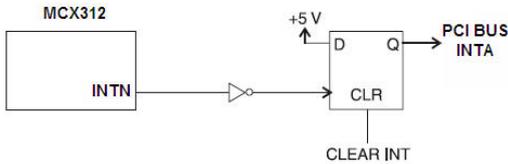
Figure 3.17: Circuit Diagram of Interrupt Setting

3.13 Connection Examples for Motor Drivers

3.13.1 Connection to Step Motor Drivers

The following figure is an example of PCI-1220U connected to 5-phase micro-step motor drives, KR515M manufactured by TECHNO company.
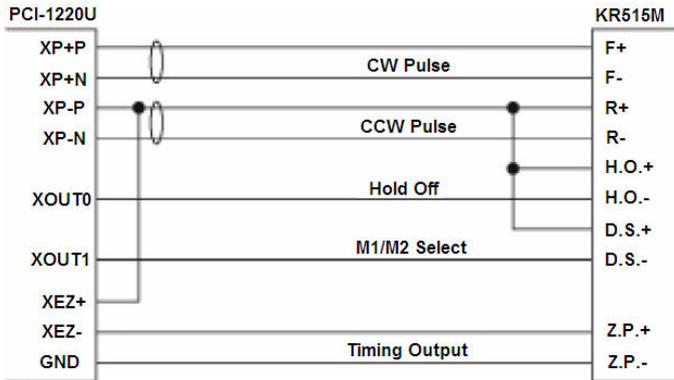
Figure 3.18: Connecting to KR515M Drive

Note   JP1~4 of PCI-1220U are set to +5V output side, +5V output for output terminals XP+P and XP-P. Setting JP1~4 as single-ended output will output +5V of PCI-1220U to external devices, this will induce noise back to PCI-1220U. So, be careful when connection.

Connect XOUT0 to H. O. (Hold off) can control the drive to hold.

Connect XOUT1 to D.S. can control the resolution of micro-step drive. Which will be controlled by setting D8, D9 of WR3 in MCX312. And, read the RR4,5 to know the status of XEZ+/-.

The following figure is an example of PCI-1220U connected to UPK step drive manufactured by ORIENTAL company.
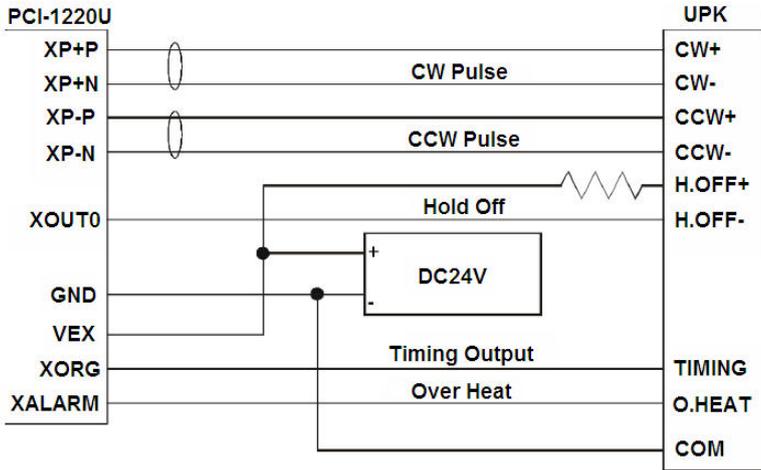
Figure 3.19: Connecting to UPK Step Drive

Note   The differential pulse output of PCI-1220U is connected
        to CW/CCW input of UPK drive. XOUT0 can control UPK
        drive to hold by setting D8 of WR3. TIMING and Over
        HEAT signals can be read back by reading RR4,5.

        It is better to use a twisted pair cable for long
        connections.

3.13.2 Connection to Servo Motor Drivers

The figure shown below is an example of PCI-1220U connected to MINAS X series AC servo motor drive.
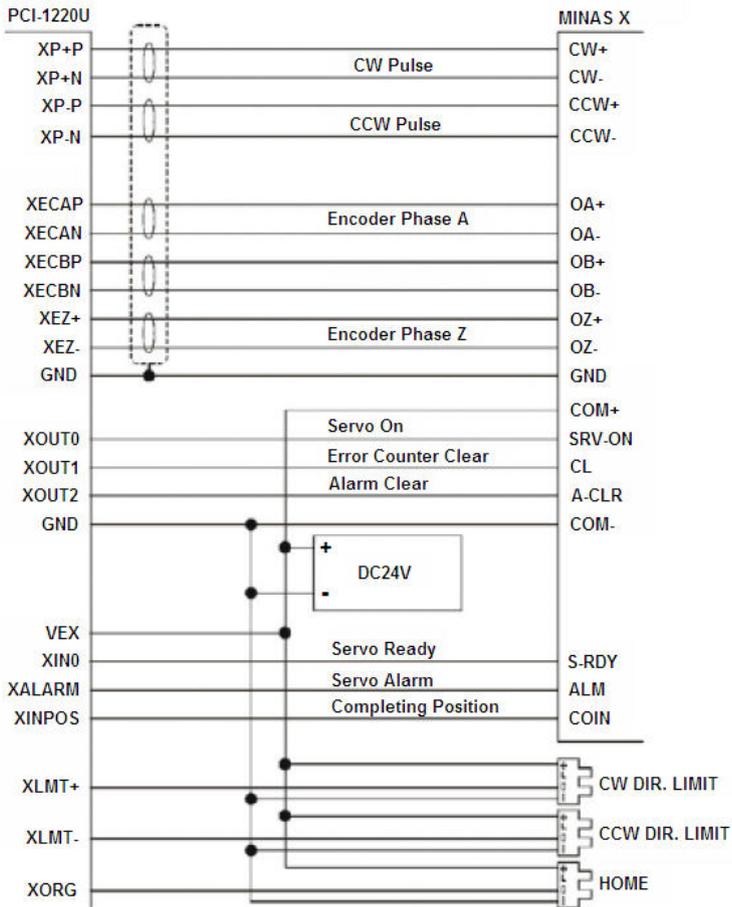
Figure 3.20: MINAS X Series AC Servo Motor Drive

Note   *The servo drive must be set in pulse-control drive mode and the type of pulse input is CW/CCW mode. This connection is not well for pulse/ direction mode because the timing is not match.*

It is optional to connect encoder A/B phase feedback signal. If connect to encoder signal, user can read the real position from PCI-1220U.

If the environment has high noise or the connection is long, we recommend you to use twist pair cable for servo drives.

3.14 Field Wiring Considerations

When you use the PCI-1220U to acquire data from outside, noises in the environment might significantly affect the accuracy of your measurements if due cautions are not taken. The following measures will be helpful to reduce possible interference running signal wires between signal sources and the PCI-1220U.

• The signal cables must be kept away from strong electromagnetic sources such as power lines, large electric motors, circuit breakers or welding machines, since they may cause strong electromagnetic interference. Keep the analog signal cables away from any video monitor, since it can significantly affect a data acquisition system.

• If the cable travels through an area with significant electromagnetic interference, you should adopt individually shielded, twisted-pair wires as the analog input cable. This type of cable has its signal wires twisted together and shielded with a metal mesh. The metal mesh should only be connected to one point at the signal source ground.

• Avoid running the signal cables through any conduit that might have power lines in it.

• If you have to place your signal cable parallel to a power line that has a high voltage or high current running through it, try to keep a safe distance between them. Or you should place the signal cable at a right angle to the power line to minimize the undesirable effect.

• The signals transmitted on the cable will be directly affected by the quality of the cable. In order to ensure better signal quality, we recommend that you use the PCL-10152 shielded cable.

3.15 I/O Signal Timing

3.15.1 Power On RESET
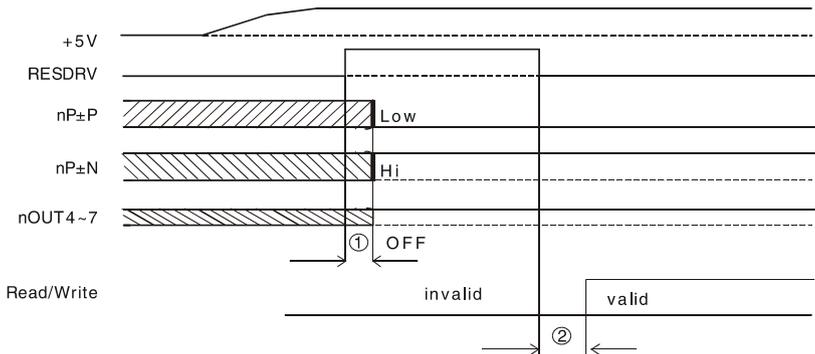
Figure 3.21: Timing Diagram of Power On Reset

- Output pulses (nP ± P, nP ± N) for drive control and general purpose output signals (nOUT0 ~ 3) for I/O control will be determined after 250 nsec from power on reset.

- User can access PCI-1220U only after 500 nsec from power-on reset.

3.15.2 Individual Axis Driving
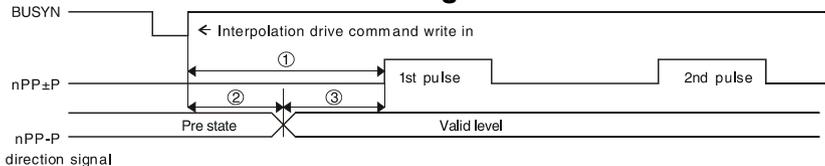
Figure 3.22: Individual Axis Driving

- The maximum time to output command pulse after first pulse command is about 650nsec.

- When pulse/direction mode, the direction signal will valid after 275 nsec and pulse output will vaild after 375 nsec after direction signal.

3.15.3 Interpolation Driving
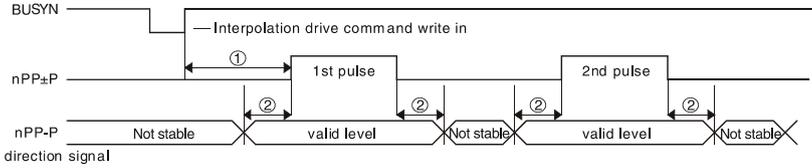
Figure 3.23: Timing Diagram of Interpolation Driving

- After interpolation command is enable, the first pulse will be outputted in 775 nsec.

- If using pulse/direction mode, direction signal (nP-P) is valid in ± 125 nsec of high-level pulse signal.

3.15.4 Input Pulse Timing

Quadrature Pulse of Encoder Input
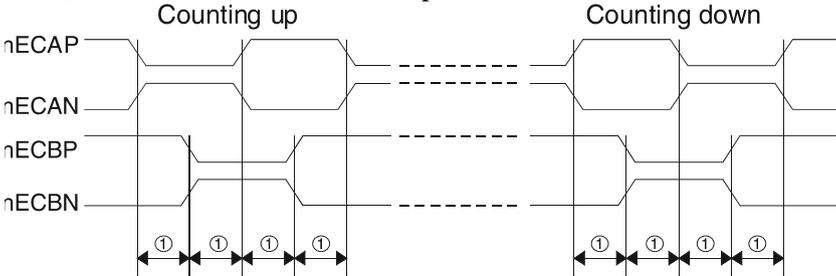
Figure 3.24: Quadrature Pulse of Encoder Input

- The minimum difference time between A/B phases is 200 nsec.

UP/DOWN Pulse Input
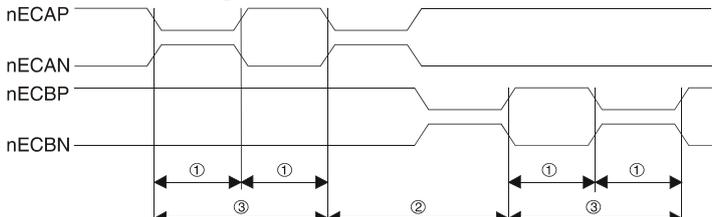
Figure 3.25: Timing Diagram of Up/Down Pulse Input

- Minimum UP/DOWN pulse width: 130 nsec.

- Minimum Increased/Decreased Pulse Interval: 130 nsec .

- Minimum UP/DOWN pulse period: 260 nsec.

3.15.5 Instantaneous Stop Timing

External Instantaneous Stop Signal
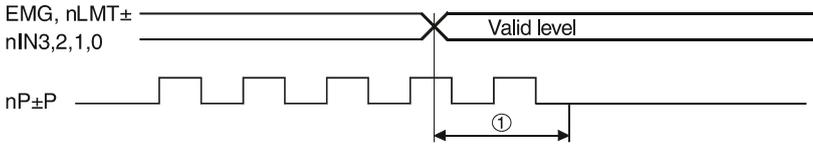
Figure 3.26: External Instantaneous Stop Signal

• When external stop signal is enabled during driving, up to 400 μ SEC + 1 pulse will be output, and then stopped.

Instantaneous Stop Instruction
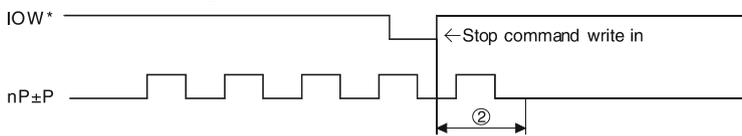
Figure 3.27: Instantaneous Stop Instruction

• When the Stop instruction is issued during driving, at most one pulse will be output, and then stopped.

3.15.6 Deceleration Stop Timing

External Deceleration/Stop Signal
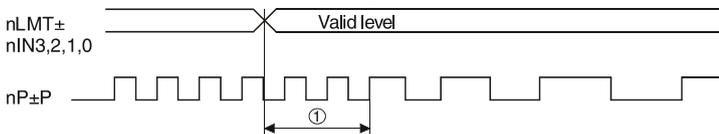
Figure 3.28: External Deceleration/Stop Signal

• When external deceleration signal is enabled during driving, up to 400 μ SEC + 2 pulses will be output, and then stopped.

Deceleration/Stop Instruction
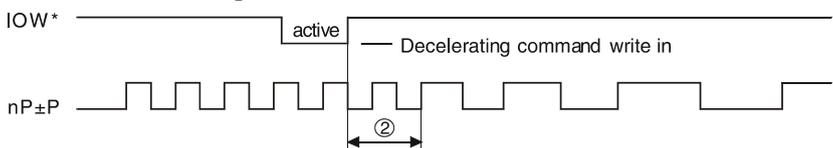
Figure 3.29: Deceleration/Stop Instruction

• When the Deceleration/Stop instruction is issued during driving, at most two pulses will be output, and then stopped.

3.16 TTL Level Position Compare Output

This is a special design for the customers who can use the position compare output to synchronize with other vision devices. For PCI-1220U, the position compare output channels are nOUT0 and nOUT1, and it is open-collector type output. In which the nOUT0 and nOUT1 represent the different direction of position compare separately. For PCI-1220U, we provide an integrated option for the position compare output. By selecting with JP6, you can choose the XOUT0 pin as original design as PCI-1220U, or TTL level output. While the JP6 is in "CMP" position, the output of XOUT0 is (XOUT0 XOUT1). With this special design you can get the compared result in both increment and decrement direction through one unified pin.

Table 3.6: Jumper Settings of JP6	
Jumper	**JP6**
The XOUT0 is defined as the pulse output channel for the incremental position compare mechanism. And it's open-collector type output.	XOUT0, Pin 1 and Pin 2 short (Default)
It's a design only for PCI-1220U. The position compare signal for both directions will output from XOUT0, and the output level of XOUT0 is TTL level.	CMP, Pin 2 and Pin 3 short

Specifications

Appendix A Specifications

A.1 Axes

Axes	2	
2-axis Linear Interpolation	Range	For each axis: -8,388,608 ~ 8,388,607
	Speed	1 PPS ~ 4 MPPS
	Precision	± 0.5 LSB
2-axis Circular Interpolation	Range	For each axis: -8,388,608 ~ 8,388,607
	Speed	1 PPS ~ 4 MPPS
	Precision	± 1 LSB
Continuous Interpolation	Speed	1 PPS ~ 2 MPPS
Single Axis Movement	Output Signal*	nP+P/N, nP-P/N
	Range	-8,388,608 ~ 8,388,607
	Precision	± 0.1 %
	Change of Acceleration for S curve	$954 \sim 31.25 \times 10^9$ PPS/sec^2
	Acceleration/ Deceleration	$125 \sim 500 \times 10^6$ PPS/sec
	Initial Velocity	1 PPS ~ 4 MPPS
	Drive Speed	1 PPS ~ 4 MPPS (Can be changed during driving)
	Number of Output Pulses	Fixed pulse driving: 0 ~ 16,777,215
	Pulse Output Type	Pulse/Direction (1-pulse, 1-direction type) or Up/Down (2-pulse type)
	Output Signal Modes	Differential line driving output / Single-ended output
	Speed Curve	T/S curve acceleration/deceleration

Note   *: "n" represents the axis (X, Y, Z or U) that is
        concerned

A.2 Digital Input/Output

Input Signals	Over Traveling Limit Switch Input*	nLMT+, nLMT-	
	General Input Signal*	nIN0~1	
	Input Signal for Servo Motor Drives*	nALARM (servo alarm); nINPOS (position command completed)	
	Emergency Stop	EMG - one emergency stop input	
	Max. Input Frequency	4 kHz	
	Input Voltage (VEX = 24V) (Support dry/wet contact)	Logic 0	21~24 V_{DC} ; open(dry contact)
		Logic 1	0~16 V_{DC}; closed (dry contact)
	Protection	2,500 V_{DC} photo coupler isolation	
General Purpose Output	Output Signal*	nOUT0 ~ 3	
	Output Voltage	Open Collector 5 ~ 40 V_{DC}	
	Sink Current	200 mA max./channel	
	Protection	2,500 V_{DC} photo coupler isolation	

A.3 Input Pulse for Encoder Interface

Input Signals	nECAP/N, nECBP/N, nEZ+, nEZ-	
Encoder Pulse Input Type	Quadrature (A/B phase) or Up/Down	
Counts per Encoder Cycle	x1, x2, x4 (A/B phase only)	
Max. Input Frequency	1 MHz	
Input Voltage	Low	0 ~ 2 V_{DC}
	High	5 ~ 30 V_{DC}
Protection	2,500 V_{DC} Isolation Protection	

A.4 External Signals Driving

Input Signals	nEXOP+, nEXOP-	
Max. Input Frequency	100 Hz	
Input Voltage (VEX = 24V) (Support dry/wet contact)	Logic 0	21~24 V_{DC} ; open(dry contact)
	Logic 1	0~16 V_{DC}; closed (dry contact)
Driving Mode	Fixed pulse driving or continuous driving. Supports hand wheel and Jog.	
Protection	2,500 V_{DC} Isolation Protection	

A.5 Other Functions

Position Counter	Range of Command Position Counter (for output pulse)	-2,147,438,648 ~ +2,147,438,647
	Range of Actual Position Counter (for input pulse)	-2,147,438,648 ~ +2,147,438,647
Comparison Register	COMP+ Register Range	-2,147,438,648 ~ +2,147,438,647
	COMP- Register Range	-2,147,438,648 ~ +2,147,438,647
Interrupt Functions (Excluding Interpolation)	Interrupt Condition (All conditions could be enabled/disabled individually)	Position Counter => COMP-
		Position Counter < COMP-
		Position Counter < COMP+
		Position Counter => COMP+
BoardID	4-bit DIP switch, ID: 0~15	

A.6 General

I/O Connector Type	50-pin SCSI-II female	
Dimensions	175 x 100 mm (6.9" x 3.9")	
Power Consumption	Typical.	300 mA @ 5 V
	Max.	600 mA @ 5 V
External Power Voltage	DC +12 ~ 24 V	
Temperature	Operating	0 ~ 60° C (32 ~ 140° F) (refer to IEC 68-2-1,2)
	Storage	-20 ~ 85° C (-4 ~ 185° F)
Relative Humidity	5~95% RH non-condensing (refer to IEC 68-2-3)	
Certifications	CE certified	

Block Diagram

Appendix B Block Diagram

Wiring with Third-Party Motor Drivers
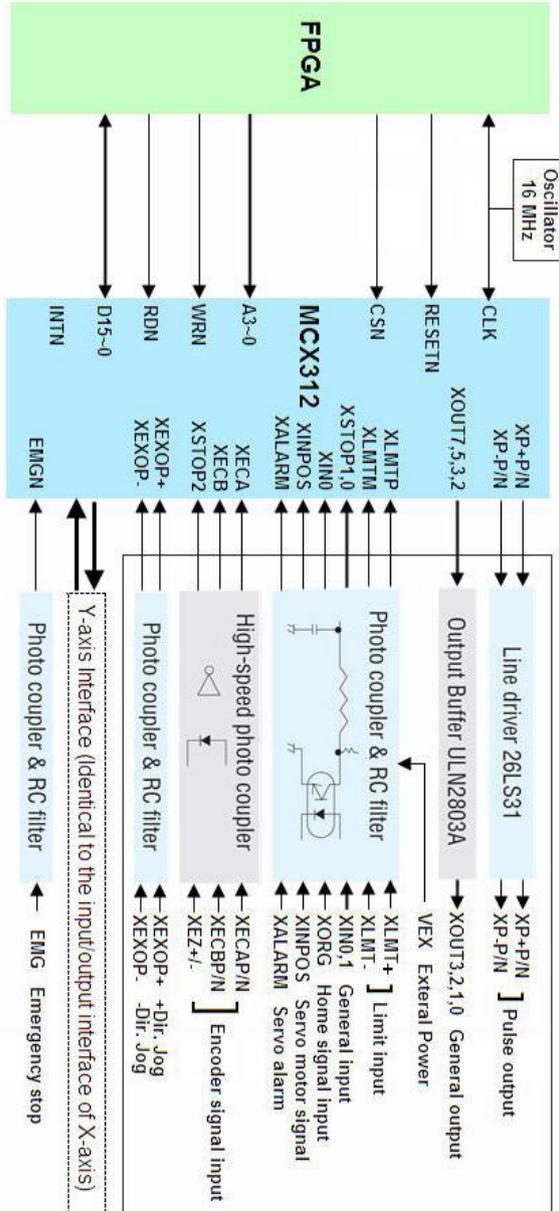
Appendix C Wiring with Third-Party Motor Drivers
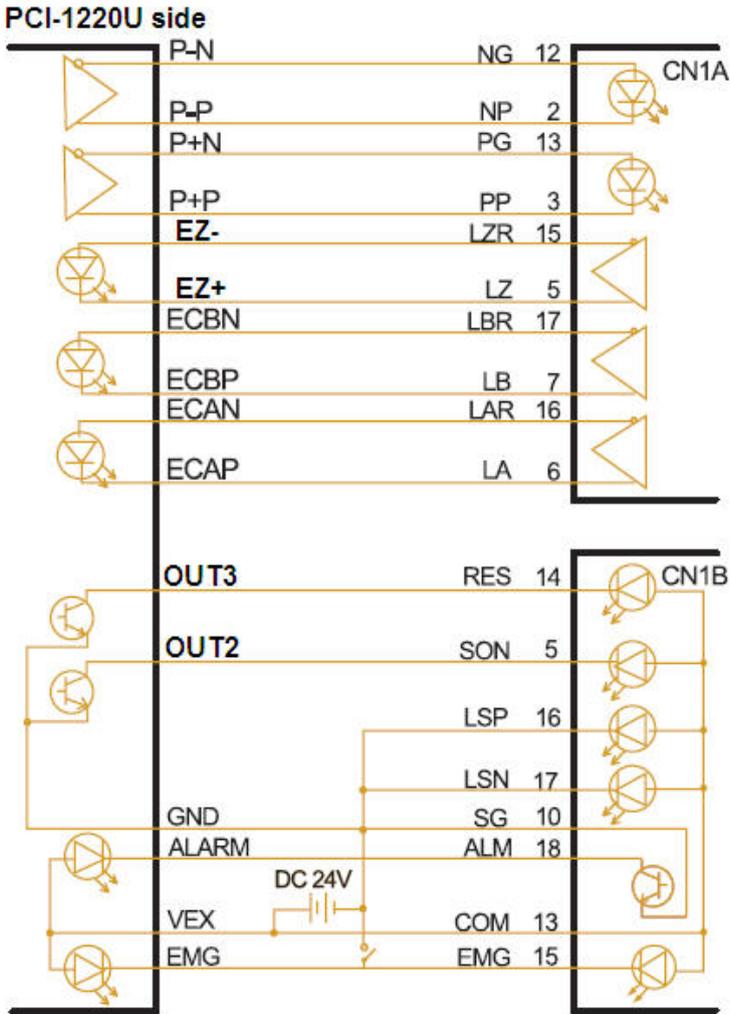
PCI-1220U side

Figure C.1: Mitsubishi MR-J2S Series Motor Driver
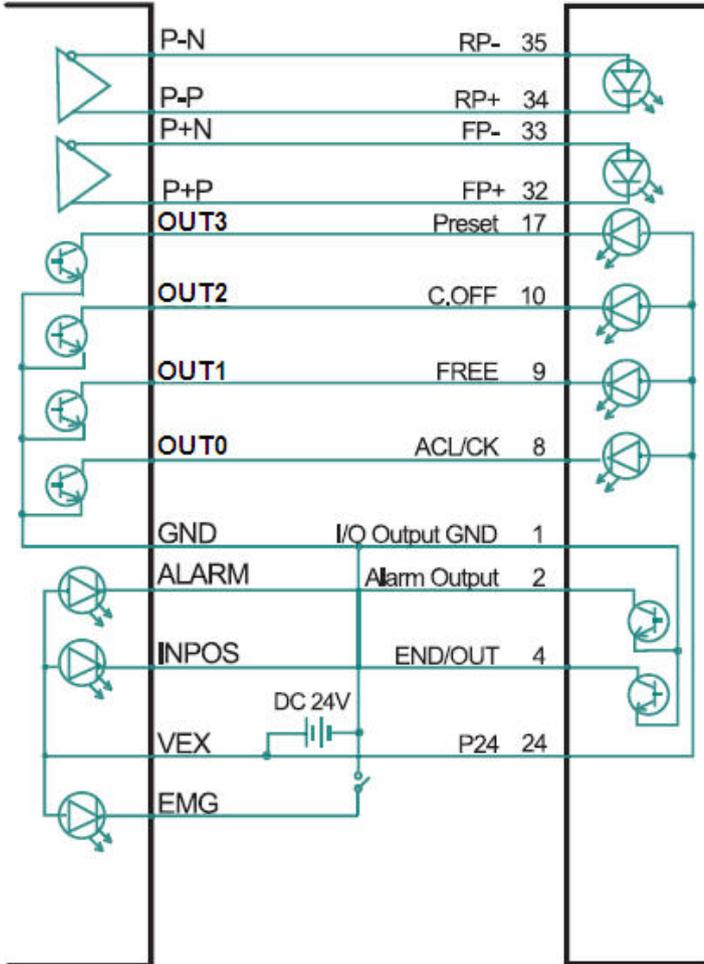
PCI-1220U side

Figure C.2: Oriental LIMO EZMC Motor Driver
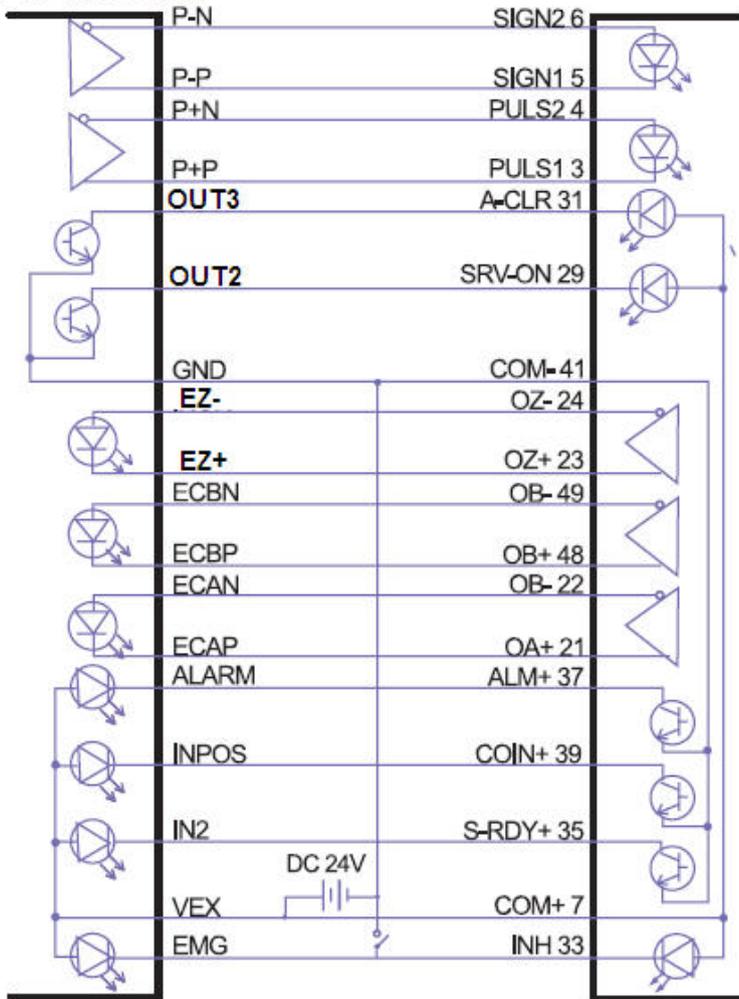
Figure C.3: Panasonic MINAS-A Series Motor Driver

PCI-1220U side

P-N	PULS* 8
P-P	PULS 7
P+N	SIGN* 12
P+P	SIGN 11
OUT3	CLR* 14
OUT2	S-ON 40
OUT1	ALM-RST 44
	SG 2
GND	SG 1
EZ-	PCO 19
EZ+	PCO* 20
ECBN	PBO 25
ECBP	PBO* 36
ECAN	PAO 33
ECAP	PAO* 34
ALARM	ALM+ 31
	ALM- 32
INPOS	COIN+ 25
	COIN- 26
VEX	24VIN 47
EMG	CLR 15

DC 24V

2.2K/0.25W
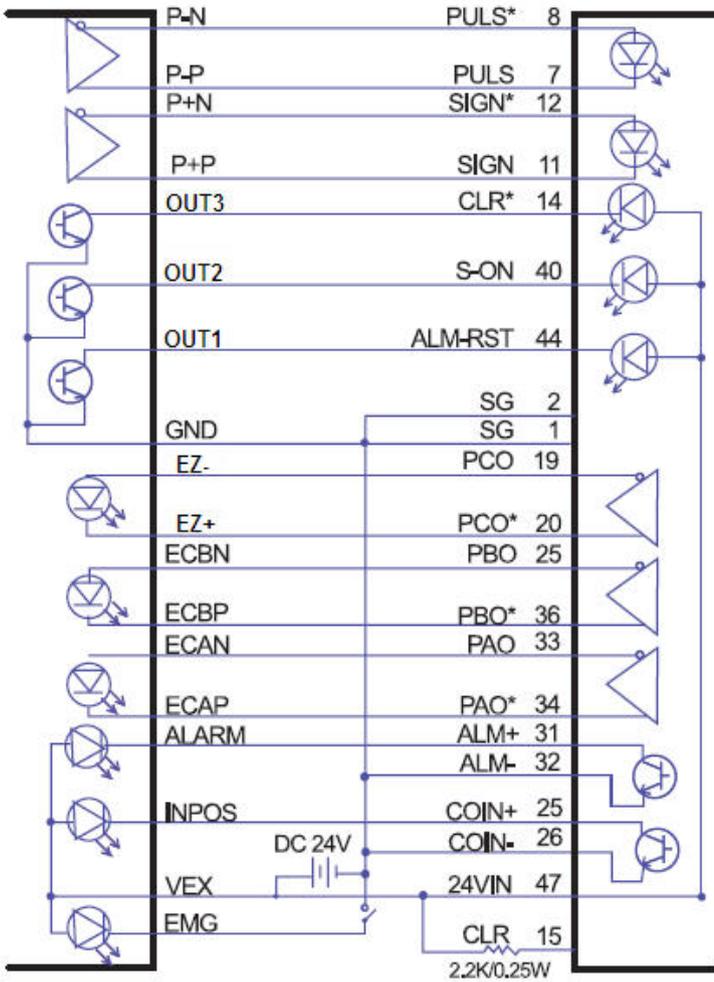
Figure C.4: Yaskawa SGDM Series Motor Driver