ADAM-5240

4-axis Stepping/Pulse-type Servo Motor Control Module

User Manual

CE notification

The ADAM-5240, 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.

Because of Advantech's high quality-control standards and rigorous testing, most of our customers never need to use our repair service. If an Advantech product is defective, it will be repaired or replaced at no charge during the warranty period. For out-of-warranty repairs, you will be billed according to the cost of replacement materials, service time and freight. Please consult your dealer for more details.

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.

- ADAM-5240

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

CHAPTER 1

Introduction

This chapter introduces ADAM-5240 and lists features and specifications.

Chapter 1 Introduction

ADAM-5240 4-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 MCX314AS motion ASIC builds in a variety of motion control functions, such as 2/3-axis linear interpolation, 2-axis circular interpolation, T/S-curve acceleration/deceleration rate and more. In addition, the next generation chip, MCX314AS is lead-free and not only increases the 2/3-axis linear interpolation range and the number of output pulses, but also provides the "Go Home" function.

1.1 Features

ADAM-5240 provides users with the most requested motor control functions as seen below:

- Independent 4-axis motion control
- Support hand wheel and jog function
- 2/3-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
- Free Motion Utility bundled for configuration and diagnosis
- "Go home" functions

The Advantech ADAM-5240 offers the following main features:

Individual Control for 4 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 MCX314AS-motion ASIC design concept.

Linear and Circular Interpolation

Any two or three axes can be selected to execute linear interpolation driving and any two axes can be selected to execute 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.

Bit Pattern Interpolation

Any 2 or 3 axes can be selected to perform the bit pattern interpolation, and the interpolation data is calculated by CPU; CPU writes the bit data into MCX314AS. Then, MCX314AS outputs pulses continuously at the preset driving speed. So, the user can process any interpolation curve by this mode.

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, MCX314AS can set a 1.414 times pulse cycle for 2-axis simultaneous pulse output, and a 1.732-time pulse cycle for 3-axis simultaneous pulse output that keep the constant speed during driving.

Position Control

Each axis has a 32-bit logic position counter and a 32-bits real position counter. The logic position counter counts the output pulse numbers, and the real position counter counts the feedback pulse numbers from the external encoder or linear scale.

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 4 points of input signals to perform deceleration and stop in driving. These input signals are for high-speed near-by home search, home search and z-phase search during the home returning. Each axis is with 8 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 once higher / lower the border-lines of the position counter range. 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-Z position control
- Precise rotation control
- Packaging and assembly equipment
- Machine control with up to 4 axes
- Semiconductor pick and place and testing equipment
- Other stepping/pulse-type servo motor applications

1.3 Accessories

Advantech offers a complete set of accessory products to support the ADAM-5240 card. These accessories include:

Wiring Cable

- PCL-10251 The PCL-10251 shielded cable is specially designed for ADAM-5240 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 ADAM-5240 card.

CHAPTER 2

Signal Connections

This chapter provides useful information about how to connect input and output signals to the ADAM-5240 via the I/O connector.

Chapter 2 Signal Connections

2.1 I/O Connector Pin Assignments

The I/O connector on the ADAM-5240 is a 100-pin connector that enables you to connect to accessories with the PCL-10251 shielded cable.

Figure 3.1 shows the pin assignments for the 100-pin I/O connector on the ADAM-5240, and Table 3-1 shows its I/O connector signal description.

Note *The PCL-10251 shielded cable is especially designed for the ADAM-5240 to reduce noise in the analog signal lines.*

2.2 Pin Assignments

YP-N	50	100	UP-N
YP-P	49	99	UP-P
YP+N	48	98	UP+N
YP+P	47	97	UP+P
YOUT7	46	96	UOUT7
YOUT6	48	95	UOUT6
YOUT5	44	94	UOUT5
YOUT4	43	93	UOUT4
GND	42	92	GND
XP-N	41	91	ZP-N
XP-P	40	90	ZP-P
XP+N	39	89	ZP+N
XP+P	38	88	ZP+P
XOUT7	37	87	ZOUT7
XOUT6	36	86	ZOUT6
XOUT5	35	85	ZOUT5
XOUT4	34	84	ZOUT4
GND	33	83	GND
YEXOP-	32	82	UEXOP-
YEXOP+	31	81	UEXOP+
XEXOP-	30	80	ZEXOP-
XEXOP+	29	79	ZEXOP+
YIN0N	28	78	UIN0N
YIN0P	27	77	UIN0P
YECBN	26	76	UECBN
YECBP	25	75	UECBP
YECAN	24	74	UECAN
YECAP	23	73	UECAP
Y_ALARM	22	72	U_ALARM
Y_INPOS	21	71	U_INPOS
XIN0N	20	70	ZIN0N
XIN0P	19	69	ZIN0P
XECBN	18	68	ZECBN
XECBP	17	67	ZECBP
XECAN	16	66	ZECAN
XECAP	15	65	ZECAP
X_ALARM	14	64	Z_ALARM
X_INPOS	13	63	Z_INPOS
Y_IN3	12	62	U_IN3
Y_IN2	11	61	U_IN2
Y_IN1	10	60	U_IN1
YLMT-	9	59	ULMT-
YLMT+	8	58	ULMT+
X_IN3	7	57	Z_IN3
X_IN2	6	56	Z_IN2
X_IN1	5	55	Z_IN1
XLMT-	4	54	ZLMT-
XLMT+	3	53	ZLMT+
EMG	2	52	NC
VEX	1	51	VEX

Figure 2.1: I/O Connector Pin Assignments

Table 2.1: 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
XIN1	-	Input	Deceleration/Instant Stop at X axis
XIN2	-	Input	Deceleration/Instant Stop at X axis
XIN3	-	Input	Deceleration/Instant Stop at X axis
YLMT+	-	Input	+ Direction Limit at Y axis
YLMT-	-	Input	- Direction Limit at Y axis
YIN1	-	Input	Deceleration/Instant Stop at Y axis
YIN2	-	Input	Deceleration/Instant Stop at Y axis
YIN3	-	Input	Deceleration/Instant Stop 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
XIN0P	-	Input	Encoder Phase Z at X axis
XIN0N	-	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
YIN0P	-	Input	Encoder Phase Z at Y axis
YIN0N	-	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
XOUT4	GND	Output	Common Output at X axis (CMP+)
XOUT5	GND	Output	Common Output at X axis (CMP-)

Table 2.1: I/O Connector Signal Description			
Signal Name	**Reference**	**Direction**	**Description**
XOUT6	GND	Output	Common Output at X axis (Server on)
XOUT7	GND	Output	Common Output at X axis (Reset)
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
YOUT4	GND	Output	Common Output at Y axis (CMP+)
YOUT5	GND	Output	Common Output at Y axis (CMP-)
YOUT6	GND	Output	Common Output at Y axis (Server on)
YOUT7	GND	Output	Common 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
VEX	-	Input	External Power (DC12~24V)
ZLMT+	-	Input	+ Direction Limit at Z axis
ZLMT-	-	Input	- Direction Limit at Z axis
ZIN1	-	Input	Deceleration/Instant Stop at Z axis
ZIN2	-	Input	Deceleration/Instant Stop at Z axis
ZIN3	-	Input	Deceleration/Instant Stop at Z axis
ULMT+	-	Input	+ Direction Limit at U axis
ULMT-	-	Input	- Direction Limit at U axis
UIN1	-	Input	Deceleration/Instant Stop at U axis
UIN2	-	Input	Deceleration/Instant Stop at U axis
UIN3	-	Input	Deceleration/Instant Stop at U axis
ZINPOS	-	Input	Positioning Complete at Z axis
ZALARM	-	Input	Servo Error at Z axis
ZECAP	-	Input	Encoder Phase A at Z axis
ZECAN	-	Input	Encoder Phase A at Z axis
ZECBP	-	Input	Encoder Phase B at Z axis
ZECBN	-	Input	Encoder Phase B at Z axis
ZIN0P	-	Input	Encoder Phase Z at Z axis
ZIN0N	-	Input	Encoder Phase Z at Z axis
UINPOS	-	Input	Positioning Complete at U axis

Table 2.1: I/O Connector Signal Description			
Signal Name	**Reference**	**Direction**	**Description**
UALARM	-	Input	Servo Error at U axis
UECAP	-	Input	Encoder Phase A at U axis
UECAN	-	Input	Encoder Phase A at U axis
UECBP	-	Input	Encoder Phase B at U axis
UECBN	-	Input	Encoder Phase B at U axis
UIN0P	-	Input	Encoder Phase Z at U axis
UIN0N	-	Input	Encoder Phase Z at U axis
ZEXOP+	-	Input	Jog at the + Direction of Z axis
ZEXOP-	-	Input	Jog at the - Direction of Z axis
UEXOP+	-	Input	Jog at the + Direction of U axis
UEXOP-	-	Input	Jog at the - Direction of U axis
GND	-	-	Ground
ZOUT4	GND	Output	Common Output at Z axis (CMP+)
ZOUT5	GND	Output	Common Output at Z axis (CMP-)
ZOUT6	GND	Output	Common Output at Z axis (Server on)
ZOUT7	GND	Output	Common Output at Z axis (Reset)
ZP+P	GND	Output	Output pulse CW/Pulse+ of Z-axis
ZP+N	GND	Output	Output pulse CW/Pulse- of Z-axis
ZP-P	GND	Output	Output pulse CCW/DIR+ of Z-axis
ZP-N	GND	Output	Output pulse CCW/DIR- of Z-axis
GND	-	-	Ground
UOUT4	GND	Output	Common Output at U axis (CMP+)
UOUT5	GND	Output	Common Output at U axis (CMP-)
UOUT6	GND	Output	Common Output at U axis (Server on)
UOUT7	GND	Output	Common Output at U axis (Reset)
UP+P	GND	Output	Output pulse CW/Pulse+ of U-axis
UP+N	GND	Output	Output pulse CW/Pulse- of U-axis
UP-P	GND	Output	Output pulse CCW/DIR+ of U-axis
UP-N	GND	Output	Output pulse CCW/DIR- of U-axis

2.3 Output Pulse Definition

The output pulse command of ADAM-5240 is from MCX314AS 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.

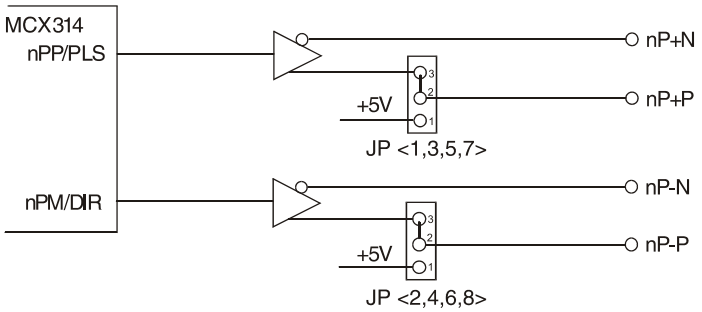


Figure 2.2: Output Signal Loop for Drive Pulses

From the circuit shown above (Figure 3-3), the default output mode is differential output. For single ended output use, user can change jumpers JP1~8 to +5V. Note that you should prevent from the noise interference when using jumpers JP1~8 to output internal +5V to external device.

Table 2.2: JP1~8 Jumpers

Jumper	JP1	JP2	JP3	JP4	JP5	JP6	JP7	JP8
Output Signal	XP+P	XP-P	YP+P	YP-P	ZP+P	ZP-P	UP+P	UP-P
IC Output (Line Driver Output)	Pin2 and Pin 3 short (Default)							
+5V Output	Pin1 and Pin 2 shor							

The following figure 3-4 and 3-5 show the examples of input circuitry connection for both photo coupler and motor driver respectively.

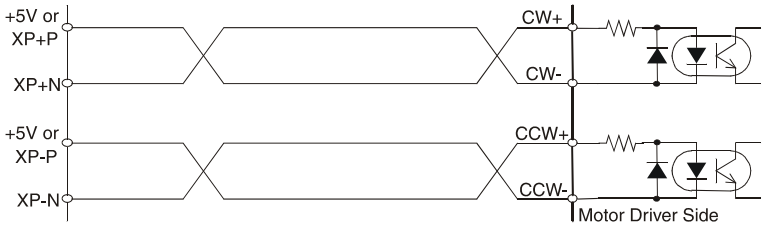


Figure 2.3: Photo Coupler Input Interface

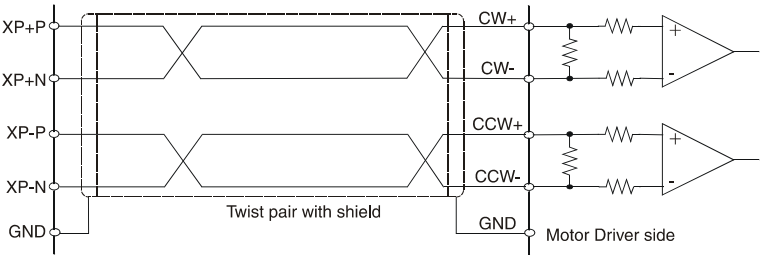


Figure 2.4: Line Driver Input Interface

2.4 General Purposed Output

The general purposed output nOUT7/DSND, nOUT6/ASND, nOUT5/CMPM, and nOUT4/CMPP are from MCX314AS, and each output signal is OFF status after system reset.

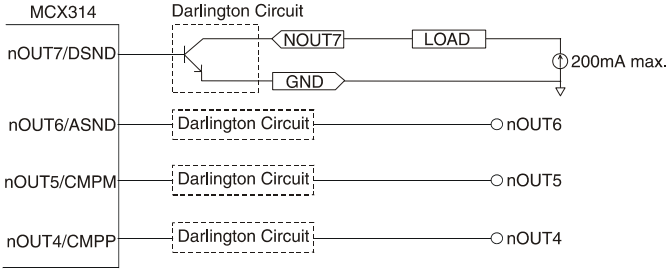


Figure 2.5: General Purpose Output

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.

2.5 Over Traveling Limit Switch Input

*Note: When the axis/axes is/are about to stop (in the deceleration stage), the axis/axes will not stop totally but keep moving at a very low speed if you use S-curve acceleration/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 MCX314AS 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 MCX314AS will be low level. This enables the over traveling function if the desired level of nLMTP is set to low.

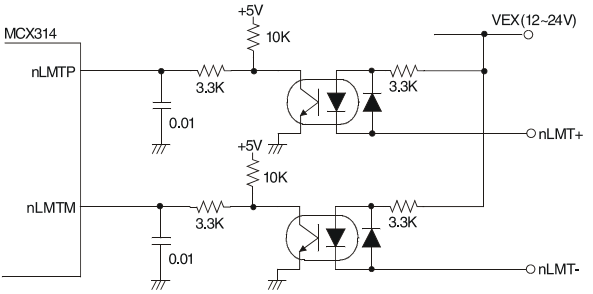


Figure 2.6: Movement Limit Input Signals

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.

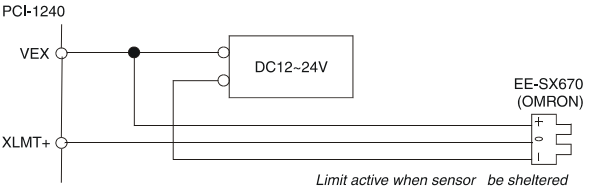


Figure 2.7: Photo Sensor in the Limit Input Signal

2.6 Deceleration/Instantaneous Stop Switch Input

*Note: When the axis/axes is/are about to stop (in the deceleration stage), the axis/axes will not stop totally but keep moving at a very low speed if you use S-curve acceleration/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 (nIN1, nIN2, nIN3) can make the motor drives deceleration or stop. Each axis has four inputs IN3 ~ IN0, wherein IN0 is used in phase Z interface of encoder feedback, and nIN1, nIN2, and nIN3 are use as input signals near the original point. If run mode is active, the output of driving pulse is terminated after those signals are enabled; The deceleration occurs during acceleration/deceleration, and it will be stopped immediately during constant drive. All the signals become invalid after reset. For example, when setting the D7 and D6 of XWR1 register to 1 and 0 (IN3 is low active), the drive will be terminated in the case of the limit switch is on and xIN3 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)

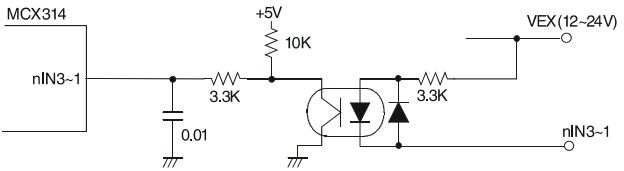


Figure 2.8: Deceleration/Instantaneous Stop Input

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

2.7 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 ADAM-5240 to stop output pulses. When enable the nALARM function of ADAM-5240, the D14 bit of RR2 will set to 1 after nALARM active. If ADAM-5240 is driving pulses output, the output pulses will stop immediately when nALARM active.

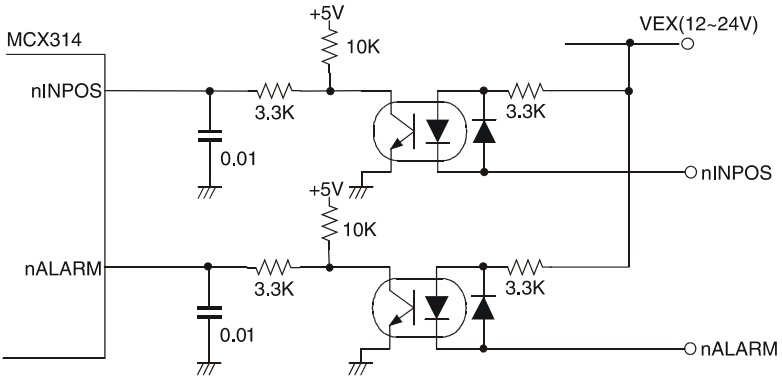


Figure 2.9: Input Signal for Servo Motor

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.

2.8 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 ADAM-5240 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.

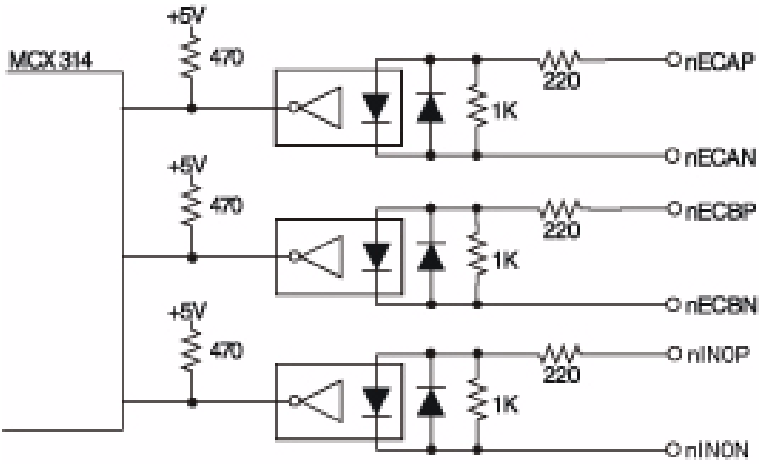


Figure 2.10: Circuit Diagram of Encoder Feedback

From the circuit diagram above, ADAM-5240 use 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 MCX314AS 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.

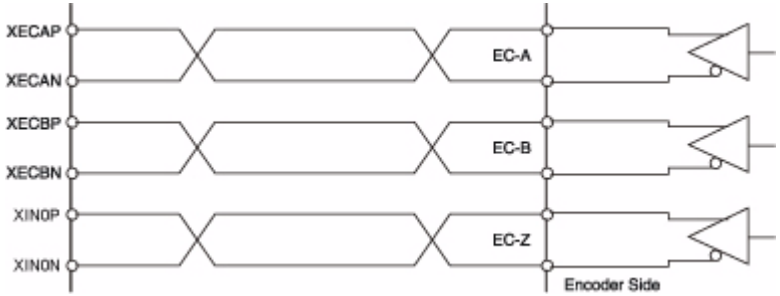


Figure 2.11: Differential-output Line Driver

The following figure is an example of connection for the encoder with open-collector output.

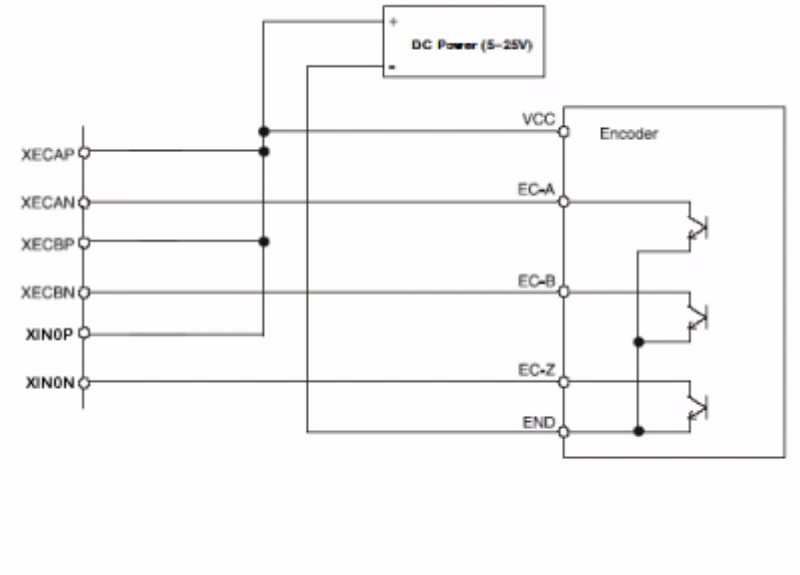


Figure 2.12: Open Collector Output Encoder

2.9 External Pulse Control Input

The pulses output function of MCX314AS chip is controlled by register setting or by external pulse command input (nEXOP+, nEXOP-). There are two output pulse mode for the external control pin. One is fixed pulse output mode, and the other is continuous output mode. In ADAM-5240, it provides Jog and Hand wheel functions that allow you driving motors through external Hand wheel or Jog equipment. In Jog mode, it is corresponding 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 combination 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.

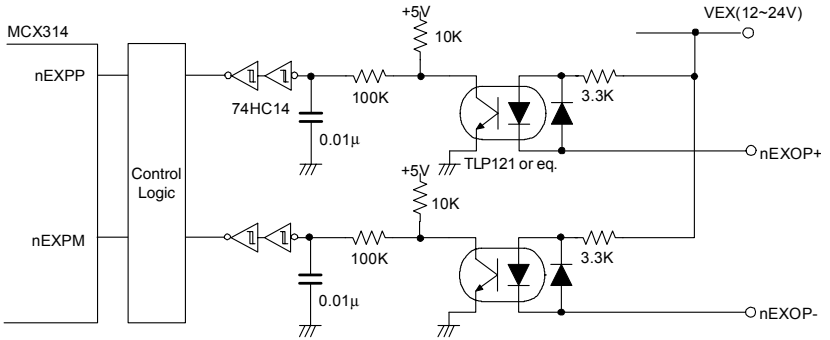


Figure 2.13: External Drive Operation Signals

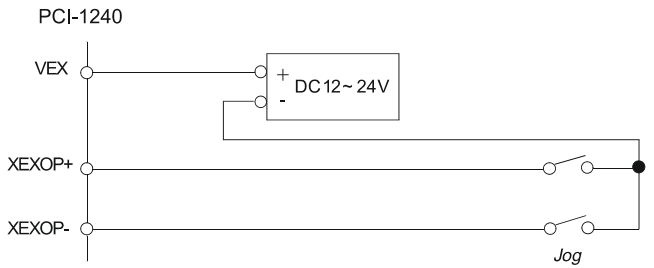


Figure 2.14: Example of Connecting to Jog

2.10 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 JP9 on the board.

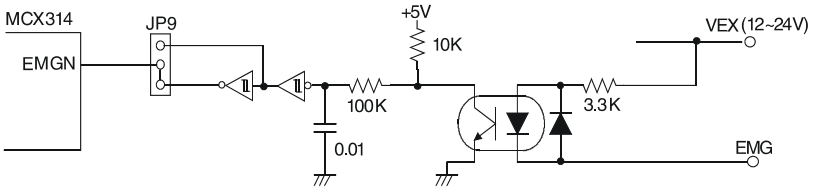


Figure 2.15: Emergency Stop Input Signal

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 2.3: Jumper Settings of JP9	
Jumper	**JP9**
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.*

2.11 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.

2.12 Interrupt Setting

When the interrupt occurs from MCX314AS, the interrupt signal of MCX314AS will be changed from high to low. Because the PCI bus interrupt is high level sensitive, the ADAM-5240 inverse the signal and latch the signal to adapt the PCI bus INTA. The Fig- 3.17 shows the interrupt structure of the ADAM-5240. 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 MCX314AS for accepting next interrupt occurs.

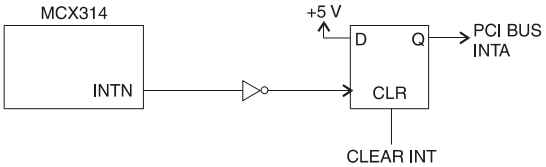


Figure 2.16: Circuit Diagram of Interrupt Setting

2.13 Connection Examples for Motor Drivers

2.13.1 Connection to Step Motor Drivers

The following figure is an example of ADAM-5240 connected to 5-phase micro-step motor drives, KR515M manufactured by TECHNO company.

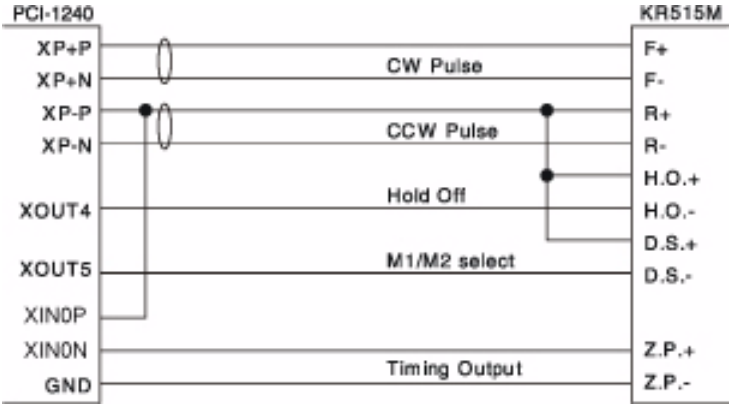


Figure 2.17: Connecting to KR515M Drive

Note *JP1~8 of ADAM-5240 are set to +5V output side, +5V output for output terminals XP+P and XP-P. Setting JP1~8 as single-ended output will output +5V of ADAM-5240 to external devices, this will induce noise back to ADAM-5240. So, be careful when connection.*

Connect XOUT4 to H. O. (Hold off) can control the drive to hold.

Connect XOUT5 to D.S. can control the resolution of micro-step drive. Which will be controlled by setting D8, D9 of WR3 in MCX314AS. And, read the RR4,5 to know the status of XIN0P/N.

The following figure is an example of ADAM-5240 connected to UPK step drive manufactured by ORIENTAL company.

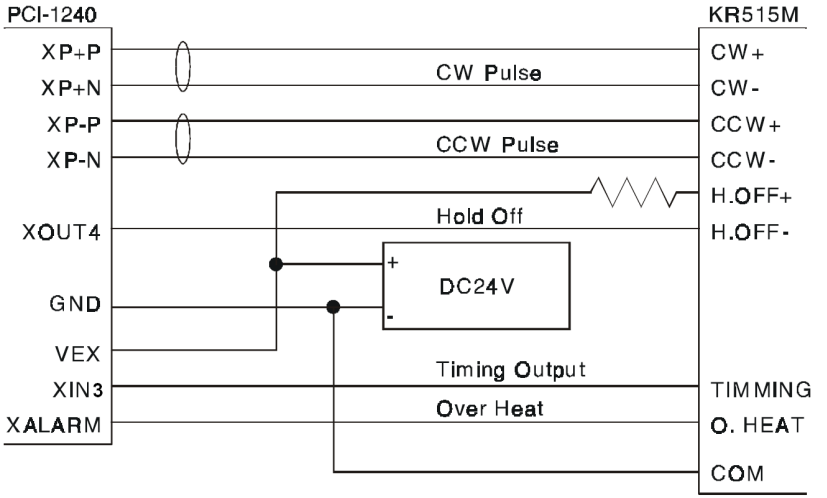


Figure 2.18: Connecting to UPK Step Drive

Note *The differential pulse output of ADAM-5240 is connected to CW/CCW input of UPK drive. XOUT4 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.

2.13.2 Connection to Servo Motor Drivers

The figure shown below is an example of ADAM-5240 connected to MINAS X series AC servo motor drive.

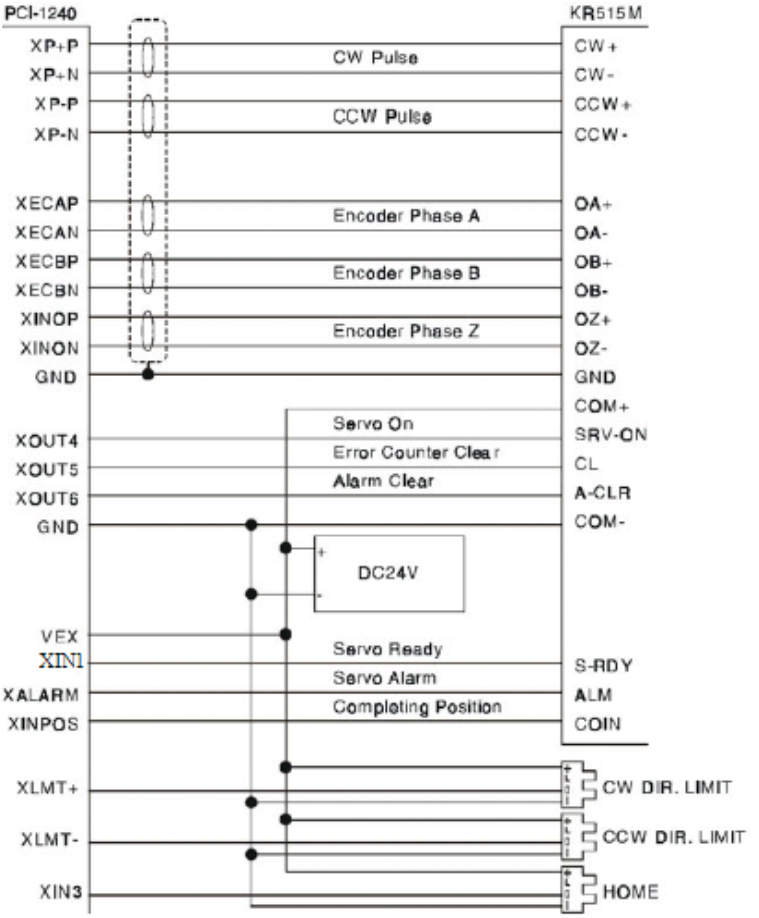


Figure 2.19: MINAS X Series AC Servo Motor Drive

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 ADAM-5240.

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

2.14 Field Wiring Considerations

When you use the ADAM-5240 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 ADAM-5240.

- 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-10251 shielded cable.

2.15 I/O Signal Timing

2.15.1 Power On RESET

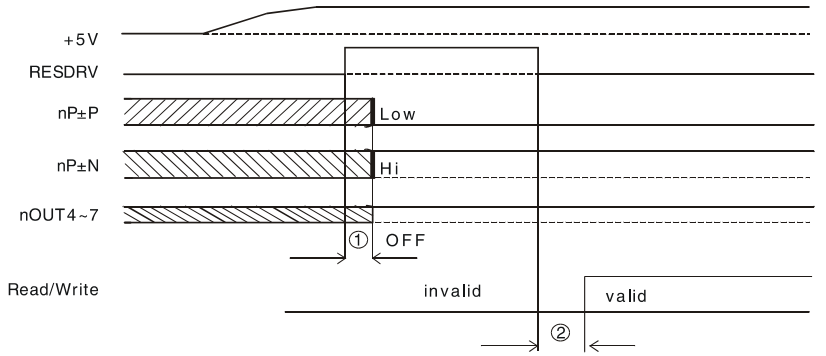


Figure 2.20: Timing Diagram of Power On Reset

- Output pulses (nP ± P, nP ± N) for drive control and general purpose output signals (nOUT4 ~ 7) for I/O control will be determined after 250 nsec from power on reset.
- User can access ADAM-5240 only after 500 nsec from power-on reset.

2.15.2 Individual Axis Driving

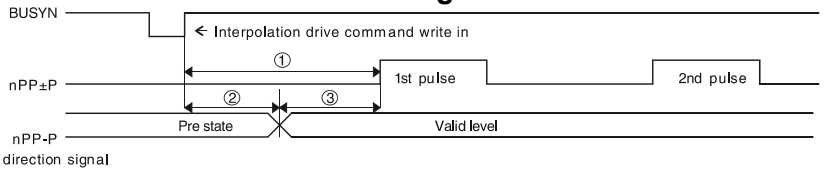


Figure 2.21: Individual Axis Driving

- 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.

2.15.3 Interpolation Driving

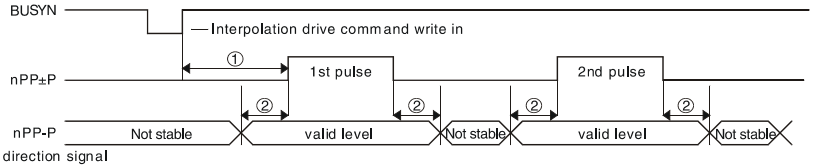


Figure 2.22: Timing Diagram of Interpolation Driving

- 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.

2.15.4 Input Pulse Timing

Quadrature Pulse of Encoder Input

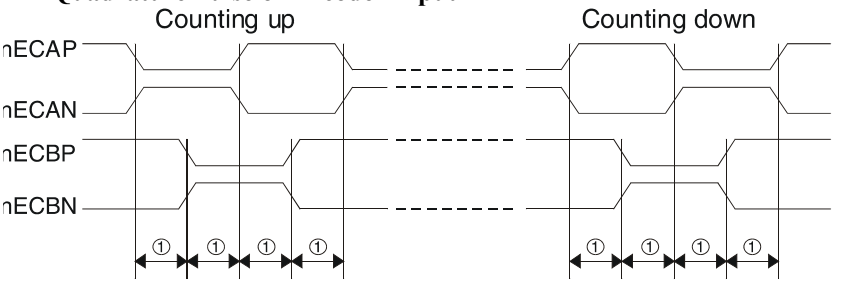


Figure 2.23: Quadrature Pulse of Encoder Input

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

UP/DOWN Pulse Input

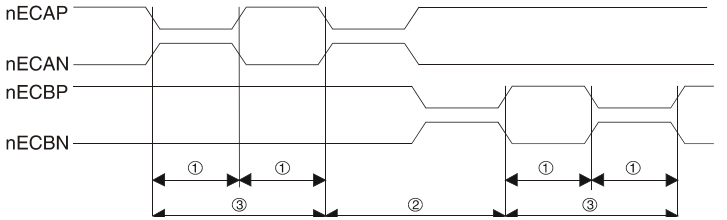


Figure 2.24: Timing Diagram of Up/Down Pulse Input

- Minimum UP/DOWN pulse width: 130 nsec.
- Minimum Increased/Decreased Pulse Interval: 130 nsec .
- Minimum UP/DOWN pulse period: 260 nsec.

2.15.5 Instantaneous Stop Timing

External Instantaneous Stop Signal

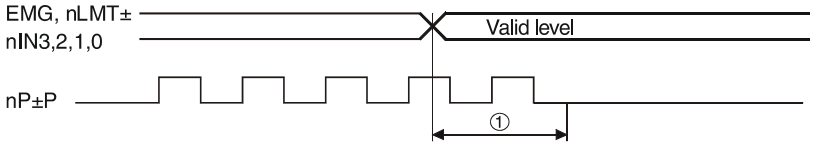


Figure 2.25: External Instantaneous Stop Signal

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

Instantaneous Stop Instruction

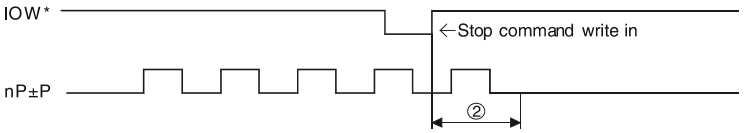


Figure 2.26: Instantaneous Stop Instruction

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

2.15.6 Deceleration Stop Timing

External Deceleration/Stop Signal

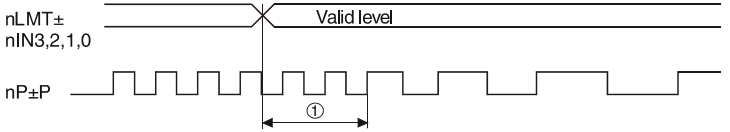


Figure 2.27: External Deceleration/Stop Signal

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

Deceleration/Stop Instruction

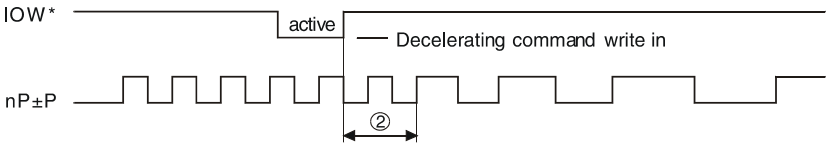


Figure 2.28: Deceleration/Stop Instruction

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

2.16 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 ADAM-5240, the position compare output channels are nOUT4 and nOUT5, and it is open-collector type output. In which the nOUT4 and nOUT5 represent the different direction of position compare separately. For ADAM-5240, we provide an integrated option for the position compare output. By selecting with JP10, you can choose the XOUT4 pin as original design as ADAM-5240, or TTL level output. While the JP10 is in "CMP" position, the output of XOUT4 is (XOUT4 XOUT5). With this special design you can get the compared result in both increment and decrement direction through one unified pin.

Table 2.4: Jumper Settings of JP10

Jumper	JP10
The XOUT4 is defined as the pulse output channel for the incremental position compare mechanism. And it's open-collector type output.	XOUT4, Pin 1 and Pin 2 short (Default)
It's a design only for ADAM-5240. The position compare signal for both directions will output from XOUT4, and the output level of XOUT4 is TTL level.	CMP, Pin 2 and Pin 3 short

APPENDIX A

Specifications

Appendix A Specifications

A.1 Axes

Axes	4	
2/3-Axis Linear Interpolation	Range	For each axis: -2,147,483,648 ~ +2,147,483,648
	Speed	1 PPS ~ 4 MPPS
	Precision	± 0.5 LSB
2-Axis Circular Interpolation	Range	-2,147,483,648 ~ +2,147,483,648
	Speed	1 PPS ~ 4 MPPS
	Precision	± 1 LSB
Continous Interpolation	Speed	1 PPS ~ 2 MPPS
	Output Signal	nP+P/N, nP-P/N
	Range	ADAM-5240:(-8,388,608 ~ +8,388,607) ADAM-5240: (-2,147,483,648 ~ +2,147,483,648)
	Precision	± 0.1%
Single Axis Movement	Change of Acceleration for S Curve	954 ~ 31.25 x 10^9 PPS/sec²
	Acceleration/ Deceleration	125 ~ 500 x 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 ~ 4,294,067,295
	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

A.2 Digital Input/Output

Input Signals	Over Traveling Limit Switch Input*	nLMT+ and nLMT-	
	External Deceleration/ Instantaneous Stop Signal	nIN1 ~ 3	
	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	Low	3 V DC max.
		High	10 V DC min.
			50 V DC max.
	Input Current	10 V DC	1.70 mA (typical)
		12 V DC	2.10 mA (typical)
		24 V DC	4.40 mA (typical)
		48 V DC	9.00 mA (typical)
		50 V DC	9.40 mA (typical)
	Protection	2,500 V DC photo coupler isolation and RC filtering	
General Purpose Output Signals	Output Signal	nOUT4 ~ 7	
	Output Voltage	Open Collector 5 ~ 40 V DC	
	Sink Current	200 mA max./channel	
	Protection	2,500 V DC photo coupler isolation	

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

A.3 Input Pulse for Encoder Interface

Input Signal*	nECAP/N, nECBP/N, nIN0P/N	
Encoder Pulse Input Type	Quadrature (A/B phase) or Up/Down x1, x2, x4 (A/B phase only)	
Counts per Encoder Cycle	x1, x2, x4 (A/B phase only)	
Max. Input Frequency	1 MHz	
Input Voltage	Low	2 V DC max.
	High	Min.: 5V DC
		Max. 30 V DC
Protection	2,500 V DC Isolation Protection	

A.4 External Signals Driving

Input Signal	nEXOP+, nEXPO-	
Max. Input Frequency	100 Hz	
Input Voltage	Low	3 V DC max.
	High	10 V DC min.
		30 V DC max.
Driving Mode	Fixed pulse driving or continuos driving. Supports Hand wheel and Jog.	
Protection	2,500 V DC photo coupler isolation	

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
	Can be used for software over traveling limit	
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+
		Constant speed begins or ends during acceleration/deceleration driving pulse finishing

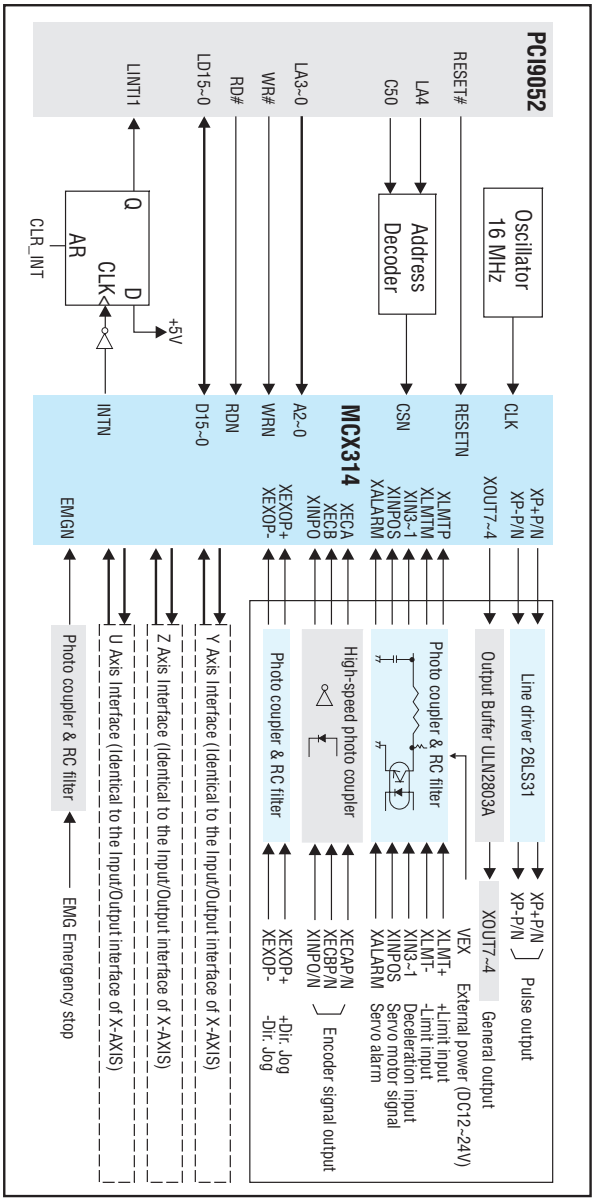
A.6 General

I/O Connector Type	100-pin SCSI-II female	
Dimensions	175 x 100 mm (6.9” x 3.9”)	
Power Consumption	Typical.	+5 V @ 850 mA +12 V @ 600 mA
	Max.	+5 V @ 1 A +12 V @ 700 mA
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	

APPENDIX B

Block Diagram

Appendix B Block Diagram

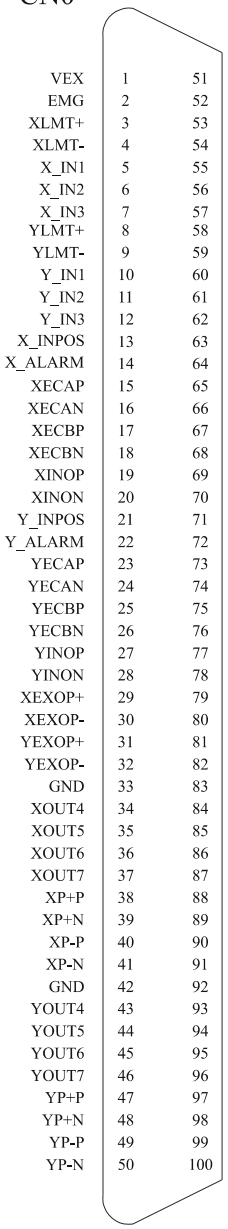


APPENDIX C

Cable Pin Assignments

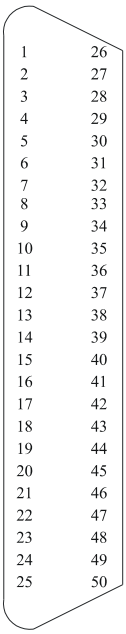
Appendix C Cable Pin Assignments

CN0



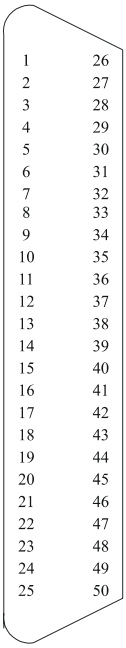
VEX	1	51	VEX
EMG	2	52	NC
XLMT+	3	53	ZLMT+
XLMT-	4	54	ZLMT-
X_IN1	5	55	Z_IN1
X_IN2	6	56	Z_IN2
X_IN3	7	57	Z_IN3
YLMT+	8	58	ULMT+
YLMT-	9	59	ULMT-
Y_IN1	10	60	U_IN1
Y_IN2	11	61	U_IN2
Y_IN3	12	62	U_IN3
X_INPOS	13	63	Z_INPOS
X_ALARM	14	64	Z_ALARM
XECAP	15	65	ZECAP
XECAN	16	66	ZECAN
XECBP	17	67	ZECBP
XECBN	18	68	ZECBN
XINOP	19	69	ZINOP
XINON	20	70	ZINON
Y_INPOS	21	71	U_INPOS
Y_ALARM	22	72	U_ALARM
YECAP	23	73	UECAP
YECAN	24	74	UECAN
YECBP	25	75	UECBP
YECBN	26	76	UECBN
YINOP	27	77	UINOP
YINON	28	78	UINON
XEXOP+	29	79	ZEXOP+
XEXOP-	30	80	ZEXOP-
YEXOP+	31	81	UEXOP+
YEXOP-	32	82	UEXOP-
GND	33	83	GND
XOUT4	34	84	ZOUT4
XOUT5	35	85	ZOUT5
XOUT6	36	86	ZOUT6
XOUT7	37	87	ZOUT7
XP+P	38	88	ZP+P
XP+N	39	89	ZP+N
XP-P	40	90	ZP-P
XP-N	41	91	ZP-N
GND	42	92	GND
YOUT4	43	93	UOUT4
YOUT5	44	94	UOUT5
YOUT6	45	95	UOUT6
YOUT7	46	96	UOUT7
YP+P	47	97	UP+P
YP+N	48	98	UP+N
YP-P	49	99	UP-P
YP-N	50	100	UP-N

CN1



VEX	1	26	EMG
XLMT+	2	27	XLMT-
X_IN1	3	28	X_IN2
X_IN3	4	29	YLMT+
YLMT-	5	30	Y_IN1
Y_IN2	6	31	Y_IN3
X_INPOS	7	32	X_ALARM
XECAP	8	33	XECAN
XECBP	9	34	XECBN
XINOP	10	35	XINON
Y_INPOS	11	36	Y_ALARM
YECAP	12	37	YECAN
YECBP	13	38	YECBN
YINOP	14	39	YINON
XEXOP+	15	40	XEXOP-
YEXOP+	16	41	YEXOP-
GND	17	42	XOUT4
XOUT5	18	43	XOUT6
XOUT7	19	44	XP+P
XP+N	20	45	XP-P
XP-N	21	46	GND
YOUT4	22	47	YOUT5
YOUT6	23	48	YOUT7
YP+P	24	49	YP+N
YP-P	25	50	YP-N

CN2



VEX	1	26	NC
ZLMT+	2	27	ZLMT-
Z_IN1	3	28	Z_IN2
Z_IN3	4	29	ULMT+
ULMT-	5	30	U_IN1
U_IN2	6	31	U_IN3
Z_INPOS	7	32	Z_ALARM
ZECAP	8	33	ZECAN
ZECBP	9	34	ZECBN
ZINOP	10	35	ZINON
U_INPOS	11	36	U_ALARM
UECAP	12	37	UECAN
UECBP	13	38	UECBN
UINOP	14	39	UINON
ZEXOP+	15	40	ZEXOP-
UEXOP+	16	41	UEXOP-
GND	17	42	ZOUT4
ZOUT5	18	43	ZOUT6
ZOUT7	19	44	ZP+P
ZP+N	20	45	ZP-P
ZP-N	21	46	GND
UOUT4	22	47	UOUT5
UOUT6	23	48	UOUT7
UP+P	24	49	UP+N
UP-P	25	50	UP-N

APPENDIX D

Wiring with Third-Party Motor Drivers

Appendix D Wiring with Third-Party Motor Drivers

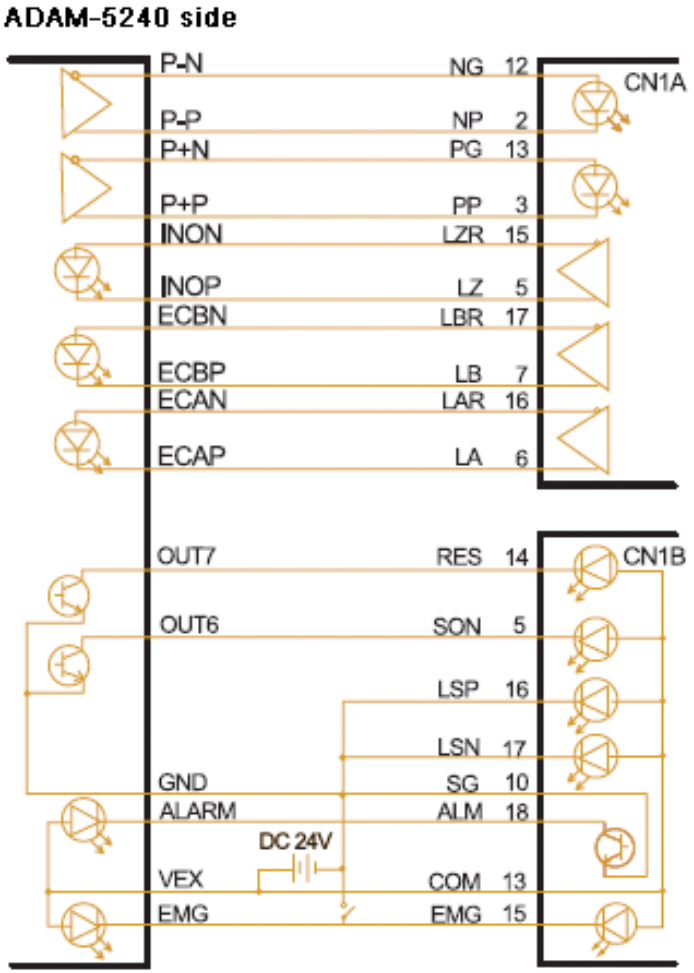


Figure D.1: Mitsubishi MR-J2S Series Motor Driver

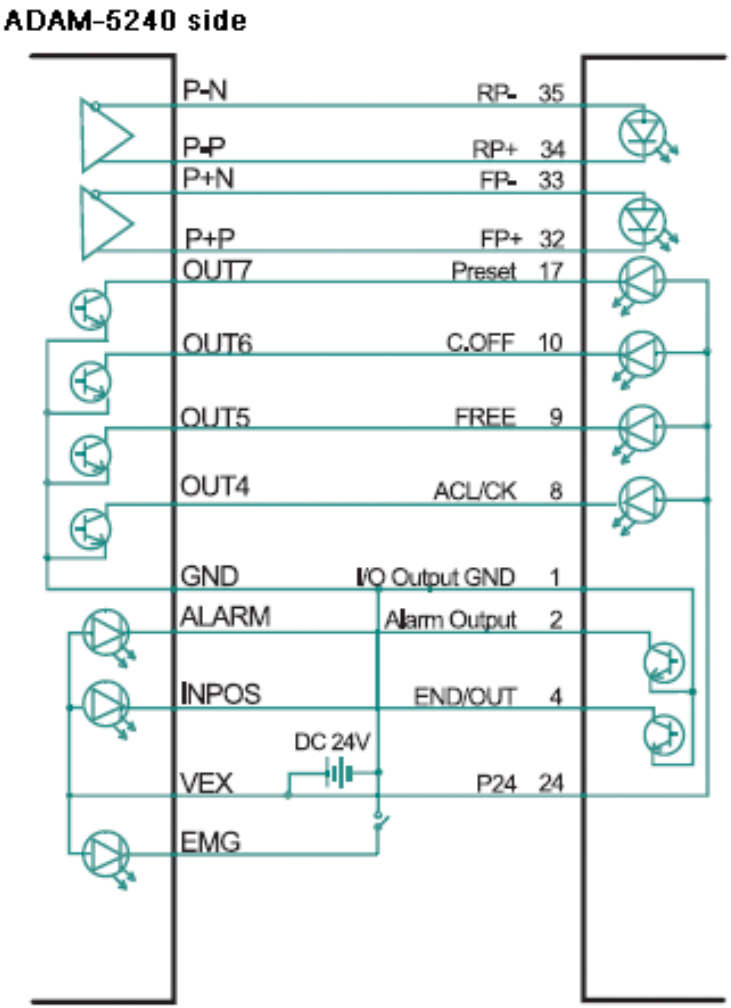


Figure D.2: Oriental LIMO EZMC Motor Driver

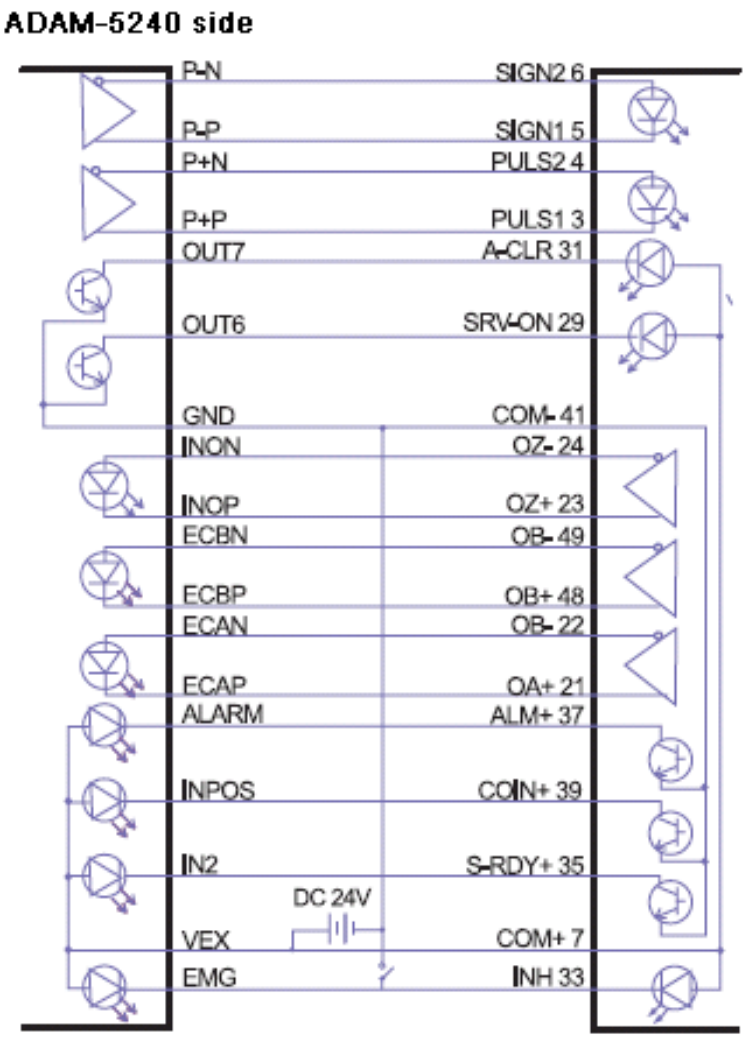


Figure D.3: Panasonic MINAS-A Series Motor Driver

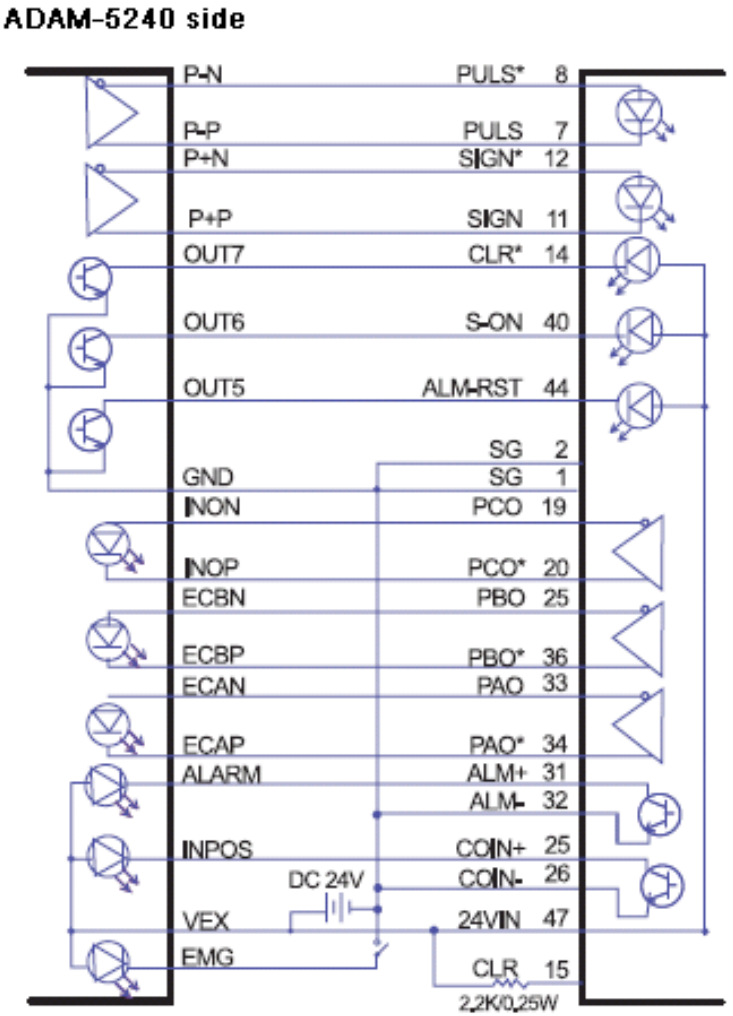


Figure D.4: Yaskawa SGDM Series Motor Driver