

CMD-4CR-EV

Advanced 4-Axis Development Kit for CMD-4CR



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First edition, October 2019

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Revision History

Date	Revision	Hardware	Changes Made
Dec 2019	1.0	B1	New Document
Dec 2019	1.1	B1	Updated cable kit part numbers
Jan 2020	1.2	B1	Updated Digital Output schematic

Cautions

Copying all or any part of this manual without written approval is prohibited. Information in this document is subject to change without notice.

The specifications of this controller may be changed to improve performance or quality without prior notice. Although this manual was produced with the utmost care, if you find any points that are unclear, wrong, or have inadequate descriptions, please let us know.

We are not responsible for any results that occur from using this controller, regardless of item (3) above. The Commander core is designed for use in commercial apparatus (office machines, communication equipment, measuring equipment, and household appliances). If you use it in any device that may require high quality and reliability, or where faults or malfunctions may directly affect human survival or injure humans, such as in nuclear power control devices, aviation devices or spacecraft, traffic signals, fire control, or various types of safety devices, we will not be liable for any problem that occurs, even if it was directly caused by the Commander core. Customers must provide their own safety measures to ensure appropriate performance in all circumstances.

Explanation of the descriptions in this manual

The "X" "Y" "Z" and "U" of terminal names and bit names refer to the X-axis, Y-axis, Z-axis, and U-axis, respectively. Terminals with a / (ex. /RST) are negative logic. Their logic cannot be changed. Terminals without a / are positive logic. Their output logic can be changed. When describing the bits in registers, "n" refers to the bit position. A "0" means that the bit is in position 0 and that it is prohibited to write to any bit other than "0." Finally, this bit will always return a "0" when readout.

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1 Introduction

CMD-4CR-EV is an advanced 4 axis Development Kit, designed to allow quick testing of the Commander core motion controller's (CMD-4CR) features. Communication to the CMD-4CR-EV and thus CMD-4CR, is established over USB, or RS-485 network. This documentation covers the hardware specifications of the CMD-4CR-EV. Refer to the Commander, Command Reference, and Software Utility Manuals for more information.

1.1. Features

Power

- +12VDC to +48VDC power input
 - +5Vdc and +3.3Vdc power supply onboard

Communication interface

- USB 2.0 communication
- RS-485 ASCII communication
- Available for future expansion
 - I2C bus [1 channel]
 - SPI bus [2 channels]
 - 10/100 Mbps Ethernet communication, ASCII over TCP/IP

Input/Output Buffering

- Digitally buffered outputs limited to 3MHz
 - Pulse, direction, enable, error clear, and sync
- Digitally buffered inputs limited to 3MHz
 - In-position, servo alarm, encoder, MPG, and latch
- Optocoupled outputs limited to 500Hz
 - General-purpose outputs
- Optocoupled inputs limited to 500Hz
 - Limits, home, slowdown, emergency stop, simultaneous start, and general-purpose inputs

Motor interface

- Stepper motor interface with pulse, direction, and enable outputs
- Servo motor interface with pulse, direction, enable, in-position, servo alarm, and error clear outputs

Inputs/Outputs

- A/B/Z encoder inputs (TTL Compatible)
- A/B MPG inputs for (TTL Compatible)
- 4 x high speed inputs / latching inputs
- 4 x high speed outputs / sync outputs
- +Limit/-Limit/Home inputs for XYZU
- Simultaneous start input
- Emergency stop input
- 16 general purpose inputs
- 16 general purpose outputs
- 2 x analog input
 - 2 analog input potentiometers
- 2 x PWM outputs

2 Electrical and Thermal Specifications

Parameter	Min	Max	Units
Main Power Input (V _{DD})	+12	+48	V
	-	1.0	A
Opto-Supply Power Input	+12	+48	V
Pulse/Direction/Enable Open Collector	-	+48	V
	-	40	mA
Alarm Input Forward Diode Current	-	40	mA
Digital Input Forward Diode Current	0	40	mA
Digital Output Source Current	0	50	mA
Operating Temperature ¹	-20	+80	°C
Storage Temperature ¹	-55	+150	°C

¹Based on component ratings

Table 2.0

3 Dimensions

All dimensions in mm with tolerance ± 0.1 [inch] with tolerance ± 0.01

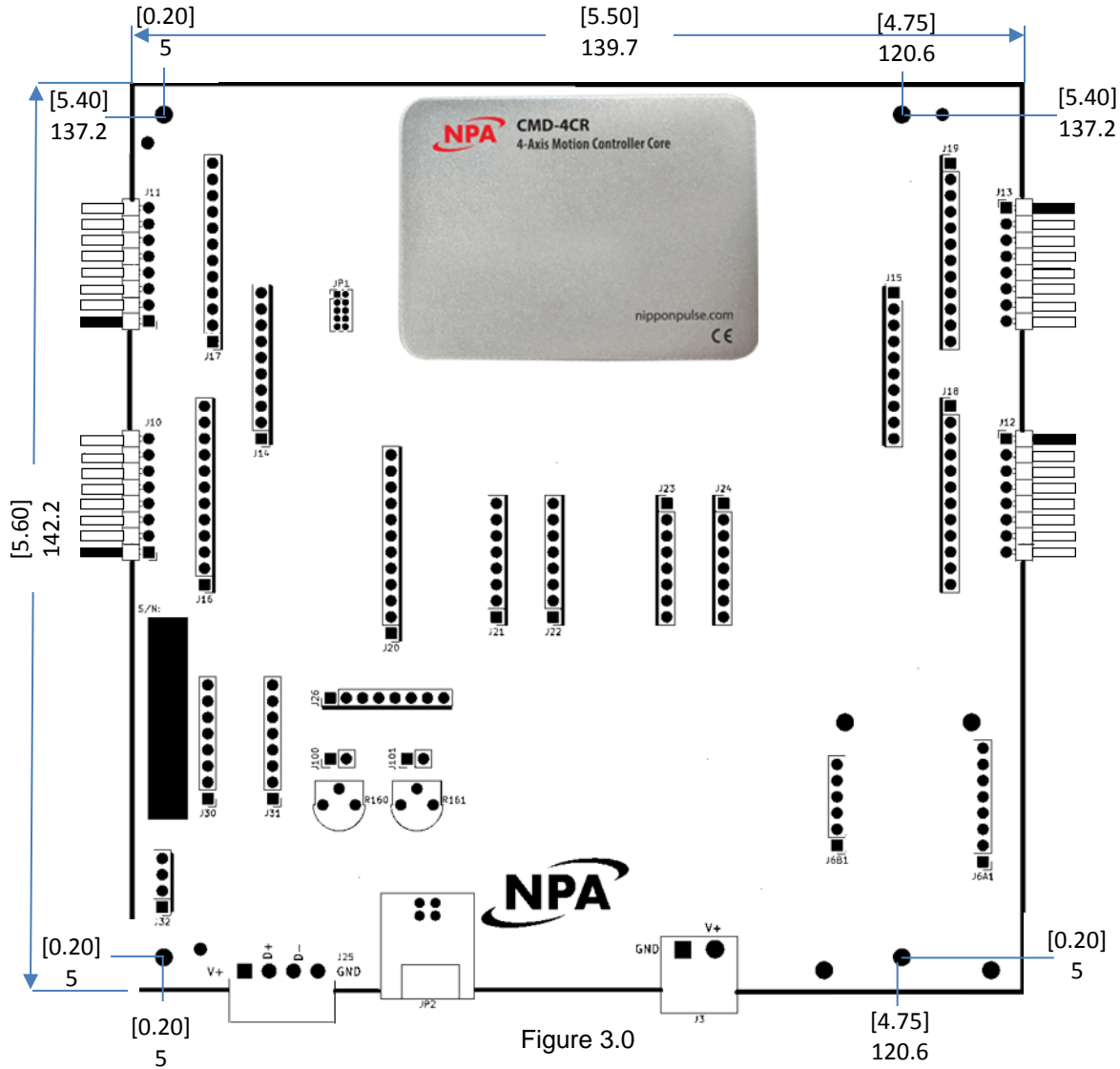


Figure 3.0

4 Connectivity

In order for CMD-4CR-EV to operate, it must be supplied with at least +12VDC, but not exceeding +48VDC. Power pins and communication pins are displayed and described below. Also listed are the recommended mating connector elements, and premade cables if available.

4.1 [J3] 2-Pin Power Connector (5.08mm)

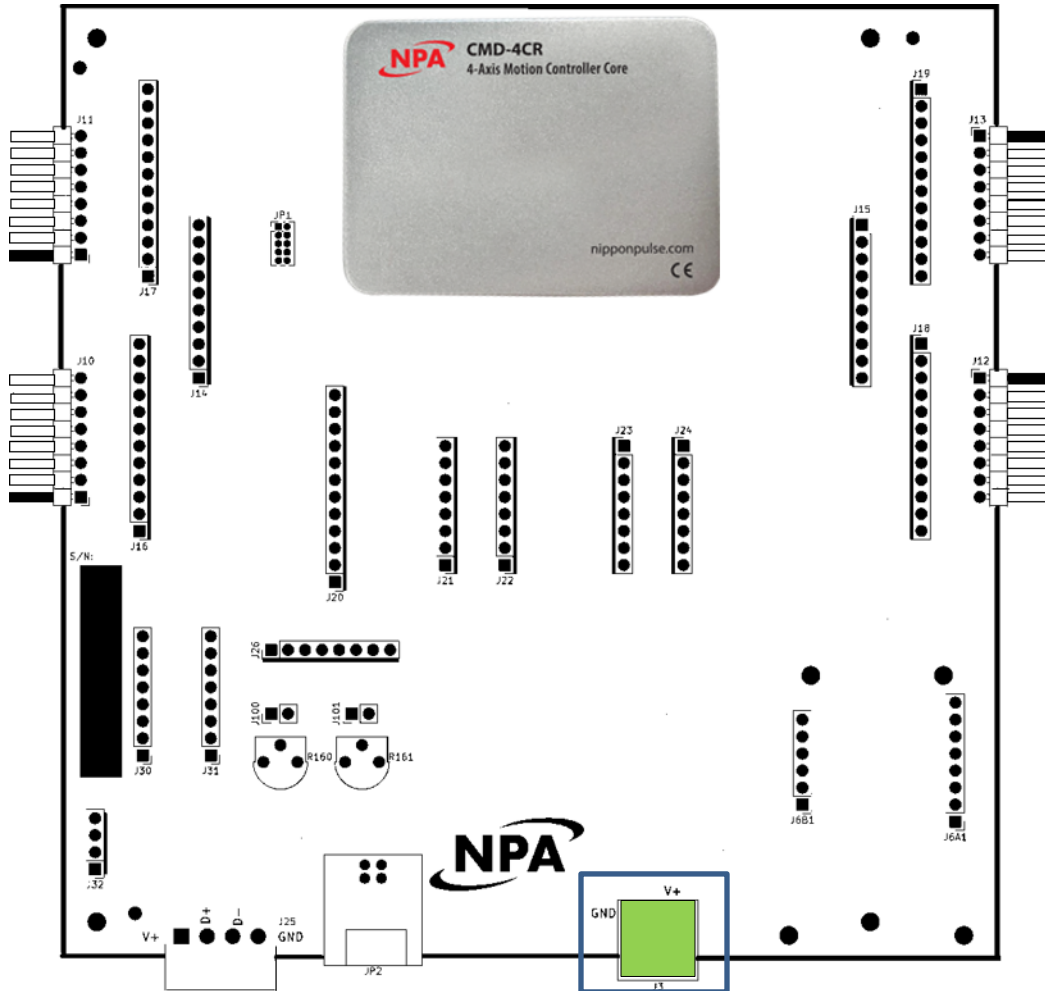


Figure 4.0

Pin #	In/Out	Name	Description
1	I	GND	Ground
2	I	V+	Power Input +12 to +48 VDC
On Shore Technology Inc Mating Connector – EDZ950/2			

Table 4.0

4.2 [J25] 4-Pin RS-485 Connector (3.81mm)

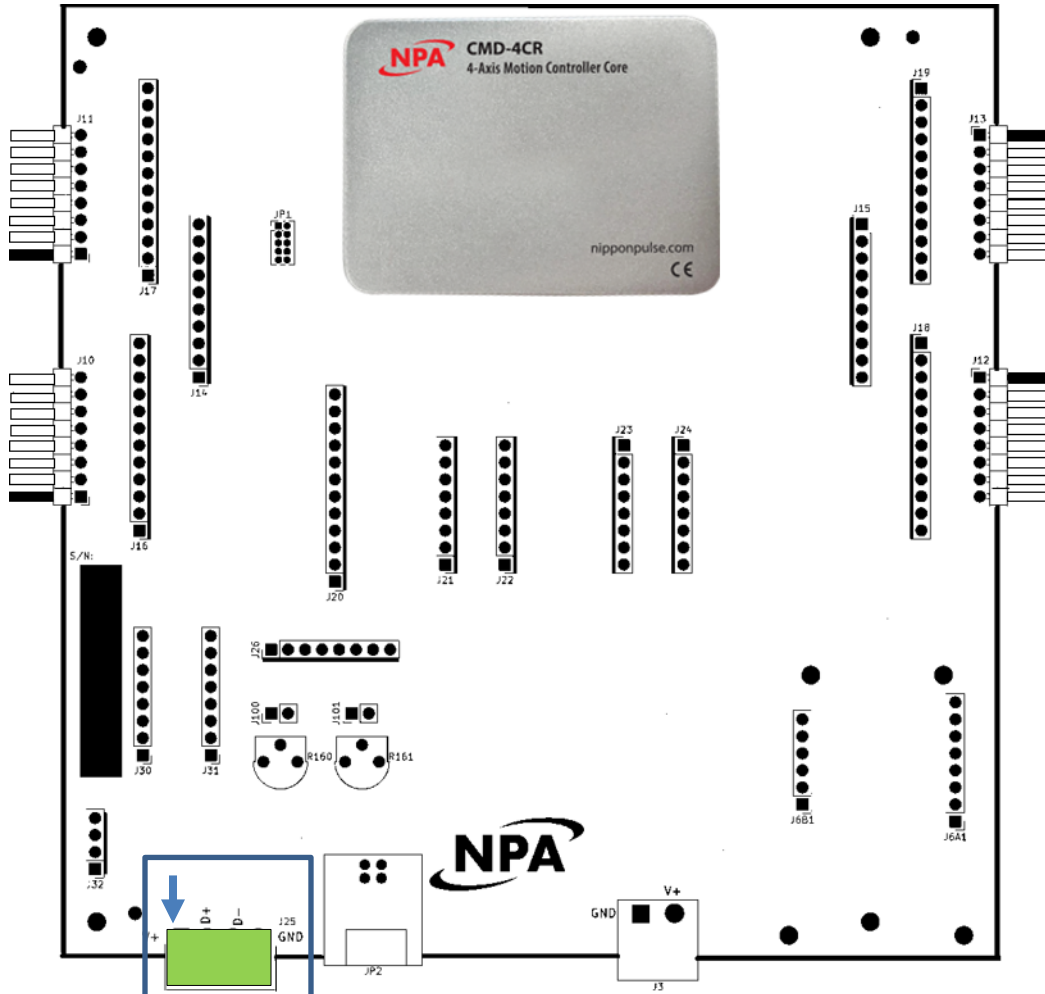


Figure 4.1

Pin #	In/Out	Name	Description
1	O	+5V	+5V
2	I/O	485+	RS-485 plus signal
3	I/O	485-	RS-485 minus signal
4	O	GND	Ground

On Shore Technology Inc Mating Connector – EDZ1550/4

Table 4.1

4.3 [J20] 12-Pin DIO Connector (2.54mm)

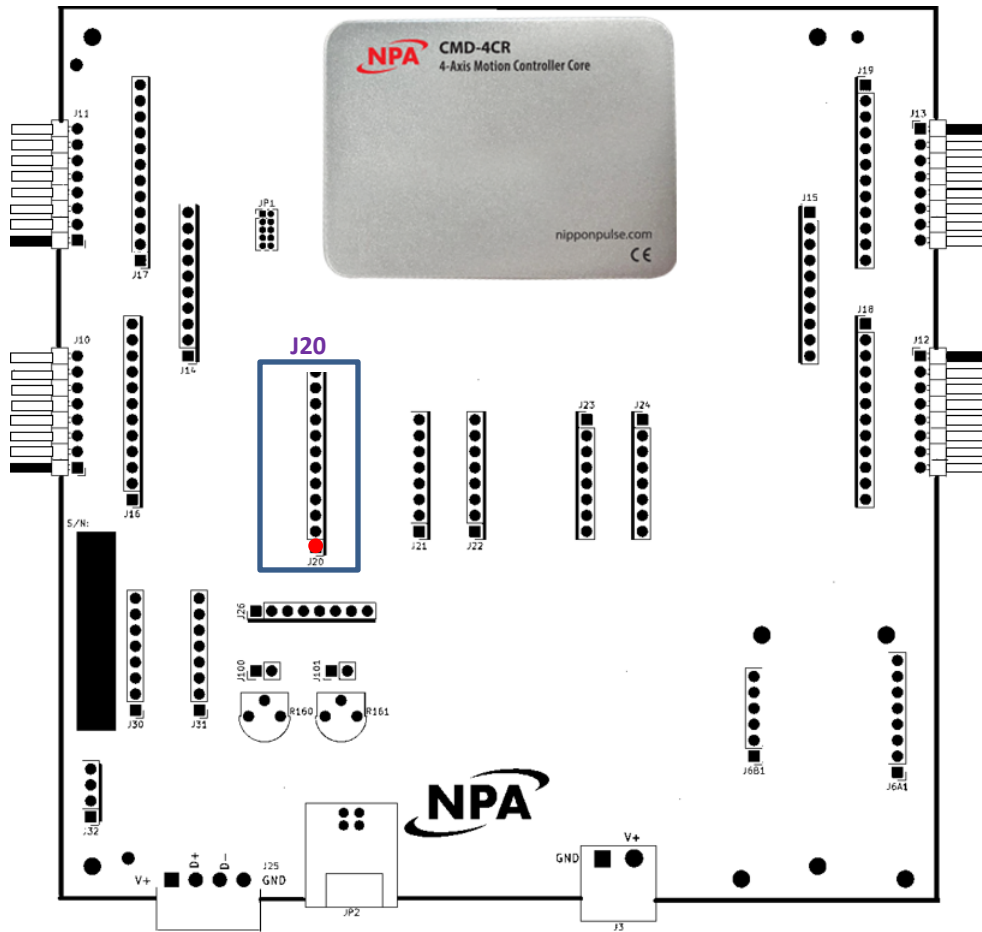


Figure 4.2

Pin #	In/Out	Name	Description
1	I	Vs	Opto-Supply +12V to +48 VDC
2	I	Vg	Opto-Ground
3	I	DI1/LTCx	Digital Input 1 [Latch X]
4	I	DI2/LTCy	Digital Input 2 [Latch Y]
5	I	DI3/LTCz	Digital Input 3 [Latch Z]
6	I	DI4/LTCu	Digital Input 4 [Latch U]
7	O	DO1/SYNCx	Digital Output 1
8	O	DO2/SYNCy	Digital Output 2
9	O	DO3/SYNCz	Digital Output 3
10	O	DO4/SYNCu	Digital Output 4
11	I	/CEMG	Emergency Stop
12	I	/CSTA	External Start
Molex Pins - 0008550101			Molex Connector Housing - 0022013127
12 position cable with Molex connector: Z3-210-242-01			

Table 4.2

4.4 [J21] 8-Pin Configurable IO Connector 1 (2.54mm)

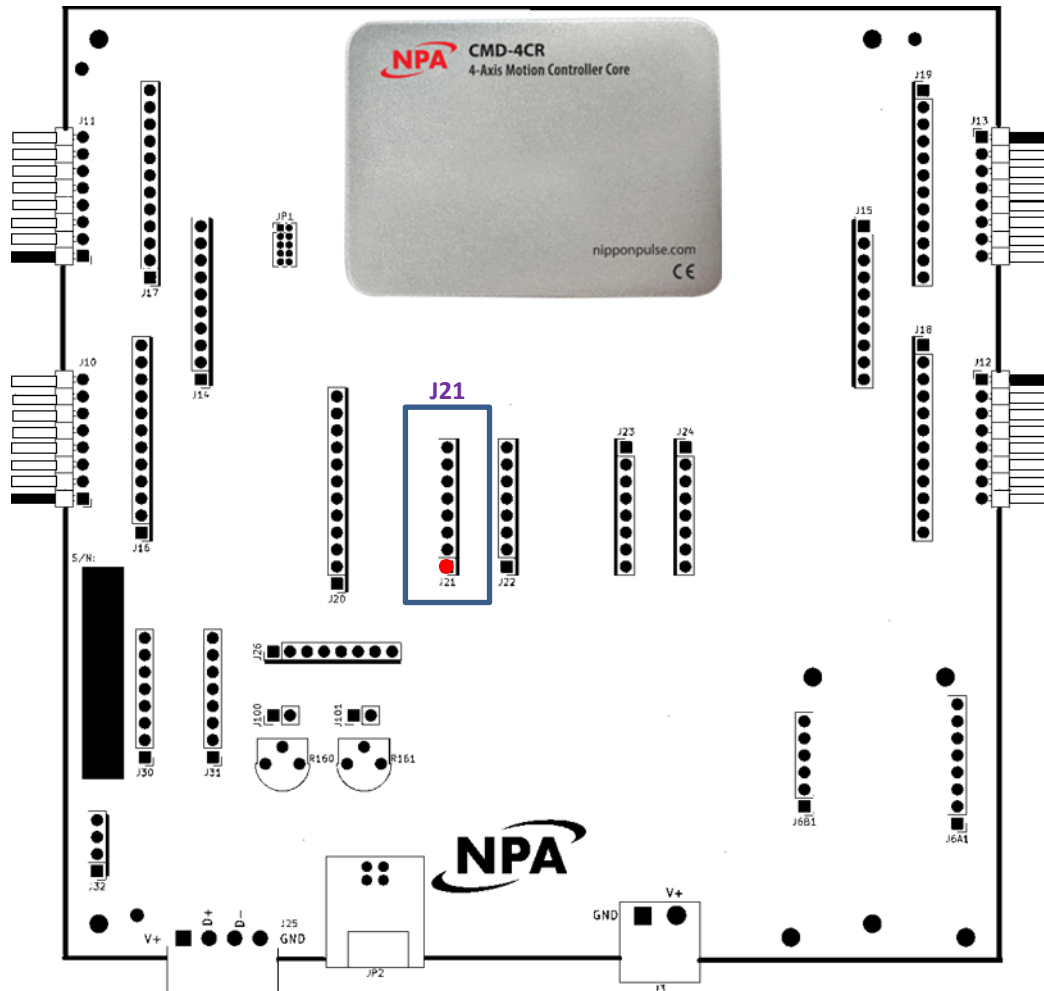


Figure 4.3

Pin #	In/Out	Name	Description
1	I	IO1	Configurable Input 1
2	I	IO2	Configurable Input 2
3	I	IO3	Configurable Input 3
4	I	IO4	Configurable Input 4
5	I	IO5	Configurable Input 5
6	I	IO6	Configurable Input 6
7	I	IO7	Configurable Input 7
8	I	IO8	Configurable Input 8
Molex Pins - 0008550101			Molex Connector Housing - 0022013087
8 position cable with Molex connector: Z3-210-238-01			

Table 4.3

4.5 [J22] 8-Pin Configurable IO Connector 2 (2.54mm)

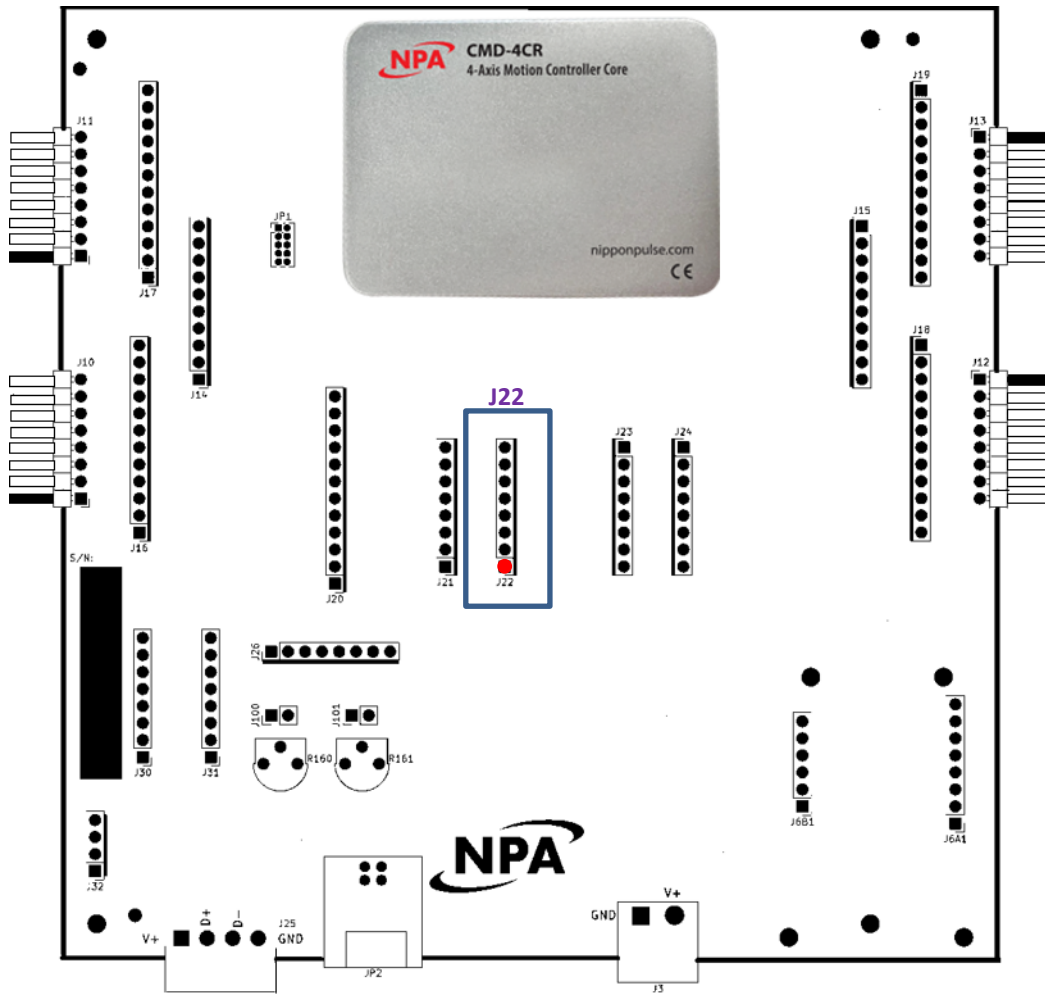


Figure 4.4

Pin #	In/Out	Name	Description
1	I	IO9	Configurable Input 9
2	I	IO10	Configurable Input 10
3	I	IO11	Configurable Input 11
4	I	IO12	Configurable Input 12
5	I	IO13	Configurable Input 13
6	I	IO14	Configurable Input 14
7	I	IO15	Configurable Input 15
8	I	IO16	Configurable Input 16
Molex Pins - 0008550101			Molex Connector Housing - 0022013087
8 position cable with Molex connector: Z3-210-238-01			

Table 4.4

4.6 [J23] 8-Pin Configurable IO Connector 3 (2.54mm)

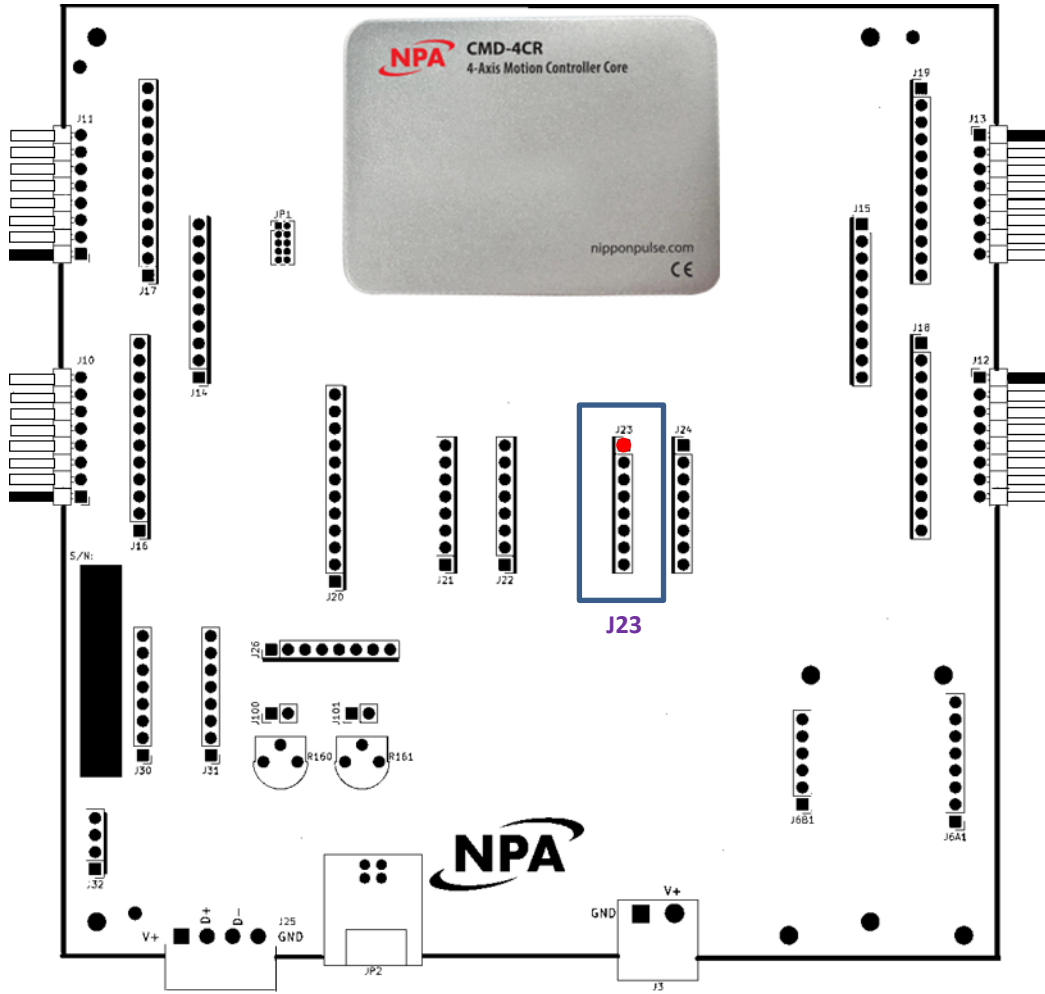


Figure 4.5

Pin #	In/Out	Name	Description
1	O	IO17	Configurable Output 17
2	O	IO18	Configurable Output 18
3	O	IO19	Configurable Output 19
4	O	IO20	Configurable Output 20
5	O	IO21	Configurable Output 21
6	O	IO22	Configurable Output 22
7	O	IO23	Configurable Output 23
8	O	IO24	Configurable Output 24
Molex Pins - 0008550101		Molex Connector Housing - 0022013087	
8 position cable with Molex connector: Z3-210-238-01			

Table 4.5

4.7 [J24] 8-Pin Configurable IO Connector 4 (2.54mm)

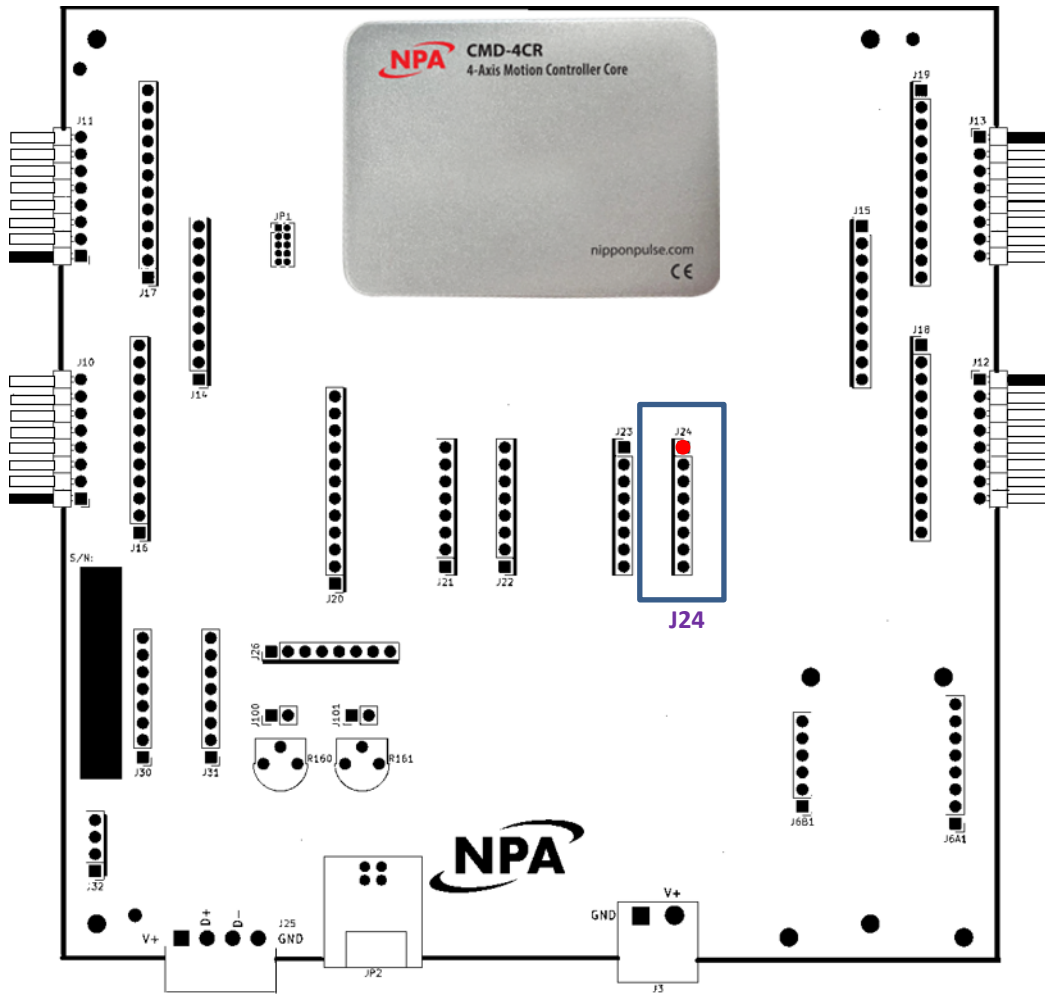


Figure 4.6

Pin #	In/Out	Name	Description
1	O	IO25	Configurable Output 25
2	O	IO26	Configurable Output 26
3	O	IO27	Configurable Output 27
4	O	IO28	Configurable Output 28
5	O	IO29	Configurable Output 29
6	O	IO30	Configurable Output 30
7	O	IO31	Configurable Output 31
8	O	IO32	Configurable Output 32
		Molex Pins - 0008550101	Molex Connector Housing - 0022013087
8 position cable with Molex connector: Z3-210-238-01			

Table 4.6

4.8 [J26] 8-Pin Analog Input Connector (2.54mm)

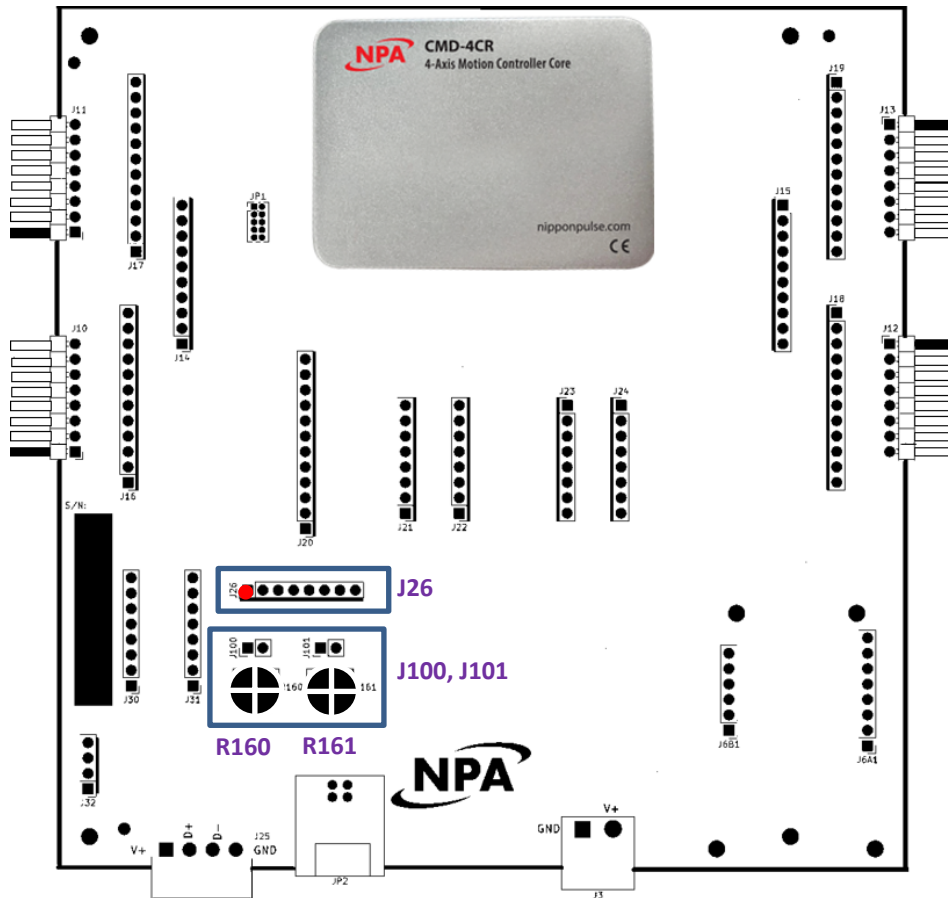


Figure 4.7

Pin #	In/Out	Name	Description
1	O	VDD	+3.3V (VDD3)
2	O	GND	Ground
3	I	AI1	Analog Input 1 (AI1)
4	I	AI2	Analog Input 2(AI2)
5	NC	NC	Reserved
6	NC	NC	Reserved
7	O	PWM1	PWMOUT1
8	O	PWM2	PWMOUT2
Molex Pins - 0008550101			Molex Connector Housing - 0022013087
8 position cable with Molex connector: Z3-210-238-01			

Table 4.7

4.8.1. Analog Input Options

There are on board potentiometers available to control **AI1** and **AI2**. Potentiometer **R160** is reserved for AI1 and **R161** is reserved for AI2. In order to use the potentiometer, close jumper **J100** and **J101** to route AI1 and AI2 respectively.

4.9 [J14] 10-Pin XY Motion Inputs Connector (2.54mm)

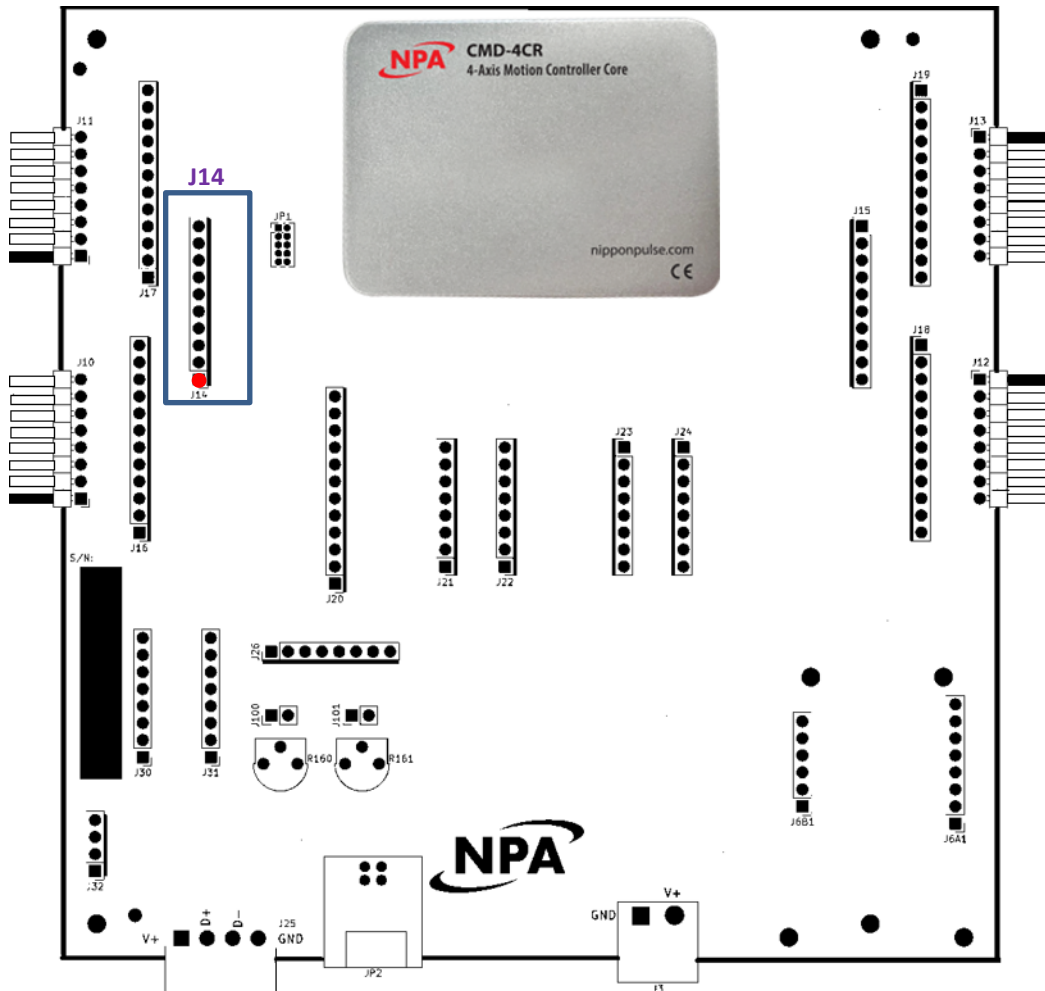


Figure 4.8

Pin #	In/Out	Name	Description
1	I	Vs	Opto-Supply +12 to +48 VDC
2	I	VG	Opto-Ground
3	I	+Lx	+Limit [X Axis]
4	I	-Lx	-Limit [X Axis]
5	I	Hx	Home [X Axis]
6	I	SDx	Slow Down Input [X Axis]
7	I	+Ly	+Limit [Y Axis]
8	I	-Ly	-Limit [Y Axis]
9	I	Hy	Home [Y Axis]
10	I	SDy	Slow Down Input [Y Axis]
Molex Pins - 0008550101			Molex Connector Housing - 0022013107
10 position cable with Molex connector: Z3-210-240-01			

Table 4.8

4.10 [J15] 10-Pin ZU Motion Inputs Connector (2.54mm)

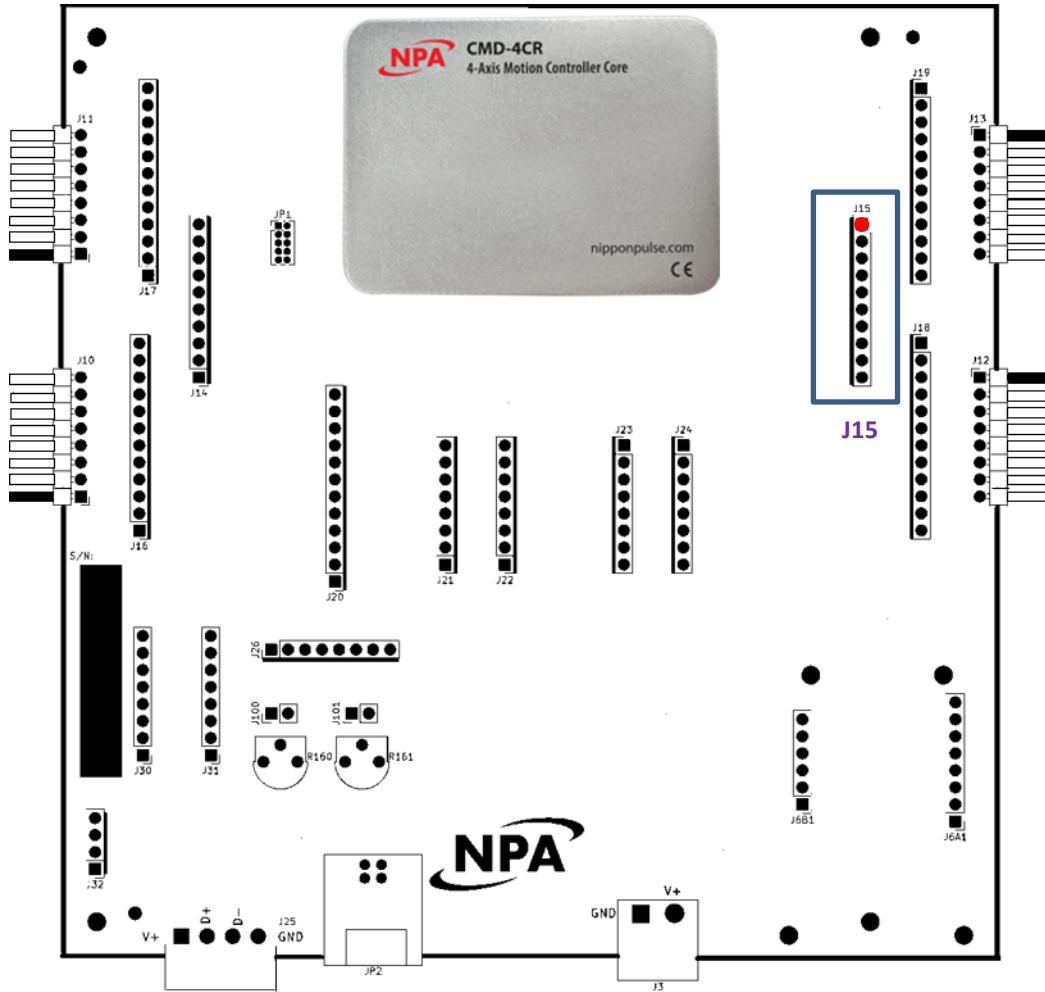


Figure 4.9

Pin #	In/Out	Name	Description
1	I	Vs	Opto-Supply +12 to +48 VDC
2	I	VG	Opto-Ground
3	I	+Lz	+Limit [Z Axis]
4	I	-Lz	-Limit [Z Axis]
5	I	H _z	Home [Z Axis]
6	I	SD _z	Slow Down Input [Z Axis]
7	I	+L _u	+Limit [U Axis]
8	I	-L _u	-Limit [U Axis]
9	I	H _u	Home [U Axis]
10	I	SD _u	Slow Down Input [U Axis]
		Molex Pins – 0008550101	Molex Connector Housing - 0022013107
10 position cable with Molex connector: Z3-210-240-01			

Table 4.9

4.11 [J16/J17/J18/J19] 8-Pin Encoder Connectors (2.54mm)

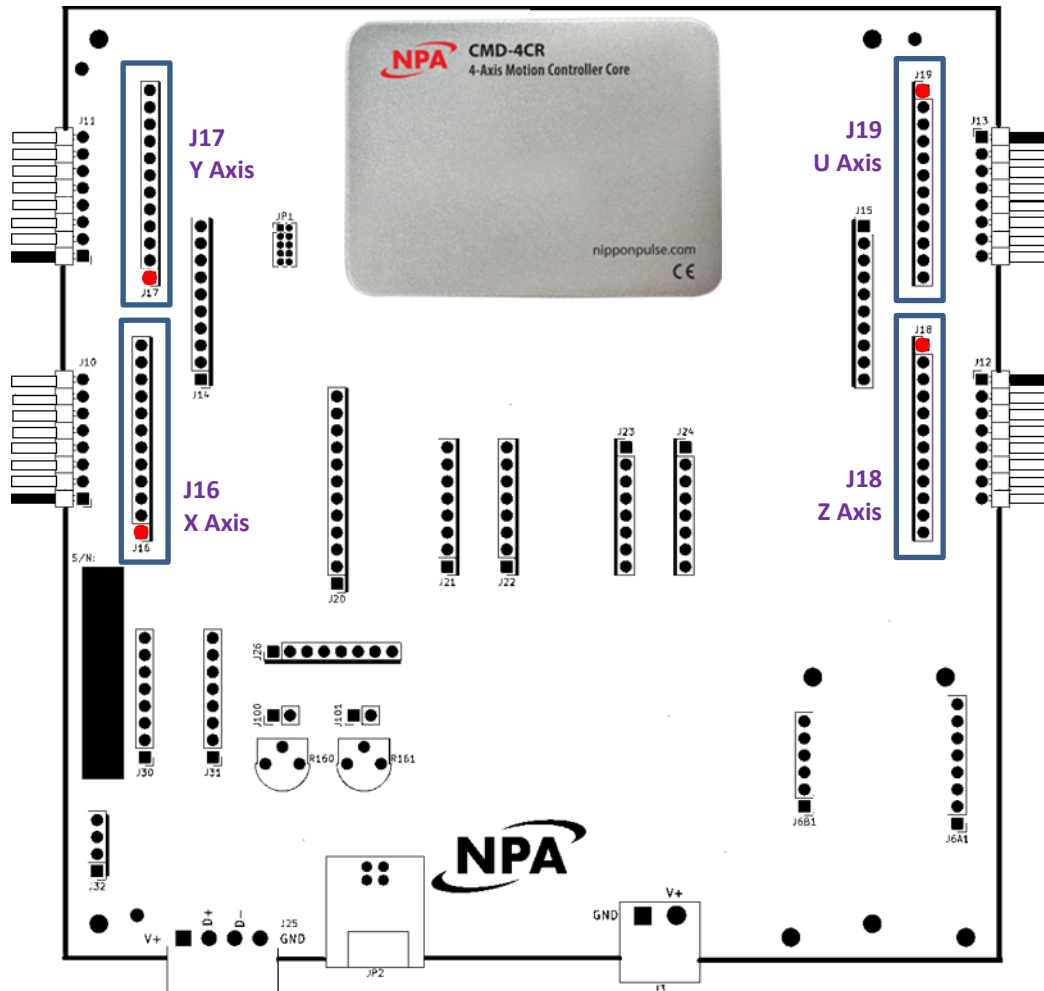


Figure 4.10

Pin #	In/Out	Name	Description
1	O	+5V	+5V (VCC)
2	O	GND	Ground
3	I	EA	A Channel Encoder Input
4	I	/EA	/A Channel Encoder Input
5	I	EB	B Channel Encoder Input
6	I	/EB	/B Channel Encoder Input
7	I	EZ	Z Index Encoder Input
8	I	/EZ	/Z Index Encoder Input
9	I	PA	A Channel MPG Input
10	I	/PA	/A Channel MPG Input
11	I	PB	B Channel MPG Input
12	I	/PB	/B Channel MPG Input
Molex Pins - 0008550101			Molex Connector Housing - 0022013127
12 position cable with Molex connector: Z3-210-242-01			

Table 4.10

4.12 [J10/J11/J12/J13] 8-Pin Axis Connectors (2.54mm)

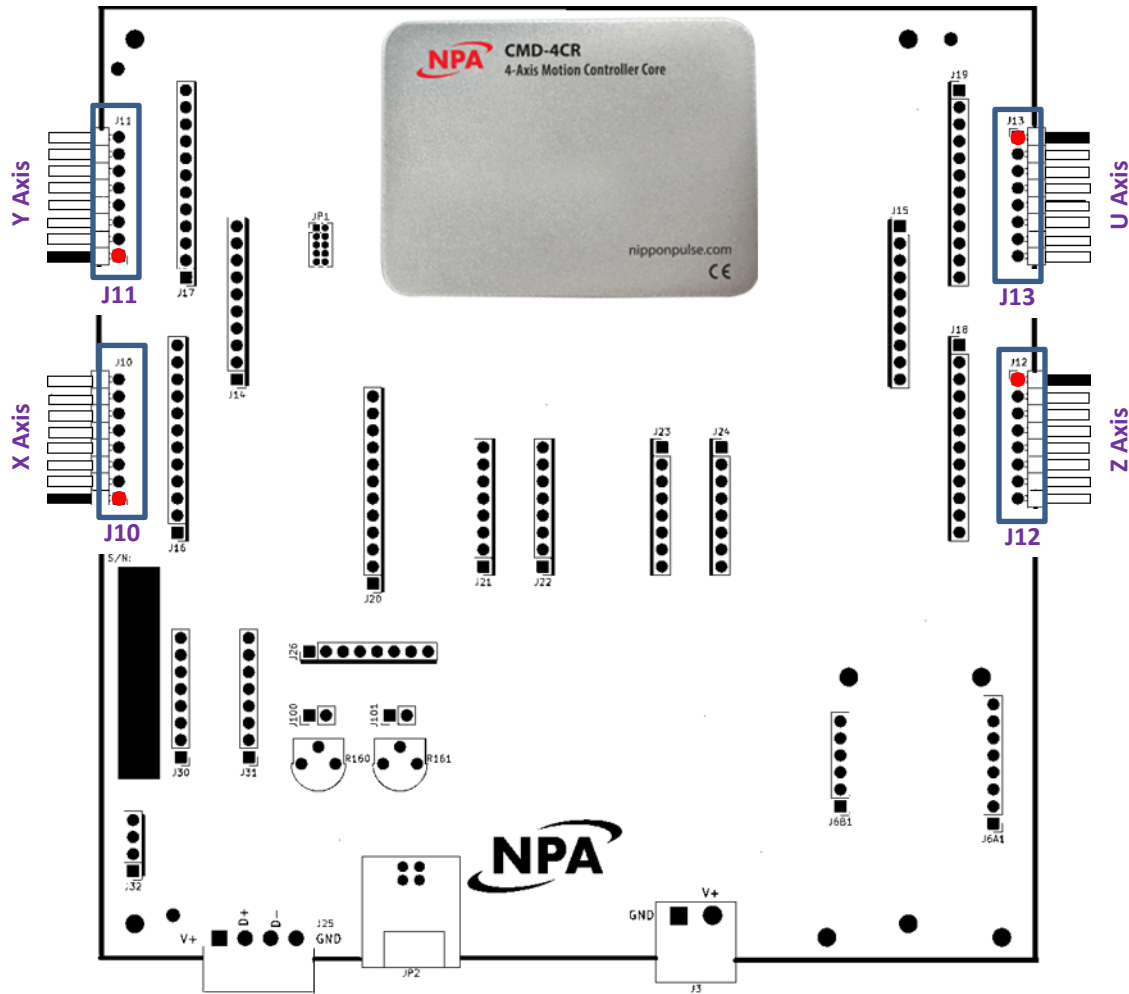


Figure 4.11

Pin #	In/Out	Name	Description
1	O	+5V	+5V
2	O	GND	Ground
3	O	PUL	Pulse
4	O	DIR	Direction
5	O	EO	Enable
6	I	INP	In-position signal
7	I	ALM	Alarm
8	O	ERC	Servo error clear
Molex Pins - 0008550101			Molex Connector Housing - 0022013087
8 position cable with Molex connector: Z3-210-238-01			

Table 4.11

4.13 Pulse, Direction, and Enable Outputs

The Pulse, Direction, and Enable outputs are open collector circuits, figure 4.12 shows a detailed schematic of these outputs. Each output is capable of sinking up to 40mA of current.

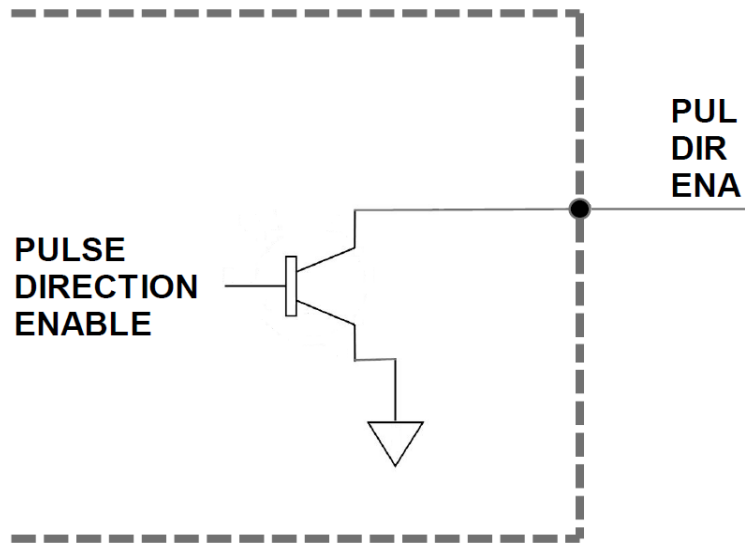


Figure 4.12

Figure 4.13 shows an example wiring diagram between the pulse, direction, and enable outputs on the CMD-4EV. The wire diagram also displays the corresponding inputs on a typical stepper driver.

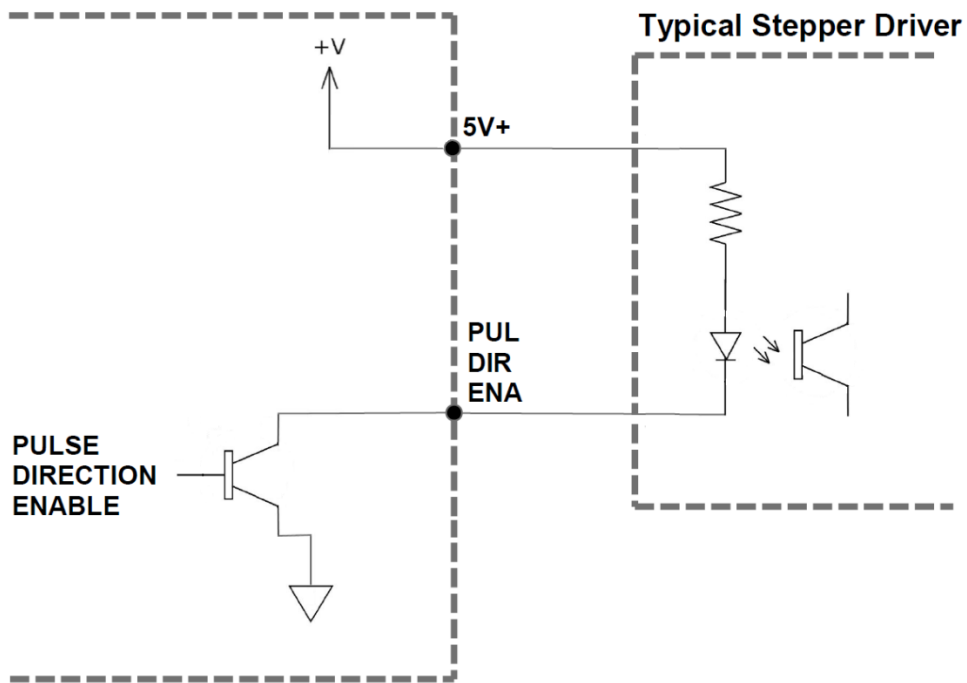


Figure 4.13

4.14 Limit, Home, and Digital Inputs

Figure 4.14 shows the detailed schematic of the opto-isolated limit, home, and general-purpose digital inputs. All opto-isolated digital inputs are NPN type.

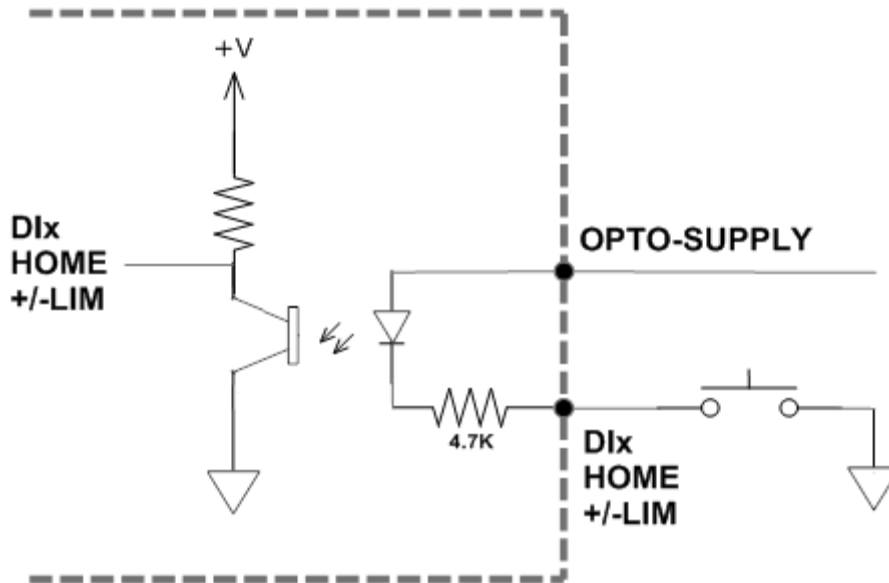


Figure 4.14

The opto-supply must be connected to at least +12VDC, but not exceed +48VDC in order for the limit, home, and digital inputs to operate at maximum efficiency.

When a digital input is pulled to ground, current will flow from the opto-supply to ground, and the opto-isolator will then power on and activate the corresponding input(s).

To de-activate the input, a digital input should be left unconnected or switched back to the opto-supply. This will stop current from flowing through the opto-isolator to ground.

4.15 Digital Outputs

Figure 4.15 shows an example circuit diagram of the digital outputs. All opto-isolated digital outputs will be Photo Darlington type.

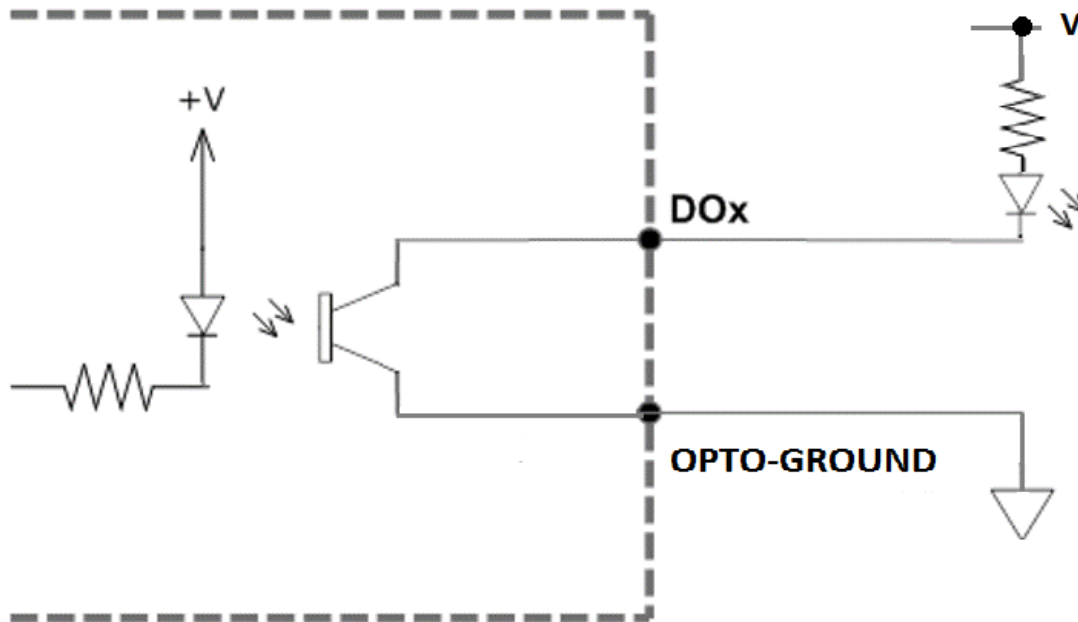


Figure 4.15

The opto-supply must be connected to at least +12VDC, but not exceed +48VDC in order for the digital outputs to operate efficiently.

When activated, the opto-isolator switches the voltage from the opto-supply to the digital output. The maximum sink current for digital outputs is 50mA. Take caution to select the appropriate external resistor so that the **current does not exceed 50mA**.

When deactivated, the opto-isolator will turn off and disconnect the digital output from the opto-supply.

4.16 Analog Inputs

Analog inputs are 0 to 3.3V range with a 10 bit in resolution. Two analog input channels are available for general purpose use or for joystick control (AI1 and AI2). The analog values are in millivolts.

The maximum source current for the analog inputs is 10mA.

4.17 Encoder Input Connection

Both single-ended and differential quadrature encoder inputs are accepted.

When using single-ended encoders, use the /A, /B, and /Z inputs.

+5V supply and Ground signals are available to power the encoder. Make sure that the total current usage is less than 200mA for the +5V.

5 Communication

CMD-4CR-EV supports both USB 2.0 compliant HID communication and RS485 communication. Please refer to the Commander manual for more details on how to configure these options.

5.1 Identification Number

If multiple CMD-4CR-EV devices are connected to the PC, each device should have a unique identification number. Please refer to the Commander manual for more details on how to configure the Identification number.

5.2 Windows GUI

CMD-4CR-EV comes with a Windows GUI program to test, program, compile, download, and debug the controller. The Windows GUI will perform all communication via USB. See the CMD-4CR Software Manual for details.

The Windows GUI is available for download at <https://www.nipponpulse.com/>

6 Ordering

6.1 Development Kits

The CMD-4CR-EV is available in three forms:

- **P-CMD-4CR-EV**
 - Commander 4CR evaluation board only.
- **P-CMD-4CR-EV-Basic**
 - Basic kit that includes the Commander 4CR evaluation board, and a CMD-4CR Commander core.
- **P-CMD-4CR-EV-Advanced**
 - Advanced kit that includes the Commander 4CR evaluation board, a CMD-4CR Commander core, development kit (with reference designs), and complete cable set for all connectors (NPA cable kit part number Z3-210-120-01)

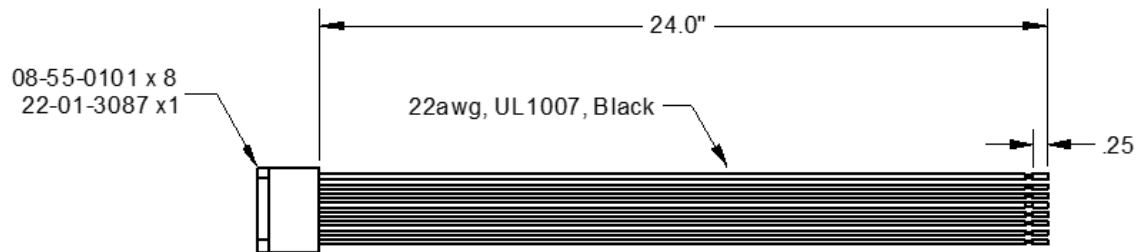
6.2 Connectors / Cables

The CMD-4CR-EV is supplied with the mating connector for J3 (power). All other mating connectors are available through a local or online parts distributor. See section 4 for connecting connector part numbers.

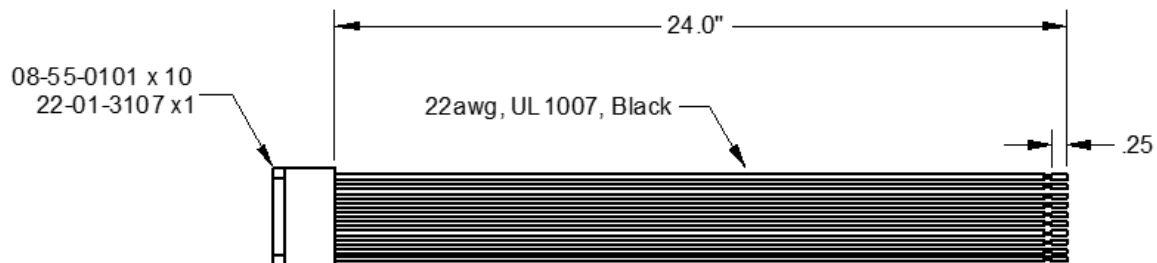
Nippon Pulse is able to provide the following premade cables. See section 4 for information on which cables you will need for your application.

Individual cables

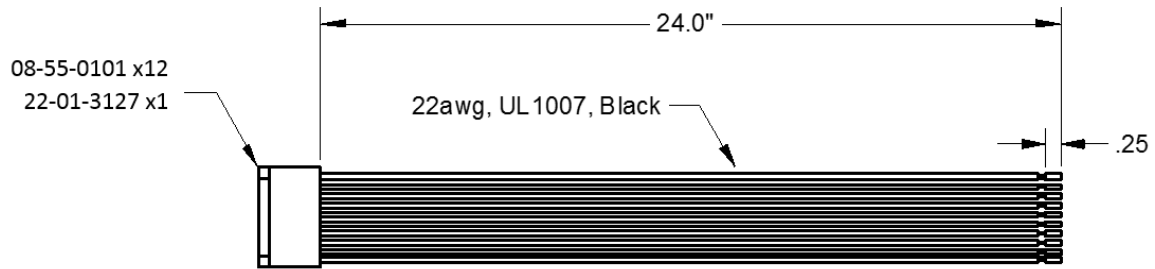
- **Z3-210-238-01** 8 position cable with Molex connector



- **Z3-210-240-01** 10 position cable with Molex connector



- **Z3-210-242-01** 12 position cable with Molex connector

**Cable kit**

- **Z3-210-120-01** CMD-4CR-EV cable kit, includes:
 - 9 Z3-210-238-01
 - 5 Z3-210-242-01
 - 2 Z3-210-240-01

The Z3-210-120-01 cable kit is included with the CMD-4CR-EV-Advanced development kit.

The information in this document is believed to be accurate at the time of publication but is subject to change without notice.

The logo for Nippon Pulse America, Inc. (NPA) features the letters "NPA" in a bold, red, sans-serif font. A red swoosh underline is positioned beneath the letters, starting under the "N" and ending under the "A".

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Commander Development Kits Manual Version 1.1

2/10/2020

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