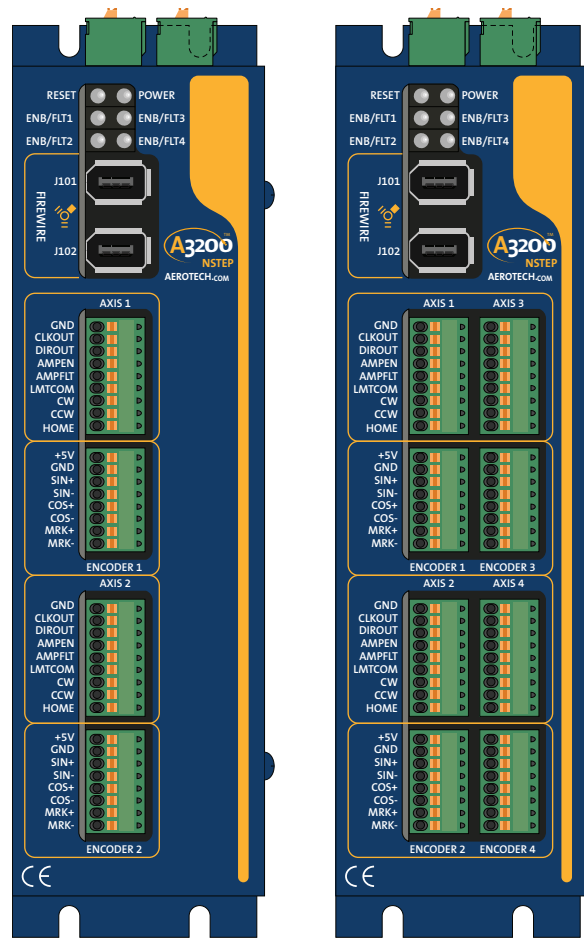


Nstep Hardware Manual

Revision: 2.05.00



1-2 Axis

3-4 Axis

Global Technical Support

Go to www.aerotech.com/global-technical-support for information and support about your Aerotech products. The website provides downloadable resources (such as up-to-date software, product manuals, and Help files), training schedules, and PC-to-PC remote technical support. You can also complete Product Return (RMA) forms and get information about repairs and spare or replacement parts. For immediate help, contact a service office or your sales representative. Have your customer order number available before you call or include it in your email.

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Aerotech Worldwide

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EC Declaration of Conformity


Manufacturer Aerotech, Inc.
Address 101 Zeta Drive
Pittsburgh, PA 15238-2897
USA
Product Nstep
Model/Types All

This is to certify that the aforementioned product is in accordance with the applicable requirements of the following Directive(s):

2006/95/EC	Low Voltage Directive
2011/65/EU	RoHS 2 Directive

and has been designed to be in conformity with the applicable requirements of the following documents when installed and used in accordance with the manufacturer's supplied installation instructions.

EN 61010-1	Safety requirements for electrical equipment
------------	--

Name  / Alex Weibel
Position Engineer Verifying Compliance
Location Pittsburgh, PA

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Safety Procedures and Warnings

Read this manual in its entirety before installing, operating, or servicing this product. If you do not understand the information contained herein, contact an Aerotech representative before proceeding. Strictly adhere to the statements given in this section and other handling, use, and operational information given throughout the manual to avoid injury to you and damage to the equipment.

The following statements apply wherever the Warning or Danger symbol appears within this manual. Failure to observe these precautions could result in serious injury to those individuals performing the procedures and/or damage to the equipment.

NOTE: Aerotech continually improves its product offerings; listed options may be superseded at any time. All drawings and illustrations are for reference only and were complete and accurate as of this manual's release. Refer to www.aerotech.com for the most up-to-date information.



DANGER: This product contains potentially lethal voltages. To reduce the possibility of electrical shock, bodily injury, or death the following precautions must be followed.

1. Disconnect electrical power before servicing equipment.
2. Disconnect electrical power before performing any wiring.
3. Access to the Nstep and component parts must be restricted while connected to a power source.
4. To minimize the possibility of electrical shock and bodily injury, extreme care must be exercised when any electrical circuits are in use. Suitable precautions and protection must be provided to warn and prevent persons from making contact with live circuits.
5. Do not connect or disconnect any electrical components or connecting cables while connected to a power source.
6. Make sure the Nstep and all components are properly grounded in accordance with local electrical safety requirements.
7. Operator safeguarding requirements must be addressed during final integration of the product.



DANGER: The Nstep case temperature may exceed 70°C in some applications.



WARNING: To minimize the possibility of electrical shock, bodily injury or death the following precautions must be followed.

1. Use of this equipment in ways other than described by this manual can cause personal injury or equipment damage.
2. Moving parts can cause crushing or shearing injuries. Access to all stage and motor parts must be restricted while connected to a power source.
3. Cables can pose a tripping hazard. Securely mount and position all system cables to avoid potential hazards.
4. Do not expose the Nstep to environments or conditions outside of the listed specifications. Exceeding environmental or operating specifications can cause damage to the equipment.
5. If the Nstep is used in a manner not specified by the manufacturer, the protection provided by the Nstep can be impaired and result in damage, shock, injury, or death.
6. Operators must be trained before operating this equipment.
7. All service and maintenance must be performed by qualified personnel.
8. The Nstep is intended for light industrial manufacturing or laboratory use. Use of the Nstep for unintended applications can result in injury and damage to the equipment.

Quick Installation Guide

This chapter describes the order in which connections and settings should typically be made to the Nstep. If a custom interconnection drawing was created for your system (look for a line item on your Sales Order under the heading “Integration”), that drawing can be found on your installation device.

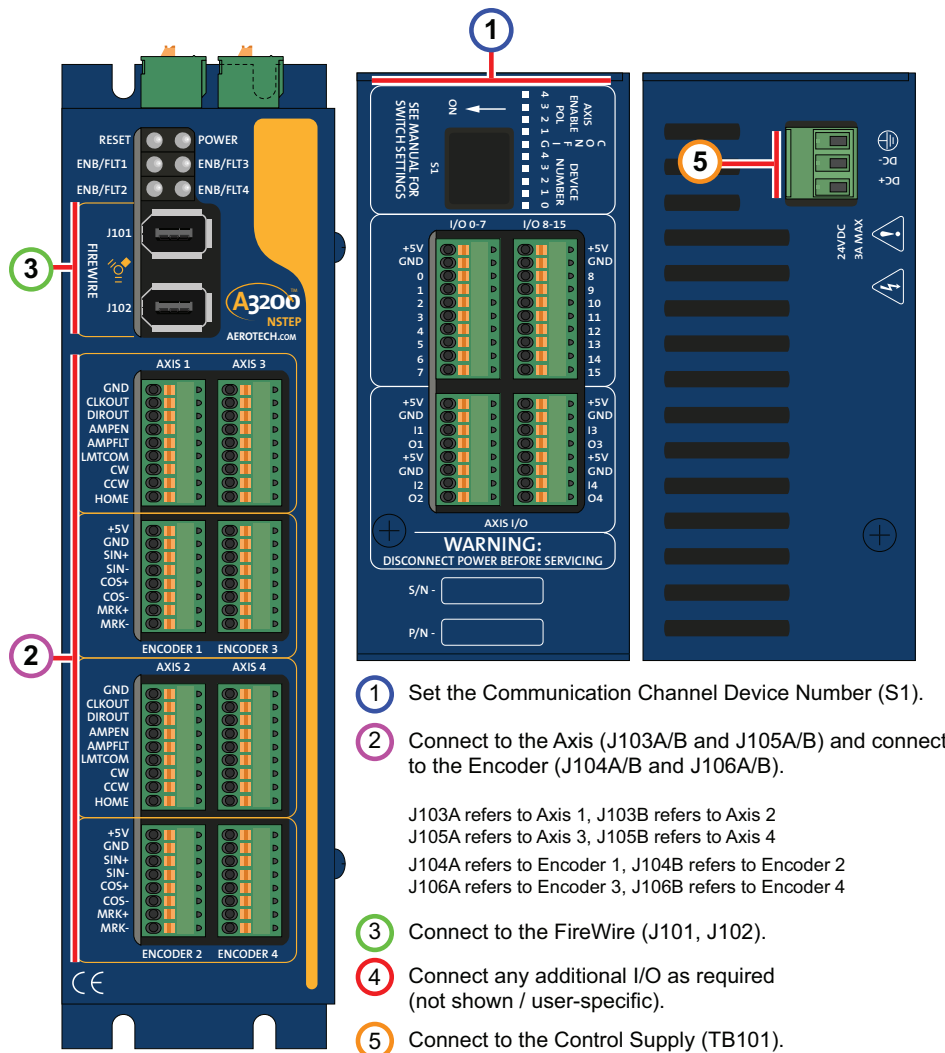


Figure 1: Quick Start Connections

Topic	Section
Set the Device Number	Section 2.1. Communication Channel Settings
Connect the Axis and Encoder	Section 2.3. Axis Connections , Section 2.4. Encoder Connections
Connect the FireWire	Section 2.7. FireWire Interface (J101/J102)
Connect to the Control Supply	Section 2.2.1. DC Power Connections (J109)

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Chapter 1: Introduction

Aerotech's Nstep allows an industry standard stepper drive (clock and direction command) to interface to Aerotech's digital drive network. The Nstep is available in both a 2- and 4- axis version. Either version may be used to upgrade an existing Aerotech system with stepper drives to the Automation 3200. The Nstep's quick release terminal blocks make it easy to interface third party, non-Aerotech stepper drives to the A3200 platform.

The Nstep's IEEE-1394 (FireWire®) communication bus provides deterministic behavior, auto-identification, and easy software setup from the Nmotion SMC software controller. The Nstep features a high-speed Harvard architecture DSP, and a 32 MHz line driver encoder data rate for encoder inputs. In addition, the use of the commercially standard FireWire communication link makes integration to the Automation 3200 network plug-n-play easy.

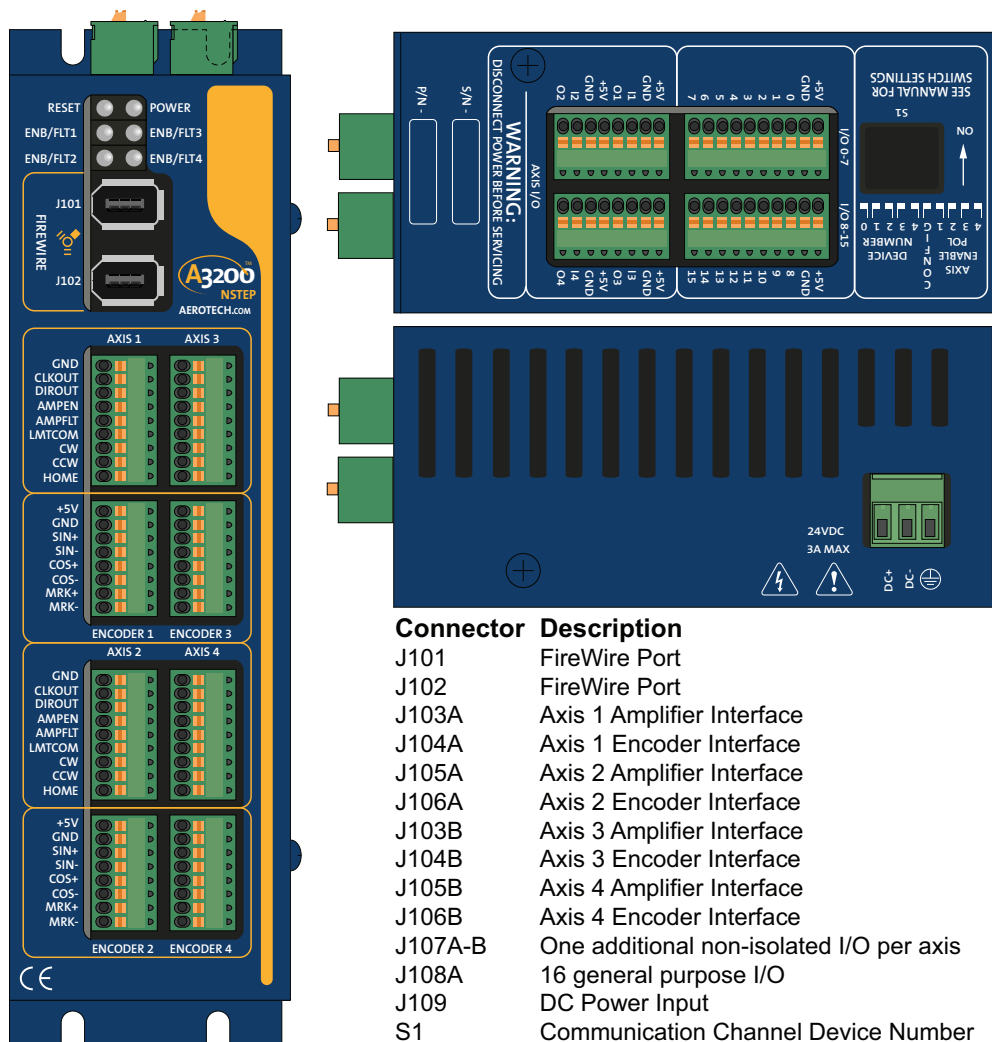


Figure 1-1: Nstep Drive Interface

Table 1-1: Feature Summary

Standard Features	
<ul style="list-style-type: none"> • Supports two (standard) or four stepper drive axes. • Each axis provides Clock & Direction stepper signals. • Up to 4 channels of 32 MHz line driver quadrature encoder inputs. • 24 V tolerant opto-isolated CW, CCW, Home and drive fault inputs per axis powered by either an internal 5V or external power supply. • 24 V tolerant drive enable output per axis (open-collector transistor; single ended; polarity selectable). • 1 digital input and output per axis • All I/O connections are through easily removable connectors. • Two FireWire ports. • 24 -80 VDC power input requirement. • Equivalent software functionality (stepper motor drives only) to the other A3200 series of drives. • Software configurable for stepper motor operation. • 5 VDC, 250 mA user output power for encoder and limits, etc. • 16 bits of programmable I/O (digital, no isolation), user definable as input/output by byte. 	
Cables	
FireWire	See Section 2.7. FireWire Interface (J101/J102) .

The following block diagram shows a connection summary (refer to Chapter 2 for connection information).

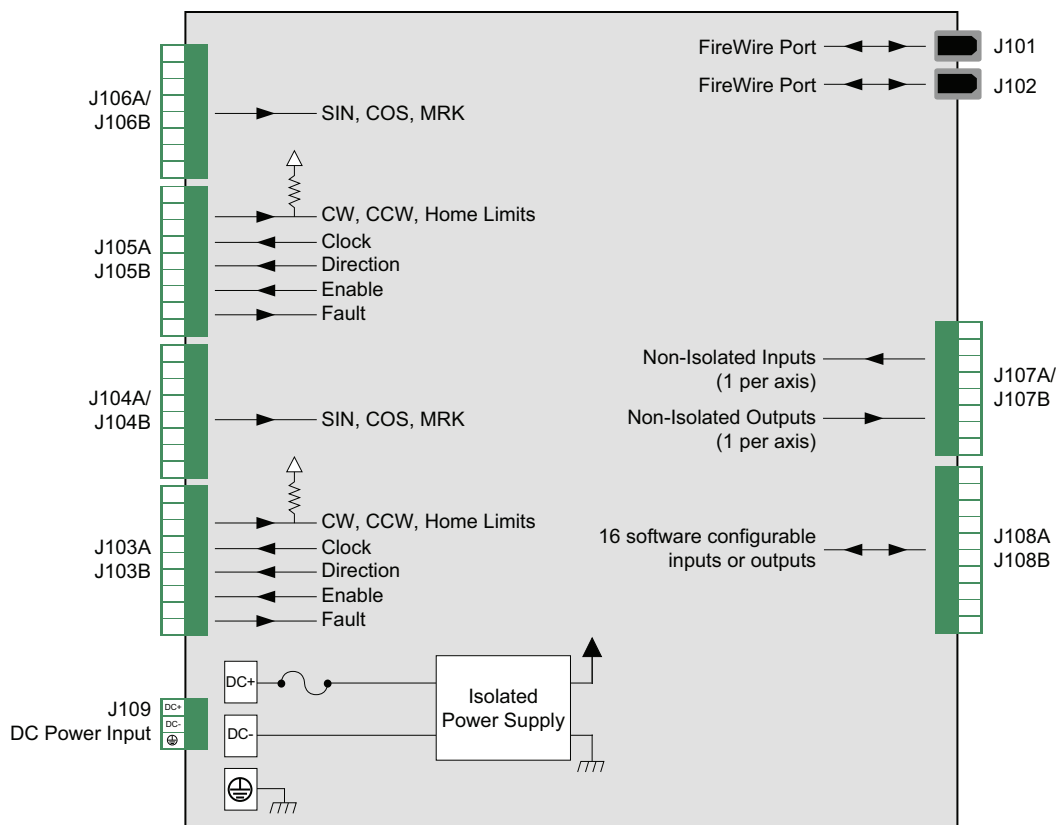


Figure 1-2: Functional Diagram

1.1. Electrical Specifications

The electrical specifications for the Nstep are listed below.

Table 1-2: Electrical Specifications

Description		Nstep
Control Supply	Input Voltage	24-80 VDC
	Input Power	20 W

1.2. Mechanical Design

Each unit should be separated from other drives and surrounded by 25 mm (1") of free air space. A space of 100 mm (4") should be allowed along the front of the unit for cable connections.

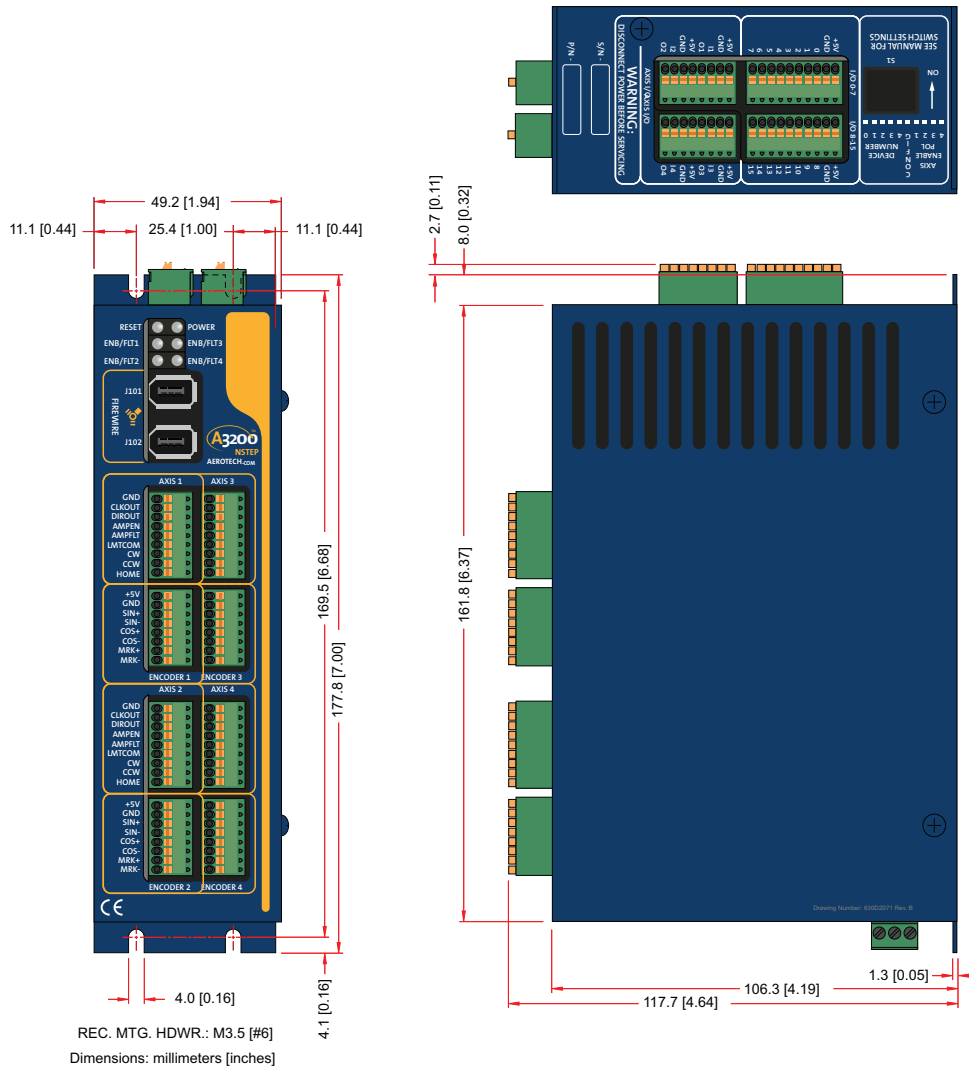


Figure 1-3: Dimensions

Table 1-3: Physical Specifications

Model	Weight
2 Axis	0.23 kg [0.5 lb]
4 Axis	0.28 kg [0.6 lb]

1.3. Environmental Specifications

The environmental specifications for the Nstep are listed below.

Ambient Temperature	Operating: 0° to 50°C (32° to 122° F)
	Storage: -30° to 85°C (-22° to 185° F)
Humidity	Maximum relative humidity is 80% for temperatures up to 31°C. Decreasing linearly to 50% relative humidity at 40°C. Non condensing.
Altitude	Up to 2000 meters.
Pollution	Pollution degree 2 (normally only non-conductive pollution).
Use	Indoor use only.

1.4. Drive and Software Compatibility

The following table lists the available A3200 drives and which version of the A3200 software first provided support for a given drive. Drives that list a specific version number in the **Last Software Version** column will not be supported after the listed version.

Table 1-4: A3200 Drive and Software Compatibility

Drive Type	Firmware Revision	First Software Version	Last Software Version
CL	-	2.18	5.02
	A	2.55	5.02
CP	-	2.03	2.55
	A	2.10	Current
	B	2.19	Current
FLS	-	4.03	Current
FLS	A	4.06.001	Current
HEX RC	-	2.14	Current
HL	-	1.01	2.55
HLe	-	2.22	Current
HP	-	1.01	2.55
	A	1.08	2.55
HPe	-	2.22	Current
ML	-	3.00	Current
MP	-	2.14	Current
Nmark CLS	-	4.02	Current
Nmark CLS	A	4.06.001	Current
Nmark SSaM	-	2.21	Current
Nmark SSaM	A	4.06.001	Current
Npaq ⁽¹⁾	-	1.07	2.55
	A	2.09	Current
Nservo	-	2.08	Current
Nstep	-	2.14	Current
QL/QLe	-	5.01	Current

(1) This section does not apply to the Npaq MR. The Npaq MR contains multiple ML or MP drives. Refer to either the ML or MP drive type to determine the value for your Npaq MR.

Chapter 2: Installation and Configuration

This chapter describes the switches, jumpers, connectors, and power connections.

2.1. Communication Channel Settings

Use the Device Number switches of S1 to assign a communication channel number to the Nstep. If you are using multiple drives, each drive must be assigned a unique communication channel. Multiple drives are typically configured using sequential communication channels.

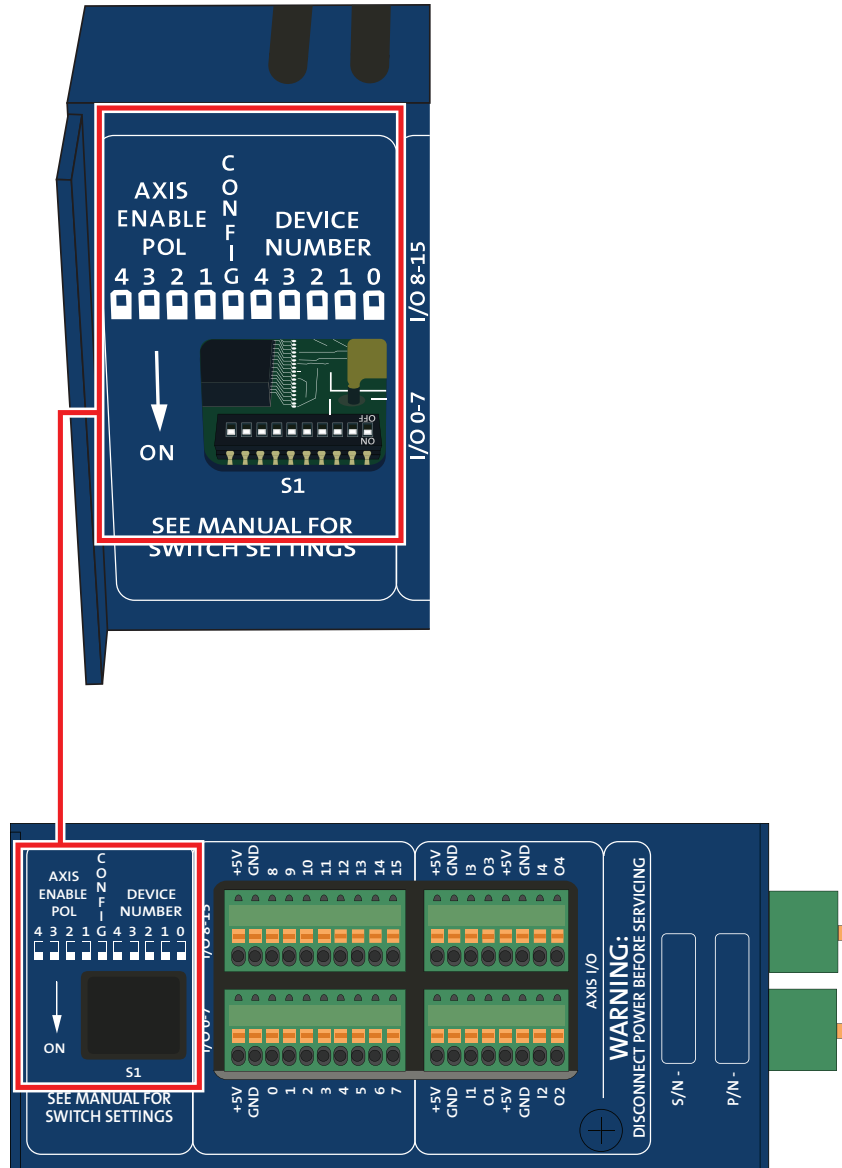


Figure 2-1: Device Number (S1) Location

NOTE: The drive assigned to the first communication channel number (all switches set to ON) will be configured by the Axis 1 parameters defined in the software. The drive assigned to the second communication channel will be configured by the Axis 2 parameters, etc.

Table 2-1: Device Number Switch Settings (S1)

Device #	Switch Settings (OFF is indicated by "-")				
	4	3	2	1	0
1	ON	ON	ON	ON	ON
2	ON	ON	ON	ON	-
3	ON	ON	ON	-	ON
4	ON	ON	ON	-	-
5	ON	ON	-	ON	ON
6	ON	ON	-	ON	-
7	ON	ON	-	-	ON
8	ON	ON	-	-	-
9	ON	-	ON	ON	ON
10	ON	-	ON	ON	-
11	ON	-	ON	-	ON
12	ON	-	ON	-	-
13	ON	-	-	ON	ON
14	ON	-	-	ON	-
15	ON	-	-	-	ON
16	ON	-	-	-	-
17	-	ON	ON	ON	ON
18	-	ON	ON	ON	-
19	-	ON	ON	-	ON
20	-	ON	ON	-	-
21	-	ON	-	ON	ON
22	-	ON	-	ON	-
23	-	ON	-	-	ON
24	-	ON	-	-	-
25	-	-	ON	ON	ON
26	-	-	ON	ON	-
27	-	-	ON	-	ON
28	-	-	ON	-	-
29	-	-	-	ON	ON
30	-	-	-	ON	-
31	-	-	-	-	ON
32	-	-	-	-	-

2.2. Power Connections

The Nstep has DC input connectors for control power.

Table 2-2: Electrical Specifications

Description		Nstep
Control Supply	Input Voltage	24-80 VDC
	Input Power	20 W

NOTE: The machine integrator, OEM or end user is responsible for meeting the final protective grounding requirements of the system.



WARNING: All service and maintenance must be performed by qualified personnel.



DANGER: Hazardous Voltages are present on Nstep systems.



DANGER: Nstep systems must be installed inside a rack or enclosure to restrict access while energized.



DANGER: Disconnect electrical power before performing any wiring.



DANGER: Disconnect electrical power before servicing equipment.

2.2.1. DC Power Connections (J109)

The Nstep requires 20 watts of power from a 24 - 80 VDC power supply. Input power is made at the DC+ and DC- terminals with earth ground connected to the ground terminal.



WARNING: Voltage polarity is important. Damage to the Nstep may occur if the DC power supply connections are reversed.

External fuses or circuit breakers are recommended for the DC+ and DC- connections for optimum protection, based upon the current draw from the selected power supply (voltage).

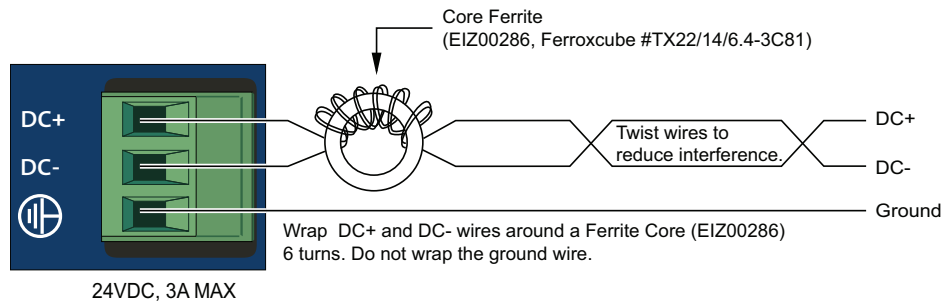


Figure 2-2: Control Supply Connections

Table 2-3: DC Supply Input Wiring

Pin	Description	Wire Size
DC+	24 - 80 VDC ($\pm 10\%$) Control Power Input (20 Watt Max)	1.3 mm ² (#16 AWG)
DC-	Control Power Common Input ⁽¹⁾	1.3 mm ² (#16 AWG)
⊕	Protective Ground (Required for Safety)	1.3 mm ² (#16 AWG)

(1) For an isolated DC supply, connect DC- to protective ground at the supply.

Table 2-4: DC Supply Mating Connector

Description	Aerotech P/N	Phoenix P/N	Tightening Torque (Nm)	Wire Size: AWG [mm ²]
3-Pin Terminal Block	ECK01387	1803581	0.22 - 0.25	14 - 30 [2.0 - 0.0516]

2.2.2. Transformer Options

A TM3 40/80 VDC Power option is available to power up to four Nsteps, providing 300 watts of power. Refer to the TM3 Users Manual, EDO117, for more information.

Table 2-5: Transformer Options

Transformer	Description
TM3	Power up to 4 Nstep drives, providing 300 watts of power

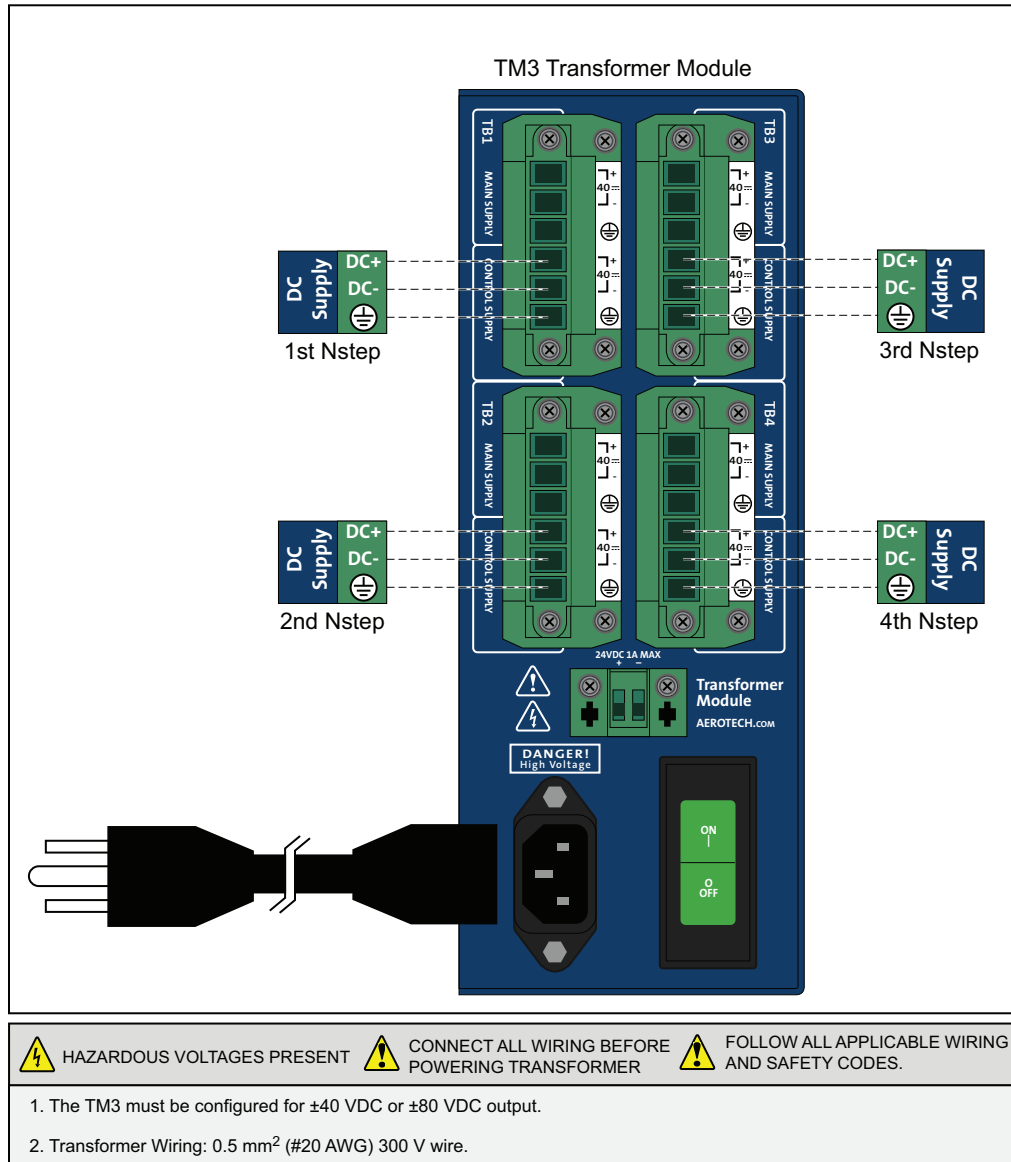


Figure 2-3: Control and Motor Power Wiring using a TM3 Transformer

2.2.3. Minimizing Conducted, Radiated, and System Noise

The Nstep generates conducted (supply) and radiated noise. Conducted emissions are minimized by using ferrites on the DC supply wires. Radiated emissions are reduced by using shielded cables with shields connected to metal backshells at both ends or to the chassis frame/earth ground if no backshell is present.

A simple ferrite-core filter can be added at each Nstep's power connector to reduce radiated and conducted emissions.

Ferrite beads (Aerotech's FBF-1 or FBF-2 filter adapters) can be used on motor leads to reduce the effects of PWM noise. Refer to the FBF-1 and FBF-2 drawings on your software or Documentation-CD ROM for more information on the ferrite beads.

Table 2-6: Motor Supply Input Wiring

Wire Size	Aerotech P/N	Third Party P/N
2.0 mm ² (#14 AWG)	EIZ01027	#2643002402 Elna-Fair-Rite Products
1.3 mm ² (#16 AWG)	EIZ01025	#2643250402 Elna-Fair-Rite Products
0.8 mm ² (#18 AWG)	EIZ01001	#2673000801 Elna-Fair-Rite Products
0.5 mm ² (#20 AWG)	EIZ01001	#2673000801 Elna-Fair-Rite Products

2.3. Axis Connections

The Nstep quick release terminal blocks contain all of the required drive interface signals for two axes of stepper control. The Nstep-4 provides two additional axes of stepper control. Each axis provides a clock and direction output for stepper control, a drive enable signal, and a drive fault input. This interface also includes CW, CCW, and Home Limit inputs, which accept 5 - 24 VDC signals.

Table 2-7: Axis Interface Pin Assignment

Pin	Label	Description	In/Out/Bit
1	GND	Signal Common	N/A
2	CLKOUT	Stepper Clock Output	Output
3	DIROUT	Stepper Direction Output	Output
4	AMPEN	Drive Enable	Output
5	AMPFLT	Drive Fault	Input
6	LMTCOM	Limit Common	N/A
7	CW	Clockwise Limit	Input
8	CCW	Counterclockwise Limit	Input
9	HOME	Home Limit	Input

Table 2-8: Axis Interface Mating Connector

Description	Aerotech P/N	Phoenix P/N	Wire Size: AWG [mm ²]
9-Pin Terminal Block	ECK01325	1881396	20 - 28 [0.5 - 0.080]

2.3.1. Stepper Motor Connections

The configuration shown in Figure 2-4 is an example of a typical stepper motor connection.

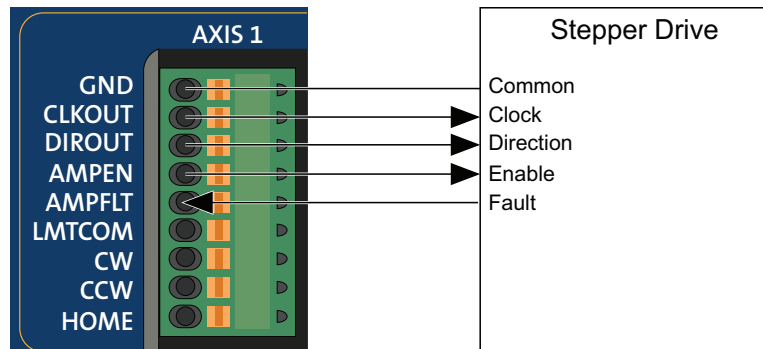


Figure 2-4: Stepper Motor Configuration

The fault feedback signal is optional, since it may not be present on all stepper drives.

Stepper Motor Phasing

A stepper motor can be run with or without an encoder. If an encoder is not being used, phasing is not necessary. With an encoder, test for proper motor phasing by running a positive motion command.

If there is a positive scaling factor (determined by the CountsPerUnit¹ parameters) and the motor moves in a clockwise direction, as viewed looking at the motor from the front mounting flange, the motor is phased correctly. If the motor moves in a counterclockwise direction, swap the motor leads and re-run the command.

Proper motor phasing is important because the end of travel (EOT) limit inputs are relative to motor rotation.

NOTE: If using standard Aerotech motors and cables, motor and encoder connection adjustments are not required.

NOTE: After the motor has been phased, use the ReverseMotionDirection parameter to change the direction of “positive” motion.

¹CountsPerUnit has replaced CntsPerMetricUnit, CntsPerEnglishUnit, and CntsPerRotaryUnit in software version 3.00.000.

2.3.2. Clock and Direction Signals

Nstep uses the CLKOUT and DIROUT outputs to interface to stepper motor drivers. These outputs are updated at an 8 kHz rate. The maximum output frequency is 25 MHz.

Table 2-9: Clock and Direction Signal Output Specifications

Specification	Value
Output Voltage	5V TTL
Maximum Source / Sink Current	+/- 20 mA
Clock Reset State	Logic Low (0 Volts)
Direction Reset State	Logic High (+5 Volts)
Maximum Clock Pulse Width	62 μ sec
Minimum Clock Pulse Width	20 nsec

If the motor's direction of rotation is the opposite of what is desired, then swap two motor connections to reverse the direction of rotation.

Table 2-10: Direction Signal Output Polarity

Direction of Motion	Direction Output Voltage
Negative / CCW Direction	Logic Low (0 Volts)
Positive / CW Direction	Logic High (+5 Volts)

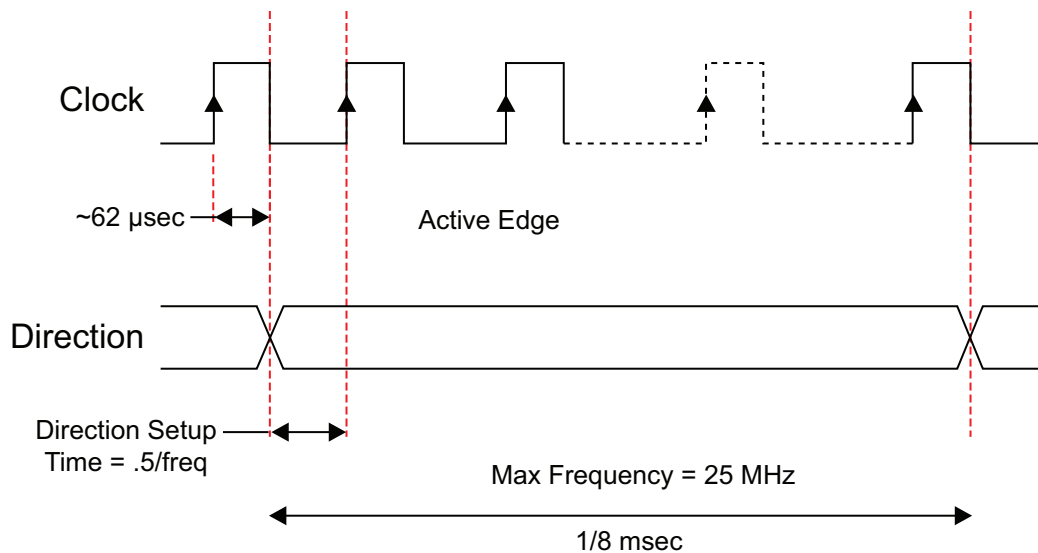


Figure 2-5: Clock and Direction Timing

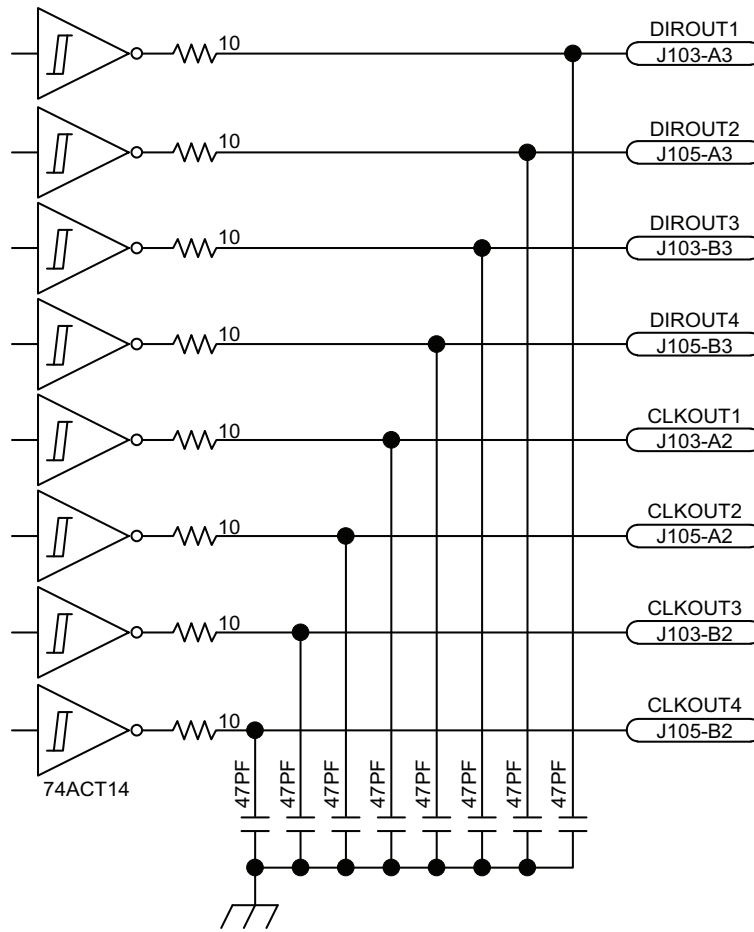


Figure 2-6: Clock and Direction Output Schematic

2.3.3. End Of Travel Limit Input Interface

End of Travel limits are required to define the end of the physical travel on linear axes. Positive (clockwise) motion is stopped by the clockwise (CW) end of travel limit input. Negative (counterclockwise) motion is stopped by the counterclockwise (CCW) end of travel limit input. The Home Limit switch can be parameter configured for use during the home cycle, however, the CW or CCW end of travel limit is typically used instead. All of the end-of-travel limit inputs accept 5-24 VDC level signals. Limit directions are relative to the encoder polarity in the diagnostics display.

Table 2-11: Clock/Direction Signal Output Specifications

Specification	Value
Maximum Source/Sink Current	30 mA
Input Voltage	5-24 V

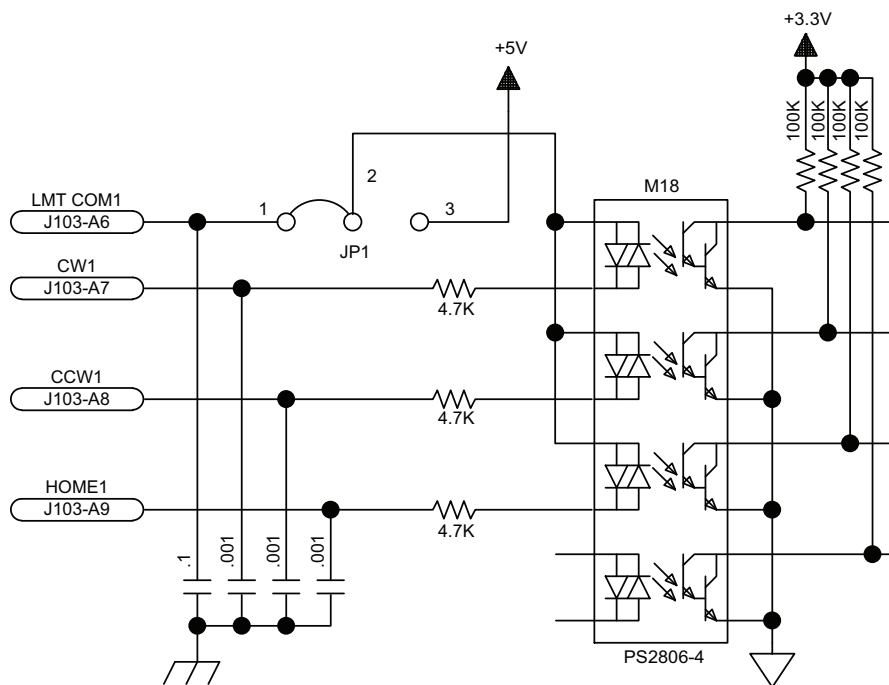


Figure 2-7: End of Travel Limit Interface Input

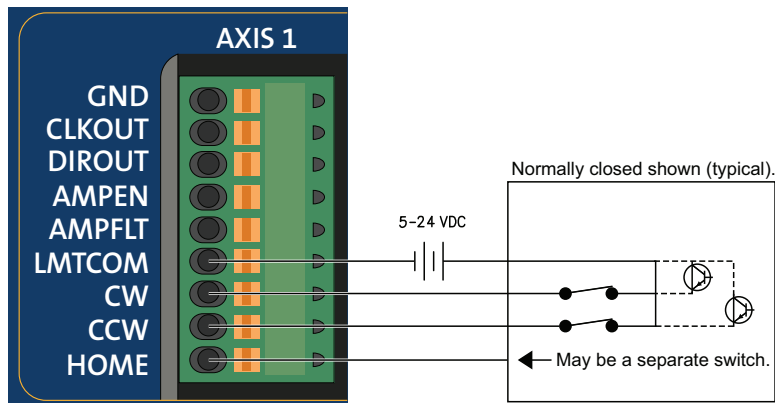


Figure 2-8: End of Travel Limit Input Connections (Sourcing)

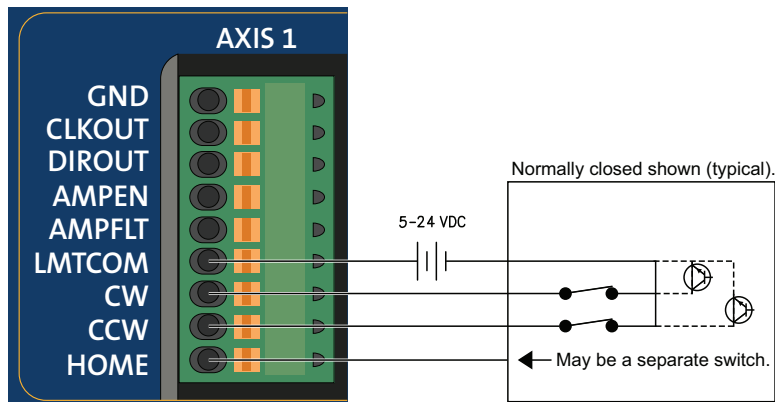


Figure 2-9: End of Travel Limit Input Connections (Sinking)

2.3.3.1. End Of Travel Limit Phasing

If the end of travel limits are reversed, you will be able to move further into a limit but be unable to move out. To correct this, swap the connections to the CW and CCW inputs. The logic level of the end of travel limit inputs may be viewed in the diagnostic display (shown in [Figure 2-10](#)).

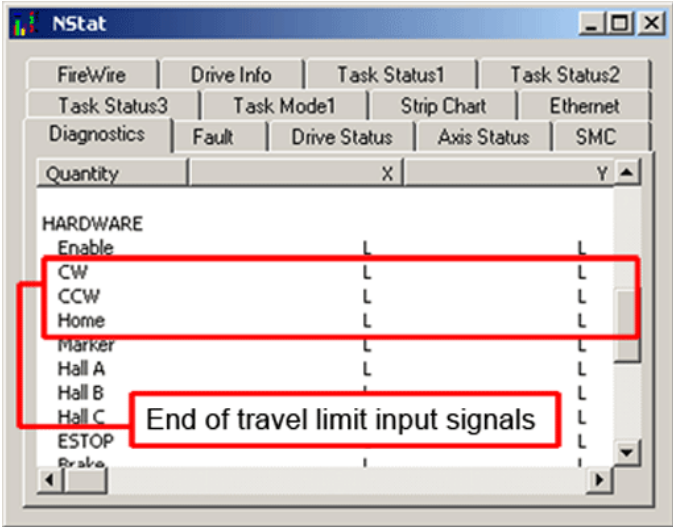


Figure 2-10: Limit Input Diagnostic Display

2.3.4. Fault Inputs

Each axis provides a drive fault input.

Table 2-12: Amplifier Fault Input Specifications

Specification	Value
Maximum Input Voltage	24 Volts

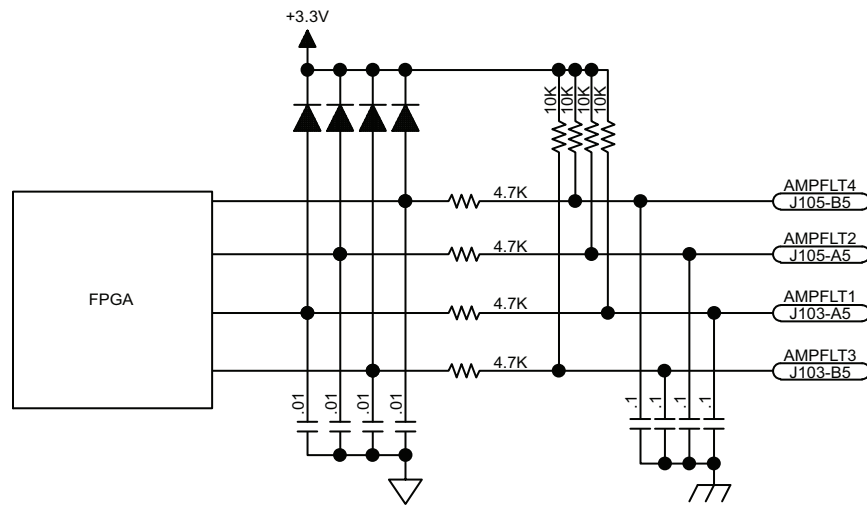


Figure 2-11: Fault Inputs

2.3.5. Axis Enable Output

The amplifier enable output can be defined as active high or active low through the switch S1. The default position is active low (ON).

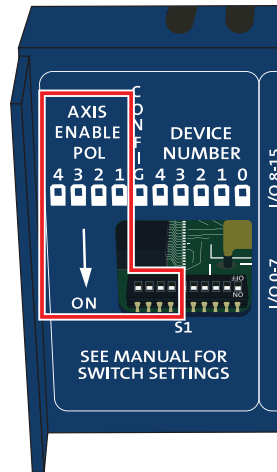


Figure 2-12: Axis Enable Polarity S1 Detail

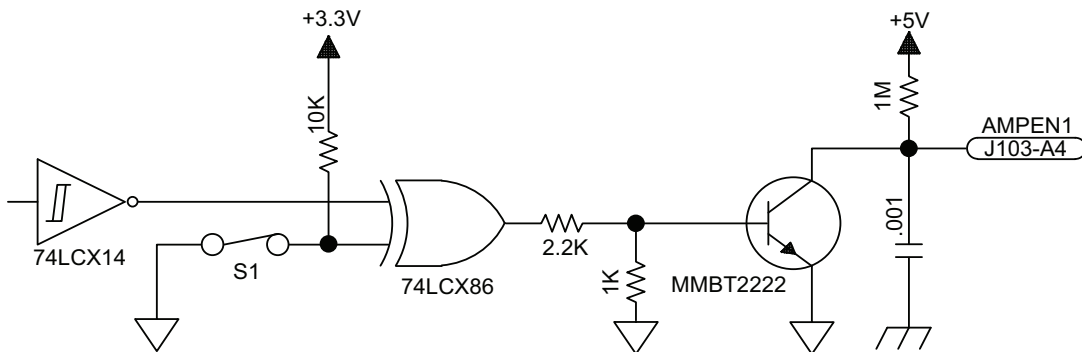


Figure 2-13: Axis Enable Outputs

Table 2-13: Axis Enable Polarity Switch Settings

Switch	Enable Active High	Enable Active Low
S1-1 (Amp 1)	Open	Closed (Default)
S1-2 (Amp 2)	Open	Closed (Default)
S1-3 (Amp 3)	Open	Closed (Default)
S1-4 (Amp 4)	Open	Closed (Default)

Table 2-14: Axis Enable Output Specifications

Specification	Value
Maximum Power Supply Voltage	35 V
Maximum Current Sink	50 mA
Maximum Power Dissipation	350 mW

2.4. Encoder Connections

The Nstep encoder interface allows the user to operate a stepper motor in a closed loop. The Nstep supports both single-ended and differential encoder feedback signals.

Table 2-15: Encoder Input Pin Assignment

Pin	Label	Description
1	+5VDC	Encoder and Limit Power (500 mA max)
2	GND	Encoder and Limit Common
3	SIN+	Sine Encoder Feedback Signal
4	SIN-	Sine-N Encoder Feedback Signal
5	COS+	Cosine Encoder Feedback Signal
6	COS-	Cosine-N Encoder Feedback Signal
7	MRK+	Marker Encoder Feedback Signal
8	MRK-	Marker-N Encoder Feedback Signal

Table 2-16: Encoder Input Mating Connector

Mating Connector	Aerotech P/N	Phoenix P/N	Wire Size: mm ² [AWG]
8-Pin Terminal Block	ECK01386	1881383	0.5 - 0.080 [20-28]

2.4.1. Encoder Interface

The encoder inputs are configured for differential line driver encoders in the range of 0 to +5 volts. They allow up to an 8 MHz (max) encoder signal frequency (31 nsec minimum edge separation), producing 32 million counts per second, after times four (x4) quadrature decoding.

An analog sine wave encoder can be used with an Aerotech MXH multiplier box to multiply the encoder resolution and simultaneously convert it to a differential line driver encoder signal.

For single-ended feedback configuration, use the Sin, Cos, and Mrk inputs, leaving the Sin-N, Cos-N and Mrk-N inputs unconnected. Set the FeedbackSetup¹ parameter to configure the hardware for single-ended encoder feedback devices.

¹FeedbackSetup has replaced DriveIOConfig in software version 3.00.000.

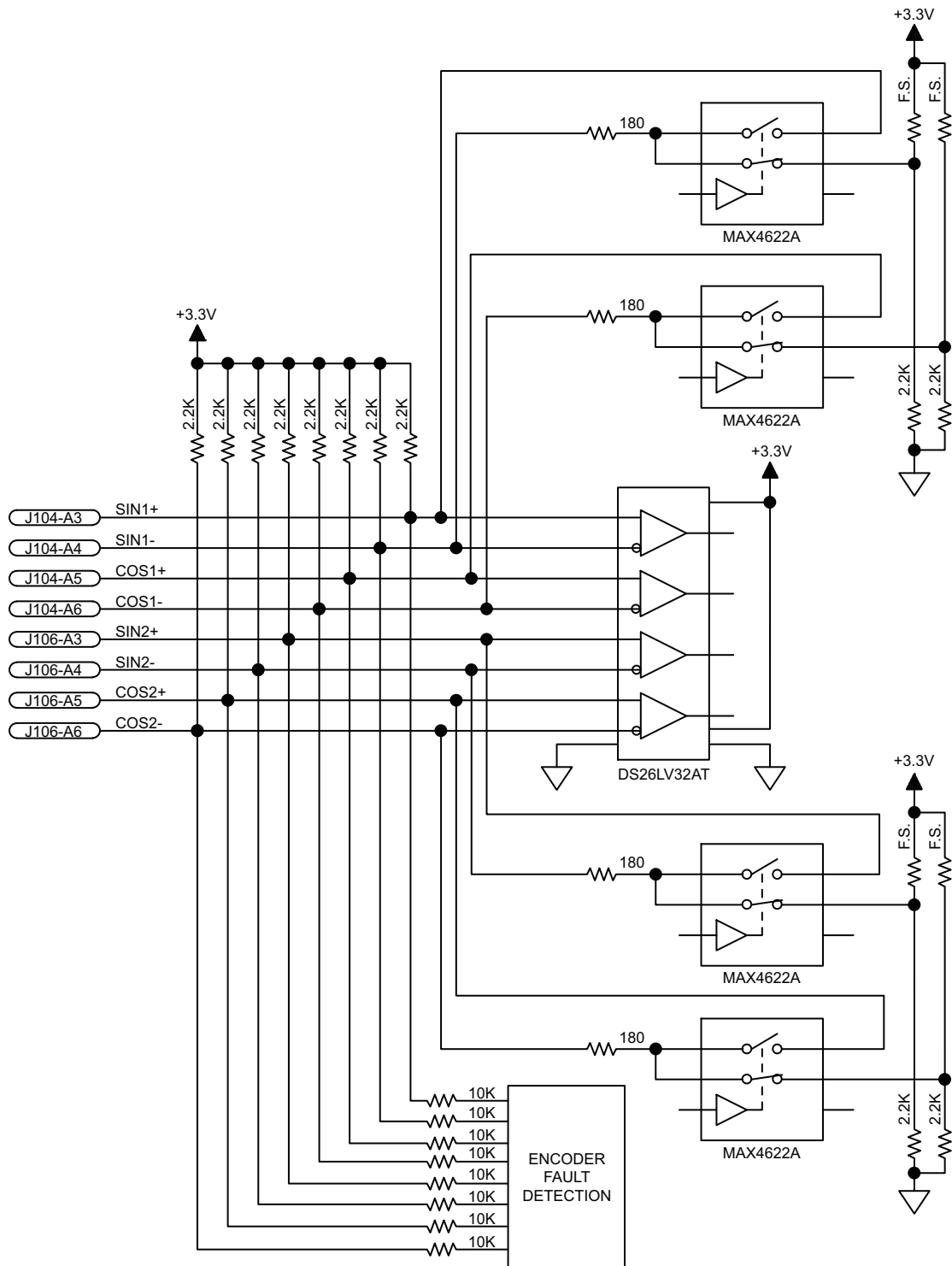


Figure 2-14: Encoder Interface Schematic (Sin/Cos)

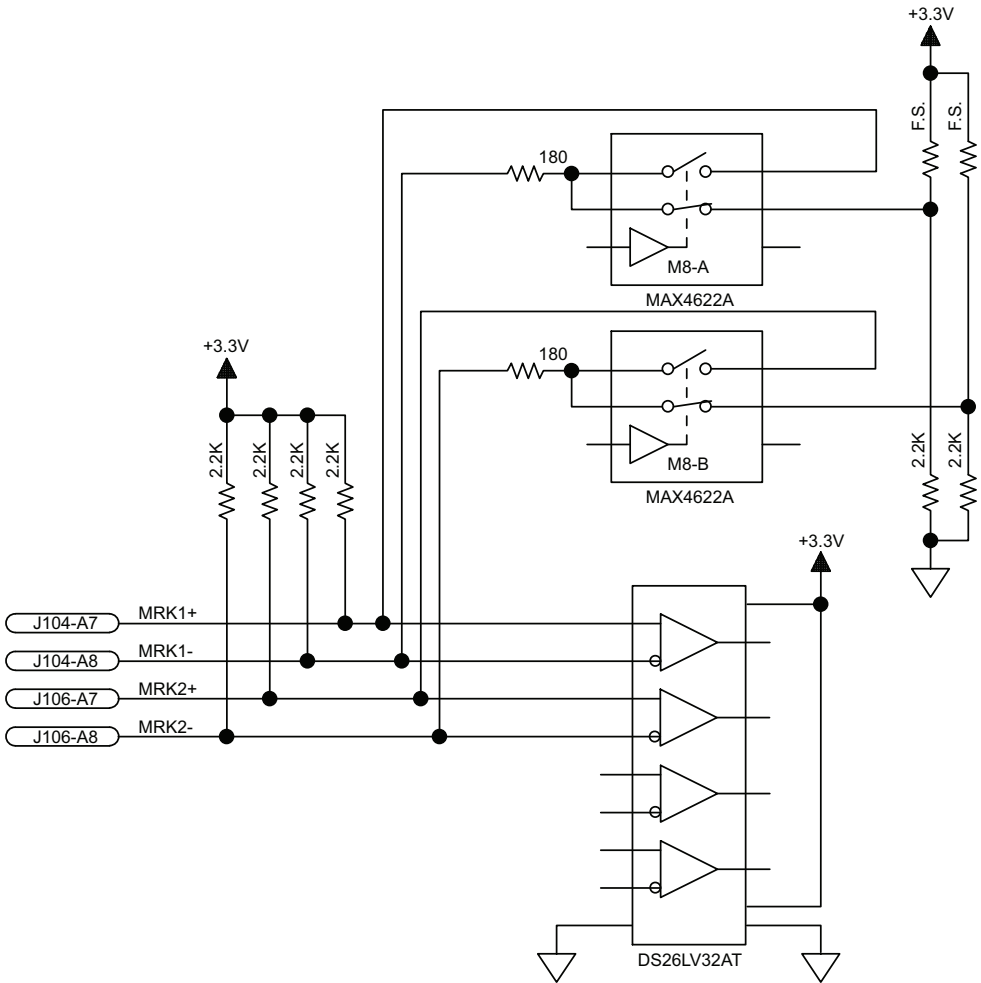


Figure 2-15: Encoder Interface Schematic (Marker)

2.5. Axis I/O (J107)

The Axis I/O connector provides one non-isolated input and one non-isolated output for each axis. The inputs are filtered and connected directly to the FPGA. The outputs are driven by a 74LCX14 driver, providing +3.3 V outputs that are capable of providing up to 24 mA/channel. [Figure 2-16](#) shows the axis outputs and [Figure 2-19](#) shows the axis inputs.

[Figure 2-17](#) and [Figure 2-18](#) illustrate how to connect to an output in current sinking and current sourcing modes, respectively. [Figure 2-20](#) illustrates how to connect to the inputs in current sinking mode.

Table 2-17: Axis I/O Interface Pin Assignment (J107A/J107B)

Pin	Description	In/Out/Power
1A	+5 V (500 mA max)	Power
2A	Ground	Power
3A	Input 16	Input
4A	Output 16	Output
5A	+5 V (500 mA max)	Power
6A	Ground	Power
7A	Input 17	Input
8A	Output 17	Output
1B	+5 V (500 mA max)	Power
2B	Ground	Power
3B	Input 18	Input
4B	Output 18	Output
5B	+5 V (500 mA max)	Power
6B	Ground	Power
7B	Input 19	Input
8B	Output 19	Output

Table 2-18: Axis I/O Interface Mating Connector

Mating Connector	Aerotech P/N	Phoenix P/N	Wire Size: mm ² [AWG]
8-Pin Terminal Block	ECK01386	1881383	0.5 - 0.080 [20-28]

Suppression diodes must be installed on outputs that are used to drive relays or other inductive devices to protect the output devices from being damaged by the inductive spikes that occur when the device is switched off. Suppression diodes can be installed on all outputs to provide greater protection. The 1N914 diode is recommended for this application. This diode is normally connected across the inductive load and must be installed so that cathode is connected to the most positive side of the load (reverse biased).

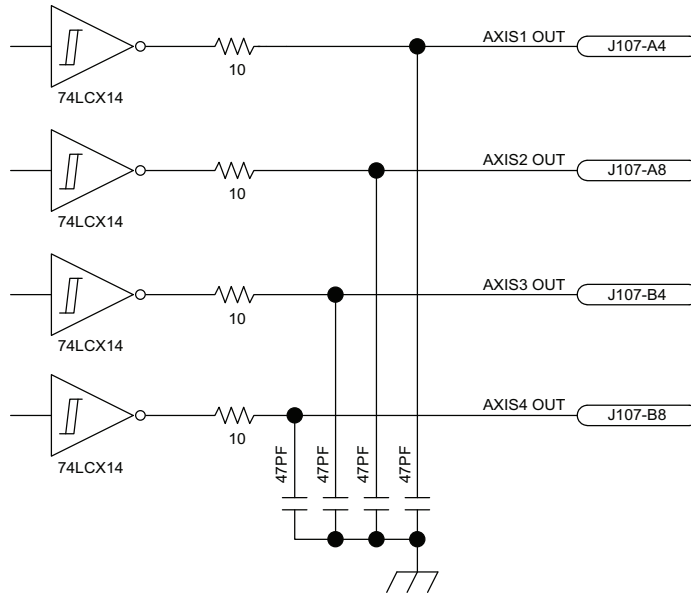


Figure 2-16: Axis I/O Outputs

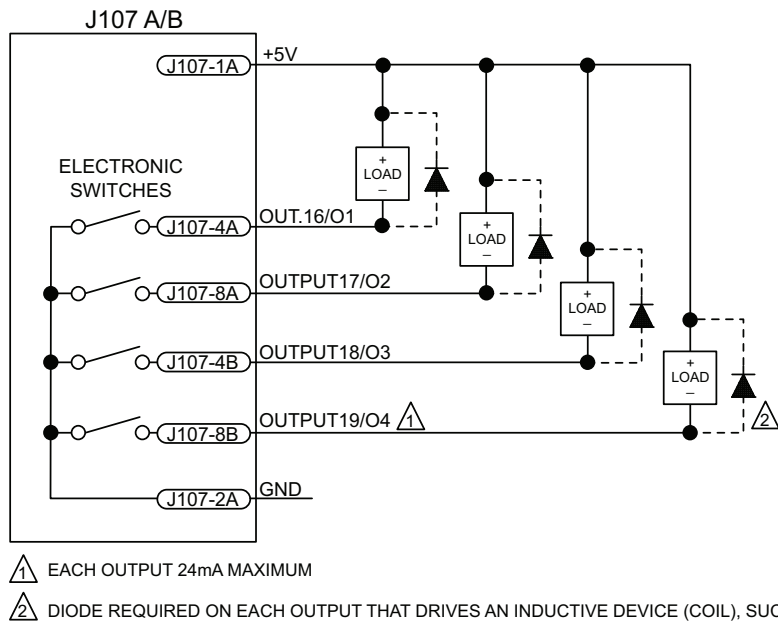


Figure 2-17: Outputs Connected in Current Sinking Mode

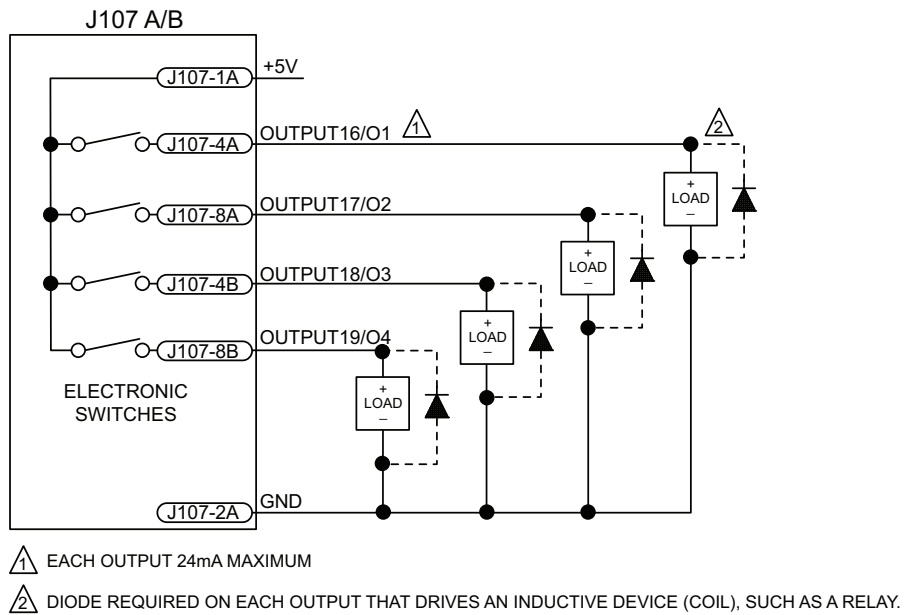


Figure 2-18: Outputs Connected in Current Sourcing Mode

Table 2-19: Input Specifications

Specification	Value
Maximum Voltage	5 VDC
Minimum Input Current (Sinking)	6 mA

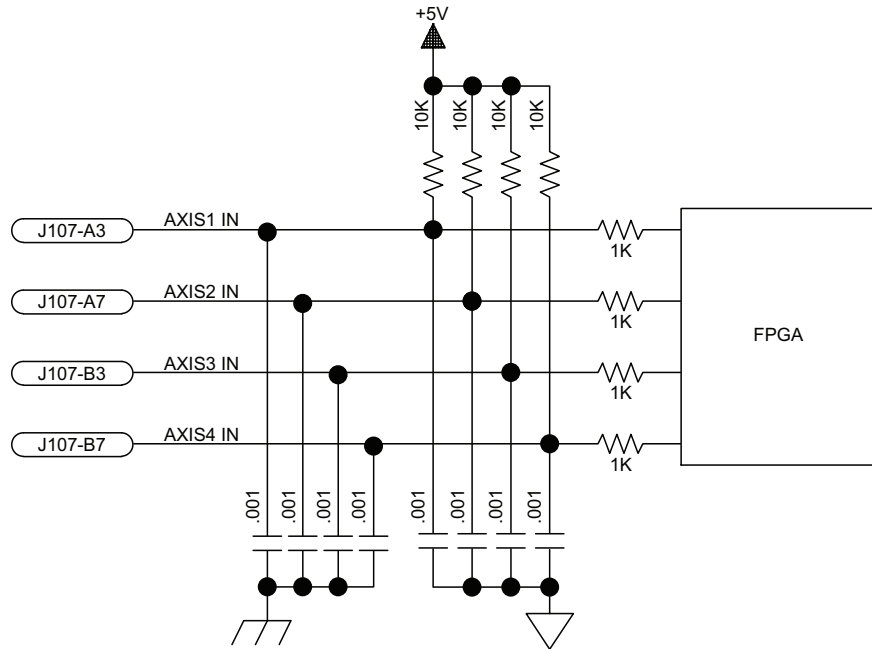


Figure 2-19: Axis I/O Inputs

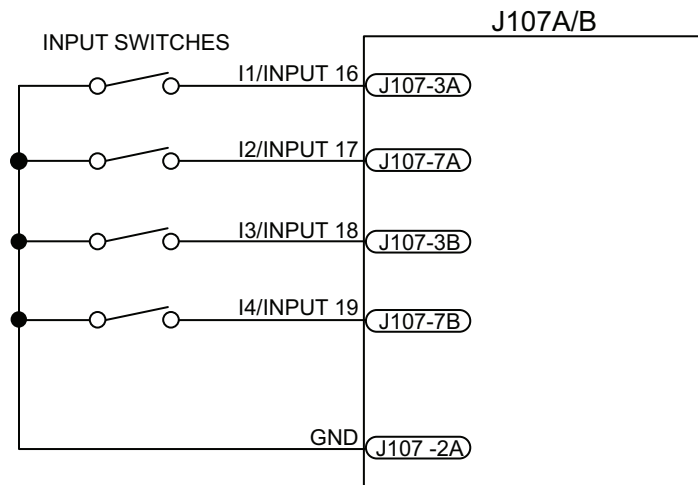


Figure 2-20: Inputs Connected to a Current Sinking Device

2.6. General Purpose I/O (J108)

The J108 connector provides 16 bits of software configurable, non-isolated, 5V TTL I/O capable of driving up to 32 mA per channel.

All I/O on this connector are configured as inputs upon system reset. See the A3200 Help file for programming information.

Table 2-20: General Purpose I/O Pin Assignment (J108A/J108B)

Pin	Label	Description
1A	+5V	+5 Volts (500 mA max)
2A	GND	Ground
3A	0	Input/Output 0 (user configurable)
4A	1	Input/Output 1 (user configurable)
5A	2	Input/Output 2 (user configurable)
6A	3	Input/Output 3 (user configurable)
7A	4	Input/Output 4 (user configurable)
8A	5	Input/Output 5 (user configurable)
9A	6	Input/Output 6 (user configurable)
10A	7	Input/Output 7 (user configurable)
1B	+5V	+5 Volts (500 mA max)
2B	GND	Ground
3B	8	Input/Output 8 (user configurable)
4B	9	Input/Output 9 (user configurable)
5B	10	Input/Output 10 (user configurable)
6B	11	Input/Output 11 (user configurable)
7B	12	Input/Output 12 (user configurable)
8B	13	Input/Output 13 (user configurable)
9B	14	Input/Output 14 (user configurable)
10B	15	Input/Output 15 (user configurable)

Table 2-21: General Purpose I/O Mating Connector

	Aerotech P/N	Phoenix P/N	Wire Size: AWG [mm ²]
10-Pin Terminal Block	ECK01294	1881406	20-28 [0.5-0.080]

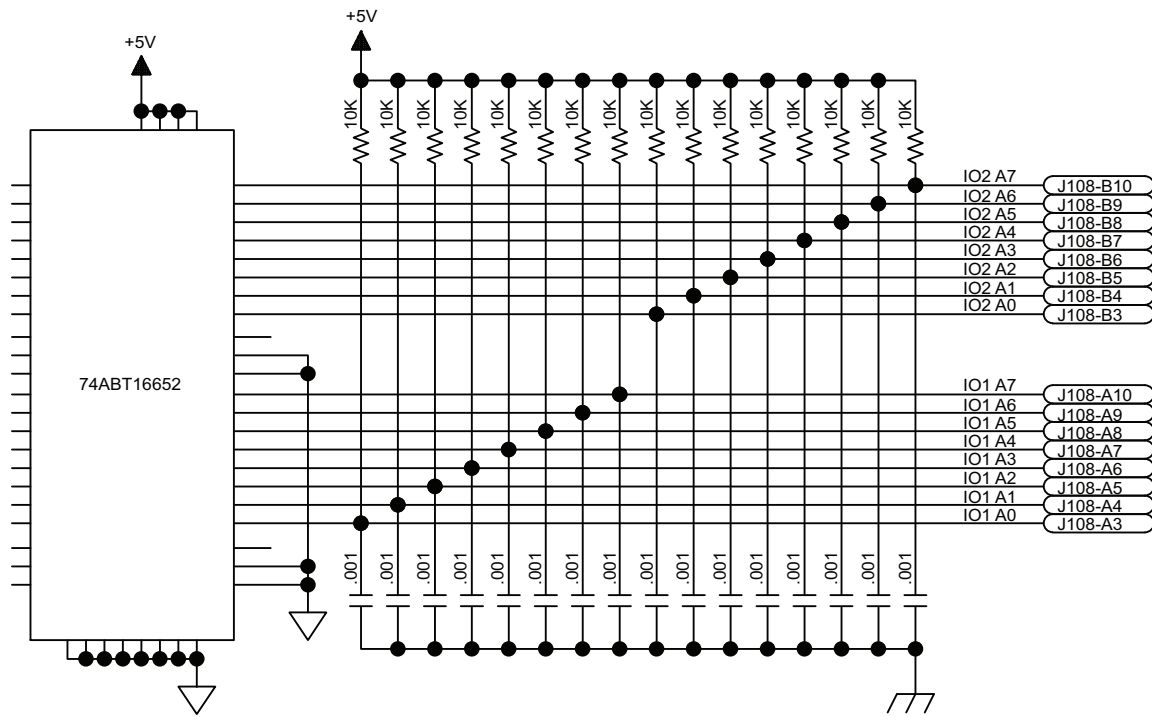


Figure 2-21: General Purpose I/O

2.7. FireWire Interface (J101/J102)

The FireWire bus is the high-speed communications connection to the Nstep operating at 400 megabits per second. All command and configuration information is sent via the FireWire port.

The following tables list compatible FireWire cards, repeaters, and cables available for use with the Nstep.

Table 2-22: FireWire Card Part Numbers

Part Number	Description
NFIRE-PCI	OHCI compliant FireWire PCI interface card, 3 port
NFIRE-PCIE	OHCI compliant FireWire PCIE x1 interface card, 2 port
NFIRE-PCI-TI-LP	Low Profile, OHCI compliant, PCI
NFIRE-PCIE-GOF	FireWire PCIE X1 Glass Optical Fiber Board

Table 2-23: FireWire Repeaters (for cables exceeding 4.5 m (15 ft) specification)

Part Number	Description
NFIRE-RPTR-1394A-1394A	Extender for copper cable lengths greater than 4.5 m (15 feet).
NFIRE-RPTR-1394A-GOF	Glass Optical Fiber FireWire Repeater, Qty. 1 (Fiber Cable not included)

Table 2-24: FireWire Cables (copper and glass/plastic fiber)

Part Number	Description
NCONNECT-4500-66	4.5 m (15 ft) long, 6 pin to 6 pin
NCONNECT-3000-66	3 m (10 ft) long, 6 pin to 6 pin
NCONNECT-1800-66	1.8 m (6 ft) long, 6 pin to 6 pin
NCONNECT-900-66	900 mm (3 ft) long, 6 pin to 6 pin
NCONNECT-381-66	381 mm (15 in) long, 6 pin to 6 pin
NCONNECT-228-66	228 mm (9 in) long, 6 pin to 6 pin
NCONNECT-10000-GOF	10 m (32.8 ft), glass fiber Optical cable
NCONNECT-15000-GOF	15 m (49.2 ft), glass fiber Optical cable
NCONNECT-20000-GOF	20 m (65.6 ft), glass fiber Optical cable
NCONNECT-30000-GOF	30 m (101.7 ft), glass fiber Optical cable

NOTE: Before connecting any device to the FireWire bus, the device should be powered up and tested independently to prevent damaging other drives on the FireWire bus.

2.8. PC Configuration and Operation Information

For additional information about Nstep and PC configuration, hardware requirements, programming, utilities and system operation see the A3200 Help file.

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Chapter 3: Maintenance

This section covers the internal boards, important board components, and how to clean the drive. Troubleshooting is covered in-depth in the A3200 Help file.



DANGER: Before performing any tests, be aware of lethal voltages inside the controller and at the input and output power connections. A qualified service technician or electrician should perform these tests.



WARNING: No user serviceable parts inside.



DANGER: Always disconnect the Mains power connection before opening the Nstep chassis.



DANGER: Motors must be mechanically secured before applying power.



DANGER: Residual voltages greater than may be present inside Nstep chassis for longer than seconds after power has been disconnected.

Table 3-1: Troubleshooting

Symptom	Possible Cause/Solution
Cannot communicate with Nstep	<ul style="list-style-type: none"> • Check the FireWire cable. • Check for power to Nstep. • Reset the Nstep. • Briefly power down the Nstep to reset it.
Stepper motor moves erratic.	Motor is not able to synchronize to the command clock. <ul style="list-style-type: none"> • Acceleration profile too fast. • Maximum speed capability of motor/amp exceeded.
Stepper motor will not turn.	<ul style="list-style-type: none"> • Check for stepper clock & direction outputs. • Check the stepper drive enable signal. • Check for motor stall
Stepper motor stalled.	<ul style="list-style-type: none"> • Check acceleration/deceleration. • Exceeded maximum speed capability of motor/driver. • Load may be too large for the motor driver.
Amplifier Faults (Flt LED on).	<ul style="list-style-type: none"> • RMS current exceeded - run at lower current. • Over temperature condition - Turn off and let the stepper driver cool down. Provide better ventilation.
Nstep Position Error Fault	<ul style="list-style-type: none"> • Encoder feedback fault. • Motor stalled.
Encoder Feedback Fault	You are using single-ended encoder without the proper FeedbackSetup ¹ parameter setting.
Motor does not move proper distance	<ul style="list-style-type: none"> • Check stepper driver counts/rev settings. • Check the axis parameters. • Check stepper driver counts/rev settings. • Check the axis parameters.
Power LED flashes on and off continuously, unit does not operate	<ul style="list-style-type: none"> • Too much current draw from the 5V power supply • Control supply voltage level is low

The following LEDs are available on each Nstep. Full Nstep status is available via the Nmotion SMC and its utilities.

Table 3-2: LED Indicators

label	Description
Reset	Drive Ready (Solid Green) / Drive Resetting (Blinking Green)
Power	Power Present (Green)
ENB/FLT1	Axis 1 Enabled (Green) / Fault Present (Red)
ENB/FLT2	Axis 2 Enabled (Green) / Fault Present (Red)
ENB/FLT3	Axis 3 Enabled (Green) / Fault Present (Red)
ENB/FLT4	Axis 4 Enabled (Green) / Fault Present (Red)

¹FeedbackSetup has replaced DriveIOConfig in software version 3.00.000.

3.1. Control Board



DANGER: Always disconnect the Mains power connection before opening the Nstep chassis.

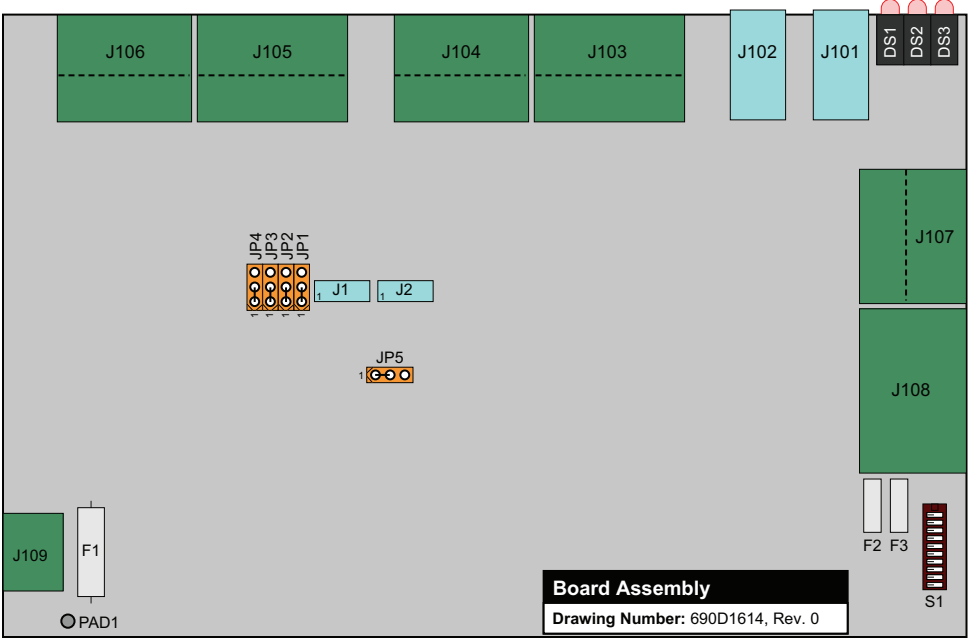


Figure 3-1: Control Board Assembly

Table 3-3: Control Board Jumper Configuration

Jumper	Setting	Description
JP1	1-2 ⁽¹⁾	Axis 1 CW/CCW/Home Limit External Power Source
	2-3	Axis 1 CW/CCW/Home Limit Internal +5VDC Power Source
JP2	1-2 ⁽¹⁾	Axis 2 CW/CCW/Home Limit External Power Source
	2-3	Axis 2 CW/CCW/Home Limit Internal +5VDC Power Source
JP3	1-2 ⁽¹⁾	Axis 3 CW/CCW/Home Limit External Power Source
	2-3	Axis 3 CW/CCW/Home Limit Internal +5VDC Power Source
JP4	1-2 ⁽¹⁾	Axis 4 CW/CCW/Home Limit External Power Source
	2-3	Axis 4 CW/CCW/Home Limit Internal +5VDC Power Source
JP4	1-2 ⁽¹⁾	Watchdog enabled
	2-3	Watchdog disabled
(1) Default		

Table 3-4: Control Board Fuse Information

Fuse	Size	Aerotech P/N	Manufacturer's P/N
F1	3 A SB	EIF1013	Littelfuse 230003S
F2	3 A	EIF1001	Raychem RGE300
F3	3 A	EIF1001	Raychem RGE300
F4	.05 A	EIF1002	Raychem SMDC05
F5	.05 A	EIF1002	Raychem SMDC05

3.2. Preventative Maintenance

The Nstep and external wiring should be inspected monthly. Inspections may be required at more frequent intervals, depending on the environment and use of the system. The table below lists the recommended checks that should be made during these inspections.



DANGER: Always disconnect the Mains power connection before opening the Nstep chassis.



DANGER: To minimize the possibility of bodily injury or death, disconnect all electrical power prior to performing any maintenance or making adjustments to the equipment.



DANGER: Hazardous Voltages are present on Nstep systems.

Table 3-5: Preventative Maintenance

Check	Action to be Taken
Visually Check chassis for loose or damaged parts / hardware. Note: Internal inspection is not required.	Parts should be repaired as required. If internal damage is suspected, these parts should be checked and repairs made if necessary.
Inspect cooling vents.	Remove any accumulated material from vents.
Check for fluids or electrically conductive material exposure.	Any fluids or electrically conductive material must not be permitted to enter the Nstep.
Visually inspect all cables and connections.	Tighten or re-secure any loose connections. Replace worn or frayed cables. Replace broken connectors.

Cleaning

The Nstep chassis can be wiped with a clean, dry, soft cloth. The cloth may be slightly moistened if required with water or isopropyl alcohol to aid in cleaning if necessary. In this case, be careful not to allow moisture to enter the Nstep or onto exposed connectors / components. Fluids and sprays are not recommended because of the chance for internal contamination, which may result in electrical shorts and/or corrosion. The electrical power must be disconnected from the Nstep while cleaning. Do not allow cleaning substances or other fluids to enter the Nstep or to get on to any of the connectors. Avoid cleaning labels to prevent removing the label information.

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Appendix A: Warranty and Field Service

Aerotech, Inc. warrants its products to be free from harmful defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products that are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, whether or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability on any claim for loss or damage arising out of the sale, resale, or use of any of its products shall in no event exceed the selling price of the unit.

THE EXPRESS WARRANTY SET FORTH HEREIN IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, BY OPERATION OF LAW OR OTHERWISE. IN NO EVENT SHALL AEROTECH BE LIABLE FOR CONSEQUENTIAL OR SPECIAL DAMAGES.

Return Products Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within thirty (30) days of shipment of incorrect material. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. A "Return Materials Authorization (RMA)" number must accompany any returned product(s). The RMA number may be obtained by calling an Aerotech service center or by submitting the appropriate request available on our website (www.aerotech.com). Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than thirty (30) days after the issuance of a return authorization number will be subject to review.

Visit <http://www.aerotech.com/service-and-support.aspx> for the location of your nearest Aerotech Service center.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an expedited method of return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Fixed Fee Repairs - Products having fixed-fee pricing will require a valid purchase order or credit card particulars before any service work can begin.

All Other Repairs - After Aerotech's evaluation, the buyer shall be notified of the repair cost. At such time the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within thirty (30) days of notification will result in the product(s) being returned as is, at the buyer's expense.

Repair work is warranted for ninety (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site Field Service Representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

On-site Non-Warranty Repair

If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site Field Service Representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

Service Locations

<http://www.aerotech.com/contact-sales.aspx?mapState=showMap>

USA, CANADA, MEXICO	CHINA	GERMANY
Aerotech, Inc. Global Headquarters Phone: +1-412-967-6440 Fax: +1-412-967-6870	Aerotech China Full-Service Subsidiary Phone: +86 (21) 3319 7715	Aerotech Germany Full-Service Subsidiary Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720
JAPAN	TAIWAN	UNITED KINGDOM
Aerotech Japan Full-Service Subsidiary Phone: +81 (0)50 5830 6814 Fax: +81 (0)43 306 3773	Aerotech Taiwan Full-Service Subsidiary Phone: +886 (0)2 8751 6690	Aerotech United Kingdom Full-Service Subsidiary Phone: +44 (0)1256 855055 Fax: +44 (0)1256 855649

Have your customer order number ready before calling.

Appendix B: Revision History

Revision	Date	Description
2.05.00	December 22, 2015	<ul style="list-style-type: none">Updated: Table 2-9
2.04.00	April 23, 2015	<ul style="list-style-type: none">Added RoHS statement to EC Declaration of ConformityAdded Tightening Torque specification: Table 2-4Added I/O connection examples: Section 2.5.
2.03.00	August 30, 2012	Revision changes have been archived. If you need a copy of this revision, contact Aerotech Global Technical Support.
2.02.00	November 9, 2011	
2.01.00	March 1, 2010	
2.00.00	September 2, 2009	
1.1	March 30, 2006	
1.0	January 24, 2006	

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