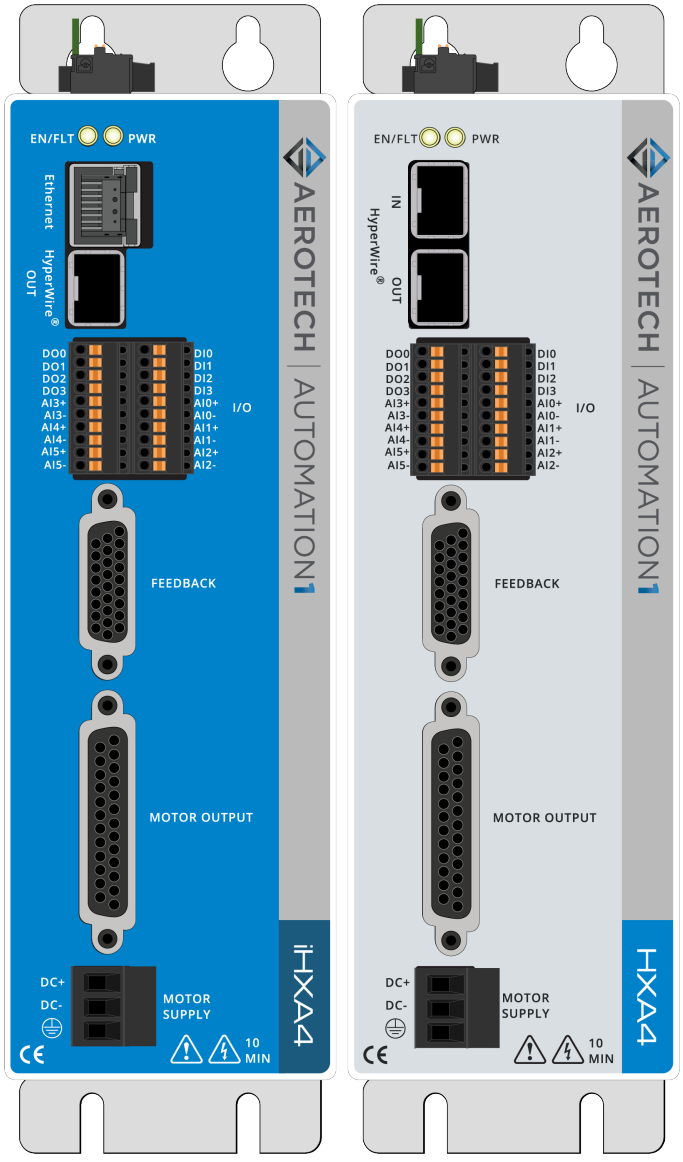
Automation1 iHXA4 and HXA4 Hexapod Digital Drives

HARDWARE MANUAL

Revision 1.01



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EU Declaration of Conformity

Manufacturer	Aerotech, Inc.
Address	101 Zeta Drive Pittsburgh, PA 15238-2811 USA
Product	iHXA4/HXA4
Model/Types	All

CE

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

2014/30/EU	Electromagnetic Compatibility (EMC)
2014/35/EU	Low Voltage Directive
2006/42/EC	Machinery Directive
EU 2015/863	Directive, Restricted Substances (RoHS 3)

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

EN 61800-3:2017	EMC Requirements for Power Drives
IEC 61800-5-1:2022	Electrical Safety for Power Drive Systems
IEC 61800-5-2:2016	Functional Safety for Power Drive Systems
CISPR 11:2015	Conducted and Radiated Emissions

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Date: 11/14/2025

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Alex Weibel

UKCA Declaration of Conformity

Manufacturer	Aerotech, Inc.
Address	101 Zeta Drive Pittsburgh, PA 15238-2811 USA
Product	iHXA4/HXA4
Model/Types	All

To which this declaration relates, meets the essential health and safety requirements and is in conformity with the relevant UK Legislation listed below:

Electrical Equipment (Safety) Regulations 2016
Electromagnetic Compatibility Regulations 2016
Supply of Machinery (Safety) Regulations 2008
Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

Using the relevant section of the following UK Designated Standards and other normative documents when installed in accordance with the installation instructions supplied by the manufacturer.

EN 61800-3:2017	EMC Requirements for Power Drives
IEC 61800-5-1:2022	Electrical Safety for Power Drive Systems
IEC 61800-5-2:2016	Functional Safety for Power Drive Systems
CISPR 11:2015	Conducted and Radiated Emissions

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Korean Certification

Registration of Broadcasting and Communication Equipments

It is verified that the foregoing equipment has been registered under the Clause 3, Article 58-2 of the radio Waves Act.

Agency Approvals

The iHXA4/HXA4 drives have been tested by the following NRTL(s) and have been certified to the standards that follow:

Certificate #:	TBD
Standards:	CE Attestation of Conformity, Low Voltage Directive2014/35/EU, IEC 61800-5-1:2020 (Adjustable speed electrical drive power systems - Part 5-1: Safety requirements)

Visit https://www.tuev-sued.de/product-testing/certificates to view Aerotech's TÜV SÜD certificates. Type the certificate number listed above in the search bar or type "Aerotech" for a list of all Aerotech certificates.

Safety Procedures and Warnings

IMPORTANT: This manual tells you how to carefully and correctly use and operate the drive.

- Read all parts of this manual before you install or operate the drive or before you do maintenance to your system.
- To prevent injury to you and damage to the equipment, obey the precautions in this manual.
- All specifications and illustrations are for reference only and were complete and accurate as of the release of this manual. To find the newest information about this product, refer to www.aerotech.com.

If you do not understand the information in this manual, contact Aerotech Global Technical Support.

Safety notes and symbols are placed throughout this manual to warn you of the potential risks at the moment of the safety note or if you fail to obey the safety note.

The voltage can cause shock, burn, or death.

You are at risk of physical injury.
You could damage the drive.

A surface can be hot enough to burn you.

Your actions, the temperature of the system, or the condition of the atmosphere that surround the system could start a fire.

Components are sensitive to electrostatic discharge.

Unsecured cables could cause you to:

- trip and fall
- drag the product off of its mounting location
- damage the cable connections.

A blue circle symbol is an action or tip that you should obey. Some examples include:

- General tip
- Read the manual/section
- Wear protective safety equipment (eye protection, ear protection, gloves)
- If applicable, do not lift unassisted

Handling and Storage

Unpacking the drive

IMPORTANT: All electronic equipment and instrumentation is wrapped in antistatic material and packaged with desiccant. Ensure that the antistatic material is not damaged during unpacking.

Inspect the shipping container for any evidence of shipping damage. If any damage exists, notify the shipping carrier immediately.

Remove the packing list from the shipping container. Make sure that all the items specified on the packing list are contained within the package.

The documentation for the drive is on the included installation device. The documents include manuals, interconnection drawings, and other documentation pertaining to the system. Save this information for future reference. Additional information about the system is provided on the Serial and Power labels that are placed on the chassis.

The system serial number label contains important information such as the:

- Customer order number (please provide this number when requesting product support)
- Drawing number
- System part number

Handling

IMPORTANT: It is the responsibility of the customer to safely and carefully lift and move the drive.

- Be careful when you move or transport the drive.
- Refer to Section 1.5. Mechanical Specifications for dimensions and weight specifications.
- Retain the shipping materials for future use.
- Transport or store the drive in its protective packaging.

WARNING: Electrostatic Discharge (ESD) Sensitive Components!

You could damage the power supply or drives if you fail to observe the correct ESD practices.

Wear an ESD wrist strap when you handle, install, or do service to the system assembly.

Storage

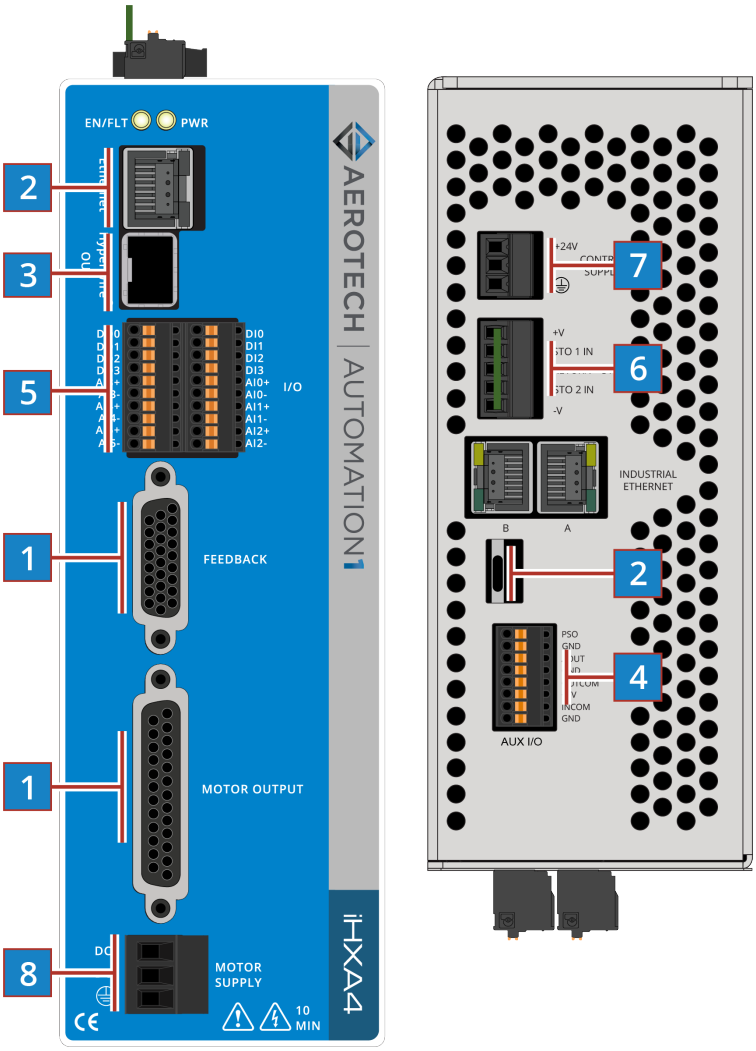
Store the drive in the original shipping container. If the original packaging included ESD protective packaging, make sure to store the drive in it. The storage location must be dry, free of dust, free of vibrations, and flat.

Refer to Section 1.6. Environmental Specifications.

Installation Overview

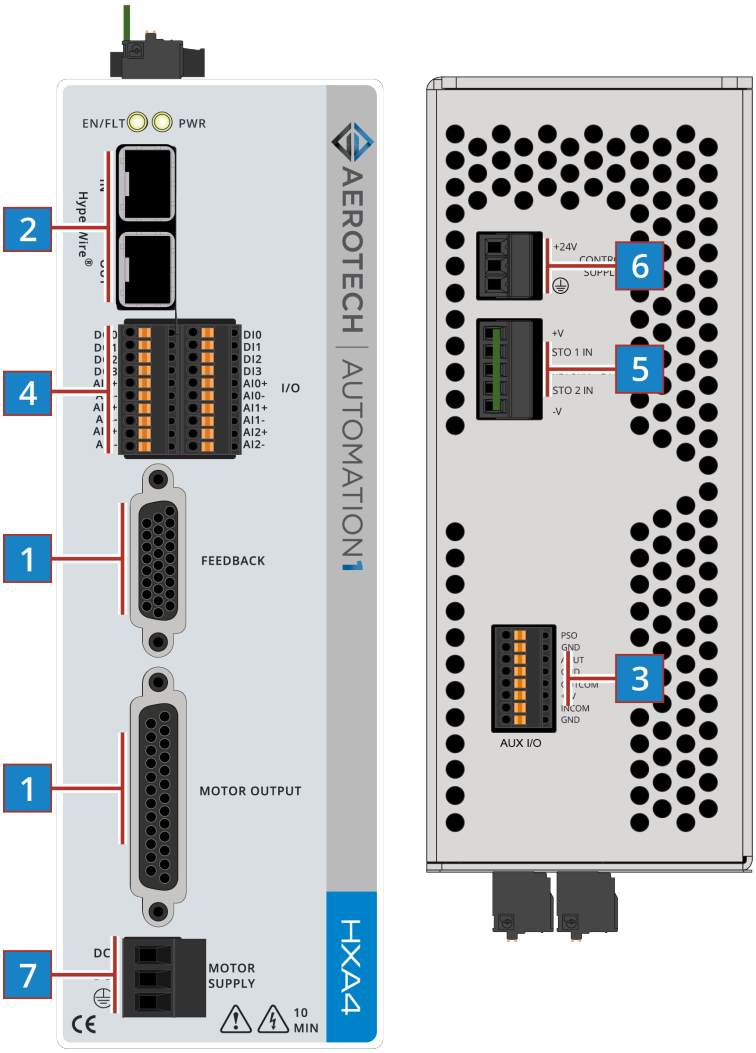
The images that follow show the order in which to make connections and settings that are typical to the iHXA4/HXA4. If a custom interconnect drawing was supplied with your system, that drawing is on your Storage Device and shows as a line item on your Sales Order in the Integration section.

Figure 1: Installation Connection Overview for the iHXA4



1	Connect the hexapod motor power to the Motor Output connector.	Section 2.2.
	Connect the hexapod feedback to the Feedback connector.	Section 2.3.
2	Connect the PC to the USB or Ethernet port.	N/A
3	Connect the next drive in the system to the HyperWire Out port.	Section 2.7.
4	Connect Auxiliary I/O (PSO/AOUT/DIO COM).	Section 2.5.
5	Connect Digital and Analog I/O.	Section 2.4.
6	Connect the Safe Torque Off (STO).	Section 2.6.
7	Connect the power supply to the Control Supply connector.	Section 2.1.1.
8	Connect the motor power to the Motor Supply connector.	Section 2.1.2.

Figure 2: Installation Connection Overview for the HXA4



1	Connect the hexapod motor power to the Motor Output connector.	Section 2.2.
	Connect the hexapod feedback to the Feedback connector.	Section 2.3.
2	Connect a PC or drive-based controller HyperWire port to the HyperWire In port.	Section 2.7.
3	Connect Auxiliary I/O (PSO/AOUT/DIO COM).	Section 2.5.
4	Connect Digital and Analog I/O.	Section 2.4.
5	Connect the Safe Torque Off (STO).	Section 2.6.
6	Connect the power supply to the Control Supply connector.	Section 2.1.1.
7	Connect the motor power to the Motor Supply connector.	Section 2.1.2.

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Chapter 1: iHXA4/HXA4 Overview

The iHXA4 is a digital drive-based controller. It runs the Automation1-iSMC controller to generate commands for itself as well as for additional drives on the chain.

The HXA4 is a digital drive. The HXA4 is based on the HyperWire communication protocol and receives commands from a PC or drive-based controller.

Both drives provide deterministic behavior, auto-identification, and are fully software configurable. A double precision floating point DSP controls the digital PID and current loops. Both drives offer standard Safe Torque Off (STO) inputs, a Position Synchronized Output (PSO) output, user-configurable digital and analog I/O, and separate power connections for motor and control supply voltages.

Figure 1-1: iHXA4 Digital Drive-Based Controller Labeled

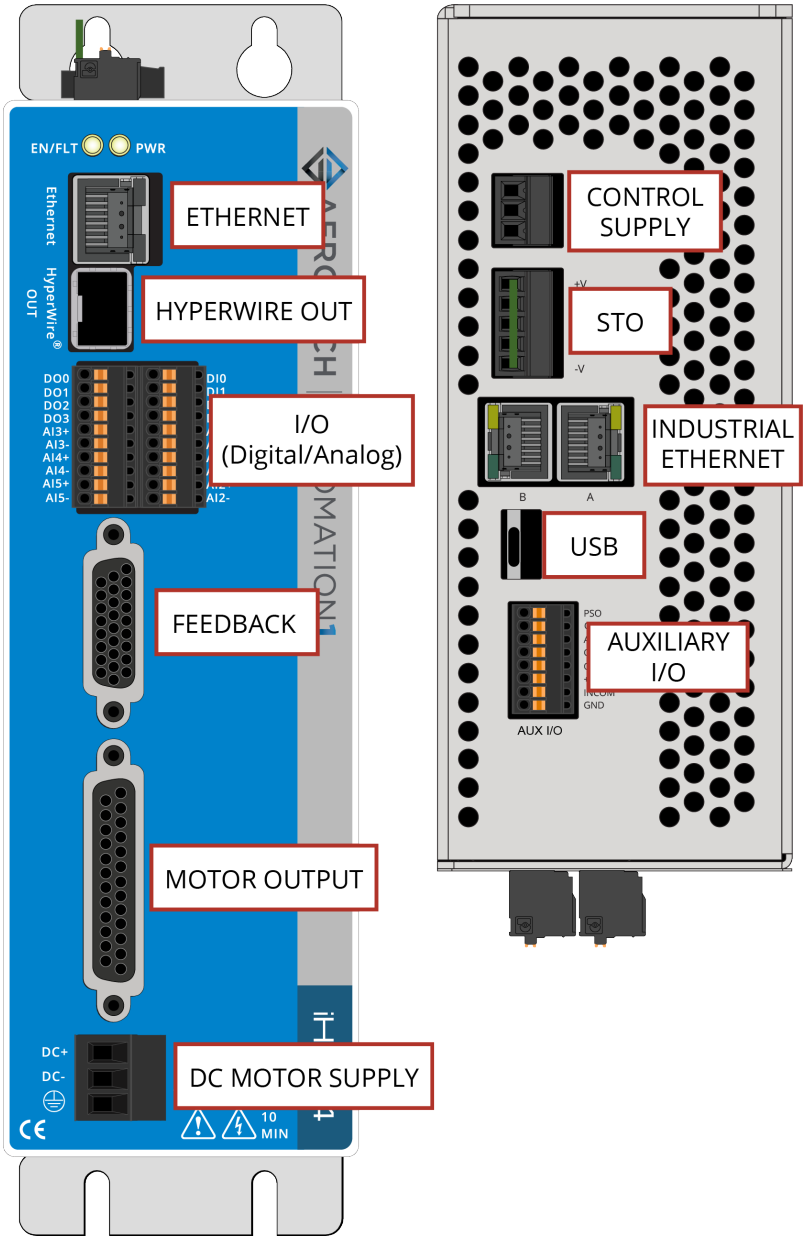
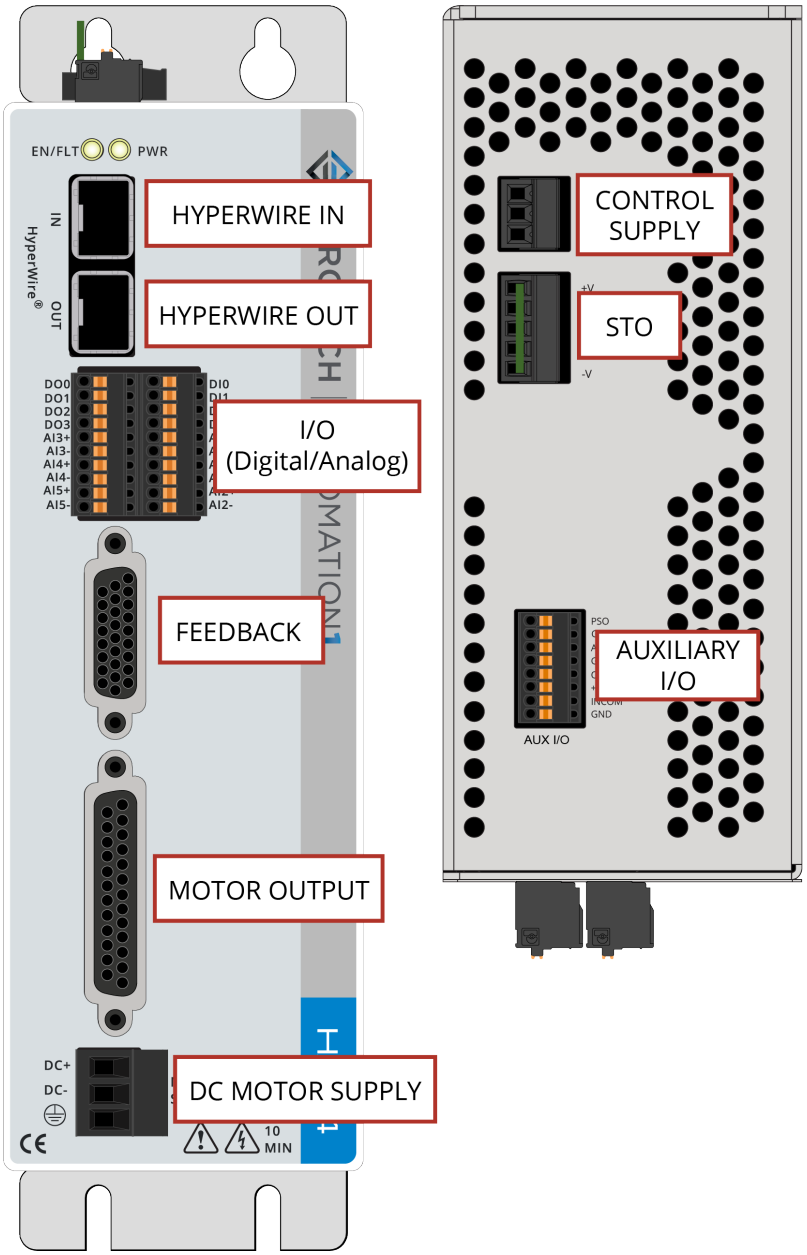


Figure 1-2: HXA4 Digital Drive Labeled



1.1. Feature Summary

- 24 VDC control supply input (Section 2.1.1.)
- 10 kHz Servo Loop Update Rate
- Sine wave quadrature encoder input for position and velocity feedback (Section 2.3.)
- Absolute Encoder support on the Feedback connector (Section 2.3.)
- Two STO sense inputs (Section 2.6.)
- Outputs
  - Four optically-isolated digital outputs (5V - 24 V)
  - One 16-bit single-ended analog output (±10 V)
- Inputs
  - Four optically-isolated digital inputs (5V - 24 V)
  - Six 16-bit differential analog inputs (±10 V)
- Position Synchronized Output (PSO):
  - Part-Speed PSO Firing:
    - One to three axes
    - Part-Speed PSO commands high-speed, low-latency output pulses based on the commanded vector velocity. Refer to the Part-Speed PSO Functions in Automation1 Help.
- One HyperWire communication channel (Section 2.7.)
- One 10/100/1000 BASE-T Ethernet Port (**iHXA4 Only**)
- One USB 2.0 Type C™ Port (**iHXA4 Only**)
- Two 100 BASE-T Industrial Ethernet Ports (**iHXA4 Only**)

1.2. Ordering Options

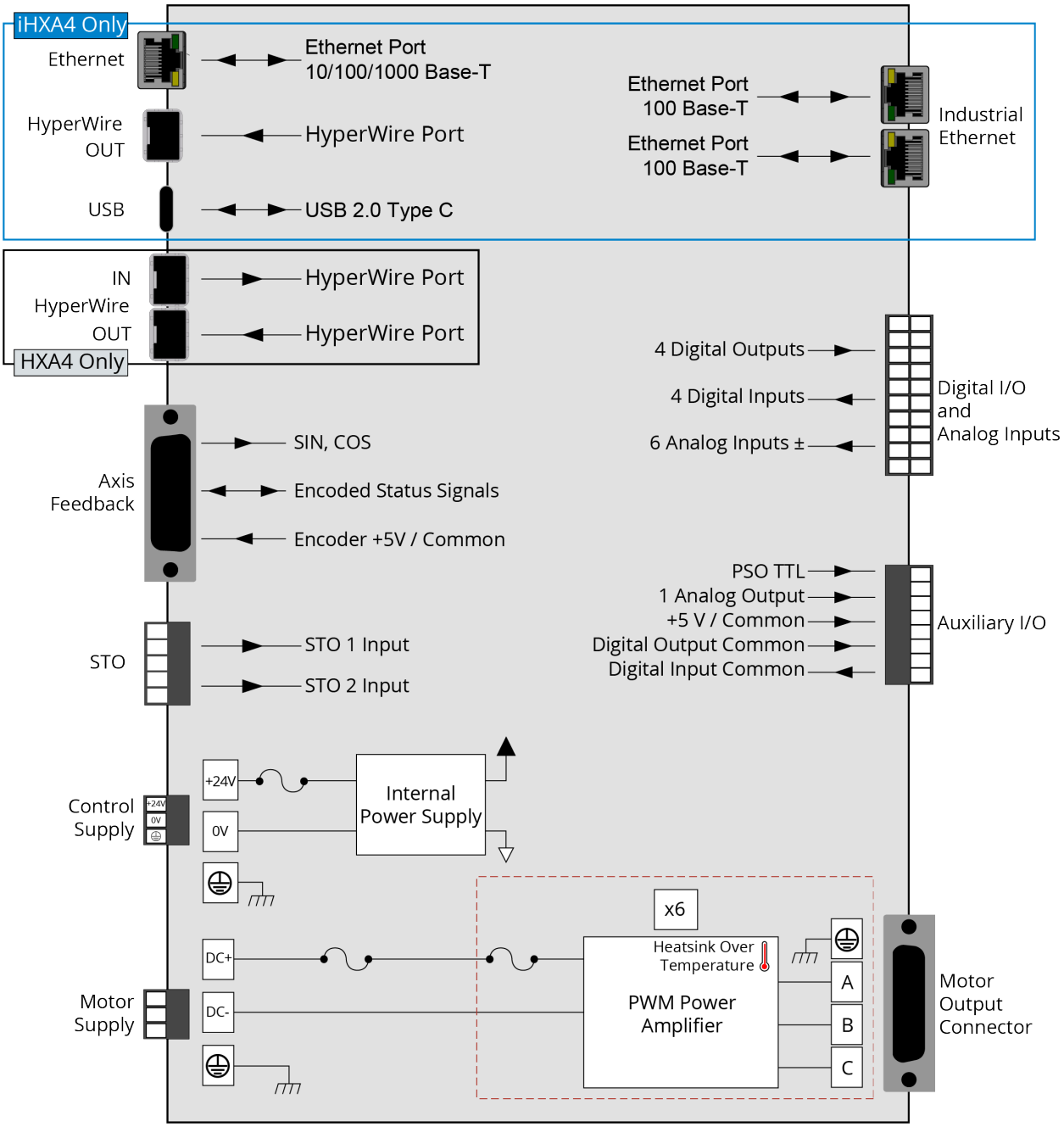
Table 1-1: Example Order and Ordering Options

Options	
iHXA4	PWM Servo Drive with Motion Controller
HXA4	PWM Servo Drive

1.3. Functional Block Diagram

The block diagram that follows shows a summary of the connector signals.

Figure 1-3: Functional Diagram



1.4. Electrical Specifications

Table 1-2: Electrical Specifications

Description		Specification	
Control Supply	Input Voltage	24 VDC	
	Input Current	5 A maximum, 0.5 A typical	
Power Amplifier Bandwidth		2500 Hz maximum (software selectable)	
PWM Switching Frequency		20 kHz	
Minimum Load Inductance		0.5 mH	
User Power Supply Output		5 VDC (@ 500 mA)	
Motor Type		Aerotech Brushless Hexapod Motors	
Protective Features		• Output short circuit • Peak over current • DC bus over voltage • Motor RMS over current	• Motor over temperature • Heatsink over temperature • Control power supply under voltage
Insulation		Over Voltage Category 2	
Conductors		Copper Only, 75°C min	
Motor Supply Input Current at full output power		5 A	
Motor Supply Input Voltage Max (1)		100 VDC	
Output Current (peak)(2,5)		10 A	
Output Current (continuous, all axes together, each axis)(2,3,4)		3 A	
Internal Time-Delay Fuse	Motor Supply Input	10 A	
	per Axis	3 A	
Peak Output Voltage(3)		100 VDC	
Internal Motor Supply Capacitance		223 µF	
Capacitor Safe Discharge Time (to 50V)		10 minutes	

(1) A lower motor supply voltage can be used. This will result in a reduction of output power.
(2) There are three motor phases per-axis from the drive.
(3) DC input voltage and load dependent.
(4) The maximum total power output is 800 W.
(5) The drive can achieve the peak output current for each axis with all axes running.

1.4.1. System Power Requirements

The following equations can be used to determine total system power requirements. The actual power required from the mains supply will be the combination of actual motor power (work), motor resistance losses, and efficiency losses in the power electronics or power transformer. For 3-phase brushless motors:

Use an EfficiencyFactor of approximately 90% in the following equations.

PWM Amplifier Types

Power Output [W] = Torque [N·m] · Angular Velocity [rad/sec] ;Rotary
= Force [N] · Linear Velocity [m/sec] ;Linear
= B_{emf} [V_{rms} l-n] · MotorCurrent [A_{rms}] · 3 ;Rotary or Linear
Power Loss [W] = MotorCurrent^2 [A_{rms}^2] · MotorHotResistance [Ω l-l] · 3/2
Power Input [W] = (Power Output [W] + Power Loss [W]) / EfficiencyFactor

NOTES

l-n = line to neutral
l-l = line to line
Vrms = Volt rms
Arms = Ampere rms
Apk = Ampere peak
Vdc = Volt DC

1.4.2. Real-Time Clock Requirements (iHXA4 Only)

The drive has an internal real-time clock that is used to time-stamp logged data. The clock is powered by an internal capacitor when the control supply is not connected to the drive. When the capacitor is fully charged, it will power the clock for 17.5 days.

If the capacitor is fully discharged, the time on the drive is not reliable. To reinitialize the real-time clock, you must:

- Connect the drive to the control supply. It will take 36 minutes to fully charge the capacitor.
- Connect the drive to the Automation1 Studio and reprogram the real-time clock.

The capacitor charges exponentially with a 7.2 minute time constant. Apply the control supply to charge the capacitor. To achieve the maximum 17.5 days of real-time clock operation in the absence of the control supply, the capacitor must be charged for 36 minutes. If the capacitor is not fully charged when the control supply is lost, the real-time clock will not last the entire 17.5 days on backup capacitor power.

1.5. Mechanical Specifications

1.5.1. Mounting and Cooling

The drive must be installed in an enclosed control cabinet suitable for installation of power equipment. A minimum enclosure rating of IP54 is required to comply with safety standards. Make sure that there is sufficient clearance surrounding the drive for free airflow and for the routing of cables and connections. Consideration for items such as line reactors, line filters, and motor chokes or inductance should be made during the initial cabinet design phase.

IMPORTANT: The amount of airflow required to keep the drive temperature within a sufficient range is dependent on the operating conditions. You could be required to supply additional airflow to the drive.

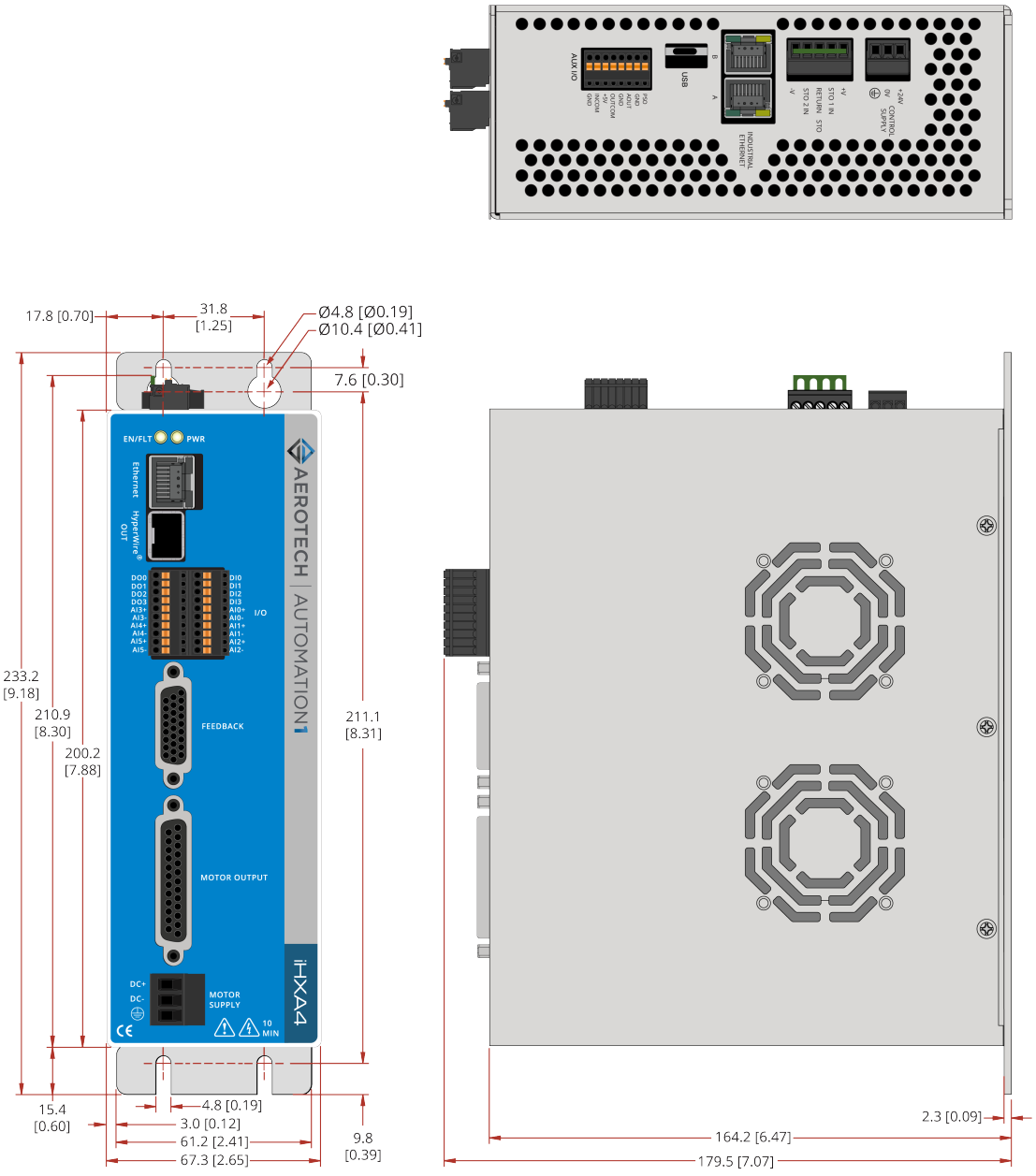
Table 1-3: Mounting Specifications

		iHXA4/HXA4
Customer-Supplied Enclosure		IP54 Compliant
Weight		0.8 kg
Mounting Hardware		M4 [#8] screws (four locations, not included)
Mounting Orientation		Vertical (typical)
Dimensions		Refer to Section 1.5.2. Dimensions
Minimum Clearance	Airflow	~25 mm
	Connectors	~100 mm
Operating Temperature		Refer to Section 1.6. Environmental Specifications
Drive IP Rating		IP20
Mounting Panel Thickness (Recommended)		2.5 - 3.5 mm (.10 - .125 in)

1.5.2. Dimensions

IMPORTANT: iHXA4 and HXA4 dimensions are the same. iHXA4 is shown.

Figure 1-4: Dimensions



1.6. Environmental Specifications

The environmental specifications are listed below.

Table 1-4: Environmental Specifications

Temperature	Operating: 0 °C to 40 °C (32 °F to 104 °F)
	Maximum Surrounding Air: 40 °C (104 °F)
	Storage: -30 °C to 85 °C (-22 °C to 185 °F)
Humidity Non-condensing	The maximum relative humidity is 80% for temperatures that are less than 31 °C and decreases linearly to 50% relative humidity at 40 °C.
Operating Altitude	0 m to 2,000 m (0 ft to 6,562 ft) above sea level.
Pollution	Pollution Degree 2 Typically only nonconductive pollution occurs.
Operation	Use only indoors

1.7. Drive and Software Compatibility

This table shows the available drives and which version of the software first supported each drive. In the **Last Software Version** column, drives that show a specific version number are not supported after that version.

Table 1-5: Drive and Software Compatibility

Drive Type	First Software Version	Last Software Version
HXA4	2.11.1	Current
iHXA4	2.11.1	Current

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Chapter 2: Installation and Configuration

The sections in this chapter include details on how to set up the electrical and safety components of your system. Obey all safety warnings, including those in Safety Procedures and Warnings (Page 12).

2.1. Input Power Connections

The drive has two DC input power connectors. One connector is for control power and the other connector is for motor power. For a full list of electrical specifications, refer to Section 1.4. For system interconnection drawings, refer to Figure 2-16 and Figure 2-17 in Section 2.10.

2.1.1. Control Supply Connector

DANGER: Shock and Fire Hazard

Electrical wiring must be designed and installed in accordance with local electrical safety regulations to prevent the risk of fire and electrical shock.

The Control Supply input supplies power to the communications and logic circuitry of the drive . The **+24V** input is connected to an internal fuse. Refer to Table 4-4 for the internal fuse value and part number. For an isolated DC supply, connect **0V** to protective ground at the supply. Use twisted pair wiring to minimize radiated noise emissions (refer to Figure 2-1).

Use a control power supply that is dedicated only to the iHXA4/HXA4 drives to minimize noise. Do not use this supply to power other system components. Locate the power supply close to the drives.

Figure 2-1: Control Supply Connections

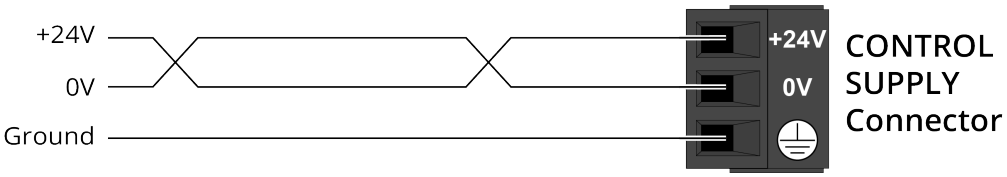


Table 2-1: Control Supply Connector Pinout

Pin	Description
+24 V	24 VDC (±10%) Control Power Input (5 A maximum, 0.5 A typical)
0 V	Control Power Common Input
⏚	Protective Ground

Table 2-2: Control Supply Mating Connector Ratings

Specification		Description
Type		3-Pin Terminal Block
Part Numbers		Aerotech: ECK02456
		Phoenix: 1839610
Conductor Cross Section	One conductor, stranded with ferrule and plastic sleeve	18...22 AWG (0.25...0.75 mm^2)
	Two conductors (same cross-section), stranded , twin ferrule with plastic sleeve	20 AWG (0.5 mm^2)
Tightening Torque		0.22...0.25 N·m
Conductor Insulation Strip Length		7 mm (0.25 in)
(1) Refer to the manufacturer website for additional information.		

2.1.2. Motor Supply Connector

DANGER: Shock and Fire Hazard!

Electrical wiring must be designed and installed in accordance with local electrical safety regulations to prevent the risk of fire and electrical shock.

If you have a combination of Aerotech drives with AC and DC motor supplies that use the same connector, Aerotech recommends that you key the Motor Supply connectors and mating cables. Refer to Section 2.1.3. Motor Supply Keying for more information.

Motor power is applied to the **DC+** and **DC-** terminals of the Motor Supply connector.

The **DC+** input is internally connected to a 5 A fuse.

Use twisted pair wiring to minimize radiated noise emissions (refer to Section 2.1.4.). For inrush limiting, you must power up control and motor supply simultaneously.

Refer to Section 4.2. for the internal fuse part numbers.

WARNING: Verify that all ground connections are installed correctly before you apply power to the iHXA4/HXA4.

Figure 2-2: Motor Supply Connections

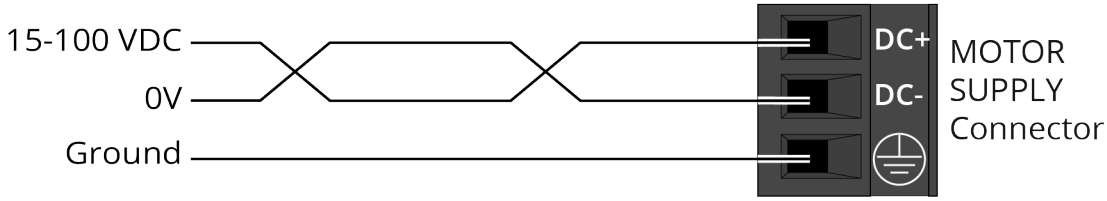


Table 2-3: Motor Supply Connector Pinout

Pin	Description
DC+	Motor Power Input (15-100 VDC)
DC-	Motor Power Input Common
⏚	Protective Earthing Conductor - 0.75 mm^2 / 18 AWG min conductor size

Table 2-4: Motor Supply Mating Connector Ratings

Specification		Description
Type		3-Pin Terminal Block
Part Numbers		Aerotech: ECK02388
		Phoenix: 1756272
Conductor Cross Section	One conductor, stranded with ferrule and plastic sleeve	14...22 AWG (0.25...2.5 mm^2)
	Two conductors (same cross-section), stranded, twin ferrule with plastic sleeve	16...20 AWG (0.5...1.5 mm^2)
Tightening Torque		0.5...0.6 N·m
Conductor Insulation Strip Length		7 mm (0.25 in)
(1) Refer to the manufacturer website for additional information.		

Use these parameters to configure motor overload protection: AverageCurrentThreshold, AverageCurrentTime, and MaxCurrentClamp.

2.1.3. Motor Supply Keying

If you have a combination of Aerotech drives with AC and DC motor supplies that use the same connector, Aerotech recommends that you key the Motor Supply Connectors and mating cable connectors. You must use keys on both the drive and any mating cable connectors in order for the keys to be effective.

IMPORTANT: If you insert a key with the cover on, you will accidentally break off the points adjacent to the point you are trying to use as a key. It would be easier to insert the key if you take the two points adjacent to the one you are trying to insert off the key star (refer to Figure 2-3).

Figure 2-3: Key Star Tool

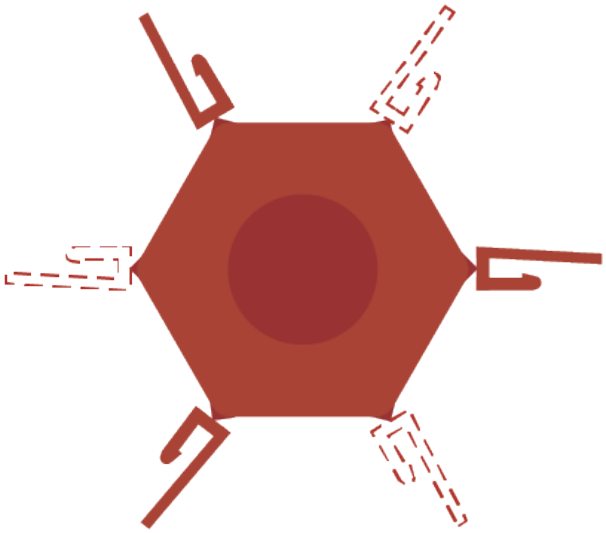


Table 2-5: Key Part Numbers

Location	Part Number
Cable Side	Aerotech P/N: EIK00501 Phoenix P/N: 1734634
Drive Side	Aerotech P/N: EIK00500 Phoenix P/N: 1734401

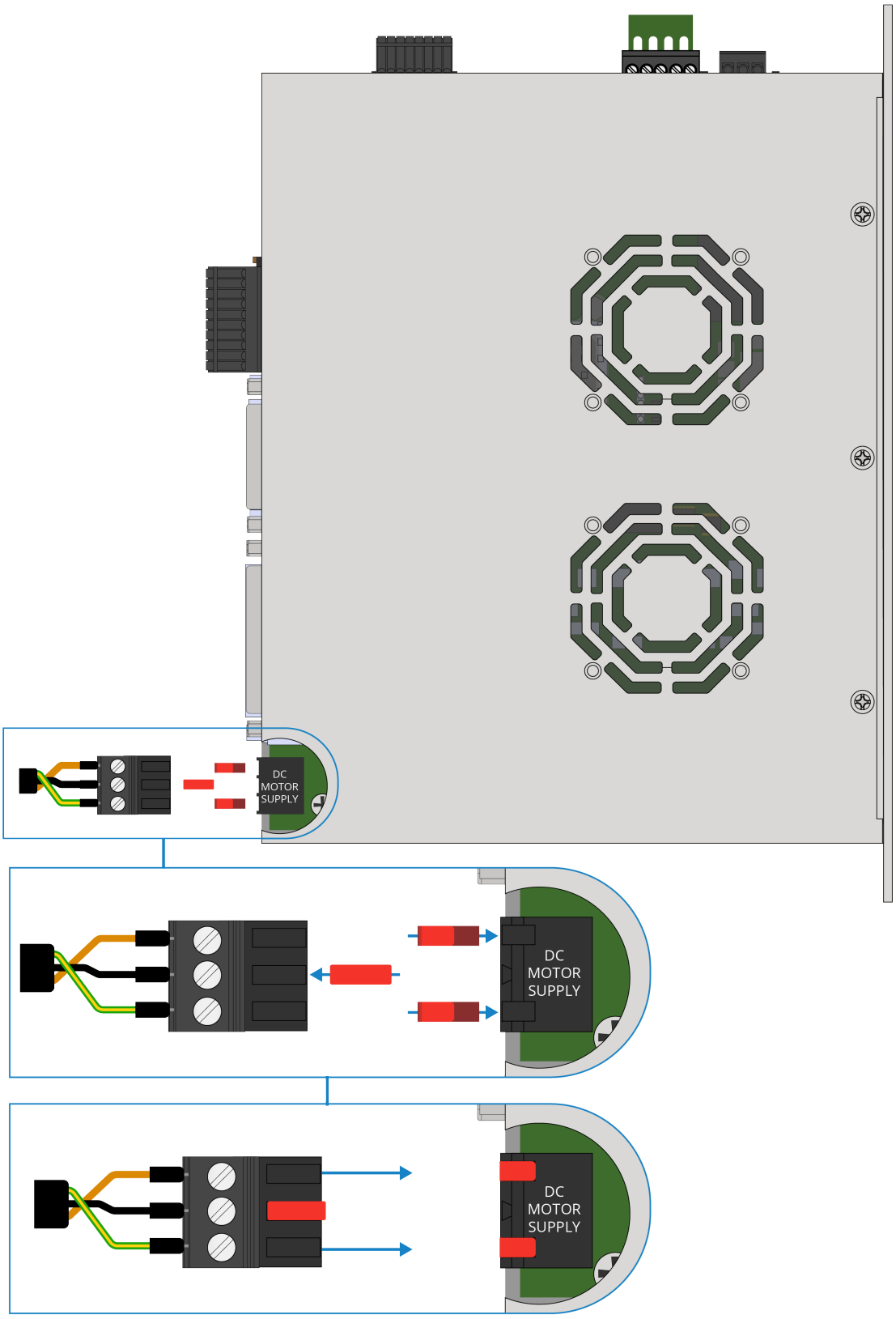
Table 2-6: Recommended Keying for DC Motor Supplies (Drive Connector)

Pin	Action
DC+	Key
DC-	Do not key
⏚	Key

Table 2-7: Recommended Keying for DC Motor Supplies (DC Supply Cables)

Pin	Action
DC+	Do not key
DC-	Key
⏚	Do not key

Figure 2-4: Recommended Keying for DC Motor Supplies



2.1.4. Minimizing Noise for EMC/CE Compliance

IMPORTANT: The iHXA4/HXA4 is a component designed to be integrated with other electronics. EMC testing must be conducted on the final product configuration.

To reduce electrical noise, observe the following motor feedback and input power wiring techniques.

1. Use shielded cable for motor and feedback connectors. Connect the shield to the backshell at each end of the cable.
2. Separate motor and power wiring from encoder and I/O wiring.
3. Mount drives, power supplies, and filter components on a conductive panel.Keep wire-run lengths to a minimum. For the AC power lines feeding the VDC Motor supply and VDC Control supply, place a line filter, such as Schaffner FN2070-10-06 (Aerotech# ECZ00284) between the VDC power supply's AC inputs and the AC power source.
4. Use the lowest motor voltage required by the application to reduce radiated emission.
5. Use a separate wire for each ground connection to the drive.Use the shortest possible wire length.

For typical system interconnections, refer to Section 2.10. System Interconnection.

2.2. Motor Power Output Connector

The drive can be used to control the following motor types:

- Aerotech Brushless Hexapod Motors

For a complete list of electrical specifications, refer to Section 1.4.

DANGER: Shock and Fire Hazard

Electrical wiring must be designed and installed in accordance with local electrical safety regulations to prevent the risk of fire and electrical shock.

Table 2-8: Motor Power Output Connector Pinout

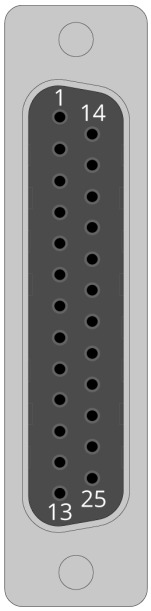
Pin #	Description	Connector
13	Earth Ground	
14	Motor Phase A (Axis 1)	
2	Motor Phase B (Axis 1)	
15	Motor Phase C (Axis 1)	
1	Motor Ground (Axis 1)	
16	Motor Phase A (Axis 2)	
4	Motor Phase B (Axis 2)	
17	Motor Phase C (Axis 2)	
3	Motor Ground (Axis 2)	
18	Motor Phase A (Axis 3)	
6	Motor Phase B (Axis 3)	
19	Motor Phase C (Axis 3)	
5	Motor Ground (Axis 3)	
20	Motor Phase A (Axis 4)	
8	Motor Phase B (Axis 4)	
21	Motor Phase C (Axis 4)	
7	Motor Ground (Axis 4)	
22	Motor Phase A (Axis 5)	
10	Motor Phase B (Axis 5)	
23	Motor Phase C (Axis 5)	
9	Motor Ground (Axis 5)	
24	Motor Phase A (Axis 6)	
12	Motor Phase B (Axis 6)	
25	Motor Phase C (Axis 6)	
11	Motor Ground (Axis 6)	

Table 2-9: Feedback Mating Connector Ratings

Specification	25-Pin Solder Cup	Backshell
Aerotech Part Number	ECK00101	ECK00656
Amphenol Part Number (1)	DB25P064TXLF	17E-1726-2
Maximum Wire Size	20 AWG (0.5 mm^2)	N/A
(1) Refer to the manufacturer website for additional information.		

2.3. Feedback Connector

The connector pin assignment is shown in Table 2-10.

Table 2-10: Feedback Connector Pinout

Pin#	Description	In/Out/Bi	Connector
1	Axis 1 Sine	Input	
	Axis 1 Absolute Encoder Data -	Bidirectional	
2	Axis 2 Sine	Input	
	Axis 2 Absolute Encoder Data -	Bidirectional	
3	Axis 3 Sine	Input	
	Axis 3 Absolute Encoder Data -	Bidirectional	
4	Axis 4 Sine	Input	
	Axis 4 Absolute Encoder Data -	Bidirectional	
5	Axis 5 Sine	Input	
	Axis 5 Absolute Encoder Data -	Bidirectional	
6	Axis 6 Sine	Input	
	Axis 6 Absolute Encoder Data -	Bidirectional	
7, 8	+5 V Power (3 A max. combined current output)	Output	
9	Reserved	Output	
10	Axis 1 Cosine	Input	
	Axis 1 Absolute Encoder Data +	Bidirectional	
11	Axis 2 Cosine	Input	
	Axis 2 Absolute Encoder Data +	Bidirectional	
12	Axis 3 Cosine	Input	
	Axis 3 Absolute Encoder Data +	Bidirectional	
13	Axis 4 Cosine	Input	
	Axis 4 Absolute Encoder Data +	Bidirectional	
14	Axis 5 Cosine	Input	
	Axis 5 Absolute Encoder Data +	Bidirectional	
15	Axis 6 Cosine	Input	
	Axis 6 Absolute Encoder Data +	Bidirectional	
16,17	Signal Common	Output	
18	Plug and Play Serial Data (for Aerotech stages only)	Bidirectional	
19	Analog Encoded Status Signal Channel 1	Input	
	Serial Encoded Status Data -	Bidirectional	
20	Analog Encoded Status Signal Channel 2	Input	
	Serial Encoded Status Data +	Bidirectional	
21	Analog Encoded Status Signal Channel 3	Input	
22	Analog Encoded Status Signal Channel 4	Input	
23	Analog Encoded Status Signal Channel 5	Input	
	Absolute Encoder Clock -	Output	
24	Analog Encoded Status Signal Channel 6	Input	
	Absolute Encoder Clock +	Output	
25, 26	Signal Common	Output	

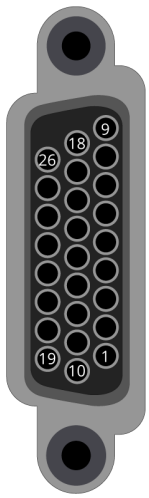


Table 2-11: Feedback Mating Connector Ratings

Specification	26-Pin Solder Cup	Backshell
Aerotech Part Number	ECK01259	ECK01022
Manufacturer Part Number (1)	Kycon K86-AA-26P	Amphenol 17E-1725-2
Maximum Wire Size	22 AWG (0.25 mm^2)	N/A
(1) Refer to the manufacturer website for additional information.		

2.4. I/O A and B Connectors

The "A" connector has four digital, optically-isolated outputs and three differential analog inputs.

The "B" connector has four digital, optically-isolated inputs and three differential analog inputs.

Digital input common and digital output common are on the Auxiliary I/O connector (refer to Section 2.5. Auxiliary I/O Connector).

Table 2-12: I/O Connector "A" Pinout

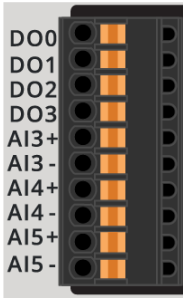
Pin #	Label	Description	In/Out/Bi	Connector
1	DO0	Digital Output 0 (Optically-Isolated)	Output	
2	DO1	Digital Output 1 (Optically-Isolated)	Output	
3	DO2	Digital Output 2 (Optically-Isolated)	Output	
4	DO3	Digital Output 3 (Optically-Isolated)	Output	
5	AI3+	Analog Input 3+	Input	
6	AI3-	Analog Input 3-	Input	
7	AI4+	Analog Input 4+	Input	
8	AI4-	Analog Input 4-	Input	
9	AI5+	Analog Input 5+	Input	
10	AI5-	Analog Input 5-	Input	

Table 2-13: I/O Connector "B" Pinout

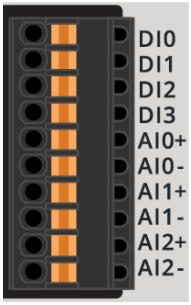
Pin #	Label	Description	In/Out/Bi	Connector
1	DI0	Digital Input 0 (Optically-Isolated)	Input	
2	DI1	Digital Input 1 (Optically-Isolated)	Input	
3	DI2	Digital Input 2 (Optically-Isolated)	Input	
4	DI3	Digital Input 3 (Optically-Isolated)	Input	
5	AI0+	Analog Input 0+	Input	
6	AI0-	Analog Input 0-	Input	
7	AI1+	Analog Input 1+	Input	
8	AI1-	Analog Input 1-	Input	
9	AI2+	Analog Input 2+	Input	
10	AI2-	Analog Input 2-	Input	

Table 2-14: Mating Connector Part Numbers for the I/O Connectors

Specification		Description
Type		10-Pin Terminal Block
Part Numbers		Aerotech: ECK02395
		Phoenix: 1700841
Conductor Cross Section	Solid or stranded	20...26 AWG (0.14...0.5 mm^2)
	Stranded, with ferrule, without plastic sleeve	20...24 AWG (0.25...0.5 mm^2)
Conductor Insulation Strip Length		8 mm (5/16 in)
(1) Refer to the manufacturer website for additional information.		

2.4.1. Digital Inputs

Input bits are arranged in a group of 4 and share a common pin (INCOM, PIN-7, located on the Auxiliary I/O connector). This lets a group be connected to current sourcing or current sinking devices, based on the connection of the common pin.

To be able to connect an input group to current sourcing devices, connect the common pin to the power supply return (-). Refer to Figure 2-6.

To be able to connect an input group to current sinking devices, connect the common pin to the power supply source (+). Refer to Figure 2-7.

The digital inputs are not designed for high-voltage isolation applications. They should only be used with ground-referenced circuits.

Table 2-15: Digital Input Specifications

Input Voltage	Approximate Input Current	Turn On Time	Turn Off Time
+5 V to +24 V	6 mA	10 µs	43 µs

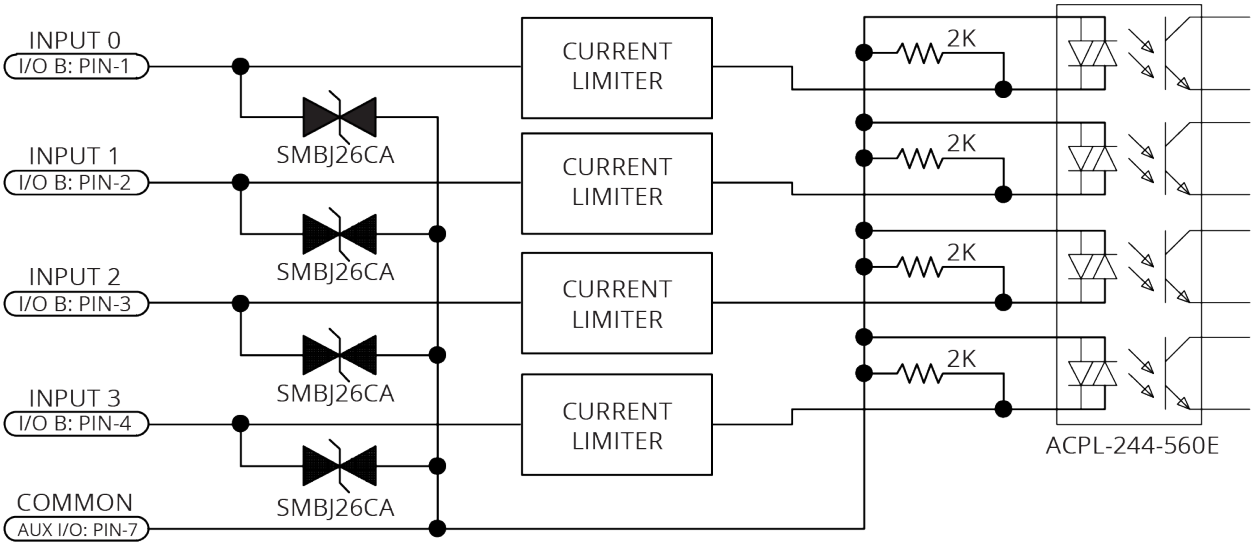
Table 2-16: Digital Input Pins on the I/O "B" Connector

Pin #	Label	Description	In/Out/Bi
1	DI0	Digital Input 0 (Optically-Isolated)	Input
2	DI1	Digital Input 1 (Optically-Isolated)	Input
3	DI2	Digital Input 2 (Optically-Isolated)	Input
4	DI3	Digital Input 3 (Optically-Isolated)	Input

Table 2-17: Digital Input Pin on the Auxiliary I/O Connector

Pin #	Label	Description	In/Out/Bi
7	INCOM	Digital Input Common	Input

Figure 2-5: Digital Inputs Schematic



IMPORTANT: Each bank of four inputs must be connected in an all sourcing or all sinking configuration.

Figure 2-6: Digital Inputs Connected to Current Sourcing (PNP) Devices

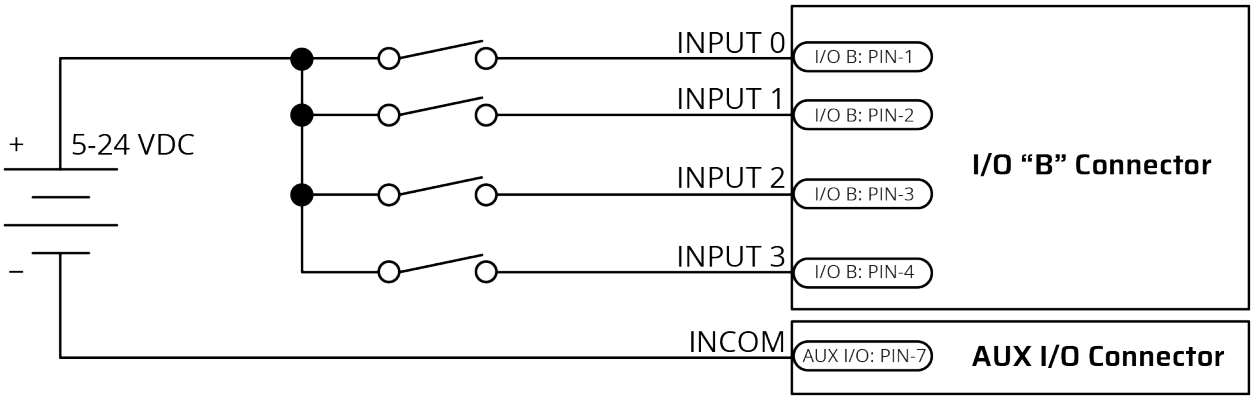
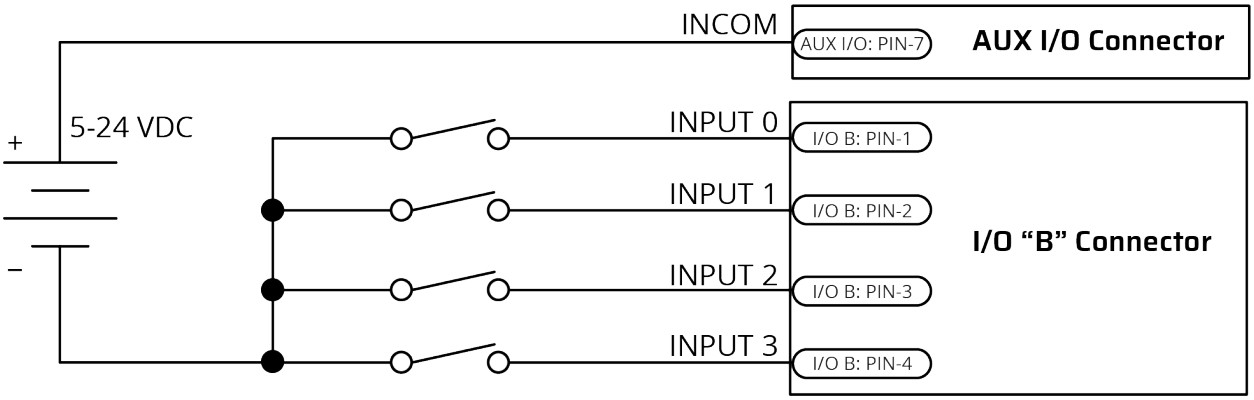


Figure 2-7: Digital Inputs Connected to Current Sinking (NPN) Devices



2.4.2. Digital Outputs

Optically-isolated solid-state relays drive the digital outputs. You can connect the digital outputs in current sourcing or current sinking mode but you must connect all four outputs in a port in the same configuration. Refer to Figure 2-9 and Figure 2-10.

The digital outputs are not designed for high-voltage isolation applications and they should only be used with ground-referenced circuits.

You must install suppression diodes on digital outputs that drive relays or other inductive devices. To see an example of a current sourcing output that has diode suppression, refer to Figure 2-9. To see an example of a current sinking output that has diode suppression, refer to Figure 2-10.

The digital outputs have overload protection. They will resume normal operation when the overload is removed.

Table 2-18: Digital Output Specifications

Digital Output Specifications	Value
Maximum Voltage	24 V (26 V Maximum)
Maximum Sink/Source Current	250 mA/output
Output Saturation Voltage	0.9 V at maximum current
Output Resistance	3.7 Ω
Rise / Fall Time	250 µs (2K pull up to 24V)
Reset State	Output Off (High Impedance State)

Table 2-19: Digital Output Pins on the I/O "A" Connector

Pin #	Label	Description	In/Out/Bi
1	DO0	Digital Output 0 (Optically-Isolated)	Output
2	DO1	Digital Output 1 (Optically-Isolated)	Output
3	DO2	Digital Output 2 (Optically-Isolated)	Output
4	DO3	Digital Output 3 (Optically-Isolated)	Output

Table 2-20: Digital Output Pin on the Auxiliary I/O Connector

Pin #	Label	Description	In/Out/Bi
5	OUTCOM	Digital Output Common	Output

Figure 2-8: Digital Output Schematic (Auxiliary I/O Connector)

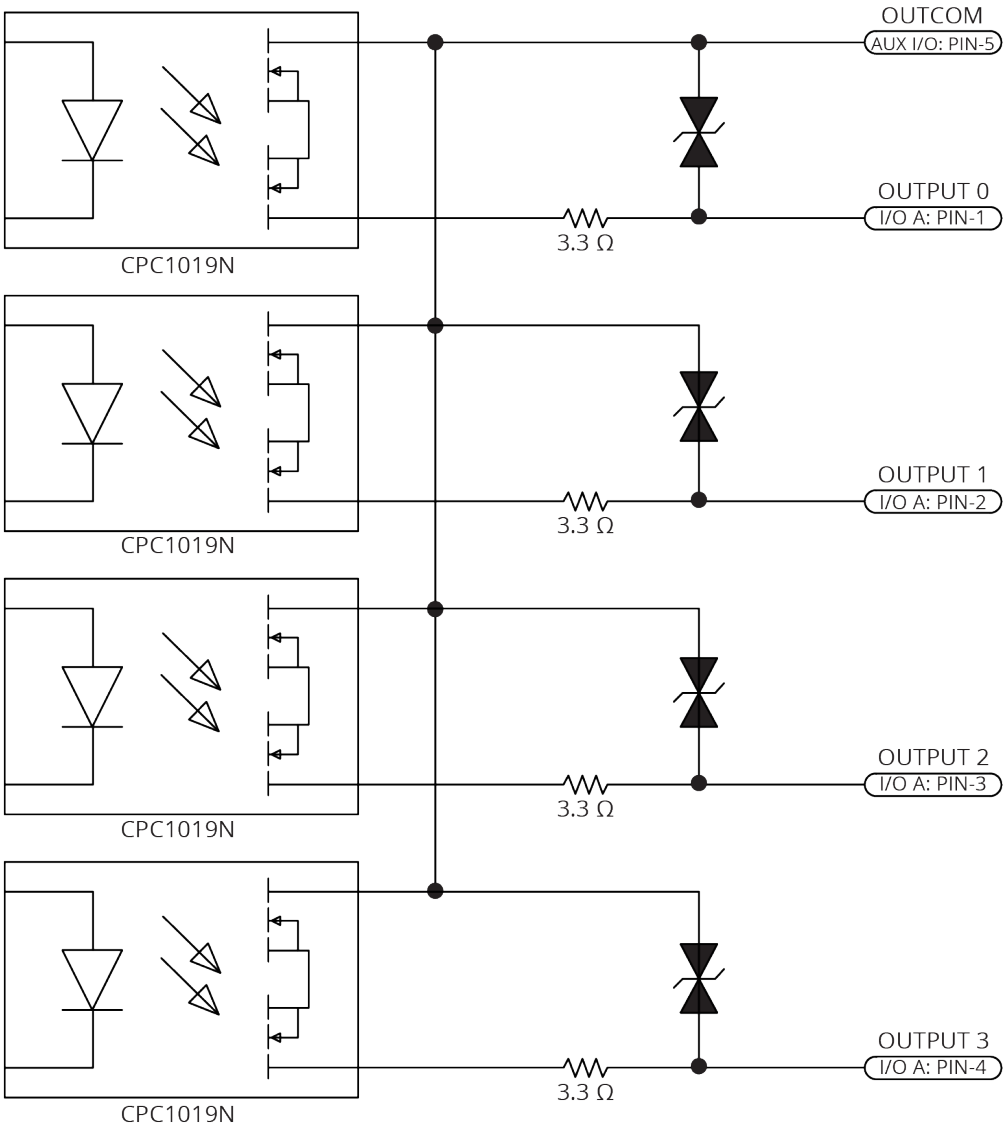


Figure 2-9: Digital Outputs Connected in Current Sourcing Mode

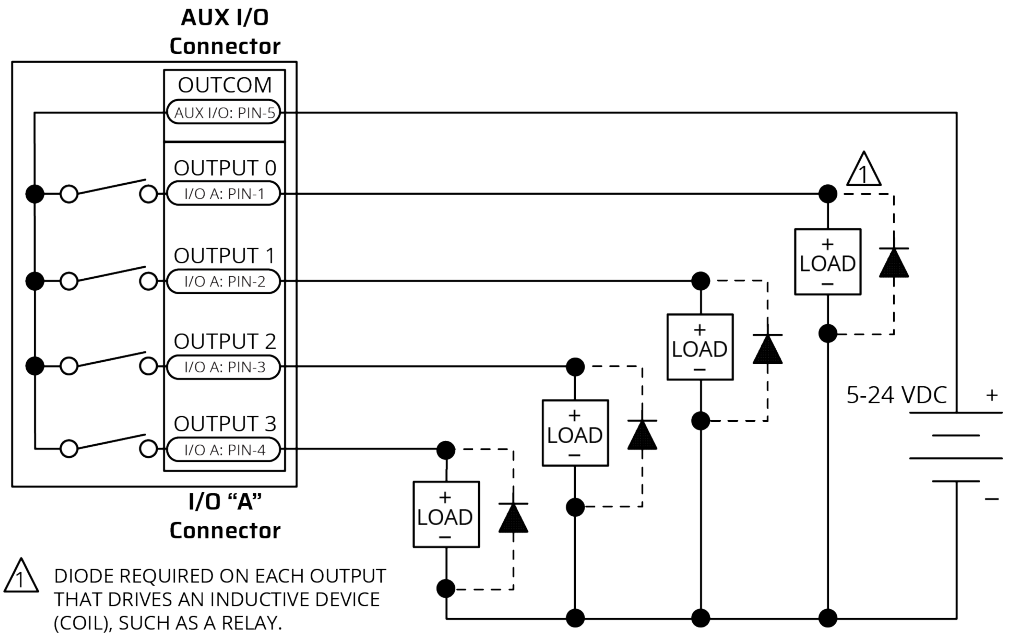
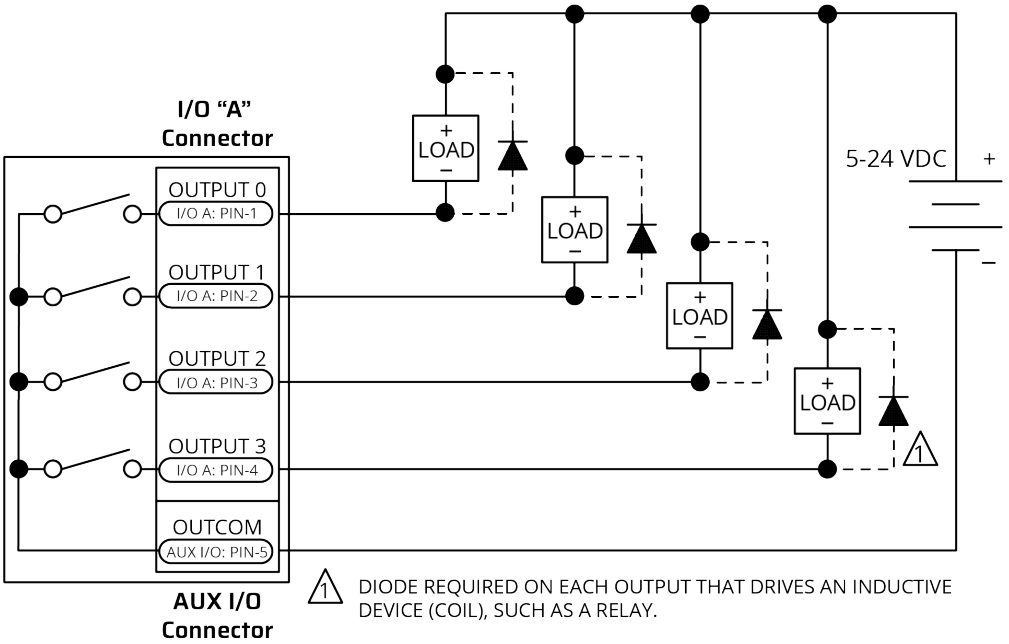


Figure 2-10: Digital Outputs Connected in Current Sinking Mode



2.4.3. Analog Inputs

To interface to a single-ended, non-differential voltage source, connect the signal common of the source to the negative input and connect the analog source signal to the positive input. A floating signal source must be referenced to the analog common. Refer to Figure 2-11.

Table 2-21: Differential Analog Input Specifications

Specification	Value
(AI+) - (AI-)	+10 V to -10 V (1)
Resolution (bits)	16 bits
Input Impedance	50 kΩ
1. Signals outside of this range may damage the input	

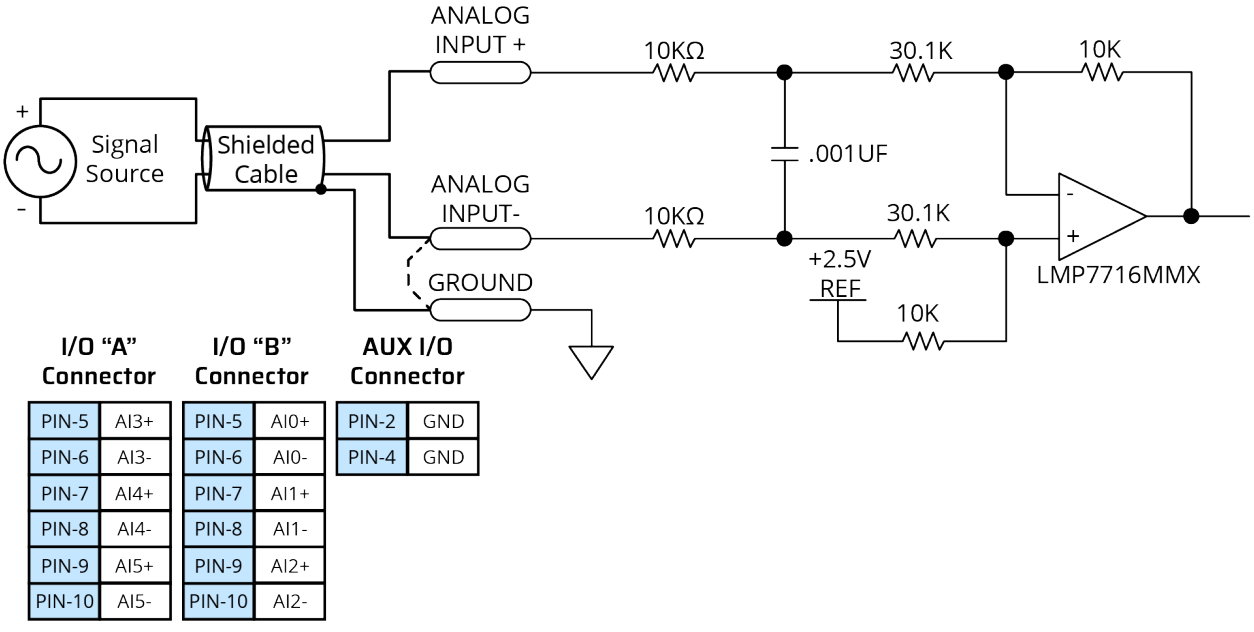
Table 2-22: I/O Connector "A" Analog Inputs Pinout

Pin #	Label	Description	In/Out/Bi
5	AI3+	Analog Input 3+	Input
6	AI3-	Analog Input 3-	Input
7	AI4+	Analog Input 4+	Input
8	AI4-	Analog Input 4-	Input
9	AI5+	Analog Input 5+	Input
10	AI5-	Analog Input 5-	Input

Table 2-23: I/O Connector "B" Analog Inputs Pinout

Pin #	Label	Description	In/Out/Bi
5	AI0+	Analog Input 0+	Input
6	AI0-	Analog Input 0-	Input
7	AI1+	Analog Input 1+	Input
8	AI1-	Analog Input 1-	Input
9	AI2+	Analog Input 2+	Input
10	AI2-	Analog Input 2-	Input

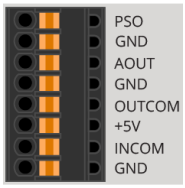
Figure 2-11: Analog Inputs Schematic



2.5. Auxiliary I/O Connector

The Auxiliary I/O connector has one PSO output, one analog output, common pins for the digital input and output pins on the I/O connector, one +5 VDC source (500 mA max), and three ground connections.

Table 2-24: Auxiliary I/O Connector Pinout

Pin #	Label	Description	In/Out/Bi	Connector
1	PSO	Position Synchronized Output (TTL)	Output	
2	GND	Ground	N/A	
3	AOUT	Analog Output	Output	
4	GND	Ground	N/A	
5	OUTCOM	Digital Output Common	Output	
6	+5V	+5 V (500 mA max)	Output	
7	INCOM	Digital Input Common	Input	
8	GND	Ground	N/A	

2.5.1. Position Synchronized Output (PSO)

This output signal is a 5V TTL signal which is used to drive an opto coupler or general purpose TTL input. This signal is active high and is driven to 5V when a PSO fire event occurs.

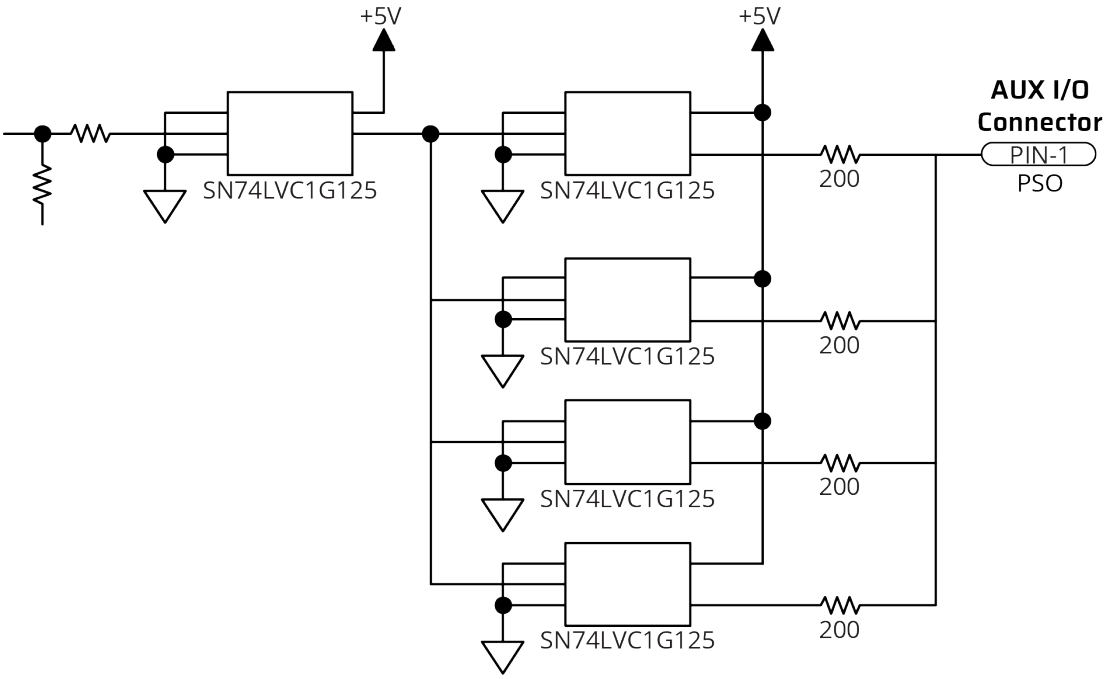
Table 2-25: PSO Specifications

Specification	Value
Output	5 V, 16 mA (max)
Maximum PSO Output (Fire) Frequency	12.5 MHz
Output Latency [Fire event to output change]	25 ns

Table 2-26: Auxiliary I/O Connector

Pin #	Label	Description	In/Out/Bi
1	PSO	Position Synchronized Output (TTL)	Output

Figure 2-12: PSO Interface



2.5.2. Analog Output

The analog output can be set from within a program or it can be configured to echo the state of select servo loop nodes.

The analog output is set to zero when you power on the system or reset the drive.

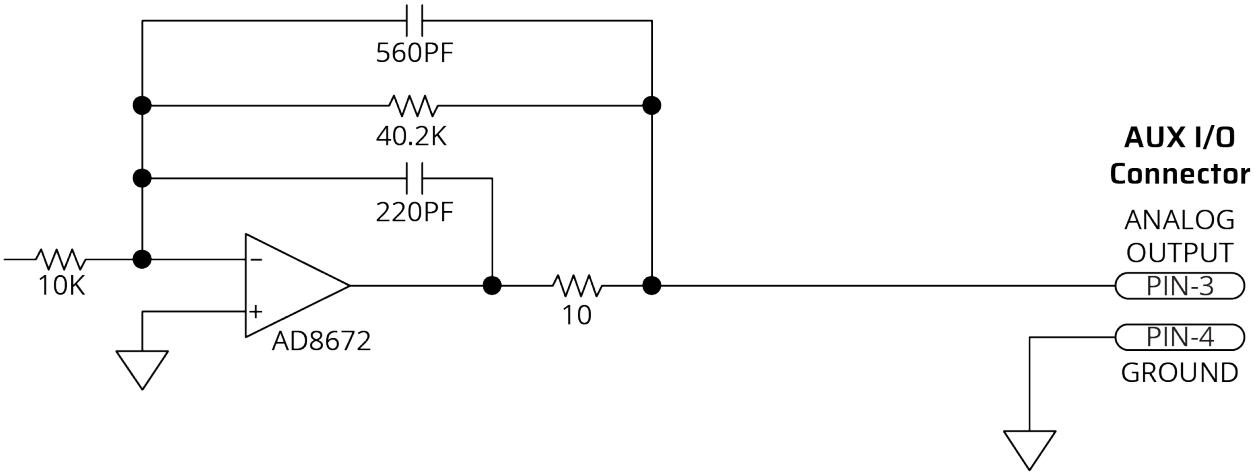
Table 2-27: Analog Output Specifications

Specification	Value
Output Voltage	-10 V to +10 V
Output Current	5 mA
Resolution (bits)	16 bits

Table 2-28: Analog Output Pin on the Auxiliary I/O Connector

Pin #	Label	Description	In/Out/Bi
3	AOUT	Analog Output	Output

Figure 2-13: Analog Output Schematic



2.6. Safe Torque Off Input (STO)

The STO circuit is comprised of two identical channels, each of which must be energized in order for the drive to produce motion. Each STO input is opto-isolated and accepts 24 V levels directly without the need for external current limiting resistors.

IMPORTANT: The drive might be equipped with an STO bypass circuit board. The bypass circuit board defeats the STO safety circuit and allows the system to run at all times. To use the STO safety functionality, remove the circuit board and make connections as outlined in this section. Refer to Installation Overview on Page 14 for the location of the STO bypass plug.

IMPORTANT: The application circuit and its suitability for the desired safety level is the sole responsibility of the user of the drive.

WARNING: STO wires must be insulated to prevent short circuits between connector pins. The primary concern is a short circuit between STO 1 IN and STO 2 IN wire strands.

Table 2-29: STO Connector Pinout

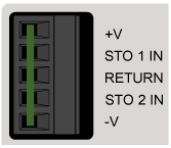
Pin #	Signal	Description	In/Out/Bi	Connector
1	Power Supply +	Use only to defeat STO by connecting to STO 1 IN and STO 2 IN. Not for customer use.	Output	
2	STO 1 IN	STO Channel 1 Positive Input	Input	
3	RETURN	STO Negative Input	Input	
4	STO 2 IN	STO Channel 2 Positive Input	Input	
5	Power Supply -	Use only to defeat STO by connecting to RETURN. Not for customer use.	Output	

Table 2-30: STO Mating Connector Ratings

Specification		Description
Type		5-Pin Terminal Block
Part Numbers		Aerotech: ECK02393
		Phoenix: 1827622
Conductor Cross Section	One conductor, stranded with ferrule and plastic sleeve	18...22 AWG (0.25...0.75 mm^2)
	Two conductors (same cross-section), stranded , twin ferrule with plastic sleeve	20 AWG (0.5 mm^2)
Tightening Torque		0.22...0.25 N·m
Conductor Insulation Strip Length		7 mm (0.25 in)
(1) Refer to the manufacturer website for additional information.		

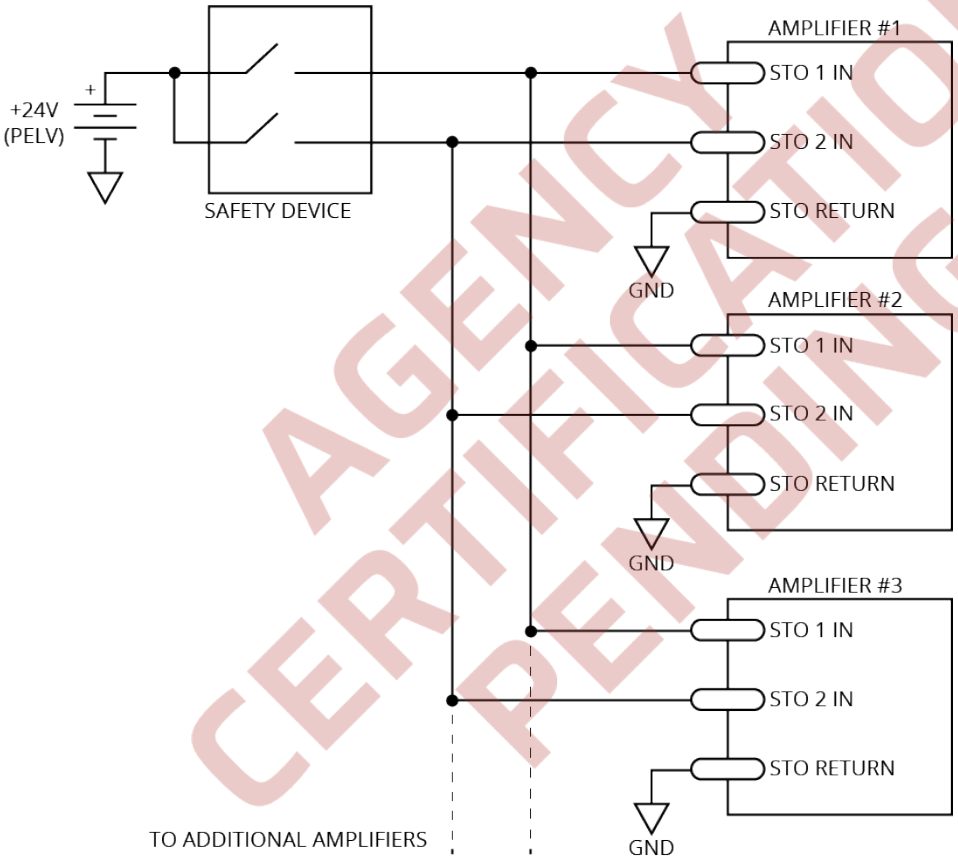
Table 2-31: STO Electrical Specifications

Status	Value
STO off (motion allowed)	18-24 V, 7 ma
STO on (safe state entered, no motion)	0-6 V
Recommended Wire Gauge	22-26 AWG (0.5 - 0.14 mm^2)
STO System Power Supply	PELV
STO Wire Length (maximum)	50 m

Figure 2-14 shows one safety device connected to multiple drives in parallel.

WARNING: The drive does not check for short circuits on the external STO wiring. If this is not done by the external safety device, short circuits on the wiring must be excluded. Refer to EN ISO 13849-2. For Category 4 systems, the exclusion of short circuits is mandatory.

Figure 2-14: Typical STO Configuration



2.6.1. STO Standards

Table 2-32 describes and specifies the safety requirements at the system level for the Safe Torque Off (STO) feature of the drive. This assumes that diagnostic testing is performed according to Section 2.6.4. and Table 2-33.

Table 2-32: STO Standards

Standard	Maximum Achievable Safety
EN/IEC 61800-5- 2:2016	SIL 3
EN/IEC 61508-1:2010	SIL 3
EN/IEC 61508-2:2010	SIL 3
EN ISO 13849-1:2015	Category 4, PL e
EN/IEC 62061:2005 with Amendments	SIL 3

Table 2-33: STO Standards Data

Standard	Value
EN ISO 13849-1:2015	$MTTF_D$ > 100 years, DC_{AVG} 99% Maximum PL e, Category 4
EN ISO 13849-1:2015 EN/IEC 61508	Lifetime = 20 years No proof test required Interval for manual STO test: • Once per year for SIL2/PL d/category 3 • Once per three months for SIL3/PL e/category 3 • Once per day for SIL3/PL e/category 4
EN/IEC 61508	SIL3 PFH < 3 FIT SFF > 99%

2.6.2. STO Functional Description

The motor can only be activated when voltage is applied to both STO 1 and STO 2 inputs. The STO state will be entered if power is removed from either the STO 1 or the STO 2 inputs. When the STO state is entered, the motor cannot generate torque or force and is therefore considered safe. Both STO channels must be driven at the same time. If they are not driven at the same time, a diagnostic test failure will occur (refer to STO Diagnostics).

The STO function is implemented with two redundant channels in order to meet stated performance and SIL levels. STO 1 disconnects the high side power amplifier transistors and STO 2 disconnects the low side power amplifier transistors. Disconnecting either set of transistors effectively prevents the drive from being able to produce motion.

The drive software monitors each STO channel and will generate an Emergency Stop software fault when either channel signals the stop state. Each STO channel contains a fixed delay which allows the drive to perform a controlled stop before the power amplifier transistors are turned off.

A typical configuration requiring a controlled stop has the Emergency Stop Fault mask bit set in the FaultMask, FaultMaskDecel, and FaultMaskDisable parameters. This stops the axis using the rate specified by the AbortDecelRate parameter. The software will disable the axis as soon as the deceleration ramp is complete. This is typically configured to occur before the STO channel turns off the power amplifier transistors.

The software-controlled stop functionality must be excluded when considering overall system safety. This is because the software is not safety rated and cannot be included as part of the safety function.

The software-controlled stop function can ignore short diagnostic pulses on the STO 1+ and STO 2+ inputs. The StoPulseFilter parameter specifies the maximum pulse width that the software will ignore. The filter parameter does not affect the operation of STO hardware channels.

To resume normal operation, apply power to both STO 1 and STO 2 inputs and use the *Acknowledge All* button or the AcknowledgeAll() or FaultAcknowledge() function to clear the Emergency Stop software fault. The recommended use of the Emergency Stop Fault fault mask bits prevent the system from automatically restarting.

You can achieve longer delay times through the use of an external delay timer, such as the Omron G9SA-321 Safety Relay Unit. Place this device between the system ESTOP wiring and the drive's STO inputs. Connect the ESTOP signal directly to a digital input, in addition to the external timer, to allow the drive to begin a software-controlled stop as soon as the ESTOP signal becomes active. Use the EmergencyStopFaultInput parameter to configure a digital input as an ESTOP input.

The STO feature can only be used with AC or stepper motor types. It is not certified to prevent hazardous motion when using DC brush or Voice Coil motor types.

Non-standard STO delay times are provided by special factory order. In this case, the non-standard STO delay time is indicated by a label placed on the slice amplifier's main connector (STO DELAY = xx sec).

Table 2-34: STO Signal Delay

	Value
STO Time Delay	450-550 msec

Table 2-35: Motor Function Relative to STO Input State

STO 1	STO 2	Motor Function
Unpowered	Unpowered	No force/torque
Unpowered (1)	Powered (1)	No force/torque
Powered (1)	Unpowered (1)	No force/torque
Powered	Powered	Normal Operation

1. This is considered a Fault Condition since STO 1 and STO 2 do not match. Refer to Section 2.6.4.

2.6.3. STO Startup Validation Testing

Verify the state of the STO 1 and STO 2 channels by manually activating the external STO hardware. Each STO channel must be tested separately in order to detect potential short circuits between the channels. The current state of the STO 1 and STO 2 inputs is shown in the Status Utility. A "–" indicates that the STO input is powered by a high voltage level (24 V). An "ON" indicates that the voltage source has been removed from the input (open circuit or 0 V), and that the STO channel is in the safe state.

DANGER: The STO circuit does not remove lethal voltage from the motor terminals. AC mains power must be removed before servicing.

2.6.4. STO Diagnostics

Activation of STO means removing power from the drive STO inputs. This is typically done by pressing the emergency stop switch. The drive initiates a diagnostic check every time the STO is activated after the Diagnostic Test Delay Time has elapsed. The diagnostic check verifies that each channel has entered the safe state. The drive is held in the safe state if it determines that one of the channels has not properly entered the safe state. An open circuit or short to 24 V in either STO channel will result in this condition (refer to Section 2.6.3.). The Status Utility screen can be used to verify the levels of the STO input signals while troubleshooting. The safe state is cleared when both STO channels are cycled with matching signal levels such that the diagnostic test completes successfully.

The drive is held in the safe state if it determines that one of the channels has not properly entered the safe state. In this case, the stoCrossCheckFault bit will be set and can be viewed in the **STO Status** status item. A **Position Error Fault** or **Emergency Stop Fault** will occur if motion is attempted while in this state. The drive will remain in the safe state until STO is reactivated with both channels in a safe state such that the diagnostics test completes successfully.

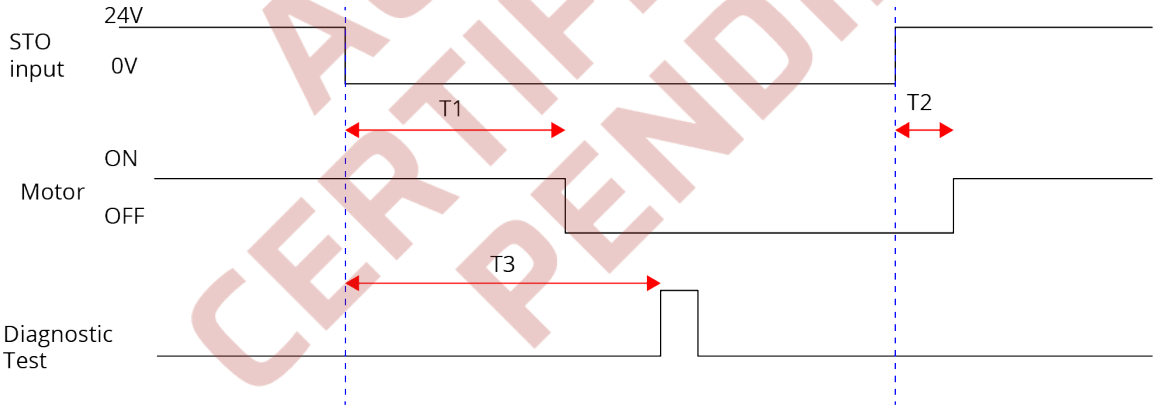
An open circuit or short to 24 V in either STO channel or a timing difference between the channels will result in a diagnostic test failure (refer to STO Startup Validation Testing). The Status Utility screen or **STO Status** status item can be used to verify the levels of the STO input signals while troubleshooting.

In order to pass internal testing, the STO circuit must be activated (power removed from both inputs) according to the interval specified in Table 2-33.

Table 2-36: STO Timing

Time	Description	Value
T1	STO Delay Time (STO input active to motor power off)	450-550 msec
T2	STO deactivated to motor power on (the software is typically configured so that the motor does not automatically re-energize).	< 1 msec
T3	Diagnostic Test Delay Time	550-610 msec

Figure 2-15: STO Timing



The software is typically configured to execute a controlled stop when the STO state is first detected. If power is reapplied to the STO inputs before the STO Delay Time, an STO hardware shutdown will not occur but a software stop may, depending on the width of the STO pulse. The controller will ignore STO active pulses shorter in length than the StoPulseFilter parameter setting.

2.7. HyperWire Interface

HyperWire cables can be safely connected to or disconnected from a HyperWire port while the PC and/or drive is powered on. However, any changes to the HyperWire network topology will disrupt communication and you must reset the controller to re-establish communication.

WARNING: Do not connect or disconnect HyperWire cables while you are loading firmware or damage to the drives may occur.

Table 2-37: HyperWire Card Part Number

Part Number	Description
HYPERWIRE-PCIE	HyperWire adapter, PCIe x4 interface

Table 2-38: HyperWire Cable Part Numbers

Part Number	Description
HYPERWIRE-AO10-5	HyperWire cable, active optical, 0.5 m
HYPERWIRE-AO10-10	HyperWire cable, active optical, 1.0 m
HYPERWIRE-AO10-30	HyperWire cable, active optical, 3.0 m
HYPERWIRE-AO10-50	HyperWire cable, active optical, 5.0 m
HYPERWIRE-AO10-200	HyperWire cable, active optical, 20.0 m

2.8. Maximum Energy Storage

Regeneration occurs during deceleration as mechanical energy is converted to electrical energy and is stored in the internal power supply capacitors, which can cause the internal bus voltage to increase. The amount of energy that could be regenerated by the drive from the system should not exceed the maximum energy storage that the drive can safely absorb.

Use Equation 1 to calculate the stored mechanical energy for either rotary or linear axes. For multiple axes, add the energy contribution for each axis that decelerates simultaneously.

Equation 1:

Calculate the kinetic energy of the system. Any energy that is not lost to the system could be regenerated to the DC bus.

$$E_M = [1/2][J_M + J_L]\omega^2_M \quad ; \text{rotary motors}$$
$$E_M = [1/2][M_M + M_L]v^2_M \quad ; \text{linear motors}$$

Where:

J_M = rotor inertia ($kg \cdot m^2$)

J_L = load inertia ($kg \cdot m^2$)

ω_M = motor speed before deceleration (rad/s)

M_M = forcer mass (kg)

M_L = load mass (kg)

v_M = velocity (m/s)

Equation 2:

The calculated sum of kinetic energy must be less than the maximum additional storage energy limits listed in Table 2-39 in order to keep the internal drive voltage within safe levels. The maximum amount of energy that the drive can safely absorb depends on the drive ordering options and the bus voltage.

$$E_{Ca} = (1/2) \cdot C \cdot (V^2_M - V^2_{NOM})$$

Where:

C = bus capacitor (F) [1,200 µF or 2,400 µF]

V_M = maximum bus overvoltage(V) [380 V]

V_{NOM} = nominal bus voltage (V)

Table 2-39: Maximum Energy that can Safely be Absorbed During Regeneration

Internal Capacitance	Nominal Bus Voltage	Maximum Additional Energy
223 µF	96 VDC	0.09 J

2.9. Industrial Ethernet (iHXA4 Only)

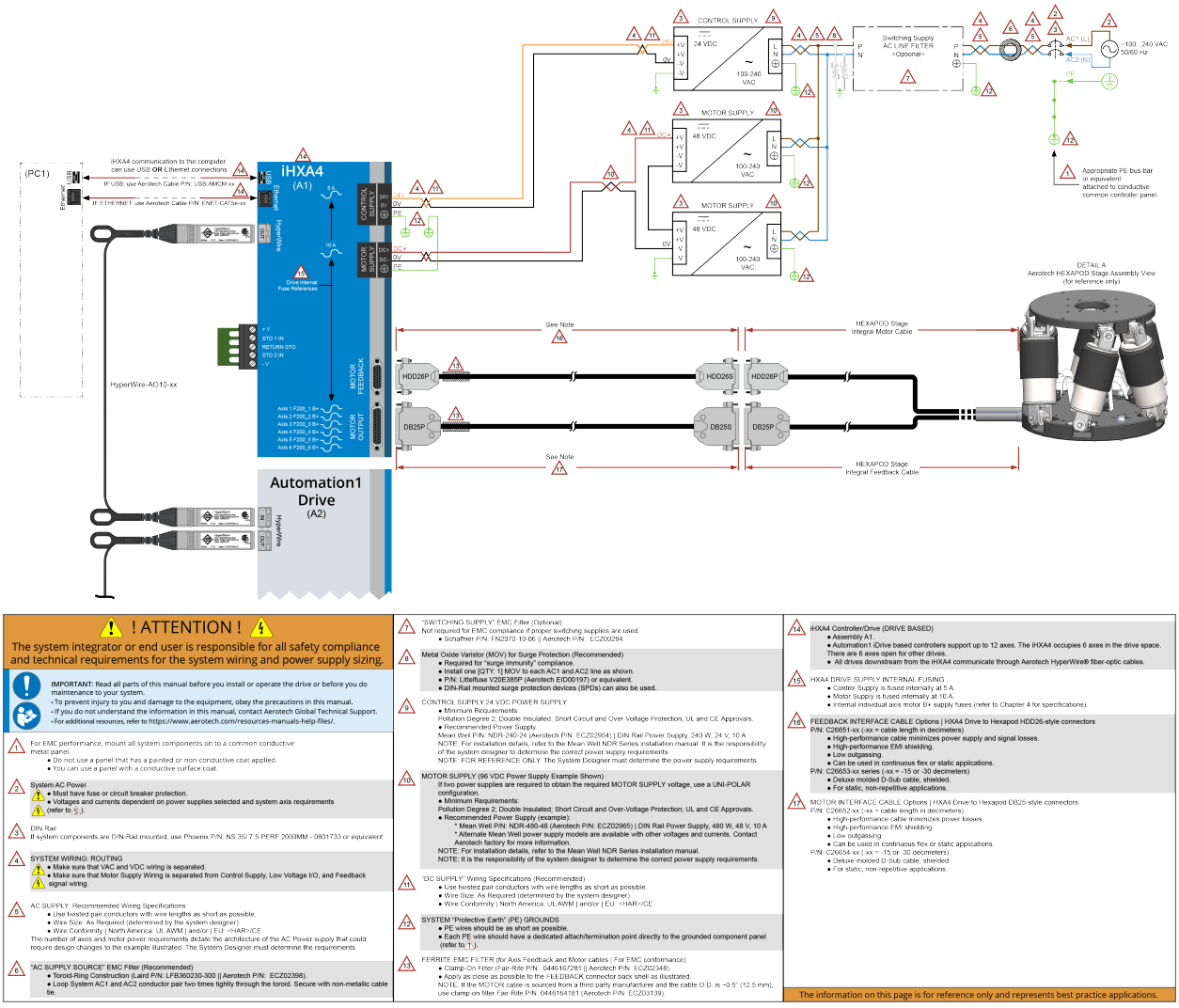
The controller is equipped with 100BASE-TX Industrial Ethernet ports.

IMPORTANT: Industrial Ethernet is only available on the iHXA4.

- For the location of the ports, refer to Figure 1-1.
- For cable part numbers, refer to Table 3-1.
- For more information, refer to Automation1 Help.

2.10. System Interconnection

Figure 2-16: iHXA4 Recommended System Connections for a Drive-Based Controller



! ATTENTION !

The system integrator or end user is responsible for all safety compliance and technical requirements for the system wiring and power supply sizing.

IMPORTANT: Read all parts of this manual before you install or operate the drive or before you do maintenance to your system.
- To prevent injury to you and damage to the equipment, obey the precautions in this manual.
- If you do not understand the information in this manual, contact Aerotech Global Technical Support.
- For additional resources, refer to https://www.aerotech.com/resources-manuals-help-files/.

1. For EMC performance, mount all system components on to a common conductive metal panel.
   - Do not use a panel that has a painted or non-conductive coat applied.
   - You can use a panel with a conductive surface coat.
2. System AC Power
   - Must have fuse or circuit breaker protection.
   - Voltages and currents dependent on power supplies selected and system axis requirements (refer to 5).
3. DIN Rail
   If system components are DIN-Rail mounted, use Phoenix P/N: NS 35/ 7,5 PERF 2000MM - 0801733 or equivalent.
4. SYSTEM WIRING: ROUTING
   - Make sure that VAC and VDC wiring is separated.
   - Make sure that Motor Supply Wiring is separated from Control Supply, Low Voltage I/O, and Feedback signal wiring.
5. AC SUPPLY: Recommended Wiring Specifications
   - Use twisted pair conductors with wire lengths as short as possible.
   - Wire Size: As Required (determined by the system designer)
   - Wire Conformity | North America: UL AWM | and/or | EU: <HAR>/CE

   The number of axes and motor power requirements dictate the architecture of the AC Power supply that could require design changes to the example illustrated. The System Designer must determine the requirements.
6. "AC SUPPLY SOURCE" EMC Filter (Recommended)
   - Toroid-Ring Construction (Laird P/N: LFB360230-300 || Aerotech P/N: ECZ02398).
   - Loop System AC1 and AC2 conductor pair two times tightly through the toroid. Secure with non-metallic cable tie.
7. "SWITCHING SUPPLY" EMC Filter (Optional)
   Not required for EMC compliance if proper switching supplies are used.
   - Schaffner P/N: FN2070-10-06 || Aerotech P/N: ECZ00284.
8. Metal Oxide Varistor (MOV) for Surge Protection (Recommended)
   - Required for "surge immunity" compliance.
   - Install one [QTY. 1] MOV to each AC1 and AC2 line as shown.
   - P/N: Littelfuse V20E385P (Aerotech EID00197) or equivalent.
   - DIN-Rail mounted surge protection devices (SPDs) can also be used.
9. CONTROL SUPPLY 24 VDC POWER SUPPLY
   - Minimum Requirements:
   Pollution Degree 2, Double Insulated, Short Circuit and Over Voltage Protection, UL and CE Approvals.
   - Recommended Power Supply:
   Mean Well P/N: NDR-240-24 (Aerotech P/N: ECZ02954) | DIN Rail Power Supply, 240 W, 24 V, 10 A
   NOTE: For installation details, refer to the Mean Well NDR Series installation manual. It is the responsibility of the system designer to determine the correct power supply requirements.
   NOTE: FOR REFERENCE ONLY. The System Designer must determine the power supply requirements
10. MOTOR SUPPLY (96 VDC Power Supply Example Shown)
    If two power supplies are required to obtain the required MOTOR SUPPLY voltage, use a UNI-POLAR configuration.
    - Minimum Requirements:
    Pollution Degree 2, Double Insulated; Short Circuit and Over-Voltage Protection; UL and CE Approvals.
    - Recommended Power Supply (example):
      - * Mean Well P/N: NDR-480-48 (Aerotech P/N: ECZ02965) | DIN Rail Power Supply, 480 W, 48 V, 10 A
      - * Alternate Mean Well power supply models are available with other voltages and currents. Contact Aerotech factory for more information.

    NOTE: For installation details, refer to the Mean Well NDR Series installation manual.
    NOTE: It is the responsibility of the system designer to determine the correct power supply requirements.
11. "DC SUPPLY" Wiring Specifications (Recommended)
    - Use twisted pair conductors with wire lengths as short as possible.
    - Wire Size: As Required (determined by the system designer).
    - Wire Conformity | North America: UL AWM | and/or | EU: <HAR>/CE
12. SYSTEM "Protective Earth" (PE) GROUNDS
    - PE wires should be as short as possible.
    - Each PE wire should have a dedicated attach/termination point directly to the grounded component panel (refer to 1).
13. FERRITE EMC FILTER (for Axis Feedback and Motor cables | For EMC conformance)
    - Clamp-On Filter (Fair-Rite P/N: 0446167281 || Aerotech P/N: ECZ02348).
    - Apply as close as possible to the FEEDBACK connector back shell as illustrated.

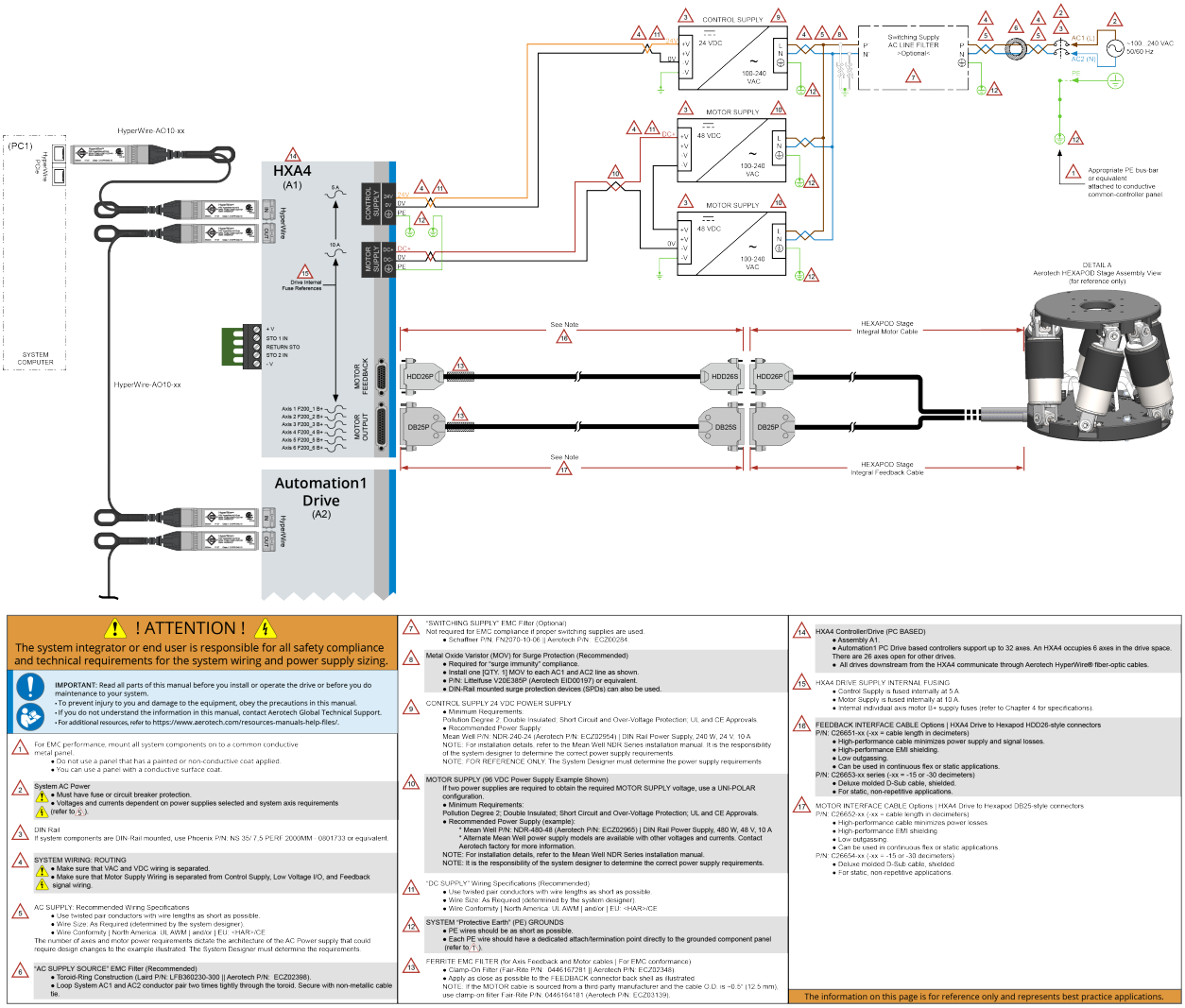
    NOTE: If the MOTOR cable is sourced from a third party manufacturer and the cable O.D. is ~0.5" (12.5 mm), use clamp-on filter Fair-Rite P/N: 0446164181 (Aerotech P/N: ECZ03139).
14. iHXA4 Controller/Drive (DRIVE BASED)
    - Assembly A1.
    - Automation1 iDrive based controllers support up to 12 axes. The iHXA4 occupies 6 axes in the drive space. There are 6 axes open for other drives.
    - All drives downstream from the iHXA4 communicate through Aerotech HyperWire® fiber-optic cables.
15. HXA4 DRIVE SUPPLY INTERNAL FUSING
    - Control Supply is fused internally at 5 A.
    - Motor Supply is fused internally at 10 A.
    - Internal individual axis motor DI+ supply fuses (refer to Chapter 4 for specifications).
16. FEEDBACK INTERFACE CABLE Options | HXA4 Drive to Hexapod HDD26-style connectors
    P/N: C26651-xx (xx = cable length in decimeters)
    - High-performance cable minimizes power supply and signal losses.
    - High-performance EMI shielding.
    - Low outgassing.
    - Can be used in continuous flex or static applications.

    P/N: C26663-xx series (xx = -15 or -30 decimeters)
    - Deluxe molded D-Sub cable, shielded.
    - For static, non-repetitive applications.
17. MOTOR INTERFACE CABLE Options | HXA4 Drive to Hexapod DB25-style connectors
    P/N: C26652-xx (xx = cable length in decimeters)
    - High-performance cable minimizes power losses.
    - High-performance EMI shielding.
    - Low outgassing.
    - Can be used in continuous flex or static applications.

    P/N: C26654-xx (xx = -15 or -30 decimeters)
    - Deluxe molded D-Sub cable, shielded.
    - For static, non-repetitive applications.

The information on this page is for reference only and represents best practice applications.

Figure 2-17: HXA4 Recommended System Connections for a PC-Based Controller



⚠ ! ATTENTION ! ⚠

The system integrator or end user is responsible for all safety compliance and technical requirements for the system wiring and power supply sizing.

IMPORTANT: Read all parts of this manual before you install or operate the drive or before you do maintenance to your system.
- To prevent injury to you and damage to the equipment, obey the precautions in this manual.
- If you do not understand the information in this manual, contact Aerotech Global Technical Support.
- For additional resources, refer to https://www.aerotech.com/resources-manuals-help-files/.

1 For EMC performance, mount all system components on to a common conductive metal panel.
- Do not use a panel that has a painted or non-conductive coat applied.
- You can use a panel with a conductive surface coat.

2 System AC Power
- Must have fuse or circuit breaker protection.
- Voltages and currents dependent on power supplies selected and system axis requirements (refer to 5).

3 DIN Rail
If system components are DIN-Rail mounted, use Phoenix P/N: NS 35/ 7.5 PERF 2000MM - 0801733 or equivalent.

4 SYSTEM WIRING: ROUTING
- Make sure that VAC and VDC wiring is separated.
- Make sure that Motor Supply Wiring is separated from Control Supply, Low Voltage I/O, and Feedback signal wiring.

5 AC SUPPLY: Recommended Wiring Specifications
- Use twisted pair conductors with wire lengths as short as possible.
- Wire Size: As Required (determined by the system designer).
- Wire Conformity | North America: UL AWM | and/or | EU: <HAR>/CE

The number of axes and motor power requirements dictate the architecture of the AC Power supply that could require design changes to the example illustrated. The System Designer must determine the requirements.

6 "AC SUPPLY SOURCE" EMC Filter (Recommended)
- Toroid-Ring Construction (Laird P/N: LFB3602230-300 || Aerotech P/N: ECZ02398).
- Loop System AC1 and AC2 conductor pair two times tightly through the toroid. Secure with non-metallic cable tie.

7 "SWITCHING SUPPLY" EMC Filter (Optional)
Not required for EMC compliance if proper switching supplies are used.
- Schaffner P/N: FN2070-10-06 || Aerotech P/N: ECZ00284.

8 Metal Oxide Varistor (MOV) for Surge Protection (Recommended)
- Required for "surge immunity" compliance.
- Install one [QTY. 1] MOV to each AC1 and AC2 line as shown.
- P/N: Littelfuse V20E385P (Aerotech EID00197) or equivalent.
- DIN-Rail mounted surge protection devices (SPDs) can also be used.

9 CONTROL SUPPLY 24 VDC POWER SUPPLY
- Minimum Requirements:

Pollution Degree 2; Double Insulated; Short Circuit and Over-Voltage Protection; UL and CE Approvals
- Recommended Power Supply:

Mean Well P/N: NDR-240-24 (Aerotech P/N: ECZ02954) | DIN Rail Power Supply, 240 W, 24 V, 10 A
NOTE: For installation details, refer to the Mean Well NDR Series installation manual. It is the responsibility of the system designer to determine the correct power supply requirements.
NOTE: FOR REFERENCE ONLY. The System Designer must determine the power supply requirements.

10 MOTOR SUPPLY (96 VDC Power Supply Example Shown)
If two power supplies are required to obtain the required MOTOR SUPPLY voltage, use a UNI-POLAR configuration.
- Minimum Requirements:

Pollution Degree 2; Double Insulated; Short Circuit and Over-Voltage Protection; UL and CE Approvals.
- Recommended Power Supply (example):
  - * Mean Well P/N: NDR-480-48 (Aerotech P/N: ECZ02965) | DIN Rail Power Supply, 480 W, 48 V, 10 A
  - * Alternate Mean Well power supply models are available with other voltages and currents. Contact Aerotech factory for more information.

NOTE: For installation details, refer to the Mean Well NDR Series installation manual.
NOTE: It is the responsibility of the system designer to determine the correct power supply requirements.

11 "DC SUPPLY" Wiring Specifications (Recommended)
- Use twisted pair conductors with wire lengths as short as possible.
- Wire Size: As Required (determined by the system designer).
- Wire Conformity | North America: UL AWM | and/or | EU: <HAR>/CE

12 SYSTEM "Protective Earth" (PE) GROUNDS
- PE wires should be as short as possible.
- Each PE wire should have a dedicated attach/termination point directly to the grounded component panel (refer to 1).

13 FERRITE EMC FILTER (for Axis Feedback and Motor cables | For EMC conformance)
- Clamp-On Filter (Fair-Rite P/N: 0446167281 || Aerotech P/N: ECZ02346).
- Apply as close as possible to the FEEDBACK connector back shell as illustrated.

NOTE: If the MOTOR cable is sourced from a third party manufacturer and the cable O.D. is ~0.5" (12.5 mm), use clamp-on filter Fair-Rite P/N: 0446164181 (Aerotech P/N: ECZ03139).

14 HXA4 Controller/Drive (PC BASED)
- Assembly A1.
- Automation1 PC Drive based controllers support up to 32 axes. An HXA4 occupies 6 axes in the drive space. There are 26 axes open for other drives.
- All drives downstream from the HXA4 communicate through Aerotech HyperWire® fiber-optic cables.

15 HXA4 DRIVE SUPPLY INTERNAL FUSING
- Control Supply is fused internally at 5 A.
- Motor Supply is fused internally at 10 A.
- Internal individual axis motor B+ supply fuses (refer to Chapter 4 for specifications).

16 FEEDBACK INTERFACE CABLE Options | HXA4 Drive to Hexapod HDD26-style connectors
P/N: C26651-xx (-xx = cable length in decimeters)
- High-performance cable minimizes power supply and signal losses.
- High-performance EMI shielding.
- Low outgassing.
- Can be used in continuous flex or static applications.

P/N: C26653-xx series (-xx = -15 or -30 decimeters)
- Deluxe molded D-Sub cable, shielded.
- For static, non-repetitive applications.

17 MOTOR INTERFACE CABLE Options | HXA4 Drive to Hexapod DB25-style connectors
P/N: C26652-xx (-xx = cable length in decimeters)
- High-performance cable minimizes power losses.
- High-performance EMI shielding.
- Low outgassing.
- Can be used in continuous flex or static applications.

P/N: C26654-xx (-xx = -15 or -30 decimeters)
- Deluxe molded D-Sub cable, shielded.
- For static, non-repetitive applications.

The information on this page is for reference only and represents best practice applications.

2.11. PC Configuration and Operation Information

For more information about hardware requirements, PC configuration, programming, system operation, and utilities, refer to Automation1 Help.

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Chapter 3: Cables and Accessories

Table 3-1: Standard Interconnection Cables

Cable Part #	Description
ENET-CAT5e-xx(1, 2)	Ethernet CAT5e Cable
USB-AMCM-xx(1, 2, 3)	USB Cable A-Male to C-Male
HyperWire	Refer to Section 2.7.
Joystick	Refer to Section 3.1. Joystick Interface

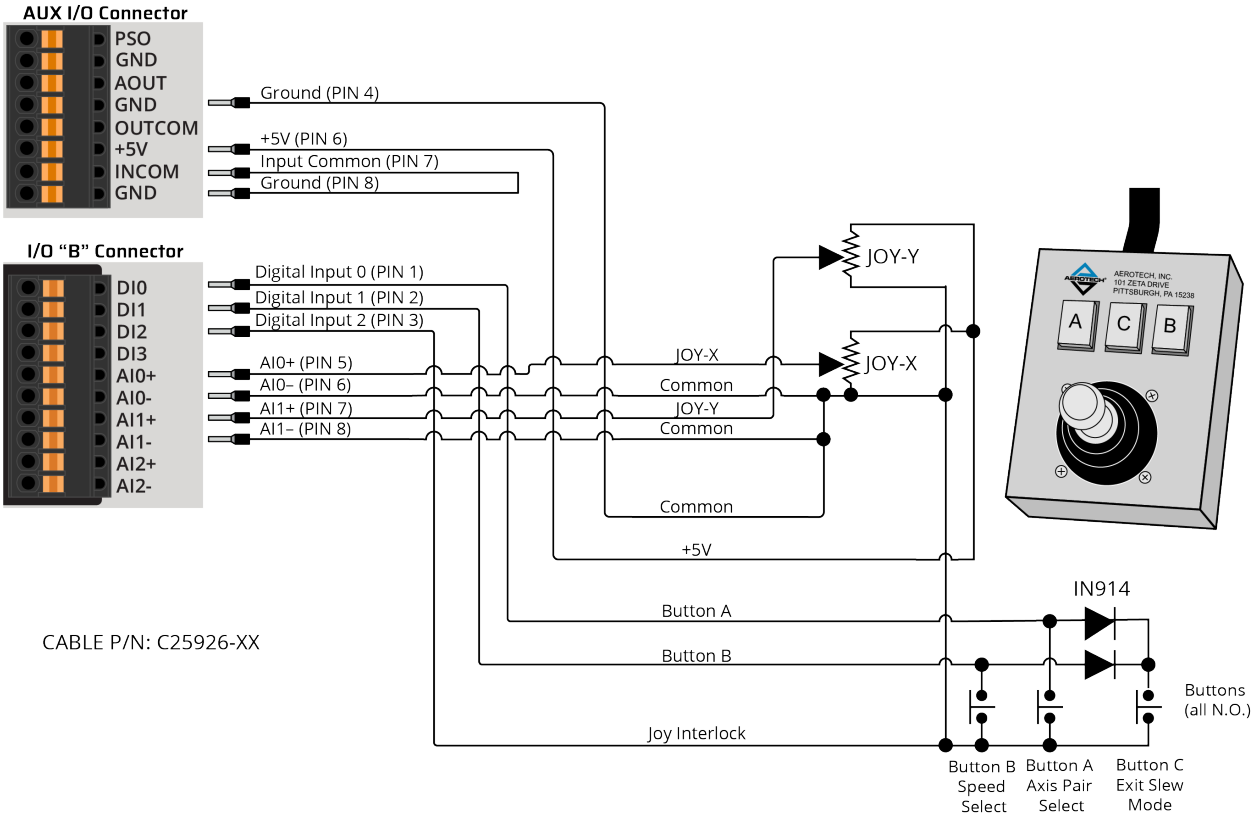
(1) The "-xx" indicates length in decimeters.
(2) iHXA4 Only
(3) Make sure that you are using a shielded USB-C cable that is designed for data transfer.

3.1. Joystick Interface

Aerotech Multi-Axis Joystick (NEMA12 (IP54) rated) is powered from 5 V and has a nominal 2.5 V output in the center detent position. Three buttons are used to select axis pairs and speed ranges. An optional interlock signal is used to indicate to the controller that the joystick is present. Joystick control will not activate unless the joystick is in the center location. Third party devices can be used provided they produce a symmetric output voltage within the range of -10 V to +10 V.

Connecting joystick with an Aerotech cable, all Aerotech cables are labeled to identify the connector and connections. The joystick parameters must be set to match the analog and digital I/O connections. Refer to Automation1 Help for programming information about how to change joystick parameters.

Figure 3-1: Two Axis Joystick Interface



Chapter 4: Maintenance

IMPORTANT: For your own safety and for the safety of the equipment:

- Do not remove the cover of the iHXA4/HXA4.
- Do not attempt to access the internal components.

A fuse that needs to be replaced indicates that there is a more serious problem with the system or setup. Contact Global Technical Support for assistance.

DANGER: If you must remove the covers and access any internal components be aware of the risk of electric shock.

1. Disconnect the Mains power connection.
2. Wait at least ten (10) minutes after removing the power supply before doing maintenance or an inspection. Otherwise, there is the danger of electric shock.
3. All tests must be done by an approved service technician. Voltages inside the controller and at the input and output power connections can kill you.

Table 4-1: LED Description

LED	Color	Description
PWR	GREEN	The drive is powered on.
	RED(1)	The light will turn red when power is first applied, a communication problem occurs, or a drive reset is initiated. It will remain red during drive initialization.
EN/FLT	GREEN	Any axis is Enabled.
	RED	Any axis is in a Fault Condition.
	GREEN/RED (alternates)	Any axis is Enabled in a Fault Condition. or The light is configured to blink for setup.

Table 4-2: Troubleshooting

Symptom	Possible Cause and Solution
No Communication	Make sure the power LED is illuminated (this indicates that power is present).
	Make sure that all communication cables (HyperWire, for example) are fully inserted in their ports.

4.1. Preventative Maintenance

Do an inspection of the iHXA4/HXA4 and the external wiring one time each month. It might be necessary to do more frequent inspections based on:

- The operating conditions of the system.
- How you use the system.

Table 4-3: Preventative Maintenance

Check	Action to be Taken
Examine the chassis for hardware and parts that are damaged or loose. It is not necessary to do an internal inspection unless you think internal damage occurred.	Repair all damaged parts.
Do an inspection of the cooling vents.	Remove all material that collected in the vents.
Examine the work area to make sure there are no fluids and no electrically conductive materials.	Do not let fluids and electrically conductive material go into the chassis.
Examine all cables and connections to make sure they are correct.	Make sure that all connections are correctly attached and not loose. Replace cables that are worn. Replace all broken connectors.

Cleaning

DANGER: Before you clean the iHXA4/HXA4, disconnect the electrical power from the drive.

Use a clean, dry, soft cloth to clean the iHXA4/HXA4. If necessary, use a cloth that is moist with water or isopropyl alcohol. If you use a moist cloth, make sure that moisture does not go into the drive. Also make sure that it does not go onto the outer connectors and components. Internal contamination from the cleaning solution can cause corrosion and electrical short circuits.

Do not clean the labels with a cleaning solution because it might remove the label information.

4.2. Fuse Specifications

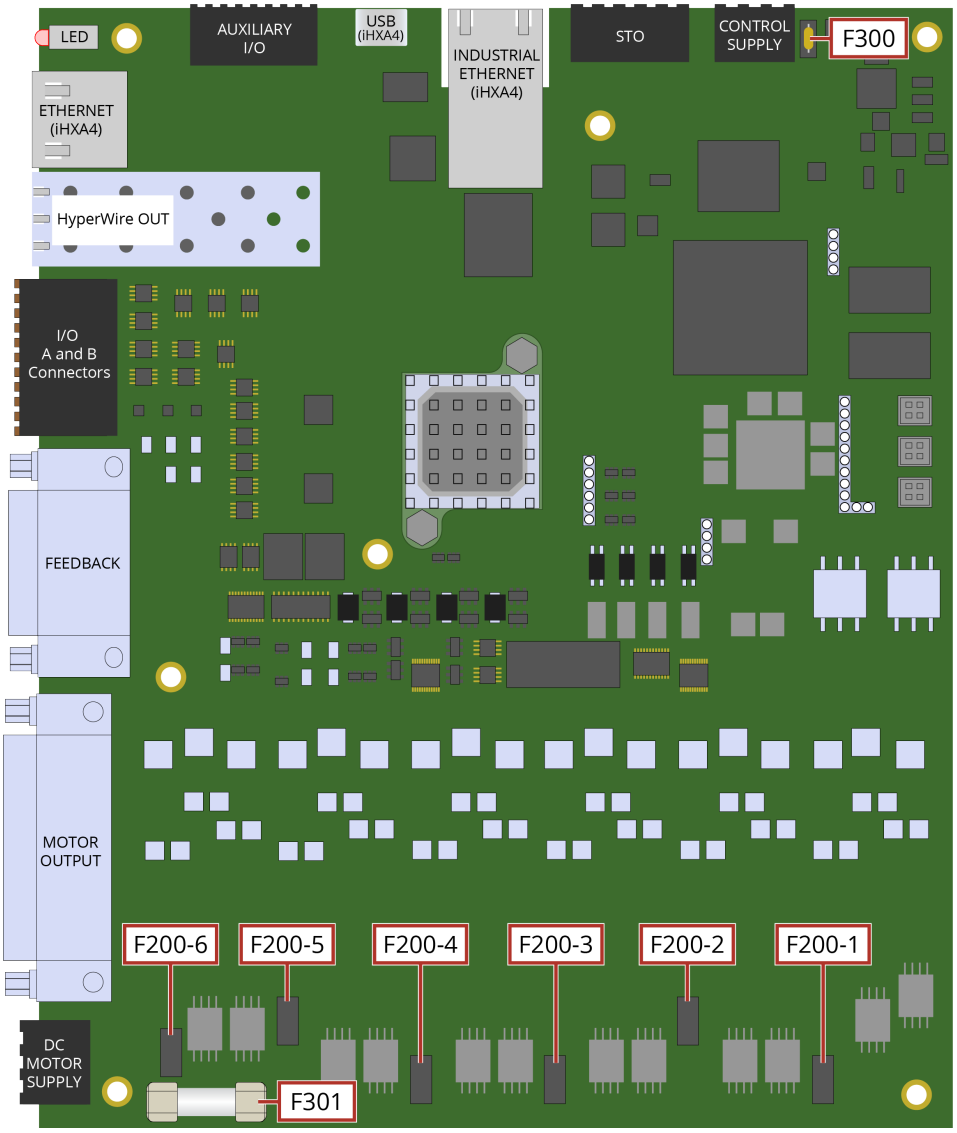
WARNING: Replace fuses only with the same type and value.

Table 4-4: Control Board Fuse Specifications

Fuse	Description	Size	SCCR(1)	Aerotech P/N	Littelfuse P/N
F300(2)	Control Power at +24 V Input	5 A S.B.	35 A	EIF01076	0473005.MRT1L
F301	Motor Bus Supply at DC+	10 A S.B.	1500 A	EIF01020	0215010.HXP
F200-1 F200-2 F200-3 F200-4 F200-5 F200-6	Motor Bus Supply at axis (amplifier)	3.15 A S.B.	35 A	EIF01080	39213150440

(1) Short circuit current rating
(2) F300 is soldered into the PCB and is not user replaceable.

Figure 4-1: Fuse Locations on the iHXA4/HXA4 Control Board



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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 Global Technical Support Portal 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

https://www.aerotech.com/contact-sales.aspx?mapState=showMap

USA, CANADA, MEXICO
Aerotech, Inc.
Global Headquarters

CHINA
Aerotech China
Full-Service Subsidiary

GERMANY
Aerotech Germany
Full-Service Subsidiary

TAIWAN
Aerotech Taiwan
Full-Service Subsidiary

UNITED KINGDOM
Aerotech United Kingdom
Full-Service Subsidiary

Appendix B: Revision History

Revision	Description
1.01	Updated: • EU Declaration of Conformity (Page 8) • Feature Summary (Section 1.1.)
1.00	New Manual

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Index

W