Npaq Hardware Manual

Revision: 3.08.00

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EU Declaration of Conformity

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

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 Directive
2014/35/EU	Low Voltage Directive
2006/42/EC	Machinery Directive
EU 2015/863	RoHS 3 Directive

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 61326-1:1998	EMC Requirements for Electrical Equipment
EN 61010-1:2010	Safety Requirements for Electrical Equipment
ISO 13849-1:2008	Safety Related Parts of Control Systems

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CE

Agency Approvals

Aerotech, Inc. Model Npaq Drive Racks have been tested and found to be in accordance to the following listed Agency Approvals:

Approval / Certification:	CUS NRTL
Approving Agency:	TUV SUD America Inc.
Certificate #:	U8 14 12 68995 016
Standards:	CAN/CSA-C22.2 No. 61010-1:2012; UL 61010-1:2012

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

This manual tells you how to carefully and correctly use and operate the Npaq. Read all parts of this manual before you install or operate the Npaq or before you do maintenance to your system. To prevent injury to you and damage to the equipment, obey the precautions in this manual. The precautions that follow apply when you see a Danger or Warning symbol in this manual. If you do not obey these precautions, injury to you or damage to the equipment can occur. If you do not understand the information in this manual, contact Aerotech Global Technical Support.

This product has been designed for light industrial manufacturing or laboratory environments. The protection provided by the equipment could be impaired if the product is used in a manner not specified by the manufacturer.

NOTE: Aerotech continually improves its product offerings; listed options may be superseded at any time.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. Ensure that all electrical power switches are in the off position when servicing the equipment.
2. Disconnect electrical power before servicing equipment.
3. Disconnect electrical power before performing any wiring.
4. Access to the Npaq and component parts must be restricted while connected to a power source.
5. Residual voltages greater than 60V may be present inside Npaq chassis for longer than 10 seconds after power has been disconnected.
6. 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.
7. Install the Npaq inside a rack or enclosure.
8. Do not connect or disconnect any electrical components or connecting cables while connected to a power source.
9. All components must be properly grounded in accordance with local electrical safety requirements.
10. Operator safeguarding requirements must be addressed during final integration of the product.

DANGER/HEAVY: To avoid injury, use two or more people to move and install this product.

- Refer to Section 1.2. for chassis mass specifications.
- Use a cart to move the product.
- Do not use the handles on the front of the product to lift or move this product. Use the handles only to slide the product in and out of its enclosure.
- Lift this product only by the base. Do not use the cables or the connectors to lift or move this product.

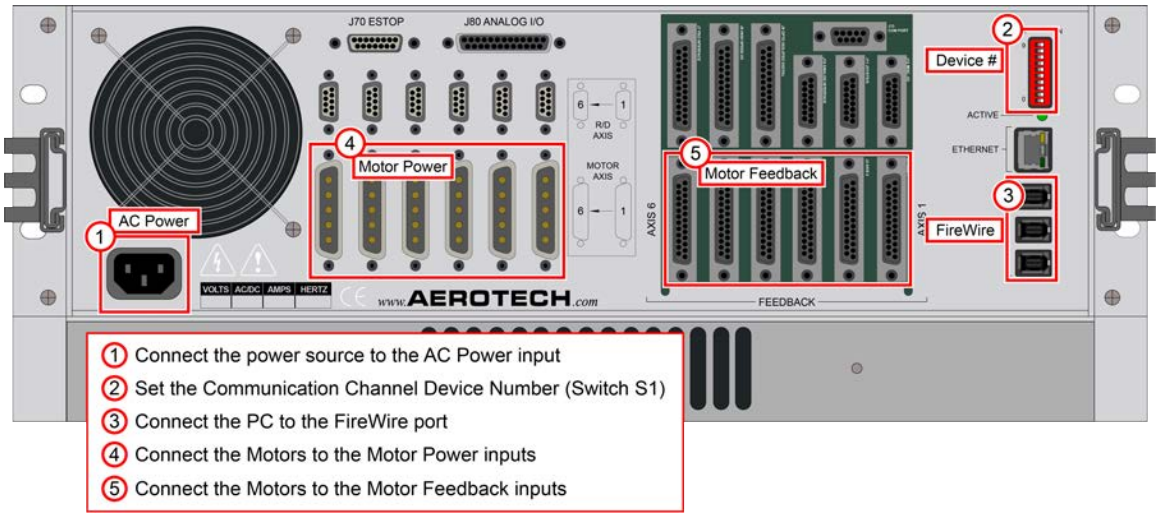
WARNING: To minimize the possibility of electrical shock, bodily injury or death the following precautions must be followed.

1. If the product is used in a manner not specified by the manufacturer, the protection provided by the product can be impaired and result in damage, shock, injury, or death.
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 this product to environments or conditions outside of the listed specifications. Exceeding environmental or operating specifications can cause damage to the equipment.
5. Operators must be trained before operating this equipment.
6. All service and maintenance must be performed by qualified personnel.

Quick Installation Guide

This chapter describes the order in which connections and settings should typically be made to the Npaq. 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.

There are five standard connections that must be made to the Npaq.



Topic	Section
AC Power	Section 2.2.1. AC Power Connections
Device Number	Section 2.3. Communication Channel Settings
PC Communication	Section 2.13. FireWire Interface
Motor Power	Section 2.5. Motor Output Connectors
Motor Feedback	Section 2.6. Motor Feedback Connectors

Figure 1: Quick Start Connections

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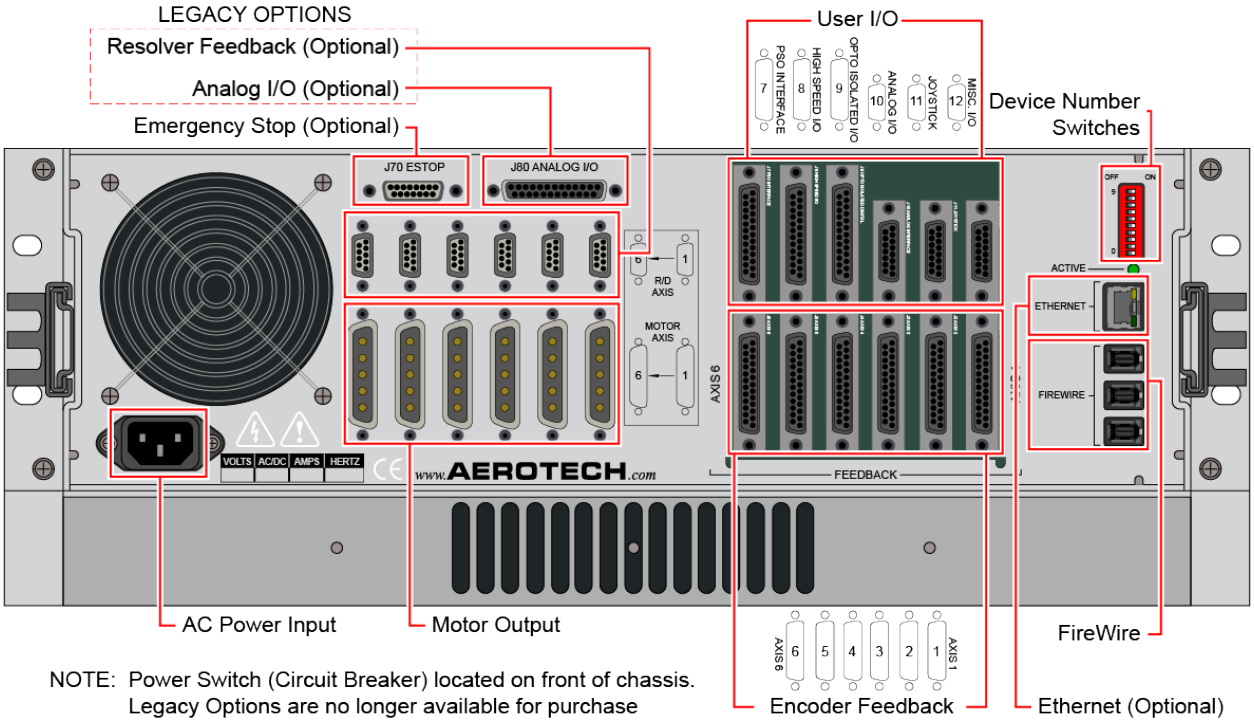
Chapter 1: Introduction

The Npaq® is a high-performance, 6-axis drive rack with field replaceable front-mounted drives. All versions are 3U in size, rack-mountable, and compatible with the Automation 3200 motion platform.

- 3U plug-in drives
- 19 inch rack-mount design
- Flexible design provides the ability to drive brush, brushless, or stepper motors with the same amplifier
- 5 A to 30 A peak output current
- PWM or linear amplifier
- Integral power supplies
- IEEE-1394 FireWire interface
- Digital current, velocity, and position loops for improved motion stability
- Optional Ethernet for I/O expansion
- Integrated encoder multiplier for higher throughput and reduced wiring
- Encoder feedback
- NRTL approval and CE compliant

Featuring high-performance double-precision DSPs, the Npaq family performs both current loop and servo-loop closures digitally to assure the highest level of positioning accuracy and rate stability. It is this processing capability that allows the Npaq to provide loop closure rates up to 20 kHz and to handle both digital and analog I/O processing, data collection, laser firing, and encoder multiplication tasks in real time.

Standard options for the Npaq family include integrated encoder multiplication, per-axis brake control logic, I/O expansion, and integrated emergency stop circuitry.



NOTE: Power Switch (Circuit Breaker) located on front of chassis.
Legacy Options are no longer available for purchase

Figure 1-1: Npaq Drive Chassis

The Npaq uses plug-in amplifiers supporting both linear and PWM topologies to control brushless, DC brush, or stepper motor types at up to 320 VDC operating voltage and 30 A peak current capability. The Npaq contains two configurable power supply sections to support a variety of motors with different operating

voltages. When only one motor voltage is required, the power supply sections are joined together for even higher power capability. The Npaq has a dedicated Ethernet port used to communicate with third-party I/O modules for increased I/O count applications.

The Npaq supports up to three axes of Position Synchronized Output (PSO) for precise synchronizing of external devices, over-voltage shunt controller, and external fans for high-power operation.

Table 1-1: Feature Summary

Standard Features	
• 6 channels of line driver square wave or optional analog sine wave quadrature encoder position and/or velocity feedback • Two independent bus supplies (factory configured) • Linear and/or PWM Amplifiers • Software configurable for brush, brushless, ceramic and stepper motor operation (the Npaq must be factory wired for a 4010 amplifier to drive a stepper motor) • Single axis PSO (Laser Firing) standard (2- and 3-axis firing optional)	
Auxiliary Power Outputs	+5V provided on all axis feedback connectors for encoder, Hall, and limit power.
-IO	• Four 16-bit differential analog inputs (2 used for the optional Joystick) • Two 16-bit analog outputs • Eight opto-isolated digital inputs • Eight opto-isolated digital outputs • Six High Speed Differential outputs • Four High Speed Differential inputs • Three High Speed Bi-directional lines • ESTOP sense Input • Two Opto-Isolated User Interrupt Inputs • Brake Output (Optional)
Feedback / Limit Inputs	• Hall Inputs (3 per axis) • Encoder / Marker Inputs • CW, CCW & Home Limit Inputs • Motor Over-Temperature Input

Table 1-2: Configurations and Options

Power Input Configurations	
-A	115 VAC
-B	230 VAC
-C	100 VAC
-D	200 VAC
Bus Voltage (Vbus1 and Vbus2) Configurations	
-0	Not wired
-10B	±10 VDC (100 W Power Supply), bipolar
-20B	±20 VDC (175 W Power Supply), bipolar
-30B	±30 VDC (175 W Power Supply), bipolar
-40B	±40 VDC (175 W Power Supply), bipolar
-80B	±80 VDC (325 W Power Supply), bipolar
-160LT	160 VDC (offline, no transformer), unipolar, (DP320XX)
-320LT	320 VDC (offline, no transformer), unipolar, (DP320XX)
Controller Options (Required)	
-ULTRA	6 axis control board
Amplifier Options	
/DP32010E	Brushless motor driver, 320 V, 5 A cont., 10 A peak, 20 kHz PWM, 3U height, enhanced resolution, requires A3200 software version 2.13 or greater
/DP32020E	Brushless motor driver, 320 V, 10 A cont., 20 A peak, 20 kHz PWM, 3U height, enhanced resolution, requires A3200 software version 2.13 or greater
/DP32030E	Brushless motor driver, 320 V, 15 A cont., 30 A peak, 20 kHz PWM, 3U height, enhanced resolution, requires A3200 software version 2.13 or greater
/DL4010	Brushless motor driver, ±40 V, 5 A cont., 10 A peak, linear DC, 3U height; actual current depends on motor parameters
Split Bus Options	
/SPLIT BUS 1/2-6	Axis 1 Vbus1, Axis 2-6 Vbus2
/SPLIT BUS 1-2/3-6	Axis 1-2 Vbus1, Axis 3-6 Vbus2
/SPLIT BUS 1-3/4-6	Axis 1-3 Vbus1, Axis 4-6 Vbus2
/SPLIT BUS 1-4/5-6	Axis 1-4 Vbus1, Axis 5-6 Vbus2
/SPLIT BUS 1-5/6	Axis 1-5 Vbus1, Axis 6 Vbus2
/SPLIT BUS 1-6	No split, Axis 1-6 Vbus1

Cooling Options	
/STAND	Built-in fan pulls cooling air from left side through the amplifier compartment
/EXT	Perforated covers above and below the amplifiers; requires external fan tray for cooling (customer supplied)
/FAN	Perforated covers above and below the amplifiers; includes 1U-high fan tray for cooling; fans wired to the Npaq power switch
Mounting Options	
/STANDARD	Rack Mount
/SLIDES	Rack-mounted drawer slides
Brake Options	
/BRAKE-z	Brake control logic and power supply; axis "z" as 1, 2, 3, 4, 5 or 6
/BRAKEIO	Brake control logic and power supply; brake signal wired to miscellaneous I/O connector
Line Cord Options	
/ENGLAND	U.K. compatible line cord
/GERMANY	German compatible line cord
/ISRAEL	Israel compatible line cord
/INDIA	India compatible line cord
/AUSTRALIA	Australia compatible line cord
/US-115VAC	U.S. 115\VAC line cord
/US-230VAC	US 230\VAC line cord
/NO-LINECORD	No line cord
Options	
/ENET	10/100BASE-T Ethernet port
/ESTOP1	Internal, disconnect AC to motor power supply. For category 2 applications. Risk assessment is responsibility of user.
/ESTOP2	Internal, disconnect AC to motor power supply. For category 3 applications. Risk assessment is responsibility of user.
/ESTOP3	Internal, disconnect AC to motor power supply. Lethal voltage removed in less 1 second. For category 3 applications. Risk assessment is responsibility of user.
/LINESEL	User selectable input voltages
/LINESEL-MX	User selectable input voltages, for MXR option
/S160-1	Shunt for Vbus1, 160 VDC operation
/S160-2	Shunt for Vbus2, 160 VDC operation
NOTE: Both shunts permitted for 160VDC option.	
/S320-1	Shunt for Vbus1, 320 VDC operation
/S320-2	Shunt for Vbus2, 320 VDC operation
NOTE: Only one shunt permitted for 320 VDC option.	

Line Filter Option	
/AC LINE FILTER	AC line filter for reducing conducted emissions (required for CE).
PSO Options (Optional)	
/DUALPSO	Dual axis PSO, includes HCPL2601 opto-isolator
/TRIPLEPSO	Triple axis PSO, includes HCPL2601 opto-isolator
/PSO-NC	JP16 is installed in position 2-3 to provide normally-closed operation
Encoder Multiplier Options	
/MXR-x	x65,536 multiplier for x (1-6) axes, 450 kHz input, real-time output for PSO operation (programmable resolution)
/MXR2M-x	x65,536 multiplier for x (1-6) axes, 2 MHz input, real time output for PSO operation
1. Effective multiplication factor after quadrature decoding (if applicable) 2. /MXR-4, /MXR-5, /MXR6: 3 axes max 3. /MXR2M-4, /MXR2M-5, /MXR2M-6: 3 axes max	
Motor Output	
/Mx	Motor output wiring installed for x (1-6) axes
Accessories (Optional)	
/JI	4-way industrial joystick sealed for harsh environments; includes 1.5 m (5 ft) cable and three dedicated function buttons
/JBV	Joystick with 5 ft cable
Archived Options (for legacy users)	
/AIO	Adds four 16-bit analog inputs and six 16-bit analog outputs.
NOTE: High speed digital I/O not available with this option.	
/RDP2-y	1-2 axis RD converter board. Must be on axis 1-2
/RDP4-y	1-4 axis RD converter board. Must be on axis 1-4
/RDP6-y	1-6 axis RD converter board.
NOTE: Where y is the frequency (options are 5, 7.5, or 10 KHz)	

The following block diagram illustrates the features and options of the Npaq.

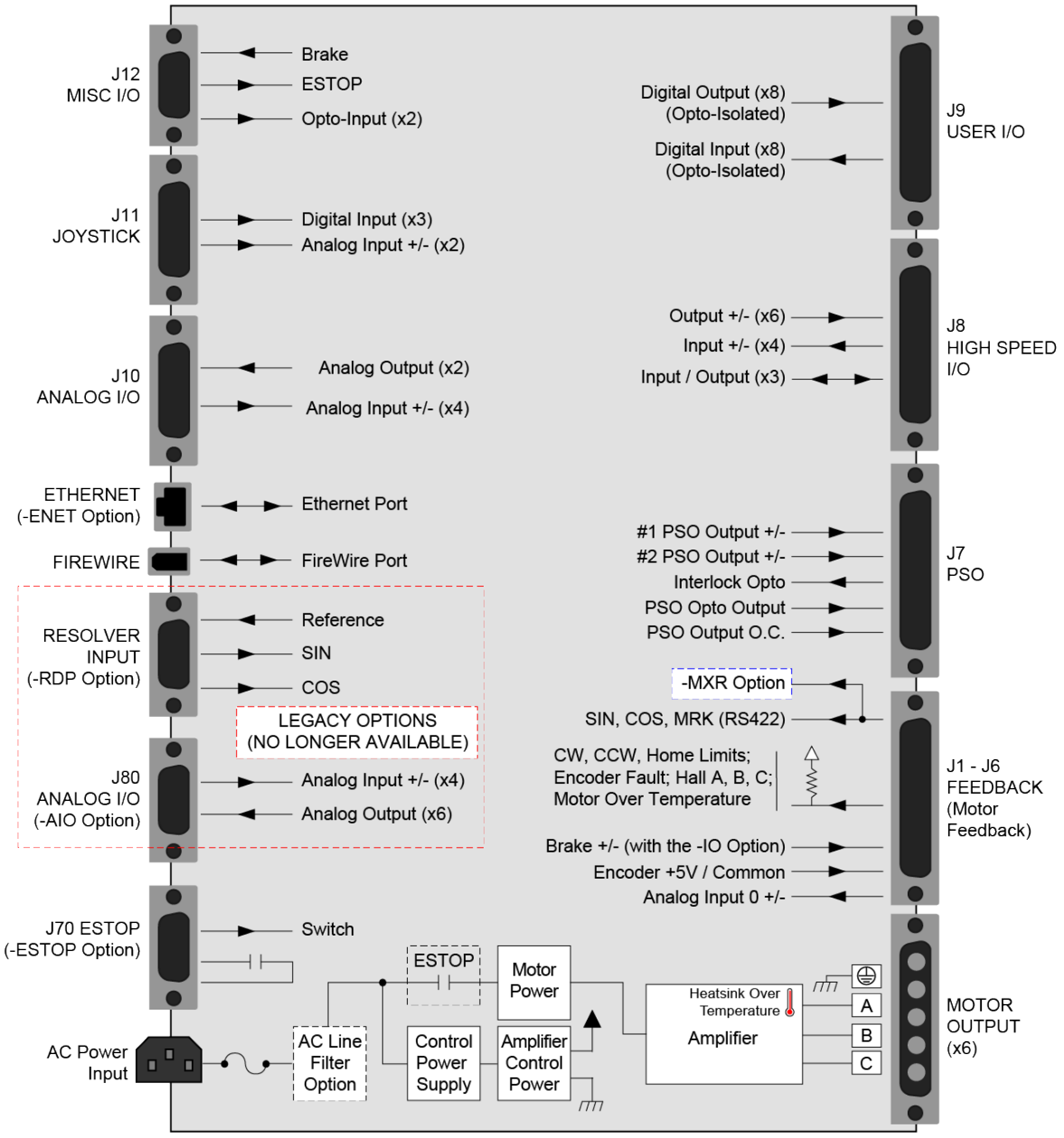


Figure 1-2: Functional Diagram

1.1. Electrical Specifications

The electrical specifications for the Npaq drive chassis are listed in Table 1-3 and the electrical specifications for the servo amplifiers in Table 1-4.

NOTE: Specifications represent the maximum capability of a feature. Other system constraints may result in significantly less performance. This is particularly applicable to the motor output specifications. The motor output specifications are affected by the Bus supply, the number of axes that are operating at the same time, the type of motion, the AC Line voltage, and motor requirements.

Table 1-3: Chassis Electrical Specifications

Description		Specification
Bus Voltage Options		10B, 20B, 30B, 40B, 80B, 160LT & 320LT [Factory Configured]
Input Current	100 VAC	10 A Maximum
	115 VAC	10 A Maximum
	200 VAC	5 A Maximum
	230 VAC	5 A Maximum
AC Power Input		AC input (Switch Selectable): AC Hi, AC Lo, Earth Ground (⏚), • 100 VAC (90-112 VAC, 50/60 Hz) • 115 VAC (103-127 VAC, 50/60 Hz) • 200 VAC (180-224 VAC, 50/60 Hz) • 230 VAC (207-254 VAC, 50/60 Hz) Note: If the Npaq contains an offline Bus power supply, the AC Input will be limited to one AC input range.
Auxiliary Power Outputs		+5 Volts is provided on all axis feedback connectors for encoder, Hall, and limit power.
Protection		AC power cord serves as the mains breaker (10 A, Supplemental Protection only).
		Internal Bus supply fusing.
		Amplifier Output short circuit protection.
		Peak and RMS over current limit.
		Over Temperature shutdown.
		Bus supply inrush current limit during initial power-on.
Isolation		Opto and transformer isolation between control and power stages.
Indicator (Power)		Power switch contains a power-on indicator.
Indicator (Enabled)		Individual Amplifier LED's indicates drive enabled state.

Table 1-4: Servo Amplifier Electrical Specifications

		Specification			
		DL Series	DP Series		
		4010	32010	32020	32030
Peak Motor Output Current (2 sec) (1)	A (pk)	10	10	20	30
Continuous Current	A (pk)	1.5 (2)	5	10	15
Peak Bus Voltage	VDC	40	320		
Maximum Power Amplifier Bandwidth (3)	kHz	2			
PWM Switching Frequency	kHz	NA	20		
Minimum Load Inductance	mH	0	0.1 mH @ 160 VDC (1.0 mH @ 320 VDC)		
Heat Sink Temperature (maximum allowable)	°C	75 (All Amplifiers)			

(1) AC voltage, Bus supply / load may result in significantly lower maximum peak currents.
(2) For a locked motor condition with 0 Ω load.
(3) Selectable through parameters.

1.1.1. 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 switching amplifier types:

An EfficiencyFactor of approximately 90% should be used in the following equations.

Brushless Motor

Output Power

Rotary Motors	Pout [W] = Torque [N·m] * Angular velocity[rad/sec]
Linear Motors	Pout [W] = Force [N] * Linear velocity[m/sec]
Rotary or Linear Motors	Pout [W] = Bemf [V] * I(rms) * 3

Ploss = 3 * I(rms)^2 * R(line-line)/2

Pin = SUM (Pout + Ploss) / EfficiencyFactor

DC Brush Motor

Pout [W] = Torque [N·m] * Angular velocity[rad/sec]

Ploss = I(rms)^2 * R

Pin = SUM (Pout + Ploss) / EfficiencyFactor

For linear amplifier types:

An EfficiencyFactor of approximately 50% should be used in the following equations.

Linear Motor

Pdiss[W] = MotorCurrentPeak[A] * TotalBusVoltage[V] * 3 / 2

Pin = SUM (Pdiss) / EfficiencyFactor

1.2. Mechanical Specifications

The Npaq must be installed in a rack mount console to comply with safety standards. Mount the Npaq so free airflow is available at the rear and along the sides of the chassis for standard cooling. External cooling and Fan Tray cooling options require airflow clearance above and below the Npaq drive chassis. Allowance must also be made for the rear panel connections and cables.

All Npaq chassis are built to the user's specifications, with the requested options, causing a variation in the actual product weight.

DANGER/HEAVY: To avoid injury, use two or more people to move and install this product.

- The approximate weight of the Npaq is 24 kg (53 lbs).
- Use a cart to move the product.
- Do not use the handles on the front of the product to lift or move this product. Use the handles only to slide the product in and out of its enclosure.
- Lift this product only by the base. Do not use the cables or the connectors to lift or move this product.

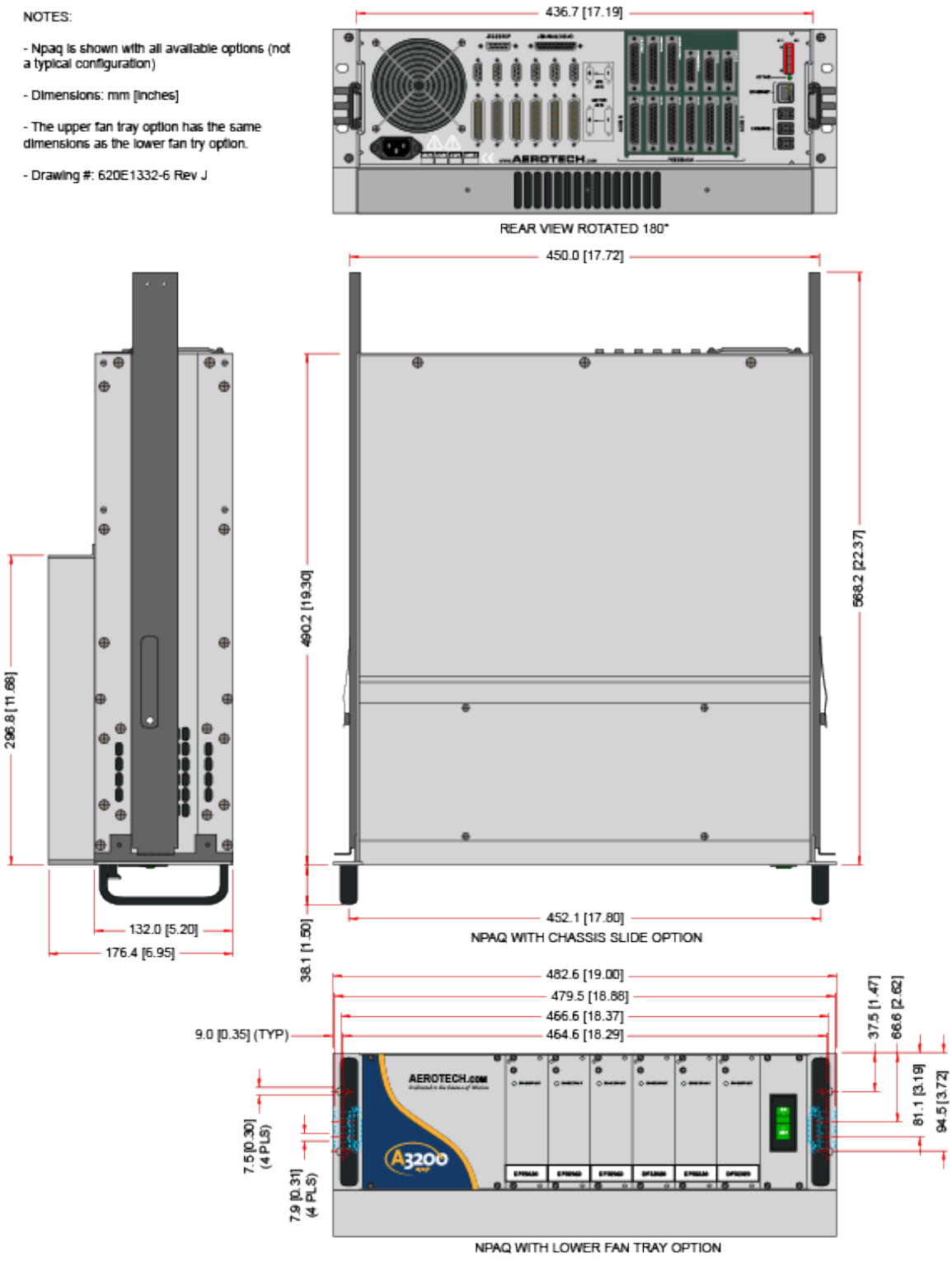


Figure 1-3: Dimensions

1.3. Environmental Specifications

The environmental specifications for the Npaq 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.
Audible Noise	71 db at 1 meter (rear fan and side fan)
	77 db at 1 meter (rear fan and side fan)

1.4. Drive and Software Compatibility

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

Table 1-5: Drive and Software Compatibility

Drive Type	Firmware Revision	First Software Version	Last Software Version
Npaq	-	1.07	2.55
	A	2.09	Current

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Chapter 2: Installation and Configuration

2.1. Unpacking the Chassis

Visually inspect the container of the Npaq for any evidence of shipping damage. If any such damage exists, notify the shipping carrier immediately.

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

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

DANGER: Cables should not be connected to or disconnected from the Npaq drive chassis while power is applied, nor should any drive modules be removed or inserted into it with power applied. Doing so may cause damage to the system or its components.

Also provided with the Npaq is a documentation package on the installation device, containing manuals, interconnection drawings, and other documentation pertaining to the Npaq system. This information should be saved for future reference. Additional information about the Npaq system is provided on the Serial and Power labels that are placed on the Npaq 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

The Npaq power label contains the factory configured AC power requirements.

DANGER: The AC power label must be changed if the AC Input Voltage is reconfigured.

2.2. Electrical Installation

Motor, power, control and position feedback cable connections are made to the rear of the Npaq.

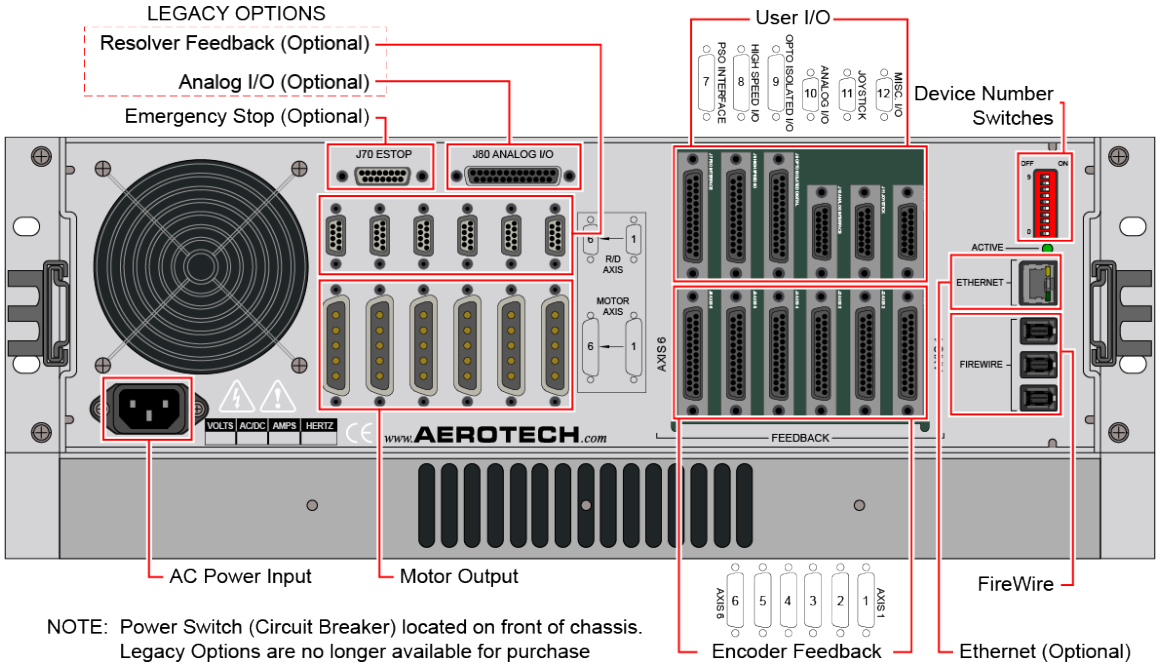


Figure 2-1: Power and Control Connections

A combination power switch/circuit breaker is located on the front of the Npaq. This breaker is connected to the incoming AC power and provides protection to the Npaq system in case of severe overloads. This breaker is selected to meet the maximum current requirements of the Npaq system and is normally a 10 A breaker.

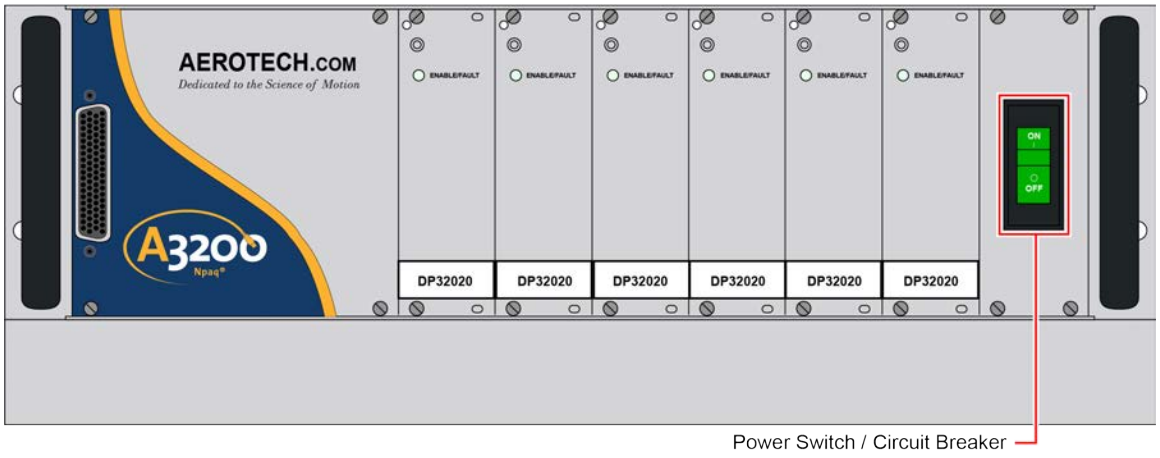


Figure 2-2: Power Switch

All low voltage connections must be made using cables/wires sized for the maximum currents that will be carried. Insulation on these cables/wires must be rated at 300 V if this wiring can come into contact with wiring operating above 100 V (AC & Motor wiring). Low voltage wiring should not be bundled with AC and motor wiring to minimize signal disturbances due to EMI interference and coupling.

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

WARNING: Before powering up the Npaq, verify that all drive modules and cables to the Npaq have been properly installed. Refer to the remaining chapters of this manual for installation and configuration procedures.

NOTE: Confirm that the AC power is the correct voltage before turning on power to the Npaq. If the -LineSel option is present, the user may verify the Soft Start/Voltage selection switches, as described in Section 2.4.

The external +5 V power is fused by re-settable (semiconductor) fuses located on the Rear Panel Interface board. These fuses protect the system should a fault or overload condition occur with the optical encoders, joystick, I/O bus, or Miscellaneous I/O connectors. This fuse will reset itself when the overload condition is removed (power may also need to be turned off to reset the fuse). In addition to this fuse, each drive module has a safety fuse. To access the safety fuse, unscrew the module from the front panel and pull out the module.

Some Npaq systems may use +12 V for the limit switch supply (Special request / requirements). The Npaq can also provide an external +24 V output for Brake applications. The +24 V Brake output is only provided when the Brake option is used.

2.2.1. AC Power Connections

AC input power to the Npaq drive chassis is applied to the AC power receptacle that is located on the rear panel. The power cord connected to this receptacle also provides the protective earth ground connection and may serve as a Mains disconnect. The main power switch located on the front panel of the Npaq drive chassis also functions as a 10 A breaker (supplementary protection only) for the incoming AC power.

Most Npaq drive chassis's can be configured for operation at any of four different AC input voltages (refer to Section 2.4.). Before attempting to reconfigure the AC input voltage for the Npaq drive chassis, the user must verify that drive chassis does not contain an offline bus supply (Ex. 160LT Bus) or other option that would limit or restrict the AC input voltages that it may operate at. These standard AC input voltages along with the current requirements for the Npaq drive chassis are listed in Table 2-1.

WARNING: The AC power cord is the Mains disconnect.

Figure 2-3: Power Supply Connection

Table 2-1: Main AC Power Input Voltages and Current Requirements

AC Input Voltage	Input Amps (maximum continuous)
100 VAC 50/60 Hz	10 A
115 VAC 50/60 Hz	10 A
200 VAC 50/60 Hz	5 A
230 VAC 50/60 Hz	5 A

The AC power cord/wiring to the Npaq must be rated for at least 300 V and have a minimum current capacity of 10 A. The insulation rating for the AC power wiring must be appropriately rated for the environment. The temperature rating of the insulation must be at least 80ºC. Environmental conditions may necessitate the need to meet additional AC wiring requirements or specifications. AC wiring should not be bundled with signal wiring to minimize EMI coupling and interference.

DANGER: See the user documentation provided with your Npaq system to determine if the Npaq chassis is limited to only one AC input voltage. Operation at other voltages may result in damage to the Npaq chassis.

2.2.2. Minimizing Conducted, Radiated, and System Noise

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

1. Use shielded cable to carry the motor current and tie the shield to earth ground.
2. Use a cable with sufficient insulation. This will reduce the capacitive coupling between the leads that, in turn, reduces the current generated in the shield wire.
3. Motor cables must be physically separated from low level cables carrying FireWire, encoder and IO signals.
4. The AC Line Filter Option is required for EMC compliance (see Section 3.2.).
5. User connections to the product must be made using shielded cables with metal D-style connectors and back shells. The shield of the cables must be connected to the metal back shell in order for the product to conform to the radiated emission standards.
6. The Npaq is a component designed to be integrated with other electronics. EMC testing must be conducted on the final product configuration.

2.2.3. I/O and Signal Wiring Requirements

The I/O, communication, and encoder feedback connections are typically very low power connections. In some applications, especially when there are significant wire distances, a larger wire size may be required to reduce the voltage drop that occurs along the wire. This increase may be necessary in order to keep the voltage within a specified range at a remote point.

Low voltage and high voltage wires should be kept physically separated so that they cannot contact one another. This reduces the risk of electric shock and improves system performance.

Connection	Specification	Value
Signal Wiring	Cable/Wire Rating (1)	300 V
	Minimum Current Capacity	.25 A
	Temperature Rating (Insulation) (2)	80°C
Low Voltage Power	Cable/Wire Rating (1)	300 V
	Minimum Current Capacity (3)	1 A
	Temperature Rating (Insulation) (2)	80°C

1. ≥ 30 V if the wiring is **not** in close proximity to wiring operating at voltages above 60 V.
2. Insulation rating will need to be rated for the higher voltage if the wiring is in proximity to wiring operating at voltages above 60 V.
3. Larger gauge wire may be required to minimize voltage drop due to voltage (IR) loss in the cable.

2.3. Communication Channel Settings

Use the Device Number switches of S2 to assign a communication channel number to the Npaq. 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 2-4: Device Number (S2) 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.

The Npaq drive chassis can be set to any communication channel number from 1 to 27 (the Npaq will automatically claim the next 5 sequential device numbers). If the Npaq is set to 2, the next available communication channel number is 8.

Table 2-2: Device Number Switch Settings (S2)

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

(1) S2 switches 5 through 9 should be left in their factory-preset positions.
(2) The maximum allowable base communication channel number for the Npaq is 27 (through 32).

2.4. Soft Start / Voltage Selection Overview

The Soft Start / Voltage Selection Board is used to limit AC inrush current during turn-on (Section 2.4.1.) and provides the user with the means to configure the Npaq for different AC line voltages (Section 2.4.2.). This board is normally accessible only by removing the top cover of the Npaq. If the -LineSel option is present; the chassis cover will have access holes and labels indicating the switch settings.

For fuse information, refer to Table 4-12.

2.4.1. Soft-Start Operation

Soft-Start circuitry automatically limits the inrush current to the Bus supply to approximately 10 A for 100/115 VAC operation and 20 A for 200/230 VAC operation. Inrush current limiting is only activated during initial power-up or when AC power interruptions last longer than .3 seconds. Short power interruptions (less than about .3 seconds) will not trigger the soft-start circuitry. This prevents the possibility of soft-start induced nuisance circuit breaker trips during normal operation.

WARNING: The Soft-Start circuit requires +24 VDC for proper operation (provided internally). Damage to the Soft-Start circuit may result if +24 VDC is not connected.

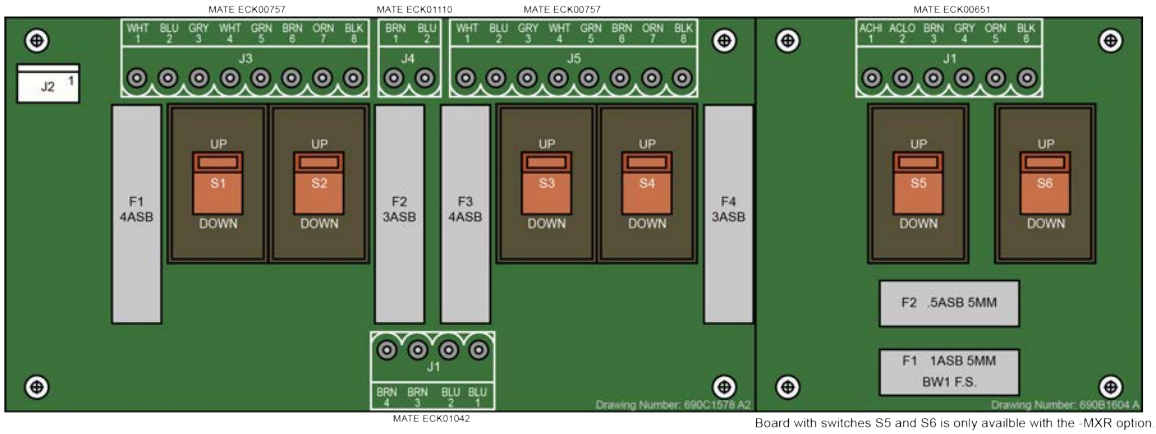


Figure 2-5: Soft-Start / Voltage Board

Table 2-3: AC Input Power Connector (J1) Pin Assignment

Pin	Description	Wire Color
1	AC LO	Blue
2	AC LO	Blue
3	AC HI	Brown
4	AC HI	Brown

Table 2-4: +24 VDC Power Connector (J2) Pin Assignment

Pin	Description
1	Common
2	Common
3	+24 VDC
4	+24 VDC

Table 2-5: Transformer Interface Connectors (J3, J5) Pin Assignment

Pin	Description	Wire Color
1	Thermal Switch	White
2	0 VAC Lead	Blue
3	0 VAC Lead	Gray
4	Thermal Switch	White
5	100 VAC Lead	Green
6	115 VAC Lead	Brown
7	100 VAC Lead	Orange
8	115 VAC Lead	Black

Table 2-6: Fan Interface Connector (J4) Pin Assignment

Pin	Description	Wire Color
1	Fan AC HI (115 VAC)	Brown
2	Fan AC LO	Blue

WARNING: Transformer wire colors refer only to Aerotech's (P/N EAX01010) transformer. Do not use with other transformers.

Table 2-7: AC Input Power Connector (J1/MXR Board) Pin Assignment

Pin	Description	Wire Color
1	AC HI	Brown
2	AC LO	Blue
3	115 VAC Lead	Brown
4	0 VAC Lead	Gray
5	100 VAC Lead	Orange
6	115 VAC Lead	Black

2.4.2. Voltage Selection Operation

Procedure for setting AC voltage selector switches:

1. Turn-off and disconnect all power from unit.
2. Determine the AC line operating voltage that unit needs be set to (Nominal settings: 100 VAC, 115 VAC, 200 VAC and 230 VAC).
3. Use Table 2-8 to set all of the voltage selector switches to the position indicated for the desired operating voltage. See Figure 2-5 for additional information.

Table 2-8: AC Input Power Connector (J1) Pin Assignment

	Switch Settings				MXR/MXR2M Only	
	S1	S2	S3	S4	S5	S6
100 VAC	UP	DN	UP	DN	UP	DN
115 VAC	UP	UP	UP	UP	UP	UP
200 VAC	DN	DN	DN	DN	DN	DN
230 VAC	DN	UP	DN	UP	DN	UP

WARNING: The Voltage Selector can only be used with transformers designed to interface with this circuit. This Voltage Selector function will not function correctly with off-line supplies. Damage to the unit may result if this function is used improperly.

WARNING: Do not change the Voltage Selector switch settings if the Npaq drive chassis contains other AC devices that do not allow universal AC input (85-250 VAC).

WARNING: The Voltage Selector must be configured to match the AC line voltage. Damage to the unit may result if the Voltage Selector is set for the incorrect AC input voltage. Switches S1 and S3 are always set the same. Switches S2 and S4 are always set the same.

DANGER: Disconnect Mains power before opening chassis. Voltage selector settings must not be changed with Mains power applied to the unit.

WARNING: S1 through S6 must be set for the applied AC power input voltage. Setting S1 through S6 incorrectly may result in damage to the system.

WARNING: If the user changes the Voltage Selector settings, it is also the user's responsibility to change the Npaq AC power label located next to the AC inlet. Refer to the Section 1.1. for power ratings.

2.5. Motor Output Connectors

The Npaq can be used to drive three motor types: Brushless, DC Brush, and Stepper motors. DC Brush and brushless motors may use two feedback channels, one channel for position feedback and another channel for velocity feedback.

The DC brush, three-phase brushless, and stepper motor connections are made to the 5-pin high power "D" style motor power connectors (Axis 1-6) that are located on the rear panel. The pin assignments for these connectors are shown in Table 2-9 should you manufacture your own cables.

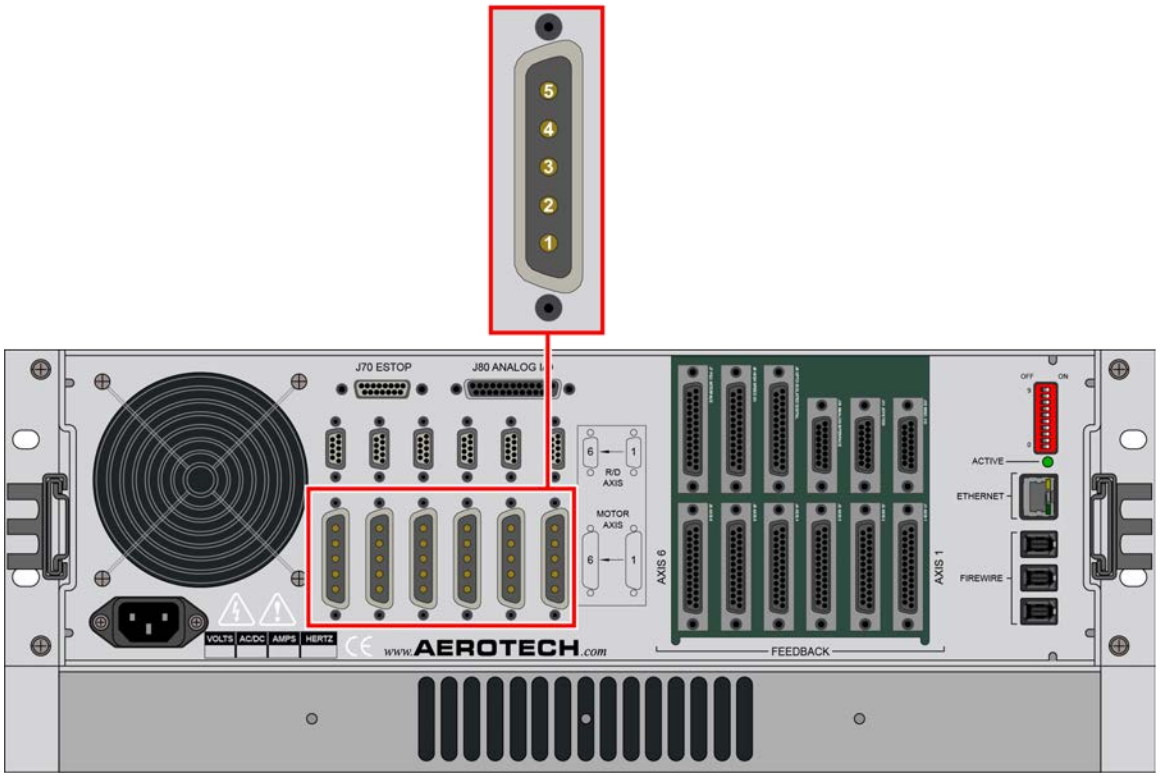


Figure 2-6: Motor Output Connections

Table 2-9: Motor Power Output Connector Pinout

Pin	Description	Wire Size
1	Brushless Phase A Motor Power / DC Brush + / Stepper	1.3 mm^2 (#16 AWG)
2	Brushless Phase B Motor Power / DC Brush - / Stepper	1.3 mm^2 (#16 AWG)
3	Brushless Phase C Motor Power / Stepper Returns	1.3 mm^2 (#16 AWG)
4	Reserved	1.3 mm^2 (#16 AWG)
5	Ground	1.3 mm^2 (#16 AWG)

Table 2-10: Mating Connector Part Numbers for the Motor Power Output Connector

Description	Aerotech P/N	Third Party Source P/N
Male 5 Pin D-Style	ECK01236	ITT Cannon DBM5W5PK87
Contact (QTY. 5)	ECK00660	ITT Cannon DM53745-7
Backshell	ECK00656	Amphenol 17-1726-2

2.5.1. Brushless Motor Connections

The configuration shown in Figure 2-7 is an example of a typical brushless motor connection.

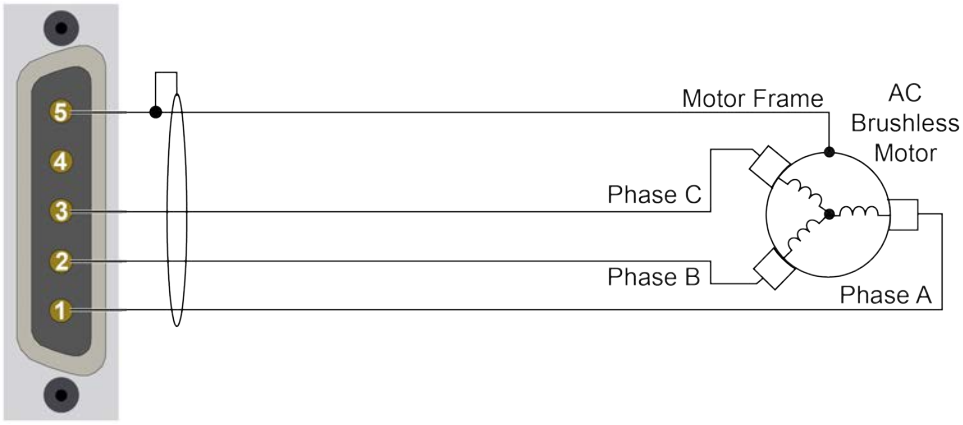


Figure 2-7: Brushless Motor Configuration

NOTE: Brushless motors are commutated electronically by the controller. The use of Hall effect devices for commutation is recommended.

The controller requires that the Back-EMF of each motor phase be aligned with the corresponding Hall-effect signal. To ensure proper alignment, motor, Hall, and encoder connections should be verified using one of the following methods: *powered*, through the use of a test program; or *unpowered* using an oscilloscope. Both methods will identify the A, B, and C Hall/motor lead sets and indicate the correct connections to the controller. Refer to Section 2.5.1.1. for powered motor phasing or Section 2.5.1.2. for unpowered motor and feedback phasing.

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

2.5.1.1. Powered Motor Phasing

Refer to the Motor Phasing Calculator in the Configuration Manager for motor, Hall, and encoder phasing.

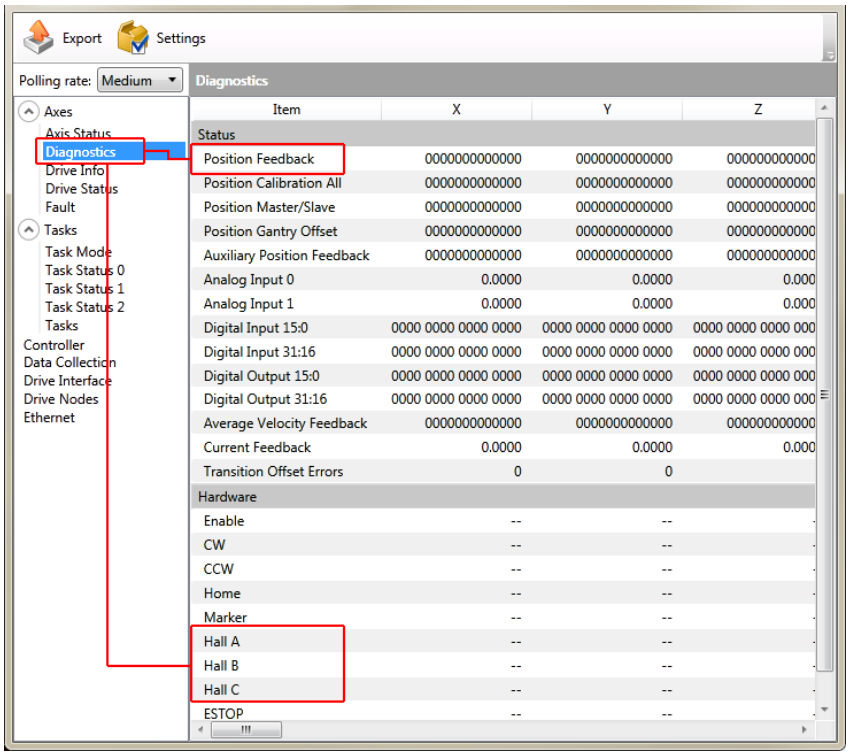


Figure 2-8: Encoder and Hall Signal Diagnostics

2.5.1.2. Unpowered Motor and Feedback Phasing

Disconnect the motor from the controller and connect the motor in the test configuration shown in Figure 2-9. This method will require a two-channel oscilloscope, a 5V power supply, and six resistors (10,000 ohm, 1/4 watt). All measurements should be made with the probe common of each channel of the oscilloscope connected to a neutral reference test point (TP4, shown in Figure 2-9). Wave forms are shown while moving the motor in the positive direction.

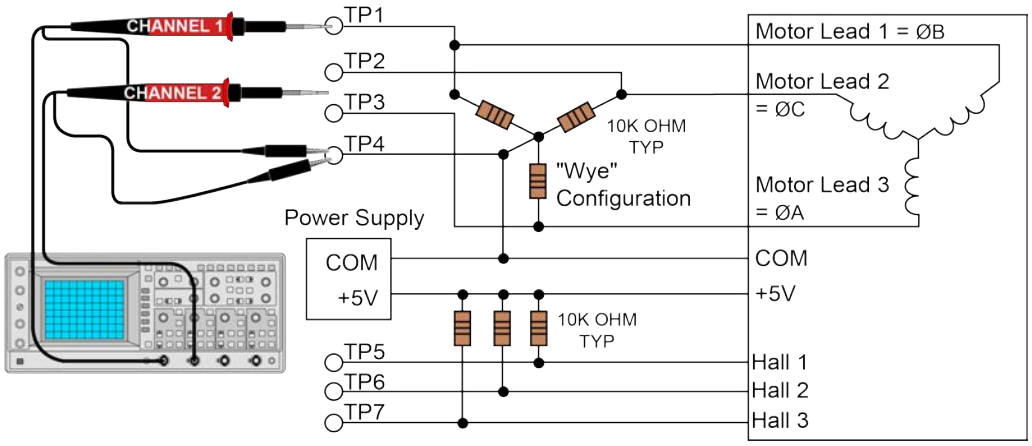


Figure 2-9: Motor Phasing Oscilloscope Example

With the designations of the motor and Hall leads of a third party motor determined, the motor can now be connected to an Aerotech system. Connect motor lead A to motor connector A, motor lead B to motor connector B, and motor lead C to motor connector C. Hall leads should also be connected to their respective feedback connector pins (Hall A lead to the Hall A feedback pin, Hall B to Hall B, and Hall C to Hall C). The motor is correctly phased when the Hall states align with the Back EMF as shown in (Figure 2-10). Use the CommutationOffset parameter to correct for Hall signal misalignment.

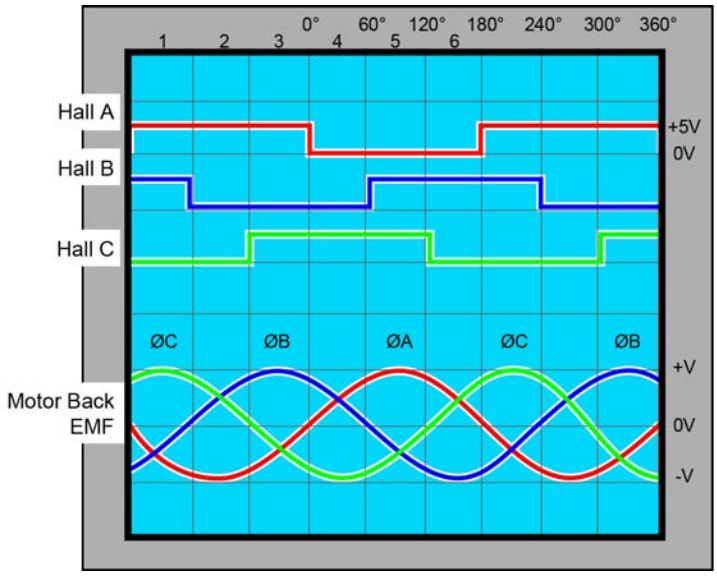


Figure 2-10: Brushless Motor Phasing Goal

2.5.2. DC Brush Motor Connections

The configuration shown in Figure 2-11 is an example of a typical DC brush motor connection. Refer to Section 2.5.2.1. for information on motor phasing.

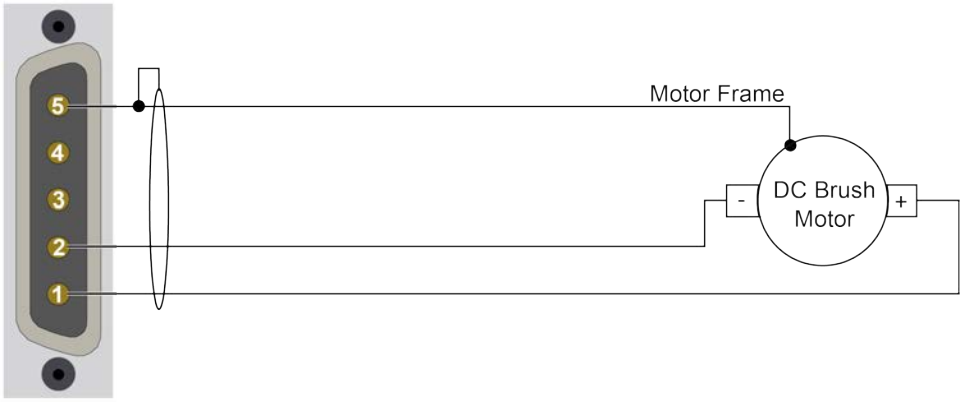


Figure 2-11: DC Brush Motor Configuration

2.5.2.1. DC Brush Motor Phasing

A properly phased motor means that the positive motor lead should be connected to the ØA motor terminal and the negative motor lead should be connected to the ØB motor terminal. To determine if the motor is properly phased, connect a voltmeter to the motor leads of an un-powered motor:

1. Connect the positive lead of the voltmeter to the one of the motor terminals.
2. Connect the negative lead of the voltmeter to the other motor terminal.
3. Rotate the motor clockwise (CW) by hand.

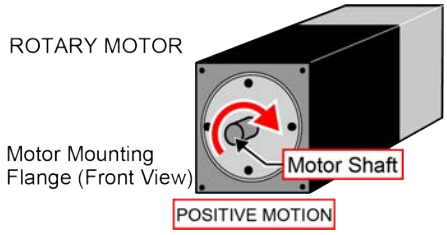


Figure 2-12: Clockwise Motor Rotation

4. If the voltmeter indicates a negative value, swap the motor leads and rotate the motor (CW, by hand) again. When the voltmeter indicates a positive value, the motor leads have been identified.
5. Connect the motor lead from the voltmeter to the ØA motor terminal on the Npaq. Connect the motor lead from the negative lead of the voltmeter to the ØB motor terminal on the Npaq.

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

2.5.3. Stepper Motor Connections

The configuration shown in Figure 2-13 is an example of a typical stepper motor connection. Refer to Section 2.5.3.1. for information on motor phasing.

In this case, the effective motor voltage is half of the applied bus voltage. For example, an 80V motor bus supply is needed to get 40V across the motor.

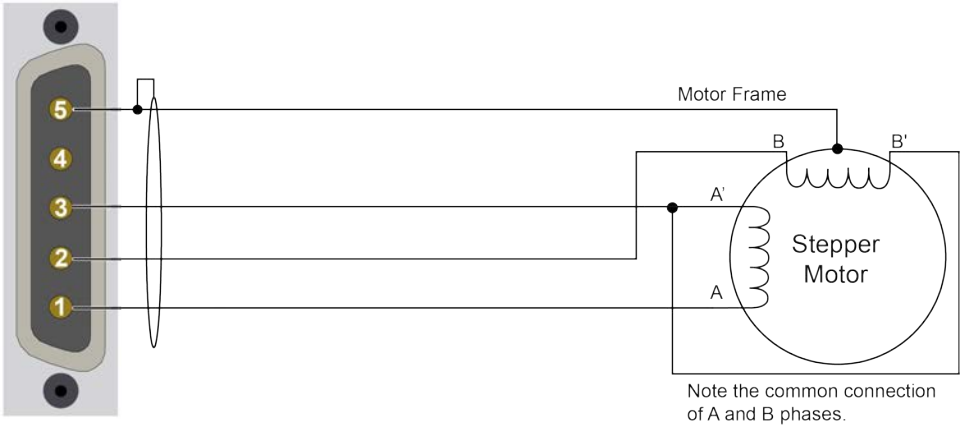


Figure 2-13: Stepper Motor Configuration

2.5.3.1. 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 CountsPerUnit 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.

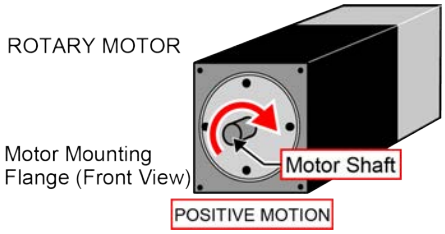


Figure 2-14: Clockwise Motor Rotation

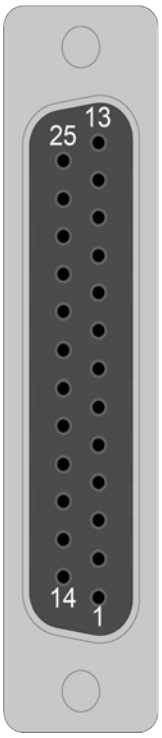
NOTE: If using standard Aerotech motors and cables, motor and encoder connection adjustments are not required.

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

2.6. Motor Feedback Connectors

The motor feedback connector (a 25-pin, D-style connector) has inputs for an encoder, limit switches, Hall-effect devices, motor over-temperature device, 5 Volt encoder and limit power, and optional brake connections. The connector pin assignment is shown in Table 2-11 with detailed connection information in the following sections.

Table 2-11: Motor Feedback Connector Pinout

Pin #	Description	In/Out/Bi	Connector
1	Chassis Frame Ground	N/A	
2	Motor Over Temperature Thermistor	Input	
3	+5V Power for Encoder (500 mA max)	Output	
4	No Connection	N/A	
5	Hall-Effect Sensor B (brushless motors only)	Input	
6	Encoder Marker Reference Pulse -	Input	
7	Encoder Marker Reference Pulse +	Input	
8	MXR Sync - (factory use only)	Output	
9	Encoder Setup (factory use only)	Input	
10	Hall-Effect Sensor A (brushless motors only)	Input	
11	Hall-Effect Sensor C (brushless motors only)	Input	
12	Clockwise End of Travel Limit	Input	
13	Optional Brake - Output	Output	
14	Encoder Cosine +	Input	
15	Encoder Cosine -	Input	
16	+5V Power for Limit Switches (500 mA max)	Output	
17	Encoder Sine +	Input	
18	Encoder Sine -	Input	
19	MHX Sync + (factory use only)	Bidirectional	
20	Signal Common for Limit Switches	N/A	
21	Signal Common for Encoder	N/A	
22	Home Switch Input	Input	
23	Encoder Fault Input	Input	
24	Counterclockwise End of Travel Limit	Input	
25	Optional Brake + Output	Output	

(1) Pins 3, 6, 7, 14, 15, 17 and 18 have a different function when used with the resolver input option, see Section 3.6. for more information.

Table 2-12: Mating Connector Part Numbers for the Motor Feedback Connector

Mating Connector	Aerotech P/N	Third Party P/N
25-Pin D-Connector	ECK00101	FCI DB25P064TXLF
Backshell	ECK00656	Amphenol 17E-1726-2

2.6.1. Encoder Interface (J1-J6)

The Npaq is equipped with standard and auxiliary encoder feedback channels. The standard encoder interface is accessible through the Motor Feedback connector. The standard version will accept an RS-422 differential line driver signal.

Refer to Section 2.6.1.3. for encoder feedback phasing. Refer to Section 2.8. for the auxiliary encoder channel.

NOTE: Encoder wiring should be physically isolated from motor, AC power, and all other power wiring.

Table 2-13: Encoder Interface Pins on the Motor Feedback Connector

Pin #	Description	In/Out/Bi
1	Chassis Frame Ground	N/A
3	+5V Power for Encoder (500 mA max)	Output
6	Encoder Marker Reference Pulse -	Input
7	Encoder Marker Reference Pulse +	Input
14	Encoder Cosine +	Input
15	Encoder Cosine -	Input
17	Encoder Sine +	Input
18	Encoder Sine -	Input
21	Signal Common for Encoder	N/A

(1) Pins 3, 6, 7, 14, 15, 17 and 18 have a different function when used with the resolver input option, see Section 3.6. for more information.

2.6.1.1. RS-422 Line Driver Encoder (Standard)

The standard encoder interface accepts an RS-422 differential quadrature line driver signal. Invalid or missing signals will cause a feedback fault when the axis is enabled.

An analog encoder is used with the -MXR option (refer to Section 2.6.1.2. for more information).

Table 2-14: Encoder Specifications

Specification	Value
Encoder Frequency	10 MHz maximum (25 nsec minimum edge separation)
x4 Quadrature Decoding	40 million counts/sec

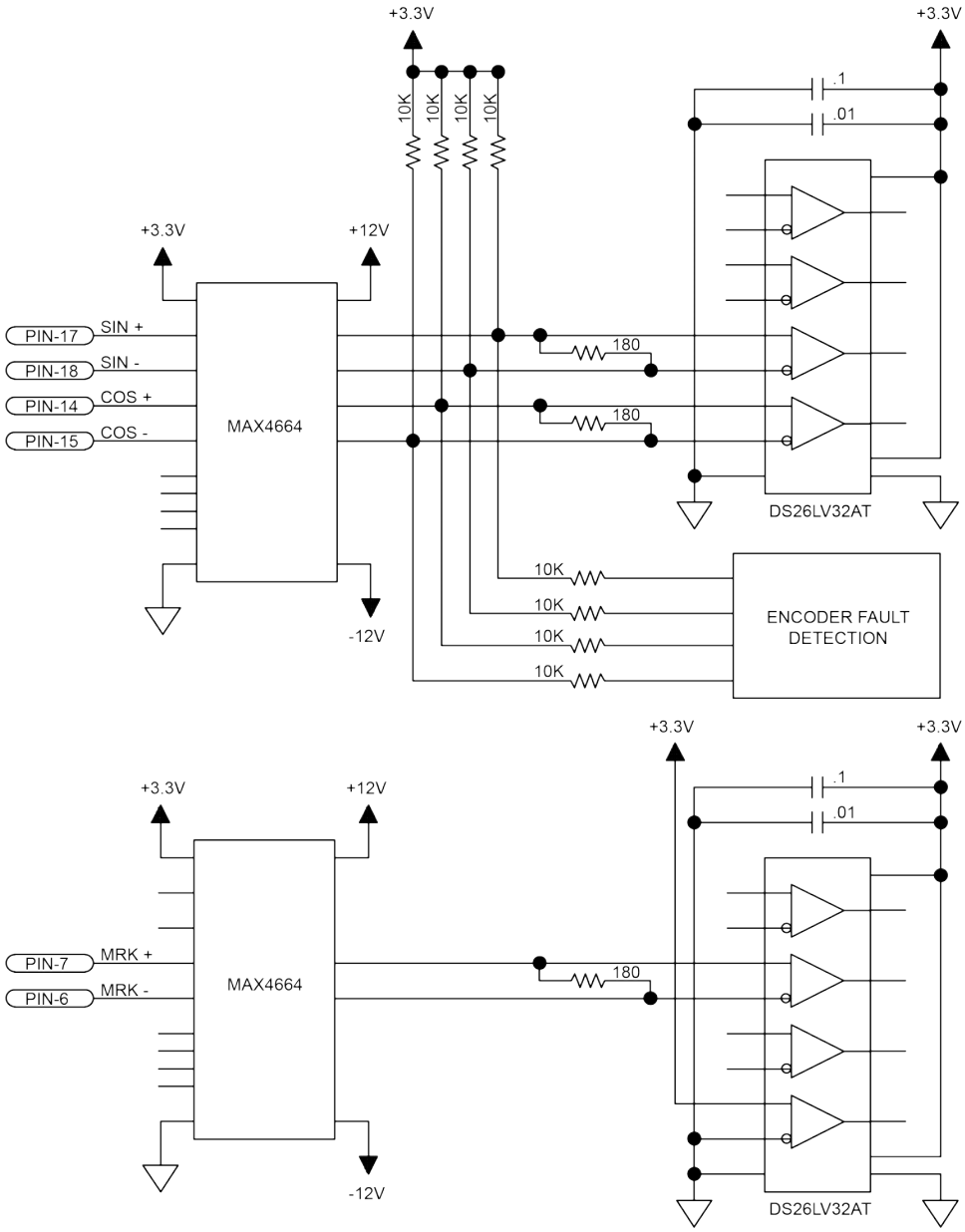


Figure 2-15: Line Driver Encoder Interface

2.6.1.2. MXR Option (Analog Encoder Interface)

If the -MXR option (-MXR or -MXR2M) has been purchased, the standard encoder channel will accept a differential analog encoder input signal. The interpolation factor is determined by the EncoderMultiplicationFactor parameter and is software selectable (refer to the A3200 Help file

Table 2-15: Analog Encoder Specifications

Specification	MXR	MXR2M
Input Frequency (max)	200 kHz	2 MHz
Input Amplitude	0.6 to 2.25 Vpk-Vpk	0.6 to 2.25 Vpk-Vpk
Interpolation Factor (software selectable)	16,384	16,384
MXR Interpolation Latency	~ 3.25 µsec (analog input to quadrature output)	~ 3.25 µsec (analog input to quadrature output)

Refer to Figure 2-16 for the MXR typical input circuitry.

The encoder interface pin assignment is indicated in Section 2.6.1.

The gain, offset, and phase balance of the analog Sine and Cosine encoder input signals can all be adjusted via controller parameters. Encoder signals should be adjusted using the Feedback Tuning tab of the Digital Scope, which will automatically adjust the encoder parameters for optimum performance. See the A3200 Help file for more information.

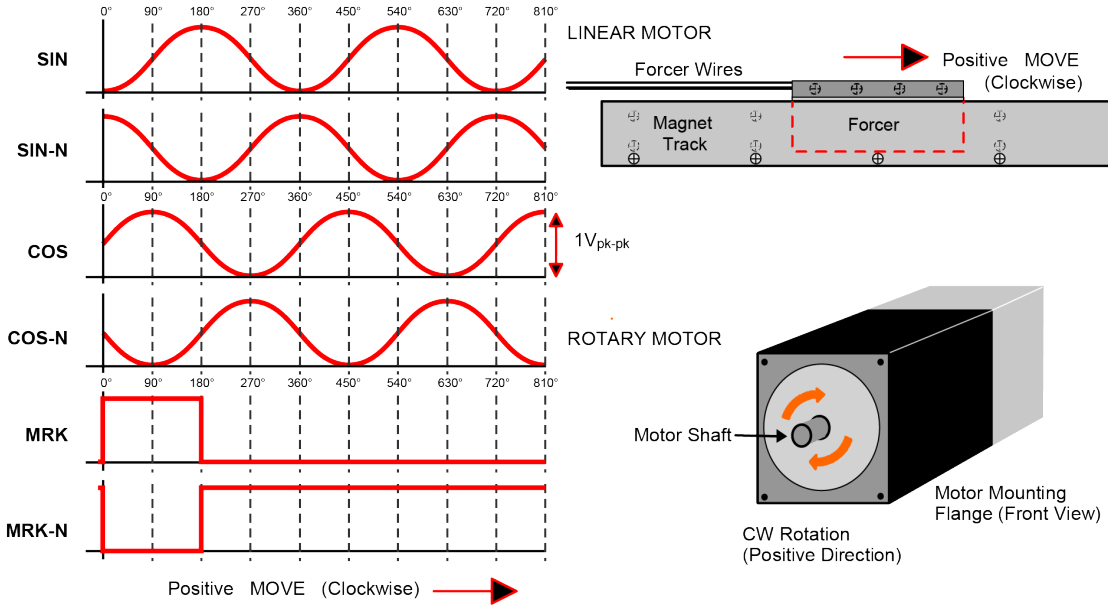


Figure 2-16: Analog Encoder Phasing Reference Diagram (-MXR option)

NOTE: The input amplitude is measured peak to peak for any encoder signal (sin, sin-n, cos, cos-n) relative to signal common. These signals have a typical offset voltage of 2V to 2.5V.

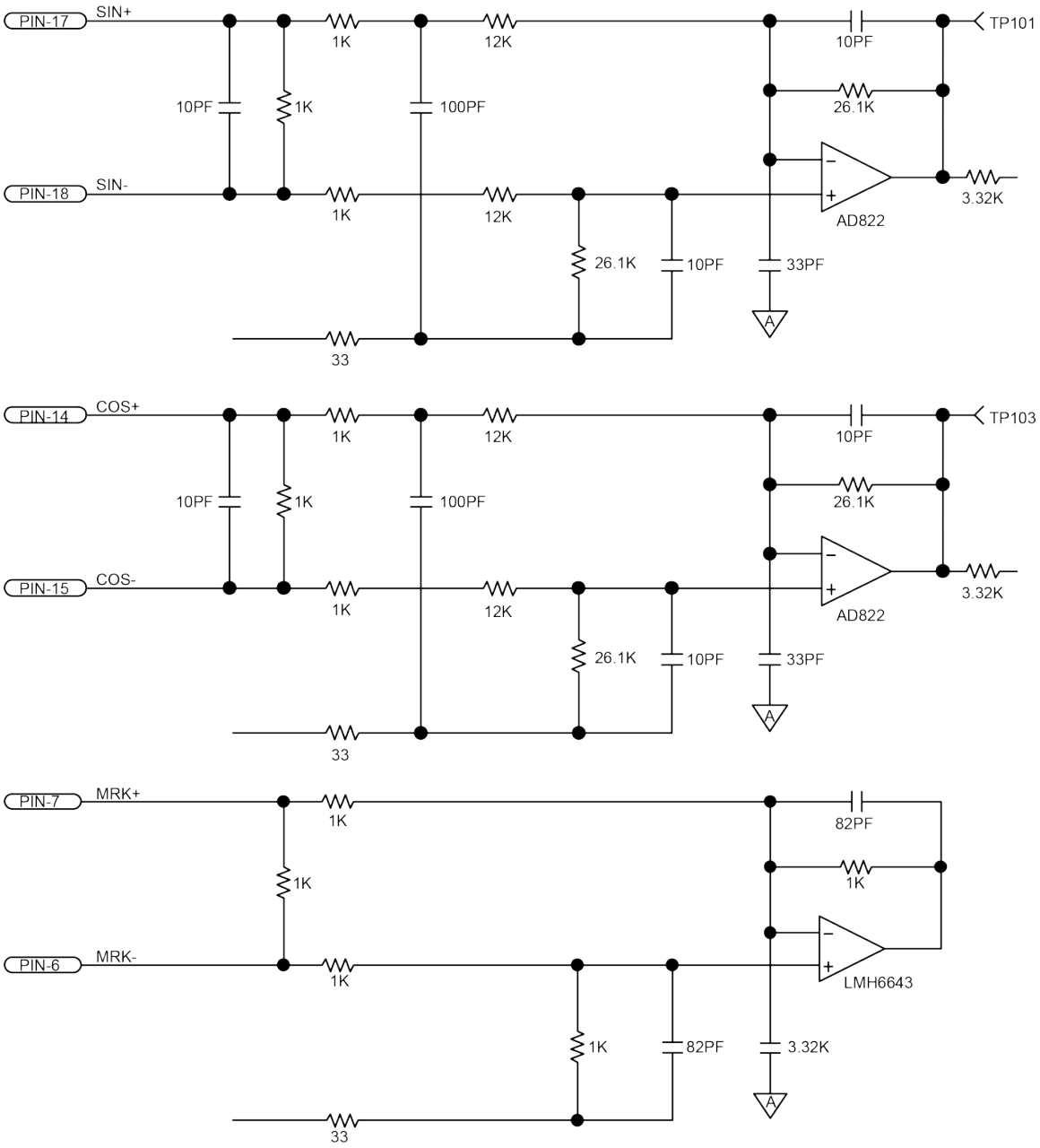


Figure 2-17: MXR Analog Encoder Interface

2.6.1.3. Encoder Phasing

Incorrect encoder polarity will cause the system to fault when enabled or when a move command is issued. Figure 2-18 illustrates the proper encoder phasing for clockwise motor rotation (or positive forcer movement for linear motors). To verify, move the motor by hand in the CW (positive) direction while observing the position of the encoder in the diagnostics display (see Figure 2-19). The Motor Phasing Calculator in the Configuration Manager can be used to determine proper encoder polarity.

For dual loop systems, the velocity feedback encoder is displayed in the diagnostic display (Figure 2-19).

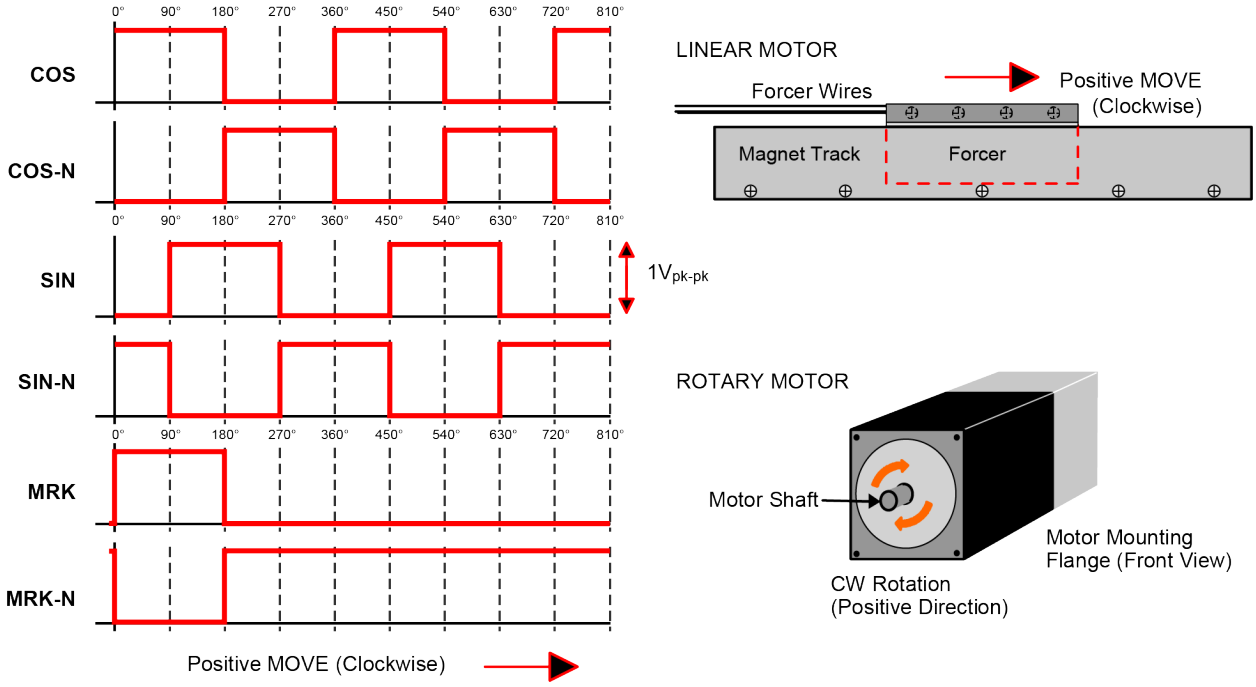


Figure 2-18: Encoder Phasing Reference Diagram (Standard)

NOTE: Encoder manufacturers may refer to the encoder signals as A, B, and Z. The proper phase relationship between signals is shown in Figure 2-18.

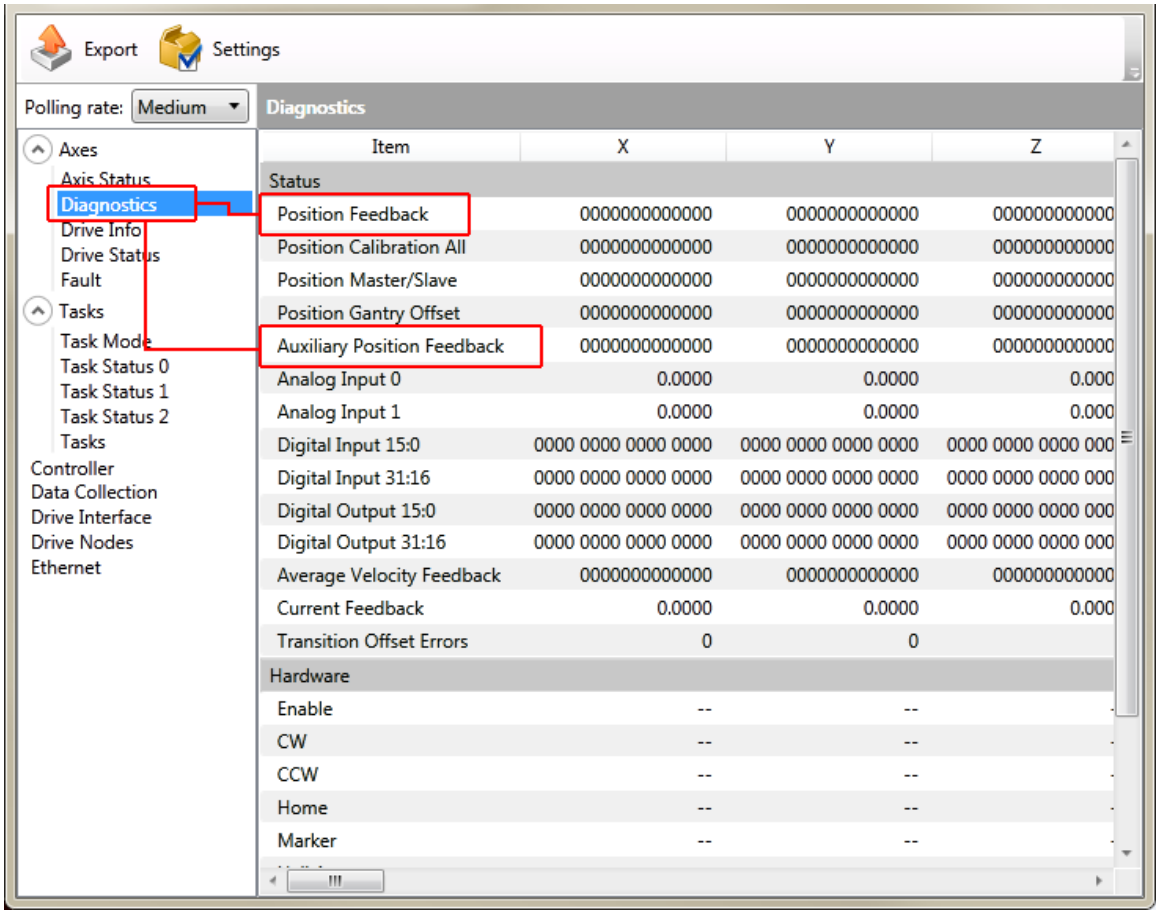


Figure 2-19: Position Feedback in the Diagnostic Display

2.6.2. Hall-Effect Interface

The Hall-effect switch inputs are recommended for AC brushless motor commutation but not absolutely required. The Hall-effect inputs accept 5 VDC level signals. Hall states (0,0,0) or (1,1,1) are invalid and will generate a "Hall Fault" axis fault.

Refer to Section 2.5.1.1. for Hall-effect device phasing.

Table 2-16: Hall-Effect Feedback Pins on the Motor Feedback Connector

Pin #	Description	In/Out/Bi
1	Chassis Frame Ground	N/A
3	+5V Power for Encoder (500 mA max)	Output
5	Hall-Effect Sensor B (brushless motors only)	Input
10	Hall-Effect Sensor A (brushless motors only)	Input
11	Hall-Effect Sensor C (brushless motors only)	Input
21	Signal Common for Encoder	N/A
(1) Pins 3, 6, 7, 14, 15, 17 and 18 have a different function when used with the resolver input option, see Section 3.6. for more information.		

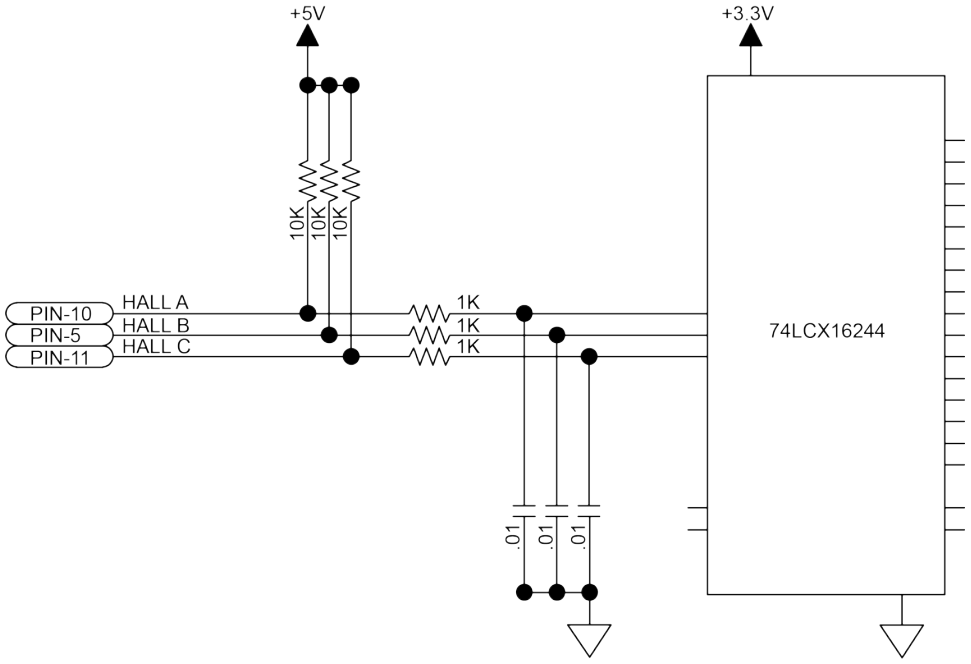


Figure 2-20: Hall-Effect Inputs

2.6.3. Thermistor Interface

The thermistor input is used to detect a motor over temperature condition by using a positive temperature coefficient sensor. As the temperature of the sensor increases, so does the resistance. Under normal operating conditions, the resistance of the thermistor is low (i.e., 100 ohms) which will result in a low input signal. As the increasing temperature causes the thermistor's resistance to increase, the signal will be seen as a logic high triggering an over temperature fault. The nominal trip value of the sensor is 1k Ohm.

Table 2-17: Thermistor Pin on the Motor Feedback Connector

Pin #	Description	In/Out/Bi
2	Motor Over Temperature Thermistor	Input

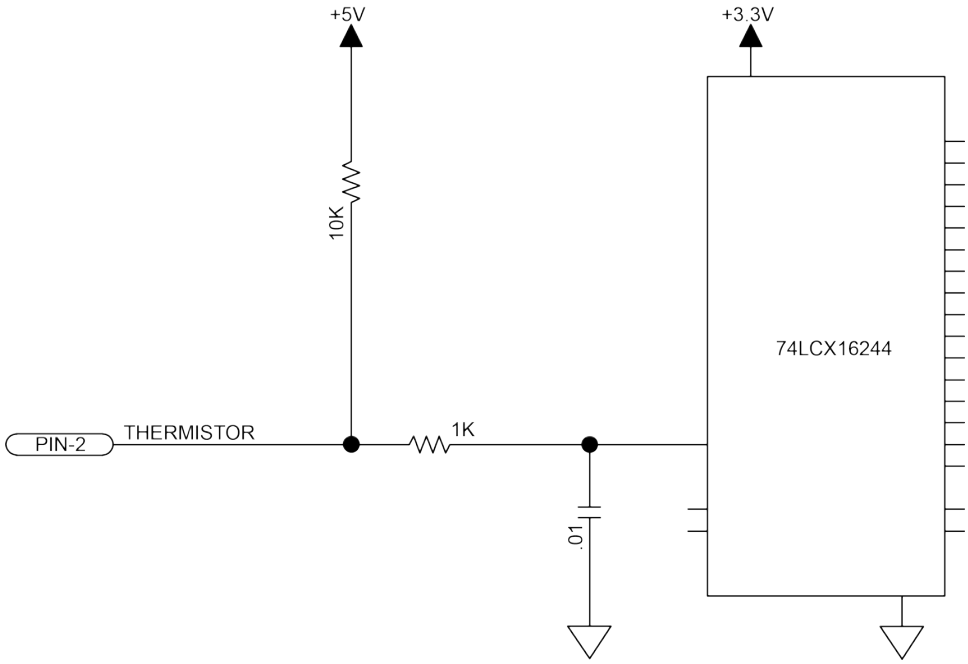


Figure 2-21: Thermistor Interface Input

2.6.4. End Of Travel Limit Input Interface

End of Travel (EOT) limits are required to define the end of the physical travel on linear axes. Positive or clockwise motion is stopped by the clockwise (CW) end of travel limit input. Negative or 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 EOT limit is typically used instead. All of the end-of-travel limit inputs accept 5 VDC level signals. Limit directions are relative to the encoder polarity in the diagnostics display (refer to Figure 2-22).

The active state of the EOT limits is software selectable (by the EndOfTravelLimitSetup axis parameter).

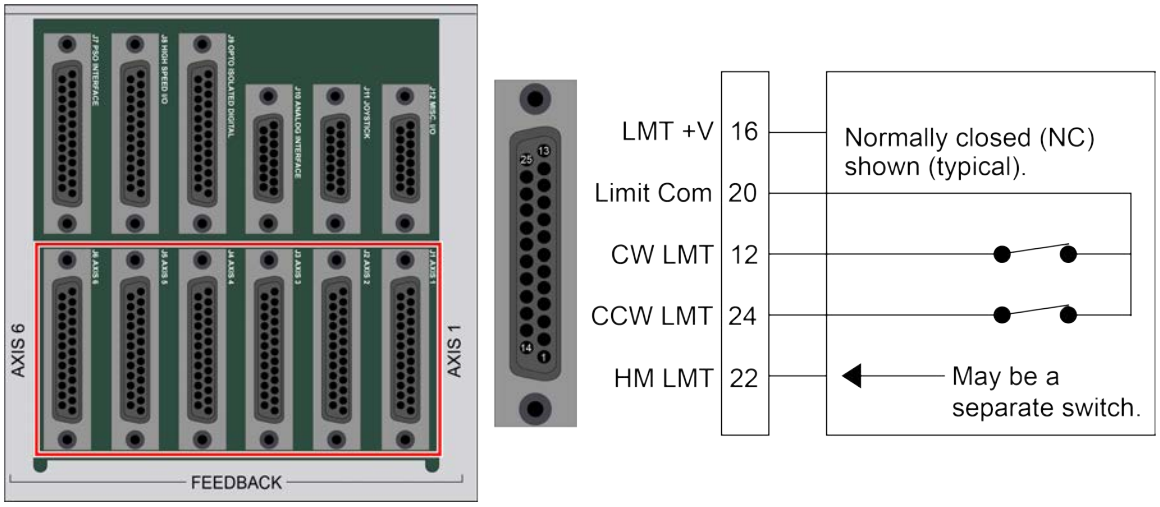


Figure 2-22: End of Travel Limit Input Connections

Table 2-18: End of Travel Limit Input Pins on the Motor Feedback Connector

Pin #	Description	In/Out/Bi
12	Clockwise End of Travel Limit	Input
16	+5V Power for Limit Switches (500 mA max)	Output
20	Signal Common for Limit Switches	N/A
22	Home Switch Input	Input
24	Counterclockwise End of Travel Limit	Input

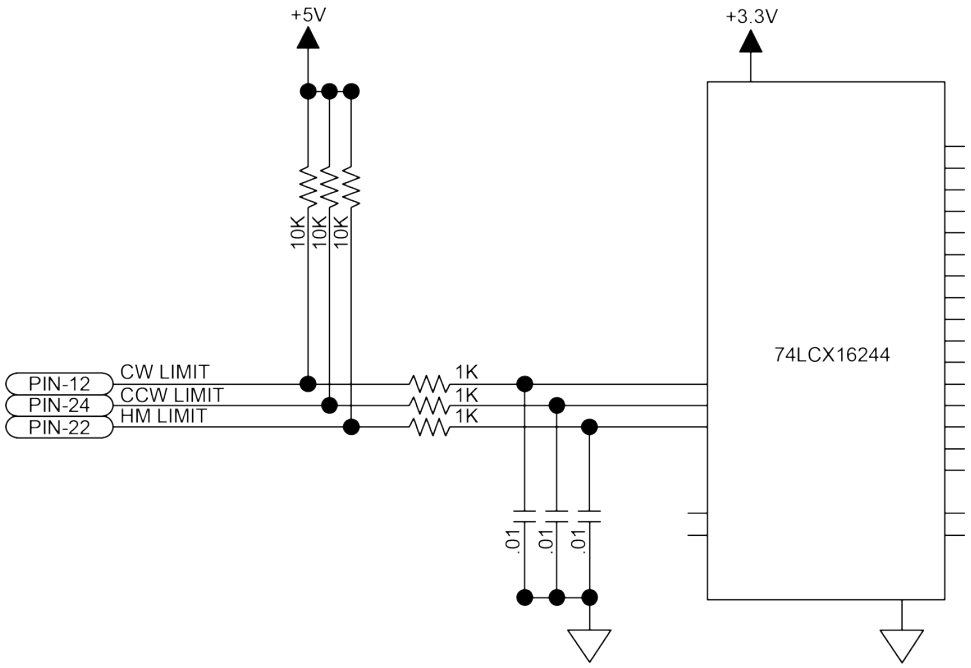


Figure 2-23: End of Travel Limit Interface Input

2.6.4.1. End Of Travel Limit Phasing

If the EOT 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 at the motor feedback connector. The logic level of the EOT limit inputs may be viewed in the diagnostic display (shown in Figure 2-24).

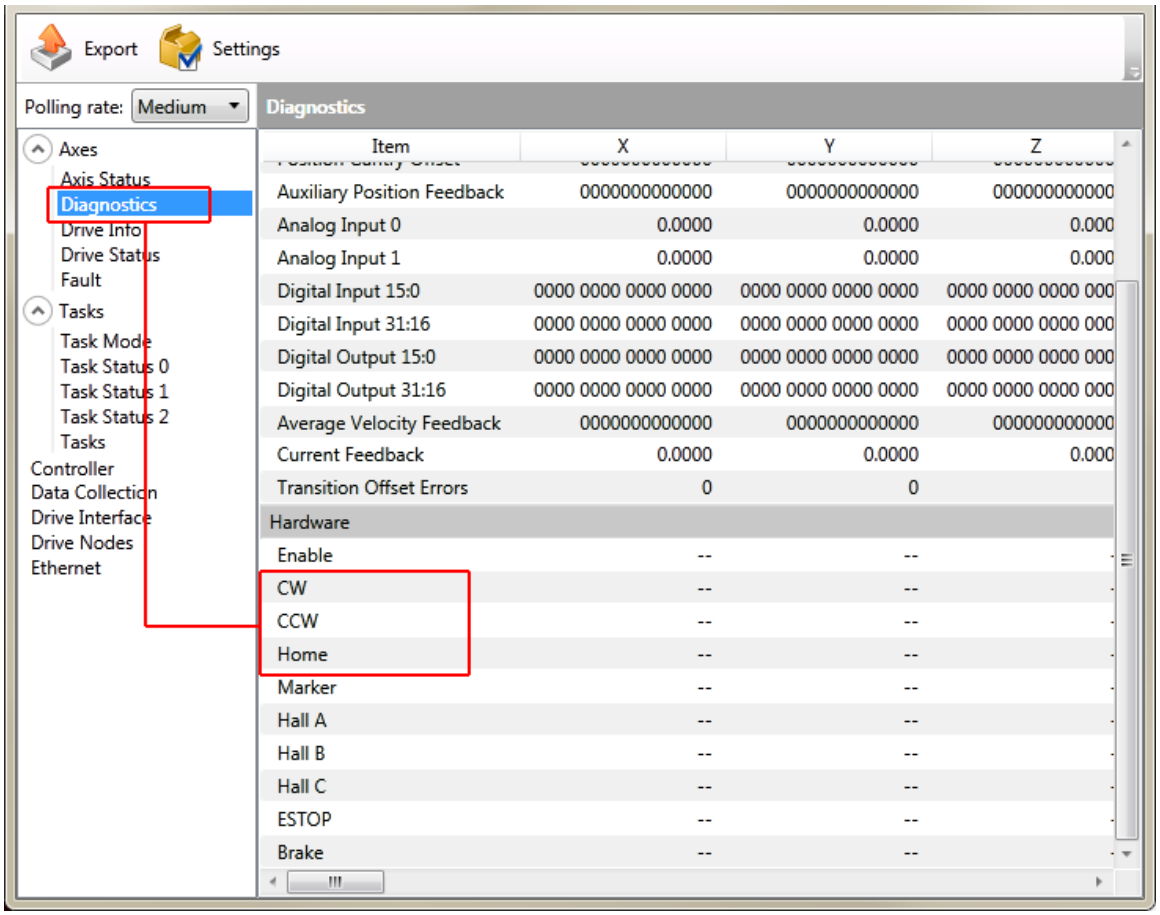


Figure 2-24: Limit Input Diagnostic Display

2.6.5. Encoder Fault Interface

The encoder fault input is for use with encoders that have a fault output. This is provided by some manufactures and indicates a loss of encoder function. The active state of this input is parameter configurable and the controller should be configured to disable the axis when the fault level is active.

Table 2-19: Encoder Fault Pin on the Motor Feedback Connector

Pin #	Description	In/Out/Bi
23	Encoder Fault Input	Input

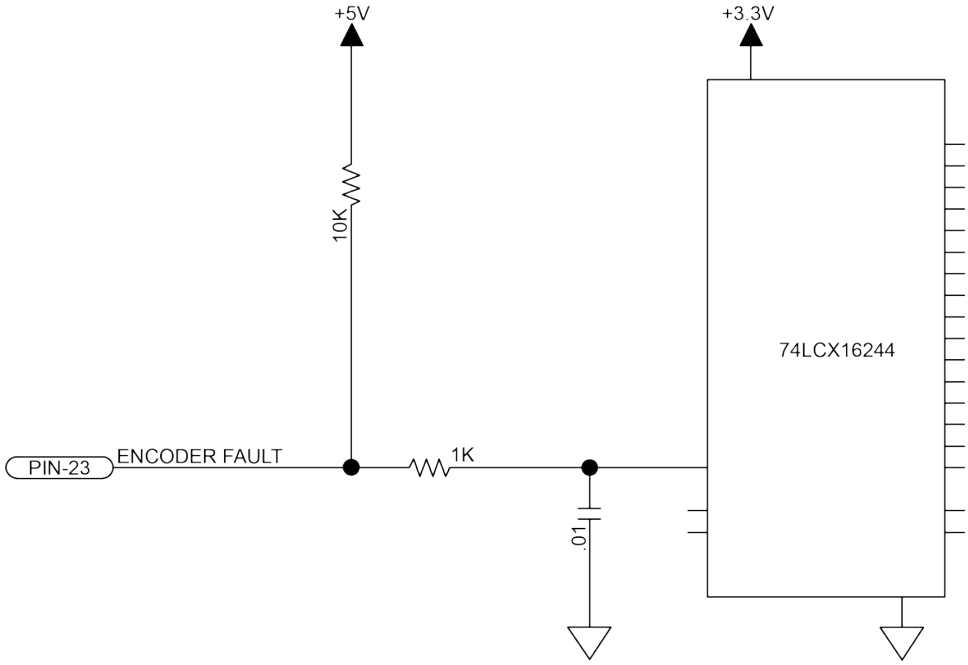


Figure 2-25: Encoder Fault Interface Input

2.6.6. Brake Output

The Brake Output pins provide a direct connection to the solid state relay on the Npaq. The brake output pins permit the brake to be wired with other signals in the feedback cable. The brake is configured for automatic or manual control using controller parameters (refer to the A3200 Help file for more information).

Refer to Section 2.12.3. for more information on using the brake output with the solid state relay.

Table 2-20: Brake Output Pins on the Motor Feedback Connector

Pin #	Description	In/Out/Bi
13	Optional Brake - Output	Output
25	Optional Brake + Output	Output

2.7. Position Synchronized Output (PSO) Connector

The Npaq PSO output signal is available in three formats: differential line driver, open collector, and opto isolated. The opto-isolated output is most commonly used and provides galvanic isolation between the Npaq and user electronics. The differential line driver output provides the highest speed and best noise immunity especially over large cable distances. Note that the line driver output requires an RS-422 compatible receiver along with a 100 Ohm (typ) terminating resistor. The open collector output may be used to drive an opto-coupler LED or connect directly with TTL level electronics. The line driver and open collector outputs are not galvanically isolated from the Npaq. For programming information, refer to the A3200 Help file.

Table 2-21: PSO Interface Connector Pinout (J7)

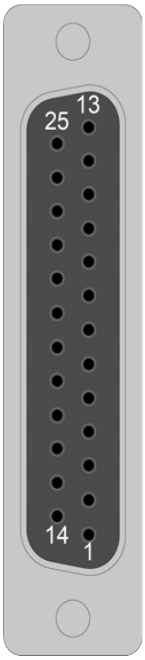
Pin #	Description	In/Out/Bi	Connector
1	Differential PSO Output 1 +	Output	
2	Differential PSO Output 1 -	Output	
3	Differential PSO Output 2 +	Output	
4	Differential PSO Output 2 -	Output	
5	Reserved	Input	
6*	PSO Opto Output	Output	
7*	PSO Opto Return	Input	
8	PSO Open Collector Output	Output	
9	Sync Output 1 (Reserved)	Output	
10	Sync Output 2 (Reserved)	Output	
11	Sync Output 3 (Reserved)	Output	
12	Sync Output 4 (Reserved)	Output	
13	Sync Output 5 (Reserved)	Output	
14	Sync Output 6 (Reserved)	Output	
15	Sync Input 1 (Reserved)	Input	
16	Sync Input 2 (Reserved)	Input	
17	Sync Input 3 (Reserved)	Input	
18	Sync Input 4 (Reserved)	Input	
19	Sync Input 5 (Reserved)	Input	
20	Sync Input 6 (Reserved)	Input	
21	PSO Opto-Isolated Interlock +	Input	
22	PSO Opto-Isolated Interlock -	Input	
23	Reset (Active Low)	Output	
24	Common	N/A	
25	+ 5 V (500 mA max)	Output	

Table 2-22: Mating Connector Part Numbers for the PSO Connector

Mating Connector	Aerotech P/N	Third Party P/N
25-Pin D-Connector	ECK00101	FCI DB25P064TXLF
Backshell	ECK00656	Amphenol 17E-1726-2

2.7.1. PSO Opto Output (J7)

The PSO OPTO OUT is electrically isolated and does not require an external power source to operate. The output may be used to source (or sink) current (as shown in Figure 2-26 and Figure 2-27).

By default, JP16 is installed in the 1-2 position for normally open operation. If the PSO-NC option is ordered, JP16 is installed in the 2-3 position giving normally-closed operation. This mode should be used with caution since the Npaq cannot maintain the closed state when its AC mains power is turned off. The PSO-NC (JP16 2-3 setting) should not be used when fail-safe operation is required. JP16 jumper settings are shown in Table 2-23. Refer to Figure 4-3 for the JP16 jumper location.

Table 2-23: PSO Output Polarity Settings for JP16

PSO Output Polarity	JP16 Setting
Normally Open	1-2 * (Recommended)
Normally Closed	2-3

Table 2-24: Output Specifications

Description	Specification
Maximum Voltage	24 V
Current	250 mA
Latency	120 ns
Maximum Frequency	12.5 MHz

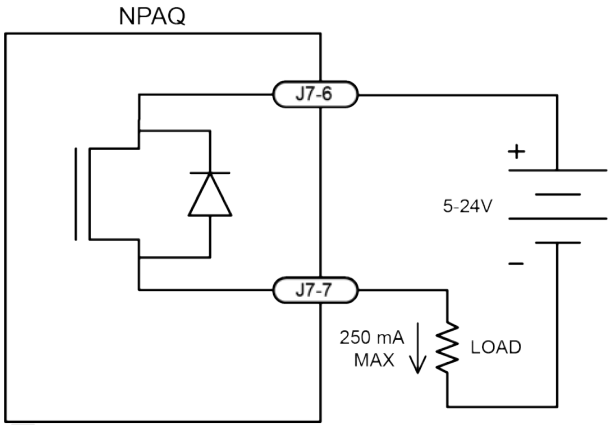


Figure 2-26: PSO Output Sources Current

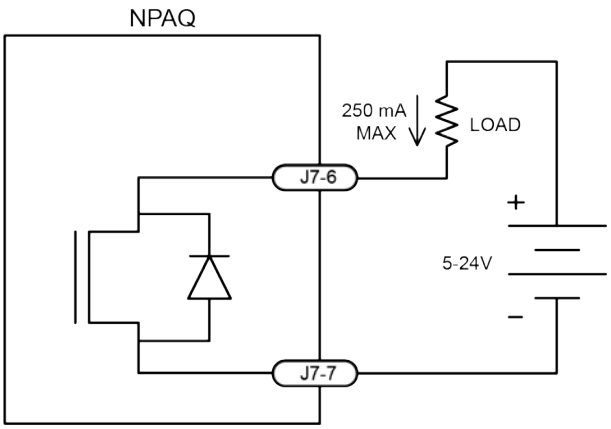


Figure 2-27: PSO Output Sinks Current

2.7.2. PSO Differential Outputs (J7)

The PSO Output is also available in differential and open collector format (as shown in Figure 2-28 and Figure 2-29). The differential format is recommended for maximum noise immunity. Differential and open-collector outputs are active low polarity only. JP16 does not change the active polarity of these signals.

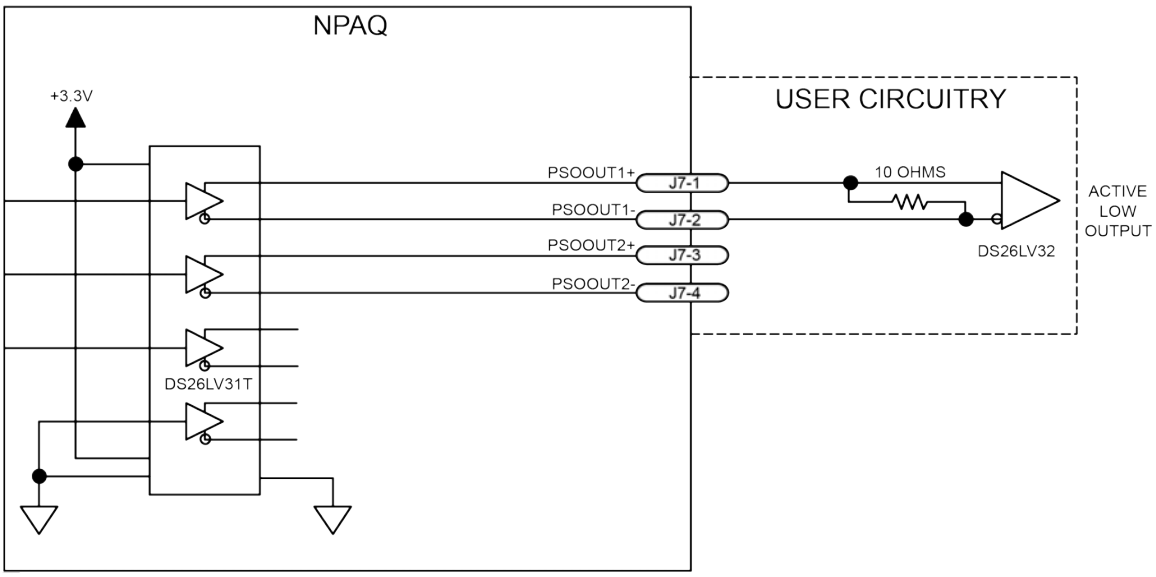


Figure 2-28: PSO Output 1 and 2 Differential Outputs

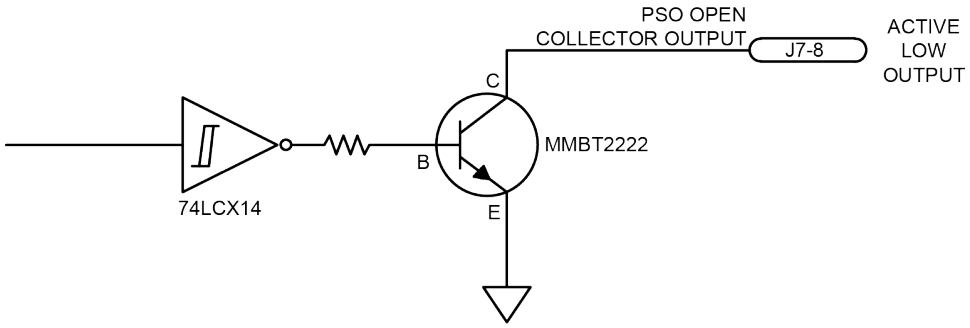


Figure 2-29: PSO Opto-Isolated Output and PSO Open Collector Outputs

2.7.3. PSO Interlock (J7)

The PSOILOCK (PSO Interlock) input signal is shown in Figure 2-30 and it may be used to inhibit pulse generation. To allow pulses to occur, the PSOILOCK input signal must be forward biased or it must be disabled using the "Npaq PSO Interlock" setting of the IOSetup parameter. See the A3200 Help file for more information. Table 2-25 shows the PSO Interlock specifications. Table 2-26 shows the reset specifications.

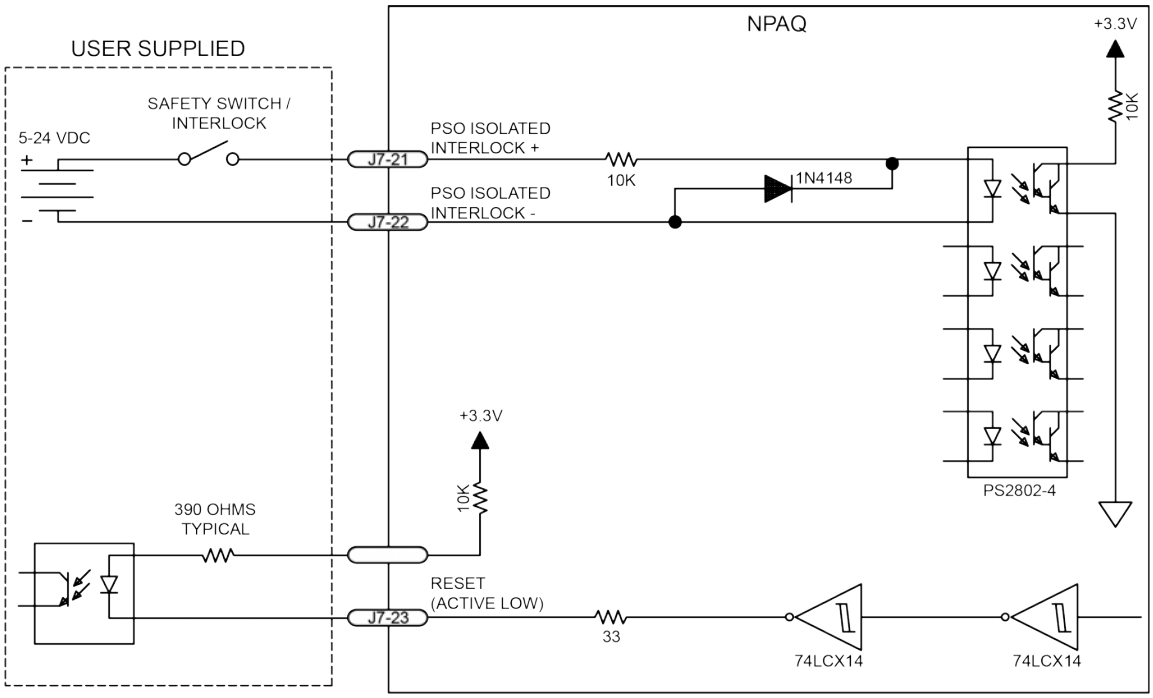


Figure 2-30: PSO Interlock Opto Input and Reset Output

Table 2-25: PSO Interlock Specifications

Description	Specification
Input Voltage Range	5 - 24 V

Table 2-26: Reset Specifications

Description	Specification
Output Voltage Level	LVTTL (3.3 V)
Max. Current (Sink / Source)	24 ma
Output Type	Active Low

2.7.4. PSO SYNC IO (J7)

The SYNCOUT (Figure 2-31) and SYNCIN (Figure 2-32) signals are for Internal use only. SYNCOUT signal specifications are provided in Table 2-27 and the SYNCIN signal specifications are listed in Table 2-28.

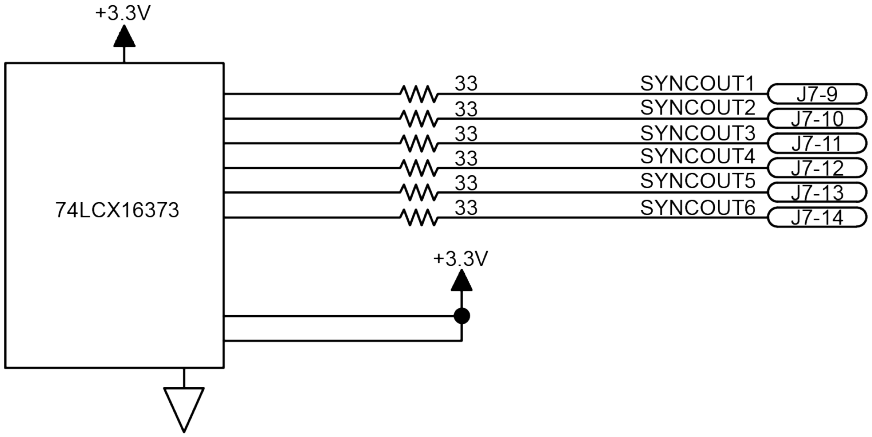


Figure 2-31: SYNCOUT (1-6) Outputs

Table 2-27: SYNCOUT Specifications

Description	Specification
Output Type	LVTTL (0 - 3.3 Volts)
Max Current	24 ma (Source & Sink)

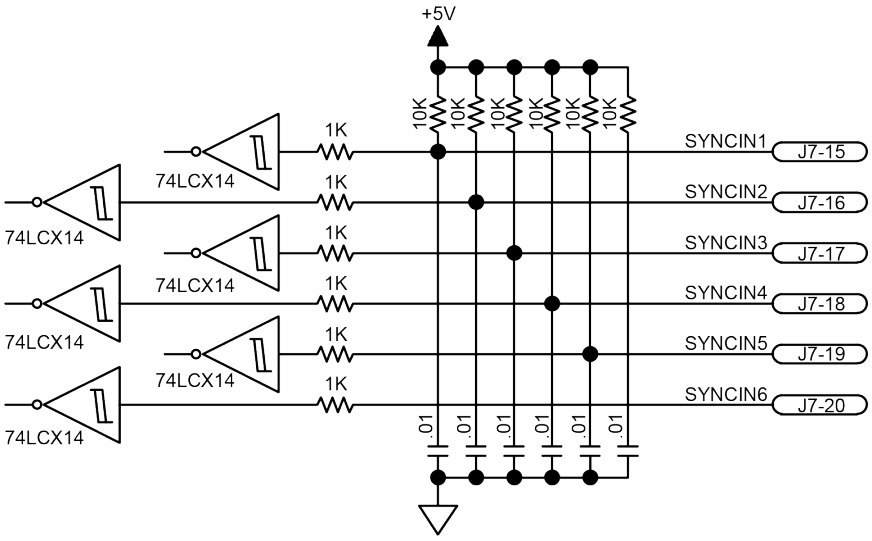


Figure 2-32: SYNCIN (1-6) Outputs

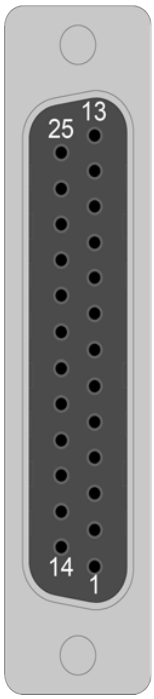
Table 2-28: SYNCIN Specifications

Description	Specification
Output Type	TTL
Input Logic Levels	0 Volt / 5 Volt

2.8. High-Speed I/O Connector (J8)

The High-Speed I/O port (J8) is a 25 pin 'D' style connector located on the Rear Panel Interface board and is accessible at the rear of the Npaq chassis. These devices have high data rates and low delay times. There are six high speed differential outputs (pins 1-12), four high speed differential inputs (pins 13-20) and three high speed bidirectional I/O lines (pins 21-23).

Table 2-29: High-Speed I/O Connector Pinout (J8)

Pin #	Description	In/Out/Bi	Connector
1	Differential Output 8+ / Sin 1+	Output	
2	Differential Output 8- / Sin 1-	Output	
3	Differential Output 9+ / Cos 1 +	Output	
4	Differential Output 9- / Cos 1 -	Output	
5	Differential Output 10+ / Sin 2 +	Output	
6	Differential Output 10-/ Sin 2 -	Output	
7	Differential Output 11+/Cos2+/Clk +	Output	
8	Differential Output 11- /Cos2-/ Clk -	Output	
9(1)	Differential Output 12+ / Sin 3+ / Dir+	Output	
10(1)	Differential Output 12- / Sin 3- / Dir -	Output	
11(1)	Differential Output 13+ / Cos 3+	Output	
12(1)	Differential Output 13- / Cos 3-	Output	
13	Differential Input 17+ / Aux Encoder 1 Sin +	Input	
14	Differential Input 17- / Aux Encoder 1 Sin -	Input	
15	Differential Input 18+ / Aux Encoder 1 Cos +	Input	
16	Differential Input 18- / Aux Encoder 1 Cos -	Input	
17(1)	Differential Input 19+ / Aux Encoder 2 Sin +	Input	
18(1)	Differential Input 19- / Aux Encoder 2 Sin -	Input	
19(1)	Differential Input 20+ / Aux Encoder 2 Cos +	Input	
20(1)	Differential Iinput 20- / Aux Encoder 2 Cos -	Input	
21(1)	Input 14 / Output 14	Bidirectional	
22(1)	Input 15 / Output 15	Bidirectional	
23	Input 16 / Output 16	Bidirectional	
24	Common	N/A	
25	+5 Volts (Fused) (500 mA max)	Output	

(1) These pins are not available to the user when the Analog I/O Board option is installed.

Table 2-30: Mating Connector Part Numbers for the High-Speed I/O Connector

Mating Connector	Aerotech P/N	Third Party P/N
25-Pin D-Connector	ECK00101	FCI DB25P064TXLF
Backshell	ECK00656	Amphenol 17E-1726-2

2.8.1. High-Speed Differential Outputs (J8)

The High-Speed Outputs can be used for general purpose user I/O or as special firmware features (Encoder Echo and Clock and Direction).

Encoder Echo

The High-Speed Outputs can be used to echo up to three channels of encoder quadrature signals (see Table 2-31). For more information on echoing encoder signals out of the Npaq, see the ENCODER OUT command in the A3200 Help file.

Clock and Direction

High-Speed Outputs 11 and 12 (pins 7 through 10) can be used as clock and direction outputs for driving an external device. For more information on using clock and direction outputs with the Npaq, see the PULSE command in the A3200 Help file.

Table 2-31: High-Speed Differential Output Pins on the High-Speed I/O Connector (J8)

Pin #	Description	In/Out/Bi
1	Differential Output 8+ / Sin 1+	Output
2	Differential Output 8- / Sin 1-	Output
3	Differential Output 9+ / Cos 1 +	Output
4	Differential Output 9- / Cos 1 -	Output
5	Differential Output 10+ / Sin 2 +	Output
6	Differential Output 10-/ Sin 2 -	Output
7	Differential Output 11+/Cos2+/Clk +	Output
8	Differential Output 11- /Cos2-/ Clk -	Output
9(1)	Differential Output 12+ / Sin 3+ / Dir+	Output
10(1)	Differential Output 12- / Sin 3- / Dir -	Output
11(1)	Differential Output 13+ / Cos 3+	Output
12(1)	Differential Output 13- / Cos 3-	Output

(1) These pins are not available to the user when the Analog I/O Board option is installed.

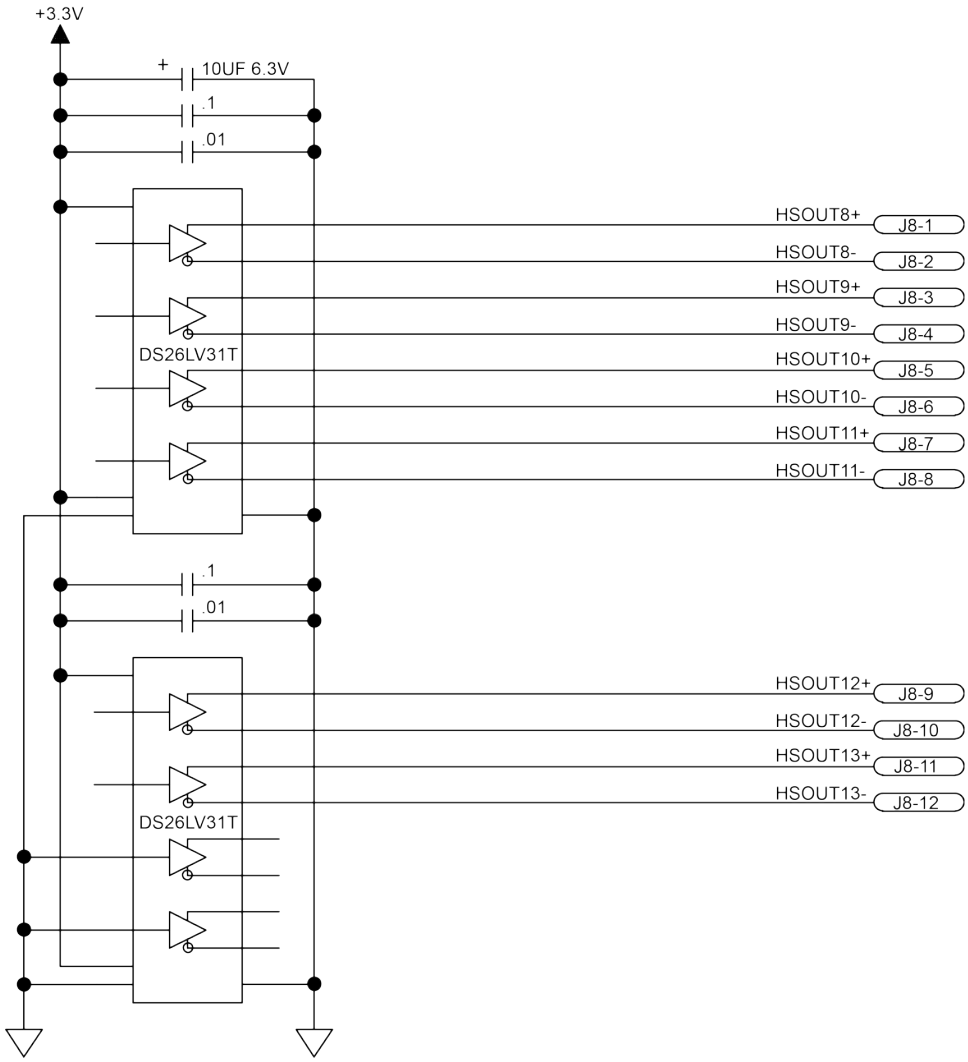


Figure 2-33: High Speed Differential Outputs

2.8.2. High-Speed Differential Inputs (J8)

The high-speed inputs can be used as general purpose I/O or as auxiliary encoder input channels (such as for velocity feedback or the MPG option or other handwheel device).

Auxiliary Encoder

The high-speed inputs can be used to provide up to two additional channels of quadrature encoder inputs. These auxiliary encoder channels can be used as the velocity feedback device for a dual-loop system (but cannot be used for position feedback due to the lack of marker input). The auxiliary encoder inputs can also be used with the MPG option or other hand wheel type devices.

Table 2-32: High-Speed Differential Input Pins on the High-Speed I/O Connector (J8)

Pin #	Description	In/Out/Bi
13	Aux Encoder 1 Sin +	Input
14	Aux Encoder 1 Sin -	Input
15	Aux Encoder 1 Cos +	Input
16	Aux Encoder 1 Cos -	Input
17(1)	Aux Encoder 2 Sin +	Input
18(1)	Aux Encoder 2 Sin -	Input
19(1)	Aux Encoder 2 Cos +	Input
20(1)	Aux Encoder 2 Cos -	Input

(1) These pins are not available to the user when the Analog I/O Board option is installed.

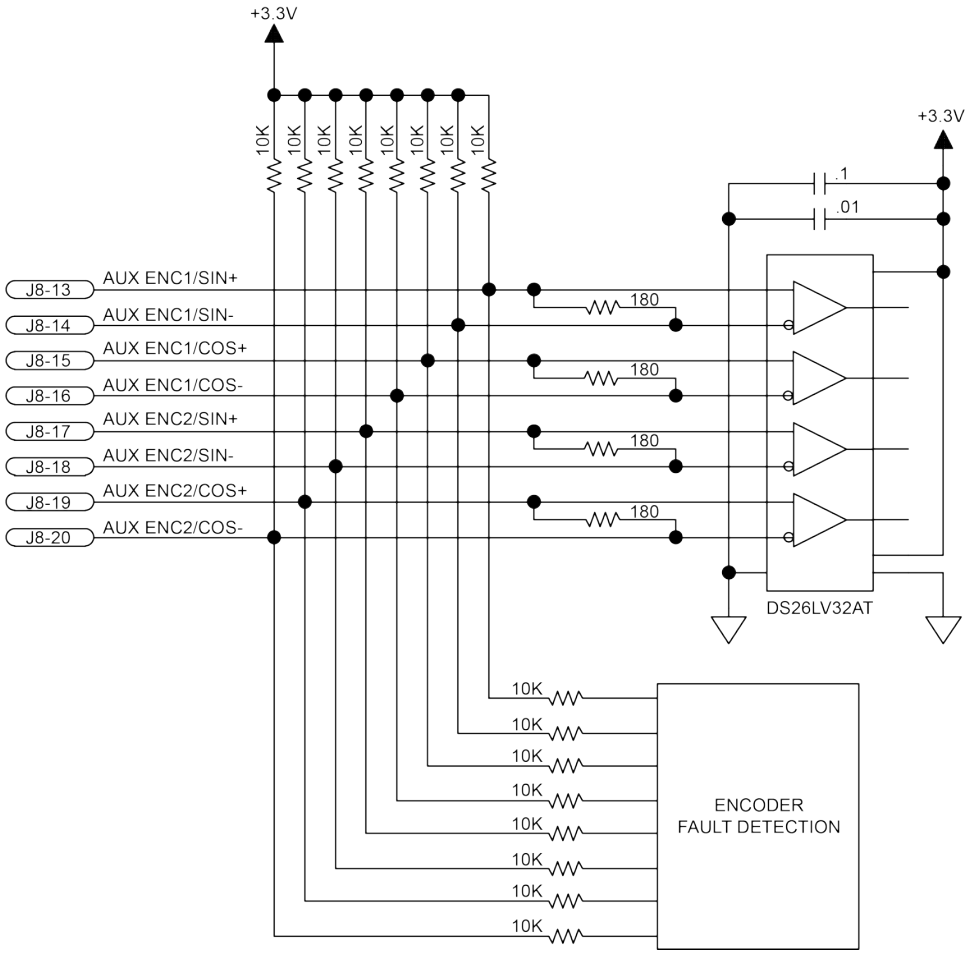


Figure 2-34: High-Speed Differential Inputs

2.8.3. High-Speed Bidirectional I/O (J8)

The bidirectional I/O signals default to inputs on reset and may be configured as input/outputs by the PORT DIR command. High-speed inputs/outputs 14-16 can source/sink 12 mA when configured as outputs.

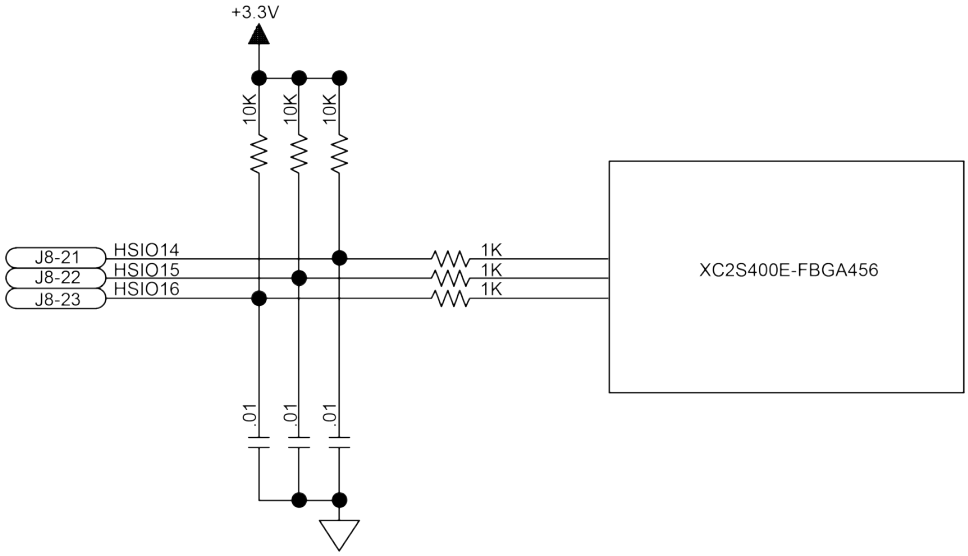


Figure 2-35: High-Speed Bidirectional I/O

2.9. Digital Opto-Isolated I/O Connector (J9)

The Digital Opto-Isolated I/O port (J9) is a 25-pin D-style connector located on the Rear Panel Interface board and is accessible at the rear of the Npaq chassis. This port provides the user with eight digital outputs and eight digital inputs.

The specifications for the digital outputs are described in Table 2-35 and the specifications for the digital inputs are described in Table 2-37.

Table 2-33: Digital Opto-Isolated I/O Connector Pinout (J9)

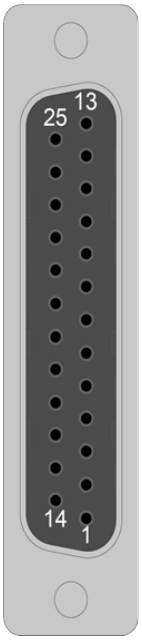
Pin #	Description	In/Out/Bi	Connector
1	User-Provided Digital Output + Supply Voltage	Input	
2	Digital Output 0 (Opto-Isolated)	Output	
3	Digital Output 1 (Opto-Isolated)	Output	
4	Digital Output 2 (Opto-Isolated)	Output	
5	Digital Output 3 (Opto-Isolated)	Output	
6	Digital Output 4 (Opto-Isolated)	Output	
7	Digital Output 5 (Opto-Isolated)	Output	
8	Digital Output 6 (Opto-Isolated)	Output	
9	Digital Output 7 (Opto-Isolated)	Output	
10	User provided Digital Output - supply voltage	Input	
11	Not Used	NA	
12	Not Used	NA	
13	Not Used	NA	
14	Digital Input Common	Input	
15	Digital Input 0 (Opto-Isolated)	Input	
16	Digital Input 1 (Opto-Isolated)	Input	
17	Digital Input 2 (Opto-Isolated)	Input	
18	Digital Input 3 (Opto-Isolated)	Input	
19	Digital Input 4 (Opto-Isolated)	Input	
20	Digital Input 5 (Opto-Isolated)	Input	
21	Digital Input 6 (Opto-Isolated)	Input	
22	Digital Input 7 (Opto-Isolated)	Input	
23	Not Used	NA	
24	Not Used	NA	
25	Not Used	NA	

Table 2-34: Mating Connector Part Numbers for the Digital Opto-Isolated I/O Connector

Mating Connector	Aerotech P/N	Third Party P/N
25-Pin D-Connector	ECK00101	FCI DB25P064TXLF
Backshell	ECK00656	Amphenol 17E-1726-2

2.9.1. Digital Outputs (J9)

The digital outputs are optically-isolated and can be connected in sourcing or sinking configurations. The digital outputs are designed to connect to other ground referenced circuits and are not intended to provide high-voltage isolation.

The outputs are software-configurable and must be connected in either all sinking or all sourcing mode. Figure 2-37 and Figure 2-36 illustrate how to connect to an output in current sourcing and current sinking modes.

The opto-isolator's common connections can be directly connected to the drive's power supply; however, doing so will effectively defeat the isolation and will reduce noise immunity.

Table 2-35: Digital Output Specifications (Outputs 0-7)

Opto Device Specifications	Value
Maximum Voltage	24 V maximum
Maximum Sink/Source Current	60 mA/channel @ 50°C
Output Saturation Voltage	2.75 V at maximum current
Output Resistance	33 Ω
Rise / Fall Time	250 usec (typical)
Reset State	Output Off (High Impedance State)

Table 2-36: Digital Output Pins on the Digital Opto-Isolated Output Connector (J9)

Pin #	Description	In/Out/Bi
1	User-Provided Digital Output + Supply Voltage	Input
2	Digital Output 0 (Opto-Isolated)	Output
3	Digital Output 1 (Opto-Isolated)	Output
4	Digital Output 2 (Opto-Isolated)	Output
5	Digital Output 3 (Opto-Isolated)	Output
6	Digital Output 4 (Opto-Isolated)	Output
7	Digital Output 5 (Opto-Isolated)	Output
8	Digital Output 6 (Opto-Isolated)	Output
9	Digital Output 7 (Opto-Isolated)	Output
10	User provided Digital Output - supply voltage	Input

Suppression diodes must be installed on outputs driving relays or other inductive devices. This protects the outputs from damage caused by inductive spikes. Suppressor diodes, such as the 1N914, can be installed on all outputs to provide protection. It is important that the diode be installed correctly (normally reversed biased). Refer to Figure 2-36 for an example of a current sinking output with diode suppression and Figure 2-37 for an example of a current sourcing output with diode suppression.

NOTE: Outputs must be connected as all sourcing or all sinking.

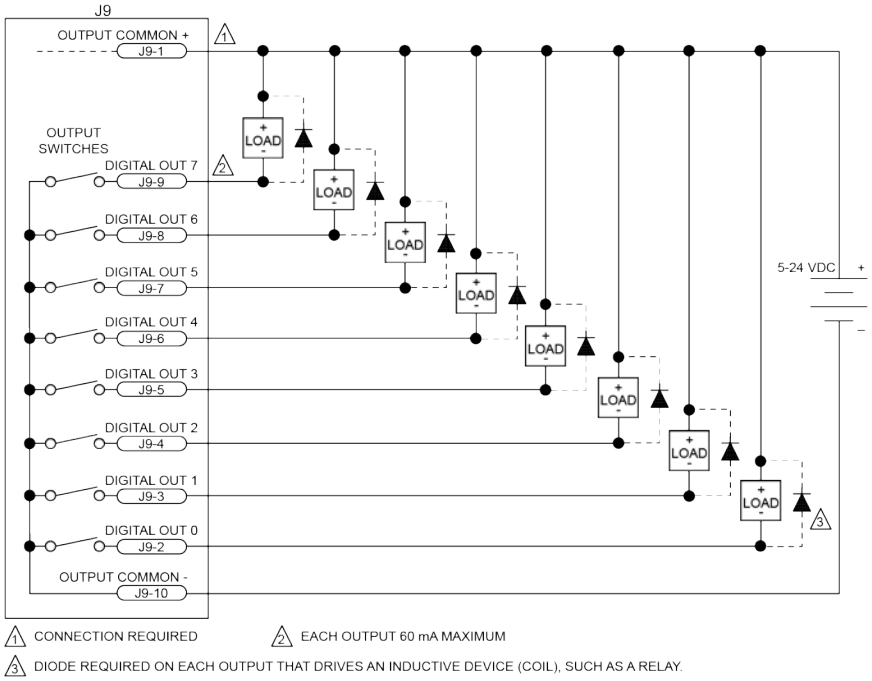


Figure 2-36: Digital Outputs Connected in Current Sinking Mode

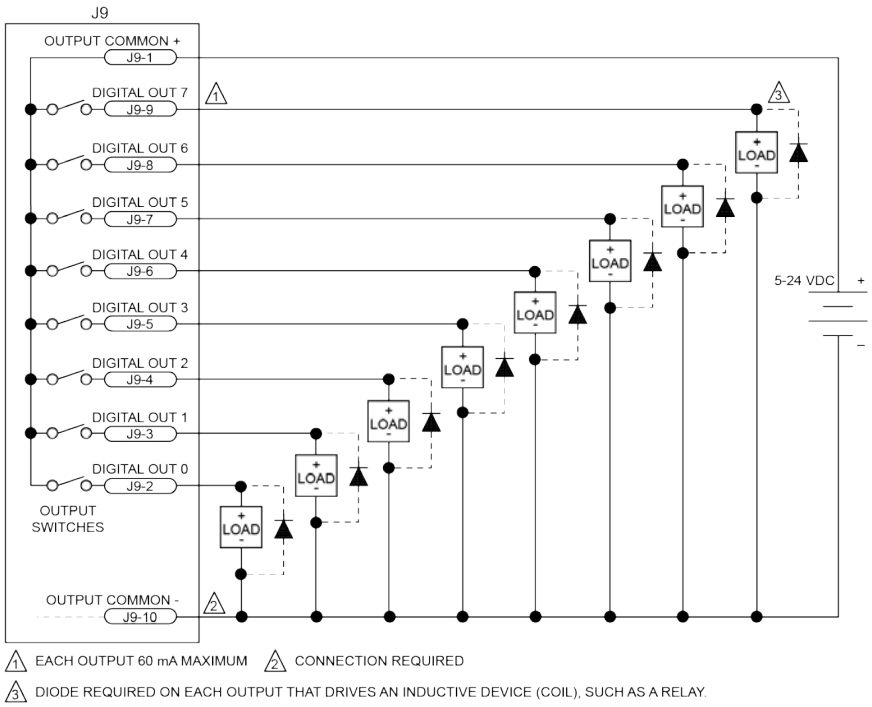


Figure 2-37: Digital Outputs Connected in Current Sourcing Mode

2.9.2. Digital Inputs (J9)

The digital inputs are opto-isolated and may be connected to current sourcing or current sinking devices, as shown in Figure 2-39 and Figure 2-38. These inputs are designed to connect to other ground-referenced circuits and are not intended for high-voltage isolation.

The opto-isolator's common connections can be directly connected to the drive's power supply; however, doing so will effectively defeat the isolation and will reduce noise immunity.

Table 2-37: Digital Input Specifications

Input Voltage	Approximate Input Current	Turn On Time	Turn Off Time
+5 V	1 mA	200 usec	2000 usec
+24 V	6 mA	4 usec	1500 usec

Table 2-38: Digital Input Pins on the Digital Opto-Isolated I/O Connector (J9)

Pin #	Description	In/Out/Bi
14	Digital Input Common	Input
15	Digital Input 0 (Opto-Isolated)	Input
16	Digital Input 1 (Opto-Isolated)	Input
17	Digital Input 2 (Opto-Isolated)	Input
18	Digital Input 3 (Opto-Isolated)	Input
19	Digital Input 4 (Opto-Isolated)	Input
20	Digital Input 5 (Opto-Isolated)	Input
21	Digital Input 6 (Opto-Isolated)	Input
22	Digital Input 7 (Opto-Isolated)	Input

NOTE: Inputs must be connected as all sourcing or all sinking.

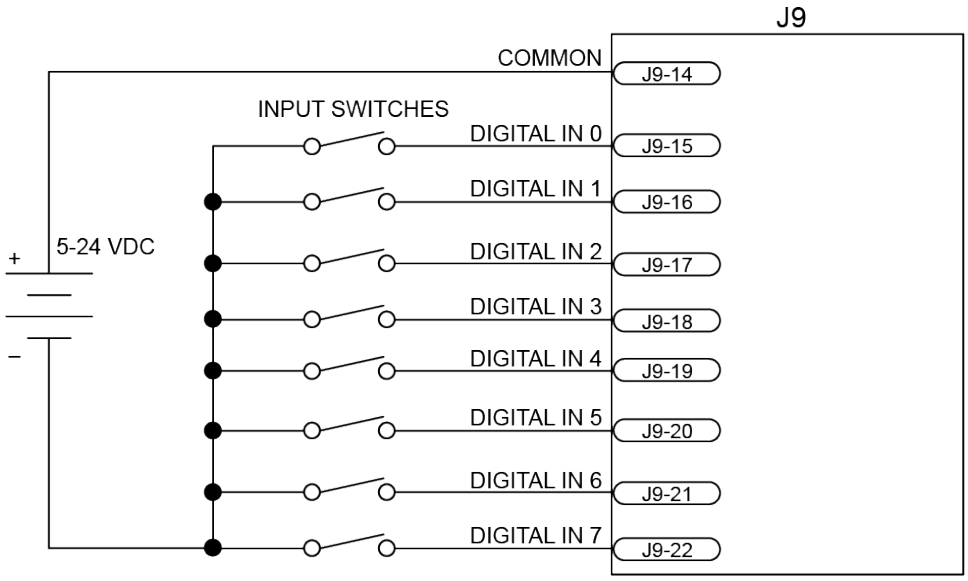


Figure 2-38: Digital Inputs Connected in Current Sinking Mode

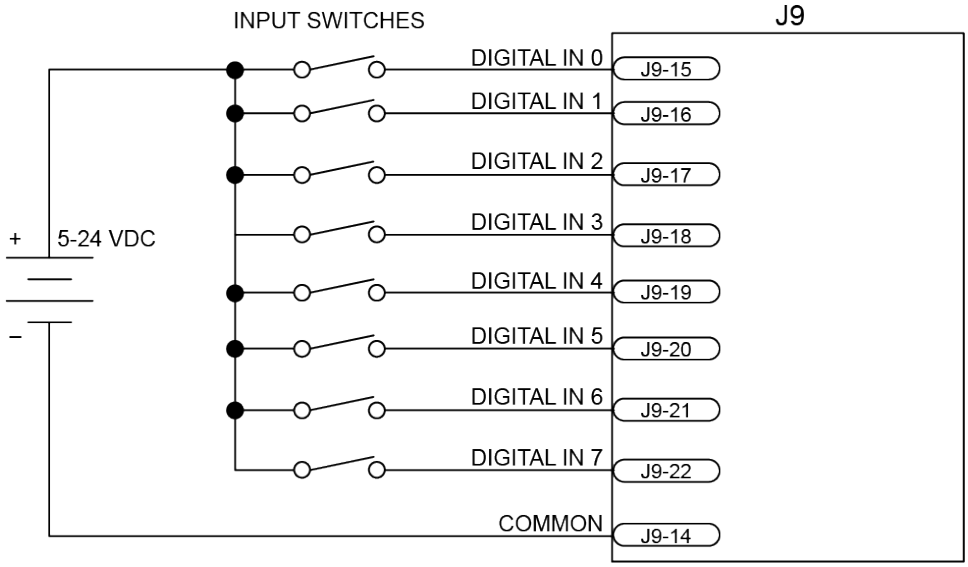
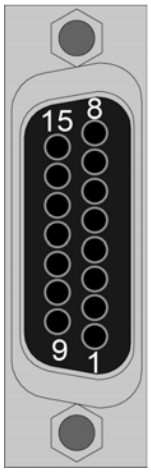


Figure 2-39: Digital Inputs Connected in Current Sourcing Mode

2.10. Analog I/O Connector (J10)

The Analog I/O Connector (J10) is a 15-pin 'D' style connector located on the Rear Panel Interface board and is accessible at the rear of the Npaq chassis. The Analog I/O interface provides the user with four differential 16-bit analog inputs and two single-ended 16-bit analog outputs. Table 2-41 provides the specifications for the analog outputs.

Table 2-39: Analog I/O Connector Pinout (J10)

Pin #	Description	In/Out/Bi	Connector
1	Analog Input 0+	Input	
2	Analog Input 1+	Input	
3	Analog Input 2+	Input	
4	Analog Input 3+	Input	
5*	+5 Volts	Output	
6	Analog Output 0	Output	
7	Analog Ground	N/A	
8	Analog Ground	N/A	
9	Analog Input 0-	Input	
10	Analog Input 1-	Input	
11	Analog Input 2-	Input	
12	Analog Input 3-	Input	
13	Not Used	N/A	
14	Analog Output 1	Output	
15	Analog Ground	N/A	

* Pin 5 is unused on Npaq's produced before February 2009.

Table 2-40: Mating Connector Part Numbers for the Analog I/O Connector (J10)

Mating Connector	Aerotech P/N	Third Party P/N
15-Pin D-Connector	ECK00100	Amphenol DA15P064TXLF
Backshell	ECK01022	Amphenol 17E-1725-2

NOTE: Analog inputs 2 and 3 are required for Joystick operation. They will not be otherwise accessible if a joystick option is present (see Section 2.11.). If a joystick option is present, AIN2 and AIN3 must be jumper configured (see Table 4-8) as single ended inputs.

2.10.1. Analog Outputs (J10)

The analog output is set to zero when power is first applied to the system or during a system reset.

Table 2-41: Analog Output Specifications (J10)

Specification	Value
Output Voltage	-10 V to +10 V
Output Current	5 mA
Resolution (bits)	16 bits
Resolution (volts)	305 µV

Table 2-42: Analog Output Pins on the Analog I/O Connector (J10)

Pin #	Description	In/Out/Bi
6	Analog Output 0	Output
7	Analog Ground	N/A
8	Analog Ground	N/A
14	Analog Output 1	Output
15	Analog Ground	N/A

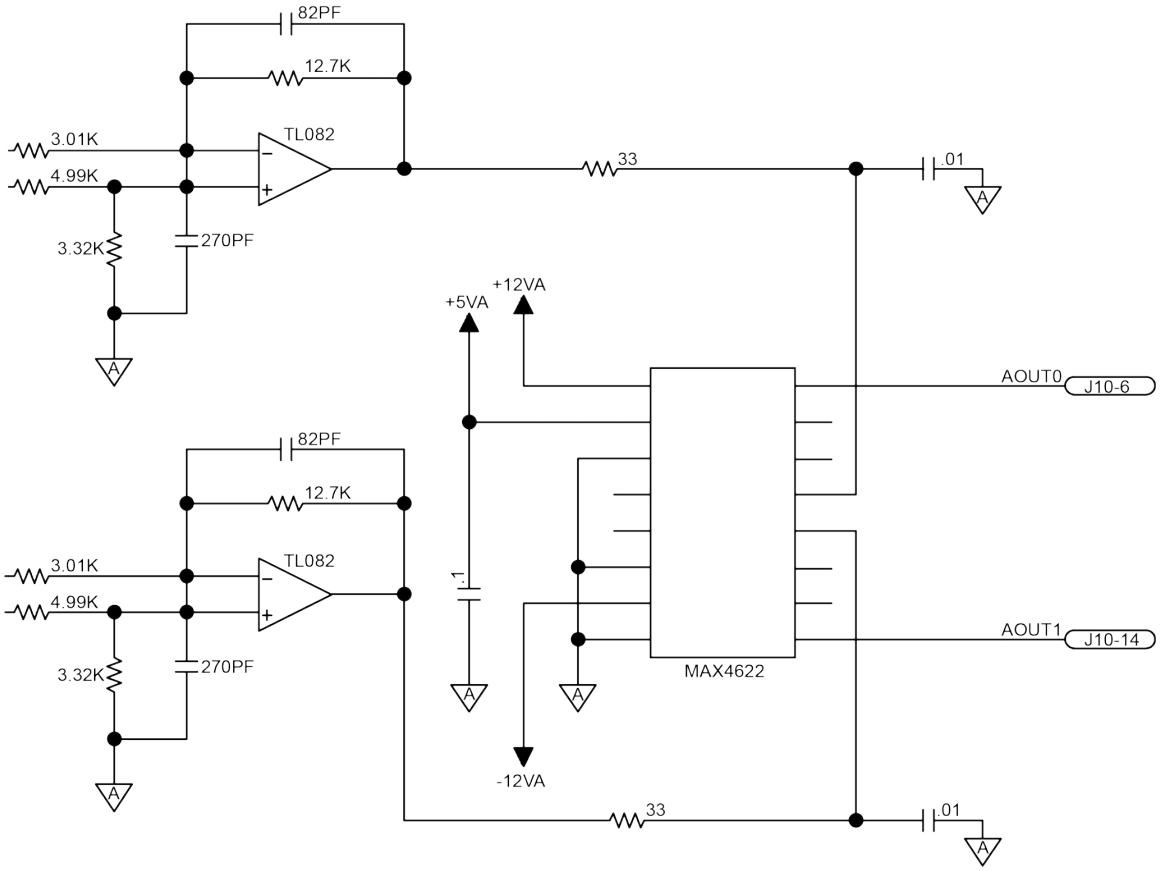


Figure 2-40: Analog Outputs (J10)

2.10.2. Analog Inputs (J10)

To interface to a single-ended (non-differential) voltage source, connect the signal common of the source to the negative input and the analog source signal to the positive input. A floating signal source should be referenced to the analog common as shown in Figure 2-41.

Table 2-43: Differential Analog Input 1 Specifications (J10)

Specification	Value
(AI+) - (AI-)	+10 V to -10 V (1)
Resolution (bits)	16 bits
Resolution (volts)	305 µV
1. Signals outside of this range may damage the input	

Table 2-44: Analog Input Pins on the Analog I/O Connector (J10)

Pin #	Description	In/Out/Bi
1	Analog Input 0+	Input
2	Analog Input 1+	Input
3	Analog Input 2+	Input
4	Analog Input 3+	Input
7	Analog Ground	N/A
8	Analog Ground	N/A
9	Analog Input 0-	Input
10	Analog Input 1-	Input
11	Analog Input 2-	Input
12	Analog Input 3-	Input
15	Analog Ground	N/A

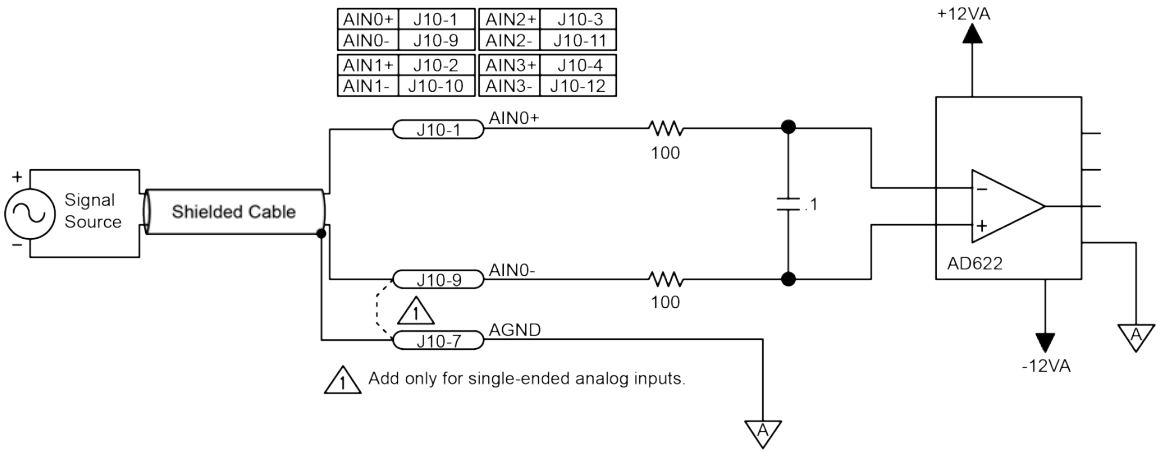


Figure 2-41: Analog Inputs (J10)

2.11. Joystick Connector (J11)

The Joystick Interface (J11) is a 15-pin 'D' style connector located on the Rear Panel Interface board and is accessible at the rear of the Npaq chassis. The Joystick Interface uses two analog inputs (analog inputs #2 & #3) and three dedicated inputs (joystick buttons). Joystick operation requires that the two analog inputs be configured as single-ended analog inputs by inserting JP14 and JP15 on the Rear Panel Interface board. These jumpers are installed at the factory. The joystick interface is shown in Figure 2-42. Figure 2-43 shows how to connect a joystick to J11.

Table 2-45: Joystick Connector Pinout

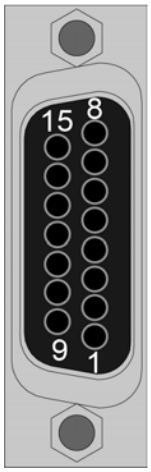
Pin #	Description	In/Out/Bi	Connector
1	Joystick +5V power	Input	
2	Joystick button A (Input 8) Axis Select	Input	
3	Analog 2+Input	Input	
4	Joystick power common	N/A	
5	Not Used	N/A	
6	Analog 3+ Input	Input	
7	Joystick button B (Input 9) Speed Select	Input	
8	Not Used	N/A	
9	Not Used	N/A	
10	Not Used	N/A	
11	Analog 2- Input (Common)	Input	
12	Not Used	N/A	
13	Joystick Interlock (Input 10)	Input	
14	Analog 3- Input (Common)	Input	
15	Not Used	N/A	

Table 2-46: Mating Connector Part Numbers for the Joystick Connector

Mating Connector	Aerotech P/N	Third Party P/N
15-Pin D-Connector	ECK00100	Amphenol DA15P064TXLF
Backshell	ECK01022	Amphenol 17E-1725-2

NOTE: The joystick uses the same analog inputs (2 and 3) provided by the Analog Interface (J10). The joystick analog inputs and the analog inputs 2 & 3 of J10 must not have devices connected to them at the same time.

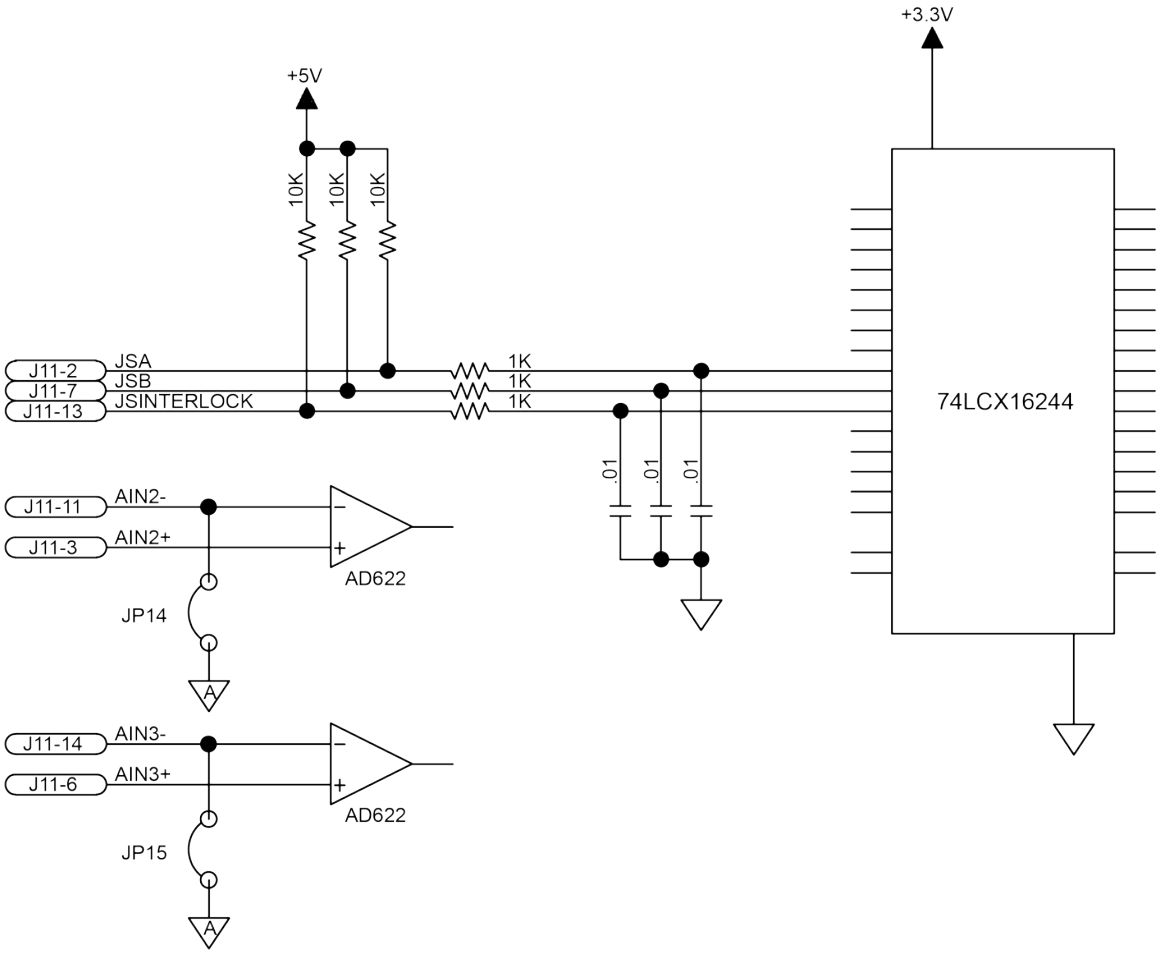


Figure 2-42: Joystick Inputs (J11)

Aerotech joysticks JI (NEMA12 (IP54) rated) and JBV are powered from 5V and have a nominal 2.5V 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 -10V to +10V.

Refer to the A3200 Help file for programming information about how to change joystick parameters.

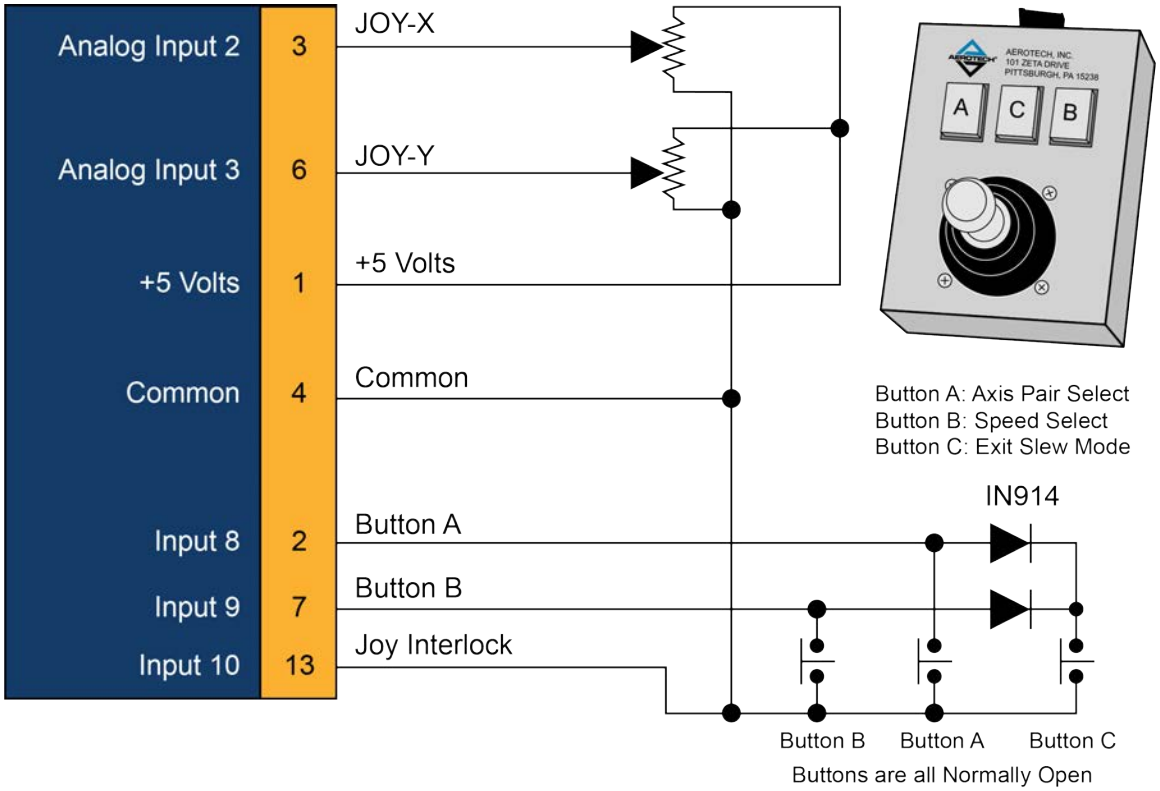


Figure 2-43: Joystick Interface

2.12. Miscellaneous I/O Connector (J12)

The Miscellaneous I/O Interface (J12) is a 15-pin 'D' style connector located on the Rear Panel Interface board and is accessible at the rear of the Npaq chassis. This Interface provides 2 opto-isolated interrupt inputs, the opto-isolated ESTOP input, +5 V, and the I/O Brake output if the I/O Brake option (see Section 2.12.3.) was ordered. Table 2-50 is the UINT specification table.

Table 2-47: Miscellaneous I/O Connector Pinout (J12)

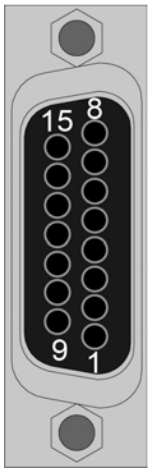
Pin #	Description	In/Out/Bi	Connector
1	Opto-Isolated User Interrupt + (Input 12+)	Input	
2	Opto-Isolated User Interrupt - (Input 12-)	Input	
3	+5 Volt (fused)	Output	
4	Reserved	N/A	
5	Reserved	N/A	
6	Not Used	N/A	
7	Opto-Isolated ESTOP + input, (5-24 volts)	Input	
8	Opto-Isolated ESTOP - input, (5-24 volts)	Input	
9	Opto-Isolated User Interrupt + (Input 13+)	Input	
10	Opto-Isolated User Interrupt - (Input 13-)	Input	
11	Common	N/A	
12	Not Used	N/A	
13	Not Used	N/A	
14	I/O Brake + output (I/O Brake option only)	Output	
15	I/O Brake - output (I/O Brake option only)	Output	

Table 2-48: Mating Connector Part Numbers for the Miscellaneous I/O Connector (J12)

Mating Connector	Aerotech P/N	Third Party P/N
15-Pin D-Connector	ECK00100	Amphenol DA15P064TXLF
Backshell	ECK01022	Amphenol 17E-1725-2

2.12.1. User Interrupt Input (UINT) (J12)

The UINT1 (Input 12) and UINT2 (Input 13) ± inputs are used for the hardware Encoder Capture feature. The delay time through the high-speed opto devices is 50 nsec (typical). The high-speed user interrupt inputs are scaled for 5 VDC input. Using a higher input voltage requires an external series resistor to limit the current to 15 mA.

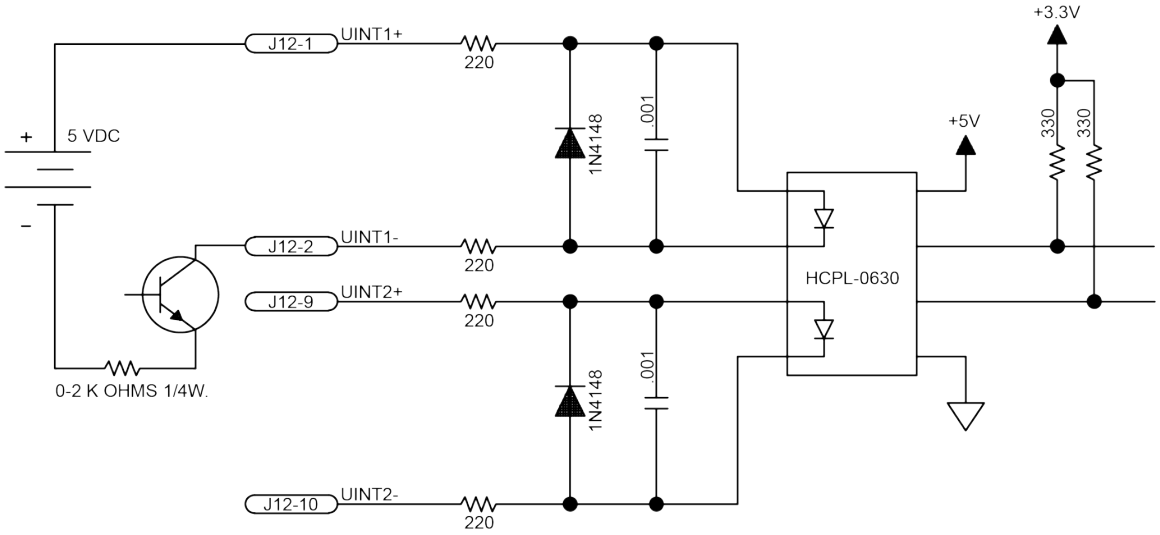


Figure 2-44: User Interrupt Inputs (J12)

Table 2-49: UINT Pins on the Miscellaneous I/O Connector (J12)

Pin #	Description	In/Out/Bi
1	Opto-Isolated User Interrupt + (Input 12+)	Input
2	Opto-Isolated User Interrupt - (Input 12-)	Input
9	Opto-Isolated User Interrupt + (Input 13+)	Input
10	Opto-Isolated User Interrupt - (Input 13-)	Input

Table 2-50: UINT Opto-Isolator Specifications (J12)

Specification (HCPL-0630)	Value
Opto Coupler Forward Current	5 - 15 mA
Opto Coupler Forward Voltage	1.5 V

2.12.2. Emergency Stop Sense Input (J12)

The ESTOP sense input (J12) is used to monitor the state of an external safety circuit only. This state allows the A3200 system to report the Emergency Stop status and to facilitate restarting the system after the Emergency Stop condition has been removed.

The response of the system to the Emergency Stop input is configurable using the FaultMask parameters. However, this operation is not considered part of the safety circuit and is not compliant with EN ISO 13849-1. For hardware options compliant with EN ISO 13849-1, see Section 3.3.

WARNING: The machine integrator, OEM, or end user is responsible for performing the design, integration, and test of the safety system in accordance with the relevant safety standards. This responsibility includes the use of safety monitoring devices, interlocks, switches, light curtains and all other means of providing operator protection.

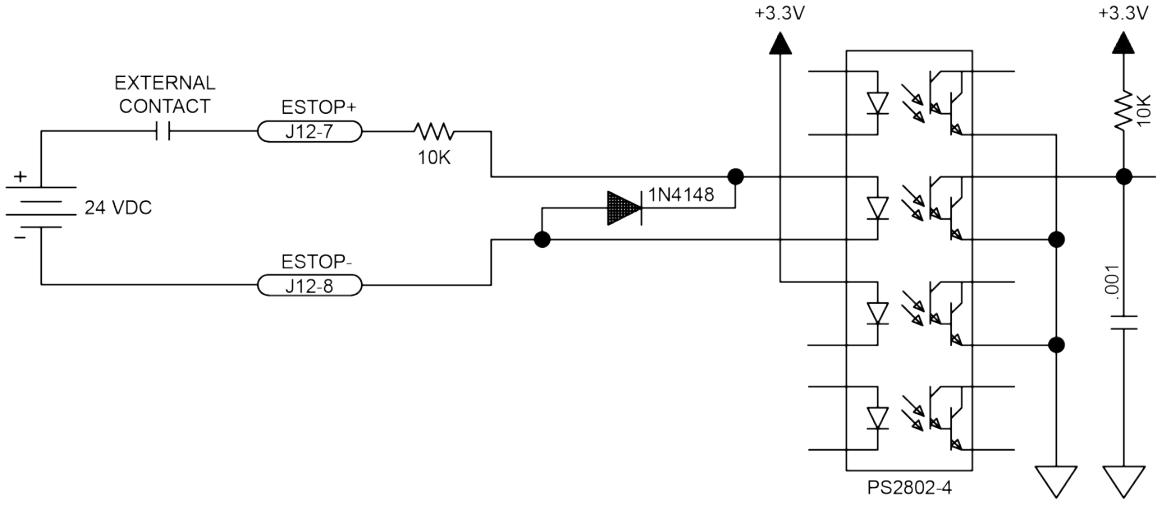


Figure 2-45: Emergency Stop Sense Input Connections (J12)

Table 2-51: ESTOP Pins on the Miscellaneous I/O Connector (J12)

Pin #	Description	In/Out/Bi
7	Opto-Isolated ESTOP + input, (5-24 volts)	Input
8	Opto-Isolated ESTOP - input, (5-24 volts)	Input

Table 2-52: ESTOP Opto-Isolator Specifications (J12)

Specification (PS2802-4)	Value
Opto Coupler Forward Current	2.9 mA
Opto Coupler Forward Voltage	1.1 V
Power Dissipation	60 mW

2.12.3. Brake Option (J12)

The Npaq's internal solid state relay is used to automatically control a fail-safe brake on a vertical axis. The Npaq contains an internal 24V power supply used to energize (release) the brake.

The brake is controlled by an Opto 22 ODC5A module and is routed to one of seven possible connectors depending on which brake option was ordered. Table 2-53 lists the connector and pinout for each of the brake options.

The brake control operation can be software configured; refer to the A3200 Help file for more information (see topics for the EnableBrakeControl axis parameter and the BRAKE command).

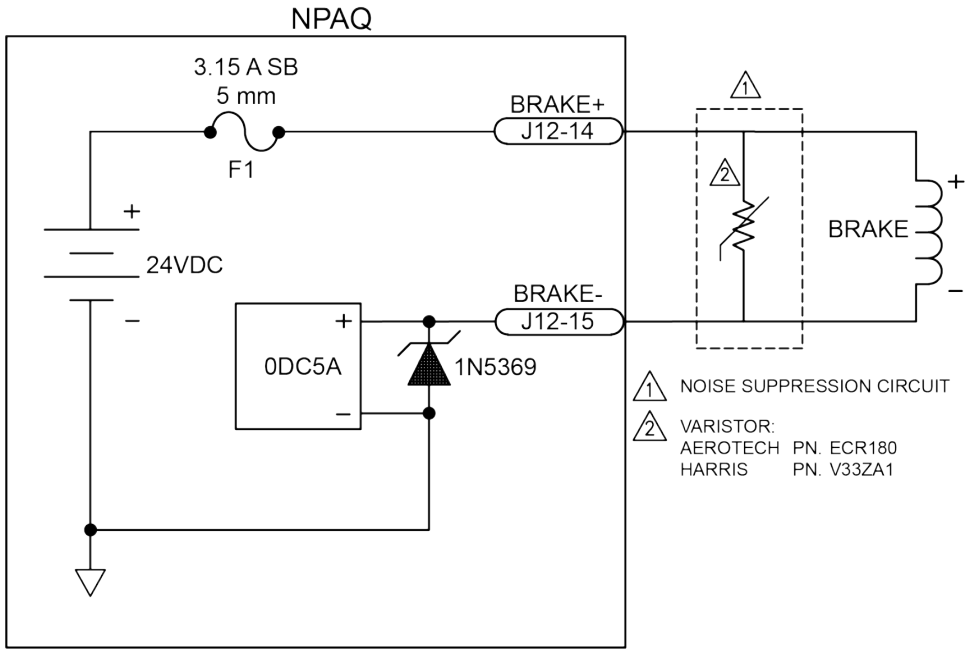


Figure 2-46: Brake Option Connections (Internal) (J12)

Table 2-53: Brake Option Connector / Pin Assignment Descriptions

Brake Option	Pin #	Description
Brake-1	J1-25	Axis #1 Brake + Output
	J1-13	Axis #1 Brake - Output
Brake-2	J2-25	Axis #2 Brake + Output
	J2-13	Axis #2 Brake - Output
Brake-3	J3-25	Axis #3 Brake + Output
	J3-13	Axis #3 Brake - Output
Brake-4	J4-25	Axis #4 Brake + Output
	J4-13	Axis #4 Brake - Output
Brake-5	J5-25	Axis #5 Brake + Output
	J5-13	Axis #5 Brake - Output
Brake-6	J6-25	Axis #6 Brake + Output
	J6-13	Axis #6 Brake - Output
Brake-IO	J12-14	I/O Brake + Output
	J12-15	I/O Brake - Output

Table 2-54: Drive Interface Board Fuse (F1) Information

Fuse	Aerotech P/N	Manufacturer P/N
3 amp, 5x20 mm Fuse	EIF00180	Littelfuse 2183.15
F1 is a socketed fuse.		

NOTE: The brake itself will normally cause a small change in axis position when activated.

2.12.3.1. Solid State Relay Specifications

The user must verify that the application will be within the specifications of the Brake output.

Table 2-55: Relay Specifications

Solid State Relay Rating (M11), Aerotech PN. ECS394	Value
Voltage	5-60 VDC
Maximum Current	1 Amp
Output Resistance	~ 0.5 ohm (Typical)
Turn-On/Turn-Off Time	100 µs / 759 µs
Output Voltage Drop (Max pk)	1.6 V

WARNING: Do not exceed the maximum specifications.

2.13. FireWire Interface

The FireWire bus is the high-speed communications connection to the Npaq 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 Npaq.

Table 2-56: 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 2-57: 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 2-58: FireWire Cables (copper and glass fiber)

Part Number	Description
NCONNECT-60	6 m (20 ft) long, 6 pin to 6 pin
NCONNECT-45	4.5 m (15 ft) long, 6 pin to 6 pin
NCONNECT-30	3 m (10 ft) long, 6 pin to 6 pin
NCONNECT-15	1.5 m (5 ft) long, 6 pin to 6 pin
NCONNECT-9	0.9 m (3 ft) 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

2.14. Ethernet Interface

The Ethernet interface provides connectivity to an external I/O module that supports Modbus TCP/IP at a speed of 10 or 100 Mbps. When using an Ethernet I/O module that will be connected directly to the Npaq, a crossover cable must be used. A network hub or a switch can be connected directly to the Npaq. Table 2-59 lists some recommended crossover Ethernet cables and their part numbers that can be used with the Npaq drive chassis.

Table 2-59: Ethernet Cable Listing

Cable Description	Aerotech P/N	Manufacturer P/N
0.9 m I/O crossover cable	NCONNECT-IO-900	L-Com # TRD855XCR-3
1.5 m I/O crossover cable	NCONNECT-IO-1500	L-Com # TRD855XCR-5
3.0 m I/O crossover cable	NCONNECT-IO-3000	L-Com # TRD855XCR-10
4.5 m I/O crossover cable	NCONNECT-IO-4500	L-Com # TRD855XCR-15

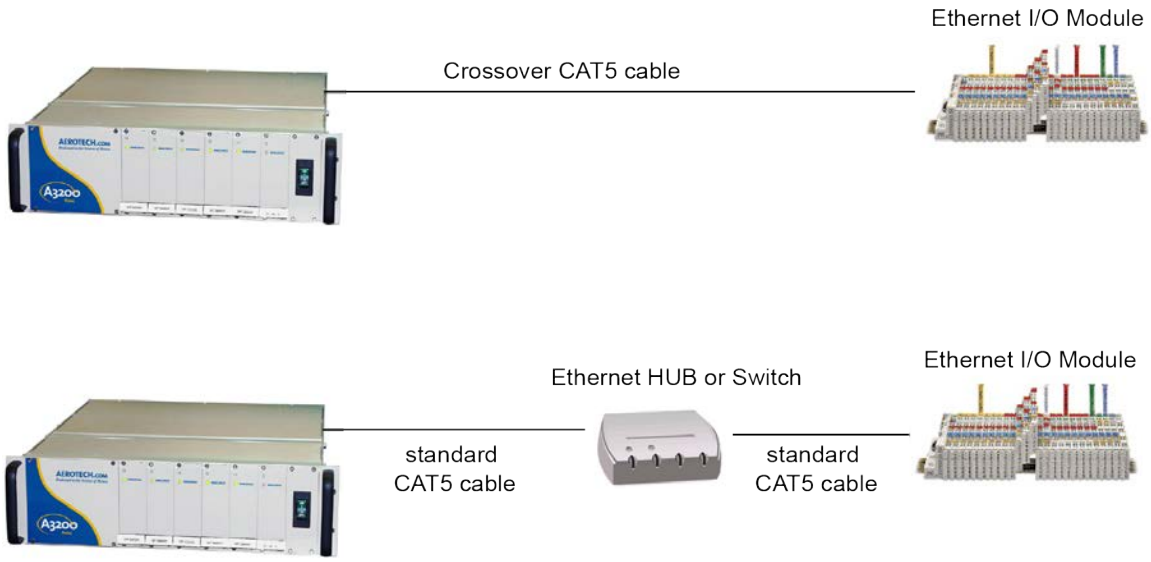


Figure 2-47: Ethernet Connection

2.15. PC Configuration and Operation Information

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

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Chapter 3: Options

Table 3-1 provides a description of the various Npaq options.

Table 3-1: Options and Capabilities

Option	Section	Description / Capabilities
Chassis Slides	Section 1.2.	Mounting option
Emergency Stop	Section 3.3.	EN ISO13849-1, Category 2, Category 3
MXR / MXR2M	Section 2.6.1.2.	Encoder Resolution Multiplier, up to 16,384 times (including x4 quadrature decoding). 200 kHz / 2 MHz max input freq. respectively
Failsafe Brake Output	Section 2.6.6. Section 2.12.3.	Brake is configured to an axis (1-6) or the I/O Standard brake voltage is 24 VDC Opto 22 module controlled brake output
Ethernet Interface	Section 2.14.	For I/O expansion only. Supports Ethernet II (formerly known as Ethernet DIX) type of packets at speed of 10 or 100 Mbps. The supported protocols are ARP, UDP, TCP/IP, Modbus-TCP, etc.
External Cooling / Fan Tray Cooling	Section 3.1.	Provides the user with the ability to provide greater cooling to the amplifiers In most cases, this will increase the output capability of the amplifiers External Cooling option is available with Fan Tray option
AC Line Filter	Section 3.2.	Required for CE compliance Provides increase EMI protection against incoming and outgoing EMI on the AC power line. Filters all of the Npaq's AC power
Shunt Regulator	Section 3.4.	Dissipates excessive regenerative energy
Analog I/O (1)	Section 3.5.	Six Analog outputs, 4 inputs, (+/-10 VDC) Four Analog inputs, (+/-10 VDC)
Resolver Interface (1)	Section 3.6.	Six channel resolver feedback interface.
(1) This option is no longer available for purchase. This section is for legacy users.		

3.1. External / Fan Tray Cooling Options

The External Cooling option requires the user to provide forced air-cooling to the Npaq drive chassis. If this option is requested the top and bottom covers for the amplifier compartment will be changed from solid covers to perforated covers and the fan located on the left side of the chassis will not be installed. The user will need to provide cooling to the Npaq amplifier compartment by directing airflow towards the perforated covers. Air is directed from the bottom of the Npaq chassis and will flow out of the top of the chassis. External Cooling requires that the top and bottom of the Npaq chassis be open so that airflow is not obstructed.

The Npaq can be ordered with an upper or a lower Fan Tray option. With either of these options, a fan tray is attached to the Npaq chassis. This tray contains several fans that draw air from below the chassis and direct the air upward and out of the top of the Npaq drive chassis. The Fan Tray option adds an additional 1U (1.75”) height to the chassis. The Fan Tray options also require additional unobstructed space both below and above the Npaq chassis to allow for sufficient airflow.

The dimensions of the Npaq with the optional fan trays are shown in Section 1.2.

3.2. AC Line Filter Option

The AC Line Filter option provides an internal line voltage filter to reduce conducted line emissions. This filter is required to meet CE requirements, but does not improve servo performance or reduce the effects of PWM noise in the motor cables.

Table 3-2: AC Line Filter Part Number

Aerotech P/N	Manufacturer P/N
ECZ284	Schaffner FN2070-10-06

3.3. Emergency Stop Options (ESTOP1,2,3)

ESTOP1, 2, and 3 are integrated emergency stop hardware options available on the Npaq.

- ESTOP1 uses a single relay to disconnect the motor power supply from the internal drive modules.
- ESTOP2 uses two relays in series to disconnect the motor power supply from the drive modules.
- ESTOP3 uses two relays in series to disconnect the motor power supply from the drive modules and dissipates the stored energy in the motor power supply.

All relays are force guided and have a monitor contact.

The ESTOP1,2,3 options can be used to provide performance in accordance with EN ISO 13849-1 as shown in Table 3-3.

Table 3-3: ESTOP Safety Ratings

Option	Relays	EN ISO 13849-1
ESTOP1	1 force guided relay with monitor contact	Category 2, PL d
ESTOP2	2 force guided relays with monitor contacts	Category 3, PL d
ESTOP3	2 force guided relays with monitor contracts	Category 3, PL d

WARNING: The machine integrator, OEM, or end user is responsible for performing the design, integration, and test of the safety system in accordance with the relevant safety standards. This responsibility includes the use of safety monitoring devices, interlocks, switches, light curtains and all other means of providing operator protection.

All ESTOP1,2,3 connections must be made to the optional J70 ESTOP connector. The Misc I/O J12 connector pin 7 (ESTOP +) and pin 8 (ESTOP -) must be left unconnected in this case (see Section 2.12.2.).

The Npaq's Emergency Stop Sense Input (see Section 2.12.2.) is internally connected to the J70 ESTOP connector when present (see Figure 3-2, Figure 3-3, and Figure 3-4). This state allows the A3200 system to report the Emergency Stop status and to facilitate restarting the system after the Emergency Stop condition has been removed. The response of the system to the Emergency Stop input is configurable using the FaultMask parameters. However, this operation is not considered part of the safety circuit and is not compliant with EN ISO 13849-1.

Table 3-4: Relay Specifications

ESTOP1 CR1 and ESTOP2 CR1 and CR2	
Relay Part Number	Aerotech: ECW01106 Sprecher & Schuh: CA7-16E-01-24E
AC-1 (resistive load)	Rating of 32 A
Turn On	The coil requires 17.0 W to turn on (which is equal to 700 mA @ 24 V)
On / Holding	The coil requires 1.7 W on (holding) current (which is equal to 70 mA @ 24 V)
ESTOP3 CR1 and CR2	
Relay Part Number	Aerotech: ECW01107 Sprecher & Schuh: CA7-16E-M31-24E
AC-1 (resistive load)	Rating of 32 A
Turn On	The coil requires 17.0 W to turn on (which is equal to 700 mA @ 24 V)
On / Holding	The coil requires 1.7 W on (holding) current (which is equal to 70 mA @ 24 V)

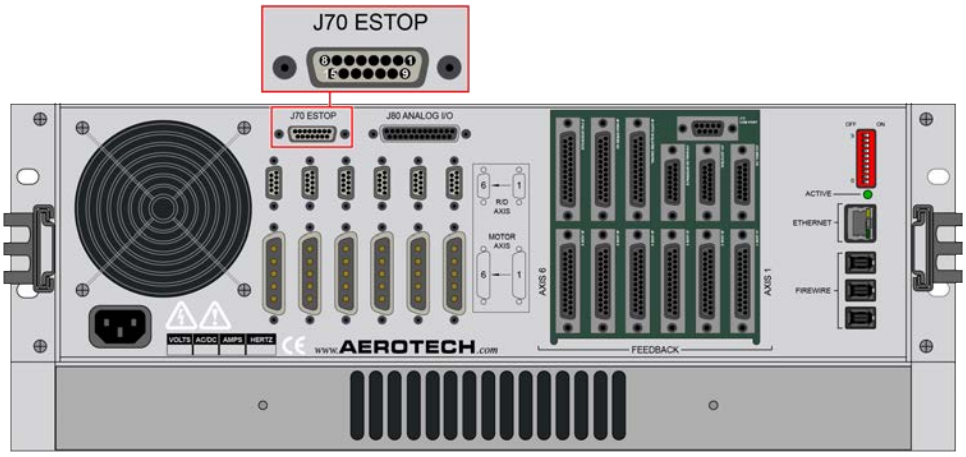


Figure 3-1: ESTOP Option Interface

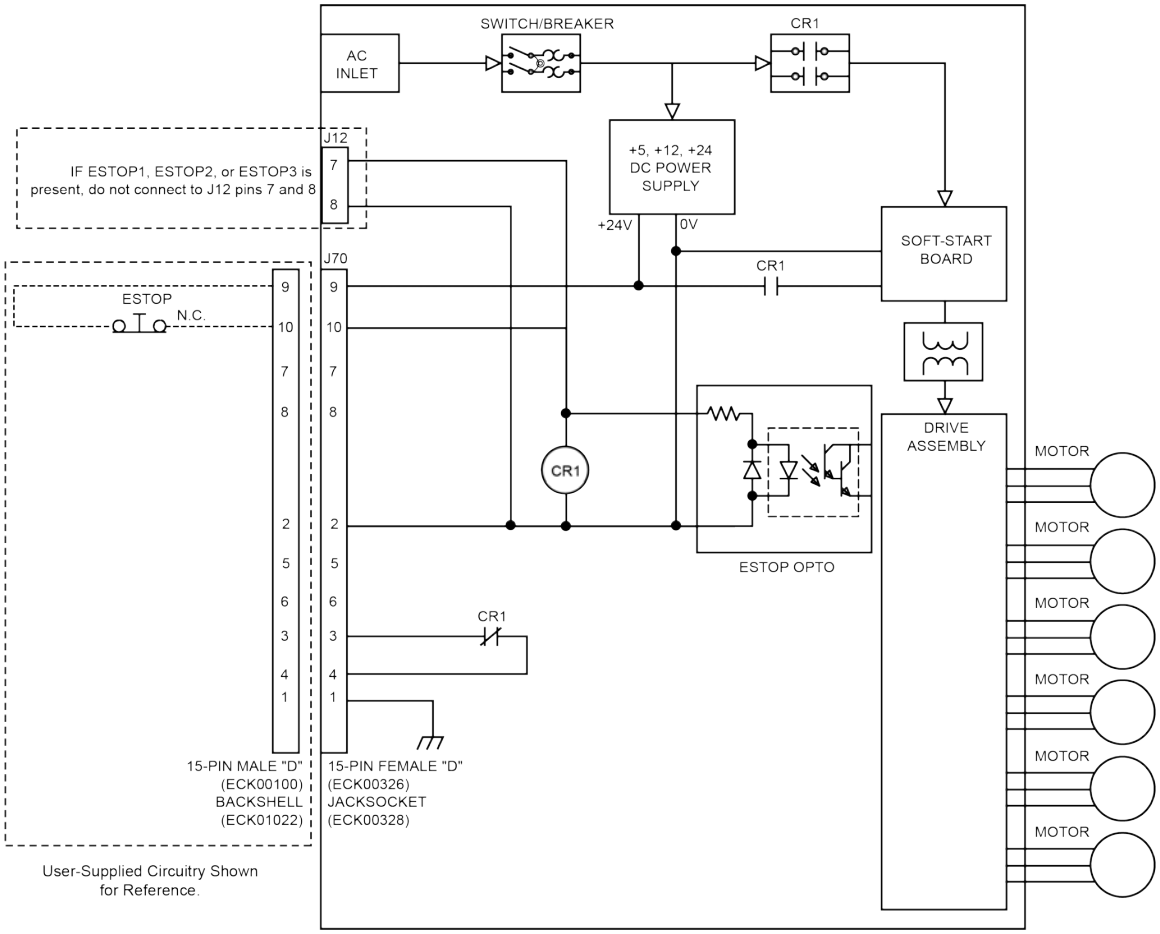


Figure 3-2: ESTOP1 Option (Category 2, PL d)

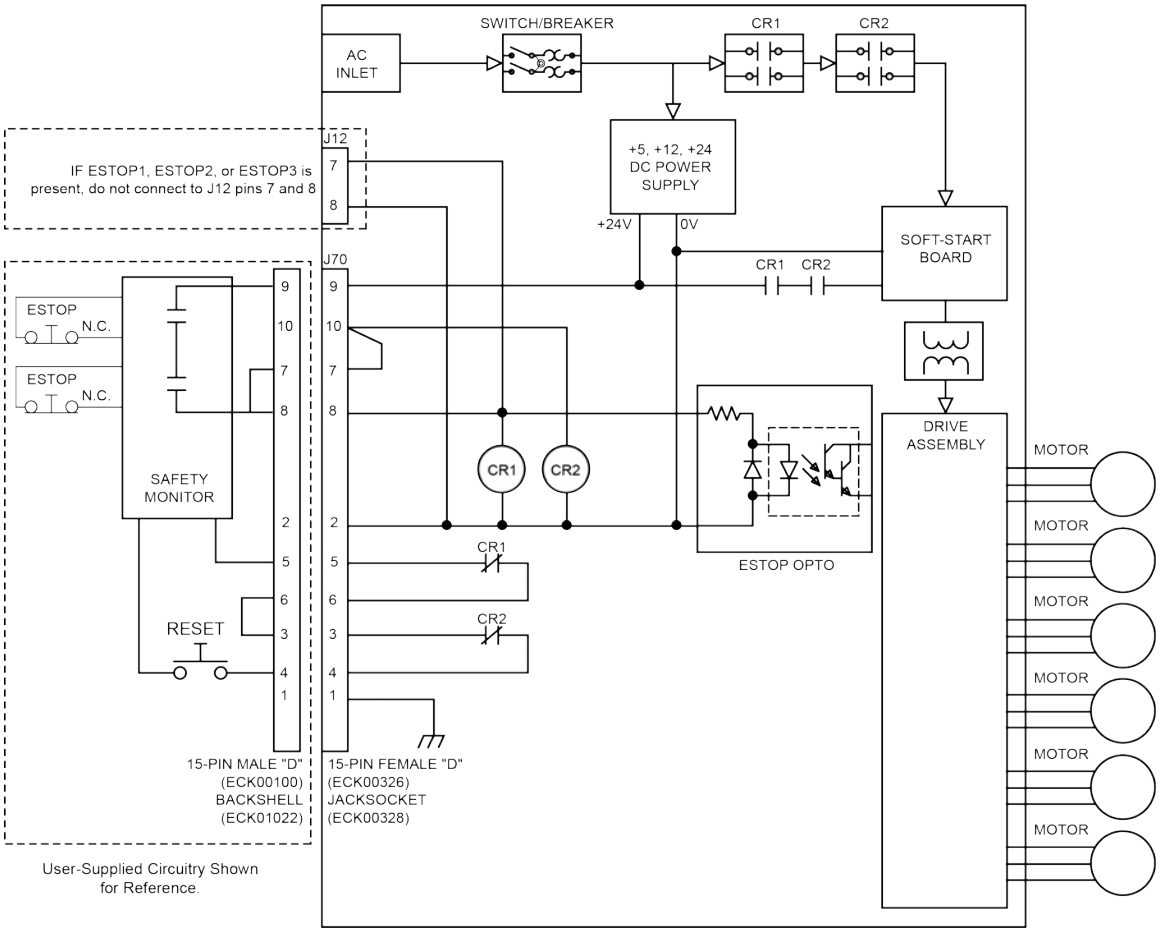


Figure 3-3: ESTOP2 Option (Category 3, PL d)

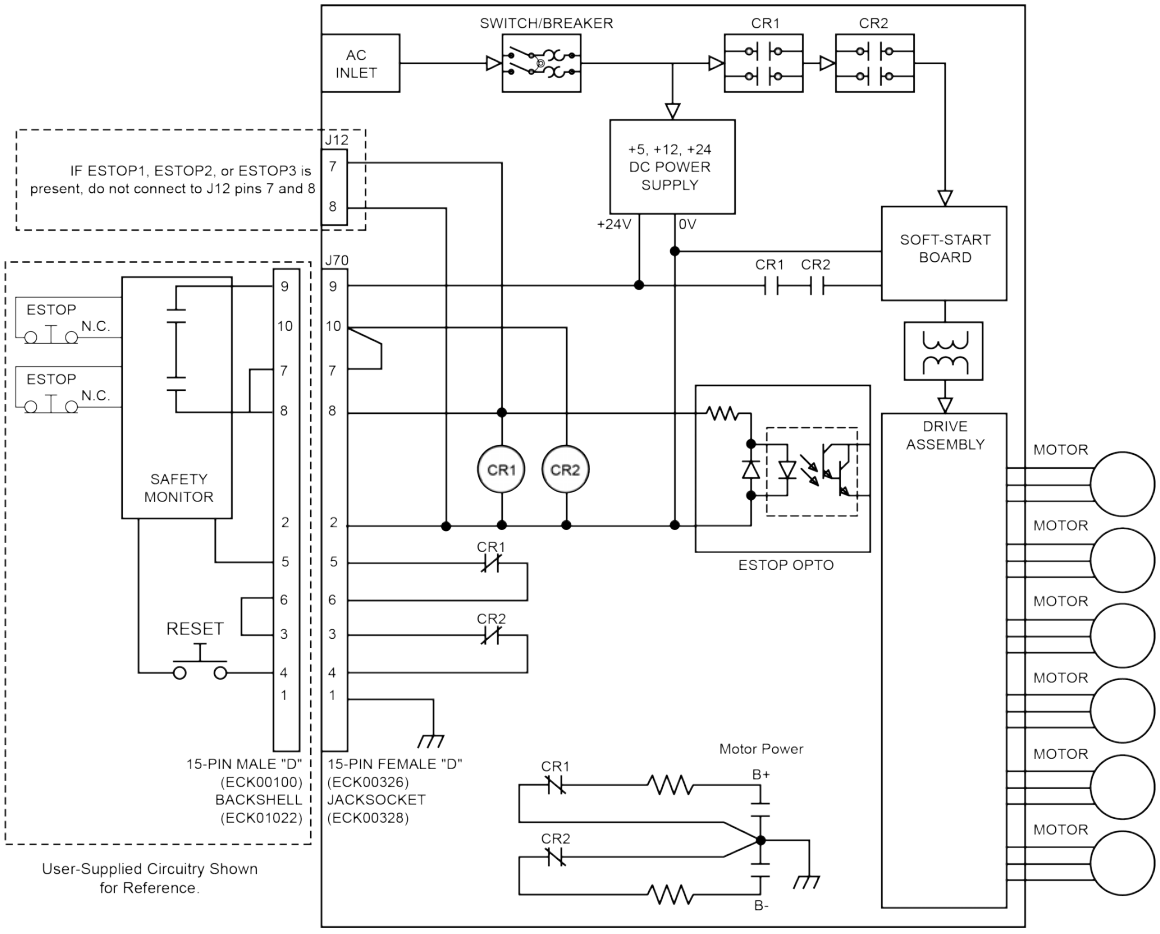


Figure 3-4: ESTOP3 Option (Category 3, PL d)

3.4. Shunt Option

There are four available shunt options (refer to Table 3-5). If one of the S320 shunts are ordered, there can only be one shunt option.

Table 3-5: Shunt Regulator Options

Option	Description
S160-1	Bus 1, 0-160 VDC
S160-2	Bus 2, 0-160 VDC
S320-1	Bus 1, 0-320 VDC
S320-2	Bus 2, 0-320 VDC

If Fuse F1 on the shunt board opens, all drives connected to that bus power supply will be automatically disabled. See Section 4.8. for fuse replacement information.

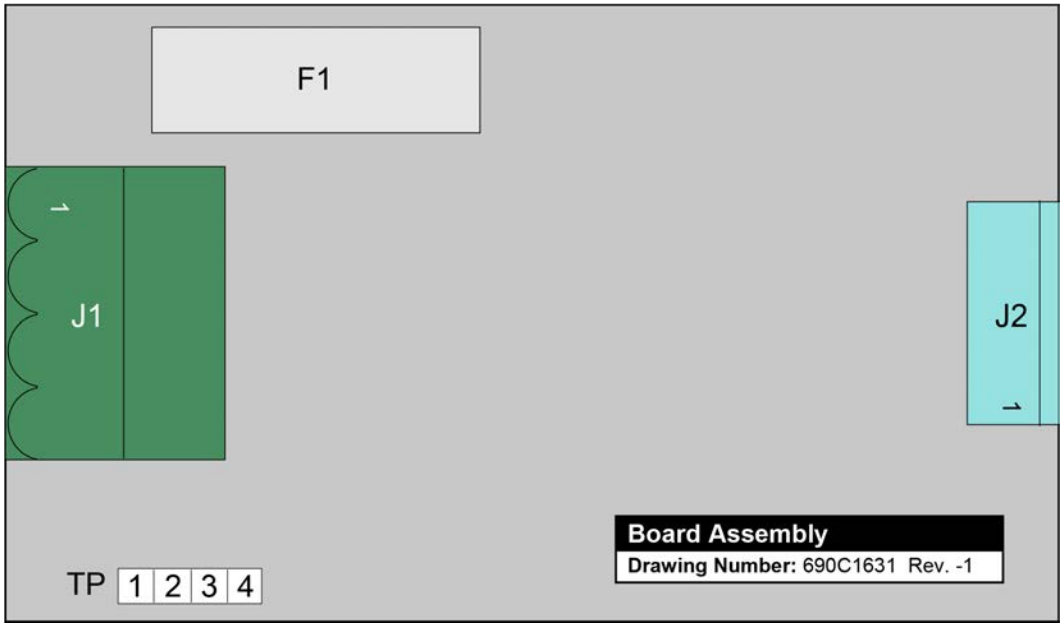


Figure 3-5: Shunt Board Assembly

3.5. Analog I/O Board Option [Archive]

NOTE: This option is no longer available for purchase. This section is for legacy users.

The Analog I/O board adds four 16-bit analog inputs and six 16-bit analog outputs to the Npaq. Both inputs and outputs have a fixed range of ±10V and are updated at a 1 kHz rate. These ranges may not be exceeded or damage may occur. It is not possible to change the input voltage range via parameters.

NOTE: The presence of the Analog I/O Board Option requires the use of several of the high-speed I/O. When the analog I/O board is installed, the following I/O are no longer available for user I/O: HSOUT12, HSOUT13, HSIN19, HSIN20, HSIO14, and HSIO15.

Table 3-6: Analog I/O Board Connector Pinout (J80)

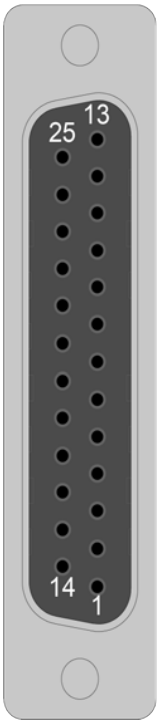
Pin #	Description	In/Out/Bi	Connector
1	Shield	--	
2	Analog Out 5	Output	
3	Analog Out 7	Output	
4	Analog Out 9	Output	
5	Ground	Refer to Section 3.5.1.	
6	+5V		
7	Ground		
8	+3.3V		
9	Analog Input 6+	Input	
10	Analog Input 7+	Input	
11	Analog Input 4+	Input	
12	Analog Input 5+	Input	
13	Ground	Refer to Section 3.5.1.	
14	Analog Out 4	Output	
15	Analog Out 6	Output	
16	Analog Out 8	Output	
17	Ground	Refer to Section 3.5.1.	
18	+12V		
19	Ground		
20	-12V		
21	Ground		
22	Analog Input 6-	Input	
23	Analog Input 7-	Input	
24	Analog Input 4-	Input	
25	Analog Input 5-	Input	

Table 3-7: Mating Connector Part Numbers for the Analog I/O Connector (J80)

Mating Connector	Aerotech P/N	Third Party P/N
25-Pin D-Connector	ECK00101	FCI DB25P064TXLF
Backshell	ECK00656	Amphenol 17E-1726-2

3.5.1. Power Configuration for the -AIO Option [Archive]

NOTE: This option is no longer available for purchase. This section is for legacy users.

The default wiring for the analog I/O board is the non-isolated configuration. In this configuration, the board draws its power from an internal power supply. J80 pins 5, 6, 7, 8, 13, 17, 18, 19, 20, and 21 are internally connected to the internal power supply.

Alternatively, the board can be wired to use the isolated configuration. In this configuration, an external power supply provides power to the board through J80 pins 5, 6, 7, 8, 13, 17, 18, 19, 20, and 21. Table 3-8 shows the power requirements for the external power supply. This wiring configuration is a factory option and should be specified at the time of the purchase.

Table 3-8: External Power Supply Specifications

Supply Voltage	Maximum Current	J80 Pin #
+3.3V	320 mA	8
+5V	50 mA	6
+12V	60 mA	18
-12V	60 mA	20
Common	-	5, 7, 13, 17, 19, 21

3.5.2. Analog Inputs on the -AIO Option Board (AIN4-AIN6) [Archive]

NOTE: This option is no longer available for purchase. This section is for legacy users.

To interface to a single-ended (non-differential) voltage source, connect the signal common of the source to the negative input and the analog source signal to the positive input. A floating signal source should be referenced to the analog common as shown in Figure 3-6.

Table 3-9: Differential Analog Input 1 Specifications

Specification	Value
(AI+) - (AI-)	+10 V to -10 V (1)
Resolution (bits)	16 bits
Resolution (volts)	305 µV
1. Signals outside of this range may damage the input	

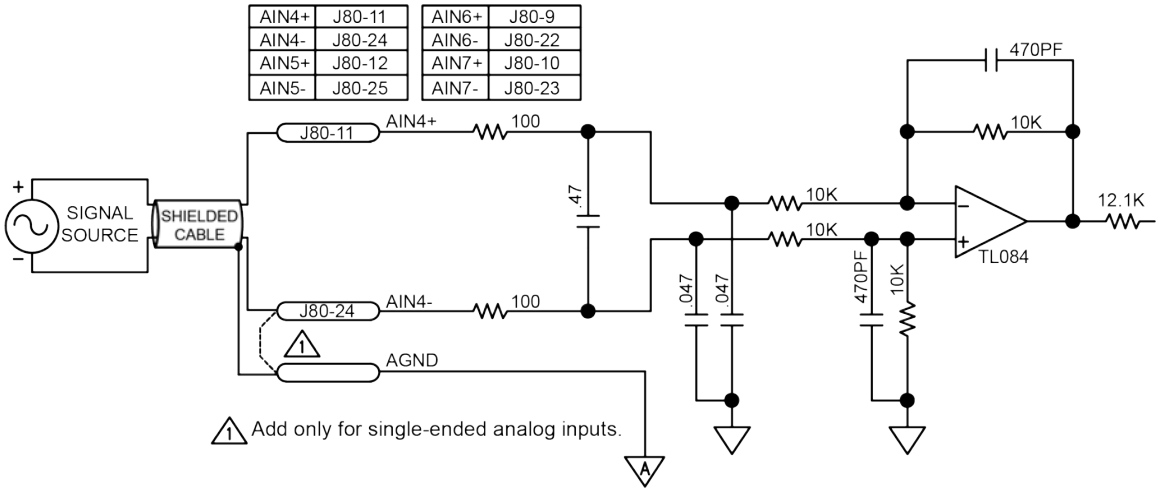


Figure 3-6: Analog I/O Option Board Inputs

3.5.3. Analog Outputs on the -AIO Option Board (AOUT4-AOUT9) [Archive]

NOTE: This option is no longer available for purchase. This section is for legacy users.

The analog output is set to zero when power is first applied to the system or during a system reset.

Table 3-10: Analog Output Specifications

Specification	Value
Output Voltage	-10 V to +10 V
Output Current	5 mA
Resolution (bits)	16 bits
Resolution (volts)	305 µV

NOTE: AO0 and AO1 are available on J10, see Section 2.10.1.

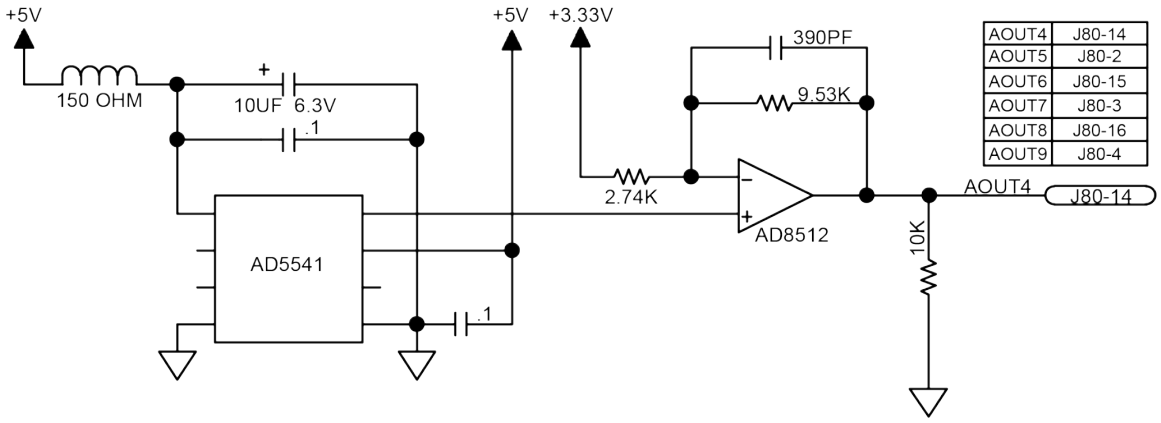


Figure 3-7: Analog I/O Option Board Outputs

3.6. Resolver Option [Archive]

NOTE: This option is no longer available for purchase. This section is for legacy users.

The optional resolver provides six industry standard resolver channels that can be used as a feedback device. The standard reference output frequency is 5 kHz (with factory configurations of 7.5 or 10 kHz). The amplitude of this signal can be adjusted on a per-channel basis through the ResolverReferenceGain axis parameter. The reference signal amplitude should be adjusted such that the level of the Sine and Cosine resolver feedback signals is at 2 V RMS (or 2.83 V peak).

For correct operation of the resolver, the alignment between the resolver and motor must be known and entered into the CommutationOffset axis parameter. This alignment can be determined by using the MSET command. See the A3200 Help file for more information, including configuration of the axis parameters for an axis with resolver feedback.

Resolver signals are provided to the user through one of two user interfaces, either the 9-pin “D” style connectors above the motor connectors or through the standard J1-J6 feedback connectors as shown in Table 2-11.

Table 3-11: Resolver Connector Pinout

Pin #	Description	Input/Output	Connector
1	Resolver Sine +	Input	
6	Resolver Sine -	Input	
2	Resolver Sine Shield	Shield	
4	Resolver Cosine +	Input	
9	Resolver Cosine -	Input	
5	Resolver Cosine Shield	Shield	
7	Resolver Reference +	Output	
3	Resolver Reference -	Output	
8	Resolver Reference Shield	Shield	

Table 3-12: Mating Connector Part Numbers for the Resolver Connector

Mating Connector	Aerotech P/N	Third Party P/N
9-Pin D-Connector	ECK00137	FCI# DE09P064TXLF
Backshell	ECK01021	Amphenol 17E-1724-2

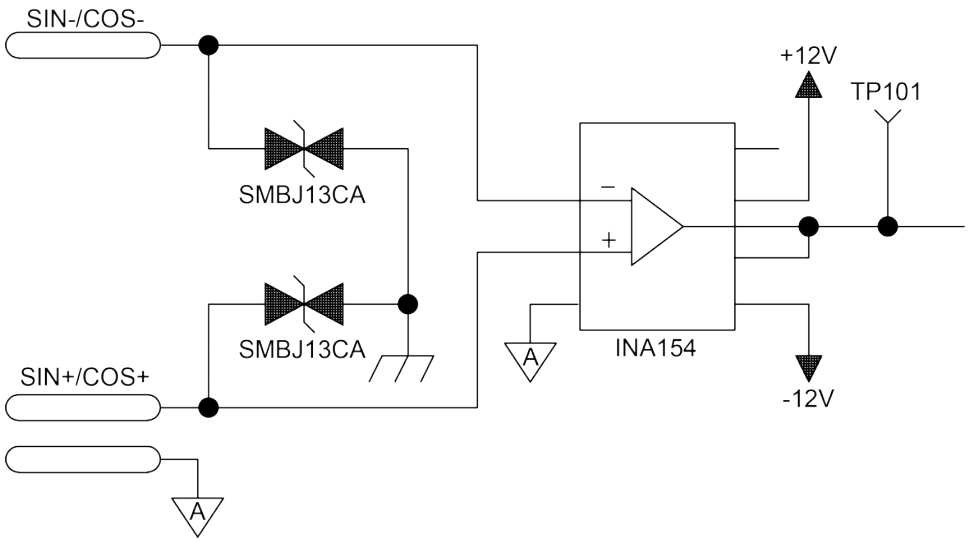


Figure 3-8: Sine/Cosine Resolver Signal Input Circuitry

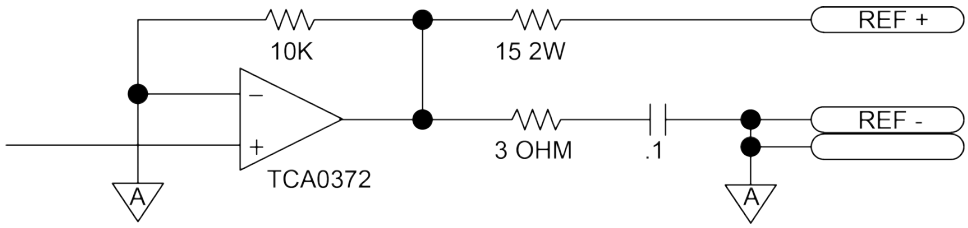


Figure 3-9: Reference Resolver Signal Output Circuitry

Chapter 4: Maintenance

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

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.

DANGER: Residual voltages greater than 60V may be present inside Npaq chassis for longer than 10 seconds after power has been disconnected.

Table 4-1: LED Indicators

Label	Description
Active (Rear Panel)	Located on Rear Panel of Npaq Drive chassis. LED indicates controller is active when on.
Active (Amplifier)	Each Amplifier contains an Active LED. Green indicates that Amplifier is enabled. Red indicates an over-temp or fault condition.
Not labeled (Ethernet connector, Rear Panel)	The green Ethernet LED indicates that the Npaq is receiving data when it is on. The orange / yellow Ethernet LED indicates that the Npaq is transmitting data when it is on.

Table 4-2: Troubleshooting

Symptom	Possible Cause and Solution
Operator Interface does not start	• Make sure that the power cord is connected and that the Npaq is turned on before you start the Operator Interface • Check the Npaq Active status LED (Green LED on rear panel of Npaq) and make sure it is not blinking. • Check FireWire Base Device # (S2, located on rear panel of Npaq). Make sure that there are no conflicts with other devices on the FireWire network.
Motor spins uncontrollably	Encoder (sine and cosine) signals are improperly connected. See Section 2.5. for motor connection and phasing information.
Brushless motor will not spin	Motor phases A, B, and C connected incorrectly relative to Hall A, Hall B, and Hall C inputs. See Section 2.5. for motor connection and phasing information.
Amplifier faults (“ENA” LED de-energizes) when motor decelerates.	Bus over voltage detected or incorrect parameter setting.
Amplifier Faults (Amplifier “ENA” LED de-energizes).	1. RMS current exceeded - run at lower current. 2. Axis parameters not set correctly or attempting to exceed system capability or setting. 3. Over temperature condition - Turn off and let amplifier cool down. Provide better ventilation. 4. Motor Feedback problem (Encoder or Hall inputs).
Encoder Feedback Fault	1. Bad encoder feedback device. 2. Power supply voltage low at encoder.

4.1. Control Board

The Npaq control board is only available in the Ultra version. Figure 4-1 highlights the important components located on the control board assembly. The Npaq jumpers are listed in Table 4-3. S1 is set at the factory and must not be changed. S2 sets the communication channel device number for the Npaq (see Section 2.3.).

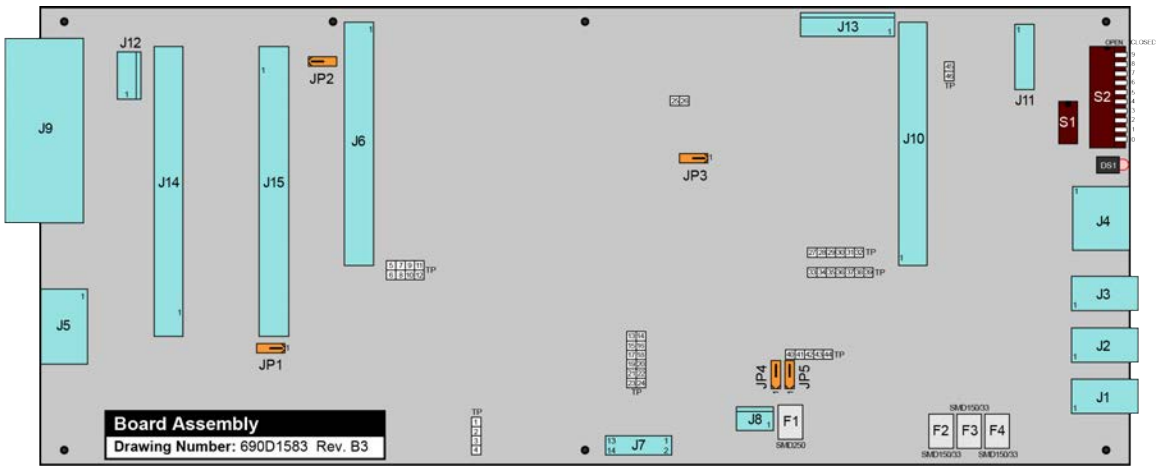


Figure 4-1: Control Board Assembly

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

Table 4-3: Control Board Jumper Configuration

Jumper	Setting	Description
JP1	1-2 (1)	PSO Output Active Low
	2-3	PSO Output Active High
JP2	1-2 (1)	N/A: Internal Aerotech Use Only
	2-3	N/A: Internal Aerotech Use Only
JP3	1-2 (1)	Reset Timeout enabled (must be set to this position)
	2-3	Reset Timeout disabled
JP4	1-2 (1)	External FireWire power source
	2-3	+12V Power Source
JP5	1-2 (1)	External FireWire power source
	2-3	+12V Power Source
(1) Default		

Table 4-4: Control Board Test Points

Test Point	Function	Test Point	Function
TP1	PSO OPTO Power (external V+)	TP26	FireWire (8 KHz)
TP2	PSO OPTO Output	TP27	PSO Int.
TP3	PSO OPTO Return (external V-)	TP29	DSP Setting (Boot-Up)
TP4	Common	TP30	DSP Setting (Boot-Up)
TP5	Asynchronous Write Enable	TP31	PLD JTAG
TP6	Byte Enable 3	TP32	DSP Originated Reset
TP7	Asynchronous Read Enable	TP33	Chip Select 3
TP8	Byte Enable 2	TP34	Big / Little endian
TP9	Asynchronous Output Enable	TP35	GP I/O
TP10	Asynchronous Ready	TP36	Chip Select 1
TP12	Chip Enable 2	TP39	DSP External Interrupt 6
TP14	Byte Enable 0	TP40	F2 PSO Out Opto
TP15	Chip Select 0	TP41	PSO OUT 1
TP16	Byte Enable 1	TP43	PSO Out 2
TP17	System Reset	TP46	8 KHz
TP19	Timer 1 Output	TP47	CPLD JTAG
TP21	Timer 0 Output	TP51	PHY-Power
TP23	TINP1	TP52	CPLD JTAG
TP25	Timer Input	TP53	CPLD JTAG
* unlisted Test Points are reserved			

The JTAG programming connector is a 14-pin header (J11) located on the Control board.

Table 4-5: JTAG Programming Connector (Internal-J11)

Pin #	Label	Description	In/Out/Bi
1	TDI	Data Input	Input
2	Common	Signal Common	N.A.
3	TDO	JTAG Data Output	Output
4	Common	Signal Common	N.A.
5	TCK	JTAG Programming Clock	Input
6	Common	Signal Common	N.A.
7	Not Used	Not Used	N.A.
8	Enable	Enable	Input
9	Not Used	Not Used	N.A.
10	TMS	Test Mode Select	Input
11	+5V	+5 Volt	Output
12	Not Used	Not Used	N.A.
13	Not Used	Not Used	N.A.
14	Not Used	Not Used	N.A.

4.2. Drive Interface Board Assembly

Figure 4-2 highlights the important components located on the power board assembly. Jumpers are factory configured and should not be changed by the user.

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

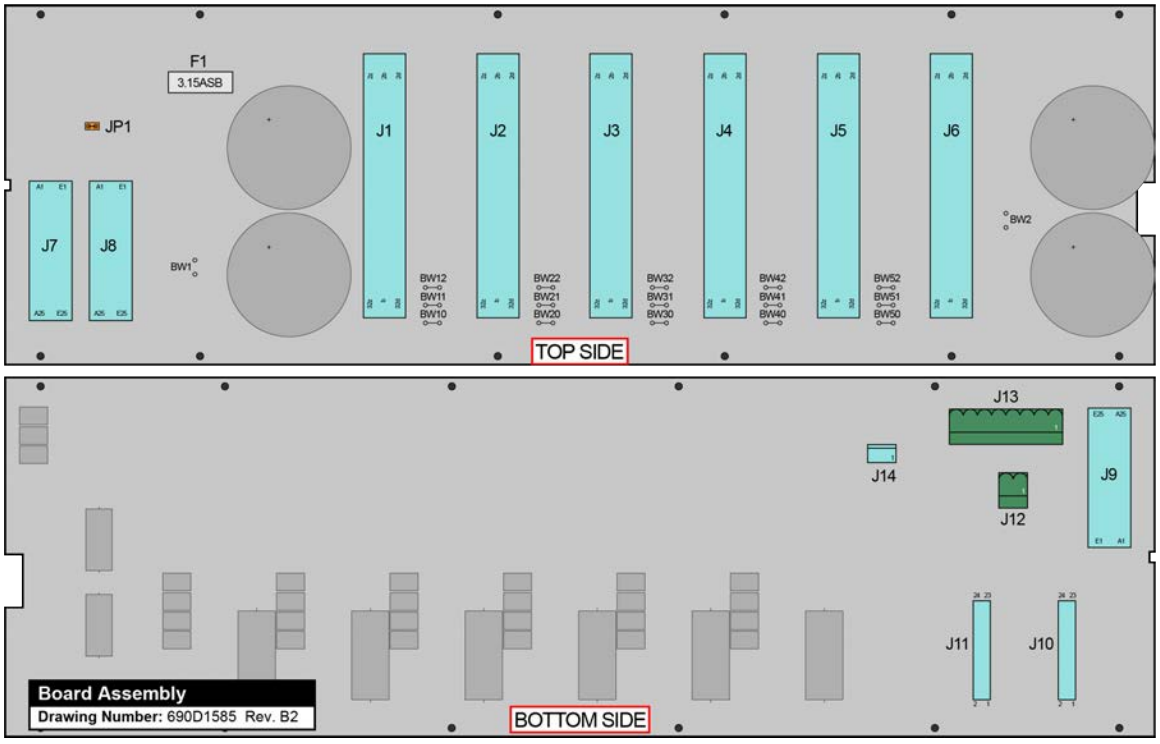


Figure 4-2: Drive Interface Board Assembly

Table 4-6: Drive Interface Board Fuse Information

Fuse	Description	Size	Aerotech P/N	Manufacturer's P/N
F1	+5 VDC User Power	3 A, resettable	EIF01001	Raychem RGE300

Table 4-7: Drive Interface Jumper Settings

Jumpers	Positions	Function
BW1	In	Bus #1 Uni-polar supply only
	Out *	Bus #1 Uni-polar / Bipolar supply
BW2	In	Bus #2 Uni-polar supply only
	Out *	Bus #2 Uni-polar / Bipolar supply
BW10, 11, 12	In *	Connects Bus Supply (B-, RTN, B+) between Axis 1 and 2
	Out	Splits Bus Supply (B-, RTN, B+) between Axis 1 and 2
BW20, 21, 22	In *	Connects Bus Supply (B-, RTN, B+) between Axis 2 and 3
	Out	Splits Bus Supply (B-, RTN, B+) between Axis 2 and 3
BW30, 31, 32	In *	Connects Bus Supply (B-, RTN, B+) between Axis 3 and 4
	Out	Splits Bus Supply (B-, RTN, B+) between Axis 3 and 4
BW40, 41, 42	In *	Connects Bus Supply (B-, RTN, B+) between Axis 4 and 5
	Out	Splits Bus Supply (B-, RTN, B+) between Axis 4 and 5
BW50, 51, 52	In *	Connects Bus Supply (B-, RTN, B+) between Axis 5 and 6
	Out	Splits Bus Supply (B-, RTN, B+) between Axis 5 and 6
JP1	In *	Disable Axis power monitor for Brake
	Out	Enable Axis power monitor for Brake (Additional wiring and hardware is required)
* default		

4.3. Rear Panel Interface Board Assembly

Figure 4-3 highlights the important components located on the Rear Panel Interface board assembly.

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

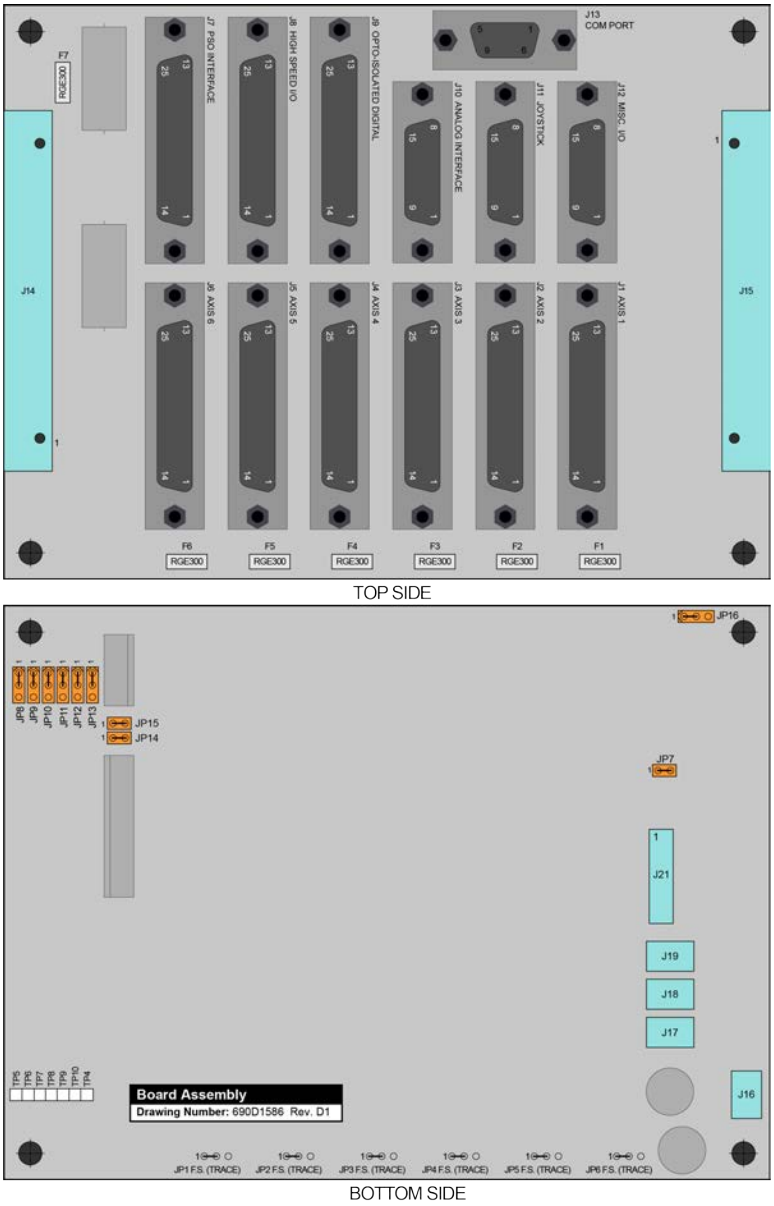


Figure 4-3: Rear Panel Interface Board Assembly

Table 4-8: Rear Panel Interface Board Jumper Information

Jumpers	Positions	Function
JP1	1-2 *	Axis 1 Limit supply is +5 Volts (1-2 is trace)
	2-3	Axis 1 Limit supply from (Internal) J16 (Cut trace 1-2)
JP2	1-2 *	Axis 2 Limit supply is +5 Volts (1-2 is trace)
	2-3	Axis 2 Limit supply from (Internal) J16 (Cut trace 1-2)
JP3	1-2 *	Axis 3 Limit supply is +5 Volts (1-2 is trace)
	2-3	Axis 3 Limit supply from (Internal) J16 (Cut trace 1-2)
JP4	1-2 *	Axis 4 Limit supply is +5 Volts (1-2 is trace)
	2-3	Axis 4 Limit supply from (Internal) J16 (Cut trace 1-2)
JP5	1-2 *	Axis 5 Limit supply is +5 Volts (1-2 is trace)
	2-3	Axis 5 Limit supply from (Internal) J16 (Cut trace 1-2)
JP6	1-2 *	Axis 6 Limit supply is +5 Volts (1-2 is trace)
	2-3	Axis 6 Limit supply from (Internal) J16 (Cut trace 1-2)
JP7	In *	+5 Volt minimum load (System has less than 3 axes)
	Out	System has more than 3 axes
JP8	1-2 *	N/A: Internal Aerotech Use Only
	2-3	N/A: Internal Aerotech Use Only
JP9	1-2 *	N/A: Internal Aerotech Use Only
	2-3	N/A: Internal Aerotech Use Only
JP10	1-2 *	N/A: Internal Aerotech Use Only
	2-3	N/A: Internal Aerotech Use Only
JP11	1-2 *	N/A: Internal Aerotech Use Only
	2-3	N/A: Internal Aerotech Use Only
JP12	1-2 *	N/A: Internal Aerotech Use Only
	2-3	N/A: Internal Aerotech Use Only
JP13	1-2 *	N/A: Internal Aerotech Use Only
	2-3	N/A: Internal Aerotech Use Only
JP14	In *	Analog Input 2 set for single-ended input (Joystick)
	Out	Analog Input 2 set for differential input
JP15	In *	Analog Input 3 set for single-ended input (Joystick)
	Out	Analog Input 3 set for differential input
JP16	1-2 *	PSO Opto Output configured as normally open
	2-3	PSO Opto Output configured as normally closed
* default		

Table 4-9: Rear Panel Interface Board Test Points

Test Point	Function
TP4	Common
TP5	Setup 1
TP6	Setup 2
TP7	Setup 3
TP8	Setup 4
TP9	Setup 5
TP10	Setup 6

4.4. MXR Board Assembly

Figure 4-4 highlights the important components located on the MXR board assembly.

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

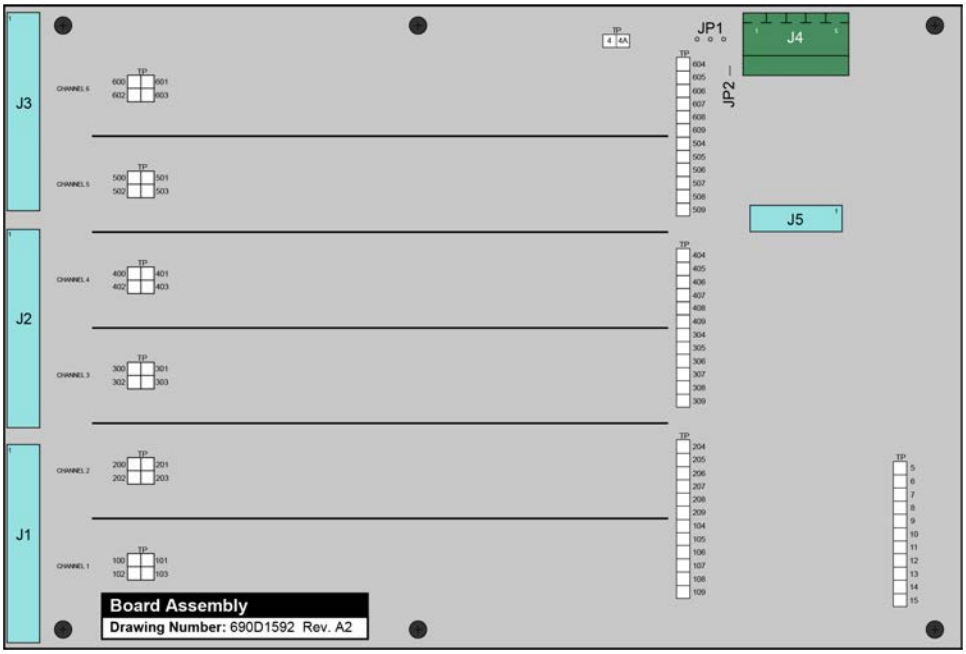


Figure 4-4: MXR Board Assembly

Table 4-10: MXR Board Jumper Selections

Jumper	Setting	Description
JP1	1-2	-5V power from external -12 V at J4-5
	2-3	-5V power from external -5 V at J4-1

Table 4-11: MXR Board Test Points (where "x" represents the channel number)

TP	Description	TP	Description
x00	2.5 V Reference Sine	5	Internal Use Only
x01	Sine after level shift	6	Internal Use Only
x02	2.5 V Reference Cosine	7	Internal Use Only
x03	Cosine	8	Internal Use Only
x04	A/D Select Sine	9	Internal Use Only
x05	A/D Clock Sine	10	Flash 1 Write Enable-N
X06	A/D Data Sine	11	Flash 1 Output Enable-N
x07	A/D Select Cosine	12	Flash 1 Chip Enable-N
x08	A/D Clock Cosine	13	Flash 2 Write Enable-N
x09	A/D Data Cosine	14	Flash 2 Output Enable-N
4	Digital Common	15	Flash 2 Chip Enable-N
4A	Analog Common		

4.5. Soft-Start Board Assembly

The Soft-Start / Voltage Select Board contains four fuses (F1-4) used in the Voltage Select circuit to protect the transformers. Fuses F1 and F3 (Typical value: 4 Amps) provide the primary protection for 100 and 115 VAC operation. Fuses F2 and F4 (Typical value: 3 A) provide the primary protection for 200 and 230 VAC operation. Fuses F1 and F2 are used to protect the transformer connected to J3. Fuses F3 and F4 are used to protect the transformer connected to J5. Table 4-12 lists the part numbers for the fuses.

Table 4-12: Soft-Start Fuse Replacement Part Numbers

Fuse	Manufacturer P/N	Aerotech P/N
2 A SLO BLO, 3AG	Littelfuse 313002	EIF00102
3 A SLO BLO, 3AG	Littelfuse 313003	EIF00103
4 A SLO BLO, 3AG	Littelfuse 313004	EIF00104
7 A SLO BLO, 3AG	Littelfuse 313007	EIF00107
8 A SLO BLO, 3AG	Littelfuse 313008	EIF00109
1A 5mm (F1, MXR Switch bd.)	Littelfuse 213001	EIF00189

NOTE: Due to inrush currents, all Soft-Start / Voltage Select Board fuses must be of the Slow Blow type.

DANGER: Always disconnect the Mains power connection before opening the Npaq chassis. Fuses must not be changed with Mains power applied to unit.

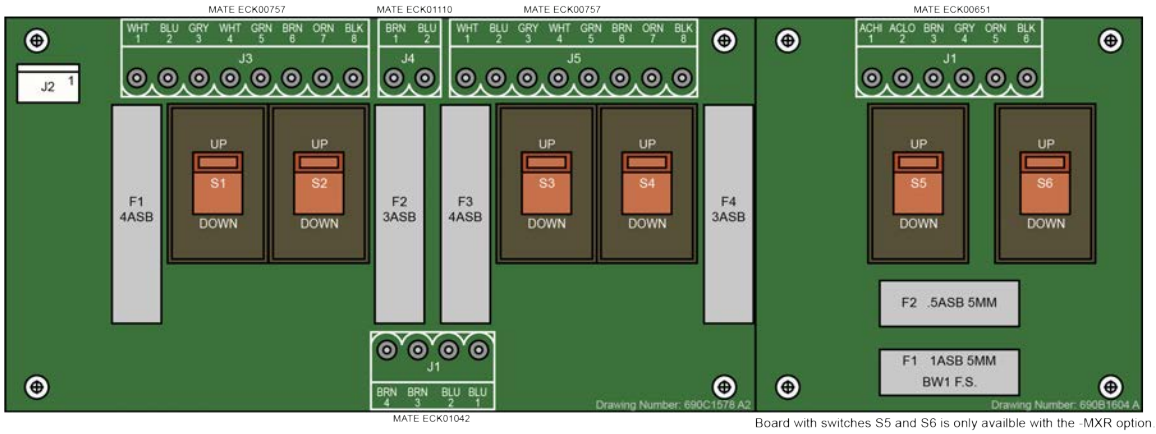


Figure 4-5: Soft-Start/Voltage Select Board

4.6. Analog I/O Board Assembly [Archive]

NOTE: This option is no longer available for purchase. This section is for legacy users.

Figure 4-6 highlights the important components located on the Analog I/O board assembly.

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

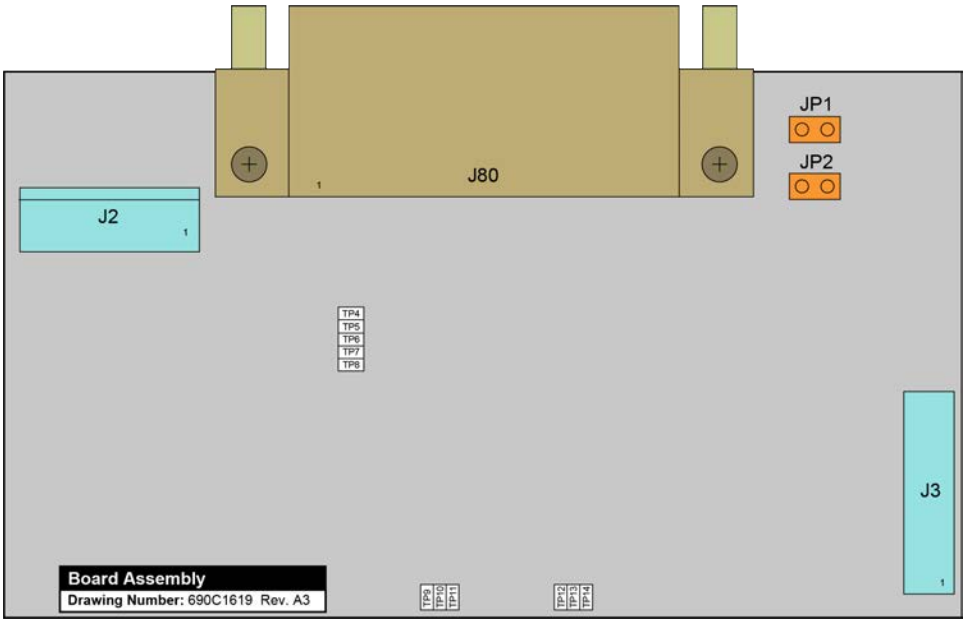


Figure 4-6: Analog I/O Board Assembly

Table 4-13: Analog I/O Option Board Jumper Settings

Jumper	Setting	Function
JP1	In	Analog and Digital +3.3V Supply Connected
	Out *	Analog and Digital +3.3V Supply Isolated (Default)
JP2	In	Analog and Digital Common Connected
	Out *	Analog and Digital Common Isolated (Default)

4.7. RDP Board Assembly [Archive]

NOTE: This option is no longer available for purchase. This section is for legacy users.

Figure 4-7 highlights the important components located on the RDP board assembly.

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

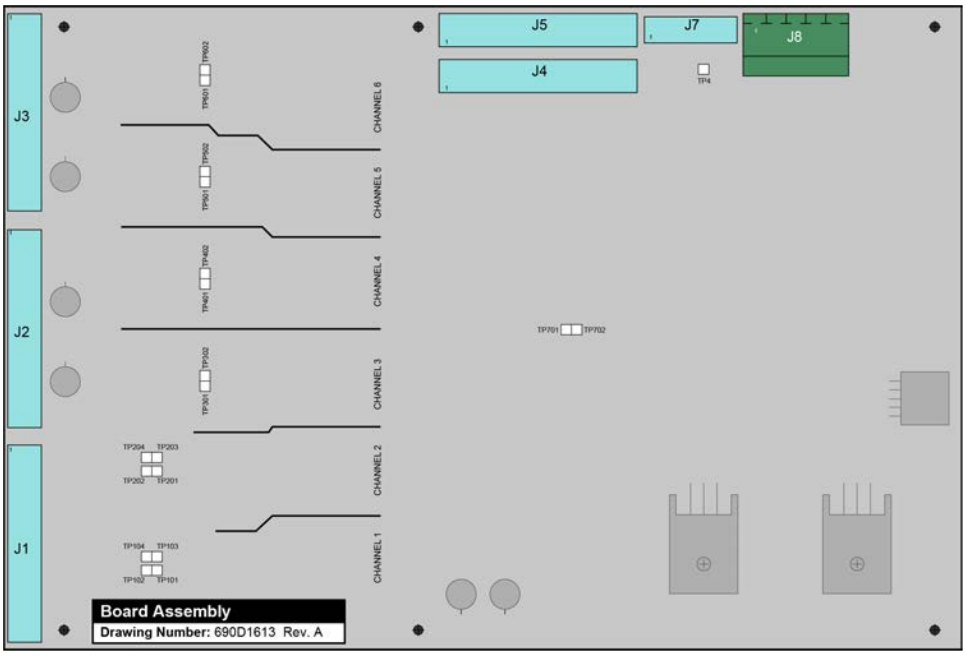


Figure 4-7: RDP Board Assembly

Table 4-14: RDP Board Test Points (where "x" represents the channel number)

Test Point	Description
TP4	Signal Common
TPx01	Cosine input Channel x after buffer
TPx02	Sine input Channel x after buffer

4.8. Fuse Replacement

Additional fuse information can be found on the system drawing that was supplied with the Npaq.

Table 4-15: Typical Fuse Replacement Part Numbers

Function / Location	Options	Fuse Rating	Manufacturer P/N	Aerotech P/N
Bus Supply #1 F1 & F2 on Voltage Select / Soft-Start Board	10B, 20B	F1: 4 A, 3 AG	Littelfuse 313004P	EIF104
		F2: 2 A, 3 AG	Littelfuse 313002P	EIF102
	30B, 40B, 80B	F1: 4 A, 3 AG	Littelfuse 313004P	EIF104
		F2: 3 A, 3 AG	Littelfuse 313003P	EIF103
	160LT	F1: 7 A, 3 AG	Littelfuse 313007P	EIF107
		F2: 3 A, 3 AG	Littelfuse 313003P	EIF103
	320LT	F1: 7 A, 3 AG	Littelfuse 313007P	EIF107
		F2: 10 A, 3 AG	Bussman MDA-10-R	EIF117
Bus Supply #2 F3 & F4 on Voltage Select / Soft-Start Board	10B, 20B	F3: 4 A, 3 AG	Littelfuse 313004P	EIF104
		F4: 2 A, 3 AG	Littelfuse 313002P	EIF102
	30B, 40B, 80B	F3: 4 A, 3 AG	Littelfuse 313004P	EIF104
		F4: 3 A, 3 AG	Littelfuse 313003P	EIF103
	160LT	F3: 7 A, 3 AG	Littelfuse 313007P	EIF107
		F4: 3 A, 3 AG	Littelfuse 313003P	EIF103
	320LT	F3: 7 A, 3 AG	Littelfuse 313007P	EIF107
		F4: 10 A, 3 AG	Bussman MDA-10-R	EIF117
MXR Voltage Select Board: F1 & F2	MXR Options	F1: 1 A, 5x20 mm	Littelfuse 218001P	EIF189
		F2: .5 A, 5x20 mm	Littelfuse 218.500P	EIF196
DL Series Amplifier: F1 & F2	DL4005A DL4010 DL4010A	5 A, 5x20 mm	Littelfuse 215005.P	EIF1023
DP Series Amplifier: F1	DP32010E	5 A, 5x20 mm	Littelfuse 215005.P	EIF1023
	DP32020E DP32030E	10 A, 5x20 mm	Littelfuse 215010.P	EIF1020
Brake / F1 on Drive Interface Board	Brake Options	3.15 A, 5x20 mm	Littelfuse 2183.15P	EIF180
Shunt Board: F1	Shunt	4 ASB, 5 mm	BEL Fuse, 5ET4-R	EIF1032

NOTE: See your System Documentation for additional and alternative fuse requirements.

NOTE: Bus Supply fuses are normally located on the Voltage Selector.

WARNING: 10 amp fuses are not user replaceable. An open fuse usually indicates that the unit should be returned to Aerotech for service.

DANGER: Residual voltages greater than 60V may be present inside Npaq chassis for longer than 10 seconds after power has been disconnected.

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

4.9. Preventative Maintenance

The Npaq 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: Disconnect power to the Npaq main supply before servicing.

Table 4-16: 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 Npaq.
Visually inspect all cables and connections.	Tighten or re-secure any loose connections. Replace worn or frayed cables. Replace broken connectors.

Cleaning

The Npaq 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 Npaq 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 Npaq while cleaning. Do not allow cleaning substances or other fluids to enter the Npaq or to get on to any of the connectors. Avoid cleaning labels to prevent removing the label information.

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 https://www.aerotech.com/global-technical-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) 5508 6731	Aerotech Germany Full-Service Subsidiary Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720

TAIWAN	UNITED KINGDOM
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	Description
3.08.00	The following sections have been updated: • EU Declaration of Conformity (RoHS Directive) • Section 1.1. Electrical Specifications (DL4010)
3.07.00	The following sections have been updated: • EU Declaration of Conformity • Agency Approvals • Section 2.2.3. I/O and Signal Wiring Requirements • Various sections: -RDP and -AIO options have been noted as for Legacy Users Only and are no longer available for purchase.
3.06.00	• General revision • Added RoHS statement to EU Declaration of Conformity • Added Section: Agency Approvals • Updated Danger/Warning notes • Updated PSO output frequency: Table 2-24 • Added ESTOP1, 2, and 3 CR Relay Specifications: Table 3-4 • Updated fuse replacement part numbers: Table 4-15
3.05.00	Revision changes have been archived. If you need a copy of this revision, contact Aerotech Global Technical Support.
3.04.00	
3.03.00	
3.02.00	
3.01.00	
3.00.00	
2.01.00	
2.00.00	
1.10	
1.09	
1.08	
1.07	
1.06	
1.05a	
1.05	
1.04	
1.03	
1.02	
1.01	
1.00	

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Appendix C: Avertissements

Déclaration de conformité

AVERTISSEMENT: Le non-respect de ces procédures peut entraîner des blessures graves, des dommages matériels et/ou des émissions excessives ou une immunité réduite de l'équipement.

Spécifications mécaniques

AVERTISSEMENT: Utiliser les deux poignées pour soulever et porter le Npaq.

Installation et configuration

DANGER: Pour minimiser les risques de blessures corporelles, s'assurer que tous les interrupteurs d'alimentation électrique (tous les interrupteurs externes à l'amplificateur) sont en position d'arrêt avant de procéder à tout réglage mécanique.

Consignes de sécurité et avertissements

AVERTISSEMENT: Former les opérateurs avant de les autoriser à utiliser l'équipement.

AVERTISSEMENT: Une utilisation incorrecte de cet équipement peut entraîner des blessures corporelles. Il est impératif que l'utilisateur lise attentivement le présent manuel, le fichier d'aide A3200 et la documentation connexe avant de faire fonctionner l'équipement.

AVERTISSEMENT: Toutes les tâches d'entretien et de maintenance doivent être effectuées par un personnel qualifié.

AVERTISSEMENT: Toutes les tâches d'entretien et de maintenance doivent être effectuées par un personnel qualifié.

DANGER: Des tensions résiduelles supérieures à 60 V peuvent être présentes à l'intérieur du châssis Npaq pendant plus de 10 secondes après la coupure de l'alimentation.

DANGER: Pour minimiser les risques de blessures corporelles, s'assurer que tous les interrupteurs d'alimentation électrique (tous les interrupteurs externes à l'amplificateur) sont en position d'arrêt avant de procéder à tout réglage mécanique.

DANGER: Les pièces mobiles connectées au Npaq posent un risque de blessures durant le fonctionnement.

Déballage du châssis

DANGER: Tous les équipements et instruments électroniques sont entourés de matériau antistatique et emballés avec un produit déshydratant. S'assurer que le matériau antistatique n'est pas endommagé lors du désemballage.

DANGER: Les câbles ne doivent pas être connectés ni déconnectés du châssis de variateurs Npaq lorsqu'il est sous tension; d'autre part, les modules variateur ne doivent pas être retirés du châssis ou insérés dans le châssis lorsqu'il est sous tension. Ceci risquerait d'endommager le système ou ses composants.

DANGER: Il est nécessaire de changer l'étiquette d'alimentation c.a. si le châssis Npaq est reconfiguré pour une tension d'entrée c.a. différente.

Installation électrique

AVERTISSEMENT: Avant de mettre le Npaq sous tension, vérifier que tous les modules variateur et les câbles reliés au Npaq sont correctement installés. Consulter les autres chapitres de ce manuel pour les procédures d'installation et de configuration.

Branchements sur le secteur

AVERTISSEMENT: Le cordon d'alimentation c.a. est le sectionneur du réseau électrique.

AVERTISSEMENT: Le cordon d'alimentation c.a. est le sectionneur du réseau électrique.

DANGER: Consulter la documentation destinée à l'utilisateur fournie avec le système Npaq pour déterminer si le châssis Npaq est limité à une seule tension d'entrée c.a. L'utilisation à d'autres niveaux de tension risque d'endommager le châssis Npaq.

DANGER: Consulter la documentation destinée à l'utilisateur fournie avec le système Npaq pour déterminer si le châssis Npaq est limité à une seule tension d'entrée c.a. L'utilisation à d'autres niveaux de tension risque d'endommager le châssis Npaq.

Fonctionnement de l'ouverture en fondu

AVERTISSEMENT: Pour un fonctionnement correct, le circuit Soft-Start requiert +24 V c.c. (fournis en interne). Si une alimentation +24 V c.c. n'est pas connectée, cela risque d'endommager le circuit Soft-Start.

AVERTISSEMENT: Les couleurs de fil du transformateur ne concernent que le transformateur d'Aerotech (réf. EAX01010). Ne pas utiliser avec d'autres transformateurs.

Sélection de la tension

AVERTISSEMENT: Le sélecteur de tension ne peut être utilisé qu'avec des transformateurs conçus pour s'interfacer avec ce circuit. Cette fonction de sélecteur de tension ne fonctionnera pas correctement avec les alimentations autonomes. Une utilisation incorrecte de cette fonction risque d'endommager l'unité.

AVERTISSEMENT: Ne pas changer les réglages d'interrupteur du sélecteur de tension si le châssis de variateurs Npaq contient d'autres dispositifs c.a. qui ne permettent pas une entrée c.a. universelle (85 à 250 V c.a.).

AVERTISSEMENT: Le sélecteur de tension doit être configuré de façon à correspondre à la tension de ligne c.a. L'unité risque d'être endommagée si le sélecteur de tension est réglé sur la tension d'entrée c.a. incorrecte. Les interrupteurs S1 et S3 ont toujours le même réglage. Les interrupteurs S2 et S4 ont toujours le même réglage.

DANGER: Couper l'alimentation secteur avant d'ouvrir le châssis. Les réglages du sélecteur de tension ne doivent pas être changés lorsque l'unité est alimentée par le secteur.

AVERTISSEMENT: S1 à S6 doivent être réglés en fonction de la tension d'entrée d'alimentation c.a. Un réglage incorrect des interrupteurs S1 à S6 risque d'endommager le système.

Phasage du moteur alimenté

AVERTISSEMENT: Le programme MsetDebug.Pgm fait passer le moteur en mode « boucle ouverte », contournant un grand nombre de défauts de sécurité standard.

AVERTISSEMENT: Il est recommandé de déconnecter les moteurs rotatifs de l'étage avant d'effectuer cet essai. Les systèmes à moteur linéaire ne doivent présenter aucune obstruction pour éviter d'endommager les autres composants. Les opérateurs ne doivent pas s'approcher des pièces mobiles durant l'essai.

AVERTISSEMENT: Il est recommandé de déconnecter les moteurs rotatifs de l'étage avant d'effectuer cet essai. Les systèmes à moteur linéaire ne doivent présenter aucune obstruction pour éviter d'endommager les autres composants. Les opérateurs ne doivent pas s'approcher des pièces mobiles durant l'essai.

Entrée de détection d'arrêt d'urgence (ESTOP)

AVERTISSEMENT: Il incombe à l'utilisateur d'évaluer les niveaux de risque pour l'opérateur et de concevoir les circuits de sécurité externes de façon appropriée.

AVERTISSEMENT: Il incombe à l'utilisateur d'évaluer les niveaux de risque pour l'opérateur et de concevoir les circuits de sécurité externes de façon appropriée.

Caractéristiques du relais à semi-conducteurs (SSR)

AVERTISSEMENT: Ne pas dépasser les spécifications maximales.

Maintenance

DANGER: Toujours débrancher la connexion d'alimentation principale avant d'ouvrir le châssis Npaq.

DANGER: Avant d'effectuer des essais, ne pas oublier que des tensions mortelles sont présentes à l'intérieur du châssis de variateurs Npaq et au niveau de certains connecteurs de l'interface utilisateur. Ces essais doivent être effectués par un technicien d'entretien ou un électricien qualifié.

Tableau de contrôle

DANGER: Toujours débrancher la connexion d'alimentation principale avant d'ouvrir le châssis Npaq.

Carte d'interface de l'entraînement

DANGER: Toujours débrancher la connexion d'alimentation principale avant d'ouvrir le châssis Npaq.

Carte d'interface du panneau arrière

DANGER: Toujours débrancher la connexion d'alimentation principale avant d'ouvrir le châssis Npaq.

Carte RDP

DANGER: Toujours débrancher la connexion d'alimentation principale avant d'ouvrir le châssis Npaq.

Carte MXR

DANGER: Toujours débrancher la connexion d'alimentation principale avant d'ouvrir le châssis Npaq.

Carte E/S analogique

DANGER: Toujours débrancher la connexion d'alimentation principale avant d'ouvrir le châssis Npaq.

Carte d'interface parallèle du laser

DANGER: Toujours débrancher la connexion d'alimentation principale avant d'ouvrir le châssis Npaq.

Carte d'ouverture en fondu

DANGER: Toujours débrancher la connexion d'alimentation principale avant d'ouvrir le châssis Npaq.

Remplacement des fusibles

AVERTISSEMENT: Les fusibles de 10 A ne sont pas remplaçables par l'utilisateur. Lorsqu'un fusible est ouvert, cela indique généralement qu'il faut renvoyer l'unité à Aerotech pour qu'elle soit réparée.

DANGER: Des tensions résiduelles supérieures à 60 V peuvent être présentes à l'intérieur du châssis Npaq pendant plus de 10 secondes après la coupure de l'alimentation.

DANGER: Toujours débrancher la connexion d'alimentation principale avant d'ouvrir le châssis Npaq.

Maintenance préventive

DANGER: Débrancher l'alimentation électrique pour éviter tout risque de choc.

Nettoyage

DANGER: Couper l'alimentation avant de procéder au nettoyage.

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