



ANT180-L Hardware Manual

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Safety Procedures and Warnings

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

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



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. Access to the ANT180-L and component parts must be restricted while connected to a power source.
2. Do not connect or disconnect any electrical components or connecting cables while connected to a power source.
3. Disconnect electrical power before servicing equipment.
4. Make sure the ANT180-L and all components are properly grounded in accordance with local electrical safety requirements.
5. Operator safeguarding requirements must be addressed during final integration of the product.



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

1. Moving parts can cause crushing or shearing injuries. Access to all stage and motor parts must be restricted while connected to a power source.
2. Cables can pose a tripping hazard. Securely mount and position all system cables to avoid potential hazards.
3. Do not expose the ANT180-L to environments or conditions outside of the listed specifications. Exceeding environmental or operating specifications can cause damage to the equipment.
4. The ANT180-L must be mounted securely. Improper mounting can result in injury and damage to the equipment.
5. Use care when moving the ANT180-L. Lifting or transporting the ANT180-L improperly can result in injury or damage to the ANT180-L.
6. The ANT180-L is intended for light industrial manufacturing or laboratory use. Use of the ANT180-L for unintended applications can result in injury and damage to the equipment.
7. If the ANT180-L is used in a manner not specified by the manufacturer, the protection provided by the ANT180-L can be impaired and result in damage, shock, injury, or death.
8. Operators must be trained before operating this equipment.
9. All service and maintenance must be performed by qualified personnel.

EC Declaration of Incorporation

Manufacturer: Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238-2897
USA

herewith declares that the product:
ANT180-L Stage

is intended to be incorporated into machinery to constitute machinery covered by the Directive 2006/42/EC as amended;

and that the following harmonized European standards have been applied:

ISO 12100

Safety of machinery - General principles for design

- Risk assessment and risk reduction

EN 60204-1

Safety of machinery - Electrical equipment of machines

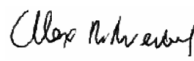
and further more declares that

it is not allowed to put the equipment into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of the Directive 2006/42/EC and with national implementing legislation, i.e. as a whole, including the equipment referred to in this Declaration.

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Chapter 1: Overview

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.

Table 1-1: Model Numbering System

ANT Series Linear Motor Stage	
ANT180-160-L	160 mm travel stage with linear motor and limits
ANT180-160-L-PLUS	160 mm travel stage with linear motor and limits (high accuracy version)
ANT180-210-L	210 mm travel stage with linear motor and limits
ANT180-210-L-PLUS	210 mm travel stage with linear motor and limits (high accuracy version)
ANT180-260-L	260 mm travel stage with linear motor and limits
ANT180-260-L-PLUS	260 mm travel stage with linear motor and limits (high accuracy version)
ANT180-360-L	360 mm travel stage with linear motor and limits
ANT180-360-L-PLUS	360 mm travel stage with linear motor and limits (high accuracy version)
Linear Encoders	
-LTAS	Amplified sine output 1 Vpp (20 μ m signal period) requires signal multiplier
-LTX50	0.1 micron line driver output
-LNAS	High-accuracy amplified sine output 1 Vpp (4 μ m signal period) requires signal multiplier
CMS Options	
-XY	Cable management system for X-Y assembly (only order with X axis)
-XYZ	Cable management system for X-Y-Z assembly (only order with X axis)
-Y	Cable management system for X-Y assembly (only order with Y axis)
-YZ	Cable management system for Y-Z assembly (only order with Y axis)
-AIR	Adds a 6 mm air line to the -XY, -XYZ, -Y, and -YZ assembly option Example: -XYZ-AIR
Accessories	
ALIGNMENT-PA10	XY assembly; 10 arc sec orthogonal
ALIGNMENT-PA10	XY assembly; 5 arc sec orthogonal

1.1. Environmental Specifications



WARNING: Do not expose the ANT180-L to environments or conditions outside of the listed specifications. Exceeding environmental or operating specifications can cause damage to the equipment.

Table 1-2: Environmental Specifications

Ambient Temperature	Operating: 10° to 35° C (50° to 95° F) The optimal operating temperature is 20° C \pm 2° C (68° F \pm 4° F). If at any time the operating temperature deviates from 20° C degradation in performance could occur.
	Storage: 0° to 40° C (32° to 104° F) in original shipping packaging
Humidity	Operating: 20% to 60% RH
	Storage: 10% to 70% RH, non-condensing in original packaging. The stage should be packaged with desiccant if it is to be stored for an extended time.
Altitude	Operating: 0 m to 2,000 m (0 ft to 6,562 ft) above sea level Contact Aerotech if your specific application involves use above 2,000 m or below sea level.
Vibration	Use the system in a low vibration environment. Excessive floor or acoustical vibration can affect system performance. Contact Aerotech for information regarding your specific application.
Protection Rating	The ANT180-L stages are not suited for dusty or wet environments. This equates to an ingress protection rating of IP00.
Use	Indoor use only

1.2. Accuracy and Temperature Effects

Aerotech products are designed for and built in a 20°C (68°F) environment. Extreme temperature changes could cause a decrease in performance or permanent damage to the ANT180-L. At a minimum, the environmental temperature must be controlled to within 0.25°C per 24 hours to ensure the ANT180-L specifications are repeatable over an extended period of time. The severity of temperature effects on all specifications depends on many different environmental conditions, including how the ANT180-L is mounted. Contact the factory for more details.

The thermal expansion coefficient of the encoder scale depends on the option purchased. For LT stages, this value is 3.25 ppm/°C. For LN stages, this value is 7.5 ppm/°C. Travel will increase or decrease at this rate as the encoder scale temperature deviates from 20°C (68°F).

The accuracy specification of ANT180-L series stages is measured 25 mm above the table with the stage in a horizontal position. The stage is assumed to be fully supported by a mounting surface meeting or exceeding the specification in [Section 2.3](#).

1.3. Basic Specifications

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.

Resolution is dependent on encoder resolution and controller interpolation.

Table 1-3: ANT180-L Series Specifications

		-160-L	-210-L	-260-L	-360-L
Travel		160 mm	210 mm	260 mm	360 mm
Accuracy ^[1]	LNAS (PLUS ^[4])	±150 nm	±150 nm	±200 nm	±200 nm
	LNAS (Std)	±2.0 µm	±2.5 µm	±3.0 µm	±3.5 µm
	LTAS (PLUS ^[4])	±300 nm	±300 nm	±350 nm	±350 nm
	LTAS (Std)	±4.0 µm	±5.0 µm	±6.0 µm	±7.0 µm
Resolution	LNAS	1 nm	1 nm	1 nm	1 nm
	LTAS	3 nm	3 nm	3 nm	3 nm
Repeatability (Bi-Directional) ^[1]	LNAS	±100 nm	±100 nm	±125 nm	±125 nm
	LTAS	±150 nm	±150 nm	±175 nm	±175 nm
Straightness ^[1]		±1.0 µm	±1.25 µm	±1.5 µm	±1.75 µm
Flatness ^[1]		±1.0 µm	±1.25 µm	±1.5 µm	±1.75 µm
Pitch		14 arc sec	14 arc sec	16 arc sec	16 arc sec
Roll		14 arc sec	14 arc sec	16 arc sec	16 arc sec
Yaw		10 arc sec	10 arc sec	12 arc sec	12 arc sec
Maximum Speed		500 mm/s	500 mm/s	500 mm/s	500 mm/s
Maximum Acceleration (no load)		2 g	2 g	2 g	2 g
Maximum Force (Continuous)		110.5 N	110.5 N	110.5 N	110.5 N
Load Capacity ^[2]	Horizontal	30 kg	30 kg	30 kg	30 kg
	Side	20 kg	20 kg	20 kg	20 kg
Moving Mass		6.6 kg	7.8 kg	9.2 kg	11.7 kg
Stage Mass		12.8 kg	14.9 kg	17.6 kg	22.4 kg
Material		Aluminum Body/Black Hardcoat Finish			
Mean Time Between Failure		30,000 Hours			
1. Certified with each stage.					
2. Axis orientation for on-axis loading is listed (refer to Section 2.4 for offset loading behavior).					
3. Specifications are for single-axis systems measured 25 mm above the tabletop. Performance of multi-axis system is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.					
4. Requires the use of an Aerotech controller.					
5. Specifications are LNAS and LTAS only. Consult factory for specifications regarding the LTX50 option.					

1.4. Vacuum Operation

Aerotech can specially prepare the ANT180-L for operation in vacuum environments. Aerotech offers two vacuum preparation options; one for low vacuum (for use in atmospheric pressures to 10^{-3} torr) and one for high vacuum (preparation for environments from 10^{-3} to 10^{-6} torr). As part of this preparation, attention to detail during modification, cleaning, and assembly results in products with optimal performance in vacuum applications.

To ensure that the ANT180-L will continue to perform well in the vacuum environment, follow the guidelines listed below (in addition to standard handling, installation, and lubrication guidelines outlined in this manual).

1. Do not remove the ANT180-L from the sealed bag until it is ready for use.
2. Always handle the ANT180-L in a clean environment and use powder-free polyethylene gloves to prevent any contaminants from adhering to the surface of the ANT180-L.
3. During installation, use cleaned, vented, stainless steel fasteners when securing the ANT180-L.
4. Reduced air pressure eliminates significant convective heat transfer. This, coupled with the viscous vacuum-compatible lubricants, could result in excessive motor operating temperatures. Because of this, consider all continuous torque ratings to be 40 to 60% lower than the value specified for operation in normal atmospheric environment. Reduce motor usage accordingly.
5. For vacuum applications, the recommended lubricant is a small quantity of **Braycote® 602EF** grease or a compatible substitute of equal quality.
6. Baking vacuum components between 100 and 125 °C for 24 to 48 hours significantly reduces outgassing at initial pump-down to vacuum pressure and evaporates water vapor that impregnates porous surfaces on the aluminum surfaces and Teflon cables. Aerotech recommends that customers bake out vacuum systems when first installing them in the vacuum chamber.

Chapter 2: Mechanical Specifications and Installation



WARNING: ANT180-L installation must be in accordance to instructions provided by this manual and any accompanying documentation. Failure to follow these instructions could result in injury or damage to the equipment.

2.1. Unpacking and Handling the Stage



DANGER/HEAVY: Manually lifting and moving the stage requires a minimum of two people on either side of the stage. Refer to [Section 1.3](#) for stage mass specifications.

- Do not attempt to lift heavy loads single handed.
- Follow the lifting instructions and only manually lift from the specified surfaces (if lifting hardware hasn't been supplied).
- Do not use any of the cables as lifting points.



WARNING: It is the customer's responsibility to safely and carefully lift the stage.

- Make sure that all moving parts are secure before moving the ANT180-L. Unsecured moving parts may shift and cause bodily injury.
- Improper handling could adversely affect the ANT180-L's performance. Use care when moving the ANT180-L.

NOTE: If any damage has occurred during shipping, report it immediately.

Carefully remove the ANT180-L from its protective shipping container. Gently set the ANT180-L on a smooth, flat, and clean surface.

Before operating the ANT180-L, it is important to let it stabilize at room temperature for at least 12 hours. Allowing it to stabilize to room temperature will ensure that all of the alignments, preloads, and tolerances are the same as they were when tested at Aerotech. Use compressed nitrogen or clean, dry, oil-less air to remove any dust or debris that has collected during shipping.

Each ANT180-L has a label listing the system part number and serial number. These numbers contain information necessary for maintaining or updating system hardware and software. Locate this label and record the information for later reference.

Shipping Clamps

All ANT180-L series stages are packaged with shipping brackets installed to prevent unwanted stage motion and potential damage from occurring during shipment. The brackets are red anodized aluminum (the only red anodized pieces Aerotech uses) that bolt the stage table to the base and they must be removed from the stage before the stage can be operated. Retain the brackets for future use.

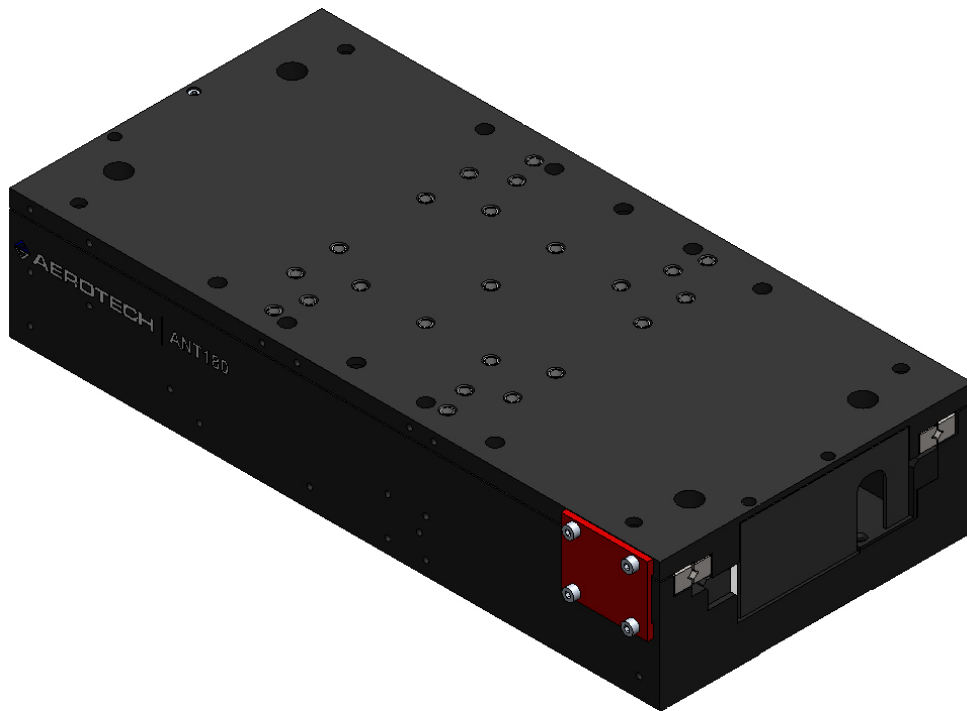


Figure 2-1: Shipping Clamps

2.2. Dimensions

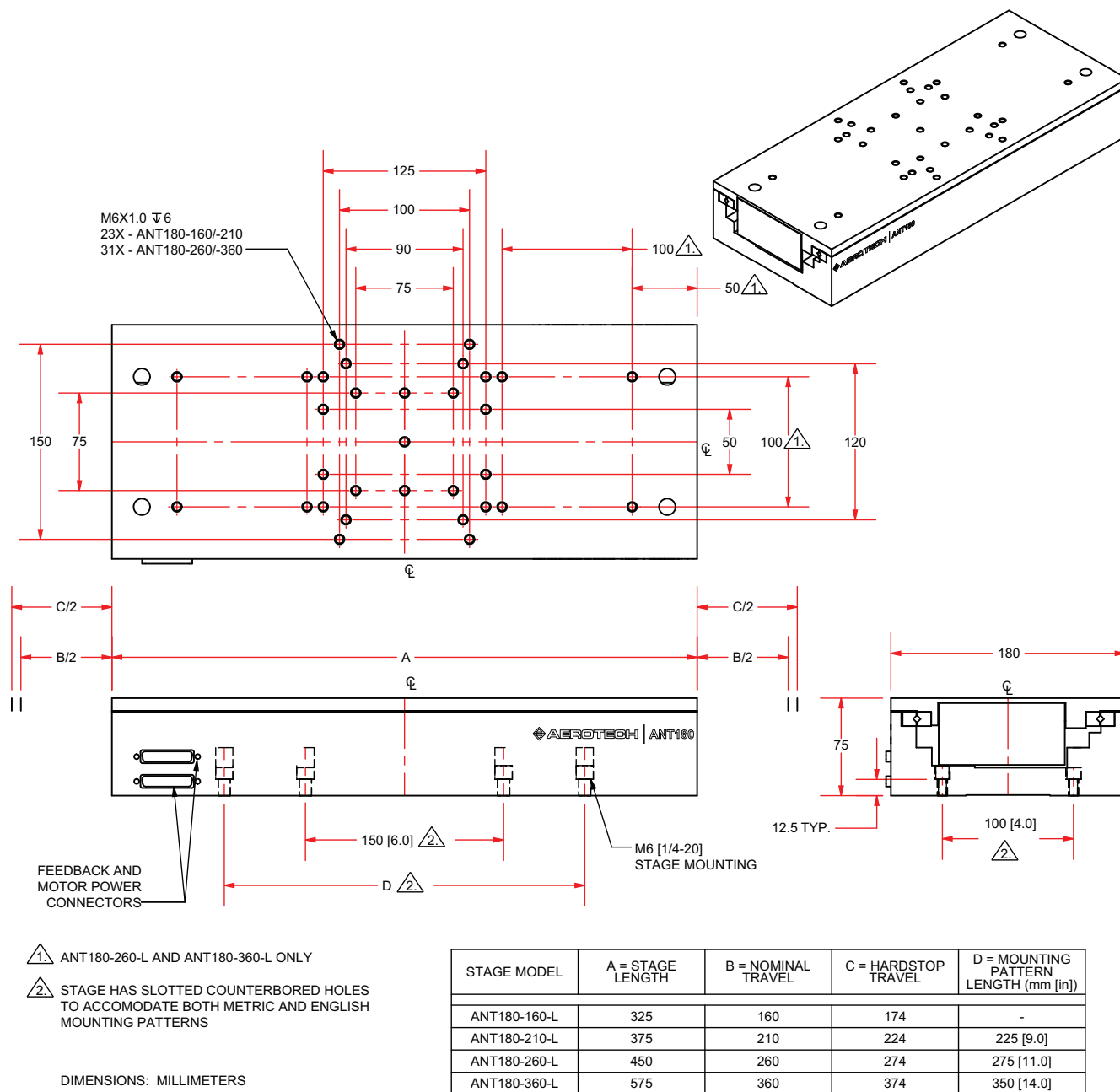


Figure 2-2: ANT180-L Dimensions

2.3. Securing the Stage to the Mounting Surface



WARNING: Do not attempt to manually move the ANT180-L if it is connected to a power source.



WARNING: The ANT180-L must be mounted securely. Improper mounting can result in injury and damage to the equipment.



WARNING: Mounting the stage requires passing the screws near the magnetic tracks mounted to the carriage. Use caution when mounting with magnetic hardware, or use non-magnetic hardware that will not be attracted to the tracks.

The mounting surface must be flat and have adequate stiffness in order to achieve the maximum performance from the ANT180-L stage. When it is mounted to a non-flat surface, the stage can be distorted as the mounting screws are tightened. This distortion will decrease overall accuracy. Adjustments to the mounting surface must be done before the stage is secured.

Inspect the mounting surface for dirt or unwanted residue and clean if necessary. Use precision flatstones on the mounting surface to remove any burrs or high spots. Clean the mounting surface with a lint free cloth and acetone or isopropyl alcohol and allow the cleaning solvent to completely dry. Gently place the stage on the mounting surface.

NOTE: To maintain accuracy, the mounting surface must be flat to within 5 μm over the entire stage footprint.

NOTE: The ANT180-L is precision machined and verified for flatness prior to product assembly at the factory. If machining is required to achieve the desired flatness, it should be performed on the mounting surface rather than the ANT180-L. Shimming should be avoided if possible. If shimming is required, it should be minimized to improve the rigidity of the system.

Tightening torque values are dependent on the properties of the surface on which the stage is being mounted. Values provided in [Table 2-1](#) are typical values and may not be accurate for your mounting surface. Refer to [Section 2.2](#) for specific model mounting locations and dimensions.

Table 2-1: Stage to Mounting Surface Hardware

Mounting Hardware	Typical Screw Torque
M6 x 25 mm (1/4-20 x 1 in) SHCS	5.4 N·m

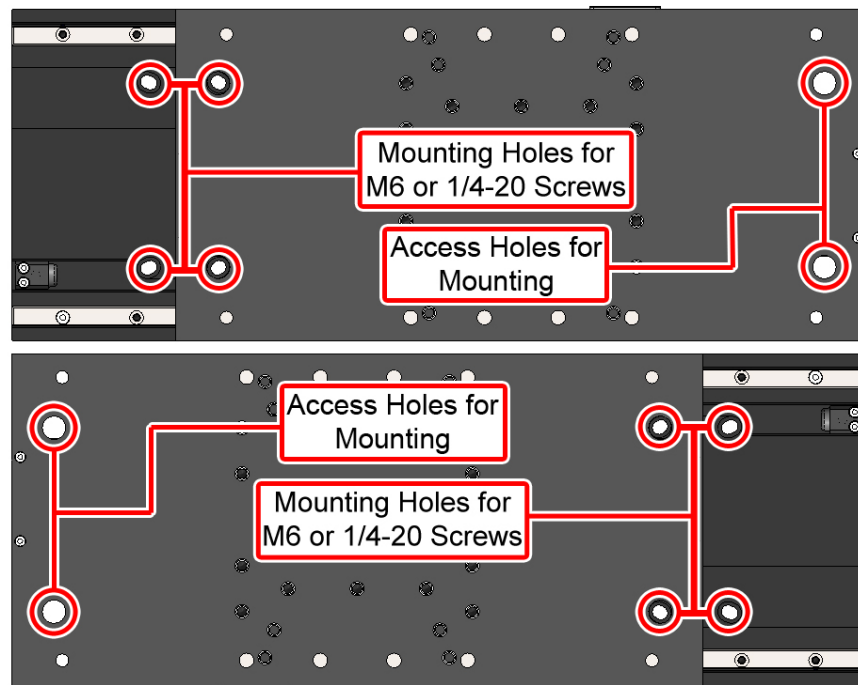


Figure 2-3: Mounting Hole Pattern

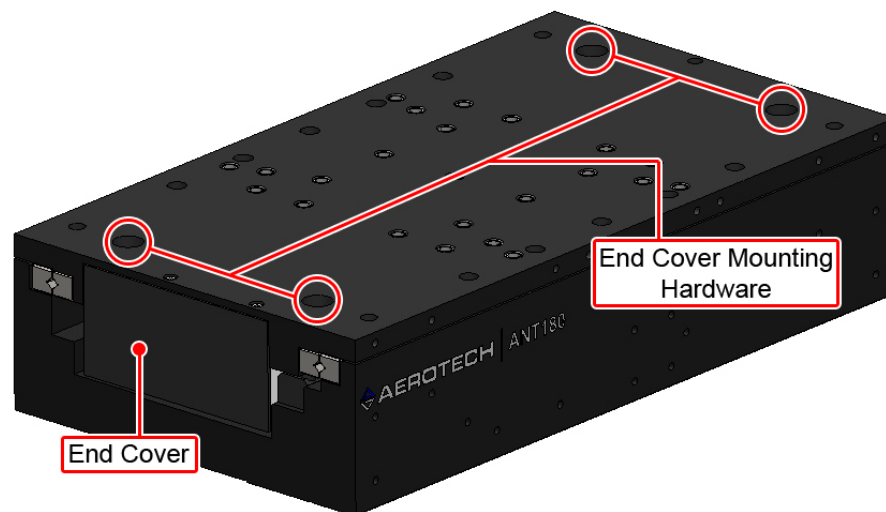


Figure 2-4: End Cover Removal

2.4. Attaching the Payload to the Stage

Inspect the mounting surface for dirt or unwanted residue and clean if necessary. Clean the mounting surface with a lint free cloth and acetone or isopropyl alcohol and allow the cleaning solvent to completely dry.

To prevent damage to the payload or stage, test the operation of the stage before the payload is attached. Aerotech recommends that customers use a representative payload during start-up to prevent accidental damage to the stage and the payload. Proceed with the electrical installation and test the motion control system in accordance with the system documentation. Document all results for future reference. For information on electrical installation refer to [Chapter 3](#) and the documentation delivered with the stage.

NOTE: Stages that ship with Aerotech controls are often tuned with a representative payload based on the information provided at the time of order. If the stage is started up without a payload, the servo gains provided by Aerotech with the shipment may not be appropriate and servo instability can occur. Refer to the controller help file for tuning assistance.

The payload must be flat, rigid, and comparable to the stage in quality to maintain optimum performance.

NOTE: For valid system performance, the mounting interface should be flat within 1 μm per 50 mm.



WARNING: Refer to the dimensions in [Section 2.2](#) for maximum allowable thread engagement. A screw extending through the stage table can affect travel and damage the stage. Do not let mounting screws project more than 7 mm (.276") into the stage table top.

Applied loads should be symmetrically distributed whenever possible (i.e., the payload should be centered on the stage table and the entire stage should be centered on the support structure).

If cantilevered loads are applied, refer to [Figure 2-5](#) to find the loading condition. Refer to [Figure 2-6](#) to find the maximum allowable load.

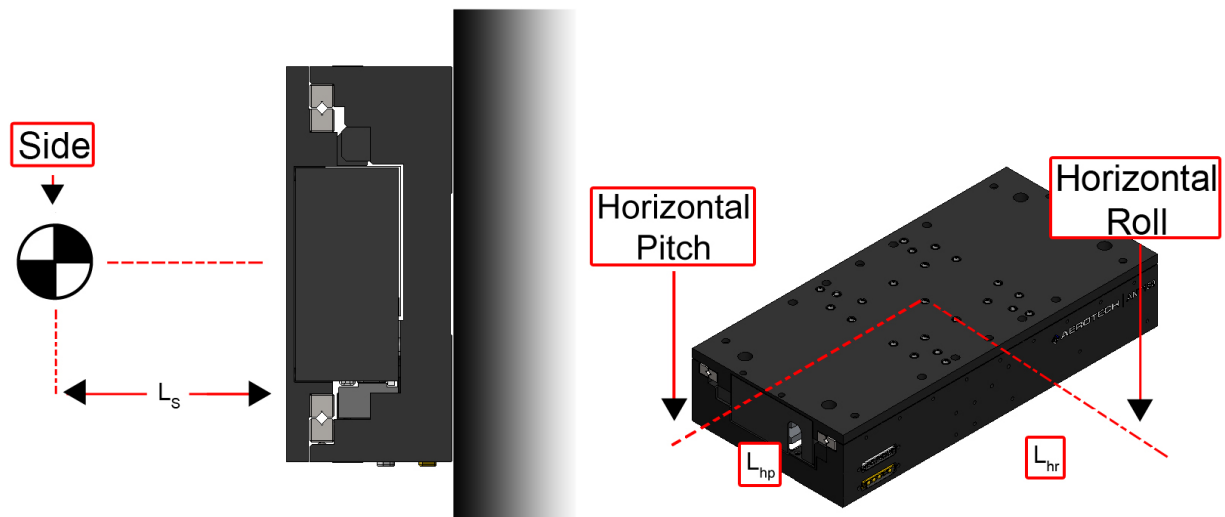
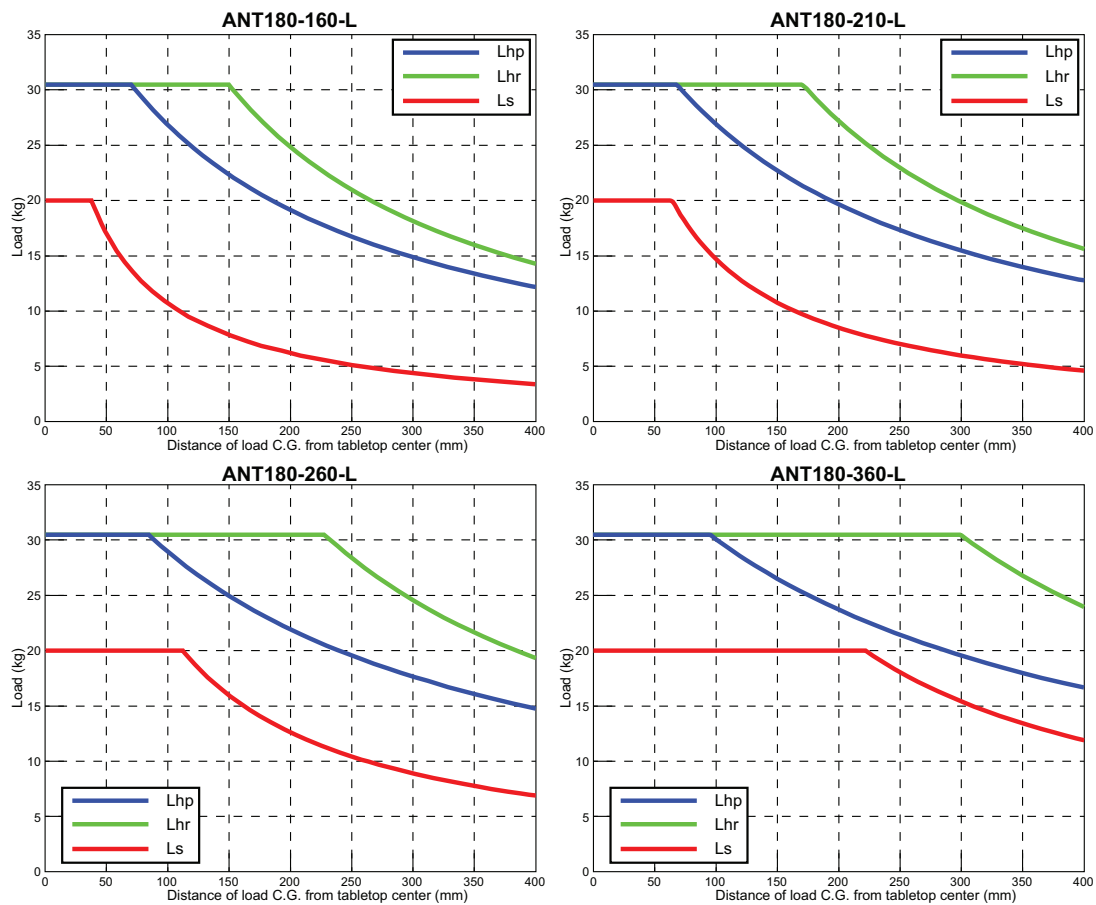


Figure 2-5: Load Orientations

**Figure 2-6: Cantilevered Load Capabilities**

Chapter 3: Electrical Specifications and Installation



WARNING: Electrical installation must be performed by properly qualified personnel.

Aerotech motion control systems are adjusted at the factory for optimum performance. When the ANT180-L is part of a complete Aerotech motion control system, setup usually involves connecting a stage to the appropriate drive chassis with the cables provided. Labels on the system components usually indicate the appropriate connections.

If system level integration was purchased along with the stage, an electrical drawing showing system interconnects has been supplied with the system (separate from this documentation).

The electrical wiring from the motor and encoder are integrated at the factory. Refer to the following sections for standard motor wiring and connector pin assignments.



DANGER: Remove power before connecting or disconnecting electrical components or cables. Failure to do so may cause electric shock.



WARNING: Operator access to the base and table top must be restricted while connected to a power source. Failure to do so may cause electric shock.

NOTE: Refer to the controller documentation to adjust servo gains for optimum velocity and position stability.



WARNING: The ANT95-R does not have Hall sensor signals. The controller has to initialize motor commutation through the use of a software algorithm.

3.1. Motor and Feedback Connectors

Stages fitted with standard motors and encoders come from the factory completely wired and assembled.

NOTE: Refer to the other documentation accompanying your Aerotech equipment. Call your Aerotech representative if there are any questions on system configuration.

The ANT180-L's protective ground connection provides motor frame ground protection only. Additional grounding and safety safeguards are required for applications requiring access to the stage while it is energized. The System Integrator or qualified installer is responsible for determining and meeting all safety and compliance requirements necessary for the integration of this stage into the final application.



DANGER: Remove power before connecting or disconnecting electrical components or cables. Failure to do so may cause electric shock.



WARNING: The protective ground connection must be properly installed to minimize the possibility of electric shock.



WARNING: Operator access to the base and table top must be restricted while connected to a power source. Failure to do so may cause electric shock.



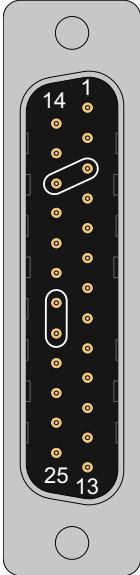
CAUTION: The stage controller must provide over-current and over-speed protection. Failure to do so may result in permanent damage to the motor and stage components.

Table 3-1: Motor Pin Assignments

Pin	Description	Connector
A1	MTR ØA (Motor Phase A)	
A2	MTR ØB (Motor Phase B)	
A3	MTR ØC (Motor Phase C)	
1	Motor Shield (EMI shield)	
2	Reserved	
3	Reserved	
4	Reserved	
5	Reserved	
A4	Frame ground (motor protective ground)	

Mating Connector	Aerotech P/N	Third Party P/N
Backshell	ECK00656	Amphenol #17E-1726-2
Sockets [QTY. 4]	ECK00659	ITT Cannon #DM53744-6
Connector	ECK00657	ITT Cannon #DBMM9W4SA197

Table 3-2: Feedback Pin Assignments

Pin	Description	Connector
1	Signal shield connection	
2	Over-Temperature Thermistor sensor	
3	+5 V power supply input	
4	Reserved	
5	Hall Effect sensor, phase B	
6	Marker-N	
7	Marker	
8	Reserved	
9	Reserved	
10	Hall Effect sensor, phase A	
11	Hall Effect sensor, phase C	
12	Signal indicating maximum travel produced by positive/CW stage direction.	
13	Reserved	
14	Cosine	
15	Cosine-N	
16	+5 V power supply input	
17	Sine	
18	Sine-N	
19	Reserved	
20	Common ground	
21	Common ground	
22	Reserved	
23	Reserved	
24	Signal indicating maximum travel produced by negative/CCW stage direction.	
25	Reserved	

Mating Connector	Aerotech P/N	Third Party P/N
Backshell	ECK00656	Amphenol #17E-1726-2
Connector	ECK00300	FCI DB25S064TLF

3.2. Motor and Feedback Wiring

All motor and controller manufacturers have their own designations for motor $\varnothing A/\varnothing B/\varnothing C$ and Hall signals A/B/C (refer to [Section 3.5](#) for motor phasing). Shielded cables are required for the motor and feedback connections.

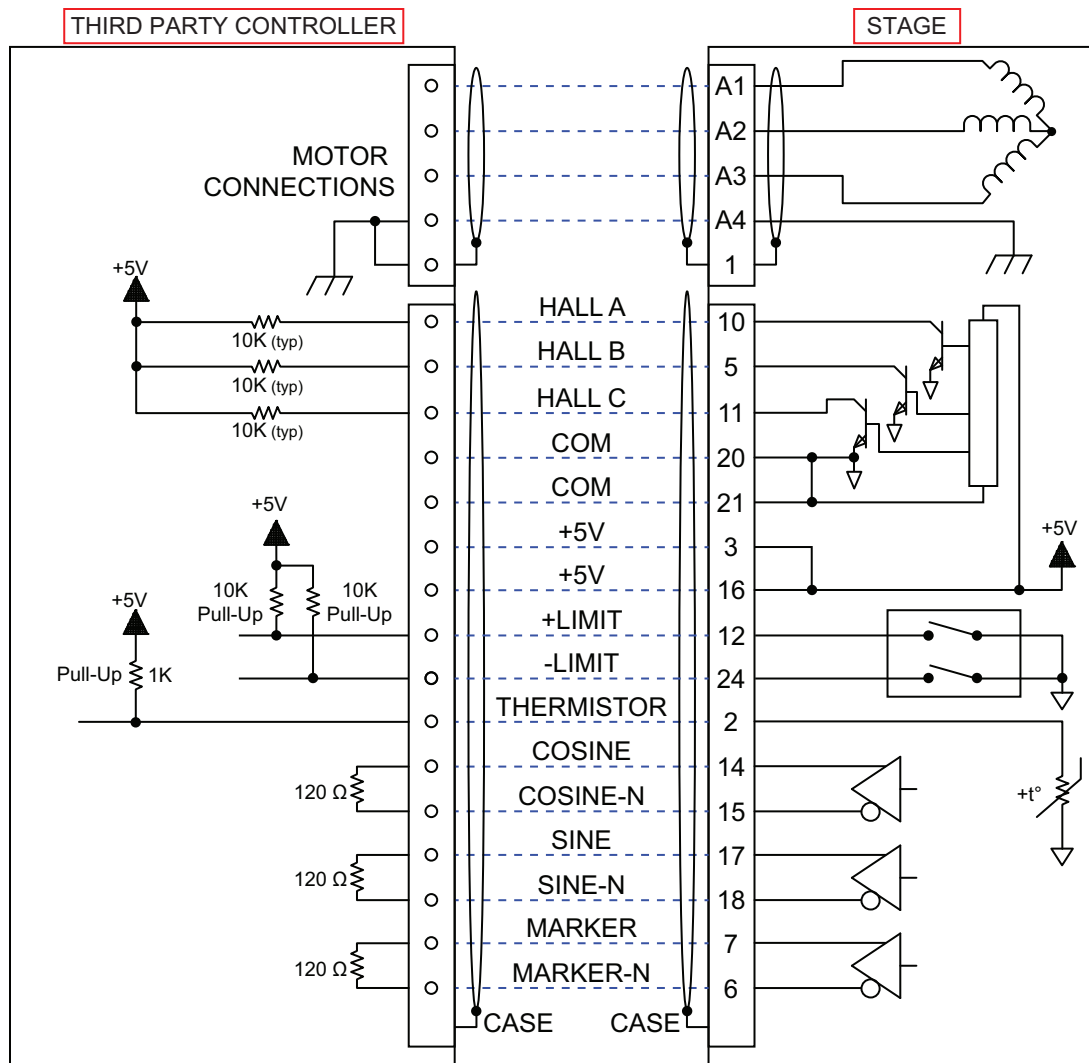


Figure 3-1: Motor and Feedback Wiring

3.3. Motor and Feedback Specifications

Table 3-3: Feedback Specifications

Hall-Effect Sensors Specifications	
Supply Voltage	5 V
Supply Current	50 mA
Output Type	Open Collector
Output Voltage	24 V max (pull up)
Output Current	5 mA (sinking)

Thermistor Specifications	
Polarity	Logic "0" (no fault)
	Logic "1" (over-temperature fault)
Cold Resistance	100 Ω
Hot Resistance	10 K
Note: 1K pull-up to +5V recommended	

Encoder Specifications	
Supply Voltage	5 V $\pm 10\%$
Supply Current	250 mA
Output Signals	Sinusoidal Type (Incremental Encoder): 1V _{pk-pk} into 120 Ω Load (differential signals SIN+, SIN-, COS+, COS- are .5V _{pk-pk} relative to ground.)
	Digital Output (Incremental Encoder): RS422/485 compatible

Limit Switch Specifications	
Supply Voltage	Generated by the encoder
Supply Current	
Output Type	Open Collector
Output Voltage	5 V
Output Current	8 mA (sinking)
Output Polarity	Normally Closed (NC) <ul style="list-style-type: none"> Sinks current to ground (Logic "0") when not in limit High impedance (Logic "1") when in limit Requires external pull-up to +5 V (10 kΩ recommended)
	Normally Open (NO) <ul style="list-style-type: none"> Sinks current to ground (Logic "0") when in limit High impedance (Logic "1") when not in limit Requires external pull-up to +5 V (10 kΩ recommended)
<ol style="list-style-type: none"> If the ANT180-L is driven beyond the electrical limit, it will encounter a mechanical stop. Impacting the mechanical stop could cause damage to the stage even at low speeds. For limit information on stages shipped with the -LNAS option, refer to Section 3.3.1. 	

Table 3-4: Motor Specifications

		BLM-142
Performance Specifications ⁽¹⁾⁽⁵⁾		
Winding Designation	A / B	-A
Continuous Force, 1.4 bar (20 psi) ⁽²⁾	N (lb)	173.2 (38.9)
Continuous Force, No Forced Cooling ⁽²⁾	N (lb)	110.5 (24.8)
Peak Force ⁽³⁾	N (lb)	692.7 (155.7)
Electrical Specifications ⁽⁵⁾		
Winding Designation	A / B	-A
BEMF Constant (line-line, max)	V/(m/s) (V/(in/s))	40.96 (1.04)
Continuous Current 1.4 bar (20 psi) ⁽²⁾	A_{pk} (A_{rms})	4.86 (3.44)
Continuous Current, No Forced Cooling ⁽²⁾	A_{pk} (A_{rms})	3.10 (2.19)
Peak Current, Stall ⁽³⁾	A_{pk} (A_{rms})	19.44 (13.75)
Force Constant, Sine Drive ⁽⁴⁾⁽⁸⁾	N/A_{pk} (lb/ A_{pk})	35.63 (8.01)
	N/A_{rms} (lb/ A_{rms})	50.39 (11.33)
Motor Constant ⁽²⁾⁽⁴⁾	N/\sqrt{W} (lb/ \sqrt{W})	10.53 (2.37)
Resistance, 25°C (line-line)	Ω	10.9
Inductance (line-line)	mH	8.70
Thermal Resistance, 1.4 bar (20 psi)	°C/W	0.37
Thermal Resistance, No Cooling	°C/W	0.91
Maximum Bus Voltage	V_{DC}	340
Magnetic Pole Pitch	mm (in)	30.48 (1.20)
1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature. 2. Values shown @ 100°C rise above a 25 °C ambient temperature, with motor mounted to the specified aluminum heat sink 3. Peak force assumes correct rms current; consult Aerotech. 4. Force constant and motor constant specified at stall. 5. All performance and electrical specifications $\pm 10\%$. 6. Maximum winding temperature is 125 °C 7. Ambient operating temperature range 0°C - 25°C; consult Aerotech for performance in elevated ambient temperatures. 8. All Aerotech amplifiers are rated A_{pk} ; use force constant in N·m/ A_{pk} when sizing.		

Table 3-5: Encoder Specifications (-LTAS)

Model	ANT180-160-L	ANT180-210-L	ANT180-260-L	ANT180-360-L
Fundamental Resolution	20 μm			
After Quadrature	5			
MXH x250	0.02			
MXH x500	0.01			
MXH x1000	0.005			
MXH x4000	0.00125			

Table 3-6: Encoder Specifications (-LNAS)

Model	ANT180-160-L	ANT180-210-L	ANT180-260-L	ANT180-360-L
Fundamental Resolution	4 μm			
After Quadrature	1			
MXH x250	0.004			
MXH x500	0.002			
MXH x1000	0.001			
MXH x4000	0.00025			

3.3.1. Limit Operation with -LNAS Encoder Option

The limit signals provided by the encoder with the -LNAS encoder option are nonstandard. These two signals do not directly indicate end of travel limits. There are two TTL compatible open-collector signals capable of sinking 8mA. [Table 3-7](#) describes these two signals. As shown in [Figure 3-2](#), if the LIMIT signal is HIGH, the DIRECTION signal will indicate which end of travel limit is active.

Table 3-7: -LNAS Encoder Option Limit Signals

Signal	Description
LIMIT	EOT Limit indicator (non-directional) 0 = No Limit 1 = In Limit
DIRECTION	LIMIT Directional Signal 0 = CW 1 = CCW

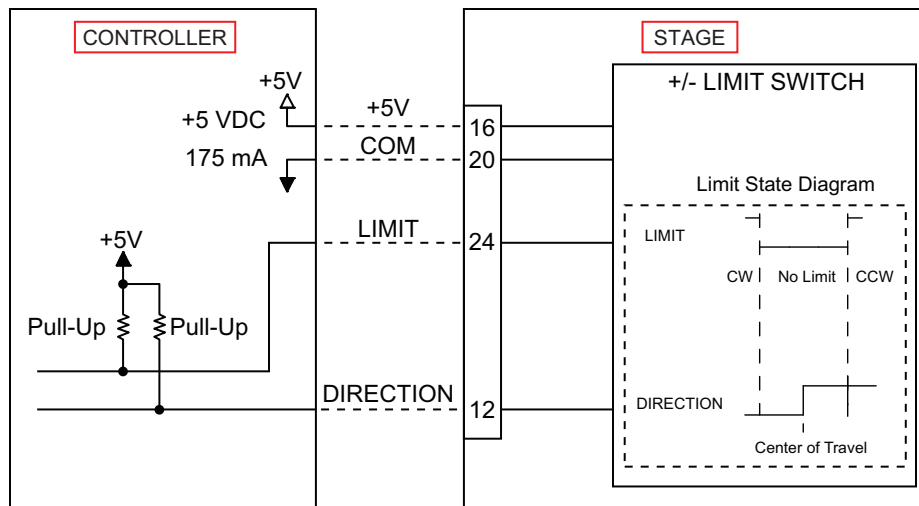


Figure 3-2: -LNAS Encoder Option Limit Wiring

3.4. Limits, Marker, and Machine Direction

Aerotech stages are configured to have positive and negative "machine" directions. The machine direction defines the phasing of the feedback and motor signals and is dictated by the stage wiring (refer to [Section 3.5](#) for Motor and Feedback phasing information). Programming direction of a stage is set by the controller that is used to move the stage. Programming direction is typically selectable in the controller, while machine direction is hardwired in the stage. [Figure 3-3](#) shows the machine direction of ANT180-L stages.

CW ROTATION
POSITIVE MACHINE DIRECTION

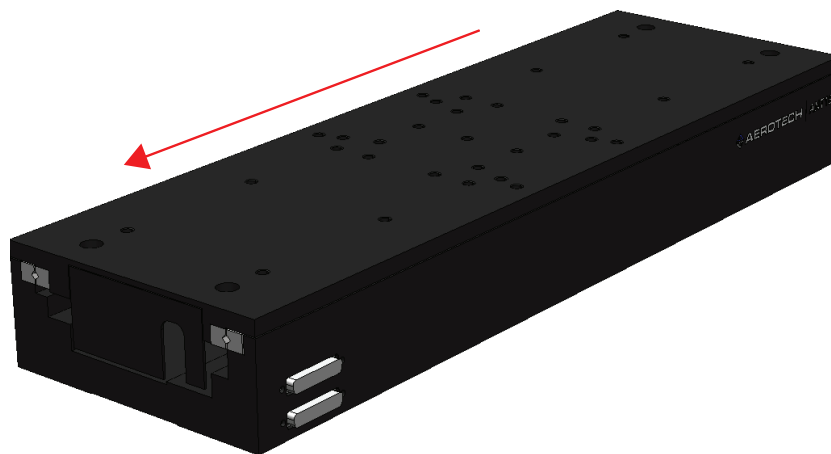


Figure 3-3: Machine Direction

3.5. Motor and Feedback Phasing

Motor phase voltage is measured relative to the virtual wye common point.

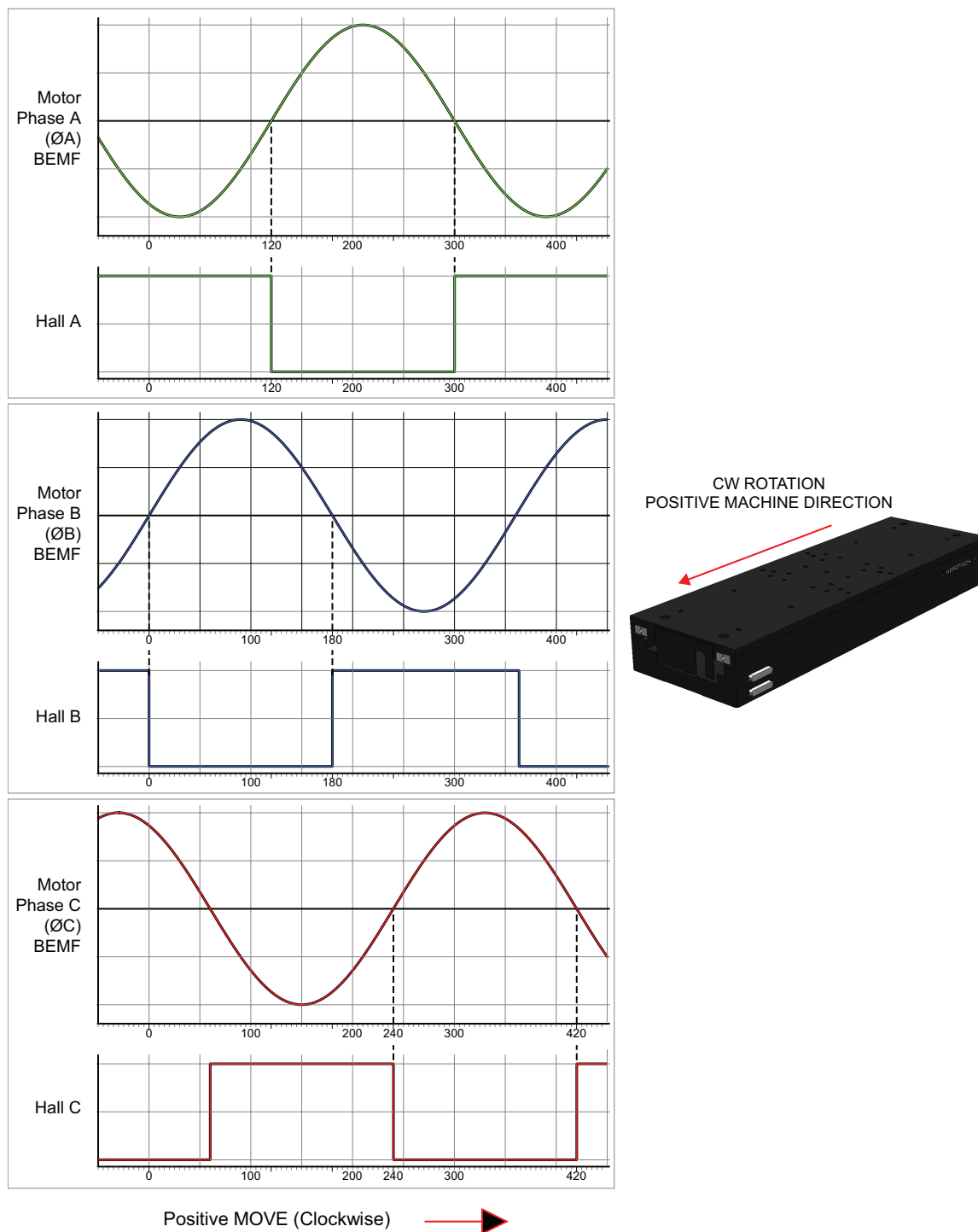


Figure 3-4: Hall Phasing

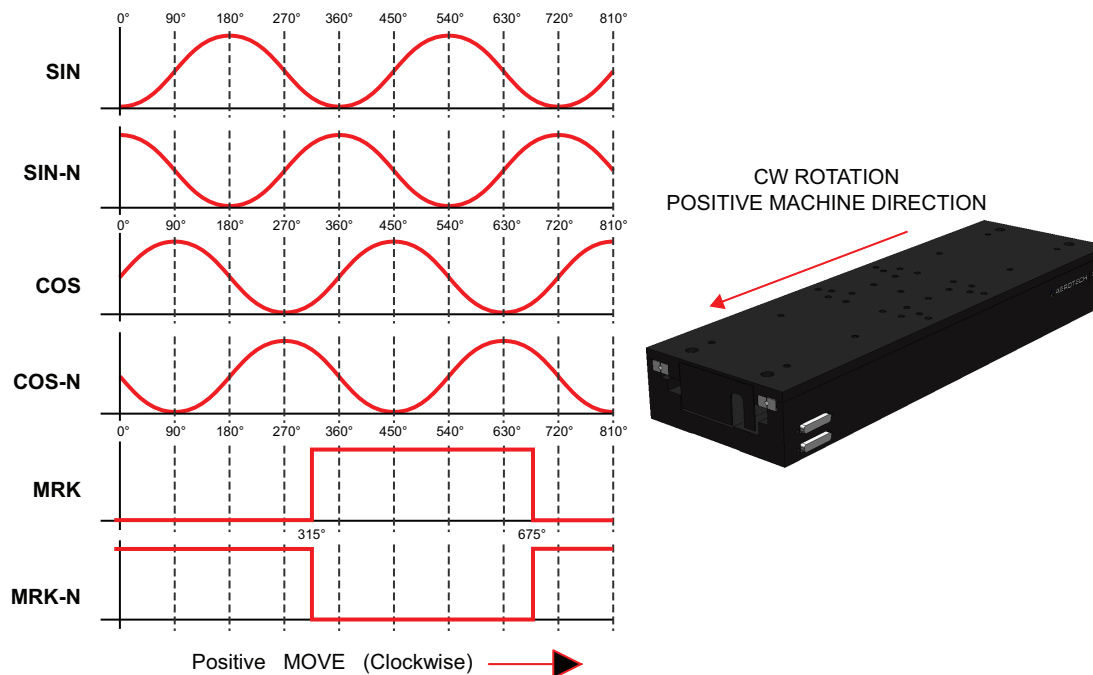


Figure 3-5: Analog Encoder Phasing Reference Diagram

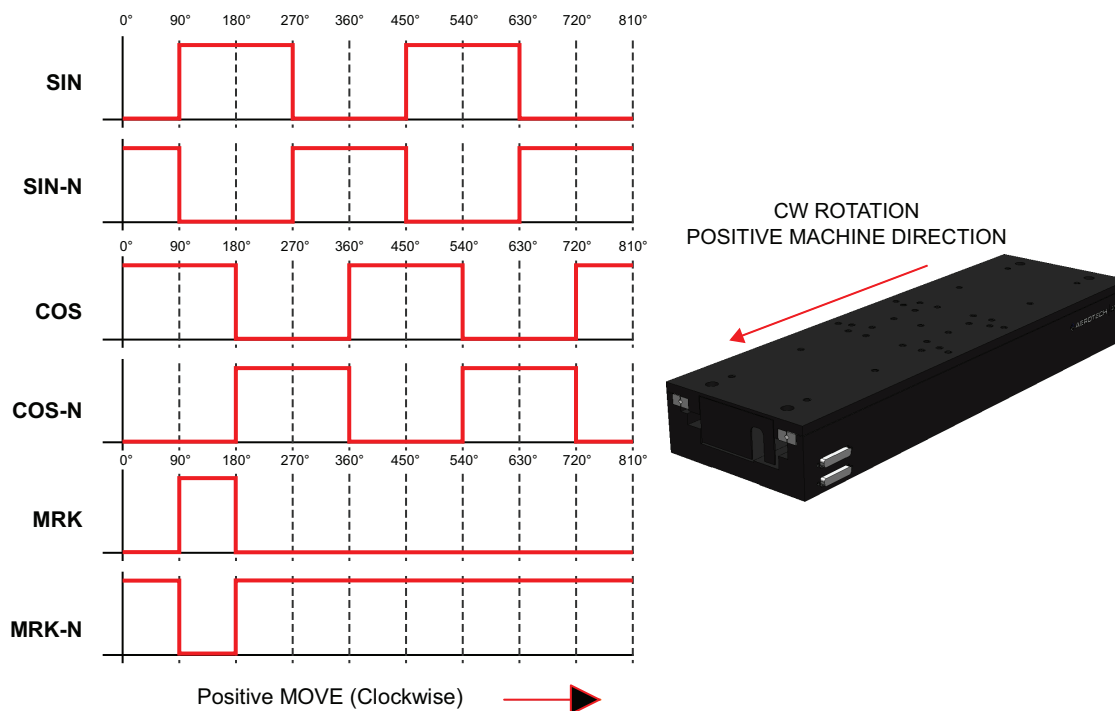


Figure 3-6: Encoder Phasing Reference Diagram (Standard)

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Chapter 4: Maintenance

NOTE: The bearing area must be kept free of foreign matter and moisture; otherwise, the performance and life expectancy of the stage will be reduced.



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

4.1. Service and Inspection Schedule

Inspect the ANT180-L once per month. A longer or shorter inspection interval may be required depending on the specific application, and conditions such as the duty cycle, speed, and environment.

In general, stages operating in a clean environment should be cleaned and lubricated annually or every 500 km (whichever comes first). For stages operating under conditions involving excessive debris, stages should be cleaned every six months. For high-speed applications (those near max speed at a duty cycle of 50%), frequent maintenance with standard lubricants is required.

Monthly inspections should include but not be limited to:

- Visually inspect the stage, motor, and cables
- Re-tighten loose connectors.
- Replace or repair damaged cables.
- Clean the ANT180-L and any components and cables if needed.
- Repair any damage before operating the ANT180-L.
- Inspect and perform an operational check on all safeguards and protective devices

4.2. Cleaning and Lubrication



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



WARNING: In applications that have multiple stages bolted together to form multi-axis systems, the orthogonality may be lost if the stage tables of the support stages are loosened. Precision aligned stages should not be loosened or disassembled.



WARNING: Further disassembly of the stage is not recommended because proper assembly and calibration can only be done at the factory or in the field by a qualified technician. In addition, a laser interferometer is required for post assembly verification to maintain warranties. Contact Aerotech for more information.

Cleaning

Before using a cleaning solvent on any part of the ANT180-L, blow away small particles and dust with nitrogen or, less preferably, clean, dry, compressed air.

Any external metal surface of the ANT180-L can be cleaned with isopropyl alcohol on a lint-free cloth.



WARNING: Make sure that all solvent has completely evaporated before attempting to move the stage.

Lubrication

For the cross-roller bearings, use Kluberplex BEM 34-132 grease. Only use the specified grease as other greases may be incompatible.

If the application process uses only a small portion of travel for most of the duty cycle, periodically drive the stage through full travel to redistribute the lubrication in the bearings.

Lubrication Procedure

1. Drive the stage table to one end of travel and remove power to the stage.
2. Remove any accumulated dust or debris that is visible inside of the assembly.
3. Manually move the stage to the opposite end of travel. This will work the grease into the linear bearing guides. The stage table should move freely with little resistance.
4. Restore power to the stage; drive the stage table back to its original position to redistribute lubricants.

4.3. Troubleshooting

Symptom	Possible Cause and Solution
Stage will not move	<ul style="list-style-type: none">• Shipping restraints still installed. Remove the red anodized shipping brackets.• In Limit condition. Check limits (refer to Chapter 3) and refer to controller documentation for polarity and compatibility requirements (Example: voltage requirements).• Controller trap or fault (refer to controller documentation).
Stage moves uncontrollably	<ul style="list-style-type: none">• Encoder (sine and cosine) signal connections (refer to Chapter 3 and Controller documentation).• Motor Connections (refer to Chapter 3 and Controller documentation).
Stage oscillates or squeals	<ul style="list-style-type: none">• Gains misadjusted (refer to the controller documentation).• Encoder signals (refer to the controller documentation).

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Appendix A: Warranty and Field Service

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

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

Return Products Procedure

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

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

Returned Product Warranty Determination

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

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

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

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

Rush Service

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

On-site Warranty Repair

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

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

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

On-site Non-Warranty Repair

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

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

Service Locations

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

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

Have your customer order number ready before calling.

Appendix B: Revision History

Revision	Date	Description
1.03.00	August 27, 2015	<ul style="list-style-type: none">• Safety information updated• General revision
1.02.00	April 15, 2011	Added -LNAS Encoder section
1.01.00	November 5, 2010	<ul style="list-style-type: none">• Added Declaration of Incorporation• Added Environmental Specifications section• Added safety information and warnings• Added note about current requirements of motor and ground wires
1.00.00	January 19, 2010	New Manual

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