



# ANT130V-5 Hardware Manual

Revision: 1.02.00



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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 ANT130V-5 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. All components must be 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 this product to environments or conditions outside of the listed specifications. Exceeding environmental or operating specifications can cause damage to the equipment.
4. The ANT130V-5 stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
5. Use care when moving the ANT130V-5 stage. Lifting or transporting the ANT130V-5 stage improperly can result in injury or damage to the ANT130V-5.
6. This product is intended for light industrial manufacturing or laboratory use. Use of this product for unintended applications can result in injury and damage to the equipment.
7. 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.
8. Operators must be trained before operating this equipment.
9. All service and maintenance must be performed by qualified personnel.

## EU Declaration of Incorporation

**Manufacturer:** Aerotech, Inc.  
101 Zeta Drive  
Pittsburgh, PA 15238-2811  
USA

**herewith declares that the product:**  
ANT130V-5 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:**

EN ISO 12100:2010

Safety of machinery - Basic concepts, general principles for design

EN 60204-1:2010

Safety of machinery - Electrical equipment of machines - Part 1: General requirements

**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.**

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

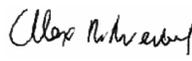
2011/65/EU

RoHS 2 Directive

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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](http://www.aerotech.com) for the most up-to-date information.

**Table 1-1: ANT130V-5 Model Numbering System**

<b>ANT Series Vertical Lift Stage</b>	
<b>Connectors (Required)</b>	
-CN1	Single connector. 25DU for motor / feedback
-CN2	Two connectors, 4DU motor, 25DU feedback
Note: -25DU single 25-pin connector option not valid for systems using bus voltages greater than 80 V	
<b>Mounting Plate (Optional)</b>	
-MP	Mounting plate
<b>Performance Grade (Required)</b>	
-PL1	Base performance
-PL2	High-accuracy performance, PLUS

## 1.1. Environmental Specifications



**WARNING:** 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.

**Table 1-2: Environmental Specifications**

<b>Ambient Temperature</b>	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
<b>Humidity</b>	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.
<b>Altitude</b>	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.
<b>Vibration</b>	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.
<b>Protection Rating</b>	The ANT130V-5 stages are not suited for dusty or wet environments. This equates to an ingress protection rating of IP00.
<b>Use</b>	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 ANT130V-5. At a minimum, the environmental temperature must be controlled to within 0.25°C per 24 hours to ensure the ANT130V-5 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 ANT130V-5 is mounted. Contact the factory for more details.

The ANT130V-5 encoder scale is mounted on glass and measures the linear travel of the wedge. The thermal expansion coefficient of the glass is 3.25 ppm/°C. Translated through the wedge angle of 12.93°, it becomes an effective thermal expansion coefficient of 0.75 ppm/°C. As the temperature of the operating environment changes from the temperature listed on the accuracy plot included with the stage, the accuracy of the stage will change by 0.75 ppm/°C from the center of travel. For calibrated -PLUS stages, Aerotech controllers can adjust the calibration based on the temperature of the environment. Contact Aerotech for more details.

The accuracy specification of ANT130V-5 series stages is measured 25 mm above the table with the stage in an unloaded condition. 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](http://www.aerotech.com) for the most up-to-date information.

Resolution is dependent on encoder resolution and controller interpolation.

**Table 1-3: ANT130V-5 Series Specifications**

		ANT130V-5
Travel		5 mm
Accuracy <sup>(1)</sup>	Base	±2.0 µm (±80 µin)
	PLUS <sup>(5)</sup>	±200 nm (±8 µin)
Resolution (Minimum Incremental Motion)		2 nm (±0.08 µin)
Bidirectional Repeatability <sup>(1)</sup>	Base	±150 nm (±6 µin)
	PLUS <sup>(5)</sup>	±100 nm (±4 µin)
Unidirectional Repeatability <sup>(1)</sup>		±75 nm (±3 µin)
Straightness <sup>(2)</sup>		±1.0 µm (±40 µin)
Pitch <sup>(1)</sup>		20 arc sec
Roll		10 arc sec
Yaw <sup>(1)</sup>		10 arc sec
Maximum Speed		75 mm/s (3 in/s)
Maximum Acceleration (No Load)		0.7 g - 7 m/s <sup>2</sup>
In-Position Stability <sup>(3)</sup>		<2 nm (<0.08 µin)
Maximum Force (continuous)		100 N
Load Capacity <sup>(4)</sup>		3.0 kg (6.6 lb)
Moving Mass		1.8 kg (4 lb)
Stage Mass		3.1 kg (7 lb)
Material		Aluminum Body/Black Hardcoat Finish
Mean Time Between Failure		30,000 Hours
1. Certified with each stage. 2. Measured perpendicular or parallel to wedge direction. 3. In-Position Jitter listing is 3 sigma value. 4. Assumes loading along axis of travel. 5. Requires the use of an Aerotech controller. Specifications are for single-axis systems measured 25 mm above the tabletop; performance of multi-axis system is payload and workpoint dependent. Consult the Aerotech factory for multi-axis or non-standard applications.		

## 1.4. Vacuum Operation

Aerotech can specially prepare the ANT130V-5 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 ANT130V-5 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 ANT130V-5 from the sealed bag until it is ready for use.
2. Always handle the ANT130V-5 in a clean environment and use powder-free polyethylene gloves to prevent any contaminants from adhering to the surface of the ANT130V-5.
3. During installation, use cleaned, vented, stainless steel fasteners when securing the ANT130V-5.
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:** ANT130V-5 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



**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 ANT130V-5. Unsecured moving parts may shift and cause bodily injury.
- Improper handling could adversely affect the performance of the ANT130V-5. Use care when moving the ANT130V-5.

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

Carefully remove the ANT130V-5 from its protective shipping container. Gently set the ANT130V-5 on a smooth, flat, and clean surface.

Before operating the ANT130V-5, 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 ANT130V-5 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

Red, anodized aluminum shipping brackets have been installed to prevent unwanted motion and potential damage from occurring during shipment. The brackets must be removed before the ANT130V-5 can be operated. Retain the brackets and hardware for future use.

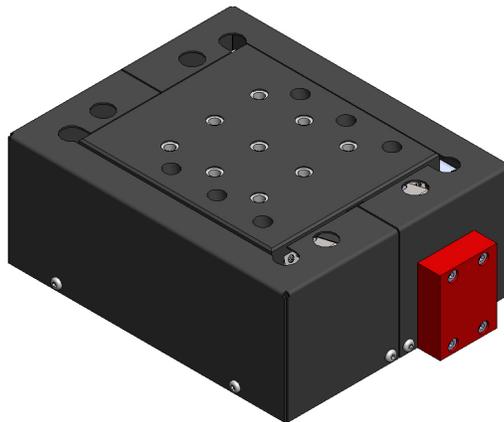


Figure 2-1: Shipping Clamps

## 2.2. Dimensions

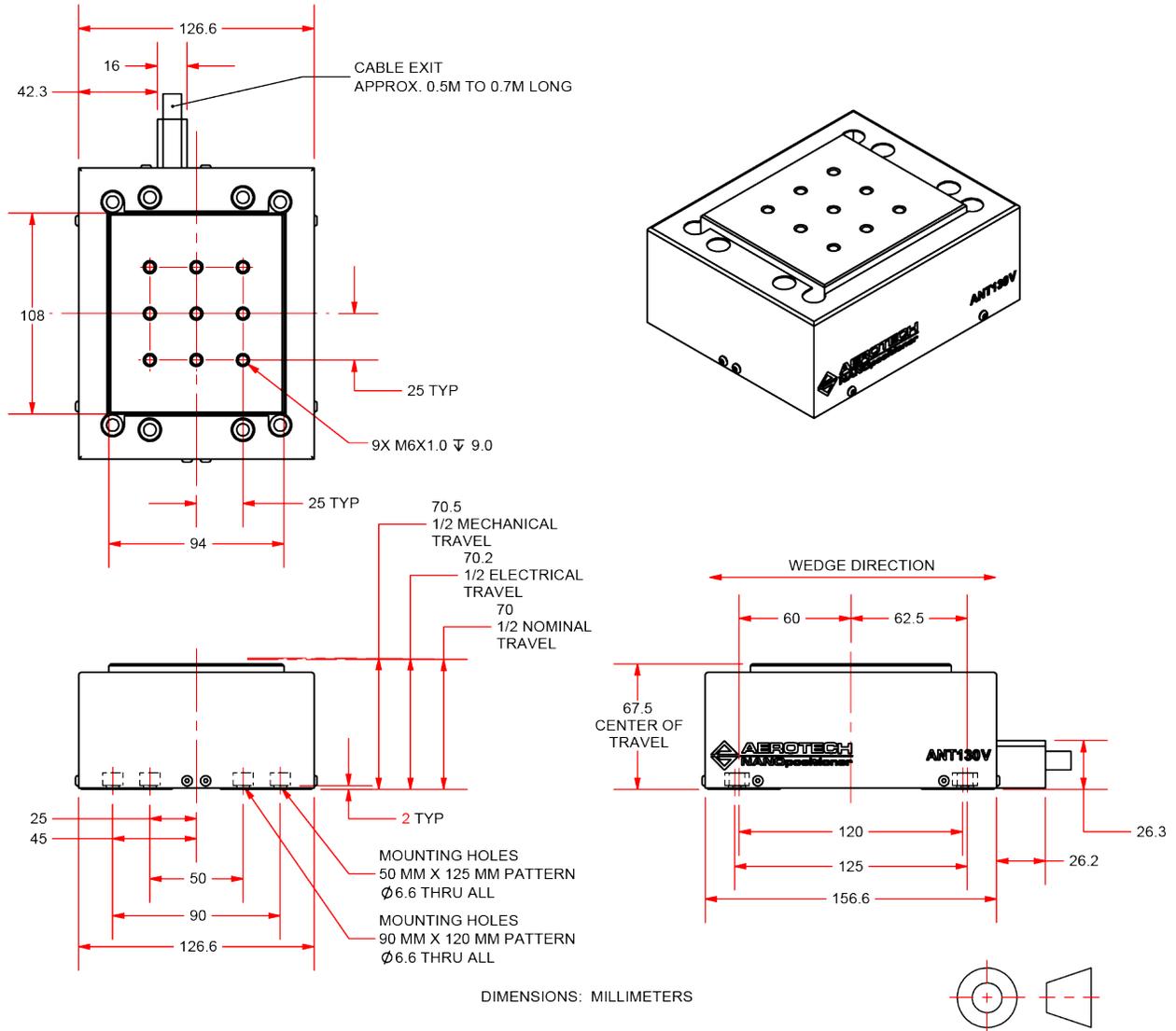
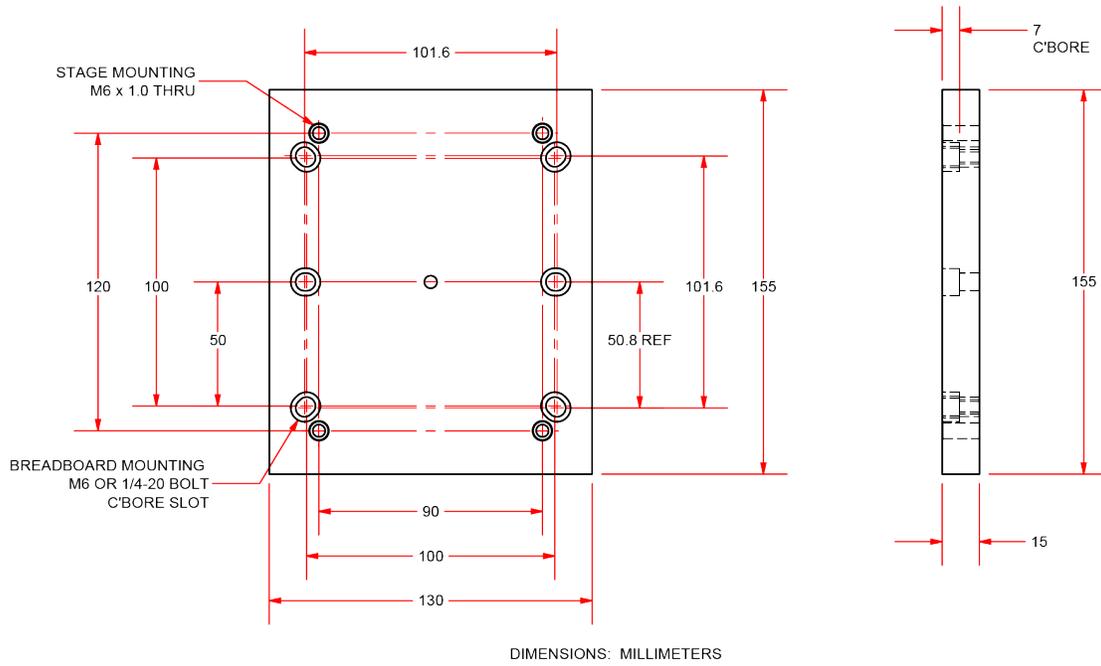


Figure 2-2: ANT130V-5 Dimensions



**Figure 2-3: ANT130V-5 Mounting Plate (-MP) Dimensions**

### 2.3. Securing the Stage to the Mounting Surface



**WARNING:** The ANT130V-5 must be mounted securely. Improper mounting can result in injury and damage to the equipment.



**DANGER:** If you remove the cover of the stage, high magnetic fields at the ends of the magnet tracks will be exposed. Keep metal objects away from the ends of the magnet tracks.

The mounting surface must be flat and have adequate stiffness in order to achieve the maximum performance from the ANT130V-5 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  $\mu\text{m}$  over the entire stage footprint.

**NOTE:** The ANT130V-5 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 ANT130V-5. Shimming should be avoided if possible. If shimming is required, it should be minimized to retain maximum rigidity of the system.

When the stage is centered, the wedge will block access to the mounting holes. Drive the stage to either end of travel to expose the mounting holes. Alternately, if the stage has not been powered up yet, access the holes by pushing down on the table top and pulling up on an M6 screw threaded into the table top.

There is a gap between the through holes in the cover and the mounting holes that can make inserting the mounting screws challenging. The hex tool that was provided has a retention mechanism that is designed to hold the screw during stage mounting. You should always use this hex tool when mounting the stage to prevent damage to exposed components below the cover.

**NOTE:** Covers should not be removed unless absolutely necessary.

If you must remove the cover, be extremely careful to not damage any of the exposed components, including cables when you reinstall the cable cover and the limit boards near the mounting holes. Do not touch or mark the flexures. Any bends, dings, or scratches could cause the flexures to fail prematurely. Do not leave covers off longer than necessary.

Tightening torque values for the mounting hardware are dependent on the properties of the surface to 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 10 mm (1/4-20 x 1/2 in) SHCS	5.4 N·m

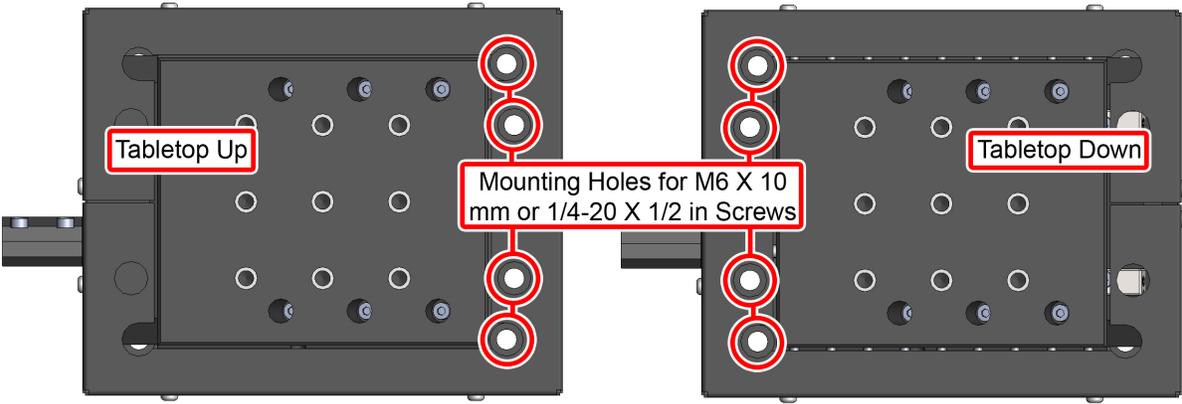


Figure 2-4: Mounting Hole Pattern

## 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.

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).

**NOTE:** If your ANT130V-5 was purchased with Aerotech controls, it might have been tuned with a representative payload based on the information provided at the time of order. If the ANT130V-5 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.

If Aerotech specifically adjusted the servo loop gains to the payload weight prior to shipment, the payload might be required to ensure proper servo operation. The ANT130V-5 is designed to carry no more than 3 kg.

**NOTE:** For valid system performance, the mounting interface should be flat within 10  $\mu\text{m}$ .



**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.

## 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 ANT130V-5 is part of a complete Aerotech motion control system, setup usually involves connecting the ANT130V-5 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, 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 tabletop 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.

### 3.1. Motor and Feedback Connectors

Stages equipped 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 protective ground connection of the ANT130V-5 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.

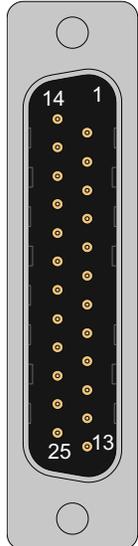


**WARNING:** Operator access to the base and tabletop must be restricted while connected to a power source. Failure to do so may cause electric shock.



**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 and Feedback Pinouts (-CN1 option)**

Pin	Description	Connector
1	Key (Ensures that correct cable is plugged into the correct jack)	
2	Cosine-N	
3	Sine-N	
4	Marker-N	
5	Common ground	
6	Common ground	
7	Negative (CCW) hardware limit	
8	Hall Effect sensor, phase A	
9	Hall Effect sensor, phase C	
10	Frame ground	
11	Motor ØA	
12	Motor ØB	
13	Motor ØC	
14	Cosine	
15	Sine	
16	Marker	
17	+5 V supply input for feedback devices	
18	Reserved	
19	Positive (CW) hardware limit	
20	Motor Thermistor	
21	Hall Effect sensor, phase B	
22	Frame ground	
23	Motor ØA	
24	Motor ØB	
25	Motor ØC	
Case	Signal shield connection (to case)	

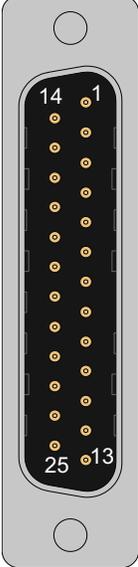
Mating Connector	Aerotech P/N	Third Party P/N
Backshell	ECK00656	Amphenol #17E-1726-2
Connector	ECK00300	FCI DB25S064TLF

**Table 3-2: Motor Pinouts (-CN2 option)**

Pin	Description	Connector
A1	Motor Phase A	
A2	Motor Phase B	
A3	Motor Phase C	
1	Reserved	
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 3-3: Feedback Pinouts (-CN2 option)**

Pin	Description	Connector
1	AUX	
2	Over-Temperature Thermistor sensor	
3	+5 V power supply	
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	
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	
Case	Signal shield connection (to case)	

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  $\emptyset A/\emptyset B/\emptyset C$  and Hall signals A/B/C (refer to for motor phasing). Shielded cables are required for the motor and feedback connections.

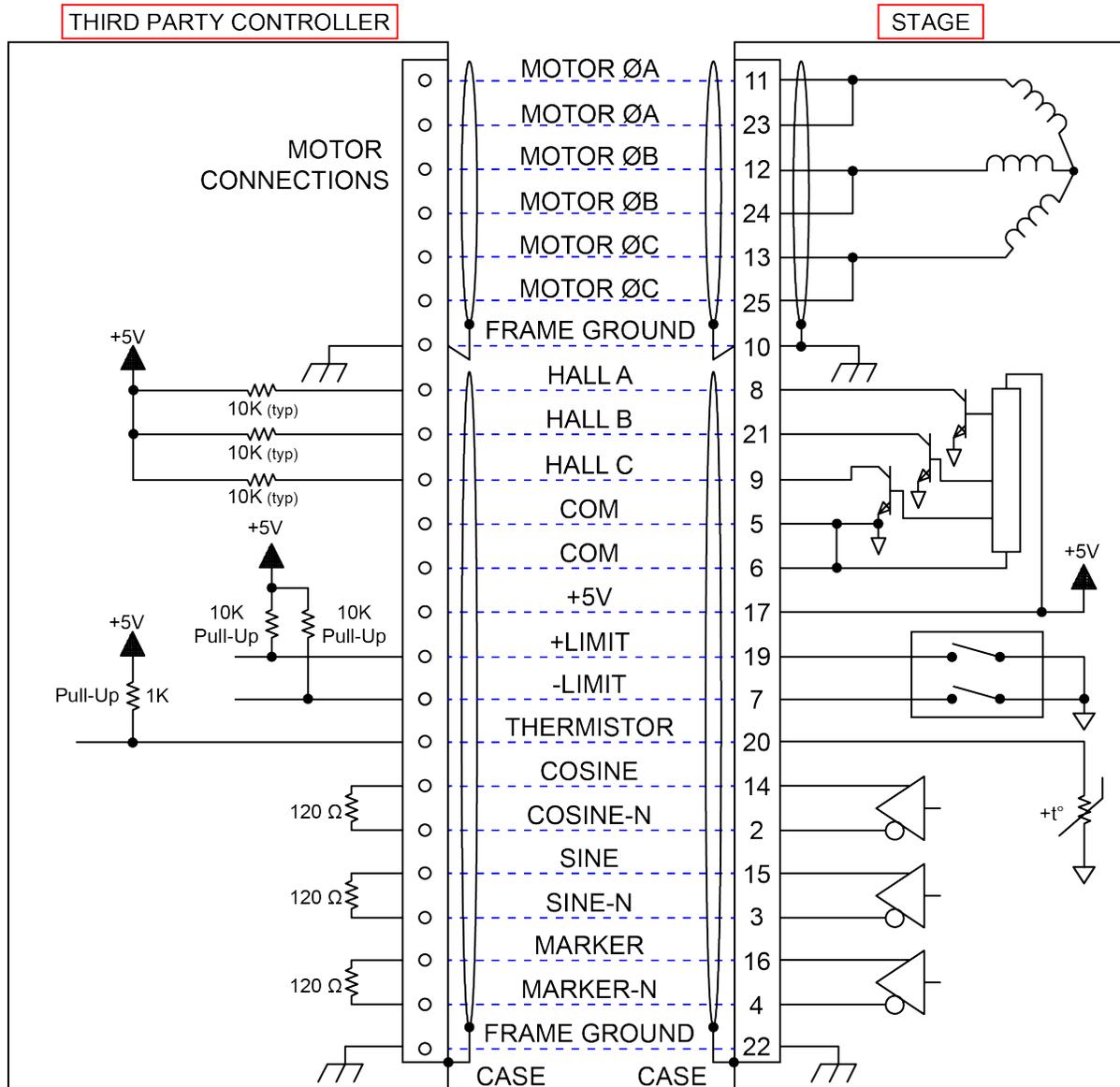


Figure 3-1: Motor and Feedback Wiring [-CN1 option]

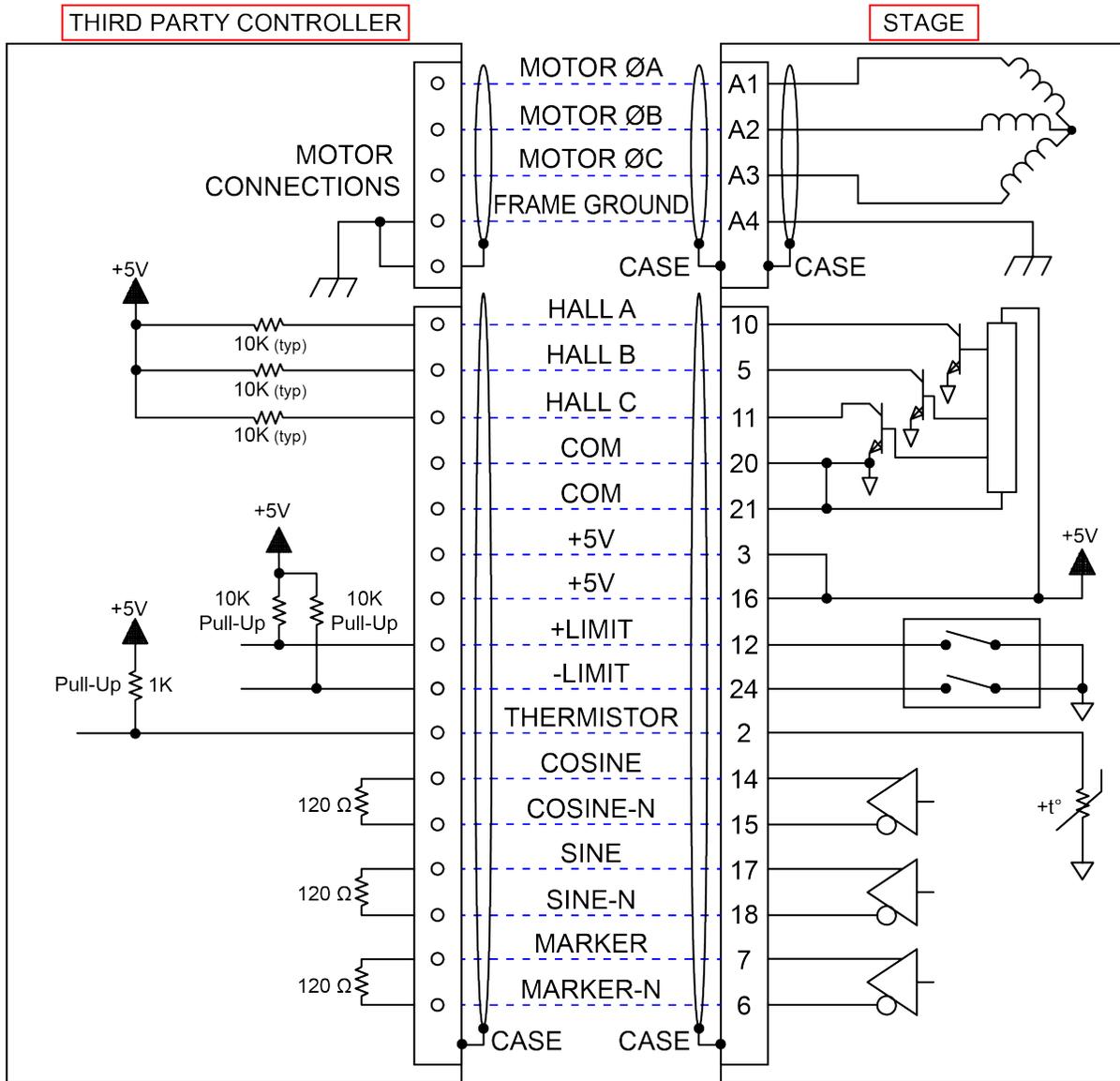


Figure 3-2: Motor and Feedback Wiring [-CN2 option]

### 3.3. Motor and Feedback Specifications

**Table 3-4: 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 $\Omega$
Hot Resistance	~ 10 K
<b>Note:</b> 1K pull-up to +5V recommended.	

Encoder Specifications	
Supply Voltage	5 V $\pm$ 5%
Supply Current	50 mA (typical)
Output Signals	<b>Sinusoidal Type (Incremental Encoder):</b> 1 V <sub>pk-pk</sub> into 120 $\Omega$ Load (differential signals SIN+, SIN-, COS+, COS- are .5 V <sub>pk-pk</sub> relative to ground.)

Limit Switch Specifications	
Supply Voltage	Generated by the encoder
Supply Current	
Output Type	Open Collector
Output Voltage	5 V
Output Current	10 mA (sinking)
Output Polarity	Normally Closed (NC) <ul style="list-style-type: none"> <li>Sinks current to ground (Logic "0") when not in limit</li> <li>High impedance (Logic "1") when in limit</li> <li>Requires external pull-up to +5 V (10 k<math>\Omega</math> recommended)</li> </ul>
	Normally Open (NO) <ul style="list-style-type: none"> <li>Sinks current to ground (Logic "0") when in limit</li> <li>High impedance (Logic "1") when not in limit</li> <li>Requires external pull-up to +5 V (10 k<math>\Omega</math> recommended)</li> </ul>
<b>Note:</b> If the ANT 130V-5 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.	

**Table 3-5: Motor Specifications**

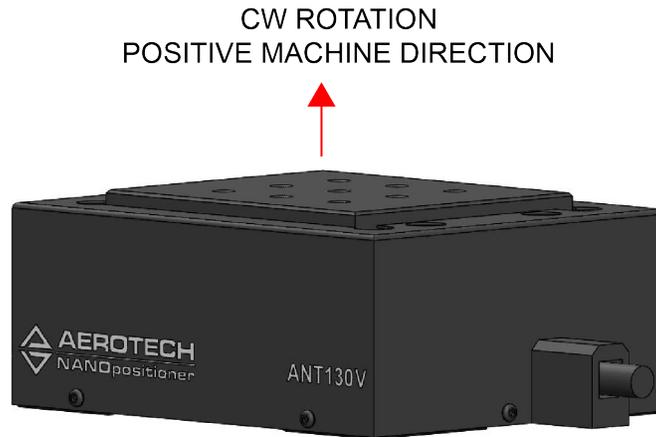
		BLMUC-95 [ANT130V-5]
<b>Performance Specifications</b> <sup>[1,5]</sup>		
Continuous Force (No cooling) <sup>[2]</sup>	N (lb)	23.0 (5.2)
Continuous Force (1.4 bar, 20 psi) <sup>[2]</sup>	N (lb)	40.5 (9.1)
<b>Electrical Specifications</b> <sup>[5]</sup>		
Winding Designation		-A
BEMF Constant (Line-Line, Max)	V/m/s (V/in/s)	9.00 (0.23)
Continuous Current (No cooling) <sup>[2]</sup>	Amp <sub>pk</sub> (Amp <sub>rms</sub> )	2.94 (2.08)
Continuous Current (1.4 bar, 20 psi) <sup>[2]</sup>	Amp <sub>pk</sub> (Amp <sub>rms</sub> )	5.17 (3.66)
Peak Current, Stall <sup>[3]</sup>	Amp <sub>pk</sub> (Amp <sub>rms</sub> )	20.68 (14.62)
Force Constant, Sine Drive <sup>[4,8]</sup>	N/Amp <sub>pk</sub> (lb/Amp <sub>pk</sub> )	7.83 (1.76)
	N/Amp <sub>rms</sub> (lb/Amp <sub>rms</sub> )	11.07 (2.49)
Motor Constant <sup>[2,4]</sup>	N/ $\sqrt{W}$ (lb/ $\sqrt{W}$ )	3.35 (0.75)
Resistance, 25°C (Line-Line)	ohms	5.2
Inductance (Line-Line)	mH	0.70
Thermal Resistance (No cooling)	°C/W	2.12
Maximum Bus Voltage	VDC	-CN2 Option: 160V -CN1 Option: 80 V
Magnetic Pole Pitch	mm (in)	16.00 (0.63)
<p>1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature</p> <p>2. Values shown @ 100°C rise above a 25°C ambient temperature, with motor mounted to the specified aluminum heat sink.</p> <p>3. Peak force assumes correct rms current; consult Aerotech.</p> <p>4. Force constant and motor constant specified at stall</p> <p>5. All performance and electrical specifications <math>\pm 10\%</math></p> <p>6. Maximum winding temperature is 125°C.</p> <p>7. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures</p> <p>8. All Aerotech amplifiers are rated Apk; use force constant in N · m/Apk when sizing.</p>		

**Table 3-6: Encoder Specifications**

Model	ANT130V-5
Fundamental Resolution	4.59 $\mu\text{m}$
with x4000 Interpolation	1.15 nm
with x16000 Interpolation	0.29 nm
1. Quadrature decoding included in interpolation resolution calculations	

### 3.4. Limits, Marker, and Machine Direction

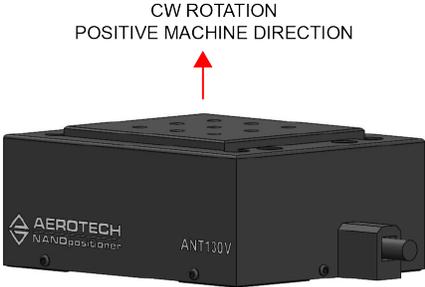
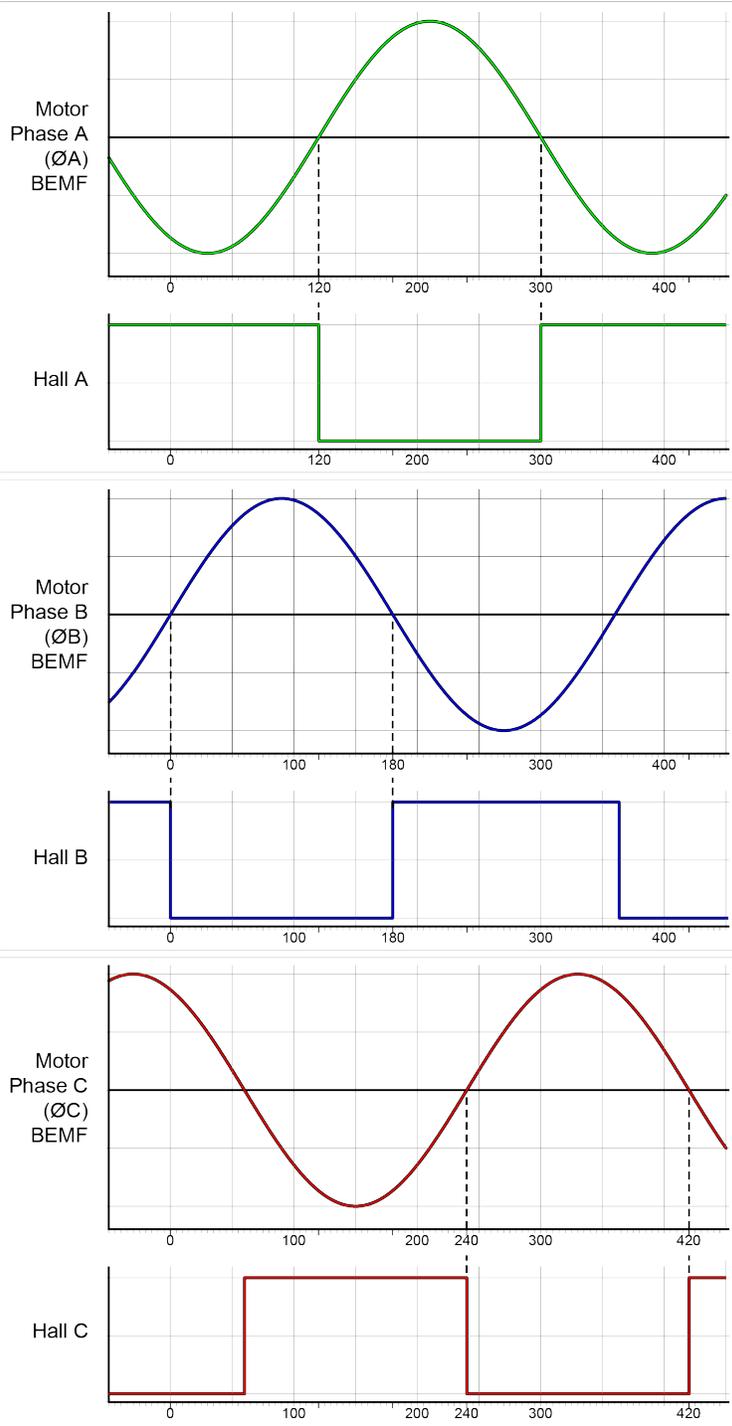
Aerotech stages are configured to have positive and negative "machine" directions. The machine direction defines the phasing of the feedback and motor signals and is dictated by the stage wiring (refer to [Section 3.5](#) for Motor and Feedback phasing information). Programming direction of a stage is 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 ANT130V-5 stages.



**Figure 3-3: Machine Direction**

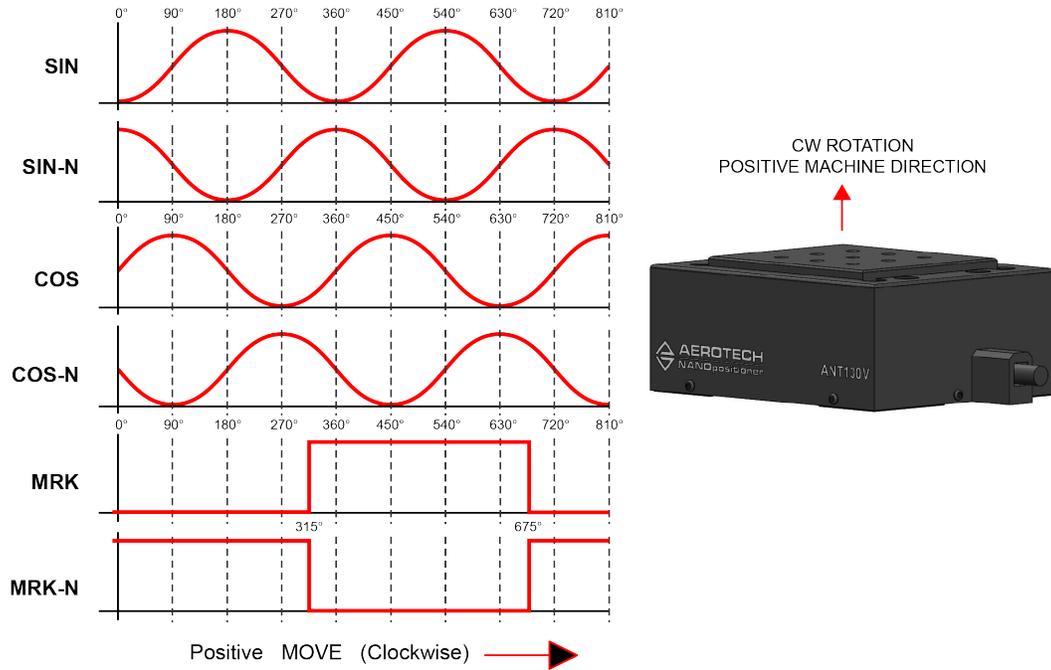
### 3.5. Motor and Feedback Phasing

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

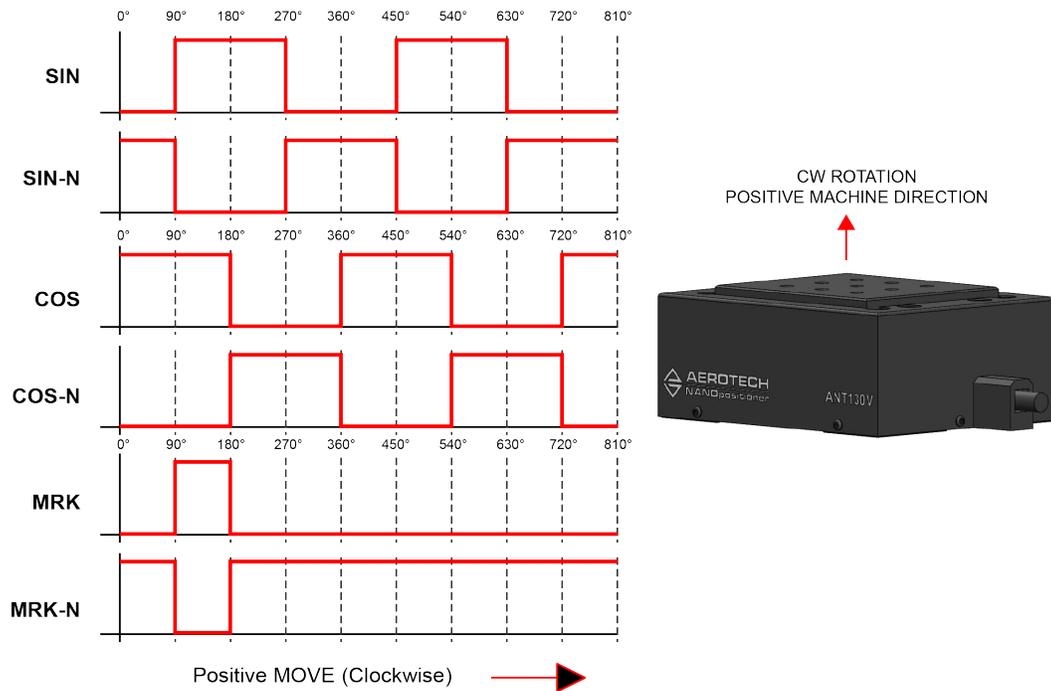


Positive MOVE (Clockwise) 

Figure 3-4: Hall Phasing



**Figure 3-5: Analog Encoder Phasing Reference Diagram**



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

## 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 ANT130V-5 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, the stage 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 and cables
- Re-tighten loose connectors
- Replace or repair damaged cables
- Clean the ANT130V-5 and any components and cables as needed
- Repair any damage before operating the ANT130V-5
- 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. 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 ANT130V-5, blow away small particles and dust with nitrogen or, less preferably, clean, dry, compressed air.

Any external metal surface of the ANT130V-5 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 linear 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. Remove any dirty or dried lubricant from the v-channels of the linear bearing rails. Use a clean, lint-free cloth with a side-to-side motion. Use a swab soaked in isopropyl alcohol to remove stubborn debris.
4. Apply a thin, continuous film of lubricant to the exposed v-channels of the cross rollers on both ends of the stage. A good quality, natural bristle artist's brush makes an excellent applicator. Do not use any applicator that could scratch or otherwise damage the v-channels.
5. 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.
6. Repeat steps 2 through 4 for any areas covered by the original table position.
7. 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"><li>• Shipping restraints still installed. Remove the red anodized shipping brackets.</li><li>• In Limit condition. Check limits (refer to <a href="#">Chapter 3</a>) and refer to controller documentation for polarity and compatibility requirements (Example: voltage requirements).</li><li>• Controller trap or fault (refer to controller documentation).</li></ul>
Stage moves uncontrollably	<ul style="list-style-type: none"><li>• Encoder (sine and cosine) signal connections (refer to <a href="#">Chapter 3</a> and Controller documentation).</li><li>• Motor Connections (refer to <a href="#">Chapter 3</a> and Controller documentation).</li></ul>
Stage oscillates or squeals	<ul style="list-style-type: none"><li>• Gains misadjusted (refer to the controller documentation).</li><li>• Encoder signals (refer to the controller documentation).</li></ul>

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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](http://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>

<b>USA, CANADA, MEXICO</b> Aerotech, Inc. Global Headquarters Phone: +1-412-967-6440 Fax: +1-412-967-6870	<b>CHINA</b> Aerotech China Full-Service Subsidiary Phone: +86 (21) 3319 7715	<b>GERMANY</b> Aerotech Germany Full-Service Subsidiary Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720
<b>JAPAN</b> Aerotech Japan Full-Service Subsidiary Phone: +81 (0)50 5830 6814 Fax: +81 (0)43 306 3773	<b>TAIWAN</b> Aerotech Taiwan Full-Service Subsidiary Phone: +886 (0)2 8751 6690	<b>UNITED KINGDOM</b> 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
1.02.00	<ul style="list-style-type: none"><li>• Product update</li><li>• Safety information updated</li><li>• General revision</li></ul>
1.01.00	<ul style="list-style-type: none"><li>• Added Declaration of Incorporation</li><li>• Added Environmental Specifications section</li><li>• Added safety information and warnings</li><li>• Added note about current requirements of motor and ground wires.</li></ul>
1.00.00	New manual

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