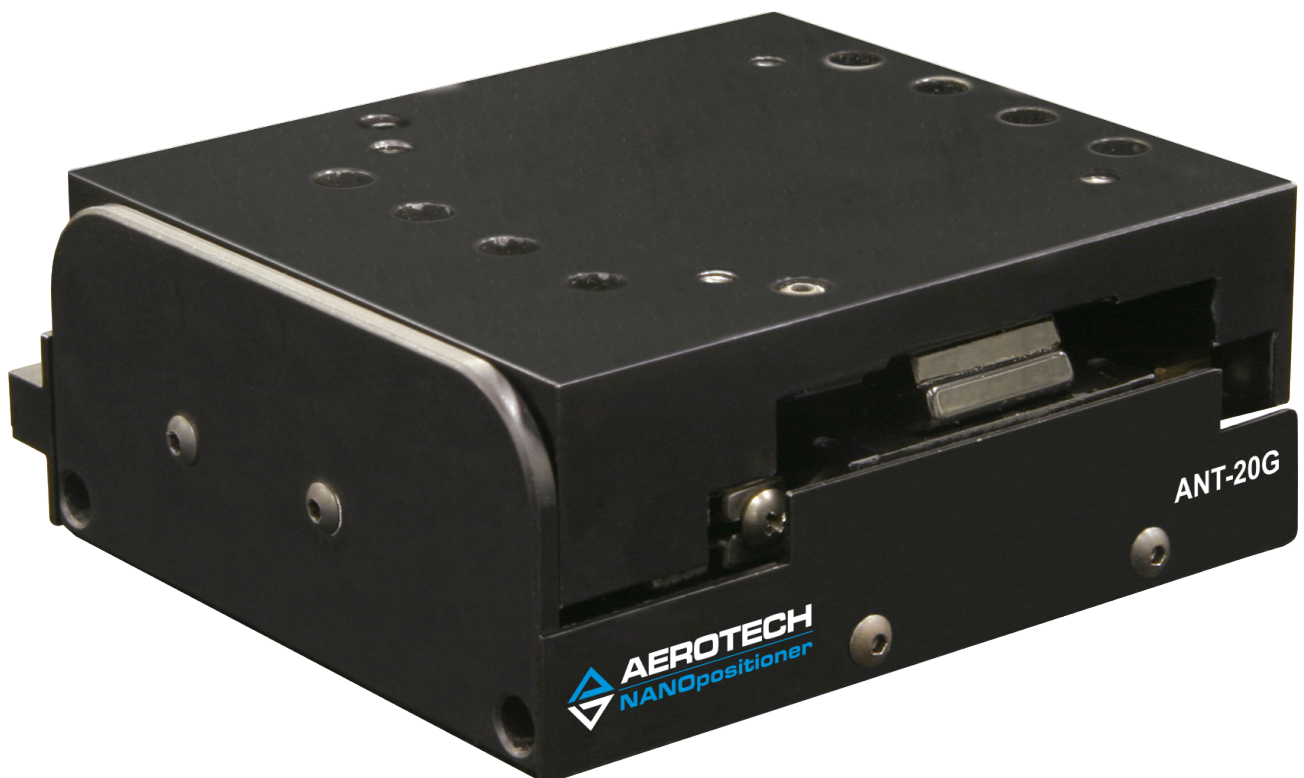




# ANT20G Hardware Manual

Revision: 1.01.00



## Global Technical Support

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

United States (World Headquarters)	
Phone: +1-412-967-6440 Fax: +1-412-967-6870 Email: <a href="mailto:service@aerotech.com">service@aerotech.com</a>	101 Zeta Drive Pittsburgh, PA 15238-2811 <a href="http://www.aerotech.com">www.aerotech.com</a>
United Kingdom	Japan
Phone: +44 (0)1256 855055 Fax: +44 (0)1256 855649 Email: <a href="mailto:service@aerotech.co.uk">service@aerotech.co.uk</a>	Phone: +81 (0)50 5830 6814 Fax: +81 (0)43 306 3773 Email: <a href="mailto:service@aerotechkk.co.jp">service@aerotechkk.co.jp</a>
Germany	China
Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720 Email: <a href="mailto:service@aerotechgmbh.de">service@aerotechgmbh.de</a>	Phone: +86 (21) 3319 7715 Email: <a href="mailto:service@aerotech.com">service@aerotech.com</a>
France	Taiwan
Phone: +33 2 37 21 87 65 Email: <a href="mailto:service@aerotech.co.uk">service@aerotech.co.uk</a>	Phone: +886 (0)2 8751 6690 Email: <a href="mailto:service@aerotech.tw">service@aerotech.tw</a>

This manual contains proprietary information and may not be reproduced, disclosed, or used in whole or in part without the express written permission of Aerotech, Inc. Product names mentioned herein are used for identification purposes only and may be trademarks of their respective companies.

Copyright © 2015-2017, Aerotech, Inc., All rights reserved.

## Aerotech Worldwide

United States ■ France ■ Germany ■ United Kingdom  
China ■ Japan ■ Taiwan



## Table of Contents

<b>ANT20G Hardware Manual</b>	<b>1</b>
Table of Contents	3
List of Figures	4
List of Tables	5
Safety Procedures and Warnings	6
EU Declaration of Incorporation	7
<b>Chapter 1: Overview</b>	<b>9</b>
1.1. Environmental Specifications	10
1.2. Accuracy and Temperature Effects	10
1.3. Basic Specifications	11
1.4. Vacuum Operation	13
<b>Chapter 2: Mechanical Specifications and Installation</b>	<b>15</b>
2.1. Unpacking and Handling the Stage	15
2.2. Dimensions	16
2.3. Securing the Stage to the Mounting Surface	20
2.4. Attaching the Payload to the Stage	21
<b>Chapter 3: Electrical Specifications and Installation</b>	<b>23</b>
3.1. Motor and Feedback Connectors	24
3.2. Motor and Feedback Wiring	26
3.3. Motor and Feedback Specifications	27
3.4. Limits, Marker, and Machine Direction	29
3.5. Motor and Feedback Phasing	30
<b>Chapter 4: Maintenance</b>	<b>33</b>
4.1. Service and Inspection Schedule	33
4.2. Cleaning and Lubrication	34
4.3. Troubleshooting	36
<b>Appendix A: Warranty and Field Service</b>	<b>37</b>
<b>Appendix B: Revision History</b>	<b>39</b>
<b>Index</b>	<b>41</b>

## List of Figures

Figure 1-1:	Step and Settle Performance .....	12
Figure 2-1:	Shipping Clamps .....	15
Figure 2-2:	ANT20G-050 Dimensions .....	16
Figure 2-3:	ANT20G-090 Dimensions .....	17
Figure 2-4:	ANT20G-110 Dimensions .....	18
Figure 2-5:	ANT20G-160 Dimensions .....	19
Figure 2-6:	Mounting Hole Pattern .....	20
Figure 3-1:	Motor and Feedback Wiring .....	26
Figure 3-2:	Machine Direction .....	29
Figure 3-3:	Hall Phasing .....	30
Figure 3-4:	Analog Encoder Phasing Reference Diagram .....	31

**List of Tables**

Table 1-1:	ANT20G Model Numbering System .....	9
Table 1-2:	Environmental Specifications .....	10
Table 1-3:	ANT20G Series Specifications (-050 and -090) .....	11
Table 1-4:	ANT20G Series Specifications (-110 and -160) .....	12
Table 2-1:	Stage to Mounting Surface Hardware .....	20
Table 3-1:	Motor and Feedback Pinouts .....	25
Table 3-2:	Feedback Specifications .....	27
Table 3-3:	Motor Specifications .....	28
Table 3-4:	Encoder Specifications .....	28

## 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 ANT20G 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 ANT20G stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
5. Use care when moving the ANT20G stage. Lifting or transporting the ANT20G stage improperly can result in injury or damage to the ANT20G.
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:**  
ANT20G

**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):*

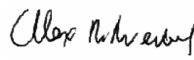
2011/65/EU

RoHS 2 Directive

**Authorized Representative:** Simon Smith, European Director

**Address:** Aerotech Ltd  
The Old Brick Kiln  
Ramsdell, Tadley  
Hampshire RG26 5PR  
UK

**Name**

 / Alex Weibel

**Position**

Engineer Verifying Compliance

**Location**

Pittsburgh, PA

*This page intentionally left blank.*



## 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: ANT20G Model Numbering System**

ANT Series Vertical Travel Stage	
Radius of Rotation (Required)	
-050	50 mm radius of rotation
-090	90 mm radius of rotation
-110	110 mm radius of rotation
-160	160 mm radius of rotation
Metrology (Required)	
-PL1	Base performance
-PL2	High-accuracy performance, PLUS
Accessories (To be Ordered as a Separate Line)	
ALIGN-PA10	XY assembly; 10 arc sec orthogonality
ALIGN-PA5	XY assembly; 5 arc sec orthogonality

## 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 ANT20G 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 ANT20G. At a minimum, the environmental temperature must be controlled to within 0.25°C per 24 hours to ensure the ANT20G 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 ANT20G is mounted. Contact the factory for more details.

The accuracy specification of ANT20G series stages is measured at the center of rotation 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: ANT20G Series Specifications (-050 and -090)**

Model		-050	-090
Rotation Angle		20°	20°
Accuracy <sup>(1)</sup>		±90 μrad (±18 arc sec)	±50 μrad (±10 arc sec)
Resolution (Minimum Incremental Motion)		0.25 μrad (0.05 arc sec)	0.25 μrad (0.05 arc sec)
Bidirectional Repeatability <sup>(1)</sup>		±18 μrad (±4 arc sec)	±10 μrad (±2 arc sec)
Unidirectional Repeatability		±5 μrad (±1 arc sec)	±5 μrad (±1 arc sec)
Tilt Error Motion		±90 μrad (±18 arc sec)	±50 μrad (±10 arc sec)
Maximum Speed		150 degrees per second	
Maximum Acceleration		1200 rad/s <sup>2</sup>	500 rad/s <sup>2</sup>
Settling Time		Refer to Figure <a href="#">Figure 1-1</a>	
In-Position Stability <sup>(2)</sup>		±0.4 μrad (±0.08 arc sec)	±0.2 μrad (±0.04 arc sec)
Nominal Radius of Rotation		50 mm	90 mm
Height from Tabletop to Rotation Point		19.1 mm	57.5 mm
Maximum Torque (Continuous)		0.40 N·m	0.85 N·m
Load Capacity	Axial	1.5 kg	2.0 kg
	Moment	60 kg·mm	80 kg·mm
Stage Mass		0.55 kg (1.2 lb)	1.1 kg (2.4 lb)
Material		Aluminum	
MTBF (Mean Time Between Failure)		30,000 Hours	
1. Certified with each stage.			
2. In-Position Jitter listing is 3 sigma value.			
Specifications are per axis, measured at the rotation point. Performance of multi-axis systems is payload and workpoint dependent.			
Consult factory for multi-axis or non-standard applications.			

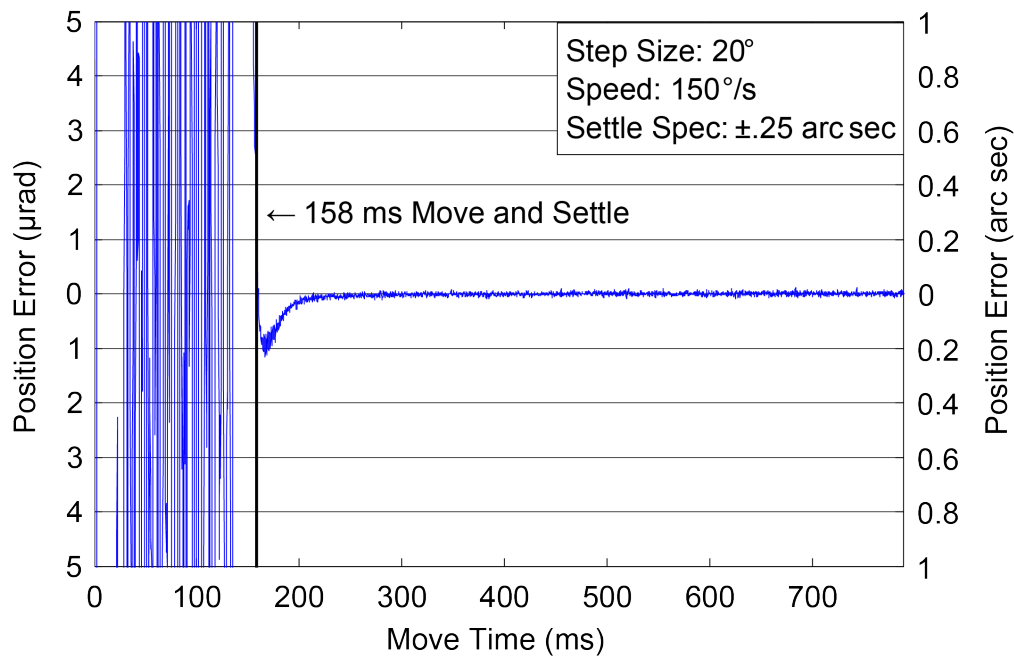
**Table 1-4: ANT20G Series Specifications (-110 and -160)**

Model	-110	-160	
Rotation Angle	20°	20°	
Accuracy <sup>(1)</sup>	±40 μrad (±8 arc sec)	±30 μrad (±6 arc sec)	
Resolution (Minimum Incremental Motion)	0.25 μrad (0.05 arc sec)	0.25 μrad (0.05 arc sec)	
Bidirectional Repeatability <sup>(1)</sup>	±10 μrad (±2 arc sec)	±10 μrad (±2 arc sec)	
Unidirectional Repeatability	±5 μrad (±1 arc sec)	±5 μrad (±1 arc sec)	
Tilt Error Motion	±40 μrad (±8 arc sec)	±30 μrad (±6 arc sec)	
Maximum Speed	150 degrees per second		
Maximum Acceleration	375 rad/s <sup>2</sup>	250 rad/s <sup>2</sup>	
Settling Time	Refer to Figure <a href="#">Figure 1-1</a>		
In-Position Stability <sup>(2)</sup>	±0.2 μrad (±0.04 arc sec)	±0.15 μrad (±0.03 arc sec)	
Nominal Radius of Rotation	110 mm	160 mm	
Height from Tabletop to Rotation Point	76.2 mm	120.4 mm	
Maximum Torque (Continuous)	1.00 N·m	2.40 N·m	
Load Capacity	Axial	2.0 kg	3.5 kg
	Moment	80 kg·mm	140 kg·mm
Stage Mass	1.2 kg (2.6 lb)	1.6 kg (3.5 lb)	
Material	Aluminum		
MTBF (Mean Time Between Failure)	30,000 Hours		

1. Certified with each stage.

2. In-Position Jitter listing is 3 sigma value.

Specifications are per axis, measured at the rotation point. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.

**Figure 1-1: Step and Settle Performance**

## 1.4. Vacuum Operation

Aerotech can specially prepare the ANT20G 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 ANT20G 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 ANT20G from the sealed bag until it is ready for use.
2. Always handle the ANT20G in a clean environment and use powder-free polyethylene gloves to prevent any contaminants from adhering to the surface of the ANT20G.
3. During installation, use cleaned, vented, stainless steel fasteners when securing the ANT20G.
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.

*This page intentionally left blank.*

## Chapter 2: Mechanical Specifications and Installation



**WARNING:** ANT20G 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 ANT20G. Unsecured moving parts may shift and cause bodily injury.
- Improper handling could adversely affect the performance of the ANT20G. Use care when moving the ANT20G.

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

Carefully remove the ANT20G from its protective shipping container. Gently set the ANT20G on a smooth, flat, and clean surface.

Before operating the ANT20G, 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 ANT20G 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 ANT20G can be operated. Retain the brackets and hardware for future use.

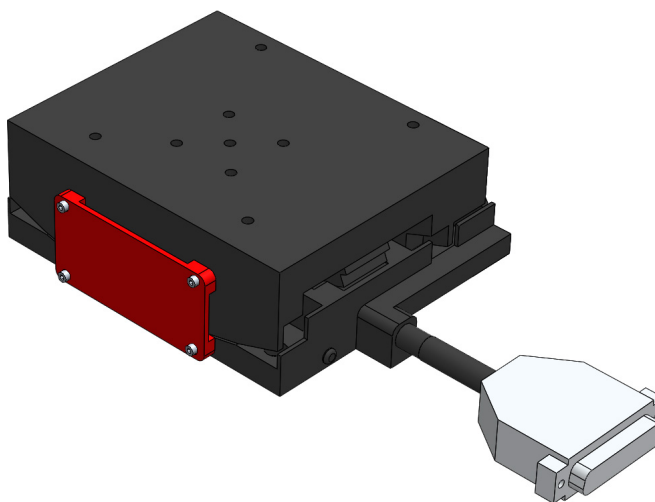
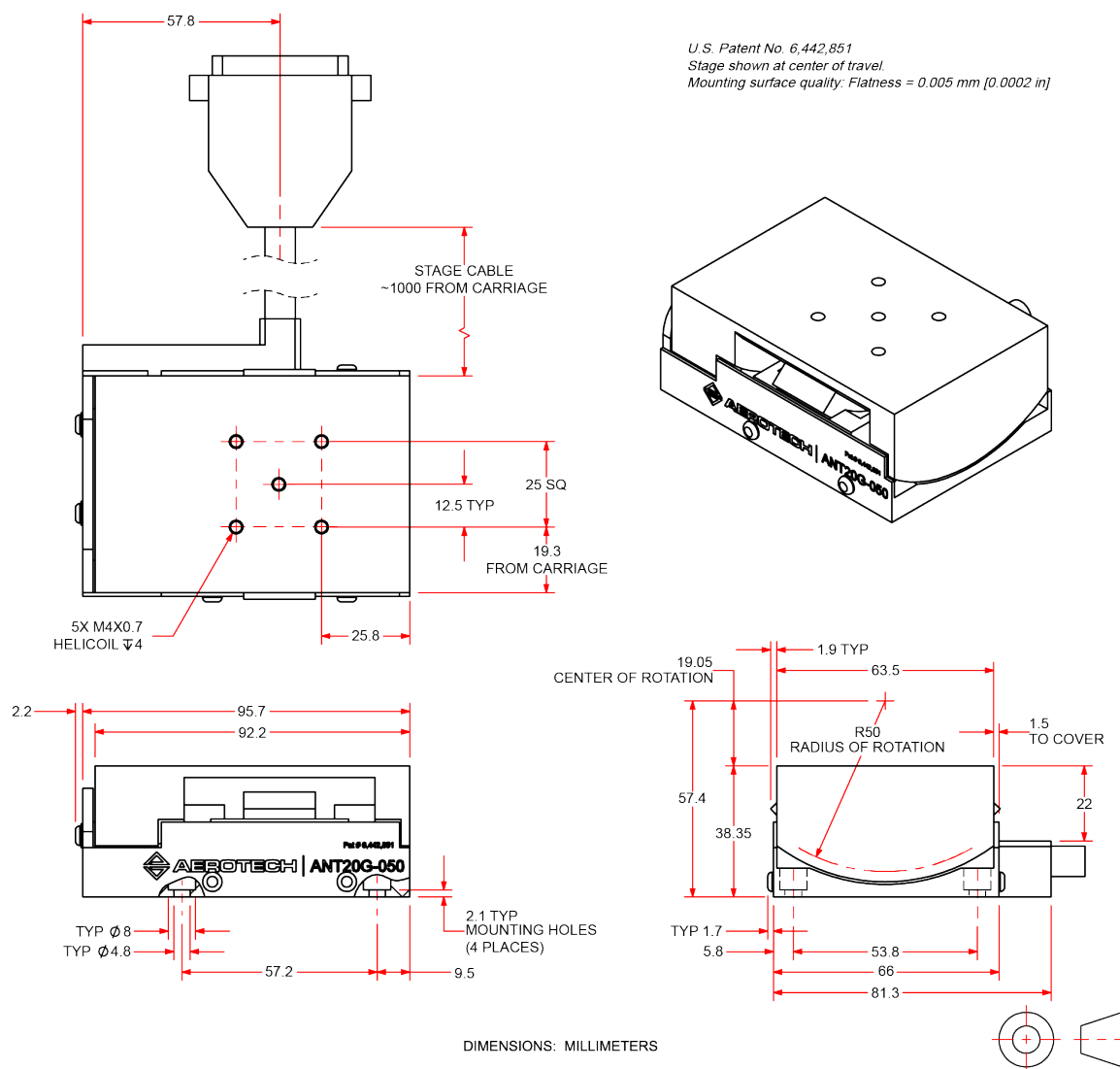


Figure 2-1: Shipping Clamps

## 2.2. Dimensions



**Figure 2-2: ANT20G-050 Dimensions**



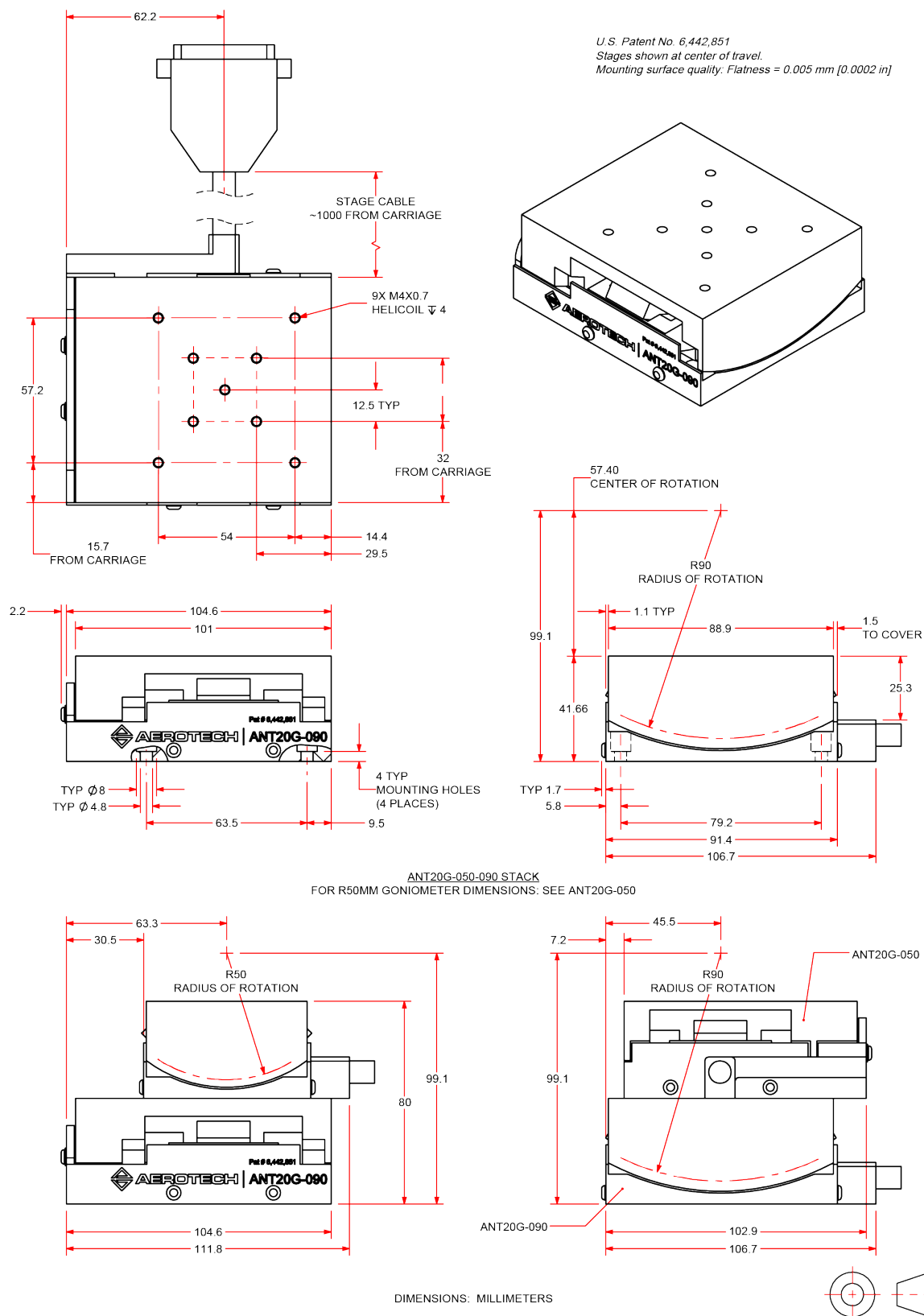


Figure 2-3: ANT20G-090 Dimensions

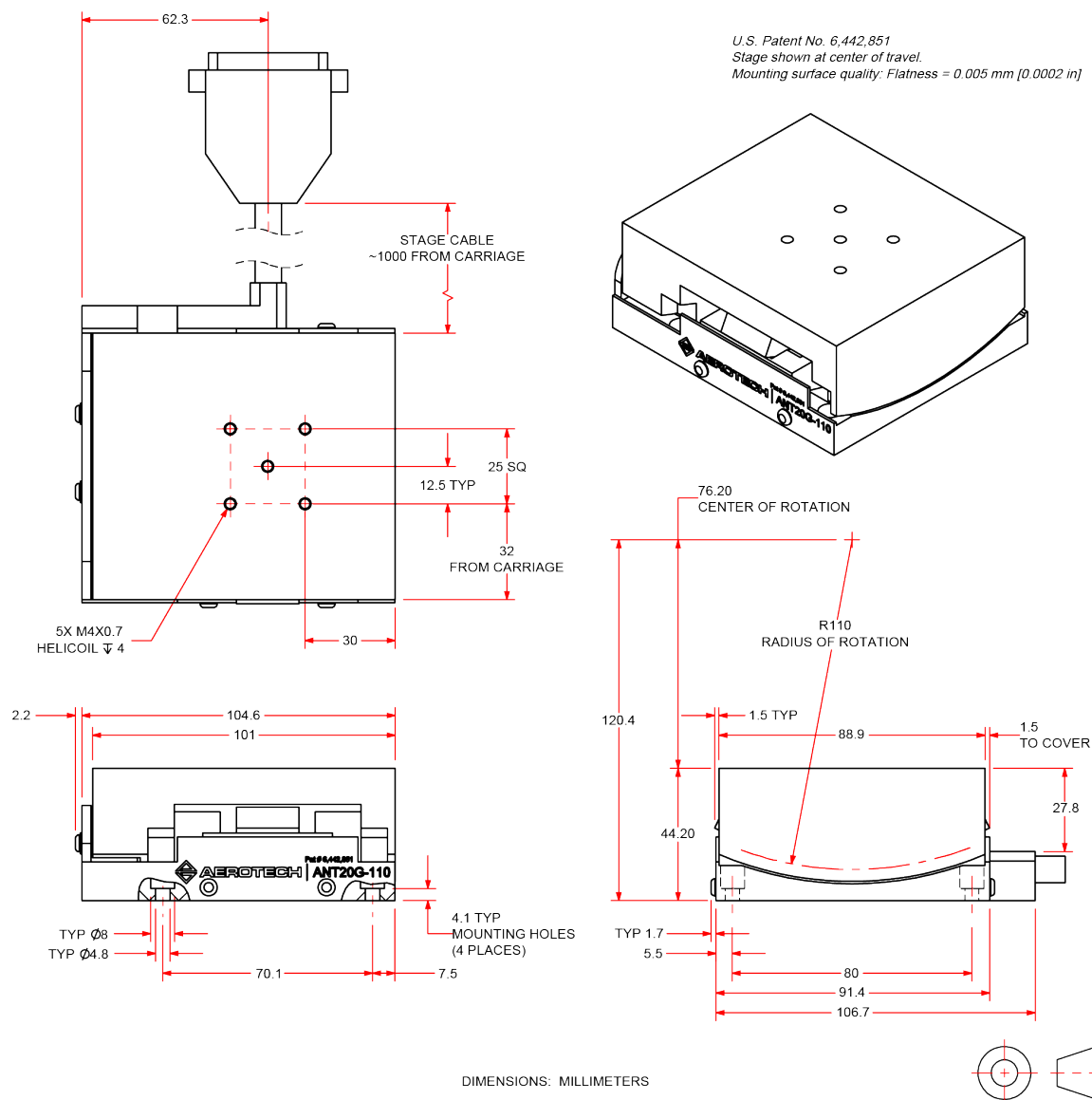


Figure 2-4: ANT20G-110 Dimensions

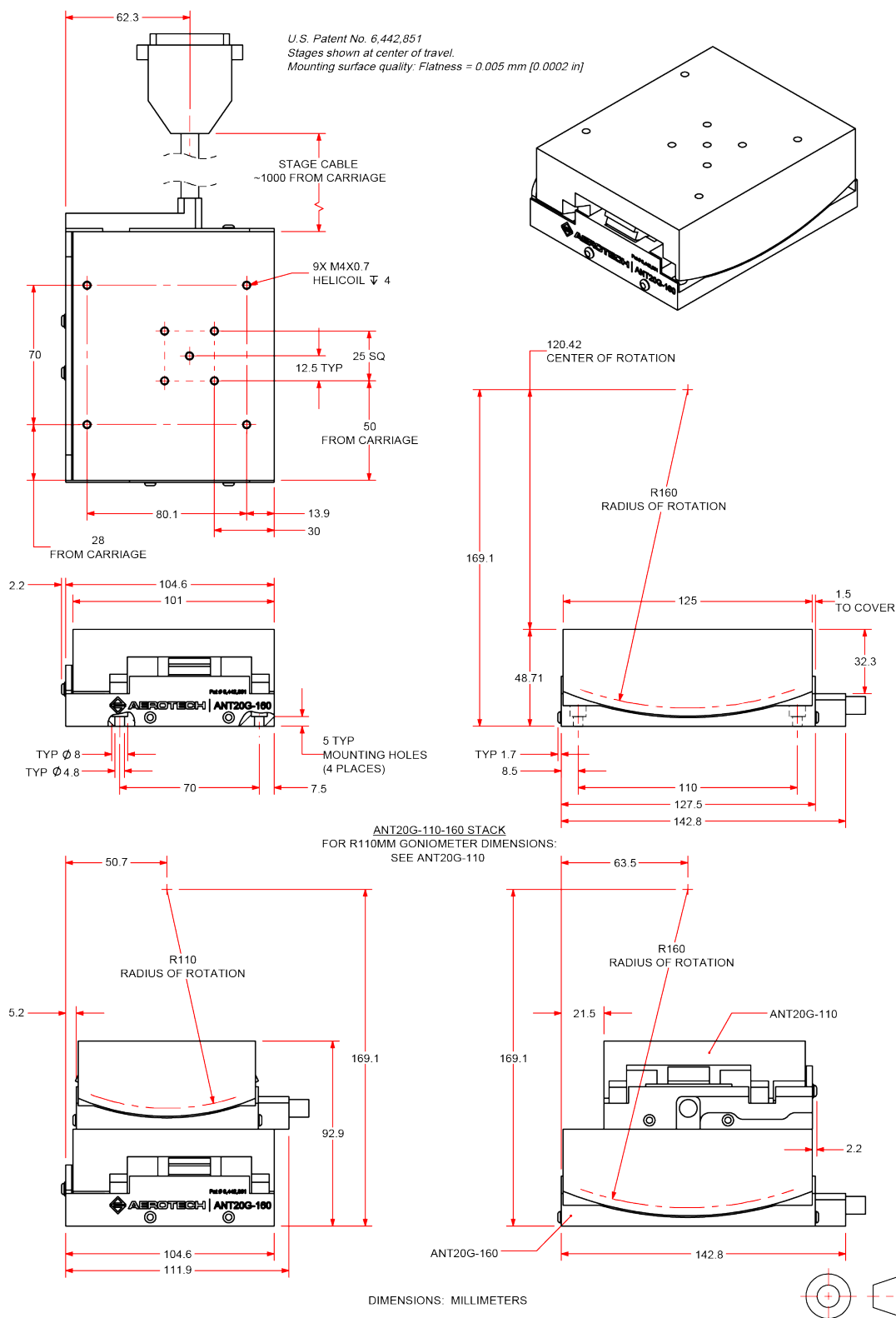


Figure 2-5: ANT20G-160 Dimensions

## 2.3. Securing the Stage to the Mounting Surface



**WARNING:** The ANT20G must be mounted securely. Improper mounting can result in injury and damage to the equipment.

The mounting surface must be flat and have adequate stiffness in order to achieve the maximum performance from the ANT20G 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  $\mu\text{m}$ .

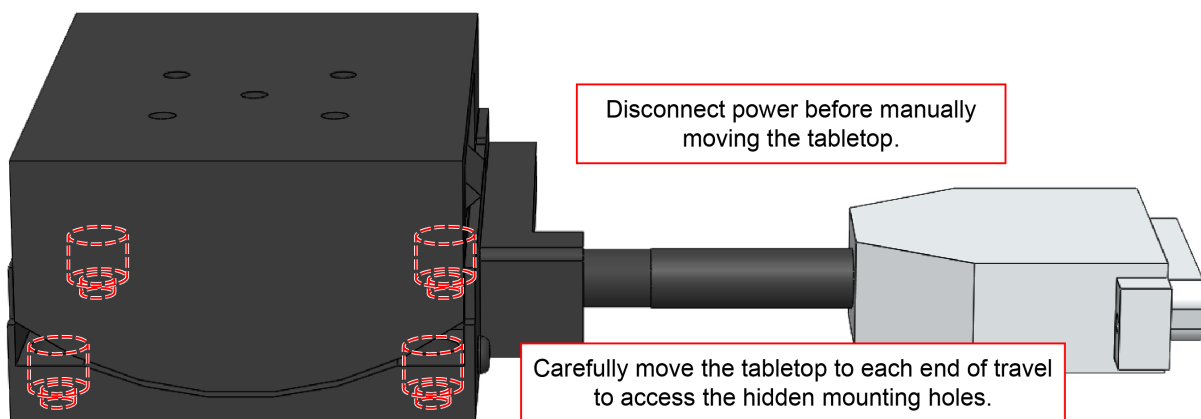
**NOTE:** The ANT20G is precision machined and verified for flatness prior to product assembly at the factory. If machining is required to achieve the desired flatness, it should be performed on the mounting surface rather than the ANT20G. Shimming should be avoided if possible. If shimming is required, it should be minimized to retain maximum rigidity of the system.

When the stage is centered, the tabletop will block access to the mounting holes. With the power disconnected, gently move the stage to either end of travel to expose the mounting holes.

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
M4 Socket Head Cap Screws (4 places)	2.0 N·m



**Figure 2-6: 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.

**NOTE:** If your ANT20G 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 ANT20G 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 5  $\mu\text{m}$ .

*This page intentionally left blank.*

## 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 ANT20G is part of a complete Aerotech motion control system, setup usually involves connecting the ANT20G 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 ANT20G 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.



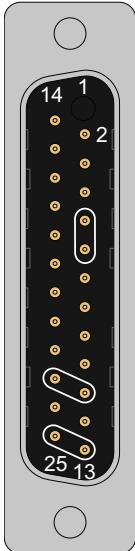
**WARNING:** Operator access to the base and tabletop must be restricted while connected to a power source. Failure to do so may cause electric shock.



**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**

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	Reserved	
21	Hall Effect sensor, phase B	
22	Reserved	
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

### 3.2. Motor and Feedback Wiring

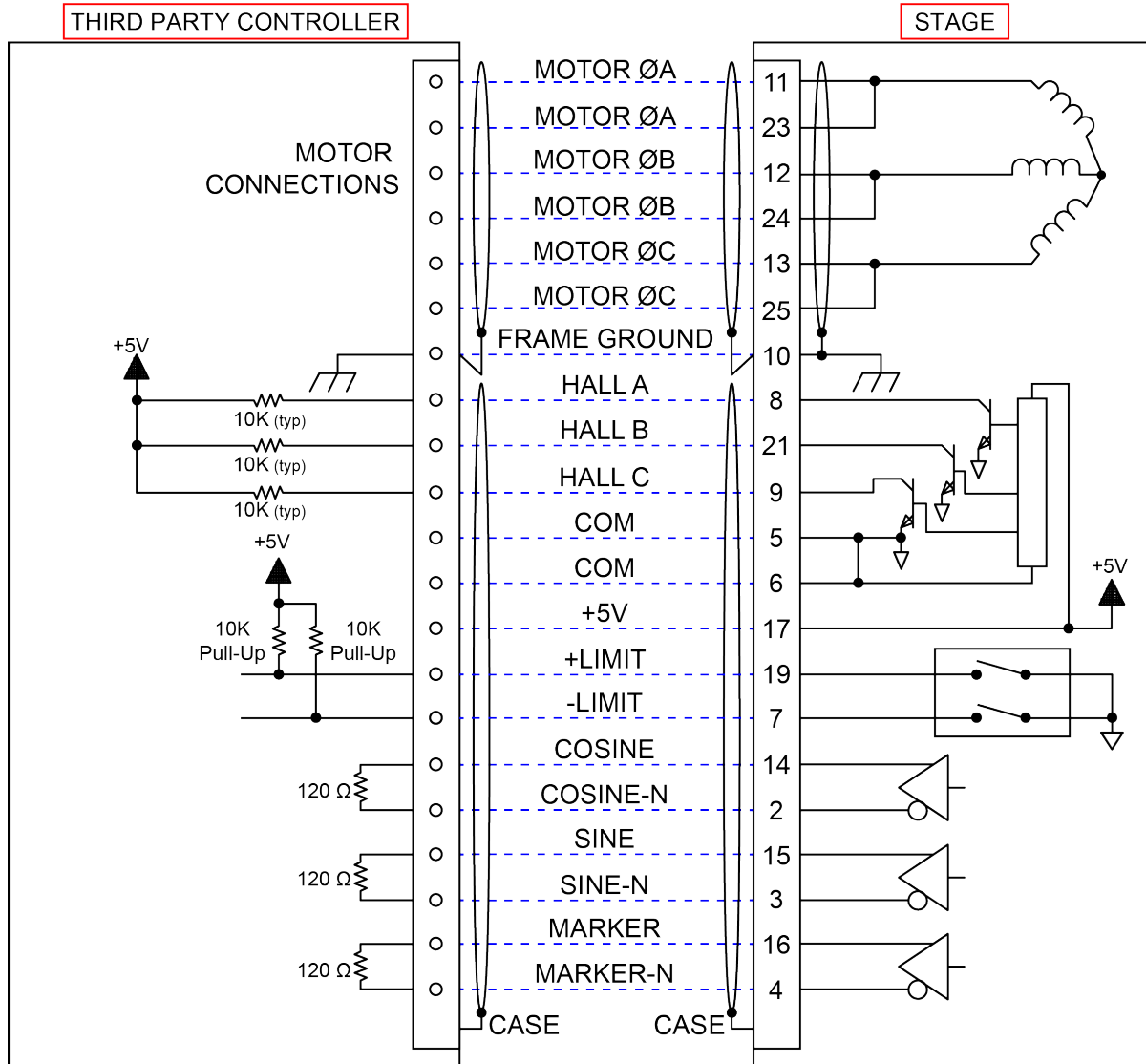


Figure 3-1: Motor and Feedback Wiring

### 3.3. Motor and Feedback Specifications

**Table 3-2: 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)

Encoder Specifications	
Supply Voltage	5 V $\pm 10\%$
Supply Current	250 mA
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	5 V
Supply Current	25 mA
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>
<b>Notes:</b> <ul style="list-style-type: none"> <li>If the ANT20G 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.</li> </ul>	

**Table 3-3: Motor Specifications**

ANT20G		-050	-090	-110	-160
<b>Performance Specifications<sup>(1,5)</sup></b>					
Stall Torque, Continuous <sup>(2)</sup>	N·m (oz·in)	0.4 (54.54)	0.9 (123.21)	1.1 (150.58)	2.4 (338.69)
Peak Torque <sup>(3)</sup>	N·m (oz·in)	1.5 (218.2)	3.5 (492.8)	4.3 (602.3)	9.6 (1354.8)
<b>Electrical Specifications<sup>(5)</sup></b>					
Winding Designation		-A	-A	-A	-A
BEMF Constant (Line to Line, Max)	V/krpm (V/in/s)	14.95 (0.073)	35.62 (0.096)	43.54 (0.096)	112.14 (0.170)
Continuous Current <sup>(2)</sup>	A <sub>pk</sub> (A <sub>rms</sub> )	3.10 (2.19)	2.94 (2.08)	2.94 (2.08)	3.00 (2.12)
Peak Current, Stall <sup>(3)</sup>	A <sub>pk</sub> (A <sub>rms</sub> )	12.40 (8.77)	11.76 (8.32)	11.76 (8.32)	12.00 (8.49)
Force Constant, Sine Drive <sup>(4, 8)</sup>	N·m/A <sub>pk</sub> (oz·in/A <sub>pk</sub> )	0.12 (17.59)	0.30 (41.91)	0.36 (51.22)	0.80 (112.90)
	N·m/A <sub>rms</sub> (oz·in/A <sub>rms</sub> )	0.18 (24.88)	0.42 (59.27)	0.51 (72.44)	1.13 (159.66)
Motor Constant <sup>(2,4)</sup>	N·m/√W (oz·in/√W)	0.06 (8.58)	0.13 (17.93)	0.15 (21.92)	0.28 (39.70)
Resistance, 25°C (Line to Line)	ohms	4.0	5.2	5.2	7.7
Inductance (Line to Line)	mH	0.51	0.70	0.70	0.99
Thermal Resistance	°C/W	2.48	2.12	2.12	1.37
Maximum Bus Voltage	VDC	80	80	80	80
<b>Mechanical Specifications<sup>(5)</sup></b>					
Motor Radius	mm (in)	50.00 (1.97)	90.00 (3.54)	110.00 (4.33)	160.00 (6.30)
Magnetic Pole Pitch	degree	22.4	11.3	9	6
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 ±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 Apk; use force constant in N·m/Apk when sizing.					

**Table 3-4: Encoder Specifications**

Model	ANT20G-050	ANT20G-090	ANT20G-110	ANT20G-160
Fundamental Resolution (arc sec/count)	115.68413	53.79535	42.41732	28.15325
x4000 Interpolation (arc sec/count)	0.02892	0.01345	0.01060	0.00704
x16000 Interpolation (arc sec/count)	0.00723	0.00336	0.00265	0.00176
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 3-2](#) shows the machine direction of ANT20G stages.

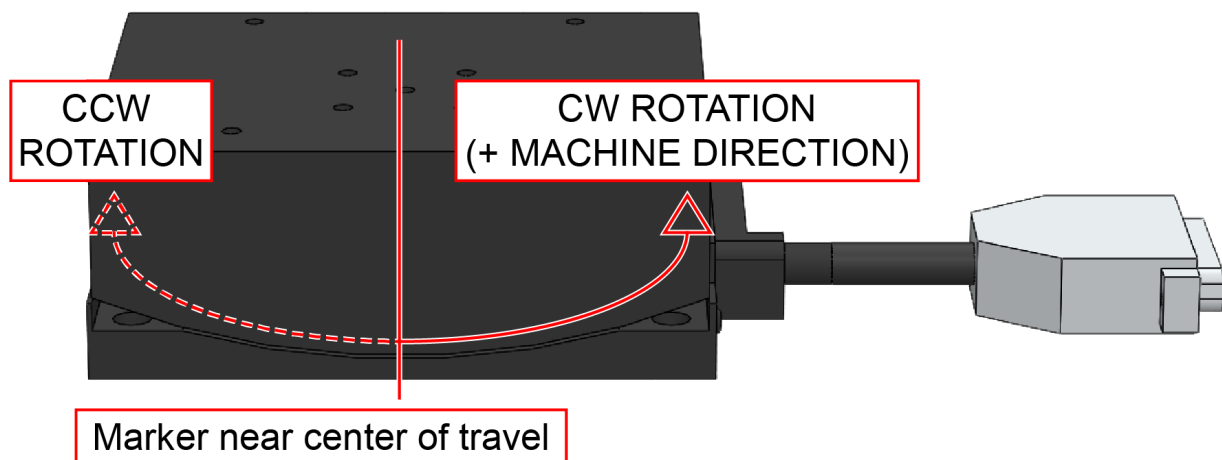
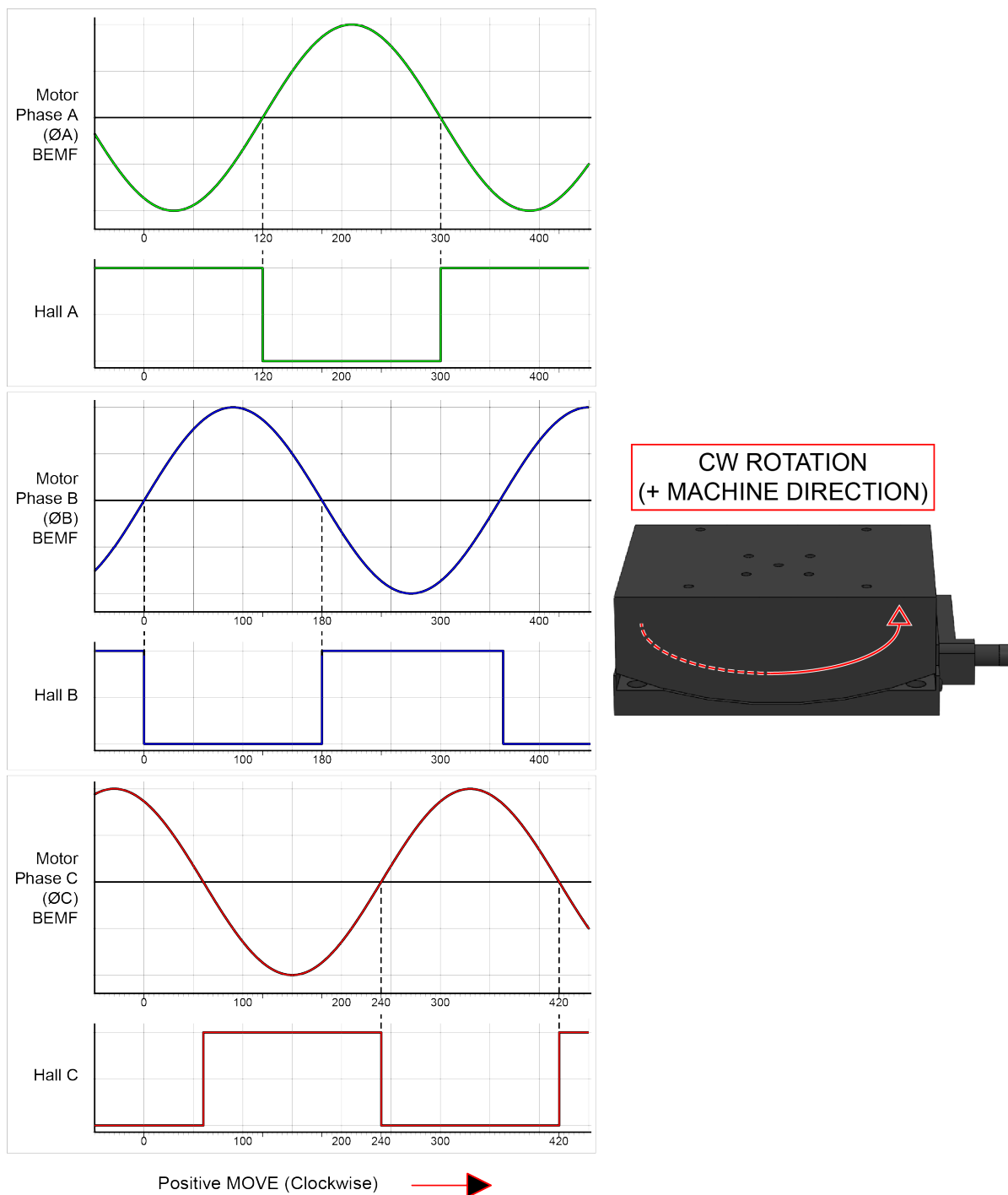


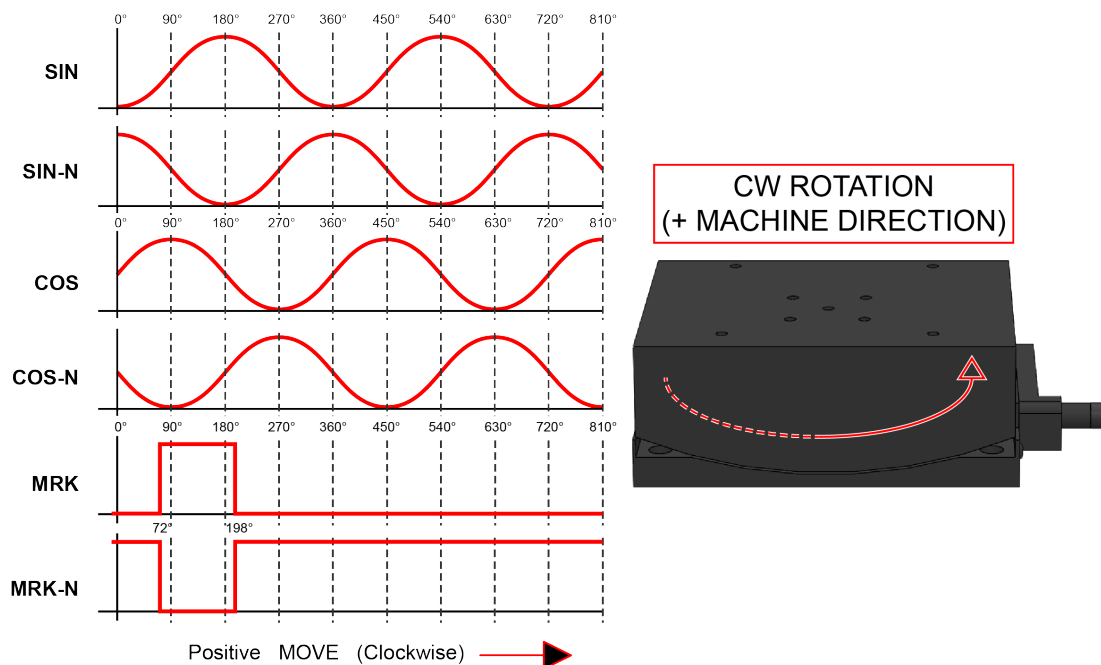
Figure 3-2: Machine Direction

### 3.5. Motor and Feedback Phasing

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



**Figure 3-3: Hall Phasing**



**Figure 3-4: Analog Encoder Phasing Reference Diagram**

*This page intentionally left blank.*



## 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 ANT20G 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 ANT20G and any components and cables as needed
- Repair any damage before operating the ANT20G
- 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 ANT20G, blow away small particles and dust with nitrogen or, less preferably, clean, dry, compressed air.

Any external metal surface of the ANT20G 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 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. The motor is completely non-contact and requires no lubrication.

**NOTE:** During the lubrication procedure, inspect the linear motion guides for any damage or signs of wear.

### Lubrication Procedure

1. 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 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. Using a grease syringe, apply an approximate 2 mm diameter bead of lubricant to the relief area below the bearing surfaces as close to the cage as possible equal to roughly  $\frac{1}{4}$  of the overall length of the bearing rail. Repeat this for both rails.
5. Manually move the stage to the opposite end of travel. This will work the grease into the 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. Gently move the stage table back and forth through travel by hand several times to distribute the lubrication.
8. Repeat this procedure four times to fully grease the bearing surfaces.

### 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>

## 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>

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	General Information
1.01.00	<ul style="list-style-type: none"><li>Product update</li><li>Updated dimension drawings: <a href="#">Section 2.2.</a></li></ul>
1.00.00	New manual

*This page intentionally left blank.*



# Index

		Lubrication	35
	<b>2</b>	lubrication schedule	33
2010		<b>M</b>	
	<b>A</b>	mounting surface	20
Altitude	10	multiaxis combinations	34
Ambient Temperature	10	<b>O</b>	
	<b>B</b>	orthogonality	34
Braycote® 602EF	13	<b>P</b>	
	<b>C</b>	part number	15
Cleaning	34	Protection Rating	10
cleaning solvent	34	protective ground connection	24
	<b>E</b>	<b>S</b>	
EN 60204-1	7	serial number	15
EN ISO 12100	7	service schedule	33
Encoder Specifications	27	Shimming	20
	<b>G</b>	Shipping Clamps	15
Global Technical Support	2	solvents	34
grease	13,35	stabilize	15
	<b>H</b>	stage distortion	20
Hall-Effect Sensors Specifications	27	Support	2
Humidity	10	<b>T</b>	
	<b>I</b>	Technical Support	2
inspect	33	<b>V</b>	
inspection schedule	33	vacuum	13
isopropyl alcohol	34	vacuum guidelines	13
	<b>K</b>	Vibration	10
Kluberplex BEM 34-132	35	<b>W</b>	
	<b>L</b>	Warranty and Field Service	37
label	15		
Limit Switch Specifications	27		
lubricants			
vacuum operation	13		

*This page intentionally left blank.*