



# AOM360D Series Direct-Drive Gimbals

## HARDWARE MANUAL

Revision 2.00



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## Table of Contents

<b>AOM360D Series Direct-Drive Gimbals</b> .....	<b>1</b>
Table of Contents .....	3
List of Figures .....	4
List of Tables .....	5
EU Declaration of Incorporation .....	6
UKCA Declaration of Incorporation .....	7
Safety Procedures and Warnings .....	8
Installation and Operation .....	9
Electrical Warnings .....	10
Motor-Related Warnings .....	11
Pinch Points .....	12
Handling and Storage .....	13
<b>Chapter 1: Overview</b> .....	<b>15</b>
1.1. Environmental Specifications .....	16
1.2. Accuracy and Temperature Effects .....	16
1.3. Basic Specifications .....	17
1.4. Vacuum Operation .....	18
1.5. Export Restrictions .....	19
<b>Chapter 2: Installation</b> .....	<b>21</b>
2.1. Dimensions .....	21
2.2. Securing the Base to the Mounting Surface .....	25
2.3. Attaching the Payload to the Stage .....	27
<b>Chapter 3: Electrical Installation</b> .....	<b>29</b>
3.1. Motor and Feedback Connectors .....	30
3.2. Motor and Feedback Wiring .....	33
3.3. Hall, Thermistor, Inductosyn, and Limits Specifications .....	35
3.4. Limits, Marker, and Machine Direction .....	38
3.5. Motor and Feedback Phasing .....	39
<b>Chapter 4: Maintenance</b> .....	<b>41</b>
4.1. Service and Inspection Schedule .....	41
4.2. Cleaning and Lubrication .....	42
<b>Appendix A: Warranty and Field Service</b> .....	<b>43</b>
<b>Appendix B: Revision History</b> .....	<b>45</b>
<b>Index</b> .....	<b>47</b>

## List of Figures

Figure 2-1: AOM360D-200 Dimensions .....	21
Figure 2-2: AOM360D-300 Dimensions .....	22
Figure 2-3: AOM360D-400 Dimensions .....	23
Figure 2-4: AOM360D-500 Dimensions .....	24
Figure 2-5: View of AOM360D Showing Mounting Holes .....	26
Figure 3-1: Motor and Feedback Wiring (AZ/EL) .....	33
Figure 3-2: Feedback Interconnection Drawing .....	34
Figure 3-3: Machine Direction .....	38
Figure 3-4: Hall Phasing Diagram .....	39

## List of Tables

Table 1-1: Model Numbers and Ordering Options .....	15
Table 1-2: Environmental Specifications .....	16
Table 1-3: AMG Series Specifications .....	17
Table 2-1: Stage Mounting Surface Flatness Requirement .....	25
Table 3-1: 26-Pin Motor Connector Pinouts [AZ and EL] .....	31
Table 3-2: Mating Connector Part Numbers for the 26-Pin Motor Connector .....	31
Table 3-3: 19-Pin Feedback Connector Pinouts [AZ and EL] .....	32
Table 3-4: Mating Connector Part Numbers for the 19-Pin Feedback Connector .....	32
Table 3-5: Hall-Effect Sensor Specifications .....	35
Table 3-6: Thermistor Specifications .....	35
Table 3-7: Inductosyn Specifications .....	35
Table 3-8: Limit Switch Specifications .....	35
Table 3-9: S-180-44 [EL] and S-180-69 [AZ] Rotary Motor Specifications (-200 and -300 options) ...	36
Table 3-10: S-240-63 [EL] and S-240-83 [AZ] Rotary Motor Specifications (-400 and -500 options) .	37

## EU Declaration of Incorporation

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

*herewith declares that the product:*

AOM360D gimbal

*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, for example, 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):*

EU 2015/863

Directive, Restricted Substances (RoHS 3)

**Authorized Representative**



/ Simon Smith, European Director

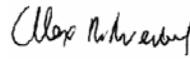
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/ Alex Weibel

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101 Zeta Drive

Pittsburgh, PA 15238-2811

USA

12/15/2022

**Date**



## UKCA Declaration of Incorporation

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

herewith declares that the product:

AOM360D gimbal

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

Supply of Machinery (Safety) Regulations 2008

Hazardous Substances in Electrical and Electronic Equipment Regulations 2012

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

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 furthermore declares that it is not allowed to put the product 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 Supply of Machinery (Safety) Regulations 2008 UK Legislation and with national implementing legislation, for example, as a whole, including the equipment referred to in this Declaration.

EN ISO 12100:2010

Safety of machinery - Basic concepts, general principles for design

**Authorized Representative**



/ Simon Smith, European Director

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**Engineer Verifying Compliance**



/ Alex Weibel

Aerotech, Inc.  
101 Zeta Drive  
Pittsburgh, PA 15238-2811  
USA  
12/15/2022

**Date**



## Safety Procedures and Warnings



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

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

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



**IMPORTANT:** This product has been designed for light industrial manufacturing or laboratory environments. If the product is used in a manner not specified by the manufacturer:

- The protection provided by the equipment could be impaired.
- The life expectancy of the product could be decreased.

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



Shock/Electrocution Hazard



Pinch, Shear, or Crush Hazard



General/Conditional Awareness



Rotational Machinery Hazard



Hot Surface Hazard



Pinch/Entanglement Hazard



Magnetic Field Hazard



Trip Hazard



Heavy, Bulky Lifting Hazard



Appropriate Equipment Required



Pressure/Explosive Atmosphere Hazard



Electrostatic Discharge Hazard

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



General tip



Read the manual/section



Wear personal protective equipment (PPE): Safety Glasses



If applicable, do not lift unassisted



Wear personal protective equipment (PPE): Gloves



Wear personal protective equipment (PPE): Hearing Protection

## Installation and Operation

To decrease the risk of damage to the equipment, you must obey the precautions that follow.



### **DANGER: General Hazard Warning!**

This product can produce high forces and move at velocities that could cause injury. The user is responsible for its safe operation. The following general equation is provided to assist with risk assessments in regards to contact and pinch points:

$$Pressure_{Max} \left[ \frac{N}{mm^2} \right] = \frac{Force_{Peak} [N]}{Area_{Contact} [mm^2]}$$



### **WARNING: General Hazard Warning!**

- Only trained operators should operate this equipment.
- All service and maintenance must be done by approved personnel.
- Use this product only in environments and operating conditions that are approved in this manual.
- Never install or operate equipment that appears to be damaged.
- Make sure that the product is securely mounted before you operate it.
- Use care when you move the AOM360D or you could negatively affect the performance of it.



### **WARNING: Trip Hazard!**

Route, house, and secure all cables, duct work, air, or water lines. Failure to do so could introduce trip hazards around the system that could result in physical injury or could damage the equipment.

## Electrical Warnings

To decrease the risk of electrical shock, injury, death, and damage to the equipment, obey the precautions that follow.



### **DANGER: Electrical Shock Hazard!**

- Stage motor phase voltage levels could be hazardous live.
- Personnel are protected from hazardous voltages unless electrical interconnections, protective bonding (safety ground), or motor/stage enclosures are compromised.
- Do not connect or disconnect stage/motor interconnections while connected to a live electrical power source.
- Before you set up or do maintenance, disconnect electrical power.
- It is the responsibility of the End User/System Integrator to make sure that stages are properly connected and grounded per Engineering Standards and applicable safety requirements.
- It is the responsibility of the End User/System Integrator to configure the system drive or controller within the Aerotech motor/stage electrical and mechanical specifications.

## Motor-Related Warnings

Aerotech motors are capable of producing high forces and velocities. Obey all warnings and all applicable codes and standards when you use or operate a stage or system that incorporates Aerotech motors.



### **DANGER: Mechanical Hazard!**

Personnel must be made aware of the mechanical hazards during set up or when you do service to the stage.



- Unintentional manual movement into the stage "end-of-travel" stops, could damage the stage or undo precision alignments.
- Stage movement could create pinch points, entanglement hazards, or rotational mechanical hazards.



### **DANGER: Hot Surface Hazard!**

- The stage/motor frame temperature could exceed 70°C in some applications.
- Do not touch the stage/motor frame while it is in operation.
- Wait until the stage/motor has cooled before you touch it.



### **DANGER: Risk of Explosive Atmosphere!**

- Standard Aerotech stage/motors are not rated for applications with explosive atmospheres such as airborne dust or combustible vapors.
- Do not operate stage/motors outside of Aerotech environmental specifications.



### **DANGER: Magnetic Field Hazard!**

Aerotech stage/motors contain magnets which can present a Magnetic Field Hazard.

- Do not disassemble a stage motor under any circumstances.
- Strong magnetic fields could interfere with external/internal medical devices.
- Strong magnetic fields could present mechanical hazards such as pinch points.

## Pinch Points

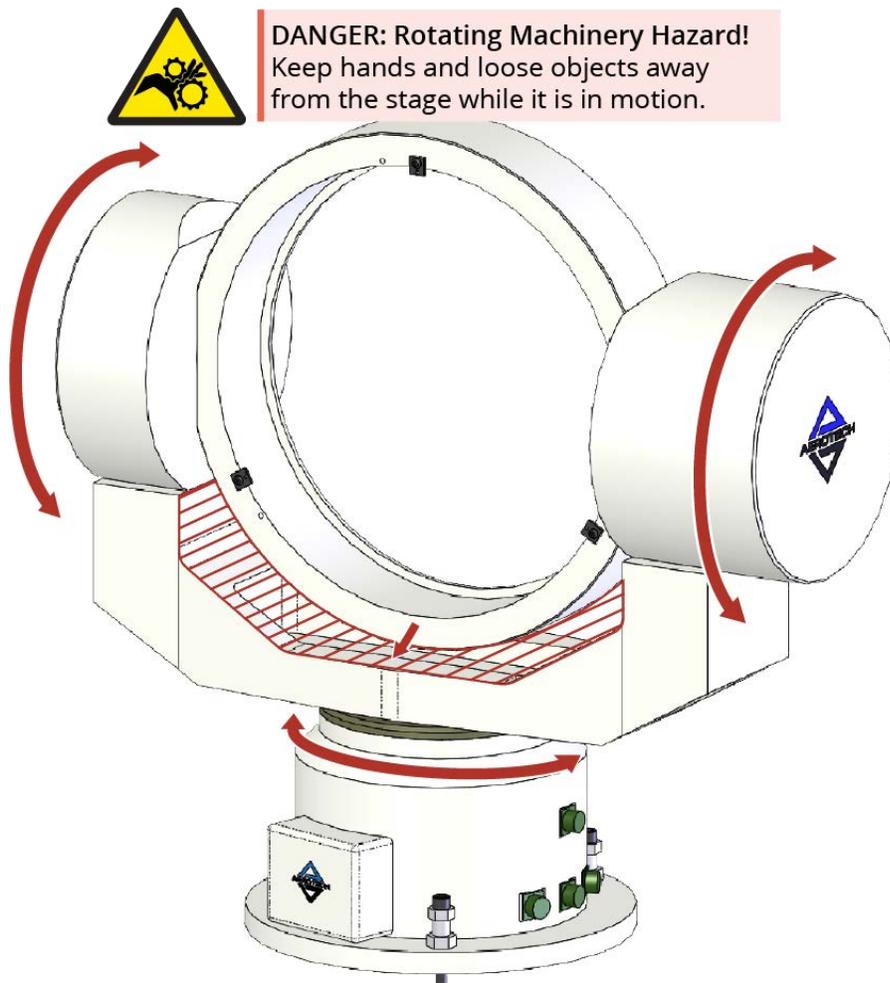
A pinch point is a mechanical hazard that can occur when there are exposed parts of the stage or system that can move. For example, the travel of a stage tabletop could expose the user to a pinch point between the tabletop and the stage housing. The images that follow will show you typical external and internal pinch point locations.

### **DANGER: Mechanical Hazard!**



- System travel can cause crush, shear, or pinch injuries.
- Only trained operators should operate this equipment.
- Do not put yourself in the travel path of machinery.
- Restrict access to all motor and stage parts
  - when the system moves under power (during normal operation, for example).
  - when the system is moved manually (during the installation process or when you do maintenance, for example).
- Motors are capable of very high speeds and acceleration rates.

**Figure 1: Typical Pinch Point Locations**



**DANGER: Rotating Machinery Hazard!**  
Keep hands and loose objects away from the stage while it is in motion.

## Handling and Storage



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

- Be careful when you move or transport the gimbal.
- Retain the shipping materials for future use.
- Transport or store the gimbal in its protective packaging.



### **WARNING: Electrostatic Discharge (ESD) Sensitive Components!**

Wear an ESD wrist strap when you handle, install, or do service to the system assembly. You could damage the power supply or drives if you fail to observe the correct ESD practices.

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

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

The documentation for the gimbal is on the included installation device. The documents include manuals, interconnection drawings, and other documentation pertaining to the system. Save this information for future reference.

Each stage has a label listing the system part number and serial number. These numbers contain information necessary for maintenance or system hardware and software updates. Locate this label and record the information for later reference.

## Unpacking and Handling

It is the responsibility of the customer to safely and carefully lift and move the gimbal.



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



**DANGER: Lifting Hazard!** Use care when you move the AOM360D or you could negatively affect the performance of it.

- Use the correct lifting techniques, mechanical assistance, or additional help to lift or move this product.
- Do not use the cables or the connectors to lift or move this product.
- Make sure that all moving parts are secure before you move the gimbal. Unsecured moving parts could shift and cause injury or damage to the equipment.
- If the gimbal is heavy, a single person lift could cause injury. Use assistance when you lift or move it.
  - Refer to [Section 2.1. Dimensions](#) for dimensions

Carefully remove the stage from its protective shipping container.

- Lift this product only by the base.
- For multi-axis assemblies, always lift the system by the lower axis.
- Use a cart, dolly, or similar device to move the stage to a new location.

Gently set the stage on a smooth, flat, and clean surface. Use compressed nitrogen or clean, dry, oil-free air to remove any dust or debris that has collected during shipping.

Before you operate the stage, let it stabilize at room temperature for at least 12 hours. This will ensure that all of the alignments, preloads, and tolerances are the same as they were when they were tested at Aerotech.

Each stage has a label listing the system part number and serial number. These numbers contain information necessary for maintenance or system hardware and software updates. Locate this label and record the information for later reference.

**Storage**

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

Refer to [Section 1.1. Environmental Specifications](#)

## Chapter 1: Overview

Table 1-1: Model Numbers and Ordering Options

AOM360D Optical Mount	
Cell Size (Required)	
-200	200 mm diameter cell
-300	300 mm diameter cell
-400	400 mm diameter cell
-500	500 mm diameter cell

## 1.1. Environmental Specifications



**WARNING: General Hazard Warning!** Do not expose this product to environments or conditions outside of the listed specifications. You could damage the equipment if you exceed the environmental or operating specifications.



**DANGER: Risk of Explosive Atmosphere!**

- Standard Aerotech stage/motors are not rated for applications with explosive atmospheres such as airborne dust or combustible vapors.
- Do not operate stage/motors outside of Aerotech environmental specifications.

**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.
<b>Humidity</b>	Storage: 0° to 40° C (32° to 104° F) in original shipping packaging
	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. Floor or acoustical vibration can affect system performance. Contact Aerotech for information regarding your specific application.
<b>Protection Rating</b>	Limited protection against dust, but not water (IP40 equivalent ingress protection rating).
<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. Temperature changes could cause a decrease in performance or permanent damage to the gimbal. At a minimum, the environmental temperature must be controlled to within 0.25°C per 24 hours to ensure the gimbal specifications are repeatable over an extended period of time. The severity of temperature effects on all specifications depends on many different environmental conditions, which include how the gimbal is mounted. Contact the factory for more details.

### 1.3. Basic Specifications

**Table 1-3: AMG Series Specifications**

		AOM360D-200	AOM360D-300	AOM360D-400	AOM360D-500
Travel		360° continuous, both azimuth and elevation			
Clear Aperture Diameter <sup>(1)</sup>		193.5 mm	292.1 mm	393.7 mm	489.0 mm
Mechanical Drive System		Direct-Drive Brushless Servomotor			
Accuracy <sup>(2)</sup>		±10 μrad (±2 arc sec)	±10 μrad (±2 arc sec)	±5 μrad (±1 arc sec)	±5 μrad (±1 arc sec)
Repeatability		±2.5 μrad (±0.5 arc sec)	±2.5 μrad (±0.5 arc sec)	±2.5 μrad (±0.5 arc sec)	±2.5 μrad (±0.5 arc sec)
Resolution		0.27 μrad (±0.055 arc sec)			
Feedback		Inductosyn (7 in diameter; 720 poles)		Inductosyn (12 in diameter; 720 poles)	
Maximum Rotary Speed <sup>(3)</sup>		100 rpm	100 rpm	50 rpm	50 rpm
Maximum Load Parameters	Diameter	203.2 mm	304.8 mm	406.6 mm	508.0 mm
	Thickness	40.6 mm	53.3 mm	63.5 mm	88.9 mm
	Weight	20.0 kg	20.0 kg	50.0 kg	50.0 kg
Axis Wobble	Azimuth	14.6 μrad (3 arc sec)			
	Elevation	24.3 μrad (5 arc sec)			
Orthogonality		48.5 μrad (10 arc sec); 12 μrad (2 arc sec) optional			
Mass		84 kg	91 kg	208 kg	234 kg
AZ Inertia		1.62 kg-m <sup>2</sup>	2.5 kg-m <sup>2</sup>	9 kg-m <sup>2</sup>	12.53 kg-m <sup>2</sup>
EL Inertia		0.019 kg-m <sup>2</sup>	0.105 kg-m <sup>2</sup>	0.27 kg-m <sup>2</sup>	0.974 kg-m <sup>2</sup>
Material		Steel AZ housing and yoke; Aluminum EL housing and mirror cell			
Standard Finish		Paint: Textured Epoxy (Polane-T), Pebble Grey Color			
(1) Special cell adapters and slip ring assemblies available by special order.					
(2) Requires Aerotech controls and axis calibration.					
(3) Maximum speed based on stage capability. Maximum application velocity may be limited by system data rate and system resolution.					

## 1.4. Vacuum Operation

There are two vacuum preparation options:

- Low Vacuum (for use in atmospheric pressures to  $10^{-3}$  Torr)
- High Vacuum (preparation for environments from  $10^{-3}$  to  $10^{-6}$  Torr).

Special preparations include:

- Parts are lubricated with vacuum-compatible lubricants.
- Materials, fasteners, and coatings are selected to be compatible with the specified level of vacuum.
- High-vacuum systems are designed to eliminate trapped volumes.
- Prior to assembly, gimbal parts are thoroughly cleaned in a clean environment.
- The gimbal is packaged in a special polyethylene bag.

### Vacuum Guidelines

To ensure that the gimbal will continue to perform well in the vacuum environment, use the guidelines that follow (in addition to standard handling, installation, and lubrication guidelines outlined in this manual).

1. Do not remove the gimbal from its sealed bag until it is ready to use.
2. Always handle the gimbal in a clean environment and use powder-free polyethylene gloves to prevent any contaminants from adhering to the surface of the gimbal.
3. During installation, use cleaned, vented, stainless steel fasteners to secure the gimbal.
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. We recommend that you use a small quantity of **Braycote® 602EF** grease or a compatible substitute of equal quality lubricant in vacuum applications.
6. To reduce outgassing during the initial pump-down to vacuum pressure, Aerotech recommends that you bake out vacuum systems when you first install them into the vacuum chamber. Bake the vacuum components at 60 °C for 24 to 48 hours to desorb water vapor from surfaces and degas polymers (such as cable insulation).

## **1.5. Export Restrictions**

This product is export controlled by United States Commerce Department export regulations.

If you are from a non-US country and wish to make a purchase, contact Aerotech to determine if an export license is required. People in countries embargoed by the United States cannot purchase and import one of these products.

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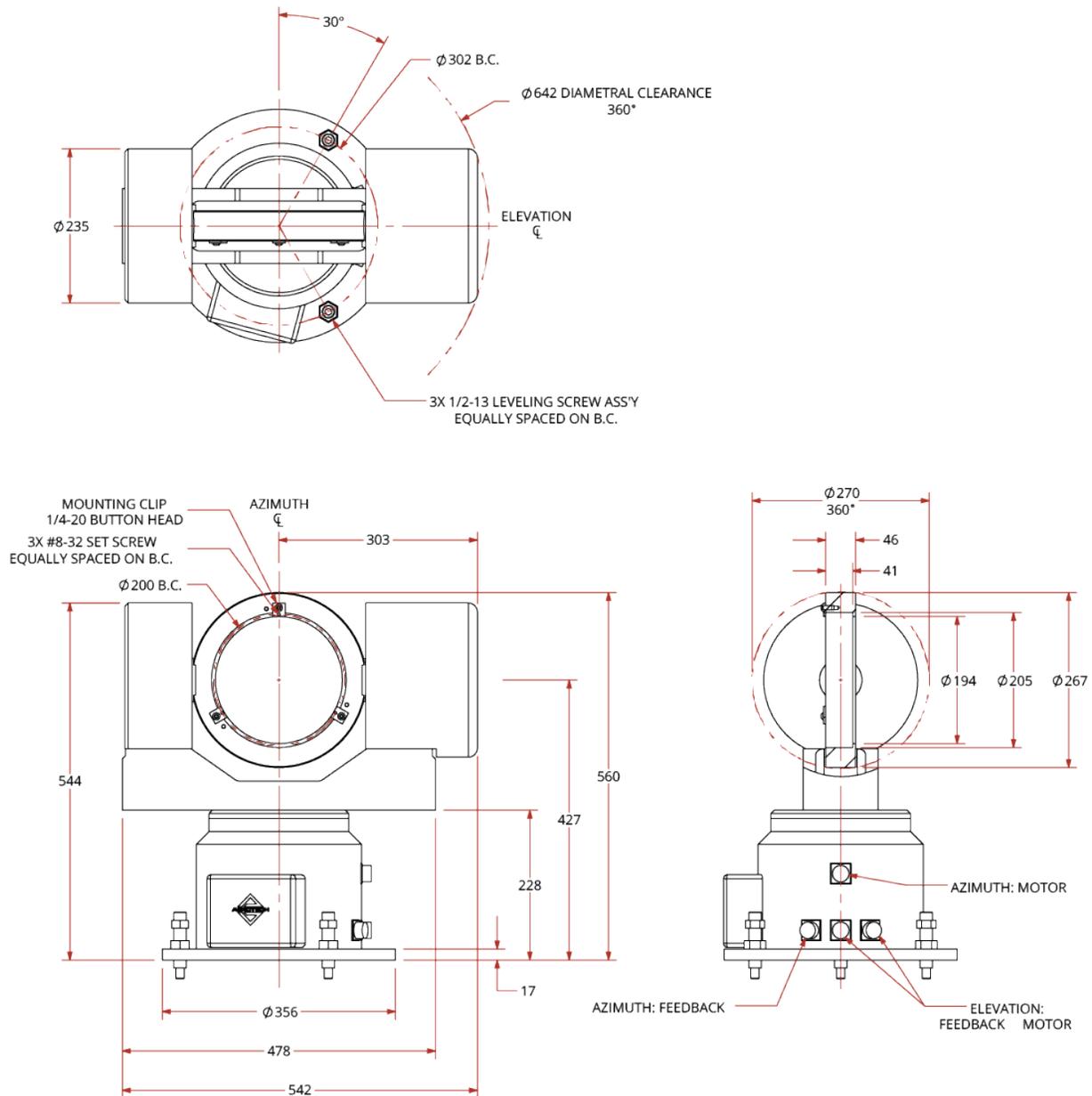
## Chapter 2: Installation



The gimbal installation must be in accordance with the 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. Dimensions

Figure 2-1: AOM360D-200 Dimensions



NOTE - THIS PRODUCT IS EXPORT CONTROLLED: ECCN 2B120

DIMENSIONS: MILLIMETERS

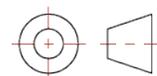
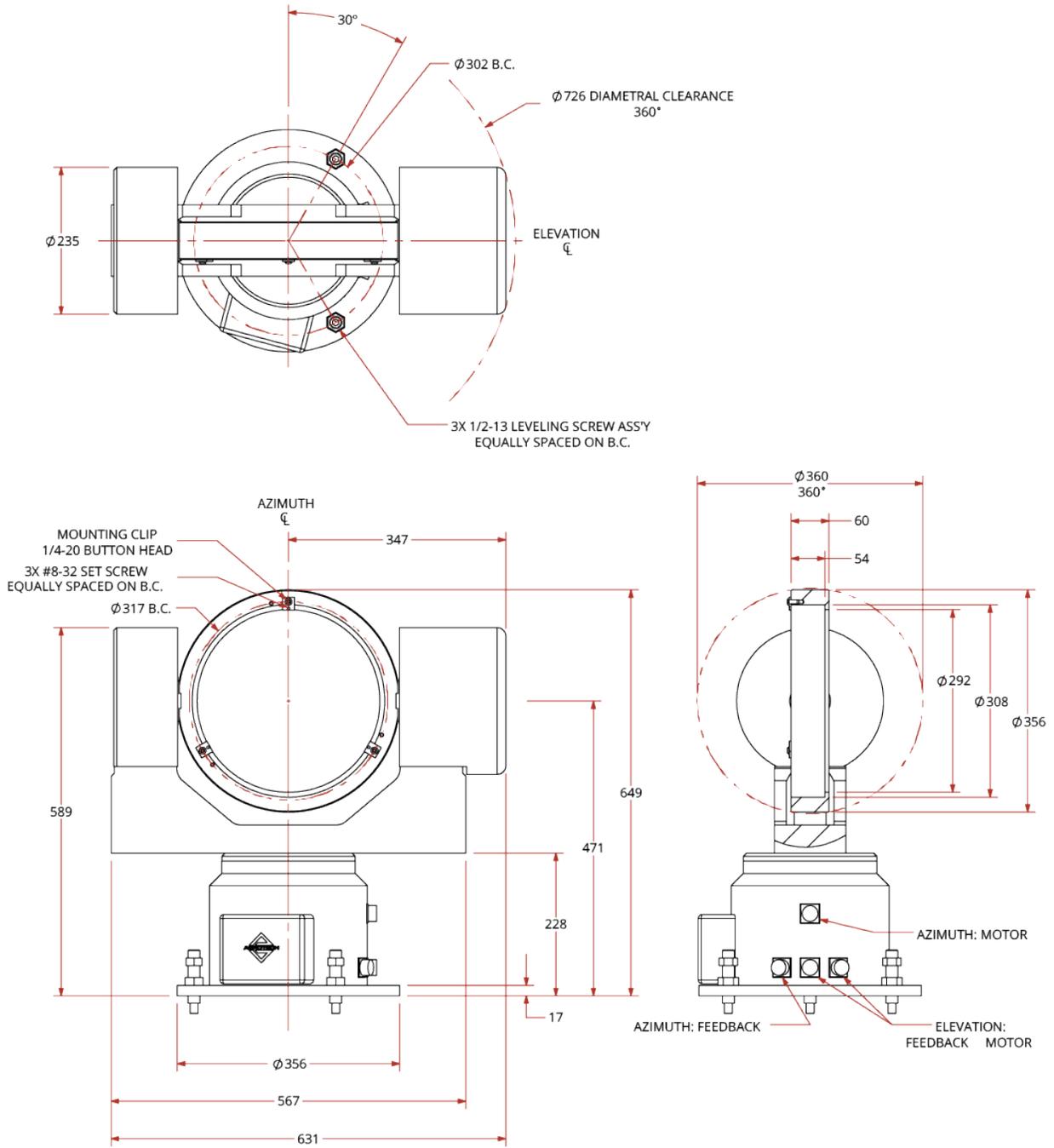


Figure 2-2: AOM360D-300 Dimensions



NOTE - THIS PRODUCT IS EXPORT CONTROLLED: ECCN 2B120

DIMENSIONS: MILLIMETERS

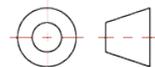
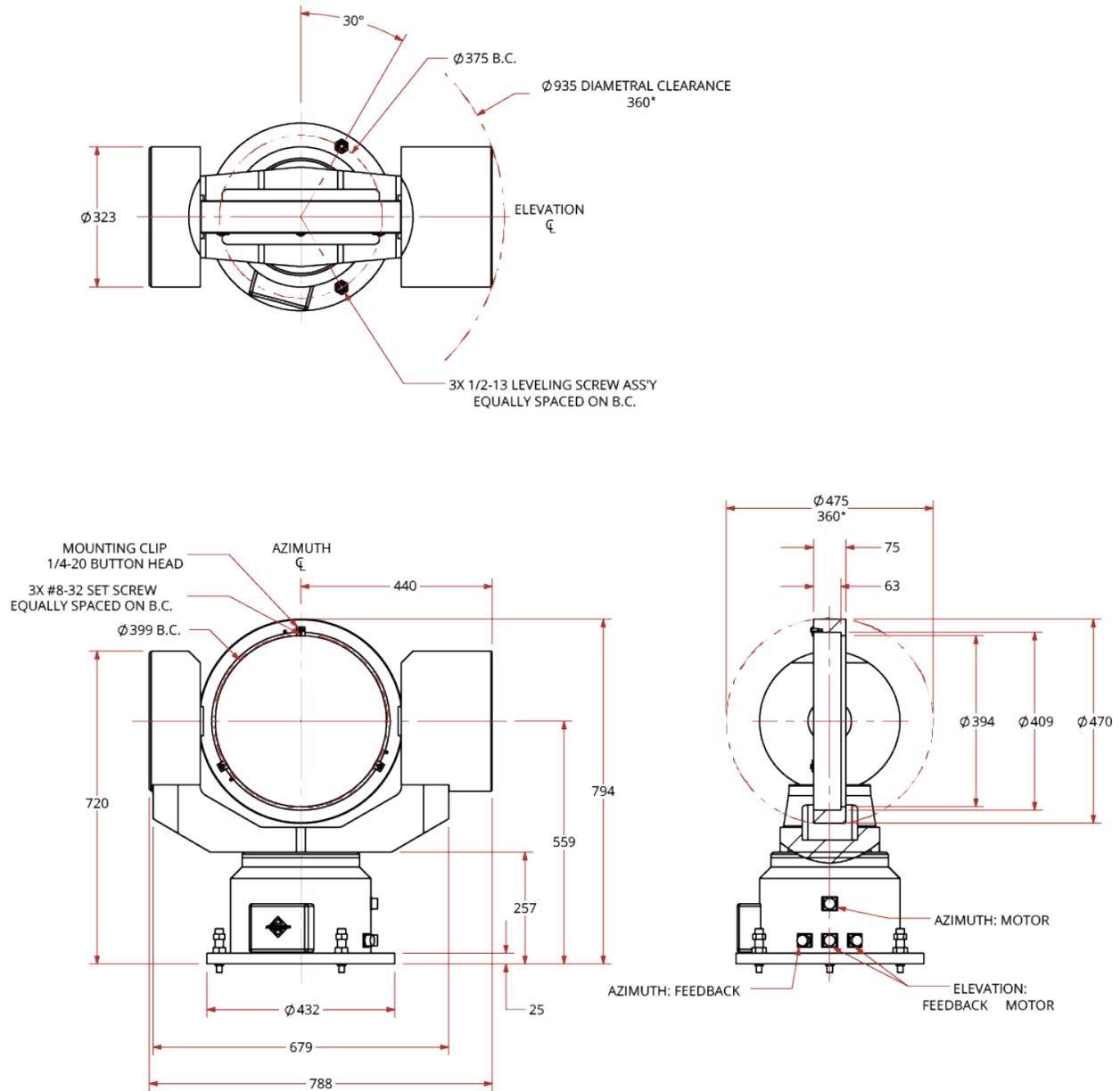


Figure 2-3: AOM360D-400 Dimensions



NOTE - THIS PRODUCT IS EXPORT CONTROLLED: ECCN 2B120

DIMENSIONS: MILLIMETERS

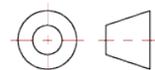
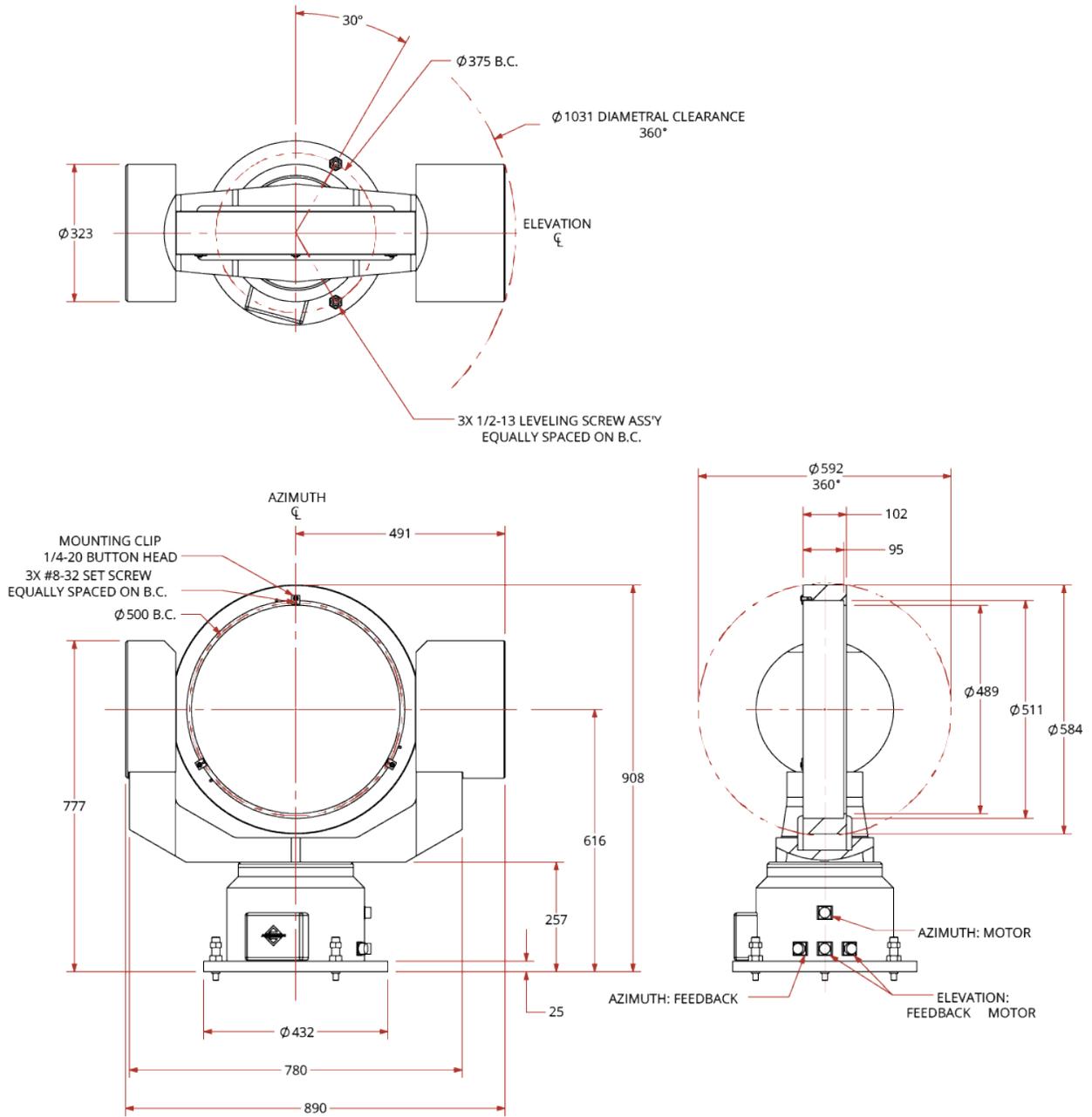
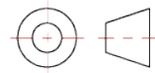


Figure 2-4: AOM360D-500 Dimensions



NOTE - THIS PRODUCT IS EXPORT CONTROLLED: ECCN 2B120

DIMENSIONS: MILLIMETERS



## 2.2. Securing the Base to the Mounting Surface



### DANGER: Mechanical Hazard!

Personnel must be made aware of the mechanical hazards during set up or when you do service to the gimbal.

- Do not manually move the gimbal if it is connected to a power source.
- The gimbal must be mounted securely. Improper mounting can result in injury and damage to the equipment.
- When you move the cell manually to do maintenance, this could expose the operator to pinch points. Refer to [Pinch Points](#) on [Page 12](#).

The mounting surface must be flat and have adequate stiffness to achieve the maximum performance from the gimbal. When it is mounted to a non-flat surface, the gimbal can be distorted while 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.



**IMPORTANT:** The gimbal is precision machined and verified for flatness at the factory.

- Do not machine the gimbal housing. If you must machine a surface to achieve a required flatness, machine the mounting surface.
- Keep the use of shims to a minimum when you mount the gimbal to the mounting surface. The use of shims could reduce the rigidity of the system.

**Table 2-1: Stage Mounting Surface Flatness Requirement**

Stage	Flatness Requirement
All Frame Sizes	2.5 $\mu$ m

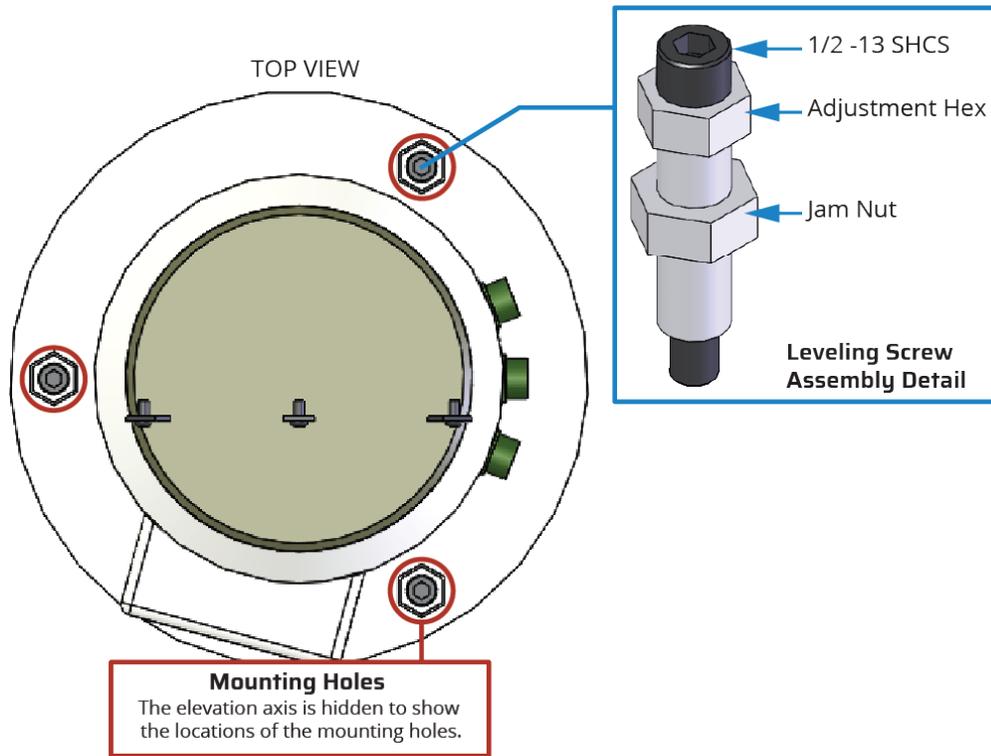
AOM360D series stages have a fixed mounting pattern (refer to [Figure 2-5](#)). Refer to [Section 2.1](#) for specific model mounting locations and dimensions.

Tightening torque values for the mounting hardware are dependent on the properties of the surface to which the stage is being mounted. Values provided are typical values and may not be accurate for your mounting surface.

Use the Leveling Screw Assembly to adjust the level:

1. Make sure that the SHCS (1/2 - 13) is loose.
2. Loosen the jam nut with a 1 1/4" wrench.
3. Adjust the height with a 1" wrench on the adjustment hex. The rate of displacement is approximately 0.032" per CW turn.
4. Tighten the jam nut.
5. Tighten the SHCS to 58 Ft-Lbs.

Figure 2-5: View of AOM360D Showing Mounting Holes



## 2.3. 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. Gently place the stage on the mounting surface.

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: Electrical Installation](#) and the documentation delivered with the stage.



**IMPORTANT:** If your AOM360D was purchased with Aerotech controls, it could have been tuned with a representative payload based on the information provided at the time of order. If you start the AOM360D 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.

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## Chapter 3: Electrical Installation

### **DANGER: Electrical Shock Hazard!**



- Stage motor phase voltage levels could be hazardous live.
- Personnel are protected from hazardous voltages unless electrical interconnections, protective bonding (safety ground), or motor/stage enclosures are compromised.
- Do not connect or disconnect stage/motor interconnections while connected to a live electrical power source.
- Before you set up or do maintenance, disconnect electrical power.
- It is the responsibility of the End User/System Integrator to make sure that stages are properly connected and grounded per Engineering Standards and applicable safety requirements.
- It is the responsibility of the End User/System Integrator to configure the system drive or controller within the Aerotech motor/stage electrical and mechanical specifications.

### **WARNING: General Hazard Warning!**



Applications that require access to the AOM360D must be restricted to qualified and trained personnel. The system integrator or qualified installer is responsible for determining and meeting all safety and compliance requirements when they integrate the AOM360D into a completed system.

Electrical installation requirements will depend on the ordered product options. Installation instructions in this section are for Aerotech products equipped with standard Aerotech motors intended for use with an Aerotech motion control system. Contact Aerotech for further information on products that are otherwise configured.

Aerotech motion control systems are adjusted at the factory for optimum performance. When the AOM360D is part of a complete Aerotech motion control system, setup should only require that you connect the gimbal to the appropriate drive chassis with the cables provided. Labels on the system components should indicate the appropriate connections.

If system level integration was purchased, an electrical drawing that shows the 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 sections that follow for standard motor wiring and connector pinouts.



**IMPORTANT:** 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.



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



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

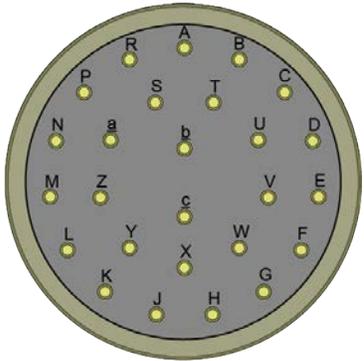
The protective ground connection of the AOM360D provides motor frame ground protection only. Additional grounding and safety precautions are required for applications requiring access to the stage while it is energized. The System Integrator or qualified installer is responsible for determining and meeting all safety and compliance requirements necessary for the integration of this stage into the final application.



**DANGER: Electrical Shock Hazard!**

- The protective ground connection must be properly installed to minimize the possibility of electric shock.
- The stage controller must provide over-current and over-speed protection. Failure to do so could cause electric shock or damage to the equipment.

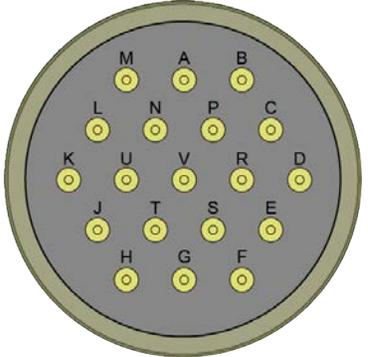
**Table 3-1: 26-Pin Motor Connector Pinouts [AZ and EL]**

Pin	Description	Connector
A	Motor Halls +5 V supply input	
B	Limits +5 V supply input	
C	Reserved	
D	Motor Phase B	
E	Motor Phase A	
F	Stage Frame Ground (PE)	
G	Reserved	
H	Reserved	
J	Brake + <sup>(1)</sup>	
K	Brake - <sup>(1)</sup>	
L	Hall Effect Sensor (Phase B)	
M	+ / CW LMT (End-of travel limit signal that indicates maximum permitted stage travel in the "machine positive" or "machine clockwise" direction.) <sup>(2)</sup> With limits option only.	
N	Hall Effect Sensor (Phase A)	
P	Hall Effect Sensor (Phase C)	
R	Motor Halls 5 V common ground	
S	- / CCW LMT (End-of travel limit signal that indicates maximum permitted stage travel in the "machine negative" or "machine counter-clockwise" direction.) <sup>(2)</sup>	
T	Limits +5 V common ground	
U	Motor Phase C	
V	Reserved	
W	Reserved	
X	Stage Frame Ground (PE)	
Y	Reserved	
Z	Over-Temperature Thermistor Sensor	
a	Home limit (connected internally to Pin-S) <sup>(3)</sup>	
b	Signal Shield	
c	Motor Shield	
<sup>(1)</sup> with Brake option. <sup>(2)</sup> with Limit option. <sup>(3)</sup> with Home Limit option.		

**Table 3-2: Mating Connector Part Numbers for the 26-Pin Motor Connector**

Mating Connector	Aerotech P/N	Third Party P/N
Connector	ECK00622	ITT Cannon, KPT06J16-26S

**Table 3-3: 19-Pin Feedback Connector Pinouts [AZ and EL]**

Pin	Description	Connector
A	+12 V supply input	
B	Signal-1/Signal-3 Shield	
C	Signal 3	
D	Signal 1	
E	Signal 2	
F	Cosine Shield	
G	COS- (Encoder Cosine-)	
H	COS+ (Encoder Cosine+)	
J	SIN+ (Encoder Sine+)	
K	REF+	
L	Supply common ground	
M	-12 V supply input	
N	Reserved	
P	Signal-2/Signal-4 Shield	
R	Signal 4	
S	Sine Shield	
T	SIN- (Encoder Sine-)	
U	REF-	
V	Ref Shield	

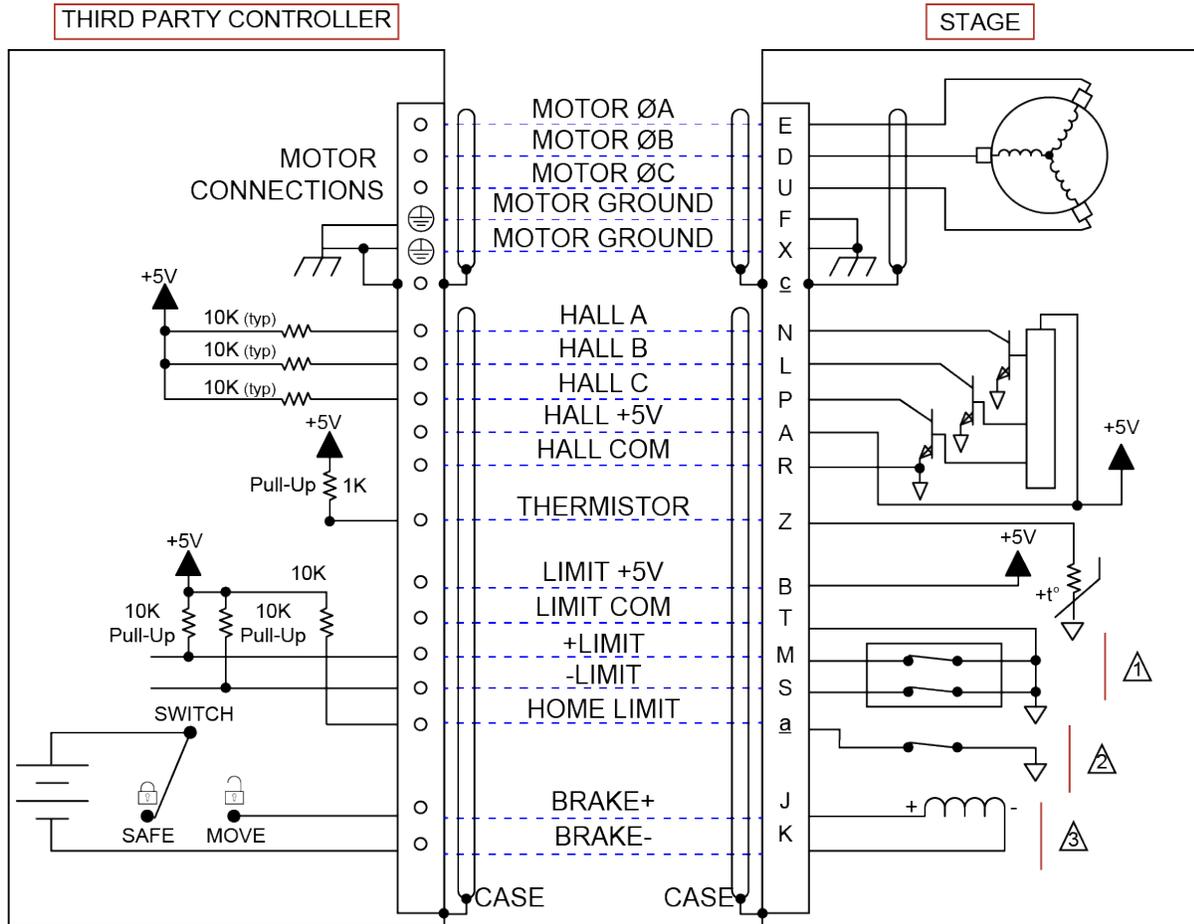
**Table 3-4: Mating Connector Part Numbers for the 19-Pin Feedback Connector**

Mating Connector	Aerotech P/N	Third Party P/N
Connector	ECK00619	ITT Cannon, KPT06J14-19S

### 3.2. Motor and Feedback Wiring

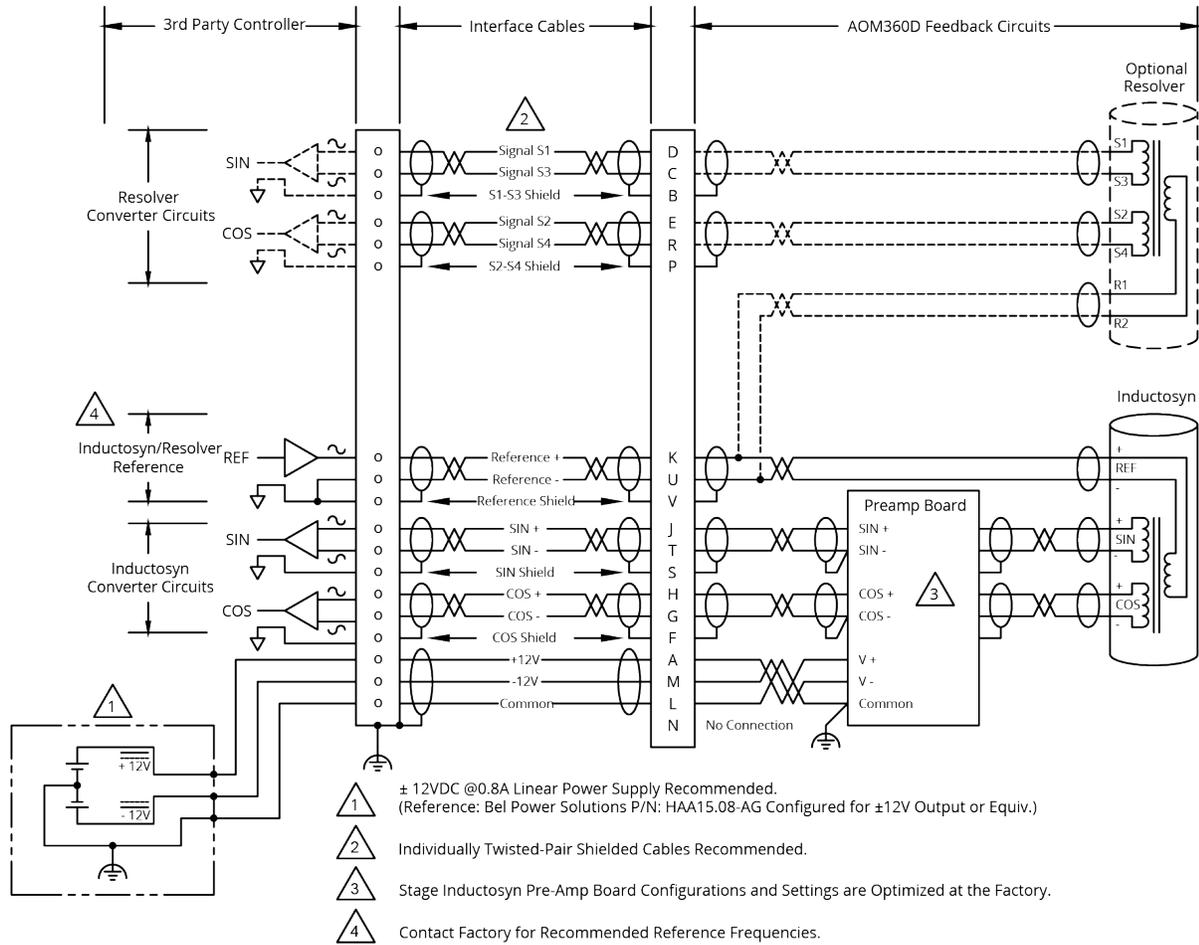
Shielded cables are required for the motor and feedback connections.

Figure 3-1: Motor and Feedback Wiring (AZ/EL)



- ⚠ Limits are optional
- ⚠ Home limit switch is optional
- ⚠ Brake is optional

**Figure 3-2: Feedback Interconnection Drawing**



### 3.3. Hall, Thermistor, Inductosyn, and Limits Specifications

**Table 3-5: Hall-Effect Sensor Specifications**

	Specification
Supply Voltage	5 V $\pm$ 5%
Supply Current	50 mA
Output Type	Open Collector
Output Voltage	24 V max (pull up)
Output Current	5 mA (sinking)

**Table 3-6: Thermistor Specifications**

	Specification
Polarity	Logic "0" (no fault)
	Logic "1" (over-temperature fault)
Cold Resistance	$\sim$ 100 $\Omega$
Hot Resistance	$\sim$ 10 K
<b>Note:</b> 1K pull-up to +5V recommended.	

**Table 3-7: Inductosyn Specifications**

	Specification
Power Supply	Linear, Dual $\pm$ 12 VDC $\pm$ 1%, @0.8 A (typical)
Signals	Differential Sine Wave, $\pm$ SIN, $\pm$ COSIN (frequency, amplitude, and phasing optimized at the factory)

**Table 3-8: Limit Switch Specifications**

	Specification
Supply Voltage	5 V $\pm$ 5%
Supply Current	25 mA
Output Type	Open Collector
Output Voltage	5 V
Output Current	10 mA (sinking)
Output Polarity (Factory Configured)	<b>Normally Closed (NC)</b> <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>Note:</b> If the AOM360D 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 3-9: S-180-44 [EL] and S-180-69 [AZ] Rotary Motor Specifications (-200 and -300 options)**

		S-180-44 AOM360D [EL]	S-180-69 AOM360D [AZ]
<b>Performance Specifications <sup>(1,5)</sup></b>			
Winding Designation		-A	-A
Stall Torque, Cont. <sup>(2)</sup>	N·m	5.99	11.12
Peak Torque <sup>(3)</sup>	N·m	23.98	44.47
<b>Electrical Specifications <sup>(5)</sup></b>			
Winding Designation		-A	-A
BEMF Const., line-line, Max	$V_{pk}/krpm$	268.7	263.9
Continuous Current, Stall <sup>(2)</sup>	$A_{pk}$	2.7	5.1
	$A_{rms}$	1.9	3.6
Peak Current, Stall <sup>(2)</sup>	$A_{pk}$	10.8	20.4
	$A_{rms}$	7.6	14.4
Torque Constant <sup>(4, 9)</sup>	$N·m/A_{pk}$	2.22	2.18
	$N·m/A_{rms}$	3.14	3.08
Motor Constant <sup>(2, 4)</sup>	$N·m/\sqrt{W}$	0.628	1.053
Resistance, 25°C, line-line	$\Omega$	12.8	4.4
Inductance, line-line	mH	3.40	1.70
Maximum Bus Voltage	$V_{DC}$	340	340
Thermal Resistance	$^{\circ}C/W$	0.82	0.67
Number of Poles	--	18	18
<p>1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature.</p> <p>2. Values shown @ 75°C rise above a 25 °C ambient temperature, with housed motor mounted to a 330 mm x 330 mm x 13 mm aluminum heat sink</p> <p>3. Peak force assumes correct rms current; consult Aerotech.</p> <p>4. Torque constant and motor constant specified at stall.</p> <p>5. All performance and electrical specifications <math>\pm 10\%</math>.</p> <p>6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered.</p> <p>7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C).</p> <p>8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures.</p> <p>9. All Aerotech amplifiers are rated <math>A_{pk}</math>; use torque constant in <math>N·m/A_{pk}</math> when sizing.</p>			

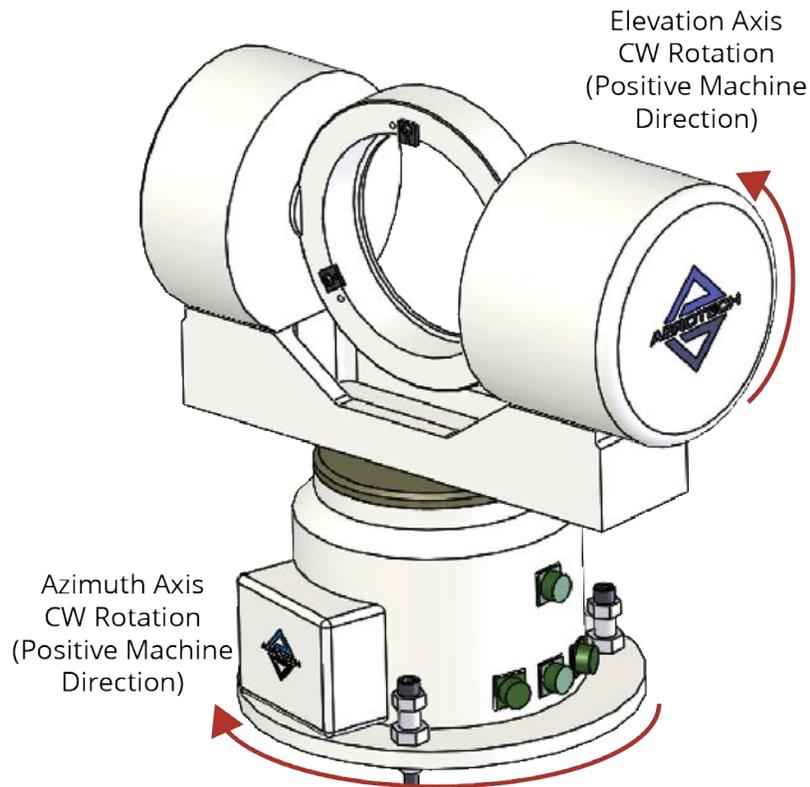
**Table 3-10: S-240-63 [EL] and S-240-83 [AZ] Rotary Motor Specifications (-400 and -500 options)**

		S-240-63 AOM360D [EL]	S-240-83 AOM360D [AZ]
<b>Performance Specifications <sup>(1,5)</sup></b>			
Winding Designation		-A	-A
Stall Torque, Cont. <sup>(2)</sup>	N·m	19.71	29.09
Peak Torque <sup>(3)</sup>	N·m	78.82	116.37
<b>Electrical Specifications <sup>(5)</sup></b>			
Winding Designation		-A	-A
BEMF Const., line-line, Max	$V_{pk}/krpm$	404.3	607.2
Continuous Current, Stall <sup>(2)</sup>	$A_{pk}$	5.9	5.8
	$A_{rms}$	4.2	4.1
Peak Current, Stall <sup>(2)</sup>	$A_{pk}$	23.6	23.2
	$A_{rms}$	16.7	16.4
Torque Constant <sup>(4, 9)</sup>	$N·m/A_{pk}$	3.34	5.02
	$N·m/A_{rms}$	4.72	7.09
Motor Constant <sup>(2, 4)</sup>	$N·m/\sqrt{W}$	1.405	1.893
Resistance, 25°C, line-line	$\Omega$	5.8	7.2
Inductance, line-line	mH	2.90	4.30
Maximum Bus Voltage	$V_{DC}$	340	340
Thermal Resistance	$^{\circ}C/W$	0.38	0.32
Number of Poles	--	26	26
<p>1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature.</p> <p>2. Values shown @ 75°C rise above a 25 °C ambient temperature, with housed motor mounted to a 330 mm x 330 mm x 13 mm aluminum heat sink</p> <p>3. Torque constant and motor constant specified at stall.</p> <p>5. All performance and electrical specifications <math>\pm 10\%</math>.</p> <p>6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered.</p> <p>7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C).</p> <p>8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures.</p> <p>9. All Aerotech amplifiers are rated <math>A_{pk}</math>; use torque constant in <math>N·m/A_{pk}</math> when sizing.</p>			

### 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 3.2](#)). 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 AOM360D stages.

**Figure 3-3: Machine Direction**

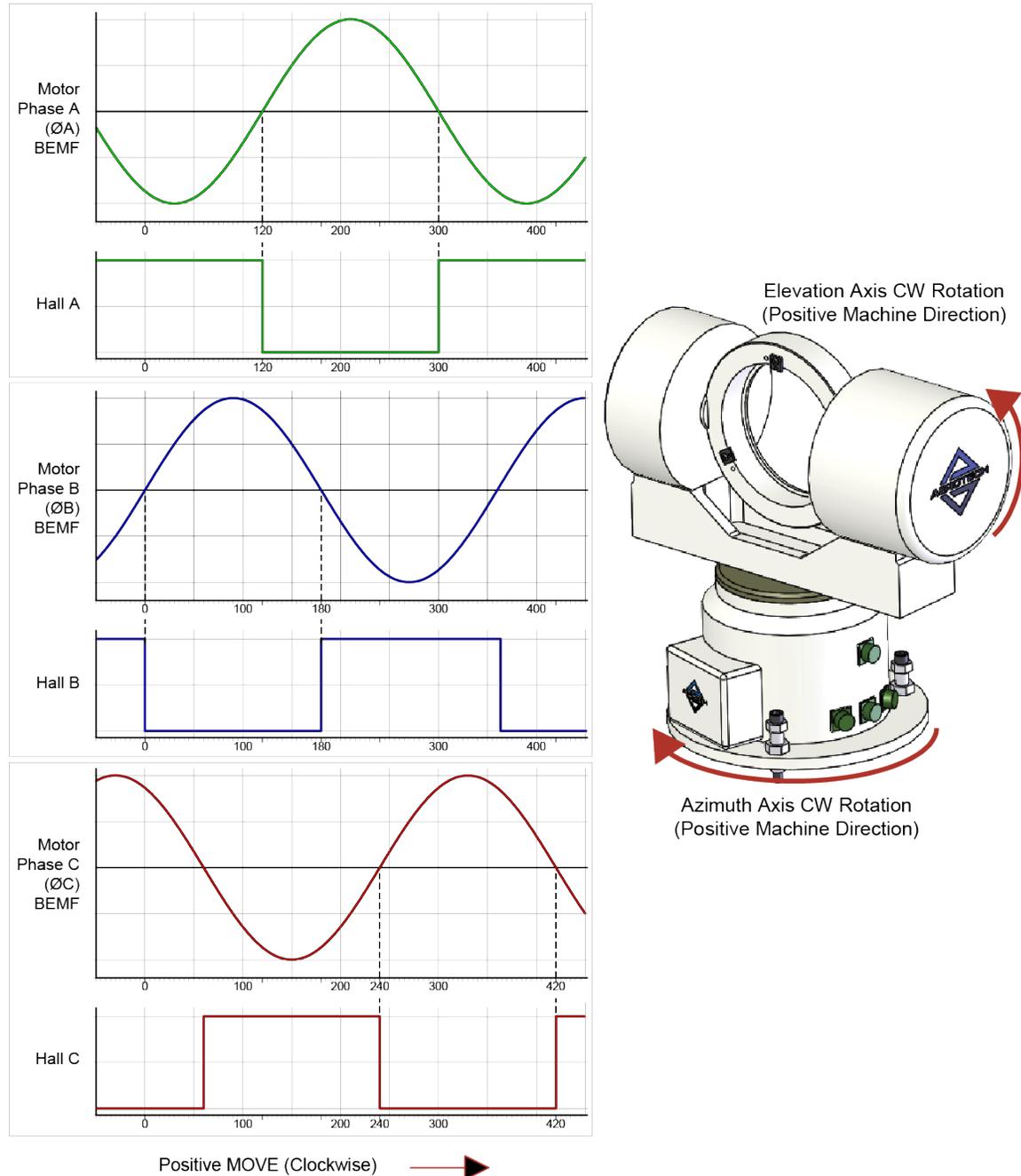


### 3.5. Motor and Feedback Phasing

Motor phase voltage is measured relative to the virtual wye common point (Figure 3-4).

CW rotation must produce a positive change in machine counts for proper servo-loop phasing. This is the same as a positive change in position, assuming the motion controller has a positive scale factor, and is not configured to reverse the machine direction.

**Figure 3-4: Hall Phasing Diagram**



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## Chapter 4: Maintenance



**IMPORTANT:** Read the [Safety Procedures and Warnings](#) (on [Page 8](#)) before you do maintenance to the gimbal.



### 4.1. Service and Inspection Schedule

Inspect the AOM360D at least once per month. The need for a longer or shorter inspection interval will depend on the application and conditions, such as the duty cycle, speed, and environment.

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 AOM360D and any components and cables as needed.
- Repair any damage before operating the AOM360D.
- Inspect and perform an operational check on all safeguards and protective devices.

## 4.2. Cleaning and Lubrication



**DANGER: Electrical Shock Hazard!** Before you do maintenance to the equipment, disconnect the electrical power.



**IMPORTANT:** Wear appropriate personal protective equipment (PPE) when you use cleaning solvents or lubricants.

### Cleaning

When you clean components of the AOM360D series stage:

1. Use a clean, dry, soft, lint-free cloth.
2. Before you use a cleaning solvent on any part of the gimbal, blow away small particles and dust with clean, dry, compressed air.
3. In applications that have multiple stages bolted together to form multi-axis systems, the orthogonality can be lost if the stage tables of the support stages are loosened. Precision aligned stages should not be loosened or disassembled.
4. We recommend that you do not disassemble the stage beyond the instructions given in this manual. Proper assembly and calibration can only be done at the factory. Contact Aerotech for more information.

Use isopropyl alcohol on a lint-free cloth to clean any external metal surface of the AOM360D.



**WARNING: General Hazard Warning!** Make sure that all solvent has completely evaporated before you move the stage.

### Lubrication

There are no elements on the stage that requires lubrication.

## 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 [Global Technical Support Portal](#) for the location of your nearest Aerotech Service center.

### Returned Product Warranty Determination

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

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

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

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

### Rush Service

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

### On-site Warranty Repair

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

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

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

### On-site Non-Warranty Repair

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

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

### Service Locations

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

#### **USA, CANADA, MEXICO**

Aerotech, Inc.  
Global Headquarters

#### **CHINA**

Aerotech China  
Full-Service Subsidiary

#### **GERMANY**

Aerotech Germany  
Full-Service Subsidiary

#### **TAIWAN**

Aerotech Taiwan  
Full-Service Subsidiary

#### **UNITED KINGDOM**

Aerotech United Kingdom  
Full-Service Subsidiary

## Appendix B: Revision History

Revision	General Information
2.00	General product and manual update
1.00	New manual

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solvents	42
Specifications	17
Hall-Effect Sensors	35
Inductosyn Specifications	35
Limit Switch	35
Thermistor Specifications	35
stabilizing stage	14
stage	
stabilizing	14
Storage	13

**T**

Table of Contents	3
Temperature Effects	16
Thermistor Specifications	35

**V**

vacuum guidelines	18
vacuum lubricant (Braycote 602EF)	18
Vacuum Operation	18
Vibration	16

**W**

Warnings	8
Warranty and Field Service	43