



# ARMS Series Stage Hardware Manual

Revision: 1.03.00



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## Safety Procedures and Warnings

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

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



**DANGER:** This product contains potentially lethal voltages. To reduce the possibility of electrical shock, bodily injury, or death the following precautions must be followed.

1. Access to the ARMS 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 ARMS stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
5. Use care when moving the ARMS stage. Lifting or transporting the ARMS stage improperly can result in injury or damage to the ARMS.
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.

**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.

## EU Declaration of Incorporation

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

*herewith declares that the product:*

Aerotech, Inc. ARMS Rotary Stage

*is intended to be incorporated into machinery to constitute machinery covered by the Directive 2006/42/EC as amended; and that the following harmonized European standards have been applied:*

EN ISO 12100:2010

Safety of machinery - Basic concepts, general principles for design

EN 60204-1:2010

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

*and further more declares that*

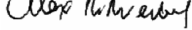
it is not allowed to put the equipment into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of the Directive 2006/42/EC and with national implementing legislation, i.e., as a whole,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

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

2011/65/EU

RoHS 2 Directive

**Authorized Representative:** Simon Smith, European Director  
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**Name**  / Alex Weibel  
**Position** Engineer Verifying Compliance  
**Location** Pittsburgh, PA  
**Date** 10/23/2018



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## Chapter 1: Overview

**NOTE:** Aerotech continually improves its product offerings; listed options may be superseded at any time. All drawings and illustrations are for reference only and were complete and accurate as of this manual's release. Refer to [www.aerotech.com](http://www.aerotech.com) for the most up-to-date information.

**Table 1-1: Model Numbers and Options**

<b>ARMS Series Rotary Motion Simulator</b>	
ARMS150	Rotary motion simulator
ARMS200	Rotary motion simulator
ARMS260	Rotary motion simulator
<b>Tabletop (Required)</b>	
-TT1	Metric dimension mounting, engraved scale
-TT2	English dimension mounting, engraved scale
-TT3	Aperture, metric dimension mounting, engraved scale
-TT4	Aperture, English dimension mounting, engraved scale
-TT5	Large diameter tabletop with metric dimension mounting
-TT6	Large diameter tabletop with English dimension mounting
-TT7	Large diameter tabletop, aperture, metric dimension mounting
-TT8	Large diameter tabletop, aperture, English dimension mounting
<b>Motor (Required)</b>	
-M1	Direct-drive brushless, slotless motor, standard torque
-M2	Direct-drive brushless, slotless motor, high torque
<b>Integrated Slip-Ring (Required)</b>	
-SR01 <sup>(1)</sup>	12 lines, 2A max current (ARMS150 and ARMS200 only)
-SR02 <sup>(1)</sup>	24 lines, 2A max current
-SR03 <sup>(1,3)</sup>	36 lines, 2A max current (ARMS200 only)
-SR04 <sup>(1)</sup>	48 lines, 2A max current (ARMS260 only)
-SR05 <sup>(1,3)</sup>	56 lines, 2A max current (ARMS200 only)
-SR06 <sup>(1)</sup>	72 lines, 2A max current (ARMS260 only)
-SR07 <sup>(1)</sup>	96 lines, 2A max current (ARMS260 only)
-SR08 <sup>(2,3)</sup>	Low-noise, 12 lines, 1A max current (ARMS150 and ARMS200 only)
-SR09 <sup>(2,3)</sup>	Low-noise, 24 lines, 1A max current with ARMS150 and ARMS200; 2A max current with ARMS260
-SR10 <sup>(2,3)</sup>	Low-noise, 30 lines, 1A max current (ARMS200 only)
-SR11 <sup>(2,3)</sup>	Low-noise, 48 lines, 2A max current (ARMS260 only)
-SR12 <sup>(2,3)</sup>	Low-noise, 70 lines, 2A max current (ARMS260 only)
-SR13 <sup>(2,3)</sup>	Low-noise, 90 lines, 2A max current (ARMS260 only)
(1) Noise Specification: <60 mOhms variation	
(2) Noise Specification: <10 mOhms variation	
(3) These options are incompatible with all aperture tabletop options (-TT3, -TT4, -TT7, -TT8).	
<b>Rotary Union (Optional)</b>	
-RU1	One (1) rotary union line for air, vacuum, or non-corrosive gas, 120 psi max
-RU2	Two (2) rotary union lines for air, vacuum, or non-corrosive gas, 120 psi max
NOTE: Rotary union options are incompatible with all aperture tabletop options (-TT3, -TT4, -TT7, -TT8). Rotary unions for carrying liquids will require customized design, potentially resulting in dimensional changes to the ARMS product.	
<b>Mounting Pedestal (Optional)</b>	
-HDP	Mounting pedestal with adjustable, hard-mount capable leveling feet

## 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 ±2° C (68° F ±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.
<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 ARMS stages are not suited for dusty or wet environments. This equates to an ingress protection rating of IP30.
<b>Use</b>	Indoor use only

## 1.2. Accuracy and Temperature Effects

Extreme temperature changes could cause a decrease in performance or permanent damage to the stage. Aerotech stages are designed for and built in a 20°C (68°F) environment. Any deviation from standard operating temperature will affect stage accuracy. The severity of temperature effects on all stage specifications depends on many different environmental conditions, including how the stage is mounted. Contact the factory for more details.

### 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.

**Table 1-3: ARMS150 Series Specifications**

ARMS Series		ARMS150-M1	ARMS150-M2
Width		146 mm	
Height <sup>(1)</sup>		183 mm	246 mm
Aperture <sup>(2)</sup>		8 mm	
Total Travel		±360° Continuous	
Motor		S-130-39-A	S-130-102-A
Bus Voltage		Up to 340 VDC	
Maximum Torque (Continuous)		2.36 N·m	7.69 N·m
Fundamental Encoder Resolution		16,200 lines/rev	
Accuracy (calibrated) <sup>(3)</sup>		±2.5 arc-sec	
Repeatability		±0.5 arc-sec	
Max Load <sup>(4)</sup>	Axial	30 kg	
	Moment	175 N·m	
Tilt Error Motion		±1 arc-sec	
Maximum Rate <sup>(5)</sup>		1500°/s	
Minimum Rate <sup>(6)</sup>		0.002°/s	
Rate Resolution <sup>(6)</sup>		0.002°/s	
Rate Stability <sup>(6)</sup>	Over 360°	0.0001%	
	Over 10°	0.005%	
	Over 1°	0.05%	
Peak Acceleration <sup>(7)</sup>		>20,000°/s <sup>2</sup>	
Inertia (unloaded) <sup>(7)</sup>		6,600 kg·mm <sup>2</sup>	9,700 kg·mm <sup>2</sup>
Total Mass <sup>(7)</sup>		9 kg	15 kg
Servo Bandwidth <sup>(8)</sup>		> 70 Hz (-3 dB)	
Material		Aluminum	
Stage Finish		Black Anodize	
Tabletop Finish		Hard Coating (62 Rockwell Hardness)	

1. Height may vary with certain slip ring and rotary union options (refer to for more details).

2. Aperture not available with all slip ring and rotary union options (refer to [Table 1-1](#) for more details).

3. Certified with each stage. Requires the use of an Aerotech controller.

4. Maximum loads are mutually exclusive.

5. Maximum rate is based on stage capability. Actual rate may depend on encoder resolution, load, amplifier bus voltage, and motor (refer to the S-series rotary motor (P/N: EDU166) for more information).

6. Minimum rate, rate resolution, and rate accuracy are based on stage capability. Actual rate, resolution, and accuracy may depend on encoder resolution.

7. Peak acceleration, inertia, and total mass based on unloaded stage with standard diameter tabletop.

8. Servo bandwidth is based on unloaded stage with standard diameter tabletop. Actual bandwidth may depend on mass and inertia of stage payload.

**Table 1-4: ARMS200 Series Specifications**

ARMS Series		ARMS200-M1	ARMS200-M2
Width		196 mm	
Height <sup>(1)</sup>		224 mm	249 mm
Aperture <sup>(2)</sup>		8 mm	
Total Travel		±360° Continuous	
Motor		S-180-69-A	S-180-94-A
Bus Voltage		Up to 340 VDC	
Maximum Torque (Continuous)		11.12 N·m	15.93 N·m
Fundamental Encoder Resolution		23,600 lines/rev	
Accuracy (calibrated) <sup>(3)</sup>		±2.5 arc·sec	
Repeatability		±0.5 arc·sec	
Max Load <sup>(4)</sup>	Axial	140 kg	
	Moment	425 N·m	
Tilt Error Motion		±1 arc·sec	
Maximum Rate <sup>(5)</sup>		1500°/s	
Minimum Rate <sup>(6)</sup>		0.002°/s	
Rate Resolution <sup>(6)</sup>		0.002°/s	
Rate Stability <sup>(6)</sup>	Over 360°	0.0001%	
	Over 10°	0.005%	
	Over 1°	0.05%	
Peak Acceleration <sup>(7)</sup>		>20,000°/s <sup>2</sup>	
Inertia (unloaded) <sup>(7)</sup>		33,600 kg·mm <sup>2</sup>	39,800 kg·mm <sup>2</sup>
Total Mass <sup>(7)</sup>		22 kg	26 kg
Servo Bandwidth <sup>(8)</sup>		> 70 Hz (-3 dB)	
Material		Aluminum	
Stage Finish		Black Anodize	
Tabletop Finish		Hard Coating (62 Rockwell Hardness)	
<p>1. Height may vary with certain slip ring and rotary union options (refer to for more details).</p> <p>2. Aperture not available with all slip ring and rotary union options (refer to <a href="#">Table 1-1</a> for more details).</p> <p>3. Certified with each stage. Requires the use of an Aerotech controller.</p> <p>4. Maximum loads are mutually exclusive.</p> <p>5. Maximum rate is based on stage capability. Actual rate may depend on encoder resolution, load, amplifier bus voltage, and motor (refer to the S-series rotary motor (P/N: EDU166) for more information).</p> <p>6. Minimum rate, rate resolution, and rate accuracy are based on stage capability. Actual rate, resolution, and accuracy may depend on encoder resolution.</p> <p>7. Peak acceleration, inertia, and total mass based on unloaded stage with standard diameter tabletop.</p> <p>8. Servo bandwidth is based on unloaded stage with standard diameter tabletop. Actual bandwidth may depend on mass and inertia of stage payload.</p>			

**Table 1-5: ARMS260 Series Specifications**

ARMS Series		ARMS260-M1	ARMS260-M2
Width		260 mm	
Height <sup>(1)</sup>		229 mm	250 mm
Aperture <sup>(2)</sup>		25 mm	
Total Travel		±360° Continuous	
Motor		S-240-63-A	S-240-83-A
Bus Voltage		Up to 340 VDC	
Maximum Torque (Continuous)		19.71 N·m	29.09 N·m
Fundamental Encoder Resolution		32,400 lines/rev	
Accuracy (calibrated) <sup>(3)</sup>		±2.5 arc·sec	
Repeatability		±0.5 arc·sec	
Max Load <sup>(4)</sup>	Axial	230 kg	
	Moment	650 N·m	
Tilt Error Motion		±1 arc-sec	
Maximum Rate <sup>(5)</sup>		1500°/s	
Minimum Rate <sup>(6)</sup>		0.001°/s	
Rate Resolution <sup>(6)</sup>		0.001°/s	
Rate Stability <sup>(6)</sup>	Over 360°	0.0001%	
	Over 10°	0.005%	
	Over 1°	0.05%	
Peak Acceleration <sup>(7)</sup>		>20,000°/s <sup>2</sup>	
Inertia (unloaded) <sup>(7)</sup>		115,200 kg·mm <sup>2</sup>	139,000 kg·mm <sup>2</sup>
Total Mass <sup>(7)</sup>		39 kg	44 kg
Servo Bandwidth <sup>(8)</sup>		> 70 Hz (-3 dB)	
Material		Aluminum	
Stage Finish		Black Anodize	
Tabletop Finish		Hard Coating (62 Rockwell Hardness)	
<p>1. Height may vary with certain slip ring and rotary union options (refer to for more details).</p> <p>2. Aperture not available with all slip ring and rotary union options (refer to <a href="#">Table 1-1</a> for more details).</p> <p>3. Certified with each stage. Requires the use of an Aerotech controller.</p> <p>4. Maximum loads are mutually exclusive.</p> <p>5. Maximum rate is based on stage capability. Actual rate may depend on encoder resolution, load, amplifier bus voltage, and motor (refer to the S-series rotary motor (P/N: EDU166) for more information).</p> <p>6. Minimum rate, rate resolution, and rate accuracy are based on stage capability. Actual rate, resolution, and accuracy may depend on encoder resolution.</p> <p>7. Peak acceleration, inertia, and total mass based on unloaded stage with standard diameter tabletop.</p> <p>8. Servo bandwidth is based on unloaded stage with standard diameter tabletop. Actual bandwidth may depend on mass and inertia of stage payload.</p>			

## **1.4. Vacuum Operation**

Contact the factory for information regarding operation in a vacuum environment.

## Chapter 2: Mechanical Specifications and Installation



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

### 2.1. Unpacking and Handling the Stage



**DANGER/HEAVY:** It is the customer's responsibility to safely and carefully lift and move the ARMS.

- Lift only by the base.
- Do not use the tabletop or cables as lifting points.
- Secure all moving parts before lifting or moving the ARMS to a new location. Unsecured moving parts could shift and cause bodily injury.
- Improper handling could adversely affect the performance of the ARMS. Use care when moving the ARMS

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

Before operating the ARMS, 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 ARMS 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.

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

## 2.2. Dimensions

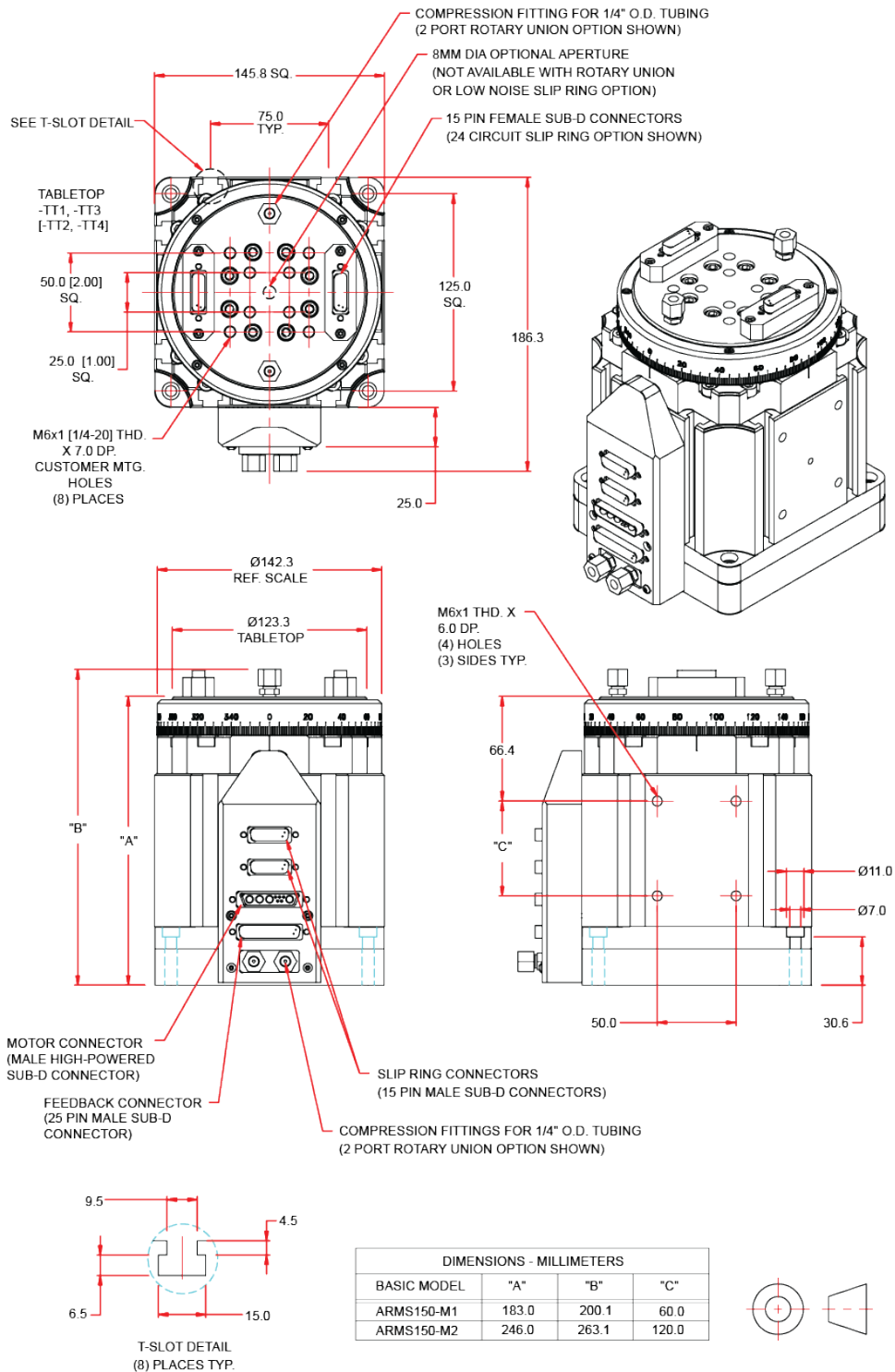


Figure 2-1: ARMS150 Dimensions (-TT1, -TT2, -TT3, -TT4)



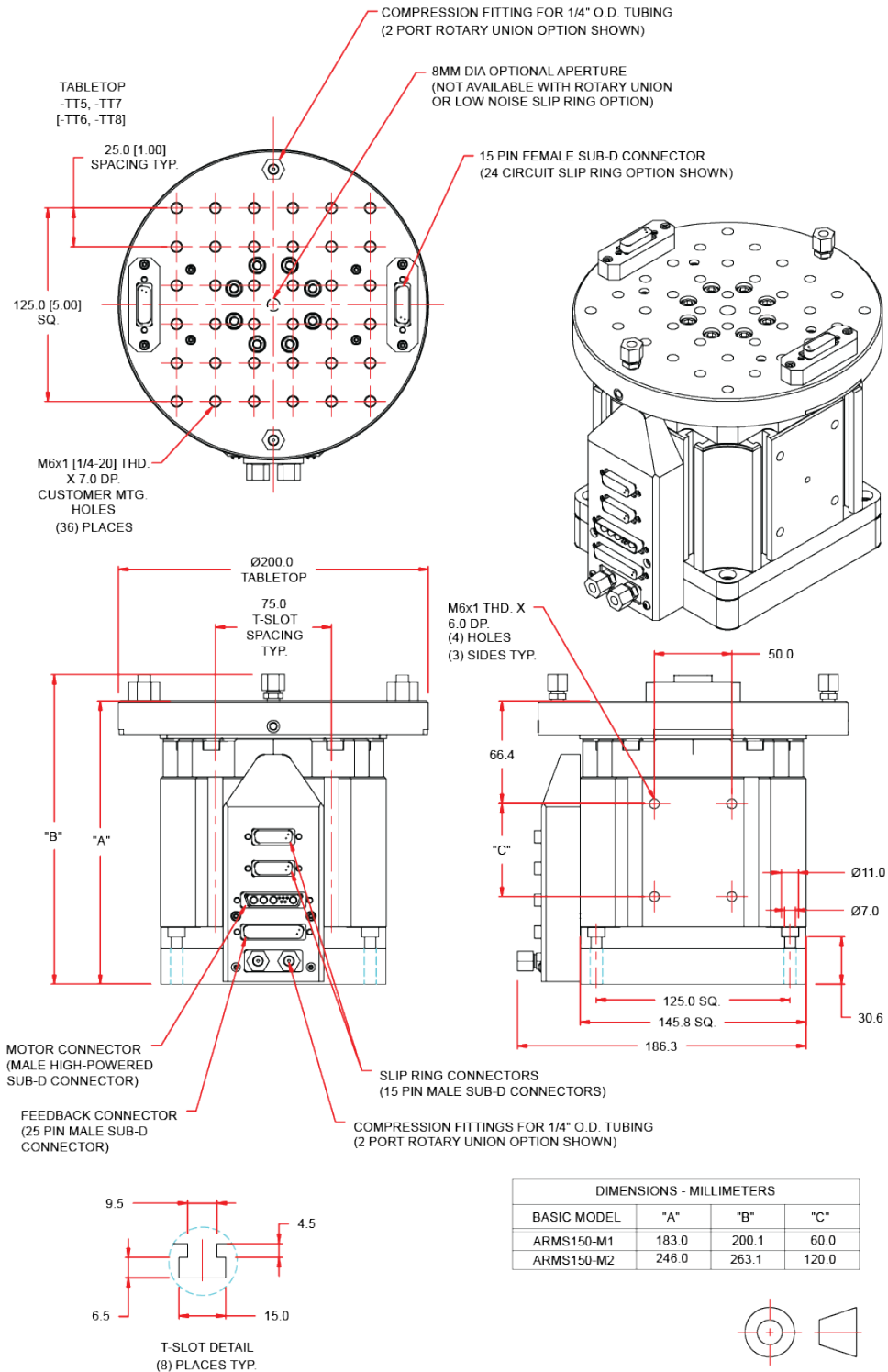
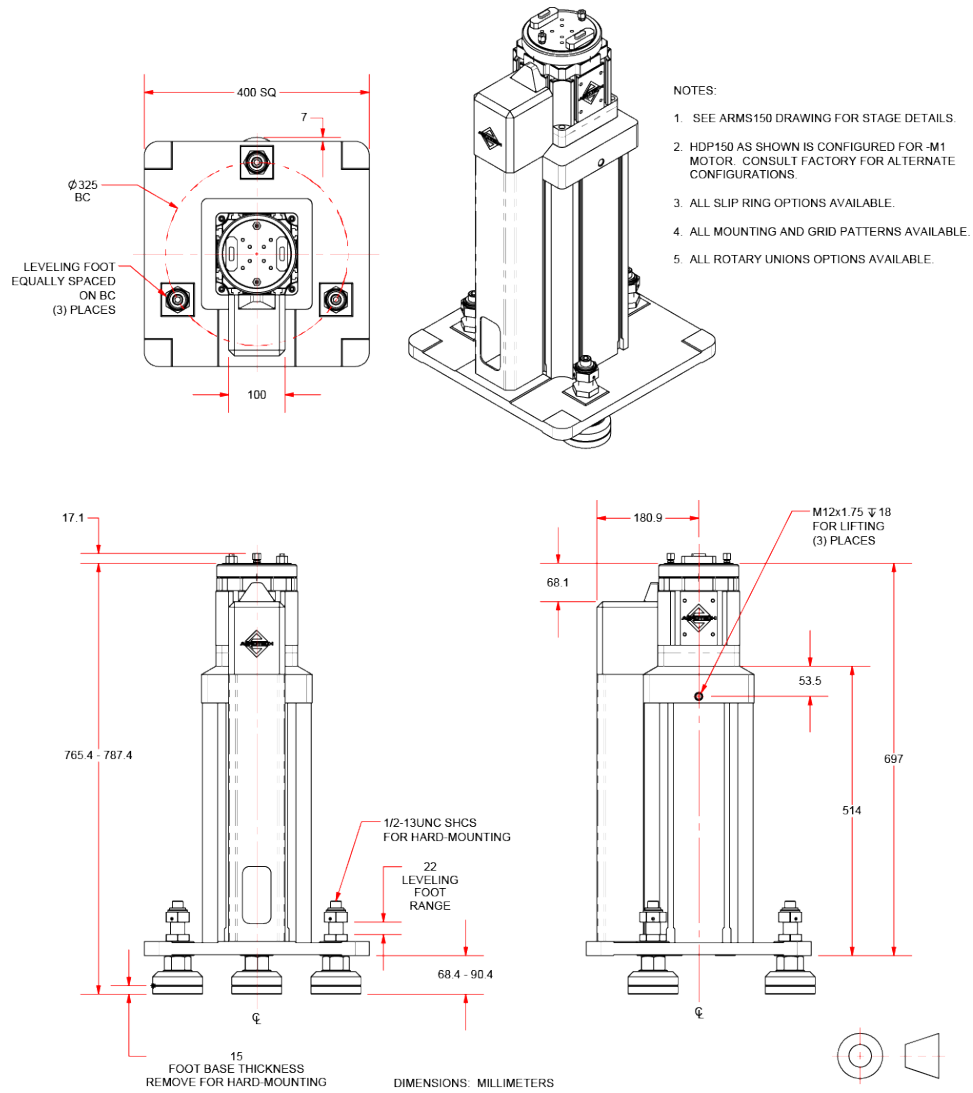


Figure 2-2: ARMS150 Dimensions (-TT5, -TT6, -TT7, -TT8)



**Figure 2-3: Mounting Pedestal Dimensions for the ARMS150 (-HDP)**

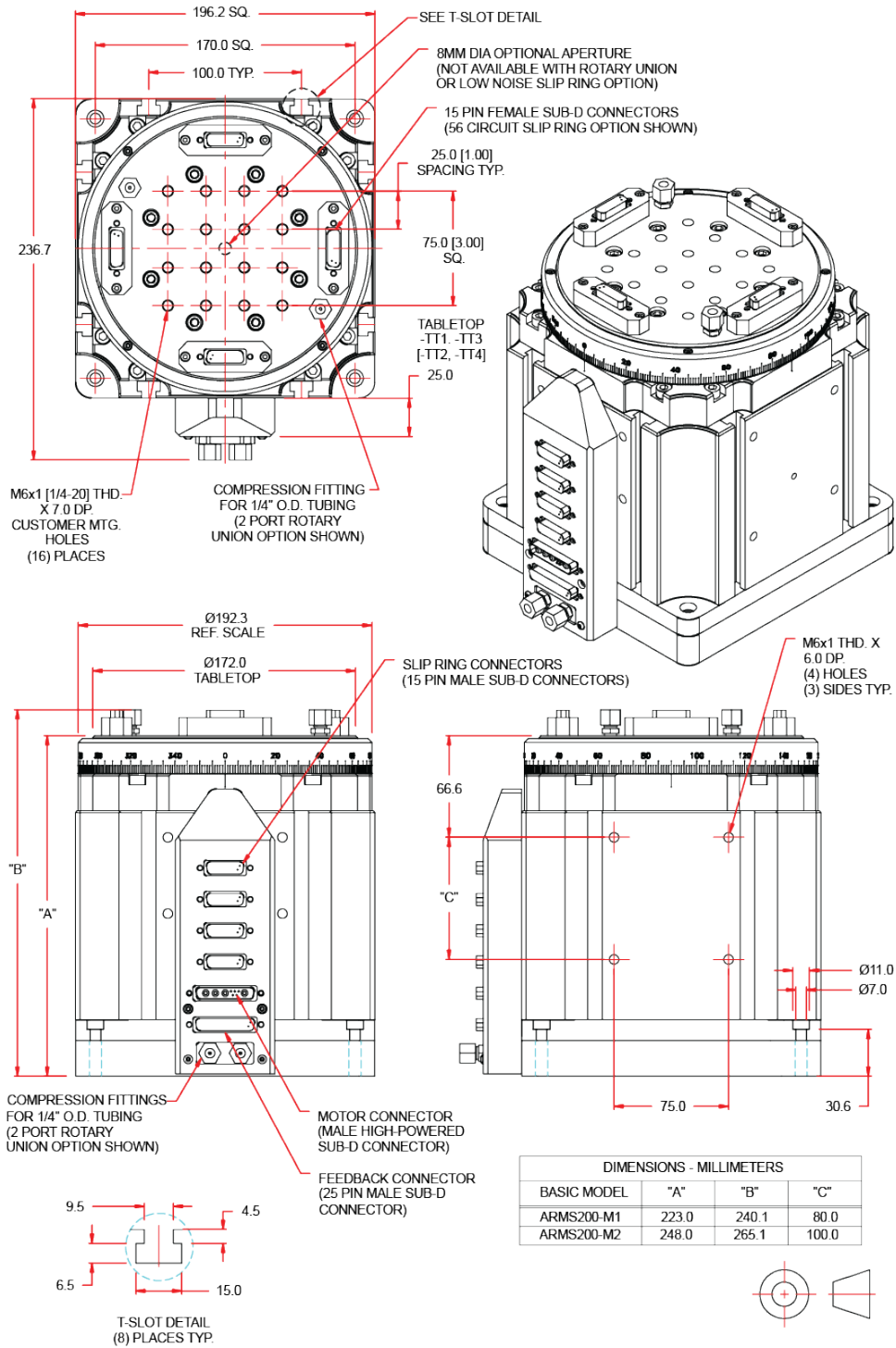


Figure 2-4: ARMS200 Dimensions (-TT1, -TT2, -TT3, -TT4)

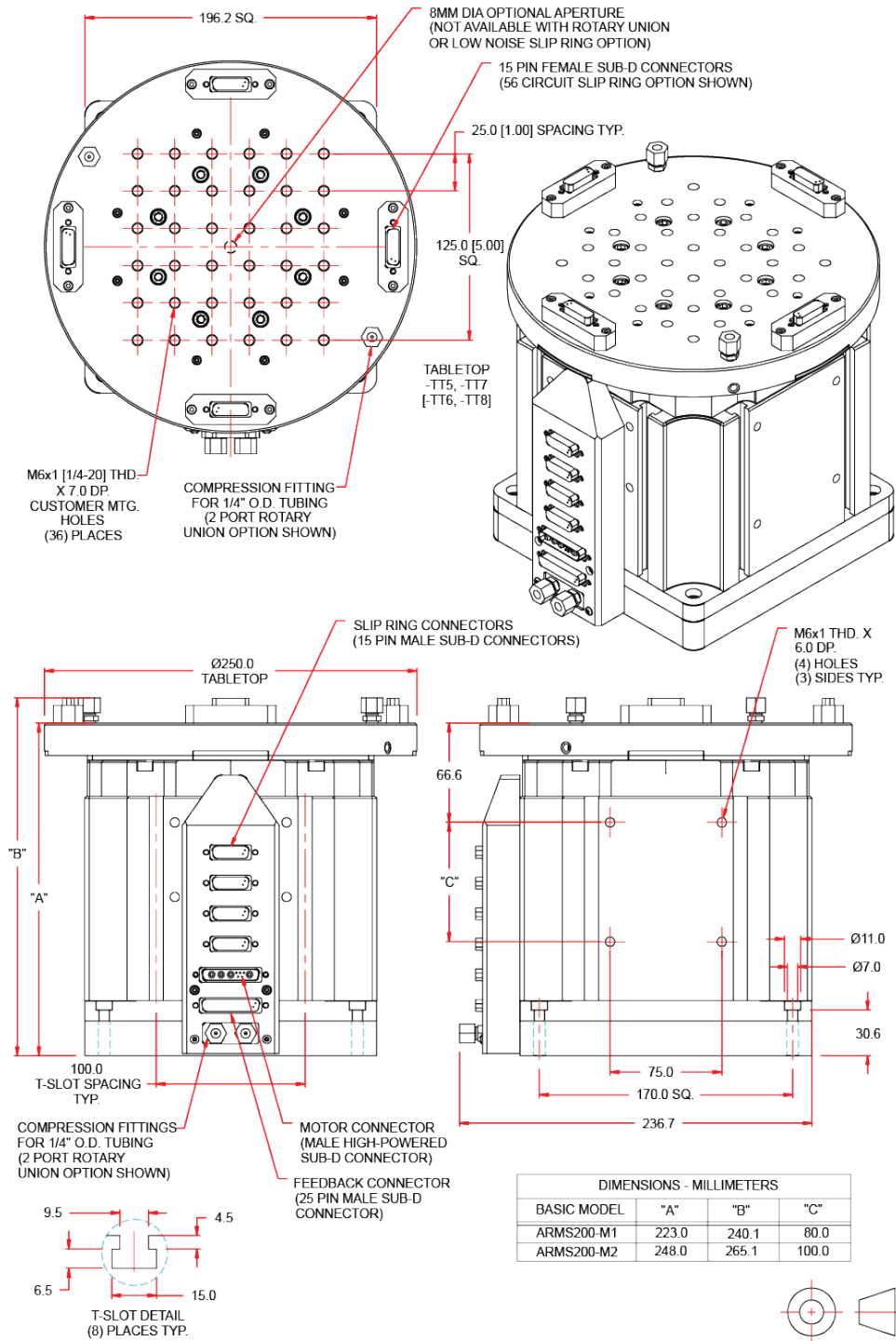


Figure 2-5: ARMS200 Dimensions (-TT5, -TT6, -TT7, -TT8)

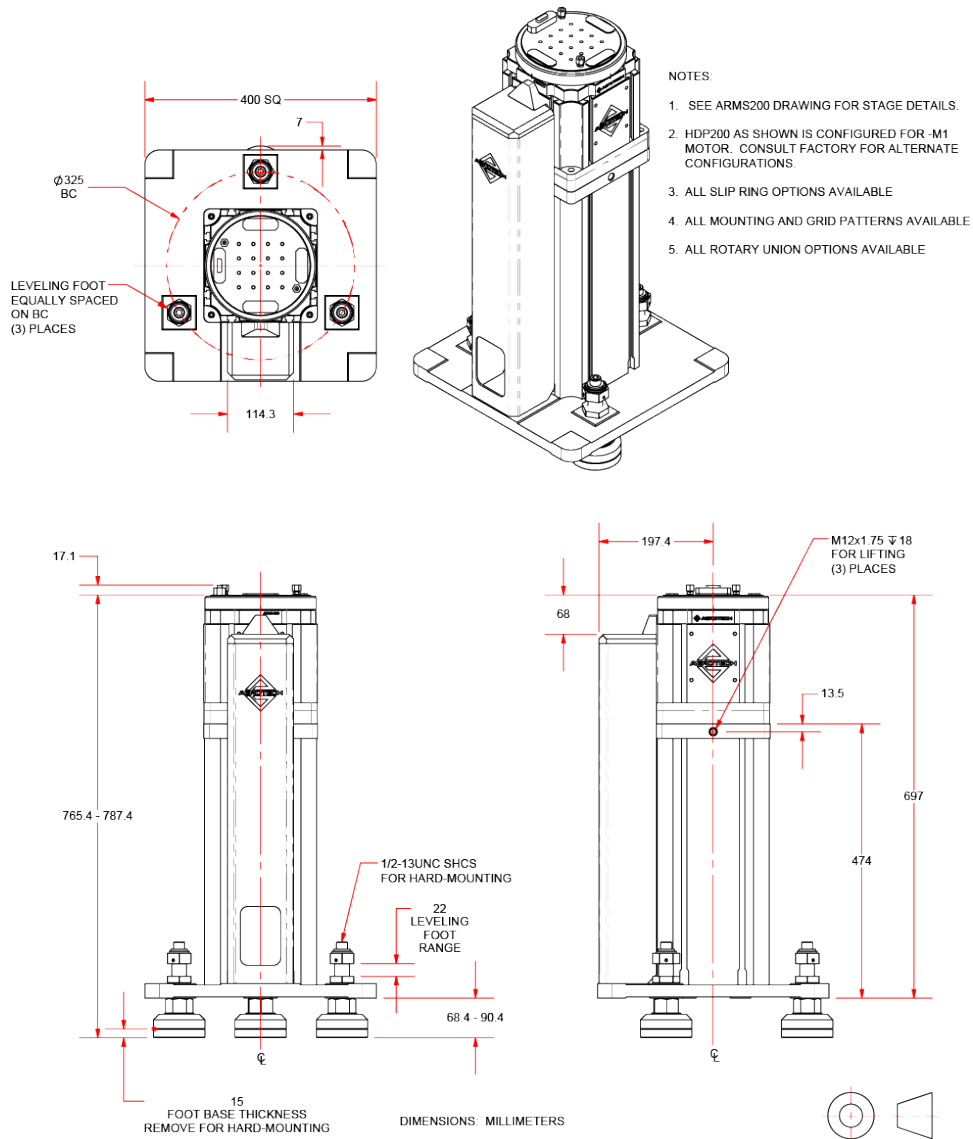


Figure 2-6: Mounting Pedestal Dimensions for the ARMS200 (-HDP)

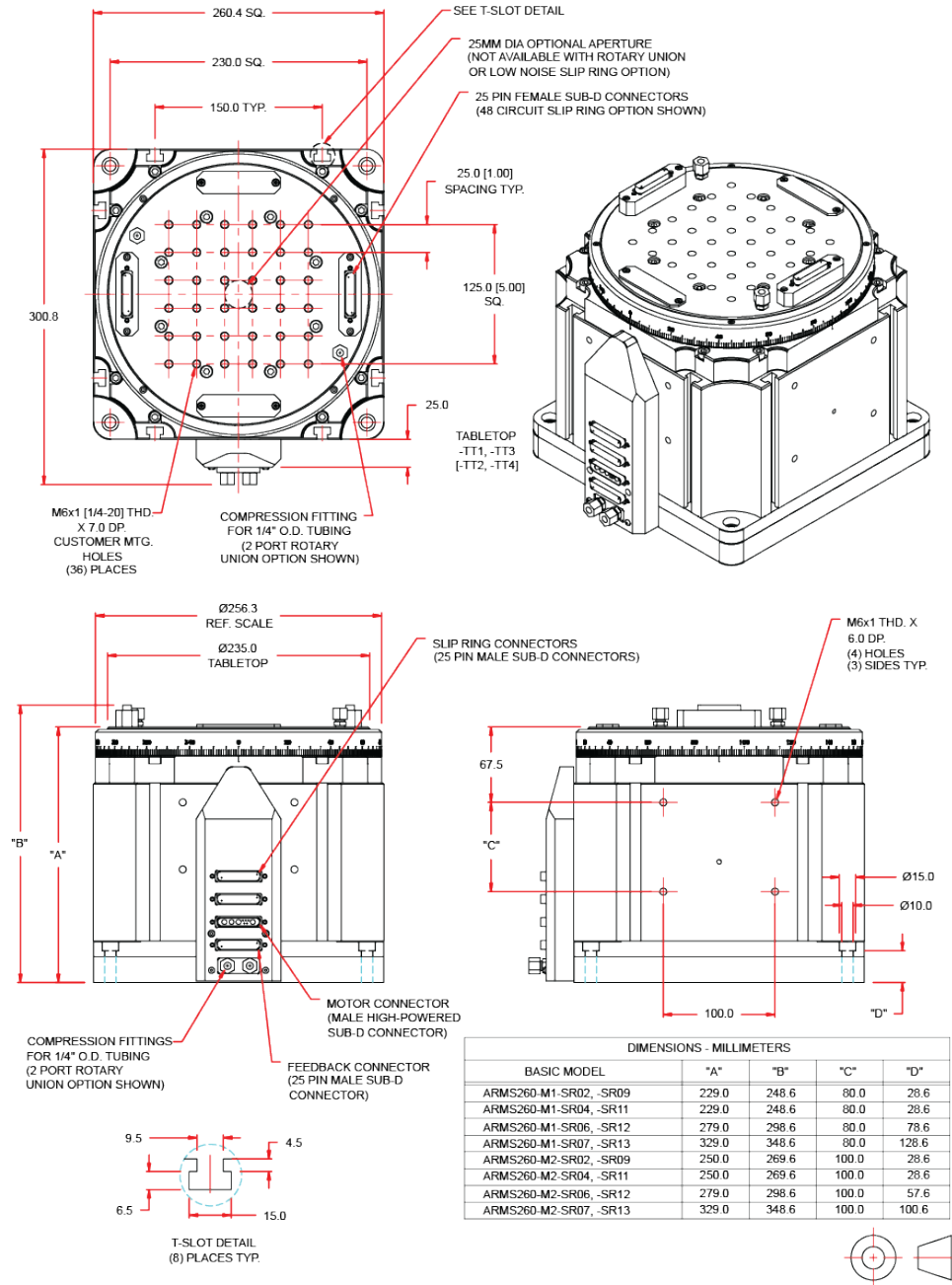


Figure 2-7: ARMS260 Dimensions (-TT1, -TT2, -TT3, -TT4)

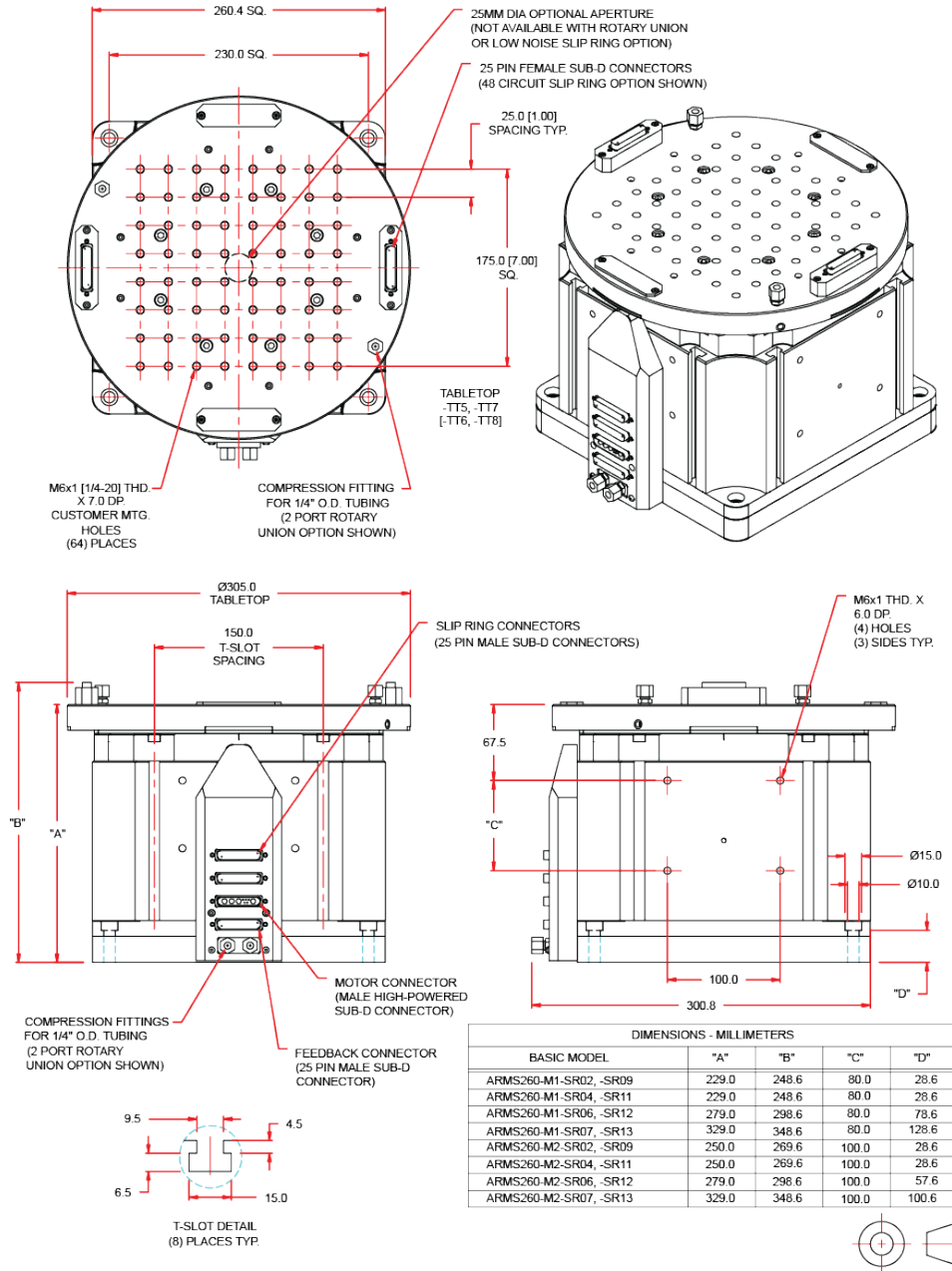


Figure 2-8: ARMS260 Dimensions (-TT5, -TT6, -TT7, -TT8)

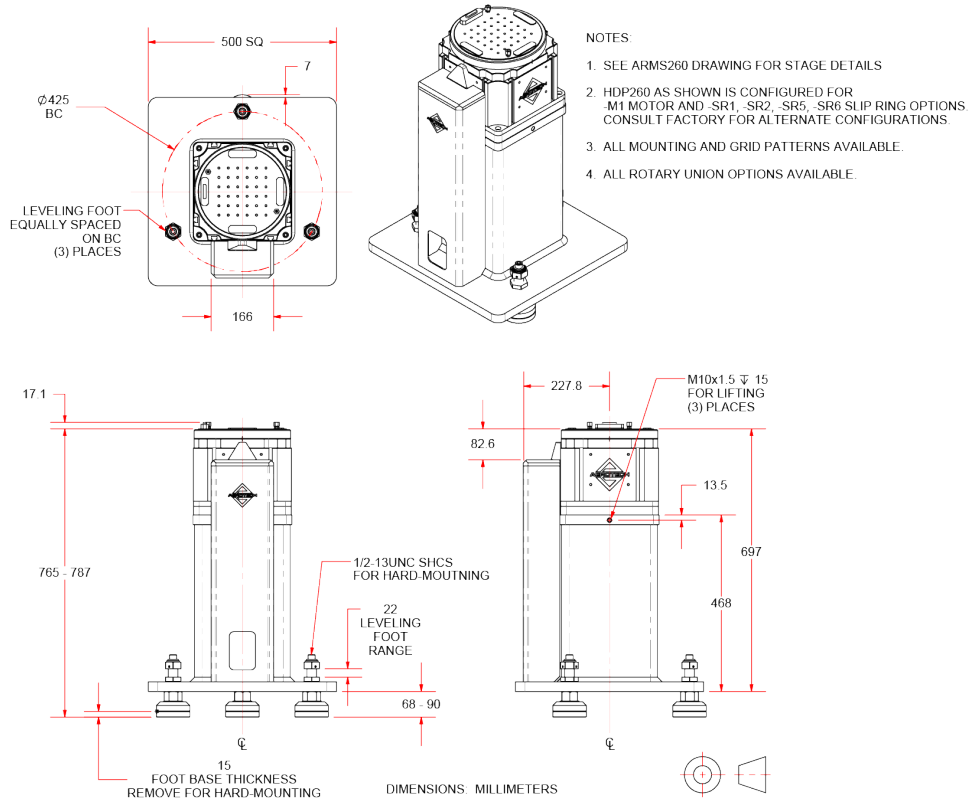


Figure 2-9: Mounting Pedestal Dimensions for the ARMS260 (-HDP)



## 2.3. Securing the Stage to the Mounting Surface



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



**WARNING:** Make sure that all moving parts are secure before moving the ARMS. Unsecured moving parts may shift and cause bodily injury.



**WARNING:** Do not attempt to manually move the ARMS if it is connected to a power source.

The mounting surface must be flat and have adequate stiffness in order to achieve the maximum performance from the ARMS 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:** The ARMS 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 ARMS. Shimming should be avoided if possible. If shimming is required, it should be minimized to retain maximum rigidity of the system.

**NOTE:** To maintain accuracy, the mounting surface must be flat to within 1  $\mu\text{m}$  per 50 mm.

ARMS series stages have a fixed mounting pattern (as shown in [Figure 2-10](#)).

**NOTE:** If the stage is not connected to a power source, the stage should move freely by hand. Do not attempt to manually move the stage if it is connected to a power source or includes an integrated brake.

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
ARMS150, ARMS200	Standard Mounting: M6 SHCS	7 N·m
ARMS150, ARMS200	Side Mounting (for stage or fixture mounting): M6 x 1.0 tapped holes with reinforced threaded inserts (four places on three sides)	7 N·m
ARMS260	Standard Mounting: M8 SHCS	17 N·m
ARMS260	Side Mounting (for stage or fixture mounting): M6 x 1.0 tapped holes with reinforced threaded inserts (four places on three sides)	7 N·m

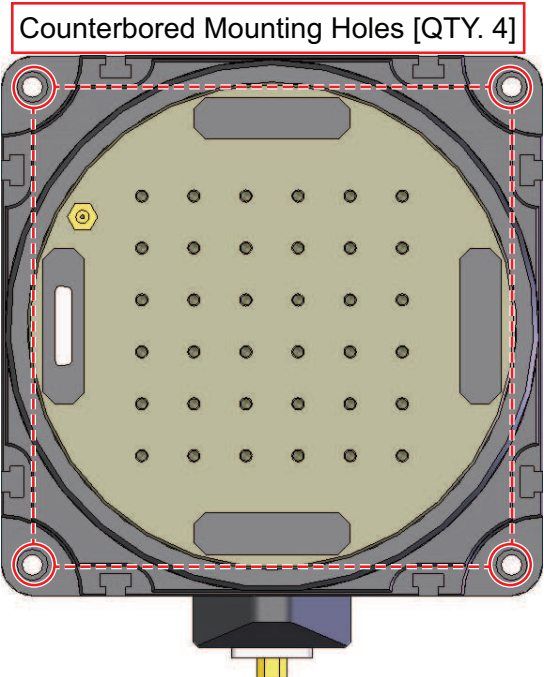


Figure 2-10: Standard Mounting Holes

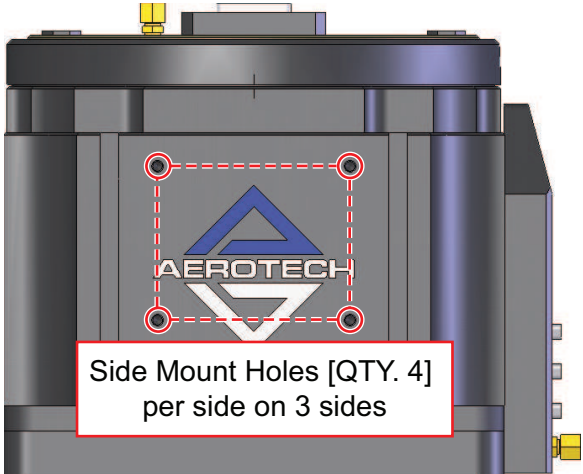


Figure 2-11: Side Mount Mounting Holes

## 2.4. Attaching the Payload to the Stage

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 ARMS 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 ARMS 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  $\mu\text{m}$  (0.0002 in).

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

For a cantilevered load, first determine if it is an Axial or a Radial cantilever system. Measure the cantilever length, then find the corresponding load value from [Figure 2-13](#).

The **Axial** curve assumes a horizontal stage orientation with the payload offset extending upwards.

The **Radial** curve is for situations where the stage is mounted on its side and the offset load extends outwards.

Refer to [Figure 2-12](#) for clarification on Axial or a Radial orientations.

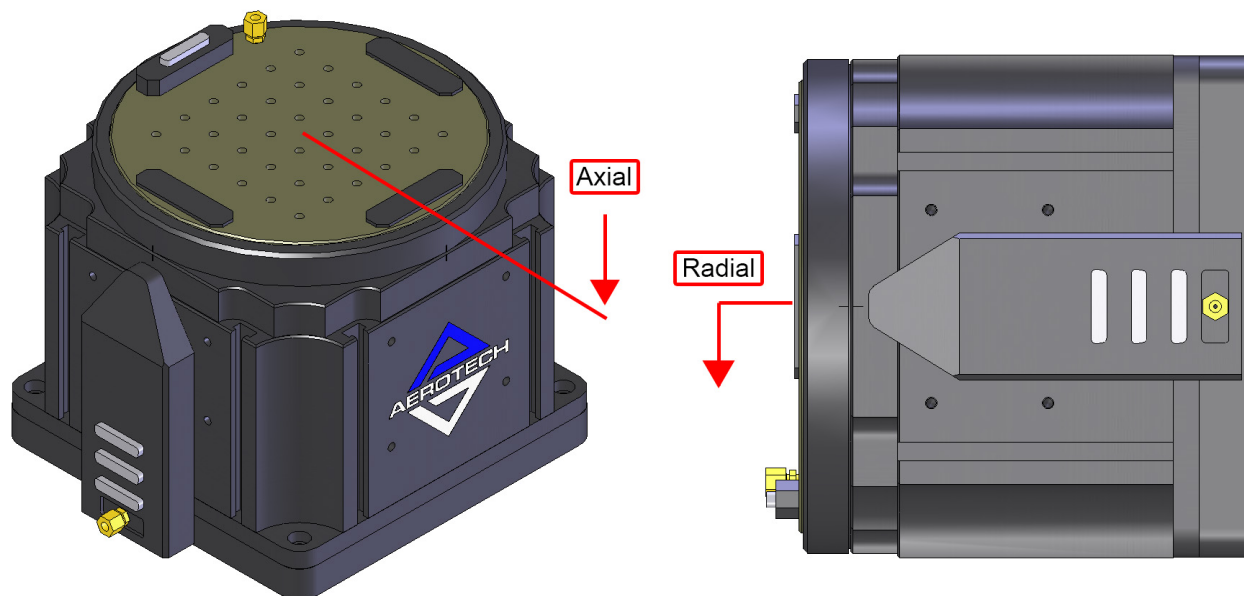


Figure 2-12: Load Orientation

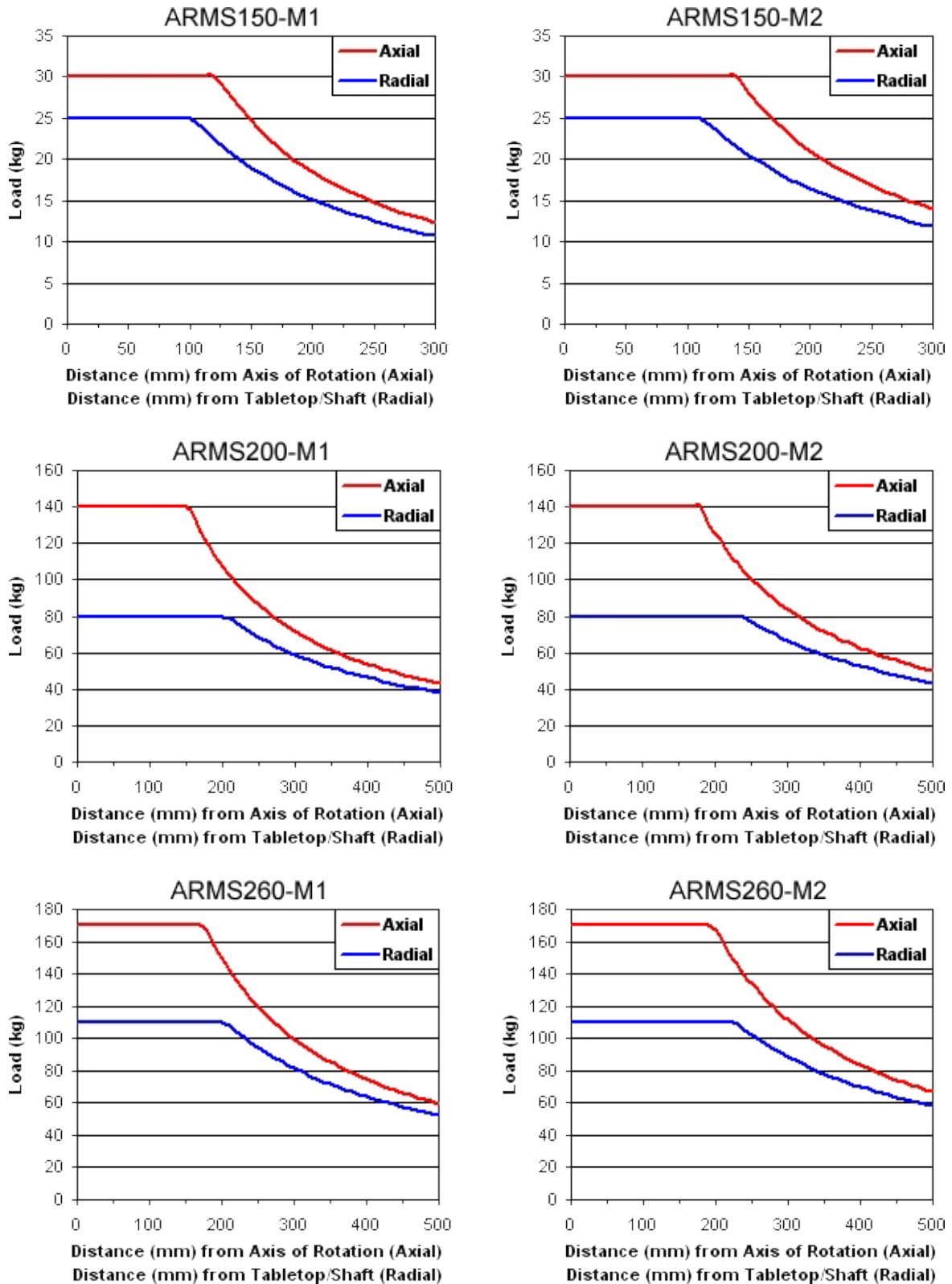


Figure 2-13: ARMS Cantilevered Load Capability

## Chapter 3: Electrical Specifications and Installation



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

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

Aerotech motion control systems are adjusted at the factory for optimum performance. When the ARMS is part of a complete Aerotech motion control system, setup usually involves connecting the ARMS 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 sections that follow for standard motor wiring and connector pinouts.



**WARNING:** Applications requiring access to the stage while it is energized will require additional grounding and safeguards. 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 or damage to the equipment.



**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.

### 3.1. Motor and Feedback Connectors

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

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

The protective ground connection of the ARMS 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.



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



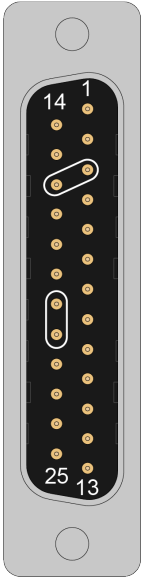
**CAUTION:** The stage controller must provide over-current and over-speed protection. Failure to do so may result in permanent damage to the motor and stage components.

**Table 3-1: Motor Wiring Connector**

Pin	Description	Connector
A1	Motor Phase A	
A2	Motor Phase B	
A3	Motor Phase C	
1	Reserved	
2	Reserved	
3	Reserved	
4	Reserved	
5	Reserved	
A4	Frame ground (motor protective ground)	

Mating Connector	Aerotech P/N	Third Party P/N
Backshell	ECK00656	Amphenol #17E-1726-2
Sockets [QTY. 4]	ECK00659	ITT Cannon #DM53744-6
Connector	ECK00657	ITT Cannon #DBM9W4SA197

**Table 3-2: Feedback Connector**

Pin	Description	Connector
Case	Shield	
1	Reserved	
2	Over-Temperature Thermistor sensor	
3	+5 V power supply	
4	Reserved	
5	Hall Effect sensor, phase B	
6	Marker-N	
7	Marker	
8	Reserved	
9	Reserved	
10	Hall Effect sensor, phase A	
11	Hall Effect sensor, phase C	
12	Reserved	
13	Reserved	
14	Cosine	
15	Cosine-N	
16	+5 V power supply	
17	Sine	
18	Sine-N	
19	Reserved	
20	Common ground	
21	Common ground	
22	Reserved	
24	Reserved	
25	Reserved	

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

### 3.2. Motor and Feedback Wiring

Shielded cables are required for the motor and feedback connections.

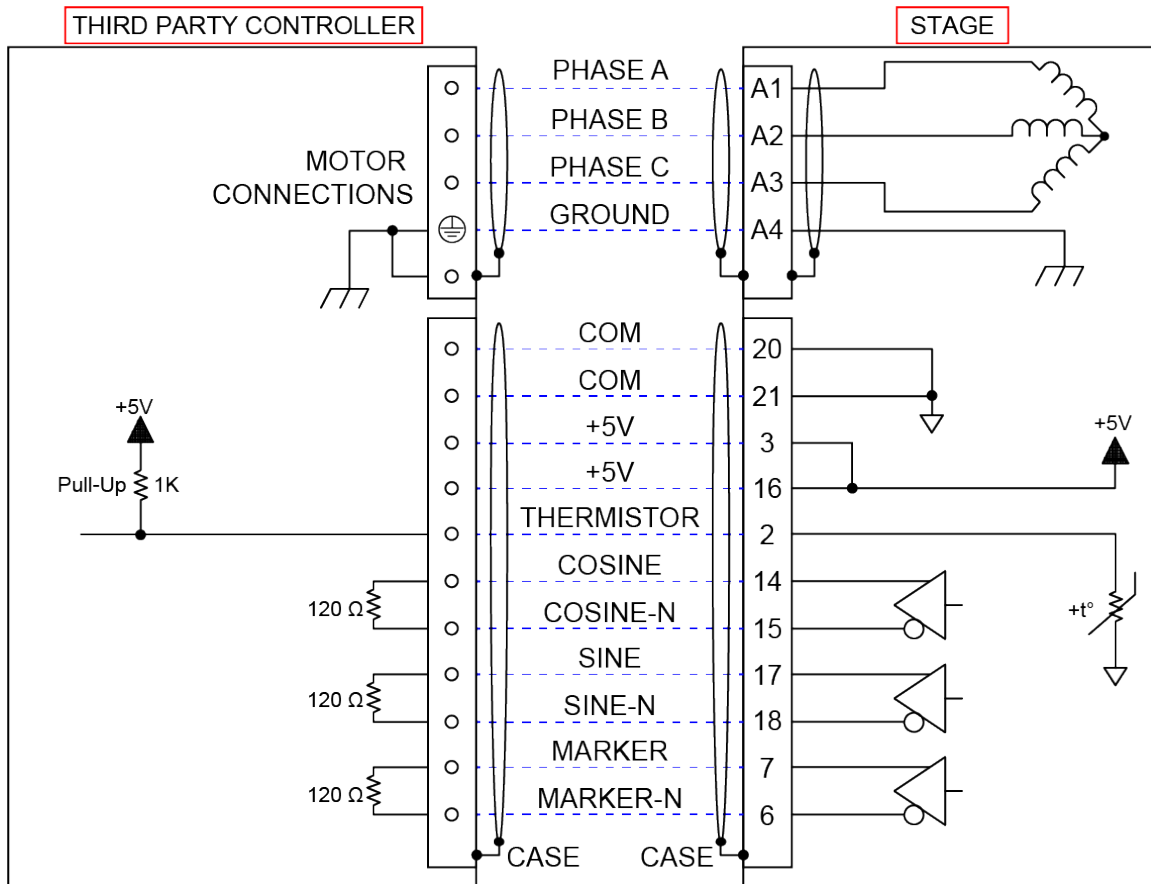


Figure 3-1: Motor and Feedback Wiring



### 3.3. Motor and Feedback Specifications

**Table 3-3: Feedback Specifications**

Hall-Effect Sensors Specifications	
Supply Voltage	5 V $\pm$ 5%
Supply Current	50 mA
Output Type	Open Collector
Output Voltage	24 V max (pull up)
Output Current	5 mA (sinking)
Thermistor Specifications	
Polarity	Logic "0" (no fault)
	Logic "1" (over-temperature fault)
Cold Resistance	$\sim$ 100 $\Omega$
Hot Resistance	$\sim$ 10 K
<b>Note:</b> 1K pull-up to +5V recommended.	
Encoder Specifications	
Supply Voltage	5 V $\pm$ 5%
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.)

**Table 3-4: S-130 Motor Specifications (for ARMS150)**

		S-130-39 (ARMS150-M1)	S-130-102 (ARMS150-M2)
<b>Performance Specifications (1,5)</b>			
Winding Designation		-A	-A
Stall Torque, Cont. (2)	N·m	2.36	7.69
Peak Torque (3)	N·m	9.42	30.75
<b>Electrical Specifications (5)</b>			
Winding Designation		-A	-A
BEMF Const., line-line, Max	$V_{pk}/krpm$	75.1	300.2
Continuous Current, Stall (2)	$A_{pk}$	3.8	3.1
	$A_{rms}$	2.7	2.2
Peak Current, Stall (2)	$A_{pk}$	15.2	12.4
	$A_{rms}$	10.7	8.8
Torque Constant (4, 9)	$N·m/A_{pk}$	0.62	2.48
	$N·m/A_{rms}$	0.88	3.51
Motor Constant (2, 4)	$N·m/\sqrt{W}$	0.265	0.710
Resistance, 25°C, line-line	$\Omega$	5.6	12.5
Inductance, line-line	mH	1.70	3.67
Maximum Bus Voltage	$V_{DC}$	340	340
Thermal Resistance	$^{\circ}C/W$	0.95	0.64
Number of Poles	--	18	18
1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature 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 3. Peak force assumes correct rms current; consult Aerotech. 4. Torque constant and motor constant specified at stall 5. All performance and electrical specifications $\pm 10\%$ 6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered. 7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C) 8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures 9. All Aerotech amplifiers are rated $A_{pk}$ ; use torque constant in $N·m/A_{pk}$ when sizing			

**Table 3-5: S-180 Motor Specifications (for ARMS200)**

		S-180-69 (ARMS200-M1)	S-180-94 (ARMS200-M2)
<b>Performance Specifications (1,5)</b>			
Winding Designation		-A	-A
Stall Torque, Cont. (2)	N·m	11.12	15.93
Peak Torque (3)	N·m	44.47	63.70
<b>Electrical Specifications (5)</b>			
Winding Designation		-A	-A
BEMF Const., line-line, Max	$V_{pk}/krpm$	263.9	393.4
Continuous Current, Stall (2)	$A_{pk}$	5.1	4.9
	$A_{rms}$	3.6	3.5
Peak Current, Stall (2)	$A_{pk}$	20.4	19.6
	$A_{rms}$	14.4	13.9
Torque Constant (4, 9)	$N·m/A_{pk}$	2.18	3.25
	$N·m/A_{rms}$	3.08	4.60
Motor Constant (2, 4)	$N·m/\sqrt{W}$	1.053	1.391
Resistance, 25°C, line-line	$\Omega$	4.4	5.6
Inductance, line-line	mH	1.70	2.60
Maximum Bus Voltage	$V_{DC}$	340	340
Thermal Resistance	$^{\circ}C/W$	0.67	0.57
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 3-6: S-240 Motor Specifications (for ARMS260)**

		S-240-63 (ARMS260-M1)	S-240-83 (ARMS260-M2)
<b>Performance Specifications (1,5)</b>			
Winding Designation		A	A
Stall Torque, Cont. (2)	N·m	19.71	29.09
Peak Torque (3)	N·m	78.82	116.37
<b>Electrical Specifications (5)</b>			
Winding Designation		A	A
BEMF Const., line-line, Max	$V_{pk}/krpm$	404.3	607.2
Continuous Current, Stall (2)	$A_{pk}$	5.9	5.8
	$A_{rms}$	4.2	4.1
Peak Current, Stall (2)	$A_{pk}$	23.6	23.2
	$A_{rms}$	16.7	16.4
Torque Constant (4, 9)	$N·m/A_{pk}$	3.34	5.02
	$N·m/A_{rms}$	4.72	7.09
Motor Constant (2, 4)	$N·m/\sqrt{W}$	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
1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature 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 3. Peak force assumes correct rms current; consult Aerotech. 4. Torque constant and motor constant specified at stall 5. All performance and electrical specifications $\pm 10\%$ 6. Specifications given are for the motor only. When integrated into a housing with bearings additional losses should be considered. 7. Maximum winding temperature is 100 °C (thermistor trips at 100 °C) 8. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures 9. All Aerotech amplifiers are rated $A_{pk}$ ; use torque constant in $N·m/A_{pk}$ when sizing			

**Table 3-7: Encoder Specifications**

Model	ARMS150-M1 / -M2	ARMS200-M1 / -M	ARMS260-M1 / -M2
Fundamental Encoder Resolution	18,200 lines/rev	23,600 lines/rev	32,400 lines/rev
Fundamental Resolution	0.22 222 222° (80 arc sec)	0.015 254 237° (54.915 arc sec)	0.011 111 111° (40 arc sec)

### 3.4. Marker and Machine Direction

Aerotech stages are configured to have positive and negative "machine" directions. The positive machine direction is also the CW limit direction. 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 ARMS stages.

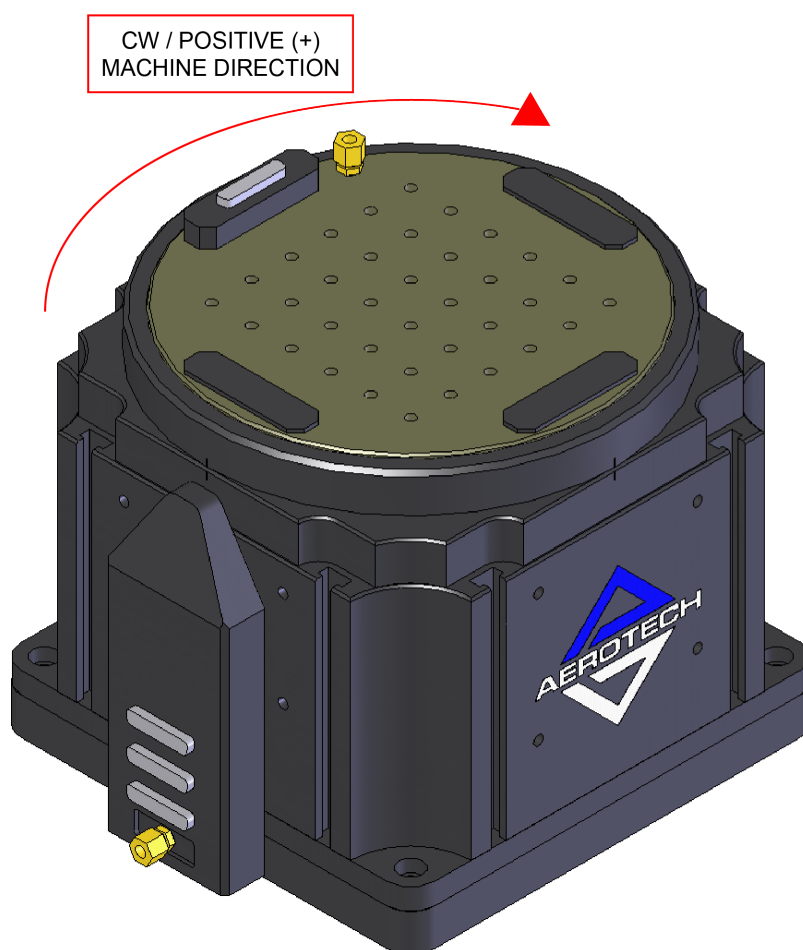
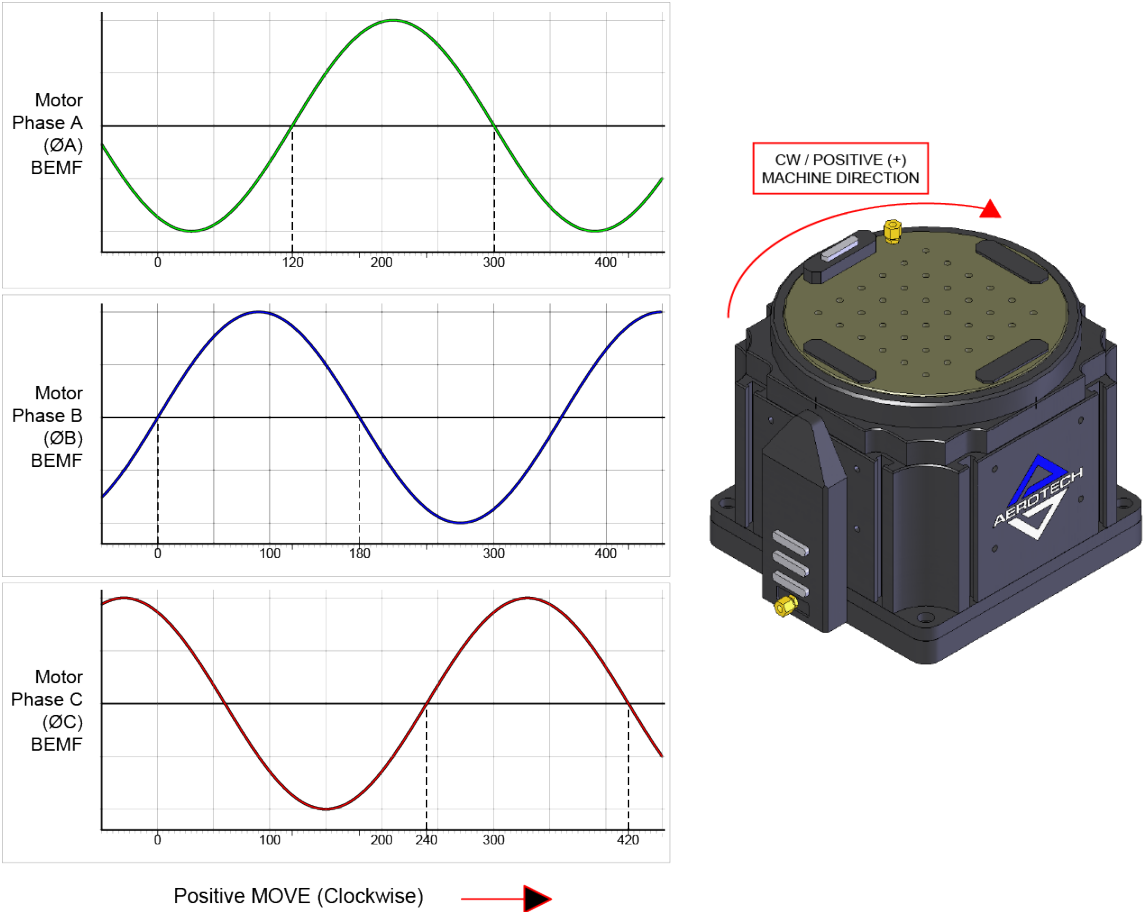


Figure 3-2: Machine Direction

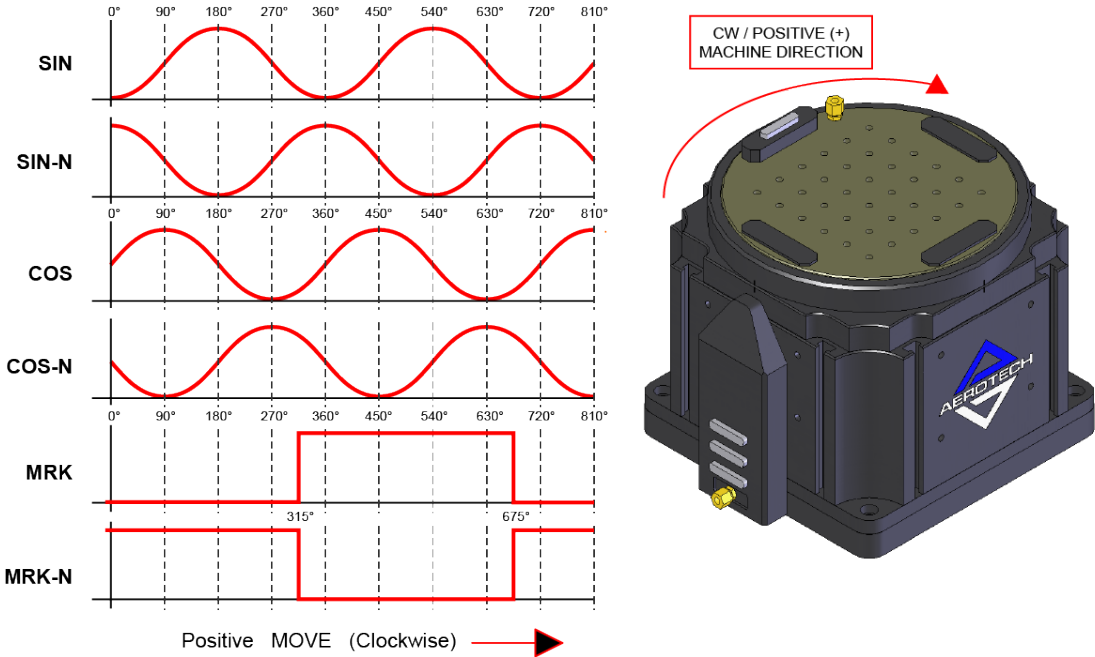
### 3.5. Motor and Feedback Phasing

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



Positive MOVE (Clockwise) →

**Figure 3-3: Hall Phasing**



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

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## Chapter 4: Maintenance

The ARMS series stages are designed to require minimum maintenance.



**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 ARMS at least 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.

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

In general, repair and/or replacement of damaged or malfunctioning components by Aerotech field service personnel is not possible. Repair typically requires that the unit be returned to the factory. Please contact Aerotech Global Technical Support for more information.

### 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.

#### Cleaning

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

Any metal surface on the stage can be cleaned with either acetone or isopropyl alcohol.



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

#### Lubrication

There are no elements on ARMS stages that require lubrication.

### 4.3. Troubleshooting

Table 4-1: Troubleshooting

Symptom	Possible Cause and Solution
Stage will not move	Controller trap or fault. See controller documentation.
Stage moves uncontrollably	Encoder (sine and cosine) signals connections. See <a href="#">Chapter 3</a> and Controller documentation. Motor Connections. See <a href="#">Chapter 3</a> and Controller documentation.
Stage oscillates or squeals	Gains misadjusted. See Controller documentation. Encoder signals. See Controller documentation.

## Appendix A: Warranty and Field Service

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

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

### Return Products Procedure

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

Visit <https://www.aerotech.com/global-technical-support.aspx> for the location of your nearest Aerotech Service center.

### Returned Product Warranty Determination

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

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

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

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

### Rush Service

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

### On-site Warranty Repair

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

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

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

### On-site Non-Warranty Repair

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

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

### Service Locations

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

<b>USA, CANADA, MEXICO</b> Aerotech, Inc. Global Headquarters Phone: +1-412-967-6440 Fax: +1-412-967-6870	<b>CHINA</b> Aerotech China Full-Service Subsidiary Phone: +86 (21) 5508 6731	<b>GERMANY</b> Aerotech Germany Full-Service Subsidiary Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720
<b>JAPAN</b> Aerotech Japan Full-Service Subsidiary Phone: +81 (0)50 5830 6814 Fax: +81 (0)43 306 3773	<b>TAIWAN</b> Aerotech Taiwan Full-Service Subsidiary Phone: +886 (0)2 8751 6690	<b>UNITED KINGDOM</b> Aerotech United Kingdom Full-Service Subsidiary Phone: +44 (0)1256 855055 Fax: +44 (0)1256 855649

Have your customer order number ready before calling.

## Appendix B: Revision History

Revision	General Information
1.03.00	Complete manual revision
1.02.00	Changed motor feedback pin 8 to reserved
1.01.00	<ul style="list-style-type: none"><li>• Declaration of Incorporation added</li><li>• Environmental Specifications added</li><li>• Safety information and warnings added/updated</li><li>• Motor Specifications added</li><li>• Note about wire current and voltage requirements added</li></ul>
1.00.00	New manual

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