



# MPS75SL/SLE 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.

This manual tells you how to carefully and correctly use and operate the MPS75SL/SLE. Read all parts of this manual before you install or operate the MPS75SL/SLE or before you do maintenance to your system. To prevent injury to you and damage to the equipment, obey the precautions in this manual. The precautions that follow apply when you see a Danger or Warning symbol in this manual. If you do not obey these precautions, injury to you or damage to the equipment can occur. If you do not understand the information in this manual, contact Aerotech Global Technical Support. This product has been designed for light industrial manufacturing or laboratory environments. The protection provided by the equipment could be impaired if the product is used in a manner not specified by the manufacturer.

**WARNING:** This product uses electrical supplies and signals. To minimize possible electrical damage to the stage or injury to the operator, obey the electrical precautions that follow.

1. Access to the MPS75SL/SLE 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.
6. Moving parts can cause crushing or shearing injuries. Access to all stage and motor parts must be restricted while connected to a power source.
7. Cables can pose a tripping hazard. Securely mount and position all system cables to avoid potential hazards.
8. 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.
9. The MPS75SL/SLE stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
10. Use care when moving the MPS75SL/SLE stage. Lifting or transporting the MPS75SL/SLE stage improperly can result in injury or damage to the MPS75SL/SLE.
11. 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.
12. 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.
13. The motor case temperature may exceed 75°C.
14. Operators must be trained before operating this equipment.
15. All service and maintenance must be performed by qualified personnel.



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## EU Declaration of Incorporation

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

**herewith declares that the product:**

MPS75SL/SLE 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  
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**Location** Pittsburgh, PA  
**Date** 1/2/2019



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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 Ordering Options**

<b>MPS75SL and MPS75SLE Miniature Mechanical-Bearing Screw-Driven Linear Stage</b>	
<b>Direct Linear Feedback (-SLE Only; Required)</b>	
-E1	Incremental linear encoder; 1 Vpp
-E2	Incremental linear encoder; 0.05 $\mu$ m digital TTL output
<b>Travel (Required)</b>	
-025	25 mm travel stage
-050	50 mm travel stage
-075	75 mm travel stage
-100	100 mm travel stage
<b>Vacuum Preparation (-SL Only; Optional)</b>	
-HV	High-vacuum preparation to $10^{-6}$ torr
<b>Motor (Required)</b>	
-M1	DC servomotor
-M2	Stepper motor
<b>Bellows (Optional)</b>	
-BL	Bellows waycover (not available with -HV option)
<b>Mounting Plate (Optional)</b>	
-MP	Optical mounting plate
<b>Metrology (Required)</b>	
-PL0	No metrology performance plots
-PL1	Metrology, uncalibrated with performance plots
-PL2	Metrology, calibrated with performance plots
<b>Accessories (To be Ordered as a Separate Line Item)</b>	
HDZ-MPS75SL	Right-angle bracket
HDZ-MPS75SL-HV	Right-angle bracket, high vacuum preparation to $10^{-6}$ torr

## 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 MPS75SL/SLE is not suited for dusty or wet environments. This equates to an ingress protection rating of IP00.
<b>Use</b>	Indoor use only

## 1.2. Accuracy and Temperature Effects

The accuracy specification of MPS75SL/SLE series stages is measured 25 mm above the table with the stage in an unloaded condition. The stage is assumed to be fully supported by a mounting surface meeting or exceeding the specification in [Section 2.3](#).

The accuracy of the screw is a key element in the overall positioning accuracy of the stage. A scale error can be expected if temperature of the screw differs from 20° C (68° F). The greater the temperature difference, the greater the error. The temperature of the screw depends on the speed and duty cycle of the stage. The faster the movement and higher the duty cycle, the more the stage accuracy will be affected by heat. The thermal expansion coefficient of the screw is 11.7 ppm/°C.

### 1.3. Basic Specifications

**Table 1-3: MPS75SL Series Mechanical Specifications**

Mechanical Specifications <sup>(1)</sup>		-025	-050	-075	-100
Travel		25 mm	50 mm	75 mm	100 mm
Accuracy <sup>(2)</sup>	Uncalibrated	±2.5 µm	±3.0 µm	±3.5 µm	±4.0 µm
	Uncalibrated with Bellows	±3.5 µm	±4.0 µm	±4.5 µm	±5.0 µm
	Calibrated <sup>(3)</sup>	±1.0 µm	±1.0 µm	±1.5 µm	±1.5 µm
Resolution (Minimum Incremental Motion)		0.1 µm	0.1 µm	0.1 µm	0.1 µm
Bidirectional Repeatability <sup>(3)</sup>		±0.75 µm	±0.75 µm	±0.75 µm	±0.75 µm
Bidirectional Repeatability (with Bellows)		±1.2 µm	±1.2 µm	±1.2 µm	±1.2 µm
Straightness		±2.0 µm	±2.0 µm	±3.0 µm	±3.0 µm
Flatness		±2.0 µm	±2.0 µm	±3.0 µm	±3.0 µm
Maximum Speed (1.0 mm/rev Ball Screw)	DC Motor (-M1)	50 mm/s	50 mm/s	50 mm/s	35 mm/s
	Stepper Motor (-M2)	30 mm/s	30 mm/s	30 mm/s	30 mm/s
Load Capacity <sup>(4)</sup>	Horizontal	15 kg	15 kg	15 kg	15 kg
	Side	15 kg	15 kg	15 kg	15 kg
	Vertical	4 kg	4 kg	4 kg	4 kg
Stage Mass		1.7 kg	1.8 kg	1.9 kg	2.0 kg
Material		Anodized Aluminum Body			
<p>1. Specifications are for single-axis systems measured 25 mm above the tabletop; performance of multi-axis system is payload and workpoint dependent. Consult the Aerotech factory for multi-axis or non-standard applications.</p> <p>2. Excessive duty cycle may impact stage accuracy.</p> <p>3. With Aerotech controllers.</p> <p>4. Payload specifications are for a single-axis system.</p>					

**Table 1-4: MPS75SLE Series Mechanical Specifications**

Mechanical Specifications <sup>(1)</sup>		-025	-050	-075	-100
Travel		25 mm	50 mm	75 mm	100 mm
Accuracy	Uncalibrated	±1.75 µm	±2.25 µm	±2.75 µm	±3.25 µm
	Uncalibrated with Bellows	±2.75 µm	±3.25 µm	±3.75 µm	±4.25 µm
	Calibrated <sup>(2)</sup>	±0.75 µm	±0.75 µm	±1.0 µm	±1.0 µm
Resolution (Minimum Incremental Motion) <sup>(3)</sup>		0.025 µm	0.025 µm	0.025 µm	0.025 µm
Bidirectional Repeatability <sup>(3)</sup>		±0.1 µm	±0.1 µm	±0.1 µm	±0.1 µm
Bidirectional Repeatability (with Bellows)		±0.2 µm	±0.2 µm	±0.2 µm	±0.2 µm
Straightness		±2.0 µm	±2.0 µm	±3.0 µm	±3.0 µm
Flatness		±2.0 µm	±2.0 µm	±3.0 µm	±3.0 µm
Maximum Speed (1.0 mm/rev Ball Screw)	DC Motor (-M1)	50 mm/s	50 mm/s	50 mm/s	35 mm/s
	Stepper Motor (-M2)	30 mm/s	30 mm/s	30 mm/s	30 mm/s
Load Capacity <sup>(4)</sup>	Horizontal	15 kg	15 kg	15 kg	15 kg
	Side	15 kg	15 kg	15 kg	15 kg
	Vertical	4 kg	4 kg	4 kg	4 kg
Stage Mass		2.3 kg	2.4 kg	2.5 kg	2.6 kg
Material		Anodized Aluminum Body			
<p>1. Specifications are for single-axis systems measured 25 mm above the tabletop; performance of multi-axis system is payload and workpoint dependent. Consult the Aerotech factory for multi-axis or non-standard applications.</p> <p>2. With Aerotech controllers.</p> <p>3. Resolution and repeatability specifications are for systems running in dual-loop mode with feedback resolutions of 25 nm on both the rotary and linear encoders.</p> <p>4. Payload specifications are for a single-axis system.</p>					

## 1.4. Vacuum Operation

MPS75SL/SLE stages ordered with the -HV option (high vacuum preparation) are designed for operation in high vacuum environments. Special preparations include:

- Stage parts are lubricated with vacuum-compatible lubricants.
- Materials, fasteners, and coatings with vacuum outgas performance are ensured to be compatible with the specified level of vacuum.
- For high vacuum stages, situations that may allow gases to become temporarily trapped during pump down are removed.
- Prior to assembly, stage parts are thoroughly cleaned in a clean environment.
- Stages are packaged in a special polyethylene bag.

### Vacuum Guidelines

To ensure that the MPS75SL/SLE will continue to perform well in the vacuum environment, follow the guidelines listed below (in addition to standard handling, installation, and lubrication guidelines outlined in this manual).

1. Do not remove the MPS75SL/SLE from its sealed bag until it is ready for use.
2. Always handle the MPS75SL/SLE in a clean environment and use powder-free polyethylene gloves to prevent any contaminants from adhering to the surface of the MPS75SL/SLE.
3. During installation, use cleaned, vented, stainless steel fasteners when securing the MPS75SL/SLE.
4. Reduced air pressure eliminates significant convective heat transfer. This, coupled with the viscous vacuum-compatible lubricants, could result in excessive motor operating temperatures. Because of this, consider all continuous torque ratings to be 40 to 60% lower than the value specified for operation in normal atmospheric environment. Reduce motor usage accordingly.
5. For vacuum applications, the recommended lubricant is a small quantity of **Braycote® 602EF** grease or a compatible substitute of equal quality.
6. Baking vacuum components at 60 °C for 24 to 48 hours significantly reduces outgassing at initial pump-down to vacuum pressure and evaporates water vapor that impregnates porous surfaces on the aluminum and Teflon cables. Aerotech recommends that customers bake out vacuum systems when first installing them in the vacuum chamber.

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## Chapter 2: Installation



**WARNING:** MPS75SL/SLE 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

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

Carefully remove the MPS75SL/SLE from the protective shipping container. Before operating the MPS75SL/SLE, it is important to let the MPS75SL/SLE stabilize at room temperature for at least 12 hours. Allowing the MPS75SL/SLE 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. Set the MPS75SL/SLE on a smooth, flat, and clean surface.

Each MPS75SL/SLE 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. If any damage has occurred during shipping, report it immediately.



**WARNING:** Make sure that all moving parts are secure before moving the MPS75SL/SLE. Unsecured moving parts may shift and cause bodily injury.



**WARNING:** Improper handling could adversely affect the performance of the MPS75SL/SLE. Use care when moving the MPS75SL/SLE.



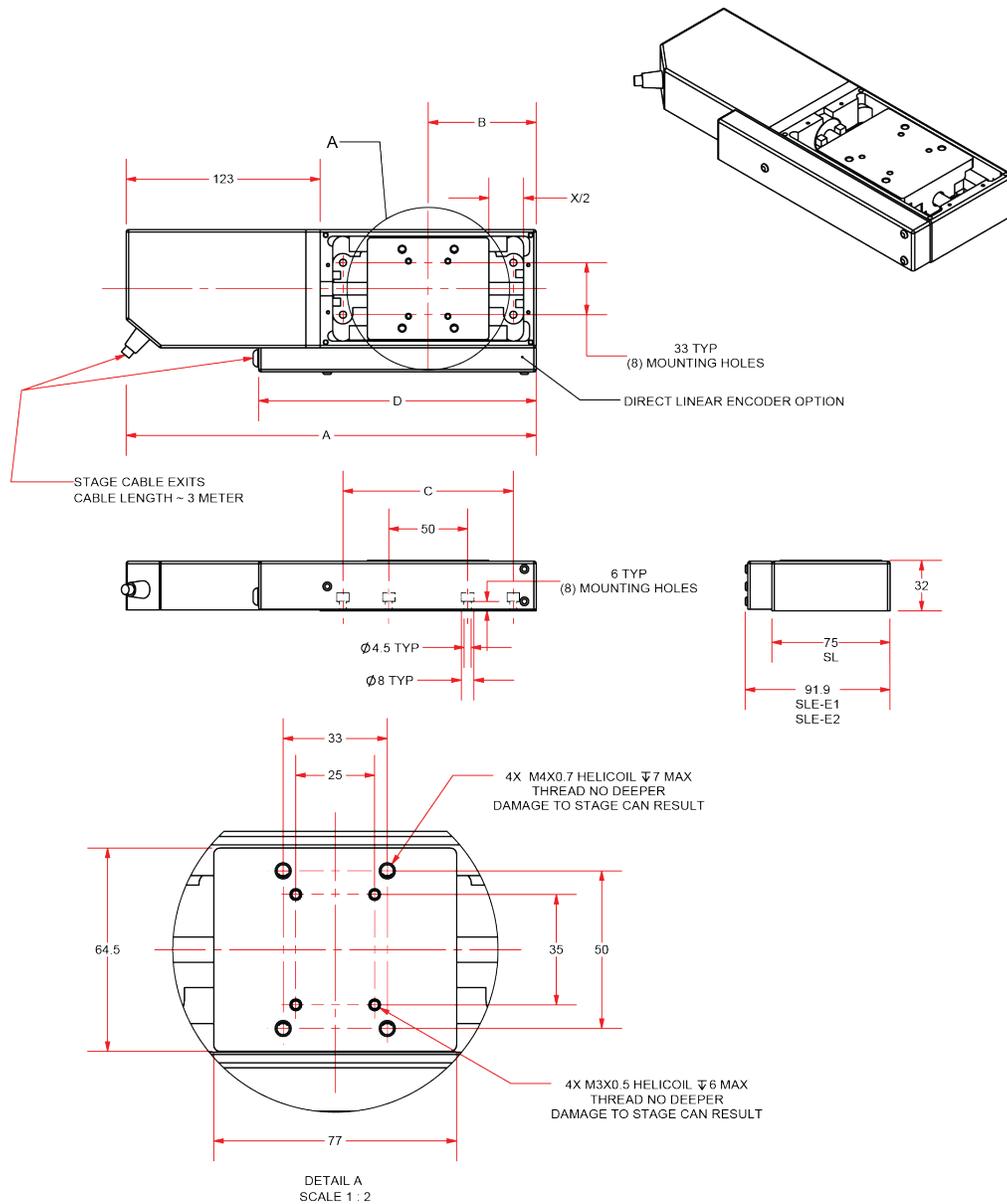
**WARNING:** An unsecured MPS75SL/SLE could be dragged off of a mounting surface by its unsupported cable.



**WARNING:** Do not use the drive screw or motor as lifting points.

## 2.2. Dimensions

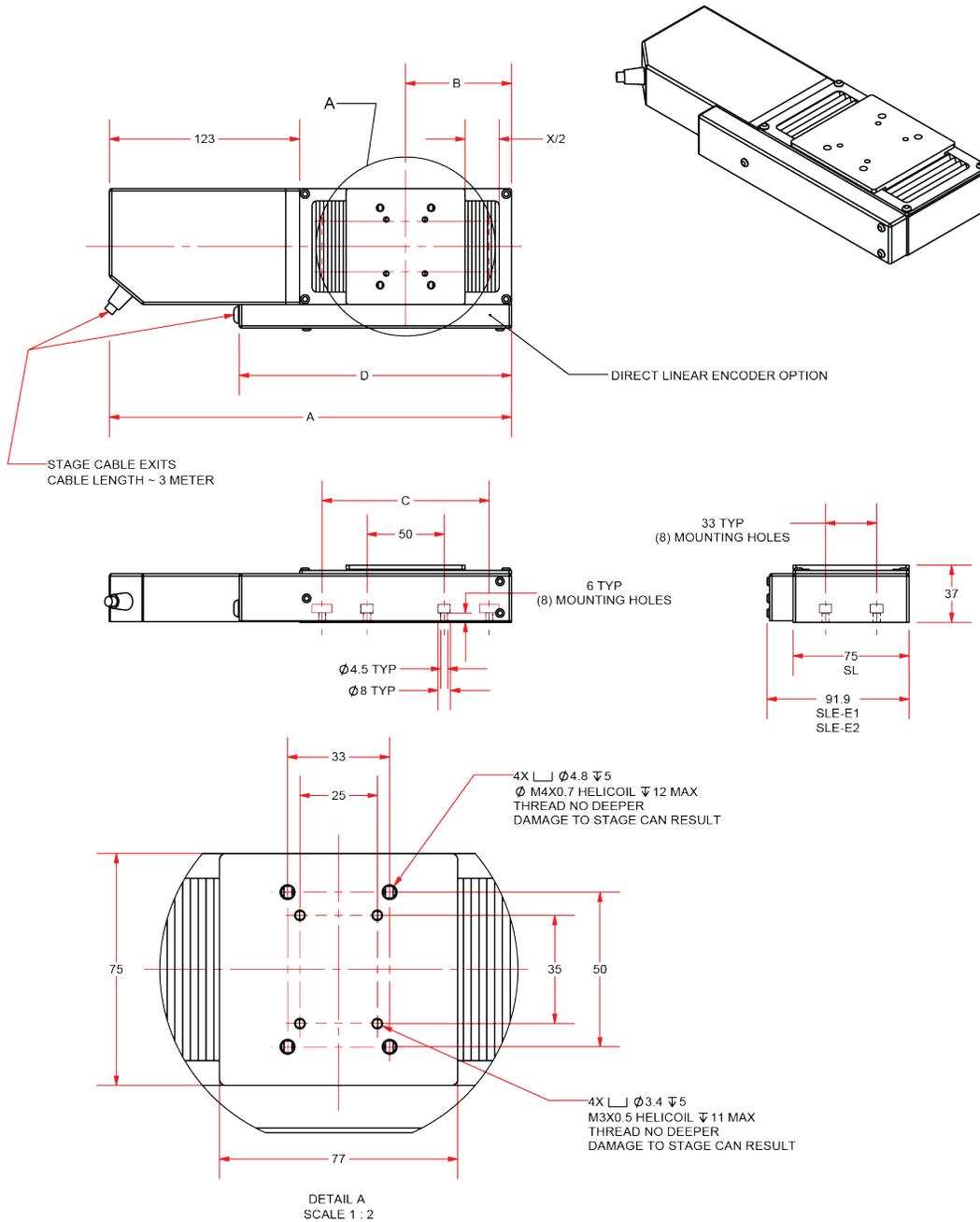
**NOTE:** Aerotech continually improves its product offerings; listed options may be superseded at any time. Refer to the most recent edition of the Aerotech Motion Control Product Guide for the most current product information at [www.aerotech.com](http://www.aerotech.com).



BASIC MODEL	A	B	C	D	X NOMINAL TRAVEL	X ELECTRICAL LIMIT TRAVEL	X MECHANICAL LIMIT TRAVEL
MPS75SL-025	260	68.5	108	176	25	29	34
MPS75SL-050	290	83.5	138	176	50	54	58
MPS75SL-075	320	98.5	125	260	75	79	84
MPS75SL-100	350	113.5	150	260	100	104	108

DIMENSIONS: MILLIMETERS

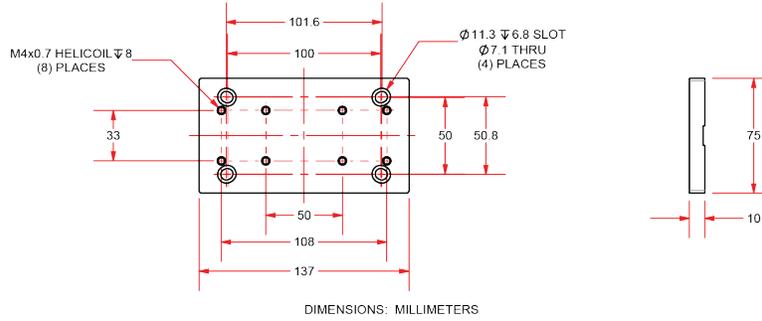
**Figure 2-1: MPS75SL/SLE Dimensions**



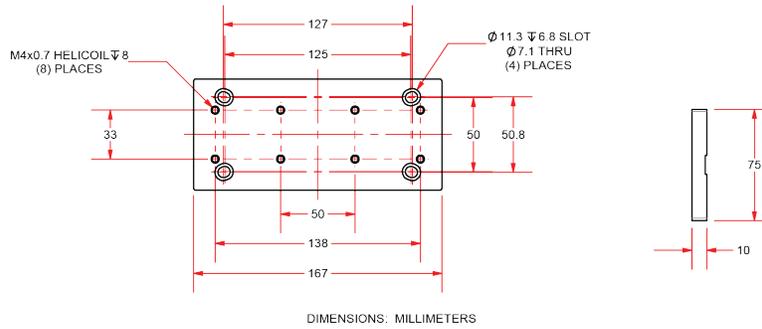
BASIC MODEL	A	B	C	D	X NOMINAL TRAVEL	X ELECTRICAL LIMIT TRAVEL	X MECHANICAL LIMIT TRAVEL
MPS75SL-025	260	68.5	108	176	25	29	34
MPS75SL-050	290	83.5	138	176	50	54	58
MPS75SL-075	320	98.5	125	260	75	79	84
MPS75SL-100	350	113.5	150	260	100	104	108

DIMENSIONS: MILLIMETERS

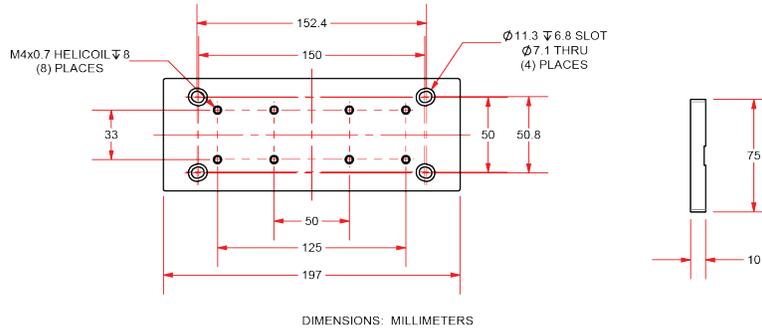
Figure 2-2: MPS75SL/SLE with Bellows Dimensions



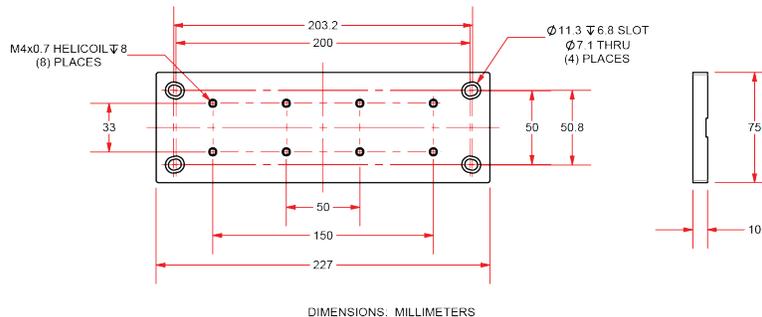
**Figure 2-3: MPS75SL/SLE-025 Mounting Plate Dimensions**



**Figure 2-4: MPS75SL/SLE-050 Mounting Plate Dimensions**



**Figure 2-5: MPS75SL/SLE-075 Mounting Plate Dimensions**



**Figure 2-6: MPS75SL/SLE-100 Mounting Plate Dimensions**

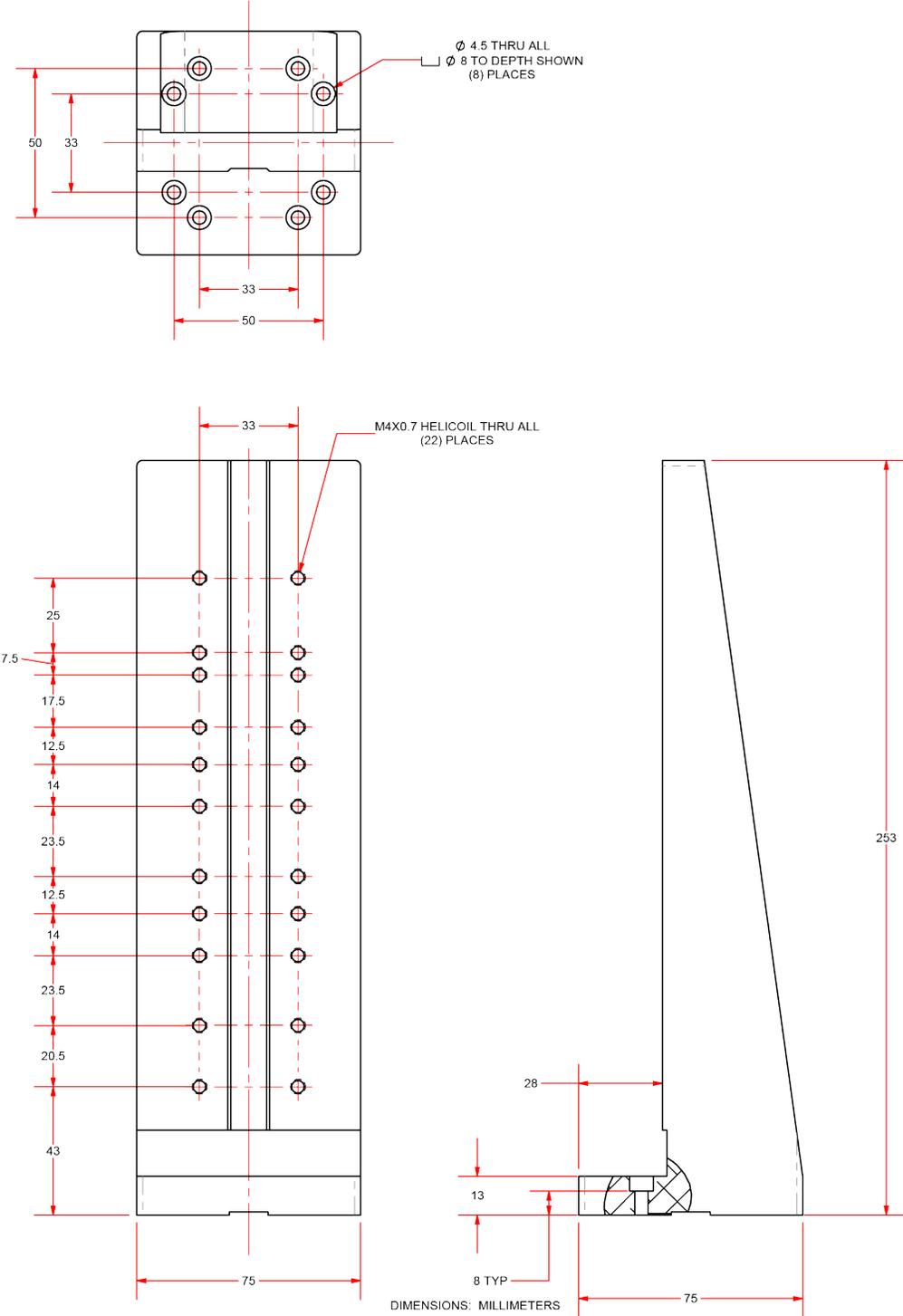


Figure 2-7: MPS75SL/SLE HDZ Angle Bracket Dimensions

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



**WARNING:** The MPS75SL/SLE must be mounted securely. Improper mounting can result in injury and damage to the equipment.

The mounting surface must be flat and have adequate stiffness in order to achieve the maximum performance from the MPS75SL/SLE stage. When it is mounted to a non-flat surface, the stage can be distorted as the mounting screws are tightened. This distortion will decrease overall accuracy. Adjustments to the mounting surface must be done before the stage is secured.

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

**NOTE:** To maintain accuracy, the mounting surface must be flat to within 5 µm.

**NOTE:** The MPS75SL/SLE 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 MPS75SL/SLE. Shimming should be avoided if possible. If shimming is required, it should be minimized to retain maximum rigidity of the system.

Mount the stage to the mounting surface using M4 socket head cap screws (SHCS) in the [QTY 4] outer mounting holes. Additional mounting holes are hidden under the stage table and should only be used for mounting XY assemblies or, in special cases, when advised to by Aerotech. Securing the stage using the inner mounting holes requires special instructions, refer to [Section 2.3.1](#).

Refer to [Section 2.2](#) for the dimension drawing for mounting hole locations and screw lengths.



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



**WARNING:** An unsecured MPS75SL/SLE could be dragged off of a mounting surface by its unsupported cable.

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
MPS75SL Outer Mounting Holes	M4 x 14 mm	2.0 N·m

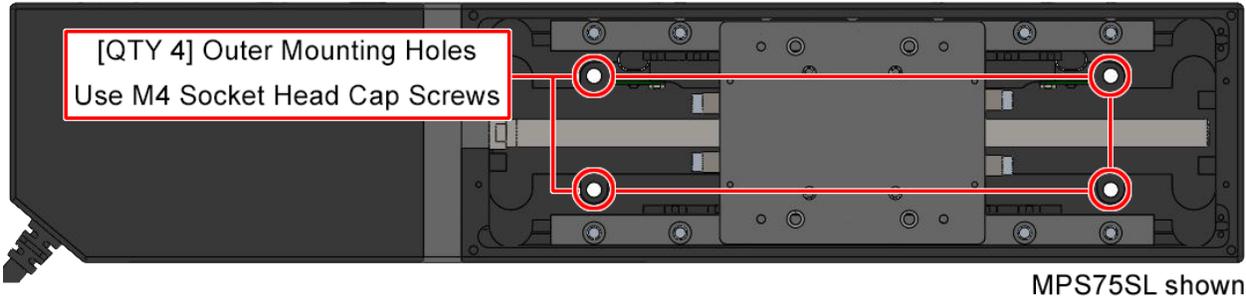


Figure 2-8: MPS75SL/SLE Mounting Hole Locations

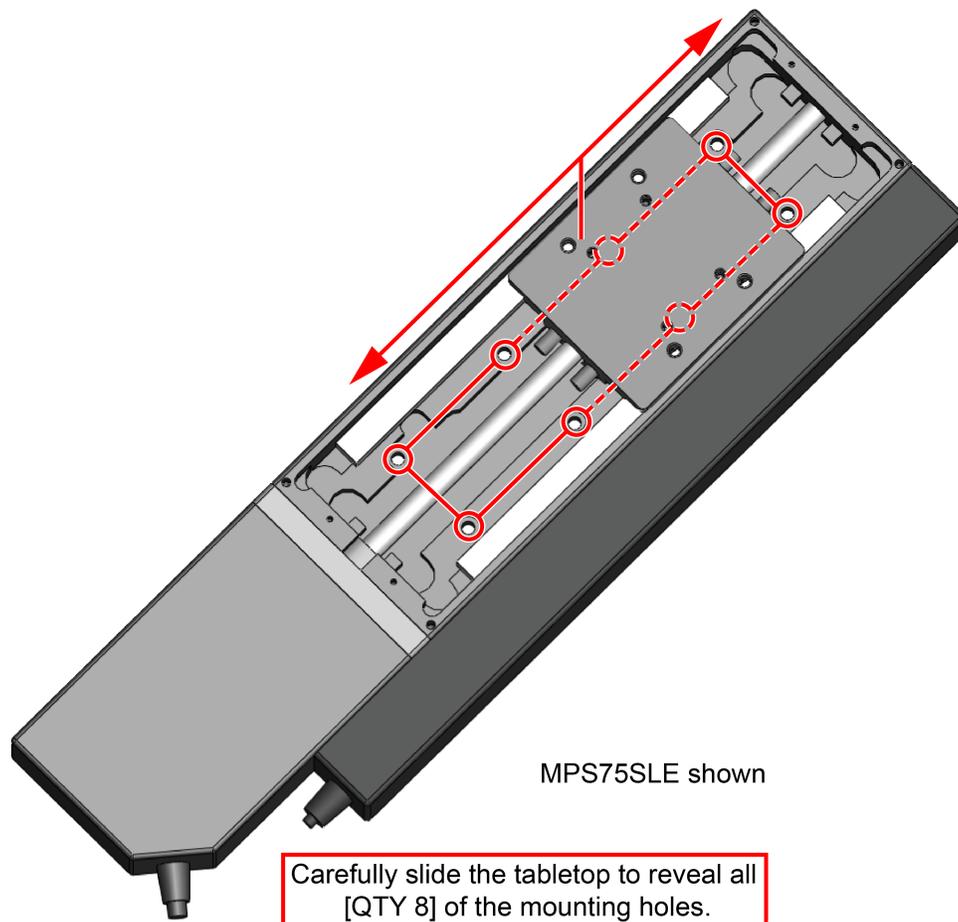
### 2.3.1. For XY Assemblies and Special Cases

To access the inner mounting holes, the stage tabletop must be moved. The following is the procedure for moving the table and mounting the stage (see [Figure 2-9](#)).

**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.

1. Manually move the stage to one end of travel, revealing two of the hidden mounting holes for the stage.
2. Mount the stage to the base with M4 socket head cap screws (SHCS).
3. Once half of the mounting screws have been installed, move the stage to the opposite end of travel to access the remaining screws.
4. Mount the stage to the base using the remaining mounting holes with M4 SHCS.

If the stage is equipped with optional bellows, refer to [Section 4.2.1](#) for bellows disassembly instructions.



**Figure 2-9: Access To All 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 MPS75SL/SLE 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 MPS75SL/SLE 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  $\mu\text{m}$ .

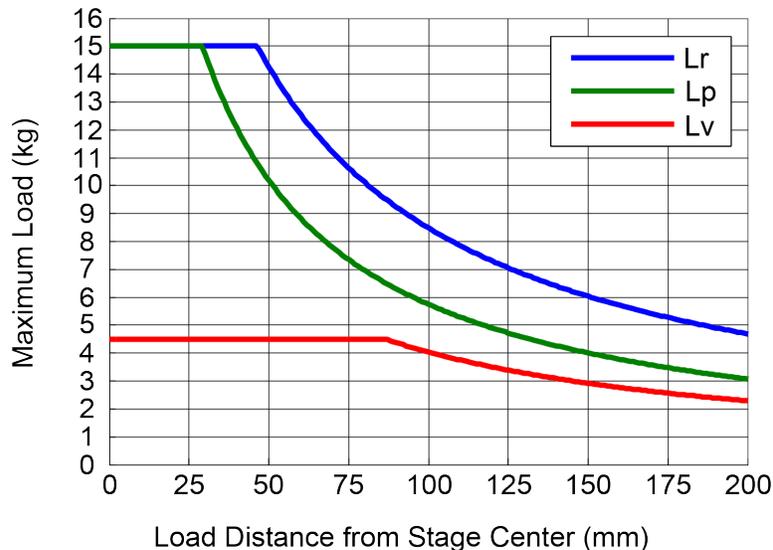


**WARNING:** Refer to the dimensions in [Section 2.2](#) for maximum allowable thread engagement. A screw extending through the stage table can affect travel and damage the stage.

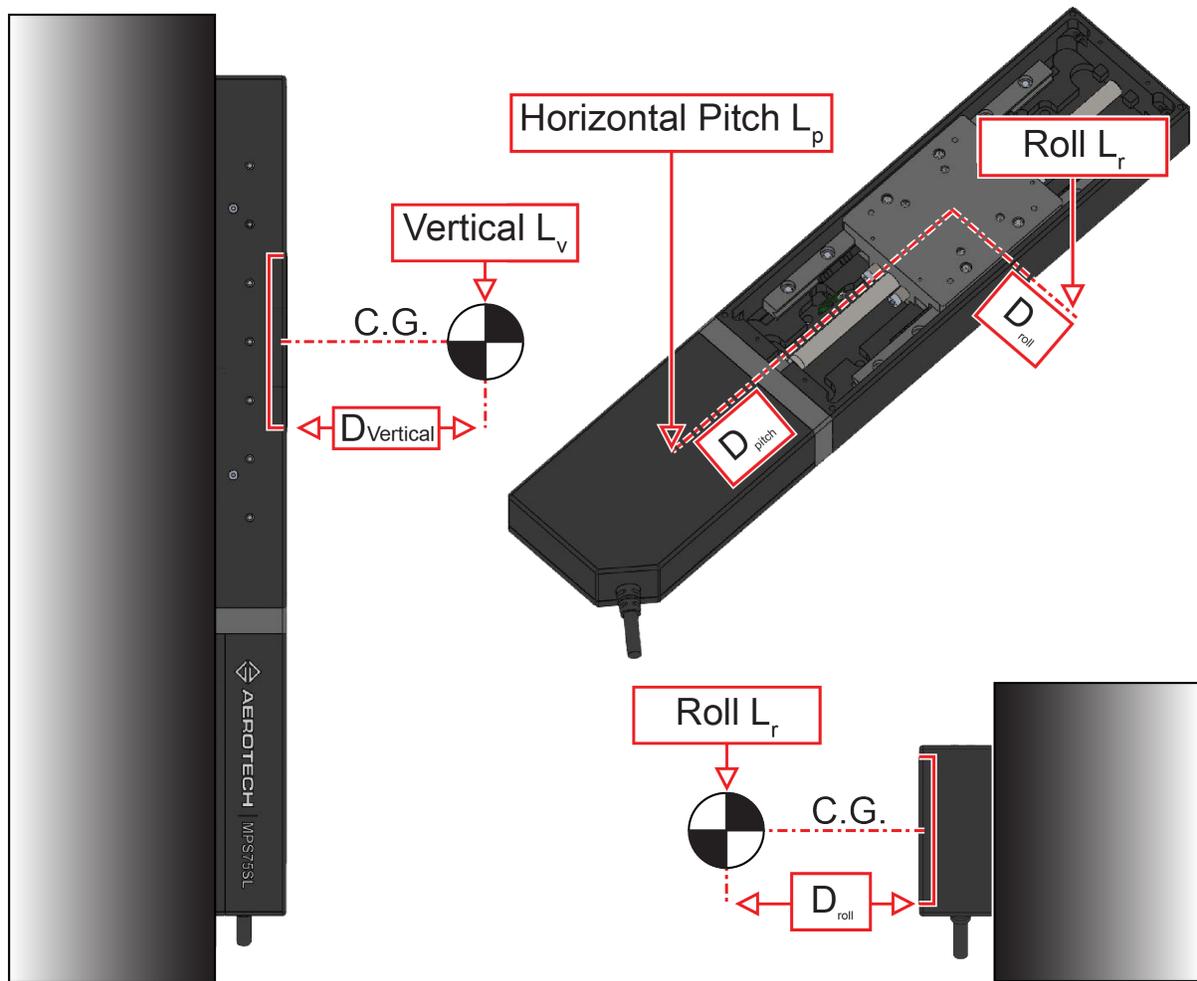
Refer to the dimension drawing in [Section 2.2](#) for mounting hole locations and screw lengths.

Application loads should be symmetrically distributed whenever possible (i.e., the payload should be centered on the stage table and the entire stage should be centered on the support structure). If cantilevered loads are applied, refer to [Figure 2-10](#) to find the maximum allowable load.

In [Figure 2-10](#), three curves are shown for different loading conditions. The vertical curve,  $L_v$ , is for situations where the stage is mounted in a vertical orientation and the payload is mounted to the table top with its center of gravity extended outward. If a cantilevered load situation is used, first determine if it is a pitch cantilever or roll cantilever system based on [Figure 2-11](#). Measure the cantilever length, then find the corresponding load value from [Figure 2-10](#).



**Figure 2-10: Load Capability of MPS75SL/SLE Series Stages**



**Figure 2-11: Stage Orientations**

The approximate amount of torque required to turn the ball screw of an MPS75SL/SLE series stage can be found from [Figure 2-12](#) or the following equation:

$$\text{Torque}_{\text{REQ}} = \frac{(\text{Axial Load}) \times (\text{Lead of Screw})}{2 \times \pi \times (\text{Efficiency})} + (\text{Preload Torque})$$

Where:

Lead of Screw = see [Table 1-3](#)

Efficiency = .90 for ball screws

Moving Mass = 0.3 kg

Preload Torque = 18 Nmm

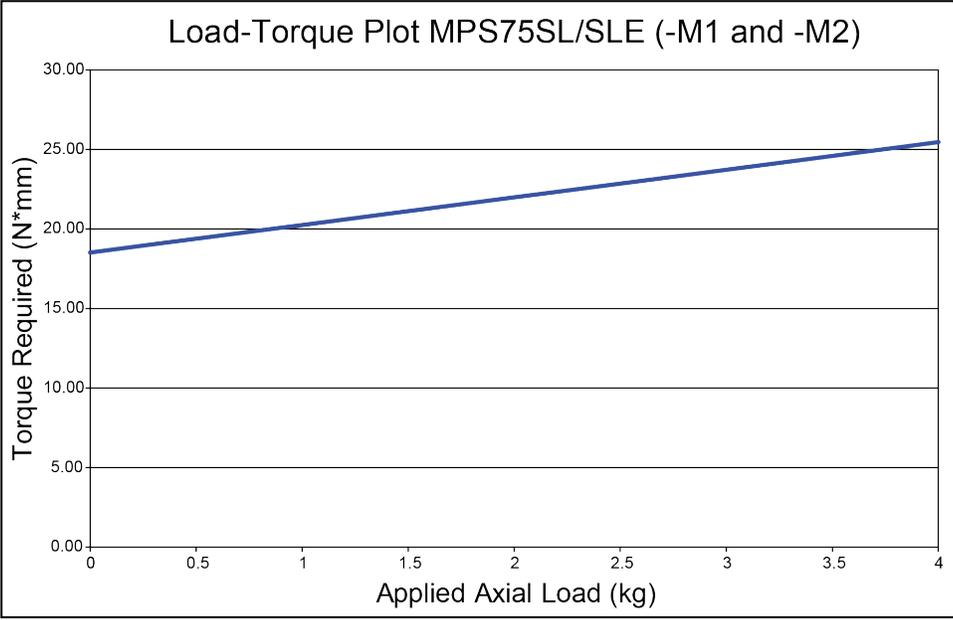


Figure 2-12: Torque Required to Turn Ball Screw in Vertical Orientation

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## Chapter 3: Electrical Specifications and Installation



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

Aerotech motion control systems are adjusted at the factory for optimum performance. When the MPS75SL/SLE is part of a complete Aerotech motion control system, setup usually involves connecting the MPS75SL/SLE 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:** The DC Power supplies for controllers must be double insulated. All Aerotech-provided power supplies are double insulated.

### 3.1. Motor and Feedback Connectors

The MPS75SL/SLE comes from the factory completely wired and assembled. Each MPS75SL/SLE is shipped with documentation regarding the wiring, controller interface connectors, and specifications.

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

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.



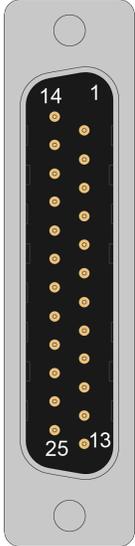
**DANGER:** Remove power before connecting or disconnecting electrical components or cables. Failure to do so may cause electric shock or damage to the equipment.



**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.

**NOTE:** When used with the Lab controller, the 2nd encoder channel will require a second axis and an adapter cable.

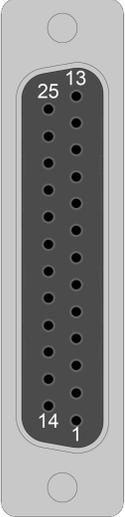
**Table 3-1: 25-Pin D Motor and Feedback Connector Pinouts (-M1 / Motor only for SLE)**

Pin	Description	Connector
1	Connector key (to prevent improper connection)	
2	Cosine-N	
3	Sine-N	
4	Marker-N	
5	Encoder Common	
6	Limit Common	
7	Negative (CCW) hardware limit	
8	Reserved	
9	Reserved	
10	Motor -	
11	Motor +	
12	Reserved	
13	Reserved	
14	Cosine	
15	Sine	
16	Marker	
17	Encoder +5 V	
18	Stage ID	
19	Positive (CW) hardware limit	
20	Reserved	
21	Reserved	
22	Motor -	
23	Motor +	
24	Reserved	
25	Reserved	
Case	Signal shield connection (to case)	

**Table 3-2: 25-Pin D Motor Mating Connector (-M1)**

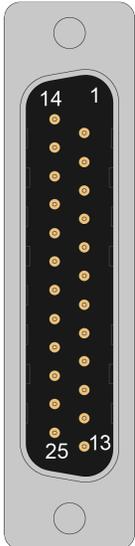
Mating Connector	Aerotech P/N	Third Party P/N
Backshell	ECK01057	TE #5745173-4
Connector	ECK00300	Amphenol #DB25S064 TLF

**Table 3-3: 25-Pin D Motor and Feedback Connector Pinouts (-M1 with -HV Option / SL Only)**

Pin	Description	Connector
1	Reserved	
2	Reserved	
3	Motor +	
4	Motor -	
5	Reserved	
6	Reserved	
7	Negative (CCW) hardware limit	
8	Limit Common	
9	Encoder Common	
10	Marker-N	
11	Sine-N	
12	Cosine-N	
13	Reserved	
14	Reserved	
15	Reserved	
16	Motor +	
17	Motor -	
18	Reserved	
19	Reserved	
20	Positive (CW) hardware limit	
21	Stage ID	
22	Encoder +5 V	
23	Marker	
24	Sine	
25	Cosine	
Case	Signal shield connection (to case)	

1. Vacuum stages require a double-male bulkhead adapter (through the vacuum chamber wall) to mate to our standard cables.

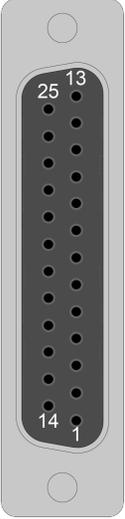
**Table 3-4: 25-Pin D Motor and Feedback Connector Pinouts (-M2 / Motor only for SLE)**

Pin	Description	Connector
1	Connector key (to prevent improper connection)	
2	Reserved	
3	Reserved	
4	Reserved	
5	Encoder Common	
6	Limit Common	
7	Negative (CCW) hardware limit	
8	Reserved	
9	Reserved	
10	Motor Return	
11	Motor Phase A	
12	Motor Phase B	
13	Reserved	
14	Reserved	
15	Reserved	
16	Reserved	
17	Encoder +5 V	
18	Stage ID	
19	Positive (CW) hardware limit	
20	Reserved	
21	Reserved	
22	Motor Return	
23	Motor Phase A	
24	Motor Phase B	
25	Reserved	
Case	Signal shield connection (to case)	

**Table 3-5: 25-Pin D Motor Mating Connector (-M2)**

Mating Connector	Aerotech P/N	Third Party P/N
Backshell	ECK01057	TE #5745173-4
Connector	ECK00300	Amphenol #DB25S064 TLF

**Table 3-6: 25-Pin D Motor and Feedback Connector Pinouts (-M2 with -HV Option / SL Only)**

Pin	Description	Connector
1	Reserved	
2	Motor Phase B	
3	Motor Phase A	
4	Motor Return	
5	Reserved	
6	Reserved	
7	Negative (CCW) hardware limit	
8	Limit Common	
9	Encoder Common	
10	Reserved	
11	Reserved	
12	Reserved	
13	Reserved	
14	Reserved	
15	Motor Phase B	
16	Motor Phase A	
17	Motor Return	
18	Reserved	
19	Reserved	
20	Positive (CW) hardware limit	
21	Stage ID	
22	Encoder +5 V	
23	Reserved	
24	Reserved	
25	Reserved	
Case	Signal shield connection (to case)	

1. Vacuum stages require a double-male bulkhead adapter (through the vacuum chamber wall) to mate to our standard cables.

**Table 3-7: 15-Pin D Feedback Connector Pinouts (MPS75SLE)**

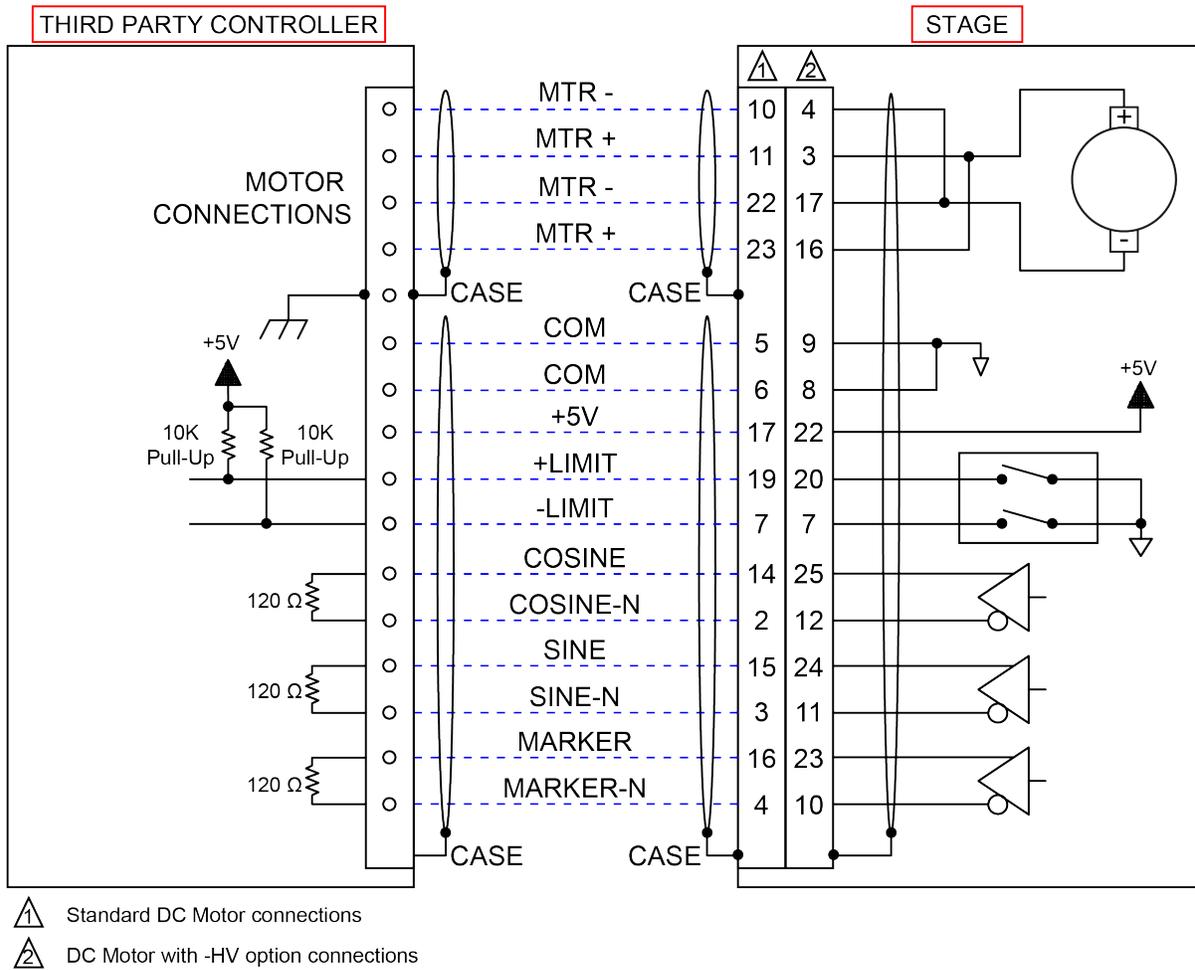
Pin	Description	Connector
1	Reserved	
2	Signal Common	
3	Reserved	
4	Marker-N	
5	Cosine-N	
6	Sine-N	
7	Encoder +5 V	
8	Encoder +5 V	
9	Signal Common	
10	CW/+LMT	
11	CCW/-LMT	
12	Marker	
13	Cosine	
14	Sine	
15	Reserved	
Case	Signal shield connection (to case)	

**Table 3-8: 15-Pin D Feedback Mating Connector**

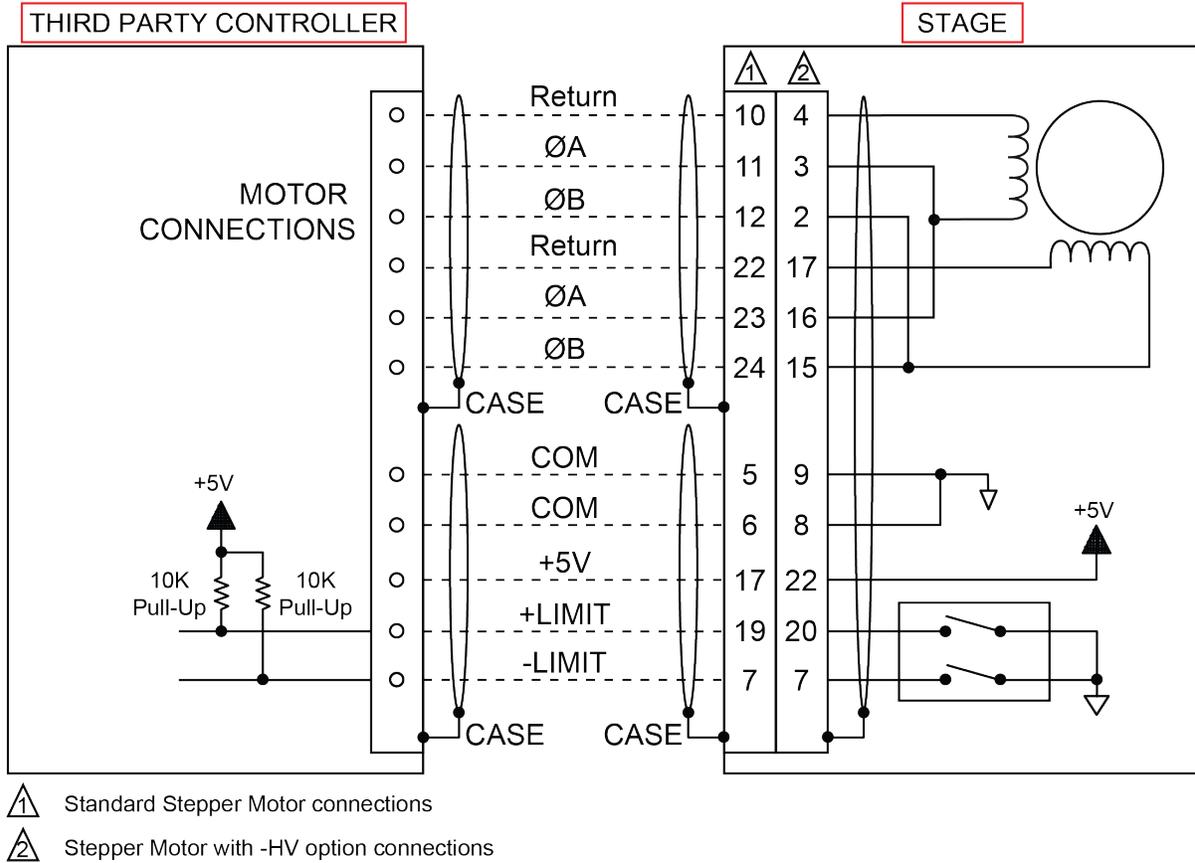
Mating Connector	Aerotech P/N	3rd Party P/N
Backshell	ECK01022	Amphenol 17E-1725-2
Connector	ECK00326	Amphenol DA15S064TLF

### 3.2. Motor and Feedback Wiring

Shielded cables are required for the motor and feedback connections.



**Figure 3-1: Motor and Feedback Wiring (-M1 Option)**



**Figure 3-2: Motor and Feedback Wiring (-M2 Option)**

### 3.3. Motor and Feedback Specifications

**Table 3-9: Feedback Specifications**

Encoder Specifications	
Supply Voltage	5 V $\pm$ 5%
Supply Current	100 mA Typical
Output Signals	<b>Sinusoidal Type (Incremental Encoder) (SLE only):</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.)
	<b>Digital Output (Incremental Encoder):</b> RS422/485 compatible
Limit Switch Specifications	
Supply Voltage	5 V
Supply Current	25 mA
Output Type	Open Collector
Output Voltage	5 V
Output Current	10 mA (sinking)
Output Polarity	Normally Closed (NC) <ul style="list-style-type: none"> <li>• Sinks current to ground (Logic "0") when not in limit</li> <li>• High impedance (Logic "1") when in limit</li> <li>• Requires external pull-up to +5 V (10 k<math>\Omega</math> recommended)</li> </ul>
<b>Notes:</b> <ul style="list-style-type: none"> <li>• If the MPS75SL/SLE is driven beyond the electrical limit, it will encounter a mechanical stop. Impacting the mechanical stop could cause damage to the stage even at low speeds.</li> </ul>	

**Table 3-10: DC Motor Specifications**

	DC Motor
Stall Torque, Continuous	0.040 N·m
Peak Torque	0.28 N·m
Maximum Speed	5800 rpm
Peak Current	8.0 A
Continuous Stall Current	1.2 A
Torque Constant	0.03867 N·m/A
Terminal Resistance	2.98 Ohm
BEMF Constant	4.05 V/krpm
Inductance	0.000365 H
Rotor Moment of Inertia	1.70E-06 kg·m <sup>2</sup>
Recommended Bus Voltage	24 V
Maximum Terminal Voltage	48 V
Motor Constant	0.021 Nm/√w
1. This table specifies the motors themselves. The stage has an additional gear ratio as listed in <a href="#">Table 1-3</a> .	

**Table 3-11: Stepper Motor Specifications**

	Stepper Motor
Stall Torque	0.13 N·m
Rated Phase Current	1.3 A
Recommended Bus Voltage	24 V
Rotor Inertia	1.80E-06 kg·m <sup>2</sup>
Full Step Angle	1.8°
Phase Resistance	1.9 Ohm
Phase Inductance	0.0017 H
Maximum Speed	1800 rpm
1. This table specifies the motors themselves. The stage has an additional gear ratio as listed in <a href="#">Table 1-3</a> .	



**WARNING:** The motor case temperature may exceed 75°C.

**Table 3-12: Encoder Specifications (MPS75SL)**

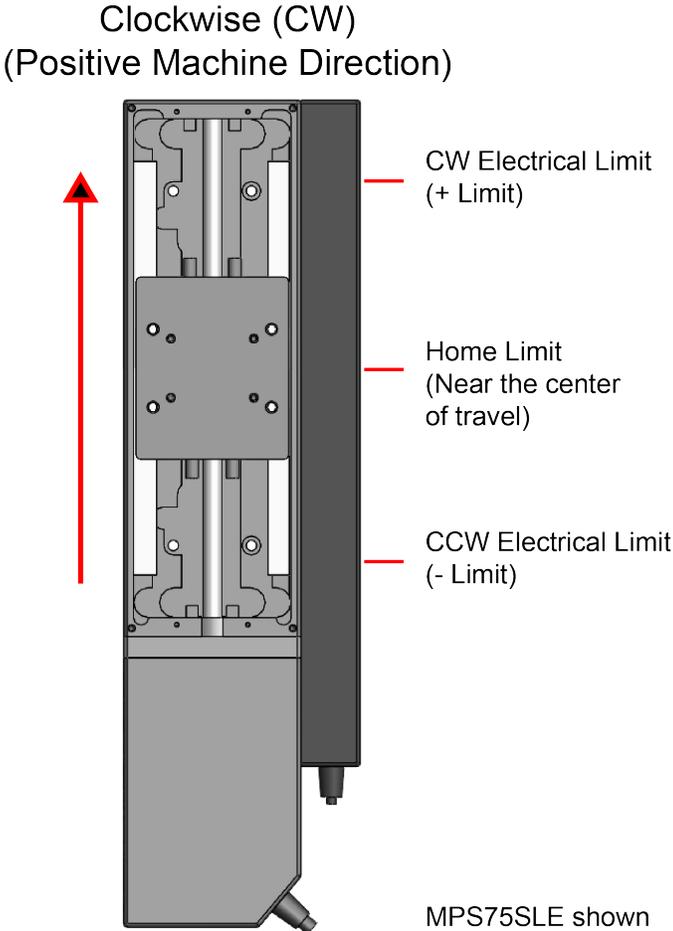
	DC Motor	Stepper Motor
Feedback	10,000 lines/rev Rotary Encoder	N/A
Maximum Bus Switch	48 VDC	48 VDC <sup>(1)</sup>

**Table 3-13: Encoder Specifications (MPS75SLE)**

	DC Motor	Stepper Motor
Feedback (Linear Encoder)	Noncontact linear encoder; Amplified sine and TTL (50 nm) versions available	
Feedback (Rotary Encoder)	10,000 lines/rev rotary encoder	N/A
Rotary encoder electronic resolution	0.025 $\mu\text{m}$	0.025 $\mu\text{m}$ @ 40,000 steps/rev motor resolution
Linear encoder electronic resolutions	-E1 option allows for electronic resolutions below 1 nm <sup>(1)</sup> -E2 option: 20 $\mu\text{m}$ fundamental 0.05 $\mu\text{m}$	
1. For optimum performance, Aerotech recommends using 0.025 $\mu\text{m}$ as the highest-resolution when using the linear encoder as part of the servo feedback loop (ex: dual-loop).		

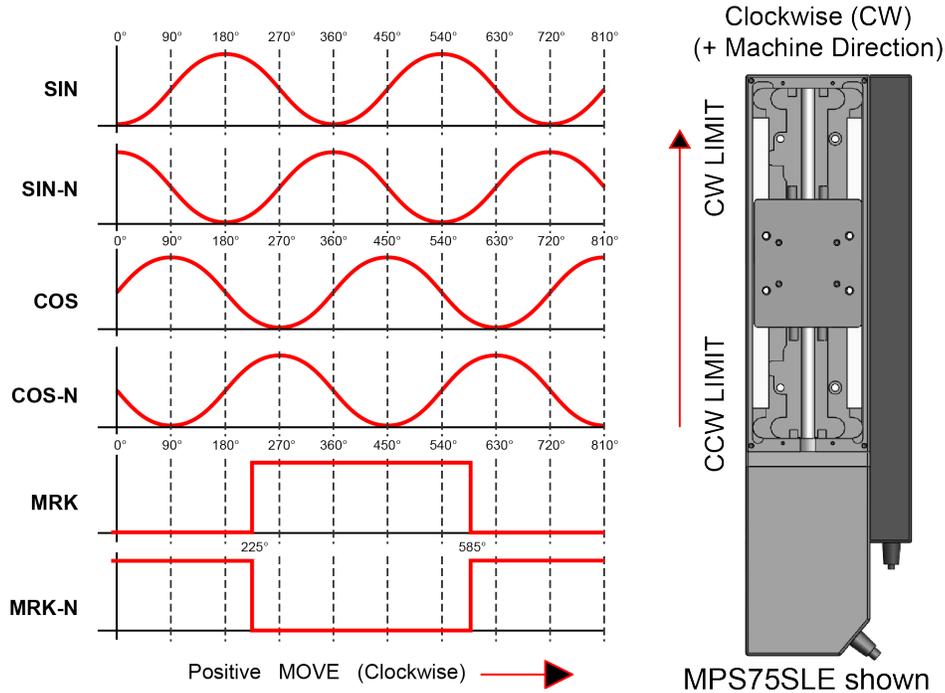
### 3.4. Limits, Marker, and Machine Direction

Aerotech stages are configured to have positive and negative "machine" directions. The machine direction defines the phasing of the feedback and motor signals and is dictated by the stage wiring (refer to [Section 3.5](#) for Motor and Feedback phasing information). Programming direction of a stage is set by the controller that is used to move the stage. Programming direction is typically selectable in the controller, while machine direction is hardwired in the stage. [Figure 3-3](#) shows the machine direction of MPS75SL/SLE stages.

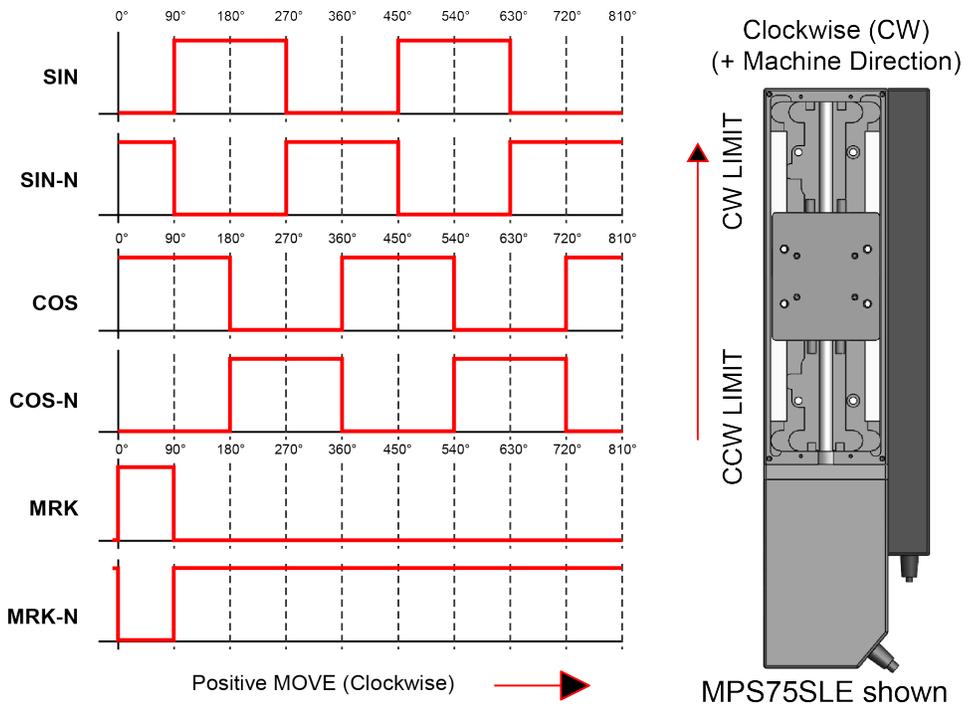


**Figure 3-3: Machine Direction**

### 3.5. Motor and Feedback Phasing



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



**Figure 3-5: Encoder Phasing Reference Diagram (Standard)**

## Chapter 4: Maintenance

This chapter provides information about intervals between lubrications, details of the lubrication and inspection process, and recommendations of lubricants for use.

**NOTE:** The bearing area must be kept free of foreign matter and moisture; otherwise, the performance and life expectancy of the stage will be reduced. Always operate the stage with the hard cover and side seals in place to help keep dirt out.



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

### 4.1. Service and Inspection Schedule

Lubricant inspection and replenishment in MPS75SL/SLE series stages depends on conditions such as duty cycle, speed, and the environment. An inspection interval of once per month is recommended until a trend develops for the application. Longer or shorter intervals may be required to maintain the film of lubricant on the bearing surfaces.

If the application process uses only a small portion of travel for most of the duty cycle, periodically drive the stage through full travel to redistribute the lubrication in the bearings and ball screw. The ball screw end bearings and motor bearings are sealed, and should not need to be relubricated under normal use.

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 MPS75SL/SLE and any components and cables as needed.
- Repair any damage before operating the MPS75SL/SLE.
- Inspect and perform an operational check on all safeguards and protective devices.

## 4.2. Cleaning and Lubrication



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



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

### Cleaning

Before using a cleaning solvent on any part of the MPS75SL/SLE, blow away small particles and dust with nitrogen or, less preferably, clean, dry, compressed air.

Any external metal surface of the MPS75SL/SLE can be cleaned with isopropyl alcohol on a lint-free cloth. Harsher solvents, such as acetone, may damage the plastic and rubber seals on the ball screw or damage the cross-roller bearing cages. If acetone is required, avoid the screw and bearing seals. Acetone can also damage the black paint on the motor and encoder covers



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

### Lubrication

Take the opportunity during the lubrication procedure to inspect the precision rail guides for any damage or signs of wear.

For standard applications, use NSK LG2 grease on the precision rail guides and ball screw. For vacuum applications, refer to the vacuum guidelines in [Section 1.4](#) for the appropriate grease. Only use the specified grease as other greases may be incompatible.

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

For high-speed applications (i.e., near maximum speed at a duty cycle of 50%), frequent maintenance with standard lubricants is required.

**NOTE:** Removing the upper axis on an XY, XZ, or YZ system will alter a precision alignment. Do not remove the upper axis for lubrication and cleaning if possible.

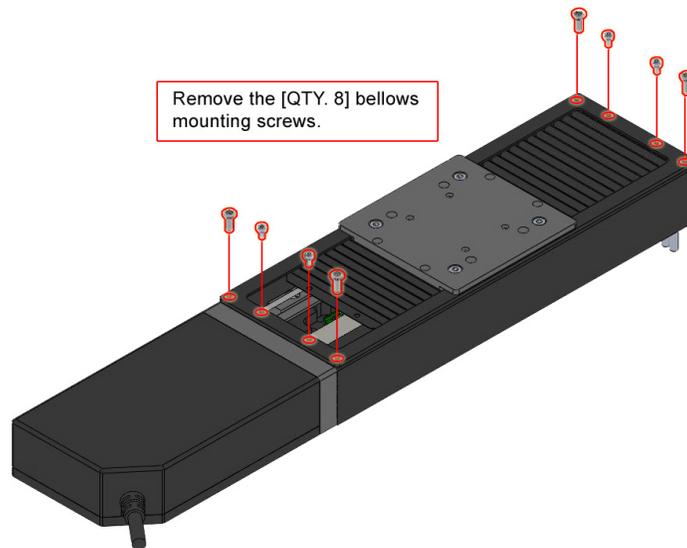
1. Drive the carriage to one end of travel, and remove power from the stage. If the stage is equipped with the optional bellows, the bellows will have to be compressed to access the inside of the assembly (refer to [Section 4.2.1](#) for bellows disassembly instructions).
2. Blow off the interior of the stage with clean, dry compressed air or nitrogen.
3. Remove all dirty or dried lubricant from the drive screw and the precision rail guides. Use a small application of isopropyl alcohol with a clean, lint-free cloth or cotton swab.
4. Using a grease syringe, apply an approximate 2 mm diameter bead of lubricant to the drive screw threads and precision rail guides.
5. Manually move the carriage to the opposite end of travel. Then repeat Steps 2 through 4 for the opposite sides of the bearing rails.
6. Manually move the carriage through full travel three or more times to distribute the lubricant.
7. Repeat the grease application process three more times to reach the total replacement grease quantity.
8. Restore power to the stage.

### 4.2.1. Bellows Removal for Re-Lubrication

For stages with the -BL option, the bellows will need to be removed to gain access to the ball screw and precision rail guides.

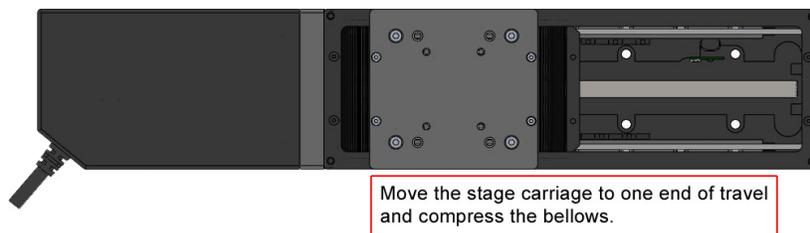
**NOTE:** Removing the upper axis on an XY, XZ, or YZ system will alter a precision alignment. Only remove the bellows on each axis and follow for re-lubrication.

1. Begin by removing power from the stage.
2. Unbolt the bellows from the stage endplates.



**Figure 4-1: Remove the Bellows Bolts**

3. Move the stage carriage to one end of travel and compress the bellows to gain access to the ball screw and precision rail guides.



**Figure 4-2: Slide the Stage Carriage and Bellow Compression**

4. Follow the steps outlined in [Section 4.2](#).
5. Move the stage carriage to the opposite end of travel and repeat the process on the newly exposed track.
6. After you have completed re-lubrication, reattach the bellows to the stage end plates and restore power to the stage.

### 4.3. Bellows Installation



**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.

1. Remove power from the stage.
2. Remove the (4) screws from the bottom of the stage that attach the motor cover. Remove the motor cover.

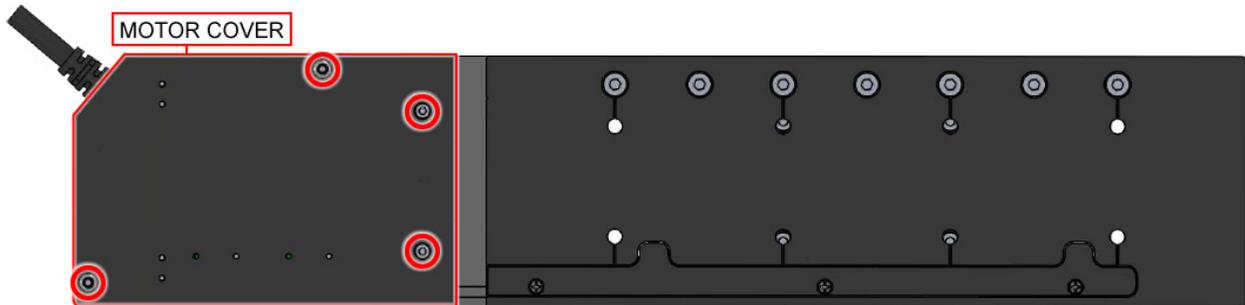


Figure 4-3: Motor Cover Screw Location

3. Slide the two bellows support rods through the holes in the motor adapter plate. The ends of the bellows support rods fit into machined slots in the opposite end of the stage. Screw (2) M4 setscrews in the same two holes to push the bellows support rods from the ends – do not over tighten or the rods will bow.

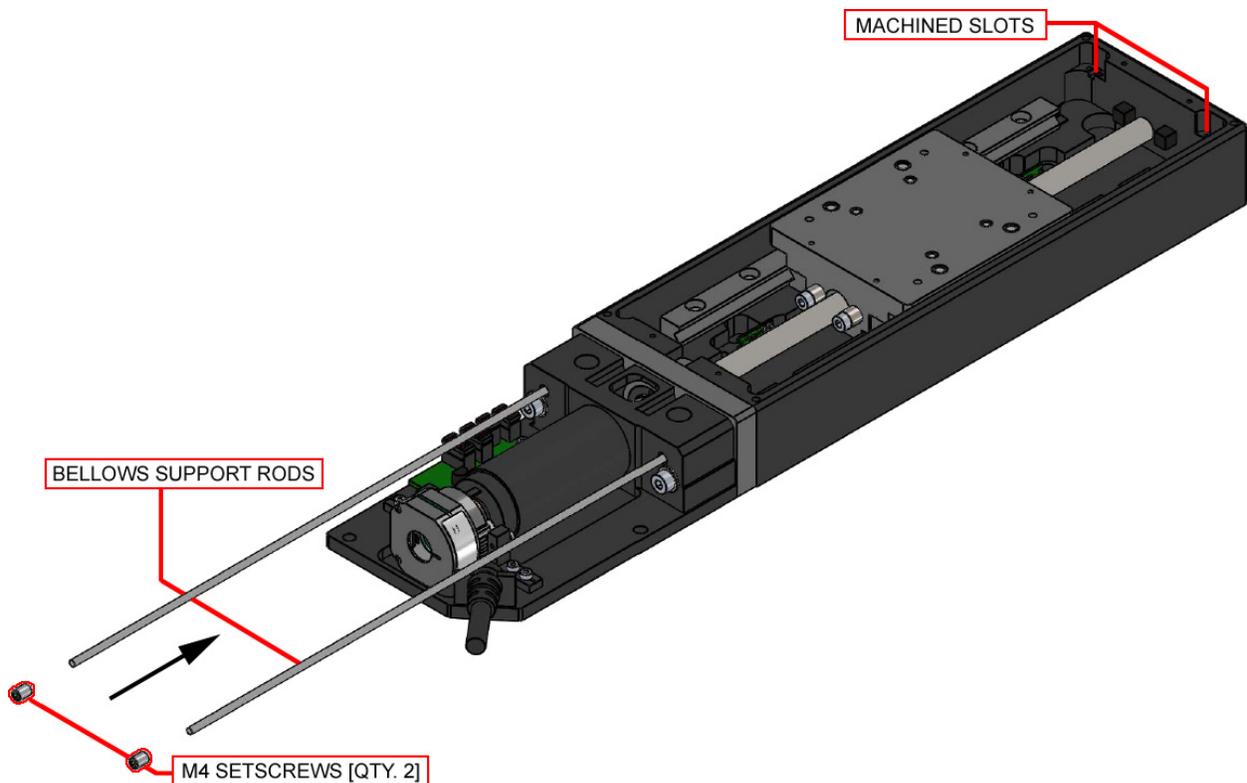


Figure 4-4: Bellows Support Rods

4. Use (4) M2 socket head cap screws to secure the opposite ends of the bellow support rods.

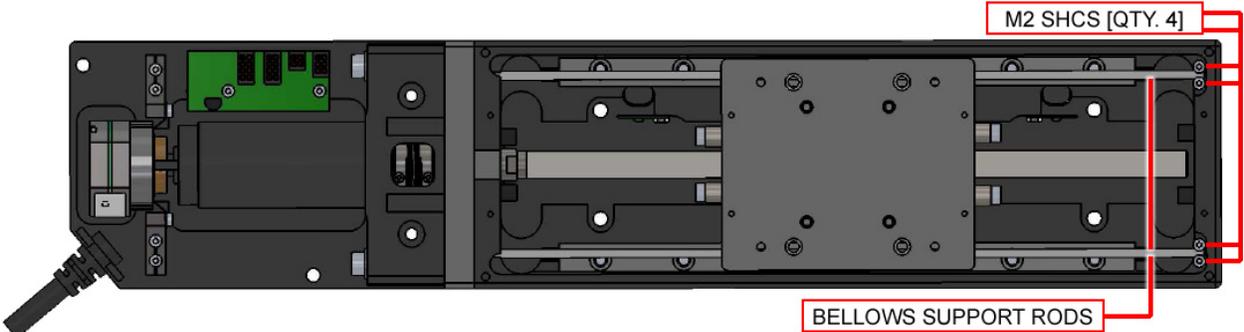


Figure 4-5: Secure the Bellows Support Rods

5. Attach the bellows to the ends of the stage and to the carriage using (8) M2 socket head cap screws. Ensure that the bellows are aligned to the stage travel.

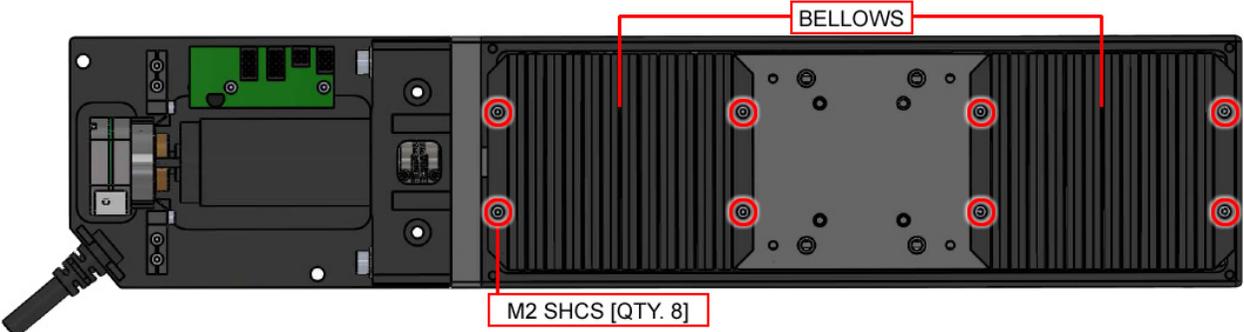


Figure 4-6: Attach the Bellows

6. Attach the bellows cover using (4) M3 button head cap screws.

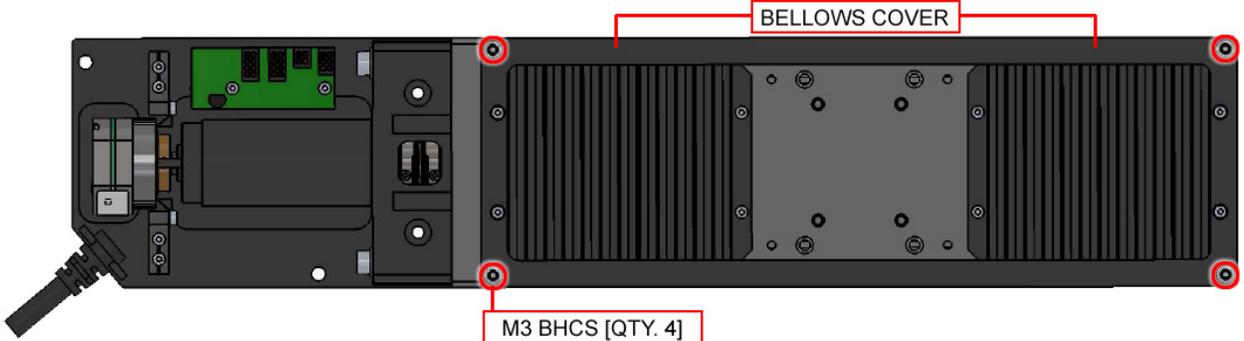
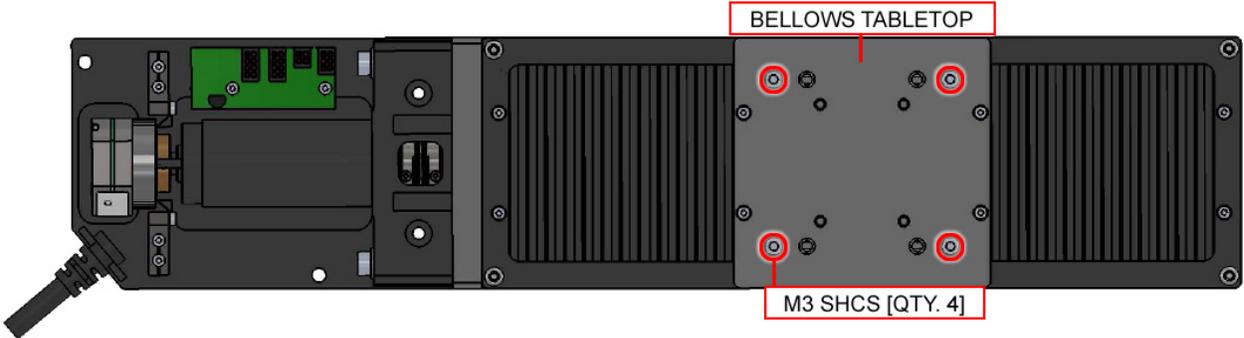


Figure 4-7: Attach the Bellows Cover

7. Attach the bellows tabletop to the carriage using (4) M3 socket head cap screws.



**Figure 4-8: Attach the Bellows Tabletop**

8. Re-install the motor cover (refer to [Figure 4-3](#)) ensuring that no wires are pinched or in the way. Do not over-tighten the screws that secure the motor cover because the cover is made of thin material and could become damaged.

## 4.4. Troubleshooting

Table 4-1: Troubleshooting

Symptom	Possible Cause and Solution
Stage will not move	Brake not released (if equipped with brake; refer to stage documentation). In Limit condition. Check limits (refer to <a href="#">Chapter 3</a> ) and refer to the Controller documentation for polarity and compatibility requirements (Example: voltage requirements). Controller trap or fault (refer to the Controller documentation).
Stage moves uncontrollably	Encoder (sine and cosine) signal connections (refer to <a href="#">Chapter 3</a> and Controller documentation). Motor Connections (refer to <a href="#">Chapter 3</a> and the Controller documentation).
Stage oscillates or squeals	Gains misadjusted (refer to the Controller documentation). Encoder signals (refer to the 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	Updated vacuum baking temperature: <a href="#">Section 1.4.</a>
1.02.00	<ul style="list-style-type: none"><li>• General revision / Product redesign</li><li>• New configuration (SL and SLE)</li><li>• Model numbers and ordering options updated: <a href="#">Table 1-1</a></li><li>• Basic specifications updated: <a href="#">Section 1.3.</a></li></ul>
1.01.00	<ul style="list-style-type: none"><li>• Updated Standard Motor Wiring</li><li>• Updated Electrical Specifications</li><li>• Updated Dimensions</li><li>• Updated Basic Specifications</li><li>• Updated safety information</li></ul>
1.00.00	New Manual

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