



PRO165SV Hardware Manual

Revision: 1.00.00



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Safety Procedures and Warnings

This manual tells you how to carefully and correctly use and operate the PRO165SV. Read all parts of this manual before you install or operate the PRO165SV 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.

NOTE: Aerotech continually improves its product offerings; listed options may be superseded at any time.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 for the most up-to-date information.



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 PRO165SV 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 PRO165SV must be mounted securely. Improper mounting can result in injury and damage to the equipment.
5. Use care when moving the PRO165SV. Lifting or transporting the PRO165SV improperly can result in injury or damage to the PRO165SV.
6. The motor case temperature may exceed 75°C.
7. Operators must be trained before operating this equipment.
8. All service and maintenance must be performed by qualified personnel.

EU Declaration of Incorporation

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

herewith declares that the product:

PRO165SV 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

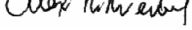
it is not allowed to put the equipment into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of the Directive 2006/42/EC and with national implementing legislation, for example, as a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

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

2011/65/EU

RoHS 2 Directive

Authorized Representative: Simon Smith, European Director
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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 for the most up-to-date information.

Table 1-1: Model Numbers and Ordering Options

PRO165SV Long-Travel Lift Stage	
Feedback (Required)	
-E1	Rotary incremental encoder, 1 Vpp
-E2	Rotary incremental encoder, digital RS-422
-E3	Direct linear encoder, 1 Vpp + rotary encoder, 1 Vpp (dual-loop)
-E4	Direct linear encoder, 1 Vpp + rotary encoder, digital RS-422 (dual-loop)
-E5	Direct linear encoder, digital RS-422 + rotary encoder, 1 Vpp (dual-loop)
-E6	Direct linear encoder, digital RS-422 + rotary encoder, digital RS-422 (dual-loop)
-E7	Absolute linear encoder + rotary encoder, 1 Vpp (dual-loop)
Tabletop (Optional)	
-TT3	Accessory tabletop with mounting for select rotary stages
Brake (Optional)	
-BK	Holding Brake
ThermoComp (Optional)	
-TCMP	ThermoComp integrated thermal compensation
Metrology (Required)	
-PL0	No metrology performance plots
-PL1	Metrology, uncalibrated with performance plots
-PL2	Metrology, calibrated (HALAR) with performance plots

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

Ambient Temperature	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
Humidity	Operating: 20% to 60% RH
	Storage: 10% to 70% RH, non-condensing in original packaging. The stage should be packaged with desiccant if it is to be stored for an extended time.
Altitude	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.
Vibration	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.
Protection Rating	The PRO165SV stages have limited protection against dust, but not water. This equates to an ingress protection rating of IP50.
Use	Indoor use only

1.2. Accuracy and Temperature Effects

The accuracy specification of PRO165SV series stages is measured 35 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 specifications in [Section 1.3](#) assume a 20 °C operating environment.

If the temperature of the ball screw in the stage is not 20 °C, a scale error will occur. The speed and duty cycle of the stage have an effect on the temperature of the screw. Faster movement and higher duty cycle increase heat and change the accuracy of the stage. The thermal expansion coefficient of the screw is 11.7 ppm for each degree Celsius. For stages with a linear encoder, the scale will expand or contract at a rate of 10.1 ppm for each degree Celsius.

The ThermoComp™ option uses the A3200 controller to sense and compensate for thermal changes. ThermoComp™ compensates for self-heating and environmental temperature changes.

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 for the most up-to-date information.

Resolution is dependent on pitch, encoder resolution, and controller interpolation.

Table 1-3: PRO165SV Series Specifications

		PRO165SV-020
Travel		20 mm
Accuracy ⁽¹⁾	Standard	±4 µm
	Calibrated	±0.75 µm
	Calibrated, Linear Encoder	±0.5 µm
Resolution (Min. Incremental Motion)	Rotary Encoder	0.025 µm ⁽²⁾
	Linear Encoder	0.010 µm ⁽³⁾
Bidirectional Repeatability ⁽¹⁾	Rotary Encoder	±0.5 µm
	Linear Encoder	±0.15 µm
Straightness		±3 µm
Pitch		50 µrad (10 arc sec)
Roll		50 µrad (10 arc sec)
Yaw		25 µrad (5 arc sec)
Maximum Speed ⁽⁴⁾		10 mm/s
Load Capacity ^(5,6)		20 kg
Stage Mass ⁽⁷⁾		5.4 kg
Material		Anodized Aluminum
<p>NOTE: Specifications are for single-axis systems measured 35 mm above the tabletop. Performance of multi-axis systems depends on payload and workpoint. Consult factory for details.</p> <p>1. Certified with -PL1/-PL2 options.</p> <p>2. With 1 Vpp amplified sine rotary encoder (-E1 feedback option) and linear amplifier.</p> <p>3. With 1 Vpp amplified sine linear encoder (-E3, -E4 feedback options) and linear amplifier.</p> <p>4. Requires the selection of an appropriate amplifier with sufficient voltage and current.</p> <p>5. Axis orientation for on-axis loading is listed.</p> <p>6. A holding brake (-BK option) is recommended when the payload exceeds 75% of the load capacity as a precaution in the event that power to the stage is unexpectedly lost.</p> <p>7. Excludes tabletop and brake options.</p>		

1.4. Vacuum Operation

Aerotech can specially prepare the PRO165SV for operation in vacuum environments. Aerotech offers two vacuum preparation options; one for low vacuum (for use in atmospheric pressures to 10^{-3} torr) and one for high vacuum (preparation for environments from 10^{-3} to 10^{-6} torr). As part of this preparation, attention to detail during modification, cleaning, and assembly results in products with optimal performance in vacuum applications.

To make sure that the PRO165SV will continue to perform well in the vacuum environment, use the guidelines that follow (in addition to standard handling, installation, and lubrication guidelines outlined in this manual).

1. Do not remove the PRO165SV from its sealed bag until it is ready to use.
2. Always handle the PRO165SV in a clean environment and use powder-free polyethylene gloves to prevent any contaminants from adhering to the surface of the PRO165SV.
3. During installation, use cleaned, vented, stainless steel fasteners when securing the PRO165SV.
4. Reduced air pressure eliminates significant convective heat transfer. This, coupled with the viscous vacuum-compatible lubricants, could result in excessive motor operating temperatures. Because of this, consider all continuous torque ratings to be 40 to 60% lower than the value specified for operation in normal atmospheric environment. Reduce motor usage accordingly.
5. For vacuum applications, the recommended lubricant is a small quantity of **Braycote® 602EF** grease or a compatible substitute of equal quality.
6. Baking vacuum components between 100 and 125 °C for 24 to 48 hours significantly reduces outgassing at initial pump-down to vacuum pressure and evaporates water vapor that impregnates porous surfaces on the aluminum and Teflon cables. Aerotech recommends that customers bake out vacuum systems when first installing them in the vacuum chamber.

Chapter 2: Mechanical Specifications and Installation



WARNING: PRO165SV installation must be in accordance to instructions provided by this manual and any accompanying documentation. Failure to follow these instructions could result in injury or damage to the equipment.

2.1. Unpacking and Handling the Stage



WARNING: It is the customer's responsibility to safely and carefully lift and move the PRO165SV.

- Secure all moving parts before lifting or moving the PRO165SV to a new location. Unsecured moving parts could shift and cause bodily injury.
- Improper handling could adversely affect the performance of the PRO165SV. Use care when moving the PRO165SV.

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

Carefully remove the PRO165SV from its protective shipping container. Gently set the PRO165SV on a smooth, flat, and clean surface.

Before operating the PRO165SV, 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 PRO165SV 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.

2.2. Dimensions

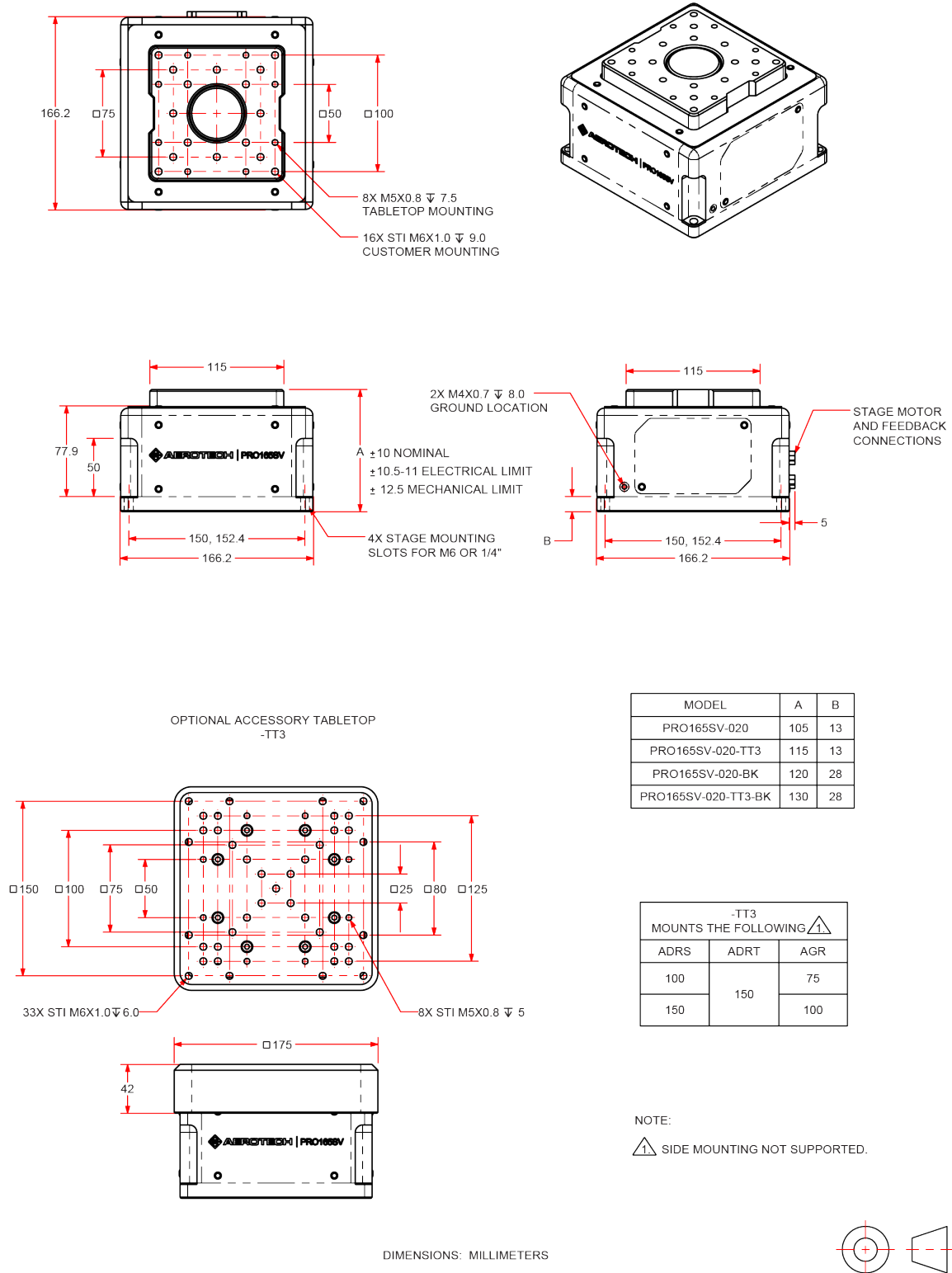


Figure 2-1: PRO165SV Dimensions

2.3. Securing the Stage to the Mounting Surface



WARNING: The PRO165SV 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 PRO165SV. Unsecured moving parts may shift and cause bodily injury.



DANGER: PINCH POINT! Keep Hands Clear while the stage is in motion.

The mounting surface must be flat and have adequate stiffness to achieve the maximum performance from the PRO165SV stage. When it is mounted to a non-flat surface, the stage can be distorted while the mounting screws are tightened. This distortion will decrease overall accuracy. Adjustments to the mounting surface must be done before the stage is secured.

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

NOTE: To maintain accuracy, the mounting surface must be flat to within 7.5 μm .

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.

Table 2-1: Stage to Mounting Surface Hardware

Mounting Hardware	Typical Screw Torque
M6 x 25 mm [1/4-20 x 1 in] SHCS	7 N·m

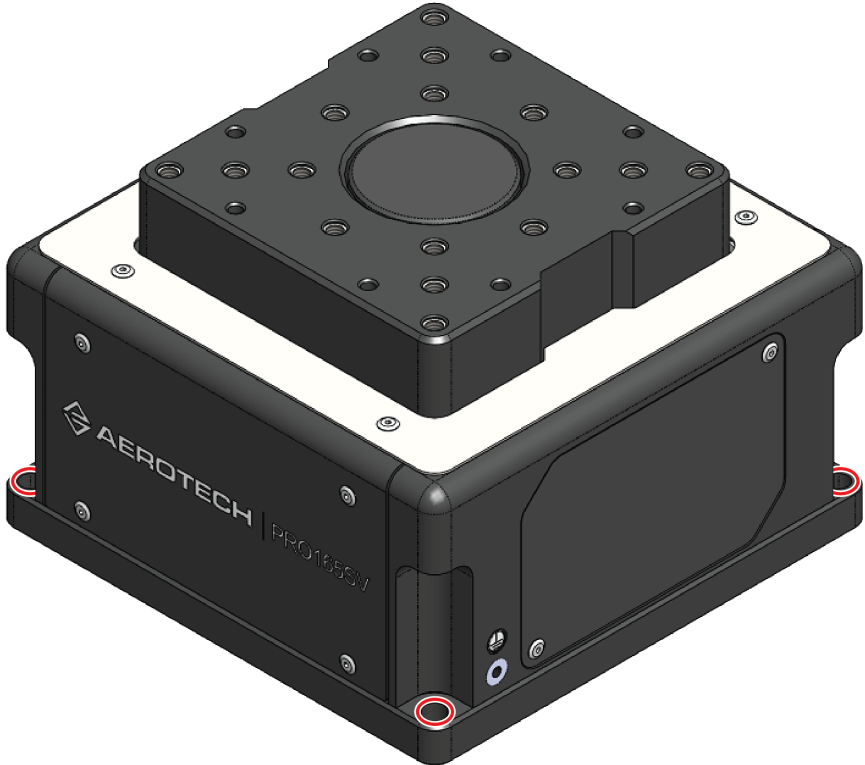


Figure 2-2: Mounting Holes [QTY. 4]

2.4. Attaching the Payload to the Stage

Inspect the mounting surface for dirt or unwanted residue and clean if necessary. Clean the mounting surface with a lint-free cloth and acetone or isopropyl alcohol and allow the cleaning solvent to completely dry.

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

NOTE: If your PRO165SV 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 PRO165SV 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.

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

NOTE: For valid system performance, the mounting interface should be flat within 12 μm .

For a cantilevered load, measure the cantilever length and then find the corresponding load value in [Figure 2-3](#).

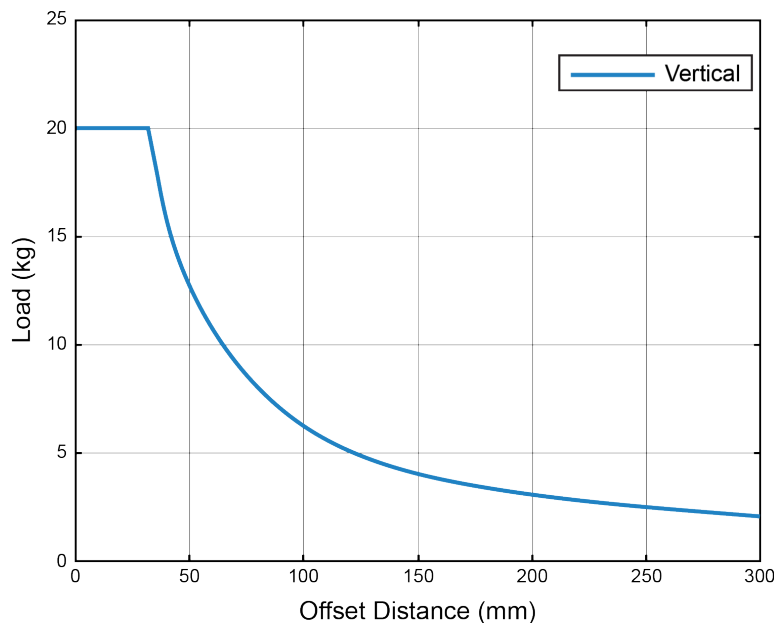


Figure 2-3: Cantilevered Load Capability

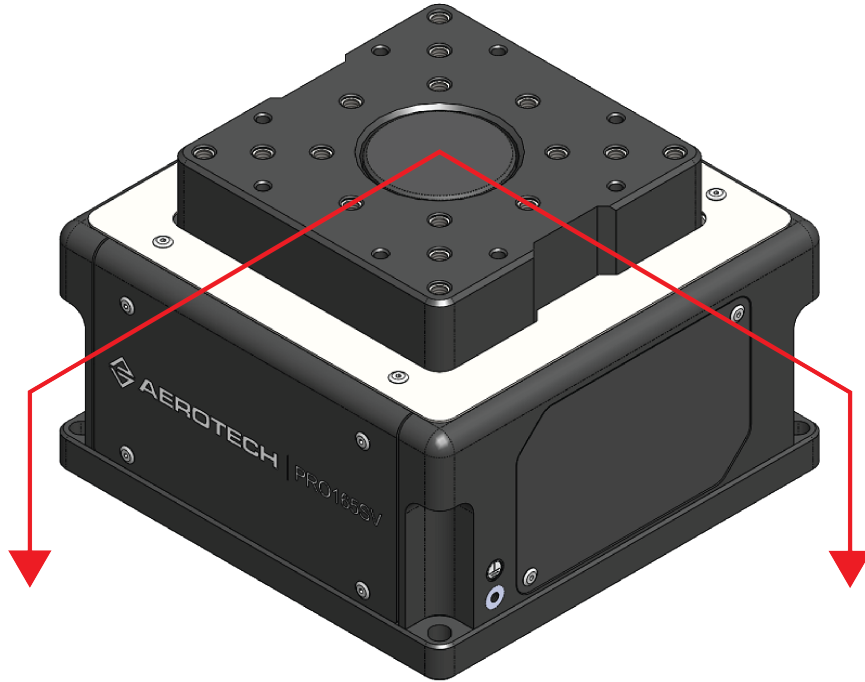


Figure 2-4: Load Curve

The approximate torque required to turn the ball screw of PRO165SV series stages can be found from [Figure 2-3](#) or the equation that follows:

$$Torque_{REQ} = \frac{(AxialLoad) \times (LeadofScrew)}{2 \times \pi \times (Efficiency)}$$

Figure 2-5: Load Torque Equation

For PRO165SV series stages, the ball screw efficiency is rated at 90% (0.90).

The maximum axial load carrying capacity of PRO165SV stages is 20 kg.

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 PRO165SV is part of a complete Aerotech motion control system, setup usually involves connecting the PRO165SV 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.



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.

NOTE: Refer to the controller documentation to adjust servo gains for optimum velocity and position stability.

3.1. Motor and Feedback Connectors

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

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

The protective ground connection of the PRO165SV provides motor frame ground protection only. Additional grounding and safety precautions are required for applications requiring access to the stage while it is energized. The System Integrator or qualified installer is responsible for determining and meeting all safety and compliance requirements necessary for the integration of this stage into the final application.



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



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



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

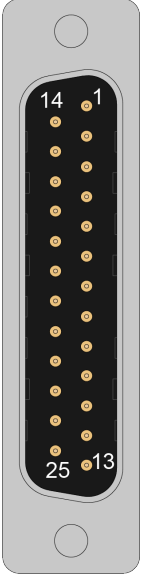
Table 3-1: Motor Connector Pinout

Pin	Description	Connector
Case	Shield Connection	
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)	

Table 3-2: Part Numbers for the Motor Connector

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 3-3: 25-Pin Feedback Connector Pinout

Pin	Description	Connector
Case	Shield Connection	
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	CW/+LMT	
13	Brake ⁻⁽¹⁾	
14	Cosine	
15	Cosine-N	
16	+5 V power supply	
17	Sine	
18	Sine-N	
19	Reserved	
20	Common ground	
21	Common ground	
22	Reserved	
23	Reserved	
24	CCW/-LMT	
25	Brake ⁺⁽¹⁾	

1. With -BK (Brake) option only

Table 3-4: 25-Pin Feedback Mating Connector Part Numbers

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

Table 3-5: 15-Pin Direct Feedback Connector Pinout [-E3, -E4, -E5, -E6]

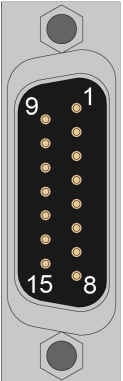
Pin	Description (-E3, -E4, -E5, -E6)	Connector
Case	Shield Connection	
1	Reserved	
2	Common ground	
3	Reserved	
4	Marker-N	
5	Sine-N	
6	Cosine-N	
7	+5 V power supply	
8	Reserved	
9	Common ground	
10	Reserved	
11	Reserved	
12	Marker	
13	Sine	
14	Cosine	
15	Reserved	

Table 3-6: 15-Pin Direct Feedback Connector Pinout [-E7]

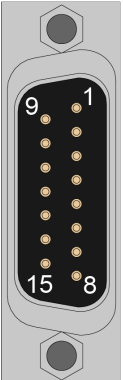
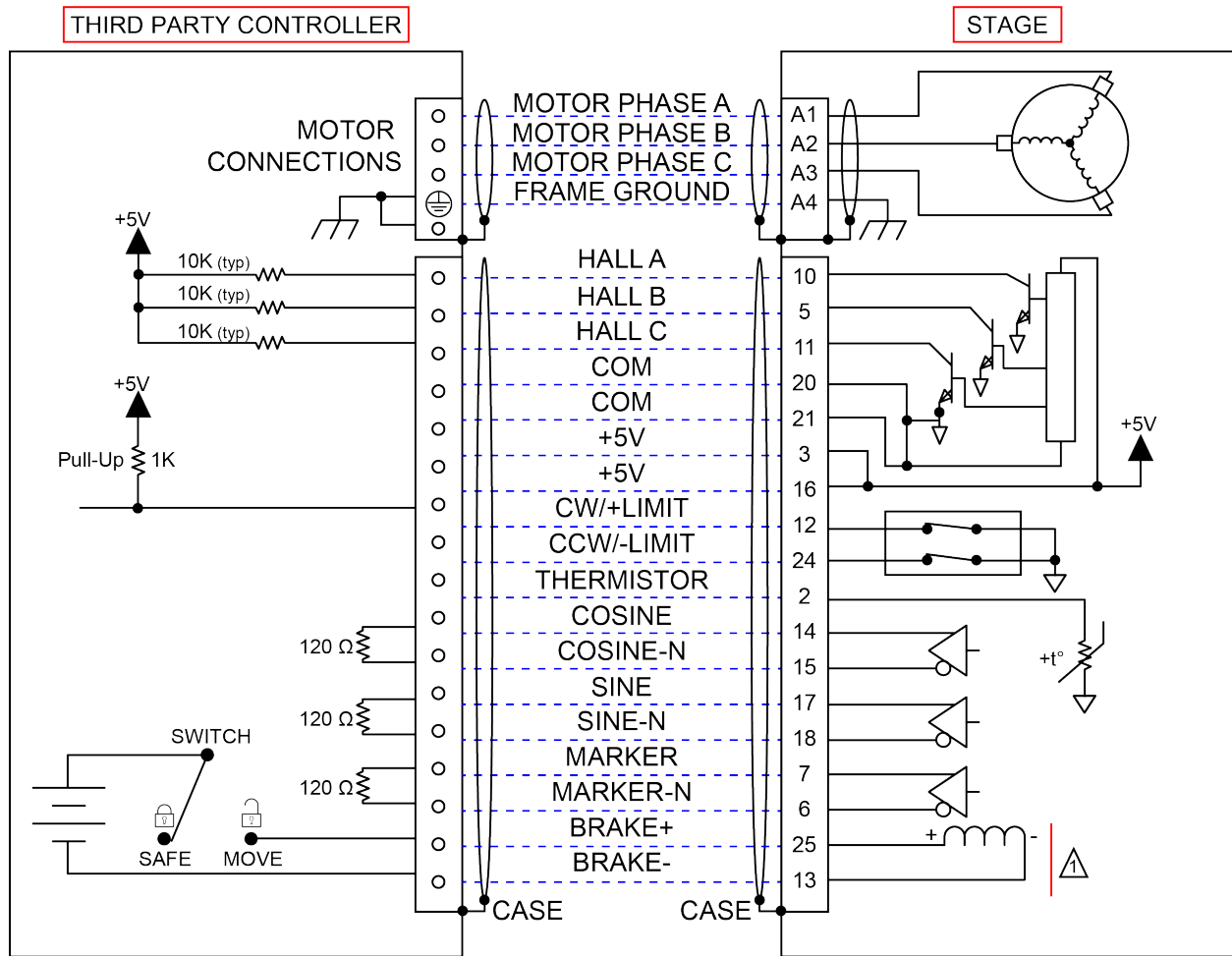
Pin	Description (-E7)	Connector
Case	Shield Connection	
1	Reserved	
2	Common ground	
3	Reserved	
4	+5 V power supply	
5	Absolute Data+ (Slo+)	
6	Reserved	
7	Reserved	
8	Absolute Clock+ (Ma+)	
9	Reserved	
10	Reserved	
11	Reserved	
12	Reserved	
13	Absolute Data- (Slo-)	
14	Reserved	
15	Absolute Clock- (Ma-)	

Table 3-7: 15-Pin Feedback Mating Connector Part Numbers

Mating Connector	Aerotech P/N	Third Party P/N
Backshell	ECK01021	Amphenol #17E-1725-2
Connector	ECK00326	Amphenol #DA15S064TLF

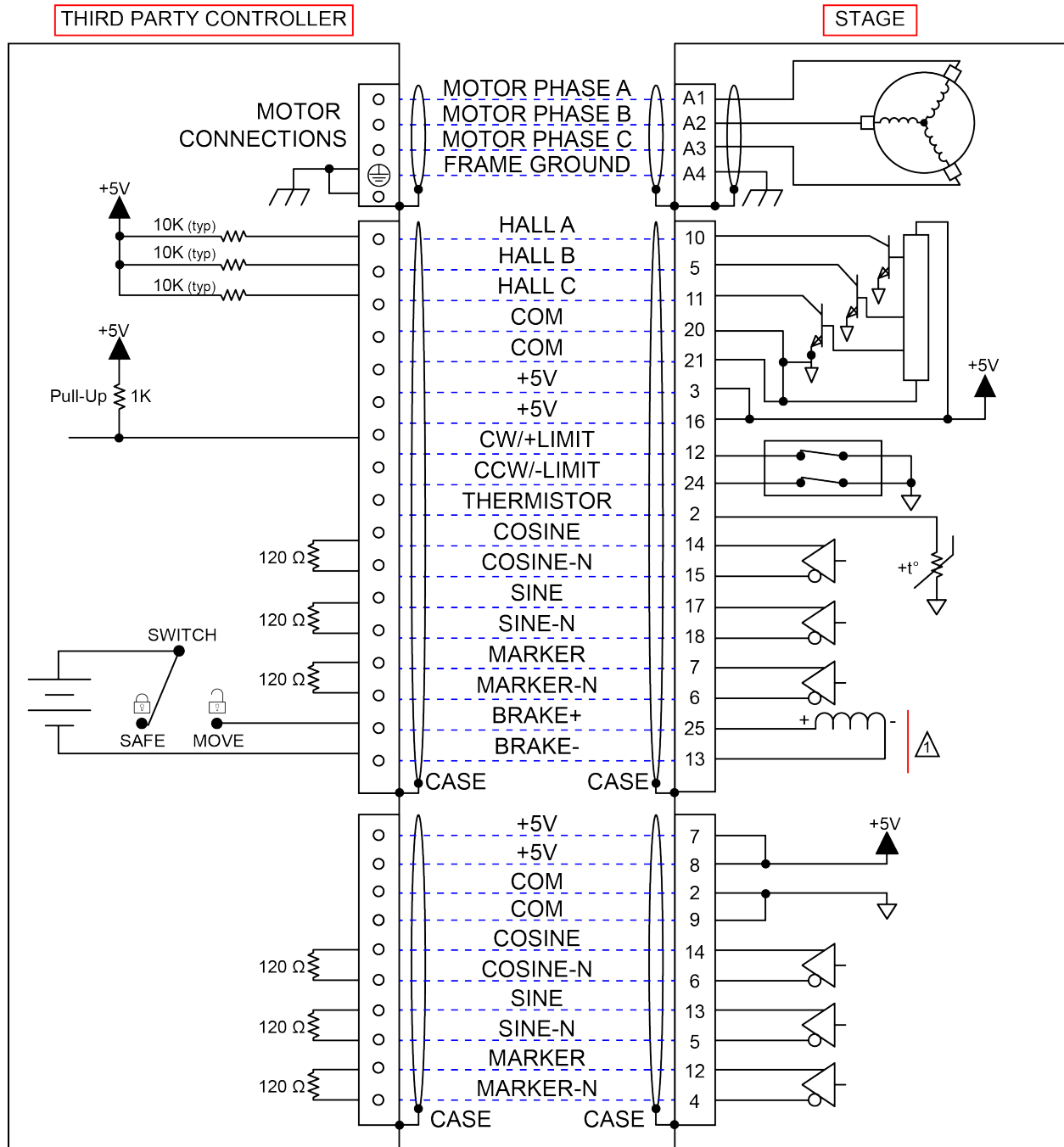
3.2. Motor and Feedback Wiring

Shielded cables are required for the motor and feedback connections.



Brake is optional.

Figure 3-1: Motor and Feedback Wiring [25-Pin Connector]



Brake is optional.

Figure 3-2: Motor and Feedback Wiring [15-Pin Connector for -E3, -E4, -E5, and -E6]

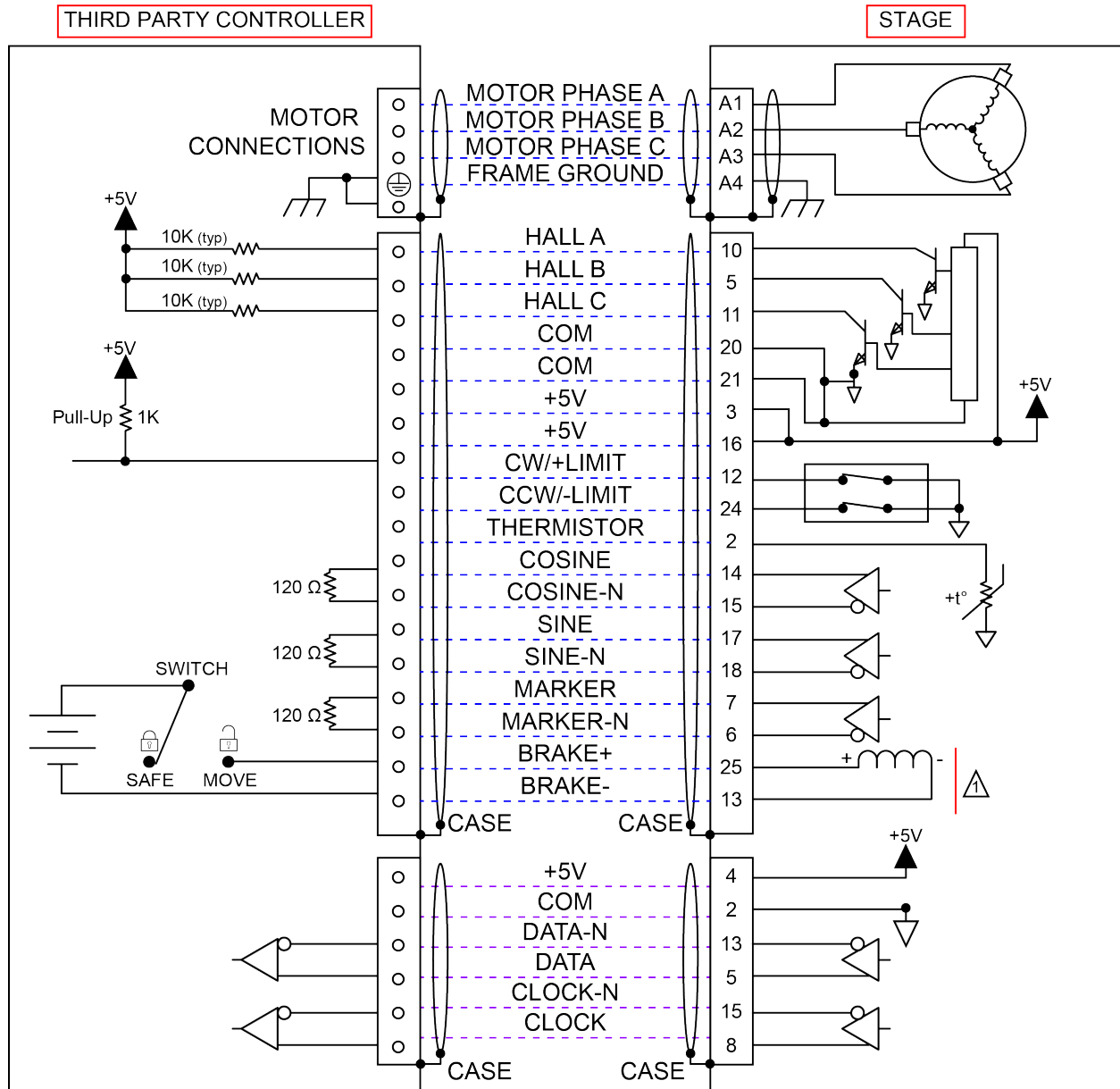


Figure 3-3: Motor and Feedback Wiring [15-Pin Connector for -E7]

3.3. Motor and Feedback Specifications

Table 3-8: 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 Ω
Hot Resistance	\sim 10 K
Note: 1K pull-up to +5V recommended.	

Encoder Specifications	
Supply Voltage	5 V \pm 5%
Supply Current	250 mA Typical
Output Signals	Sinusoidal Type (Incremental Encoder): 1 V _{pk-pk} into 120 Ω Load (differential signals SIN+, SIN-, COS+, COS- are .5 V _{pk-pk} relative to ground.)
	Digital Output (Incremental Encoder): RS422/485 compatible
	Serial Output (Absolute Encoder): EnDat 2.2 with 36 bit word

Limit Switch Specifications	
Supply Voltage	5 V \pm 5%
Supply Current	25 mA
Output Type	Open Collector
Output Voltage	5 V
Output Current	10 mA (sinking)
Output Polarity	Normally Closed (NC)
	<ul style="list-style-type: none"> Sinks current to ground (Logic "0") when not in limit High impedance (Logic "1") when in limit Requires external pull-up to +5 V (10 kΩ recommended)
Note: If the PRO165SV 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.	

Brake Specifications	
Supply Voltage	24 VDC \pm 10%, ripple free (if brake supply is 21V or less, brake release may not operate)
Supply Current (typical)	0.69 A (Current required to release the brake and allow motion)

Table 3-9: Motor Specifications

		S-76-35
Performance Specifications (1,5)		
Winding Designation		-A
Stall Torque, Cont. (2)	N·m	0.48
Peak Torque (3)	N·m	1.92
Electrical Specifications (5)		
Winding Designation		-A
BEMF Const., line-line, Max	$V_{pk}/krpm$	29.1
Continuous Current, Stall (2)	A_{pk}	2.0
	A_{rms}	1.4
Peak Current, Stall (2)	A_{pk}	8.0
	A_{rms}	5.7
Torque Constant (4, 9)	$N·m/A_{pk}$	0.24
	$N·m/A_{rms}$	0.34
Motor Constant (2, 4)	$N·m/\sqrt{W}$	0.075
Resistance, 25°C, line-line	Ω	10.5
Inductance, line-line	mH	1.40
Maximum Bus Voltage	V_{DC}	
Thermal Resistance	°C/W	1.83
Number of Poles	--	14
<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 250 mm x 250 mm x 6 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 $\pm 10\%$</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 A_{pk}; use torque constant in $N·m/A_{pk}$ when sizing</p>		

3.4. Limits, Marker, and Machine Direction

Aerotech stages are configured to have positive and negative "machine" directions. The machine direction defines the phasing of the feedback and motor signals and is dictated by the stage wiring (refer to [Section 3.5](#) 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 3-4](#) shows the machine direction of PRO165SV stages.

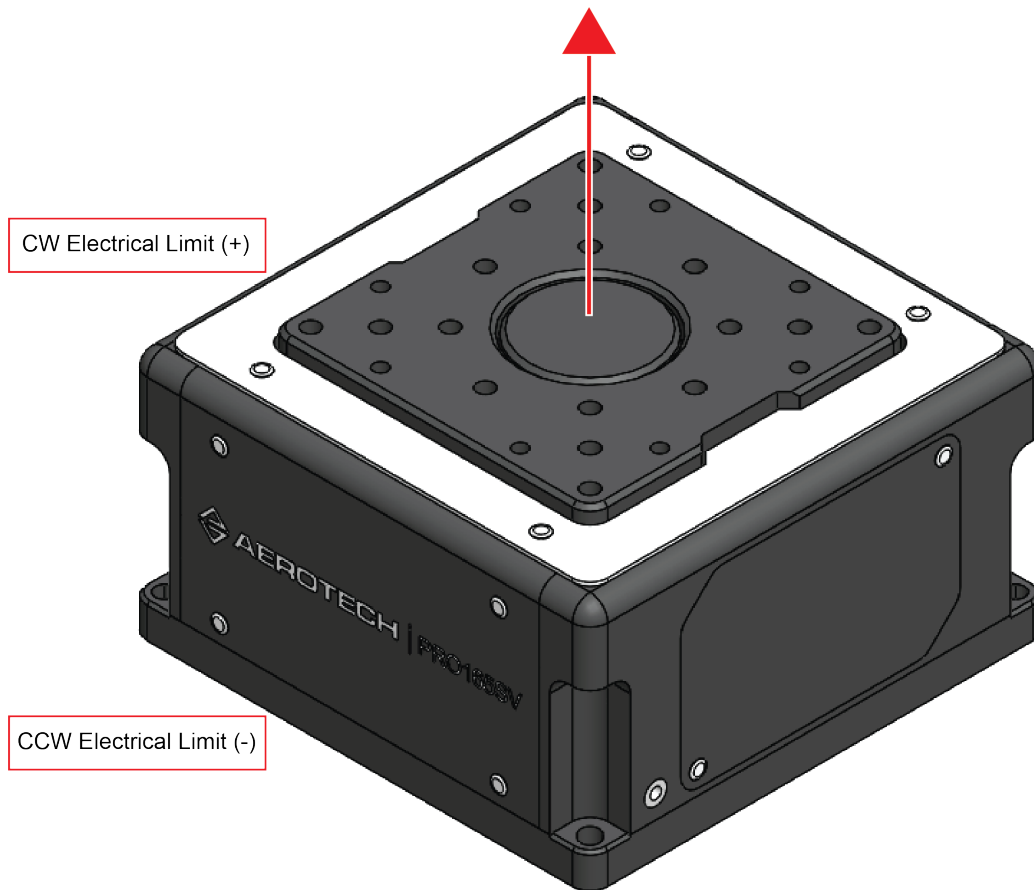


Figure 3-4: Machine Direction

3.5. Motor and Feedback Phasing

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

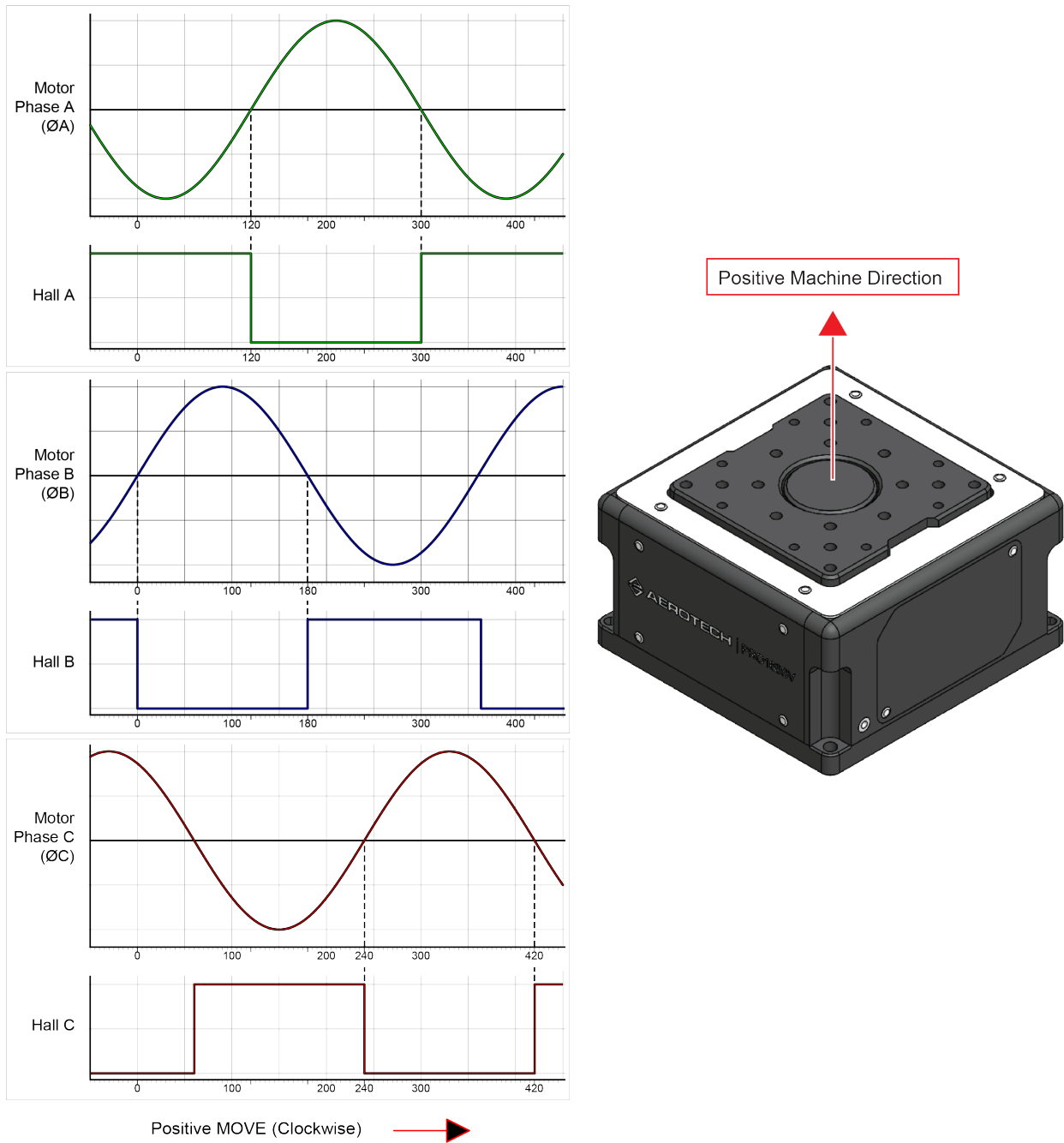


Figure 3-5: Hall Phasing

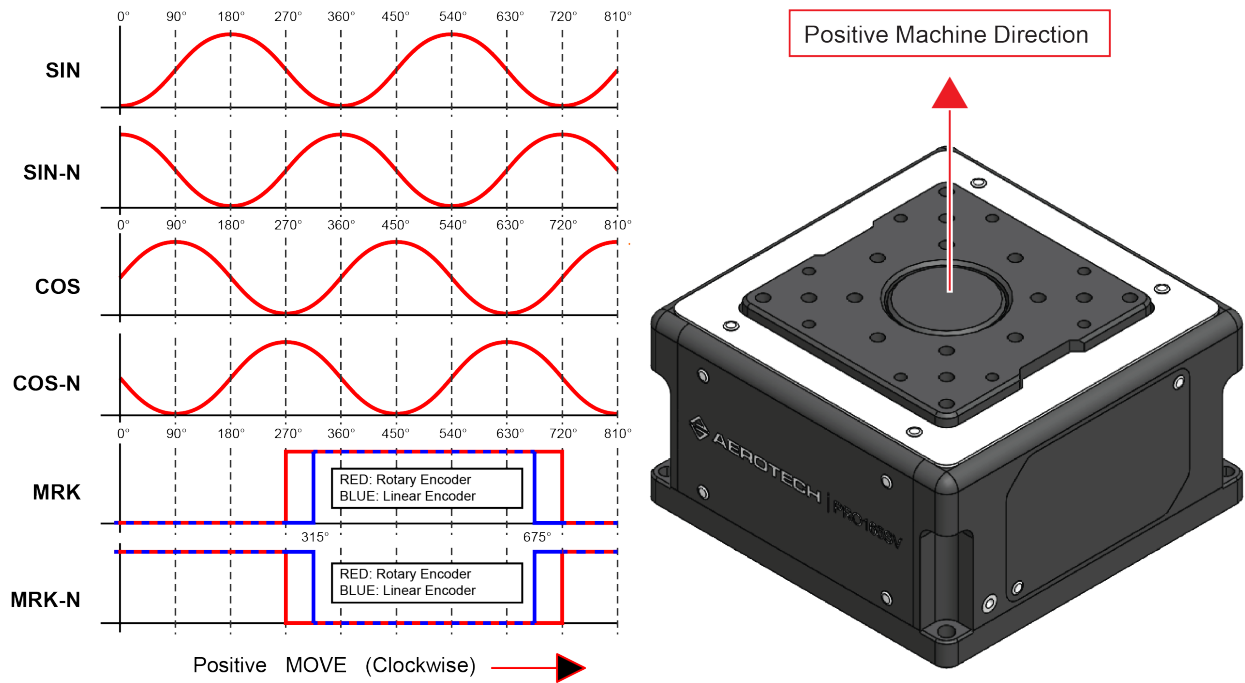


Figure 3-6: Analog Encoder Phasing Reference Diagram

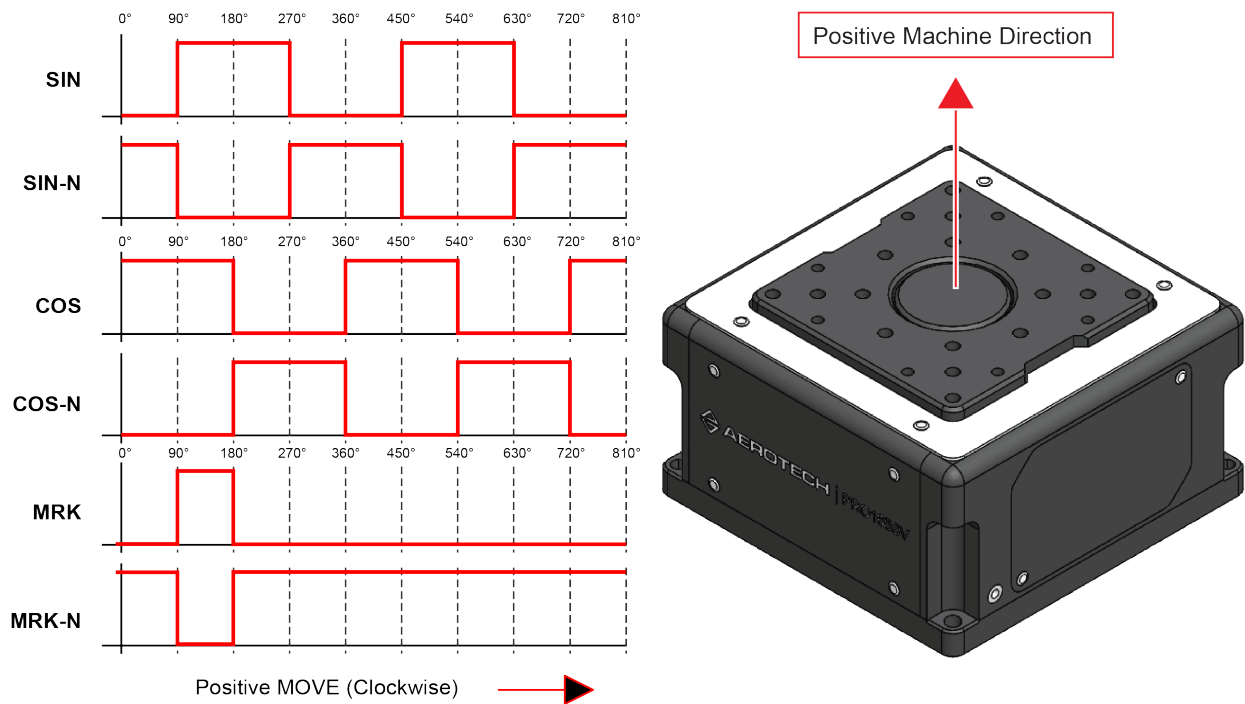


Figure 3-7: Encoder Phasing Reference Diagram (Standard)

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Chapter 4: Maintenance

NOTE: If the bearing area is not kept free of foreign matter and moisture, the performance and life expectancy of the stage will be reduced.



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

4.1. Service and Inspection Schedule

Inspect the PRO165SV at least once per month. A longer or shorter inspection interval may be required depending on the application and conditions, such as the duty cycle, speed, and environment.

In general, stages operating in a clean environment should be cleaned and lubricated annually or every 500 km (whichever comes first). For stages operating under conditions involving excessive debris, the stage should be cleaned every six months. For high-speed applications (those near max speed at a duty cycle of 50%), frequent maintenance with standard lubricants is required.

Monthly inspections should include but not be limited to:

- Visually inspect the stage and cables.
- Re-tighten loose connectors.
- Replace or repair damaged cables.
- Clean the PRO165SV and any components and cables as needed.
- Repair any damage before operating the PRO165SV.
- Inspect and perform an operational check on all safeguards and protective devices.

4.2. Cleaning and Lubrication



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



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



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

Cleaning

Before using a cleaning solvent on any part of the PRO165SV, blow away small particles and dust with nitrogen or, less preferably, clean, dry, compressed air.

Any external metal surface of the PRO165SV can be cleaned with isopropyl alcohol on a lint-free cloth.



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

Lubrication

For the cross-roller bearings, only use Kluberplex BEM 34-132 grease. Other greases may be incompatible.

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

Lubrication Procedure

1. Drive the stage table to the bottom of travel, and remove power to the stage.
2. Remove the top cover to get access to the linear bearings (refer to [Figure 4-1](#)).
3. Clean any dust or debris that you can see inside of the assembly.
4. Use a clean, lint-free cloth with a side-to-side motion to remove any dirty or dried lubricant from the v-channels of the linear bearing rails. Use a swab soaked in isopropyl alcohol to remove stubborn debris.
5. With a grease syringe, apply a 2 mm diameter (approximately) bead of lubricant to the relief area below the bearing v-channels, as close to the bearing cage as possible. Do this for about 1/4 of the overall length for all bearing rails.
6. Restore power to the stage and move the stage through the full travel to distribute the grease. Use extreme caution when operating the stage without the top cover.
7. Remove power to the stage and repeat steps 5 and 6 two or more times to sufficiently lubricate the bearings.
8. Install the top cover.
9. Restore power to the stage, and drive the stage table back to its original position to redistribute lubricants.

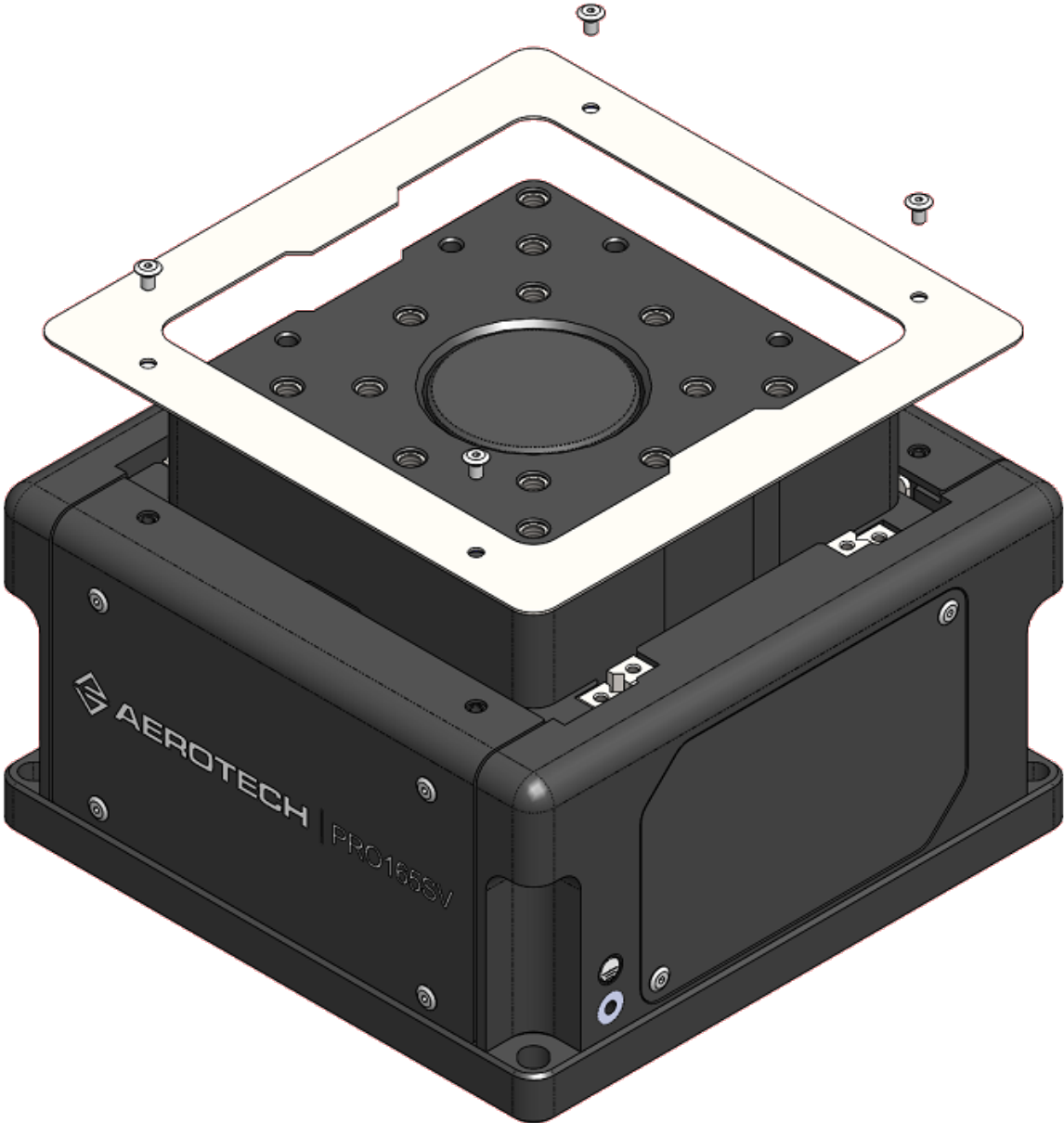


Figure 4-1: Hardcover Removal

4.3. 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 Chapter 3) 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 Chapter 3 and Controller documentation). Motor Connections (refer to Chapter 3 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). Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than thirty (30) days after the issuance of a return authorization number will be subject to review.

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

Returned Product Warranty Determination

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

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

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

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

Rush Service

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

On-site Warranty Repair

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

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

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

On-site Non-Warranty Repair

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

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

Service Locations

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

USA, CANADA, MEXICO	CHINA	GERMANY
Aerotech, Inc. Global Headquarters Phone: +1-412-967-6440 Fax: +1-412-967-6870	Aerotech China Full-Service Subsidiary Phone: +86 (21) 5508 6731	Aerotech Germany Full-Service Subsidiary Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720
TAIWAN	UNITED KINGDOM	
Aerotech Taiwan Full-Service Subsidiary Phone: +886 (0)2 8751 6690	Aerotech United Kingdom Full-Service Subsidiary Phone: +44 (0)1256 855055 Fax: +44 (0)1256 855649	

Have your customer order number ready before calling.

Appendix B: Revision History

Revision	Description
1.00.00	New manual

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