



ANT95L Hardware Manual

Revision: 1.04.00



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Safety Procedures and Warnings

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

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



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

1. Access to the ANT95L 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 ANT95L stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.
5. Use care when moving the ANT95L stage. Lifting or transporting the ANT95L stage improperly can result in injury or damage to the ANT95L.
6. This product is intended for light industrial manufacturing or laboratory use. Use of this product for unintended applications can result in injury and damage to the equipment.
7. If the product is used in a manner not specified by the manufacturer, the protection provided by the product can be impaired and result in damage, shock, injury, or death.
8. Operators must be trained before operating this equipment.
9. All service and maintenance must be performed by qualified personnel.

EU Declaration of Incorporation

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

herewith declares that the product:
ANT95L 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):

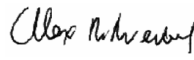
2011/65/EU

RoHS 2 Directive

Authorized Representative: Simon Smith, European Director

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

 / Alex Weibel

Position

Engineer Verifying Compliance

Location

Pittsburgh, PA

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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: ANT95L Model Numbering System

ANT95L Single-Axis Linear Direct-Drive Nanopositioning Stage	
Travel (Required)	
-025	25 mm travel
-050	50 mm travel
-075	75 mm travel
-100	100 mm travel
Mounting Plate (Optional)	
-MP	Mounting plate
Performance Grade (Required)	
-PL1	Base Performance
-PL2	High-accuracy performance, PLUS

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 \pm 2° C (68° F \pm 4° F). If at any time the operating temperature deviates from 20° C degradation in performance could occur.
	Storage: 0° to 40° C (32° to 104° F) in original shipping packaging
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 ANT95L stages are not suited for dusty or wet environments. This equates to an ingress protection rating of IP00.
Use	Indoor use only

1.2. Accuracy and Temperature Effects

Aerotech products are designed for and built in a 20°C (68°F) environment. Extreme temperature changes could cause a decrease in performance or permanent damage to the ANT95L. At a minimum, the environmental temperature must be controlled to within 0.25°C per 24 hours to ensure the ANT95L specifications are repeatable over an extended period of time. The severity of temperature effects on all specifications depends on many different environmental conditions, including how the ANT95L is mounted. Contact the factory for more details.

The thermal expansion coefficient of the encoder scale is 3.25 ppm/°C. Travel will increase or decrease at this rate as the temperature of the encoder scale temperature deviates from 20°C (68°F).

The accuracy specification of ANT95L 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](#).

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 encoder resolution and controller interpolation.

Table 1-3: ANT95L Series Specifications (-025 and -050)

		-025	-050
Travel		25 mm	50 mm
Accuracy ⁽¹⁾	Base (-PL1)	±2.5 µm (±100 µin)	±2.5 µm (±100 µin)
	PLUS ⁽⁴⁾ (-PL2)	±250 nm (±10 µin)	±250 nm (±10 µin)
Resolution (Minimum Incremental Motion)		1 nm (0.04 µin)	1 nm (0.04 µin)
Bidirectional Repeatability ⁽¹⁾	Base (-PL1)	±100 nm (±4 µin)	±100 nm (±4 µin)
	PLUS ⁽⁴⁾ (-PL2)	±75 nm (±3 µin)	±75 nm (±3 µin)
Unidirectional Repeatability		±25 nm (±1 µin)	±25 nm (±1 µin)
Straightness ⁽¹⁾		±1.0 µm (±40 µin)	±1.0 µm (±40 µin)
Flatness ⁽¹⁾		±1.0 µm (±40 µin)	±1.0 µm (±40 µin)
Pitch		10 arc sec	10 arc sec
Roll		10 arc sec	10 arc sec
Yaw		5 arc sec	5 arc sec
Maximum Speed		500 mm/s (20 in/s)	500 mm/s (20 in/s)
Maximum Acceleration (No Load)		5 g - 50/ms ²	4 g - 40/ms ²
In-Position Stability ⁽²⁾		<1 nm (<0.04 µin)	<1 nm (<0.04 µin)
Maximum Force (continuous)		7.75 N	9.5 N
Load Capacity ^(3, 4, 5)	Horizontal	5.0 kg (11 lb)	7.0 kg (15.4 lb)
	Side	5.0 kg (11 lb)	5.0 kg (11 lb)
Moving Mass		0.46 kg (1.0 lb)	0.52 kg (1.1 lb)
Stage Mass		0.8 kg (1.8 lb)	1.2 kg (2.7 lb)
Material		Aluminum Body/Black Hardcoat Finish	
Mean Time Between Failure		30,000 Hours	
1. Certified with each stage.			
2. In-Position Jitter listing is 3 sigma value.			
3. Axis orientation for on-axis loading is listed (refer to Section 2.4 for offset loading behavior).			
4. Requires the use of an Aerotech controller.			
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.			

Table 1-4: ANT95L Series Specifications (-075 and -100)

		-075	-100
Travel		75 mm	100 mm
Accuracy ⁽¹⁾	Base (-PL1)	±4.0 µm (±160 µin)	±5.0 µm (±200 µin)
	PLUS ⁽⁴⁾ (-PL2)	±275 nm (±11 µin)	±275 nm (±11 µin)
Resolution (Minimum Incremental Motion)		1 nm (±0.04 µin)	1 nm (±0.04 µin)
Bidirectional Repeatability ⁽¹⁾	Base (-PL1)	±100 nm (±4 µin)	±100 nm (±4 µin)
	PLUS ⁽⁴⁾ (-PL2)	±75 nm (±3 µin)	±75 nm (±3 µin)
Unidirectional Repeatability		±25 nm (±1 µin)	±25 nm (±1 µin)
Straightness ⁽¹⁾		±2.0 µm (±80 µin)	±2.5 µm (±100 µin)
Flatness ⁽¹⁾		±2.0 µm (±80 µin)	±2.5 µm (±100 µin)
Pitch		10 arc sec	10 arc sec
Roll		10 arc sec	10 arc sec
Yaw		5 arc sec	5 arc sec
Maximum Speed		500 mm/s (20 in/s)	500 mm/s (20 in/s)
Maximum Acceleration (No Load)		3 g - 30 m/s ²	3 g - 30 m/s ²
In-Position Stability ⁽²⁾		<1 nm (<0.04 µin)	<1 nm (<0.04 µin)
Maximum Force (continuous)		9.5 N	12.9 N
Load Capacity ^(3, 4)	Horizontal	7.0 kg (15.4 lb)	7.0 kg (15.4 lb)
	Side	5.0 kg (11 lb)	5.0 kg (11 lb)
Moving Mass		0.72 kg (1.6 lb)	0.91 kg (2.0 lb)
Stage Mass		1.64 kg (3.6 lb)	2.1 kg (4.6 lb)
Material		Aluminum Body/Black Hardcoat Finish	
Mean Time Between Failure		30,000 Hours	
1. Certified with each stage.			
2. In-Position Jitter listing is 3 sigma value.			
3. Axis orientation for on-axis loading is listed (refer to Section 2.4 for offset loading behavior).			
4. Requires the use of an Aerotech controller.			
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.			

Chapter 2: Mechanical Specifications and Installation



WARNING: ANT95L installation must be in accordance to instructions provided by this manual and any accompanying documentation. Failure to follow these instructions could result in injury or damage to the equipment.

2.1. Unpacking and Handling the Stage



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

- Make sure that all moving parts are secure before moving the ANT95L. Unsecured moving parts may shift and cause bodily injury.
- Improper handling could adversely affect the performance of the ANT95L. Use care when moving the ANT95L.

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

Carefully remove the ANT95L from its protective shipping container. Gently set the ANT95L on a smooth, flat, and clean surface.

Before operating the ANT95L, 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 ANT95L has a label listing the system part number and serial number. These numbers contain information necessary for maintaining or updating system hardware and software. Locate this label and record the information for later reference.

Shipping Clamps

Red, anodized aluminum shipping brackets have been installed to prevent unwanted motion and potential damage from occurring during shipment. The brackets must be removed before the ANT95L can be operated. Retain the brackets and hardware for future use.

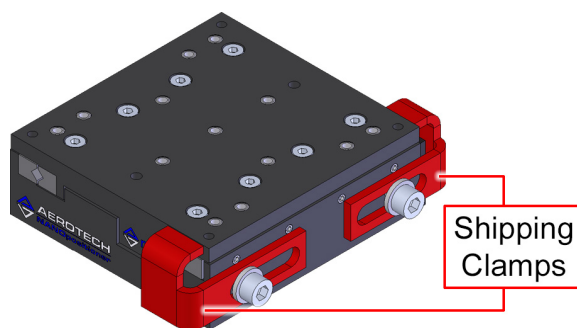


Figure 2-1: Shipping Clamps

2.2. Dimensions

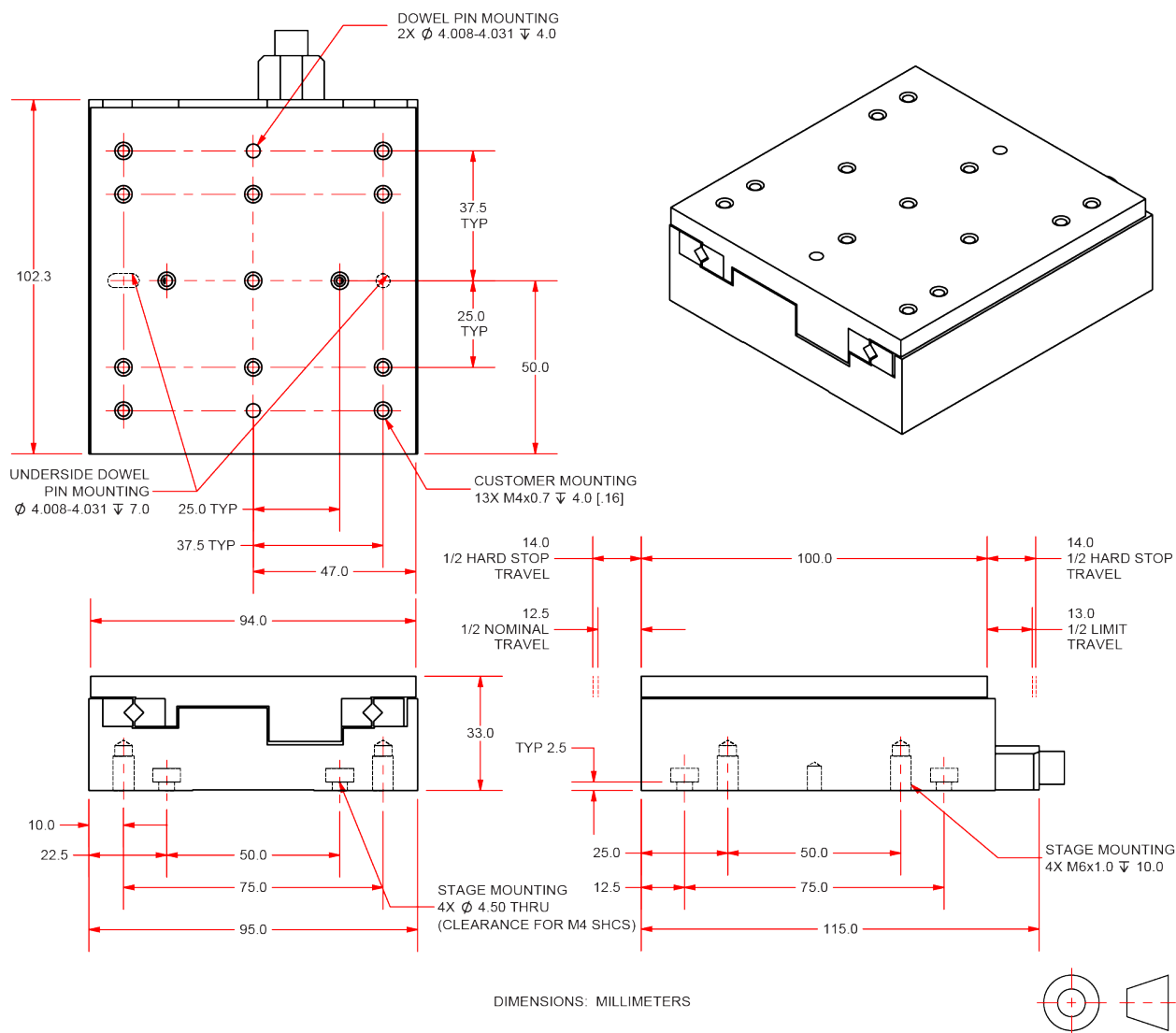
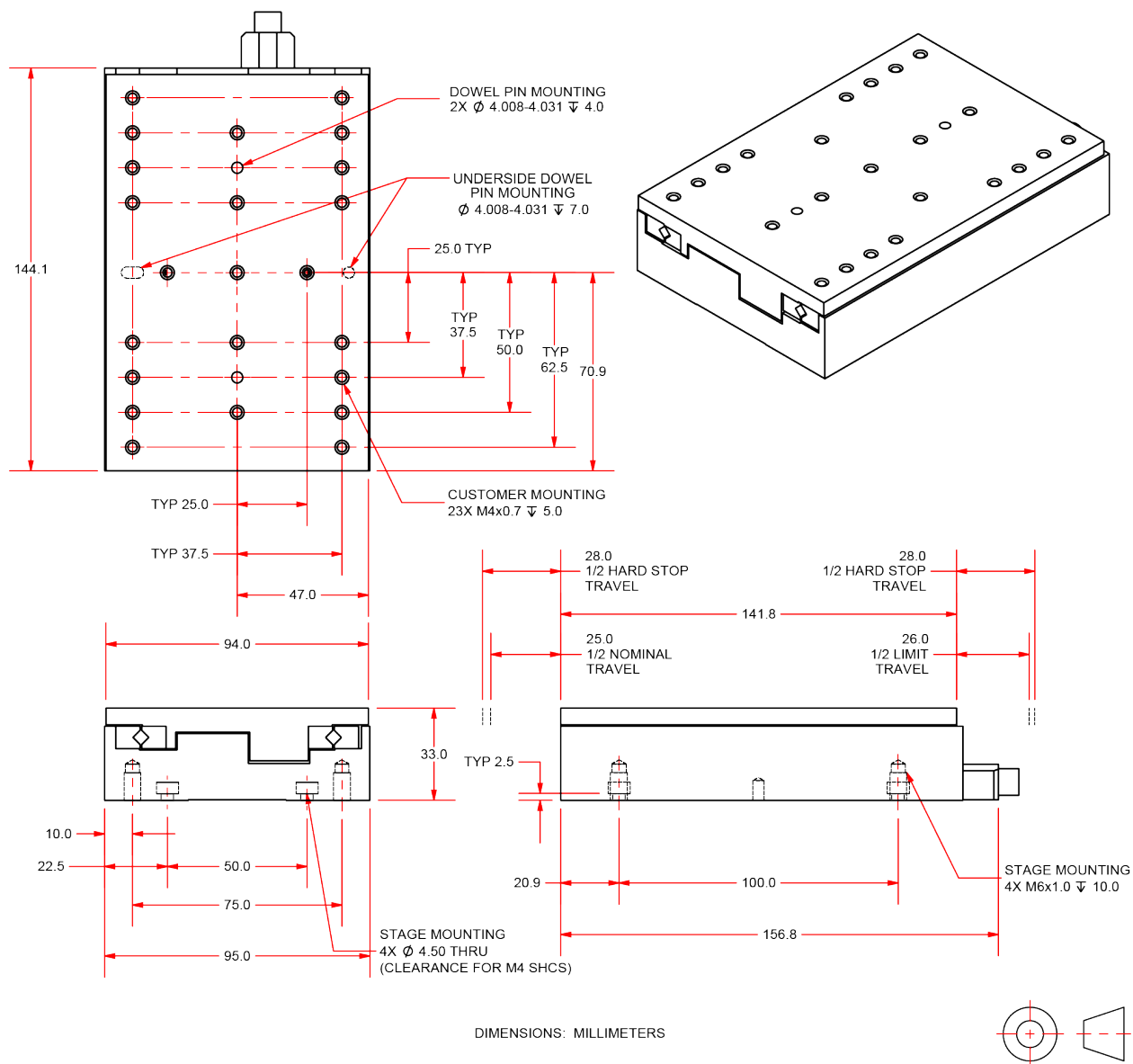


Figure 2-2: ANT95L-025 Dimensions

**Figure 2-3: ANT95L-050 Dimensions**

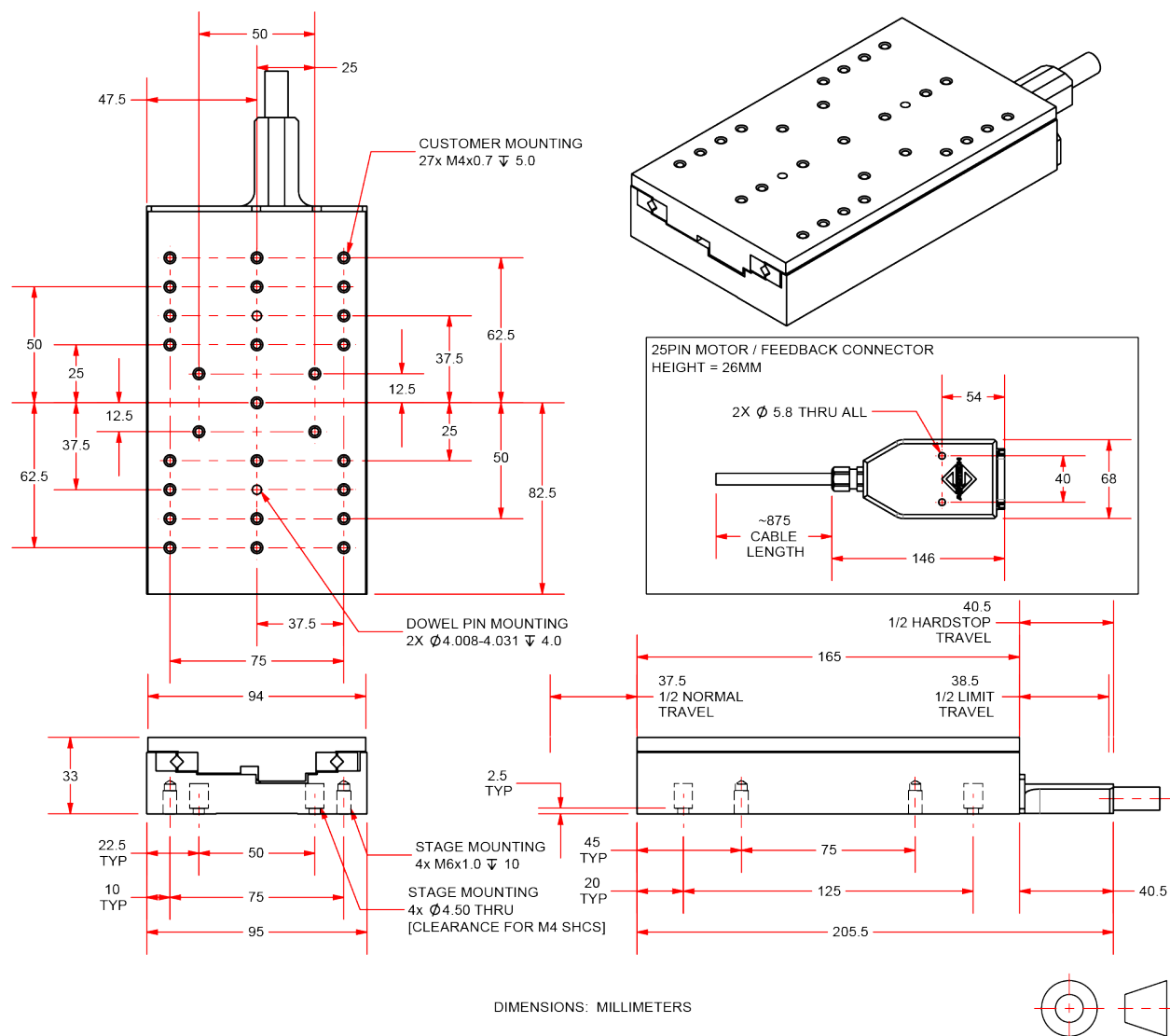


Figure 2-4: ANT95L-075 Dimensions

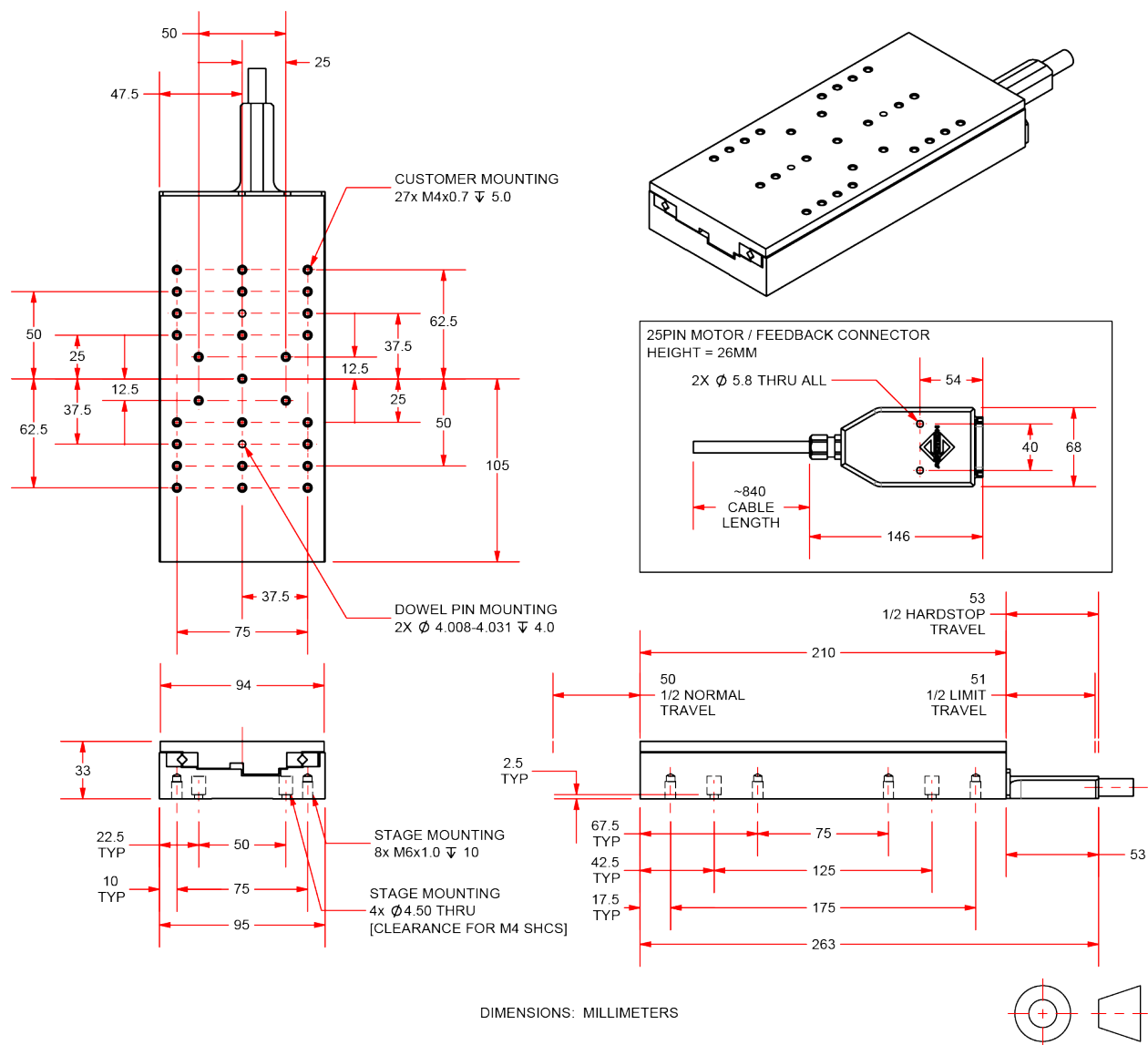


Figure 2-5: ANT95L-100 Dimensions

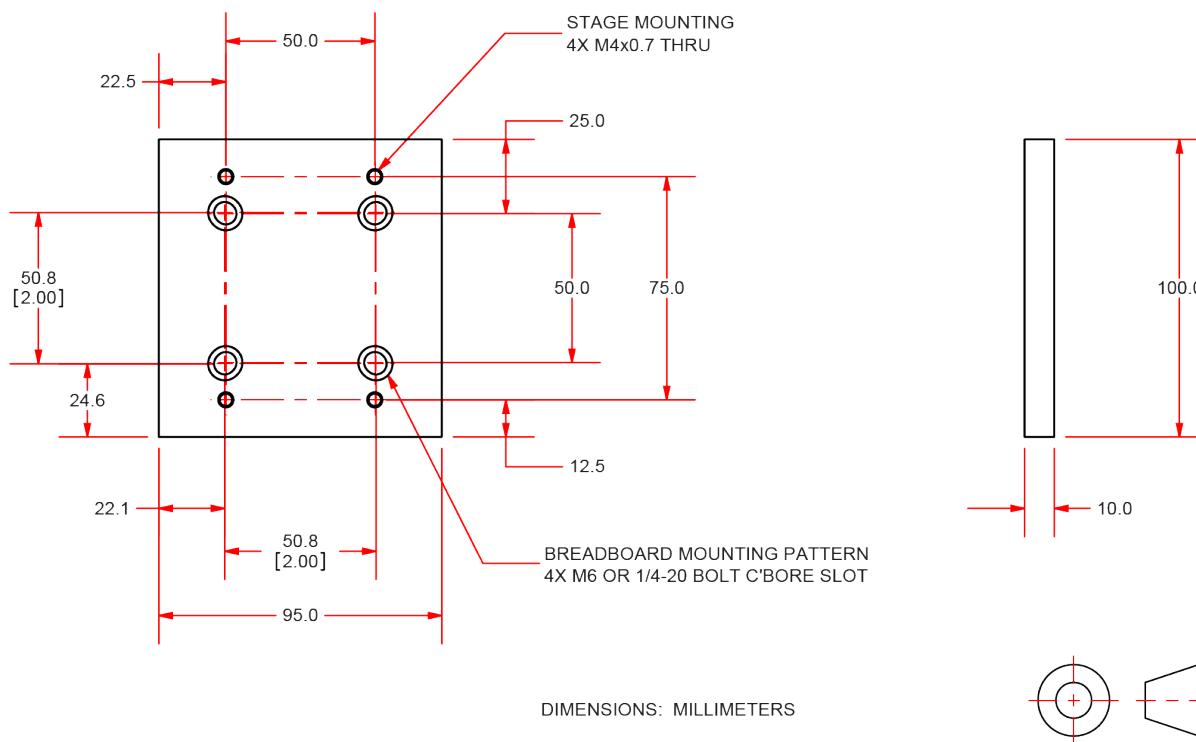


Figure 2-6: ANT95L-025 Mounting Plate (-MP) Dimensions

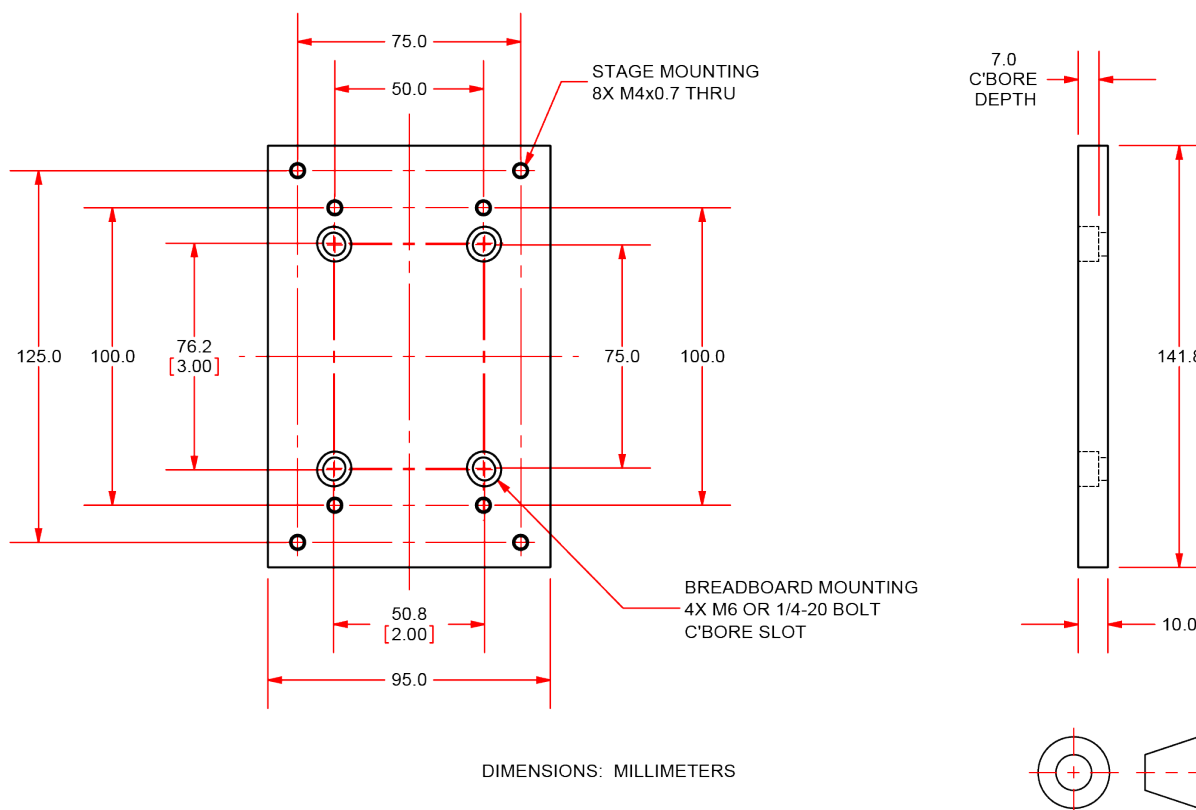


Figure 2-7: ANT95L-050 Mounting Plate (-MP) Dimensions

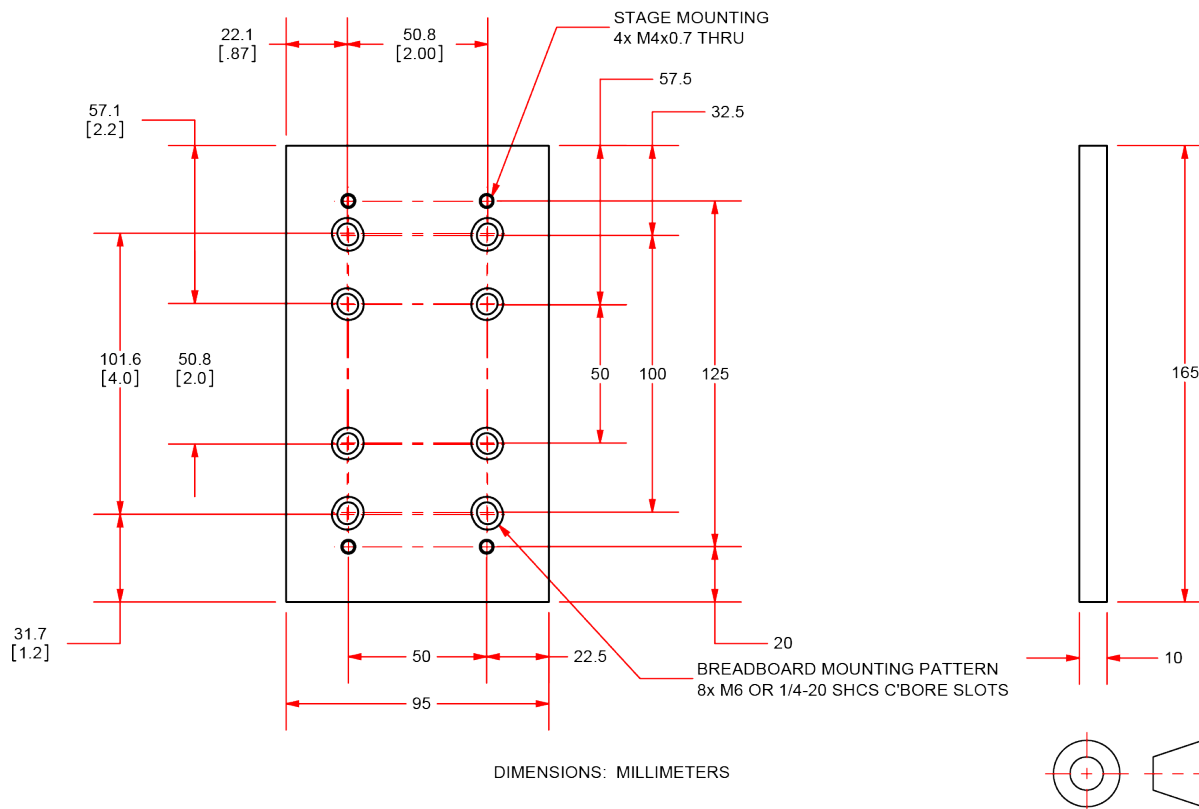


Figure 2-8: ANT95L-075 Mounting Plate (-MP) Dimensions

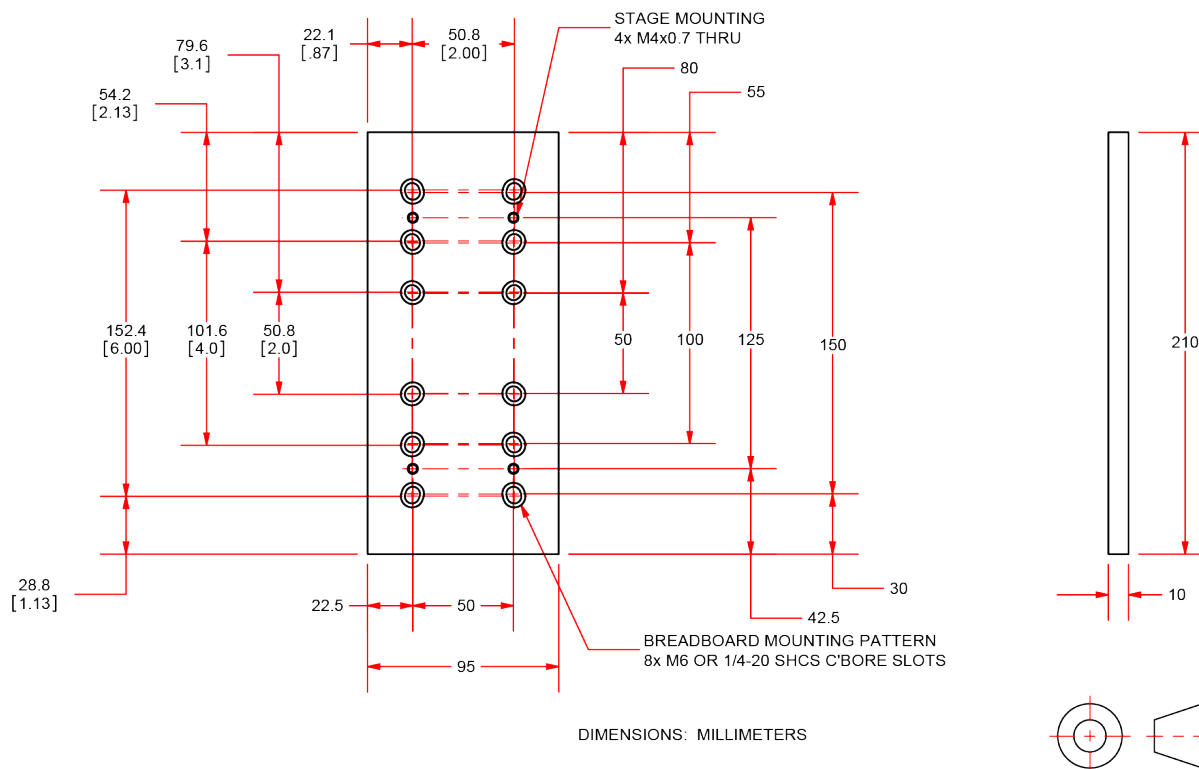


Figure 2-9: ANT95L-100 Mounting Plate (-MP) Dimensions

2.3. Securing the Stage to the Mounting Surface



WARNING: The ANT95L 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 ANT95L 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 1 μm per 50 mm.

NOTE: The ANT95L 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 ANT95L. Shimming should be avoided if possible. If shimming is required, it should be minimized to retain maximum rigidity of the system.

Access the mounting holes in the base of the ANT95L stage by sliding the carriage all the way to either end of travel (as shown in [Figure 2-10](#)).

Four additional mounting holes in the base of the ANT95L are also available for customer use (refer to [Section 2.2](#) for locations and [Table 2-1](#) for mounting hardware information). For X-Y configurations, mount the upper axis to the tabletop of the lower stage. A mounting plate is required if the upper axis is an ANT95L-050.

Tightening torque values for the mounting hardware are dependent on the properties of the surface to which the stage is being mounted. Values provided in [Table 2-1](#) are typical values and may not be accurate for your mounting surface. Refer to [Section 2.2](#) for specific model mounting locations and dimensions.

Table 2-1: Stage to Mounting Surface Hardware

Mounting Hardware	Typical Screw Torque
M4 by 8 mm [#8 by 3/8 in] SHCS	2.3 N·m
M6X1.0 by 10 mm deep threaded holes (refer to for the locations) are available for customer use.	7 N·m
Mounting an upper axis to a lower axis tabletop (a mounting plate is required if the upper axis is an ANT95L-050): M4 x 6 mm SHCS	2.3 N·m

NOTE: The ANT95L 75 mm and 100 mm travel stages are only available for lower axis (X-axis) configurations.

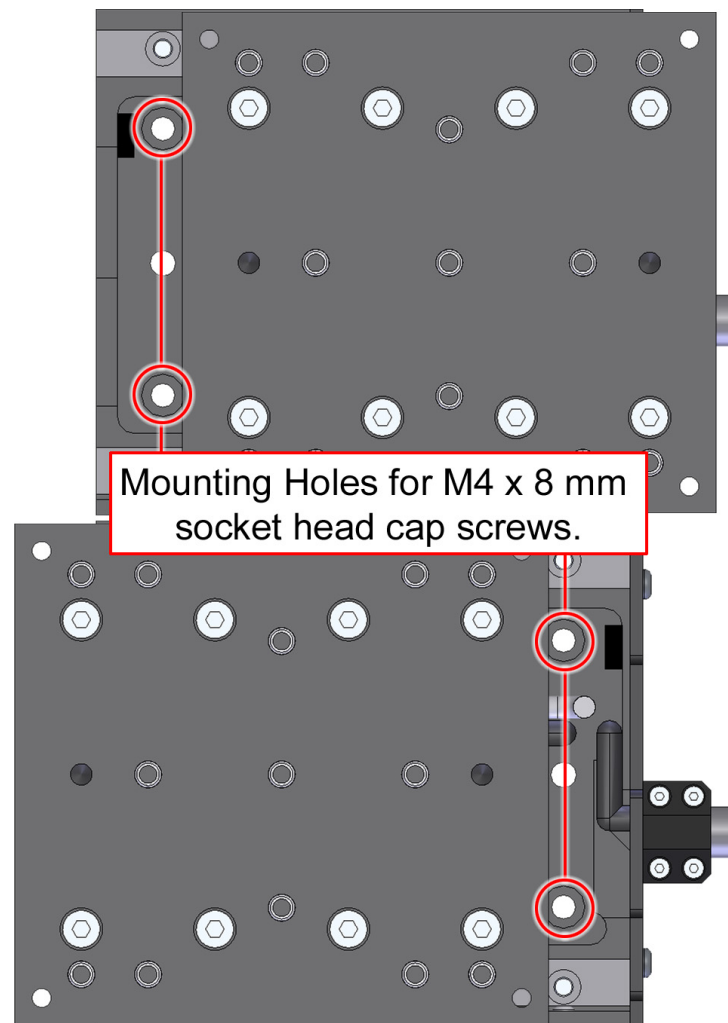


Figure 2-10: Mounting Hole Pattern

2.4. Attaching the Payload to the Stage

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

To prevent damage to the payload or stage, test the operation of the stage before the payload is attached. Aerotech recommends that customers use a representative payload during start-up to prevent accidental damage to the stage and the payload. Proceed with the electrical installation and test the motion control system in accordance with the system documentation. Document all results for future reference. For information on electrical installation refer to [Chapter 3](#) and the documentation delivered with the stage.

NOTE: If your ANT95L 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 ANT95L 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: Use 3-point mounting, if possible, when attaching the payload to the stage.

NOTE: For valid system performance, the mounting interface should be flat within 5 μm .



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.

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).

If cantilevered loads are applied, refer to [Figure 2-11](#) to find the loading condition. Refer to [Figure 2-12](#) to find the maximum allowable load.

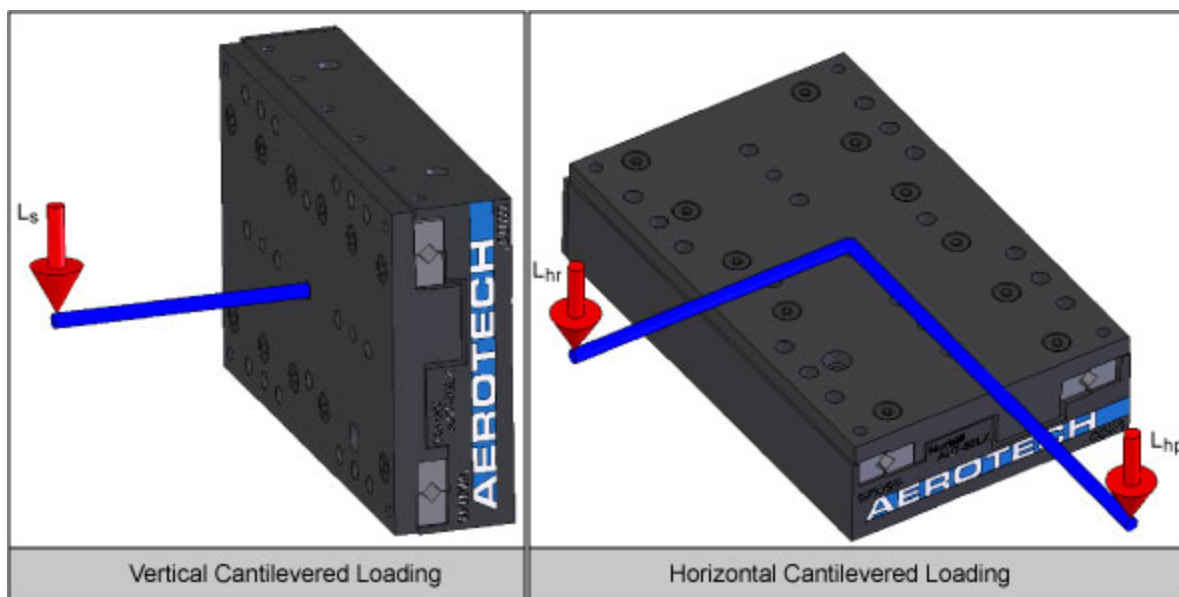
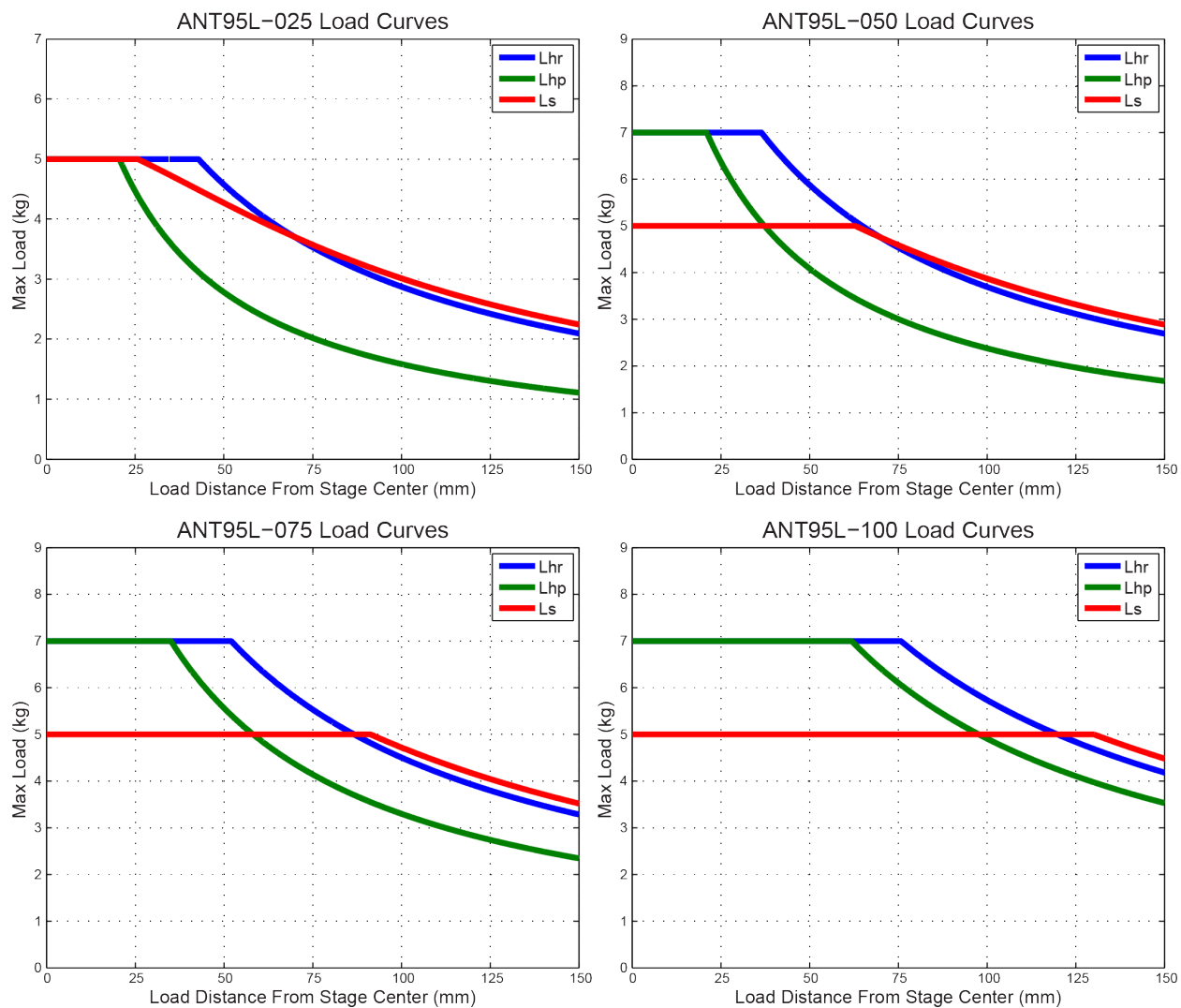


Figure 2-11: Load Orientations

**Figure 2-12: Cantilevered Load Capabilities**

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 ANT95L is part of a complete Aerotech motion control system, setup usually involves connecting the ANT95L 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 pin assignments.



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



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

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

3.1. Motor and Feedback Connectors

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

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

The protective ground connection of the ANT95L provides motor frame ground protection only. Additional grounding and safety safeguards are required for applications requiring access to the stage while it is energized. The System Integrator or qualified installer is responsible for determining and meeting all safety and compliance requirements necessary for the integration of this stage into the final application.



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



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

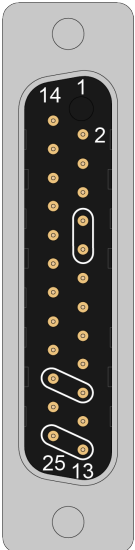


WARNING: Operator access to the base and tabletop must be restricted while connected to a power source. Failure to do so may cause electric shock.



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

Table 3-1: Motor and Feedback Pinouts

Pin	Description	Connector
1	Key (Ensures that correct cable is plugged into the correct jack)	
2	Cosine-N	
3	Sine-N	
4	Marker-N	
5	Common ground	
6	Common ground	
7	Negative (CCW) hardware limit	
8	Hall Effect sensor, phase A	
9	Hall Effect sensor, phase C	
10	Frame ground	
11	Motor ØA	
12	Motor ØB	
13	Motor ØC	
14	Cosine	
15	Sine	
16	Marker	
17	+5 V supply input for feedback devices	
18	Reserved	
19	Positive (CW) hardware limit	
20	Reserved	
21	Hall Effect sensor, phase B	
22	Signal shield connection	
23	Motor ØA	
24	Motor ØB	
25	Motor ØC	
Case	Signal shield connection (to case)	

1. Pins [5 and 6], [11 and 23], and [13 and 25] are not externally jumpered on the ANT95XY-025 and ANT95XY-050

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

3.2. Motor and Feedback Wiring

All motor and controller manufacturers have their own designations for motor $\emptyset A/\emptyset B/\emptyset C$ and Hall signals A/B/C (refer to [Section 3.5](#) for motor phasing). Shielded cables are required for the motor and feedback connections.

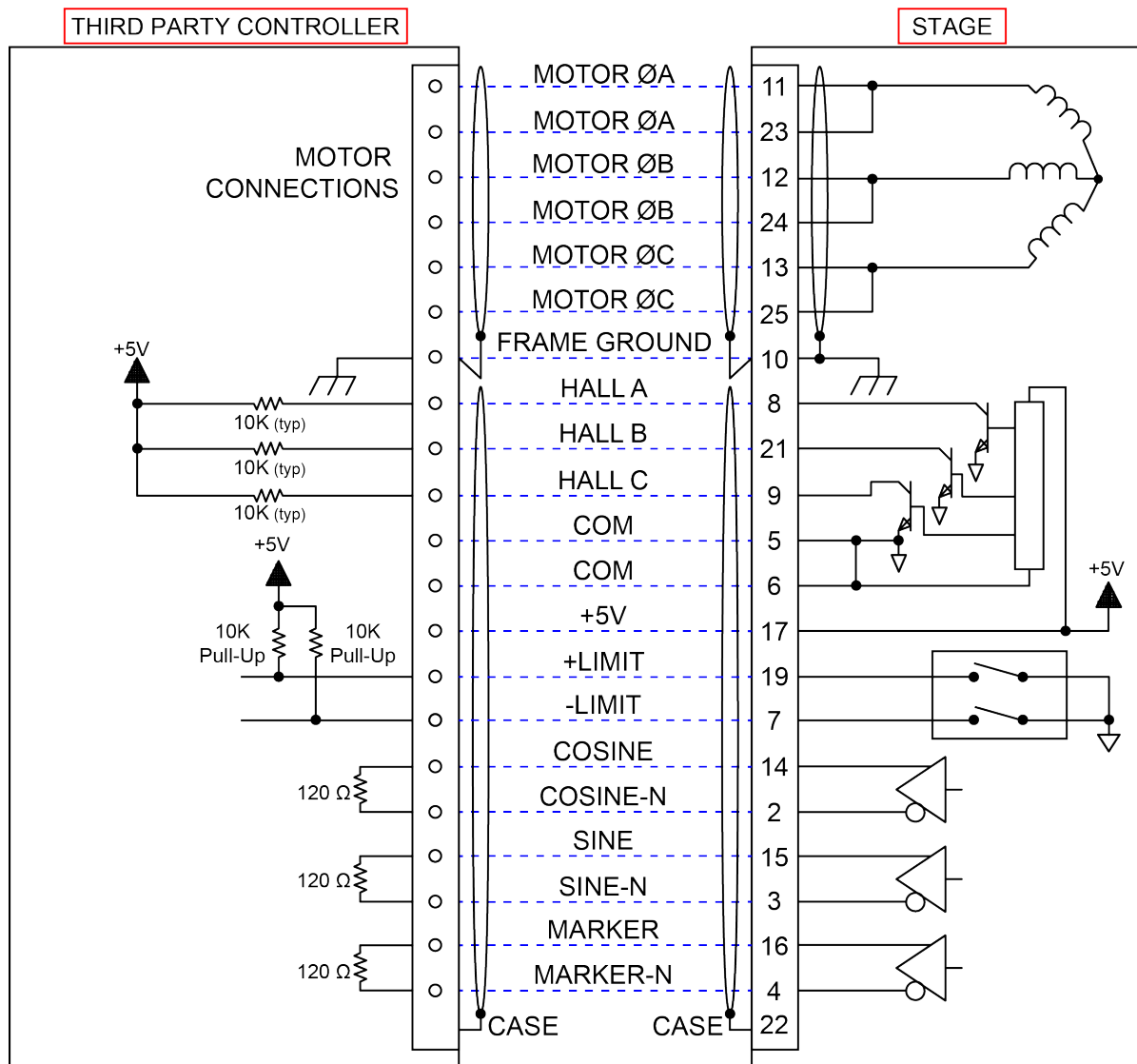


Figure 3-1: Motor and Feedback Wiring

3.3. Motor and Feedback Specifications

Table 3-2: 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)

Encoder Specifications	
Supply Voltage	5 V \pm 5%
Supply Current	250 mA
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.)

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"> 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)
Notes: <ul style="list-style-type: none"> If the ANT95L is driven beyond the electrical limit, it will encounter a mechanical stop. Impacting the mechanical stop could cause damage to the stage even at low speeds. 	

Table 3-3: Motor Specifications

		Linear Motor [ANT95L-025]	Linear Motor [ANT95L-050]	Linear Motor [ANT95L-075]	Linear Motor [ANT95L-100]
Performance Specifications^(1,5)					
Continuous Force ⁽²⁾	N (lb)	7.7 (1.73)	9.7 (2.17)	9.7 (2.17)	12.9 (2.89)
Electrical Specifications⁽⁵⁾					
Winding Designation		-A	-A	-A	-A
BEMF Constant (Line to Line, Max)	V/m/s (V/in/s)	2.86 (0.07)	3.78 (0.10)	3.78 (0.10)	4.77 (0.12)
Continuous Current ⁽²⁾	Amp _{pk} (Amp _{rms})	3.10 (2.19)	2.94 (2.08)	2.94 (2.08)	3.10 (2.19)
Peak Current, Stall ⁽³⁾	Amp _{pk} (Amp _{rms})	12.40 (8.77)	11.76 (8.31)	11.76 (8.31)	12.40 (8.77)
Force Constant, Sine Drive ^(4, 8)	N/Amp _{pk} (lb/Amp _{pk})	2.48 (0.56)	3.28 (0.74)	3.28 (0.74)	4.15 (0.93)
	N/Amp _{rms} (lb/Amp _{rms})	3.51 (0.79)	4.65 (1.05)	4.65 (1.05)	5.87 (1.32)
Motor Constant ^(2,4)	N/√W (lb/√W)	1.21 (0.27)	1.41 (0.32)	1.41 (0.32)	1.59 (0.36)
Resistance, 25°C (Line to Line)	ohms	4.0	5.2	5.2	6.5
Inductance (Line to Line)	mH	0.51	0.70	0.70	0.87
Thermal Resistance	°C/W	2.48	2.12	2.12	1.52
Maximum Bus Voltage	VDC	80	80	80	80
Magnetic Pole Pitch	mm (in)	16.00 (0.63)	16.00 (0.63)	16.00 (0.63)	16.00 (0.63)
1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature 2. Values shown @ 100°C rise above a 25°C ambient temperature, with motor mounted to the specified aluminum heat sink. 3. Peak force assumes correct rms current; consult Aerotech. 4. Force constant and motor constant specified at stall 5. All performance and electrical specifications ±10% 6. Maximum winding temperature is 125°C. 7. Ambient operating temperature range 0 °C - 25 °C; consult Aerotech for performance in elevated ambient temperatures 8. All Aerotech amplifiers are rated Apk; use force constant in N·m/Apk when sizing.					

Table 3-4: Encoder Specifications

Model	ANT95L-025	ANT95L-050	ANT95L-075	ANT95L-100
Fundamental Resolution	20 μm			
with x4000 Interpolation	5 nm			
with x16000 Interpolation	1.25 nm			
1. Quadrature decoding included in interpolation resolution calculations				

3.4. Limits, Marker, and Machine Direction

Aerotech stages are configured to have positive and negative "machine" directions. The machine direction defines the phasing of the feedback and motor signals and is dictated by the stage wiring (refer to [Section 3.5](#) for Motor and Feedback phasing information). Programming direction of a stage is set by the controller that is used to move the stage. Programming direction is typically selectable in the controller, while machine direction is hardwired in the stage. [Figure 3-2](#) shows the machine direction of ANT95L stages.

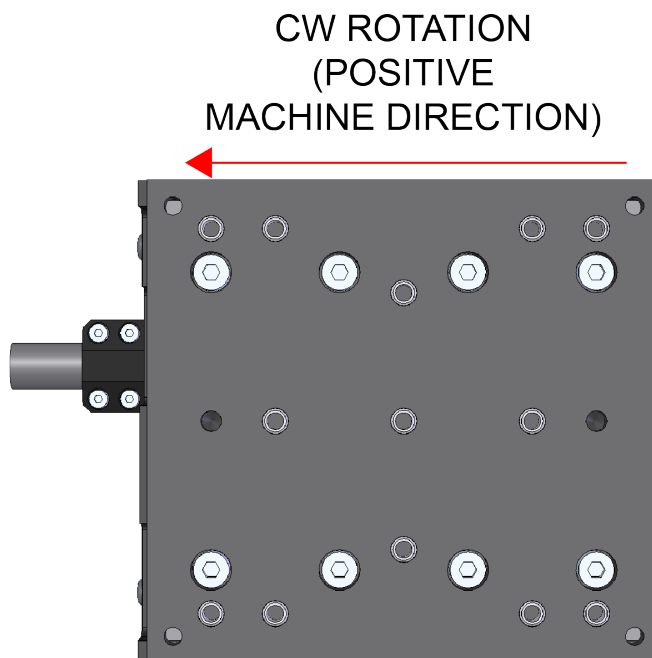


Figure 3-2: Machine Direction

3.5. Motor and Feedback Phasing

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

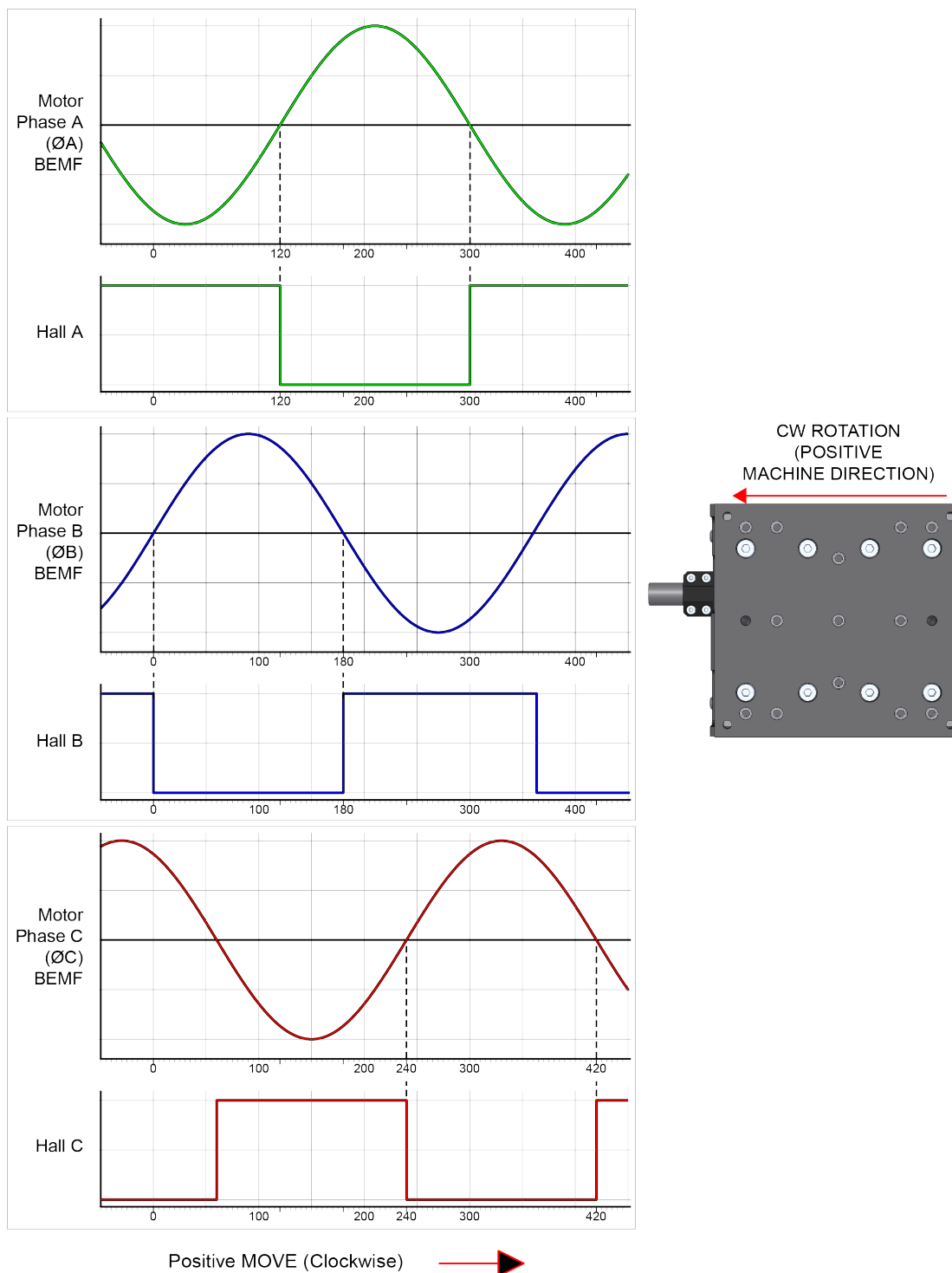


Figure 3-3: Hall Phasing

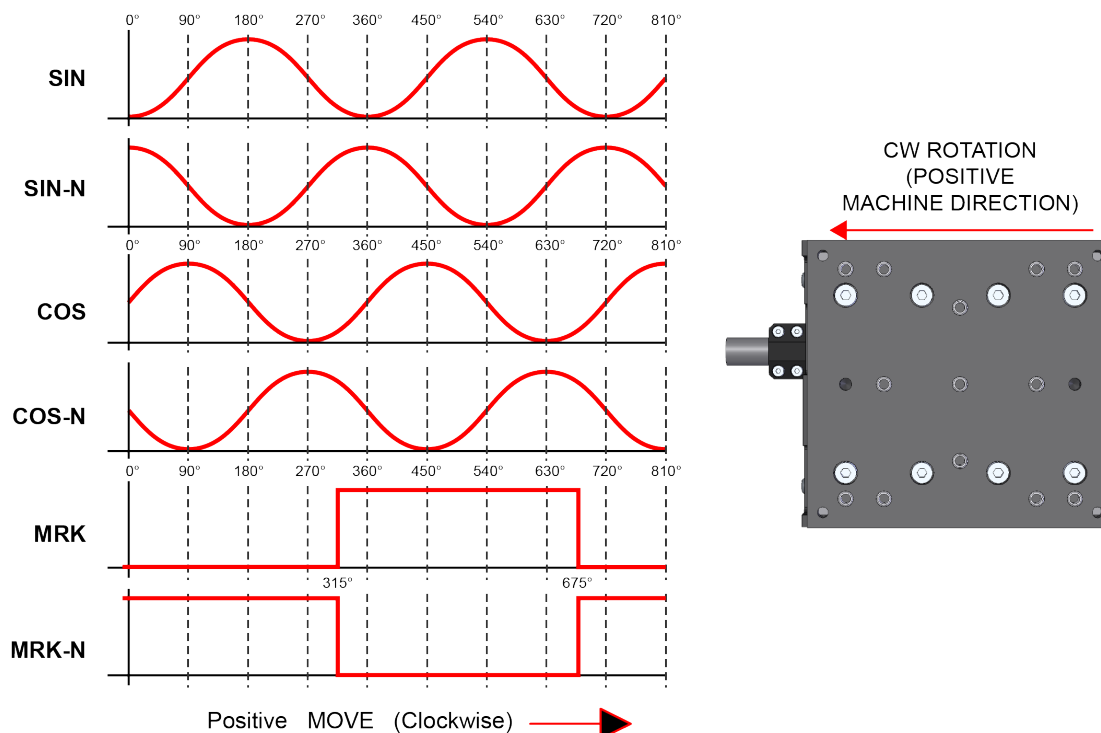


Figure 3-4: Analog Encoder Phasing Reference Diagram

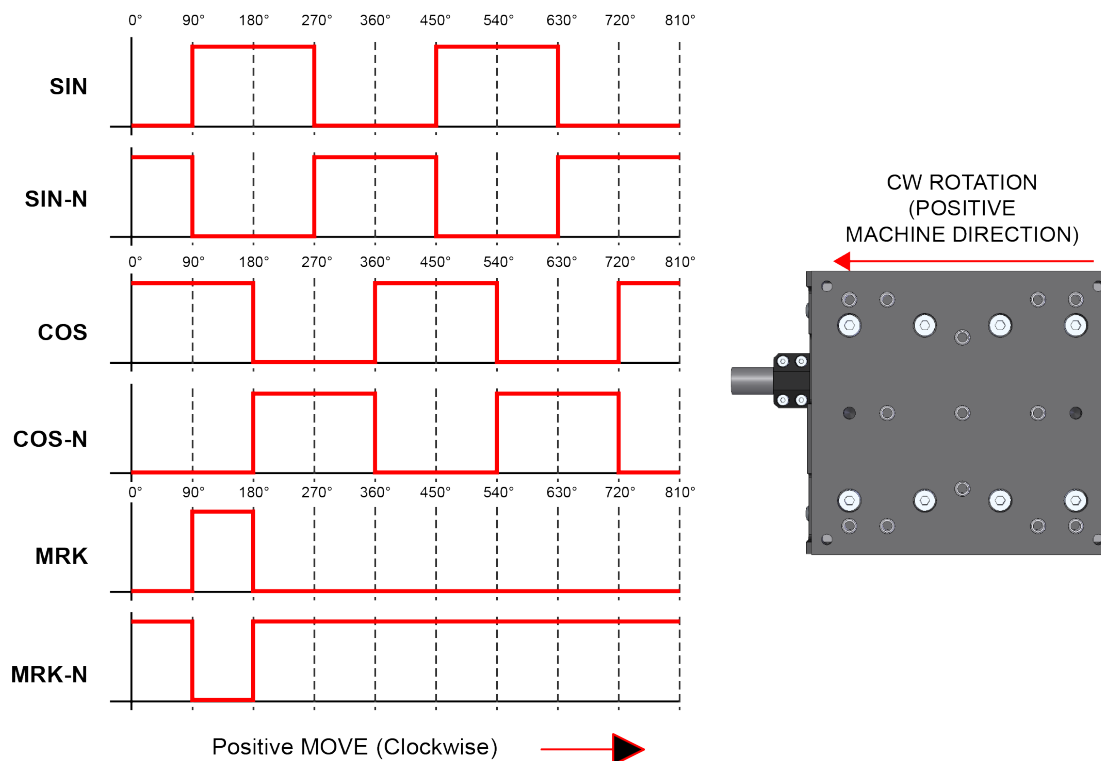


Figure 3-5: Encoder Phasing Reference Diagram (Standard)

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Chapter 4: Maintenance

NOTE: The bearing area must be kept free of foreign matter and moisture; otherwise, the performance and life expectancy of the stage will be reduced.



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

4.1. Service and Inspection Schedule

Inspect the ANT95L once per month. A longer or shorter inspection interval may be required depending on the specific application, and conditions such as the duty cycle, speed, and environment.

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

Monthly inspections should include but not be limited to:

- Visually inspect the stage and cables.
- Re-tighten loose connectors.
- Replace or repair damaged cables.
- Clean the ANT95L and any components and cables as needed.
- Repair any damage before operating the ANT95L.
- 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 ANT95L, blow away small particles and dust with nitrogen or, less preferably, clean, dry, compressed air.

Any external metal surface of the ANT95L 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 linear roller bearings, use Kluberplex BEM 34-132 grease. Only use the specified grease as other greases may be incompatible.

If the application process uses only a small portion of travel for most of the duty cycle, periodically drive the stage through full travel to redistribute the lubrication in the bearings. The motor is completely non-contact and requires no lubrication.

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

Lubrication Procedure

1. Drive the stage table to one end of travel and remove power to the stage.
2. Remove any accumulated dust or debris that is visible inside of the assembly.
3. Remove any dirty or dried lubricant from the v-channels of the linear bearing rails. Use a clean, lint-free cloth with a side-to-side motion. Use a swab soaked in isopropyl alcohol to remove stubborn debris.
4. Apply a thin, continuous film of lubricant to the exposed v-channels of the cross rollers on both ends of the stage. A good quality, natural bristle artist's brush makes an excellent applicator. Do not use any applicator that could scratch or otherwise damage the v-channels.
5. Manually move the stage to the opposite end of travel. This will work the grease into the linear bearing guides. The stage table should move freely with little resistance.
6. Repeat steps 2 through 4 for any areas covered by the original table position.
7. Restore power to the stage; drive the stage table back to its original position to redistribute lubricants.

4.3. Troubleshooting

Symptom	Possible Cause and Solution
Stage will not move	<ul style="list-style-type: none">• Shipping restraints still installed. Remove the red anodized shipping brackets.• In Limit condition. Check limits (refer to Chapter 3) and refer to controller documentation for polarity and compatibility requirements (Example: voltage requirements).• Controller trap or fault (refer to controller documentation).
Stage moves uncontrollably	<ul style="list-style-type: none">• Encoder (sine and cosine) signal connections (refer to Chapter 3 and Controller documentation).• Motor Connections (refer to Chapter 3 and Controller documentation).
Stage oscillates or squeals	<ul style="list-style-type: none">• Gains misadjusted (refer to the controller documentation).• Encoder signals (refer to the controller documentation).

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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) 3319 7715	Aerotech Germany Full-Service Subsidiary Phone: +49 (0)911 967 9370 Fax: +49 (0)911 967 93720
JAPAN	TAIWAN	UNITED KINGDOM
Aerotech Japan Full-Service Subsidiary Phone: +81 (0)50 5830 6814 Fax: +81 (0)43 306 3773	Aerotech Taiwan Full-Service Subsidiary Phone: +886 (0)2 8751 6690	Aerotech United Kingdom Full-Service Subsidiary Phone: +44 (0)1256 855055 Fax: +44 (0)1256 855649

Have your customer order number ready before calling.

Appendix B: Revision History

Revision	Description
1.04.00	<ul style="list-style-type: none">• Product update• Safety information updated• General revision
1.03.00	<ul style="list-style-type: none">• Added Declaration of Incorporation• Added Environmental Specifications section• Added safety information and warnings• Added note about current requirements of motor and ground wires
1.02.00	ANT95L-050 mounting plate modified for compatibility with ANT95V-3
1.01.00	Added stage limit travel dimension
1.00.00	New manual

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