



ANT95R

Hardware Manual

Revision: 1.07.00



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Safety Procedures and Warnings

This manual tells you how to carefully and correctly use and operate the ANT95R.

- Read all parts of this manual before you install or operate the ANT95R or before you do maintenance to your system.
- To prevent injury to you and damage to the equipment, obey the precautions in this manual.
- Aerotech continually improves its product offerings; listed options may be superseded at any time.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.

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



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 ANT95R 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. Moving parts can cause crushing or shearing injuries. Access to all stage and motor parts must be restricted while connected to a power source.
4. Disconnect electrical power before servicing equipment.
5. All components must be properly grounded in accordance with local electrical safety requirements.
6. Operator safeguarding requirements must be addressed during final integration of the product.



WARNING: To prevent damage to the equipment and to decrease the risk of electric shock and injury, obey the precautions that follow.

1. Cables can pose a tripping hazard. Securely mount and position all system cables to avoid potential hazards.
2. 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.
3. The ANT95R stage actuator unit must be mounted securely. Improper mounting can result in injury and damage to the equipment.
4. Use care when moving the ANT95R stage actuator unit. Lifting or transporting the ANT95R stage actuator unit improperly can result in injury or damage to the ANT95R.
5. 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.
6. Operators must be trained before operating this equipment.
7. 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:

ANT95R 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):

EU 2015/863

Directive, Restricted Substances (RoHS3)

Authorized Representative: Simon Smith, European Director
Aerotech Ltd


Address: The Old Brick Kiln, Ramsdell, Tadley
Hampshire RG26 5PR
UK

Name

Position

Location

Date

 / Alex Weibel
Engineer Verifying Compliance
Pittsburgh, PA
4/12/2021



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Chapter 1: Overview



IMPORTANT: Aerotech continually improves its product offerings, and 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.

Table 1-1: ANT95R Model Numbering System

ANT95R Single-axis Rotary Direct-drive Nanopositioning Stage	
Travel (Required)	
-360	Continuous travel
-020	Limited travel, ± 10 degrees
-180	Limited travel, ± 90 degrees
Mounting Plate (Optional)	
-MP	Mounting plate
Performance Grade (Required)	
-PL1	Base performance
-PL2	High-accuracy performance

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 Aero for information regarding your specific application.
Protection Rating	The ANT95R 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 ANT95R. At a minimum, the environmental temperature must be controlled to within 0.25°C per 24 hours to ensure the ANT95R 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 ANT95R is mounted. Contact the factory for more details.

The accuracy specification of ANT95R 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

Resolution is dependent on encoder resolution and controller interpolation.

Table 1-3: ANT95R Series Specifications

		-020	-180	-360
Rotation Angle		20°	180°	±360° Continuous
Accuracy ⁽¹⁾	-PL1	10 arc sec	10 arc sec	10 arc sec
	-PL2	3 arc sec	3 arc sec	3 arc sec
Resolution (Minimum Incremental Motion)		0.01 arc sec	0.01 arc sec	0.01 arc sec
Bidirectional Repeatability ⁽¹⁾		1.5 arc sec	1.5 arc sec	1.5 arc sec
Unidirectional Repeatability		0.5 arc sec	0.5 arc sec	0.5 arc sec
Tilt Error Motion	Synch	Not applicable	Not applicable	10 arc sec
	Asynch	Not applicable	Not applicable	3 arc sec
Axial Error Motion ⁽¹⁾	Synch	Not applicable	Not applicable	2 μm
	Asynch	Not applicable	Not applicable	0.5 μm
Radial Error Motion ⁽¹⁾	Synch	Not applicable	Not applicable	3 μm
	Asynch	Not applicable	Not applicable	1 μm
Maximum Speed		20 rpm	20 rpm	200 rpm
Maximum Acceleration		400 rad/s ²	400 rad/s ²	400 rad/s ²
In-Position Stability ⁽²⁾		0.005 arc sec	0.005 arc sec	0.005 arc sec
Aperture		11 mm (0.433 in)	11 mm (0.433 in)	11 mm (0.433 in)
Maximum Torque (Continuous)		0.2 N·m	0.2 N·m	0.2 N·m
Load Capacity ⁽³⁾	Axial	2.0 kg (4.4 lb)	2.0 kg (4.4 lb)	2.0 kg (4.4 lb)
	Radial	1.5 kg (3.3 lb)	1.5 kg (3.3 lb)	1.5 kg (3.3 lb)
	Moment	2 N·m	2 N·m	2 N·m
Rotor Inertia (Unloaded)		0.00065 kg·m ²	0.00066 kg·m ²	0.00069 kg·m ²
Stage Mass		1.2 kg (2.6 lb)	1.2 kg (2.6 lb)	1.2 kg (2.6 lb)
Material		Aluminum Body/Black Hardcoat Finish		
Mean Time Between Failure		30,000 Hours		
1. Certified with each stage.				
2. In-Position Jtter listing is 3 sigma value.				
3. Axis orientation for on-axis loading is listed (refer to Section 2.4 for offset loading behavior).				
• 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.				
• All error motion specifications are measured at 60 rpm.				
• For high speed operation, customer payload must be balanced to G1.0 per ISO 1940.				

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Chapter 2: Mechanical Specifications and Installation



WARNING: The ANT95R must be installed according to the instructions in 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: Manually lifting and moving the stage requires a minimum of two people on either side of the stage. Refer to [Section 1.3](#) for stage mass specifications.

- Do not attempt to lift heavy loads single handed.
- Follow the lifting instructions and only manually lift from the specified surfaces (if lifting hardware hasn't been supplied).
- Do not use any of the cables as lifting points.



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 ANT95R. Unsecured moving parts may shift and cause bodily injury.
- Improper handling could adversely affect the performance of the ANT95R. Use care when moving the ANT95R.



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

Carefully remove the ANT95R from its protective shipping container. Gently set the ANT95R on a smooth, flat, and clean surface.

Before operating the ANT95R, 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-free air to remove any dust or debris that has collected during shipping.

Each ANT95R 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

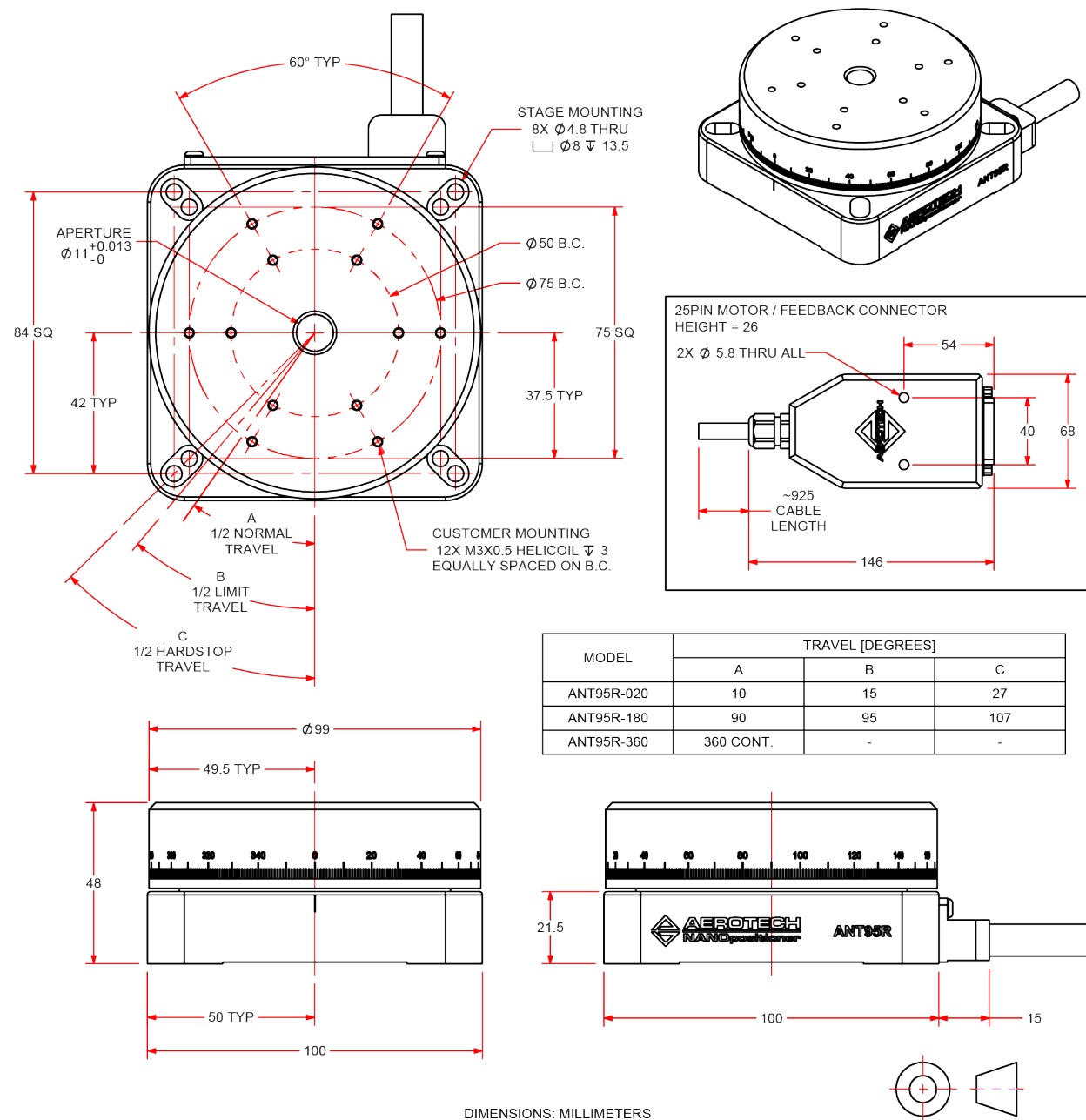


Figure 2-1: ANT95R Dimensions

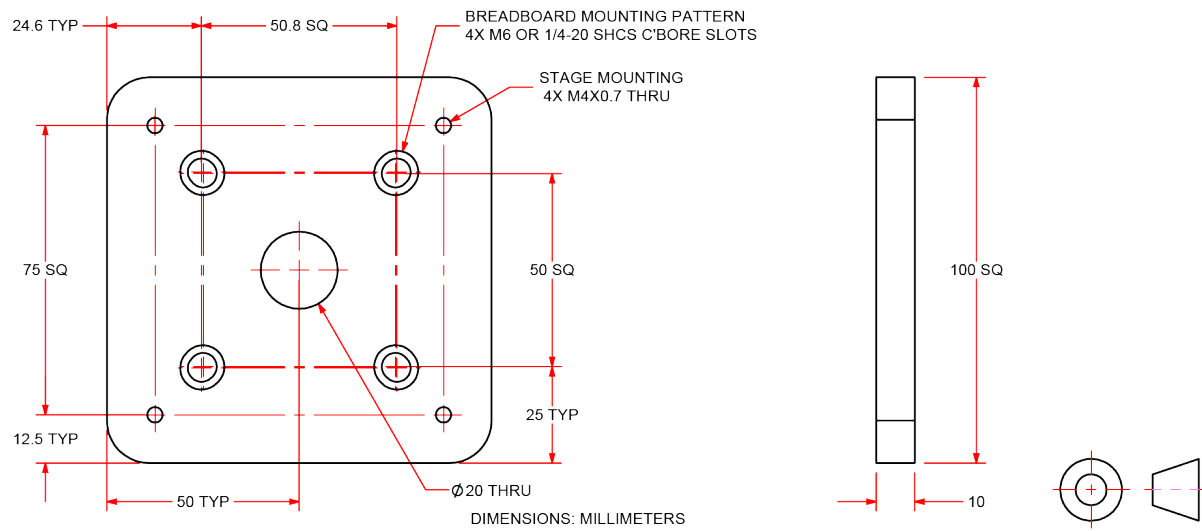


Figure 2-2: ANT95R Mounting Plate (-MP) Dimensions

2.3. Securing the Stage to the Mounting Surface



WARNING: The ANT95R must be mounted securely. Improper mounting can result in injury or damage to the equipment.

The mounting surface must be flat and have adequate stiffness to achieve the maximum performance from the ANT95R 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.



IMPORTANT: To maintain accuracy, the mounting surface must be flat to within 1 μm per 50 mm.



IMPORTANT: The ANT95R 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 ANT95R. Shimming should be avoided if possible. If shimming is required, it should be minimized to retain maximum rigidity of the system.

ANT95R series stages have a fixed mounting pattern (as shown in [Figure 2-3](#)).

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 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
M4 by 16 mm [#8 by 5/8 in] SHCS	2.3 N·m

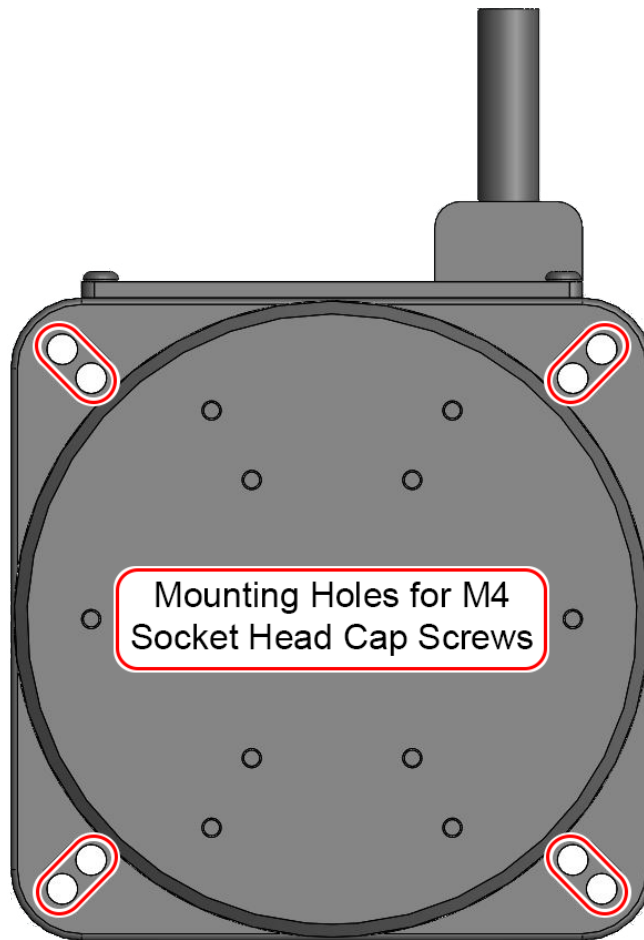


Figure 2-3: Mounting Hole Pattern

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.

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.



IMPORTANT: If your ANT95R 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 ANT95R 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.



IMPORTANT: If possible, use 3-point mounting when you attach the payload to the stage.



IMPORTANT: For valid system performance, the mounting interface should be flat within 1 μm per 50 mm.



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 2-4](#) to find the loading condition. Refer to [Figure 2-5](#) to find the maximum allowable load.

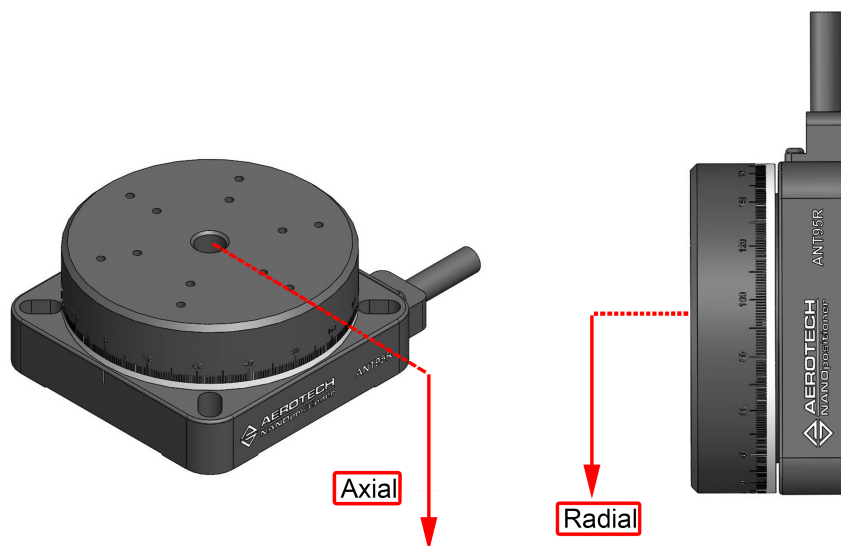


Figure 2-4: Load Orientations

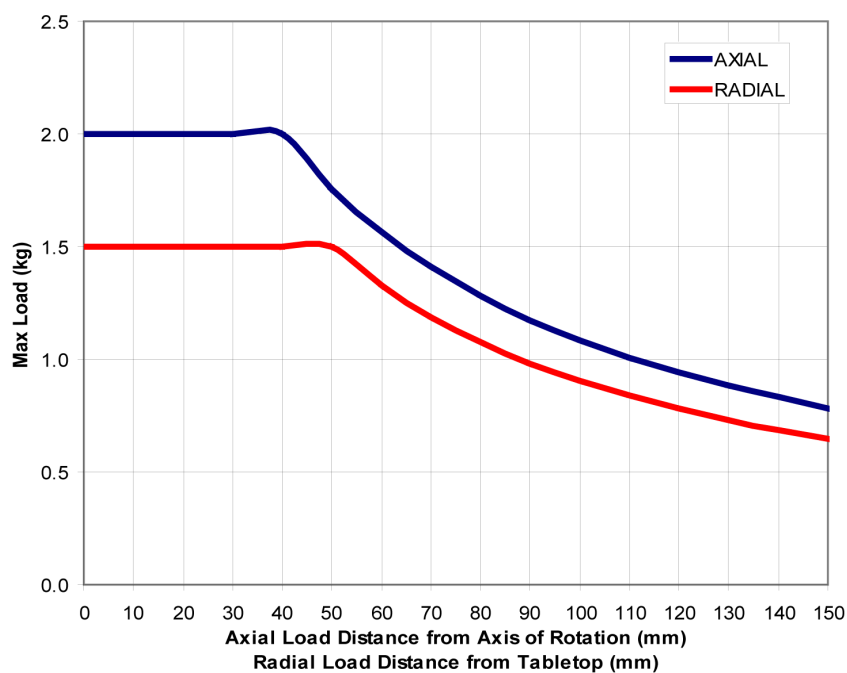


Figure 2-5: Cantilevered Load Capabilities

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Chapter 3: Electrical Specifications and Installation



IMPORTANT: Electrical installation must be performed by qualified personnel only.

Aerotech motion control systems are adjusted at the factory for optimum performance. When the ANT95R is part of a complete Aerotech motion control system, setup usually involves connecting the ANT95R 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 disconnection electrical components. Failure to do so can cause electric shock or damage to the equipment.



DANGER: Access to the base and tabletop must be restricted while connected to a power source. Failure to do so can cause electric shock or other bodily harm.



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



IMPORTANT: The ANT95R does not have Hall sensor signals. The controller has to initialize motor commutation through the use of a software algorithm.

3.1. Motor and Feedback Connectors

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

The protective ground connection of the ANT95R 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.

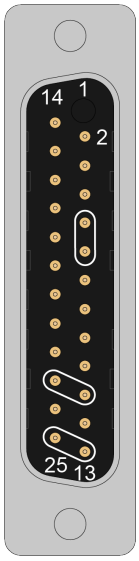


DANGER: The protective ground connection must be properly installed to minimize the possibility of electric shock.



DANGER: The stage controller must provide over-current and over-speed protection. Failure to do so could cause electric shock or damage to the equipment.

Table 3-1: Motor and Feedback Pinouts

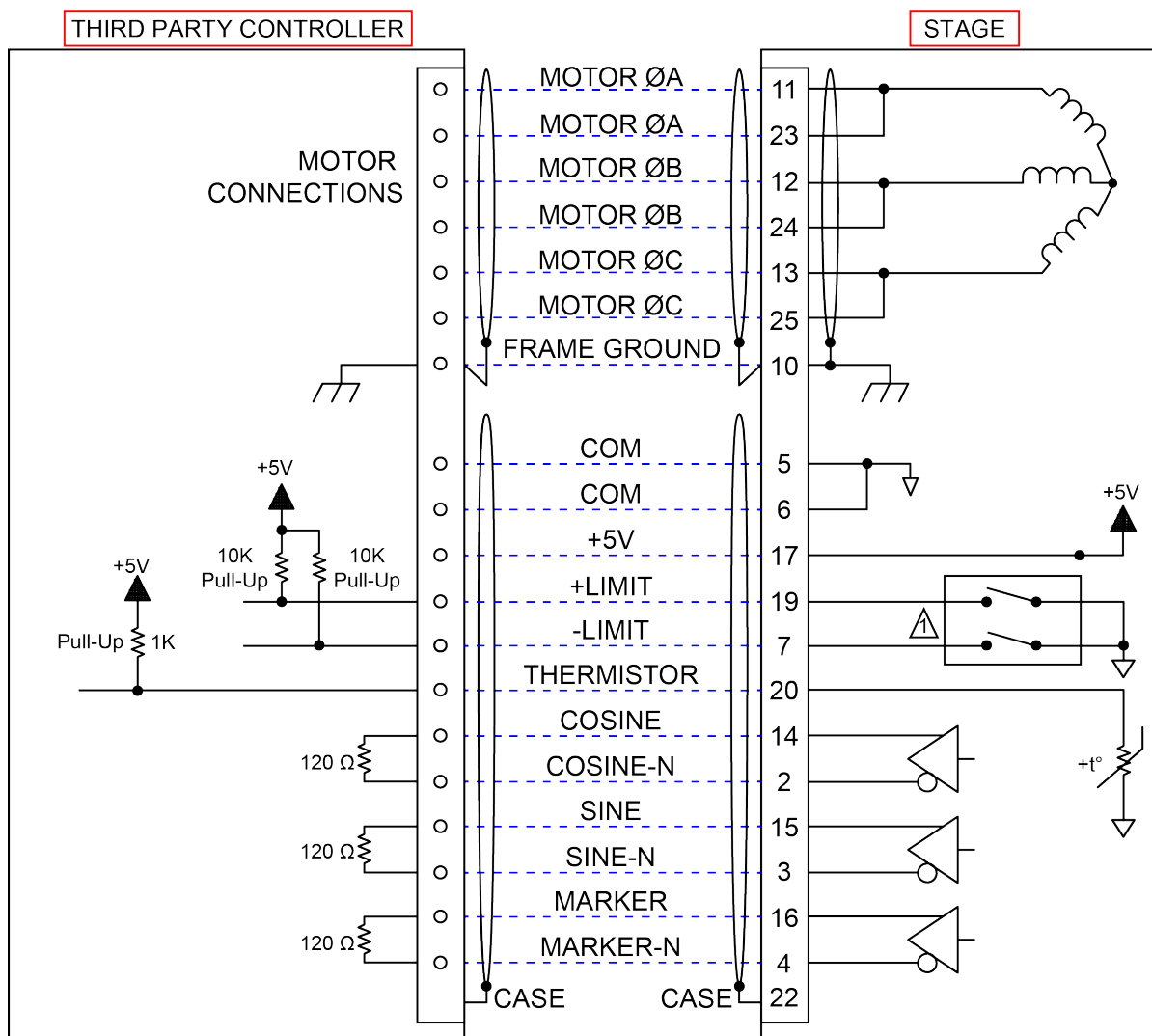
Pin	Description	Connector
1	Key (Ensures that correct cable is plugged into the correct jack)	
2	Cosine-N	
3	Sine-N	
4	Marker-N	
5	Common ground	
6	Common ground	
7	Negative (CCW) hardware limit ¹	
10	Frame Ground	
11	Motor Phase A	
12	Motor Phase B	
13	Motor Phase C	
14	Cosine	
15	Sine	
16	Marker	
17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

1. Limit pins 7 and 19 are reserved on ANT95R-360

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 $\emptyset A/\emptyset B/\emptyset C$ (refer to for motor phasing). Shielded cables are required for the motor and feedback connections.



Limit pins 7 and 19 are reserved (not used) on the ANT95R-360.

Figure 3-1: Motor and Feedback Wiring

3.3. Motor and Feedback Specifications

Table 3-2: Feedback Specifications

Thermistor Specifications	
Polarity	Logic "0" (no fault)
	Logic "1" (over-temperature fault)
Cold Resistance	~ 100 Ω
Hot Resistance	~ 10 K
Note: 1K pull-up to +5V recommended.	
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 [Not available on the ANT95R-360]	
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 ANT95R 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

		SF-75-21-2X ⁽²⁾ [ANT95R]
Performance Specifications^(1,6)		
Stall Torque, Continuous	N-m (oz-in)	0.27 (38.4)
Peak Torque ⁽⁴⁾	N-m (oz-in)	1.08 (153.6)
Rated Power Output, Continuous	watts	113.6
Electrical Specifications⁽⁶⁾		
Winding Designation		-B
BEMF Constant (Line to Line, Max)	Volts _{pk} /krpm	10.9
Continuous Current, Stall	Amp _{pk} (Amp _{rms})	3.00 (2.12)
Peak Current, Stall ⁽⁴⁾	Amp _{pk} (Amp _{rms})	12.00 (8.49)
Torque Constant ^(5,7)	N-m/Amp _{pk} (oz-in/Amp _{pk})	0.09 (12.8)
	N-m/Amp _{rms} (oz-in/Amp _{rms})	0.13 (18.1)
Motor Constant ⁽⁵⁾	N/√W (lb/√W)	0.042 (5.92)
Resistance, 25°C (Line to Line)	ohms	4.8
Inductance (Line to Line)	mH	0.45
Maximum Bus Voltage	VDC	80
Thermal Resistance	°C/W	1.78
Number of Poles	P	8
1. Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature 2. Values shown @ 68°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 4. Peak torque assumes correct rms current; consult Aerotech 5. Torque constant and motor constant specified at stall 6. All performance and electrical specifications ±10% 7. All Aerotech amplifiers are rated A _{pk} ; use torque constant in N·m/A _{pk} when sizing		

Table 3-4: Encoder Resolution

Model	ANT95R-020	ANT95R-180	ANT95R-360
Fundamental Resolution	11840 Lines / Rev		
With x4000 Interpolation	0.0274 arcsec		
With x16000 Interpolation	0.0068 arcsec		
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 ANT95R stages.

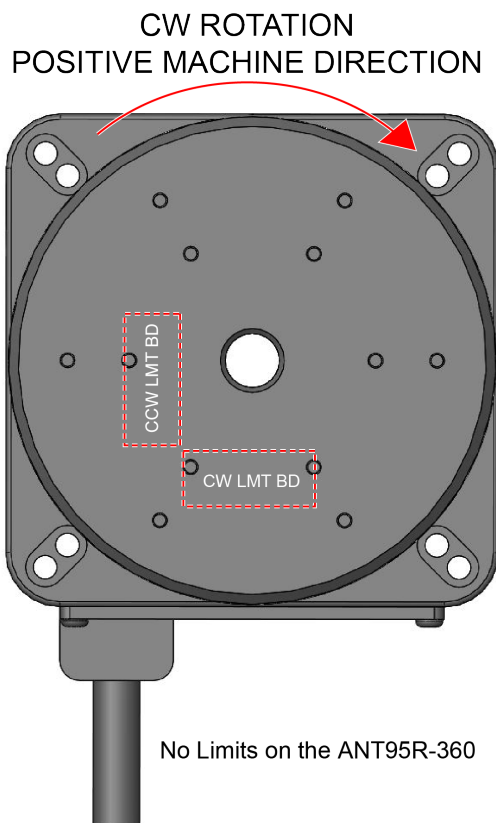


Figure 3-2: Machine Direction

3.5. Motor and Feedback Phasing

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

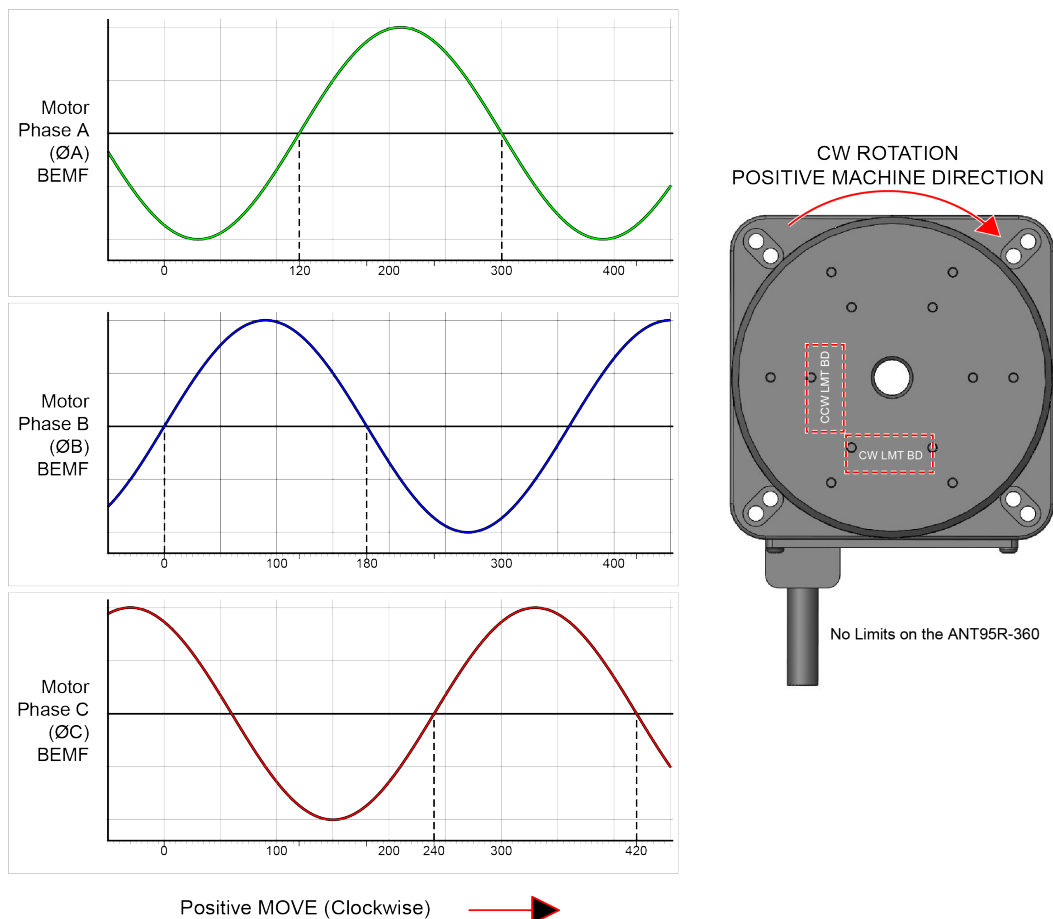


Figure 3-3: Hall Phasing

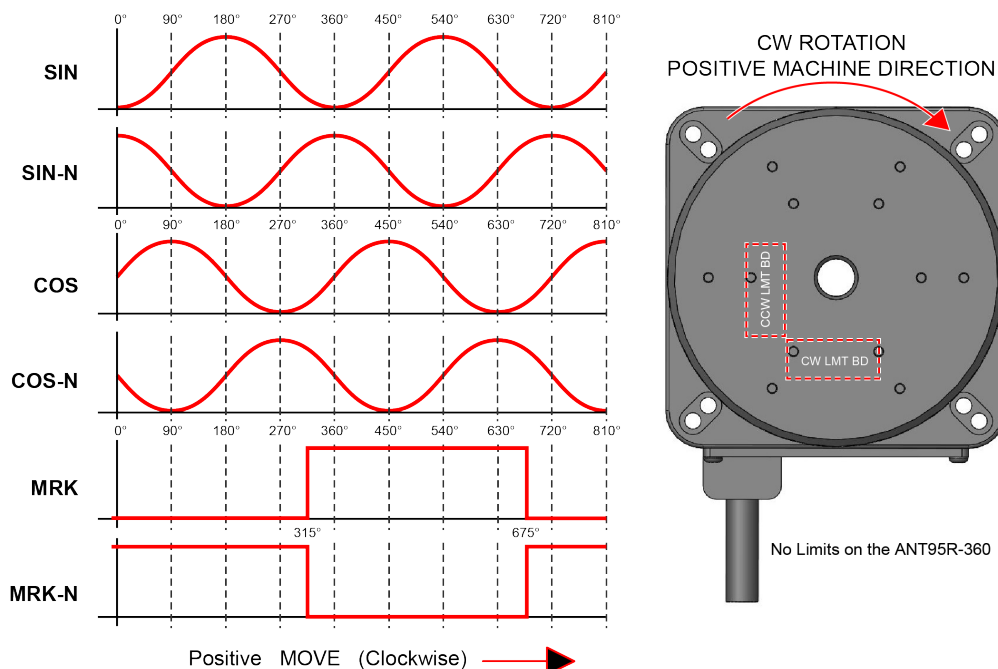


Figure 3-4: Analog Encoder Phasing Reference Diagram

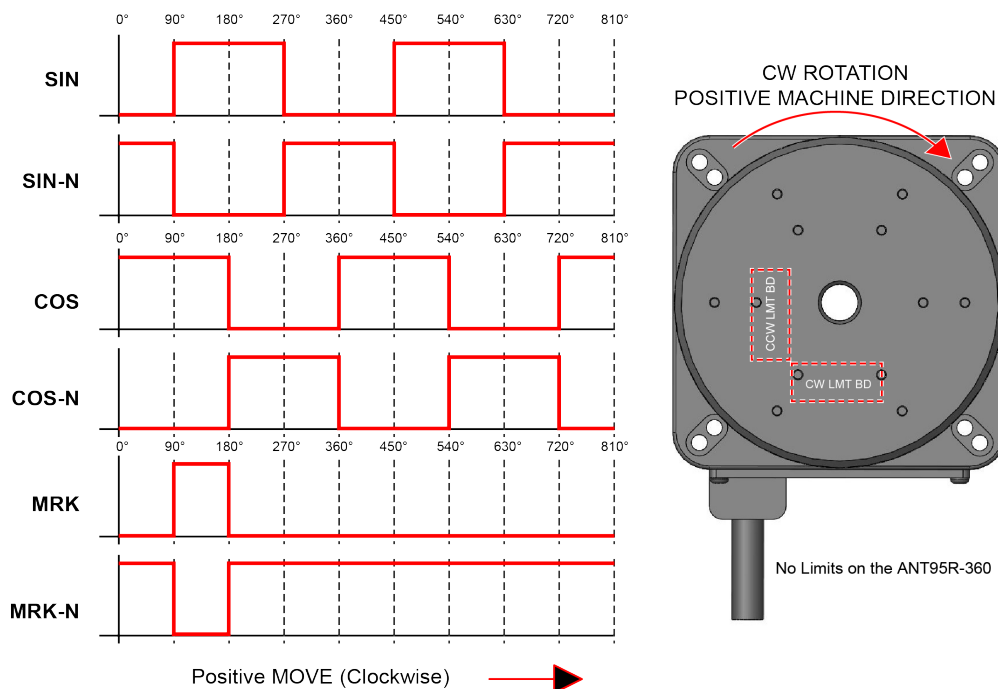


Figure 3-5: Encoder Phasing Reference Diagram (Standard)

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Chapter 4: Maintenance



IMPORTANT: 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 ANT95R 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 annually. For stages operating under conditions involving excessive debris, stages should be cleaned every six months. In normal operating conditions and with proper cleanliness of the stage, the bearing will not require lubrication or maintenance for the life of the stage.

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 ANT95R and any components and cables as needed.
- Repair any damage before operating the ANT95R.
- 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.



IMPORTANT: 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.



IMPORTANT: 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 ANT95R, blow away small particles and dust with nitrogen or, less preferably, clean, dry, compressed air.

Any external metal surface of the ANT95R can be cleaned with isopropyl alcohol on a lint-free cloth.



WARNING: Make sure that all solvent is completely dry before you move the stage.

Lubrication

There are no elements on ANT95R stages that require lubrication.

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.

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 Electrical Specifications and Installation) 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	<ul style="list-style-type: none">• Encoder (sine and cosine) signal connections (refer to Electrical Specifications and Installation and Controller documentation).• Motor Connections (refer to Electrical Specifications and Installation and the 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>

Appendix B: Revision History

Revision	Description
1.07.00	Updated encoder specs
1.06.00	<ul style="list-style-type: none">• Product update• Safety information updated• Dimensions updated• General revision
1.05.00	Added -PLUSoption
1.04.00	<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
1.03.00	Updated stage and motor specifications
1.02.00	Added Motor / Feedback Plug Mounting Pattern
1.01.00	Removed incorrect statement about captive screws
1.00.00	New manual

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