ANT130-5-V Stage

User's Manual

P/N: EDS154 (Revision 1.01.00)

Dedicated to the Science of Motion
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Revision History

Revision 1.01.00	November 5, 2010
Revision 1.00.00	April 12, 2010

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Chapter 1: Overview

This manual describes Aerotech's ANT130-5-V series positioning stage. Figure 1-1 shows a typical ANT130-5-V vertical lift stage.

This chapter introduces standard and optional features of the ANT130-5-V, explains the model numbering system, and gives general safety precautions.

Figure 1-1: ANT130-5-V Vertical Lift Stage

NOTE: Aerotech continually improves its product offerings, and listed options may be superseded at any time.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.

1.1. Standard Features

The ANT lift stages incorporate linear cross-roller bearings, a linear motor, a non-contact linear encoder, and constraint flexures into a compact three-piece wedge design. The combination of their features and size make the ANT lift stages unlike any other lift stage on the market. No other stage matches their accuracy, repeatability, resolution, speed, and smoothness of motion in such a small package size

The linear cross-roller bearings combined with the wedge style design offer excellent stiffness with minimal friction for smooth movement. The cross roller bearings also incorporate a system to prevent cage creep and keep the rollers centered in the bearing rails.

The ANT130-5-V is driven by a linear motor. The brushless linear motor uses an ironless forcer, which means there is zero cogging and there are no attractive forces – resulting in unsurpassed smoothness of motion. A moving magnet track design eliminates the need for cable management, improving long-term reliability.

A high-accuracy, non-contact linear encoder allows the ANT130-5-V series stages to have an incremental step size of 2 nm when coupled with Aerotech drives and controls. This is especially useful in alignment applications, where outstanding step-to-step resolution is critical.

The unique flexure constraint allows smooth and extremely repeatable motion that takes full advantage of the drive wedge style design without the extra vertically oriented bearing set used in competing designs.

For multi-axis applications, the ANT130-5-V can mount directly to any standard ANT130-L or ANT130-XY stage.

1.1.1. Optional Features

The ANT130-5-V stages have two accuracy grades: standard accuracy and high accuracy (-PLUS). The high accuracy grade offers a dramatic improvement for more demanding applications. See Section 3.5. Basic Specifications for more details.

ANT130-5-V stages come standard with a single, 25-pin D connector, however there is the option to have a 4-pin hi-power D and 25-pin D connector for applications that require bus voltages greater than 80 V.

For vacuum applications, two preparation options are available; one for low vacuum environments (down to 10^{-3} torr) and the other for high vacuum (10^{-3} to 10^{-6} torr).

A mounting plate is also available for customers who wish to mount the ANT130-5-V to a standard grid patterned surface. The mounting plate will accommodate a 25 mm or 1 in grid pattern.

1.1.2. Model Numbers

Stage model number example: ANT130-5-V-PLUS-25DU-NONE

The tables below list the available options in the order they appear in the example above. 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: Model Numbering System for ANT130-5-V Stages

ANT130-5-V Series Vertical Lift Stage	
ANT130-5-V	5 mm travel stage with linear motor and limits
ANT130-5-V-PLUS	5 mm travel stage with linear motor and limits and high accuracy calibration
Output Cable Connectors	
-25DU	Single 25-pin D connector (standard)
-4DU-25DU	4-pin HPD and 25-pin D connectors
Mounting Plate	
-NONE	No mounting plate
-MP-ANT-130-5-V	Breadboard mounting plate
Note: -25DU single 25-pin connector option not valid for systems using bus voltages greater than 80 V	

1.2. Dimensions

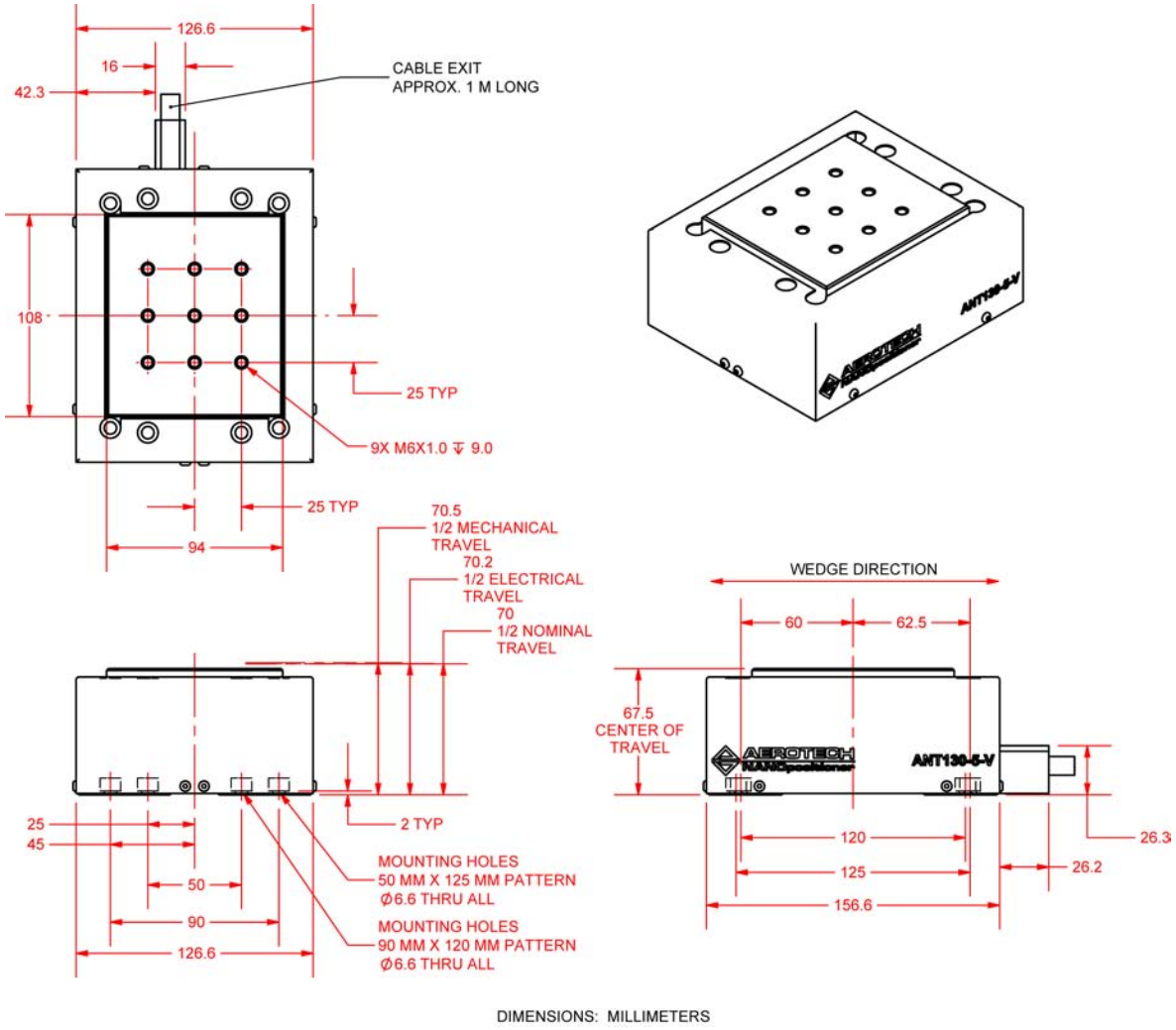


Figure 1-2: ANT130-5-V Dimensions

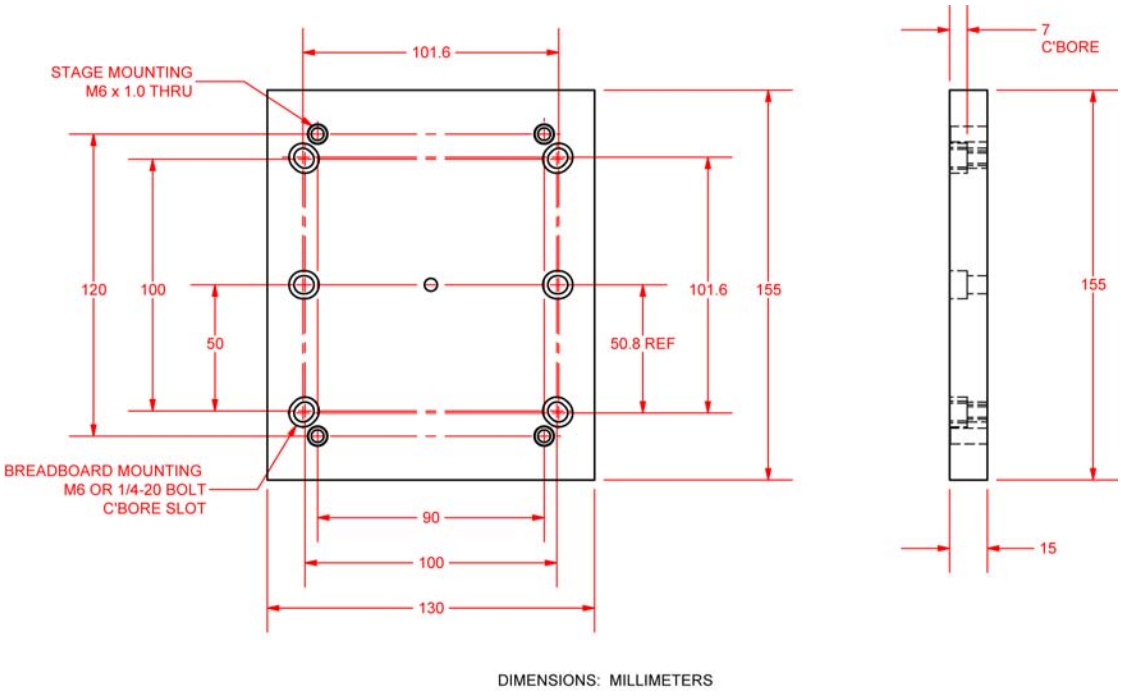


Figure 1-3: MP-ANT-130-5-V Dimensions

1.3. Safety Procedures and Warnings

The following statements apply throughout this manual. Failure to observe these precautions could result in serious injury to those performing the procedures and damage to the equipment.

This manual and any additional instructions included with the stage should be retained for the lifetime of the stage.

	To minimize the possibility of electrical shock and bodily injury or death, disconnect all electrical power prior to making any electrical connections.
	To minimize the possibility of electrical shock and bodily injury or death when any electrical circuit is in use, ensure that no person comes in contact with the circuitry when the stage is connected to a power source.
	To minimize the possibility of bodily injury or death, disconnect all electrical power prior to making any mechanical adjustments.
	Moving parts of the stage can cause crushing or shearing injuries. All personnel must remain clear of any moving parts.
	Improper use of the stage can cause damage, shock, injury, or death. Read and understand this manual before operating the stage.
	If the stage is used in a manner not specified by the manufacturer, the protection provided by the stage can be impaired.
	Stage cables can pose a tripping hazard. Securely mount and position all stage cables to avoid potential hazards.

Do not expose the stage to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.

The stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.

Use care when moving the stage. Manually lifting or transporting stages can result in injury.

Only trained personnel should operate, inspect, and maintain the stage.

This stage is intended for light industrial manufacturing or laboratory use. Use of the stage for unintended applications can result in injury and damage to the equipment.

Before using this stage, perform an operator risk assessment to determine the needed safety requirements.

1.4. EC Declaration of Incorporation

Manufactorer: Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA 15238
USA

herewith declares that the product:
Aerotech, Inc. ANT130-5-V Stage
is intended to be incorporated into machinery to constitute machinery covered by the Directive 2006/42/EC as amended;

does therefore not in every respect comply with the provisions of this directive;

and that the following harmonized European standards have been applied:
EN ISO 12100-1,-2:2003+A1:2009
Safety of machinery - Basic concepts, general principles for design
ISO 14121-1:2007
Safety of machinery - Risk assessment - Par 1: Principles
EN 60204-1:2005
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.

Authorized Representative: Manfred Besold
Address: AEROTECH GmbH
Süd-West-Park 90
D-90449 Nürnberg

Name: Alex Weibel /
Position: Engineer Verifying Compliance
Location: Pittsburgh, PA
Date: November 5, 2010

Chapter 2: Installation

This chapter describes the installation procedure for the ANT130-5-V stage, including handling the stage properly, preparing the mounting surface to accept the stage, securing the stage to the mounting surface, attaching the payload, and making the electrical connections.

Installation must follow the instructions in this chapter. Failure to follow these instructions could result in injury and damage to the equipment.

2.1. Unpacking and Handling the Stage

Carefully remove the stage from the protective shipping container. Use compressed nitrogen or clean, dry air to remove any dust or debris that has collected during shipping. Visually inspect the stage for damage. If any damage has occurred during shipping report it immediately. Set the stage on a smooth, flat, and clean surface. This is a simple, yet very important step in maintaining the integrity of the stage.

Each stage 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.

Improper stage handling could adversely affect the stage's performance. Therefore, use care when moving the stage. Manually lifting or transporting stages can result in injury.

Lift the stage only by the base.

2.2. Shipping Bracket

Aerotech provides a shipping bracket to prevent unwanted stage motion and potential damage from occurring during transport. The bracket is red anodized aluminum, and it must be removed from the stage before it can operate. Figure 2-1 depicts the shipping bracket as it is used to constrain an ANT130-5-V stage.

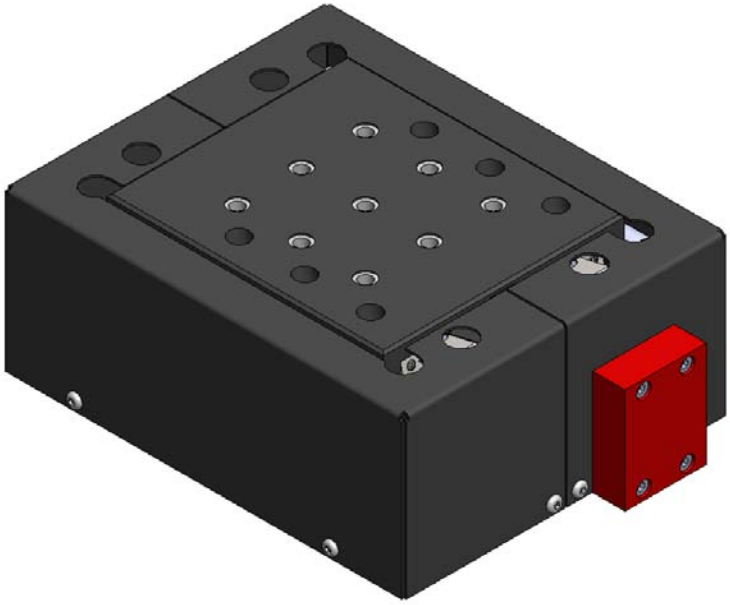


Figure 2-1: Shipping Bracket Used on ANT130-5-V

NOTE: After removing the shipping bracket, you should retain it for future use. In the event the stage requires service at the factory, the shipping bracket should be reattached to ensure the stage ships safely.

2.3. Preparing the Mounting Surface

The mounting surface should be flat to 5 µm and have adequate stiffness in order to achieve the maximum performance from the ANT130-5-V. When an ANT130-5-V stage is mounted to a warped surface, the stage can be distorted as the mounting screws are tightened (see Figure 2-2). Any distortion will decrease the overall accuracy of the stage. Adjustments to the mounting surface must be done before the stage is secured.

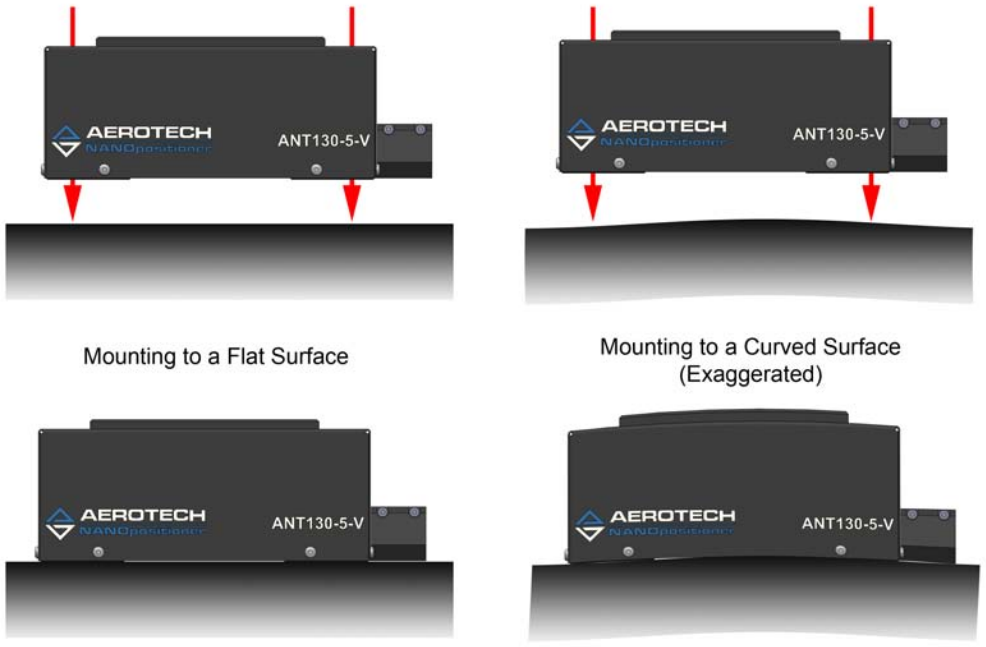


Figure 2-2: Mounting to a Flat Surface

NOTE: To maintain accuracy, the mounting surface should be flat within 5 µm over the entire stage footprint.

NOTE: The stage base is precision machined and verified for flatness prior to stage assembly at the factory. If machining is required to achieve the desired flatness, it should be performed on the mounting surface rather than the stage base. Shimming should be avoided if possible. If shimming is required, it should be minimized to improve the rigidity of the system.

2.4. Securing the Stage to the Mounting Surface

The ANT130-5-V is designed to be mounted using four M6 X 10 mm or 1/4-20 X 1/2 in. socket head cap screws. Using the specified screw length will guarantee a minimum of 1.5x diameter thread engagement. Torque the mounting screws to 5.4 N-m (4 ft-lb). There are two counterbored mounting patterns available (50 X 125 mm and 90 X 120 mm).

When the stage is centered, the wedge will block access to the mounting holes. Drive the stage to either end of travel to expose the mounting holes. Alternately, if the stage has not been powered up yet, access the holes by pushing down on the table top and pulling up on an M6 screw threaded into the table top.

There is a gap between the through holes in the cover and the mounting holes, which can make inserting the mounting screws challenging. You can remove the cover of the stage to more easily access the mounting holes. Replace the cover immediately afterwards to prevent damage to the stage. Take special care not to touch or mark the flexures in any way. Any bends, dings, or scratches could cause them to fail prematurely.

The stage must be mounted securely. Improper mounting can result in injury and damage to the equipment.

If you remove the cover of the stage, high magnetic fields at the ends of the magnet tracks will be exposed. Keep metal objects away from the ends of the magnet tracks.

NOTE: Do not attempt to manually move the stage if it is connected to a power source.

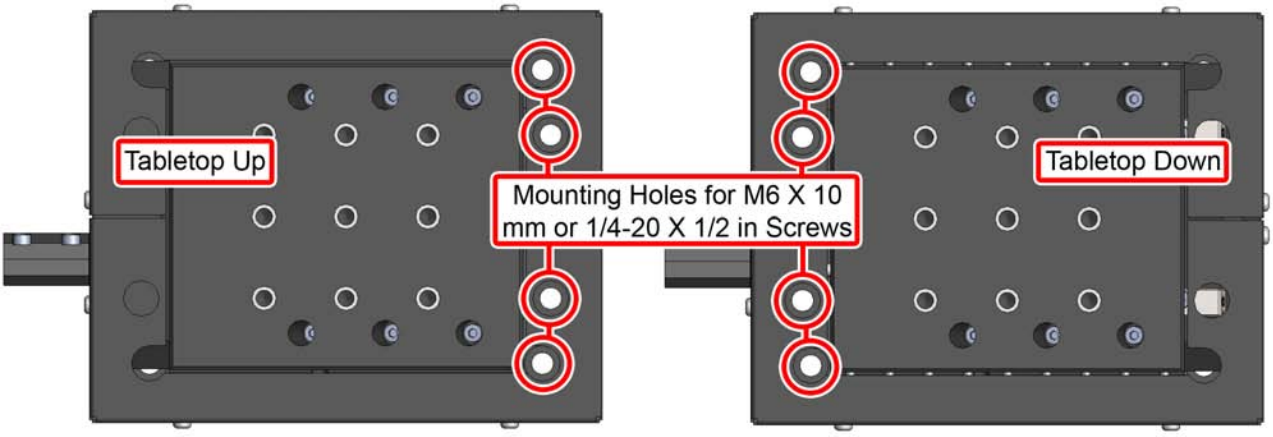


Figure 2-3: Mounting Hole Locations

2.5. Attaching the Payload to the Stage

To prevent damage to the stage or parts, test the operation of the stage before any payload is mounted to the stage tabletop. Proceed with the electrical installation and test the motion control system in accordance with the system documentation. Document all results for future reference.

If Aerotech specifically adjusted the servo loop gains to the payload weight prior to shipment, the payload might be required to ensure proper servo operation. The ANT130-5-V is designed to carry no more than 3 kg.

The mating surface of the payload must be flat to approximately 10 µm to prevent distortion of the stage, which would invalidate the specified accuracy.

For information on electrical connections, refer to the Electrical Installation section later in this chapter, the documentation of the motion control system delivered with the stage, and the wiring drawings in Chapter 3: Operating Specifications.

NOTE: For valid accuracies, the mounting interface should be flat within 10 µm.

NOTE: Do not attach a payload to the stage table with screws that are too long. Mounting screws should not project more than 7 mm (.276") into the stage table top.

2.6. Electrical Installation

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

Aerotech motion control systems are adjusted at the factory for optimum performance. When the ANT130-5-V series stage is part of a complete Aerotech motion control system, setup involves connecting a stage and motor combination to the appropriate drive chassis with the cables provided. Connect the provided cables to the motor and encoder connectors on the stage (the number and location of the connectors can vary depending on the options purchased). Labels on the drive indicate the appropriate connections. Refer to your drive manuals and documentation for additional installation and operation information. In some cases, if the system is uniquely configured, a drawing showing system interconnects is supplied.

An integral linear motor comes mounted to all ANT130-5-V stages. The electrical wiring from the motor and encoder are integrated into two main connectors at the factory. Refer to Section 3.7. for standard motor wiring and connector pin outputs.

Never connect or disconnect any electrical component or connecting cable while power is applied, or serious damage may result.

The stage's protective ground is integrated into the motor and encoder connector. If you are using cables other than those provided by Aerotech, you must connect the pin listed as the ground in Section 3.7. to a ground connection.

Chapter 3: Operating Specifications

The surrounding environment and operating conditions can affect the performance and service life of the stage. This chapter provides information on ideal environmental and operating conditions.

3.1. Environmental Specifications

The environmental specifications for the ANT130-5-V are listed in the following table.

Table 3-1: 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. Contact Aerotech for information regarding your specific application and environment.
	Storage: 0° to 40° C (32° to 104° F) in original shipping packaging
Humidity	Operating: 40 percent to 50 percent RH The optimal operating humidity is 50 percent RH.
	Storage: 30 percent to 60 percent RH, non-condensing in original packaging
Altitude	Operating: 0 to 2,000 m (0 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 stage and system performance. Contact Aerotech for information regarding your specific application.
Dust Exposure	The ANT130-5-V stages are not suited for dusty or wet environments. This equates to an ingress protection rating of IP00.
Use	Indoor use only

Do not expose the stage to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.

3.2. Accuracy and Temperature Effects

The accuracy specification of ANT130-5-V stages is measured at the center of travel 25 mm above the tabletop with the stage in a horizontal position. The stage is assumed to be fully supported by a mounting surface meeting or exceeding the specification in Section 2.3.

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

The ANT130-5-V encoder scale is mounted on glass and measures the linear travel of the wedge. The thermal expansion coefficient of the glass is 3.25 ppm/°C. Translated through the wedge angle of 12.93°, it becomes an effective thermal expansion coefficient of 0.75 ppm/°C. As the temperature of the operating environment changes from the temperature listed on the accuracy plot included with the stage, the accuracy of the stage will change by 0.75 ppm/°C from the center of travel. For calibrated -PLUS stages, Aerotech controllers can adjust the calibration based on the temperature of the environment. Contact Aerotech for more details.

3.3. Encoder Resolution

The encoder in the ANT130-5-V has a 20 µm fundamental resolution. The encoder reads the horizontal drive wedge motion, not the vertical tabletop motion. This increases the fundamental resolution seen at the tabletop. The angle of the drive wedge is 12.93º, which results in a fundamental encoder resolution of 4.59 µm.

The fundamental resolution is not the same as the electrical resolution. The encoder signal is multiplied inside Aerotech's controller to yield a much smaller resolution. Consult the system documentation included with the stage to determine this value.

The mechanical resolution, which is listed in the stage specification table in Section 3.5. , is distinct from the electrical and fundamental resolution. It is the smallest motion increment Aerotech can consistently measure using an external measurement device such as a laser or a capacitance probe. The mechanical resolution can never be smaller than the electrical resolution of the stage

3.4. Flexure Handling

The ANT130-5-V stage uses flexures to laterally constrain the tabletop so it will move vertically as the drive wedge moves horizontally. The flexures are engineered to provide smooth, repeatable motion for the entire life of the stage. They are made of thin steel, however, and can fail if they are mishandled. Do not remove the cover from the stage unless it is absolutely necessary. When the cover is off, take care not to bend, nick, ding, or mar the flexures in any way. Never handle the stage by the flexures or flexure mounting supports. If a flexure appears damaged, contact Aerotech support.

3.5. Basic Specifications

Basic ANT130-5-V series positioning stage specifications are shown in Table 3-2. Resolution is dependent on encoder resolution and controller interpolation. Specifications for the standard BLMUC-95-A motor are given in Table 3-3.

Table 3-2: ANT130-5-V Specifications

Mechanical Specifications	ANT130-5-V	ANT130-5-V-PLUS
Travel	5 mm	
Accuracy(1)	± 2 µm	± 200 nm
Resolution	2 nm	
Repeatability (Bi-Directional)(1)	± 150 nm	± 100 nm
Repeatability (Uni-Directional)	± 75 nm	
Straightness(2)	± 1.0 µm	
Pitch(1)	20 arc-sec	
Roll(1)	10 arc-sec	
Yaw	10 arc-sec	
Maximum Speed	75 mm/s	
Maximum Acceleration	0.7 g	
In-Position Stability(3)	1 nm	
Maximum Force (Continuous)	30 N	
Load Capacity(4)	3.0 kg	
Moving Mass	1.8 kg	
Stage Mass	3.1 kg	
Material	Aluminum Body/Black Hardcoat Finish	
MTBF (Mean Time Between Failure)	30,000 Hours	

(1) Certified with each stage.
(2) Measured perpendicular or parallel to wedge direction.
(3) In-Position Stability listing is a 3 sigma value.
(4) Assumes loading along axis of travel.
(5) Specifications are for single-axis systems measured 25 mm above the tabletop. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.
(6) -PLUS requires the use of an Aerotech controller.

Table 3-3: Motor Specifications

	Units	Specifications
Performance Specifications(1,5)		
Continuous Force (No cooling)(2)	N (lb)	23.0 (5.2)
Continuous Force (1.4 bar, 20 psi)(2)	N (lb)	40.5 (9.1)
Peak Force(3)	N (lb)	161.9 (36.4)
Electrical Specifications(5)		
Winding Designation		-A
BEMF Constant (Line-Line, Max)	V/m/s (V/in/s)	9.00 (0.23)
Continuous Current (No cooling)(2)	Amp_{pk} (Amp_{rms})	2.94 (2.08)
Continuous Current (1.4 bar, 20 psi)(2)	Amp_{pk} (Amp_{rms})	5.17 (3.66)
Peak Current, Stall(3)	Amp_{pk} (Amp_{rms})	20.68 (14.62)
Force Constant, Sine Drive(5,6)	N/Amp_{pk} (lb/Amp_{pk})	7.83 (1.76)
	N/Amp_{rms} (lb/Amp_{rms})	11.07 (2.49)
Motor Constant(2,4)	$N/\sqrt{W}$ ($lb/\sqrt{W}$)	3.35 (0.75)
Resistance, 25°C (Line-Line)	ohms	5.2
Inductance (Line-Line)	mH	0.70
Thermal Resistance (No cooling)	°C/W	2.12
Maximum Bus Voltage	VDC	160
Mechanical Specifications		
Air Flow, 20 psi	m^3/s (SCFM)	$1.5x10^{-3}$ (3.2)
Magnetic Pole Pitch	mm (in)	16.00 (0.63)

(1) Performance is dependant upon heat sink configuration, system cooling conditions, and ambient temperature.

(2) Values shown @ 100°C rise above a 25°C ambient temperature.

(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) All Aerotech amplifiers are rated A_{pk}; use torque constant in $N\text{-}m/A_{pk}$ when sizing.

3.6. Limit Switches

ANT130-5-V stages have integral EOT (end of travel) limit switches. The limit switches signal when the stage has reached its maximum useable travel distance in both directions.

3.6.1. Limit Switch Wiring

Limit switches are open-collector, TTL–compatible devices that change output states when the stage approaches its maximum travel distance. Since they are open-collector devices, they may be interfaced to 24 Volt logic inputs.

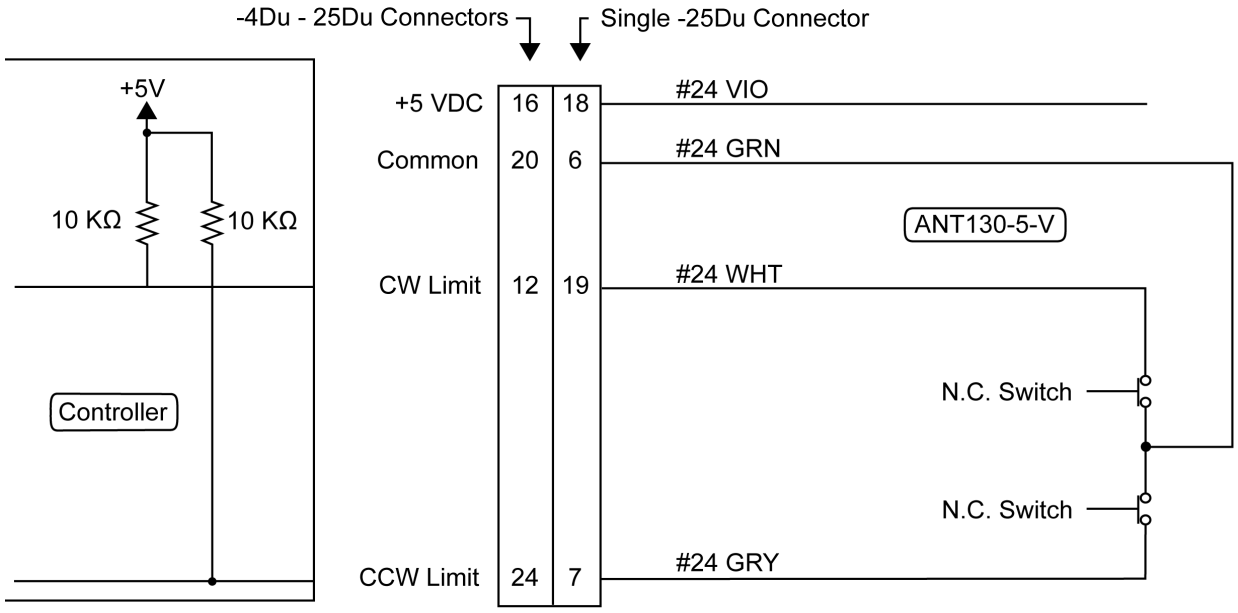


Figure 3-1: ANT130-5-V Limit Switch Wiring

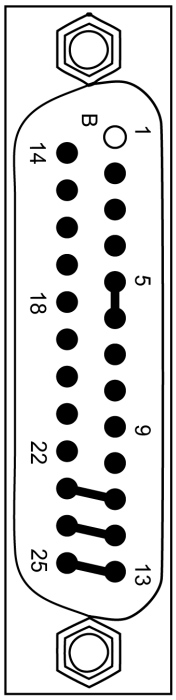
The input to the controller is seen as a logic 0 (typical 0.4V) when no limit condition is present. When the limit switch is activated, a 5V source through a pull-up resistor, on the controller, causes a logic 1 (typically 4.8-5 V) to be seen by the controller input. See Figure 3-1 for a diagram of limit switch wiring.

3.7. Standard Stage Wiring

Stages fitted with standard motors and encoders come from the factory completely wired and assembled. For reference, connector pin outputs and general wiring information is given in 3.7 and the following figures. Pin outputs are defined in Table 3-4.

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

NOTE: If you are using your own cables to connect the stage, ensure that motor and ground wires can handle current higher than the continuous motor current listed in Table 3-3. The voltage rating of the wire insulation must be greater than the maximum drive output voltage listed in Table 3-3.



PIN	SIGNAL
1	KEYED
2	COS-N
3	SIN-N
4	MKR-N
5	COM
6	COM
7	-LMT
8	HA
9	HC
10	FRM GND
11	MTR ØA
12	MTR ØB
13	MTR ØC
14	COS
15	SIN
16	MKR
17	ENC +5V
18	LMT+5V
19	+LMT
20	Thermistor
21	HB
22	FRM GND
23	MTR ØA
24	MTR ØB
25	MTR ØC

Figure 3-2: Feedback and Motor Pin Assignments for -25DU Cable Option

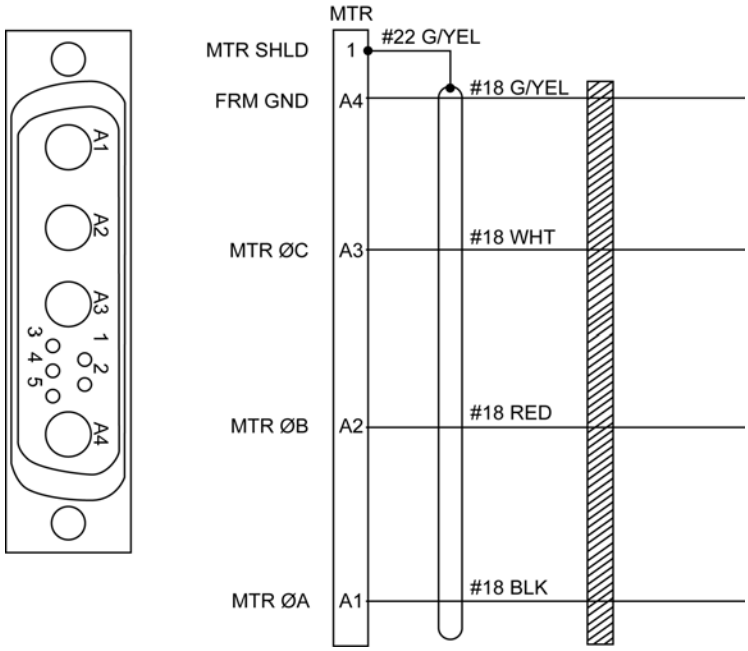
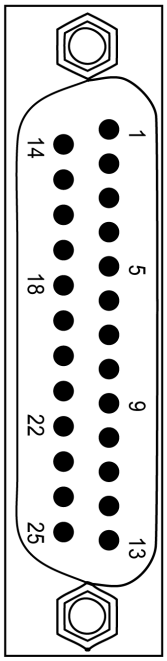


Figure 3-3: Motor Wiring Connector for Optional 4 pin Hi-Power D Connector



PIN	SIGNAL
21	ENC COM
6	MKR-N
3	ENC +5V
7	MKR
24	-EOT Limit
12	+EOT Limit
1	SHLD
18	SIN-N
11	HC
2	Thermistor
10	HA
17	SIN
20	LMT COM
16	LMT +5VDC
15	COS-N
5	HB
14	COS
TO BACKSHELL	SHIELD

Figure 3-4: 25 pin Encoder Connector with Optional 4 pin Hi-Power D Connector

Table 3-4: Motor and Feedback Wiring Pinout Descriptions

Pin Output	Description
COM	Common ground for feedback connector wiring
COS	Cosine. Incremental encoder output; either TTL line driven or amplified sine wave type signal.
COS-N	Incremental encoder output. Complement of cos.
ENC +5V	+5 V supply input for optical encoders. Typical requirement is 250 mA.
FRM GND	Motor common ground
HA	Hall Effect A. Brushless motor commutation track output. TTL line driven signal.
HB	Hall Effect B. Brushless motor commutation track output. TTL line driven signal.
HC	Hall Effect C. Brushless motor commutation track output. TTL line driven signal.
KEYED	Connector has key to prevent improper connection
LMT PWR	PWR supply input. Typical requirement is 50 mA. (+5VDC)
LMT COM	Common ground for limit switch
LMT +5V	+ 5 V supply input for optical limit switch boards. Typical requirement is 50 mA.
MKR	Marker. Incremental encoder output pulse once per travel length. Typically used for home reference cycle.
MKR-N	Incremental encoder output; either the compliment of Marker with a line driven, TTL type encoder or 2.5 V DC bias level with amplified sine wave type encoder.
MTR ØA	Motor Phase A.
MTR ØB	Motor Phase B.
MTR ØC	Motor Phase C.
SIN	Sine. Incremental encoder output; either TTL line driven or amplified sine wave type signal.
SIN-N	Incremental encoder output. Complement of sin.
Thermistor	Over-Temperature sensor
+LMT	Signal indicating maximum travel produced by positive stage direction.
-LMT	Active high signal indicating stage maximum travel produced by negative stage direction.

3.8. Vacuum Operation

Aerotech can specially prepare the ANT130-5-V stage 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 stages with optimal performance in vacuum applications. Preparation techniques for stages that will operate in a vacuum include:

- Lubrication with vacuum–compatible lubricants
- Use of materials, fasteners, and coatings with vacuum outgas performance compatible with the level of vacuum specified
- For high vacuum stages, elimination of situations that may allow gases to become temporarily trapped during pump down
- Extensive cleaning prior to assembly in a clean environment and packaging in a special polyethylene bag

3.8.1. Special Guidelines

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

1. Do not remove the stage from the sealed bag until it is ready for use.
2. Always handle the stage in a clean environment and use powder-free polyethylene gloves to prevent any contaminants from adhering to the surface of the stage.
3. During installation, use cleaned, vented, stainless steel fasteners when securing the stage.
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 substitute of equal quality.

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 aluminum parts and Teflon cables. Aerotech recommends that customers bake out vacuum systems when first installing them in the vacuum chamber.

Chapter 4: Maintenance

This chapter will cover information about intervals between lubrications, detail the lubrication and inspection process, and cover which lubricants are recommended for use.

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

To minimize the possibility of bodily injury, confirm that all electrical power is disconnected prior to making any mechanical adjustments.

4.1. Service and Inspection Schedule

Lubricant inspection and replenishment in ANT130-5-V stages depends on conditions such as duty cycle, speed, and the environment. Inspect the stage once per month until a trend develops for the application. Longer or shorter intervals may be required to maintain the film of lubricant on the bearing surfaces. In general, lubricate stages operating in a clean environment annually, or every 500 km, whichever comes first. For stages operating under conditions involving excessive debris, lubrication every six months is recommended.

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

4.2. Cleaning and Lubrication

4.2.1. Recommended Cleaning Solvents

For standard linear roller bearings, Kluberplex BEM 34-132 grease is recommended.

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

If a solvent is necessary for cleaning the stage, use isopropyl alcohol.

4.2.2. Important Notes on Lubrication

When cleaning and/or lubricating components of the ANT130-5-V stages:

1. Be sure to use a clean, dry, soft, lint–free cloth for cleaning.
2. Take the opportunity during the lubrication procedure to inspect the linear motion guides for any damage or signs of wear.
3. 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.
4. Because proper assembly and calibration can only be done at the factory , do not further disassemble the stage. If the stage is disassembled then reassembled, a laser interferometer is required for post assembly verification to maintain warranties.

4.2.3. Lubrication and Cleaning Process

The lubrication and cleaning process is outlined in the steps that follow. Before beginning lubrication, see Section 4.2.1. for recommended lubricants.

To minimize the possibility of bodily injury, confirm that all electrical power is disconnected prior to making any mechanical adjustments.

1. Remove power to the stage.
2. Remove any accumulated dust or debris from the 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. You can 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 bearing rails 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.

Appendix A: Warranty and Field Service

Aerotech, Inc. warrants its products to be free from 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, where 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 or 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.

Laser Products

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Return Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. 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. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. 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 (30) days after the issuance of a return authorization number will be subject to review.

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 airfreight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Returned Product Non-warranty Determination

After Aerotech's examination, 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 (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (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 service 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.

Company Address

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Appendix B: Technical Changes

Table B-1: Current Changes (1.01.00)

Section(s) Affected	General Information
Section 1.4.	Added section
Section 3.1.	Added section
Chapter 2: Installation, Section 2.1. , Section 2.4. , Section 2.6. , and Section 1.3.	Added safety information and warnings
Section 3.7.	Added note about current requirements of motor and ground wires

Table B-2: Archived Changes

Revision	Section(s) Affected	General Information
1.00.00	--	New manual

Index

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Reader's Comments

ANT130-5-V Series Stage Manual **P/N: EDS154, November 5, 2010** **Revision 1.01.00** Please answer the questions below and add any suggestions for improving this document.	

Is the manual:	Yes	No
Adequate to the subject		
Well organized		
Clearly presented		
Well illustrated		

How do you use this document in your job? Does it meet your needs? What improvements, if any, would you like to see? Please be specific or cite examples.

	Stage/Product Details		Name	
Model #			Title	
Serial #			Company Name	
Date Shipped			Address	
Customer Order #				
Aerotech Subsidiary Order #			Email	

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