

# **ABL1000 Series Stage**

## **User's Manual**

(Revision 1.02.00)



Dedicated to the Science of Motion  
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## Chapter 1: Overview

This chapter introduces standard and optional features of the ABL1000 stages and gives general safety precautions.

The ABL1000 series supports travel distances ranging from 25 mm to 150 mm (1 in to 6 in) and are our highest performance miniature air-bearing stages.

### 1.1. Standard Features

The ABL1000 series stages all incorporate completely non-contact air bearing surfaces, linear motors, and feedback devices to provide a completely maintenance free stage. There is no mechanical contact to become worn or require lubrication, making these stages ideal for clean room and medical applications.

The ABL1000 incorporates preload on both vertical and horizontal surfaces. This increases the stiffness of the air film. The brushless linear motor uses an ironlessforcer, which means there is zero cogging and no attractive forces – resulting in unsurpassed smoothness of motion. This is especially useful in applications where velocity control is important.

**NOTE:** Aerotech continually improves its product offerings, and listed options may be superseded at any time.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](http://www.aerotech.com).



Figure 1-1: ABL1000 Series Positioning Stage in XY Configuration

### 1.1.1. Optional Features

For applications where two-axis motion is required, the ABL1000 is available in an XY configuration, shown below in Figure 1-1. Two encoder options are available to meet various motion requirements.

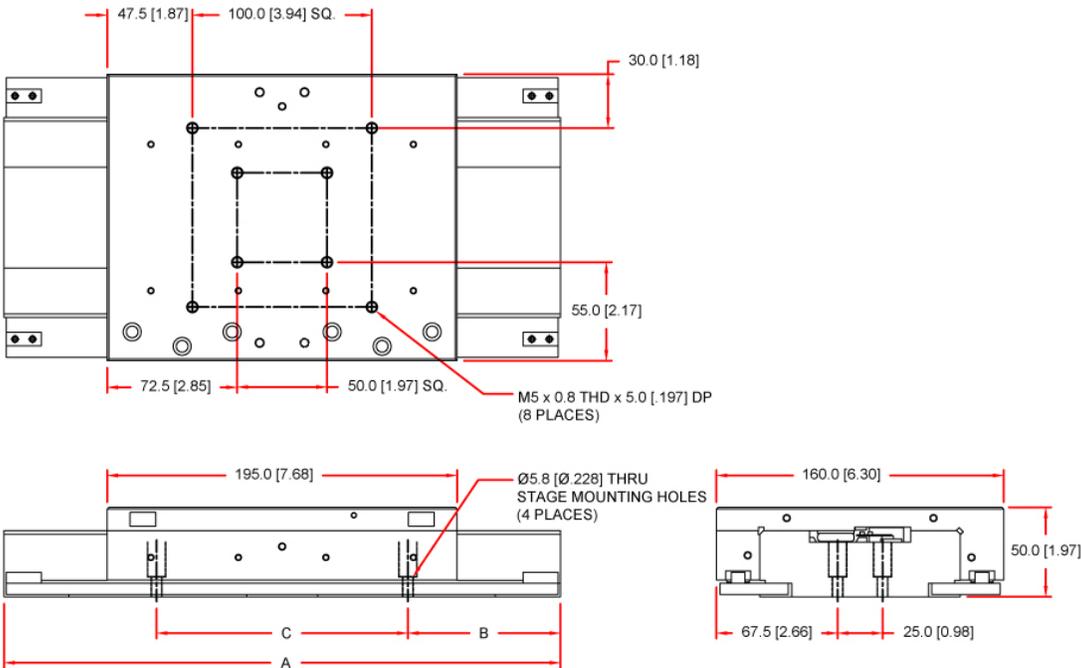
**Table 1-1: Ordering Example (ABL10100-LT)**

Series	Travel (mm)	Feedback
ABL10	100	-LT

**Table 1-2: Model Numbers and Ordering Options**

ABL1000 Series Linear Air-Bearing Stage <sup>(1)</sup>	
ABL10025 <sup>(2)</sup>	25 mm (1 in) travel stage with linear motor
ABL10050	50 mm (2 in) travel stage with linear motor
ABL10100	100 mm (4 in) travel stage with linear motor
ABL10150 <sup>(2)</sup>	150 mm (6 in) travel stage with linear motor
Mounting and Grid Pattern	
-LT	Linear encoder feedback (10 nm resolution); amplified sine output
-LN	High-accuracy linear encoder feedback (2 nm resolution); amplified sine output
-LT/lower	LT option with lower axis cable management
-LN/lower	LN option with lower axis cable management
-LT/upper	LT option with upper axis cable management
-LN/upper	LN option with upper axis cable management
1. Requires clean, dry air supply. In-line under pressure switch provided.	
2. ABL10025 can only be used in an XY configuration with the ABL10150 as the lower axis	

1.2. Dimensions



Basic Model	Total Travel	Dimensions - Millimeters [Inches]		
		A	B	C
ABL10025	25.0 [1.00]	235.0 [9.25]	35.0 [1.38]	165.0 [6.49]
ABL10050	50.0 [2.00]	260.0 [10.24]	60.0 [2.36]	140.0 [5.51]
ABL10100	100.0 [4.00]	310.0 [12.20]	85.0 [3.35]	140.0 [5.51]

Figure 1-2: ABL1000 Dimensions

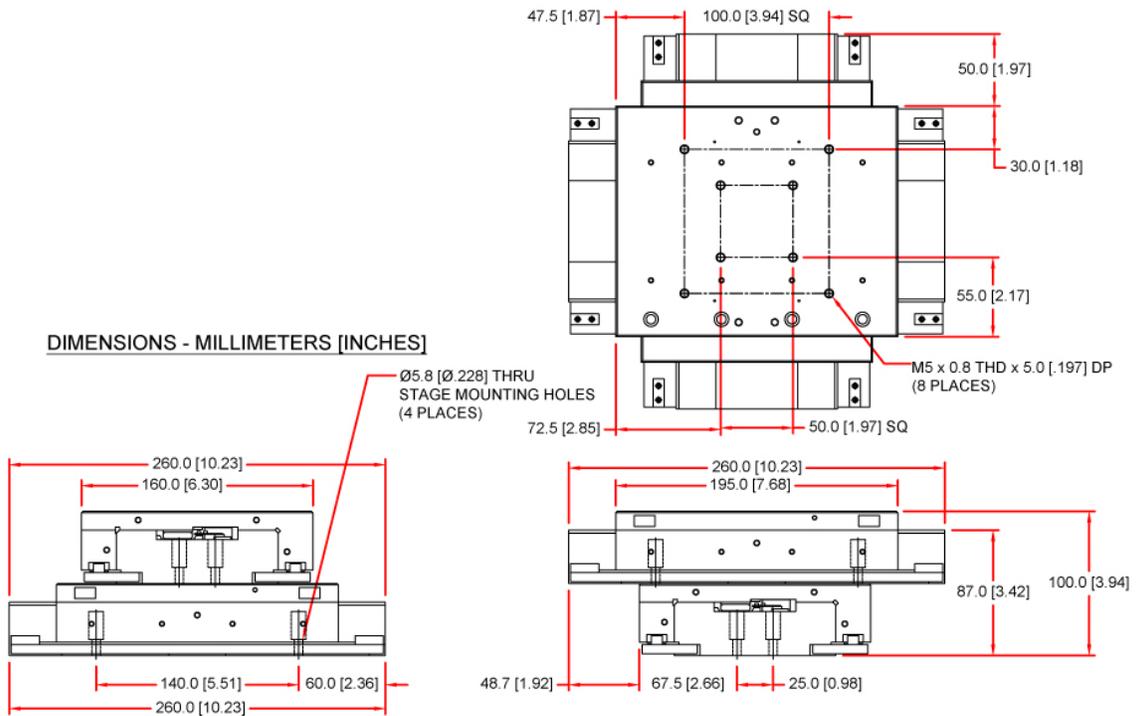


Figure 1-3: ABL1000 XY Dimensions

### 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.



WARNING

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.



WARNING

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



WARNING

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



WARNING

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



WARNING

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.



WARNING

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

## 1.4. EC Declaration of Incorporation

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



**herewith declares that the product:**

Aerotech, Inc. ABL1000 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 - Part 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.***

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

**Name:**

Alex Weibel /   
Engineer Verifying Compliance

**Position:**

**Location:** Pittsburgh, PA

**Date:** March 2, 2011



## Chapter 2: Installation

This chapter describes the installation procedure for the ABL1000 stage, including handling the stage properly, preparing the stage environment, securing the stage to the mounting surface, attaching the payload, and making the electrical connections.



Installation must follow the instruction 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. Before operating the stage, it is important to let the stage to stabilize at room temperature for at least 12 hours. It is also important to clean the stage by blowing it off with pressurized nitrogen or clean, oil-less air.

Before the stage can be operated, the shipping clamps must be removed. These are the only red anodized parts on the stage and must all be removed (see Figure 2-2). Save the shipping clamps to be used for long-term storage of the stage or return shipping for service.

The stage should be lifted from the bottom of the base. Do not attempt to lift or move the stage from the table.

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



Do not attempt to move the stage until the air supply, detailed in Section 2.6, has been installed. Moving the stage table without air supplied can cause permanent damage to the stage.



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

## 2.2. Preparing the Mounting Surface

The mounting surface should be flat and have adequate stiffness in order to achieve the maximum performance from the ABL1000. When an ABL1000 series stage is mounted to a non-flat surface, the stage can be distorted as the mounting screws are tightened. This distortion will decrease the overall accuracy of the stage. *To maintain accuracy, the mounting surface should be flat within  $1\mu\text{m}$  per 50mm.* Adjustments to the mounting surface must be done before the stage is secured. The effects of flatness on mounting are illustrated in Figure 2-1.

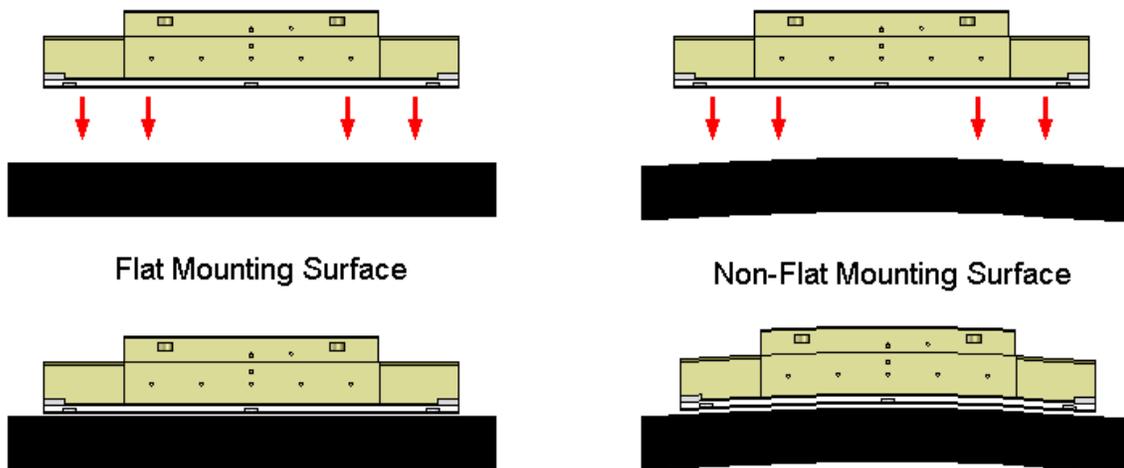


Figure 2-1: Results of Flat Versus Non-Flat Mounting

**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.

It is important that the stage is mounted to a horizontal surface. Vertical- or side-mounted orientations are not recommended and could affect performance. Mounting to a slight angle may be possible depending on other loading conditions, please contact the factory for details.

## 2.3. Securing the Stage to the Mounting Surface

In order to mount the stage to the mounting surface, the stage table must be moved. The following is the procedure for moving the table and mounting the stage (see Figure 2-3).



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

1. Supply air to the stage via the air inlet. See Section 2.6. for more information on air supply.
2. Manually move the stage to one end of travel, revealing half of the mounting holes for the stage.
3. Mount the stage to the base using M5 screws. The number of mounting holes will depend on stage travel.
4. Once half the mounting screws have been installed, move the stage to the opposite end of travel to access the remaining screws. Repeat the installation process for these holes.

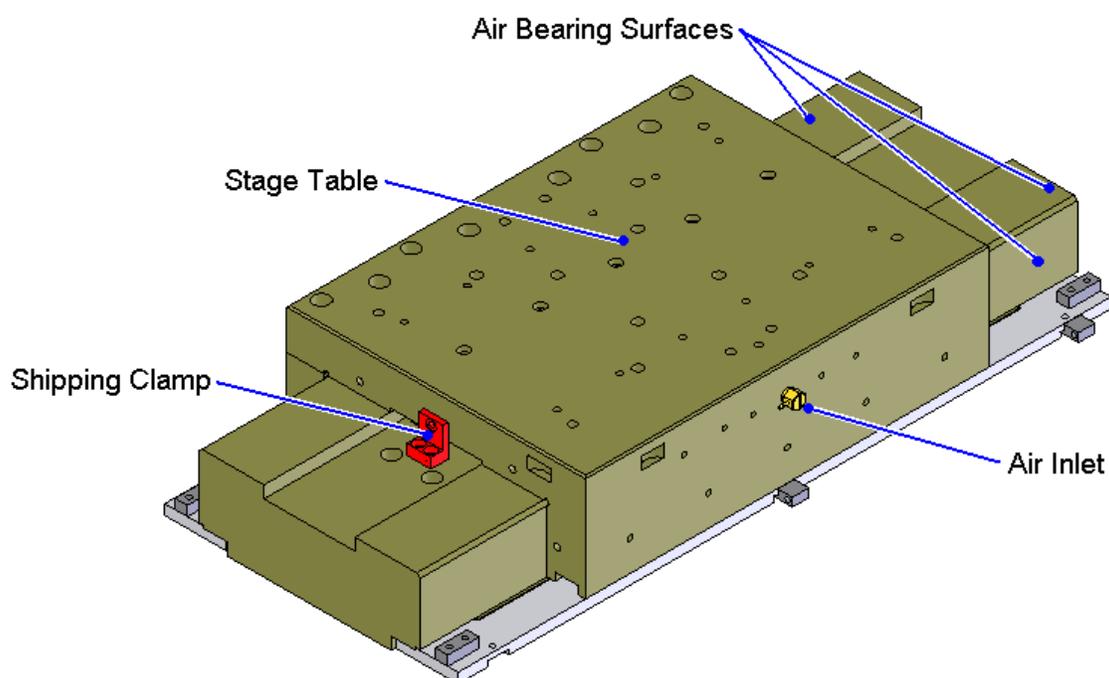


Figure 2-2: ABL1000 Stage Showing Air Inlet

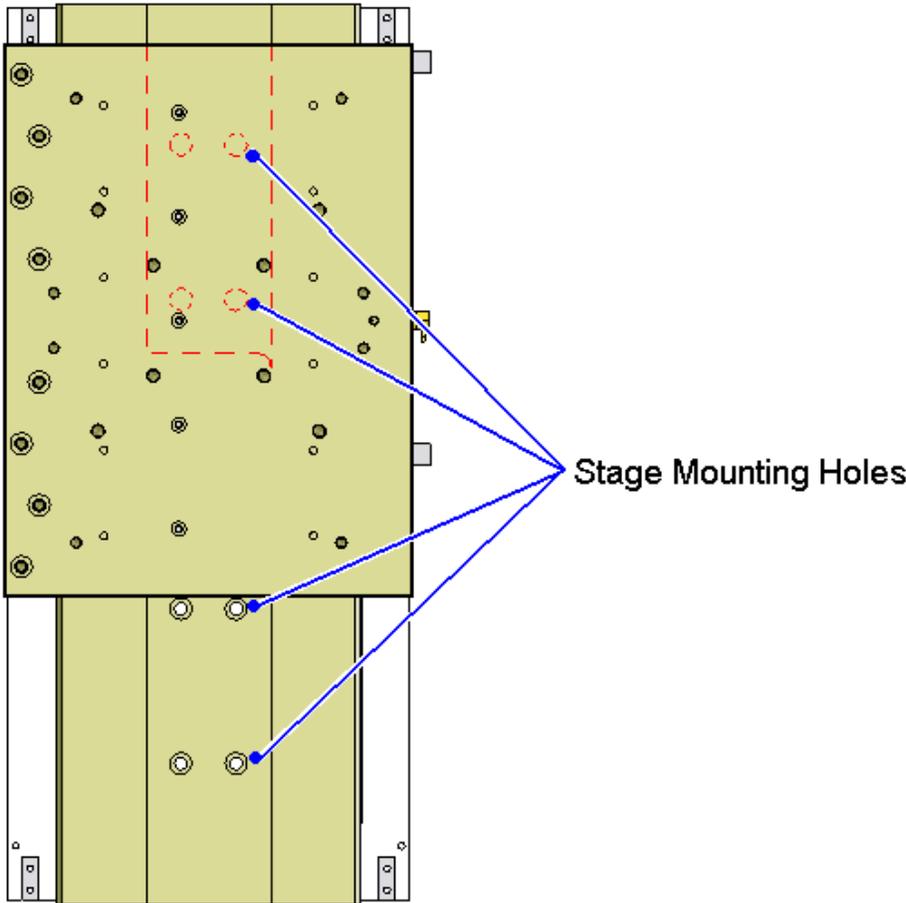


Figure 2-3: The Stage Table Must BE Moved to Access All Mounting Holes

## 2.4. Attaching the Payload to the Stage

To prevent damage to payloads, test the operation of the stage before the payload is attached to the stage table. 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 connections, refer to Section 2.5. , Chapter 4: Maintenance and the documentation delivered with the stage.

The payload should be flat, rigid, and comparable to the stage in quality.

**NOTE:** For valid system performance, the mounting interface should be flat within 1  $\mu\text{m}$  per 25 mm.

There are several mounting holes provided on the stage table to mount payloads. Shown in Figure 2-4 are the available mounting holes for payload and fixture mounting. The payload mounting holes are M5 x 0.8 and have reinforced threads to allow frequent removal and installation of mounting screws. On a single-axis stage or the upper axis of a multi-axis stage, the multi-axis stage mounting holes may also be used for payload mounting if necessary. It is not recommended that these holes be used for fixtures or payloads that require constant removal and installation because the threads are not reinforced and may become damaged over time.

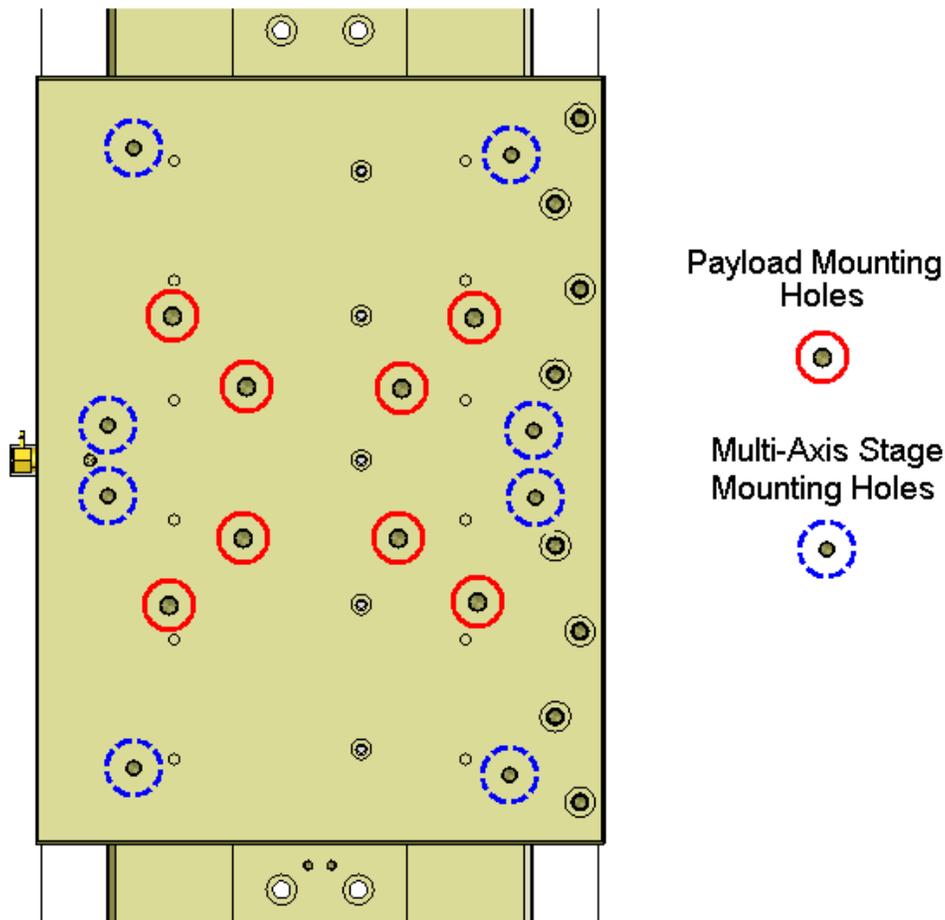


Figure 2-4: Available Mounting Holes in Stage Table

## 2.5. Electrical Installation

Aerotech motion control systems are adjusted at the factory for optimum performance. When the ABL1000 series stage is part of a complete Aerotech motion control system, setup involves connecting a stage to the appropriate drive chassis with the cables provided. Connect the provided cable to the electrical connector on the stage. 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.

See Section 3.5. for wiring diagrams, connector pin labels, and pin descriptions.



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

## 2.6. Air Requirements

The air supply to the air bearing is important for the operation of the system. If compressed air is used, it must be filtered to 0.25 microns, dry to 0°F dewpoint, and oil free. If nitrogen is used, it must be 99.99% pure and filtered to 0.25 microns. The filtration requirement is to prevent particles from clogging the air bearing orifices, which can be as small as a few thousandths of an inch in diameter. Air pressure of 80 psi,  $\pm 5$  psi, is necessary for use. Air should be supplied via a 1/4" OD (1/8" ID) polyurethane air hose. It is recommended that a pressure switch is installed to remove power from the air bearing if pressure drops below 40 psi because the bearing surfaces could be damaged. An air flow rate of 0.5 SCFM at 80 psi should be observed (single axis).

## Chapter 3: Operating Specifications

This chapter contains general technical information about ABL1000 series stages. Included are basic product specifications and general information on limit switches and motor wiring.

### 3.1. Environmental Specifications

The environmental specifications for the ABL1000 are listed in the following table.

**Table 3-1: Environmental Specifications**

<b>Ambient Temperature</b>	Operating: 16° to 25° C (61° to 77° 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. Contact Aerotech for information regarding your specific application and environment.
	Storage: 0° to 40° C (32° to 104° F) in original shipping packaging
<b>Humidity</b>	Operating: 40 percent to 60 percent RH The optimal operating humidity is 50 percent RH.
	Storage: 30 percent to 60 percent RH, non-condensing in original packaging
<b>Altitude</b>	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.
<b>Vibration</b>	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.
<b>Dust Exposure</b>	The ABL1000 stages are not suited for dusty or wet environments. This equates to an ingress protection rating of IP00.
<b>Use</b>	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. Basic Specifications

For the most recent specifications, see Aerotech's website. Stage specifications are given in Table 3-2, and motor specifications are given in Table 3-3.

**Table 3-2: ABL1000 Series Specifications**

Basic Model		ABL1000			
Total Travel		25 mm (1in)	50 mm (2in)	100 mm (4in)	150 mm (6in)
Drive System		Linear Brushless Servomotor			
Feedback		Noncontact Linear Encoder (LN or LT)			
Resolution	LN	0.5 nm (0.04 μin)			
	LT	2.5 nm (0.2 μin)			
Maximum Travel Speed <sup>(1)</sup>		300 mm/s (12 in/s)			
Maximum Load <sup>(2)</sup>		15.0 kg (33.0 lb)			
Overall Accuracy	LN <sup>(1)</sup>	±0.2 μm (±8 μin) <sup>(3)</sup> ; ±1 μm (±40 μin)	±0.2 μm (±8 μin) <sup>(3)</sup> ; ±1 μm (±40 μin)	±0.2 μm (±8 μin) <sup>(3)</sup> ; ±2 μm (±80 μin)	±0.5 μm (±20 μin) <sup>(3)</sup> ; ±5 μm (±200 μin)
	LT <sup>(2)</sup>	±0.3 μm (±12 μin) <sup>(3)</sup> ; ±2 μm (±80 μin)	±0.3 μm (±12 μin) <sup>(3)</sup> ; ±2 μm (±80 μin)	±0.3 μm (±12 μin) <sup>(3)</sup> ; ±5 μm (±200 μin)	±0.5 μm (±20 μin) <sup>(3)</sup> ; ±5 μm (±200 μin)
Repeatability	LN <sup>(3)</sup>	±50 nm (±2 μin)			
	LT <sup>(3)</sup>	±50 nm (±2 μin) <sup>(3)</sup> ; ±100 nm (±4 μin)			
Straightness and Flatness	Differential	0.25 μm/25 mm (10 μin/in)			
	Max Deviation	±0.25 μm (±10 μin)	±0.25 μm (±10 μin)	±0.4 μm (±16 μin)	±0.4 μm (±16 μin)
Pitch and Yaw		±0.25 arc sec	±0.50 arc sec	±1.0 arc sec	±1.5 arc sec
Operating Pressure <sup>(5)</sup>		80 psi ±5 psi			
Air Consumption <sup>(6)</sup>		0.5 SCFM @ 80 psi			
Stage Weight		4.5 kg (10 lb)	5.5 kg (12 lb)	6.4 kg (14 lb)	12.7 kg (28 lb)
Moving Mass		1.9 kg (4.2 lb)			4.8 kg (10.6 lb)
<p>(1) Maximum speed based on stage capability; maximum application velocity may be limited by system data rate and system resolution.</p> <p>(2) Max load for XY configuration is 10.0 kg.</p> <p>(3) Values with Aerotech controls and HAL option.</p> <p>(4) Dependent on flatness of stage mounting surface.</p> <p>(5) To protect air bearing against under-pressure, an in-line pressure switch is required and tied to the controller E-stop input.</p> <p>(6) Air supply must be clean, dry to 0° F dew point, and filtered to 0.25 μm or better; recommend nitrogen at 99.99% purity.</p>					

**Table 3-3: ABL1000 Motor Specifications**

<b>Performance Specifications (1,5)</b>		
Continuous Force, 20 psi, 1.4 bar (2)	N	40.5
	lb	9.1
Continuous Force, No Cooling, (2)	N	23.0
	lb	5.2
Peak Force (3)	N	161.9
	lb	36.4
<b>Electrical Specifications (5)</b>		
BEMF Constant (line to line, max)	V / m / sec	3.78
	V / in / sec	0.10
Continuous Current, 20 psi, 1.4 bar (2)	A, pk	5.17
	A, rms	3.66
Continuous Current, No Cooling (2)	A, pk	2.94
	A, rms	2.08
Peak Current, Stall (3)	A, pk	20.68
	A, rms	14.62
Force Constant, Sinusoidal Drive (4,8)	N / A, pk	3.29
	lb / A, pk	0.74
	N / A, rms	4.65
	lb / A, rms	1.05
Motor Constant (2,4)	N / √W	3.35
	lb / √W	0.75
Resistance, 25 °C (line to line)	Ohms	5.2
Inductance (line to line)	mH	0.70
Thermal Resistance, 20 psi, 1.4 bar	°C / W	0.69
Thermal Resistance, No Cooling	°C / W	2.12
Maximum Bus Voltage	VDC	up to 80
(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 torque constant in N-m / Apk when sizing		

### 3.3. Load Capability [TBD]

### 3.4. Limit Switch Wiring

ABL1000 series stages are provided with a hall-effect limit switch. The limit switch signals when the stage has reached its maximum useable travel distance in all directions. The limit switch is mounted to a small circuit board within the stage and two magnets, used as triggers, are mounted to the bottom of the stage table.



If the stage is driven approximately 7.5mm beyond the electrical limit, it will encounter a mechanical stop. Although the operating speed of the stage may be relatively slow, damage to the stage could result.

#### 3.4.1. Limit Switch Operation

The limit switch is mounted on a small printed circuit board. Standard ABL1000 Stages include limit switch wiring integrated into the main wiring connector. Limit switches on ABL1000 series stages are typically configured normally-closed. The input to the controller is seen as a logic 0 (typical 0.4V @ 12.8mA) when no limit condition is present. When the limit switch is activated, a 5V source through a pull-up resistor causes a logic 1 (typically 4.8-5V) to be seen by the controller input.

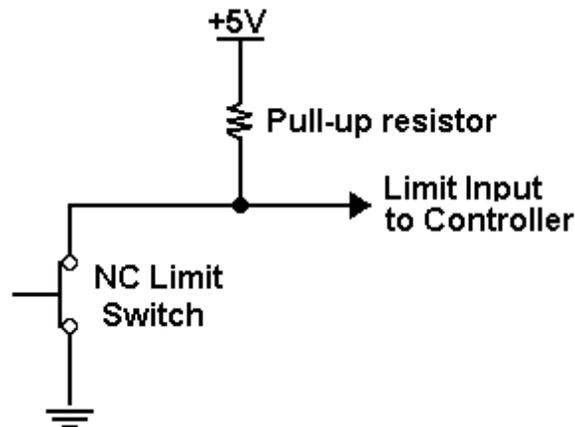


Figure 3-1: Limit Switch Wiring

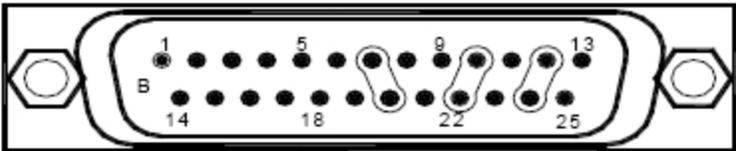
### 3.5. Standard Stage Wiring

Stages come from the factory completely wired and assembled. For reference, connector pin outputs (pin-outs) and general wiring information is given in the following figures. Pinouts are defined in Table 3-5.

**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 current listed in Table 3-3. The voltage rating of the wire insulation must be greater than the maximum bus voltage listed in Table 3-3.

**Table 3-4: Connector Pinouts for ABL1000 Single Axis Stage**



Pin	Description	Pin	Description
1	KEY	14	COS
2	COS-N	15	SIN
3	SIN-N	16	MKR
4	MKR-N	17	+5V
5	COM	18	+5V
6	COM	19	+LMT
7	-LMT	20	HM LMT
8	HALL A	21	HALL B
9	HALL C	22	SHIELD
10	FRAME	23	MTR ØA
11	MTR ØA	24	MTR ØB
12	MTR ØB	25	MTR ØC
13	MTR ØC		

**Table 3-5: Motor Wiring Pinout Descriptions**

Pin Output	Description
+LMT	Active high signal indicating maximum travel produced by positive stage direction.
COS	Cosine. Incremental encoder output; either TTL line driven or amplified sine wave type signal.
COS-N	Incremental encoder output. Complement of cos.
-LMT	Active high signal indicating stage maximum travel produced by negative stage direction.
HALL A	Hall Effect A. Brushless motor commutation track output. TTL line driven signal with rotary motor.
HALL B	Hall Effect B. Brushless motor commutation track output. TTL line driven signal with rotary motor.
HALL C	Hall Effect C. Brushless motor commutation track output. TTL line driven signal with rotary motor.
MKR	Marker. Incremental encoder output pulse given once per revolution. 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.
SIN	Sine. Incremental encoder output; either TTL line driven or amplified sign wave type signal.
SIN-N	Incremental encoder output. Complement of sin.
MTR ØA	Motor Phase A.
MTR ØB	Motor Phase B.
MTR ØC	Motor Phase C.
+5V	+5V supply.
SHIELD	Signal shield connection.
KEY	Ensures that correct cable is plugged into correct jack.
COM	Common ground.

### 3.6. Vacuum Operation

The ABL1000 is an air-bearing stage and is not compatible with operation in a vacuum environment. Please contact Aerotech for alternate solutions.

## Chapter 4: Maintenance

The ABL1000 series stages are designed to be maintenance free positioning systems. Due to the non-contact air bearing design, there are no friction surfaces or dynamic seals to wear or require lubrication. However, it is important to clean the bearing surfaces and encoder strips to maintain the accuracy of the stage. This chapter will detail the cleaning process and specify recommended cleaning solvents.

**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. See Section 2.6. for air requirements.



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

Aerotech recommends that the ABL1000 be inspected once per month until a trend develops for the specific application and environment.

### 4.2. Cleaning and Lubrication

There are no elements on the ABL1000 that require lubrication. Periodic cleaning to remove dust is recommended.

#### 4.2.1. Recommended Cleaning Solvents

Before using a cleaning solvent on any part of the stage, it is recommended that clean, dry compressed air is used to blow away small particles and dust. All encoder surfaces and magnet tracks should be cleaned with isopropyl alcohol. Aluminum hardcoated metal surface may be cleaned with acetone. Acetone should not be used on magnet tracks because it could break down the epoxy that holds the magnets in place.

**Table 4-1: Recommended Cleaning Solvents**

Item	Recommended Cleaner
Encoders, Magnets	Isopropyl Alcohol
Hardcoded Aluminum	Acetone

### 4.2.2. Cleaning Process

It is recommended that all air-bearing surfaces are cleaned often to prevent damage to the stage or decreased performance. The entire stage should be blown with clean, dry, compressed air often to prevent dust from building up in the linear motors, encoders, and air bearing surfaces. Due to the non-contact design, these surfaces operate very close together, allowing dust to easily buildup and cause damage.

In order to access the entire length of the air bearing surfaces, it will be necessary to move the stage. Begin with the stage at one end of travel and remove power. Clean all accessible surfaces using a clean, lint-free cloth soaked in solvent, being sure that the correct solvent is used on each surface (see Table 4-1). Once the cleaner has dried completely, restore power and move the stage to the opposite end of travel. This should expose all previously covered surfaces. Remove power and repeat the cleaning process. Restore power to the stage only once all solvents have dried completely.

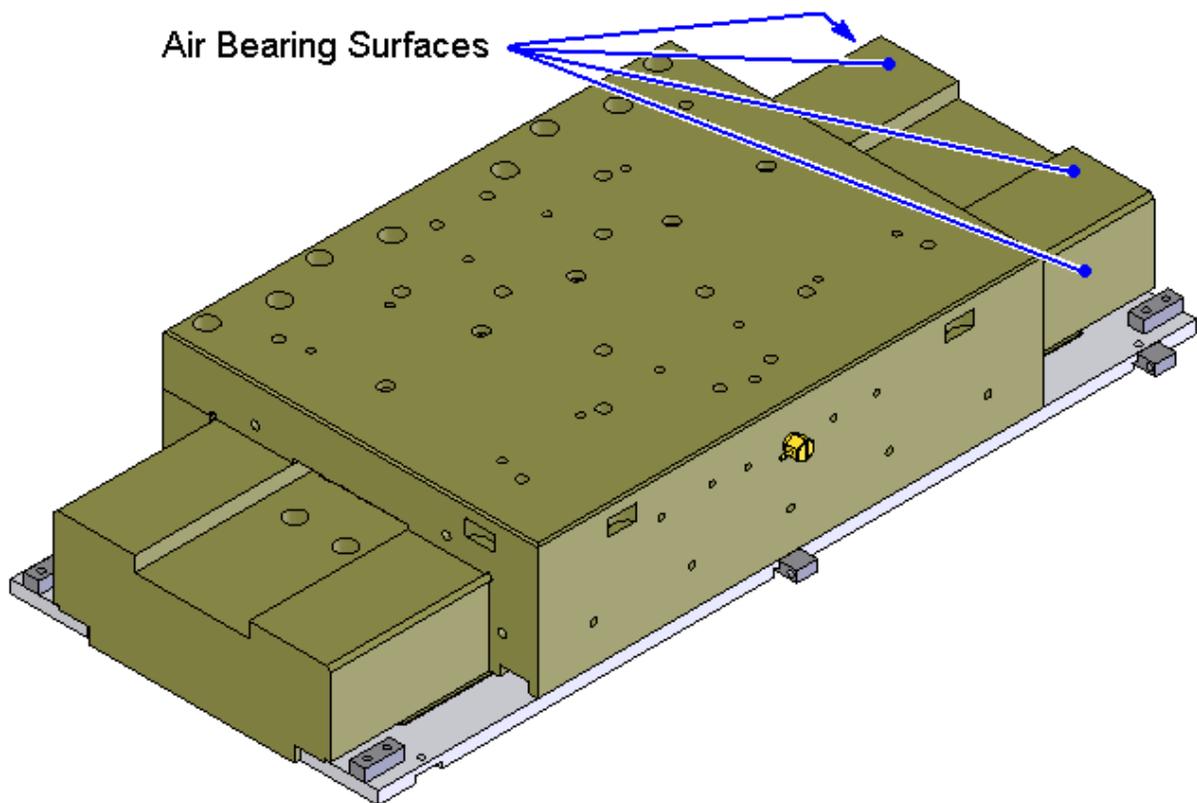


Figure 4-1: Air Bearing Surfaces Require Periodic Cleaning



WARNING

Be sure that all solvent is completely evaporated before attempting to move the stage. Even the slightest amount of solvent could cause damage to the air bearing surfaces, clog the air ducts, or damage the electronics of the stage.

## 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.

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.

### ***Laser Products***

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.

### ***Return Procedure***

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 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.

### ***Returned Product Non-warranty Determination***

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.

### ***Rush Service***

**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.

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## Appendix B: Technical Changes

Table B-1: Current Changes (1.02.00)

Section(s) Affected	General Information
Section 1.4.	Added section
Section 3.1.	Added section
Chapter 2: Installation, Section 2.1. , Section 2.3. , and Section 1.3.	Added Dimensions section
Section 2.6.	Updated air flow requirements
Section 3.2.	Updated stage specifications
Section 3.2.	Added motor specifications
Section 3.5.	Added note about motor wire current and voltage requirements

**Table B-2: Archived Changes**

Revision	Section(s) Affected	General Information
1.00.00	--	New Manual
1.01.00	Section 1.2.	Added Dimensions section

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# Reader's Comments

<b>ABL1000 Series Stage Manual</b> <b>P/N: EDS106, March 2, 2011</b> <b>Revision 1.02.00</b> Please answer the questions below and add any suggestions for improving this document.	
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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	
<b>Model #</b>			Title	
<b>Serial #</b>			Company Name	
Date Shipped			Address	
Customer Order #				
Aerotech Subsidiary Order #			Email	

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