

ABL2000 Series Stage

User's Manual

P/N: EDS105 (Revision 1.02.00)



Dedicated to the Science of Motion
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Chapter 1: Overview

This manual describes Aerotech's ABL2000 series of air bearing positioning stages.

The ABL2000 series supports travel distances ranging from 100 mm to 1200 mm (4 in to 48 in). The ABL2000 combines excellent pitch/yaw characteristics with the unsurpassed velocity control that is necessary for printing, imaging, and fiber-optic applications.

This chapter introduces standard and optional features of the ABL2000 stages and gives general safety precautions.

1.1. Standard Features

The ABL2000 series stages all incorporate completely non-contact air bearing surfaces, linear motors, and feedback devices to provide a maintenance free stage. There is no mechanical contact to wear or require lubrication, making these stages ideal for clean room and medical applications.

The ABL2000 incorporates an active preload on both vertical and horizontal surfaces. The opposing thin-film pressure maintains the bearing nominal gap tolerance. This design, in addition to the large air-bearing surface that distributes the load over a large surface area, results in a stage with outstanding stiffness that is ideal for heavy or offset loading.

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.

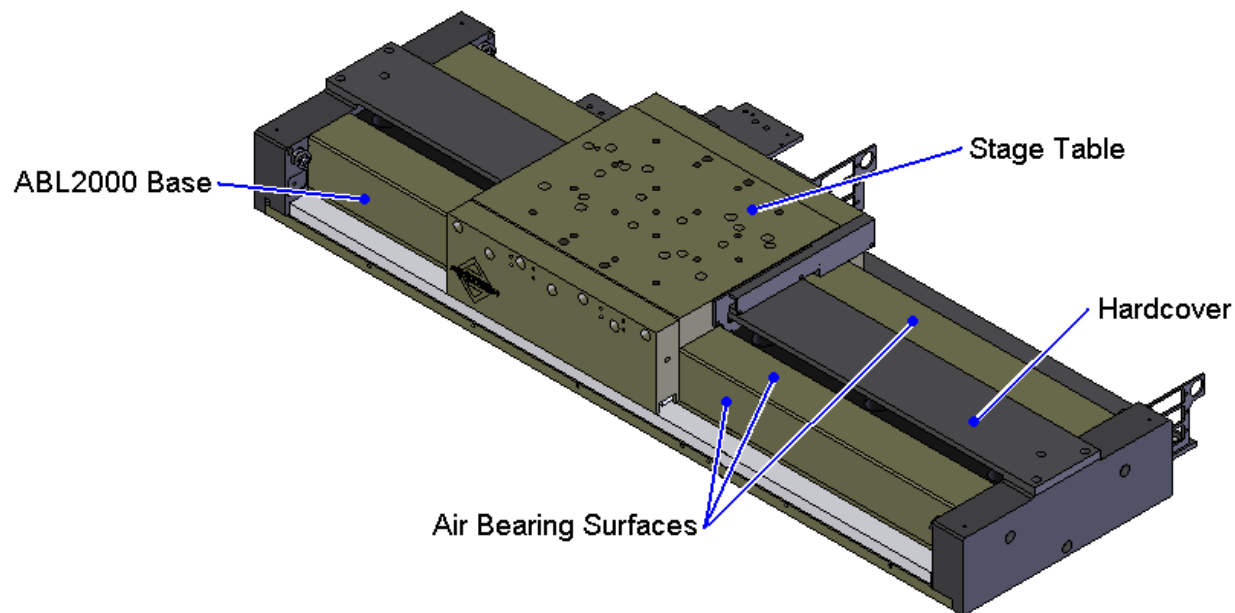


Figure 1-1: ABL2000 Series Stage

NOTE: Aerotech continually improves its product offerings, and listed options may be superseded at any time.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

1.1.1. Optional Features

The ABL2000 can be readily customized to meet the needs of individual applications. Common examples include cable management for stage-mounted payloads, custom tabletops, and granite bases. Contact the Aerotech factory for more details.

Table 1-1: Ordering Example (ABL20100-10-RIBBON-LN100AS-NC-XY-CMS)

Series	Travel (mm)	Motor	Cabling	Linear Encoder	Limits	Options
ABL20	100	-10	-RIBBON	-LN100AS	-NC	-XY-CMS

Table 1-2: Model Numbers and Ordering Options

ABL2000 Series Linear Air-Bearing Stage	
ABL20010	100 mm (4 in) travel linear air-bearing stage with linear motor and limits
ABL20020	200 mm (8 in) travel linear air-bearing stage with linear motor and limits
ABL20030	300 mm (12 in) travel linear air-bearing stage with linear motor and limits
ABL20040	400 mm (16 in) travel linear air-bearing stage with linear motor and limits
ABL20050	500 mm (20 in) travel linear air-bearing stage with linear motor and limits
ABL20075	750 mm (30 in) travel linear air-bearing stage with linear motor and limits
ABL20100	1000 mm (40 in) travel linear air-bearing stage with linear motor and limits
ABL20120	1200 mm (48 in) travel linear air-bearing stage with linear motor and limits
Motor	
-10	Brushless linear motor (BLMC-192-A)
Cabling	
-RIBBON	Flat ribbon cabling
-ROUND	E-chain and round wire cabling
Standard Linear Encoders	
-LT10AS	Linear encoder for ABL20010; amplified sine output
-LT20AS	Linear encoder for ABL20020; amplified sine output
-LT30AS	Linear encoder for ABL20030; amplified sine output
-LT40AS	Linear encoder for ABL20040; amplified sine output
-LT50AS	Linear encoder for ABL20050; amplified sine output
-LT75AS	Linear encoder for ABL20075; amplified sine output
-LT100AS	Linear encoder for ABL20100; amplified sine output
-LT120AS	Linear encoder for ABL20120; amplified sine output
-LT10X5	Linear encoder for ABL20010; 1.0 micron line driver output
-LT20X5	Linear encoder for ABL20020; 1.0 micron line driver output
-LT30X5	Linear encoder for ABL20030; 1.0 micron line driver output
-LT40X5	Linear encoder for ABL20040; 1.0 micron line driver output
-LT50X5	Linear encoder for ABL20050; 1.0 micron line driver output
-LT75X5	Linear encoder for ABL20075; 1.0 micron line driver output
-LT100X5	Linear encoder for ABL20100; 1.0 micron line driver output
-LT120X5	Linear encoder for ABL20120; 1.0 micron line driver output

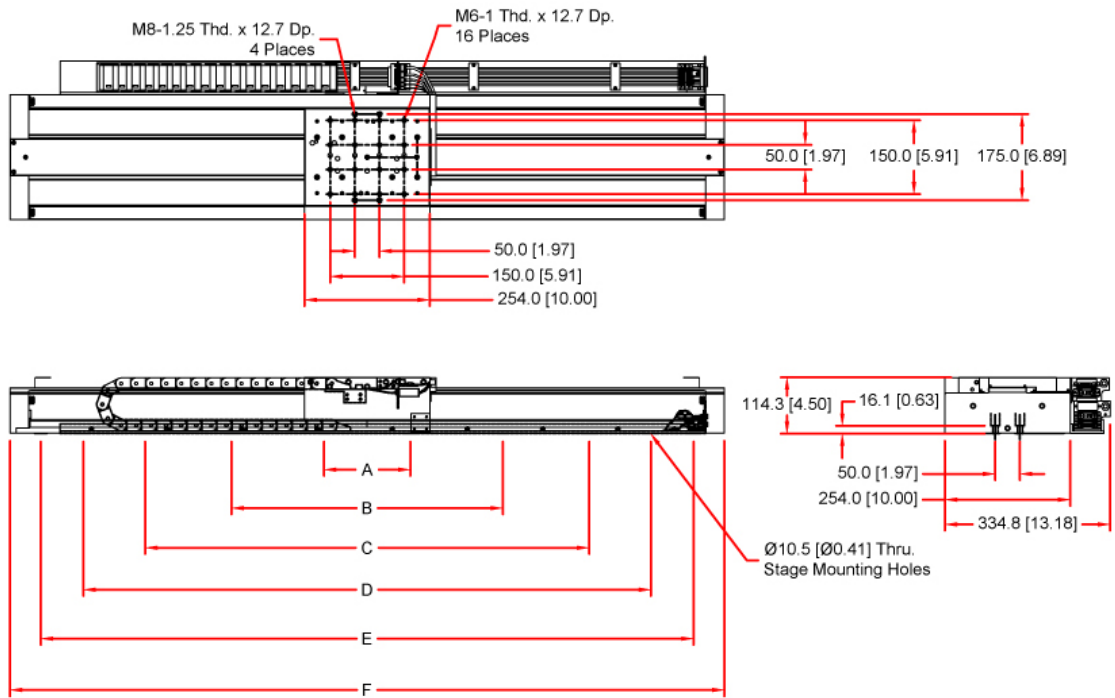
Table 1-2: Model Numbers and Ordering Options (continued)

High-Accuracy Linear Encoders	
-LN10AS	High-accuracy linear encoder for ABL20010; amplified sine output
-LN20AS	High-accuracy linear encoder for ABL20020; amplified sine output
-LN30AS	High-accuracy linear encoder for ABL20030; amplified sine output
-LN40AS	High-accuracy linear encoder for ABL20040; amplified sine output
-LN50AS	High-accuracy linear encoder for ABL20050; amplified sine output
-LN75AS	High-accuracy linear encoder for ABL20075; amplified sine output
-LN100AS	High-accuracy linear encoder for ABL20100; amplified sine output
-LN120AS	High-accuracy linear encoder for ABL20120; amplified sine output
High-Accuracy/High-Resolution Linear Encoders	
-LZAS10	High-accuracy/high-resolution linear encoder for ABL20010; amplified sine output
-LZAS20	High-accuracy/high-resolution linear encoder for ABL20020; amplified sine output
Laser Interferometer Feedback Option	
-LZR	Laser interferometer feedback; amplified sine output
Limits	
-NC	Normally-closed end of travel limit switches (standard)
-NO	Normally-open end of travel limit switches
Options	
-X-Y-CMS	Cable management system for X-Y assembly; order with X-axis only

1.1.2. Cable Management Systems

ABL2000 stages come with two options for connecting cables; flat ribbon cable or round wire cables. For round wire cable applications, a plastic cable carrier chain is used to route and protect the cables. For travel lengths of 400 mm and less, flat ribbon cable is used without a plastic chain. For 500 mm and greater travel lengths, ribbon cable is also encased in a plastic chain. Please consult the factory for more details on wire style selection.

1.2. Dimensions



Basic Model	Total Travel	Dimensions - Millimeters [Inches]					
		A	B	C	D	E	F
ABL20010	100.0 [4.00]	175.0 [6.89]	350.0 [13.78]	-	-	-	457.2 [18.00]
ABL20020	200.0 [8.00]	175.0 [6.89]	450.0 [17.72]	-	-	-	558.8 [22.00]
ABL20030	300.0 [12.00]	175.0 [6.89]	550.0 [21.65]	-	-	-	660.4 [26.00]
ABL20040	400.0 [16.00]	175.0 [6.89]	450.0 [17.72]	650.0 [25.59]	-	-	762.0 [30.00]
ABL20050	500.0 [20.00]	175.0 [6.89]	450.0 [17.72]	750.0 [29.53]	-	-	863.6 [34.00]
ABL20075	750.0 [30.00]	175.0 [6.89]	450.0 [17.72]	750.0 [29.53]	1000.0 [39.37]	-	1117.6 [44.00]
ABL20100	1000.0 [40.00]	175.0 [6.89]	550.0 [21.65]	900.0 [35.53]	1250.0 [49.21]	-	1371.6 [54.00]
ABL20120	1200.0 [48.00]	175.0 [6.89]	550.0 [21.65]	900.0 [35.53]	1150.0 [45.76]	1450.0 [57.09]	1574.8 [62.00]

Figure 1-2: ABL2000 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. ABL2000 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 / 

Position: Engineer Verifying Compliance

Location: Pittsburgh, PA

Date: March 2, 2011

Chapter 2: Installation

This chapter describes the installation procedure the ABL2000 stage, including handling the stage properly, securing the stage to the mounting surface, attaching the payload, and making the electrical connections.



WARNING

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. Before operating the stage, it is important to let the stage to stabilize at room temperature for at least 12 hours. 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.

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

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.



WARNING

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.



WARNING

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 ABL2000. When an ABL2000 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. 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.

NOTE: To maintain accuracy, the mounting surface should be flat within 1 μm per 50 mm.

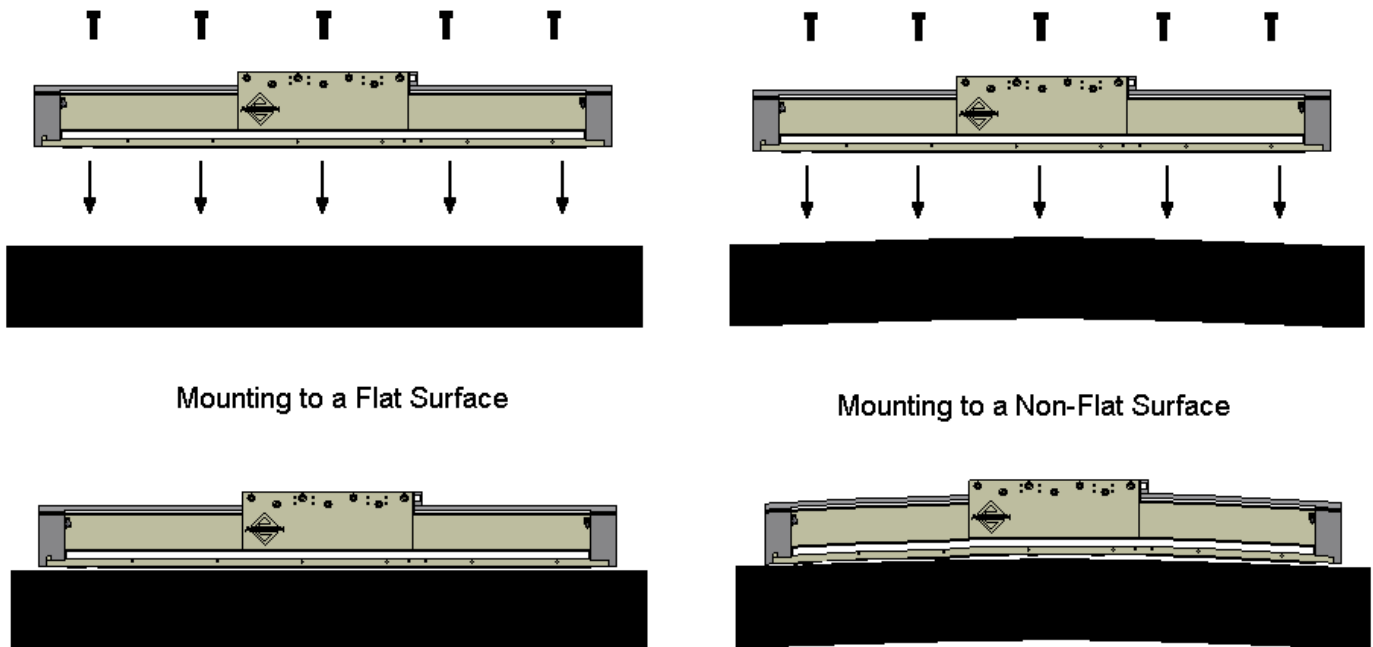


Figure 2-1: Results of Flat Versus Non-Flat Mounting

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.

2.3. Securing the Stage to the Mounting Surface

In order to mount the stage to the mounting surface, the magnet track for the linear motor must be removed. The following is the procedure for removing the magnet track, mounting the stage, and replacing the components.



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



The magnet track contains strong magnets. Exercise caution when handling them. Keep the magnet tracks away from each other and all ferrous material (such as steel).

Procedure for ABL2000 mounting:

1. Remove hardcover from lower axis, if present (See 2.3)
2. Remove either end plate (See 2.3)
3. Supply air to lower axis so that magnet track screws can be accessed. The red shipping clamp must be removed in order for the carriage to move freely.
4. Remove screws holding magnet track to base (See 2.3)



DO NOT remove screws that have security-torx heads. These screws are for magnet track assembly and removal may cause bodily injury.

5. Note the orientation of the magnet track as there can be more than one in the assembly and orientation is important. Carefully remove magnet tracks from assembly. The magnet tracks are highly magnetic and should be kept away from each other and all ferrous material.
6. Mount ABL2000 onto mounting surface using M8 mounting screws and washers.
7. Follow mounting instructions in reverse order to re-assemble. Use caution when handling and installing the magnet tracks.

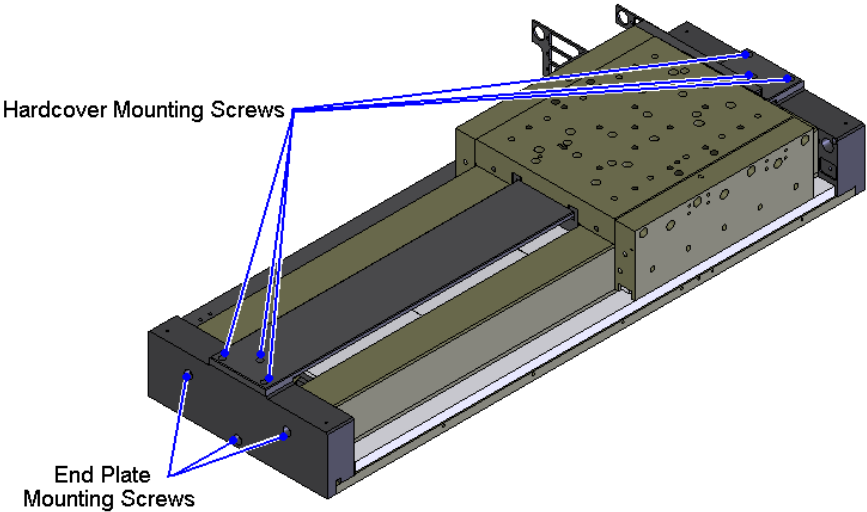


Figure 2-2: Hardcover and End Plate Mounting Screws

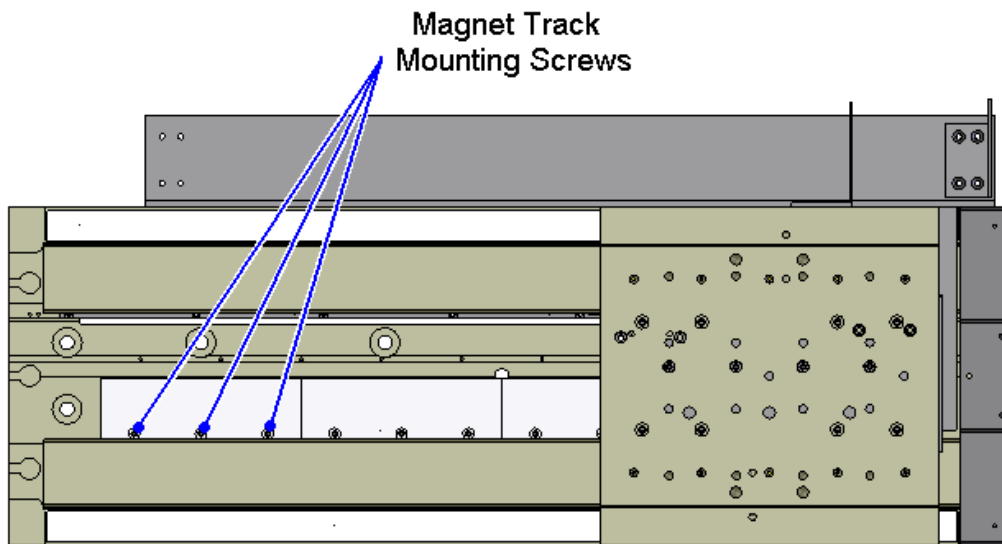


Figure 2-3: Magnet Track Mounting Hardware

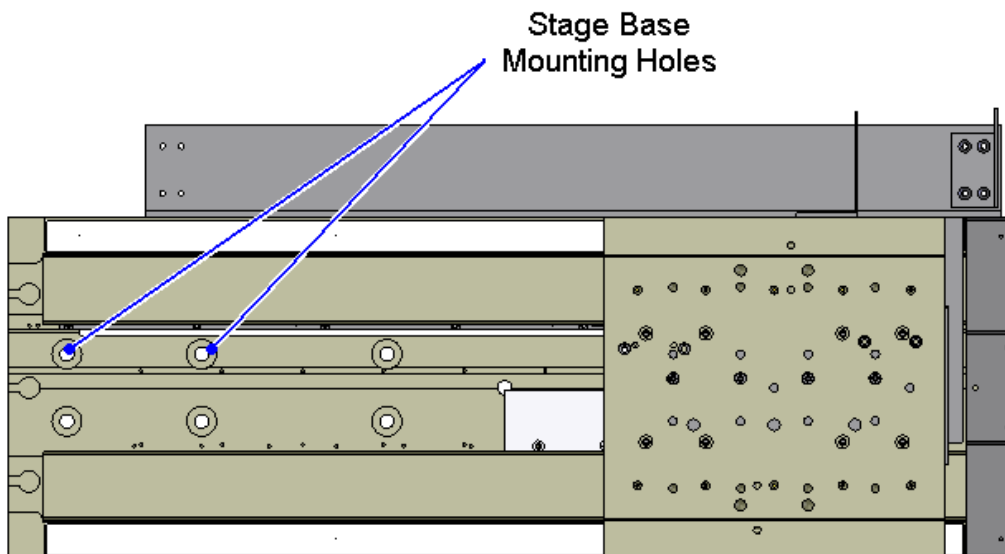


Figure 2-4: With Magnet Tracks Removed, Stage Mounting Holes are Accessible

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. 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 μm per 50 mm.

2.5. Electrical Installation

Aerotech motion control systems are adjusted at the factory for optimum performance. When the ABL2000 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 cables to the motor and feedback connectors on the stage. Labels on the drive indicate the appropriate connections. Refer to 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 standard wiring pinouts.



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 located on pin A4 of the motor connector. If you are using cables other than those provided by Aerotech, you must connect pin A4 to a ground connection.

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 dew point, 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. Air pressure in the range of 80 psi, ± 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 airflow rate of between .25 CFM and .30 CFM at 80 psi should be observed (single axis).

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 instructions for estimating load capability.

3.1. Environmental Specifications

The environmental specifications for the ABL2000 are listed in the following table.

Table 3-1: Environmental Specifications

Ambient Temperature	Operating: 16° to 25° C (61° to 77° 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 60 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 ABL2000 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. Basic Specifications

For the most recent specifications, see Aerotech's website.

Table 3-2: ABL2000 Series Specifications

Basic Model		ABL20010	ABL20020
Total Travel		100 mm (4 in)	200 mm (8 in)
Drive System		Linear Brushless Servomotor (BLMC-192-A)	
Feedback		Noncontact Linear Encoder (LN, LT, or LZAS) or Laser interferometer	
Resolution	LN	0.001 μm - 0.2 μm (0.04 μin - 8 μin)	
	LT	0.005 μm - 1.0 μm (0.2 μin - 40 μin)	
	LZR	0.3nm - 79nm (0.12 μin - 3.2 μin)	
	LZAS	0.064nm - 6.4nm (0.0025 μin - 0.25 μin)	
Maximum Travel Speed ⁽¹⁾		2m/s (80in/s)	
Maximum Linear Acceleration		2g - 20m/s ² (768in/s ²)(no-load)	
Maximum Load ⁽²⁾		50.0 kg (110.0 lb)	
Overall Accuracy	LN	HALAR ⁽⁴⁾	±0.5 μm (±20 μin)
		Standard	±5.0 μm (±200 μin)
	LT	HALAR ⁽⁴⁾	±0.5 μm (±20 μin)
		Standard	±4.0 μm (±160 μin)
	LZR	Standard ±10ppm; Compensated ±1.5ppm ⁽⁵⁾	
LZAS	±0.2 μm over entire travel (±8 μin)		
Repeatability	LN	±0.2 μm (±8 μin)	
	LT	±0.2 μm (±8 μin)	
	LZAS	±0.1 μm (±4 μin)	
Straightness and Flatness	Differential	0.25 μm/25mm (10 μin/in)	
	Max. Deviation	±0.25 μm (±10 μin)	±0.40 μm (±16 μin)
Pitch/Roll/Yaw		1 arc sec	2 arc sec
Nominal Stage Mass		30.0 kg (66.1 lb)	34.5 kg (76.1 lb)
Operating Pressure ⁽⁶⁾		80 psi ±5 psi	
Air Consumption ⁽⁷⁾		0.7 SCFM (Single Axis)	
Moving Mass		9 kg	
Material		Aluminum	
Finish		Hard Coating	
<p>(1) Maximum speed based on stage capability; maximum application velocity may be limited by system data rate and system resolution.</p> <p>(2) Maximum load based on bearing capability; maximum application load may be limited by acceleration requirements.</p> <p>(3) Thermal limitations of positioning stage with respect to performance may limit continuous force output.</p> <p>(4) Available with Aerotech controllers.</p> <p>(5) Requires environmental compensation. See Options and Accessories section for more information.</p> <p>(6) To protect air bearing against under-pressure, an in-line pressure switch tied to controller E-stop input is recommended.</p> <p>(7) Air supply must be clean, dry to 0° F dewpoint and filtered to 0.25 μm or better; recommend nitrogen at 99.9% purity.</p>			

Table 3-2: ABL2000 Series Specifications (continued)

Basic Model		ABL20030	ABL20040	
Total Travel		300 mm (12 in)	400 mm (16 in)	
Drive System		Linear Brushless Servomotor (BLMC-192-A)		
Feedback		Noncontact Linear Encoder (LN, LT, or LZAS) or Laser interferometer		
Resolution	LN	0.001µm - 0.2µm (0.04µin - 8µin)		
	LT	0.005µm - 1.0µm (0.2µin - 40µin)		
	LZR	0.3nm - 79nm (0.12µin - 3.2µin)		
	LZAS	0.064nm - 6.4nm (0.0025µin - 0.25µin)		
Maximum Travel Speed ⁽¹⁾		2m/s (80in/s)		
Maximum Linear Acceleration		2g - 20m/s ² (768in/s ²)(no-load)		
Maximum Load ⁽²⁾		50.0 kg (110.0 lb)		
Overall Accuracy	LN	HALAR ⁽⁴⁾	±0.5 µm (±20 µin)	±0.75 µm (±30 µin)
		Standard	±5.0 µm (±200 µin)	
	LT	HALAR ⁽⁴⁾	±0.5 µm (±20 µin)	±0.75 µm (±30 µin)
		Standard	±12.0 µm (±480 µin)	±16.0 µm (±640 µin)
	LZR	Standard ±10ppm; Compensated ±1.5ppm ⁽⁵⁾		
	LZAS	±0.2 µm over entire travel (±8 µin)		
Repeatability	LN	±0.2 µm (±8 µin)	±0.3 µm (±12 µin)	
	LT	±0.2 µm (±8 µin)	±0.3 µm (±12 µin)	
	LZAS	±0.1 µm (±4 µin)		
Straightness and Flatness	Differential	0.25 µm/25mm (10µin/in)	.050 µm/25mm (20 µin/in)	
	Max. Deviation	±0.75 µm (±30 µin)	±1.5 µm (±60 µin)	
Pitch/Roll/Yaw		3 arc sec	4 arc sec	
Nominal Stage Mass		39.5 kg (87.1 lb)	44.0 kg (97.0 lb)	
Operating Pressure ⁽⁶⁾		80 psi ±5 psi		
Air Consumption ⁽⁷⁾		0.7 SCFM (Single Axis)		
Moving Mass		9 kg		
Material		Aluminum		
Finish		Hard Coating		
<p>(1) Maximum speed based on stage capability; maximum application velocity may be limited by system data rate and system resolution.</p> <p>(2) Maximum load based on bearing capability; maximum application load may be limited by acceleration requirements.</p> <p>(3) Thermal limitations of positioning stage with respect to performance may limit continuous force output.</p> <p>(4) Available with Aerotech controllers.</p> <p>(5) Requires environmental compensation. See Options and Accessories section for more information.</p> <p>(6) To protect air bearing against under-pressure, an in-line pressure switch tied to controller E-stop input is recommended.</p> <p>(7) Air supply must be clean, dry to 0° F dewpoint and filtered to 0.25 µm or better; recommend nitrogen at 99.9% purity.</p>				

Table 3-2: ABL2000 Series Specifications (continued)






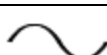



Basic Model		ABL20050	ABL20075	
Total Travel		500 mm (20 in)	750 mm (30 in)	
Drive System		Linear Brushless Servomotor (BLMC-192-A)		
Feedback		Noncontact Linear Encoder (LN, LT, or LZAS) or Laser interferometer		
Resolution	LN	0.001µm - 0.2µm (0.04µin - 8µin)		
	LT	0.005µm - 1.0µm (0.2µin - 40µin)		
	LZR	0.3nm - 79nm (0.12µin - 3.2µin)		
	LZAS	0.064nm - 6.4nm (0.0025µin - 0.25µin)		
Maximum Travel Speed ⁽¹⁾		2m/s (80in/s)		
Maximum Linear Acceleration		2g - 20m/s ² (768in/s ²)(no-load)		
Maximum Load ⁽²⁾		50.0 kg (110.0 lb)		
Overall Accuracy	LN	HALAR ⁽⁴⁾	±0.75 µm (±30 µin)	±1 µm (±40 µin)
		Standard	±5.0 µm (±200 µin)	
	LT	HALAR ⁽⁴⁾	±0.75 µm (±30 µin)	±1 µm (±40 µin)
		Standard	±20.0 µm (±800 µin)	±30.0 µm (±1200 µin)
	LZAS	Standard ±10ppm; Compensated ±1.5ppm ⁽⁵⁾		
LZAS	±0.2 µm over entire travel (±8 µin)			
Repeatability	LN	±0.3 µm (±12 µin)		±0.4 µm (±16 µin)
	LT	±0.3 µm (±12 µin)		±0.4 µm (±16 µin)
	LZAS	±0.1 µm (±4 µin)		
Straightness and Flatness	Differential	.050 µm/25mm (20 µin/in)		
	Max. Deviation	±2.0 µm (±80 µin)	±3.0 µm (±120 µin)	
Pitch/Roll/Yaw		5 arc sec	7.5 arc sec	
Nominal Stage Mass		49.0 kg (108.0 lb)	61.0 kg (134.5 lb)	
Operating Pressure ⁽⁶⁾		80 psi ±5 psi		
Air Consumption ⁽⁷⁾		0.7 SCFM (Single Axis)		
Moving Mass		9 kg		
Material		Aluminum		
Finish		Hard Coating		
<p>(1) Maximum speed based on stage capability; maximum application velocity may be limited by system data rate and system resolution.</p> <p>(2) Maximum load based on bearing capability; maximum application load may be limited by acceleration requirements.</p> <p>(3) Thermal limitations of positioning stage with respect to performance may limit continuous force output.</p> <p>(4) Available with Aerotech controllers.</p> <p>(5) Requires environmental compensation. See Options and Accessories section for more information.</p> <p>(6) To protect air bearing against under-pressure, an in-line pressure switch tied to controller E-stop input is recommended.</p> <p>(7) Air supply must be clean, dry to 0° F dewpoint and filtered to 0.25 µm or better; recommend nitrogen at 99.9% purity.</p>				

Table 3-2: ABL2000 Series Specifications (continued)

Basic Model		ABL20100		ABL20120	
Total Travel		1000 mm (40 in)		1200 mm (48 in)	
Drive System		Linear Brushless Servomotor (BLMC-192-A)			
Feedback		Noncontact Linear Encoder (LN, LT, or LZAS) or Laser interferometer			
Resolution	LN	0.001µm - 0.2µm (0.04µin - 8µin)			
	LT	0.005µm - 1.0µm (0.2µin - 40µin)			
	LZR	0.3nm - 79nm (0.12µin - 3.2µin)			
	LZAS	0.064nm - 6.4nm (0.0025µin - 0.25µin)			
Maximum Travel Speed ⁽¹⁾		2m/s (80in/s)			
Maximum Linear Acceleration		2g - 20m/s ² (768in/s ²)(no-load)			
Maximum Load ⁽²⁾		50.0 kg (110.0 lb)			
Overall Accuracy	LN	HALAR ⁽⁴⁾	±1 µm (±40 µin)		
		Standard	±5.0 µm (±200 µin)		
	LT	HALAR ⁽⁴⁾	±1 µm (±40 µin)		
		Standard	±40.0 µm (±1600 µin)	±48.0 µm (±1960 µin)	
	LZR	Standard ±10ppm; Compensated ±1.5ppm ⁽⁵⁾			
	LZAS	±0.2 µm over entire travel (±8 µin)			
Repeatability	LN	±0.4 µm (±16 µin)			
	LT	±0.4 µm (±16 µin)			
	LZAS	±0.1 µm (±4 µin)			
Straightness and Flatness	Differential	.050 µm/25mm (20 µin/in)			
	Max. Deviation	±4.0 µm (±160 µin)	±5.0 µm (±200 µin)		
Pitch/Roll/Yaw		10 arc sec		12 arc sec	
Nominal Stage Mass		72.5 kg (159.8 lb)		79.5 kg (9175.3 lb)	
Operating Pressure ⁽⁶⁾		80 psi ±5 psi			
Air Consumption ⁽⁷⁾		0.7 SCFM (Single Axis)			
Moving Mass		9 kg			
Material		Aluminum			
Finish		Hard Coating			
<p>(1) Maximum speed based on stage capability; maximum application velocity may be limited by system data rate and system resolution.</p> <p>(2) Maximum load based on bearing capability; maximum application load may be limited by acceleration requirements.</p> <p>(3) Thermal limitations of positioning stage with respect to performance may limit continuous force output.</p> <p>(4) Available with Aerotech controllers.</p> <p>(5) Requires environmental compensation. See Options and Accessories section for more information.</p> <p>(6) To protect air bearing against under-pressure, an in-line pressure switch tied to controller E-stop input is recommended.</p> <p>(7) Air supply must be clean, dry to 0° F dewpoint and filtered to 0.25 µm or better; recommend nitrogen at 99.9% purity.</p>					

Table 3-3: ABL2000 Series Resolution Information

Code	Signal Period	Travel/Step	Multiplier
LTAS	20 μm	0.02 μm - 1.0 μm	Requires External
LTX5	20 μm	1.0 μm	Integral x5
LN	4 μm	0.004 μm - 0.2 μm	Requires External
LZAS	128 μm	.0064nm - 6.4nm	Requires External
LZR	316.5 μm	79nm	Integral $\lambda/8$
LZR	316.5 μm	.3nm - 15.8nm	Requires External

Code	Maximum Speed	Signal Type	Encoder Connector
LTAS	System Data Rate		
LTX5	2 m/s		
LN	System Data Rate		
LZAS	System Data Rate		
LZR	1 m/s ⁽¹⁾		
LZR	System Data Rate		

1. Requires system data rate of at least 14 MHz

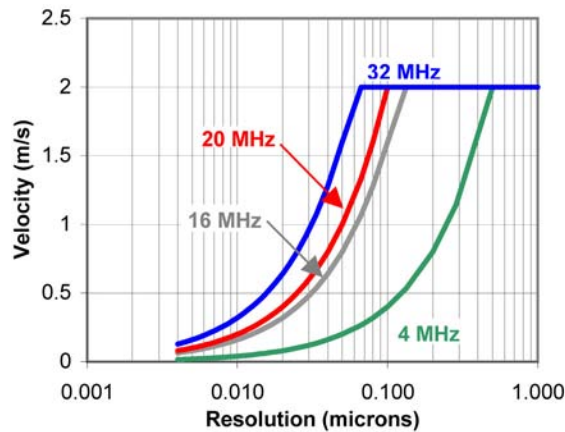


Figure 3-1: Velocity vs. resolution as a function of system data rate (ABL2000 with LTAS or LNAS encoder)

Table 3-4: ABL2000 Motor Specifications

Model	BLMC-192	
Winding Designation	-A	
Performance Specifications (1,5)		
Continuous Force, 20 psi, 1.4 bar (2)	N	154.7
	lb	34.8
Continuous Force, No Cooling, (2)	N	106.7
	lb	24.0
Peak Force (3)	N	618.8
	lb	139.1
Electrical Specifications (5)		
BEMF Constant (line to line, max)	V / m / sec	30.66
	V / in / sec	0.78
Continuous Current, 20 psi, 1.4 bar (2)	A, pk	5.80
	A, rms	4.10
Continuous Current, No Cooling (2)	A, pk	4.00
	A, rms	2.83
Peak Current, Stall (3)	A, pk	23.20
	A, rms	16.40
Force Constant, Sinusoidal Drive (4,8)	N / A, pk	26.67
	lb / A, pk	6.00
	N / A, rms	37.72
	lb / A, rms	8.48
Motor Constant (2,4)	N/√W	10.29
	lb / √W	2.31
Resistance, 25 °C (line to line)	Ohms	6.4
Inductance (line to line)	mH	1.90
Thermal Resistance, 20 psi, 1.4 bar	°C / W	0.44
Thermal Resistance, No Cooling	°C / W	0.93
Maximum Bus Voltage	VDC	340
<p>(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</p>		

3.3. Load Capability

It is recommended that application loads 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). With the stage lying flat (horizontal) and the application load vertically applied and symmetrically distributed, the maximum vertical load carrying capacity of ABL2000 stages is 50.0 kg. If cantilevered loads are applied, refer to Figure 3-2 to find the maximum allowable load.

In Figure 3-2, the Lsc or “side cantilever” curve assumes a horizontal stage orientation. If a cantilevered load situation is used, measure the cantilever length (Dsc) and find the corresponding load value from Figure 3-2.

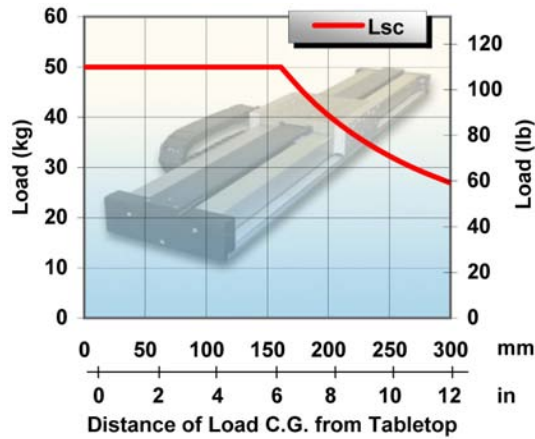


Figure 3-2: Load capability of ABL2000 Series Stages

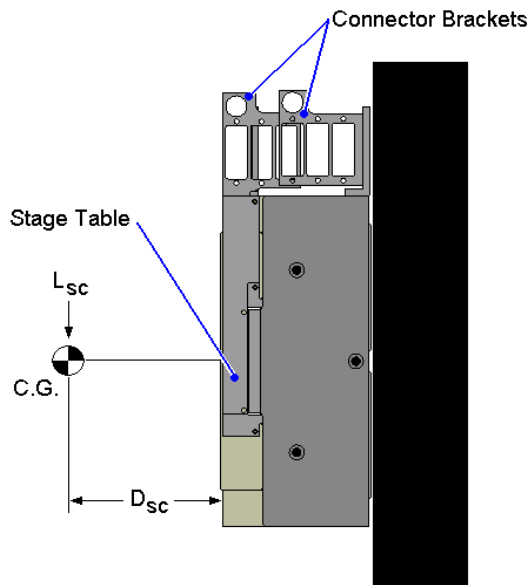


Figure 3-3: Cantilever Length Diagram

Figure 3-4 shows the relationship between mass carried by the stage and maximum acceleration capabilities of the stage. Both peak and continuous acceleration capabilities are given. The maximum acceleration possible for the ABL2000 series stages is 2g. Note that this assumes that the payload is mounted close to the stage table center of gravity. Consult the factory if high accelerations are required with cantilevered or overhanging loads.

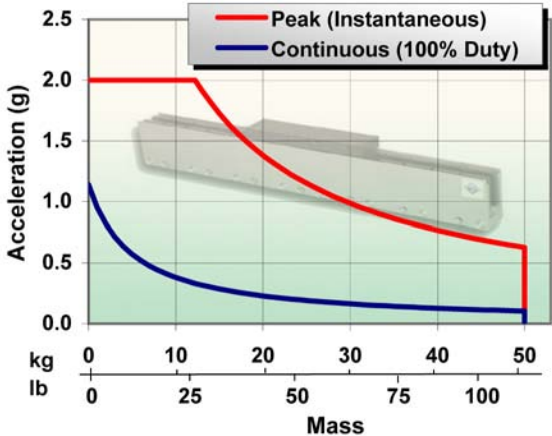


Figure 3-4: Maximum Accelerations Possible Based on Mass

3.4. Optical Limit Switch

ABL2000 series stages are provided with a series of optical limit switch assemblies. The limit switches signal when the stage has reached its maximum useable travel distance in all directions.

3.4.1. Limit Operation

Each limit switch has a light source and detector mounted to a small printed circuit board. Each limit switch board is mounted at the ends of an axis with their emitter–detector axes perpendicular to the direction of axis motion. The limit switch itself can be configured as normally closed (NC) or normally open (NO).



If the stage is driven approximately 6 mm 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.

3.4.2. Limit Switch Wiring

Limit switches are open-collector, TTL-compatible, electro-optical devices powered by 5 Volts that change output states when the stage approaches its maximum travel distance and breaks the light beam. Since they are open-collector devices, they may be interfaced to 24Volt logic inputs. Each limit switch is mounted on a small printed circuit board. Standard ABL2000 Stages include limit switch wiring integrated into the feedback connector.

Assuming a NC limit configuration, 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. The limit switch operation for a NO limit configuration is the exact opposite as described above. See Figure 3-5 for a diagram of limit switch wiring.

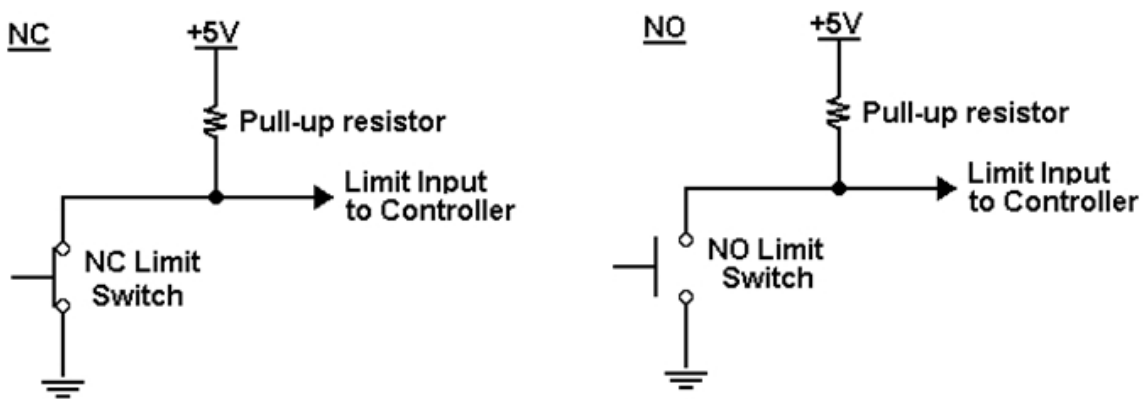


Figure 3-5: Normally Closed (NC) and Normally Open (NO) Limit Switch Wiring

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 7.

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 3-4. The voltage rating of the wire insulation must be greater than the maximum bus voltage listed in Table 3-4.

Table 3-5: Motor Connector Pinouts for all ABL2000 Stages

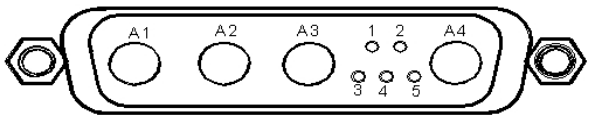
			
Pin	Description	Pin	Description
A1	MTR ØA	3	RESERVED
A2	MTR ØB	4	RESERVED
A3	MTR ØC	5	RESERVED
1	MTR SHLD	A4	FRM GND
2	RESERVED		

Table 3-6: Connector Pinouts for LNAS Encoder Option

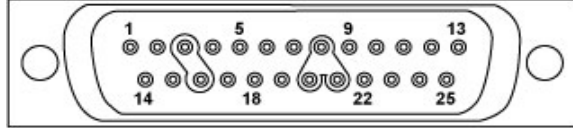
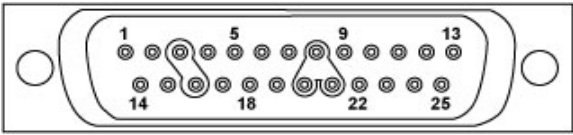
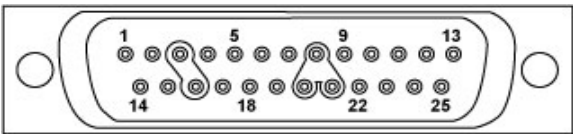
			
Pin	Description	Pin	Description
1	SIG SHLD	14	COS
2	THERM SW	15	COS-N
3	ENC +5V	16	LMT +5V
4	SIG COM	17	SIN
5	HB	18	SIN-N
6	MKR-N	19	RESERVED
7	MKR	20	SIG COM
8	SIG COM	21	SIG COM
9	RESERVED	22	RESERVED
10	HA	23	RESERVED
11	HC	24	-LMT
12	+LMT	25	RESERVED
13	RESERVED		

Table 3-7: Connector Pinouts for all LT Encoders, Including Squarewave and Amplified Sine Models



Pin	Description	Pin	Description
1	SIG SHLD	14	COS
2	THERM SW	15	COS-N
3	ENC +5V	16	LMT +5V
4	SIG COM	17	SIN
5	HB	18	SIN-N
6	MKR-N	19	RESERVED
7	MKR-N	20	SIG COM
8	SIG COM	21	SIG COM
9	SETUP	22	RESERVED
10	HA	23	ERROR -
11	HC	24	-LMT
12	+LMT	25	RESERVED
13	RESERVED		

Table 3-8: Wiring Connector Pinouts for Stages with LZR (Laser) Feedback



Pin	Description	Pin	Description
1	SIG SHLD	14	RESERVED
2	THERM SW	15	RESERVED
3	+5V	16	LMT +5V
4	SIG COM	17	RESERVED
5	HB	18	RESERVED
6	RESERVED	19	KEY
7	RESERVED	20	SIG COM
8	SIG COM	21	SIG COM
9	RESERVED	22	RESERVED
10	HA	23	RESERVED
11	HC	24	-LMT
12	+LMT	25	RESERVED
13	RESERVED		

Table 3-9: 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. Compliment of cos.
-LMT	Active high signal indicating stage maximum travel produced by negative stage direction.
ENC +5V	+5 V supply input for optical encoders. Typical requirement is 250 mA.
HA	Hall Effect A. Brushless motor commutation track output. TTL line driven signal with rotary motor.
HB	Hall Effect B. Brushless motor commutation track output. TTL line driven signal with rotary motor.
HC	Hall Effect C. Brushless motor commutation track output. TTL line driven signal with rotary motor.
LMT +5v	+ 5 V supply input for optical limit switch boards. Typical requirement is 50 mA.
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. Compliment of sin.
THERM SW	Positive lead for motor thermistor (to motion controller).
MTR ØA	Motor Phase A.
MTR ØB	Motor Phase B.
MTR ØC	Motor Phase C.
+5V	+5V supply.
LMT COM	Common ground to limit switch.
SIG SHLD	Signal shield connection.
SETUP	Analog output that represents quality of encoder signal, used for troubleshooting and setup. Renishaw encoders only.
ERROR-	Active high TTL output that represents encoder failure or misalignment. Renishaw encoders only.
RESERVED	Not used.
SIG COM	Signal common.
KEY	To ensure correct connections.
COM	Common ground.

3.6. Vacuum Operation

The ABL2000 is an air-bearing stage and is not compatible with operation in a vacuum environment. Contact Aerotech for alternate solutions.

Chapter 4: Maintenance

The ABL2000 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 ABL2000 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 ABL2000 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 and encoder scales 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.

In order to clean the entire length of the air bearing surfaces and encoder scales, it will be necessary to move the stage. Begin with the stage at one end of travel and remove power. Clean all accessible surfaces, being sure that the correct solvent is used on each surface (see Table 4-1). Once the cleaner has dried, move the stage by hand to the opposite end of travel. This should expose all previously covered surfaces. Repeat the cleaning process, and then restore power to the stage once all solvents have dried.

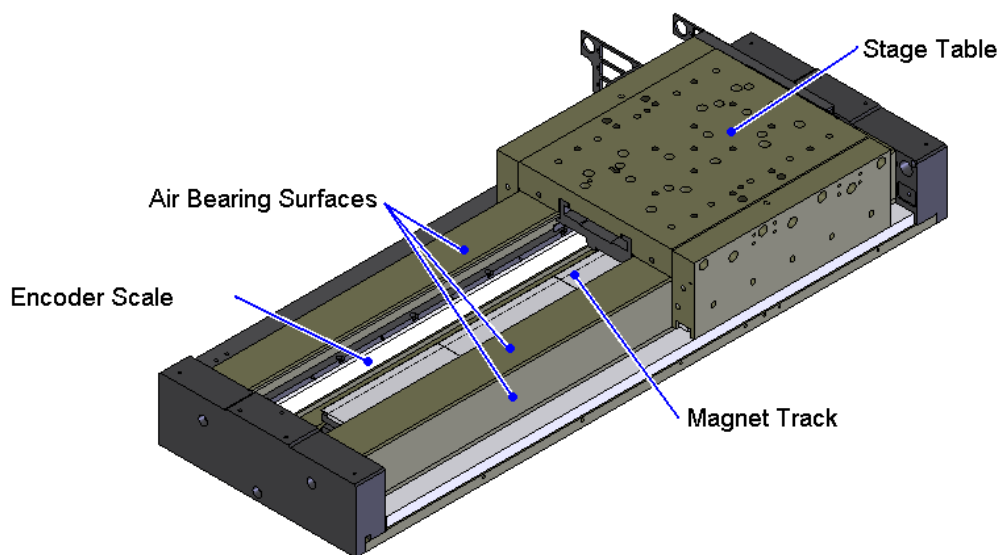


Figure 4-1: Air Bearing Surfaces and Encoder Scales Require Periodic Cleaning

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.

Company Address Aerotech, Inc.
101 Zeta Drive
Pittsburgh, PA
15238-2897

Phone: (412) 963-7470

Fax: (412) 963-7459

Appendix B: Technical Changes

Table B-1: Current Changes (1.02.00)

Section(s) Affected	General Information
Section 1.4.	Section added
Section 3.1.	Section added
Section 1.1.1.	Ordering information updated
Chapter 2: Installation, Section 2.1. , Section 2.3. , Section 2.5. , and Section 1.3.	Safety information and warnings added
Section 3.2.	Stage specifications updated
Section 3.2.	Motor specifications added
Section 3.5.	Note about motor wire current and voltage requirements added


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

ABL2000 Series Stage Manual P/N: EDS105, March 2, 2011 Revision 1.02.00 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	
Model #			Title	
Serial #			Company Name	
Date Shipped			Address	
Customer Order #				
Aerotech Subsidiary Order #			Email	

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