Planar HD Series Stage

User's Manual

P/N: EDS144 (Revision 1.01.00)

Dedicated to the Science of Motion
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Chapter 1: Overview

This manual describes Aerotech's Planar HD series of air bearing positioning stages. Figure 1-1 shows a typical Planar HD positioning stage.

This chapter introduces standard and optional features of the Planar HD stages and gives general safety precautions. The Planar HD is a full air-bearing planar positioning system, available in various sizes up to 650 mm by 650 mm.

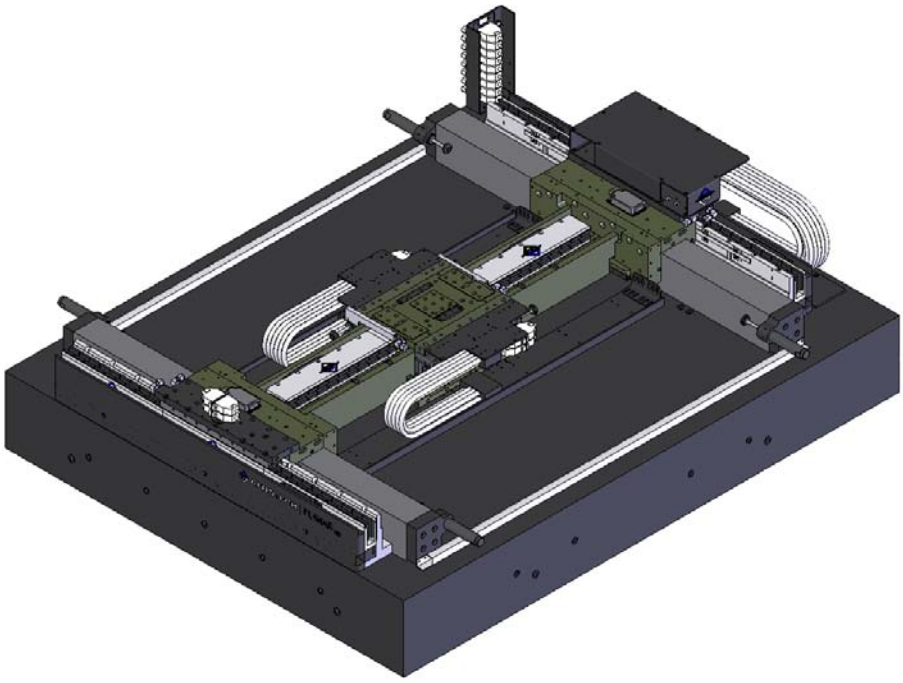

Figure 1-1: Typical Planar HD Series Positioning Stage

NOTE: Aerotech continually improves its product offerings, and listed options may be superseded at any time.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 Planar HD 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 Planar HD incorporates air-on-air preload in the lateral bearing directions of each axis. The opposing thin-film pressure maintains the bearing nominal gap tolerance. Non-contact magnetic or vacuum loads pre-load the vertical air bearing directions. These designs, in addition to the large air-bearing surfaces that distributes the load over a large surface area, results in a stage with outstanding stiffness that is ideal for heavy loads or high accelerations.

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. This is especially useful in applications where velocity control is important.

The trackless cable guides are enclosed in a Teflon sheath in all sections that experience motion. This eliminates particle generation due to alternative cable guiding systems making it ideal for clean room application. The lack of linked cable guiding systems also produces extremely smooth motion and velocity control.

A water-cooled circuit isolates the forcer and magnet tracks of each axis, minimizing the effects of heat generation due to high duty cycles. This allows maximum throughput while maintaining a high degree of accuracy.

Optical limit switches and mechanical end stops, which protect the carriage from over-travel, are also standard.

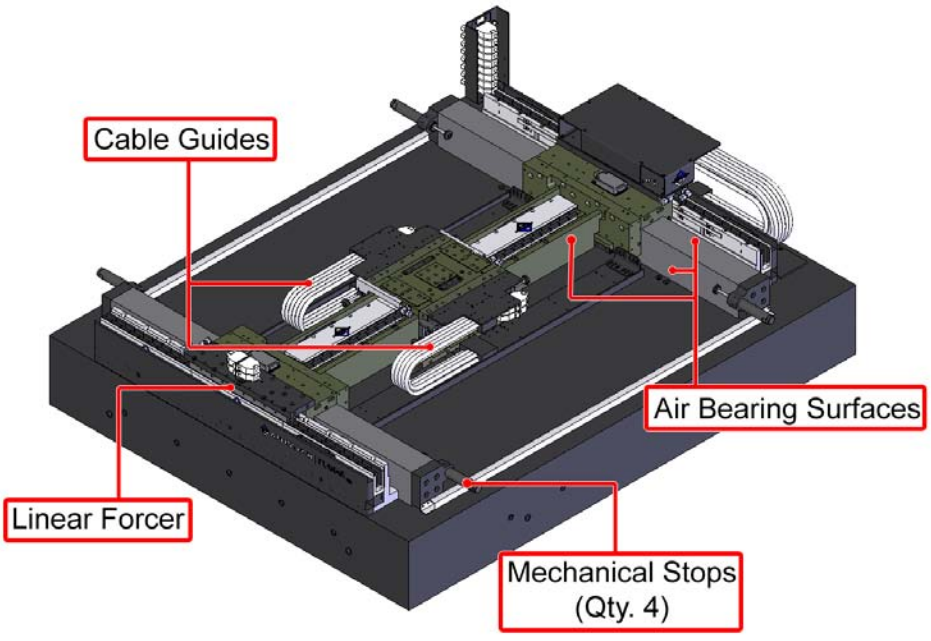

Figure 1-2: Planar HD Series Stage Components

1.1.1. Optional Features

On the Planar HD many unique features are possible as a custom design, such as a wide range of cable management possibilities, encoder options for the highest resolution or temperature stability, or vacuum braking options. The standard options for the Planar HD are shown in Table 1-1. Contact the Aerotech factory for more details.

Table 1-1: Model Numbering System

Planar HD Travel Options	
PLANAR HD-350-350	350 mm Scan Axis Travel, 350 mm Step Axis Travel
PLANAR HD-350-500	350 mm Scan Axis Travel, 500 mm Step Axis Travel
PLANAR HD-350-650	350 mm Scan Axis Travel, 650 mm Step Axis Travel
PLANAR HD-500-350	500 mm Scan Axis Travel, 350 mm Step Axis Travel
PLANAR HD-500-500	500 mm Scan Axis Travel, 500 mm Step Axis Travel
PLANAR HD-500-650	500 mm Scan Axis Travel, 650 mm Step Axis Travel
PLANAR HD-650-350	650 mm Scan Axis Travel, 350 mm Step Axis Travel
PLANAR HD-650-500	650 mm Scan Axis Travel, 500 mm Step Axis Travel
PLANAR HD-650-650	650 mm Scan Axis Travel, 650 mm Step Axis Travel
Planar HD Scan Axis Encoder Options	
-LN350SC	High-Accuracy Encoder, 350 mm Scan Axis Travel
-LN500SC	High-Accuracy Encoder, 500 mm Scan Axis Travel
-LN650SC	High-Accuracy Encoder, 650 mm Scan Axis Travel
-LT350SC	Standard Encoder, 350 mm Scan Axis Travel
-LT500SC	Standard Encoder, 500 mm Scan Axis Travel
-LT650SC	Standard Encoder, 650 mm Scan Axis Travel
Planar HD Step Axis Encoder Options	
-LN350ST	High-Accuracy Encoder, 350 mm Step Axis Travel
-LN500ST	High-Accuracy Encoder, 500 mm Step Axis Travel
-LN650ST	High-Accuracy Encoder, 650 mm Step Axis Travel
-LT350ST	Standard Encoder, 350 mm Step Axis Travel
-LT500ST	Standard Encoder, 500 mm Step Axis Travel
-LT650ST	Standard Encoder, 650 mm Step Axis Travel

1.2. Dimensions

STAGE	A	B	C	D
PLANAR HD-350-350	350	350	1345	1116
PLANAR HD-350-500	350	500	1345	1266
PLANAR HD-350-650	350	650	1345	1416
PLANAR HD-500-350	500	350	1495	1116
PLANAR HD-500-500	500	500	1495	1266
PLANAR HD-500-650	500	650	1495	1416
PLANAR HD-650-350	650	350	1645	1116
PLANAR HD-650-500	650	500	1645	1266
PLANAR HD-650-650	650	650	1645	1416

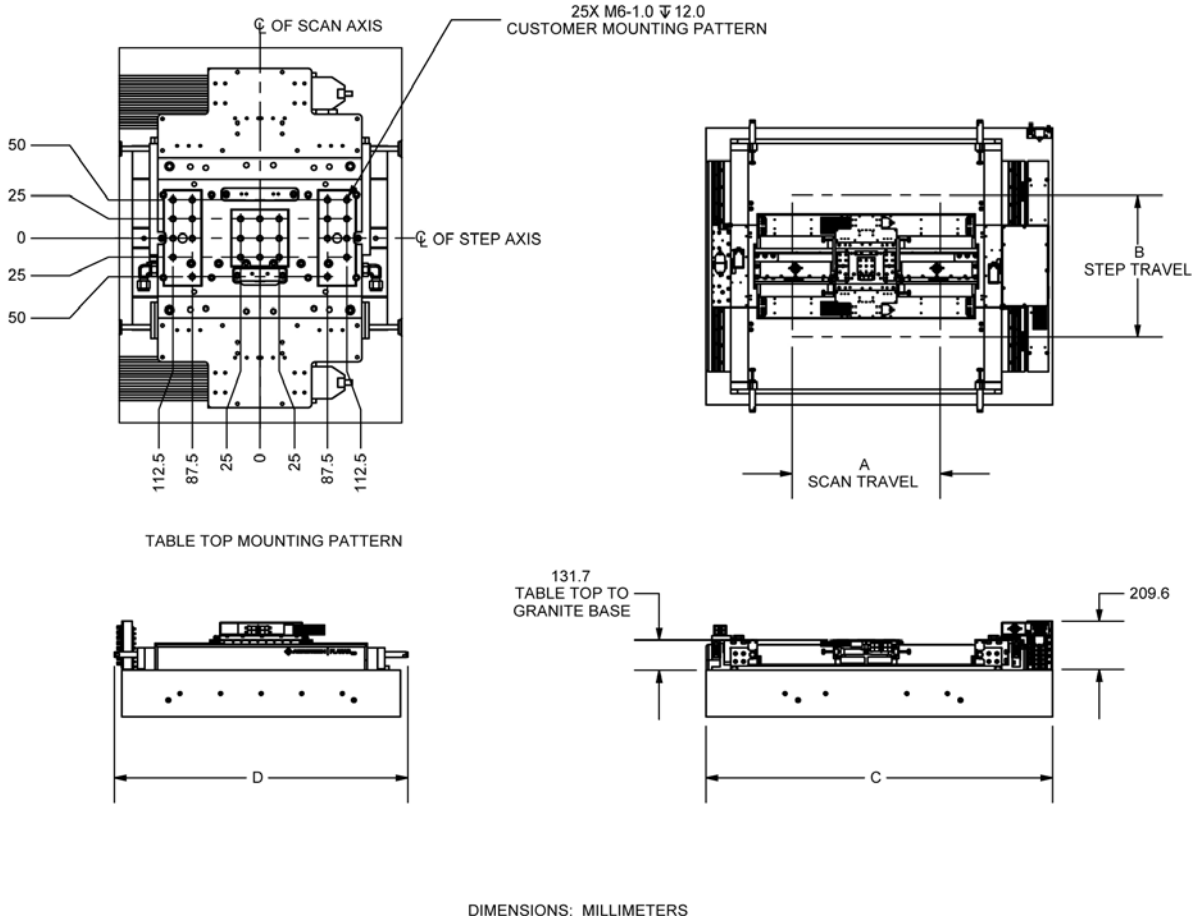

Figure 1-3: Planar HD Outline Dimensions and Axes Information

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. Planar HD 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.

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: November 10, 2010

Chapter 2: Installation

This chapter describes the installation procedure of the Planar HD stage, including handling the stage properly, the proper base for stage mounting, attaching the payload, and making the electrical and pneumatic 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. Perparing the Mounting Frame or Mechanics

The Planar HD is always integrated into a granite base that will often be designed to mount on a sub-frame. The sub-frame will frequently incorporate an isolation system. Assemble any sub-frame and isolation prior to unpacking the Planar HD. The design and support type and locations of the mounting frame or mechanics should be designed by or in collaboration with Aerotech to ensure optimal stage performance.

2.2. Unpacking and Handling the Stage

Carefully remove the stage from the protective shipping container. Tapped holes are provided in each side of the granite base for lifting rings (see Figure 2-1). Set the stage on the frame, isolation, or other prepared mounting mechanics. It may be necessary to make adjustments to the location of the isolation or mounting mechanics during the process of setting the stage into its final positions.

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.

Before operating the stage, it is important to let the stage stabilize to room temperature for at least 12 hours. Clean the stage by blowing it off with pressurized nitrogen or clean, oil-free air.

Remove all red anodized shipping clamps before attempting to move the axis (see Figure 2-1).

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 provided lifting inserts in the granite base.

Do not attempt to move the stage until the air supply, detailed in Section 2.3. , has been installed. Moving the stage table without air supplied can cause permanent damage to the stage.

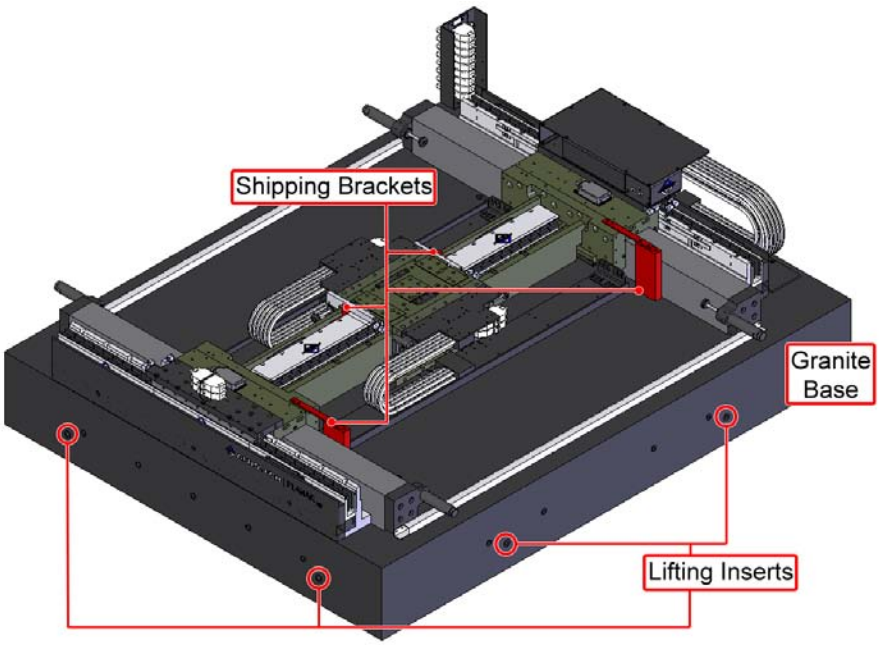

Figure 2-1: Planar HD With Lifting Inserts and Shipping Clamps Shown

2.3. Air/Vacuum Requirements

The quality of the air supplied 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. Air pressure in the range of 517 kPa to 551 kPa (75 psi to 80 psi) is necessary for use. A standard airflow rate of 45 to 55 SLPM (standard liters per minute) at 551 kPa should be observed for the entire system.

Vacuum in the range of 18 to 20 inches of Mercury is necessary for the proper preloading of the scan carriage air bearing. A standard vacuum-flow rate of 4.5 SLPM at 20 inches of Mercury should be observed. Refer to Figure 2-2 for the air and vacuum connection locations.

To protect the air bearing against under pressure or loss of pressure, an inline pressure switch tied to the motion controller's E-stop is recommended. The pressure switch should be set to 60 psi for high dynamic applications and no lower than 40 psi for slow speed applications.

2.4. Water Cooling Requirements

There are three water cooling circuits in the Planar HD that require a source of distilled, temperature controlled water. A chiller will be sized based on the specific duty cycle of the Planar HD for intended process. Refer to Figure 2-2 for the water connection locations.

WARNING

Use distilled water for the Planar HD water cooling system. De-ionized water, un-distilled water or other coolants may lead to corrosion of the water cooled components of the system.

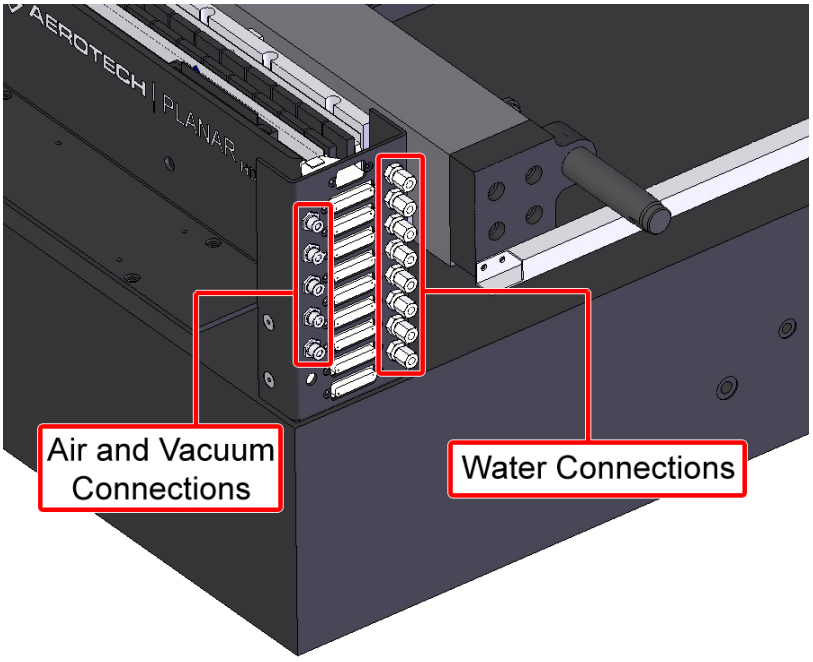

Figure 2-2: Planar HD Air, Water, and Vacuum Connections

2.5. Attaching the Payload to the Stage

Strong rare-earth magnets are present in the linear motor magnet tracks. Loose metal objects (tools, hardware, etc.) can cause personal injury and damage to the equipment.

To prevent damage to delicate 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 2.6.

The payload should be flat, rigid, and comparable to the stage in quality. *For valid accuracies, the mounting interface should be flat within 1µm per 50mm.*

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 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 Planar HD 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 feedback and motor power cables to the electrical connectors 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.

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

The stage's protective grounds are located on pin A4 of the motor power connectors. If you are using cables other than those provided by Aerotech, you must connect pin A4 to a ground connection.

2.6.1. Optical Limit Swtiches

Planar HD stages are equipped with a pair of optical limit switches for each axis. Refer to Section 3.4. for a description of limit switch operation and wiring.

Chapter 3: Operating Specifications

This chapter contains general technical information about Planar HD 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 Planar HD 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 Planar HD 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 of the encoder scales are a key element in the overall positioning accuracy. In most stages, a scale error can be expected if the temperature of the scale differs from 20° C (68° F); however, the Planar HD is designed with encoder scales having vary small coefficients of thermal expansion (CTE). This feature makes the accuracy of the stage much less dependent on the operating temperature. Although the accuracy is much less sensitive to temperature than many systems, the best accuracy will still be achieved if the stage is operated at the 20° C (68° F) temperature at which it was calibrated.

3.3. Basic Specifications

Basic Planar HD series positioning stage specifications are shown in Table 3-2. For the most recent specifications, see Aerotech's website (www.aerotech.com).

Table 3-2: Planar HD Series Specifications

Travel	Scan Axis	350mm, 500mm, 650mm
	Step Axis	350mm, 500mm, 650mm
Drive System		Linear Brushless Motor (Scan Axis: BLM-264-A) (Step Axis: Two BLM-325-A)
Resolution		0.25 nm
Accuracy (1) (Low CTE Scale)		±300 nm
Repeatability (Long Term)		±50 nm
XYZ Position Stability (Air On)		20 nm
Granite Base Thickness		250 mm
Moving Masses	Scan Carriage	10 kg
	Step Axis (350 mm Scan Travel)	60 kg (2)
	Step Axis (500 mm Scan Travel)	64 kg (2)
	Step Axis (650 mm Scan Travel)	68.5 kg (2)
Rated Payload (Maintaining Dynamic Specifications)		5 kg
Maximum Payload (3)		30 kg
Maximum Velocity with Rated Payload (4)	Scan Axis	2000 mm/s
Peak Acceleration with Rated Payload (4)	Scan Axis	5G (50m/s^2)
RMS Acceleration with Rated Load	Scan Axis	1.25G (12 m/s^2)
Stiffness, First Natural Frequency with Rated Payload		>330 Hz
Pitch		2 arc sec
Roll		2 arc sec
Yaw		2 arc sec
XY Orthogonality (5)		1 arc sec
MTBF		>40,000 hours

(1) Available with Aerotech controllers and HALAR calibration option.

(2) Includes Scan Carriage Mass

(3) Maximum load based on bearing capability; maximum application load may be limited by acceleration requirements.

(4) Maximum speed based on stage capability; maximum application velocity may be limited by system data rate and system resolution.

(5) Requires calibration

(6) To protect air bearing against under-pressure, an in-line pressure switch tied to motion controller E-stop input is recommended.

(7) Air supply must be clean, dry to 0°F dew-point and filtered to 0.25 µm or better; Aerotech recommends nitrogen at 99.9% purity.

(8) Optional construction materials include ceramic, invar, stainless, and titanium.

Table 3-3: Motor Specifications

	Units	Specifications	
Motor Model		BLM-264-A	BLM-325-A
Performance Specifications(1,5)			
Continuous Force, 1.4 bar, 20 psi(2)	N (lb)	301.7 (67.8)	332.2 (74.7)
Continuous Force, No Air(2)	N (lb)	197.2 (44.3)	230.7 (51.9)
Peak Force(3)	N (lb)	1206.6 (271.3)	1328.6 (298.7)
Electrical Specifications(5)			
Winding Designation		-A	-A
BEMF Constant (Line-Line, Max)	V/m/s (V/in/s)	44.46 (1.13)	53.03 (1.35)
Continuous Current, 1.4 bar, 20 psi(2)	Amp_{pk} (Amp_{rms})	7.80 (5.52)	7.20 (5.09)
Continuous Current, No Air(2)	Amp_{pk} (Amp_{rms})	5.10 (3.61)	5.00 (3.54)
Peak Current, Stall(3)	Amp_{pk} (Amp_{rms})	31.20 (22.06)	28.80 (20.36)
Force Constant, Sine Drive(5,6)	N/Amp_{pk} (lb/Amp_{pk})	38.67 (8.69)	46.13 (10.37)
	N/Amp_{rms} (lb/Amp_{rms})	54.69 (12.30)	65.24 (14.67)
Motor Constant(2,4)	$N/\sqrt{W}$ ($lb/\sqrt{W}$)	16.39 (3.69)	17.66 (3.97)
Resistance, 25°C (Line-Line)	ohms	5.3	6.5
Inductance (Line-Line)	mH	4.20	5.20
Thermal Resistance, 1.4 bar, 20 psi	°C/W	0.30	0.28
Thermal Resistance, No Cooling	°C/W	0.69	0.59
Maximum Bus Voltage	VDC	340	340
Mechanical Specifications			
Air Flow, 20 psi	m^3/s (SCFM)	$1.6x10^{-3}$ (3.3)	$1.6x10^{-3}$ (3.3)
Magnetic Pole Pitch	mm (in)	30.48 (1.20)	30.48 (1.20)

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

3.4. Limit Switches

Planar HD series stages are provided with a series of optical limit switch assemblies for each axis. The limit switches signal when the stage has reached its maximum useable travel distance in both directions.

3.4.1. Limit Switch 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 end of the stage with its emitter–detector axes perpendicular to the direction of table motion. When movement of the stage table causes the blade mounted to the stage base or bridge to break the light beam from the emitter to the detector, a clockwise (CW) or counterclockwise (CCW) limit signal is generated. The limit switch itself can be configured as normally closed (NC) or normally open (NO).

If the stage is driven past the electrical limit, it will encounter the hard stop. Where these hard limits occur is dependent on stage travel. Depending on the operating speed of the stage, even though the hard stop shocks will provide some protection, damage to the stage could result.

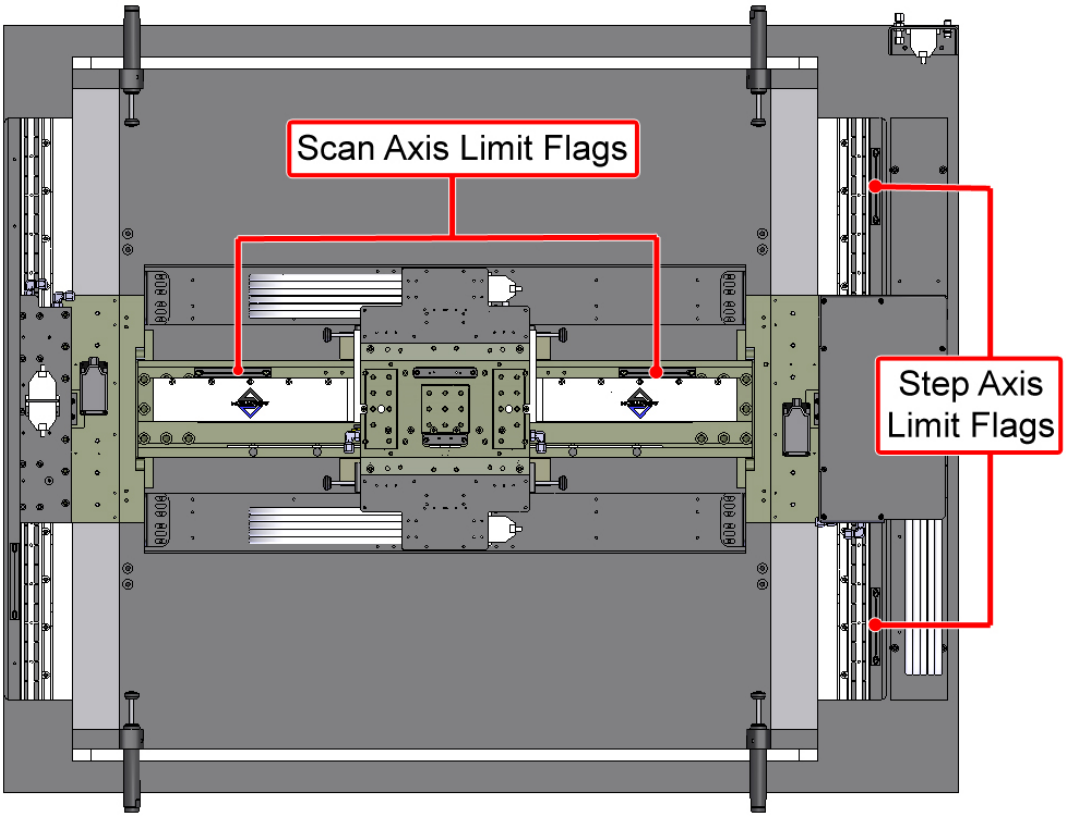

Figure 3-1: View of a Typical Planar HD Showing Limit Switches

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 24 Volt logic inputs. Each limit switch is mounted on a small printed circuit board.

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, on the controller, 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 3-2 for a diagram of limit switch wiring.

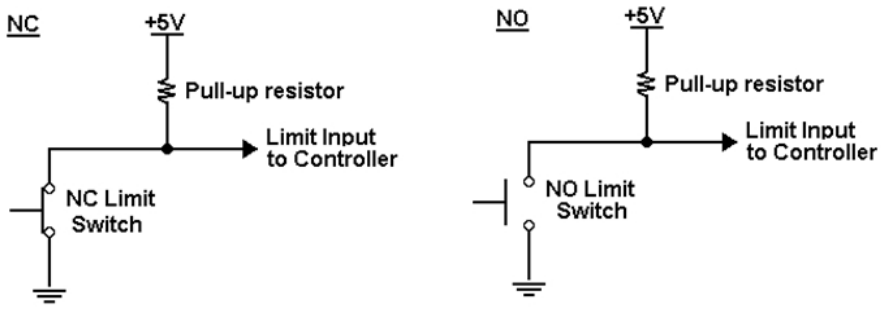

Figure 3-2: Normally Closed (NC) and Normally Open (NO) Limit Switch Wiring

3.5. Standard Motor 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 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 current listed in 3.3. The voltage rating of the wire insulation must be greater than the maximum bus voltage listed in 3.3.

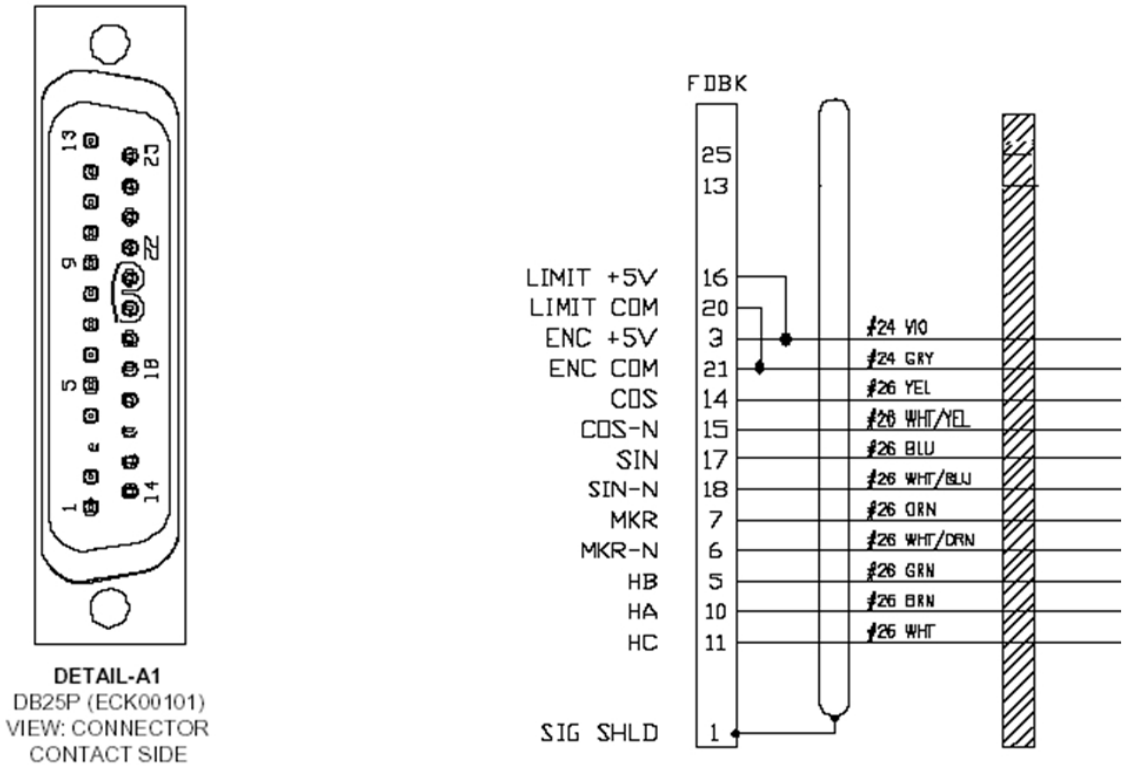

Figure 3-3: Limit and Encoder Wiring for Standard Planar HD Stages

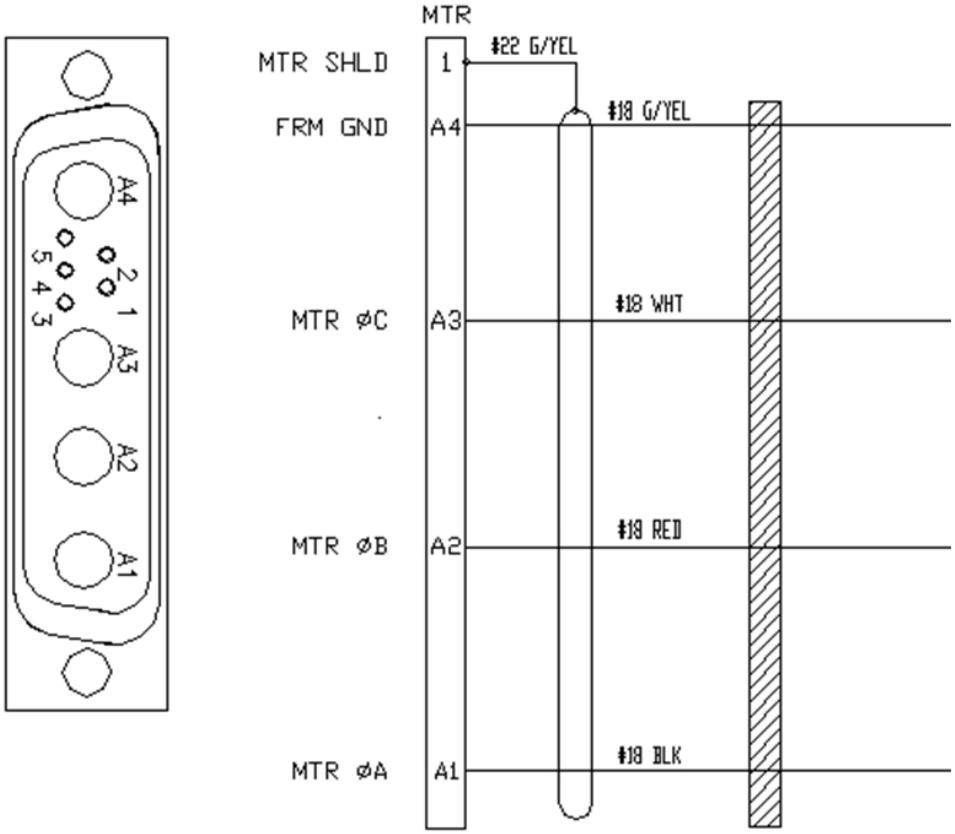

Figure 3-4: Motor Wiring Connector for all Planar HD Stages

Table 3-4: Limit/Motor Wiring Pin Descriptions

Pin Output	Description
CW Limit	Signal indicating stage maximum travel produced by CW motor rotation (Normally Active Low).
COS	Cosine. Incremental encoder output; either TTL line driven or amplified sine wave type signal. Cos leads Sin for CW/positive motion.
COS-N	Incremental encoder output. Compliment of cos.
Counter-clockwise (CCW/-) Limit	Signal indicating stage maximum travel produced by CCW motor rotation (Normally Active Low).
HOME LMT	Home Limit. Paralleled with CCW/- (with Standard Jumper) or CW/+ (Optional Jumper) limit. Typically not used.
ENC +5V	+5 V supply input for optical encoders. Typical requirement is 250 mA.
ENC COM	Optical encoder common.
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
LMT +5v	+ 5 V supply input for optical limit switch boards. Typical requirement is 50 mA.
LMT COM	Optical limit switch boards common.
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 VDC 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. Cos leads sin for CW/positive motion.
SIN-N	Incremental encoder output. Compliment of sin.

3.6. Vacuum Operation

The Planar HD 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 Planar HD 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 2.3. 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 Planar HD 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 Planar HD 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

Do not the cleaning encoder scales with Acetone. Cleaning the encoder scales with Acetone can result in permanent damage to the scale.

4.2.2. Cleaning Process

The cleaning process is outlined in the steps that follow. It is recommended that all air bearing surfaces and encoder scales be 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 form 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.

Strong rare-earth magnets are present in the linear motor magnet tracks. Loose metal objects (tools, hardware, etc.) may cause personal injury and/or damage to the equipment.

Moving the stage table without air supplied can cause permanent damage to the stage. Refer to Section 2.3. for more information about air requirements and installation.

Begin with the each axis of 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 each axis of 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.

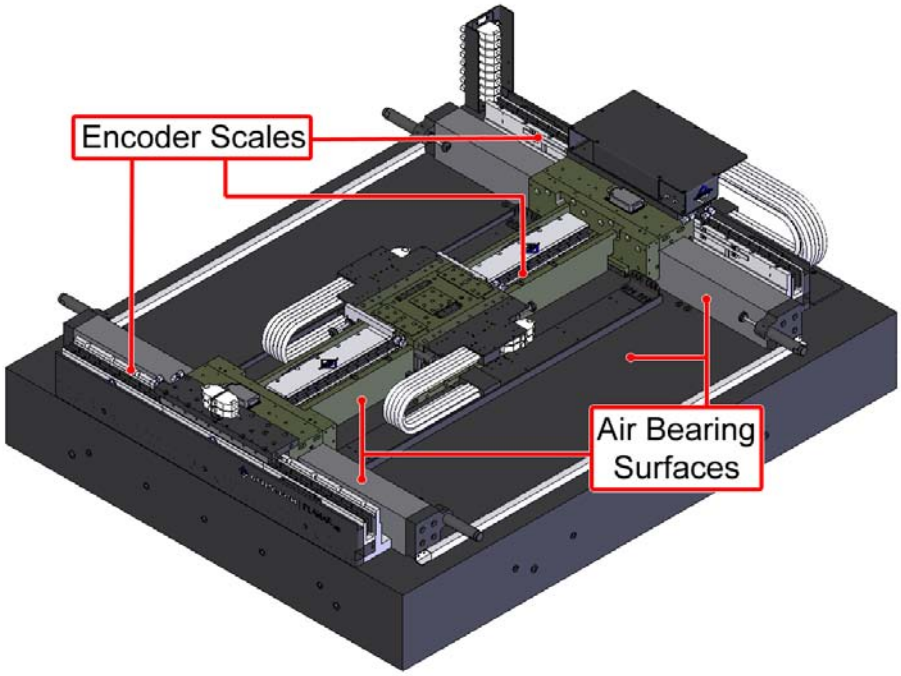

Figure 4-1: Air Bearing Surfaces and Encoder Scales Require Periodic Cleaning

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

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 2.2. , Section 2.6. , and Section 1.3.	Added safety information and warnings
Section 3.5.	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

Reader's Comments

Planar HD Series Stage Manual **P/N: EDS144, November 10, 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	

Mail your comments to:	**Fax to:**
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	Email:
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