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Single-Axis Tables



OVERVIEW

LEADSCREW DRIVEN

- KV™ Ultra-Compact Positioner
- RM™ Compact Ball Way Table
- RMS™ Compact Single-axis Shuttle
- TM™ Ball Way Table
- TMS™ Single-Axis Shuttle
- LM™ Crossed Roller Way Table

HIGH PRECISION SCREW DRIVEN

- XM™ Smooth Motion Table

BALLSCREW DRIVEN

- LMB™ Crossed Roller Way Ballscrew Table
- FM™ Compact Ball Way Table
- RBS™ Servo Motor Positioner

LINEAR MOTOR-DRIVEN

- Force™ Recirculating Ball Stage
- MAG™ Moving Magnet Linear Motor Stage
- NanoSlide-20™ Linear Motor Stage
- SAS™ Recirculating Way Table
- NanoBeam™ Linear Motor Positioner
- NanoBeam II Linear Motor Positioner
- AirBeam™ Single-Axis Shuttle
- MicroBeam™ Low Profile Shuttle
- FiberBeam™ Linear Motor Stage

Z-ELEVATORS

- Z-Elevator™ Vertical Motion Units
- Z-Theta™ Z-Elevator with Small Angle Theta
- BAZ™ Ultra-Stiff Z-Elevator Unit

Features

- **Ready to integrate**
- **Include motor, knob, coupling, and built-in limit sensors**
- **Motor and limit/encoder connectors are locking with strain-relieved cables**

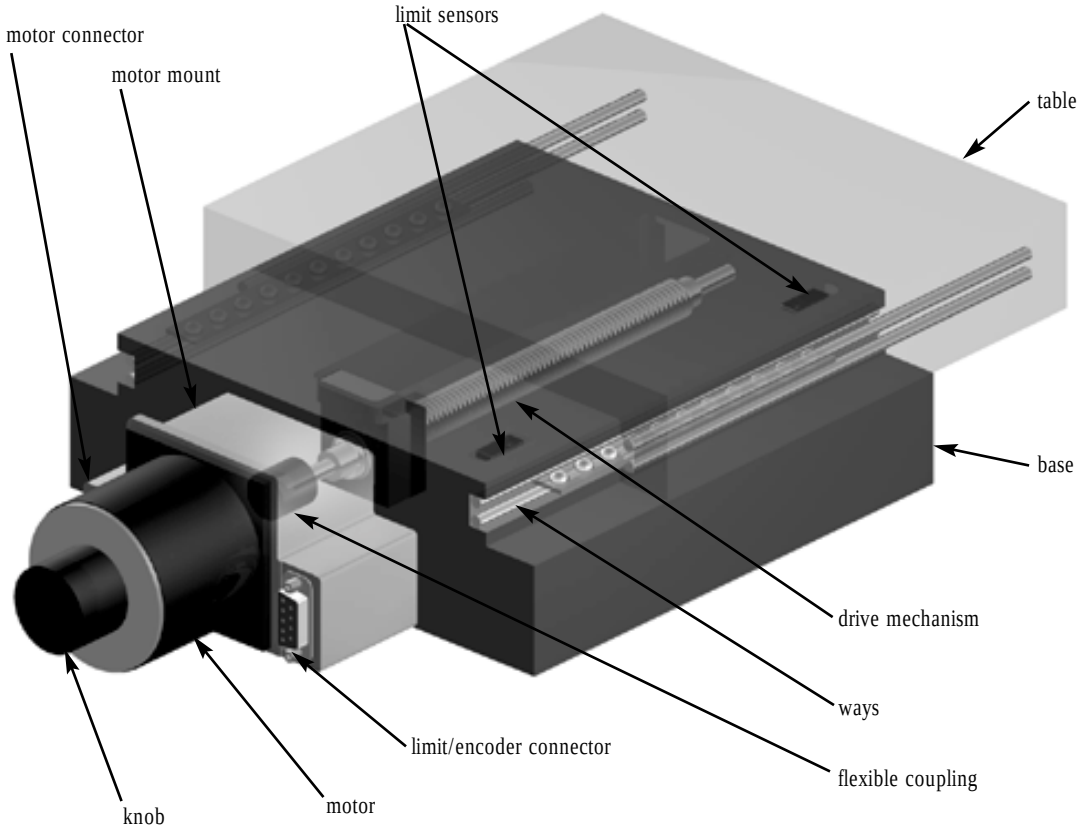
Single-Axis Table Overview

Danaher Precision Systems' motorized single-axis tables include a number of standard features, making them ready to integrate. All units include a motor, built-in Hall-effect limit switches, and locking, strain relieved motor and Limit/Limit Connectors. The limit switches are repeatable to ±2.5 microns, providing precision position references in addition to overtravel protection. The separate connectors provide convenient connection of motor and limit/encoder signals. Units with rotary motors also include a rear shaft-mounted knob, for fine manual control, and a flexible coupling. Our anti-backlash friction nut is a key feature of our leadscrew-driven tables. It provides very high repeatability and automatically compensates for wear, achieving backlash-free lifetimes in excess of 7.5×10^6 meters. Units driven by a precision ballscrew achieve stiffnesses of 5×10^7 Newtons per meter.

A number of options are available for our single-axis tables. They include non-standard motors, encoders, laser interferometers, vacuum preparation, brackets, metric versions, and controllers. Most tables accept our integral rotary encoder, which mounts out of harms way within the motor mount of rotary motor driven units. These encoders provide 2000 or 4000 counts per revolution with standard 4x counting circuitry, resulting in 1µm or 0.5µm resolution when used with a 2mm leadscrew. Linear encoders with a variety of resolutions are also available. Most standard single-axis tables are supplied with mounting holes for both rotary and linear encoders. Linear motor-driven tables automatically include a linear encoder.

While we offer a complete line of true X-Y tables, X-Y assemblies can also be configured from two of our single-axis tables. A rationalized system of upper and lower mounting hole patterns allows our single-axis positioning tables to be directly bolted to another table of equal or larger cross section. This provides a high degree of flexibility, and avoids the added height penalty, surcharges, and shipping delays that would be incurred were adapter plates necessary.

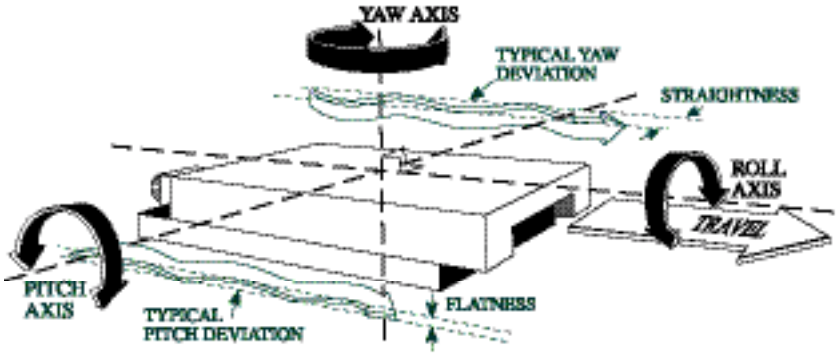
There are a number of selections to make when choosing a motorized single-axis table. Two major components are the ways; which determine load capacity, stiffness, and straight-line accuracy; and the drive mechanism, which determines speed and smoothness. One also needs to determine the accuracy, repeatability, and resolution required; the appropriate motor for the application; and whether or not an encoder is needed. The primary options for each component and specification definitions are detailed on the pages that follow.



Definition of Specifications

Positional Accuracy: The maximum difference between a commanded move and an actual move for each axis, one inch above the table top, as measured by a laser interferometer.

Leadscrew/Ballscrew Accuracy: The sum of the cumulative and periodic lead errors resulting from the machining of the drive screw.



Bidirectional Repeatability: The difference in absolute position reached when returning to a given position from the opposing direction. This value is usually larger than the uni-directional repeatability.

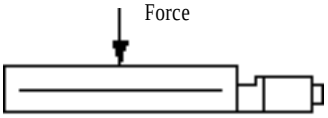
Flatness of Travel: Deviation from ideal straight line travel in a vertical plane, also referred to as vertical runout.

Straightness of Travel: Deviation from straight line motion in a horizontal plane. Also referred to as horizontal runout. This error is usually traceable to an underlying angular error of the ways.

Pitch: An angular deviation possible in positioning systems, in which the tables' leading edge rises or falls as the table translates along its direction of travel. This represents rotation around a horizontal axis, perpendicular to the direction of travel.

Yaw: An angular deviation from ideal straight line motion, in which the positioning tables rotates around the Z (vertical) axis as it translates along its travel axis.

Load Capacity: The maximum allowable load, centered and normal to the mounting surface, on a positioning table which is mounted horizontally.



Maximum Speed: The highest speed recommended to prevent degradation of positioner life. For leadscrew and ballscrew-driven tables, this may be calculated by multiplying the listed rps (revolutions per second) by the screw lead.

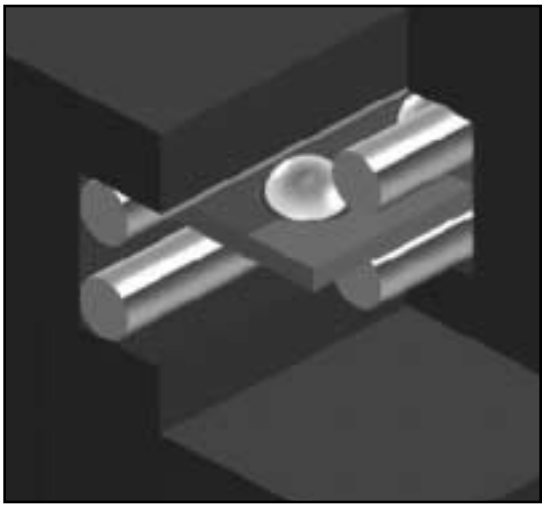
Way Type

There are four types of ways used in Danaher Precision Systems' standard line of single-axis tables: ball ways, crossed roller ways, recirculating ways, and air bearing ways.

Ball Ways

- **Low to moderate load capacity**
- **Insensitive to environmental contaminants**
- **Lowest cost**

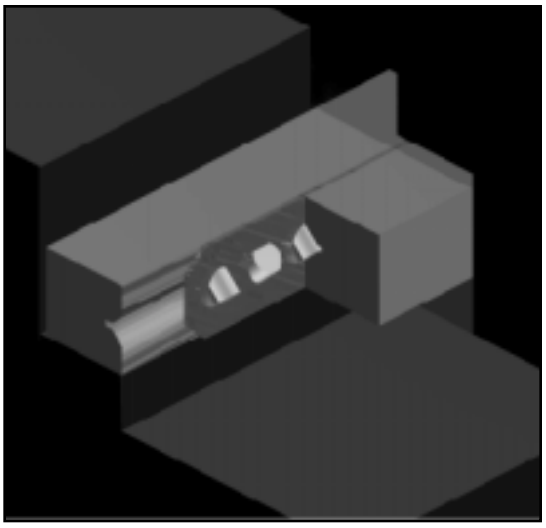
The exceptional accuracy of our ball ways results from the use of precision tool steel balls and centerless ground rods, hardened to Rockwell C 60-64. The stage base (normally stationary) carries two hardened steel rods on each side. The stage body carries a similar set of rods, with an adjustable hardened steel pressure plate on one side to preload the stage assembly. Between each side of the stage base and body is a set of uniformly spaced steel balls, each of which contacts the base at two points and the body at two points. Spacing between the balls is maintained by a nylon retainer. As the stage body moves back and forth, the ball complement rolls along the rods at half the velocity and travel of the stage body.

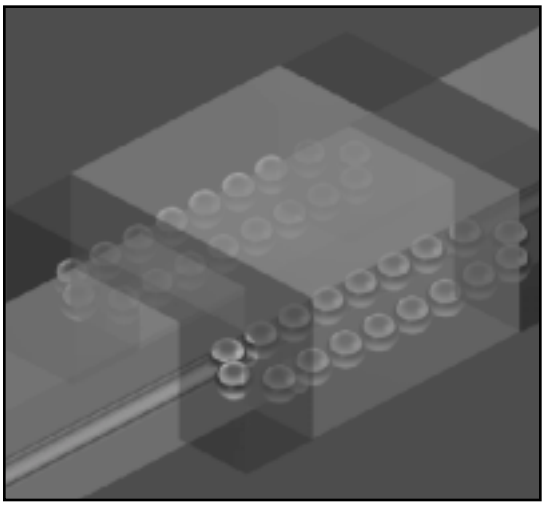


Crossed Roller Ways

- **Highly accurate linear motion**
- **High load capacity**
- **Very stiff**

Crossed roller ways provide accurate linear motion, together with high load capacity and stiffness. Their operation is very similar to that of ball ways, described above. Two V-ways replace the four ground rods, and a set of cylindrical rollers replace the steel balls. The resulting line contact provides a much higher load capacity than the four-point contact of ball ways. The V-ways and rollers, which define the linear motion, are precision ground using tool steel hardened to Rockwell C 60-64. Due to the averaging characteristics of the line contact inherent in crossed roller ways, run-out in the motion of crossed roller ways is generally below that found in ball ways. The line contact found in crossed roller ways is less effective at occluding foreign particles than the point contact inherent in ball ways. Accordingly, the ballways may be preferred for operation in environments with fine abrasive contaminants (grinding operations, for example).

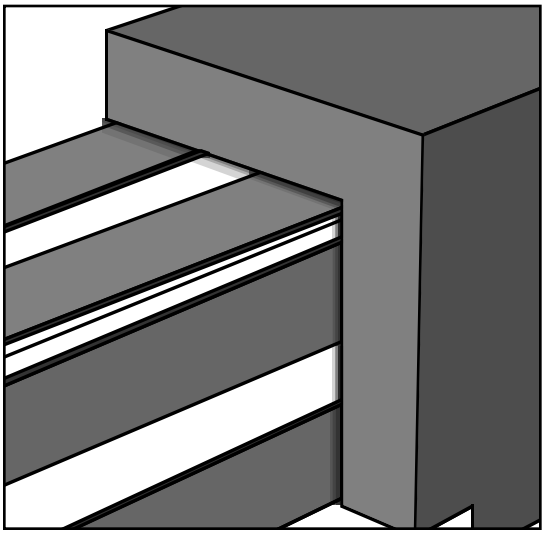




Recirculating Ways

- **Small moving envelope**
- **Low pitch errors (load does not overhang base at ends of travel)**

Recirculating ways have ball or roller bearings which recirculate in a module, mounted to the stage body, which travels along a way on each side of the stage base. Recirculating ways are typically not as smooth as linear ways (since the bearings must enter and exit the preload region), but they allow a shuttle design that provides comparable travel in less space.



Air Bearing Ways

- **Ultra-precise**
- **Frictionless motion**
- **Unlimited life**

Air bearing stages provide the ultimate in precision linear motion. Virtually frictionless, they consist of a shuttle which floats on a thin film of air above a precision ground base. Their exceptional linear and angular accuracy stems from the inherent averaging of non-contact air bearing technology. Within the air bearing slide, air is restricted to provide a thin film of air (5µm to 10µm) upon which the shuttle floats. This air film behaves as a stiff spring, which develops a restoring force in response to applied loads. As a load is applied to the shuttle, the air gap decreases slightly. This reduces the air flow, which decreases the pressure drop across the restrictors. The result is an increase in the pressure of the air under the shuttle, which produces a force opposing the original applied force. The air bearing thereby functions as a position servo system, resisting deflections due to applied forces, and maintaining a relatively constant gap thickness. In addition to its stiffness, air bearings exhibit an inherent averaging property, which results in the shuttle possessing a smoother runout profile than the surface over which it slides. Danaher Precision Systems' unique clog-free air bearing technology provides superior reliability while eliminating costly filtration requirements.

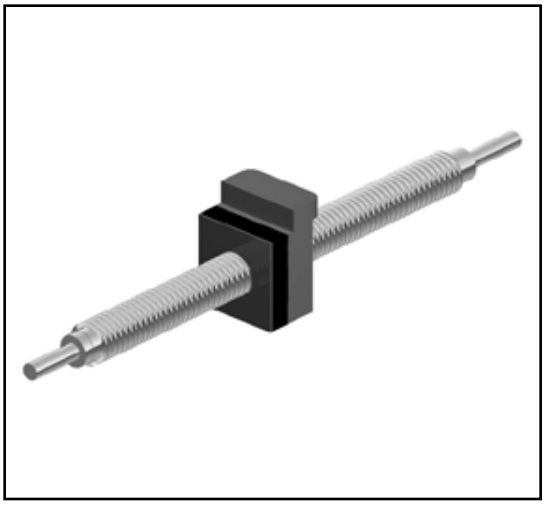
Drive Mechanism

There are three types of drive mechanisms used in Danaher Precision Systems' standard line of single-axis tables: leadscrews, ballscrews, and linear motors. A brief summary follows; please refer to our Motion Control Handbook for more detailed discussions.

Leadscrews

- **Moderate speed**
- **Excellent damping**
- **High repeatability**
- **Ideal for vertical applications (no backdriving with finer pitches)**

Leadscrews provide precise, cost-effective solutions to many motion control requirements. Each leadscrew is paired with a specially designed anti-backlash friction nut, which provides excellent repeatability, typically less than ±2.5µm (unloaded), and fast settling. The self-compensating feature of the nut maintains its original low backlash for travels exceeding 7.5×10^6 meters. Finer pitches used in vertical orientations won't backdrive. Universal thread grinding leadscrews are available for applications requiring extremely smooth motion.

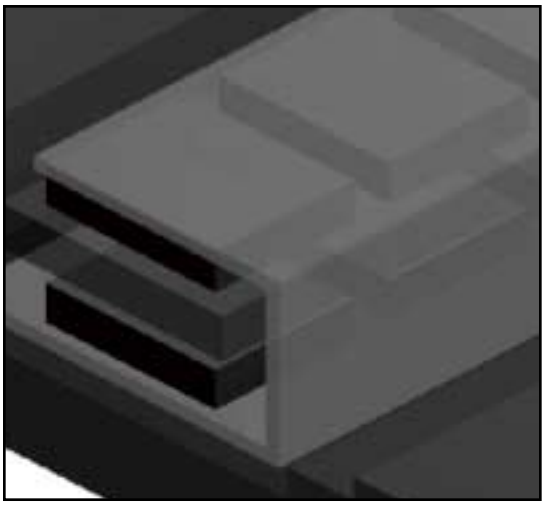


Ballscrews

- **High speed**
- **Ideal for quick, short moves**
- **High stiffness**

Ballscrews utilize steel balls between the nut and screw, which increase efficiency and decrease wear. Although not as smooth as leadscrews with friction nuts, they are ideal for applications with high acceleration and deceleration requirements since they wear less, and therefore have a longer life. Please note that a motor mounted brake is recommended when using a ballscrew in a vertical orientation (to prevent backdriving).





Our high performance brushless linear servo motors provide a very high speed, smooth motion alternative to more traditional leadscrew and ballscrew drive mechanisms. They directly drive the user load and may be commutated digitally or sinusoidally, with the latter providing the smoothest motion. Linear servo motors require some form of positioning feedback. This feedback mechanism also dictates the stage's resolution and accuracy, so its selection is important to system performance. We use linear encoders since they are non-contacting, cost-effective, and available in a wide range of resolutions and accuracies. Laser interferometers may be used for feedback in applications with extremely demanding accuracy requirements.

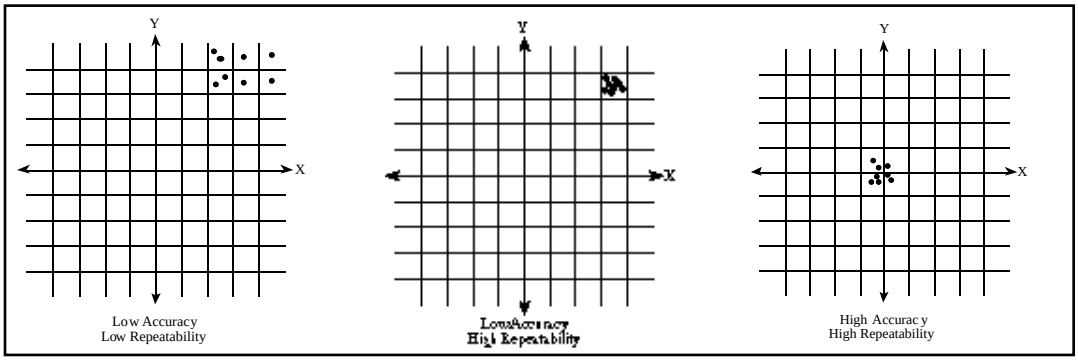
Linear Motors

- **Highest speed**
- **Ultra-smooth motion**
- **Non-contact design (virtually no maintenance)**

Accuracy, Repeatability, & Resolution

One should carefully consider actual application requirements. Specifying high accuracy, when high repeatability or resolution is all that's really needed, can unnecessarily inflate system cost. Some applications have position feedback built-in, and may only need sufficient resolution to reach a desired position. Using a standard, end-of-travel Hall-effect limit sensor as a "home" reference position, and commanding moves relative to this position allows a highly repeatable positioning system to satisfy many applications. Some more demanding applications may require a linear encoder for position feedback, while the most demanding applications may call for laser interferometer feedback. Please reference our Motion Control Handbook for more detailed discussions on each of these topics.

The following figures illustrate the difference between repeatability and accuracy.



Accuracy

- **The difference between actual position and commanded position**
- **Function of ways, drive mechanism, and encoder**

Positioning system accuracy can be conveniently divided into two categories: the accuracy of the way itself, and the linear positioning accuracy along the way. The former describes the degree to which the ways (ball and rod, crossed roller, air bearing, etc.) provide an ideal single-axis translation, while the latter is concerned with the precision of incremental motion along the axis (typically related to the leadscrew, ballscrew, linear encoder, or other feedback device).

Many of our single-axis tables are available in two accuracy classes: precision and commercial. These two classes define the stage's leadscrew/ballscrew accuracy, repeatability, flatness, straightness, and angular errors, with the precision grade holding tighter tolerances. The rated tolerance values are meant as "not to exceed" values; in many cases, the actual values are held to levels well below our published values.

Repeatability

- **Describes relative position error (the scatter in successive moves to a given position)**
- **Function of drive mechanism**

The repeatability of a positioning system is the extent to which successive attempts to move to a specific location vary in position. A highly repeatable system (which may or may not also be accurate) exhibits very low scatter in repeated moves to a given position, regardless of the direction from which the point was approached. A distinction can be drawn between the variance in moves to a point made from the same direction (uni-directional repeatability) and moves to a point from opposing directions (bi-directional repeatability). In general, the positional variance for bi-directional moves is higher than that for uni-directional moves. Quoting uni-directional repeatability figures alone can mask dramatic amounts of backlash error.

Resolution

- **The smallest possible increment that can be commanded**
- **Function of leadscrew/ballscrew, motor, and controller (or encoder and controller in a linear motor based system)**

Resolution must also be considered when determining your application requirements. A very accurate and repeatable system may not be able to reach a desired position if it doesn't have fine enough resolution. Resolution is defined as the smallest positional increment that can be commanded of a motion control system. The pitch of the leadscrew or ballscrew, the motor, and the controller together determine resolution in many stages, while the encoder and controller determine resolution in a linear motor based system. One must also be careful to avoid "empty", or unachievable resolution, where a system is incapable of reliably making moves at the one count or microstep level. Sample calculations follow.

An assembly with a 0.10" leadscrew, 1.8 degree stepping motor, and divide by 10 microstep drive will have 50 microinch resolution.

$$\left(\frac{1.8 \text{ degrees}}{10 \text{ microsteps}}\right)\left(\frac{1 \text{ leadscrew rev.}}{360 \text{ degrees}}\right)\left(\frac{0.10"}{1 \text{ leadscrew rev.}}\right) = 0.00005 \text{ inch/microstep}$$

To convert to microns, divide by 40 microinches.

$$\left(\frac{0.00005 \text{ inch}}{\text{microstep}}\right)\left(\frac{1 \text{ micron}}{40 \times 10^{-6} \text{ inch}}\right) = 1.27 \text{ micron/microstep}$$

A system with a 2mm leadscrew, servo motor, and 2000 count/revolution rotary encoder will have 1 micron resolution.

$$\left(\frac{2\text{mm}}{1 \text{ leadscrew rev.}}\right)\left(\frac{1 \text{ leadscrew rev.}}{2000 \text{ encoder counts}}\right) = 0.001 \text{ mm/encoder count}$$

The resolution of a servo system with a linear encoder is simply the same as the encoder resolution.

The pitch of the leadscrew, the ratio of the wedge mechanism, the motor, and the controller together determine resolution in our Z-Elevator tables. Examples follow.

The standard resolution of our ZE Series Z-Elevator is 0.4 micron. This is achieved with a 2mm leadscrew and a 1.8° stepping motor, controlled by a 310M microstepping unit (with the standard divide by 10 microstepping drive).

$$\left(\frac{1.8 \text{ degrees}}{10 \text{ microsteps}}\right)\left(\frac{1 \text{ leadscrew rev.}}{360 \text{ degrees}}\right)\left(\frac{2 \text{ mm}}{1 \text{ leadscrew rev.}}\right)\left(\frac{1 \text{ wedge unit up}}{2.5 \text{ units across}}\right) = 0.0004 \text{ mm/microstep}$$

While our ZE-5 incorporates a 2.5:1 wedge, our BAZ utilizes a 20:1 wedge, with a standard resolution of 0.05 micron.

$$\left(\frac{1.8 \text{ degrees}}{10 \text{ microsteps}}\right)\left(\frac{1 \text{ leadscrew rev.}}{360 \text{ degrees}}\right)\left(\frac{2\text{mm}}{1 \text{ leadscrew rev.}}\right)\left(\frac{1 \text{ wedge unit up}}{20 \text{ units across}}\right) = 0.05 \text{ micron/microstep}$$

Stepper vs. Servo Motors

Stepping and servo motors each have specific strengths and weaknesses, which must be weighed relative to your application requirements. The stepper motor requires no tuning, and can be used open-loop (with no encoder). This makes them easier and less expensive to use than servo motors. A servo motor should be considered for applications requiring high speed, high accuracy, and/or particularly smooth, quiet motion. Please refer to the Drives and Controls section for more details.

Rotary vs. Linear Encoders

While feedback is optional in stepping motor-based systems, it is required in systems with servo motors, and optical encoders are typically the preferred choice. Rotary encoders are effective, low cost feedback devices that can confirm motor shaft position (or provide feedback to a servo motor). They depend on the system accuracy, whereas linear encoders can increase the system accuracy. Linear encoders report a stage's position, independent of system inaccuracies (leadscrew errors, thermal expansion, and nut backlash, for example, are measured by a linear encoder). For applications with extremely demanding accuracy requirements, laser interferometers should be considered. Please see our Encoders and Displays section for details on rotary and linear encoders and our Motion Control Handbook for details on laser interferometers.

Features

- Ball, crossed roller, recirculating, or air bearing ways
- Leadscrew, ballscrew, or linear motor
- Travels from 2” to 36”
- Stage heights as low as 2”

Product Family Overview

Danaher Precision Systems' standard product line consists of a number of series of single-axis tables, which together satisfy a wide range of application requirements. Selection among our single-axis product series is typically driven by the required travel, as well as by space constraints, which may dictate the selection of a shuttle design over a full sized (non-recirculating) stage. The choice between ball and crossed roller ways is a function of the application requirements for load capacity, stiffness, and straightline accuracy. Speed and duty cycle considerations differentiate between models employing friction nuts, ballscrews, and linear motors. Additional choices relate to the motor type (stepper vs. servo), as well as the addition of rotary or linear encoders. Specific application requirements may best be addressed with more advanced configurations, such as those highlighted in our Advanced Technologies section. Our Applications Engineers have extensive experience with positioning systems, and are available to guide you through the selection process.

Note that all positioners should be mounted horizontally to a surface precision-machined to 10µm flatness to ensure listed







Lead Screw Stages	High Precision Screw Stages	Ball Screw Stages
KV™ Ultra-Compact Positioner	XM™ Smooth Motion Table	LMB™ Crossed Roller Ballscrew Table
RM™ Compact Ball Way Table		FM™ Fast Motion Table
RMS™ Compact Single-Axis Shuttle		RBS™ Servo Motor Positioner
TM™ Ball Way Table		
TMS™ Single-Axis Shuttle		
LM™ Crossed Roller Way Table		
HM™ Large Crossed Roller Way Table		

- **Mounting hole patterns allow stacking for X-Y configurations**
- **Complete with motor, knob and coupling (where applicable), built-in Hall-effect limit switches, and locking motor and limit/encoder connectors with strain-relieved cables**

specifications and optimal performance. All specifications reflect unloaded conditions. Maximum leadscrew and ballscrew speeds also assume that the table is mounted horizontally, although some leads may be operated at higher speeds. The maximum speed of linear motor driven positioners is limited only by the amplifier voltage, available acceleration distance, and encoder performance. The rated stage tolerances are "not to exceed" values. In many cases, the actual values are held to levels well below our published values. Single-axis table model numbers denote the units travel, in inches. For example, an RM-200 provides two inches of travel. Standard configurations and options are noted on individual product pages.

Please contact our Applications Engineers with high load or high speed applications, when a positioner is to be mounted vertically, for OEM or multi-axis configuration requirements, and with any questions you may have. They will be happy to go over your application in detail to ensure that you receive the optimal configuration and performance.





Linear Motor Stages	Z-Elevator Stages
Force™ Low Profile Shuttle	ZE-0.5™ Stage
MAG™ Moving Magnet Linear Motor Stage	ZE-1.0™ Stage
NanoSlide-20™ Linear Motor Stage	Z-Theta™ Z-Elevator with Small Angle Theta
SAS™ Recirculating Way Table	BAZ™ Ultra-Stiff Z-Elevator Unit
NanoBeam™ Linear Motor Positioner	
NanoBeam II Linear Motor Positioner	
AirBeam™ Single-Axis Shuttle	
MicroBeam™ Low Profile Shuttle	
FiberBeam™ Linear Motor Stage	

KV™ Ultra-Compact Positioner

Features

- Compact, high accuracy, high performance
- Standard NEMA 17-frame stepper motor
- Three finishes to choose from:
  - Black anodize
  - Gold irridite
  - Chrome plated



Linear Positioner

The KV shuttle stages from Danaher Precision offer compact size, high accuracy, and high performance. This series is designed using high accuracy recirculating ball ways, integrated end of travel limits, standard NEMA 17-frame stepper motor with coupling and mount, and anti-backlash leadscrews. Travels range from 10mm to 200mm. Flatness of travel is less than 1 micron over every 25mm travel. Linearity of the screw is less than +/-2 microns over full travel. The stage is available in three finishes: black anodize, gold irridite, and chrome plated.

KV Linear Positioner Specifications

Specification	KV-50 Stage	KV-80 Stage	KV-110 Stage	KV-140 Stage	KV-200 Stage
Travel (mm)	50	80	110	140	200
Leadscrew Accuracy (micron, for all)			0.0001mm/mm		
Bidirectional Repeatability (micron, for all)					
open loop			3 microns		
Flatness & Straightness (micron)	4	7	10	13	18
Pitch & Yaw (arc-seconds, for all)			10 arc-seconds per 25mm travel		
Load Capacity (kg)*	15	15	15	15	15
Mass (grams)					
moving	175	175	175	175	175
total	850	950	1,050	1,150	1,300
Configuration					
Leadscrew					
lead (mm)			1mm or 2mm pitch		
Motor					
Stepper (oz-in) 400 step/rev.			44 oz/in		
Stepper (oz-in) 200 step/rev.			44 oz/in		
Options					
Encoder					
rotary (counts/rev.)			2,000 or 4,000 CPR		

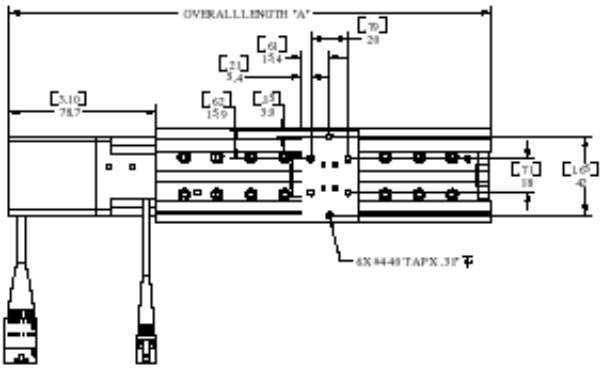
Note: Brake available for vertical applications.

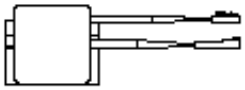
* Please contact our Applications Engineers for loads exceeding 15kg.

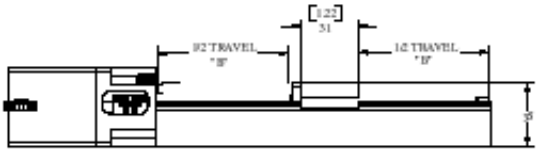
KV™ Ultra-Compact Positioner

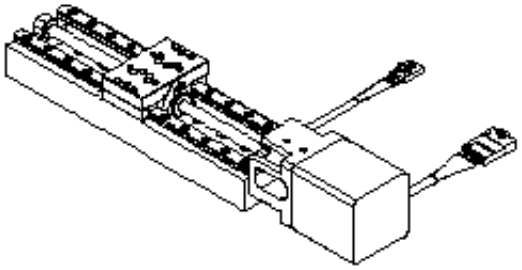
KV LINEAR POSITIONER SPECIFICATIONS

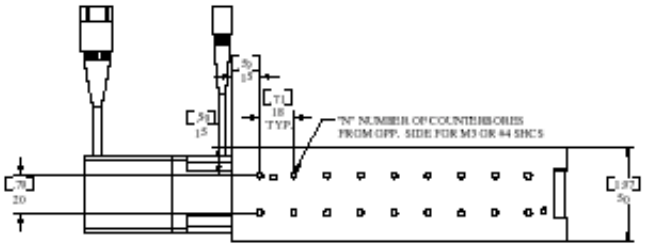
OVERALL LENGTH "A"	TRAVEL "B"	NUMBER OF HOLES "N"
[5.46"] 139mm	[2.9"] 20mm	4
[6.84"] 189mm	[1.97"] 50mm	8
[7.82"] 199mm	[3.15"] 80mm	10
[9.00"] 229mm	[4.33"] 110mm	14
[10.19"] 259mm	[5.51"] 140mm	16
[12.55"] 319mm	[7.87"] 200mm	24











RM™ Compact Ball Way Table

Features

- Compact 2-5/8" wide x 2" high design
- Cost-effective ball ways
- Wide range of travels — from 2" to 10"
- High repeatability friction nut



Small, Ball Way Tables

The RM Series of single-axis positioning tables provides a compact, low cost alternative to conventional full-sized units. Overall dimensions are 2" high x 2 5/8" wide, with a table length equal to 1" more than the table travel, making them ideal for disk drive certifiers, analyzers, spinstands and other applications with demanding space constraints. Hall-effect limit sensors are built-in to each table. Miniature, latching, in-line connectors provide a convenient detachable coupling between the table and its control electronics. A motor, knob, and coupling are also included.

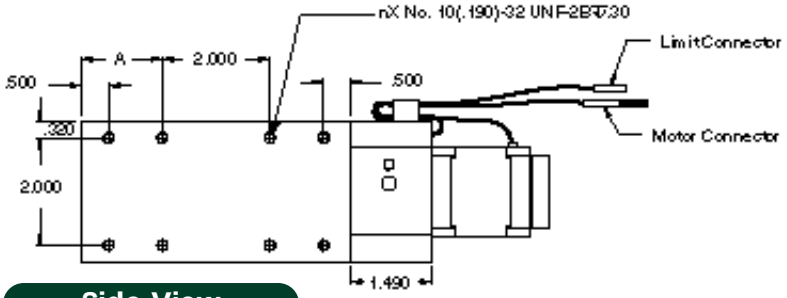
SPECIFICATIONS		RM-200	RM-400	RM-600	RM-800	RM-1000
Travel (inches)		2	4	6	8	10
Leadscrew Accuracy (µm)	Precision Commercial	15 45	20 65	20 75	20 80	25 100
Bidirectional Repeatability (µm)	Precision Commercial	3 6				
Flatness & Straightness (µm)	Precision	5	10	15	20	25
Pitch & Yaw (arc-seconds)		50	50	50	60	70
Load Capacity (kg)[1]		10	20	30	40	50
Maximum Leadscrew Speed (rps)		15				
Mass (kg)	Moving Total	0.2 1.2	0.4 1.5	0.5 1.9	0.6 2.3	0.8 2.6

CONFIGURATIONS (Apply to all of the above models)[2]							
Leadscrew	Lead (inch)	Precision Commercial	0.40 0.50	0.20 0.40	0.10 0.20	0.02 **0.10**	0.02
	Lead (mm)	Precision Commercial	2 3	2	1.4		
Motor	Stepper (oz-in)	400 step/rev. 200 step/rev.	23 **44**	others available others available			
	Servo[3]		brush	brushless			
OPTIONS							
Encoder	Rotary (counts/rev.)[3]		2000	4000			

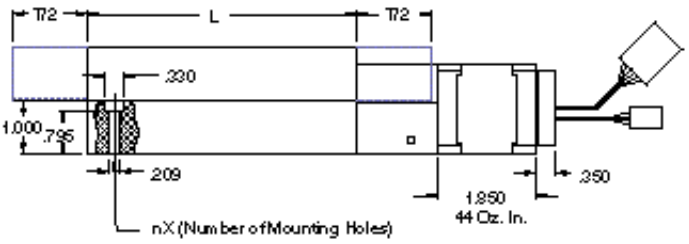
[1]Please contact our Applications Engineers for loads exceeding 10kg.
[2]Standard configuration is highlighted.
[3]A special motor mount is needed to accommodate a rotary encoder. Please contact our Applications Engineers for dimensional details.

RM™ Compact Ball Way Table

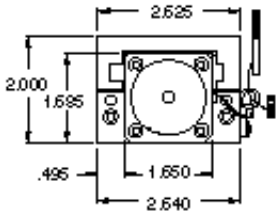
Top View



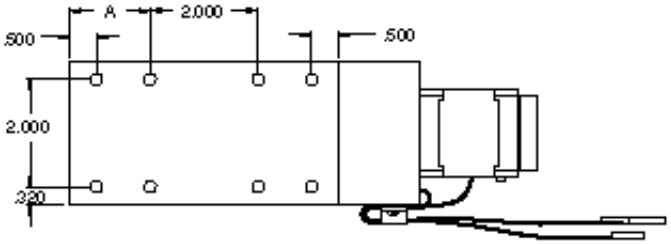
Side View



End View



Bottom View



Third Angle Projection
Note: All Dimensions in Inches

MODEL	TRAVEL T	LENGTH L	A
RM-200-SM	2.00	3.00	—
RM-400-SM	4.00	5.00	1.500
RM-600-SM	6.00	7.00	2.500
RM-800-SM	8.00	9.00	3.500
RM-1000-SM	10.00	11.00	4.500

Note: All dimensions are in inches.

RMS™ Compact Single-Axis Shuttle

Features

- 3" x 3.25" moving shuttle in a small footprint
- Only 2 inches tall
- Wide range of travels — from 2" to 8"
- High repeatability friction nut



Small, Ball Way Shuttles

The RMS Series of positioning tables is a "shuttle" configuration of our RM tables. Recirculating ball modules are incorporated in the table top, resulting in a compact, 3.00" long x 3.25" wide shuttle. The remaining dimensions match those of our full-top RM Series, including base and shuttle mounting holes. This allows units of either series to be bolted together to form X-Y positioning assemblies. Hall-effect limit sensors are built-in to each table, and in-line connectors allow modular cabling to both the motor and limit switches. A motor, knob, and coupling are also included on all standard units.

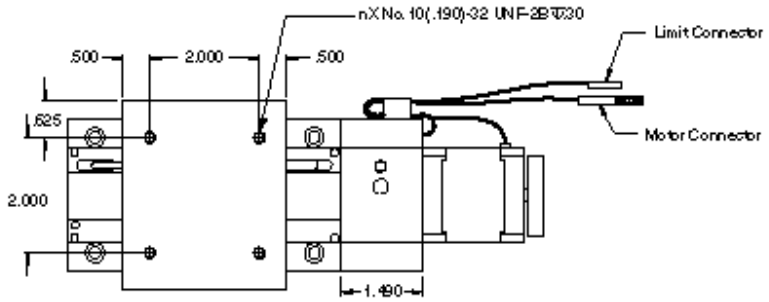
SPECIFICATIONS		RMS-200	RMS-400	RMS-600	RMS-800
Travel (inches)		2	4	6	8
Leadscrew Accuracy (µm)	Precision Commercial	15 45	20 65	20 75	20 80
Bidirectional Repeatability (µm)	Precision Commercial	3 6			
Flatness & Straightness (µm)	Precision	5	10	15	20
Pitch & Yaw (arc-seconds)		30	40	50	60
Load Capacity (kg)[1]		25			
Maximum Leadscrew Speed (rps)		15			
Mass (kg)	Moving	0.4			
	Total	2.3	2.5	2.7	2.9

CONFIGURATIONS (Apply to all of the above models)[2]							
Leadscrew	Lead (inch)	Precision Commercial	0.40 0.50	0.20 0.40	0.10 0.20	0.02 **0.10**	0.02
	Lead (mm)	Precision Commercial	2 3	2	1.4		
Motor	Stepper (oz-in)	400 step/rev. 200 step/rev.	23 **44**	others available others available			
	Servo[3]		brush	brushless			
OPTIONS							
Encoder	Rotary (counts/rev.)[3]		2000	4000			

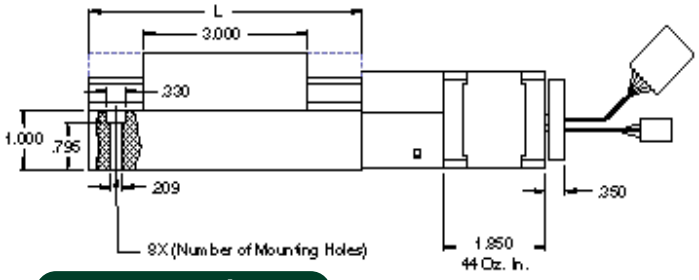
[1]Please contact our Applications Engineers for loads exceeding 5kg.
[2]Standard configuration is highlighted.
[3]A special motor mount is needed to accommodate a rotary encoder. Please contact our Applications Engineers for dimensional details.

RMS™ Compact Single-Axis Shuttle

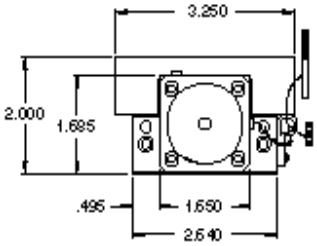
Top View



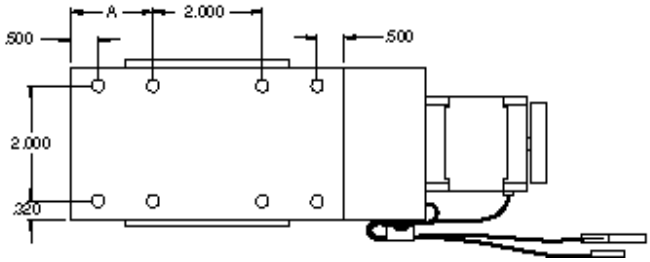
Side View



End View



Bottom View



Third Angle Projection
Note: All Dimensions in Inches

MODEL	TRAVEL T	LENGTH L	A
RMS-200-SM	2.00	5.00	1.500
RMS-400-SM	4.00	7.00	2.500
RMS-600-SM	6.00	9.00	3.500
RMS-800-SM	8.00	11.00	4.500

Note: All dimensions are in inches.

TM™ Ball Way Table

Features

- Cost-effective ball ways
- Travels from 2" to 10"
- Center-driven leadscrew design is only 2.5" high
- Anti-backlash friction nut



Ball Way Tables

The TM Series is one of our most widely used lines of single-axis positioning tables. Its center-driven leadscrew design provides highly repeatable motion in a compact unit. It incorporates cost-effective ball ways, and is built using a monolithic, two piece design which precisely locates the critical duplex and radial bearing journals within the massive base section. They come complete and ready to operate, including a motor with knob, Hall-effect limit switches, and locking connectors.

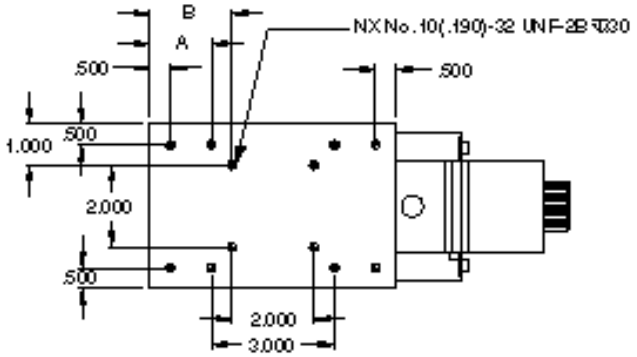
SPECIFICATIONS		TM-200	TM-400	TM-600	TM-800	TM-1000
Travel (inches)		2	4	6	8	10
Leadscrew Accuracy (µm)	Precision Commercial	15 45	20 65	20 75	20 80	25 100
Bidirectional Repeatability (µm)	Precision Commercial	3 6				
Flatness & Straightness (µm)	Precision	5	10	15	20	25
Pitch & Yaw (arc-seconds)		30	40	50	60	70
Load Capacity (kg)[1]		35	45	55	70	80
Maximum Leadscrew Speed (rps)		15				
Mass (kg)	Moving Total	0.5 2.5	0.7 3.2	0.9 3.9	1.1 4.6	1.4 5.2

CONFIGURATIONS (Apply to all of the above models)[2]							
Leadscrew	Lead (inch)	Precision Commercial	0.40 0.50	0.20 0.40	0.10 0.20	0.02 **0.10**	0.02
	Lead (mm)	Precision Commercial	2 3	2	1.4		
Motor	Stepper (oz-in)	400 step/rev. 200 step/rev.	118 **53**	100	others available others available		
	Servo		brush	brushless			
OPTIONS							
Encoder	Rotary (counts/rev.)		2000	4000			
	Linear (µm/count)[3]		5	1	0.5	0.1	

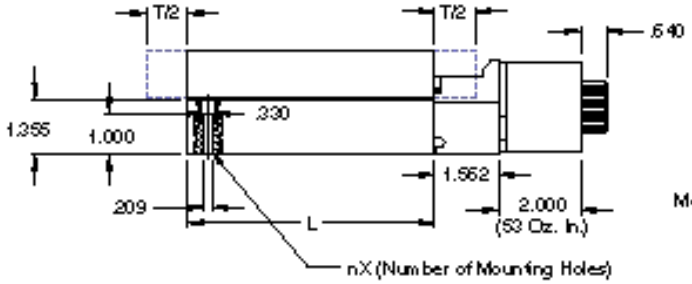
[1]Please contact our Applications Engineers for loads exceeding 15kg.
[2]Standard configuration is highlighted.
[3]No servo with linear encoder.

TM™ Ball Way Table

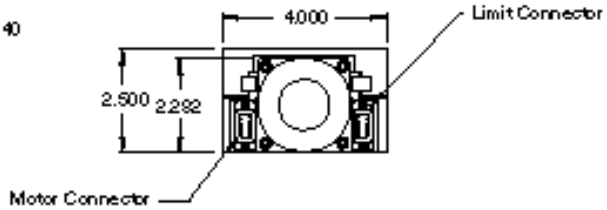
Top View



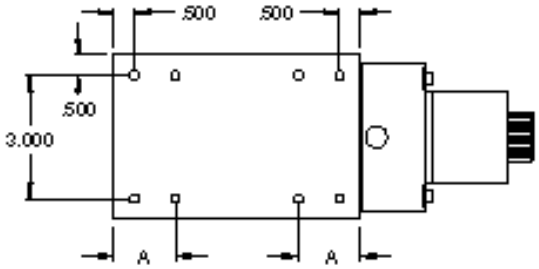
Side View

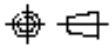


End View



Bottom View





Third Angle Projection
Note: All Dimensions in Inches

MODEL	TRAVEL T	LENGTH L	n	N	A	B
TM-200-SM	2.00	4.00	4	8	—	1.000
TM-400-SM	4.00	6.00	8	12	1.500	2.000
TM-600-SM	6.00	8.00	8	12	2.500	3.000
TM-800-SM	8.00	10.00	8	12	3.500	4.000
TM-1000-SM	10.00	12.00	8	12	4.500	5.000

Note: All dimensions are in inches.

TMS™ Single-Axis Shuttle

Features

- Space-saving design with 4" x 4.25" moving shuttle
- Wide range of travels — from 3" to 11"
- Low profile – only 2.5 inches high
- Anti-backlash friction nut



Ball Way Shuttles

The TMS Series is a "shuttle" version of our TM series of single-axis positioning tables. TMS models replace the conventional, full sized top of the TM series with a recirculating shuttle assembly. This results in a much more compact overall moving envelope for the table for use in limited space applications. These units come complete and ready to operate with a motor, flexible coupling, knob, Hall-effect limit switches, and locking connectors.

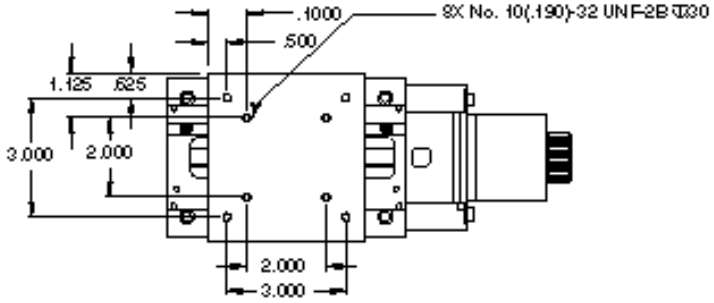
SPECIFICATIONS		TMS-300	TMS-500	TMS-700	TMS-900	TMS-1100
Travel (inches)		3	5	7	9	11
Leadscrew Accuracy (µm)	Precision Commercial	20 55	20 65	20 70	25 90	30 110
Bidirectional Repeatability (µm)	Precision Commercial	3 6				
Flatness & Straightness (µm)	Precision	5	10	15	20	25
Pitch & Yaw (arc-seconds)		35	45	55	65	75
Load Capacity (kg)[1]		25				
Maximum Leadscrew Speed (rps)		15				
Mass (kg)	Moving	0.7				
	Total	2.5	3.0	3.5	4.4	4.8

CONFIGURATIONS (Apply to all of the above models)[2]							
Leadscrew	Lead (inch)	Precision Commercial	0.40 0.50	0.20 0.40	0.10 0.20	0.02 **0.10**	0.02
	Lead (mm)	Precision Commercial	2 3	2	1.4		
Motor	Stepper (oz-in)	400 step/rev. 200 step/rev.	118 **53**	100	others available others available		
	Servo		brush	brushless			
OPTIONS							
Encoder	Rotary (counts/rev.)		2000	4000			

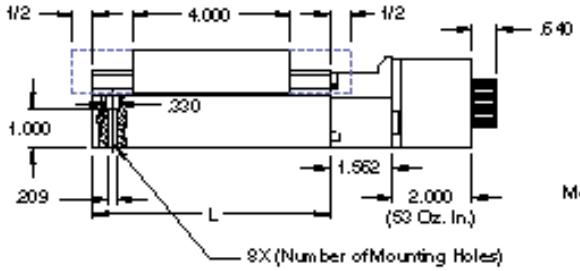
[1]Please contact our Applications Engineers for loads exceeding 5kg.
[2]Standard configuration is highlighted.

TMS™ Single-Axis Shuttle

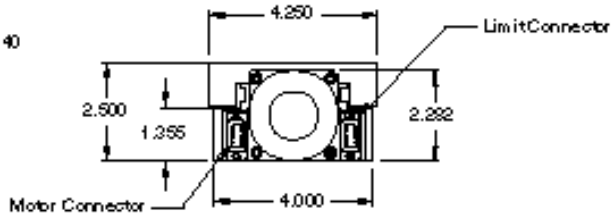
Top View



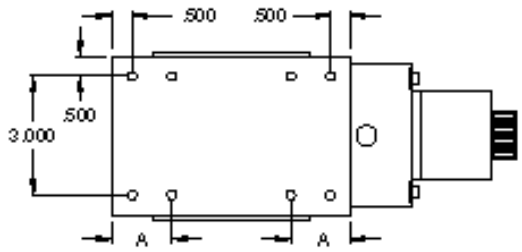
Side View



End View



Bottom View



Third Angle Projection
Note: All Dimensions in Inches

MODEL	TRAVEL T	LENGTH L	A
TMS-300-SM	3.00	6.00	1.500
TMS-500-SM	5.00	8.00	2.500
TMS-700-SM	7.00	10.00	3.500
TMS-900-SM	9.00	12.00	4.500
TMS-1100-SM	11.00	14.00	5.500

Note: All dimensions are in inches.

LM™ Crossed Roller Way Table

Features

- Precision crossed roller ways for high stiffness
- Center-driven lead-screw design is only 2.5" high
- 2" to 10" travel versions
- Anti-backlash friction nut



Crossed Roller Way Tables

The LM Series is a very popular single-axis positioning table. It incorporates precision crossed roller ways into the same envelope as its TM series counterpart providing high load capacities and increased stiffness. The LM Series has the bearing journals machined into the base section, as most of NEAT's stages do, to ensure precise location. Standard units include a motor, knob, limit switches, and locking connectors.

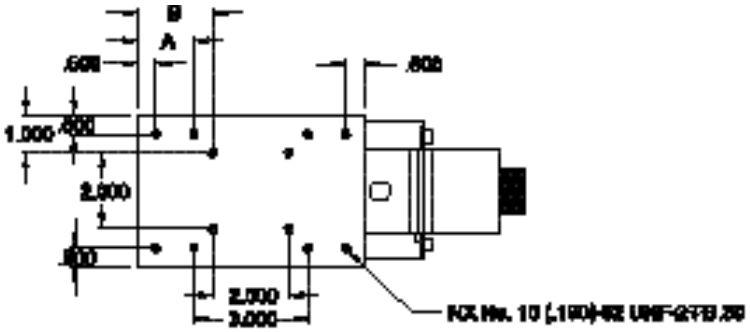
SPECIFICATIONS		LM-200	LM-400	LM-600	LM-800	LM-1000
Travel (inches)		2	4	6	8	10
Leadscrew Accuracy (µm)	Precision Commercial	15 45	20 65	20 75	20 80	25 100
Bidirectional Repeatability (µm)	Precision Commercial	3 6				
Flatness & Straightness (µm)	Precision	5	6	8	10	12
Pitch & Yaw (arc-seconds)		15	20	25	30	35
Load Capacity (kg)[1]		75	95	125	145	175
Maximum Leadscrew Speed (rps)		15				
Mass (kg)	Moving Total	0.5 2.5	0.7 3.2	0.9 3.9	1.1 4.6	1.4 5.2

CONFIGURATIONS (Apply to all of the above models)[2]							
Leadscrew	Lead (inch)	Precision Commercial	0.40 0.50	0.20 0.40	0.10 0.20	0.02 **0.10**	0.02
	Lead (mm)	Precision Commercial	2 3	2	1.4		
Motor	Stepper (oz-in)	400 step/rev. 200 step/rev.	118 **53**	100	others available others available		
	Servo		brush	brushless			
OPTIONS							
Encoder	Rotary (counts/rev.)		2000	4000			
	Linear (µm/count)[3]		5	1	0.5	0.1	

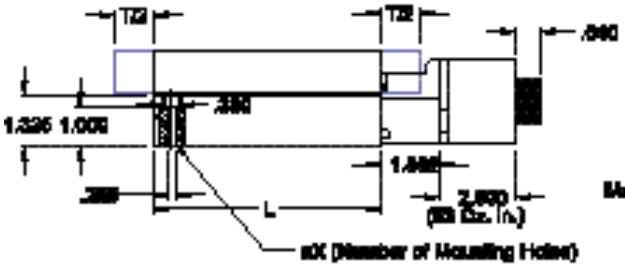
[1]Please contact our Applications Engineers for loads exceeding 35kg.
[2]Standard configuration is highlighted.
[3]No servo with linear encoder.

LM™ Crossed Roller Way Table

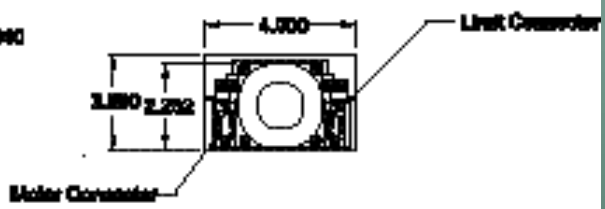
Top View



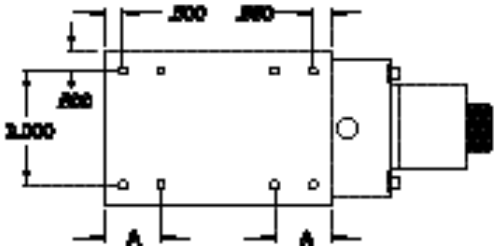
Side View

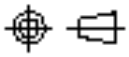


End View



Bottom View





Third Angle Projection
Note: All Dimensions in Inches

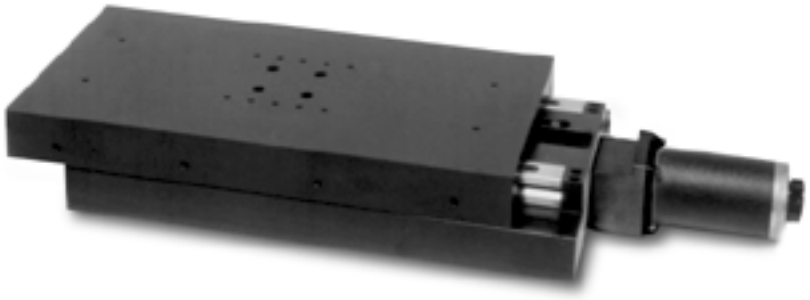
MODEL	TRAVEL T	LENGTH L	n	N	A	B
LM-200-SM	2.00	4.00	4	8	—	1.000
LM-400-SM	4.00	6.00	8	12	1.500	2.000
LM-600-SM	6.00	8.00	8	12	2.500	3.000
LM-800-SM	8.00	10.00	8	12	3.500	4.000
LM-1000-SM	10.00	12.00	8	12	4.500	5.000

Note: All dimensions are in inches.

HM Series

Features

- Precision crossed roller ways for high stiffness
- 12", 18", or 24" travel in 3" high design
- Anti-backlash friction nut



Large, Crossed Roller Way Tables

The HM Series of single-axis positioning tables offers the highest linear and torsional load capacity of our standard positioning tables. Its large 22mm crossed roller ways and 9mm rollers, together with a monolithic two piece design, provide excellent stability and accuracy. The upper mounting hole pattern of the HM Series is designed to allow any other single-axis positioning table to be mounted directly to it in an X-Y configuration. A motor, knob, coupling, Hall-effect limits, and locking connectors are also included.

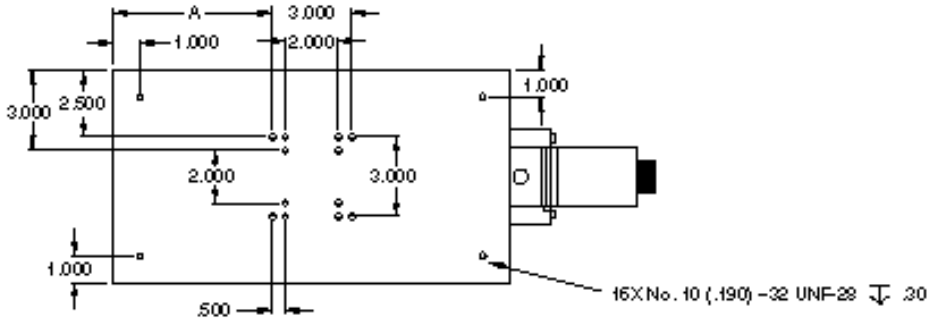
SPECIFICATIONS		HM-1200	HM-1800	HM-2400
Travel (inches)		12	18	24
Leadscrew Accuracy (µm)		120	180	240
Bidirectional Repeatability (µm)		6		
Flatness & Straightness (µm)		120	180	240
Load Capacity (kg)[1]		215	295	390
Maximum Leadscrew Speed (rps)		15		
Mass (kg)	Moving	6.4	9.3	12.2
	Total	18.1	26.3	34.9

CONFIGURATIONS (Apply to all of the above models)[2]						
Leadscrew	Lead (inch)		0.50	0.40	0.20	**0.10**
	Lead (mm)		2			
Motor	Stepper (oz-in)	400 step/rev.	118	others available		
		200 step/rev.	**100**	others available		
	Servo		brush	brushless		
OPTION						
Encoder	Rotary (counts/rev.)		2000	4000		
	Linear (µm/count)		5	1	0.5	0.1

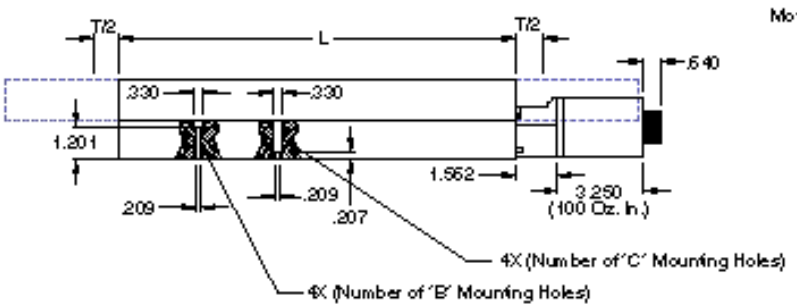
[1]Please contact our Applications Engineers for loads exceeding 70kg.
[2]Standard configuration is highlighted.

HM Series

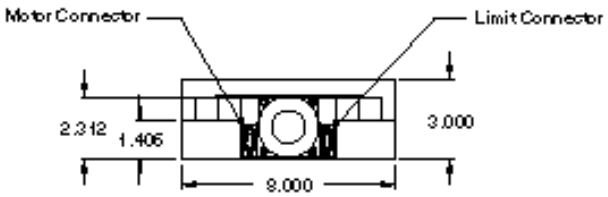
Top View



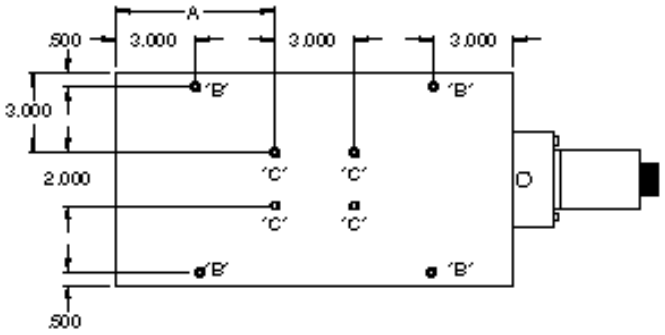
Side View

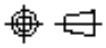


End View



Bottom View





Third Angle Projection
Note: All Dimensions in Inches

MODEL	TRAVEL T	LENGTH L	A
HM-1200-SM	12.00	15.00	6.000
HM-1800-SM	18.00	21.00	9.000
HM-2400-SM	24.00	27.00	12.000

Note: All dimensions are in inches.

XM™ Smooth Motion Table

Features

- High accuracy with center-driven leadscrew design
- Exceptionally low angular errors
- Standard travels from 4" to 12" in 3" height
- Pinch point protection



Smooth Motion Tables

The XM Series of positioning tables incorporates a high accuracy Universal Threadgrinding leadscrew to minimize linear errors resulting from screw irregularities, making them ideal for scanning applications and other systems that require a high degree of absolute accuracy and smoothness. Low angular errors result from precision interface surfaces and 6mm crossed roller ways. Convenient leadscrew access makes servicing easy and pinch point protection eliminates any safety concerns. For applications requiring exceptional scanning smoothness, XM stages can be provided with tachometer feedback resulting in velocity ripple well below 0.5% at 10mm/second. The XM Series is dimensionally equivalent to the FM Series and two tables can be combined to form a high precision X-Y stage. They include built-in Hall-effect limit switches (to prevent overtravel and provide a highly repeatable home position); a motor with a flexible coupling and a knob for fine manual control; and locking motor and limit/encoder connectors with strain-relieved cables.

SPECIFICATIONS		XM-400	XM-600	XM-800	XM-1200
Travel (inches)		4	6	8	12
Positional Accuracy (µm) Leadscrew Accuracy (µm)	with linear encoder[1] open loop	5 8	6 12	8 16	10 24
Bidirectional Repeatability	with linear encoder open loop	±1 count 3 µm			
Flatness & Straightness (µm)		2	5	7	9
Pitch & Yaw (arc-seconds)		10	15	20	25
Load Capacity (kg)[2]		70	80	90	115
Maximum Leadscrew Speed (rps)		15			
Mass (kg)	Moving Total	2.7 6.4	3.2 8.2	3.6 10.0	4.8 13.6

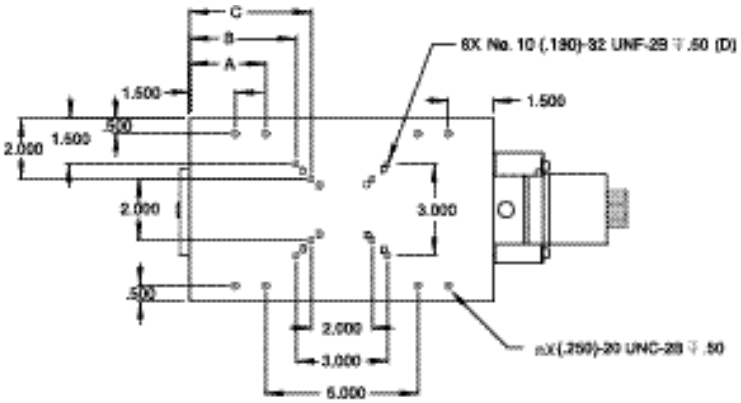
CONFIGURATIONS (Apply to all of the above models)[3]			
Leadscrew	Lead (inch)	0.20 0.10 0.025	
	Lead (mm)	**2**	
Motor	Stepper (oz-in) 400 step/rev.	118	others available
	200 step/rev.	**100**	others available
	Servo	brush brushless	
OPTIONS			
Encoder	Rotary (counts/rev.)	2000 4000	
	Linear (µm/count)	5 1 0.5 0.1	

Brake: Nema 23 in-line

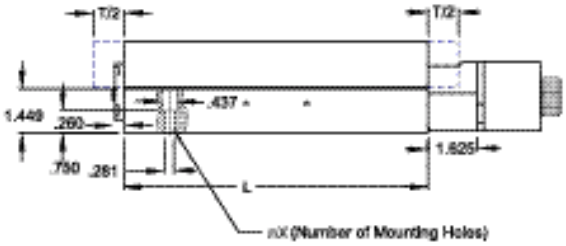
[1]With 2 point slope correction
[2]Please contact our Applications Engineers for loads exceeding 70kg.
[3]Standard configuration is highlighted.

XM™ Smooth Motion Table

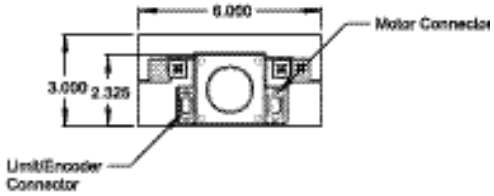
Top View



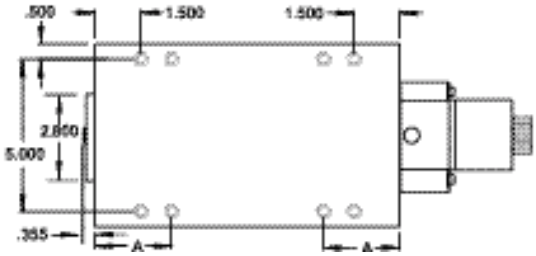
Side View



End View



Bottom View



Third Angle Projection
Note: All Dimensions in Inches

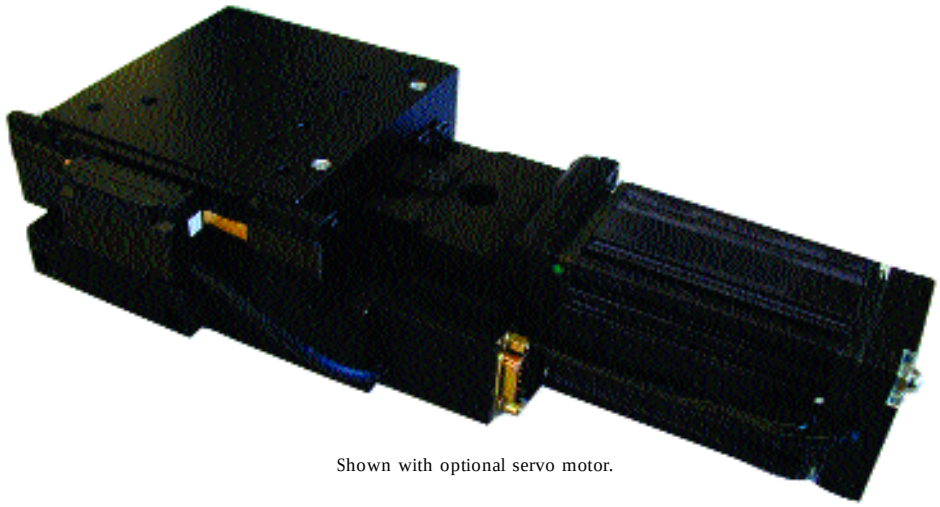
MODEL	TRAVEL T	LENGTH L	A	B	C	n
XM-400	4.00	8.00	—	2.500	3.000	4
XM-600	6.00	10.00	2.500	3.500	4.000	8
XM-800	8.00	12.00	3.500	4.500	5.000	8
XM-1200	12.00	16.00	5.500	6.500	7.000	8

Note: All dimensions are in inches.

LMB™ Stage

Features

- Precision crossed roller ways for high stiffness
- Center-driven ballscrew design is only 2.5" high
- 2" to 10" travel versions
- Precision ballscrew
- Ideal for vertical applications



Shown with optional servo motor.

Ballscrew Driven Stage

The DPS LMB stage takes our standard LM™ stage and upgrades it in several ways. First and most importantly the enhancement adds a precision ground preloaded ballscrew inside the same cross section. The added ballscrew increases axial stiffness and the preloaded nature allows linear encoders to be used in servo applications. Duty cycle, life, and speed are also greatly improved with this upgrade. Leads are available in 2 and 5mm standard sizes.

A larger thrust bearing is also used to increase axial load carrying capabilities These enhancements make this stage ideal to be used in vertical applications. Optional inline brakes are available to prevent the stage from back driving. The LMB ballscrew driven stage has also added pinch cover design, eliminating any safety concerns. Travels are available from 2 to 10 inches.

LMB Stage Specifications

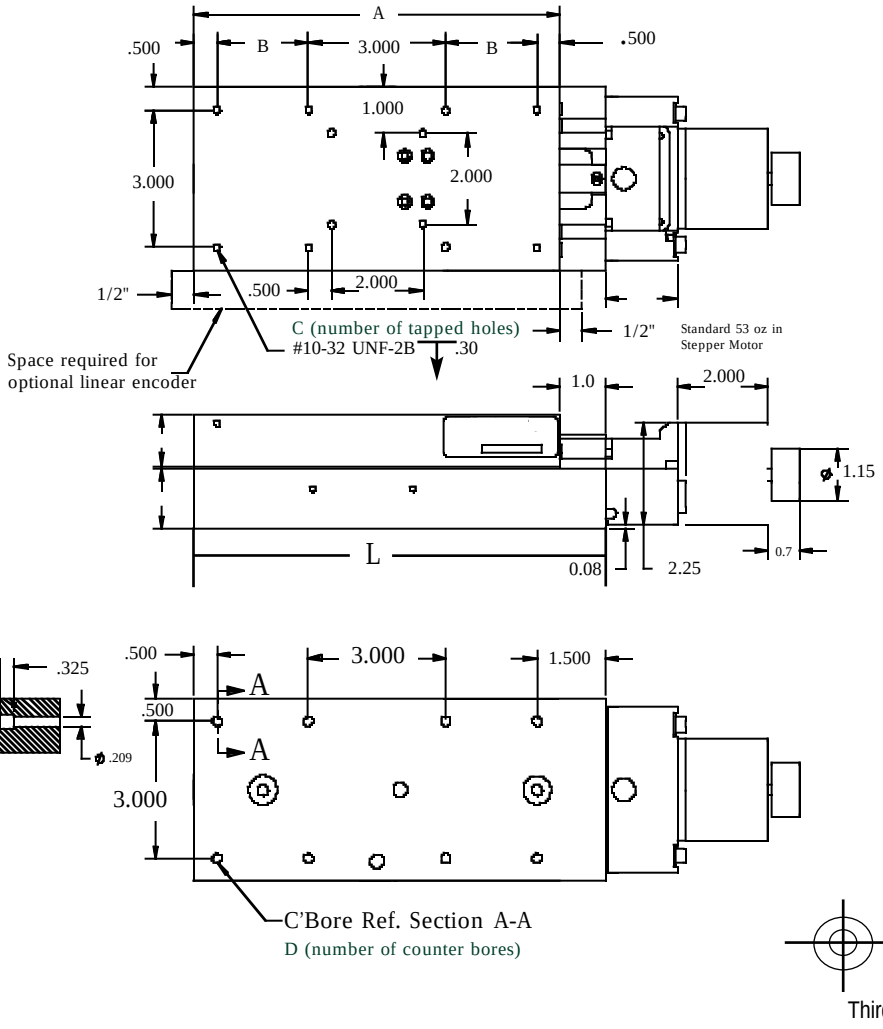
Specification	LMB-200	LMB-400	LMB-600	LMB-800	LMB-1000
Travel (inches)	2	4	6	8	10
Positional Accuracy					
(microns) w/linear encoders	8	10	15	20	25
Positional Accuracy					
(microns) open loop	13	15	20	25	30
Bidirectional Repeatability (micron, for all)					
with linear encoder			±1 count		
open loop			1 micron		
Flatness & Straightness (micron)	5	6	8	10	12
Pitch & Yaw (arc-seconds)	15	20	25	30	35
Load Capacity (kg)*	75	95	125	145	175
Mass (kg)					
moving	0.5	0.7	0.9	1.1	1.4
total	2.5	3.2	3.9	4.6	5.2
Configuration					
Ballscrew					
lead (mm)	2	5			
Motor					
Stepper (oz-in) 400 step/rev.	118		others available		
Stepper (oz-in) 200 step/rev.	53	100	others available		
Servo	brush	brushless			
Options					
Encoder					
rotary (counts/rev.)	2000	4000			
linear (microns/count)	5	1	0.5	0.1	

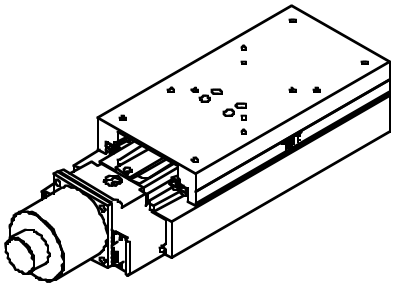
NEMA 23 in-line brake available for vertical applications.

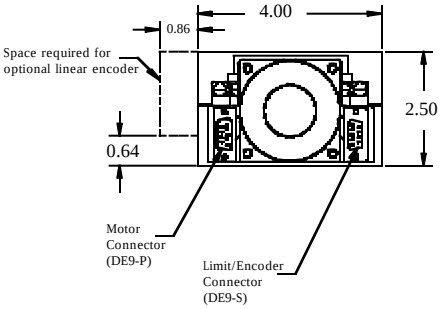
* Please contact our Applications Engineers for loads exceeding 35kg.

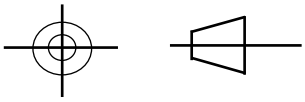
LMB™ Stage

LMB Stage Specifications









Third Angle Projection

Model	Travel	Length (L)	A	B	C	D
LMB-200-SM	2	5	4	—	8	4
LMB-400-SM	4	7	6	1	12	8
LMB-600-SM	6	9	8	2	12	8
LMB-800-SM	8	11	10	3	12	8
LMB-1000-SM	10	13	12	4	12	8

FM™ Fast Motion Table

Features

- High speeds and accelerations with center-driven ballscrew design
- Pinch point protection
- Low profile – only 3 inches high



Ballscrew Tables

Our new FM Series tables are ideal for applications requiring low angular errors and high speeds. This unit utilizes precision ground interface surfaces and crossed roller ways to achieve exceptionally low angular errors and high stiffness. Its center-driven ballscrew design allows speeds to 500mm/second and is only 3 inches high. The inherent symmetry of its center-driven design avoids offset torques that can be created by side-driven stages. Convenient ballscrew access makes servicing easy, and a way cover provides pinch point protection, eliminating any safety concerns. These units include a motor with coupling, a knob for fine manual control, Hall-effect limit sensors, and locking motor and limit/encoder connectors with strain-relieved cables. The FM Series is an ideal choice for automation and inspection systems, disk drive testing, and laser machining applications.

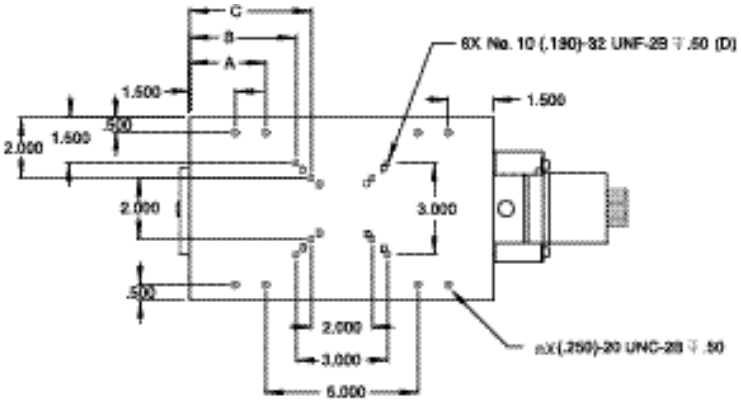
SPECIFICATIONS		FM-400	FM-600	FM-800	FM-1200
Travel (inches)		4	6	8	12
Positional Accuracy (µm) Ballscrew Accuracy (µm)	with linear encoder[1] open loop	5 8	6 12	8 16	10 24
Bidirectional Repeatability	with linear encoder open loop	±1 count 1 µm			
Flatness & Straightness (µm)		4	6	8	10
Pitch & Yaw (arc-seconds)		10	15	20	25
Load Capacity (kg)[2]		70	80	90	115
Maximum Ballscrew Speed (rps)		50			
Mass (kg)	Moving Total	2.7 6.4	3.2 8.2	3.6 10.0	4.8 13.6

CONFIGURATIONS (Apply to all of the above models)[3]			
Ballscrew	Lead (mm)	2	**5**
Motor	Stepper (oz-in) 400 step/rev.	118	others available
	200 step/rev.	**100**	others available
	Servo	brush	brushless
OPTIONS			
Encoder	Rotary (counts/rev.)	2000	4000
	Linear (µm/count)	5	1 0.5 0.1

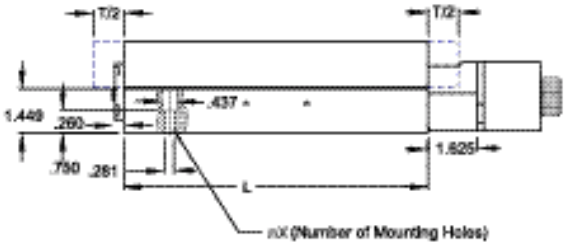
[1]With 2 point slope correction
[2]Please contact our Applications Engineers for loads exceeding 70kg.
[3]Standard configuration is highlighted.

FM™ Fast Motion Table

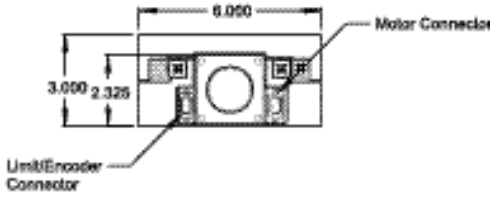
Top View



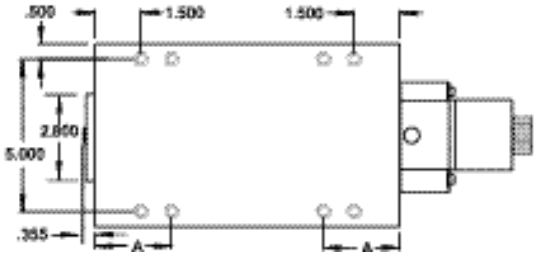
Side View

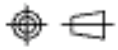


End View



Bottom View





Third Angle Projection
Note: All Dimensions in Inches

MODEL	TRAVEL T	LENGTH L	A	B	C	n
FM-400	4.00	8.00	—	2.500	3.000	4
FM-600	6.00	10.00	2.500	3.500	4.000	8
FM-800	8.00	12.00	3.500	4.500	5.000	8
FM-1200	12.00	16.00	5.500	6.500	7.000	8

Note: All dimensions are in inches.

RBS™ Servo Motor Positioner

Features

- Recirculating ballscrew shuttle configuration
- Speeds to 500mm/s
- Low profile: only 3 inches high!
- Center-drive design avoids offset torques



Ballscrew Driven Stage

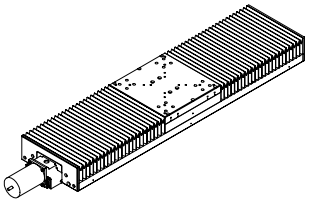
The DPS RBS positioning table is a recirculating ballscrew shuttle configuration. They have been developed to address applications which require a minimal overall moving envelope, while retaining a high load capacity and stiffness. Its center-driven ballscrew design allows speeds to 500 mm/s and is only 3 inches high. The inherent symmetry of its center-drive design avoids offset torques that can be created by side-drive stages. Convenient ballscrew access makes service easy. Standard units include flexible bellows. Optional inline brakes for vertical applications are available to prevent the stage from back driving. Travels range from 8 to 36 inch travels with ballscrew leads of 2, 5, and 10mm.

RBS Servo Motor Positioner Specifications

Specification	RBS-800	RBS-1200	RBS-1800	RBS-2400	RBS-3600
Travel (inches)	8	12	18	24	36
Overall Height (inches, for all)			3		
Ballscrew Accuracy (microns)					
open loop, commercial ballscrew	15	22	33	44	66
open loop, precision ballscrew	9	12	18	24	36
Closed Loop Accuracy	6	9	11	13	21
Bidirectional Repeatability (for all)					
closed loop			±1 count		
open loop			6 microns		
Flatness & Straightness (microns)	3	5	9	13	30
Pitch & Yaw (arc-seconds)	<15	<20	<25	<30	<50
Load Capacity (kg, for all)			75		
Moving Mass (kg, for all)			5		
Total Mass (kg)	18	21	25	30	36
Configuration					
Ballscrew, commercial or precision					
lead (mm, for all)			2, 5, 10		
Motor (for all)			Stepper: 200, 400 steps/rev; Servo: 23 frame		
Options					
Encoder (for all)					
rotary (counts/rev.)			2000, 4000		
linear (microns/count)			5.0, 1.0, 0.5, 0.1		

RBS™ Servo Motor Positioner

RBS Servo Motor Positioner Specifications



RBS Stage Dimensions

Model	Travel	Length	n	A
RBS-800	8.00	22	8	—
RBS-1200	12.00	26	8	—
RBS-1800	18.00	32.5	12	7.625
RBS-2400	24.00	39.5	12	9.125
RBS-3600	36.00	53	12	12.5

Features

- Very low profile: only 50mm high x 126mm wide
- 5G acceleration and 2.5 m/second maximum speed
- High reliability: linear motor drive is completely non-contact
- Complete motion control package available — just plug and play!

Force™ Recirculating Ball Stage



Smallest Profile Linear Motor Stage

The DPS Force linear motor stage is a very compact, high performance, direct drive shuttle stage suitable for use in a wide range of applications. The integral iron core direct drive linear motor features up to 5G acceleration and a peak force generation of 170N. Its high acceleration and force generation make it an ideal candidate for demanding life science, photonics, semiconductor, and disk positioning applications.

The stage's cross section is 150mm x 62.5mm and includes all moving cables which are completely enclosed to minimize particle generation. Versions will bolt directly together to form a very stiff, compact X-Y assembly, without the need of adapter plates. The stage uses recirculating bearings to minimize the overall-moving envelope. The built-in encoder is available with resolutions from 1 micron down to 50nm. Standard travels range from 100mm to 350mm in increments of 50mm.

FORCE LINEAR MOTOR STAGE SPECIFICATIONS

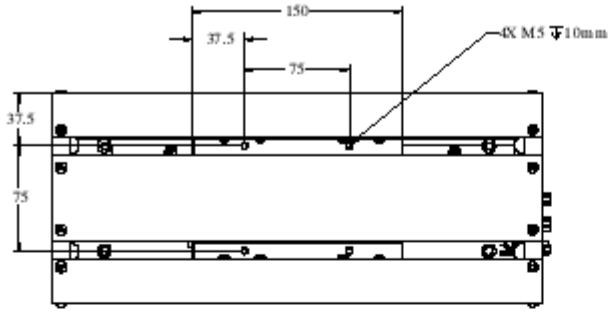
Specification	Force-100 Stage	Force-150 Stage	Force-200 Stage	Force-250 Stage	Force-300 Stage
Travel (mm)	100	150	200	250	300
Encoder Options (microns, for all)	1, 0.5, 0.1, 0.05				
Resolution Options	5	8	10	12	15
Bi-Directional Repeatability	± 1 count	± 1 count	± 1 count	± 1 count	± 1 count
Maximum Acceleration (m/s^2)	50	50	50	50	50
Maximum Velocity (m/s)	5	5	5	5	5
Load Capacity (kg)[1]	75	75	75	75	75
Moving Mass (kg)	1.8	1.8	1.8	1.8	1.8
Total Mass (kg)	5.7	6.4	7.3	8.1	9
Pitch & Yaw (arc-seconds)	15	15	20	20	25
Straightness & Flatness (microns)	5	5	9	9	12

Motor Force Specification	All
Fundamental Motor Constant	10 N-m/$\sqrt{\text{Watt}}$
Motor Force Constant	26.7 N/A
Back-emf Constant	21.8 V/m/s
Coil Resistance @ 25°C	3.2 Ohms
Coil Inductance	9.1 mH
Continuous Current @ 130°C	2.1 Amps
Peak Current	7.9 Amps
Continuous Force @ 130°C	57 N
Peak Force	170 N
Continuous Power Rating	30W
Thermal Resistance	3.5 °C/W
Continuous Power Dissipation	30W

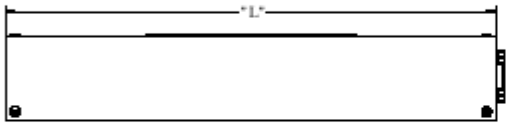
[1] Please contact our Applications Engineers for loads exceeding 75kg.

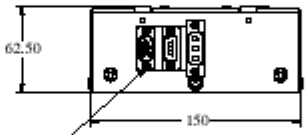
Force™ Recirculating Ball Stage

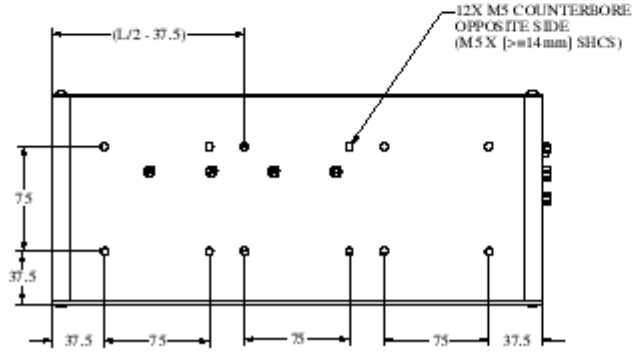
Force Linear Motor Stage Specifications



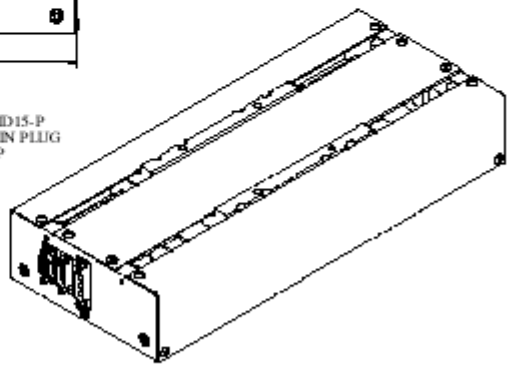
MODEL	TRAVEL "T" (mm)	LENGTH "L" (mm)
FORCE-100	100	300
FORCE-150	150	350
FORCE-200	200	400
FORCE-250	250	450
FORCE-300	300	500
FORCE-350	350	550

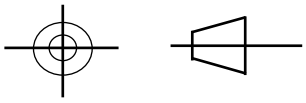






ENCODER/LIMIT CONN: HD15-P
MOTOR CONNECTOR: 3-PIN PLUG
HALL CONNECTOR: DE9-P





Third Angle Projection

Features

- Direct drive linear motor
- Anti-creep cross roller design for smooth motion
- Compact cross section 150mm x 50mm
- No moving cables

MAG™ Moving Magnet Linear Motor Stage



Linear Motor Stage

The MAG Linear motor stage is a very compact, high performance, direct drive table suitable for use in applications that require high accelerations as well as high performance scanning. The product line has been designed in two versions, MAG-IC stage, which is best suited for high acceleration point-to-point type moves, and MAG-IL stage, which is suited for scanning type applications.

Cross sections for both MAG-IC and MAG-IL stages are identical at 50mm tall x 150mm wide. Any two versions will bolt directly together to form a very stiff, compact X-Y assembly, without the need of adapter plates. MAG stages employ a moving magnet design, which locates all cables and connectors in the stationary base. The resulting absence of any moving cable is clean and compact and eliminates motion errors due to cable forces. The precision ground cross roller way provides high stiffness together with smooth motion, and are capable of supporting torques due to offset loads. Cage creep is eliminated through the use of geared cage assemblies.

Two types of linear motors are available, the MAG-IC stage incorporates ironcore motors while the MAG-IL stage uses ironless. Each one provides characteristics that are optimal depending on the applications. Iron core motors, which have their coils wound on steel laminates, maximizes force with a single-sided magnet way. Their high thrust force make them ideal for accelerating and moving higher masses, and maintaining stiffness during process forces. Ironless motors have no iron, therefore, these motors have zero cogging and no attractive forces between the coil and the magnetic way. These characteristics make these types of motors ideal for applications that require constant velocity control.

The built-in non-contact encoder is available with resolutions from 1 micron to 50 nanometers in digital and to 10 nanometers with 1vpp with 2048 interpolation. Both versions plug directly into Kollmorgen CD and Pico products for a complete staging and controller solution, and are available in standard travels of 50 to 300 millmeter in 50 millmeter increments.

Mag Moving Magent Linear Motor Stage Specifications

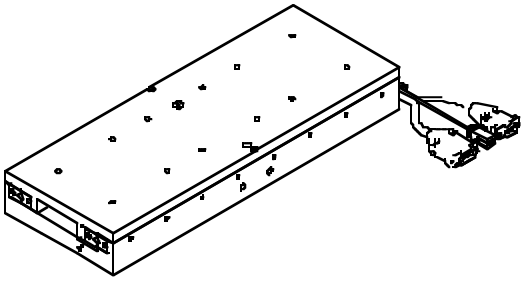
Specification	MAG-50 Stage	MAG-100 Stage	MAG-150 Stage	MAG-200 Stage	MAG-250 Stage
Travel (mm)	50	100	150	200	250
Accuracy (microns)	3	5	8	10	12
Resolution Options (microns)		1, 0.5, 0.1, 0.05			
Bi-Directional Repeatability	± 1 count	±1 count	± 1 count	± 1 count	± 1 count
Maximum Acceleration (m/s^2) IC	50	50	50	40	30
Maximum Acceleration (m/s^2) IL	20	20	18	17	16
Maximum Velocity (m/s)	5	5	5	5	5
Load Capacity (kg)*	75	75	75	75	75
Moving Mass (kg) IC	2.4	2.7	3	4	5
Moving Mass (kg) IL	5.8	6.0	6.1	6.3	6.5
Total Mass (kg) IC	3.8	4.8	5.5	6.5	9
Total Mass (kg) IL	8.5	8.8	9.0	9.3	9.5
Pitch & Yaw (arc-seconds)	5	10	15	20	25
Straightness & Flatness (microns)	3	5	7	9	12

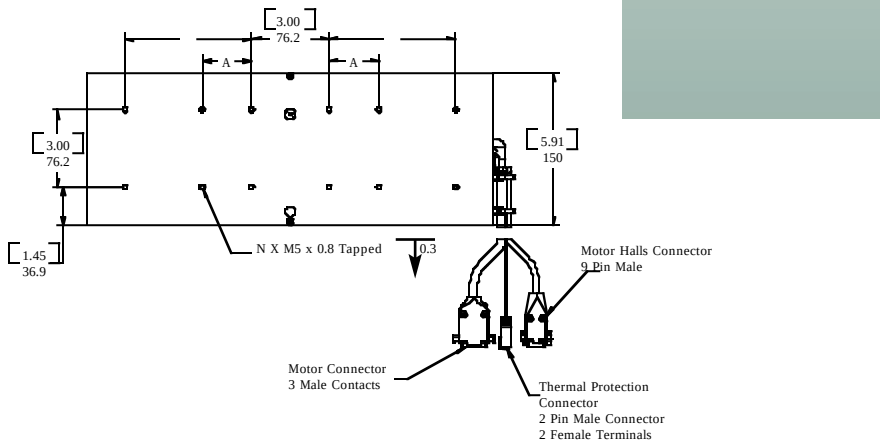
Motor Force Specification	IC Configuration	IL Configuration
Fundamental Motor Constant	10 N / $\sqrt{\text{Watt}}$	4.7 N / $\sqrt{\text{Watt}}$
Motor Force Constant	26.7 N/A	16.8 N/A
Back-emf Constant	21.8 V/m/s	13.7 V/m/s
Coil Resistance @ 25°C	3.2 Ohms	6.1 Ohms
Coil Inductance	9.1 mH	1.3 mH
Continuous Current @ 130°C	2.1 A	2.3 A
Peak Current	7.9 A	7.1 A
Continuous Force @ 130°C	57 N	38 N
Peak Force	170 N	120 N
Continuous Power Rating	30 W	65 W
Thermal Resistance	3.5°C/W	1.61°C/W

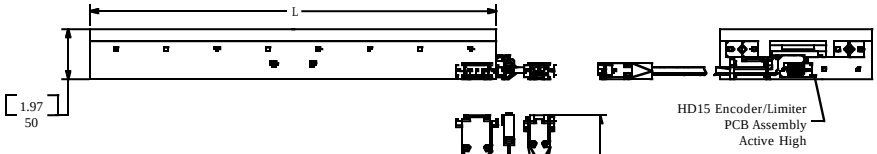
* Please contact our Applications Engineers for loads exceeding 75kg.
Note: Maximum speed and velocity is load and encoder dependent.

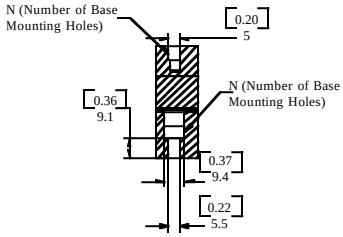
MAG™ Moving Magnet Linear Motor Stage

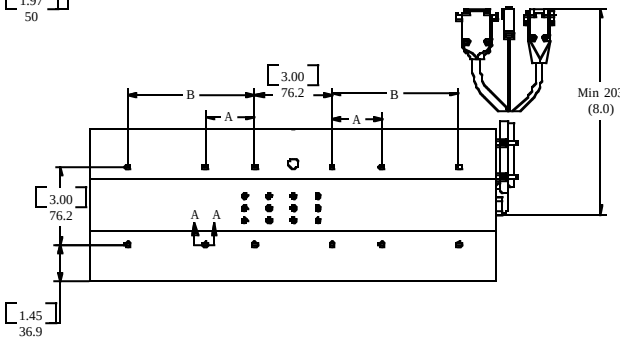
Mag Moving Magent Linear Motor Stage Specifications

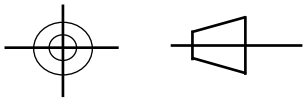












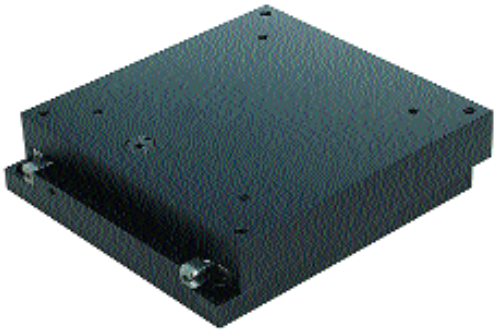
Third Angle Projection

Model	Part #	Travel	Length (L)	Dim. A	Dim. B	N
MAG-50 Stage	**1122348**	59 (1.97)	200 (7.87)	N/A	N/A	4
MAG-100 Stage	**1122349**	100 (3.94)	250 (9.8)	76.2 (3)	NA	8
MAG-150 Stage	**1122358**	150 (5.91)	300 (11.81)	76.2 (3)	N/A	8
MAG-200 Stage	**1122359**	200 (7.87)	350 (13.78)	38.1 (1.5)	114.3 (4.5)	12
MAG-250 Stage	**1122349**	250 (9.84)	400 (15.75)	48.77 (1.92)	125.0 (4.92)	12

NanoSlide-20™ Linear Motor Stage

Features

- Compact, low profile, direct drive stage
- Stationary connectors: no moving cables
- Smooth, stiff crossed roller ways
- High performance, single phase linear motor
- Resolutions from 5 nanometers to 1 micron
- Units stack directly to form X-Y assemblies





Linear Motor Table

Danaher Precision Systems' NanoSlide-20 Linear Motor Table is a very compact, high performance, direct drive stage suitable for use in a wide range of applications, including photonic alignment and automation. The integral, center drive linear motor features an advanced magnetic design that supports up to 3G acceleration and 44N force generation and its single phase coil allows the use of simple brush type amplifiers.

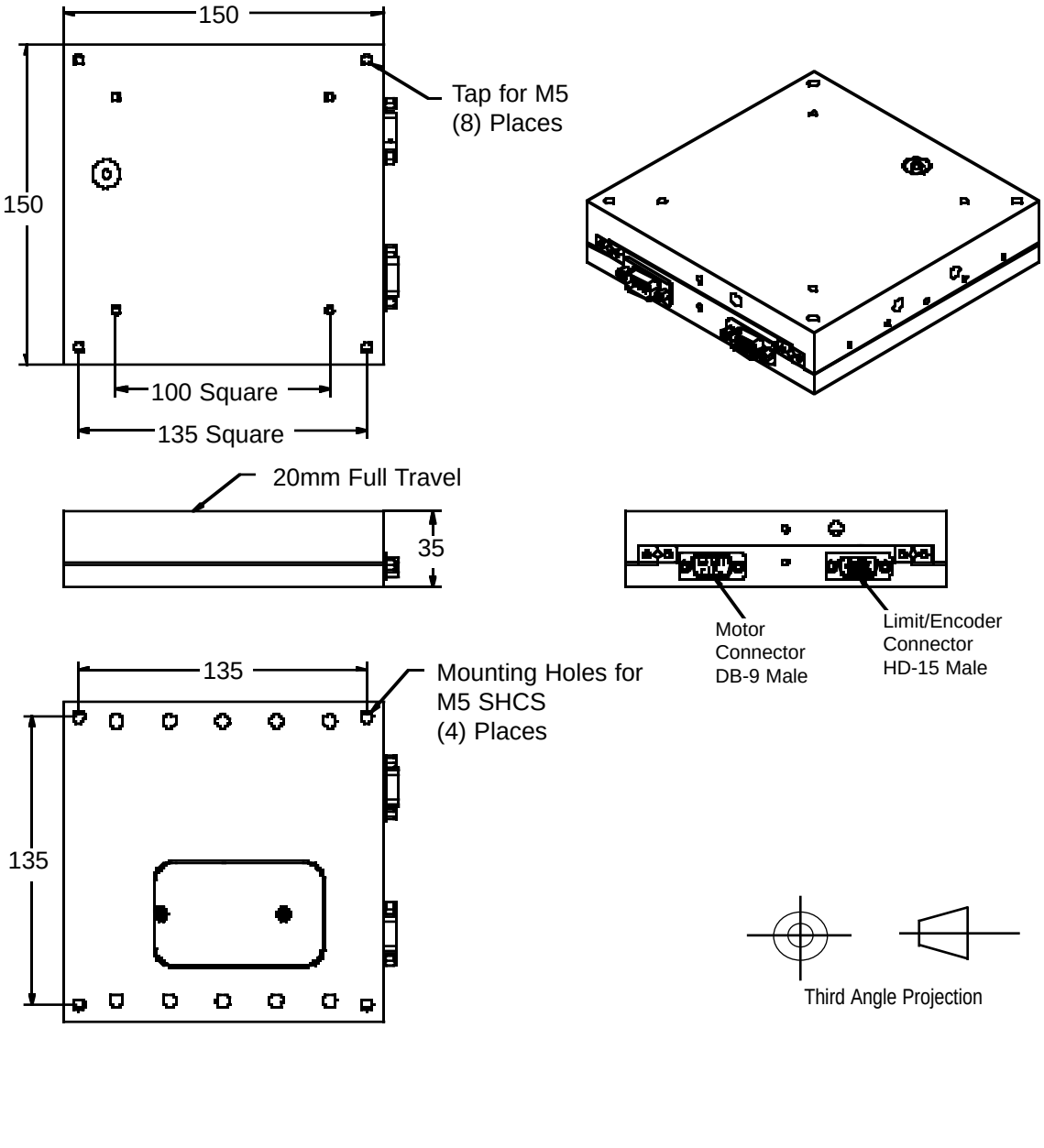
The NanoSlide-20 Stage has a very low profile of 35mm and the overall dimensions are only 150mm square. Two of these stages bolt directly together to form a very stiff, compact X-Y assembly, without the need for adapter plates. The NanoSlide-20 Table uses a unique moving magnet, moving encoder design, which locates all electrical conectors in the stationary stage base. The resulting absence of moving cables is clean and compact and eliminates motion errors due to cable forces. The precision ground crossed roller ways provide high stiffness together with smooth motion, and are capable of supporting torques due to offset loads.

Cage creep is eliminated through the use of geared cage assemblies. The built-in encoder is available with resolutions of 1 micron and 0.1 micron, which are directly output in digital quadrature format together with a unique index output. For high resolution applications, an analog sine/cosine output version supports 5 nanometer resolution.

NanoSlide-20 Linear Motor Specifications

Specification	
Travel	20 millimeters
Accuracy	4 microns
Resolution	1 micron, 0.1 micron, 5 nanometers
Repeatability	+/- 1 count (for 5 nanometer resolution repeatability ±25 nanometers)
Maximum Acceleration	30 m/sec^2
Load Capacity	15 kg
Moving Mass	1.2 kg
Total Mass	2.4 kg
Fundamental Motor Constant	3 N / $\sqrt{Watt}$
Motor Force Constant	5.5 N/A
Back-emf Constant	5.5 V/m/s
Coil Resistance	3.5 Ohms
Coil Inductance	1.5mH
Continuous Current	2.75 Amps
Peak Current	8.0 Amps
Continuous Force	15N
Peak Force	44N
Continuous Power Rating	25 Watts
Thermal Resistance	3.2° C/W
Pitch & Yaw	<5 arc seconds
Straightness & Flatness	<500 nanometers

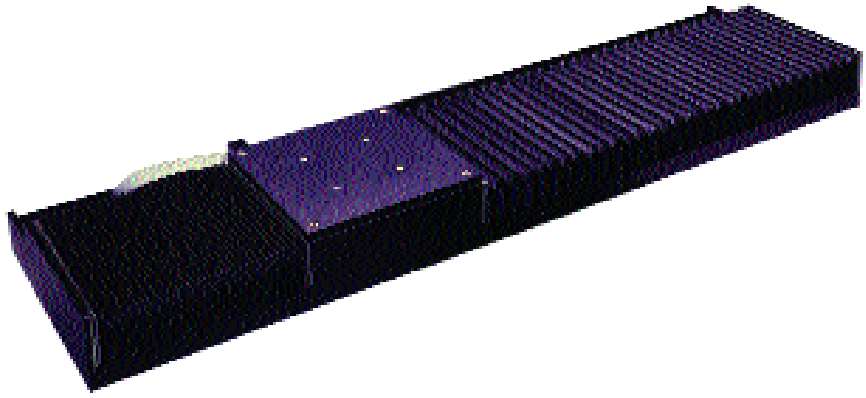
NanoSlide-20™ Linear Motor Stage



SAS™ Recirculating Way Table

Features

- Ideal for scanning and step and repeat applications
- High speed linear motor
- Space-saving shuttle design



Linear Motor Shuttle Stages

The SAS Series single-axis shuttle stages provide high speed in a very compact design. The stage design uses recirculating bearings to minimize the overall moving envelope. Its brushless linear servo motor allows high speeds with smooth positioning, making it ideal for use in high throughput scanning applications.

A linear encoder is standard and available in several resolutions. The bearings and lubricants have been optimized for low and uniform moving friction. Standard units include flexible bellows. This unit's cabling terminates on a static base plate, simplifying external wiring for convenient integration.

Vacuum and signal lines can also be made available on the stationary base plate, and routed to the top plate. These units can be conveniently stacked into an X-Y configuration with 15 arc-second orthogonality.

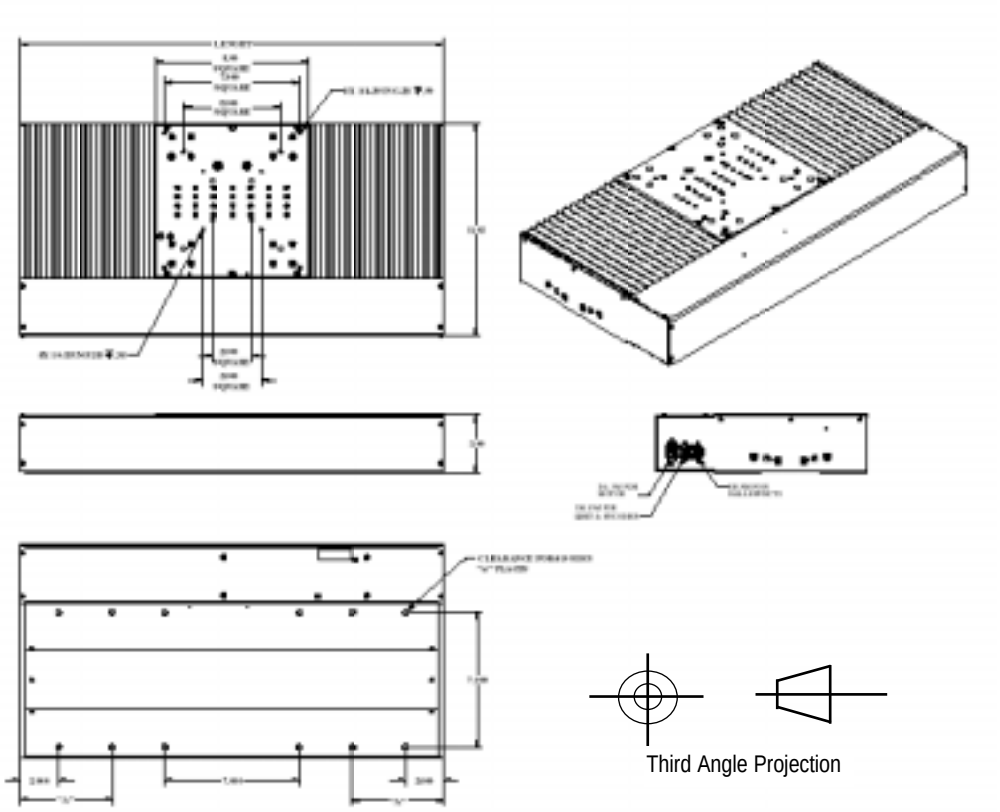
SAS-IC Table Specifications

Specifications		SAS-IC-800	SAS-IC-1200	SAS-IC-1800	SAS-IC-2400	SAS-IC-3600
Travel (inches)		8	12	18	24	36
Overall Height (inches)		3	3	3	3	3
Positional Accuracy (microns)[1]		6	9	11	13	21
Resolution (for all, micron)				5, 1, 0.5, 0.1		
Bi-directional Repeatability		±1 count	±1 count	±1 count	±1 count	±1 count
Load Capacity (for all, kg)[2]				70		
Maximum Acceleration (m/s^2)[2]		50	50	50	50	50
Maximum Velocity (m/s)		5	5	5	5	5
Mass (kg)	Moving (for all)			6.6		
	Total	20	23	27	32	38
Motor Force Constant (for all, N/A)				44.6		
Fundamental Motor Constant (for all, 130°C)				20.5N / $\sqrt{\text{Watt}}$		
Bank-emf Constant (for all, V/m/s)				42.0		
Coil Resistance (for all, 25°C, Ohm)				3.0		
Coil Inductance (for all, mH)				9.7		
Continuous Current (for all, 130°C, Amps)				3.3		
Peak Current (for all, Amps)				13.7		
Continuous Force (for all, 130°C, N)				171		
Peak Force (for all, N)				560		
Continuous Power Rating (for all, Watts)				69		
Pitch & Yaw (arc-seconds)		15	20	25	30	50
Flatness & Straightness (micron)		3	5	9	13	30

1 With 2 point slope correction.
2 Please contact our Applications Engineers for loads exceeding 75kg.
3 The maximum speed is encoder and load dependent.

SAS™ Recirculating Way Table

SAS Table Specifications



Third Angle Projection

SAS-IL Table Specifications

Specifications	SAS-IL-800	SAS-IL-1200	SAS-IL-1800	SAS-IL-2400	SAS-IL-3600
Travel (inches)	8	12	18	24	36
Overall Height (inches)	3	3	3	3	3
Positional Accuracy (microns)[1]	6	9	11	13	21
Resolution (for all, micron)			5, 1, 0.5, 0.1		
Bi-directional Repeatability	±1 count	±1 count	±1 count	±1 count	±1 count
Load Capacity (for all, kg)[2]			70		
Maximum Acceleration (m/s^2)	40	40	40	40	40
Maximum Velocity (m/s)[3]	5	5	5	5	5
Mass (kg) **Moving (for all)**			5.2		
Total	18	21	25	30	36
Motor Force Constant (for all, N/A)			16.9		
Fundamental Motor Constant (for all, 130°C)			6.6N / $\sqrt{\text{Watt}}$		
Bank-emf Constant (for all, V/m/s)			13.8		
Coil Resistance (for all, 25°C, Ohm)			3.1		
Coil Inductance (for all, mH)			0.65		
Continuous Current (for all, 130°C, Amps)			4.5		
Peak Current (for all, Amps)			14.2		
Continuous Force (for all, 130°C, N)			76		
Peak Force (for all, N)			240		
Continuous Power Rating (for all, Watts)			131		
Pitch & Yaw (arc-seconds)	15	20	25	30	50
Flatness & Straightness (micron)	3	5	9	13	30

Model	Travel	Length	n	A
SAS-800 Stage	8.00"	22	8	—
SAS-1200 Stage	12.00"	26	8	—
SAS-1800 Stage	18.00"	32.5	12	7.375
SAS-2400 Stage	24.00"	39.5	12	9.125
SAS-3600 Stage	36.00"	53	12	12.5

Features

- Non-contact air bearing, linear motor stage
- Non-contact optical encoder with resolutions to 1 nanometer
- 1 micron move and settle times of 15 milliseconds to within 20 nanometers
- No exposed magnets, coils, or moving cables

NanoBeam™ Linear Motor Positioner



Air Bearing, Linear Motor Positioner

The NanoBeam family of Linear Motor Positioners are specifically designed to meet the demands of photonic alignment and assembly systems. Design principals incorporate many of the same design principles and benefits of our larger FiberBeam™ and NanoBeam II linear stages but in an even more compact footprint with lower moving and total mass. The NanoBeam stage is designed to be incorporated as a stand alone ultra-high accuracy linear positioner or, due to its extremely low mass, as the Z, or top axis, in a multi-axis stack of NanoBeam II and NanoBeam stages when XYZ motion is required.

NanoBeam Linear Motor Positioners incorporate a unique moving magnet/moving glass design which locates all cables and connectors in a stationary base, avoiding any cable influence on stage movement. Design simplicity makes these positioners ideally suited to cleanroom applications: the carriage floats over a featureless, precision-ground base.

For high-resolution applications demanding rapid settling, the NanoBeam Stages are an ideal match to our NanoDrive™ Linear Amplifier series of ultra-low noise and low distortion sinusoidal amplifiers.

Right angle brackets and frictionless spring or air counterbalances are available to permit vertical operation. This allows three axis X-Y-Z assemblies to be easily configured. Dual carriage/single base versions can also be supplied, where the motion of the two carriages is parallel to less than 2 arc-seconds.

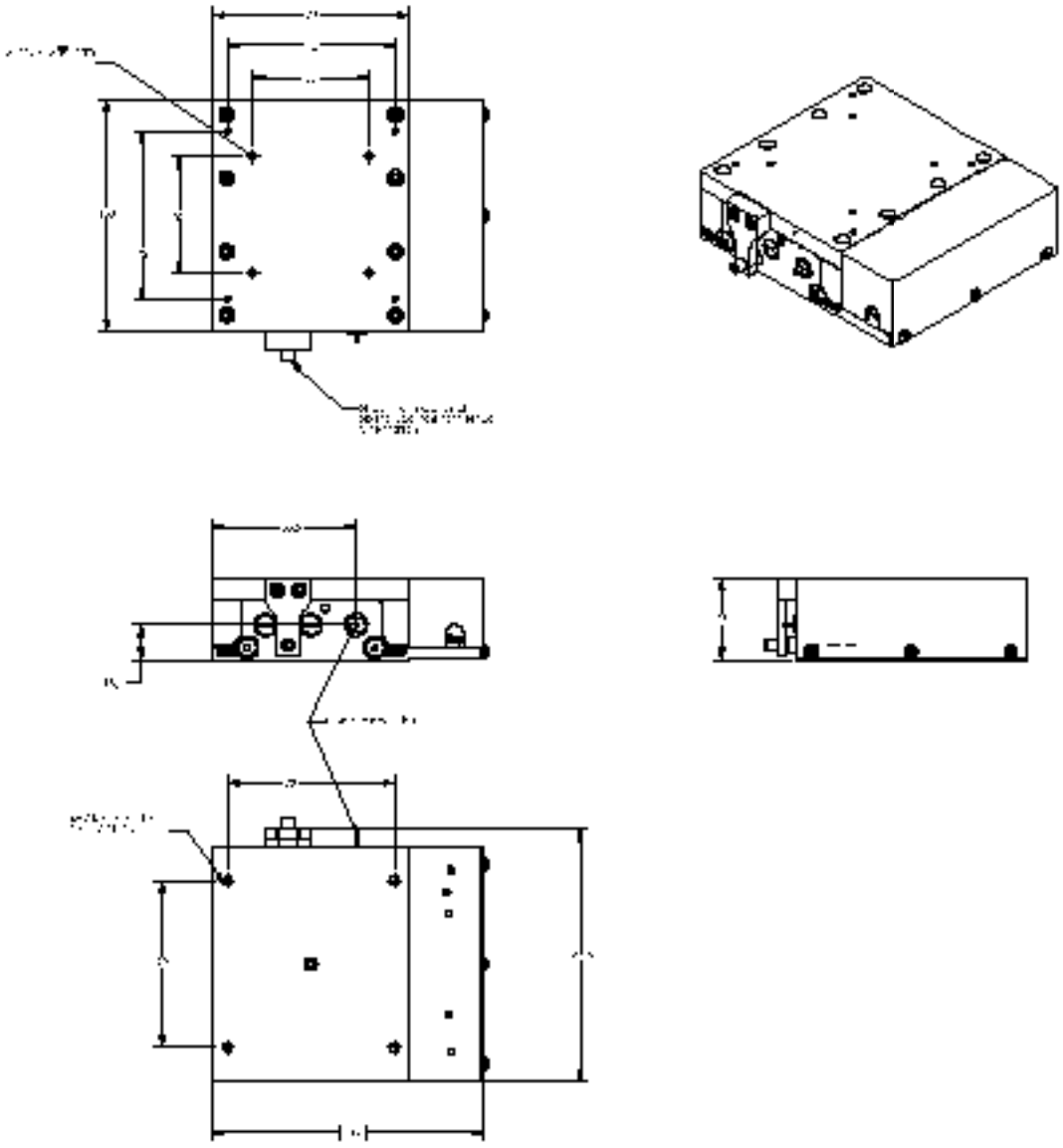
In constant velocity applications, tracking errors during motion can be held to +/- 10 nanometers. The use of a single phase, brushless motor in the NanoBeam-20 stage provides the high performance of sinusoidal commutation from brush-type amplifiers — no commutation required.

NanoBeam Linear Motor Positioner Specifications

Specification	
Travel (mm)	5
Overall Height (mm)	35
Accuracy (microns)	1.0
Resolution Options (nm)	100, 40, 20, 10, 1
Bi-directional Repeatability	±1 count
Maximum Acceleration (m/s^2)	45
Load Capacity (kg)	2.5
Moving Mass (kg)	0.4
Total Mass (kg)	1.1
Pitch & Yaw (arc-second)	< 1
Straightness & Flatness (nanometer)	< 100
Fundamental Motor Constant ($N / \sqrt{Watt}$)	2.0
Motor Force Constant (N/A)	0.6
Coil Resistance (Ohm)	7.5
Coil Inductance (mH)	0.8
Continuous Current (A)	1.5
Peak Current (A)	4.5
Continuous Force (N)	8
Peak Force (N)	24
Motor	Single Phase Brushless
Air Consumption (for all)	2250 SCCM @ 60PSI (2.25 liters/minute)
Continuous Power Rating (Watts)	17

NanoBeam™ Linear Motor Positioner

NanoBeam Linear Motor Positioner Specifications



Features

- Non-contact air bearing, linear motor stage
- Non-contact optical encoder with resolutions to 1 nanometer
- 1 micron move and settle times of 15 milliseconds to within 20 nanometers
- No exposed magnets, coils, or moving cables

NanoBeam II™ Linear Motor Positioner



Air Bearing, Linear Motor Positioner

The NanoBeam II family of Linear Motor Positioners are specifically designed to meet the demands of photonic alignment and assembly systems. Design principals incorporate many of the same design principles and benefits of our larger FiberBeam" linear stages but in a much more compact footprint. The NanoBeam II stage is designed to be incorporated as a stand-alone ultra high accuracy linear positioner or as the base axes in a multi-axis stack of NanoBeam II and NanoBeam stages when XYZ motion is required.

NanoBeam Linear Motor Positioners incorporate a unique moving magnet/moving glass design which locates all cables and connectors in a stationary base, avoiding any cable influence on stage movement. Design simplicity makes these positioners ideally suited to cleanroom applications: the carriage floats over a featureless, precision-ground base.

For high-resolution applications demanding rapid settling, the NanoBeam Stages are an ideal match to our NanoDrive™ Linear Amplifier series of ultra-low noise and low distortion sinusoidal amplifiers.

Right angle brackets and frictionless spring or air counterbalances are available to permit vertical operation. This allows three axis X-Y-Z assemblies to be easily configured. Dual carriage/single base versions can also be supplied, where the motion of the two carriages is parallel to less than 2 arc-seconds.

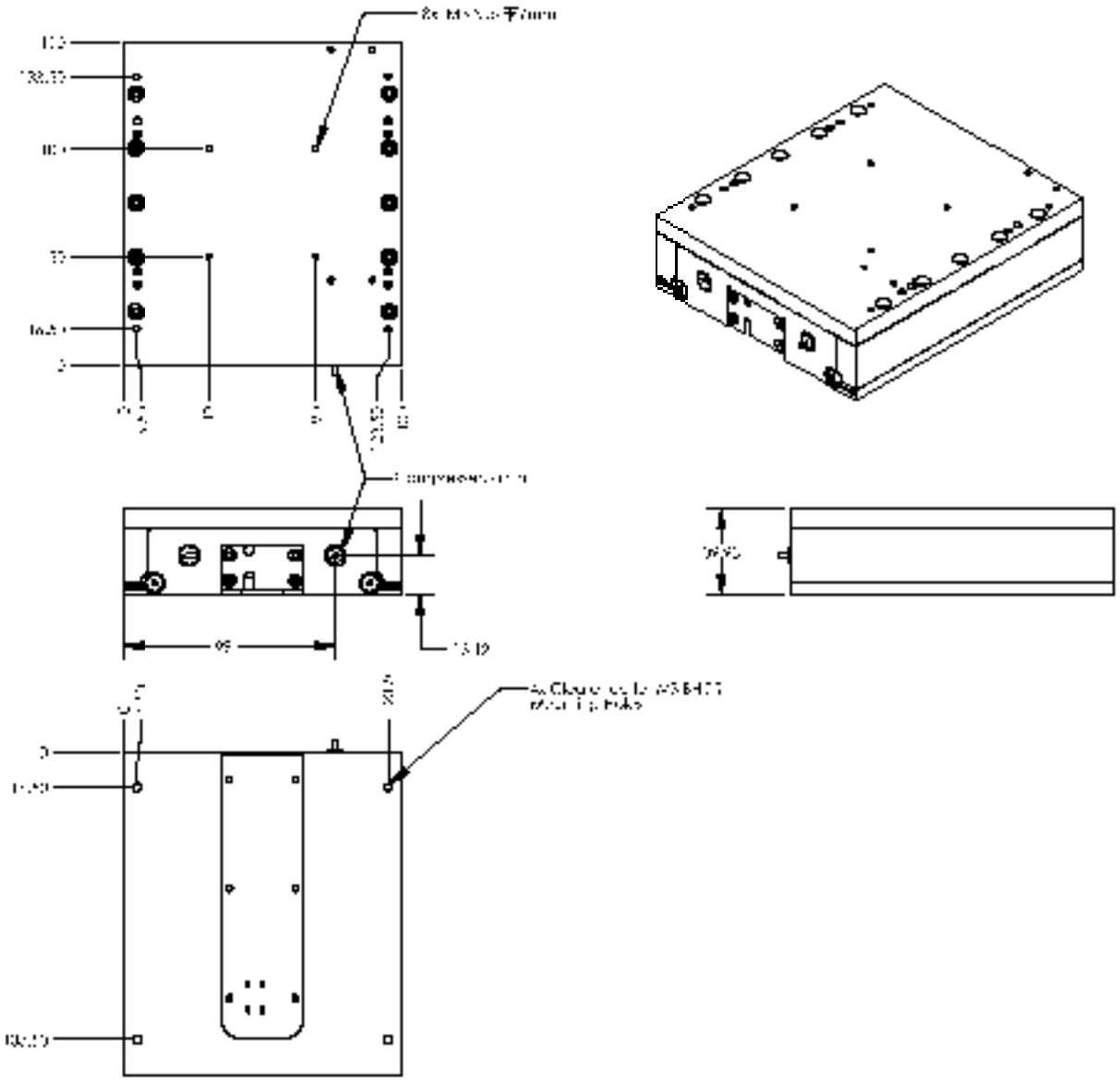
In constant velocity applications, tracking errors during motion can be held to +/- 10 nanometers. The use of a single phase, brushless motor in the NanoBeam-20 stage provides the high performance of sinusoidal commutation from brush-type amplifiers — no commutation required.

NanoBeam II Linear Motor Positioner Specifications

Specification	
Travel (mm)	5
Overall Height (mm)	40
Accuracy (microns)	1.0
Resolution (microns)	0.1
Bi-directional Repeatability	±1 count
Maximum Acceleration (m/s^2)	20
Load Capacity (kg)	3.5
Moving Mass (kg)	0.9
Total Mass (kg)	2.1
Pitch & Yaw (arc-second)	< 1
Straightness & Flatness (nanometer)	< 100
Fundamental Motor Constant ($N / \sqrt{Watt}$)	1.5
Motor Force Constant (N/A)	0.4
Coil Resistance (Ohm)	7.4
Coil Inductance (mH)	1.1
Continuous Current (A)	1.7
Peak Current (A)	5.1
Continuous Force (N)	7
Peak Force (N)	21
Motor	Single Phase Brushless
Air Consumption (for all)	2250 SCCM @ 60PSI (2.25 liters/minute)
Continuous Power Rating (Watts)	21

NanoBeam II™ Positioner

NanoBeam II Linear Motor Positioner Specifications



AirBeam™ Single-Axis Shuttle

Features

- Ultra-smooth — ideal for scanning applications
- Air bearing accuracy
- Clog-free air bearing technology
- High speed linear motor
- Virtually unlimited service life without particle generation
- High-flex optional cabling available upon request



Linear Motor Air Bearing Stage

The AirBeam Series is ideal for Computer-To-Plate systems, photoplotters, wafer scanning systems, and factory automation applications. It provides straight, stiff, cog-free motion at resolutions less than a micron. The AirBeam combines breakthrough linear servo motor technology and an ultra-smooth air bearing way in a single structural beam. The linear motor and modular, serviceable moving cable set are uniquely mounted inside the main beam, minimizing particulate generation. The integral linear motor allows carriage speeds up to 1 meter per second, and accelerations up to 1 G. The linear encoder mounts just below the upper surface, minimizing Abbé error. A laser interferometer option is available for particularly demanding OEM applications with resolution down to 2.5 nanometers. Since the air bearing carriage, linear motor, and linear encoder are non-contact devices, the AirBeam provides virtually unlimited life without particle generation.

Danaher Precision Systems' unique clog-free air bearing technology provides superior reliability while eliminating costly filtration requirements, and requires minimal air consumption. The AirBeam series mounts via 3 points, eliminating degradation of positioning accuracy due to imperfect mounting surfaces. Locking, D sub-mini connectors with strain-relieved cables mount on the box beam end plate to provide convenient access to motor and limit/encoder signals. An auxiliary connector is provided for user signals, and terminates on the air bearing moving carriage. Please contact one of our Applications Engineers when high stability is needed. An optional solenoid may be added which rapidly disables compressed air to the moving carriage, resulting in a "Coulomb welded" state. In this state, motion between the spar and carriage is eliminated at the atomic level, and the only relative movement is due to thermal phenomena.

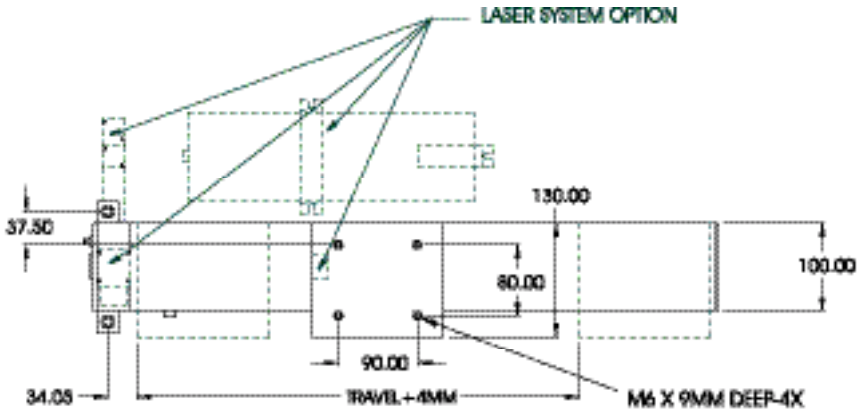
SPECIFICATIONS		AB-305	AB-610
Travel (mm)		305	610
Positional Accuracy (µm)[1]		10	12
Bidirectional Repeatability		±1 count	
Flatness & Straightness (µm)		2	6
Pitch & Yaw (arc-seconds)		10	14
Load Capacity (kg)[2]		10	
Maximum Speed (m/sec)[3]		1	
Mass (kg)	Moving	5.0	
	Total	10.9	16.3

CONFIGURATIONS (Apply to all of the above models)[4]				
Motor	Linear Servo	**brushless**		
Encoder	Linear (µm/count)	1	**0.5**	0.1
OPTIONS				
Laser Interferometer				

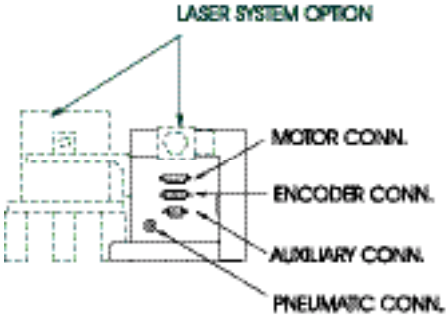
[1]With 2 point slope correction.
[2]Please contact our Applications Engineers for loads exceeding 4kg.
[3]The maximum speed is encoder and load dependent.
[4]Standard configuration is highlighted.

AirBeam™ Single-Axis Shuttle

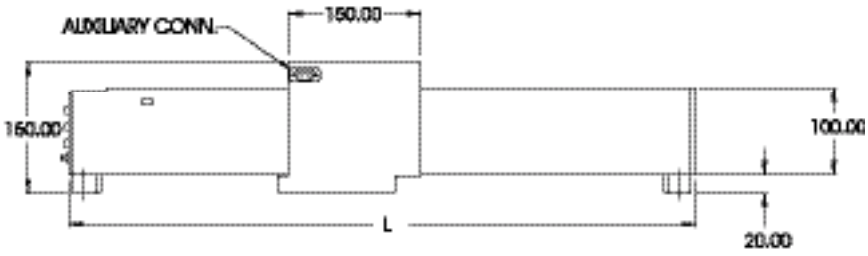
Top View



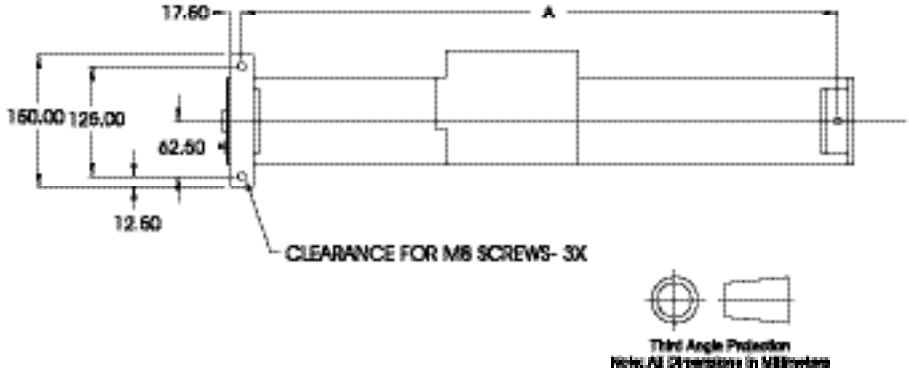
End View



Side View



Bottom View



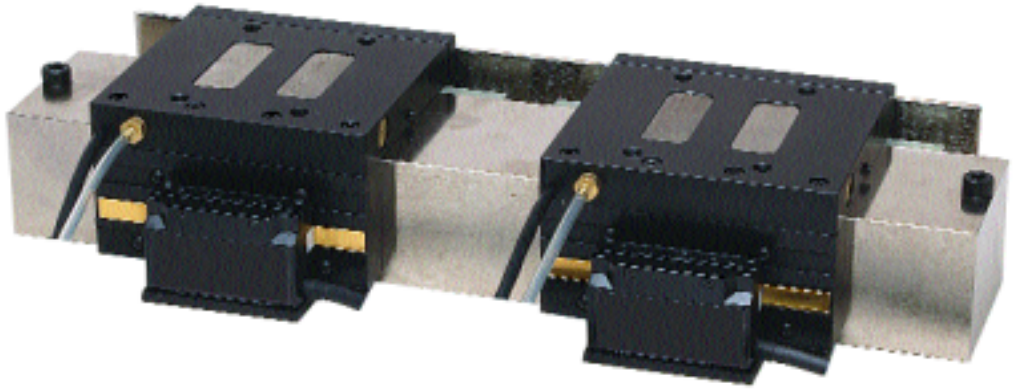
MODEL	TRAVEL T	LENGTH L	A
AB-305	305	520	485
AB-610	610	825	790

Note: All dimensions are in millimeters.

MicroBeam™ Low Profile Shuttle Stage

Features

- Ultra-compact — only 50mm high with 75mm square carriage
- Extremely precise, non-contact air bearing ways
- Linear motor provides zero backlash direct drive
- Single and dual carriage designs available
- CE Compliant



Miniature Air Bearing Linear Motor Stage

DPS MicroBeam linear motor positioners are specifically designed to meet the highest performance in the smallest package possible. Microbeam stages cross-section of 104mm x 50mm tall make it one of the smallest airbearing stages on the market. This allows the stage to be used in applications limited by space. Dual axis versions are also availabale where the motion of the two carriages is parallel to less than 2 arc-seconds.

MicroBeam stages incorporate proprietary porous bearing technology, avoiding the clogging problems associated with orifice bearing designs. For high resolution applications demanding rapid settling, MicroBeam stages are an ideal match to our NanoDrive™ ultra-low noise and low distortion sinusoidal linear amplifier.

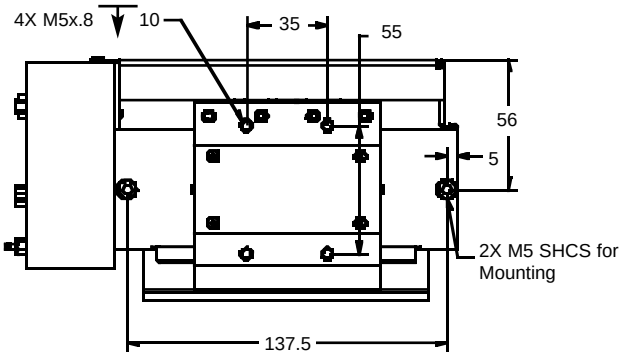
In constant velocity, the MicroBeam stage provides the highest performance of a sinusoidal commutation from brush-type amplifiers because of its unique magnetic circuit no commutations is required. Standard travels of 40, 100, 150,and 200mm are available with encoders resolutions of 100, 40, 20, 10, and 1nm. Both single and dual carriage versions are available.

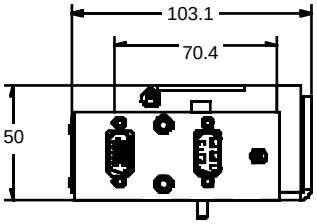
MicroBeam Low Profile Shuttle Stage Specifications

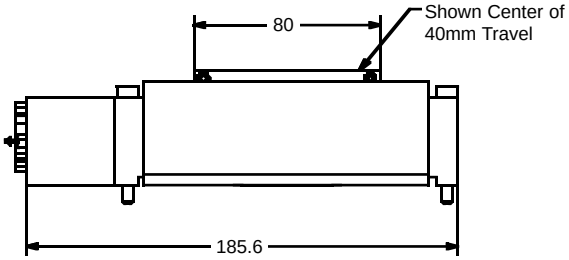
Specification	MB-40 Stage	MB-100 Stage	MB-150 Stage	MB-200 Stage
Travel (millimeters)	40	100	150	200
Overall Height (millimeters)	50	50	50	50
Accuracy (microns)	3	4	6	8
Resolution (microns, for all)		0.05, 0.1, 0.5, 1.0		
Repeatability (for all)		+/- 1 count		
Maximum Acceleration (G)	2	2	2	2
Load Capacity (kg)	6	9	9	9
Moving Mass (kg)	0.4	0.6	0.6	0.6
Total Mass (kg)	3.2	5	6.5	8
Motor	Single Phase Brush	3 Phase Brushless	3 Phase Brushless	3 Phase Brushless
Fundamental Motor Constant (N-m/$\sqrt{\text{Watt}}$)	1.4	1.73	1.73	1.73
Motor Force Constant (N/A)	5.2	5.5	5.5	5.5
Back-emf Constant (V/m/s)	5.2	5.5	5.5	5.5
Coil Resistance (Ohms)	5.7	4.8	4.8	4.8
Coil Inductance (mH)	0.0	1.25	1.25	1.25
Continuous Current (Amps)	1.5	2.5	2.5	2.5
Peak Current (Amps)	4.5	7	7	7
Continuous Force (N)	7.9	9	9	9
Peak Force (N)	23	25	25	25
Continuous Power Rating (Watts)	13.5	20	20	20
Thermal Resistance (° C/W)	5.8	4	4	4
Pitch & Yaw (arc-seconds)	2	3	4	5
Straightness & Flatness (microns)	0.25	0.5	1	2

MicroBeam™ Shuttle Stage

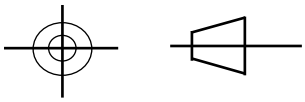
MicroBeam Low Profile Shuttle Stage Specifications







Travel	A	B
100mm	278.6	230.5
150mm	386.6	280.5
200mm	468.6	330.5

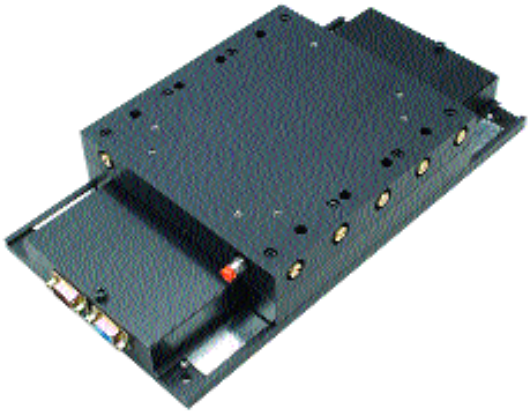


Third Angle Projection

FiberBeam™ Linear Motor Positioner

Applications

- Non-contact air bearing, linear motor stage
- Non-contact optical encoder with resolutions to 1 nanometer
- 1 micron move and settle times of 15 milliseconds to within 20 nanometers
- No exposed magnets, coils, or moving cables
- CE Compliant



Air Bearing, Linear Motor Positioner

The FiberBeam Family of Linear Motor Positioners are specifically designed to meet the demands of photonic alignment and assembly systems. With travels of 20, 50, and 100mm, all share a very low profile of only 50mm.

FiberBeam Linear Motor Positioners incorporate a unique moving magnet/moving glass design which locates all cables and connectors in a stationary base, avoiding any cable influence on stage movement. Design simplicity makes these positioners ideally suited to cleanroom applications: the carriage floats over a featureless, precision-ground base.

For high-resolution applications demanding rapid settling, the FiberBeam Stages are an ideal match to our NanoDrive™ Linear Amplifier series of ultra-low noise and low distortion sinusoidal amplifiers.

The FiberBeam Stages incorporate proprietary porous bearing technology, avoiding the clogging problems common to orifice bearing designs. All models bolt together directly to form X-Y assemblies without the need for adapter plates. The height of such a stack is a low 100mm.

Right angle brackets and frictionless spring or air counterbalances are available to permit vertical operation. This allows three axis X-Y-Z assemblies to be easily configured. Dual carriage/single base versions can also be supplied, where the motion of the two carriages is parallel to less than 2 arc-seconds.

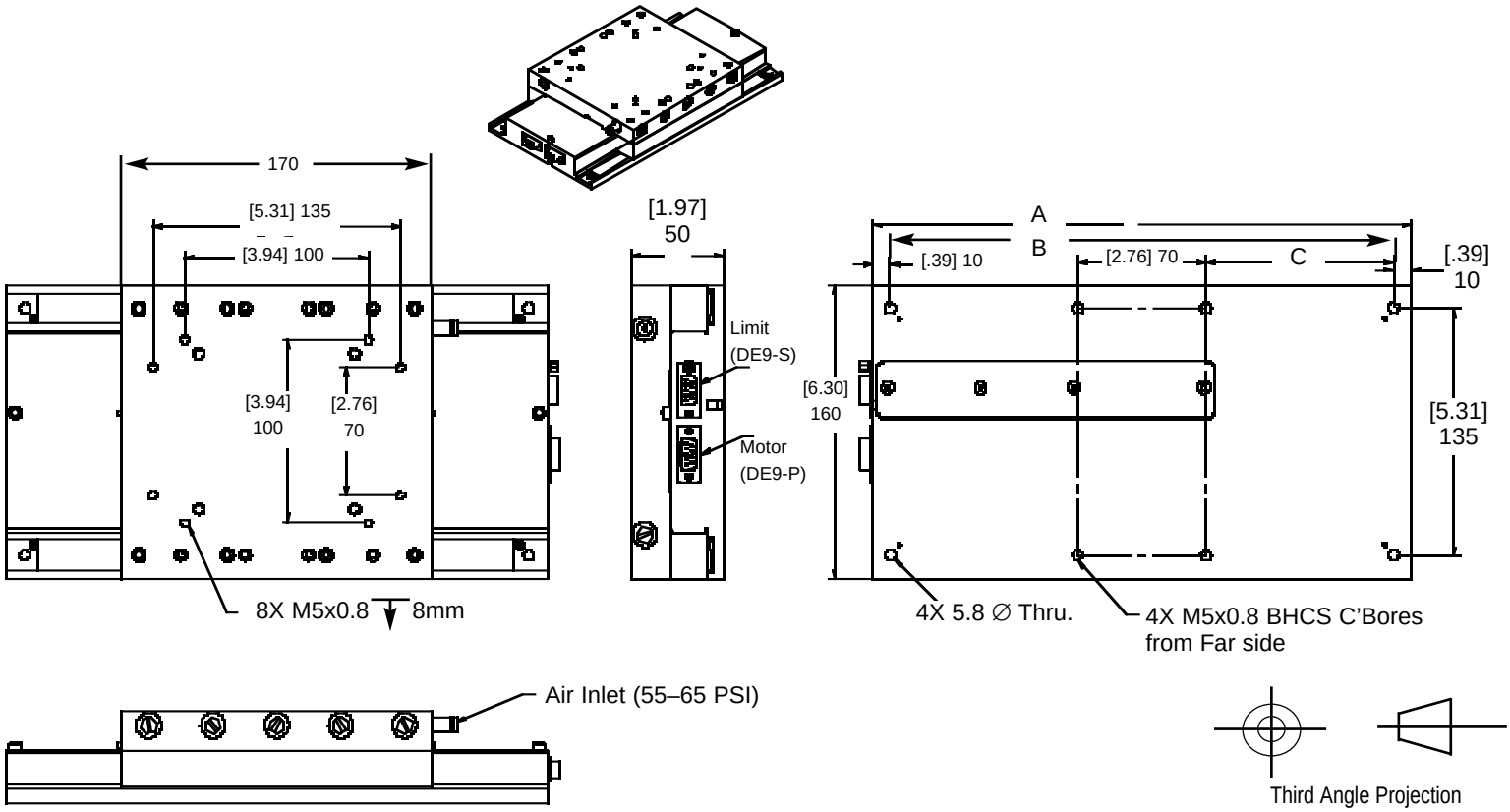
In constant velocity applications, tracking errors during motion can be held to +/- 10 nanometers. The use of a single phase, brushless motor in the FiberBeam 20 stage provides the high performance of sinusoidal commutation from brush-type amplifiers — no commutation required.

FiberBeam Linear Motor Positioner Specifications

Specification	FiberBeam-20 Stage	FiberBeam-50 Stage	FiberBeam-100 Stage
Travels	20	50	100
Overall Height	50	50	50
Accuracy	1 micron	1.5 micron	2 micron
Resolution Options		100, 40, 20, 10, 1 nm	
Bi-directional Repeatability	± 1 count	± 1 count	± 1 count
Maximum Acceleration	10 m/s^2	10 m/s^2	10 m/s^2
Load Capacity	15 kg	15 kg	15 kg
Moving Mass (kg)	2.25	2.25	2.25
Total Mass (kg)	3.8	4.5	5
Motor Force Constant	6.1 N/A	3.8 N/A	3.8 N/A
Fundamental Motor Constant	2.8N / $\sqrt{Watt}$	1.73N / $\sqrt{Watt}$	1.73N / $\sqrt{Watt}$
Coil Resistance	4.8 Ohm	4.8 Ohm	4.8 Ohm
Coil Inductance	1.1mH	1.25mH	1.25mH
Continuous Current	3.4 A	2.7 A	2.7 A
Peak Current	60 A	7.5 A	7.5 A
Continuous Force	20N	10N	10N
Peak Force	44N	30N	30N
Continuous Power Rating	50 Watts	35 Watts	35 Watts
Thermal Resistance	1.33° C/W	2.3° C/W	2.3° C/W
Air Consumption (for all)		2250 SCCM @ 60PSI (2.25 liters/minute)	
Pitch & Yaw	1 arc-second	2 arc-seconds	3 arc-seconds
Motor	Single Phase Brushless	Three Phase Brushless	Three Phase Brushless
Straightness & Flatness	<100 nanometer	125 nanometer	250 nanometer

FiberBeam™ Motor Positioner

FiberBeam Linear Motor Positioner Specifications



Model	A	B
FiberBeam 20 Stage	215mm	62.5mm
FiberBeam 50 Stage	245mm	77.5mm
FiberBeam 100 Stage	295mm	103mm

Z-Elevator Vertical Motion Units

Features

- Low profile with no cantilevering
- 0.5" and 1" travel versions
- Excellent straightness and repeatability
- Anti-backlash friction nut



Vertical Motion Stages

Our Z-Elevator Stages provide a very compact, accurate means of achieving vertical motion. Precision, non-recirculating ways in each of the four corners keep pitch and yaw below 15 arc-seconds over full travel. This way configuration provides very straight, smooth, and repeatable motion which is needed to satisfy demanding wafer inspection, scanning, and probing applications. Both 0.5 inch and 1.0 inch travel versions are available with collapsed heights of only 2.874 inches and 3.150 inches respectively. The users load is not cantilevered; it is fully supported by an 8" x 8" top plate. Our Z-Elevator Stages incorporate a 23 frame motor (either stepper or servo), coupled to a leadscrew which drives a cam-follower along a wedge. The wedge ratio is 2.5:1 for the ZE-5 and 1.25:1 for the ZE-10. This design provides high resolution, while our anti-backlash friction nut ensures excellent repeatability. Each stage includes precision Hall-effect limit switches, which terminate on convenient, locking D sub-mini connectors. The pitch of the leadscrew, the ratio of the wedge mechanism, the motor, and the controller together determine the resolution in our Z-Elevator stages. Please see page 55 for calculation details.

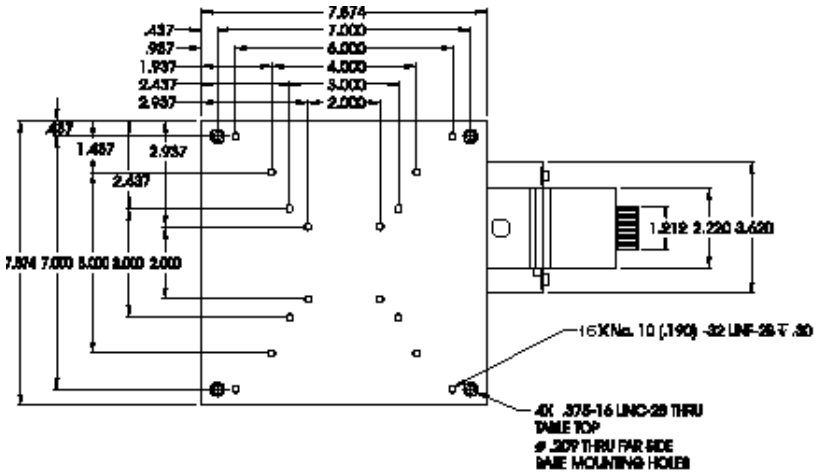
SPECIFICATIONS		ZE-5™ Z-Elevator	ZE-10™ Z-Elevator
Travel (inches)		0.5	1.0
Positional Accuracy (µm)[1]		15	20
Bidirectional Repeatability (µm)		3	
Flatness & Straightness (µm)		5	10
Pitch & Yaw (arc-seconds)		15	
Load Capacity (kg)		10	
Maximum Leadscrew Speed (rps)		15	
Mass (kg)	Moving	2.3	2.7
	Total	7.4	9.1

CONFIGURATIONS (Apply to both of the above models)[2]							
Leadscrew	Lead (inch)	0.50	0.40	0.20	0.10	0.02
	Z Resolution (inchx10-6)[3]	100	80	40	20	4
	Lead (mm)	3	**2**	1.4		
	Z Resolution (µm)[3]	0.6	**0.4**	0.28		
Motor	Stepper (oz-in) 400 step/rev.	118		others available		
	200 step/rev.	**53**	100	others available		
	Servo	brush	brushless			
OPTIONS						
Encoder	Rotary (counts/rev.)	2000	4000			

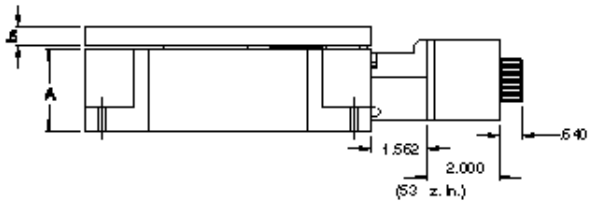
[1]With 2 point slope correction.
[2]Standard configuration is highlighted.
[3]Z resolution assuming ÷ 10 microstep drive and standard 200 step/rev. stepping motor.

Z-Elevator Vertical Motion Units

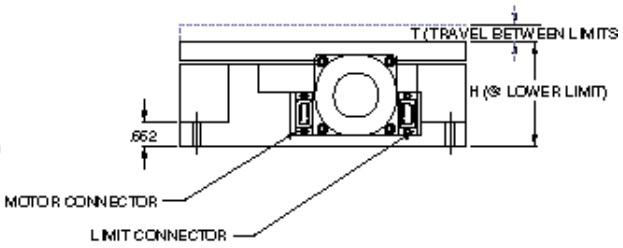
Top View



Side View



End View



Third Angle Projection
Note: All Dimensions in Inches

MODEL	TRAVEL T	HEIGHT H	A
ZE-050-SM	0.50	2.874	2.274
ZE-100-SM	1.00	3.150	2.615

Note: All dimensions are in inches.

Features

- Low profile with no cantilevering
- 0.5" vertical travel; ±4° theta travel
- High repeatability, anti-backlash friction nuts

Z-Theta™ Z-Elevator with Small Angle Theta



Z-Elevator with Small Angle Theta

Our Z-Theta Stage adds a small angle theta-axis to our 0.5 inch travel Z-Elevator stage. This second axis adds only 15mm to the overall height, making the total collapsed height of this two-axis assembly only 3.465". It is designed to accommodate varying sample thicknesses and provide theta alignment. The theta axis uses a leadscrew with a high repeatability friction nut as its drive mechanism while a decoupling device allows precise angular motion. Both axes incorporate 23 frame motors and Hall-effect limits with locking connectors.

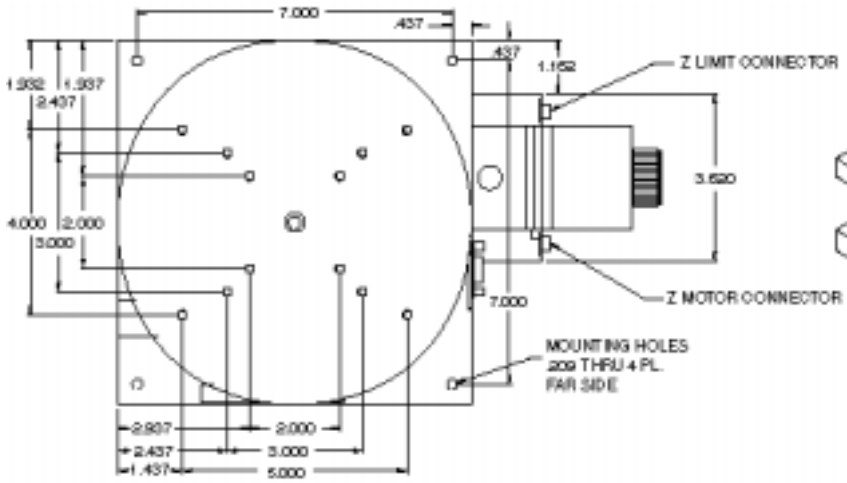
SPECIFICATIONS		Z-AXIS	THETA AXIS
Travel		0.5 inch	±4 degrees
Positional Accuracy		10µm	0.05 degree
Bidirectional Repeatability		3µm	0.003 degree
Flatness & Straightness		5µm	—
Pitch & Yaw		15 arc-seconds	—
Load Capacity (kg)		10	10
Maximum Speed		15 leadscrew rps	7°/sec
Mass (kg)	Moving	5.3	3
	Total	10	10

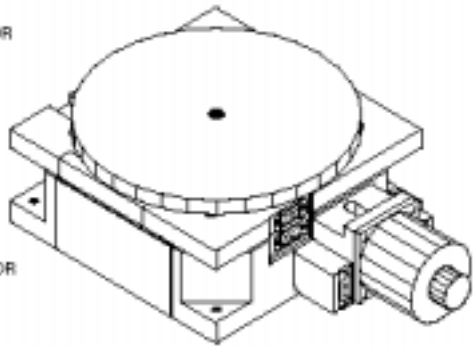
CONFIGURATIONS (Apply to both of the above axes)[1]							
Leadscrew	Lead (inch) Z Resolution (inch x 10^{-6})[2]		0.50 100	0.40 80	0.20 40	0.10 20	0.02 4
	Lead (mm) Z Resolution (µm)[2]		3 0.6	**2** **0.4**	1.4 0.28		
	Theta Resolution[2]		0.000752° (2.7 arc-seconds)				
Motor	Stepper (oz-in)	400 step/rev. 200 step/rev.	118 **53**	100	others available others available		
	Servo[3]		brush	brushless			
OPTIONS							
Encoder	Rotary (counts/rev.)[4]		2000	4000			

[1]Standard configuration is highlighted.
[2]Resolution assuming ÷ 10 microstep drive and standard 200 step/rev. stepping motor.
[3]Servo on Z axis only.
[4]Enclosed on Z axis only.

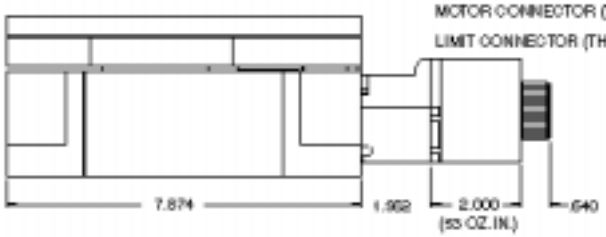
Z-Theta™ Z-Elevator with Small Angle Theta

Top View

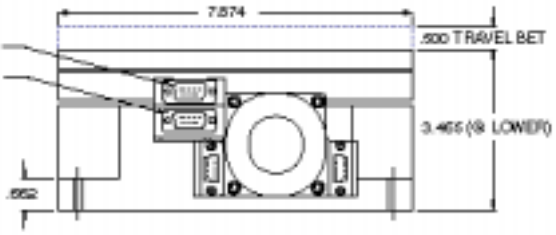


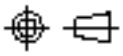


Side View



End View





Third Angle Projection
Note: All Dimensions in Inches

BAZ™ Ultra-Stiff Z-Elevator Unit

Features

- Ideal for use in applications which require low vibration during X-Y scans
- High natural frequency
- High load capacity



Ultra Stiff Z-Elevator

Our BAZ Z-Elevator Stage provides very stiff vertical motion with low angular errors and high resolution. Its unique design maintains a torsional stiffness of 4×10^5 N-m/rad and a lateral stiffness of 1×10^7 N/m, making it ideal for wafer positioning applications. Precision, crossed roller ways support user loads up to 50 kg and keep angular runouts to 5 arc-seconds or less over the full 5mm travel.

Our BAZ stage incorporates a 23 frame motor (either stepper or servo), coupled to a leadscrew or ballscrew which moves the center section horizontally. A 20:1 wedge provides high resolution. A flexure couples the top section to the base section, tightly constraining motion in the XY plane while allowing vertical motion.

A linear encoder may be mounted vertically, to maximize positional accuracy, or horizontally, to provide a tighter servo loop and/or higher resolution. Please see page 55 for resolution calculation details.

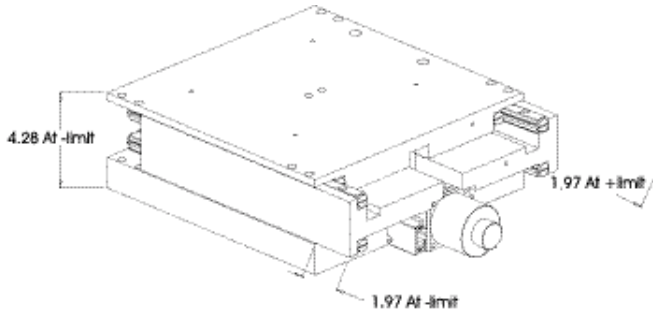
SPECIFICATIONS		BAZ-5
Travel (mm)		5
Positional Accuracy (µm)	with linear encoder[1] open loop	1 10
Bidirectional Repeatability (µm)		2
Flatness & Straightness (µm)		4
Pitch/Roll & Yaw (arc-seconds)		10
Stiffness	torsional (N-m/radian) lateral (N/m)	$4x10^5$ $1x10^7$
Load Capacity (kg)[2]		50
Maximum Speed (rps)	leadscrew ballscrew	15 50
Mass (kg)	Moving Total	7 25

CONFIGURATIONS[3]						
Leadscrew	Lead (inch) Z Resolution (inch x 10^{-6})[4]		0.50 12.5	0.40 10	0.20 5	0.10 2.5
	Lead (mm) Z Resolution (µm)[4]		**2** **0.05**			
Ballscrew	Lead (mm) Z Resolution (µm)[4]		5 0.125	2 0.05		
Motor	Stepper (oz-in)	400 step/rev. 200 step/rev.	118 **53**	 100	others available others available	
	Servo		brush	brushless		
OPTIONS						
Encoder	Rotary (counts/rev.)		2000	4000		
	Linear (µm/count)	vertical horizontal	5 0.25	1 0.05	0.5 0.025	0.1 0.005

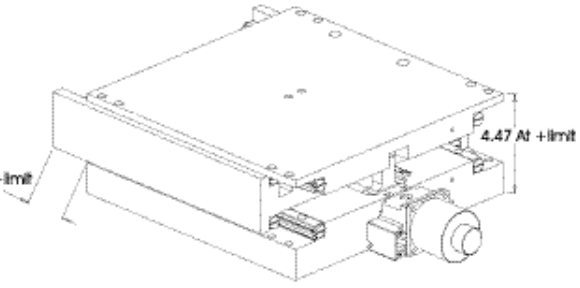
[1]With 2 point slope correction.
[2]Please contact our Applications Engineers for loads exceeding 30kg.
[3]Standard configuration is highlighted.
[4]Z resolution assuming ÷ 10 microstep drive and standard 200 step/rev. stepping motor.

BAZ™ Ultra-Stiff Z-Elevator Unit

– End of Travel



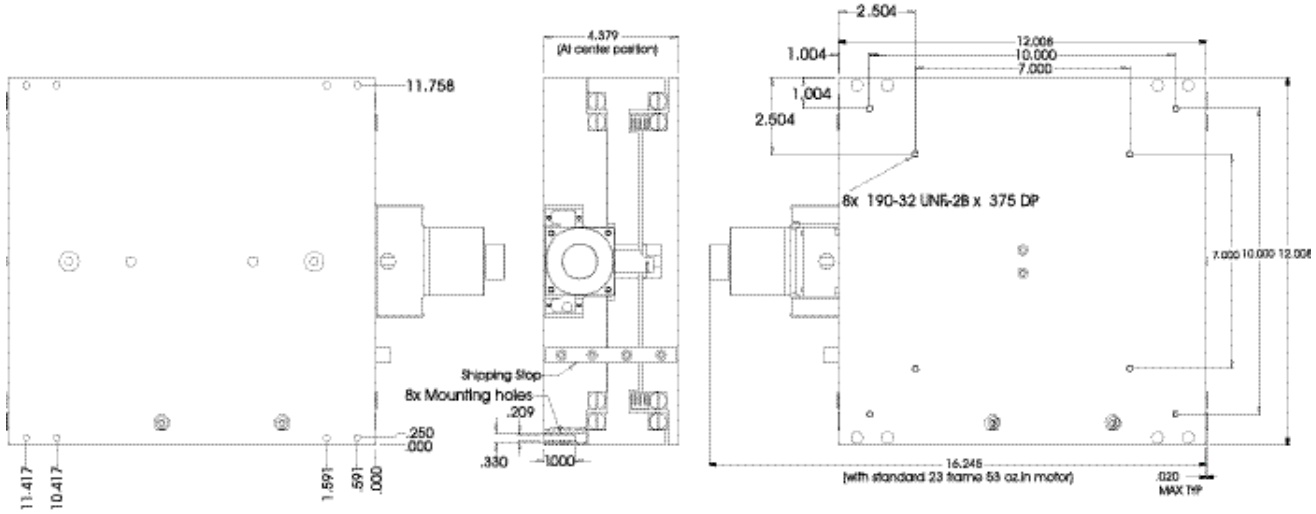
+ End of Travel



Bottom View

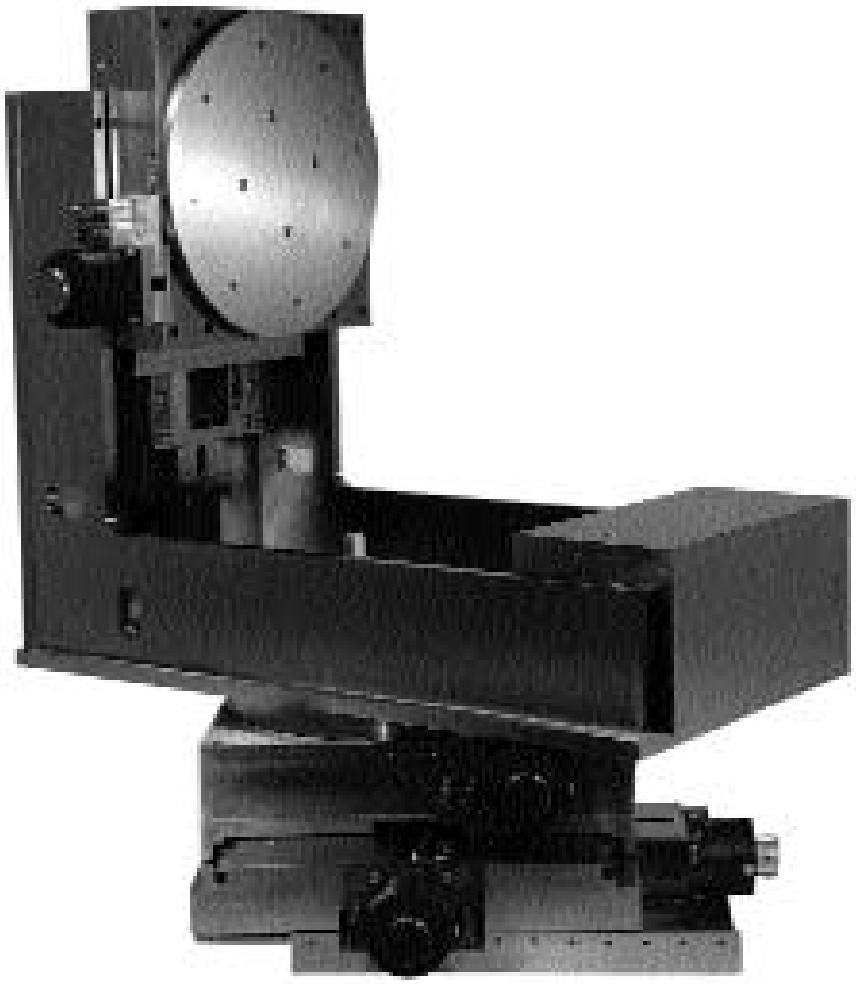
End View

Top View



Third Angle Projection
Note: All Dimensions in Inches

NOTES



Multi-Axis Positioning System

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