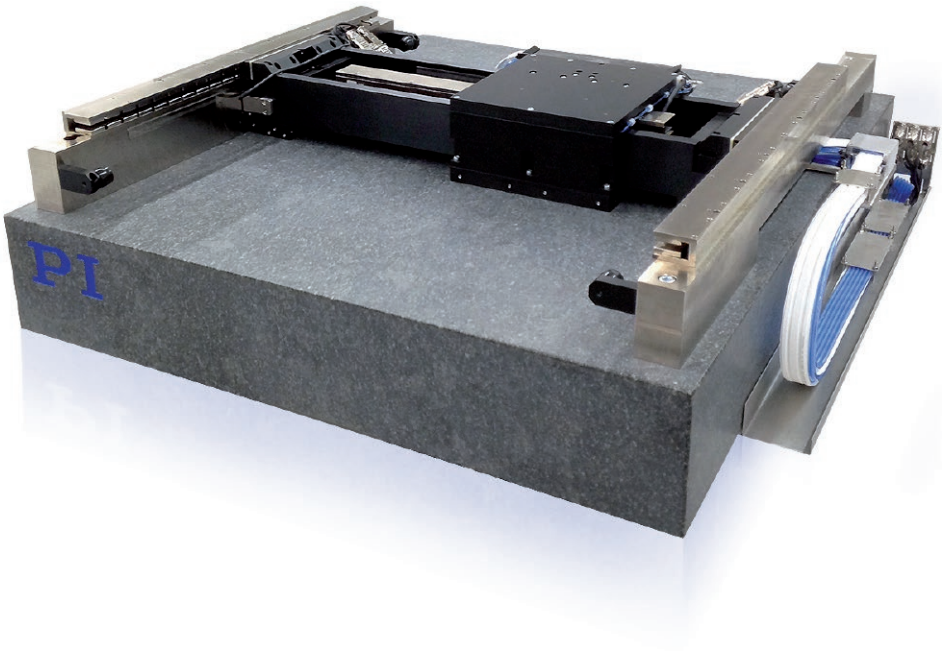


PIglide Air Bearing Technology

NANOMETER PRECISION, MULTI-AXIS MOTION, STANDARD & CUSTOM DESIGNS

Plglide

The Step Ahead with Air Bearing Technology

Frictionless High-Precision Positioning

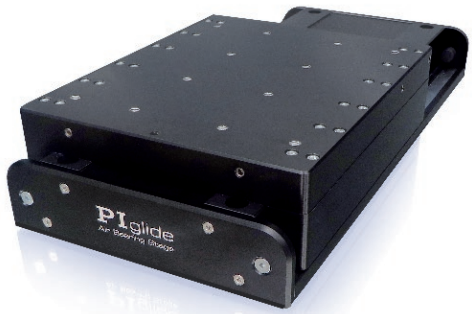
A direct-drive motor and high-resolution encoder can position a moving carriage supported by an air bearing to within nanometers in a linear application or within tenths of arc-seconds in rotational applications. The lack of friction and mechanical contact means there is minimal hysteresis or reversal error, making it highly repeatable and ideal for many inspection and manufacturing operations. Stiction is virtually eliminated, improving resolution capabilities, position repeatability can be obtained within a few fundamental encoder counts. Similar precision can be obtained by piezo flexure guided stages, however over much smaller travel ranges.

Velocity Stability and Scanning

The lack of mechanical bearing elements means there is nothing to get in the way of smooth, controlled velocity (stability to better than 0.01%). Experiments and processes like inertial sensor testing, tomography, wafer scanning, and surface profiling require continuous motion at a tightly controlled speeds are best served by air bearing systems.

High Guiding Accuracy

Linear air bearing stages have incredibly straight and flat travels, measured in the 100's or 10's of nanometers and sub-arc-second pitch, roll, and yaw errors. Rotary stages have tilt (wobble) errors less than 1 arc-second. Additionally, the angular performance of an air bearing is remarkably repeatable. This guarantees optimal part quality and measurement reliability for applications such as optics inspection, semiconductor inspection, and medical device manufacturing.



Air Bearing Technology

The Step Ahead with the Full Range of PI Technologies

Experience with Air Bearing Technology

PI is building on over 200 man-years of in-house air bearing experience and offers comprehensive precision air bearing motion control and positioning products and systems.

With 4 decades of experience in piezo nanopositioning systems design and motorized precision positioning equipment, the new air bearing systems capabilities are a natural and logical extension of PI's precision motion offerings.

Core Technology Inhouse

Having all the core technologies available in-house allows PI to design and manufacture excellent products. Optimum performance is achieved by extensive simulations of relevant components, from the magnetic field for the motor layout, the FEM simulations of stages, to the control algorithm design. Keeping the number of parts low secures high reliability of the system.

Flexible Axis Configuration

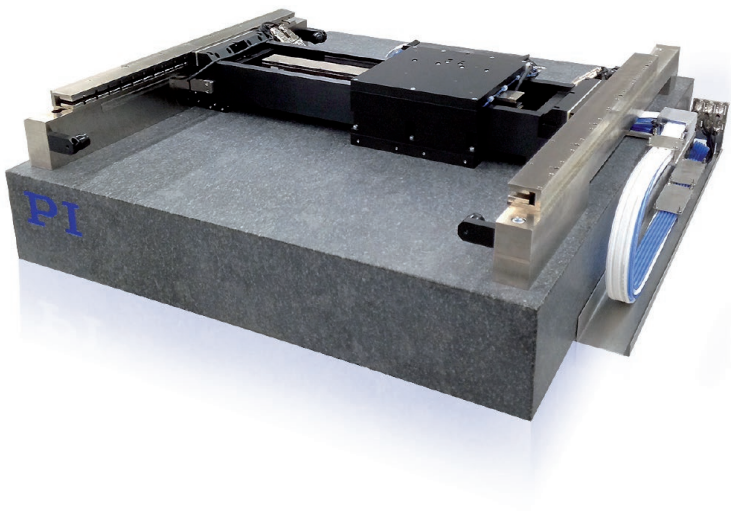
- Single axis linear stages
- Rotary stages
- XY Planar Scanners
- Non-motorized linear and rotary bearings
- Hemispherical bearings
- Rotary air bearing spindles

PI serves both the research and industrial markets.

Customization

PI is in the unique position to cover the whole motion range from finger-tip sized nano-positioners to large scale stages with long travel ranges, through a plethora of different drive and guiding systems tailored exactly to the customer's needs.

By combining extremely responsive engineering consultative support and lean manufacturing techniques, PI is able to provide the highest quality customer service. Maximum performance of precision systems is achieved thru extensive design and analysis expertise, using equipment built in-house with proprietary techniques.



PIglide MB: Miniature Linear Air Bearing Stage

HIGH PERFORMANCE, CLEANROOM COMPATIBLE, CUSTOMIZABLE

A-141 Series

- Table size 57mm x 83mm
- Overall height 38mm
- Travel lengths to 40 mm
- 3.5 kg max payload
- Non-contact fully preloaded air bearings
- Ironless cog-free linear motor
- Integral optical linear encoder
- Resolutions to 20nm
- Velocity to 0.5 m/sec
- Acceleration to 0.75 g

Overview

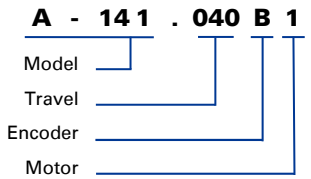
The PIglide MB air bearing stage is linear servo motor driven with fully preloaded air bearings and an integral optical linear encoder. This stage offers ultra-precision in a miniature package. The combination of non-contact components results in a frictionless motion platform that offers the highest performance, quality, and life. This stage is ideally suited for many high precision applications, such as metrology, photonics alignment, optics positioning, and scanning. The non-contact design also makes these stages ideal for cleanroom applications. There are no moving electrical cables to manage. The air bearing offers a locking design for the ultimate in position stability.

Accessories and Options

- Air preparation kits
- Single or multi-axis motion controller and servo drives
- Additional accessories available upon request

Model	A-141.040B1
Travel	40 mm
Drive System	Brushless linear servo motor, 3-phase
Feedback System	Non-contact optical linear encoder
Motor Bus Voltage	Up to 80 VDC
Motor Force Constant	2.1 N/A
Motor Back EMF	0.7 V/m/sec
Motor Resistance (@25°C, phase-to-phase)	22.4 ohms
Limit Switches	Differential, at each end of travel
Home Index	Near center of travel, repeatable to +/- 1 encoder count
Maximum Velocity [1]	Up to 0.5 m/sec
Maximum Acceleration [1]	Up to 0.75 g
Maximum Payload [2]	3.5 kg
Accuracy [3]	+/-3.0 µm
Repeatability	+/-0.2 µm
Encoder Resolution [4]	20 nm
Straightness & Flatness [5]	< 1µm TIR over full travel
Pitch & Yaw [5]	< 2 arc-sec TIR over full travel
Stage Mass	0.6 kg
Moving Mass	0.3 kg
Cabling	Internal, non-moving
Operating Pressure [6]	65 +/-5 psi (450 +/-35 kPa)
Air Consumption	< 1.0 SCFM (28 SLPM)
Air Quality	Clean (filtered to 1.0 µm or better) / Oil-free / Dry (-15 °C dew point)
Construction	Hardcoat Aluminum / SS Fasteners

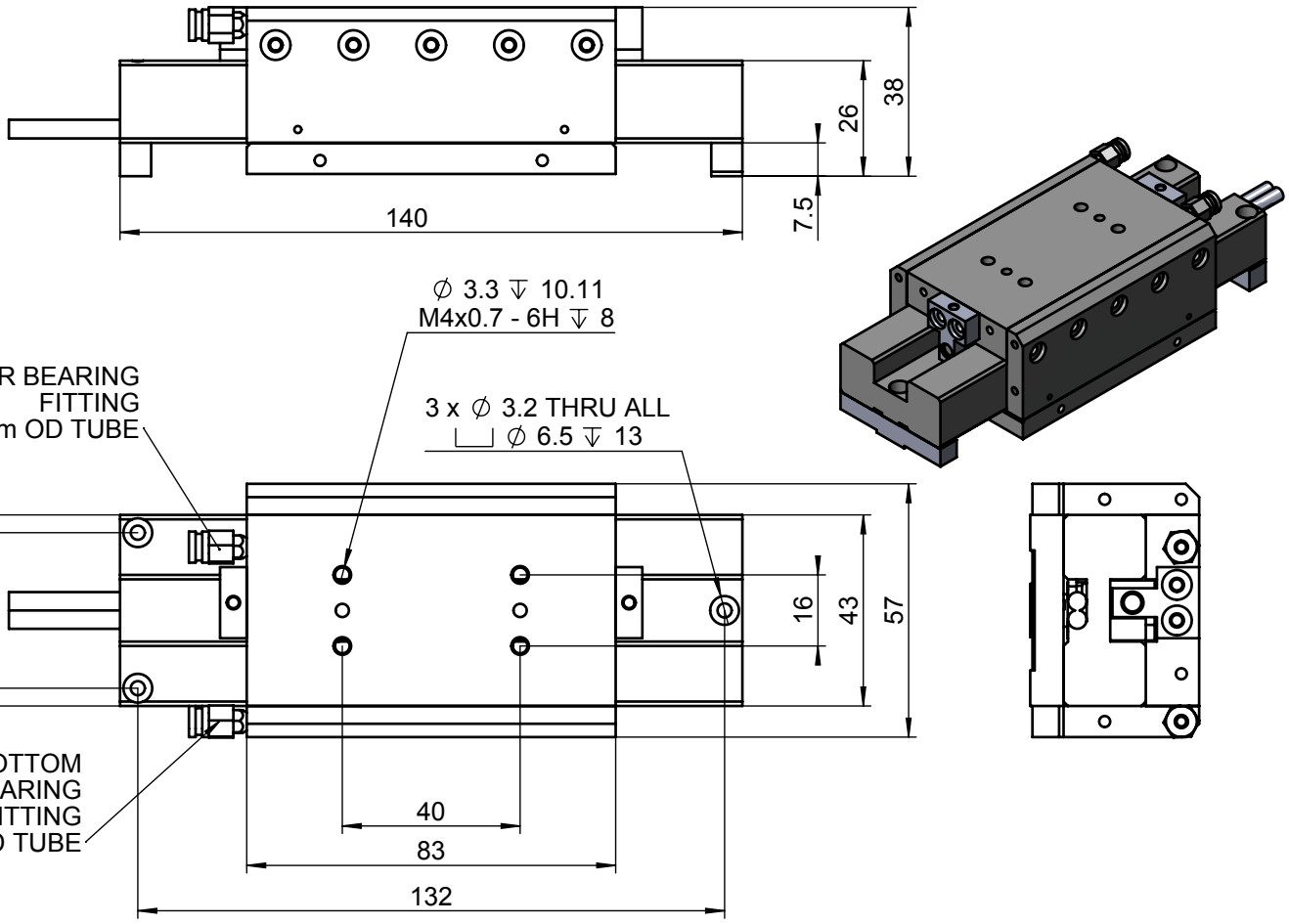
1. Maximum velocity and acceleration based on stage capability, may be limited by controller or drive performance.
2. Assumes payload CG is centered no more than 50mm above the stage table.
3. Improved accuracy can be obtained with controller-based error compensation.
4. Encoder resolution can be changed upon request, please contact PI for a quote.
5. Dependent on the flatness of the surface to which the stage is mounted.
6. To protect stage from damage, an under-pressure air sensor tied to the controller E-stop input is recommended.



Model	Travel	Encoder [1]	Motor Wiring
A-141	040 = 40 mm	B = 20 nm/count TTL A-quad-B output	1 = Standard motor option, 48 VDC

1. Alternate encoder resolutions available on request.

Ordering Example
Part# A-141.040B1 is a
Model: A-141 (PIglide MB miniature linear motorized air bearing stage)
Travel: 40 mm
Encoder: B (20 nm/count TTL A-quad-B output)
Motor Wiring: 1 (48 VDC)



Model A-141.040, in mm

PIglide LC: Linear Air Bearing Stage

HIGH PERFORMANCE AFFORDABLE NANOPOSITIONING SYSTEM

A-110 Series

- Ideal for scanning or high-resolution positioning
- Cleanroom compatible
- Customizable
- Table size 160 mm x 200 mm
- Travel lengths to 400 mm
- 10 kg max payload
- Non-contact fully preloaded air bearings
- Ironless cog-free linear motor
- Integral optical linear encoder
- Resolutions to 1nm
- Velocity to 1 m/sec
- Acceleration to 1 g

Overview

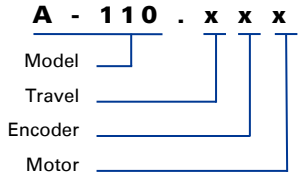
The PIglide LC series of stages are linear servo motor driven with fully preloaded air bearing and an integral optical linear encoder. The combination of these non-contact components results in a frictionless motion platform that offers the highest performance, quality and life. These stages are ideally suited for many high precision applications, such as metrology, photonics alignment, semiconductor, flat panel display and precision scanning applications. The non-contact design also makes these stages ideal for cleanroom applications.

Accessories and Options

- Air preparation kit
- Single or multi-axis motion controller and servo drives
- Additional accessories available on request
- XY stacks and custom configurations available upon request

Model	A-110.100	A-110.200	A-110.300	A-110.400
Travel (limit to limit)	100 mm	200 mm	300 mm	400 mm
Drive System	Brushless linear servo motor, 3-phase			
Feedback System	Non-contact optical linear encoder			
Motor Bus Voltage	Up to 80 VDC (48 VDC nominal)			
Motor Force Constant	4.2 N/A	12 N/A		
Motor Back EMF	4.2 V/m/sec	12 V/m/sec		
Motor Resistance (@25°C, phase-to-phase)	8.2 ohms	5.2 ohms		
Limit Switches	Normally closed			
Home Switch	Near end of travel			
Maximum Velocity (1)	Up to 1 m/sec			
Maximum Acceleration (1)	Up to 1 g			
Maximum Payload (2)	10 kg			
Accuracy (3)	+/-2.0 µm	+/-2.0 µm	+/-2.5 µm	+/-3.0 µm
Repeatability	+/-0.5 µm			
Encoder Resolution (4)	up to 1 nm			
Straightness & Flatness (5)	< 0.1 µm / 25mm	2µm TIR overall		
Pitch & Yaw (5)	2 arc-sec TIR	2 arc-sec TIR	4 arc-sec TIR	6 arc-sec TIR
Stage Mass	7.5 kg	11 kg	12 kg	14 kg
Moving Mass	2.5 kg	2.6 kg		
Cabling	Internal	External, moving loop		
Operating Pressure (6)	65 (+/-5) psi (450 +/-35 kPa)			
Air Consumption	< 1.0 SCFM (28 SLPM)			
Air Quality	Clean (filtered to 1.0 µm or better) / Oil-free / Dry (-15 °C dew point)			
Construction	Hardcoat Aluminum / SS Fasteners			

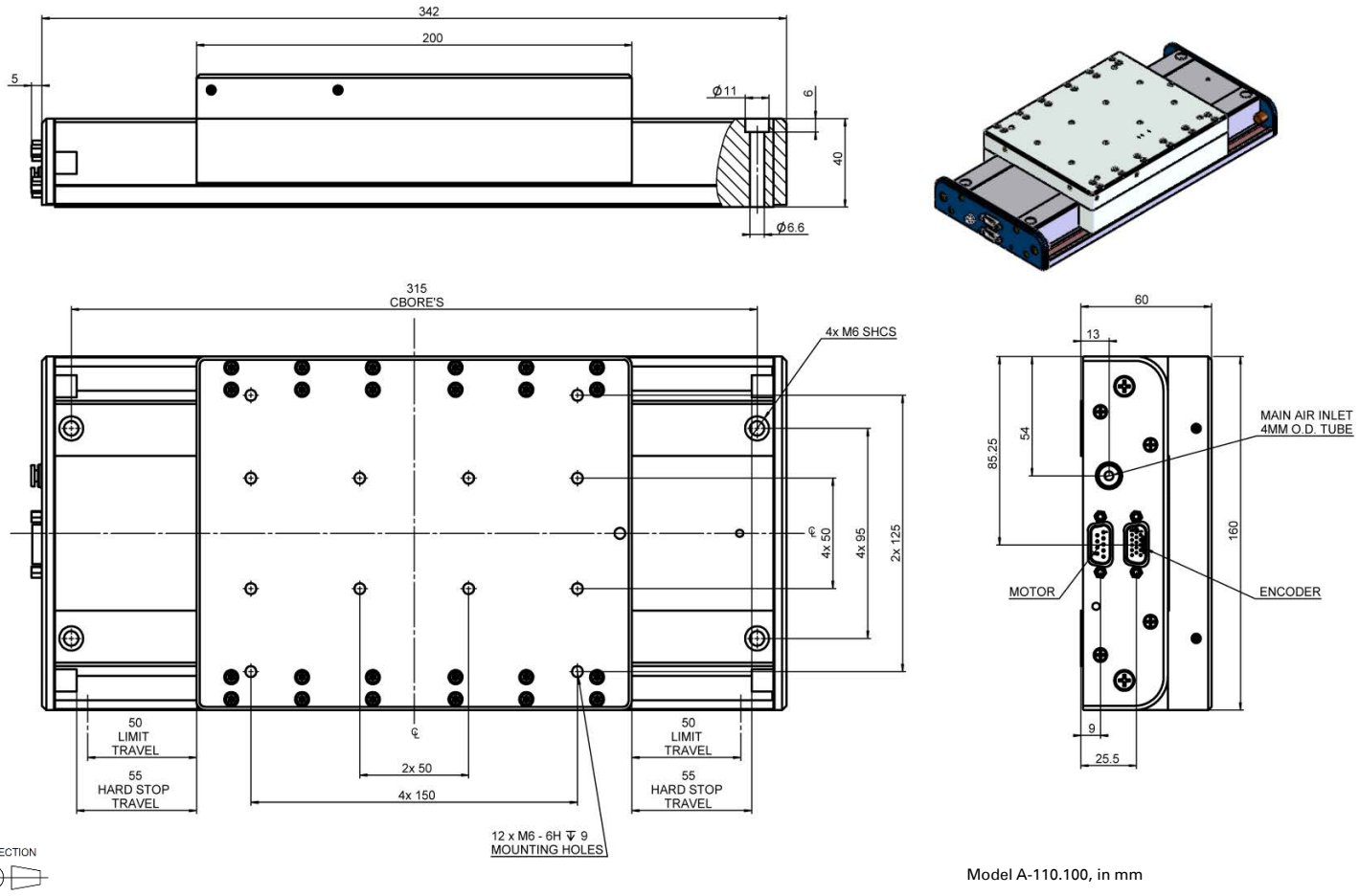
1. Maximum velocity and acceleration based on stage capability, may be limited by controller or drive performance.
2. Assumes payload CG is centered no more than 50mm above the stage table.
3. Improved accuracy can be obtained with controller-based error compensation.
4. Encoder resolution depends on options chosen and interpolation used.
5. Dependent on the flatness of the surface to which the stage is mounted.
6. To protect stage from damage, an under-pressure air sensor tied to the controller E-stop input is recommended.



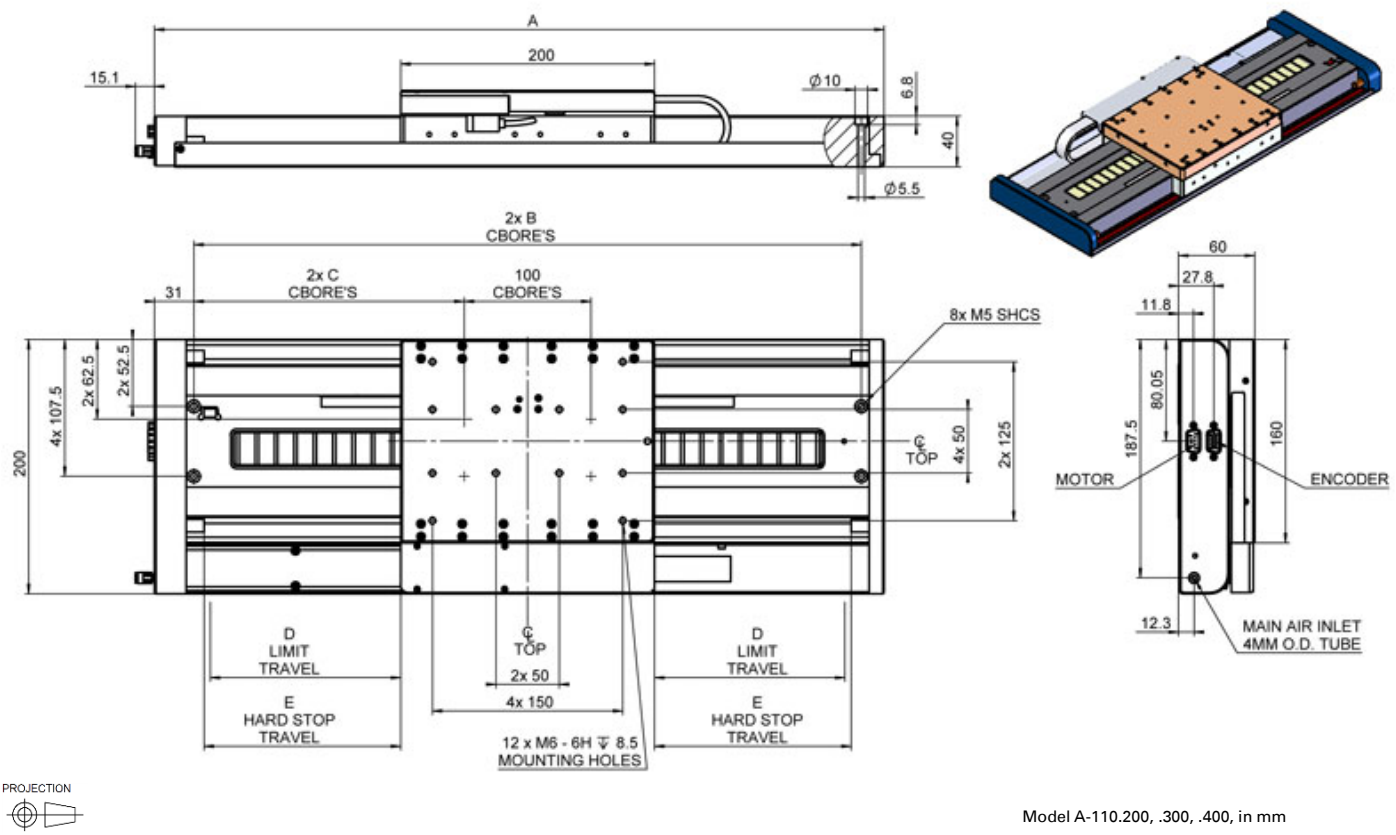
Model	Travel	Encoder (1)	Motor Wiring
A-110	100	A = 20 µm/line sine output (1 Vp-p)	1 = Standard motor option, 48 VDC
	200		
	300		
	400		

1. Alternate encoder options, such as TTL quadrature output, are available on request.

Ordering Example
Part# A-110.300A1 is a
Model: A-110 (Plglide LC linear motorized air bearing stage)
Travel: 300 mm
Encoder: A (20 µm/line sine output, 1 Vp-p)
Motor Wiring: 1 (48 VDC)



Model A-110.100, in mm

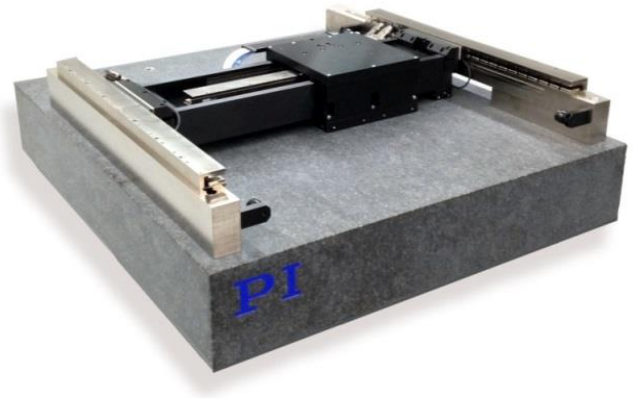


Model A-110.200, .300, .400, in mm

Model	A	B	C	D	E
A-110.200	475	400	150	100	105
A-110.300	575	526	213	150	155
A-110.400	675	626	263	200	205

PIglide HS: Planar Air Bearing Stage

ULTRA PERFORMANCE XY NANOPOSITIONING SYSTEM



A-322 Series

- Ideal for scanning or high-resolution positioning
- Clean room compatible
- Customizable
- Travel lengths to 500 mm x 1000 mm
- Load to 15 kg max
- Non-contact fully preloaded air bearings
- Resolution to 1 nm
- Velocity to 1 m/sec
- Acceleration to 1 g
- Straightness/Flatness to 0.25 µm
- Active yaw control and error compensation
- Dynamic mapping achieves near "laser" performance
- Active error compensation algorithms for straightness

Overview

The PIglide HS planar air-bearing stage has been designed to maximize throughput while providing the ultimate level of precision. This stage is ideal for wafer inspection and scribing applications, as well as other ultra-precision motion applications such as flat panel inspection.

Flexural coupling of the cross beam to the lower axis provides yaw-compliance without sacrificing system stiffness. The gantry axis cross beam incorporates dual linear motors and dual linear encoders. Ironless linear motors provide smooth motion and no cogging or attractive forces. Both incremental and absolute encoder options are available. The PIglide HS incorporates three high-accuracy linear encoders, one for the bridge axis and two for the gantry axis.

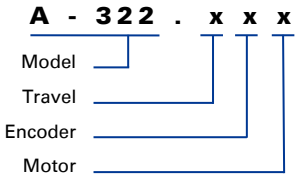
The PIglide HS can be coupled with a variety of industry-leading digital controls and drives that offer advanced algorithms to improve dynamic performance and error compensation and a wide suite of software development tools.

Accessories and Options

- Air preparation kits
- Multi-axis motion controller and servo drives
- Machine bases
- Vibration isolation systems
- Additional accessories and customizations available on request

Model A-322.BB1	X-Axis (Cross Axis)	Y-Axis (Lower Axis)
Travel (limit to limit)	350 mm	500 mm
Drive System	Brushless linear servo motor, 3-phase	
Feedback System	Non-contact optical linear encoder	
Motor Bus Voltage	Up to 80 VDC (48 VDC nominal)	
Maximum Velocity [1]	Up to 1 m/sec	
Maximum Acceleration [1]	Up to 1 g	
Maximum Payload [2]	15 kg	
Accuracy [3]	+/-1.0 µm	
Repeatability	+/-50 nm	
Servo Stability [5]	+/-10 nm	+/-15 nm
Velocity Stability [5]	< 0.06% @ 80 mm/sec	< 0.1% @ 80 mm/sec
Encoder Resolution [4]	Up to 1.0 nm	
Flatness	< 0.1 µm / 25 mm 2.0 µm TIR overall	< 0.1 µm / 25mm 4.0 µm TIR overall
Straightness [3]	< 0.1 µm / 25 mm 1.0 µm TIR overall	< 0.1 µm / 25 mm 1.0 µm TIR overall
Pitch	4 arc-sec TIR	6 arc-sec TIR
Yaw [3]	0.6 arc-sec TIR	0.4 arc-sec TIR
XY Orthogonality	+/-2 arc-sec	
Step and Settle [1]	10 mm step, settle to +/-0.1 µm within 150 msec 20 mm step, settle to +/-0.1 µm within 190 msec 50 mm step, settle to +/-0.1 µm within 262 msec	
Stage Mass	705 kg	
Moving Mass	13 kg	39 kg
Operating Pressure [6]	65 (+/-5) psi (450 +/-35 kPa)	
Air Consumption	< 2.0 SCFM (56 SLPM)	
Air Quality	Clean (filtered to 1.0µm or better) and oil-free / Dry (-15 °C dew point)	
Construction	Hardcoat Aluminum with SS Fasteners / Granite Base [7]	

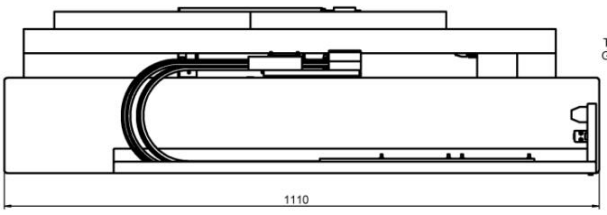
1. Maximum velocity and acceleration based on stage capability, may be limited by controller or drive performance.
2. Assumes payload CG is centered no more than 50mm above the table.
3. Values shown obtained using controller-based error compensation.
4. Encoder resolution depends on options chosen and interpolation used.
5. Dependent on the machine base and isolation system to which the stage is mounted.
6. To protect stage from damage, an under-pressure air sensor tied to the controller E-stop input is recommended.
7. Other materials are available, please contact a PI Sales Engineer for more information.

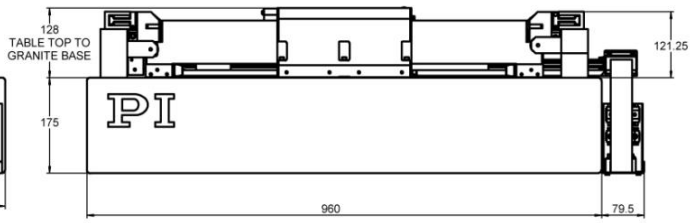


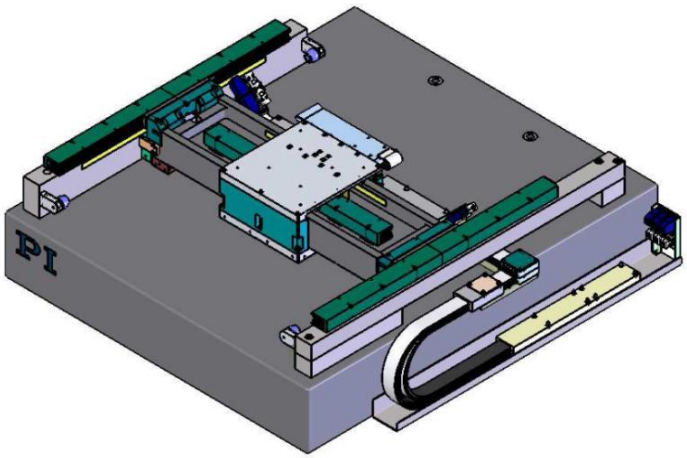
Model	Travel (X-Axis x Y-Axis)	Encoder [1]	Motor Wiring
A-322	A = 350 mm x 350 mm	A = 20 µm/line incremental Sine output (1 Vp-p)	1 = Standard motor option, 48 VDC
	B = 350 mm x 500 mm	B = 1 nm absolute BiSS serial output	
	C = 500 mm x 500 mm		
	D = 500 mm x 1000 mm		

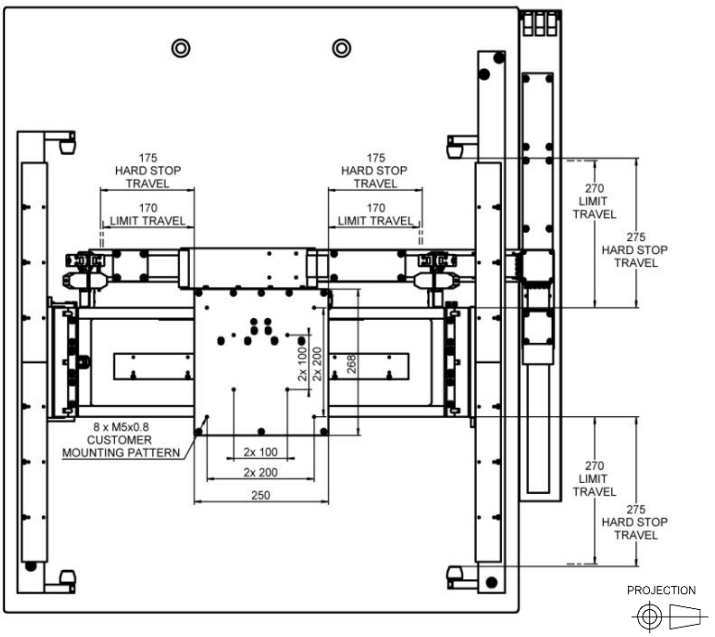
1. Alternate encoder options, such as TTL quadrature output, are available on request.

Ordering Example
Part# A-322.BB1 is a
Model: A-322 (PIglide HS planar motorized air bearing stage)
Travel: B (350 mm x 500 mm
Encoder: B (1 nm absolute BiSS)
Motor Wiring: 1 (48 VDC)





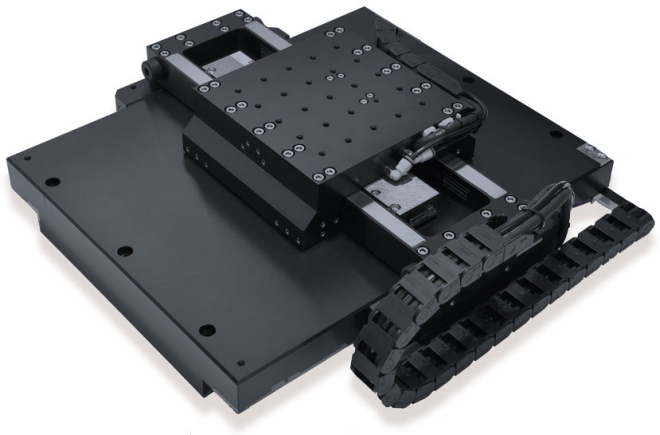




Model A-322.Bxx, in mm

PIglide IS: Planar XY Air Bearing Stage

ULTRA PERFORMANCE, COMPACT XY NANOPOSITIONING SYSTEM



A-311 Series

- Ideal for scanning or high-resolution positioning
- Clean room compatible
- Customizable
- Travel lengths to 200mm x 200mm
- Load to 15kg max
- Non-contact fully preloaded air bearings
- Low profile design
- Resolution to 1nm
- Velocity to 1m/sec
- Acceleration to 1g

Overview

The PIglide IS planar XY air-bearing stage is a low profile, high precision alternative to stacked XY stages. The fully preloaded air bearing puck floats in both X and Y directions on a common base, providing smooth, frictionless motion. Ideal for inspection, laser marking, microscopy, scanning, and other precision motion applications. The efficient, compact design saves space in tight machine designs. Ironless linear motors provide smooth motion with no cogging or attractive forces. Optical linear encoders provide position feedback information down to 1nm, depending on interpolation.

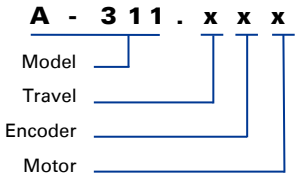
The PIglide IS can be coupled with a variety of industry-leading digital controls and drives that offer advanced algorithms to improve dynamic performance and error compensation and a wide suite of software development tools.

Accessories and Options

- Air preparation kits
- Multi-axis motion controller and servo drives
- Machine bases
- Vibration isolation systems
- Additional accessories and customizations available

Model A-311.BA1	X-Axis (Lower Axis)	Y-Axis (Upper Axis)
Travel	150 mm	150 mm
Drive System	Brushless linear servo motor, 3-phase	
Feedback System	Non-contact optical linear encoder	
Motor Bus Voltage	Up to 80 VDC (48 VDC nominal)	
Maximum Velocity [1]	Up to 1 m/sec	
Motor Force Constant	12.3 N/A	
Motor Back EMF	10.1 V/m/sec	
Motor Resistance (@25°C, phase-to-phase)	2 ohms	
Maximum Acceleration [1]	Up to 1 g	
Maximum Payload [2]	15 kg	
Accuracy [3]	+/-5.0 µm	
Repeatability	+/-0.5 µm	
Encoder Resolution [4]	Up to 1.0 nm	
Flatness [5]	<0.1µm / 25 mm, 1 µm TIR overall	
Straightness	<0.1µm / 25mm, 1 µm TIR overall	<0.1µm / 25mm, 1 µm TIR overall
Roll/Pitch	1 arc-sec TIR	
Yaw	2 arc-sec TIR	
XY Orthogonality	5 arc-sec	
Stage Mass	20 kg	
Moving Mass	5 kg	2.5 kg
Operating Pressure [6]	65 (+/-5) psi (450 +/-35 kPa)	
Air Consumption	< 2.0 SCFM (56 SLPM)	
Air Quality	Clean (filtered to 1.0µm or better) and oil-free Dry (-15 °C dew point)	
Construction	Hardcoat Aluminum with SS Fasteners	

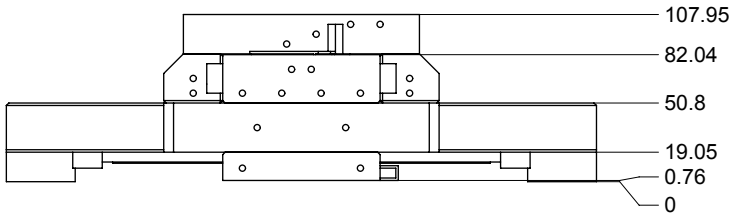
1. Maximum velocity and acceleration based on stage capability, may be limited by controller or drive performance.
2. Assumes payload CG is centered no more than 50mm above the stage table.
3. Can be improved using controller-based error compensation.
4. Encoder resolution depends on options chosen and interpolation used.
5. Dependent on the machine base and isloation system to which the stage is mounted.
6. To protect stage from damage, an under-pressure air sensor tied to the controller E-stop input is recommended.

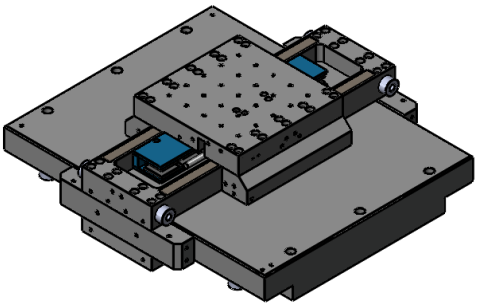


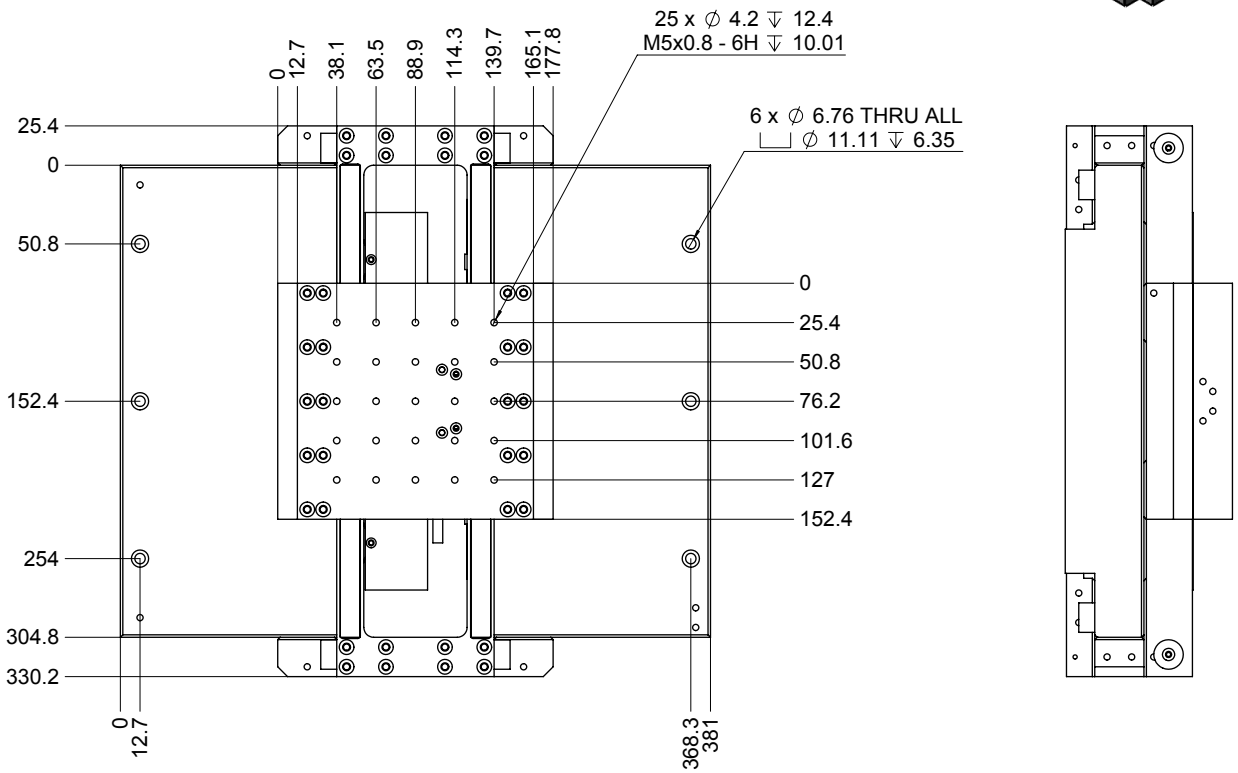
Model	Travel (X-Axis x Y-Axis)	Encoder (1)	Motor Wiring
A-322	A = 100 mm x 100 mm	A = 20 µm/line incremental Sine output (1 Vp-p)	1 = Standard motor option, 48 VDC
	B = 150 mm x 150 mm		
	C = 200 mm x 200 mm		

1. Alternate encoder options, such as TTL quadrature output, are available on request.

Ordering Example
Part# A-311.BA1 is a
Model: A-311 (PIglide IS planar motorized air bearing stage)
Travel: B (150 mm x 150 mm)
Encoder: A (20 µm/line sine output, 1 Vp-p)
Motor Wiring: 1 (48 VDC)





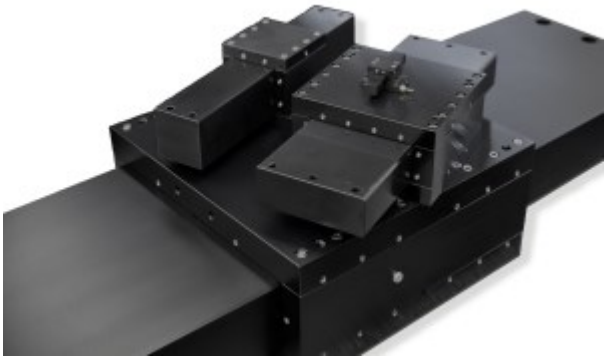


PROJECTION

Model A-311.Bxx, in mm

PIglide RB: Linear Air Bearing

FRICTIONLESS, IDEAL FOR POSITIONING, SCANNING, METROLOGY



A-10X Series

- Ideal for scanning or high-resolution positioning
- Clean room compatible
- Table sizes up to 300mm x 300mm
- Travel lengths up to 1m
- Load to 775kg
- Straightness/Flatness to 0.5µm / 25mm
- Pitch/Roll/Yaw to 0.25 arc-sec / 25mm

Overview

For applications that require smooth, precise, linear motion, the PIglide RB series linear air bearings are right for you. These bearings can easily replace ball bearing and crossed roller bearing slides, and are simple to integrate and use.

They offer better straightness, angular deviation, and repeatability than ball bearing slides, especially for travel lengths over 4". In addition, because air bearings are inherently frictionless, they do not exhibit breakaway or running friction, even under their maximum loading. The totally noncontact, clean nature of air bearings means that they are virtually maintenance free and their accuracy won't degrade over time due to wear.

Accessories and Options

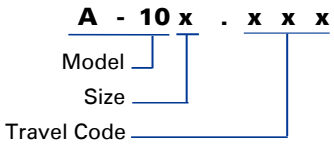
- Air preparation kit
- Mounting feet
- Custom configurations available upon request

Model	Table Size Length x Width (mm x mm)	Travels Available (mm)	Load Capacity (N)	
			Normal	Lateral
A-101	50 x 50	50 - 200	130	75
A-102	50 x 100	50 - 300	260	260
A-103	75 x 75	50 - 300	350	195
A-104	75 x 115	50 - 300	540	540
A-105	100 x 100	50 - 300	630	370
A-106	100 x 150	50 - 600	950	950
A-107	150 x 150	50 - 750	1580	790
A-108	200 x 200	50 - 1000	2950	1475
A-109	300 x 300	50 - 1000	7600	2210

Note: Load capacities listed assume supply pressure of 80 psi.

		Travels to 300 mm	Travels to 600 mm	Travels to 1000 mm
Straightness & Flatness (TIR)	Short-term	0.5µm / 25mm		
	Overall	2.5 µm	5.0 µm	10.0 µm
Stability	+/- 0.05 µm			
Pitch & Yaw (TIR)	Short-term	0.25 arc-sec / 25 mm		
	Overall	2.0 arc-sec	4.0 arc-sec	6.0 arc-sec
Operating Pressure	80 psi (550 kPa) nominal			
Air Consumption	< 1.0 SCFM (28 SLPM)			
Air Quality	Clean (filtered to 1.0 µm or better) Oil-free Dry (-15 °C dew point)			
Construction	Hardcoat Aluminum SS Fasteners			

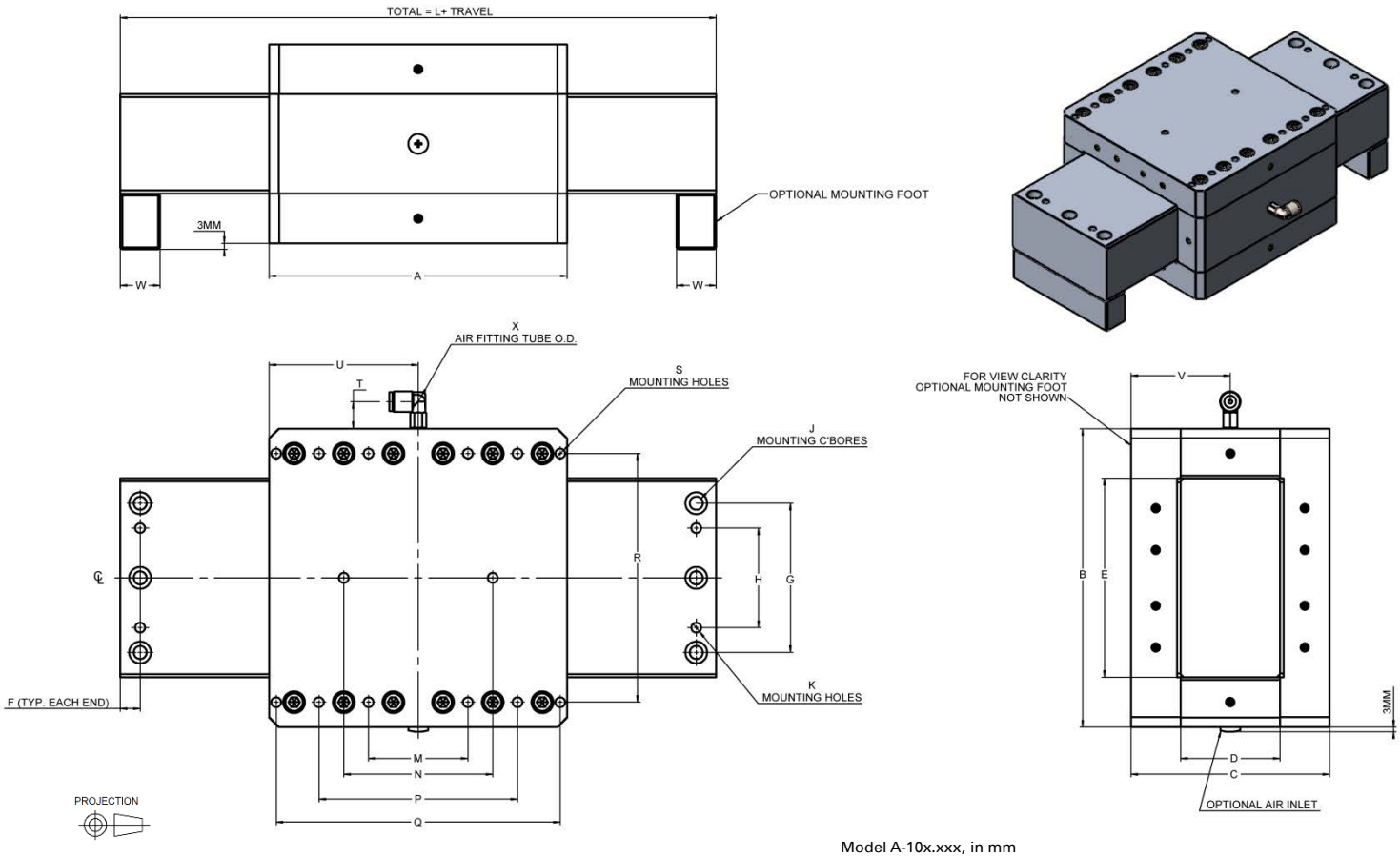
Note: Precision specifications are dependent on load, orientation, and external forces on the bearing. Please consult PI for application-specific parameters.



Code	Travel (mm)
50	50
100	100
150	150
200	200
300	300
450	450
600	600
750	750
A00	1000

Ordering Example
Part# A-102.450 is a
Model: A-10 (PIglide RB linear air bearing)
Size: 2 (50x100mm table)
Travel: 450mm

Accessories
Order the A10x-MNT mounting feet kit separately.
Check the drawing and table on following page for dimensions.
x = size (1...9)



Model A-10x.xxx, in mm

Model	A	B	C	D	E	F	G	H	J	K	L	M	N	P	Q	R	S	T	U	V	W	X
A-101	50	50	35	15	25	5	15	CL	4x M3 C'BORE	2x M3	80	15	40	N/A	N/A	40	6x M3	12	21	30	10	4 (5/32")
A-102	100	50	45	25	25	5	15	CL	4x M3 C'BORE	2x M3	130	15	40	60	N/A	40	10x M3	12	46	40	10	6 (1/4")
A-103	75	75	55	25	45	7.5	30	12.5	4x M5 C'BORE	2x M5	115	35	N/A	N/A	N/A	60	4x M5	14	37.5	47.5	15	6 (1/4")
A-104	115	75	75	45	45	7.5	30	12.5	4x M5 C'BORE	2x M5	155	50	N/A	N/A	N/A	60	4x M5	14	57.5	67.5	15	6 (1/4")
A-105	100	100	75	35	60	10	40	20	4x M6 C'BORE	2x M6	150	50	N/A	N/A	N/A	80	4x M6	14	50	37.5	20	6 (1/4")
A-106	150	100	100	60	60	10	40	20	4x M6 C'BORE	2x M6	200	50	N/A	110	N/A	80	8x M6	14	75	50	20	6 (1/4")
A-107	150	150	100	50	100	10	75	50	6x M6 C'BORE	4x M6	200	50	N/A	110	N/A	125	8x M6	14	75	50	20	6 (1/4")
A-108	200	200	130	70	140	10	100	50	6x M6 C'BORE	4x M6	250	50	N/A	150	N/A	170	8x M6	14	100	65	20	6 (1/4")
A-109	300	300	140	70	240	10	200	100	6x M6 C'BORE	4x M6	350	50	N/A	150	250	270	12x M6	14	150	65	20	6 (1/4")

PIglide HB: Hemispherical Air Bearing

FRICTIONLESS, IDEAL FOR ROTATIONAL MOTION IN THREE AXES

A-65X Series

- Clean room compatible
- Low intertia
- Diameters up to 300mm
- Freedom of rotation in three directions
- Load to 635kg
- Range of tip/tilt motion up to +/- 45 degrees
- Operating pressures from 30 to 90 psi
- Ideal for satellite attitude control testing and zero-g simulation

Overview

The PIglide HB series spherical air bearing enables unique positioning and simulation applications in both research and industrial fields. These bearings provide excellent load capacity and stiffness while allowing three axes of inherently frictionless rotational motion. Commonly used for zero-g satellite research, spherical bearings are also used in systems for precision chip bonding and optical alignment. Extremely rigid spindles can be made using a spherical bearing at each end of the spindle shaft. This arrangement also allows precision alignment of the spindle shaft on the fly by moving one spherical bearing relative to the other.

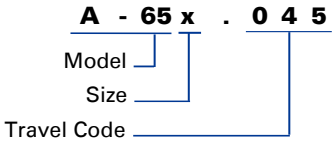
Accessories and Options

- Air preparation kit
- Mounting pedestals
- Custom configurations available upon request

Model	Sphere Dia. (mm)	Travel [2] (+/- °)	Load Capacity [1] (kg)	Mass (g)		Moment of Inertia [3] (g*m²)
				Base	Sphere	
A-651	50	45	15	115	70	0.02
A-652	75	45	35	235	215	0.15
A-653	100	45	65	550	475	0.6
A-654	150	45	160	1350	1475	4.5
A-655	200	45	265	2500	3350	18
A-656	250	45	405	4000	5525	48
A-657	300	45	635	6500	8100	103

1. Load capacities listed assume supply pressure of 80 psi. Contact PI to determine load capacity if alternate supply pressures are required.
2. Other travels available upon request.
3. About the sphere center.

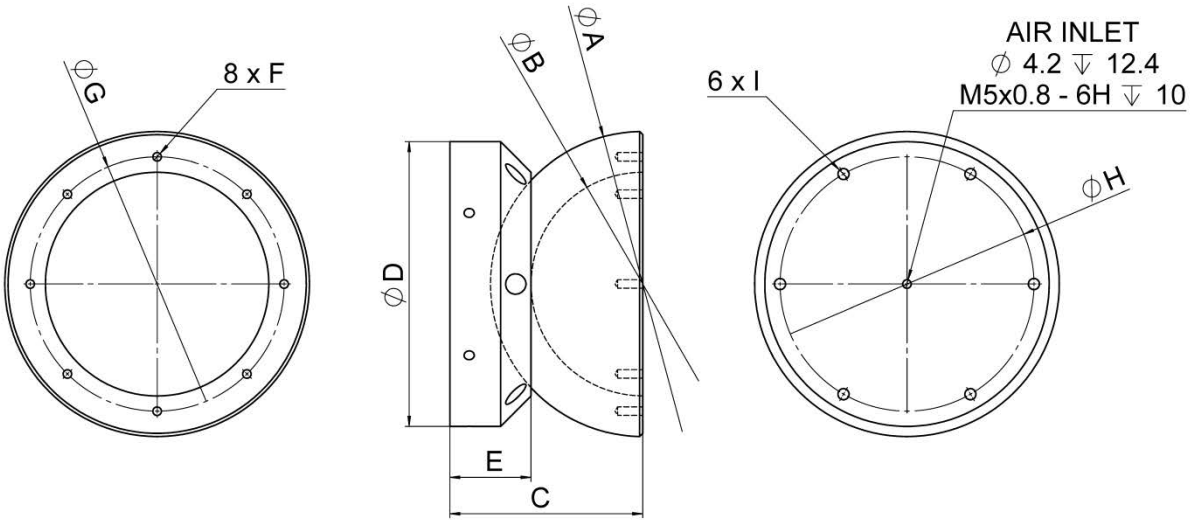
Operating Pressure:	80 psi (550 kPa) nominal, 90 psi maximum
Air Consumption:	< 1.0 SCFM (28 SLPM)
Air Quality:	Clean (filtered to 1.0 µm or better) and oil-free Dry (-15 °C dew point)
Materials:	Hardcoat aluminum, stainless steel fasteners Alternate materials available upon request



Ordering Example
Part# A-652.045 is a
Model: A-65 (PIglide HB hemispherical air bearing)
Size: 2 (75mm diameter hemisphere)
Travel: 045 (+/-45 degrees)

Accessories
Order the A65x-PED pedestal mounting kit separately.
x = size (1...7)

PIglide HB Hemispherical Air Bearing, shown on optional pedestal mount; sold separately.



Model A-65x.045, in mm

Model	A	B	C	D	E	F	G	H	I
A-651	30	30	42	55	23	M3	38	M3	45
A-652	50	50	55	70	27	M3	60	M3	60
A-653	70	70	70	100	30	M4	85	M4	85
A-654	110	110	95	140	40	M5	125	M5	125
A-655	150	150	125	170	50	M5	175	M5	150
A-656	200	200	150	210	55	M6	225	M6	190
A-657	250	250	175	250	65	M6	250	M6	230

PIMag®

Magnetic Direct Drive Technology

Drive technology and control know-how as well as an expertise in bearings and encoders allow for a broad range of motors for system integration. Proprietary developments also include high-resolution force sensors for manufacturing and test equipment.

Ironless Linear Motors

- High acceleration and velocity
- Linear stages, planar scanners, PIMag® 6D positioning system
- Torque motors for rotation stages

Voice Coil Drives

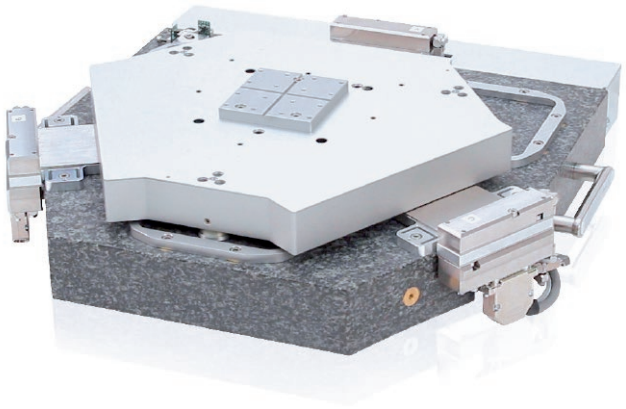
- High dynamics for fast scanning and positioning
- OEM actuators, linear scanners, Hexapods
- Optional force sensors

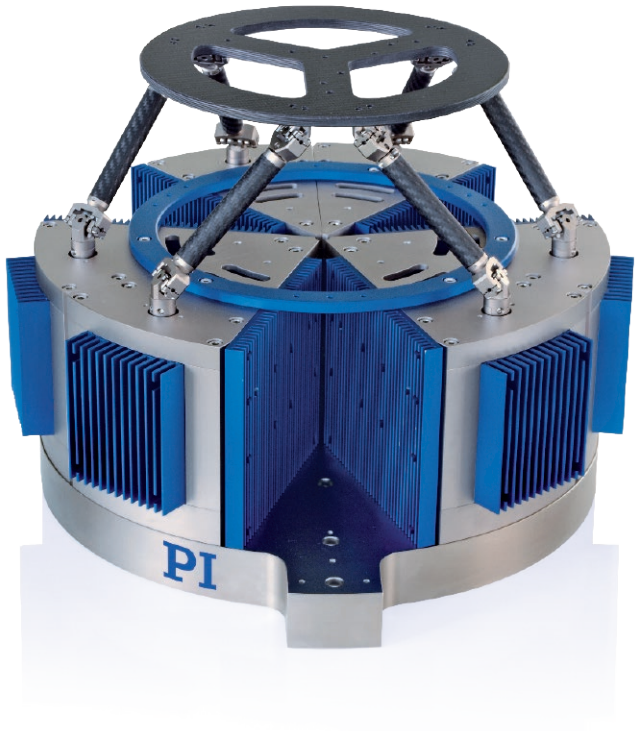
Drive Technology Beyond Standard

- Highest accelerations up to 60g with resonance motor
- Highest force density for single phase linear motors with reluctance motor and cylindrical Halbach arrays
- High force density and low weight with linear Halbach arrays

Guiding Systems

- Plglide air bearings for frictionless motion and optimum straightness and flatness
- Active magnetic guidings align flatness during motion
- Flexure guidings provide frictionless motion over short strokes
- Ball and roller bearings from the leading suppliers





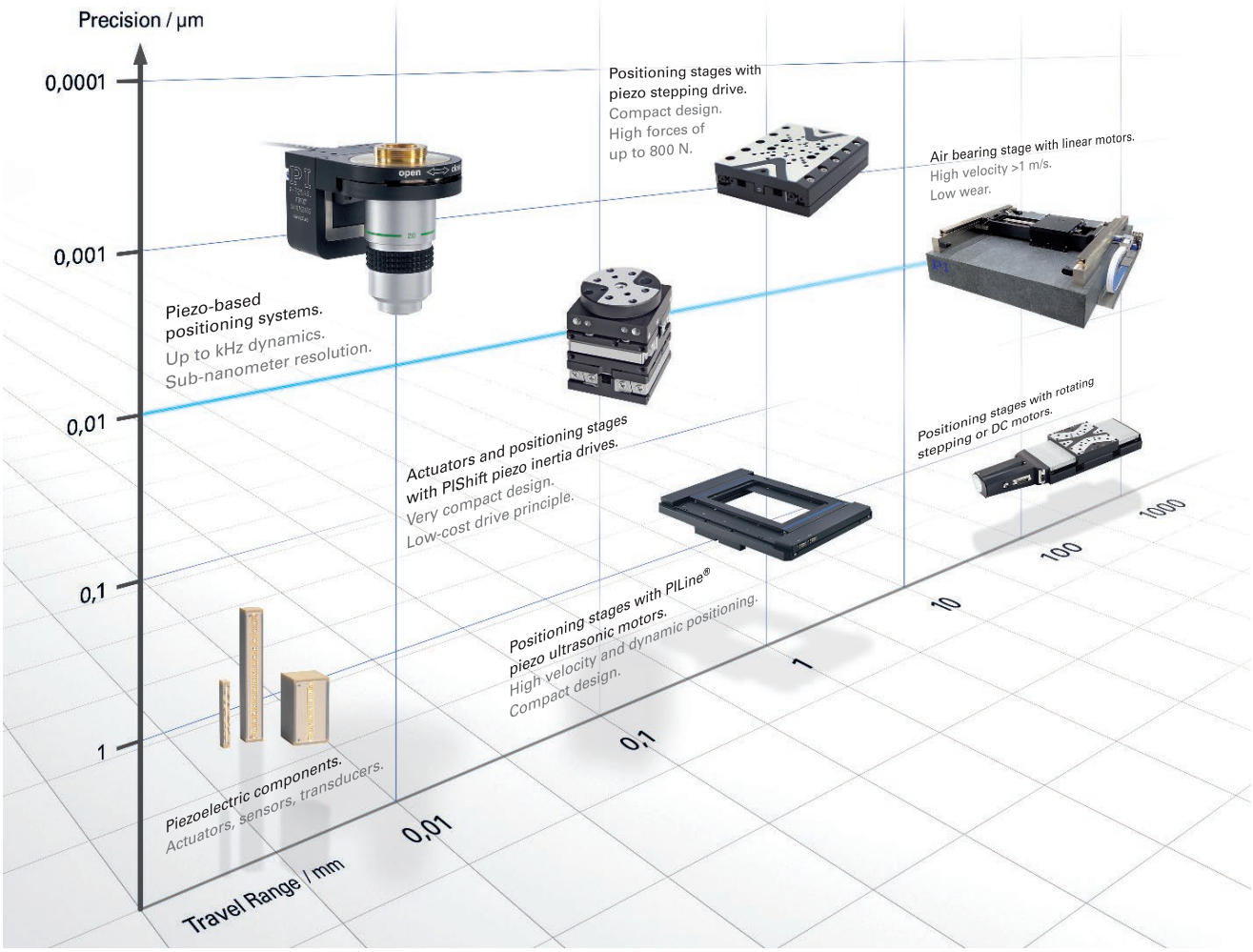
Technology

The Broadest and Deepest Portfolio

The technological scope of the PI Group is unique worldwide. PI develops, manufactures and qualifies all its core technologies itself. Thus PI is independent of components available on the market and offers individual solutions that go beyond the state of the art. Through its high measure of flexibility, PI plays a pioneering role in precision positioning and enables PI customers to benefit from distinct competitive advantages.

Core Technologies

- Piezo components, actuators and motors
- Magnetic drives
- Air bearing technology
- Guiding systems
- Nanometrology sensors
- Electronic amplifiers
- Digital controllers
- Software



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