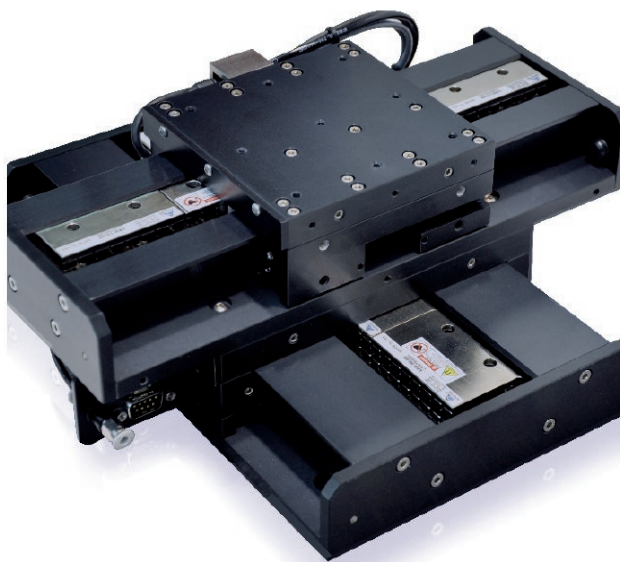


# Pliglide Air Bearing Products & Technology

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

# The Step Ahead with Air Bearing Technology



## FLEXIBLE AXIS CONFIGURATION

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

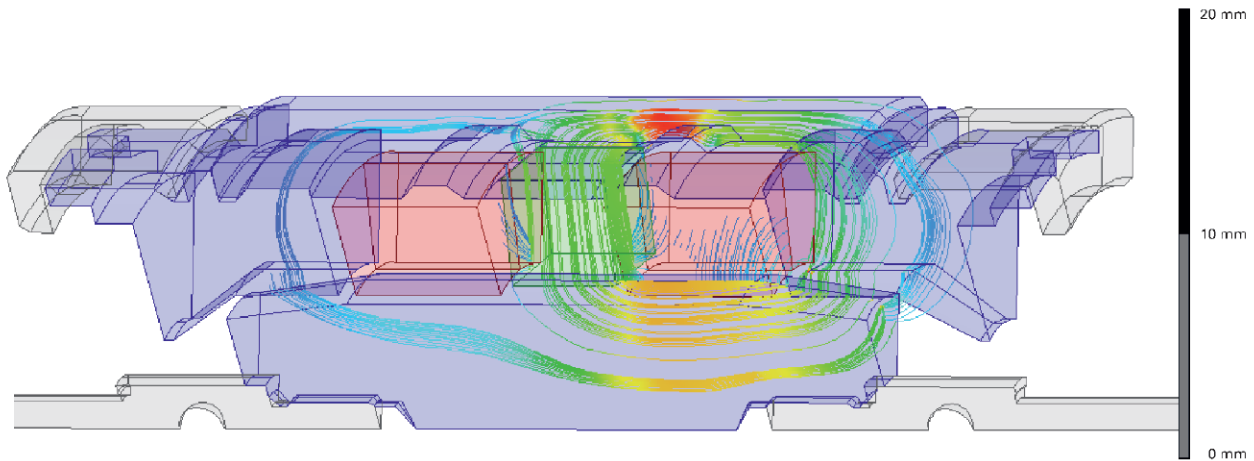
## NANOMETER PRECISION, SINGLE- & MULTI-AXIS MOTION

- Frictionless high-precision positioning
- Excellent velocity stability
- Excellent guiding accuracy up to 5  $\mu$ rad/100 mm
- Active yaw control for gantries
- Direct drive linear & torque motors for smooth, high speed scanning
- State of the art controls powered by ACS Motion Control

## EXPERIENCE WITH AIR BEARING TECHNOLOGY MATTERS FOR OEMS

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





Simulation of the magnetic field  $B$  of a reluctance motor. This drive principle allows a higher power density than can be achieved with voice coil drives and makes for most compact motors with maximum force generation.



## 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 inhouse with proprietary techniques.

## OEM USERS BENEFIT FROM TECHNOLOGICAL BREADTH

PI serves both the research and industrial markets. The complete control over the design and manufacturing process provides our customers with significant competitive advantages, as PI can modify and customize its products in all areas, from drive and sensor technology, to the control technology and software.

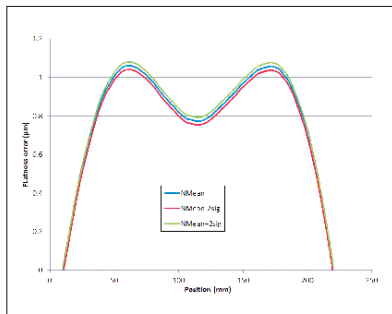
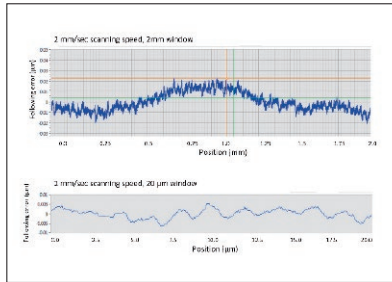
All system components are developed, manufactured and tested in-house. Optimized processes allow PI to deliver customized products in quantities up to several 100,000 units per year at low cost and right on time.

The range of OEM products offered by the PI Group varies widely, ranging from "bare" actuators and sensors to highly integrated parallel-kinematic positioning systems. Evaluation of pre-production run samples, test procedures, production processes and quality management are all included in the development process.

## 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.

# Characteristics of Air Bearings



## STRAIGHTNESS AND FLATNESS

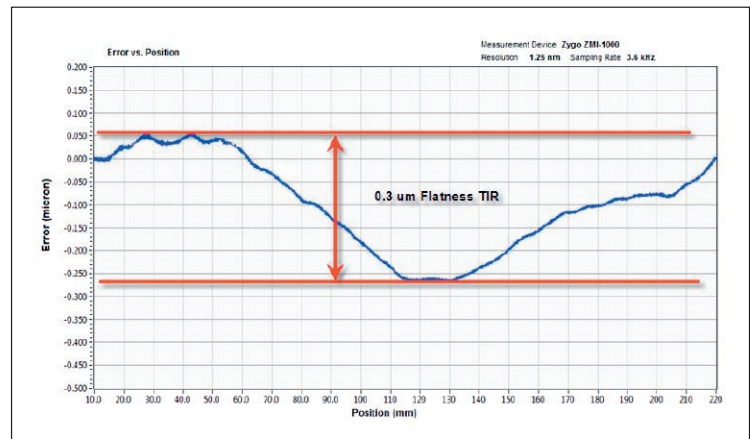
The total error motion over full travel is usually specified in microns TIR (Total Indicator Reading). TIR is specifying the peak-to-peak measurement of error motion. Symmetry about a zero reference is not assumed. Air bearing stages can typically achieve better than 1 µm flatness and straightness TIR for every 200 mm of travel.

## 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 tightly controlled speeds are best served by air bearing systems.

## REPEATABILITY OF 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 vibration, hysteresis or reversal error, making it highly repeatable and ideal for many inspection and manufacturing operations. Stiction is virtually eliminated, improving resolution capabilities and reducing in-position “hunting” (limit cycling). 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. Magnetic levitation is another option.



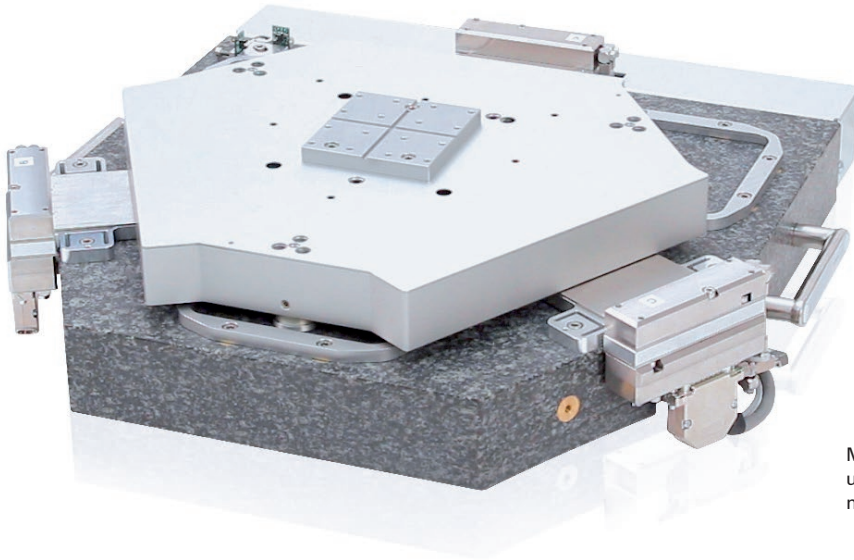
**Typical specifications are:**

Linear: Straightness/Flatness 0.1 µm/25 mm, Pitch/Yaw 0.5 arcsec/25 mm  
 Rotary: Radial/Axial Runout 0.1 µm, Wobble <1 arcsec



# PIMag<sup>®</sup>

## Magnetic Direct Drive Technology



Magnetic levitation guides achieve ultimate precision in this linear motor driven technology study

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

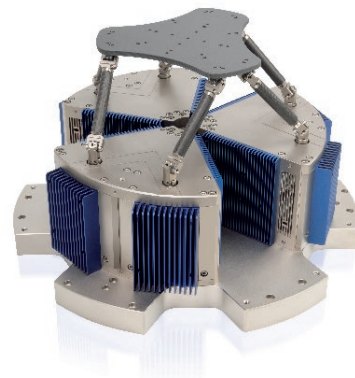
- High acceleration and velocity
- Linear stages, planar scanners, PIMag<sup>®</sup> 6D positioning system
- Torque motors for rotation stages Voice Coil Drives
- High dynamics for fast scanning and positioning
- OEM actuators, linear scanners, Hexapods
- Optional force sensors

### Drive Technology Beyond Standard

- Highest accelerations up to 60 g 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

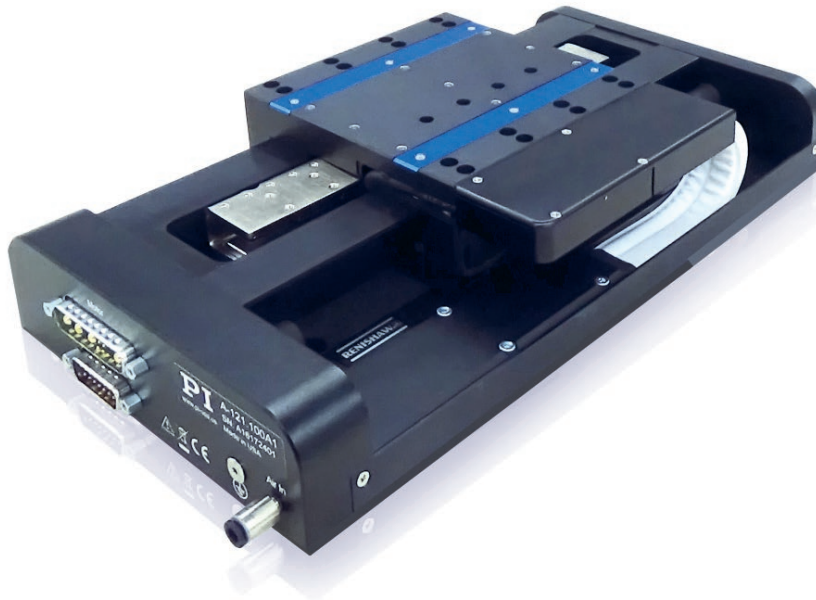
- PIGlide air bearings for frictionless motion and optimum straightness and flatness
- Active magnetic guidings align flatness during motion
- Flexure guidings provide frictionless motion over short strokes
- Ball and roller bearings from the leading suppliers



Dynamic 6-axis positioning with voice coil drives, H-860 hexapod

# A-121 Pliglide AT1 Linear Stage with Air Bearings

High Performance Small Footprint Nanopositioning Stage



- Ideal for scanning applications or high-precision positioning
- Cleanroom compatible
- Size of the motion platform 115 mm × 115 mm
- Travel ranges to 350 mm
- Low profile of 60 mm
- Resolution to 1 nm

The Pliglide AT1 series of air bearing stages is equipped with a servo drive linear motor with preloaded air bearings and integrated linear encoder. The combination of these non-contact components results in a frictionless motion platform that offers the highest performance, quality, and life.

A high-force linear motor can drive the stage to top speed within a few milliseconds. The dovetail preloaded air bearing design in this model will support normal, vertical, and side-mounted orientations.

## Accessories and options

- Encoder
- Pliglide filter and air preparation kits
- Multi-axis motion controller and servo drives
- XY setups and individual configurations
- Cable track variations
- Counterbalance options for vertical assembly
- Base plates made of granite and systems for reducing vibration

## Fields of application

Pliglide positioning systems are ideally suited for many high-precision applications, such as metrology, photonics, and precision scanning as well as in semiconductor or flat panel display manufacturing.

Thanks to the friction-free motion, no particles are formed, which makes Pliglide stages ideal for cleanroom applications.

	A-121.050	A-121.100	A-121.150	A-121.200	A-121.250	A-121.350	Unit	Tolerance
<b>Motion and positioning</b>								
Active axes	X	X	X	X	X	X		
Travel range	50	100	150	200	250	350	mm	
Pitch*	12	12	15	20	25	35	µrad	max.
Yaw*	12	12	15	20	25	35	µrad	max.
Straightness / Flatness*	±0.5	±0.5	±0.5	±0.75	±0.75	±1.25	µm	max.
Straightness / Flatness per 25 mm travel range*	0,1	0,1	0,1	0,1	0,1	0,1	µm	max.
Velocity, unloaded**	1	1	1	1	1	1	m/s	max.
Acceleration, unloaded**	20	20	20	20	20	20	m/s <sup>2</sup>	max.
<b>Mechanical properties</b>								
Load capacity in z***	100	100	100	100	100	100	N	max.
Load capacity in y***	40	40	40	40	40	40	N	max.
Moved mass	1,2	1,2	1,2	1,2	1,2	1,2	kg	
Overall mass	3,5	4,2	4,5	5,2	5,7	6,8	kg	
Guide type	Air bearing	Air bearing	Air bearing	Air bearing	Air bearing	Air bearing		
<b>Drive properties</b>								
Drive type	Linear motor, ironless, 3-phase	Linear motor, ironless, 3-phase	Linear motor, ironless, 3-phase	Linear motor, ironless, 3-phase	Linear motor, ironless, 3-phase	Linear motor, ironless, 3-phase		
Intermediate circuit voltage, effective	48, nominal 80, max.	48, nominal 80, max.	48, nominal 80, max.	48, nominal 80, max.	48, nominal 80, max.	48, nominal 80, max.	V DC	
Peak force	33,2	33,2	33,2	33,2	33,2	33,2	N	typ.
Nominal force	11,1	11,1	11,1	11,1	11,1	11,1	N	typ.
Force constant, effective	6,67	6,67	6,67	6,67	6,67	6,67	N/A	typ.
Resistance phase-phase	6,3	6,3	6,3	6,3	6,3	6,3	Ω	typ.
Inductivity phase-phase	1	1	1	1	1	1	mH	typ.
Back EMF phase-phase	7,7	7,7	7,7	7,7	7,7	7,7	V·s/m	max.
Cabling	External, moving cable	External, moving cable	External, moving cable	External, moving cable	External, moving cable	External, moving cable		

### A-121

Operating pressure##	65 to 75 psi (450 to 620 kPa)
Air consumption	<1.0 SCFM (28 SLPM)
Air quality	Clean (filtered to 1.0 µm or better) - ISO 8573 1 Class 1 Oil free – ISO 8573 1 Class 1 Dry (-15 °C dew point) – ISO 8573 1 Class 3
Materials	Hardcoat aluminum, stainless steel fasteners

\* Dependent on the flatness of the surface, on which the stage is mounted.

\*\* Can be limited by the payload, controller or drive.

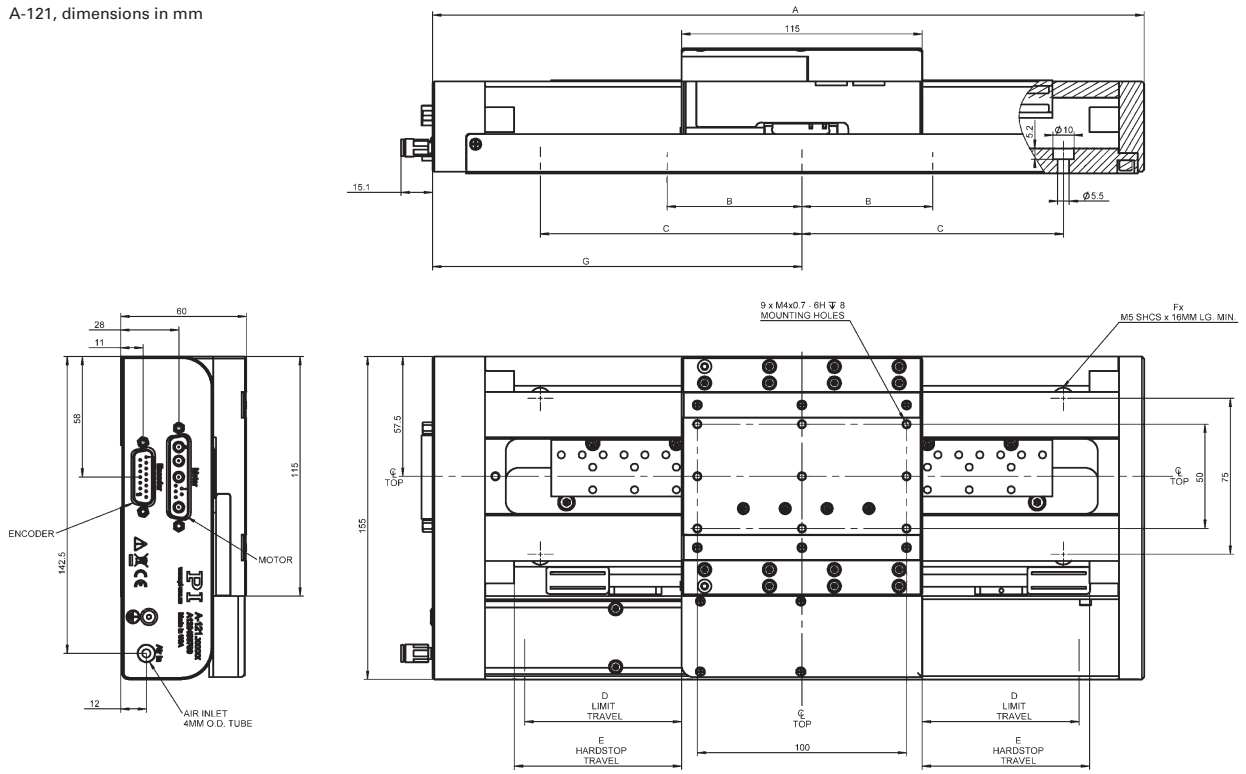
\*\*\* Assumes payload CG is centered no more than 50 mm above the stage table.

## To protect the stage against damage, it is recommended to connect an air pressure sensor to the Motion-Stop input of the controller.

	A-121.xxxA	A-121.xxxB	A-121.xxxC
Integrated Sensor	Incremental linear encoder	Absolute encoder	Incremental linear encoder
Sensor signal	Sin/cos, 1 V peak-peak, 20 μm signal period	BiSS-C	A/B quadrature, TTL
Sensor resolution	Controller dependent	1 nm	50 nm
Bidirectional repeatability	A-121.050: ±0,25 μm A-121.100: ±0,25 μm A-121.150: ±0,25 μm A-121.200: ±0,25 μm A-121.250: ±0,25 μm A-121.350: ±0,50 μm	A-121.050: ±0,25 μm A-121.100: ±0,25 μm A-121.150: ±0,25 μm A-121.200: ±0,25 μm A-121.250: ±0,25 μm A-121.350: ±0,50 μm	A-121.050: ±0,25 μm A-121.100: ±0,25 μm A-121.150: ±0,25 μm A-121.200: ±0,25 μm A-121.250: ±0,25 μm A-121.350: ±0,50 μm
Accuracy, uncompensated#	A-121.050: ±1,0 μm A-121.100: ±1,0 μm A-121.150: ±1,5 μm A-121.200: ±2,0 μm A-121.250: ±2,0 μm A-121.350: ±3,0 μm	A-121.050: ±1,5 μm A-121.100: ±1,5 μm A-121.150: ±1,5 μm A-121.200: ±1,5 μm A-121.250: ±1,5 μm A-121.350: ±1,5 μm	A-121.050: ±1,0 μm A-121.100: ±1,0 μm A-121.150: ±1,5 μm A-121.200: ±2,0 μm A-121.250: ±2,0 μm A-121.350: ±3,0 μm
Accuracy, with error compensation#	A-121.050: ±0,50 μm A-121.100: ±0,50 μm A-121.150: ±0,50 μm A-121.200: ±0,50 μm A-121.250: ±0,50 μm A-121.350: ±1,0 μm	A-121.050: ±0,5 μm A-121.100: ±0,5 μm A-121.150: ±0,5 μm A-121.200: ±0,5 μm A-121.250: ±0,5 μm A-121.350: ±0,5 μm	A-121.050: ±0,50 μm A-121.100: ±0,50 μm A-121.150: ±0,50 μm A-121.200: ±0,50 μm A-121.250: ±0,50 μm A-121.350: ±1,0 μm

# Improved accuracy can be obtained with controller-based error compensation.  
Accuracy values assume short-term time duration and do not consider the long-term effects of thermal drift on the stage.

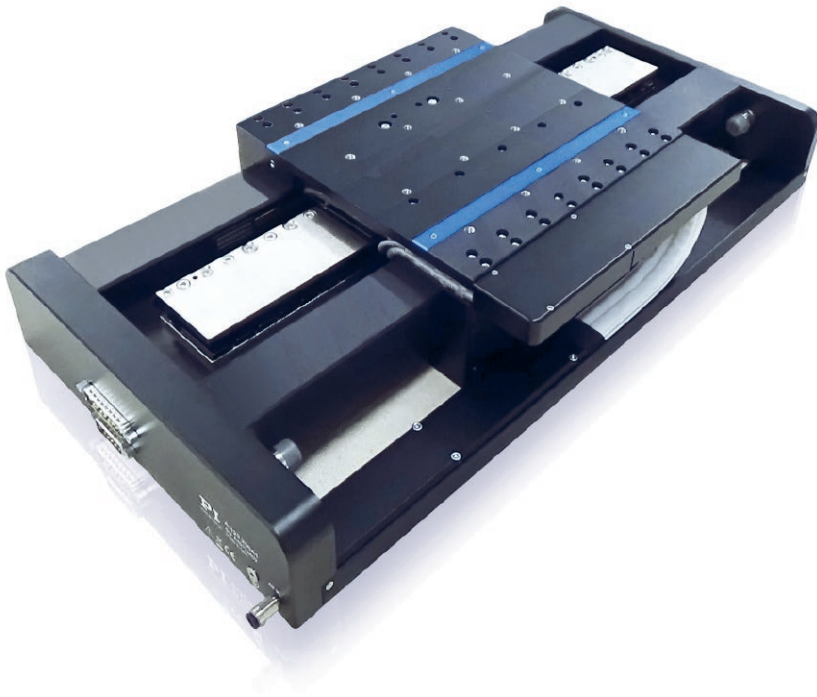
A-121, dimensions in mm



	A	B	C	D	E	F	G
A-121.050	240		75	25	30	4	126.5
A-121.100	290		100	50	55	4	151.5
A-121.150	340		125	75	80	6	176.5
A-121.200	390		150	100	105	6	201.5
A-121.250	440		150	125	130	6	226.5
A-121.350	540	100	200	175	180	10	276.5

# A-123 Plglide AT3 Linear Stage with Air Bearing

High Performance Nanopositioning Stage



- Ideal for scanning applications or high-precision positioning
- Cleanroom compatible
- Size of the motion platform 210 mm x 210 mm
- Travel ranges 50 mm to 750 mm
- Resolution to 1 nm

The Plglide series of stages is equipped with a servo drive linear motor with preloaded air bearings and integrated linear encoder. The combination of these noncontact components results in a frictionless motion platform that offers the highest performance, quality, and lifetime.

A high-force linear motor can drive the stage to top speed within a few milliseconds, and the high-capacity bearings can support payloads up to 60 kg. The laterally opposed, actively preloaded air bearing design in this model allows mounting in any orientation.

#### Accessories and options

- Encoder
- Plglide filter and air preparation kits
- Single and multi-axis motion controller
- XY setups and individual configurations
- Cable track variations
- Options with counterweight for vertical (Z) orientation
- Customizations available
- Base plates made of granite and systems for reducing vibration

#### Fields of application

Plglide positioning systems are ideally suited for high-precision application in measuring technology, fiber positioning, semiconductor and flat screen inspection, laser processing, and precision scanning.

Thanks to the friction-free motion, no particles are formed, which makes Plglide stages ideal for cleanroom applications.

	A-123.050	A-123.100	A-123.150	A-123.200	A-123.350	A-123.500	A-123.750	Unit	Tolerance
Travel range	50	100	150	200	350	500	750	mm	
Pitch*	5	10	15	15	20	25	35	μrad	max.
Yaw*	5	10	15	15	20	25	35	μrad	max.
Straightness / Flatness*	±0.5	±0.5	±0.5	±1	±1.5	±1.5	±2.5	μm	max.
Straightness / flatness per 25 mm travel range*	±0.5	±0.5	±0.5	±0.75		±0.75	±1.25	μm	max.
<b>A-123</b>								<b>Unit</b>	<b>Tolerance</b>
<b>Motion and positioning</b>									
Active axes	X								
Velocity, unloaded**	1							m/s	max.
Acceleration, unloaded**	30							m/s <sup>2</sup>	max.
<b>Mechanical properties</b>									
Load capacity in z***	590							N	max.
Load capacity in y***	295							N	max.
Moved mass	5							kg	
Overall mass	A-123.050: 14 A-123.100: 15.5 A-123.150:16.5 A-123.200: 18 A-123.350: 21.5 A-123.500: 25 A-123.750: 32							kg	
Guide type	Air bearing								
<b>Drive properties</b>									
Drive type	Linear motor, ironless, 3-phase								
Intermediate circuit voltage, effective	48, nominal 80, max.							V DC	
Peak force	298							N	typ.
Nominal force	87,5							N	typ.
Force constant, effective	19,9							N/A	typ.
Resistance phase-phase	3,6							Ω	typ.
Inductivity phase-phase	1,2							mH	typ.
Back EMF phase-phase	16							V·s/m	max.
<b>Air supply</b>									
Operating pressure#	75 to 85 (515 to 585)							psi (kPa)	
Air consumption	<1.0 (28)							SCFM (SLPM)	
Air quality	Clean (filtered to 1.0 μm or better) – ISO 8573-1 Class 1 Oil free – ISO 8573-1 Class 1 Dry (-15 °C dew point) – ISO 8573-1 Class 3								
<b>Miscellaneous</b>									
Cabling	External, moving cable								
Materials	Hardcoat aluminum, stainless steel fasteners								

\* Dependent on the flatness of the surface, on which the stage is mounted.

\*\* Can be limited by the payload, controller or drive.

\*\*\* Assumes payload CG is centered no more than 50 mm above the stage table.

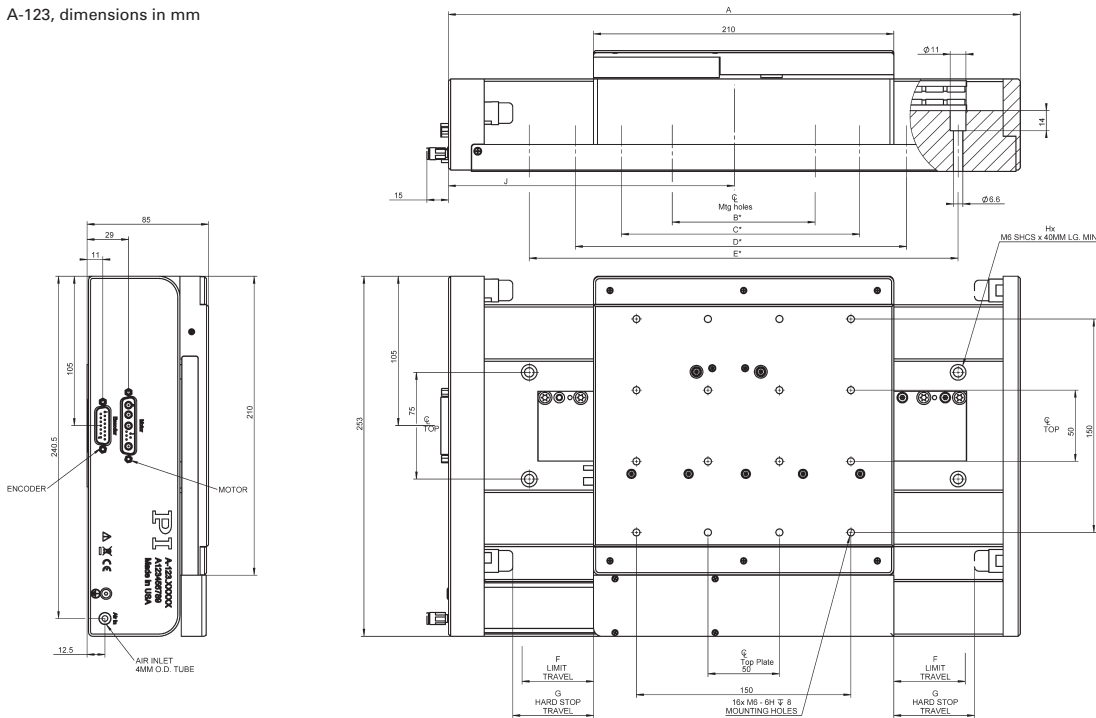
# To protect the stage against damage, it is recommended to connect an air pressure sensor to the Motion-Stop input of the controller.



	A-123.xxxA	A-123.xxxB	A-123.xxxC
Integrated Sensor	Incremental linear encoder	Absolute encoder	Incremental linear encoder
Sensor signal	Sin/cos, 1 V peak-peak, 20 μm signal period	BiSS-C	A/B quadrature, TTL
Sensor resolution	Controller dependent	1 nm	50 nm
Bidirectional repeatability	A-123.050: ±0.25 μm A-123.100: ±0.25 μm A-123.150: ±0.25 μm A-123.200: ±0.25 μm A-123.350: ±0.5 μm A-123.500: ±0.5 μm A-123.750: ±0.75 μm	A-123.050: ±0.25 μm A-123.100: ±0.25 μm A-123.150: ±0.25 μm A-123.200: ±0.25 μm A-123.350: ±0.5 μm A-123.500: ±0.5 μm A-123.750: ±0.75 μm	A-123.050: ±0.25 μm A-123.100: ±0.25 μm A-123.150: ±0.25 μm A-123.200: ±0.25 μm A-123.350: ±0.5 μm A-123.500: ±0.5 μm A-123.750: ±0.75 μm
Accuracy, uncompensated##	A-123.050: ±1 μm A-123.100: ±1 μm A-123.150: ±1.5 μm A-123.200: ±2 μm A-123.350: ±3 μm A-123.500: ±3.5 μm A-123.750: ±5 μm	A-123.050: ±1.5 μm A-123.100: ±1.5 μm A-123.150: ±1.5 μm A-123.200: ±1.5 μm A-123.350: ±1.5 μm A-123.500: ±1.5 μm A-123.750: ±1.5 μm	A-123.050: ±1 μm A-123.100: ±1 μm A-123.150: ±1.5 μm A-123.200: ±2 μm A-123.350: ±3 μm A-123.500: ±3.5 μm A-123.750: ±5 μm
Accuracy, with error compensation##	A-123.050: ±0.5 μm A-123.100: ±0.5 μm A-123.150: ±0.5 μm A-123.200: ±0.5 μm A-123.350: ±1 μm A-123.500: ±1 μm A-123.750: ±1.5 μm	A-123.050: ±1.5 μm A-123.100: ±1.5 μm A-123.150: ±1.5 μm A-123.200: ±1.5 μm A-123.350: ±1.5 μm A-123.500: ±1.5 μm A-123.750: ±1.5 μm	A-123.050: ±0.5 μm A-123.100: ±0.5 μm A-123.150: ±0.5 μm A-123.200: ±0.5 μm A-123.350: ±1 μm A-123.500: ±1 μm A-123.750: ±1.5 μm

## Improved accuracy can be obtained with controller-based error compensation.  
Accuracy values assume short-term time duration and do not consider the long-term effects of thermal drift on the stage.

A-123, dimensions in mm



	A	B*	C*	D*	E*	F	G	Hx	J
A-123.050	350				250	25	31.5	4	181.5
A-123.100	400	100			300	50	56.5	8	206.5
A-123.150	450	100			350	75	81.5	8	231.5
A-123.200	500	100			400	100	106.5	8	256.5
A-123.350	650	100	325		550	175	181.5	12	331.5
A-123.500	500	100	300	500	700	250	256.5	16	406.5
A-123.750	1050	100	400	700	1000	375	381.5	16	531.5

\* The mounting holes are symmetric around the center line located at "J"

# A-110 Pliglide LC Linear Stage with Air Bearings

High-Performance Nanopositioning System with a good Price



- Ideal for scanning applications or high-precision positioning
- Cleanroom compatible
- Size of the motion platform 160 mm × 200 mm
- Travel ranges to 400 mm
- Load capacity to 100 N

## Pliglide Reference-Class Linear Stage

Pliglide positioning systems have a magnetic linear motor, magnetically preloaded air bearings and an optical linear encoder: Noncontact and friction-free motion for the highest accuracy and reliability.

## Accessories and options

- Encoder
- Pliglide Filter and Air Preparation Kits
- Single and multi-axis motion controller
- XY setups and individual configurations
- Base plates made of granite and systems for reducing vibration

## Fields of application

Pliglide positioning systems are ideally suited for many high-precision applications, such as metrology, photonics, and precision scanning as well as in semiconductor or flat panel display manufacturing.

Thanks to the friction-free motion, no particles are formed, which makes Pliglide stages ideal for cleanroom applications.

	A-110.050xx	A-110.100xx	A-110.200xx	A-110.300xx	A-110.400xx	Unit	Tolerance																												
<b>Motion and positioning</b>																																			
Active axes	X	X	X	X	X																														
Travel range	50	100	200	300	400	mm																													
Pitch*	10	20	30	40	50	μrad	max.																												
Yaw*	10	20	30	40	50	μrad	max.																												
Straightness / Flatness*	±1	±1	±1.5	±2	±2.5	μm	max.																												
Straightness / flatness per 10 mm travel range*	±1	±1	±1.5	±2	±2.5	μm	max.																												
Velocity, unloaded**	0.5	0.5	1	1	1	m/s	max.																												
Acceleration, unloaded**	10	10	30	30	30	m/s <sup>2</sup>	max.																												
<b>Mechanical properties</b>																																			
Load capacity in z***	100	100	100	100	100	N	max.																												
Moved mass	2.5	2.5	2.6	2.6	2.6	kg																													
Overall mass	6.3	7.5	11	12	14	kg																													
Guide type	Air bearings	Air bearings	Air bearings	Air bearings	Air bearings																														
<b>Drive properties</b>																																			
Drive type	Linear motor, ironless, 3-phase	Linear motor, ironless, 3-phase	Linear motor, ironless, 3-phase	linear motor, ironless, 3-phase	Linear motor, ironless, 3-phase																														
Intermediate circuit voltage, effective	48, nom. 60, max.	48, nom. 60, max.	48, nom. 60, max.	48, nom. 60, max.	48, nom. 60, max.	VDC																													
Peak force	25	25	85	85	85	N	typ.																												
Nominal force	9.2	9.2	39	39	39	N	typ.																												
Force constant, effective	4.2	4.2	12.3	12.3	12.3	N/A	typ.																												
Resistance phase-phase	8.2	8.2	3.6	3.6	3.6	Ω	typ.																												
Inductivity phase-phase	2.7	2.7	1.24	1.24	1.24	mH	typ.																												
Back EMF phase-phase	4.2	4.2	10.1	10.1	10.1	V·s/m	max.																												
Cabling	Internal, no moving cable	Internal, no moving cable	External, moving cable	External, moving cable	External, moving cable																														
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th>A-110.xxxA</th> <th>A-110.xxxB</th> <th>A-110.xxxC</th> </tr> </thead> <tbody> <tr> <td>Integrated Sensor</td> <td>Incremental linear encoder</td> <td>Absolute Encoder</td> <td>Incremental linear encoder</td> </tr> <tr> <td>Sensor signal</td> <td>Sin/cos, 1 V peak-peak, 20 μm signal period</td> <td>BiSS-C</td> <td>A/B quadrature, TTL</td> </tr> <tr> <td>Sensor resolution</td> <td>controller dependent</td> <td>1 nm</td> <td>50 nm</td> </tr> <tr> <td>Bidirectional repeatability</td> <td>controller dependent</td> <td>±0.5 μm</td> <td>±0.5 μm</td> </tr> <tr> <td>Accuracy, uncompensated#</td> <td>A-110.050: ±1 μm A-110.100: ±1.5 μm A-110.200: ±2 μm A-110.300: ±3 μm A-110.400: ±4 μm</td> <td>A-110.050: ±1.5 μm A-110.100: ±1.5 μm A-110.200: ±1.5 μm A-110.300: ±1.5 μm A-110.400: ±1.5 μm</td> <td>A-110.050: ±1 μm A-110.100: ±1.5 μm A-110.200: ±2 μm A-110.300: ±3 μm A-110.400: ±4 μm</td> </tr> <tr> <td>Accuracy, with error compensation#</td> <td>A-110.050: ±1 μm A-110.100: ±1 μm A-110.200: ±1 μm A-110.300: ±1.5 μm A-110.400: ±1.5 μm</td> <td>A-110.050: ±1 μm A-110.100: ±1 μm A-110.200: ±1 μm A-110.300: ±1.5 μm A-110.400: ±1.5 μm</td> <td>A-110.050: ±1 μm A-110.100: ±1 μm A-110.200: ±1 μm A-110.300: ±1.5 μm A-110.400: ±1.5 μm</td> </tr> </tbody> </table>									A-110.xxxA	A-110.xxxB	A-110.xxxC	Integrated Sensor	Incremental linear encoder	Absolute Encoder	Incremental linear encoder	Sensor signal	Sin/cos, 1 V peak-peak, 20 μm signal period	BiSS-C	A/B quadrature, TTL	Sensor resolution	controller dependent	1 nm	50 nm	Bidirectional repeatability	controller dependent	±0.5 μm	±0.5 μm	Accuracy, uncompensated#	A-110.050: ±1 μm A-110.100: ±1.5 μm A-110.200: ±2 μm A-110.300: ±3 μm A-110.400: ±4 μm	A-110.050: ±1.5 μm A-110.100: ±1.5 μm A-110.200: ±1.5 μm A-110.300: ±1.5 μm A-110.400: ±1.5 μm	A-110.050: ±1 μm A-110.100: ±1.5 μm A-110.200: ±2 μm A-110.300: ±3 μm A-110.400: ±4 μm	Accuracy, with error compensation#	A-110.050: ±1 μm A-110.100: ±1 μm A-110.200: ±1 μm A-110.300: ±1.5 μm A-110.400: ±1.5 μm	A-110.050: ±1 μm A-110.100: ±1 μm A-110.200: ±1 μm A-110.300: ±1.5 μm A-110.400: ±1.5 μm	A-110.050: ±1 μm A-110.100: ±1 μm A-110.200: ±1 μm A-110.300: ±1.5 μm A-110.400: ±1.5 μm
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\*\* Can be limited by the payload, controller or drive.

\*\*\* Assumes payload CG is centered no more than 50 mm above the stage table. Stage is designed for horizontal operation only.

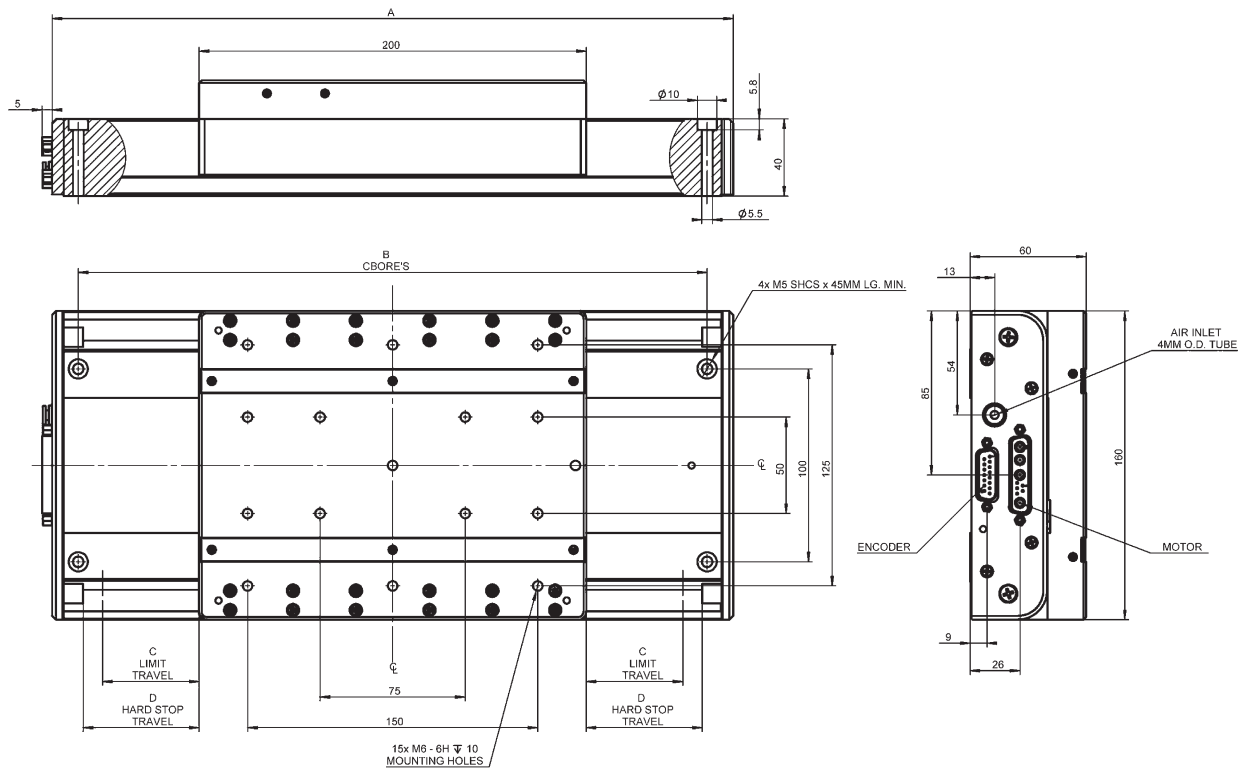
# Improved accuracy can be obtained with controller-based error compensation. Accuracy values assume short-term time duration and do not consider the long-term effects of thermal drift on the stage.

**A-110**

Operating pressure##	60 to 70 psi (415 to 485 kPa)
Air consumption	<1.0 SCFM (28 SLPM)
Air quality	Clean (filtered to 1.0 µm or better) – ISO 8573 1 Class 1 Oil free – ISO 8573 1 Class 1 Dry (-15 °C dew point) – ISO 8573 1 Class 3
Materials	Hardcoat aluminum, stainless steel fasteners

## To protect the stage against damage, it is recommended to connect an air pressure sensor to the Motion-Stop input of the controller.

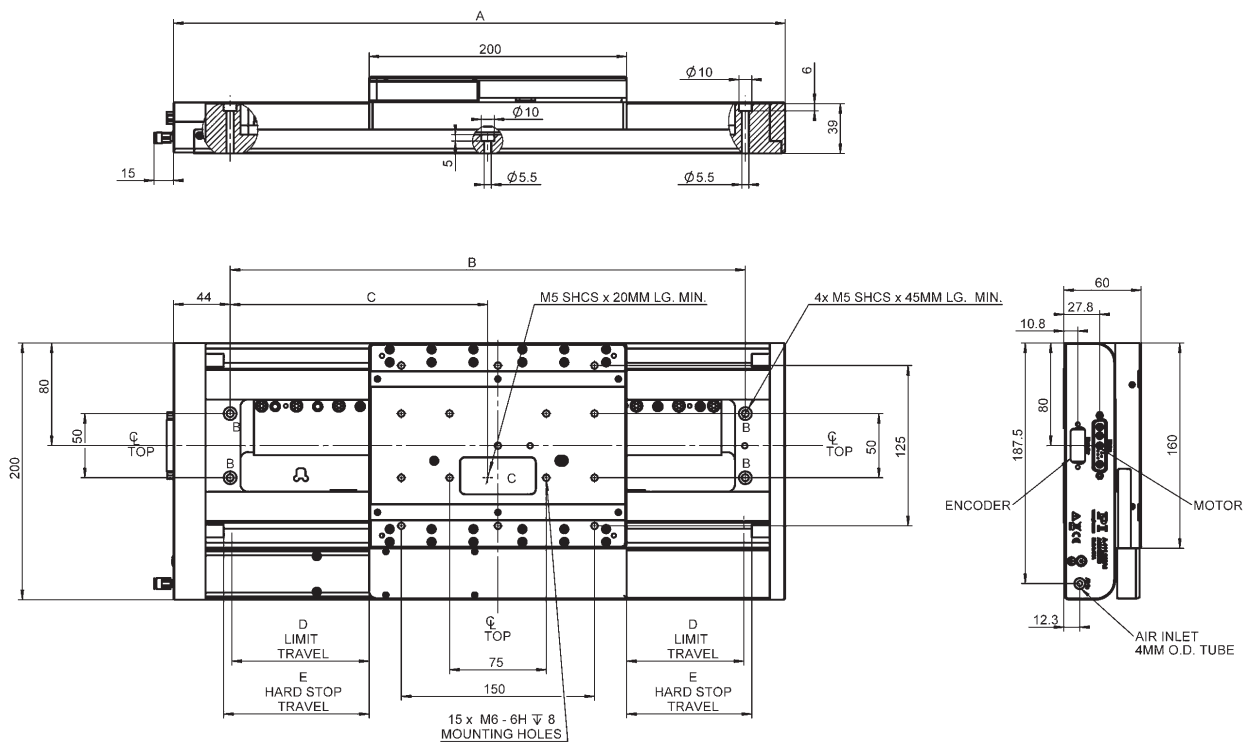
A-110.050 and A-110.100, dimensions in mm



	A	B	C	D
A-110.050	302	275	25	35
A-110.100	352	325	50	60

<b>A110 - xxx xx</b>		<b>Ordering Example</b>
Model	└──┬──┘	Part# A-110.300A1 is a
Travel	└──┬──┘	Model: A-110 (Piglide LC linear motorized air bearing stage)
Encoder	└──┬──┘	Travel: 300 mm
Motor	└──┬──┘	Encoder: A (20 μm/line sine output, 1 V <sub>pp</sub> )
		Motor Wiring: 1 (48 VDC)

A-110.200, A-110.300 and A-110.400, dimensions in mm



	A	B	C	D	E
A-110.200	475	400	200	102	105
A-110.300	575	500	250	152	155
A-110.400	675	600	300	202	205

# PIglide MB Miniature Linear Air Bearing Stage

High Performance, Cleanroom Compatible, Customizable



- Size of the motion platform 57 mm x 83 mm
- Low profile 38 mm
- Travel ranges to 40 mm
- Load capacity to 3.5 kg
- Non-contact fully preloaded air bearings
- Ironless cog-free linear motor
- Integral optical linear encoder
- Resolution to 20 nm
- Velocity to 0.5 m/sec
- Acceleration to 7.5 m/s<sup>2</sup>

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 controllers and servo drives
- XY stacks and custom configurations with precision alignment
- Counterbalance options for vertical (Z) orientations
- Customizations available
- Granite bases and vibration isolation systems

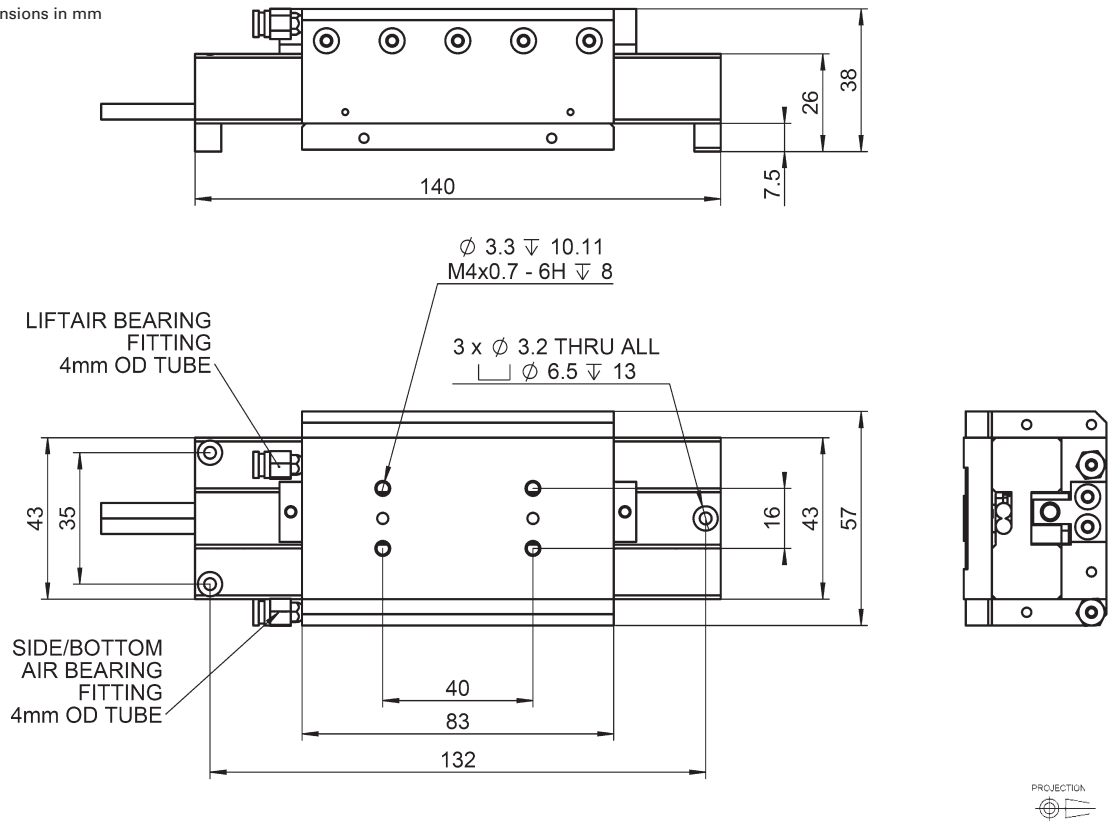


## A-141.040E1

Travel	40 mm
Drive type	Brushless ironless linear servo motor, 3-phase
Feedback system	Non-contact optical linear encoder with travel limits and home index
Intermediate circuit voltage, effective	48 VDC nominal, 80 VDC max
Force constant, effective	2.1 N/A
Nominal force	0.58 N
Peak force	2.3 N
Back EMF phase-phase	0.7 V·s/m
Resistance phase-phase	22.4 Ω
Inductivity phase-phase	1.0 mH
Maximum velocity (1)	Up to 0.5 m/s
Maximum acceleration (1) unloaded	Up to 7.5 m/s <sup>2</sup>
Load capacity in z (2)	±2.0 μm
Accuracy (3) (uncompensated)	±0.5 μm
Accuracy (3) (with error compensation)	±0.2 μm
Repeatability	20 nm
Encoder resolution (4)	<1 μm TIR over full travel
Straightness / flatness (5)	<5 μrad over full travel
Pitch / yaw (5)	0.6 kg
Overall mass	0.3 kg
Moving mass	Internal, non-moving
Cabling	65±5 psi (450±35 kPa)
Operating pressure (6)	<1.0 SCFM (28 SLPM)
Air consumption	Clean (filtered to 1.0 μm or better) – ISO 8573-1 Class 1;
Air quality	Clean (filtered to 1.0 μm or better) – ISO 8573-1 Class 1; Oil-free – ISO 8573-1 Class 1; Dry (–15 °C dew point) – ISO 8573-1 Class 3
Materials	Hardcoat aluminum, stainless steel fasteners

- (1) Maximum velocity and acceleration based on unloaded stage capability, may be limited by payload, controller, or drive performance.
- (2) Assumes payload CG is centered no more than 50mm above the stage table. Stage is designed for horizontal operation only.
- (3) Improved accuracy can be obtained with controller-based error compensation.  
Accuracy values assume short-term time duration and do not consider the long-term effects of thermal drift on the stage.
- (4) Encoder resolution depends on encoder option chosen. Resolution will impact repeatability specification.
- (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.

A-141.040, dimensions in mm



# A-131 Plglide VC Voice Coil Linear Stage with Air Bearing

## High-Performance Miniature Nanopositioning System



- Ideal for scanning applications or high-precision positioning
- Cleanroom compatible
- Travel ranges to 25 mm
- Load capacity to 100 N
- Acceleration to 80 m/s<sup>2</sup>

### Reference-class Plglide linear stage

The Plglide stage with air bearing and voice coil drive offers high velocity and acceleration in a compact package. The contactless components of the motion platform ensure the highest performance, quality, and lifetime.

### Voice coil drive technology

Voice coil drives consist of 2 essential components: A permanent magnet and a coil, which is located in the air gap of the magnetic field. When current flows through the coil, it moves in the magnetic field of the permanent magnet. The direction of motion depends on the polarity. Thanks to their low weight and friction-free drive principle, voice coil drives are particularly suitable for applications, which require high dynamics and high velocities at limited travel ranges. High scan frequencies and precision positioning are also possible with these drives, because they are free of the effects of hysteresis.

### Accessories and options

- Encoder
- Bellows for additional protection
- Plglide® filter and air preparation kits
- Single and multi-axis motion controllers

### Fields of application

High-speed scanning, applications in manufacturing. Thanks to the friction-free motion, no particles are formed, which makes Plglide® stages ideal for cleanroom applications.

<b>A-131.025xxx</b>		<b>Unit</b>	<b>Tolerance</b>
<b>Motion and positioning</b>			
Active axes	X		
Travel range	25	mm	
Pitch*	10	μrad	max.
Yaw*	10	μrad	max.
Straightness / flatness*	±0.125	μm	max.
Velocity, unloaded**	1	m/s	max.
Acceleration, unloaded**	80	m/s <sup>2</sup>	max.
<b>Mechanical properties</b>			
Load capacity in z***	100	N	max.
Moved mass	0.85	kg	
Overall mass	3.6	kg	
Guide type	Air bearing		
<b>Drive properties</b>			
Drive type	Brushless voice coil drive, ironless, 1 phase		
Intermediate circuit voltage, effective	48, nominal 80, max.	V DC	
Peak force	70.4	N	typ.
Nominal force	22.3	N	typ.
Force constant, effective	6.9	N/A	typ.
Resistance	2.7	Ω	typ.
Inductivity (at 1000 Hz)	1.4	mH	typ.
Back EMF	6.9	V·s/m	
Nominal power	28	W	max.
Cabling	Internal, no moving cable		

	<b>A-131.025A1x</b>	<b>A-131.025D1x</b>	<b>A-131.025F1x</b>
Integrated sensor	Incremental linear encoder	Incremental linear encoder	Incremental linear encoder
Sensor signal	Sin/cos, 1 V peak-peak, 20 μm signal period	A/B quadrature, TTL	A/B quadrature, TTL
Sensor resolution#	Controller dependent	100 nm	500 nm
Bidirectional repeatability	±0.1 μm	±0.1 μm	±0.1 μm
Accuracy##	0.2 μm	0.2 μm	0.2 μm
Reference point switch	Home index	Home index	Home index
Reference point switch repeatability	±1 encoder step	±1 encoder step	±1 encoder step

<b>A-131</b>	
Operating pressure###	75 to 85 psi (520 to 585 kPa)
Air consumption	<1.0 SCFM (28 SLPM)
Air quality	Clean (filtered to 1.0 μm or better) – ISO 8573 1 Class 1 Oil free – ISO 8573 1 Class 1 Dry (–15 °C dew point) – ISO 8573 1 Class 3
Materials	Hardcoat aluminum, stainless steel fasteners

\* Dependent on the flatness of the surface, on which the stage is mounted.

\*\* Can be limited by the payload, controller or drive.

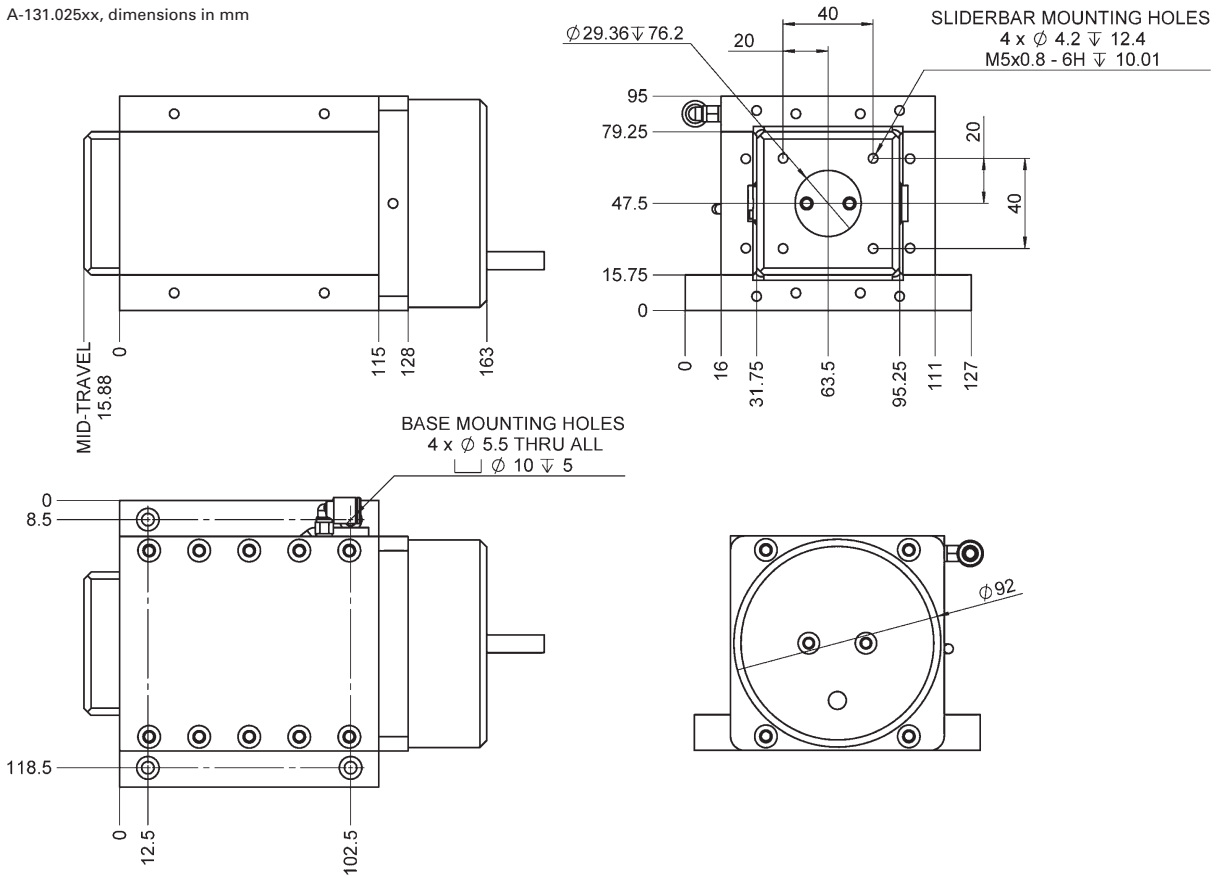
\*\*\* Assumes that the center of gravity is centered no more than 50 mm from the motion platform.

# Alternative resolutions on request. Higher resolutions can limit the velocity.

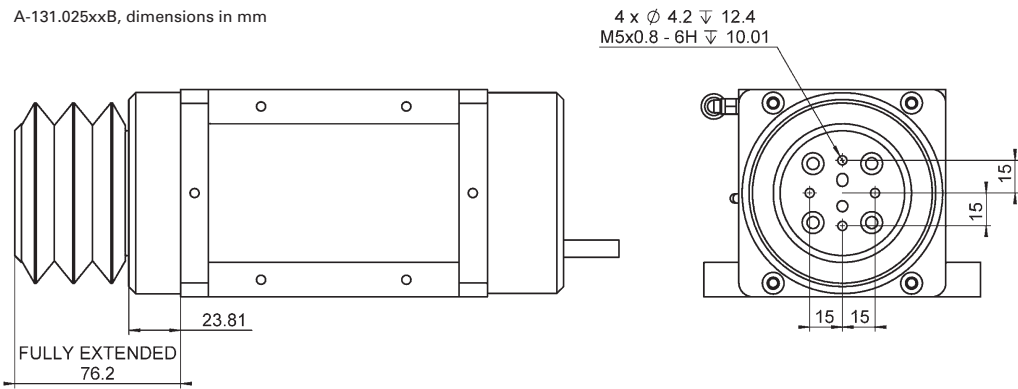
## Improved accuracy can be obtained with controller-based error compensation.

### To protect the stage against damage, it is recommended to connect an air pressure sensor to the Motion-Stop input of the controller.

A-131.025xx, dimensions in mm

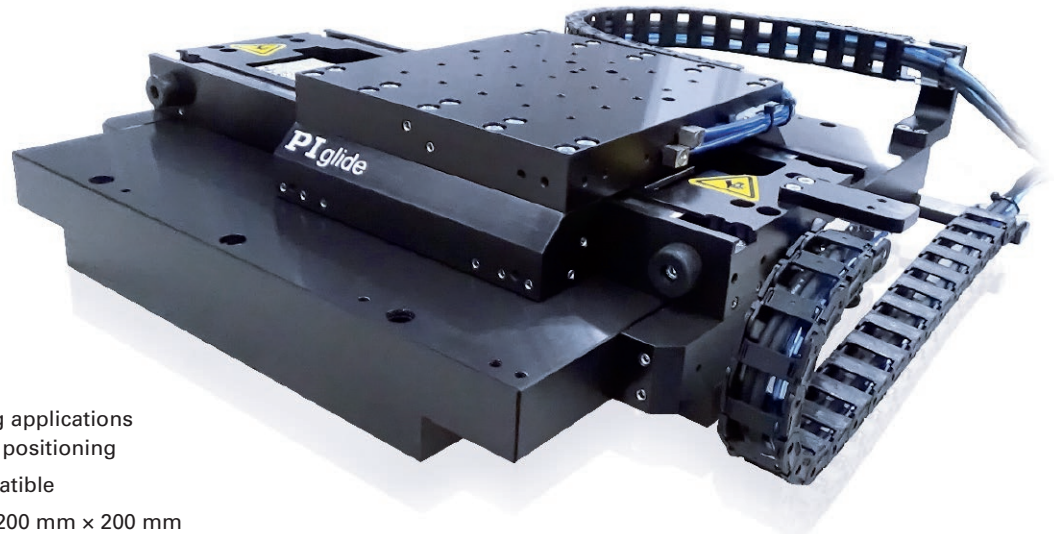


A-131.025xxB, dimensions in mm



# A-311 Plglide IS Planar Scanner with Air Bearing

High-Performance, Compact XY Nanopositioning System



- Ideal for scanning applications or high-precision positioning
- Cleanroom compatible
- Travel ranges to 200 mm × 200 mm
- Load capacity to 147 N
- Low profile
- Resolution to 1 nm

## Plglide reference-class XY positioning system

The high-precision Plglide IS XY planar scanner with air bearing has a flat design and is an alternative to the stacked XY stages. The efficient, compact design saves space in machines with limited installation space.

## PIMag® magnetic direct drive

3-phase magnetic direct drives do not use mechanical components in the drivetrain, they transmit the drive force to the motion platform directly and without friction. The drives reach high velocities and accelerations. Ironless motors are particularly suitable for positioning tasks with the highest demands on precision because there is no undesirable interaction with the permanent magnets. This allows smooth running even at the lowest velocities and at the same time, there is no vibration at high velocities. Nonlinearity in control behavior is avoided and any position can be controlled easily. The drive force can be set freely.

Operation with digital controllers from leading manufacturers offers advanced control algorithms for improving the dynamics and error compensation.

## Accessories and Options

- Encoder
- Plglide filter and air preparation kit
- Multi-axis motion controller and servo drives
- Machine bases
- Base plates made of granite and systems for reducing vibration

## Fields of application

Plglide positioning systems are ideally suited for high-precision applications, such as inspection systems, laser marking, microscopy or scanning.



	A-311.Dxx	A-311.Axx	A-311.Bxx	A-311.Cxx	Unit	Tolerance
<b>Motion and positioning</b>						
Travel range	50 × 50	100 × 100	150 × 150	200 × 200	mm	
Pitch*	20	30	40	50	μrad	max.
Yaw*	5	10	15	20	μrad	max.
Straightness*	±0.25	±0.25	±0.5	±0.5	μm	max.
Straightness per 10 mm travel range*	±10	±10	±10	±10	nm	max.
Flatness*	±0.5	±0.5	±1	±1	μm	max.
Flatness per 10 mm travel range*	±10	±10	±10	±10	nm	max.
XY orthogonality	25	25	25	25	μrad	max.
Velocity, unloaded**	2	2	2	2	m/s	max.
Acceleration of the upper axis, unloaded**	27.5	27.5	27.5	27.5	m/s <sup>2</sup>	max.
Acceleration of the lower axis, unloaded**	15	13	11	10	m/s <sup>2</sup>	max.
<b>Mechanical properties</b>						
Load capacity in z***	147	147	147	147	N	max.
Moved mass, upper axis	3	3	3	3	kg	
Moved mass, lower axis	5.5	6.5	7.5	8.5	kg	
Overall mass	14.5	18.5	22.5	27.5	kg	
Guide type	Air bearing	Air bearing	Air bearing	Air bearing		
<b>Drive properties</b>						
Drive type	Linear motor, ironless, 3-phase	Linear motor, ironless, 3-phase	Linear motor, ironless, 3-phase	Linear motor, ironless, 3-phase		
Intermediate circuit voltage, effective	48, nominal 80, max.	48, nominal 80, max.	48, nominal 80, max.	48, nominal 80, max.	VDC	
Peak force	85	85	85	85	N	typ.
Nominal force	39	39	39	39	N	typ.
Force constant, effective	12.3	12.3	12.3	12.3	N/A	typ.
Resistance phase-phase	3.6	3.6	3.6	3.6	Ω	
Inductivity phase-phase	1.24	1.24	1.24	1.24	mH	
Back EMF phase-phase	10.1	10.1	10.1	10.1	V·s/m	max.
Cabling	External, movable drag chain	External, movable drag chain	External, movable drag chain	External, movable drag chain		

**A-311.xCx**

Operating pressure##	60 to 70 psi (415 to 485 kPa)
Air consumption	<2 SCFM (56 SLPM)
Air quality	Clean (filtered to 1.0 μm or better) – ISO 8573 1 Class 1 Oil free – ISO 8573 1 Class 1 Dry (–15 °C dew point) – ISO 8573 1 Class 3
Materials	Hardcoat aluminum, with stainless steel fasteners

\* Dependent on the flatness of the surface, on which the stage is mounted.

\*\* Can be limited by the payload, controller or drive.

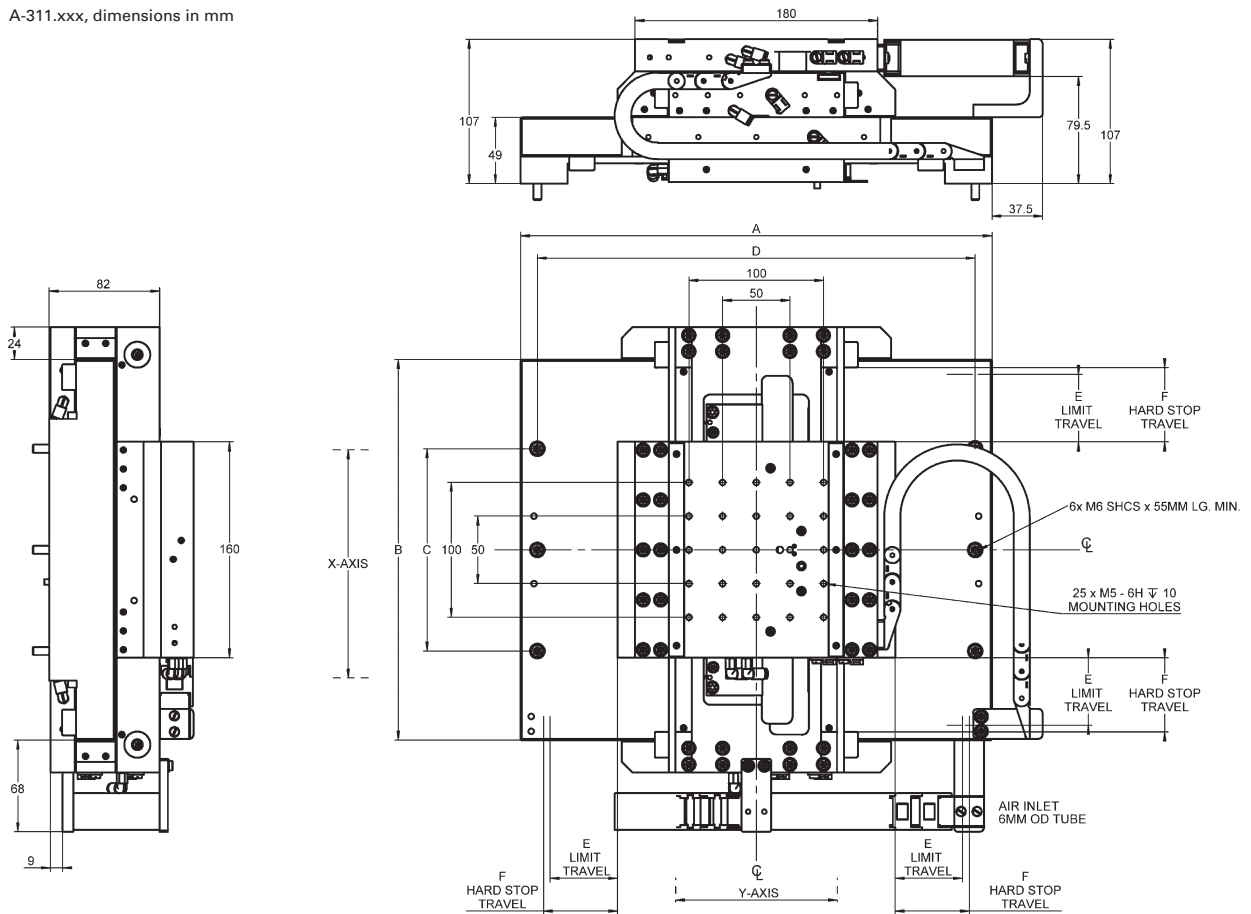
\*\*\* Assumes payload CG is centered no more than 50 mm above the stage table. Stage is designed for horizontal operation only.

## To protect the stage against damage, it is recommended to connect an air pressure sensor to the Motion-Stop input of the controller.

	A-311.xAx	A-311.xBx	A-311.xCx
Integrated sensor	Incremental linear encoder	Absolute encoder	Incremental linear encoder
Sensor signal	Sin/cos, 1 V peak-peak, 20 $\mu$ m signal period	BiSS-C	A/B quadrature, TTL
Sensor resolution	Controller dependent	1 nm	50 nm
Bidirectional repeatability	Controller dependent	$\pm 0.05 \mu$ m	$\pm 0.05 \mu$ m
Accuracy, uncompensated#	A-311.Dxx: $\pm 1 \mu$ m A-311.Axx: $\pm 1.5 \mu$ m A-311.Bxx: $\pm 2 \mu$ m A-311.Cxx: $\pm 2.5 \mu$ m	A-311.Axx: $\pm 1.5 \mu$ m A-311.Axx: $\pm 1.5 \mu$ m A-311.Axx: $\pm 1.5 \mu$ m A-311.Axx: $\pm 1.5 \mu$ m	A-311.Dxx: $\pm 1 \mu$ m A-311.Axx: $\pm 1.5 \mu$ m A-311.Bxx: $\pm 2 \mu$ m A-311.Cxx: $\pm 2.5 \mu$ m
Accuracy, with error compensation#	$\pm 0.5 \mu$ m	$\pm 0.5 \mu$ m	$\pm 0.5 \mu$ m
Reference point switch repeatability	$\pm 1$ encoder step	$\pm 1$ encoder step	$\pm 1$ encoder step

# Improved accuracy can be obtained with controller-based error compensation.  
Accuracy values assume short-term time duration and do not consider the long-term effects of thermal drift on the stage.

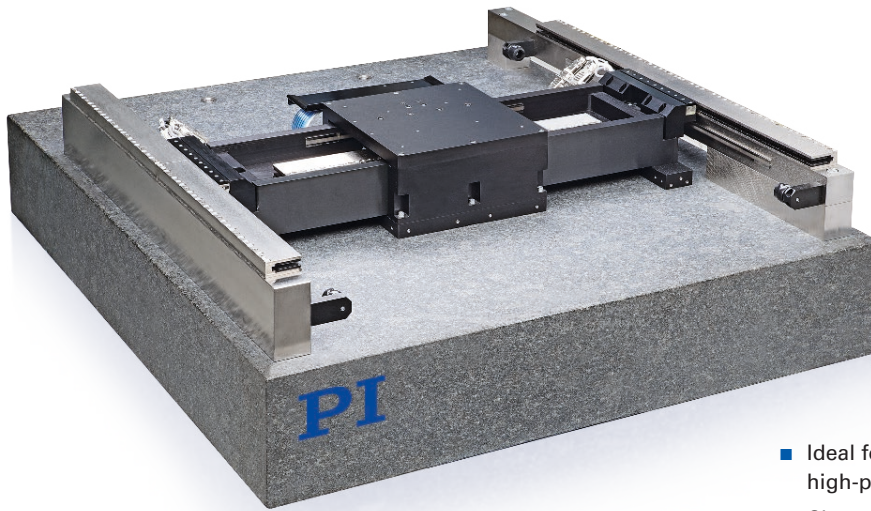
A-311.xxx, dimensions in mm



	A	B	C	D	E	F
A-311.Dxx	300	232	100	275	25	30
A-311.Axx	350	282	150	325	50	55
A-311.Bxx	400	332	200	375	75	80
A-311.Cxx	450	382	250	425	100	105

# A-322 Pliglide HS Planar Scanner with Air Bearing

XY Positioning System with 1 nm Resolution



- Ideal for scanning applications or high-precision positioning
- Clean room compatible
- Travel ranges to 500 mm × 1000 mm
- Load capacity to 245 N
- Resolution to 1 nm
- Velocity up to 2 mm/s

## Pliglide® reference-class XY positioning system

The Pliglide® HS planar scanner has magnetic linear motors, vacuum preload and absolute encoders: Contact- and friction-free motion for the highest accuracy and reliability.

### Absolute encoder

Absolute encoders supply explicit position information that enables immediate determination of the position. This means that referencing is not required during switch-on, which increases efficiency and safety during operation.

### PIMag® magnetic direct drive

The stage has an ironless magnetic direct drive, which makes high velocities and acceleration possible. At the same time, sine-commutated control makes high positioning resolution possible because the drive is friction free. The drive force can be set freely.

The positioning system was designed to both maximize the throughput and ensure the highest precision. The flexible coupling of the bridge axis to the gantry axis allows lateral decoupling without sacrificing the stiffness of the system.

Operation with digital controllers from leading manufacturers offers advanced control algorithms for improving the dynamics and error compensation.

### Accessories and options

- Pliglide® filter and air preparation kits
- Additional axes
- Machine bases
- Base plates made of granite and systems for reducing vibration

### Fields of application

Pliglide® positioning systems are ideally suited for many high-precision applications, such as metrology, photonics, and precision scanning as well as in semiconductor or flat panel display manufacturing.

Thanks to the friction-free motion, no particles are formed, which makes Pliglide® stages ideal for cleanroom applications.

	A-322.Axx	A-322.Bxx	A-322.Cxx	A-322.Dxx	Unit	Tolerance
<b>Motion and positioning</b>						
Active axes	X, Y	X, Y	X, Y	X, Y		
Travel range (bridge axis × gantry axis)	350 × 350	350 × 500	500 × 500	500 × 1000	mm	
Integrated sensors	Absolute Encoders	Absolute Encoders	Absolute Encoders	Absolute Encoders		
Sensor resolution	1	1	1	1	nm	
Bidirectional repeatability	±0.08	±0.08	±0.08	±0.08	µm	max.
Accuracy*	±0.5	±0.5	±0.5	±0.5	µm	max.
Pitch	15	20	30	40	µrad	max.
Yaw*	5	5	7	7	µrad	max.
Straightness*	±0.5	±0.5	±1	±1	µm	max.
Straightness per 10 mm travel range*	±10	±10	±10	±10	nm	max.
Flatness	±0.5	±1	±1.5	±2.5	µm	max.
Flatness per 10 mm travel range	±10	±10	±10	±10	nm	max.
XY orthogonality	25	25	25	25	µrad	max.
Velocity, unloaded**	2	2	2	2	m/s	max.
Acceleration, bridge axis, unloaded**	20	20	20	20	m/s <sup>2</sup>	max.
Acceleration, gantry axis, unloaded**	15	15	12	12	m/s <sup>2</sup>	max.
Load capacity in z***	245	245	245	245	N	max.
Moved mass, bridge axis	14	14	14	14	kg	
Moved mass, gantry axis	40	40	43	43	kg	
Overall mass	610	700	1075	1525	kg	
Guide type	Air bearings	Air bearings	Air bearings	Air bearings		
<b>Drive properties</b>						
Drive type	Linear motor, ironless, 3-phase, 1 × to bridge axis, 2 × to gantry axis	Linear motor, ironless, 3-phase, 1 × to bridge axis, 2 × to gantry axis	Linear motor, ironless, 3-phase, 1 × to bridge axis, 2 × to gantry axis	Linear motor, ironless, 3-phase, 1 × to bridge axis, 2 × to gantry axis		
Intermediate circuit voltage, effective	48, nominal 80, max.	48, nominal 80, max.	48, nominal 80, max.	48, nominal 80, max.	VDC	
Peak force#	298	298	298	298	N	typ.
Nominal force#	87	87	87	87	N	typ.
Force constant, effective#	19.9	19.9	19.9	19.9	N/A	typ.
Resistance phase-phase#	3.6	3.6	3.6	3.6	Ω	
Inductivity phase-phase#	1.2	1.2	1.2	1.2	mH	
Back EMF phase-phase#	16	16	16	16	V·s/m	max.
Cabling	moved ribbon cable, cleanroom compatible	moved ribbon cable, cleanroom compatible	moved ribbon cable, cleanroom compatible	moved ribbon cable, cleanroom compatible		

\* Improved accuracy can be obtained with controller-based error compensation. Stage must be ordered with controller. Accuracy values assume short-term time duration and do not consider the long-term effects of thermal drift on the stage.

\*\* Can be limited by the insulating system payload, controller or drive.

\*\*\* Assumes payload CG is centered no more than 50 mm above the stage table.

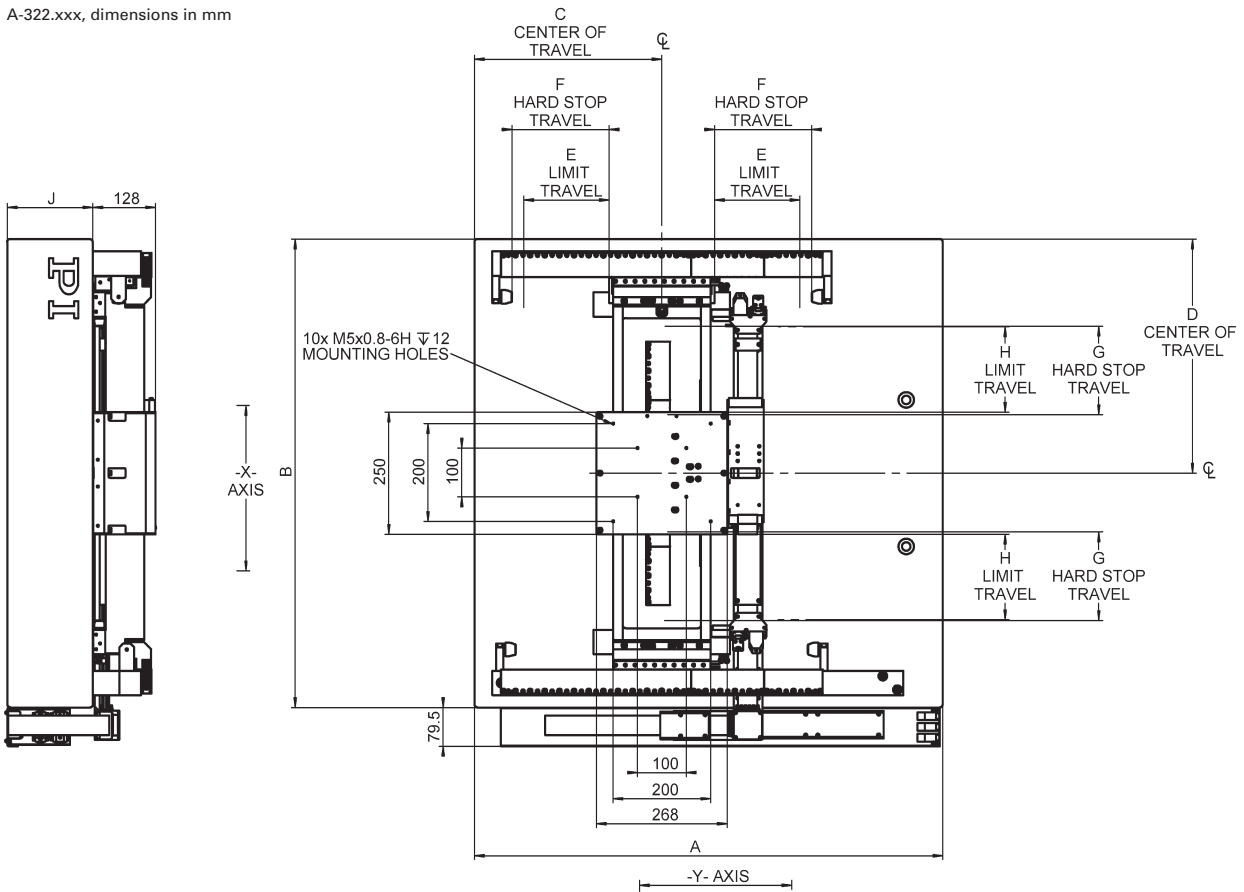
# Specifications for the drive apply per motor. Two motors are located at the gantry axis.

## A-322

Operating pressure ##	80 psi (552 kPa)
Air consumption with external vacuum supply	<2 SCFM (56 SLPM)
Air consumption with internal vacuum supply	<3.2 SCFM (100 SLPM)
Vacuum	10.8 psi (74.7 kPa), <0.5 SCFM (14 SLPM)
Air quality	Clean (filtered to 1.0 $\mu\text{m}$ or better) – ISO 8573 1 Class 1 Oilfree – ISO 8573 1 Class 1 Dry (-15 °C dew point) – ISO 8573 1 Class 3
Materials	Hardcoat aluminum and nickel-plated steel with stainless steel mounting material, granite base

## To protect the stage against damage, it is recommended to connect an air pressure sensor to the Motion-Stop input of the controller.

A-322.xxx, dimensions in mm



# A-62x Plglide RM Rotation Stage with Air Bearing

Friction-Free, Ideal for Indexing, Positioning, Scanning, Measuring Technology

- Cleanroom compatible
- Table diameters from 50 mm to 300 mm
- Load capacity up to 4170 N
- Eccentricity and flatness <200 nm
- Can be mounted vertically or horizontally



## Plglide motorized rotation stage

The Plglide RM series of motorized rotation stages are designed for accuracy, precision, high stiffness, and ease of use, and can be mounted in any orientation.

Various options can be combined to create a solution ideal for point-to-point indexing or constant velocity scanning.

The RM stages offer superior runout, flatness, and wobble performance. Because they are friction free and require no maintenance or lubrication, they are ideal for use in cleanrooms.

## 3-phase torque motor

- Brushless
- Slotless
- Low cogging torque

## Absolute encoder (optional)

Absolute encoders supply explicit position information that enables immediate determination of the position. This means that referencing is not required during switch-on, which increases efficiency and safety during operation.

## Accessories and options

- Encoder
- Optional tip/tilt platform
- Custom mounting flanges
- Vacuum feedthrough
- Slip rings
- Plglide filter and air preparation kit
- Single or multi-axis motion controllers and servo drives
- Base plates made of granite and systems for reducing vibration

## Fields of application

Optical adjustment, metrology, inspection systems, calibration, scanning.



	A-621.025	A-623.025	A-623.050	A-624.050	A-627.075	Unit	Tolerance
<b>Motion and positioning</b>							
Travel range	Unlimited, > 360°	Unlimited, > 360°	Unlimited, > 360°	Unlimited, > 360°	Unlimited, > 360°		
Table Diameter	50	100	100	150	300	mm	
Bearing journal length	25	25	50	50	75	mm	
Eccentricity*	300	200	200	100	75	nm	max.
Flatness*	150	100	100	75	50	nm	max.
Wobble*	5	3	3	2	1	μrad	max.
<b>Mechanical properties</b>							
Load capacity, axial	134	536	536	1206	4244	N	max.
Load capacity, radial	57	115	229	344	1203	N	max.
Load torque MX,Y	0.57	1.7	4.52	22.6	141.3	N·m	max.
Axial stiffness	26	96	96	210	788	N/μm	
Radial stiffness	8	18	35	64	204	N/μm	
Moment of inertia	125	1485	1530	8790	210850	kg·mm <sup>2</sup>	
Moved mass	0.4	1.2	1.4	3.2	21.5	kg	
Overall mass	1.2	3.1	4.5	8.6	50	kg	
Guide type	Air bearing	Air bearing	Air bearing	Air bearing	Air bearing		
<b>Drive properties</b>							
Drive type	Torque motor, 3-phase, brushless, ironless, slotless	Torque motor, 3-phase, brushless, ironless, slotless	Torque motor, 3-phase, brushless, ironless, slotless	Torque motor, 3-phase, brushless, ironless, slotless	Torque motor, 3-phase, brushless, ironless, slotless		
Intermediate circuit voltage, effective	48, nominal 80, max.	48, nominal 80, max.	48, nominal 80, max.	48, nominal 80, max.	48, nominal 80, max.	V DC	
Peak torque	0.21	2.1	2.1	4.71	8.46	N·m	typ.
Nominal torque	0.07	0.7	0.7	1.57	2.82	N·m	typ.
Force constant, effective	0.03	0.26	0.26	0.59	0.61	N·m/A	typ.
Resistance phase-phase	2.7	4.2	4.2	6.7	4.5	Ω	
Inductivity phase-phase	0.1	0.4	0.4	0.9	0.6	mH	
Back EMF phase-phase	4.1	31.8	31.8	71	74	V/kRPM	max.
<b>A-62x</b>							
Operating pressure###	75 to 85 psi (515 to 585 kPa)						
Air consumption	<2 SCFM (56 SLPM)						
Air quality	Clean (filtered to 1.0 μm or better) – ISO 8573 1 Class 1 Oil free – ISO 8573 1 Class 1 Dry (–15 °C dew point) – ISO 8573 1 Class 3						
Materials####	Hardcoat aluminum, stainless steel fasteners						

\* Depending on the quality of the underlying surface, the payload, orientation, and forces that act on the stage from the outside. Please contact PI for application-specific parameters. The specified values are static (no rotary motion during measuring) and without load.  
 # Uses 400-fold interpolation. Alternative digital encoder resolutions on request. Please contact PI for a quote.  
 ### To protect the stage against damage, it is recommended to connect an air pressure sensor to the Motion-Stop input of the controller.  
 #### Customer-specific materials such as rust-free steel on request. Please contact PI for a quote.

	A-62x.xxxAx	A-62x.xxxBx	A-62x.xxxCx
Integrated sensor	Incremental angle measuring system	Absolute-measuring angle measuring system	Incremental angle measuring system
Sensor signal	Sin/cos, 1 V peak-peak	BiSS-C	A/B quadrature, TTL
Lines/revolution	A-621: 8192 A-623: 15744 A-624: 23600 A-627: 47200	-	A-621: 8192 A-623: 15744 A-624: 23600 A-627: 47200
Velocity**	A-621: 2500 rpm max. A-623: 1200 rpm max. A-624: 600 rpm max. A-627: 500 rpm max.	A-621: 2500 rpm max. A-623: 1200 rpm max. A-624: 600 rpm max. A-627: 500 rpm max.	A-621: 550 rpm max.*** A-623: 300 rpm max.*** A-624: 175 rpm max.*** A-627: 75 rpm max.***
Sensor resolution	A-621: 0.19 $\mu$ rad**** A-623: 0.1 $\mu$ rad**** A-624: 0.06 $\mu$ rad**** A-627: 0.03 $\mu$ rad****	A-621: 0.0015 $\mu$ rad A-623: 0.0015 $\mu$ rad A-624: 0.0015 $\mu$ rad A-627: 0.0015 $\mu$ rad	A-621: 1.94 $\mu$ rad# A-623: 1.02 $\mu$ rad# A-624: 0.68 $\mu$ rad# A-627: 0.33 $\mu$ rad#
Bidirectional repeatability	$\pm 4 \mu$ rad	$\pm 4 \mu$ rad	$\pm 4 \mu$ rad
Accuracy, with error compensation##	$\pm 8 \mu$ rad	$\pm 8 \mu$ rad	$\pm 8 \mu$ rad
Reference point switch	1 / revolution, differential pulse over one sensor signal period, 1 V peak-peak	-	1 / revolution, one count over one step of the encoder, synchronized to output signal

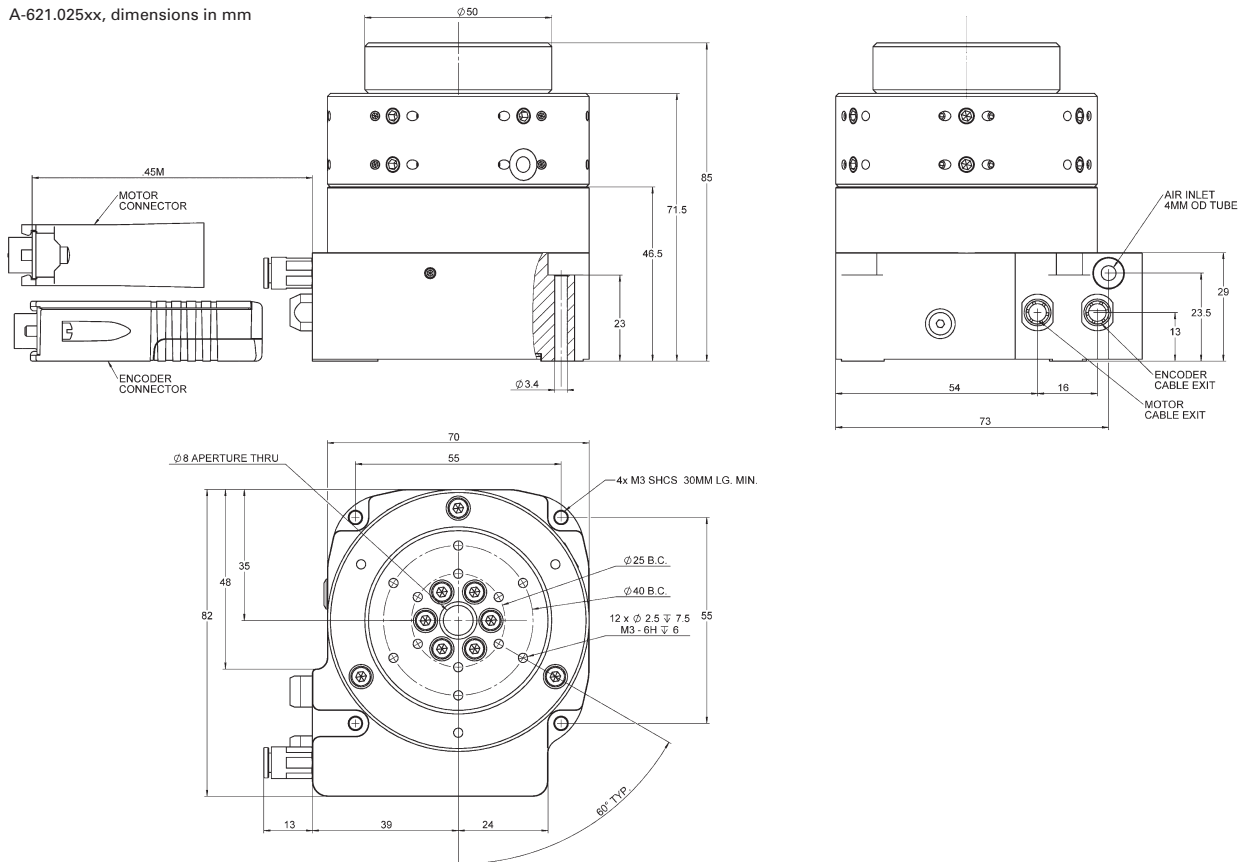
\*\* Can be limited by imbalance of the payload or the controller and the drive.

\*\*\* Assumes a sampling rate of 50 MHz.

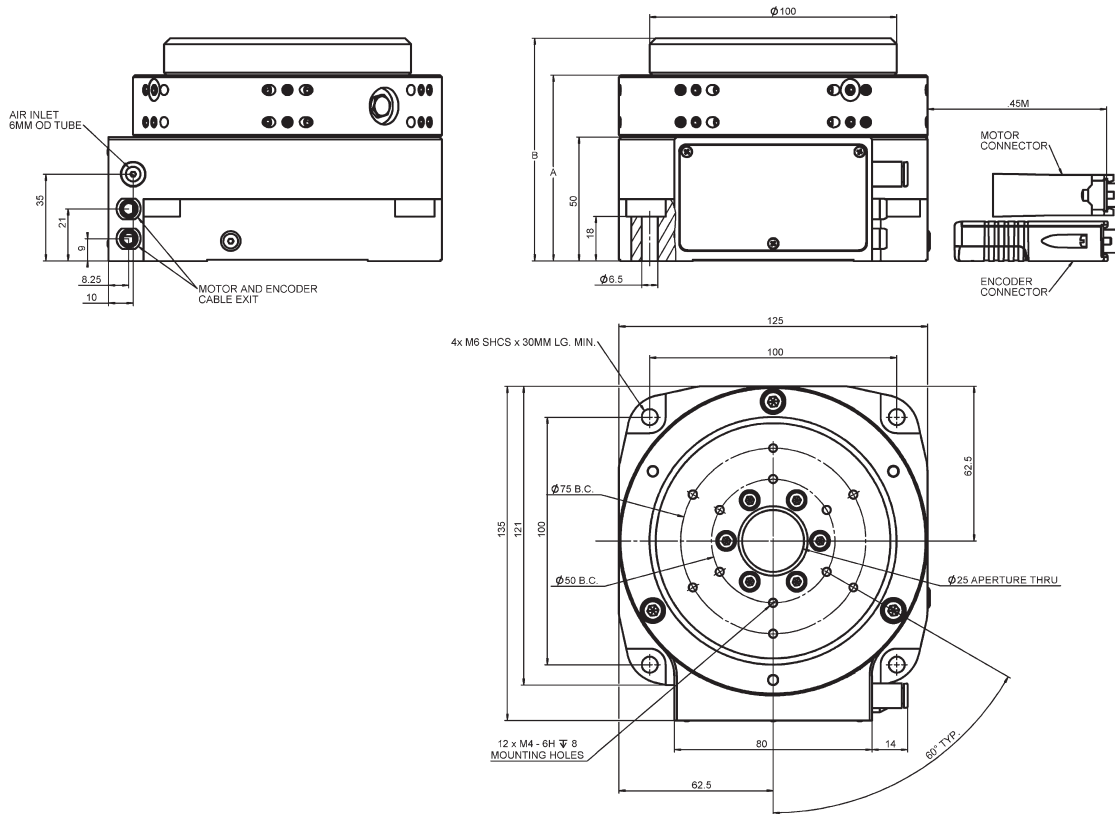
\*\*\*\* Assumes 4096-fold interpolation. Contact PI for the use of other factors.

## The specified values are based on error compensation controlled by the controller. The stage must be ordered with a controller from PI to reach these values. Accuracy values assume short-term time duration and do not consider the long-term effects of thermal drift on the stage.

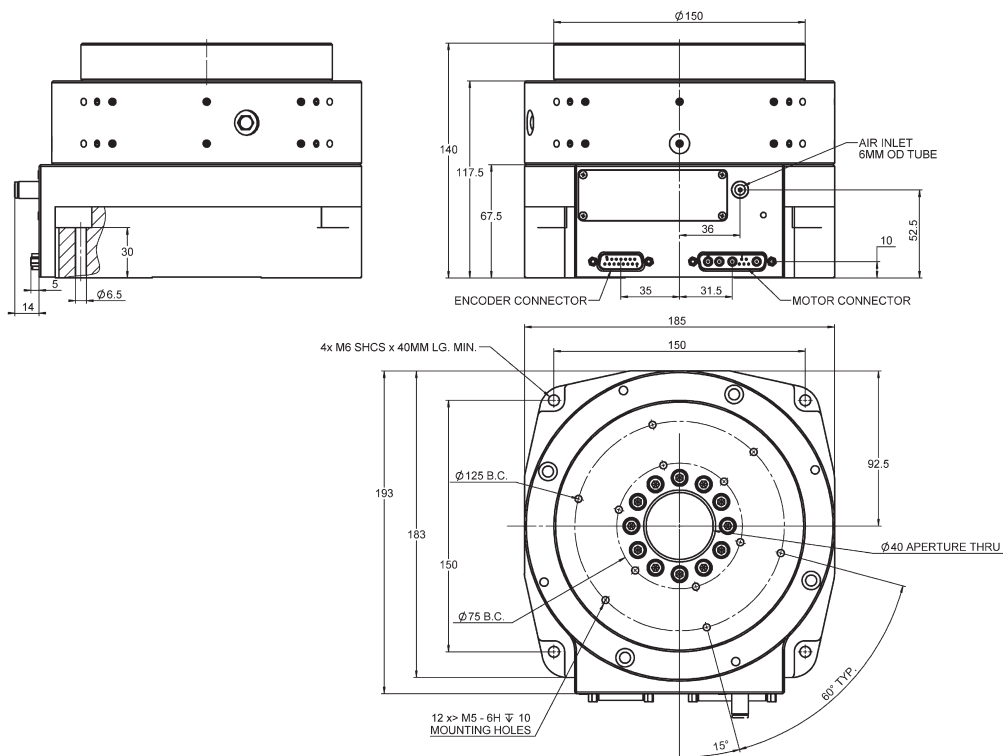
A-621.025xx, dimensions in mm



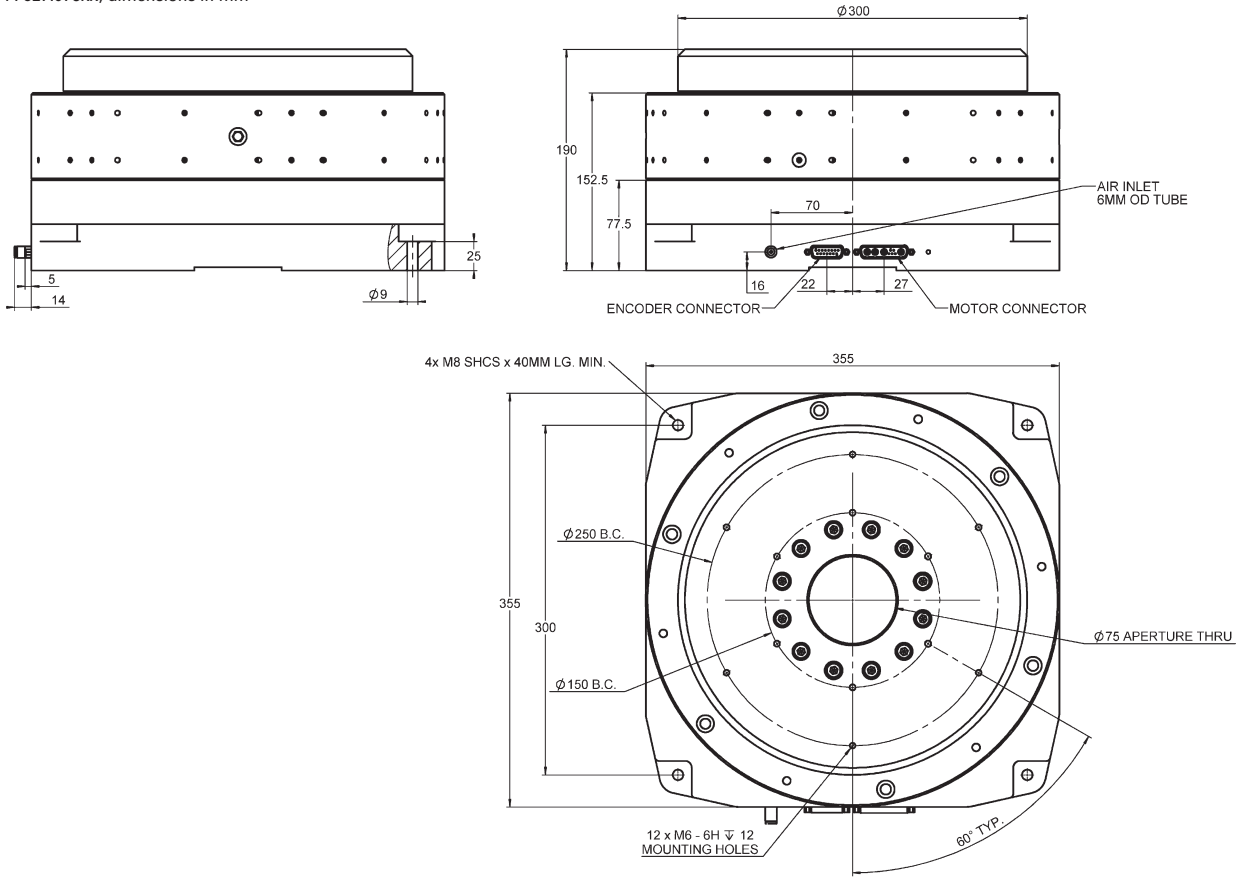
A-623.xxxxx, dimensions in mm  
 A-623.025xx: A=75 mm; B=90 mm  
 A-623.050xx: A=100 mm; B=115 mm



A-624.050xx, dimensions in mm



A-627.075xx, dimensions in mm



# A-10x Plglide RB Linear Air Bearing Module

Friction Free, Ideal for Positioning, Scanning, Metrology



- Ideal for scanning applications or high-resolution positioning
- Cleanroom compatible
- Size of the motion platform to 300 mm × 300 mm
- Travel ranges to 1 m
- Load capacity to 775 kg
- Straightness / flatness to 0.5 μm per 25 mm
- Pitch / roll / yaw to 1.2 μrad per 25 mm

Linear air bearings of the Plglide RB series are exactly right for applications that need smooth, precise, linear motion. The air bearing modules replace ball or crossed roller guides and are easy to integrate. They offer improved straightness, angular deviation, and repeatability compared to stage units with ball bearings, especially for travel ranges longer than 100 mm.

Because air bearings are basically friction free, they work without stiction on approach or during operation, even under maximum load. Air bearings work without making contact and with purified air, and are virtually maintenance and wear free.

#### Accessories and options

- Air preparation kit
- Mounting Feet
- Custom configurations on request
- Several motion platforms on one guide
- Constructions with moving guide

	Size of the motion platform / mm x mm	Travel range / mm	Vertical load capacity* / N	Lateral load capacity* / N
A-101	50 x 50	50 to 200	130	75
A-102	50 x 100	50 to 300	260	260
A-103	75 x 75	50 to 300	350	195
A-104	75 x 115	50 to 300	540	540
A-105	100 x 100	50 to 300	630	370
A-106	100 x 150	50 to 600	950	950
A-107	150 x 150	50 to 750	1580	790
A-108	200 x 200	50 to 1000	2950	1475
A-109	300 x 300	50 to 1000	7600	2210

	Travel ranges to 300 mm	Travel ranges to 600 mm	Travel ranges to 1000 mm	Lateral load capacity* / N
Straightness / flatness**	±1.25 µm	±2.5 µm	±5 µm	75
Straightness / flatness, per 25 mm travel range**	±0.25 µm	±0.25 µm	±0.25 µm	260
Position stability**	±0.05 µm	±0.05 µm	±0.05 µm	195
Pitch / yaw, per 25 mm travel range**	1.2 µrad	1.2 µrad	1.2 µrad	540
Pitch / yaw, overall**	10 µrad	20 µrad	30 µrad	370

**A-10x.xxx**

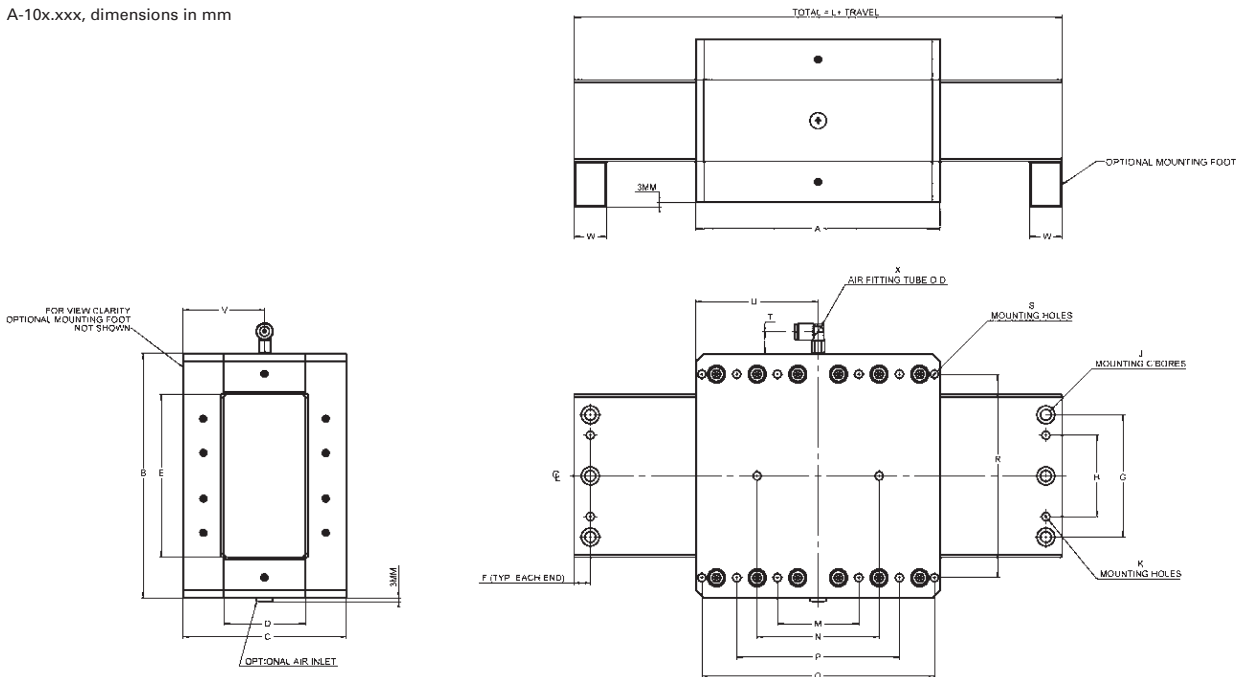
Operating pressure	80 psi (550 kPa) nominal
Air consumption	<1.0 SCFM (28 SLPM)
Air quality	Clean (filtered to 1.0 µm or better) – ISO 8573 1 Class 1 Oil free – ISO 8573 1 Class 1 Dry (-15 °C dew point) – ISO 8573 1 Class 3
Materials	Hardcoat aluminum, stainless steel fasteners

\* The specified load capacities assume an operating pressure of 80 psi (550 kPa).

For an alternative operating pressure, contact PI for determining other load capacities.

\*\* Precision specifications depend-ing on load, orientation, and external forces on the bearing. Contact PI for applicationspecific parameters.  
Ask about custom designs!

A-10x.xxx, dimensions in mm



	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	100	65	20	6 (1/4")

## A-10x.MNT Mounting Feet

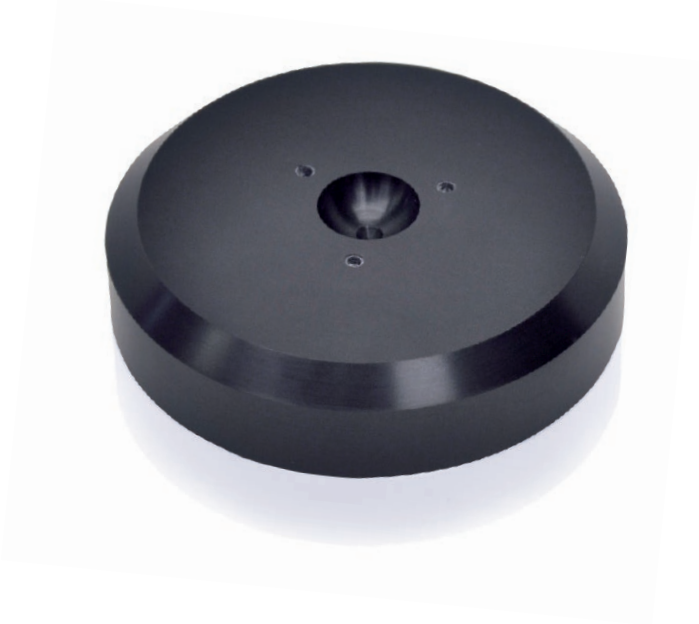
For Mounting the Air Bearing Modules of the A-10x Series

- Hardcoat aluminum
- Matched exactly to the respective air bearing module

	Compatible with	Width/mm	Overall mass (one set)/kg
A-101.MNT	A-101.xxx	10	0.03
A-102.MNT	A-102.xxx	10	0.03
A-103.MNT	A-103.xxx	15	0.08
A-104.MNT	A-104.xxx	15	0.08
A-105.MNT	A-105.xxx	20	0.13
A-106.MNT	A-106.xxx	20	0.13
A-107.MNT	A-107.xxx	20	0.27
A-108.MNT	A-108.xxx	20	0.46
A-109.MNT	A-109.xxx	20	0.94

# A-41x Plglide FPC: Flat, Circular Air Bearing Modules

Friction-free, modular air bearings



- Diameters from 25 mm to 300 mm
- Load capacity to 15500 N
- Stiffness to 860 kN/mm
- Mounting hardware, customizations, and accessories available

The Plglide Flat Pad Circular air bearing series is suitable for applications that require friction-free, accurate linear or planar motion. The modular concept of these air bearings allows the user to build their own motion system. Several bearings can be combined to increase the load capacity or to create multi-axis motion platforms.

#### Application fields

For the set-up of positioning, scanning, metrology, inspection and calibration systems.

Thanks to the friction-free motion, no particles are formed, which makes Plglide stages ideal for cleanroom applications.



Part #	Diameter/ mm	Ball interface diameter/mm	Load capacity/N	Stiffness/ N/ $\mu$ m	Air consumption/ l/h (SCFH)	Mass/g
A-411.025	25	13	88	17.5	60 (2)	16
A-411.040	40	13	220	28.0	60 (2)	42
A-411.050	50	13	330	52.5	85 (3)	66
A-411.065	65	13	660	78.8	115 (4)	171
A-411.080	80	13	1010	111	170 (6)	259
A-411.100	100	20	1710	175	170 (6)	505

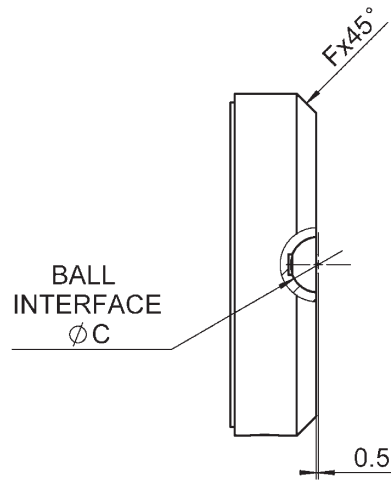
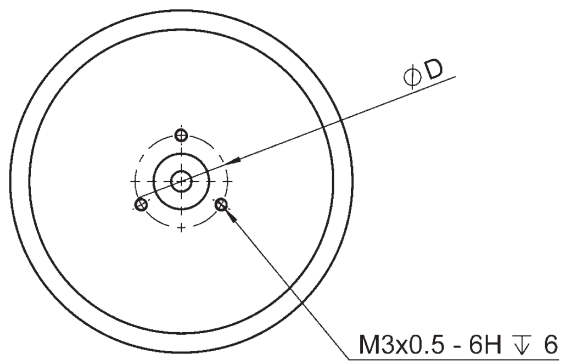
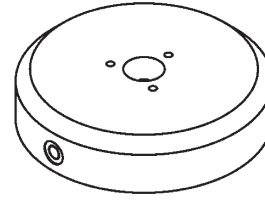
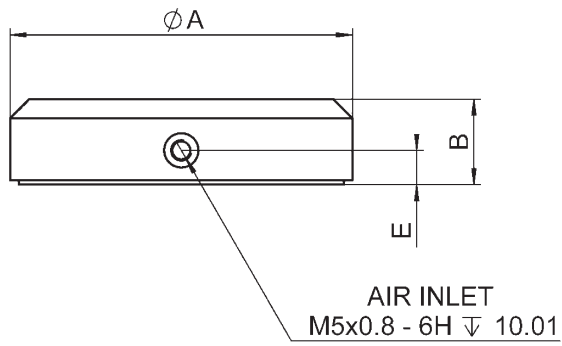
#### Air supply

Operating pressure	80 psi (550 kPa) nominal
Air quality	Clean (filtered to 1.0 $\mu$ m or better) – ISO 8573 1 Class 1 Oil free – ISO 8573 1 Class 1 Dry (-15 °C dew point) – ISO 8573 1 Class 3
<b>Miscellaneous</b>	
Guideway surface flatness	<1 $\mu$ m/300 mm
Nominal fly-height	10-15 $\mu$ m
Materials	Hardcoat aluminum, stainless steel fasteners
Recommended guideway materials	Guideways are supplied by the customer. Granite, hardcoat aluminum, stainless steel, ceramics, nickel-plated steel, nickel-plated cast iron
Air bearing type	Discrete orifice

#### Mounting Hardware (sold separately)

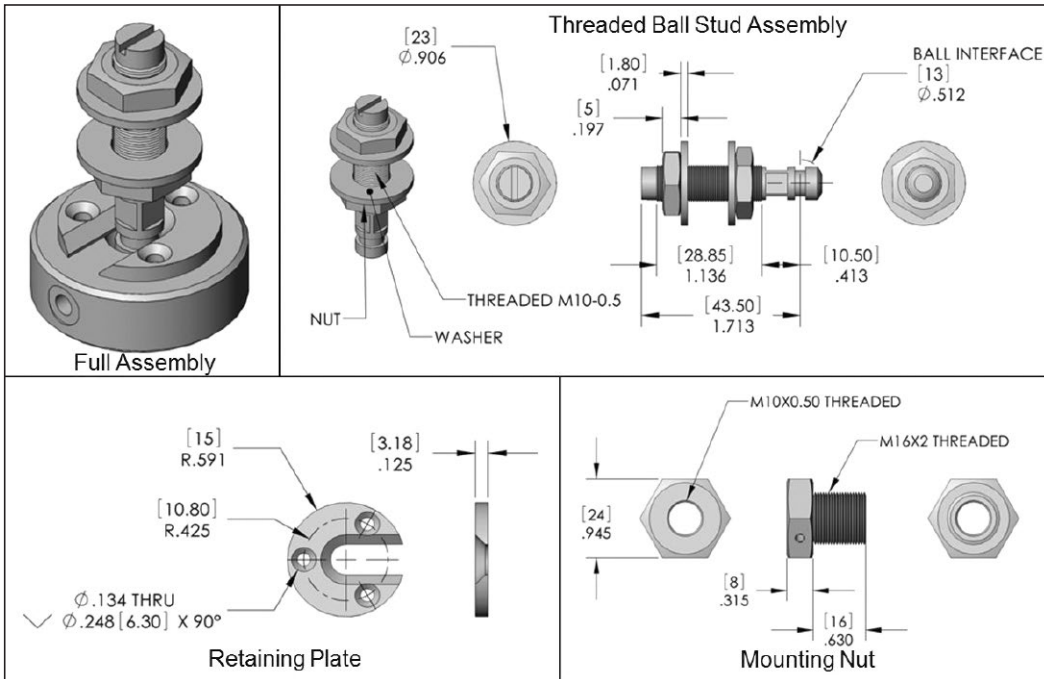
Part #	Description	Ball interface diameter
A-412.013S	Threaded ball stud assembly	13
A-412.013N	Mounting nut	13
A-412.013P	Retaining plate	13
A-412.020S	Threaded ball stud assembly	20
A-412.020N	Mounting nut	20
A-412.020P	Retaining plate	20

A-110.200, A-110.300 and A-110.400, dimensions in mm

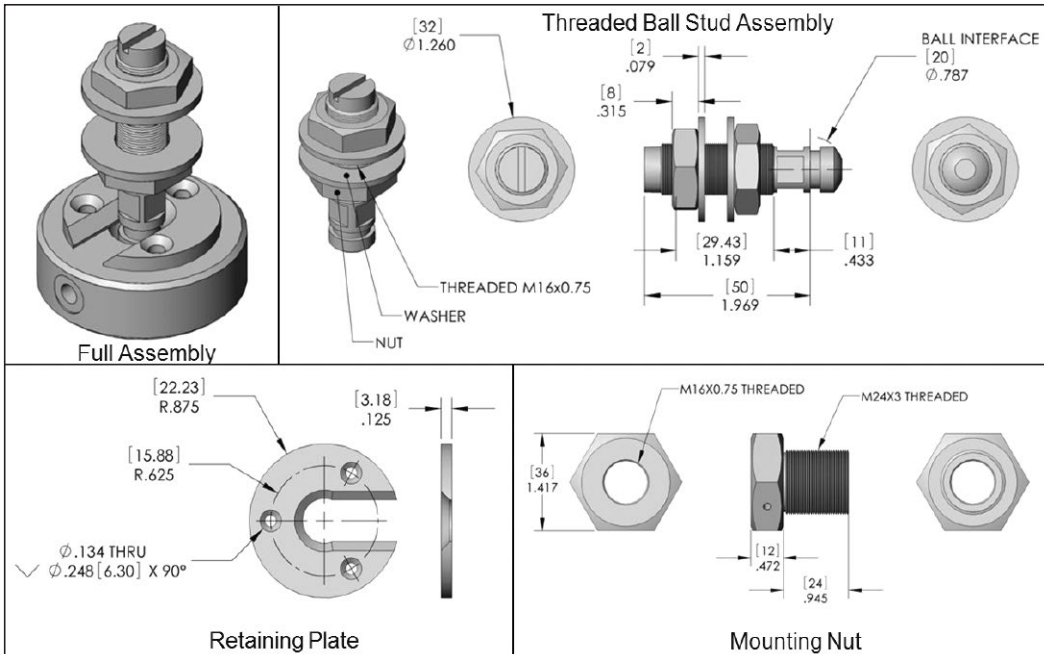


	A	B	C	D	E	F
A-411.025	25	13	13	N/A	6.4	1.5
A-411.040	40	13	13	21.6	7	1
A-411.050	50	13	13	21.6	7	1
A-411.065	65	20	13	21.6	8	1
A-411.080	80	20	13	21.6	8	4.5
A-411.100	100	25	20	31.6	9	6.4
A-411.125	125	35	20	31.6	9	6.4
A-411.150	150	35	20	31.6	9	6.4
A-411.200	200	66	20	31.6	9	25
A-411.300	300	66	20	31.6	9	25

Mounting hardware dimensions: 13 mm ball interface diameter



Mounting hardware dimensions: 20 mm ball interface diameter



Air Bearings

# A-60x Plglide RT Rotary Air Bearing Module

Frictionless, Non-motorized



- Table diameters from 50 mm to 300 mm
- Load capacity to 425 kg
- Eccentricity / flatness <200 nm
- Can be mounted vertically or horizontally

The Plglide RT series of nonmotorized passive rotary air bearings are designed for accuracy, precision, high stiffness, and ease of use. They can be used in any orientation and are easy to integrate with motors and encoders for complete positioning solutions.

The bearings of the RT series offer superior eccentricity, flatness, and wobble performance. Because they are completely friction-free, they exhibit no breakaway torque and no frictional resistance during operation. They are ideal for use in cleanrooms, require no maintenance or lubrication, and have unlimited lifetime.

## Accessories and options

- Encoder for precise acquisition of stage angle during manual operation
- Mounting base
- Plglide filter and air preparation kits
- Custom mounting flanges and square housings

## Application fields

Optical alignment, metrology, parts inspection, calibration, scanning, torque measurement.

Thanks to the friction-free motion, no particles are formed, which makes Plglide stages ideal for cleanroom applications.

Size and loads	Table diameter/mm	Journal length/mm	Load capacity* axial/radial/N	Permissible tilt torque*/N-m	Stiffness axial/ radial/N/μm
A-601.025	50	25	134 / 57	0.57	26 / 8
A-602.038	75	38	299 / 132	1.13	57 / 22
A-603.025	100	25	536 / 115	1.70	96 / 18
A-603.050	100	50	536 / 229	4.52	96 / 35
A-604.050	150	50	1206 / 344	22.6	210 / 64
A-604.090	150	90	1206 / 605	36.7	210 / 113
A-605.065	200	65	2144 / 577	39.6	385 / 110
A-605.100	200	100	2144 / 917	67.8	385 / 175
A-607.075	300	75	4244 / 1203	141.3	788 / 204
A-607.175	300	175	4244 / 2789	282.5	788 / 475

Performance specifications	Eccentricity**/ μm	Flatness**/ μm	Wobble**/ μrad	Max. velocity***/rpm	Moment of inertia/kg-mm <sup>2</sup>	Rotating mass/kg	Overall mass/kg
A-601.025	300	150	5	3000	35	0.15	0.4
A-602.038	300	150	5	3000	231	0.4	1.2
A-603.025	200	100	3	3000	705	0.7	1.5
A-603.050	200	100	3	3000	750	0.8	2.5
A-604.050	100	75	2	3000	4715	2.1	5.4
A-604.090	100	75	2	3000	5050	2.6	8.2
A-605.065	100	75	1.5	2000	17900	4.6	11.6
A-605.100	100	75	1.5	2000	18800	5.3	16.3
A-607.075	75	50	1	1000	181900	19.4	38.1
A-607.175	75	50	1	1000	206700	26.0	59.0

Optional encoders	Sensor signal	Sensor resolution/μrad	Max. velocity/ rpm	Reference point switch
A-601.xxxH	A/B quadrature, differential, RS-422, 4 MHz	192	2500	1 / revolution, one count over one step of the encoder, synchronized to output signal
A-602.xxxH	A/B quadrature, differential, RS-422, max. 4 MHz	133	2000	1 / revolution, one count over one step of the encoder, synchronized to output signal
A-603.xxxH	A/B quadrature, differential, RS-422, max. 4 MHz	100	1500	1 / revolution, one count over one step of the encoder, synchronized to output signal
A-604xxxH	A/B quadrature, differential, RS-422, max. 4 MHz	66.4	1000	1 / revolution, one count over one step of the encoder, synchronized to output signal
A-605.xxxH	A/B quadrature, differential, RS-422, max. 4 MHz	50	800	1 / revolution, one count over one step of the encoder, synchronized to output signal
A-607.xxxH	A/B quadrature, differential, RS-422, max. 4 MHz	33.5	500	1 / revolution, one count over one step of the encoder, synchronized to output signal

#### A-60x

Operating pressure	75 to 85 psi (515 to 585 kPa)
Air consumption	<2.0 SCFM (57 SLPM)
Air quality	Clean (filtered to 1.0 μm or better) – ISO 8573 1 Class 1 Oil free – ISO 8573 1 Class 1 Dry (-15 °C dew point) – ISO 8573 1 Class 3
Materials#	Hardcoat aluminum, stainless steel fasteners

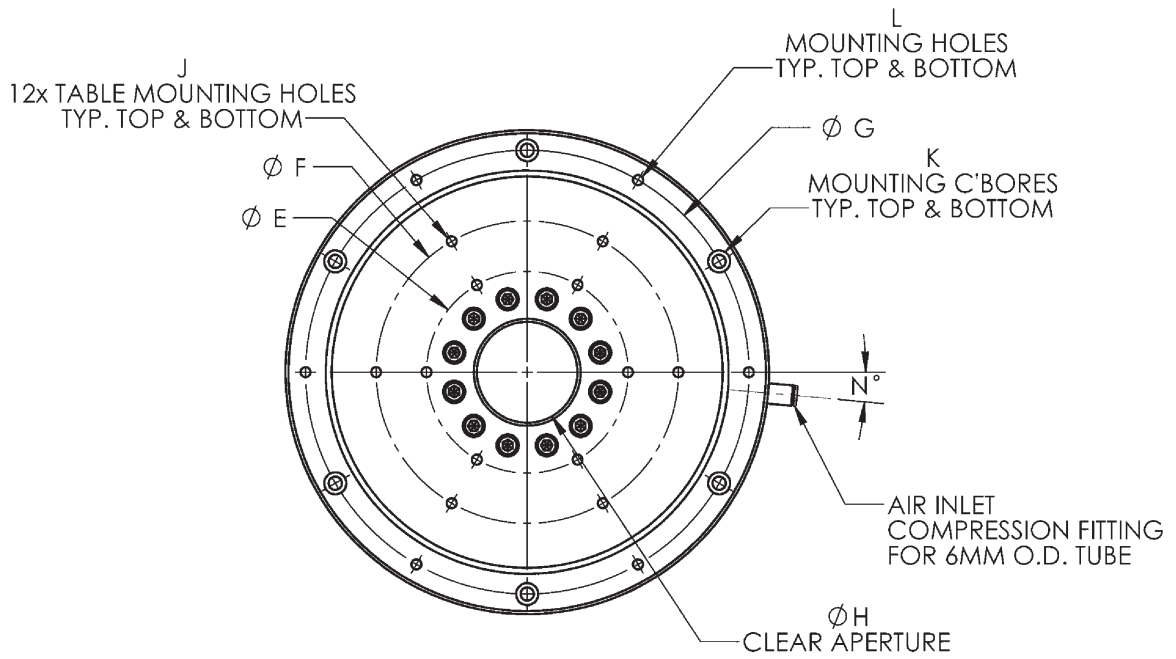
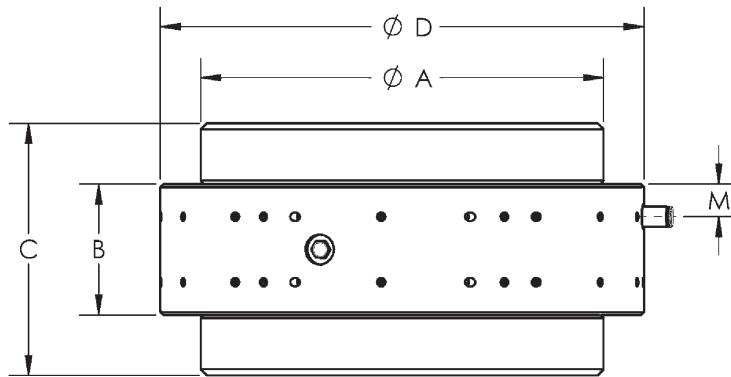
\* Loads listed assume supply pressure of 80 psi. Please contact PI if other pressures are required.

\*\* Precision specifications are dependent on quality of mounting surfaces, payload, orientation, and external forces on the bearing. For application-specific parameters, please contact PI. Values shown are static (no rotational velocity during measurement).

\*\*\* Velocity may be limited by the encoder option or payload imbalance. Please contact PI for further details.

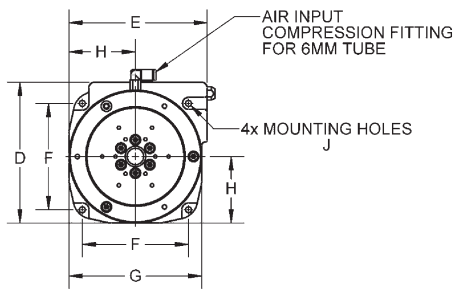
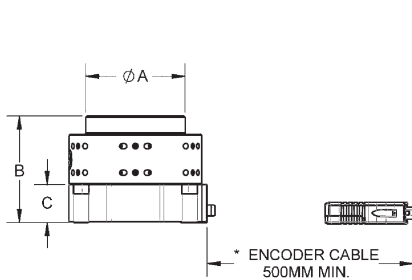
# Alternative stage surface materials such as stainless steel available. Please contact PI for a quote.

A-60x.xxx, dimensions in mm

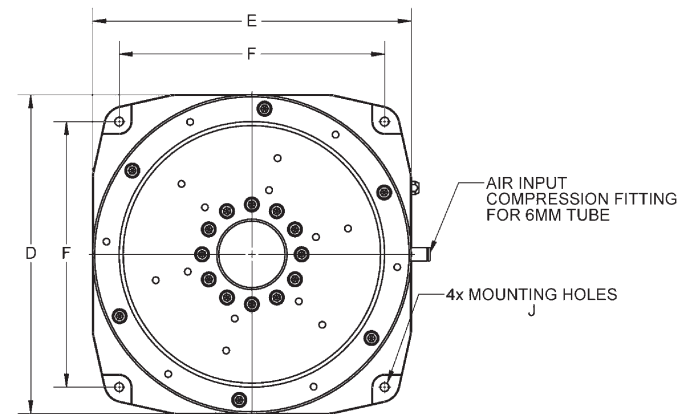
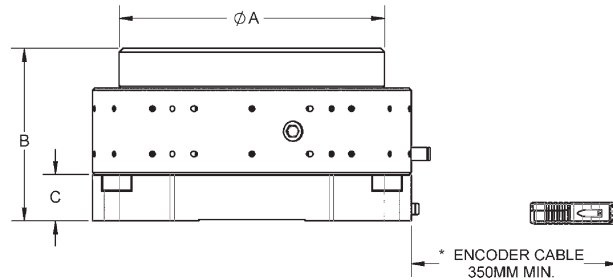


	A	B	C	D	E	F	G	H	J	K	L	M	N
A-601.025	50	25	50	70	25	40	60	8	M3x0.5, 6 DEEP	3x M3 SHCS, 30 LG. MIN	3x M3x0.5, 6 DEEP	6	30
A-602.038	75	38	65	100	30	50	87.5	12.5	M3x0.5, 6 DEEP	3x M4 SHCS, 40 LG. MIN	3x M4x0.7, 8 DEEP	9.5	30
A-603.025	100	25	55	125	50	75	112.5	25	M4x0.7, 8 DEEP	3x MS SHCS, 30 LG. MIN	3x M5x0.8, 10 DEEP	6	30
A-603.050	100	50	80	125	50	75	112.5	25	M4x0.7, 8 DEEP	3x MS SHCS, 50 LG. MIN	3x M5x0.8, 10 DEEP	12.5	30
A-604.050	150	50	95	185	75	125	170	40	M5x0.8, 10 DEEP	4x M6 SHCS, 50 LG. MIN	4x M6x1.0, 12 DEEP	12.5	68
A-604.090	150	90	135	185	75	125	170	40	M5x0.8, 10 DEEP	4x M6 SHCS, 90 LG. MIN	4x M6x1.0, 12 DEEP	22.5	68
A-605.065	200	65	125	240	100	150	220	60	M6x1.0, 12 DEEP	6x M6 SHCS, 70 LG. MIN	6x M6x1.0, 12 DEEP	16	5
A-605.100	200	100	160	240	100	150	220	60	M6x1.0, 12 DEEP	6x M6 SHCS, 100 LG. MIN	6x M6x1.0, 12 DEEP	23.5	5
A-607.075	300	75	150	355	150	250	330	75	M6x1.0, 12 DEEP	6x MS SHCS, 80 LG. MIN	6x M8x1.25, 16 DEEP	17.3	5
A-607.175	300	175	250	355	150	250	330	75	M6x1.0, 12 DEEP	6x MS SHCS, 150 LG. MIN	6x M8x1.25, 16 DEEP	58.5	5

A-60x.xxxH and A-60x.xxxM, dimensions in mm



SIZES A-601 & A-602



SIZES A-603 THRU A-607

NOTES:

- REFER TO RT SERIES DRAWING FOR TABLETOP DETAIL
- ENCODER DETAIL APPLIES ONLY TO "H" MODEL

	A	B	C	D	E	F	G	H	I
A-601.025 M or H	50	65	26.5	82	74	55	70	70	M3 SHCS, 25 LG. MIN
A-602.038 M or H	75	80	26.5	106	104	80	100	100	M4 SHCS, 30 LG. MIN
A-603.025 M or H	100	65	25	135	125	100	-	-	M5 SHCS, 25 LG. MIN
A-603.050 M or H	100	90	25	135	125	100	-	-	M5 SHCS, 25 LG. MIN
A-604.050 M or H	150	100	27.5	185	185	150	-	-	M5 SHCS, 30 LG. MIN
A-604.090 M or H	150	140	27.5	185	185	150	-	-	M5 SHCS, 30 LG. MIN
A-605.065 M or H	200	130	35	240	240	200	-	-	M6 SHCS, 35 LG. MIN
A-605.100 M or H	200	165	35	240	240	200	-	-	M6 SHCS, 35 LG. MIN
A-607.075 M or H	300	155	42.5	355	355	300	-	-	MB SHCS, 40 LG. MIN
A-607.175 M or H	300	255	42.5	355	355	300	-	-	MB SHCS, 40 LG. MIN

# A-65x Pliglide HB: Hemispherical Air Bearing

Friction-free, ideal for rotary motion on three axes



- Clean room compatible
- Low inertia
- Diameter up to 300 mm
- Rotatable in three directions
- Load capacity to 635 kg
- Tip/tilt range to  $\pm 45^\circ$
- Operating pressure of 30 psi to 90 psi (207 kPa to 621 kPa)
- Ideal for satellite control and simulation of weightlessness

## Overview

The Pliglide HB series with spherical air bearings makes unique positioning and simulation applications possible in the fields of research and industry. The bearings offer excellent load capacity and stiffness, and at the same time, inherent friction-free motion on three rotational axes. The spherical bearings, which are often used in research on weightlessness in satellites, are also used in systems for precision chip contacting and optical alignment. Due to the use of spherical bearings at both ends of the drive screw shaft, it is possible to build extremely stiff drive screws. This arrangement allows precision alignment of the drive screw shaft due to the motion of one spherical bearing relative to the other.

## Accessories and Options

- Air preparation kit
- Custom configurations on request

## Related and compatible products

- Accessories
- A-65x.PED Pedestal

	Sphere diameter	A-110.200xx	A-110.300xx	A-110.400xx	Unit	Tolerance
A-651	50	$\pm 45$	15	115	70	0.02
A-652	75	$\pm 45$	35	235	216	0.14
A-653	100	$\pm 45$	65	550	475	0.58
A-654	150	$\pm 45$	160	1350	1475	4.21
A-655	200	$\pm 45$	265	2500	3350	17.2
A-656	250	$\pm 45$	405	4000	5525	46.3
A-657	300	$\pm 45$	635	6500	8100	103

Operating pressure	80 psi (550 kPa) nominal, 90 psi (621 kPa) maximum
Air consumption	<1.0 SCFM (28 SLPM)
Air quality	Clean (filtered to 1.0 $\mu\text{m}$ or better) – ISO 8573 1 Class 1 Oil-free – ISO 8573 1 Class 1 Dry ( $-15^\circ\text{C}$ dew point) – ISO 8573 1 Class 3
Materials	Hardcoat aluminum, stainless steel fasteners, walternative materials on request

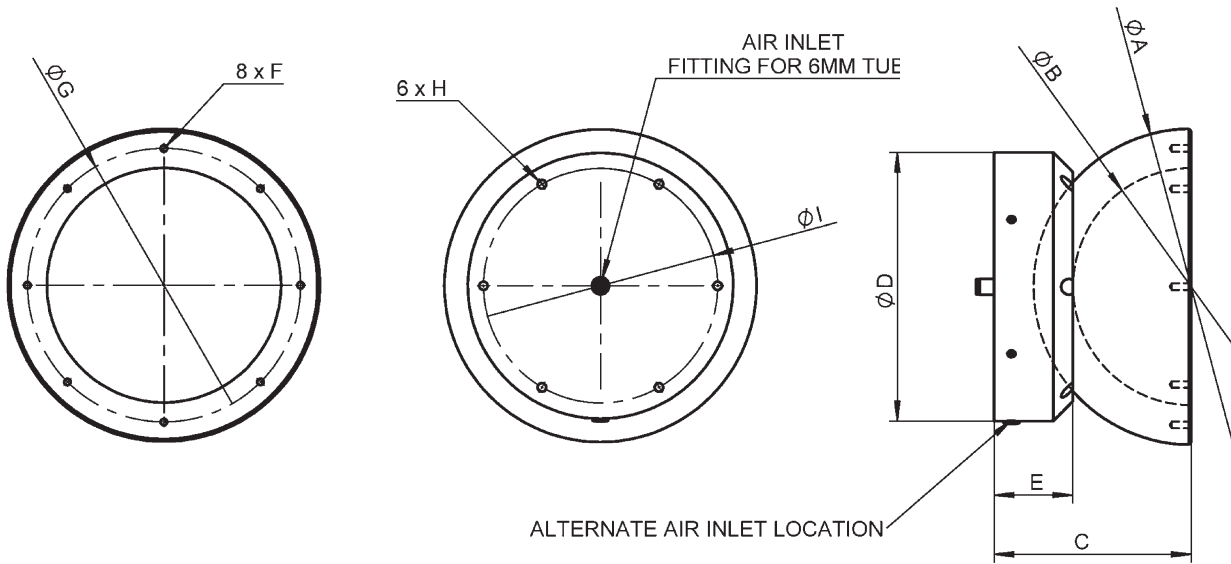
\* The specified load capacities assume an operating pressure of 80 psi (550 kPa).  
For an alternative operating pressure, contact PI for determining other load capacities.

\*\* Other travel ranges on request.

\*\*\* Around the center of the sphere.



A-65x.045, dimensions in mm

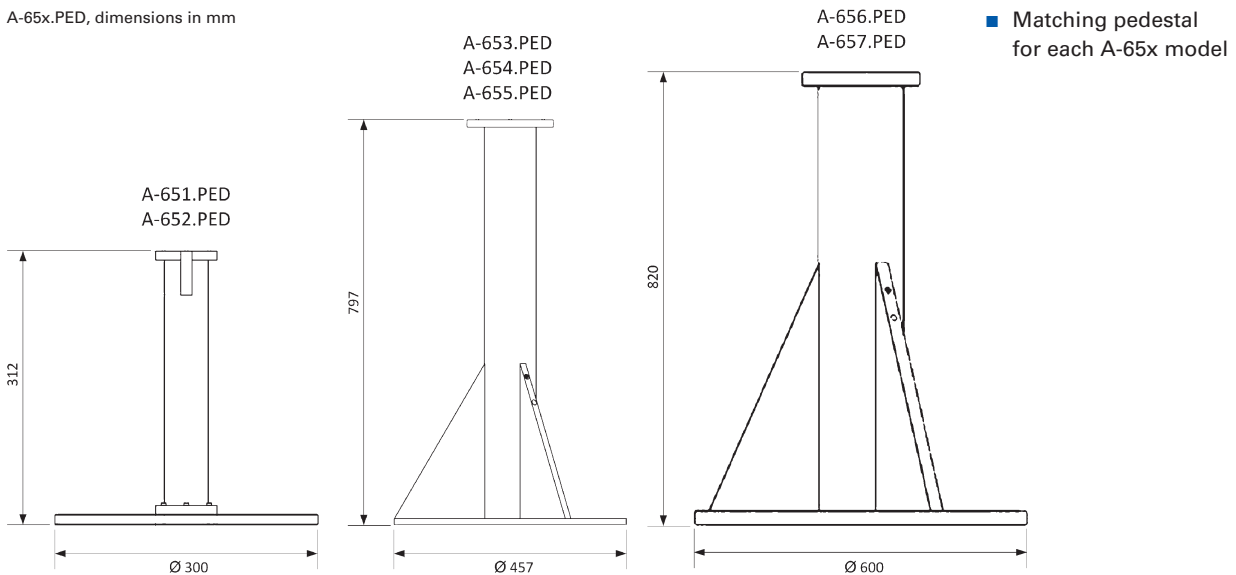


	A	B	C	D	E	F	G	H	I
A-651	50	30	42	55	23	M3	38	M3	45
A-652	75	50	55	70	27	M3	60	M3	60
A-653	100	70	70	100	30	M4	85	M4	85
A-654	150	110	95	140	40	M5	125	M5	125
A-655	200	150	125	170	50	M5	175	M5	150
A-656	250	200	150	210	55	M6	225	M6	190
A-657	300	250	175	250	65	M6	275	M6	230

## A-65x.PED Pedestal

Compatible with A-65x Pliglide HB Hemispherical Air Bearing

A-65x.PED, dimensions in mm



# A-81x Pliglide Motion Controller

## Multi-Axis Controller for Direct Drive Air Bearing Stages



- 1, 2, & 4 motion axes
- Fully integrated closed-loop servo control, amplifier module, and power supplies
- For voice coils, DC motors, and 3-phase brushless motors
- Quiet PWM drives
- Encoder inputs support sine/cosine and BiSS-C
- 19" rack unit
- 5 A average current / 10 A peak output current per axis

The A-81x motion controller series from PI offers a fully integrated electronics solution with controller, drives, and power supplies in a compact 19-inch rack unit. They are designed and optimized for Pliglide air bearing tables that are equipped with direct drive linear and rotation servo motors and high-resolution encoders.

Standard options include inputs for incremental sine/cosine and absolute encoders that use the BiSS-C data protocol. Support for sine/cosine encoders has an integrated interpolation factor of 16384x. All controllers feature integrated flash memory for stored motion programs and parameters.

The A-81x controllers can run in standalone mode running stored programs, or controlled via an external PC. A PC is required for programming and start-up. All software is supplied with the controller.

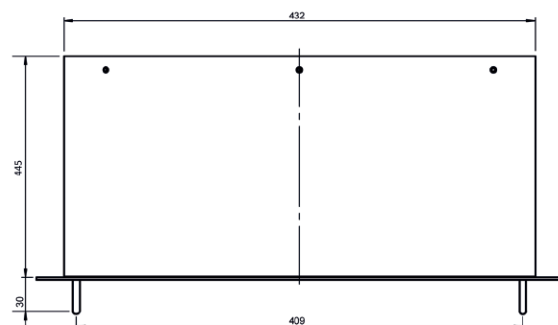
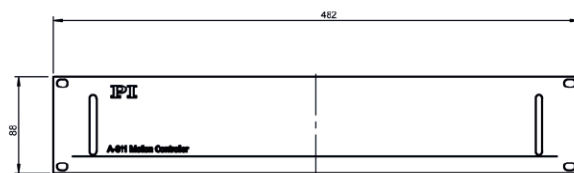
If the controller is purchased with a Pliglide air bearing table or positioning system, PI will perform the servo tuning, start-up of the controller, and error calibration and supplies a complete ready-to-use positioning system.

### Typical customizations

- Alternate packaging for OEM designs
- I/O configurations
- Position triggering
- Virtual encoder outputs
- Advanced Control Algorithms
- Dual-feedback servo loops
- Additional axes
- Higher power output
- Linear servo drives and power supplies

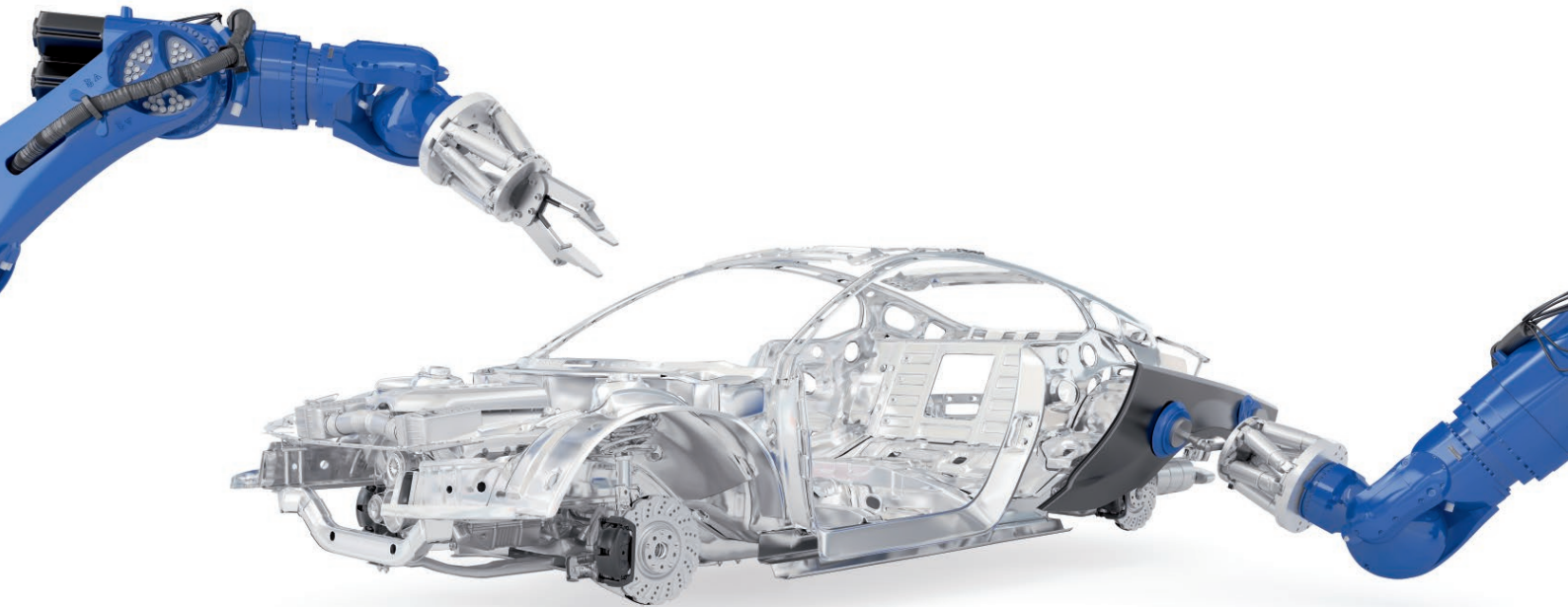
	A-811.23x00	A-812.21x00	A-814.21x00
Number of axes	1	2	4
Controller type	Closed loop servo control (PID) with parameter changing during operation	Closed loop servo control (PID) with parameter changing during operation	Closed loop servo control (PID) with parameter changing during operation
Servo-frequency position control	10 kHz	10 kHz	10 kHz
Servo frequency current control	20 kHz	20 kHz	20 kHz
Trajectory profile modes	Point-to-point, jog	Point-to-point, jog, S-curve, interpolated coordinated multi-axis	Point-to-point, jog, S-curve, interpolated coordinated multi-axis
Cooling	Fan on the side, continuous operation, constant speed	Fan on the side, continuous operation, constant speed	Fan on the side, continuous operation, constant speed
Drive type	PWM	PWM	PWM
Encoder options (factory configured)	Incremental sine / cosine (1 Vp-p), Absolute, BiSS-C	Incremental sine / cosine (1 Vp-p), A/B quadrature (RS-422) Absolute, BiSS-C	Incremental sine / cosine (1 Vp-p), A/B quadrature (RS-422) Absolute, BiSS-C
Interpolation factor (Sine encoder options)	Up to 16384x	Up to 16384x	Up to 16384x
Motor output voltage	60 V DC	60 V DC	60 V DC
Motor types	Voice coil, DC motor, 3-phase brushless servo motor with encoder-based sine commutation	Voice coil, DC motor, 3-phase brushless servo motor with encoder-based sine commutation	Voice coil, DC motor, 3-phase brushless servo motor with encoder-based sine commutation
Output current (per axis)	5 A continuous operation, 10 A peak	5 A continuous operation, 10 A peak	5 A continuous operation, 10 A peak
Power supply	120/240 V AC, single phase, 50-60 Hz (factory configured)	120-240 V AC, single phase, 50-60 Hz (factory configured)	120-240 V AC, single phase, 50-60 Hz (factory configured)
User I/O (Without reference and limit switch)	4x digital input, 24 V DC, sink 4x digital output, 24 V DC, sink 1x analog input, differential, $\pm 10$ V DC, 12 bit	2x digital input, 24 V DC, sink 2x digital output, 24 V DC, source 1x analog input, differential, $\pm 10$ V DC, 12 bit 1x analog output, differential, $\pm 10$ VDC, 10 bit 2x RS-422 high-speed output for position trigger (PEG)	4x digital input, 24 V DC, sink 4x digital output, 24 V DC, source 2x analog input, differential, $\pm 10$ V DC, 12 bit 2x analog output, differential, $\pm 10$ V DC, 10 bit 4x RS-422 high-speed output for position trigger (PEG)
Communication	USB 2.0 or TCP/IP	TCP/IP	TCP/IP
Interlock / Motion-Stop	1x24 V DC	1x24 V DC	1x24 V DC
Connector interface	Rear panel connectors Sub-D for motor and signal connections IEC 60320 type C14 for power supply	Rear panel connectors Sub-D for motor and signal connections IEC 60320 type C14 for power supply	Rear panel connectors Sub-D for motor and signal connections IEC 60320 type C14 for power supply
Mass (approx.)	7.3 kg	8.5 kg	9.3 kg

A-81x, dimensions in mm



Motion Control

# Solutions for Motion Centric Industrial Automation



Positioning and motion tasks in industrial automation such as those in assembly, semiconductor manufacturing, mechanical engineering, laser material processing, inspection systems or in additive manufacturing demand solutions that need to be robust and reliable. Submicrometer accuracy, exact position reproducibility, high dynamics, and throughput are just as essential. This is particularly the case with industry 4.0 where safety and simple networking options play an important role.

## SMARTER MOTION AND POSITIONING

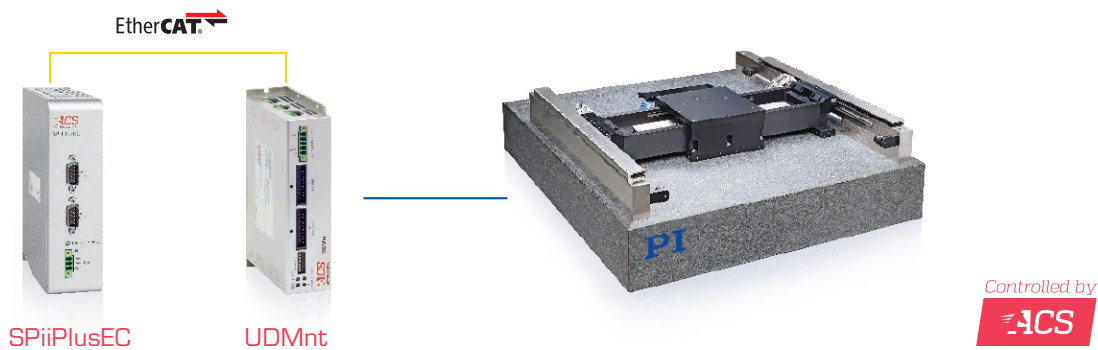
What makes a positioner and motion solution smart? What functions and features must a high-performance control solution offer to make smart motion and positioning possible? PI has identified the following list of basic requirements that make it possible to offer solutions for industrial applications that fulfill the high demands for precision and dynamics irrespective of the number of motion axes.

- Functional safety
- Communication via fieldbus interfaces
- Autotuning
- Synchronization of the individual axes in the system
- Multidimensional motion profiles
- 3-DOF compensation of the position error
- Yaw compensation for gantry solutions
- Suppression of system oscillation
- Robust control behavior
- Easy integration into the higher-level automation environment

## COMPLETE SOLUTIONS FOR HIGH-THROUGHPUT AND HIGH-PRECISION MULTI-AXIS APPLICATIONS

Those requirements can only be fulfilled when the mechanics, drive technology, and control electronics of the positioning system are perfectly matched to each other.

A solution from a single-source supplier does not just offer the customer sophisticated positioning technology and high-performance control solutions, but also faster start-up and high flexibility when implementing new requirements.



## HIGH-PERFORMANCE MOTION CONTROL SYSTEMS

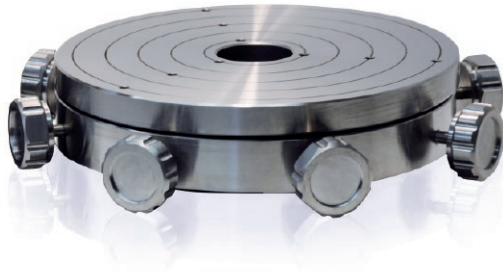
ACS Motion Control offers distributed-architecture motion control systems, completely modular, with components organized over three levels: The first level is the user interface. This is basically the host software and allows communication with the motion system.

The devices on the second level are called motion controllers. The motion controller is responsible for communication with the host software and also takes care of everything related to profile generation, trajectory, macros, diagnostics, and so on. The position commands are sent to the universal drive modules on the third level via an EtherCAT real-time network. In some products, the motion controller, the drives, and the power supplies are integrated into one housing. These products are called control modules.

The universal drive modules on the third level include the digital servo processor (DSP). It performs the servo positioning of the axes. The drive modules power and actuate the motors, handle the feedback devices, manage the I/Os, and analyze the sensor signals for closed-loop positioning control.

# A-60x.MTT Pliglide Manual X-Y-Tilt Platform

Compatible with A-60x and A-62x

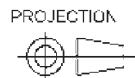
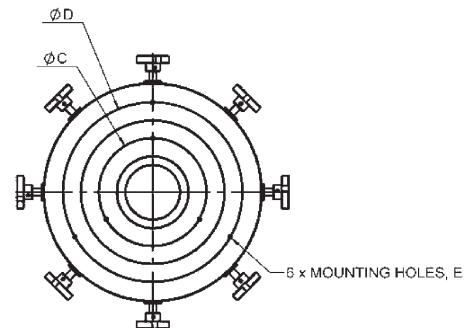
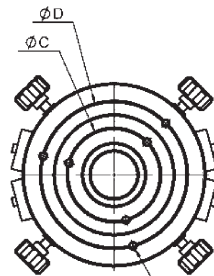
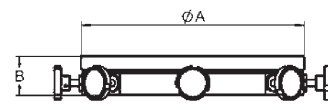
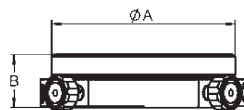


- Table diameters from 75 to 300 mm
- Manual operation
- 4 degrees of freedom: X, Y,  $\theta_x$ ,  $\theta_y$
- Clear aperture
- Directly mounts to A-60x and A-62x

	Table diameter/mm	Travel range X,Y	Travel range $\theta_x$ , $\theta_y$	Overall mass/kg	Moment of inertia/kg-mm <sup>2</sup>
A-602.MTT	75	±3 mm	±1,25°	0,8	620
A-603.MTT	100	±3 mm	±1,25°	1,5	2090
A-604.MTT	150	±3 mm	±1,25°	4	12900
A-605.MTT	200	±3 mm	±1,25°	8,6	52100
A-607.MTT	300	±3 mm	±1,25°	25	319000

	Table diameter /mm	Compatibility with A-60x	Compatibility with A-62x
A-602.MTT	75	A-602.xxx	
A-603.MTT	100	A-603.xxx	A-623.xxx
A-604.MTT	150	A-604.xxx	A-624.xxx
A-605.MTT	200	A-605.xxx	
A-607.MTT	300	A-607.xxx	A-627.xxx

A-60x.MTT, dimensions in mm



A-602 / A-603

6 x MOUNTING HOLES, E

A-604 through A-607

	A	B	C	D	E
A-602.MTT	75	25	30	50	M3x0.5, 6 DEEP
A-603.MTT	100	30	50	75	M4x0.7, 8 DEEP
A-604.MTT	150	35	75	125	M5x0.8, 10 DEEP
A-605.MTT	200	45	100	150	M6x0.5, 6 DEEP
A-607.MTT	300	55	150	250	M3x0.5, 6 DEEP

# A-80x Plglide Filter and Air Preparation Kits

## Accessories for Air Bearing Stages



- Cleans and filters compressed air supply
- Regulates supply pressure
- Optional pressure switch
- Recommended for use with all Plglide air bearing products
- Customization available

### Overview

In order to guarantee long-term reliability and proper operation of air bearings, their air supply must be clean, dry, and oil free. Contamination in the air can cause a reduction in stiffness and load capacity as well as increase in friction. Eventually, the bearing will be damaged and fail due to contamination. To prevent such contamination, PI offers efficient and cost effective air preparation assemblies which give users a simple way to clean any air supply. These kits filter particles and remove oil down to ISO 8573-1 Class 1.

### Sizing & Selection

PI recommends the A-801 model for installations where the air supply quality is not clean to ISO 8573-1 Class 3 or for installations supporting more than four axes of air bearing motion.

If the air supply is clean and oil free to ISO 8573-1 Class 3 and the installation requires less than 1ww0 SCFM (300 SLPM) of air flow, customers may select the smaller A-802 model. Customers unsure of their air supply quality should use the A-801 model.

If the compressed air supply contains moisture (ISO 8573-1 Class 4 or higher, dew point higher than 0°C), PI recommends adding a dryer (desiccant or refrigeration type) to the air supply upstream of the air preparation kit.

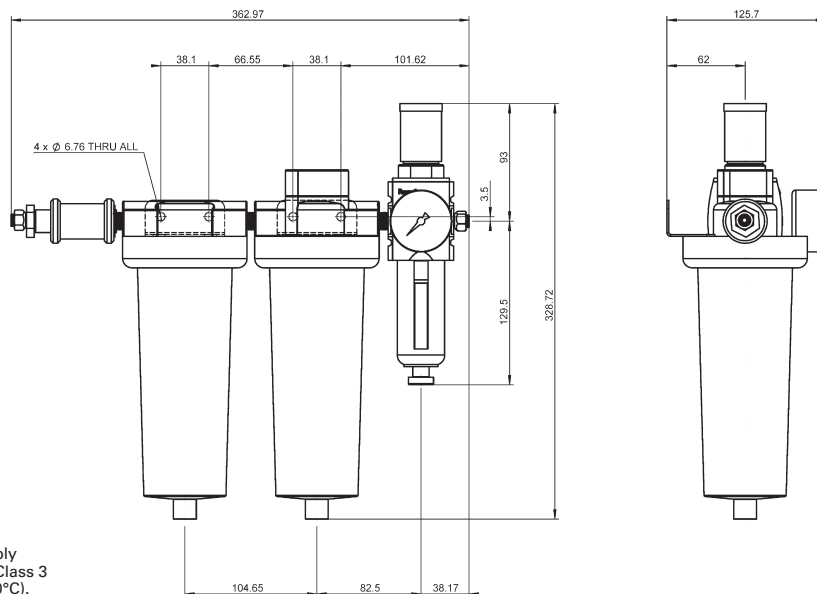
### Characteristics

- Multi-stage filtration – multiple filter elements enable the air preparation assembly to remove the most common air contaminants.
- Pressure regulation – the assembly includes a pressure regulator with integrated pressure gage. Adjustments to the bearing supply pressure are easily made.
- Shut-off Valve – a manual shut-off valve is standard with the air preparation kit.
- Tubing and fittings – PI offers a variety of air fittings for the input and the output connections to the air preparation kit. If you do not see the fitting you require, please contact us for customizations. 2 meters of tubing to connect the air preparation kit to the air bearing are included with each kit.
- Semi-automatic drains – allow easy removal of captured materials.
- Optional Pressure switch – when used to supply a motorized air bearing stage, the air preparation kit should be purchased with the optional air pressure switch. This switch can be wired into the Motion-Stop input of the motion controller to help prevent damage to the air bearing in the event of supply pressure failure. The set point of the switch is adjustable.



	A-801	A-802
<b>Description</b>	Large 4-stage air preparation kit	Small 2-stage air preparation kit
<b>Air supply</b>		
Max flow	60 SCFM (1680 SLPM)	10 SCFM (300 SLPM)
Compressed air supply quality (ISO 8573-1)	as desired	Class 3 or better
Max input pressure	150 bar (1035 kPa)	150 bar (1035 kPa)
<b>Miscellaneous</b>		
Primary construction	Aluminum	Polycarbonate
Mass	4.2 kg	0.7 kg
<b>Options</b>		
Option 1 Pressure Switch	1 = None	2 = N/O contact, adjustable set point
Option 2 Input Air Fitting	0 = one-touch fitting, 6 mm and 8 mm external diameter in the scope of delivery	0 = one-touch fitting, 1/4" and 3/8" external diameter in the scope of delivery
Option 3 Output Air Fitting	0 = one-touch fitting, 6 mm and 8 mm external diameter in the scope of delivery	0 = one-touch fitting, 1/4" and 3/8" external diameter in the scope of delivery

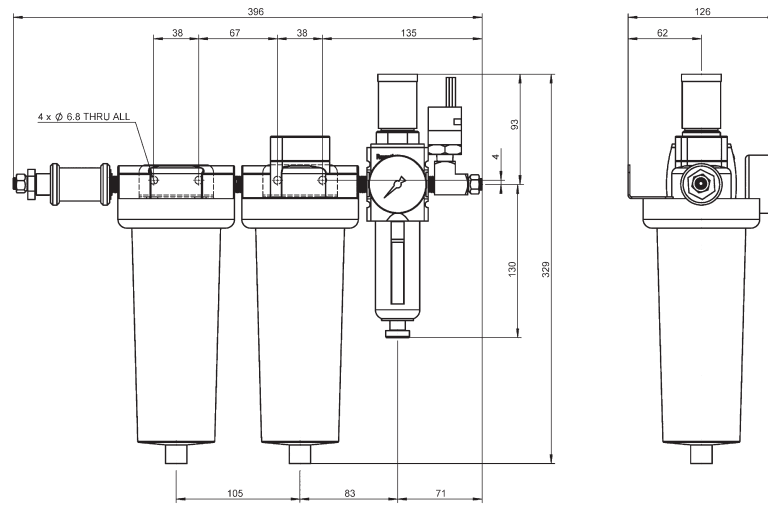
A-801.100, dimensions in mm



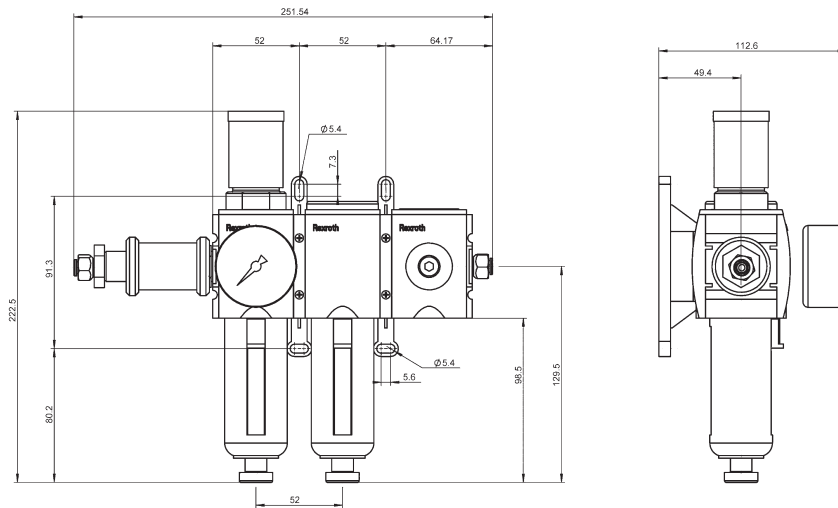
All kits require a compressed air supply with dry air according to ISO 8573-1 Class 3 or better (dew point no greater than 0°C).



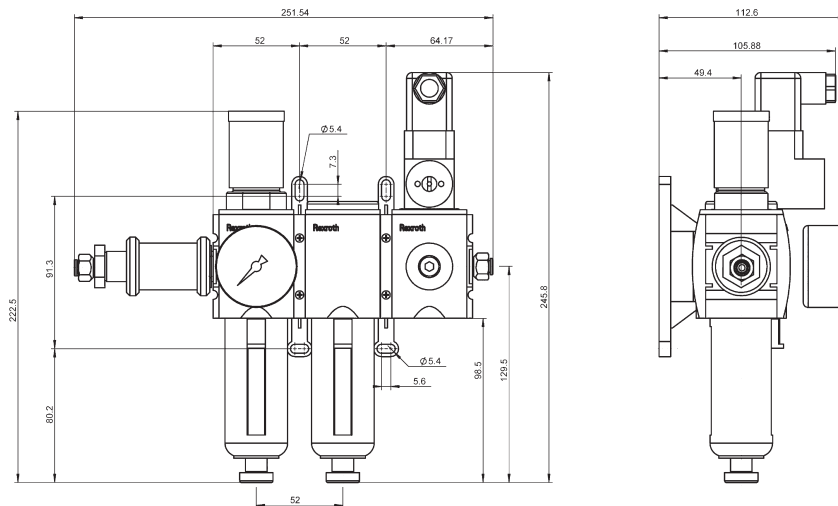
A-801.200, dimensions in mm



A-802.100, dimensions in mm



A-802.200, dimensions in mm



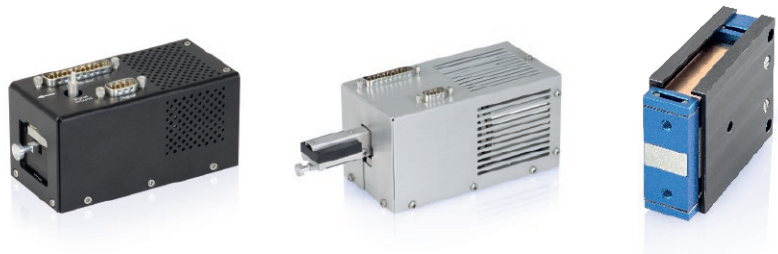
Air consumption below the set point, open pressure switch (left).  
 Air consumption above the set point, closed pressure switch (right).

# Product Overview PIMag® Stages

## Linear Motors and Voice Coil Drives

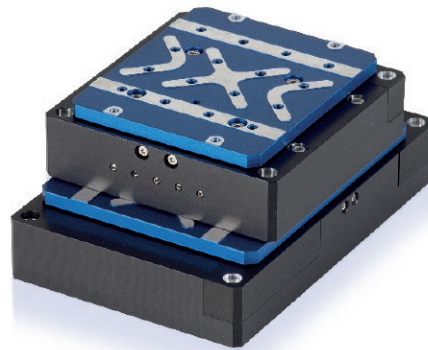
V-273, V-275, V-277PIMag® VC Voice Coil Actuators  
High Dynamics & Force Control Option

- Push force up to 20 N
- Velocity up to 750 mm/s
- Integrated linear encoder, 0.01  $\mu\text{m}$  resolution
- Weight force compensation
- Optional force sensor with 1 mN resolution
- High scanning frequencies, fast step-and-settle
- Wear-free flexure guiding for long lifetime
- Compact design & customization



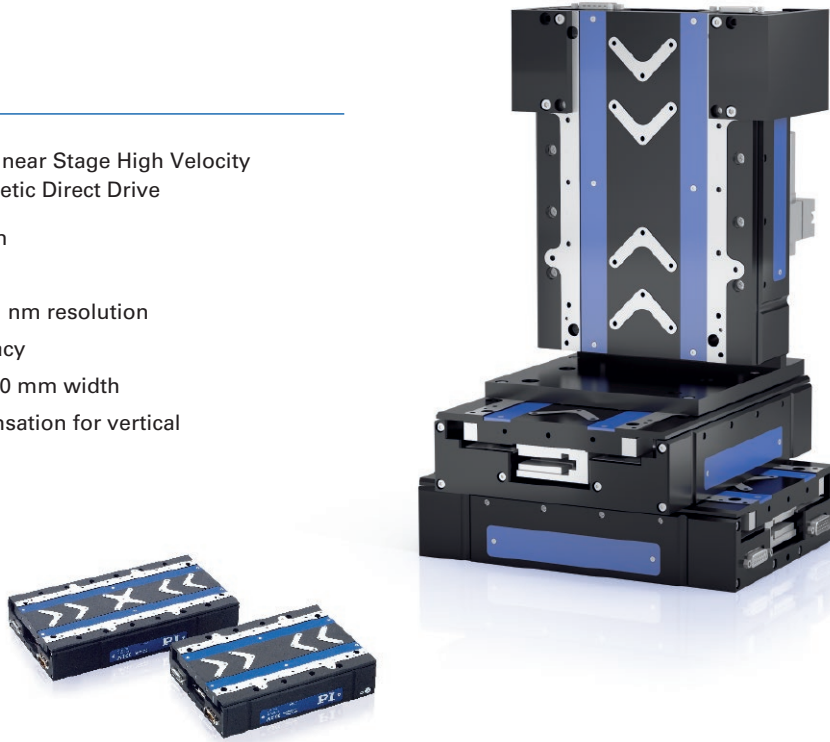
V-522, V-524, V-528 High-Dynamics PIMag® Linear Stage  
Voice Coil Direct Drive With Direct Position Measurement

- Fast scanning and positioning
- Travel ranges 5 mm, 10 mm, 20 mm
- Scanning frequencies of more than 10 Hz
- Max. velocity 250 mm/s
- Crossed roller bearings for the highest precision



## VV-551 PIMag® Precision Linear Stage High Velocity and Precision due to Magnetic Direct Drive

- Travel ranges to 230 mm
- Velocity up to 0.5 m/s
- Absolute encoder with 1 nm resolution
- Excellent guiding accuracy
- Compact design with 160 mm width
- Optional weight compensation for vertical operation



## V-731 High-Precision XY Stage High Travel Accuracy and Stability, Magnetic Direct Drive

- Travel range 205 mm × 205 mm (8")
- Unidirectional repeatability to 0.05 μm
- Velocity to 200 mm/s
- Incremental encoder with 10 nm resolution
- Other travel ranges available on request
- Optionally with stepper motor

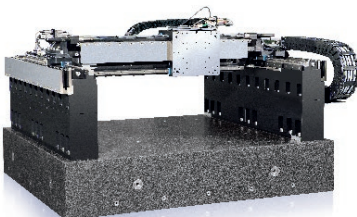


# Engineered Systems Capabilities



Precision components, stable control and a great deal of experience in engineering are essential for high-precision complex motion and positioning solutions. PI is a supplier of technologically sophisticated drive components and high-precision positioners and also offers all levels of integration up to the turnkey solution.

Engineering services have been a part of PI's core business for many years. Complete solutions, fitting seamlessly into existing processes, advance automation in major research installations as well as manufacturing and inspection processes for chip production or photonics packaging.



Gantries are normally equipped with linear motors. Travel ranges of up to 2 meters in XY are possible. If preferred, DC or stepper motors can be used for the Z axis. If nanometer precision is required, piezo actuators take care of dynamic fine adjustment.

## Core Competences

- Application support and consulting for motion and positioning applications
- Reliable and prompt series production even for large quantities
- Economic design
- Commissioning of turnkey solutions
- Complex multi-axis designs and parallel kinematic robotics
- Broad spectrum of technologies: Drive, guide, and sensor technologies
- In-house motion control electronics and software platform
- Customized software integration such as Epics, LabVIEW, Tango, ...
- Top-quality components from PI's broad portfolio of high-end standard products

# PI's Global Services



## WHAT IS “WORLD CLASS”

Customers everywhere would define “World Class Customer Support” differently. They may consider the highest priority being the speed of response, the level of competence of the person that deals with the request, or it could simply be how quickly the solution was found. Whatever the priority is for customer service and support, PI is committed to exceeding all expectations that relate to our service deliverables.

PI's Global Service Division (GSD) is focused on ensuring that:

- The Right People are;
- In the Right Place;
- At the Right Time;
- With the Right Skills.

This level of conditioning means that PI's customers are able to benefit from World Class customer support services regardless of their requirement, challenge or need.

## SUPPORT FROM START TO FINISH

PI is dedicated to supporting its customers' right from the initial consultation through to when a customer has purchased a PI system. But we don't stop there, PI's services division is committed to ensuring that every aspect of owning a PI stage is catered for. Including:

- **Quick Start** – On-site support setting up a new system;
- **Training** – Ensuring that a new user gets the most out of their PI system;
- **Support** – On-going remote and on-site continued support for the whole life of any system.

Every customer is unique with their applications, environments, challenges and the way they like to be supported. As such, PI has a series of packaged service offerings to cover most customer demands, but in addition to that, PI can design **bespoke flexible service packages** that are tailored exactly to match each customer needs.

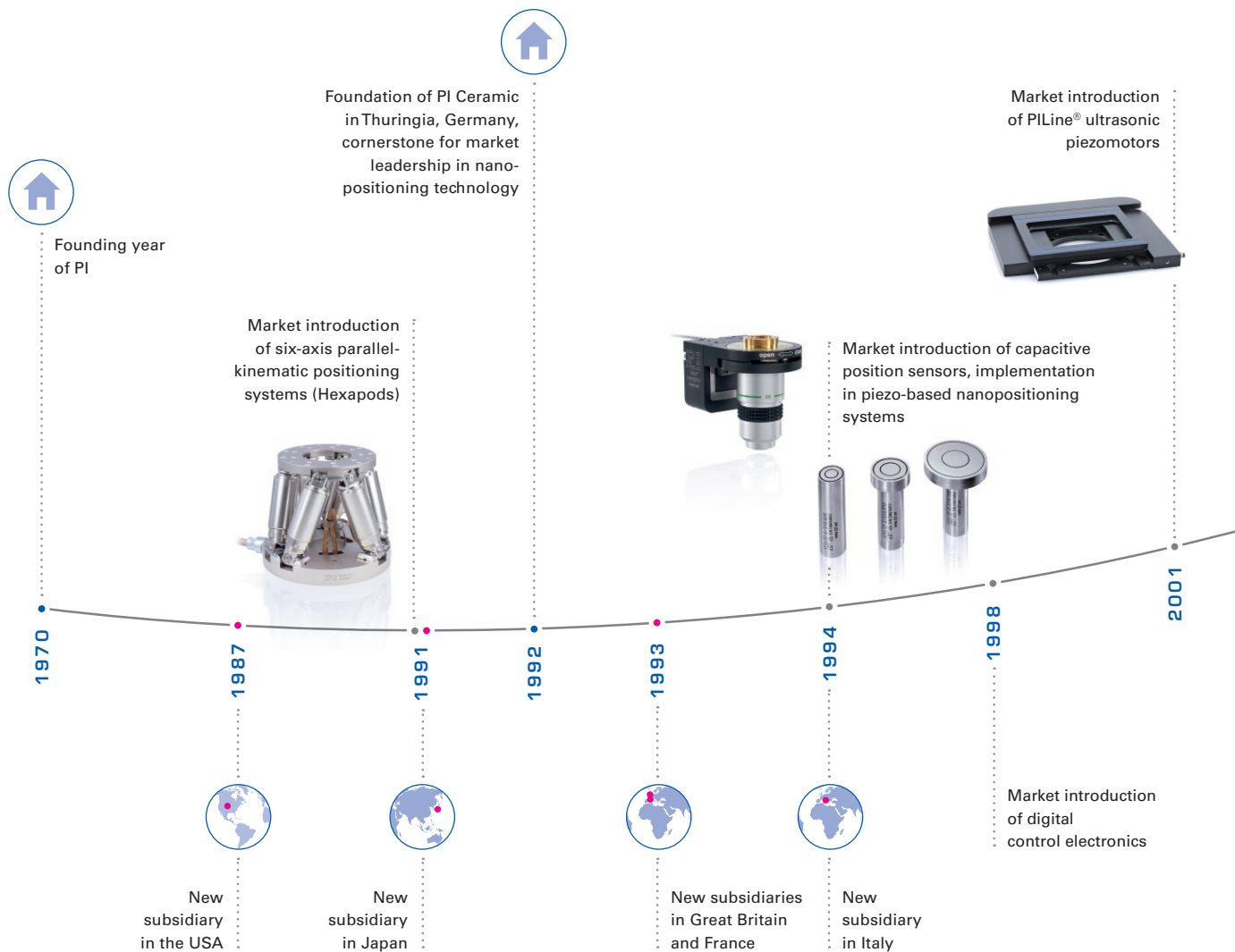


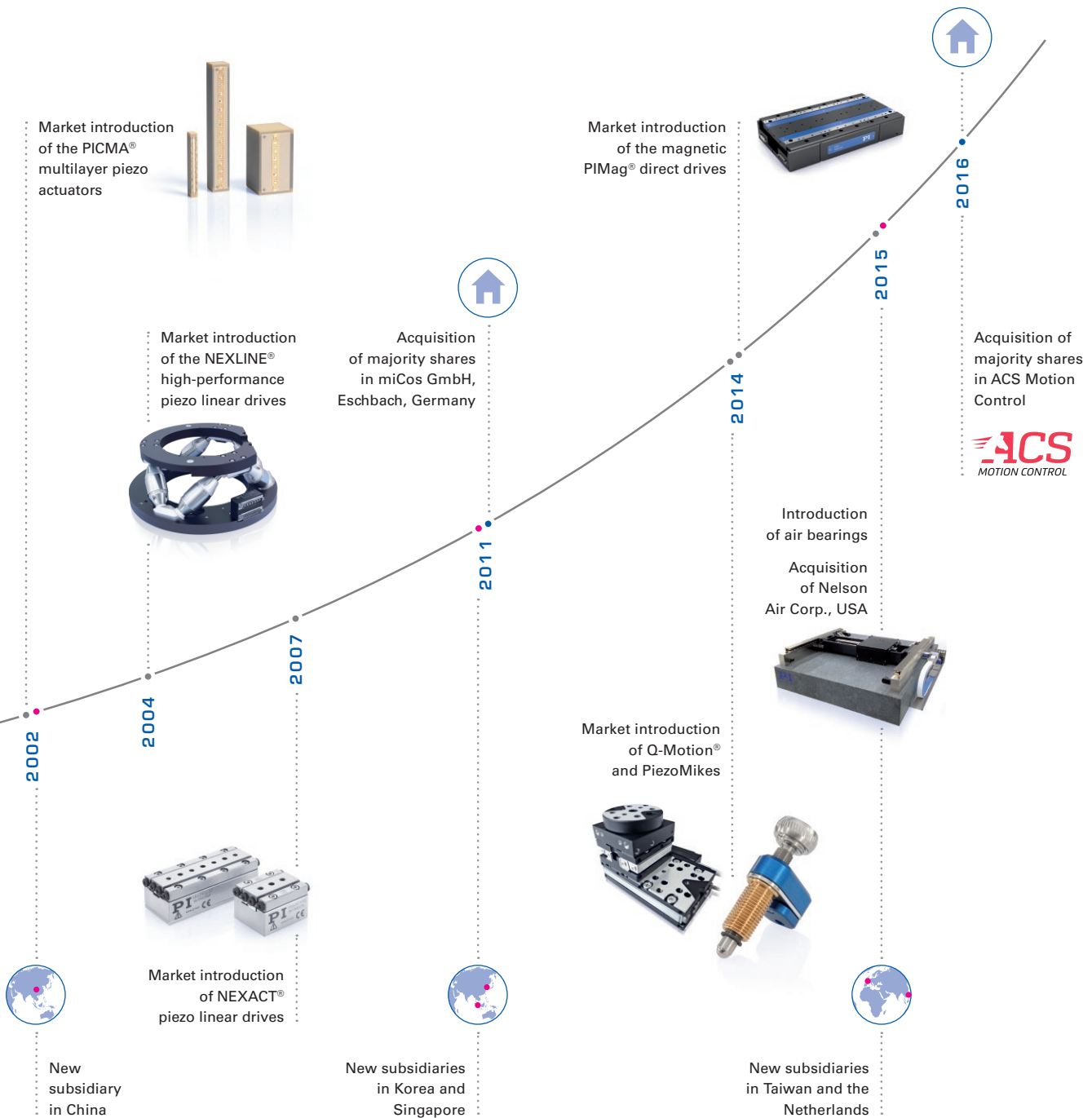
# The PI Group Milestones

## A Success Story

Well known for the high quality of its products, PI (Physik Instrumente) has been one of the leading players in the global market for precision positioning technology for many years. PI has been developing and manufacturing standard

and OEM products with piezo or motor drives for more than 40 years. In addition to four locations in Germany, the PI Group is represented internationally by fifteen sales and service subsidiaries. All of our customers worldwide can rely on this.







## Headquarters

### GERMANY

**Physik Instrumente (PI)  
GmbH & Co. KG**  
Auf der Roemerstrasse 1  
76228 Karlsruhe  
Phone +49 721 4846-0  
Fax +49 721 4846-1019  
info@pi.ws  
www.pi.ws

**PI miCos GmbH**  
Freiburger Strasse 30  
79427 Eschbach  
Phone +49 7634 5057-0  
Fax +49 7634 5057-99  
info@pimicos.com  
www.pi.ws

**PI Ceramic GmbH**  
Lindenstrasse  
07589 Lederhose  
Phone +49 36604 882-0  
Fax +49 36604 882-4109  
info@piceramic.com  
www.piceramic.com



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## Subsidiaries

### USA (East) & CANADA

**PI (Physik Instrumente) L.P.**  
Auburn, MA 01501  
www.pi-usa.us

### USA (San Francisco Bay Area)

**PI (Physik Instrumente) L.P.**  
Sausalito, CA 94965  
www.pi-usa.us

### ITALY

**Physik Instrumente (PI) S. r. l.**  
Bresso  
www.pionline.it

### FRANCE

**PI France SAS**  
Aix-en-Provence  
www.pi.ws

### JAPAN

**PI Japan Co., Ltd.**  
Tokyo  
www.pi-japan.jp

### CHINA

**Physik Instrumente  
(PI Shanghai) Co., Ltd.**  
Shanghai  
www.pi-china.cn

### SOUTHEAST ASIA

**PI (Physik Instrumente)  
Singapore LLP**  
Singapore  
www.pi-singapore.sg  
For ID / MY / PH / SG / TH / VNM

### KOREA

**PI Korea Ltd.**  
Seoul  
www.pikorea.co.kr

### USA (West) & MEXICO

**PI (Physik Instrumente) L.P.**  
Irvine, CA 92620  
www.pi-usa.us

### UK & IRELAND

**PI (Physik Instrumente) Ltd.**  
Cranfield, Bedford  
www.physikinstrumente.co.uk

### NETHERLANDS

**PI Benelux B.V.**  
Sint-Oedenrode  
www.pi.ws/benelux

### SPAIN

**Micos Iberia S.L.**  
Vilanova i la Geltrú  
www.pimicos.es

**PI Japan Co., Ltd.**  
Osaka  
www.pi-japan.jp

**Physik Instrumente  
(PI Shanghai) Co., Ltd.**  
Beijing  
www.pi-china.cn

### TAIWAN

**Physik Instrumente (PI)  
Taiwan Ltd.**  
Taipei  
www.pi-taiwan.com.tw