Ultra-High Precision Vertical Positioning Stage

High-Load Motorized Vertical Platform / Linear Translation Stage with Nanometer Resolution

UPL-120

- Vertical motion range 13 mm (1/2")
- Positioning repeatability to 0.05 µm
- High load capacity to 20 kg
- Direct-measuring linear encoder option
- Servo motor and stepper motor options

Low Profile, High Precision Vertical Translation Stage Platform
The UPL-120 vertical translation stage platform provides high precision Z-axis motion with sub-micron resolution, for loads up to 20 kg. Unlike vertically mounted linear stages, the high-stiffness platform concept allows for a much lower profile with 360-degree access to its payload while avoiding moment loads that can affect bearing performance and/or straightness of motion.

Elevation Stage with Excellent Straightness and Flatness of Motion
The vertical stage platform design provides excellent straightness and flatness, with better pitch and yaw performance compared to vertically mounted linear positioning stages, where the cantilevered load can cause deflections in the supporting linear bearings.

High Resolution Linear Motion with Closed-Loop Servo Motors or Stepper Motors
The vertical stage platform is guided by precision cross-roller bearings and driven by a high-resolution, low friction ball screw through stepper motors or servo motors. The precision bearings enhance platform stability and stiffness while integrated optical limit switches protect the mechanics against over travel conditions. Direct-measuring linear encoders (or rotary encoders on the lower cost variants) provide high resolution position feedback for closed-loop operation with a motion controller. The highest performance variant of the UPL-120 vertical linear translation stage features 5 nanometer encoder resolution. For open-loop position control, a lower cost stepper motor Z-stage variant is also available.

Computer Control, Software, Programming
A selection of single-axis and multi-axis, high-performance motion controllers are available to operate the UPL-120 series of Z-stages. PI provides drivers and software for commissioning and easy operation as well as program examples in popular programming languages. See motion and positioning controller recommendations in the technical specifications table for more information on matching control electronics from PI.

Multi-Axis Stage Combinations
UPL-120 vertical positioning stages can be combined with motorized long-travel linear stages and integrated motorized XY tables to form multi-axis precision motion systems.

Other Elevation Stage Options – Longer Travel / Higher Resolution
PI also offers a selection of standard and custom elevator stages for long travel ranges. For example, direct-drive, frictionless air bearing linear stages with integrated counterbalance can provide even higher precision than the UPL-120 stage over significantly longer travel ranges, and with higher velocities. PI also manufactures a compact, high-speed Z-stage with voice-coil linear motors and user-adjustable magnetic counterbalance for fast focusing and surface metrology applications. When even higher resolution and step-and-settle response in the millisecond range is required, piezoelectric nanopositioning Z stages are recommended.

Equipped with Crossed Roller Guides for Higher Performance
Crossed roller guides provide lower friction, higher stiffness, load capacity and higher overall precision compared to ball bearings.

Highly Accurate Position Measuring with Incremental Linear Encoder
Noncontact optical encoders measure the position directly at the moving platform with the greatest accuracy. Nonlinearity, mechanical play or elastic deformation have no influence on the measurement.

Application Fields for UPL Vertical Lift Stages
Based on the low profile design and high-performance motion capabilities, the UPL vertical lift stage family is a great choice for applications that require very straight and smooth vertical motion with high resolution and repeatability, such as optical inspection, surface metrology, semiconductor wafer inspection, high precision device alignment, and quality control processes of highly accurate mechanical, electrical and optical components.

Motion	Unit	Toleran-ce	6635911030	6635911130	6635921030	6635921130-0001
Active axes			Z	Z	Z	Z
Travel range in Z	mm		13	13	13	13
Maximum velocity in Z, unloaded	mm/s		6	6	3	3
Flatness (Linear crosstalk in X with motion in Z)	µm	Typ.	±3	±3	±3	±3
Straightness (Linear crosstalk in Y with motion in Z)	µm	Typ.	±3	±3	±3	±3
Yaw (Rotational crosstalk in θX with motion in Z)	µrad	Typ.	±100	±100	±100	±100
Pitch (Rotational crosstalk in θY with motion in Z)	µrad	Typ.	±100	±100	±100	±100

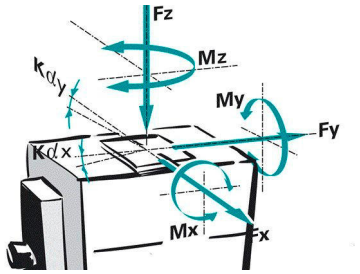
Positioning	Unit	Toleran-ce	6635911030	6635911130	6635921030	6635921130-0001
Minimum incremental motion in Z	µm	Typ.	0.1	0.1	0.1	0.05
Unidirectional repeatability in Z	µm	Typ.	±0.125	±0.125	±0.1	±0.075
Bidirectional repeatability in Z	µm	Typ.	4	2	3	1
Reference switch			Encoder index	Encoder index	Encoder index	Encoder index
Reference switch repeatability	µm		1	1	1	1
Limit switches			Optical	Optical	Optical	Optical
Integrated sensor				Incremental linear encoder		Incremental linear encoder
Sensor signal				A/B quadrature, RS-422		Sin/cos, 1 V peak-peak
Sensor signal period	µm					20
Sensor resolution	nm			50		
Motor encoder			Incremental rotary encoder	Incremental rotary encoder		
Motor encoder: Sensor signal			A/B quadrature, RS-422	A/B quadrature, RS-422		
Resolution, motor encoder	Cts./rev.		20000	20000		

Drive Properties	Unit	Toleran-ce	6635911030	6635911130	6635921030	6635921130-0001
Drive type			DC motor	DC motor	2-phase stepper motor	2-phase stepper motor
Operating voltage	V		24	24	24	24
Peak voltage	V		48	48	48	48
Nominal current, RMS	A	Typ.	1.1	1.1	1.2	1.2
Maximum power consumption	W		52,8	52,8	57,6	57,6
Motor resolution	Full steps/ rev.				200	200
Antriebskraft in Z	N	Typ.	200	200	150	150
Resistance phase-phase	Ω	Typ.	5.78	5.78	1.25	1.25
Inductance phase-phase	mH		1.1	1.1	1.2	1.2

Mechanical Properties	Unit	Toleran-ce	6635911030	6635911130	6635921030	6635921130-0001
Permissible push force in Y	N	Max.	150	150	150	150
Permissible push force in Z	N	Max.	200	200	150	150
Permissible torque in θx	N·m	Max.	130	130	130	130
Permissible torque in θY	N·m	Max.	38	38	38	38
Permissible torque in θZ	N·m	Max.	150	150	150	150
Holding force in Z, passive	N		40	40	80	80
Moved mass in X, unloa-ded	g		1.3	1.3	1.3	1.3
Drive screw type			Ball screw	Ball screw	Ball screw	Ball screw
Drive screw pitch	mm		1	1	1	1
Gear ratio i			2911 : 780	2911 : 780	2911 : 780	2911 : 780
Guide			Crossed roller guide	Crossed roller guide	Crossed roller guide	Crossed roller guide
Overall mass	g		2400	2400	2300	2300
Material			Aluminum, black anodi-zed	Aluminum, black anodi-zed	Aluminum, black anodi-zed	Aluminum, black anodi-zed

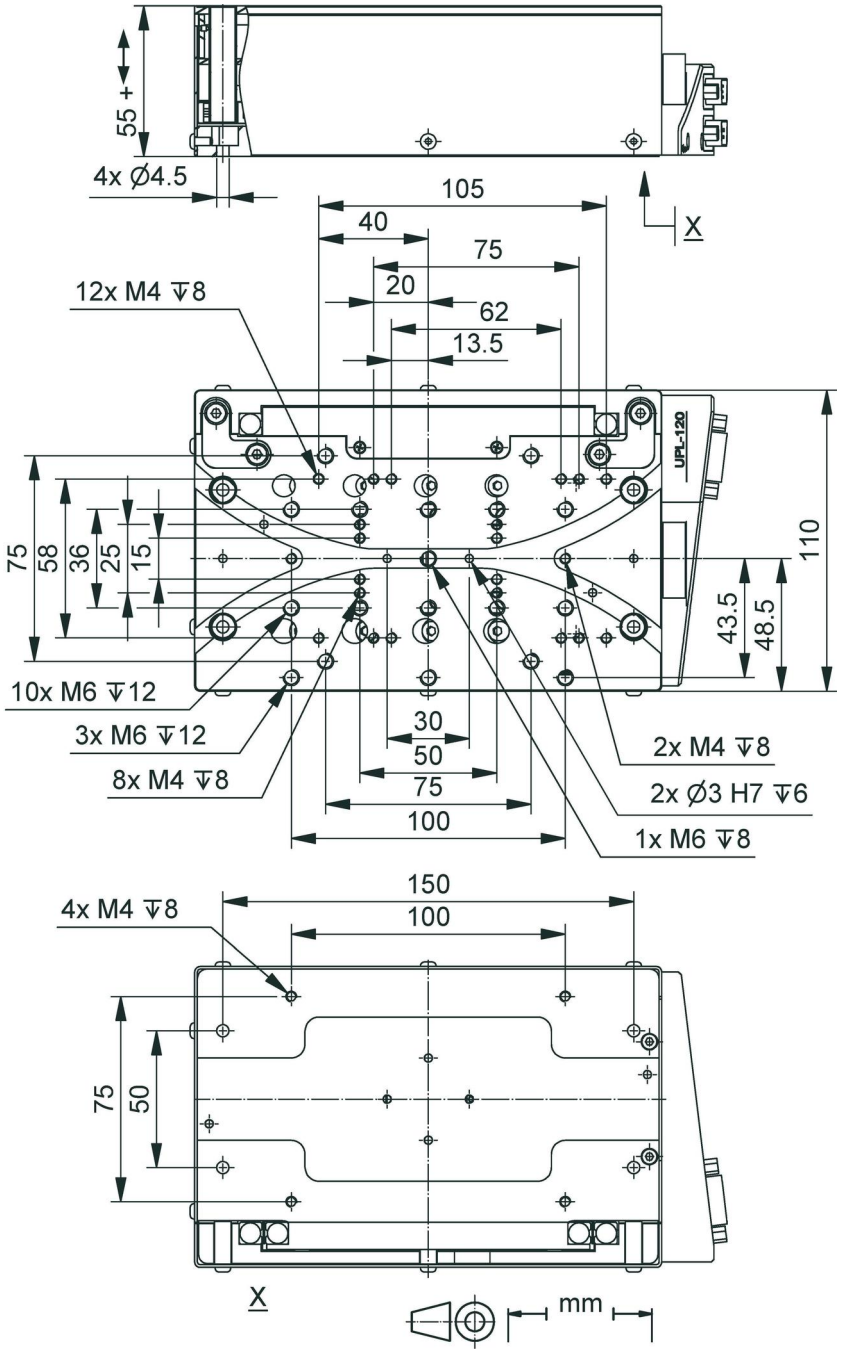
Miscellaneous	Unit		6635911030	6635911130	6635921030	6635921130-0001
Operating temperature range	°C		5 to 40	5 to 40	5 to 40	5 to 40
Connector			HD D-sub 15-pin (m)	HD D-sub 15-pin (m)	HD D-sub 15-pin (m)	HD D-sub 15-pin (m)
Sensor connector				D-sub 9-pin (m)		D-sub 9-pin (m)
Recommended controllers / drivers			C-863 C-885 with C-863.20C885 C-884 ACS modular controller	C-863 C-885 with C-863.20C885 C-884 ACS modular controller	C-663 C-885 with C-663.12C885 ACS modular controller	C-663 C-885 with C-663.12C885 ACS modular controller

Drawings / Images



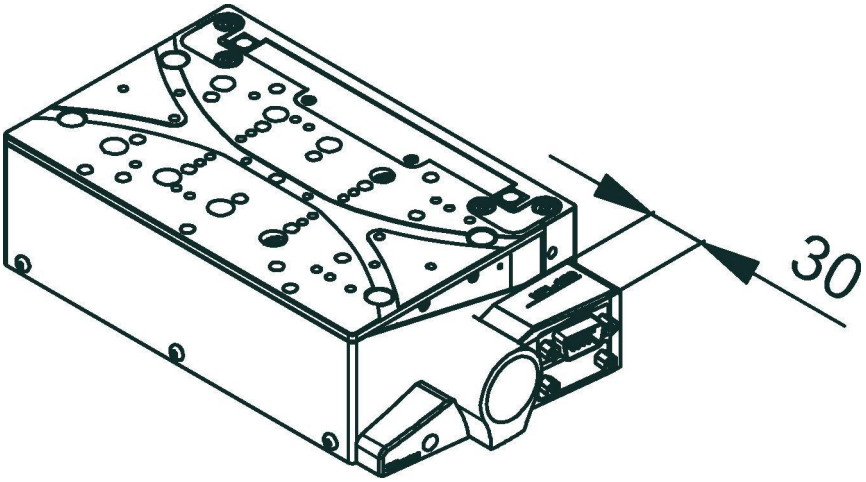
UPL-120, direction of the axes and torques for Z stages.

Drawings / Images

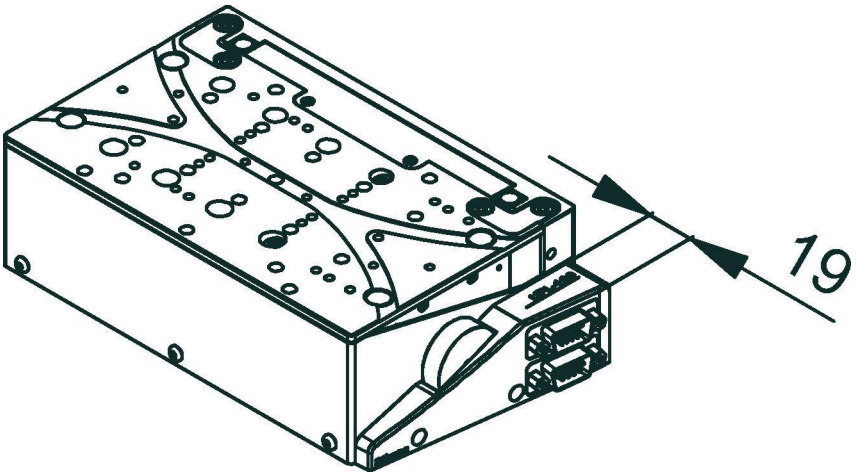


UPL-120, dimensions in mm. Note that a comma is used in the drawings instead of a decimal point.

Drawings / Images



UPL-120 with DC motor drawing, dimensions in mm



UPL-120 with stepper motor drawing, dimensions in mm

Order Information

6635911030
Precision Z stage; DC motor; 13 mm travel range; 200 N load capacity; 6 mm/s maximum velocity; ball screw; incremental rotary encoder, 20000 counts/rev sensor resolution, A/B quadrature, RS-422

6635911130
Precision Z stage; DC motor; 13 mm travel range; 200 N load capacity; 6 mm/s maximum velocity; ball screw; incremental rotary encoder, 20000 counts/rev sensor resolution, A/B quadrature, RS-422; incremental linear encoder, 50 nm sensor resolution, A/B quadrature, RS-422

Order Information

6635921030
Precision Z stage; 2-phase stepper motor; 13 mm travel range; 150 N load capacity; 3 mm/s maximum velocity; ball screw

6635921130-0001
Precision Z stage; 2-phase stepper motor; 13 mm travel range; 150 N load capacity; 3 mm/s maximum velocity; ball screw; incremental linear encoder, 20 µm sensor signal period, sin/cos, 1 V peak-peak