

5.194 Tip-Tilt Stage TT-65

NEW

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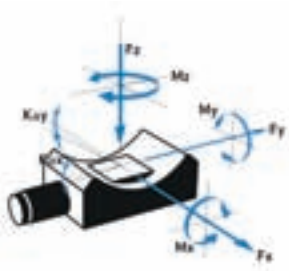
FACTS

Load characteristics	$F_x(N)$	$F_y(N)$	$F_z(N)$	$M_x(Nm)$	$M_y(Nm)$	$M_z(Nm)$
DC-B-005	1	1	5	0.05	0.05	0.3



KEY FEATURES

- Uni-directional repeatability down to 0.004 °
- Travel range in tip, tilt 5 °
- Maximum speed 0.25 °/sec
- Load capacity up to 0.5 kg
- Integrated mechanical limit switches
- Clear aperture 25 mm diameter



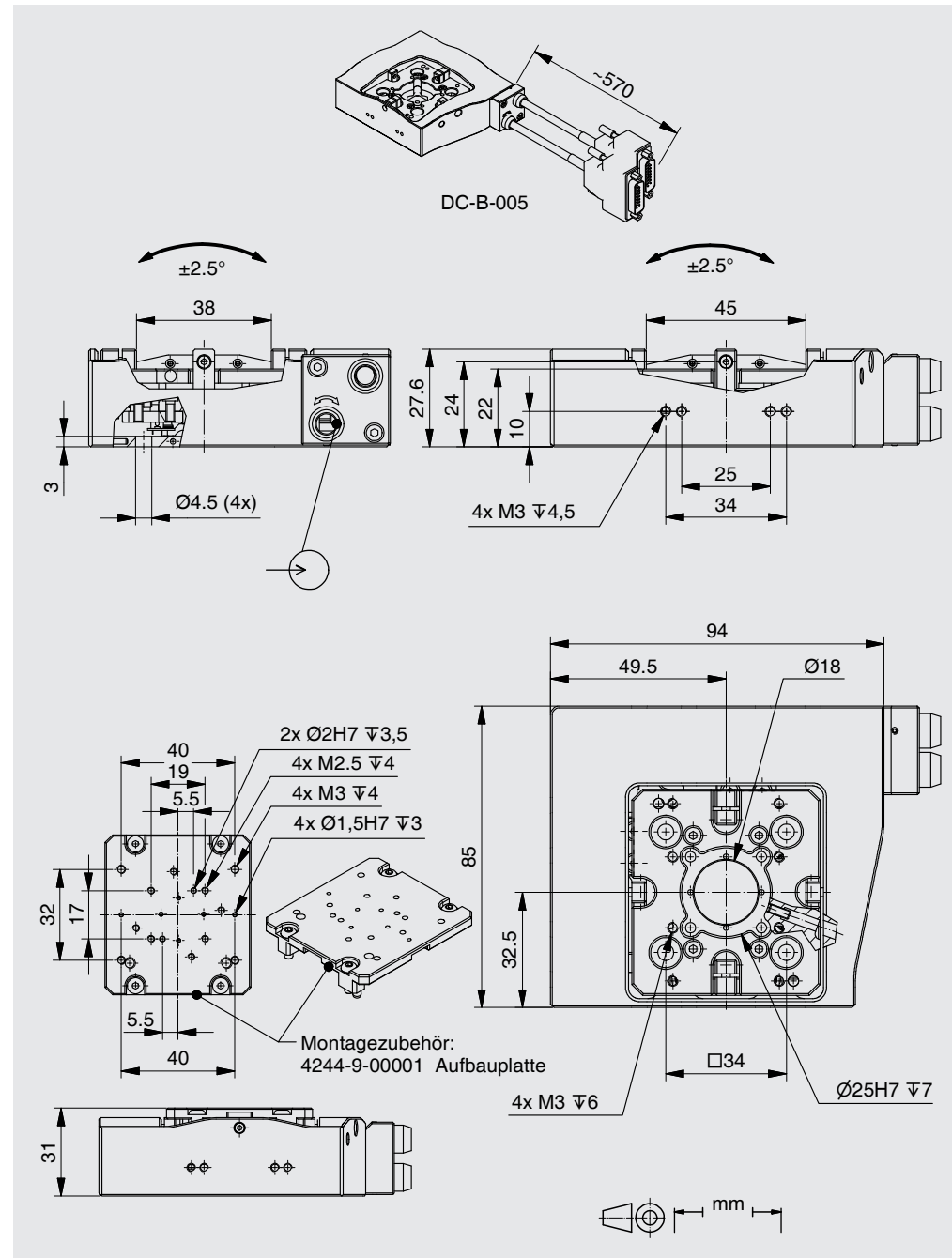
The TT-65 tip-tilt stage was designed for applications where optical elements have to be remotely tilted in an optical beam path. The tilt range in both axes is 5°. The stage can be mounted horizontally on linear stages like LS-65 or vertically, for example in our CAMPUS systems. The tip-tilt stage is equipped with a reference switch and is offered with a DC or stepper motor.

TECHNICAL DATA

Travel range (°)	5
Weight (kg)	0.45
Motor	DC-B-005
Speed max. (°/sec)	0.25
Resolution calculated (°)	0.0018675 (RE)
Resolution typical (°)	0.001
Bi-directional Repeatability (°)	± 0.004
Uni-directional Repeatability (°)	0.004
Nominal Current (A)	0.08
Voltage Range (V)	12
Accuracy	on request
Velocity range (°/sec)	0.00025 ... 0.25
Material	Aluminum, black anodized

Note: FS = full step, RE = rotary encoder
More info: Detailed information concerning motors and encoders, see appendix.

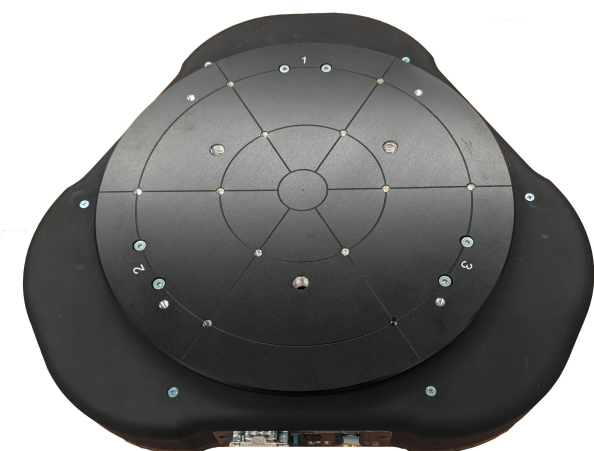
Error and technical modifications are subject to change



Order No.	4244-9-	1	0	0
DC-B-005		1		
OLS-010, Optical limit switches		3		

High-Precision Z Tip/Tilt Stage with Air Bearings

High Performance • Cleanroom-Compatible • Low Profile



A-523

- Travel range in Z to ± 2.5 mm
- Rotation range in θX , θY to $\pm 1^\circ$
- Load capacity to 8 kg
- Platform diameter 250 mm
- Overall height 60 mm

Product overview

A-523 is an air bearing Z tip/tilt stage with direct drive. Designed as a parallel-kinematic multi-axis system, the platform can be used for Z and tip/tilt motion. This stage offers ultra-precision in miniature format. The combination of the noncontact components results in a frictionless motion platform that offers top performance, quality, and lifetime.

When the A-523 is ordered together with a controller of the A-81x or A-82x series, PI carries out the configuration and cabling of the Z stage with applied servo tuning optimization and under applied load. You receive a complete, ready-to-use positioning system.

Accessories and options

- Air filter sets
- Built-in vacuum clamping mechanism

Application fields

The Z tip/tilt stage is ideally suited for high-precision applications, such as wafer inspection, fiber positioning, optics positioning, flat screen inspection, maskless lithography, and ultra-LED manufacturing. The noncontact design is ideal for cleanroom applications.

Motion	Unit	Tolerance	A-523.25005B3
Active axes			Z θX θY
Travel range in Z	mm		5
Rotation range in θX	°		2
Rotation range in θY	°		1.6
Acceleration in Z	m/s ²	Max.	10
Maximum velocity in Z	mm/s		200
Rotational crosstalk in θX with motion in Z	μ rad	Typ.	± 25
Rotational crosstalk in θY with motion in Z	μ rad	Typ.	± 25

Order information

A-523.25005B3

PIglide high-precision Z tip/tilt stage with air bearings; ironless 3-phase linear motor; 5 mm travel range; $2^\circ \times 1.6^\circ$ rotational angle ($\theta X \times \theta Y$); 80 N load capacity; 200 mm/s maximum velocity; absolute linear encoder, 1 nm sensor resolution, BiSS-C

Positioning	Unit	Tolerance	A-523.25005B3
Bidirectional repeatability in Z	μm	Typ.	± 0.25
Bidirectional repeatability in ΘX	μrad	Typ.	± 8
Bidirectional repeatability in ΘY	μrad	Typ.	± 8
Positioning accuracy in Z, calibrated	μm	Typ.	± 0.5
Positioning accuracy in ΘX, uncalibrated	μrad	Typ.	± 15
Positioning accuracy in ΘY, uncalibrated	μrad	Typ.	± 15
Minimum incremental motion in Z	μm	Typ.	0.01
Minimum incremental motion in ΘX	μrad	Typ.	0.06
Minimum incremental motion in ΘY	μrad	Typ.	0.06
Integrated sensor			Absolute linear encoder
Sensor signal			BiSS-C
Sensor resolution	nm		1

Drive Properties	Unit	Tolerance	A-523.25005B3
Drive type			Electric motor/Magnetic direct drive/Ironless 3-phase linear motor
Nominal voltage	V		48
Peak voltage	V		80
Nominal current, RMS	A	Typ.	0.8
Peak current, RMS	A	Typ.	1.5
Force constant	N/A		10
Resistance phase-phase	Ω	Typ.	23.5
Inductance phase-phase	mH		5.2
Back EMF phase-phase	V·s/m	Max.	10

Mechanical Properties	Unit	Tolerance	A-523.25005B3
Guide			Air bearing guide/Air bearing guide with air preload
Permissible push force in Z	N	Max.	80
Overall mass	g		8.2
Material			Hardcoat aluminum, stainless steel mounting hardware

Miscellaneous	Unit	Tolerance	A-523.25005B3
Connector			HD D-sub 26 (m)
Air bearing connection			Plug connection for hose with 6 mm outer diameter
Operating pressure	kPa		515 to 585 (75 to 85 psi)
Air consumption	L/min	Max.	84
Air quality			Clean (filtered up 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
Recommended controllers / drivers			A-814 (four axes), A-82x (4 / 6 axes)
Operating temperature range	°C		+15 to +25

Note on travel and rotation ranges: The travel range in Z and the rotation areas in ΘX and ΘY depend on each other. The values in the table show the maximum travel range for each axis, when all other axes are at the reference position.

Note on acceleration and velocity: The given values are valid in an unloaded state.

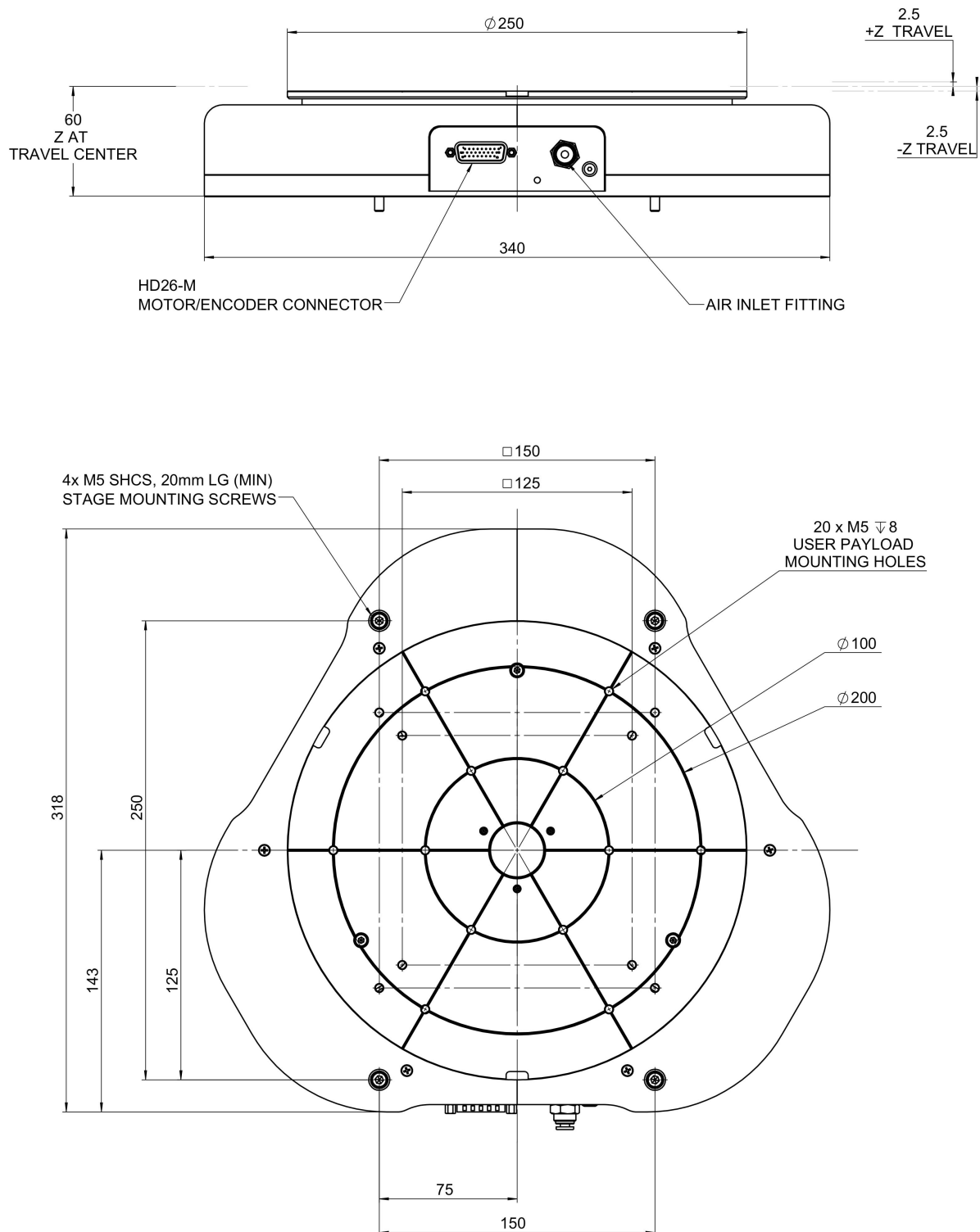
Note on positioning accuracy: The calibrated accuracy can only be achieved with a controller-driven error compensation. The stage must be ordered with a controller from PI to reach these values. Accuracy values assume short duration and do not consider the long-term effects of thermal drift on the stage.

Note on minimum incremental motion: Is directly related to the system stability (servo jitter); this depends on the servo drive used. The position stability can be improved by using Servo-Boost™ PLUS on an ACS SPiPlus controller.

Note on the permissible push force: Assumes an operating pressure of 480 kPa of the air bearings. The stage is designed for horizontal operation only.

Note on the operating pressure: To protect the stage against damage, it is recommended to connect an air pressure sensor to the E-Stop input of the controller.

Drawings / Images



A-523.25005B3, dimensions in mm

High Dynamics PIMag® Voice Coil Tip/Tilt Platform

For Fast Steering Mirrors



V-931

- Beam deflection angle to 8°
- Two orthogonal tip/tilt axes with common center of rotation
- Identical motion characteristics of both axes thanks to parallel kinematics
- Compact design
- Durable and friction free thanks to flexures
- Noncontact direct position measuring with linear encoders

PIMag® voice coil motor

Voice coil motors are direct drives. In direct drives, the force of the drive element is transmitted directly to the load to be moved without the use of mechanical transmission elements such as coupling, drive screw, or gearhead. Voice coil drives consist of a permanent magnet and a winding body that are located in the air gap of the magnetic field. When current flows through the winding body, it moves in the magnetic field of the permanent magnet. Thanks to their low weight and friction-free drive principle, voice coil drives are particularly suitable for applications that 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.

High dynamics multi-axis operation due to parallel kinematics

In a parallel-kinematic multi-axis system, all actuators act on a common platform. The minimum mass inertia and the identical design of all axes allow fast, dynamic, and nevertheless precision motion.

Application fields

- Beam stabilization
- Satellite communication
- Image processing / stabilization
- Laser micromachining. Laser tuning. Laser scanning / beam steering with large deflection angles.
- Test & inspection: AOI (automated optical inspection). Noncontact profilometry. Sensor testing.
- Optics: Optical filters / switches. Optical trapping. Raster scan. Tracking.

Specifications

	V-931.01	Unit
Active axes	A (θ_X), B (θ_Y)	

Motion and positioning	V-931.01	Unit
Integrated sensor	4 x optical linear encoder	
Tip/tilt range	± 35 ($\pm 2^\circ$)	mrad
Minimum incremental motion	< 1	μrad
Bidirectional repeatability	< 2	μrad
Reference accuracy	≤ 50	μrad
Linearity	$< 0.2 \%$	
Step response	< 20 ⁽¹⁾	ms
3dB small signal bandwidth	≥ 75 ⁽²⁾	Hz

Mechanical properties	V-931.01	Unit
Resonant frequency, unloaded	29	Hz
Cross-axis coupling	$\leq 1 \%$	
Orthogonality	≥ 89	°
Pivot point (center of rotation) ⁽³⁾	3.2	mm
Max. mirror diameter	25.4	mm
Max. payload	20	g
Max. moment of inertia around the center axis on back of the mirror mount	1500	$\text{g} \times \text{mm}^2$

Miscellaneous	V-931.01	Unit
Operating temperature range	5 to 40	°C
Overall mass (incl. cable and connector)	290	g
Mass without cable and connector	135	g
Cable length	1	m
Sensor/voltage connector	D-sub 15 (m)	
Recommended controllers	C-413.2x	

⁽¹⁾ 44 mrad, 2 % settling band, payload: 1-inch mirror 5 mm thickness

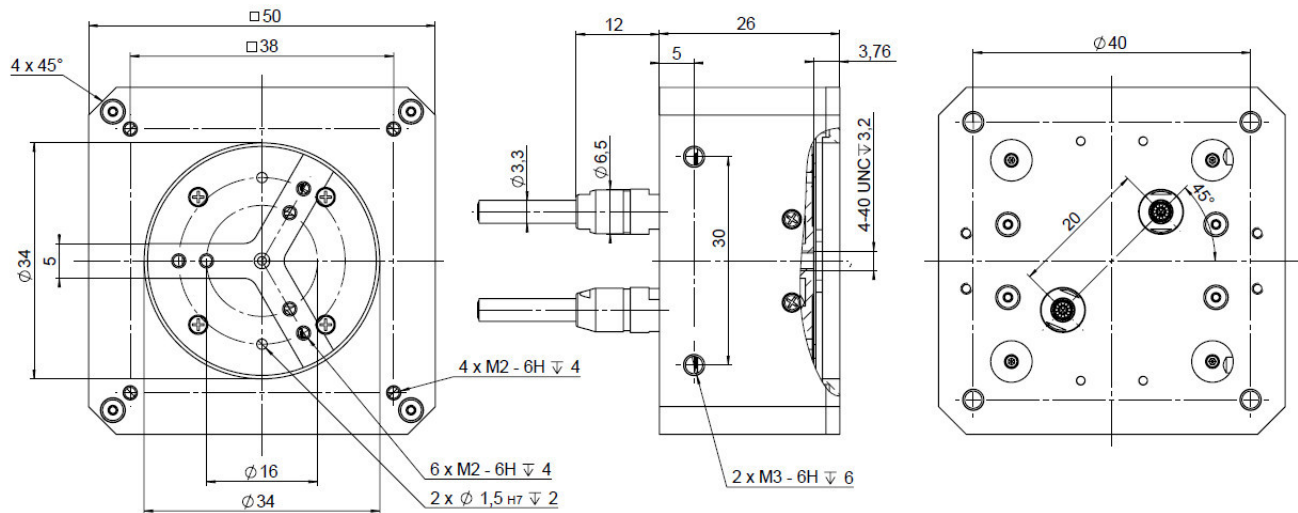
⁽²⁾ 1 mrad, payload: 1-inch mirror 5 mm thickness

⁽³⁾ Gap below platform's mounting surface

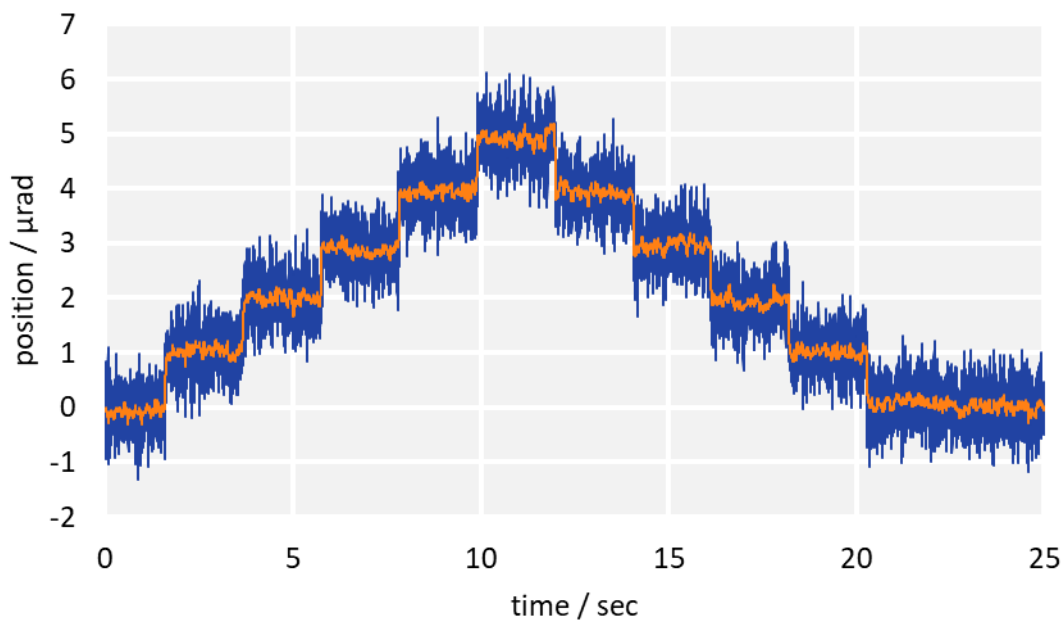
The specifications apply to 22 °C $\pm$ 3 °C. The specifications can deviate outside of this range.

Ask about customized versions.

Drawings / Images



V-931.01, dimensions in mm



V-931.01: Measurement for proving the minimum incremental motion ($< 1 \mu\text{rad}$)

Ordering Information

V-931.01

PIMag® tip/tilt platform, voice coil motor, 4° rotation range

Mirrors and mirror holders available on request

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