

PIMag® Precision Linear Stage

High Velocity and Precision due to Magnetic Direct Drive



V-551

- Travel ranges to 230 mm
- Velocity up to 0.5 m/s
- Absolute encoder with 1 nm resolution
- Highest precision with PIONe linear encoder: Minimum incremental motion 0.5 nm
- High guiding accuracy
- Compact design with 160 mm width

Reference-class linear stage

Thanks to the smooth-running precision linear guides with crossed roller bearings, the linear stage is particularly suitable for scanning applications with constant velocity. The anti-creep system reliably prevents cage creep. The guides have high load capacity and high precision under all operating conditions.

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.

Direct position measuring

Position measuring is performed with the highest accuracy directly at the motion platform so that nonlinearity, mechanical play or elastic deformation have no influence on position measuring.

The high-resolution PIONe encoder was developed by PI and, with corresponding processing of the measured values, allows a position resolution of much less than one nanometer. The optical and noncontact PIONe encoders are based on an interferometric measuring principle. Due to the short signal period and the high quality of the signals, the linearity error of PIONe encoders is less than 1 %. PIONe encoders support direction sensing when evaluating a reference signal.

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.

Fields of application

Industry and research. Automation, measuring technology, photonics and precision scanning in semiconductor or flat panel display manufacturing

Specifications

Motion and positioning	V-551.2x	V-551.4x	V-551.7x	Unit	Tolerance
Active axes	X	X	X		
Travel range	60	130	230	mm	
Pitch	±50	±100	±100	μrad	typ.
Yaw	±50	±50	±50	μrad	typ.
Straightness	±1	±1	±2	μm	typ.
Flatness	±2	±2	±2	μm	typ.
Velocity	0.5*	0.5*	0.5*	m/s	max.

Mechanical properties	V-551.2x	V-551.4x	V-551.7x	Unit	Tolerance
Load capacity in Z	150	150	150	N	max.
Load capacity in Y	50	50	50	N	max.
Moved mass	2.2	2.7	4.9	kg	
Overall mass	4.2	5.5	9.7	kg	
Linear guide	Crossed roller bearing with anti-creep system	Crossed roller bearing with anti-creep system	Crossed roller bearing with anti-creep system		

Drive properties	V-551	Unit	Tolerance
Drive type	PIMag® linear motor, ironless, 3-phase		
Intermediate circuit voltage	110 **	V DC	max.
Peak force	180	N	typ.
Nominal force	27	N	typ.
Peak current, RMS	10	A	typ.
Nominal current, RMS	1.5	A	typ.
Force constant, RMS	18	N/A	typ.
Resistance per phase	3.15	Ω	typ.
Inductance per phase	0.9	mH	typ.
Back EMF phase-phase	16	V·s/m	max.
Pole pitch N-N	30	mm	

Encoder options	V-551.xB	V-551.xD
Integrated sensor	Absolute encoder	PIOne incremental linear encoder
Sensor signal	BiSS-C	Sin/cos, 1 V peak-peak, 2 μ m signal period
Sensor resolution	1 nm	0.2 nm***
Min. incremental motion	2 nm	0.5 nm
Unidirectional repeatability	0.02 μ m	0.02 μ m
Bidirectional repeatability	\pm 0.05 μ m	\pm 0.05 μ m
Travel range limit	Limits are set via software; additional mechanical stop buffers.	Hall effect limit switches
Reference point switch	–	Encoder index
Reference point switch repeatability	–	<1 μ m

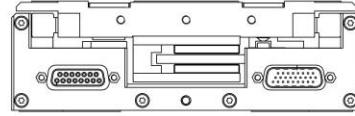
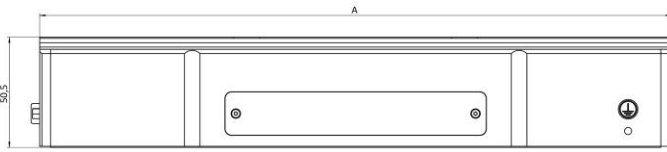
Miscellaneous	V-551
Operating temperature range	10 °C to 50 °C
Humidity	20 – 90% rel., not condensing
Material	Aluminum, black anodized
Motor connector	HD D-sub 26 (m)
Sensor connector	D-sub 15 (f)

* max. 0.2 m/s for V-551.xD when combined with the C-891

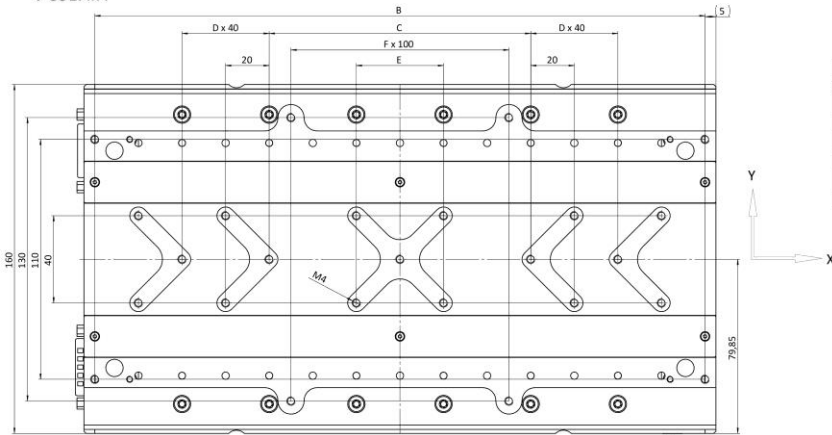
** 24 VDC with C-891.120200

*** interpolated

Drawings / Images

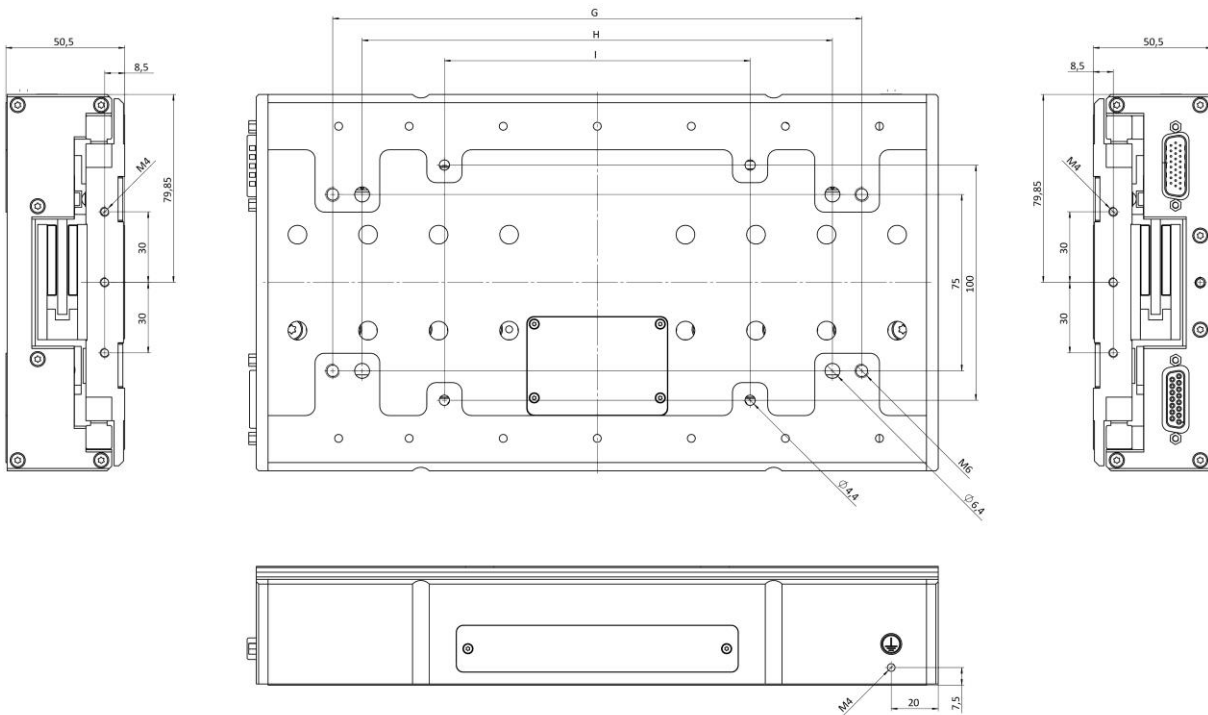


V-551.4x :



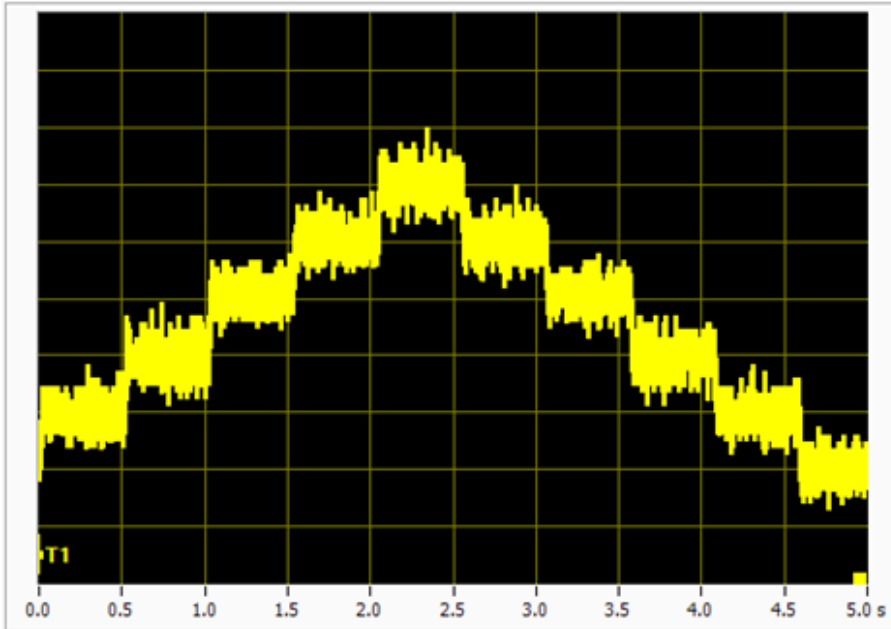
	V-551.2x	V-551.4x	V-551.7x
Stroke	60	130	230
A	220	290	450
B	210	280	440
C	60	120	120
D	1	1	3
E	-	40	40
F	1	1	3

V-551, dimensions in mm

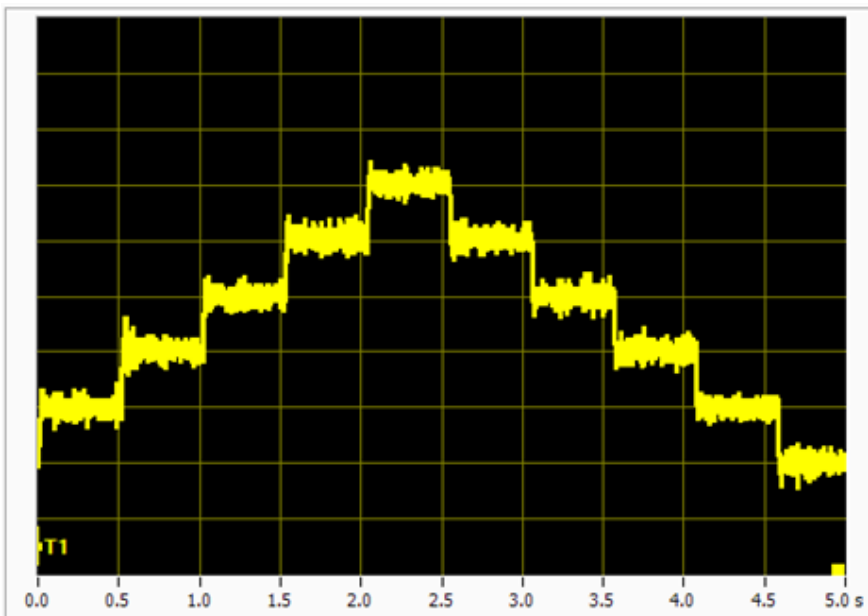


	V-551.2x	V-551.4x	V-551.7x
G	125	225	225
H	175	200	250
I	130	130	190

V-551, dimensions in mm



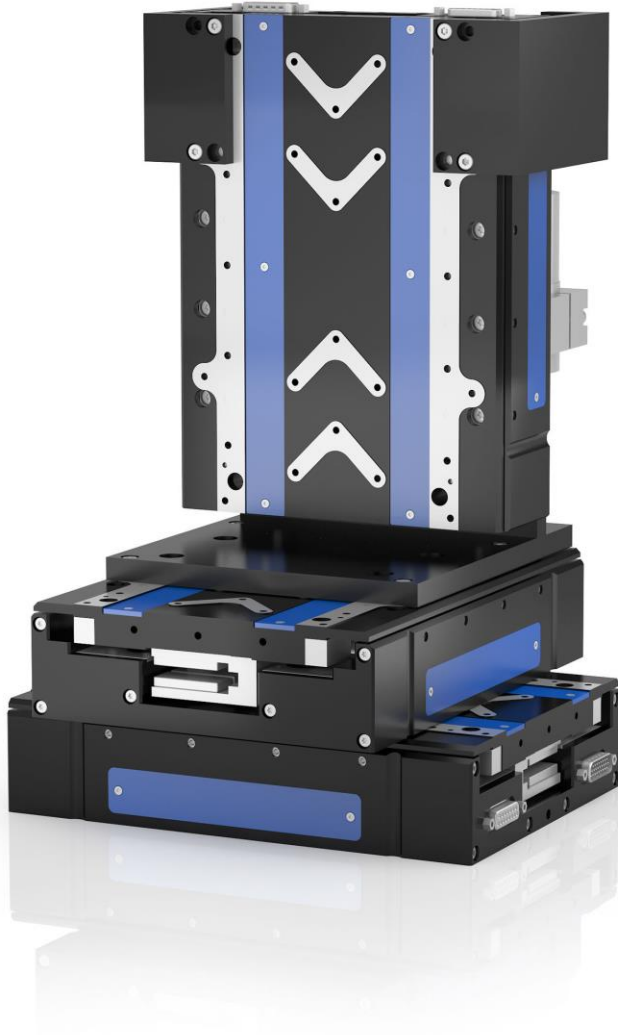
A V-551.4D with PIOne linear encoder performs a sequence of 0.5-nm steps.



A V-551.4D with PIOne linear encoder performs a sequence of 1-nm steps.



An XY setup of modified V-551.4D linear stages and an optional drag chain.



An XYZ assembly consisting of three V-551 linear stages each with 60 mm travel range. The Z axis was modified and has magnetic compensation of the weight force.

Ordering Information

V-551.2B

PIMag® precision linear stage, 160 mm width, 60 mm travel range, 150 N load capacity, absolute encoder, 1 nm sensor resolution, ironless 3-phase linear motor

V-551.2D

PIMag® precision linear stage, 160 mm width, 60 mm travel range, 150 N load capacity, PIONe linear encoder with sin/cos signal transmission, 2 µm sensor signal period, ironless 3-phase linear motor

V-551.4B

PIMag® precision linear stage, 160 mm width, 130 mm travel range, 150 N load capacity, absolute encoder, 1 nm sensor resolution, ironless 3-phase linear motor

V-551.4D

PIMag® precision linear stage, 160 mm width, 130 mm travel range, 150 N load capacity, PIONe linear encoder with sin/cos signal transmission, 2 µm sensor signal period, ironless 3-phase linear motor

V-551.7B

PIMag® precision linear stage, 160 mm width, 230 mm travel range, 150 N load capacity, absolute encoder, 1 nm sensor resolution, ironless 3-phase linear motor

V-551.7D

PIMag® precision linear stage, 160 mm width, 230 mm travel range, 150 N load capacity, PIONe linear encoder with sin/cos signal transmission, 2 µm sensor signal period, ironless 3-phase linear motor