PIMag® High Dynamics Linear Stage

Voice Coil Direct Drive with Direct Position Measuring

V-522 • V-524 • V-528

- Fast scanning and positioning
- Travel ranges 5 mm, 10 mm, 20 mm
- Scanning frequency of more than 10 Hz
- Max. Velocity 250 mm/s
- Crossed roller bearings for the highest precision
- PIMag® voice coil motor developed by PI

Reference-class linear stage
Linear stages with magnetic direct drives largely dispense with mechanical components in the drivetrain and the drive force acts directly on the motion platform. Together with precision bearings, a high travel accuracy and longer lifetime is achieved. The linear stages are particularly suitable for scanning applications.

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.

PIMag®
PI develops proprietary magnetic motors if positioning systems need to achieve specific performance characteristics that cannot be reached by using drive components currently available on the market, for example, to achieve a high force density or a compact design. The motors developed in-house are identified by the PIMag® brand name.

Crossed roller guide
With crossed roller guides, the point contact of the balls in ball guides is replaced by line contact of the hardened rollers. Consequently, they are considerably stiffer and need less preload, which reduces friction and allows smoother running. Crossed roller guides are also distinguished by high guide accuracy and load capacity. Force-guided rolling element cages prevent cage creep.

Highly accurate position measuring with incremental linear encoder
Noncontact optical linear encoders measure the position directly at the platform with the greatest accuracy. Nonlinearity, mechanical play or elastic deformation have no influence on the measurement.

Application fields
Industry and research. Measuring technology. Photonics and precision scanning in semiconductor or flat panel display manufacturing.

Motion	Unit	Tolerance	V-522.1AA	V-522.1AB	V-524.1AA	V-524.1AB	V-528.1AA	V-528.1AB
Active axes			X	X	X	X	X	X
Travel range in X	mm		5	5	10	10	20	20
Maximum velocity in X, unloaded	mm/s		250	250	250	250	250	250
Straightness (Linear crosstalk in Y with motion in X)	µm	Typ.	±0.25	±0.25	±0.5	±0.5	±1.25	±1.25
Flatness (Linear crosstalk in Z with motion in X)	µm	Typ.	±0.25	±0.25	±0.25	±0.25	±0.5	±0.5
Pitch (Rotational crosstalk in θY with motion in X)	µrad	Typ.	±50	±50	±100	±100	±200	±200
Yaw (Rotational crosstalk in θZ with motion in X)	µrad	Typ.	±50	±50	±100	±100	±200	±200

Positioning	Unit	Tolerance	V-522.1AA	V-522.1AB	V-524.1AA	V-524.1AB	V-528.1AA	V-528.1AB
Minimum incremental motion in X	µm	Typ.	0.02	0.02	0.02	0.02	0.02	0.02
Bidirectional repeatability in X	µm	Typ.	0.24	0.24	0.24	0.24	0.24	0.24
Reference switch			Optical	Optical	Optical	Optical	Optical	Optical
Reference switch repeatability	µm	Max.	1	1	1	1	1	1
Integrated sensor			Incremental linear encoder	Incremental linear encoder	Incremental linear encoder	Incremental linear encoder	Incremental linear encoder	Incremental linear encoder
Sensor signal			Sin/cos, 1 V peak-peak	Sin/cos, 1 V peak-peak	Sin/cos, 1 V peak-peak	Sin/cos, 1 V peak-peak	Sin/cos, 1 V peak-peak	Sin/cos, 1 V peak-peak
Sensor resolution	nm		10	10	10	10	10	10

Drive Properties	Unit	Tolerance	V-522.1AA	V-522.1AB	V-524.1AA	V-524.1AB	V-528.1AA	V-528.1AB
Drive type			Voice coil	Voice coil	Voice coil	Voice coil	Voice coil	Voice coil
Nominal voltage	V		24	24	24	24	24	24
Nominal current, RMS	A	Typ.	1	1	1	1	1	1
Peak current, RMS	A	Typ.	3	3	3	3	3	3
Drive force in X	N	Typ.	3.4	3.4	2.9	2.9	2.3	2.3
Peak force in X	N		10.2	10.2	8.7	8.7	6.9	6.9
Force constant	N/A		3.4	3.4	2.9	2.9	2.3	2.3
Motor constant	N/√W	Typ.	1.3	1.3	1.1	1.1	0.85	0.85
Time constant	ms		0.32	0.32	0.32	0.32	0.32	0.32
Resistance phase-phase	Ω	Typ.	7.2	7.2	7.2	7.2	7.2	7.2
Inductance phase-phase	mH		1.7	1.7	1.7	1.7	1.7	1.7
Back EMF	V·s/m	Max.	3.4	3.4	2.9	2.9	2.3	2.3
Permissible maximum temperature for drive components	°C		75	75	75	75	75	75

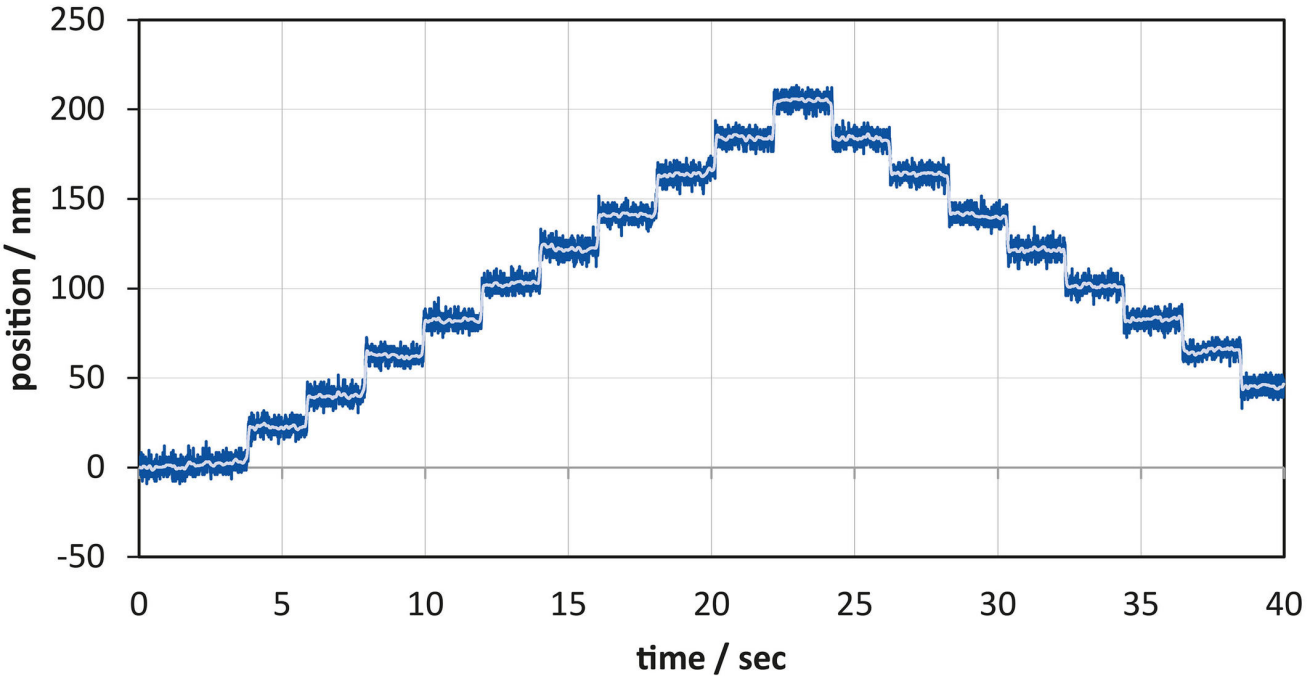
Mechanical Properties	Unit	Tolerance	V-522.1AA	V-522.1AB	V-524.1AA	V-524.1AB	V-528.1AA	V-528.1AB
Permissible push force in Z	N	Max.	100	100	100	100	100	100
Moved mass in X, unloaded	g		131	131	137	137	150	150
Guide			Crossed roller guide	Crossed roller guide	Crossed roller guide	Crossed roller guide	Crossed roller guide	Crossed roller guide
Overall mass	g		460	460	500	500	580	580
Material			Aluminum	Aluminum	Aluminum	Aluminum	Aluminum	Aluminum

Miscellaneous	Unit		V-522.1AA	V-522.1AB	V-524.1AA	V-524.1AB	V-528.1AA	V-528.1AB
Operating temperature range	°C		18 to 45	18 to 45	18 to 45	18 to 45	18 to 45	18 to 45
Connector			D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)
Cable length	m		2	2	2	2	2	2
Cable exit			Cable exit in X	Cable exit in Y	Cable exit in X	Cable exit in Y	Cable exit in X	Cable exit in Y
Recommended controllers / drivers			C-413.2G(A), C-413.20(A)	C-413.2G(A), C-413.20(A)	C-413.2G(A), C-413.20(A)	C-413.2G(A), C-413.20(A)	C-413.2G(A), C-413.20(A)	C-413.2G(A), C-413.20(A)

Note on sensor resolution: With C-413 controller
Ask about customized versions.

At PI, technical data is specified at 22 ±3 °C. Unless otherwise stated, the values are for unloaded conditions. Some properties are interdependent. The designation "typ." indicates a statistical average for a property; it does not indicate a guaranteed value for every product supplied. During the final inspection of a product, only selected properties are analyzed, not all. Please note that some product characteristics may deteriorate with increasing operating time.

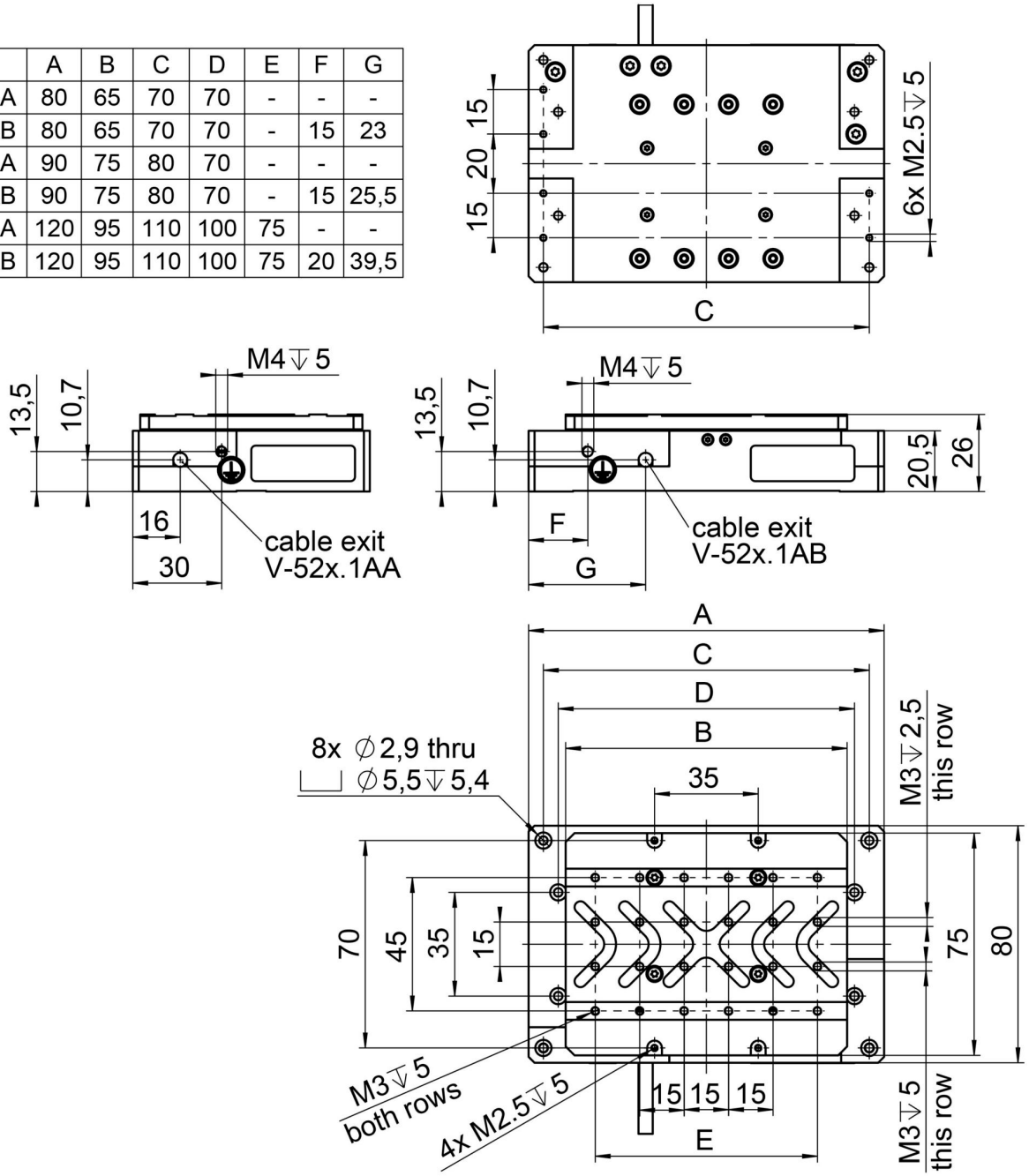
Drawings / Images



The V-522 reliably performs 20-nm repeatable steps.

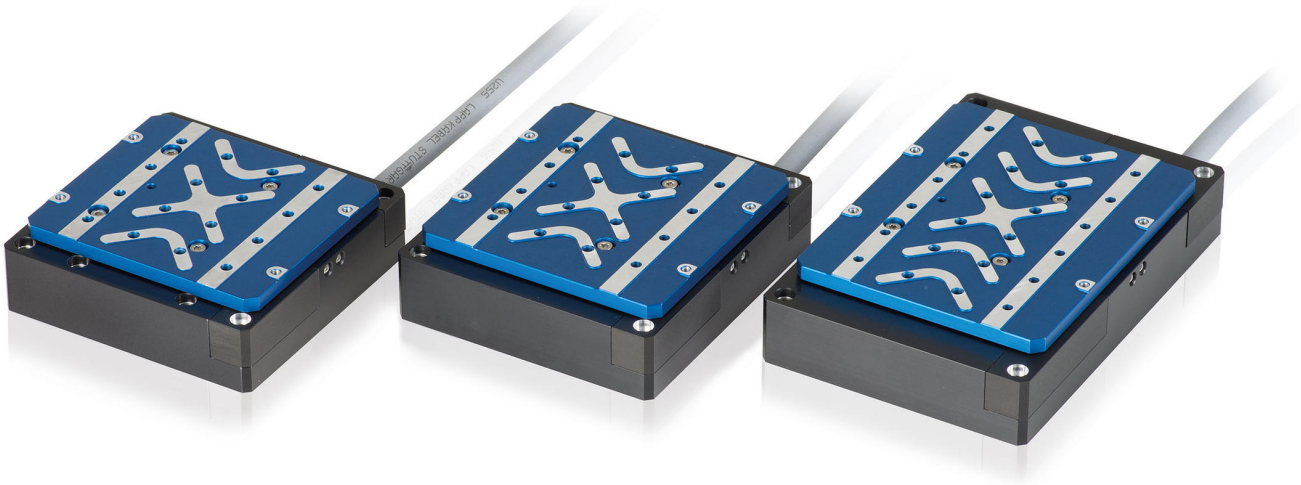
Drawings / Images

	A	B	C	D	E	F	G
V-522.1AA	80	65	70	70	-	-	-
V-522.1AB	80	65	70	70	-	15	23
V-524.1AA	90	75	80	70	-	-	-
V-524.1AB	90	75	80	70	-	15	25,5
V-528.1AA	120	95	110	100	75	-	-
V-528.1AB	120	95	110	100	75	20	39,5



V-52x, dimensions in mm. Note that a comma is used in the drawings instead of a decimal point.

Drawings / Images



V-522, V-524, and V-528 PIMag® voice coil linear stages

Drawings / Images

Multi-axis setup with two V-528 PIMag® voice coil linear stages

Order Information

V-522.1AA
PIMag® voice coil linear stage, direct drive, velocity 250 mm/s, 5 mm travel range, direct position measuring with incremental encoder, cable exit in direction of motion

V-522.1AB
PIMag® voice coil linear stage, direct drive, velocity 250 mm/s, 5 mm travel range, direct position measuring with incremental encoder, cable exit orthogonal to direction of motion

V-524.1AA
PIMag® voice coil linear stage, direct drive, velocity 250 mm/s, 10 mm travel range, direct position measuring with incremental encoder, cable exit in direction of motion

Order Information

V-524.1AB
PIMag® voice coil linear stage, direct drive, velocity 250 mm/s, 10 mm travel range, direct position measuring with incremental encoder, cable exit orthogonal to direction of motion

V-528.1AA
PIMag® voice coil linear stage, direct drive, velocity 250 mm/s, 20 mm travel range, direct position measuring with incremental encoder, cable exit in direction of motion

V-528.1AB
PIMag® voice coil linear stage, direct drive, velocity 250 mm/s, 20 mm travel range, direct position measuring with incremental encoder, cable exit orthogonal to direction of motion