

M-511 · Linear Positioning Stage

Heavy-Duty Linear Stages with Linear Guiding Rails and Recirculating Ball Bearings



M-531.DD, M-521.DD, M-511.DD and M-505.2DG heavy duty translation stages with recirculating ballscrew drive (bottom to top)

- Travel Ranges 102, 204 and 306 mm (4", 8", 12")
- Max. Velocity 125 mm/s with ActiveDrive™ Motors
- Optional 0.1 μm Linear Encoder for Highest Accuracy
- Load Capacity of 100 kg
- Stress-Relieved Aluminum Base for Highest Stability
- Zero-Backlash Recirculating Ballscrews
- Non-contact Limit and Reference Switches
- XY & XYZ Combinations (Special Z-Stages Available)
- MTBF >20,000 h

M-5x1-series translation stages are designed to meet the most demanding positioning requirements and are available in a number of different models. They boast an extremely low profile design to allow multiaxis combinations (see also see page 7-56 and page 7-58) and

feature a precision-machined base of high-density, stress-relieved aluminum for exceptional stability and minimum weight.

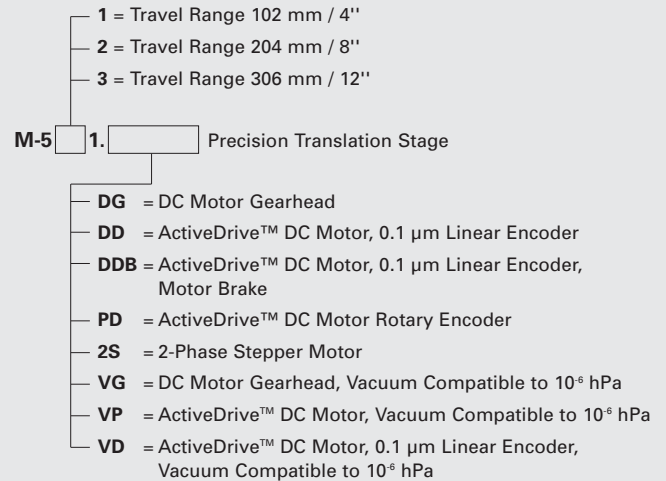
Heavy Duty and Maintenance Free

The stages are equipped with high-precision linear guiding rails with recirculating ball bearings to guarantee 1 μm/100 mm straightness and flatness. Precision-ground recirculating ball screws with preloaded nuts provide low-friction, maintenance-free and backlash-free positioning. This equipment provides high load capacity and guiding accuracy with long lifetime.

Four Drive Options

Maximum dynamic performance is possible with versions featuring the highly efficient

Ordering Information



ActiveDrive™ direct-drive system, which can achieve speeds of up to 125 mm/s.

The ActiveDrive™ design, developed by PI, features a high-efficiency PWM (pulse width modulation) servo-amplifier mounted side-by-side with the DC motor and offers several advantages:

- Increased efficiency, by eliminating power losses between the amplifier and motor
- Reduced cost of ownership and improved reliability, because no external driver is required
- Elimination of PWM amplifier noise radiation, by mounting the amplifier and motor together in a single, electrically shielded case

The M-5x1.PD version provides velocities up to 125 mm/sec and resolution of 0.5 μm. It is equipped with an ActiveDrive™ DC motor and rotary encoder.

The M-5x1.DD models provide superior accuracy by means of an integrated non-contact optical linear encoders (direct metrology eliminates drive-train errors such as backlash and elastic deformation). A

motor brake which assures maintenance of the stage position after power-down is also available.

The M-5x1.DG versions feature closed-loop DC motors with shaft-mounted position encoders and precision gearheads providing minimum incremental motion to 0.1 μm with velocities up to 6 mm/s.

The M-5x1.2S versions models feature a cost-effective direct-drive, 2-phase stepper motor, providing very smooth operation and a resolution of 0.1 μm.

Limit and Reference Switches

For the protection of your equipment, non-contact Hall-effect limit and reference switches are installed. The direction-sensing reference switch supports advanced automation applications with high precision.

Precision Assembly

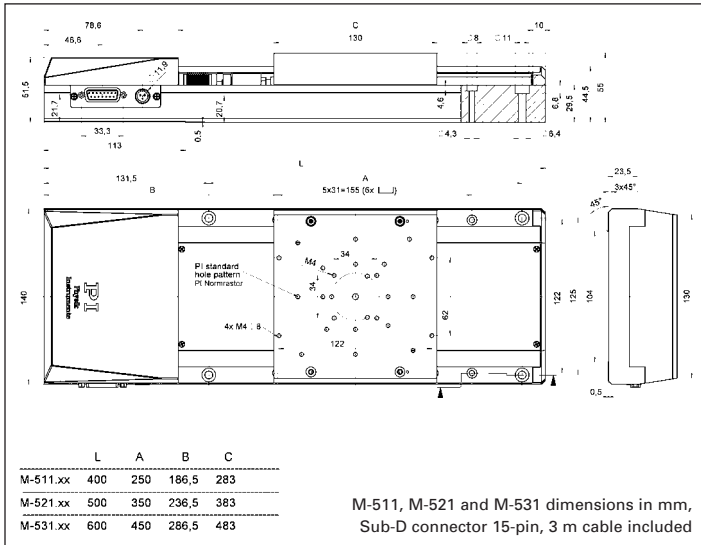
The stages are individually tested and optimized using a laser interferometer.

Notes

For adapters, bracket, etc. see page 7-92 ff.

Application Examples

- R&D
- Semiconductor testing
- Mass storage device testing
- Metrology
- Photonics packaging
- Quality assurance testing
- Precision Linear Motion Control



Technical Data

Models	M-511.DD / M-521.DD / M-531.DD	M-511.PD / M-521.PD / M-531.PD	M-511.DG / M-521.DG / M-531.DG	M-511.2S / M-521.2S / M-531.2S	Unit
Active axes	X	X	X	X	
Motion and positioning					
Travel range	102 / 204 / 306	102 / 204 / 306	102 / 204 / 306	102 / 204 / 306	mm
Integrated sensor	Linear encoder	Rotary encoder	Rotary encoder	-	
Sensor resolution	0.1 µm	4000	2048	-	cts./rev.
Design resolution	0.1	0.5	0.033	0.31	µm
Min. incremental motion	0.1	0.5	0.1	0.1	µm
Unidirectional repeatability	0.1	0.5	0.2	0.2	µm
Bidirectional repeatability	0.2	1	1	1	µm
Accuracy	0.2	2	2	2	µm
Pitch	50	50	50	100	µrad
Yaw	50	50	50	80	µrad
Straightness	1	1	1	1	µm
Flatness	1	1	1	1	µm
Max. velocity	100	125	6	20	mm/s
Origin repeatability	1	1	1	1	µm
Mechanical properties					
Drive screw	Recirculating ballscrew	Recirculating ballscrew	Recirculating ballscrew	Recirculating ballscrew	
Thread pitch	2	2	2	2	mm
Gear ratio	-	-	(28/12) ¹ : 1 ~ 29.6:1	-	
Motor resolution*	-	-	-	6400*	steps/rev.
Max. load	1000	1000	1000	1000	N
Max. push/pull force	80 / 80	80 / 80	80 / 80	80 / 80	N
Max. lateral force	200	200	200	200	N
Drive properties					
Motor type	ActiveDrive™ DC Motor	ActiveDrive™ DC Motor	DC-motor, gearhead	2-phase stepper motor*	
Operating voltage	24 (PWM)	24 (PWM)	0 to ±12	24	V
Electrical power	30	30	3		W
Limit and reference switches	Hall-effect	Hall-effect	Hall-effect	Hall-effect	
Miscellaneous					
Operating temperature range	-20 to +65	-20 to +65	-20 to +65	-20 to +65	°C
Material	Al (black anodized)	Al (black anodized)	Al (black anodized)	Al (black anodized)	
Mass	5 / 6.1 / 7.2	5 / 6.1 / 7.2	4.9 / 6 / 7.1	4.9 / 6 / 7.1	kg
Recommended controller/driver	C-862 (single-axis) C-843 PCI board (up to 4 axes)	C-862 (single-axis) C-843 PCI board (up to 4 axes)	C-862 (single-axis) C-843 PCI board (up to 4 axes)	C-663 (single-axis)	

* 2-phase stepper motor, 24 V chopper voltage, max. 0.8 A/phase, 400 full steps/rev., motor resolution with C-663 stepper motor controller

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