

M-511 · M-521 · M-531

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



Ordering Information

- 1 = Travel Range 102 mm / 4"
 - 2 = Travel Range 204 mm / 8"
 - 3 = Travel Range 306 mm / 12"
- M-5 1. Precision Translation Stage
- DG = DC Motor Gearhead
 - DD = ActiveDrive™ DC Motor, 0.1 μm Linear Encoder
 - DDB = ActiveDrive™ DC Motor, 0.1 μm Linear Encoder, Motor Brake
 - PD = ActiveDrive™ DC Motor Rotary Encoder
 - 2S = 2-Phase Stepper Motor
 - VG = DC Motor Gearhead, Vacuum Compatible to 10⁻⁶ hPa
 - VP = ActiveDrive™ DC Motor, Vacuum Compatible to 10⁻⁶ hPa
 - VD = ActiveDrive™ DC Motor, 0.1 μm Linear Encoder, Vacuum Compatible to 10⁻⁶ hPa

- 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

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. It is equipped with an ActiveDrive™ DC motor and rotary encoder.

The M-5x1.DD models provide superior repeatability of only 0.2 μm by means of integrated optical linear encoders. 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.

Precision Assembly

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

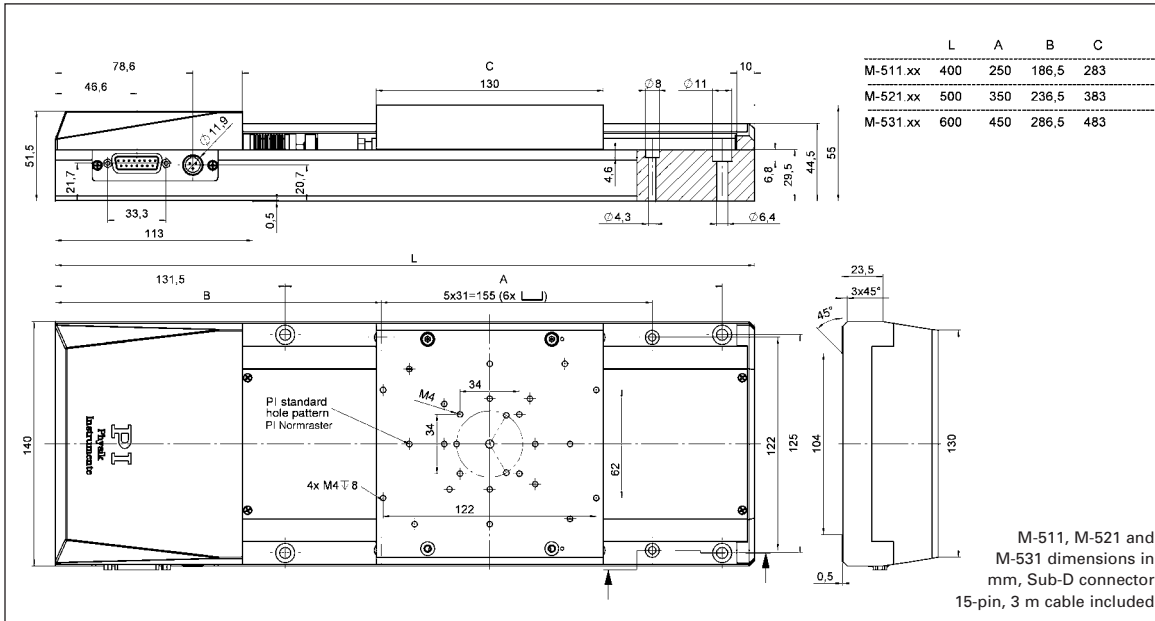
Notes

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



- Piezo Actuators
- Nanopositioning & Scanning Systems
- Active Optics / Steering Mirrors
- Tutorial: Piezo-electrics in Positioning
- Capacitive Position Sensors
- Piezo Drivers & Nanopositioning Controllers
- Hexapods / Micropositioning**
- Photonics Alignment Solutions
- Motion Controllers
- Ceramic Linear Motors & Stages
- Index

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
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	—	—	—	µm
Backlash	—	1	1	1	µm
Accuracy per 50 mm	0.2	2	2	2	µm
Pitch/Yaw	±25 / ±35 / ±50	±25 / ±35 / ±50	±25 / ±35 / ±50	±25 / ±35 / ±50	µrad
Straightness/Flatness per 100 mm	1	1	1	1	µm
Max. velocity	50	125	6	20	mm/s
Mechanical properties					
Thread pitch	2	2	2	2	mm
Gear ratio	—	—	(28/12) ⁴ : 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-863 (single-axis) C-843 PCI board (up to 4 axes)	C-863 (single-axis) C-843 PCI board (up to 4 axes)	C-863 (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