

# M-511 · M-521 · M-531

## Low-Profile, High-Load Translation Stages with Ballscrew Drives

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M-531.DD, M-521.DD and M-511.DD and M-505.2DG precision translation stages (bottom to top)

- Travel Ranges to 306 mm (12")
- Velocity up to 125 mm/sec.
- ActiveDrive™ Motors
- Compatible with Leading Industrial Motion Controllers
- Linear-Scale Encoders for Highest Accuracy
- Stress-Relieved Aluminum Stage Base for Highest Stability
- Zero-Backlash Recirculating Ballscrews
- Non-Contacting Origin and Limit Switches
- PIIntelliStage™ Version with Integrated Controller
- Load Capacity 100 kg
- >20,000 Hours MTBF

M-500 series translation stages are designed to meet the most demanding positioning requirements. They combine an extremely flat design to allow multi-axis combinations and feature a precision-machined base of high-density, stress-relieved aluminum for excep-

tional stability and minimum weight. Precision-ground recirculating ballscrews (more accurate than rolled ballscrews) with preloaded nuts provide low friction, backlash-free positioning.

### Drive Selections

Five different stepper- and DC-motor drives are available. The innovative PIIntelliStage™ models (M-511.5i, M-521.5i and M-531.5i) feature integrated motion controllers (see page 7-54).

For highest accuracy and repeatability we recommend versions with integrated linear-scale encoder (direct output metrology) providing 0.1 µm minimum incremental motion.

An optional auto-lock motor brake is available for the DC-Motor Direct Drive versions to secure the stage position after power-down.

### Maintenance Free and Heavy Duty

High-precision linear guiding rails with recirculating ball bearings guarantee 1 µm/100 mm straightness and flatness. They are also maintenance free and immune to the cage migration problems which can plague crossed roller bearings when small ranges are scanned repeatedly.

The precision-ground ballscrew is also maintenance-free and can carry more load with less friction than simple lead screws.

### Direction-Sensing Origin Switch

Integrated, high-precision, non-contact Hall-effect origin and limit switches with direction sensing on the origin switch protect your equipment and increase versatility in automation applications.

### Precision Assembly

Each M-500 stage is precision assembled and optimized using laser interferometers for performance testing.

### Notes

See "Accessories", page 7-92 ff. for adapters, brackets, etc.

### Ordering Information

- M-511.DG**  
Translation Stage, 4", DC Motor / Gearhead
  - M-511.DD\***  
Translation Stage, 4", ActiveDrive™ DC Motor, 0.1 µm Linear Encoder
  - M-511.PD**  
Translation Stage, 4", ActiveDrive™ DC Motor, Rotary Encoder
  - M-511.2S**  
Translation Stage, 4", 2-Phase Stepper Motor
  - M-521.DG**  
Translation Stage, 8", DC Motor / Gearhead
  - M-521.DD\***  
Translation Stage, 8", ActiveDrive™ DC Motor, 0.1 µm Linear Encoder
  - M-521.PD**  
Translation Stage, 8", ActiveDrive™ DC Motor, Rotary Encoder
  - M-521.2S**  
Translation Stage, 8", 2-Phase Stepper Motor
  - M-531.DG**  
Translation Stage, 12", DC Motor / Gearhead
  - M-531.DD\***  
Translation Stage, 12", ActiveDrive™ DC Motor, 0.1 µm Linear Encoder
  - M-531.PD**  
Translation Stage, 12", ActiveDrive™ DC Motor, Rotary Encoder
  - M-531.2S**  
Translation Stage, 12", 2-Phase Stepper Motor
- \* version M-5x1.DDB with motor brake available
- For PIIntelliStage™ versions see datasheet on p. 7-54.**
- Options**
- M-500.90**  
Linear and Guiding Accuracy Interferometric Test Sheet
  - M-590.00**  
Three-Point Support
  - M-592.10**  
Z-axis Mounting Bracket for Vertical Mount of M-500 Series Stages
- Ask about custom designs!**

### Application Examples

- Photonics packaging
- Quality control
- Semiconductor test equipment
- Metrology
- Disk drive test assemblies
- R&D

## Drive Options for M-500 Stages

### M-5x1.DD, ActiveDrive™ with Direct Metrology

These models are equipped with non-contact optical linear encoders (direct metrology) which enable a resolution of 0.1 µm. The linear encoder and ballscrew drive are mounted in the center of the stage to eliminate cosine error.

Because the encoder measures the actual position of the moving carriage, drivetrain errors like backlash and elastic deformation are eliminated. A remote-controlled brake option is available with product number M-5x1.DDB.

For maximum dynamic performance, the M-5x1.DD versions are equipped with the highly efficient ActiveDrive™ direct-drive system, which can achieve speeds of up to 100 mm/s. This unique design features a high-power PWM servo-amplifier mounted with the motor in the same casing, and provides a number of advantages:

- Increased efficiency by eliminating power losses between the amplifier and motor
- Reduced cost, smaller form-factor and improved reliability, because no external driver and cabling are required
- Elimination of PWM amplifier noise radiation, by mounting the amplifier and motor together in an electrically shielded case

### M-5xx.PD, ActiveDrive™ Direct-Drive DC Motor

This version provides velocities up to 125 mm/sec and resolution of 0.5 µm. It is equipped with an ActiveDrive™ DC motor (see description above) and rotary encoder.

### M-5x1.DG Backlash-Free DC Motor Gearheads

These models have backlash-free DC motor gearhead drive and high-resolution optical encoder (34 nm encoder resolution); minimum incremental motion is 0.1 µm, velocity 6 mm/s.

### M-5x1.2S Models with Stepper Motors

The M-5x1.2S Models are equipped with low-vibration, 2-phase stepper motors capable of microstep operation with a stepsize of 0.1 µm 5-phase stepper motors are available on request.

### M-5x1.5i PIIntelliStage™

This unique series features a motion controller integrated in the stage (see p. 7-54).

### Vacuum Versions

Vacuum versions of the M-5x1.DG, M-5x1.PD and M-5x1.DD stages are available. They are suitable for operation to 10<sup>-6</sup> hPa.

Piezo Actuators

Nanopositioning & Scanning Systems

Active Optics / Steering Mirrors

Tutorial: Piezo-electrics in Positioning

Capacitive Position Sensors

Piezo Drivers & Nanopositioning Controllers

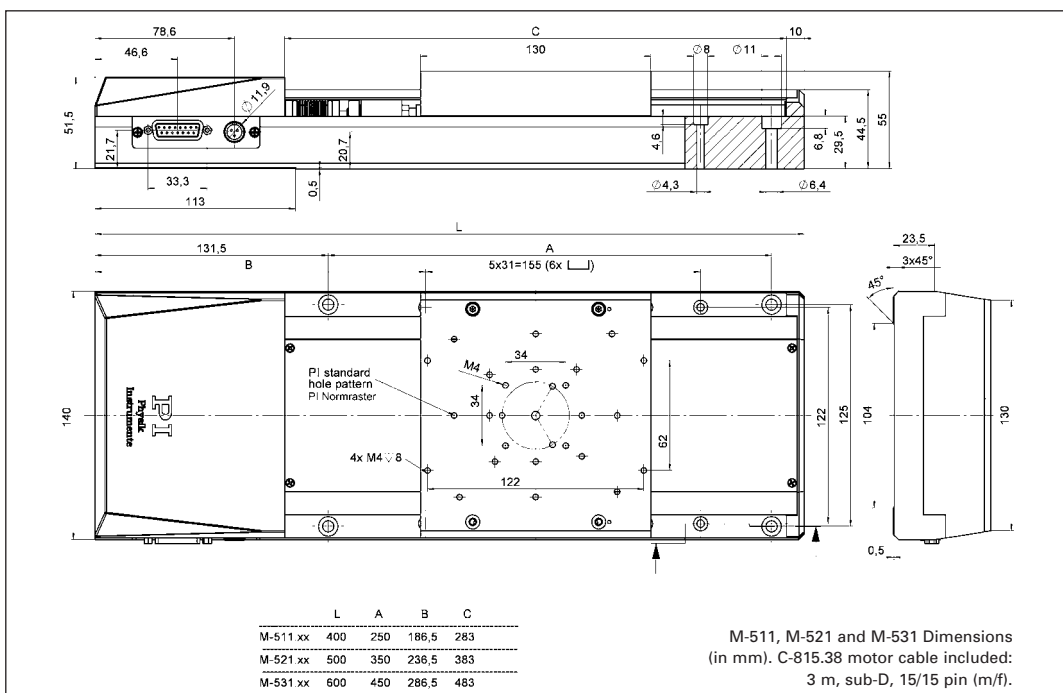
Hexapods / Micropositioning

Photonics Alignment Solutions

Motion Controllers

Ceramic Linear Motors & Stages

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Pneumatic gripper mounted on an M-511/M-605 XZ micropositioning assembly, for high-precision pick-and-place applications.

**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	Units <sup>#</sup>
Travel range	102	204	306	102	204	306	102	204	306	102	204	306	mm
Design resolution	0.1	0.1	0.1	0.5	0.5	0.5	0.033	0.033	0.033	0.1	0.1	0.1	µm
Min. incremental motion	0.1	0.1	0.1	0.5	0.5	0.5	0.1	0.1	0.1	0.1	0.1	0.1	µm
Unidirectional repeatability	0.1	0.1	0.1	0.5	0.5	0.5	0.2	0.2	0.2	0.2	0.2	0.2	µm
Bidirectional repeatability	0.2	0.2	0.2	1	1	1	1	1	1	1	1	1	µm
Origin repeatability	1	1	1	1	1	1	1	1	1	1	1	1	µm
Accuracy per 50 mm	0.2	0.2	0.2	2	2	2	2	2	2	2	2	2	µm
Straightness / flatness per 100 mm	1	1	1	1	1	1	1	1	1	1	1	1	µm
Max. velocity	100****	100****	100****	125	125	125	6	6	6	20	20	20	mm/s
Max. normal load capacity	100	100	100	100	100	100	100	100	100	100	100	100	kg
Max. push / pull force	80 / 80	80 / 80	80 / 80	80 / 80	80 / 80	80 / 80	80 / 80	80 / 80	80 / 80	80 / 80	80 / 80	80 / 80	N
Max. lateral force	200	200	200	200	200	200	200	200	200	200	200	2000	N
Encoder resolution	0.1 µm *	0.1 µm *	0.1 µm *	4000	4000	4000	2048	2048	2048	-	-	-	counts/rev.
Motor resolution	-	-	-	-	-	-	-	-	-	20,000**	20,000**	20,000**	steps/rev.
Ballscrew pitch	2	2	2	2	2	2	2	2	2	2	2	2	mm/rev.
Gear ratio	-	-	-	-	-	-	(28/12) <sup>d</sup> : 1 ≈29.6:1	(28/12) <sup>d</sup> : 1 ≈29.6:1	(28/12) <sup>d</sup> : 1 ≈29.6:1	-	-	-	
Nominal motor power	30 ***	30 ***	30 ***	30 ***	30 ***	30 ***	3	3	3	- **	- **	- **	W
Motor voltage	24	24	24	24	24	24	12	12	12	24 **	24 **	24 **	V
Weight	5.0	6.1	7.2	5.0	6.1	7.2	4.9	6.0	7.1	4.9	6.0	7.1	kg
Body material	Al	Al	Al	Al	Al	Al	Al	Al	Al	Al	Al	Al	
Recommended motor controller	C-843, C-848, C-862	C-843, C-848, C-862	C-843, C-848, C-862	C-843, C-848, C-862	C-843, C-848, C-862	C-843, C-848, C-862	C-843, C-848, C-862	C-843, C-848, C-862	C-843, C-848, C-862	C-600, C-630	C-600, C-630	C-600, C-630	

\* Linear encoder

\*\* 2-phase stepper, 24 V chopper voltage, max. 0.8 A / phase, 20,000 microsteps with C-600, C-630 controllers;

\*\*\* ActiveDrive™ (integrated PWM servo-amplifier); brake option for M-5x1.DD = M-5x1.DDB

\*\*\*\* With C-843 motor controller.

# See page 7-106 for notes and explanations.



M-511 in a fiber alignment setup.



XYZ combination of two M-511.DD translation stages and one M-501.1PD precision vertical stage.

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