

M-511 M-521 M-531 Low-Profile, High-Resolution Linear Translation Stages

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-511.5i****
IntelliStage™ Translation Stage, 4", 5-Phase Stepper Motor, Integrated Motor Controller
- 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-521.5i****
IntelliStage™ Translation Stage, 8", 5-Phase Stepper Motor, Integrated Motor Controller
- 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
- M-531.5i****
IntelliStage™ Translation Stage, 12", 5-Phase Stepper Motor, Integrated Motor Controller

* version M-5x1.DDB with motor brake available

** see separate datasheet, p. 7-44.

Custom Designs for Volume Buyers



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

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

- **Travel Ranges to 306 mm (12")**
- **Velocity up to 150 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**
- **IntelliStage™ 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 multiaxis combinations and feature a precision-machined base of high-density, stress-relieved aluminum for exceptional stability and minimum weight. Precision ground recirculating ballscrews (more accurate than rolled ballscrews) with preloaded nuts provide low friction, backlash-free positioning.

Drive Options

Five different stepper- and DC-motor drives are available. The IntelliStage™ models (M-511.5i, M-521.5i and M-531.5i) feature integrated motion controllers, another first from PI (see p. 7-44).

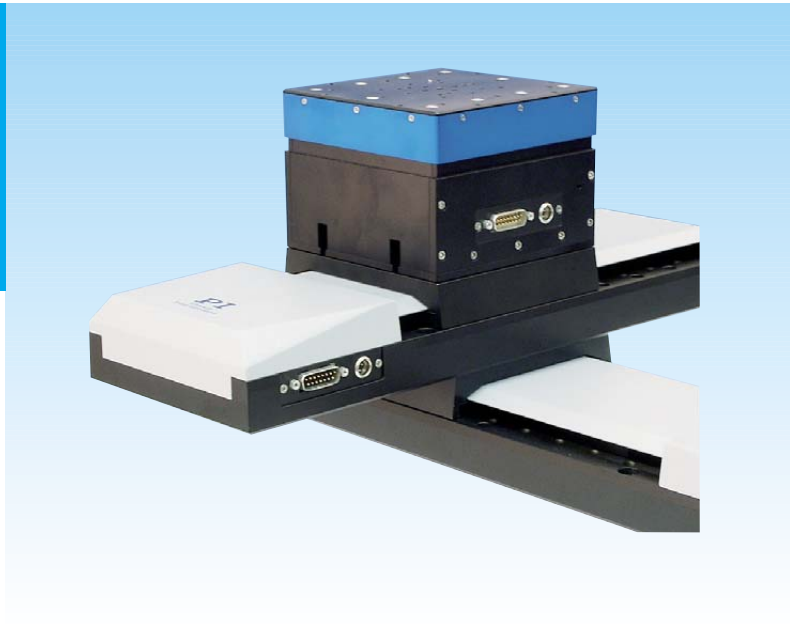
For highest accuracy and repeatability we recommend versions with integrated linear-scale encoder (**direct output metrology**) providing 0.1 μm minimum incremental motion and 1 μm full-travel accuracy.

PZT Actuators
PZT Flexure NanoPositioners
PZT Active Optics / Steering Mirrors
Tutorial: Piezoelectrics...
Capacitive Position Sensors
PZT Control Electronics
MicroPositioners / Hexapod Systems
Photonics Alignment & Packaging Systems
Motor Controllers
Index

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Application Examples

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



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

Notes

See "Accessories," page 7-82 ff.
for adapters, brackets, etc.

Options

M-500.90

Linear and Guiding Accuracy
Interferometric Test Sheet for M-500
Stages

M-590.00

Three-Point Support

M-592.10

Z-axis Mounting Bracket for Vertical
Mount of M-500 Series Stages

Maintenance Free

High-precision linear guiding rails with recirculating ball bearings guarantee 1 $\mu\text{m}/100\text{ mm}$ straightness and flatness. They are also immune to the cage migration problems of crossed roller bearings (can be an issue where small ranges are scanned repeatedly) and are maintenance free.

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

Precision Assembly

Each M-500 stage is precision assembled and optimized using laser interferometers for performance testing. For the most stringent testing requirements individual stage data are available as option M-500.90.

Drive Options for M-500 Stages

M-5xx.DD, ActiveDrive™ DC-Motor with Direct Output Metrology

This version features 0.1 μm minimum incremental motion and a max. velocity of 50 mm/sec. An optical linear encoder (mounted in the center of the stage, close to the ballscrew drive to prevent cosine errors found in other designs) eliminates drivetrain errors due to non-linearity, backlash and elastic deformation. The linear encoder measures the actual position of the moving carriage directly and with exceptional accuracy. The encoder is based on an optical grating and a non-contacting read head with integrated signal conditioner and interpolator.

For maximum dynamic performance we integrated our unsurpassed **ActiveDrive™** system. This unique design features a high efficiency PWM servo amplifier mounted side-by-side with the motor. It provides superior dynamic performance and several additional 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 an electrically shielded case

A remote-control brake is available to lock the stage after power-off (part No. M 5x1.DDB).

M-5xx.PD, ActiveDrive™ DC Motor

This version provides velocities to 150 mm/sec and resolution of 0.5 μm, a unique combination. It is equipped with the ActiveDrive™ found in the M-5xx.DD versions but uses a 4000 counts/rev. shaft-mounted position encoder instead of the linear scale for position feedback. A remotely controllable brake is available to lock the stage after power-off.

M-5xx.DG, DC-Motor/Gearhead Drive

A 3-watt DC motor with zero-backlash gearhead and shaft-mounted 2048 counts/rev. optical encoder is used. The gear ratio is 29.6:1, providing minimum incremental motion of 0.1 μm and a maximum velocity of 6 mm/sec.

M-5xx.2S, Stepper-Motor Direct Drive

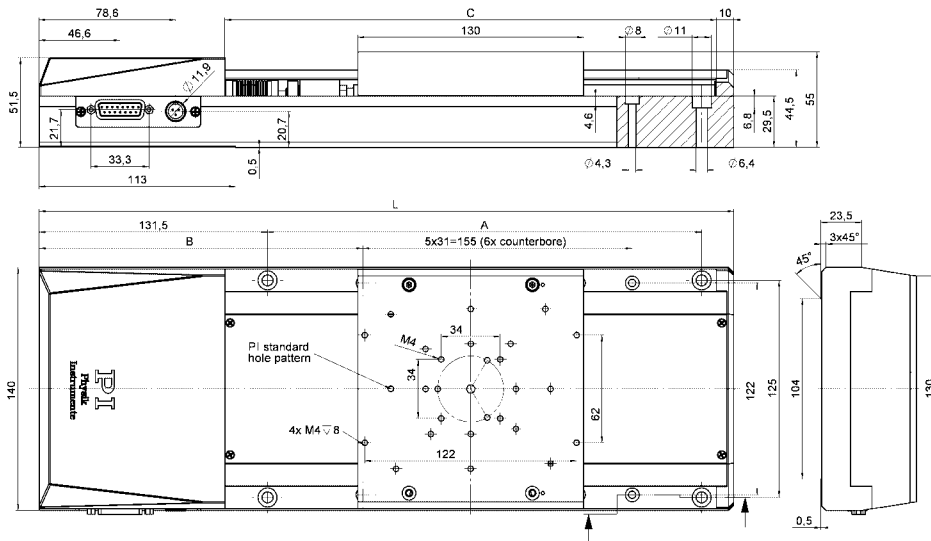
A micro-stepped 2-phase stepper motor (20,000/rev. with the C-600 controller) combines high resolution with ultra-smooth low-speed positioning. 5-phase stepper motors are available on request.

M-5xx.5i IntelliStage™

This unique series features an integrated motion controller (see p. 7-44).

Technical Data

Models	M-511.DD	M-521.DD
Key features	Linear scale, ActiveDrive DC motor	Linear scale, ActiveDrive DC motor
Travel range	102	204
Design resolution	0.1	0.1
Min. incremental motion	0.1	0.1
Unidirectional repeatability	0.1	0.1
Bidirectional repeatability	0.2	0.2
Origin repeatability	1	1
Accuracy per 50 mm	0.2	0.2
Straightness / flatness per 100 mm	1	1
Max. velocity	50	50
Max. normal load capacity	100	100
Max. push/pull force	80 / 80	80 / 80
Max. lateral force	200	200
Encoder resolution	0.1 μm *	0.1 μm *
Motor resolution	-	-
Ballscrew pitch	2	2
Gear ratio	-	-
Nominal motor power	30 ***	30 ***
Motor voltage range	0 to ±24	0 to ±24
Weight	5.0	6.1
Body material	Al	Al
Recommended motor controller	C-842, C-844, C-860	C-842, C-844, C-860



	L	A	B	C
M-511.xx	400	250	186,5	283
M-521.xx	500	350	236,5	383
M-531.xx	600	450	286,5	483

M-511, M-521 and M-531 Dimensions (in mm)

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	M-511.5i	M-521.5i	M-531.5i	Units	Notes see p. 7-96
Linear scale, ActiveDrive DC motor	ActiveDrive DC motor, rotary encoder	ActiveDrive DC motor, rotary encoder	ActiveDrive DC motor, rotary encoder	DC motor / gear head, rotary encoder	DC motor / gear head, rotary encoder	DC motor / gear head, rotary encoder	2-phase stepper motor	2-phase stepper motor	2-phase stepper motor	IntelliStage, integrated controller	IntelliStage, integrated controller	IntelliStage, integrated controller		
306	102	204	306	102	204	306	102	204	306	102	204	306	mm	
0.1	0.5	0.5	0.5	0.033	0.033	0.033	0.1	0.1	0.1	0.1	0.1	0.1	µm	A3
0.1	0.5	0.5	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	µm	A4
0.1	0.5	0.5	0.5	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	µm	
0.2	1	1	1	1	1	1	1	1	1	1	1	1	µm	
1	1	1	1	1	1	1	1	1	1	1	1	1	µm	
0.2	2	2	2	2	2	2	2	2	2	2	2	2	µm	
1	1	1	1	1	1	1	1	1	1	1	1	1	µm	
50	125	125	125	6	6	6	20	20	20	20	20	20	mm/sec	
100	100	100	100	100	100	100	100	100	100	100	100	100	kg	B1
80 / 80	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	B2
200	200	200	200	200	200	200	200	200	200	200	200	200	N	
0.1 µm *	4000	4000	4000	2048	2048	2048	-	-	-	-	-	-	counts/rev.	
-	-	-	-	-	-	-	20000**	20000**	20000**	20000	20000	20000	steps/rev.	
2	2	2	2	2	2	2	2	2	2	2	2	2	mm/rev.	
-	-	-	-	(28/12) [±] : 1 ≈29.6:1	(28/12) [±] : 1 ≈29.6:1	(28/12) [±] : 1 ≈29.6:1	-	-	-	-	-	-		
30 ***	30 ***	30 ***	30 ***	3	3	3	- **	- **	- **	-	-	-	W	
0 to ±24	0 to ±24	0 to ±24	0 to ±24	0 to ±12	0 to ±12	0 to ±12	24 **	24 **	24 **	24	24	24	V	
7.2	5.0	6.1	7.2	4.9	6.0	7.1	4.9	6.0	7.1	5.1	6.2	7.3	kg	
Al	Al	Al	Al	Al	Al	Al	Al	Al	Al	Al	Al	Al		L
C-842, C-844, C-860	C-842, C-844, C-860	C-842, C-844, C-860	C-842, C-844, C-860	C-842, C-844, C-860	C-842, C-844, C-860	C-842, C-844, C-860	C-600, C-630	C-600, C-630	C-600, C-630	Integra- ted ****	Integra- ted ****	Integra- ted ****		D2

* Linear encoder

** 2-phase stepper, 24 V chopper voltage, max. 1.5 A / phase, 20,000 microsteps with C-600, C-630 controllers;

*** ActiveDrive™ (integrated PWM servo-amplifier), brake option for M-5xx.DD

**** Motor controller integrated in stage, cable for RS-232 interface and power included, power supply included in M-5x1.5iM Master Sets, see separate datasheet, p. 7-44.