M-511 · M-521 · M-531 Linear Slide

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

Ordering Information

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<td>Precision Translation Stage</td>
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<td>DG</td>
<td>DC Motor Gearhead</td>
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<td>DD</td>
<td>ActiveDrive™ DC Motor, 0.1 µm Linear Encoder</td>
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<td>DDB</td>
<td>ActiveDrive™ DC Motor, 0.1 µm Linear Encoder, Motor Brake</td>
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<td>PD</td>
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<td>2S</td>
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<td>VP</td>
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<td>VD</td>
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M-511, M-521, M-531, M-505, and M-505.DDG heavy duty translation stages with recirculating ball screw 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 multi-axis 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 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-5x1.2S versions 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.
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

Active axes
- X
- X
- X
- X

Motion and positioning

Travel range
- 102 / 204 / 306 mm
- 102 / 204 / 306 mm
- 102 / 204 / 306 mm
- 102 / 204 / 306 mm

Integrated sensor
- Linear encoder
- Rotary encoder
- Rotary encoder
- 

Sensor resolution
- 0.1 µm
- 0.5 µm
- 0.033 µm
- 0.31 cts./rev.

Design resolution
- 0.1 µm
- 0.5 µm
- 0.033 µm
- 0.31 µm

Min. incremental motion
- 0.1 µm
- 0.5 µm
- 0.1 µm
- 0.5 µm

Unidirectional repeatability
- 0.1 µm
- 0.5 µm
- 0.2 µm
- 0.2 µm

Bidirectional repeatability
- 0.2 µm
- 2 µm
- 2 µm
- 2 µm

Accuracy
- 0.2 µm
- 2 µm
- 2 µm
- 2 µm

Pitch
- 50 µm
- 50 µm
- 50 µm
- 50 µm

Yaw
- 50 µm
- 50 µm
- 50 µm
- 50 µm

Straightness
- 1 µm
- 1 µm
- 1 µm
- 1 µm

Flatness
- 1 µm
- 1 µm
- 1 µm
- 1 µm

Max. velocity
- 100 mm/s
- 125 mm/s
- 6 mm/s
- 20 mm/s

Origin repeatability
- 1 µm
- 1 µm
- 1 µm
- 1 µm

Mechanical properties

Drive screw
- Recirculating ball screw
- Recirculating ball screw
- Recirculating ball screw
- Recirculating ball screw

Thread pitch
- 2 mm
- 2 mm
- 2 mm
- 2 mm

Gear ratio
- (28/12) : 1 = 2.33
- (28/12) : 1 = 2.33
- (28/12) : 1 = 2.33
- (28/12) : 1 = 2.33

Motor resolution
- 6400 steps/rev.
- 6400 steps/rev.
- 6400 steps/rev.
- 6400 steps/rev.

Max. load
- 1000 N
- 1000 N
- 1000 N
- 1000 N

Max. push/pull force
- 80 / 80 N
- 80 / 80 N
- 80 / 80 N
- 80 / 80 N

Max. lateral force
- 200 N
- 200 N
- 200 N
- 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 W
- 30 W
- 3 W
- 3 W

Limit and reference switches
- Hall-effect
- Hall-effect
- Hall-effect
- Hall-effect

Miscellaneous

Operating temperature range
- 20 to +65 °C
- 20 to +65 °C
- 20 to +65 °C
- 20 to +65 °C

Material
- Al (black anodized)
- Al (black anodized)
- Al (black anodized)
- Al (black anodized)

Mass
- 5 / 6.1 / 7.2 kg
- 5 / 6.1 / 7.2 kg
- 4.9 / 6 / 7.1 kg
- 4.9 / 6 / 7.1 kg

Recommended controller/driver
- C-882 (single-axis)
- C-882 (single-axis)
- C-862 (single-axis)
- C-863 (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