

# M-014

## Ultra-High-Precision, Side-Drive Stages with Magnetic-Kinematic Bearings

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M-014.D01 translation stage

- Travel Range 25 mm
- Compact Side Drive
- Straightness/Flatness  $\leq 0.3 \mu\text{m}$
- PZT Drive for Scanning and Tracking Applications
- 0.1  $\mu\text{m}$  Resolution w/ Closed-Loop DC Motor
- 5 nm Resolution with Closed-Loop PZT Drive
- 30 mm  $\varnothing$  Clear Aperture

M-014 ultra-high-precision magnetically coupled stages use the force of integrated magnets to preload the bearing. This magnetic preload results in extremely uniform and smooth motion with minimum friction. Unlike conventional stages, where two bearings with limited parallelism guide the carriage (inducing runout and rotational errors) in M-014 stages, only one of the two linear bearings has a guiding function (V-groove) while the second bearing is for support only (U-groove).

### Ultra-Straight Motion

The coupling between the stage and the space-saving side drive units (DC-motor drives, PZTs, micrometer drives) is not rigid but via magnets. This design allows only

on-axis forces (drive direction) to be transmitted to the stage; torque-induced positioning errors induced by non-parallelism between the drive axis and the guiding axis are eliminated.

### Six Different Versions

The basic version, the M-014.00, is equipped with a precision manual micrometer providing a sensitivity of 1  $\mu\text{m}$ . M-014.D01 is equipped with a closed-loop DC-motor drive providing 0.1  $\mu\text{m}$  minimum incremental motion.

### High-Resolution Piezo Option

For both the manual and motorized version, closed-loop and open-loop piezo drives are available. They provide 5 nm minimum incremental motion over a travel range of 45  $\mu\text{m}$  and allow for dynamic operation such as scanning and tracking. The closed-loop piezo drive provides repeatability of 90 nm (see the "Piezo Actuators" section for further details on piezo actuators and recommended controllers).

All stages can be cross stacked and combined with the M-053.10 (manual versions) and M-053.20 (motorized versions) Z-axis mounting bracket to provide multi-axis motion. Vertical use of the M-014 is only permitted with loads less than 0.5 kg. For vertical positioning with loads in excess of 0.5 kg we recommend M-126 stages (see page 7-40) and the 125.90 Z-axis mounting bracket.

### Upgrades

M-014 stages without PZT or DC-motor drives can be upgraded at a later date (see ordering information).

### Notes

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

### Ordering Information

- M-014.00**  
Translation Stage, 25 mm
- M-014.P0**  
Translation Stage, 25 mm, Manual + PZT Drive
- M-014.PS**  
Translation Stage, 25 mm, Manual + Closed-Loop PZT Drive
- M-014.D01**  
Translation Stage, 25 mm, DC-Motor Drive
- M-014.DP1**  
Translation Stage, 25 mm, DC-Motor + PZT Drive
- M-014.DS1**  
Translation Stage, 25 mm, DC-Motor + Closed-Loop PZT Drive
- Upgrades**
- M-014.U0**  
Upgrade Kit with Open-Loop PZT Drive
- M-014.US**  
Upgrade Kit with Closed-Loop PZT Drive
- M-014.UD**  
Upgrade Kit with DC-Motor Drive and Limit Switches (Factory Installed)

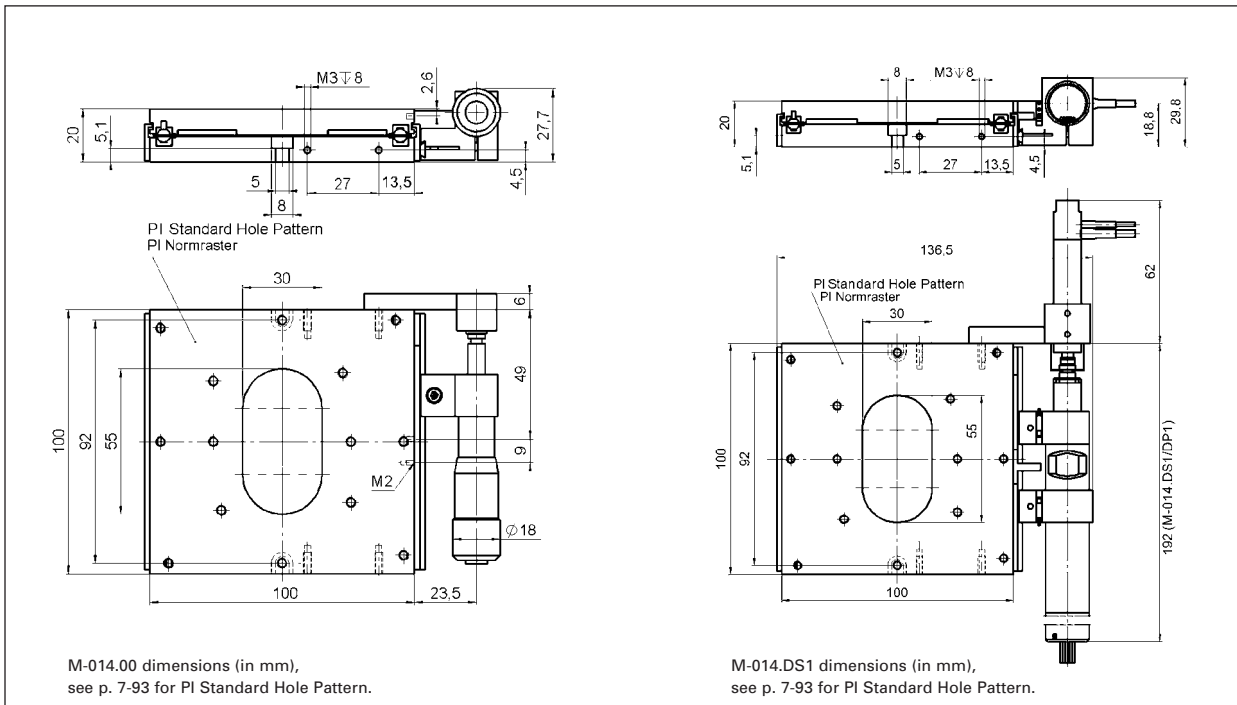
Ask about custom designs!



M-014.00 translation stage

### Application Examples

- Microscopy
- Quality control
- Metrology



- 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-014.00 | M-014.P0 | M-014.PS | M-014.D01           | M-014.DP1           | M-014.DS1           | Units       | Notes see page 7-106 |
|--|----------|----------|----------|---------------------|---------------------|---------------------|-------------|----------------------|
| Travel range   | 25       | 25       | 25       | 25                  | 25                  | 25                  | mm          |                      |
| Piezo fine travel range                                      | -        | 45       | 45       | -                   | 45                  | 45                  | µm          |                      |
| Min. incremental motion (piezo drive)                        | -        | 0.005    | 0.005    | -                   | 0.005               | 0.005               | µm          | A4                   |
| Repeatability (piezo drive)                                  | -        | -        | 0.09     | -                   | -                   | 0.09                | µm          |                      |
| Design resolution (DC Motor)                                 | -        | -        | -        | 0.0035              | 0.0035              | 0.0035              | µm          | A3                   |
| Min. incremental motion                                      | 1        | 1        | 1        | 0.1                 | 0.1                 | 0.1                 | µm          | A4                   |
| Unidirectional repeatability                                 | -        | -        | -        | 0.1                 | 0.1                 | 0.1                 | µm          |                      |
| Bidirectional repeatability                                  | -        | -        | -        | 2                   | 2                   | 2                   | µm          |                      |
| Backlash   | -        | -        | -        | 2*                  | 2*                  | 2*                  | µm          |                      |
| Straightness / flatness per 5 mm                             | 0.1      | 0.1      | 0.1      | 0.1                 | 0.1                 | 0.1                 | µm          |                      |
| Straightness / flatness full travel                          | 0.3      | 0.3      | 0.3      | 0.3                 | 0.3                 | 0.3                 | µm          |                      |
| Max. normal load capacity                                    | 5        | 5        | 5        | 5                   | 5                   | 5                   | kg          | B1                   |
| Max. velocity (motor)  | -        | -        | -        | 1                   | 1                   | 1                   | mm/sec      |                      |
| Max. push/pull force   | 15/5     | 15/5     | 15/5     | 15/5                | 15/5                | 15/5                | N           | B2                   |
| Max. lateral force   | 10       | 10       | 10       | 10                  | 10                  | 10                  | N           |                      |
| Drive  | M-624    | M-624    | M-624    | M-227.25            | M-227.25            | M-227.25            |             |                      |
| Piezo drive  | -        | P-840.30 | P-841.30 | -                   | P-840.30            | P-841.30            |             | D1                   |
| Encoder resolution   | -        | -        | -        | 2048                | 2048                | 2048                | counts/rev. |                      |
| Drive screw pitch  | 0.5      | 0.5      | 0.5      | 0.5                 | 0.5                 | 0.5                 | mm/rev.     |                      |
| Gear ratio   | -        | -        | -        | 69.12:1             | 69.12:1             | 69.12:1             |             |                      |
| Nominal motor power  | -        | -        | -        | 2                   | 2                   | 2                   | W           |                      |
| Motor voltage  | -        | -        | -        | 12                  | 12                  | 12                  | V           |                      |
| Weight   | 0.72     | 0.78     | 0.8      | 0.98                | 1.04                | 1.06                | kg          |                      |
| Body material  | Al, St   | Al, St   | Al, St   | Al, St              | Al, St              | Al, St              |             | L                    |
| Recommended piezo controller (codes explained see page 6-11) | -        | A, C, G  | D, H     | -                   | A, C, G             | D, H                |             |                      |
| Recommended motor controller                                 | -        | -        | -        | C-843, C-848, C-862 | C-843, C-848, C-862 | C-843, C-848, C-862 |             | D2                   |

\* gearhead