

# M-403 · M-404 Precision Translation Stage

## Cost-Effective, Large Choice of Drives & Travel Ranges



M-403 linear stage versions (from left) M-403.1PD, M-403.2PD, M-403.4PD, M-403.6PD und M-403.8PD provide travel ranges from 25 to 200 mm

- For Cost-Sensitive Precision Positioning Applications
- Travel Ranges 25 to 200 mm
- Resolution to 0.012  $\mu\text{m}$
- Min. Incremental Motion to 0.1  $\mu\text{m}$
- Preloaded Precision Leadscrew or Recirculating Ball Screw Drives Provide High Speeds & Long Lifetimes
- Stress-Relieved Aluminum Base for Highest Stability
- Vacuum-Compatible Versions Available
- M-413 and M-414 Versions for Higher Load Requirements

The M-403 and M-404 linear translation stage series provide cost-effective solutions for precision positioning of loads up to 20 kg over travel ranges to 200 mm. They are designed with high-value components and feature a precision-machined, high-density, stress-relieved aluminum base for exceptional stability with minimum weight.

The highly precise M-403 drive includes a preloaded lead screw, providing a minimum incremental motion of 0.2  $\mu\text{m}$ . For higher velocities and long lifetime, the M-404 versions feature a low-friction ball screw

offering a minimum incremental motion down to 0.1  $\mu\text{m}$ . Three motor drive options allow easy adaptation to different automation applications. Five travel ranges from 25 to 200 mm are offered. The stages can carry up to 20 kg and push/pull up to 50 N. Special versions for vacuum applications are also available (see ordering information).

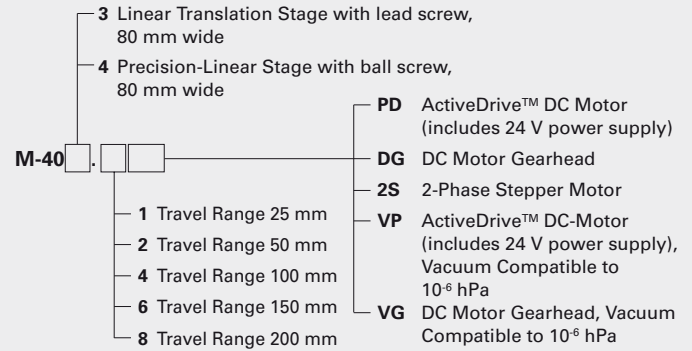
### Maintenance-Free, High Guiding Precision

All models are equipped with high-precision linear guiding rails and recirculating ball bearings. The recirculating ball bearings are maintenance free and immune to cage migration. The choice of components and careful mounting guarantees high load capacity, longer lifetime and high guiding accuracy. Additionally, in the M-404 series the bearings are polished to achieve the optimum guiding accuracy.

### Application Examples

- Automation
- R&D
- Semiconductor technology
- Metrology
- Quality assurance testing

### Ordering Information



Ask about custom designs!

### Low Cost of System Ownership

The combination of these stages with the networkable single-axis C-863 Mercury™ (see p. 4-114) and C-663 Mercury™ Step (see p. 4-112) controllers offers high performance for a very competitive price in both single and multi-axis configurations. Alternatively, the C-843 motion controller PCI card with on-board servo amplifiers is available.

### Three Motor Drive Options

The top-of-the-line M-40x.xPD high-speed versions come equipped with the high-performance ActiveDrive™ system. 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

M-40x.xDG models are equipped with a DC motor and a shaft-mounted optical encoder, providing a minimum incremental motion of down to 0.1  $\mu\text{m}$ . M-40x.x2S models feature a cost-effective direct-drive, 2-phase stepper motor, providing very smooth operation and a resolution of 0.16  $\mu\text{m}$ .

### Limit and Reference Switches

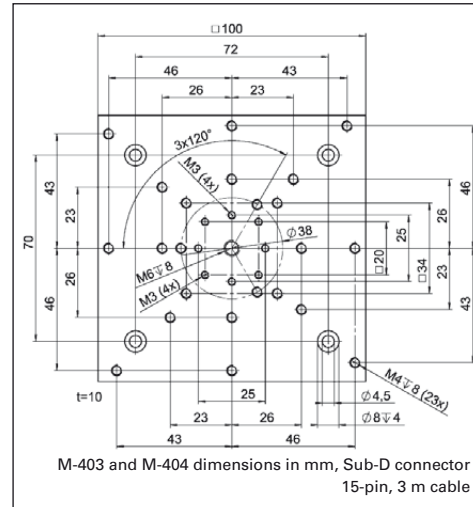
For the protection of your equipment, non-contact Hall-effect limit and reference switches are installed. The direction-sensing reference switch supports advanced automation applications with high precision.

### Other Family Members

The M-403/M-413 and M-404/M-414 series of linear stages form a modular system. The M-403 is the basic family, providing travel ranges from 25 to 200 mm. M-413 is designed for higher loads with travel ranges from 100 to 300 mm. The M-404 and M-414 stages have the same travel ranges and load capacities, but offer higher precision and more speed.



Different motor versions of the M-403 linear stage family with 100 mm travel range (from left) M-403.4PD (DC-motor/ActiveDrive™), M-403.4DG (DC-motor/gearhead) and M-403.42S (stepper motor)



## Technical Data

Model	M-404.xPD	M-404.xDG	M-404.x2S	M-403.xPD	M-403.xDG	M-403.x2S	Units
<b>Motion and positioning</b>							
Travel range	for all models: 25 / 50 / 100 / 150 / 200 mm (see Order Information)						
Integrated sensor	Rotary encoder	Rotary encoder	–	Rotary encoder	Rotary encoder	–	
Sensor resolution	4000	2000	–	4000	2000	–	Cts./rev.
Design resolution	0.25	0.012	0.16**	0.25	0.018	0.16**	µm
Min. incremental motion	0.25	0.1	0.2	0.25	0.2	0.2	µm
Backlash	0.5	2	2	6	10	6	µm
Unidirectional repeatability	0.5	1	1	1	1	1	µm
Pitch***	±75	±75	±75	±200	±200	±200	µrad
Yaw***	±75	±75	±75	±200	±200	±200	µrad
Max. velocity	50	1.5	3	10*	2.5	3	mm/s
Origin repeatability	1	1	1	1	1	1	µm
<b>Mechanical properties</b>							
Spindle	Recirculating ballscrew	Recirculating ballscrew	Recirculating ballscrew	Leadscrew	Leadscrew	Leadscrew	
Spindle pitch	1	1	1	1	1	1	mm
Gear ratio	–	42.92063:1	–	–	28.44444:1	–	
Motor resolution**	–	–	6400**	–	–	6400**	steps/rev.
Stiffness in motion direction	3500	3500	3500	3500	3500	3500	N/µm
Max. load	200	200	200	200	200	200	N
Max. push/pull force	100	100	100	50	50	50	N
Max. lateral force	100	100	100	100	100	100	N
<b>Drive properties</b>							
Motor type	ActiveDrive™ DC Motor	DC-motor, gearhead	2-phase stepper motor**	ActiveDrive™ DC Motor	DC-motor, gearhead	2-phase stepper motor**	
Operating voltage	24	0–12	24	24	0–12	24	V
Electrical power	26	2.5	4.8	26	2.5	4.8	W
Torque	50	3	200	50	3	200	Ncm
Limit and reference switches	Hall-effect	Hall-effect	Hall-effect	Hall-effect	Hall-effect	Hall-effect	
<b>Miscellaneous</b>							
Operating temperature range	-20 to +65	-20 to +65	-20 to +65	-20 to +65	-20 to +65	-20 to +65	°C
Material	for all models: Aluminum (black anodized)						
Mass (depends on dimensions/travel range)	1.7 / 1.8 / 2.1 / 2.2 / 2.5 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-663 (single-axis)	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)	

\*Max. recommended velocity

\*\*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

\*\*\* For travels >100 mm, the pitch/yaw value is valid for every 100 mm.

Data for vacuum versions may differ.