

M-413 · M-414 High-Load Precision Stage

Cost-Effective, Large Choice of Drives & Travel Ranges, Loads to 50 kg



M-413 linear stage versions (from right: the M-413.1PD, M-413.2PD and M-413.3PD provide travel ranges from 100 to 300 mm (CD for size comparison)

- For Cost-Sensitive Precision Positioning Applications
- Travel Ranges 100 to 300 mm
- Resolution to 0.018 μm
- Min. Incremental Motion to 0.1 μm
- 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-403 and M-404 Versions for Reduced Load Requirements

The M-413 and M-414 linear translation stage series provide cost effective solutions for precision positioning of higher loads up to 50 kg over travel ranges up to 300 mm.

They are designed with a precision-machined, high-density, stress-relieved aluminum base for exceptional stability and robustness. The highly precise M-413 drive includes a preload-ed leadscrew, providing a minimum incremental motion of 0.2 μm .

High Resolution Ball Screws & Lead Screws

For higher velocities and a long lifetime the M-414 versions fea-

Application Examples

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

ture a low-friction ball screw offering a minimum incremental motion down to 0.1 μm .

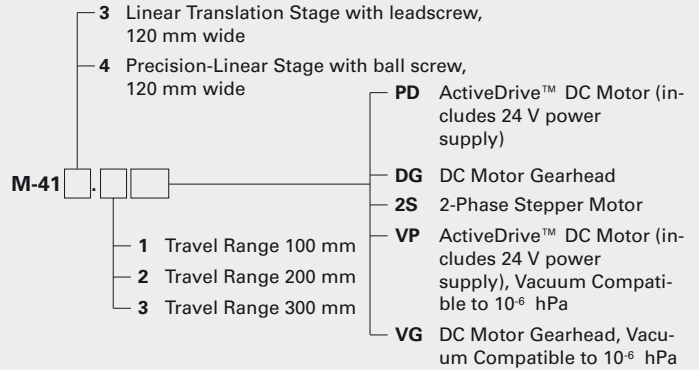
Three motor drive options allow the optimum adaptation to the requirements of different automation applications.

M-413s and M-414s are available in 3 lengths providing travel ranges from 100 to 300 mm. The stages can carry up to 50 kg and push/pull up to 50 N. Special versions for vacuum applications are 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 the bearings are

Ordering Information



polished to guide the carriage with optimum straightness and flatness.

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

M-41x.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

M41x.xDG models are equipped with a DC motor with a low-backlash gearhead and a shaft-mounted optical encoder to give a minimum incremental motion of 0.1 μm .

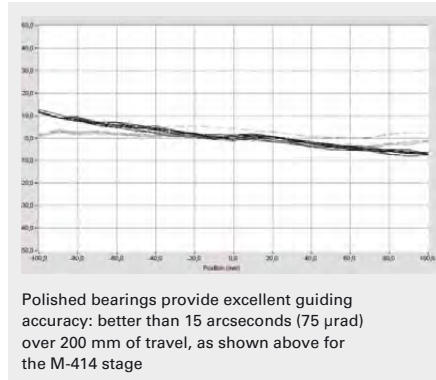
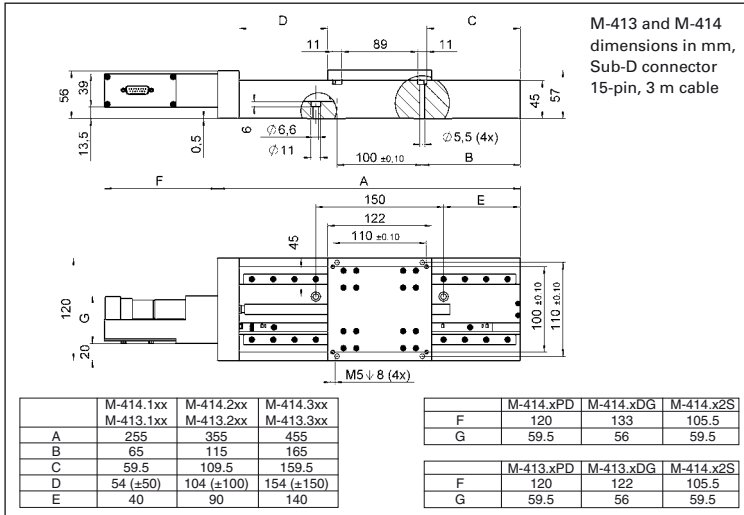
M-41x.x2S models feature a cost-effective direct-drive, 2-phase stepper motor, providing very smooth operation and a resolution of 0.2 μm .

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.

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.



Technical Data

Model	M-414.xPD	M-414.xDG	M-414.x2S	M-413.xPD	M-413.xDG	M-413.x2S	Units
Motion and positioning							
Travel range	for all models: 100 / 200 / 300 mm (see Ordering Information)						
Integrated sensor	Rotary encoder	Rotary encoder	–	Rotary encoder	Rotary encoder	–	
Sensor resolution	4000	2000	–	4000	2000	–	cts/rev.
Design resolution	0.5	0.023	0.31	0.25	0.018	0.16	µm
Min. incremental motion	0.5	0.1	0.4	0.25	0.2	0.2	µm
Backlash	0.5	4	2	6	10	6	µm
Unidirectional repeatability	0.5	1	1	1	1	1	µm
Pitch**	±100	±100	±100	±300	±300	±300	µrad
Yaw**	±100	±100	±100	±300	±300	±300	µrad
Max. velocity	100	3	6	10 [#]	2.5	3	mm/s
Origin repeatability	1	1	1	1	1	1	µm
Mechanical properties							
Spindle	Recirculating ballscrew	Recirculating ballscrew	Recirculating ballscrew	Leadscrew	Leadscrew	Leadscrew	
Spindle pitch	2	2	2	1	1	1	mm
Gear ratio	–	42.92063:1	–	–	28.44444:1	–	
Motor resolution	–	–	6400*	–	–	6400*	steps/rev.
Stiffness in motion direction	6000	6000	6000	6000	6000	6000	N/µm
Max. load	500	500	500	500	500	500	N
Max. push/pull force	200	200	150	50	50	50	N
Max. lateral force	200	200	200	200	200	200	N
Drive properties							
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	70	3.6	4.8	70	3.6	4.8	W
Torque	80	3	200	80	3	200	Ncm
Limit and reference switches	Hall-effect	Hall-effect	Hall-effect	Hall-effect	Hall-effect	Hall-effect	
Miscellaneous							
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)	4.4 / 5.4 / 6.6	4.2 / 5.2 / 6.4	4.4 / 5.4 / 6.6	4.4 / 5.4 / 6.6	4.2 / 5.2 / 6.4	4.4 / 5.4 / 6.6	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)	

Data for vacuum versions may differ.

*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

[#]Max. recommended velocity

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