

## Precision Linear Stage

COST-EFFECTIVE WITH HIGH GUIDING ACCURACY



### M-406

- Travel ranges to 150 mm
- Crossed roller bearings
- DC servo and stepper motor drive
- Direction-sensing reference point switch

#### Precision-class linear drive

Crossed roller bearings for high travel accuracy and load capacity. Precision leadscrew with 0.5 mm thread pitch, backlash-compensated, self-locking (50 N holding force). Stress-relieved aluminum base for highest stability

#### Drive types and position measurement

PD variant: Direct drive. DC motor with integrated ActiveDrive amplifiers for higher velocity

DG variant: DC servo motor with gearhead in combination with precision rotary encoder for high resolution and repeatability

2S variant: 2-phase stepper motor

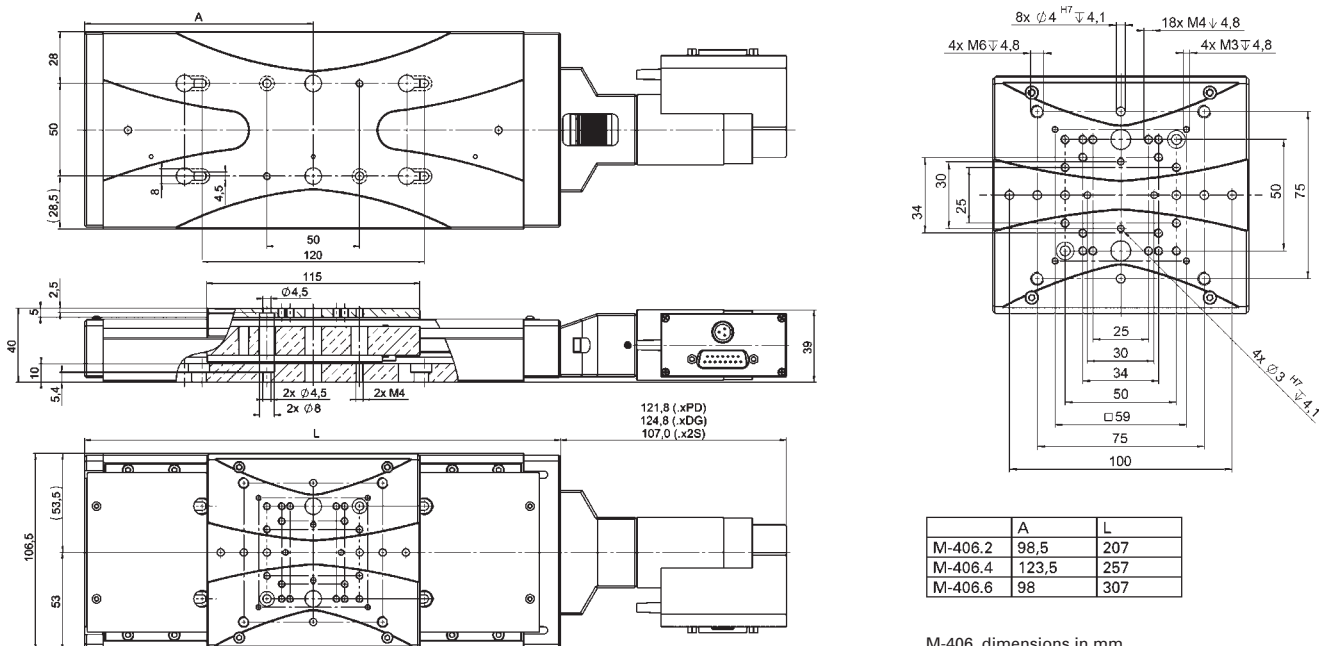
Noncontact limit switches. Noncontact direction-sensing reference point switches in the middle of the travel range

#### Fields of application

Precision positioning for science and industry, low duty cycles

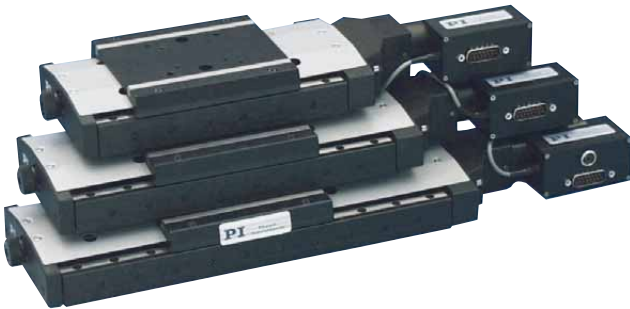
Preliminary data	M-406.2DG / M-406.4DG / M-406.6DG	M-406.2PD / M-406.4PD / M-406.6PD	M-406.22S / M-406.42S / M-406.62S	Unit
<b>Motion and positioning</b>				
Travel range	50 / 100 / 150	50 / 100 / 150	50 / 100 / 150	mm
Integrated sensor	Rotary encoder	Rotary encoder	–	
Sensor resolution	2000	4000		cts./rev.
Design resolution	0.0085	0.125	0.0781	μm
Min. incremental motion	0.1	0.25	0.1	μm
Unidirectional repeatability	0.2	0.2	0.2	μm
Backlash	2	2	2	μm
Crosstalk, angular error	±25 / ±50 / ±75	±25 / ±50 / ±75	±25 / ±50 / ±75	μrad
Max. velocity	1	15	3.5	mm/s
<b>Mechanical properties</b>				
Thread pitch	0.5	0.5	0.5	mm
Gear ratio	29.6:1	–	–	
Max. load	200	200	200	N
Max. push / pull force	50 / 50	50 / 50	50 / 50	N
Max. lateral force	150	150	150	N
<b>Drive properties</b>				
Motor type	DC gear motor	DC motor with PWM control	2-phase stepper motor*	
Operating voltage	0 to ±12	24 (PWM)	24	V
Motor power	3	30	–	W
Motor resolution	–	–	6,400*	steps/rev.
Reference point and limit switches	Hall effect	Hall effect	Hall effect	
<b>Miscellaneous</b>				
Operating temperature range	-20 to 65	-20 to 65	-20 to 65	°C
Material	Aluminum, steel	Aluminum, steel	Aluminum, steel	
Mass	2.1 / 2.4 / 2.8	2.1 / 2.4 / 2.8	2.1 / 2.4 / 2.8	kg
Connector	Sub-D 15-pin, 3 m cable incl.	Sub-D 15-pin, 3 m cable incl.	Sub-D 15-pin, 3 m cable incl.	
Recommended controller / driver	C-863 (single-axis), C-884 (up to 4 axes)	C-863 (single-axis), C-884 (up to 4 axes)	C-663 (single-axis)	

\* Max. 0.85 A/phase, 400 full steps/rev., motor resolution with C-663 stepper motor controller  
Ask about custom designs!



# M-405 · M-410 · M-415 Precision Translation Stage

## High-Load Linear Stage with Crossed Roller Bearings



M-405.DG, M-410.DG and M-415.PD high-precision translation stages

- Travel Ranges up to 150 mm
- Stress-Relieved Aluminum Base for Highest Stability
- Crossed Roller Bearings
- Manual, DC-Servo and Stepper-Motor Drives
- Knob for Convenient Manual Position Adjustment
- Direction-Sensing Reference Switch

M-400 series translation stages are compact, leadscrew-driven stages with a travel range of 50, 100 and 150 mm. All models are equipped with low-friction leadscrews for excellent resolution and repeatability. Precision crossed roller bearings guarantee 2 µm/100 mm straightness of travel. The stage base is precision machined from high-density, stress-relieved aluminum for exceptional stability and minimum weight.

### Five Versions

One manual and four motorized versions are available: Models M-4xx.2S are equipped

with direct-drive, 2-phase stepper motors providing 0.1 µm minimum incremental motion. Models M-4xx.CG and M-4xx.DG utilize closed-loop DC motors with shaft-mounted position encoders and precision gearheads providing 0.1 µm minimum incremental motion (encoder resolution 3 nm). The top-of-the-line M-4xx.PD versions feature the high-performance ActiveDrive™ system.

### ActiveDrive™

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

switch supports advanced automation applications with high precision (motorised versions only). All stages of this series can be cross stacked and combined with the M-592.00 Z-axis mounting bracket to provide multi-axis motion.

### Notes

See "Accessories" for adapters, bracket, etc. (p. 4-90 ff).

### Ordering Information

#### Translation Stage

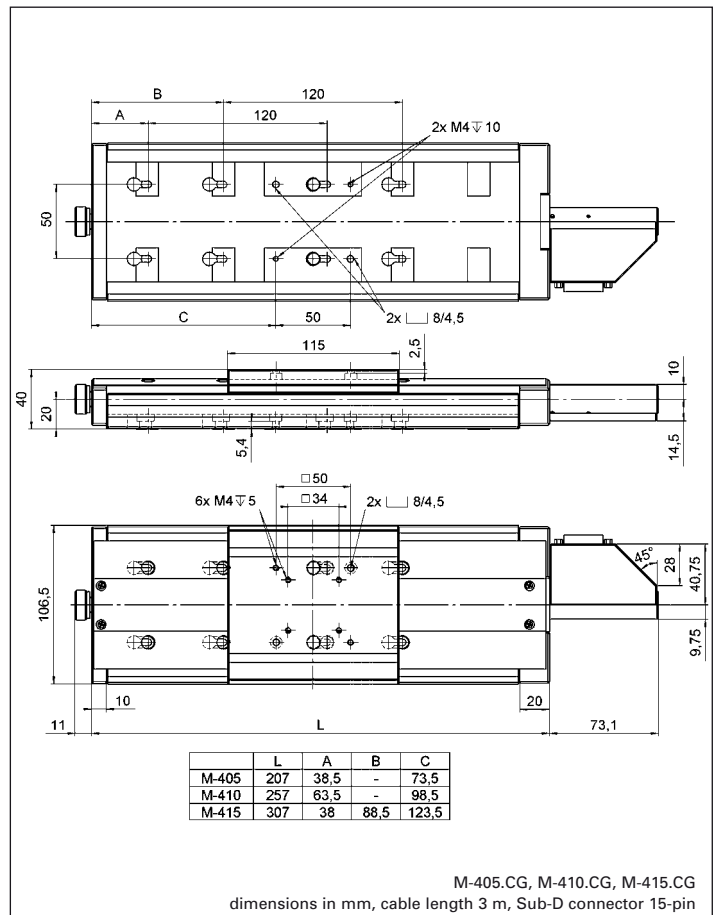
05	Travel Range 50 mm	CG	DC Motor Gearhead
10	Travel Range 100 mm	DG	DC Motor Gearhead
15	Travel Range 150 mm	PD	ActiveDrive™ DC Motor, Includes 24 V Power Supply
M-4		2S	2-Phase Stepper Motor
		M0	Manual Drive

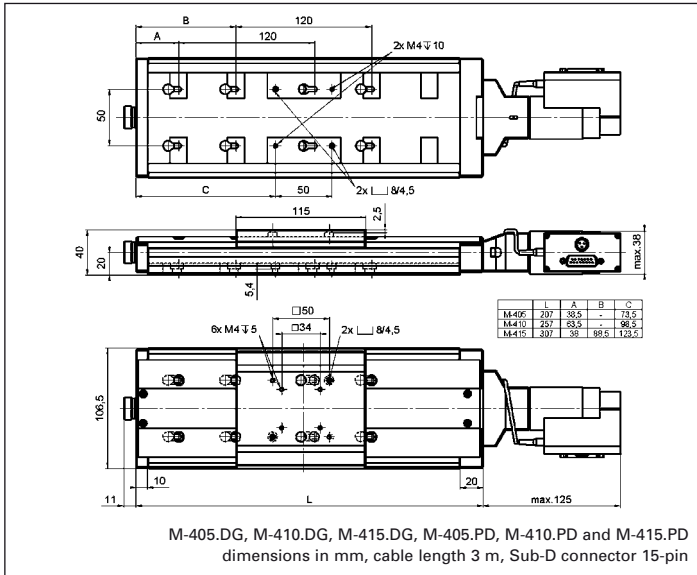
Ask about custom designs!

- Elimination of PWM amplifier noise radiation, by mounting the amplifier and motor together in a single, electrically shielded case

### Limit and Reference Switches

For the protection of your equipment, non-contact Hall-effect limit and reference switches are installed. The direction-sensing reference





M-405.CG translation stage

## Technical Data

Model	M-405.CG / M-410.CG / M-415.CG	M-405.DG / M-410.DG / M-415.DG	M-405.PD / M-410.PD / M-415.PD	M-405.2S / M-410.2S / M-415.2S	Units
<b>Motion and positioning</b>					
Travel range	50 / 100 / 150	50 / 100 / 150	50 / 100 / 150	50 / 100 / 150	mm
Integrated sensor	Rotary encoder	Rotary encoder	Rotary encoder	-	
Sensor resolution	2048	2000	4000		cts./rev.
<b>Encoder bandwidth</b>					
Design resolution	0.0035	0.0085	0.125	0.0781	µm
Min. incremental motion	0.1	0.1	0.25	0.1	µm
Unidirectional repeatability	0.2	0.2	0.2	0.2	µm
Bidirectional repeatability	2	2	2	2	µm
Pitch, yaw	±25 / ±50 / ±75	±25 / ±50 / ±75	±25 / ±50 / ±75	±25 / ±50 / ±75	µrad
Max. velocity	0.7	1.5	15	3.5	mm/s
<b>Mechanical properties</b>					
Spindle pitch	0.5	0.5	0.5	0.5	mm
Gear ratio	69.12:1	(28/12) <sup>2</sup> :1 ≈ 29.6:1			
Motor resolution	-	-	-	6400*	steps/rev.
Max. load	200	200	200	200	N
Max. push / pull force	40 / 40	50 / 50	50 / 50	50 / 50	N
Max. lateral force	150	150	150	150	N
<b>Drive properties</b>					
Motor type	DC-motor, gearhead	DC-motor, gearhead	ActiveDrive™ DC Motor	2-phase stepper motor*	
Operating voltage	0 to ±12	0 to ±12	0 to ±24	24	V
Electrical power	2	3	30	-	W
Limit and reference switches	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	°C
Material	Aluminum, steel	Aluminum, steel	Aluminum, steel	Aluminum, steel	
Mass	2	2.1	2.1	2.1	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-863 (single-axis, p. 4-114) C-843 PCI board (p. 4-120) (up to 4 axes)	C-663 (single-axis) (p. 4-112)	

\*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