

Linear Stage

Inexpensive, Reliable, Precise



M-403

- Inexpensive, cost-optimized design for precise positioning
- Travel ranges from 25 to 200 mm
- Resolution to 0.018 μm
- Minimum incremental motion to 0.2 μm
- Preloaded precision threaded spindle
- Higher loads with M-414

Application fields

Measuring technology. Adjustment.

Motion	Unit	Tolerance	M-403.1PD	M-403.2PD	M-403.4PD	M-403.6PD	M-403.8PD	M-403.1DG	M-403.2DG	M-403.4DG
Active axes			X	X	X	X	X	X	X	X
Travel range in X	mm		25	50	100	150	200	25	50	100
Maximum velocity in X, unloaded	mm/s		10	10	10	10	10	2.5	2.5	2.5
Angular error around Y (pitch)	μrad	Typ.	± 200	± 200	± 200	± 200	± 200	± 200	± 200	± 200
Angular error around Z (yaw)	μrad	Typ.	± 200	± 200	± 200	± 200	± 200	± 200	± 200	± 200

Positioning	Unit	Tolerance	M-403.1PD	M-403.2PD	M-403.4PD	M-403.6PD	M-403.8PD	M-403.1DG	M-403.2DG	M-403.4DG
Minimum incremental motion in X	μm	Typ.	0.25	0.25	0.25	0.25	0.25	0.2	0.2	0.2
Unidirectional repeatability in X	μm	Typ.	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5	± 0.5
Bidirectional repeatability in X	μm	Typ.	8	8	8	8	8	12	12	12
Backlash in X	μm	Typ.	6	6	6	6	6	10	10	10
Reference switch			Hall effect	Hall effect	Hall effect	Hall effect	Hall effect	Hall effect	Hall effect	Hall effect
Reference switch repeatability	μm		1	1	1	1	1	1	1	1
Limit switches			Hall effect	Hall effect	Hall effect	Hall effect	Hall effect	Hall effect	Hall effect	Hall effect
Integrated sensor			Incremental rotary encoder	Incremental rotary encoder	Incremental rotary encoder	Incremental rotary encoder	Incremental rotary encoder	Incremental rotary encoder	Incremental rotary encoder	Incremental rotary encoder
Sensor signal			A/B quadrature, RS-422	A/B quadrature, RS-422	A/B quadrature, RS-422	A/B quadrature, RS-422	A/B quadrature, RS-422	A/B quadrature, RS-422	A/B quadrature, RS-422	A/B quadrature, RS-422
Sensor resolution	Cts./rev.		4000	4000	4000	4000	4000	2000	2000	2000

Drive Properties	Unit	Tolerance	M-403.1PD	M-403.2PD	M-403.4PD	M-403.6PD	M-403.8PD	M-403.1DG	M-403.2DG	M-403.4DG
Drive type			DC motor with Active-Drive	DC motor with Active-Drive	DC motor with Active-Drive	DC motor with Active-Drive	DC motor with Active-Drive	DC gear motor	DC gear motor	DC gear motor
Nominal voltage	V		24	24	24	24	24	12	12	12
Nominal current, RMS	A	Typ.	—	—	—	—	—	0.43	0.43	0.43
Motor resolution	Full steps/rev.		—	—	—	—	—	—	—	—
Drive force in X	N	Typ.	50	50	50	50	50	50	50	50
Resistance phase-phase	Ω	Typ.	—	—	—	—	—	9.6	9.6	9.6
Inductance phase-phase	mH		—	—	—	—	—	0.44	0.44	0.44
Short-term maximum operating frequency	Hz		—	—	—	—	—	—	—	—

Mechanical Properties	Unit	Tolerance	M-403.1PD	M-403.2PD	M-403.4PD	M-403.6PD	M-403.8PD	M-403.1DG	M-403.2DG	M-403.4DG
Stiffness in X	N/μm		3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Permissible push force in Y	N	Max.	100	100	100	100	100	100	100	100
Permissible push force in Z	N	Max.	200	200	200	200	200	200	200	200
Permissible torque in θX	N·m	Max.	6	6	6	6	6	6	6	6
Permissible torque in θY	N·m	Max.	4	4	4	4	4	4	4	4
Permissible torque in θZ	N·m	Max.	4	4	4	4	4	4	4	4
Moved mass in X, unloaded	g		240	240	240	240	240	240	240	240
Drive screw type			Trapezoidal drive screw	Trapezoidal drive screw	Trapezoidal drive screw	Trapezoidal drive screw	Trapezoidal drive screw	Trapezoidal drive screw	Trapezoidal drive screw	Trapezoidal drive screw
Drive screw pitch	mm		1	1	1	1	1	1	1	1
Gear ratio i			—	—	—	—	—	28,444	28,444	28,444
Overall mass	g		1700	1800	2100	2200	2500	1700	1800	2100
Material			Anodized aluminum	Anodized aluminum	Anodized aluminum	Anodized aluminum	Anodized aluminum	Anodized aluminum	Anodized aluminum	Anodized aluminum

Miscellaneous	Unit		M-403.1PD	M-403.2PD	M-403.4PD	M-403.6PD	M-403.8PD	M-403.1DG	M-403.2DG	M-403.4DG
Operating temperature range	°C		-20 to 65	-20 to 65	-20 to 65	-20 to 65	-20 to 65	-20 to 65	-20 to 65	-20 to 65
Connector			D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)
Connector for supply voltage			M8 4-pole (m)	M8 4-pole (m)	M8 4-pole (m)	M8 4-pole (m)	M8 4-pole (m)	—	—	—
Recommended controllers / drivers			C-863 C-884 G-901 G-910 ACS modular controller	C-863 C-884 G-901 G-910 ACS modular controller	C-863 C-884 G-901 G-910 ACS modular controller	C-863 C-884 G-901 G-910 ACS modular controller	C-863 C-884 G-901 G-910 ACS modular controller	C-863 C-884 G-901 G-910 ACS modular controller	C-863 C-884 G-901 G-910 ACS modular controller	C-863 C-884 G-901 G-910 ACS modular controller

Motion	Unit	Tolerance	M-403.6DG	M-403.8DG	M-403.12S	M-403.22S	M-403.42S	M-403.62S	M-403.82S
Active axes			X	X	X	X	X	X	X
Travel range in X	mm		150	200	25	50	100	150	200
Maximum velocity in X, unloaded	mm/s		2.5	2.5	3	3	3	3	3
Angular error around Y (pitch)	μrad	Typ.	±200	±200	±200	±200	±200	±200	±200
Angular error around Z (yaw)	μrad	Typ.	±200	±200	±200	±200	±200	±200	±200

Positioning	Unit	Tolerance	M-403.6DG	M-403.8DG	M-403.12S	M-403.22S	M-403.42S	M-403.62S	M-403.82S
Minimum incremental motion in X	µm	Typ.	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Unidirectional repeatability in X	µm	Typ.	±0.5	±0.5	±0.5	±0.5	±0.5	±0.5	±0.5
Bidirectional repeatability in X	µm	Typ.	12	12	8	8	8	8	8
Backlash in X	µm	Typ.	10	10	6	6	6	6	6
Reference switch			Hall effect	Hall effect	Hall effect	Hall effect	Hall effect	Hall effect	Hall effect
Reference switch repeatability	µm		1	1	1	1	1	1	1
Limit switches			Hall effect	Hall effect	Hall effect	Hall effect	Hall effect	Hall effect	Hall effect
Integrated sensor			Incremental rotary encoder	Incremental rotary encoder	—	—	—	—	—
Sensor signal			A/B quadrature, RS-422	A/B quadrature, RS-422	—	—	—	—	—
Sensor resolution	Cts./rev.		2000	2000	—	—	—	—	—

Drive Properties	Unit	Tolerance	M-403.6DG	M-403.8DG	M-403.12S	M-403.22S	M-403.42S	M-403.62S	M-403.82S
Drive type			DC gear motor	DC gear motor	2-phase stepper motor	2-phase stepper motor	2-phase stepper motor	2-phase stepper motor	2-phase stepper motor
Nominal voltage	V		12	12	24	24	24	24	24
Nominal current, RMS	A	Typ.	0.43	0.43	1.2	1.2	1.2	1.2	1.2
Motor resolution	Full steps/rev.		—	—	400	400	400	400	400
Drive force in X	N	Typ.	50	50	50	50	50	50	50
Resistance phase-phase	Ω	Typ.	9.6	9.6	2.6	2.6	2.6	2.6	2.6
Inductance phase-phase	mH		0.44	0.44	1.9	1.9	1.9	1.9	1.9
Short-term maximum operating frequency	Hz		—	—	—	—	—	—	—

Mechanical Properties	Unit	Tolerance	M-403.6DG	M-403.8DG	M-403.12S	M-403.22S	M-403.42S	M-403.62S	M-403.82S
Stiffness in X	N/µm		3.5	3.5	3.5	3.5	3.5	3.5	3.5
Permissible push force in Y	N	Max.	100	100	100	100	100	100	100
Permissible push force in Z	N	Max.	200	200	200	200	200	200	200
Permissible torque in θX	N·m	Max.	6	6	6	6	6	6	6
Permissible torque in θY	N·m	Max.	4	4	4	4	4	4	4
Permissible torque in θZ	N·m	Max.	4	4	4	4	4	4	4
Moved mass in X, unloaded	g		240	240	240	240	240	240	240
Drive screw type			Trapezoidal drive screw	Trapezoidal drive screw	Trapezoidal drive screw	Trapezoidal drive screw	Trapezoidal drive screw	Trapezoidal drive screw	Trapezoidal drive screw
Drive screw pitch	mm		1	1	1	1	1	1	1
Gear ratio i			28,444	28,444	—	—	—	—	—
Overall mass	g		2200	2500	1700	1800	2100	2200	2500
Material			Anodized aluminum	Anodized aluminum	Anodized aluminum	Anodized aluminum	Anodized aluminum	Anodized aluminum	Anodized aluminum

Miscellaneous	Unit		M-403.6DG	M-403.8DG	M-403.12S	M-403.22S	M-403.42S	M-403.62S	M-403.82S
Operating temperature range	°C		-20 to 65	-20 to 65	-20 to 65	-20 to 65	-20 to 65	-20 to 65	-20 to 65
Connector			D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)	D-sub 15 (m)
Connector for supply voltage			—	—	—	—	—	—	—
Recommended controllers / drivers			C-863 C-884 G-901 G-910 ACS modular controller	C-863 C-884 G-901 G-910 ACS modular controller	C-663 G-901 G-910 ACS modular controller	C-663 G-901 G-910 ACS modular controller	C-663 G-901 G-910 ACS modular controller	C-663 G-901 G-910 ACS modular controller	C-663 G-901 G-910 ACS modular controller

Note on the velocity for M-403.xPD: Maximum recommended velocity

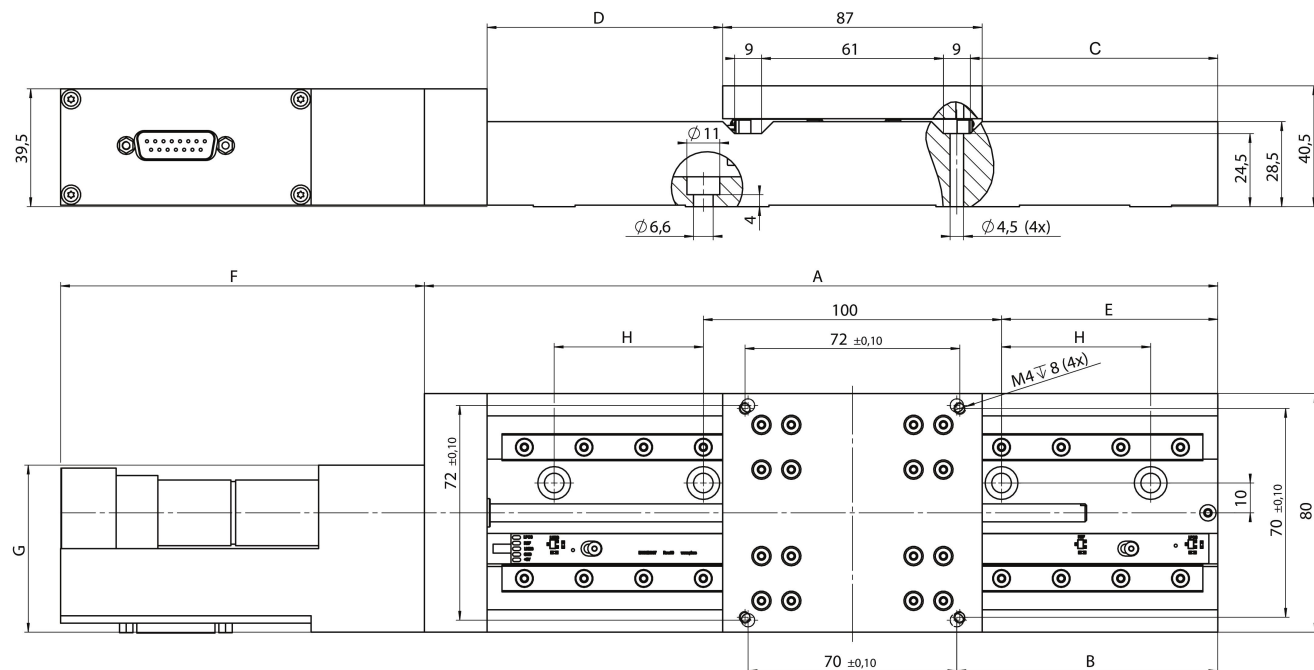
Note on the sensor resolution: Quadruple evaluated

Note on the permissible push force in Z: Maximum possible normal load capacity, centered, vertical load (linear stage installed horizontally)

Note on the motor resolution and drive type for M-403.x2S: Maximum 0.85 A/phase; 400 full steps/rev., motor resolution with C-663 stepper motor controller

At PI, technical data is specified at 22 ±3 °C. Unless otherwise stated, the values are for unloaded conditions. Some properties are interdependent. The designation "typ." indicates a statistical average for a property; it does not indicate a guaranteed value for every product supplied. During the final inspection of a product, only selected properties are analyzed, not all. Please note that some product characteristics may deteriorate with increasing operating time.

Drawings / Images



	M-403.1xx M-404.1xx	M-403.2xx M-404.2xx	M-403.4xx M-404.4xx	M-403.6xx M-404.6xx	M-403.8xx M-404.8xx
A	141	166	216	266	316
B	25	37.5	62.5	87.5	112.5
C	20.5	33	58	83	108
D	16.5 (±12.5)	29 (±25)	54 (±50)	79 (±75)	104 (±100)
E	10	22.5	47.5	72.5	97.5
H	x	x	x	50	75

	M-403.xPD	M-403.xDG
F	114	122
G	59.5	56

	M-404.xPD	M-404.xDG
F	114	133
G	59.5	56

M-40x, dimensions in mm. Note that a comma is used in the drawing instead of a decimal point.

Order Information

M-403.1PD

Linear stage; DC motor with ActiveDrive; 25 mm travel range; 200 N load capacity; 10 mm/s maximum velocity; trapezoidal-threaded spindle; incremental rotary encoder, 4000 counts/rev sensor resolution, A/B quadrature, RS-422

M-403.2PD

Linear stage; DC motor with ActiveDrive; 50 mm travel range; 200 N load capacity; 10 mm/s maximum velocity; trapezoidal-threaded spindle; incremental rotary encoder, 4000 counts/rev sensor resolution, A/B quadrature, RS-422

M-403.4PD

Linear stage; DC motor with ActiveDrive; 100 mm travel range; 200 N load capacity; 10 mm/s maximum velocity; trapezoidal-threaded spindle; incremental rotary encoder, 4000 counts/rev sensor resolution, A/B quadrature, RS-422

Order Information

M-403.6PD

Linear stage; DC motor with ActiveDrive; 150 mm travel range; 200 N load capacity; 10 mm/s maximum velocity; trapezoidal-threaded spindle; incremental rotary encoder, 4000 counts/rev sensor resolution, A/B quadrature, RS-422

M-403.8PD

Linear stage; DC motor with ActiveDrive; 200 mm travel range; 200 N load capacity; 10 mm/s maximum velocity; trapezoidal-threaded spindle; incremental rotary encoder, 4000 counts/rev sensor resolution, A/B quadrature, RS-422

M-403.1DG

Linear stage; DC gear motor; 25 mm travel range; 200 N load capacity; 2.5 mm/s maximum velocity; trapezoidal-threaded spindle; incremental rotary encoder, 2000 counts/rev sensor resolution, A/B quadrature, RS-422

M-403.2DG

Linear stage; DC gear motor; 50 mm travel range; 200 N load capacity; 2.5 mm/s maximum velocity; trapezoidal-threaded spindle; incremental rotary encoder, 2000 counts/rev sensor resolution, A/B quadrature, RS-422

M-403.4DG

Linear stage; DC gear motor; 100 mm travel range; 200 N load capacity; 2.5 mm/s maximum velocity; trapezoidal-threaded spindle; incremental rotary encoder, 2000 counts/rev sensor resolution, A/B quadrature, RS-422

M-403.6DG

Linear stage; DC gear motor; 150 mm travel range; 200 N load capacity; 2.5 mm/s maximum velocity; trapezoidal-threaded spindle; incremental rotary encoder, 2000 counts/rev sensor resolution, A/B quadrature, RS-422

M-403.8DG

Linear stage; DC gear motor; 200 mm travel range; 200 N load capacity; 2.5 mm/s maximum velocity; trapezoidal-threaded spindle; incremental rotary encoder, 2000 counts/rev sensor resolution, A/B quadrature, RS-422

M-403.12S

Linear stage; 2-phase stepper motor; 25 mm travel range; 200 N load capacity; 3 mm/s maximum velocity; trapezoidal-threaded spindle

M-403.22S

Linear stage; 2-phase stepper motor; 50 mm travel range; 200 N load capacity; 3 mm/s maximum velocity; trapezoidal-threaded spindle

M-403.42S

Linear stage; 2-phase stepper motor; 100 mm travel range; 200 N load capacity; 3 mm/s maximum velocity; trapezoidal-threaded spindle

M-403.62S

Linear stage; 2-phase stepper motor; 150 mm travel range; 200 N load capacity; 3 mm/s maximum velocity; trapezoidal-threaded spindle

M-403.82S

Linear stage; 2-phase stepper motor; 200 mm travel range; 200 N load capacity; 3 mm/s maximum velocity; trapezoidal-threaded spindle