

Stepper Motor Linear Actuators

Classical Motor-Leadscrew / Ballscrew Linear Actuators

HIGH FORCE



PRECISE



ECONOMICAL



Motors & Drives Fundamentals

Classic Drive Systems (Stepper & Servo Motors)

ActiveDrive™ DC Motor

Some of the advantages of DC-motor drives are good dynamic performance, fast response, high torque at low rpm, low heat dissipation and low vibration. The cost of a high-performance amplifier, however, is generally higher than that for a stepper motor.

The ActiveDrive™ system reduces this cost considerably, by integrating a PWM (pulse width modulation) driver and amplifier in the motor case. This design provides several advantages:

- Increased efficiency, by eliminating power losses between the amplifier and motor
- Reduced cost, more-compact system, and improved reliability,

- because no external driver and cabling are required
- Elimination of PWM amplifier noise radiation by mounting the amplifier and motor together in a single electrically shielded case
- Positioning accuracy is assured with either rotary or optical linear encoders.

DC Servo-Motor

A direct current motor that is operated in a closed-loop system (servo-loop). Characteristics of DC servo-motors are lack of vibration, smooth running, wide speed range and very good low-speed torque. For optimum performance, a good motor controller with PID (proportional, integral, derivative) algorithm and filter settings is mandatory. Some of the advantages of DC motor

drives are good dynamic performance, fast response, high torque at low rpm, low heat dissipation and low vibration.

DC-Motor / Gearhead Drive

A few advantages of DC-motor/gearhead drives are very high angular resolution, small form factor and low power consumption with high torque. They can be operated by PC controller boards such as the C-843 without an external amplifier. PI uses various types with maximum power in the 2 to 3 watt range and optical rotary encoders with up to 4000 counts per revolution. Most models use preloaded gearheads to eliminate backlash.

Stepper Motor

An electric motor providing motion in discrete angular

steps, without the need of position sensor or servo-loop. Stepper motors have very long lifetimes and are especially suited for applications where predictable positioning is required as opposed to fast response and extreme acceleration. Another advantage lies in the simple control electronics. Compared to closed-loop DC motors of the same size, stepper motors provide poorer dynamic performance and dissipate more heat, especially in steady state operation. PI offers microstepped 2-phase motors, which are very cost-effective.

Drive Screws

Leadscrews

Leadscrews can provide very high resolutions and very smooth motion. A leadscrew drive consists of a motor-driven screw with a nut coupled to the sled of the stage. The nut can be spring preloaded to reduce backlash. Leadscrews are self-locking but exhibit higher friction than recirculating ballscrews, with the predictable effect on velocity, required motor power, and lifetime. Typical leadscrews have a pitch between 0.4 and 0.5 mm/revolution, or up to 1 mm/revolution for longer travel ranges.

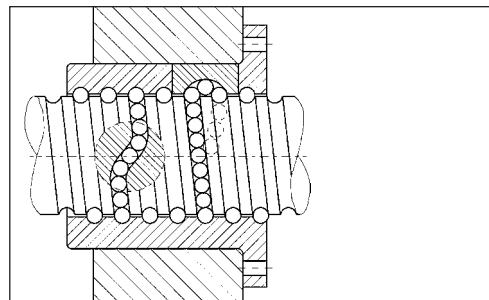
Recirculating Ballscrews

Recirculating ballscrews have significantly less friction than leadscrews, because they replace sliding friction with rolling friction.

A recirculating ballscrew drive consists of a motor-driven screw with a nut (ball housing) coupled to the sled of the stage, and a number of balls riding between the screw and the nut in a closed-circuit passage. Backlash can be eliminated by selecting the proper ball-to-thread-diameter ratio. Ballscrews are not self-locking, but are maintenance free, very effi-

cient and offer high speeds and long lifetime in continuous operation. Standard PI ballscrews have pitches of 0.5, 1 or 2 mm/revolution.

The screw type is noted in the data sheet of each product.

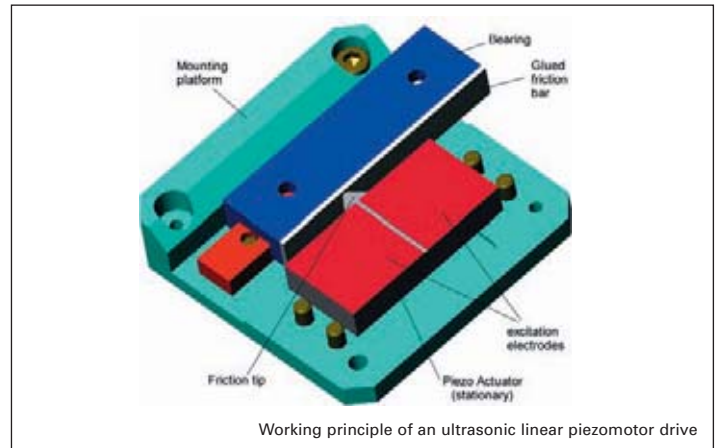


Piezo Drives

It is important to distinguish between different types of piezo drives: classical piezo actuators (direct acting), flexure amplified actuators, and piezo linear motors. Direct-drive piezo actuators offering resolutions of under one nanometer can be combined with classical motorized actuators and stages to form coarse/fine systems or the more advanced hybrid systems (p. 4-132). Piezo linear motors provide basically unlimited travel ranges. PI offers two types: Ultrasonic (high-speed) motors and PiezoWalk® (high-force, high resolution) motors. Piezo actuators can achieve extremely high accelerations of many thousands of g's, are frictionless and backlash-free.

Ultrasonic Piezomotors

Ultrasonic piezomotors are direct-drive systems; they do not use leadscrews or gearheads and are backlash-free. In addition, they neither create, nor are influenced by, magnetic fields. The drive consists of a stator, containing a piezoceramic oscillator and a slider (friction bar), which is attached to the moving part of the stage. With PI ultrasonic piezomotors speeds of up to 500 mm/s and resolutions of 0.1 µm in closed-loop are possible. They are also extremely compact, self-locking and have lifetimes of over 20,000 hours. PI piezomotors are used in miniature



translation stages like the M-661, M-662, M-663 and M-664 series, and in XY stages like the M-686.

Voice-Coil Linear Drives

These friction-free electromagnetic linear drives are characterized by their good dynam-

ics, albeit with relatively low holding force. They are used primarily in scanning applications with travel ranges in the millimeter to low centimeter range. PI offers voice coil drives in the V-106 stages, as well as in custom-designed systems.

Hybrid Drives (Coarse / Fine)

Classic Combinations

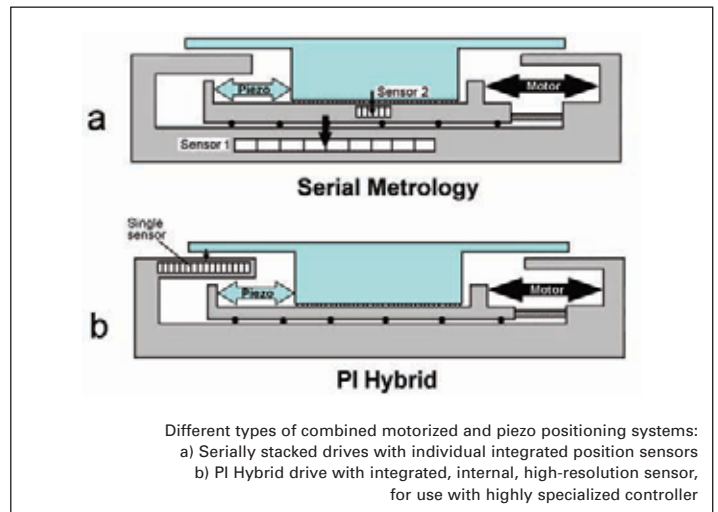
Combinations of different drive concepts are called hybrid drives. PI's micropositioning systems realize stacked systems of piezo and manual or motorized stages, where a motor/screw drive combination provides a long travel range and a piezo drive adds fine positioning accuracy and exceptional responsiveness over small ranges. For example, PI offers a fiber-scanning and coupling system comprising a 6-DoF micropositioner (F-206) mounted beside a multi-axis piezo system (P-611 Nanocube®) with high position resolution.

The servo-control algorithms with stacked systems like these generally operate independently, with the piezo system only

becoming activated after the motorized positioner has come to a complete stop. Because separate position sensors are used, the absolute accuracy (not the resolution) is limited by the precision of the motorized long-range positioner.

Novel Hybrid Concept

A novel concept is implemented in the M-511.HD and M-714 Hybrid Translation Stages and C-702 Hybrid Controllers, that evaluate a nanometer-precision, long-range, sensor and provide nanometer accuracy over the whole travel range. The motor-leadscrew and the piezo actuator are fully integrated to form one motion system, and act simultaneously at all times. Thus every move benefits from the specific advan-



tages of both the motorized actuator and the piezo actuator from startup to settling. The result is immediate starting, smoothness of motion, and a highly constant velocity. This

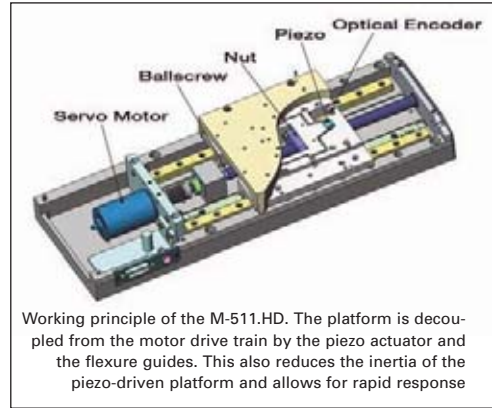
makes hybrid systems ideal for applications where the position of an incident needs to be read and repositioned precisely, or where an externally specified target position needs to be hit

within few a nanometers, such as in surface inspection or metrology.

On the mechanical side, this is accomplished by decoupling the motion platform of the hybrid positioning stage from the micropositioner's motor-spindle-drive by frictionless flexures and stiff, fast response piezo actuators. The piezo actuators actively smooth out the irregularities in the motion of

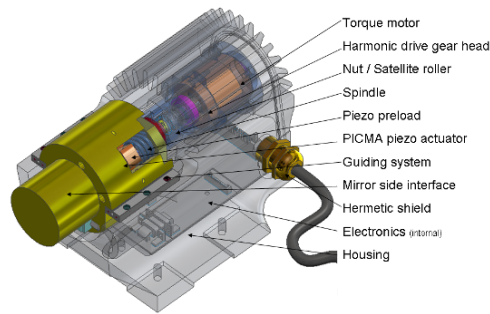
the platform caused by the motorized drive train to provide full move capability down to the sensor range.

The control algorithms treat the motor and piezo combination as one single drive unit and continuously compare the actual platform position (by reading the integrated linear encoder) with a calculated, smooth trajectory.



Working principle of the M-511.HD. The platform is decoupled from the motor drive train by the piezo actuator and the flexure guides. This also reduces the inertia of the piezo-driven platform and allows for rapid response

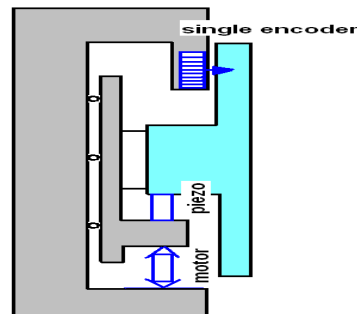
Hybrid piezoelectric / motor actuator system



Hybrid piezoelectric and (brushless torque) motor actuator system with a long travel range and extremely high resolution. Travel range 15mm and extremely accurate positioning and tracing within

less than 2nm RMS. Force range of zero to 900N. Low power dissipation). Position command bandwidth: 1 kHz. Velocity up to :250µm/s

The position is measured via a high precision optical sensor. It's solid amplitude and phase stability allows for an interpolation factor of 2000 and results in a resolution of 0.125nm. The short term interpolation error does not exceed 1.7nm.



Principle of hybrid system

M-228 · M-229 Stepper-Motor Leadscrew-Drive Linear Actuators

High-Load, Compact and Highly Cost-Efficient, with Limit Switches



M-228 and M-229 series linear actuators are driven by powerful direct-drive stepper motors, or are equipped with more compact, gearhead stepper motors: M-229.26S, M-228.11S, M-229.25S, M-228.10S (from left)

- **Highly Cost-Efficient, Compact Design**
- **10 and 25 mm Travel Range**
- **High Load Capacity to 80 N**
- **Gearhead Version: 46 nm Resolution (with C-663 Controller)**
- **Direct Drive: Max. Velocity 5 mm/s**
- **Non-Rotating Tip**
- **Non-Contact Limit and Reference Switches**

M-228 and M-229 series linear actuators provide a travel range of 10, resp. 25 mm, and are equipped with high-resolution stepper motors. The stepper mikes can push or pull loads up to 80 N, and provide speeds up to 5 mm/s. Models featuring gearhead/stepper motor combinations offer the same stroke in a more compact package.

Cost-Effective Design, Valuable Features

The cost-effective design offers many useful features such as a non-rotating tip, limit and reference switches and a mechanical position display.

A spherical tip and a 3 m extension cable are included in the delivery. The more compact gearhead versions include an additional flat tip.

Non-Rotating Tip

Compared to conventional rotating-tip micrometer drives, the non-rotating tip design offers several advantages:

- Elimination of torque-induced positioning errors
- Elimination of sinusoidal motion errors
- Elimination of wear at the contact point

- Elimination of tip-angle-dependent wobble

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.

Low Cost of Ownership

The combination of these actuators with the networkable C-663 Mercury Step controller (s. p. 4-112) offers high performance for a very competitive price in both single and multi-axis configurations.

Ordering Information

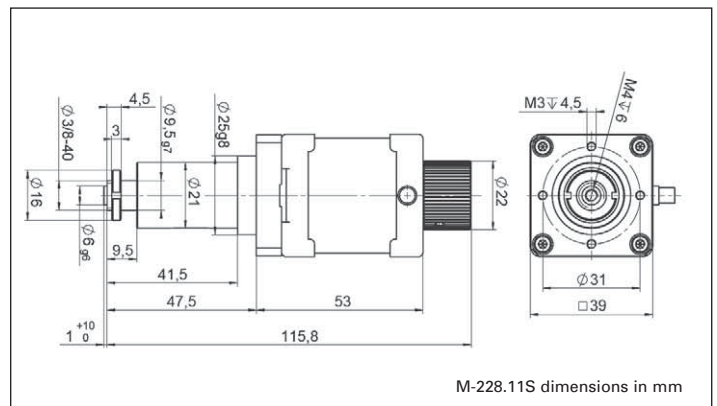
M-228.10S
Stepper-Mike Linear Actuator, 10 mm, Stepper Motor, Gearhead, Limit Switches

M-228.11S
Stepper-Mike Linear Actuator, 10 mm, Stepper Motor, Direct Drive, Limit Switches

M-229.25S
Stepper-Mike Linear Actuator, 25 mm, Stepper Motor, Gearhead, Limit Switches

M-229.26S
Stepper-Mike Linear Actuator, 25 mm, Stepper Motor, Direct Drive, Limit Switches

Ask about custom designs!



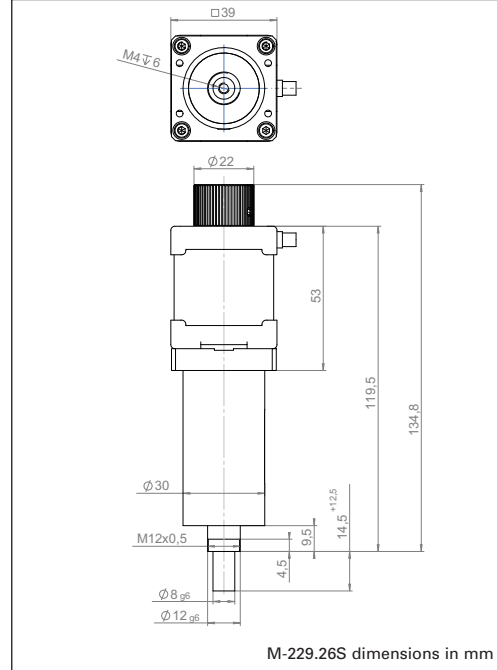
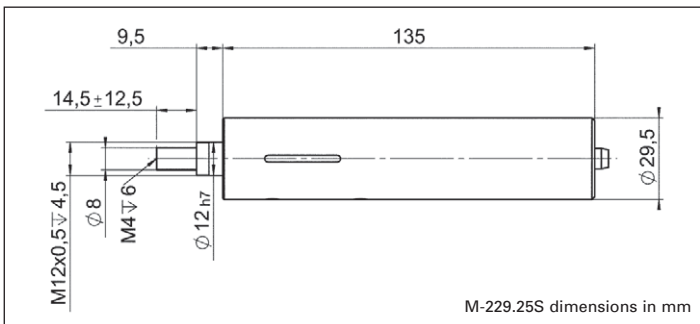
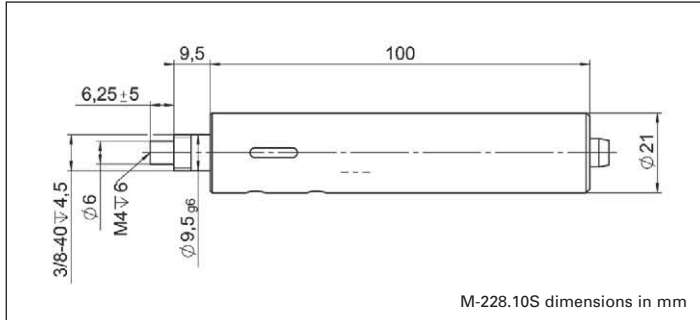
M-228.11S dimensions in mm



M-229 high-load stepper mike with gearhead, C-663 Mercury stepper motor controller (rear)

Application Examples

- Quality assurance testing
- Testing equipment
- Alignment of secondary mirrors
- Automation
- Metrology
- Precision machining



Technical Data

Model	M-228.10S	M-228.11S	M-229.25S	M-229.26S	Units
Active axes	X	X	X	X	
Motion and positioning					
Displacement	10	10	25	25	mm
Design resolution*	0.046	0.078	0.046	0.078	μm
Min. incremental motion*	1	1	1	1	μm
Backlash**	5	10	10	10	μm
Unidirectional repeatability	±2	±2	±2	±2	μm
Max. velocity*	1.5	5	1.5	5	mm / s
Reference switch repeatability	1	1	1	1	μm
Mechanical properties					
Drive screw	Leadscrew	Leadscrew	Leadscrew	Leadscrew	
Thread pitch	0.5	0.5	0.5	0.5	mm / rev.
Gear ratio	28.44444:1	–	28.44444:1	–	
Motor resolution*	384	6400	384	6400	steps / rev.
Max. push/pull force	20	50	50	80	N
Drive properties					
Motor type	2-phase stepper motor	2-phase stepper motor	2-phase stepper motor	2-phase stepper motor	
Operating voltage	24***	24*	24**	24*	V
Reference and limit switches	Hall-effect	Hall-effect	Hall-effect	Hall-effect	
Miscellaneous					
Operating temperature range	-20 to +65	-20 to +65	-20 to +65	-20 to +65	°C
Material	Al-(anodized), steel, brass	Al-(anodized), steel, brass	Al-(anodized), steel, brass	Al-(anodized), steel, brass	
Mass	0.23	0.36	0.4	0.61	kg
Cable length	0.5	0.6	0.5	0.6	m
Connector	15-pin sub-D connector	15-pin sub-D connector	15-pin sub-D connector	15-pin sub-D connector	
Recommended controller	C-663 single-axis	C-663 single-axis	C-663 single-axis	C-663 single-axis	

Please avoid lateral forces at the tip.

* with C-663 stepper motor controller

** with preload
*** max. 0.25 A / phase;
24 full steps / rev.

* max. 0.85 A / phase;
400 full steps / rev.

** max. 1 A / phase;
24 full steps / rev.

M-230 Stepper / Servo Precision Linear Actuator

Non-Rotating Tip, Limit Switches, Stroke to 25 mm



M-230.10, M-230.25, high-resolution DC-Mike actuators, 10 and 25 mm travel range

Ordering Information

M-230.10S
High-Resolution Stepper-Mike
Linear Actuator, 10 mm,
Limit Switches

M-230.25S
High-Resolution Stepper-Mike
Linear Actuator, 25 mm,
Limit Switches

- Travel Range 10 & 25 mm
- Min. Incremental Motion to 0,05 µm
- Non-Rotating Tip
- Max. Velocity 1.5 mm/s
- Closed-Loop DC Motors and Stepper Motors
- Non-Contact Limit and Reference Switches
- Front Mount or Clamp Mount
- MTBF>20.000 h

M-230 are ultra-high-resolution linear actuators providing linear motion up to 25 mm with sub-micron resolution in a compact package. They consist of a micrometer with non-rotating tip driven by a 2-phase stepper motor or a closed-loop DC motor / gearhead combination with motor-shaft-mounted, high-resolution encoder.

Non-Rotating Tip

Compared to conventional rotating-tip micrometer drives, the non-rotating-tip design offers several advantages:

- Elimination of torque-induced positioning errors
- Elimination of sinusoidal motion errors
- Elimination of wear at the contact point
- Elimination of tip-angle-dependent wobble

High Accuracy & Long Life

M-230 actuators provide a cost-effective solution for heavier-duty industrial and OEM environments. They feature extremely low-stiction, low-friction construction, allowing for minimum incremental motion as low as 50 nanometers.

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 au-

tomation applications with high precision.

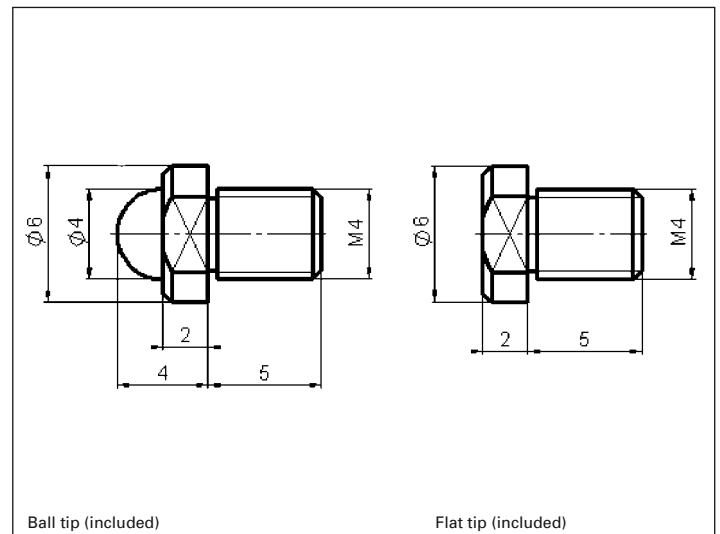
Integrated Line Drivers

All actuators include an integral 0.5 m cable with 15-pin sub-D connector and come with a 3 m extension cable. On the DC servo versions, the connector features integrated line drivers for cable lengths up to 10 meters between actuator and controller.

High-Load Versions

For higher loads and travel ranges refer to the M-235 (see p. 1-50) and M-238 (see p. 1-52).

A screw-in ball tip and a flat tip are included.

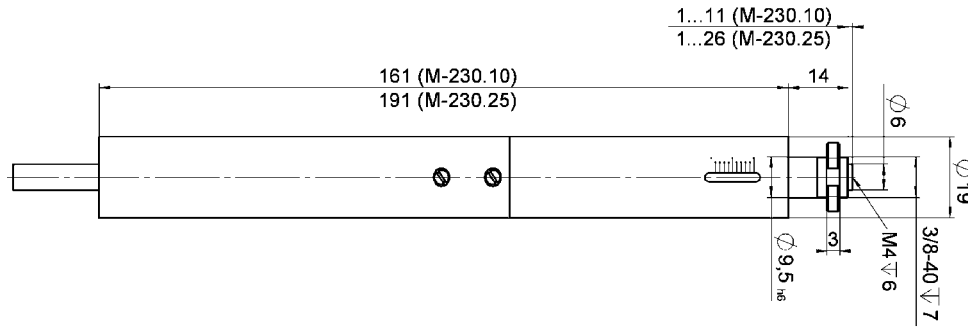


Ball tip (included)

Flat tip (included)

Application Examples

- Fiber positioning
- Metrology
- Photonics packaging
- Quality assurance testing
- Testing equipment



M-230. Cable length: 500 mm, 15-pin sub-D connector with integrated line drivers (DC motor models). Dimensions in mm

Technical Data

Model	M-230.10	M-230.25	M-230.10S	M-230.25S	Units
Active axes	X	X	X	X	
Motion and positioning					
Travel range	10	25	10	25	mm
Integrated sensor	Rotary encoder	Rotary encoder			
Sensor resolution	2,048	2,048			Cts./rev.
Design resolution	0.0046	0.0046	0.037	0.037	μm
Min. incremental motion	0.05	0.05	0.05	0.05	μm
Backlash	2	2	2	2	μm
Unidirectional repeatability	0.1	0.1	0.1	0.1	μm
Max. velocity	0.8	0.8	1.5	1.5	mm/s
Reference switch repeatability	1	1	1	1	μm
Mechanical properties					
Spindle	Leadscrew	Leadscrew	Leadscrew	Leadscrew	
Spindle pitch	0.4	0.4	0.4	0.4	mm
Gear ratio	42.92063:1	42.92063:1	28.44444:1	28.44444:1	
Motor resolution**			384**	384**	steps/rev.
Max. push/pull force	70	70	45*	45*	N
Max. lateral force	30	20	30	20	N
Drive properties					
Motor type	DC-motor, gearhead	DC-motor, gearhead	2-phase stepper motor**	2-phase stepper motor**	
Operating voltage	0 to ±12	0 to ±12	24	24	V
Electrical power	2	2			W
Limit and reference switches	Hall-effect	Hall-effect	Hall-effect	Hall-effect	
Miscellaneous					
Operating temperature range	-20 to +65	-20 to +65	-20 to +65	-20 to +65	°C
Material	Al (anodized), steel	Al (anodized), steel	Al (anodized), steel	Al (anodized), steel	
Mass	0.3	0.35	0.3	0.35	kg
Cable length	0.5	0.5	0.5	0.5	m
Connector	15-pin sub-D connector	15-pin sub-D connector	15-pin sub-D connector	15-pin sub-D connector	
Recommended controller/driver	C-863 single-axis C-843 PCI board, for up to 4 axes	C-863 single-axis (p. 4-114) C-843 PCI board, for up to 4 axes (p. 4-120)	C-663 single-axis	C-663 single-axis (p. 4-112)	

*at velocities of up to 1 mm/s

**2-phase stepper motor, 24 V chopper voltage, max. 0.25 A/phase, 24 full steps/rev., motor resolution with C-663 stepper motor controller

M-235 Stepper-Motor Ballscrew-Drive Precision Linear Actuator

High-Dynamics, Stroke to 50 mm, Forces to 120 N



M-235.22S high-resolution Stepper-Mike

- Travel Range 20 & 50 mm
- Min. Incremental Motion to 0.1 μm
- High-Speed Direct Drive Option
- Push/Pull Load 120 N
- Lateral Force 100 N
- Recirculating Ballscrew Drives Provide High Speeds & Long Lifetimes
- Closed-Loop DC Motors and Stepper Motors
- Non-Contact Limit and Reference Switches
- MTBF >20.000 h
- Vacuum-Compatible Versions Available to 10^{-6} hPa

The M-235 is an ultra-high-resolution linear actuator providing linear motion of up to 50 mm with sub-micron resolution in a compact package. It consists of a preloaded ultra-low-friction, heavy-duty ballscrew which is driven by a 2-phase stepper motor or a closed-loop DC motor with motor-shaft-mounted, high-resolution encoder (2048 counts/rev.).

Three Different Drives

The M-235 is available with three different motor drives:

Application Examples

- Fiber positioning
- Automation
- Metrology
- Photonics packaging
- Quality assurance testing
- Testing equipment

The M-235.5DD version is equipped with a direct drive motor for high-speed positioning applications. The DC-motor models provide a minimum incremental motion of 100 nm only and are equipped with high-resolution rotary encoders for position control. The M-235.x2S versions have a high-power, low-vibration 2-phase stepper motor.

Non-Rotating Tip

Compared to conventional rotating-tip micrometer drives, the non-rotating-tip design offers several advantages:

- Elimination of torque-induced positioning errors
- Elimination of sinusoidal motion errors
- Elimination of wear at the contact point
- Elimination of tip-angle-dependent wobble

Ballscrews for High Speed and Long Lifetime

The recirculating ballscrew is maintenance-free and pre-loaded to eliminate mechanical play. Its significantly reduced friction, compared to conventional lead screws, allows for higher velocity, lower power consumption and longer service life. Thus, a bidirectional repeatability of 1 μm is made possible!

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.

Integrated Line Drivers

All actuators include an integral 0.5 m cable with 15-pin sub-D connector and come with a 3 m extension cable. On the DC servo versions, the connector features integrated line drivers for cable lengths up to 10 meters between actuator and controller (DC-motors only).

A screw-in ball tip and a flat tip are included.



M-235.2DG (top) and M-235.5DG (bottom) high-resolution DC-Mike, ballscrew

Ordering Information

M-235.22S
High-Power Linear Actuator, 20 mm, Ballscrew, Stepper Motor

M-235.52S
High-Power Linear Actuator, 50 mm, Ballscrew, Stepper Motor

M-235.2DD
High-Power Linear Actuator, 20 mm, Ballscrew, Direct-Drive DC Motor

M-235.2VD
Vacuum Version of M-235.2DD

M-235.2DG
High-Power Linear Actuator, 20 mm, Ballscrew, DC Motor Gearhead

M-235.2VG
Vacuum Version of M-235.2DG

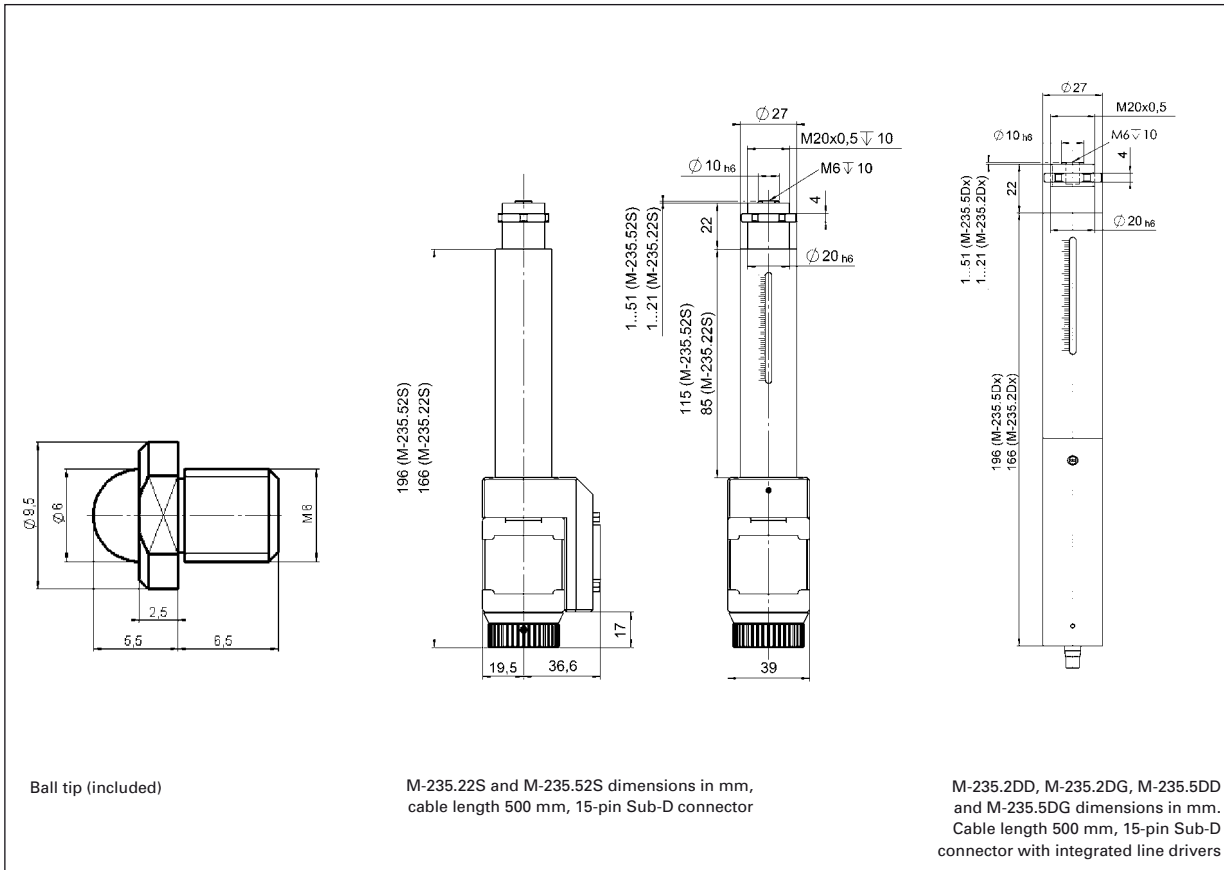
M-235.5DD
High-Power Linear Actuator, 50 mm, Ballscrew, Direct-Drive DC Motor

M-235.5VD
Vacuum Version of M-235.5DD

M-235.5DG
High-Power Linear Actuator, 50 mm, Ballscrew, DC Motor Gearhead

M-235.5VG
Vacuum Version of M-235.5DG

Ask about custom designs!



Technical Data

Model	M-235.2DG	M-235.2DD	M-235.22S	M-235.5DG	M-235.5DD	M-235.52S	Units
Active axes	X	X	X	X	X	X	
Motion and positioning							
Travel range	20	20	20	50	50	50	mm
Integrated sensor	Rotary encoder	Rotary encoder		Rotary encoder	Rotary encoder		
Sensor resolution	2.048	2.048		2.048	2.048		Cts./rev.
Design resolution	0.016	0.5	0.156	0.016	0.5	0.156	μm
Min. incremental motion	0.1	0.5	0.1	0.1	0.5	0.1	μm
Unidirectional repeatability	0.1	0.5	0.2	0.1	0.5	0.2	μm
Bidirectional repeatability	1	1	1	1	1	1	μm
Max. velocity	2.6	>30	20	2.6	>30	20	mm/s
Mechanical properties							
Gear ratio	29.6:1			29.6:1			
Motor resolution*			6,400*			6,400*	steps/rev.
Max. push/pull force	120	50	100**	120	50	100**	N
Max. lateral force	100	100	100	100	100	100	N
Drive properties							
Motor type	DC-motor, gearhead	DC-motor	2-phase stepper motor*	DC-motor, gearhead	DC-motor	2-phase stepper motor*	
Operating voltage	0 to ±12	0 to ±12	24	0 to ±12	0 to ±12	24	V
Electrical power	4	17	4.75	4	17	4.75	W
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	Al (anodized), steel	Al (anodized), steel	Al (anodized), steel	Al (anodized), steel	Al (anodized), steel	Al (anodized), steel	
Mass	0.55	0.5	0.65	0.7	0.65	0.8	kg
Recommended controller/driver	C-863 single-axis C-843 PCI board, for up to 4 axes	C-863 single-axis C-843 PCI board, for up to 4 axes	C-663 single-axis	C-863 single-axis C-843 PCI board, for up to 4 axes	C-863 single-axis (p. 4-114) C-843 PCI board, for up to 4 axes (p. 4-120)	C-663 single-axis (p. 4-112)	

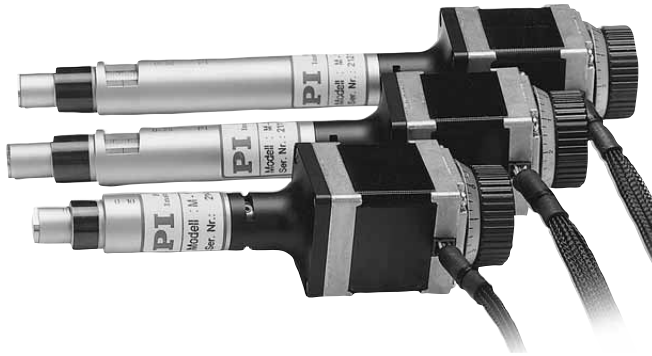
*2-phase stepper motor, 24 V chopper voltage, max. 0.8 A/phase, 400 full steps/rev., motor resolution with C-663 stepper motor controller

**at up to 10 mm/sec

Data for vacuum versions may differ.

M-168 Stepper-Mike Leadscrew-Drive Precision Linear Actuator

Non-Rotating Tip, Strokes to 50 mm



M-168 Stepper-Mikes providing 10, 25 and 50 mm travel range (from front to back)

- 10, 25 and 50 mm Travel Range
- Resolution <math><0.1 \mu\text{m}</math>
- 2-Phase Stepper Motor
- Manual Positioning Knob
- Sub-nm-Resolution with Optional PZT Actuator
- >5,000 h MTBF

M-168 are compact, high-resolution linear actuators providing linear motion up to 50 mm with sub-micron resolution. They consist of a micrometer drive with non-rotating tip driven by a 6400 microstep/rev and 2-phase stepper motor.

Non-Rotating Tip

Compared to conventional rotating-tip micrometer drives, the non-rotating-tip design offers several advantages:

- Elimination of torque-induced positioning errors
- Elimination of sinusoidal motion errors
- Elimination of wear at the contact point
- Elimination of tip-angle-dependent wobble

M-168 Stepper-Mikes feature an extremely low-stiction, low-friction construction allowing for high resolution and repeatability. A manual positioning knob provides coarse resolution of 5 μm . All models come with standard flat tips (see

p. 1-58 for spherical tips and other options).

High-Resolution Piezo Option

The optional piezo tip provides 20 μm travel with sub-nanometer resolution for dynamic scanning and tracking (see p. 1-73).

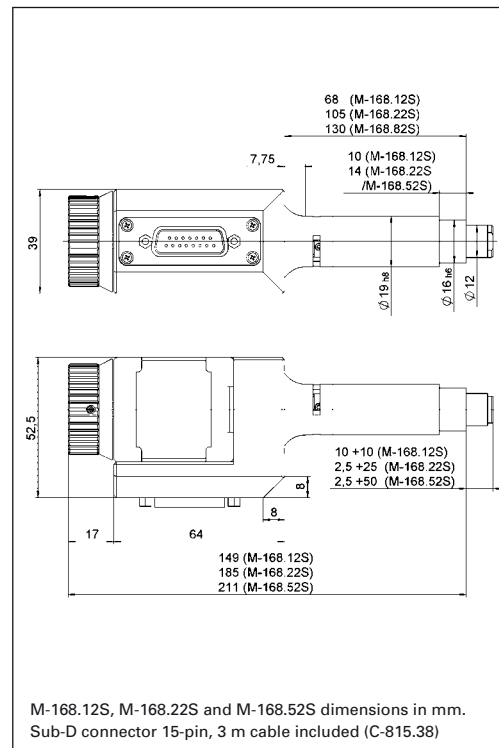
Ordering Information

M-168.12S
High-Resolution Stepper-Mike Linear Actuator, 10 mm

M-168.22S
High-Resolution Stepper-Mike Linear Actuator, 25 mm

M-168.52S
High-Resolution Stepper-Mike Linear Actuator, 50 mm

Ask about custom designs!



Technical Data

Model	M-168.12S	M-168.22S	M-168.52S	Unit
Travel range	10	25	50	mm
Design resolution	0.078	0.078	0.078	μm
Min. incremental motion	0.3	0.3	0.3	μm
Unidirectional repeatability	0.1	0.1	0.1	μm
Backlash	2	2	2	μm
Max. velocity	5	5	5	mm/s
Max. push/pull force	50	50	50	N
Max. lateral force	0.02	0.02	0.02	N (at tip)
Motor resolution*	6400*	6400*	6400*	steps/rev.
Drive screw pitch	0.5	0.5	0.5	mm/rev.
Weight	0.4	0.45	0.5	kg
Recommended motor controllers	C-663 single-axis	C-663 single-axis	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

C-663 Programmable Stepper Motor Controller & Driver

1-Axis Networkable Stepper-Motor Controller



Mercury Step controller with M-403.62S precision translation stage

- High Performance at Low Cost
- Stand-Alone Functionality
- Network Capability for Multi-Axis Applications
- Compatible and Networkable with Mercury DC-Motor Controllers
- Joystick Port for Manual Control
- Non-Volatile Macro Memory
- Data Recorder
- Parameters Changeable On-the-Fly

The Mercury Step stepper motor controller is the perfect solution for cost-effective and flexible motion control applications where a precision positioner is to be controlled by a

PC or PLC (programmable logic controller). The C-663 supplements the successful C-863 Mercury servo motor controller.

Microstepping of 1/16 full step (up to 6400 steps/rev. with PI stepper motors) provides for ultra-smooth, high-resolution motion.

Multi-Axis Control

Up to 16 Mercury class controllers can be networked and controlled over a single PC interface.

Such daisy chain networks are flexible, can be extended at any

time and are compatible with over PI controllers for DC servomotors or stepper motors, PLine® ultrasonic piezomotor drives or piezostepping drives.

Flexible Automation

The C-663 offers a number of features to achieve automation and handling tasks in research and industry in a very cost-effective way. Programming is facilitated by the high-level mnemonic command language with macro and compound-command functionality. Macros can be stored in the non-volatile memory for later recall.

For easy synchronization of motion with internal or external trigger signals four input and four output lines are provided. A joystick can also be connected for manual control.

Stand-alone capability is provided by a user-programmable autostart macro to run automation tasks at power up (no runtime computer communication required!).

User-Friendly: Comprehensive Software Package and Two Interface Options

Easy data interchange with laptop or PC is possible via the USB interface. To facilitate industrial applications, an RS-232 interface is also standard.

The included software supports networking of multiple controller devices. LabVIEW drivers and Windows DLLs allow for easy programming and integration into your system. Mercury Step controllers can be operated using the PI General Command Set (GCS). PI-GCS allows networking of different PI-controllers such as piezo drivers and multi-axis servo controllers with minimal programming effort.

Ordering Information

C-663.11
Mercury Step Stepper Motor Controller with Wide-Range Power Supply, 24 V

C-819.20
2-Axis Analog Joystick for Mercury Controller

C-819.20Y
Y-Cable for Connecting 2 Controllers to C-819.20

C-170.IO
I/O cable, 2 m, open end

C-170.PB
Push Button Box, 4 Buttons and 4 LEDs

Contents of Delivery

Each Mercury Step comes with a wide-range power supply, RS-232 communications cables, a USB cable and a comprehensive software package.

Application Examples

- Flexible automation
- Handling
- Quality control
- Testing equipment
- Photonics applications
- Fiber positioning

Technical Data

Model	C-663.11
Function	Stepper motor controller, stand-alone capability
Drive type	2-phase stepper motor
Channels	1
Motion and control	
Trajectory profile modes	Trapezoidal, point-to-point
Microstep resolution	1/16 full step
Limit switches	2 x TTL, programmable
Reference switches	1 x TTL, programmable
Motor brake	1 x TTL, programmable
Electrical properties	
Operating voltage	15 to 30 V
Current limitation per motor phase	1000 mA
Interface and operation	
Interface/Communication	USB, RS-232 (bus architecture)
Motor connector	Sub-D 15 (f)
Controller network	Up to 16 units* on single interface
I/O ports	4 analog/digital in, 4 digital out
Command set	PI General Command Set (GCS)
User software	PI MikroMove®
Software drivers	LabVIEW drivers
Supported functionality	Start-up macro, data recorder for recording parameters as motor input voltage, velocity, position or position error
Manual control	Joystick, Y-cable for 2D motion, pushbutton box
Miscellaneous	
Operating temperature range	0 to 50 °C
Mass	0.3 kg
Dimensions	130 x 76 x 40 mm ³

*16 with USB; 6 with RS-232 (depending on RS-232 output driver of PC)

Program Overview

- Piezo Ceramic Actuators & Motors
- Piezo Nanopositioning Systems and Scanners
- Active Optics / Tip-Tilt Platforms
- Capacitive Nanometrology Sensors
- Piezo Electronics: Amplifiers and Controllers
- Hexapod 6-Axis Positioners / Robots
- Micropositioning Stages & Actuators
- Photonics Alignment Systems, Solutions for Telecommunications
- Motor Controllers
- Ultrasonic Linear Motors

Request or download the complete PI Nanopositioning & Piezo Actuator Catalog



USA (East) & CANADA

PI (Physik Instrumente) L.P.
16 Albert St.
Auburn, MA 01501
Tel: +1 (508) 832 3456
Fax: +1 (508) 832 0506
info@pi-usa.us
www.pi-usa.us

USA (West) & MEXICO

PI (Physik Instrumente) L.P.
5420 Trabuco Rd., Suite 100
Irvine, CA 92620
Tel: +1 (949) 679 9191
Fax: +1 (949) 679 9292
info@pi-usa.us
www.pi-usa.us

JAPAN

PI Japan Co., Ltd.
Akebono-cho 2-38-5
Tachikawa-shi
J-Tokyo 190
Tel: +81 (42) 526 7300
Fax: +81 (42) 526 7301
info@pi-japan.jp
www.pi-japan.jp

PI Japan Co., Ltd.
Hanahara Dai-ni Building, #703
4-11-27 Nishinakajima,
Yodogawa-ku, Osaka-shi
J-Osaka 532
Tel: +81 (6) 6304 5605
Fax: +81 (6) 6304 5606
info@pi-japan.jp
www.pi-japan.jp

CHINA

**Physik Instrumente
(PI Shanghai) Co., Ltd.**
Building No. 7-301
Longdong Avenue 3000
201203 Shanghai, China
Tel: +86 (21) 687 900 08
Fax: +86 (21) 687 900 98
info@pi-china.cn
www.pi-china.cn

UK & IRELAND

PI (Physik Instrumente) Ltd.
Trent House
University Way,
Cranfield Technology Park,
Cranfield,
Bedford MK43 0AN
Tel: +44 (1234) 756 360
Fax: +44 (1234) 756 369
uk@pi.ws
www.physikinstrumente.co.uk

FRANCE

PI France S.A.S
244 bis, avenue Max Dormoy
92120 Montrouge
Tel: +33 (1) 55 22 60 00
Fax: +33 (1) 41 48 56 62
info.france@pi.ws
www.pi-france.fr

ITALY

Physik Instrumente (PI) S.r.l.
Via G. Marconi, 28
I-20091 Bresso (MI)
Tel: +39 (02) 665 011 01
Fax: +39 (02) 873 859 16
info@pionline.it
www.pionline.it

GERMANY

**Physik Instrumente (PI)
GmbH & Co. KG**
Auf der Römerstr. 1
D-76228 Karlsruhe/Palmbach
Tel: +49 (721) 4846-0
Fax: +49 (721) 4846-100
info@pi.ws · www.pi.ws