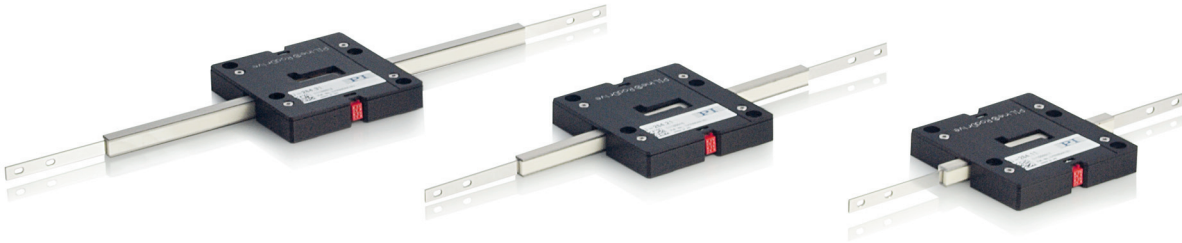


Small Ultrasonic Motors and Actuators



RodDrive Piezomotor Direct Drive

LOW PROFILE, HIGH SPEED, EASY INTEGRATION



U-264

- Velocity up to 250 mm/s
- Travel ranges up to 150 mm
- Linear drive for integration
- Generated force up to 15 N

Fast OEM linear drive

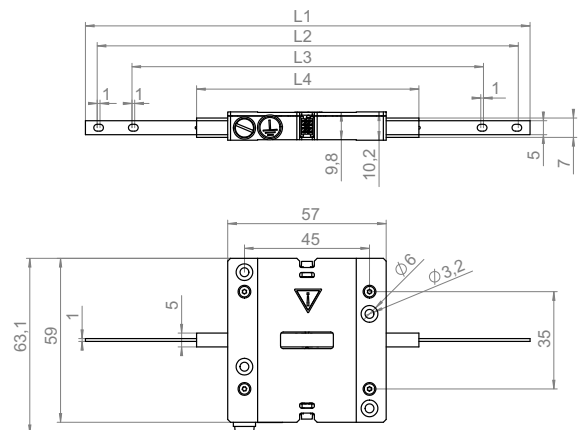
For integration into guided systems

RodDrive direct drive with integrated and preloaded PLine ultrasonic piezo drives

Self-locking, no heat generation at rest. Excellent start/stop dynamics. Easy integration by coupling the rod to a guided payload (e.g. a linear slide)

Application fields

OEM drives for automation. For handling and high-precision positioning systems



	U-264.10/11	U-264.20/21	U-264.30/31
L1	160.0	210.0	260.0
L2	151.5	201.5	251.5
L3	126.5	176.5	226.5
L4	80.0	130.0	180.0

U-264, dimensions in mm

Related Products

M-272 Linear Drive for Automation

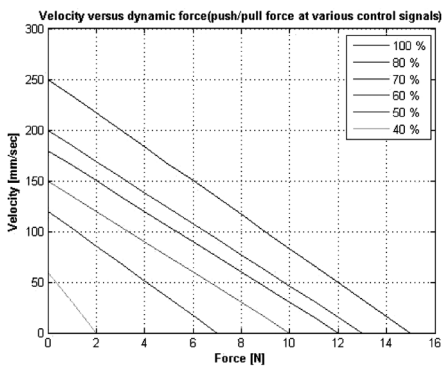
N-310 NEXACT OEM Miniature Linear Motor / Actuator

C-872 Driver for PLine® Ultrasonic Piezomotors

	U-264.10/20/30	U-264.11/21/31	Units	Tolerance
Motion and positioning				
Travel range	50 / 100 / 150	50 / 100 / 150	mm	
Open-loop step size	0.1*	2*	μm	typ.
Open-loop velocity	250	200	mm/sec	max.
Mechanical properties				
Stiffness when powered down	1.5	1.5	N/μm	±10 %
Holding force when powered down	8	15	N	max.
Push/pull force	7 (at 50 mm/s) 2 (at 250 mm/s)	12 (at 50 mm/s) 3 (at 200 mm/s)	N	max.
Drive properties				
Resonant frequency	158	159	kHz	±2 kHz
Motor voltage	200 V _{pp} 65 V _{rms}	200 V _{pp} 65 V _{rms}		
Input impedance	40 to 80**	50 to 100**	Ω	
Miscellaneous				
Operating temperature range	0 to 40	0 to 40	°C	
Material case	Al (black anodized)	Al (black anodized)		
Mass	0.08 / 0.09 / 0.1	0.08 / 0.09 / 0.1	kg	±5 %
Connector	D-Sub 15 (m)	D-Sub 15 (m)		
Recommended controller/driver	C-872.160 driver, C-867 motion controller/driver	C-872.160 driver, C-867 motion controller/driver		
Dimensions	57 x 63 x 10.2 plus rod	57 x 63 x 10.2 plus rod	mm	

* pulsed operation, 1 msec ON time, 50 % duty cycle
 ** at resonant frequency

PILine RodDrive with variable travel ranges



U-264.11/21/31, velocity (open-loop) vs. dynamic force (push/pull force) at various drive signal amplitudes



RodDrive integrated in a micro stage

M-272 Linear Shaft Motor, Ultrasonic Drive

Fast and Self-Locking with PLine® Piezomotors

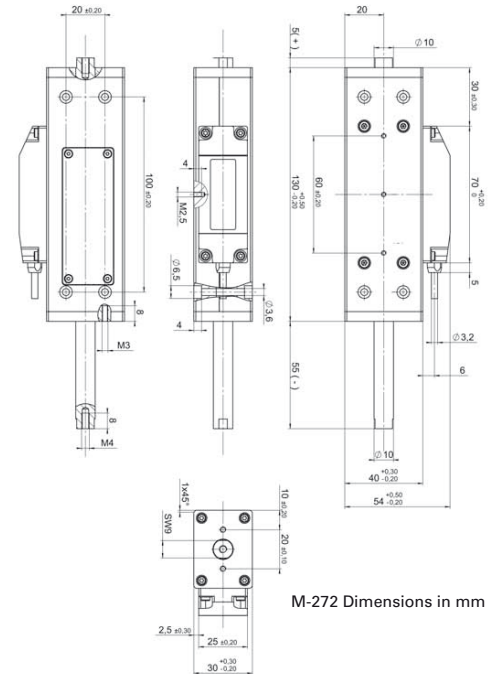


The M-272 linear shaft motor shown with OEM controller

- Force Generation up to 8 N
- Self Locking at Rest
- Velocity up to 200 mm/s
- 5 μm Encoder Resolution
- Linear Guiding

Ordering Information

M-272
PLine® Linear Actuator with Ultrasonic Motor and Linear Encoder, 50 mm, 8 N



M-272 Dimensions in mm

PLine® piezoceramic ultrasonic drives offer an affordable alternative to motor-leadscrew combinations and electromagnetic linear motors when small dimensions and/or high speed are important. With velocities of up to 200 mm/s, these drives are fast, compact, and are readily integrated. In addition, PLine® motors are self-locking when at rest with zero heat generation, and doing away with the need for an additional motor brake.

The novel M-272 closed-loop linear drive combines motor, actuator, linear encoder, guiding system and brake functionality in a very compact package. Due to the integrated guiding system a payload can be easily attached to the drive rod of the M-272 drive. The drive can also function as a drop-in-replacement for motor-leadscrew drives facilitating assembly and reducing the number of components significantly. Due to the integrated linear encoder, positioning can be done precisely and repeatably.

Self-locking Instead of Quiescent Current

PLine® piezo motors are based on a new, patented, ultrasonic drive principle developed by PI. The core piece of the system is a piezoceramic plate, which is excited with high-frequency eigenmode oscillations. A friction tip attached to the plate moves along an inclined linear path at the eigenmode frequency. Through its contact with the friction bar, the moving part of the mechanics drives forward or backwards. With each oscillatory cycle, the mechanics executes a step of a few nanometers; the macroscopic result is smooth motion with a virtually unlimited travel range. The ceramic plate is preloaded against the runner and thus ge-

Technical Data (Preliminary Data)

Model	M-272	Tolerance
Active axes	X	
Motion and positioning		
Travel range	50 mm	
Integrated sensor	Linearencoder	
Sensor resolution	5 μm	
Design resolution	5 μm	typ.
Min. incremental motion	10 μm	typ.
Backlash	5 μm	typ.
Unidirectional repeatability	10 μm	typ.
Velocity	200 mm/s	max.
Mechanical properties		
Guiding	Ball bearings	
Push/pull force	8 N	max.
Holding force	8 N	max.
Lateral force	5 N	max.
Drive properties		
Motor type	U-164 PLine® piezomotor	
Current	800 mA	
Reference switch	Hall-effect	
Miscellaneous		
Operating temperature range	-20 to +50 °C	
Material	Aluminum	
Dimensions		
Mass	0.5 kg	± 5%
Cable length	0.5 m	± 10 mm
Connector	MDR, 14-pin	

Recommended controller/driver: C-867.OE

* Power for the motor is supplied by the drive electronics, which requires 12 VDC.

** For drive electronics

P-661 PLine® Ultrasonic Piezo Motor

Fast, Compact OEM Ultrasonic Linear Motor



PLine® P-661 OEM piezo linear motor

- Patented Principle Features with High Forces in Small Space
- Max. Velocity 500 mm/s
- Acceleration to 5 g
- Min. Incremental Motion to 0.05 µm
- Self-Locking to 1.5 N
- No Electro-Magnetic Fields
- MTBF 20,000 h
- Integrated Actuators & Positioning Systems Also Available

PLine® Linear Motors – Small, Fast, Highly Effective

Despite their small size, PLine® linear motors generate high driving and holding forces.

Application Examples

- Biotechnology
- R&D
- Semiconductor testing
- Mass storage device testing
- Metrology
- Micromanipulation
- Microscopy
- Photonics packaging
- Quality assurance testing

PLine® motors have a new, patented, ultrasonic drive developed by PI. The core piece of the system is a piezoceramic plate, which is excited to produce high-frequency eigenmode oscillations. A friction tip attached to the plate moves along an inclined linear path at the eigenmode frequency. Through its contact with the friction bar, the moving part of the mechanics drives forward or backwards. With each oscillatory cycle, the mechanics executes a step of a few nanometers; the macroscopic result is smooth motion with a virtually unlimited travel range.

High Speed and Acceleration

PLine® piezomotor drives can provide accelerations of up to 5 g and speeds of up to 500 mm/s, together with high resolution and high holding

force. Because the ceramic stator is pressed against the slider, holding forces are generated when the motor is powered down. The result is very high position stability without the heat dissipation common in conventional linear motors.

Accessories for Easy Integration

PLine® piezomotors require a special drive electronics to generate the ultrasonic oscillations for the piezoceramic element. The drive electronics is available as OEM board, stand-alone device or integrated controller and therefore not included in the delivery. PI offers friction bars with different lengths.

Long Lifetime

PI has over 30 years experience with piezo technology and nanopositioning. PLine® drives offer high precision and reliability, with over 20,000 hours MTBF. This is because PLine® piezo linear motor drives have no mechanical components such as shafts and gears which can cause failures in conventional motors.

Ordering Information

P-661.P01

PLine® Miniature Linear Piezomotor, 2 N

Accessories:

P-661.B01

Friction Bar for P-661 PLine® Miniature Linear Piezomotor, 15 mm

P-661.B02

Friction Bar for P-661 PLine® Miniature Linear Piezomotor, 25 mm

P-661.B05

Friction Bar for P-661 PLine® Miniature Linear Piezomotor, 55 mm

C-184.161

Analog OEM Driver Board for PLine® P-661 Motors

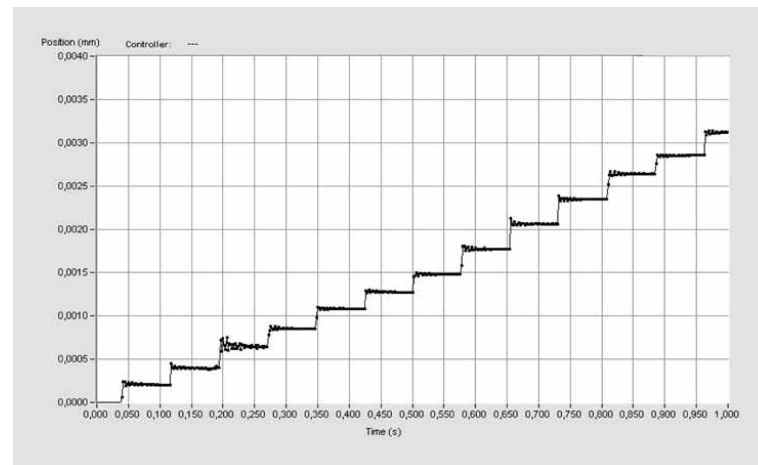
C-185.161

Analog Stand-Alone Drive Electronics with Power Supply for PLine® P-661 Motors

Controller for closed-loop operation are available as C-867 s. p. 4-116.

Note

The products described in this document are in part protected by the following patents:
US Pat. No. 6,765,335
German Patent No. 10154526



0.3 µm steps performed by P-661 piezomotor integrated in an M-662 translation stage

U-164 PLine® Ultrasonic Piezo Motor

Fast, Compact OEM Ultrasonic Linear Motor



OEM ultrasonic piezo linear motor
U-164.01

- Patented Principle Features with High Forces in Small Space
- Easy Mounting
- Max. Velocity 500 mm/s
- Acceleration up to 5 g
- Min. Incremental Motion to 0,05 µm
- Self Locking, Push-/Pull Forces to 4 N
- No Electro-Magnetic Fields
- Integrated Actuators & Positioning Systems Also Available

PLine® Linear Motors—Small, Fast, Highly Effective

Despite their small size, PLine® linear motors generate high driving and holding forces. PLine® piezo motors have a new, patented, ultrasonic drive

developed by PI. The core piece of the system is a piezoceramic plate, which is excited with high-frequency eigenmode oscillations. A friction tip attached to the plate moves along an inclined linear path at the eigenmode frequency. Through its contact with the friction bar, the moving part of the mechanics drives forward or backwards. With each oscillatory cycle, the mechanics executes a step of a few nanometers; the macroscopic result is smooth motion with a virtually unlimited travel range.

High Speed and Acceleration

PLine® piezomotor drives can provide accelerations of up to 5 g and speeds of up to 500 mm/s, together with high resolution and high holding force. Because the ceramic

stator is pressed against the slider, holding forces are generated when the motor is powered down. The result is very high position stability without the heat dissipation common in conventional linear motors.

Accessories for Easy Integration

The PLine® motors require a special drive electronics to generate the ultrasonic oscillations for the piezoceramic element. The drive electronics is available as OEM board, stand-alone device or integrated inside a controller and therefore not included in the delivery. PI offers friction bars with different lengths.

Long Lifetime

PI has over 30 years experience with piezo technology and nanopositioning. PLine® drives offer high precision and reliability. This is because PLine® piezo linear motor drives have no mechanical components such as shafts and gears which can cause failures in conventional motors.

Ordering Information

U-164.01
PLine® Piezo Linear Motor, 4 N

Accessories:

P-664.B01
Friction Bar for PLine® Miniature Linear Piezomotor, 15 mm

P-664.B02
Friction Bar for PLine® Miniature Linear Piezomotor, 25 mm

P-664.B05
Friction Bar for PLine® Miniature Linear Piezomotor, 55 mm

C-184.164
Analog OEM Driver Board for PLine® Motors

C-185.164
Analog Stand-Alone Drive Electronics with Power Supply for PLine® Motors

Controllers for closed-loop operation are available as C-867 (see p. 4-116).

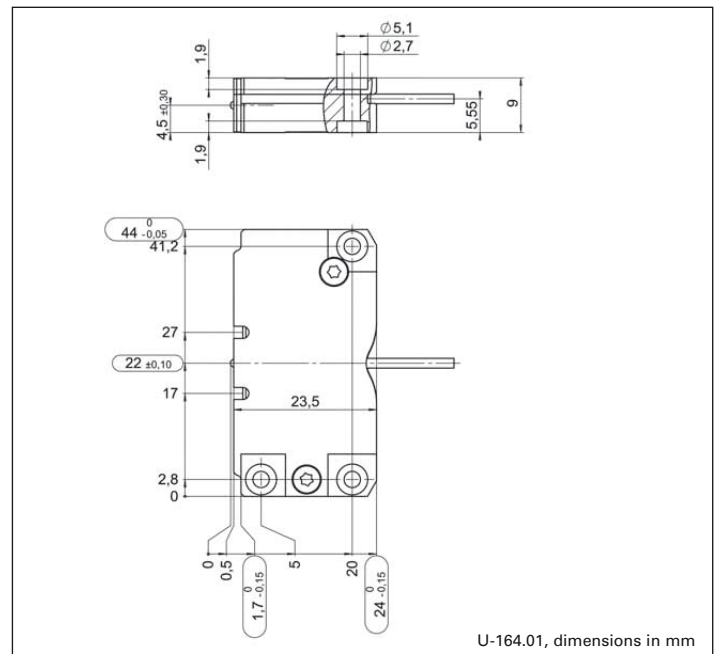
Ask about custom designs!

Patent Information

The products described in this document are in part protected by the following patents:
US Pat. No. 6,765,335
German Patent No. 10154526

Application Examples

- Biotechnology
- R&D
- Semiconductor testing
- Mass storage device testing
- Metrology
- Micromanipulation
- Microscopy
- Photonics packaging
- Quality assurance testing



U-164.01, dimensions in mm

Technical Data (preliminary)

Model	U-164.01	Unit	Tolerance
Motion and positioning			
Displacement	unlimited*	mm	
Minimum incremental motion, open-loop	0.05**	µm	typ.
Max. velocity	500	mm/s	
Mechanical properties			
Stiffness when powered down	3	N/µm	±10 %
Holding force when powered down	3	N	Max.
Push / pull force	4	N	Max.
Preload on friction bar	18	N	±10 %
Drive properties			
Resonant frequency	155	kHz	typ.
Motor voltage	60 (RMS)	V	
Operating voltage driver electronics	12	V	
Max. el. power consumption driver	10	W	
Miscellaneous			
Operating temperature range	-20 to +50	°C	
Body material	Al (black anodized)		
Mass	0.02	kg	±5 %
Cable length	1.0	m	±10 mm
Connector	Open leads		
Recommended controller/driver	C-184.164 OEM board C-185.164 in box		

*The travel range of piezo linear motors is virtually unlimited and depends on the length of the friction bar, which is available separately.

**The minimum incremental motion is a typical value that can be achieved in the open-loop mode of a piezomotor stage. To reach the specifications it is important to follow the mounting guidelines of the OEM-motors.

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



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