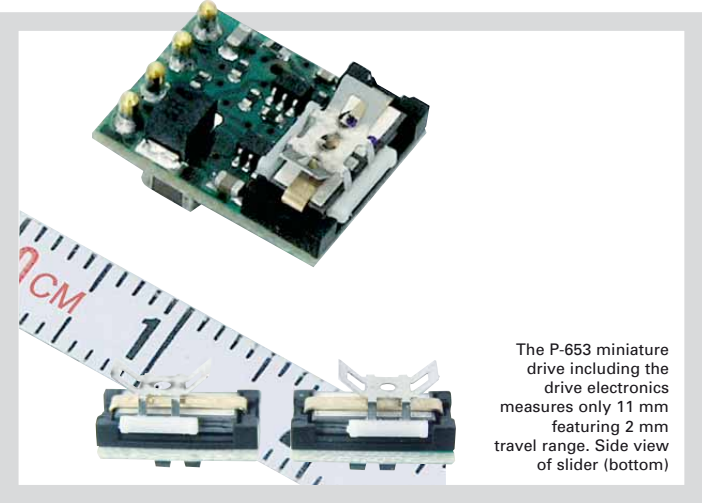
P-653 PILine® Miniature Linear Motor / Slide

OEM Drive for High Volume Applications



The P-653 miniature drive including the drive electronics measures only 11 mm featuring 2 mm travel range. Side view of slider (bottom)

- **True Linear Motor Slide / No Rotary Conversion Losses**
- **Cost-Effective OEM Drive for High Quantity-Applications**
- **Preassembled and Mounted on a PCB Board**
- **Very Compact: Piezomotor Drive is Only 8 mm Long**
- **Fast Response: Full Stroke in <50 ms**
- **Force Generation to 0.15 N**
- **Self Locking at Rest**
- **Travel Range 2 mm, Velocity up to 200 mm/s**

P-653 PILine® OEM piezomotor drives are ideal for OEM applications where space is limited and moved masses are small. These tiny linear positioners can be used to replace classical drive elements like miniaturized motor/spindle systems or other linear motors, which P-653 outclasses with its speed of up to 200 mm/s. PILine® piezo linear motors offer a number of advantages over classical drives:

- High velocities
- Compact design
- High push/pull and holding forces relative to the drive size

Integration of the P-653 in an application is simple because the moving slider and the piezo actuator are delivered assembled as a unit and already mounted on a PCB board. Drive electronics is included on the same board and requires a supply voltage of only 5 VDC.

Mechanical mounting is thus facilitated as well: All that remains is to affix the payload to the slider.

The motors are designed for moving small objects such as optical fibers, optics, micro- or electro-mechanical elements fast and precisely.

Application Examples

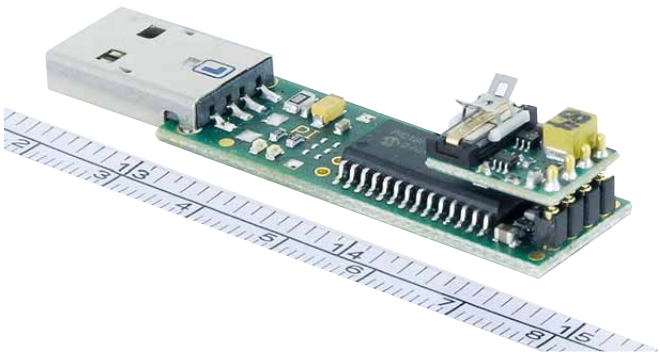
- Consumer electronics
- Miniature mechatronics
- Micromanipulation
- Micropositioning
- Toys

Working Principle

P-653 drives employ a new, patented, ultrasonic piezomotor drive developed by PI. The highly compact, integrated piezomotor can attain velocities of up to 200 mm/s together with high position resolution and—considering its length of only 8 mm—a high holding force. Because the ceramic stator is pressed against the slider, piezomotor drives resist motion with an intrinsic holding force when the unit is at rest. The result is very high position stability, without the heat dissipation common with conventional linear motors. During operation, the oscillating piezoceramic propels the slider over the length of the motor. There are no gears, leadscrews or other mechanical components to contribute play or backlash.

Simple Control

The high-frequency, nanometer level oscillations (~500 kHz) needed by the PILine® motors are created by driver electronics, which self-adjusts to the resonant frequency of the motor ceramic, meaning that no individual tuning is necessary. The driver electronics can in turn be controlled by short voltage pulses.



Included in the P-653.01D demo sample there is the P-653.01 OEM drive together with additional electronics featuring an USB interface

Order Information

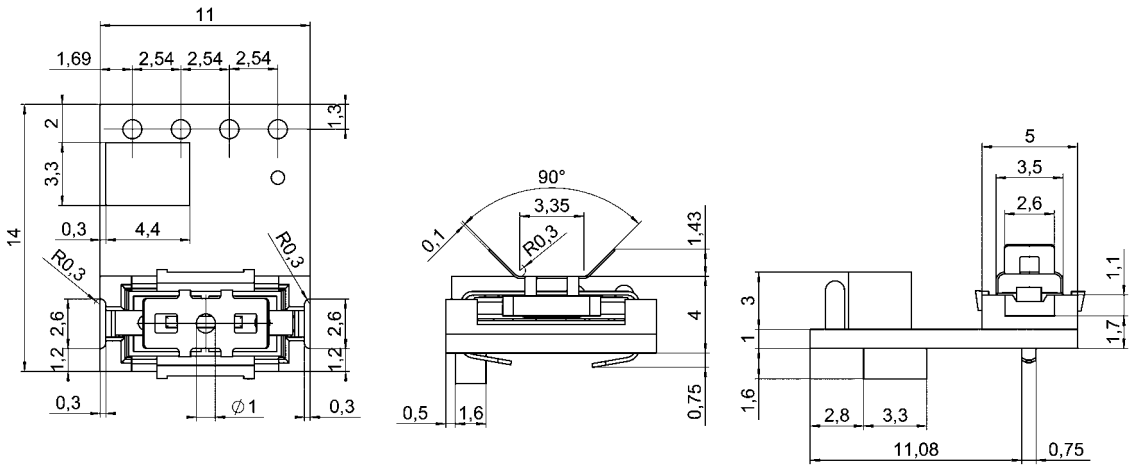
P-653.01
Miniatur PILine® OEM Drive, 2 mm Travel Range, 0.15 N, mounted on PCB board

P-653.01D
Miniature PILine® OEM Drive, 2 mm Travel Range, 0.15 N, Demo Sample Kit with USB Interface

Ask about custom designs

Note

The products described in this document are in part protected by the following patents:
German Patent
No. 102004059429
International Patent
No. WO2006/027031A1



P-653.01 dimensions in mm: top view, view from drive side, end view along axis of motion (from left)

Technical Data

Model	P-653.01
Motion and positioning	
Travel range	2 mm
Step size at 0.25 ms ON time	5 to 15 µm
Step size at 1.0 ms ON time	20 to 120 µm
Max. velocity*	100 to 200 mm/s
Typ. velocity**	50 to 90 mm/s
Mechanical properties	
Holding force when powered down	0.3 N
Max. push / pull force	0.15 N
Drive properties	
Resonant frequency (typ.)	515 kHz
Integrated piezo motor	PILine® P-653
Operating voltage (drive electronics)	5 VDC
Current consumption incl. drive electronics	0.1 A
Control voltage	5 V TTL
Miscellaneous	
Operating temperature range	-40 to 85 °C
Mass	1 g ±5 %
Connectors	Header pin sockets
Recommended driver	Piezomotor drive electronics included
Dimensions	15 x 11 x 8 mm incl. drive electronics
Lifetime	>5,000,000 cycles

All data refer to 100 % duty cycle.
*without load. @ 5 g: 80 to 140 mm/s; @ 10 g: 50 to 100 mm/s
**without load.

P-653K PILine® Miniature Rotary and Linear Piezo Motor Actuators

Compact PCB Mounted Motion Control Solutions for OEMs

Two custom piezo motors based on the P-653 ultrasonic miniature motor show the versatility and adaptability of the basic concept: P-653KMRD on the right is based on the RodDrive principle and provides a virtually unlimited linear travel range. With the P-653KROT three miniature motors move a ring, for example for fast positioning of optical elements

Application Examples

- Consumer electronics
- Miniature mechatronics
- Micromanipulation
- Micropositioning
- Medical technology
- Optomechanics: Rotating Filters, etc.

- **Cost-Effective OEM Drive for High Quantity-Applications**
- **Preassembled and Mounted on a PCB Board**
- **Miniature Piezo Motor Drive: 8 mm Length Only!**
- **Fast Response: Full Stroke in <50 ms for Single Actuators**
- **Force Generation to 0.15 N; Torque to 2 mNm**
- **Self Locking at Rest**
- **Travel Range 50 mm (Runner), Velocity up to 200 mm/s and 230 rev/min, respectively**

The P-653 miniature drive including the drive electronics measures only 11 mm

Technical Data

Model	P-653KMRD	P-653KROT
Active axes	X	θ_Z
Motion and positioning		
Travel range	50 mm	>360 deg
Step size at 0.25 ms ON time	5 to 15 µm	0.2 to 0.5 arcsec
Step size at 1.0 ms ON time	20 to 120 µm	0.6 to 3.5 arcsec
Max. velocity, without load	100 to 200 mm/s*	200 to 230 rev/min
Typ. velocity, without load	50 to 90 mm/s	120 to 150 rev/min
Mechanical properties		
Holding force when powered down	0.3 N	–
Max. push / pull force	0.15 N	–
Max. torque active / passive	–	2 / 4 mNm
Drive properties		
Resonant frequency (typ.)	515 kHz	515 kHz
Integrated piezo motor	P-653 PILine®	3 x P-653 PILine®
Operating voltage driver electronics	5 VDC	5 VDC
Current consumption incl. drive electronics	0.1 A	0.3 A
Control voltage	5 V TTL	5 V TTL
Miscellaneous		
Operating temperature range	-40 to +80 °C	-40 to +80 °C
Mass	2 g ±5%	4.5 g ±5%
Connectors	Miniature 4 pin connector	Miniature 4 pin connector
Recommended driver	Piezomotor drive electronics included	Piezomotor drive electronics included
Dimensions	40 x 10 x 4 mm incl. drive electronics	Ø 40 mm, 5 mm high incl. drive electronics, clear aperture Ø 14 mm
Typ. min. endurance	25 km	1.000.000 cycles

All data refer to 100% duty cycle.
*no load. Differing data at 5g: 80 to 140 mm/s, at 10g: 50 to 100 mm/s