

## P-661 · P-664 PLine® Piezo Linear Drive High-Speed, Compact, Ultrasonic Piezo Drives for OEMs



PLine® P-661 and P-664 OEM piezo linear motors with C-184 drive electronics

- **Patented Principle Features Very Compact Dimensions and High Force**
- **Max. Velocity 500 mm/s**
- **Acceleration to 5 g**
- **Min. Incremental Motion to 0.05 µm**
- **Self-Locking to 3 N**
- **No Electromagnetic Fields**
- **MTBF 20,000 h**
- **Integrated Actuators & Positioning Systems Also Available**

### PLine® Linear Motors – Smaller, Faster, More Effective

Despite their small size, PLine® linear motors generate higher driving and holding forces than conventional ultrasonic piezo-motors.

#### 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

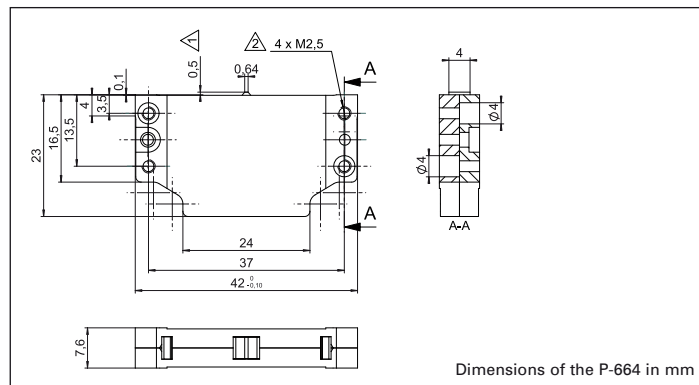
PLine® piezomotor drives can provide accelerations of up to 5 g and speeds of up to 500 mm/s, together with high resolution and high holding force. Because the ceramic stator is pressed against the slider, holding forces are generated when the motor is powered down. The result is very high position stability without the heat dissipation common in conventional linear motors.

### Accessories for Easy Integration

PLine® piezomotors require a drive electronics for exciting the ultrasonic oscillations. 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, with over 20,000 hours



Dimensions of the P-664 in mm

### Ordering Information

**P-661.P01**  
PLine® Miniature Linear Piezomotor, 2 N

**P-664.P01**  
PLine® Miniature Linear Piezomotor, 4 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

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

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

**P-664.B05**  
Friction Bar for P-664 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

**C-184.164**  
Analog OEM Driver Board for PLine® P-664 Motors

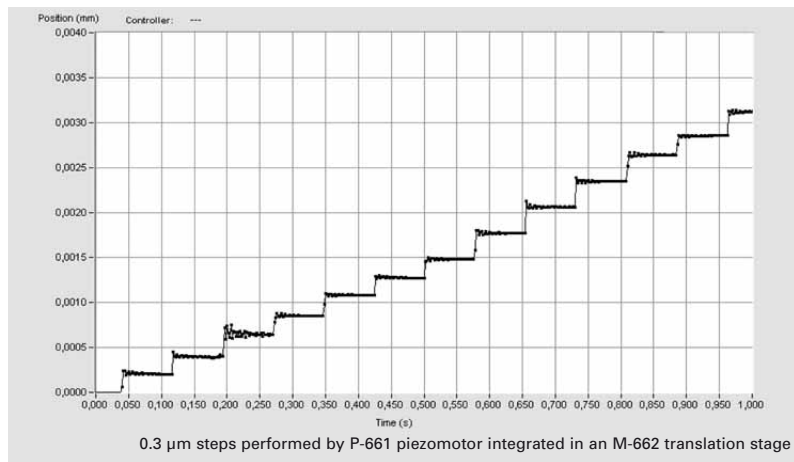
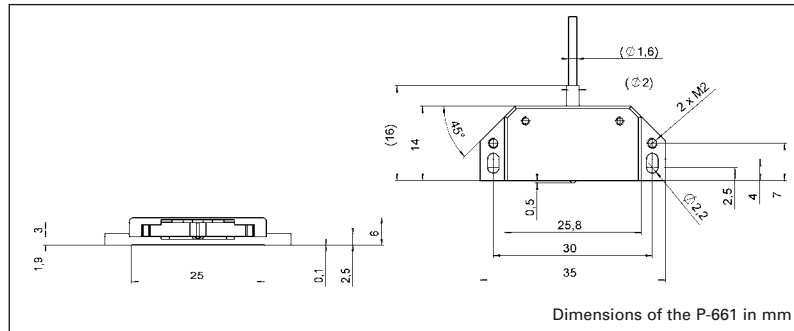
**C-185.164**  
Analog Stand-Alone Drive Electronics with Power Supply for PLine® P-664 Motors

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

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.

### 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



### Technical Data

| Model                                 | P-661.P01                               | P-664.P01   | Units              | Tolerance          |
|---------------------------------------|---|---|--------------------|--------------------|
| <b>Motion and positioning</b>         |   |   |                    |                    |
| Travel range                          | No limit*                               | No limit*   | mm                 |                    |
| Minimum incremental motion, open-loop | 0.05**                                  | 0.05**  | $\mu\text{m}$      | typ.               |
| Max. velocity                         | 500                                     | 500   | mm/s <sup>2</sup>  |                    |
| <b>Mechanical properties</b>          |   |   |                    |                    |
| Stiffness when powered down           | 0.7                                     | 3   | N/ $\mu\text{m}$   | $\pm 10\%$         |
| Holding force when powered down       | 1.5                                     | 3   | N                  | max.               |
| Push / pull force                     | 2                                       | 4   | N                  | max.               |
| Preload on friction bar               | 9                                       | 9   | N                  | $\pm 10\%$         |
| <b>Drive properties</b>               |   |   |                    |                    |
| Resonant frequency                    | 210                                     | 155   | kHz                | typ.               |
| Motor voltage range                   | 120 (peak-peak)<br>42 (RMS)             | 168 (peak-peak)<br>60 (RMS)                           | V                  |                    |
| Operating voltage drive electronics   | 12                                      | 12  | V                  |                    |
| Electrical power drive electronics    | 5                                       | 10  | W                  |                    |
| <b>Miscellaneous</b>                  |   |   |                    |                    |
| Operating temperature range           | -20 to +50                              | -20 to +50  | $^{\circ}\text{C}$ |                    |
| Body material                         | Al (black anodized)                     | Al (black anodized)                                   |                    |                    |
| Mass                                  | 0.01                                    | 0.02  | kg                 | $\pm 5\%$          |
| Cable length                          | 1.6                                     | 1.6   | m                  | $\pm 10\text{ mm}$ |
| Connector                             | Open leads                              | Open leads  |                    |                    |
| Recommended controller/driver         | C-184.161 OEM board<br>C-185.161 in box | C-184.164 OEM board<br>C-185.164 in box (see p. 1-36) |                    |                    |
| Dimensions                            | 14 x 35 x 6                             | 22 x 42 x 7   | mm                 |                    |
| MTBF                                  | >20,000                                 | >20,000   | h                  |                    |

\*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 specs it is important to follow the mounting guidelines of the OEM-motors.

### Linear Actuators & Motors

PiezoWalk® Motors / Actuators

### PILine® Ultrasonic Motors

DC-Servo & Stepper Actuators

Piezo Actuators & Components

Guided / Preloaded Actuators

Unpackaged Stack Actuators

Patches/Benders/Tubes/Shear..

### Nanopositioning / Piezoelectrics

Nanometrology

Micropositioning

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