

## M-674 PLine® RodDrive Piezo Linear Drive Integrated Fast Ultrasonic Piezo Drives



### ■ Drive-Component for Integration into Micropositioning Systems

- Travel Ranges to 150 mm
- Push/Pull Forces to 7 N
- Min. Incremental Motion to 0.05 µm
- Velocity to 450 mm/s
- Self-Locking at Rest

M-674 PLine® RodDrives represent a level of integration between PLine® OEM piezo linear motors such as P-664 (see p. 1-28) and guided micropositioning systems such as the M-682 (see p. 4-32) series stages.

RodDrives may replace classical drive elements like rotary motor/leadscrew assemblies, or magnetic linear drives integrated into a micropositioner.

### Application Examples

- System integration for micropositioning products
- Automation
- Handling
- Micromanipulation
- Biotechnology
- Metrology

They consist of a rod which is preloaded by piezo linear motors from two sides. Depending on the way of integration, either the rod or the motor block is coupled to the moving platform.

### Advantages of PLine® Micropositioning Systems

The ultrasonic piezoceramic drives used in PLine® micropositioners have a number of advantages over classical drives:

- Higher Accelerations, up to 5 g
- Speeds up to 500 mm/s
- Small Form Factor
- Self-Locking When Powered Down
- No Shafts, Gears or Other Rotating Parts
- Non-Magnetic and Vacuum Compatible Drive Principle

### Working Principle

RodDrives employ a patented ultrasonic drive developed by PI. The highly compact, integrated P-664 piezomotors can provide velocities of 450 mm/s, together with high resolution and holding force. The maximum travel is determined by the length of the rod and is basically unlimited. Customized adaptations in terms of operating and holding force are feasible by varying type and number of motors used. Because the integrated ceramic motors are preloaded against the rod, RodDrives resist motion with an intrinsic holding force when at rest. The result is very high position stability without the heat dissipation common with conventional linear motors. Furthermore, there are no gears, leadscrews or other mechanical components to contribute play or backlash.

### Variety of Drivers / Controllers

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 closed-loop motion controller and therefore not included in the delivery.

### Ordering Information

**M-674.164**  
PLine® RodDrive, 50 mm, 7 N

**M-674.264**  
PLine® RodDrive, 100 mm, 7 N

**M-674.364**  
PLine® RodDrive, 150 mm, 7 N

#### Accessories:

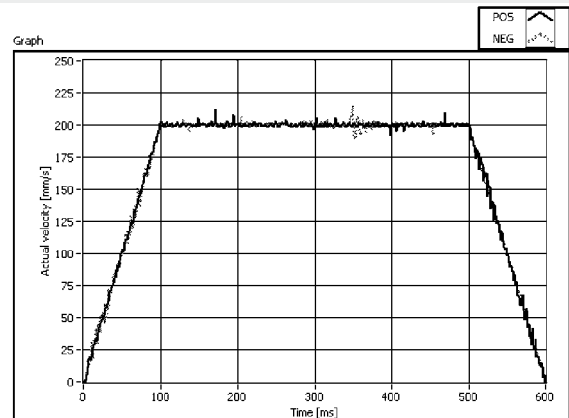
**C-184.D64**  
Analog OEM Driver Board for PLine® RodDrive M-674

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

**C-867.D64**  
Piezomotor Controller with Drive Electronics, 1 Channel, for PLine® Systems with M-674 RodDrive

### Closed-Loop Operation: Optimized for High Velocity and Rapid Step/Settling

Together with a position sensor, RodDrives can be operated in closed-loop with the C-867.D64 (see p. 4-116) piezo motor controller. This specialized servo-controller also integrates the motor drive electronics and enables highly constant speeds up to 350 mm/s with very short settling times (tens of milliseconds). RodDrives can also be operated with conventional servo-controllers. In this case, the C-185 (see p. 1-36)

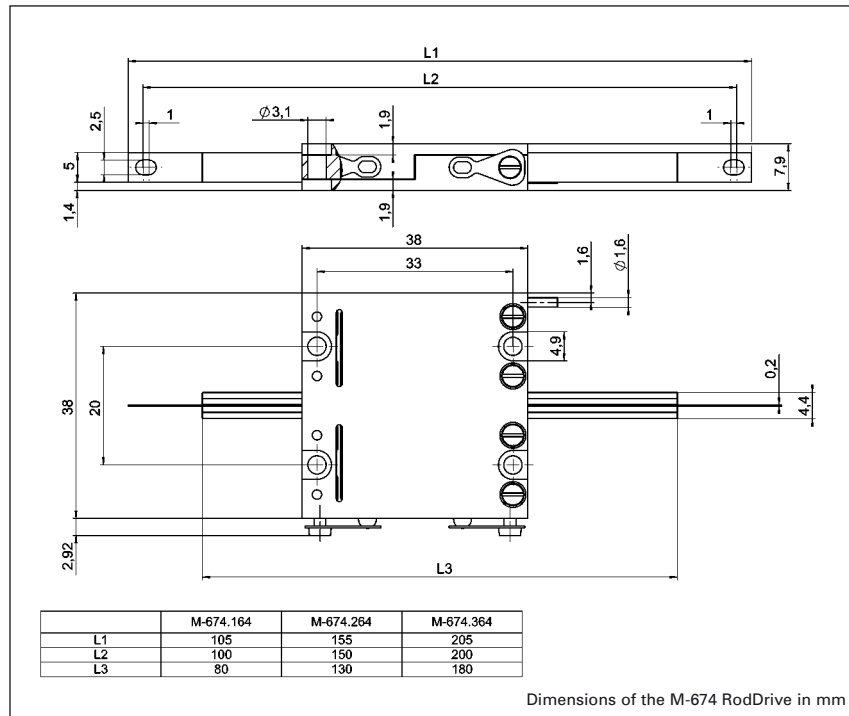
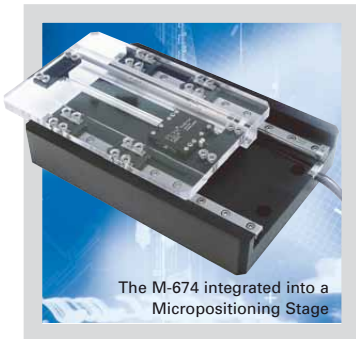


Constancy of closed-loop velocity at 200 mm/s of an integrated M-674 RodDrive

(to be ordered separately) external drive electronics is required which accepts a  $\pm 10$  V analog signal from the controller.

#### 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



#### 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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#### Technical Data

Model	M-674.164	M-674.264	M-674.364	Units	Tolerance
<b>Motion and positioning</b>					
Travel range	50	100	150	mm	x
Minimum incremental motion, open-loop	0.05*	0.05*	0.05*	$\mu\text{m}$	typ.
Max. velocity	450	450	450	mm/s	
Max. acceleration	10	10	10	$\text{m/s}^2$	
<b>Mechanical properties</b>					
Stiffness when powered down	5**	5**	5**	$\text{N}/\mu\text{m}$	$\pm 10\%$
Holding force when powered down	7	7	7	N	max.
Push / pull force	7	7	7	N	max.
<b>Drive properties</b>					
Resonant frequency	155	155	155	kHz, typ.	
Integrated piezo motor	2 x PILine® P-664 (Dual Motor)	2 x PILine® P-664 (Dual Motor)	2 x PILine® P-664 (Dual Motor)		
Motor voltage range	190 (peak-peak)*** 67 (RMS)***	190 (peak-peak)*** 67 (RMS)***	190 (peak-peak)*** 67 (RMS)***	V	
Operating voltage drive electronics	12	12	12	V	
Max. elec. power consumption drive electronics	15	15	15	W	
<b>Miscellaneous</b>					
Operating temperature range	-20 to +50	-20 to +50	-20 to +50	$^{\circ}\text{C}$	
Body material	PEEK-PTFE	PEEK-PTFE	PEEK-PTFE		
Mass	0.1	0.12	0.14	kg	$\pm 5\%$
Cable length	1.5	1.5	1.5	m	$\pm 10$ mm
Connector	LEMO connector	LEMO connector	LEMO connector	LEMO connector	
Recommended controller/driver	C-184.D64 OEM drive electronics board C-185.D64 driver ****C-867.D64 Controller for closed-loop operation	C-184.D64 OEM drive electronics board C-185.D64 driver ****C-867.D64 Controller for closed-loop operation	C-184.D64 OEM drive electronics board C-185.D64 driver ****C-867.D64 Controller for closed-loop operation		

\*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-drives.

\*\*Stiffness at 25  $^{\circ}\text{C}$ .

\*\*\*The operating voltage is supplied by the drive electronics.

\*\*\*\*MDR 14-connector for closed-loop systems separate required