

## N-865

### NEXACT® SpaceFAB

6 Degrees of Freedom, Highest Precision, Flat Design



- Six Degrees of Freedom
- Clear aperture
- Sensor resolution 0.5 nm
- 15 N load capacity
- Self-locking when switched off: Saves energy and reduces generation of heat

#### **PiezoWalk® technology: High resolution and low wear**

The PiezoWalk® technology combines the technological advantages of piezo actuators with those of piezomotors. PiezoWalk® stepping drives offer not only subnanometer resolution, high forces, and high stiffness but, based on their drive principle, allow theoretically unlimited travel ranges. In contrast to other piezo-motorized drive principles, PiezoWalk® stepping drives are not subject to sliding friction effects. They are based on stiction contacts of several piezo actuators that step along a runner. For feed forward, the actuators are lifted physically from the runner, which causes hardly any wear and abrasion. Preloading the actuators against the runner ensures self-locking of the stepping drive. Therefore, the stepping drive holds the position at rest and mechanically stable when switched off (no servo jitter). Due to the self-locking at rest, no energy is consumed and no heat is generated.

#### **Direct position measuring with PIONe linear encoder**

The high-resolution PIONe encoder was developed by PI and, with corresponding processing of the measured value, allows a position resolution of much less than one nanometer. The optical and noncontact PIONe encoders are based on an interferometric measuring principle. They measure the actual position directly at the motion platform with the highest accuracy so that nonlinearity, mechanical play or elastic deformation have no influence on position measuring. Due to the short signal period of 0.5  $\mu\text{m}$  and the high quality of the signals, the linearity error of PIONe encoders is less than 1 %. PIONe encoders support direction sensing when evaluating a reference signal.

### Crossed roller bearings

With crossed roller bearings, the point contact of the balls in ball bearings is replaced by a line contact of the hardened rollers. Consequently, they are considerably stiffer and need less preload, which reduces friction and allows smoother running. Crossed roller bearings are also distinguished by high guiding accuracy and load capacity. Force-guided rolling element cages prevent linear guide creeping.

### Valid patents

In the technological field of piezo stepping drives (NEXACT®, NEXLINE®), PI has the following patents and patent applications:

DE10148267B4, EP1267478B1, EP2209202B1, EP2209203B1, US6800984B2

### Fields of application

Sample manipulation, sample positioning, optics or mechanical components with high precision and stability, precision mechanics in the semiconductor industry, micromanipulation, microscopy, automation, applications in confined spaces, applications in a vacuum or nonmagnetic environments.

## Specifications

Preliminary data	N-865.160	Unit	Tolerance
<b>Motion and positioning</b>			
Active axes	X, Y, Z, $\theta_x$ , $\theta_y$ , $\theta_z$		
Integrated sensor	Incremental linear encoder PIONe		
Travel range* in X, Y	$\pm 6.5$	mm	
Travel range* in Z	$\pm 5$	mm	
Rotation range* in $\theta_x$ , $\theta_y$	$\pm 7$	°	
Rotation range* in $\theta_z$	$\pm 8$	°	
Sensor resolution	0.5	nm	
Minimum incremental motion in X, Y	2	nm	typ.
Minimum incremental motion in Z	2	nm	typ.
Minimum incremental motion in $\theta_x$ , $\theta_y$ , $\theta_z$	0.2	$\mu\text{rad}$	typ.
Unidirectional repeatability in X	$\pm 40$	nm	typ.
Unidirectional repeatability in Y	$\pm 30$	nm	typ.
Unidirectional repeatability in Z	$\pm 20$	nm	typ.
Unidirectional repeatability in $\theta_x$	$\pm 5$	$\mu\text{rad}$	typ.
Unidirectional repeatability in $\theta_y$	$\pm 7$	$\mu\text{rad}$	typ.
Unidirectional repeatability in $\theta_z$	$\pm 7$	$\mu\text{rad}$	typ.
Backlash in X	70	nm	typ.
Backlash in Y	30	nm	typ.
Backlash in Z	20	nm	typ.
Backlash in $\theta_x$	12	$\mu\text{rad}$	typ.

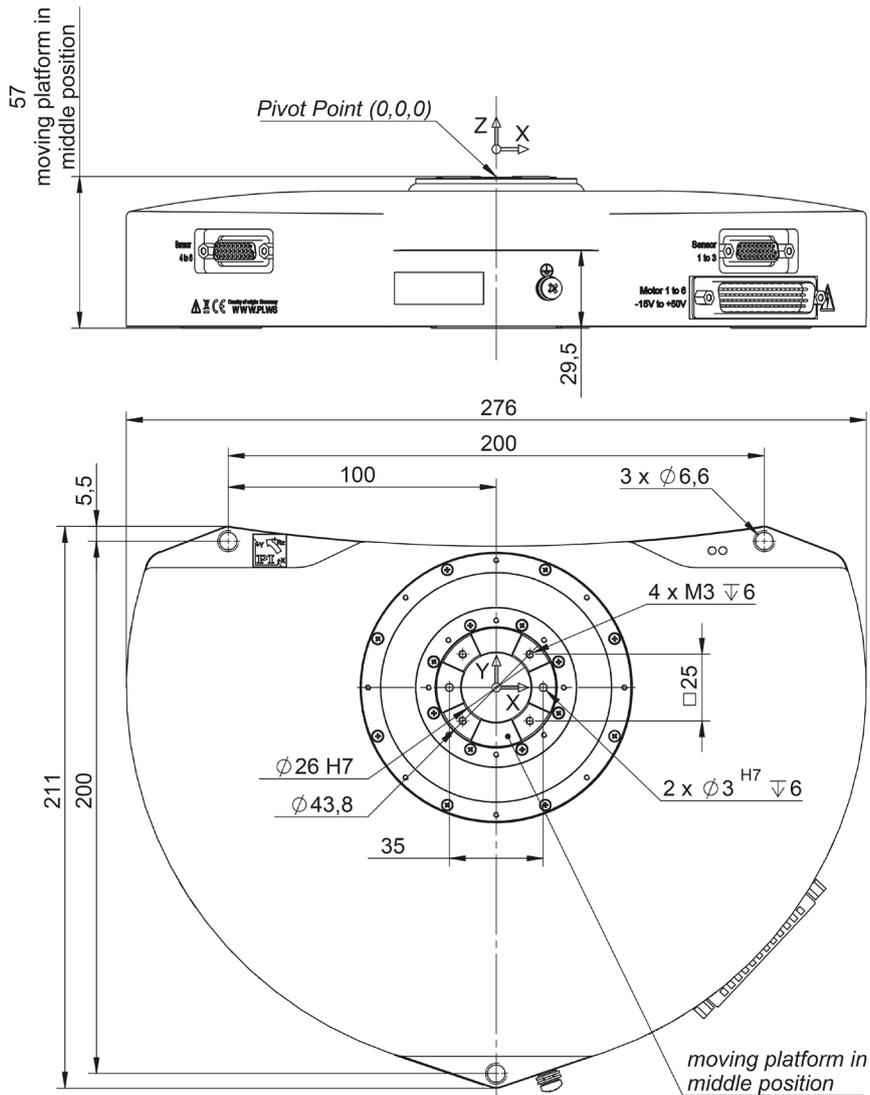
Backlash in $\theta_y$	9	$\mu\text{rad}$	typ.
Backlash in $\theta_z$	4	$\mu\text{rad}$	typ.
Max. velocity in X, Y, Z		mm/s	max.
Max. angular velocity in $\theta_x, \theta_y, \theta_z$		mrad/s	max.
<b>Mechanical properties</b>			
Stiffness in X, Y		N/ $\mu\text{m}$	
Stiffness in Z		N/ $\mu\text{m}$	
Load capacity in X, Y	7,5	N	max.
Load capacity in Z (base plate horizontal)	15	N	max.
Drive type	NEXACT® piezo walking drive		
<b>Miscellaneous</b>			
Connection	HD Sub-D 78 (m)		
Sensor connection	2x HD Sub-D 26 (f)		
Material	Stainless steel, aluminum		
Mass	3.9	kg	$\pm 5\%$
Operating temperature range	10 to 50	$^{\circ}\text{C}$	

Technical data specified at  $20 \pm 3\text{ }^{\circ}\text{C}$ .

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\* The travel ranges of the individual coordinates (X, Y, Z,  $\theta_x, \theta_y, \theta_z$ ) are interdependent. The data for each axis in this table shows its maximum travel range, where all other axes and the pivot point are at the reference position.

## Drawings and Images



N-865.160, dimensions in mm

## Ordering Information

### N-865.160

SpaceFAB, NEXACT® Piezo Walking Drive,  $\pm 6.5$  mm Travel Range in X and Y,  $\pm 5$  mm Travel Range in Z,  $\pm 7^\circ$  Rotation Range in  $\theta_x$  and  $\theta_y$ ,  $\theta_z$ ,  $\pm 8^\circ$  Rotation Range in  $\theta_z$ , 15 N Load Capacity in Z