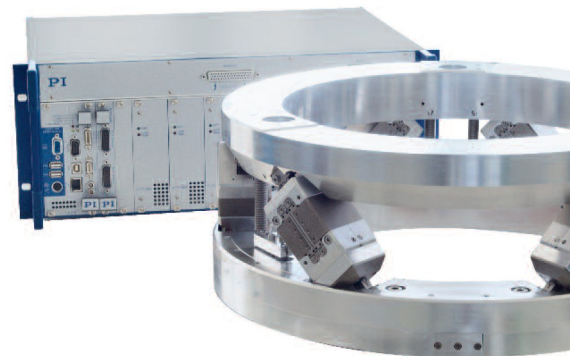
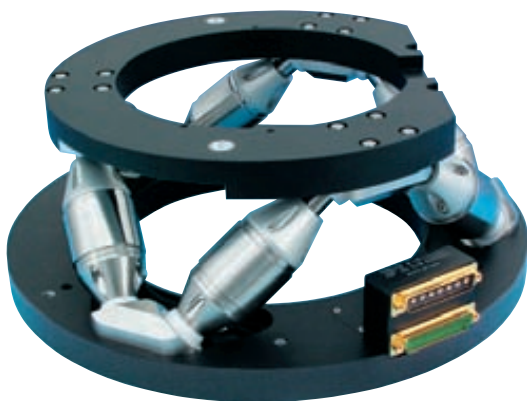
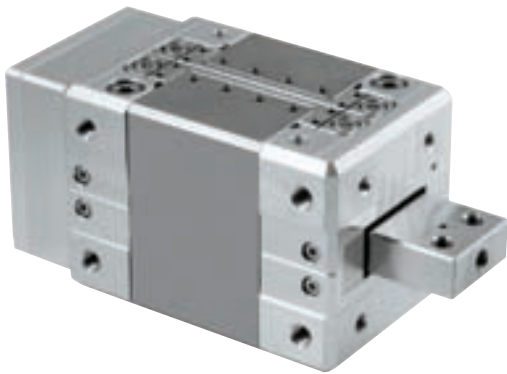


High Load PiezoWalk Linear Motors & Actuators Non-Magnetic & Vacuum Models



N-111 NEXLINE® High Force Piezo Motor, 50 N Nanopositioning Over Long Travel, PiezoWalk® Principle



N-111 compact
OEM nanopositioning actuator.
In principle the movement by
piezo steps allows an infinite
travel range

- Travel Range 10 mm
- Resolution to 0.025 nm Open-Loop, 5 nm Closed-Loop
- Up To 50 N Force Generation and 70 N Holding Force
- Self Locking at Rest, No Heat Generation
- Non-Magnetic and Vacuum-Compatible Working Principle
- Cleanroom Compatible

The innovative N-111 NEXLINE® OEM linear actuators are compact actuators for nanopositioning with travel ranges to 10 mm, high resolution, and generated forces to 50 N. The operating principle is based on coordinated motion of a number of highly preloaded linear and shear piezo elements acting on a runner. NEXLINE® drives thus combine long travel ranges with piezo-class pre-

cision. For closed-loop operation without an additional position sensor the N-111.2A is equipped with a linear encoder that provides 5 nm resolution over the full travel range. In open-loop operation position resolution down to 25 picometers can be achieved by use of a high-dynamics analog mode.

NEXLINE® Working Principle for Application Flexibility

NEXLINE® PiezoWalk® drives can be used wherever high loads must be positioned very precisely over long distances and then perhaps subjected to small-amplitude dynamic adjustment, as for active vibration control. By varying the combination of longitudinal and shear piezo elements, the step size, dynamic operating range (analog travel), clamping force, speed and stiffness can all be optimized for a particular application.

One Working Principle – Different Operating Modes

NEXLINE® PiezoWalk® drives overcome the limitations of conventional nanopositioning systems in their combination of long travel ranges and high resolution and stiffness. The piezoceramic clamping and shear elements act directly on a moving runner that is coupled to the moved object. While in full step mode the runner can be moved over larger distances with maximum velocity, nanostepping mode allows uniform motion with highly constant speed. In open-loop operation any position resolution may be achieved which only depends on the stability of the control signal. Analog operation over a distance of less than one step enables high-dynamics positioning with resolutions far below one nanometer.

Choice of Controllers for Optimization

NEXLINE® operation is supported by two motion controller models providing different features. The E-755 controller offers full functionality for nanometer precise positioning. The E-712 supplies more sophisticated linearization

Ordering Information

N-111.20
NEXLINE® OEM Piezo Stepping Actuator, 10 mm, 50 N

N-111.2A
NEXLINE® OEM Piezo Stepping Actuator, 10 mm, 50 N, Linear Encoder, 5 nm Resolution

Ask about custom designs!

algorithms resulting in very smooth motion with highly constant velocity. It can also provide higher speed with maximum force.

Patented Technology

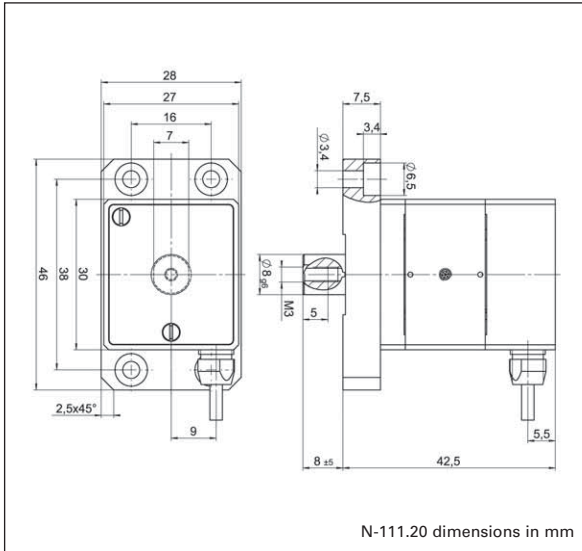
The products described in this document are in part protected by the following patents:
German Patent No. 10148267
US Patent No. 6,800,984

Application Examples

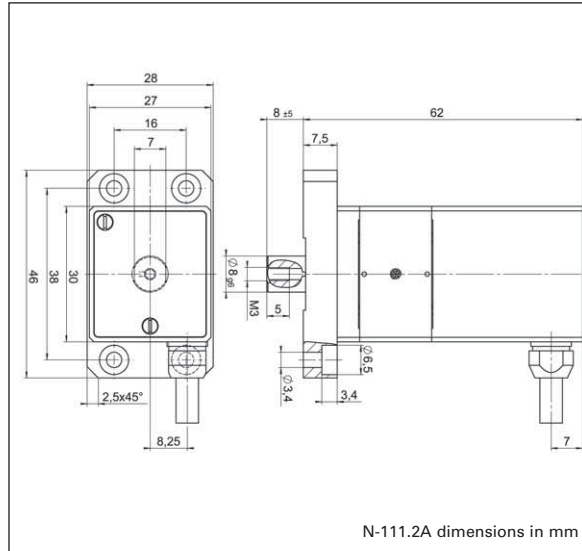
- Semiconductor technology
- Semiconductor testing
- Wafer inspection
- Nano lithography
- Nano-imprinting
- Nanometrology
- Active vibration damping
- Motion in strong magnetic fields



Z / tip / tilt platform with NEXLINE® drives and position sensors;
300 mm (12") diameter, 200 N load capacity,
1.3 mm travel range, 10 mrad tilt range



N-111.20 dimensions in mm



N-111.2A dimensions in mm

Technical Data

Model	N-111.20	N-111.2A	Tolerance
Active axes	X	X	
Motion and positioning			
Travel range	10 mm	10 mm	
Step size (in step mode)	10 nm to 7 µm	10 nm to 7 µm	
Travel range in analog mode	±2 µm	±2 µm	
Integrated sensor	–	Linear encoder	
Open-loop resolution	0.025 nm	0.025 nm	typ.
Closed-loop resolution	–	5 nm	
Max. velocity (10 % duty cycle, full step mode)*	1.0 mm/s	1.0 mm/s	
Max. velocity (100 % duty cycle, full step mode)*	0.6 mm/s	0.6 mm/s	
Max. velocity (100 % duty cycle, nanostepping mode)**	0.4 mm/s	0.4 mm/s	
Mechanical properties			
Stiffness in motion direction	16 N/µm	16 N/µm	±20%
Drive force (active)***	50 N	50 N	max.
Holding force (passive)	70 N	70 N	min.
Drive properties			
Motor type	NEXLINE®	NEXLINE®	
Operating voltage	±250 V	±250 V	
Miscellaneous			
Operating temperature range	-40 to 80 °C	-40 to 80 °C	
Material	Aluminium stainless steel, titanium	Aluminium stainless steel, titanium	
Mass	245 g	325 g	
Cable length	1.5 m	1.5 m	±10 mm
Connector	Sub-D connector NEXLINE® single-channel	Sub-D connector NEXLINE® single-channel plus sensor connector	
Recommended controller	E-755,101, E-712	E-755.1A1, E-712	

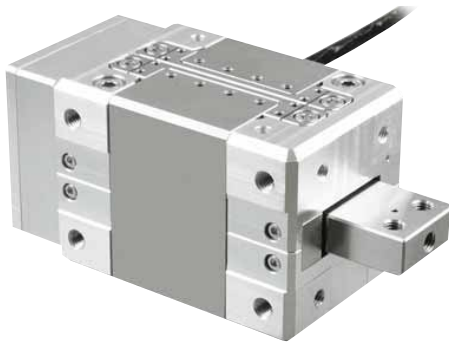
* Depending on drive electronics. Data refer to operation together with E-712 controller.

** Depending on drive electronics. Data refer to operation together with E-712 controller. Together with the E-755 controller a velocity of up to 0.1 mm/s (closed-loop) and 0.2 mm/s (open-loop) can be achieved. The maximum speed in nanostepping mode is set so as to ensure the highest possible velocity constancy, with no speed fluctuations while steps are being performed.

*** Data refer to full step mode operation.

N-216 NEXLINE® High Force Piezo Motor, 600 N

High-Force PiezoWalk® Drive for Long-Range Nanopositioning



N-216 NEXLINE® High-Load Actuator. Feed motion is realized by piezo stepping motion which allows basically unlimited travel ranges with nanometer accuracy

- Travel Range 20 mm
- Resolution to 0.03 nm Open-Loop, 5 nm Closed-Loop
- Up to 800 N Holding Force
- Self Locking at Rest
- Non-Magnetic and Vacuum-Compatible Working Principle
- Cleanroom Compatible

N-216 NEXLINE® high-load linear actuators are ultra-precision nanopositioning actuators with travel ranges to 20 mm and push / pull forces to 600 N. The operating principle is based on coordinated motion of a number of highly preloaded linear and shear piezo elements acting on a runner. NEXLINE® drives combine long travel ranges with piezo-class precision.

N-216 comes in two versions for open- or closed-loop operation, as well as in two different load configurations. Closed-loop versions are equipped with a linear encoder for direct

position measurement of the moving runner. The encoder features 5 nm resolution over the full travel range. In open-loop operation a positioning resolution to 30 picometers can be realized by use of the high-dynamics analog operation mode.

Unlimited Lifetime

The application area of NEXLINE® drives often lies in the difficult-to-access internals of machines, where nanometer-realm adjustment and vibration cancellation are required. Long lifetime is therefore a basic requirement for NEXLINE® actuators. To promote long lifetime, the controller can reduce the operating voltage on all the piezo elements to zero at any position and still maintain the full holding force.

One Working Principle – Different Operating Modes

NEXLINE® PiezoWalk® drives overcome the limitations of conventional nanopositioning systems in their combination of long travel ranges and high resolution and stiffness. The piezo-ceramic clamping and shear

elements act directly on a moving runner that is coupled to the moved object. While in full step mode the runner can be moved over larger distances with maximum velocity, nanostepping mode allows uniform motion with highly constant speed. In open-loop operation any position resolution may be achieved which only depends on the stability of the control signal. Analog operation over a distance of less than one step enables high-dynamics positioning with resolutions far below one nanometer.

Choice of Controllers for Optimization

NEXLINE® operation is supported by two motion controller models providing different features. The E-755 controller offers full functionality for nanometer precise positioning. The E-712 supplies more sophisticated linearization algorithms resulting in very smooth motion with highly constant velocity. It can also provide higher speed with maximum force.

Ordering Information

N-216.10
NEXLINE® Piezo Stepping High-Load Actuator, 20 mm, 300 N, Open-Loop

N-216.1A
NEXLINE® Piezo Stepping High-Load Actuator, 20 mm, 300 N, Linear Encoder, 5 nm Resolution

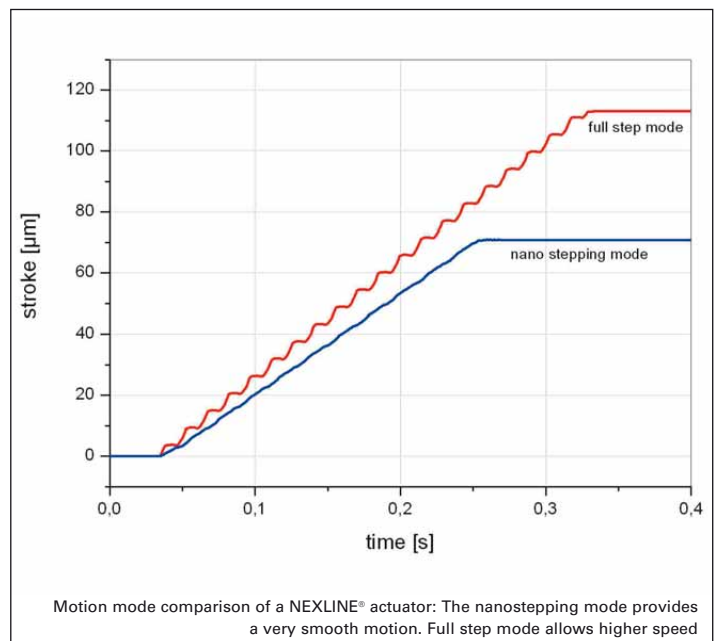
N-216.20
NEXLINE® Piezo Stepping High-Load Actuator, 20 mm, 600 N, Open-Loop

N-216.2A
NEXLINE® Piezo Stepping High-Load Actuator, 20 mm, 600 N, Linear Encoder, 5 nm Resolution

Ask about custom designs!

Patented Technology

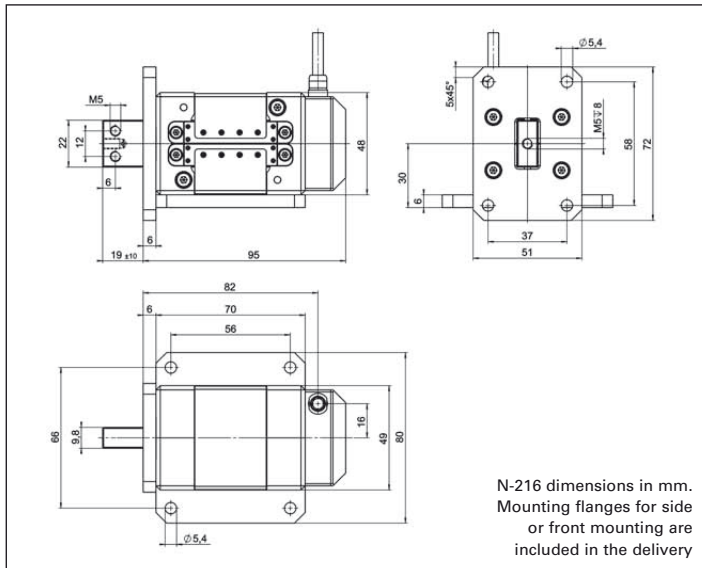
The products described in this document are in part protected by the following patents:
German Patent No. 10148267
US Patent No. 6,800,984



Motion mode comparison of a NEXLINE® actuator: The nanostepping mode provides a very smooth motion. Full step mode allows higher speed

Application Example

- Semiconductor technology
- Semiconductor testing
- Wafer inspection
- Nano lithography
- Nano-imprinting
- Nanometrology
- Active vibration damping
- Motion in strong magnetic fields



6-axis parallel kinematics (Hexapod) with integrated NEXLINE® high-load actuators, suitable for applications in strong magnetic fields

Technical Data

Model	N-216.10 / N-216.1A	N-216.20 / N-216.2A	Tolerance
Active axes	X	X	
Motion and positioning			
Displacement	20 mm	20 mm	
Step size (in step mode)	10 nm to 10 µm	10 nm to 10 µm	
Travel range in analog mode	±3 µm	±3 µm	
Integrated sensor	N-216.10: none N-216.1A: linear encoder	N-216.20: none N-216.2A: linear encoder	
Open-loop resolution	0.03 nm	0.03 nm	typ.
Closed-loop resolution	- / 5 nm (N-216.1A)	- / 5 nm (N-216.2A)	
Max. velocity (10% duty cycle, full step mode)*	1.0 mm/s	1.0 mm/s	
Max. velocity (100% duty cycle, full step mode)*	0.6 mm/s	0.6 mm/s	
Max. velocity (100% duty cycle, nanostepping mode)**	0.4 mm/s	0.4 mm/s	
Mechanical properties			
Drive force (active)***	300 N	600 N	max.
Holding force (passive)	400 N	800 N	min.
Drive properties			
Motor type	NEXLINE®	NEXLINE®	
Operating voltage	±250 V	±250 V	
Miscellaneous			
Operating temperature range	-40 to 80 °C	-40 to 80 °C	
Material	Aluminum, stainless steel	Aluminum, stainless steel	
Mass	1150 g	1250 g	
Cable length	2.0 m	2.0 m	
Connector	Sub-D connector NEXLINE® single-channel N-216.1A: plus sensor connector	Sub-D connector NEXLINE® single-channel N-216.2A: plus sensor connector	
Recommended controller	E-755, E-712	E-755, E-712	

* Depending on drive electronics. Data refer to operation together with E-712 controller.

** Depending on drive electronics. Data refer to operation together with E-712 controller. Together with the E-755 controller a velocity of up to 0.1 mm/s (closed-loop) and 0.2 mm/s (open-loop) can be achieved. The maximum speed in nanostepping mode is set so as to ensure the highest possible velocity constancy, with no speed fluctuations while steps are being performed.

*** Data refer to full step mode operation.

N-515K Non-Magnetic Piezo Motor Hexapod

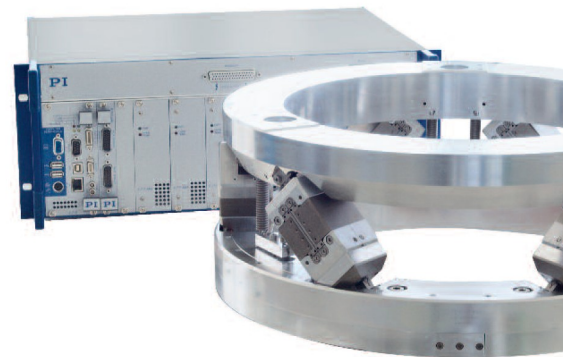
6-Axis Precision Positioning System with NEXLINE® Linear Motor Drives



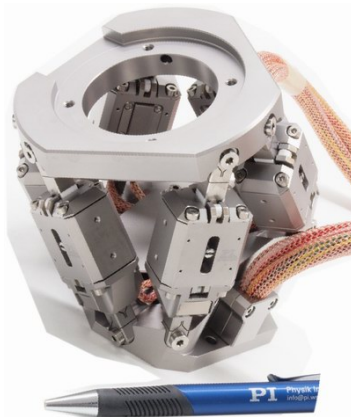
6-axis parallel kinematics (Hexapod) with integrated N-215 NEXLINE® high-load actuators, suitable for applications in strong magnetic fields

- Travel Ranges 10 mm Linear, 6° Rotation
- Large Clear Aperture Ø 202 mm
- Non-Magnetic
- Nanometer Resolution
- Low-Profile: 140 mm Height Only
- Parallel Kinematics for Enhanced Dynamics and Better Multi-Axis Accuracy
- Up to 500 N Force Generation
- Self Locking at Rest, No Heat Generation

Model	Travel range	Load capacity	Dimensions
N-515KNPH	X, Y, Z: 10 mm	50 kg	Outer Ø baseplate, 380 mm
NEXLINE®	$\theta_x, \theta_y, \theta_z: 6^\circ$		Ø moved platform (top) 300 mm
Piezo Hexapod			140 mm height



Custom piezo motor 6-axis positioner



Custom miniature 6-axis positioner with piezo motor drives

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

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