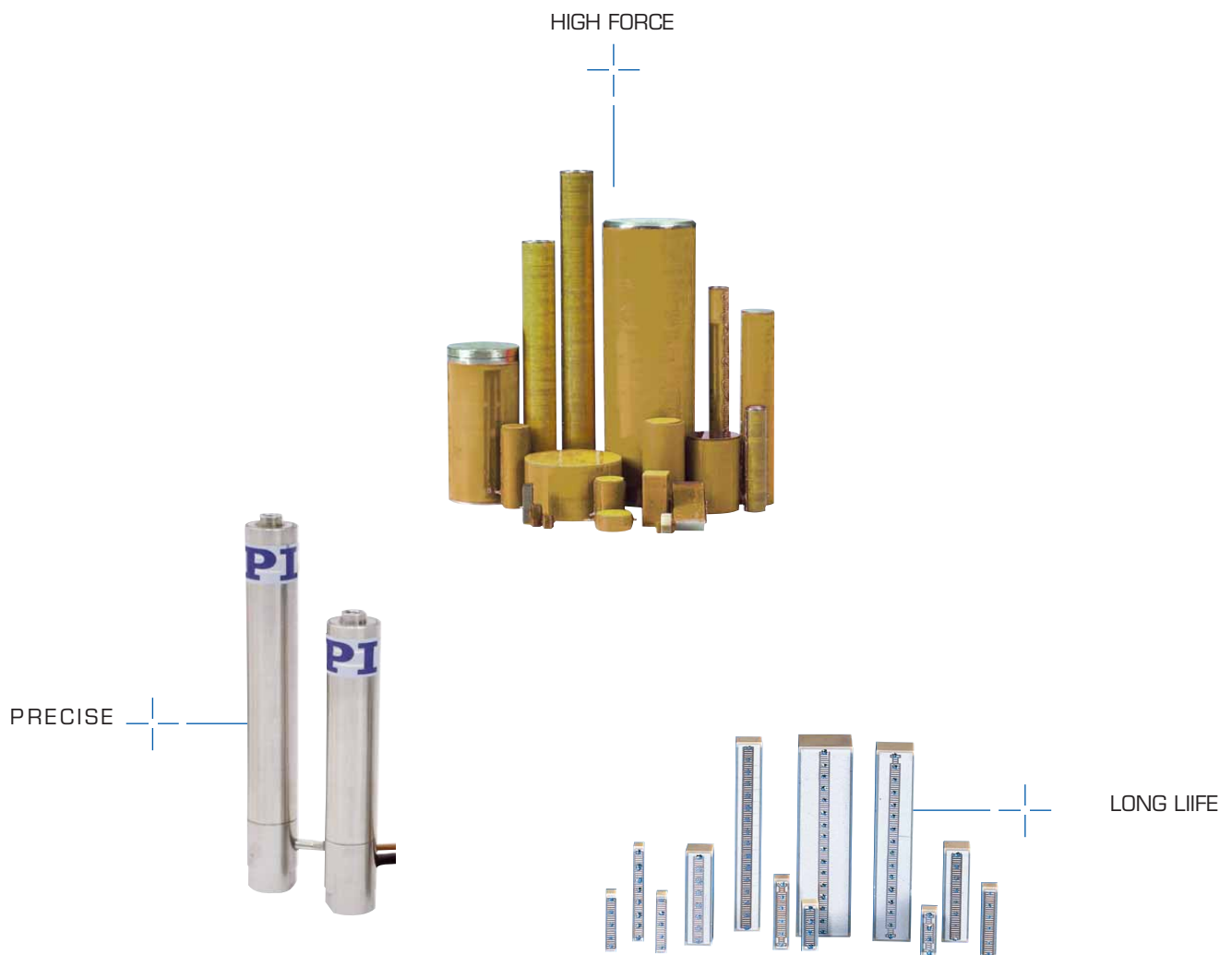


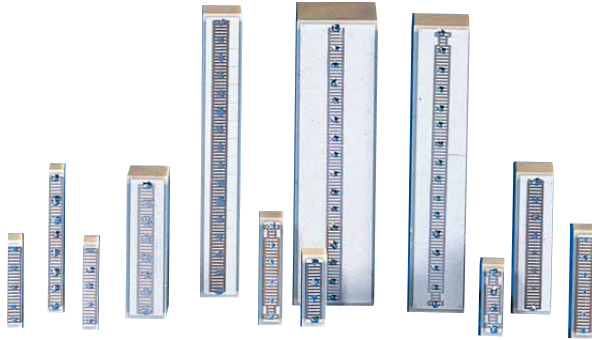
Piezo Linear Stack Actuators

High Force, Fast Response, High Stability



PICMA[®] Multilayer Piezo Stack Linear Actuators

Ceramic-Insulated High-Power Actuators



PICMA[®] piezo actuators are available with cross-sections of 2 x 3, 3 x 3, 5 x 5, 7 x 7 and 10 x 10 mm²

- Superior Lifetime Even Under Extreme Conditions
- Very Large Operating Temperature Range
- High Humidity Resistance
- Excellent Temperature Stability
- High Stiffness
- Peak Current up to 20 A
- UHV Compatible to 10⁻⁹ hPa
- Sub-Millisecond Response / Sub-Nanometer Resolution
- Ideal for Dynamic Operation

PICMA[®] (PI Ceramic Monolithic Multilayer Actuator) piezo stack actuators are characterized by their high performance and reliability, even in extremely harsh environments. They are superior to conventional multilayer actuators in

industrial applications and high-endurance situations, where they show substantially longer lifetimes both in static and dynamic operation.

New Production Process, Optimized Piezo Ceramics

PICMA[®] piezo actuators are made from a ceramic material in which the piezoceramic properties such as stiffness, capacitance, displacement, temperature stability and lifetime are optimally combined. Thus the actuators accomplish sub-nanometer resolution in positioning and sub-millisecond response!

Increased Lifetime Through Humidity Resistance

The monolithic ceramic-encapsulated design provides better humidity protection than poly-

mer-film insulation. Diffusion of water molecules into the insulation layer is greatly reduced by the use of cofired, outer ceramic encapsulation. Due to their high resonant frequency the actuators are suitable for highly dynamic applications with small loads; depending on the load an external preload for dynamic applications is recommended. The high Curie temperature of 320 °C gives PICMA[®] actuators a usable temperature range extending up to 150 °C, far beyond 80 °C as is common for conventional multilayer actuators. With conventional multilayer actuators, heat generation - which is proportional to operating frequency - either limits the operating frequency or duty cycle in dynamic operation, or makes ungainly cooling provisions necessary. At the low end, operation down to a few Kelvin is possible (with reduction in performance specifications).

Optimum UHV Compatibility - Minimum Outgassing

The lack of polymer insulation and the high Curie temperature make for optimal ultra-high-vacuum compatibility (high bakeout temperatures, up to 150 °C).



PICMA[®] actuator with optional 0.1 m PTFE insulated wire leads and optional rounded top piece for decoupling lateral forces

Ideal for Closed-Loop Operation

The ceramic surface of the actuators is extremely well suited for use with resistive or optical fiber strain gauge sensors. Such sensors can be easily applied to the actuator surface and exhibit significantly higher stability and linearity than with conventional polymer-insulated actuators.

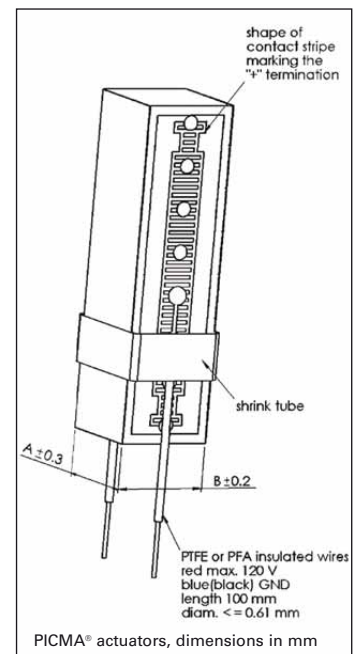
Piezo Drivers, Controllers & High-Voltage Amplifiers

High-resolution amplifiers and servo-control electronics, both digital and analog, are described in the "Piezo Drivers / Servo Controllers" section.

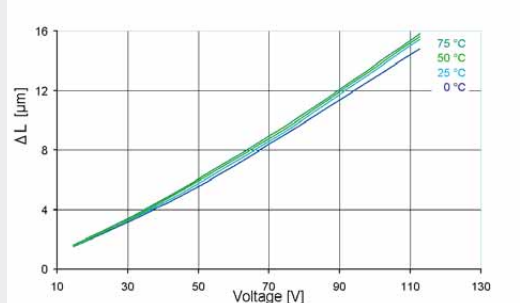
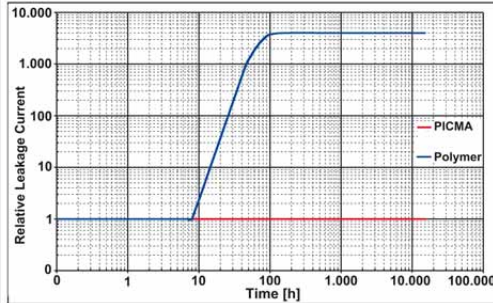
Read more on PICMA[®] reliability on page 1-65 ff.

Application Examples

- Precision mechanics / -machining
- High-speed switching
- Active and adaptive Optics
- Active vibration damping
- Pneumatic & hydraulic valves
- Metrology / Interferometry
- Life science, Biotechnology
- Nanotechnology



PICMA[®] actuators, dimensions in mm



PICMA® piezo actuators (bottom curve) compared with conventional multilayer actuators with polymer insulation (top curve). PICMA® actuators are not affected by the high-humidity test conditions. Conventional piezo actuators exhibit increased leakage current after only a few hours. Leakage current is an indicator quality and expected lifetime.

The displacement of PICMA® actuators exhibits very low temperature dependence. This, in combination with their low heat generation, makes PICMA® actuators optimal for dynamic operation

Test conditions: U = 100 VDC, T = 25 °C, Relative Humidity = 70 %

Technical Data / Product Order Numbers

Order number*	Dimensions A x B x L [mm]	Nominal displacement [μm @ 100 V]	Max. displacement [μm @ 120 V]	Blocking force [N @ 120 V]	Stiffness [N/μm]	Electrical capacitance [μF] ±20 %	Resonant frequency [kHz] ±20 %
P-882.11	3 x 2 x 9	6.5 ±20 %	8 ±20 %	190	24	0.15	135
P-882.31	3 x 2 x 13.5	11 ±20 %	13 ±20 %	210	16	0.22	90
P-882.51	3 x 2 x 18	15 ±10 %	18 ±10 %	210	12	0.31	70
P-883.11	3 x 3 x 9	6.5 ±20 %	8 ±20 %	290	36	0.21	135
P-883.31	3 x 3 x 13.5	11 ±20 %	13 ±20 %	310	24	0.35	90
P-883.51	3 x 3 x 18	15 ±10 %	18 ±10 %	310	18	0.48	70
P-885.11	5 x 5 x 9	6.5 ±20 %	8 ±20 %	800	100	0.6	135
P-885.31	5 x 5 x 13.5	11 ±20 %	13 ±20 %	870	67	1.1	90
P-885.51	5 x 5 x 18	15 ±10 %	18 ±10 %	900	50	1.5	70
P-885.91	5 x 5 x 36	32 ±10 %	38 ±10 %	950	25	3.1	40
P-887.31	7 x 7 x 13.5	11 ±20 %	13 ±20 %	1700	130	2.2	90
P-887.51	7 x 7 x 18	15 ±10 %	18 ±10 %	1750	100	3.1	70
P-887.91	7 x 7 x 36	32 ±10 %	38 ±10 %	1850	50	6.4	40
P-888.31	10 x 10 x 13.5	11 ±20 %	13 ±20 %	3500	267	4.3	90
P-888.51	10 x 10 x 18	15 ±10 %	18 ±10 %	3600	200	6.0	70
P-888.91	10 x 10 x 36	32 ±10 %	38 ±10 %	3800	100	13.0	40

Standard piezo ceramic type: 252

Standard electrical interfaces: 100 mm wire leads

*For optional solderable contacts, change order number extension to .x0 (e.g. P-882.10).

Recommended preload for dynamic operation: 15 MPa

Maximum preload for constant force: 30 MPa

Resonant frequency at 1 V_{pp}, unloaded, free at both sides. The value is halved for unilateral clamping

Capacitance at 1 V_{pp}, 1 kHz

Operating voltage: -30 to +130 V; the lifetime depends on the voltage applied

Operating temperature range: -40 to +150 °C

Standard Mechanical Interfaces: Ceramics

Available Options: strain gauge sensors, special mechanical interfaces, etc.

Other specifications on request.

Medium Force Piezo Linear Actuator, Preloaded

Optional with Integrated Position Sensor



P-840, P-841 piezo translators (DIP switch for size comparison)

- Outstanding Lifetime Due to PICMA® Piezo Ceramic Stacks
- Travel Range to 90 µm
- Compact Case
- Pushing Forces to 1000 N
- Pulling Forces to 50 N
- Sub-Millisecond Response, Sub-Nanometer Resolution
- Versions: with Ball Tip, Vacuum Versions

The P-840 and P-841 series translators are high-resolution linear actuators for static and dynamic applications. They provide sub-millisecond response and sub-nanometer resolution.

Application Examples

- Static and dynamic Precision positioning
- Disc-drive-testing
- Adaptronics
- Smart structures
- Active vibration control
- Switches
- Laser tuning
- Patch-Clamp
- Nanotechnology

Design

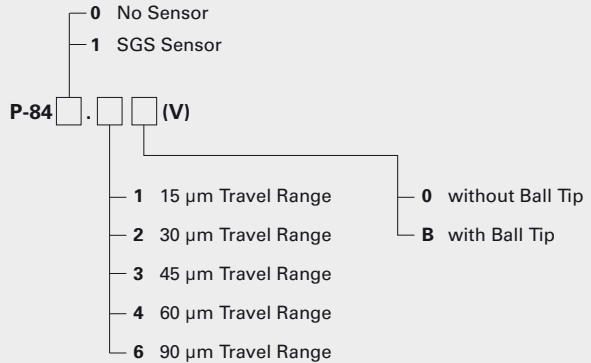
These translators are equipped with highly reliable multilayer piezo ceramic stacks protected by a non-magnetic stainless steel case with internal spring preload. The preload makes them ideal for dynamic applications and for tensile loads as well.

Ceramic Insulated Piezo Actuators Provide Long Lifetime

The highest possible reliability is assured by employing the award-winning PICMA® multilayer piezo actuators. PICMA® actuators are the only actuators on the market with a ceramic-only insulation, which makes them resistant to ambient humidity and leakage-current failures. They are thus far superior to conventional actuators in reliability and lifetime.

Ordering Information

Preloaded Piezo Actuator, 1000/50 N



V: Vacuum Compatible to 10⁻⁶ hPa

Optimum UHV Compatibility – Minimum Outgassing

The lack of polymer insulation and the high Curie temperature make for optimal ultra-high-vacuum compatibility (no outgassing / high bakeout temperatures, up to 150 °C).

Mounting

Mounting is at the foot, with push/pull forces of less than 5 N, the actuator can be held by clamping the case. The versions with ball tip decouple torque and off-center forces from the piezoceramic.

To provide magnetic coupling, the P-176.20 magnetic adapter can be screwed into the top piece (only for versions without ball tip).

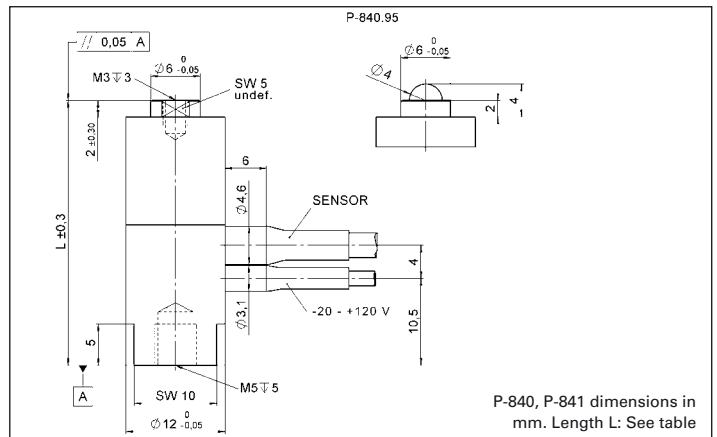
Read details in Mounting and Handling Guidelines (p. 1-67).

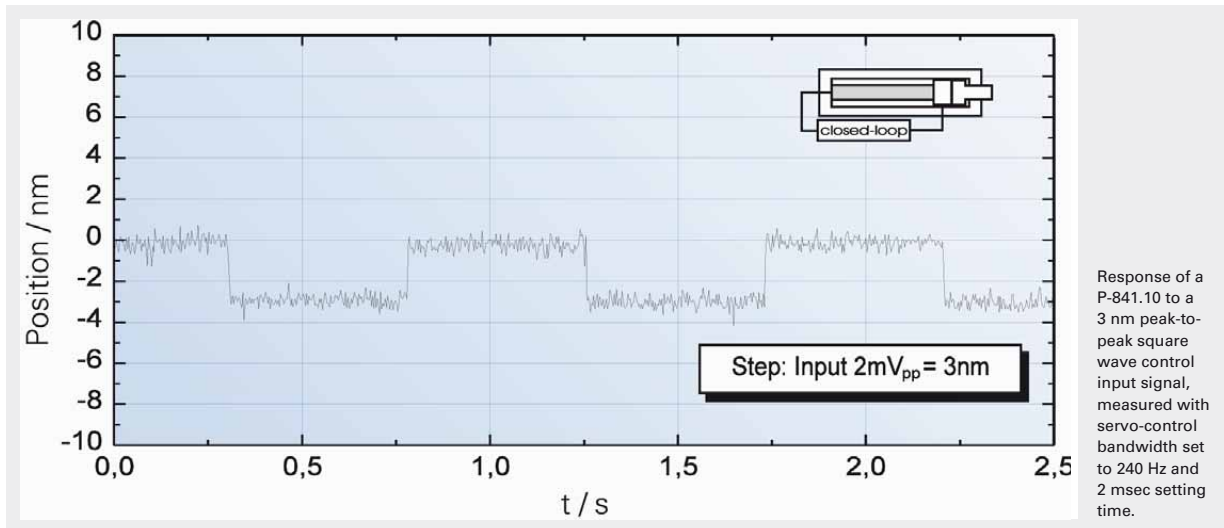
High Accuracy in Closed-Loop Operation

The standard model P-840 is designed for open-loop positioning. Version P-841 with integrated high-resolution strain gauge position sensors provides high precision for closed-loop operation (further details see p. 2-199).

Piezo Drivers, Controllers & Amplifiers

High-resolution amplifiers and servo-control electronics, both digital and analog, are described in the “Piezo Drivers / Servo Controllers” (see p. 2-99) section.





Technical Data

Model	P-841.1 P-840.1	P-841.2 P-840.2	P-841.3 P-840.3	P-841.4 P-840.4	P-841.6 P-840.6	Units
Open-loop travel @ 0 to 100 V	15	30	45	60	90	$\mu\text{m} \pm 20\%$
Closed-loop travel	15 / -	30 / -	45 / -	60 / -	90 / -	μm
Integrated feedback sensor*	SGS / -	SGS / -	SGS / -	SGS / -	SGS / -	
Closed-loop / open-loop resolution**	0.3 / 0.15	0.6 / 0.3	0.9 / 0.45	1.2 / 0.6	1.8 / 0.9	nm
Static large-signal stiffness***	57	27	19	15	10	$\text{N}/\mu\text{m} \pm 20\%$
Pushing forces to 1000 N	1000	1000	1000	1000	1000	N
Pulling forces to 50 N	50	50	50	50	50	N
Max. torque limit (on tip)	0.35	0.35	0.35	0.35	0.35	Nm
Electrical capacitance	1.5	3.0	4.5	6.0	9.0	$\mu\text{F} \pm 20\%$
Dynamic operating current coefficient (DOCC)	12.5	12.5	12.5	12.5	12.5	$\mu\text{A} / (\text{Hz} \cdot \mu\text{m})$
Unloaded resonant frequency f_0	18	14	10	8.5	6	$\text{kHz} \pm 20\%$
Operating temperature	-20 to +80	-20 to +80	-20 to +80	-20 to +80	-20 to +80	$^{\circ}\text{C}$
Mass without cables	20	28	46	54	62	$\text{g} \pm 5\%$
Material: case, end pieces	N-S	N-S	N-S	N-S	N-S	
Length L	32	50	68	86	122	$\text{mm} \pm 0.3$

*Closed-loop models can attain linearity up to 0.15% and are shipped with performance reports.

**Resolution of piezo actuators is not limited by stiction or friction. Value given is noise equivalent motion with E-503 amplifier. (p. 2-146)

***Dynamic small-signal stiffness is ~ 30 % higher.

Voltage connection: LEMO FFA.00.250. Coaxial cable, RG 178, 1 m.

Sensor connector: LEMO FFA.0S.304. Coaxial cable, 1 m.

Recommended amplifiers / controllers

Single-channel: E-610 servo-controller / amplifier (p. 2-110), E-625 servo-controller, bench-top (p. 2-114), E-621 controller module (p. 2-160)

Modular piezo controller system E-500 (p. 2-142) with amplifier module E-505 (high-power) (p. 2-147) and E-509 controller (p. 2-152) (optional)

Multi-channel: modular piezo controller system E-500 (p. 2-142) with amplifier module E-503 (three channels) (p. 2-146) or E-505 (1 per axis, high-power) (p. 2-147) and E-509 controller (p. 2-152) (optional)

High-Force Piezo Stack Linear Actuators, Preloaded

Preloaded Piezo Actuators (HVPZT) w/ Sensor Option



From left: P-212.1S and .8S, P-216.9S, .4S and .1S piezo actuators (CD for size comparison)

- Travel Range to 180 μm
- Pushing Forces to 4500 N
- Pulling Forces to 500 N
- Sub-millisecond Response
- Sub-nanometer Resolution
- Options: Vacuum, High- and Low-Temperature

The P-212 and P-216 series are high-resolution linear piezo actuators (translators) for static and dynamic applications. They provide sub-millisecond

Application Examples

- Optics
- Metrology / interferometry
- Adaptronics
- Precision engineering / micromechanics
- Adaptive mechanics
- Active vibration damping
- Switches
- Laser tuning
- Force generation / materials testing
- Nanotechnology

response and sub-nanometer resolution.

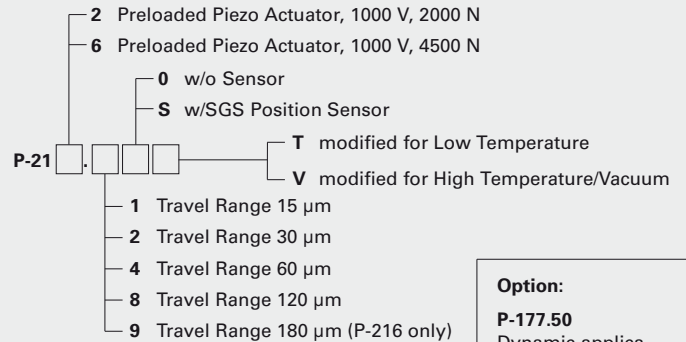
These actuators have the friction-free, preloaded PICA™ Power actuators inside. The preload makes them ideal for dynamic applications like precision machining or active damping.

High Displacement with Ultra-High Reliability

PICA™ Power actuators are optimized for high-temperature working conditions and high-duty-cycle dynamic applications.

All PICA™ piezo ceramics are specifically designed for high-duty-cycle applications. With PI's extensive applications knowledge, gained over several decades, performance does

Ordering Information



Please read "Options and Accessories" (page 1-102 ff) for further information. Extensions cables, adapters & connectors: see in "Accessories" in the "Piezo Drivers / Servo Controllers" (see p. 2-168 ff) section.

Option:
P-177.50
 Dynamic applications (with E-481): temperature sensor and protective air for PICA™ HVPZT

not come at the price of reliability. All materials used are specifically matched for robustness and lifetime. Endurance tests on PICA™ actuators prove consistent performance, even after billions (1,000,000,000) of cycles.

Open- and Closed-Loop Models for Optimum Dynamics and Linearity

The standard models are ideal for open loop positioning applications. In this mode the actuator displacement is roughly proportional to the applied voltage.

Open-loop operation is ideal for applications where fast response and very high resolution with maximum bandwidth are essential. Here, commanding and reading the target position in absolute values is either not important or carried out by external position sensors (see p. 2-104).

For highest positioning accuracy and repeatability, select the factory installed closed-loop option with integrated ultra-high-resolution strain gauge position sensors and operate with PI servo-control electronics. For more information, read the tutorial "Piezo-

electrics in Positioning" (see p. 2-169 ff).

Mechanical Mounting

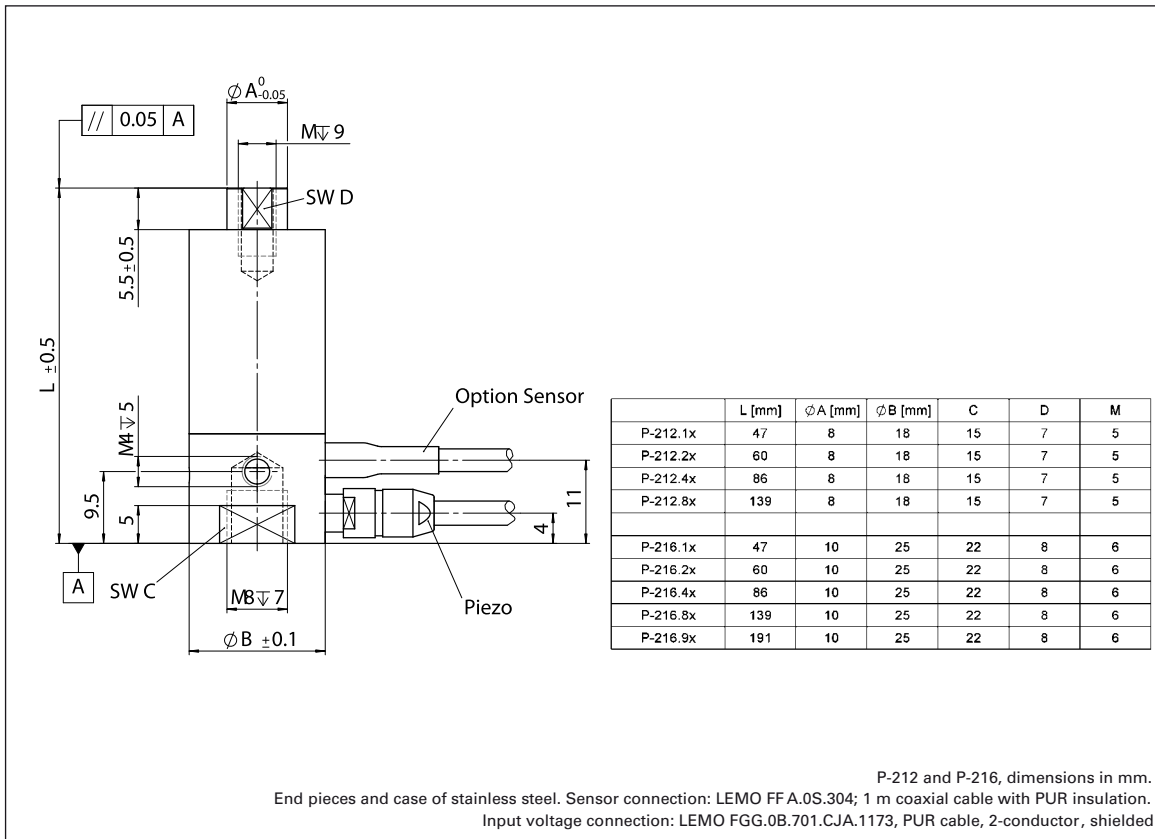
Mounting is at the foot, with push/pull forces of less than 5 N, the actuator can be held by clamping the case. The optional ball tip is intended to decouple torque and off-center forces from the translator. Read details in Mounting and Handling Guidelines (p. 1-67).

High Flexibility with PI Amplifiers, Drivers & Controllers

PI offers a wide range of control electronics for piezo actuators from low-power drivers to the high-performance amplifier / controller E-481.

For closed-loop operation PI offers a wide variety of analog and digital controllers. The E-500 modular system can be easily upgraded from an amplifier to a servo controller, including different interface / display modules.

High-resolution amplifiers and servo-control electronics, both digital and analog, see selection guide in the "Piezo Drivers / Servo Controllers" section (see p. 2-99 ff).



Technical Data

	P-212.10	P-212.20	P-212.40	P-212.80	P-216.10	P-216.20	P-216.40	P-216.80	P-216.90	Unit	Tolerance
Operating voltage	0 to 1000	0 to 1000	0 to 1000	0 to 1000	0 to 1000	0 to 1000	0 to 1000	0 to 1000	0 to 1000	V	
Motion and positioning											
Closed-loop travel*	15	30	60	120	15	30	60	120	180	μm	
Closed-loop resolution*/**	0.3	0.6	1.2	2.4	0.3	0.6	1.2	2.4	3.6	nm	typ.
Open-open resolution**	0.15	0.3	0.6	1.2	0.15	0.3	0.6	1.2	1.8	nm	typ.
Linearity*	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	%	typ.
Mechanical properties											
Static large-signal stiffness***	90	60	34	18	210	140	80	50	32	N/μm	±20%
Unloaded resonant frequency	17	12	7	4.5	17	12	7	4.5	3	kHz	±20%
Push/pull force capacity	2000/300	2000/300	2000/300	2000/300	4500/500	4500/500	4500/500	4500/500	4500/500	N	Max.
Shear force limit	15	10	10	10	60	36	23	23	23	N	
Torque limit (on tip)	0.5	0.5	0.5	0.5	1	1	1	1	1	Nm	
Drive properties											
Electrical capacitance	47	90	180	370	130	250	500	1000	1500	nF	±20%
Dynamic operating current coefficient	5	5	5	5	13	13	13	13	13	μA/(Hz • μm)	±20%
Miscellaneous											
Mass (with cable)	110	120	150	210	170	200	250	370	480	g	±5%

* Requires SGS sensor. SGS versions are shipped with performance reports

** Measured with an Interferometer. The resolution of piezo actuators is not limited by stiction or friction

*** Dynamic small-signal stiffness is ~50% higher

Piezo ceramic type: PICA™ Power

Operating temperature range: -40 to +80 °C

Recommended controller/driver see p. 2-100 ff

For maximum lifetime, voltages in excess of 750 V should be applied only for short durations

See Notes (Technical Data) for further information (p. 1-106 ff)

Ultra-High-Force Piezo Stack Linear Actuators, Preloaded

Preloaded High-Load Piezo Actuators (HVPZT) w/ Sensor Option



High-load piezo actuators P-235.1S, .4S and .9S, P-225.8S and .1S (from left) with CD for size comparison

- **Extremely High Stiffness**
- **Pushing Forces to 30,000 N**
- **Pulling Forces to 3500 N**
- **Travel Ranges to 180 μm**
- **Options: Versions for Vacuum, High- and Low-Temperatures and with Water-Resistant Case**

P-225 and P-235 are preloaded, high-load piezo actuators (translators) for static and dynamic applications. They provide sub-millisecond re-sponse and sub-nanometer resolution.

These ultra-high-force linear

Application Examples

- Precision engineering / micromechanics
- Adaptive mechanics
- Active vibration damping
- Adaptronics
- Static and dynamic precision positioning
- Force generation / materials testing

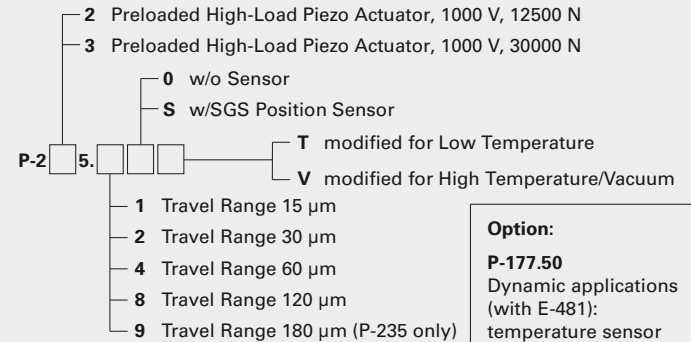
actuators consist of PICA™ Power piezoelectric ceramic-stacks encapsulated in a stainless steel case with stainless steel end pieces and a frictionless internal spring preload. The high load capacity and preload makes them ideal for machining applications and active vibration cancellation.

High Displacement with Ultra-High Reliability

PICA™ Power actuators are optimized for high-temperature working conditions and high-duty-cycle dynamic applications.

All PICA™ piezo ceramics are specifically designed for high-duty-cycle applications. With PI's extensive applications knowledge, gained over sever-

Ordering Information



Please read "Options and Accessories" (page 1-102 ff) for further information.
Extensions cables, adapters & connectors: "Accessories" in the "Piezo Drivers / Servo Controllers" (see p. 2-168 ff) section.

Option:

P-177.50
Dynamic applications (with E-481): temperature sensor and protective air for PICA™ HVPZT

P-706.00
Water-resistant case

al decades, performance does not come at the price of reliability. All materials used are specifically matched for robustness and lifetime. Endurance tests on PICA™ actuators prove consistent performance, even after billions (1,000,000,000) of cycles.

Open- and Closed-Loop Models for Optimum Dynamics and Linearity

The standard models are ideal for open loop positioning applications. In this mode the actuator displacement is roughly proportional to the applied voltage.

Open-loop operation is ideal for applications where the fastest response and the highest bandwidth are essential. Here, commanding and reading the target position in absolute values is either not important or carried out by an external feedback loop.

For highest positioning accuracy and repeatability, select the factory installed closed-loop option with integrated ultra-high-resolution strain gauge position sensors and operate with PI servo-control electronics. For more information, read

the tutorial "Piezo electrics in Positioning" (see p. 2-169 ff).

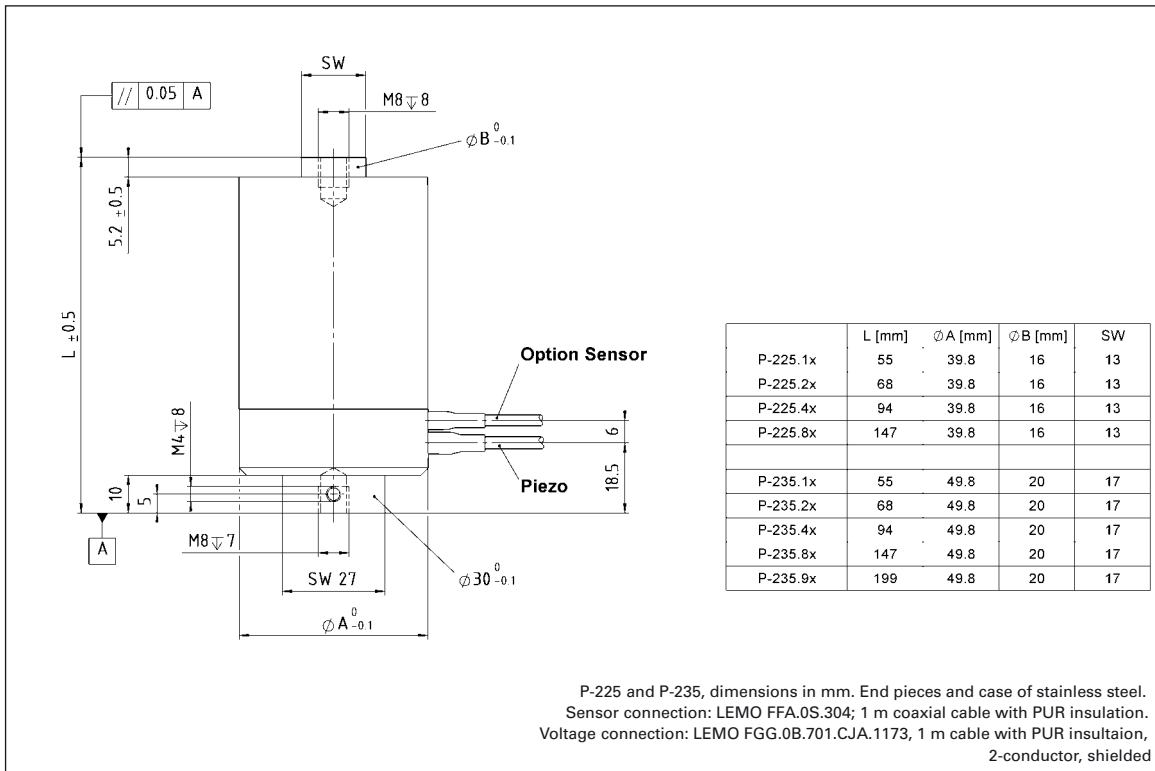
High Flexibility with PI Amplifiers, Drivers & Controllers

PI offers a wide range of control electronics for piezo actuators from economical, low-power piezo drivers to the E-481 high-performance amplifier / controller providing 2000 W of dynamic power.

For closed-loop operation a wide variety of analog and digital controllers is available. The E-500 modular system can be easily upgraded from an amplifier to a servo controller, including different interface / display modules.

Read details in Mounting and Handling Guidelines (p. 1-67).

High-resolution amplifiers and servo-control electronics, both digital and analog, see selection guide in the "Piezo Drivers / Servo Controllers" section (see p. 2-99 ff).



Technical Data

Model	P-225.10	P-225.20	P-225.40	P-225.80	P-235.10	P-235.20	P-235.40	P-235.80	P-235.90	Unit	Tolerance
Operating voltage	0 to 1000	0 to 1000	0 to 1000	0 to 1000	0 to 1000	0 to 1000	0 to 1000	0 to 1000	0 to 1000	V	
Motion and positioning											
Closed-loop travel*	15	30	60	120	15	30	60	120	180	μm	
Closed-loop resolution*/**	0.3	0.6	1.2	2.4	0.3	0.6	1.2	2.4	3.6	nm	typ.
Open-loop resolution**	0.15	0.3	0.6	1.2	0.15	0.3	0.6	1.2	1.8	nm	typ.
Linearity*	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	%	typ.
Mechanical properties											
Static large-signal stiffness***	480	330	200	110	860	600	380	210	150	N/ μm	± 20
Unloaded resonant frequency	14	10	7	4	14	10	7	3,9	2,8	kHz	$\pm 20\%$
Push/pull force capacity	12500 / 2000	12500 / 2000	12500 / 2000	12500 / 2000	30000 / 3500	30000 / 3500	30000 / 3500	30000 / 3500	30000 / 3500	N	Max.
Shear force limit	255	152	84	73	707	420	232	147	147	N	
Torque limit (on tip)	1,5	1,5	1,5	1,5	2	2	2	2	2	Nm	
Drive properties											
El. capacitance	320	630	1300	2600	550	1100	2400	5100	7800	nF	$\pm 20\%$
Dynamic operating current coefficient	33	33	33	33	65	65	65	65	65	$\mu\text{A}/(\text{Hz} \cdot \mu\text{m})$	$\pm 20\%$
Miscellaneous											
Mass (with cable)	410	470	610	900	580	690	940	1400	1900	g	$\pm 5\%$

*Requires SGS sensor. SGS versions are shipped with performance reports

**Measured with an interferometer. The resolution of piezo actuators is not limited by stiction or friction

***Dynamic small-signal stiffness is ~50 % higher

Piezo ceramic type: PICA™ Power

Operating temperature range: -40 to +80 °C

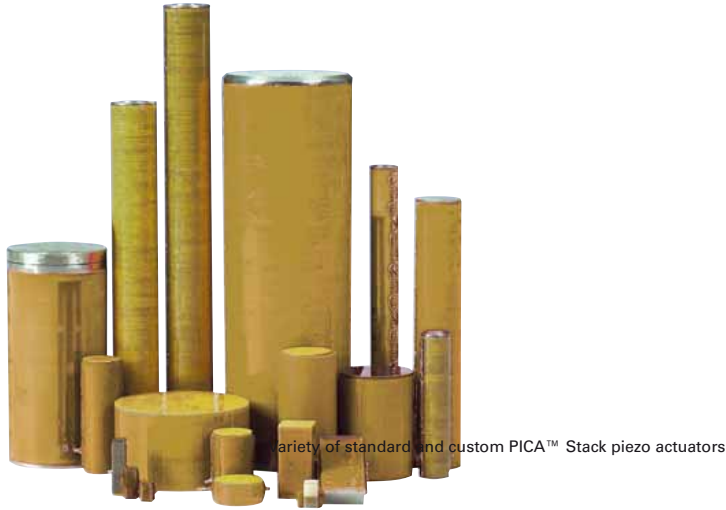
Recommended controller/driver see p. 2-100 ff

For maximum lifetime, voltages in excess of 750 V should be applied only for short durations

See Notes (Technical Data) for further information (see p. 1-106 ff)

PICA™ Stack High Force Piezo Linear Actuators

Piezo actuator for highly dynamic applications



variety of standard and custom PICA™ Stack piezo actuators

- High Load Capacity to 100 kN
- High Force Generation to 80 kN
- Large Cross Sections to 56 mm Diameter
- A selection of Variety of Shapes
- Extreme Reliability >10⁹ Cycles
- Sub-Millisecond Response, Sub-Nanometer Resolution
- Vacuum-Compatible Versions

PICA™ Stack piezo ceramic actuators are offered in a large variety of standard shapes and sizes with additional custom designs to suit any application.

Ultra-High Reliability, High Displacement, Low Power Requirements

PICA™ piezo actuators are specifically designed for high-duty-cycle applications. With our extensive applications

Application Examples

- Nanopositioning
- High-load positioning
- Precision mechanics / -machining
- Semiconductor technology / test systems
- Laser tuning
- Switches
- Smart structures (Adaptronics)

knowledge, gained over several decades, we know how to build performance that does not come at the price of reliability. All materials used are specifically matched for robustness and lifetime. Endurance tests on PICA™ actuators prove consistent performance, even after billions (1,000,000,000) of cycles. The combination of high displacement and low electrical capacitance provides for excellent dynamic behavior with reduced driving power requirements.



Standard actuators are covered with heat-shrink tube, shown here is the model P-025.40

Flexibility / Short Leadtimes

All manufacturing processes at PI Ceramic are set up for flexibility. Should our standard actuators not fit your application, let us provide you with a custom design. Our engineers will work with you to find the optimum solution at a very attractive price, even for small quantities. Some of our custom capabilities are listed below:

- Custom Materials
- Custom Voltage Ranges
- Custom Geometries (Circular, Rectangular, Triangular, Layer Thickness ...)
- Custom Load / Force Ranges
- Custom Flat or Spherical Endplates (Alumina, Glass, Sapphire, ...)
- Extra-Tight Length Tolerances
- Integrated Piezoelectric Sensor Discs
- Special High / Low Temperature Versions
- Vacuum Compatible Versions

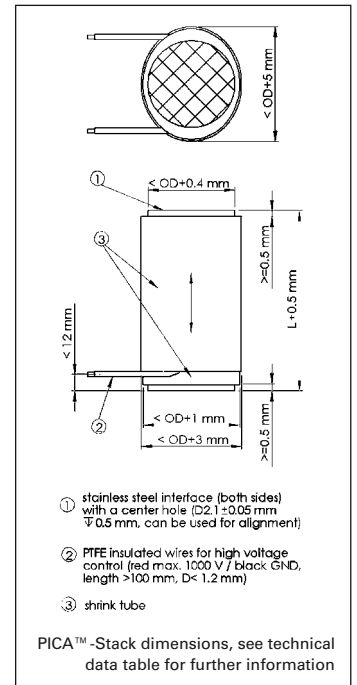
Because all piezoelectric materials used in PICA™ actuators are manufactured at PI Ceramic, leadtimes are short and quality is outstanding. All standard and custom actuators are delivered with performance test sheets.

Piezo Drivers, Controllers & High-Voltage Amplifiers

High-resolution amplifiers and servo-control electronics, both

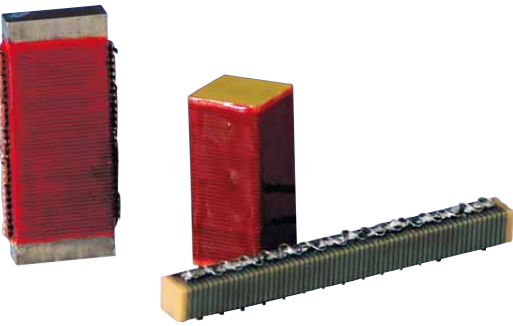


Custom PICA™-Stack actuator with 350 µm displacement

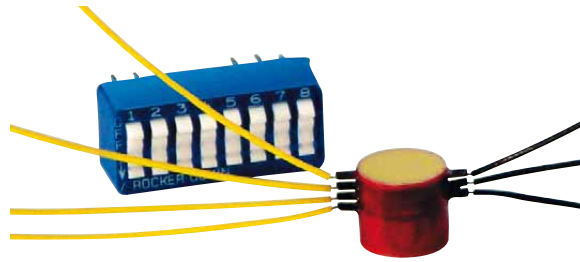


digital and analog, are described in the "Piezo Drivers / Servo Controllers" (see p. 2-99 ff) section.

PICA™ Stack piezo actuators are delivered with metal endcaps for improved robustness and reliability. For preloaded versions with steel casings (see p. 1-78, p. 1-80).



Custom PICA™-Stack actuators with rectangular cross-sections.



Custom PICA™-Stack actuator, each layer wired individually.

Technical Data / Product Order Numbers

Order number	Displacement [μm] -10/+20%	Diameter D [mm]	Length L [mm] ±0.5	Blocking force [N]	Stiffness [N/μm]	Capacitance [nF] ±20%	Resonant frequency [kHz]
P-007.00	5	7	8	650	130	11	126
P-007.10	15	7	17	850	59	33	59
P-007.20	30	7	29	1000	35	64	36
P-007.40	60	7	54	1150	19	130	20
P-010.00	5	10	8	1400	270	21	126
P-010.10	15	10	17	1800	120	64	59
P-010.20	30	10	30	2100	71	130	35
P-010.40	60	10	56	2200	38	260	20
P-010.80	120	10	107	2400	20	510	10
P-016.10	15	16	17	4600	320	180	59
P-016.20	30	16	29	5500	190	340	36
P-016.40	60	16	54	6000	100	680	20
P-016.80	120	16	101	6500	54	1300	11
P-016.90	180	16	150	6500	36	2000	7
P-025.10	15	25	18	11000	740	400	56
P-025.20	30	25	30	13000	440	820	35
P-025.40	60	25	53	15000	250	1700	21
P-025.80	120	25	101	16000	130	3400	11
P-025.90	180	25	149	16000	89	5100	7
P-025.150	250	25	204	16000	65	7100	5
P-025.200	300	25	244	16000	54	8500	5
P-035.10	15	35	20	20000	1300	700	51
P-035.20	30	35	32	24000	810	1600	33
P-035.40	60	35	57	28000	460	3300	19
P-035.80	120	35	104	30000	250	6700	11
P-035.90	180	35	153	31000	170	10000	7
P-045.20	30	45	33	39000	1300	2800	32
P-045.40	60	45	58	44000	740	5700	19
P-045.80	120	45	105	49000	410	11000	10
P-045.90	180	45	154	50000	280	17000	7
P-050.20	30	50	33	48000	1600	3400	32
P-050.40	60	50	58	55000	910	7000	19
P-050.80	120	50	105	60000	500	14000	10
P-050.90	180	50	154	61000	340	22000	7
P-056.20	30	56	33	60000	2000	4300	32
P-056.40	60	56	58	66000	1100	8900	19
P-056.80	120	56	105	76000	630	18000	10
P-056.90	180	56	154	78000	430	27000	7

Standard piezo ceramic type: PIC 151
 Recommended preload for dynamic operation: 15 MPa
 Maximum preload for constant force: 30 MPa
 Resonant frequency at 1 V_{pp}, unloaded, free at both sides. The value is halved for unilateral clamping
 Capacitance at 1 V_{pp}, 1 kHz blocking force at 1000 V
 Operating voltage: 0 to 1000 V
 Operating temperature range: -20 to +85 °C
 Standard mechanical interfaces: steel plates, 0.5 to 2 mm thick (depends on model)
 Standard electrical interfaces: two PTFE-insulated wires, pigtail length 100 mm
 Available options: integrated piezo force sensor or strain gauge sensors, non magnetic, vacuum compatible, etc.
 Other specifications on request.

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

Request or download the complete PI Nanopositioning & Piezo Actuator Catalog



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