

# PICMA® Stack Multilayer Piezo Actuators

CERAMIC-INSULATED HIGH-POWER ACTUATORS



## P-882 – P-888

- Superior lifetime
- High stiffness
- UHV-compatible to  $10^{-9}$  hPa
- Microsecond response
- Sub-nanometer resolution
- Large choice of designs

### Patented PICMA® Stack multilayer piezo actuators with high reliability

Operating voltage -20 to 120 V. Ceramic insulation, polymer-free. Humidity resistance. UHV-compatible to  $10^{-9}$  hPa, no outgassing, high bakeout temperature. Encapsulated versions for operation in splash water or oil

### Custom designs with modified specifications

- For high operating temperature up to 200°C
- Special electrodes for currents of up to 20 A
- Variable geometry: Inner hole, round, rectangular
- Ceramic or metal end pieces in many versions
- Applied SGS sensors for positional stability

### Fields of application

Research and industry. Cryogenic environment with reduced displacement. For high-speed switching, precision positioning, active and adaptive systems

### Suitable drivers

E-610 Piezo Amplifier / Controller  
E-617 High-Power Piezo Amplifier  
E-831 OEM Piezo Amplifier Module

### Valid patents

German Patent No. 10021919C2  
German Patent No. 10234787C1  
German Patent No. 10348836B3  
German Patent No. 102005015405B3  
German Patent No. 102007011652B4  
US Patent No. 7,449,077  
Japan Patent No. 4667863  
China Patent No. ZL03813218.4

Order number*	Dimensions A x B x L [mm]	Nominal displacement [μm] (0 – 100 V)	Max. displacement [μm] (0 – 120 V)	Blocking force [N] (0 – 120 V)	Stiffness [N/μm]	Electrical capacitance [μF] ±20%	Resonant frequency [kHz] ±20%
P-882.11	3 × 2 × 9	6.5 ±20%	8 ±20%	190	24	0.15	135
P-882.31	3 × 2 × 13.5	11 ±20%	13 ±20%	210	16	0.22	90
P-882.51	3 × 2 × 18	15 ±10%	18 ±10%	210	12	0.31	70
P-883.11	3 × 3 × 9	6.5 ±20%	8 ±20%	290	36	0.21	135
P-883.31	3 × 3 × 13.5	11 ±20%	13 ±20%	310	24	0.35	90
P-883.51	3 × 3 × 18	15 ±10%	18 ±10%	310	18	0.48	70
P-885.11	5 × 5 × 9	6.5 ±20%	8 ±20%	800	100	0.6	135
P-885.31	5 × 5 × 13.5	11 ±20%	13 ±20%	870	67	1.1	90
P-885.51	5 × 5 × 18	15 ±10%	18 ±10%	900	50	1.5	70
P-885.91	5 × 5 × 36	32 ±10%	38 ±10%	950	25	3.1	40
P-887.31	7 × 7 × 13.5	11 ±20%	13 ±20%	1700	130	2.2	90
P-887.51	7 × 7 × 18	15 ±10%	18 ±10%	1750	100	3.1	70
P-887.91	7 × 7 × 36	32 ±10%	38 ±10%	1850	50	6.4	40
P-888.31	10 × 10 × 13.5	11 ±20%	13 ±20%	3500	267	4.3	90
P-888.51	10 × 10 × 18	15 ±10%	18 ±10%	3600	200	6.0	70
P-888.91	10 × 10 × 36	32 ±10%	38 ±10%	3800	100	13.0	40

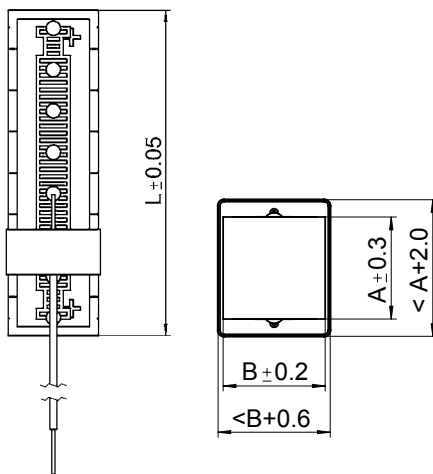
\* For optional solderable contacts, change order number extension to .x0 (e. g. P-882.10).

Piezo ceramic type: PIC 252.  
Standard electrical interfaces: PTFE-insulated wire leads, 100 mm, P-882, P-883:

AWG 32 (Ø 0.49 mm); P-885, P-887, P-888: AWG 30 (Ø 0.61 mm).  
Recommended preload for dynamic operation: 15 MPa.  
Maximum preload for constant force: 30 MPa.

Resonant frequency at  $1 V_{pp}$  unloaded, free on both sides. The value is halved for unilateral clamping.  
Capacitance at  $1 V_{pp}$ , 1 kHz, RT.  
Operating voltage: -20 to 120 V.

Operating temperature range: -40 to 150°C.  
Custom designs or different specifications on request.



PICMA® Stack actuators, L, A, B see table

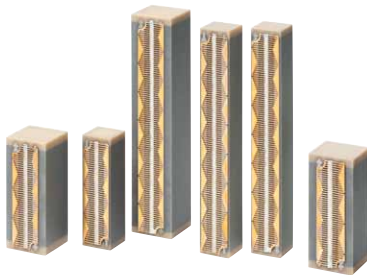
# Custom Designs

## PICMA® STACK PIEZO ACTUATORS



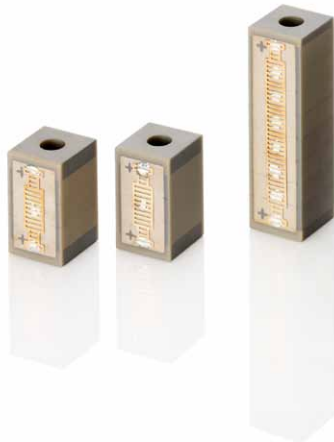
### Variety of tips

Spherical tips. PI Ceramic has suitable tips with standard dimensions in stock and mounts them prior to delivery. Application-specific tips can be manufactured on request.



### PICMA® Actuators for maximum dynamics

For high-dynamics applications, the multilayer actuators are equipped with electrodes for especially high currents of up to 20 A. Together with a high-performance switching driver such as the E-618, high operating frequencies in the kHz range can be attained. The rise times for the nominal displacement are a few tens of microseconds.



### PICMA® Multilayer actuators with ceramic-insulated inner hole

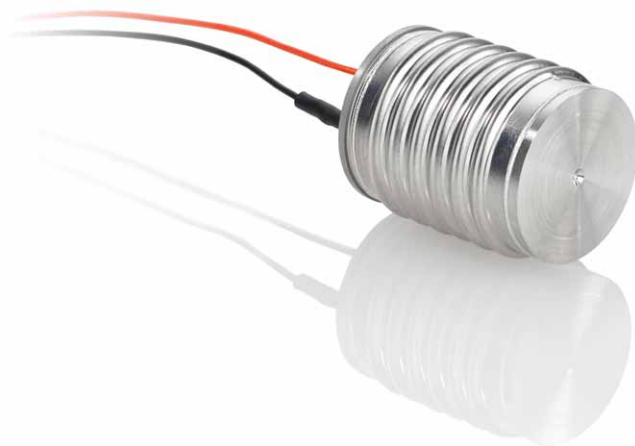
A new technology allows multilayer piezo actuators to be manufactured with an inner hole. Using special manufacturing methods the holes are already made in the unsintered actuator. As with the PICMA® standard actuators, the co-firing process of the ceramics and the internal electrodes is used to create the ceramic encapsulation which protects the piezo actuator against humidity and considerably increases its lifetime compared to conventional polymer-insulated piezo actuators. PICMA® stack actuators with an inner hole are ideally suited for applications such as fiber stretching. PICMA® actuators with holes are manufactured on request.

### High operating temperature of up to 200°C

For especially high-dynamics applications or high ambient temperatures, there are PICMA® multilayer actuator versions that can reliably function at temperatures of up to 200°C.

# Encapsulated PICMA® Stack Piezo Actuators

FOR TOUGH INDUSTRIAL ENVIRONMENTS



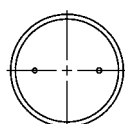
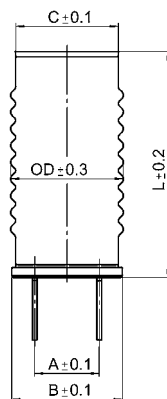
## P-885 • P-888

- Splash-resistant full encapsulation
- Superior lifetime
- High stiffness
- UHV-compatible to  $10^{-9}$  hPa
- Microsecond response
- Sub-nanometer resolution
- Large choice of designs

### Encapsulated PICMA® Stack multilayer piezo actuators with inert gas filling

Operating voltage -20 to 120 V. UHV-compatible to  $10^{-9}$  hPa. Version for operation in environments where exposure to splash water, high humidity or oil occurs

	A [mm]	B [mm]	C [mm]
P-885.XX	6.40	11.00	10.25
P-888.XX	12.00	17.50	16.85



Encapsulated PICMA® actuators, dimensions in mm

Order number*	Dimensions OD x L [mm]	Nominal displacement [ $\mu\text{m}$ ] (0 – 100 V)	Max. displacement [ $\mu\text{m}$ ] (0 – 120 V)	Blocking force [N] (0 – 120 V)	Stiffness [N/ $\mu\text{m}$ ]	Electrical capacitance [ $\mu\text{F}$ ] $\pm 20\%$	Resonant frequency [kHz] $\pm 20\%$
P-885.55	11.2 x 22.5	14 $\pm 10\%$	17 $\pm 10\%$	850	50	1.5	60
P-885.95	11.2 x 40.5	30 $\pm 10\%$	36 $\pm 10\%$	900	25	3.1	35
P-888.55	18.6 x 22.5	14 $\pm 10\%$	17 $\pm 10\%$	3400	200	6.0	60

Piezo ceramic type: PIC 252.  
Standard electrical interfaces: PTFE-insulated wire leads, 100 mm, AWG 30 ( $\varnothing$  0.61 mm).  
Resonant frequency at  $1 V_{pp}$ , unloaded, free on both sides. The value is halved for unilateral

clamping. Capacitance at  $1 V_{pp}$ , 1 kHz, RT. Operating voltage: -20 to 120 V. Operating temperature range: -40 to 150°C. Ask about custom designs!



Encapsulated PICMA® Stack actuators can also be used when the application environment is characterized by oil, splash water or continuously high humidity. The piezo actuators are surrounded by inert gas