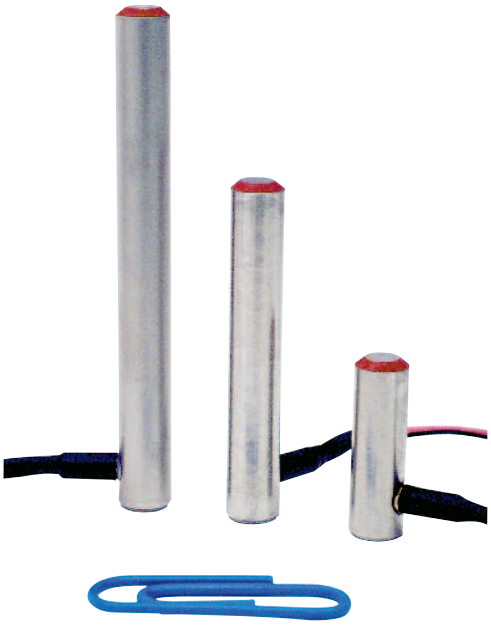
P-810 · P-830 Piezo Actuators

For Light and Medium Loads



P-810 piezo actuators

P-830 piezo actuators

- **Outstanding Lifetime Due to PICMA® Piezo Ceramics**
- **Travel Range to 60 µm**
- **Pushing Forces to 1000 N**
- **Pulling Forces to 5 N**
- **Sub-Millisecond Response**
- **Sub-Nanometer Resolution**

The P-810 and P-830 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
- Fiber positioning
- Laser tuning
- Patch-Clamp
- Nanotechnology

Design

These actuators consist of a highly reliable monolithic multilayer piezoceramic stack protected by a stainless steel case. PI offers a variety of preloaded translators for applications involving higher tensile loads (see the "Selection Guide" on p. 1-62).

Ceramic Insulated Piezo Actuators Provide Long Lifetime

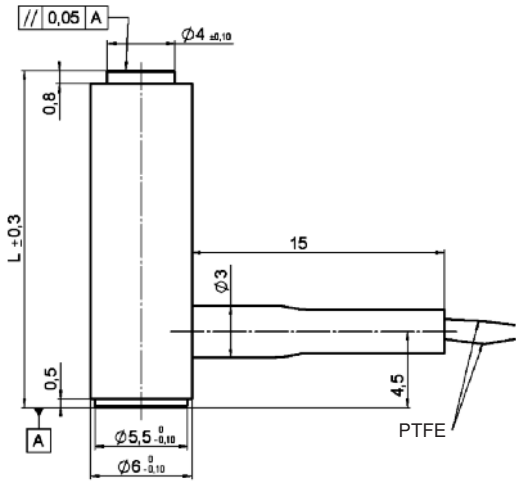
Highest possible reliability is assured by the use of award-winning PICMA® multilayer piezo actuators. PICMA® actuators are the only actuators on the market with ceramic-only insulation, which makes them resistant to ambient humidity and leakage-current failures. They are thus far superior to conventional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

Mounting

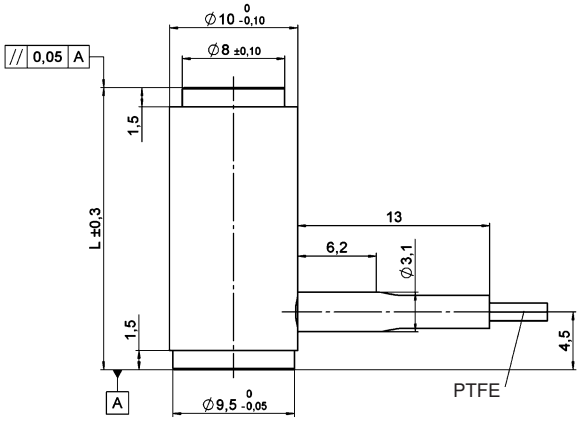
Attachment is realized via the ferromagnetic end surfaces, with epoxy or magnets.
Read details in Mounting and Handling Guidelines (p. 1-67).
For extensions, adapter cables and connectors, see "Accessories" (p. 2-168 *ff*).

Piezo Drivers, Controllers & Amplifiers

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



P-810 dimensions in mm. Two 0.1 m long teflon insulated pigtails. Length L: see table. Max. torque at top piece: 0.08 Nm.



P-830 dimensions in mm. Two 0.1 m long teflon insulated pigtails. Length L: see table. Max. torque at top piece: 0.2 Nm.

Technical Data and Product Order Numbers

Order number	Travel range for 0 to 100 V [µm] ±20 %	*Resolution [nm]	**Static large-signal stiffness [N/µm] ±20 %	Push- / pull force capacity [N]	Electrical capacitance [µF] ±20 %	Dynamic operating current coefficient [µA / (Hz • µm)]	Resonant frequency (unloaded) [kHz] ±20 %	Mass [g] ±5 %	Length L [mm] ±0.3
P-810.10	15	0.15	14	50 / 1	0.3	3.0	22	4	20
P-810.20	30	0.3	7	50 / 1	0.7	3.0	15	6	38
P-810.30	45	0.45	4	50 / 1	1.0	3.0	12	8	56
P-830.10	15	0.15	57	1000 / 5	1.5	12.5	23	10	22
P-830.20	30	0.3	27	1000 / 5	3.0	12.5	14	16	40
P-830.30	45	0.45	19	1000 / 5	4.5	12.5	10	21	58
P-830.40	60	0.6	15	1000 / 5	6.0	12.5	8.5	27	76

*The resolution of piezo actuators is not limited by stiction or friction. Value given is noise equivalent motion with E-503 amplifier (p. 2-144)
**Dynamic small-signal stiffness is ~ 30 % higher. Operating temperature range: -20 to 120° C. Case: non-magnetic steel; end pieces: stainless steel. Recommended preload for dynamic operation: 10–20 MPa.
Recommended amplifiers / controllers
One channel: E-831 amplifier (p. 2-164), E-610 amplifier / controller (p. 2-110)
Multi-channel: E-663 amplifier (p. 2-136)

P-820 Preloaded Piezo Actuators

For Light and Medium Loads

P-820.10 and P-820.30 piezo actuators

- **Outstanding Lifetime Due to PICMA® Piezo Ceramic Stacks**
- **Travel Range to 45 µm**
- **Pushing Forces to 50 N**
- **Pulling Forces to 10 N**
- **Sub-Millisecond Response, Sub-Nanometer Resolution**
- **Versions with Ball Tip**

The P-820 series piezo translators are high resolution linear actuators for static and dynamic applications. They provide submillisecond response and subnanometer resolution.

Design

These actuators consist of a friction-free, preloaded monolithic piezo ceramic stack integrated in a stainless steel housing.

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.

Mounting

Mounting is at the foot, with push/pull forces of less than 3 N, the actuator can be held by clamping the case. The versions with ball tip decouple torque and off-center forces from the piezo ceramic.
Read details in Mounting and Handling Guidelines (s. p. 1-67).

Accessories

To provide magnetic coupling, the P-176.30 magnetic adapter can be glued on (only for versions without ball tip).
P-176.30 Magnetic Adapter
For extensions, adapter cables and connectors, see "Accessories" in the piezo electronics chapter (s. p. 2-168 *ff*).

Piezo Drivers, Controllers & Amplifiers

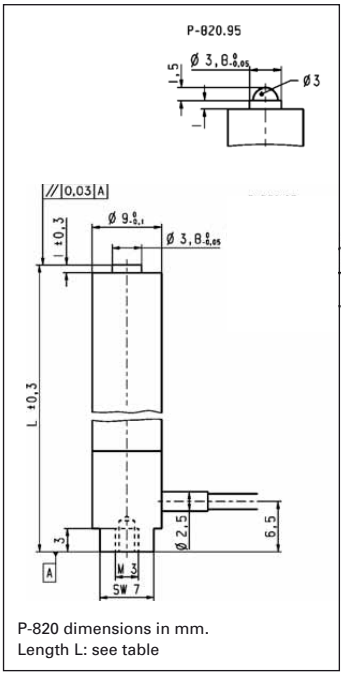
High-resolution amplifiers and servo-control electronics, both digital and analog, are described in the "Piezo Drivers / Servo Controllers" (s. p. 2-99 *ff*) section.

Ordering Information

Preloaded Piezo Actuator, 50/10 N

P-820. ☐☐

- **1** 15 µm Travel Range
- **2** 30 µm Travel Range
- **0** without Ball Tip
- **B** with Ball Tip



P-820 dimensions in mm.
Length L: see table

Application Examples

- Static and dynamic precision positioning
- Fiber positioning
- Laser tuning
- Nanotechnology

Technical Data

Model	P-820.10 P-820.1B	P-820.20 P-820.2B	P-820.30 P-820.3B	Units
Displacement at 0 to 100 V	15	30	45	µm ±20 %
*Resolution	0.15	0.3	0.45	nm
**Static large-signal stiffness	13	7	4	N/µm ±20 %
Push/pull force capacity	50 / 10	50 / 10	50 / 10	N
Max. torque limit (on tip)	0.08	0.08	0.08	Nm
Electrical capacitance	0.3	0.7	1.0	µF ±20 %
Dynamic operating current coefficient (DOCC)	3.0	3.0	3.0	µA / (Hz • µm)
Unloaded resonant frequency f_0	22	15	12	kHz ±20 %
Operating temperature	-20 to +80	-20 to +80	-20 to +80	°C
Mass	8	11	14	g ±5 %
Material: case, end pieces	N-S	N-S	N-S	
Length L	26	44	62	mm ±0.3

*The 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.
Recommended amplifiers / controllers
One channel: E-610 controller / amplifier (p. 2-110)
Modular system E-500 (p. 2-142) with amplifier module E-503 (multi-channel) (p. 2-146)
Multi-channel: E-663 amplifier (p. 2-136)

P-840 · P-841 Preloaded Piezo Actuators

Optional with Integrated Position Sensor

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

Ordering Information

Preloaded Piezo Actuator, 1000/50 N

P-84□.□□(V)

- **0** No Sensor
- **1** SGS Sensor

- **1** 15 µm Travel Range
- **2** 30 µm Travel Range
- **3** 45 µm Travel Range
- **4** 60 µm Travel Range
- **6** 90 µm Travel Range

- **0** without Ball Tip
- **B** with Ball Tip

V: Vacuum Compatible to 10^{-6} hPa

- **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.

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).

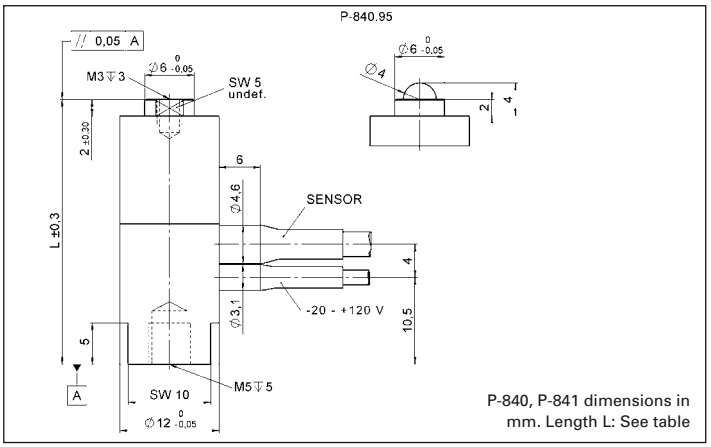
Read details in Mounting and Handling Guidelines (p. 1-67).

High Accuracy in Closed-Loop Operation

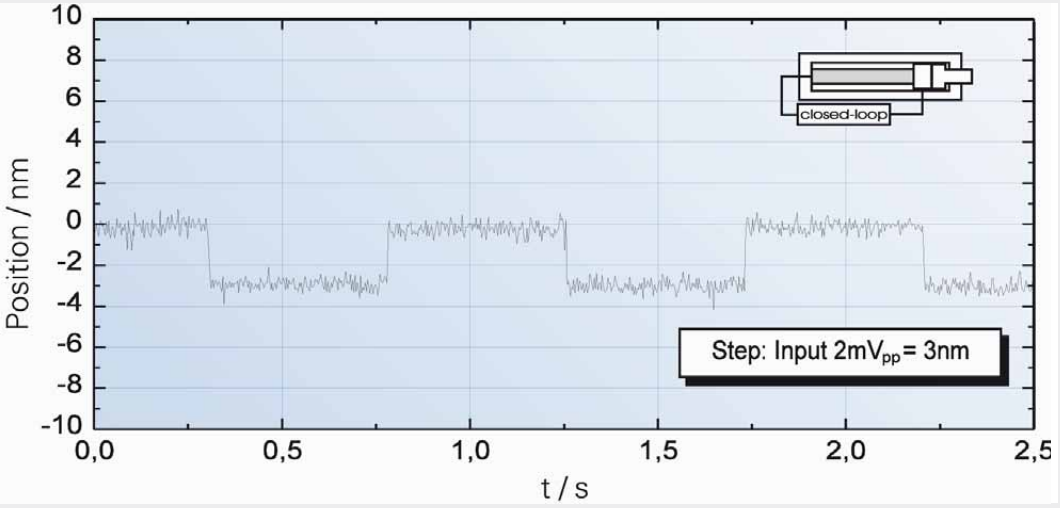
The standard model P-840 is designed for open-loop positioning. Version P-841 with integrated high-resolution strain gauge position sensors provides high precision for closed-loop operation (further details see p. 2-199).

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.



P-840, P-841 dimensions in mm. Length L: See table



Response of a P-841.10 to a 3 nm peak-to-peak square wave control input signal, measured with servo-control bandwidth set to 240 Hz and 2 msec setting time.

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	µm ±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	N/µm ±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	µF ±20%
Dynamic operating current coefficient (DOCC)	12.5	12.5	12.5	12.5	12.5	µA / (Hz • µm)
Unloaded resonant frequency fo	18	14	10	8.5	6	kHz ±20%
Operating temperature	-20 to +80	-20 to +80	-20 to +80	-20 to +80	-20 to +80	°C
Mass without cables	20	28	46	54	62	g ±5%
Material: case, end pieces	N-S	N-S	N-S	N-S	N-S	
Length L	32	50	68	86	122	mm ±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)