

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 sub-millisecond response and sub-nanometer 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® multi-

layer 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

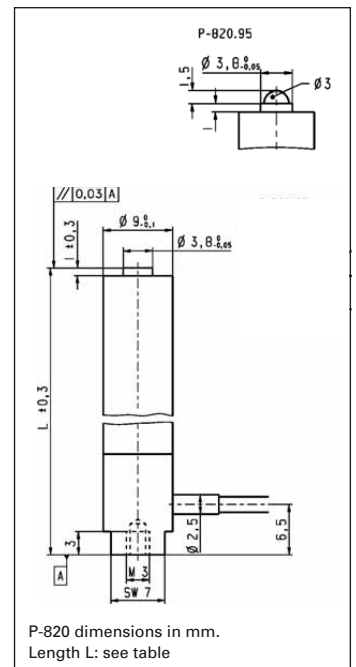
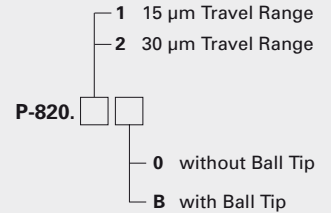
To provide magnetic coupling, the P-176.30 magnetic adapter can be glued on (only for versions without ball tip). P-176.30 Magnetic Adapter For extensions, adapter cables and connectors, see "Accessories" in the piezo electronics chapter (s. p. 2-168 ff).

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



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	$\mu\text{m} \pm 20\%$
*Resolution	0.15	0.3	0.45	nm
**Static large-signal stiffness	13	7	4	N/ $\mu\text{m} \pm 20\%$
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	$\mu\text{F} \pm 20\%$
Dynamic operating current coefficient (DOCC)	3.0	3.0	3.0	$\mu\text{A} / (\text{Hz} \cdot \mu\text{m})$
Unloaded resonant frequency f_0	22	15	12	$\text{kHz} \pm 20\%$
Operating temperature	-20 to +80	-20 to +80	-20 to +80	°C
Mass	8	11	14	g $\pm 5\%$
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)

Application Examples

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

P-840 · P-841 Preloaded Piezo Actuators

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

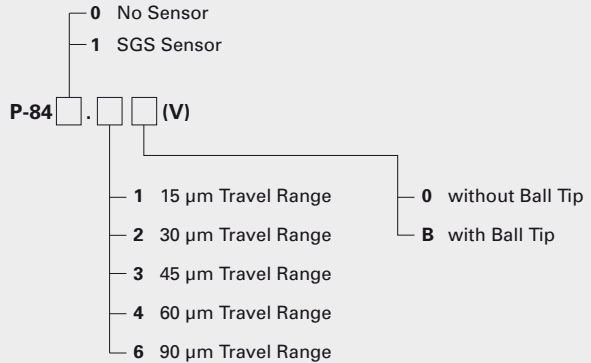
These translators are equipped with highly reliable multilayer piezo ceramic stacks protected by a non-magnetic stainless steel case with internal spring preload. The preload makes them ideal for dynamic applications and for tensile loads as well.

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).

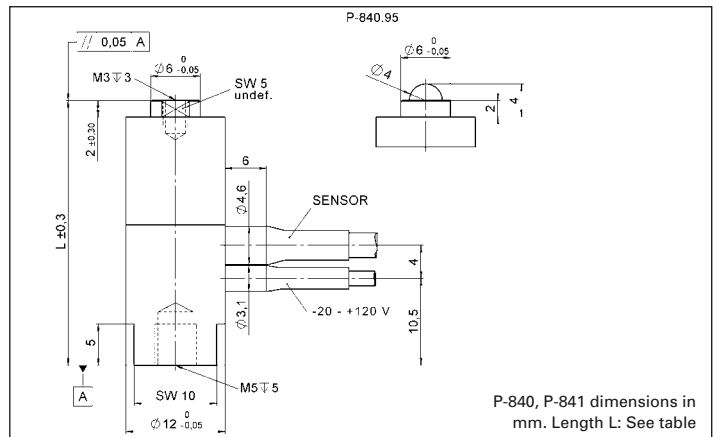
Read details in Mounting and Handling Guidelines (p. 1-67).

High Accuracy in Closed-Loop Operation

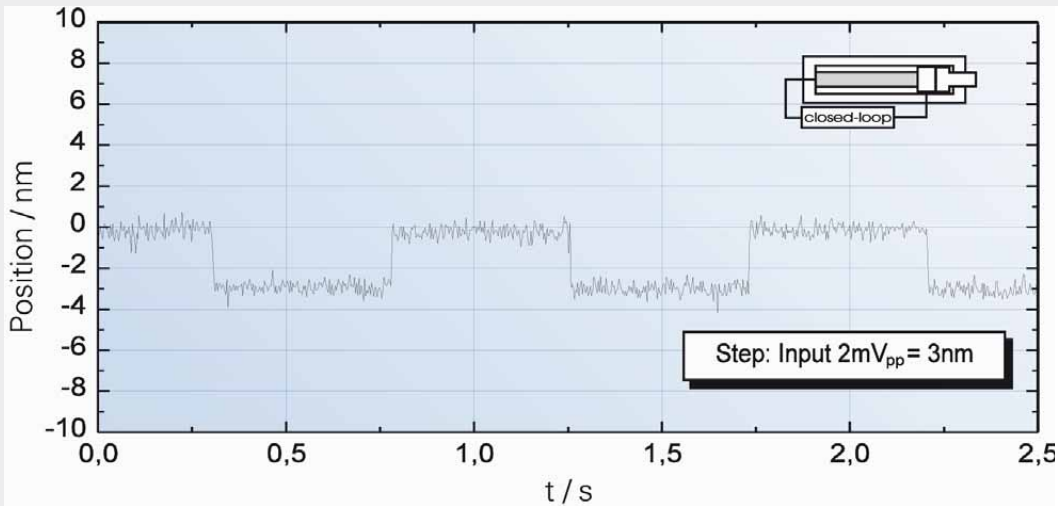
The standard model P-840 is designed for open-loop positioning. Version P-841 with integrated high-resolution strain gauge position sensors provides high precision for closed-loop operation (further details see p. 2-199).

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.



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 settling 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	$\mu\text{m} \pm 20\%$
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)

Linear Actuators & Motors

PiezoWalk® Motors / Actuators

PILine® Ultrasonic Motors

DC-Servo & Stepper Actuators

Piezo Actuators & Components

Guided / Preloaded Actuators

Unpackaged Stack Actuators

Patches/Benders/Tubes/Shear..

Nanopositioning / Piezoelectrics

Nanometrology

Micropositioning

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P-842 – P-845 Preloaded Piezo Actuators

For High Loads and Force Generation, Optional with Integrated Position Sensors



P-844 piezo actuators
(battery for size comparison)

- Outstanding Lifetime Due to PICMA® Piezo Ceramic Stacks
- Travel Range to 90 μm
- Pushing Forces to 3000 N
- Pulling Forces to 700 N
- Sub-Millisecond Response, Sub-Nanometer Resolution
- Vacuum Version, Optional Water-Resistant Case

The P-842 / P-843 and P-844 / P-845 series piezo translators are high-resolution linear actuators for static and dynamic applications. They provide sub-millisecond response and sub-nanometer resolution.

Design

These translators are equipped with PICMA® multilayer piezo ceramic stacks protected by a non-magnetic stainless steel case with internal spring preload. The preload makes them ideal for dynamic applications (such as precision machining, active damping etc.) and for tensile loads as well.

High Accuracy in Closed-Loop Operation

P-842 and P-844 are designed for open-loop positioning or use with external feedback. Versions P-843 and P-845 are equipped with integrated high-resolution SGS-position sensors for high precision in closed-loop operation (for fur-

Application Examples

- Static and dynamic precision positioning
- Disc-drive-testing
- Optics
- Metrology / interferometry
- Smart structures / adaptronics
- Precision mechanics / machining
- Active vibration control
- Switches
- Laser tuning

ther notes see the nanopositioning tutorial, see p. 2-199).

Ceramic Insulated Piezo Actuators Provide Long Lifetime

Highest possible reliability is assured by the use of award-winning PICMA® multilayer piezo actuators. PICMA® actua-

Technical Data and Product Order Numbers

Model	Open-loop travel for 0 to 100 V $[\mu\text{m}] \pm 20\%$	Closed-loop travel $[\mu\text{m}]^*$	Integrated feedback sensor**	Closed-loop / Open-loop resolution $[\text{nm}]^{***}$	Static large-signal stiffness $[\text{N}/\mu\text{m}] \pm 20\%$	Push/pull force capacity [N]	Electrical capacitance $[\mu\text{F}] \pm 20\%$
P-842.10 (V)	15	–	–	- / 0.15	57	800 / 300	1.5
P-842.20 (V)	30	–	–	- / 0.3	27	800 / 300	3.0
P-842.30 (V)	45	–	–	- / 0.45	19	800 / 300	4.5
P-842.40 (V)	60	–	–	- / 0.6	15	800 / 300	6.0
P-842.60 (V)	90	–	–	- / 0.9	10	800 / 300	9.0
P-843.10 (V)	15	15	SGS	0.3 / 0.15	57	800 / 300	1.5
P-843.20 (V)	30	30	SGS	0.6 / 0.3	27	800 / 300	3.0
P-843.30 (V)	45	45	SGS	0.9 / 0.45	19	800 / 300	4.5
P-843.40 (V)	60	60	SGS	1.2 / 0.6	15	800 / 300	6.0
P-843.60 (V)	90	90	SGS	1.8 / 0.9	10	800 / 300	9.0
P-844.10 (V)	15	–	–	- / 0.15	225	3000 / 700	6.0
P-844.20 (V)	30	–	–	- / 0.3	107	3000 / 700	12.0
P-844.30 (V)	45	–	–	- / 0.45	75	3000 / 700	18.0
P-844.40 (V)	60	–	–	- / 0.6	57	3000 / 700	24.0
P-844.60 (V)	90	–	–	- / 0.9	38	3000 / 700	36.0
P-845.10 (V)	15	15	SGS	0.3 / 0.15	225	3000 / 700	6.0
P-845.20 (V)	30	30	SGS	0.6 / 0.3	107	3000 / 700	12.0
P-845.30 (V)	45	45	SGS	0.9 / 0.45	75	3000 / 700	18.0
P-845.40 (V)	60	60	SGS	1.2 / 0.6	57	3000 / 700	24.0
P-845.60 (V)	90	90	SGS	1.8 / 0.9	38	3000 / 700	36.0

