

Piezoelectric

Python™ – Advanced Piezo Bending Actuators

Product data sheet



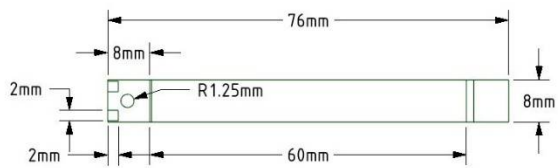
Python™ provides high performance bending actuators designed for applications requiring extremely high reliability. With dual-layer protection technology, Python™ actuators can run more than 1 billion cycles without experiencing any degradation. The Python™ family includes unimorph benders, bimorph benders and energy harvesters. It offers a wide range of displacements up to 1.85mm.

Unimorph

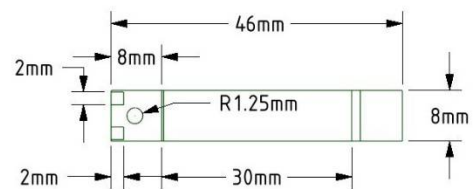
	Unit	Tolerance	PUA3008-5H200	PUA3014-5H200	PUA3020-5H200	PUA6008-5H200	PUA6014-5H200	PUA6020-5H200
Total length	mm	±0.4	46	46	50	76	76	80
PZT length	mm	±0.2	30	30	30	60	60	60
PCB length	mm	±0.2	8	8	10	8	8	10
Width	mm	±0.2	8	14	20	8	14	20
Thickness	mm	±0.1	0.54	0.54	0.54	0.54	0.54	0.54
Dome-height	mm	±0.2	0.45	0.45	0.45	1.3	1.3	1.3
Mass	g	±0.1	0.59	1.12	1.58	1.02	1.83	2.87
Displacement	mm	±15%	-0.15 to 0.42	-0.15 to 0.42	-0.15 to 0.42	-0.68 to 1.85	-0.68 to 1.85	-0.68 to 1.85
Blocking force	N	±15%	0.18	0.3	0.49	0.08	0.14	0.24
Resonance	Hz	±15%	271	271	271	65	65	65

Piezo MAT			PZT-5H	PZT-5H	PZT-5H	PZT-5H	PZT-5H	PZT-5H
Piezo thickness	mm	±10%	0.2	0.2	0.2	0.2	0.2	0.2
Capacitance	nF	±15%	26	45	71	52	90	142
Operating volt	V	-	-90 to +160	-90 to +160	-90 to +160	-90 to +160	-90 to +160	-90 to +160
Operating T	C	-	-20 to 85	-20 to 85	-20 to 85	-20 to 85	-20 to 85	-20 to 85

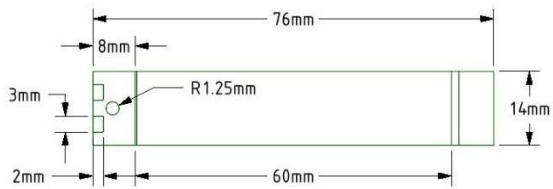
Mechanical dimensions



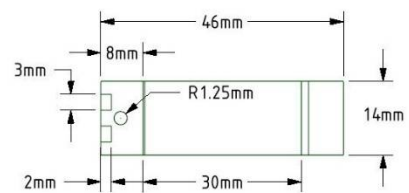
PUA6008-5H200



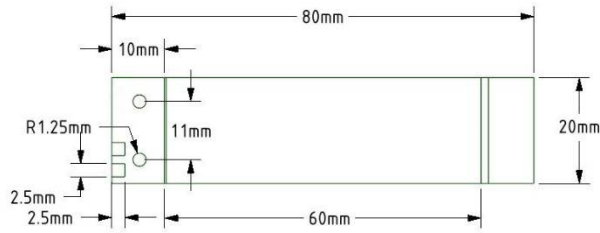
PUA3008-5H200



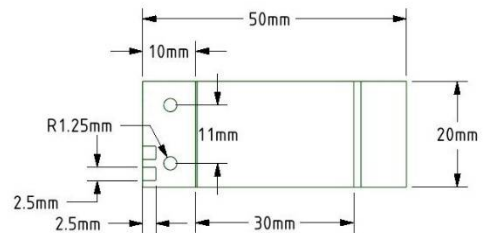
PUA6014-5H200



PUA3014-5H200



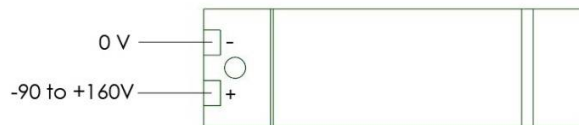
PUA6020-5H200



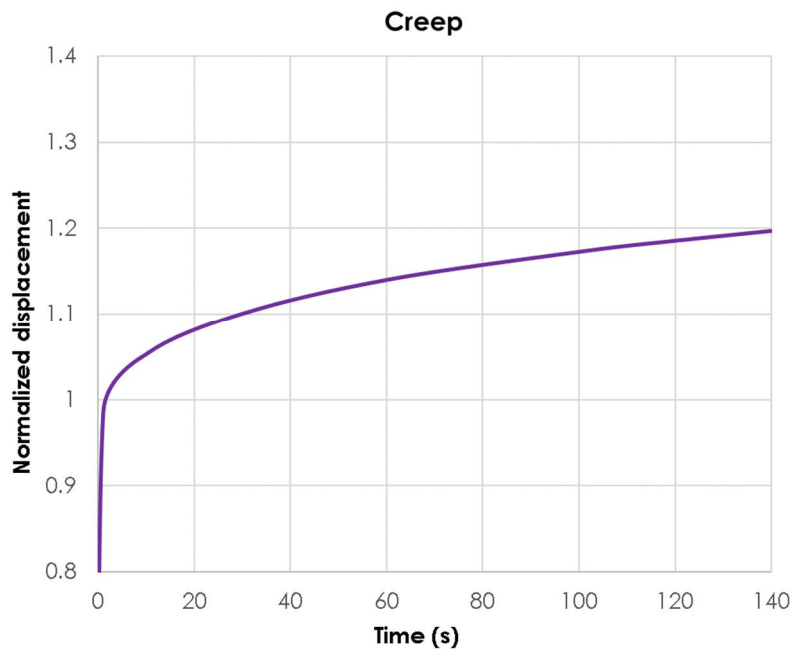
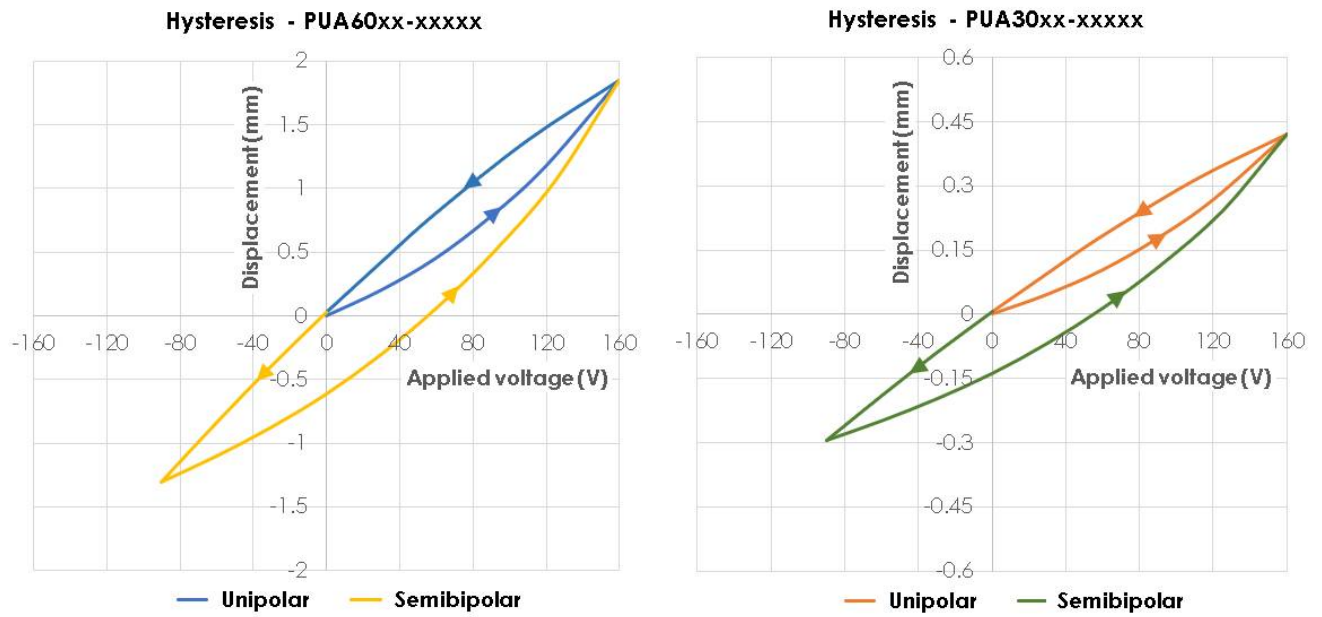
PUA3020-5H200

Electrical connections

Python™ unimorph actuators are designed with two thermally isolated copper pads for wired connections. The actuator can be driven using both unipolar voltages (0 to 160V) or semi-bipolar voltages (-90 to 160V). However, semi-bipolar voltages should be used only in cases where additional displacement is required, since there may be significant hysteresis and energy loss of the actuators when using semi-bipolar voltages.

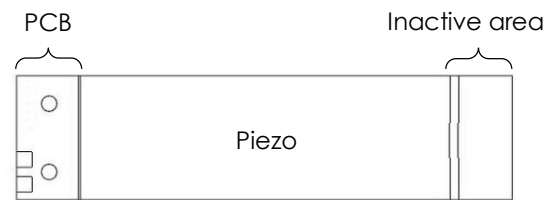
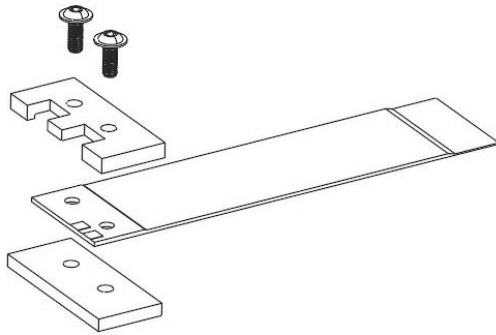


Performance



Mounting instructions

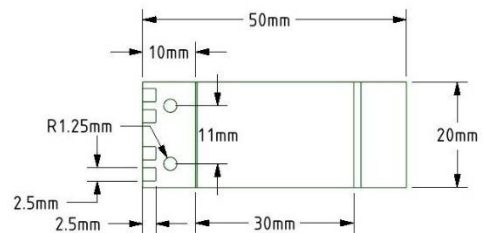
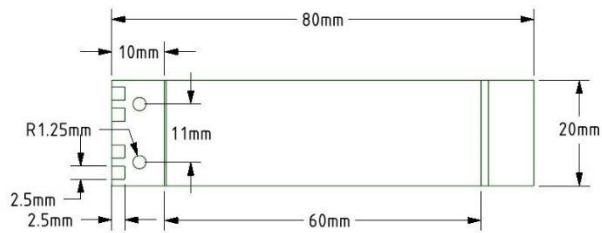
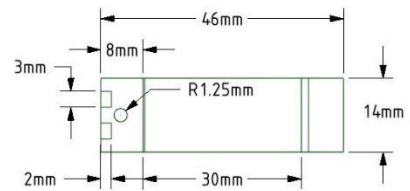
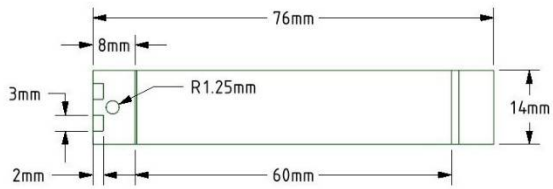
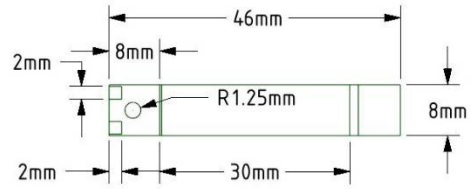
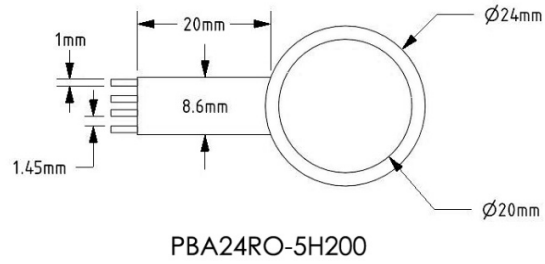
The PCB includes two holes allowing the actuator to be clamped using screws and holders/washers. An example design of the holder (as shown in the picture below) can be provided upon request. Clamping force should be applied to the PCB area only, as excessive clamping directly on the piezo layer may damage it. Another mounting method is to use epoxy, which should also be applied to the PCB area only. Note that there is also an inactive area at the other end of the actuator for any further mechanical integration. This area can be drilled, machined, or removed entirely if needed.



Bimorph

	Unit	Tolerance	PBA24RO-5H200	PBA3008-5H200	PBA3014-5H200	PBA3020-5H200	PBA6008-5H200	PBA6014-5H200	PBA6020-5H200
Total length	mm	±0.4	24 (dia.)	46	46	50	76	76	80
PZT length	mm	±0.2	20 (dia.)	30	30	30	60	60	60
PCB length	mm	±0.2		8	8	10	8	8	10
Width	mm	±0.2		8	14	20	8	14	20
Thickness	mm	±0.1	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Dome-height	mm	±0.2	0	0	0	0	0	0	0
Mass	g	±0.1	1.24	0.82	1.52	2.35	1.54	2.84	4.23
Displacement	mm	±15%	±0.046	±0.39	±0.43	±0.48	±1.34	±1.52	±1.69
Blocking force	N	±15%	1.42	0.15	0.29	0.48	0.07	0.14	0.23
Resonance	Hz	±15%	8640	219	219	219	58	58	58
Piezo MAT			PZT-5H	PZT-5H	PZT-5H	PZT-5H	PZT-5H	PZT-5H	PZT-5H
PZT thickness	mm	±10%	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Capacitance	nF	±15%	76	52	90	142	104	180	284
Operating volt	V	-	-90 to +160	-90 to +160	-90 to +160	-90 to +160	-90 to +160	-90 to +160	-90 to +160
Operating T	C	-	-20 to 85	-20 to 85	-20 to 85	-20 to 85	-20 to 85	-20 to 85	-20 to 85

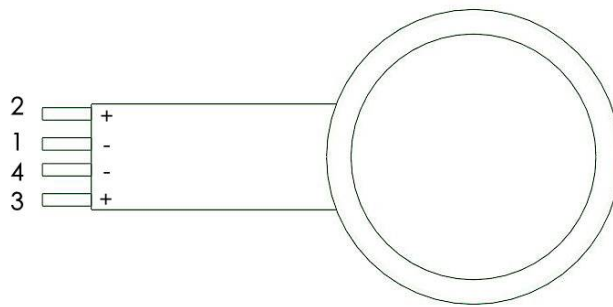
Mechanical dimensions



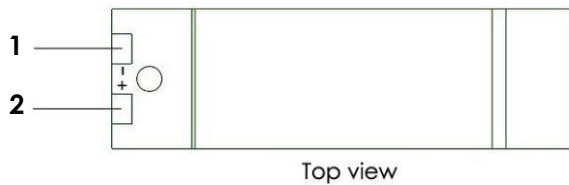
Electrical connections

Python™ bimorph actuators are designed with four thermally isolated copper pads, two of them are connected to the top piezo layer and the other two are connected to the bottom one. This gives you maximum flexibility in selecting driving configurations. Examples of driving configurations are shown in the table below. Single-side voltage control where unipolar voltages are applied to either the top piezo or the bottom can be used when displacement is needed in only one direction. When displacement in both directions is desired, configurations 3 and 4 can be used. Note that configurations 3 and 4 are similar to that of a conventional 3-wire bimorph in the market. In configurations 5 and 6, additional displacement (up to 50%) can be achieved by applying a positive voltage to one piezo and a negative voltage to the other.

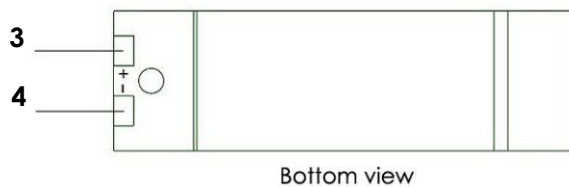
PBA24RO-5H200



PBAxx14-xxxxx



Top view



Bottom view

PBAxx08-xxxxx

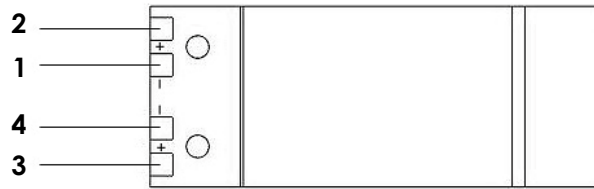


Top view



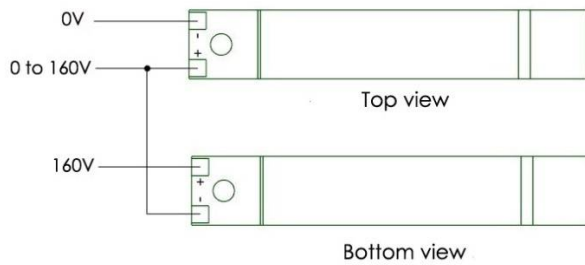
Bottom view

PBAxx20-xxxxx

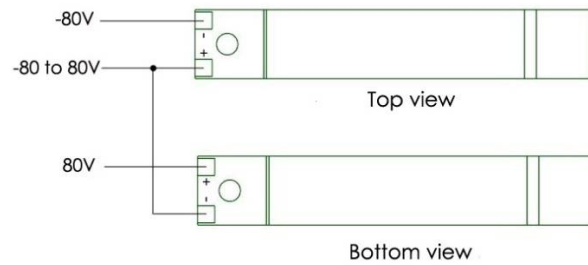


Wire #	1	2	3	4	Displacement
Configuration 1	0V	0 to 160V	0V	0V	Single side - upward
Configuration 2	0V	0V	0 to 160V	0V	Single side - downward
Configuration 3	0V	0 to 160V	160V	0 to 160V (connected to 2)	Both side - symmetrical
Configuration 4	-80V	-80 to 80V	80V	-80 to 80V (connected to 2)	Both side - symmetrical
Configuration 5	0V	0 to 160V	0V	0 to 90V	Single side - upward
Configuration 6	0 to 90V	0V	0 to 160V	0V	Single side - downward

Configuration 3



Configuration 4



Performance

Hysteresis and creep behavior of the bimorph is similar to those of the unimorph.

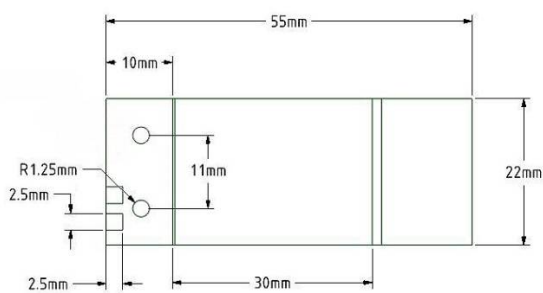
Mounting instructions

See the instructions for unimorph.

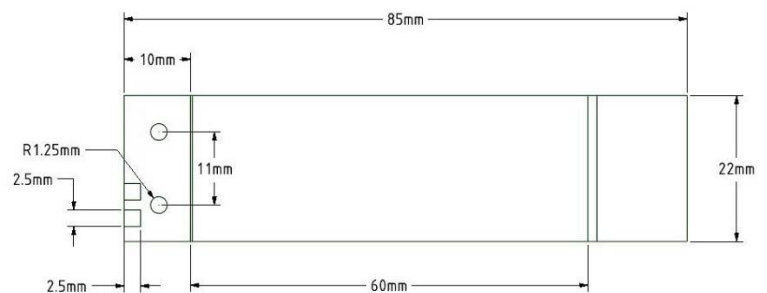
Energy Harvester

	Unit	Tolerance	PEH3020-5H250	PEH6020-5H250
Total length	mm	±0.4	55	85
PZT length	mm	±0.2	30	60
PCB length	mm	±0.2	10	10
Width	mm	±0.2	22	22
Thickness	mm	±0.1	0.7	0.7
Dome-height	mm	±0.2	0.65	1.6
Mass	g	±0.1	2	3.46
Max applied displ.	mm	±15%	±3.7mm	±9mm
Blocking force	N	±15%	-	-
Resonance	Hz	±15%	268	92
Piezo MAT			PZT-5H	PZT-5H
Piezo thickness	mm	±10%	0.25	0.25
Capacitance	nF	±15%	55	110
Generated volt	V	-	±25 @±3.7mm	±25 @±9mm
Operating T	C	-	-20 to 85	-20 to 85

Mechanical dimensions



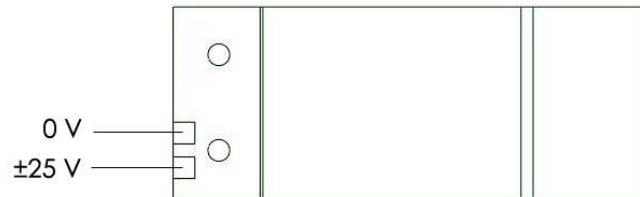
PEH3020-5H250



PEH6020-5H250

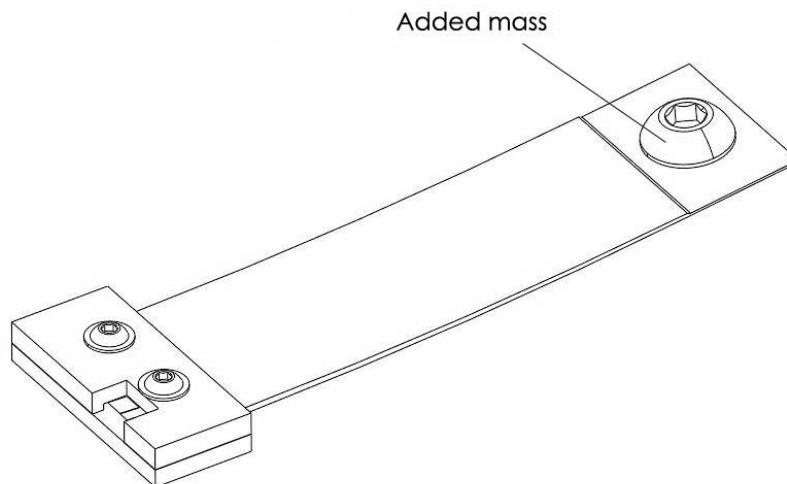
Electrical connections

Similar to the actuators, Python™ energy harvesters have two thermally isolated copper pads for convenient soldering.



Mounting instructions

The energy harvester should be clamped or glued at one end (PCB end) (see the instructions for unimorph). Displacement is applied at the other end (free end) to generate voltage. When energy is harvested from vibration, mass can be added to the free end of the harvester to adjust its resonance frequency. In either case, tip displacement should not exceed the values shown in the spec table ($\pm 3.7\text{mm}$ for PEH3020-5h250 and $\pm 9\text{mm}$ for PEH6020-5h250) to avoid damage to the piezo layer. A mechanical stop can be used to achieve this.



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