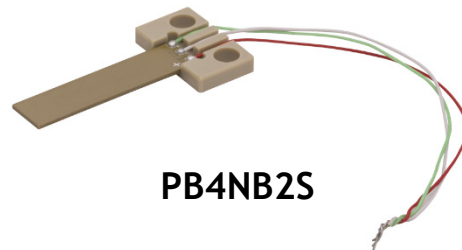


## Piezoelectric Bimorph with Holder, 150 V, $\pm 450 \mu\text{m}$ Travel



**PB4NB2S**

### Description

The PB4NB2S bender actuator consists of a piezoelectric bimorph attached to a specially designed carrier which make easier for customers to incorporate. The holder has two  $\varnothing 4.3$  mm thru holes with a 12.5 mm center-to-center spacing that accept M3 or M4 cap screws. The piezoelectric bimorph is co-fired with multiple piezoelectric ceramic layers. The PB4NB2S offers a maximum displacement of  $\pm 450 \mu\text{m} \pm 15\%$ . It has three electrodes on the top surface and a silver plus sign is located next to the electrode attached to the red wire, which should receive positive bias.

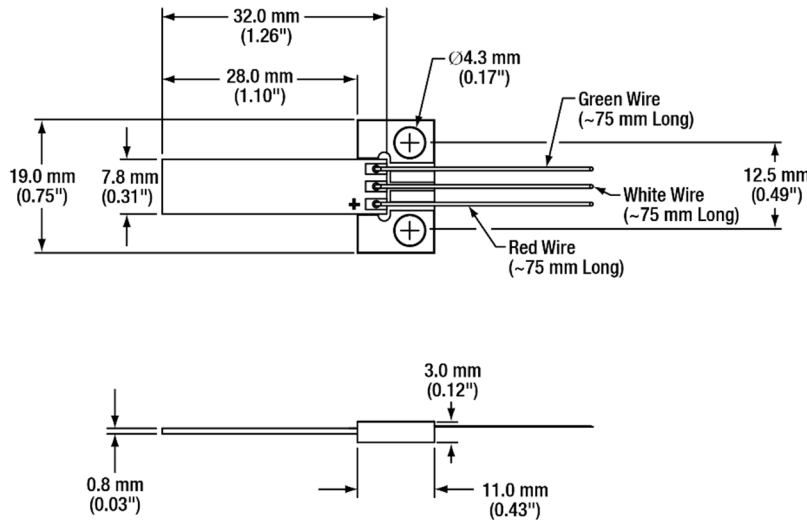
### Specifications

PB4NB2S <sup>a</sup>	
Drive Voltage Range	0 - 150 V
Displacement at 150 V	$\pm 450 \mu\text{m} \pm 15\%$
Hysteresis	<15% (See Graph on Next Page)
Free Length	28 mm
Bare Piezo Item #	PB4NB2W
Blocking Force at 150 V	1.5 N (0.33 lbs)
Resonant Frequency <sup>b</sup>	370 Hz (No Load)
Dissipation Factor	<2.0%
Capacitance	550 nF $\pm 15\%$ (For Each Side of the Bimorph)
Operating Temperature	-25 to 130 °C
Curie Temperature	230 °C
External Electrodes	Screen-Printed Silver
Bare Piezo Dimensions	Length: 32.0 mm $\pm 0.5$ mm Width: 7.8 mm $\pm 0.1$ mm Thickness: 0.8 mm $\pm 0.1$ mm
Holder Dimensions	Length: 11.0 mm $\pm 0.2$ mm Width: 19.0 mm $\pm 0.2$ mm Thickness: 3.0 mm $\pm 0.1$ mm

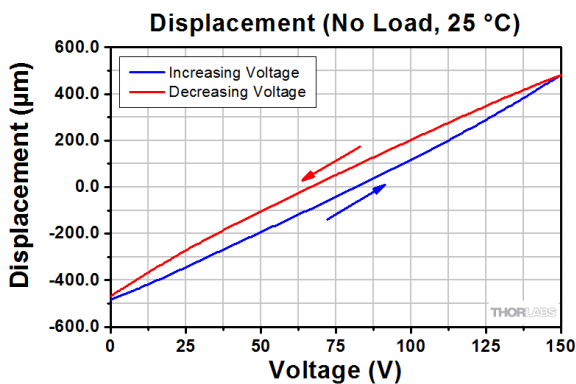


- a. All specifications are quoted at 25 °C, unless otherwise stated.  
b. Fixed on breadboard, without load.

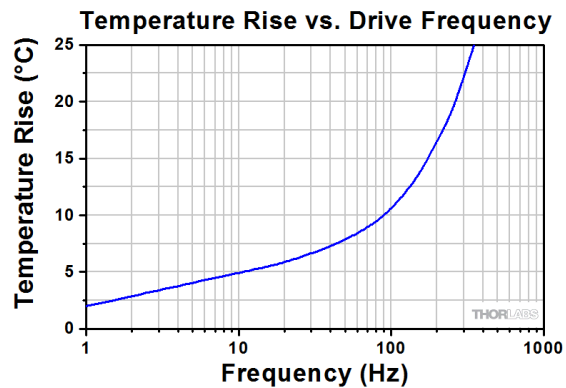
## Drawing



## Typical Performance Plots



Differential Voltage Control was used for this displacement test: Red Wire at 150 V, White Wire varied from 0 to 150 V, Green Wire at 0 V.

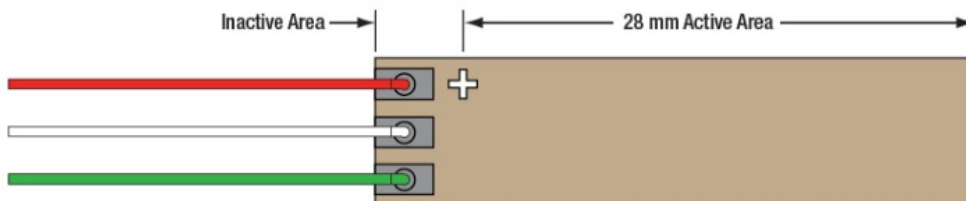


These temperature rises were measured after applying a sine-wave drive voltage ranging from 0 to 150 V applied to the white wire at the specified frequency for 10 minutes. The red wire was held at 150 V and the green wire at 0 V.

## Operation

### Electrical Connections

PB4NB2S has three electrodes: the positive electrode is attached with red wire, and the other two electrodes are soldered to white and green wires, shown as below.



**Caution:** After driving, the piezo is fully charged. Directly connecting the green and white wires or red and white wires has the risk of electricity discharging, spark, and even failure. We recommend using a resistor ( $>1\text{ k}\Omega$ ) between the wires to release the charge.

## Driving Modes

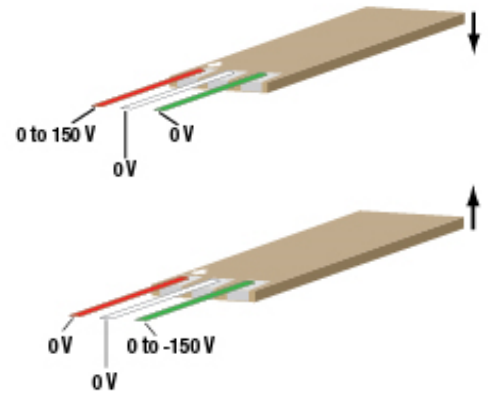
The bimorph bender can be operated following one of two basic driving principles:

### Single-Side Voltage Control

If a positive voltage ( $\leq 150\text{V}$ ) is applied between red and white lead wire, PB4NB2S will bend down when the silver plus is facing up, as shown in the diagrams below.

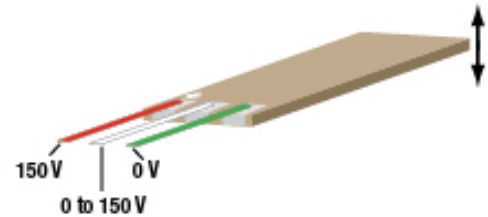
If a negative voltage ( $\geq -150\text{V}$ ) is applied between white and green lead wires, PB4NB2S will bend up when the silver plus is facing up, as shown in the diagrams below.

When operating in Single-Side Voltage Control mode, never apply the voltage to both the green and red leads at the same time, as a voltage difference  $>150\text{ V}$  between the two leads could damage the actuator.



### Differential Voltage Control

In this mode, the bending can be controlled both upwards and downwards. This type of the driving requires a dual power supply to providing differential voltage to the two electrodes which are attached with red and green, respectively. Then the voltage applied in white can be varied to obtain up and down. As shown in the tale below.



Soldering Contact	Red	White	Green
Option 1	150 V	0 V to 150 V	GND
Option 2	75 V	-75 V to 75 V	-75 V

### Long Term Operation

PB4NB2S actuators remained functional after a long-term durability test of  $1 \times 10^8$  cycles at a frequency of 100 Hz under conditions of 25 °C room temperature and 45% ambient humidity.

### Storage Instructions

- Do not store the device at temperatures above 80 °C.
- Do not store the device in humid environments. The relative humidity (RH) should be less than 40%.
- Do not immerse the device in organic solvents.
- Do not use the device around combustible gases or liquids.