Creative Commons (BY SA) licence granted by the authors. **First published on Oct 23, 2013**
Last Modified on Jul 24, 2014. Please keep us updated if you use this protocol and make improvements.
Authors: Tibi add your name here

Content on this document is *Creative Commons (BY SA)*. All rights reserved for SENSORICA logo.

MPM-S1 - Piezo Manual

NOTE: This manual is for use by SENSORICA members. A different manual was made for customers.

If you contribute to this doc **make sure you respect** the Content rules

Contents

- Important links
- Piezo driver
  - 50um range 2 axis
    - Introduction
    - Input side of the driver
    - Output side of the driver
  - 50um range 3 axis
  - 100um range one axis
  - 100um range x and 50um range y
  - 100um range xy and 50um range y
- Piezo actuator
  - 2 (or 1) axis piezo actuator
  - 3ax piezo actuator
  - Long range low cost 1ax piezo actuator
- Connections to the (DAQ) card
- LabView program

Creative Commons (BY SA) licence granted by the authors. **First published on Oct 23, 2013**
Last Modified on Jul 24, 2014. Please keep us updated if you use this protocol and make improvements.
Authors: Tibi add your name here

Important links

- Project page
- Technical manual
- BOM for the electronic driver

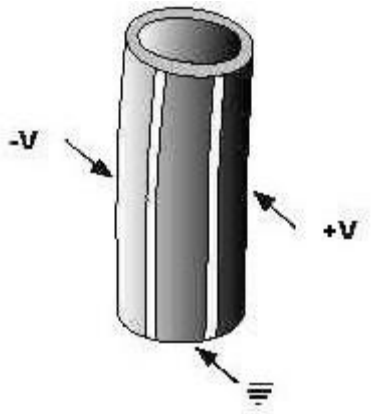
Piezo driver

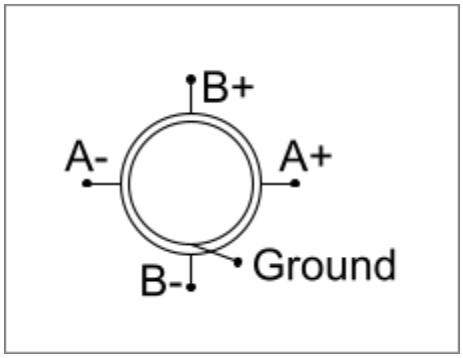
There are multiple configurations of the Piezo system. It can come in 1 axis, 2 axis or 3 axis, with motion ranges of 50um to 100um. The sections below present all these options.

50um range 2 axis

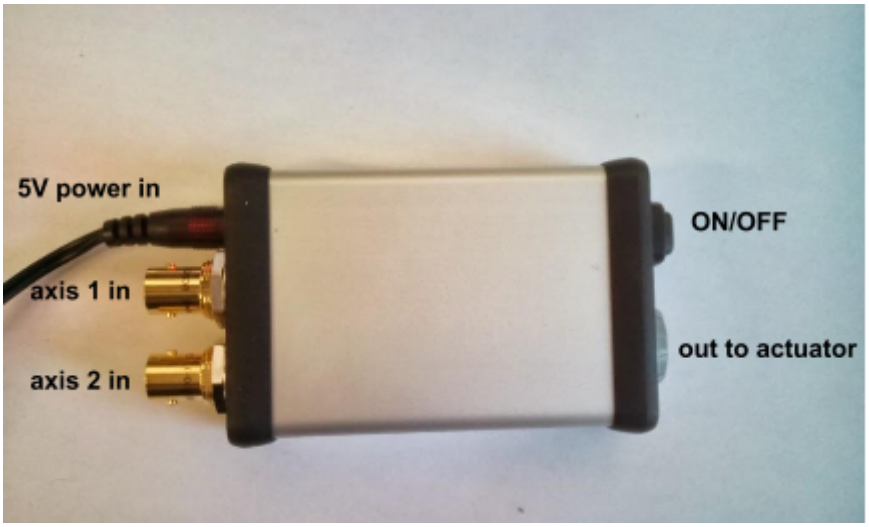
Introduction

The Mantis piezo driver was designed to operate with piezoceramic tubes similar to the ones produced and distributed by Boston Piezo Optics (open product page). These piezo tubes are made of 4 quadrants opposing each others in pairs. Each pair produces a displacement in one axis. Each pair is connected to one BNC output of the Mantis piezo driver.





Creative Commons (BY SA) licence granted by the authors. **First published on Oct 23, 2013**
Last Modified on Jul 24, 2014. Please keep us updated if you use this protocol and make improvements.
Authors: Tibi add your name here

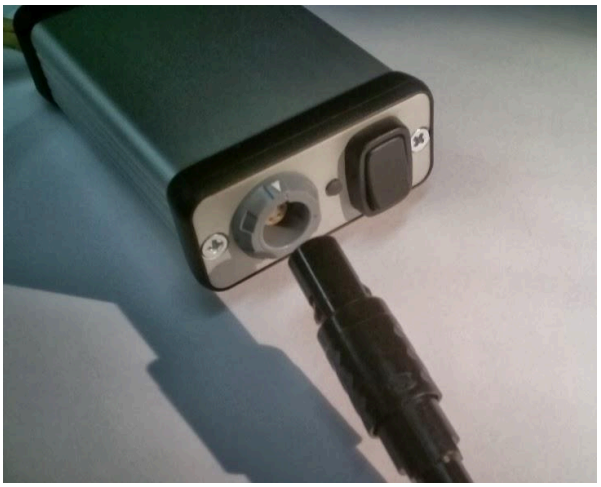


Input side of the driver

	The Mantis piezo driver takes 5V DC in (up to 1.5A). If the **orange** LED is ON, the power supply works correctly. If not, you probably need to change the power supply. The two gold BNC connectors are DC control inputs from a DAQ (data acquisition card) or from a signal generator. The full input range is 3.8V (min = 0.7V and max = 4.5V). They each control one axis of the piezo actuator.
	5V DC in (up to 1.5A) power supply.

Creative Commons (BY SA) licence granted by the authors. **First published on Oct 23, 2013**
Last Modified on Jul 24, 2014. Please keep us updated if you use this protocol and make improvements.
Authors: Tibi add your name here

Output side of the driver

	The output side of the box, with the ON/OFF button. When the driver is powered ON the LED in the middle turns **green**. If not, see if the **orange** LED on the input side is let. If not, check the power supply. The output female (left) connector receives its male counterpart below.
	Male output connector. Brings high voltage to the piezo actuator (See the Piezo actuator section)
	The output connector is plugged simply by pushing it in. The orientation is fixed, there is only one way to push it in. To disconnect simply pull it out.

Creative Commons (BY SA) licence granted by the authors. **First published on Oct 23, 2013**
Last Modified on Jul 24, 2014. Please keep us updated if you use this protocol and make improvements.
Authors: Tibi add your name here

50um range 3 axis

Not yet ready…

100um range one axis

Not yet ready…

100um range x and 50um range y

Not yet ready…

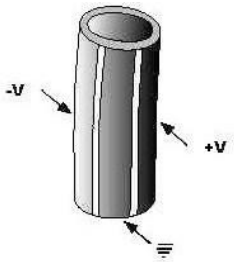
100um range xy and 50um range y

Not yet ready…

Piezo actuator

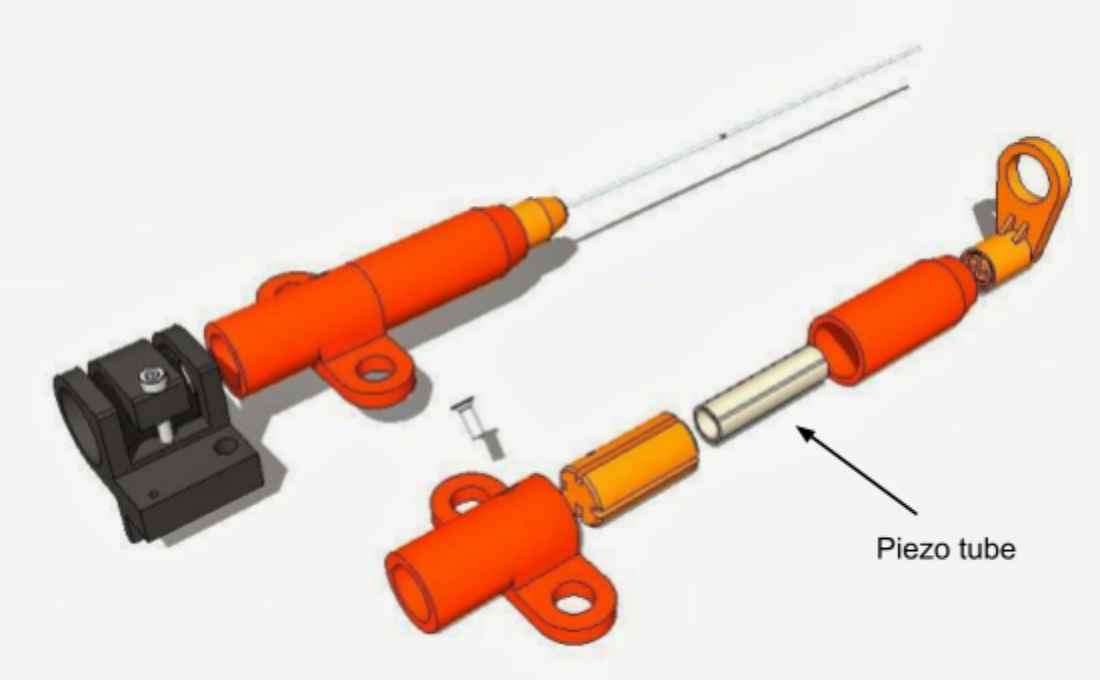
The piezo actuator can come in 2 configurations: 1 or 2 axis or 3 axis

2 (or 1) axis piezo actuator

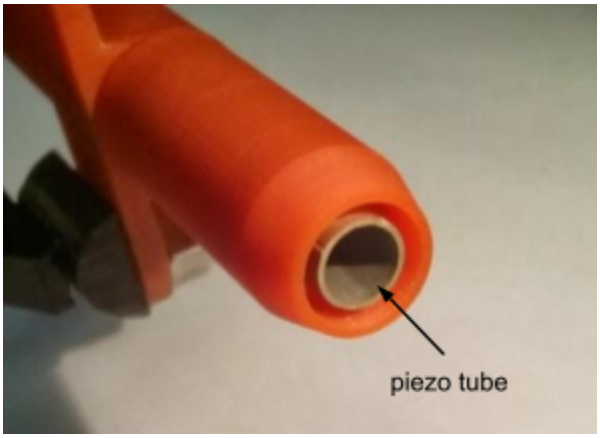


The 2 axis Mantis piezo actuator was designed to operate with a piezoceramic tube similar to the ones produced and distributed by Boston Piezo Optics (open product page). These piezo tubes are made of 4 quadrants opposing each others in pairs. Each pair produces a displacement in one axis. The pairs operate independent of each other giving the possibility to operate in a single-axe or bi-axe mode.
The piezoceramic tube is assembled into a device with functional parts (adapters) for attaching tools to it (a glass needle for example), or to attach itself to other tools or instruments.

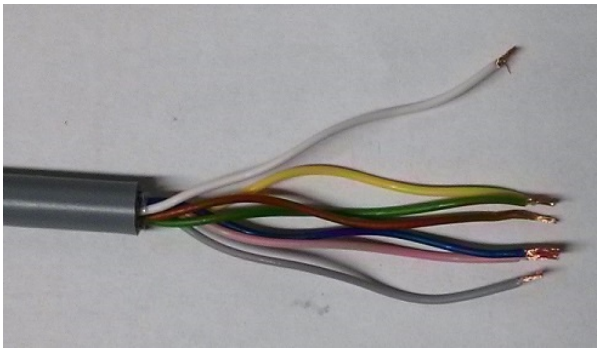
Creative Commons (BY SA) licence granted by the authors. **First published on Oct 23, 2013**
Last Modified on Jul 24, 2014. Please keep us updated if you use this protocol and make improvements.
Authors: Tibi add your name here



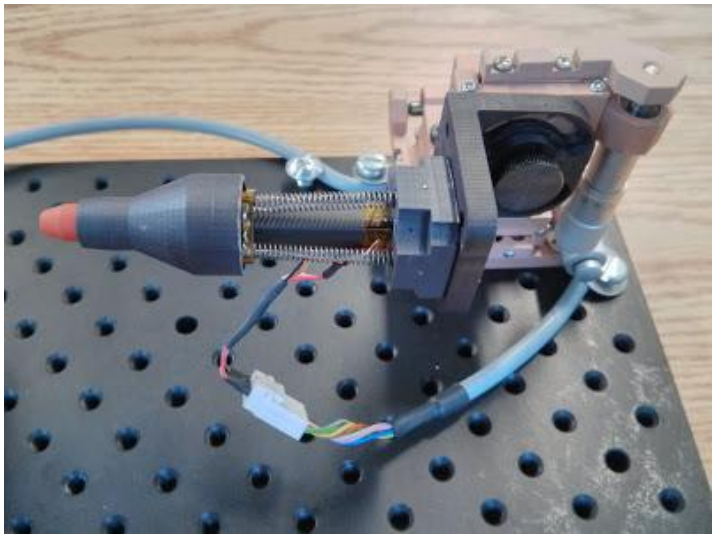
3D model of the piezo actuator - open 3D model

	The piezo actuator has 5 wires sticking out of it. For the 50um range 2 axis configuration one wire is the ground. The other 4 are connected to each one of the 4 quadrants of the piezo tube (see piezo tube in the 3D model above). Each axis is driven by 2 opposite quadrants, connected to 2 wires. See more instructions in the last row below.
	Piezoceramic tube inside the actuator assembly. Different adapters can be mounted on the piezo tube, to grip different tools, like in this picture below.

Creative Commons (BY SA) licence granted by the authors. **First published on Oct 23, 2013**
Last Modified on Jul 24, 2014. Please keep us updated if you use this protocol and make improvements.
Authors: Tibi add your name here

 **WARNING!** Isolate the wires ends not connected.	Wire connections to the piezo actuator. See more on the Piezo actuator section. • **Brown** and **White** are ground. • **Pink** and **Blue** for Channel B+ and B-, respectively. • **Yellow** and **Grey** for Channel A+ and A-, respectively. **WARNING!** Always turn off the power before working on the given circuit to avoid electrical shock.

3ax piezo actuator



Uses the same wire connections as the 2 axis one. The only thing that changes is a piezo stack for an extra axe. This stack has 50 microns range. See Z-axe spring specifications.

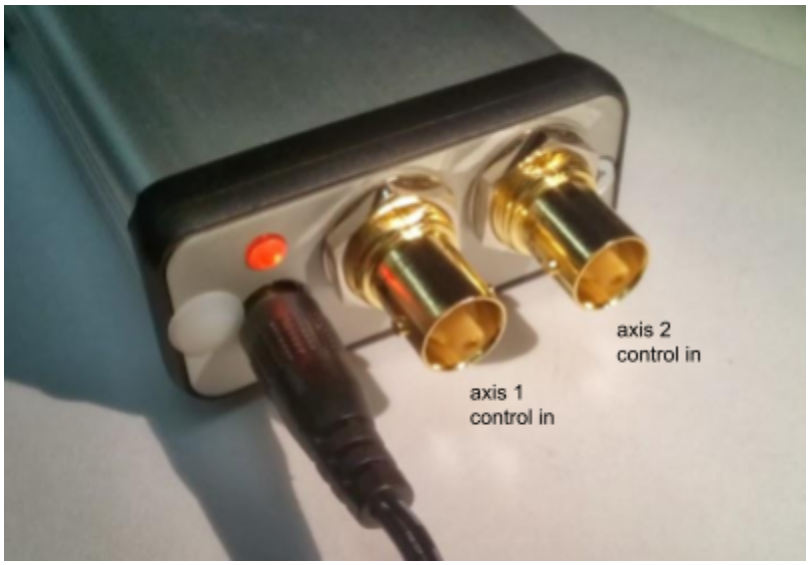
Creative Commons (BY SA) licence granted by the authors. **First published on Oct 23, 2013**
Last Modified on Jul 24, 2014. Please keep us updated if you use this protocol and make improvements.
Authors: Tibi add your name here

Long range low cost 1ax piezo actuator

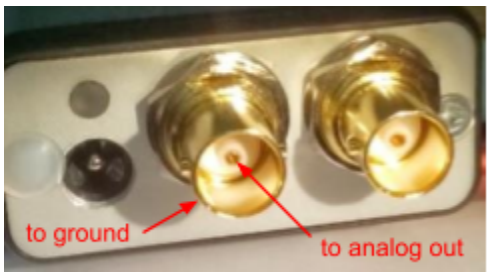
This actuator is still in prototyping stage. Open main doc.

Connections to the (DAQ) card

The **2 axis 50um range piezo driver** takes in DC voltage on a ~3.8V$^{-0.2}$ range, min = 0.7$^{+0.1}$ and max = 4.5$^{-0.1}$.. A DAQ (data acquisition card) or a signal generator is needed to drive it.
In order to drive 2 axis one needs 2 analog outputs. Simply connect each analog out to the BNC input connectors of the piezo driver.



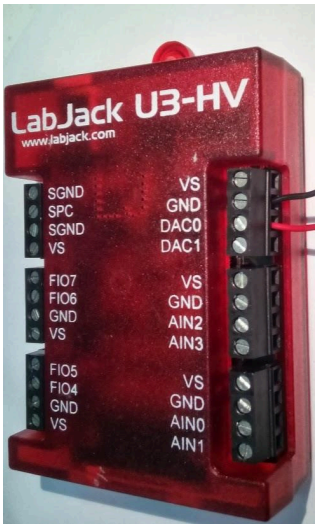
The center wire of the BNC is connected to an analog out of the DAQ card. The analog out ground pin of the DAQ card is connected to the casing.

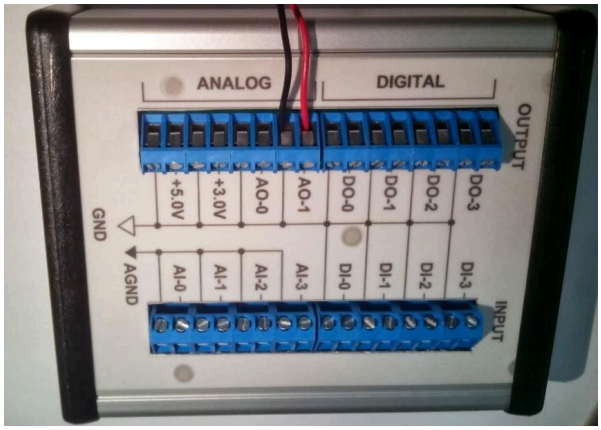


The pictures below show 2 examples of DAQ cards we are using in our labs. The **red** wire goes to the middle of the BNC cable and the **black** one goes to ground.

Labjack DAC card	Frederic's DAQ card, see webpage.

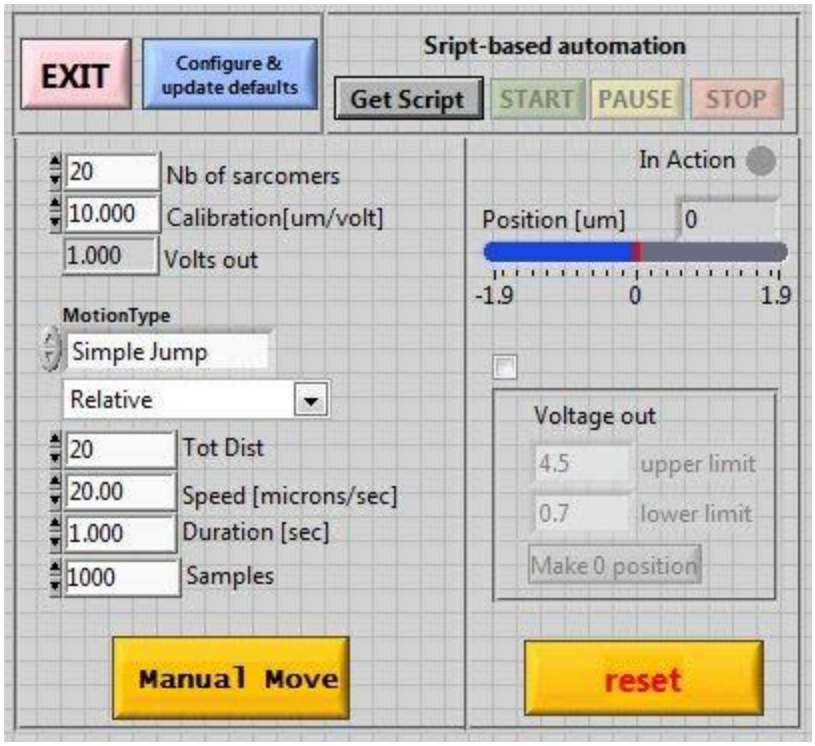
Creative Commons (BY SA) licence granted by the authors. **First published on Oct 23, 2013**
Last Modified on Jul 24, 2014. Please keep us updated if you use this protocol and make improvements.
Authors: Tibi add your name here





LabView program

We are using the IAC's LabView platform
See more on the LabView program HERE.
SENSORICA Piezo LabView Driver debugging reports



Creative Commons (BY SA) licence granted by the authors. **First published on Oct 23, 2013**
Last Modified on Jul 24, 2014. Please keep us updated if you use this protocol and make improvements.
Authors: Tibi add your name here