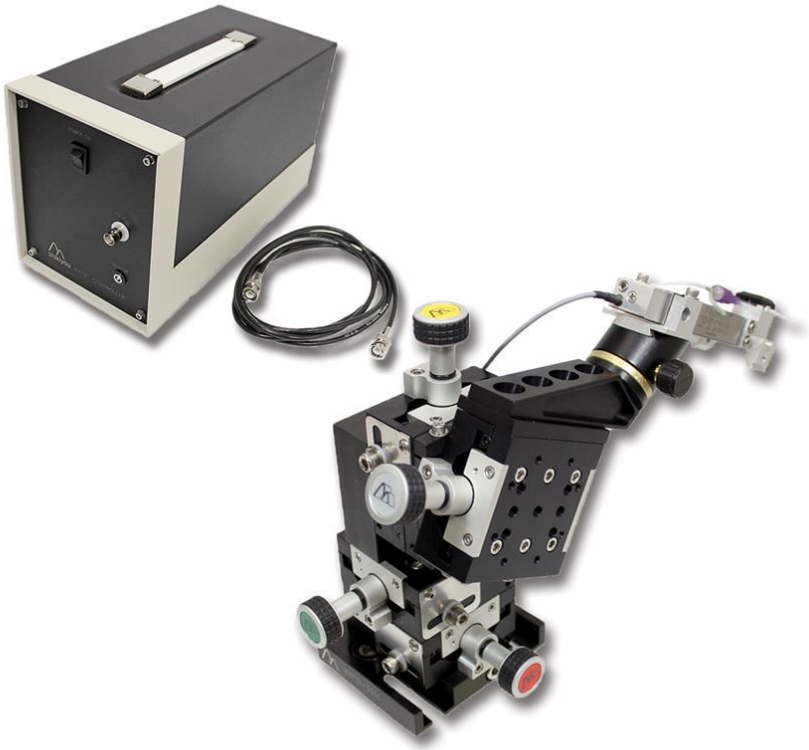
Setup Instructions For MXPZT-300

Solution Switcher



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Introduction:

Congratulations on your purchase of a Siskiyou MXPZT-300 series high-speed solution switcher. Our controller and stable cross roller bearing manipulator along with PI's piezo actuator, provide the fastest possible PZT translation of solution exchange pipettes.

Specifications:

Input Power Requirements: 1A @ 90-264VAC, 47-63Hz

Output: -20V TO +120V, LEMO CONNECTOR, FEMALE

Items Included:

Remove all items from packing materials and confirm that all items listed in Table 1 (below) are available.

DESCRIPTION	QUANTITY
MX1640 SISKIYOU MANIPULATOR WITH INTEGRAL PZT ACTUATOR	1
MZPZT-300 POWER SUPPLY / SIGNAL CONDITIONING CONTROLLER BOX	1
POWER CABLE	1
BNC SIGNAL CABLE, 6 FT	1
THETA GLASS PIPETTE	1

Table 1

Theory of Operation:

Rapid sweeps of the theta-glass pipette are desirable for quick switching of solutions. Piezoelectric actuators are ideal for this since they are capable of extremely high acceleration and deceleration. Simplistic actuation of a motion mechanism can present many problematic issues: in particular, the rapid actuation drives resonances in the pipette, PZT mechanism and the supporting coarse-positioning structure. This can greatly shorten PZT life, and the vibrations often manifest themselves as unwanted rapid "switching" as the bores repetitively sweep back and forth due to the vibrations.

The MXPZT-300 controller incorporates a powerful PZT amplifier and a patented Input Shaping® circuit based on a digital signal processor. This Input Shaping® coprocessor is factory-configured to nullify the structural vibrations caused by rapid PZT actuation. The nullification targets the specific resonant frequencies characteristic of your MX1640 configuration. This allows especially rapid switching without driving lingering vibrations of the structure and pipette, and it protects the PZT mechanism from amplifier saturation and excessive slew rates. Any motion profile may be safely commanded.

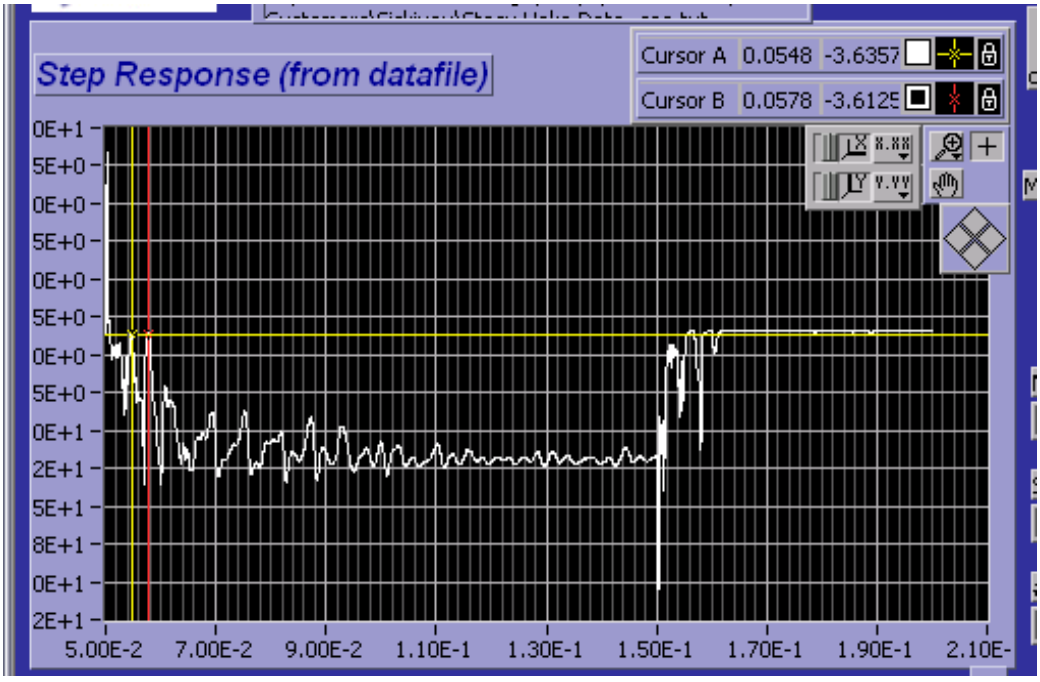

Figure 1. HEKA data showing repetitive switching of theta-glass pipette in rapid back-and-forth actuation. Vertical axis is proportional to HEKA picocurrent signal; horizontal axis is time.

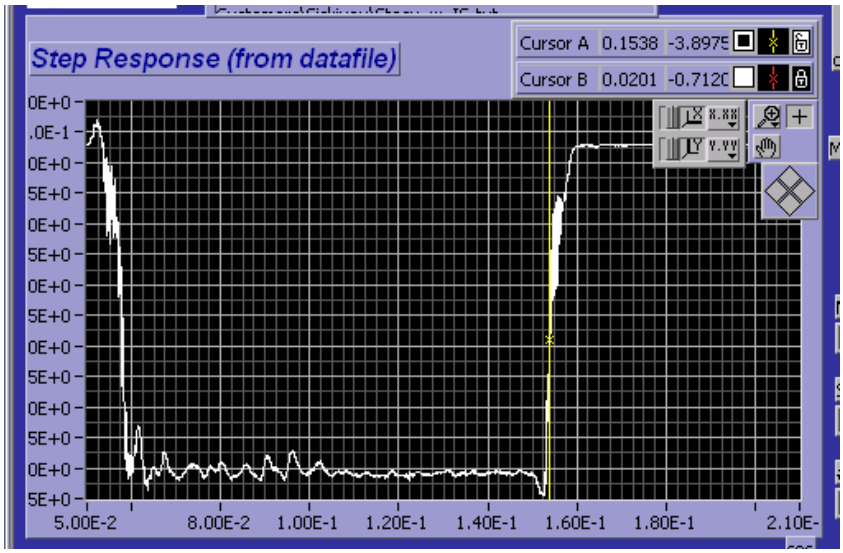

Figure 2. HEKA data of theta-glass pipette in rapid back-and-forth switching, similar to Figure 1 but using the Input Shaping® technology built into the Siskiyou MX-PZT controller. The undesirable switching is eliminated.

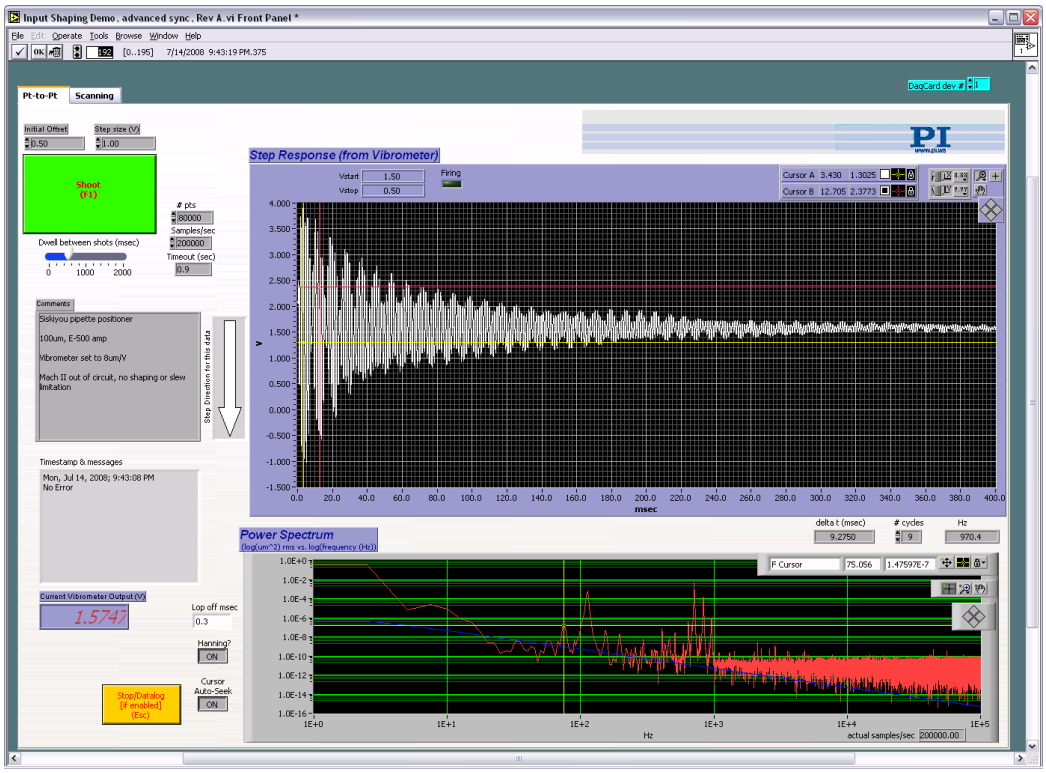

Figure 3. Interferometric position metrology of pipette motion using a laser Doppler vibrometer operating in the position domain. Top graph shows vibrometer position out put in Volts (8V/µm) vs. time after a sharp step *without* Input Shaping®. Motion-driven vibrations in the structure and pipette constitute ringing which can manifest as unwanted repetitive switching of the theta glass solutions.

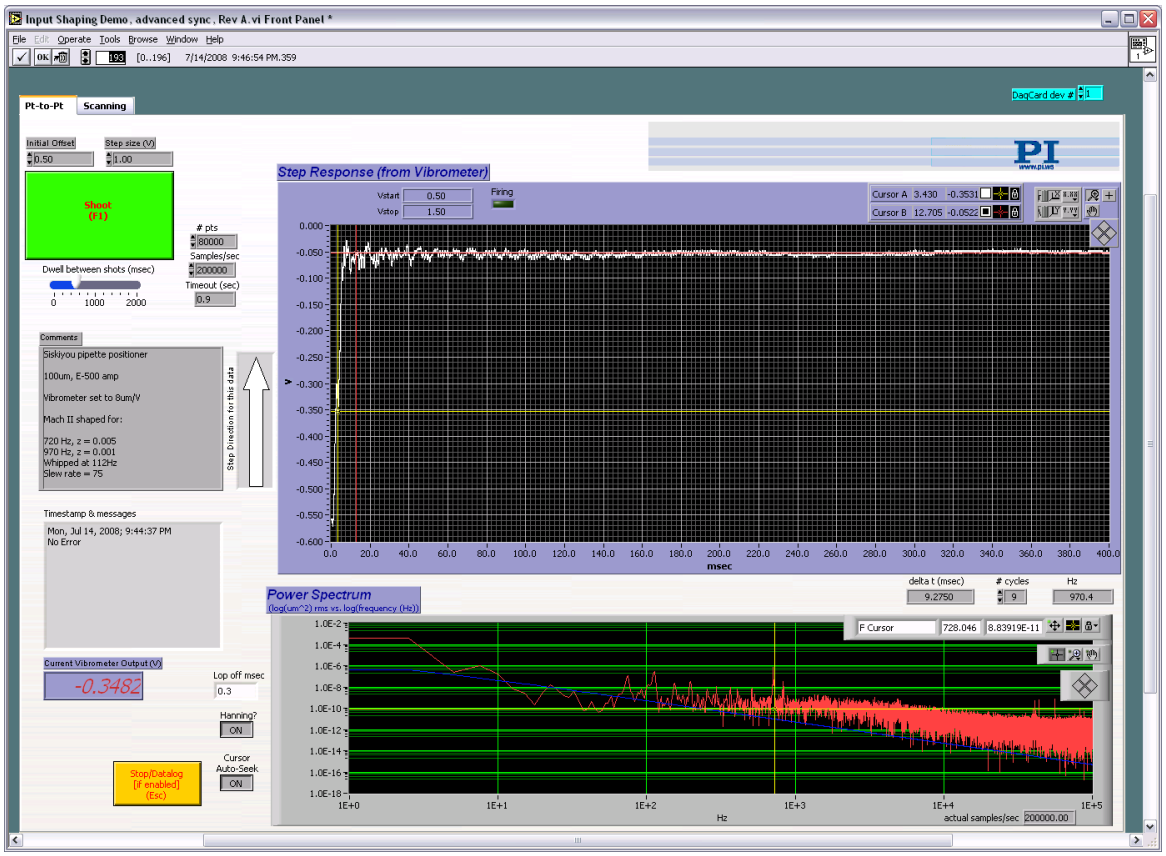

Figure 4. Same as Figure 3 but using Input Shaping®. The rapid actuation of the PZT no longer excites resonances in the structure and pipette. The cleaner step means repetitive switching is eliminated.

Setup and Operation:

Setup and operation are very simple. Rigidly mount the manipulator to a sturdy platform, taking care that all bolts are securely tightened. Don't over tighten, just make certain there are no loose mechanical items. Make certain that whatever Theta glass you are using, there is continuous contact between the glass and the aluminum mounting bracket along the entire length of the bracket. This will minimize any unwanted mechanical resonances, which act to slow down switching speeds. The actuation waveform has been optimized for our standard configuration. Once this has been changed, the resonant frequency of the system will also change. For this reason, a new waveform maybe needed - see Data Acquisition below.

Theta Glass Orientation:

Mount the manipulator such that the Theta glass is easily visible in the microscope optics. Siskiyou Theta glass has two pre-plumbed arms that are horizontal – this positions the septum of the Theta glass vertically. Locate the Theta glass, using the manipulator axis adjustments to position it where desired. If you have trouble seeing the tip of the recording electrode,

gradually close the iris diaphragm of the microscope condenser to maximize the contrast. If you are using a Siskiyou IS-GCI gradient contrast condenser, rotate that for maximum contrast, then re-tighten the thumbscrews on the mounting dovetail This will help you see the tip of the recording electrode much better. Focus on the tip of the recording electrode with the 40X microscope objective, using the microscope focus adjustment.

Now, using the focus adjustment in the MX1640 manipulator, adjust the height of the Theta glass such that the center of the vertically oriented septum is in the focal plane of the recording electrode. Place the recording electrode such that it is in the liquid stream of the desired side of the Theta glass – don't position it directly across from the septum. This configuration assumes that the solution switcher will be located on the left side of the microscope, and the direction of travel of the pipette is back-to-front. This orientation of the glass tips provides the fastest possible switching speed.

Theta glass, as supplied by Siskiyou, has not been etched or fire-polished. Various users etch to different septum thicknesses. The pre-plumbed Theta glass we supply has a tip diameter in the 150 – 200 micron diameter range.

Attach Cables and Power Up:

Locate the power supply / PZT amplifier box such that the BNC cable can easily reach from your voltage source to the box, and the PZT actuator drive cable reaches the power supply / PZT amplifier box. Attach those two cables, as well as the power cord. After power up of the controller box the PZT actuator will move to a position that corresponds to the input voltage of you supply. Once you have the electrode tip and the Theta glass positioned properly, and solution is flowing through the Theta tube, you are ready to start acquiring signals.

Data Acquisition:

The power supply box is configured to accept inputs from –10V to +10 V. The Input Shaping coprocessor takes care of vibrations associated with square wave inputs, so there's no need to specify " softer " waveforms. Depending on how you have mechanically configured your manipulator and related components, you may see vibrational peaks in your data. These can be minimized or eliminated. Send us a curve trace of the data that encompasses as many vibrational cycles as practical, with the cursor showing the X-axis separation between the first and last easily discerned peaks. We will need to receive the controller box back for loading the new dampening profile. Please get back to us if you have any problems.

EU Declaration of Conformity

In accordance with EN 45014: 1998

Manufacturer: **Siskiyou Corporation**

Address: **110 SW Booth Street**
Grants Pass, OR 97526-2410
USA

Declare that:

Equipment	Motion Controller
Model Name/Number	MXPZT-300 Series
Serial Number	N/A

In accordance with the following directives:

2014/35/EU The Low Voltage Directive and its amending directives

2014/30/EU The Electromagnetic Compatibility Directive and its amending directives

2006/42/EC The Machinery Directive and its amending directives

2011/65/EU Restriction of use of certain hazardous substances (RoHS)

I hereby declare that the equipment above has been designed and found to comply with the relevant sections of the above referenced specifications. The unit complies with all essential requirements of the Directives.

Signed by:

Name: John Wingerd
Position: Engineering
Place: USA
Date: July 27, 2018

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