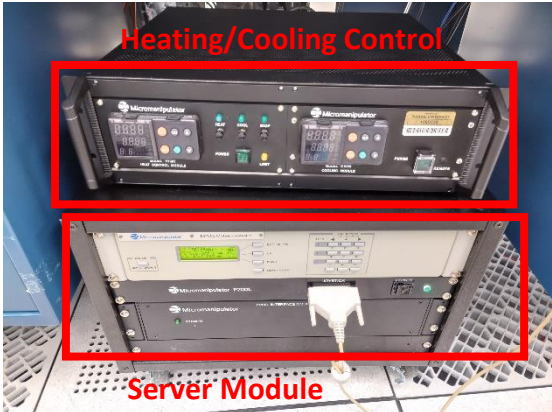
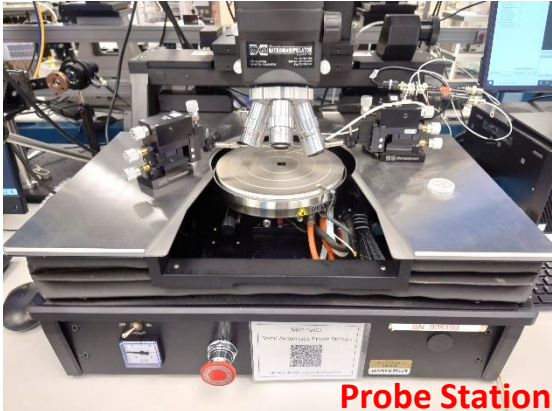


# Micromanipulator P200L SOP

## Introduction

P200L is a powerful tool for automated stage movement between devices to measure and probe movement in vertical direction. It is also possible to pair it with measurement tool to realize full-automation if configured correctly (not yet achieved now) via packets received and sent through TCP port. The entire semi-auto probe station is comprised of 4 main parts.



## Start-up

Turn on ESP301 Motion Controller and then go to control PC to turn on P200L software by clicking on this icon. Once the software starts up, press “Connect” to connect to P200L server. If experiencing issues, change to different ports from the drop-down list and re-connect until success.

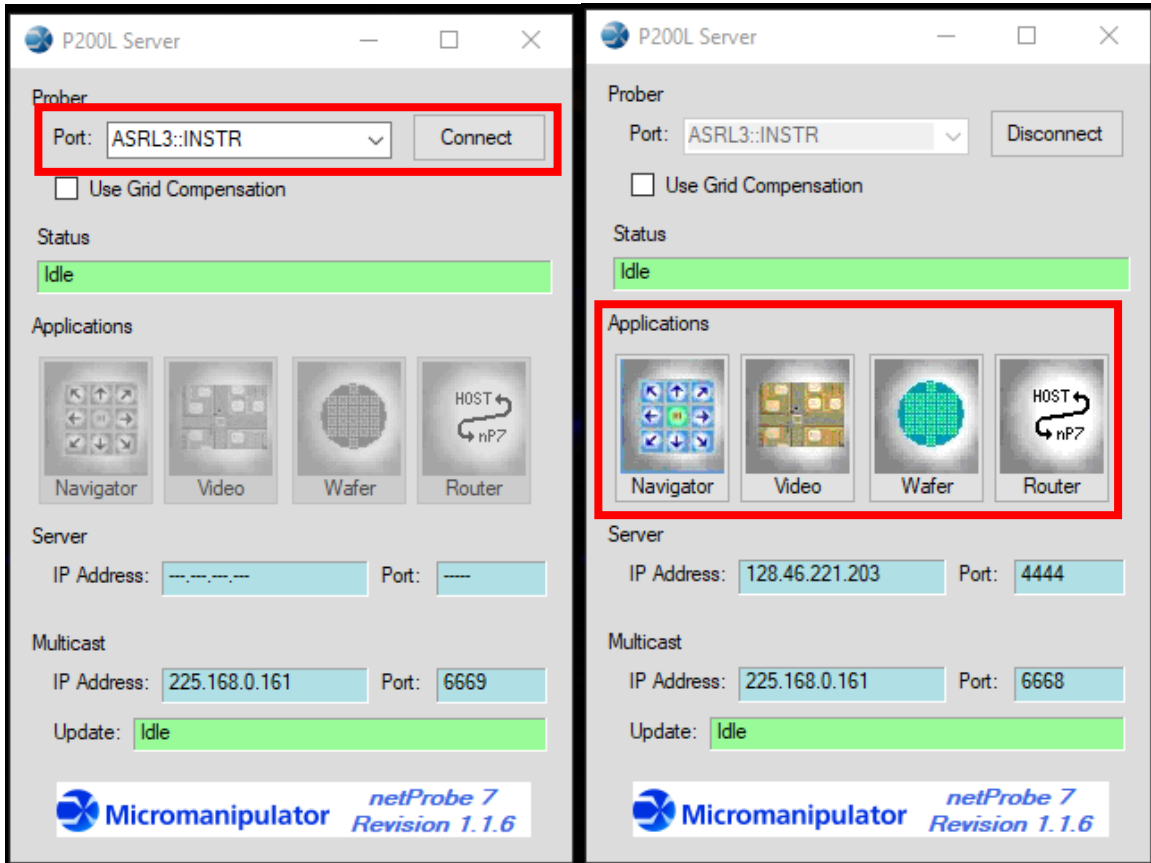
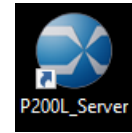


Figure 1. P200L Software Disconnected (Left) vs Connected (Right)

## X-Y Stage Configuration

On this interface, two applications (Navigator and Wafer) will be used for automated sample testing. Navigator allows different types of navigation across the wafer and will be used in initial stage of setting up the measurement.

Click on navigator to enter navigator window. There are three actions to be performed before the X and Y axes are fully calibrated.

Click “Home Stage” and then “Home XYZ”. This will allow the stage to home itself back to its absolute zero position. You may need to wait for 30 seconds to 2 mins for the stage to finish homing.

Wait until the stage stabilizes itself at front left corner and verify stage status is “Command Complete” with a green background (in the middle of Navigator window). Click on “Done”.

Status: **Command Completed**

Click “New DUT” in Navigator window and then “Move to Unload Location”. Wait for the stage to move out and then load the sample on. **Turn on vacuum after the sample is loaded onto the stage.**

Select “Move to Center” so that center of the stage goes right under the microscope. When the stage finishes moving, close “New DUT” window by pressing “Done”.

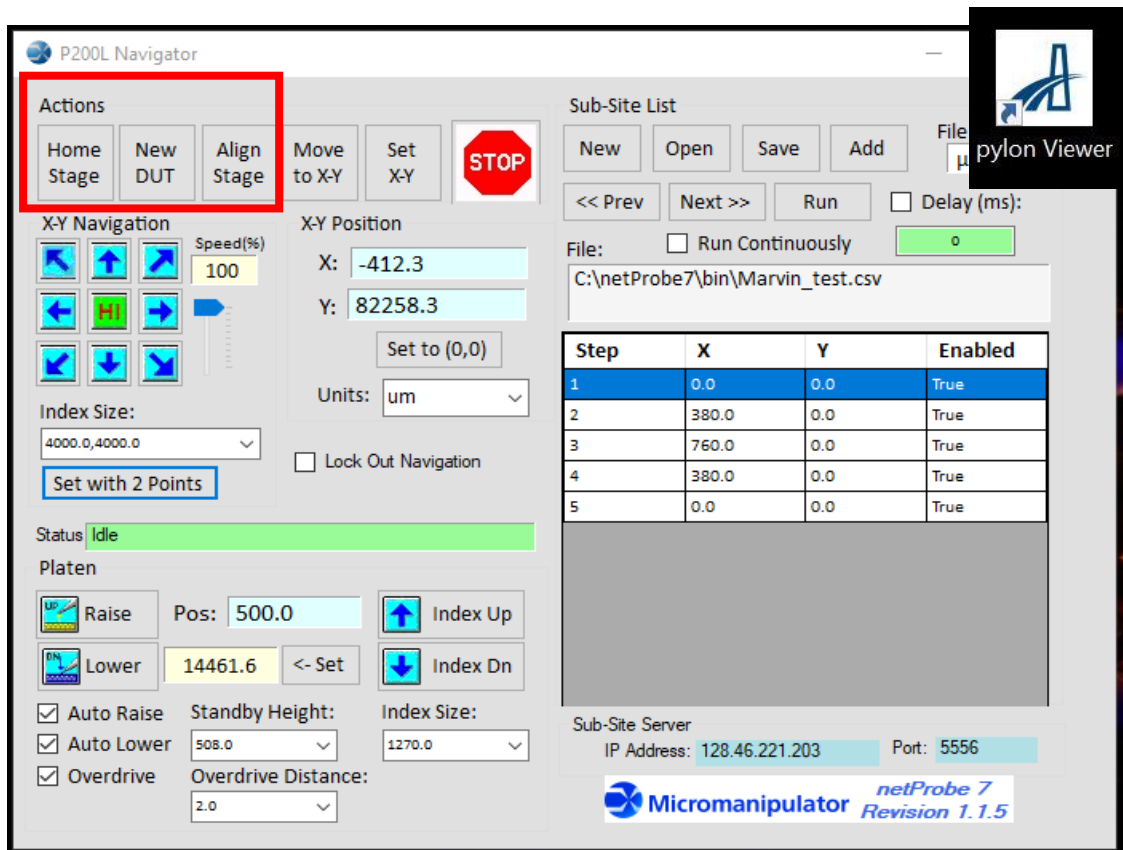
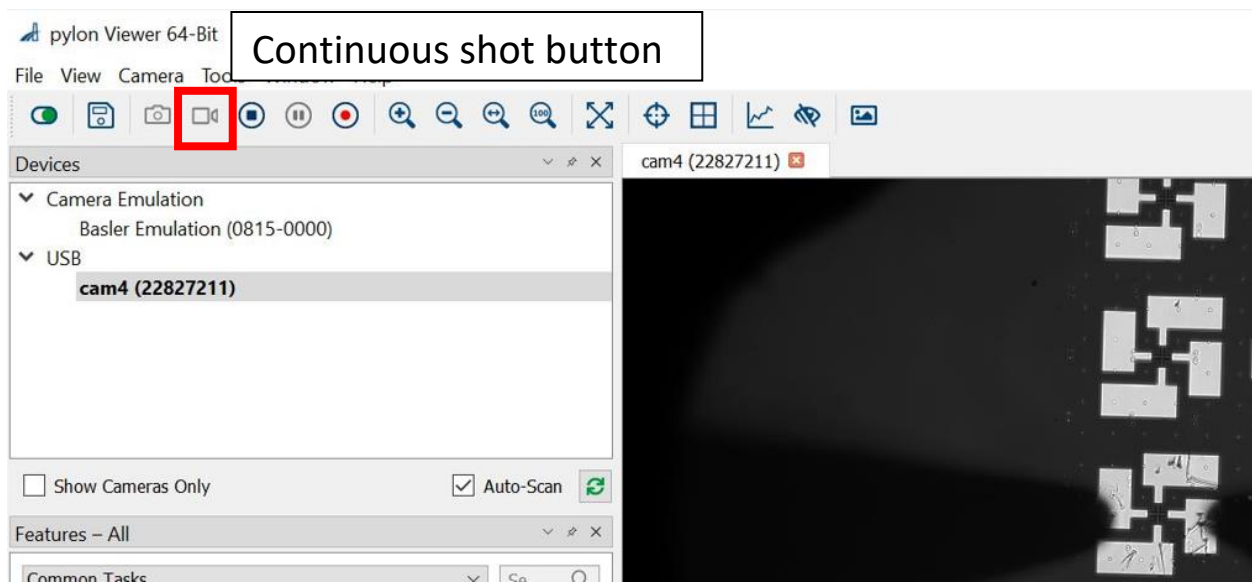
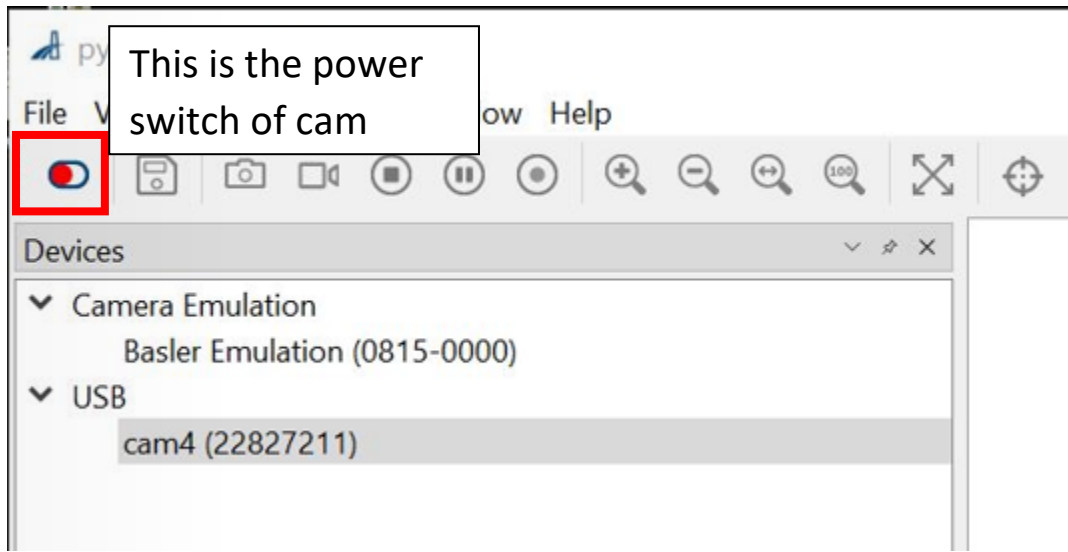


Figure 2. Navigator Window

On the camera PC, open camera software by double-clicking on Pylon Viewer.

When in Pylon Viewer, find the camera (cam4) that is connected through USB interface. Turn on the power of camera by clicking on the power switch icon on the top left.

Click on “Continuous Shot” button to get video feed from camera.



On the shelf above probe station, identify the illuminator “Fiber-lite MI-150R High Intensity Illuminator”. Turn on the power of illuminator and then turn the knob of illuminator’s controller (on the desk near P200L stage) till the camera video gives a clear view. **If changing between different object lenses, consider using the knob on the right of microscope to better focus on sample.**

Click “Align Stage” and then use the joystick together with the camera to find the 1<sup>st</sup> point for X-Y alignment, use camera crosshair if necessary for precise movement onto the 1<sup>st</sup> alignment point. Click “Set 1<sup>st</sup> Point” when done.

Move the stage to the 2<sup>nd</sup> point for X-Y alignment, repeat the previous step for locating and zeroing onto the 2<sup>nd</sup> point and then click “Set 2<sup>nd</sup> Point” when finished.

Select "Apply" and the computer will calculate alignment degree, click "Done" if the alignment goes well. If not, repeat Align Stage steps.

When stage alignment is finished, go back to the geometric center of device used as origin, click on "Set to (0,0)" in Navigator window. This step should always be re-performed after running stage alignment.

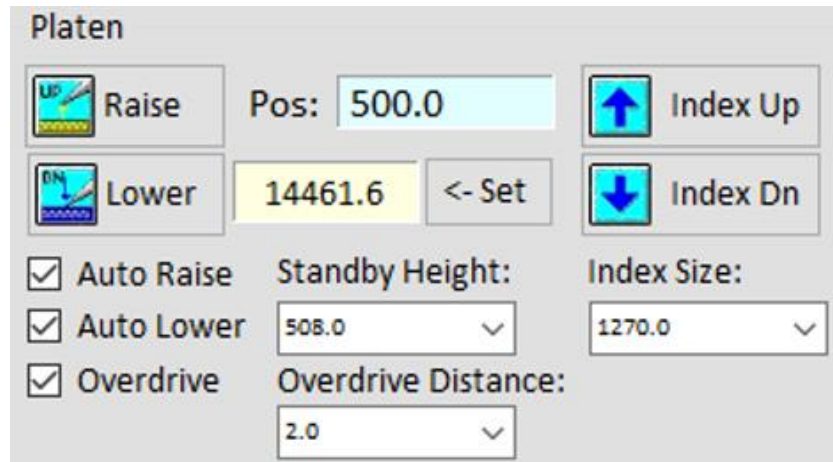


Figure 3. Z Stage Setup Interface in Navigator Window

## Z Stage Configuration

Before continuing, move the crosshair of camera to the geometric center of a device to be measured, prepare and complete the wiring of measurement instruments if needed. Make sure all probes are connected and raised clear from the stage before moving forward. Aim the crosshair of camera to the geometric center of a device. Click "Set to (0,0)" so this device will be used as the original point across the entire sample

P200L's Index refers to the platen on which all probe arms are mounted. Instead of moving stage up or down, P200L moves the platen(index).

Turn off "Auto Raise", "Auto Lower" and "Overdrive". Select a large index size (3000um is recommended for starting up) and move the platen down by clicking "Index Dn". Keep moving platen down till probe tips can safely approach/retract/land on the sample (Pos reading 6000 to 8000um can be a good starting point).

Press "set" when the platen's height is satisfactory. The set Pos defines the default height at which all probes will be landed on the sample. When the stage moves between different devices, P200L first moves the platen up, moves stage around and then moves the platen back down to ensure all probes touch the new device.

Position and land all the probes onto the device. If needed, check electrical continuity by measurement.

Set "Standby Height" to 508 um and "Index Size" to 25.4 um. If overdrive (let the probes drop down more than current probe height) is needed for ensuring good contact, setting the overdrive distance to 1 or 2 um and gradually increase and test the electrical connection between probe and pad. For those

who need to scratch oxide off the pad, position the probes at the edge of the contact pad and set the overdrive to 5um is a good starting point; for bare metal pads, position the probes a little away from the center of contact pad and set overdrive to 2um.

Test the Z stage configuration by clicking "Raise". Verify the probes are of enough clearance above sample. Press "Lower" and verify the probes are back in contact with your device terminals and measurement gives good reading. If some probes are not making contact, setting a higher overdrive could be an option.

When Z stage configuration is finished, tick "Auto Raise", "Auto Lower" and "Overdrive" (optional).

## Sizing device-to-device distance

This section is helpful if wafer map mode is not to be used. If using wafer map mode, skip this section.

If design GDS files are still available, using it could help with sizing the distance between devices. These distances are important for automation. Only one set of X-Y distances is accepted by the software. This means that all devices to be measured must be equally spaced out.

If no measurement of distance can be acquired from design files, stay at the geometric center of one device (bottom left would be good) and then click "Set to (0,0)" so this device is going to be used as origin.

Click "Move to X-Y" and observe the camera feedback, use trial and error method to find the X and Y distances it takes to move from the origin device to one device that is on the upper right. Record these distance readings.

## Wafer Map Configuration

Go back to P200L Software and click “Wafer” to bring up Wafer Map window.

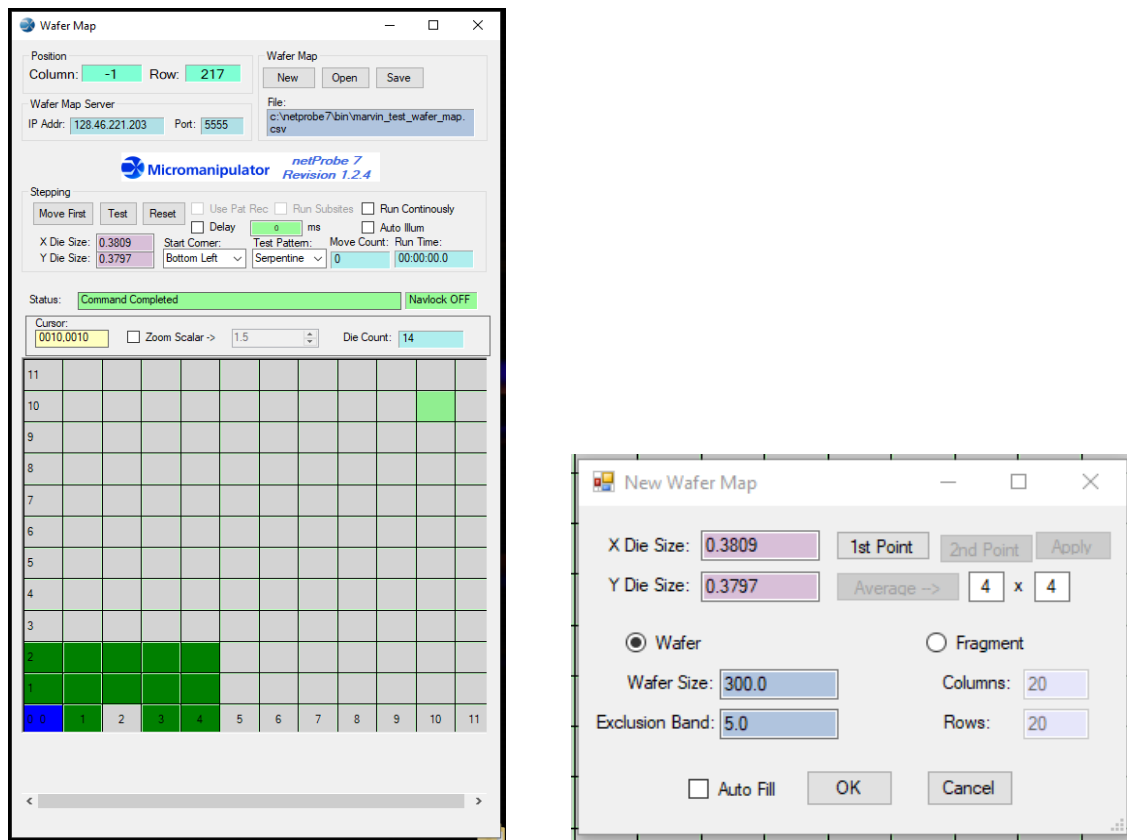


Figure 4. Wafer Map Window (Left) and New Wafer Map Window (Right)

Click “New” to create a wafer map for measurements. New Wafer Map window will pop up for setting up the wafer map. **To reduce chance of encountering problems, distance between devices should be designed in multiples of 100um.**

In New Wafer Map window, input X and Y Die Sizes according to the measured X and Y distances. Alternatively, move camera crosshair to geometric center of device on bottom left corner and click “1<sup>st</sup> point” and then move to the center of device on top right and click “2<sup>nd</sup> point”. Set values near “Average->” button and click “Average->”. This could give a better measurement reading by averaging the total distance against number of spacings between devices. Note: Values of A x B near “Average ->” should be A = (devices on a column - 1) and B = (devices on a row - 1).

Select Fragment in New Wafer Map window to define the number of devices on rows and columns. Click “OK” when finished. Now we can finish up the wafer map setting with the last step.

On the lower side of Wafer Map window, the squares represent different devices, right click on any of them to Add or Remove the device from measurement list. Right click on the lower left square and select “Reference” so the tool knows that is the origin device. Keep Shift key pressed while dragging the mouse will enable selection of multiple squares.

For some users, setting delay will enable enough time to average the measurement results, so tick “Delay” and input some desired wait time would be a good idea.

Before starting automated measurements, make sure the measurement instruments (oscilloscope, power supply etc.) have been fully set up to record the results.

When everything is ready, click on “Test” and automation will start. The automation only takes care of moving between devices, it is the duty of users to configure the measurement tools around and take measurements appropriately.