New Scale Technologies

**TECH NOTE**
V1.1 | 04.03.2017

# Multi-Probe Micromanipulator (MPM) System
# Probe Mounting and Pre-Positioning Solution

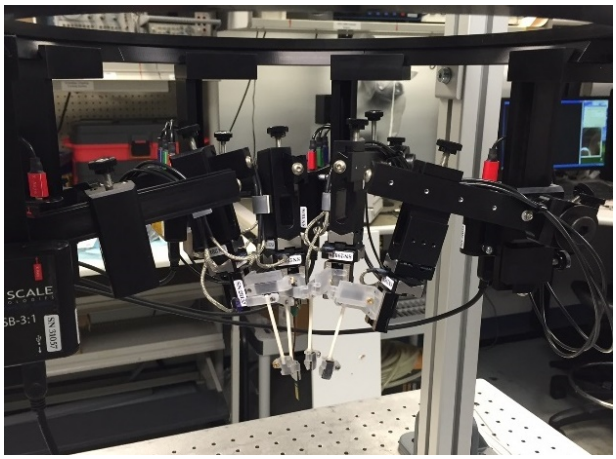
The New Scale Multi-Probe Micromanipulator (MPM) System enables precise positioning of multiple silicon neural probes in a very small area. It includes an innovative probe mounting and pre-positioning solution to reduce the setup time, minimize the risk of damage to the silicon probes during setup, and maximize data collection time.

This tech note describes the probe mounting and pre-positioning solution for the **NeuroNexus A32 probe** with **NeuroNexus OM32 adapter**.

## System Features

The components and critical features of this probe mounting and pre-positioning solution include:

- An MPM-4 DOF ARM mounting arm with four degrees of freedom to manually pre-position the probe prior to motorized positioning.
- A probe mount that is easily installed and removed using one captive screw.
- A steel reference probe that replaces the silicon probe during pre-positioning to enable precise, low-risk calibration of the desired starting position.
- The ability to rotate the silicon probe and electronics to any angle in the probe mount.
- A very slim probe mount assembly that allows close spacing of adjacent probes.
- A lightweight probe mount assembly that is compatible with the tiny motorized M3-LS stages of the MPM System.



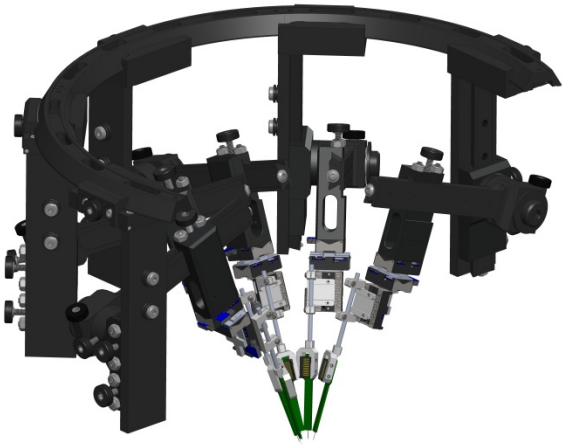


**Figure 1**: MPM System with five MPM-4-DOF ARM mounting arms and five probes.

## Mounting Arm (MPM-4 DOF ARM)

The MPM-4 DOF ARM provides the starting insertion point for motorized probe positioning.

The MPM system provides 6 mm of XYZ motorized probe movement. In practice this means that the probe tip must be “pre-positioned” within ~1 mm of the target insertion point in the brain.

The MPM-4 DOF ARM provides four manual axes of adjustment for pre-positioning the probe tip prior to motorized positioning.

The four axes of the MPM-4-DOF ARM are:

1. **Base polar angle.** The arm assembly rotates around the Z axis of the stereotactic coordinates. The range of adjustment can be up to 360 degrees when five MPM-Ring-72 ring segments are used. The recommend minimum separation between probes is 45 degrees.
2. **Arm height.** Motion is parallel to the Z axis with a range of 85 mm. The height has an adjustable stop.
3. **Arm angle.** The arm angle determines the probe insertion angle. Typical range is 5 to 45 degrees from vertical. The angle has an adjustable stop.
4. **Arm length.** Adjusting the length accommodates the desired insertion angle. Range is 85 mm.

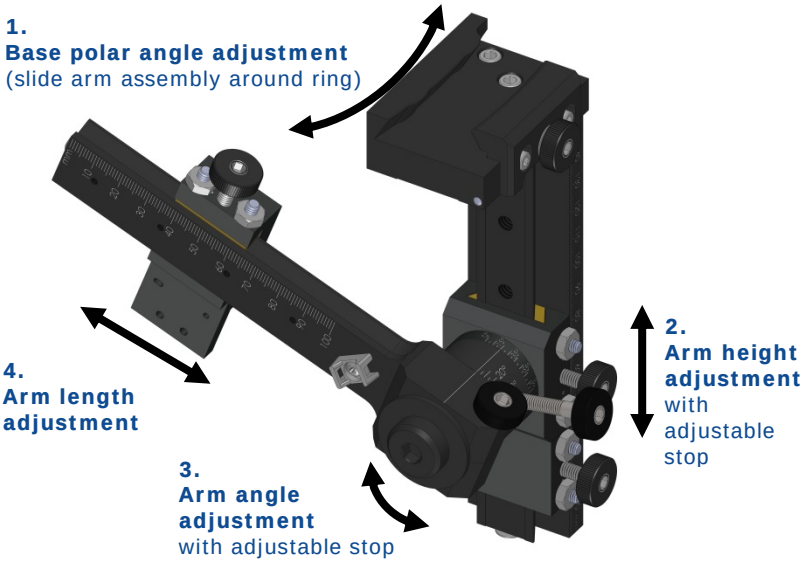



**Figure 2: The MPM-4 DOF ARM** is adjusted manually to provide large, sequential and predictable movements in four degrees of freedom. (Inverted configuration shown.)

## Pre-positioning With the Mounting Arm (MPM-4 DOF ARM)

Manual adjustment of the MPM-4 DOF ARM provides large, sequential and predictable movements in four axes. Adjustable stops set during initial alignment with the steel reference probe provide a repeatable starting position for the silicon probes. A typical pre-positioning sequence is:

a) Fix the base polar angle (1) and arm angle (4).

b) Adjust the arm height (2) to move the probe away from the brain.

c) Adjust the arm angle (3) to rotate the probe further away from the brain.

d) Install, adjust or replace the silicon probe.

e) Reverse steps b, c, and d to bring the probe tip back to the pre-position insertion point.

## The MPM Probe Mount-2

The MPM-Probe Mount-2 is an example of New Scale's novel solution for mounting advance silicon probes. This version is for the NeuroNexus A32 probe using the OM32 adapter.

The assembly has a mass less than 10 grams and is compatible with the tiny M3-LS motorized stages of the MPM System.

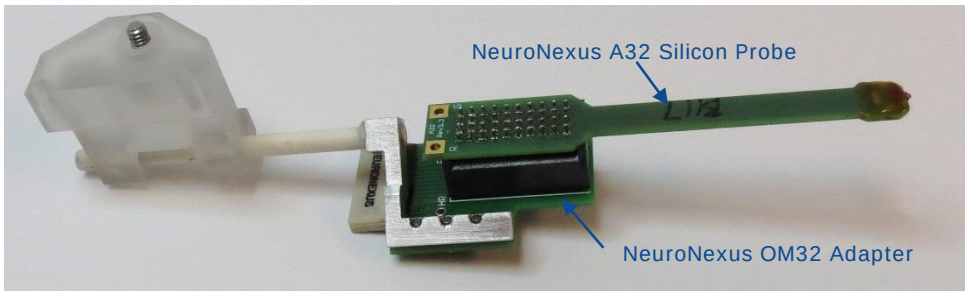



**Figure 3: MPM Probe Mount-2** with NeuroNexus A32 probe and OM32 adapter

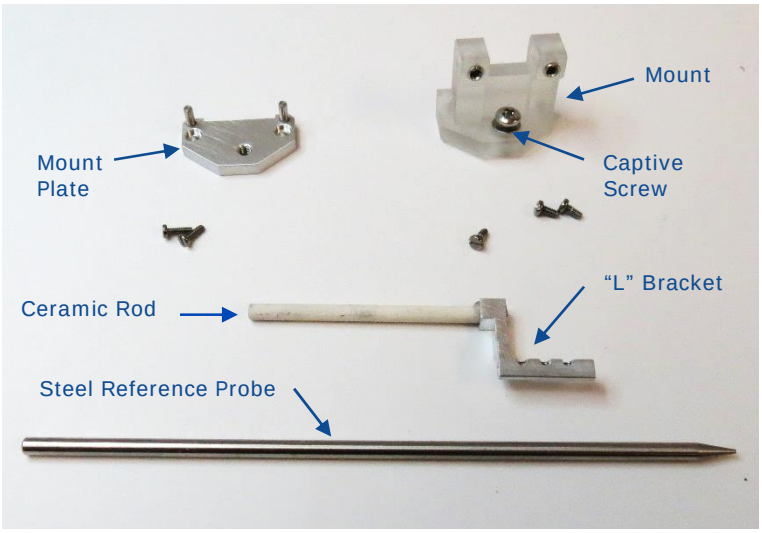



**Figure 4: MPM Probe Mount-2** components. The probe mount assembly is installed and removed using one captive screw.

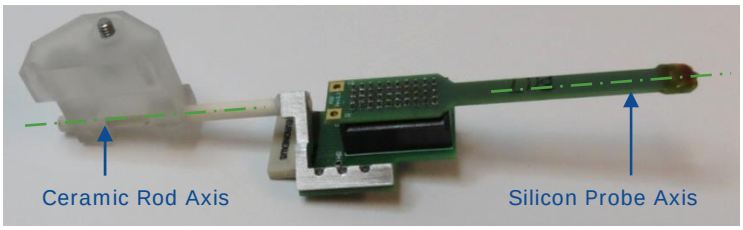



**Figure 5:** Using the MPM Probe Mount-2, the axes of the silicon probe and the ceramic rod are parallel and concentric.

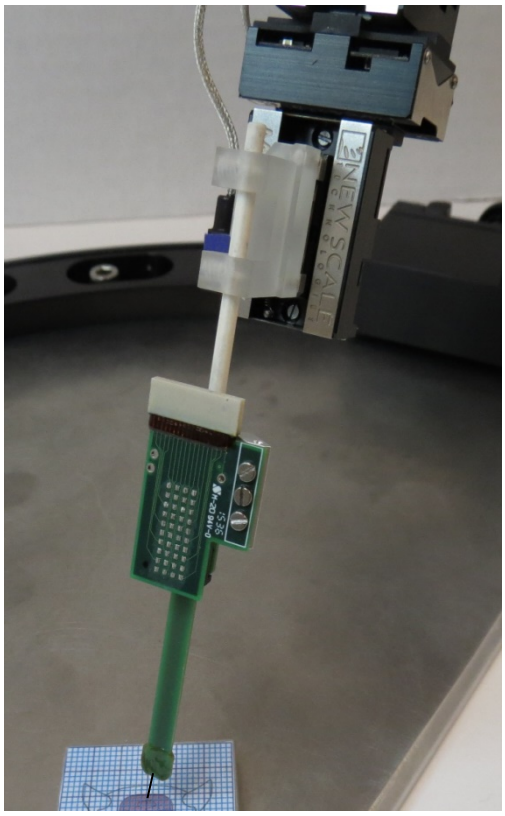


**Figure 6: MPM Probe Mount-2** mounted on the insertion (Z) axis of the M3-LS-1.8-XYZ manipulator with the NeuroNexus A32 Silicon Probe and OM32 Adapter installed.

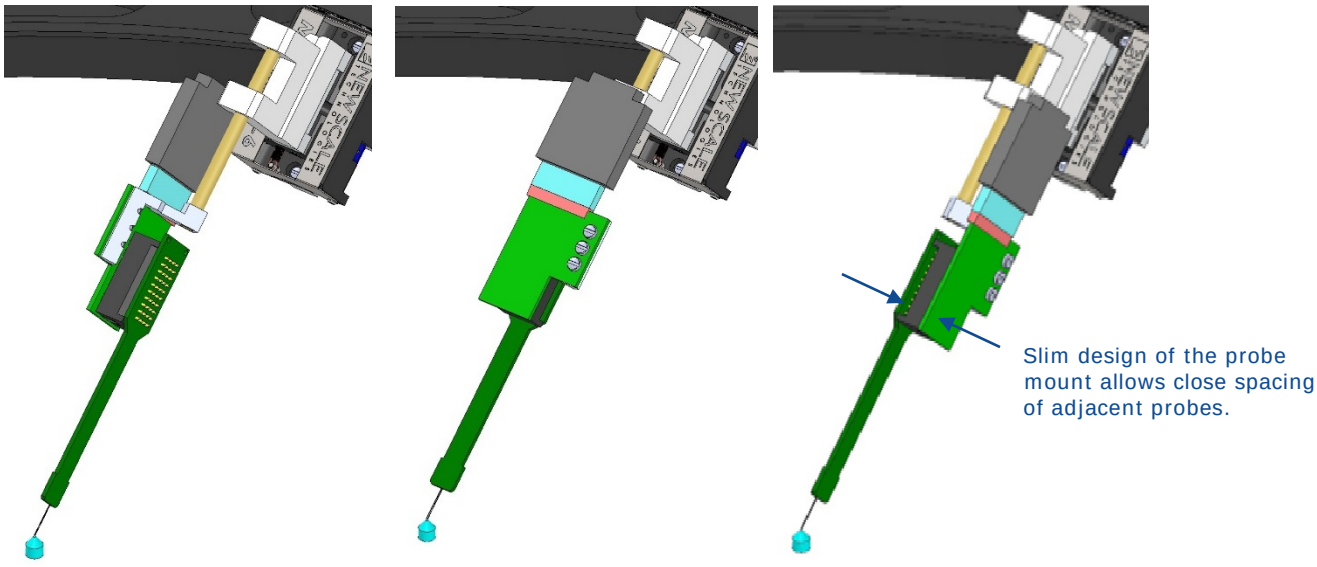



**Figure 7:** Rotating the ceramic rod in the MPM-Probe Mount-2 allows the silicon probe and electronics to be rotated to any angle without significant lateral displacement.

## Using the Steel Reference Probe

The steel reference probe is used to precisely establish the pre-position insertion point without risking damage to the silicon probe. The general steps are as follows:

a) Determine length A that is needed for your experiment. This length will be specific to each probe type, insertion angle and other factors.

b) Install the steel reference probe in the MPM Probe Mount-2 to achieve length A. The tip of the steel reference point is on the same centerline as the silicon probe.

c) Move the motorized stages to the desired “home” locations for X, Y and Z.

d) Adjust the MPM-4 DOF ARM to position the reference probe tip at the required insertion point, insertion angle, and base angle.

e) Move the adjustable stops for the insertion angle and Z height to these fixed positions.

f) Manually translate the Z height and rotate the insertion angle to bring the reference probe away from the insertion point for easier access.

g) Remove the steel reference probe and install the ceramic rod with the silicon probe assembly installed. Rotate the probe around the rod axis to the desired angle. Translate the ceramic rod within the mount as needed to achieve length A.

h) Carefully translate the arm Z height and rotate the insertion angle until the stops are touched.
The tip of the silicon probe should be at the insertion point within ~1 mm.

i) Use the motorized stages to precisely position the silicon probe and begin recording.

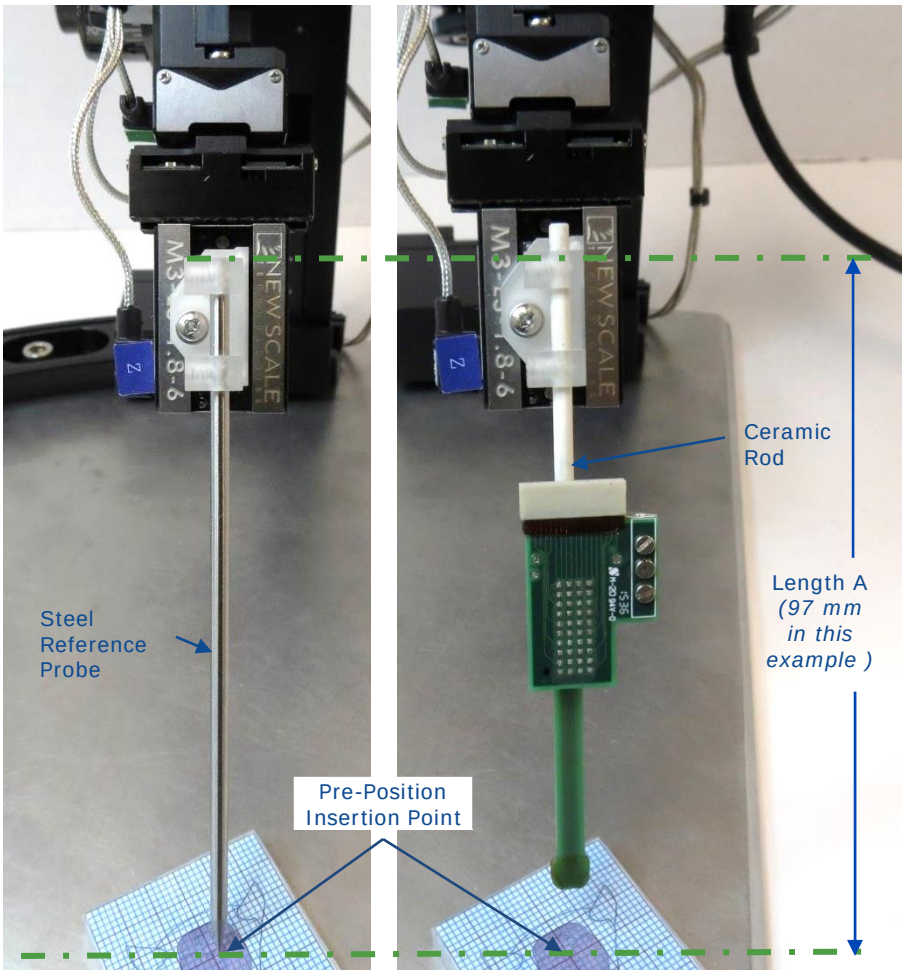



**Figure 8:** Use the steel reference probe to precisely establish the pre-position insertion point without risking damage to the silicon probe.

## For More Information

Visit newscaletech.com to contact our tech support team or find a MPM System distributor for local sales and support.