Selecting the Best Manipulator for your probing Application

Selecting the **BEST** manipulator for your application can be a challenge with the large number of products offered in the market. The easiest rule to remember is not to select the "best" manipulator available unless you have unlimited budget. It makes sense to select a manipulator that will do the job you need it to do and known future requirements. Here are some simple questions that will help you select the right manipulator.

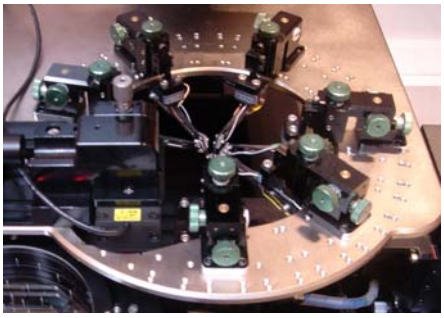
1.) What is the smallest size structure I need to land a probe on?

The resolution of the manipulator is directly related to the cost. The higher the resolution the more expensive the manipulator. If you are only probing pads then it is not cost effective to purchase a high resolution manipulator. Generally, for pad probing any manipulator with resolution greater than 20um (40 TPI) is adequate.

2.) Will I be doing any HF/Microwave probing?

For HF/Microwave probing you will need a much stronger manipulator to support the probe. Successful HF probing requires stability. The manipulator you select should be one designed for this purpose. Avoid both low and high resolution manipulators for this application.

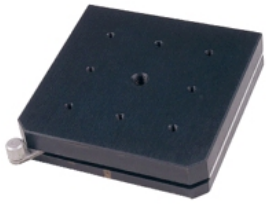
3.) How many probes will I be using at any one time?



Many times multiple manipulators are used instead of an expensive probe card. This is often the case when many different pad layouts require testing such as at Universities and R & D centers. For this application you will need a small footprint manipulator so that a large number can be placed next to one another and still be manipulated.

4.) **How should I hold my manipulators in place?**

Traditionally, vacuum has been the preferred method of holding all manipulators except for HF/Microwave applications. These are functional however the test area is filled with tangled vacuum tubes and is subject to positional loss if vacuum is lost for any reason. As platens become scratched they do not hold vacuum as well. Earlier magnetic bases have also been used but had the disadvantage of



"grabbing" the surface from a distance endangering expensive probes. For this reason, in the past, many HF/Microwave applications utilized bolt down bases where the manipulator was firmly bolted to pre-tapped holes positioned in the platen. This works well but limits the positions available for the manipulator. It also requires a special platen. SemiProbe now has a magnetic base with linear holding power! You can start with little or no magnetic hold and gradually move up until the manipulator is held firmly in place. There is no limit to the possible positions, no loss of holding power due to vacuum failure, and the manipulator is held securely for any application.

5.) What types of probe arms and probes are available for this manipulator?

Your application will dictate the type of probe you require. When selecting your manipulator, make sure that an adequate probe arm is available for your application. Not all manipulators or faceplates are usable with every manipulator. Generally a faceplate is used to provide mounts for a variety of probe arms. A good faceplate allows for multiple mounting positions to accommodate a wide variety of setups. There are a wide variety of probe arms and tips available. Here is a list of the most common:

- Standard DC
- Coaxial
- Triaxial
- Kelvin
- High Current
- High Temperature
- HF/Microwave

FAQ

1.) Many companies specify TPI (Threads per Inch) on the manipulator lead screw instead of resolution. How can I evaluate these manipulators?

Using TPI is another way of specifying how precise the motion control of the manipulator is. As a general rule, 40 TPI is adequate for pad probing, 80 TPI is adequate for general probing requirements from pads down to 3 microns, and 100 TPI or better is required for probing submicron structures.

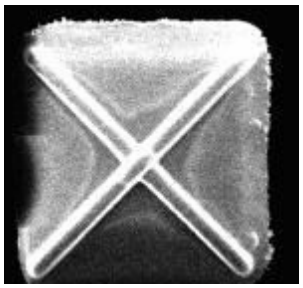
2.) What is the difference between left hand and right hand manipulators?

If the manipulator is placed on the right side of the probe station platen and the X axis knob is facing the front of the probe station then this is a right hand manipulator. If the X axis control is on the far side of the manipulator then it is a left handed manipulator. Moving it to the left side of the platen will make the X axis control face front.

3.) How small a structure can I probe?

This question needs further specification. Using a standard probe station with a visible microscope system sub-micron probing down to approximately 0.6 microns can be successfully probed. The use of a visual microscope system to see structures and probes below this size is improbable because of diffraction limitation (Laws of physics). Other techniques such as AFM, FIB, etc. can allow probing of structures below this size.

4.) Can deep sub-micron structures be modified for probing with standard probing equipment?



Yes, using a FIB, a deep sub-micron structure may be modified to create a mushroom shaped metal structure above it with a cap large enough to see and contact with a standard probe. Typically an "X" is formed to allow the probes to be pushed into a corner of the "X" for easier probe manipulation. This is often done when longer or multiple tests need to be accomplished on the same sample. It also allows a sample to be outsourced for preparation and then returned in-house for further study. While this does allow contact never before available, there are distinct disadvantages to this technology. Sample preparation time is up to 3 hours for a single transistor, the cost is high, access to this equipment is often limited, the structure may change the device characteristics, and further reprocessing is difficult or impossible.

5.) Are there other issues when probing very small structures I need to know about?

Yes, absolutely! Vibration is one condition that needs to be limited. This can usually be done using a vibration isolation system. Another factor to consider is the motion created by touching the manipulator to make positional adjustments. For deep sub-micron work a

"hands free" solution is recommended. This can be a computer controlled manipulator, a joystick motorized manipulator or for most applications a microfluidic manipulator which allows the user to control motion from remote control panel is the easiest to use and most cost effective.

6.) Are there special considerations for HF/Microwave probing?

Yes, the manipulator needs to be strong enough to hold the HF/Microwave or probe wedge so that there is no vibration between the probe tip and the test substrate. The HF probe arm is heavier than a standard arm and includes a device for planarizing the tips so that every tip on the probe remains in contact at the same contact force. Because these probes are always touching down on pads, there is no requirement for high resolution. Typically 80 TPI manipulators are adequate. Typically, these manipulators are set up in either an East/West or a North/South/East/West configuration. This makes bolt down positions easier to accommodate if desired.

Many HF testing setup require the shortest possible distance from the probe tip to the instrumentation. This often creates challenges for the manipulator configuration. SemiProbe has created their HF probe so that it can be switched from a horizontal to vertical configuration within minutes to accommodate multiple test setups.

7.) How do I select a probe tip?

As a general rule, to compensate for mechanical inaccuracies with manipulators and probe systems, select a tip size that is 1/4 the size of the structure you desire to probe. High Current or High Voltage probing requires larger diameter probe tips. The SemiProbe online store at www.semiprobe.com has additional information.

The Parts of a Manipulator