



Lab Manual

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I-V Probe Station

(iv)

1. Introduction

The Signatone S-1150 Analytical Prober, with Bausch & Lomb MicroZoom microscope and the following equipment is available for device testing. This manual describes only the operation of the probe station.

2. Description & Operational Overview

The probe station consists of the following:

- ▶ Bausch & Lomb MicroZoom Microscope with 3 objectives: 2.25X (blue), 8X (green), 25X (gray)
- ▶ 5" Vacuum Chuck Stage with X, Y, Z and Θ motion
- ▶ 4 Micromanipulators
- ▶ Z-Motion Adjustable Platen
- ▶ HP 4145A Semiconductor Parameter Analyzer
- ▶ Tektronics 576 Curve Tracer
- ▶ HP 34401A Digital Multimeter
- ▶ HP 6237B Power Supply
- ▶ HP 3312A Function Generator
- ▶ Tektronics 475 Oscilloscope

The light source for the B&L MicroZoom microscope is located on the table, left of the station, and has three intensity settings. Please be sure to turn the light off when you are through using the system.

Instrumentation

- ▶ HP 4145A manual is on top of the equipment
- ▶ HP 4145A BNC connectors are marked for SMU connections

The microscope can be displaced independently from the chuck in X, Y and Z (focus) directions

The platen is the metallic shelf to which three micromanipulators are held by vacuum. The large handle on the left side of the system raises and lowers the platen and the probes. This handle should always be in the up (rearmost) position when you leave the system.

A micromanipulator is moved by pressing the button at its base to release the vacuum, and gently sliding it to the desired position. Be careful! The micromanipulators have a tendency to "stick" and may move very suddenly from their position if you exert too much force, causing the probe or the micromanipulator itself to jam into another part of the system and damage it.

The various chuck motion controls are located as described here:

X Motion: Crank at right front of station.

Y Motion: Crank at left front of station.

Z Motion: Knob to left at base of chuck.

Θ Motion: Knob in front at base of chuck.

The chuck vacuum used to secure the sample on the chuck is controlled by a toggle switch on the left hand side of the station.

The strategy used to set up a sample for testing is first to set the probes up correctly, and then to bring the probes and the sample into the same focus plane. This will get you to a position from which it will be easy to make the minor adjustments necessary to probe the devices without damaging either the probe tips or the sample.

3. Operating Procedure

Use the following procedures to set up a sample for probing. Take extreme caution at all times not to jam the probes into each other or into the sample, as this will cause the probe tips to be bent into a hook, at which point they must be changed. Changing the probes is tedious, so the care you take in handling them is well worth the effort. If the probes hook, it is the user's responsibility to change them. New probes are available at the front desk in 406 Cory to replenish your personal probe supply.

Before beginning, check that the system is in standby condition as follows:

Light off;
Platen elevated (handle in rearmost position);
Vacuum off;
Probes raised well above chuck.

1. Make sure that the chuck is sufficiently low that when the platen is lowered, the probe tips do not bottom out on the wafer (it should have been left this way by the previous user). Make sure that the microscope is reasonably well centered.
2. Put the wafer on the chuck and turn on the vacuum.
3. Rotate the chuck theta adjustment as needed to "square" the wafer. Be careful not to rotate the chuck so far that the vacuum tube gets wrapped around the shaft driving the chuck.
4. Turn on the lamp. Move the X and Y of the chuck to place the area of interest under the microscope. The 2.25X magnification is recommended, as is the widest field of view for the alignment procedure.
5. Raise the probes' Z adjustment all the way up. Put the X and Y adjustments near the middle of their ranges.
6. Lower the platen.
7. Holding the vacuum switch on the micromanipulator in, move each micromanipulator so that its probe is under the microscope and a few millimeters above the wafer. Look at the probe tip from the side, not through the microscope.
8. If needed, adjust the height of the probe tip as follows.
 - a) Move the micromanipulator so that the probe is away from the chuck and accessible to you.
 - b) Gently retract the sleeve away from the probe while holding onto the top of the probe with flat-tipped tweezers. This will allow you to move the probe. Use the tweezers to slide the probe up or down as necessary. If the probe is too long on top and threatens to hit the objective, you can either cut the top with the wire cutters or bend it over using the tweezers. Wire cutters are available in the "IV Probe Station" drawer located below the station.
 - c) Allow the sleeve to return to its normal position. It will hold the probe in place. Move the probe back over the chuck and check that it is nearly level with the other probes.
 - d) The used probe tips should be placed in a "Sharps Box" (not the regular trash) to avoid injuring the custodian.
9. Lower each probe until it comes into focus. Move the probes to the spot to be probed. Finally, lower them onto the wafer. You will know that the tips are on the sample when they appear to "slide" in the direction they are angled.
10. Devices with the same bond-pad pattern can be probed by simply raising the platen, moving the chuck to so that the new device is in view, and lowering the platen.

When switching wafers, the probes only need to rise slightly using the micromanipulators; they can be raised up the rest of the way using the platen.

The microscope can be moved independently from the chuck in order to inspect the entire device at high magnification while the probe tips stay in position.

11. Make sure that the cable connections are correct. Because poor or missing connections occur frequently on the probe station, it is worth doing a "sanity check" by gently touching pairs of probes together and checking that the wires you have connected to the probes are indeed shorted together.

Attention: Do not connect HP 4145A and the curve tracer together. Check and make sure that they are not already both connected to the probe station.

12. When you are finished, return the system to standby by raising the probe tips so that they will not touch a wafer when the platen is lowered, raising the platen all the way, turning off the lamp and all the equipment you used, turning off the vacuum, moving the chuck out from under the microscope, and removing your sample. If used, make sure that the curve tracer is left on the lowest voltage scale. Disable the system.
13. To reiterate, when you are done with the probe station, raise both the probe tips AND the platen so that the next user doesn't jam the probe tips into his wafer, damaging both.
14. Users are required to maintain a supply of replacement probe tips. During qualification, users must show their probe-tip supply (minimum of two) to the Superuser.

One way to store spare probe tips is to put a piece of thick two-sided tape in a plastic dish. Probes are placed on the tape with their tips hanging over the side of the tape, in free space. The dish is kept in the user's storage space with the lid on.

