



Lab Manual

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General Probe Station

(probe145)

1.0 Title

General Probe Station in Room 145

2.0 Purpose

This document describes the operation of the I-V probe station located in 145 Cory Hall. It also provides information about how to covert measurement data from the HP4145B Semiconductor Parameter Analyzer's binary format to universal text format that can be opened on PC-s under Windows or MS-DOS operation system.

3.0 Scope

The I-V probe station is capable of general semiconductor parameter testing, measurement data saving and formatting.

4.0 Applicable Documents

[Revision History](#)

Copy of the HP 4145 operation manual is located next to the probe station. Please do not remove the manual from the site.

5.0 Definitions and Process Terminology

5.1 The probe station consists of the following:

- ▶ Bausch & Lomb Microscope with a zoom objective from 1x to 7x magnification
- ▶ 4" vacuum chuck stage with X and Y motion capability
- ▶ 4 micromanipulators
- ▶ Z-motion adjustable platen
- ▶ HP 4145B Semiconductor Parameter Analyzer
- ▶ PC with MS-DOS operation system for data conversion

5.2 The light source for the B&L microscope is located on the outside of the right side cover wall, and has three intensity settings. Please be sure to turn the light off when you are done using the system.

5.3 HP 4145B BNC connectors are marked for SMU connections.

5.4 The microscope can be displaced independently from the chuck in Z direction.

5.5 The platen is the metallic shelf to which four micromanipulators are held by magnet. The 2 large handles on back of each side of the system raise and lower the platen and the probes. The handle should be always in the up (rearmost) position when you leave the system.

5.6 The micromanipulator is moved by releasing from the platen against the magnetic force and gently moving it to the desired position. Be careful! The micromanipulators have the 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 other part of the system and damage it.

- 5.7 The various chuck motion controls are located as described here:
- ▶ X-motion: Knob at left and right front of station
 - ▶ Y-motion: Knob to pull and push the chuck with at the front of the station (Note: no **fine** alignment in Y direction)
 - ▶ Z-motion: Knob at the inner right side of the platen
- 5.8 The chuck vacuum used to secure the wafer or the sample on the chuck is controlled by a toggle switch located at the front side of the base. The system vacuum on and off switch is located on the outside of the right side cover wall. Please turn off the system vacuum with the main switch when you are done with your measurements.

6.0 Safety

To keep the integrity of the probe station, please follow these simple rules:

- To avoid contamination please always wear gloves when installing a new probe tip or touching the end of the micromanipulators
- Do no force the movement of the micromanipulators
- Raise the platen and the probe tips when you are done using the station so the next user doesn't jam the probe tips into his/her wafer damaging both

7.0 Statistical Process Data

N/A

8.0 Available Processes and Gases

N/A

9.0 Equipment Operation

9.1 Operating Procedure of the Probe Station

- 9.1.1 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).
- 9.1.2 Put the wafer on the chuck and turn on the vacuum – toggle in front.
- 9.1.3 Turn on the lamp. Move the X and Y of the chuck to place the area of interest under the microscope.
- 9.1.4 Raise the probes' Z adjustment all the way up. Put the X and Y adjustments near the middle of their ranges.
- 9.1.5 Lower the platen.
- 9.1.6 Carefully 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.
- 9.1.7 If needed, adjust the height of the probe tip or replace them as follows:
- 9.1.7.1 Move the micromanipulator so that the probe is away from the chuck and accessible to you.
 - 9.1.7.2 Gently loosen the screw with the small screwdriver located on the inner left wall of the station, while holding onto the top of the probe with a flat-tipped tweezers. This will allow you to move the probe. Use the tweezers to slide the probe up or down as necessary. Tighten the screw and place the screwdriver to its location.

- 9.1.7.3 Move the probe back over the chuck and check that it is nearly level with the other probes.
- 9.1.7.4 The used probe tips should be placed in a **Sharps Box** (not the regular trash) to avoid injuring the custodian.
- 9.1.8 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.
- 9.1.9 Devices with the same bond-pad pattern can be probed by simply raising the platen, moving the chuck 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.
- 9.1.10 Make sure that the cable connections are correct.
- 9.1.11 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.
- 9.1.12 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.
- 9.1.13 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.

9.1 Step-by-Step Instructions for File Transfer from Binary HP4145 Format to PC Text Format

- 9.1.1 Go into the USER directory on the PC (type: CD USER at MS-DOS prompt)
- 9.1.2 The directory needs to contain the following files (type **dir**):
- 4284
 - EXTRACT
 - QSCV
 - AUTOST
- The content of the directory can be checked by typing DIR command.
- 9.1.3 Type htb386, press Enter and the High Tech Basic program starts.
- 9.1.4 If you happen to make typing or any other mistake in the program, press Ctrl+Break/Pause to reset the program.
- 9.1.5 Insert your floppy disk into the PC on which you want to see that measurement file and press Enter.
- 9.1.6 Press **F5** (LOAD).
- 9.1.7 Type **EXTRACT** then press Enter.
- 9.1.8 Press **F3** (RUN).
- 9.1.9 Type a name you desire to give to the measurement file (i.e. TEST).
- 9.1.10 The program now asks for the name of the HP4145 data file to be converted (Name of BDAT file). If you wish to convert the very last measurement result (which is in the

buffer), then press Enter; otherwise type the name of the file you saved previously (i.e. MEAS). To display the files stored on the HP4145 disk, press MENU followed by the 6CAT button on the HP4145B panel.

9.1.11 Give the following information as they appear in the HP4145 measurement setup:

Note: Follow the screen of the HP4145, it displays the relevant setup pages.

- name of variable1 (i.e. VDS)
- variable1 start, variable1 stop (i.e. -2.5, 2.5)
- name of variable2 (i.e. VG)
- variable2 start, step size of variable2 (i.e. 0, -1)
- number of curves: type 1 if you executed a SINGLE measurement; or the number corresponds to the amount of measurements executed under REPEAT measurement (it does not ask about the number of curves within the measurement)
- enter your comments
- name of the Y1 column
- name of the Y2 column
- name of the Y3 column

9.1.12 **Data transferred successfully** appears after the program has transferred the data from the HP4145. The screen displays the content of the floppy disk.

9.1.13 When you finished, type **QUIT** to exit the program

10.0 Troubleshooting Guidelines

N/A

11.0 Figures & Schematics

N/A

12.0 Appendix

N/A