

# Standard Operating Procedure:

## Proxima Keysight B1500A Semiconductor

### Device Analyzer

Date of Update: - 21<sup>st</sup> September 2021

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This document contains two parts:-

#### **1. Basic Operating Procedure**

- a. Comprises of a Video link explaining the Basic Operating Procedure and Overview of using Proxima tool.
- b. Explanation of the part of the Proxima tool and the Operating procedure.

#### **2. Lab policy which every user must adhere to while using the lab.**

**Please go through both the section before starting to use the tool.**

## 1. Basic Operating Procedure:-

Further, the entire Operating procedure is explained in the video -

[Proxima SOP video link](#) (video credit – Yaswanth Chebrolu).

This video (of 20 minutes) contains step by step procedure to:-

1. I -V
2. C-V
3. MOSFET Characterization

This system is used for room temperature IV/CV and pulse/dynamic I-V measurements. It is a product by Keysight Model B1500A semiconductor device analyzer.

**Following Measurement can be done:**

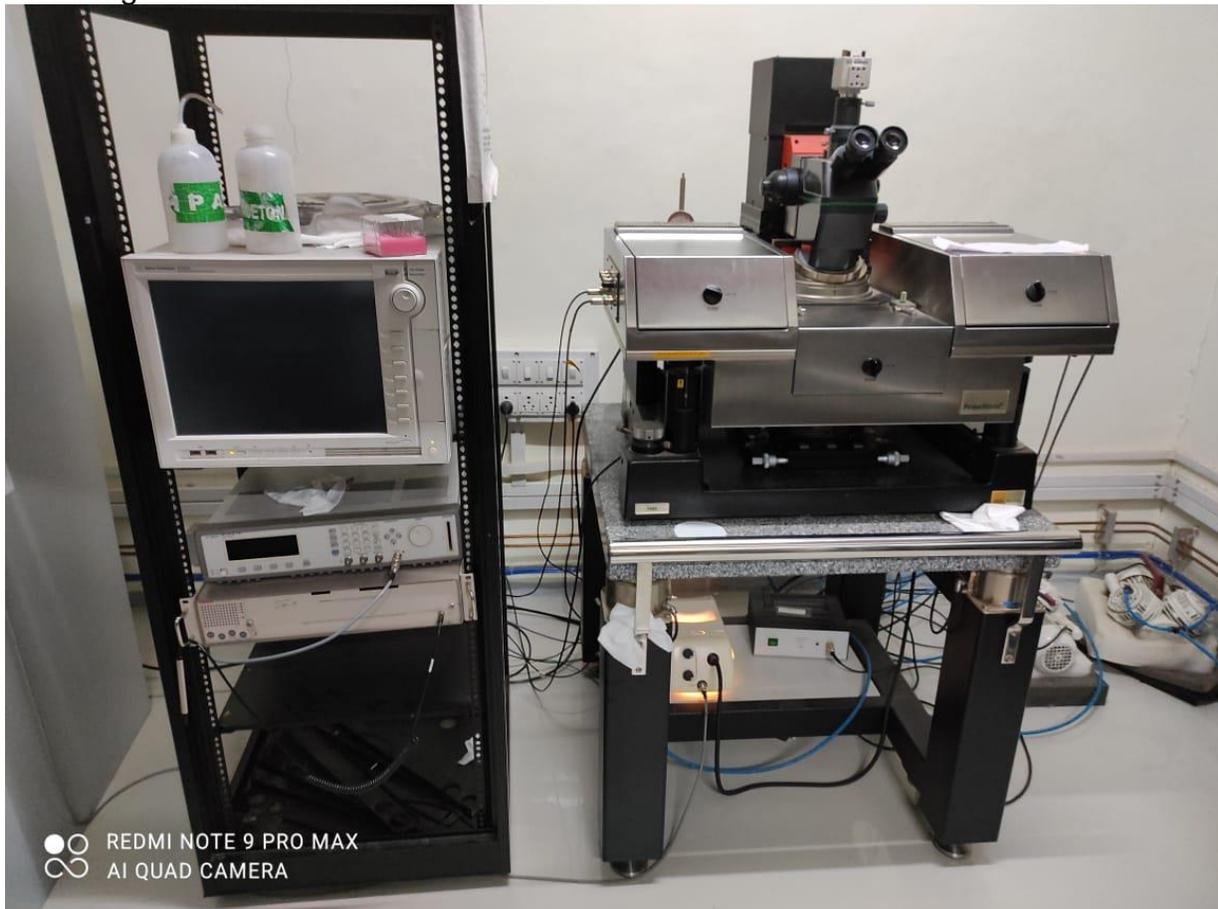
1. I-V/ C-V measurement.
2. Pulsed IV/Fast IV/Transient IV measurement.
3. Pulse generation

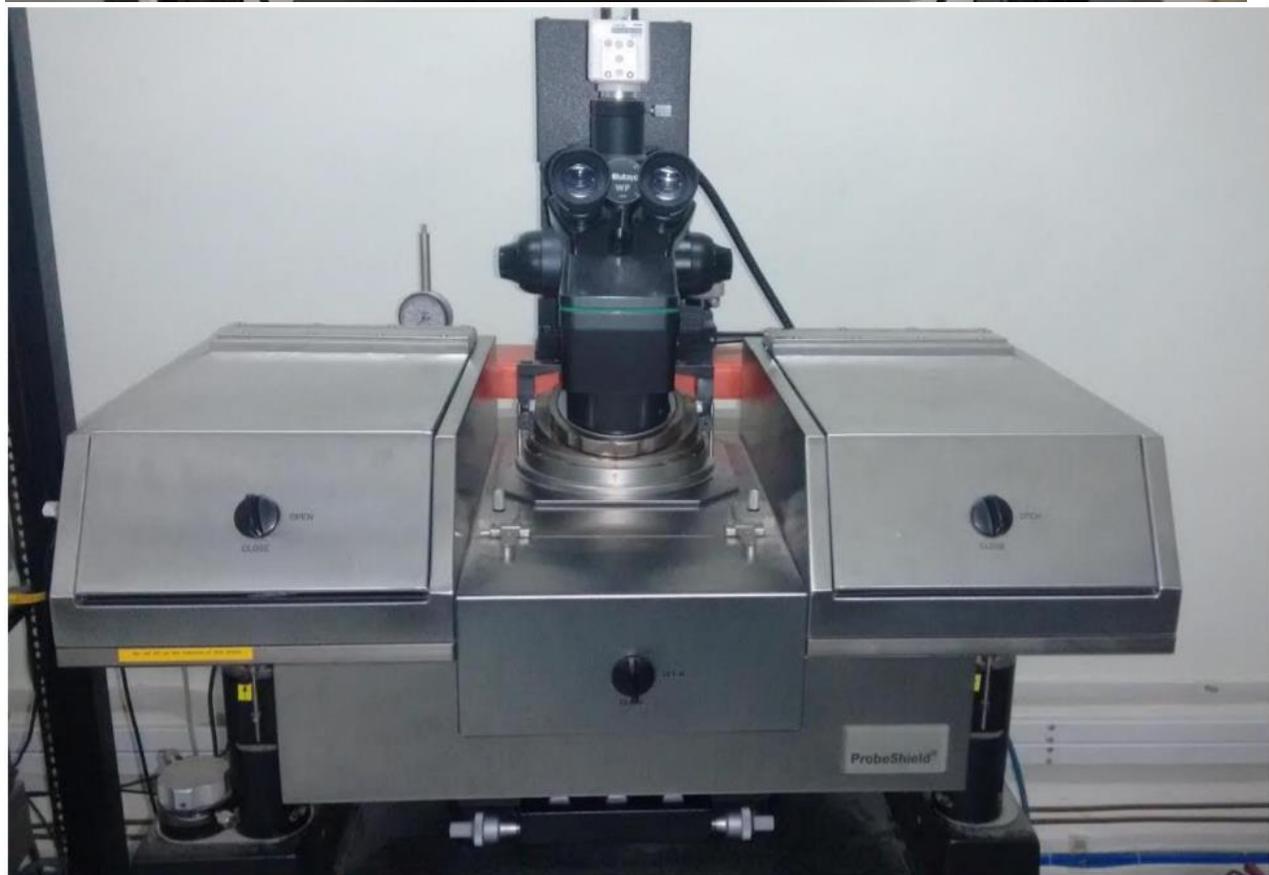
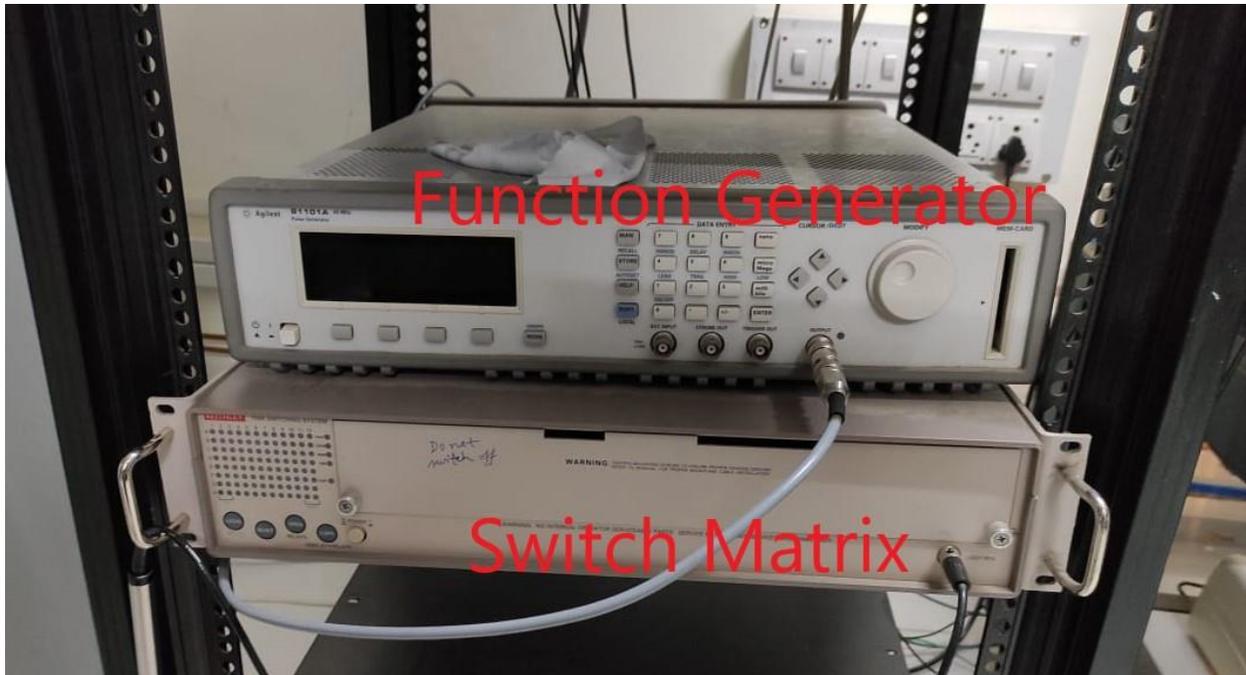
**Instrument Connections:**

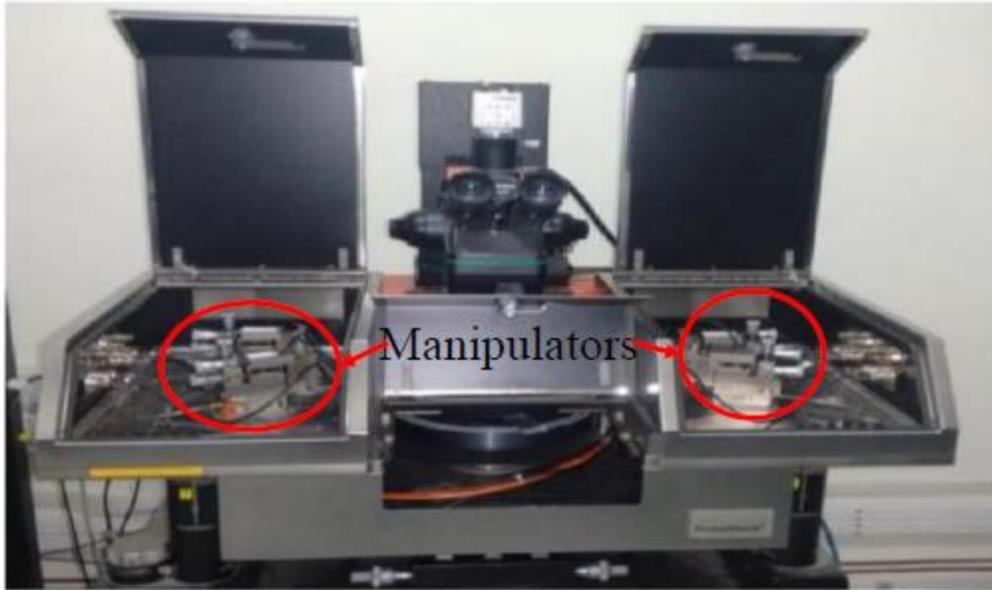
1. Three SMUs are connected to switch matrix column 1 (SMU 1) ,2 (SMU 2) and 3 (SMU 3) respectively.
2. GNDU is connected to switch matrix column 4.
3. Manipulator A, B, C and D connected to switch matrix rows A, B, C & D respectively.
4. Chuck connected to row E.
5. CV (High) connected to column 10.
6. CV (Low) connected to column 11.

**Parts of the Tools Explained**

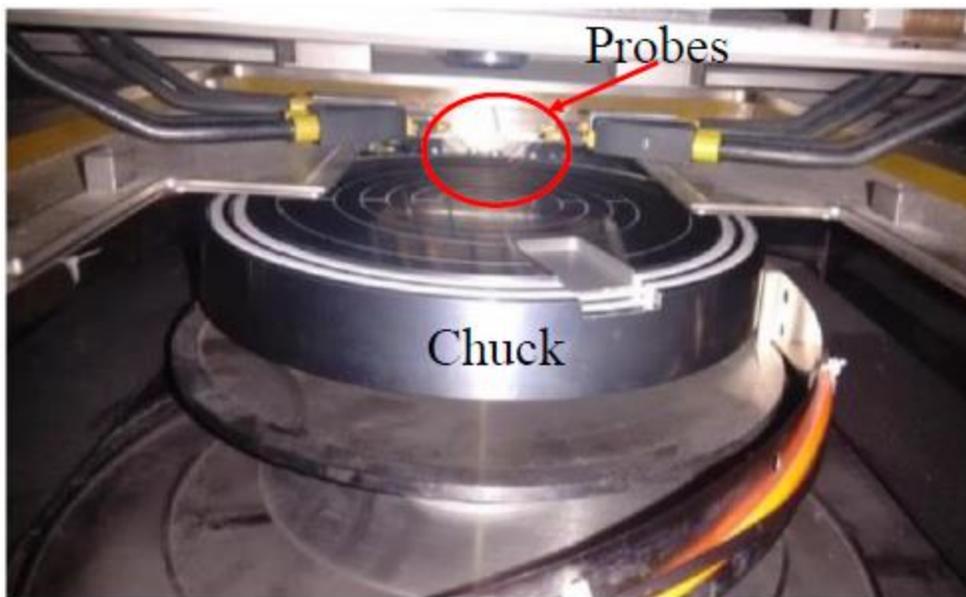
The image of the Proxima is shown below:-

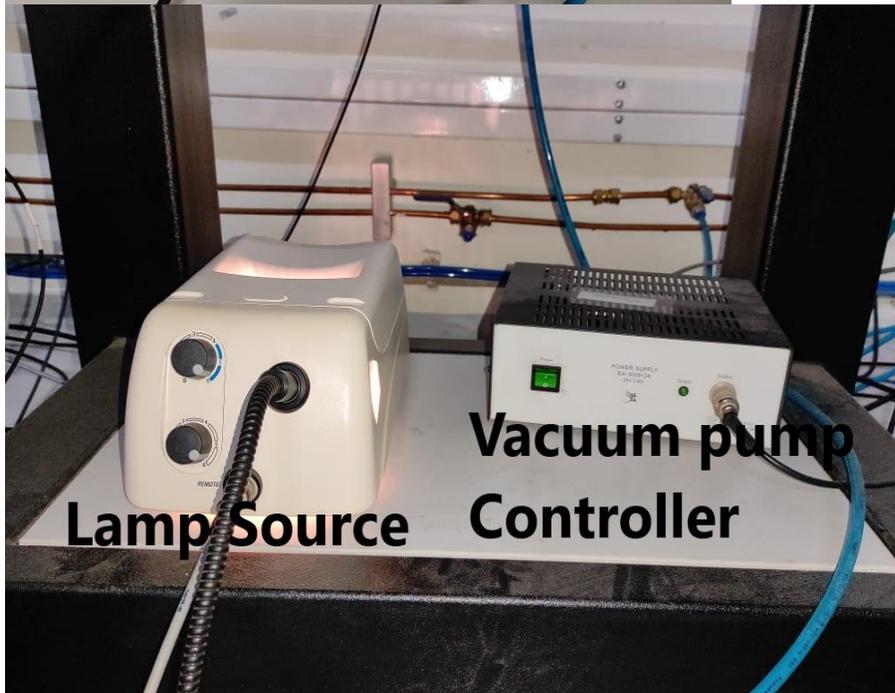
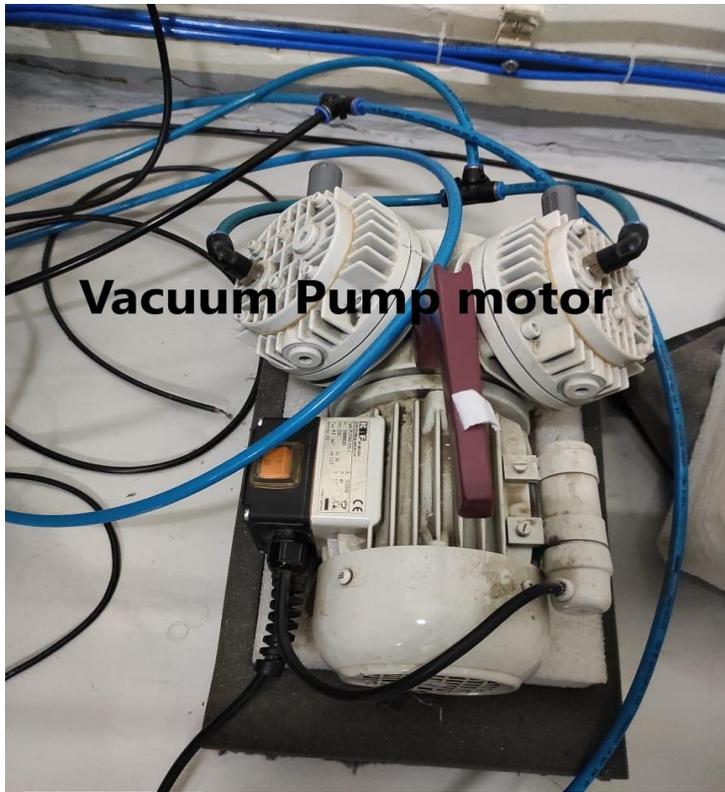






Probe station with 4 manipulators which can be moved in the x, y and z directions using the respective knobs.





## Part A: Hardware Setup Usage Instruction

Step1:

Switch on the vacuum pump. Press VAC button. The vacuum reaches the center of the chuck

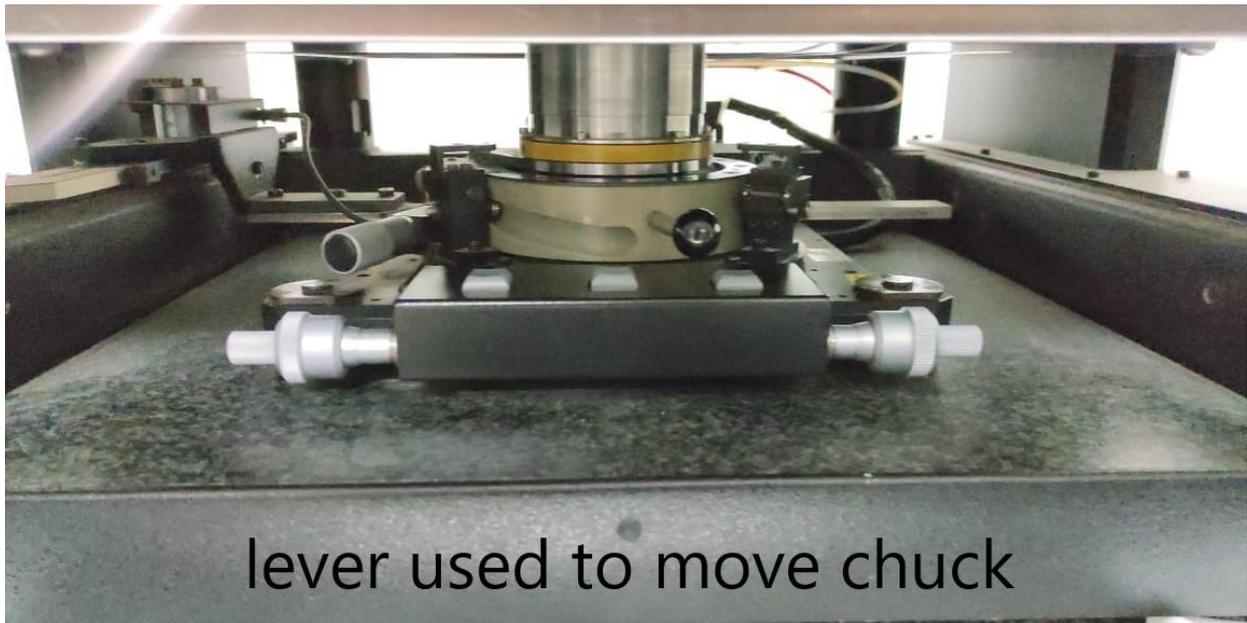
through a hole. This creates a suction force to the DUT (Device under test). The vacuum hold firmly holds the device on the chuck.

Step2:

Switch On the light source. The intensity of the light is controllable using the knob.

Step 3:

The chuck is movable in X-Y plane by pressing both X-Y button. X and Y button moves chuck in X and Y direction respectively. Pull the chuck out. Move chuck down by using lever as shown in the figure below. Place the DUT exactly at the center of the chuck. Then move chuck up by using a lever.

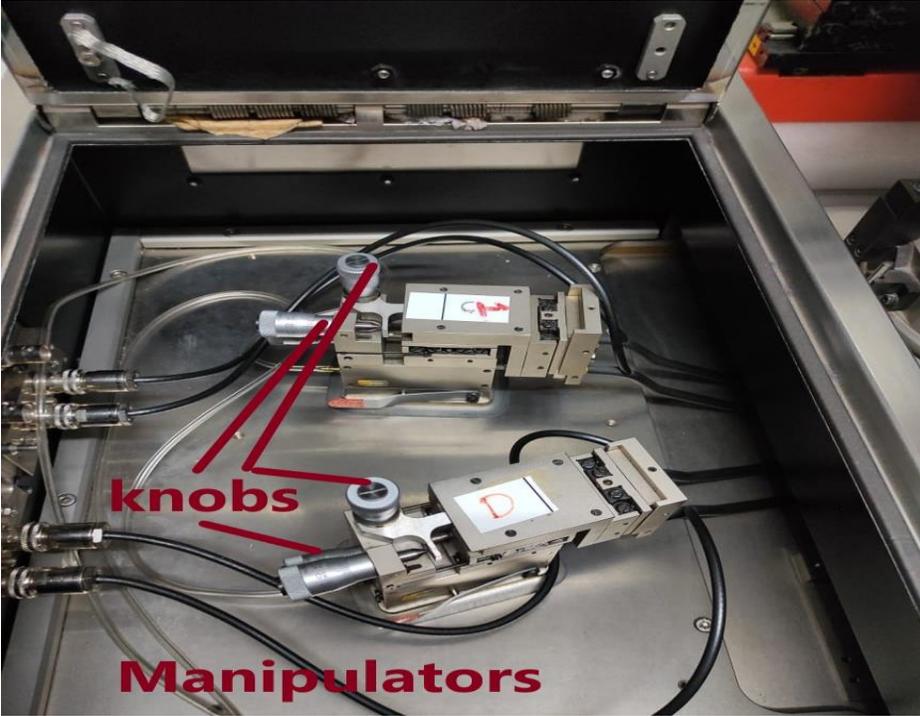


(**Caution:** Before making the chuck up, make sure that probe needle is sufficiently up so that chuck does not hit the probe tip.)

Step 4:

There are 4 manipulators named as A, B, C, D. The chuck is named as E. Focus the lens of microscope properly till contacts of sample are clearly visible. Probe the DUT with probe needle. Switch off the light source after probing is done.

There are three knobs associated with each manipulator. These are used for moving the probe needle in X, Y and Z direction. Once the probe tip makes contact with DUT, it will slide over DUT indicating contact is done. Now Z- direction knob should not be rotated further otherwise it will damage the DUT or the probe needle can break.



**Part B: Switch Matrix Connection.**

Switch matrix establishes connection between hardware and software setup. It consist grid interconnection. Columns of switch matrix are connected to SMU/CMU. Rows of switch matrix are connected to manipulators.

SMU 1, 2 and 3 represent column 1, 2 and 3 respectively.

There are 2 CMU: CVH and CVL. These represents column 10 and 11. Ground (GNDU) : Column 4.

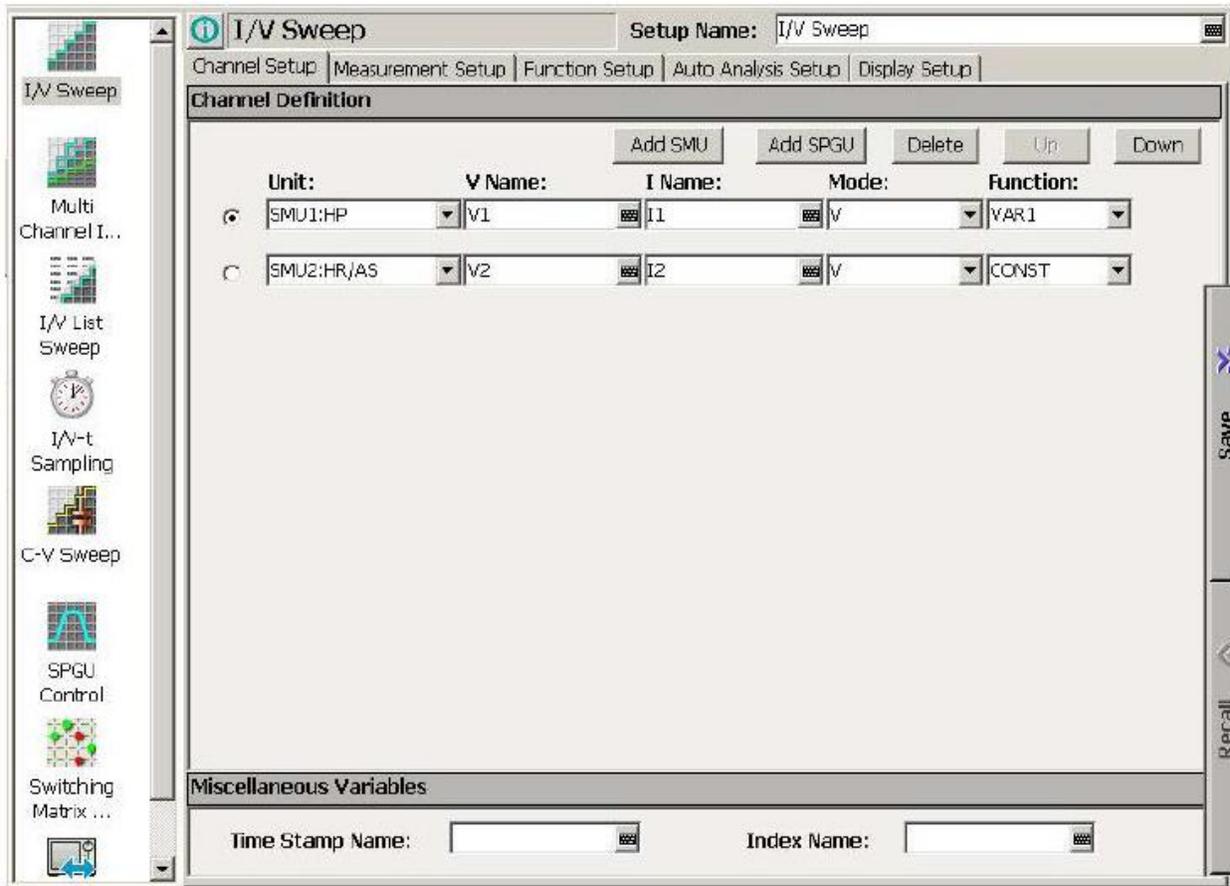
Example: If you are doing a 2 terminal I-V measurement by using SMU 1 and SMU 2 and sample is probed using manipulator A , C. If you want to make connection of SMU 1 with A and SMU 2 with C then it can be done by pressing the dot corresponding to A1 (Row A, Column 1) and C2 (Row C, Column 2) with the help of light pen. Then press copy button.

### Part C: Software Setup Usage Instruction

1. Double click on the Keysight icon. Start Easy Expert Window will be displayed.



2. Click on the "Start EasyExpert". A new window will open, there, select No.
3. At the left most column of the screen, click on Classic Test Tab.
4. Then, select the desired sweep. A display window will appear. For example, after selecting I-V sweep, the following display window will appear.



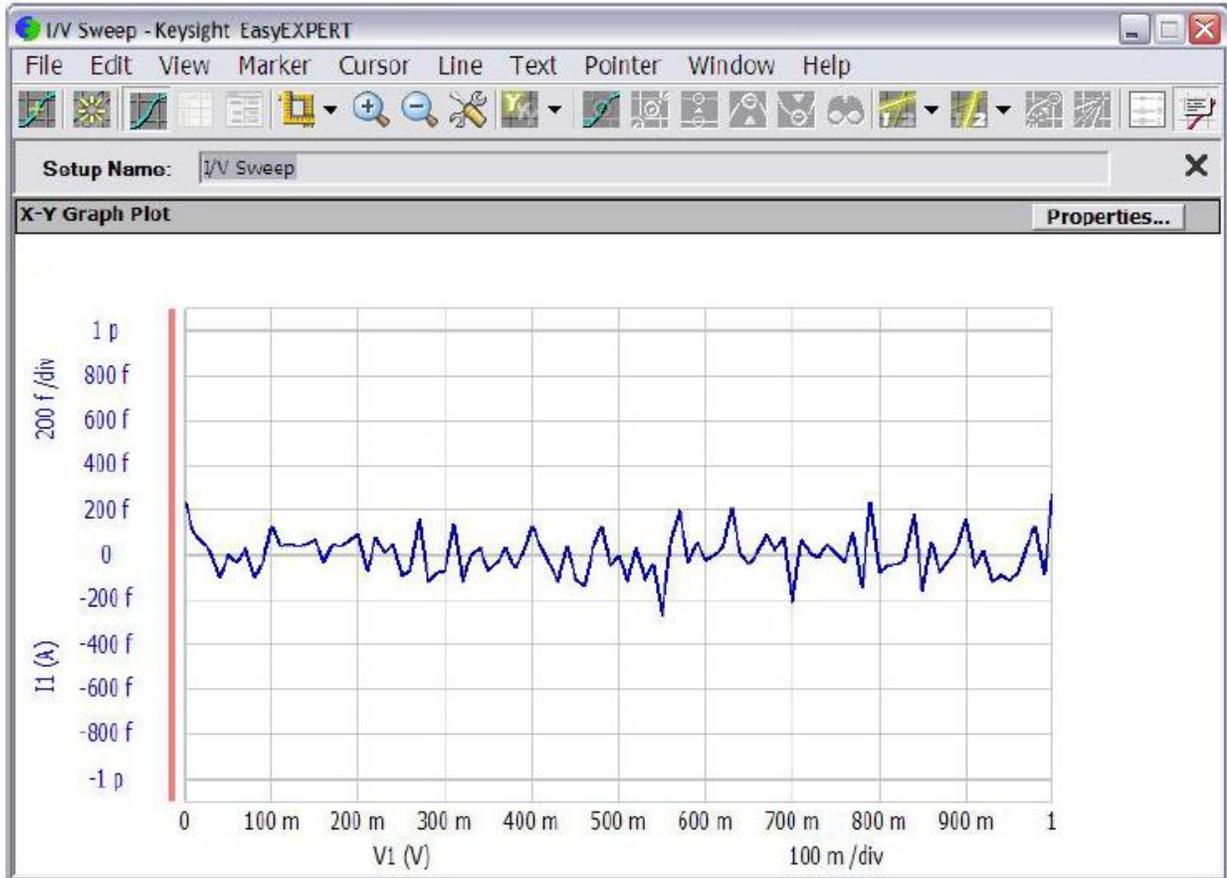
5. In the channel setup dialog box, setup the configuration for different SMUs as shown in the above dialog box. In case more SMUs are required, for example in case of Four probe measurement, we can add more SMUs by using Add SMU button. Also, in Mode setup, we need to set I or IPULSE for the current output and voltage measurement or set V, VPULSE, or COMMON for the voltage output and current measurement. In the Function dialog box, set Var if want to perform a sweep on it, else select Const which keep the voltage on that SMU constant during the sweep.
6. Now click on measurement setup Tab where we can set up everything required to perform the measurement, for example, starting voltage, stop voltage, number of steps, direction of sweep, whether we want to sweep in one direction or both the direction, compliance, whether we want linear scale or log scale, etc. A typical window of measurement setup for the I-V sweep is shown below:-

VAR1		Timing		Constants	
<b>Unit</b>	SMU1	<b>Hold</b>	0 s	<b>Unit</b>	SMU2
<b>Name</b>	V1	<b>Delay</b>	0 s	<b>V Name</b>	V2
<b>Direction</b>	Single			<b>I Name</b>	I2
<b>Linear/Log</b>	LINEAR			<b>Mode</b>	V
<b>Start</b>	0 V			<b>Source</b>	0 V
<b>Stop</b>	1 V			<b>Compliance</b>	100 mA
<b>Step</b>	10 mV				
<b>No of Step</b>	101				
<b>Compliance</b>	100 mA				
<b>Pwr Comp</b>	OFF	<b>Sweep</b>	CONTINUE AT ANY	<b>status</b>	

7. Then we go to the Display Setup, where we need to setup, how we want to display our plot. The display setup window is shown below:-

	<b>Name</b>	<b>Sharing</b>	<b>Scale</b>	<b>Min</b>	<b>Max</b>
<b>X</b>	V1	(None)	Linear	0 V	1 V
<b>Y1</b>	I1	(None)	Linear	-1 pA	1 pA

8. Then, in the upper right of the main screen, click on  button. The measurement will start and it will start displaying the result. The sample window would be like shown below:-



### Post Measurement Steps:

1. Switch off vacuum pump.
2. Move probe needle up by rotating the knob.
3. Move chuck down by using lever.
4. Safely remove the sample.
5. Close the EasyEXPERT application.

### Skills and Risks:

1. Before making the chuck up, make sure that probe needle is sufficiently up so that chuck does not hit the probe tip.
2. While turning the knob off the manipulators, ensure that the knobs should not be turned to extreme ends. (New users are requested to learn this from the AU/SO).

### Checklist

1. **Hardware Setup Usage Instruction**
  - a. Switch ON the vacuum pump.
  - b. Switch ON the lamp source.

- c. Place Device Under Test (DUT) at the center of the chuck.
- d. Look from the microscope and move the chuck using the lever.

## 2. Switch Matrix Connection

- a. To establish connection between Hardware and Software setup.
- b. SMU 1, 2, 3 → Column 1, 2, 3, GND → Column 4, CMU (CVH & CVL) → Column 10, 11.

## 3. Software Setup Usage Instruction

- a. Click on Keysight icon and click on Easy Expert.
- b. Then click on channel setup, measurement setup, and display setup as explained above.

# 2. Lab Policy for the Users

### ***Before entering into the Lab***

- **Must Plan and book the slot one day in Advance.**

### ***On entering the Lab***

- Always **first check the online Slot Booking Module**. If your **work** is going to **overlap** with **someone else's work** on another tool/s, you must **switch ON** relevant switches for the **Vacuum pump** for the **respective tools**.
- If your tool is already ON, you can start your work. However, **if all switches are not ON**, **contact SO / Lab RA or the user** already doing the measurement **before turning any switch**.

### ***While using the Lab***

- **Do not plug in or plug off any chargers**, any **laptops** etc. when the **measurement is going ON** on any system. Coordinate with the Lab members.
- **Must not plug out and plug in any tools** without the prior **permission of Lab Incharge**.
- **Must not turn any switch** while **measurements** are **going ON** in the Lab.
- In case you are **leaving the lab** during the measurements, **put a label** near the tool stating measurements are going on.
- You should not change the **grounding lines** already present. If any change is needed, **please contact SO/Lab Incharge/FIC**.

### ***Before Leaving the Lab***

- If your **slot** is already **overlapping** with **someone else's slot**, **don't turn OFF** the system, simply leave the lab.
- In case you **want to cancel your booked slot**, you must **inform the user** whose slot was overlapping with your slot **before his/her slot ends** for proper turning OFF of the tools.

- In case of a **cancelled slot**, if you **forget to inform** the user who has booked the slot prior to you, then it's **your responsibility to turn the tools OFF**.
- If your **slot is not overlapping with anyone**, i.e, when your slot is over, at that time **if no other instrument is in use**, then you should **turn OFF all the tools before leaving the Lab**.