

Standard Operating Procedure: Phoenix

Keithley 4200 Semiconductor Characterization System

This system is used for temperature IV/CV measurements. It is a product by Keithley Instruments Model 4200 semiconductor characterization system (SCS).

Following Measurement can be done:

1. Room temperature 2, 3, 4 terminal IV.
2. Room temperature 2 terminal CV.
3. Temperature dependent IV/CV measurement.
4. Stress measurement/ Pulse measurement.

Following Measurement cannot be done:

1. Frequency/ Noise measurement.
2. Low temperature measurement.

Instruments Presents:

1. Keithley S4200 SMUs - 3
2. Keithley C4200 CV card – 1
3. Keithley 708 A switch matrix – 1
4. Keithley 4200 PG2 PGU – 1
5. Keithley 4200 SCP2 Scope card – 1

Specification:

1. Through SMU :
Max Voltage: 210 Volts
Max Current: 105 mA
2. Through LCR meter :
Min Frequency: 1KHz
Max Frequency: 10MHz

Instrument Connections:

1. Two SMUs are connected to switch matrix column 1 (SMU 1) and 2 (SMU 2) respectively.
2. SMU 3 is directly connected to manipulator B.
3. GNDU is connected to switch matrix column 4.
4. Manipulator A, C and D connected to switch matrix rows A, C & D respectively.
5. Chuck connected to row G.
6. LCR High connected to column 10.
7. LCR Low connected to column 11.
8. VPU channel 1 and OSC channel 1 is directly connected to the RBT.
9. VPU channel 2 connected to column 5.
10. OSC channel 2 connected to column 6.

Part A: Hardware Setup Usage Instruction

Step1:

Switch on the vacuum pump. Then 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). This vacuum hold the device firmly on the chuck.

Step 2:

Switch on the light source. The intensity of light is controllable using 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. 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 G. 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: Software Setup Usage Instruction

1. Login using your charlab domain username and password.
2. If you are first time user, then “**Initialize New User**”.
(Start -> All Programs ->Keithley Instruments -> Initialize New User) and click OK.
3. Open KITE (Keithley Interactive Test Environment).

KITE Specific Instruction

Add the following

1. New Project
2. New Subsite plan
3. New Device plan
4. New ITM

- For Adding New Project

File -> New Project -> Project Name

- For Adding New Subsite Plan

Click Subsite plan -> Give name and press OK.

- For Adding New Device Plan

Click Device Plan -> A window by name “Add new device to project” will appear -> Select the device plan -> Give the name and press OK.

- For Adding New ITM

Click New ITM -> Give the name and press OK.

Part C: 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.

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 KITE application.

Temperature Controller Operation:

1. Switch ON the power supply
2. Switch ON the temperature controller by pulling up the level at the back side of the instrument.
3. Press I/O key on the front side of the instrument.
4. Press the SETUP key.
5. Select the line (T1/T2).
6. Input the temperature by using the keypad.
7. Press ENT key.

For reducing the temperature:

1. Reduce the temperature to initial value (25°C) using the procedure mentioned above.
2. Wait for 5 minutes to settle the temperature down.
3. Press I/O key.
4. Pull the lever up and switch off the power supply.

