

## Cryo pump regeneration Process

- 1) Close the valve between the Growth chamber and Cryo Pump.
- 2) Stop the Compressor of the cryo pump. To do that first switch off the MCB for compressor from the power supply panel of the control rack and secondly switch off the compressor from the service corridor. And also the chillers water for the compressor should be OFF.
- 3) Then wait to reach the temperature of the cryo pump upto 356K that is room temperature.
- 4) Separate the vacuum line which is used for the roughing the cryo pump from the inlet flange and attach the pure nitrogen to it for purging the cryo pump. Open the inlet and outlet valve of cryo to start the purging.
- 5) Continue this purging for 1 hour.
- 6) After that CLOSE the inlet and outlet valve of cryo pump.
- 7) Remove the pure nitrogen line form the inlet of the cryo pump.
- 8) Then attached the vacuum line to the inlet of the cryo pump to start the rough pumping.
- 9) Then switch ON the roughing pump and wait for 5minutes before opening inlet valve of the cryo pump and wait for 1 hour.
- 10) After one hour is over close the valve of the inlet of the cryo pump and switch off the roughing pump.
- 11) Switch on the MCB of the compressor and switch on the compressor from the service corridor as well as the chilled water supply from the same service corridor.
- 12) Monitor the temperature falling up to 100K and it should get stabilise in between 10K and 11K.
- 13) There should not be too much condensation on the body of the cryo pump and if there is ice formation on it then this is a clear indication that the Cryo pump regeneration process is not successful or the cryo pump has some problem.

### **What to do if there is a power shut down**

- 1) If power shut down happen when the machine is on, the gate valve between the turbo and the load-lock chamber get closed. This is because this gate valve has power as an interlock parameter . So whenever it will sense there is no power it will close automatically to maintain the vacuum inside the load-lock chamber.
- 2) So when the power resume we have to follow some step to restart the system.
- 3) Press the green switch on the left-top of control rack. This will on the power supply to the system.
- 4) First check the vacuum in each and every chamber (Growth, Buffer and Load-lock).
- 5) For checking the vacuum of the Growth and Buffer chamber, one has to switch on the ion gauges of those chambers. Before switching the ion gauges set the scaling parameter of the ion gauge to 0.1, as the vacuum condition inside the chamber is not known. This step is extremely important otherwise the ion gauge may damage. If the pressure inside is  $10E-6$  or less than that then the ion gauge will continue but if the pressure is higher than  $10E-5$  it will switch off just showing the pressure inside the chamber once. Don't try to restart the ion gauge again. If the pressure is  $10E-9$  or less gauge will continue and you can switch to the scaling parameter 10.
- 6) If the pressure is high enough in the Growth or Buffer chamber, we have to pump down the pressure inside the chamber. For that follow the steps mentioned in the chapter called "Venting and regeneration of vacuum of the whole system".
- 7) For checking the vacuum in the load-lock chamber, switch on the pirani gauge of the load lock chamber and if the value is 0E0, penning gauge for load lock can be start.
- 8) As it is mentioned that when power shutdown happen, the valve between turbo and load-lock will close automatically. Naturally the pressure in the turbo will reach the atmospheric pressure so one has to equate the pressure inside the load-lock chamber and turbo before opening the valve

in between these two. Turbo pump attached to this MBE system can give  $10E-3$  vacuum after running for 1min. So there will be a waiting period depending upon the vacuum reading in the load-lock chamber before opening the gate valve between the load-lock and Turbo pump.

- 9) If the pressure inside the growth and the buffer chamber is  $10E-5$  or less, the ion pump can be start. Close the valve between the Buffer and load-lock To start the ion pump press the HV1 on the control panel of the ion pump. Wait for some time so that the value of the voltage reaches the 5000 value then switch on the start protect of the ion pump. This will protect the ion pump.
- 10) After switching on the ion pump and if it is running fine, start the TSP1 & TSP2 and do one sublimation to check the vacuum.
- 11) If the power shut down was during the baking then after the power resume switch on the system after switching off the MCB switch to start the baking. Once the system is stabilised baking can be restart.

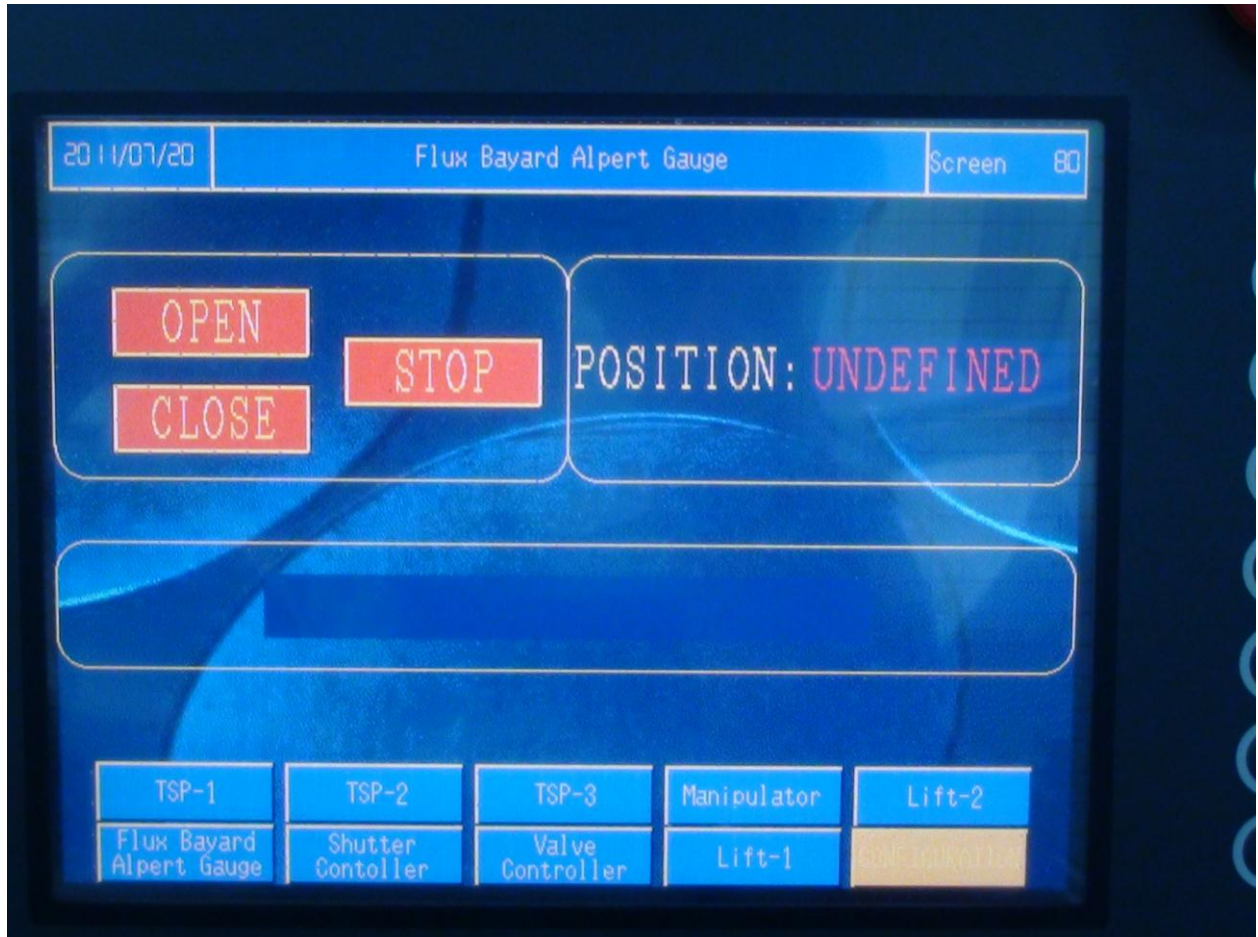
Few more important points

- 1) If power shut down happens close the gate valve in between Growth and Buffer chamber and in between Buffer and load-lock chamber.
- 2) The three phase power supply in the MBE system is as follows
  - I. Phase to Phase – 420volt
  - II. Phase to Neutral – 240 volt
  - III. Neutral to ground – -0.6 volt
- 3) There are three interlock for the automatic operated gate valve. They are mentioned bellow.
  - I. I1 is the pressure interlock for the valve in between cryo pump and growth chamber.
  - II. I2 is the pressure interlock for the valve in between load-lock and turbo pump.

- III. I3 is the temperature interlock for the valve in between cryo pump and growth chamber.
  - IV. I4 is the power interlock for the valve in between load-lock and the turbo pump.
- 4) In the valve control tab of the touch panel display V1 represent the gate valve in between cryo pump and growth chamber and V2 represent the gate valve in between the load-lock and turbo pump.

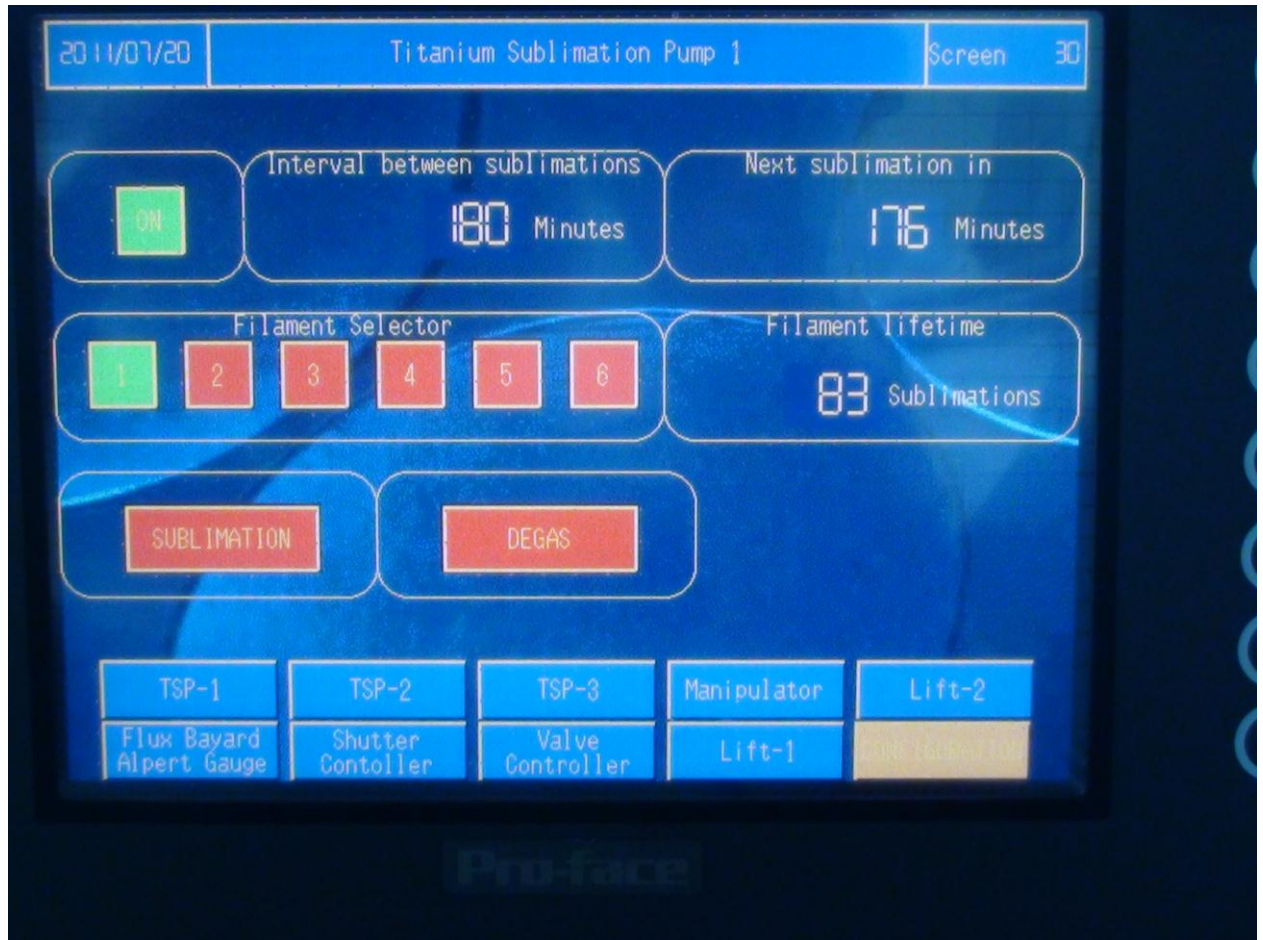
## Touch panel display:

1) Flux bayard alpert gauge:



OPEN: show your position of gauge and vice versa for CLOSE position.

2) Titanium sublimation pump 1 and 2 :



ON: it will switch on your TSP(GREEN indicator shows it is ON).

Filament selector: it will select which filament to select

(If GREEN then you have selected filament no.1).

Interval between sublimation shows you time 180 minutes.

Sublimation: if your panel is in RED then your sublimation is OFF and its GREEN it is ON.

Degas: if you are selecting new filament then first of all you have to degas it.

3) Manipulator:



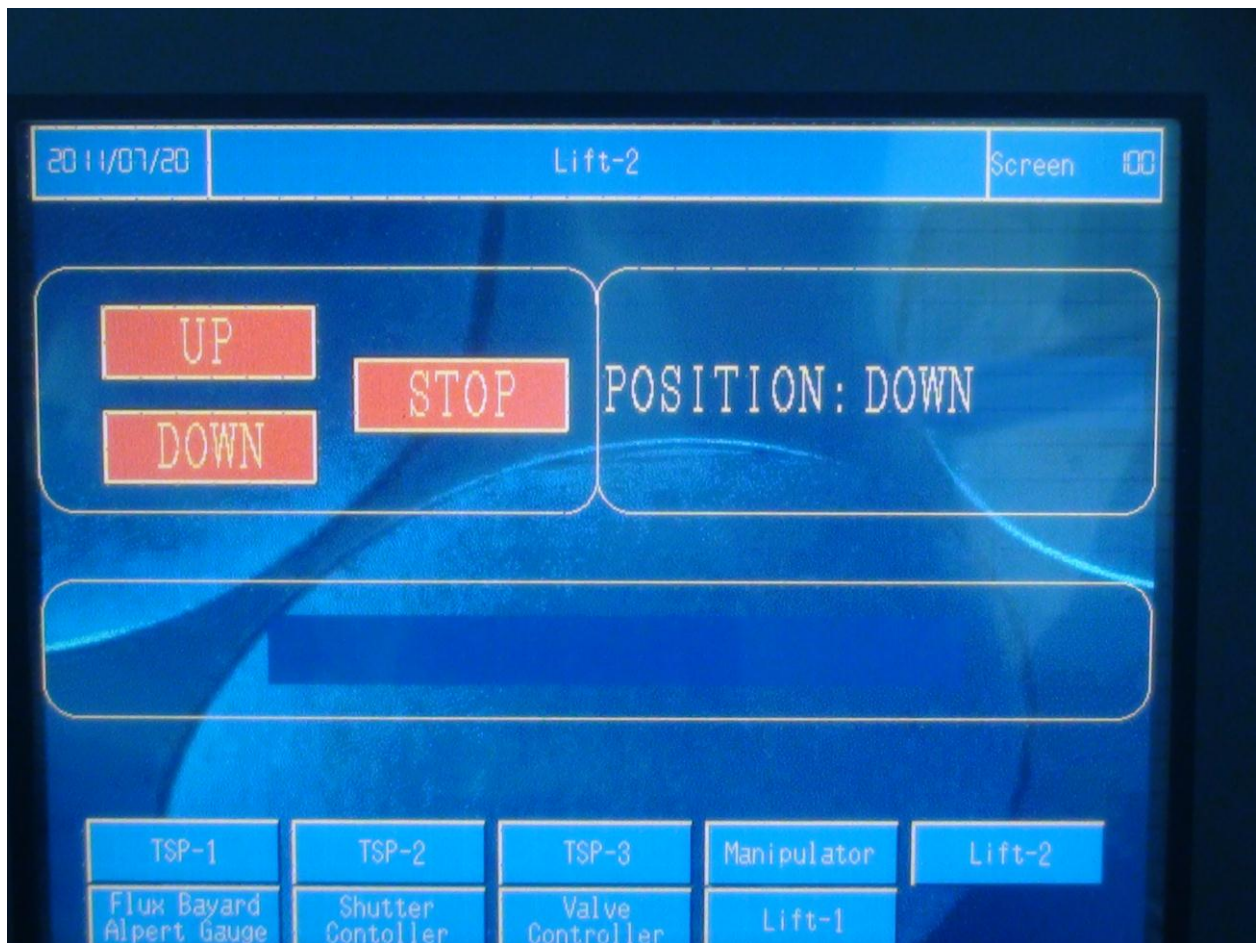
HOME: It will take manipulator to initial position.

UP-DOWN: it will take manipulator to UP and DOWN position.

ROTATION: it will show actual speed in RPM of manipulator.

TRANSFER POSITION: it will show your transfer rod position.

4) Lift 1(buffer chamber) and Lift 2(load lock chamber):



UP-DOWN: it will take manipulator to UP and DOWN position.



5) Valve controller:



V1 valve: it is a GATE valve between cryo pump and growth chamber.

(In this picture the valve V1 is closed and it is RED)

V2 valve: GATE valve between growth and buffer chamber.

(In this picture the valve V2 is open and it is GREEN)

I1 I2 I3 I4: these all are used for security purpose.

Bypass: it is used to bypass the security parameters.

6) Shutter controller :



There are 1 to 16 shutter controllers which are used for opening and closing of shutter.

(RED indicates it is CLOSED and GREEN it is OPEN)

### **Venting Growth, Buffer chamber through Load lock:**

1. Check that IR furnace controller should be OFF.
2. Check the pressure between Buffer and Load lock chamber on gauges.
3. If it's OK then OPEN the valve between Buffer and Load lock.
4. BYPASS valve V2.
5. Switch OFF BUFFER gauge (bottom varian).
6. START/PROT OFF, HV1 OFF, switch OFF mains.
7. Switch OFF ion gauge IG1.
8. TSP1 and TSP2 should be OFF.
9. Switch OFF GROWTH gauge (bottom varian).
10. START/PROT OFF, HV1 OFF, switch OFF mains.
11. Check the temperature of preparation furnace should be 20 degree C (on PC).
12. CLOSE the valve between CRYO and GROWTH CHAMBER.
13. For venting the PN2 pressure should be 2 b ar.
14. Switch OFF TURBO pump.
15. OPEN the valve between GROWTH AND BUFFER CHAMBER.
16. Release valve knob of Load lock.
17. Wait for venting pressure comes up to  $7.6E+2$ .
18. SHUTTER 16 should be OFF.
19. Take out wafer.

### **After Venting Procedure:**

1. Switch ON TURBO Pump.
2. Then wait until the pressure up to  $0.0E-0$ .
3. Wait for 5 minutes after that.

### **NOTE:**

1. If we immediately release the BYPASS after starting turbo it will sense the interlocks which is RED in present condition to close the GATE valve so our purpose of doing vacuum fails.
2. 2 inter locks I1 and I4.I1 for inter lock of pressure, I2 for speed of turbo.
3. Pressing BYPASS we don't care about inter locks condition and we can make the GATE valve OPEN or CLOSE valve between turbo and load lock.
4. Put IG1 and IG2 at 0.1.and IG1 ON.
5. Switch ON BUFFER gauge (bottom varian).
6. Switch ON mains, HV1 ON (ion pump started), voltage starts increasing (up to 5000V)and then start START/PROT ON(protect ion pump).

7. Switch ON GROWTH gauge (bottom varian).
8. Switch ON mains, HV1 ON (ion pump started), voltage starts increasing (up to 5000V)and then start START/PROT ON(protect ion pump).
9. See the pressure and turn BUFFER gauge and GROWTH gauge put it to 1 position.
10. CLOSE the valve between GROWTH and BUFFER CHAMBER.
11. CLOSE the valve between BUFFER CHAMBER and LOAD LOCK chamber.
12. BYPASS should be removed V2.
13. Switch ON TSP1growth chamber filament selector 1, sublimation ON.
14. TSP2 ON filament selector 2, sublimation ON.
15. If ERROR occurs ion gauge BUFFER gets OFF. Switch OFF TSP2.
16. Close the valve between Buffer and Load lock.
17. And again switch ON TSP2. Switch ON ion gauge BUFFER ON.
18. OPEN valve between BUFFER and Load Lock.
19. TSP2 ON and filament selector 1and DEGAS.

#### IMPORTANT TIPS:

1. For checking valve position after dis mounting see valve position on PC.
2. Then rechecks the mark position handle.
3. Press HOME button HOME position (7.15 on vernier scale).
4. While fixing PYRO see that pin is attached to it and on screen we can see that on MODLINE3 –LO-C.