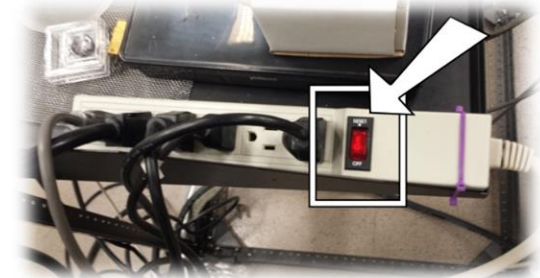
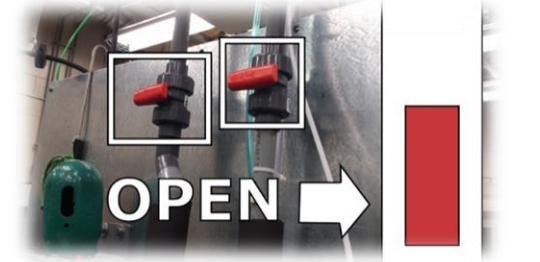
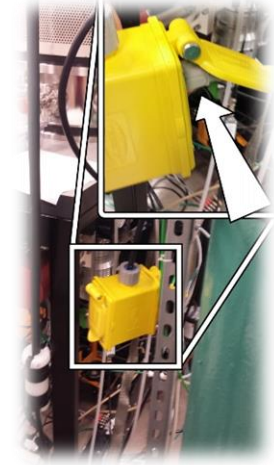
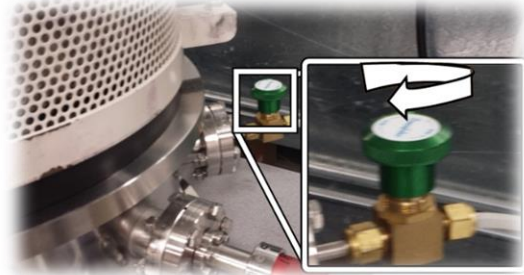
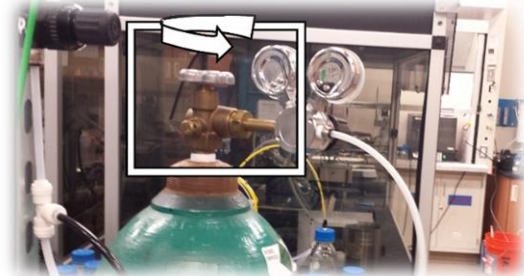
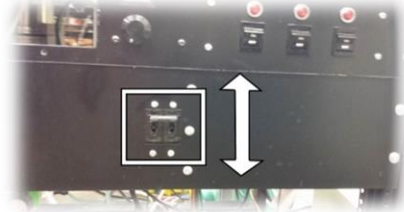




# Thermionics (Simiran) Evaporator SOP

## Executing a Deposition from Machine Storage Mode

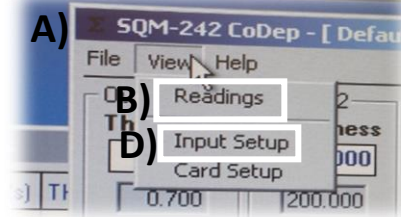
<p>1) Turn on the power strip located on the rack to the right of the machine</p>	
<p>2) Turn on both of the red handled water valves located on the back of the board located at the rear of the machine</p>	
<p>3) Ensure that the E-beam power supply located in the bottom of the rack to the right is plugged into the large overhead power cord</p> <p><b>NOTE:</b> If a yellow cord from the rear left hood is plugged into the large overhead outlet do the following: Check if the equipment in the rear left hood is on. If it is, you must contact Isaiah with the Sisom company before removing the cord. If the equipment is not on, un-plug the yellow cord and plug in the power supply cord. If you cannot contact Isaiah, contact Seth Calhoun.</p>	

<p>4) Ensure that the green vent valve at the rear right bottom of the chamber is closed.</p>	
<p>5) Turn on the N2 cylinder valve located at the rear of the machine.</p> <p><b>NOTE:</b> The regulator attached to the cylinder should be set to approximately 10 psi.</p>	
<p>6) Turn on the double pole breaker located at the lower front middle of the machine</p>	
<p>7) Turn on the power switch located to the far left of the upper panel.</p>	
<p>8) Boot up the PC located on the floor to the right of the machine.</p>	

9) Click on the SQM-242 codep icon.

**NOTE:** This program is used to interface with the crystal rate monitor. Use the program as follows:

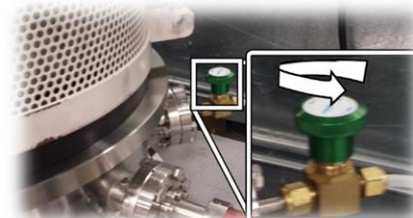
- A) Click on View
- B) Click on readings, this gives the usage data for the crystal. A new crystal starts at 100% and is good till 80%, which is when it needs to be replaced. If monitor needs to be replaced see step #16a-e below for replacement instructions.
- C) Click on view again
- D) Click on input setup
- E) Change the density and Z-factor to suit your evaporant



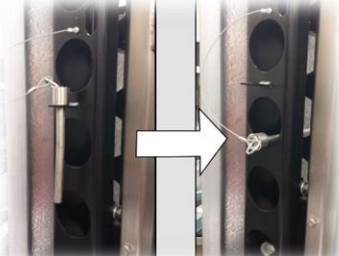


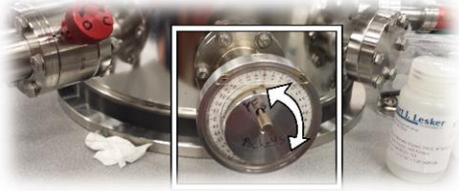

Sensor	Rate (A/s)	Thick (kA)	Freq. (Hz)	Life (%)	Control
Sensor 1	.00	0.000	5360750.2	96.1	Output 1
Sensor 2	.00	0.000	Fail	?	Output 2
Sensor 3	.00	0.000	Fail	?	None
Sensor 4	.00	0.000	Fail	?	None




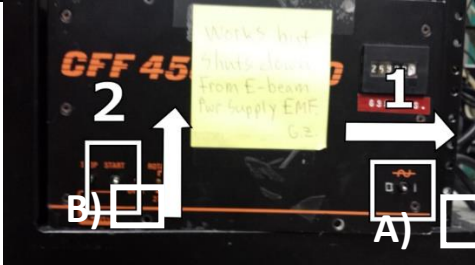

Sensors	Density	ZFactor	Tooling	Monitor ->	SetPt (kA)
1	4.09	0.775	100.0	<input checked="" type="checkbox"/>	2.000
2	7.20	0.305	100.0	<input type="checkbox"/>	102.000
3	19.30	0.381	103.0	<input type="checkbox"/>	103.000
4	14.00	4.000	104.0	<input type="checkbox"/>	104.000

10) After ensuring that the turbo pump is off (not spinning and no lights on the controller) vent the chamber by slowly opening the green vent valve. **NOTES:** You will hear the N2 entering the chamber and will see the pressure rise on the 338 gauge controller. Venting will normally take a few minutes. You will hear and feel N2 coming from the lower bell jar gasket contact point when venting is complete.



<p>11) Turn off the green vent valve and the 338 vacuum gauge controller by utilizing its switch located on its rear panel.</p>	 <p>The top photograph shows a green vent valve on a metal assembly with a white arrow pointing to it. The bottom photograph shows a control panel with a red 'OFF' indicator and a white arrow pointing to a switch.</p>
<p>12) Raise the bell jar by pushing and holding the "UP" position of the switch located in the center of the upper panel. When the bottom of the bell jar is above the sample holder release the switch.</p>	 <p>The photograph shows a control panel with a switch labeled 'UP' and 'DOWN BELL JAR'. A white double-headed vertical arrow indicates the range of motion for the bell jar.</p>
<p>13) Utilize the large safety pin which is attached to the hoist structure by inserting it into the hoist assembly under the silver bell jar arm. <b>NOTE:</b> This pin will catch the bell jar for any reason</p>	 <p>The photograph shows a vertical hoist assembly with a white arrow pointing to a safety pin inserted into a slot.</p>
<p><b>NOTE: YOU MUST USE GLOVES WHEN TOUCHING ANY INTERNAL CHAMBER PARTS. ALSO, ONLY CLEAN SAMPLES THAT DO NOT OUT GAS SHOULD BE USED</b></p>	
<p>14) Remove the sample holder by grasping its edges, slightly push it up while rotating until it releases</p>	
<p>15) Secure your sample to the sample holder and replace it.</p>	
<p>16) Check the usage of the crystal before performing steps <b>9a</b> and <b>9b</b> above. If</p>	

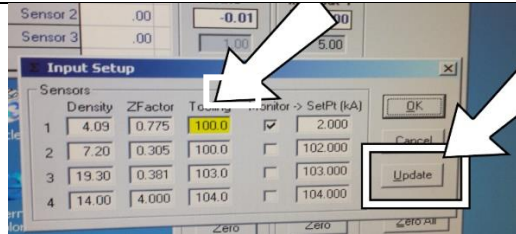
<p>the usage is less than 80% do the following:</p> <ul style="list-style-type: none"> <li>A) Carefully grasp the crystal monitor head with one hand and remove the crystal head lower cover with your other hand by pulling it downward while slightly rotating it.</li> <li>B) Remove the crystal by turning the lower plate over and letting it fall out.</li> <li>C) Insert a new unused crystal into the lower plate with the gold contacts facing up towards the crystal monitor head.</li> <li>D) Snap it back onto the crystal monitor head.</li> <li>E) Check the usage again if it is close to 100% all is well. If it reads 0 or reads erratically push up and turn the crystal monitor head lower cover until it reads close to 100%.</li> </ul>	
<p>17) Rotate the chamber evaporant pocket knob located at the bottom of the chamber facing to the front until your desired evaporant pocket is open. Check that the evaporant material is filling the crucible liner to approximately <math>\frac{3}{4}</math> full. If not fill it with proper material.</p>	
<p>18) Slowly turn the chamber shutter knob located at the bottom of the chamber facing to the right until the shutter closes over your sample.</p>	
<p>19) Remove the hoist safety pin and lower the bell jar by pushing and holding "Down" on the switch used in step #12 above. When the bell jar gasket area gets close to sealing use your hand to help center it onto its seat. Release the switch when the bell jar makes complete contact.</p>	

<p>20) Turn the 338 gauge controller back on using its switch on the rear panel.</p>	
<p>21) Open the chamber gate valve by switching up the red switch located to the right of the lower panel. <b>NOTE:</b> You will hear a woosh and clunk sound when it opens.</p>	
<p>22) Turn on the roughing pump using the “pump down” switch located at the center of the upper panel.</p>	
<p>23) When the pressure read on the 338 gauge controller is less than 3 Torr start the turbo pump as follows: <b>NOTE:</b> The turbo controller is located at the bottom front left of the machine.</p> <p>A) Turn on the turbo controller by flipping its bottom right switch to the “1” position</p> <p>B) Momentarily flip the start switch to the left and release it</p> <p><b>NOTE:</b> Within approximately 30s you will hear the turbo spinning up. It is at its operational speed when the “=” LED is lit.</p>	
<p>24) Wait approximately 30 minutes for pump down</p>	
<p>25) Check the chamber pressure on the 338 gauge controller. If it reads “0-” momentarily depress the “Gauge” switch to turn on the ion gauge. <b>NOTES:</b> Re-pressing the “Gauge” switch turns it off. The gauge must remain on during the deposition to</p>	

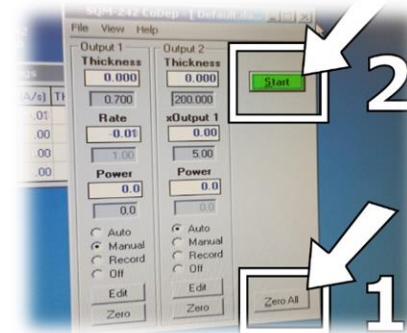
satisfy the pressure interlock of the E-beam power supply

**CAUTION: THE MAXIMUM PRESSURE FOR EVAPORATION IS  $8 \times 10^{-5}$  TORR.**

26) Ensure the proper "Tooling Factor" is entered into the window of the SQM-242 program. If it is unknown enter 100 until the true factor is known.  
**NOTES:** The tooling factor is used to compensate for the crystal monitor head position in relation to the sample position. It is arrived at by creating a step in the thin film evaporation by utilizing a small piece of kapton tape placed on the sample before deposition and then removed post deposition. This step is measured using the profilometer to get the film thickness. This film thickness is compared to the film thickness from the SQM-242 program with 100 entered in the tooling factor. The needed correction, either above or below, the tooling factor of 100 is now made.



27) Click on "update", click on "Zero All", click on "start".



28) Ensure the Ion gauge is on.



29) Turn on the double pole break on the front of the E-beam power supply and ensure that the Mains and Interlock lamps are lit. If not check the cooling water or chamber pressure for problems. Wait approximately 2 minutes for the power supply to warm up.



30) Ensure the “emission” knob on the E-beam power supply hand held controller is fully counterclockwise and the toggle switch is in the “1 amp” position.



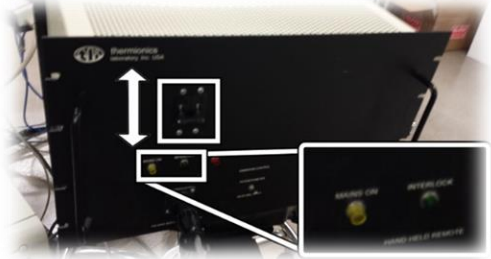
31) Momentarily press the “ON” button on the hand held controller. The “HV On” lamp should come on.





32) Very slowly increase the emission knob clockwise. After approximately 1/8 – 1/4 turn you will see a small upward bump on the emission meter. **Pause at this point.** The bump you saw was the filament in the E-beam gun coming on. Monitor the pressure gauge at this point and ensure it does not increase past  $8 \times 10^{-5}$  torr. If it does slightly back off on the emission knob and wait for the pressure to drop. You may have to do this multiple times until the evaporant stops outgassing. If the supply interlocks, you must restart at step #29 above. If the pressure holds, very slowly increase the emission knob a fraction of a turn then wait several minutes for the E-beam to further heat the evaporant. Eventually you will see a rate on the SQM-242 program. When the desired


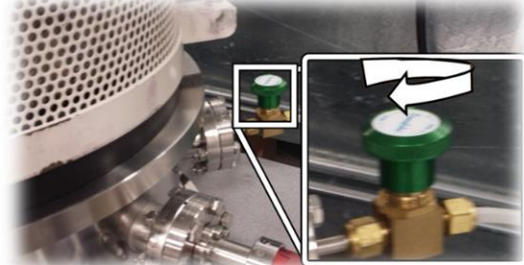




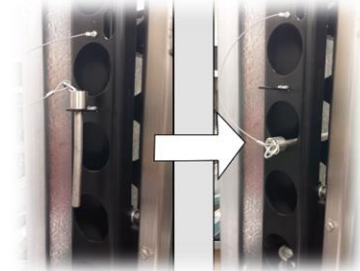





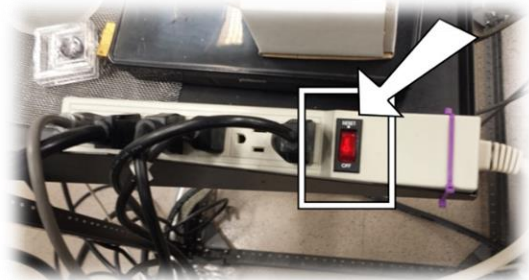


<p>rate is achieved open the shutter and click “zero all” to start the deposition on to your sample. When the desire thickness is reached, close the shutter and very slowly ramp down the emission current so not to thermally shock the crucible liner. When the emission knob is fully counterclockwise momentarily press the OFF button on the remote. <b>Wait approximately 2 minutes before the next step</b></p>	
<p>33) After the above 2 minutes are up turn off the double breaker on the power supply.</p>	

## Procedure for opening the chamber and putting back into storage mode

<p>1) Close the gate valve by flipping the red switch downwards.</p>	
<p>2) Turn off the Ion gauge by momentarily pressing the “Gauge” switch.</p>	
<p>3) Spin down the turbo pump by momentarily flipping the “Stop” switch to the left. <b>NOTE:</b> Takes approximately 20 minutes to spin down</p>	

<p>4) Turn off the “Pump Down” switch</p>	
<p>5) Ensure the turbo pump is spun down (can't hear it any more) then slowly open the green vent valve while watching the pressure. When the pressure increases to approximately <math>1.5 \times 10^{-1}</math> Torr slowly open the red handled butterfly valve to equalize the pressure on both sides of the gate valve. <b>NOTE:</b> The chamber is fully vented when you can both hear and feel N<sub>2</sub> escaping from under the bell jar bottom seal.</p>	
<p>6) When the chamber is fully vented close both the red butterfly and green vent valves.</p>	
<p>7) Turn off the 338 gauge controller rear power switch.</p>	
<p>8) Push and hold the bell jar “UP” switch. Release it when the bottom of the bell jar is above the sample holder.</p>	

<p>9) Insert the hoist safety pin.</p>	
<p>10) Remove your sample.</p>	
<p>11) Remove the hoist safety pin and lower the bell jar while centering it onto its bottom seat.</p>	
<p>12) Turn off the 338 gauge controller.</p>	
<p>13) Open the gate valve.</p>	
<p>14) Turn on the "pump down" switch.</p>	
<p>15) When the chamber pressure drops below 100 mTorr close the gate valve and turn off the "pump down" switch</p>	
<p>16) Exit the SQM-242 program and shut down the computer using the start menu.</p>	

<p>17) Turn off the power strip on the rack to the right of the machine.</p>	
<p>18) Turn off both red handled water valves</p>	
<p>19) Turn off the N2 cylinder valve but leave the regulators set as they are.</p>	
<p>20) Done</p>	