



Standard Operating Procedure (SOP)

Lesker Nano-36 Thermal Evaporator

(PVD-01)

Version 1.0.1, Updated 11/12/2025

In case of emergency, please call 911 (511 from a campus phone)

For any other major safety concerns, contact EHRS at: 215-898-4453 or via email:
ehrs@ehrs.upenn.edu

**If there is an error on the system/tool please report it on NEMO,
and staff will address it**

Please *DO NOT* run diagnosis without a staff member's approval

General safety tips and common mistakes

- Note: This chamber allows for deposition of high vapor pressure metals such as Sn, Zn, Bi, In.
- You must work with staff to obtain permission and develop recipes for any new materials.
- Clips are preferred for securing samples. Kapton may be used only if necessary.
- Make sure to pump down the chamber when you are finished
- This SOP is written to **ONLY** provide some key operational procedures in a step-by-step manner. Neither this SOP nor any other documentation is a substitute for training and qualification to use the tool.

Lesker PVD75 E-beam/Thermal Evaporator

Procedure Overview

1. Sample Loading
2. Load Evaporation Materials
3. Pump Chamber
4. Run Deposition Recipe
5. Vent Chamber and Unload Samples

Info & policies

Location: QNF, Bay 2

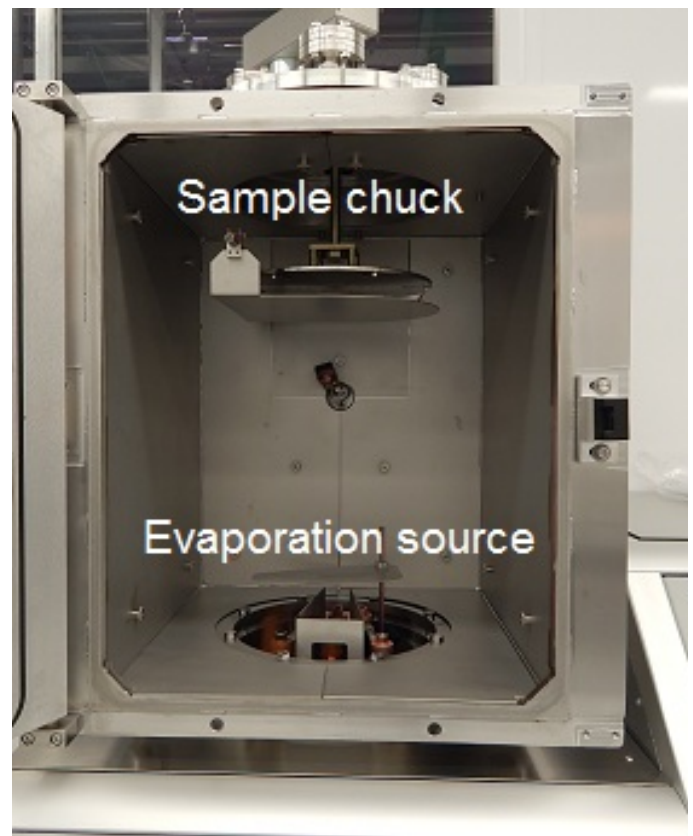
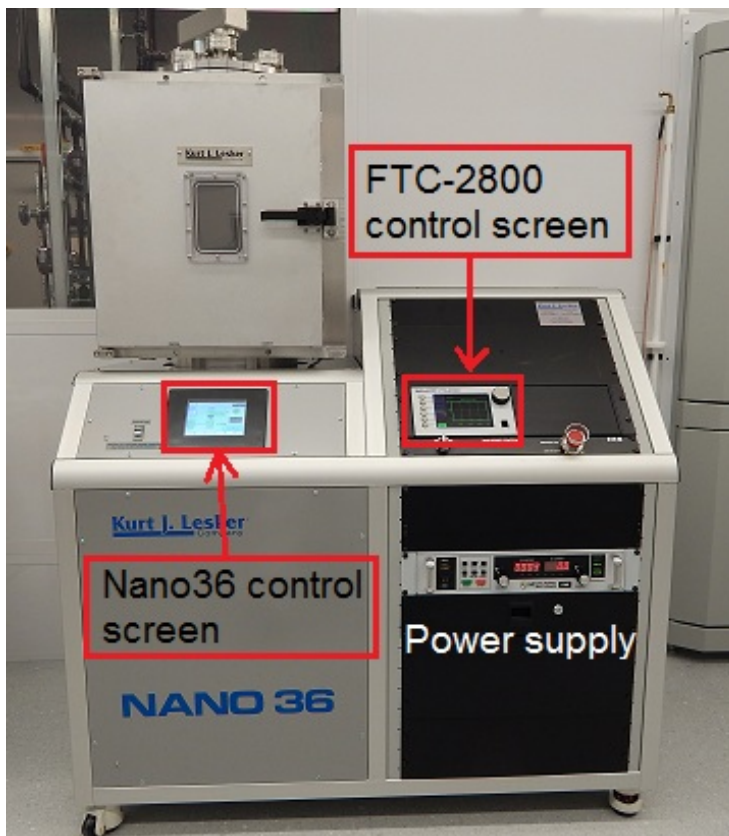
Tool owner: Daniel Sabrsula (dsabr@seas.upenn.edu)

Tool training: 2-hour in-person training

Tool Overview:

The Kurt J. Lesker Nano36 will evaporate a metal film under high vacuum while measuring the thickness in-situ by a thickness monitor. Up to three different materials can be loaded in one batch, and the evaporation sources are sufficiently isolated from each other by shields to prevent cross-contamination. The wafer platen can accommodate sizes up to 150 mm.

The tool is primarily used for deposition of materials whose vapor pressure or other properties make them unsuitable for other chambers (such as indium, tin, zinc, and bismuth). Most other materials are allowed in this tool. Please discuss with staff before beginning any new process in the tool.



Full Thermal Evaporation Procedure

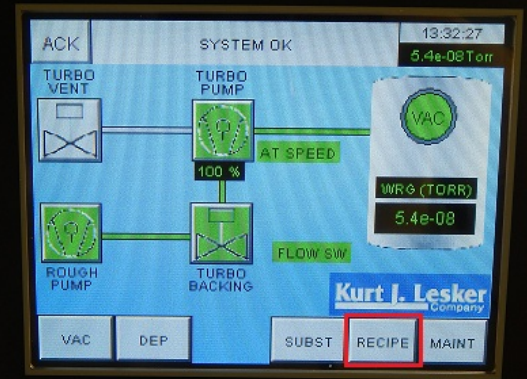
1. Sample Loading

1.0. Log into the tool via NEMO

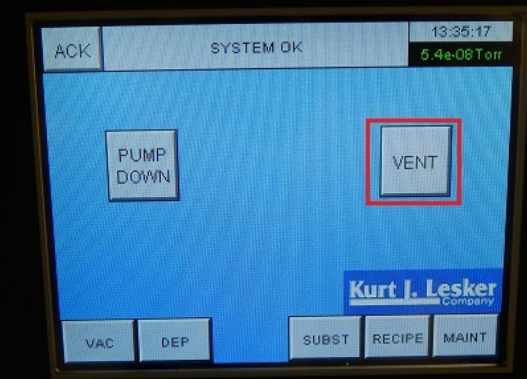
1.1. Vent the chamber

1.1.1. Press the "Recipe" button on the Nano 36 screen and press "Vent" to run the vent recipe

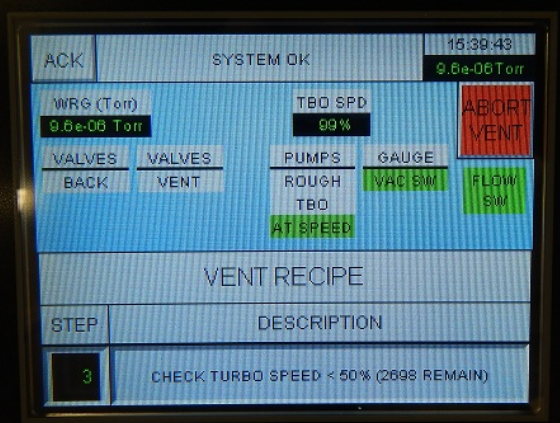
1.1.2. The vent process takes over 15 minutes



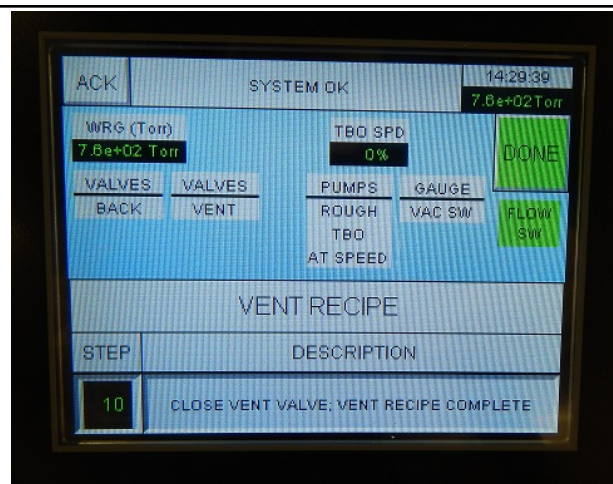
VAC screen



RECIPE screen

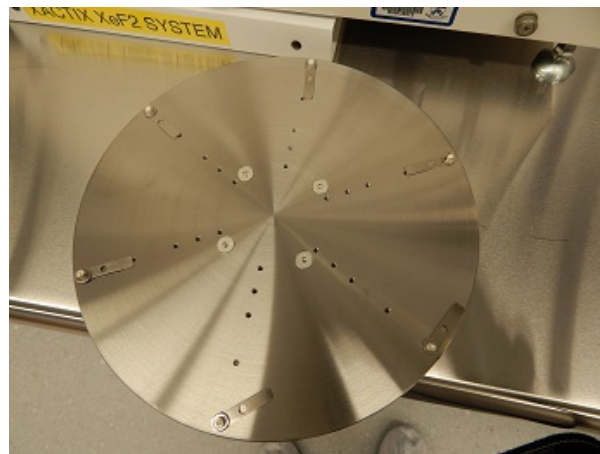


1.1.3. When the recipe is complete, the recipe window will turn green, and the chamber door can be pulled open. Press the green “DONE” button to exit the recipe window



1.2. Mount sample

- 1.2.1.** Attach the sample to the sample holder
- 1.2.2.** Metal clips are preferred, but Kapton can be used if necessary
- 1.2.3.** Samples should be secured as the holder is turned upside down when it goes into the tool



1.3. Check the Kapton film in front of the glass viewport

- 1.3.1.** If the film is coated in metal and hard to see through, replace it with a new one

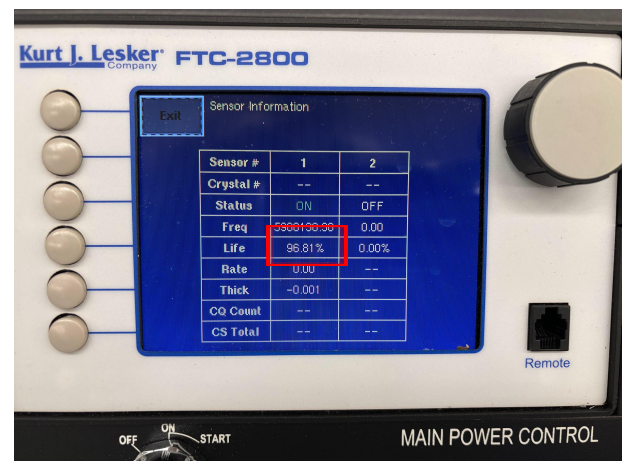
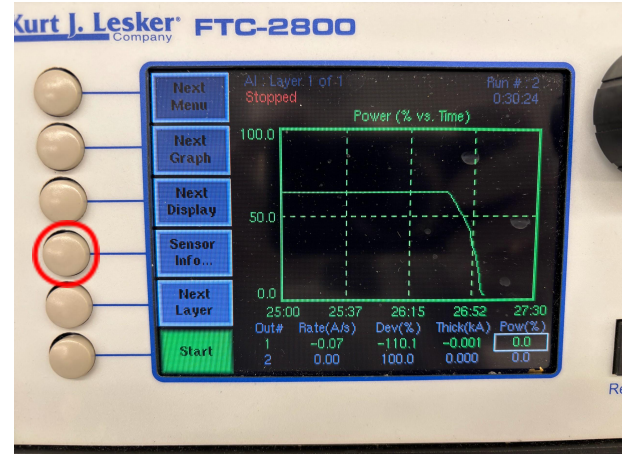
Note: It is not safe to deposit if you cannot see through the viewport!



1.4. Check crystal monitor life (Q).

1.4.1. Crystal lifetime can be found under "Sensor Info..."

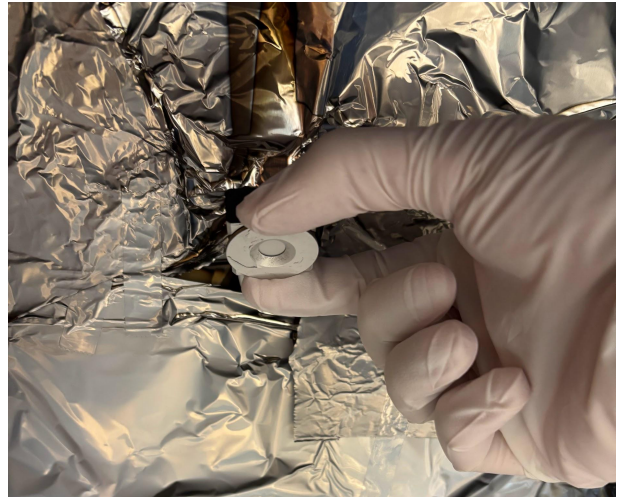
1.4.2. If the life percentage for sensor #1 is <30%, the crystal must be changed. Crystals can also be changed at higher percentages if you will be performing a long deposition (>500nm)



1.4.3. To change the crystal, locate the socket at the back of the chamber



1.4.4. Grab the circular holder and pull straight down to remove it from the socket. **DO NOT TWIST**, the crystal holder does not have threads to keep it in the socket. It is held in place by metal clips that will be bent out of position if the holder is turned while in the socket.



1.4.5. Remove the old crystal by pushing on the deposition-facing side to pop it out from the back



1.4.6. Dispose of the old crystal in the red sharps bin

1.4.7. Retrieve a new crystal from the crystal package and push it into place from behind.

1.4.8. Replace the new crystal into the socket and confirm the Life percent on the sensor info is ~98%

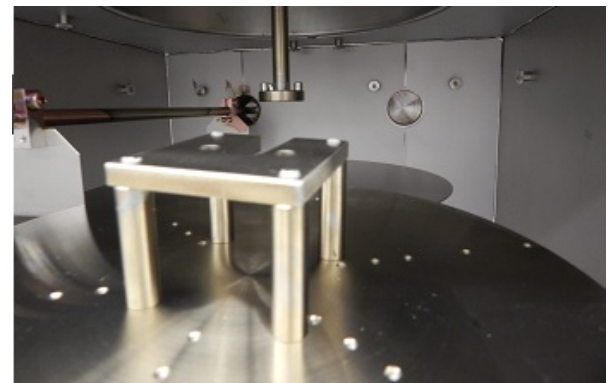


1.5. Load the sample holder

1.5.1. Press the “Subst” button to open the substrate window and press the cylinder icon to open the substrate shutter



1.5.2. Pick up the holder with the sample facing down



1.5.3. Place the holder onto the hook and make sure the pins fit into the holes of the substrate holder



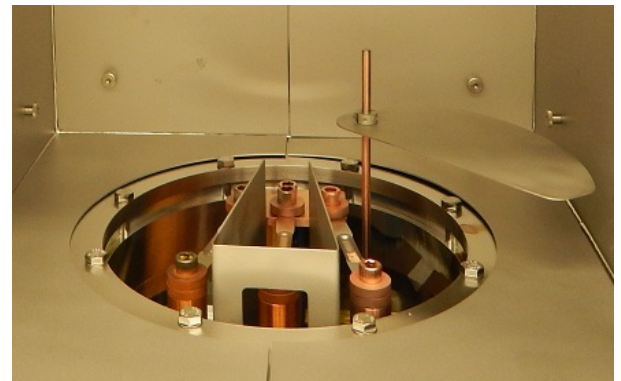
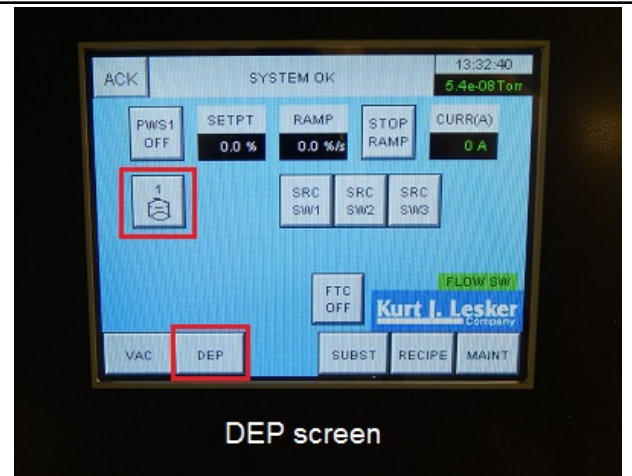
2. Loading Evaporation Materials

2.1. Prepare source material

2.1.1. To open the source shutter, press the “DEP” button and then the “1” cylinder icon

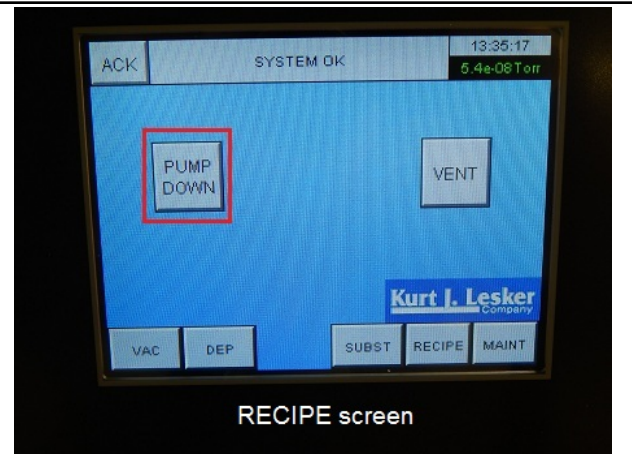
2.1.2. Place the required amount of thermal boats into the sources; the number of each source is shown on the right.

2.1.3. Tighten down each boat thoroughly using the Allen wrench



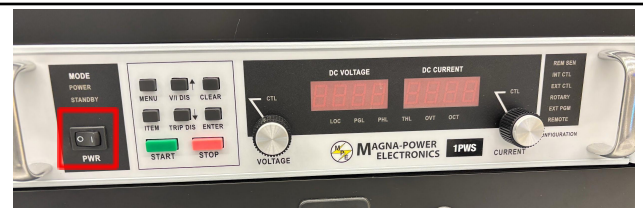
3. Pump Chamber

- 3.1. Press the “Recipe” button on the main screen and press “Pump Down” to run the pump recipe
- 3.2. In order for the door to seal properly, push on the top and bottom of the right side of the door
- 3.3. As soon as the chamber pressure starts to drop, you can release the door
- 3.4. Wait for the chamber to reach a base pressure below 1×10^{-5} Torr. This should take ~ 1 hour
- 3.5. The pump recipe may fail if it does not reach the target pressure in the appropriate amount of time. When the recipe fails, it will turn off the pumps and will need to be restarted



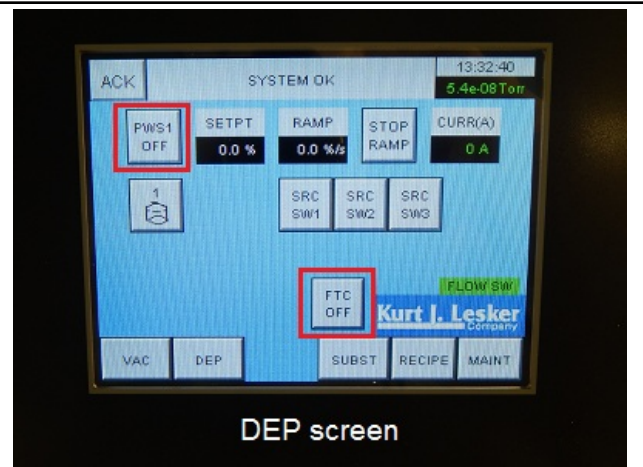
4. Run Deposition Recipe

- 4.1. Turn on the power supply by flipping the power switch



- 4.2. Set up the main screen for deposition

- 4.2.1. Press the “Dep” button on the main screen, then press “PWS1 OFF” and “FTC OFF” to switch control to the FTC-2800 controller

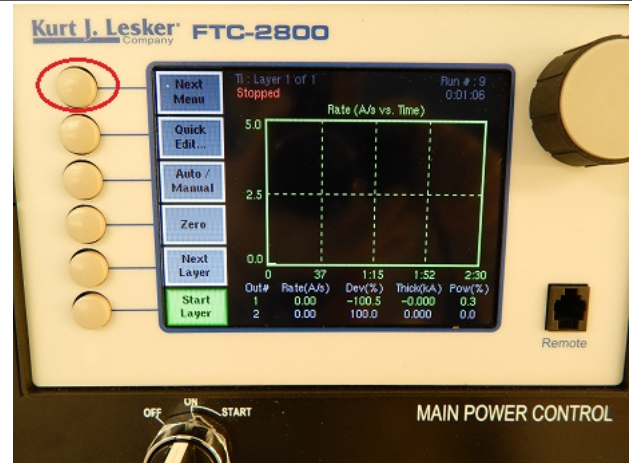


- 4.2.2.** Press the “Subst” button to open the substrate window, then press “Motor Rotate” to enable substrate rotation



4.3. Define Film

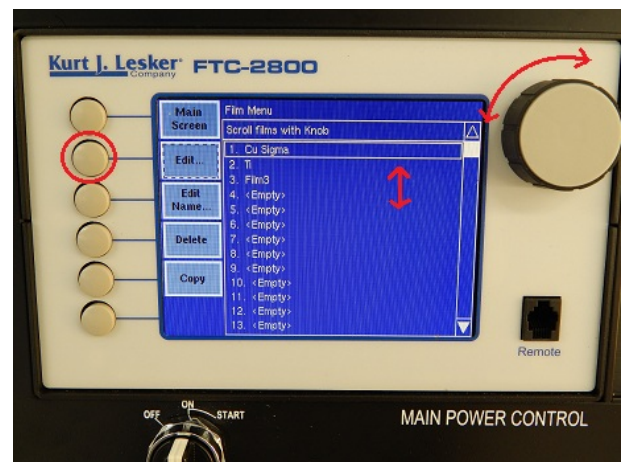
4.3.1. On the FTC-2800 screen, press the button for "Next Menu" to scroll through options until you see "Film Menu..."



4.3.2. Press the button to open "Film menu"



4.3.3. Use the dial to scroll through the available material list until you find the desired film



4.3.4. Highlight the desired film and press the button for "Edit..."

4.3.5. On the following screen, change the pocket number to the source location where the material is installed in the chamber.

4.3.6. You can make changes by highlighting the parameter with the dial and pressing “Edit”, then scroll with the dial to choose the correct value. When you are done making changes, press “Done”

4.3.7. Press the button to open the window for “Film Conds...” (Film Conditions)

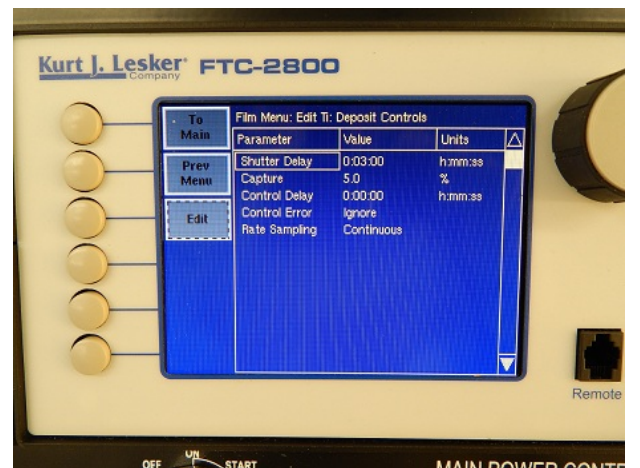
4.3.8. You may check the power setpoints, ramp time, and soak time for the warmup process. Edits can be made if necessary

4.3.9. Press the button for “Prev Menu”

4.3.10. Press the button for “Deposit Controls”

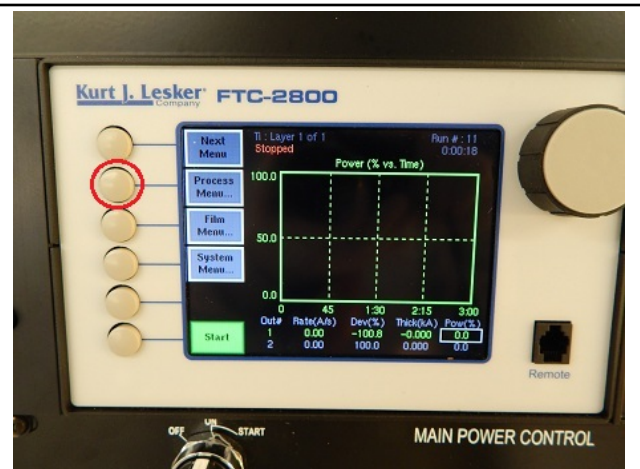
4.3.11. You may check the values for shutter delay time as well as capture percent. Changing the capture percent will determine how much rate deviation is allowed before the deposition starts

4.3.12. Press the button for “To Main” to return to the home screen



4.4. Define Process

4.4.1. On the home screen, press the button for “Process Menu...”

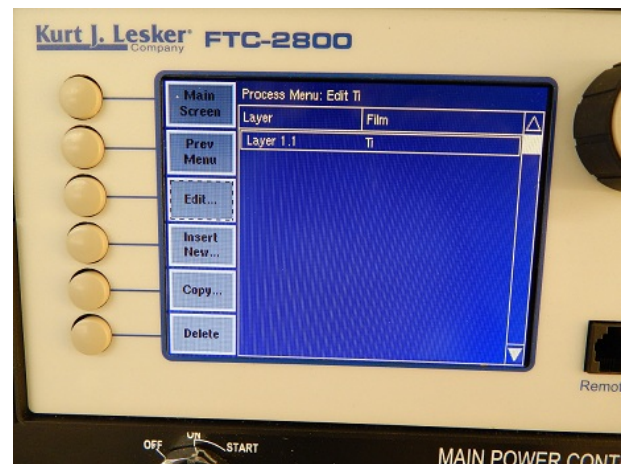


4.4.2. Use the dial to choose the correct material, then press the button for “Select” followed by “Edit”

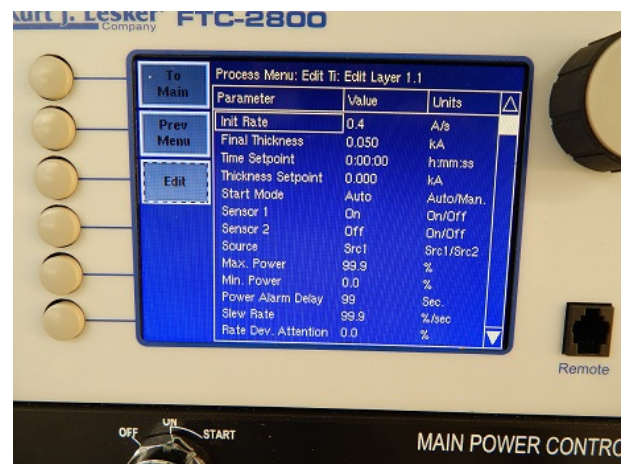
4.4.2.1. Pressing “Select” will choose that process as the active recipe for deposition



4.4.3. Press the button for “Edit...” on the selected layer



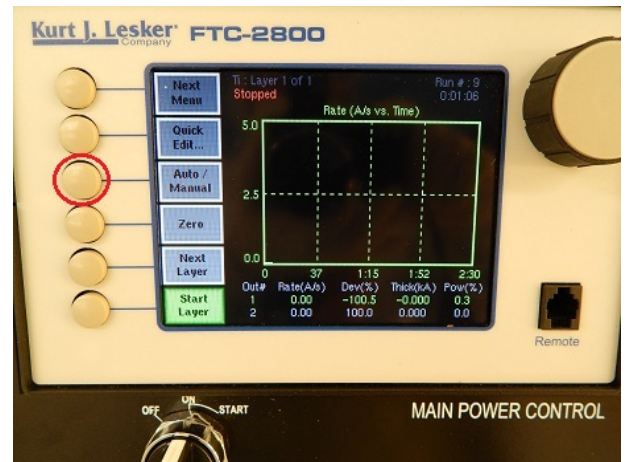
4.4.4. You may choose your deposition rate (Init Rate) in Å/s as well as final thickness in kÅ



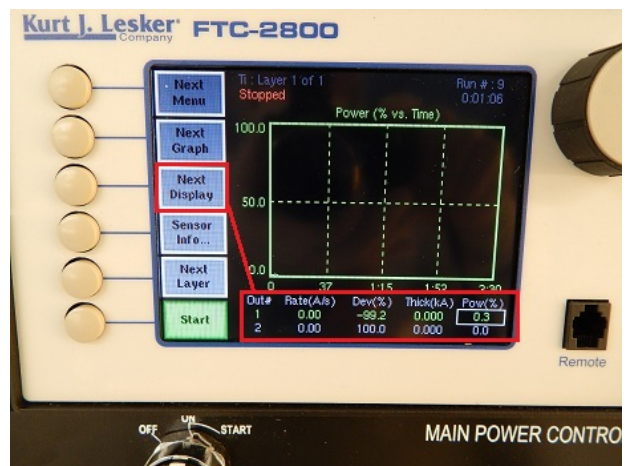
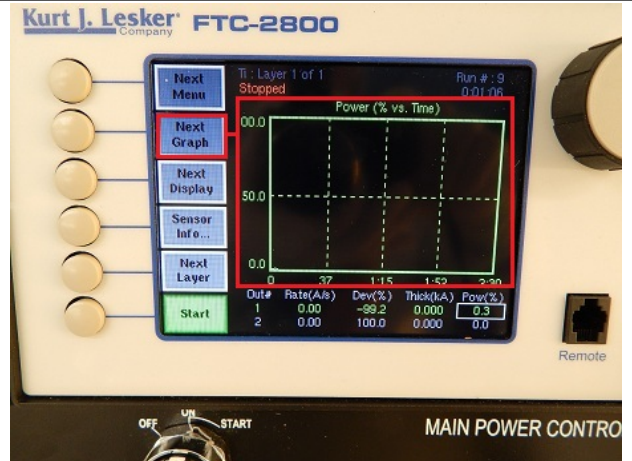
4.4.5. Return to the home screen by pressing “To Main”

4.5. Start Deposition

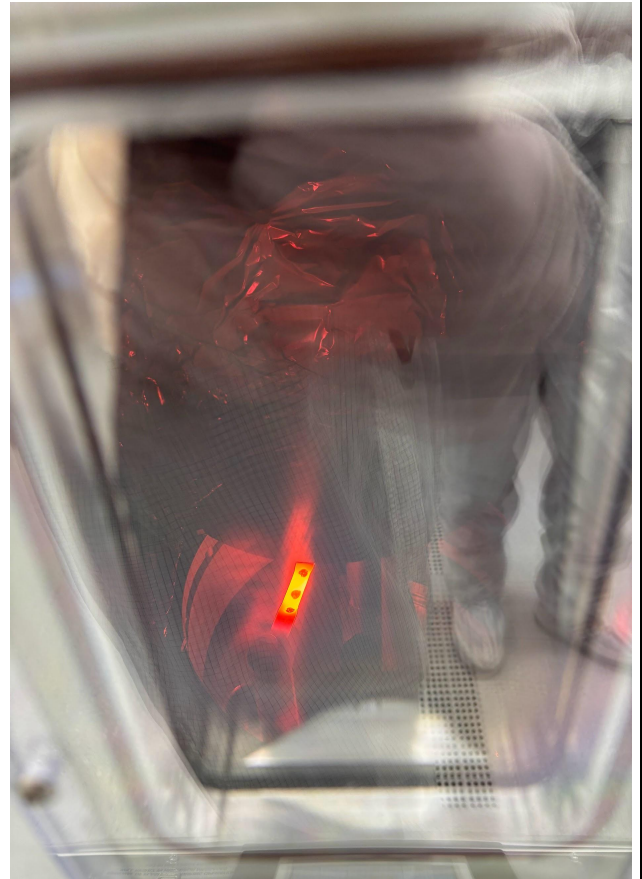
- 4.5.1. On the home screen, make sure that the desired process is loaded by checking the top left of the screen. If the recipe displayed is incorrect, go back to the "Process Menu" and select the correct layer
- 4.5.2. To make sure the controller is in automatic mode, tab through the menu options by pressing "Next Menu" until you see the option for "Auto/Manual".
- 4.5.3. The operation mode will be whichever option is listed first - if the button reads "Auto/Manual" it is in automatic mode, if it reads "Manual/Auto" it is in manual mode
- 4.5.4. Once you are ready, press the button for "Start Layer" to begin the deposition



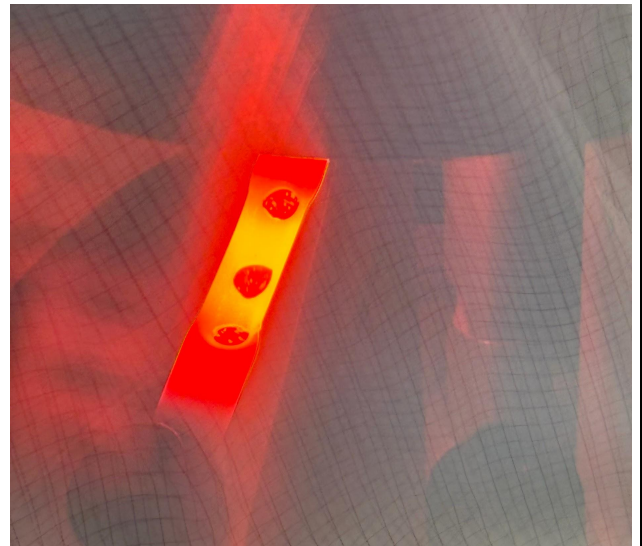
- 4.5.5. While the recipe is running, you may change the parameters displayed on the screen by selecting “Next Graph” and “Next Display” to show deposition rate, power, thickness, etc...



4.5.6. Make sure the recipe is running correctly by checking the current output on the power supply and looking through the window to see the thermal boat heating up



4.5.7. Once the recipe starts, it will run automatically until it completes or aborts due to an error



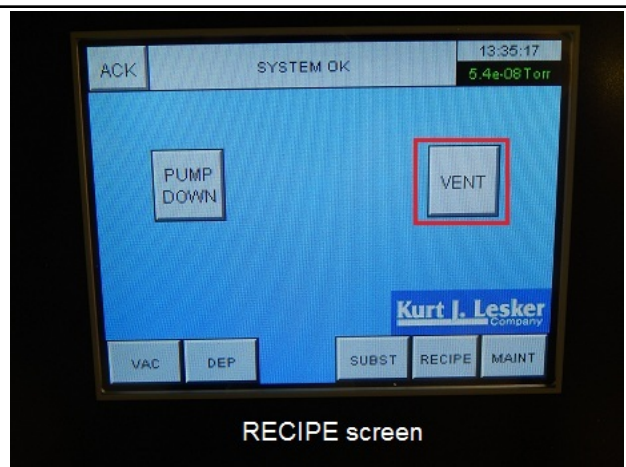
4.5.8. If depositing multiple layers, you may start the next deposition once the previous recipe has stopped

5. Vent Chamber and Unload Samples

5.1. Vent Chamber

5.1.1. When your deposition is complete, press the “Recipe” button on the Nano 36 screen and run the “Vent” recipe

5.1.2. There is no wait time required before venting, since the vent recipe takes over 15 minutes, all evaporation sources should be cooled to a safe temperature by the time the recipe completes

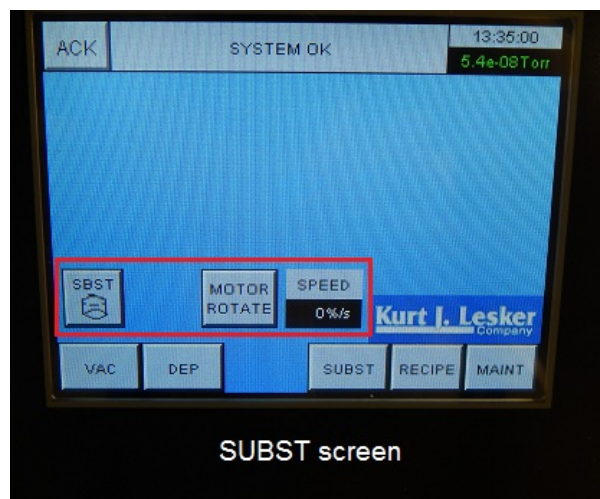
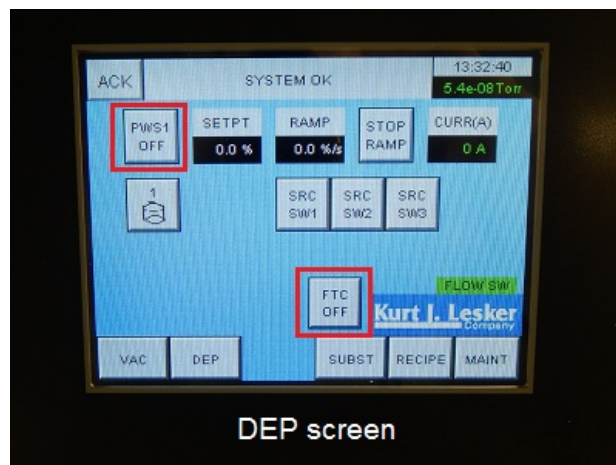
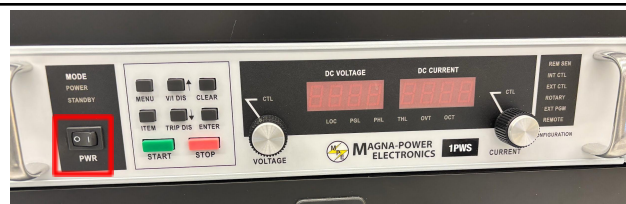


5.2. Unload Samples and Sources

5.2.1. Before opening the process chamber, turn off the power supply switch.

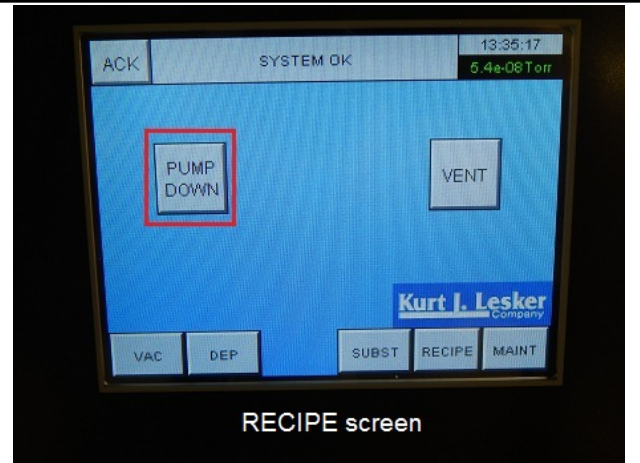
5.2.2. Press the “Dep” button, then the “PSW1 ON” and “FTC ON” to disable both the power supply and the FTC-2800

5.2.3. Press the “Subst” button, then the “Motor Rotate” button to stop the platen rotation



5.2.4. Open the chamber door, and remove the substrate holder and thermal boats

5.2.5. With the chamber empty, close the door and run the “Pump Down” recipe



5.3. Log out of the tool on NEMO

Feel free to contact the staff members with any questions about your process and the tool.