

# Trion Mini-lock Phantom III REACTIVE ION ETCH with ICP



NCF's TRION Mini-lock-Phantom III ICP-RIE system comes with a vacuum load-lock that allows for isolation of the reaction chamber from atmosphere to reduce the impact of exposure to atmosphere between runs. With a 600 watt, 13.56 MHz solid state RF generator, users have the option of standard processing or inductively coupled plasma enhanced etching. The system can accommodate multiple wafers in a single run.

## Pre-Operation

By NCF policy, the Trion ICP-RIE is always in standby mode meaning the system is always running. The user simply needs to check that the nitrogen tank outside is open and then proceed into the clean room.

1. Check to make sure the N<sub>2</sub> tank outside is open and that the RIE/PECVD tag is on the tank.



2. Check the N<sub>2</sub> valve is open as well.

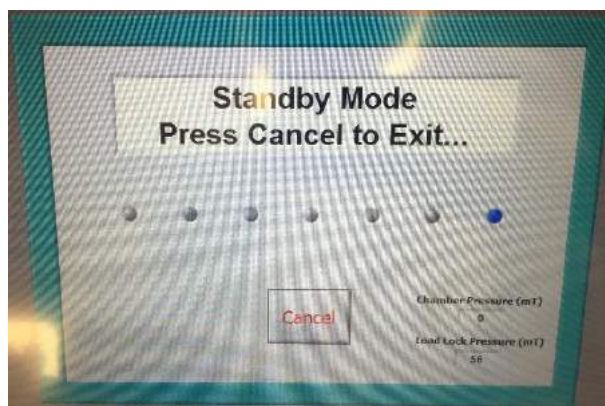


### Operation

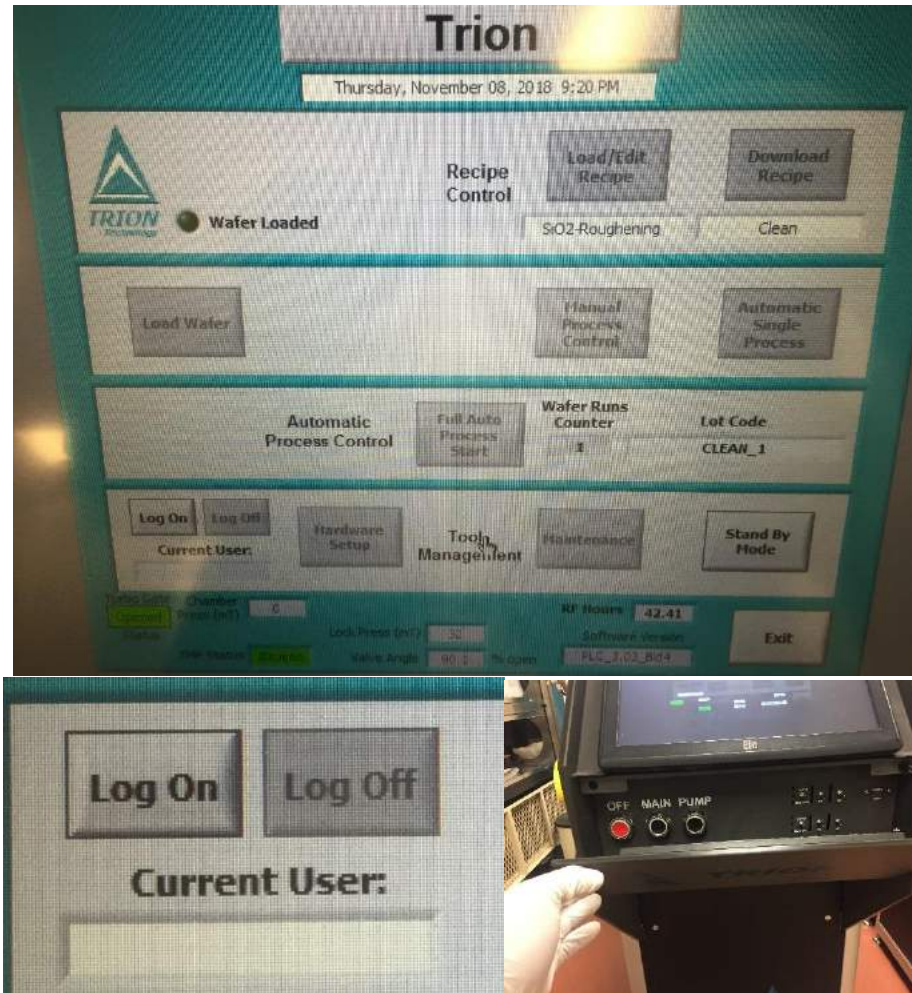
3. Inside the cleanroom, check the N<sub>2</sub> gas valve behind the system and make sure it's open. The names of the gases are written on the pipes, so **please make sure the right gas is open**.



4. The system is left in **Standby Mode**. Press the **Cancel** button on the screen and wait for the purging operation to complete.



5. The system will enter the software main page. Press the **Log On** button and enter your login information. Push the keyboard to bring it down.

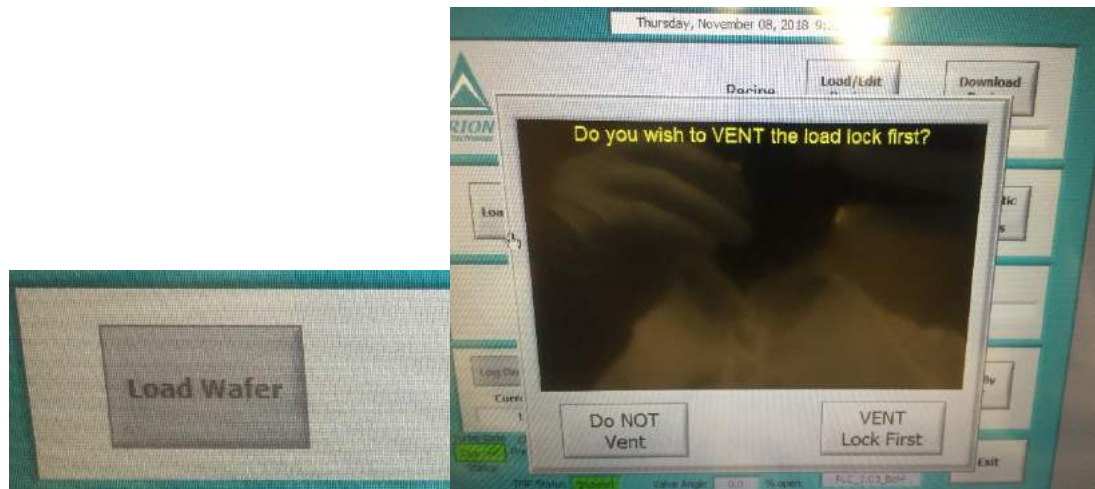


**NOTE:** Please make sure that all four switches on the system used for the matching capacitances should be in the **AUTO** position.

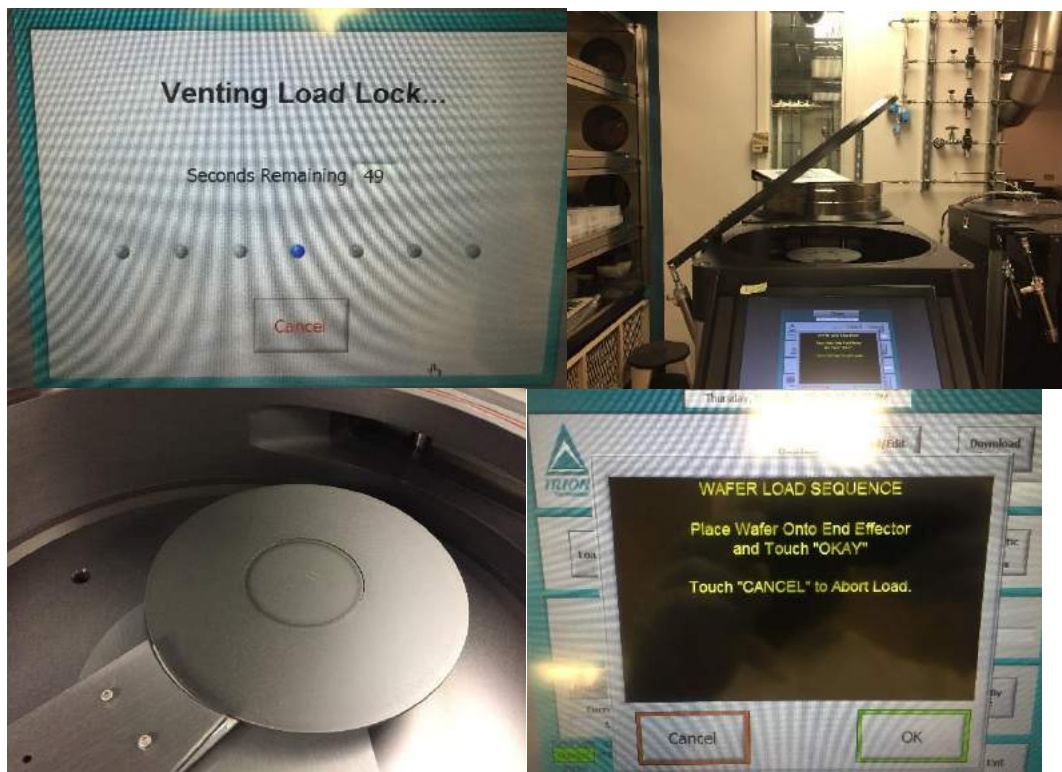




6. Once logged in, press the **Load Wafer** button. The system will ask if you want to vent the load lock. If your sample is not already in the chamber, press the **VENT LOCK FIRST** button. If your sample is already in the chamber, press the **DO NOT VENT** button.



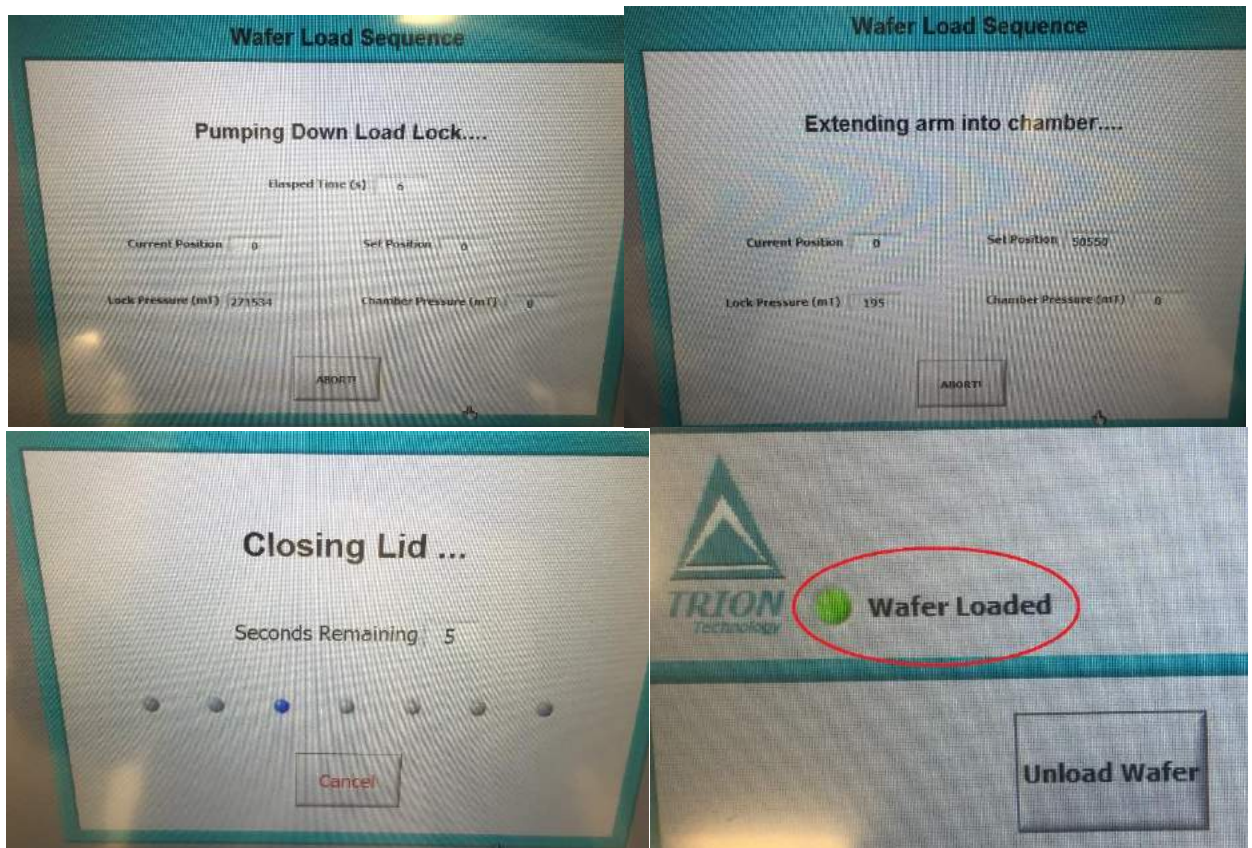
7. If you pressed the **VENT LOCK FIRST** button, the system will vent the load lock and open the chamber. Place your sample on the holder and press the **OK** button on the screen. You can also cancel the venting the process if you need too.



**NOTE: NCF has different sample holders available. They are located on the rack next to the system. To change the holder, simply replace it with the desired one on the robotic arm.**



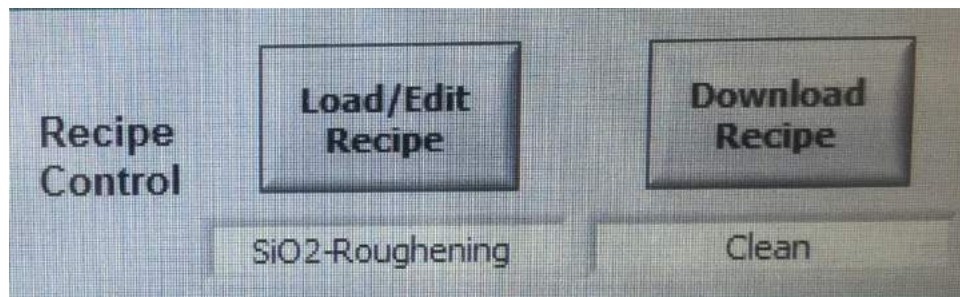
8. The system will pump down the load lock and place the sample into the chamber using the robotic arm. Once loaded, the screen will display **Wafer Loaded** as highlighted.





**NOTE: NCF POLICY IS THAT THE CHAMBER MUST BE CLEANED BEFORE AND AFTER USE.**

- On the main page, press the [Load/Edit Recipe](#). A recipe control page will come up. On this page, you have the option to create a new recipe, or load one that was previously saved.



The image shows the "Recipe Parameters" screen for the "SiO2-Roughening" recipe. The screen displays various parameters and their values, along with control buttons.

**Recipe name:** SiO2-Roughening

Pressure (mT)	SiCl4	CF4/Ar/He/
50	0	30

ICP RF (W)	Refl. Tol (W)	SF6	NF3
100	0	0	0

RIE RF (W)	Refl. Tol (W)	O2/CHF3/	H2
65	0	0	0

Cl2	CH4
0	0

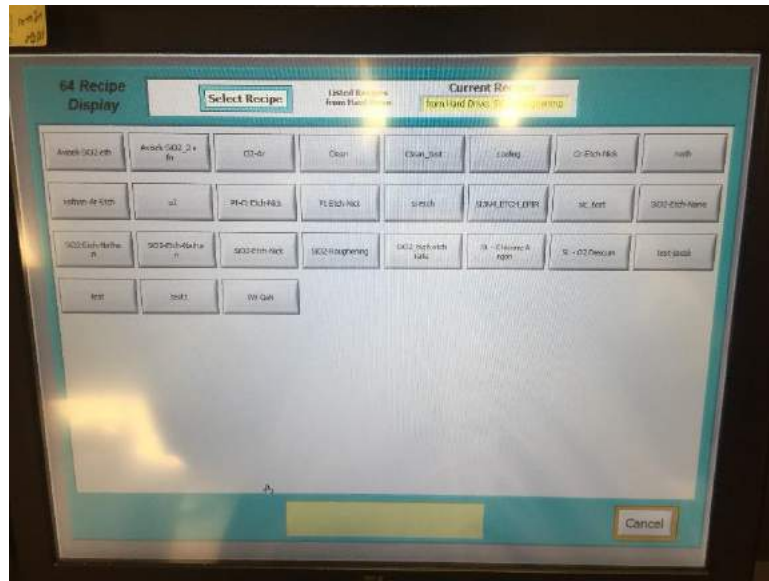
**RF Stable Time (s):** 10  
**Process Time (s):** 450.0

**Step #:** 1

**Buttons:** Delete Recipe File, Create New Recipe, Recipe From Disk, Save Recipe to Disk, EXIT

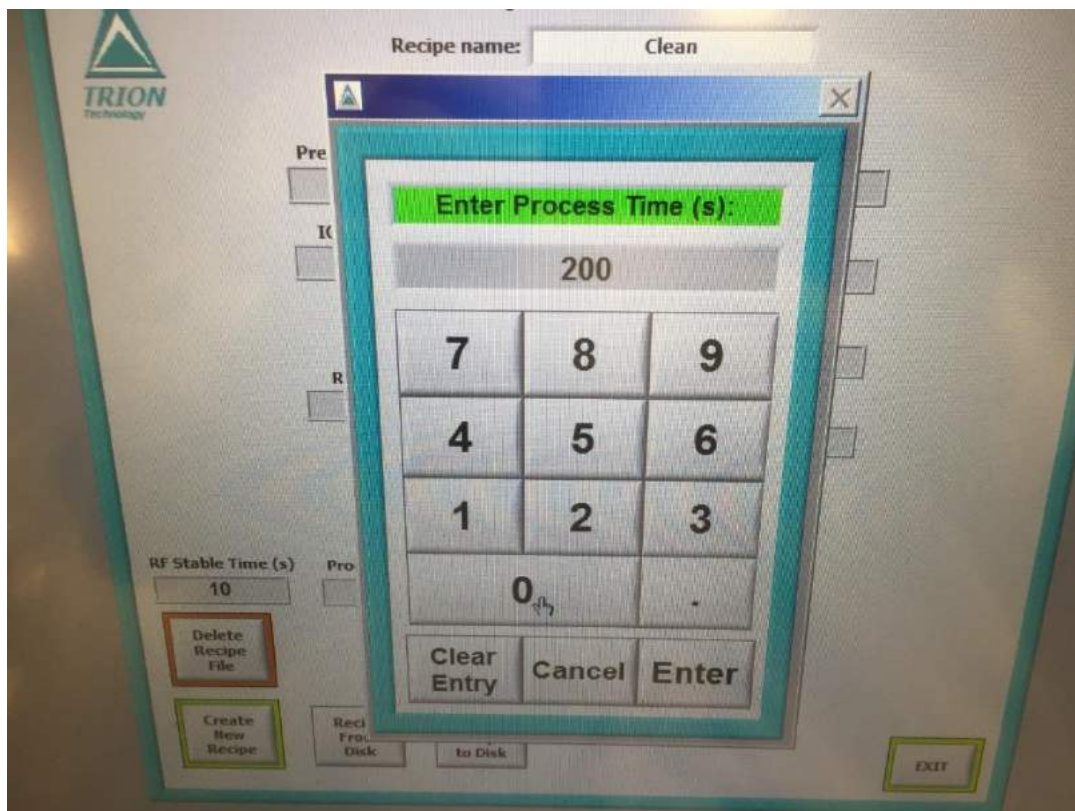
To load a saved recipe, press [Recipe from Disk](#) and select desired recipe from the page that comes up.

**NOTE:** You can edit the process parameters for the recipe you chose. However, the parameters will not be saved unless you press **Save Recipe to Disk**. The edited parameter(s) will be used only for the current process. The next time you run the recipe, the parameters will be back to their original values.



To create a new recipe, press **Create New Recipe**. Assign a name to your recipe on the page that comes up.

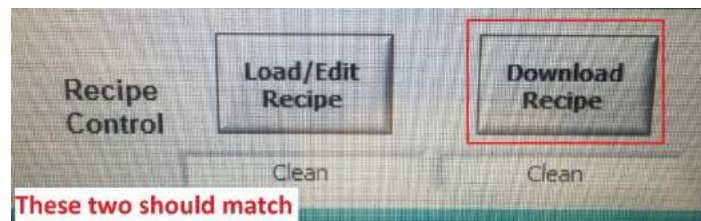
To edit a parameter, simply touch the parameter and a window will come up. Edit the parameter and press **Enter**.



- Pressure – minimum pressure is 0 mTorr.
- ICP RF (W) – maximum ICP RF power is 600 Watts
- RIE RF (W)
- Refl. Tol (W) – tolerance for reflected power. Available for ICP RF and RIE RF
- Gases flow rates in Sccm
- Process Time (s) – length of the process step in seconds
- RF stable Time (s) – time given for the RF power to stabilize
- Step # – you can include multiple steps in your recipe

To save a new recipe, press **Save Recipe to Disk**. Assign a name to your recipe on the page that comes up and save it.

10. Press **Exit** at the bottom of the **Recipe Parameters** page. Remember that edited parameters will not be saved to the recipe unless you press **Save Recipe to Disk**. The edited parameter(s) will be used only for the current process. The next time you run the recipe, the parameters will be back to their original values.
11. You should see on the recipe main page that the Loaded and Downloaded recipes should be the same. If not, press **Download Recipe**.



12. Open the gases you want to use behind the system.

**Note: Some gases share the same mass flow controller (MFC). If you want to use a combination of the gases on the same MFC, you will only be able to control the flow rate of the gas mixture, not the individual flow rates. Gases that share the same MFC are**

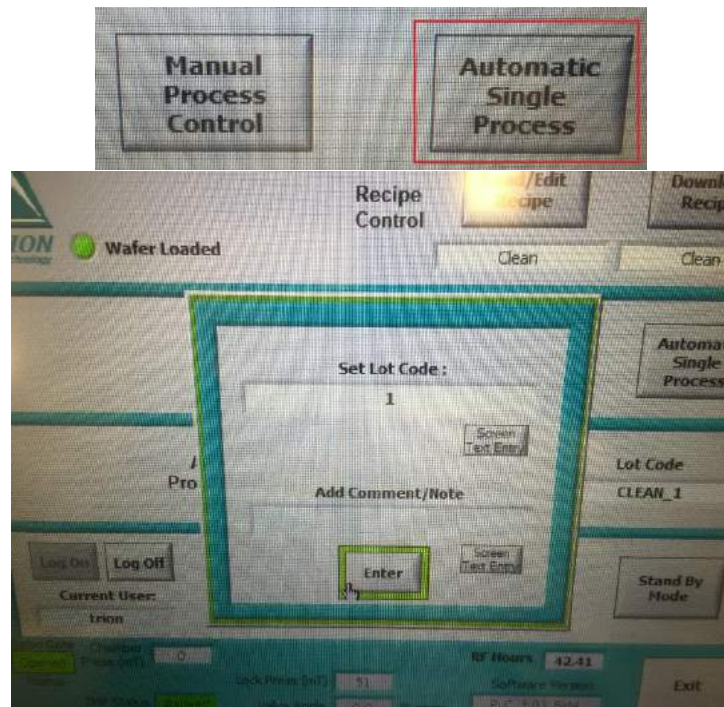
- $O_2$  and  $CHF_3$  - make sure to open the blue valve below both gas lines
- $CF_4$ ,  $Ar$ , and  $He$  - make sure to open the blue valve below the gas lines

You can choose to perform and **Automatic Single Process** or a **Manual Process**.

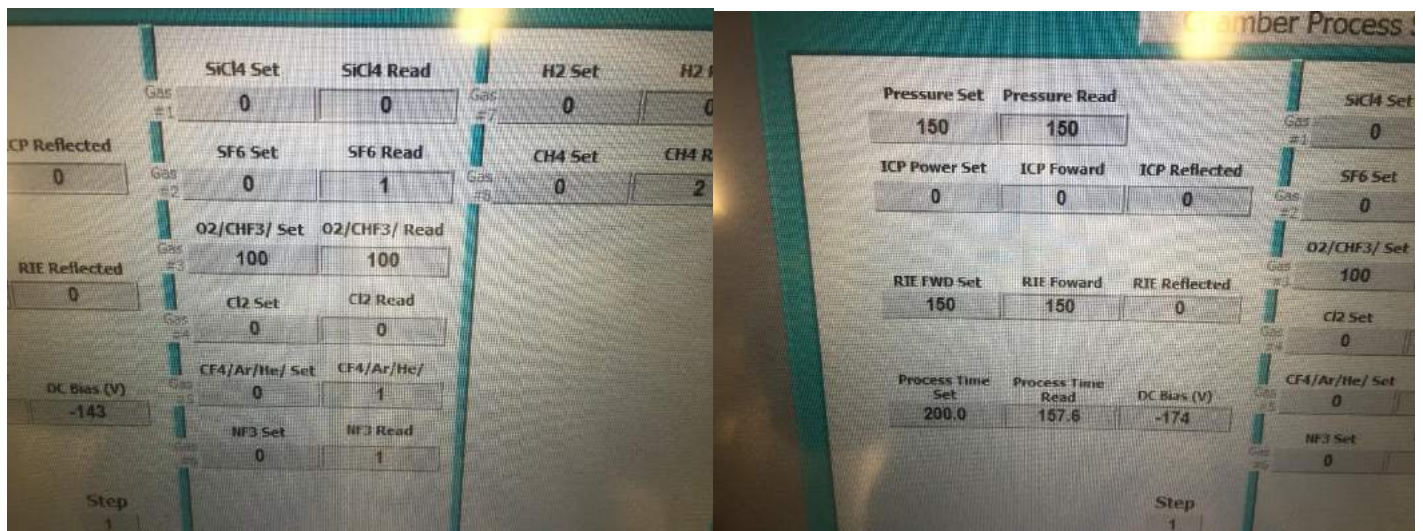
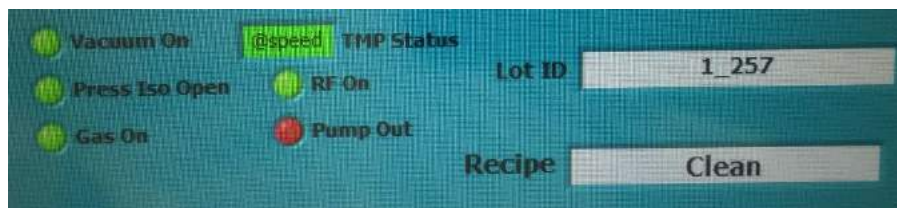
- An **Automatic Single Process** – the process is automatic, and time **COUNTS DOWN**. The process will stop when the time finishes.
- Manual Process** – the user tells the system what to do and when and the process time **COUNTS UP**. The user must stop the process when the time finishes.



13. If you want an automatic process, press **Automatic Single Process**, and enter the wafer number and press the **ENTER** button on the screen. The Lot Code is just a number to keep track of samples. Enter any number you wish. If you chose **Manual Process**, skip to the manual operations section



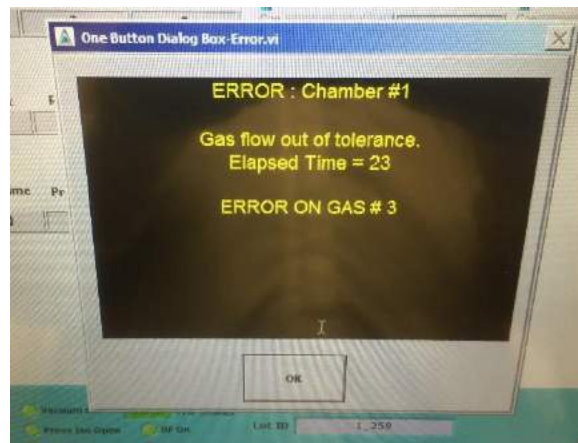
The system will run the entire recipe automatically. **If you're running a recipe with multiple steps, make sure all the gases you need are open.** Please check to make sure the process parameters are close to their set values.



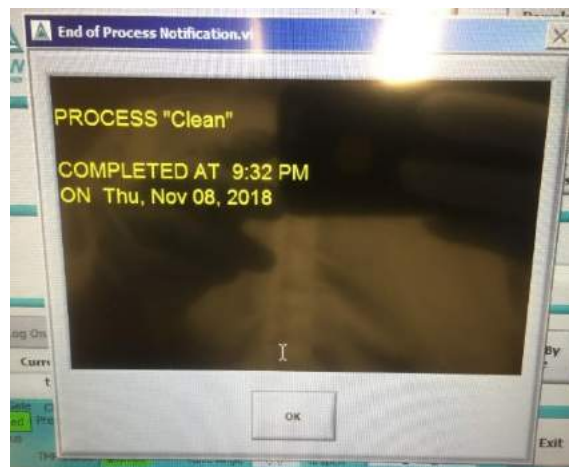
You may check to see the plasma is on by looking through the view port.



**NOTE:** If the process parameters are not within tolerance, the system will abort the run and display a message with the details of the problem. In this case, press **OK** and run the recipe again after resolving the issue.



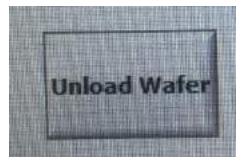
14. Once the process is complete, the system will display the message. Press the **OK** button.





15. The system will return to the main page. To run another recipe on the same wafer, repeat steps 9 – 13.

16. To unload the wafer, press the **Unload Wafer** button.

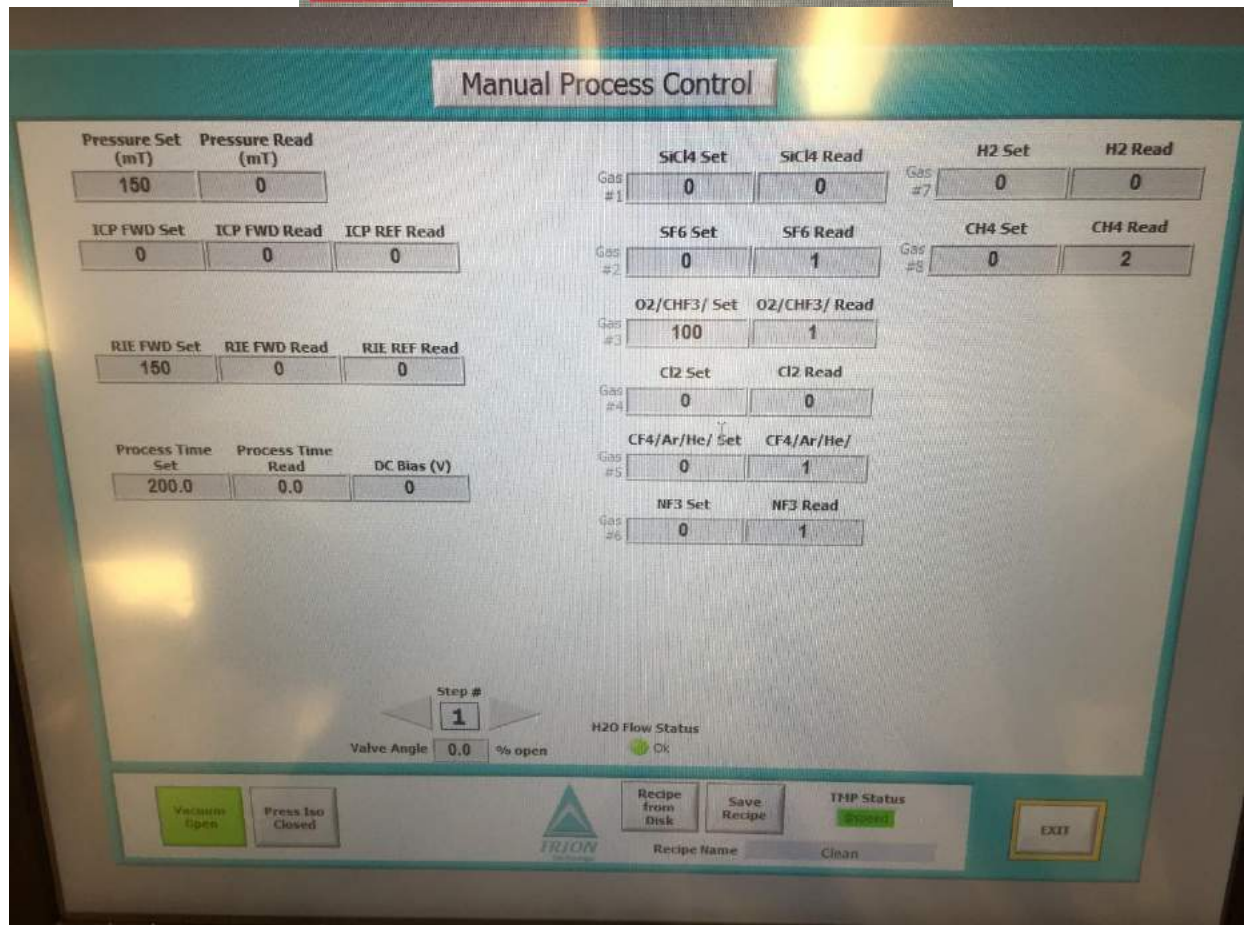
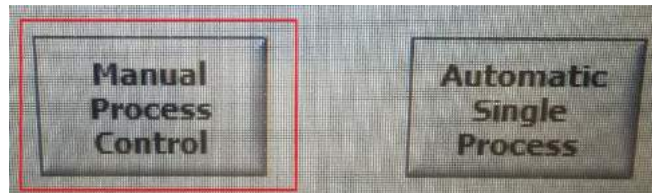


If finished with your sample, skip to the **After Processing Your Sample** section.

### Manual Process Operation

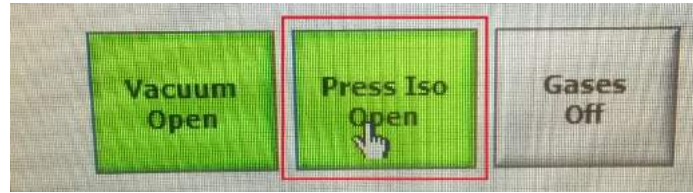
**NOTE:** Remember that the process time **COUNTS UP**. The user must stop the process when the time finishes.

17. Press the **Manual Process** button. The system will go the manual process control page.

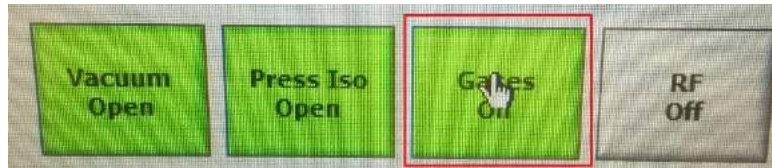




18. Press the **Press Iso Closed** button to open the ISO valve. The button will turn green and show **Press Iso Open**.



19. Press the **Gases Off** button to open the MFC(s) so that the gas(es) can flow into the chamber. The button will turn green and show **Gases On**.



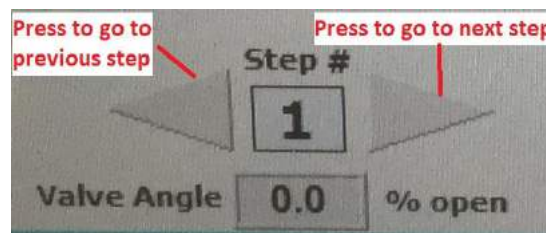
20. Press the **RF Off** button to turn on the RF power. The button will turn green and show **RF On**.



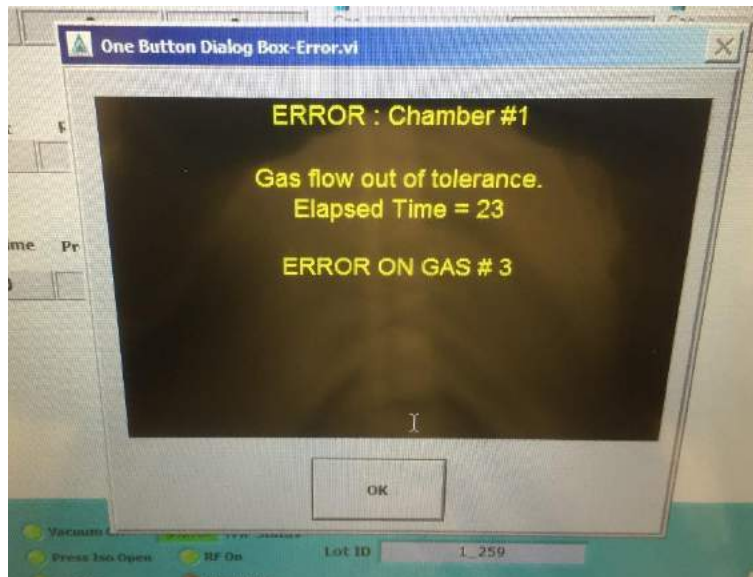
21. Once the process time finishes, press the buttons in reverse.

- Press **RF On** button to turn off the RF power. The button will turn gray and show **RF OFF**.
- Press the **Gases On** button to close the MFC(s). The button will turn gray and show **Gases OFF**.
- Press the **Press Iso Open** button to close the ISO valve. The button will turn gray and show **Press Iso Closed**.

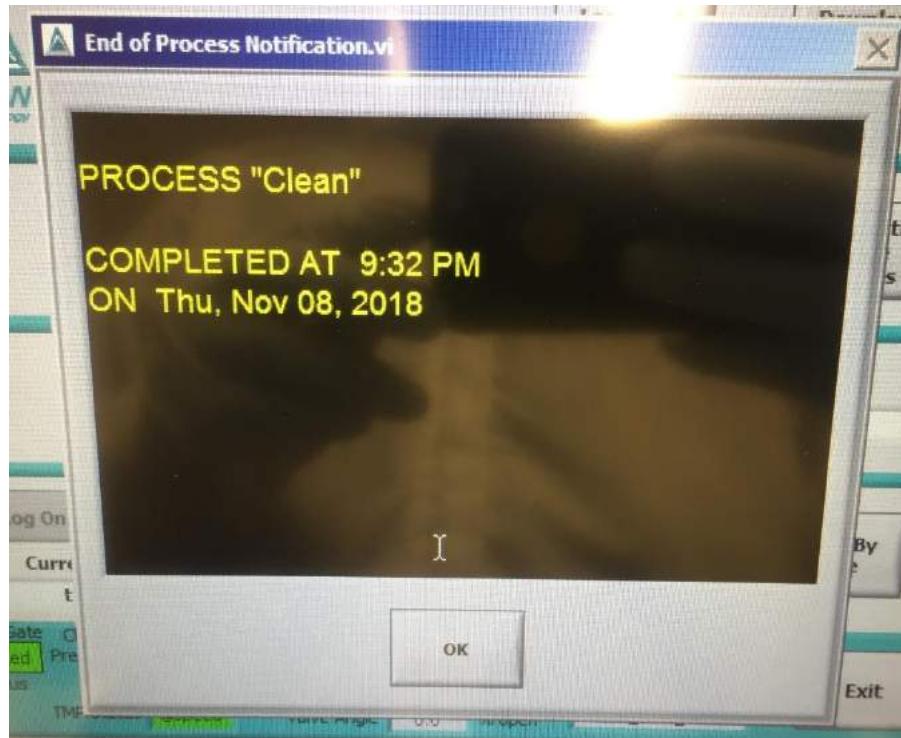
22. If your recipe has multiple steps, press the **Step #** arrow to run the next part of the recipe. Open the valves of the gases you will need and close the ones you don't. Then repeat steps 17-20



**NOTE:** If the process parameters are not within tolerance, the system will abort the run and display a message with the details of the problem. In this case, press **OK** and run the recipe again after resolving the issue.



23. Once the process is complete, the system will display the message. Press the **OK** button.



24. The system will return to the main page. To run another recipe in Manual mode on the same wafer, repeat steps 9 – 13, then repeat steps 17 - 23.

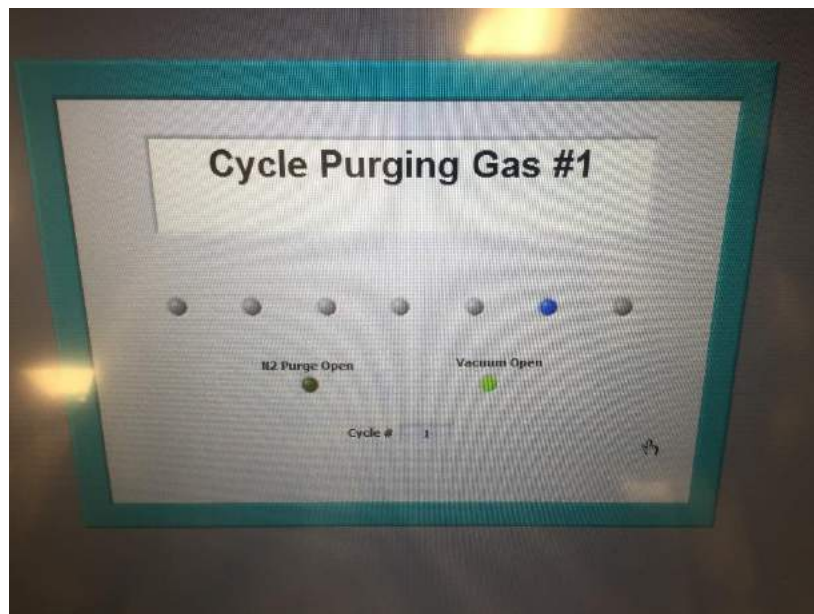
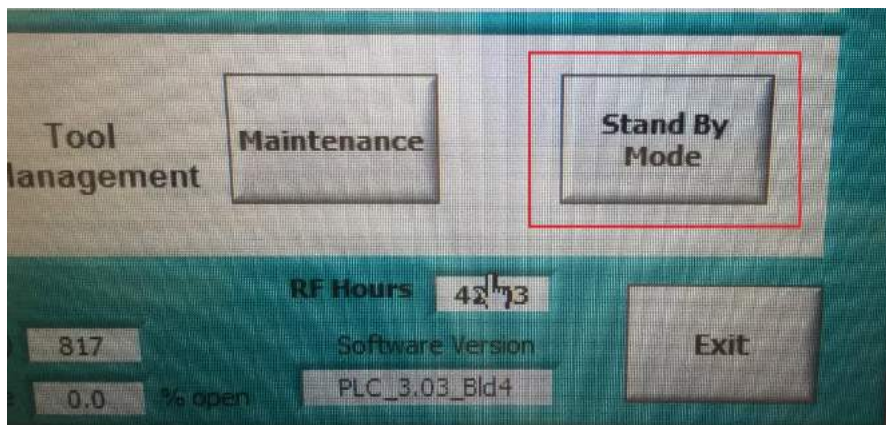
25. To unload the wafer, press the **Unload Wafer** button.

### AFTER PROCESSING YOUR SAMPLE

26. Run the **Clean** recipe by following steps 9 - 13. You don't have to put a wafer in the chamber for this step.
27. Press the **Log Off** button.



28. Press the **Standby Mode** button. The system will purge the gas lines with N<sub>2</sub> and go into standby.



29. Close the gas valves at the back. Leave the N<sub>2</sub> gas valve open.