

ION MILLING USING PVD 75 SOP

Revised April 2020

START UP

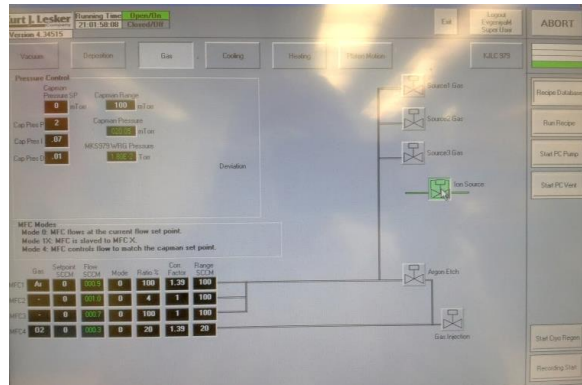
1. Log into the tool in your FOM account.
2. Select the **VACUUM** tab at the top left of the screen.
NOTE: The current vacuum found at the bottom of the screen in Torr.
3. To open the chamber press **START PC VENT** located at the middle right of the screen.
4. Once system is vented, remove the aluminum foil over the ion milling gun and install a filament as noted in the picture below.
5. After loading the sample/wafer pump the system down by press the **START PC PUMP** button located at the right center of screen.



6. When system vacuum reaches at least 5×10^{-5} Torr, select the **VACUUM** page at the top left of the screen.
7. Turn **ON** the **PC HIGH VACTHROTTLE** valve near the center of the screen.
8. There are two modes of operation for the discharge. They are Constant Current Mode or Constant Voltage Mode. The **Constant Current Mode** allows for small variations in the discharge voltage while maintaining a constant current and is recommended when operating at 120 V and below. The **Constant Voltage Mode** will allow for small variations in discharge current while maintaining a constant voltage and is recommended when operating at 120 V and above.

ETCHING IN CONSTANT CURRENT MODE

1. Turn **ON** the Ion Source under the **GAS** tab.



2. Open the panel door to get access to power supplies and Ion Mill controllers. Turn **ON** the rocker switches (On/Off power) of the KRI Auto Controller, KRI Filament Controller, and KRI Discharge Controller.
3. Place the KRI Auto Controller, KRI Filament Controller, and KRI Discharge Controller in **Local**.
4. Change the Operating mode of on KRI Auto Controller to **GAS ONLY**.

The operating condition selected for this demonstration is Constant Current Mode with a 2.5A, 120V discharge. These conditions are based on a vacuum pump speed of 800 liters per second. Operating parameters for other pump speeds and gases can be found in the Ion Source Manual located in the pocket at the bottom of the door. Note that the operating range of the ion source may be limited by the vacuum facility pump speed or other process that take place while the ion source is running.



5. From the KRI Auto Controller, select **GAS 1** using the white **Gas Channel Select Button**.
6. From the KRI Auto Controller, turn the **GAS ADJUST KNOB** until 10 SCCM is displayed on the SCCM display.
7. From the KRI Filament Controller, turn the **EMISSION ADJUST KNOB** until 2.7 Amps is indicated in the Emission Amps display. Note that the filament emission is usually equal to or up to 10% greater than the discharge current.

8. From the KRI Discharge Controller, use the white **SELECT** button to select Volts.
9. From the KRI Discharge Controller, turn the **SETPOINT ADJUST KNOB** until the discharge voltage is set to maximum as indicated on the Discharge Volts display.
10. From the KRI Discharge Controller, use the white **SELECT** button to select Amps.
11. From the KRI Discharge Controller, turn the **SETPOINT ADJUST KNOB** until the discharge current is set to **2.5 Amps** as indicated on the Discharge Amps display.
12. From the KRI Auto Controller, press the white **ENABLE/STANDBY BUTTON** to **ENABLE**.
13. From the KRI Filament Controller, press the white **ENABLE/STANDBY BUTTON** to **ENABLE**.
14. From the KRI Discharge Controller, press the white **ENABLE/STANDBY BUTTON** to **ENABLE**.
15. From the KRI Auto Controller, adjust the gas flow using the **GAS ADJUST KNOB** until the discharge voltage is approximately 120 V as read from the KRI Discharge Controller.
16. Operate the ion source for at least 10 minutes to clean any contaminants from the ion source that may have been introduced while at atmosphere.
17. The discharge voltage (as read from the KRI Discharge Controller) will vary slightly during this time. Adjust the gas flow (from the KRI Auto Controller) after the 10 minutes to obtain a discharge voltage of approximately 120 V (as read from the KRI Discharge Controller) and **OPEN** the substrate shutter to continue Ion Milling until the desired amount of etching has been achieved.

NOTE: The KRI Auto Controller can be used later in the **AUTO GAS** mode or the **MANUAL GAS** mode. If not them, proceed to step 18. To save program settings for **AUTO GAS** mode, first press the white **PROGRAM SELECT BUTTON** (located on the KRI Auto Controller) repeatedly until the desired program number is selected as indicated by the numbered red LED's. From the KRI Auto Controller, press and hold the white **ACQUIRE SETPOINTS BUTTON** until the red numbered LED that was selected stops flashing.

TURNING OFF THE ION SOURCE GUN

1. When etching is complete press the **ENABLE/STANDBY BUTTON** and switch to **STANDBY** on the KRI Discharge Controller.
2. From the KRI Filament Controller, press the white **ENABLE/STANDBY BUTTON** to **STANDBY**.
3. From the KRI Auto Controller, press the white **ENABLE/STANDBY BUTTON** to **STANDBY**.

NOTE: If you need to restart the ion source in the **GAS ONLY** mode start the KRI Auto Controller, KRI Filament Controller and KRI Discharge Controller in that order. Slight

variations in discharge voltages may be seen while the source is reaching operating temperature. The variations should be acceptable for most cleaning or ion-assist applications.

4. Wait 5 minutes to allow the filament to cool before venting the process chamber.
5. Press **START PC VENT**.
6. When the chamber is vented remove your sample, remove the filament from the ion source and cover the ion gun with new aluminum foil.
7. Press **START PC PUMP** and logoff.

ETCHING IN CONSTANT VOLTAGE MODE

1. Turn **ON** the Ion Source under the **GAS** tab.
2. Turn **ON** the rocker switches (On/Off power) of the KRI Auto Controller, KRI Filament Controller, and KRI Discharge Controller.
3. Place the KRI Auto Controller, KRI Filament Controller, and KRI Discharge Controller in **LOCAL**.
4. Change the Operating mode of on KRI Auto Controller to **GAS ONLY**.

The operating condition selected for this demonstration is with a 2.5A, 150V discharge which is Constant Voltage Mode operation. The following conditions are based on a vacuum pump speed of 1600 liters per second. Operating parameter for other pump speeds and gases can be found in the Ion Source Manual. Note that the operating range of the ion source may be limited by the vacuum facility pump speed or other process that takes place while the ion source is running.

5. From the KRI Auto Controller, select **GAS 1** using the white Gas Channel Select Button.
6. From the KRI Auto Controller, turn the **GAS ADJUST KNOB** until 15 SCCM is displayed on the SCCM display.
7. From the KRI Filament Controller, turn the **EMISSION ADJUST KNOB** until **2.7 Amps** is indicated in the Emission Amps display. Note that the filament emission is usually set equal to or up to 10% greater than the discharge current.
8. From the KRI Discharge Controller, use the white **SELECT** button to select Volts.
9. From the KRI Discharge Controller, turn the **SETPOINT ADJUST KNOB** until the discharge voltage is set to **150 Volts** as indicated on the Discharge Volts display.
10. From the KRI Discharge Controller, use the white **SELECT** button to select Amps.
11. From the KRI Discharge Controller, turn the **SETPOINT ADJUST KNOB** until the discharge current is set to its maximum as indicated on the Discharge Amps display (5 Amps)
12. From the KRI Auto Controller, press the white **ENABLE/STANDBY BUTTON** to **ENABLE**.

13. From the KRI Filament Controller, press the white **ENABLE/STANDBY BUTTON** to **ENABLE**.
14. From the KRI Discharge Controller, press the white **ENABLE/STANDBY BUTTON** to **ENABLE**.
15. From the KRI Auto Controller, adjust the gas flow using the **GAS ADJUST KNOB** until the discharge current is approximately 2.5 Amps as read from the KRI Discharge Controller.
16. Operate the ion source for at least 10 minutes to clean any contaminants from the ion source that may have been introduced while at atmosphere.
17. The discharge current (as read from the KRI Discharge Controller) will vary slightly during this time. Adjust the gas flow (from the KRI Auto Controller) after the 10 minutes to obtain a discharge current of approximately **2.5 Amps** (as read from the KRI Discharge Controller).

NOTE: The KRI Auto Controller can be used later in the **AUTO GAS** mode or the **MANUAL GAS** mode. If not them, proceed to step 18. To save program settings for **AUTO GAS** mode, first press the white **PROGRAM SELECT BUTTON** (located on the KRI Auto Controller) repeatedly until the desired program number is selected as indicated by the numbered red LED's. From the KRI Auto Controller, press and hold the white **ACQUIRE SETPOINTS BUTTON** until the red numbered LED that was selected stops flashing.

TO TURN OFF THE ION SOURCE

18. From the KRI Discharge Controller, press the white **Enable/Standby Button** to **Standby**.
19. From the KRI Filament Controller, press the white **Enable/Standby Button** to **Standby**.
20. From the KRI Auto Controller, press the white **ENABLE/STANDBY BUTTON** to **Standby**.

NOTE: If you need to restart the ion source in the **GAS ONLY** mode start the KRI Auto Controller, KRI Filament Controller and KRI Discharge Controller in that order. Slight variations in discharge voltages may be seen while the source is reaching operating temperature. The variations should be acceptable for most cleaning or ion-assist applications.

MANUAL GAS MODE

1. Manual Gas mode sequentially enables the gas, filament and discharge in the same manner that these would be enabled manually if the **GAS ONLY** mode were used. There is no feedback to adjust the gas flow to maintain the constant discharge parameters.
2. From the KRI Auto Controller, select the **MANUAL GAS** mode using the **OPERATING MODE BUTTON**. Select the program to run using the **PROGRAM SELECT** button. Enable the program by pressing the **ENABLE/STANDBY** button on the KRI Auto

Controller. Press the **ENABLE/STANDBY** button again to stop the program and put the units into **STANDBY**.

3. All of the setpoints can be adjusted before or after the KRI Auto Controller is enabled as in the **GAS ONLY** mode.
4. Saving a program is accomplished in the same manner as described above for the **Auto Gas** and **Gas Only** operating modes.

ACTIONS TO PERFORM PRIOR TO RUNNING IN REMOTE MODE

NOTE: These steps must be performed prior to running in Remote Mode:

Determine what mode of operation is compatible with system and perform these operational steps (Constant Current Mode Operation OR Constant Voltage Mode Operation) prior to running in **REMOTE MODE**.

OPERATION OF ION SOURCE FROM GUI (REMOTE MODE)

1. Turn **ON** the Ion Source Gas valve for the Ion Source and evacuate the line to the MFC supplied with the Ion Gun.
2. Determine that system base pressure is acceptable.
3. Turn **ON** the KRI Auto Controller via rocker switch (manually).
4. Turn **ON** the KRI Filament Controller via rocker switch (manually).
5. Turn **ON** the KRI Discharge Controller via rocker switch (manually).
6. From the KRI Auto Controller, select the program that is desired to run.
7. From the KRI Auto Controller, select **REMOTE** mode.
8. From the KRI Auto Controller, change the Operating Mode to **MANUAL GAS**.
9. Turn **ON** the Ion Source via the **GAS** tab on GUI screen.
10. This action will run the Program in remote mode using the Cware interlocks.

NOTE: Operation in Manual Mode does not use interlocks

SHUTDOWN OF ION SOURCE FROM GUI (REMOTE MODE)

1. Turn **OFF** the Ion Source via the **GAS** tab on GUI screen.
2. Turn **OFF** the KRI Discharge Controller via rocker switch manually.
3. Turn **OFF** the KRI Filament Controller via rocker switch manually.
4. Turn **OFF** the KRI Auto Controller via rocker switch manually.
5. Turn **OFF** the Source Gas valve for the Ion Source.
6. Log out of the tool in your FOM account.