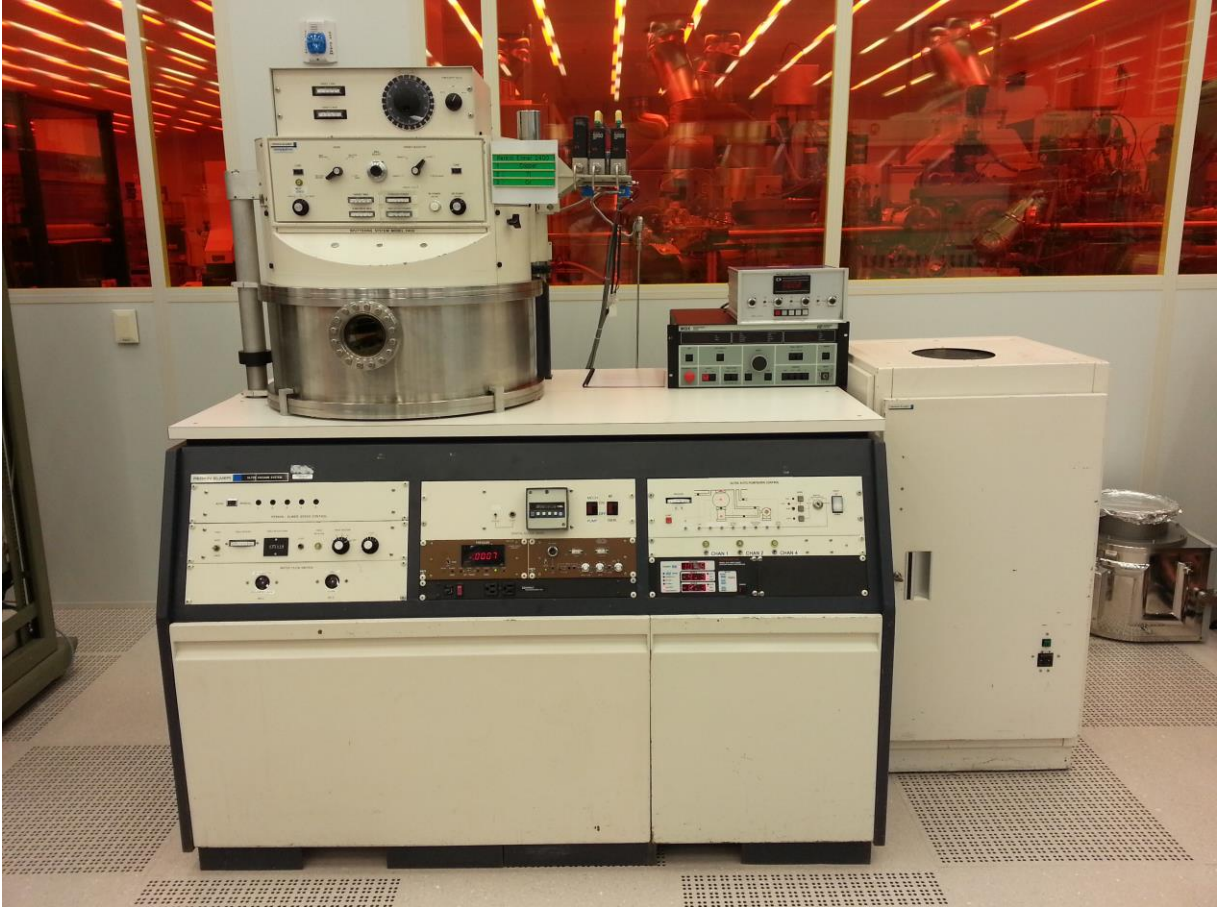


# PE 2400 User Instructions



**University of Notre Dame**

**Department of Electrical Engineering**

## Sputtering (Start Procedure)

Refer to Figure #1 for all indicators light locations on page #4.

The MFC Controller measures value in percentage of Full scale as given in 8a.

1. Sign into Coral and enable the machine.
2. If needed, perform “To Change a Sample” on Page #3.
3. Wait until the system vacuum reaches  $10^{-6}$ .
4. Turn off the Ion Gauge Filament by pressing the blue button on the Controller.
5. Switch the Throttle Valve Controller to “Auto” from “Open”.
6. Simultaneously press “START” and “GAS” buttons. Gas Light will illuminate.
7. Turn on appropriate switches on Gas Controller to give you the necessary flow rate. Open and set as many as needed.
  - a. Maximum gas channel flow rates.
    - i. Channel 1 = 1000 SCCM.
    - ii. Channel 2 = 200 SCCM
    - iii. Channel 4 = 200 SCCM
8. Push the appropriate button on the Mass Flow Controller and adjust the potentiometer to give required flow rate. MFC’s are read in percentage of full scale.
9. Set throttle valve controller to desired pressure by using the “Set Point” adjustment (10 mTorr=0.0100).
10. Turn on “RF GEN” on the Timer Controller.
11. Wait 10 minutes for power supply tubes to warm up.
12. Set Mode of Operation. See page #5 for clarification of modes.
13. Select the desired sputtering source on the TARGET SELECTOR of the RF control panel. List of installed targets is immediately to the right of the Target Selector.
14. To set the deposition time push and hold the “BLUE” button on the Digital Clock Timer (central panel). Use “white” buttons to set the desired value.
15. Press the large white “RF power On/Off” button on the RF control panel until it lights.
16. Use the shutters and table rotation to set up your experimental conditions.
17. Turn CW “RF POWER Adjust” knob very slowly until a maximum of 1150 watts or to your desired power. (Reading is X 10) To give time for auto tune system to adjust, make a small adjustment and then wait a few seconds for Reflected power to go down in value. Reflected power should never exceed 50 watts for more than 5 sec.
18. Allow a minute for any contamination to be sputtered off of the target.
19. Rotate samples into Target Area as necessary by using “Table Speed” control.
20. Push the “START” button on the Timer Controller to start the process. Note: The RF will automatically turn off when the timer reaches zero.
21. When the deposition is done, turn “RF Power Adjust” knob fully CCW.
22. Perform step #10 thru step #23 for as many sputtering depositions as needed.

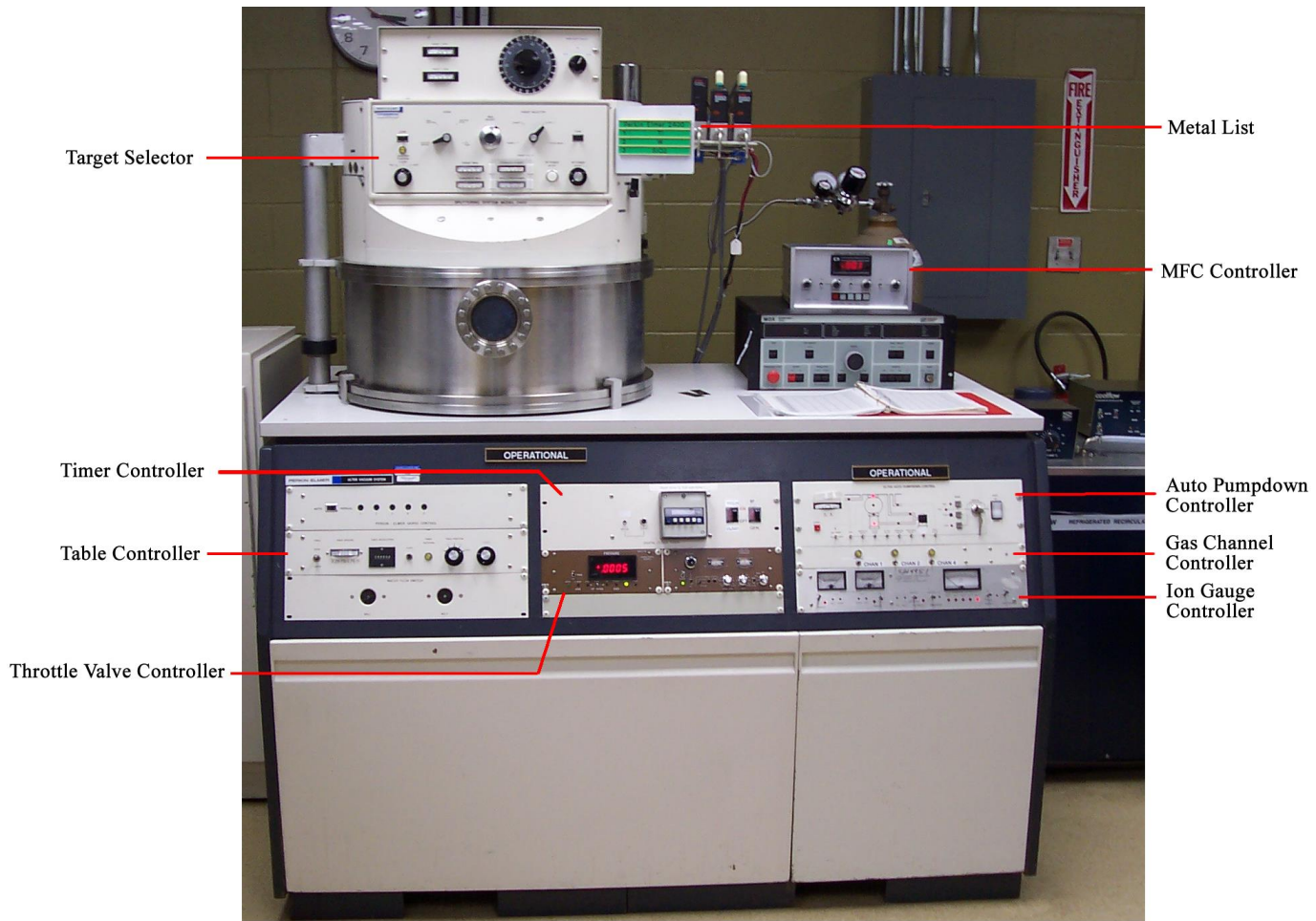
**NOTE: Never change the TARGET SELECTOR with the RF POWER ON.**
23. Simultaneously press “START” and “PUMP” buttons on the Auto Pumpdown Controller.

24. Change the Throttle Valve controller from “Auto” to “Open”.
25. Turn off all channel switches on Gas Controller.
26. Wait 10 minutes to allow the targets and machine to cool down.
27. Switch off the “RF GEN” on the Timer Controller.
28. If needed, perform “To Change a Sample” on Page #3.
29. Turn the Ion Gauge Filament to “on” on the Controller.
30. Disable the machine in Coral and fill out the Run Data Collector with appropriate information. Take trash and materials with you when you leave the machine.

## **To Change a Sample**

Refer to Figure #1 for all indicators light locations on page #4.

1. Verify the ion gauge Filament is off. If it isn't off then turn off the “filament” and verify it is off.
2. Simultaneously press “START” and “VENT” buttons on the Auto Pumpdown Controller. “Vent” light will illuminate. The “Vent valve” opens after a 3-5 second delay.
3. Roughing pressure gauge on the top left of the Auto Pumpdown Controller goes from zero to ATM within seconds.
4. Wait for about 3 minutes or until after click sound from the bottom back of the vacuum chamber.
5. To open the chamber, press and hold down the “HOIST UP” rocker switch on the Auto Pumpdown Controller.
6. Load or unload your samples. Place wafers under shutters and away from the target to allow removal of target surface contamination.
7. Close the chamber by pressing and holding down the “HOIST DOWN” rocker switch on the Auto Pumpdown Controller.
8. Turn on “Mech pump” on the Timer Controller panel.
9. Simultaneously press “START” and “PUMP” buttons. Pump light will illuminate and stay lit until Cryo pump has High Vacuum control. After few seconds delay, the auto pump down sequence starts. Cryo crossover is about 180 - 200 mTorr.
10. Turn the “Mech pump” to “OFF” on the Timer Controller panel.
11. After Roughing pressure gauge reaches zero turn the Ion gauge ON.
12. Return to step #3 on page #2 if a sample was just installed or go to step # 29 on page #3 if a sample was just removed.



**Figure 1:** Overall System Components

## Appendix A

### Control Descriptions

#### MODE SELECTOR Switch

1. Sputter Deposit
  - a. RF power is only applied to the target(s).
  - b. The Substrate Table is grounded.
2. Bias Sputter
  - a. RF power is applied to the target selected.
  - b. A small portion of the RF is also applied to the table. (The substrates are bombarded by ions but to a much lesser degree than the target. In many cases, this results in film characteristics different from RF sputtering with grounded substrates.)
3. Sputter Etch
  - a. RF power is applied only to the substrate table and material is removed (etched) from the substrate by ion bombardment.
  - b. Maximum power should be limited to 1KW.
4. DC Bias (This is an option; it is *not* installed on this machine.)
  - a. This mode is essentially the same as sputter deposit. However, instead of grounding the substrate table, a DC bias is applied to from an external DC power supply.

#### TARGET SELECTOR Switch

This connects the output of the matching circuit to one or two of the three targets.

- 1 Target 1: RF power is connected to the left target (as viewed from the front).
- 2 Target 2: RF power is connected to the rear target (as viewed from the front).
- 3 Target 3: RF power is connected to the right target (as viewed from the front).
- 4 Target 1 & 3: RF power is connected to targets #1 & # 3.
- 5 Etch/Heat: RF power is connected to the substrate table; it is used when the “Sputter Etch” mode is selected. The heat option is not installed in our system.

#### BIAS ADJUST control

This control is used only in the Bias Sputter mode of operation (see above). It adjusts the percentage of RF power applied to the substrate table. Varying the amount of power varies negative self-bias on the table. This bias is measured by the *Substrate Bias* meter.

## PE2400 Deposition table

FWD Power (W)	REF Power (W)	Pressure (mT)	Bias Volts (Volts)	Argon Flow (sccm)	Table Position	Rate (A/min)	Date
<b>AlSi</b>							
<b>Chrome</b>							
1150	50	20			2.5in	425	25-Mar-15
<b>Copper</b>							
1150		20		74	2.6cm	650	4-Jun-04
1150	45	20	150	124	2.5in	650	4-Sep-14
1150	50	20	140	130	2.5in	720	10-Sep-14
1150	75	10	150	64	2.5in	576	4-Sep-14
<b>Silicon Dioxide (SiO<sub>2</sub>)</b>							
1150	40	20		560	2.5in	468	13-Mar-15
1150	25	20			2.5in	528	25-Mar-15
<b>Tantalum</b>							
1150	60	20	160	124	2.5in	420	4-Sep-14
1150	45	10	190	64	2.5in	402	4-Sep-14
1150		200				451	1-Sep-15
1150		200				522	1-Sep-15
<b>Titanium</b>							
1150		20		74	2.6cm	350	4-Jun-04
1150	50	20	110	124	2.5in	258	4-Sep-14
1150	40	20	100	130	2.5in	289	10-Sep-14
<b>Tungsten</b>							
1150		20		74	2.6cm	300	4-Jun-04