



High Voltage Power Supply Calibrations

Purpose

Provide a standard procedure for calibrating the analog I/O boards for the high voltage power supplies. This section contains the calibration procedures that pertain to the VISta HC power supplies specifically. This section also contains the calibration procedures that pertain only to the Universal End Station for the VISta HC. The Universal End Station calibration procedure included is:

- Dual Plasma Flood Gun (PFG) power supply calibration.

Knowledge/Skill Level

Completion of operation, maintenance, and electronics training courses. Only trained people authorized to work on high voltage electrical systems should work on the high voltage power supplies.

Tools	<ul style="list-style-type: none"> • hex key set • large slotted screwdriver • calibrated high voltage probe and digital volt meter
Materials	<ul style="list-style-type: none"> • high voltage barrier tape • warning signs

Required Tools And Materials

Warnings



High Voltage Electrical Hazard

Implanters operate at voltages that will cause serious injury or death.

People servicing high voltage areas must be trained. Manual grounding rods must be connected from ground to terminal potential. Manual grounding rods must be connected from ground to the source cabinet. Leave manual grounding rods in place while servicing.



Summarized High Voltage Power Supply Calibration



Note: Follow appropriate safety precautions including the use of high voltage barrier tape and warning signs. Use a digital volt meter to verify that all hand held grounding rods are properly connected to ground.

Type 4 Electrical Procedure

High Voltage Calibration

Source Power Supply Calibration

1. Perform a safe system shutdown.
2. Lockout/tagout the extraction and extraction suppression power supplies.
3. Lockout/tagout the D1 and D1 suppression power supplies.
4. Lockout/tagout the 90 Magnet and source magnet power supplies.
5. Lockout/tagout any of the source power supplies that are not needed for calibration.
 - a. If calibrating the arc power supply, tagout the source bias and filament supplies.
 - b. If calibrating the source bias power supply, tagout the arc supply but not the filament supply since the filament is used during the source bias supply calibration.
 - c. If calibrating the filament power supply, tagout the arc and source bias power supplies.
 - d. If calibrating the source magnet power supply, tagout the arc, filament, and source bias power supplies.
6. On VCS navigation bar select Setup and then select PS Calib in the navigation tabs window.
7. Select the power supply from the Left Function window.
8. Follow the directions on the screen and input 4 points of reference.
9. Compare the programmed voltage to the measured voltage.
10. Calculate the new scale factor and offset.
11. Enter the new scale factor and offset.
12. Verify the new scale factor and offset by rechecking voltages.
13. Compare the programmed voltage to the readback voltage.
14. Calculate the new scale factor and offset.
15. Enter the new scale factor and offset.

16. Verify the new scale factor and offset by rechecking voltages.
17. Perform a safe system shutdown.
18. Lockout/tagout the extraction and Decel 1 suppression power supplies.
19. Safely disconnect the high voltage probe.
20. Remove lockout/tagout of extraction and Decel 1 suppression power supplies.
21. Perform a system startup.



Extraction Voltage Power Supply Calibration

Calibration



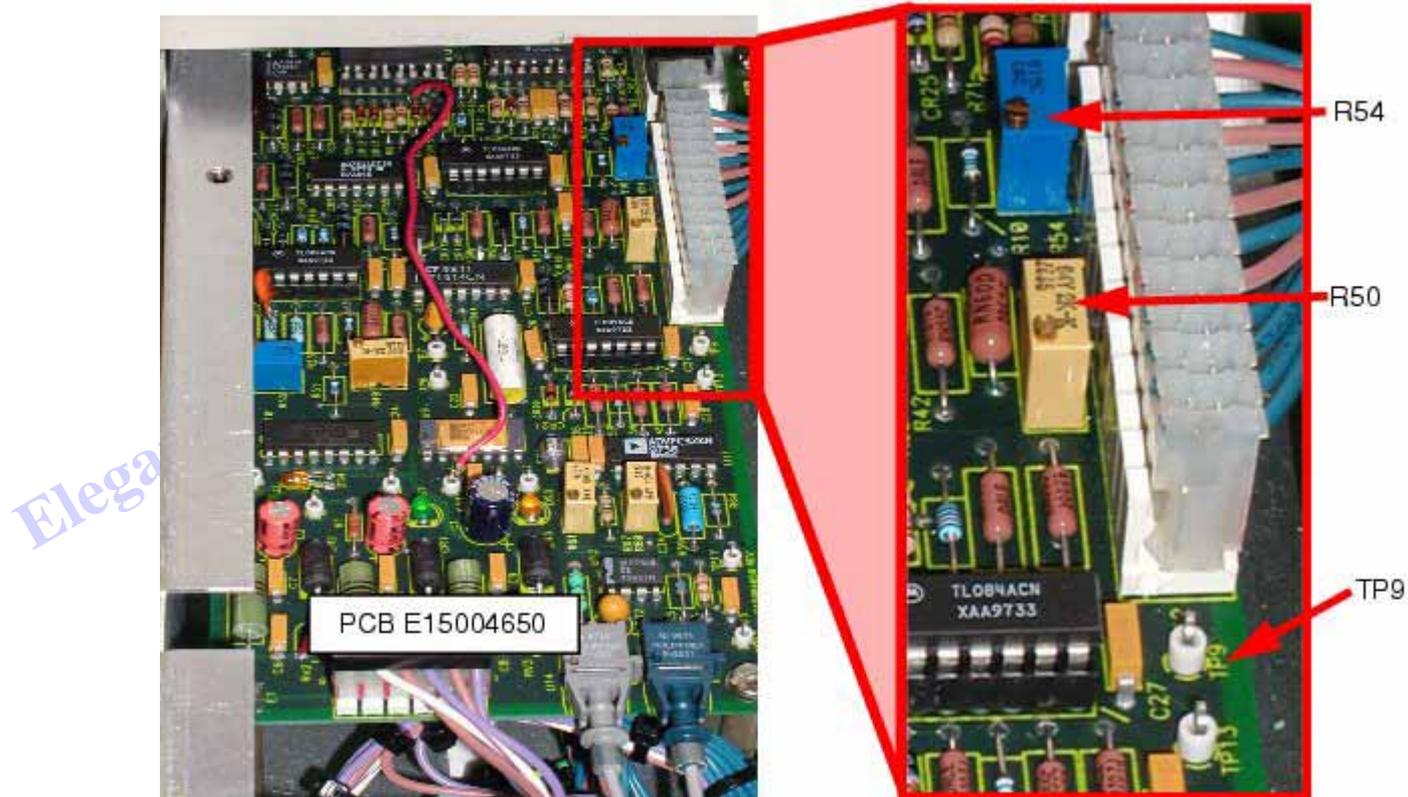
Observe the 2 person work rule and use external ground sticks when entering the enclosure.

1. Ensure that the implanter is shutdown.
2. If a beam is running, perform a Beam Shutdown.
3. Insure both the Extraction LOW and Extraction HIGH drivers are functional.

4. Rack out and remove the cover of the Extraction PS Controller (E11076590).

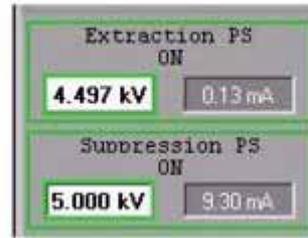


5. Locate PCB E15004650.



6. Locate R50, R54, and TP9 on the PCB E15004650.
7. Enable/verify High Voltage to the machine.
8. Turn on and program the Source Suppression power supply to 5KV to meet the interlock requirements for the Extraction P.S.
9. Turn on the Extraction P.S. and program the supply to 4.5KV (LowRange) or 72KV (HighRange).

Note: To select LowRange or HighRange, double-click the Extraction State Icon, select LowRange/HighRange, and select On.



10. With either Extraction Driver programmed at 90% (LowRange at 4.5KV or HighRange at 72KV) adjust R50 for 8.55VDC at TP9.
11. With either Extraction Driver programmed at 10% (LowRange at 0.50KV or HighRange at 8.0KV) adjust R54 for 0.95VDC at TP9.
12. Repeat this procedure until the voltages at TP9 are correct.
13. Shutdown all High Voltage Supplies.
14. Replace the Extraction Controller (E11076590) cover and reinstall it in the system.



Connect The High Voltage Probe



Note: Observe all applicable safety requirements, Dangers, Warnings, Cautions and Notes. Observe the two person work rule and use external ground sticks when entering the enclosure!



Unlocking the Enclosure Doors

Electrical Hazard



1. Locate the Enclosure Door/High Voltage interlock panel.



Note: Each grounding rod fits into a color coded receptacle. The left side is color coded blue and corresponds to the 40 KV enclosure doors 1, 2, 3, and 4. The right side is color coded white and corresponds to the Decel enclosure doors 5, 6, 7, and 8.

2. Locate the two manual grounding rods above the Enclosure Door/High Voltage interlock panel.

3. Select the appropriate grounding rod and slide it upward to unlock the corresponding doors.
4. At this time the doors can be opened and the Operation/Services screen indicates door status.

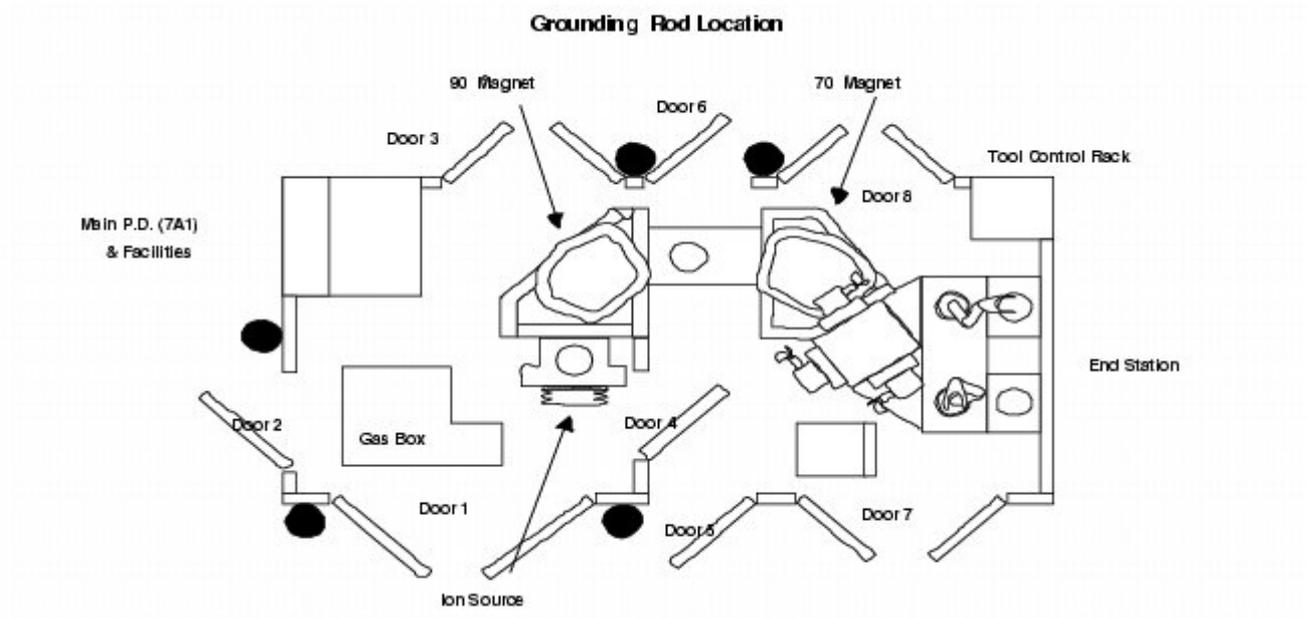


Enter the High Voltage Enclosure

Electrical Hazard



1. Use the following diagram for door and grounding rod location.

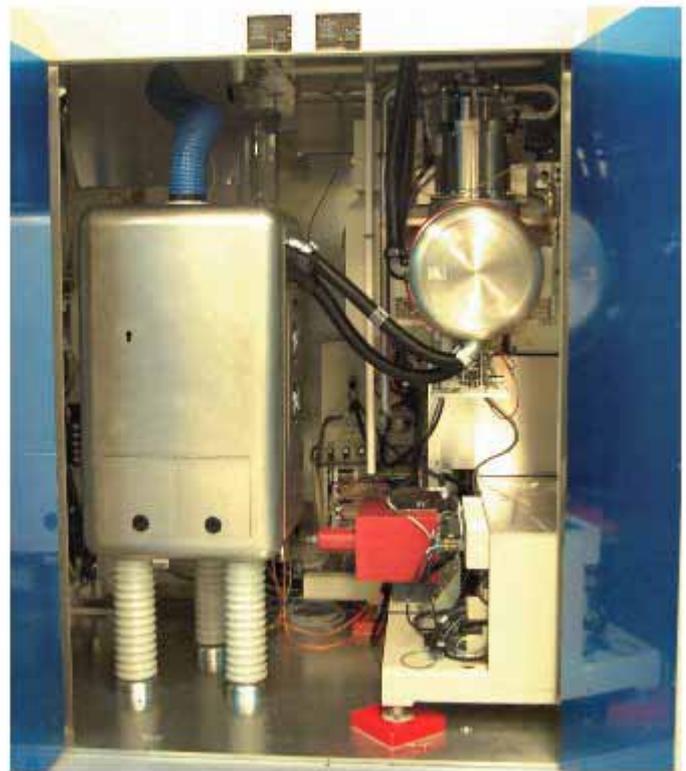


2. When entering the 40 KV (source) area, first open Door # 2.
3. Verify that the pneumatically operated grounding drop rod is making contact with the gas box.



Grounding Drop Rod

4. Touch and then attach the grounding rod to the gasbox assembly.
5. Open door #1 and attach the hand held grounding rod to the ground rod holder mounted on the gas cabinet.



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6. Position the high voltage probe as close to the gas cabinet as possible and attach the high voltage wire to the gasbox.
7. Ground the Probe to either the floor or to one of the grounding rods. DO NOT ground it to the 90 or 70 module!
8. Route the signal cable under a door opening to the high voltage probe meter. Ensure that you do not pinch the cable when closing the doors.

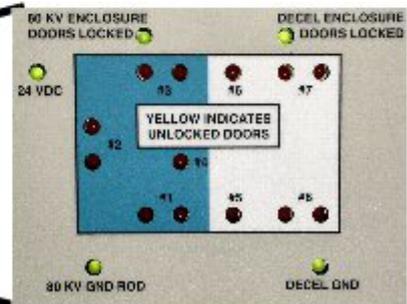


Note: Seal off the area around the high voltage meter and do not allow anyone to come in contact with the meter while the high voltage is on. Observe all applicable safety requirements, Dangers, Warnings, Cautions and Notes. Observe the two person work rule and use external ground sticks when entering the enclosure!

9. Remove the grounding rod from the gas cabinet and close door #1.
10. Go to door #2 and remove the hand held grounding rod attached to the gas cabinet.
11. Close door #2.
12. Verify that all of the high voltage enclosure doors are closed.



13. At the Enclosure Door/High Voltage interlock panel insert the manual grounding rods in to the key-slot and slide them downward to lock the corresponding doors.
14. Push the lock enclosure doors push button.
15. Verify on the panel that the doors are locked.
16. Energize HV on the machine.





Observe the two person work rule and use external grounding rods when entering the enclosure!

1. Go to the Maint./Universal screen. In the Right Function window open the Machine/Ion Beam Control/EnergySelect Section/Extraction Control/ Extraction PS folder. Select Extraction PS Range.
2. Expand the Extraction PS Range under the Name column.

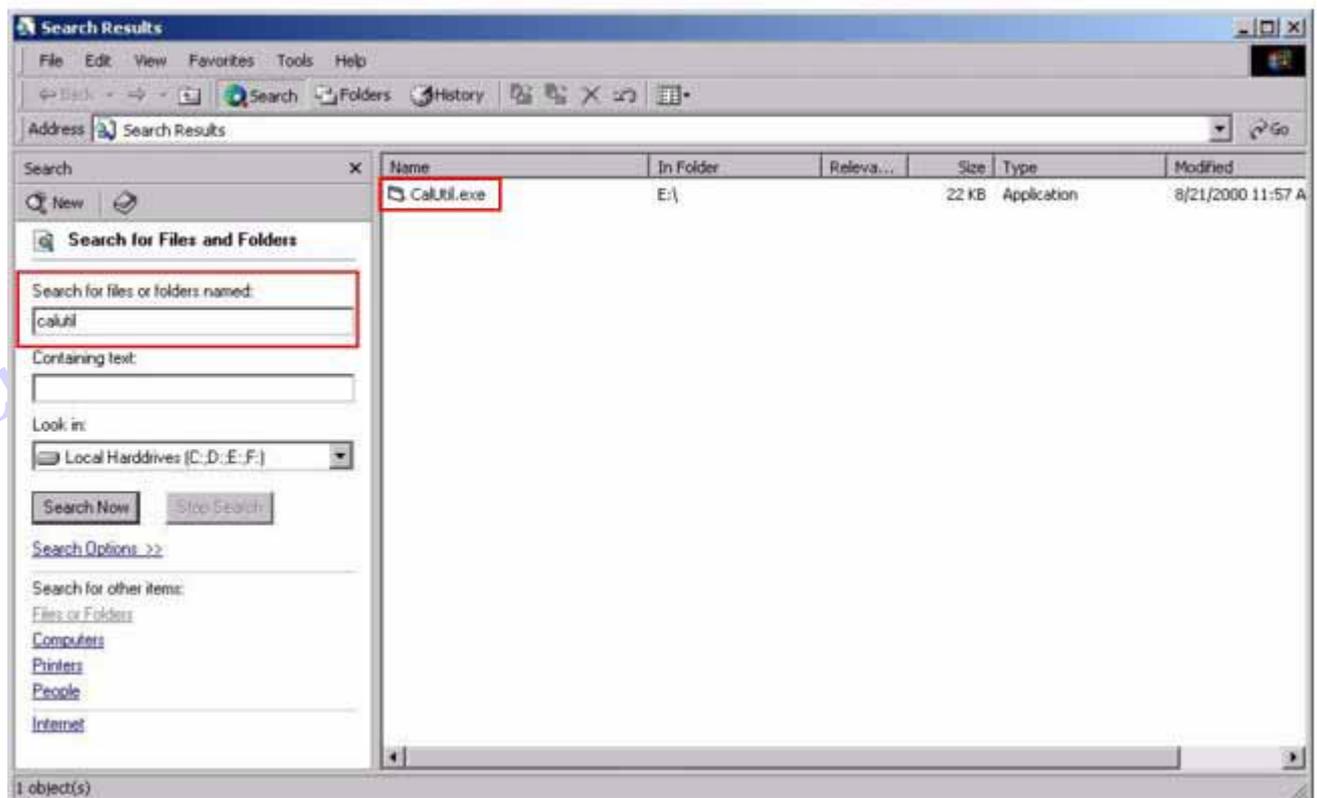
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Name Column

Name	Template Name	State	Obs. State	Group
Extraction PS Range		In 50V	50V	BeamControl
		VID	Value	Max Min
10kV Feedback Calibration*High	1000035000	00	2147483647	-2147483648
10kV Feedback Calibration*Low	1000034990	00	2147483647	-2147483648
10kV Feedback Calibration*Offset	1000035020	1.022800e-2	1.797693e8	-1.797693e8
10kV Feedback Calibration*Scaler	1000035010	7.700000e-5	1.797693e8	-1.797693e8
10kV Program Calibration*High	1000035200	5.00	3.40e38	-3.40e38
10kV Program Calibration*Low	1000035190	0.00	3.40e38	-3.40e38
10kV Program Calibration*Offset	1000035220	-4.757620e1	1.797693e8	-1.797693e8
10kV Program Calibration*Scaler	1000035210	1.248630e4	1.797693e8	-1.797693e8
10kV Program Feedback*High	1000035000	05	2147483647	-2147483648
10kV Program Feedback*Low	1000035070	00	2147483647	-2147483648
10kV Program Feedback*Offset	1000035100	0.000000	1.797693e8	-1.797693e8
10kV Program Feedback*Scaler	1000035090	0.000000e-5	1.797693e8	-1.797693e8
80kV Feedback Calibration*High	1000035040	00	2147483647	-2147483648
80kV Feedback Calibration*Low	1000035030	00	2147483647	-2147483648
80kV Feedback Calibration*Offset	1000035060	4.277860e-2	1.797693e8	-1.797693e8
80kV Feedback Calibration*Scaler	1000035050	1.236000e-3	1.797693e8	-1.797693e8
80kV Program Calibration*High	1000035160	9.00e1	3.40e38	-3.40e38
80kV Program Calibration*Low	1000035150	0.00	3.40e38	-3.40e38
80kV Program Calibration*Offset	1000035180	5.252898	1.797693e8	-1.797693e8
80kV Program Calibration*Scaler	1000035170	7.820454e2	1.797693e8	-1.797693e8
80kV Program Feedback*High	1000035120	100	2147483647	-2147483648
80kV Program Feedback*Low	1000035110	00	2147483647	-2147483648
80kV Program Feedback*Offset	1000035140	-2.120000e-3	1.797693e8	-1.797693e8
80kV Program Feedback*Scaler	1000035130	7.780000e-2	1.797693e8	-1.797693e8
ExtProgFails	1000034980	0.000	80.000	0.000
SystemTime	1000035230	22932926	-1	-1

3. At this point it would be a good idea to take a screen capture of the displayed data.
4. Make note of the following values:
 - o 10KV Feedback Calibration Offset
 - o 10KV Feedback Calibration Scaler
 - o 10KV Program Calibration Offset
 - o 10KV Program Calibration Scaler
 - o 40KV Feedback Calibration Offset

- 40KV Feedback Calibration Scaler
 - 40KV Program Calibration Offset
 - 40KV Program Calibration Scaler
5. Use the [CTRL+ESC] keys to bring up the Start Menu and select the Search Command.
 6. In the Search for files or folders named: box, type calutil.
 7. When the Search routine finds the CalUtil.exe program, double-click the file name to open the program.



Note: A window similar to the one below will open.

	Program	Feedback	Actual
Lo	<input type="text"/>	<input type="text"/>	<input type="text"/>
High	<input type="text"/>	<input type="text"/>	<input type="text"/>
Scalar	<input type="text"/>	<input type="text"/>	
Offset	<input type="text"/>	<input type="text"/>	

New Values

	Program	Feedback
Scalar	<input type="text"/>	<input type="text"/>
Offset	<input type="text"/>	<input type="text"/>

Note: This supply has two drivers that need calibration. One is the 0 to 5KV referenced in Universal as the "10KV" driver. The other is the 40KV driver. We will calibrate the LowRange driver first.



Extraction Low Driver Calibration

1. Take the 10KV Feedback Calibration Offset value and input it under Feedback Offset on the Calibration Utility screen.
2. Take the 10KV Feedback Calibration Scalar value and input it under Feedback Scalar on the Calibration Utility screen.
3. Take the 10KV Program Calibration Offset value and input it under Program Offset on the Calibration Utility screen.

4. Take the 10KV Program Calibration Scalar value and input it under Program Scalar on the Calibration Utility screen.
5. Under Lo Program input 0.25 as the value.
6. Under High Program input 4.5 as the value.
7. Select/verify that the machine is in manual mode.
8. From the Operation/Beam Tune Detail screen turn on the Source Suppression supply and set it to 5KV. Verify that the readback is correct. At this point verify that the enclosure HIGH VOLTAGE warning lights are lit.
9. Double Click the Extraction State icon.
10. Select Low Range.
11. Select On.
12. Set the Extraction Desired value to 0.25.
13. On the Calibration Utility screen input the Extraction "actual" value from the Beam Tune Detail screen into the Lo Feedback box.
14. On the Calibration Utility screen under Lo Actual input the Ross Probe meter value.
15. On the Operation/Beam Tune Detail screen set the Extraction value to 4.5.
16. On the Calibration Utility screen input the Extraction "actual" value from the Beam Tune Detail screen into the High Feedback box.
17. On the Calibration Utility screen under High Actual input the Ross Probe meter value.
18. On the Calibration Utility screen select the Calculate icon.

The screenshot shows a software window titled "Calibration Utility". It contains two main sections: a data entry table and a "New Values" section.

	Program	Feedback	Actual
Lo	0.25	0.25	0.25
High	4.5	4.33	4.48
Scalar	1.248690e4	7.700000e-5	
Offset	-6.757620e1	1.023800e-2	

Below the table is a "Calculate" button. Underneath is a section titled "New Values" with the following data:

	Program	Feedback
Scalar	12545.939716	0.000080
Offset	-82.336129	0.000897

Note: Under "New Values" there are 4 new values.

19. Take these values and input them into the Maintenance/Universal screen in their associated places.

Note: Ensure that the values are correctly input into the correct boxes. Putting a value in the wrong box can be detrimental to machine performance.

20. Set the Extraction P.S. to 0.25KV and verify the actual value on the Operations/Beam Tuning Detail reads 0.25 +/- the tolerance.
21. Set the Extraction P.S. to 4.5KV and verify the actual value on the Operations/Beam Tuning Detail reads 4.5 +/- the tolerance.
22. If steps 20 and 21 are good, clear all data from the calibration utility program and proceed to the Extraction High Driver Calibration.
23. If steps 20 and 21 are not good, repeat steps 12 through 21 until the calibration is within the tolerance.



Extraction High Driver Calibration

1. Take the 40KV Feedback Calibration Offset value and input it under Feedback Offset on the Calibration Utility screen.
2. Take the 40KV Feedback Calibration Scalar value and input it under Feedback Scalar on the Calibration Utility screen.
3. Take the 40KV Program Calibration Offset value and input it under Program Offset on the Calibration Utility screen.
4. Take the 40KV Program Calibration Scalar value and input it under Program Scalar on the Calibration Utility screen.
5. Under Lo Program input 10 as the value.
6. Under High Program input 36 as the value.

7. Select/verify that the machine is in manual mode.
8. From the Operation/Beam Tune Detail screen turn on the Source Suppression supply and set it to 5KV. Verify that the read back is correct. At this point verify that the enclosure HIGH VOLTAGE warning lights are lit.
9. Double Click the Extraction State icon.
10. Select High Range.
11. Select On.
12. Set the Extraction Desired value to 10.
13. On the Calibration Utility screen input the Extraction "actual" value from the Operation/Beam Tune Detail screen into the Lo Feedback box.
14. On the Calibration Utility screen under Lo Actual input the Ross Probe meter value.
15. On the Beam Tune Detail screen set the Extraction value to 36.
16. On the Calibration Utility screen input the Extraction "actual" value from the Operation/Beam Tune Detail screen into the High Feedback box.
17. On the Calibration Utility screen under High Actual input the Ross Probe meter value.
18. On the Calibration Utility screen select the Calculate icon.

Note: Under "New Values" there are 4 new values.

19. Take these values and input them in the Maintenance/Universal screen in their associated places.

Note: Ensure that the values are correctly input into the correct boxes. Putting a value in the wrong box can be detrimental to machine performance. This procedure usually needs to be repeated at least once.

20. Set the Extraction P.S. to 10 and verify the actual value on the Operations/Beam Tuning Detail reads 10KV +/- the tolerance.
21. Set the Extraction P.S. to 36 and verify the actual value on the Operations/Beam Tuning Detail reads 36KV +/- the tolerance.
22. If steps 20 and 21 are good, proceed to step 24.
23. If steps 20 and 21 are not good, repeat steps 12 through 21 until the calibration is within the tolerance.

24. Shut down all High Voltage supplies. Open the enclosure and hang the grounding rod on the Gas Box. Disconnect the High Voltage probe from the Gas Box and put the probe away.

This completes the Extraction power supply calibration.



Source Suppression Voltage Power Supply

Calibration

Calibration

Connect The High Voltage Probe



Note: Observe all applicable safety requirements, Dangers, Warnings, Cautions and Notes.





Shut Down the Beam

1. Ensure that the implanter is shutdown.
2. If a beam is running, perform a Beam Shutdown.

To shutdown the beam, perform the following:

- A. Select **Jobs** from the navigation bar.
- B. Select **System Startup** from the navigation tabs.
- C. Click the **Commands** tab in the upper right function window.
- D. Click **SHUTDOWN BEAM**.

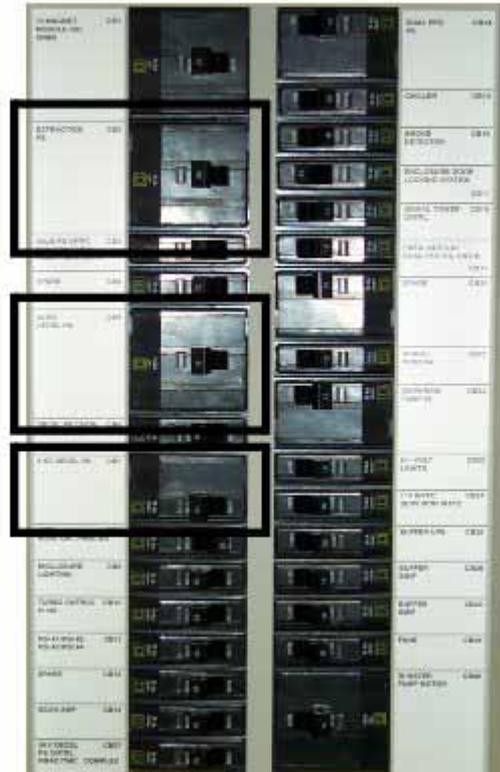
Note: Refer to the VCS Made Easy manual [E82009010] and your machine's VCS Help screen functions for additional information on using the VCS control system.

3. Open the main power distribution panel door, and lockout/tagout circuit breaker two (CB2) for the extraction power supply.

CB 2

CB 5

CB 7



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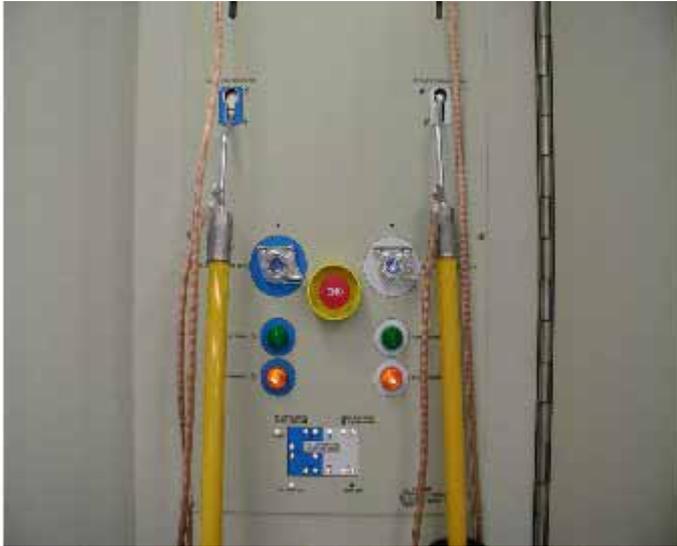


Unlocking the Enclosure Doors

Electrical Hazard

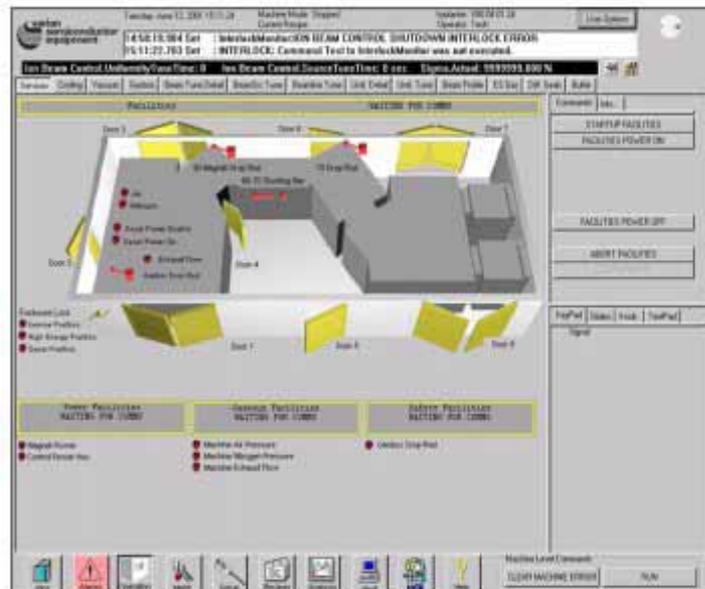


1. Locate the Enclosure Door/High Voltage interlock panel.



Note: Each grounding rod fits into a color coded receptacle. The left side is color coded blue and corresponds to the 40 KV enclosure doors 1, 2, 3, and 4. The right side is color coded white and corresponds to the Decel enclosure doors 5, 6, 7, and 8.

2. Locate the two manual grounding rods above the Enclosure Door/High Voltage interlock panel.
3. Select the appropriate grounding rod and slide it upward to unlock the corresponding doors.
4. At this time the doors can be opened and the Operation/Services screen indicates door status.



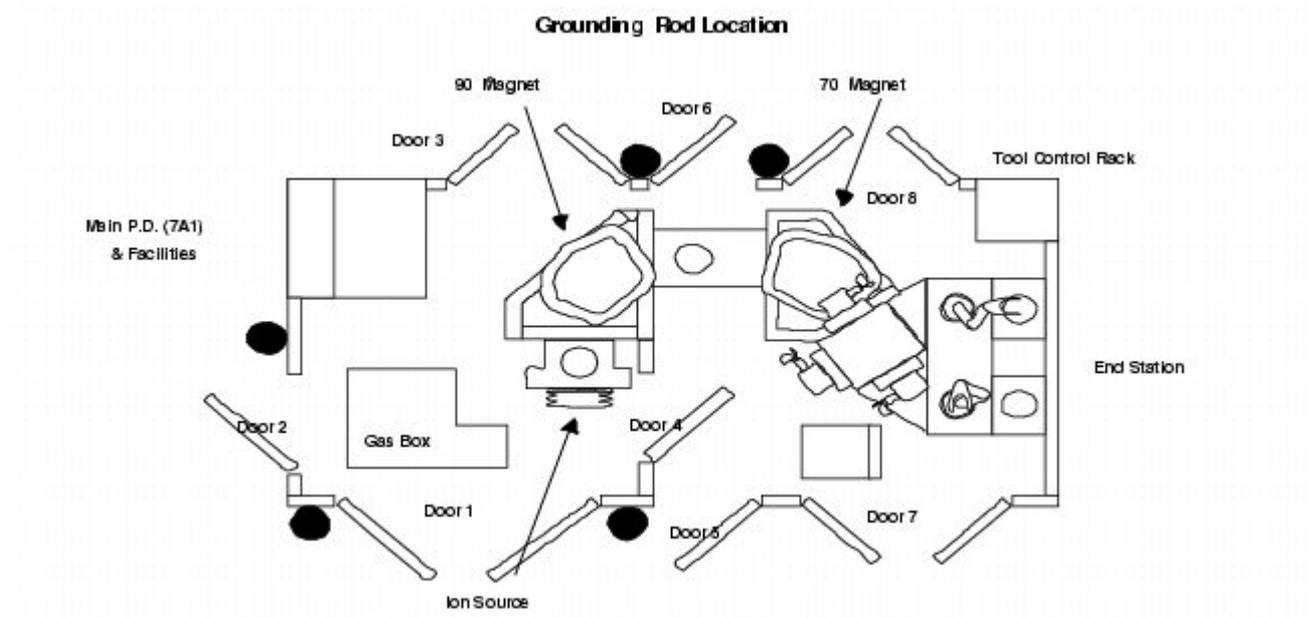


Enter the High Voltage Enclosure

Electrical Hazard



1. Use the following diagram for door and grounding rod location.

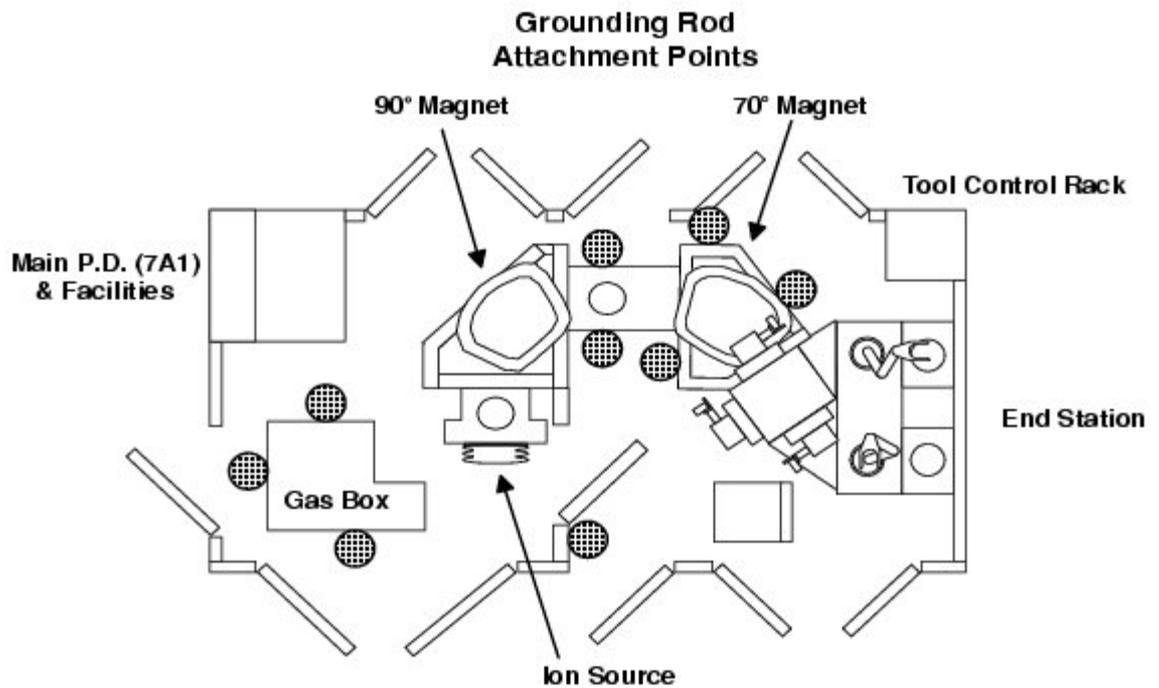


2. When entering the 40 KV (source) area, first open Door # 2.
3. Verify that the pneumatically operated grounding drop rod is making contact with the gas box.



Drop Rod

4. Touch, and then attach the grounding rod to the gasbox assembly.
5. Use the following diagram for grounding rod attachment points.

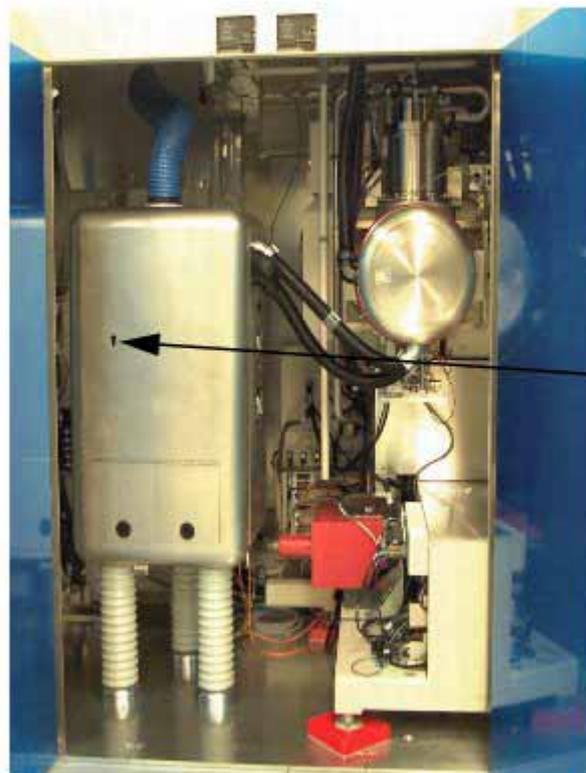


6. Open door #3, and attach the hand held grounding rod to the ground rod holder mounted on the 90 degree magnet frame.

7. Open the 90 degree magnet power distribution panel door, and lockout/tagout CB3 for the Source suppression power supply.



8. Open door #1, and use the hand held grounding rod to apply ground to the suppression voltage input on the source manipulator drive assembly suppression voltage feedthrus.
9. Attach the hand held grounding rod to the ground rod holder mounted on the gas cabinet.



Ground Rod Holder

10. Attach the high voltage probe to the suppression voltage input on the source manipulator drive assembly.
11. Remove the hand held grounding rod attached to the gas cabinet.
12. Close door #1.
13. Remove the hand held grounding rod attached to the gas cabinet at door #2.
14. Close door #2.
15. Go to the 90 degree power distribution panel at door #3, and remove the lockout/tagout of CB3 for the source suppression power supply.
16. Close the 90 degree power distribution panel door.
17. Remove the hand held grounding rod attached to the 90 degree magnet frame.
18. Close door #3.
19. Close the high voltage enclosure doors.
20. At the Enclosure Door/High Voltage interlock panel insert the manual grounding rods in to the key-slot and slide it downward to lock the high voltage doors.
21. Push the lock enclosure doors push button.
22. Verify on the panel that the doors are locked.



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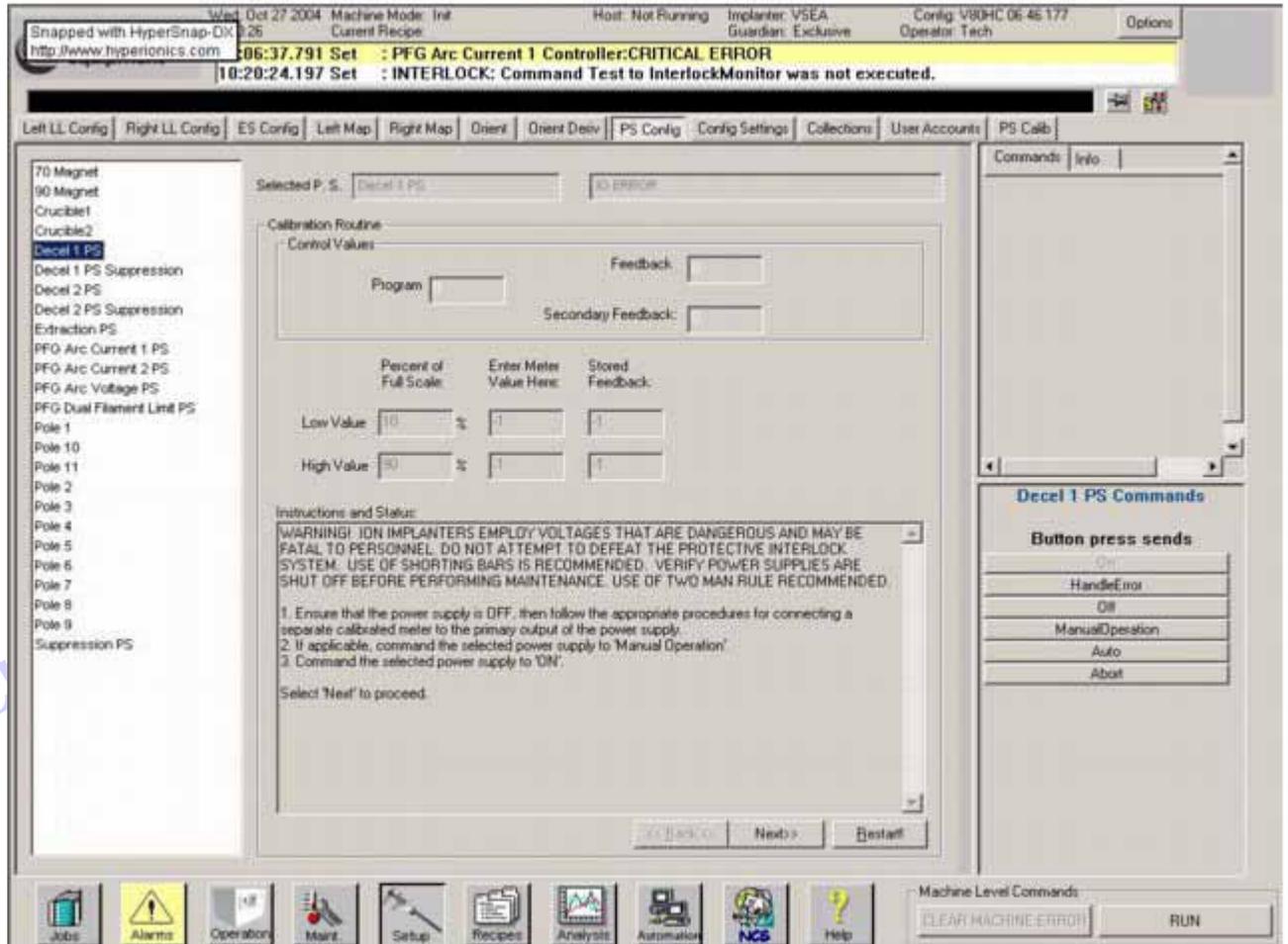


23. Go to the main power distribution panel, and remove the lockout/tagout of CB2 for the extraction power supply.
24. Close the main power distribution panel door.
25. Select [Startup] in the [Jobs] Startup/Shutdown function window.



Automatic Calibration

1. Select [Setup] in the navigation bar window. Select [PS Config] in the navigation tabs window.



2. Select [Suppression PS] in the Left Function window.
3. Follow the instructions in the Instructions Status window.



Remove The High Voltage Probe



1. Select [Shutdown] in the [Jobs] Startup/Shutdown function window.
2. Open the main power distribution panel door, and lockout/tagout CB2 for the extraction power supply.
3. Locate the Enclosure Door/High Voltage interlock panel.

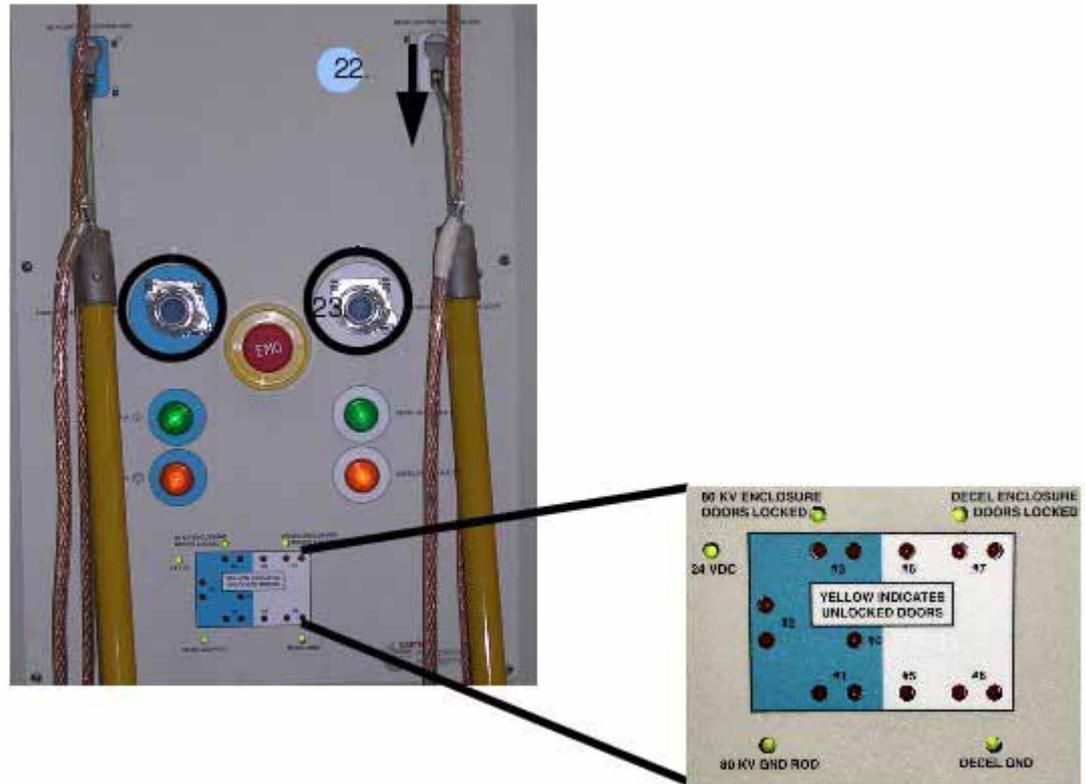


Note: Each grounding rod fits into a color coded receptacle. The left side is color coded blue and corresponds to the 40 KV enclosure doors 1, 2, 3, and 4. The right side is color coded white and corresponds to the Decel enclosure doors 5, 6, 7, and 8.

4. Locate the two manual grounding rods above the Enclosure Door/High Voltage interlock panel.
5. Select the appropriate grounding rod and slide it upward to unlock the corresponding doors.
6. At this time the doors can be opened and the Operation/Services screen indicates door status.
7. Open door #3, and attach the hand held grounding rod to the 90 degree magnet frame.
8. Open the 90 degree magnet power distribution panel door, and lockout/tagout CB3 for the source suppression power supply.
9. Open door #2, and attach the hand held grounding rod to the gas cabinet.

10. Open door #1, and use the hand held grounding rod to apply ground to the high voltage probe and the suppression voltage input on the source manipulator drive assembly suppression voltage feedthrus.
11. Attach the hand held grounding rod to the gas cabinet.
12. Remove the high voltage probe from the suppression voltage input to the source manipulator drive assembly suppression voltage feedthrus.
13. Remove the hand held grounding rod attached to the gas cabinet.
14. Close door #1
15. Remove the hand held grounding rod attached to the gas cabinet at door #2.
16. Close door #2.
17. Go to the 90 degree magnet power distribution panel at door #3, and remove the lockout/tagout of CB3 for the source suppression power supply.
18. Close the 90 degree magnet power distribution panel door.
19. Remove the hand held grounding rod attached to the 90 degree magnet frame.
20. Close door #3.
21. Close the high voltage enclosure doors.
22. At the Enclosure Door/High Voltage interlock panel insert the manual grounding rods in to the key-slot and slide it downward to lock the high voltage doors.
23. Push the lock enclosure doors push button.

24. Verify on the panel that the doors are locked.



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- 25. Go to the main power distribution panel, and remove the lockout/tagout of CB2 for the extraction power supply.
- 26. Close the main power distribution panel door.
- 27. Select [Startup] in the [Jobs] Startup/Shutdown function window.

This completes the Source Suppression power supply calibration.

