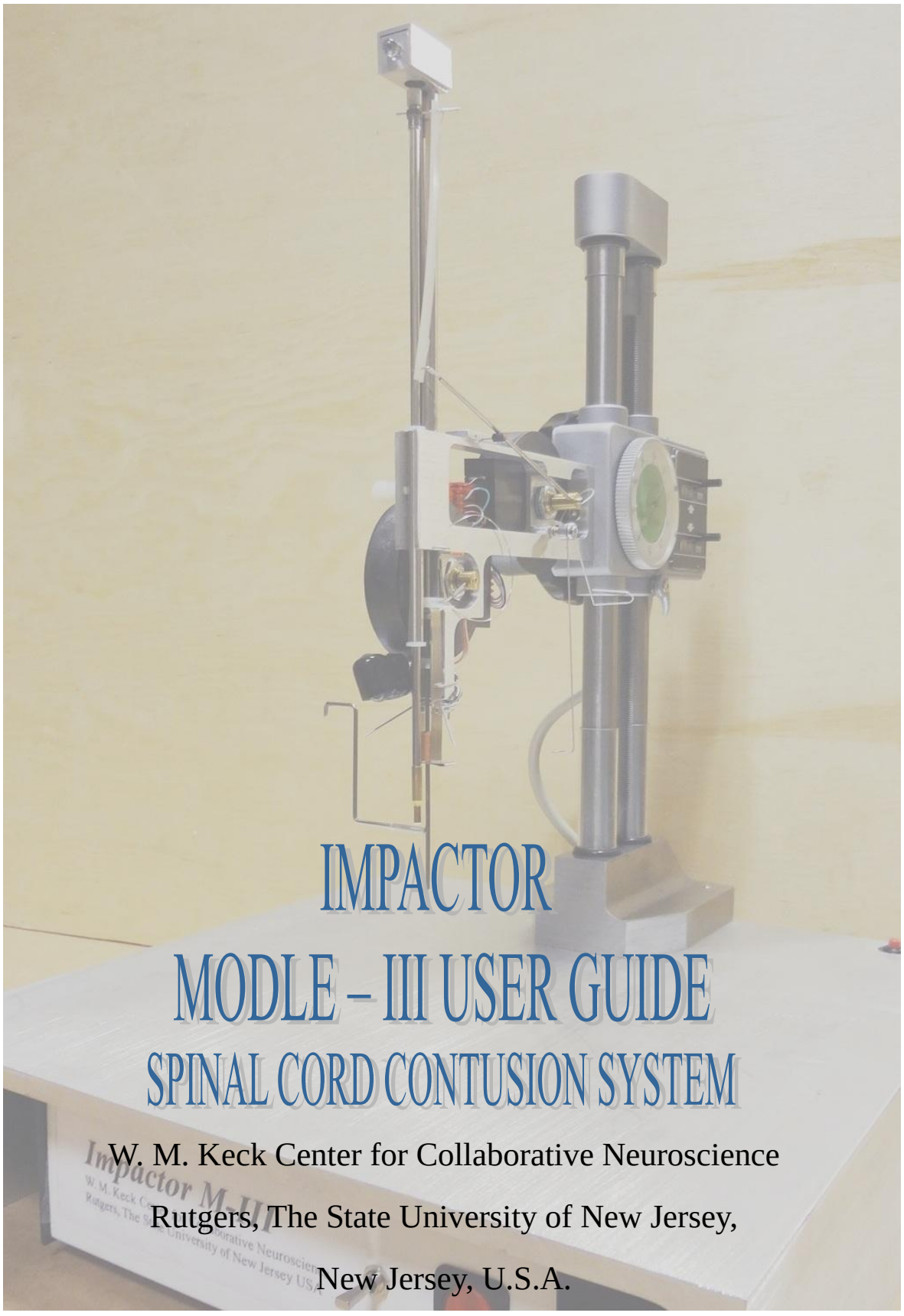


IMPACTOR

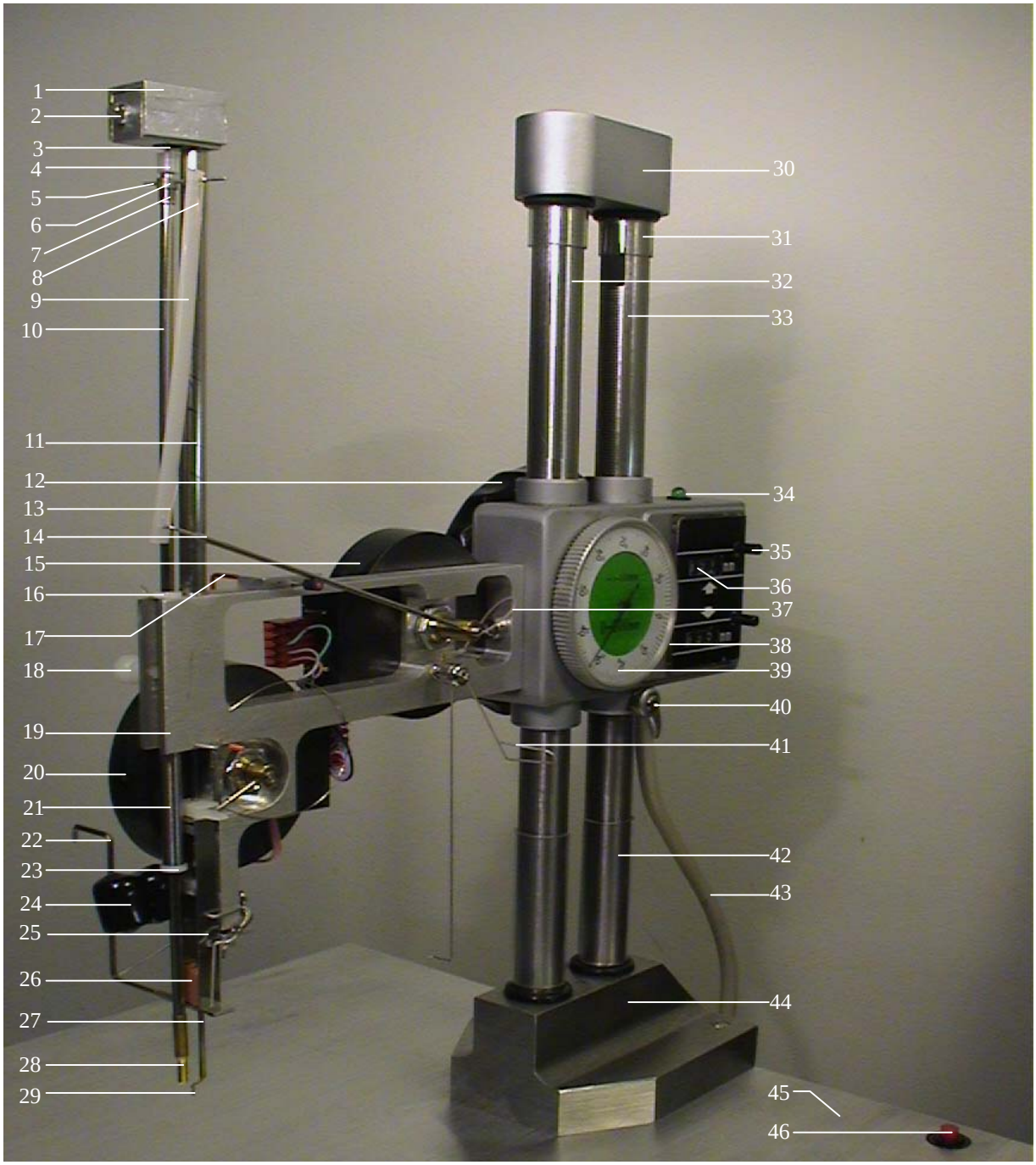
MODLE – III USER GUIDE

SPINAL CORD CONTUSION SYSTEM

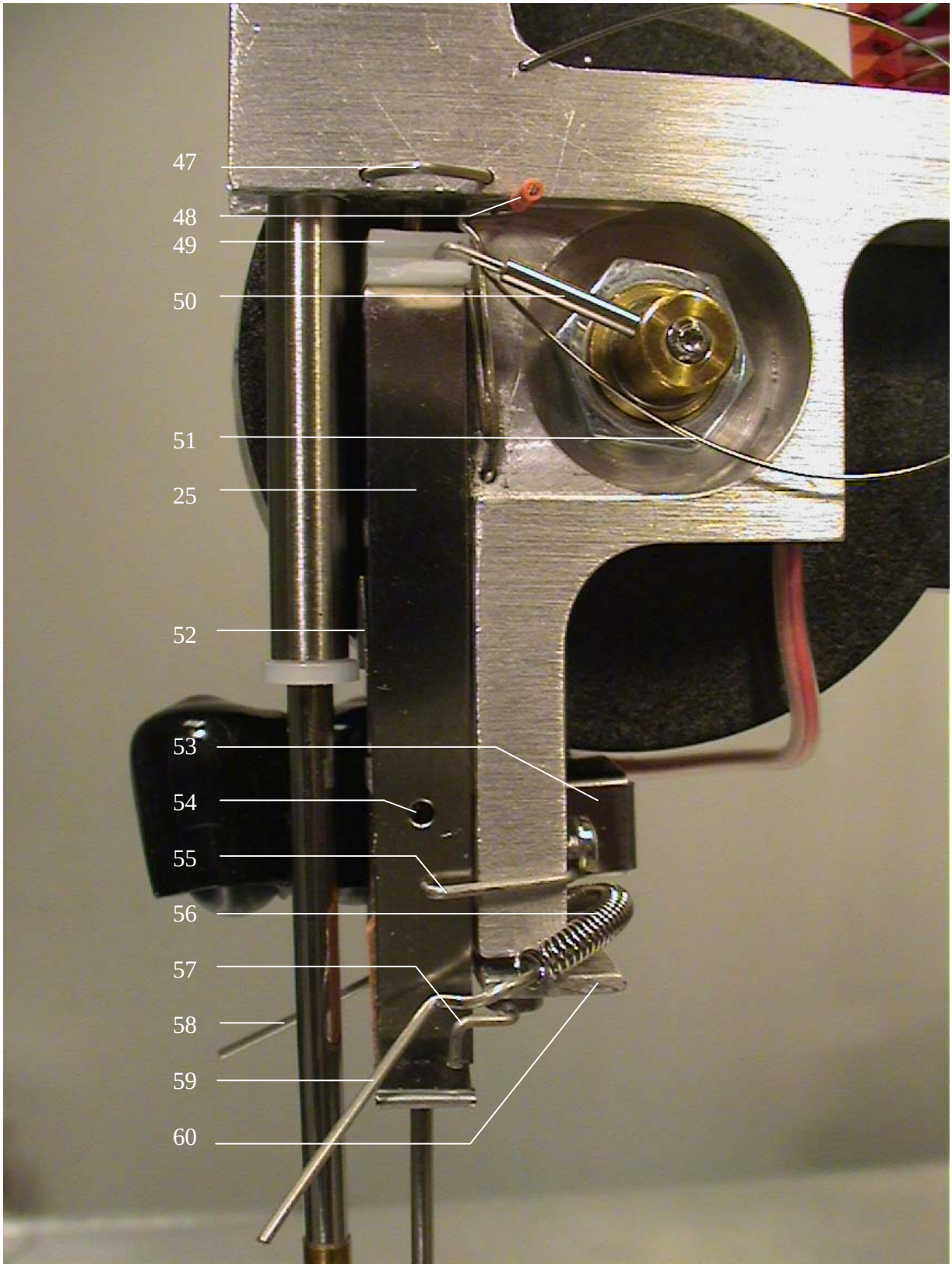
W. M. Keck Center for Collaborative Neuroscience

Rutgers, The State University of New Jersey,

New Jersey, U.S.A.



1. Electromagnet Housing
2. Impact Contact LED
3. Impactor Rod Attach Pin
4. Impactor Rod Nylon Cap
5. Connecting Rod Upper Pin
6. Upper Pin Lock Ring
7. Lock Ring Spring
8. Signal Wire Top End
9. Connecting Rod
10. Impactor Rod
11. Frame Standing Tube
12. Meter Manual Wheel
13. Signal Wire Mid-End
14. Impactor Rod Encoder Arm
15. Impactor Rod Encoder
16. I. Rod Guide Tube Up. Bearing
17. Drop Safety Key
18. Nylon Thumb Screw
19. Main Frame
20. Vertebral Rod Encoder
21. Impactor Rod Guide Tube
22. Vertebral Rod “Z” Bar
23. I. Rod G. Tube L. Bearing
24. Impact Point LED
25. Vertebral Rod Controller
26. V. Rod Controller Break
27. Vertebral Rod
28. Impactor Rod Head
29. Vertebral Rod Tip
30. Double Column Cap
31. Upper Plastic Stopper
32. Front Standing Column
33. Rear Standing Column
34. Impactor Power LED
35. Reading # Release Button
36. Meter Reading Number
37. Signal Wire Rear End
38. Dial Meter Adjust. Ring
39. Dial Meter Scale Plate
40. Height Gauge Meter Stopper
41. Impactor Rod Raiser
42. Column Lower Stop Plastic
43. Impactor Main Cable
44. Height Gauge Base
45. Impactor Base
46. Impact Dropping Button



47. Controller Top Holder
48. “V” Holder
49. Controller Groove Piece
50. V Rod Encoder Arm
51. Controller Spring
25.Vertebral Rod Controller
52.Controller “U” Stopper
53. Led Jack Supporter
54.Controller Mid-Hole
55. Controller Mid-Hole Pin
56. “V” Clip Spring
57.Controller Release Pin
58. “V” Clip Left Bar
59. “V” Clip Right Bar
60. Bottom Piece

Contents

I ASSEMBLY

WARNING

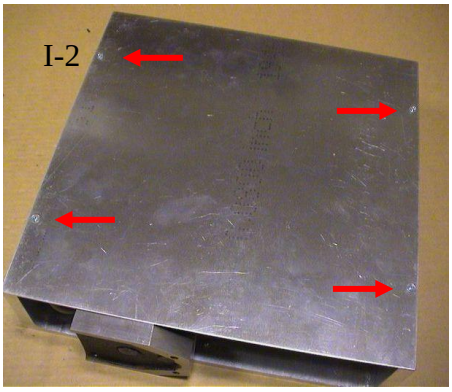
BE VERY CAREFULBE TO REMOVE ALL HOLDERS!

PROTECT THE ULTRA FINE SIGNAL WIRE AND THE CONNECTING ROD!

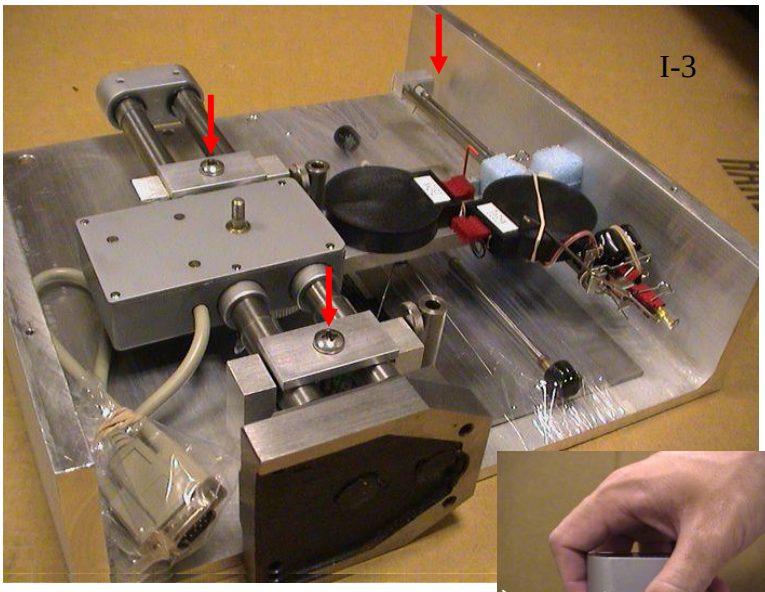
PLEASE CUT THE BOUND RUBBER BANDS GENTLY WITH SCISSORS WHILE PROTECTING THE LED WIRE!

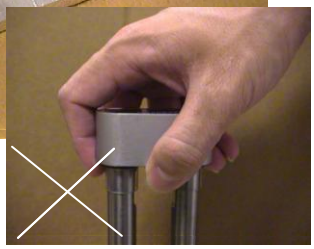
1. Unpack the impactor and the accessory box.

I-1

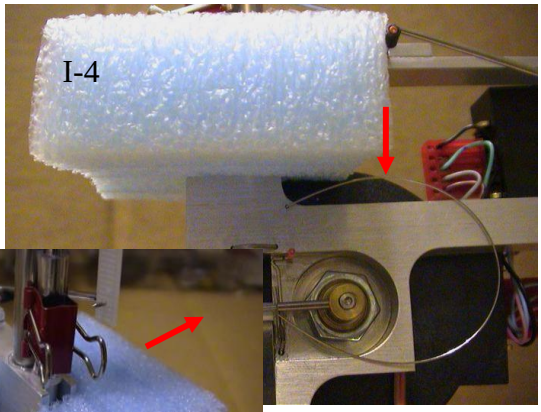


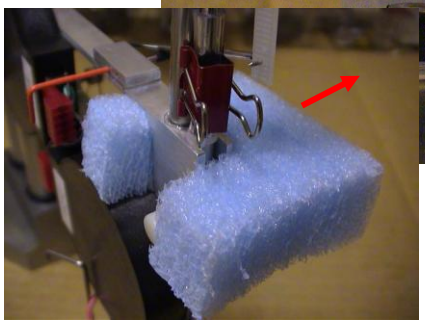
2. Loosen the 4 screws and remove the protective cover.



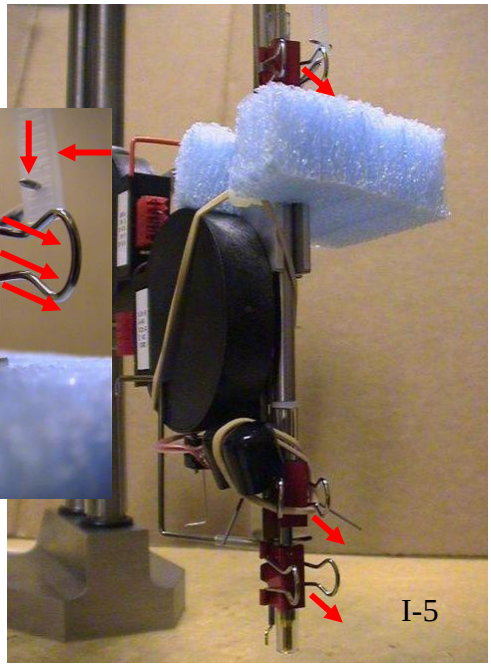


3. Loosen the screws that secure the 2 shipping pieces and remove the Impactor main body carefully holding both ends to avoid damage to the Contact LED.

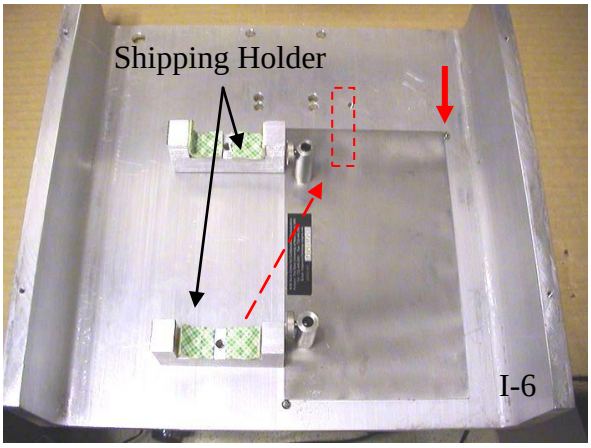




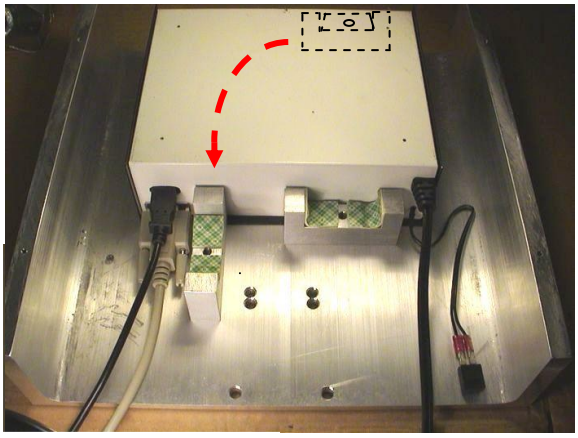
4. Remove the support foam and avoid touching the “O” spring.

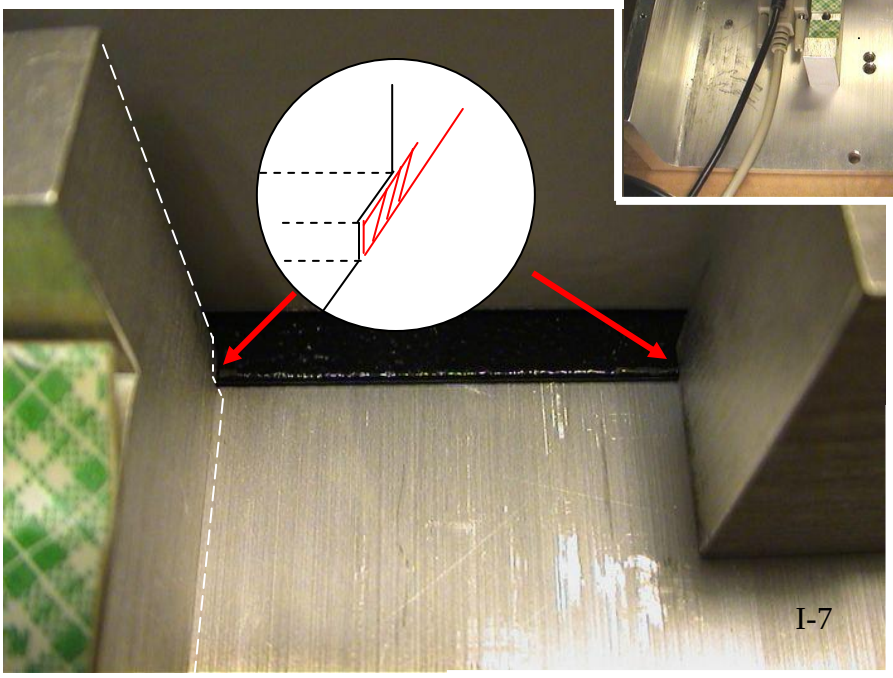


5. Remove the binder clips and the plastic covers around the Impactor Rod. Do not touch the Connecting Rod or the Upper Pin! Cut-off the Rubber Bands.



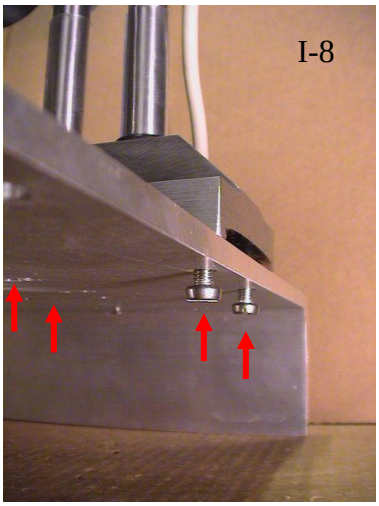
6. Loosen the shipping screw and remove away the Clamping System Base.

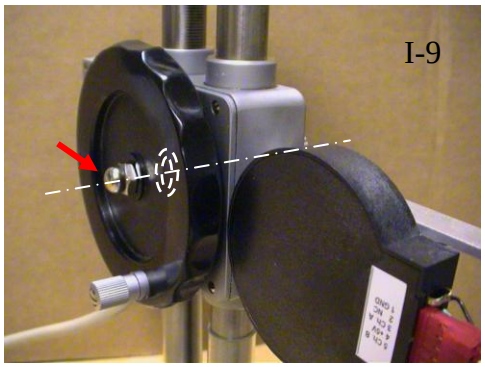




7. Move the front shipping holder to rear area, positioning it perpendicular to the other shipping holder. Press the rear edge of the white-black box (WBB) under the holder following the location mark, then tighten the screw with the attached hex key. Next, lock the front edge of WBB with the screw.

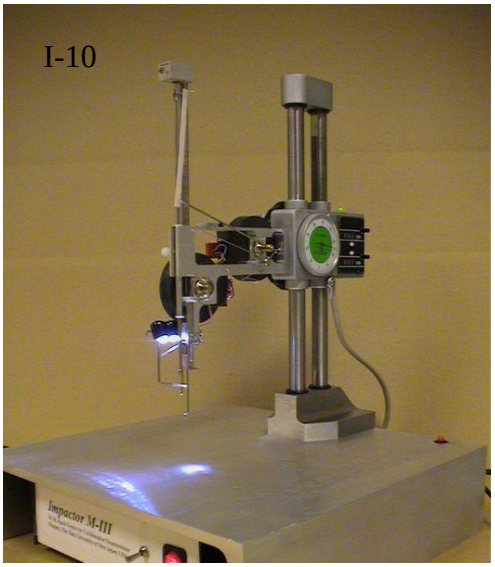
8. Attach the Impactor main body to the Impactor Base with 4 screws.


I-8


I-9

9. Put the washer between the meter housing and the Manual Wheel and tighten the acorn nut.

10. Connect the Main Cable, the USB cable and the Base Drop Button wires for the WBB.

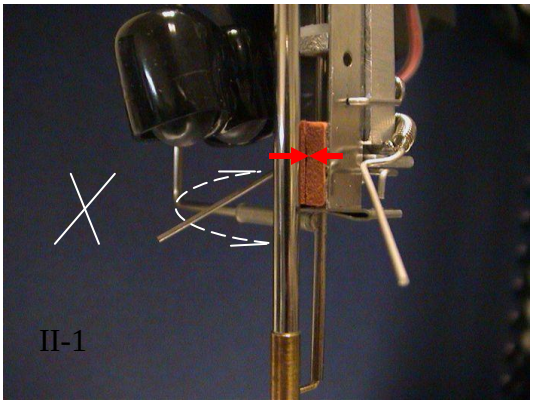

I-10

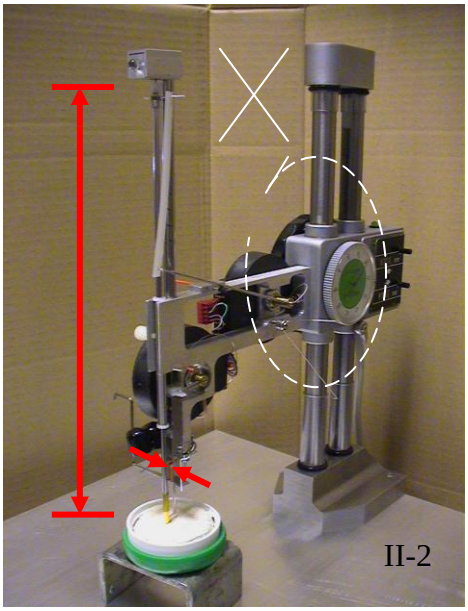
CAUTION

1. It needs to have an insulator between the impactor and the surface of the lab bench if the surface material of the bench is metal (stainless steel, aluminum, brass galvanized iron etc.), or, it will cause the short circuit to damage the device.
2. The device base should be placed on the flat support surface without any gaps between the surface and the base to avoid the vibration possibility during the dropping test.
3. Waiting 1 minute to turn on the power after the power off each time.

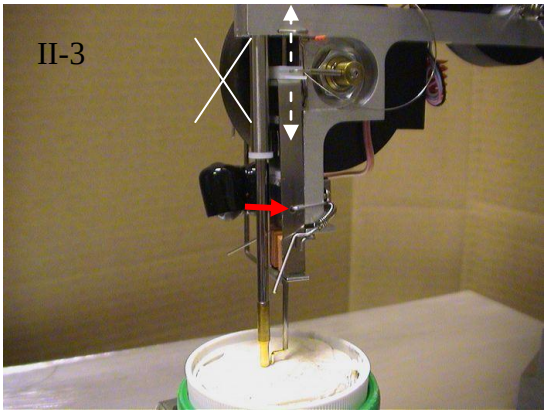
II DEVICE PROTECTION

1. Do not adjust the angle with the “Z” Bar (Vertebral Rod) while the Controller Brakes are closed.

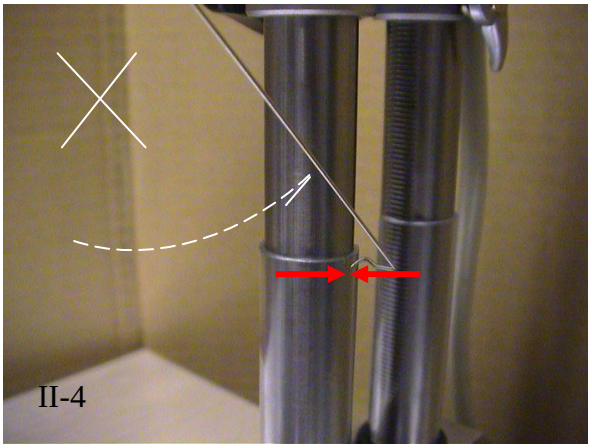




2. Do not move the Main Frame down when the Controller Brakes are closed or when the Impactor Rod touches both the Electromagnet (upper end) and the impact object (lower end).

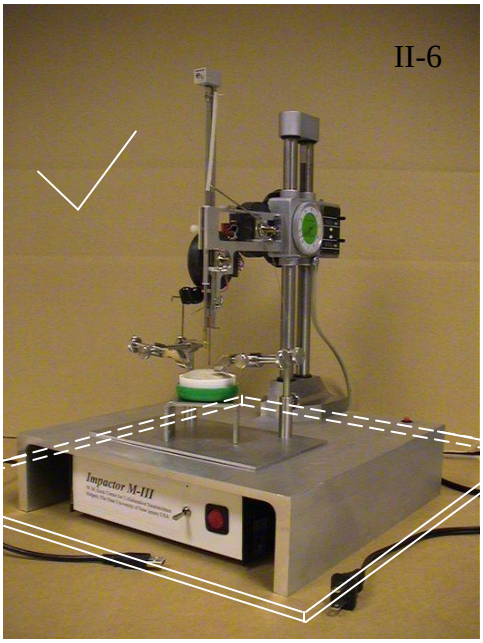


3. Do not move the “Z” Bar and/or the Controller up or down when the breaks open and it is held by the Mid-Hole Pin.



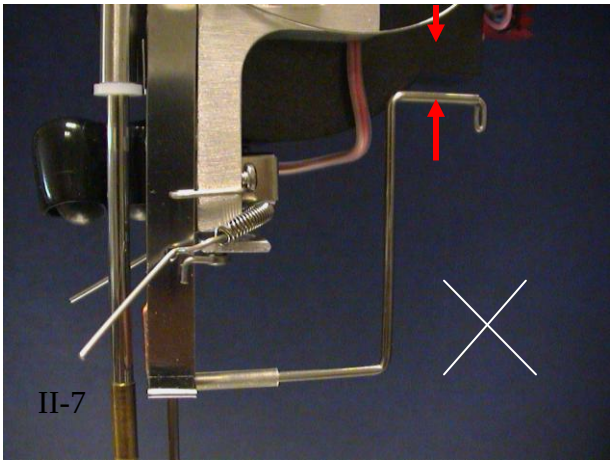
4. Do not make the Impactor Rod Raiser contact the Height Gauge Standing Column.

5. Turn -off the Impactor power when finished for the day.



6. If used on a metal desk, the Impactor should be placed on insulation to avoid a short circuit..

7. The "Z" bar should not be positioned under the Main Frame.



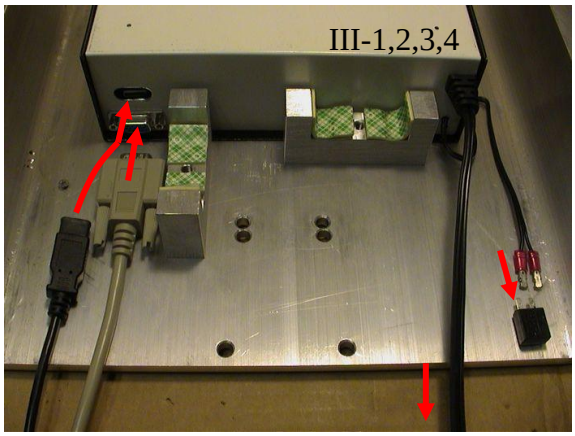
8. Close the other program(s) while the Impactor Program is running to avoid software conflict.

III DEVICE CONNECTION

1. Impactor USB Connector connects with the computer. (PC or lap top)

2. Main Unit 15 Pin Male Connector connects with White-Black Box 15 Pin Female D-sub Connector.

3. White-Black Box 2 Female Terminals connect with the Base Drop Button.



4. Impactor Power Plug connects with the electrical power source. (110V AC or 220V AC)

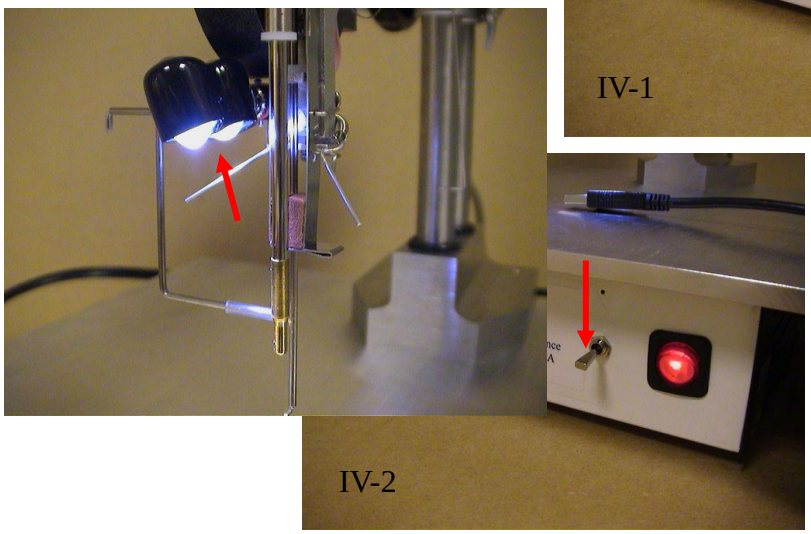
IV WORKING CONDITION AND TESTS

1. Turn on the Rocker Power Switch.

The switch and the Impactor Power

LED should light.

IV-1

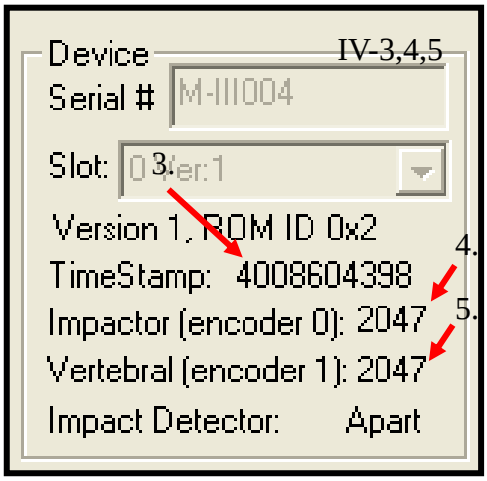

IV-2

2. Depress the Toggle Switch. The Impact Point LED should light.

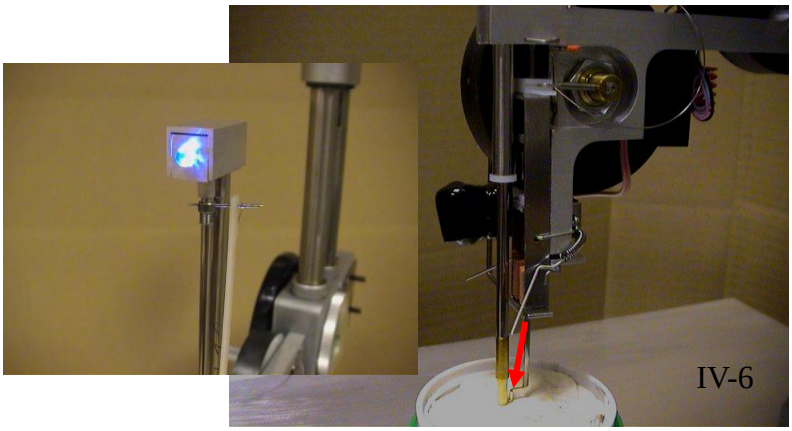
3. When running the Impactor Program, the time stamp value should continuously increase.

4. When moving the Impactor Rod up and down, the Impactor Rod Encoder Reading Number should increase and decrease.

5. When moving the "Z" Bar (Vertebral Rod) up and down, the Vertebral Rod Encoder Reading Number should increase and decrease.

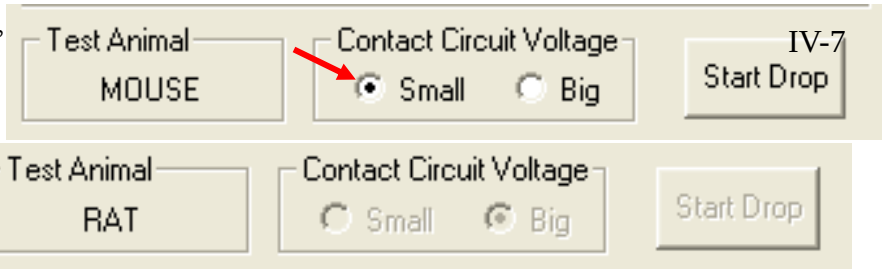


IV-3,4,5

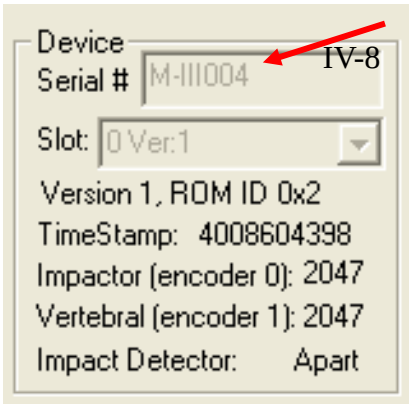

IV-6

6. If both Impactor Rod Head and Vertebral Rod Tip contact the same object covers with saline, it should cause a "beep" and a LED light.

7. For the mouse test, click “Small” to set a lower Contact Voltage. (The LED contact light should be red.) For the rat test, click “Big” to set a higher Contact Voltage. (The LED contact light should be blue.)



IV-7



IV-8

8. A serial number needs to be shown in the window to verify the effective coefficients after the Impactor manufacturing specific adjustment and calibration. (It cannot be used for the animal experiment without the qualified serial number.)

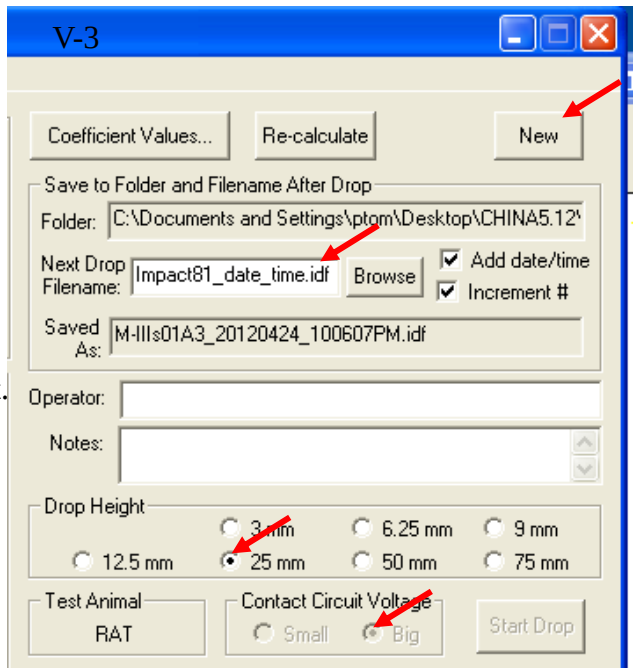
V OPERATION PROCEDURE

The following operations should be performed gently, taking care with all moving parts!

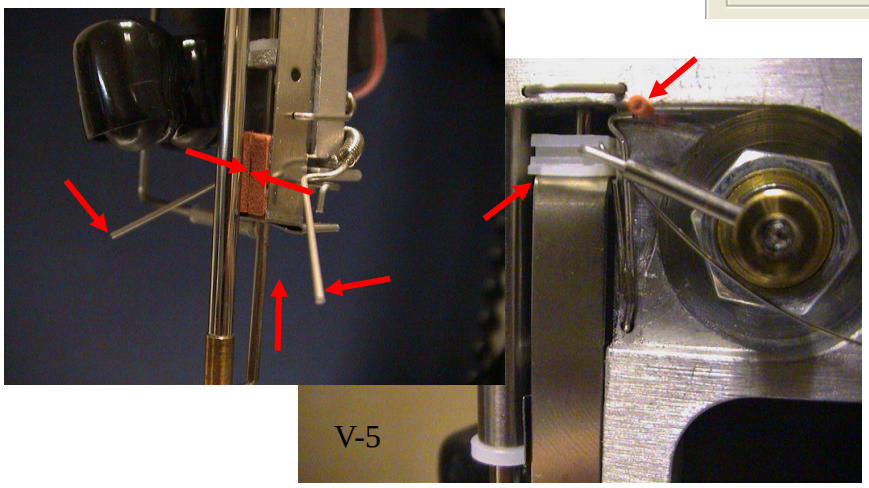
1. Turn the power on for the Impactor and the computer.

2. Open the program “Impactor”. (If you turn-off the Impactor, you need to close the program. Turn on the Impactor first, then open the program again.)

3. Set the experiment file: Click icon “New”, then, enter the file name in “Next Drop File Name”. Select the Contact Circuit Voltage and chose the Drop Height.

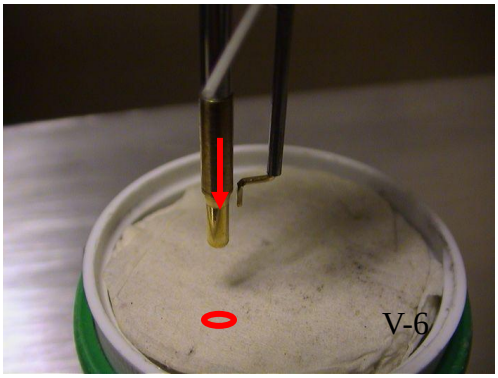


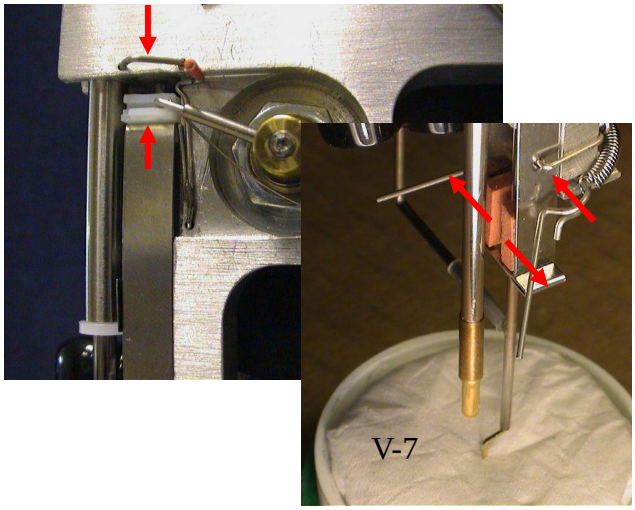
4. Lift up the impactor rod: Move it up with the Raiser (41) to attach to the electromagnet (above the Impactor Rod).Then, lock the safety key (17).



5. Hold up the Vertebral Rod: Hold the “Z” bar (22) of the Vertebral Rod with left hand, lift the Controller Groove Piece (49) with right hand to the top until the Breaks (26) releasing. Then, move down the Controller down until it is stopped by Mid-Hole Pin. Raise the “Z” Bar to the upper end, lock the Controller Breaks with “V” clip (58-59). Clip the Left Bar first (58), then the Right Bar (59). Lift up the Controller again with thumb and close the “V” Holder (48) by the forefinger lightly holding the Controller.*

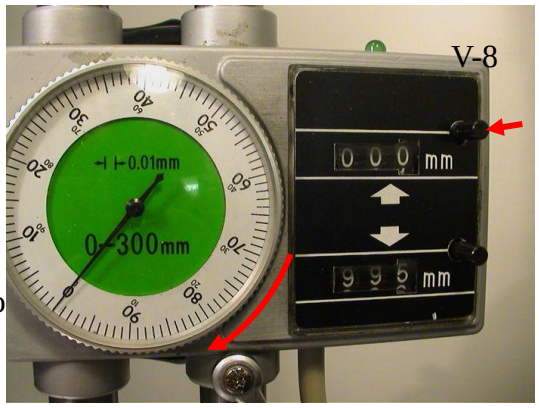
6. Set the impact point: Move the Main Frame down with the Height Gauge Manual Wheel (12), to aim the dropping point with the Impactor Rod Head (28). Adjust the animal location by moving the Clamping System Base.


V-6


V-7

7. Release the Vertebral Rod: Raise up the Controller (25) with the Groove Piece (49) to the top until the brakes releasing, (hold the "Z" Bar with the other hand at the same time.) Move it down until it is stopped by the Mid-Hole Pin (55), and then move the "Z" Bar down to the impacting object.

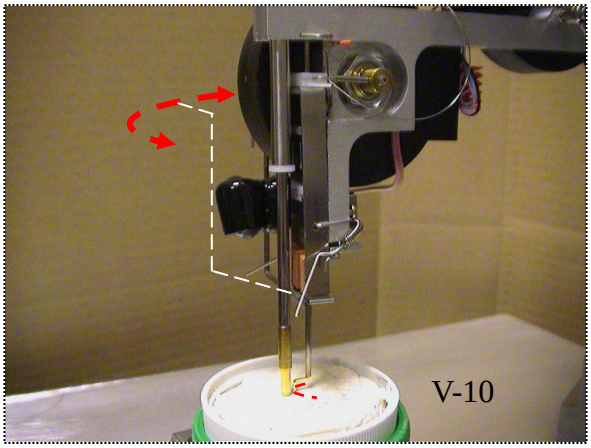
8. Set zero: Raise up the Impactor Rod to attaches the electromagnet. Move the Main Frame down slowly with the Manual Wheel (12) to make the Impactor Rod Head (28) just touch the object and cause a light-beep. Then, set the Meter Reading Number (36) to zero with pressing Reading Number Release Button (35) and set the dial meter to zero by turning the Dial Meter Adjustment Ring (38).



V-8

9. Set drop height: Move the Main Frame up to the drop height level.

10. Set vertebral rod: Adjust the Vertebral Rod Tip on a proper detected point [with "Z" Bar (22)] and lift the Controller up to the upper edge of the Mid-Hole (54) then lock the Controller Breaks by “V” clip bar (58-59). Clip left Bar firs (58), then the Right Bar (59).]


V-10

11. Unlock the Drop Safety Key (17).

12. Start Drop: Click the icon “Start Drop” on screen.

13. Drop: Press the Impact Dropping Button (46) on the Base.

14. Lift up the Impactor Rod. (As item 4)

15. Move up the Main Frame and remove the object (animal).

16. Hold up the Vertebral Rod. (As item 5)

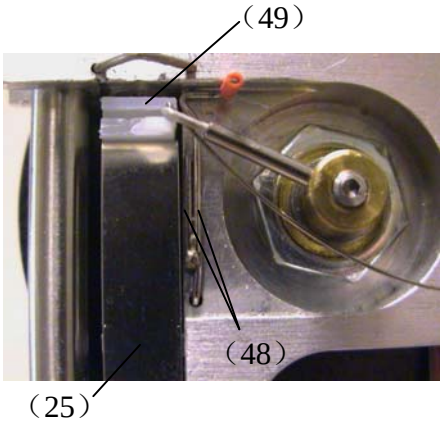
17. Clean the Impactor Rod Head and the Vertebral Rod Tip with clear water for the next test.

Turn off the power when finished.

* About the “V” Holder holding details, please see next page.

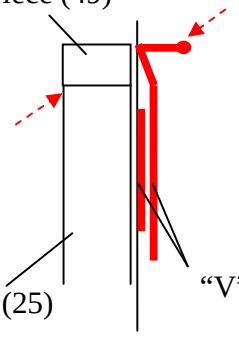
“V” HOLDER HOLDING DETAILS
How it works and how to make it working?

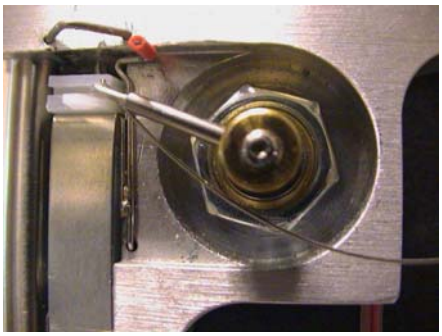
Note: The operation needs only a gentle squeeze. The strong force will damage the parts.



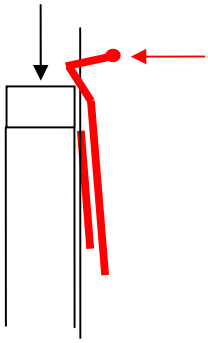
Controller Groove Piece (49)

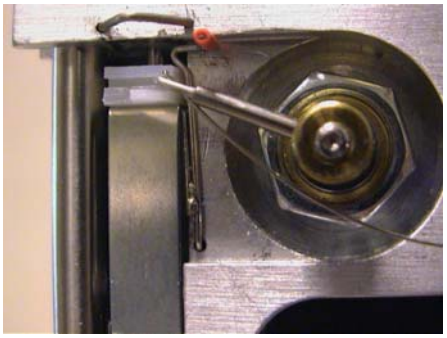
1. Move the Controller Groove Piece to the top level with the thumb gently and do not release the breaks, press and keep the “V” Holder touching the Controller with the forefinger lightly.



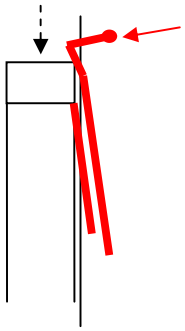


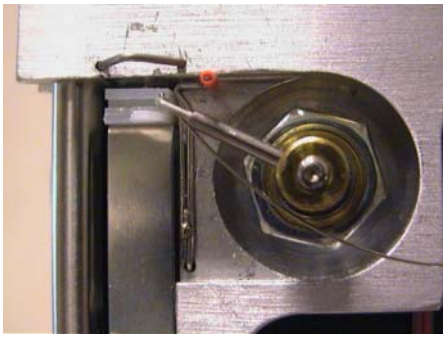
2. Move the Controller down a little bit slowly (with the thumb).



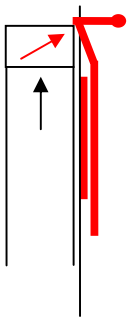


3. When the Controller goes down to the stopping level, the “V” Holder will move into the Controller “n” space and stop it.





4. When you move up the Controller (with its Groove Piece) the upper right corner of the Controller will push away the “V” Holder on its angle edge and free of the stopper at the same time. So, the holding function is ended.

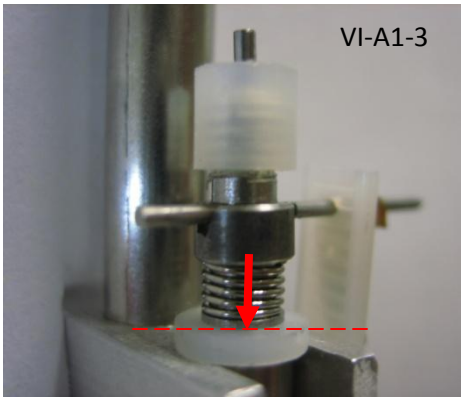


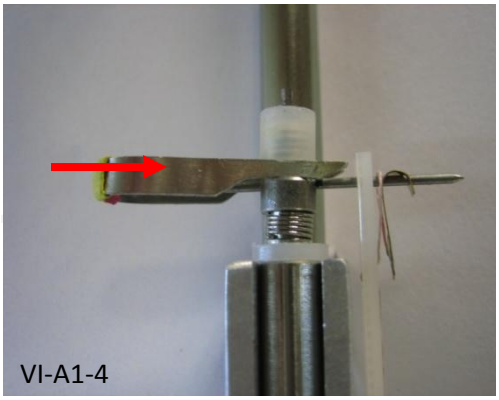
VI IMPACTOR RODS/TIPS SWAP (For M-III Rat / Mouse)

Two different Impactor Rods and Vertebral Tips are provided for the Impactor M-III Rat and Mouse model. The Impactor Rod is custom made for the unit and cannot be used on the other impactors. The Impactor Rod dropping weight includes Impactor Rod, Connecting Rod, and front end of Cross Arm, Upper Pin, Lower Pin and Signal Wire. Rat Impactor Rod is 10 grams / 2.5 mm diameter head. Mouse Impactor Rod is 5 grams / 1.2 mm diameter head. "Z" shape Vertebral Rod Tip is for rat model. "L" shape Vertebral Rod Tip is for mouse model. The lower part of the Impactor Head and the Vertebral Rod Tip are gold plated.

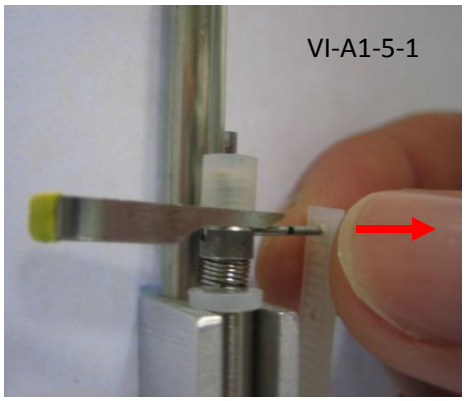
A1. Impactor Rod Swap:

1. Turn off power.
2. Hold up the Vertebral Rod as step 5 on page 14.
3. Raise the Main Frame (19) up and move down the Impactor Rod (10) to the Impactor Rod Guide Tube Upper Bearing (16) level. (VI-A1-3)

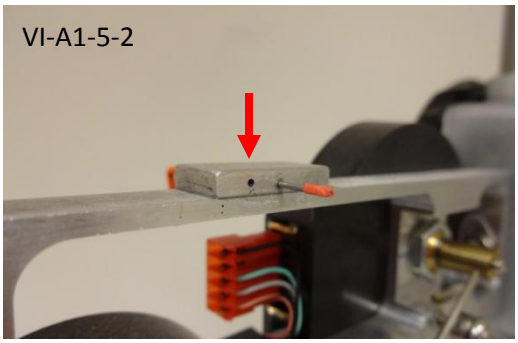


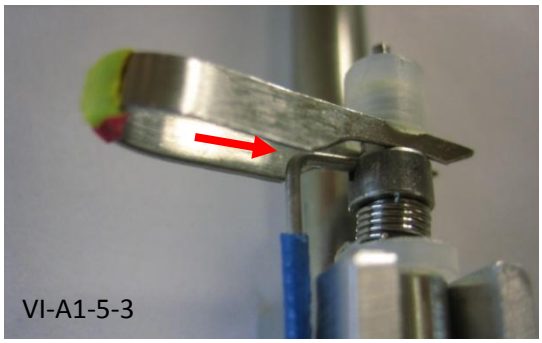


4. Insert the swap tool "U" Piece into the space between the Impactor Rod Nylon Cap (4) and the Upper Pin Lock Ring (6) from left side of the Impactor Rod to unlock the Connecting Rod Upper Pin (5). (VI-A1-4)



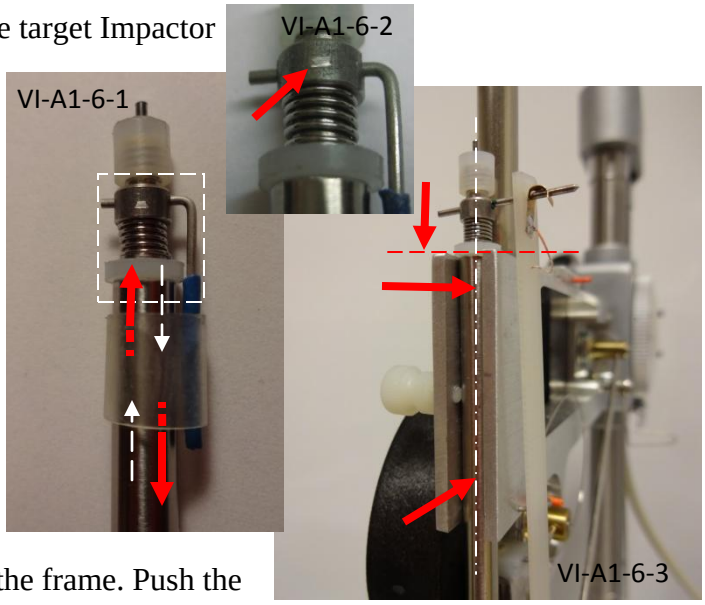
5. Remove the Connecting Rod Upper Pin (5) from right side horizontally by holding the top end of the Connecting Rod (9) with thumb and forefinger as shown in figure (VI-A1-5-1) and avoid damaging the Signal Wire Connecter on the same pin. Insert the pin (5) into the small hole on the Drop Safety Key (17) metal piece (VI-A1-5-2). Insert the Blue Coat "L" Pin into the hole where the Connecting Rod Upper Pin (5) was from left side (VI-A1-5-3).



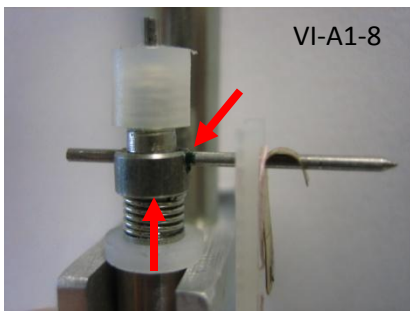


Hold the "L" pin with finger and remove the "U" Piece. Then, loosen the Nylon Thumb Screw (18); take out the Impactor Rod Guide Tube (21) from the Main Frame (19). Move the plastic tube from the lower end of the Impactor Rod (10) to cover the Blue Coat "L" Pin as figure (VI-A1-6-1). Then store it into the plastic cylinder for next use.

6. Take out the plastic tube from the target Impactor Rod as shown in the figure (VI - A1-6-1). Keep Blue Coat "L" Pin in place. Make the mark on the Upper Pin Lock Ring (6) (VI-A1-6-2) face to the meter side. Insert it into the Main Frame (19) groove vertically. Make sure the Impactor Rod Guide Tube Upper Bearing (16) sits exactly on the upper end of the frame. Push the Impactor Rod Guide Tube (21) into the groove until it touches on the back wall firmly (VI-A1-6-3). Tighten the Nylon Screw (18) to secure the Impactor Rod Guide Tube (21).



7. Use the "U" Piece to unlock the Blue Coat "L" Pin as step 4 on page17.



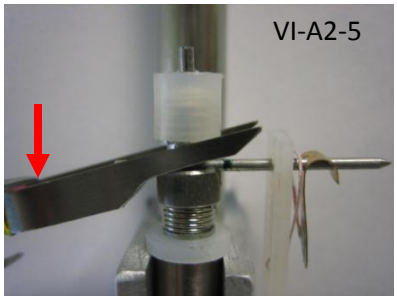
8. Insert the Connecting Rod Upper Pin (5) and push away the Blue Coat "L" Pin at the same moment. Be sure the mark on the Connecting Rod Upper Pin (5) locates on the right edge of the Upper Pin Lock Ring (6) (VI-A1-8). Remove the "U" Piece. Hold the Impactor Rod Nylon Cap (4) and push the Upper Pin Lock Ring (6) upward with a small

slot screw driver. Save the Blue Coat "L" Pin for the future use.

9. Hold the top end of the Connecting Rod (9) and slightly pull it toward right to check the Connecting Rod Upper Pin (5) locking status, if the pin doesn't move, it is secure. Otherwise, repeat step 7 to 8.
10. Move the Impactor Rod up and down several times with the Impactor Rod Raiser (41) without touching the electromagnet to make the Impactor Rod move smoothly. If the movement is not smooth, check and repeat step 6 to 9; make sure all details are corrected.
11. Repeat 25, 12.5 and 6.25 mm height dropping tests several times to confirm the device is under normal working condition.

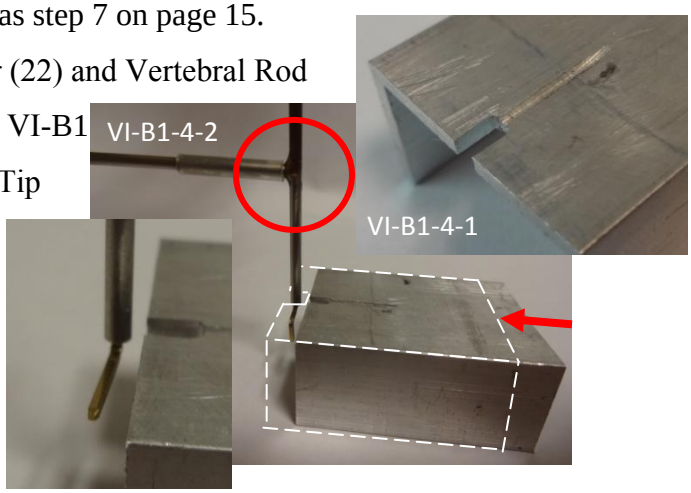
A2. Tips for Impactor Rod Swap:

1. Check the spare Impactor Rod carefully before a swap. The Blue Coat "L" Pin (VI-A1-5-3) should be in the correct position of the upper part of the Impactor Rod and turning easily. The connection between the Impactor Rod (10) and its upper parts, the connection between the Impactor Rod (10) and Impactor Rod Head (28) should be tight.
2. Be sure Connecting Rod (9) Upper Pin goes into Impactor Rod (10) thoroughly smoothly after "U" Piece is placed between Impactor Rod Nylon Cap (4) and Upper Pin Lock Ring (6). The mark on the Upper Pin Lock Ring should face to impactor meter side before the Impactor Rod installation.
3. The Blue Coat "L" Pin (VI-A1-5-3) should be put into the correct side of the Impactor Rod (10) during the swap. [The Blue Coat area should be on the right side when facing the mark on the Upper Pin Lock Ring (6). See figure (VI-A1-6-2)]
4. Hold the top end of Connecting Rod (9) carefully to avoid damaging or moving Signal Wire connector while swapping Impactor Rod.
5. It is possible to adjust the direction of the Connecting Rod Upper Pin (5) within a small range when inserting it into the pin hole. The "U" Piece can be pressed down slightly to open a bigger gap between the Impactor Rod Nylon Cap (4) and the Upper Pin Lock Ring (6) for pin insertion. (VI-A2-5)

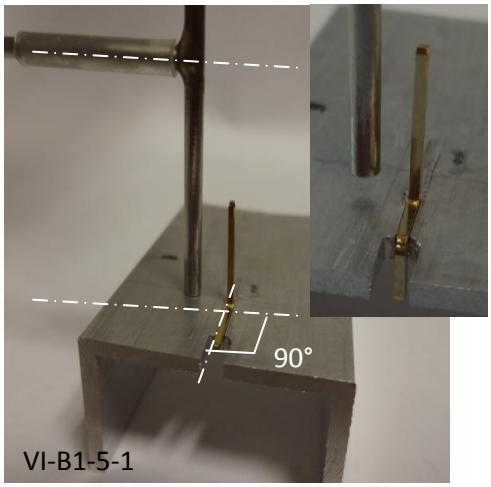


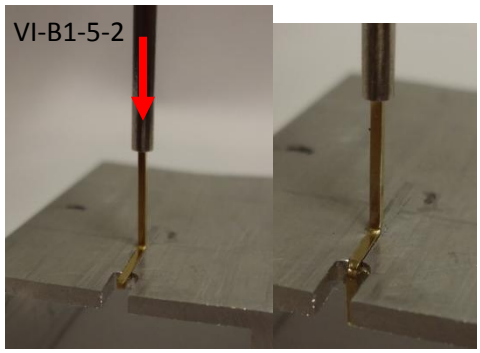
B1. Vertebral Rod Tip Swap:

1. Raise Main Frame (19) to the top with Meter Manual Wheel (12).
2. Lift up the Impactor Rod (10) as step 4 on page 14.
3. Release the Vertebral Rod (27) as step 7 on page 15.
4. Hold the Vertebral Rod "Z" Bar (22) and Vertebral Rod vertical bar "T" area (red circle, VI-B1-4-2) with left hand, move the "Tip Tool" (VI-B1-4-1) with its "U" Gap to cover the Vertebral Rod Tip (29) as the figure (VI-B1-4-2), press the "Tip Tool" with right hand and lift up the Vertebral Rod to remove the old tip.



5. Set up the new tip in the groove vertically on the Tip Tool. The angle between the "Z" Bar and the tip should be 90º as figure (VI-B1-5-1). Press down the Vertebral Rod (27) little by little to plug the new tip into the rod hole vertically fully. (VI-B1-5-2)

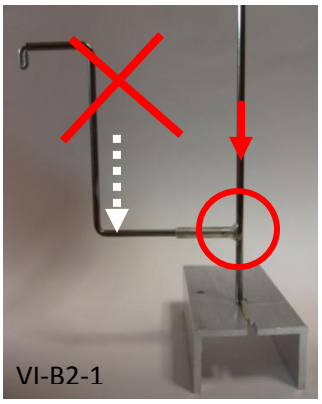




6. Move up the Vertebral Rod "Z" Bar (22) until it is touched to the bottom of the Vertebral Rod Controller (25), then, close the Vertebral Rod Controller Break. (26)

B2. Tips for Vertebral Rod Tip Swap:

1. When press down the Vertebral Rod (27) to install tip, to hold “T” area (red circle) only. It will damage the “Z” Bar if pressed down on left side as figure (VI-B2-1). The angle between “Z” Bar and Tip can be adjusted when it is needed as shown on figure VI-B1-5-1.



VII TIPS

Daily Use and Maintenance:

Impactor Rod (10)

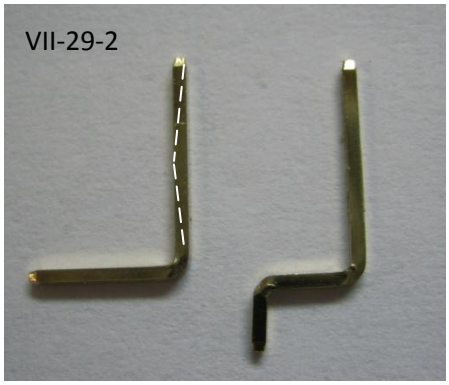
1. Keep Impactor Rod Head (28), Impactor Rod, pins and bearings clean all the time. Do not touch those areas with fingers.
2. Do not put water, saline or other liquids in the gap between Impactor Rod Head (28) and Impactor Rod and its upper area to avoid increasing drop weight.
3. Do not touch the Impactor Rod Attached Pin (3) with hand or wet cotton applicator swab etc. to prevent rust. Keep it clean and dry.
4. The spare Impactor Rod (for rat and mouse model only) should be placed in the attached plastic cylinder.
5. Use only cold pure water (but not saline or alcohol) as daily cleaner for Impactor Head and Rod.
6. Flush the lower part of Impactor Rod Head (28) and the Vertebral Rod Tip (29) with water and remove residue debris and blood after each drop.

Impactor Rod Raiser (41)

1. Raise and attach the Impactor Rod (10) to the electromagnet slowly and gently with the Impactor Rod Raiser to protect the electromagnet.
2. The raise arm of Impactor Rod Raiser should be turned to vertical place after use, to avoid touching Impactor Rod Encoder Arm (14) or Front Standing Column (32).
3. If raise arm of Impactor Rod Raiser hits with "V" Holder (48), adjust the position of "V" Holder.

Vertebral Rod Tip (29)

1. Flush with water; remove debris and blood after each animal drop.
2. If the tip is loose, the vertical part of the tip can be bent a little bit, then re-plug into the Vertebral Rod. (VII-29-2)



3. The Vertebral Rod Tip should be placed on the animal spinal column as close to the impacting point as possible to get better accuracy for animal vertical movement detection during the impact. It should not contact the spinal cord and not place on fat or muscle.
4. The suggested distance between the Rat Impactor Head and the Rat Vertebral Tip is approximately 1.8 ~ 2.0 mm.
5. The suggested distance between the Mouse Impactor Head and the Mouse Vertebral Tip is approximately 1.0 ~ 1.5 mm.
6. By turning Vertebral Rod "Z" Bar (22), Vertebral Rod Tip can be placed at multiple swap locations as long as it close to impact site.
7. The standard Mouse Vertebral Tip is long enough to cover all detecting areas. It can reach to the Impactor Head. But be careful to avoid touching the Impactor Head. (VII-29-7)