

Benchmark[™] Stereotaxic Impactor

Instruction Manual

Reproducible Controlled Cortical Trauma

Benchmark: “A point of reference from which measurements may be made, the standard against which all others are measured”.

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Figure 1. Benchmark Stereotaxic Impactor

Actuator mounted on a stereotaxic manipulator on right, control box on the left side of the picture. Tip at bottom of actuator is the site of impact. The tip can be unscrewed, and a variety of tip sizes and an extender are included.

Impactor Components:

The impactor will be shipped in one box with two major parts and two small packages inside the box.

- 1) The actuator that mounts on the stereotaxic instrument (Figure 1, right side), with the offset adaptor needed to mount on most makes of stereotaxic instrument.
- 2) The electronics control box (Figure 1 left). A cable connects the two at a front panel connector on the control box.
- 3) A selection of 4 impact probes are provided, one will be installed. The impact probes screw into the impeller in the actuator, and are the parts that make contact with the animal.
- 4) A cable with a connector to plug into the jack labeled contact sensor on the front panel.

Caution:

The impact force is very sufficient to cause pain and injury to human skin at high velocity settings. Be careful to not have the tip near yourself when the instrument is powered. Do not test it on your finger. Impact may be severe and may cause injury.

Assembly:

Select the probe tip you wish to use from the available sizes (1.0, 1.5, 2.0 & 3.0 mm). Screw it into the impeller at the bottom center of the actuator. Make sure that both 3-position toggle switches on the front panel of the Impactor Control box are in the Center (pointing straight out) position. Connect the cable on the actuator to the jack on the front panel of the Impactor Control Box, and connect the Impactor control box to power mains. Mount the actuator on your stereotaxic instrument. It should connect directly with no additional parts if your stereotaxic instrument is Benchmark, Kopf or Stoelting. The standard offset adaptor to mount probe holders on the manipulator is included. Turn on the power switch on the back panel.

Contact Sensor

Plug in the contact sensor lead wire. Put the Extend/Retract Switch is in the Extend position. Touch the clip on the end of the lead wire to the tip of the actuator to test. This should sound a beep. Switch the Extend/Retract Switch back to the center position. Connect the clip to an earbar, cut skin or other solid connection to the animal. This will sound the beep when the Impactor Actuator tip makes contact with the animal if the probe tip is in the Extend position. This contact sensor enables reproducible judgments between operators as to when the probe has made contact.

Concept:

Head trauma is a leading cause of serious injury in children. Animal research on diagnosis and treatment of head trauma has been hampered by a lack of instruments that can deliver an impact reproducible in velocity, dwell, location and penetration depth. The Benchmark Stereotaxic Impactor is the first controlled cortical impact device that mounts directly on a stereotaxic instrument and takes advantage of its position and angle adjustment features. It is especially useful when mounted on a Benchmark Angle Two Stereotaxic Instrument, with 10 micron resolution, probe angle readout, and a very tight compression lock on the angle swivel. Controlled impact may be on any part of the body; skull, spinal cord, brain, or even skin.

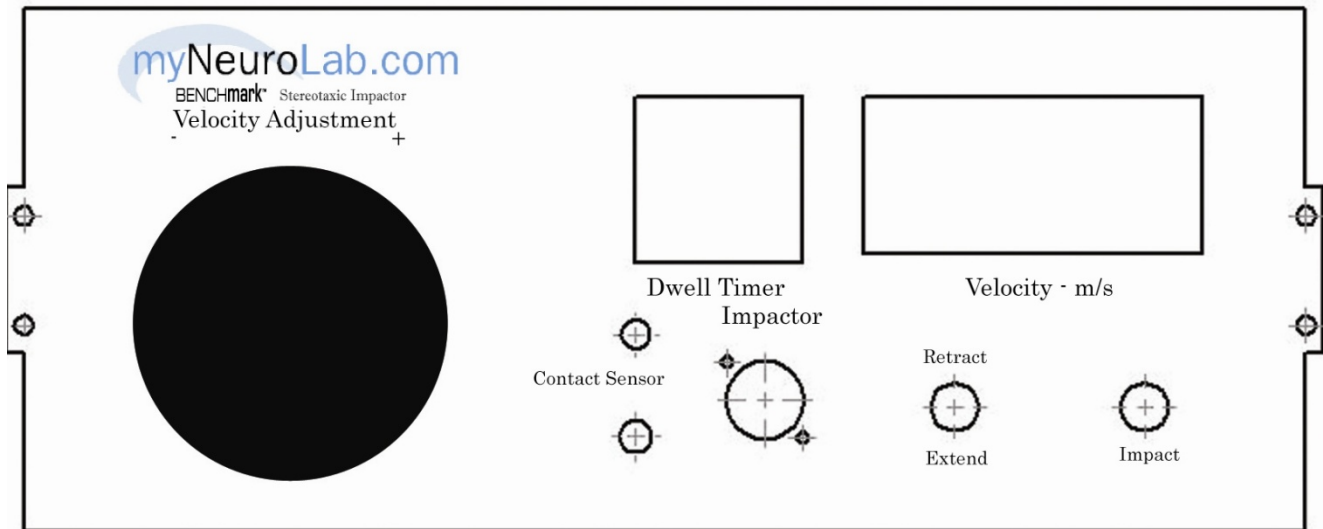


Figure 2. Face Plate for Impactor Control Panel

Normal Operation:

Control Details

1. The circles above labeled Retract/Extend or Impact are 3-position toggle switches. Retract/Extend is a three position switch that passes current to the actuator coil in either the Extend or Retract position, and should be in the center position whenever not in immediate use to avoid overheating the coil or fuse, and to save energy.
2. Rotate the large knob (filled black circle) on the left clockwise to increase probe terminal velocity. The velocity setting will be displayed on the LED in the upper right rectangular box. The capacitors will charge slowly, so the LED will update to reflect the velocity at current charge levels. Turning the knob counterclockwise will not discharge the capacitors, so you will need to turn the knob counterclockwise and fire an impact to set a lower velocity setting.
3. The LED display will count up, rapidly at first, then slowly as the capacitor charge approaches the target setting. It counts up as the capacitors charge. You can wait for a stable display, or fire an impact when the display has the desired reading. The number displayed is the velocity the probe tip will have at the end of range when the right toggle switch is pressed down to trigger an impact.
4. The black timer is for the dwell setting, the time between impact and auto-retraction. There are thumb wheels to rotate to the correct setting for each digit. The lowest place digit sets tenths of seconds, the next left sets seconds, etc.
5. The jack labeled Contact Sensor is for connection of a wire between the controller and the animal (via earbars is OK).

6. Start with the Retract/Extend toggle switch in the middle position.
7. Mount the actuator on the stereotaxic manipulator, and swivel out of the way.
8. Install an animal in the stereotaxic instrument and expose Bregma and the target area, the brain surface or bone area you will impact.
9. Return the actuator to over the animal.
10. Move the Retract/Extend toggle switch to the Extend Position.
11. Position the actuator so the probe tip you are using is just touching Bregma. The contact sensor should beep on contact only if the toggle switch is in the Extend position. Use a leading edge rather than trying to center the tip on Bregma in order to improve reproducibility.
12. Operate the stereotaxic instrument to move the probe to the desired target coordinates from Bregma at the desired angle.
13. Lower the probe tip to first contact or just barely above the target surface. The contact sensor will beep on contact.
14. Operate the Extend/Retract toggle switch up to the Retract position. The tip will withdraw from contact with the animal.
15. Advance the stereotaxic manipulator down by the desired impact depth.
16. Flip the right toggle switch to Impact.
17. The probe tip will accelerate down at a calibrated rate to reach the specified velocity by the end of the travel range. Just before that end, by the amount of the penetration, the tip will impact the target, hold and push for the preset dwell time, then retract back into the cylinder.
18. Remove the animal from the instrument.
19. Move the Extend/Retract Switch to the center position, and prepare the next subject.
- 20. If the Impactor will be idle for an extended period of time, (more than 1 minute) be sure the toggle switches are in the center position. This will save current flow, and possible overheating and damage to the coils.**

Impactor Care and Cleaning

Blood and body fluids are extremely corrosive. Clean the probe tips after each use, and carefully at the end of the day. Check for fluids on other actuator parts. Disconnect the actuator connector to prevent damage to the cable due to dropping or moving the actuator separately from the controller.

The impactor is calibrated at the factory, and requires specialized equipment. Calibration may drift as the equipment ages. Return the instrument for recalibration if you suspect it is needed.

With repeated impacts, the DV drive on the stereotaxic instrument may work loose. To tighten, loosen the set screw on the knob, and then tighten it while pushing up on the lead screw, and down on the knob, in other words, pushing them together to compress the wavy washer under the knob.

Specifications for Benchmark™ Impactor

Velocity at end of range:	1.5 to 6 meters/second calibrated range
Travel Range:	10.1 mm.
Dwell settings:	0.1 to 9.9 seconds
Weight- Actuator	
Weight- Controller	
Power:	110 volt, 60 cycle, or 220 volt, 50 cycle models with external transformer

Impact Mass:

Voice Coil = 36.0g
Delrin Piston = 15.0g
Screws = 2.4g
5mm tip = 4.4g
0.5mm tip = 2.8g

So Impact with a 5 mm tip involves a total mass of 57.8 grams moving at the preset velocity under continued force. Starting velocity is zero, so the equation below can be simplified to $A = \text{Terminal velocity (meter setting)}^2 / 2 \times \text{travel range (10.1 mm)}$.

$$v_f^2 - v_o^2 = 2ad$$

The force applied will depend on the stiffness of the tissue to be penetrated. The tissue will give and decelerate the probe tip. The mass times the rate of deceleration will determine the force exerted.

The instrument is calibrated at the factory. The permanent magnet and other components may change with age. If you suspect the instrument is no longer accurate, it must be returned to the factory for recalibration. As a rule of thumb, annual recalibration should be sufficient.

Compatibility:

The Benchmark Impactor can be mounted on most common makes of stereotaxic instruments.

MyNeuroLab Limited Warranty

MyNeuroLab warrants this instrument to be free from defects in material and workmanship for a period of one year from the date of original purchase. This warranty covers parts and labor. We may repair or replace defective instruments at our option.

There is no warranty on consumables supplied with the instrument. The warranty does not cover damage from abuse, neglect or use for purposes other than those intended and described in the manual. MYNEUROLAB/CORETECH HOLDINGS DISCLAIMS ALL RESPONSIBILITY FOR

CONSEQUENTIAL DAMAGES OR INCIDENTAL LOSSES CAUSED BY USE OF THIS INSTRUMENT, except where such disclaimer is not allowed by law. To claim, send an email to sales@myneurolab.com, visit our website at URL <http://www.myneurolab.com> and find the latest contact information, or call 314 522 0300. Do not ship the instrument back without first contacting the company and obtaining a routing number. This warranty gives you specific legal rights, which may vary from state to state or province to province.