



SpikerBox 2-Channel Instructions

Prepare yourself. In 2-6 hours, you will have built your own SpikerBox to begin doing neuroscience and whatever your creative mind can conjure.

Materials Needed:

1. A Backyard Brains 2-Channel Bag of Parts
2. Soldering Iron
3. Solder
4. Magnifying Glass to read labels on Chips and Capacitors
5. 9V battery to power your SpikerBox.
6. Silly Putty to hold components in place on board while you solder on backside
7. Pair of scissors
8. Wire Strippers and Wire Clippers
9. Superglue (gel is best) to glue speaker into the acrylic enclosure.
10. Electrical Tape

A Soldering Iron can be purchased at RadioShack or any local hardware store. The Magnifying Glass and Silly Putty are available at drug stores.

SpikerBox Circuit Construction (Blue PCB Board)

1. Solder Speaker Connector
2. Install Audio Line Out
3. Install Power Switch
4. Install LED (bulb pointing out)
5. Install Red and White RCA connectors (White towards the outside).
6. Install Chip Holders. The half circle should point toward the front of the board (where input, switch, LED, and line out are).
7. Install 220 uF capacitor (the big one) at C3. Grey Stripe needs to point toward connector row
8. Install 10 uF (blue cap) capacitor at C10, C100, C1, and C2 . These have "106" in small text on them.
9. Install 10 k Ω resistors at R1 and R2 (brown black orange).
10. Install 390 Ω resistor at R5 (near LED)
11. Install 1 k Ω resistor at R7 and R70 (brown black red)
12. Install 0.47 uF capacitor at C7 and C70. The capacitor has "474" in small text on it.
13. Install 220 k Ω resistor at R8 and R80 (red red yellow).
14. Install 560 pF capacitor at C8 and C80. The capacitor has "561" in small text on it.
15. Install 0.047 uF capacitor at C4. The capacitor has "473" in small text on it.
16. Install 10 Ω resistor at R3 (brown black black).
17. Install 0.1 uF capacitor at C5. The capacitor has "104" in small text on it.
18. Install the 9V battery connectors. Take care to ensure the two connectors are flush with each other or else battery will not plug in. The "skinny" connector

(male) goes on the bottom of the board (This mates to the negative side). We recommend soldering with a battery in place.

19. Install Chips in holders, with circle on all chips pointing towards top of board. INA2126 goes in the long holder, the TLC2272 goes in the middle holder, and the LM386 in the remaining holder.

20. Install battery.

Note: R4, R6, R60 and C6 are not needed. They are just there in case people want to modify our circuit.

Electrode and Speaker Construction:

(note --- making the two channel electrode can be confusing based on this text alone. Use our step by step photos at diy.backyardbrains.com --> 2chan - as a guide if necessary

1. You begin with two 6-inch lengths of speaker wire, two RCA connectors, and a red, white, and black map pin
2. Peel apart the two speaker wire pairs so you have four 6 inch lengths. Cut one length to 3 inches. Strip $\sim 1/4$ inch of insulation from each speaker wire end.
3. Twist one end of the 3 inch length and one 6 inch length together, and insert wire into ground hole of connector on white RCA.
4. Solder the white ground connection and crimp the tabs.
5. Solder the black map pin to the other end of the 6 inch speaker wire length.
6. Solder another 6 inch speaker wire length to the RCA connector.
7. Solder the white map pin to the other end of the 6 inch speaker wire.
8. Carefully thread the wires through the wire connector cover and screw it on.
9. Now slide the red RCA connector cover through the 3 inch length, and solder the other end of the three inch speaker wire to the ground connection on the red RCA connector.
10. Insert the remaining 6 inch speaker wire length through the red connector cover, and solder it to the remaining tab.
11. Screw the RCA connector cover on the connector, and solder the red map pin on the remaining end of the 6 inch speaker wire. You are done with your electrode!
12. Now it's time to build your speaker. Cut off the last few inches of the speaker wires and remove $\sim 1/4$ inch of insulation.
13. Solder the wires to the 2-pin speaker connector, and twist the two wires together.
14. Separate and wrap solder joints away from each other using electrical tape. Take care that the two solder joints do not touch.

Full Assembly:

1. Measure your tubing and cut it into 4 equal parts of 0.75 inches and 4 parts of 0.25 inches.
2. Place the four machine screws into the enclosure board without the speaker hole, turn the board over, and place the 0.25 inch tubing over the screws.

3. Place the assembled circuit board over the screws on top of the 0.25 inch tubing.
4. Add the 0.75 inch tubing to the four screws.
5. Press the speaker into the enclosure, then attach the female end of the cord to the male end of the PCB. If the speaker doesn't fit, you can lightly sand the inner hole until the speaker fits. You can use just a touch of superglue in the inside hole to secure speaker. Be careful—superglue smears acrylic very easily.
6. Slide the top enclosure board on your circuit, and add the hex nuts to the top of the SpikerBox. Note that the nuts could go either on the top or bottom of the board. There is an internal struggle here at Backyard Brains on which looks better: Nuts up vs. Nuts down. It's your SpikerBox, you decide.
7. Peel and place the cork sticker to the right of the speaker, close to the RCA jack.

Now grab your favorite invertebrate and do some experiments.

What resistor is what?

Resistors have 3 color stripe bands that signify their values. For example, a 10 Ohm resistor is Brown, Black, Black as below:



Sometimes you will find an extra silver or gold stripe, but you can ignore those. (They specify the tolerances, 5%, 10%, etc). For your kit, you will need the following values:

10 Ω = Brown Black Black
390 Ω = Orange White Brown
1 k Ω = Black Brown Red
10 k Ω = Brown Black Orange
220 k Ω = Red Red Yellow



2-Channel SpikerBox Board

(your board color may be different)

Note R4, C6, R6, and R60 are not populated—these are for custom mods

- connector (skinny)

+ connector (fat)

C8, C80 = 560 μ F (561 label)
R8, R80 = 220 k Ω red red yellow

C1, C2, C10, C100 = 10 μ F (106 label)

R1, R2 = 10 k Ω (brown black orange)

C4 = 0.047 μ F (473 label)

R3 = 10 Ω (brown black black)

C5 = 0.1 μ F (104 label)

C3 = 220 μ F
Grey Stripe
Points Down

R7, R70 = 1 k Ω (brown black red)

C7, C70 = 0.47 μ F (474 label)

R5 = 390 Ω (orange white brown)

Speaker
Connector

Audio
Out

Power
Switch

LED

RCA inputs

Make sure all chips face towards the connectors (notice circle mark in corner of chip)

