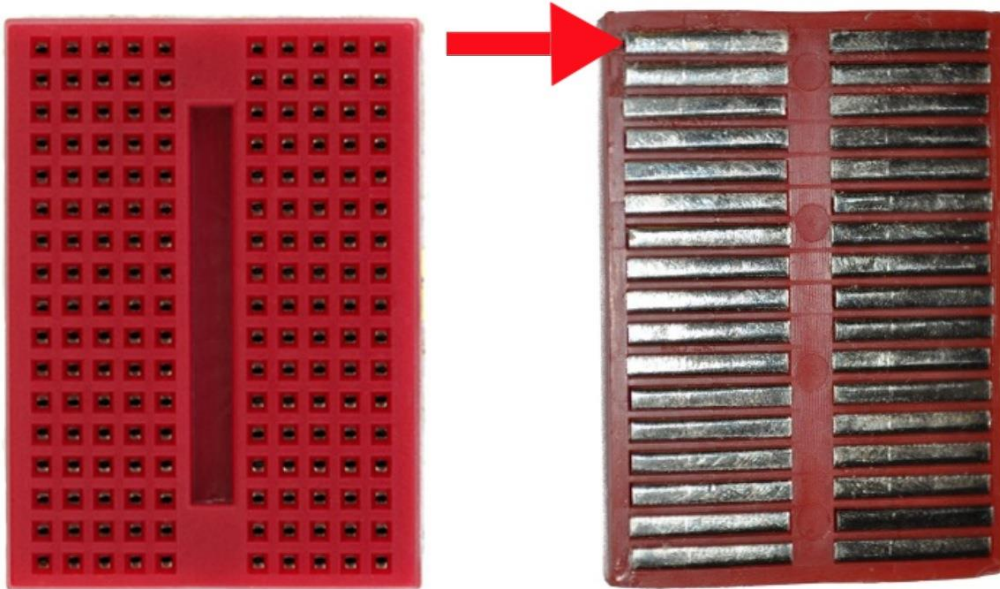
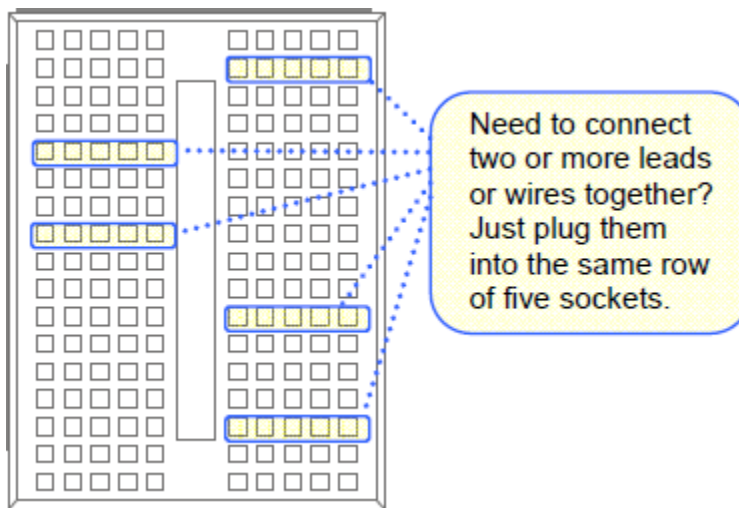


# Instructions for Building a DIY Magnetic Mixer

## Background - How to use a Mini Breadboard



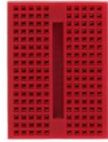
Top view and bottom view (with the adhesive back removed) of a mini breadboard.



For example, if you plug the negative (-) Ground wire of the power supply into the 5<sup>th</sup> row down on the left side of the board, then anything else that you connect to the other 4 holes in that row will also be connected to Ground.

## Parts

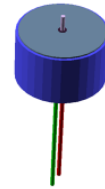
- Mini Breadboard



- DC Motor – 100mA, 3 – 6 volt



- Motor Clamp



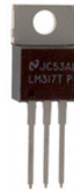
- Rotor (T-nut)



- Magnets



- LM317 Voltage Regulator



- 5K ohm Variable Resistor



- 1K ohm Resistor



- 0.1 uF Capacitor x 2



- Wire



- Power Supply – 5v 500mA (or 9v 1A)



- Washer & nut

- Plastic container & lid (approx. 4 x 4 x 2)

## Assembly Instructions

1. Punch two holes in the sides of the plastic container.
  - a) One hole should be large enough for the 5K ohm variable resistor. You will turn the knob on the resistor to control the speed of the mixer from the outside of the box.
  - b) The other hole should be large enough to fit the wire of the power supply.
  
2. For the Motor Mount: Cut a 2" section of plastic (pvc) pipe and slice with razor or scissors according to the picture.
  - a) Attach 2 round magnets to the top of the T-nut, one with North facing up, the other with South facing up with double-sided tape.
  - b) Push the bottom of the T-nut onto the motor spindle.
  - c) Insert the motor into the "C-clamp" portion of the mount.
  - d) Attach the mount with double sided tape to the inside of the box, with the motor-clamping "C" pointing up. Make sure to leave room for later placement of the Mini Breadboard.
  
3. Connect components to the Mini Breadboard. Feel free to use pieces of wire to make connections when needed. Eventually, you will attach the breadboard to the inside of the box, but it does not need to be in the box while you are working on it. For reference, orient the breadboard so the center blank section (without holes) is vertical. This will give you a set of rows on the left side of the board, and a set of rows on the right side of the board.
  - a) Thread the wire of the power supply through the smaller hole in the plastic box.
  
  - b) Connect the positive (+) wire of the power supply (wire with black & white lines) to a row on the left side of the breadboard. This is your **(+5/+9 volt) Power** connection.
  
  - c) Connect the negative (-) wire of the power supply (solid black wire) to a row on the right side of the breadboard. This is your **Ground** connection.
  
  - d) For reference, if you can read the printing on the LM317 Voltage Regulator and the pins are pointing down, the pins are, from left-to-right:
    - 1) Pin 1 - Voltage-adjustment
    - 2) Pin 2 - Output voltage
    - 3) Pin 3 - Input voltage

Insert the LM317 into the left side of the breadboard so that

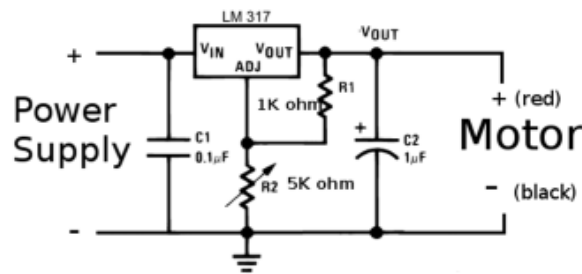
i) each pin is in a different row and

ii) Pin 3 is in the same row as the (+) wire of the power supply.

- e) Connect the 1K ohm resistor between Pin 1 and Pin 2 of the LM317.
- f) For reference, with the shaft of the 5K ohm variable resistor pointing up, and the 3 terminals facing you, the terminals are numbered from left (1) to right (3). Connect Terminal 1 to Pin 1 of the LM317. Connect the wire joining Terminal 2 and Terminal 3 to Ground.
- g) Connect the motor's red wire to Pin 2 of the LM317.
- h) Connect the motor's black wire to Ground.
- i) Connect one 0.1 uF capacitor between Pin 2 of the LM317 and Ground.
- j) Connect the other 0.1 uF capacitor between Pin 3 of the LM317 and Ground.

[An alternative instruction would be “connect the components as shown in the schematic, below”.]

## Schematic Diagram of Breadboard Layout



- 4. Remove protective paper from the breadboard and attach it inside the plastic container.
- 5. Place the washer on the 5K ohm variable resistor shaft, then insert it through the hole in the box and screw the nut onto it.
- 6. Snap the lid on the container and place the beaker on top of it. Add liquid and a stir bar.
- 7. Turn it on!

## Assembly Notes

- The capacitors have their negative leads connected to ground, one is the input capacitor because it filters the voltage going into the voltage regulator circuit (pin 3), and the other is the output capacitor because it filters the voltage coming out of the voltage regulator (pin 2) to supply power to the motor.
- Fixed resistors are not polarized: it doesn't matter which end is connected to which of the two circuit connections.
- Small yellow, ceramic capacitors are not polarized so it doesn't matter which end is which.
- Cylindrical electrolytic capacitors are nearly always polarized, the negative lead is usually marked.
- Note that if the capacitors are polarized, the positive lead (wire) must be connected to a higher voltage than the negative lead, which is often connected to ground.