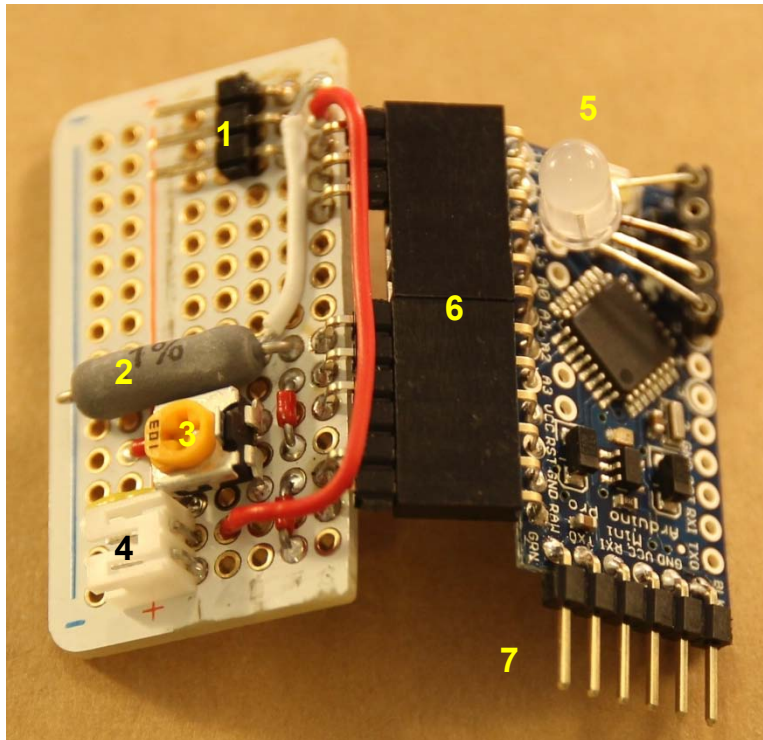


Buoyancy Engine Controller



The Buoyancy Engine Controller manages the servo motor on the buoyancy engine and directs it when to draw in water and when to expel it. It consists of two main parts: The circuit board on the left and the Arduino Pro Mini microcontroller on the right. These are connected by sets of header pins in the middle.

The main components of the circuit board are:

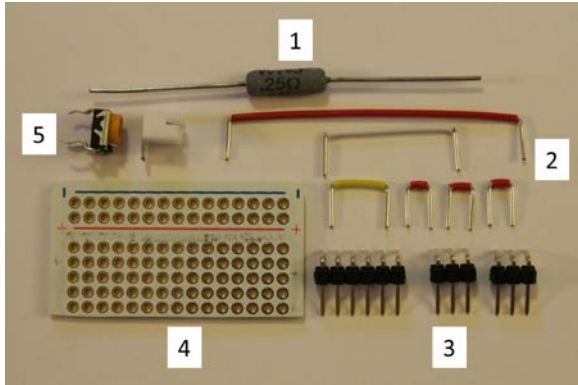
1. THREE-PIN HEADER - Connects to the buoyancy engine servo motor.
2. RESISTOR - Enables microcontroller to detect small changes in voltage and thus stop and reverse the plunger in the buoyancy engine when it runs up against a stop.
3. POTENTIOMETER - Controls the amount of water buoyancy engine draws in.
4. POWER SUPPLY JACK - Plug-in location for the battery power supply.

The main parts of the Arduino Pro Mini microcontroller are:

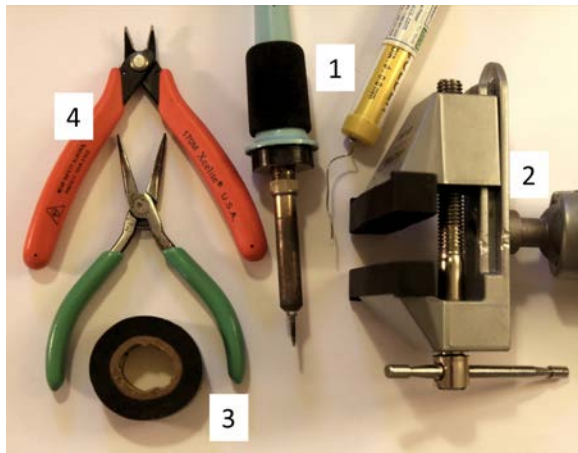
5. RGB LED – Indicates glider's descent or ascent by color changes.
6. HEADER PINS along length - Connect the Pro Mini to the circuit board.
7. HEADER PINS along width - Enable connection to FTDI breakout board for programming.

To create the Buoyancy Engine Controller, follow the Circuit Board Build and Arduino Pro Mini Build instructions then join these two components together as illustrated in the directions.

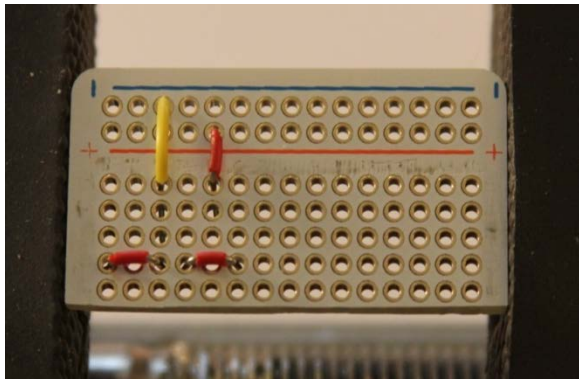
Circuit Board Build



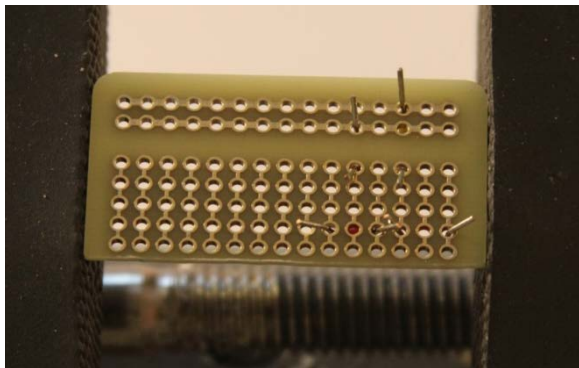
1. The circuit includes a 5.0-ohm resistor (1), jumper wires (2), male right angle header pins (3), prototype circuit board (PCB) (4), and a 10k-ohm potentiometer and power jack.



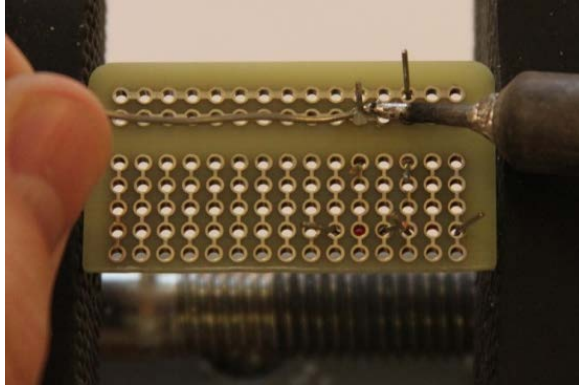
2. Tools and supplies needed are soldering iron with solder (1), small vice (2), electrical tape (3), and wire clippers and needle nose pliers.



3. With PCB board in vise, position jumper wires as shown.



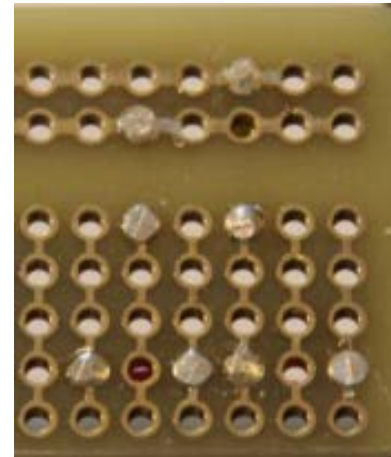
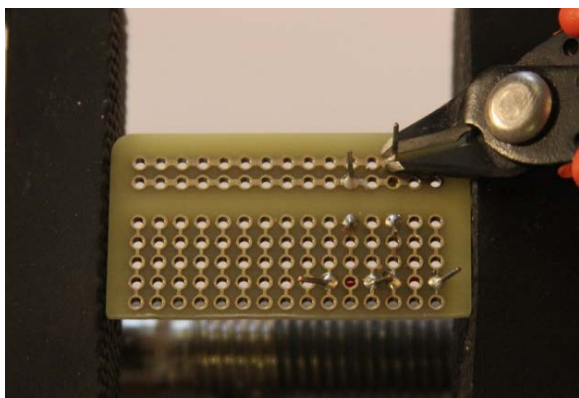
4. Carefully flip PCB board over and bend wires to hold them in place.



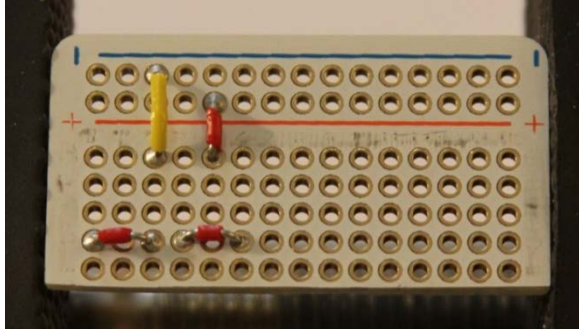
5. Solder all four jumper wires in place.
There should be eight solder joints



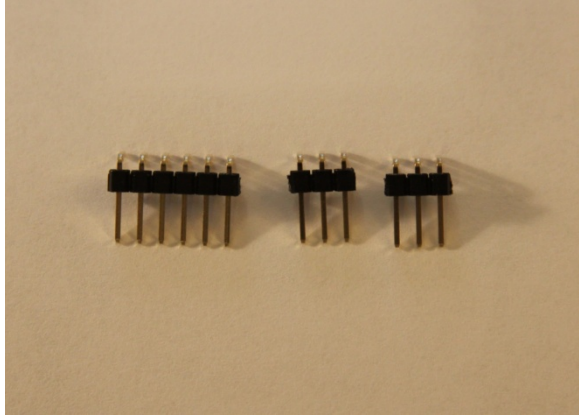
6. Inspect solder joints and re-solder if necessary.



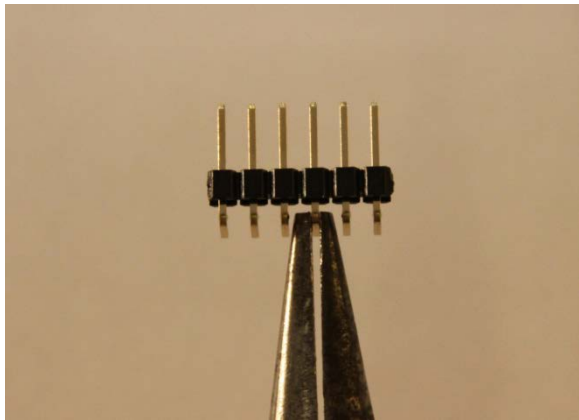
Snip off Extra Pin Material and Reexamine Solder Joints



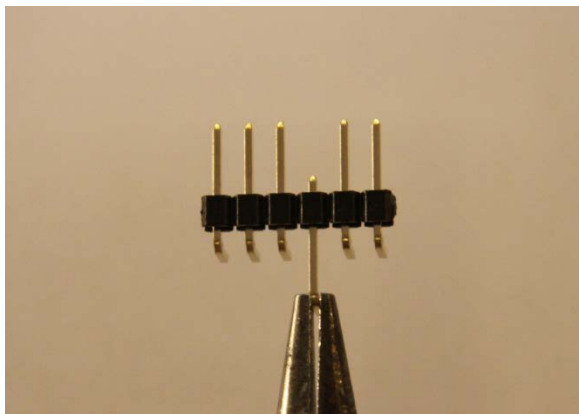
7. Flip board back to top view.



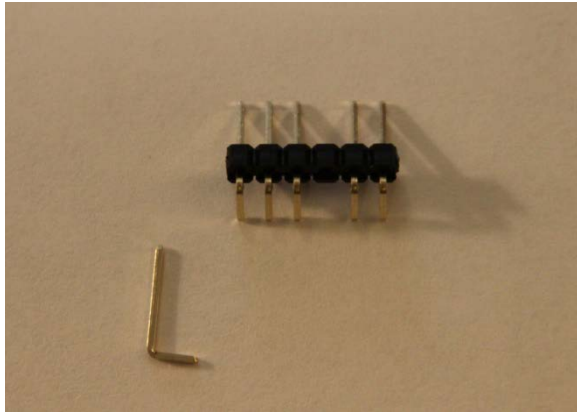
8. Locate three sets of male right angle header pins: One six pin set and two three pin sets.



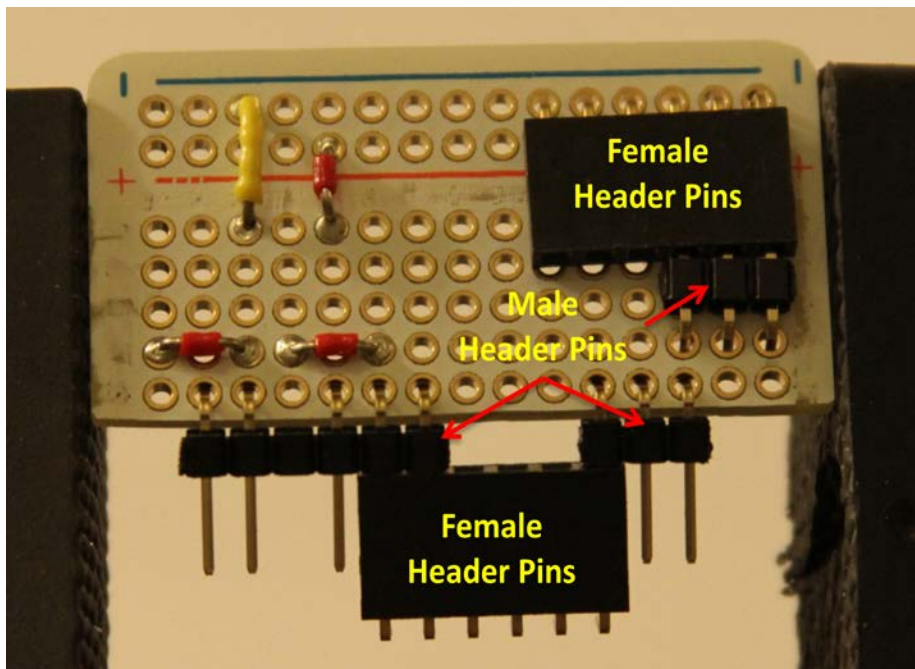
9. On the six pin set remove the fourth pin from the left using needle nose pliers as illustrated. Right angle pins should be pointed downward.



10. Extract 4th pin from the left.

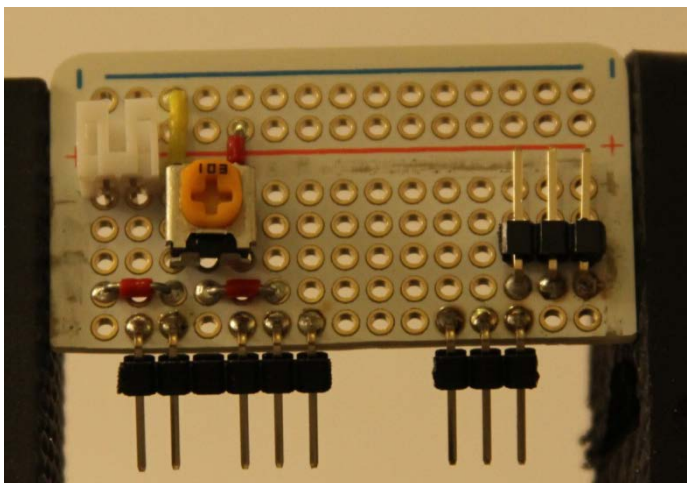


11. Discard removed pin.

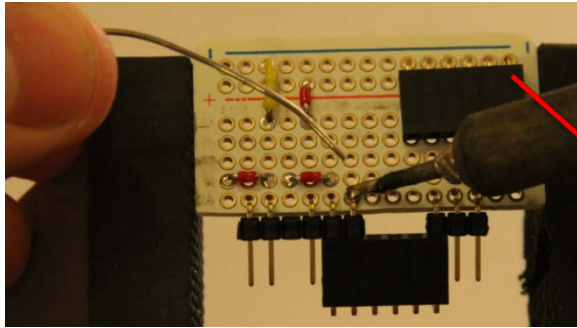


12. Place male right angle header pins in circuit board as illustrated.

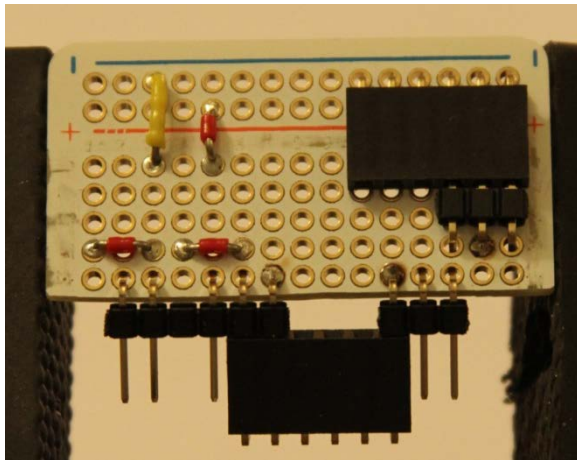
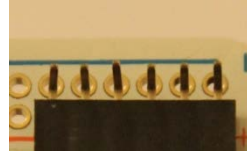
(Female right angle header pins may be used to help stabilize the male header pins' positions.)



13. Male right angle header pin locations after soldering.



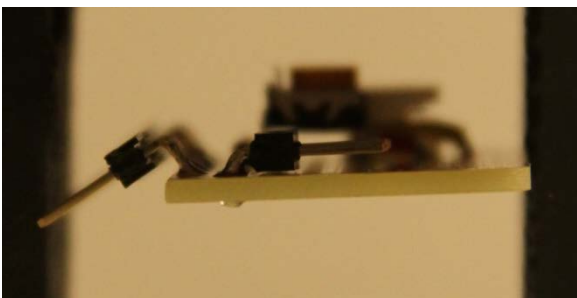
14. Solder one pin on each male header set to hold them in place.
 CAREFUL: Female support header pins on board must have exposed pins turned up before soldering begins.



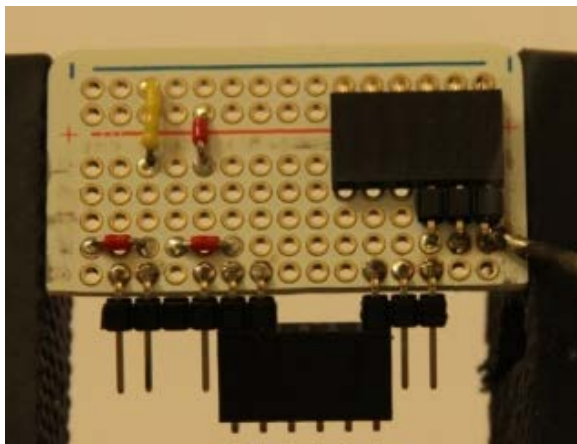
One Pin Soldered on each Header Pin Set

Notice that the pins on the edge of the circuit board will be at an angle.

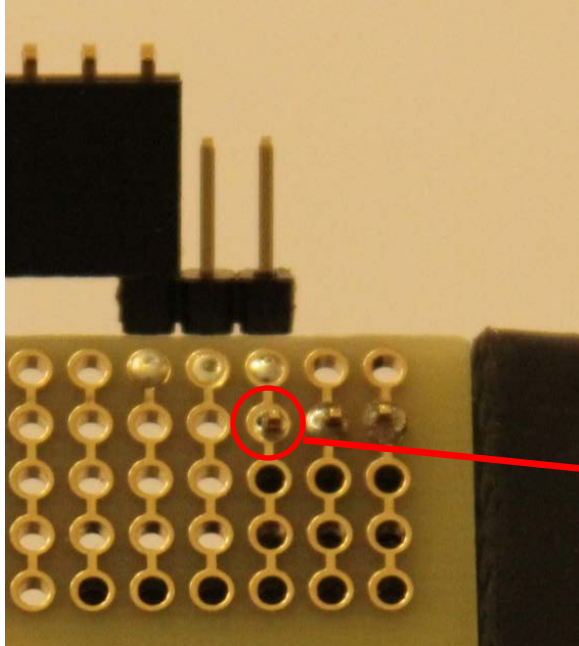
(See below.)



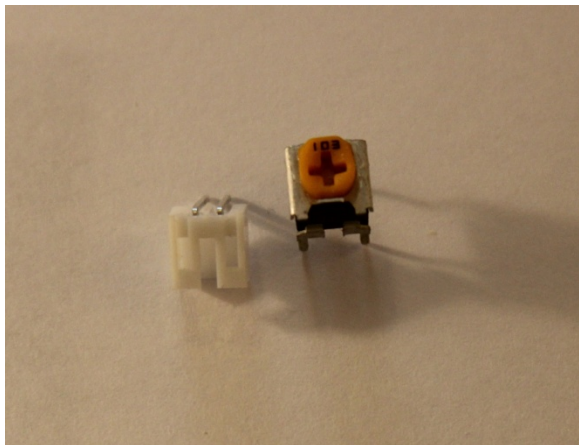
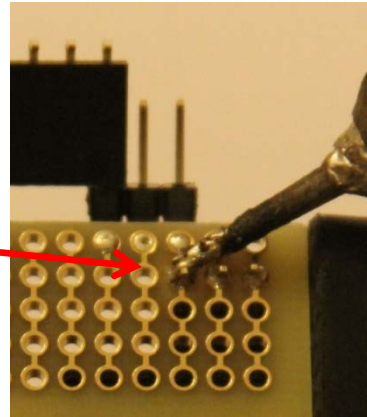
Edge Header Pins at an Angle



15. Solder the rest of the male header pins in place.

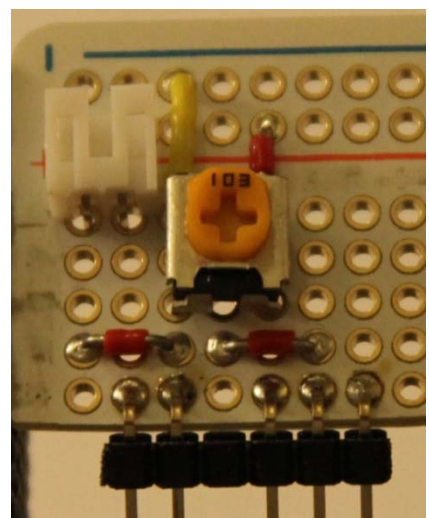
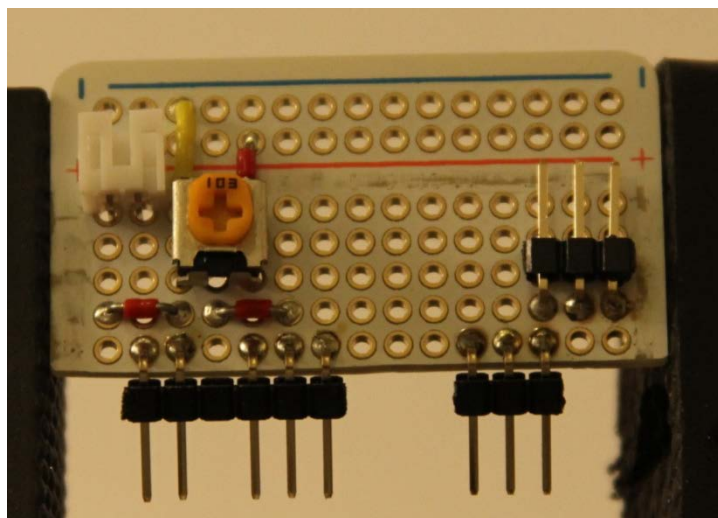


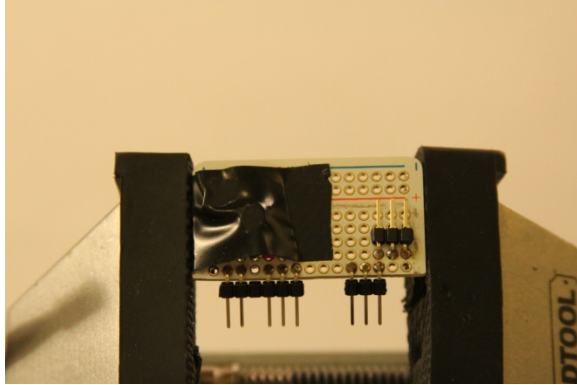
16. Turn circuit board over and check for any bad solder joints. Repair if necessary



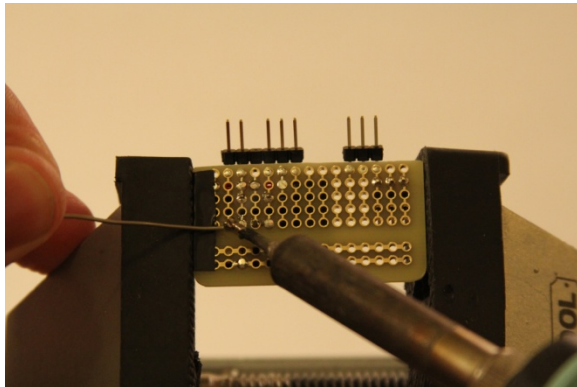
17. Locate power jack and 10k-ohm potentiometer.

18. Position power jack and potentiometer on board as shown below.

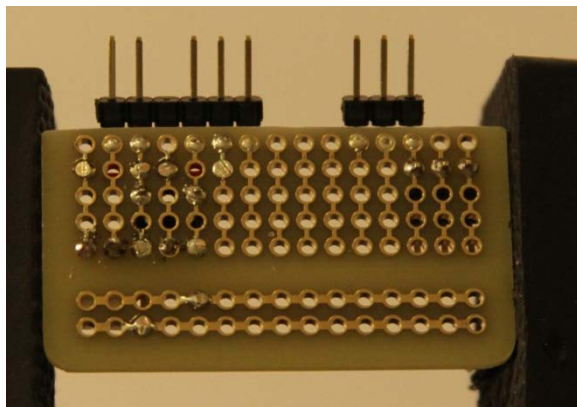




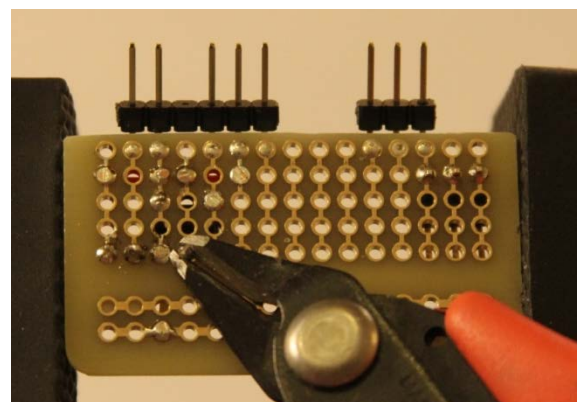
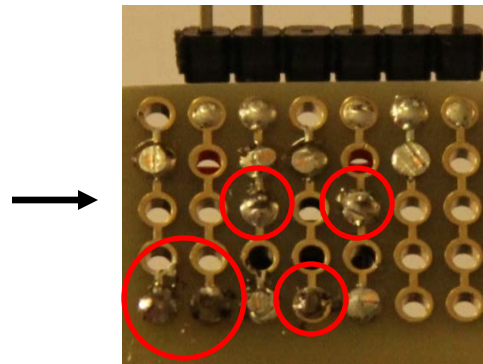
19. Use electrical tape to temporarily secure these components to circuit board for soldering.



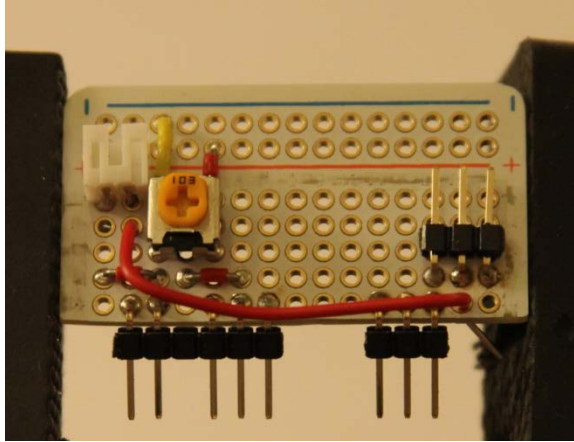
20. Flip board over and solder potentiometer and power jack to circuit board.



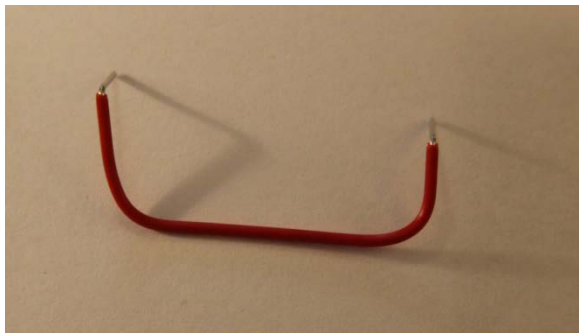
21. Check all solder joints.



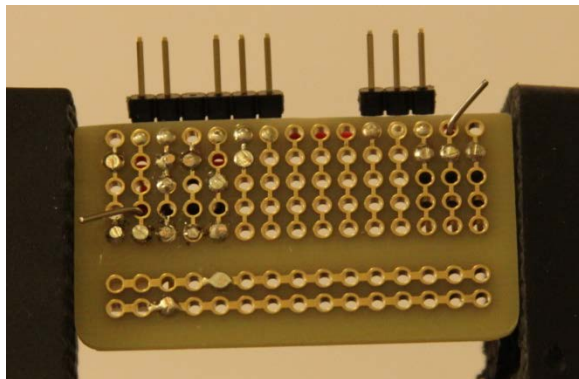
22. Remove any excess pin material with wire clippers.



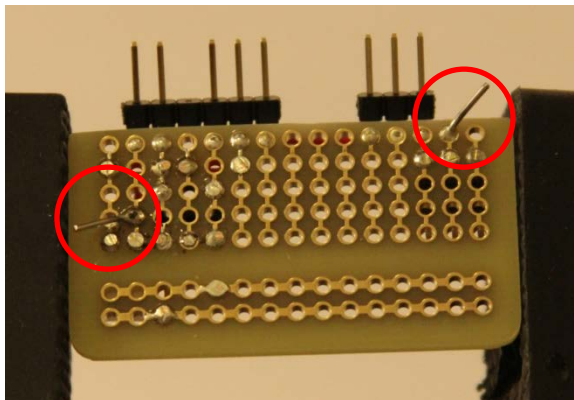
23. Position large red jumper wire on circuit board as shown.



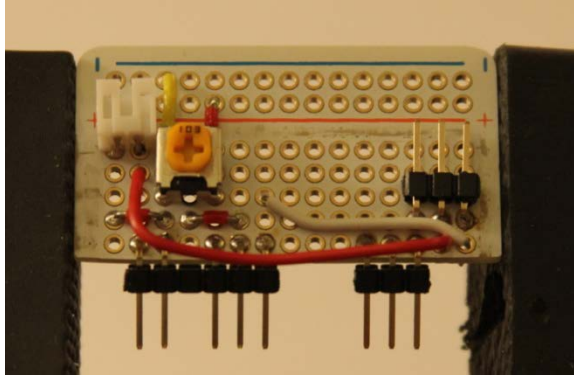
24. Bend wire as needed to fit between the plated-through holes or vias shown above.



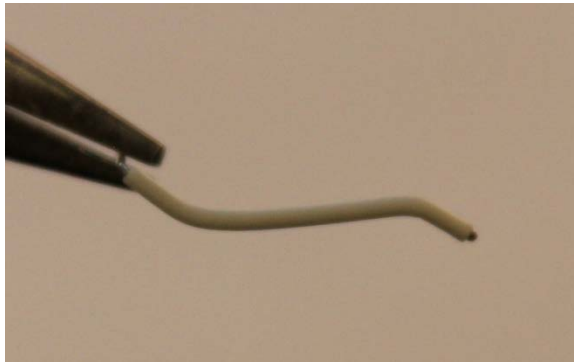
25. With red wire in place, flip circuit board over and bend wire leads to secure for soldering.



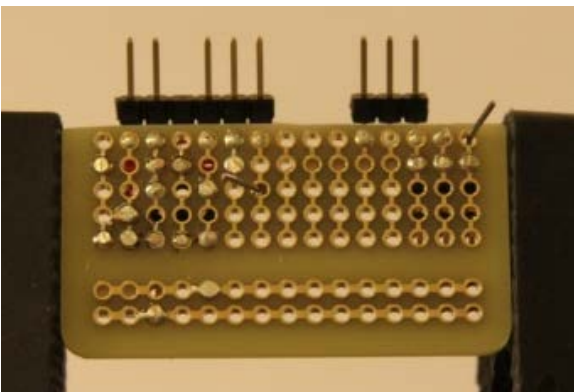
26. Solder large red jumper wire in position. Clip off excess wires.



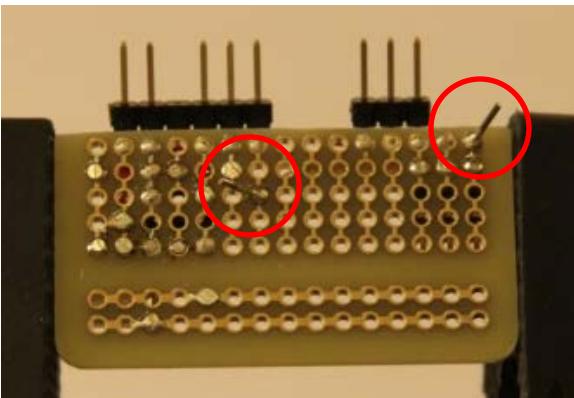
27. Position white jumper wire on circuit board as shown.



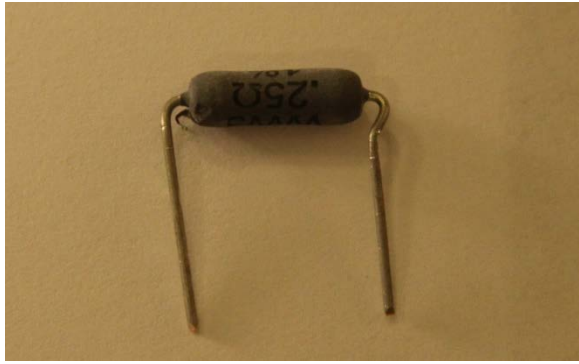
28. Bend wire as needed to fit between the plated-through holes or vias shown above.



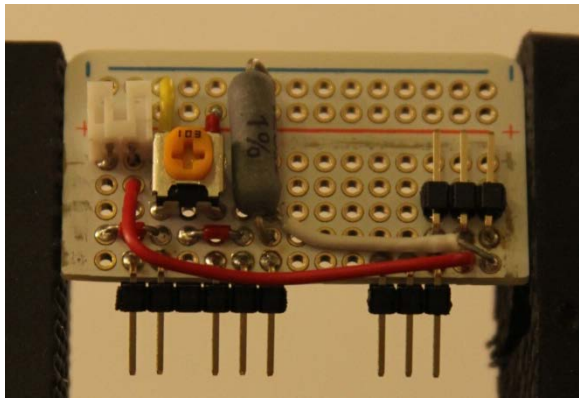
29. With white wire in place, flip circuit board over and bend wire leads to secure for soldering.



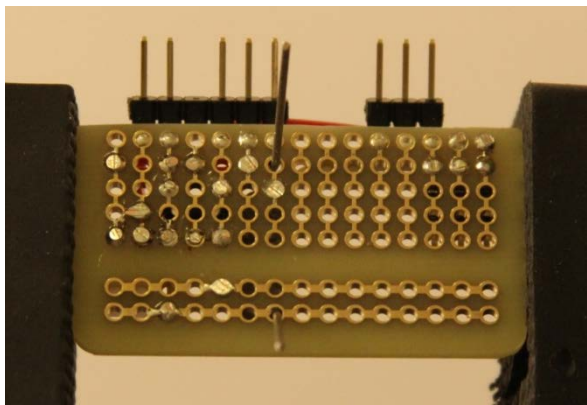
30. Solder white jumper wire in position. Clip off excess wires.



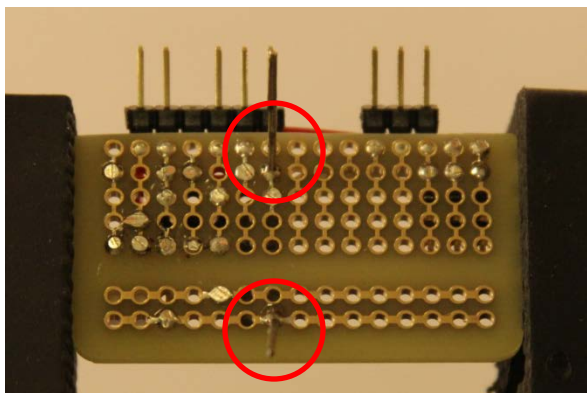
31. Locate 5.0-ohm resistor, the final circuit board component.



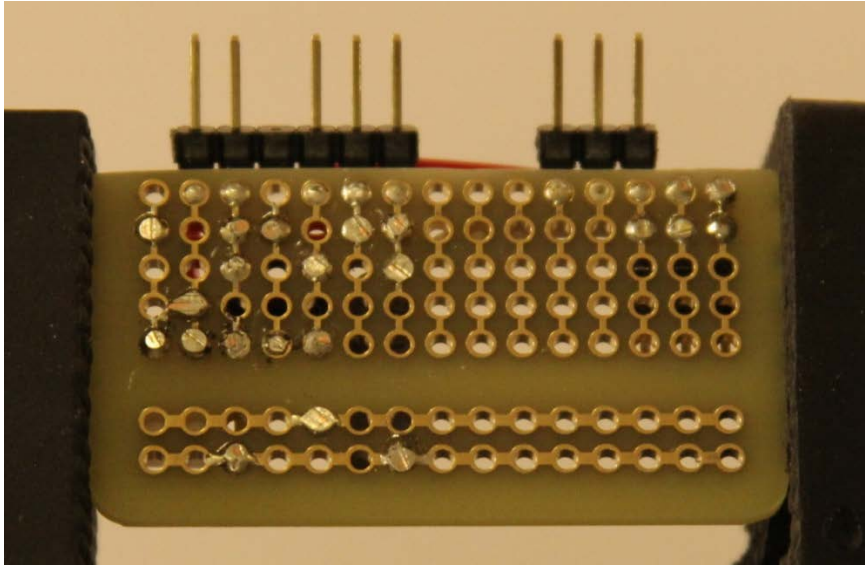
32. Position it on circuit board as shown.



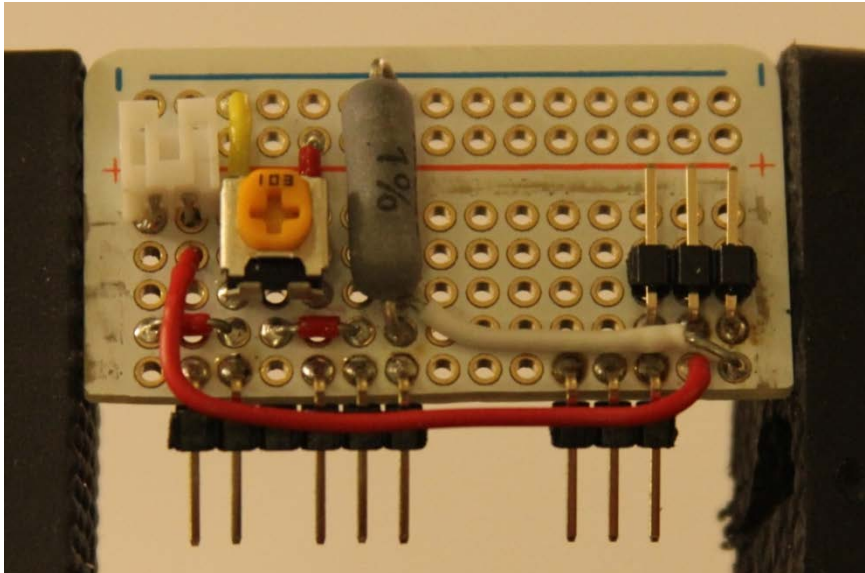
33. With resistor in place, flip circuit board over and bend wire leads to secure for soldering.



34. Solder resistor in position. Clip off excess wires.



35. Check that all protruding wires and pin have been clipped. Check all solder joints.



36. Flip board over and again check all solder joints. Also ensure that all components are positioned correctly.

FINISHED! ... with the build. Circuit board will still need to be tested.