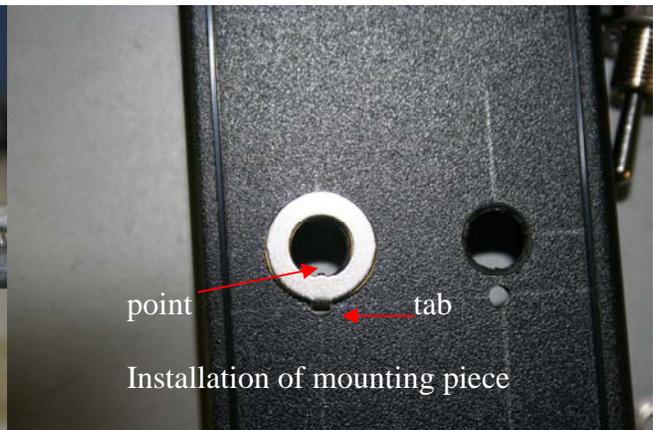


Instructions for building wired remote controls:

Take a minute to open up the remote control that was pre-built for you by removing the screw from the back of the remote case. Look at the way everything is connected inside. This will help you to understand the instructions better. You can leave it open as a reference to look at as you're building your remotes if you wish.

1. First, install the switches. Screw the first nut down to the bottom of the switches, and place the washer on top of the nut. Push the switches through the large holes in the front of the black case (from the inside). Place the top mounting piece on the switch, aligning the groove in the switch with the little point on the mounting piece. Make sure the tab on the mounting piece is facing towards the case, and goes into the smaller hole on the case. This will prevent the switches from turning while they are mounted. Then, screw the remaining nut onto the switch and tighten.



2. For the next parts, a vise or someone to hold the case will help greatly. Turn the front of the case over so that you can work with the solder lugs on the switches. Now, take one of your diodes, and hold one of the leads across the middle terminals of both switches. Cut just enough of the lead off so that it will reach across both middle terminals (if you're uncomfortable cutting your diode leads, a piece of paper clip or similar metal will also work).

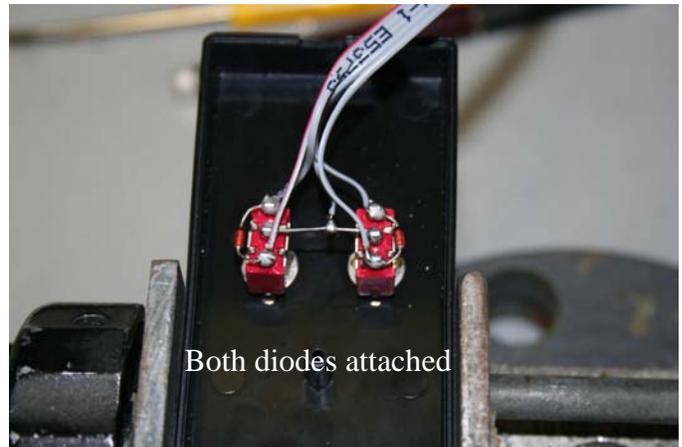
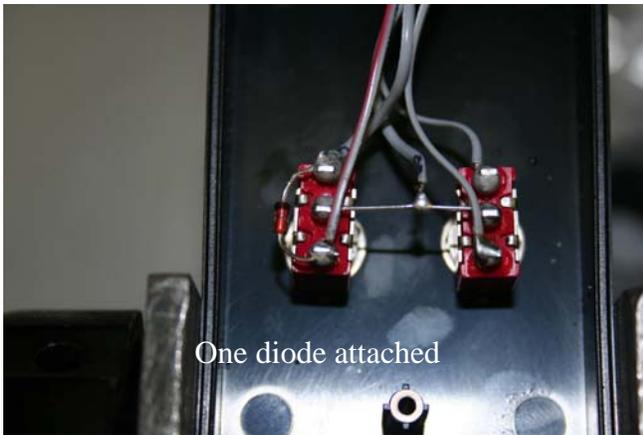
- Heat the middle terminals up with the soldering iron, making a large blob of solder on each one. Usually, making large blobs of solder is bad, but here it is necessary. Once large blobs are on the middle terminals, hold the piece of metal you cut with needlenose pliers, and sink one side of it into one of the blobs while heating the blob. Hold it there while the solder hardens (this could take a few seconds, due to the mass of molten metal). Repeat with the other side. Now you should have a bar of metal stretching between the middle terminals of the switches.



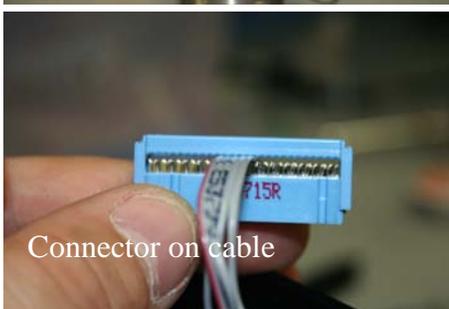
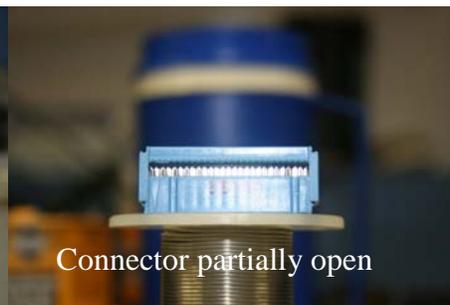
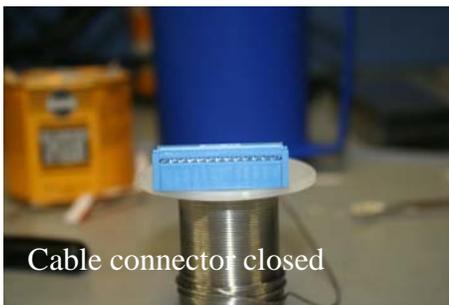
- Take the ribbon cable and separate the 5 wire ends so that you have about 2" of wires coming off the main solid cable on both sides. Strip the insulation off each wire tip about 1/4" down. Tin each of the ends with solder lightly. Choose one side of the cable to be the right side, and mark it with a marker at both ends. (Some of the cables will have a red wire on one side, which will also work.)
- Solder the middle wire of one end of the cable to the middle of the metal piece you attached earlier, making sure that the marked side of the cable is facing left (it will be facing right once the remote is turned over). Then, insert the innermost wire ends into the top terminals (the switches are closer to the top of the case) and solder, leaving a big blob of solder (you'll see why in a minute). Repeat with the outermost wires on the bottom terminals. Try to keep the wires towards the center of the case, so they won't get in the way for the next step.



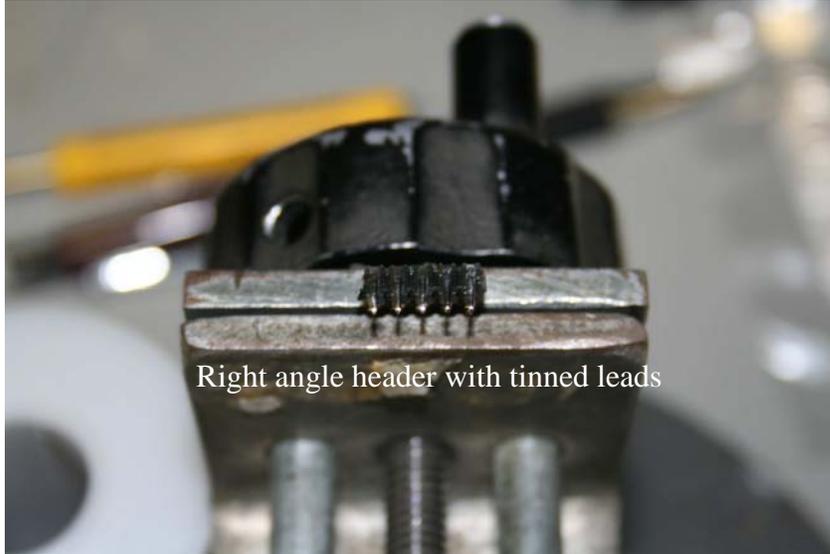
6. Here's the tricky part: you're going to solder a diode across the top and bottom terminals of each switch, with the black line on the diodes facing the top of the case. Holding the diode with needlenose pliers, heat the top terminal's solder blob and sink the diode lead (making sure the black line is facing up) into the blob about 1/4" to 1/2" away from the diode. Make sure to hold it there for a few seconds while the solder cools. Repeat with the bottom lead of the diode and the bottom terminal. Be careful that no metal from the diodes touch the middle terminals and that you don't burn the wire insulation accidentally. You can cut the diode leads beforehand if you feel comfortable, or cut the excess off when you are finished, making sure that you don't accidentally cut the wires.



7. Now, take the ribbon cable connector, and gently remove the top of it. Place the ribbon cable towards the middle of the connector and replace the top. Make sure that the cable has some slack between where the connector bumps into the top of the case, and where you soldered it onto the switches, because this connector is going to function as a "strain relief". This will ensure that the wires don't rip loose from the switches when you are using the remote. When you have the connector positioned where you want it, and the wires are aligned with the little grooves in the connector, you are going to squeeze the top and bottom of the connector together with pliers. What this does is to insert little "knives" of metal through the wire insulation, and would normally be used to connect devices to the wires without having to strip them.



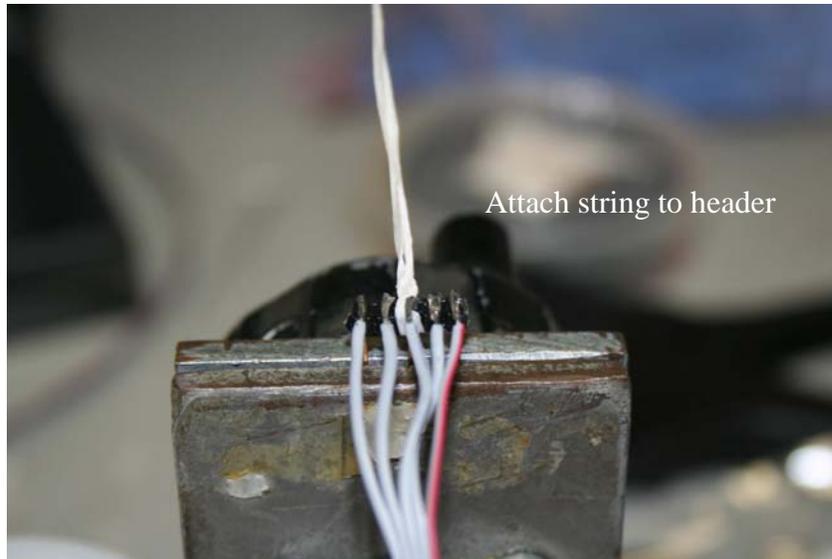
8. You can screw on the back of your remote case, making sure that the cable feeds through the slot at the top of the case. You will now move to the connector at the other end of the cable. Snap off a piece of right-angle male header containing 5 pins, and place it in your helping-hand device or into a breadboard, leaving the bent side of the pins exposed, and bent towards you. Tin each of the bent ends of the header with solder.
- 9.



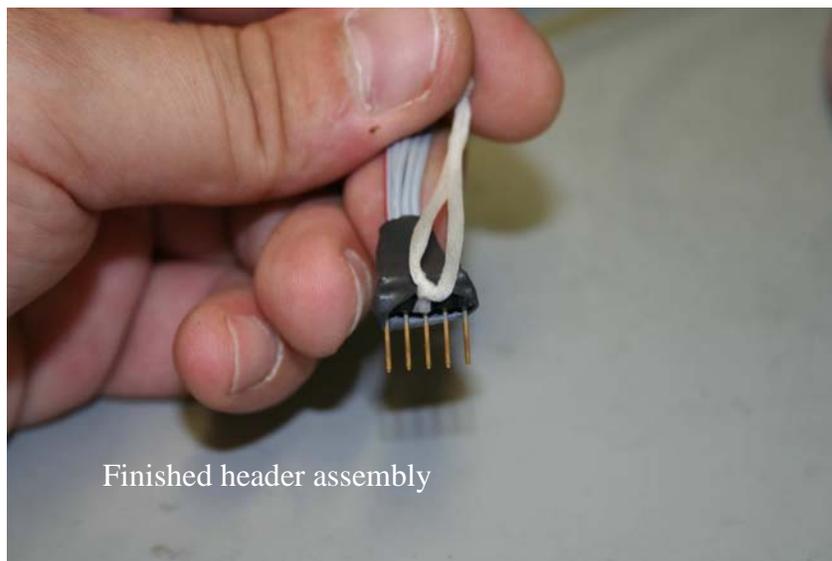
10. Place the piece of heat shrink tubing over the ribbon cable and slide it down a ways, so that you don't accidentally shrink it yet. Then solder each of the wire ends of the cable that you stripped earlier to each of the header ends, starting from the right side you marked and moving left in the order that the ribbon cable wires go. Make sure that you don't short a wire to another header, and that the connections are firm.



11. Take a piece of string and tie it around the middle of the header. The best way to do this is to run it between the second and third pin on the bottom, and then double knot it between the third and fourth pin at the top, although you can just tie it on either side of the middle pin if that's easier. The string is used to pull the remote out of the breadboard, so as not to damage the header connections.



12. Finally, take the piece of shrink tubing and slide it over the connections you made on the header. You can use your soldering iron to shrink it, or a hair dryer on its hottest setting should also work. Your remote should be completed at this point.



Test the remote's function on a Tekbot. If it doesn't work correctly, here are some things to look for: bad connections on the headers; diodes upside down or not connected well; strain relief connector crooked; wires broken off from the terminals or the center metal bar.