

## Assembly Instructions for the Continuity Tester Project (PICAXE Primer, Nuts & Volts Magazine, August 2014)

Read through the following list of assembly instructions to be sure you understand the entire procedure before beginning to assemble the board. You may find it easier to refer to the full-size layout as you carry out the following instructions:

- ❑ Cut & sand a piece of stripboard to size (6 traces with 21 holes each).
- ❑ Sever the traces on the bottom of the board as indicated in the layout.
- ❑ Clean the bottom of the board with a plastic abrasive pad.
- ❑ Install all the jumpers on the top of the board, **except the two that will later be installed across the top of the two banana jack tabs** (i.e., the jumpers in columns A and U), solder them in place, and snip the excess leads.
- ❑ Solder the four resistors in place, and snip all excess leads.
- ❑ Sand trace 6 a little at a time, until it fits snugly into the bottom position in the holder. (Again, be careful not to sand through the three leads that are soldered into row 6.)
- ❑ Insert the by-pass capacitor at locations O1 & P1, bend the lead on the bottom of the board from P1 to P2, and snip it so that it does not extend past row 2. Solder the leads at O1, P1, and P2, and snip the excess lead at O1.
- ❑ Solder the 8-pin machined IC socket in place.
- ❑ Observing the correct polarity, solder the LED in place, and snip its leads.
- ❑ Solder the CPC1002N stripboard in place, and snip the excess pin length.
- ❑ Solder the piezo in place, and snip the excess leads.
- ❑ **Do not yet solder the two 2-pin female headers in place.**
- ❑ Insert an 08M2 into the IC socket, and then insert the switch.
- ❑ See if it feels comfortable to press the switch, or if the switch seems too low to reach. If it does seem too low, snap off a two-pin male header, pull out both pins, and insert the black plastic piece onto the switch's pins, so that the switch is about 0.1" taller.
- ❑ Solder the switch in place, and snip the excess leads.
- ❑ Sand or file the bottom of the stripboard, so that it will sit as low as possible in the battery header.
- ❑ Clean the flux from the bottom of the board and allow it to dry.
- ❑ Inspect the board for accidental solder connections or other problems.

Now we get to the part that I didn't think of until I had finished struggling with my banana jacks! We're going to prepare each banana jack tab so that it can be soldered to the top of the stripboard, with its larger hole in line with the hole in the side of the battery holder.

- ❑ Place the stripboard in the lowest battery slot, making sure that it sits as low as it can, and that it's reasonably level.
- ❑ Straighten one of the metal tabs that comes with the banana jacks, insert its narrower end between the left edge of the stripboard and the edge of the battery holder, so that the end of the tab passes through the slot in the bottom of the holder at that point.
- ❑ Adjust the tab so that the hole at its top lines up with the hole you drilled in the holder.
- ❑ Insert the small bolt of one of the banana jacks through the hole and temporarily finger-tighten the nut so the metal tab is held firmly against the side of the holder.
- ❑ Make sure the metal tab is positioned at a right angle relative to the top of the stripboard, and draw a line across the tab where it passes the edge of the stripboard.
- ❑ Remove the banana jack and the tab from the battery box.
- ❑ Make a right-angle bend in the tab by using a pair of needle-nose pliers to grab it so that the pliers are holding the narrower end of the tab, with one edge of the pliers lined up with the line you just drew, and very slightly overlapping it. Bend the tab at a right angle in line with the edge of the pliers.
- ❑ Snip the tab on its narrow end, 0.1" away from the bend, and parallel to it. You should end up with an L-shaped tab, with the wider portion and the larger hole on the long side of the "L," and a 0.1" narrower portion on the shorter side of the "L."
- ❑ Now repeat the above sequence of instructions, so that you end up with two identically shaped tabs.

At this point, we're ready to solder the tabs to the stripboard.

- ❑ Cut and bend two pieces of bare jumper wire (one for the A2 to A5 jumper, and the other for the U2 to U5 jumper. Make sure to allow enough extra length for the jumper wires to be extended on the bottom of the board (one from A2 to A3, and the other from U5 to U4).
- ❑ Insert each jumper wire into the stripboard, and bend and snip each one as shown in the layout.
- ❑ Solder the two jumper wires in place (one at A2, A3, & A5, and the other at U2, U4, and U5).

- ❑ If necessary, sand the solder joints so that the board still sits level in the slot of the battery holder.
- ❑ Slide the 0.1" section of each L-shaped tab under each of the two jumpers. Line up the long section of the tab on the left with the left edge of the board, and the long section of the tab on the right with the right edge of the board.
- ❑ Insert the stripboard (with the two tabs) back into the battery holder, and make sure that you can insert the small banana jack bolt into each pair of holes. If necessary, adjust the bend in the tabs, and/or **slightly** enlarge the holes in the holder or tabs so that everything fits together properly.
- ❑ Carefully remove the stripboard/tab assembly (so that the tabs do not shift position), and solder each jumper wire to the tab underneath.
- ❑ Solder the two 2-pin female headers as shown in the layout. If the tabs are slightly higher than the headers, you may need to support the headers as you solder them in place. If necessary, sand the solder joints so that the board still sits level in the slot of the battery holder.
- ❑ **Finally!** Place the completed stripboard circuit back into the battery holder, and tighten the each banana jack to one of the tabs. (Polarity doesn't matter, but you may want to place the red jack on the left to remind yourself that the female header on that side is the power connection.) You will need to shorten the small bolt on the right side, so that it fits in the space between the side of the battery holder and the edge of the piezo. One way to do that is to insert the black banana jack into the left side of the holder, tighten the nut, and mark the bolt at the edge of the nut. Then, disassemble the jack, cut the bolt (I used a Dremel tool and cut-off wheel.), file the cut end (if necessary), and then install the black jack on the right side of the battery holder. The bolt on the red jack does not need to be shortened, but if you're like me, you will have to do that anyway! ☺

As I mentioned earlier, it's a good idea to tin the ends of the two battery connection wires (+V on the left, and ground on the right) before inserting them into the holder. Also, if the wire on the left side isn't long enough, you will need to extend it slightly. If the 08M2 is still in the IC socket, remove it before you insert the three AA-cells into the battery holder (observing the correct polarity, which is embossed on the bottom of each slot). Then use a multi-meter to check that power is connected to the female header on the left side, and ground to the female header on the right side.

Insert the pre-programmed 08M2 into the IC socket, attach a set of probes to the banana jacks, and press the pushbutton switch. The LED should begin to blink occasionally, and the piezo should beep whenever you touch to two probe tips together; if not, have fun troubleshooting! ☺