

## How To: Arduino Assembly Pt. 2 – Breadboard McDannald Lab

### MATERIALS:

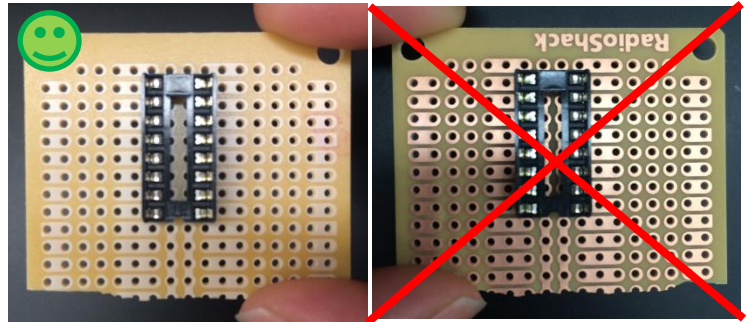
- Half a bread-board
- Assorted Jumper Wire Kit
- 2.2K Resistors (4)
- Opto-isolator and Housing
- 8 pointed crimp pins
- 4 plastic molex housings

1. Obtain half a breadboard. If halves are not pre-cut, split the

board using strong clippers such as the red ones (above) we have in the McDannald Lab. Ideally, the board will be split down the middle and each piece will have 13 rows of holes.

2. If you miss the center, just make sure you are using a board with at least 11 rows.

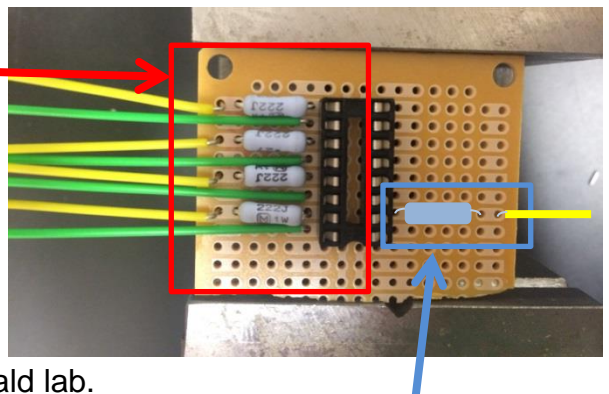
**NOTE: NO components will be soldered to the short row closest to the large holes at the end of the breadboards. This row MUST be left open.**



3. Install the opto-isolator housing first, make sure you put it on the correct side (non-metallic) of the breadboard. → Solder the pins on the metallic side, you do not need to clip them. The housing can be installed “either way”. The position of the housing must reflect that in the photo above. You want to bridge the gap between both sets of 3-hole groupings on the board by placing the pins of the housing into the inner-most hole of each of the 3-hole rows. Remember to avoid the first short row of holes.

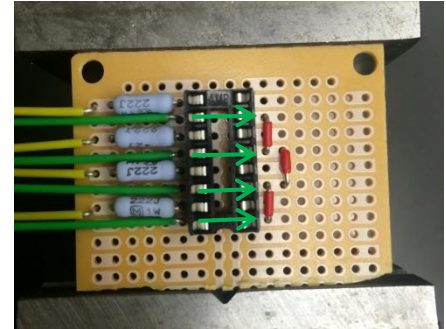
**\*NOTE: Breadboards are NOT completely symmetrical. One side has 3 rows of single dots and the other has only two. Depending on which half you use, the alignment of the parts may look slightly different on the board. The position of the parts in relation to one another is more important than which dots they occupy on the board.\***

4. Next, you can install the four 2.2K resistors and the first 4 yellow and green jumper wires. Carefully follow the layout of the picture (Inside RED box) to the right. For easy assembly, bend resistors into a staple shape and bend the leads outwards to secure them. For the jumper wire, it may help to bend the ends back to form hooks to secure them. Flip the device over, solder the wires and the resistor leads, and clip all the ends with the small green clippers in the McDannald lab.



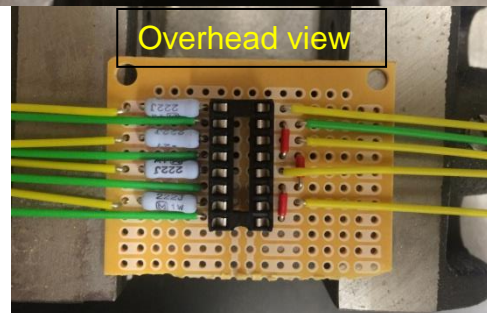
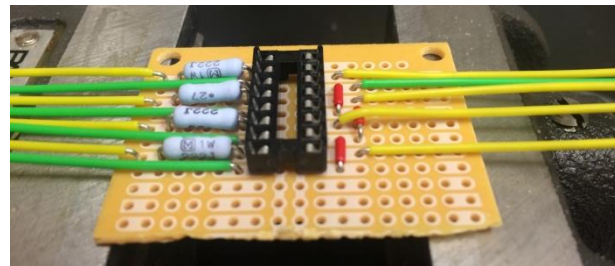
\*NOTE: If you are using the bread-board half that requires the resistors to bridge a 3 dot gap, the resistors leads will still share the outer, 2-hole grouping with yellow jumper wire and the resistor lead toward the opto-isolator housing will still occupy the hole immediately next to this housing. In other words, the staple will be slightly longer to accommodate this gap. See the *example* of how you would bridge this gap in the blue box on the photo above.\*

5. Install 3 short, red jumper wires on the opposite side of the opto-isolator housing. You want to place the ends of these wires into the rows of holes that contain the green wires you have already installed. These jumper wires are already bent into staples and will fit in easily. Flip the board over to solder the ends and then clip them.

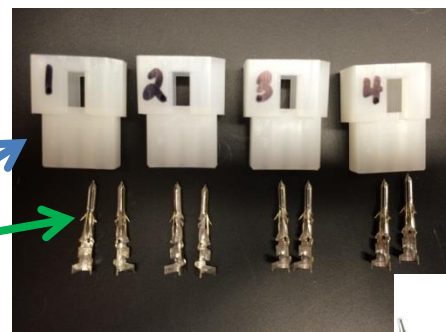
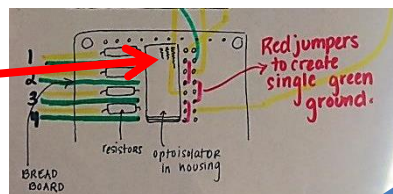
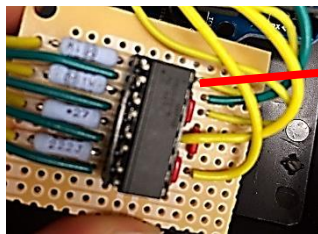


NOTE: the central red jumper wire shares a row with one end of each of the other red jumper wires. Red jumpers link the green wires to create a single ground wire which can be attached to the waveshield you assembled earlier.

6. Solder the last 4 yellow, long jumper wires into the holes directly across from the yellow wires you have already installed on the left side of the opto-isolator housing. Then solder the single green ground.
7. Plug the opto-isolator into its housing unit.



NOTE: proper orientation of the opto-isolator is required for device function. The writing on the opto-isolator must be located in the corner of the housing that is closest to the single green (ground) jumper wire output. See photo and diagram below.



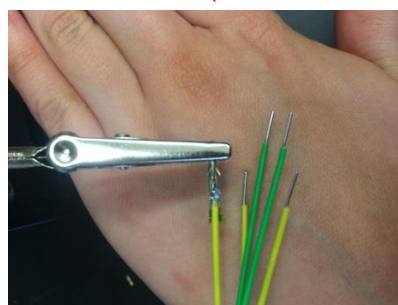
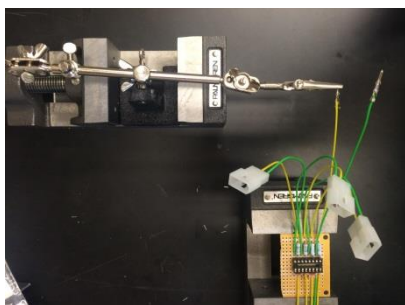
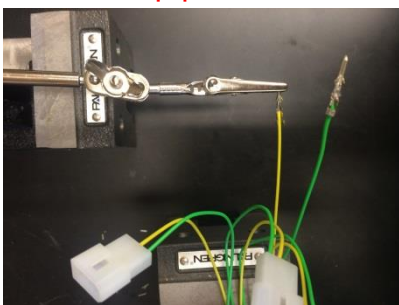
8. Next, you will need to use **8 crimp pins** and 4 **plastic molex housing units**. Label the plastic housing 1, 2, 3 and 4 with a sharpie.

9. Pinch the tip of a crimp pin in a "helping hand" alligator clip (it may help to use a drill press vise to stabilize the helping hands unit). Next, align the drill press vise holding your assembled bread board perpendicular to the helping hand unit, so you may insert the wire you plan to solder to the crimp pin.



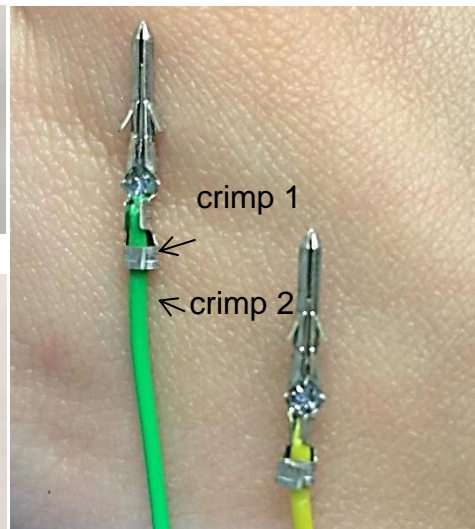
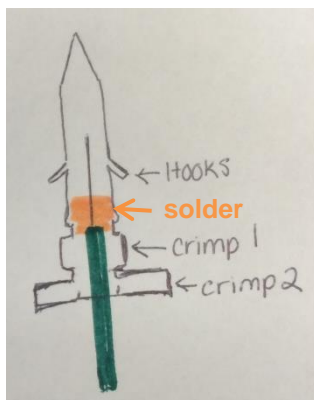


**NOTE:** crimp pins are installed on the side of the breadboard with 8 wires (4 Green & 4 Yellow)



10. Each of the 4 yellow and green wires will need a crimp pin soldered to it. Before soldering, align the wire within the crimp pin to match the diagram to the right.

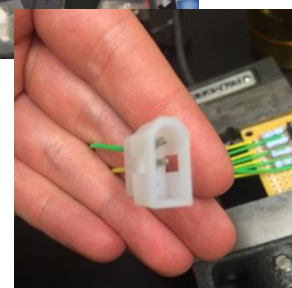
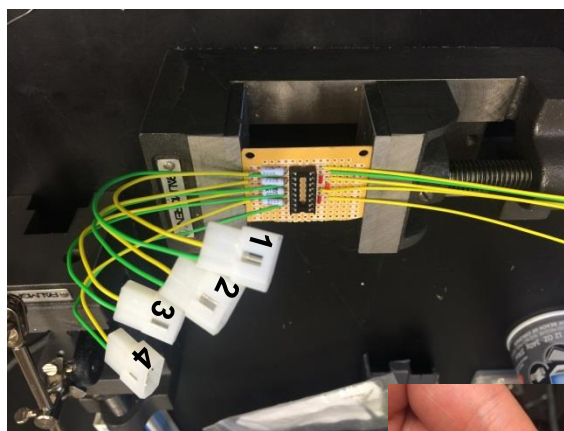
**NOTE:** The solder applied to the crimp pin should be applied in the area of orange mark on the diagram. It is important that the solder is only applied inside of the crimp pin casing. If it builds up on the outside, the crimp pin will not fit into the molex housing.



11. Once the solder is in place, you can pinch the area labeled “crimp 1” with the small green needle-nose pliers in the picture above to further secure the wire.
12. Next, you can pinch the “crimp 2” area. For this portion, you will have to wrap one Metal flap around the wire first and place the second flap on top of it so that they are overlapping. See photo on the far right.

13. Once you have installed all 8 crimp pins, Plug each pair of green and yellow wires into one of the four molex housing units. Make sure the numbers on the molex housing match the photo to the right.

**NOTE:** The green wire must be placed in the rounded side of the molex housing, the yellow wire will be immediately next to it. When inserting the crimp pins into the molex housing units, the “hooks” should click and lock the crimp pins and their wires into place.



14. Finally, you will attach the completed waveshield to the breadboard you have just assembled. The placement of the following wires is crucial to function of the device, so follow the diagram below closely and **ASK** if you have any questions. Solder each wire into place and clip the leads.

