

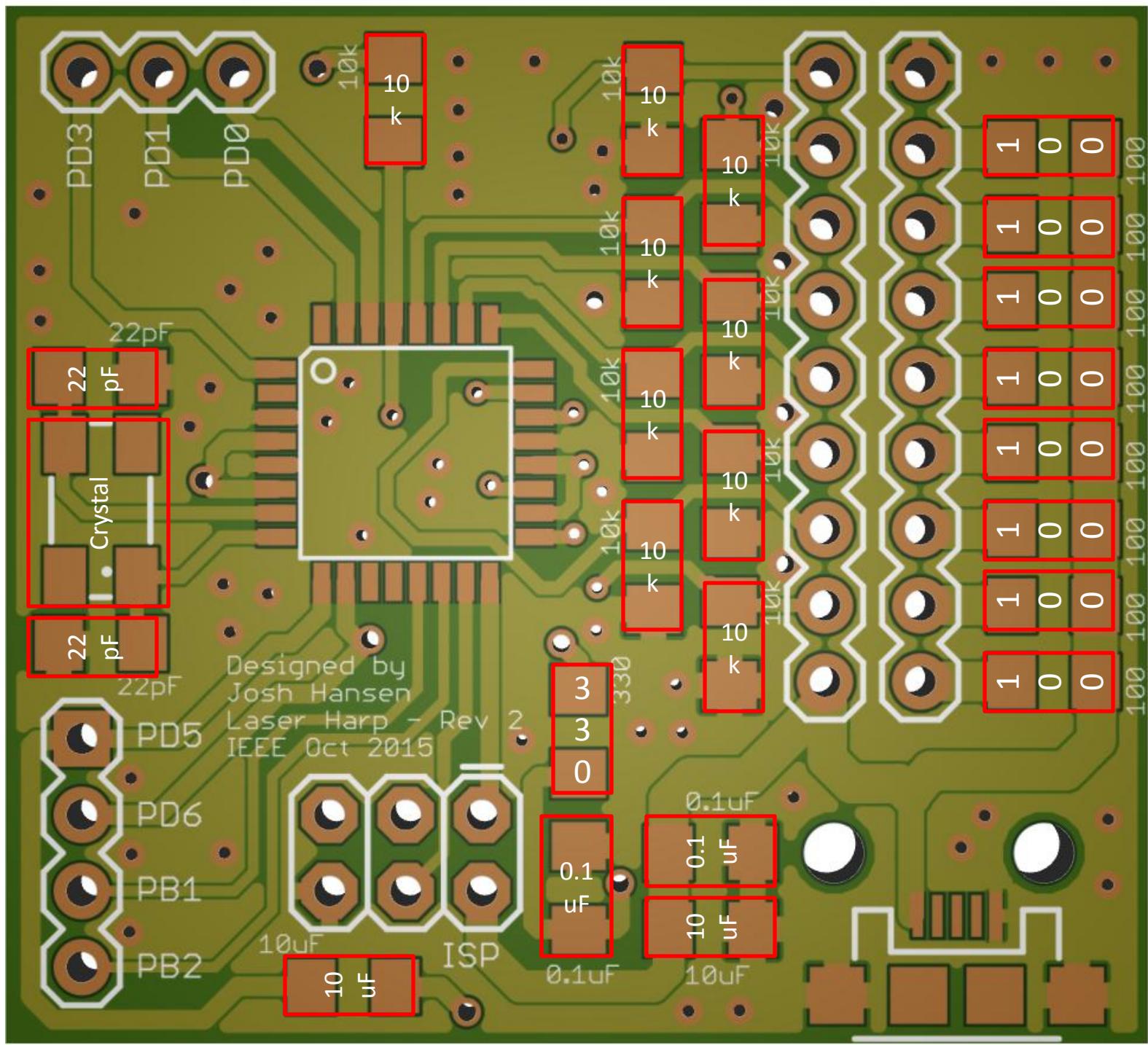
Laser Harp Build Instructions

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PKI-IEEE March 2016

- **CAUTION** – Although the lasers used in this project are very low power, they can still damage the human eye. Do not point the laser at your self or others. If you are observed doing this intentionally you will be asked to leave.
- The hot glue used in this project is easily capable of causing moderate burns to the skin. Exercise caution when using it to avoid contact between the glue and your body.

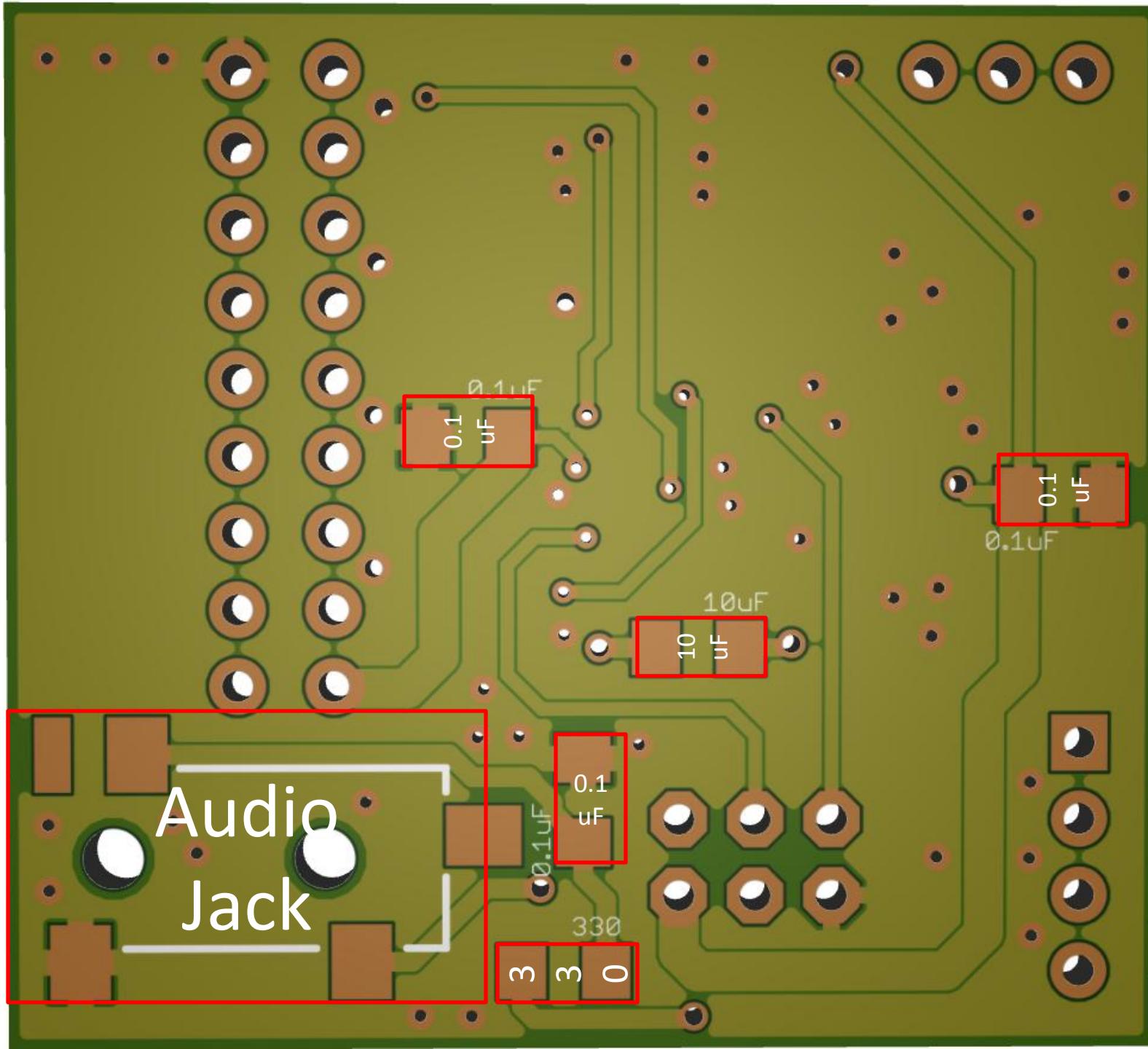
Step 1

- Take your PCB to have solder paste applied to the top.
- Carefully place the surface mount components to the front of the PCB using the guide on the following page. Be careful to not smear the solder paste and to center your components as well as you can.
- **Note** – Pay careful attention to how all of the components are placed. If you're not careful you could place them in the wrong orientation.



Step 2

- Carefully take your board to the reflow oven to be reflowed being careful to not move any of the components around during transport.
- Once your board has been reflowed, solder by hand the remaining surface mount components to the bottom of the board using the guide on the following page.

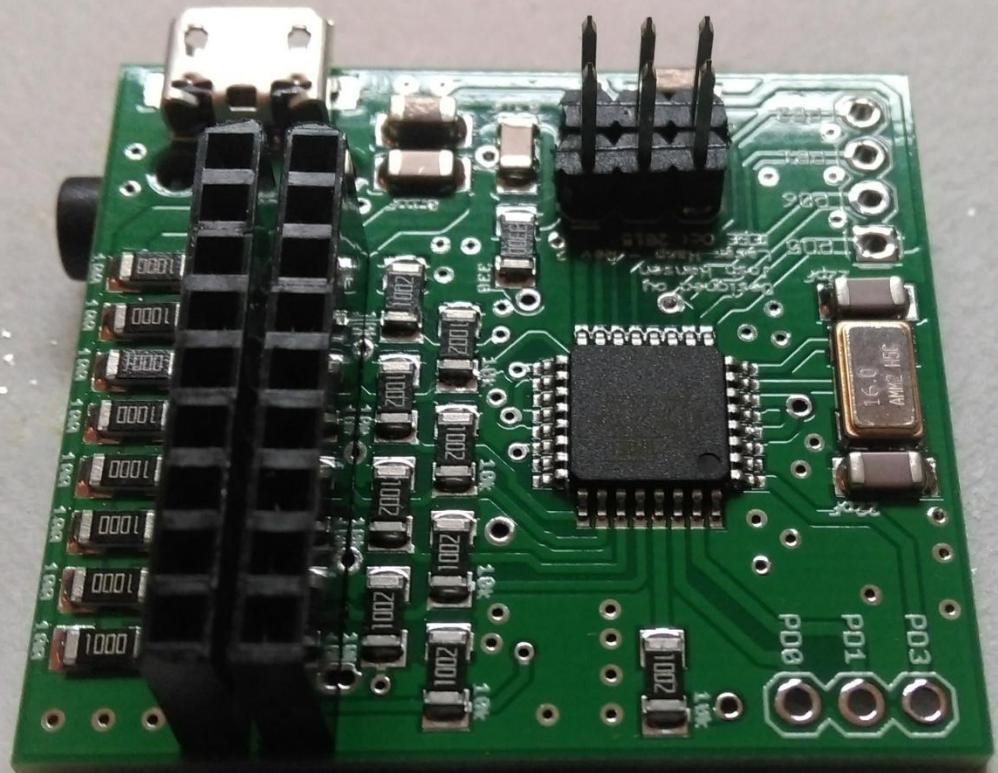


Audio
Jack

3 3 0

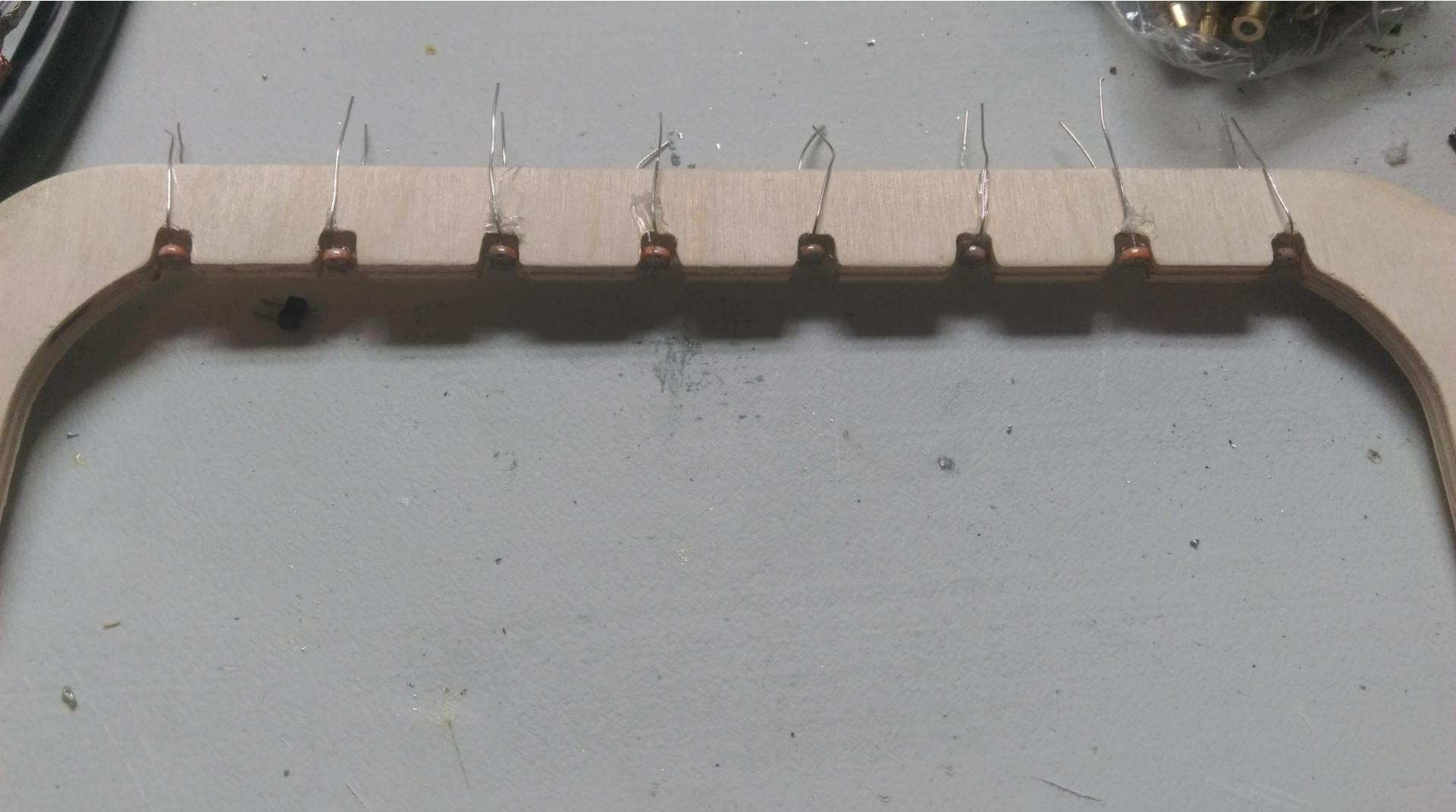
Step 3

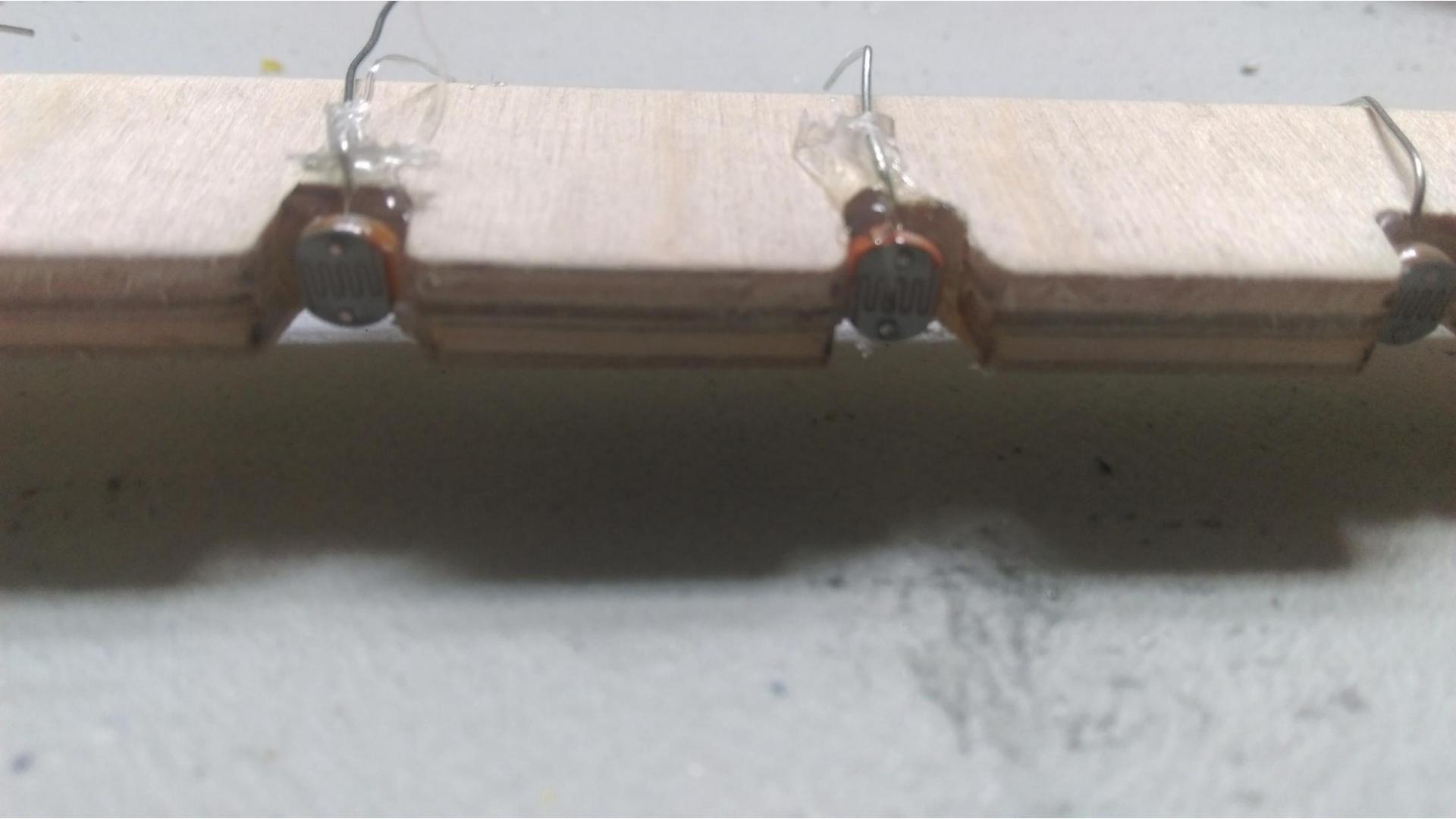
- Solder the through hole headers to the board using the image on the following page as a guide. Make sure that the longer side of the six pin header is facing up as shown.



Step 4

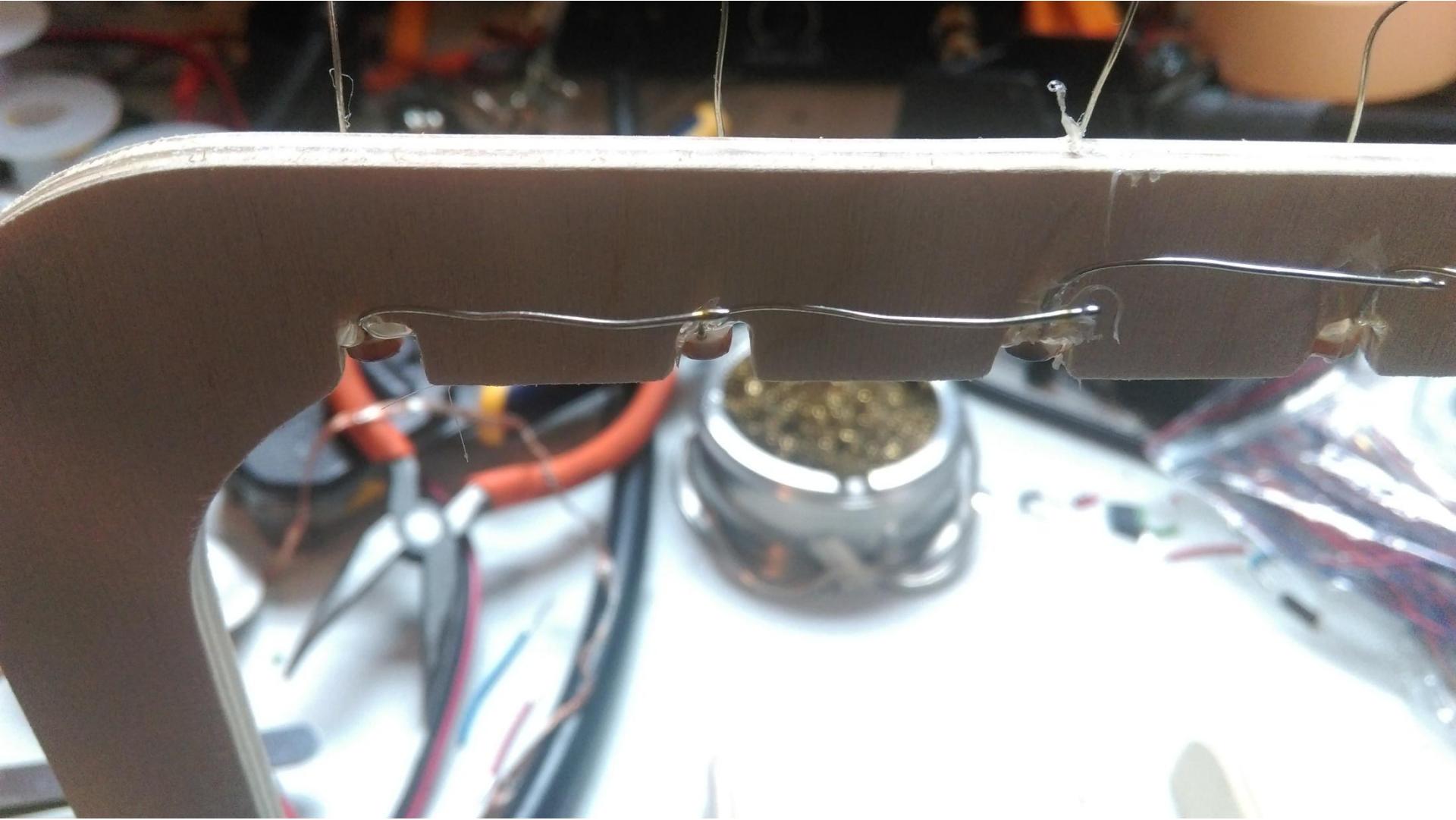
- Using hot glue, glue the eight photo resistors into place making sure that one wire protrudes from each side of the wood frame as shown in the following image.
- Be careful not to burn your self and to make sure that you don't get hot glue on the front face of the photo resistor as this will block the light from hitting the resistor.





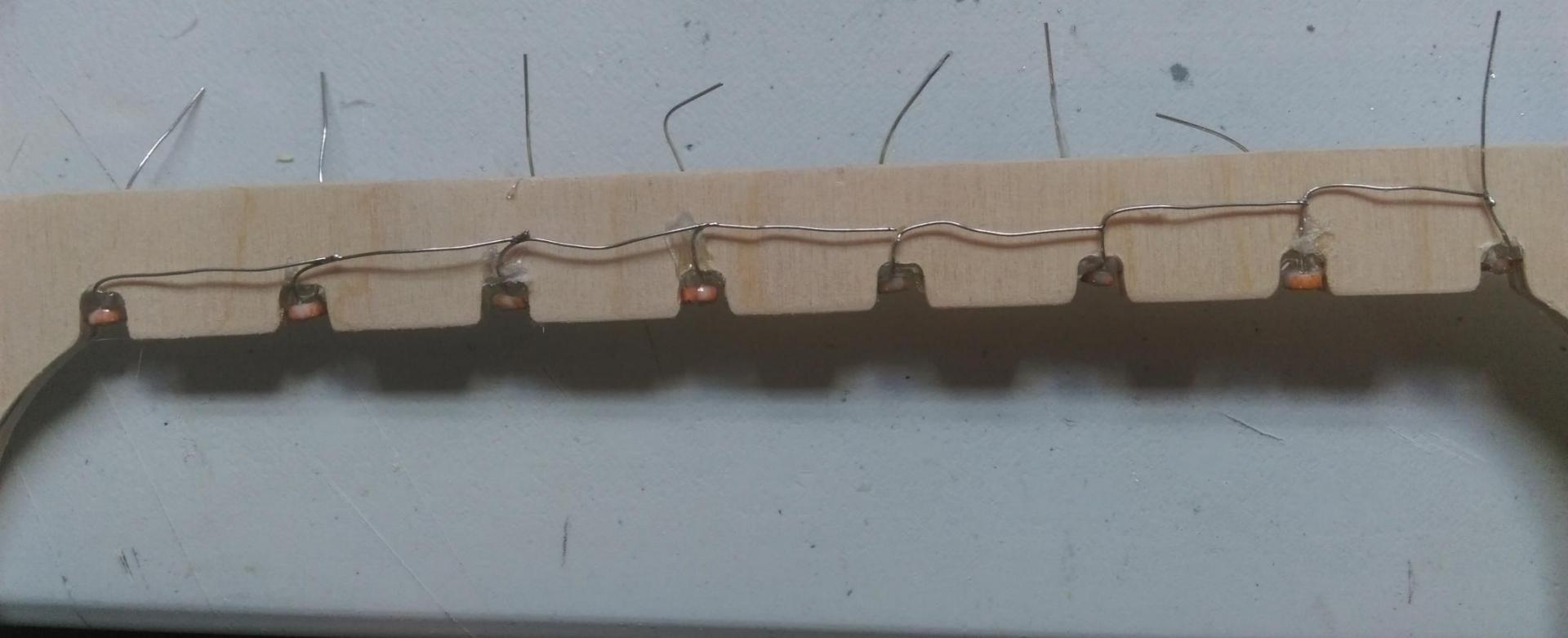
Step 5

- Apply solder to all eight ends of one side of the photo resistor leads. You don't have to have a large glob of solder on the leads, just a light coating. This processes is called tinning the wires and will be used several more times in this project.



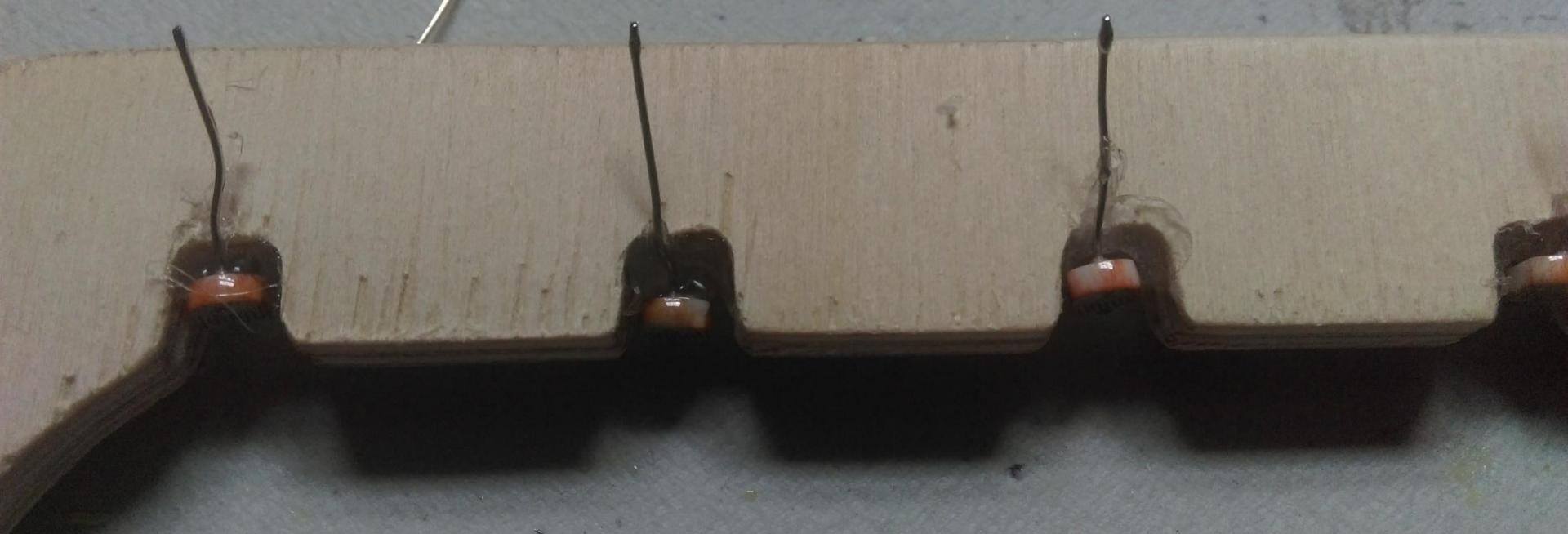
Step 6

- Carefully bend each of the previously tinned wires over so that it comes in contact with the wire next to it. Using a soldering iron heat the previously applied solder up in order to solder one photo resistor lead to the one next to it.
- When you are finished the leads from one side of the photo resistor should all be soldered together with one lead at the end remaining unsoldered.



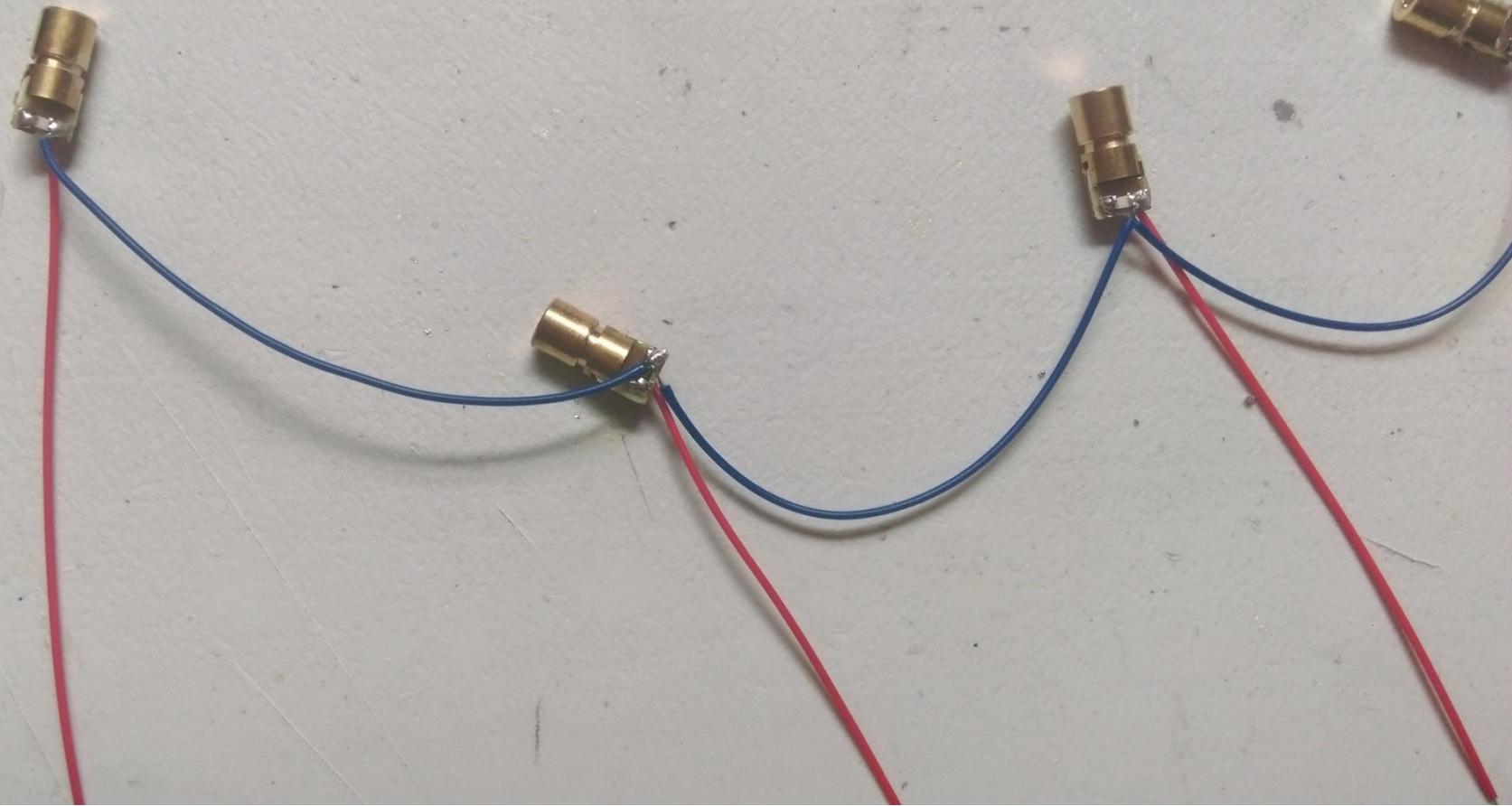
Step 7

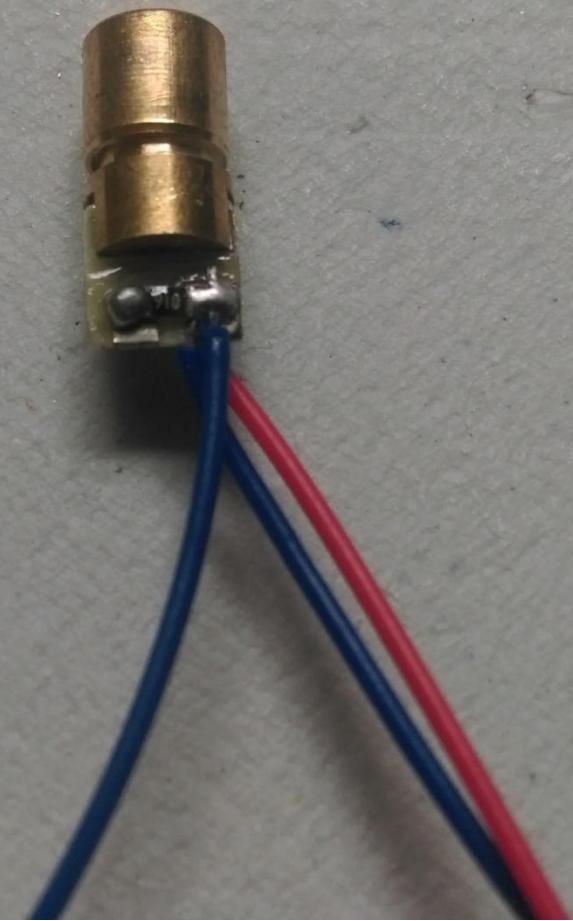
- Trim the leads on the remaining side of the photo resistor so that they are the same length as the wood frame as shown in the image.
- Once trimmed, tin these leads with solder using the same process as before.



Step 8

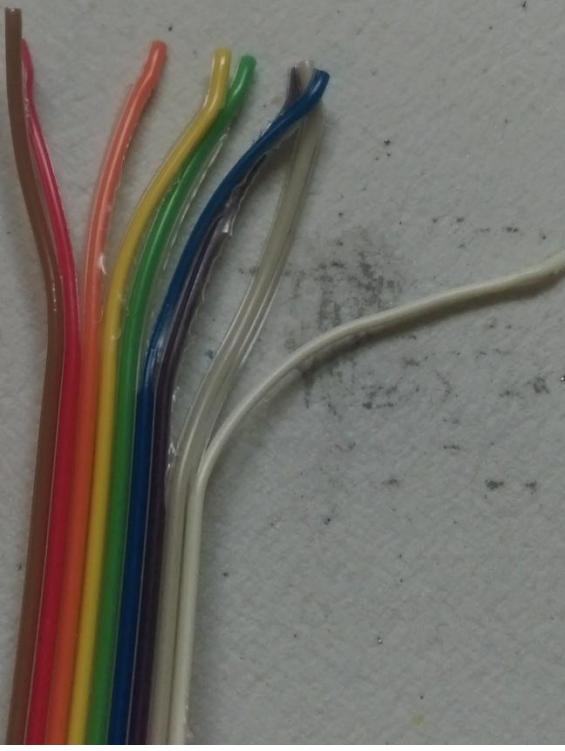
- Set the frame aside for now and get out your eight lasers.
- Daisy chain the blue wire from the lasers together by soldering the blue wire from one laser to the side of the resistor where the blue wire connects on another resistors. Continue this process until all eight lasers have their blue wires connected as shown in the images.

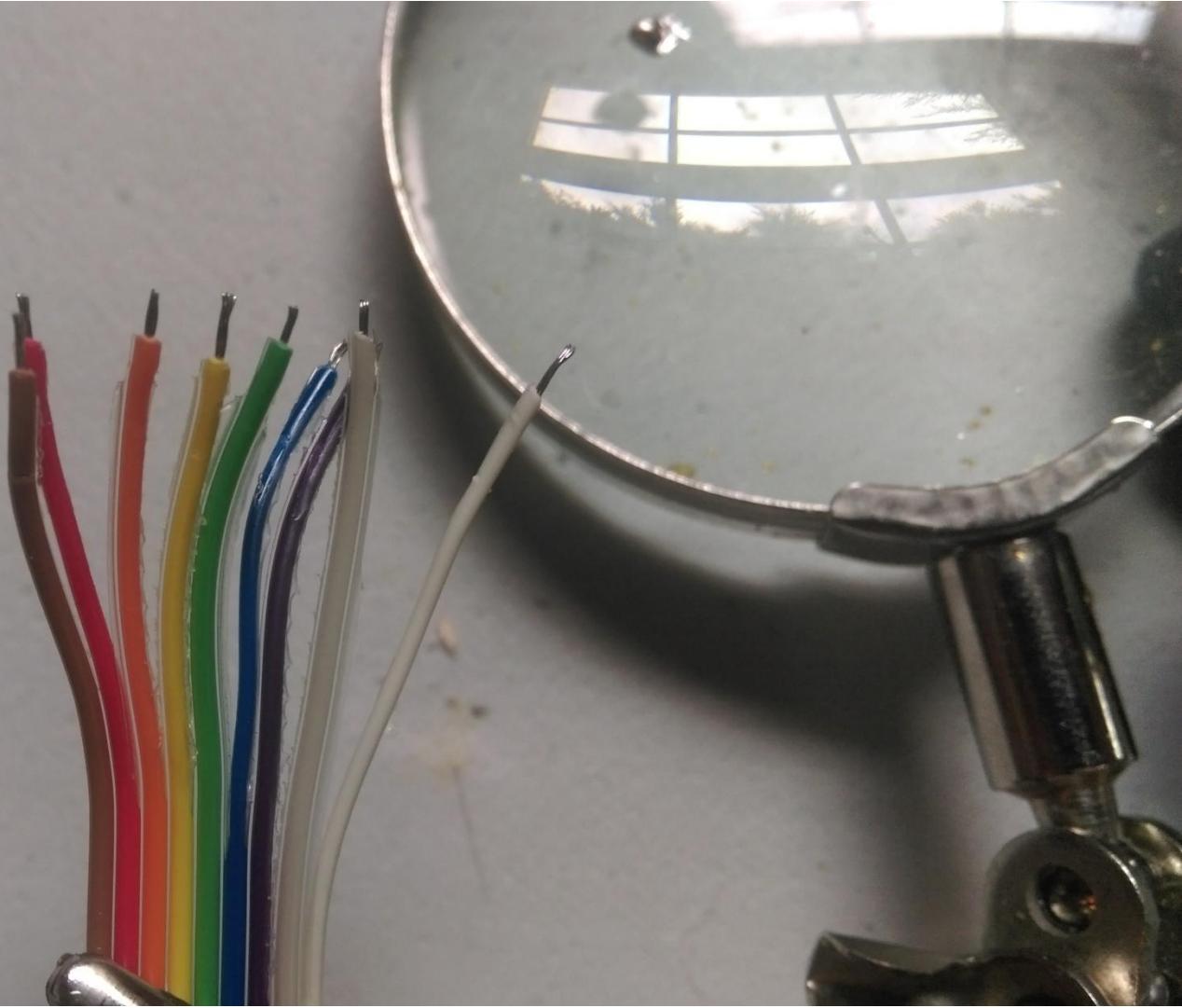




Step 9

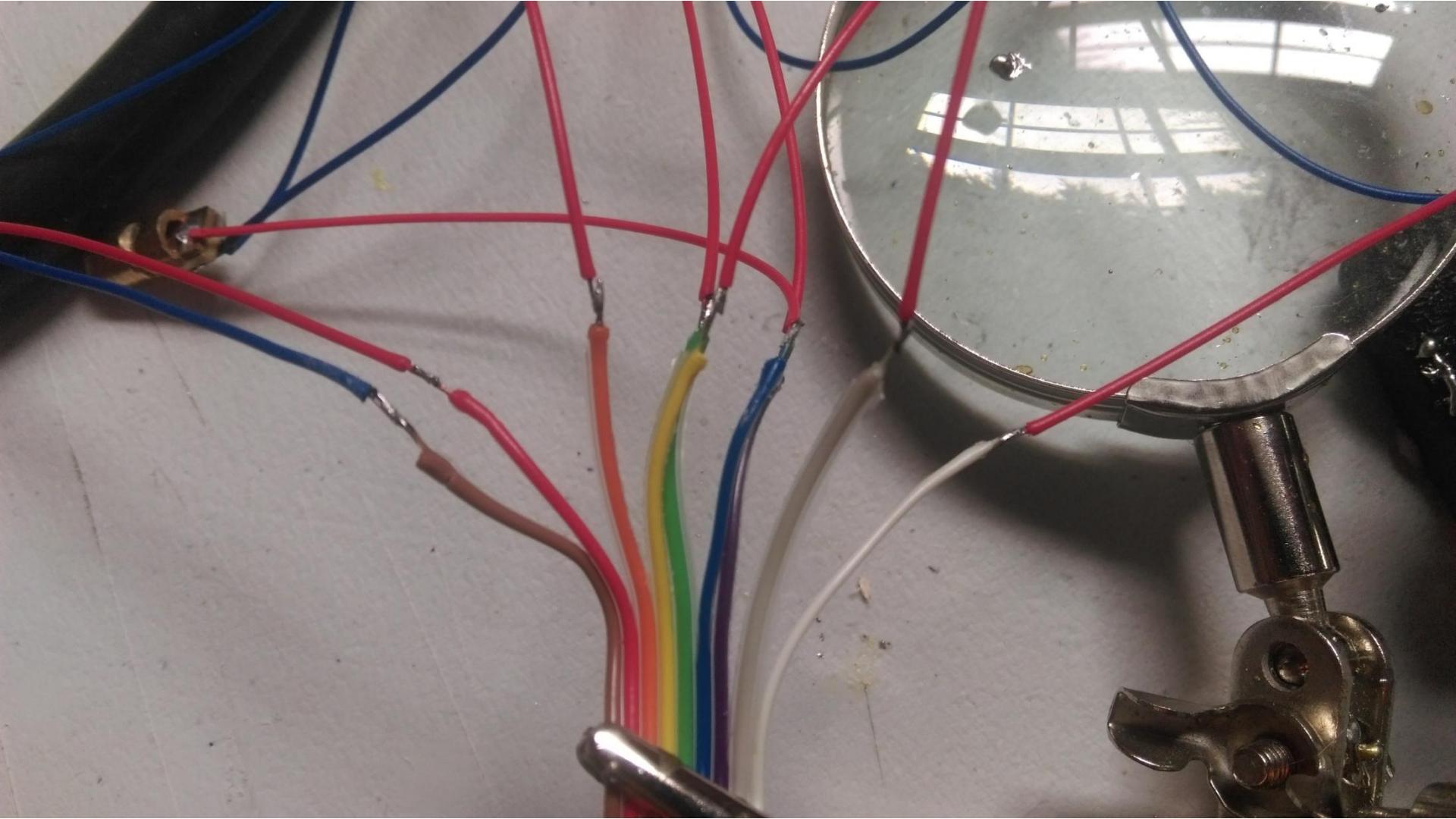
- Take the SHORT ribbon cable and separate out the nine wires on one end.
- Strip a SMALL amount of insulation off from each of the nine wires and the tin those wires by applying solder to them. Be careful not to hold the soldering iron to the wire for too long as this will cause the insulation to start to melt and expose too much of the bare wire.





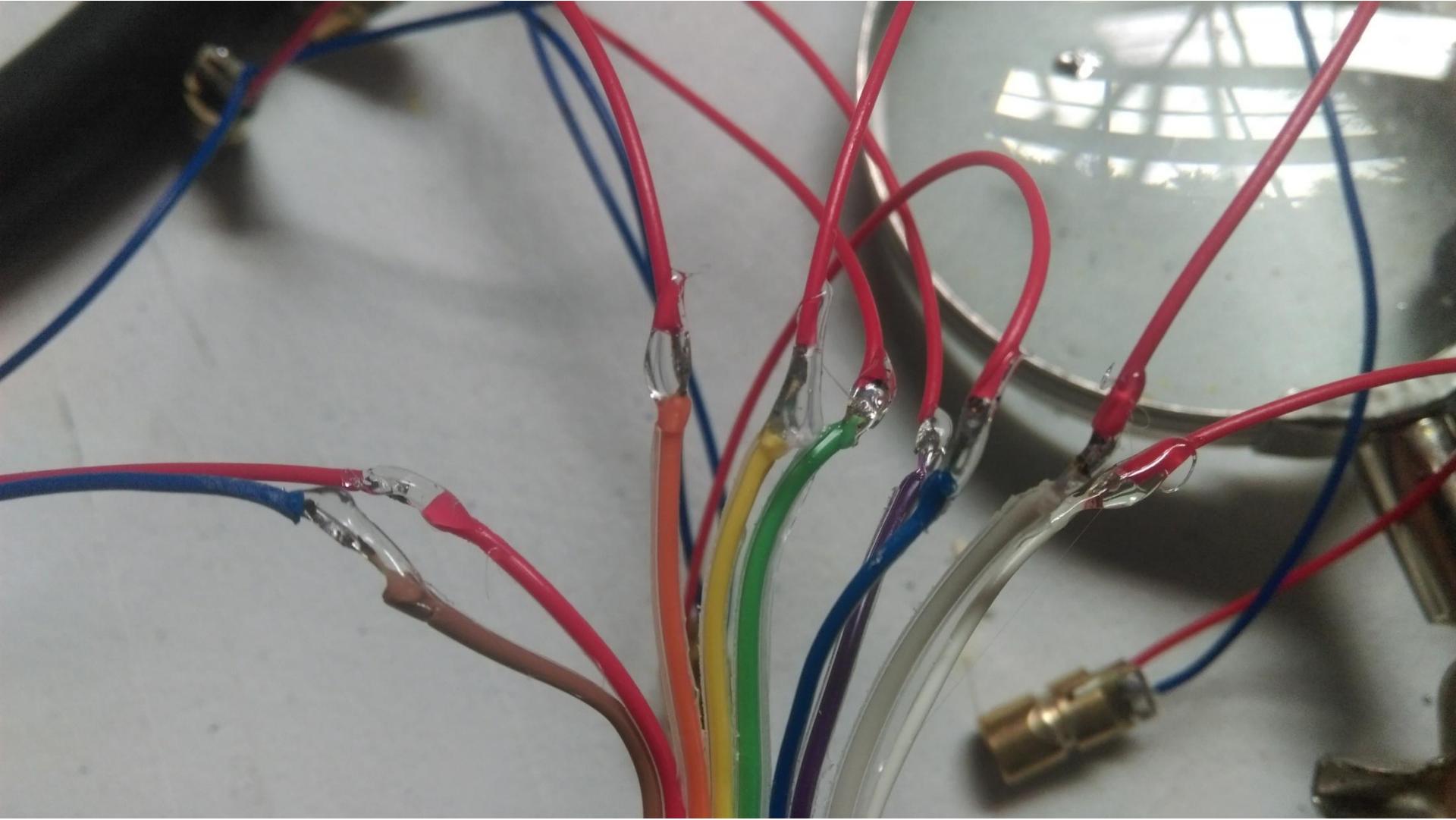
Step 10

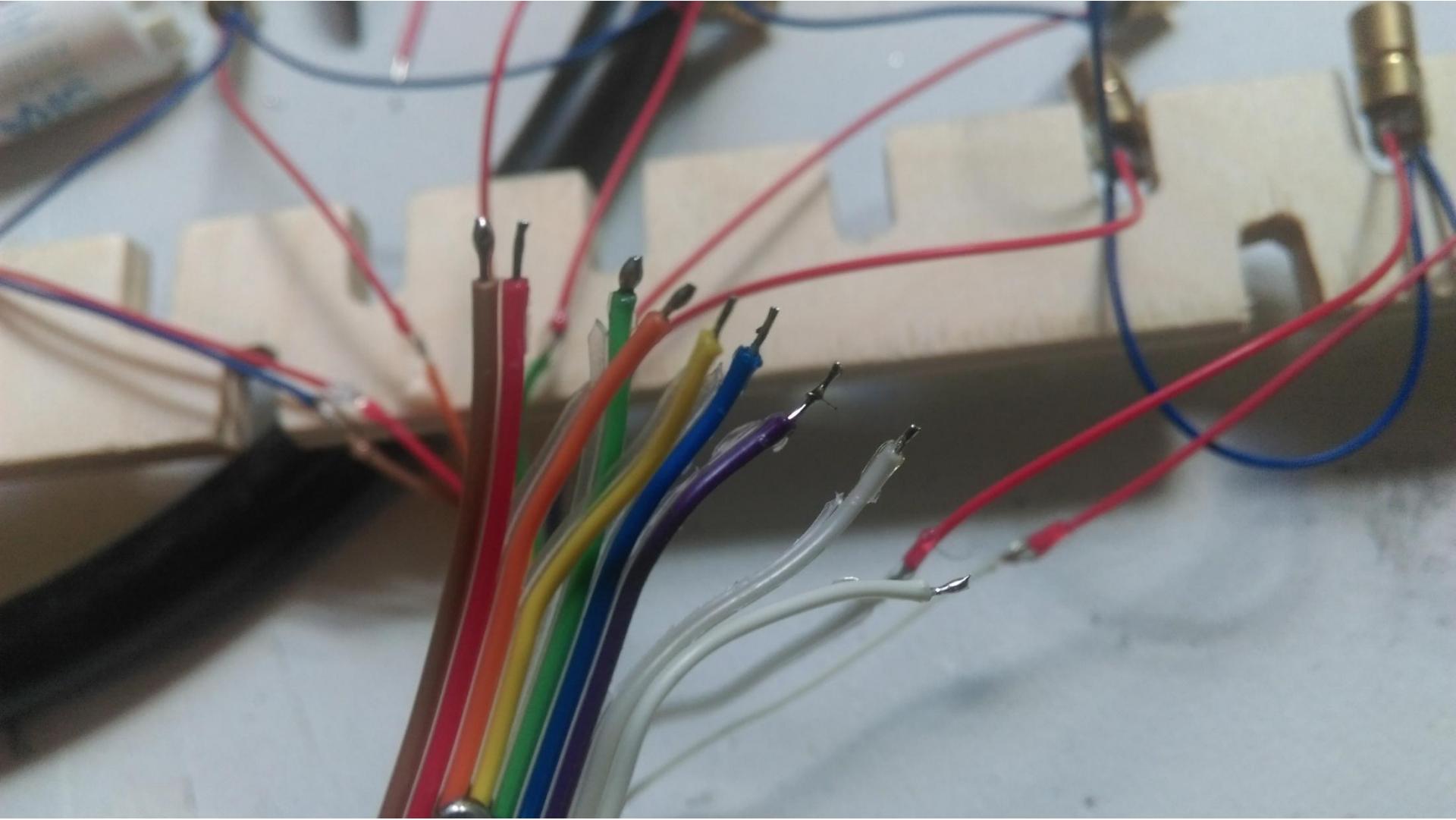
- Solder eight of the ribbon cable wires to the eight red wires of the lasers. Make sure to solder them IN THE ORDER the lasers are arranged in the chain. Because both wires have been pre-tinned soldering them together is as simple as holding them close to each other and then heating the solder on the wires up with a soldering iron
- Solder the ninth ribbon cable wire to the remaining blue laser wire. This wire should be on the end of the ribbon cable if you went in order.



Step 11

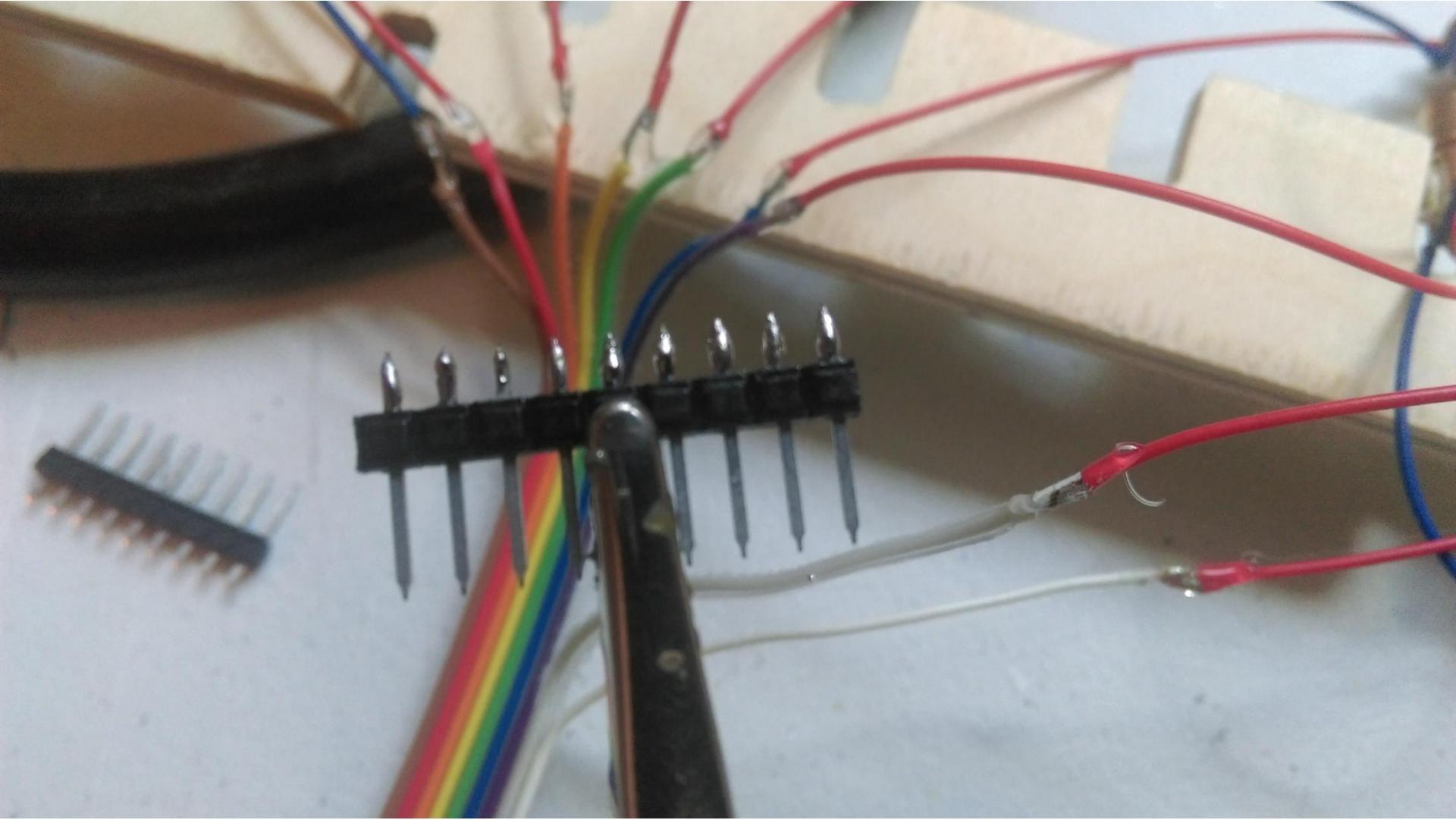
- Apply a small amount of hot glue to each of the nine wires at the point where they are soldered. This will provide insulation and keep the wires from shorting together.
- Take the other end of the ribbon cable and separate, strip, and tin the wires

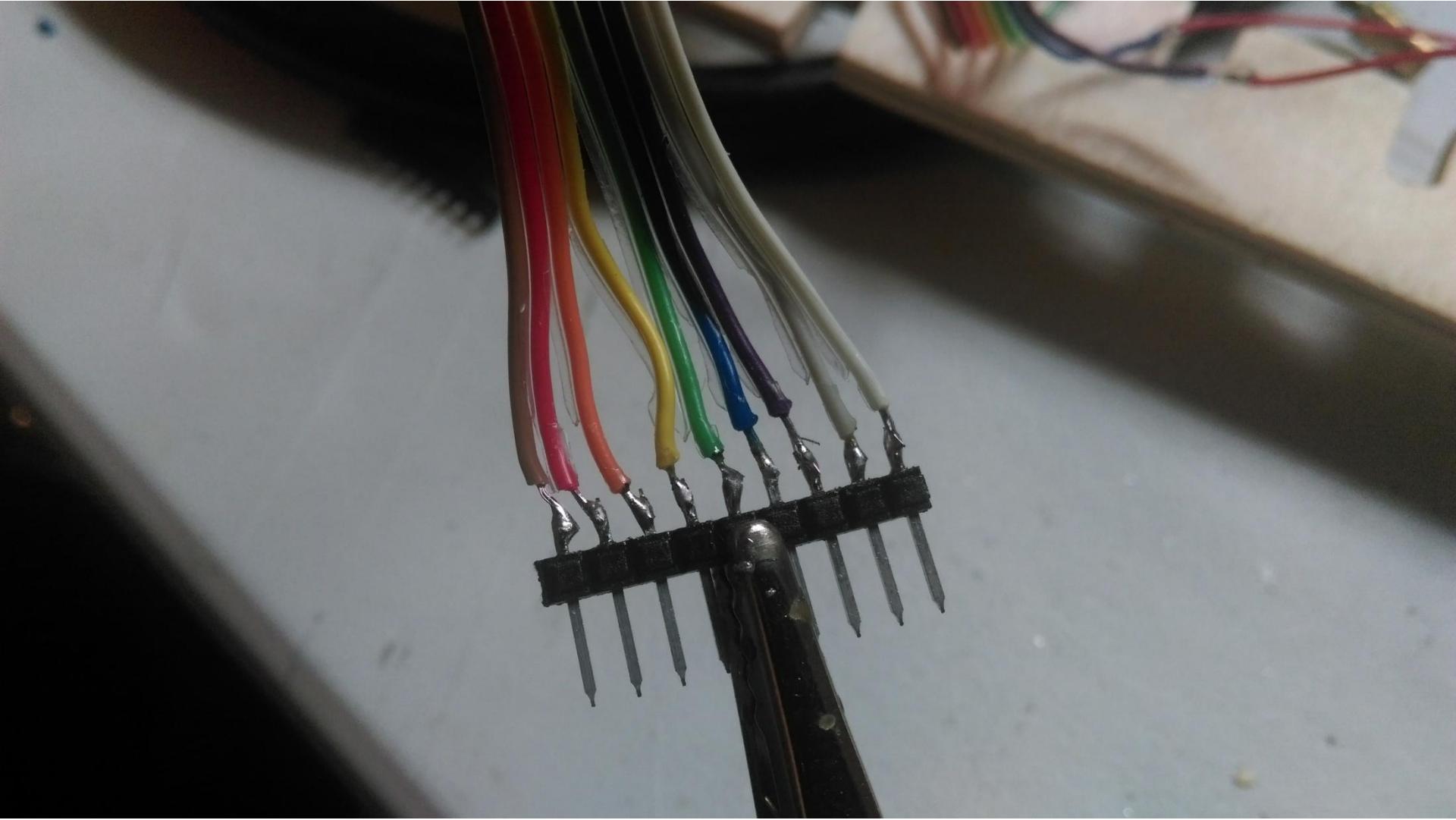


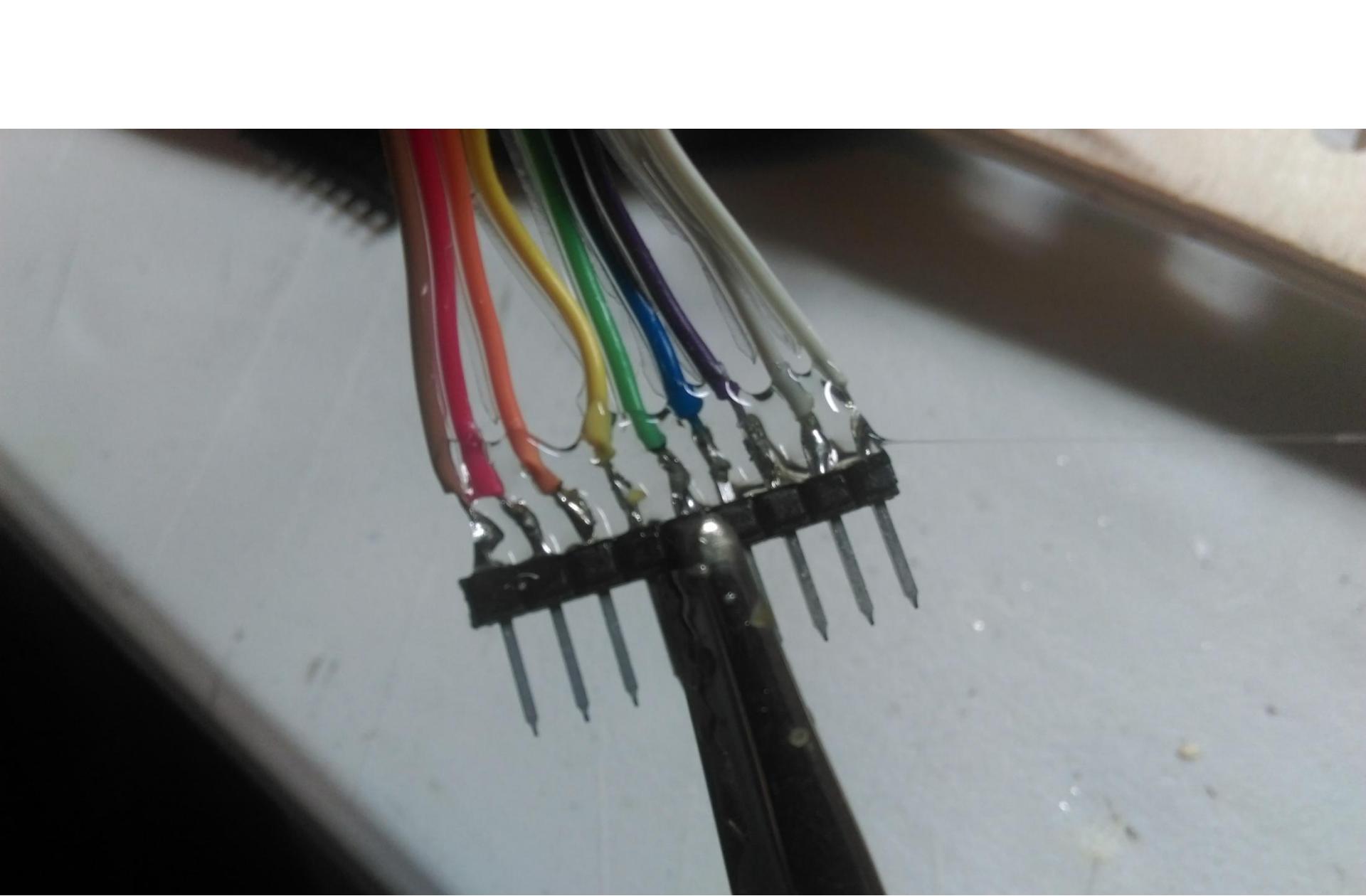


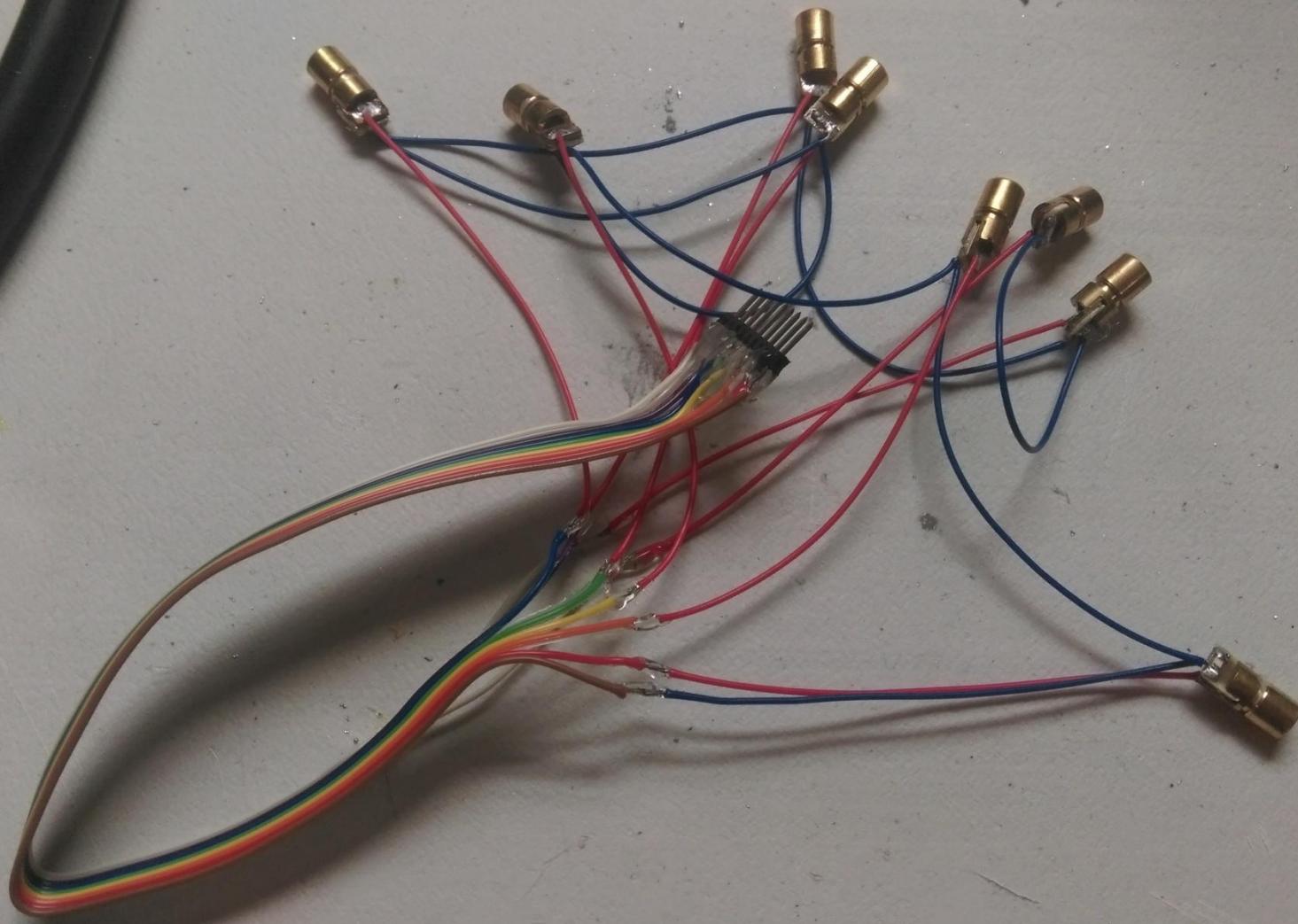
Step 12

- Take one of the 9 pin male headers and tin each of the pins on the short side
- Solder each of the nine wires from the laser ribbon cable to the short side of the 9 pin header. Make sure you solder the wires IN ORDER.
- Apply a small amount of hot glue over the soldered wires on the header to provide strength.



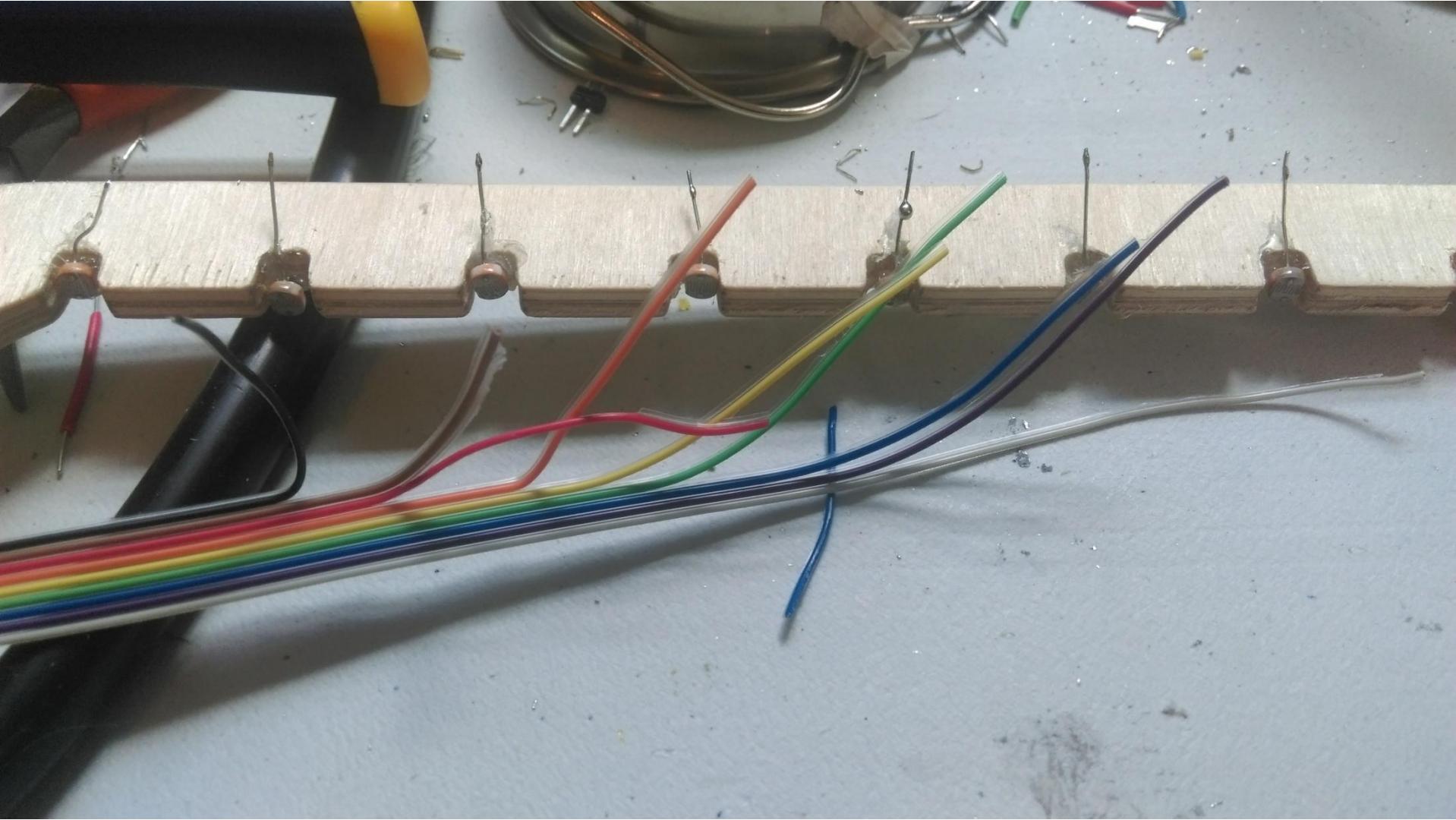


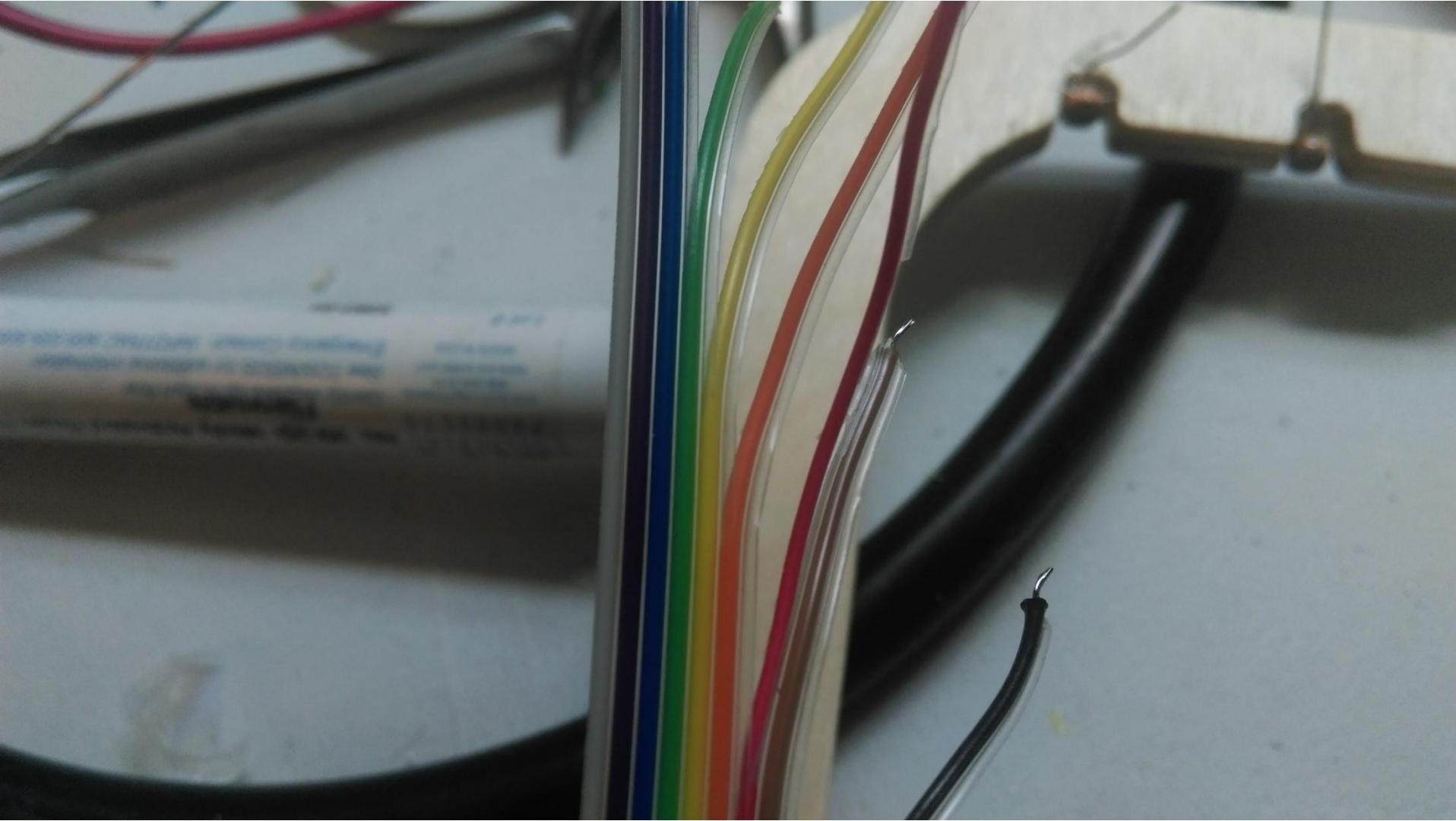




Step 13

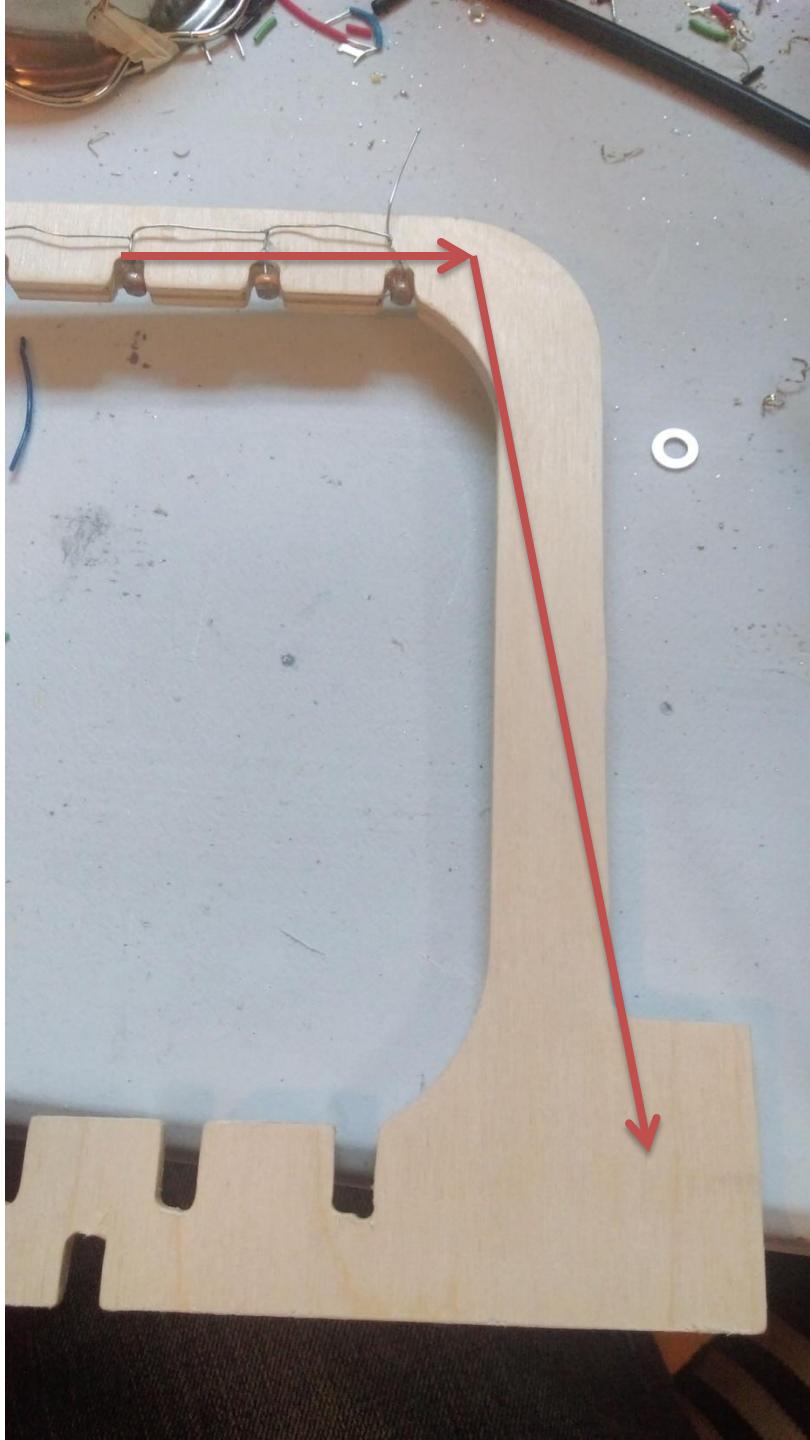
- Set the laser harness aside and get out the longer ribbon cable.
- Using the wood frame as a guide, separate and cut the wires on one end of the ribbon cable so that they are the correct length to match up with the photo resistor leads. The ninth wire will be connected to the side of the photo resistors that are all connected together. The **ribbon cable must go towards** the block on the side of the frame where the PCB will be mounted.
- Once cut to the correct length, strip and tin each of these nine ribbon cable wires.

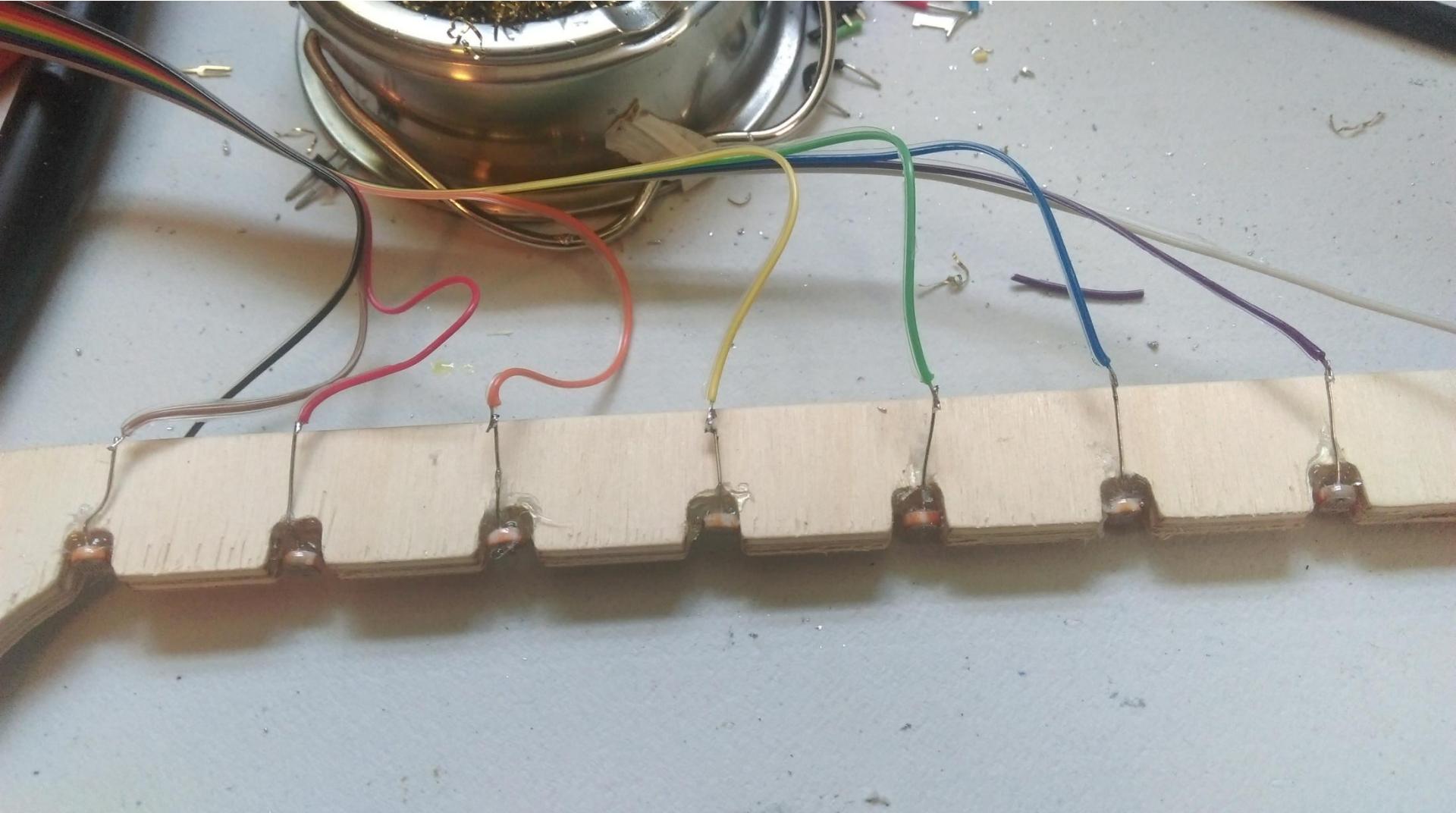


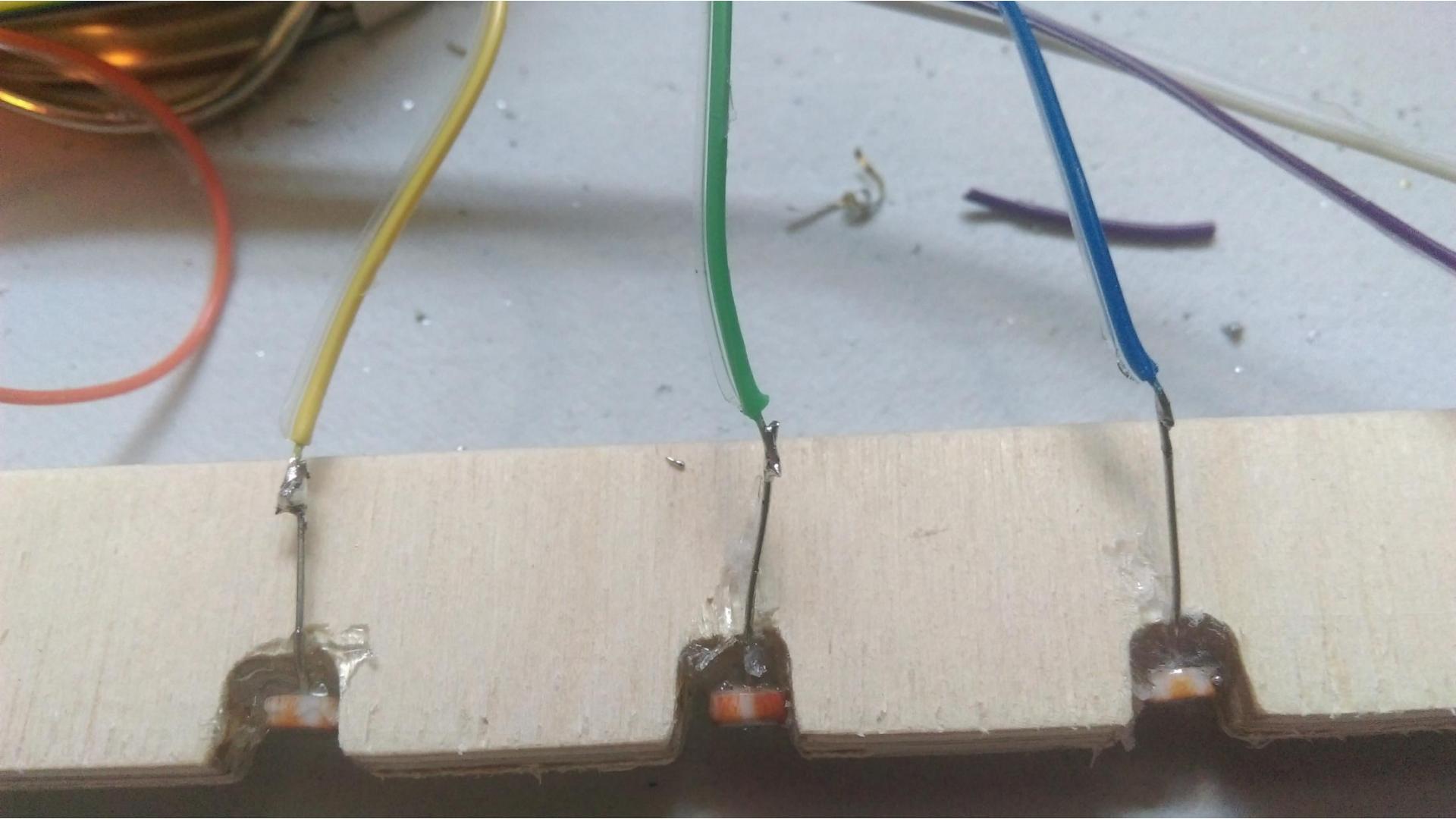


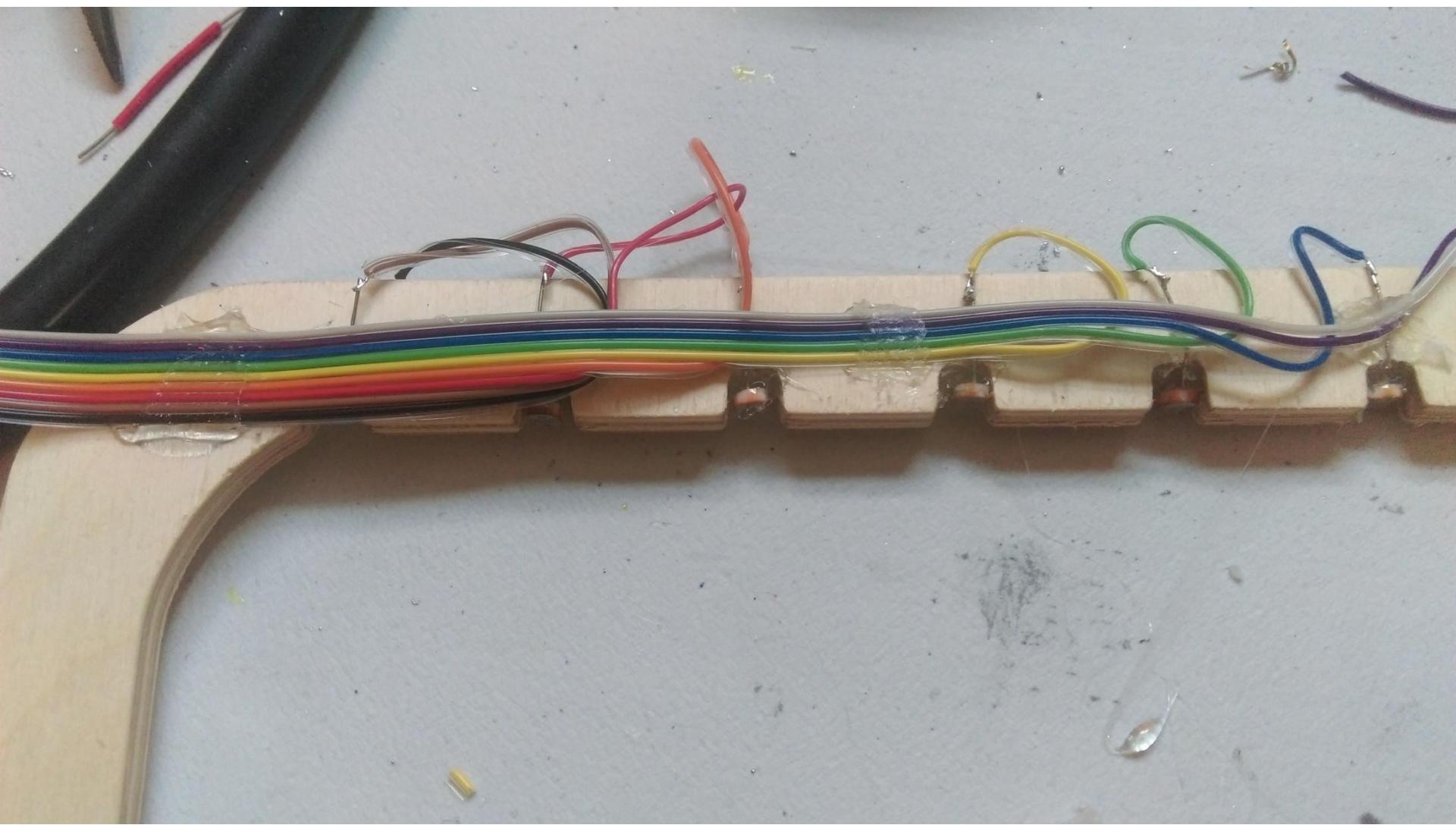
Step 14

- Solder the previously cut ribbon cable wires to the eight photo resistors leads and the one connected photo resistor lead.
- Once soldered, use hot glue to tack down the ribbon cable



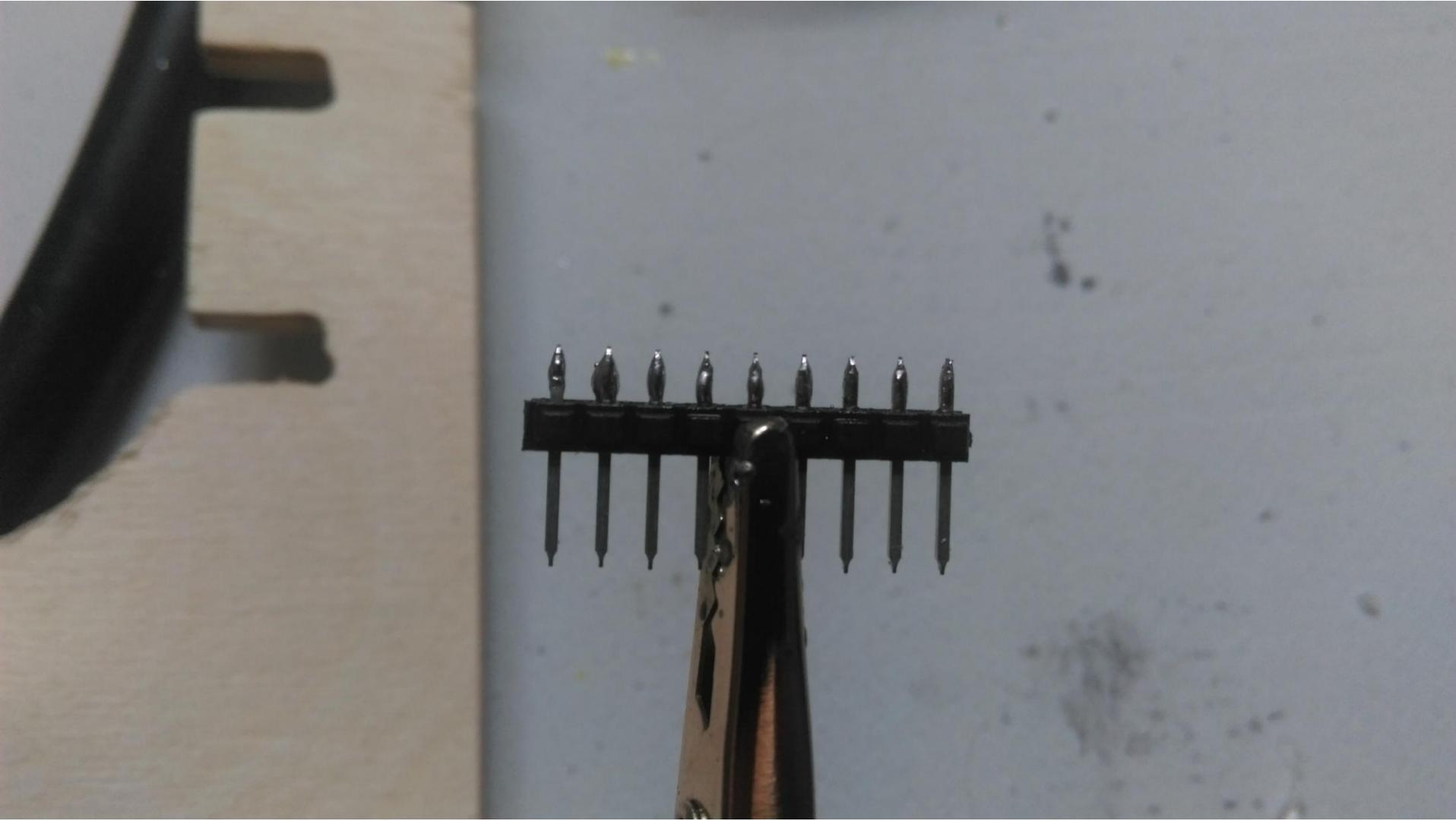


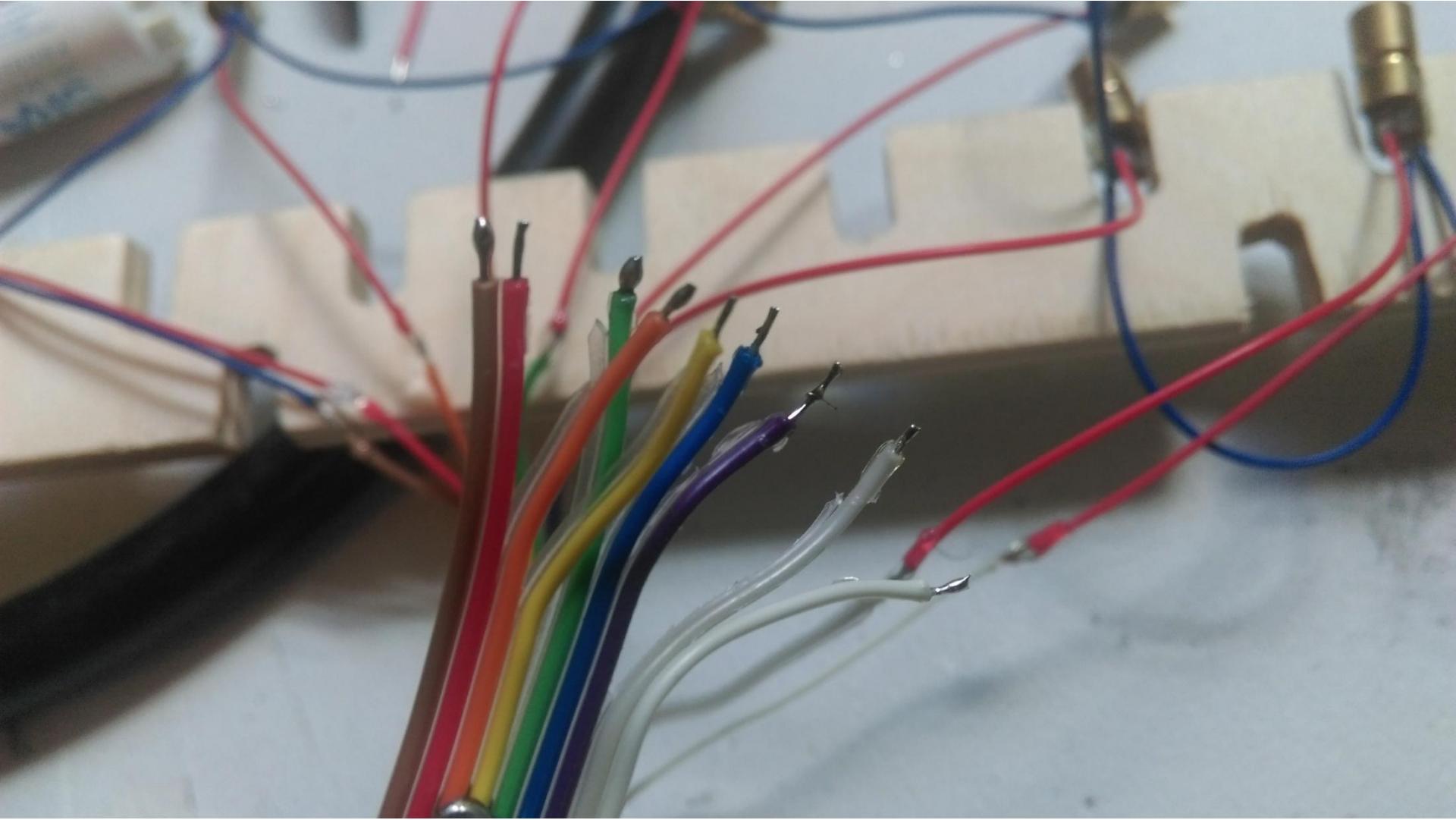


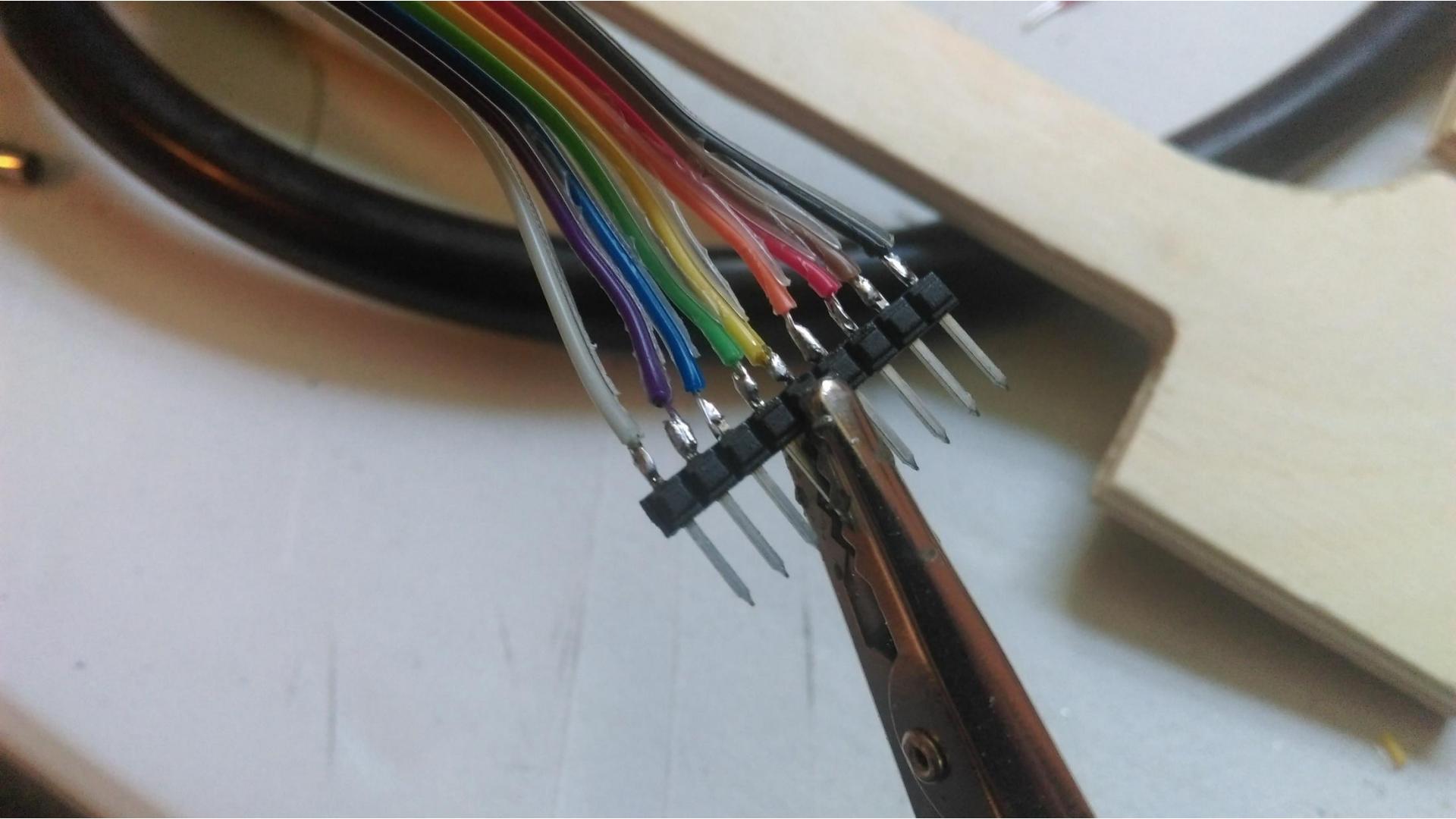


Step 15

- Take the remaining 9 pin male header and tin the short side of the pins as was done before.
- Separate, strip and tin the other side of the photo resistor ribbon cable harness.
- Solder the nine ribbon cable wires to the nine pin male header making sure to solder IN ORDER.
- Place a small amount of hot glue over the soldered wires to provide strength.

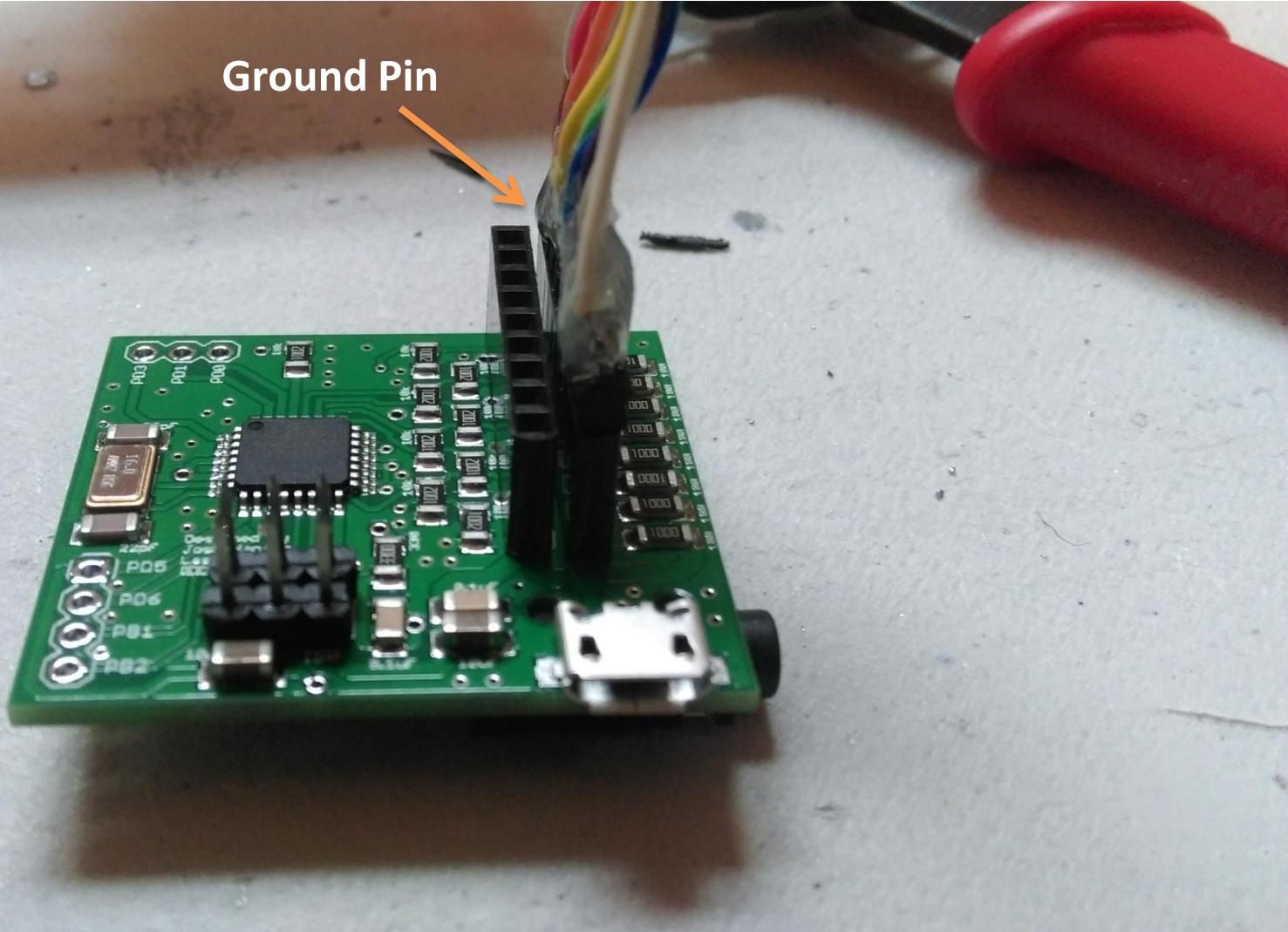






Step 16

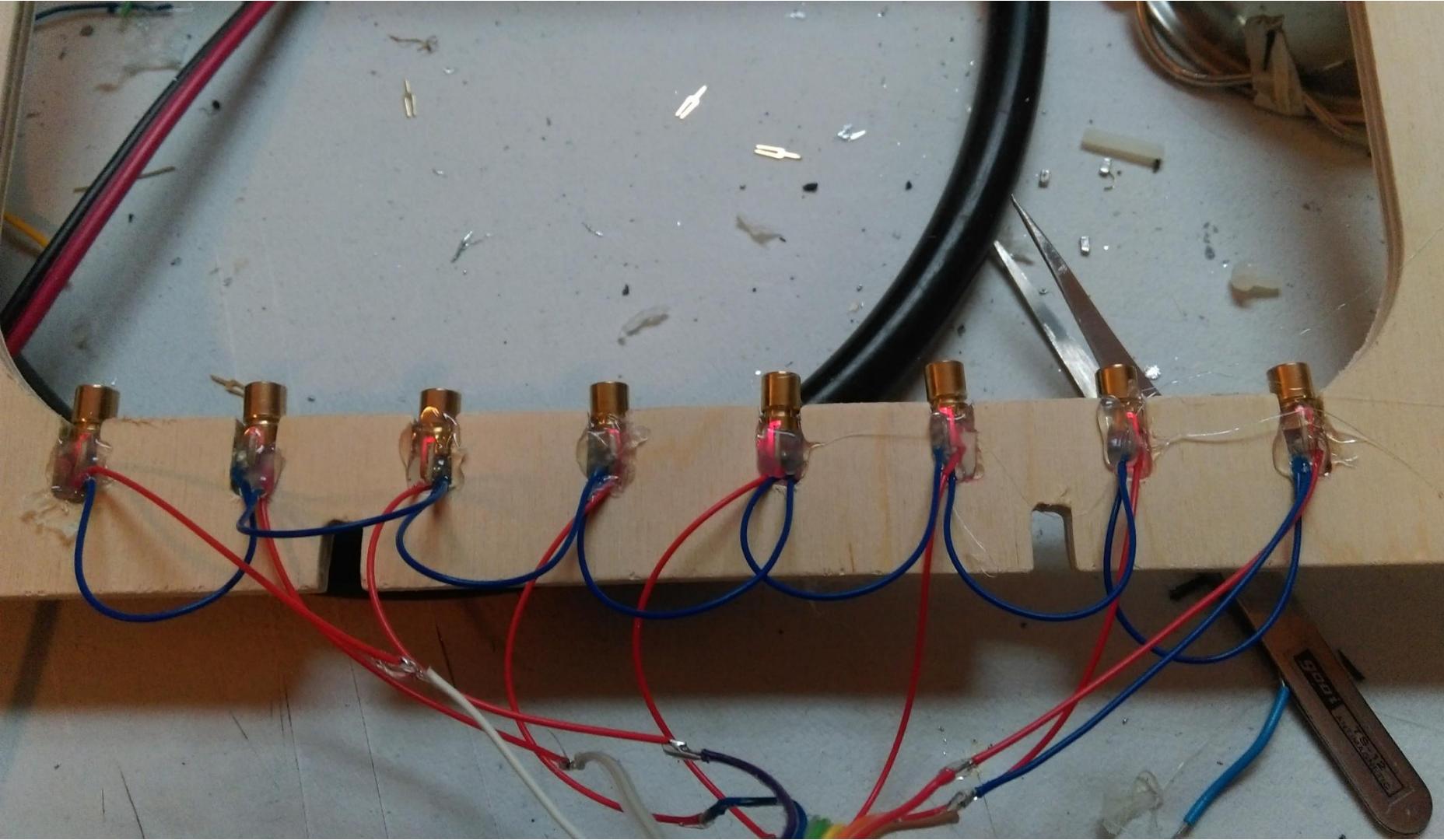
- Ensure that the lasers are not aimed at anyone and then plug the laser harp ribbon cable harness into the PCB as shown in the following image. Make sure that the ground pin is connected at the top of the PCB as marked in the image.
- Power the PCB with a micro USB cable. All eight lasers should light up

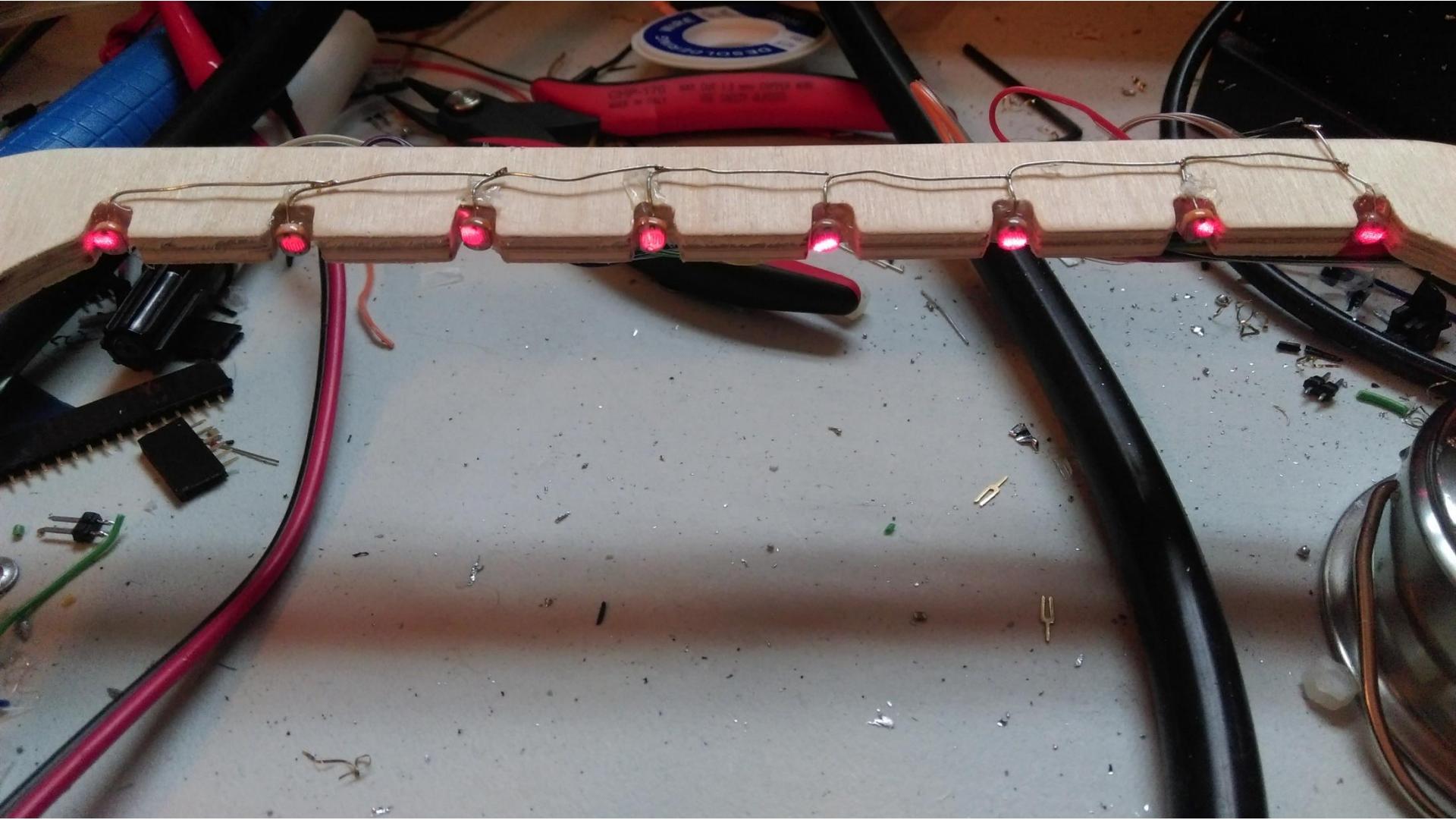


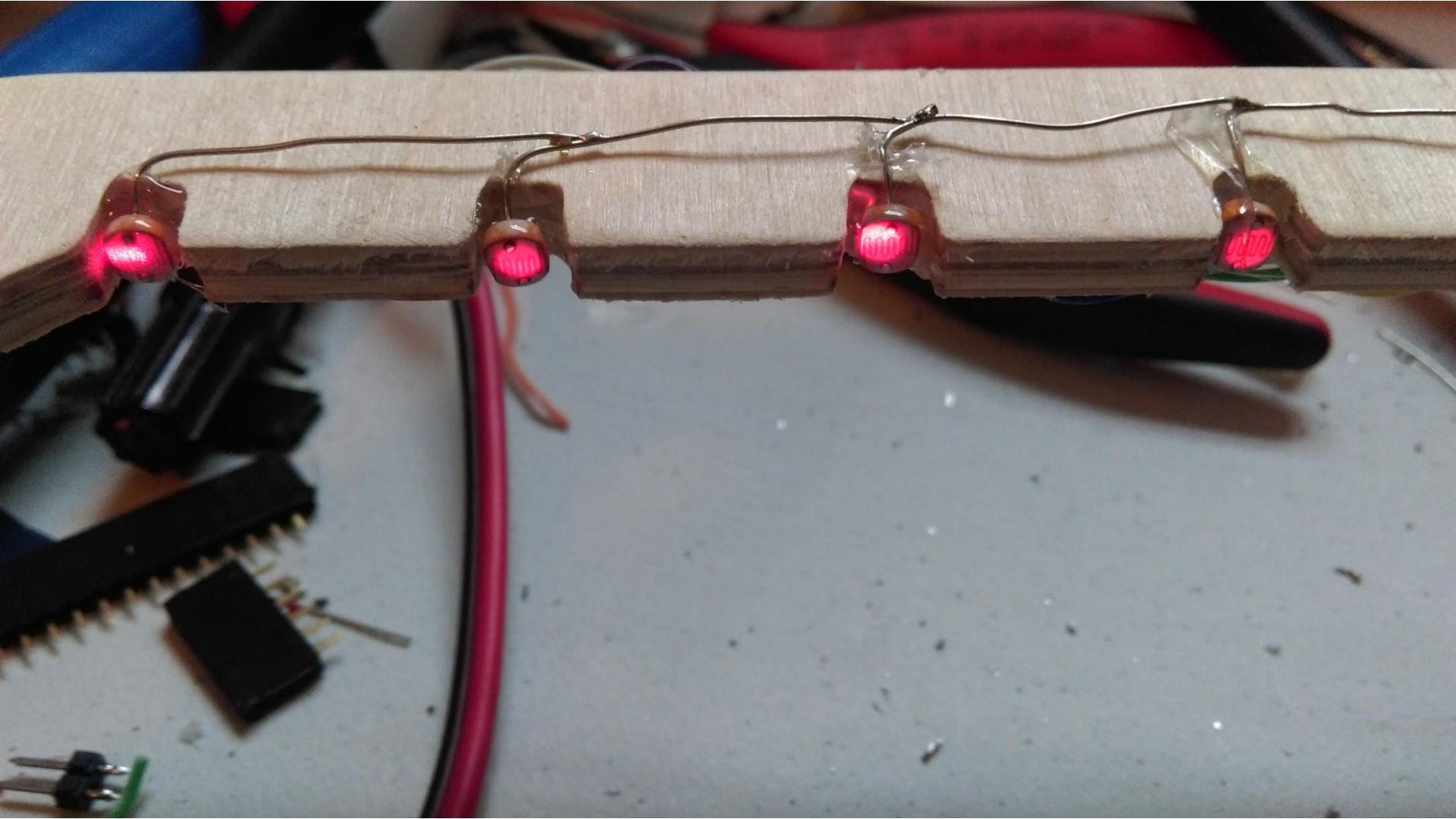
Ground Pin

Step 17

- Going in the ordered they are soldered to the harness, place one of the lasers into its corresponding slot in the frame. Move the laser around until the red dot is illuminating the photo resistor opposite the laser.
- Fill the void around the laser in its slot with hot glue on both sides of the frame. Hold the tip of the laser being careful not to touch the hot glue. Aim the laser at the photo resistor and hold it there until the glue hardens.
- Do this for the remaining seven other lasers. When you are finished all eight lasers should be glued into place and pointing at their photo resistors.







Step 18

- Unplug the USB cable from the PCB and then plug the photo resistor harness into the remaining female headers. Make sure the common wire is connected at the top in the same way the laser harness was connected.
- Plug the USB cable and speaker into the PCB and your laser harp should begin to function.