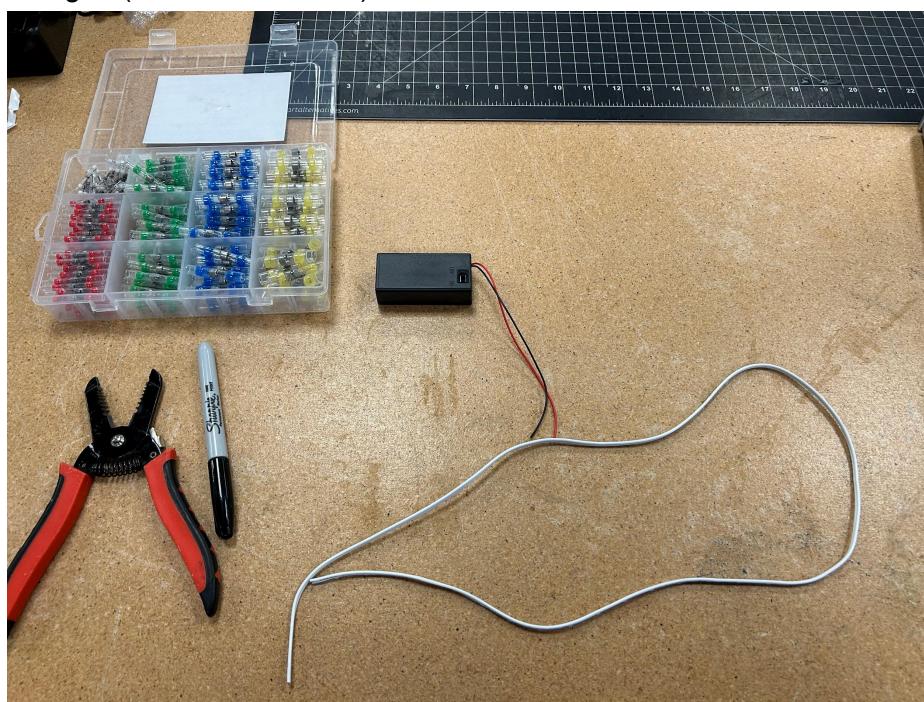


# ROV Motor Control Steps

## 1. Make Battery Connections

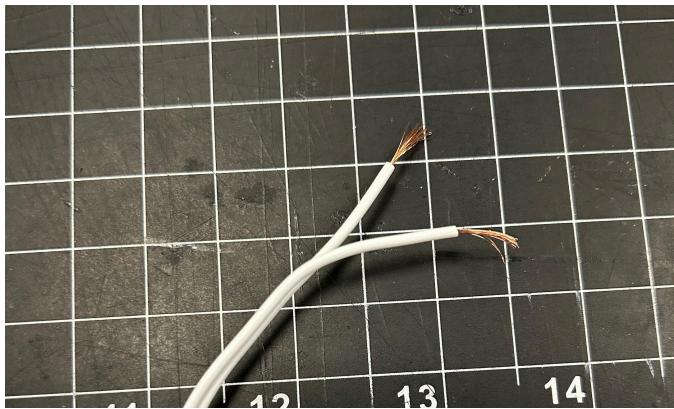
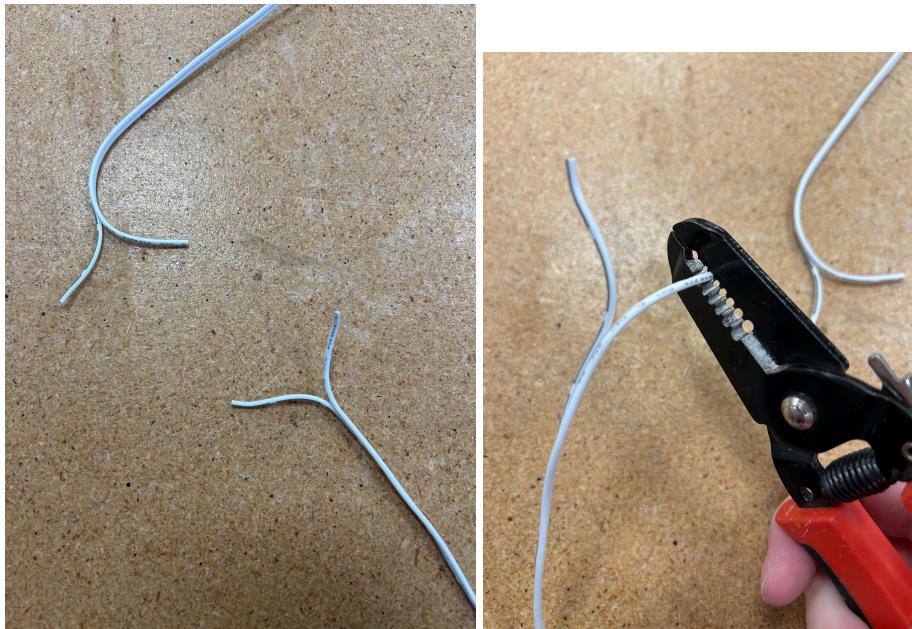
### Gather Materials

1. 1x 3 ft long 2 strand white wire
2. 1x 9v battery holder
3. Red Solder Seal Wire Connectors (Share with Others)
4. Wire Strippers (Share with others)
5. Sharpie (Share with others)
6. Heatgun (Share with others)

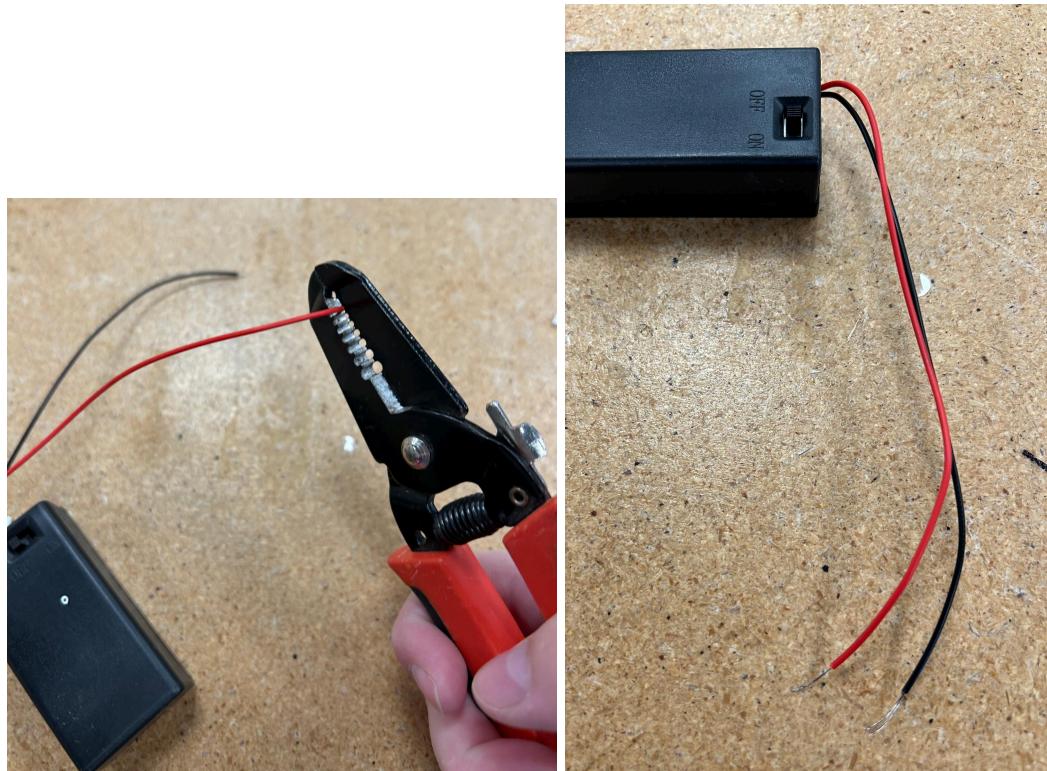


## Battery to wires

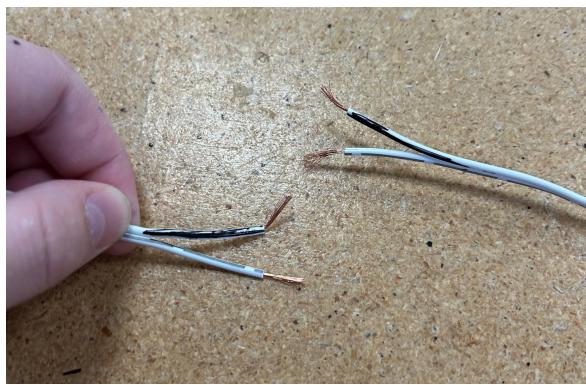
1. Separate a small amount of the white wire at the ends. Strip the ends of the white wires carefully to about  $\frac{1}{2}$  in to 1 inch long on all 4 ends.



2. Strip the ends of the battery holder  $\frac{1}{4}$  in to  $\frac{1}{2}$  inch long



3. Take one side of the white wire at the end and mark it with a black sharpie. This is your GND (ground) wire. Follow that side to the opposite end and mark that with a black sharpie



4. Twist the wire ends so they are neater

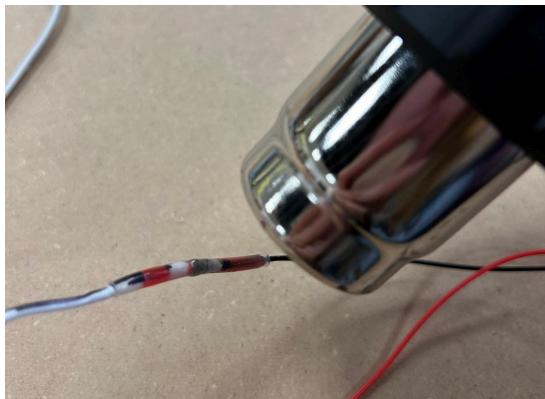


5. Pick one end of the white wire with the sharpie mark to connect to the black wire of the battery holder. Use a solder seal wire connector to connect the black wire of the box and the sharpie marked wire together. Put the ends of the wires inside the seal piece and make sure the silver part in the middle (solder) is touching both wires. You may have to push the wires in further to reach properly.

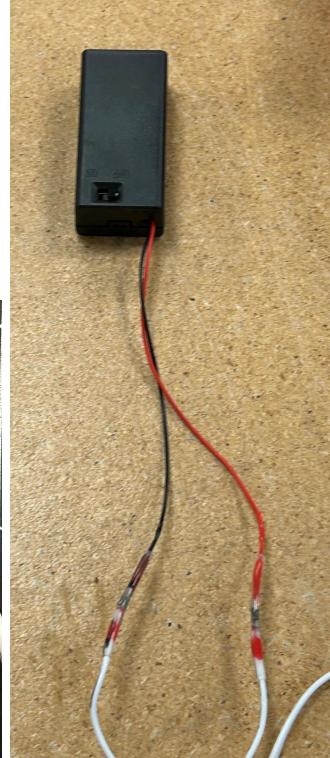
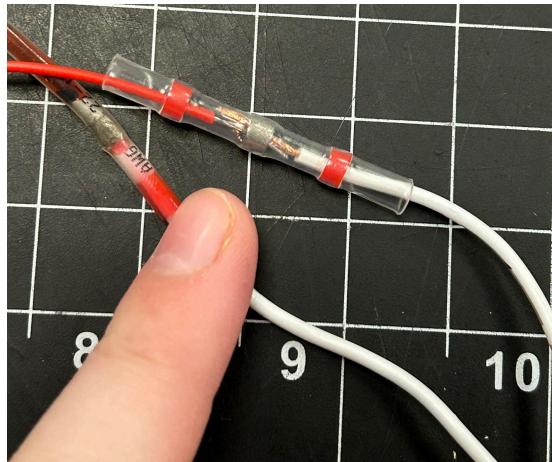


6. Use the heat gun about 3 inches away from the wire to very carefully to shrink the connector ON A HEAT SAFE SURFACE (the regular wood of the table will burn so use a piece of scrap wood. Wait until the solder in the middle has melted to stop heating it. Don't touch it with your fingers until it has cooled. Try your best

not to melt the wires themselves and if you see that happening turn off the heat gun and ask for help.



7. Wait till it has cooled and check that the wires are secure in the connector and don't move when you lightly tug on them.
8. Now on the same end of the white wire take the side you did not mark and connect it to the red wire. Make sure the metal in the connector is touching both the wires. Use the heat gun very carefully to shrink the connector. Don't touch it with your fingers until it has cooled.

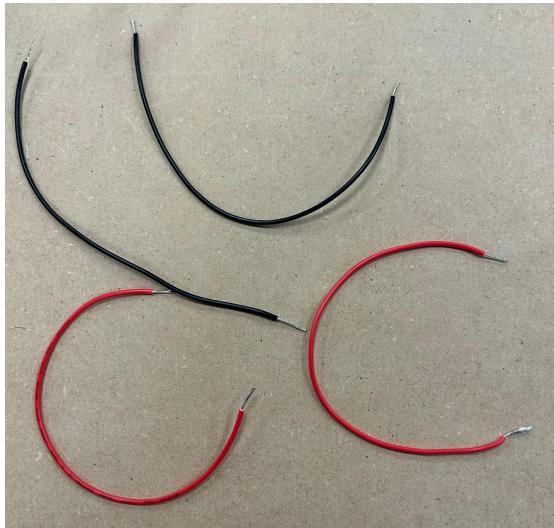
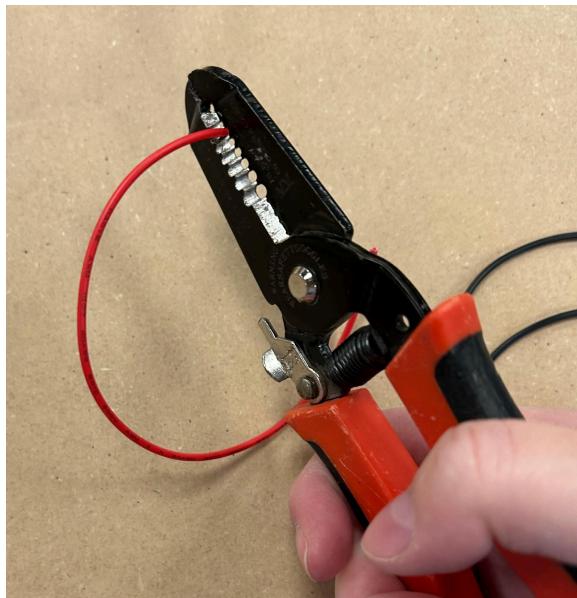


## Wires to the switches

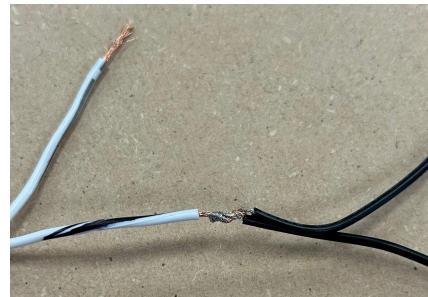
1. Requirements
  - a. Red wire spool
  - b. Black wire spool
  - c. 2 switches
  - d. Control box
2. Cut 2 pieces of red wire about 8 in long and 2 pieces of black wire about 8 inches long



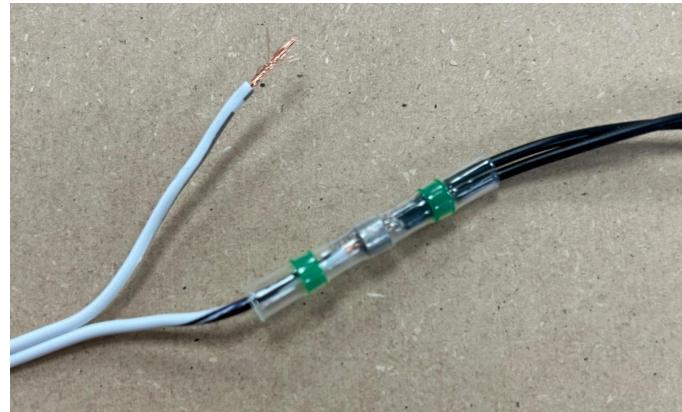
3. Strip the ends of the loose black and red wires about  $\frac{1}{2}$  in and twist the ends so they are neat



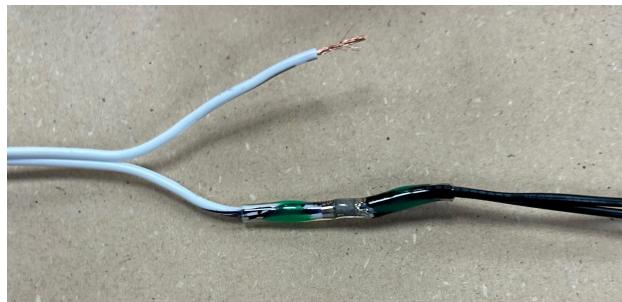
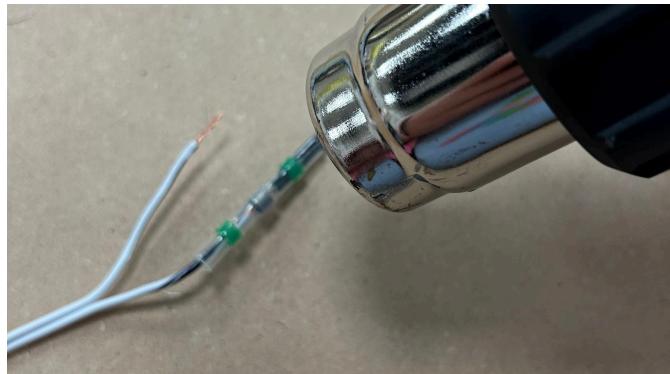
4. Take the other end of the white wire that has not been used yet. Identify the GND wire (marked with sharpie). Twist together the sharpie end with the two black wires.



5. Use a green solder connector and run it over both the black wires and bring it to the point where the wires are twisted. Make sure the silver middle is overtop the twisted wires.



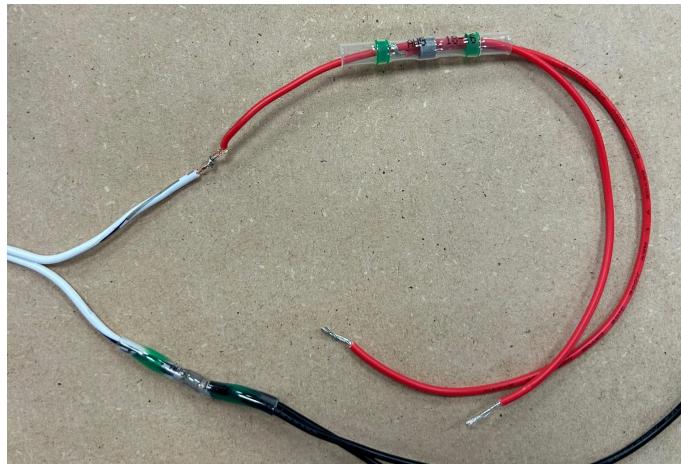
6. Again carefully use the heat gun on a safe surface to shrink the connector. Do not touch it will your hands until it has cooled.



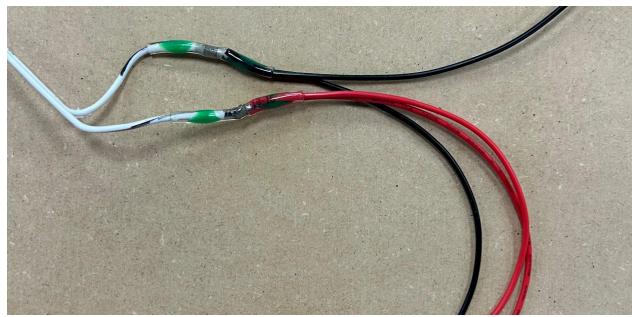
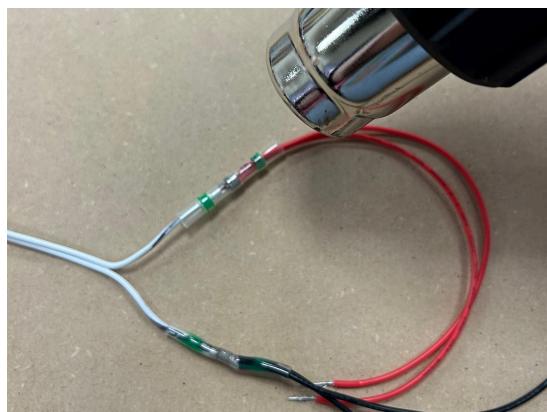
7. Now take the last end of the white wire and twist it with the two red wires.



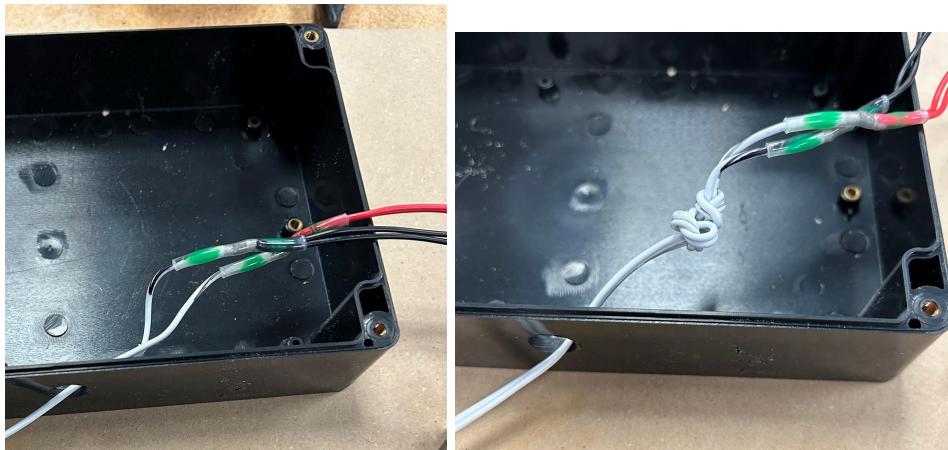
8. Run a green solder connector over top both of the red wires and bring it to the point the wires are twisted. Make sure the silver middle is overtop the twisted wires.



9. Again carefully use the heat gun on a safe surface to shrink the connector. Do not touch it will your hands until it has cooled.



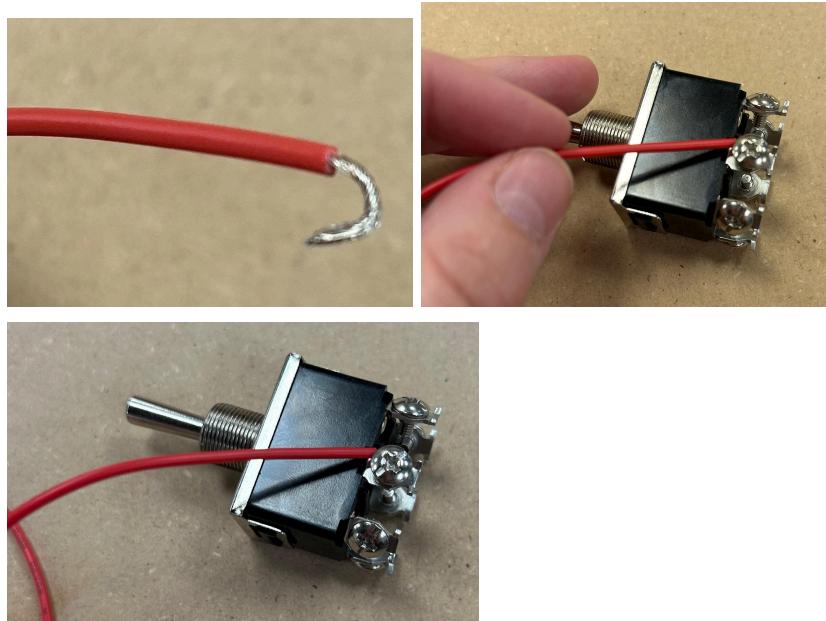
10. Take all the wires and push them through the side hole in the control box. Double knot the wire so that it doesn't slip back though the hole easily.



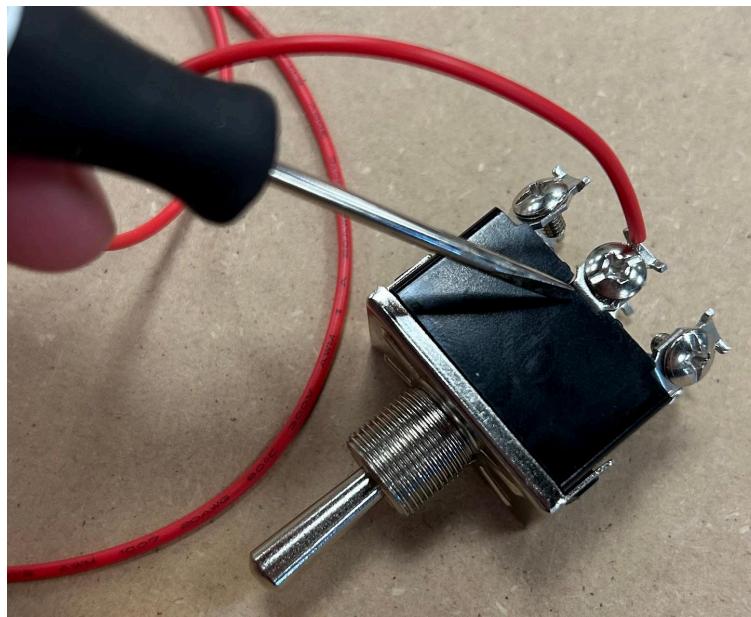
11. Take one of your switches and use a flathead screwdriver to loosen the screws on middle poles. You do not have to take them out all the way.



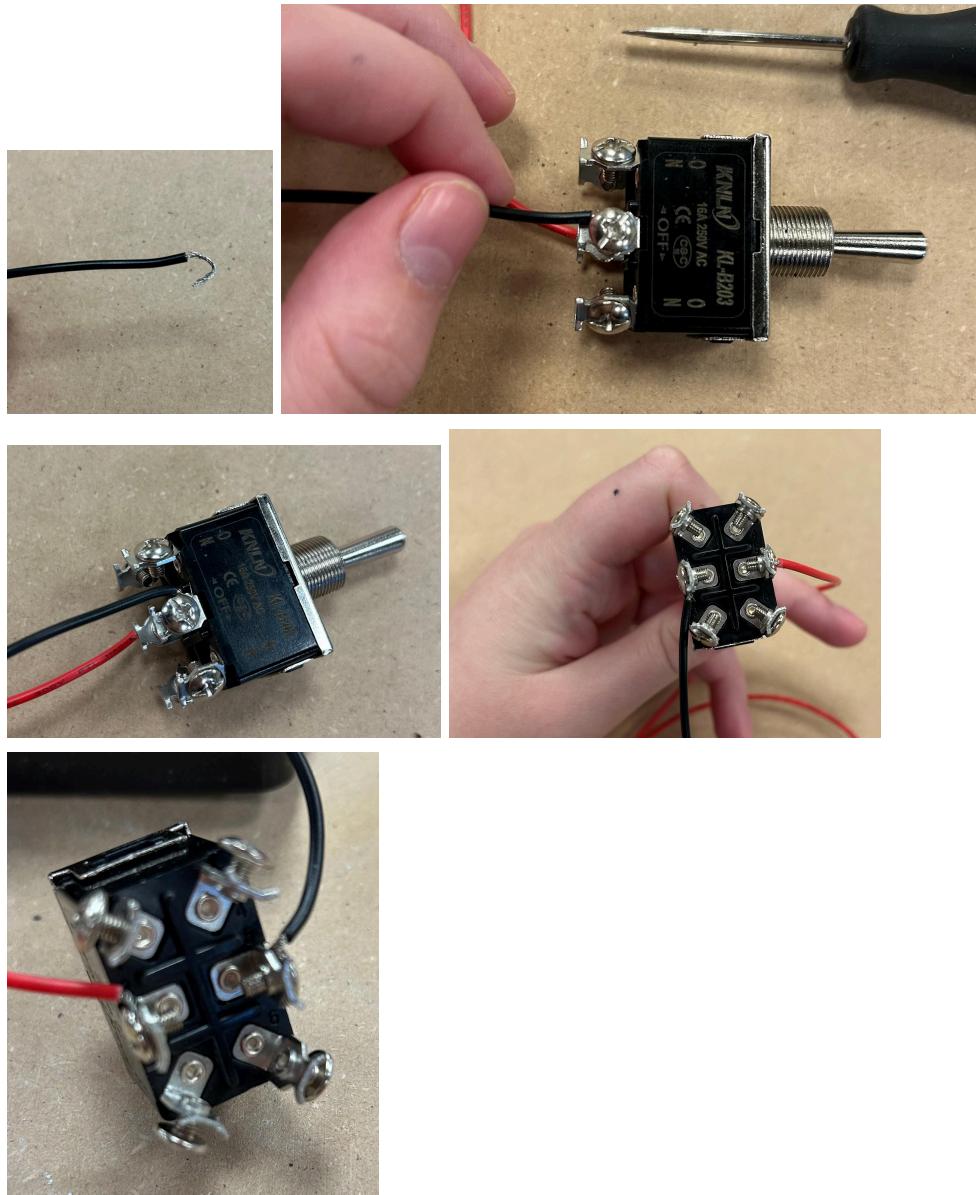
12. Take one of the red wires and make a hook like shape at the end



13. Hook the red wire to one of the middle poles of the switch. While it is hooked tighten the screw so that the red wire is stuck underneath it and it is snug enough you can not tug it out easily



14. Do the same with the other middle side of the switch but use a black wire instead.



15. With the remaining red and black wires connect the second switch in the same way

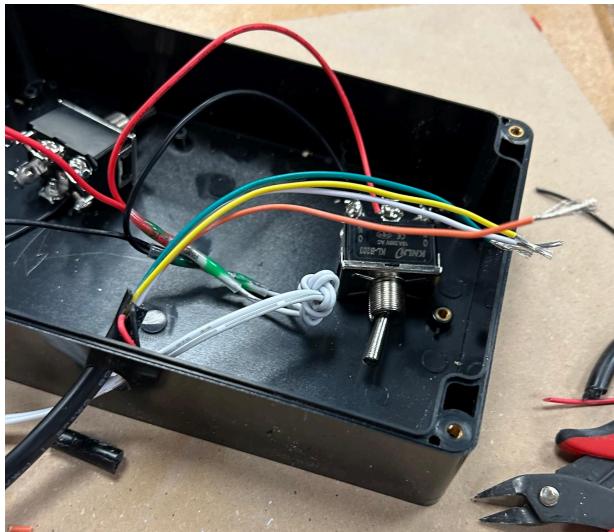
## Motor Tether to switches

1. Requirements
  - a. 6 wire black tether
  - b. Blue wire spool
  - c. Yellow wire spool
  - d. Screwdriver
  - e. Wire strippers
  - f. 2x Switches and switch secures
  - g. Control box base and top

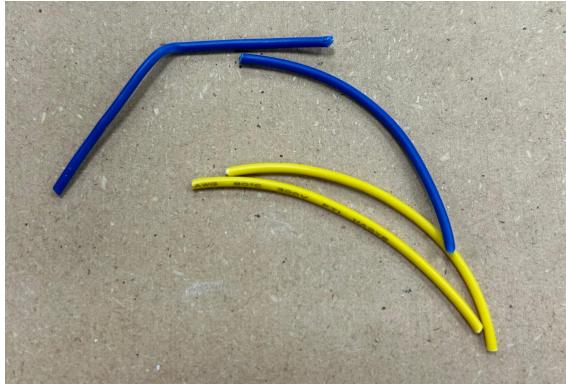
- h. Bolts for control box lids
  - i. Electrical tape
- 2. Take the black tether and strip the ends so that the colored wires are showing.  
Strip the black about 6 inches on one side and 3 inches on the other



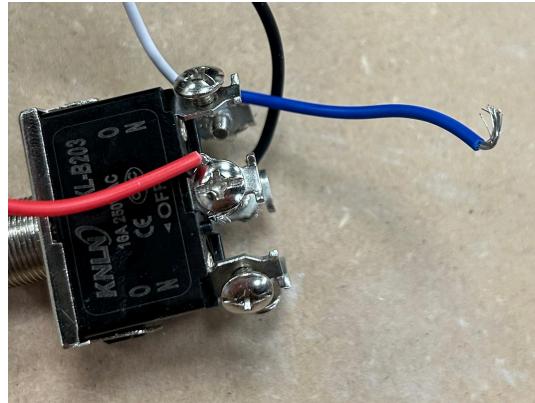
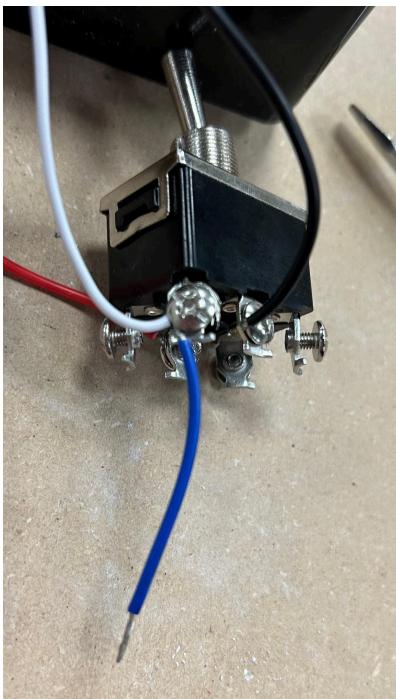
- 3. Strip the yellow, white, orange and green colored wires  $\frac{1}{2}$  inch and twist the ends of the wires so they are neat
- 4. Push the colored wires on the 6 inch side through the hole on the side of the control box (the same one the white wire comes out of).



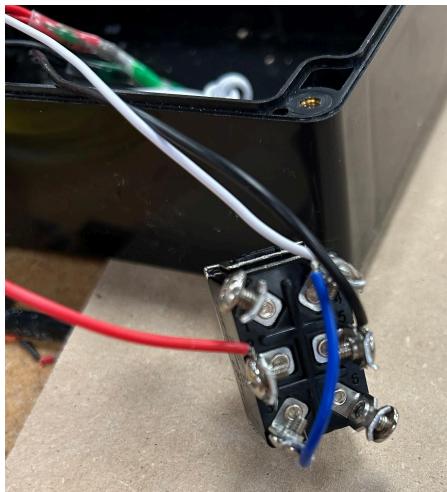
5. Cut 2 blue wires and 2 yellow wires from the spools that are about  $2\frac{1}{2}$  inches long



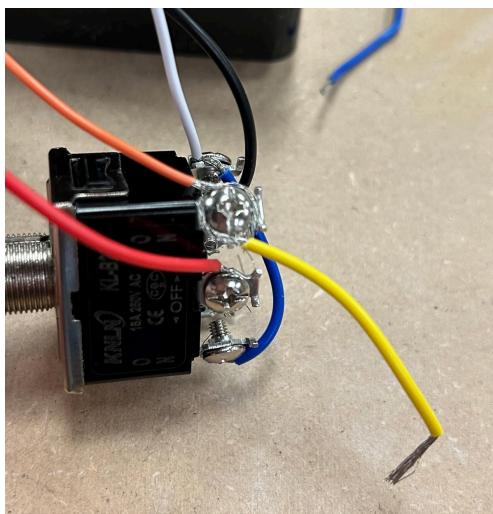
6. Strip the wires off the ends of the yellow and blue wires you just cut about  $\frac{1}{2}$  inch. Twist the ends so they are neat.
7. Now take one of the switches and the white and orange wires from the black tether. Loosen the screws on the switch. This is tricky but put both the white tether wire and the small loose blue wire in the same hole on the top left of the switch (above the black wire). Tighten the screw so they are connected.



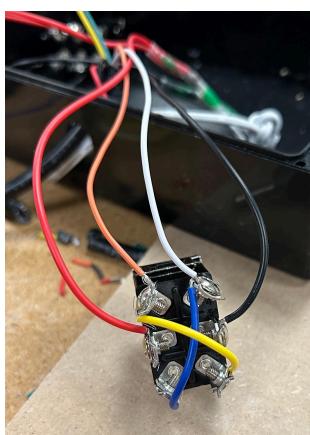
8. Then diagonally from it screw the other side of the blue wire to the pole below the black wire



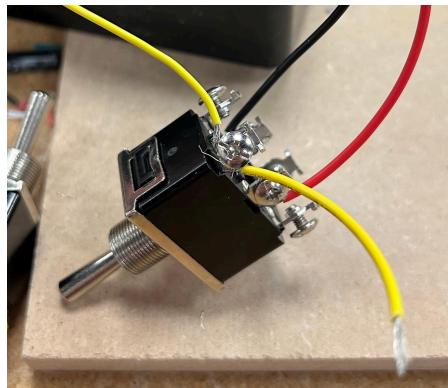
9. On the other side screw the orange wire and a yellow wire into the top right pole so they are connected.



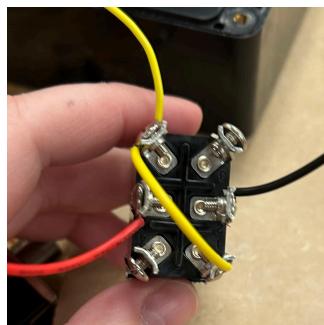
10. Screw the other side of the yellow wire into the pole diagonal from it so below the black wire. The end result should be a cross shape of wires.



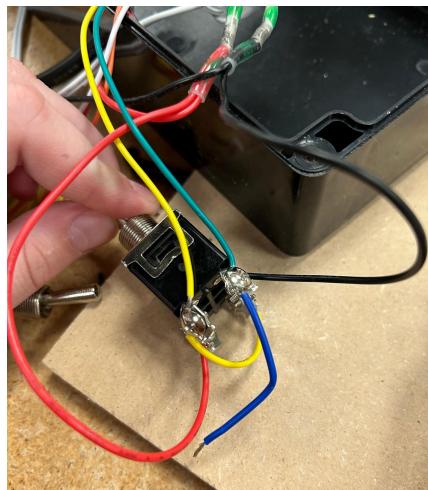
11. On the other switch take the yellow wire from the tether and the small yellow wire and screw them into the top left pole (above the red wire).



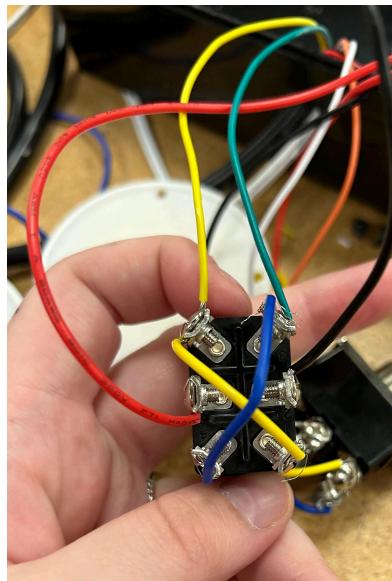
12. Screw the other end of the small yellow wire into the pole diagonal from it so below the black wire



13. Now take the green tether wire and the short blue wire and screw them into the top right pole (above the black wire)



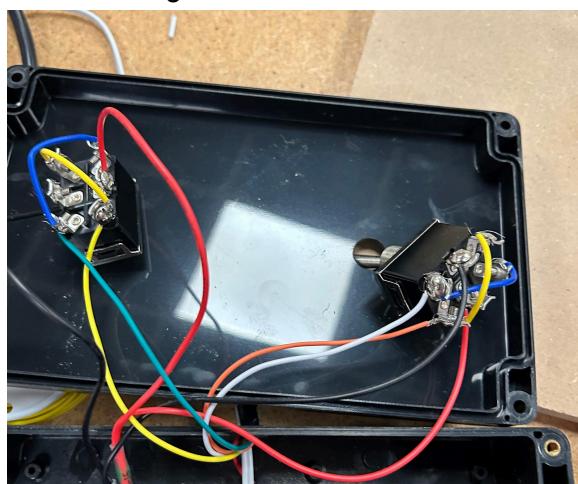
14. Screw the other end of the blue wire diagonally across from it so underneath the red wire. The end result should be a cross shape



15. Now check both switches for straggly wires that might accidentally touch other poles. You can trim them away or try to tuck them. Crossing poles is not good and your robot won't work



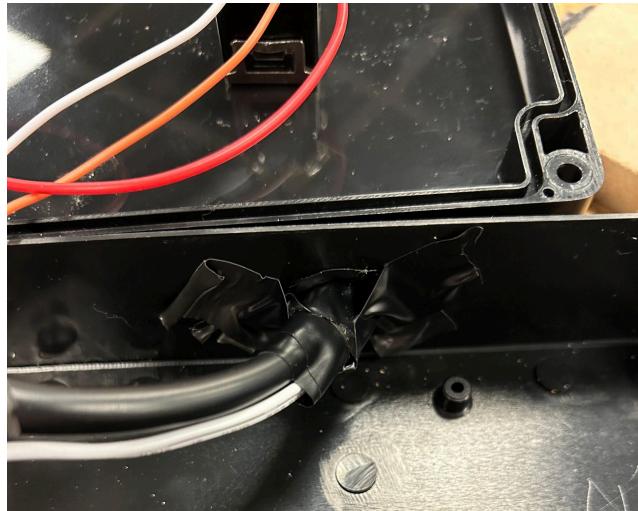
16. Now you are ready to put the switches into the lid of the box. With the lid upside down the yellow green wire switch should be on the left and the white and orange one on the right.



17. On the top of the lid secure the switches by using the items in this order 1) on/off label 2) washer 3) nut 4) rubber topper if you choose



18. You can use electrical tape to secure the wires for the tether and the white wire to the box. The goal is to not rip out the colored wires from the other side



19. Now you can use the box bolts to screw the lid back on. The bolts are in a bag together so you have to ask for them.

## 2. Make Motor-to-Tether Connections

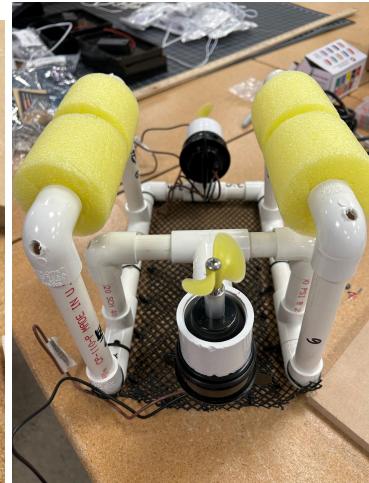
### Prep the motors

1. Requirements
  - a. 2 motors and propellor parts
  - b. 2 PVC motor holders
2. Follow this powerpoint to attach the propellers to the motors
  - a. [https://docs.google.com/presentation/d/e/2PACX-1vT4Y5R5tdTKjkt-p8Nh4H92TbXgnJ9fwY\\_43HqT1g4gGURMVNj59lkxz6pV4XoALNTm\\_cE2GIU4UCr0/pub?start=false&loop=false&delayms=3000&slide=id.g16ac84f6ec2\\_47](https://docs.google.com/presentation/d/e/2PACX-1vT4Y5R5tdTKjkt-p8Nh4H92TbXgnJ9fwY_43HqT1g4gGURMVNj59lkxz6pV4XoALNTm_cE2GIU4UCr0/pub?start=false&loop=false&delayms=3000&slide=id.g16ac84f6ec2_47)

- b. Do it for both of your motors



3. Undo the ties around the wires of the motor and set them into the frame of your robot. The back motor should be facing away from the body and the up/down motor should face towards the ceiling

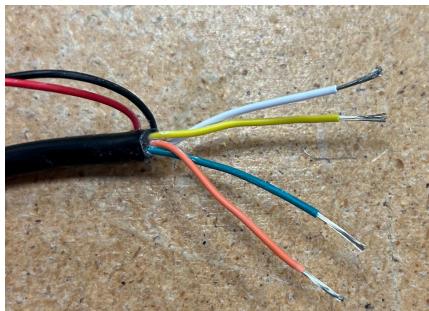


4. Strip the brown and black motor wires about  $\frac{1}{2}$  inch

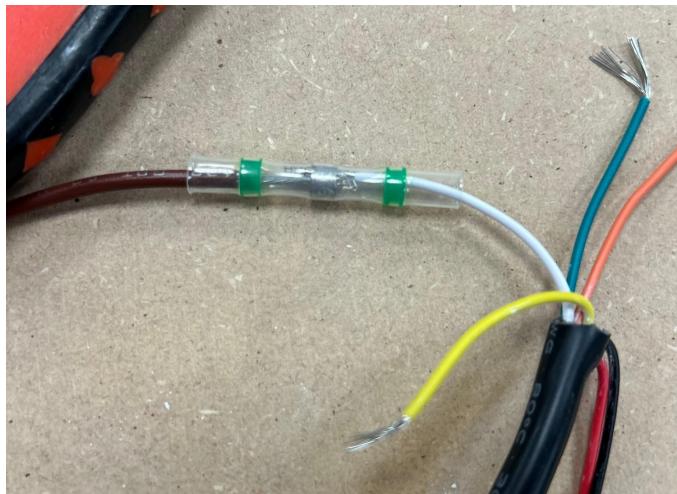


## Connect the Tether to the motors

1. Requirements
  - i. Wire strippers
  - ii. Heat gun
  - iii. Solder connectors
2. Strip the colored wires of the tether, yellow, green, orange, and white about  $\frac{1}{2}$  inch , twist the ends to make them neat



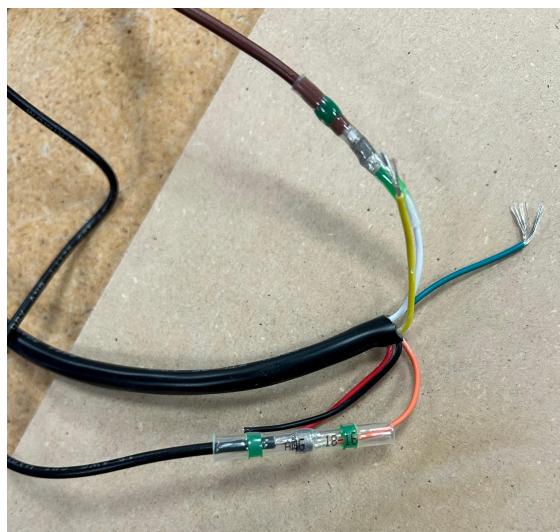
3. Take the white and orange wires and the wires of the horizontal (forward backward) motor. Connect the brown wire of the motor to the white wire of the tether using a green solder connector. Make sure the silver part is touching both of the wires.

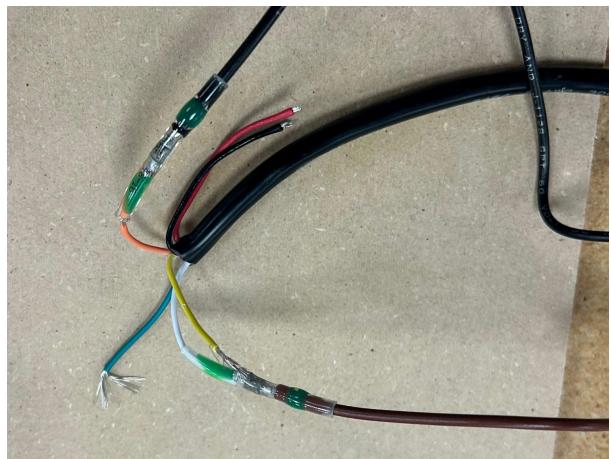
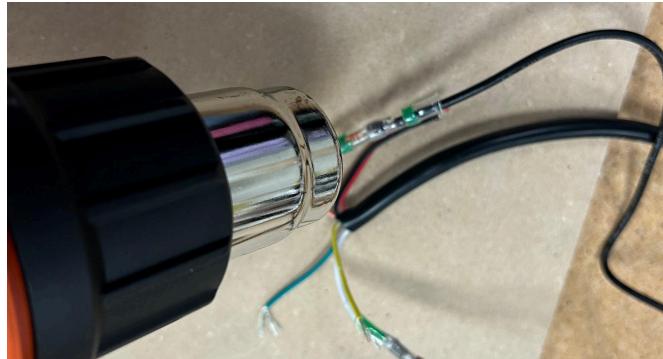


4. Carefully use the heat gun to melt the solder. Do not touch the wires till they have cooled. Make sure to do this on a safe surface such as the scrap wood.

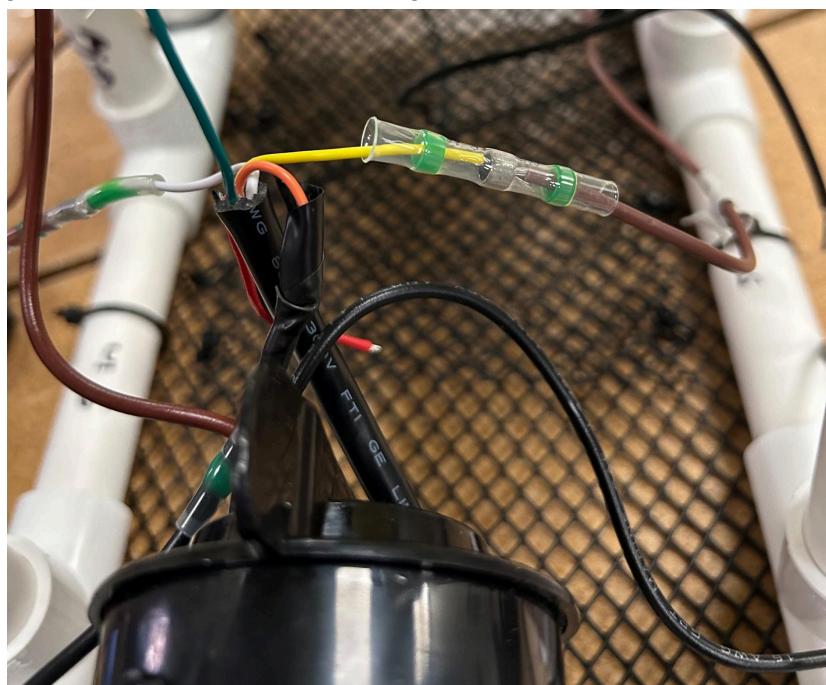


5. Take the black motor wire and connect it to the orange tether wire using the same method

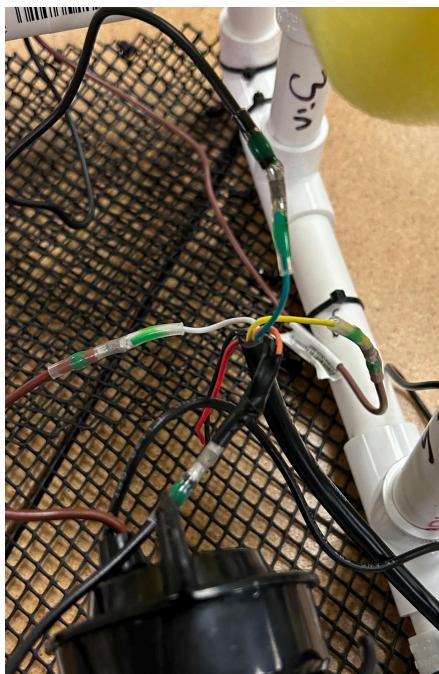
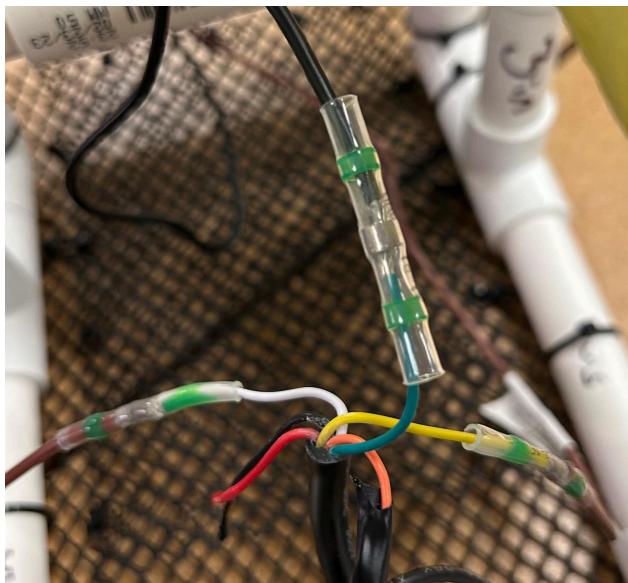




6. Now working with the vertical up and down motor connect the yellow tether wire to the brown wire of the motor. You may have to put the the tether into the middle of the fram so the wire can reach. Try not to melt anything when using the heat gun, so use it on the cool setting



7. Using the same method connect the black motor wire to the green tether wire



### 3. Plug it in

- a. Make sure the wires won't get caught in the motors
- b. Be careful of your hands and hair it hurts

- c. Plug in the 9 v battery and switch it on



- d. Use the switches to turn the motors on and off. One direction should be clockwise and the other should be counterclockwise. The middle of the switch is off.
- e. If one of the motors is not working ask for assistance to find where the issue is in the wiring or try to find which wires are not connected properly.



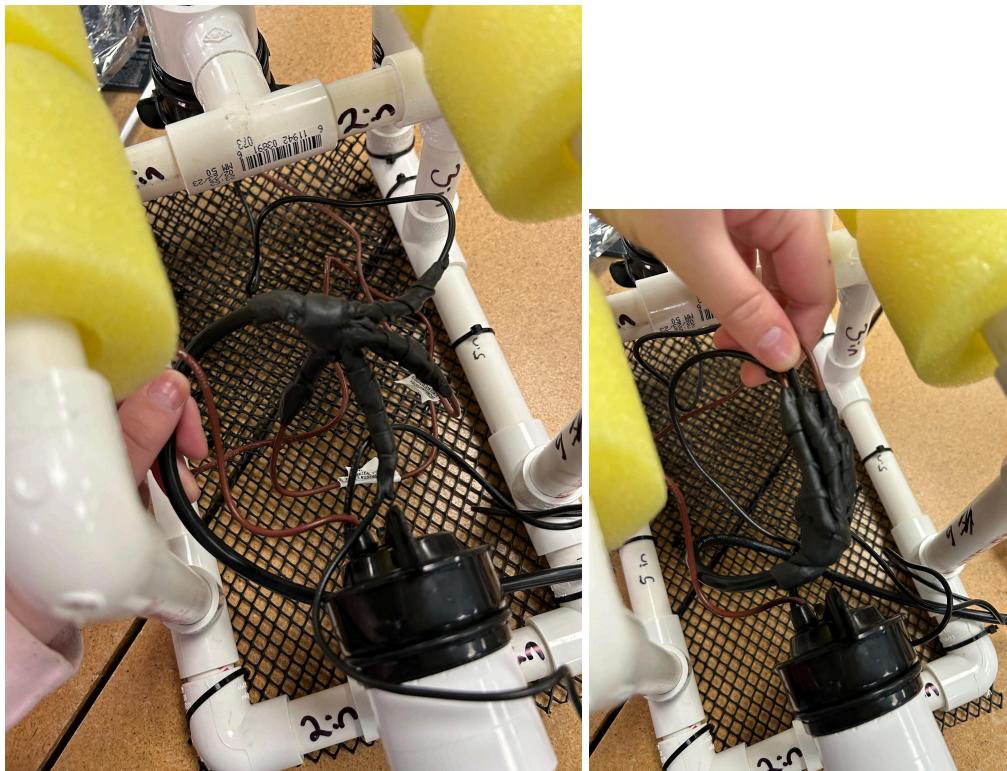
## 4. Waterproofing and Zip Tie

- a. Requirements
  - a. Coax seal
  - b. Zip ties

- b. If everything is working properly you can now waterproof your motors using coax seal. Wrap each of the joints from the motor to the tether with it overtop of the solder connectors. Make sure to squish it in and make all the connections covered. You may have to ask for the coax seal.

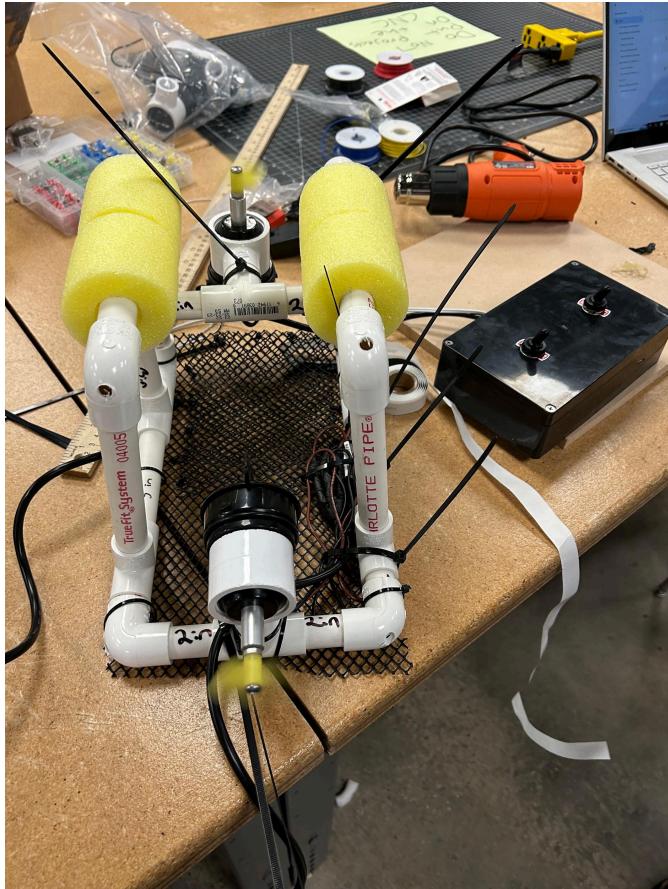


- c. Also cover the based of the tether where the wires come out. You can trim the red and black wires and cover them up since they are not being used



- d. After waterproofing secure the wires to the frame using zip ties. How you zip tie is up to you but realize it will change the balance of the ROV. Most of my wires are on one side so I may have to add weight to the other side to compensate. The

goal is to make the wires out of the way of the motors



e. Trim the zip ties

**CONGRATULATIONS YOU ARE DONE WITH YOUR  
UNDERWATER ROBOT!!**