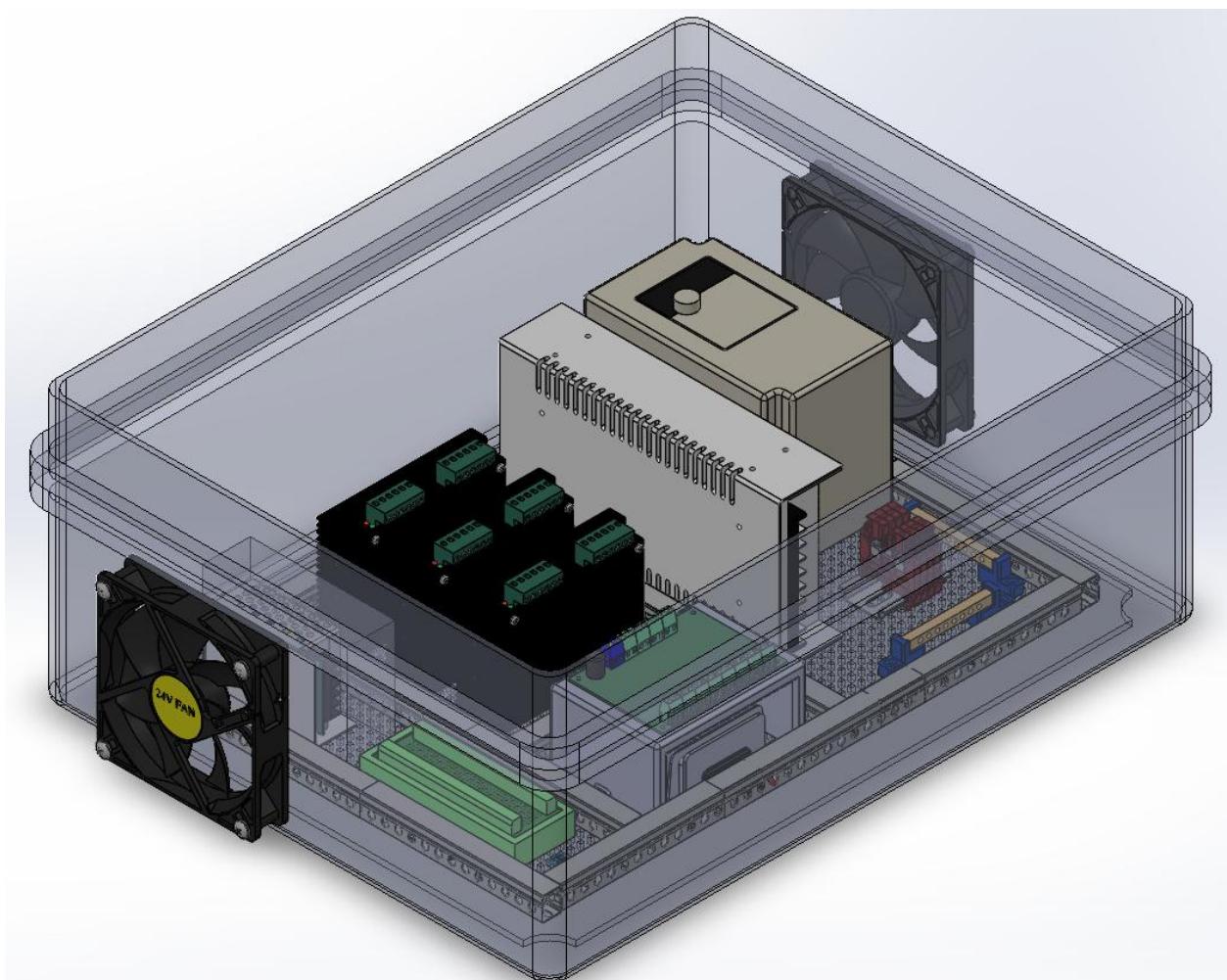
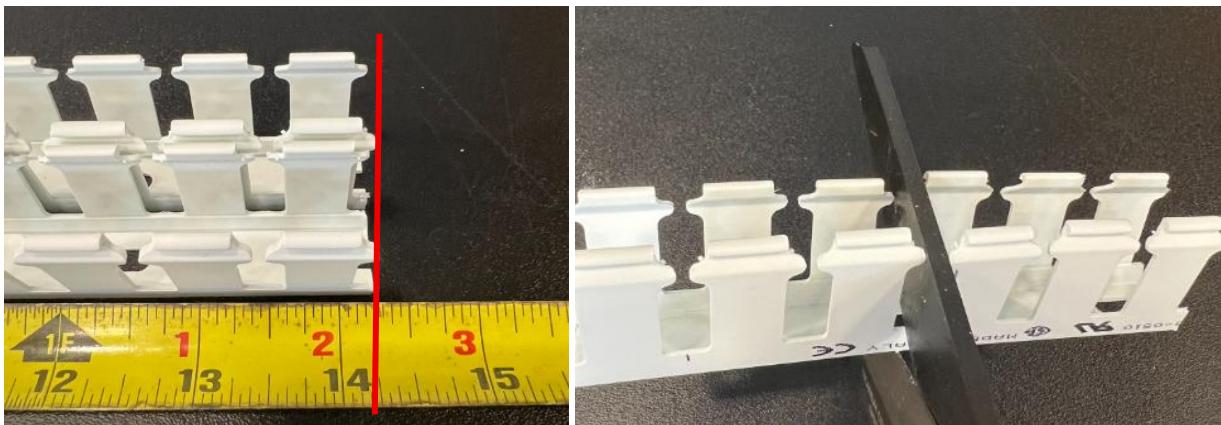


## Electrical Box Instructions



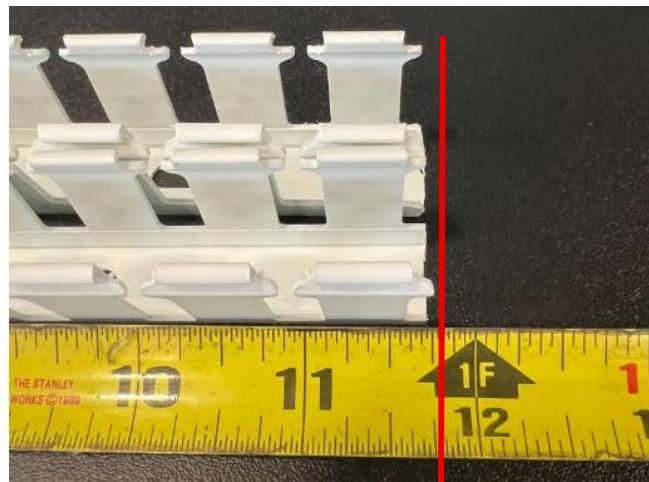
## Electrical Box Instructions

1. Start by taking the 10 foot long wire duct channel and make a mark at around 14.25" from one end. Use scissors to cut this section out in between the grooves as shown below. Note: Wire duct distances are approximate; if a measurement does not fall within a slotted groove, make the cut inside the nearest groove. Repeat to cut out another 14.25" segment.

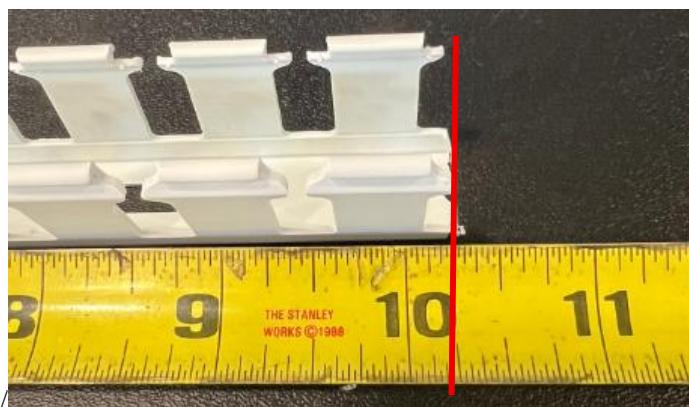


2. Next, mark off a section approximately 11.75" long and cut out with scissors. Repeat to cut out another 11.75" segment.

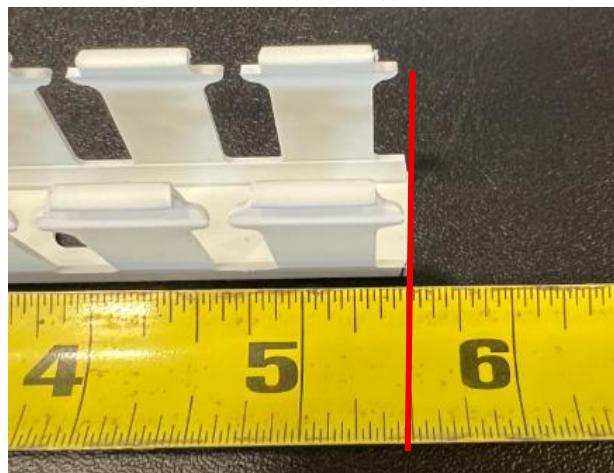
## Electrical Box Instructions



3. Next, mark off a section approximately 10.25" long and cut out with scissors.

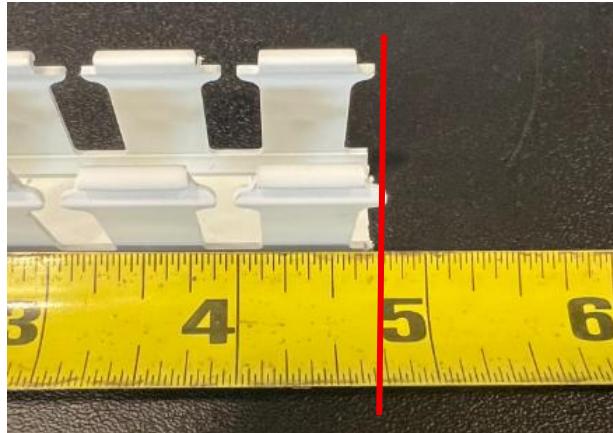


4. Next, mark off a section approximately 5.5" long and cut out with scissors.



5. Next, mark off a section approximately 4.75" long and cut out with scissors.

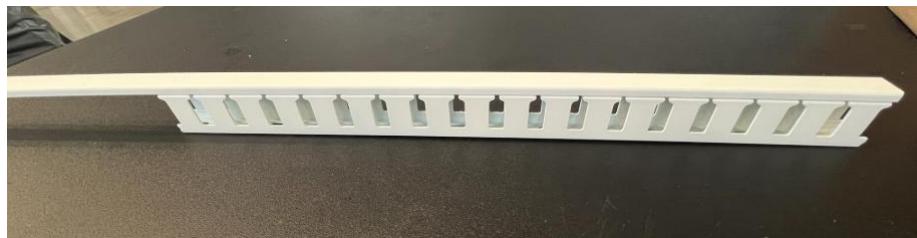
## Electrical Box Instructions



- Finally, cut the remaining wire duct segment in half to produce two sections approximately 3.25" long. Cut ~1" off of one of the segments so you have one 3.25" segment and one 2.25" segment.



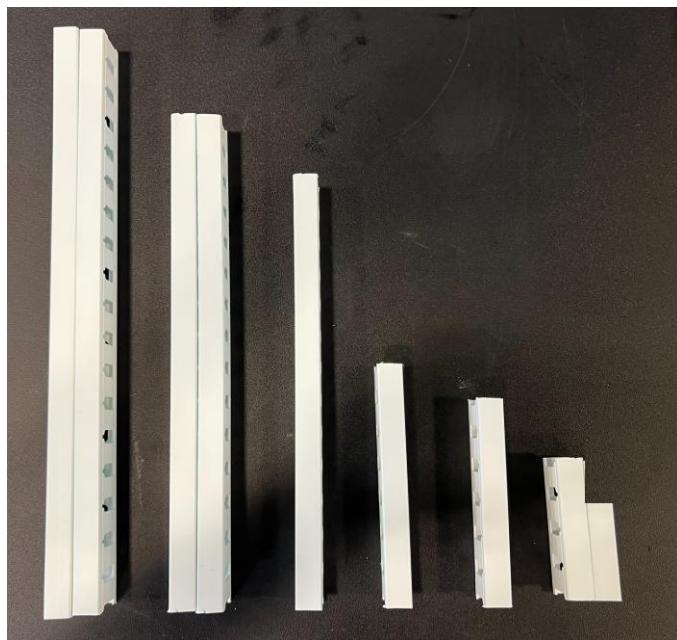
- Slide the wire duct lid onto one of the 14.25" segments from Step 1 and make sure that the ends line up. Cut out the same size lid as the segment used as shown in the picture below.



## Electrical Box Instructions

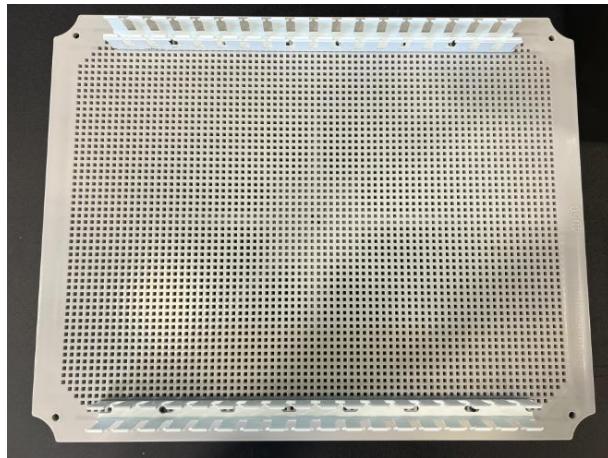
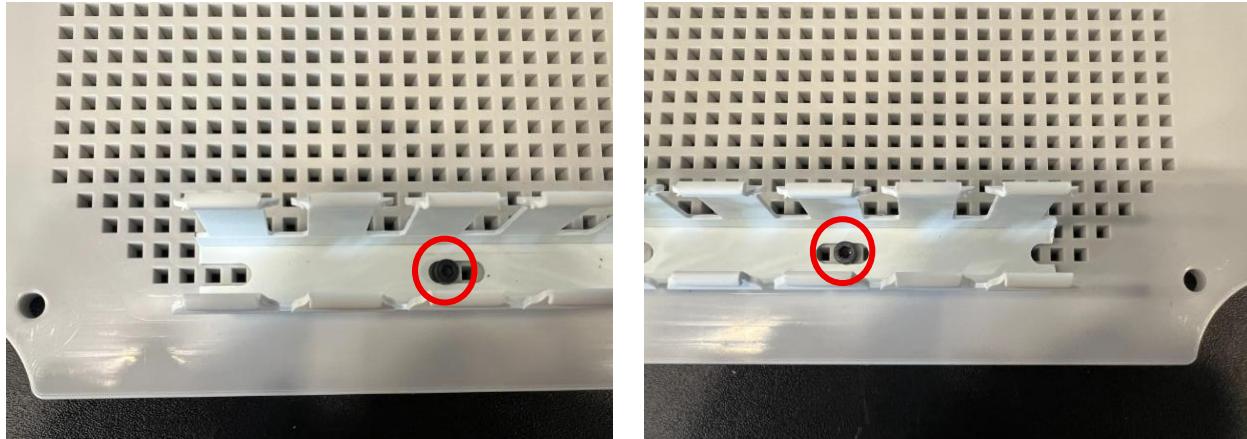


8. Repeat Step 7 for all 9 wire duct segments until you have 9 ducts and 9 lids as shown below.

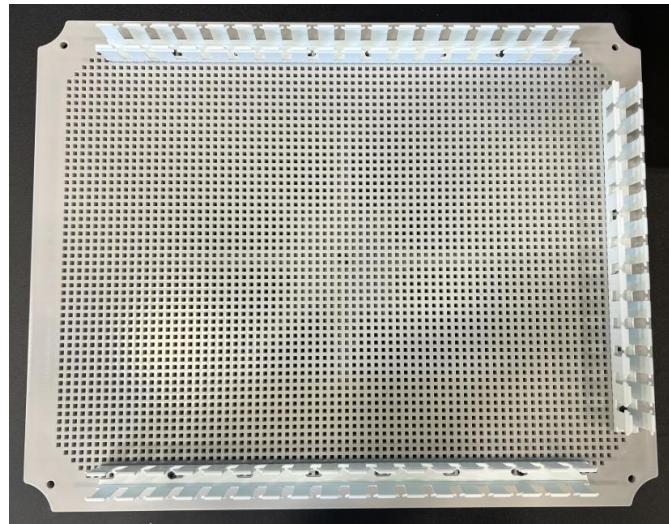


9. Using two M3x10 screws, mount one of the 14.25" segments of wire ducts on the last row of grids on the long side of the grid plate. Repeat with the other 14.25" segment on the other long side of the grid plate. The result is shown below.

## Electrical Box Instructions

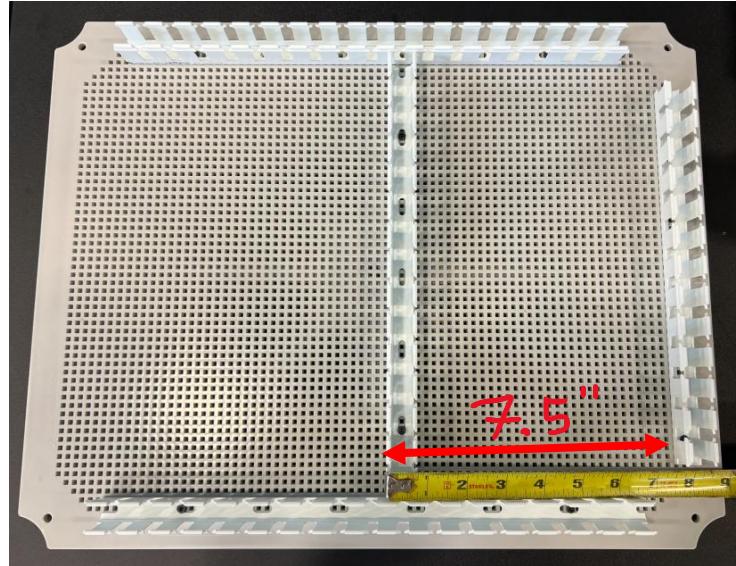


10. Mount the 10.25" wire duct segment onto one of the shorter sides with two M3x10 bolts as shown below.

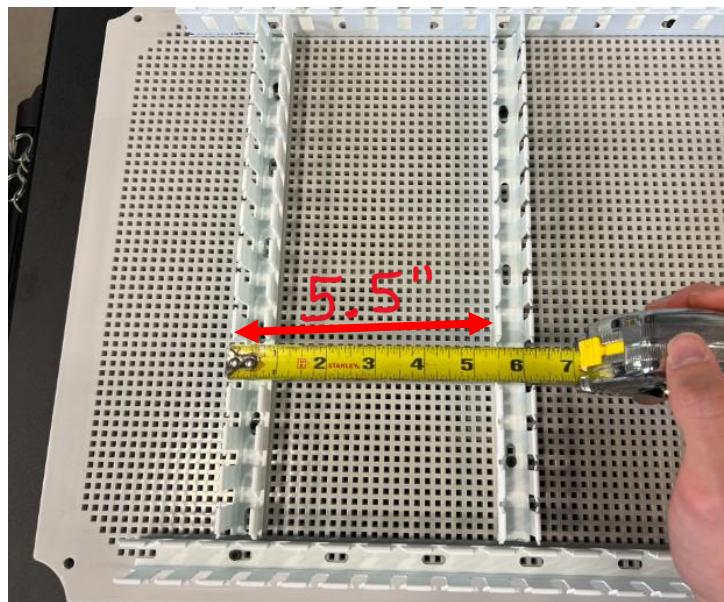


11. Mount one of the 11.75" wire duct segments 7.5" to the left of the 10.25" segment from Step 10 using two M3x10 bolts. Note that 7.5" distance between the ducts is measured from the left edge of each segment, as shown below.

## Electrical Box Instructions

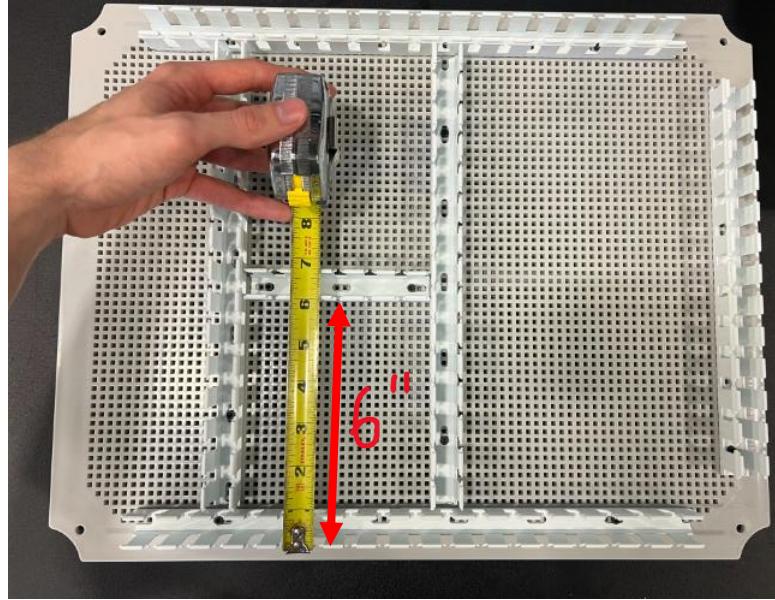


12. Mount the other 11.75" segment 5.5" to the left of the other 11.75" segment from Step 11 using two M3x10 bolts. Note that the 5.5" distance between the ducts is measured from the left edge of each segment, as shown below.

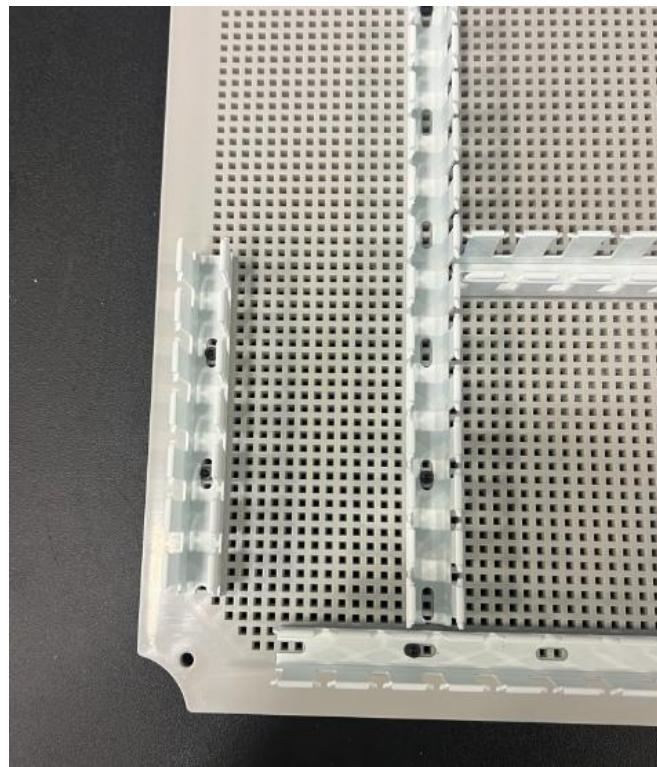


13. Mount the 4.75" segment 6" up from the bottom of the lower 14.25" segment from Step 9. Note that the 6" distance between the ducts is measured from the bottom edge of each segment, as shown below.

## Electrical Box Instructions

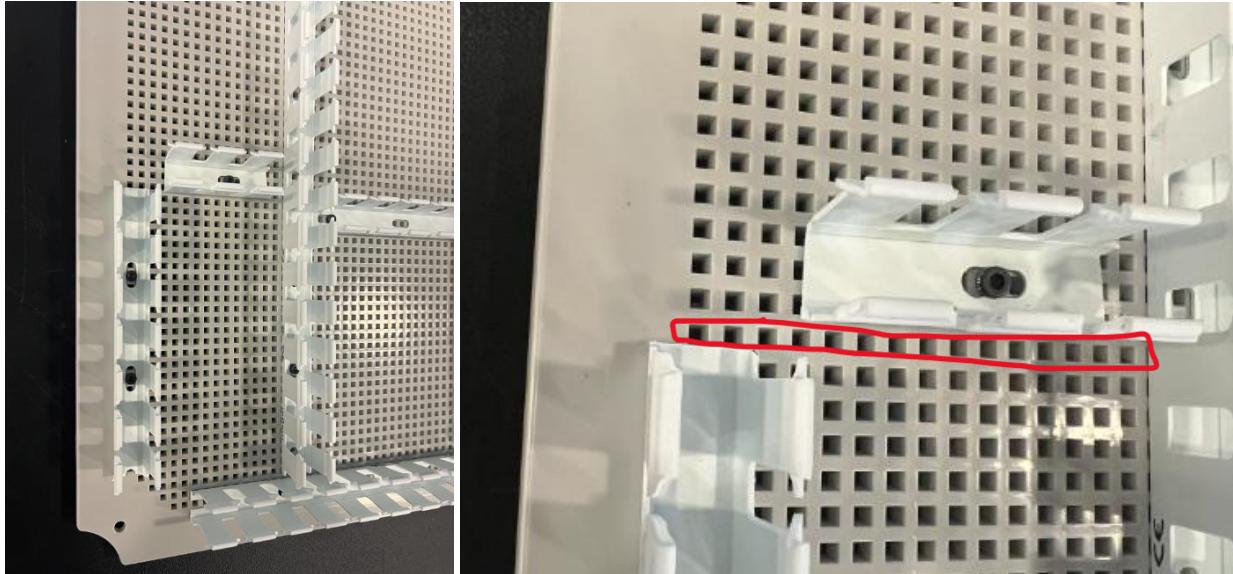


14. Mount the 5.5" wire duct segment on the far left side of the grid plate using two M3x10 bolts. Make sure the bottom part of the wire duct matches up with the bottom grid on the far left column of grids, as shown below.

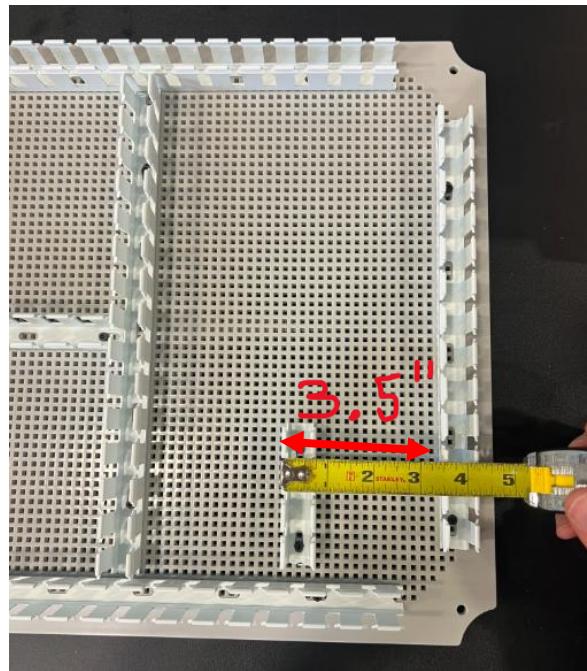


15. Mount the 2.25" wire duct segment 1 grid above and to the right of the 5.5" segment from Step 14 using one M3x10 bolt. Make sure that the end of the channel lines up with one of the grooves from the 11.75" segment to the right, as shown below.

## Electrical Box Instructions

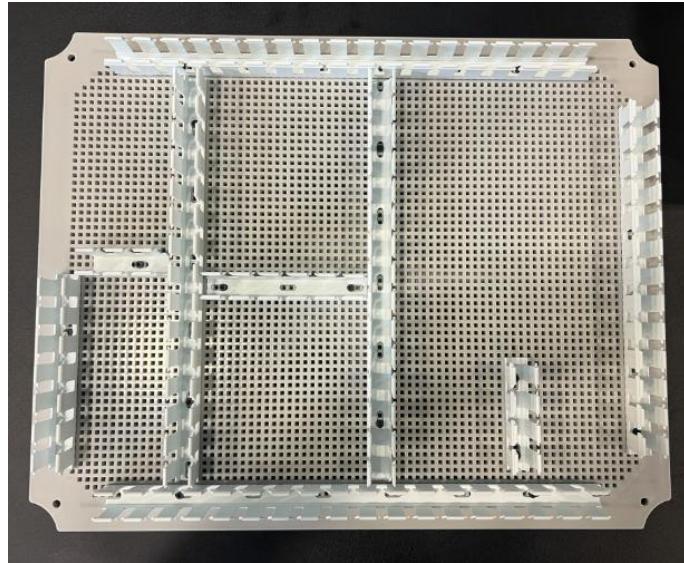


16. Mount the 3.25" wire duct segment 3.5" from the 10.25" wire duct segment on the far right side using two M3x10 bolts. Note that the 3.5" distance between the two segments is measured from the left side of each channel, as shown below.

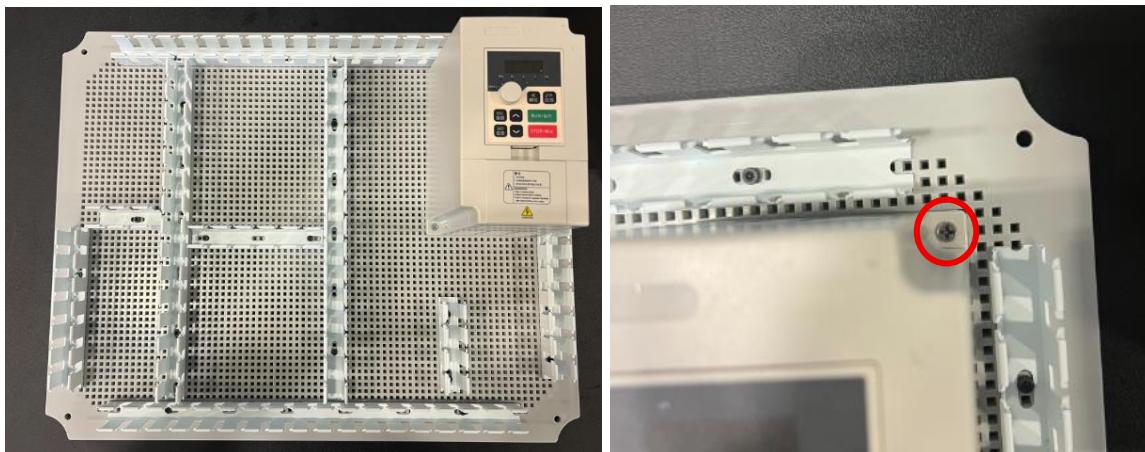


17. This concludes the grid plate preparation. The final result should look like the image below.

## Electrical Box Instructions



18. Using two #6 screws, mount the VFD into the top right corner of the grid plate. Leave about gap of about 1 grid between the VFD and wire ducts on its right and top sides. Note that the VFD may not be perfectly square due to grid spacing not lining up exactly with mounting holes.

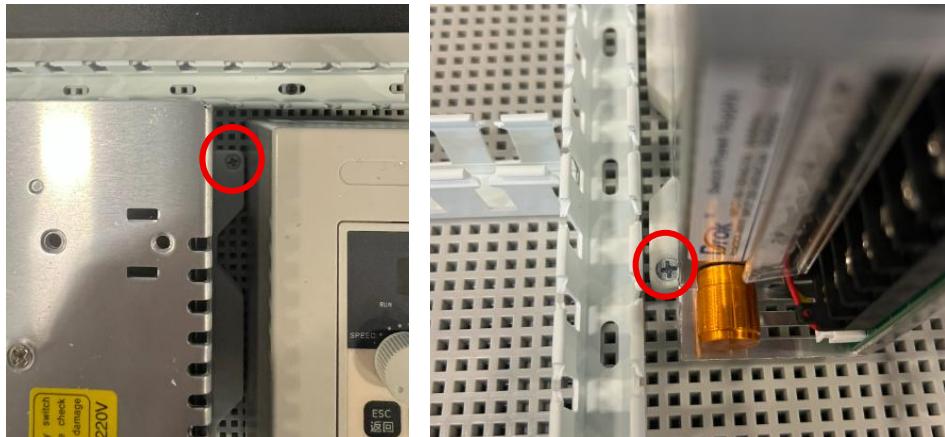


19. Using two M4 bolts, attach the PSU mounting plate to the PSU as shown below.



20. Using two #6 screws, mount the PSU to the grid plate to the left of the VFD as shown below.

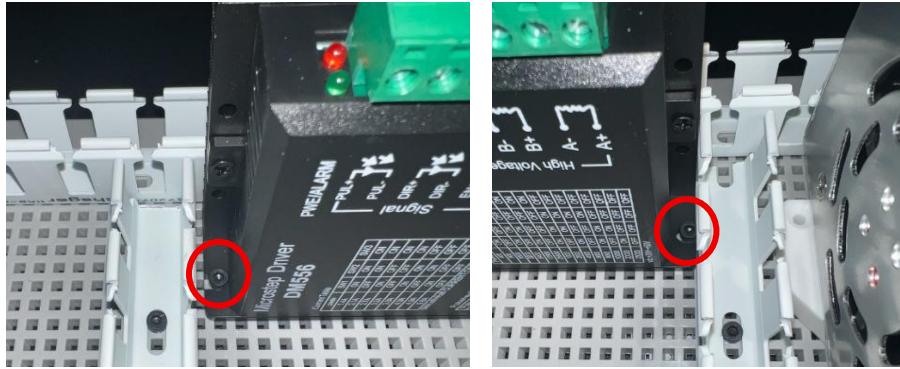
## Electrical Box Instructions



- Using two M3x10 bolts, mount one of the DM556 drivers to the left of the PSU. The finned side should be facing the back of the grid plate and should be pushed all the way up against the wire channel.



## Electrical Box Instructions



22. Repeat Step 21 to add the other two DM556 drivers in front of the first one. Make sure to leave about 3 grid spaces worth of distance in between each driver as shown in the picture below.



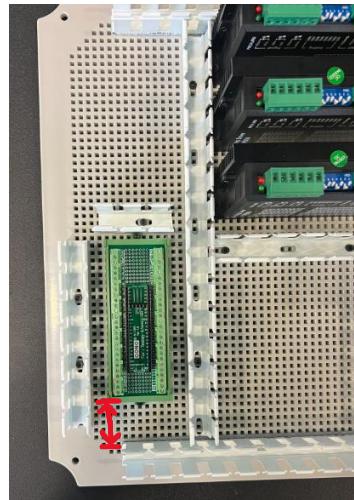
23. Select the driver settings for the DM556 drivers.

- 1: ON
- 2: OFF
- 3: ON
- 4: OFF
- 5: ON
- 6: ON
- 7: OFF
- 8: ON

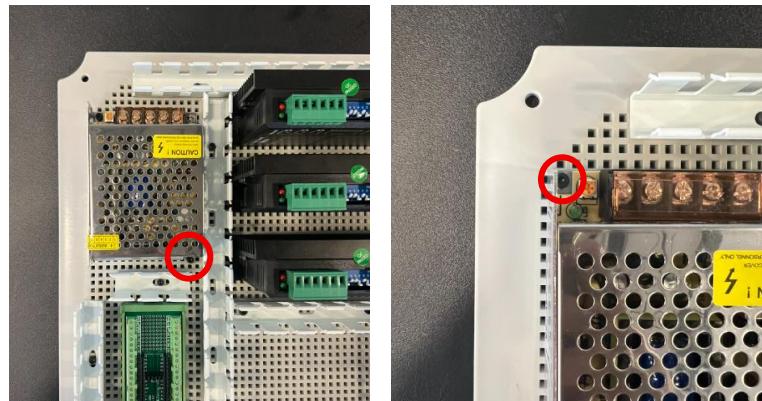


## Electrical Box Instructions

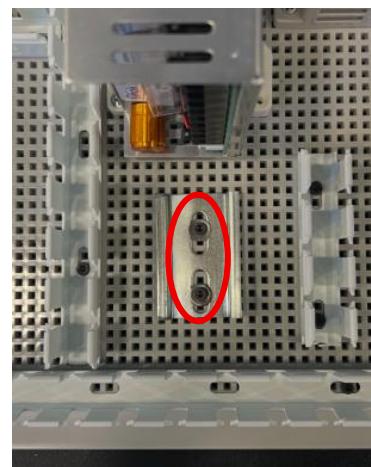
24. Using two M3x10 bolts, mount the Teensy 4.1 breakout board into the bottom left section of the grid plate as shown below. The top screw should be all the way up against the upper wire channel, and the bottom screw should have 5 grid spaces between it and the bottom wire channel.



25. Using two M3x10 bolts, mount the 5V PSU to the top left section of the grid plate. There should be 2-3 grid spaces between the top of the 5V PSU and the top wire channel, as shown below.

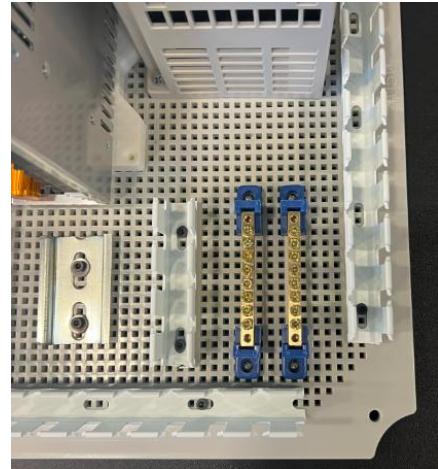


26. Using two M3x10 bolts and two washers, mount the DIN rail in front of the PSU as shown below.

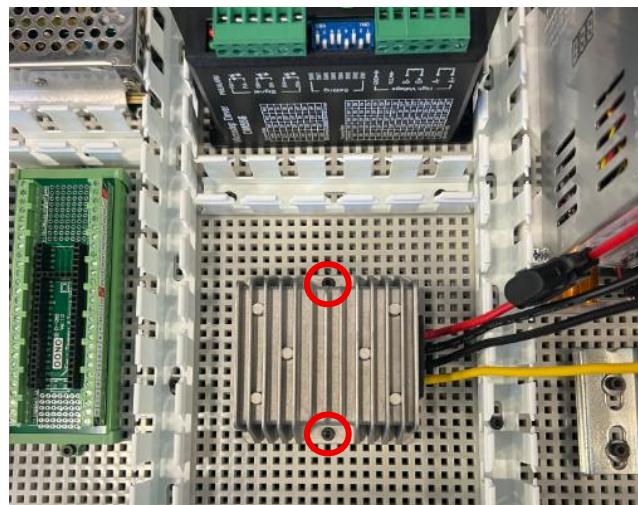


## Electrical Box Instructions

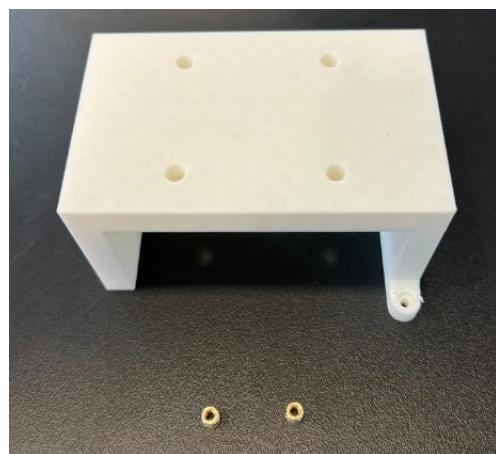
27. Using four M3x10 bolts, mount the two bus bars in front of the VFD as shown below.



28. Using two M3x10 bolts, mount the 12V step down converter in the section in front of the three DM556 drivers as shown in the picture below. Leave the wires floating and unconnected for now.

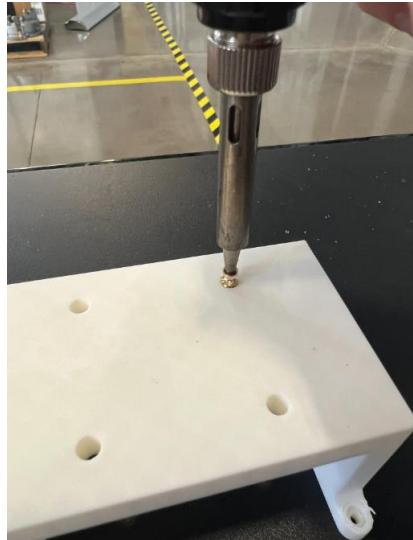


29. Find and set aside the white optocoupler mount and two M3x6x5 heat set inserts as shown below.

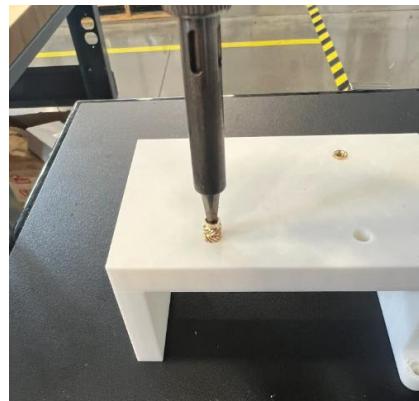


## **Electrical Box Instructions**

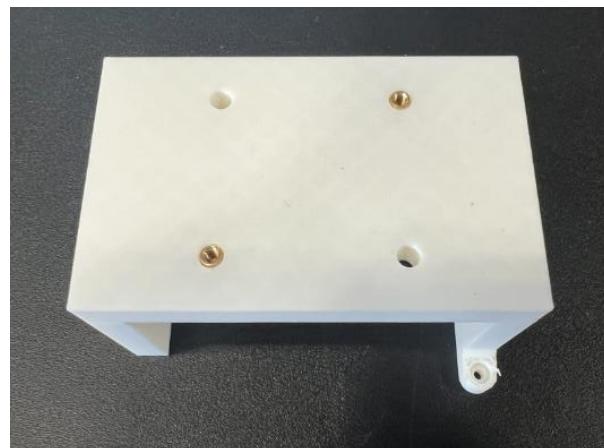
30. Using a soldering iron set to approximately 450 °F, use a light to moderate amount of force to push one of the heat set inserts into one of the four holes on top of the optocoupler mount as shown below. The heat set insert should finish flush with top of the mount.



31. Repeat Step 30 for the other heat set insert in the hole diagonal from the previous step.

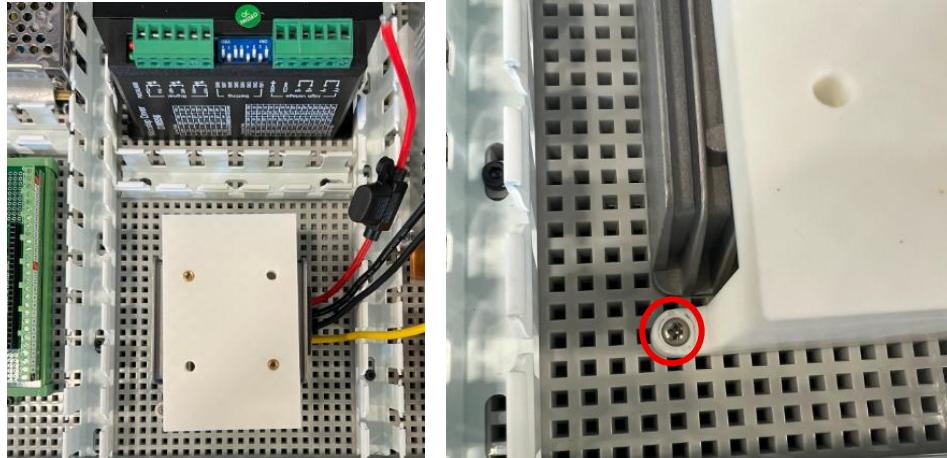


32. The two previous steps should result in the product shown below.

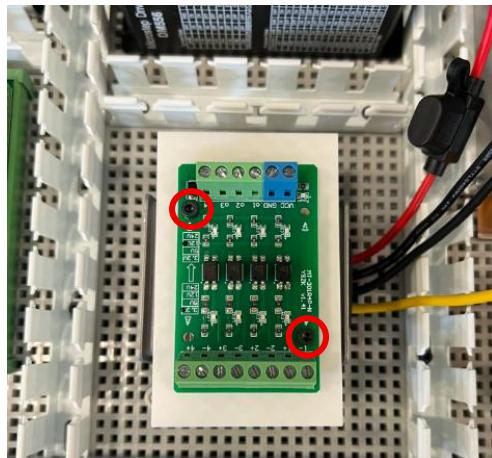


## Electrical Box Instructions

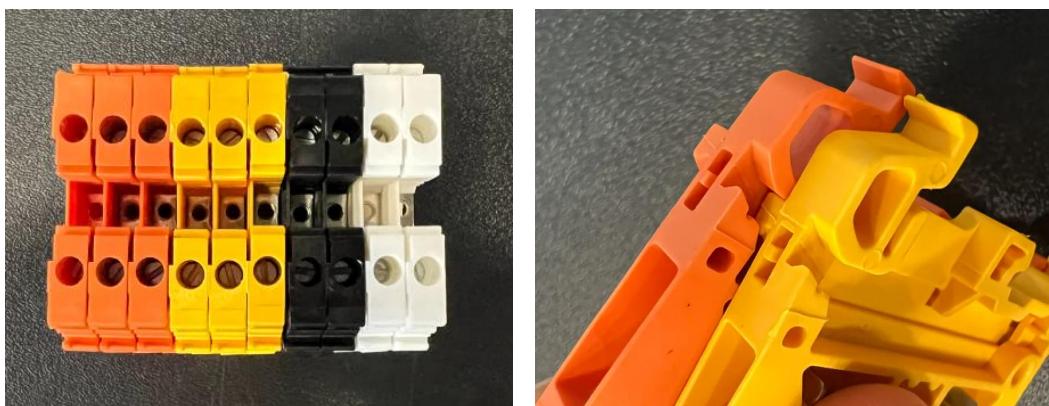
33. Using two M3x10 screws, insert the optocoupler mount directly over the 12V stepdown converter as shown in the image below. Note that the mount may be slightly crooked due to grid spacing.



34. Using two M3x10 bolts, install the optocoupler on top of the mount by screwing the bolts through the heat set insert as shown below. Make sure that the side with 8 channels faces away from the DM556 drivers.

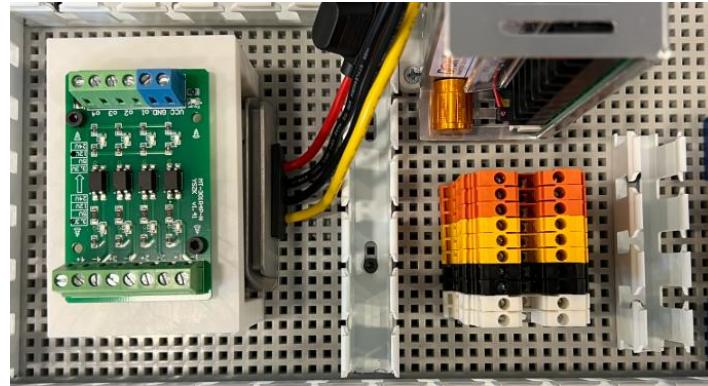


35. Grab three orange, three yellow, two black, and two white DIN rail terminal blocks. Snap the connectors together in the orientation shown using the clips on the sides of the terminal blocks.

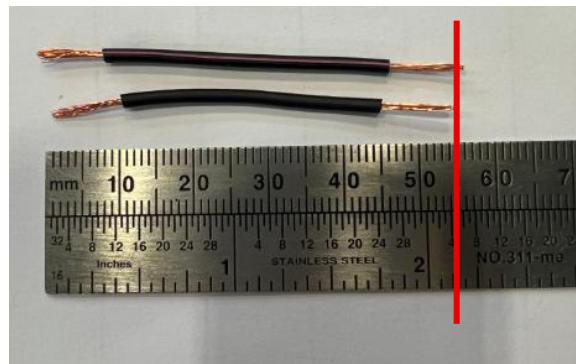


## Electrical Box Instructions

36. Snap the terminal blocks onto the DIN rail in the orientation shown below. Note, it is easier to put the terminal blocks on the DIN rail and snap two on at a time rather than pressing all ten together.



37. Cut two black 22AWG wires to 55 mm and strip both sides to 8 mm. To strip the wires, use the Weicon tool and set the backstop to 8 mm, then squeeze to pull back the insulation as shown.



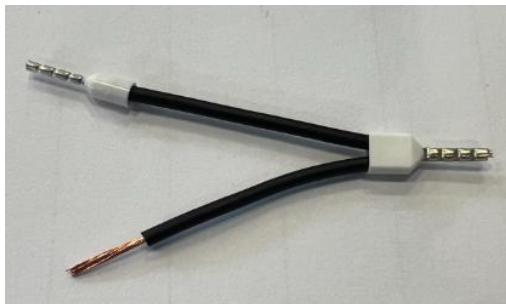
38. Crimp a 22AWG ferrule connector to one side of one of the 55 mm black wires.



## Electrical Box Instructions



39. Crimp a 22AWG twin ferrule connector onto both 55 mm black wires.



40. Cut a black 22AWG wire to 110 mm and strip both ends to 8 mm.

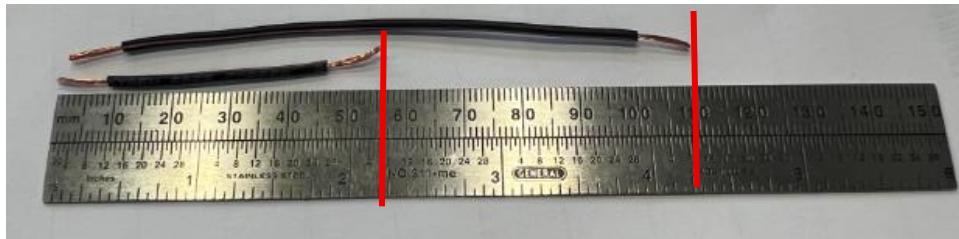


41. Crimp a 22AWG twin ferrule connector between the open 55 mm lead and the 110 mm wire.

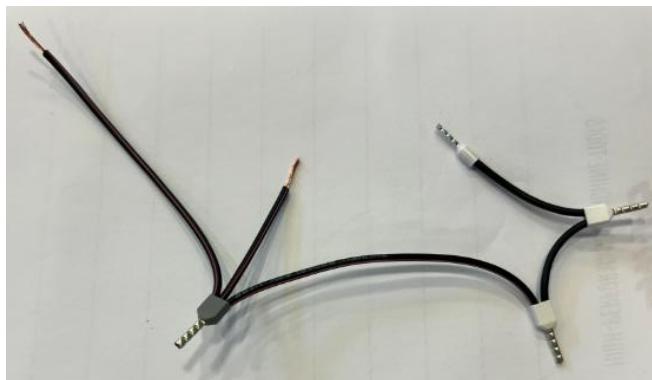


## **Electrical Box Instructions**

42. Cut out another 55 mm wire and another 110 mm wire and strip both ends to 8 mm.



43. Attach the two 110 mm wires and the new 55 mm wire together with a 20AWG twin ferrule connector as shown below.



44. Cut out another 55 mm wire and strip both ends to 8 mm.

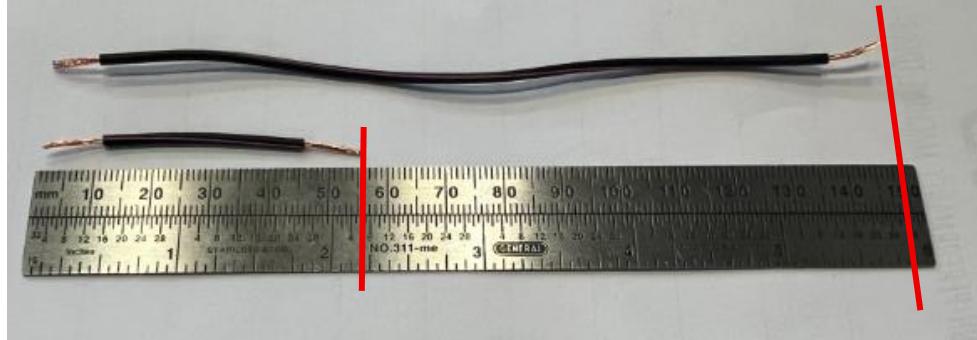


45. Crimp a 22AWG twin ferrule connector between the open 55 mm lead from Step 43 and the new 55 mm wire. Then crimp a 22AWG ferrule connector onto the open end of the new 55 mm wire.



## Electrical Box Instructions

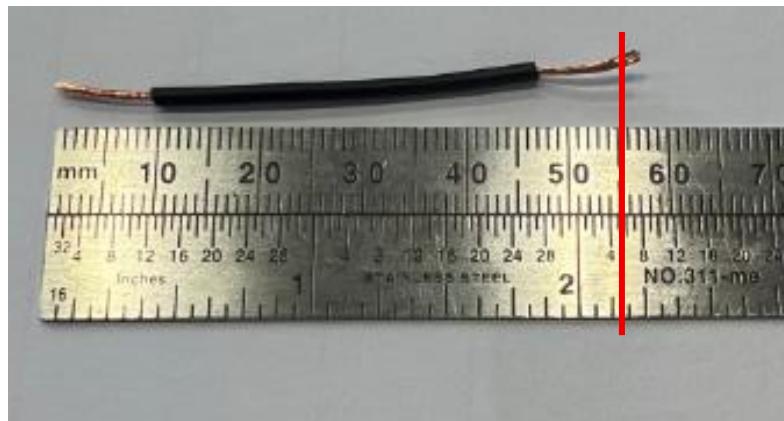
46. Cut another 55 mm black wire and a new 150 mm black wire and strip both ends to 8 mm.



47. Attach the open 110 mm lead from Step 43, the new 55 mm wire, and the new 150 mm wire together by crimping a 20AWG twin ferrule connector on them as shown below.



48. Cut out another 55 mm wire and strip both ends to 8 mm.

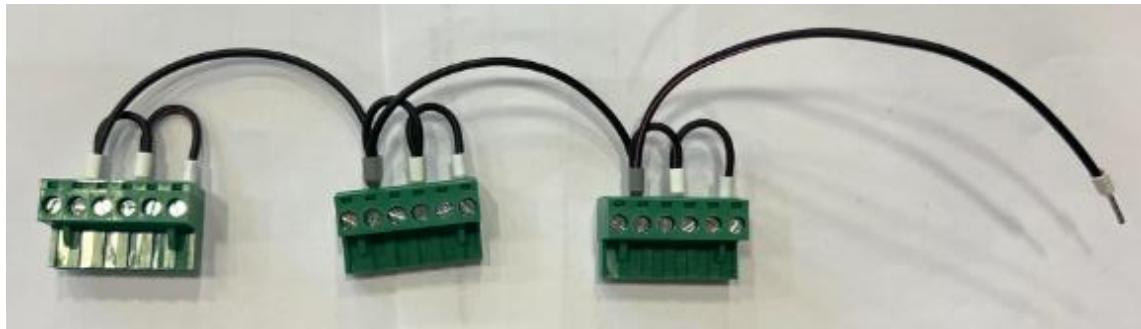


## Electrical Box Instructions

49. Repeat Step 45 with the open 55 mm lead from Step 47 and the new 55 mm wire from Step 48.  
Crimp a 22AWG ferrule connector onto the free end of the 150 mm lead.

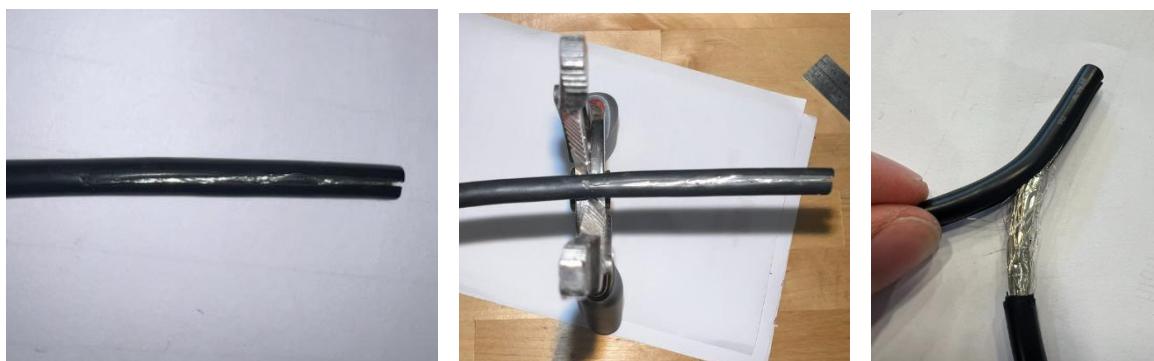
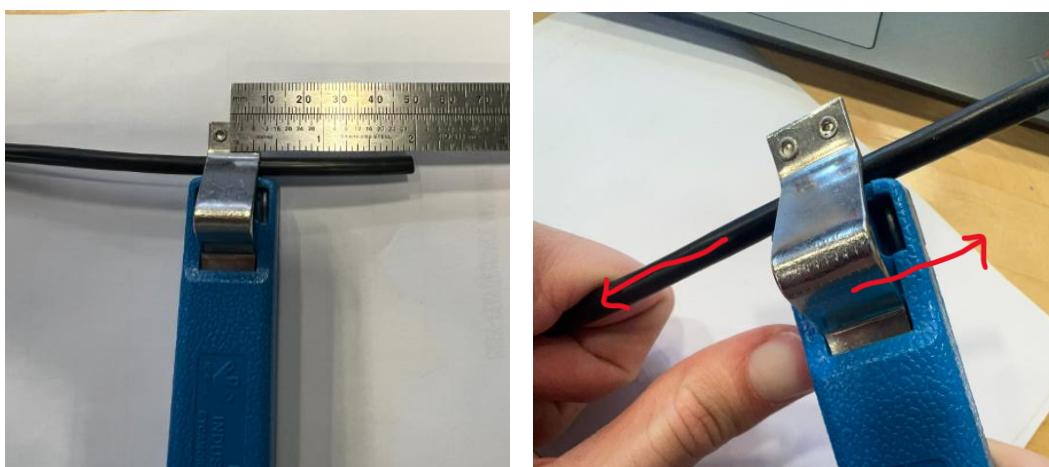


50. Remove the terminal blocks from the signal side of the DM556 motor drivers. Attach the jumped ground connections from Step 49 to the ENA-, DIR-, and PUL- pins on the motor drivers outlined in red.



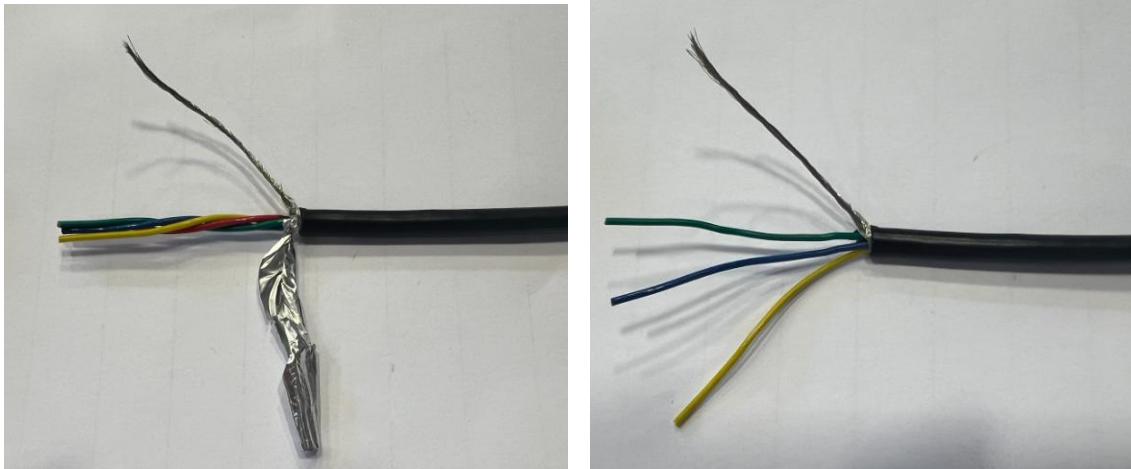
## Electrical Box Instructions

51. Begin preparing the rest of the signal wires. Cut a 4-core shielded cable to 11 in. and strip back 50 mm (2 in.) of insulation on one side. Note, the easiest way to strip the 4-core shielded cable is to use the Ideal Swivel-Blade Cable Stripper to cut the required distance lengthwise. Then, using wire cutters, circumferentially cut at the base of the first cut to peel the insulation off, as shown on the next page.

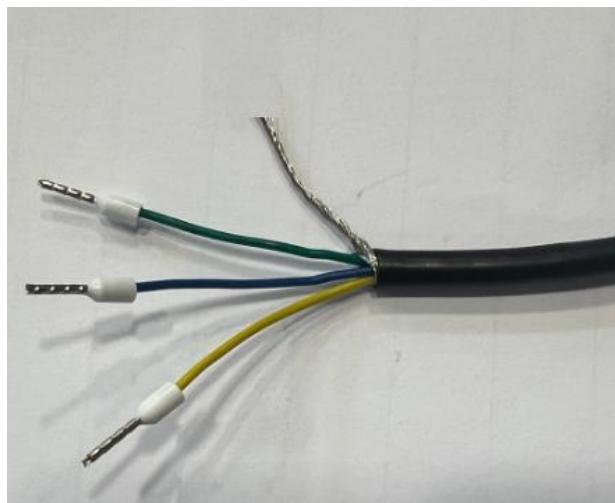


## **Electrical Box Instructions**

52. Twist the stranded shielding wire together and remove the shielded foil and red wire as shown.



53. Strip the ends of the blue, green, and yellow wires to 8 mm. Crimp 22AWG ferrule connectors onto these wires, leaving the stranded shielded wire free.

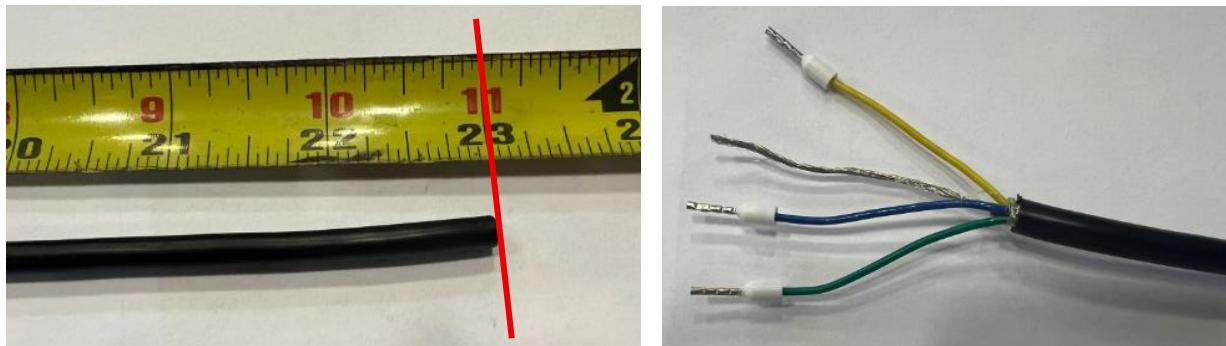


54. Strip the other end to 50 mm as well, and repeat Step 52, except you can also cut off / remove the stranded shielded wire as well. Repeat Step 53 as well to produce the final result below.

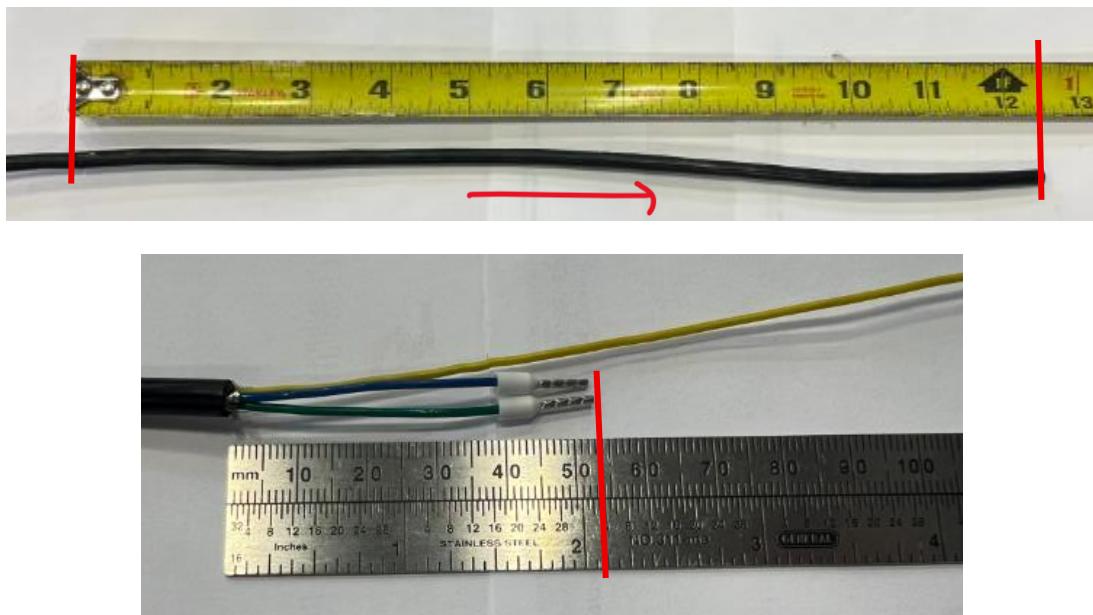


## Electrical Box Instructions

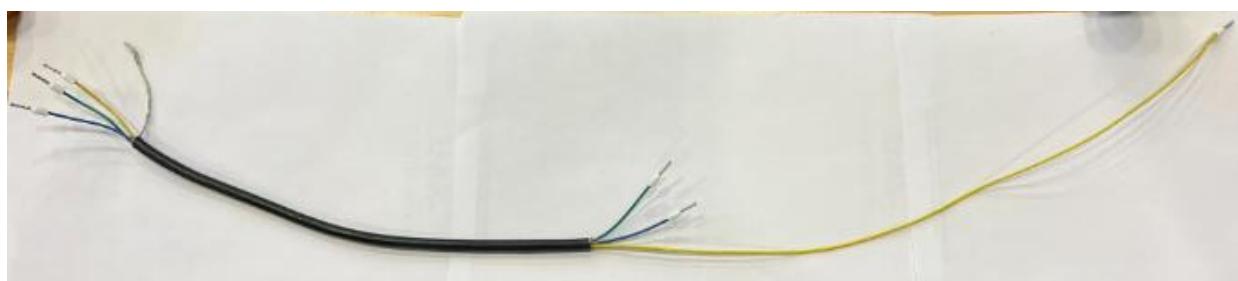
55. Cut a 4-core shielded cable to 23 in. and strip one end to 50 mm, removing the red wire and foil. Strip the blue, green, and yellow wires to 8 mm and attach 22AWG ferrule connector to them.



56. Strip 12.5 inches of insulation off of the other side and remove the red wire and foil. Then cut off all but 55 mm of the blue and green wire, leaving the yellow wire at full length. Strip these new lengths to 8 mm and attach 22AWG ferrule connectors as shown.

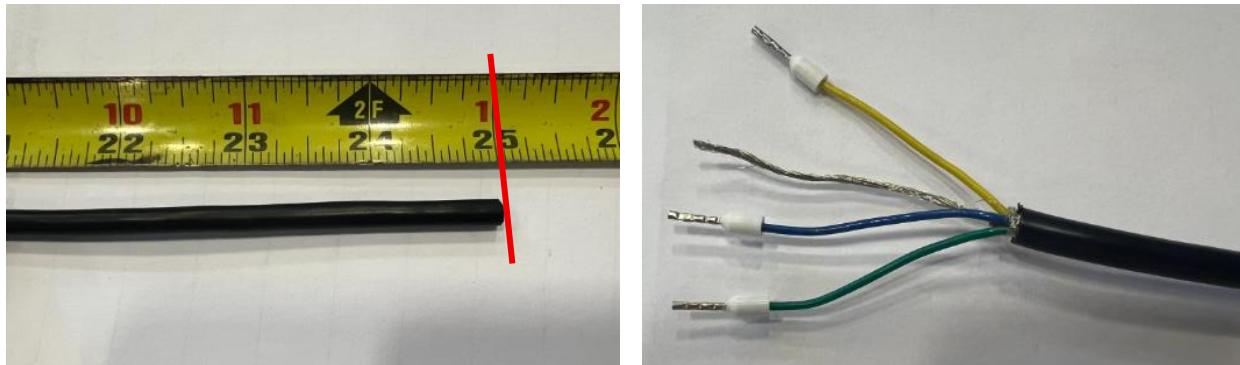


57. Strip the end of the yellow wire to 8 mm and crimp a 22AWG ferrule connector to the end to produce the final result shown below.

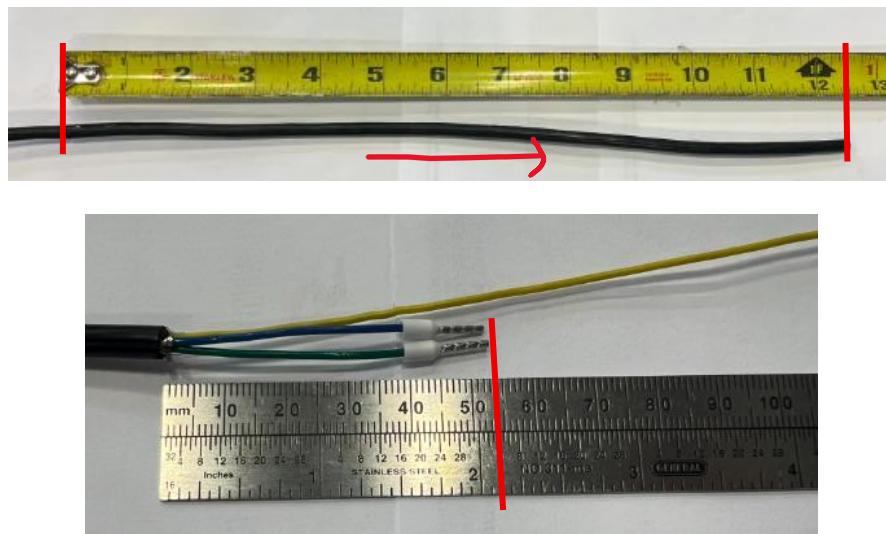


## **Electrical Box Instructions**

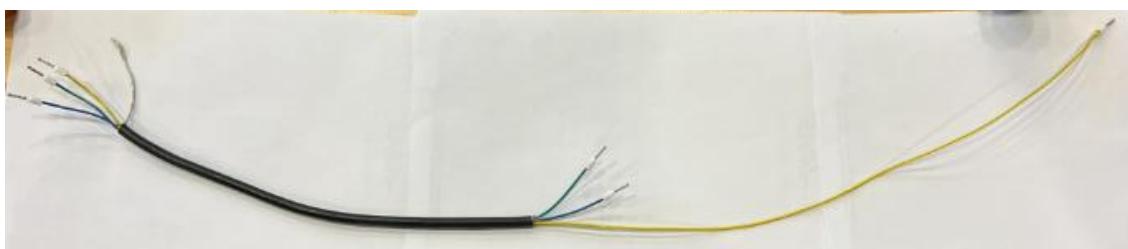
58. Cut a 4-core shielded cable to 25 in. and strip one end to 50 mm, removing the red wire and foil. Strip the blue, green, and yellow wires to 8 mm and attach 22AWG ferrule connector to them.



59. Strip 12.5 inches of insulation off of the other side and remove the red wire and foil. Then cut off all but 55 mm of the blue and green wire, leaving the yellow wire at full length. Strip these new lengths to 8 mm and attach 22AWG ferrule connectors as shown.



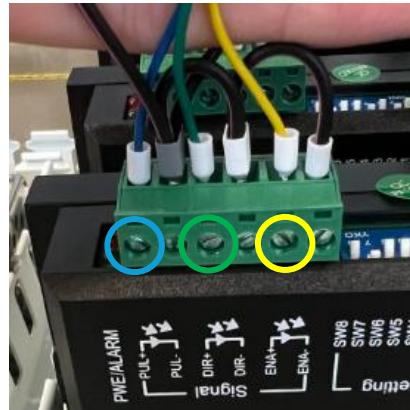
60. Strip the end of the yellow wire to 8 mm and crimp a 22AWG ferrule connector to the end to produce the final result shown below.



## Electrical Box Instructions

61. First, take the 11-in. 4-core shielded cable from Step 54. Using the side with the stranded shielding, plug in the blue, green, and yellow wires into the following ports. Note, leave the long black wire coming from the PUL- port on the front drive unconnected on its free end for now.

- a. Blue wire = PUL+
- b. Green wire = DIR+
- c. Yellow wire = ENA+



62. Repeat for the 23 in. and 25 in. wires to produce the result shown below.



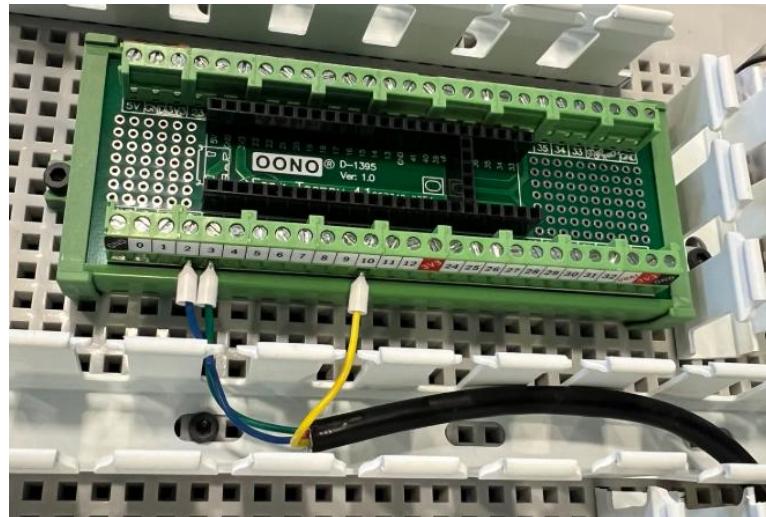
63. Starting with the 11 in. shielded cable, route the cord in front of the DM556 driver and through the wire channels as shown below.



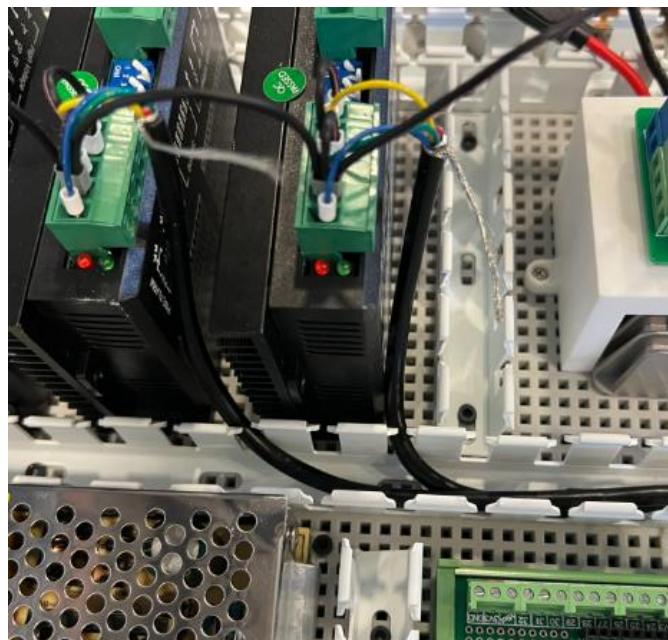
## Electrical Box Instructions

64. Connect the blue, green, and yellow wires from the 11 in. cable into the Teensy 4.1 following the GRBLHAL reference page. The front DM556 driver is now the X-axis drive.

- a. Blue: PUL+ → Pin 2: Step X
- b. Green: DIR+ → Pin 3: Direction X
- c. Yellow: ENA+ → Pin 10: Enable X



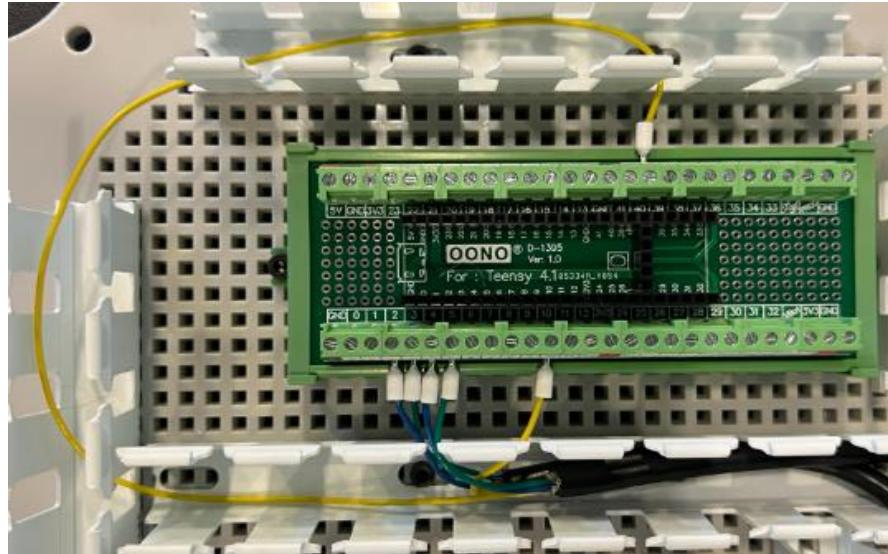
65. Now with the 23 in. shielded cable from the middle DM556 driver, route the cord in front the middle driver and through the wire channels as shown below.



## Electrical Box Instructions

66. Connect the blue, green, and yellow wires from the 23 in. cable into the Teensy 4.1 following the GRBLHAL reference page. The middle DM556 driver is now the Y-axis drive.

- a. Blue: PUL+ → Pin 4: Step Y
- b. Green: DIR+ → Pin 5: Direction Y
- c. Yellow: ENA+ → Pin 40: Enable Y



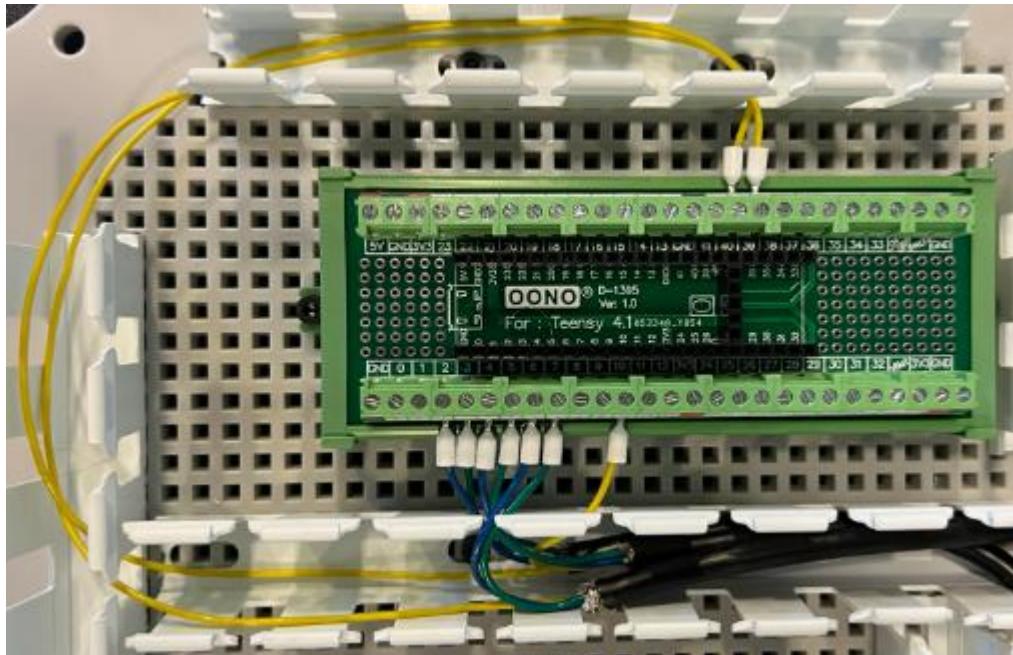
67. Finally with the 25 in. shielded cable from the back DM556 driver, route the cord in front of the back driver and through the wire channels as shown below.



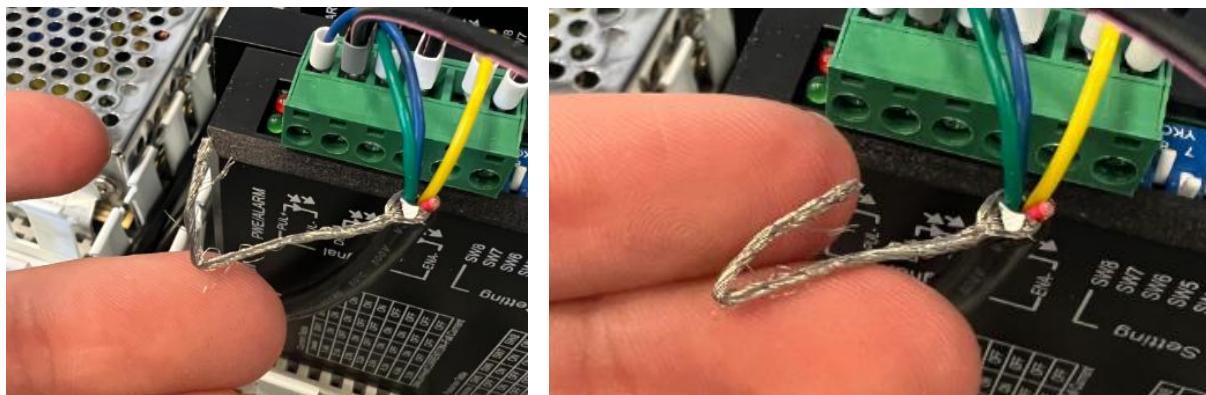
## Electrical Box Instructions

68. Connect the blue, green, and yellow wires from the 25 in. cable into the Teensy 4.1 following the GRBLHAL reference page. The back DM556 driver is now the Z-axis drive.

- a. Blue: PUL+ → Pin 6: Step Z
- b. Green: DIR+ → Pin 7: Direction Z
- c. Yellow: ENA+ → Pin 39: Enable Z

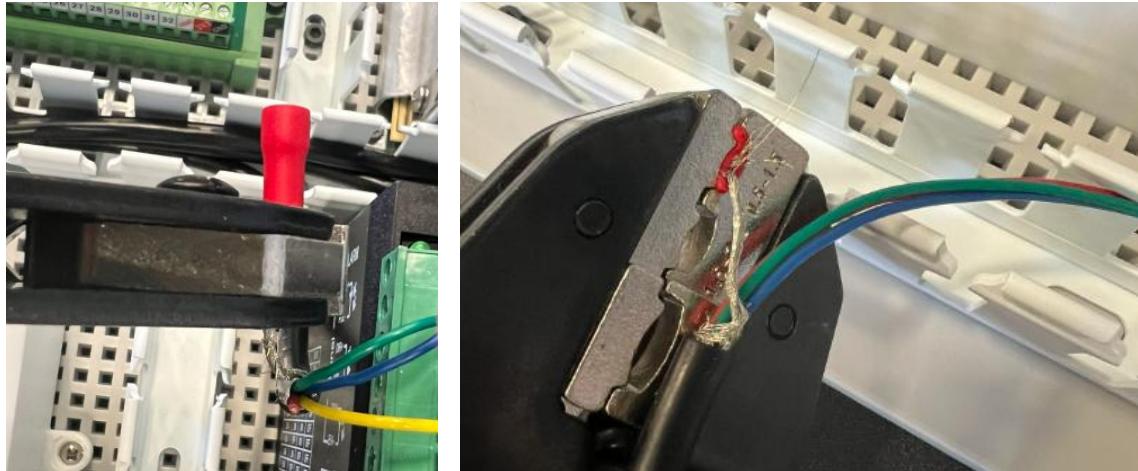


69. Starting with the 11 in. wire, fold the end of the stranded shielding wire over on itself as shown.



## Electrical Box Instructions

70. Using the connector crimp tool, crimp the folded over stranded shielding wire into one end of a red butt connector as shown below.

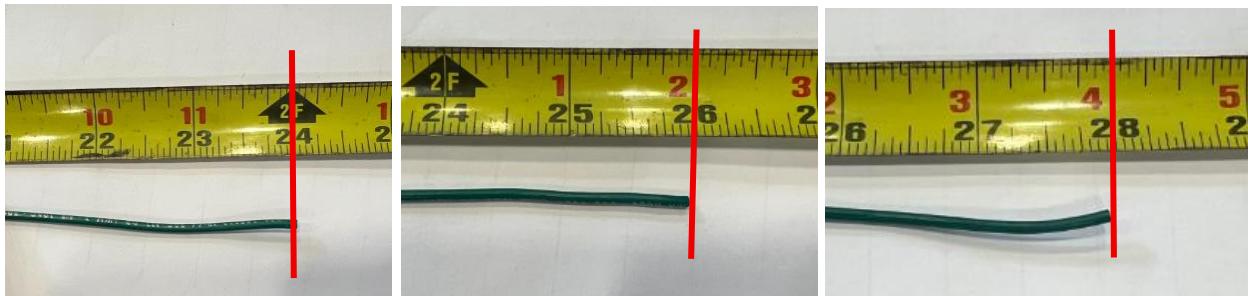


71. Repeat Step 69-70 for the 23 in. and 25 in. wires to produce the result shown below.

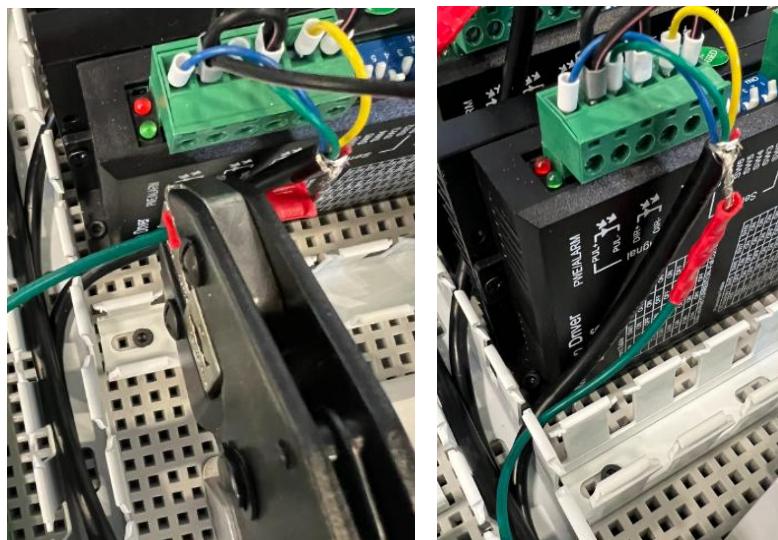


## Electrical Box Instructions

72. Cut a 24 in., a 26 in., and a 28 in. length of 16AWG green wire as shown below.



73. Starting with the 24 in. wire, strip one end to 8 mm and crimp into the red butt connector on the X-axis drive (front DM556 driver). Route in the same channel as the shielded cable.

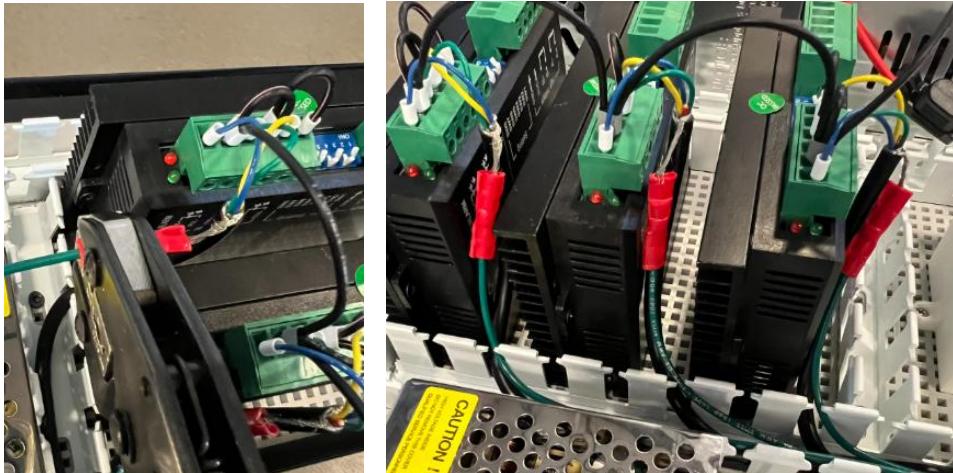


74. Strip one end of the 26 in. green wire to 8 mm and crimp into the red butt connector on the Y-axis drive (middle DM556 driver). Route in the same channel as the shielded cable.

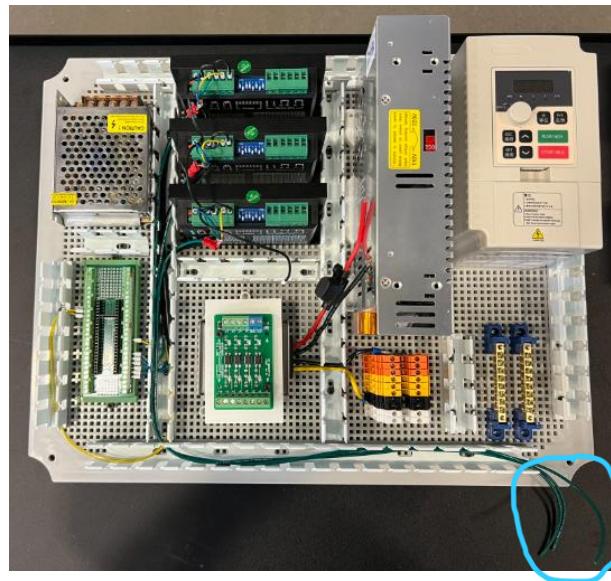


## Electrical Box Instructions

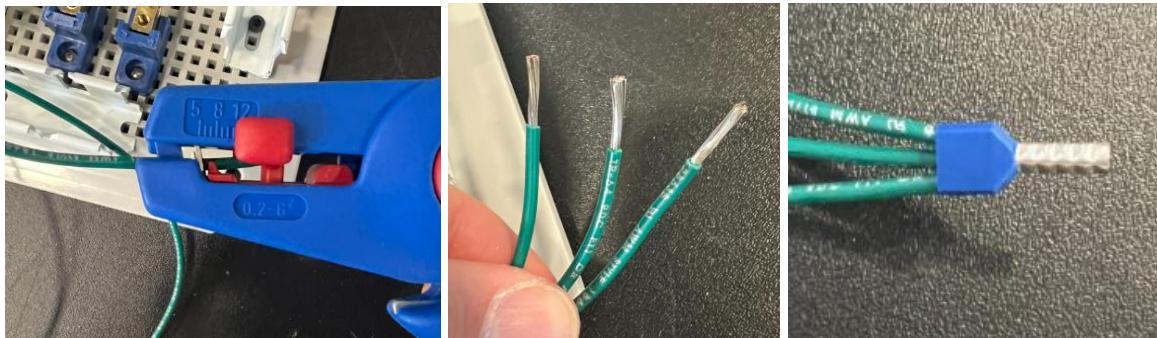
75. Strip one end of the 28 in. green wire to 8 mm and crimp into the red butt connector on the Z-axis driver (back DM556 driver). Route in the same channel as the shielded cable.



76. Route the green cables all the way to the bus bars as shown below.



77. Strip the end of all three green wires to 10 mm. Crimp all three wires into a blue twin ferrule connector as shown below.

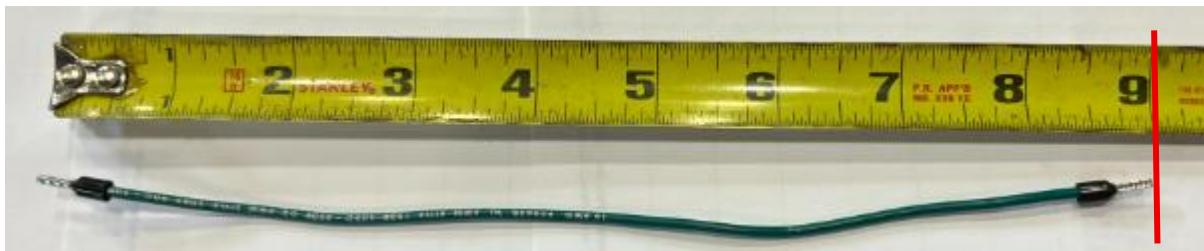


## Electrical Box Instructions

78. Insert these wires into the bus bar and tighten into place.



79. Cut a 16AWG green wire to 9 in., strip both ends to 8 mm, and crimp a 16AWG ferrule connector on each end.

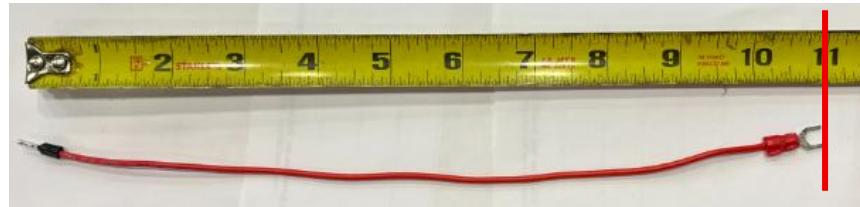
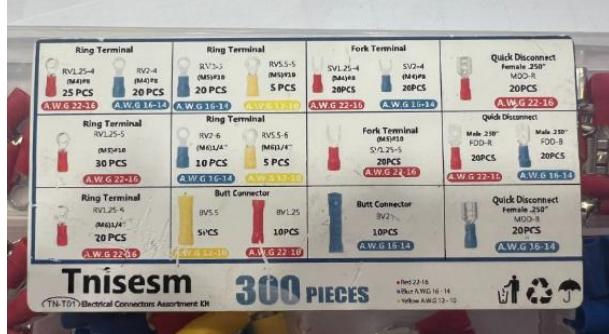


80. Insert one end of the green wire into one of the bus bars and tighten down. Route the wire through the wire channels and insert the other end into the other bus bar, as shown below.

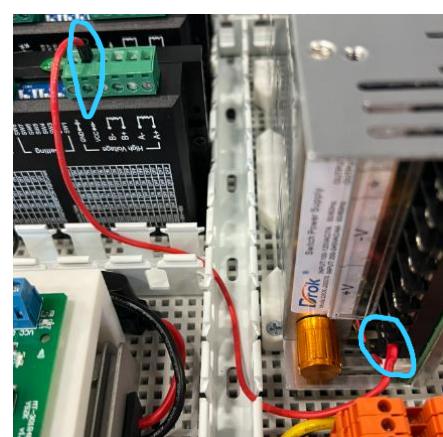


## Electrical Box Instructions

81. Cut a 16AWG red wire to 11 in. and strip both ends to 8 mm. Crimp a 16AWG ferrule connector onto one end and crimp an (M4)#8 or (M5)#10 fork terminal onto the other end as shown. When crimping these connectors, make sure the split in the connector contacts the top jaw of the tool as shown.



82. Insert the ferrule connector side into the VCC port on the High Voltage side of the X-axis DM556 drive and tighten to secure. Insert the fork connector side into the bottom +V port on the 48V PSU and tighten to secure. [Note, it may be necessary to scoop the colored DIN rail terminal blocks down to assist in inserting the fork connectors.](#)



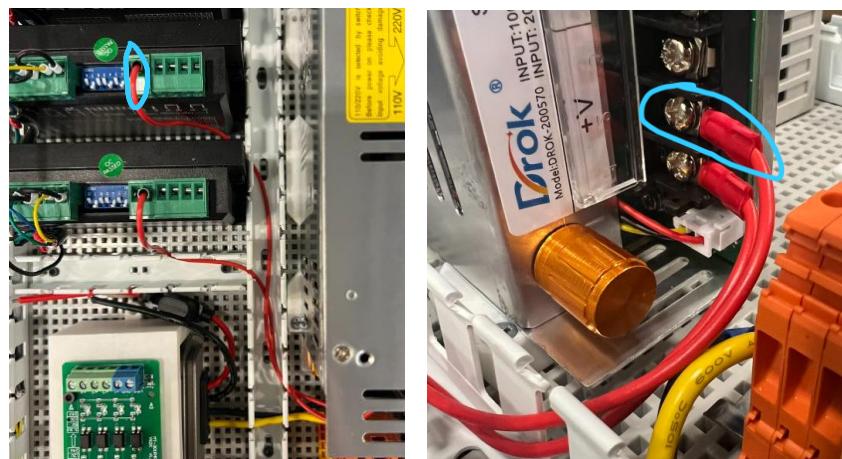
## Electrical Box Instructions



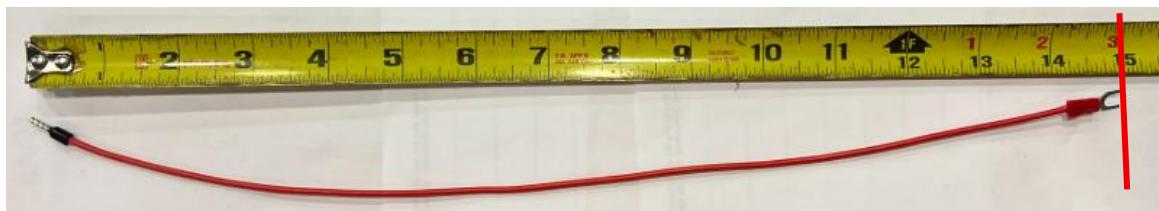
83. Cut a 16AWG red wire to 13 in. and crimp both ends to 8 mm. Crimp a 16AWG ferrule connector onto one end and crimp an (M4)#8 or (M5)#10 fork terminal onto the other end as shown.



84. Insert the ferrule connector side into the VCC port on the High Voltage side of the Y-axis DM556 drive and tighten to secure. Insert the fork connector side into the middle +V port on the 48V PSU and tighten to secure.

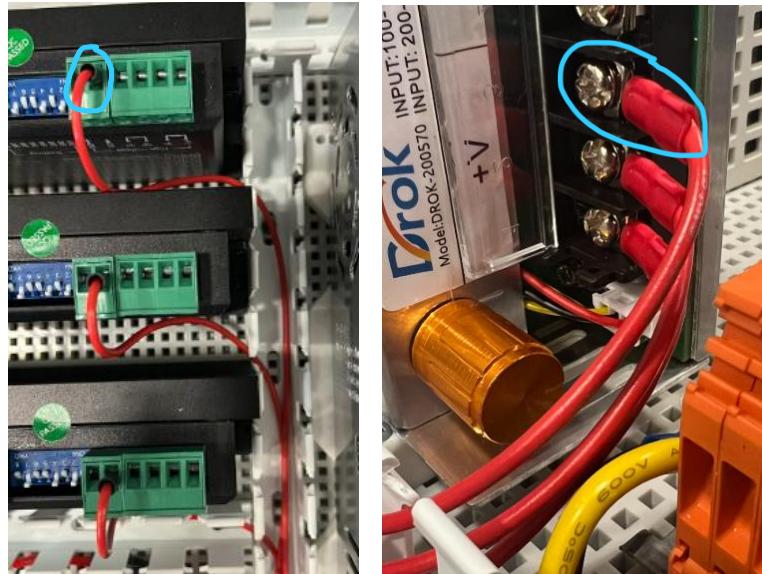


85. Cut a 16AWG red wire to 15 in. and strip both ends to 8 mm. Crimp a 16AWG ferrule connector onto one end and crimp an (M4)#8 or (M5)#10 fork terminal onto the other end as shown.



## Electrical Box Instructions

86. Insert the ferrule connector side into the VCC port on the High Voltage side of the Z-axis DM556 drive and tighten to secure. Insert the fork connector side into the top +V port on the 48V PSU and tighten to secure.



87. Cut a 23 in., a 25 in., and a 27 in. length of 16AWG green wire as shown below. Strip one end of all three wires to 8 mm, and the other end of all three wires to 10 mm.

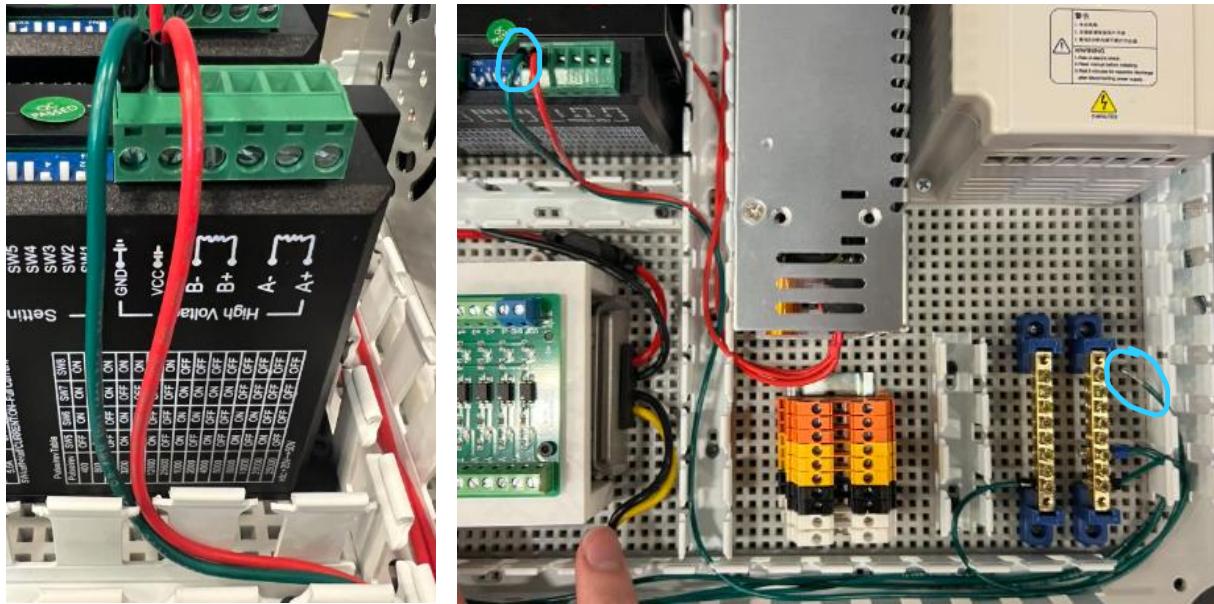


88. Crimp a 16AWG ferrule connector onto the three sides stripped to 8 mm.

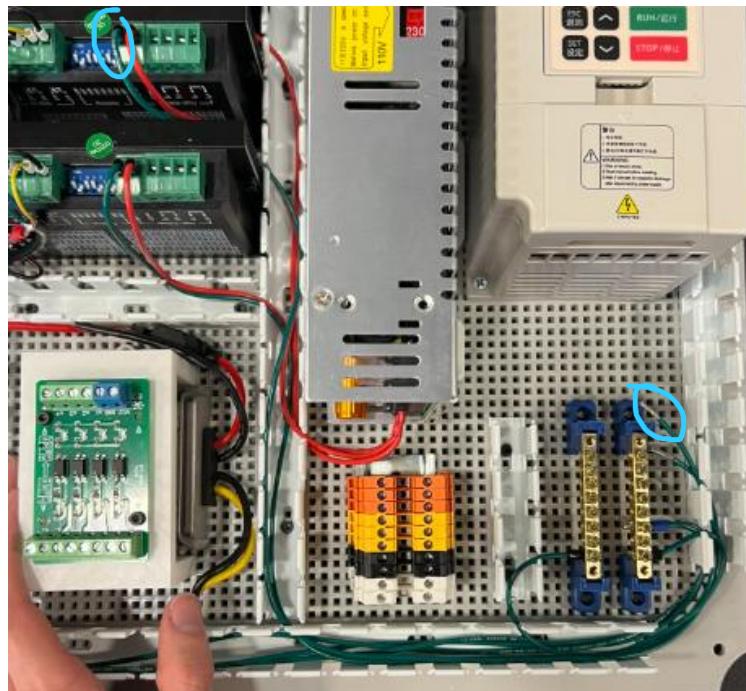


## Electrical Box Instructions

89. Starting with the 23 in. wire, insert the ferrule connector into the GND port on the High Voltage side of the X-axis DM556 drive and tighten to secure. Route the remaining wire and 10 mm stripped end to the bus bar as shown below.

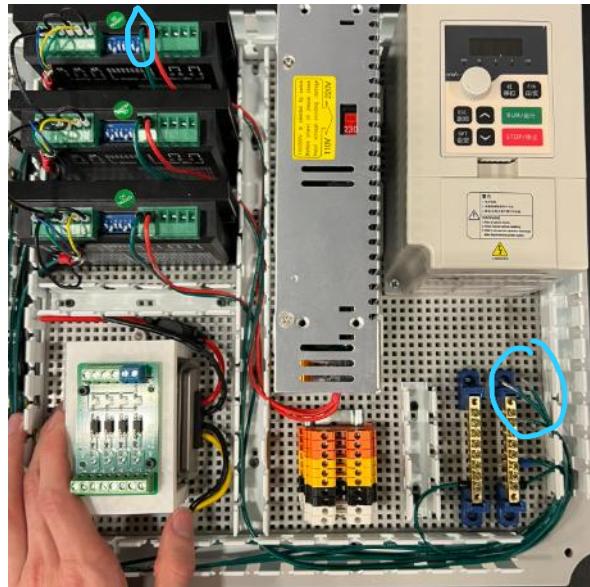


90. Now with the 25 in. wire, insert the ferrule connector into the GND port on the High Voltage side of the Y-axis DM556 drive and tighten to secure. Route the remaining wire and 10 mm stripped end to the bus bar as shown below.

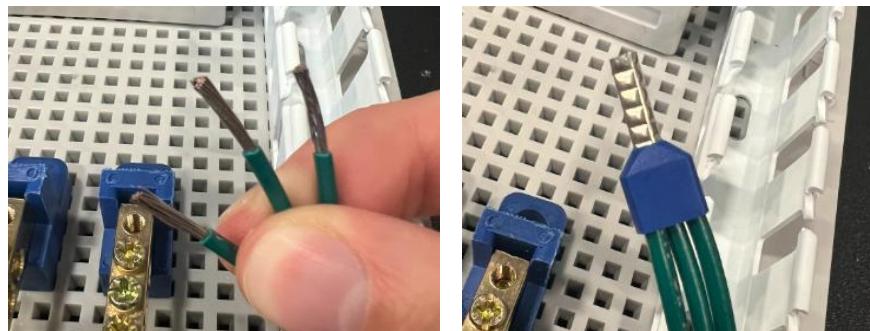


## Electrical Box Instructions

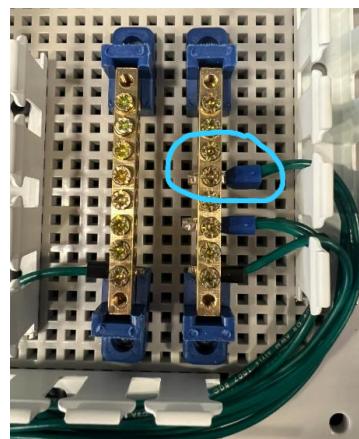
91. Finally with the 27 in. wire, insert the ferrule connector into the GND port on the High Voltage side of the Z-axis DM556 drive and tighten to secure. Route the remaining wire and 10 mm stripped end to the bus bar as shown below.



92. Crimp a 14AWG twin ferrule connector onto all three of the 10 mm stripped ends of the green wires as shown.



93. Insert the twin ferrule connector with all three wires into the bus bar as shown and tighten to secure.

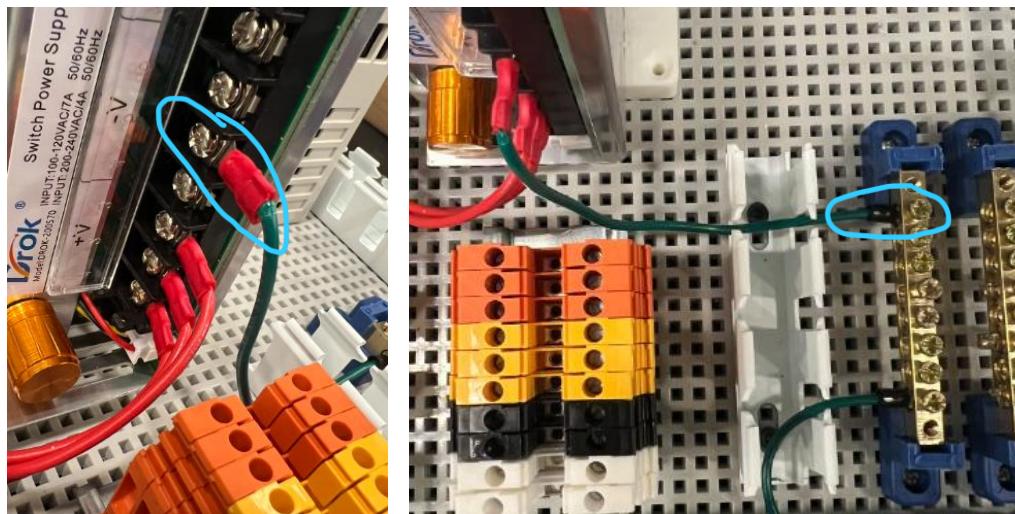


## Electrical Box Instructions

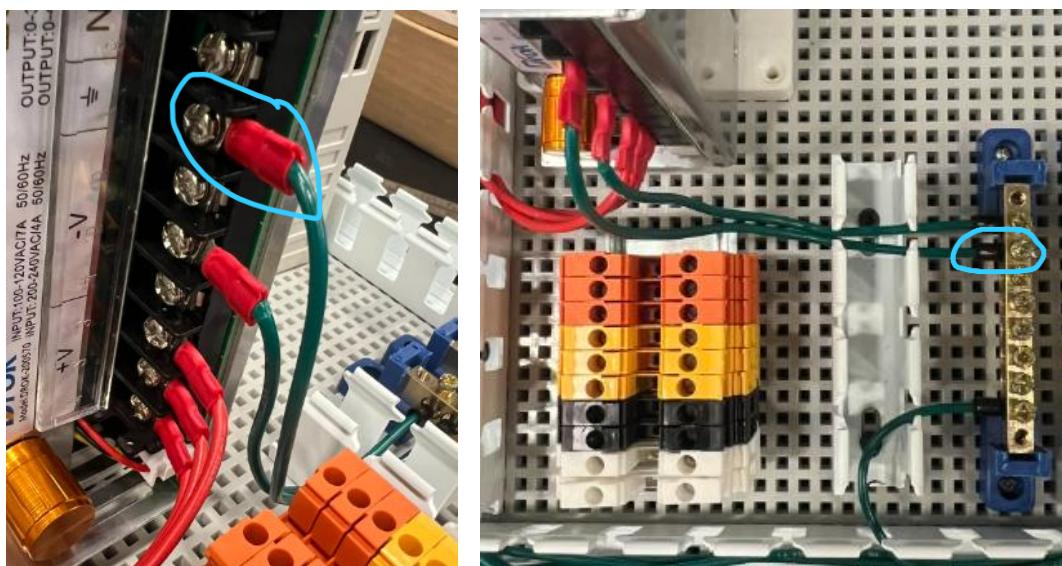
94. Cut a 6 in. and a 7 in. length of 16AWG green wire and strip both ends of both wires to 8 mm. On one side of each wire, crimp a 16AWG ferrule connector. On the other side of each wire, crimp a (M4)#8 or (M5)#10 fork connector as shown below.



95. Secure the fork connector on the 6 in. wire into the middle -V port on the 48V PSU and route the remaining wire and ferrule connector to the bus bar as shown.

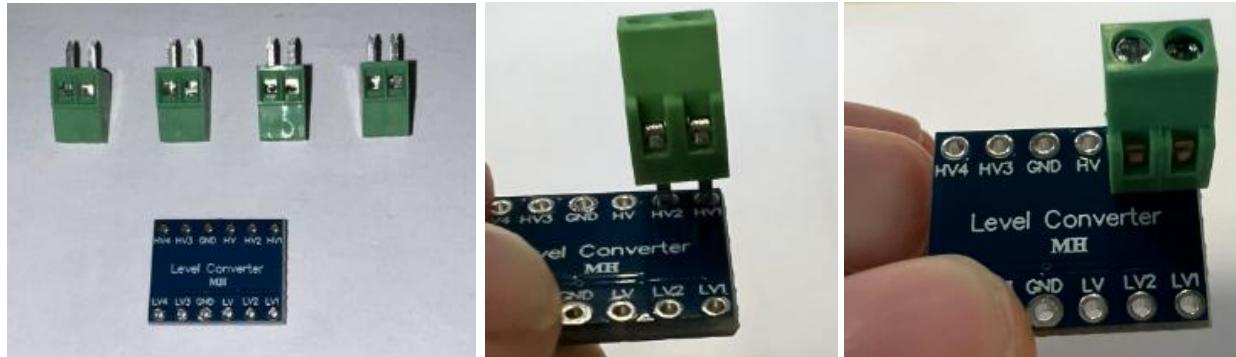


96. Secure the fork connector on the 7 in. wire into the ground port on the 48V PSU and route the remaining wire and ferrule connector to the bus bar as shown.

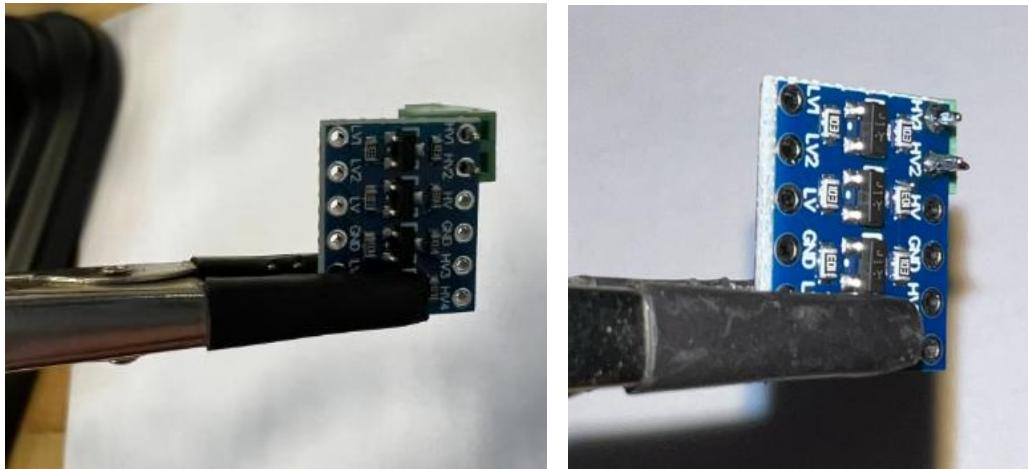


## Electrical Box Instructions

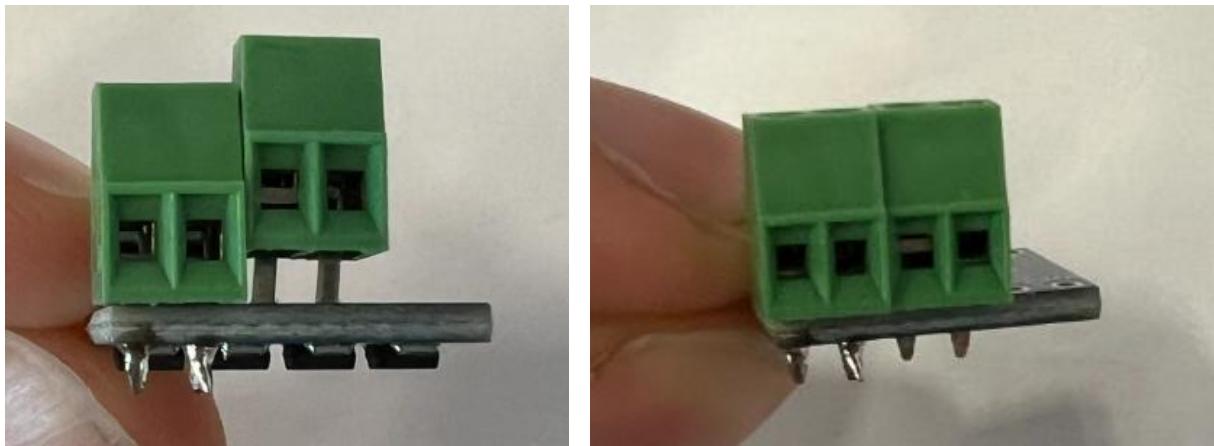
97. Next, grab the logic level converter and the four small terminal blocks. Insert one of the terminal blocks into the HV1 and HV2 pins on the level converter as shown. Make sure it is flush.



98. Hold the level converter in place with a set of alligator clips. Once secured, solder the two pins in place as shown.

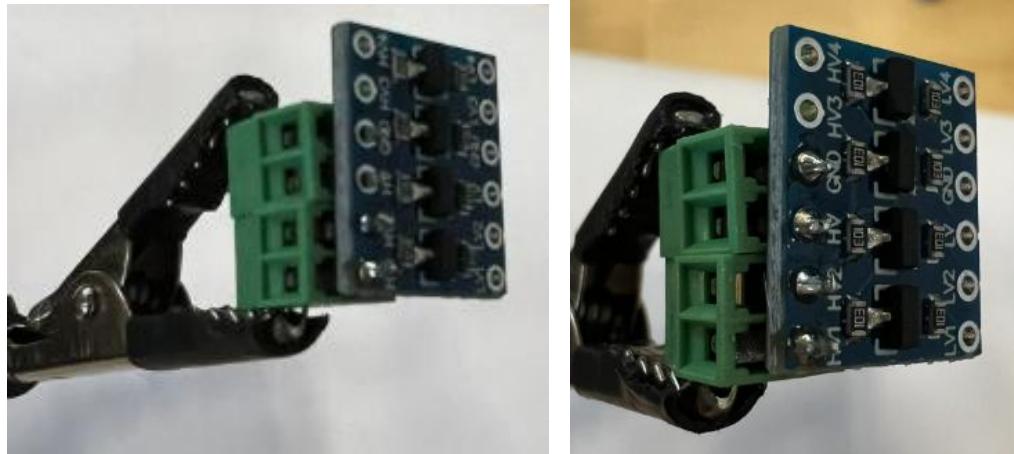


99. Insert a new terminal block into the HV and GND pins next to the HV1 and HV2 pins.

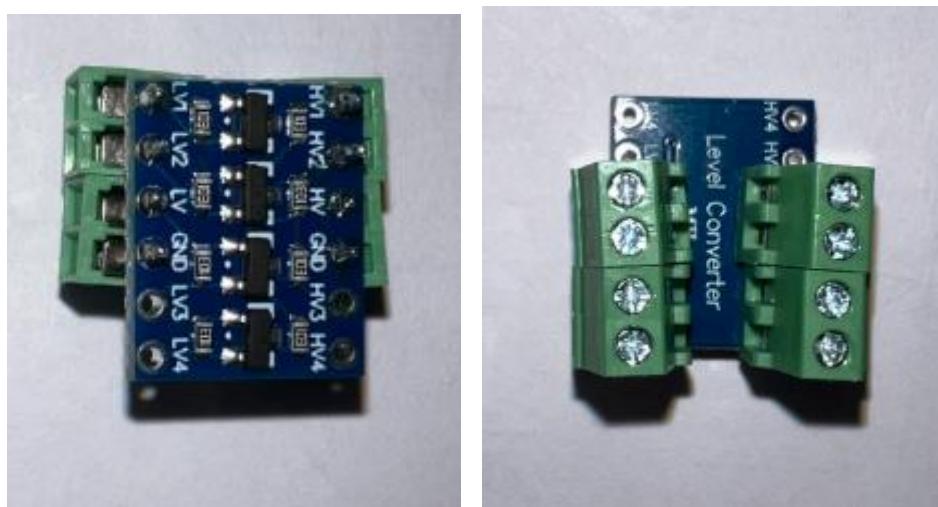


## Electrical Box Instructions

100. Hold the two terminal blocks together with alligator clips and solder the new terminal block in place.



101. Repeat Steps 97-100 on the other side of the level converter with the LV1, LV2, LV, and GND pins to produce the result shown below.

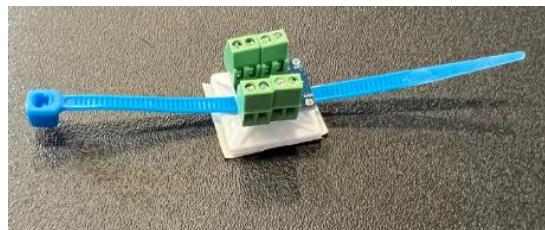


102. Set aside the three components shown below: level converter, zip tie, adhesive zip tie mount.



## Electrical Box Instructions

103. Insert the zip tie through the zip tie mount and then mount the level converter on top of the mount as shown below. Tighten the zip tie down to secure the level converter.

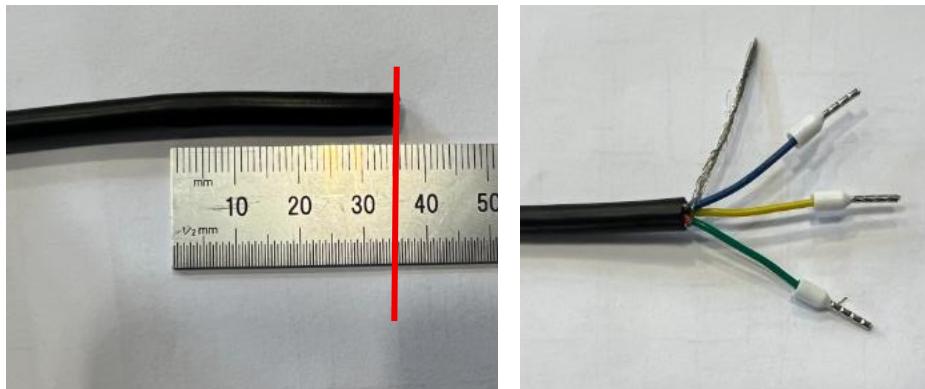


104. Peel the sticker off of the back of the adhesive mount and install the mount below the Teensy 4.1 on the grid plate as shown below. Make sure the level converter is oriented correctly with the terminal blocks on the bottom.

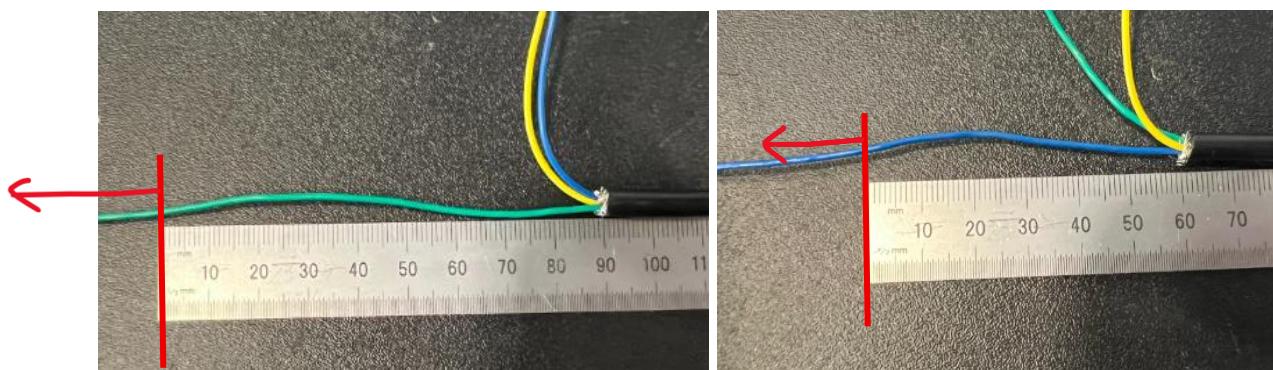
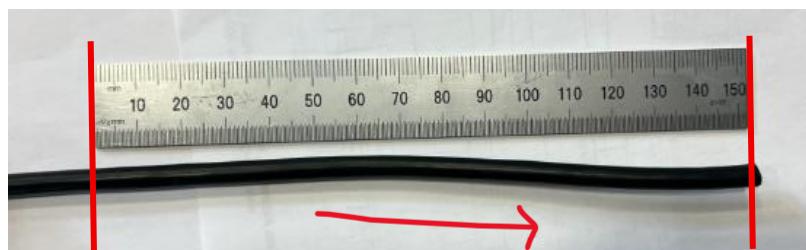


## Electrical Box Instructions

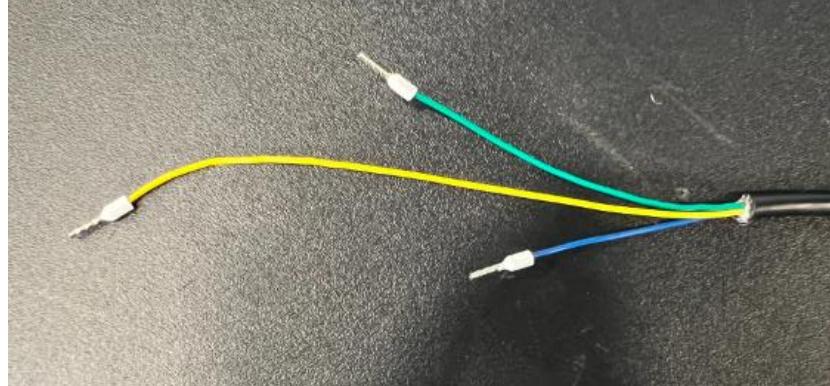
105. Cut out a 28 in. length of 4-core shielded cable. Strip one end to 35 mm and remove the red wire and foil from this side. Strip the blue, green, and yellow wires to 8 mm and crimp 22 AWG ferrule connectors onto their ends.



106. Strip the other end to 150 mm and remove the red wire, foil, and stranded shielding. Trim the green wire to 90 mm, trim the blue wire to 60 mm, and leave the yellow wire at its full 150 mm length. Strip the ends of these three wires to 8 mm and crimp 22AWG ferrule connectors on their ends.



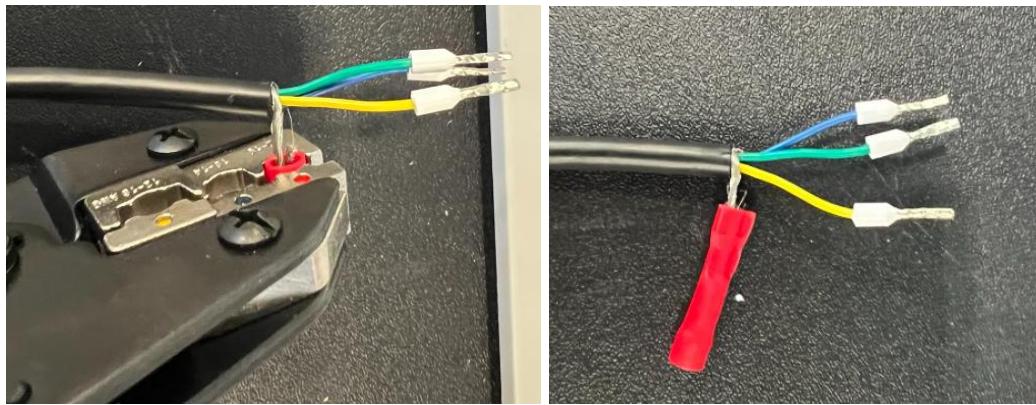
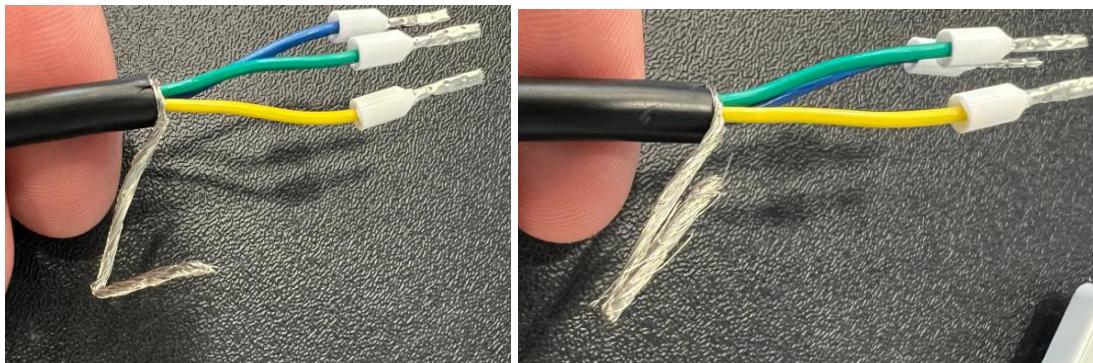
## Electrical Box Instructions



107. Cut a 16AWG green wire to 7 in. and strip both ends to 8 mm. On one side only, crimp a 16AWG ferrule connector as shown below.

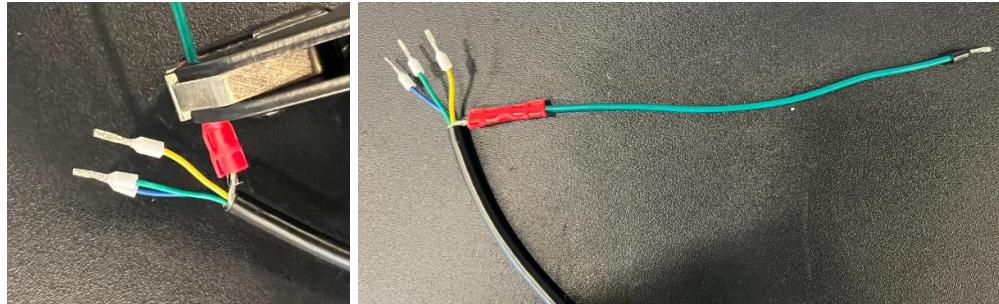


108. On the 35mm side of the 4-core shielded cable from Step 106, fold the stranded shielding over on itself as shown. Then, crimp a red butt connector on the folded end.



## Electrical Box Instructions

109. Crimp the open end of the 7 in. green wire from Step 107 into the other end of the red butt connector as shown.

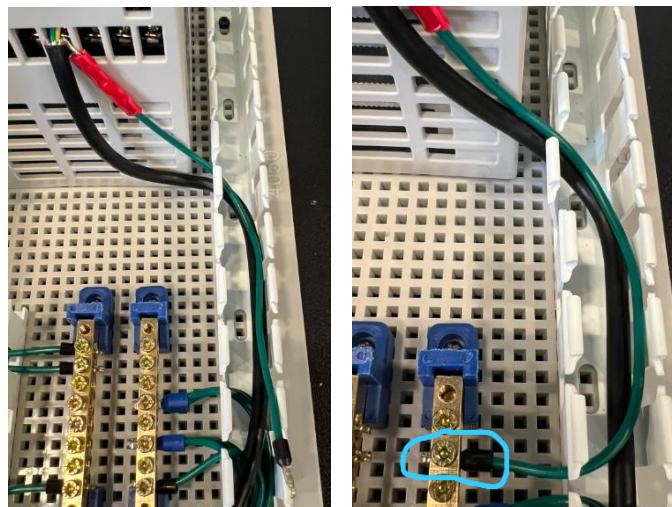


110. Insert the 35 mm end of the 4-core shielded cable through into the VFD as shown and make the following connections:

- Blue → AI1
- Green → GND
- Yellow → X1



111. Route the shielded cable and green wire through the wire channels as shown. Ground the green wire into the bus bar.

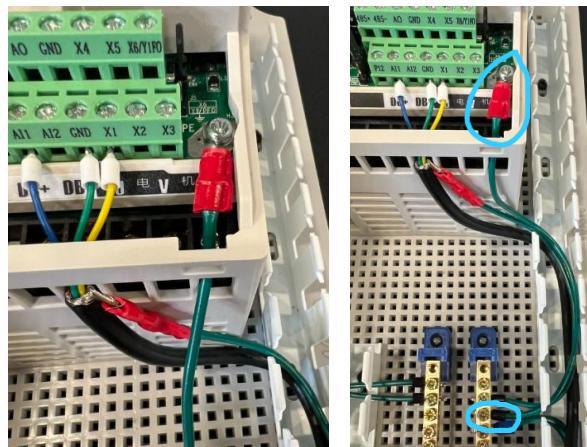


## Electrical Box Instructions

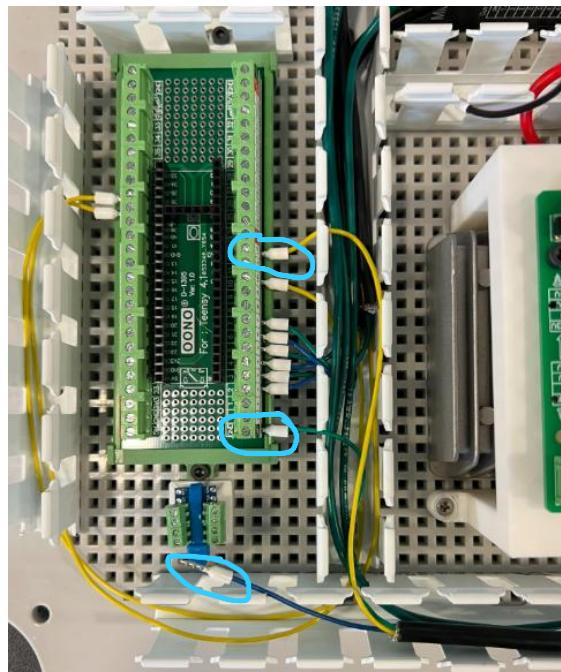
112. Cut a 16AWG green wire to 8.5 in. and strip both ends to 8 mm. Crimp a 16AWG ferrule connector on one end and a (M4) #8 fork connector on the other end.



113. Insert the fork connector into the ground terminal on the VFD and route the cable to the bus bar.

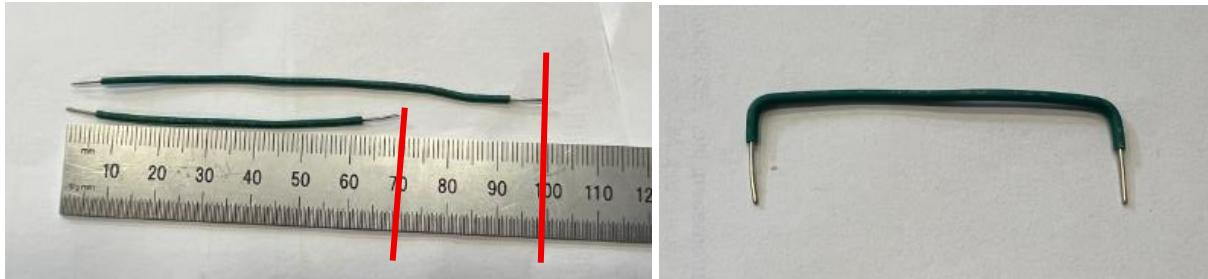


114. Route the 4-core shielded cable through the wire ducts along the bottom of the box to the Teensy 4.1 as shown. Connect the yellow wire to pin 12 and the green wire to a GND port, as highlighted in the photo below. Leave the blue wire unconnected for now.

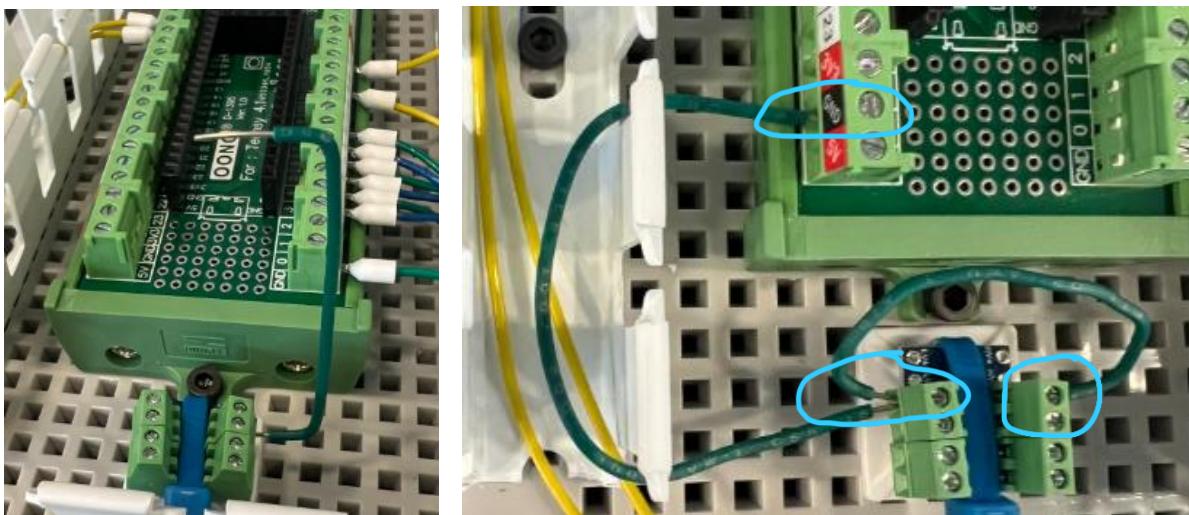


## Electrical Box Instructions

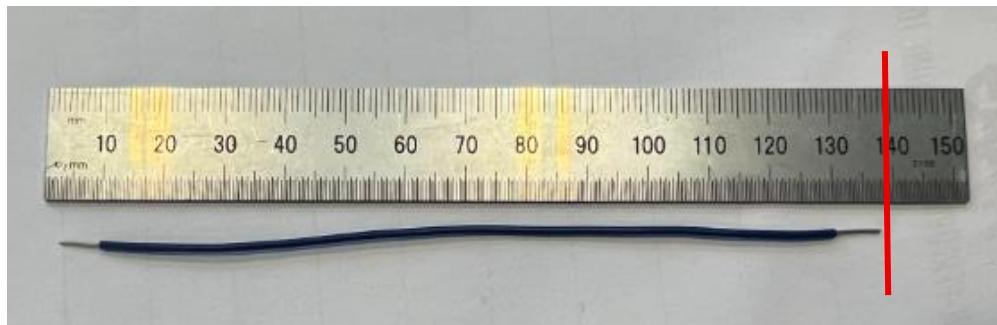
115. Cut two 22AWG solid core wires: a 70 mm length and a 100 mm length. Strip both ends to 5 mm. Bend the 70 mm wire to form the shape shown below.



116. Insert the bent 70 mm wire into one of the GND ports on the level converter and jump the bent wire to the GND port on the other side of the level converter as well. On the left side, also insert the 100 mm green wire and tighten to secure. Route the 100 mm cable to the GND port shown on the Teensy 4.1 below.

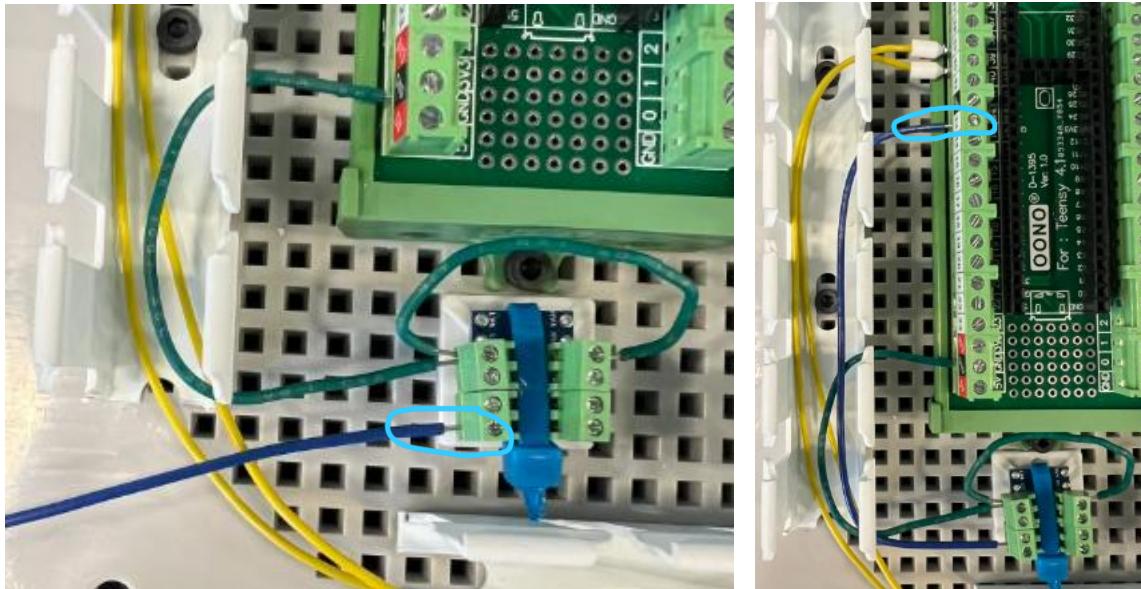


117. Cut a blue 22AWG solid core wire to 140 mm and strip both ends to 5 mm.

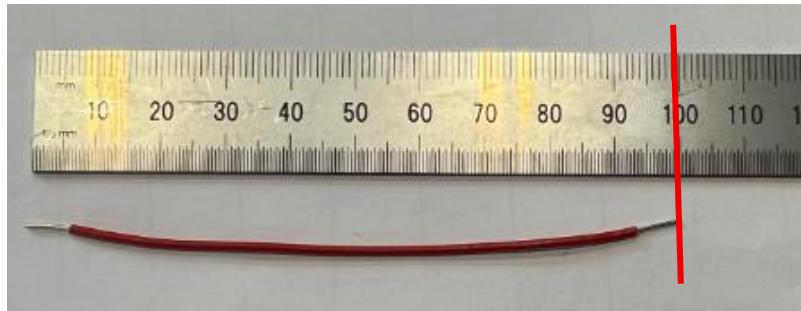


## Electrical Box Instructions

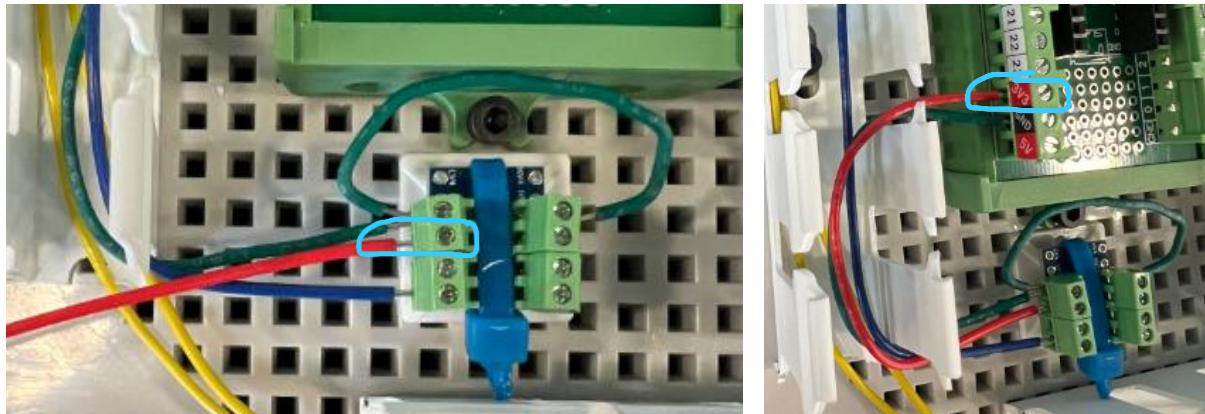
118. Connect one end of the blue wire into the LV1 port on the level converter (circled in picture below) and route the other side through the cable trays and into pin 13 on the Teensy 4.1.



119. Cut a red 22AWG solid core wire to 100 mm and strip both ends to 5 mm.

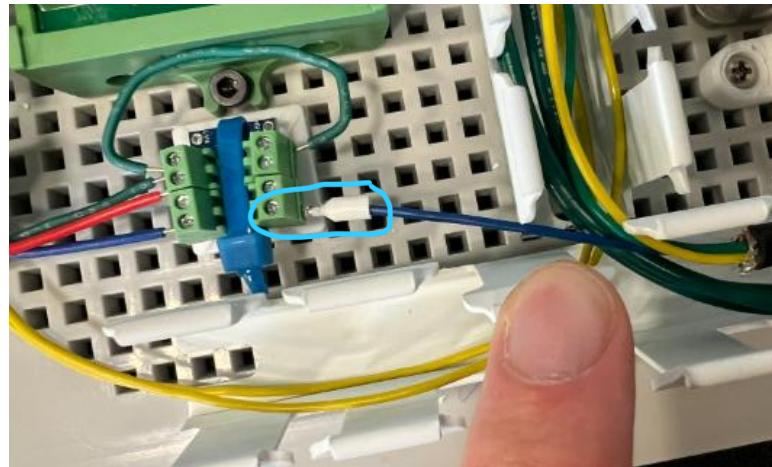


120. Connect one end of the red wire to the LV port on the level converter (circled in the picture below) and route the other side through the cable trays and into the 3V3 port on the Teensy 4.1.

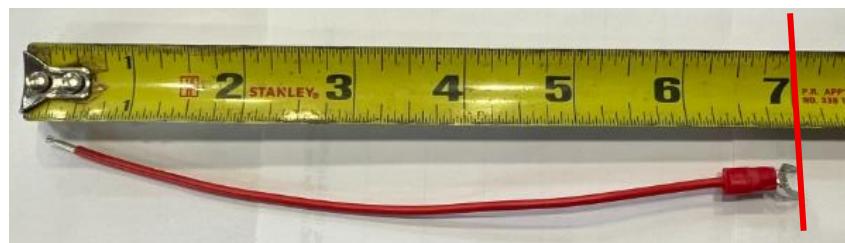


## Electrical Box Instructions

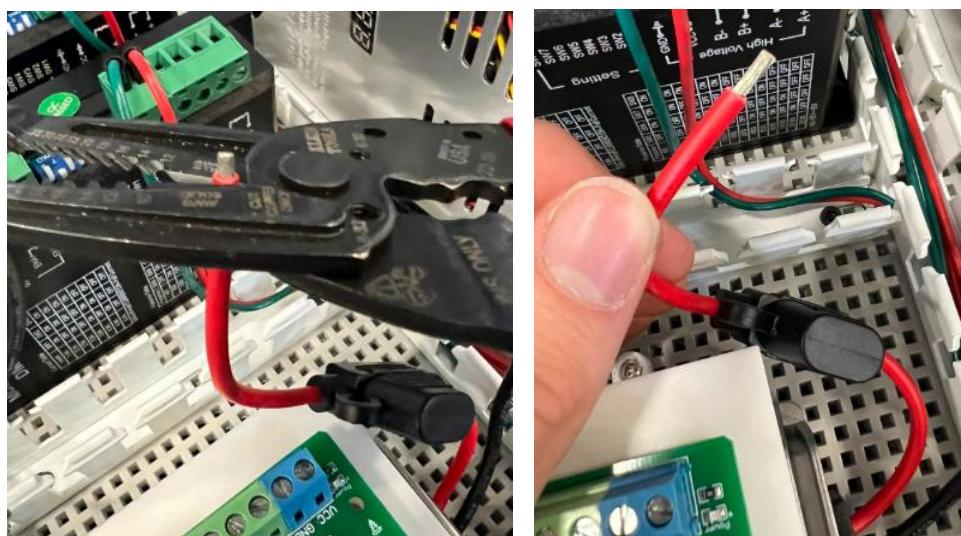
121. Insert the hanging blue wire from the 4-core shielded cable in Step 114 into the HV1 port on the level converter (circled in the picture below).



122. Cut a 16AWG red wire to 7 in. and strip both ends to 8 mm. Crimp a (M4)#8 or (M5)#10 fork connector onto one end and leave the other end stranded.

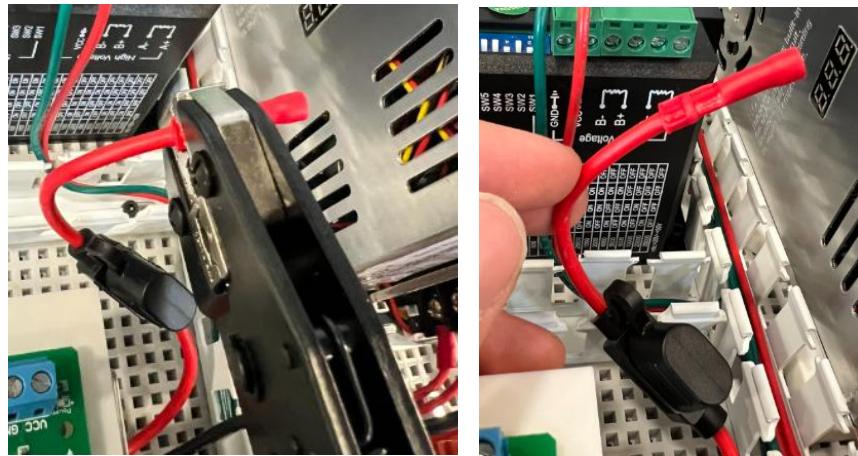


123. Find the red wire coming out of the 12V step down transformer (it should have an in-line fuse on it). Cut off the tinned end of the wire as shown below. Be careful not to remove too much wire, a few millimeters should do. Then strip the end to 8 mm.



## Electrical Box Instructions

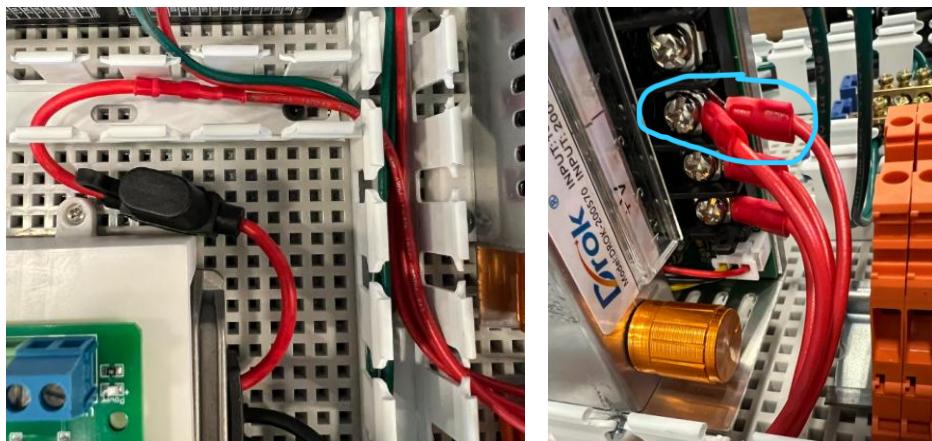
124. Crimp a red butt connector onto the end of this wire as shown.



125. Take the red wire from Step 122 and insert the free stranded end into the other end of the butt connector. Crimp tightly to make a secure connection.

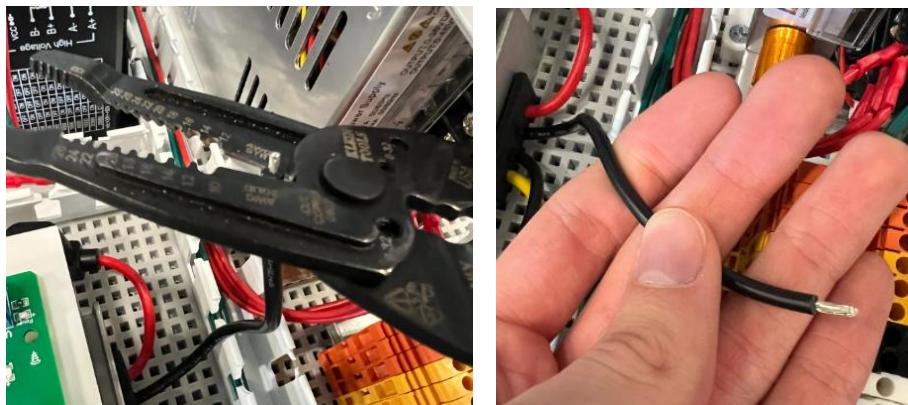


126. Route the cable through the cable trays as shown below and insert the fork connector into the top +V port on the 48V PSU. Note that it will be doubled up with the Z-axis drive.



## Electrical Box Instructions

127. Locate the black wire directly next to the red wire from the 12V step down transformer. Cut off the tinned end of the wire, being careful not to remove too much wire. Strip the end to 8 mm.



128. Crimp an (M4)#8 or (M5)#10 fork connector onto the free end as shown. Once crimped, leave the black wire unrouted / unconnected for now.

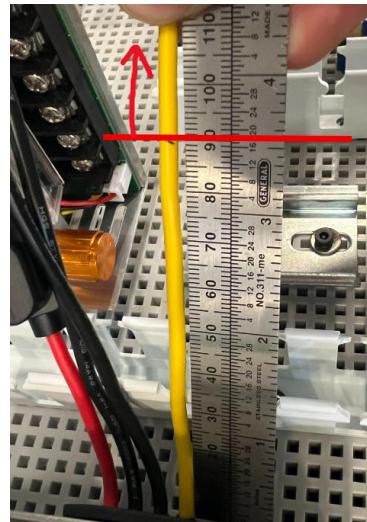


129. Using the wire cutters, cut off the tinned end of the all four wires coming from the 12V stepdown converter, as shown for the yellow wire below. Be careful not to cut off too much wire, a few millimeters is sufficient.



## Electrical Box Instructions

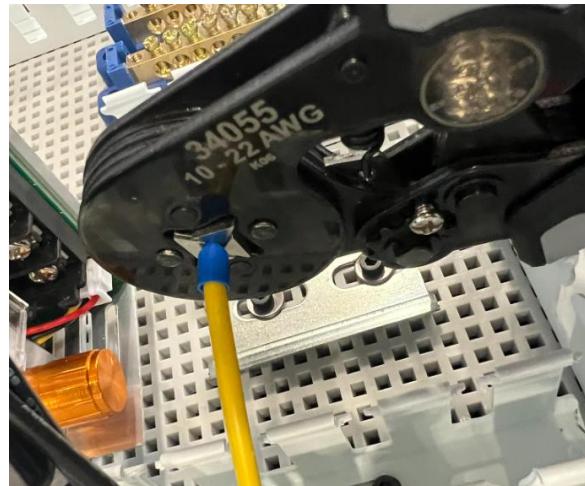
130. Cut the yellow wire to a length of 90 mm from the 12V step down transformer, as shown.



131. Strip the yellow wire to a length of 8mm using the Weicon wire stripping tool as shown below. Use this setting on the wire stripper for all ferrule connectors unless otherwise specified.

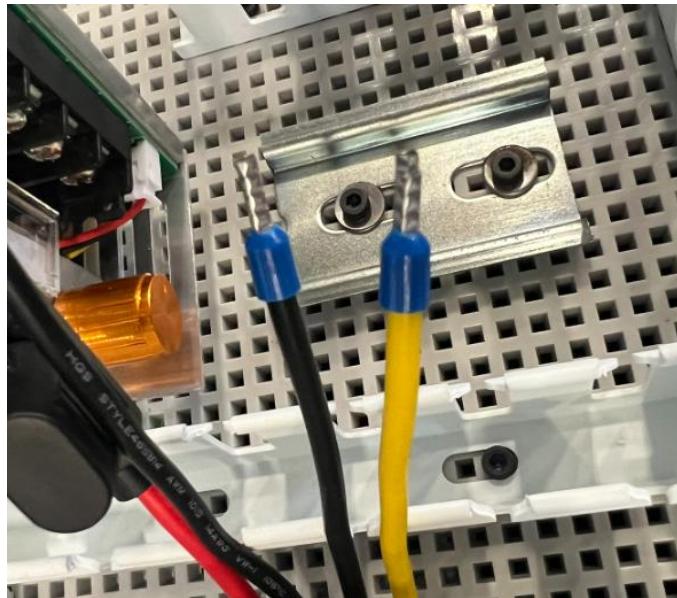


132. Crimp a blue 14AWG ferrule connector onto the stripped end of the yellow wire using the Klein crimping tool. Make sure to give a tight squeeze to ensure a proper connection.

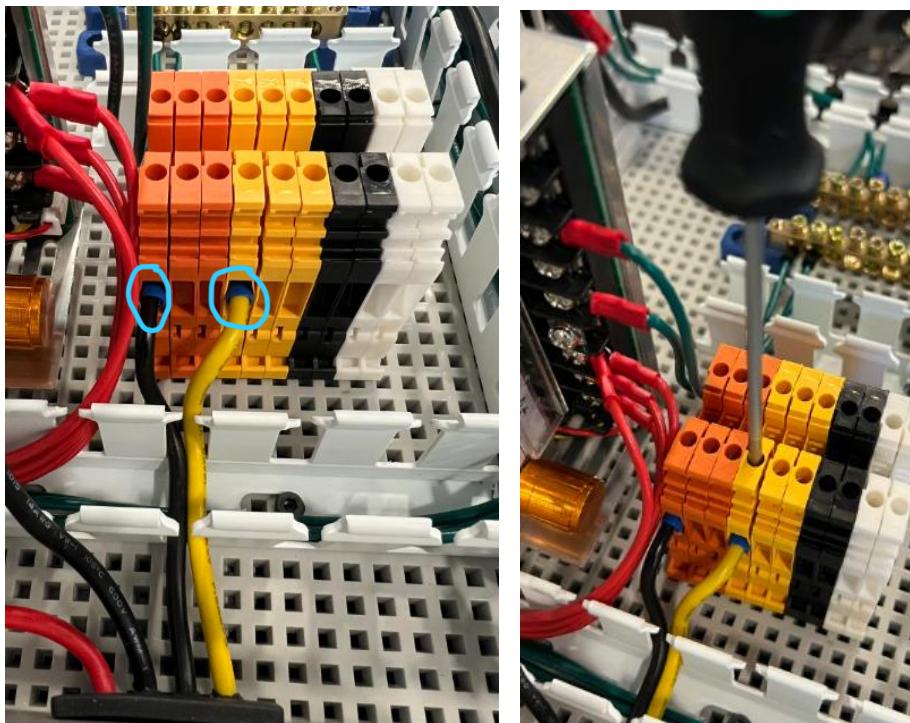


## Electrical Box Instructions

133. Repeat Steps 129-132 on the black wire to produce the result shown below.

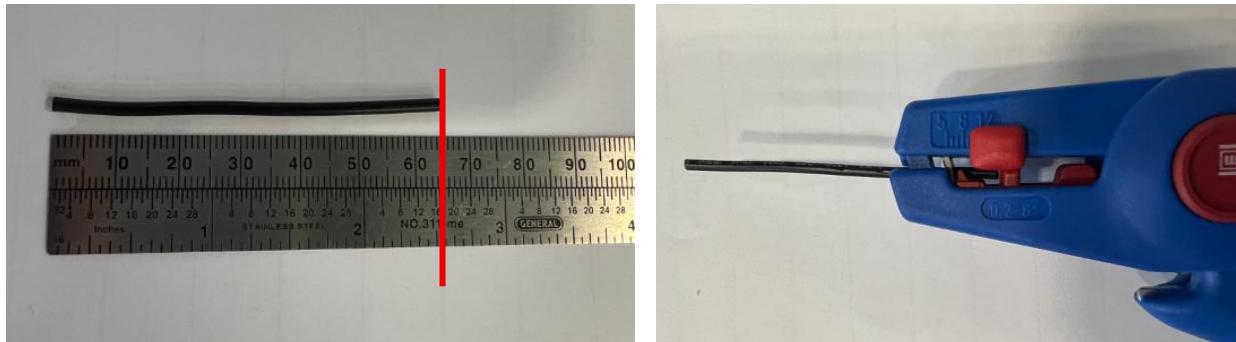


134. Route both the yellow and black wires through the cable tray to the right of the 12V stepdown converter and insert them into the two terminal slots shown in the image below. To secure the wires, use a flat head screwdriver to tighten from above.

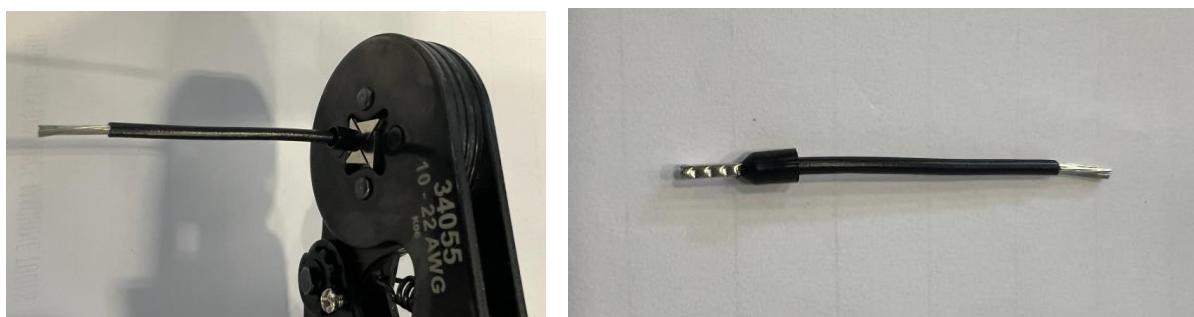


## Electrical Box Instructions

135. Cut a section of black 16AWG wire to 65 mm and strip both ends to 8 mm.



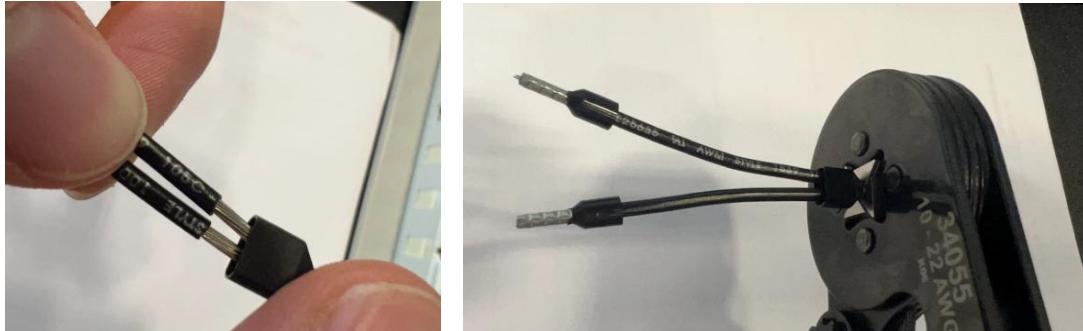
136. Crimp a black 16AWG ferrule connector onto ONE end of the wire.



137. Repeat Steps 135-136 to create an identical 65 mm length of 16AWG wire.

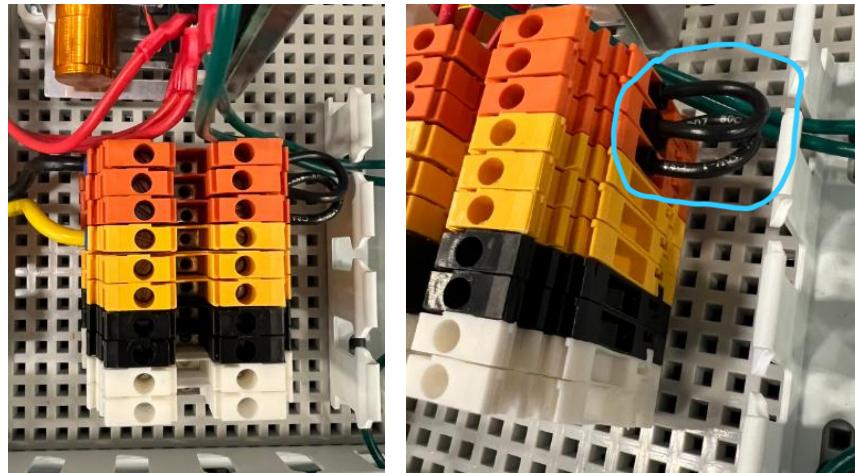


138. Insert the two free stripped ends of both wires into a 16AWG twin ferrule connector. Clamp tightly to ensure a secure connection.

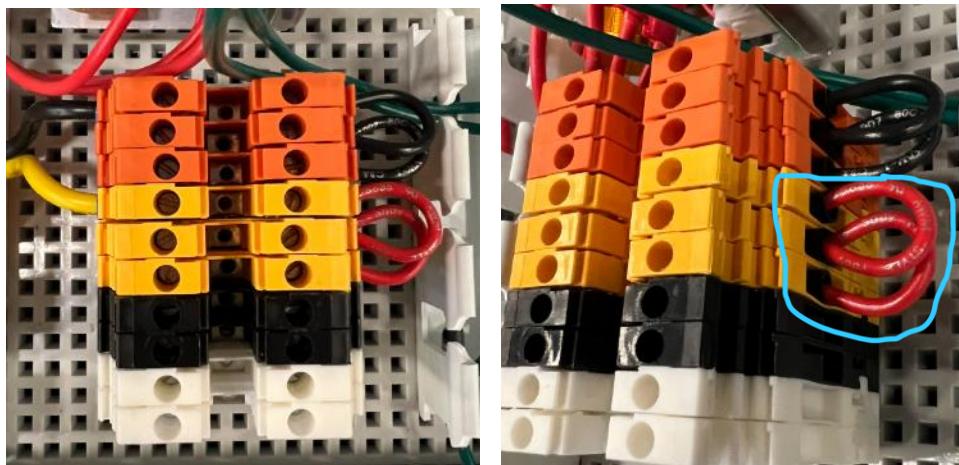


## Electrical Box Instructions

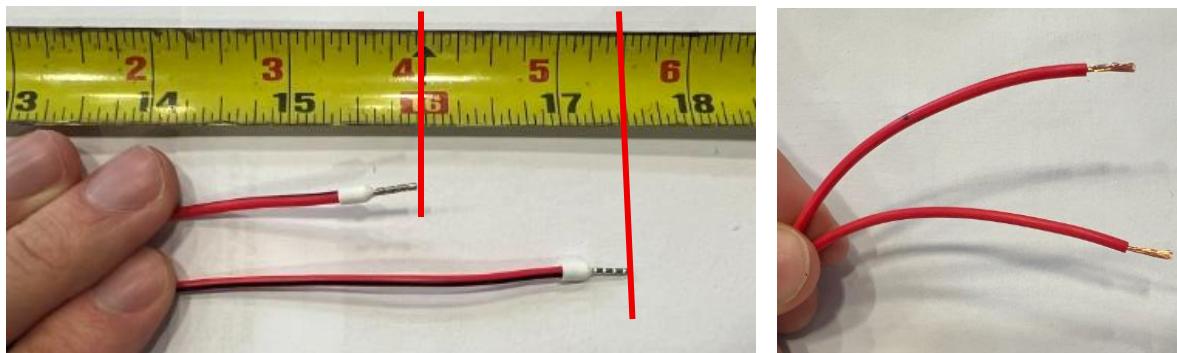
139. Use the result from Step 138 to jump the wires between all three orange terminal blocks on the side closest to the grounding bus bars, as shown below. Note that the twin connector will have to be inserted into the middle orange terminal block vertically in order to fit.



140. Repeat Steps 135-139 with red 16AWG wire to produce the result shown below.

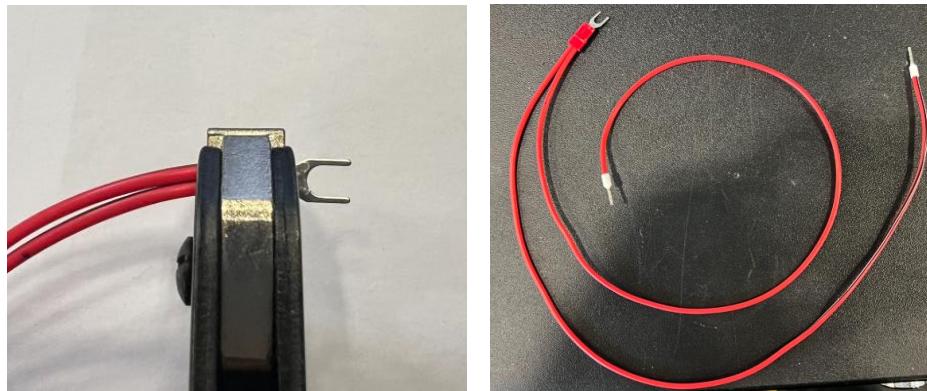


141. Cut two red 22AWG stranded core wires: a 16 in. length and a 17.5 in. length. Strip both ends of each wire to 8 mm. On one side of each wire, crimp 22AWG ferrule connectors, leaving the other two sides uncrimped as shown.



## Electrical Box Instructions

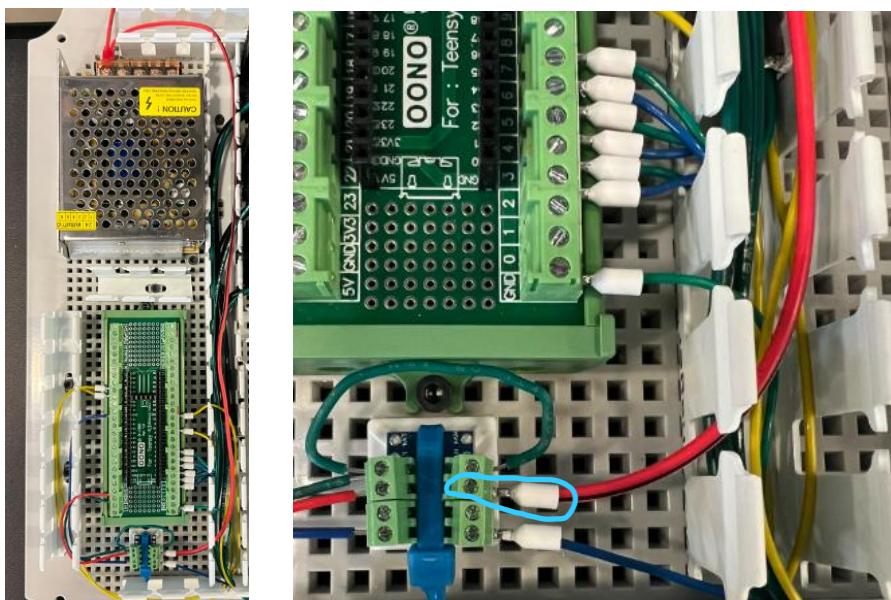
142. Twist the two bare ends of each wire together and crimp an (M4)#8 fork connector onto both wires as shown below.



143. Insert the fork connector into the +V terminal on the 5V PSU as shown below.

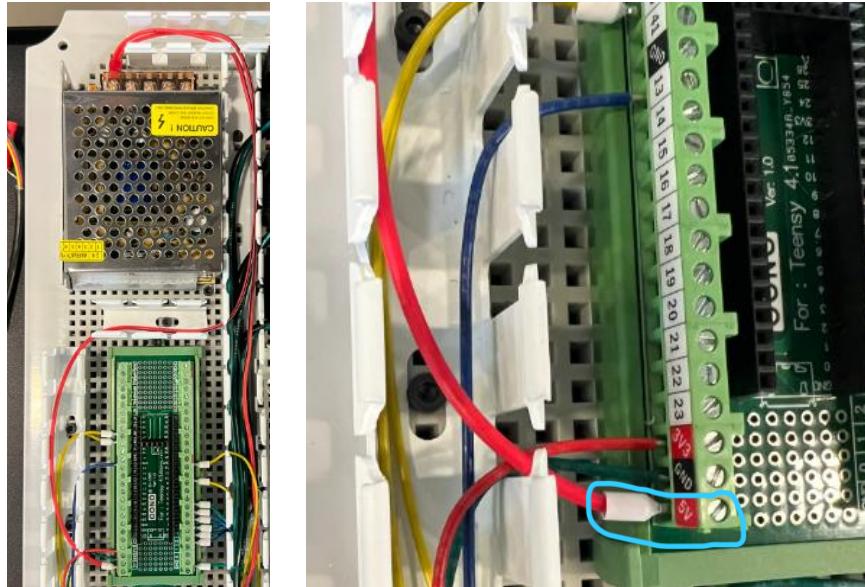


144. Route the 16 in wire along the right side of the Teensy 4.1 to the HV port on the level converter as shown.



## Electrical Box Instructions

145. Now route the 17.5 in wire along the left side of the Teensy 4.1 to the 5V port on the Teensy 4.1 as shown.



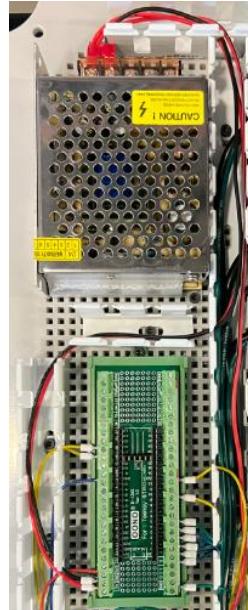
146. Cut a black 22AWG stranded core wire to 17 in. and strip both ends to 8 mm. Crimp a 22AWG ferrule connector on one end and a (M4)#8 fork connector on the other end as shown.



147. Insert the fork connector into the -V port on the 5V PSU. Route the black wire along the left side of the Teensy 4.1 and connect to the bottom left GND port on the Teensy 4.1. Note that there will be two wires in this GND port since the ground from the level converter is already in this port as well.



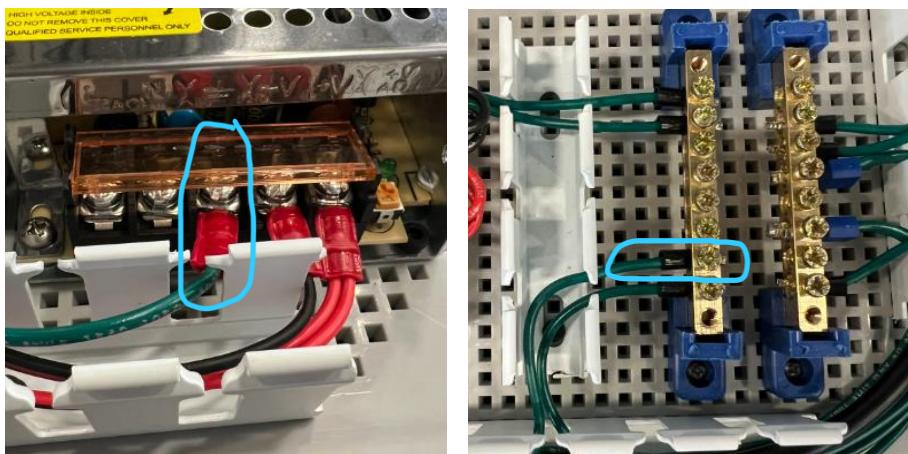
## Electrical Box Instructions



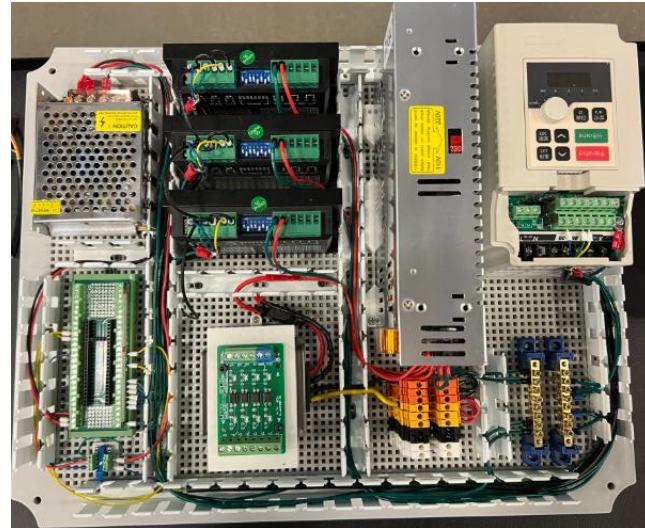
148. Cut a green 16AWG wire to 27 in. and strip both ends to 8 mm. Crimp a 16AWG ferrule connector on one end and an (M4)#8 fork connector on the other end as shown.



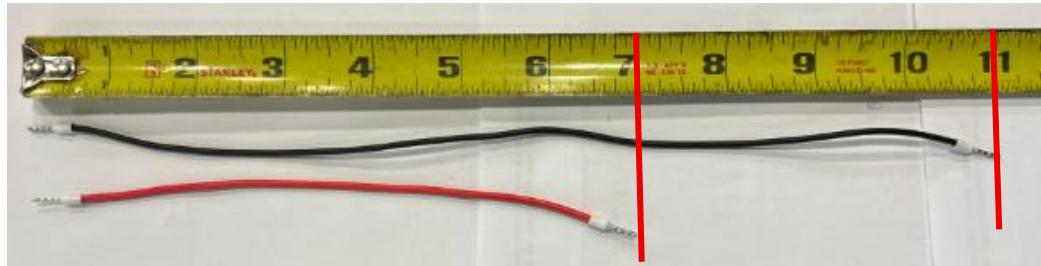
149. Insert the fork connector into the ground terminal on the 5V PSU and route the cable to the bus bar as shown.



## Electrical Box Instructions



150. Cut a red 22AWG stranded core wire to 7 in. and a black 22AWG stranded core wire to 11 in. Strip both ends of each wire to 8 mm and crimp 22AWG ferrule connectors to both sides of each wire.

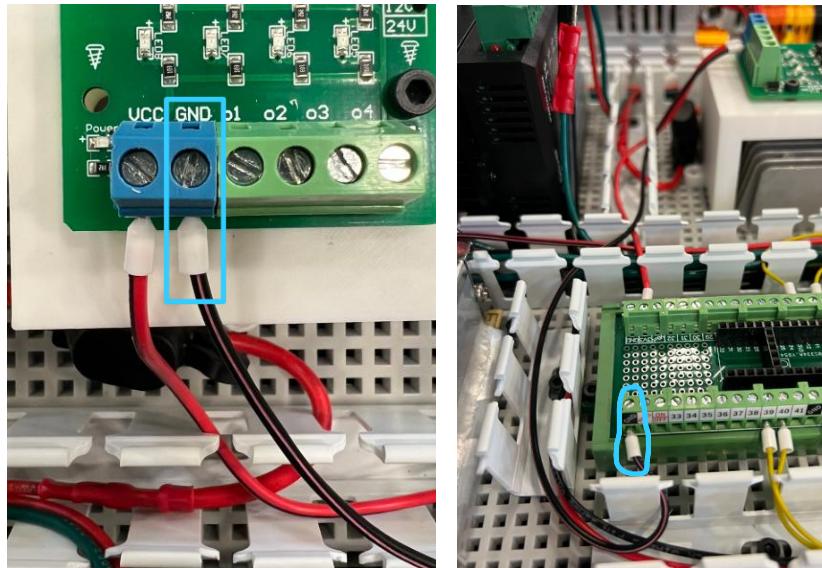


151. Secure one end of the red wire into the VCC port on the optocoupler. Route the wire through the wire channels to the nearest 3V3 port on the Teensy 4.1 as shown.

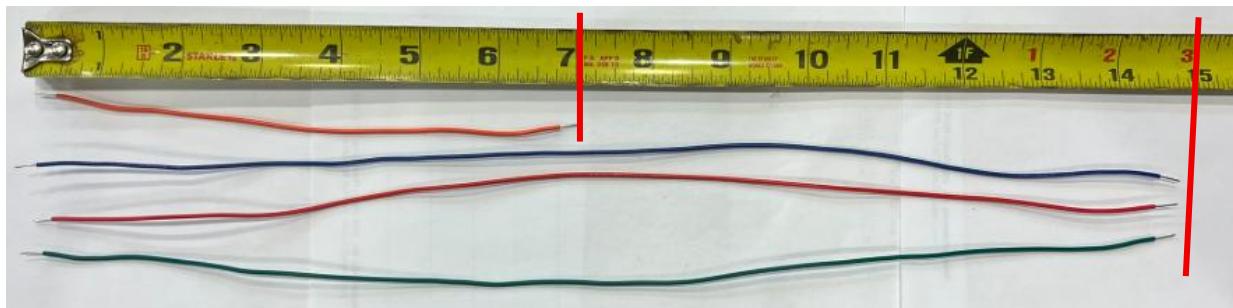


## Electrical Box Instructions

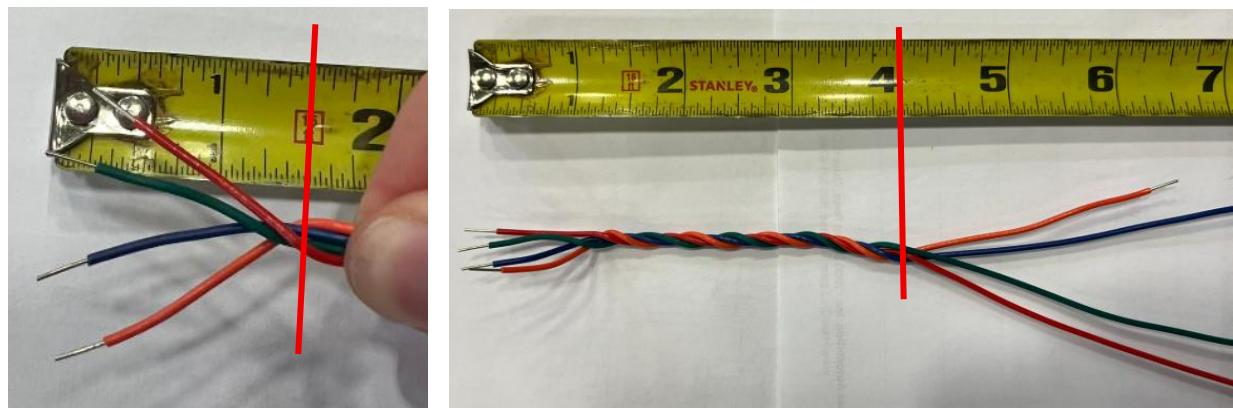
152. Secure one end of the black wire to the GND port on the optocoupler. Route the wire through the wire channels to the GND port shown below on the Teensy 4.1.



153. Collect four colors of 22AWG solid core wire: orange, blue, green, and red. Cut the orange wire to 7 in. and the blue, green, and yellow wires to 15 in. Strip both ends of each wire to 5 mm.

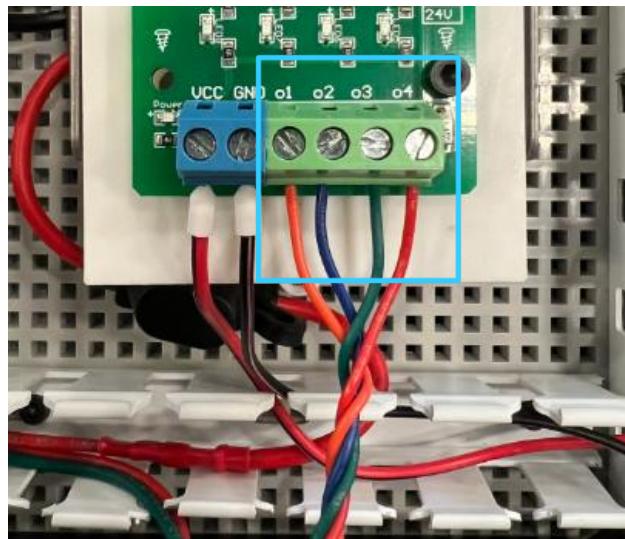


154. Arrange the wires in the order orange, blue, green, red. Starting ~1.5 in. from one end, begin twisting the wires together as shown. Stop twisting the wires ~4 in. from the end you started at.

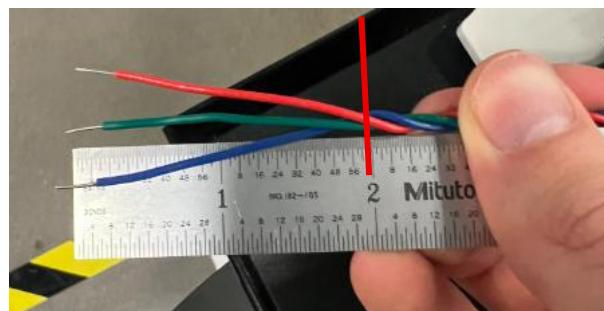


## Electrical Box Instructions

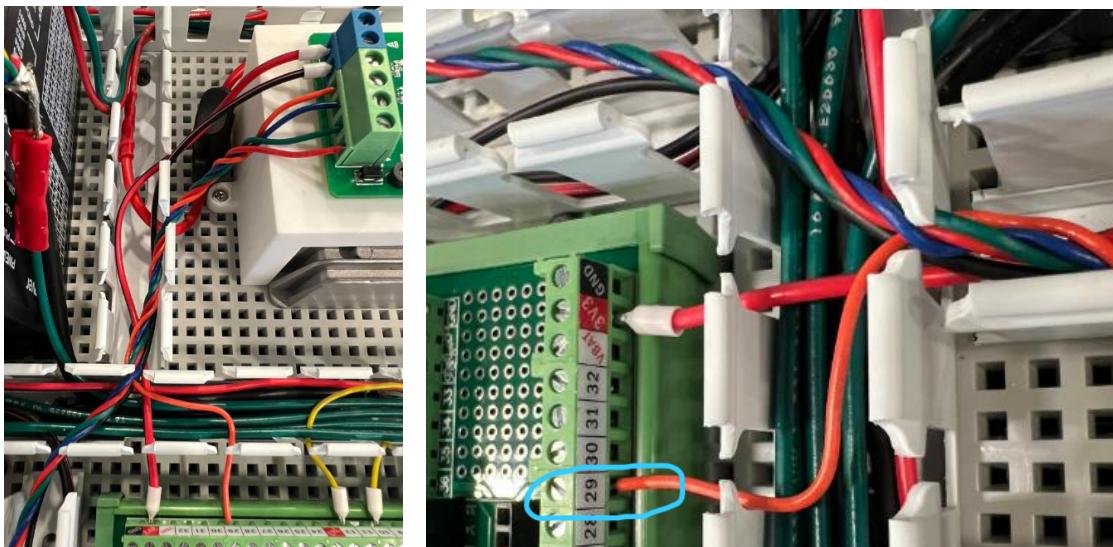
155. Secure the four wires into the optocoupler in the exact order shown in the image below.



156. Leaving the orange wire out, twist the blue, green, and red wires together until the last 2 in. of the wire as shown.

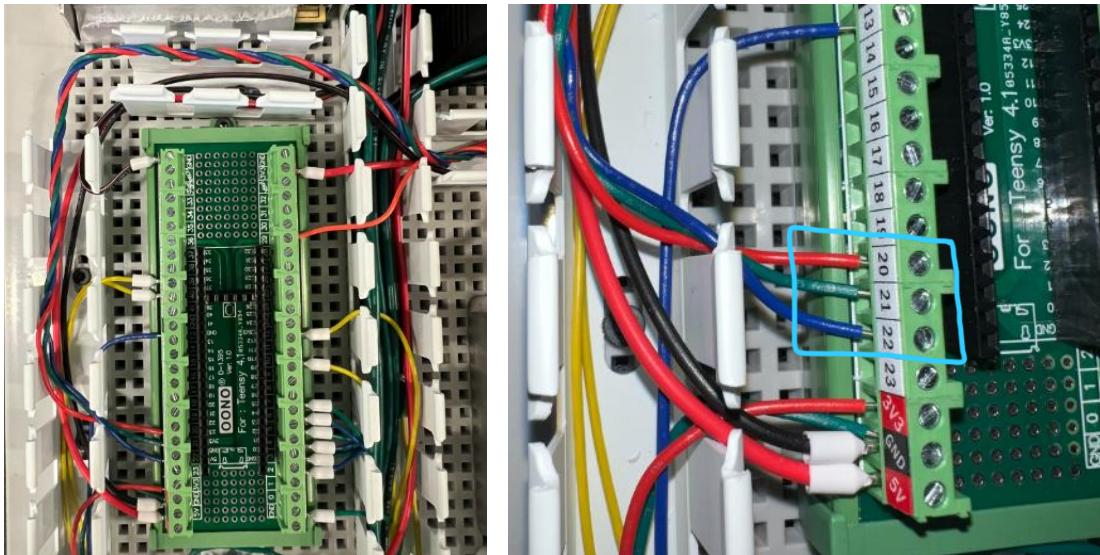


157. Route the twisted cables through the cable tray as shown. Insert the orange wire into pin 29 on the Teensy 4.1.

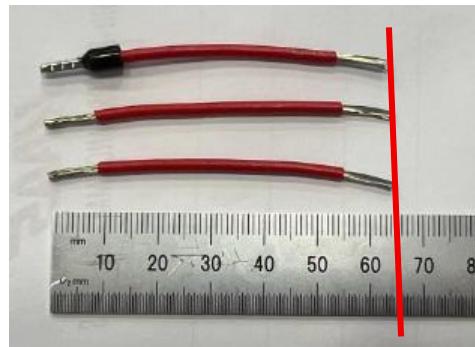


## Electrical Box Instructions

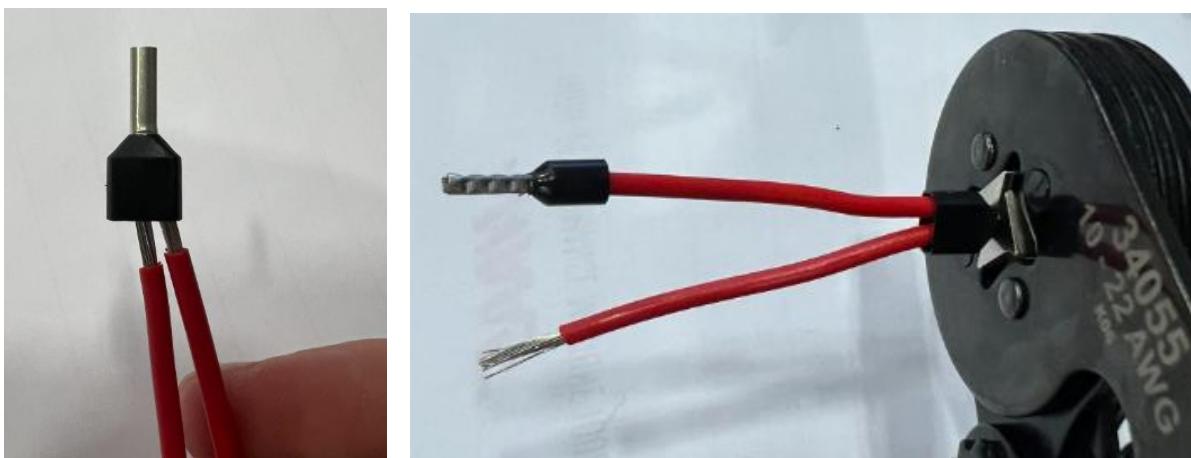
158. Route the remaining blue, green, and red wires as shown below. Insert red into pin 20, green into pin 21, and blue into pin 22 on the Teensy 4.1.



159. Cut three red 16AWG wires to 65 mm and strip both ends to 8 mm. On one side of one of the wires, crimp a 16AWG ferrule connector to produce the three wires shown below.



160. Crimp a 16AWG twin ferrule connector onto the free end of the wire with the ferrule connector and one of the free ends from another wire as shown.



## Electrical Box Instructions

161. Crimp another 16AWG twin ferrule connector between the free end of the wire from Step 160 and the last red wire.



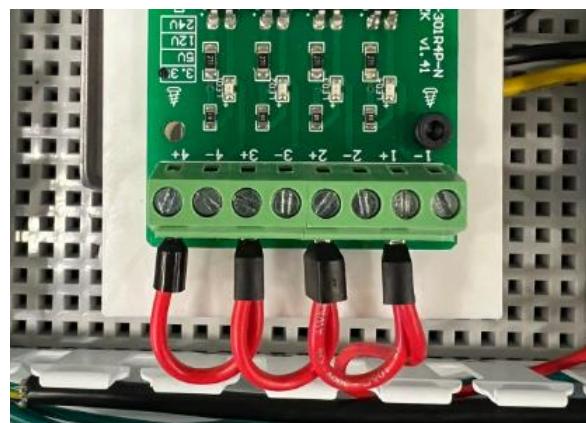
162. Cut a 16AWG red wire to 8.5 in. and strip both ends to 8 mm. Crimp a 16AWG ferrule connector onto one end, leaving the other end bare.



163. Using one more 16AWG twin ferrule connector, crimp the free end of the 8.5 in. wire to the free end of the result from Step 161 as shown below.

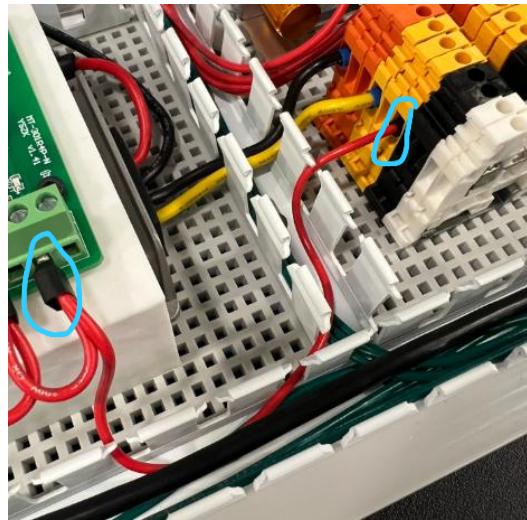


164. Insert the wire assembly into the 1+, 2+, 3+, and 4+ ports on the optocoupler as shown below. Make sure that the long wire's twin ferrule connector is in the 1+ port.



## Electrical Box Instructions

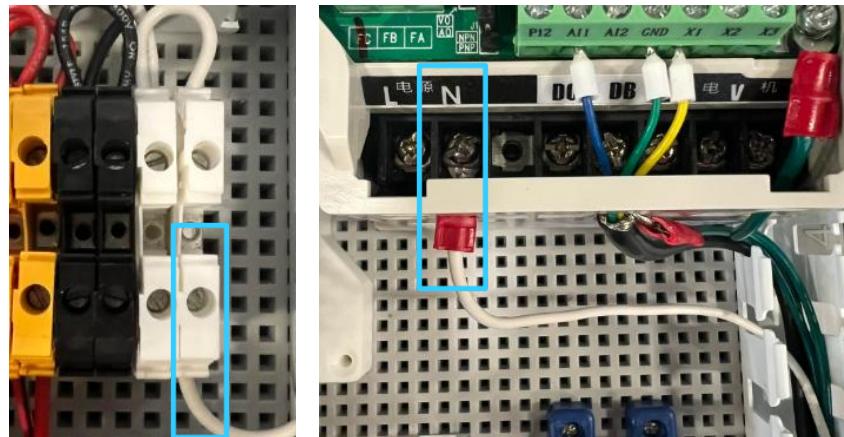
165. Route the long red wire to the yellow DIN rail terminal block shown below.



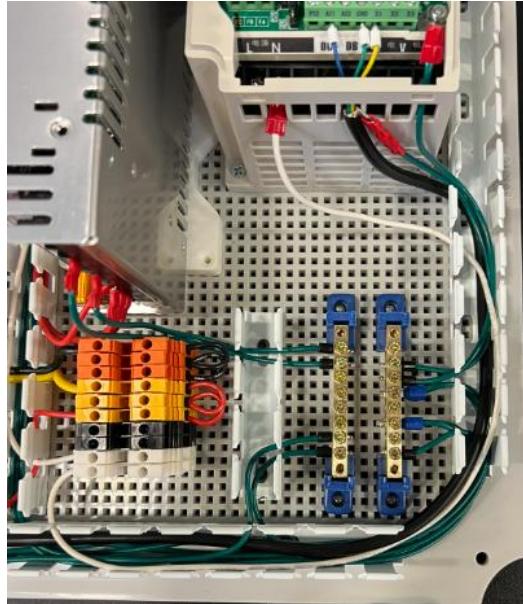
166. Cut a 16AWG white wire to 18 in. and strip both ends to 8 mm. Crimp a 16AWG ferrule connector on one end and an (M4) #8 fork connector on the other end.



167. Insert the ferrule connector into the open white DIN rail terminal block and route to the Neutral ('N') terminal on the VFD as shown.



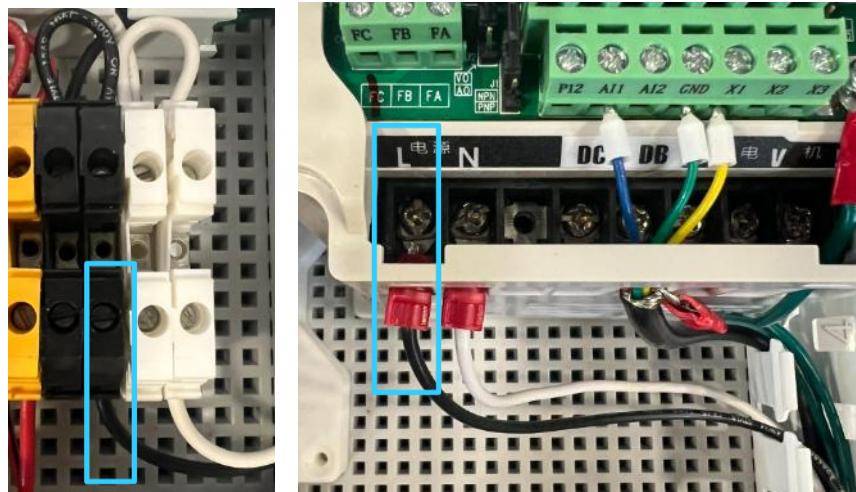
## Electrical Box Instructions



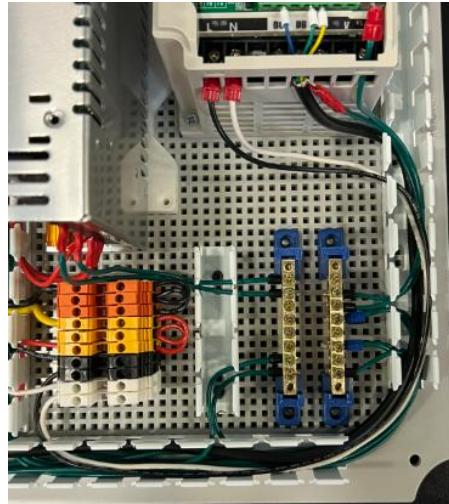
168. Cut a 16AWG black wire to 18.5 in. and strip both ends to 8 mm. Crimp a 16AWG ferrule connector to one end and an (M4)#8 fork connector to the other end.



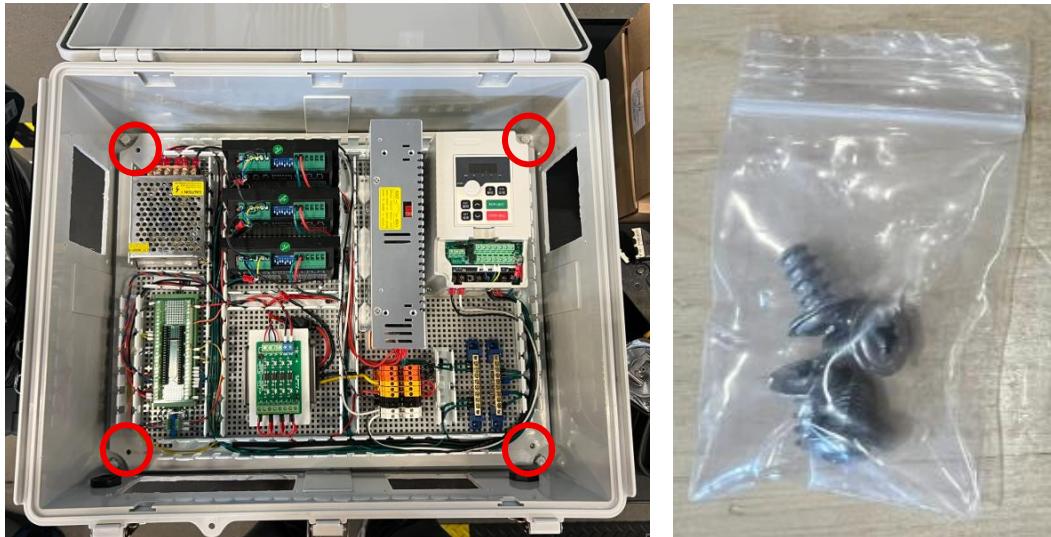
169. Insert the ferrule connector into the other black DIN rail terminal block. Route the wire through the wire ducts to the Live ('L') terminal on the VFD as shown.



## Electrical Box Instructions



170. For the next set of steps, set the grid plate inside the provided electrical box and mount with the included screws.



171. Locate the two Thermalright TL-C12 120MM Fans. Set aside one fan and remove it from its packaging.



## **Electrical Box Instructions**

172. Cut off the 4-pin port on the end of the wire as shown below. This port can be thrown away.



173. After cutting off the 4-pin port, remove the sheathing around the four wires as shown below. This sheathing can be thrown away as well.

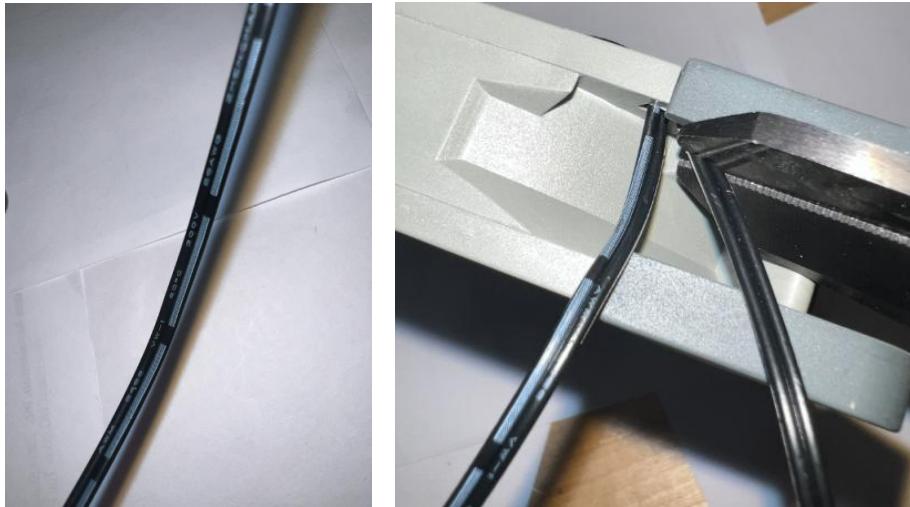


174. Split the four wires directly down the middle, keeping the left two connected and the right two connected as shown. Separate these wires all the way down to the frame of the fan.



## Electrical Box Instructions

175. Locate the two wires shown in the picture on the left below. The wire with gray rectangles is the ground, and the wire connected to it with writing on it is the power. Being careful not to cut these wires, use scissors or wire cutters to remove the other two wires from Step 174 as shown.



176. Repeat Steps 171-175 for the other fan to produce the results below.

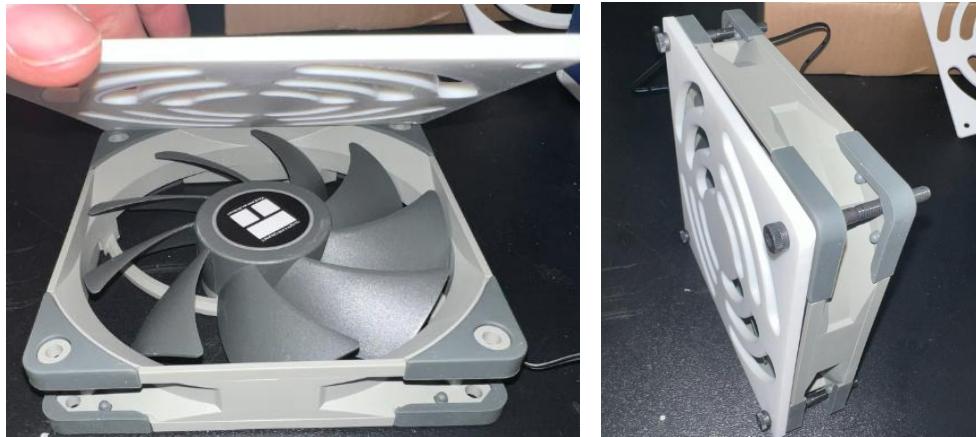


177. Locate the two 3D printed fan grills shown below.



## Electrical Box Instructions

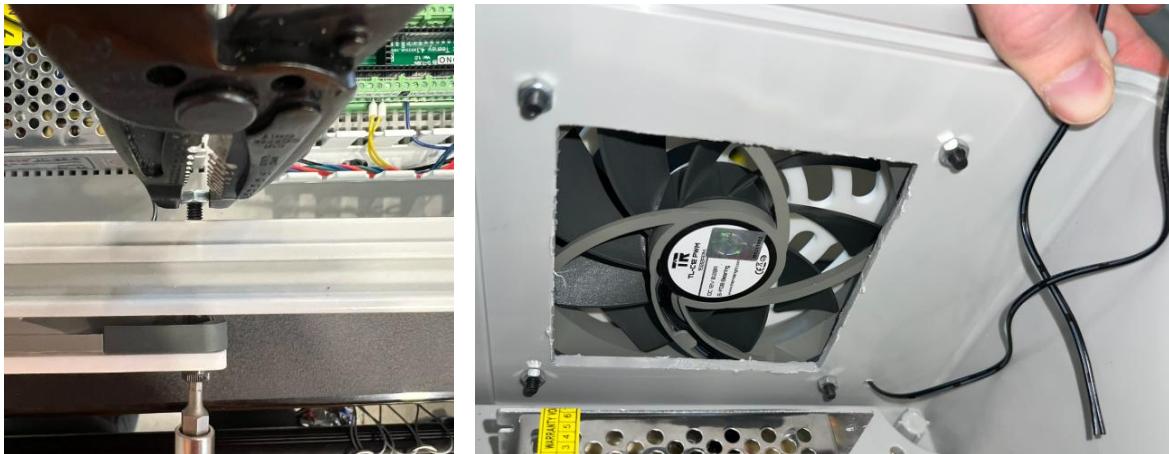
178. Set one of the grills on top of one of the fans exactly as shown, with the blade side facing up. Insert four M4x40 bolts through the four mounting holes as shown.



179. On the left side of the electrical box, there should be a cutout right next to the 5V PSU. Using the fan from Step 178, feed the wire through the bottom left most hole in the box as shown. Make sure that the fan is rotated such that the wire is coming out of the bottom left side of the fan.



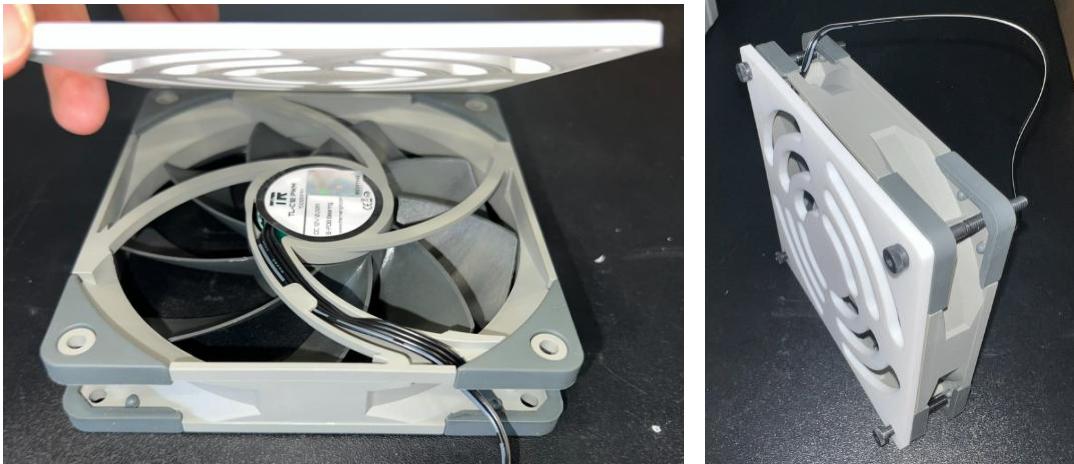
180. Insert the four M4x40 bolts through the four holes on the box and tighten a nut on the other side using a screw driver and pliers as shown.



## Electrical Box Instructions



181. Set the other fan grill on top of the other fan exactly as shown, this time with the frame side facing up. Insert four M4x40 bolts through the mounting holes to produce the following.



182. On the right side of the electrical box, there should be a cutout right next to the VFD. Using the fan from Step 181, feed the wire through the bottom right most hole in the box as shown. Make sure that the fan is rotated such that the wire is coming out of the bottom right side of the fan.



## Electrical Box Instructions

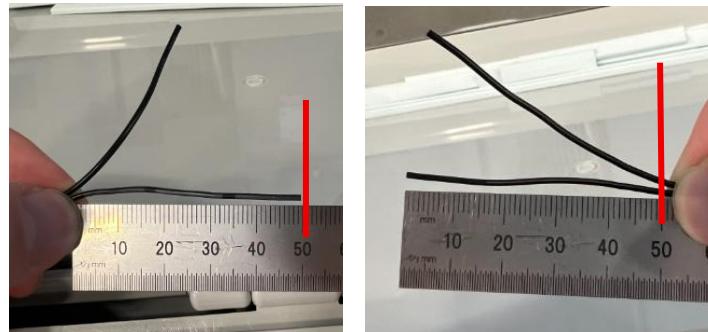
183. Repeat Step 180 with the new fan to produce the result below.



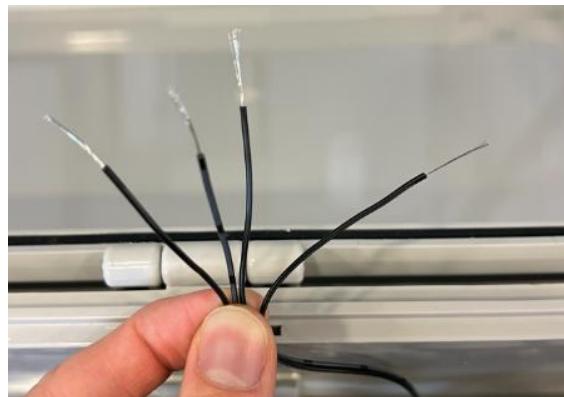
184. The two wires from each fan should meet up in the back middle of the box as shown.



185. For both set of two wires, peel 50 mm of the wires apart as shown.

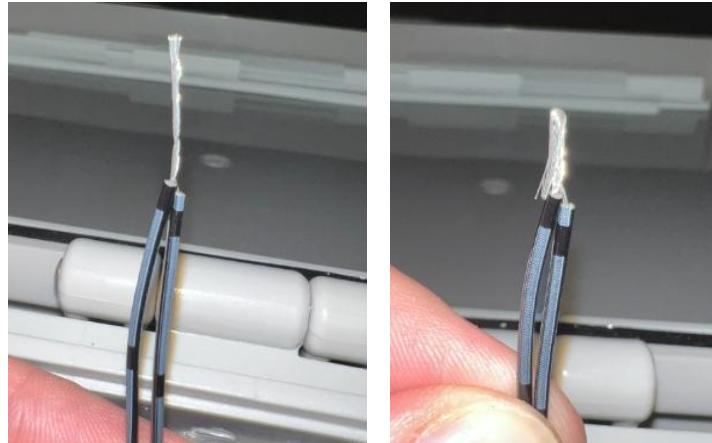


186. Strip 12 mm off of all four wires.



## **Electrical Box Instructions**

187. Twist the two ground wires (the ones with the grey rectangles on the insulation) together. Then, fold the twisted wire in half as shown.



188. Crimp a red butt connector over the two wires. Then, color the connector black to indicate ground.

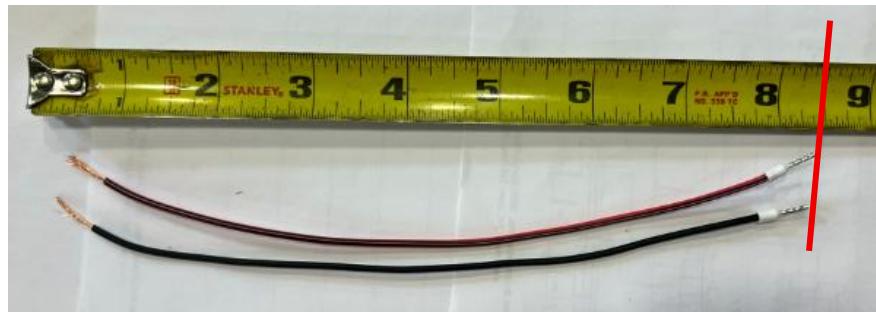


189. Repeat Steps for 187-188 for the other two wires, but do not color the connector black since this is the power line. The result is shown below.

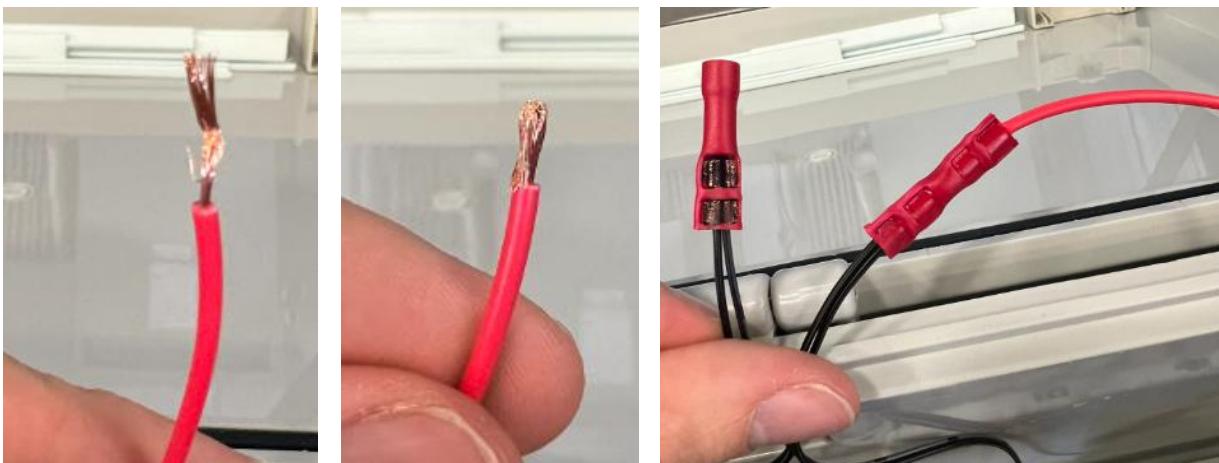


## Electrical Box Instructions

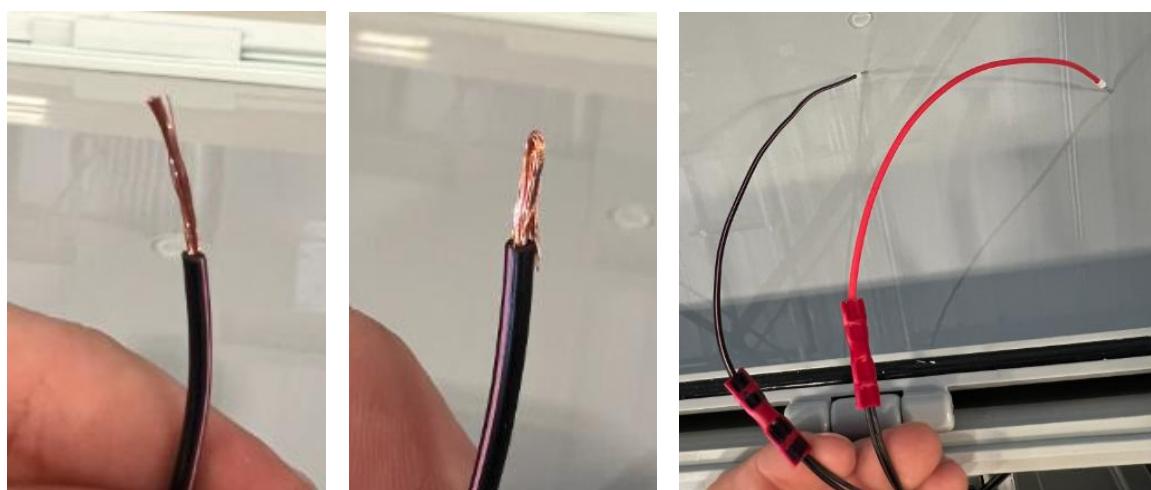
190. Cut out two 8.5 in. lengths of 22AWG stranded core wire. Strip one end of each wire to 8 mm and strip the other end to 12 mm. Crimp a 22AWG ferrule connector onto both of the 8 mm ends of each wire.



191. Starting with the red wire, fold the stripped stranded end in half and crimp into the other end of the power (red) butt connector as shown.

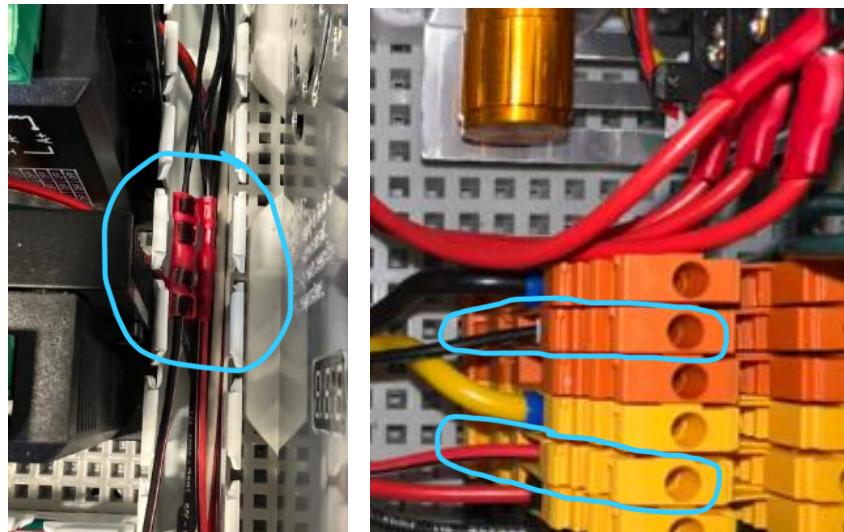


192. Now fold the stripped stranded end of the black wire in half and crimp into the other end of the ground (colored black) butt connector as shown.

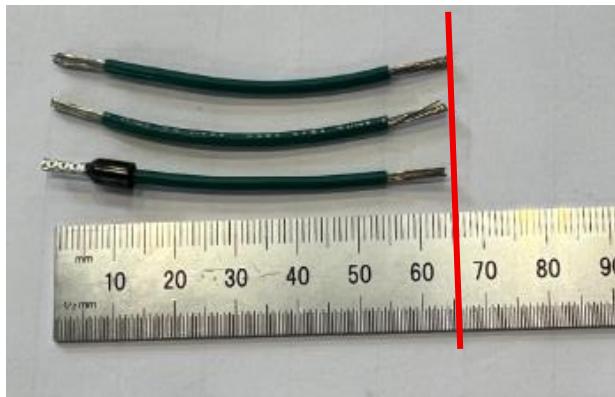


## Electrical Box Instructions

193. Route these wires through the middle wire channel in the box. Connect the red wire into the last yellow DIN rail terminal block. Connect the black wire into the orange DIN rail terminal block.



194. Cut three 65 mm lengths of 16AWG green wire and strip both ends of each wire to 8 mm. Crimp a 16AWG ferrule connector onto one end of one wire.



195. Crimp a 16AWG twin ferrule connector onto the free end of the wire with the ferrule connector and one of the free ends from another wire as shown.



## **Electrical Box Instructions**

196. Crimp the other 65 mm wire onto the free end of Step 195 with another 16AWG twin ferrule connector as shown.



197. Cut a 16AWG green wire to 12 in. and strip both ends to 8 mm. Crimp a 16AWG ferrule connector onto one end of the wire.



198. Crimp the 12 in. wire and the free end of the 65 mm wire from Step 196 together with a 16AWG twin ferrule connector to produce the result shown below.

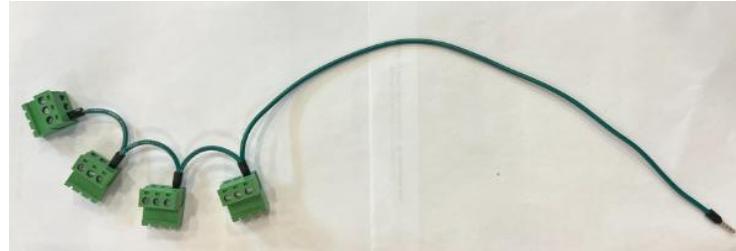


199. Grab four 3-port terminal blocks.

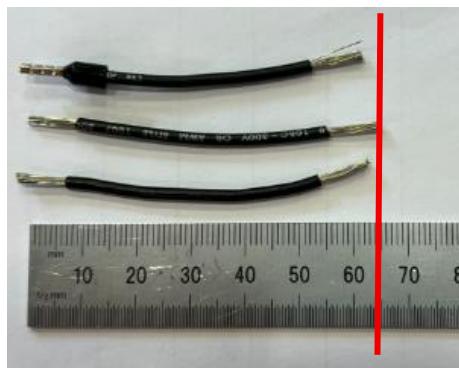


## **Electrical Box Instructions**

200. Connect the green wire assembly from Step 198 into the four 3-port terminal blocks as shown below.



201. Cut three 65 mm lengths of 16AWG black wire and strip both ends of each wire to 8 mm. Crimp a 16AWG ferrule connector onto one end of one wire.



202. Cut out a 9 in. 16AWG black wire and strip both ends to 8 mm. Crimp a 16AWG ferrule connector onto one end of the wire.

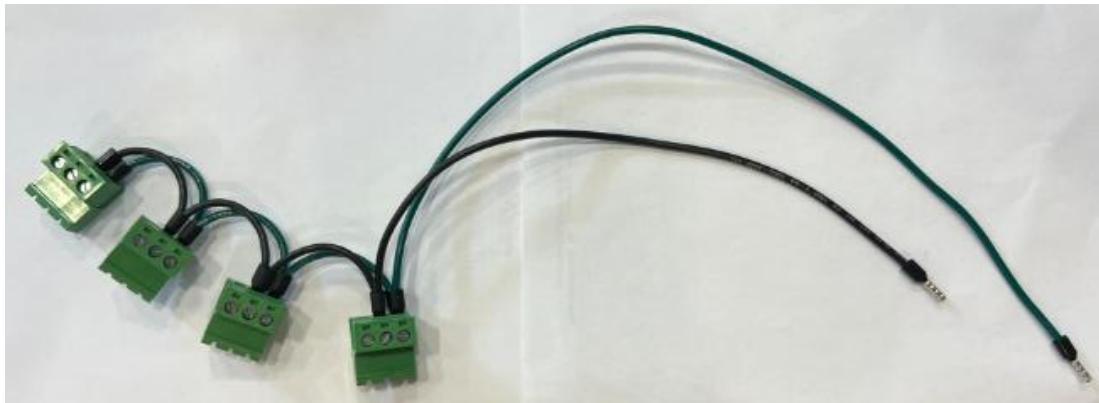


203. Repeat Steps 195-198 but with the black wires from the previous steps to produce the following.

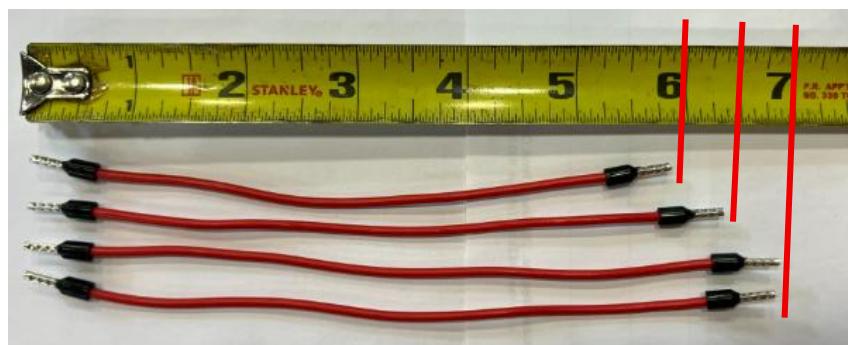


## Electrical Box Instructions

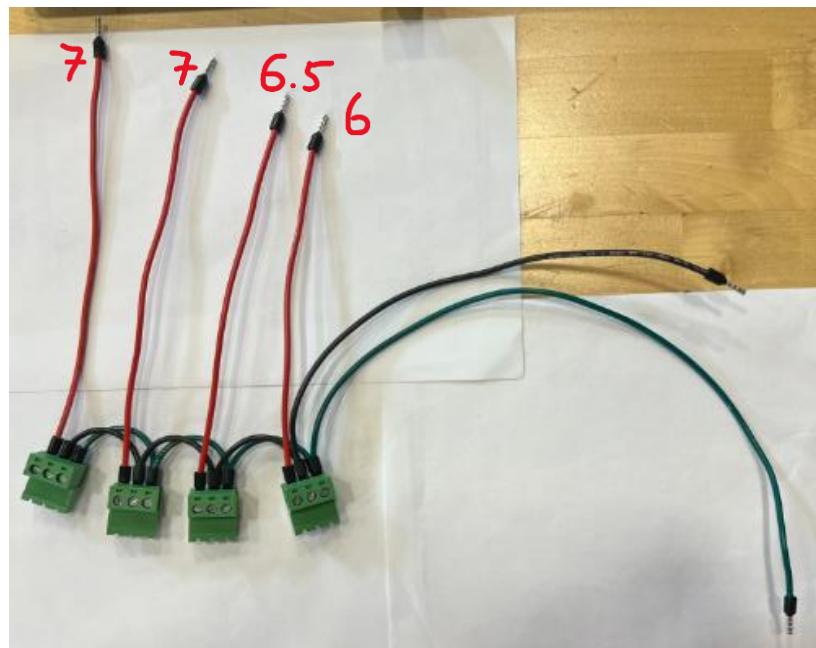
204. Insert the assemble black wire into the four 3-port terminal blocks as shown.



205. Next cut out four red wires: a 6 in. length, a 6.5 in. length, and two 7 in. lengths.

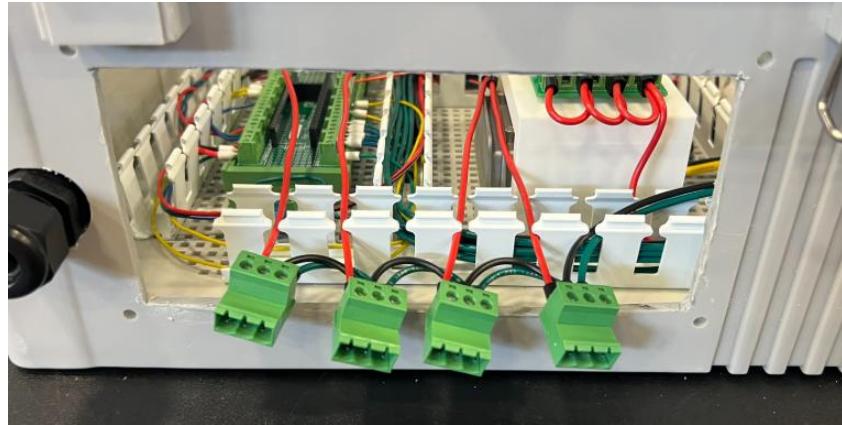


206. Insert the four red wires into the four 3-port terminal blocks as shown below.

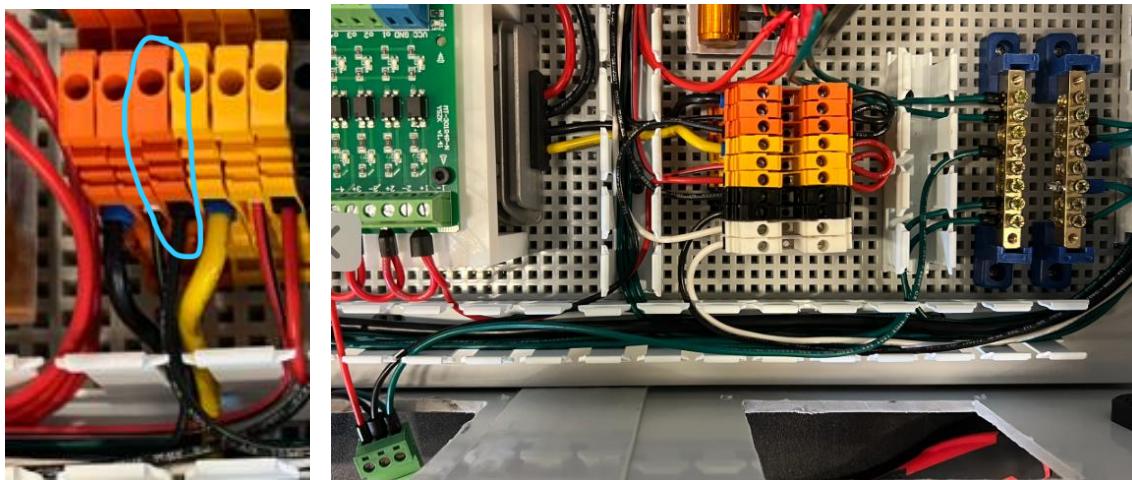


## Electrical Box Instructions

207. Feed the wires through the front left cutout on the electrical box as shown.

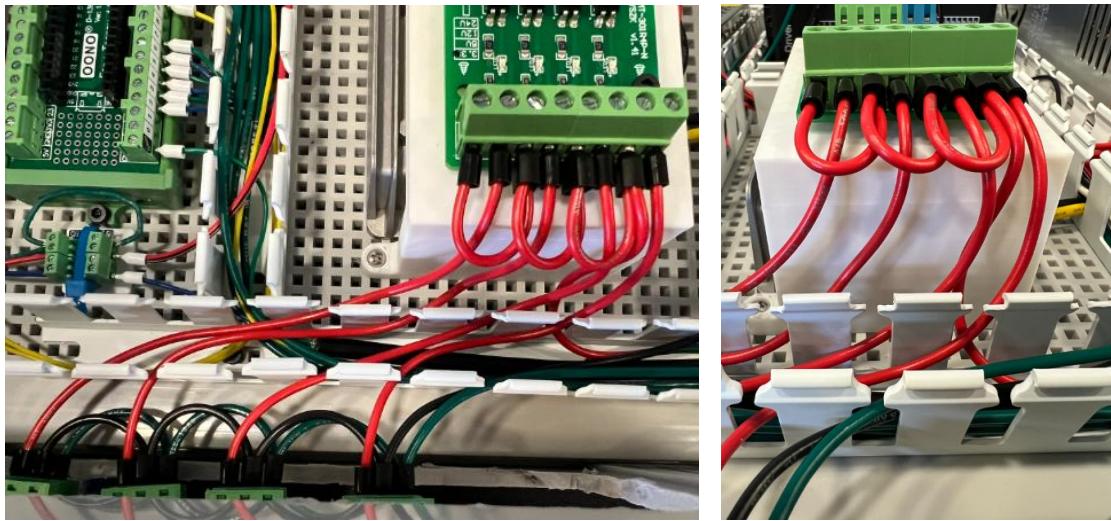


208. Route the long black wire to the last remaining orange DIN rail terminal block, and the green wire to the bus bar.

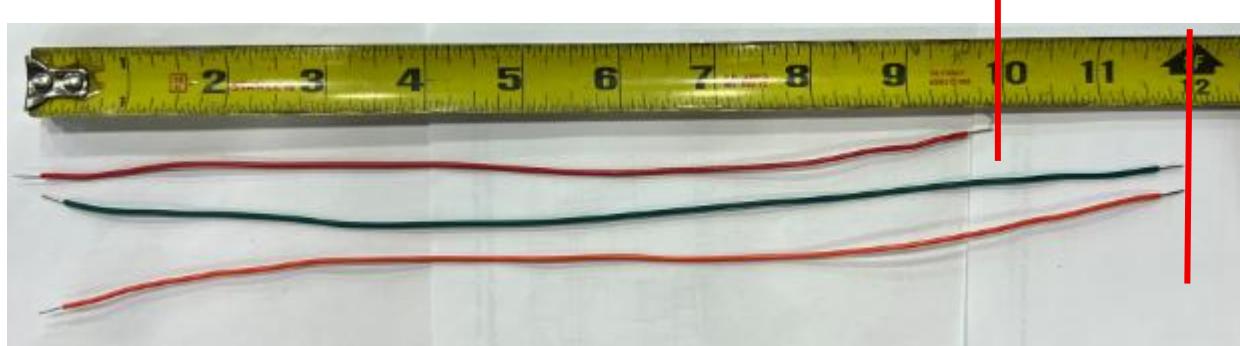


## Electrical Box Instructions

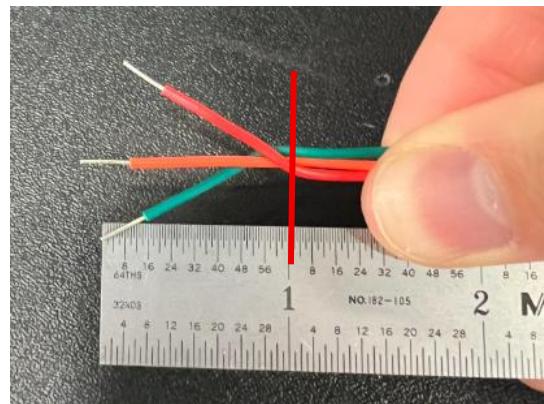
209. Feed the four red wires through the wire channels and into the optocoupler as shown. The order of the red wires should match exactly with the order of the four ports (1-, 2-, 3-, 4-) on optocoupler.



210. Cut a 22AWG solid core red wire to 10 in., a 22AWG solid core green wire to 12 in., and a 22AWG solid core orange wire to 12 in. as shown below.

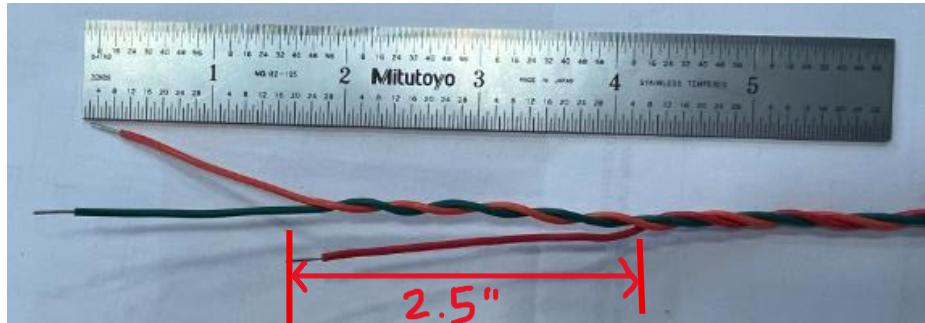


211. Line up one end of each three wires. Begin twisting the wires together about 1 in. from the end as shown.

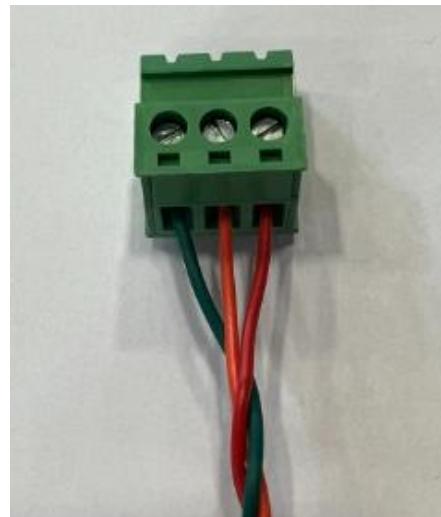


## Electrical Box Instructions

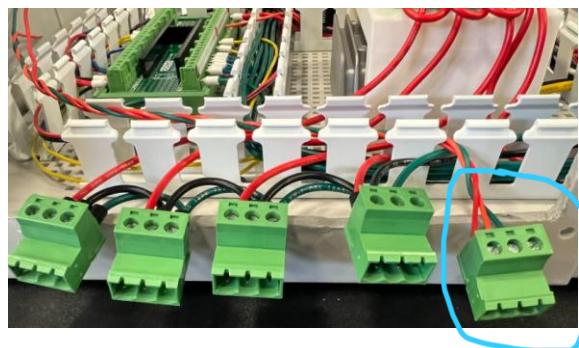
212. Twist all three wires together until there is about 2.5 in. of red wire remaining. At this point, twist just the orange and green wires together, leaving the red wire by itself. Twist the green and orange wires until there is about 2 – 2.5 in. of each, at which point you can leave them untwisted as shown.



213. Insert the side of the twisted wire from Step 211 into a 3-port terminal block as shown. Make sure the order is exactly as shown in the photo.

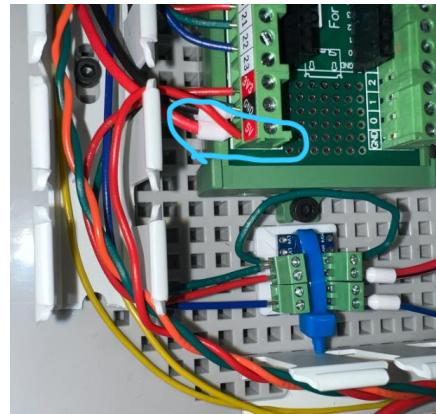


214. Place this new 3-port terminal block to the right of the terminal blocks from Step 207 as shown.



## Electrical Box Instructions

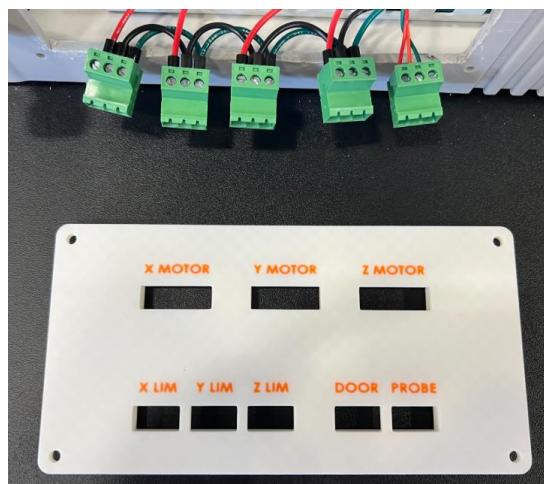
215. Route the twisted cable through the cable trays to the left side of the Teensy 4.1. Insert the red wire into the 5V port on the bottom left side of the Teensy 4.1. Note: there is already a connector in this 5V port, so you will have to stack up two wires in this terminal.



216. Insert the green wire into the GND port and the orange wire into pin 15 on the Teensy 4.1 as shown.



217. Acquire the front panel shown below.



## **Electrical Box Instructions**

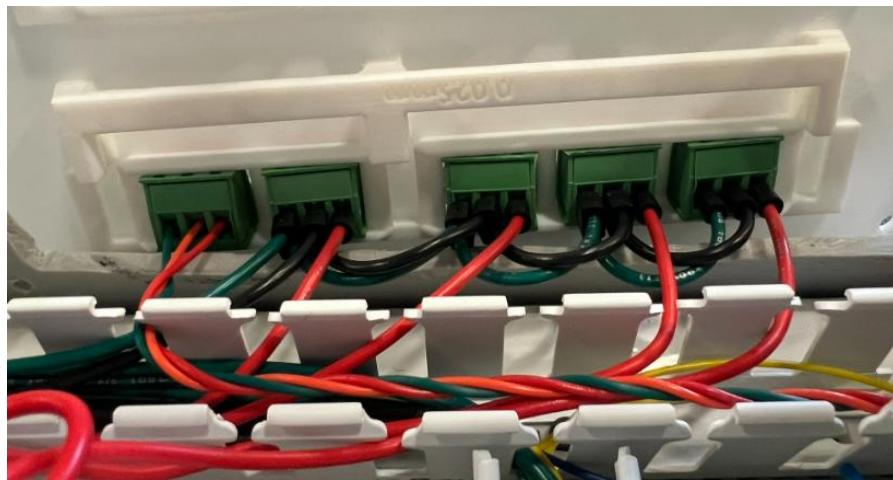
218. From the inside of the box, insert the five 3-port terminal blocks into the front panel as demonstrated below.



219. Acquire the slide connector piece shown below.



220. Slide the slide connector over the five 3-port terminal blocks to lock them in place, as shown below.



## Electrical Box Instructions



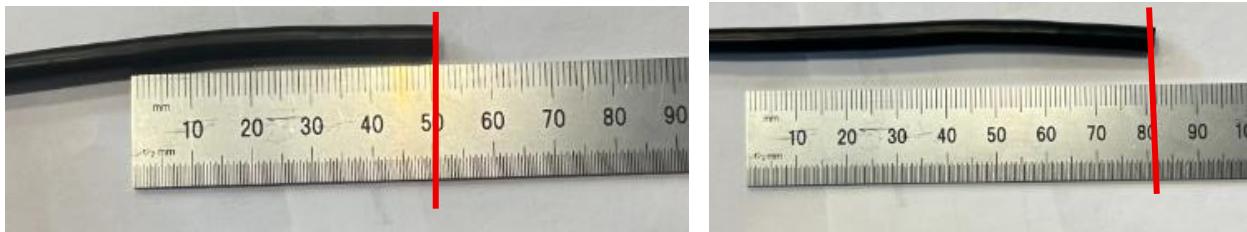
221. Leave the front panel disconnected from the box for the moment. From the outside of the box, it should look like the image below.



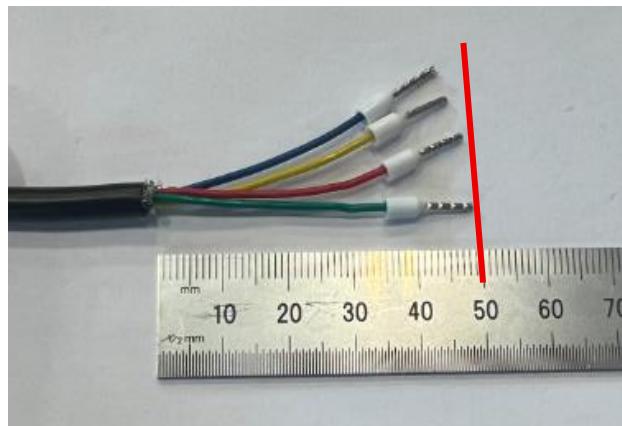
222. Cut out three 21 in. lengths of 4-core shielded cable. Strip one end of each wire to 50 mm and the other end of each wire to 80 mm.



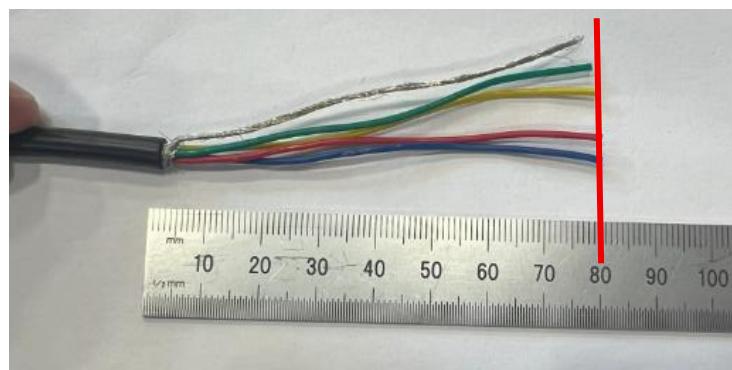
## Electrical Box Instructions



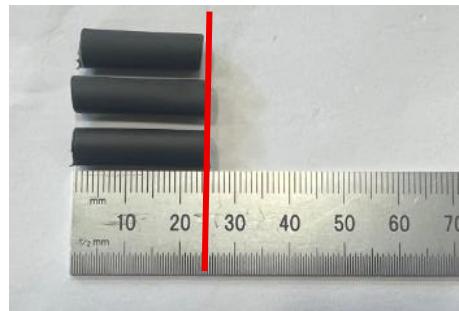
223. On the 50 mm stripped side, remove the foil and stranded wire. Strip the red, blue, green, and yellow wires to 8 mm and crimp a 22 AWG ferrule connector on each wire. Repeat for all three wires.



224. On the 80 mm side, remove just the foil, leaving the stranded wire connected as shown.

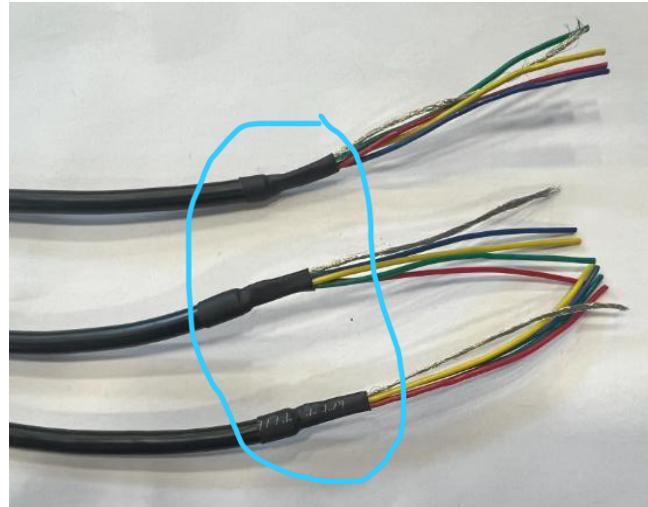


225. Cut out three ~25 mm lengths of black heat shrink.

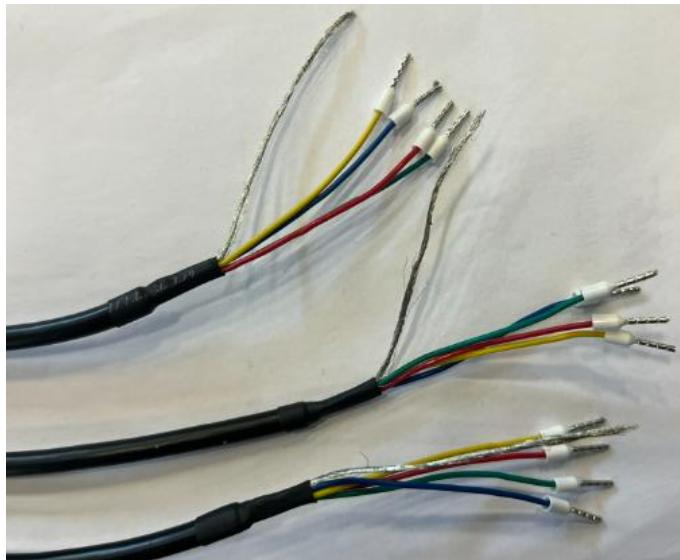


## Electrical Box Instructions

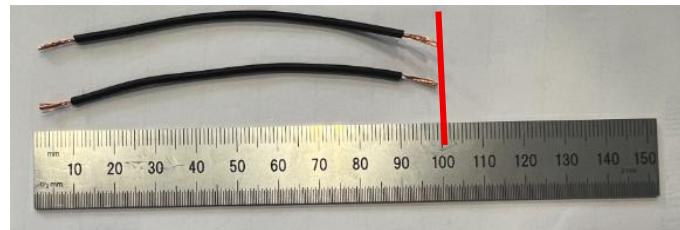
226. Apply the heat shrink around the base of the 80 mm stripped side of each cable as shown.



227. Strip the red, blue, green, and yellow wires on the 80 mm side of each cable to 8 mm and crimp 22AWG ferrule connectors to each.



228. Cut out two 100 mm lengths of black 22AWG stranded core wire and strip both ends of each to 8 mm.

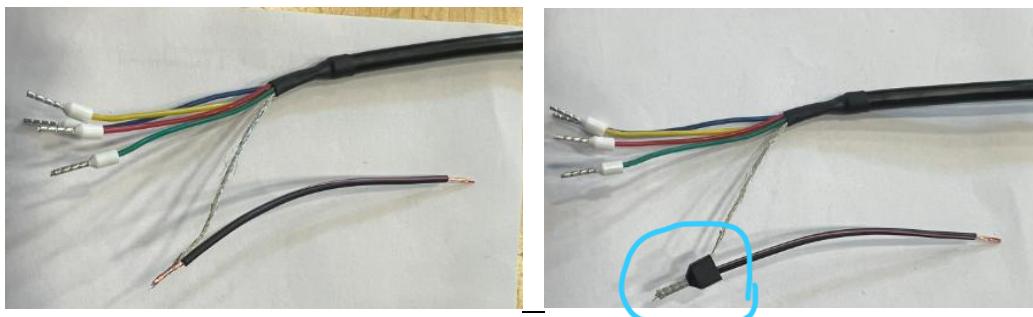


## Electrical Box Instructions

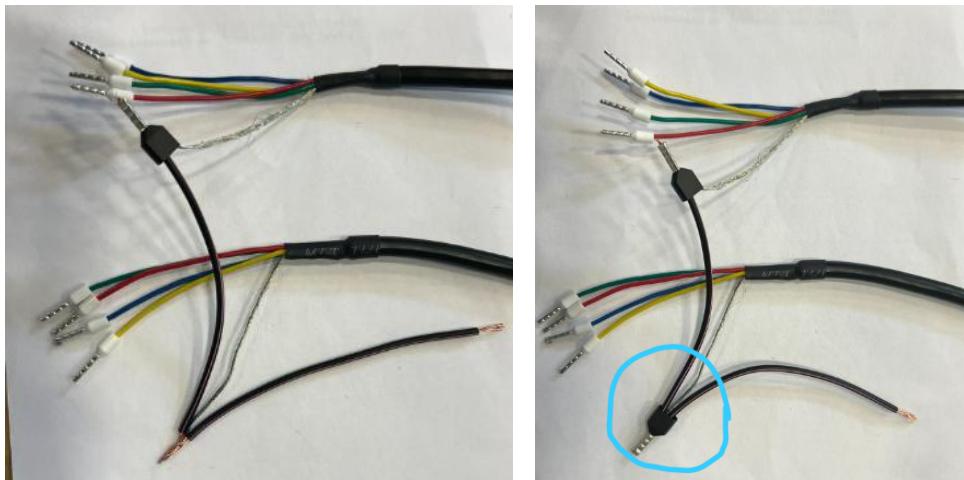
229. Cut out a 12 in. length of 16AWG green wire and strip both ends to 8 mm. Crimp a 16AWG ferrule connector on one end, leaving the other end stranded.



230. Twist one of the 100 mm black wires onto the shielded section of one of the 4-core shielded cables as shown below. Crimp a black twin ferrule connector onto these two wires.

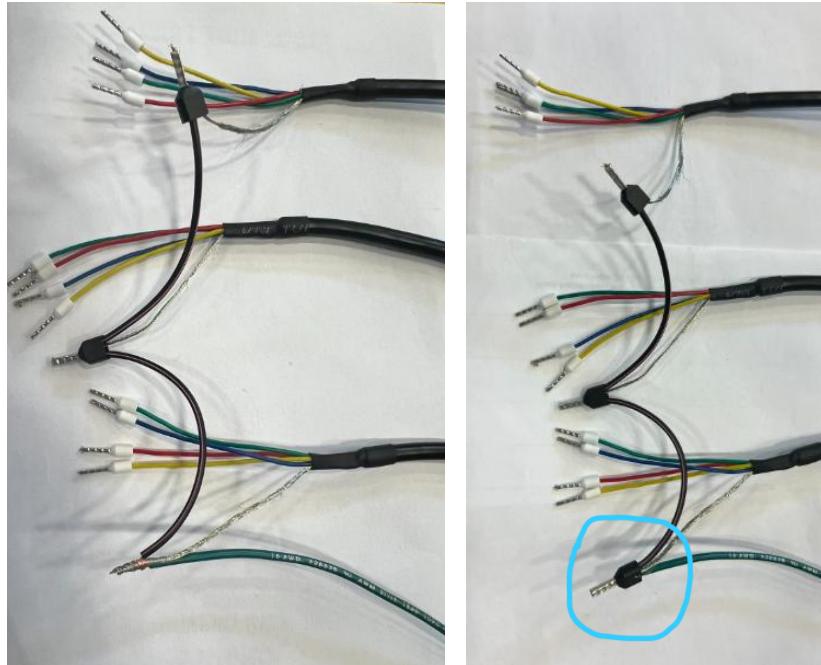


231. Twist the other end of the 100 mm black wire from Step 230 onto the other black 100 mm wire and the stranded wire from another one of the 4-core shielded cables as shown. Crimp a black twin ferrule connector onto these three wires.

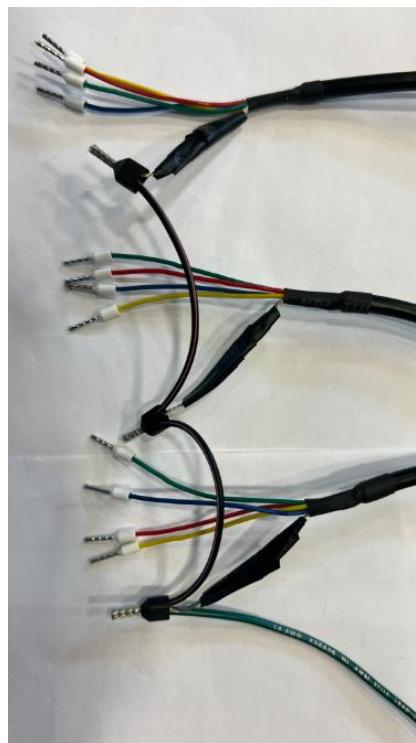


## **Electrical Box Instructions**

232. Twist the other end of the 100 mm black wire from Step 231 onto the stranded wire from the final 4-core shielded cable and the stranded wire from the free side of the green wire as shown. Crimp a black twin ferrule connector onto these three wires.

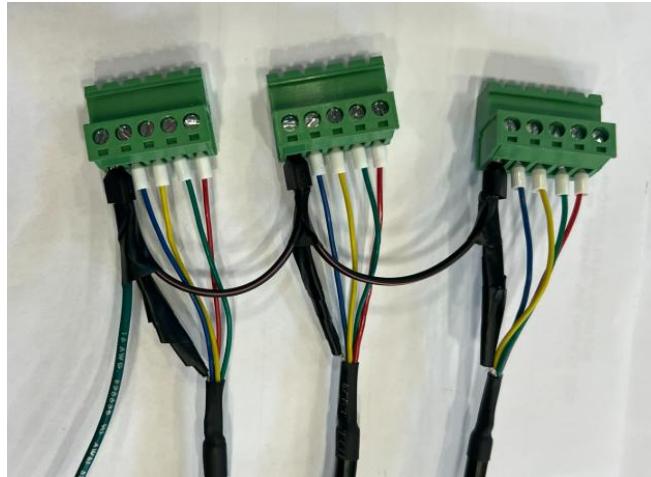


233. Apply electrical tape around the exposed stranded shielding from the 4-core shielded cables as shown.



## Electrical Box Instructions

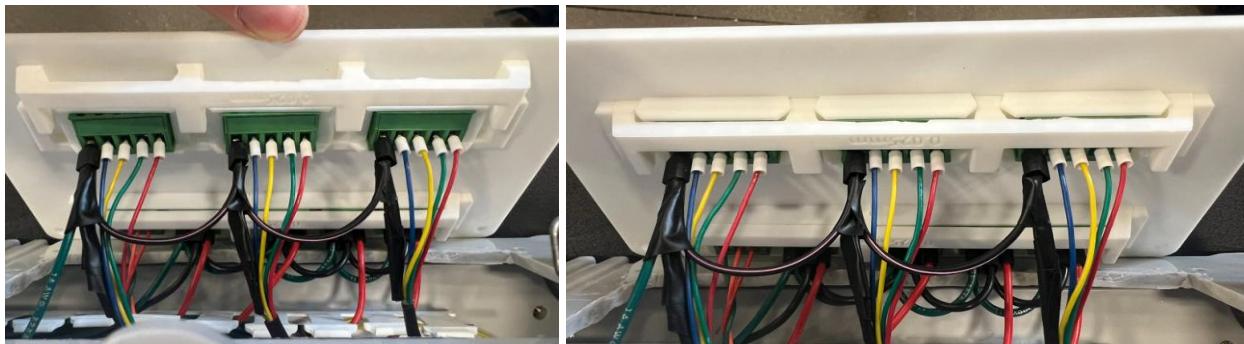
234. Insert and secure the wire assemblies from Step 233 into three 5-port terminal blocks as shown below. Note, make sure that the wire orders are exactly as shown below.



235. Insert the three 5-port terminal blocks into the 'X MOTOR', 'Y MOTOR', and 'Z MOTOR' slots on the front panel from inside the box as shown. Make sure that the terminal block with the green wire coming out of it is in the 'Z MOTOR' slot.

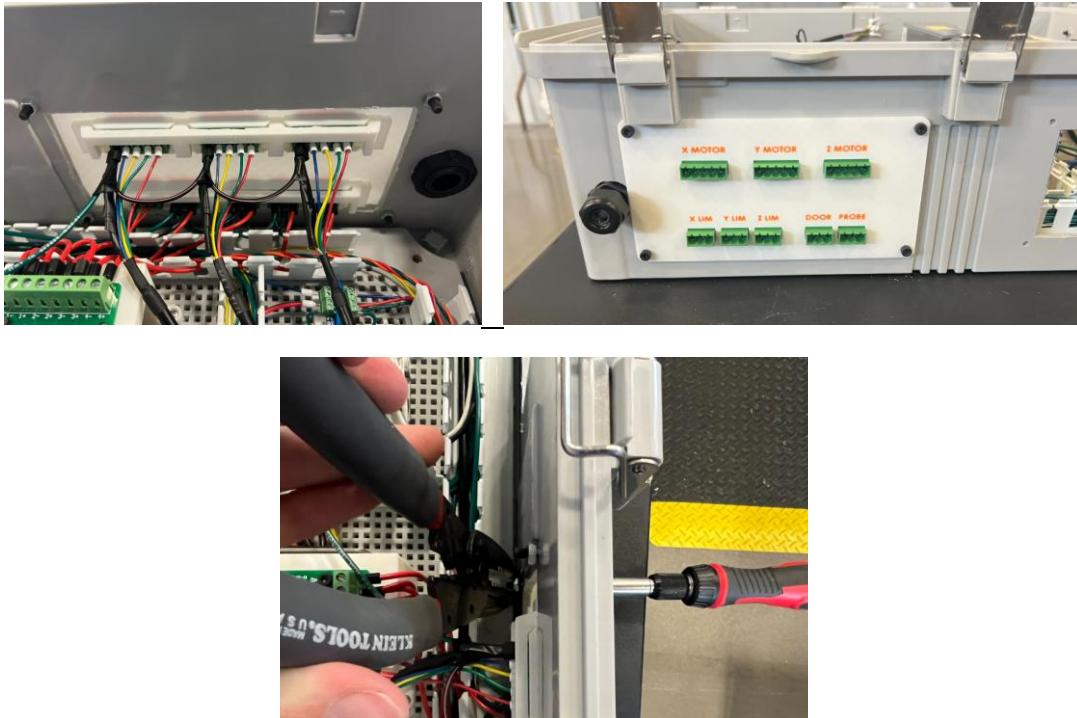


236. Slide the other slide connector over the three terminal blocks to lock them in place.



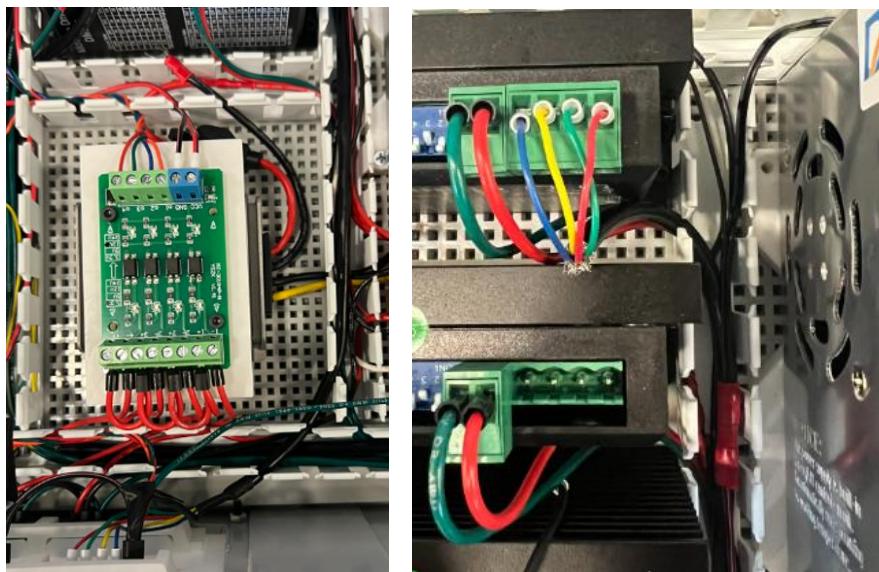
## Electrical Box Instructions

237. The front panel can now be mounted onto the box using four M4x16 bolts and four M4 nuts. Use a screw driver and pliers to secure the nuts on the bolts.



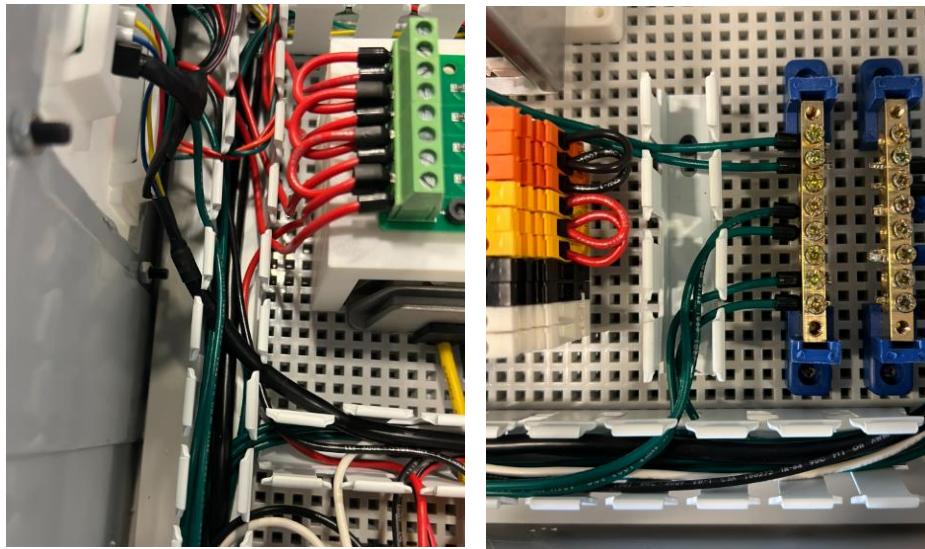
238. Route the 4-core shielded cable from the 'Z MOTOR' to the Z-axis drive through the middle wire duct in the box as shown. Secure the four ferrule connectors on the blue, yellow, green, and red wires on the Z-axis's High Voltage terminal block exactly as shown.

- a. Blue → B-
- b. Yellow → B+
- c. Green → A-
- d. Red → A+

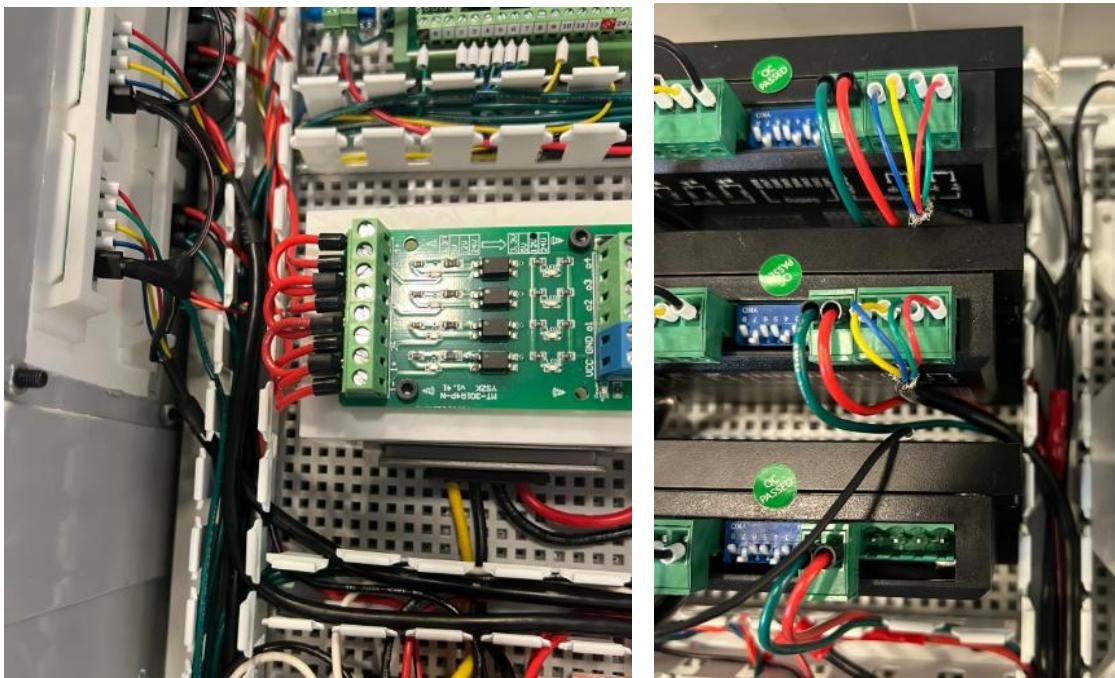


## Electrical Box Instructions

239. Route the green cable from the ‘Z MOTOR’ port to the bus bar as shown.

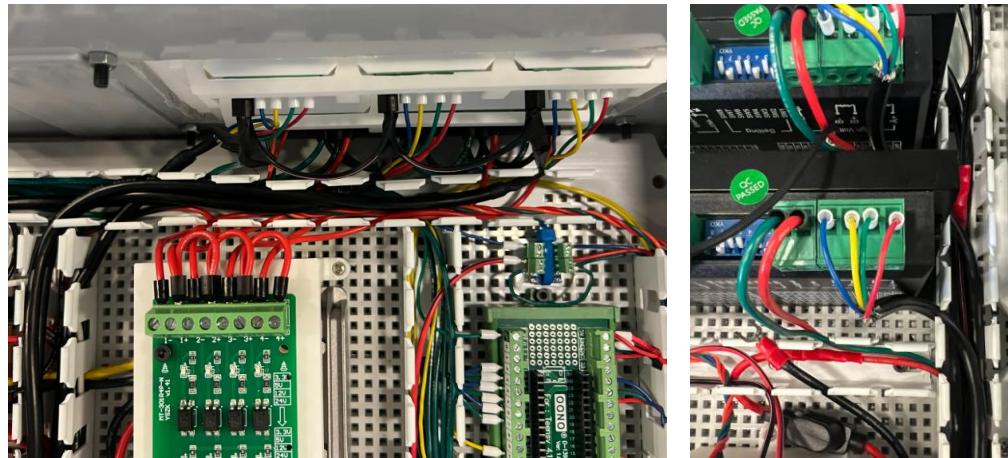


240. Route the 4-core shielded cable from the ‘Y MOTOR’ to the Y-axis drive through the middle wire duct in the box as shown. Secure the four ferrule connectors on the blue, yellow, green, and red wires on the Y-axis’s High Voltage terminal block exactly as shown.



## Electrical Box Instructions

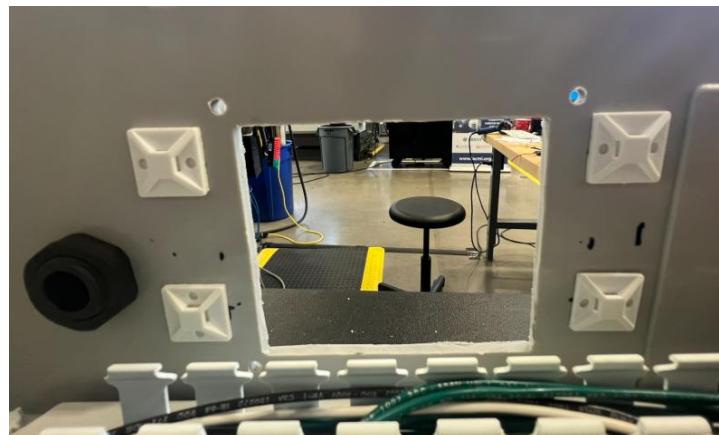
241. Route the 4-core shielded cable from the ‘X MOTOR’ to the X-axis drive through the middle wire duct in the box as shown. Secure the four ferrule connectors on the blue, yellow, green, and red wires on the X-axis’s High Voltage terminal block exactly as shown.



242. Acquire four zip ties and four zip tie mounts as shown below.



243. Take the adhesive off of the zip tie mounts and install in the locations shown below. The top of the top two zip tie mounts should be in line with the top of the square cutout as shown. The top of the bottom two zip ties should be ~25 mm above the bottom of the square cutout.



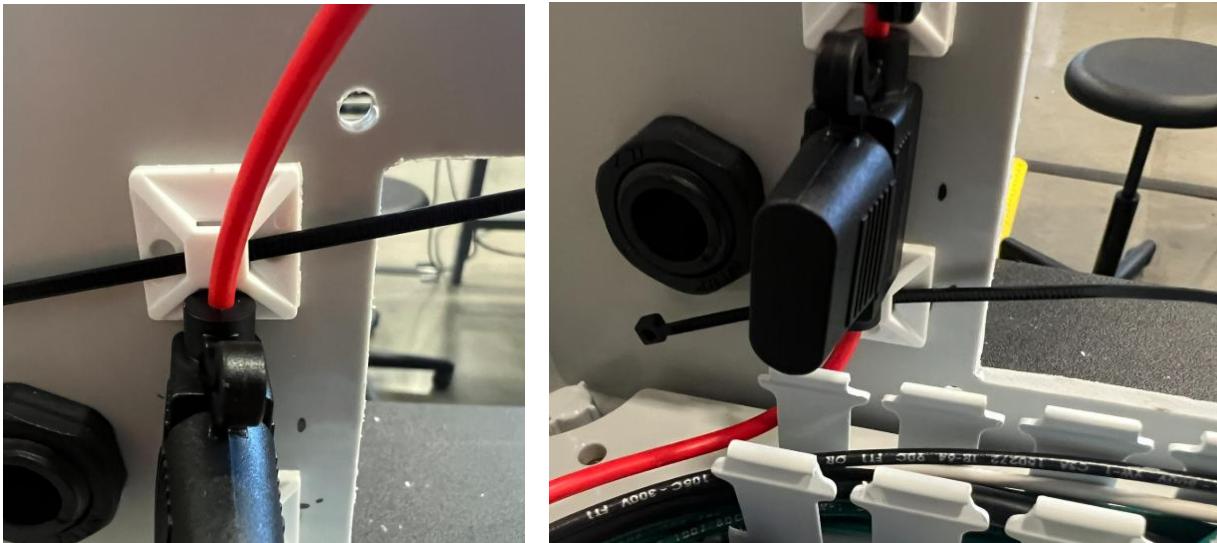
## Electrical Box Instructions



244. Starting with the top left mount, slide a zip tie horizontally through the mount as shown. Repeat for the bottom mount as well.



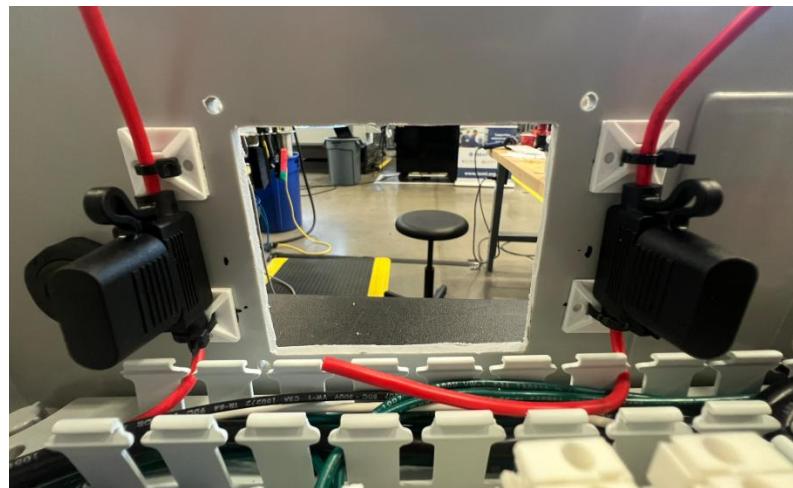
245. Place an in-line fuse over the mount as shown. Make sure that the fuse is positioned such that the fuse box opens upwards. Tighten both zip ties and cut off the extra to produce the following.



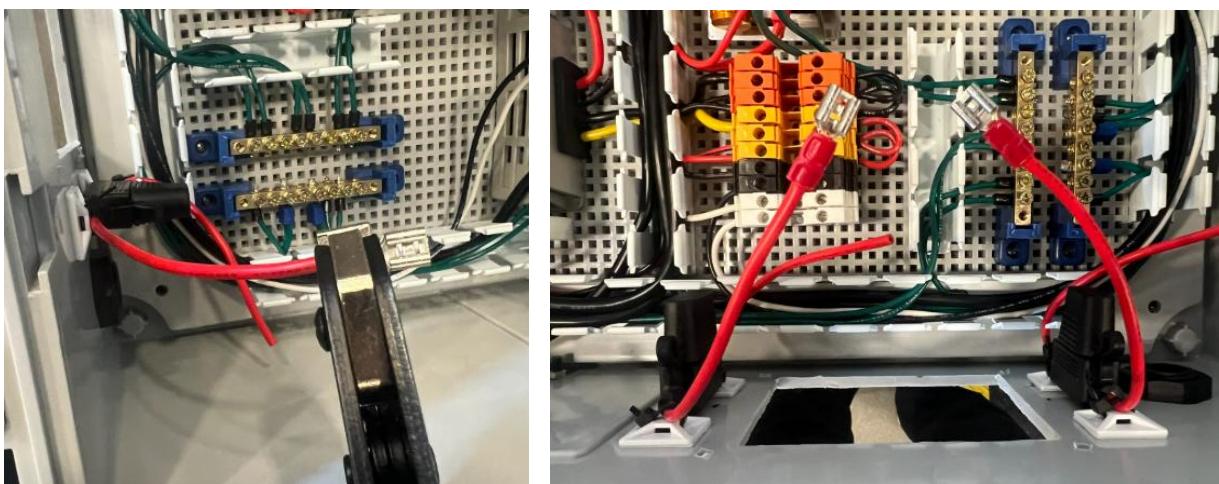
## Electrical Box Instructions



246. Repeat Steps 244-246 on the other side to produce the following.

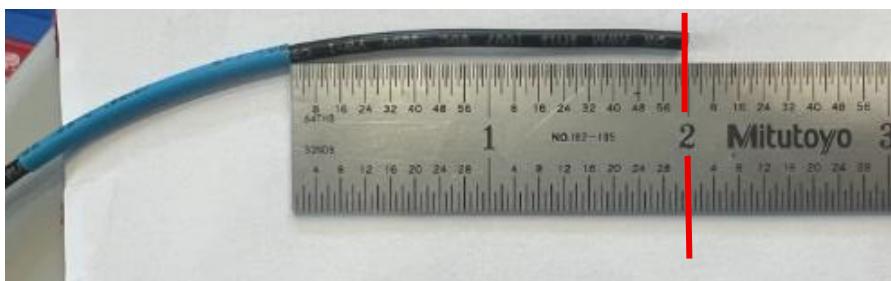


247. Strip the top red wires on both fuse lines to 8 mm and crimp a red quick-disconnect connector onto both.

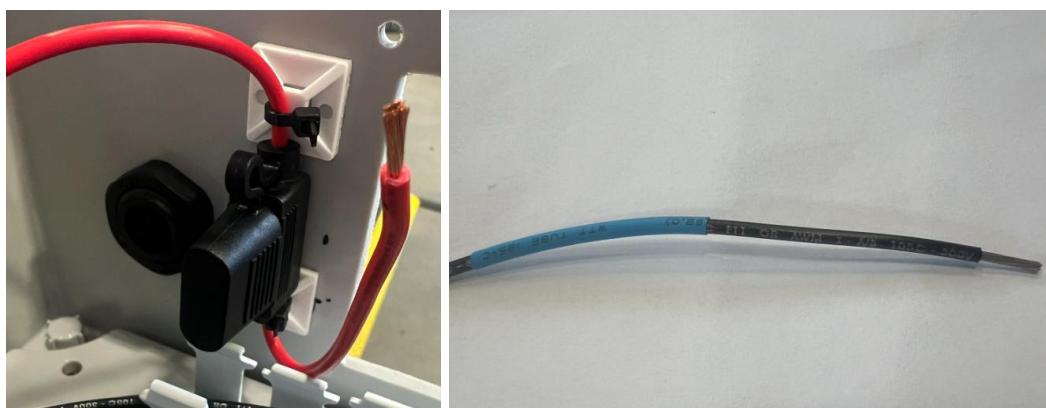


## Electrical Box Instructions

248. Cut 4 black 16AWG wires to 48 in. On two of the wires, apply green heat shrink 2 in. from the ends. On the other two wires, apply blue heat shrink 2 in. from the ends as seen below.

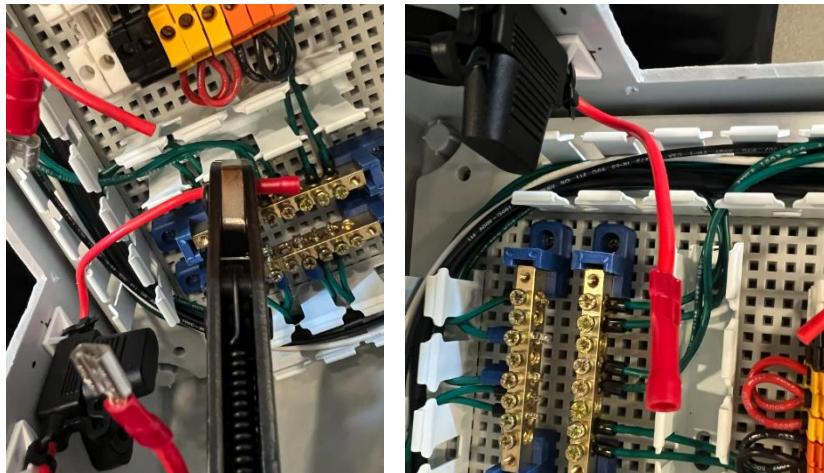


249. Now strip the bottom red wire from the fuse line on the left side (from the inside of the box) of the cut out to 8 mm. Strip one end of one of the blue heat shrink wires from above to 8 mm.

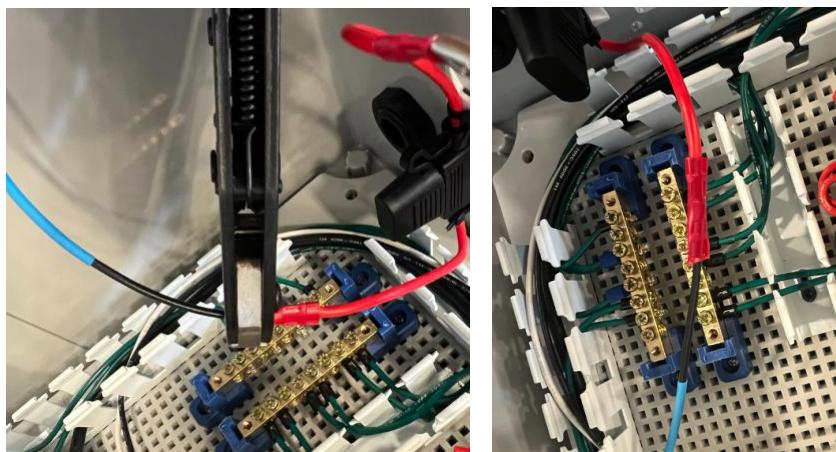


## Electrical Box Instructions

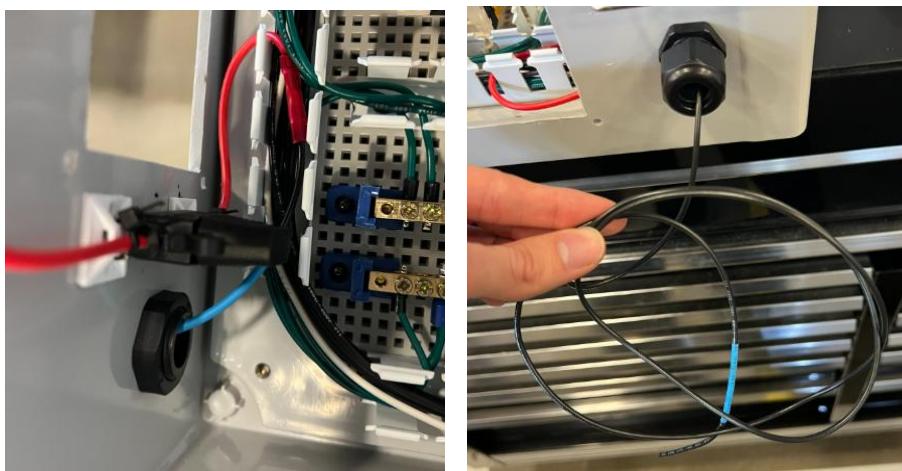
250. Crimp a red butt connector onto the stripped end of the red fuse line from the previous step.



251. Crimp the stripped end of the blue heat shrink wire from Step 249 into the other end of the butt connector as shown.

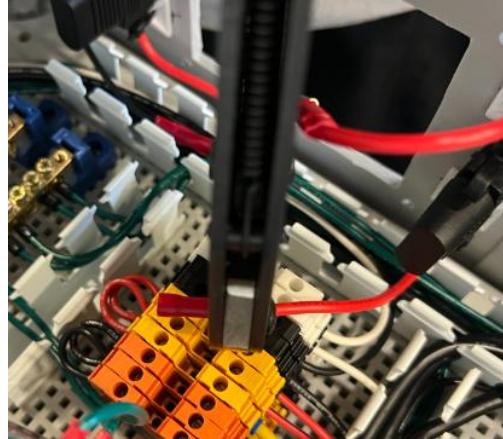


252. Route the cable through the cable trays and through the cable gland to the outside of the box as shown.

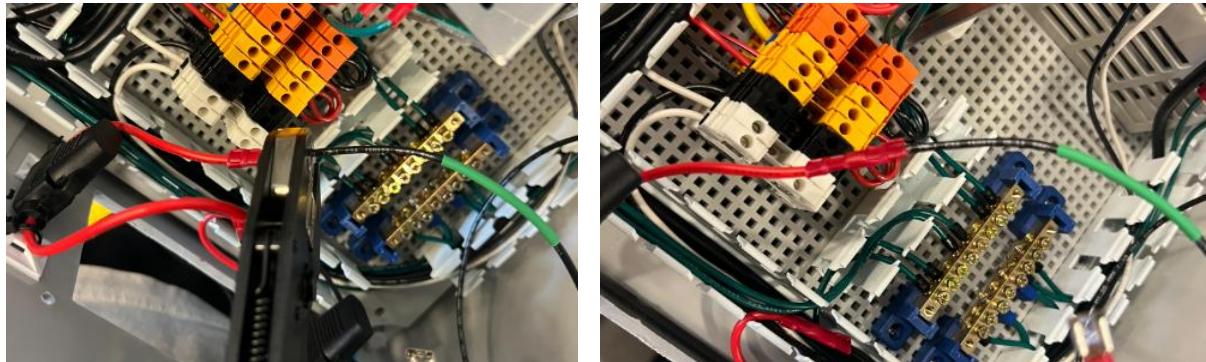


## Electrical Box Instructions

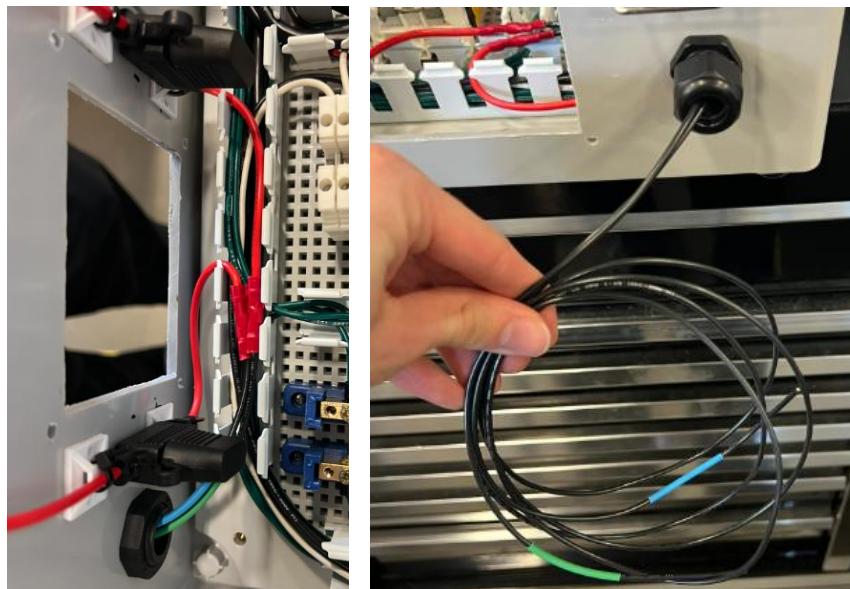
253. Now strip the bottom red wire from the other fuse line to 8 mm and crimp a red butt connector onto the end.



254. Strip one end of one of the green heat shrink wires to 8 mm. Insert this stripped end into the other side of the red butt connector and crimp to secure.



255. Route this wire through the cable trays to the cable gland as well to the outside of the box.



## Electrical Box Instructions

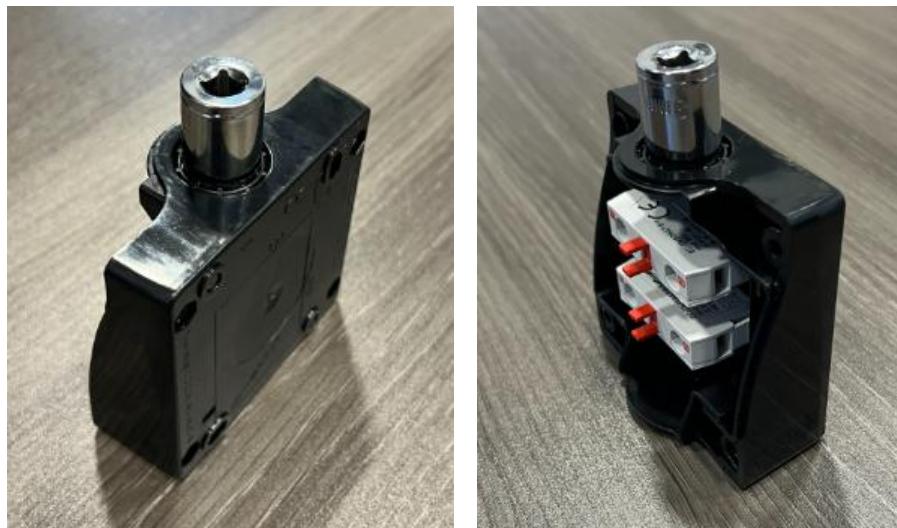
256. Strip the ends of the black wires with blue and green heat shrink that are now outside of the box to 8 mm. Crimp an (M4)#8 fork connector onto each end as shown.



257. Grab the emergency stop and disassemble it by loosening the four screws on top.



258. Take the bottom half (black portion) of the E-Stop and set vertically so that the skinnier side is facing up. Place a socket attachment from the screwdriver kit on top of the circular port as shown.

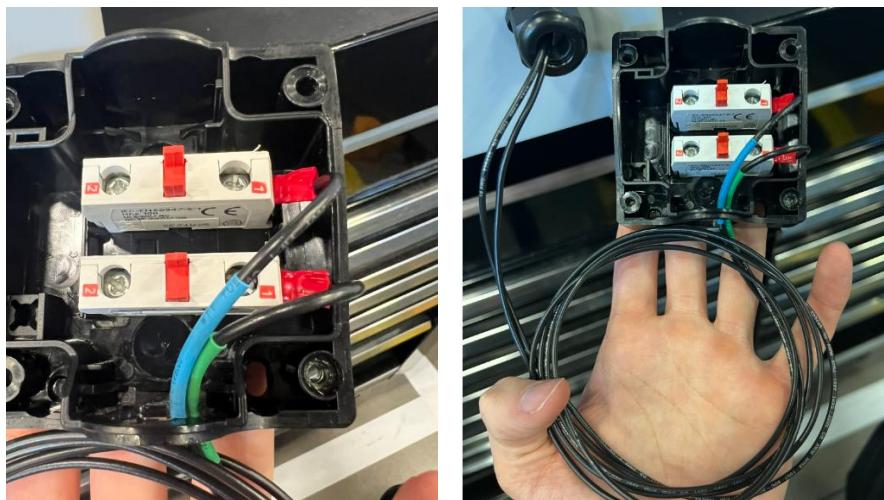


## Electrical Box Instructions

259. Using a hammer, use a single strike to the socket as shown below. This should knock out the vent cover and leave an empty hole.



260. Insert the fork connectors on the black wires from Step 256 through the hole made in the previous step. Secure the fork connectors into the terminal blocks within the E-Stop as shown.

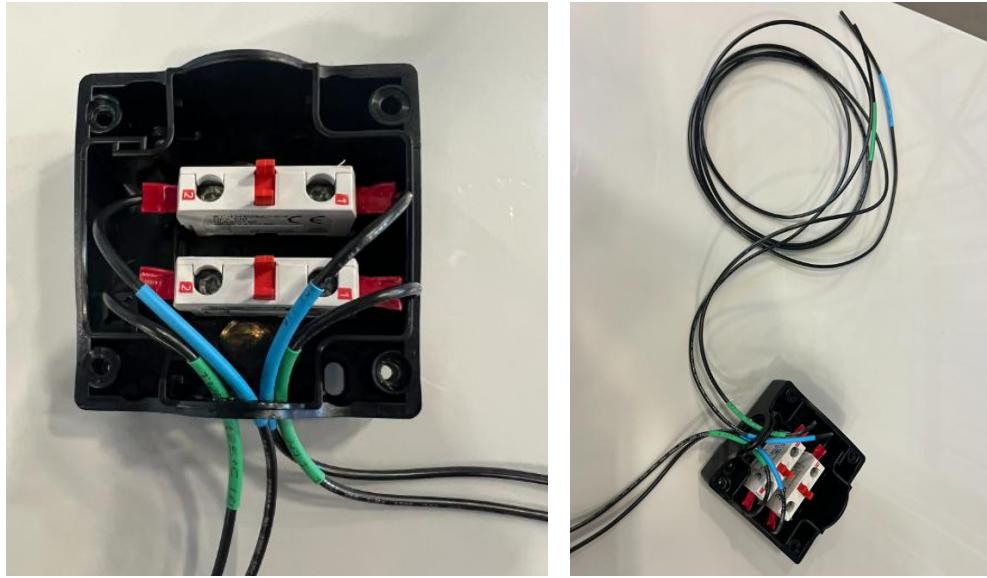


261. On the other two black wires that have not been connected to anything yet, strip one end of each wire to 8 mm and crimp an (M4)#8 fork connector onto these ends.



## Electrical Box Instructions

262. Secure the fork connectors from these new wires into the terminal blocks in the E-Stop as shown below. Note, make sure that the blue wires are on the same terminal block, and the green wires are on the same terminal block.



263. Cut a black 16AWG wire to 65 mm and strip both ends to 8 mm. Crimp a 16AWG ferrule connector onto one end.



264. Strip the free end of the black wire with blue heat shrink on it from Step 262 to 8 mm. Using a 16AWG twin ferrule connector, crimp this wire and the black wire from the previous step together as shown.

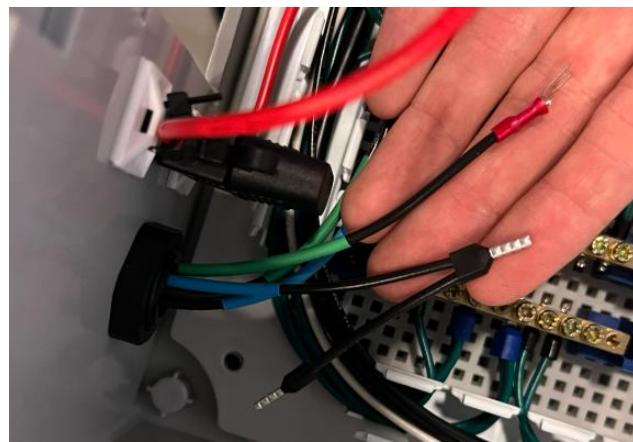
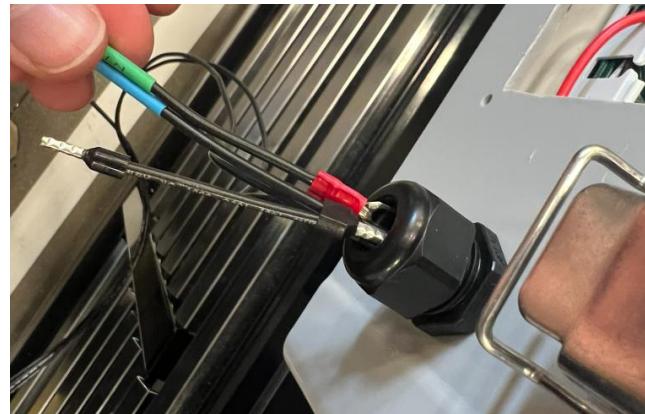


## **Electrical Box Instructions**

265. Strip the free end of the black wire with green heat shrink on it from Step 262 to 8 mm. Crimp an (M4)#8 fork connector onto the end of this wire to produce the result shown below.

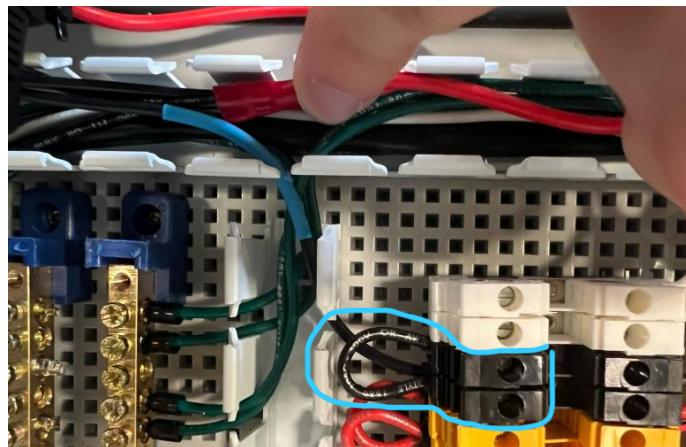


266. Slide these new connections through the cable gland from the outside of the box to the inside of the box as shown.

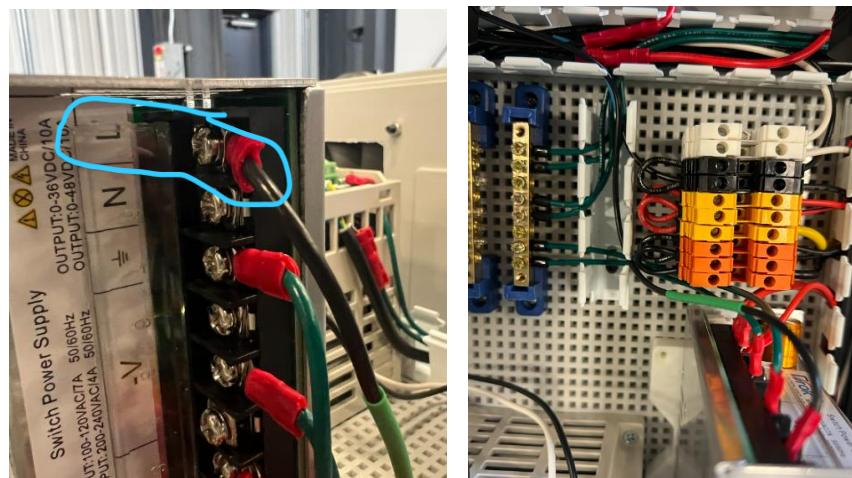


## Electrical Box Instructions

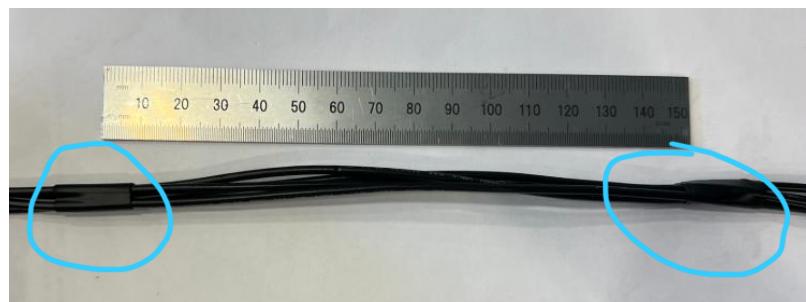
267. Route the blue wire through the cable trays to the DIN rail terminal blocks as shown. Insert one end into one of the black DIN rail terminal blocks and jump the 65 mm wire to the other black terminal block.



268. Route the green wire through the cable trays to the 48V PSU. Secure the fork connector into the Live (L) port on the 48V PSU as shown.



269. Starting at the E-Stop itself, use electrical tape to hold the four black wires together as shown. Add tape approximately every 150 mm. Note: once you get to the box, the four wires will not evenly line up due to differing lengths routed inside the box. To fix this, push more of the longer wire lengths through the cable gland and route through the cable trays as shown until the lengths match up.



## Electrical Box Instructions

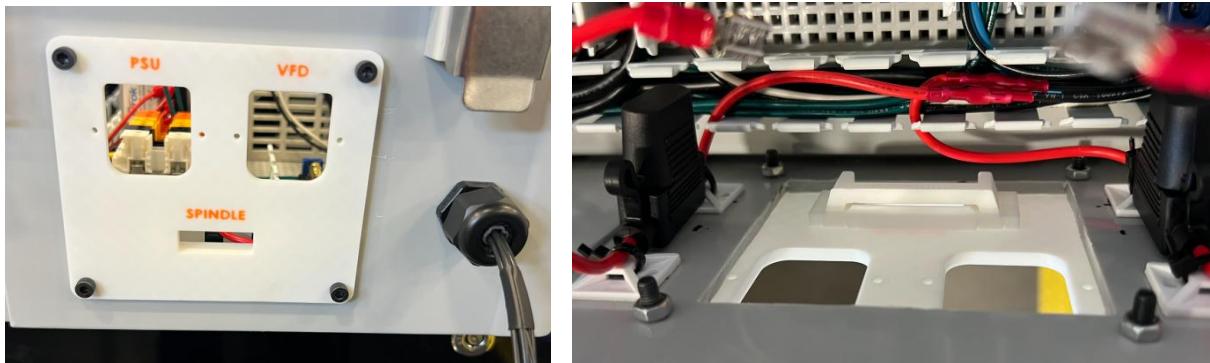


270. Once the lengths line up, add electrical tape to the four wires directly outside of the cable gland. Tighten the cable gland to secure the wires in place.

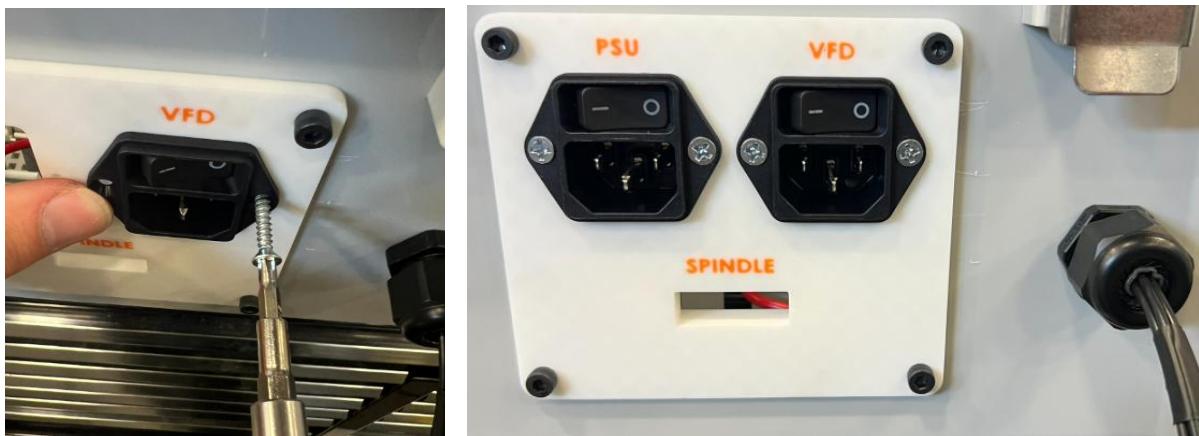


## Electrical Box Instructions

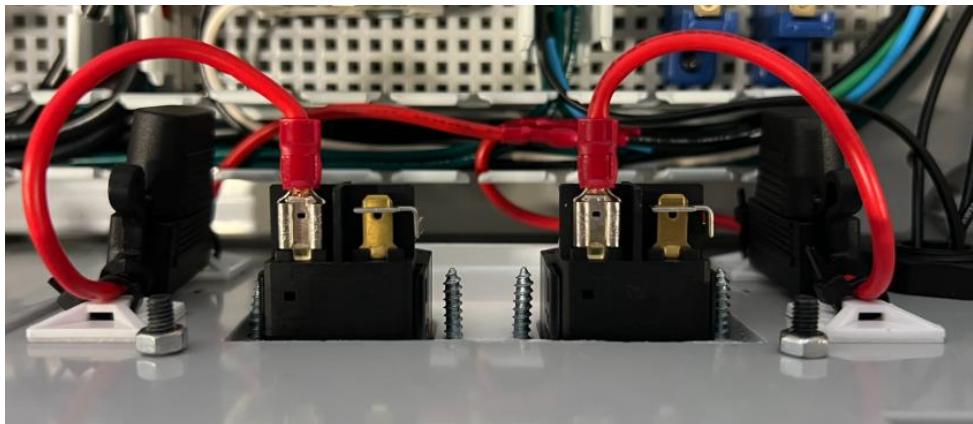
271. Using four M4x16 bolts and M4 nuts, secure the other front panel in place as shown.



272. Acquire two IEC receptables and secure into the 'PSU' and 'VFD' ports with four #6 screws.

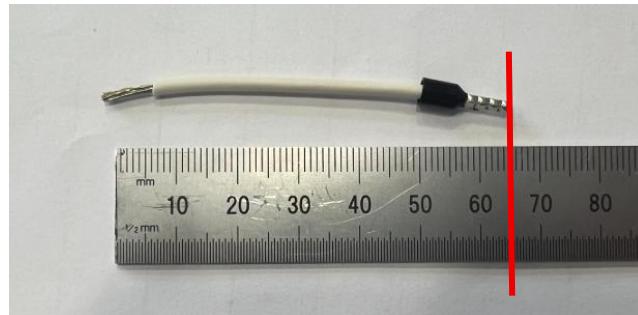


273. On the inside of the box, connect the quick-disconnect connectors from the fuse lines to the Live terminal on the IEC receptacles as shown.



## **Electrical Box Instructions**

274. Cut out a white 16AWG wire to 65 mm and strip both ends to 8 mm. Crimp a 16AWG ferrule connector onto one end.



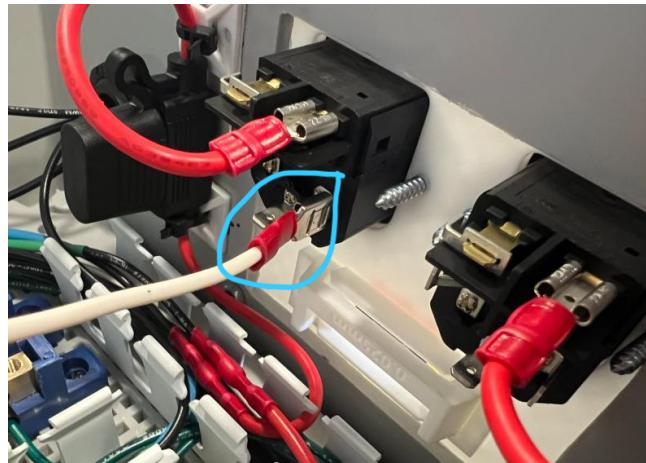
275. Cut out a white 16 AWG wire to 8 in. and strip both ends to 8 mm. Crimp a red quick-connect connector onto one end of the wire.



276. Using a 16AWG twin ferrule connector, crimp the free ends of the two white wires together.

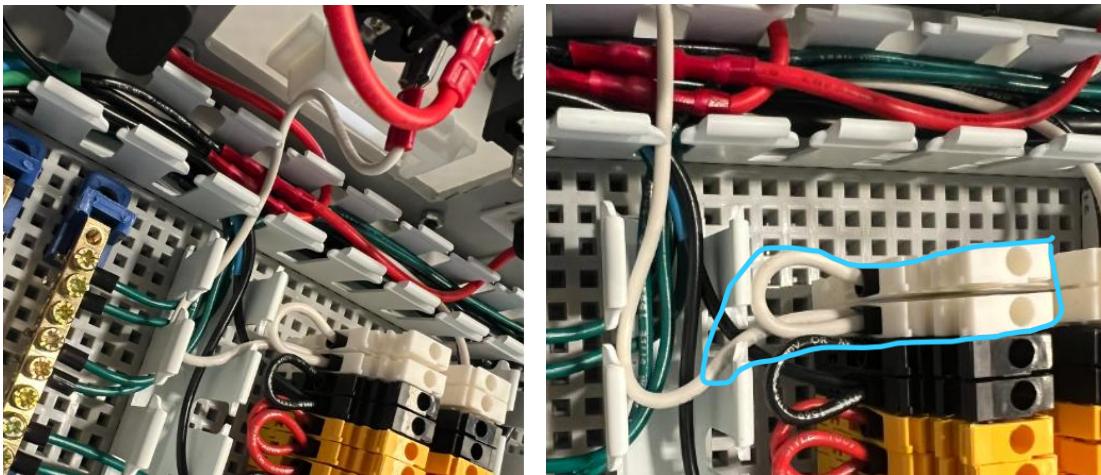


277. Insert the quick-connect onto the Neutral port on the VFD's IEC receptacle as shown.



## Electrical Box Instructions

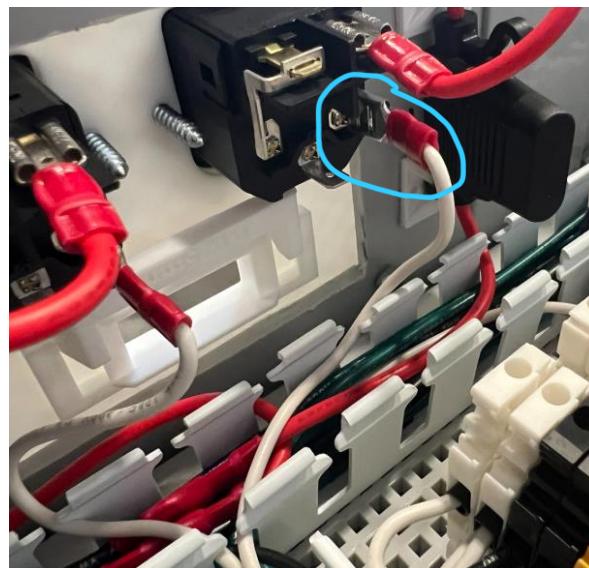
278. Route the white cable through the cable trays and to the DIN rail terminal blocks. Insert the twin ferrule connector into one of the white terminal blocks and jump the 65 mm cable to the other white terminal block as shown.



279. Cut a white 16AWG wire to 12 in. and strip both ends to 8 mm. Crimp a red quick-connect on one end and an (M4) #8 fork connector on the other.



280. Insert the quick-connect onto the Neutral port on the PSU's IEC as shown.



## Electrical Box Instructions

281. Route the cable through the cable trays and to the 48V PSU as shown. Secure the fork connector into the Neutral (N) terminal on the 48V PSU.



282. Cut two 16AWG green wires, one to 8.5 in. and one to 9 in.

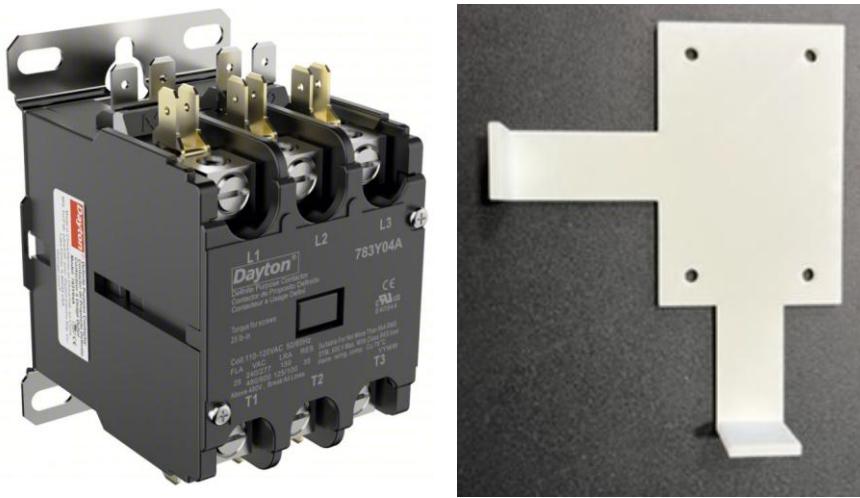


283. Plug the 8.5 in. green wire into the ground terminal on the VFD's IEC receptacle as shown. Plug the 9 in. green wire into the PSU's IEC receptacle. Route both wires to the bus bar and secure.



## Electrical Box Instructions

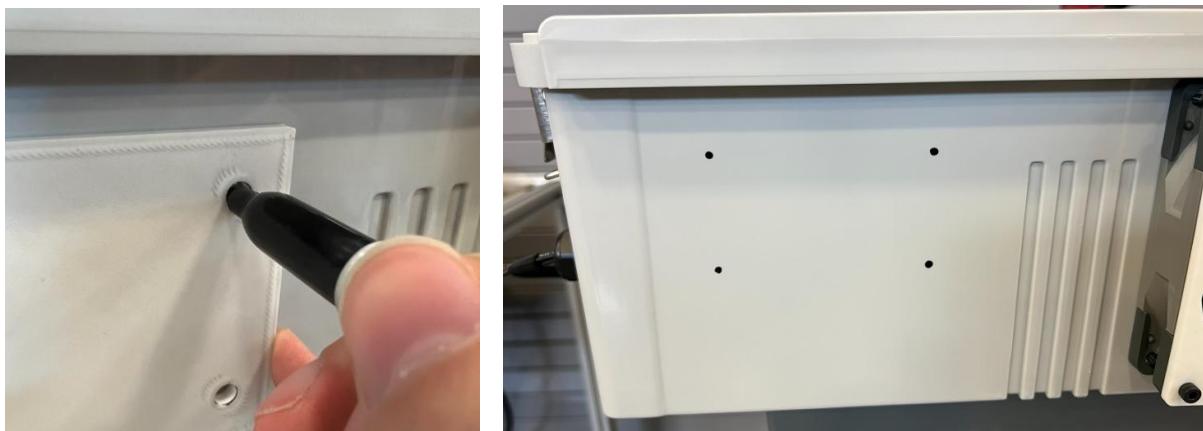
284. Acquire the Definite Purpose Contactor and 3D printed drill guide shown below.



285. Slide the 3D printed drill guide onto the outside of the box as shown. When looking down at the top of the box with the stainless steel latches facing you, the guide will fit on the bottom right side of the box. Make sure the stoppers are flush against the side and bottom of the box. Tape in place to secure.



286. Using a sharpie, mark the location of the holes as shown. Once all four are marked, you can remove the guide from its position.

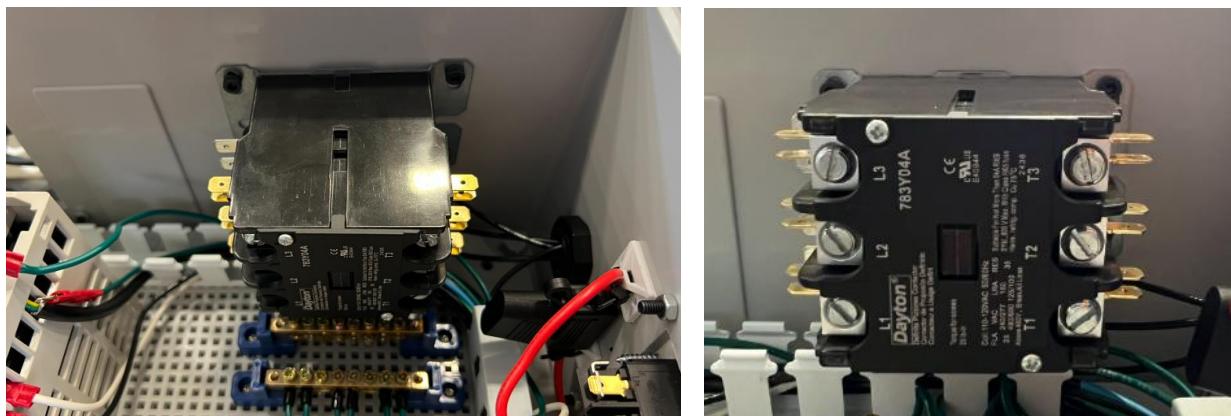


## Electrical Box Instructions

287. Using a drill and a 5.5 mm bit, drill each of the four holes out. Note, the drill bit has a tendency to walk / slide out of position without careful attention. Try to make sure the bit stays directly over the sharpie mark or punch the holes first with a center punch if one is available to prevent this.



288. Using four M5x10 bolts and four M5 nuts, secure the contactor on the inside of the box as shown. Make sure that the side with the L1, L2, and L3 terminals is facing the VFD, and the side with the T1, T2, and T3 terminals is facing the IEC receptacles.

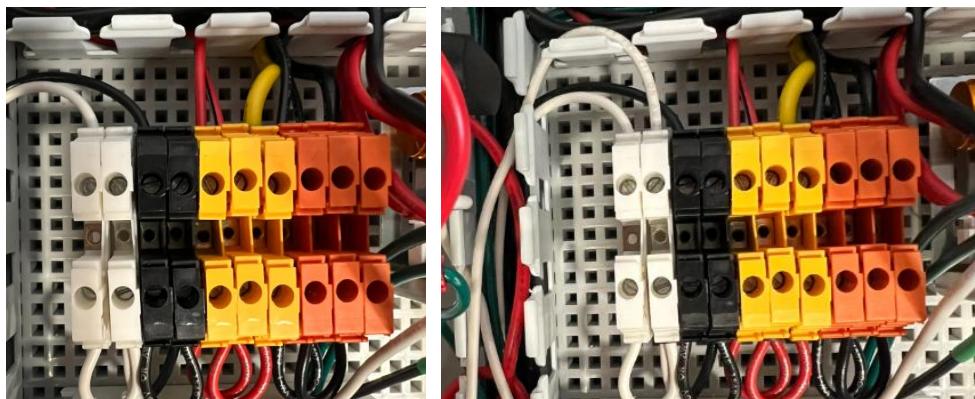


## Electrical Box Instructions

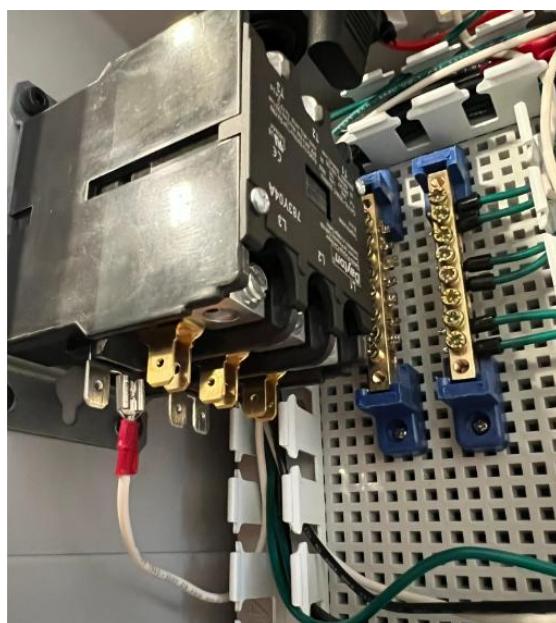
289. Cut two white 16AWG wires, one to 26 in. and one to 17.5 in. Strip both ends of each wire to 8 mm. On the 17.5 in. wire, crimp a red quick-connect on one side and a 16AWG ferrule connector on the other. On the 26 in. wire, crimp a red quick-connect on one side and an (M4)#8 fork connector on the other.



290. Insert the 16AWG ferrule connector of the 17.5 in. white wire into the open white DIN rail terminal block as shown. Route the white wire through the bottom channel and under the Contactor.

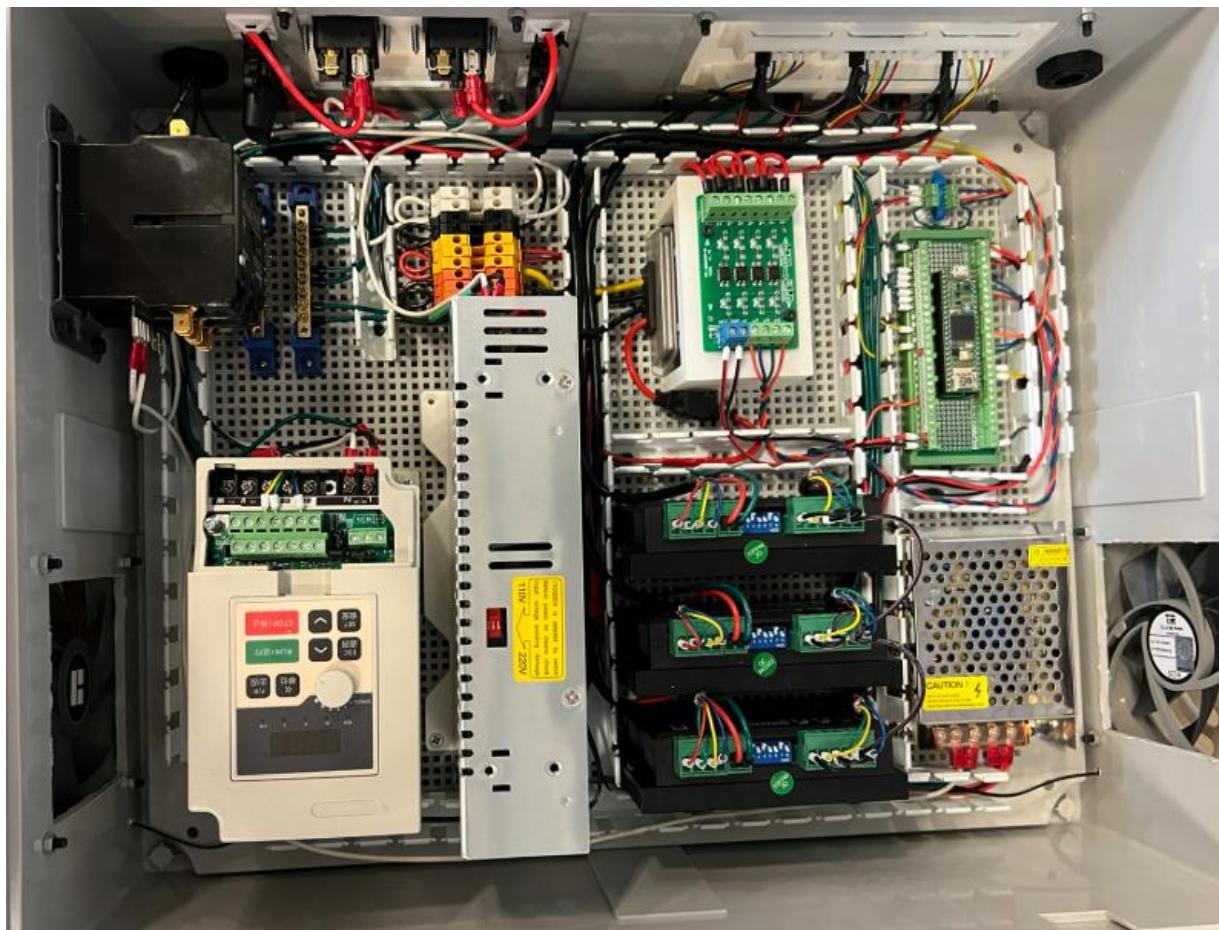
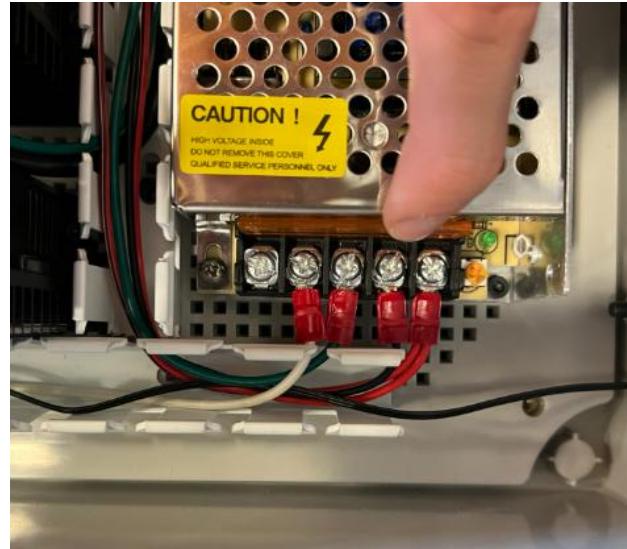


291. Plug the quick-connect from the 17.5 in. wire into one of the A2 ports on the Definite Purpose Contactor as shown.



## Electrical Box Instructions

292. Plug the quick-connect on the 26 in. wire into the other A2 port as shown and route the side with the (M4)#8 fork connector along the back side of the box to the 5V PSU. Secure the fork connector into the Neutral (N) port on the 5V PSU.



## Electrical Box Instructions

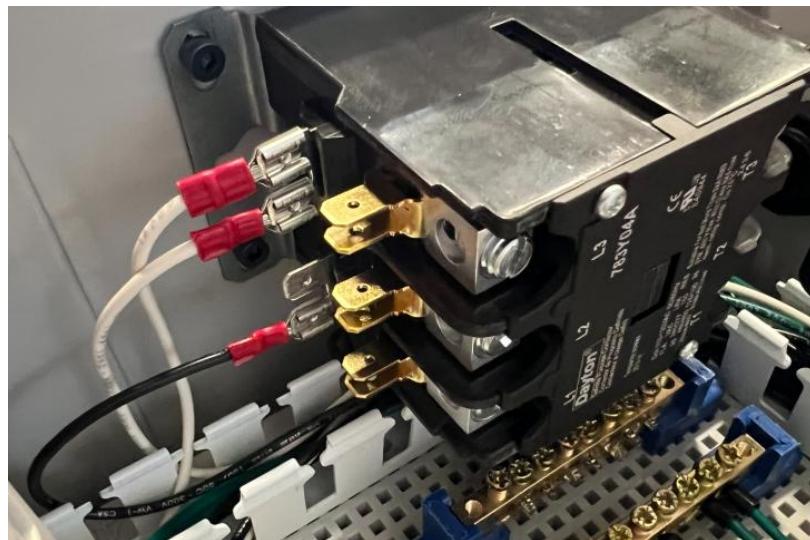
293. Cut two black 16AWG wires, one to 24 in. and one to 18 in. Strip both ends of each wire to 8 mm. On the 18 in. wire, crimp a red quick-connect on one end and a 16AWG ferrule connector on the other. On the 24 in. wire, crimp a red quick-connect on one end and an (M4)#8 fork connector on the other.



294. Insert the 16AWG ferrule connector of the 18 in. black wire into the open black DIN rail terminal block as shown. Route the black wire through the bottom channel and under the Contactor.

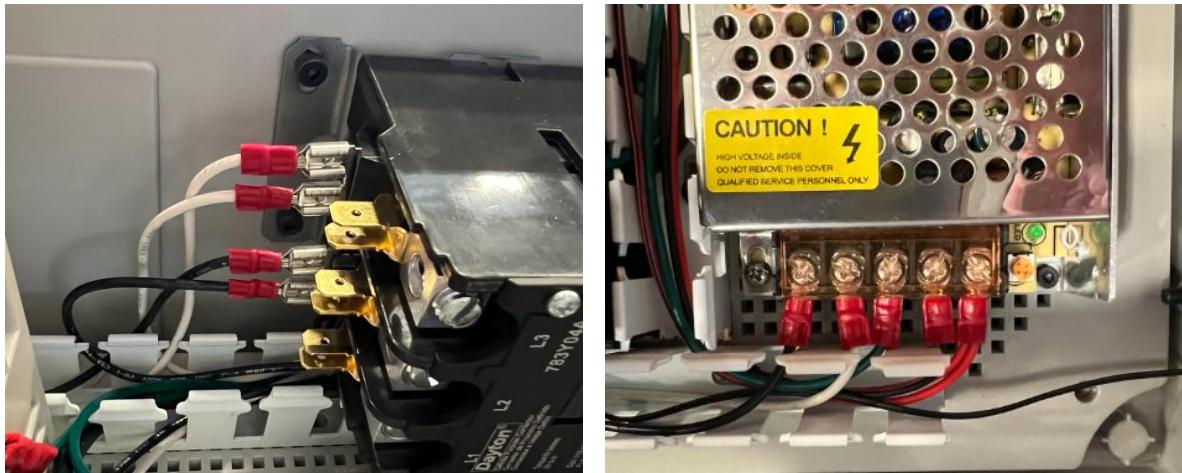


295. Plug the quick-connect from the 18 in. wire into one of the A1 ports on the Definite Purpose Contactor as shown.

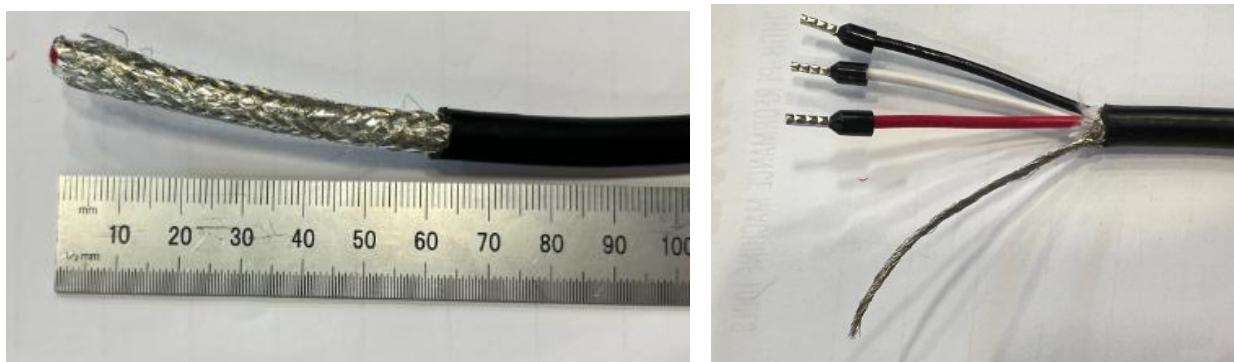


## Electrical Box Instructions

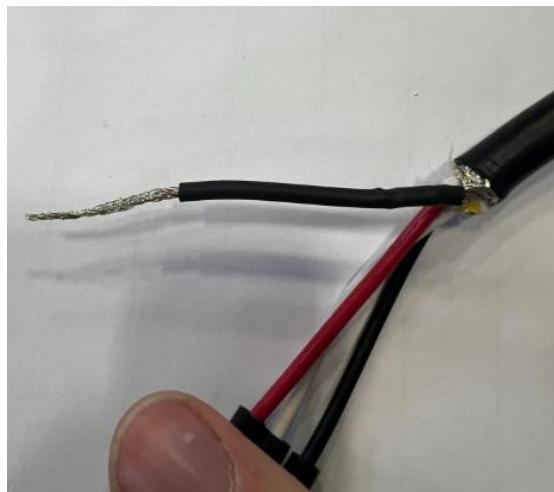
296. Plug the quick-connect on the 24 in. wire into the other A1 port as shown and route the side with the (M4)#8 fork connector along the back side of the box to the 5V PSU. Secure the fork connector into the Live (L) port on the 5V PSU.



297. Acquire shielded spindle cable and cut to 7 in. Strip one end to 60 mm, removing the foil, yellow wire, and filler textile material. Strip the ends of the red, white, and black wires to 8 mm and crimp 16AWG ferrule connectors to produce the result seen below.

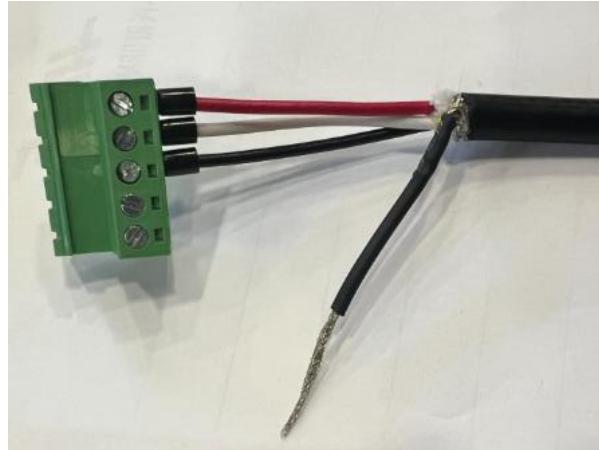


298. Apply heat shrink around the stranded shielding cable from the spindle cable as shown.



## **Electrical Box Instructions**

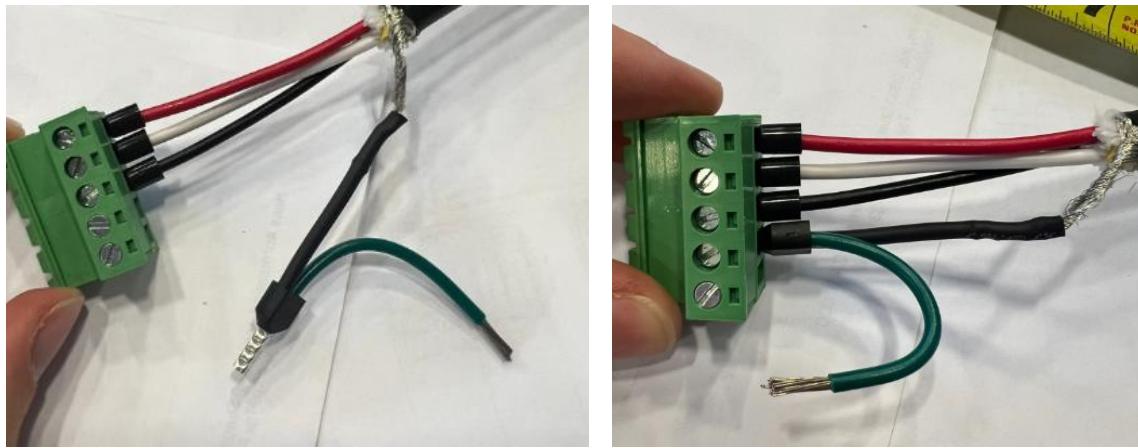
299. Acquire a 5-port terminal block and secure the red, white, and black wires into it exactly as shown.



300. Cut two green 16AWG wires, one to 9 in. and one to 65 mm. Strip both ends of each wire to 8 mm. On the 9 in. wire, crimp a 16AWG ferrule connector onto one end as shown.

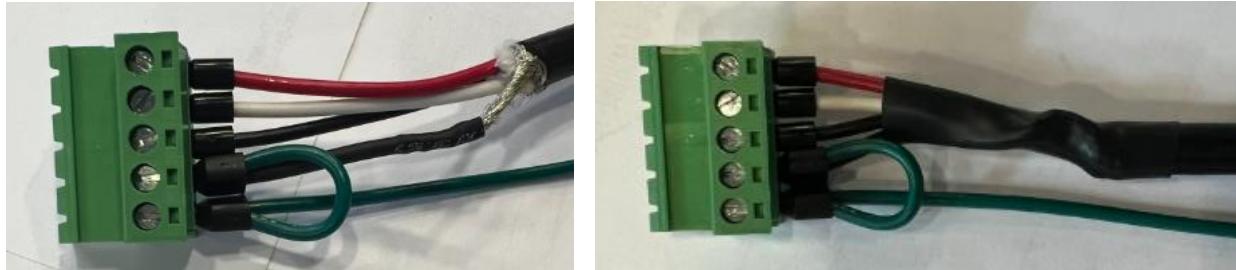


301. Crimp a 16AWG twin ferrule connector onto the 65 mm green wire and exposed portion of the stranded shielding cable from Step 299. Secure the twin ferrule connector into the 5-port terminal block as shown.



## **Electrical Box Instructions**

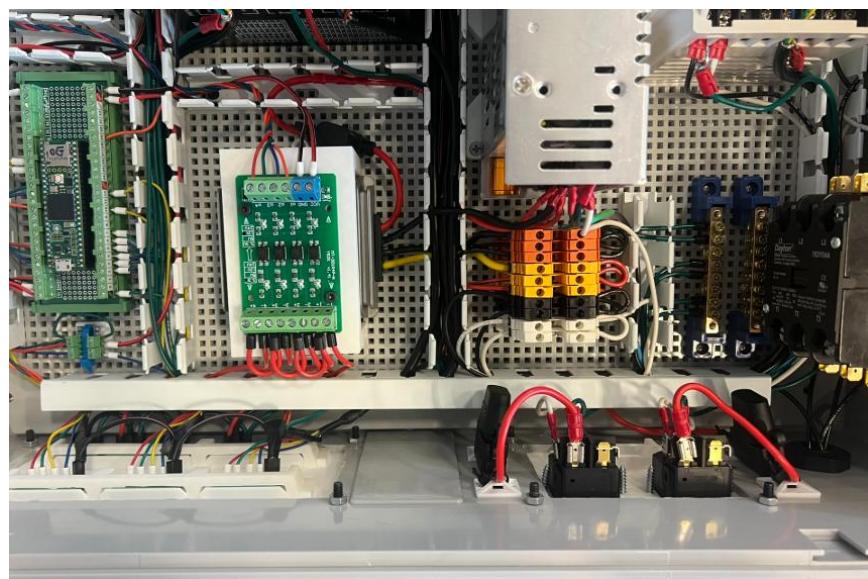
302. Crimp a 16AWG twin ferrule connector onto the free end of the 65 mm green wire and the free end of the 9 in. green wire. Secure this twin connector into the final slot of the 5-port terminal block as shown. Slide black heat shrink over the shielded cable from the other side of the wire and position as shown, applying heat to set it in place.



303. On the other side of the shielded spindle cable, strip to 60 mm. Remove the foil, stranded shielding cable, yellow wire, and filler textile such that all that remains is the red, white, and black wires. Strip the red, white, and black wires to 8 mm. Crimp 16AWG ferrule connectors on all three.



304. Acquire one of the 14.25 in. wire duct covers and install it over the bottom wire duct as shown.

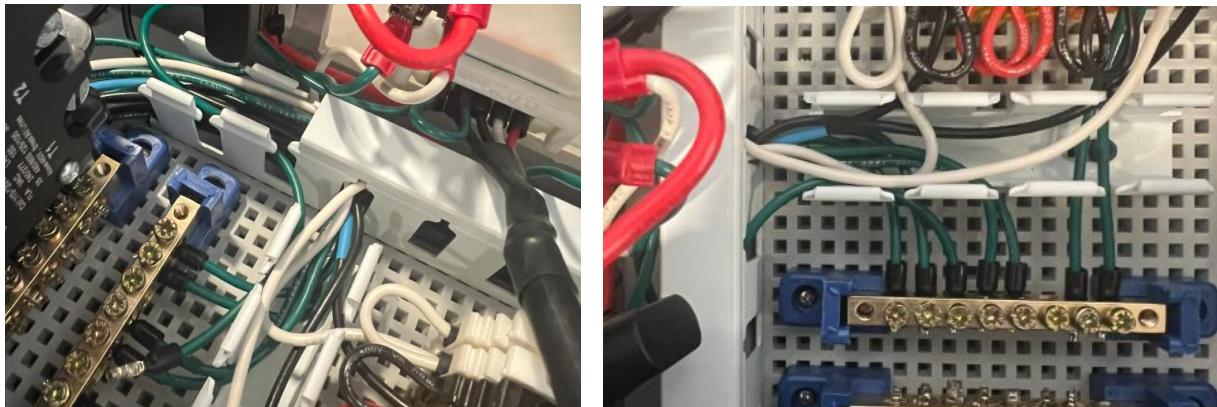


## Electrical Box Instructions

305. Insert the 5-port terminal block from the spindle cable through the spindle port below the IEC receptacles as shown. Note that the spindle cable should just rest on top of the wire duct cover. Once the terminal is in place, slide the slide cover down over the terminal block to lock in place.



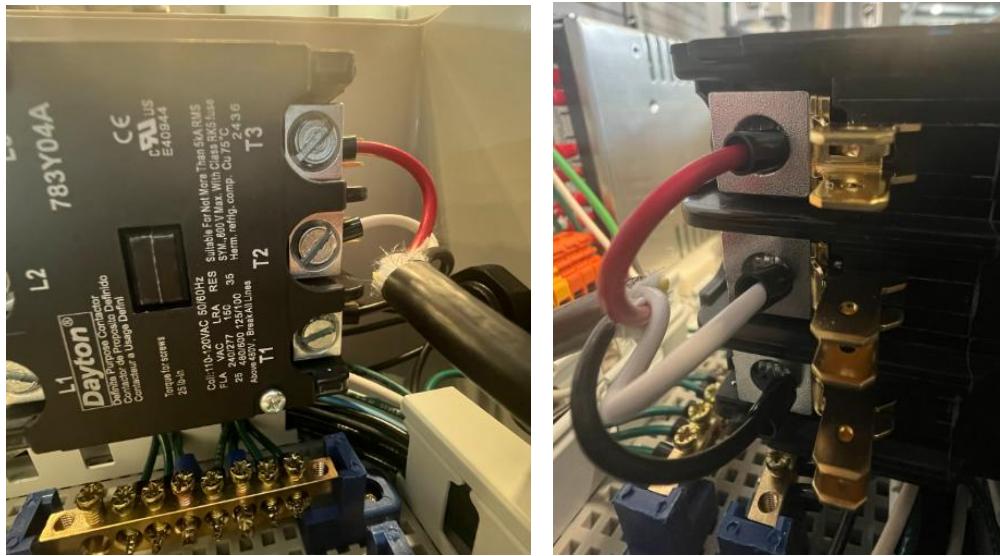
306. Slide the wire duct over about 2 in. and route the long green cable from the spindle cable's terminal block to the bus bar and secure as shown. Move duct back in place after securing.



## Electrical Box Instructions

307. On the other end of the spindle cable, secure the ferrule connectors into the Definite Purpose Contactor following the instructions below:

- a. Black → T1
- b. White → T2
- c. Red → T3



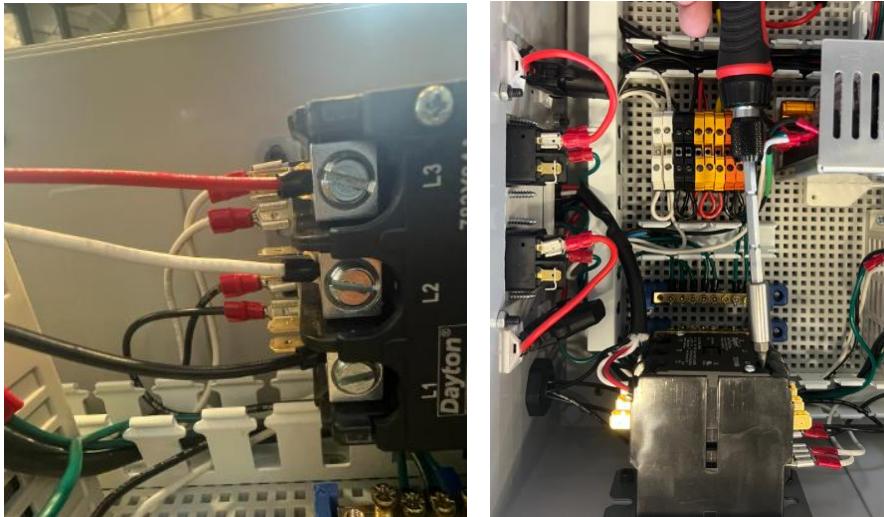
308. Cut a red, black, and white wire each to 4 in. and strip both ends of each wire to 8 mm. Crimp a 16AWG ferrule connector onto one end of each wire, and an (M4)#8 fork connector on the other end of each wire.



## Electrical Box Instructions

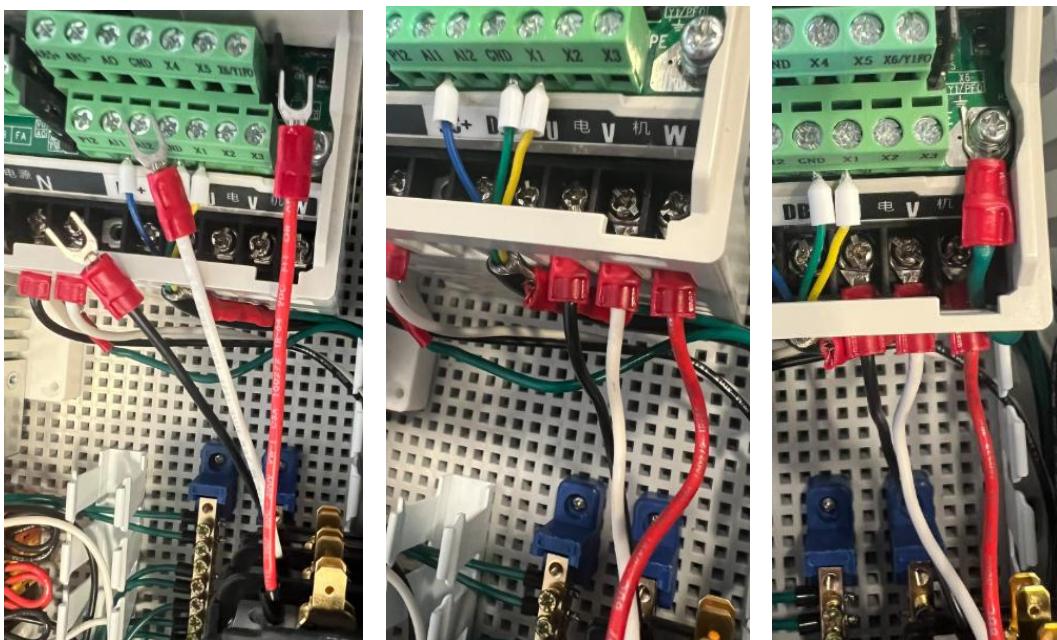
309. Insert the ferrule connector side of each wire into the Definite Purpose Contactor following the instructions below. Note: It may be necessary to extend screw driver length as shown to access the terminals on this side.

- a. Black → L1
- b. White → L2
- c. Red → L3



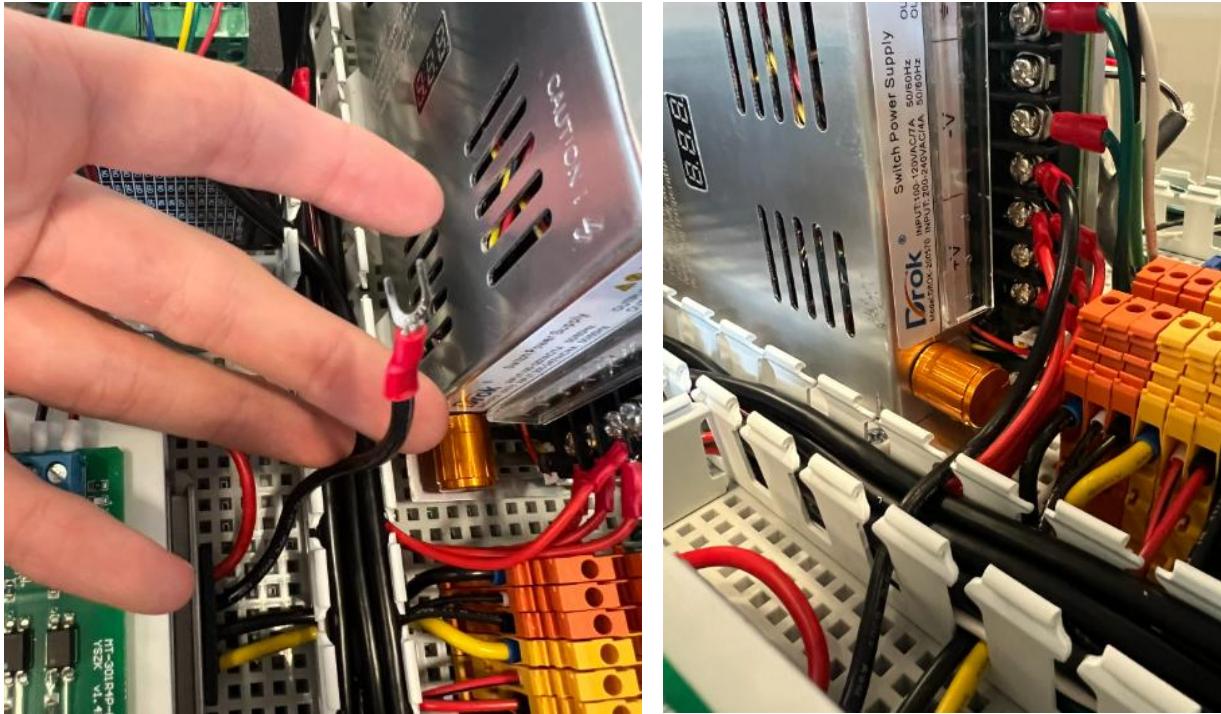
310. Insert the fork connectors from the other ends of these three wires into the VFD following the instructions below: Note: it may be necessary to remove the green wire to access the W port. If so, make sure to plug it back in afterwards.

- a. Black → U
- b. White → V
- c. Red → W

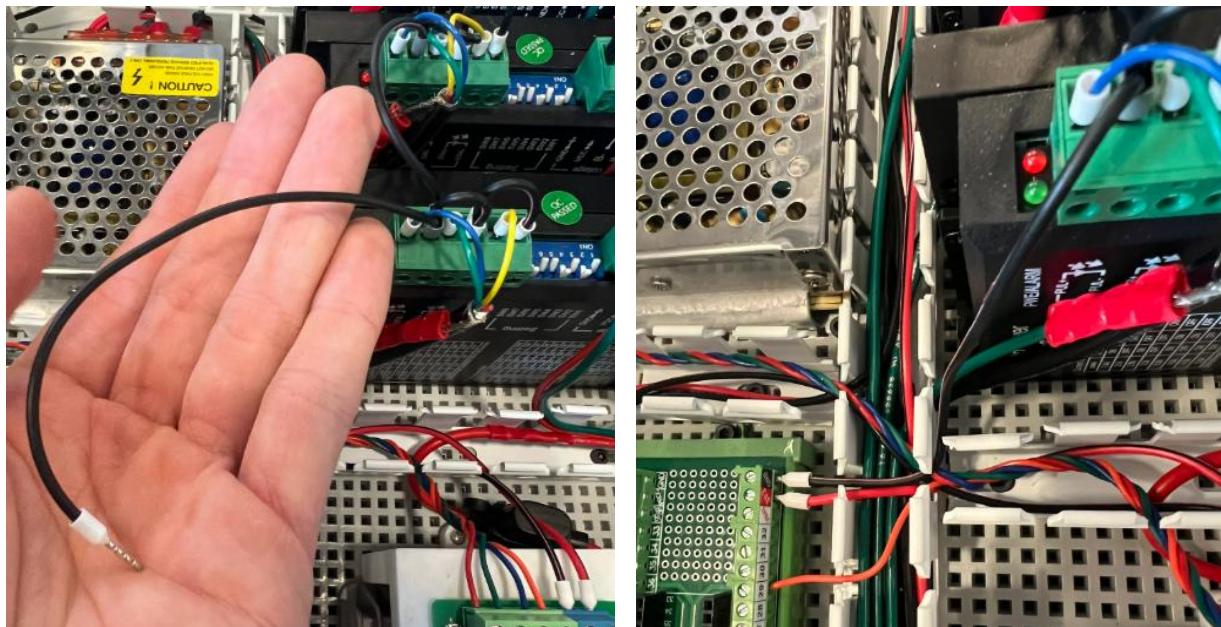


## Electrical Box Instructions

311. Find the black ground cable from the 12V step down converter that was left unplugged. Route this cable through the middle cable tray as shown and secure it into the -V port on the 48V PSU.



312. Find the black ground cable coming out of the X-axis drive's signal side that was left unplugged from an earlier step. Route this cable through the cable trays and to the ground port on the Teensy 4.1 as shown.



## Electrical Box Instructions

313. On the 48V PSU, flip the red switch from 230 to 115 as shown.



314. Acquire two fuses as shown below.



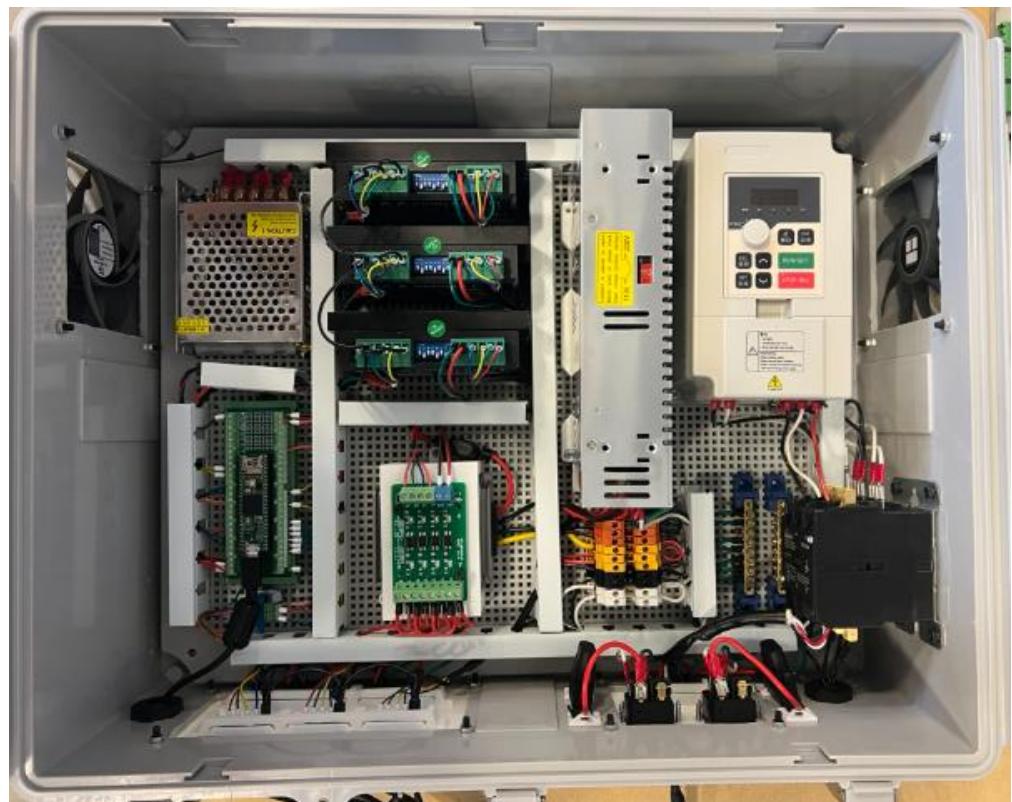
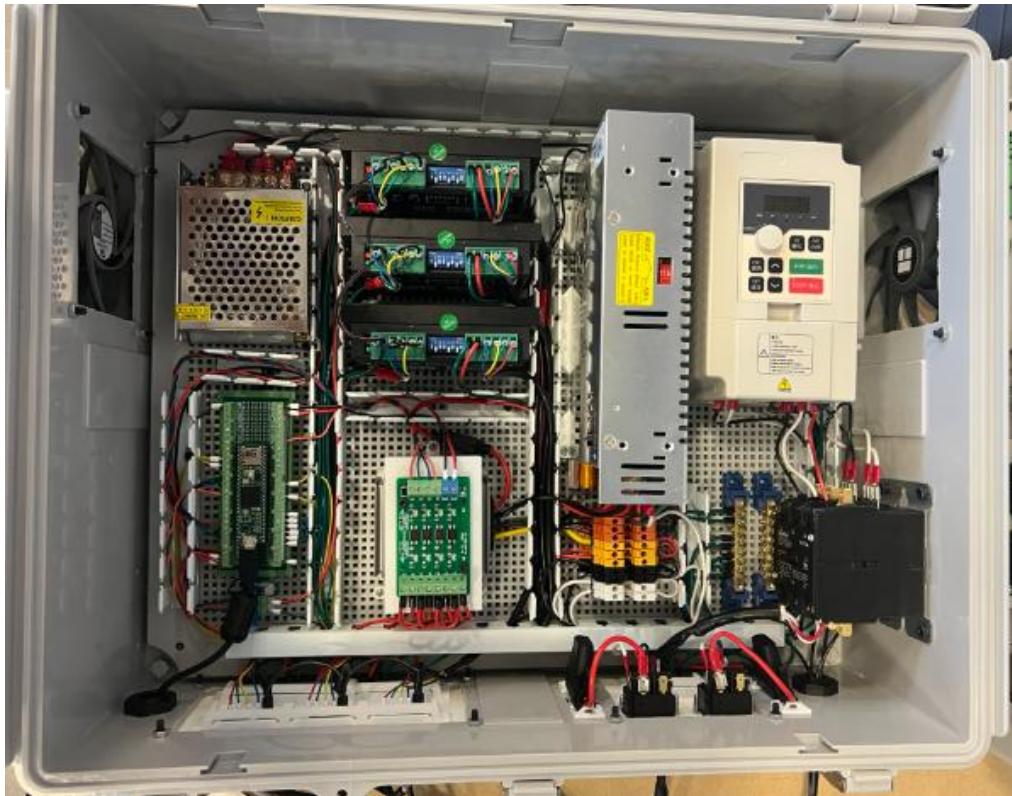
## **Electrical Box Instructions**

315. Open the fuse boxes as shown. Install the fuses into the boxes by pressing the fuses as far as possible. Once they have been completely installed, close the lids.



## Electrical Box Instructions

316. The electrical box is now complete. Optionally, you can add the wire duct covers over the wire channels, or it can be left without them.



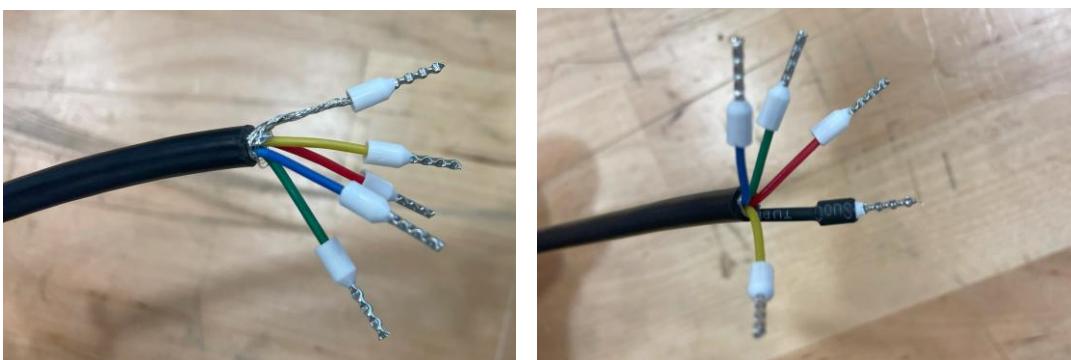
## Electrical Box Instructions

Now the cables for connecting the machine will be created.

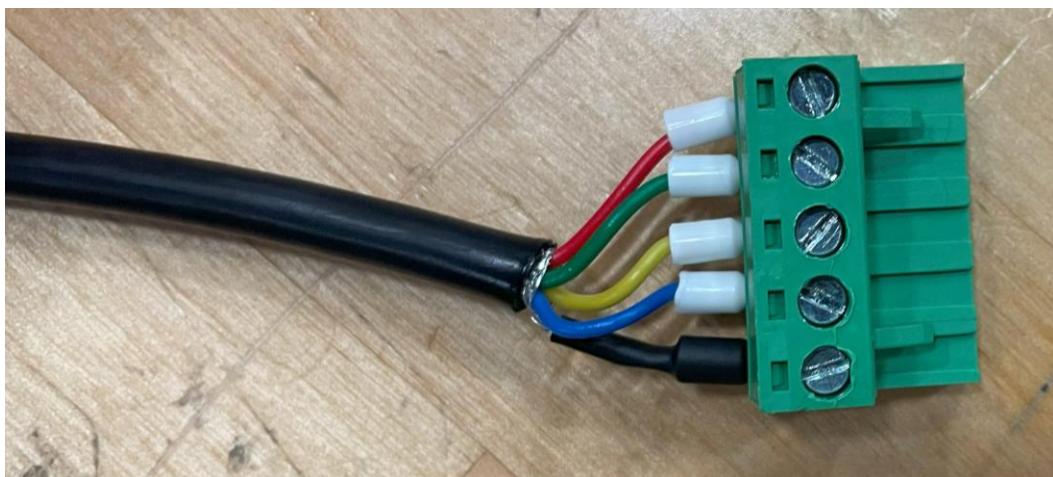
317. Cut three 4-core wires to 6 ft.



318. Strip one end of all three 4-core wires to 40 mm. Leave the stranded shielding on this side and attach five 22 AWG ferrule connectors. Apply heat shrink to the stranded shielding. Repeat this for all three 6 ft wires.

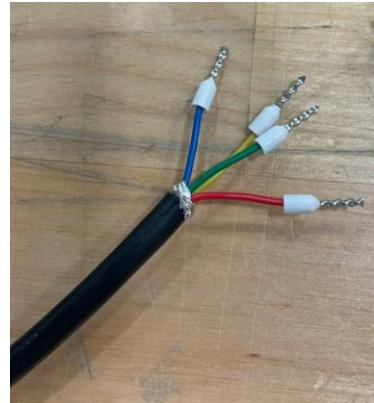


319. Attach a male 5-pin terminal block as shown below. Repeat for all three 6 ft wires.

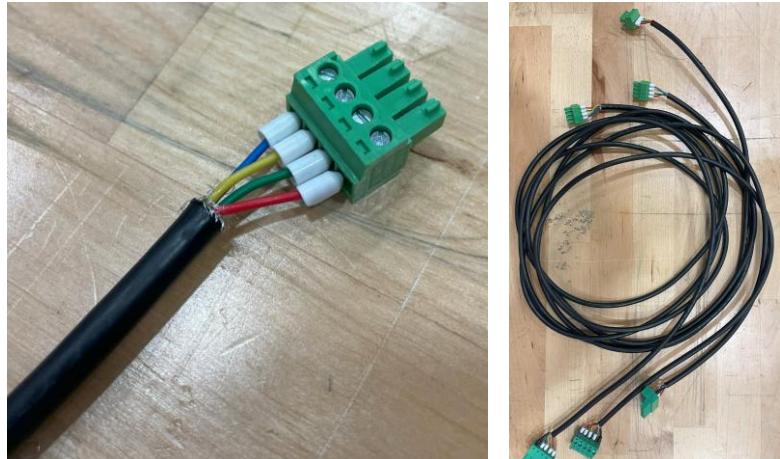


## **Electrical Box Instructions**

320. Strip the opposite end of each 6 ft wire to 40 mm. Remove the foil and stranded shielding from this side. Crimp 22 AWG ferrule connectors to each wire.



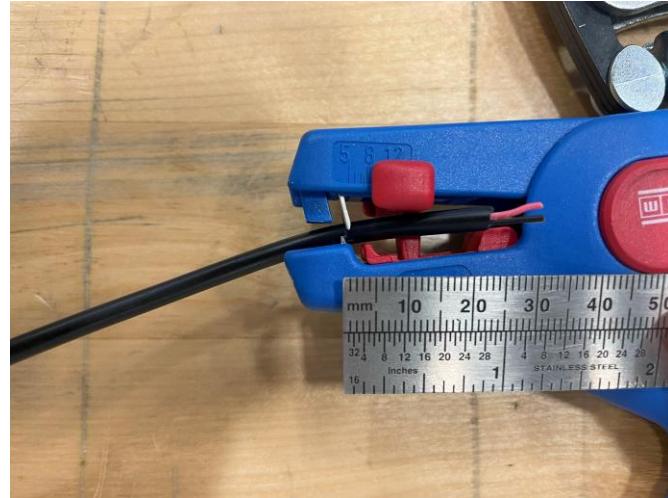
321. Attach the male 4-pin terminal block provided with the Nema 23 stepper motor to all three 6 ft wires. The motor cables are now complete.



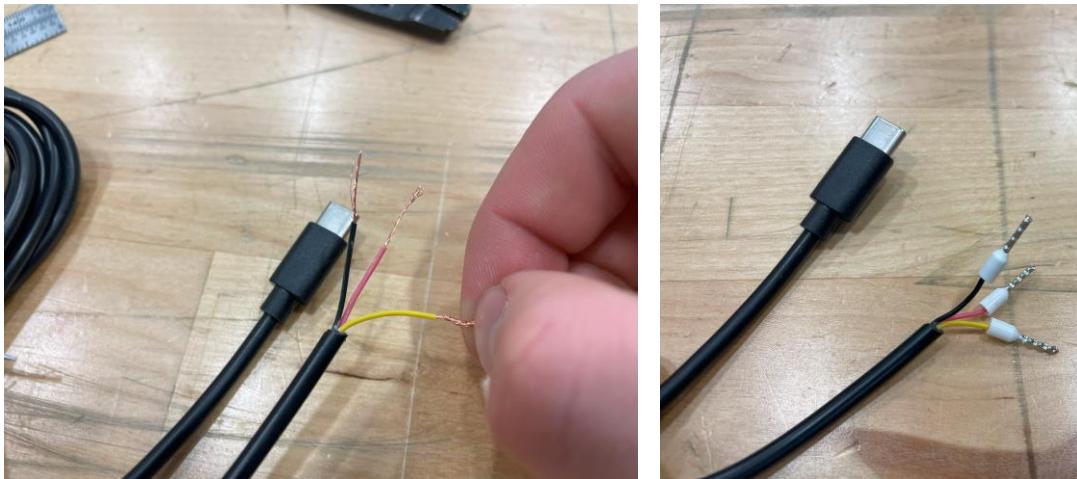
322. Grab the USB-C cable that came with the probe and cut the ends. Strip the insulation to 30 mm. Feed the wire through the Weicon wire strippers past the stopper. Gently pull the trigger of the tool until the insulation is separated and release the trigger. From there the insulation can be pulled off by hand.



## Electrical Box Instructions



323. Crimp 22 AWG ferrule connectors to each wire of the probe cable. These wires are slightly undersized so they can be stripped to 12 mm and the bare wires can be folded in half before being inserted into the ferrule connector.



324. Connect the three wires to a 3-pin male terminal block as shown.

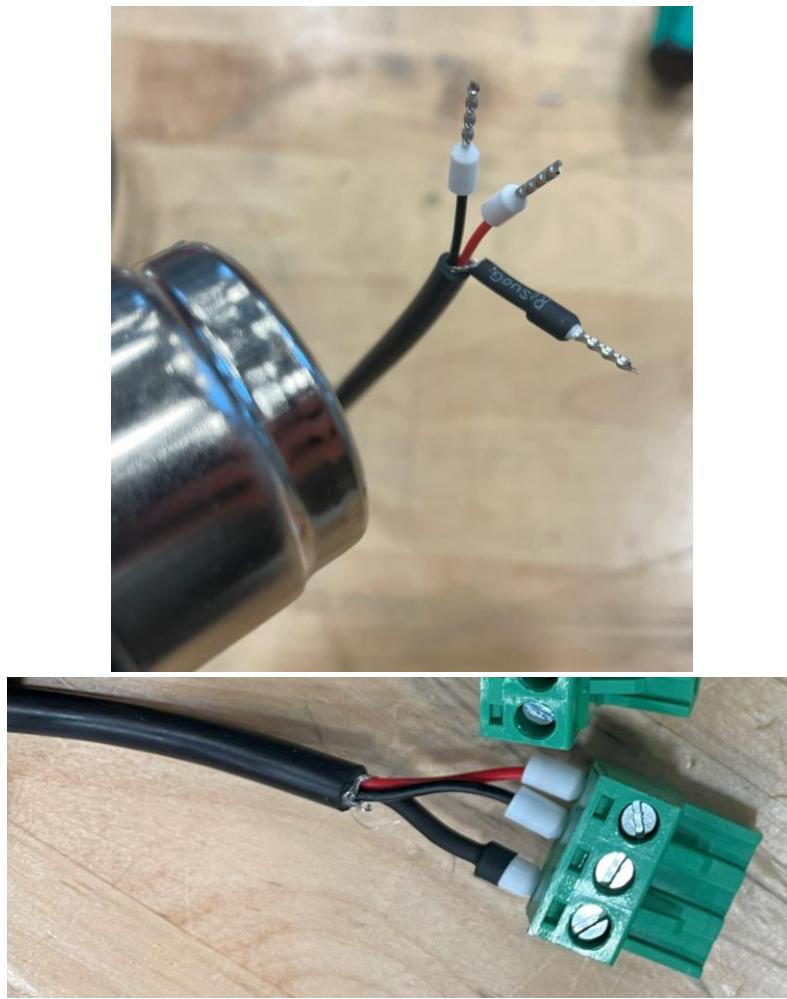


## Electrical Box Instructions

325. Cut a 2-core wire to 6 ft.

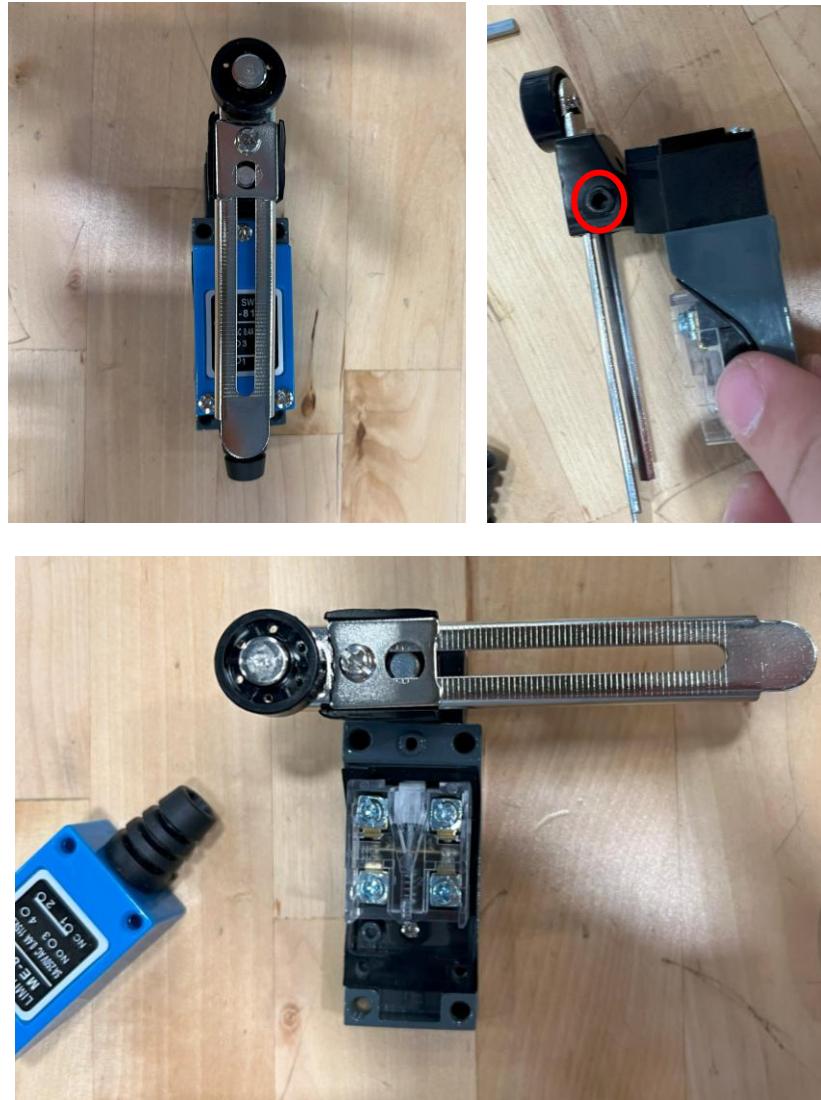


326. Strip both ends to 40 mm. Leave the stranded shielding on this side and attach 3 22 AWG ferrule connectors. Apply heat shrink to the stranded shielding. Connect this cable to a male 3-pin connector as shown. Repeat on the other end of the 6 ft cable.



## Electrical Box Instructions

327. Take apart a limit switch by removing the top three screws. The set screw on the side of the limit switch allows the arm to be clocked in any desired position. Set the arm perpendicular to the body so the screws are more accessible. Remove the top plate of the limit switch.

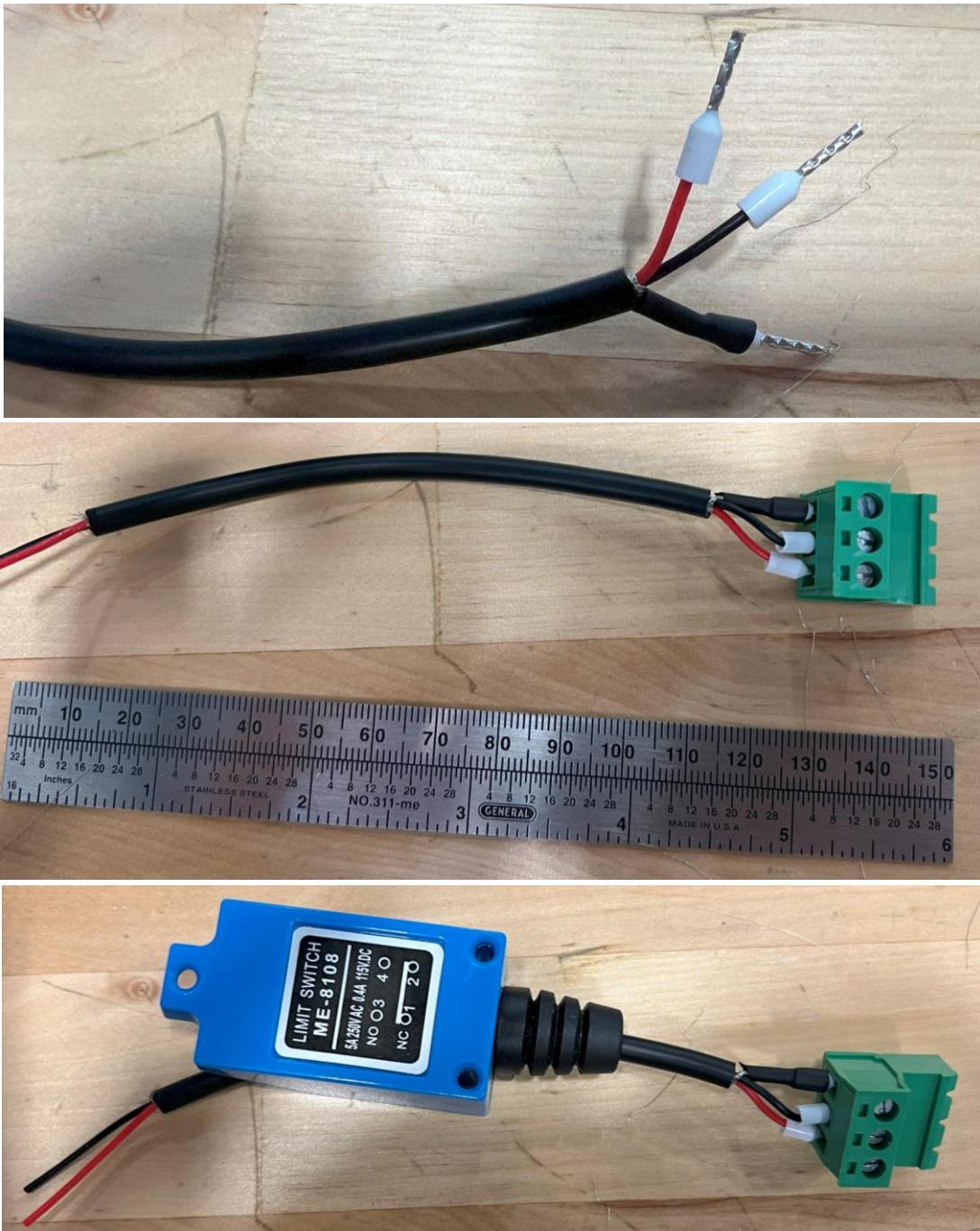


328. Cut a 2-core wire and strip both ends to 35 mm. Leave the stranded shielding on one side.



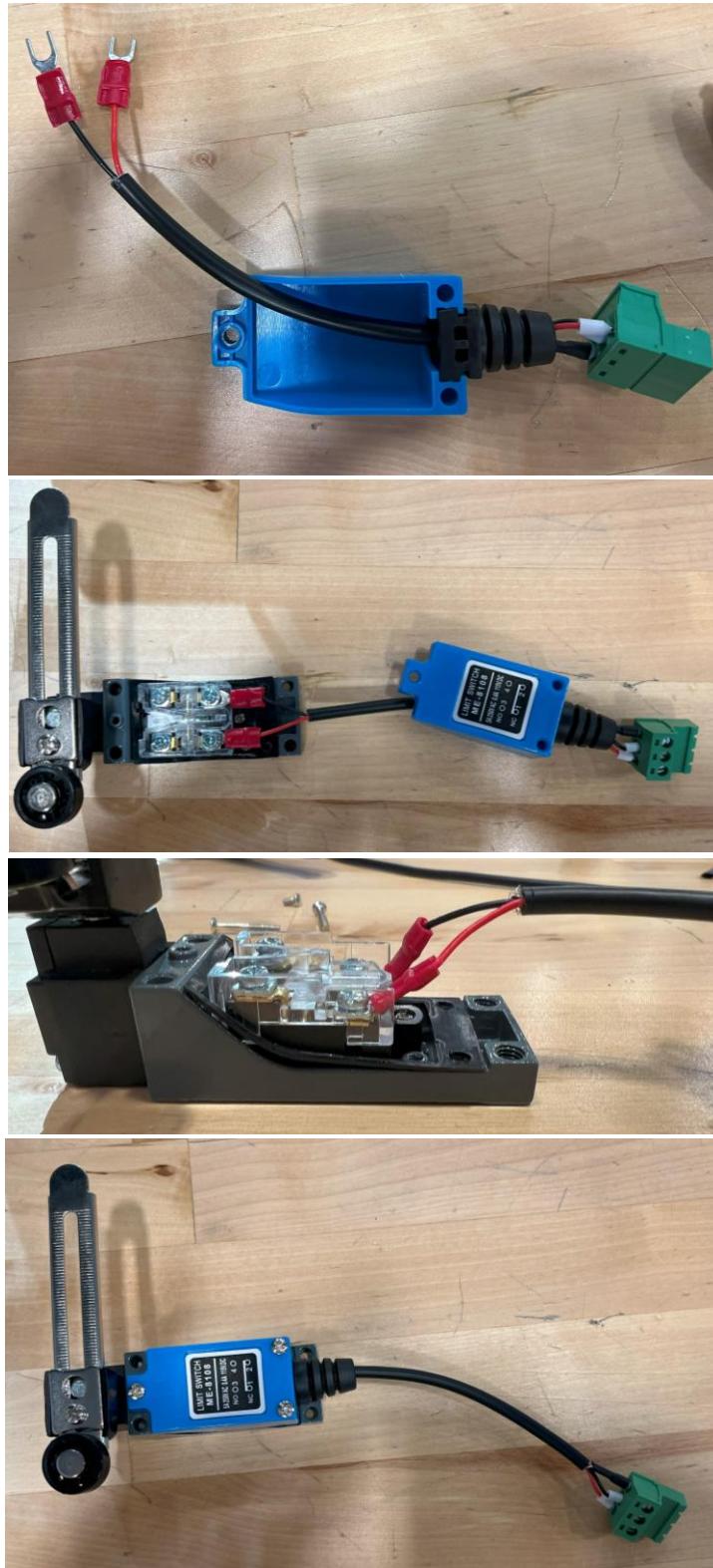
## Electrical Box Instructions

329. Crimp three 22 AWG ferrule connectors to one end of the 2-core wire. Apply heat shrink over the stranded shielding. Connect this side to a 3-pin female terminal block as shown. Feed this cable through the top cover of the limit switch.



## Electrical Box Instructions

330. Crimp fork connectors on each wire. Connect these to normally closed terminals on the limit switch. Replace the top cover on the limit switch.

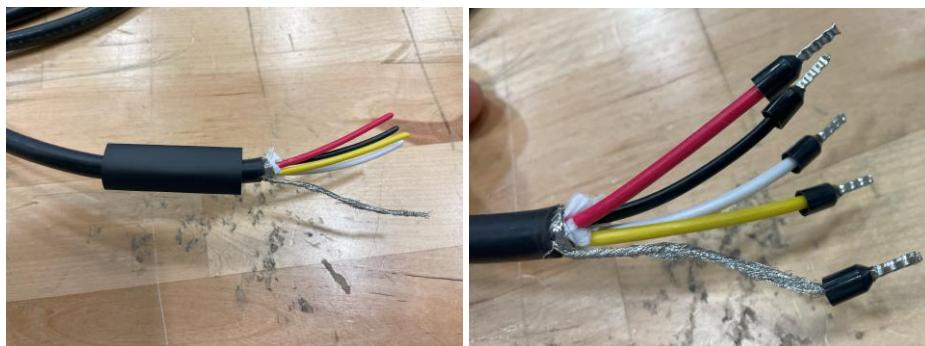


## Electrical Box Instructions

331. Cut the 4-core 16AWG wire to 8 ft. Strip one end to 50 mm. Remove the foil and leave the stranded shielding like before.



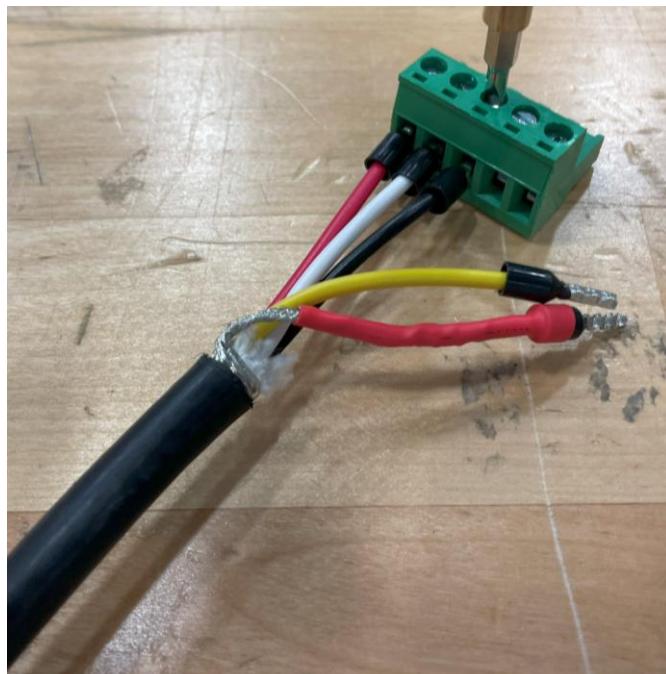
332. Place heat shrink over the entire cable. Do not apply heat yet. Crimp five 16AWG ferrule connectors. Apply heat shrink over the stranded shielding cable.



## Electrical Box Instructions

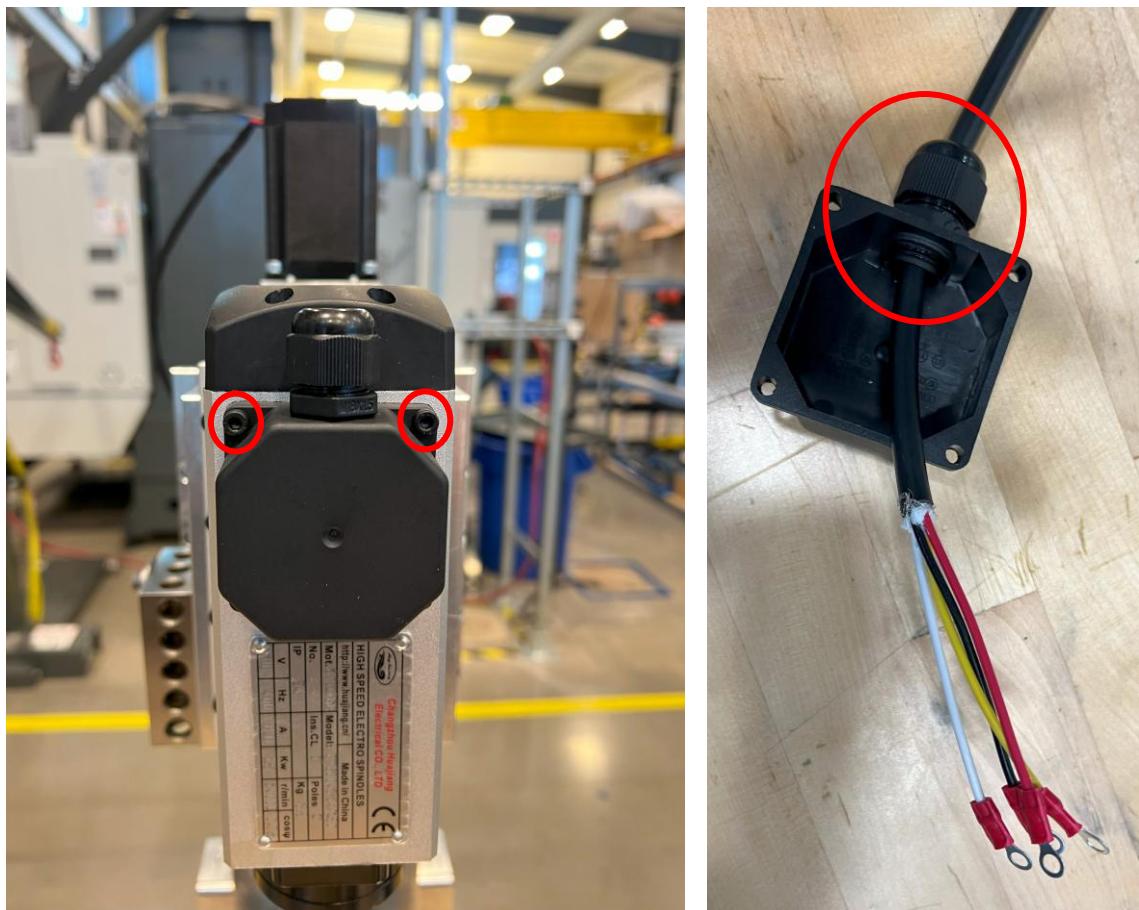
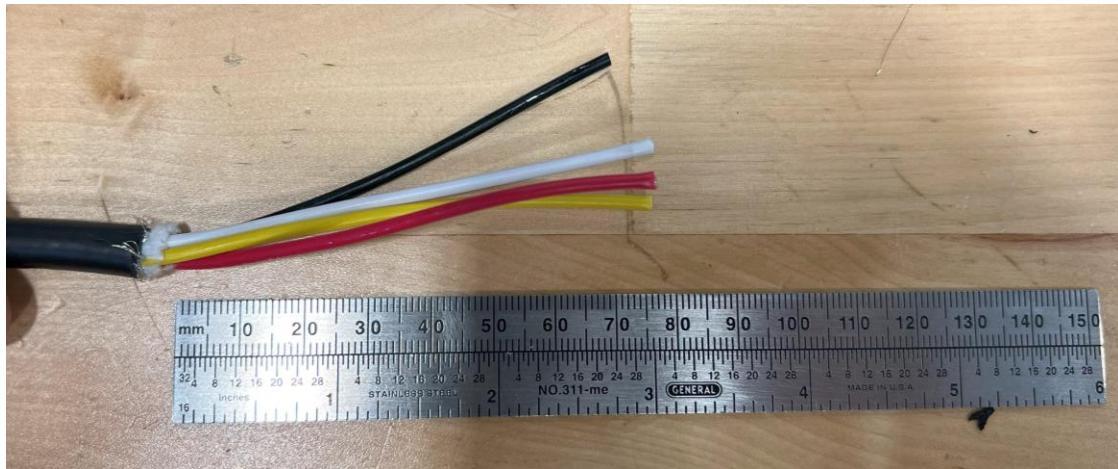


333. Connect the cable to a 5-pin male terminal block. Apply heat to the shrink tubing applied in the previous step.



## Electrical Box Instructions

334. Strip the other end of this cable to 80 mm. Remove the stranded shielding and foil from this end. Remove the cover on the spindle and feed the cable through the top. Crimp ring terminals to the end of each wire.



## Electrical Box Instructions

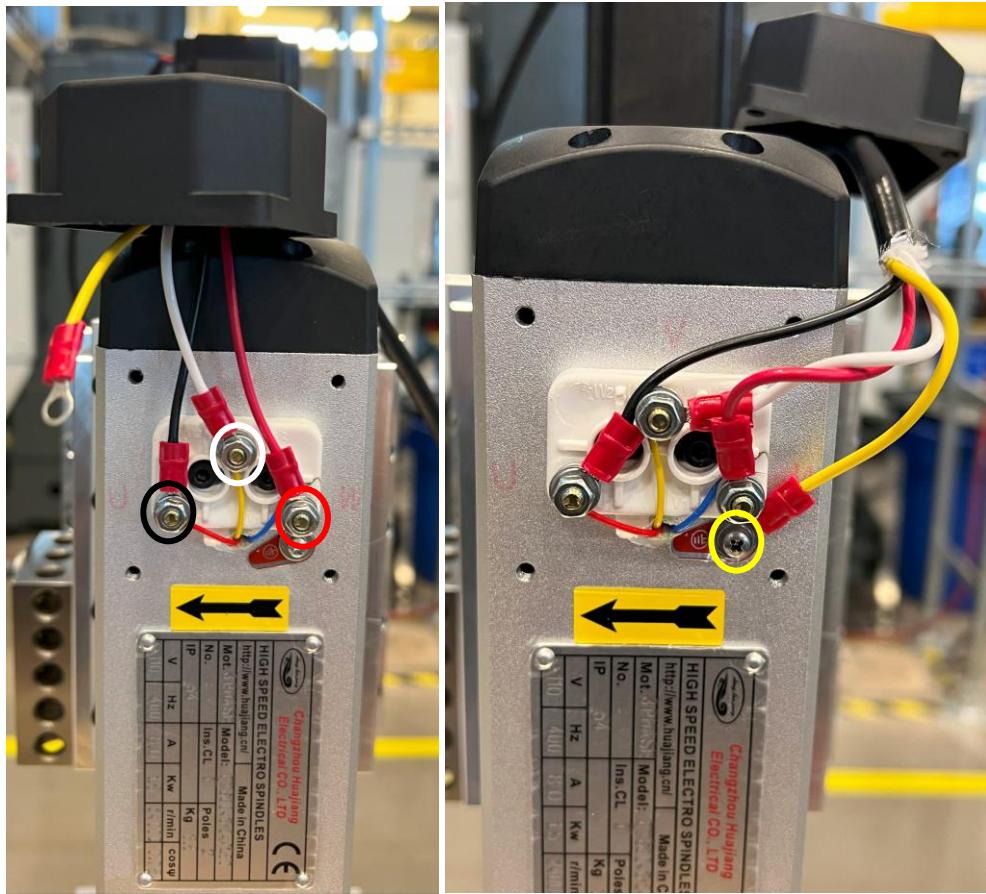
335. Connect the spindle cable as follows. After connecting, replace the cover on the spindle.

Green/Yellow → Ground

Black → U

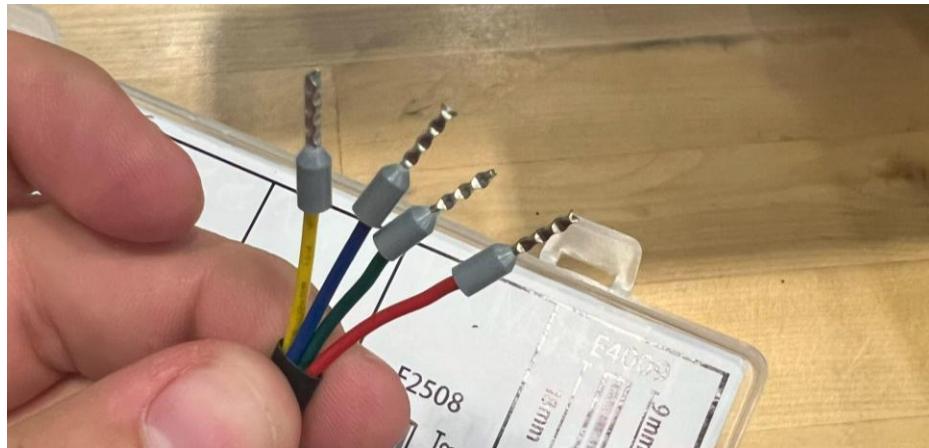
White → V

Red → W



## **Electrical Box Instructions**

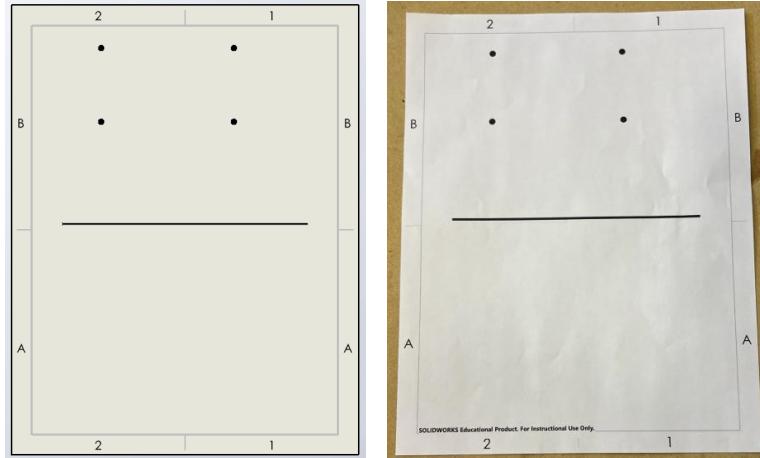
336. Attach the 4-pin terminal block connector to all three Nema 23 stepper motors as shown.



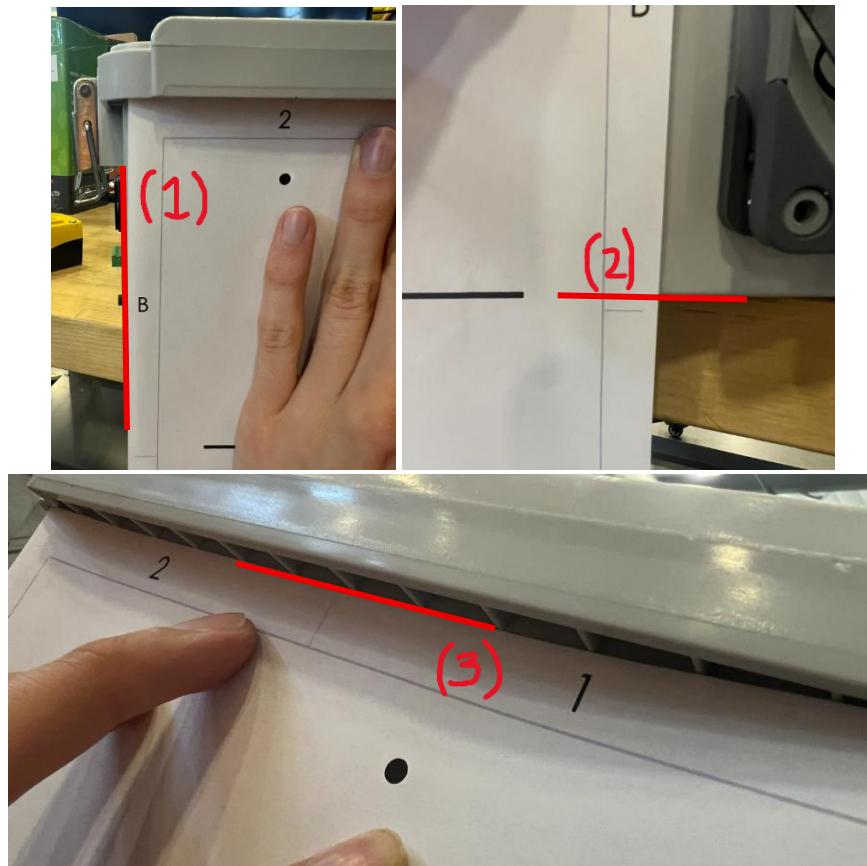
## Electrical Box Instructions

**2D Contactor Guide** – If using a 2D printed drill guide for the contactor instead of the 3D printed drill guide, refer to the following steps below:

337. Acquire the 2D printed contactor drill guide as shown below.



338. Align the 2D guide on the right side of the box as shown below. The left edge of the paper should line up with the left edge (1), the black line should align with the bottom of the box (2), and the top edge of the paper should be flush with the bottom side of the lip of the box (3).



## Electrical Box Instructions

339. Once aligned, tape in place as shown.



340. Drill holes in the locations of the four dots from the previous step.



341. Proceed with Step 288 in the main document.