

# Foam Farm Activity Guide

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# Fabrication

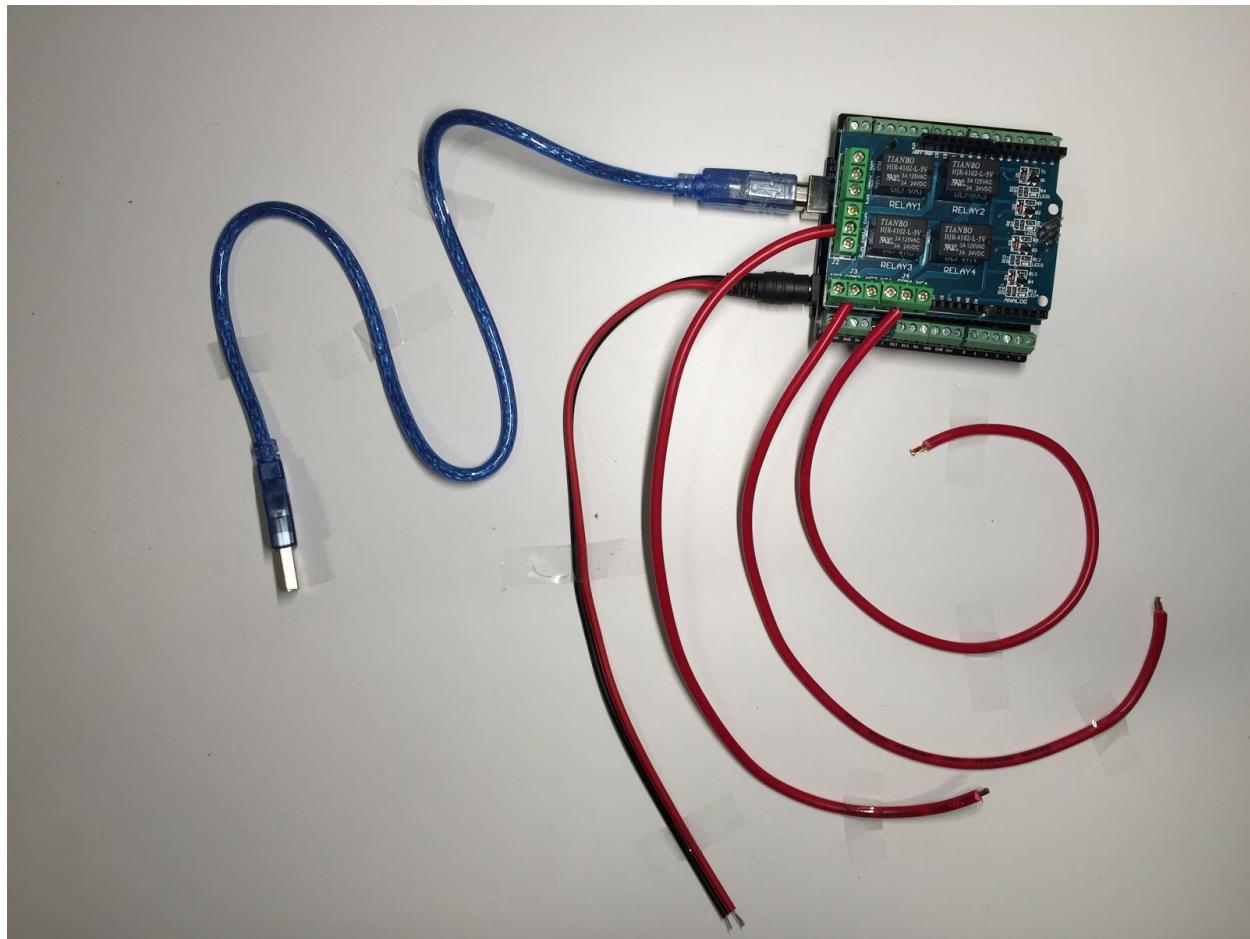
## Fabrication Tools Module



### A. Tools

- a. *Utility Knife*
- b. *Wire Cutters*
- c. *Small Flathead Screwdriver*
- d. *Large Phillips Screwdriver*

# Arduino Controller Module Fabrication Instructions



## A. Tools

- a. *Small Flathead Screwdriver*

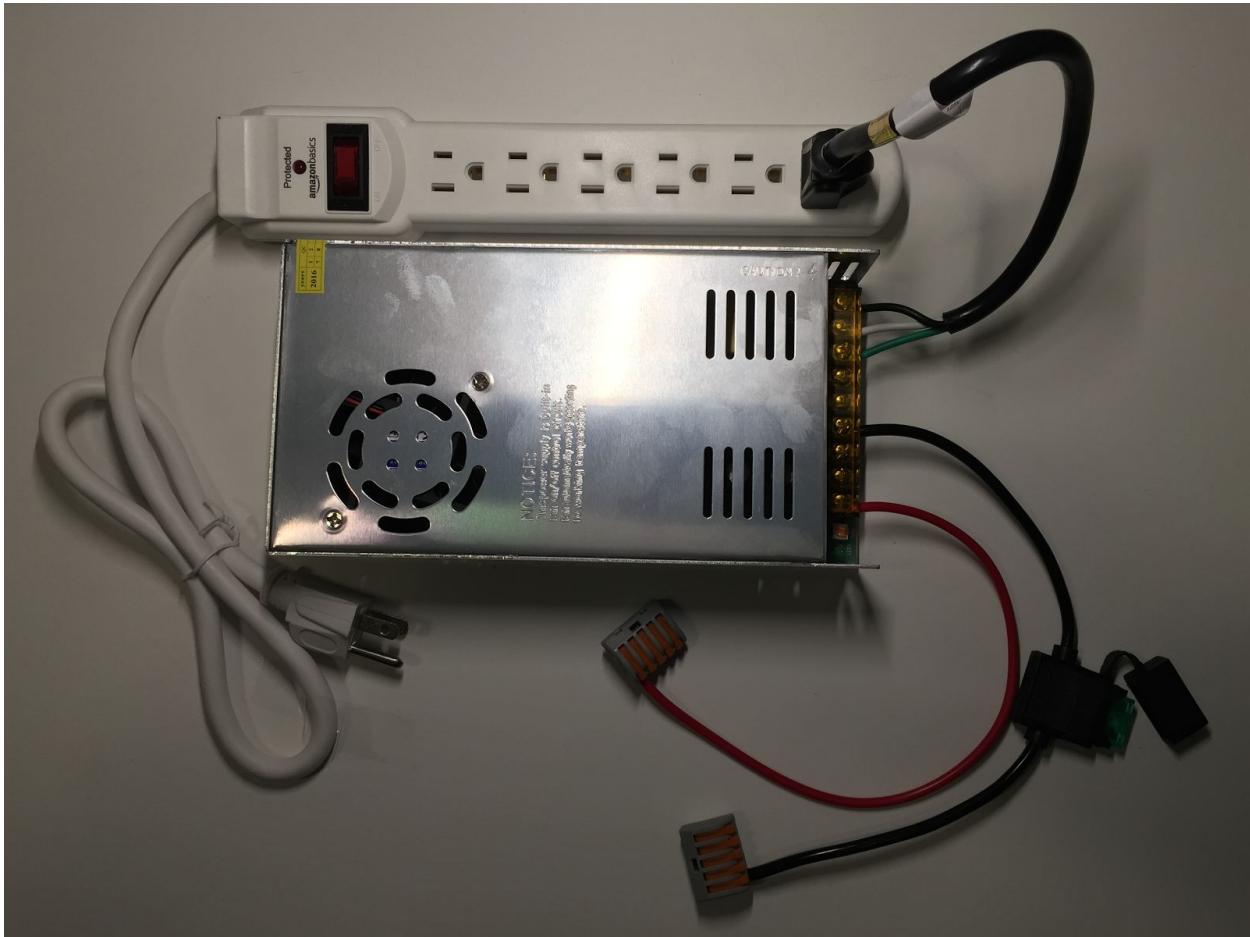
## B. Materials

- a. *Arduino Uno*
- b. *USB A-to-B Cable*
- c. *Barrel Plug Cable*
- d. *Screw Shield*
- e. *Relay Shield*
- f. *12" Red Hook-up Wire (x3)*

### C. Instructions

- a. Stack the *Screw Shield* onto the *Arduino Uno*.
- b. Stack the *Relay Shield* onto the *Arduino Uno*.
- c. Use the *Small Flathead Screwdriver* to connect a *12" Red Hook-up Wire* to each of the COM2, COM3, and COM4 *Screw Terminals* on the *Relay Shield*
  - i. To connect a wire to a *Screw Terminal*, unscrew the top-screw by turning it counter-clockwise. This should open up the side port so a wire can be inserted. Sometimes the side port does not open up all the way after full unscrewing. This is because the metal that screws down to make contact with the wire can get bent. If this happens, insert the *Small Flathead Screwdriver* into the port to unbend it and make room for your wire. Before inserting the wire, twist the stripped portion (the  $\frac{1}{4}$ " end of the wire without insulation) with your forefinger and thumb to turn the stranded wires into a single, unified, braid. After inserting your wire, screw down the top-screw by turning it clockwise.
- d. Insert the *Barrel Plug Cable* into the *Barrel Jack* on the *Arduino Uno*.
- e. Insert the *USB A-to-B Cable* into the *USB-B Port* on the *Arduino Uno*.

# Power Module Fabrication Instructions



## A. Tools

- a. Large Phillips Screwdriver

## B. Materials

- a. 6-Channel Power Strip
- b. 12V-30A Power Supply
- c. Extension Cable
- d. 12" Red Hook-up Wire
- e. 12" Black Inline Fuse Hook-up Wire
- f. 30A Fuse
- g. 5-Channel Easy Connector (x2)

### C. Instructions

- a. Use the *Large Phillips Screwdriver* to connect the **Green Wire** in the *2' Extension Cable* to the **Port 7 / Ground** *Screw Terminal Block* on the *12V-30A Power Supply*.
  - i. To connect a wire to a *Screw Terminal Block*, partially unscrew the top-screw by turning it counter-clockwise such that there is an opening for a wire to be inserted. Place the wire on the left side of the screw and sandwiched in between the two square plates. Make sure the *Wire Insulation* is flush to the *Screw Terminal Block*. Once the wire is inserted, turn the top-screw clockwise until the wire is firmly clamped between the two square plates.
- b. Use the *Large Phillips Screwdriver* to connect the **White Wire** in the *2' Extension Cable* to the **Port 8 / Neutral (N)** *Screw Terminal Block* on the *12V-30A Power Supply*.
- c. Use the *Large Phillips Screwdriver* to connect the **Black Wire** in the *2' Extension Cable* to the **Port 9 / Load (L)** *Screw Terminal Block* on the *12V-30A Power Supply*.
- d. Plug in the other side of the *2' Extension Cable* into *Plug 1* on the *6-Channel Power Strip*.
  - i. *Plug 1* is the plug furthest away from the *On/Off Switch*.
- e. Insert the *30A Fuse* into the *Fuse Receptacle* in the *12" Black Inline Fuse Hook-up Wire*.
- f. Use the *Large Phillips Screwdriver* to connect one end of the *12" Black Inline Fuse Hook-up Wire* to the *Port 4 / -V Screw Terminal Block* on the *12V-30A Power Supply*.
- g. Connect the other end of the *12" Black Inline Fuse Hook-up Wire* to *Socket 1* on one of the *5-Channel Easy Connectors*.
  - i. *Socket 1* is the socket all the way to the left when the *Connector Levers* are pointing down.
  - ii. To insert a wire into the *5-Channel Easy Connector*, first twist the stripped portion (the  $\frac{1}{4}$ " end of the wire without insulation) with your forefinger and thumb to turn the stranded wires into a single, unified, braid. Next, lift up on the *Connector Lever*, insert the wire all the way into the *Socket*, and push the lever back down so that it is flush with the other *Connector Levers*. Test the connection by tugging on the wire to ensure it does not come loose.
- h. Use the *Large Phillips Screwdriver* to connect one end of the *12" Red Hook-up Wire* to the *Port 1 / +V Screw Terminal Block* on the *12V-30A Power Supply*.
- i. Connect the other end of the *12" Red Hook-up Wire* to *Socket 1* on the other *5-Channel Easy Connector*.

# Grow Light Module Fabrication Instructions



## A. Tools

- a. *Small Flathead Screwdriver*

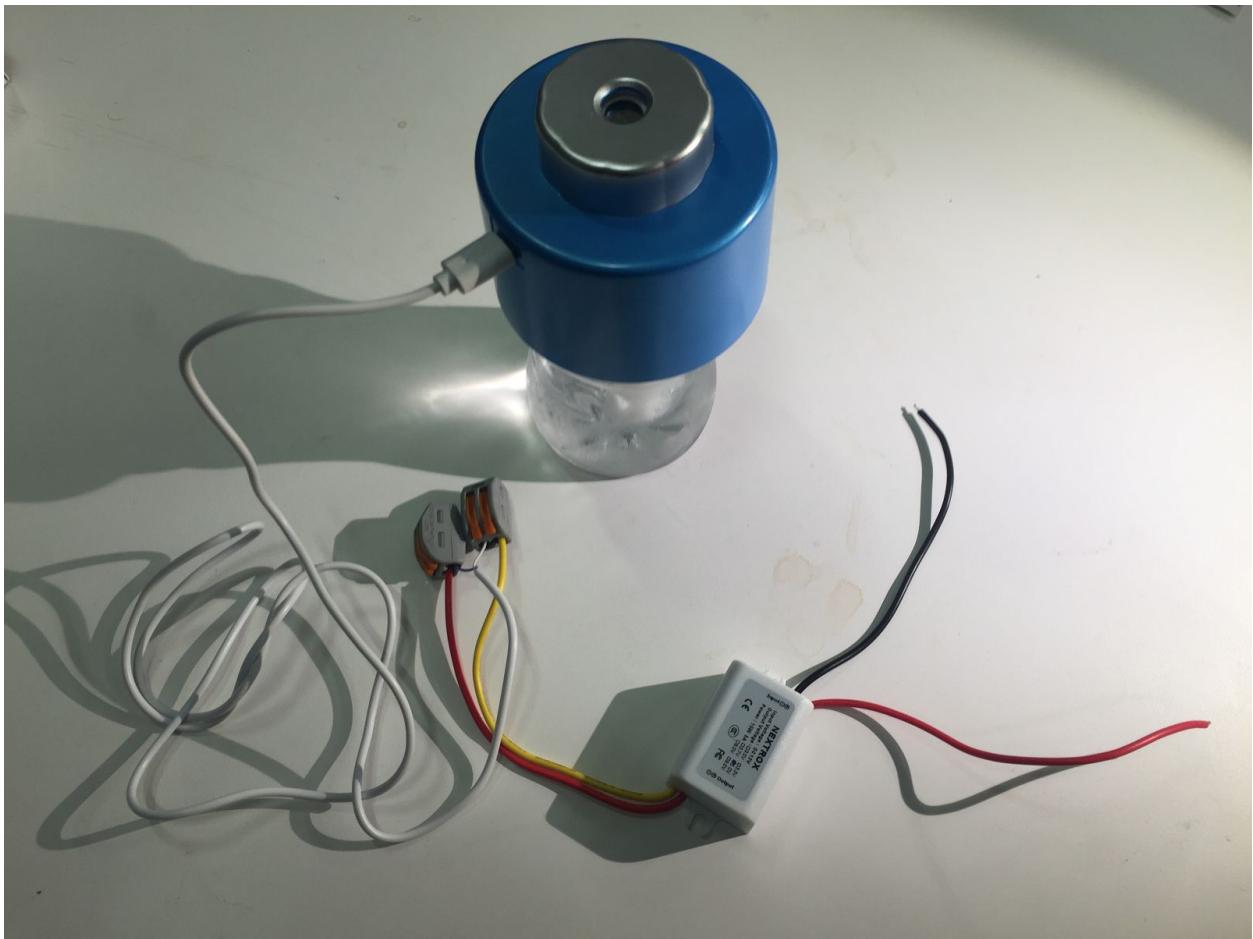
## B. Materials

- a. *Grow Light*
- b. *Grow Light Power Cable*
- c. *Powerswitch Tail*
- d. *Black Signal Wire*
- e. *Blue Signal Wire*

### C. Instructions

- a. Use the *Small Flathead Screwdriver* to connect one end of the **Black Signal Wire** to the **Port 2 / -in Screw Terminal** in the *Powerswitch Tail*
  - i. To connect a wire to a *Screw Terminal*, unscrew the top-screw by turning it counter-clockwise. This should open up the side port so a wire can be inserted. Sometimes the side port does not open up all the way after full unscrewing. This is because the metal that screws down to make contact with the wire can get bent. If this happens, insert the *Small Flathead Screwdriver* into the port to unbend it and make room for your wire. Before inserting the wire, twist the stripped portion (the  $\frac{1}{4}$ " end of the wire without insulation) with your forefinger and thumb to turn the stranded wires into a single, unified, braid. After inserting your wire, screw down the top-screw by turning it clockwise.
- b. Use the *Small Flathead Screwdriver* to connect one end of the **Blue Signal Wire** to the **Port 1 / +in Screw Terminal** in the *Powerswitch Tail*
- c. Plug one side of the *Grow Light Power Cable* to the socket in the *Powerswitch Tail*
- d. Plug the other side of the *Grow Light Power Cable* into the socket on the *Grow Light*

# Humidifier Module Fabrication Instructions



## A. Tools

- a. None

## B. Materials

- a. Humidifier
- b. Humidifier Wick
- c. Humidifier Reservoir
- d. Micro-USB Cable
- e. Inline 12V-to-5V Step-down Regulator
- f. 2-Channel Easy Connectors (x2)

### C. Instructions

- a. Connect the **Blue Wire** from the *Micro-USB Cable* into *Socket 1* on one of the *2-Channel Easy Connectors*. Then, connect the **Red Output Wire** from the *Inline 12V-to-5V Step-down Regulator* to *Socket 2* on the same *2-Channel Easy Connector*.
  - i. *Socket 1* is the socket all the way to the left when the *Connector Levers* are pointing down.
  - ii. To insert a wire into the *5-Channel Easy Connector*, first twist the stripped portion (the  $\frac{1}{4}$ " end of the wire without insulation) with your forefinger and thumb to turn the stranded wires into a single, unified, braid. Next, lift up on the *Connector Lever*, insert the wire all the way into the *Socket*, and then push the lever back down so that it is flush with the other *Connector Levers*. Test the connection by tugging on the wire to ensure it does not come loose.
- b. Connect the **White Wire** from the *Micro-USB Cable* into *Socket 1* on one of the *2-Channel Easy Connectors*. Then, connect the **Yellow Output Wire** from the *Inline 12V-to-5V Step-down Regulator* to *Socket 2* on the same *2-Channel Easy Connector*.
- c. Plug the other end of the *Micro-USB Cable* into the side of the *Humidifier*.
- d. Insert the *Humidifier Wick* into the bottom of the *Humidifier*.
- e. Fill the *Humidifier Reservoir* with water then screw it onto the bottom of the *Humidifier*.

# Water Aeration Module Fabrication Instructions



## A. Tools

- a. *None*

## B. Materials

- a. *Air Pump*
- b. *2' Air Tubing*
- c. *Air Stone*

## C. Instructions

- a. Connect one side of the *2' Air Tubing* to the *Air Outlet* on the *Air Pump*.
- b. Connect the other side of the *2' Air Tubing* to the *Air Stone*.

# Air Vent Module Fabrication Instructions



## A. Tools

- a. *None*

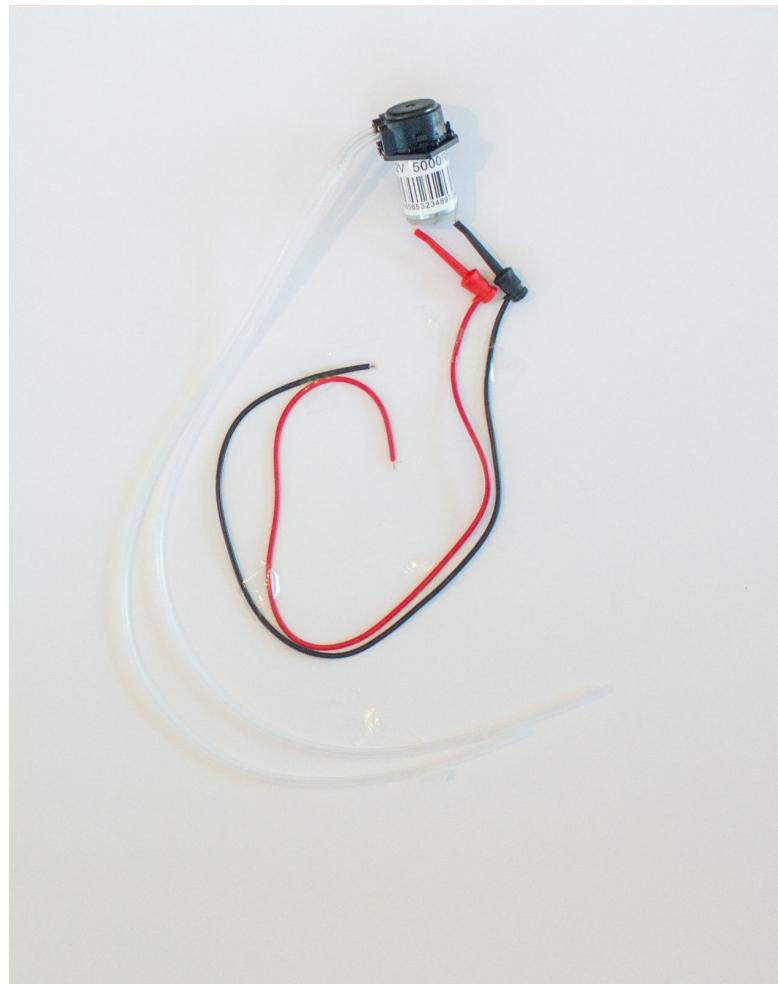
## B. Materials

- a. *Fan*
- b. *Fan Guard*
- c. *Louver (x2)*

## C. Instructions

- a. *None*

# Liquid Doser Module Fabrication Instructions



## A. Tools

- a. None

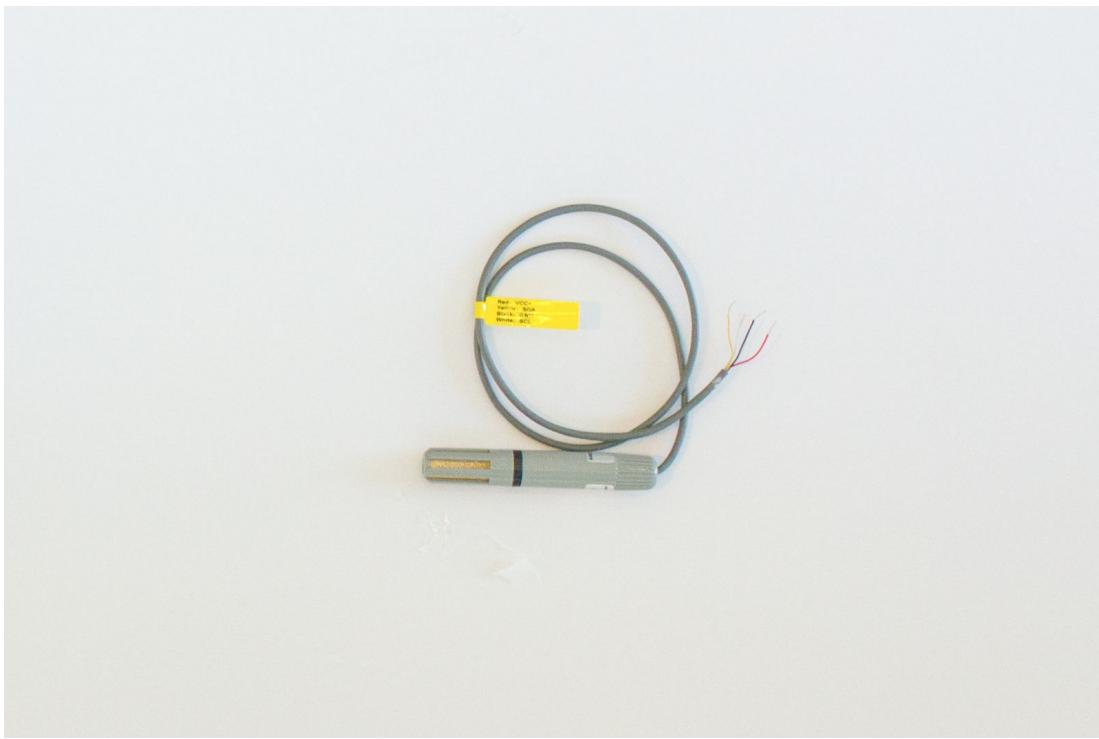
## B. Materials

- a. Peristaltic Pump
- b. 12" Red Mini-Grabber Cable
- c. 12" Black Mini-Grabber Cable

## C. Instructions

- a. Clip **12" Red Mini-Grabber** to the *Contact* on *Peristaltic Pump* with the **Red Circle**

# Air Temperature & Humidity Module Fabrication Instructions



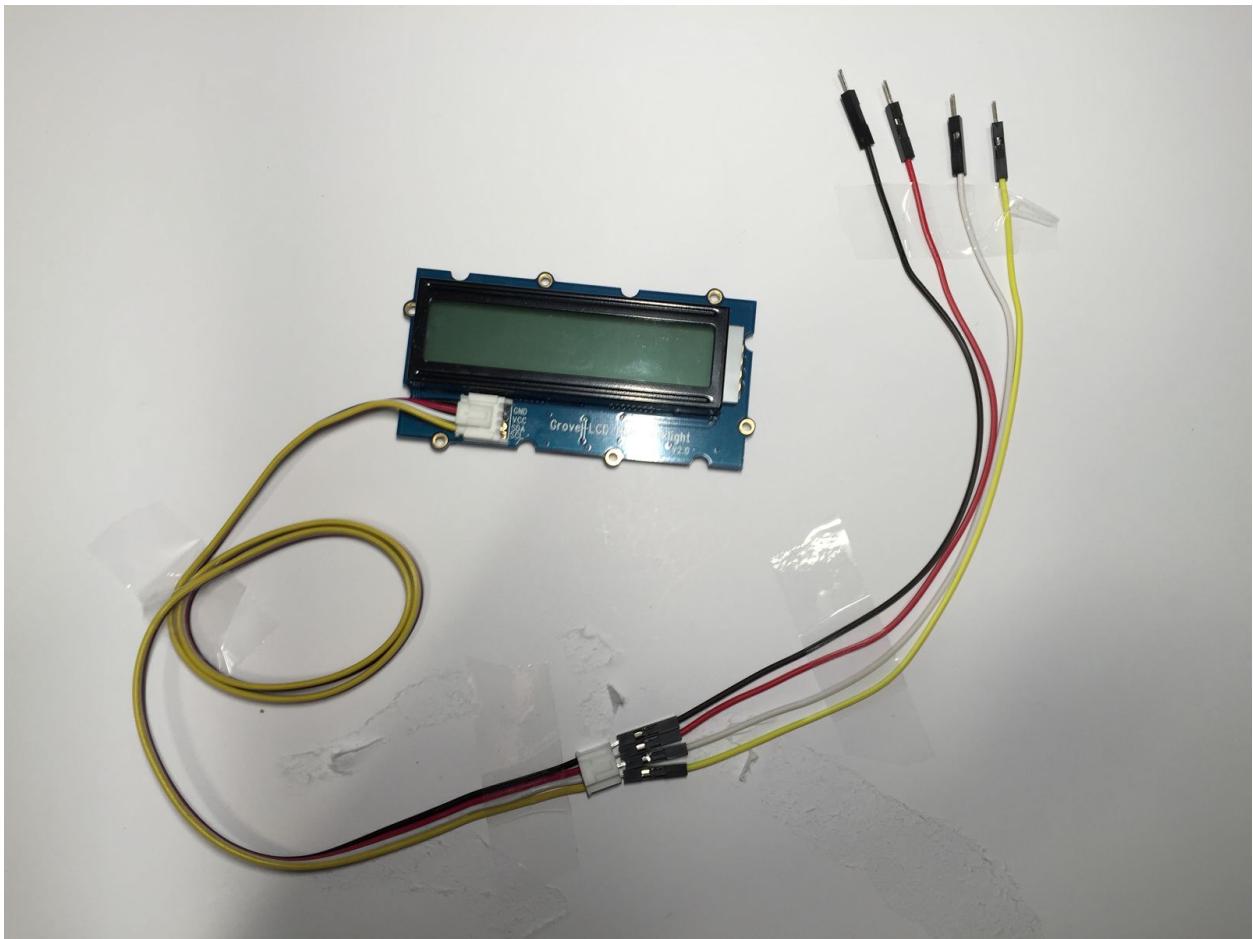
- A. Tools
  - a. None
- B. Materials
  - a. Air Temperature & Humidity Sensor
- C. Instructions
  - a. None

# Water Circulation Module Fabrication Instructions



- A. Tools
  - a. *None*
- B. Materials
  - a. *Water Circulation Pump*
- C. Instructions
  - a. *None*

# LCD Display Module Fabrication Instructions



## A. Tools

- a. *None*

## B. Materials

- a. *LCD Display*
- b. *50cm Groove Connector*
- c. *Red Male-to-Male Jumper Wire*
- d. *Black Male-to-Male Jumper Wire*
- e. *White Male-to-Male Jumper Wire*
- f. *Yellow Male-to-Male Jumper Wire*

## C. Instructions

- a. *None*

# Integration

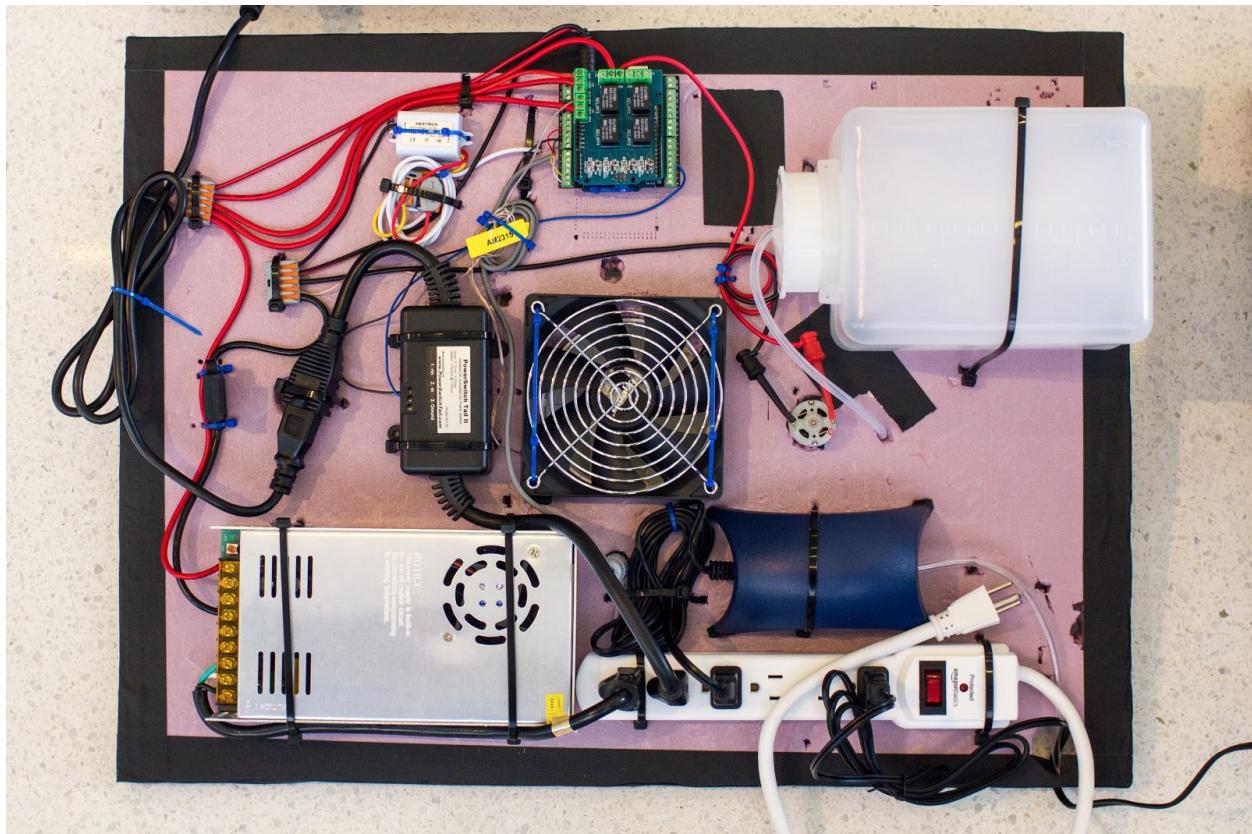
# Integration Materials Module



## A. Materials

- a. *Roll Gaffers Tape*
- b. *Small Zip Ties (x30)*
- c. *Large Zip Ties (x30)*

# Integration Procedure



## A. Tools

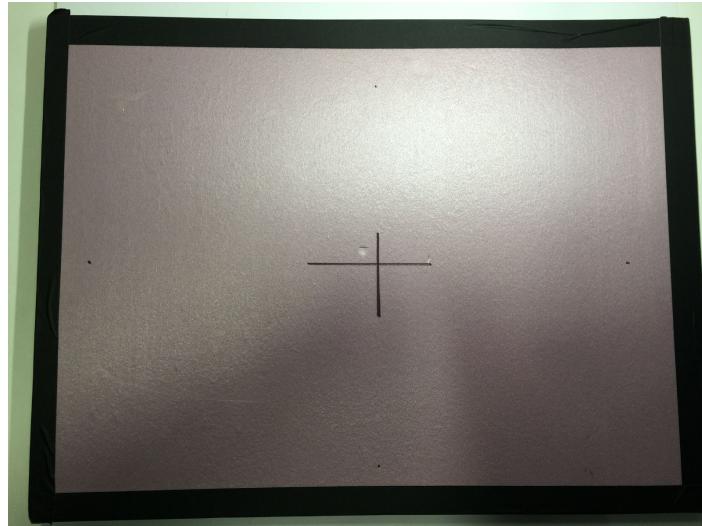
- a. *Fabrication Tools Module*

## B. Materials

- a. *Bare Electronics Panel*
- b. *Integration Materials Module*
- c. *Fabricated Arduino Controller Module*
- d. *Fabricated Power Module*
- e. *Fabricated Grow Light Module*
- f. *Fabricated Humidifier Module*
- g. *Fabricated Water Aeration Module*
- h. *Fabricated Air Vent Module*
- i. *Fabricated Liquid Doser Module*
- j. *Fabricated Temperature & Humidity Sensor Module*

### C. Instructions

- a. Use *Gaffers Tape* to tape a 1" border around the edge of the *Bare Electronics Panel*, this is to avoid placing components on the area where the panel will seal into the chassis.
- b. Use a *Meter Stick* to Mark the center of the panel, your panel should look like this:



- c.
- d. Take a *Louver* from the *Air Vent Module* and place it over the center of the panel. Press down so you get a circular depression on the foam.
- e. Use the *Utility Knife* to cut out the circle.
- f. Check to see if the *Louver* fits in the hole. If it does not, trim some excess material away until it does.
- g. Remove the *Louver* from the panel and take out the *Fan* from the *Air Vent Module*. Inspect the sides of it and look for arrow that indicate the direction the fan spins as well as the direction it will blow air. They look something like this:

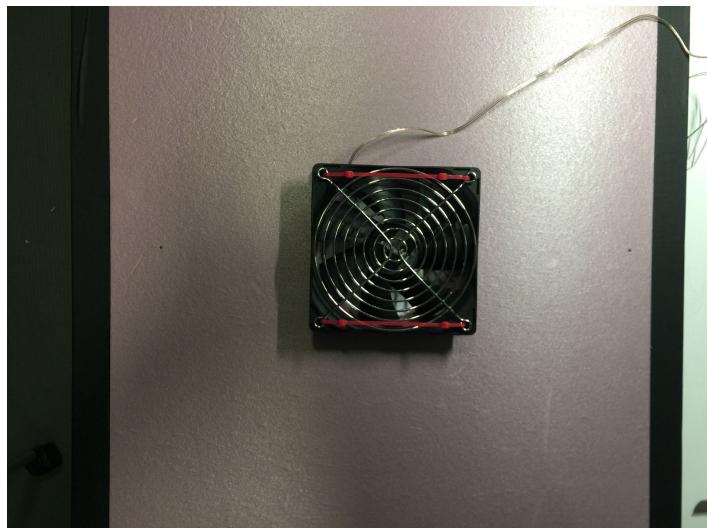


- h.

- i. Place the *Fan* over top of the hole cut in the *Bare Electronics Panel* so that the air blows through it.
- j. Make sure it is aligned straight.
- k. Use the *Small Flathead Screwdriver* to poke out 4 holes in the *Bare Electronics Panel* that line up perfectly with the holes in the corners of the *Fan*. This motion will look something like this:

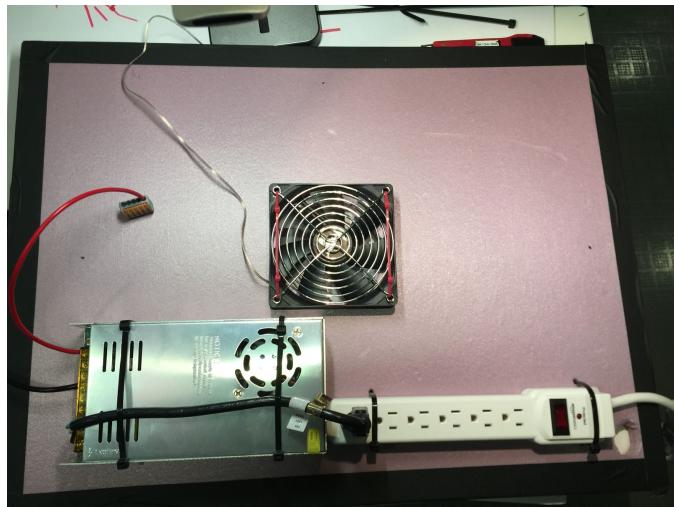


- l.
- m. Make sure the holes you poke protrude all the way through the *Bare Electronics Panel*.
- n. Lay the *Fan Guard* over top of the *Fan* such that it is elevated far enough away from the *Fan Blades* so that it does not make contact when the blades spin. If the *Fan Guard* is placed the wrong way, the *Vent* will not work properly.
- o. Once the *Fan Guard* is placed correctly on top of the *Fan*, secure them to the *Electronics Panel* with the *Small Zip Ties*. You may need to chain a few of them together to make them reach all the way around.
- p. After tightening the zip ties, use the *Wire Cutter* to trim off any remaining *Zip Tie* on your *Zip Tie Chain*. The panel will now look something like this:

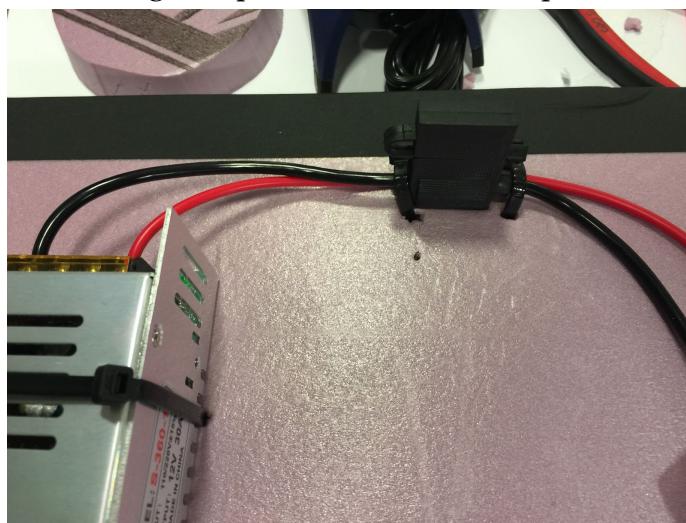


q.

- r. Use the *Utility Knife* to cut a 1" diameter hole in the bottom left corner of the panel. The edge of the hole should almost touch the *Gaffers Tape* border.
- s. Place the *Fabricated Power Supply Module* on the panel as shown below.
- t. Use the *Large Phillips Screwdriver* to poke 4 holes and insert *Large Zip Ties* through them in order to secure the *Power Strip*. Use the *Wire Cutters* to trim off any remaining *Zip Tie*.
- u. Use the *Large Phillips Screwdriver* to poke 4 holes and insert *Large Zip Ties* through them in order to secure the *Power Supply*. You may need to create a *Zip Tie Chain* in order to secure it. Use the *Wire Cutters* to trim off any remaining *Zip Tie*. The panel will now look something like this:



- v.
- w. Use the *Large Phillips Screwdriver* to poke 2 holes and insert *Large Zip Ties* through them in order to secure the *12" Black Inline Fuse Hook-up Wire* and *12" Red Hook-up Wire*. Be very careful when tightening the *Zip Ties* so you do not rip them through the panel. The secured component will look something like this:



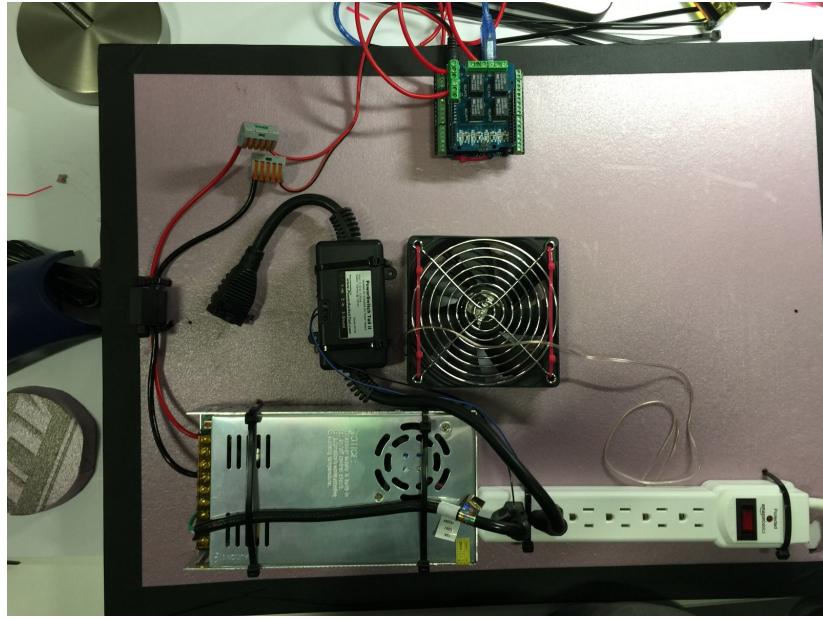
- x.
- y. Take the *Powerswitch Tail* from the *Fabricated Grow Light Module* and use *Large Zip Ties* to secure it. You will need to poke holes. From now on, assume

that whenever securing something with *Large Zip Ties*, you will use the *Large Phillips Screwdriver* to poke holes first. And whenever securing something with *Small Zip Ties*, you will use the *Small Flathead Screwdriver* to poke holes first. Also, assume you will always trim your *Zip Ties* once they are fastened. The panel will now look something like this:



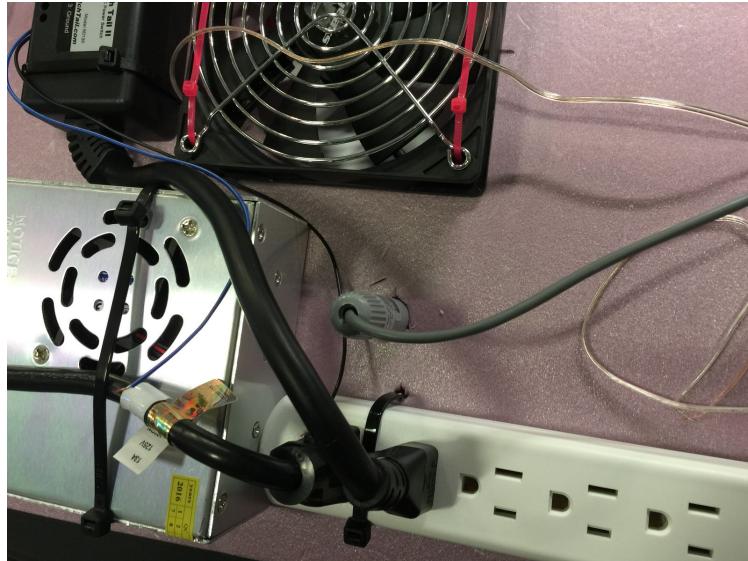
Z.

- aa. From the Fabricated *Arduino Control Module*, take the *Shields* off of the *Arduino Uno*. Secure the *Arduino Uno* to the right of the fan on the panel . Set it right up to the inner edge of the *Gaffers Tape Border*. Use *Small Zip Ties* to secure it.
- bb. Place the *Shields* back onto the *Arduino Uno* and connect the **Red Wire** from the *Barrel Plug Cable* into Socket 5 on the *5-Channel Easy Connector* that has the **Red Wire** from the *Power Supply* connected to it.
- cc. Connect the **Black Wire** from the *Barrel Plug Cable* into Socket 5 on the *5-Channel Easy Connector* that has the **Black Wire** from the *Power Supply* connected to it. The panel will now look something like this:



dd.

- ee. Mount the *Air Temperature & Humidity Sensor* in between the *Fan* and the *Power Strip* by cutting a small hole and inserting it through. If you cut a small enough hole, the *Sensor* will hold from the *Friction*. The panel will now look something like this:



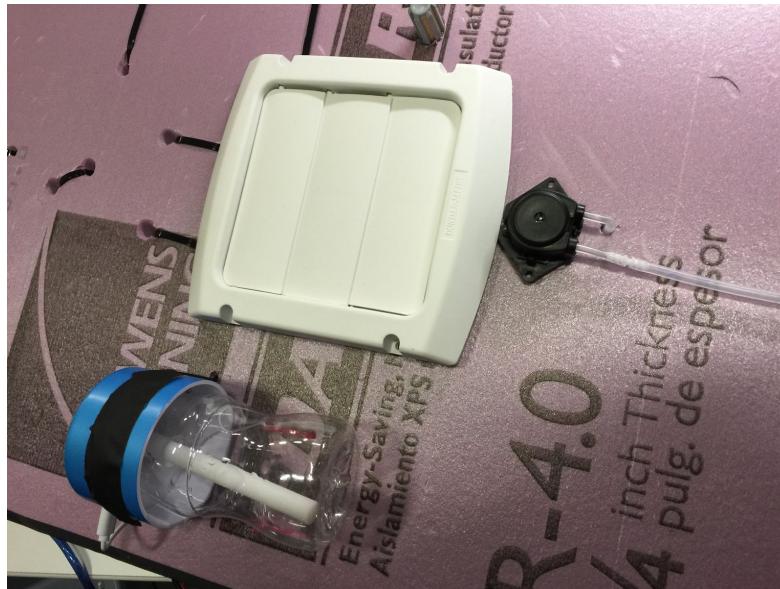
ff.

- gg. Flip the panel over and push the *Louver* into the center hole that was cut earlier.  
hh. Secure the *Humidifier* to the left of the *Louver* with a *Large Zip Tie*.  
ii. Make a hole to run the *Micro-USB Cable* through to the left of the *Humidifier*.  
jj. Run the *Micro-USB Cable* through that hole and plug it into the *Humidifier*.  
kk. Take a thin strip of *Gaffers Tape* and tape the *Humidifier* to the *Zip Tie* so it does not slide around. The inside panel will now look something like this:



ll.

mm. Cut a 1" hole directly below the center of the *Louver* and insert the *Peristaltic Pump* through it. Poke a hole beneath the right tube and insert the right tube through it. You will get something that looks like this:

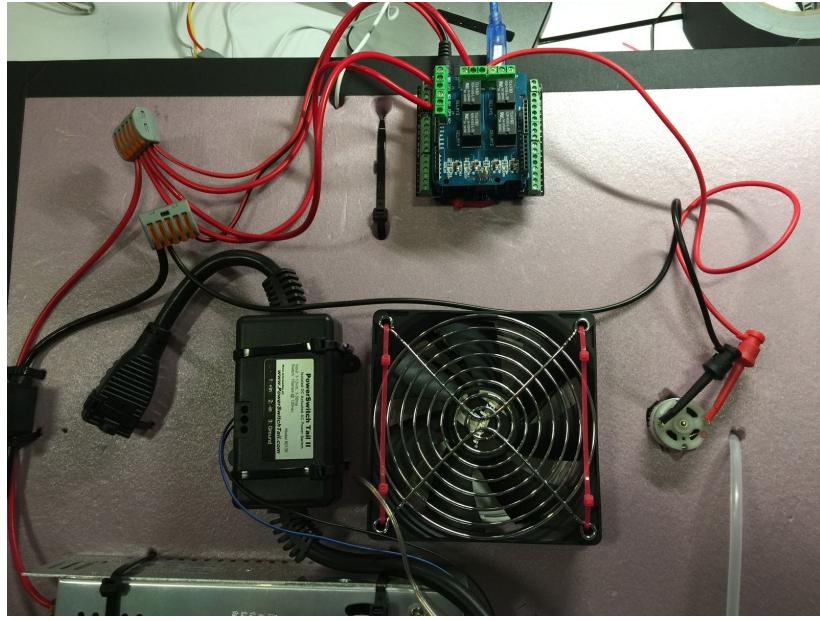


nn.

oo. Clip the 12" Red Mini-Grabber Wire to the *Contact* on the *Peristaltic Pump* with the Red Circle. Connect the other end of it to NO2 on the *Relay Shield*. "NO" stands for "Normally Open" so that means the default state of the *Peristaltic Pump* will be OFF.

pp. Clip the 12" Black Mini-Grabber Wire the *Contact* on the *Peristaltic Pump* WITHOUT the Red Circle. Connect the other end of it Socket 2 on the *5-Channel Easy Connector Bus*.

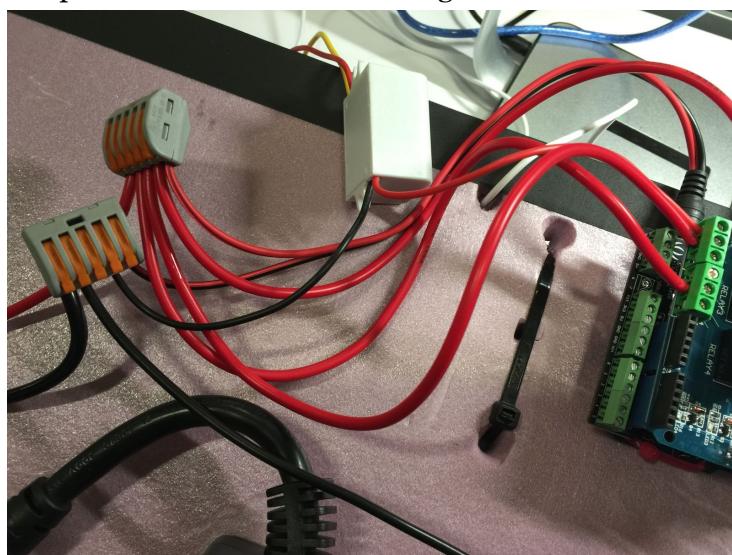
qq. Now connect the three 12" Red Hook-up Wires coming out of the *Relay Shield's* COM1, COM2, and COM3 to the red-wired *5-Channel Easy Connector's* Socket 2, Socket 3, and Socket 4, respectively. The panel will now look something like this:



rr.

ss. Connect the **Black Input Wire** from the *Inline 12V-to-5V Step Down Converter* that is attached to the *Humidifier's Micro-USB Cable* to Socket 4 on the **Black-Wired 5-Channel Easy Connector**.

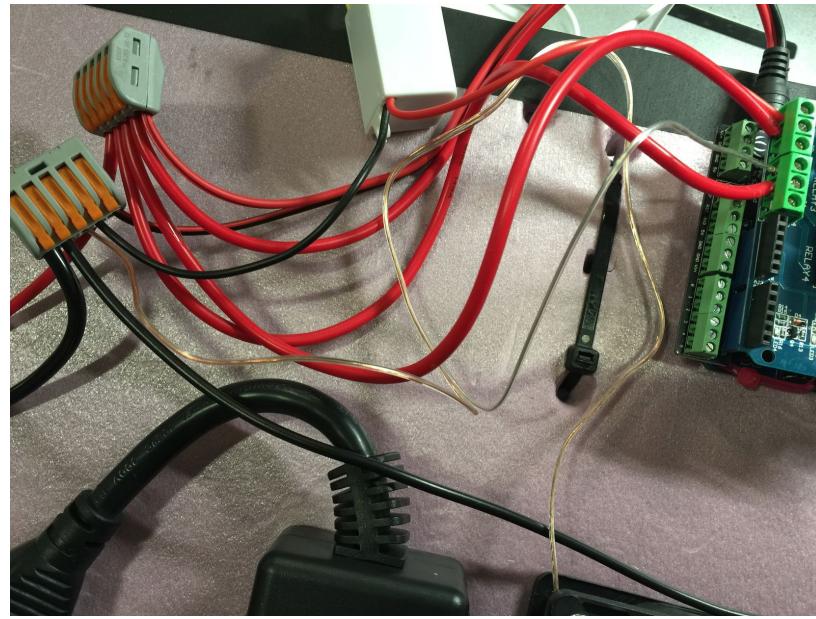
tt. Connect the **Red Input Wire** from the *Inline 12V-to-5V Step Down Converter* that is attached to the *Humidifier's Micro-USB Cable* to NO3 on the *Relay Shield*. The panel will now look something like this:



uu.

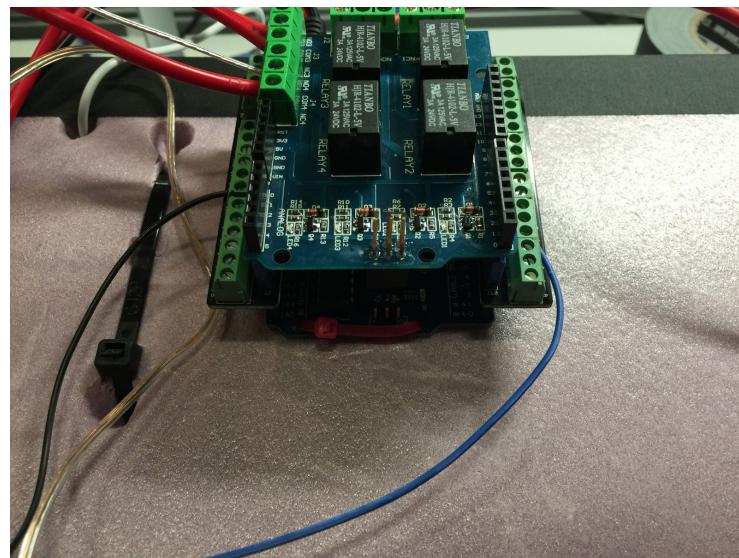
vv. Connect the **Brown Wire** from the *Fan* to Socket 3 on the **Black-Wired 5-Channel Easy Connector**.

ww. Connect the **Silver Wire** from the *Fan* to NO4 on the *Relay Shield*. The panel will now look something like this:



xx.

- yy. Connect the **Black Wire** coming from the *Powerswitch Tail* to one of the GNDs on the *Screw Shield* and the **Blue Wire** coming from the *Powerswitch Tail* to Pin 3 on the *Screw Shield*. The panel will look something like this:

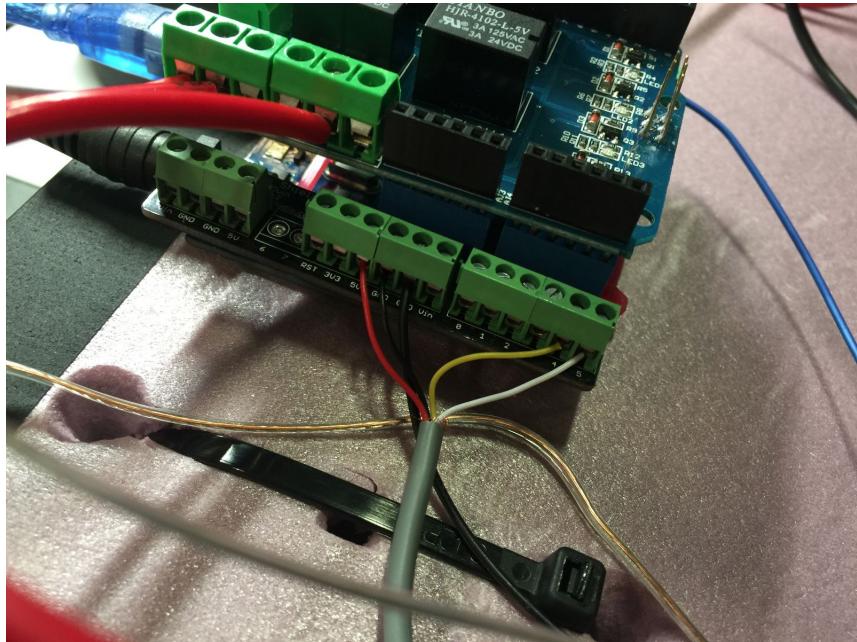


zz.

- aaa. Connect the **Black Wire** from the Temperature & Humidity Sensor to one of the GNDs on the *Screw Shield*.
- bbb. Connect the **Red Wire** from the Temperature & Humidity Sensor to 5V on the *Screw Shield*.

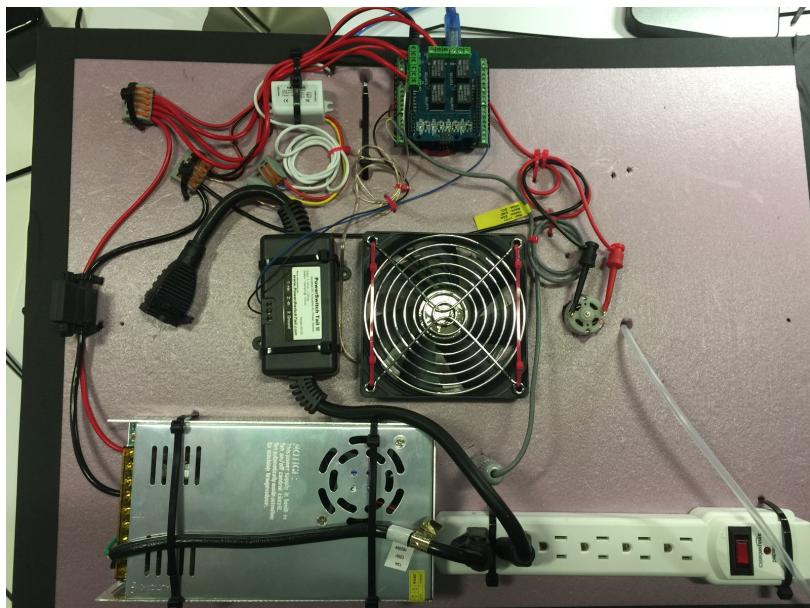
ccc. Connect the **Yellow Wire** from the Temperature & Humidity Sensor to A4 on the *Screw Shield*.

ddd. Connect the **White Wire** from the Temperature & Humidity Sensor to A5 on the *Screw Shield*. The panel will now look something like this:



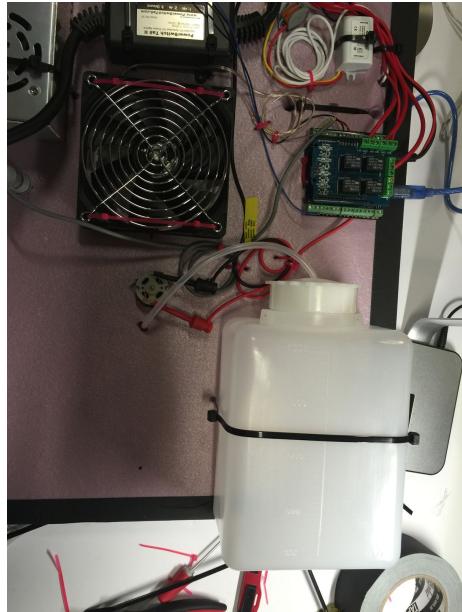
eee.

fff. Secure the mess of wires, also referred to as a *Ratsnest*, by using whatever wire coiling method plus *Zip Tie* method makes the most sense for your panel. The panel will now look something like this:



ggg.

hhh. Secure the *Doser Reservoir* to the panel with *Zip Ties*. The panel will now look something like this:



iii.

- jjj. Secure the *Air Pump* to the panel with *Zip Ties* and connect it to Plug 3 on the *Power Strip*. The panel will now look something like this:



kkk.

- lll. Connect the *Circulation Pump* to Plug 4 on the *Power Strip*. The panel will now look something like this:



mmm.

nnn. Connect the *Grow Light* to the *Powerstrip Tail* and install this panel into the *Chassis*