mycoclimate.

Build Manual

MycoClimate is a user-friendly, automated mushroom growing chamber designed for hobbyists and home growers. It controls humidity, temperature, CO2 levels, and lighting to provide an optimal microclimate for mushroom cultivation.

This manual includes illustrations, part descriptions, 3D printing notes, and a link to download all code, files, and diagrams.

Here is a link to the repo:
https://github.com/savvatsekmes/MycoClimate_Git

Just a heads-up before you dive in—this isn't the easiest build. If you decide to take it on, know that it's a bit of a journey. 3D printing can be a lot of fun, but it does fail sometimes, so patience is key. If you're new to Arduino coding, I highly recommend getting familiar with how my code works—I've left notes throughout to help guide you. And most importantly, please take care when wiring everything up. Double-check your connections, and don't rush. It's all part of the process

⚠ Important: Disclaimer:

Contents

Technical Drawings

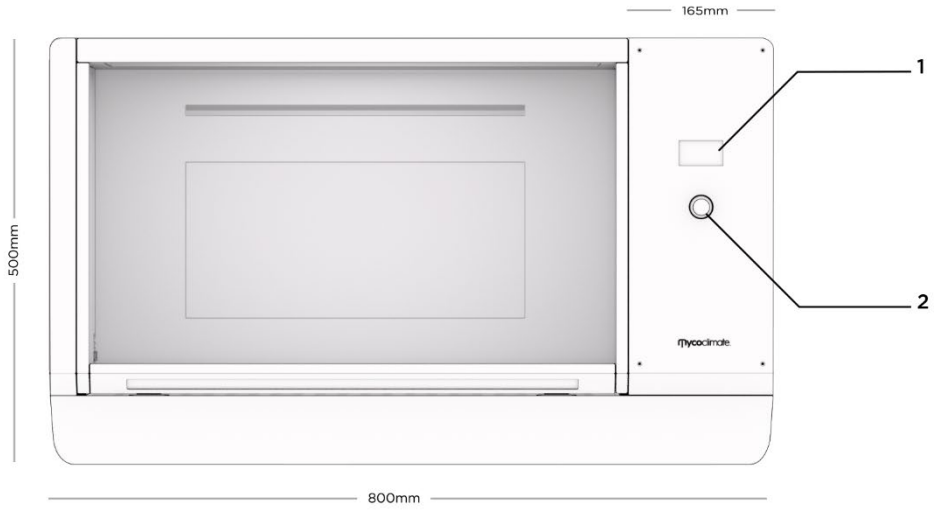
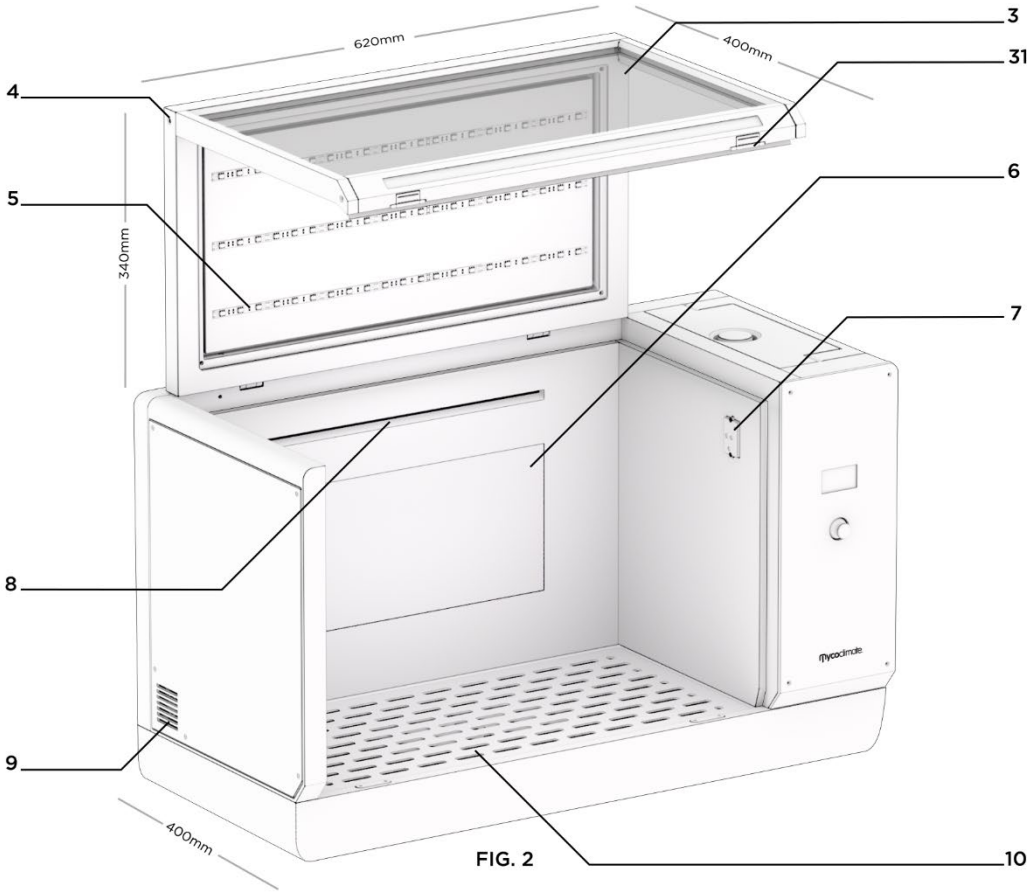


FIG. 1



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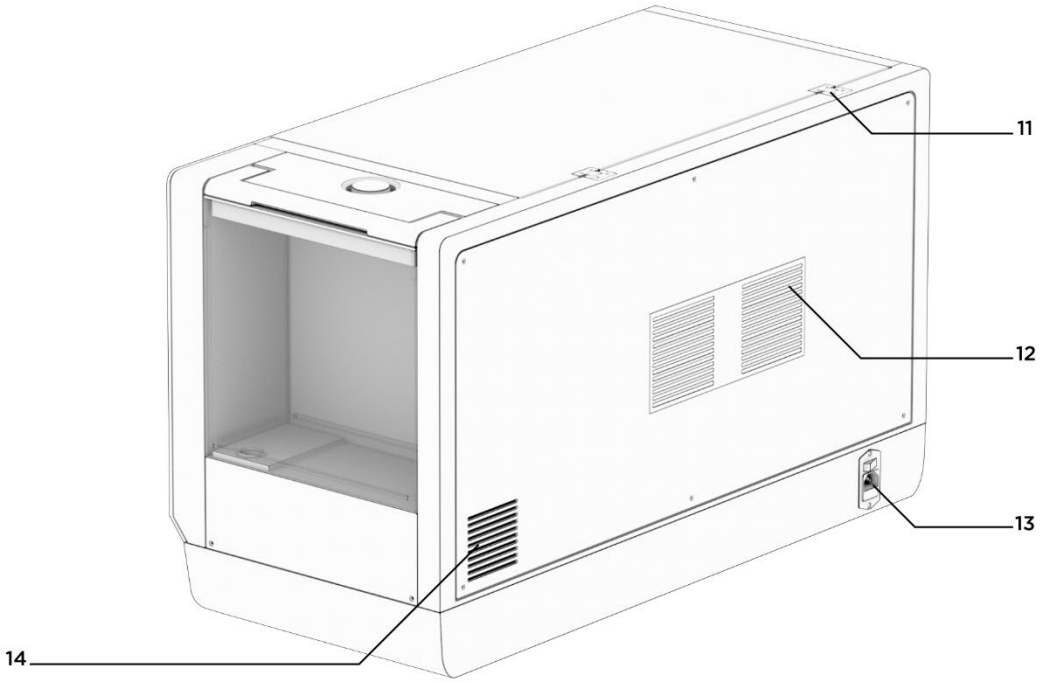
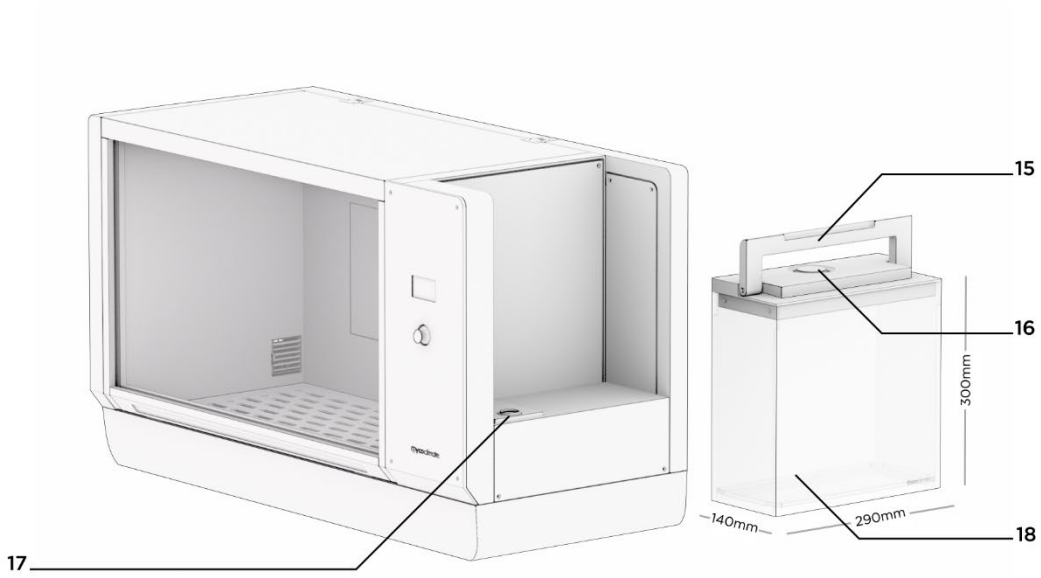


FIG. 3



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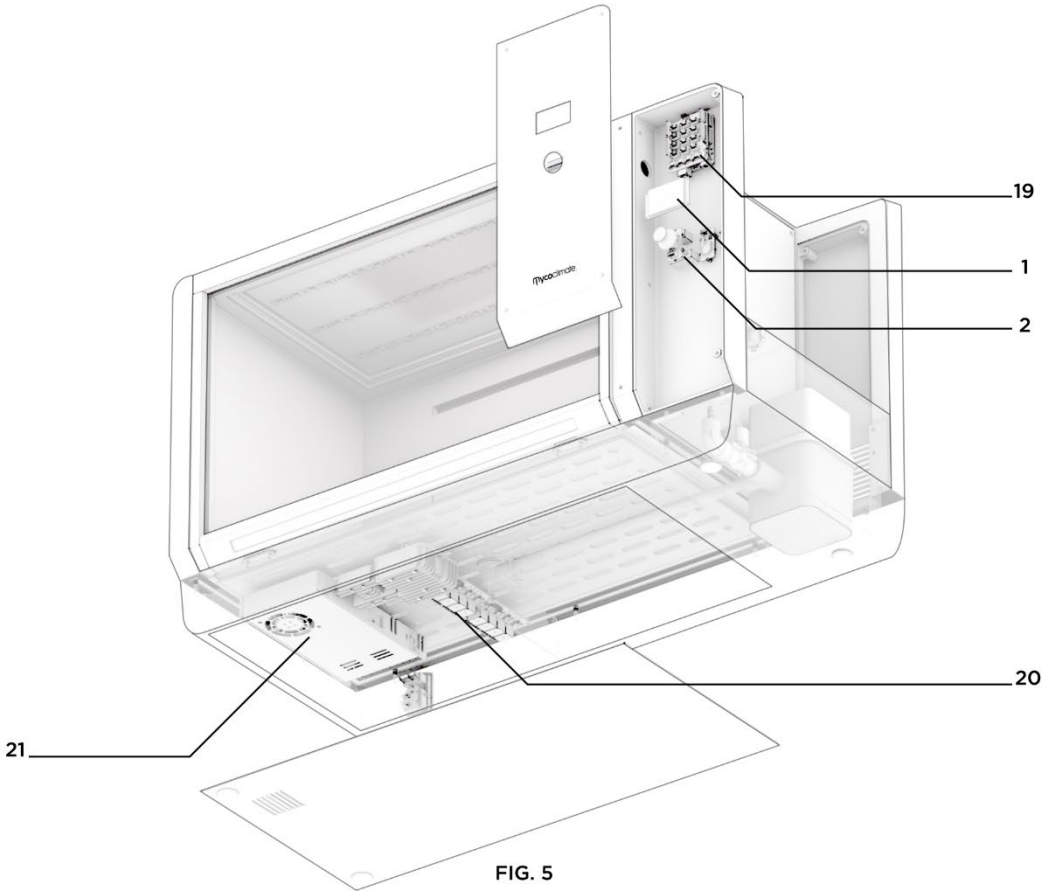

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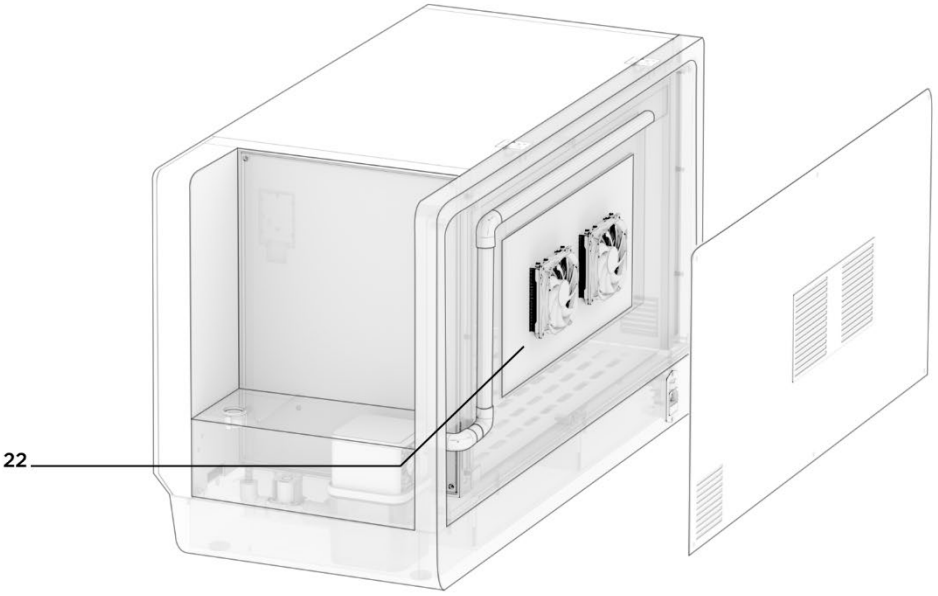


FIG. 6

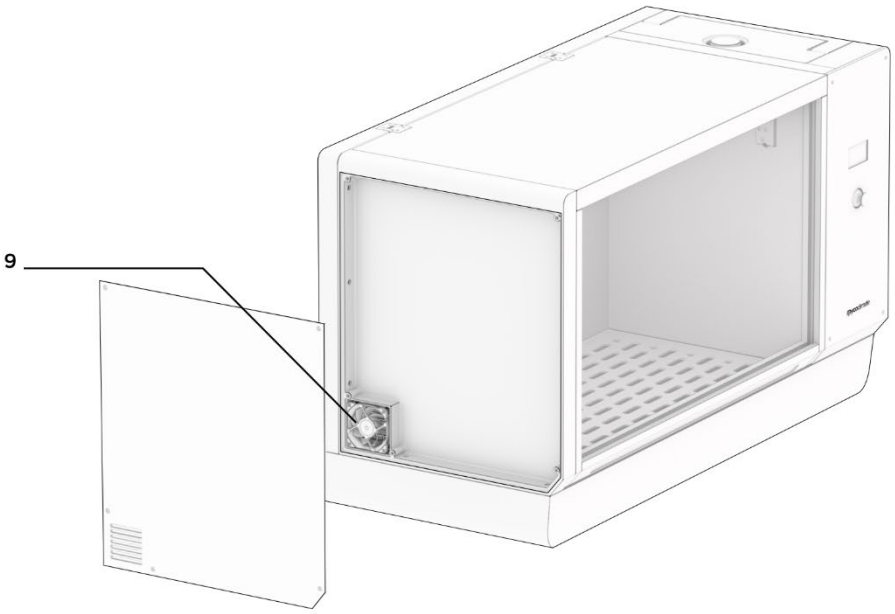


FIG. 7

FIG. 8

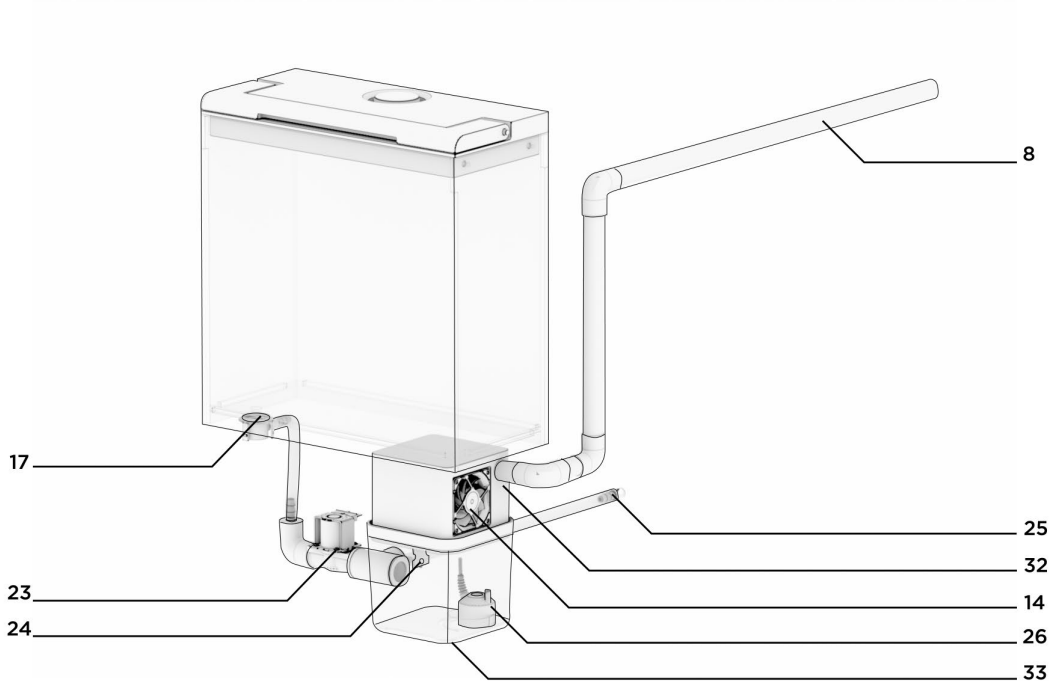


FIG. 9

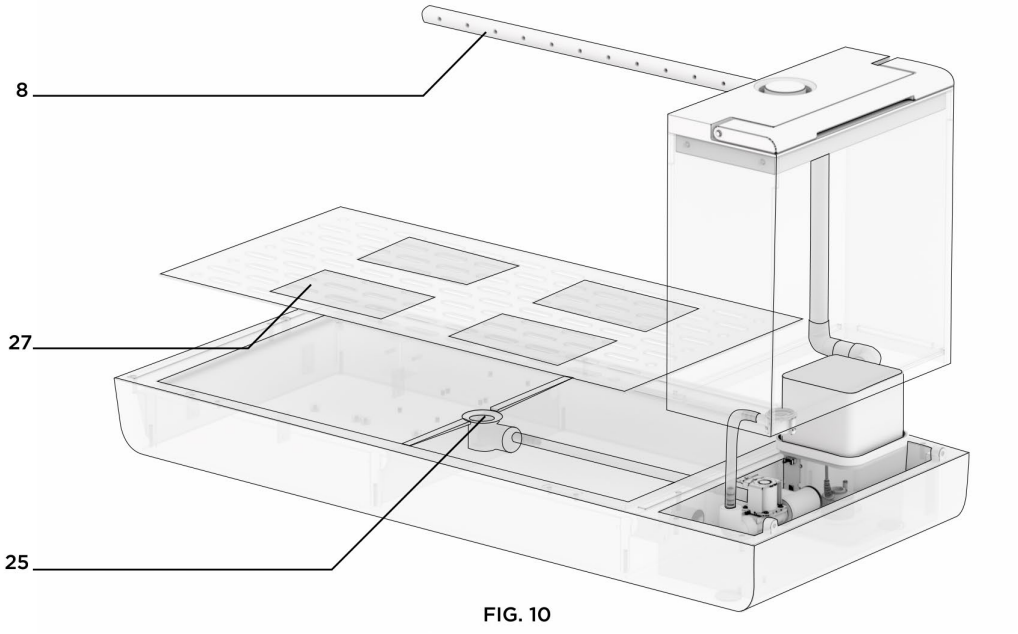


FIG. 10

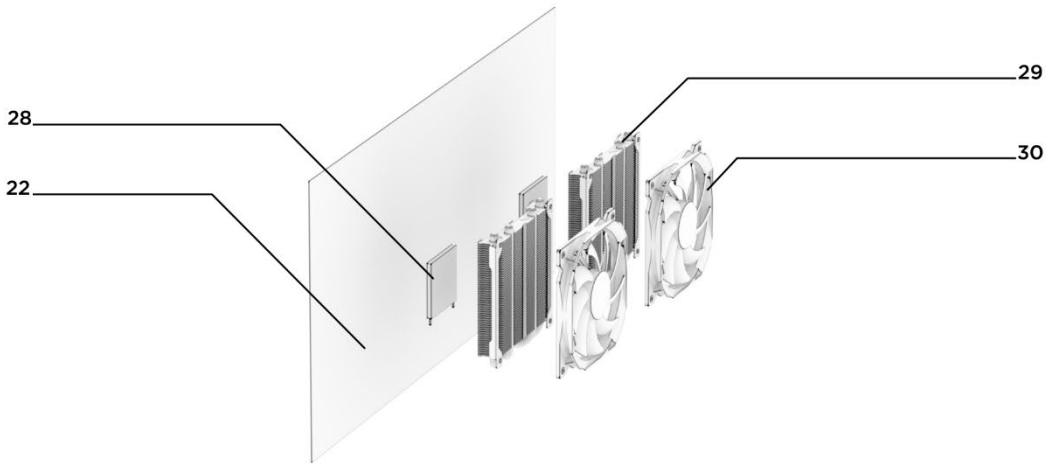


FIG. 11

Brief Description of the Drawings

Figure 1 is a front view of the chamber.

Figure 2 is a three quarter view from the front of the chamber illustrating how the hinged door of the chamber opens and some internal chamber components.

Figure 3 is a three quarter view from the back illustrating where the fresh air intake and power input.

Figure 4 is another view of the chamber illustrating the removable water reservoir and its handle.

Figure 5 is the machine pulled apart to give the internals a closer look.

Figure 6 is a view of the back cover off exposing the cooling system and the humidifier plumbing.

Figure 7 is another angle with the left panel removed to show the CO2 exhaust fan.

Figure 8 is the view from the bottom

Figure 9 is a closer look at the humidifier system.

Figure 10 Illustrates where the 12v silicone Rubber Waterproof heater pads are located underneath the aluminium tray. Also illustrates another angle of the humidifier assembly and drainage system, which feeds back into the humidifier system.

Figure 11 illustrates the peltier cooling stack assembly, consisting of an aluminium cooling surface, two 12v Peltier modules, and accompanying

heatsinks and fans. These components work in tandem to efficiently manage heat on the hot side of the Peltier modules.

Item Details

1. LCD screen: Enabling users to select settings and monitor real-time humidity, CO2 levels, and temperature. Enhanced control is facilitated through a thumbstick interface.

2. Thumb stick for controlling the user interface.

3. Acrylic transparent pane on chamber door.

4. Chamber door assembly: The chamber door is equipped with an acrylic transparent pane, allowing clear visibility into the cultivation environment. Integrated LEDs simulate a natural day/night cycle, providing 12 hours of sunlight-like illumination daily..

5. LEDs positioned on the chamber's door, simulating a day/night cycle to provide sunlight-like illumination for 12 hours a day.

6. Temperature Regulation for cooling: A cooling system employing 12v Peltier modules, triggered by the microcontroller in response to excessively high temperatures, ensuring the chamber remains within the optimal temperature range.

7. This is the CO2, humidity and temperature sensor. It makes all the readings and send that data in real-time to the microprocessor.

8. Humidity and fresh air chamber intake powered by fan in the humidifier assembly. It is where all the vaporised water and fresh air enter the main chamber.

9. CO_2 Exhaust System: The dedicated CO_2 exhaust outlet, powered by a fan, facilitates the timely removal of excess carbon dioxide, promoting a healthy cultivation atmosphere.

10. Aluminium tray within the chamber.

11. Spring loaded hinges to keep the chamber door upright when needed.

12. Air intake for Peltier cooling system.

13. IEC power connector, this is wired up to the 12v power supply.

14. Fresh air and humidifier intake fan. This aids in bringing fresh air into the chamber as well as blowing the humidified water vapour into the chamber.

15. Water reservoir handle.

16. Water reservoir refill cap.

17. Water reservoir inlet, allowing water to flow into the humidifier water chamber.

18. Primary water Reservoir: MycoClimate incorporates a removable water reservoir designed with a user-friendly handle for easy handling. The reservoir includes a refill cap and inlet, simplifying the process of water replenishment and ensuring consistent humidity for long periods of time.

19. Microcontroller, which is performing the task of checking the data sent from the sensors, sending signals to the relay modules and running the user interface.

20. Relay modules which are capable of switching hardware on and off.

21. 12v Power supply, powering the whole machine.

22. This is the aluminium cooling sheet used to cool the MycoClimate chamber and part of the peltier cooling assembly.

23. Solenoid valve to control the flow of water into the secondary smaller water reservoir.

24. This is the water sensor in the chamber, if it detects no water it will trigger the solenoid valve to open.

25. This is the drain for the chamber, any excess water will drain back into the humidifier chamber through a tube.

26. This is a 24v ultrasonic Atomizer module, vaporising the water within the chamber when humidity is needed.

27. Four 12v silicone Rubber Waterproof heater pads located beneath the aluminium tray within the chamber, activated by the microcontroller when temperature levels drop below the desired range.

28. Two 12v peltier modules, part of the peltier cooling stack.

29. Heatsink part of the peltier cooling stack. These are used to dissipate the heat from the hot side of the peltier modules.

30. Fans to cool the heatsinks, part of the peltier cooling stack.

31. Magnet latch for secure closure of the chamber door.

32. Fan assembly, part of the secondary smaller water reservoir.

33. Secondary smaller water reservoir, this is part of the humidifier assembly. Within this reservoir lives the ultrasonic atomizer and the water level sensor.

3D Printing & Build Notes

To bring **MycoClimate** to life, I used two 3D printers:

- **Creality CR-30 (Belt Printer):** Perfect for printing long pieces in a single go.
- **Creality CR-10:** Used for base parts and detail components.

All parts were printed using **PETG filament** for improved durability and food safety. Supports and rafts were used selectively depending on part orientation.

⚠ **Note:** The printed enclosure is likely over-engineered. If you're looking for a more accessible setup, you could skip the 3D printing entirely and still use the code and components in a basic monotub-style chamber.

⚠ Peltier Cooling System Disclaimer

The Peltier cooling system included in this project was an **experimental attempt** and never functioned efficiently. Peltier modules are notoriously inefficient and generate a lot of heat.
I highly recommend NOT replicating this part unless you have specific expertise. It's included in the files purely for reference and experimentation.

Additional Build Notes

- This project was completed in **2023**, and I might not use the same printers anymore. Printer capabilities have likely improved since then.
- Some parts had to be **split for printing**. I've included both split and un-split versions in the repository.
- I used **2-stage epoxy** to connect split parts, which provided a strong and reliable bond.

Water Reservoir

- The reservoir body was made from **laser-cut acrylic** and assembled using **acrylic glue**. The files are in the repo
- The 3D-printed **lid** sits neatly on top.
- The **cap** is *not* 3D-printed — I sourced it (with compatible threading) from a local hardware store.

One-Way Valve

The one-way valve where the reservoir connects to the chamber was **repurposed from an old Aldi Expressi pod machine** (Aldi's version of Nespresso).

I reused both the **valve on the tank** and the **input valve** from the machine.

You'll need to source a similar valve or find spares online — a bit of a stitch-up, I know!

Door Hinges

I used spring-loaded hinges I found online (linked in the parts list).

Feel free to **modify the model to fit your own hinges** if you prefer a different setup.

Door Closure Mechanism

The MycoClimate chamber door is held shut using **magnet latches**, which I sourced from a local hardware store. These are the same **generic cabinet-style magnetic catches** you'll find in most kitchen or cupboard setups — making them easy to source or replace.

An image or product link to a similar model will be added in the parts list.

💬 **Note:** The magnetic latches I used are functional, but not exceptional. If you're planning to replicate the build, I highly recommend **replacing them with stronger neodymium magnets** or more robust latch systems for a firmer seal — especially if you're working in more humid environments.

Door Connector (Electronics)

To connect the door electronics (like the LEDs and screen) to the main chamber, I used a **magnetic connector**, which is also listed in the parts list:
🔗 Adafruit Magnetic Plug - Product #5358

You *can* run a regular cable across the hinge, but repeated door movement may cause it to wear or break over time. The magnetic connector offers a neat, durable, and detachable solution.

Plumbing & Water System

The plumbing system handles the automated hydration process for the humidifier. Here are a few notes and tips:

- **Solenoid Valve:**
  Make sure to use a solenoid that **isn't pressure-activated** — mine activates purely based on electrical signal, not water pressure.

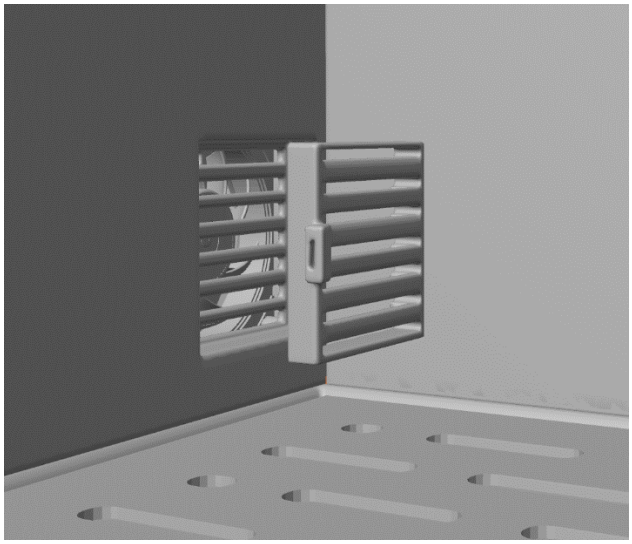
- **Water Level Sensor:**
  This sensor detects low water in the secondary tank and triggers the solenoid to refill it. Pretty straightforward but essential for automation.

- **UV Sterilizer Light:**
  I installed a small **UV light (265nm range)** in the secondary water reservoir to sterilize it.
  ⚠ **Caution:** UV light can be harmful to skin and eyes.
  I completely enclosed mine so no UV light could escape, but in hindsight, this feature might be overkill. You likely don't need it — I was just experimenting with extra cleanliness.

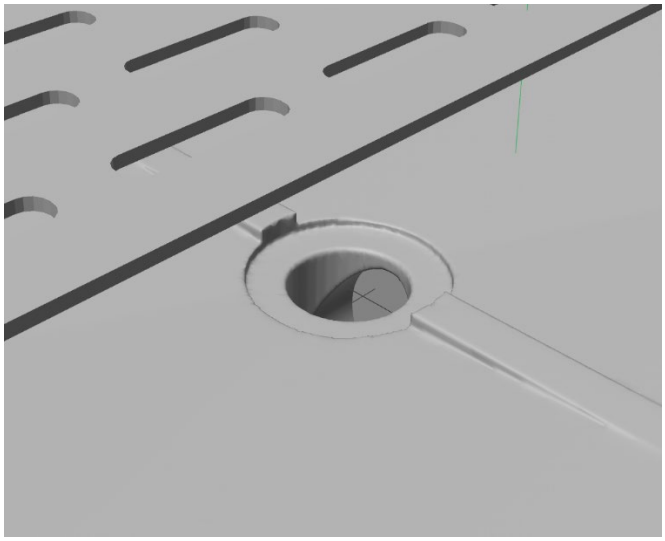
- **Secondary Reservoir:**
  I used a **Sistema Ultra (700mL)** Tupperware container.
  It's cheap, airtight, easy to find, and I've designed a 3D-printed lid specifically for it. A link and image are included in the parts list.

Filters

I installed a small filter on the CO_2 exhaust to help prevent spores from escaping—especially important for high-spore producers like oyster mushrooms. Make sure to clean after every grow.



I installed a small foam filter in the drain to catch larger debris—this helps prevent clogging the solenoid and keeps the secondary chamber clean. Make sure to clean the filter after every grow cycle.



Code Notes

The Arduino code is included in the repo, along with all required libraries. A few important details:

- WSWire Library:
  I've replaced the standard Wire.h library with a modified version (WSWire.h) because I was getting system freezes using the default. This custom version is included in the repo.

- Watchdog Timer:
  I've set up a watchdog to ping every 8 seconds and reset the system in case it hangs. It helps with long-term stability.

- Mushroom Settings in EEPROM:
  Species-specific environmental settings are stored in EEPROM. Just note that EEPROM has a limited write lifespan (usually 100k+ writes), so while it's not a problem short-term, it's something to consider over the very long run.
  I didn't get around to improving this, but alternatives are easy to implement if needed.

- Peltier Cooling System Disabled:
  I've disabled the Peltier cooling system in the code. It just wasn't efficient or effective, so I recommend leaving it out unless you're doing your own R&D.

Setting the Time

```
220
221     RTclock.begin();
222
223 /*
224     // Set the time and date. Use once and comment out.
225         RTclock.stopClock();
226         RTclock.fillByYMD(2023,9,23);//
227         RTclock.fillByHMS(9,51,00);//
228         RTclock.fillDayOfWeek(SAT);//
229         RTclock.setTime();//write time to the RTC chip
230         RTclock.startClock();
231 */
```

Use this section to set the time on the RTC module. After setting it once, you must comment out the line and re-upload the code to the Arduino to prevent it from resetting each time. A bit annoying I know.

Configuring Mode settings.

If you want to change the specific settings I've made for each mushroom, scroll down to Mode Settings in the code.

Here you can set:

TSETPOINT - Once temperature hits Tsetpoint it triggers the cooler.

THSETPOINT - Desired temperature for chamber. If under THsetpoint triggers heating pads.

HSETPOINT - Desired Humidity level.

CSETPOINT – Once Csetpoint is reached it triggers Co2 exhaust.

DNC – Day/nightime cycle, LED in chamber. 0 = off | 1 = on

```
1138 //--------------------------------------
1139 // Mode Settings
1140 //--------------------------------------
1141 void modeSettings(){
1142
1143 //Cleared Settings - OFF
1144 if (mode==0){
1145   TSETPOINT=100;
1146   THSETPOINT=0;
1147   HSETPOINT=0;
1148   CSETPOINT=10000;
1149   DNC=0;
1150 }
1151
1152 //Incubation Settings
1153 else if (mode==1){
1154   TSETPOINT=27;
1155   THSETPOINT=21;
1156   HSETPOINT=40;
1157   CSETPOINT=10000;
1158   DNC=0;
1159 }
1160
1161
1162 //Cubensis Settings
1163 else if (mode==2){
1164   TSETPOINT=33;
1165   THSETPOINT=0;
1166   HSETPOINT=81;
1167   CSETPOINT=990;
1168   DNC=1;
1169 }
1170
1171
1172 //Lions Mane Settings
1173 else if (mode==3){
1174   TSETPOINT=23;
1175   THSETPOINT=9;
1176   HSETPOINT=75;
1177   CSETPOINT=990;
1178   DNC=1;
1179 }
```

Parts list

MEAN WELL LRS-350-12 Enclosed 348W 12V 29A Power Supply

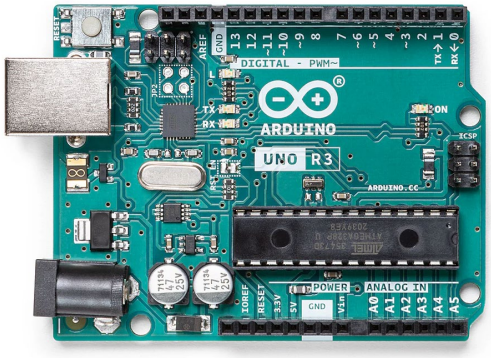
https://www.meanwellaustralia.com.au/products/LRS-350

I used this which is definitely too much power, I bought it because I was going to mess around with cooling. So feel free to get less amps just make sure its 12v.

Arduino Uno R3

This is the brain that drives everything!

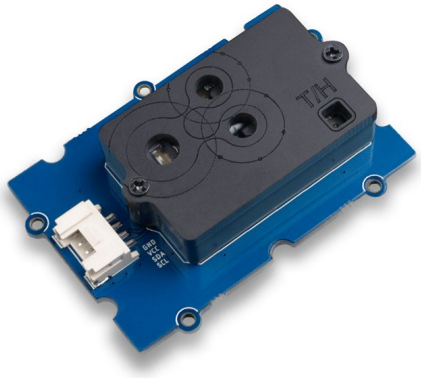
https://store-usa.arduino.cc/products/arduino-uno-rev3



Grove - CO2 & Temperature & Humidity Sensor (SCD30) - NDIR technology, algorithms, ideal for Smart Ventilation System

This sensor is one of best sensors out there and monitors the C02, Humidity and Temperature.

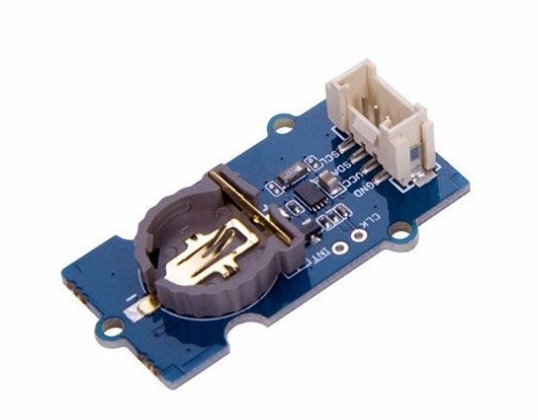
https://www.seeedstudio.com/Grove-CO2-Temperature-Humidity-Sensor-SCD30-p-2911.html



Grove - High Precision RTC (DS1307)

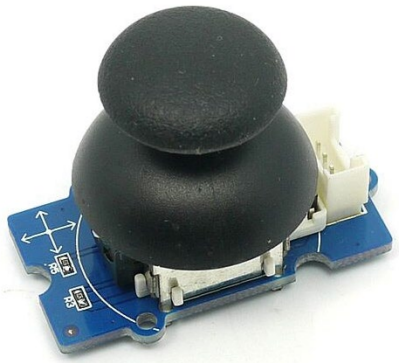
This is needed to keep time, the schedules are time triggered

https://www.seeedstudio.com/Grove-High-Precision-RTC.html



Grove - Thumb Joystick

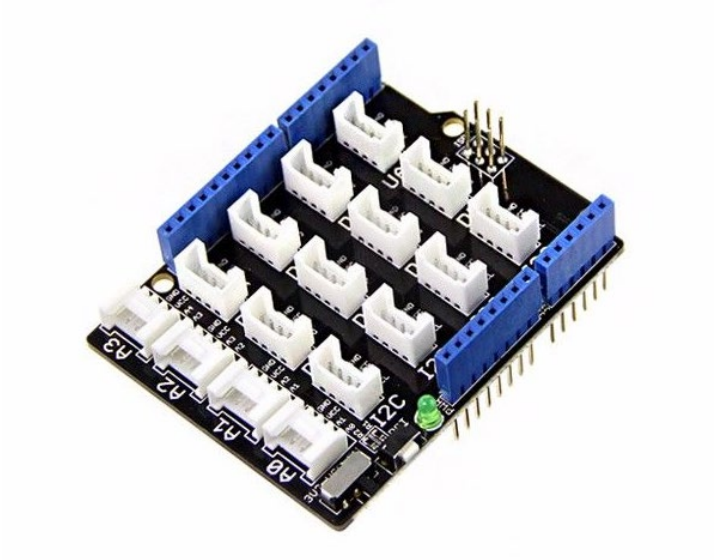
https://www.seeedstudio.com/Grove-Thumb-Joystick.html



Grove Base Shield V2.0 for Arduino

This is to turn your Arduino into a grove system. The grove system make the wiring much easier.

https://www.seeedstudio.com/Base-Shield-V2.html



4 Channel Relay Module 5V x 2

Using relays to trigger turn other parts in the system on and off, it's basically a switch for components.

Ultrasonic Mist Maker Fogger Water Fountain Atomizer Air Humidifier Adapter Mini

24v needs a Step up I used a Waterproof DC/DC Car Voltage Converter 12V Step Up to 24V, there are heaps on ebay

I2C LCD

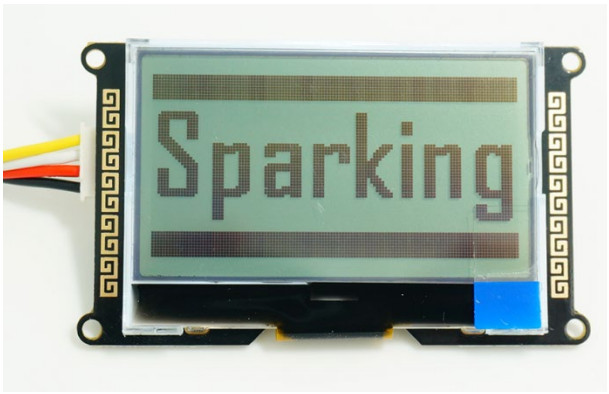
I used this screen which runs on the I2C cable like the grove system, and works with grove, but it's been discontinued unfortunately. Sorry about that, there are some lying around on the net otherwise you can find a similar screen that uses I2C is 128 x 64 LCD pixels. And uses the LiquidCrystal_I2C library. Otherwise feel free to use any screen you like if you have the coding capabilities.

https://wiki.seeedstudio.com/I2C_LCD/

https://www.seeedstudio.com/I2C-LCD-With-universal-Grove-cable.html

I found one online, I'm sure there's more out there.

https://rlx.sk/en/9-5-lcd-display/5037-i2c-lcd-with-female-jumper-cable-er-ct520177y-128x64-dual-color-.html



UV-C LED

I used UVC LED to sterilise secondary water reservoir | 264nm is best at killing bacteria/mould. I found mine on Ebay.

Peltier Thermo-Electric Cooler Module - 12V 5A

These are Peltier cooler modules, I built my cooler out of these but I don't think it's worth the trouble to be quite honest. If you want to cool down you chamber I would invest in a 12v mini fridge compressor and go that route.

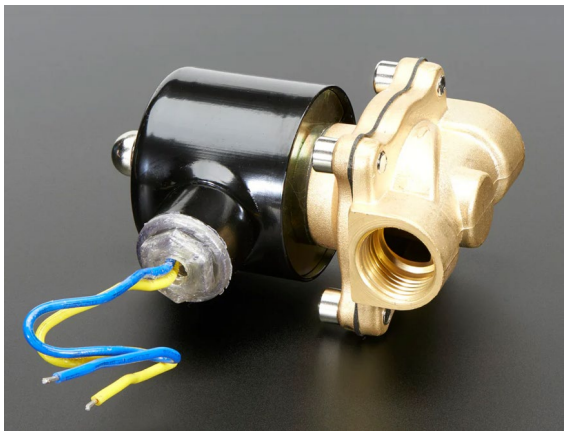
Magnetic Cabinet Latch

These are the types of latches I used to seal the chamber.

These are the same **generic cabinet-style magnetic catches** you'll find in most kitchen or cupboard setups — making them easy to source or replace.

12v Solenoid Valve

Normally, the valve is closed. When 12VDC is applied to the two terminals, the valve opens and water can flow. Unlike the plastic solenoid valve, this one does not have a gasket, so there is no minimum pressure requirement.



https://www.pakronics.com.au/products/brass-liquid-solenoid-valve-12v-1-2-nps-ada996?_pos=5&_sid=b89dd1b91&_ss=r

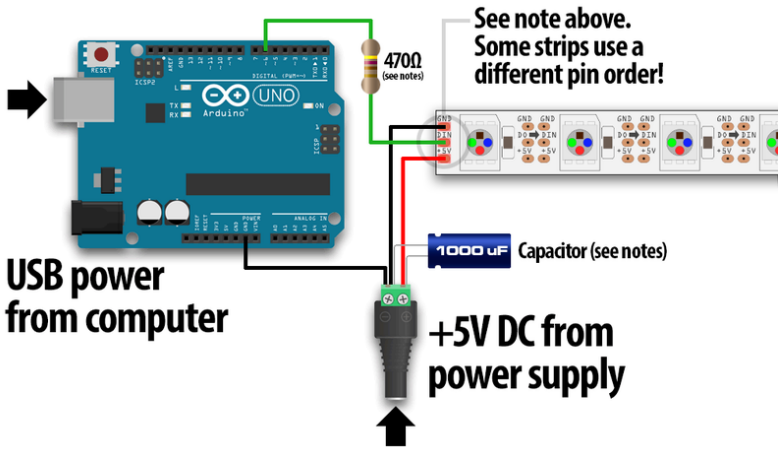
Adafruit NeoPixel Digital RGB LED Strip

I used neopixels for the lighting, can change the light colour through the code. I have it set on purple because it looks cool. And I never

Power these with 5v, they also need a 1000uF capacitor and 470om resistor. Check wiring image below.

https://www.adafruit.com/product/1138

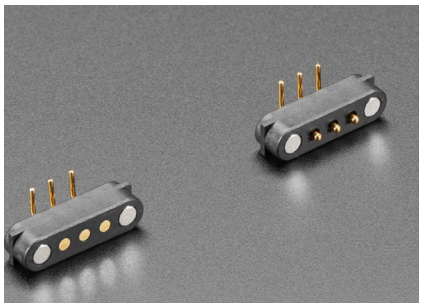
https://learn.adafruit.com/adafruit-neopixel-uberguide/basic-connections



Magnetic Connector

I used these connectors for the lid to connect up the LEDs to the Arduino.

https://www.adafruit.com/product/5360



Sistema Ultra 700ml Square

I used a Sistema Ultra (700mL) Tupperware container.

It's cheap, airtight, easy to find, and I've designed a 3D-printed lid specifically for it. A link and image are included in the parts list.
https://www.sistemaplastics.com/au/700ml-square

Step up and step Down Converters

To power everything reliably from a single 12V power source, you'll need two voltage converters:

12V → 24V Step-Up Converter:

Required to power the ultrasonic humidifier, which runs on 24V.

12V → 5V Step-Down Converter:

Used to power the Arduino and the NeoPixel LEDs, both of which operate on 5V.

I used converters similar to those designed for automotive use — compact, reliable, and widely available. You can find these easily online or at electronics stores. I've added examples to the parts list.

💡 Tip: Make sure to double-check the amp rating of each converter — especially for the humidifier, which can draw a bit more current.

Water Tank Coupling & One-Way Valve

The water reservoir connects to the main chamber via a **custom coupling system** I repurposed from an old **Aldi Expressi coffee machine** I found on the sidewalk.

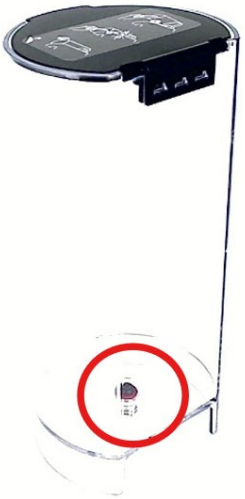
- I used the **water tank coupling port** from the machine as the connection point.
- I also salvaged the **one-way valve** and **O-ring gasket** from the same machine's reservoir.

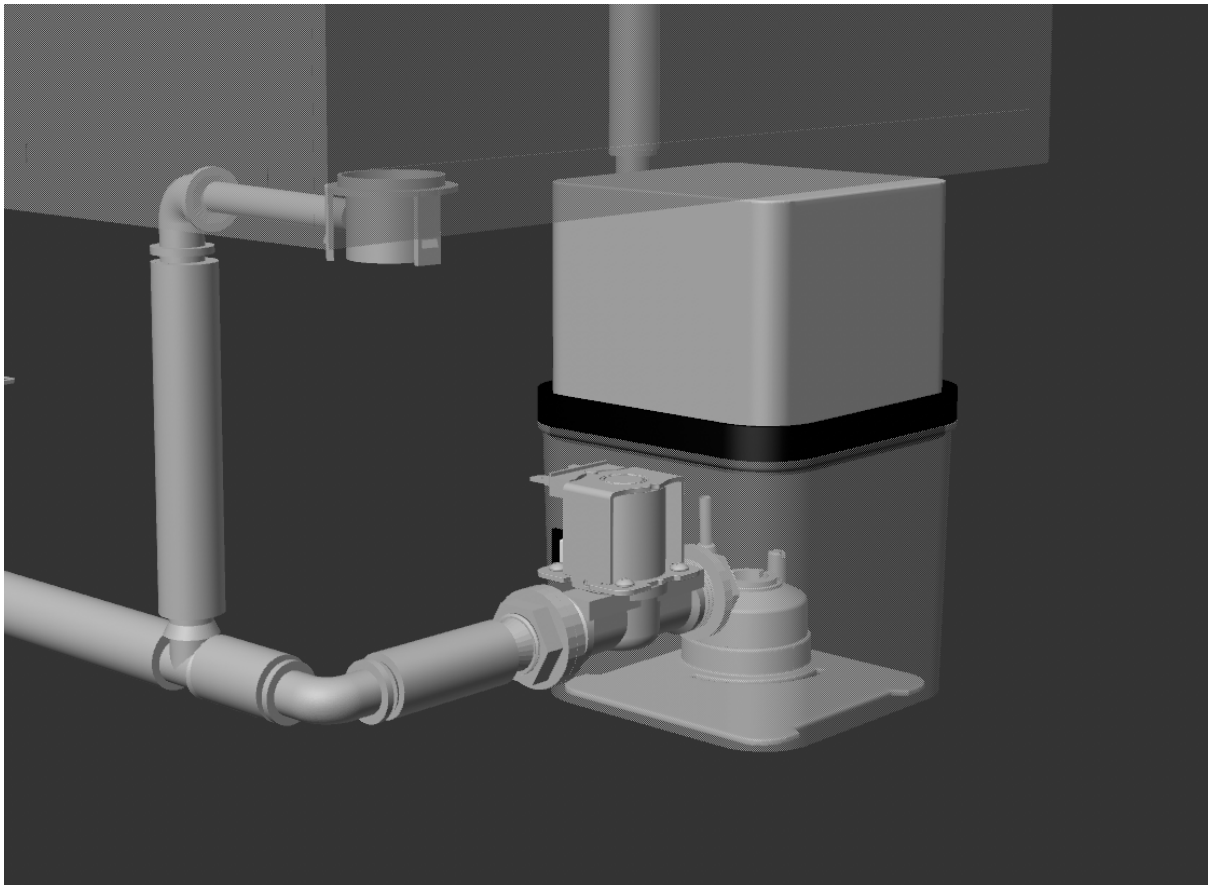
These components ensure a secure, leak-resistant connection that only allows water to flow **one way**, preventing backflow into the tank.

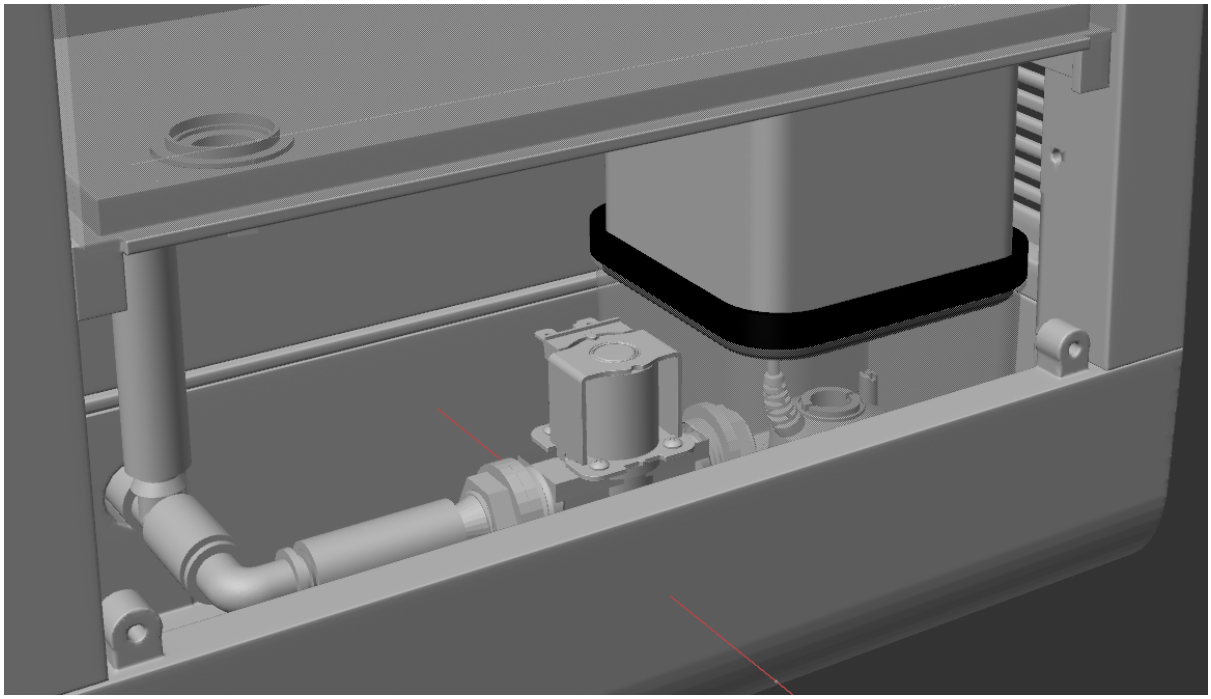
🛠 In the 3D reservoir designs included in the GitHub repo, you'll notice a **hole specifically shaped** to fit this coupling.
If you don't have access to a salvaged Expressi machine, you'll need to either:

- Source a compatible coupling and one-way valve online, or
- Modify the design to work with an alternative valve or connector.

💬 It's a bit of a hacky workaround — but it worked well for this build. I encourage you to adapt as needed!







Non Contact Liquid Level Sensor Water Level Sensor

To monitor the water level in the **secondary reservoir** (where the ultrasonic humidifier sits), I used a:

→ **Non-Contact Liquid Level Sensor**
(AKA Water Level Detection Tool)

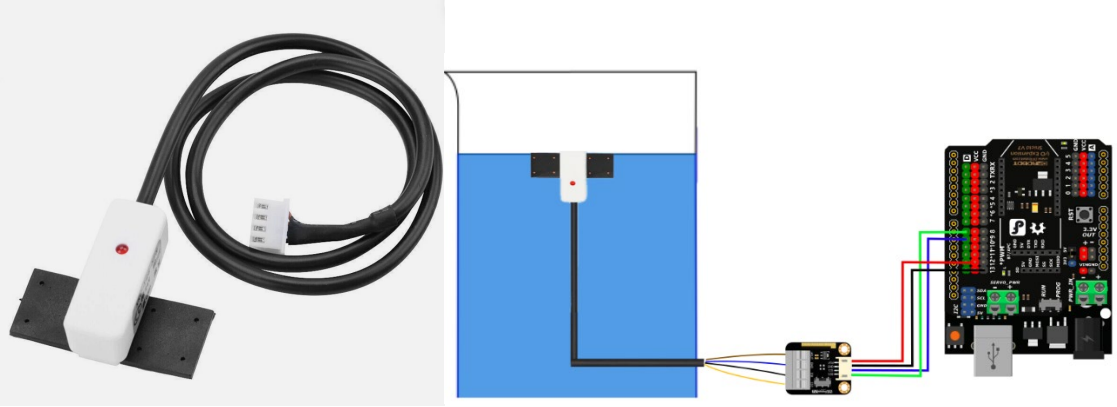
This sensor allows the system to detect when water is low **without physically touching the water**, reducing contamination risk and improving durability.

When the sensor detects a low level, it **triggers the solenoid valve** to open and refill the secondary reservoir from the **main water tank**.

I've included a reference model in the parts list — these are affordable, simple to install, and don't require waterproofing since they stick to the outside of the container.

💡 Works best with thin-walled containers (like the Sistema Tupperware I used).

https://wiki.dfrobot.com/Non_Contact_Capacitive_Liquid_Level_Sensor_SKU_SEN0368



Pinet Aluminium Spring Hinge, Screw Fixing, 30mm x 35mm x 3.3mm

https://au.rs-online.com/web/p/hinges/9174573?gb=s

These are the hinges I used, but feel free to use whatever hinge you prefer, you just need to alter the 3d model on the lid and back wall.

IEC Connector with Fuse

This component connects the MycoClimate unit to the **main power supply** — it's your standard **IEC power inlet**, commonly used in electronics and appliances.

🔌 It delivers power from the mains to the internal 12V system, which then branches out to power all components (via converters where needed).

⚠ **Important:**
Wiring mains electricity can be dangerous. Please ensure you **follow proper safety practices**. If you're unsure, consult a qualified electrician or refer to **trusted wiring guides** available online.

💡 Search: "How to wire an IEC power socket safely"

12v 50mm Fans

To manage airflow and environmental control, I used **two 50mm fans** — each serving a vital function:

1. Humidifier Intake Fan

Mounted on the **3D-printed lid** that sits atop the *Sistema* Tupperware (secondary water reservoir).

Pulls in fresh air and drives it through the ultrasonic humidifier, pushing humidified air into the main chamber.

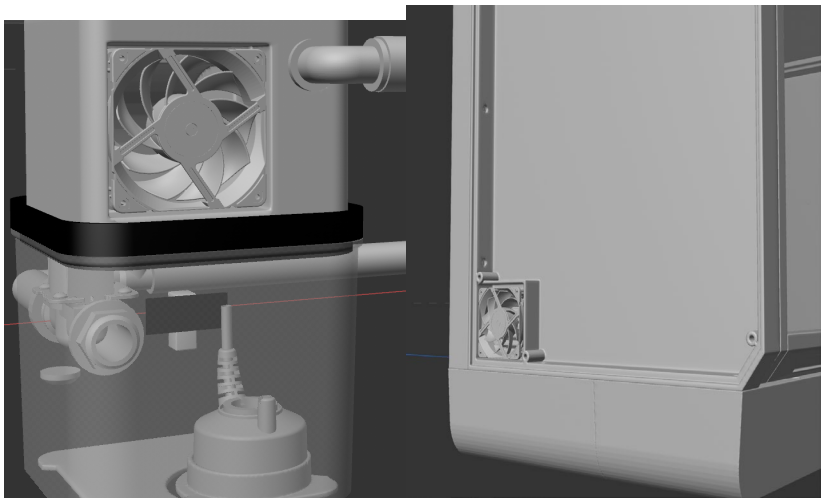
Ensure the fan is oriented to **draw air into** the reservoir system, creating a smooth airflow.

2. CO_2 Exhaust Fan

Installed on the **bottom-left side of the main chamber**.

Continuously draws out excess CO_2 to maintain healthy air exchange for the mushrooms.

Together, these two fans function like **MycoClimate's lungs** — one inhaling moisture-rich, fresh air, the other exhaling CO_2-laden air to keep the growing environment in balance.

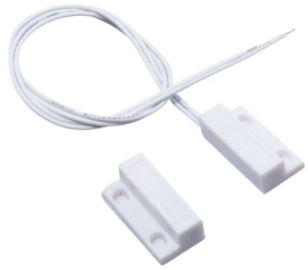


Magnet Sensor

I installed a **magnetic reed sensor** underneath the main water reservoir cover. This acts as a safety switch:

If the cover is removed **while the UV-C light is on** in the secondary reservoir, the system cuts power to the light — preventing accidental exposure to harmful UV rays.

⚠ UV-C light can damage skin and eyes — this sensor was added as a precaution.
While this may be over-engineered for a home grow setup, I included it to prioritize safety and peace of mind.



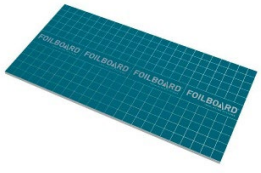
Foilboard 20mm

To improve thermal efficiency, I **designed all the walls of MycoClimate — including the lid — with a 20mm cavity** specifically to fit foilboard insulation.

I used standard **20mm foilboard** (the kind commonly found at hardware stores) and cut it to size for each wall. This helps:

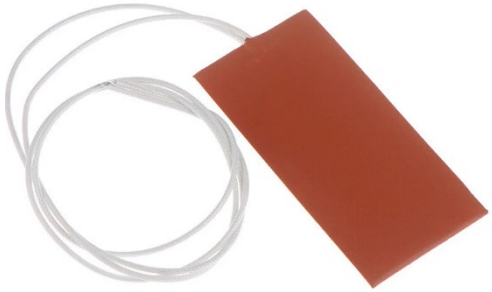
- Maintain stable internal temperatures
- Reduce energy draw from heating and cooling systems
- Create a more controlled microclimate for mushroom cultivation

You can skip or replace this with other insulation materials, but foilboard offered a good balance of **rigidity, reflectivity, and ease of cutting**.



Silicone Heater Pad

I used four heater pads beneath the aluminum tray in the main chamber to provide heat when needed.



Fasteners & Assembly

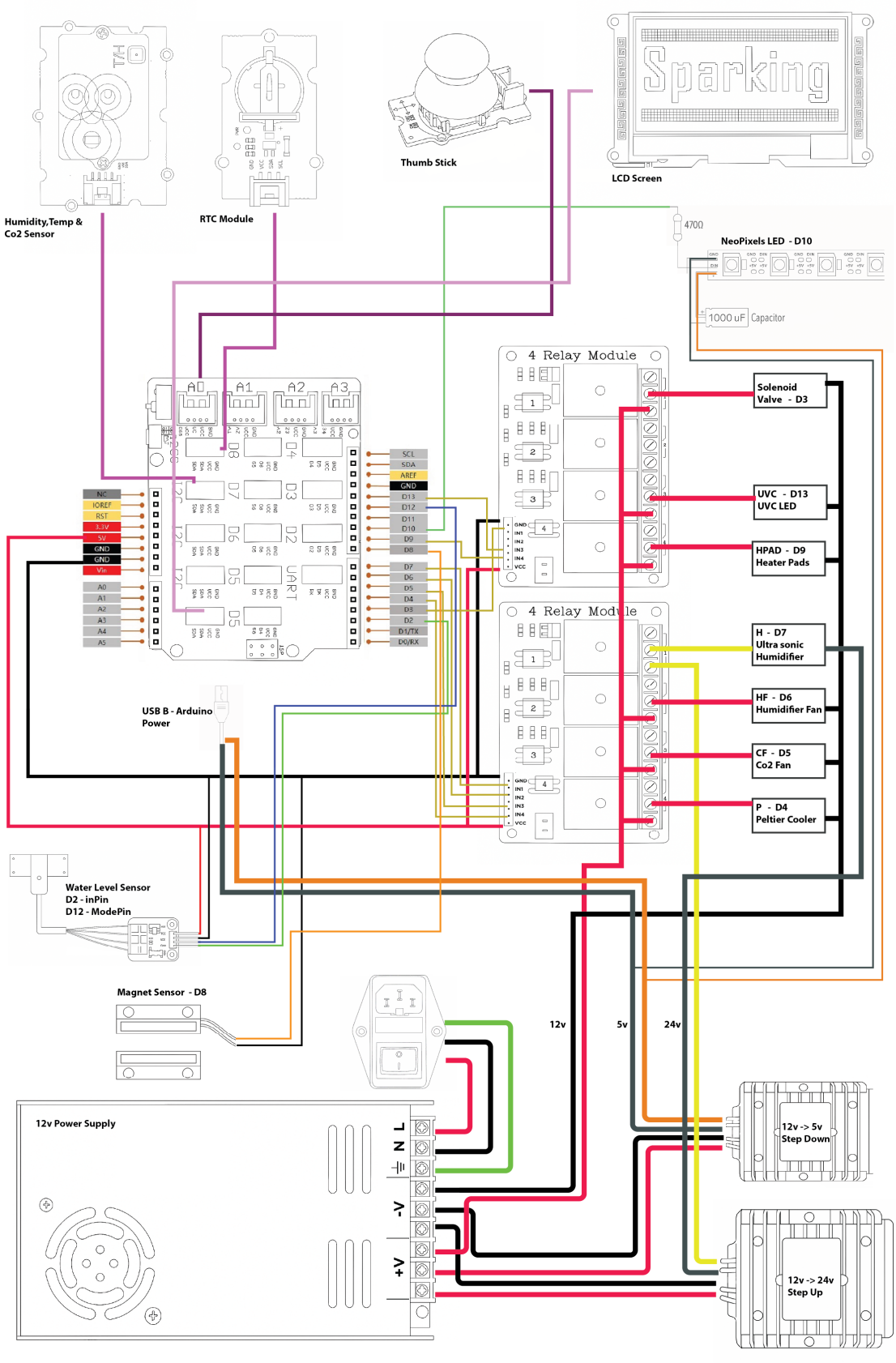
To assemble MycoClimate, I used a combination of **hex screws and threaded inserts** for a clean, secure build:

- **M4 hex screws + M4 inserts** — used to join the main structural components of the chamber.
- **M3 countersunk hex screws + M3 inserts** — used for attaching covers, panels, and smaller detailed parts.

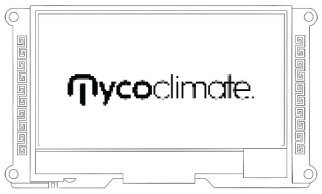
Threaded inserts were heat-set into the printed parts using a soldering iron, allowing for a **reliable and removable fastening method** that won't wear out over time like screws into raw plastic might.

This approach makes it easier to **disassemble and reassemble** the unit for upgrades, cleaning, or troubleshooting.

Wiring Schematics

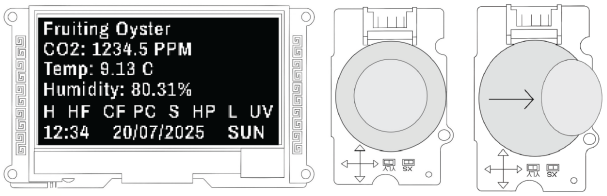


User Interface



When you power on the machine, you'll be greeted with the MycoClimate splash screen.

You can navigate the menus by move the joystick to the right.



It will then proceed to the Home Screen, which displays the last selected settings along with real-time readings for CO_2, temperature, and humidity.

----------→

Beneath these values, you'll see status codes indicating which components are currently active: These codes help you quickly assess what's running at a glance.

At the bottom of the screen, the current time and date are displayed.

H – Humidifier

HF – Humidifier Fan

CF – CO_2 Fan

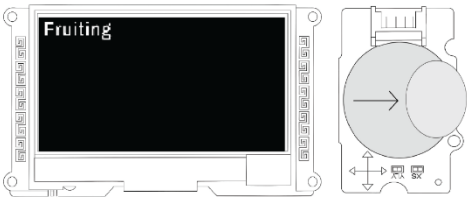
PC – Peltier Cooler

S – Solenoid Valve

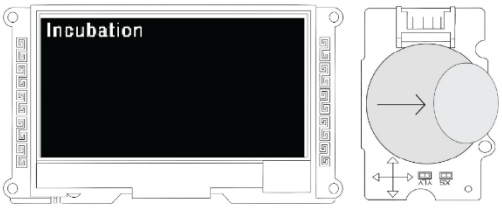
HP – Heater Pads

L – Chamber LEDs

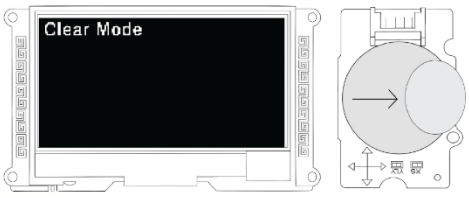
UV – UV LED



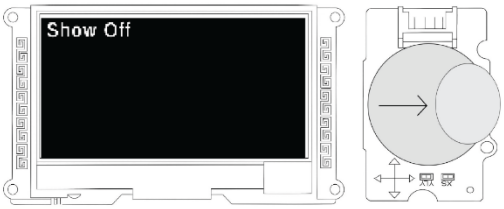
Here you can select which mushroom you would like to fruit. See page 37.



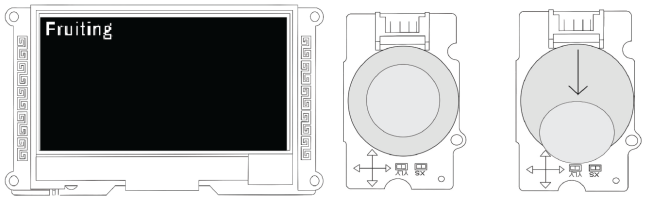
Incubation mode is used for growing and developing mycelium within the substrate block.



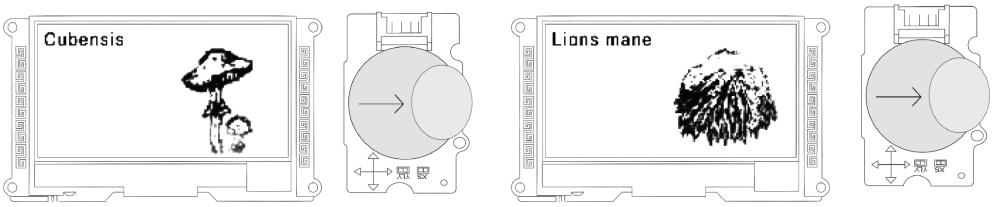
Clear the fruiting mode.

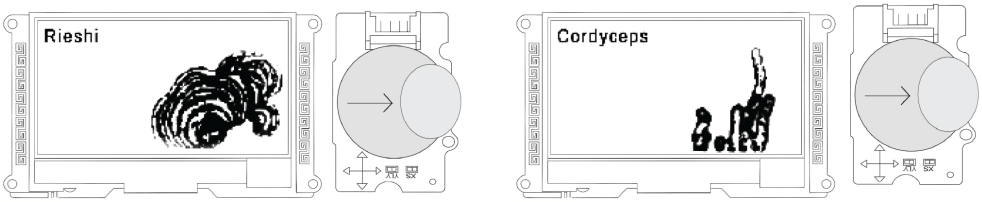


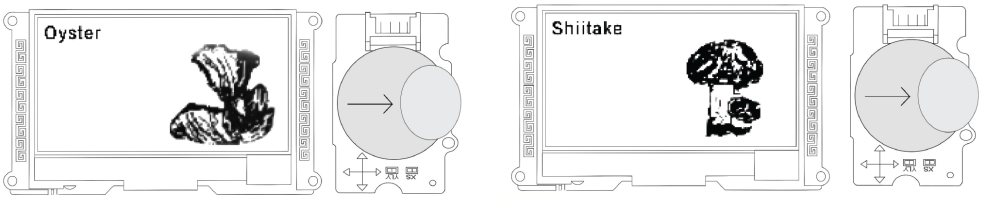
This will trigger the humidifier and LED lights in the chamber to show off what you have growing.



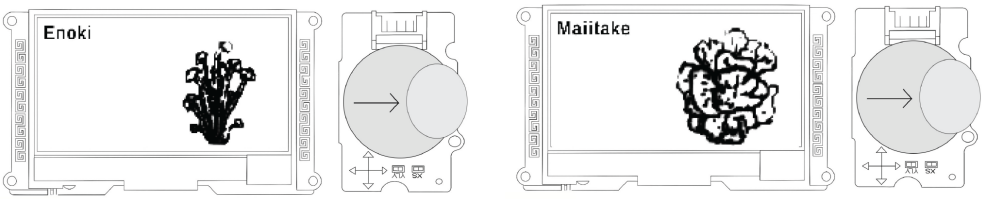
While on the Fruiting page, pressing down on the thumbstick lets you select your desired mode.

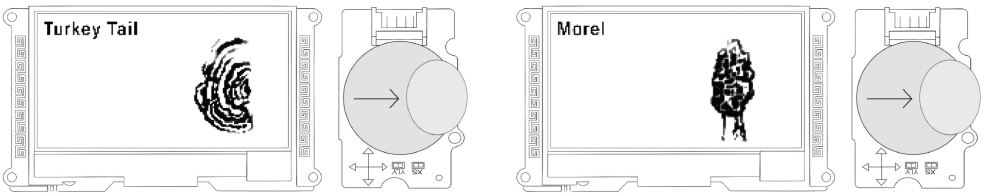






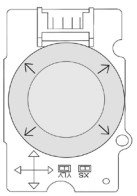
v



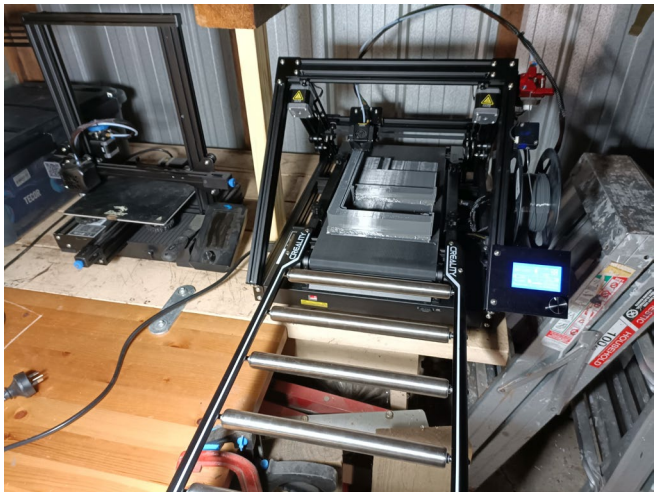


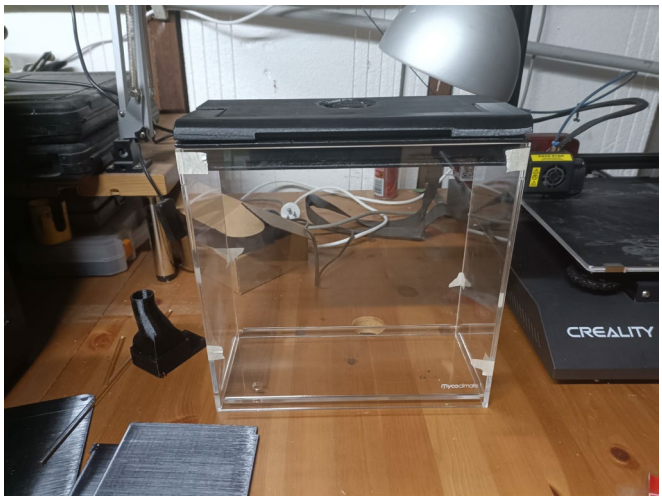
When you've picked the mode you want, just press the thumbstick in to lock it in.

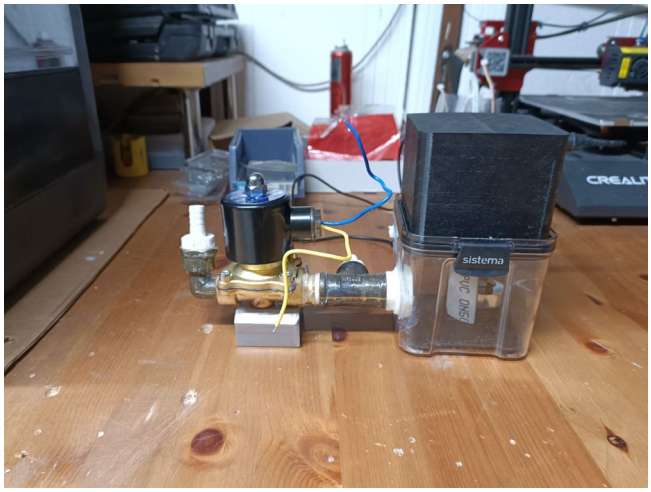
It will take you back to the Home screen.



Build Photos






sistema


sistema