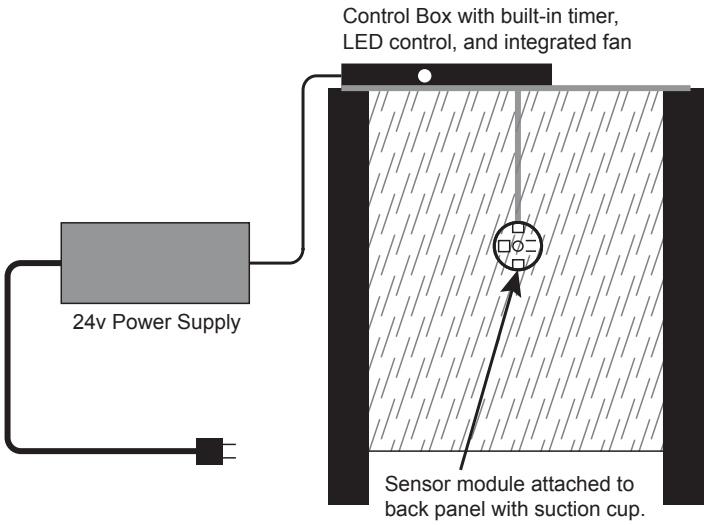
Growing Beyond Earth® Control Box Quick-Start Guide (Fall 2024)



Welcome to the **Growing Beyond Earth® classroom kit**! This guide will help you set up the system, explain the default program, and show you how to connect to Wi-Fi so you can view sensor data and control the system remotely. We're here to make sure you have a smooth experience growing plants in your classroom!

1. Powering On the System

1. Connect the 24v power supply cable to the jack on the the Control Box
2. Plug in the 24v power supply to an outlet

When powered on, the LED on the Control Box pulses to show the system is running:

- **Blue**: Connected to Wi-Fi.
- **White**: Not connected to Wi-Fi.
- **Yellow**: No SD card detected.
- **Red (flashing)**: SD card inserted but unreadable (might not be formatted correctly).

2. Default Program

Your Control Box comes pre-programmed to control the lights and fan automatically, but you can easily adjust the settings through the **micro-SD card** or, even better, by connecting to Wi-Fi. Here's what the default settings do:

- The **fan** will run only when **humidity is 60% or greater**.
- The lights are programmed to turn on at **7 AM** and turn off at **7 PM** each day with the following brightness levels: Red: **10**, Green: **0**, Blue: **30**, White: **115**

3. Connecting to Wi-Fi

While your system will work without Wi-Fi, connecting it has several important benefits:

- **View sensor data** from your classroom in real time via a web interface.
- **Modify the light and fan program** directly from the web without needing to access the Control Box.
- **Receive program updates** automatically from the Growing Beyond Earth team.

Wi-Fi Setup Steps:

1. **Edit the Wi-Fi settings:** On the micro-SD card, open the file called **“wifi_settings.json”** using a text editor like Notepad (Windows) or TextEdit (Mac), and enter your network information. The file looks like this:

   wifi_settings.json

   ```
   {
     "NETWORK_NAME": "Your_SSID",
     "NETWORK_PASSWORD": "Your_Password"
   }
   ```

   Replace **“Your_SSID”** with your Wi-Fi network name and **“Your_Password”** with the network password. Save the file after editing.

2. **Find your device’s MAC address** by scanning the **QR code** on the light panel.
3. **Provide this MAC address to your school’s IT technician to have the Control Box put on the “allow list” for Wi-Fi access.**
4. Once the device is on the network, it will upload sensor data to the cloud, and you’ll be able to view and adjust settings from any web browser.

4. Sensors and Data Logging

The Control Box comes with an attached sensor module that monitors the environment inside the growth chamber. The sensor module, along with sensors located inside the Control Box, gathers the following data

- **Temperature**
- **Humidity**
- **CO2 concentration**
- **Pressure**
- **Lux (light intensity)**
- **Voltage, current, and power usage of the lights**
- **Fan speed**

These readings are logged every ten minutes (by default) to a **single CSV file** on the **micro-SD card**. If connected to Wi-Fi, the data will also be uploaded to the cloud for easy access. Future upgrades may allow for the addition of a **soil moisture sensor**, a **programmable water pump**, and a **camera** to monitor plant growth.

5. Accessing and Modifying Settings

The system is already set up with the default program. However, you can make adjustments to the light and fan settings by editing the **JSON files** on the micro-SD card or via the web interface if connected to Wi-Fi.

Editing Light and Fan Settings via SD Card:

1. **Turn off** the Control Box.
2. Remove the **micro-SD card** and insert it into your computer.
3. Open the **“program.json”** file using a text editor like Notepad (Windows) or TextEdit (Mac).
4. Modify the settings as needed. This section of the program indicates the values you might want to modify to adjust the timing and color balance of your light:

program.json

```
…
    {
        "type": "time",
        "start": "07:00",
        "end": "19:00",
        "actions": [
          {
            "red": 10,
            "green": 0,
            "blue": 30,
            "white": 115
          }
        ]
      },
…
```

5. To set your **time zone**, open **“timezone.json”** and adjust the **UTC offset**. The file looks like this:

   timezone.json

   ```
   {
     "time zone": {
       "UTC offset": -4
     }
   }
   ```

   The **UTC offset** sets the correct time for your location. You can look up your UTC offset at websites like timeanddate.com.

6. Save your files after making changes, and safely eject the SD card..
7. Reinsert the SD card into the Control Box and turn it back on. Your new settings will take effect immediately.
8. If anything goes wrong, or if you want to revert to the default program, you can simply delete your edited files from the SD card. New files will be created with the default settings next time you power on the system.

6. Accessing Data Logs

Sensor data are logged in **one large CSV file** stored on the SD card. This file includes hourly logs of all the parameters measured by the system.

To view the logs:

1. **Turn off** the Control Box and remove the SD card.
2. Insert the SD card into your computer.
3. Open the **“log.csv”** file.
4. You can copy and paste the data into a spreadsheet for further analysis.

7. Troubleshooting

Here are a few common issues and their solutions:

- **No SD card**: If the LED is pulsing **yellow**, make sure the micro-SD card is inserted correctly.
- **Unreadable SD card**: If the LED is **flashing red**, the SD card might not be formatted correctly. Make sure the card is formatted as **FAT32**.
- **Wi-Fi connection issues**: If your school uses a captive portal or restricted network, ask your IT technician to **put the device on the allow list** using the MAC address from the QR code.

8. Included accessories

Growth chamber assembly screws and protective pads— Use the screws to assemble the growth chamber, and use the optional protective pads on the bottom plate to protect your table.

USB Micro-SD card reader— Plugs into a USB-A port on your computer, allowing you to read and write files on the micro-SD card.

Micro-SD to SD card adapter—As an alternative to the card reader described above, this adapter will allow you to read the micro-SD card if your computer has a full-size SD card slot.

USB to micro-USB cable— For installing GBE software updates and for coding your own software using Micropython, CircuitPython, Arduino, etc.

USB-C to USB-A adapter— For newer computers without USB-A ports.

9. Future Additions

The Growing Beyond Earth system is designed to grow with you. While the current kit includes essential features, future upgrades may allow for:

- A **soil moisture sensor** to monitor the water needs of your plants.
- A **programmable water pump** to automate watering schedules.
- A **camera** to take time-lapse images of plant growth.

10. Additional Resources

For more advanced use of the Control Box, or to learn more about the code running on the system, check out these resources:

- **Help with JSON editing**: You can use online tools like jsonlint.com to validate any changes you make to the JSON files before saving them.
- **Learn more about Raspberry Pi Pico**: The Control Box runs on a Raspberry Pi Pico. Learn more about it here: hackspace.raspberrypi.com/books/micropython-pico