# Beehive Monitor User Manual

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This User Manual will help you setup, operate, and understand the Beehive monitor. This Beehive Monitor was built in 2020-2021 and installed in 2021. If you are operating on it and have any questions, please contact the listed technician.

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# Installation Instructions

WARNING, read all installation instructions before attempting installation.

1. Lift the beehive up enough that the monitor can be slid underneath.
2. Place the monitor underneath the beehive with the side of the load cell shown in Figure 1 facing down. Make sure each of the four load cell sensors are aligned with each of the four corners of the beehive.

Diagram

Description automatically generated

Figure

1. Place the battery module near the beehive monitor in a location that is protected from exposure to rain or sunlight.
2. Insert the internal temperature and humidity sensors through the beehive entrance. Ensure the internal sensors are well inside the beehive, a few inches from the opening, for accurate measurements. Place the external temperature sensor outside the hive.
3. Place the beehive atop the monitor, being careful to leave the blue USB connection cord for the monitor exposed so that a laptop can connect to it. Connect the Arduino to a laptop to power it up.
4. Ensure the beehive monitor Arduino is displaying its *white* indicator “heartbeat” light and the system can be powered on.
5. Ensure the laptop in use has the Arduino IDE software installed. The Arduino will come programmed to zero out sensor measurements on power up. If you would like to zero out other components, please contact a technician listed.
6. Run the standard operation Arduino program on the beehive monitor while maintaining a direct connection between the laptop and the monitor. A link to the program GitHub containing the necessary code is provided at the end of the document. When you open the Arduino file it will look like figure 2. How to find the standard operation Arduino program is located in the contact section.

Graphical user interface, text, application

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Figure

1. Press the arrow button while maintaining a connection, via the blue connection cable, between the laptop USB port and the Arduino. The arrow is seen in figure 3.

A picture containing graphical user interface

Description automatically generated

Figure

1. Select the Serial Monitor on the left side of the Arduino IDE to bring up the monitor window and check the program is running properly, as seen in figure 4.

Graphical user interface, application, website

Description automatically generated

Figure

1. Wait until the output window outputs these 3 lines, as seen in figure 5. If it does not, please email the technician with the output from the output window.

Graphical user interface, application, Word

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Figure

1. Disconnect the laptop and ensure the weatherization capsule is secure.

\*If you do not have any of the programs mentioned, please email [sethworthylake@gmail.com](mailto:sethworthylake@gmail.com)\*

# Setting Up Bluetooth

While near the monitor and *disconnected* from the Arduino open your Windows laptop settings. Navigate to Bluetooth & other devices. Select add a device as seen in figure 6.

Text

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Figure

Select Bluetooth. You should see a device named H-C 2020-06-1. Pair the laptop to this device. When a prompted for a password enter 1234 or 0000.

Once connected go to the More Bluetooth Options on the right side. Select COM Ports and then select Add.

Graphical user interface, text, application

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Figure

Then select Outgoing and find the H-C-2010-06-01 and then select it and hit Ok. The menu should look like figure 4.

Graphical user interface, text, application

Description automatically generated

Figure

Return to the More Bluetooth Options page and note which COM port is used for the Outgoing direction. You will use it when running the BeeHive\_Data\_Client.exe program on your laptop that communicates with the Monitor Bluetooth. When you go to run the program make sure your Bluetooth is on and you are connected to the Bluetooth monitor.

# Operating Instructions

Verify the monitor reading light is blinking every 30 minutes to an hour. If that is not happening check to make sure the Arduino heartbeat indicator is on. If the light is not on or the reading light is not going off, then please email the technician.

\*Read the Setting Up Bluetooth section and make sure everything is working before continuing.\*

Ensure that The Monitor’s send light turns on once the button is pressed. Then, using the Bluetooth Connection executable, connect to the Bluetooth and it will return a comma delimited text file that will be located in the folder where the Bluetooth Connection executable is located. The file will be named in the following format:

DAYOFTHEWEEK\_MONTH\_DAY#\_HOUR;MINUTE;SECOND\_YEAR.txt

Example Fri\_Mar\_12\_13;38;17\_2021.txt

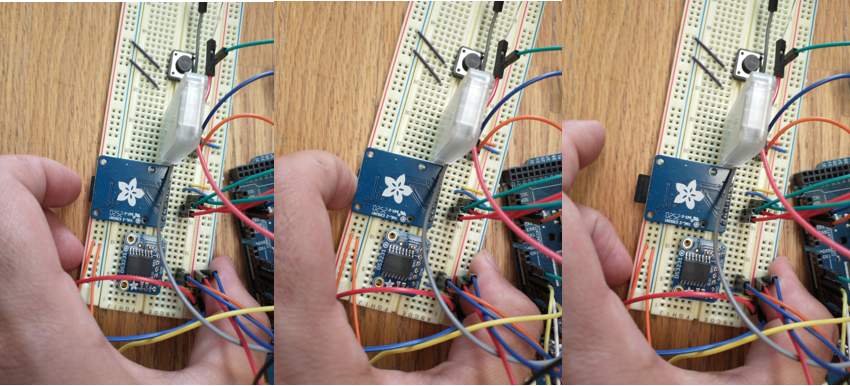
If the data transmission button is not pressed prior to opening the executable file, the output will appear as shown in figure 9.

Text

Description automatically generated

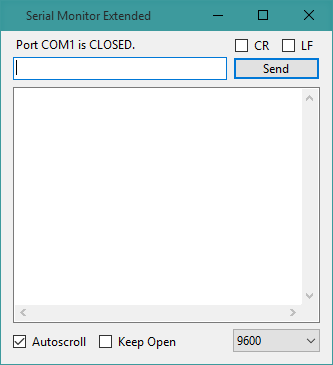
Figure 9

If the system ever dies and you need to extract the data, open the monitor’s Tupperware container with the Arduino and circuitry in it. Extract the SD card, which will contain all monitor measurements, by gently depressing the card into its slot and releasing to “click it out”, as shown in this diagram.



\*Make sure to put the SD card into the system before continuing as that is where the data is saved\*

# Images



Output window

Graphical user interface, text, application

Description automatically generated

Bluetooth Executable

Graphical user interface, text

Description automatically generated

Data Output

A picture containing indoor, floor, wooden, room

Description automatically generated

Monitor

# Importing Data into Excel

Go into your Excel file and go to Data. Then to Get Data -> From File -> From Txt/Csv. Then select the monitor file retrieved through Bluetooth transmission or copied from the SD card.

Graphical user interface, application, table, Excel

Description automatically generated

Ensure the data formatting is as desired, then select load.

Graphical user interface, table

Description automatically generated

Your data should then appear relative to your selections:

Table

Description automatically generated

# 

# Theory of Operation

The Monitor will spend most of its time in low power mode. It will wait until either the button to request a transmission is pressed or the program timer goes off. If the system wakes up from the timer, then it will turn the *red* Read LED ON and read data from all the sensors before writing that data to the SD card. The Read LED will then turn OFF and the monitor controller will go back to sleep. If the system wakes up in response to a button press it will turn the *green* Send LED ON. It will wait for the user to run the BeeHive\_Data\_Client.exe so it can establish a connection then send the data stored on the SD card. If the user does not run the BeeHive\_Data\_Client.exe within 2 minutes the transmission will be halted, and the green Send LED will shut OFF before the monitor returns to sleep mode.

Text, chat or text message

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# Hardware Components

HX711 Load Cell Sensors x4

DHT11 Humiture Sensor x1

DS18B20 Waterproof Temperature Sensor x2

HC-05 Bluetooth Module x1

MicroSD card breakout board+ x1

5mm Led x2

Button x1

ExpertPower 12 Volt 12 Ah Rechargeable Battery with F2 Terminals || EXP12120 x1

# Operating Conditions & Ranges

HX711 Load Cell Single

Max Weight: 50kg, 110.2 lbs.

HX711 Load Cell All four in Wheatstone configuration

Max Weight: 50kg \* 4 = 200kg, 440.9 lbs.

DHT11 Humiture Sensor

Min Temperature: -55°C

Max Temperature: 125°C

Humidity Accuracy: ±5％

Temperature Accuracy: ±2°C

DS18B20 Waterproof Temperature Sensor

Min Temperature: -55°C

Max Temperature: 125°C

±0.5°C Accuracy from -10°C to +85°C

HC-05 Bluetooth Module

Min Temperature: -20 °C

Max Temperature: 75°C

\*MINIMIZE EXPOSURE TO HUMIDITY\*

MicroSD card breakout board+

Min Temperature: -25°C

Max Temperature: 85°C

\*MINIMIZE EXPOSURE TO HUMIDITY\*

ExpertPower 12 Volt 12 Ah Rechargeable Battery with F2 Terminals || EXP12120

Temperature will affect capacity, can be found in Specification Sheet.

Battery Capacity: 12000 Milliampere Hour (mAh)

\*MINIMIZE EXPOSURE TO RAIN\*

# Warnings & Cautions

This monitor is designed to work with Honeybees. To ensure your safety and the Bee’s safety please wear a Bee suit and operate slowly and carefully. If you are allergic to Bee stings, please operate with an EpiPen pen or someone who can drive you to a nearby emergency room.

# Solar Extension

Solar Component : Topsolar Solar Panel Kit 30W

Operating Guide: There is a charger controller that controls the power going to the Monitor from the battery and the power that is coming from the solar panel. If there are any issues with this component, please research the Topsolar Solar Panel Kits Documentation.

# Contact

Technician – Seth Worthylake, Email: [sethworthylake@gmail.com](mailto:sethworthylake@gmail.com)

Program Code – <https://github.com/sethWorthylake/BeeBoxPublic>

To get the Standard Operation software. Go to the link above then go to download ZIP

Graphical user interface, text, application, email

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From there unzip the files and go to BuzzBox/BuzzBox/BeeHiveMonitorTest



From there double click on the BeeHiveMonitorTest.ino

Table

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If the Arduino IDE does not open it up downloaded it at this link

https://www.arduino.cc/en/software

Then try again.