USER DOCUMENTATION

Welcome to the world of BroodMinder

None

None

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2. Introduction

2.1 Welcome to the world of BroodMinder

If you're reading this, it's the start of a new adventure. You are now part of the precision beekeeper community. A community that uses information to improve bees' health. But also to improve everyone's practice, thanks to a deeper knowledge of the behaviour of colonies and their ecosystems.

2.2 Introduction to precision beekeeping

In precision beekeeping, the objective is to make the best use of all available data to provide the beekeeper with the right information at the right time. The beekeeper is informed in real time of all the events in their apiary. Those that are taking place at the moment, but also those to come. In this way, one can plan inspections in advance and knows in advance what to expect. The diagnosis is made before the journey to the apiary and completed by the inspection itself.

To achieve this goal, algorithms are our best friends. These are models that analyse the collected information and translate it into "beekeeping language".

Some resources on precision beekeeping:

- Precision beekeeping - Wikipedia
- Precision beekeeping 101

2.3 Overview of the system

The Broodminder system consists of several components. With this very modular system, you can start simply and then expand the use according to your needs.

Here in a few words are the main components of the system.

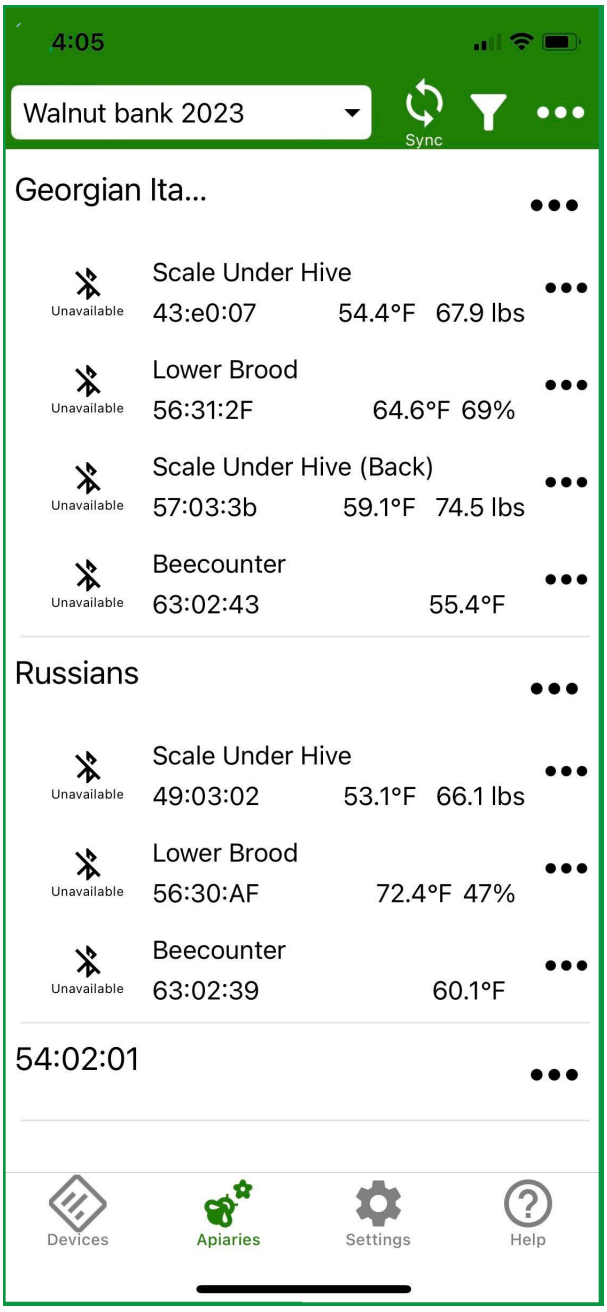
BroodMinder Sensors

Weight, temperature, humidity sensors... A complete and at the same time modular range of devices that enable you to equip your hives according to your needs.

All the sensors transmit the information via Bluetooth and, of course, you can use your smartphone to collect this data. Simply download the BroodMinder Bees App from your favorite store (Apple or Android).

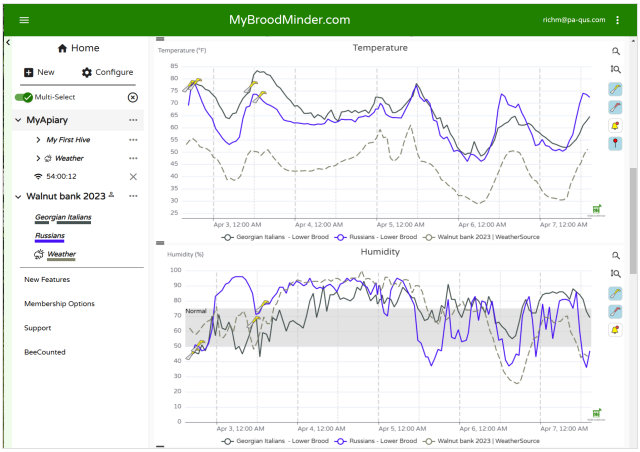
BroodMinder Bees App

The 4th generation app for your phone or tablet is called the "Bees" app and is available for iPhone or Android. This is the quickest and easiest way to start collecting data from the sensors. Use it in the apiary to locate the sensors and to take hive/apiary notes by either typing or speaking to the phone. With the app you can collect and review the data regardless of if the apiary has cellular or WiFi connectivity. The app will then automatically synchronize with MyBroodMinder.com, our cloud based analysis system. when internet becomes available.



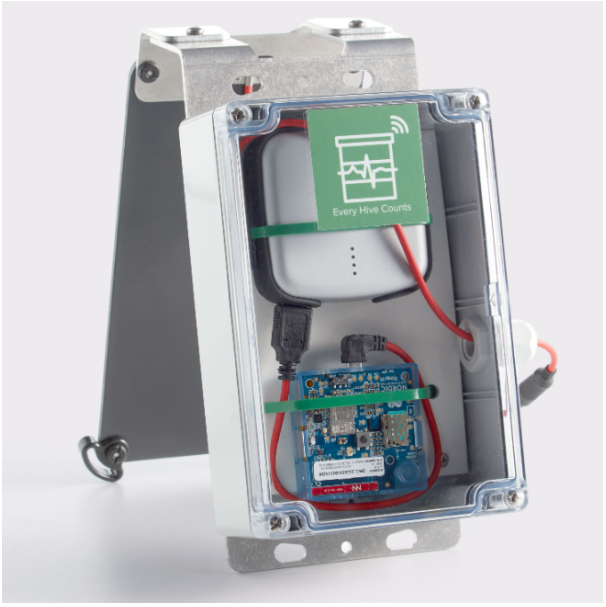
MyBroodMinder.com

The data transmitted by your phone or by the hub arrives on the Mybroodminder.com portal. In this space, you can configure your apiary, your hives and assign your sensors to them. You can also visualize the raw data on fluid and interactive graphs.



Hub

For those who want real-time data, the Hub is the solution. This autonomous box must be installed in the middle of the apiary. It automatically reads the information from all the sensors and transmits them via the 3G/4G cellular network or WIFI to the cloud, where they are processed.



2.4 And the adventure begins!

We hope that this first round makes you want to continue discovering the full potential of the system. Each brick that makes up the system has its own features and you will explore them in greater depth as you go along.

3. Quick Start Guide

We've done our best to make the installation and use of your BroodMinders intuitive and easy. Follow the process below to get to grips with all aspects of the solution (Sensors, App and Web...) and you'll have every chance of success.

Each step is described in detail later in this document.

AT HOME		
1.		Install the App
2.		Create your account
3.		Power your devices
4.		Assign to a hive
5.		Make your first sync
6.		Power on Hub

AT YOUR APIARY		
7.		Install devices in hive
8.		Install your hub
9.		Update starting dates
10.		View and explore

3.1 Before you start

Take note of the following best practices:

Set-up everything AT HOME

Make sure the system is functional before installing it in the apiary, then it will be less easy to set up.

Tag your hives

Do what it takes to identify your hives, it will be much better. 1, 2, 3 ..... A, B, C ... K254.

Use our video library

Watch the video help "Quick Start with CS Kit"

Need help?

You can always contact us at Support@BroodMinder.com

3.2 START AT HOME

1. Install BroodMinder Bees

Download Broodminder Bees from your preferred store.
Scan this QR code to be headed to it :

2. Create your account

Create your account into the Bees App. A single account for everything : App and Web MyBroodminder.

In BeesApp, on the Apiary tab, create your first apiary and your first hive, they will be needed for the next steps.

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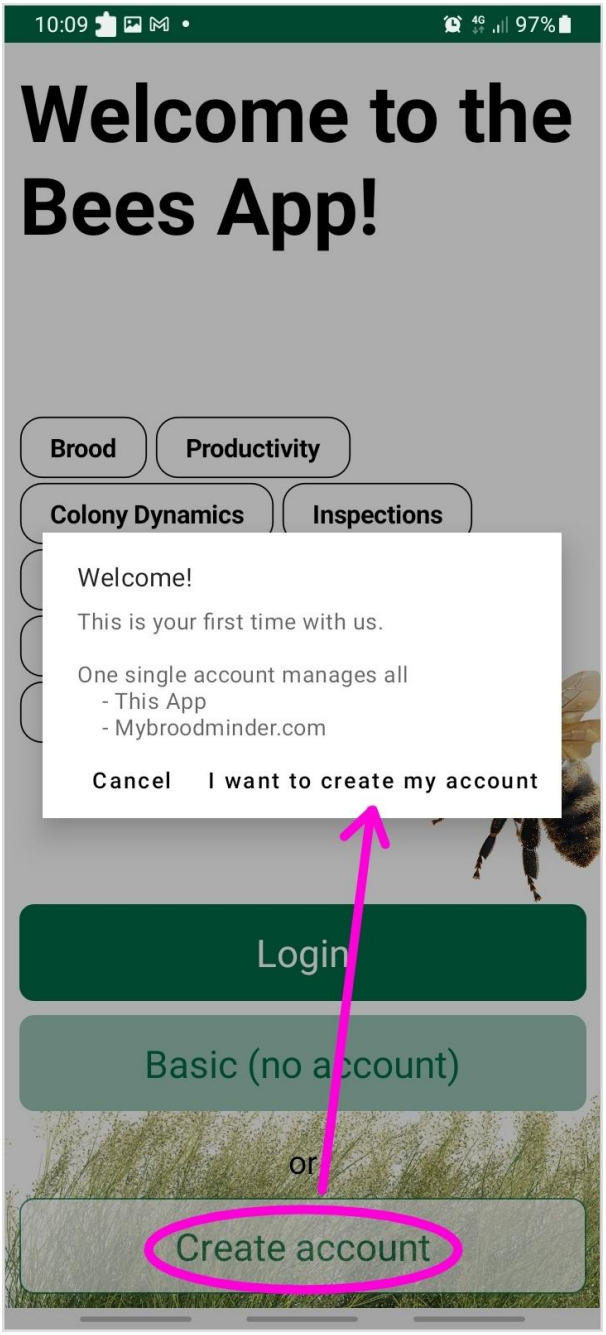
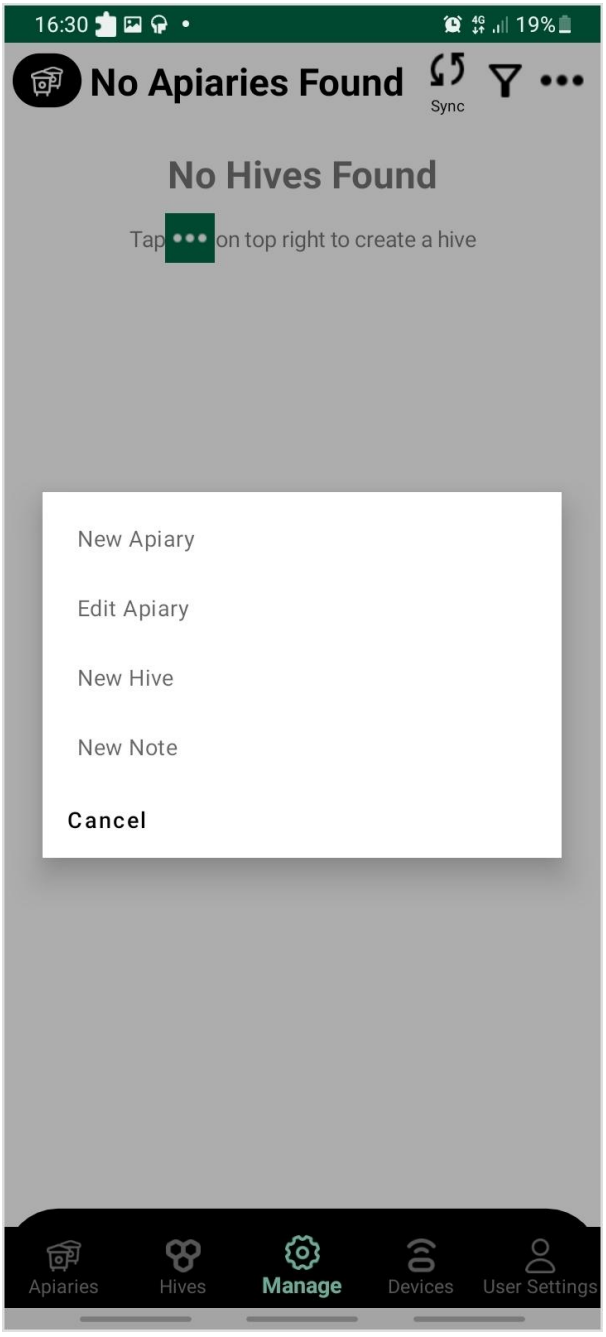
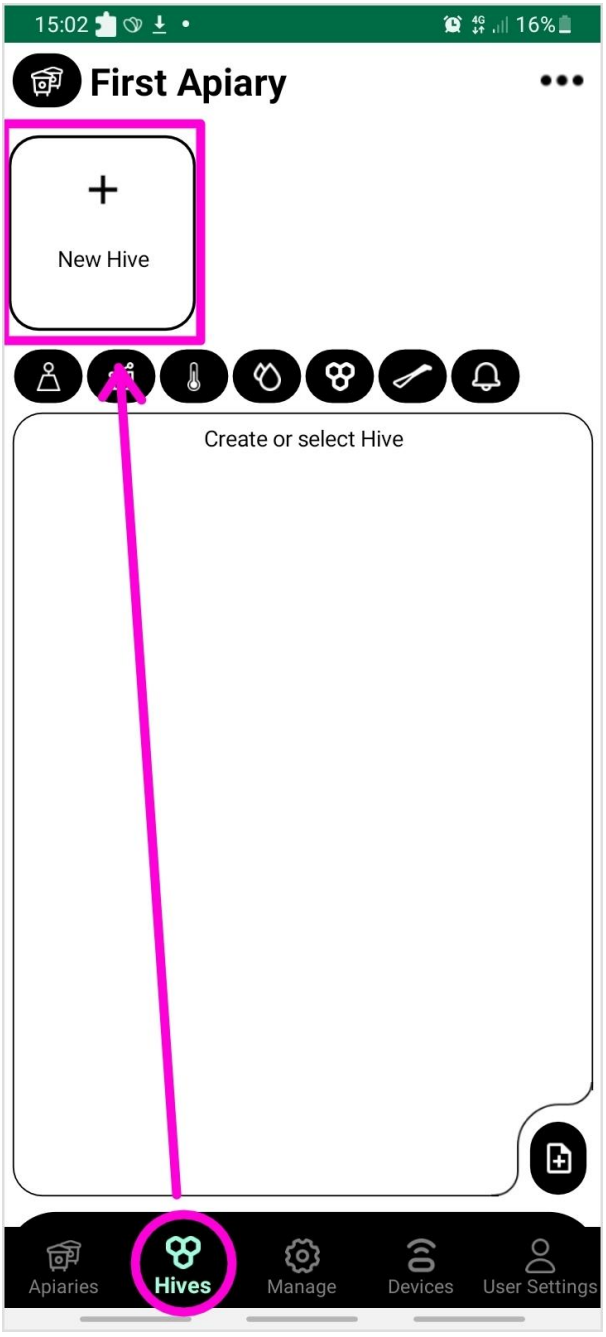


In Bees you have several tabs that we will navigate :

Create your first apiary with `... > New apiary`



Create your first hive with `Hives > New hive`



We can now move on to assign sensors to this newly created hive. But first we have to power on devices.

3. Activate your devices

In general all our devices have a pull strip. Older models (T2) might have a push button.

Take care of this:

With any device, pulling the tab should make the board blink. If you do not see any blink, push the batteries against the + contact. Sometimes the battery holder can be stiff and avoid the spring to push them through. (mostly for AA batteries)

Do not discard any plastic part. Keep them all in place.

Check that all seals are properly installed.

Verify that cable glands are tight too when appropriate.

Understand device model

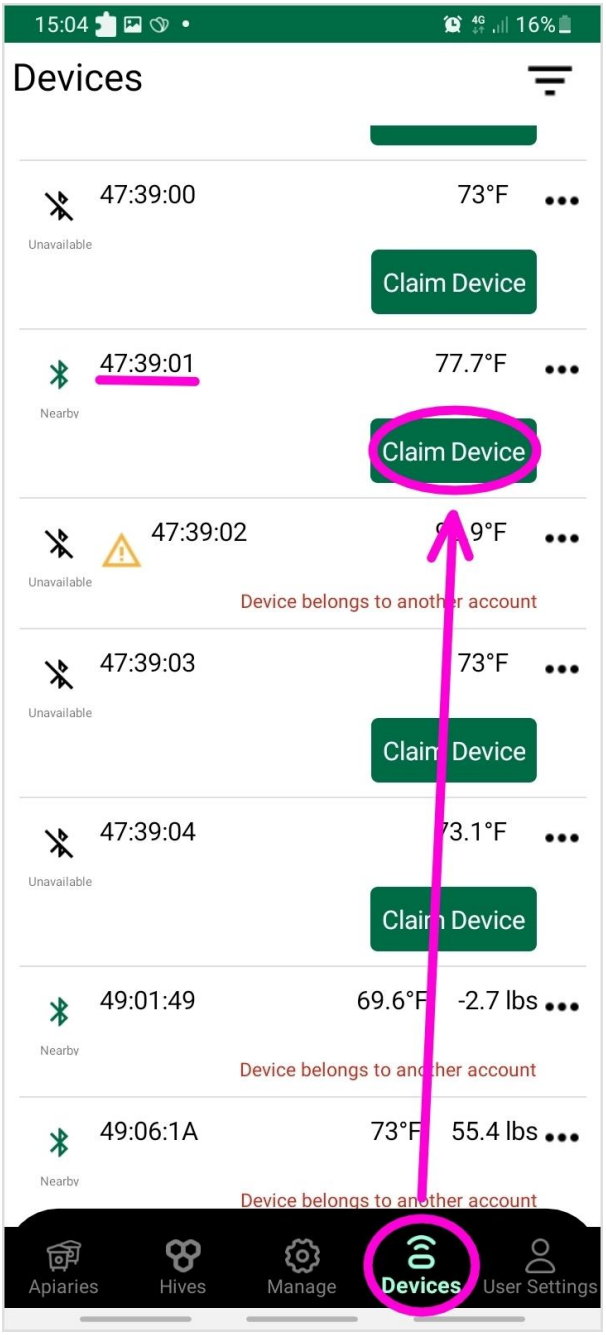
All BroodMinder sensors have a 6-digit reference number in the form XX:XX:XX. The first two digits of this reference define the model:

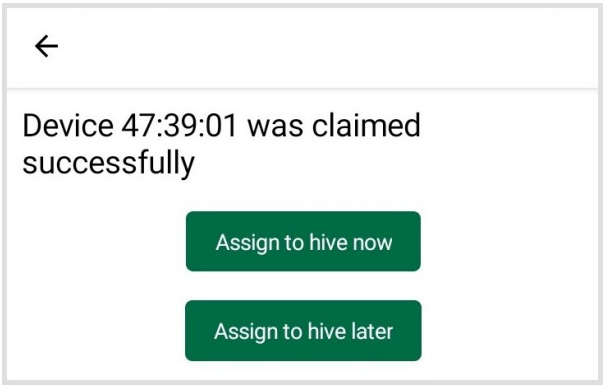
- 41, 47 : T
- 42, 56 : TH
- 43, 57 : W
- 49 : W3 et W4
- 52 : SubHub
- 54 : Hub
- 58 : DIY
- 63 : BeeDar

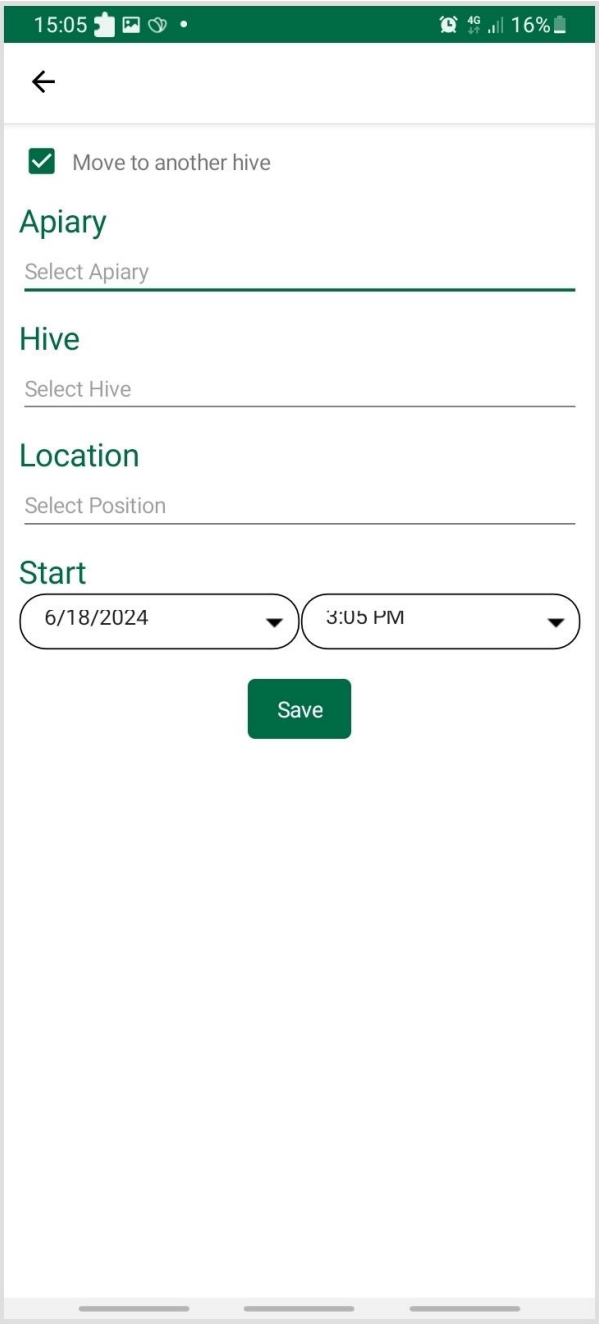
4. Assign devices to hives

First you need to claim the device by clicking on the green `Claim` button found in the `Devices` tab. This operation will associate each sensor you claim to your account . You will then be asked to attach the sensor to a hive. You can proceed or cancel and come back later via the menu `...`.

Attach each device to a hive.







Available device positions are

Position	typical use
Lower brood	TH or T into the lower brood box
Upper brood	TH or T into the upper brood box
Inner cover	TH or T under the cover
Scale under hive	full weight scales like W3, W4
Scale under hive (back)	half weight (bar) scales like W and W5
Beecounter	Beedar
Outside Hive	beekeeper's choice
Other	beekeeper's choice
Custom [1-7]	for research purposes (multiple devices)

Device location is important

Carefully select position for internal sensors. Some metrics like brood are only computed if the device is assigned to the brood location.

Now return to the **Apiaries** tab to perform the first sync.

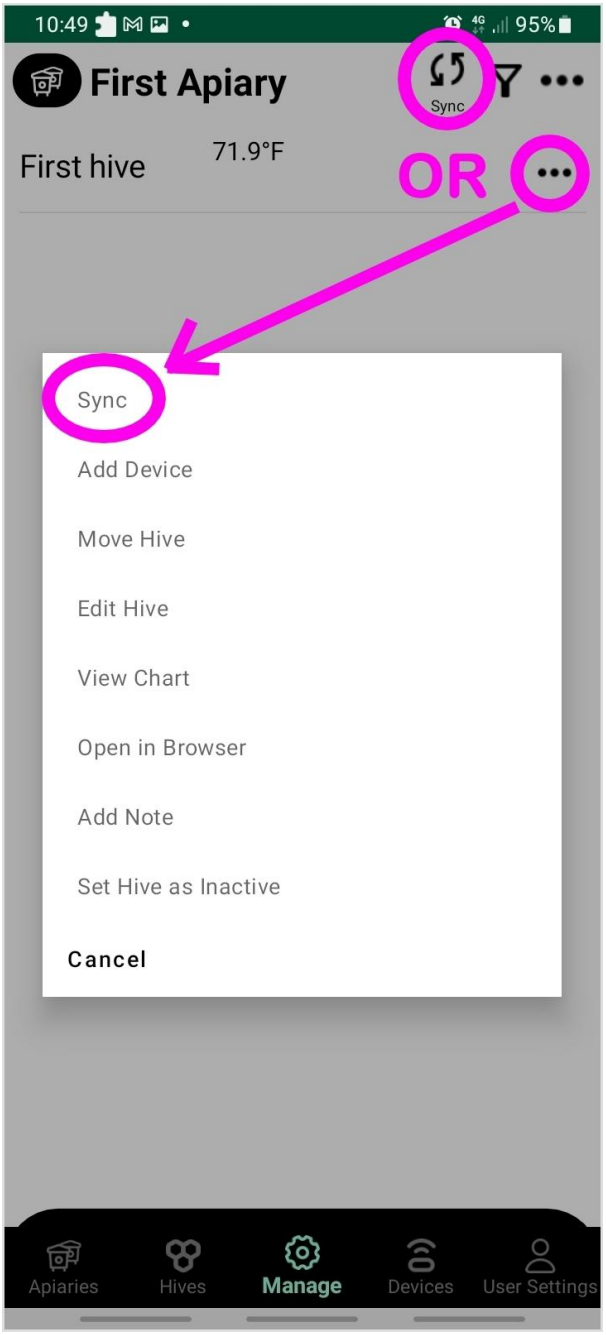
5. Make your first sync

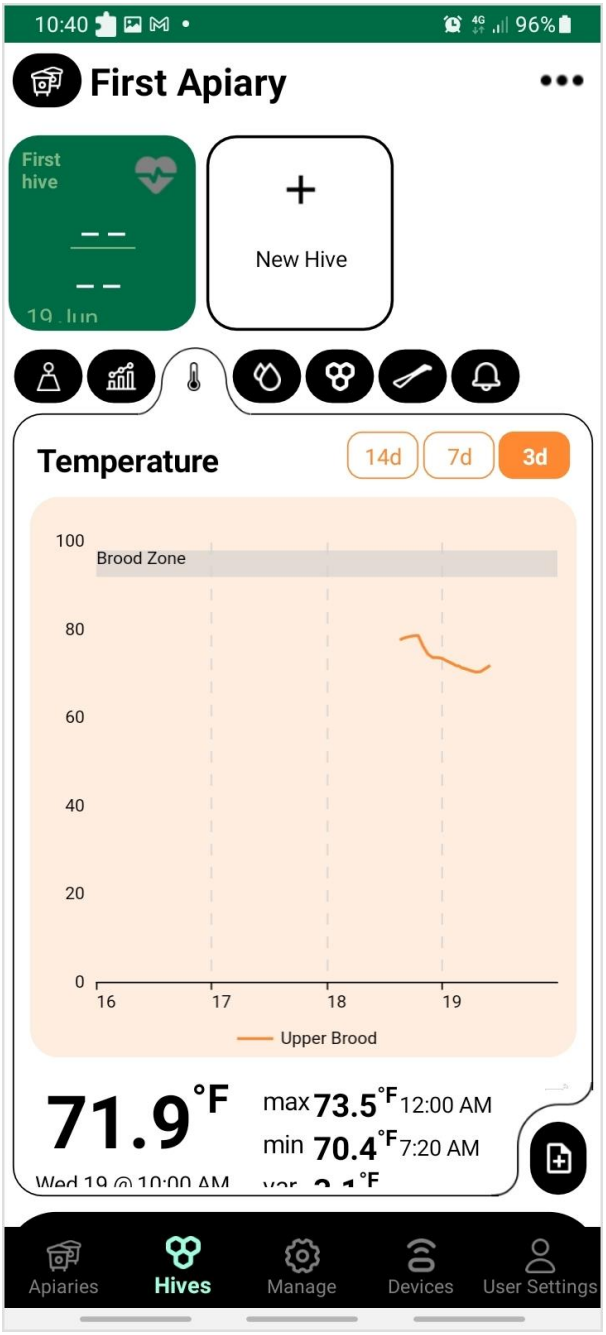
Using BroodMinder Bees App there are multiple ways of syncing:

- `Multi-Sync` is at the top of the screen in the `Apiaries` tab. This syncs all devices at once and is a Premium feature.
- `Single Sync` is within the 3dots `...` menus, either in `Devices` or in `Apiaries` tab

Tip

You can only sync devices appearing in green (within bluetooth range)





Now look to your data using `... > Show Graph` or `... > Show Details`.

Info

On your first sync you probably do not see much data since there is only one or two samples.

6. Power-On your Hub

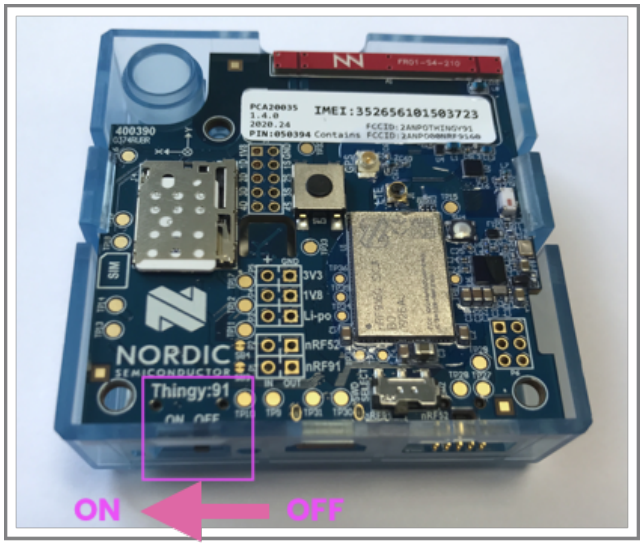
This stage is intended for those owning a Hub for real time monitoring. If you do not have a Hub, move to the next chapter.

Remember from Hubs page that there are several hub versions:

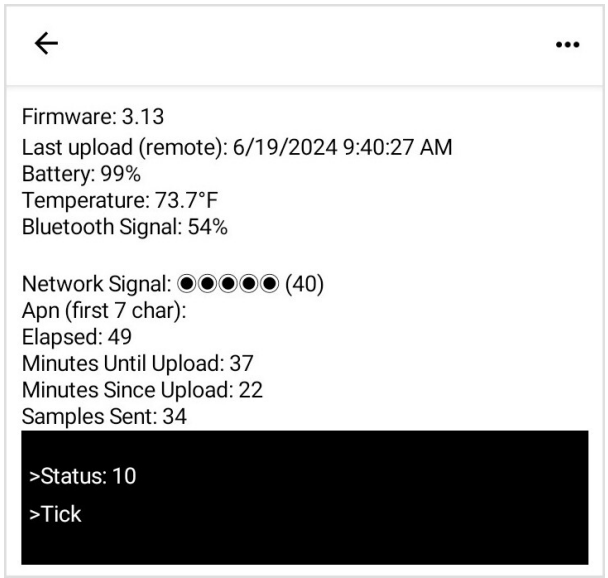
- Broodminder-T91 Cellular Hub [solar, weather, naked]
- BroodMinder-Wifi Hub
- BroodMinder-Sub-Hub

6.1 Cellular Weather hub

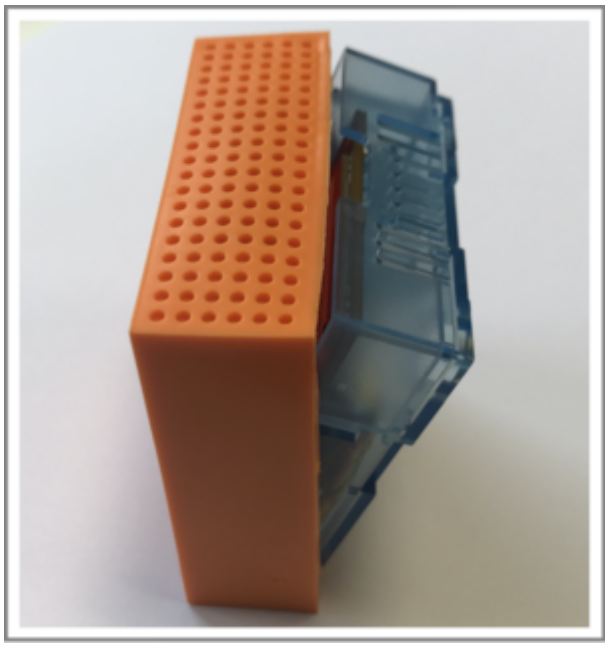
1. Remove the orange silicon protection
2. Power ON the hub with the small black switch (use a pen tip to operate)



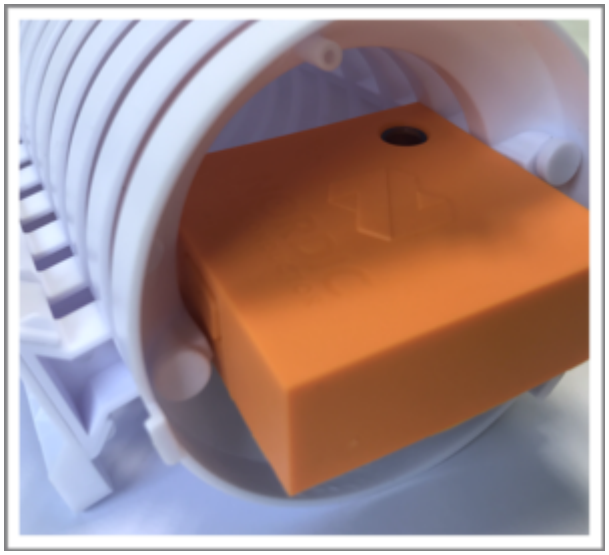
1. Color Leds will blink green, then blue, then green again
2. Check on Bees App that transmission has been established. Go to `Devices tab > Hub ID > Show details > MBM last upload` shall display current date/time.



1. Install orange protection again, starting from the USB side.



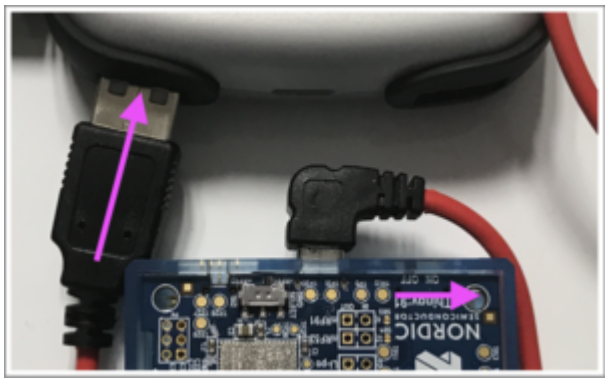
1. Insert the T91 within the weather shield with the USB face sidewise to avoid condensation deposition on this and the opposite face.



6.2 Cellular Solar hub

Follow the same process as above, with the difference that you will have to plug in the USB to the battery (we ship unpluged to avoid battery discharge during transport)

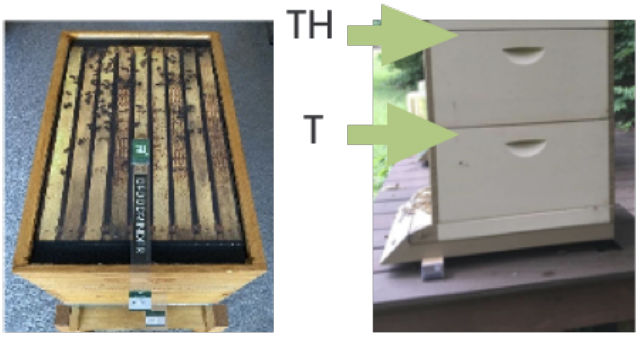
1. Unscrew the cover lid.
2. Insert the USB plug into the battery
3. Slide the power switch to the right



1. Hub will start and you can check data transmission using Bees App as described above.

3.3 NOW MOVE TO THE APIARY

7. Install devices in hives



Internal sensors

Install BroodMinder-T (model 47) and -TH (model 56) on the middle frame (usually no. 5), starting on the left-hand side as seen from the front of the hive. The identifier at the end of the tab should protrude so as to be visible from the front of the hive.

Scales

Place your BroodMinder-W scale preferably **at the back** of the hive. Make sure the hive is as level as possible. BroodMinder-W3 and W4 scales do not require precise levelling.

Beedar

The BeeDar is mounted on the front of the hive, centered on the hive axis. The height from the flight deck is just right to allow you to handle the entrance reducers without worry. Typically 5 to 7 cm above the floor.

Beedar has a horizontal "view" angle of 85° and a vertical angle of 30°. You can hang it with two 4mm-diameter screws.

8. Install your hub

This stage is optional : only intended for those owning a Hub for real time monitoring.

As a general rule for any kind of hub you should know that - overall range for Hub <=> internal devices is ~ 10 meters (30ft) - overall range for Hub <=> external devices is ~ 30-40 m

Important

- hubs should be located at least at 1.5m height from the ground (Cellular and Wifi reception damps A LOT when close to the ground)
- avoid direct sun exposition

There are multiple ways to install the hub - solar versions can go on a pod or mural or even on hive

- other cell versions and SubHubs install nicely within the weather shield

Now check Connectivity - Check hub connectivity with Bees App (in the `devices Tab > hub ID > ... > Show details`) - You should have a Network signal greater than 20% to be comfort.

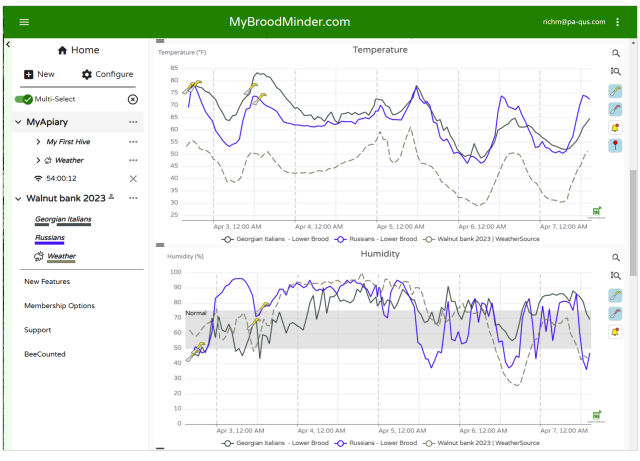
9. Update start date/time

To avoid having measurements from outside the hive, change the start date of the sensors. To do so, go to `BeesApp > Apiaries > unfold the hives to see the sensors > "..." > Change the current position`. Edit the `start date/time`.

10. Explore and discover

Now you can also go to MyBroodMinder.com and explore your data.

Sign in with the same account you created on the Bees App.



In this interface you will be able to follow the brood levels, the weight gains and losses, configure your alerts or even the past and forecasted weather as well as the nectar-flow indexes and much more!

Info

Attention: Some data is computed daily and you will begin to see it from D+3 (D1 does not count because partial data, D2 will be the first complete day which will be posted the following day => D3)

4. Broodminder-BEES App

4.1 Overview

This section contains the nuts and bolts of using the app. There is a brief introductory video that you can also watch.

We have released a major update in June 2024 with numerous new features. We recommend exploring the app, reading the manual, and watching our videos to understand the extensive range of features available to you. Our development team are all beekeepers so we have added many features that we love and know you will love too.

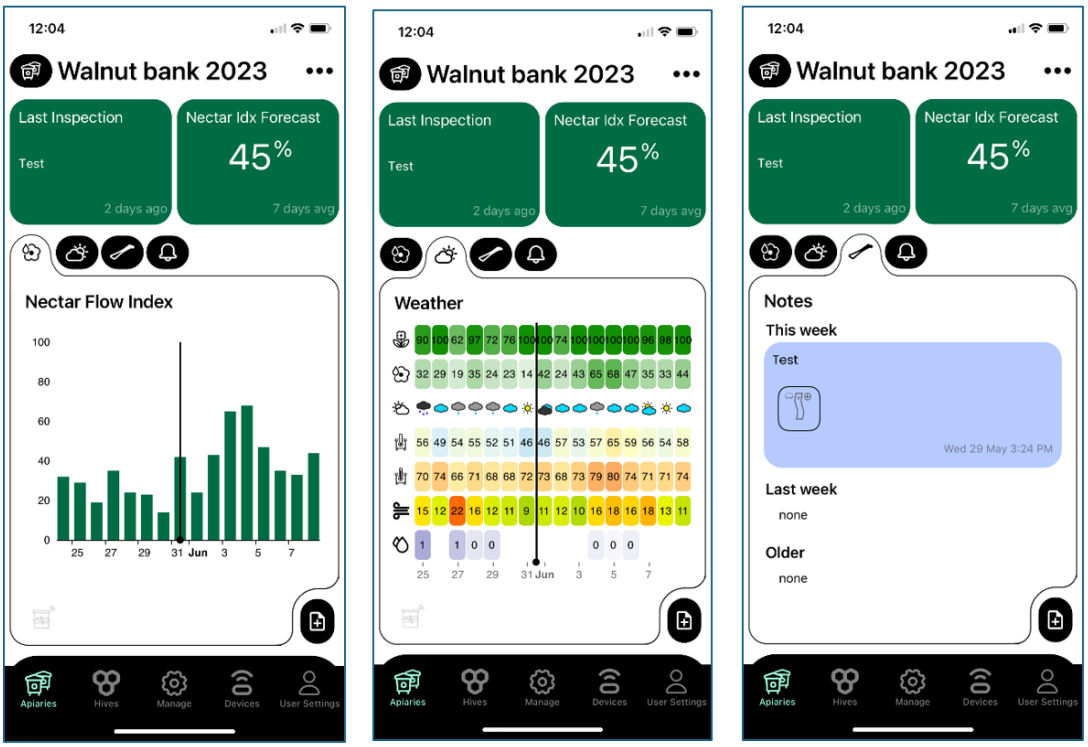
- One touch reading of all sensors within range of the phone/tablet
- Apiaries tab displays weather and nectar flow conditions -NEW 2024
- Hives tab displays brood level, productivity, and internal conditions - NEW 2024
- Powerful voice powered apiary and hive logbook with predefined tags
- Manage apiaries, hives, and device locations
- Set devices to battery saver mode with 5+ year battery life - NEW 2024
- Tightly integrated with MyBroodMinder.com w/automatic sync for remote apiaries which have no internet (cellular) access.
- BroodMinder-SubHub support
- Real-time display of device signal levels
- Read composite device log and assign data to proper BroodMinder devices

Basic operation for a new user

- First Time
- Download BroodMinder-Bees from your app store
- Start the app and enter (or create) your MyBroodMinder.com user ID & password
- Create an Apiary and Hive using the MANAGE tab
- The DEVICES tab will automatically display all BroodMinder devices you own and all BroodMinder devices it detects close by
- Claim your devices and nssign your BroodMinder devices to a location within the hive
- Every Time
- Choose the MANAGE tab and press SYNC. Stored data will read and local and MyBroodMinder.com databases will be updated. NOTE: You can skip this step if you have a Cellular/WIFI/LoRa hub.
- Review your data with the Hives and Apiaries tabs
- Add hive and apiary notes during inspections
- If you do not have internet/cellular connection in your apiary, start the bees app when you return home and it will automatically sync data with MyBroodMinder.

4.2 APIARIES Tab

The Apiaries tab displays information about the selected apiary.

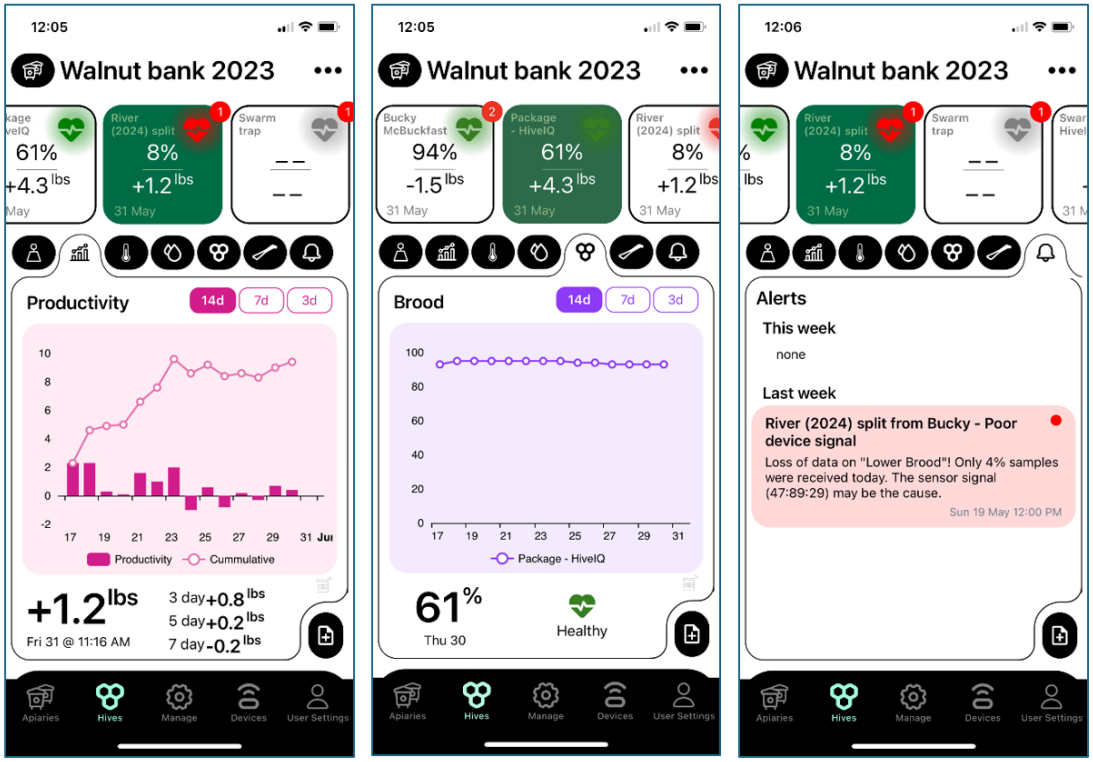


1 2 3

1. Notes from the last inspection are displayed in the upper left and expected nectar flow (based on the weathersource.com forecast) is displayed on the graph.
2. Note the "+" in the lower right corner. That will allow you to add notes about the apiary. Any place you see that "+" will take you to a new note for your logbook. There is more information about note taking below.
3. Weather log and forecast are shown in this screen.
4. Apiary notes can be reviewed here.
5. Alerts are displayed in the rightmost tab.

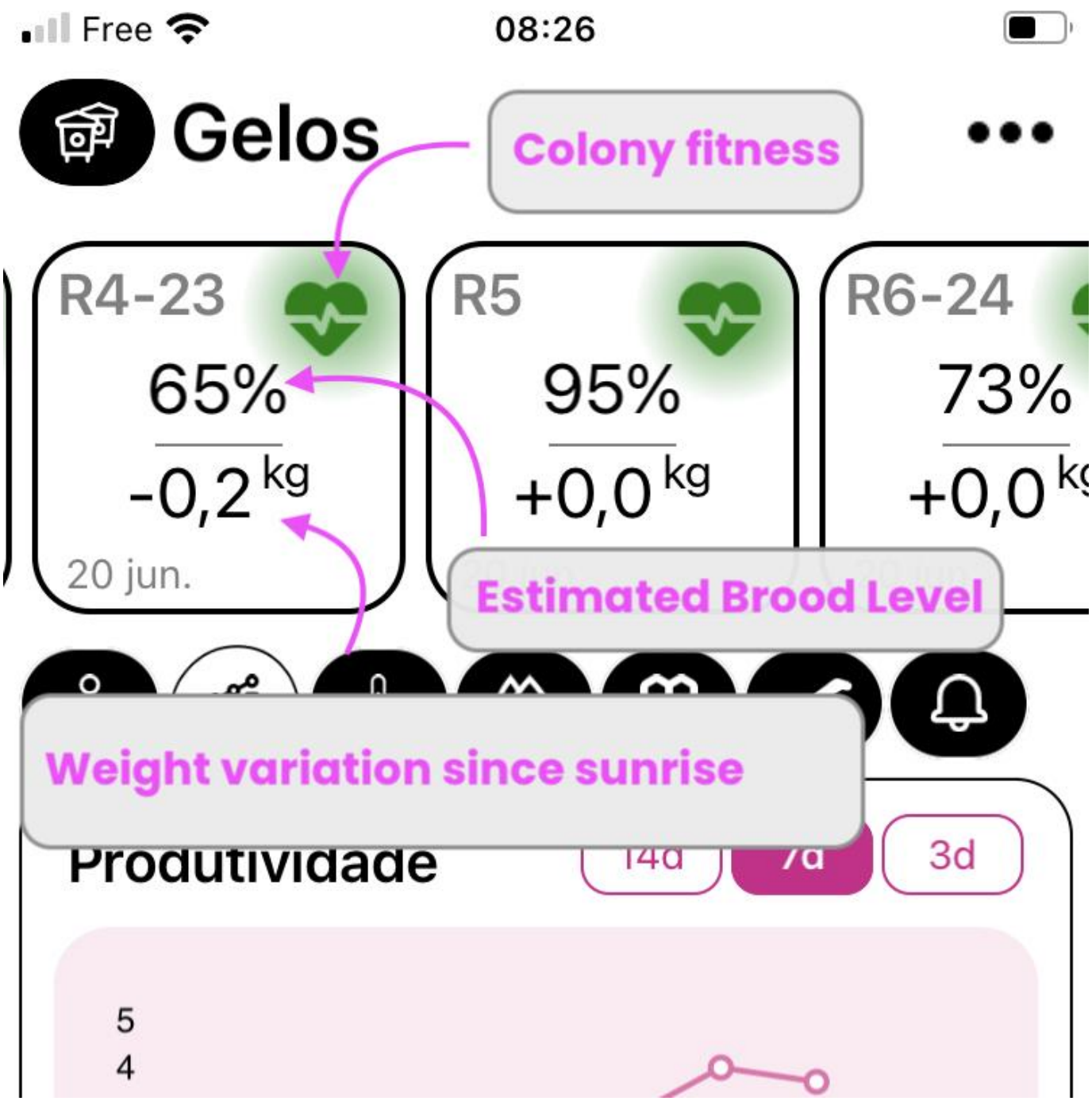
4.3 HIVES Tab

We've created the Hives tab to make it easy to quickly see the status of each of the hives in your apiary.



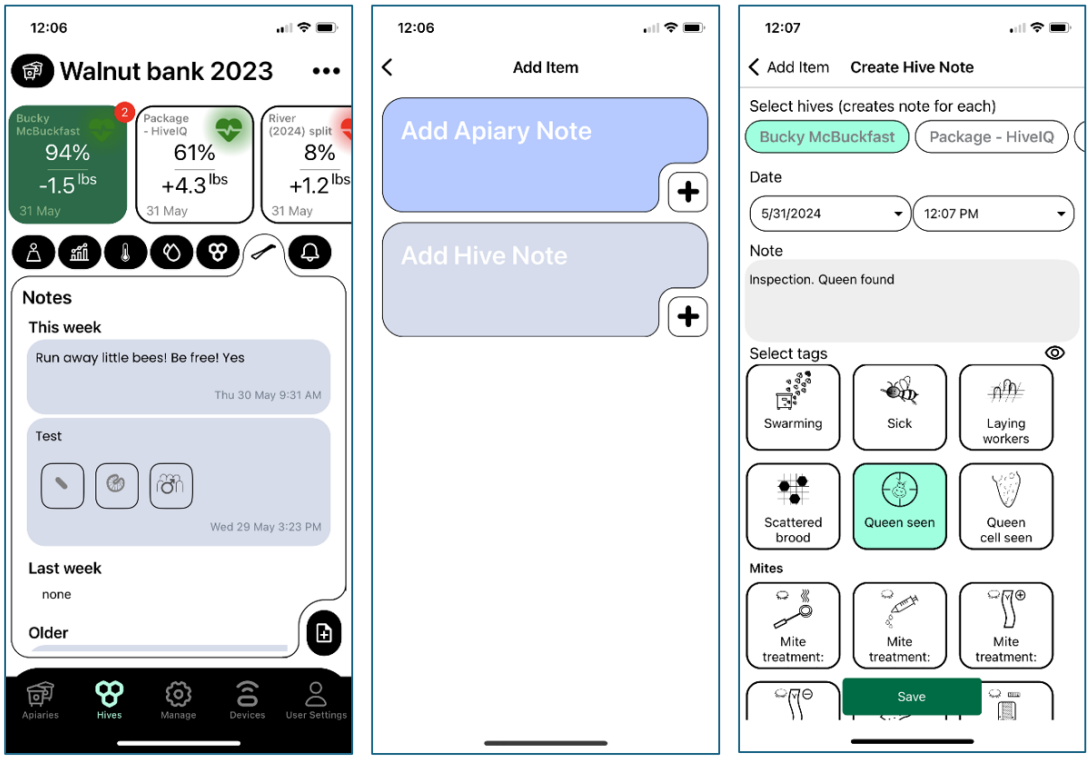
1 2 3

Your hives are listed across the top with the **brood level** and **daily change in weight** displayed. The heart displays the estimated fitness of the hive and the eventual number red dot in the upper right corner of the squared boxes indicates if there are any alerts to be reviewed.



Selecting any hive will bring all of its data to the graph below.

1. **Productivity** displays the change in weight after removing any beekeeper instigated changes such as adding or removing a super. Both the daily change (bars) and the cumulative change (dots) are displayed.
2. **Brood** is the estimated brood level determined from the hive internal temperature and external (weather) temperature.
3. **Alerts** make you aware of any items needing attention. Note that the alerts are set up and adjusted in MyBroodMinder under the Configure|Alerts section.



1 2 3

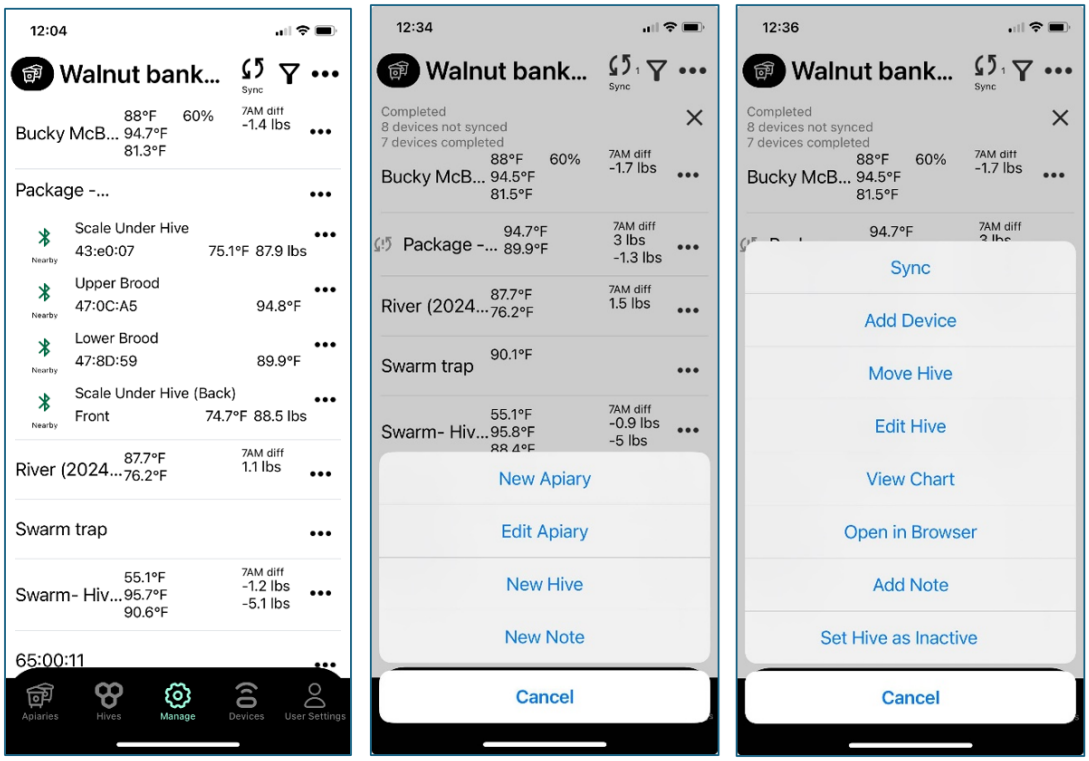
We have included in the Bees app and in MyBroodMinder powerful note taking features. Besides being a useful logbook to track your hives, the notes and tag selections are being used to drive our workflow engine that is under development. Soon we will be using workflows to track hive processes such as swarming and requeening.

1. Hive notes are shown here. Pressing the "+" in the lower right corner will bring up screen 2.
2. You can choose to add an apiary or a hive note.
3. Hive notes will allow you to add notes to one or multiple hives at a time. The tags below will be used for automatic workflow notifications (added soon).

Hint: The note function allows the use of your microphone for easy transcription.

4.4 MANAGE Tab

The MANAGE tab is where you will sync your entire apiary at once as well as move and configure devices. You must have a MyBroodMinder account (free or premium) since your apiary/hive configuration is stored there.



1 2 3

1. This screen shows the hives and current values of the sensors. Clicking on the hive will reveal more details about device numbers as shown for hive "Package" above. Note the Sync button at the top, this button will attempt to sync all of the devices in this apiary. You can see the status of the sync in image 2 right below the apiary name. In this case, the sync completed with 7 devices but was canceled before 8 of the 15 devices were completed.
2. The `...` beside the apiary name allows you to create a new apiary or create new hives in this apiary.
3. The `...` beside the Hive name allows you do do all the things show above.
4. To move a device to a different hive, click the `...` beside device for example 43:e0:07 in image 1.

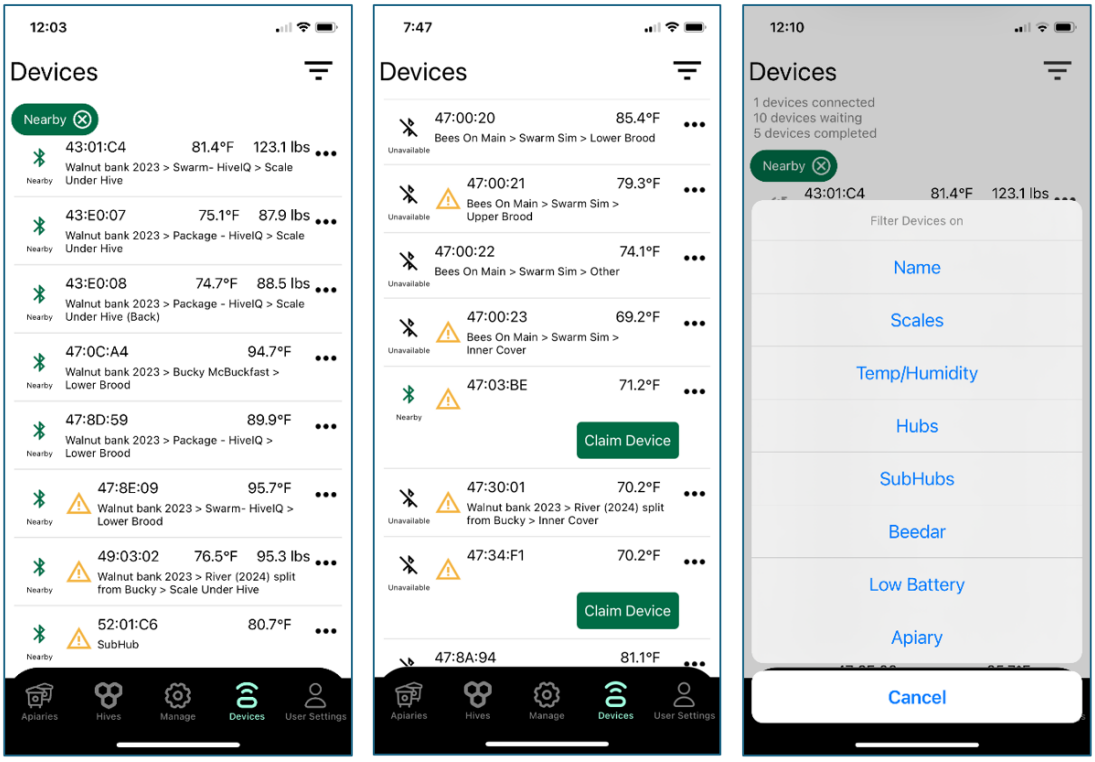
Hint: Sometimes it works better to sync Hive-by-Hive if they are far apart. You can choose Sync with the `...` for each hive. Start the hives close to the phone, you don't have to wait for each hive to finish before starting the next one. Then move the phone to a new position close to the remaining hives and sync again. If you tap on the sync status that appear near the top, it will show more details about exactly where it is in the synchronizing process.

4.5 DEVICES Tab

The DEVICES tab gives you full control of BroodMinder devices which are:

- In your device inventory on MyBroodMinder.com
- and/or seen by your phone via Bluetooth.
- If the device is new, a CLAIM DEVICE button will appear to take ownership
- If the device is owned by somebody else, that will also show on this screen
- Watch the icon to the left of the device, it will indicate "Nearby" when you are withing Bluetooth range
- If the device is "Nearby" it will display the current temperature/battery/weight/etc
- Tap any "!" and the app will inform you of an issue such as low battery or firmware update needed

You can Sync individual devices from this page by pressing the `...` beside the device.



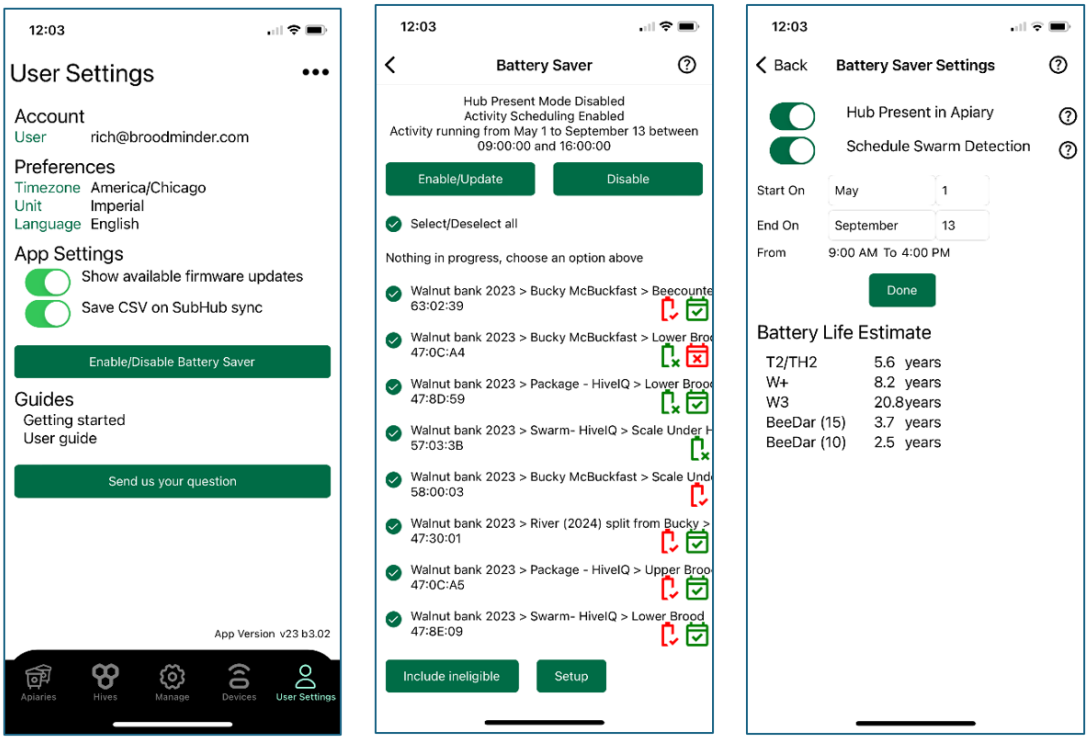
1 2 3

Hint: Image 3 show the filter button and it is awesome. It will limit what is shown on this list. For example if you select `Nearby`, it will show only those device where the phone sees the BroodMinder. Then if you refresh the screen (pull down in iOS or Android) it will clear the list and then fill it back in as it see the Bluetooth signal from each BroodMinder. This is a great way to verify your BroodMinder is operating.

4.6 USER SETTINGS Tab

The settings tab allows you to customize your Bees app. It will display the users account as well as a few items which can be modified.

Note that if we wish to update the firmware in your devices the "Show available firmware updates" must be selected. This toggle defaults to off unless a mandatory update is required. You can update your older devices in order to utilize the new (2024) battery saver features discussed below.



1 2 3

4.7 Battery Saver

We recommend watching the video and reading these notes to fully understand battery saver.

You can extend the sensor battery life to 5+ years in two ways.

- If you have a hub (SubHub, Cell, WiFi, or LoRa), you can set your devices to reduce advertising. This will add a year to your -T2 and -TH2 devices and 5+ years to your -W devices.
- Since swarms only happen during daylight hours and during part of the year, several years of battery life can be gained by reducing the detection time.

Note: If your devices are 5 years old or newer, you can update the firmware in the device using the Bees app. To enable updates, select "Show available firmware updates" in the User Settings screen.

1. Choose "Enable/Disable Battery Saver" to manage this option.
2. Once on the Battery Saver Screen, the Bees app will search for any BroodMinder devices that it can control. Note that you must be within Bluetooth range to configure the device. It will only display devices with firmware which supports battery saver. To see all of your devices within range, press "Include Ineligible".
3. Setup will let you adjust Battery Saver settings to best suit your purposes. Note that an estimated life for different BroodMinder devices is calculated and displayed based on your settings. Select "Hub Present" if you own a hub and set when you want to detect swarms.
4. Once the setting are adjusted, return to screen 2 and press "Enable/Update". As the devices are configured, the icons to the left will indicate battery and/or scheduling enabled (green with check).
5. To turn off battery saver features, press "Disable". NOTE: It may take up to 10 minutes to shift devices from hub mode to normal because the devices "sleep" for 9.5 minutes between advertising.

Here are more details for the interested student.

BroodMinder -T2 and -TH2 devices transmit their current condition via "advertising pulses" every 5 seconds. Transmitting this data 24/7 is the major energy use for the system. If you have a hub in the apiary, it "listens" for these pulses every 10 minutes. If

the data is only changing once per hour, then we only need to have the devices advertise for 10 minutes per hour extending battery life for 12-13 months.

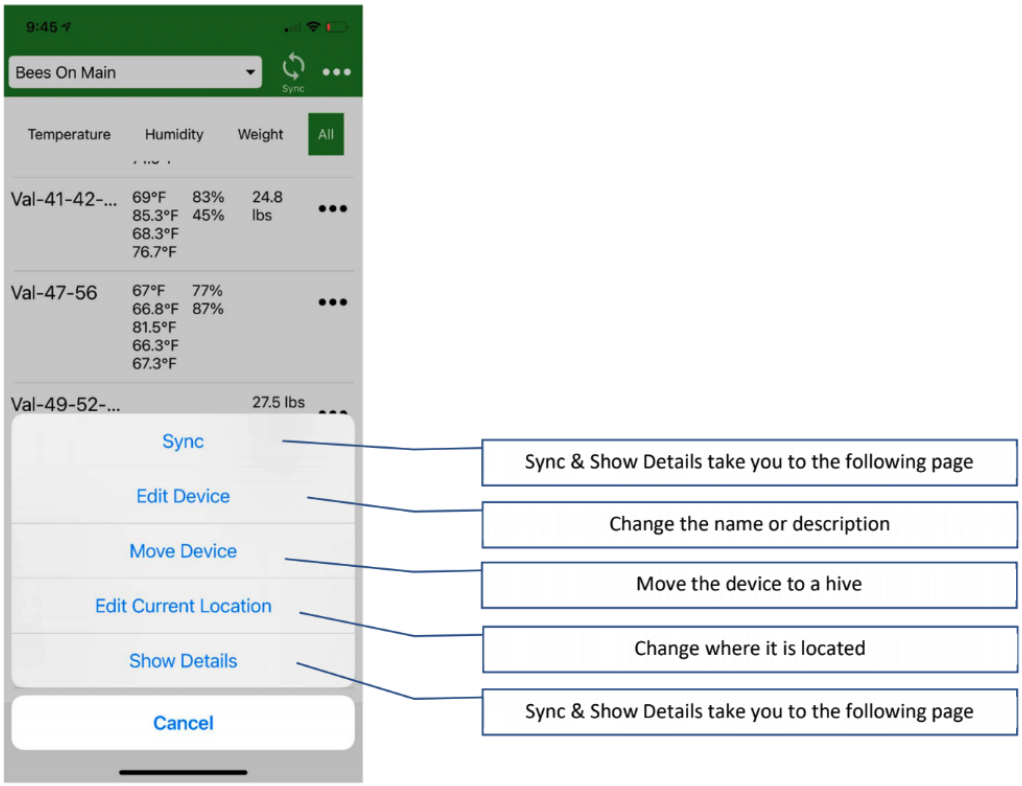
The -T2 and -TH2 read data every 60 seconds and watch for temperature events (swarms). This is the next largest energy consumption. When not detecting events, one hour sampling is adequate. So, by limiting the time one minute data is collected to the time swarms are likely, we can extend the life much longer. For example, battery life for T2/Th2 is 5.6 years if we only detect from May-August and from 9am to 4pm and have a hub present.

BeeDars also benefit from limiting swarm detection. While watching for swarms, the radar samples for 30 seconds in order to get an average and more accurate value. at night we can reduce this to 3 seconds and still see activity, but save a lot of energy.

Our weight scale devices transmit adverting pulses every one second. With a hub available, we reduce that to every 5 seconds and extend the battery life from 2 to 8 years for the -W and from 5 to 20 years for the W3.

4.8 SubHub Devices

SubHub devices are a bit special since they are listening to all of your nearby BroodMinder devices. When you press the three dots by a SubHub, this menu pops up



SubHub Details

This page is where you control the SubHub. You can sync all of the data and you can view live data from here. See the next pages for more detail

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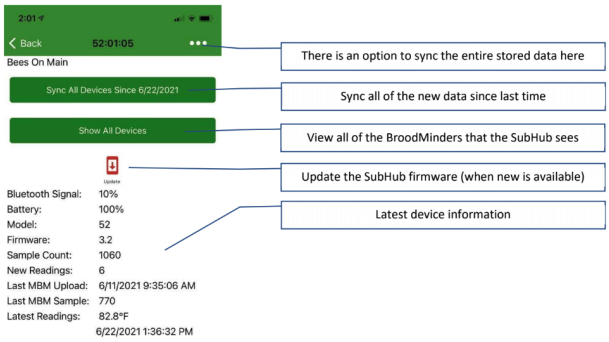
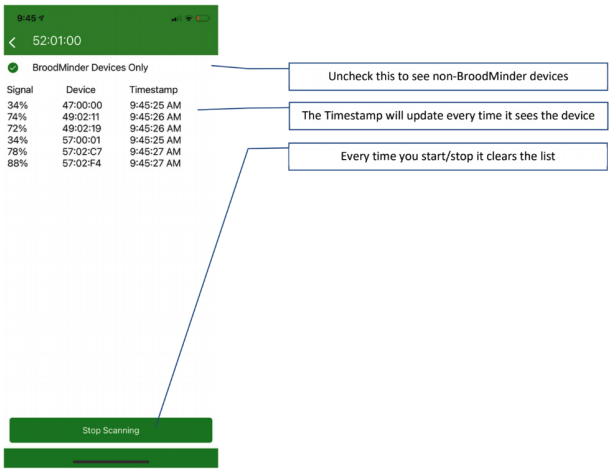


SubHub Show All Devices

When you set up your SubHub, you can use this display to know exactly which devices your SubHub sees. All BroodMinders advertise every 5 or every 1 second. That means you should see them all show up here if your close enough. It will also show any Bluetooth Low Energy (BLE) device in range if you uncheck the `BroodMinder Devices Only` box



Hint: This is an especially useful page to use when optimizing the position of your SubHub. It is handy even if you do not sync with your phone. You will see what devices are being extended to your remote hub device.

5. MyBroodMinder Version 5

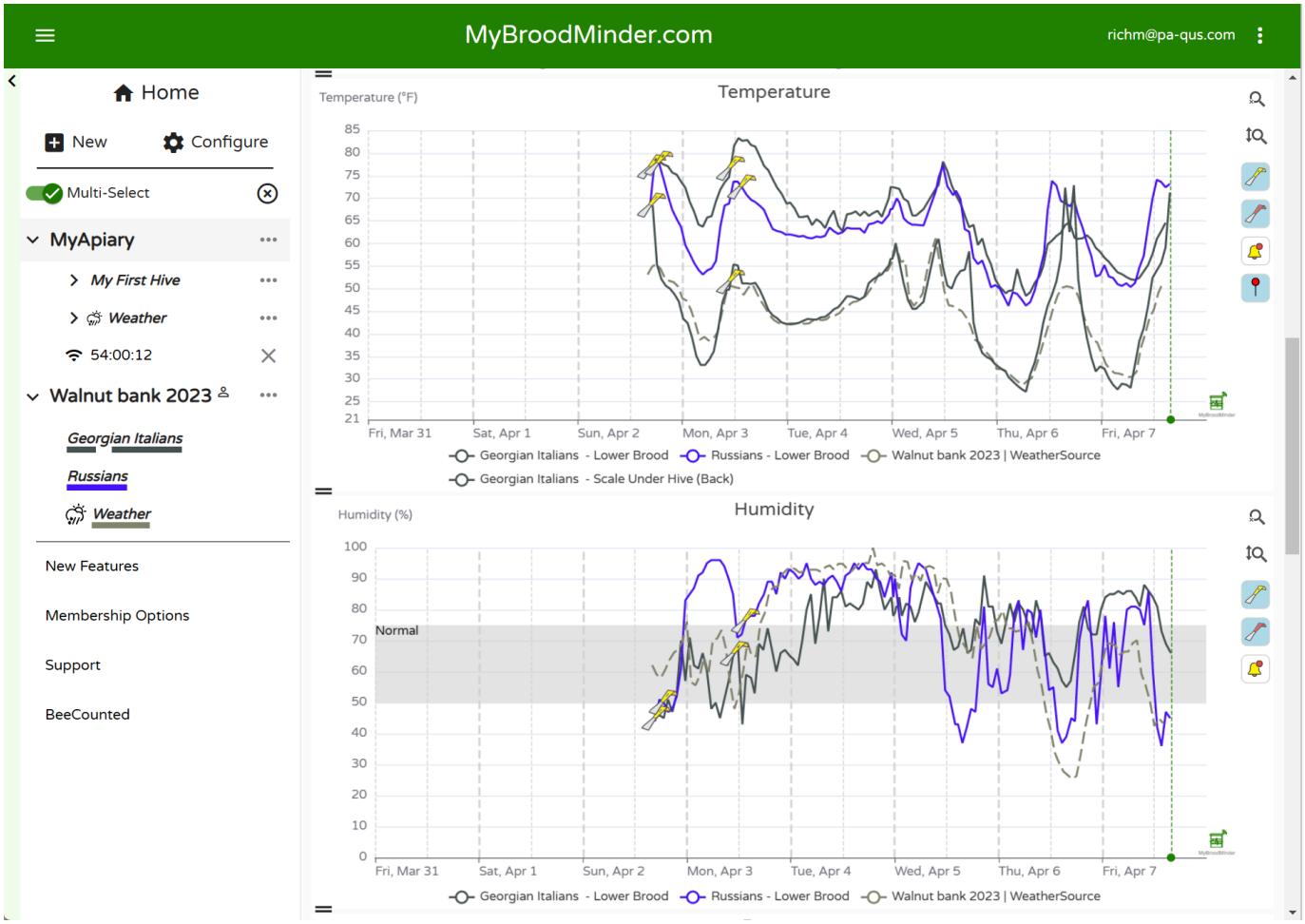
5.1 Overview Quick Tour

There are many great features available in MyBroodMinder to view and analyze your data. Please note that there is a lot of context help by either hovering your cursor over an item or clicking the `?` next to an item.

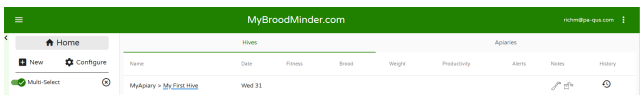
We have updated the video library for Version 5.

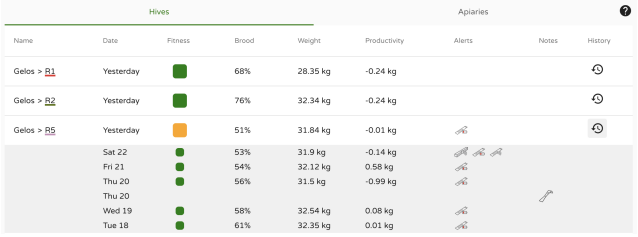
The quick tour is pretty long. There are a lot of useful features. Let's start by describing the functions available to you.

The best way to learn is to read this guide while looking at your MyBroodMinder account.



Home Screen





HIVES

Here you will find a quick glanceable view of all the hives that you own. Hives are shown here if you have sensors currently assigned in the hive. Learn more about device assignment and configuration here.

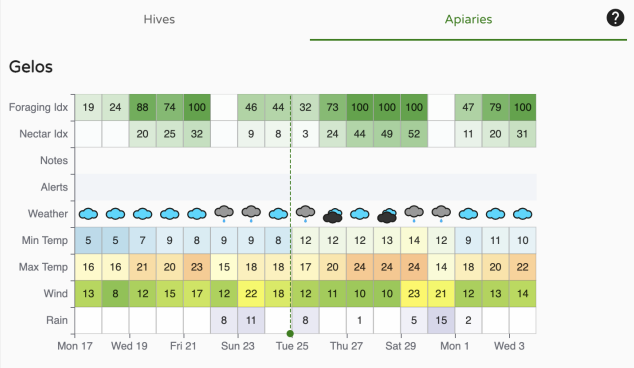
At a glance information shown here:

- Fitness - Daily hive fitness state, learn more here
- Brood - Daily brood level, learn more here
- Weight - Daily hive weight
- Productivity - Daily hive productivity, learn more here
- Alerts
- Notes

Click the `History` icon on the right to view this data for the last 7 days for each hive.

APIARIES

Here you will find a quick glanceable view of all the apiaries that you own. Apiaries are shown if they have hives with currently assigned sensors. Learn more about apiary, hive, and device assignment and configuration here.

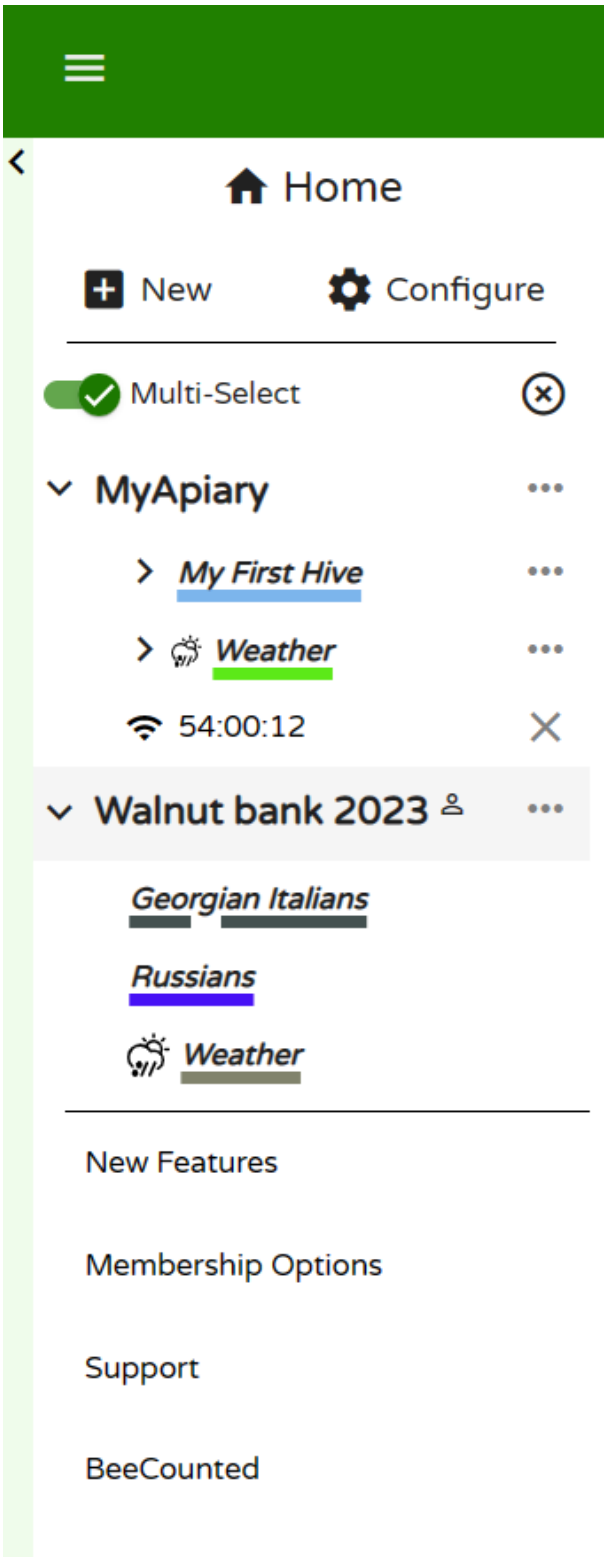


At a glance information shown here:

- Foraging Index - learn more here
- Nectar-Flow Index - learn more here
- Notes
- Alerts
- Other basic weather readings

Left Sidebar - Choose which hives to view

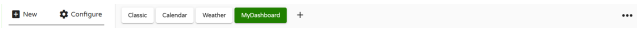
The left sidebar is your key to navigating your apiaries and hives as well as apiaries shared with you by your friends. There is a lot of functionality built into this menu. Explore by clicking around.



- Clicking on `>` opens up hives in the apiary and devices in the hives
- Hovering over a BroodMinder device will display the ID number
- `...`
- Apiary - Edit apiary info and location, add hives, share with friends, add apiary notes
- Hive - Edit hive information, color of graph trace, move to new apiary, add BroodMinder devices, get link to BeeCounted.org, add hive notes
- Device - Edit device name, adjust/move device location
- Multi-Select is a powerful feature that lets you overlay data from many different hives and apiaries. If you want to focus on one hive at a time, turn it off.
- When you click on an Apiary, it will display the hives in the apiary and bring up the data in the main window. Click it a second time and it removes the data from the view.
- Clicking a second apiary will add the hives to the view. Notice that the hives which are displayed are underlined. The color of the underline is the color of the graph line for that hive.
- Clicking a hive will toggle it to display or not display.
- The small `X` to the right of `Multi-Select` will clear all of the hive displays.

Dashboard - Choose how to display the data

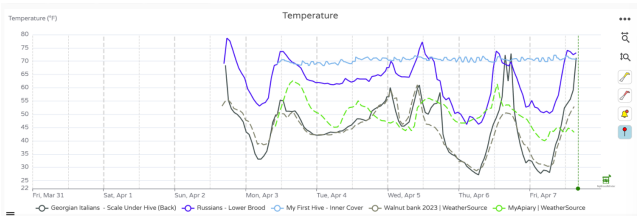
The buttons at the top of the view window let you chose how to display your information. We provide some standard views that we believe are useful. You can also add custom view to include many new analysis features.



- Classic
- Calendar
- Weather
- You can create your own custom displays using the `+`
- Sensor readings
- Weather
- Analysis
- Maps and images
- Note - The `v` to the right of the notes section will expand the text of all of the notes within the timeframe shown. There are many powerful note features discussed below.
- `...` to the right of the dashboard buttons
- Create sharable link - This is a powerful feature. Once you get the display looking like you like it, you can create a browser link to share with anybody, even if they do not have a MyBroodMinder account. You can choose a fixed timeframe to share, or a variable timeframe such as the last 2 weeks. When you share it this way, it will always bring up the newest 2 weeks of data. You can also add a description which will display at the top of the graph.
- Download - You can download the BroodMinder data, the weather data, and/or the notes to a CSV (Comma Separated Variable) file.
- Notice all the BroodMinder IDs of devices in the graph are identified at the very bottom of the view. If you click one, it will take you do the data graph for that device. In that view you will see all of the data for that device no matter where it has been installed.

Graph Controls

There are many terrific graph

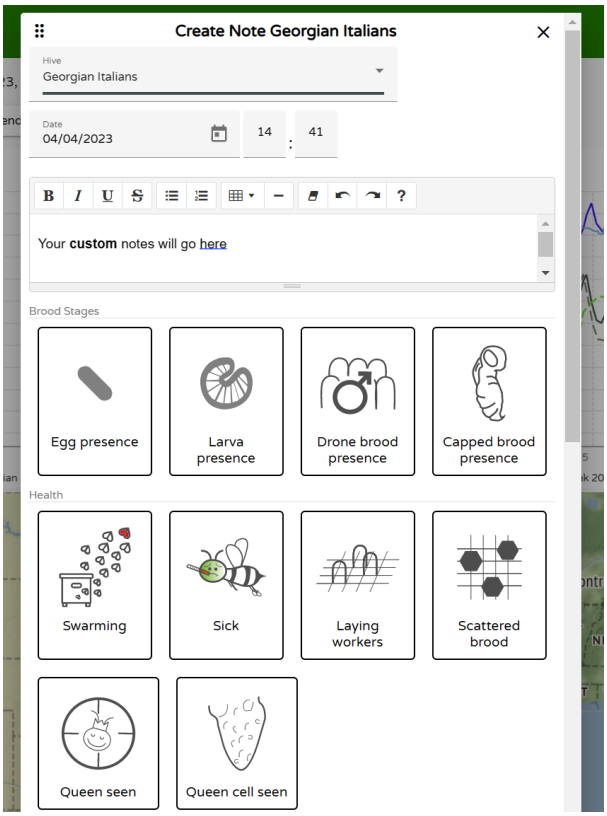


controls available to get your reports looking just right.

- Time Range - Using the dropdown menu at the top, `Last 7 days`, you can chose the duration of the display
- Change the height of each individual graph using the `=` on the leftof the window between the graphs.
- Turn individual graph lines on/off by clicking the legend below the dates
- Highlight the line of a graph by placing the cursor directly over if. The other graph lines will dim.
- Tools to the right of the graph
- Zoom time scale - click the horizontal tool, then drag the cursor over the region of interest while holding the left mouse button. Un-zoom by clicking the tool again.
- Zoom vertical - click the vertical tool, then drag the cursor over the region of interest while holding the left mouse button. Un-zoom by clicking the tool again.
- Clicking the yellow hive tool will hide/unhide hive notes
- Clicking the red hive tool will hide/unhide the apiary notes
- Clicking the bell tool will hide/unhide the alerts

Adding Notes

There are powerful new note capabilities in both MyBroodMinder and the Bees app. You can use the Bees app to add notes in the field, and then edit or add additional notes when you review them in MyBroodMinder.



The most simple way to add a note is to double click on a graph at the time you want to add a note. An editor will pop up. You can enter text and you can also add tags. Once you save the note it will show up on the graph as a hive tool.

You can also add a note for the entire apiary such as `Performed OA treatment on all hives`. Do this by clicking the `...` to the right of the apiary in the side bar and choosing add note. This note will display in all hives.

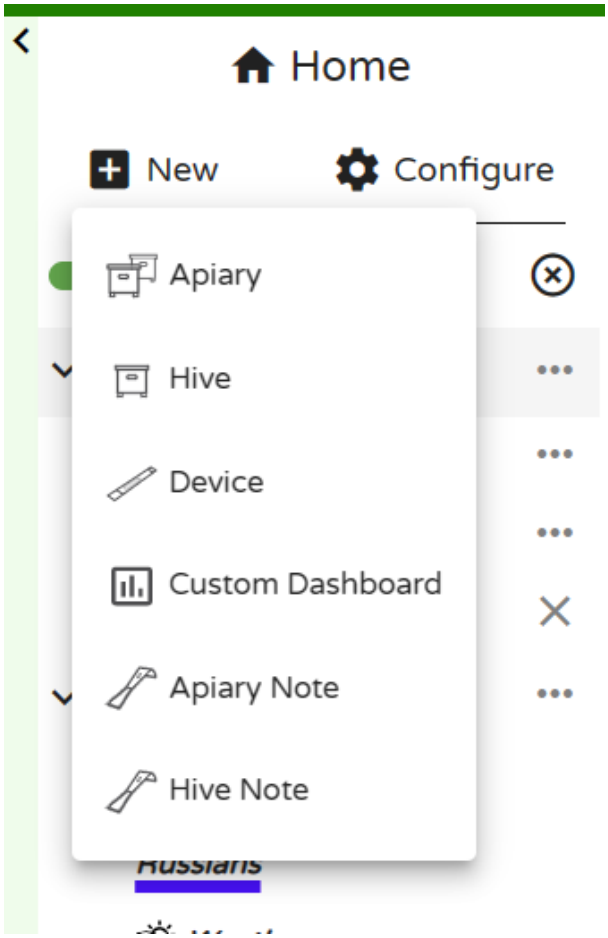
5.2 Managing

New

Note that we recommend setting up your apiaries, hives, and devices using the Bees app. The Bees app makes it easier to assign the devices.

New

Note that we recommend setting up your apiaries, hives, and devices using the Bees app. The Bees app makes it easier to assign the devices.



Apiary

When you add a new apiary to your setup you will name it and give it a location. We only track location by zip/postal code in order to preserve privacy. You can also set a default color for the graphs related to this apiary. This color will be used for the weather display of this apiary

Hive

It is easiest to add the hive using the `...` to the right of the apiary. This automatically enters the apiary as the location. When you add a hive, you can give a name and a color for the graphs related to this hive.

Device

it is easiest to add the devices using the `...` to the right of the hive. This automatically enters the apiary and hive as the location. You will need to select the location of the device in the hive. You can not have two devices in one location. We include several custom locations if you want to do your own thing.

Custom Dashboard

You can create a number of custom dashboards. You can drag any or all of more than a dozen widgets and place them in your preferred order. This allows you to create reports exactly how you would like them. (Amanda and Lorenzo did a great job on this feature.)

Apiary Note

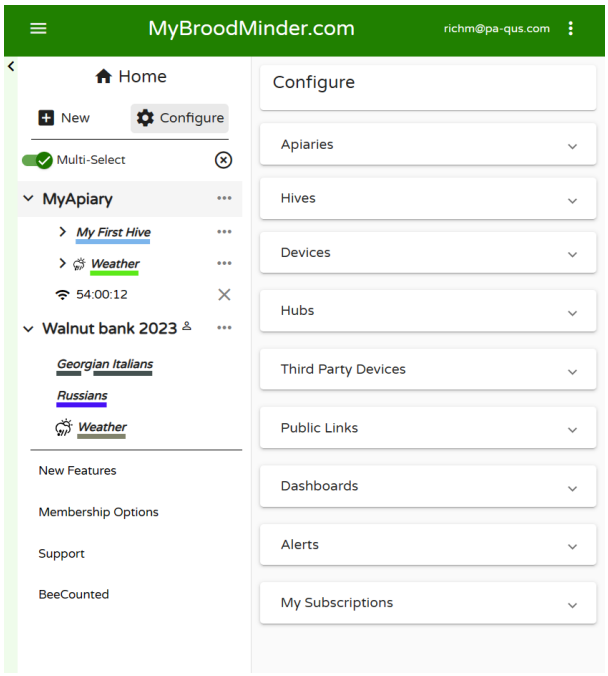
Apiary notes are assigned to all hives in an apiary. You will notice that the choices for tags are different than for hives. These notes will show up on the graph with the red hive tool.

Hive Note

Hive notes are not shared across an apiary. I suppose this is pretty obvious. Once you create a note, it can not be assigned to a different hive. These notes will show up on the graph with the yellow hive tool.

Configure

Once you have apiaries/hives/devices added, you may need to move or delete them. All of this can be accomplished in the `Configure` screen.



Apiaries

Here you can update your apiary. You can also set it to hide which will remove it from your Left Sidebar but keep the data. Deleting the apiary will remove all traces of it. Both of these changes can not be reversed.

You can also add a local source of weather information in the apiary. By default, we retrieve weather information from weathersource.com based on your postal code. You can replace this with a BroodMinder device that is in your apiary. You can use any of our devices which broadcast temperature and/or humidity values.

Hives

Hives can be configured and moved between apiaries, set inactive (data remains), or deleted (data is destroyed). From this menu you can also display which and when BroodMinder devices were installed and removed.

Devices

The devices section will display every BroodMinder device that you own. Note that you can sort this list by clicking the headings and you can filter the list to display only certain types. You can also download a CSV file that lists every device shown. This can be handy for taking care of inventory and battery replacement.

If you sell your device or give it to another beekeeper, you will need to delete it from your account. We only allow one owner of a device at a time for data management reasons.

If you reach out to support, we can rename your device (the "mac address") and then you can keep the data.

Hubs

If you own hubs, they will show up here. Hubs will send any data they receive from any apiary, but if you want the hub to show up in the Left Sidebar correctly, you must assign it to the proper apiary.

This is also where you manage and assign tokens which are required for real-time updates. See the Managing tokens section for more information on this.

Third Party Devices

Third party devices are sensors that are not made by BroodMinder. Currently we support YoLink sensors. They are managed in this section similar to the `Devices` section. See the Third Party section of this manual for more information.

Public Links

The public links feature is a powerful feature of MyBroodMinder. Once you start making them it can be difficult to keep track of them. You can do that here. You can change the notes and graph timeframe of the link.

Dashboards

Version 5 is all about dashboards and this is where you control them. You can hide any dashboard and/or duplicate and modify them quite easily.

Alerts

There are almost 30 events from hives, devices, & weather that can trigger an alert. In this section you can adjust the thresholds of these alerts and disable any that you do not want to see. It is important to note that you must enable the `Alert Summary Email` (at the top of this section) to enable alerts.

My Subscriptions

We wish everything was free, but we want to stay in business and keep paying our bills, so we ask for and appreciate your help. The more advance features, the ones that take a lot of programming work, come at a cost. Here is where you can keep track of your contributions to sustaining the effort.

5.3 Sharing

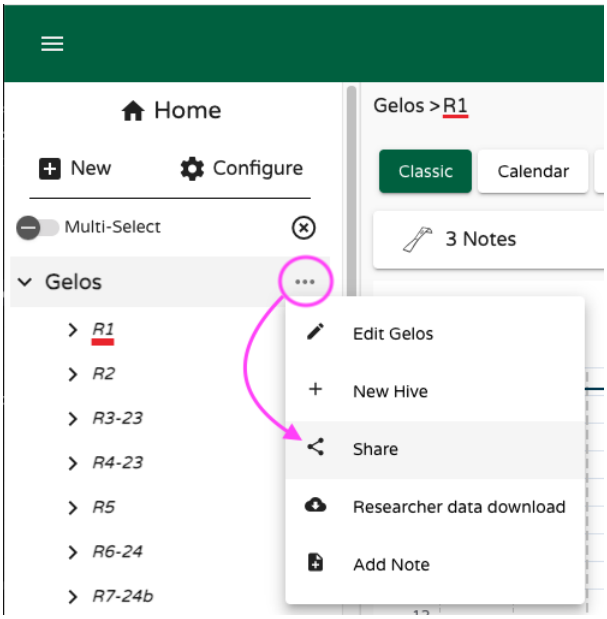
From MyBroodMinder you have many options to share your hives with other beekeepers and friends:

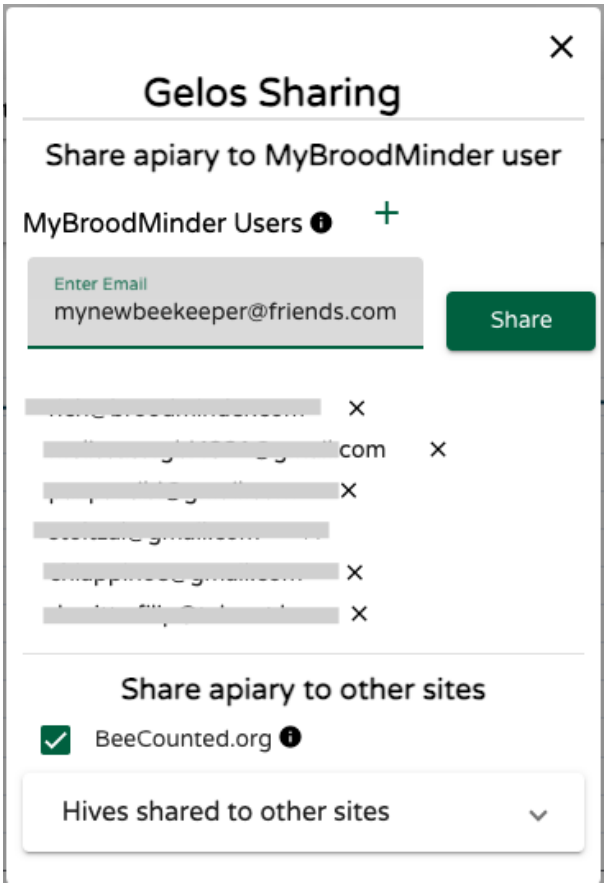
With another user

- you can share an Apiary (in the Apiary `… > share`) with another Mybroodminder user simply enter his/her account email. Acces is granted per apiary, in read only mode. They will see apiary and hives but not devices.

With another user

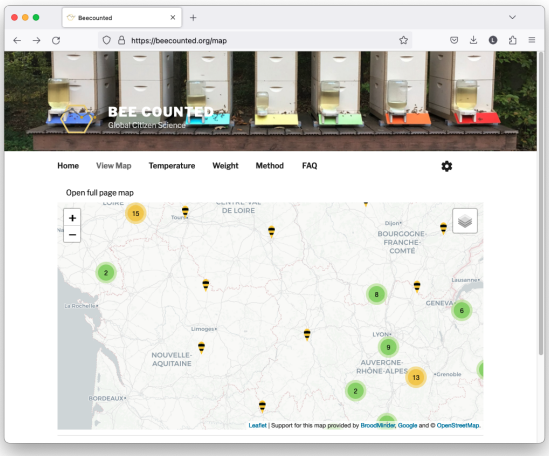
- you can share an Apiary (in the Apiary `… > share`) with another Mybroodminder user simply enter his/her account email. Acces is granted per apiary, in read only mode. They will see apiary and hives but not devices.





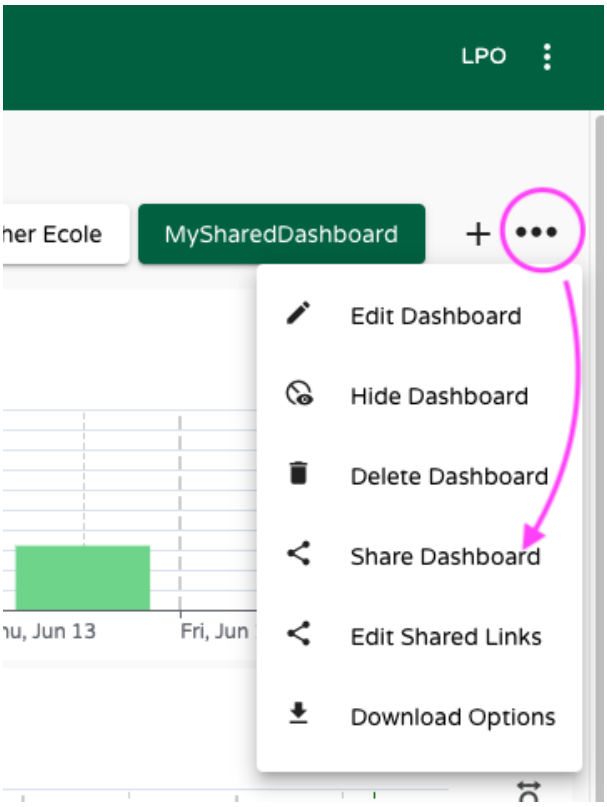
On beecounted

- you can also share an apiary beecounted.org (in the Apiary `… > share`, see above). By default, all free acounts are sharing on beecounted.



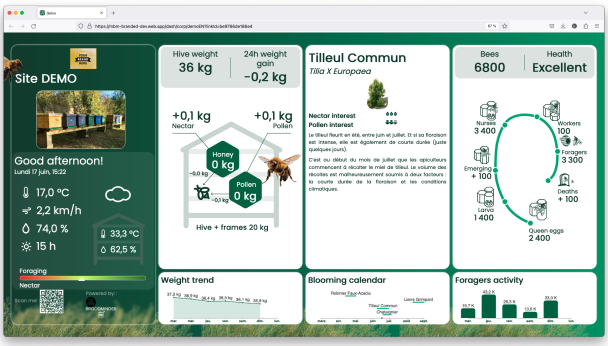
With an URL

- you can share a dashboard (in the Dashboards `…` > `share`): this produces an URL and anyone having it will see your dashboard. You can post it on social networks too. When creating the url you will notice that you have some choices : which hives to share, what time frame, frozen or continuous etc..



Educational Dashboards

- And Last but not least, there's a fourth and the most classy way to share your hive : **Educational Dashboards** This is a big screen mode for associations, schools or corporations that are willing to display their bees to colleagues and fellows. Send us an email to support@broodminder.com to know more about this service.



Educational Dashboards are fun!

5.4 Models & algorithms

In this section, we will discuss the more technical aspects of Mellisphera's way of functioning. We will thus present the different models - BFIT, BFORCE, BWEIGHT - as well as the WEATHER sources and ALERTS.

Colony Health - BFit

BFIT for Bee Fitness is the algorithm that informs the beekeeper of each hive's condition. We use benchmarks such as the time of the season and the surrounding hive state in order to define a "nominal" state. Then we position each hive in relation to this reference.

The color code is the following:

color	meaning
Green	Healthy
Orange	Disturbed (declining or with abnormal events)
Red	In trouble
Black	Dead
White	No data or no weather

BFit is based on algorithms that collect events. The 'Learning' algorithm learns from previous events to preserve, or not, future events. Afterwards, it classifies the detected events between those affecting the hive state and the others.

BFit also takes into account the results from BForce. In this way, it can determine the difference between the current hive dynamics and a theoretical brood dynamics that is constantly changing. These theoretical dynamics are regularly updated. It also takes into account the different regions of the world to provide relevant information according to latitude or climate.

Brood level - BForce

Note on Brood Levels

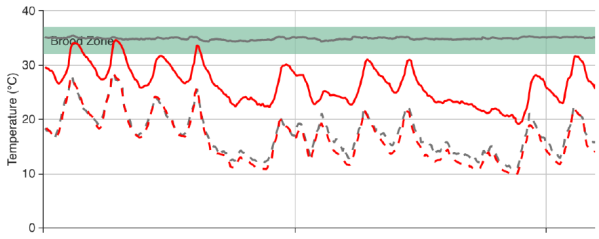
Brood is estimated using internal temperature measurements and other parameters (T2 or TH sensor required). Brood levels are given in percentages. Familiarize yourself with these values in your hives. As a starting point, in a 10-frame hive, 90% brood could mean 9 frames, 80% 8 frames, etc. However, this varies with hive configuration, so learn what these percentages mean for your bees.

Brood development is a key factor for bee colonies. The aim of BForce is to provide an indication of the brood level in the hive on a range of 0 to 100%.

When the colony is at its full capacity, it reaches a stable state of 35°C. This state is associated with 100% brood. This means that the hive is strong.

On the contrary, when there is no brood, the bees do not need to regulate the cluster temperature. In this case, the hive internal temperature will roughly follow the ambient temperature. If this is the case, there will be 0% brood.

Between these two extreme points, we can imagine a lot of intermediate situations.



In order to illustrate this, here are the hourly measurements on two hives from the same apiary. The first is represented in red and the second in grey. Each hive has a very different condition. The red one has an internal temperature close to 25°C/30°C - following the same fluctuations as the external temperature (dotted lines) - while the grey one is situated in the famous 'Optimal Brood Zone' with a constant temperature of 35°C.

In this example, the grey hive has a high proportion of brood, contrary to the red one. **BForce correlates this colony characteristic and translates the raw temperature measurement into standardized and understandable information**. The model takes a range of parameters into account to optimally estimate the brood level.

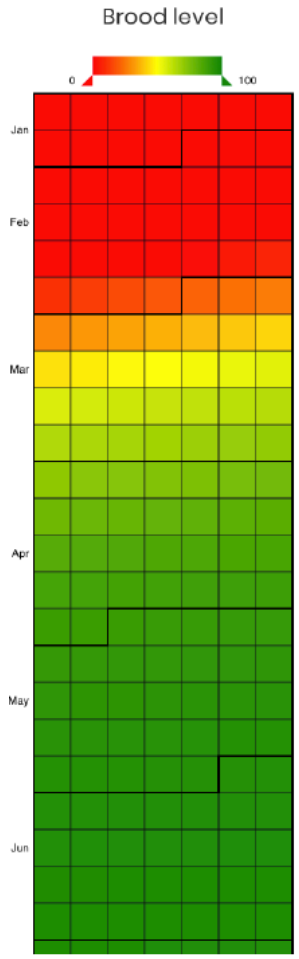
- hive internal temperature
- ambient temperature
- evolution of surrounding colonies
- season, latitude & climate
- other events identified in the hive

BForce is also a **strengthening tool in swarm detection**. In fact, when a swarm has been detected by one of our Machine Learning tools, the brood is impacted by the queen loss and thus the interruption of egg-laying. With BForce, we can classify the different swarms detected.

Comprehensive results

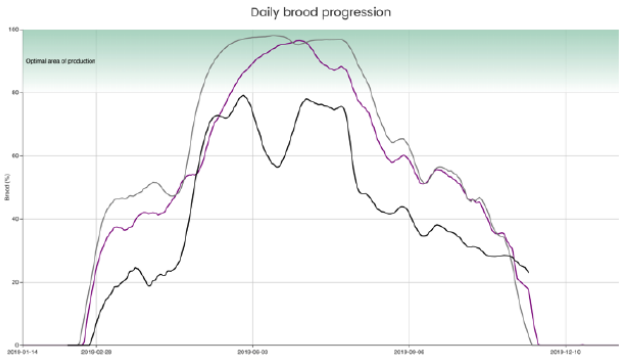
Brood calendars & charts show the daily progress of the brood in each hive. The values vary from 0% (no brood) to 100% (complete brood). Generally, 10% is one brood frame, 40% 4 frames, etc. Depending on your practice and the hive model used (Langstroth, Dadant) you might have to adjust these values. Therefore, **hives with a brood level higher than 80% generally produce honey**.

You can visualize the season's history at a glance. The egg laying stops and restarts are clearly visible.



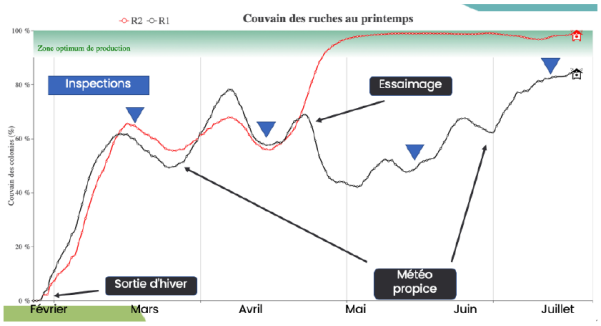
Brood calendar

You can also compare several hives with each other, whatever their apiary.



Annual brood - same hive compared with two others

With practice, we can identify several events on these graphs. We can identify when the egg-laying starts & stops, of course. But we can also detect swarms, bad weather periods that have impacted brood production, the effect of Asian hornets, etc.



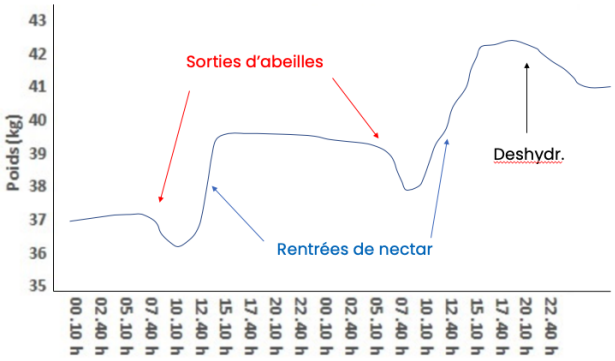
Two hive path over a season, with some events

Productivity - BWeight

Having flowers does not necessarily imply nectar - and thus resources for bees. Indeed, many factors condition the occurence of a honeydew: the ambient temperature and humidity, the last rains and their intensity, the root depth for plants such as rapeseed or sunflower. Honeydews are therefore not acquired nor easy to identify. However, understanding them is a basic need for every beekeeper.

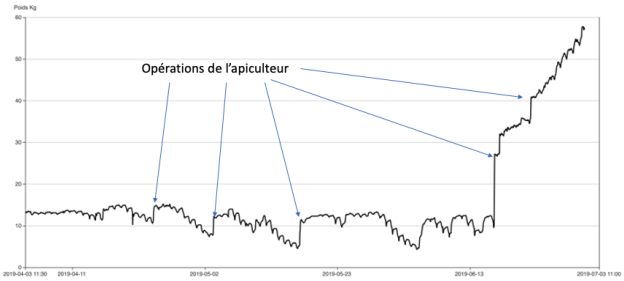
A weight sensor installed under a hive provides detailed information on weight gain and loss. However, this information takes into account several factors that are not necessarily related to productivity.

First of all, during the day, weight variations depend on the resources brought in or consumed. But they also depend on the bees' movements: during the day, they are more or less numerous to come out to forage.



In red: when bees get out of the hive In blue: when they bring back nectar In black: dehydration

This is why the hive weight graph shows some "bumps". A bump every day, as you can see in the graph below. On the chart, you can also see sudden weight variations, related to the beekeeper's interventions.



Gross weight history with beekeeper's interventions in blue

With these facts, we can see that **for a proper productivity evaluation, we must only consider the weight variations coming exclusively from the bees' production**. In this way, external events must be ignored: feeding, swarming, addition/withdrawal of suppers, beekeeper interventions, unexplained loss or gain. The BWeight algorithm makes it easy to identify these distinct events and to exclude them from the productivity calculation.

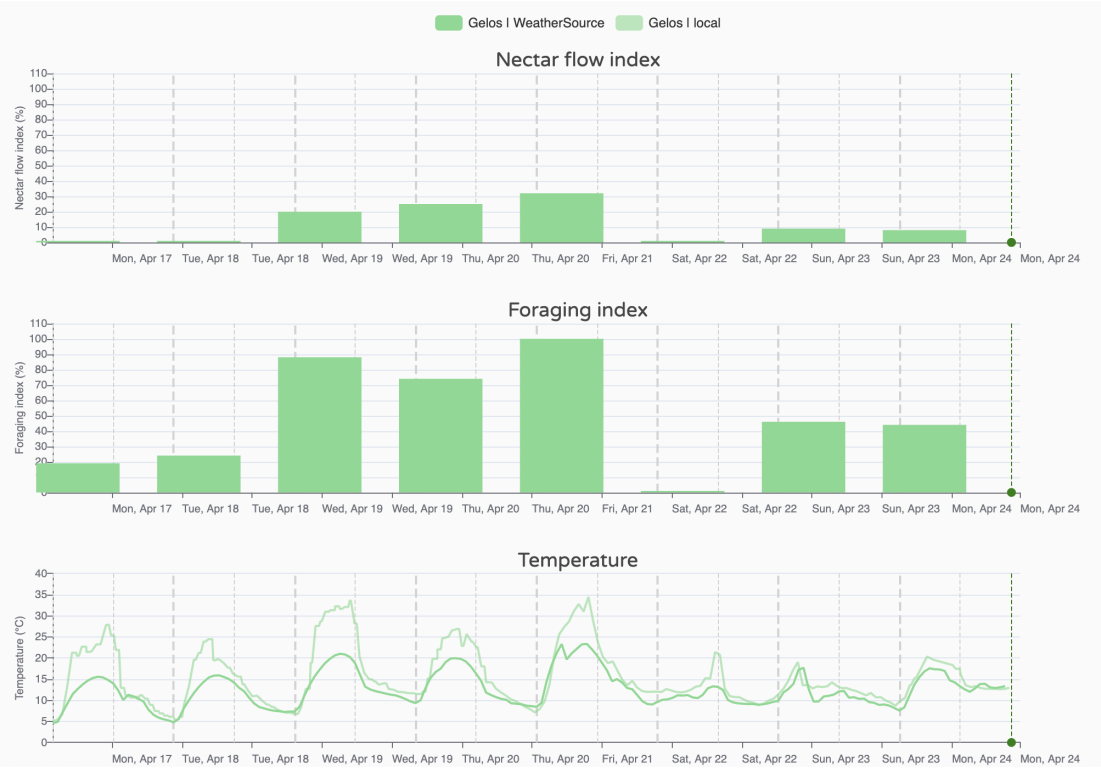
5.5 Weather

For each apiary, several information are presented from several sources:

- apiary weather: typically temperature, hygrometry, rainfall and wind.
- Foraging and Nectar Flow Indexes (see below)
- sources from which these values are derived or computed

The weather data displayed in this space is derived from two main sources:

1. By default, they come from WeatherSource. This service provides real-time weather conditions for a given location defined by its country/postal code. The service also includes a 10-day forecast. The current day is indicated by the vertical dotted line. All users have access to this source.
2. When the user has defined a local weather source, the data measured by this personal source is also displayed.



On top of the raw weather data we have developed an algorithm translating this information into beekeeping specific metrics. The result takes the form of two indices on a scale of 0-100%:

- **Foraging Index (FI)**: evaluates the atmospheric conditions for bees to forage. This index considers the outside temperature, the hygrometry, rain and wind.
- **Nectar Flow Index (NFI)** : evaluates the atmospheric conditions for the nectarification of the flowers. Here too, several factors are analyzed in relation to the nectar flow conditions. 0% means that the conditions for honeyflow are not met, 100% that it is damn great. But beware, depending on your climate zone, 100% may never be reached and you will have to be satisfied with lower rates! To validate the forecast range, this algorithm has been developed with apiaries located in various climatic zones (temperate, cold, very cold, tropical...); We ensure you that in some cases it can reach 100% ☺

The 10-day weather forecast allows to project these indices over a week and a half. These foraging and nectarflow forecasts are helpful for the beekeeper to identify the relevance of certain actions.

Practical use of the Nectar Flow Index (NFI)

Understanding and utilizing the Nectar Flow Index (NFI) can significantly enhance your beekeeping practices. Here's a guide on how to practically apply the NFI:

1. Monitor Local Blooming Plants: Keep track of the types of plants in your area and their blooming periods. The NFI is only useful if there are plants in bloom.

2. Understand Plant-Specific NFI Thresholds: Different plants have varying NFI thresholds for nectar release. For instance:
a. Rapeseed: Nectar flow generally starts at an NFI > 7 because of the cooler early-season conditions.
b. Sunflower: Nectar flow typically begins at an NFI > 30 during the warmer summer months.

3. Observe and Record: Regularly observe your hives and note when bees start to gather nectar from different plants. Record the NFI readings corresponding to these observations. Over time, you'll identify specific NFI thresholds for various plants in your area.

4. Make Informed Decisions: Use your observations and recorded data to make informed decisions about hive management. For example, if the NFI indicates that nectar flow is likely but your bees are not active, check for other factors such as plants blooming, hive health or local microclimate conditions.
Plan hive movements or resource supplementation based on anticipated nectar flows.

By effectively integrating the NFI into your beekeeping routine, you can optimize nectar collection and overall hive productivity.

6. The widest range of sensors for beekeeping

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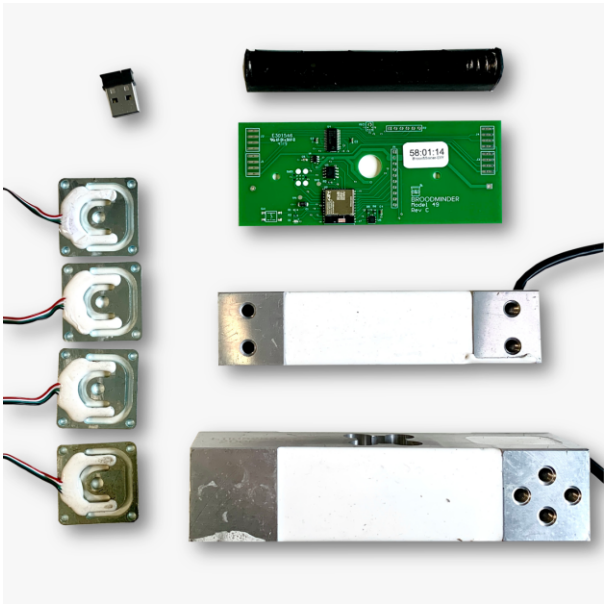
Product	Name	Description
	Internal sensor T	Small sensor, big benefits. The best tool for monitoring hive dynamics.
	Internal sensor TH	Temperature and humidity, all in one.
	Scale W	Ideal scale for hobby beekeeping Best value for money.
	Scale W4	Scale for migratory beekeeping, adaptable to a wide range of supports. Tough as nails

6. The widest range of sensors for beekeeping

Product	Name	Description
		
	Scale DIY	A do-it-yourself kit for DIY beekeepers.
	Weather station	Hyper-local conditions for temperature and humidity in the apiary.
	BeeDar	A Radar to track bee activity during the day.

6. The widest range of sensors for beekeeping

Product	Name	Description
		
	SubHub	The subHub is both a data hub and a transmission relay.
	Hub Wifi	Ideal if your hives are close to a Wifi network.

Product	Name	Description
		
	Hub 4G	Optimal connectivity with multi-operator SIM card.
	Hub 4G Weather	Two in one: Data transmission AND weather station (temperature, humidity and pressure)

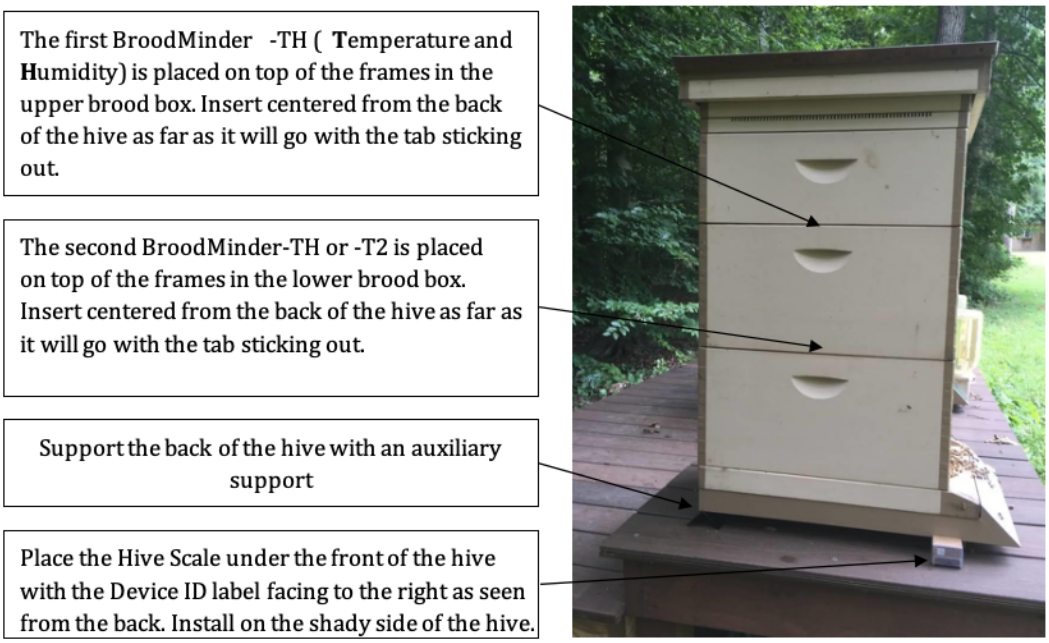
6. The widest range of sensors for beekeeping

Product	Name	Description
		
	Hub 4G Solar	Endless autonomy with this version boosted with a solar kit.

7. Sensors

7.1 Installing your BroodMinder

The Citizen Science Package contains two Broodminder-TH (temperature and humidity) or T2 (temperature only) Devices and a Broodminder-W hive scale. Here is where you install these devices:



7.2 Routine Maintenance

There is not much routine maintenance that is required. Please note that if your batteries are lasting less than 6 months, something is wrong and you should contact Support@Broodminder.com for replacement or refurbishment.

Spring

We have a video talking about spring maintenance on the support page at mybroodminder.com/resources. In the spring, it is a good time to clean up your devices. You can use 91% or better Isopropyl or Ethyl Alcohol, it will not harm the electronics.

You can place the wrappers in the freezer and then propolis will break off more easily.

Ensure that the scale wrapper is not cracked, that will allow rain to harm the sensors. You can seal any cracks with packing tape.

We also have replacem ent wrappers for all the devices on our website at Broodminder.com.

We also offer Refresh service where we replace the housings and batteries and test the devices. This is a very good option every couple of years to ensure that your devices are operating properly. There is more information at broodminder.com/collections/service-warranty/products/refresh-broodminder-t2

Winter Service check-list

For peace of mind and greater efficiency, we recommend servicing all of your devices at the end of each season. Starting the next season with empty memory devices, loaded batteries and updated firmware will put all the chances on your side.

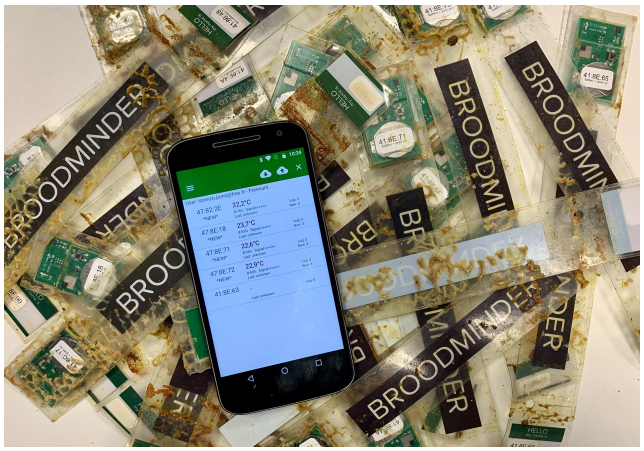
If you would like us to do this for you go to BroodMinder-Refresh at BroodMinder.com. We will clean, test, add new batteries and housings. If something fails testing, then we will contact you and offer you a refurbished device at 50% the cost of a new device.

Prepare hardware

- [ ] Order some CR2032 batteries to have enough stock

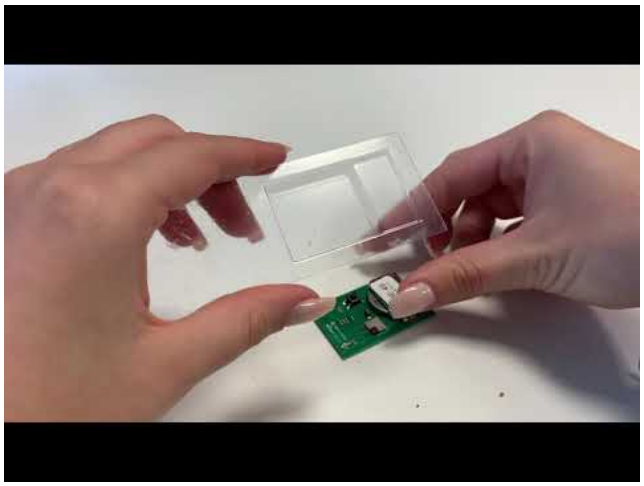
> **Note**
>
> Forget your supermarket and low cost sites where you won't have any quality guarantee. Order a batch of batteries in dedicated shops to get a fair price (about 0,50€). Farnell

- [ ] Collect all your devices and bring them at home, you want to work comfortable
- [ ] Make a full sync of all your devices with the Apiary App to catch any sample that the hub eventually missed (leave your phone syncing and charging and go for a coffee or two)



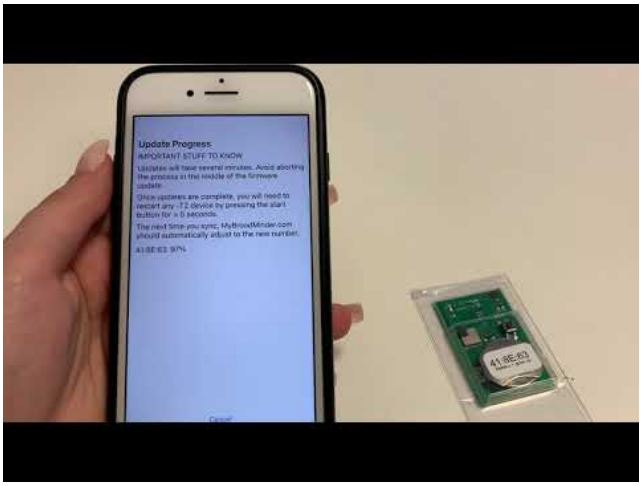
T2 Maintenance

- [ ] Change the battery as described in the video



- [ ] Start the device

- [ ] Upgrade firmware as needed



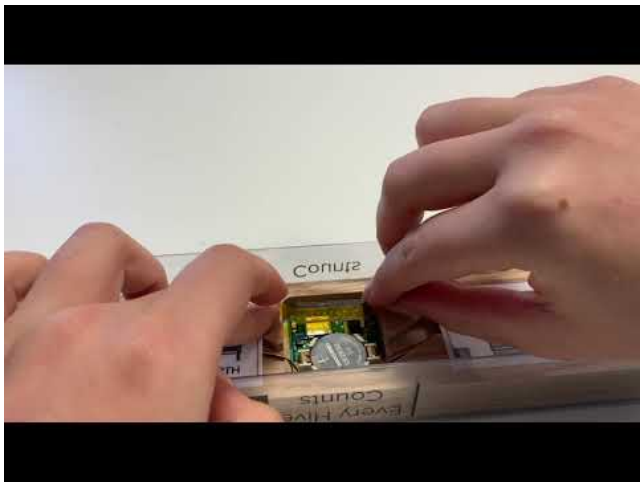
TH Maintenance

- [ ] Change the battery as described in the video

- [ ] Upgrade firmware as needed (see above)

W Maintenance

- hange the battery as described in the video using the provided tool to remove the battery

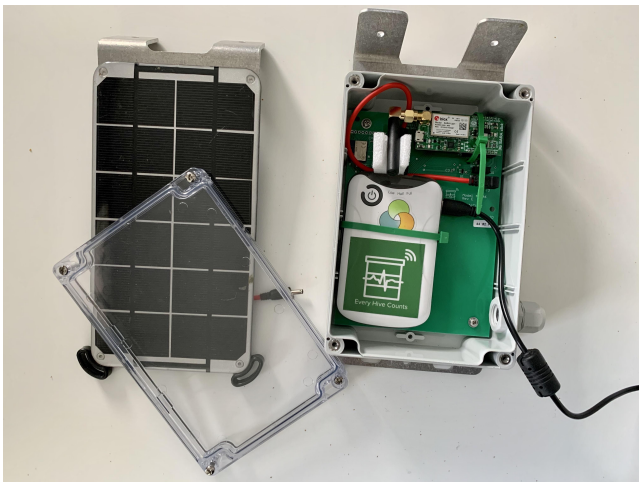


> **Warning**
>
> Pull the battery carefully from one side of the holder while pushing the circuit board against the wooden part. This will avoid tou also pull the board out of the scale or breake the holder under too much pressure

> **Warning**
>
> Once you're done place the small tool carefully into its original location and avoid any interference if it hosts between the two amovible parts of the scale.

Hub Maintenance

- harge the battery to its maximum using a phone charger with a micro-usb cable



- nstall any available firmware updates (Broodminder Cell App will tell you)
- fter upgrading the Cell Hub check you have the right APN either `hologram` or `matooma.m2m` (into `Configure > Diagnostics > Cell Network > Custom APN`)

> **Warning**
>
> Remember the battery (older white style, not the new silver battery) has two modes **Always on** and **Auto off** : in the apiary it has to be **Always on**.

7.3 Device Firmware Updates

All BroodMinder devices have provision for Over-The-Air (OTA) upgrades. These are performed by the Bees app. For more information, go to this link.

resourcesmybroodminder.com/resources

and also read here : Device updating

8. BroodMinder TH & T

8.1 Broodminder TH (56)

This sensor measures in-hive temperature and humidity and will also watch for temperature events such as swarms. Based on those informations we will be computing Brood level, hive fitness and a set of specific alerts (hotter and colder limits, excessive humidity...).

The first BroodMinder-TH was released in 2016. It was model 42 and was evolved into TH2 back in 2019. The SwarmMinder (see below) version TH2SM was introduced in May of 2020 evolving to model 56. In 2023 it was evolved to TH3 which is the current version distributed.

Installation

All Broodminder-TH device IDs start with 56 so they should be easy to recognize. The normal placement of the sensor is on top of the frame near the middle of the hive box of interest. This position is chosen for several reasons:

- Heat rises, therefore the sensor will feel the heat of the brood below.
- The brood tends towards the middle of the hive and then surrounds the brood with pollen and honey. Placing the temperature sensor here has the best chance of sensing the brood.
- Using this standardized position allows for cross-hive comparisons across the world.

If you are in a cold climate and you overwinter in more than two boxes, then you may want to move the sensors up to under the inner cover. This is because as the cluster moves above a sensor, that sensor tends to sense the outside temperature (since heat rises).

By placing the Broodminder-TH sensor right below the inner cover, you will sense the heat of the entire hive. Condensation is very likely when it reaches 100% and you may want to inspect the hive and take appropriate action if necessary.

Note: Relative humidity (RH) depends both on moisture in the air and temperature. As temperature goes down, RH goes up. A good example is when RH = 100% outside dew forms. The same thing will happen in your hive.

If you move the Broodminder-TH to the top, then you may want to move the other Broodminder-TH to right below the top box. That way you will see as the cluster moves up past this box.

As a final note, the Broodminder-TH is thin enough that if you want to experiment with different positions such as between the frames you can. We would love to know how this works for you and what you learn.

Whatever position you choose, you can add a tag to the data using the Broodminder app. We'll talk about doing that in a later chapter.

Note

Do not forget to adjust the actual date/time you installed the device in hive. It is necessary to start with clean data from the onset, otherwise (if you powered on a few days before) the brood estimation will start with the data from your livingroom!

SwarmMinder

SwarmMinder is a special feature of BroodMinder TH and T. The device is scaning for sudden thermal variations. It enters a decision loop that depending on how in-hive conditions evolve, might end-up trigering a Themperature Event.

See below the details of this feature.

Maintenance

The CR2032 battery is replaceable by opening the wrapper. It should last more than a year and we recommend replacement each fall before the low temperatures of winter.

If your plastic wrapper gets used by time, you can order new ones and replace them during your winter service.

8.2 Broodminder-T (47)

The BroodMinder-T (**Temperature**) is a cost reduced version of the BroodMinder-TH. It will sense the hive temperature which will indicate brood rearing during the season and winter survival during the winter. We will be computing Brood level, hive fitness and a set of specific alerts (hotter and colder limits..)

BroodMinder-T was introduced in 2019 as model 41 and evolved to the SwarmMinder version BroodMinder-T2SM in May of 2020 becoming model 47.

Installation

All BroodMinder-T device IDs start with 47 so they should be easy to recognize. However, they exist in 2 versions :

- Broodminder-T2 with a button (until febr. 2023),
- Broodminder-T3 without button (from febr. 2023 ahead).

For the version with no button, just remove the "remove before use" tag and it will run automatically.

The button version (T2) is a little more complicated. to turn on the BroodMinder-T2, press the button for 10 seconds. **The LED will flash 10 times to indicate success.**

Warning

IF YOU DON'T HOLD THE BUTTON LONG ENOUGH, YOUR T2 WILL SHUT DOWN AFTER ABOUT 10 SECONDS.

If you ever want to know if the -T2 is operating, press the button again, and the LED will flash momentarily to indicate the battery is fine and the device is operating.

The normal placement of the sensor is on top of the frame near the middle of the hive box of interest. See the TH section above for the full explanation.

Note

Do not forget to adjust the actual date/time you installed the device in hive. It is necessary to start with clean data from the onset, otherwise (if you powered on a few days before, the brood estimation will start with the data from your livingroom!)

SwarmMinder

Broodminder-T model 47 also operates with SwarmMinder. Find all the details in the paragraph below.

Maintenance

BroodMinder-T2 : To change the battery, simply cut the tape on three sides around the circuit board. Then swing the board out and replace the battery with a new CR2032. Be sure to seal the circuit board again using packing tape.

If you want to turn off the T2, you simply have to push long on the button and it will power off. You can double check by pushing again short : the led should not flash.

8.3 SwarmMinder Details

Swarm Thermoregulation

It is well known that during a swarm event there is a lack of thermoregulation from the colony and that this is reflected by a temperature overshoot like the ones displayed in the following picture:

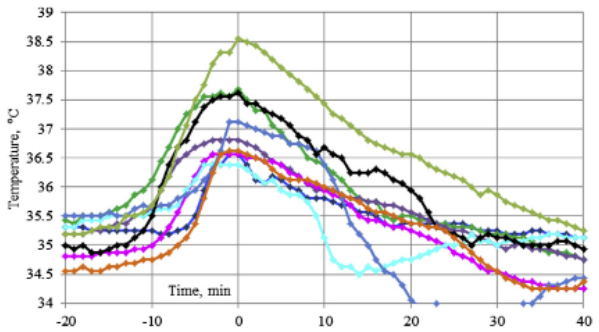
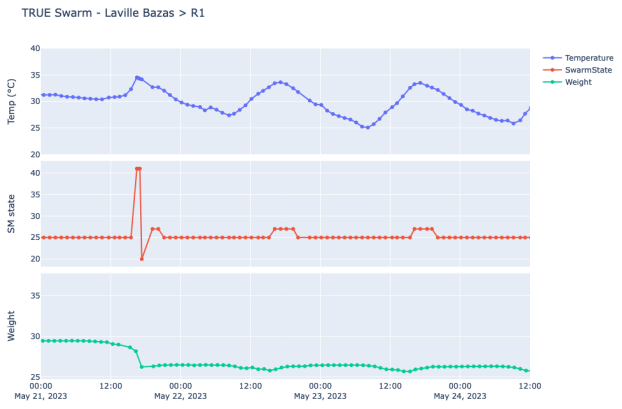


Fig. 2 – Summary of temperature dynamics during registered swarming events normalised by the moment of maximal temperature (time point zero).

And here is an actual swarm trace:



We can note the temperature peak in the afternoon of May 31st. This peak is detected by SwarmMinder and the `SM state` code jumps from 25 to 42. At the same time the weight drops down due to bees leaving the hive.

SwarmMinder algorithm

To capture those events, every SM device (T or TH) is reading temperature once per minute. Then it compares current and prior values looking for specific changes. It watches for a minimum temperature change to be obtained. Once achieved, it watches for a temperature increase of at least 1°C from 30 minutes prior. That increase must continue for between 2 and 20 minutes and be followed by a temperature decrease.

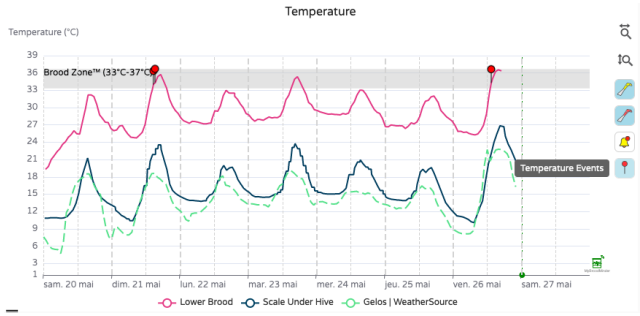
Any time the sensor sees a 2°C (4°F) increase in temperature (when brood is present) then the sensor records the 30 minutes before and 40 minutes after with 1 minute resolution and sets a flag indicating a `Temperature Event` has occurred. See the data interpretation section for more information.

> **Note**
>
> SwarmMinder delivers `Temperature Events` and not `Swarm events` because so far the events trigering might be from different sources, and not only swarms. Other SM triggers might be:
>
> - a pre-swarm some days before
> - a beekeeper inspection (exposing the internal sensor to teh sun)
> - a very steep ambient temperature variation and/or a low insulated hive

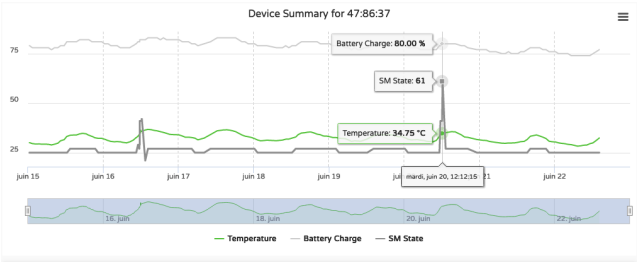
SwarmMinder events display

SwarmMinder events are displayed at 3 different levels:

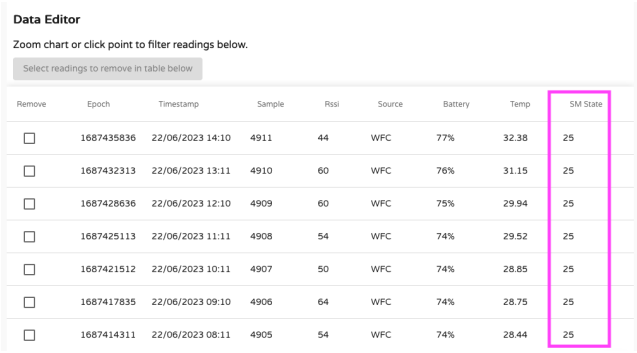
1. At hive level you will only be notified of Temperature Events (ie. SM triggered). Those events are materialized by red needdles displayed on the temperature curve. And you can choose wether you want to see them or not clicking on the corresponding icon available on the right side menu bar.



1. At the device level you have the hole series of SM codes displayed on the graph. It is called `SM State`



1. This same data is displayed on the respective table and of course can be exported to csv, just in case you would like to play a bit more with it.

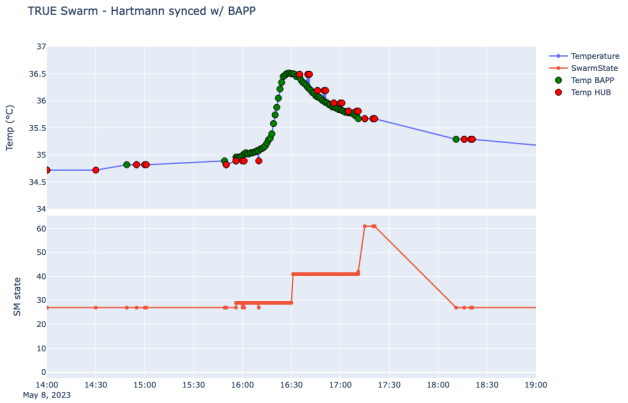


Sampling the event

As described above, the sensor is scanning every minute and if the event is detected it will keep record of the temperatures associated with it.

For those having a hub in the apiary, the trigger will be automatically detected by the hub and sent through email or SMS to the beekeeper. However the hub is not harvesting the minute information. it only takes a few points of the trace. When you do a sync with the Bees App the whole timeseries is collected and sent to the cloud.

The chart below clearly shows what are the samples sent through the hub (red dots) and the full series collected by BeesApp (green dots).



Note

There might be some slight time shift between the samples collected by the hub and those from Bees App. This is due to the fact that the timestamp set by the Hub and the BeesApp can be different.

SwarmMinder State Codes (Models 47, 56)

The following numeric codes (base 10) will be displayed in the `SM State` value.

SWM_STATE_STOPPED

```
00 SM Stopped
01 Initialization complete - stopped
02 Stopped: by STOP request
```

SWM_STATE_CHECKING

```
20 Start checking for swarm event
21 Buffering temperature data
22 Temperature < Hive Base Temp (32.5C, 90.5F)
25 Buffered Hive Temp < Hive Base Temp
29 SWARM EVENT DETECTED
```

SWM_STATE_LOGGING

```
40 Swarm Event Detected - start logging
41 Still logging swarm data
```

SWM_STATE_WAITING

```
60 Swarm Event logging complete- start waiting - swarm detection
61 Swarm Event logging complete- still waiting
```

Info

The temperature event trigger will only operate if the device position is assigned to the `upper` or `lower brood box`. Since the algorithm is really only meant for brood areas, this prevent spurious triggers when the SwarmMinder devices are located elsewhere.

Note

It is important to note that not all `Temperature Events` are swarms. In some cases it can be the consequence of other actions like for example 1/ your own inspection or 2/ a very thin and uninsulated roof that does not protect the hive from overheating at the sun => you should think on insulating.. 3/ the colony preparing for swarming the days before it actually does.

We are still learning on all the different circumstances and patterns that might happen. If you want to contribute to build this knowledge and share your experience with us, feel free to drop us an email to support.

9. BroodMinder W

9.1 Broodminder-W (57)

The Broodminder-W (**W**eight) is a single-bar hive scale that goes under the hive. It is an excellent tool to track nectar flows as for following winther ressource consumption.

The first W was released in 2017, it was model 43 and lasted for 5 years unitil in 2022 was released the W+ scale under model 57 improving bluetooth range and battery life.

Installation

There is an extensive writeup about positioning the scale in appendix A. That is a good thing to read, but if you are in a hurry, here are the basics.

Warning

the most typical error source is inadequate support under the scale. This can result in strange behavior as the hive flexes as it expands and contracts due to sun, rain, temperature, etc. Providing a flat support will improve results. An easy fix is to place a ¾" plywood sheet (or equivalent) under the scales.

ADDITIONAL NOTE

If all you want to see is honey flow, good support is not required. You will just have to ignore the daily fluctuations. You will still be able to observe the overall change in weight.

Place the scale in the shade

The Broodminder-W has a temperature sensor inside which reads the local temperature. For the temperature to be accurate, it should be shaded from direct sun. This temperature is also used to compensate the weight sensors so avoiding the temperature spike created by direct sunshine will improve performance.

Being in the shade will also extend the housing life. We use UV resistant plastic, but in the direct sun even that will become degraded. If this happens, you can order a new housing on Broodminder.com.

Get the Broodminder-W level

We have done our best to make installation simple. However, you need to pay attention to a couple of things.

Make sure the hive is level. This doesn't mean "crazy level" but if your hive looks like the Leaning Tower of Pisa, then you won't get good results. 2x4's and shims are your friends. By using a few 2x4's and shims creatively, you can level almost anything! We also find that screwing the 2x4's together makes life better and more stable.

After you install the Broodminder -W, look at the end of it. Through the plastic cover, (remember… install it with the

plastic cover), you will see the upper wooden piece and the lower aluminum piece. Make sure that they do not touch. This will ensure that all the weight is sitting on the two little buttons on top of the aluminum base and not somewhere else.

Typical installation, not as accurate

Using the typical installation, you will see small changes to the hive however, the absolute accuracy will not be as good. For improved accuracy, see the recommendations of the next section.

The Broodminder-W is designed to measure ½ of the hive weight. To do this, we want you to support one side of the hive (front or back, left or right) with a 2x4 or similar However, we recommend that you use a piece of 2" angle for the support. By orienting it so that the point of the angle iron is up, it gives a very precise pivot point. You should be able get this at your local hardware store. Aluminum is extra nice because it won't rust. A great place to get just what you need for less than $5 each is Speedy Metals (1/8" {A} x 2" {B} x 2" {C} Angle 6061-T6 Aluminum, Extruded).]

The Broodminder-W is placed under the opposite side.

There is a nice explanation of the math and physics involved in Appendix A, however it boils down to this. **Do your best to place the support and the scale directly under the wall of the hive body.** That will give good results.

Better installation, more accurate

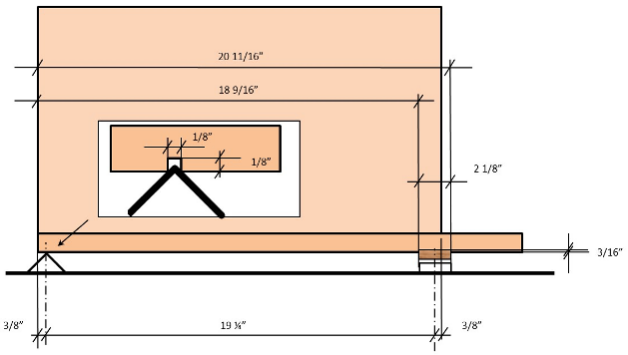
A better way to install will require a few modifications to your bottom board. You will make a couple of small cuts that will be used to accommodate precise and repeatable placement of the scale and support.

First off, we recommend that you use a piece of 2" angle for the support. By orienting it so that the point of the angle iron is up, it gives a very precise pivot point. You should be able get this at your local hardware store. Aluminum is extra nice because it won't rust. A great place to get just what you need for less than $5 each is Speedy Metals (1/8" {A} x 2" {B} x 2" {C} Angle 6061-T6 Aluminum, Extruded).

Now we want to make the cuts in the bottom board. For this setup we recommend using front and back supports and not side to side. That given, you must choose whether to place the Broodminder-W under the front of the hive, or the back of the hive.

In general, it is better to place the Broodminder-W out of the sun. This is because the sun will heat the scale and give you a false reading of the outside temperature. Placing it in the shady side of the scale avoids this problem. It will also make the housing last longer.

Next you will cut the bottom board. For the angle iron side, you will cut a groove the width of your saw blade that the point of the angle will fit in. For the scale side, you will cut a notch 3/16" deep that ends 1" inside the center of the hive body wall. See the images below.



Maintenance

Model 43 :

The CR2032 battery is replaceable. It should last more than a year and we recommend replacement each fall before the low temperatures of winter.

If you find that your scale sucks the batteries, contact support. There is maybe a workarround you can make yourself.

Model 57 : You will have to replace the two AAA batteries. They should last about 2 years.

Info

You can order a new housing on Broodminder.com.

10. W3 and DIY circuit board assembly

What follows explains how to assemble the hive scale boards wheter if they are for the BroodMinder-W3 model or for the BroodMinder-DIY.

Important

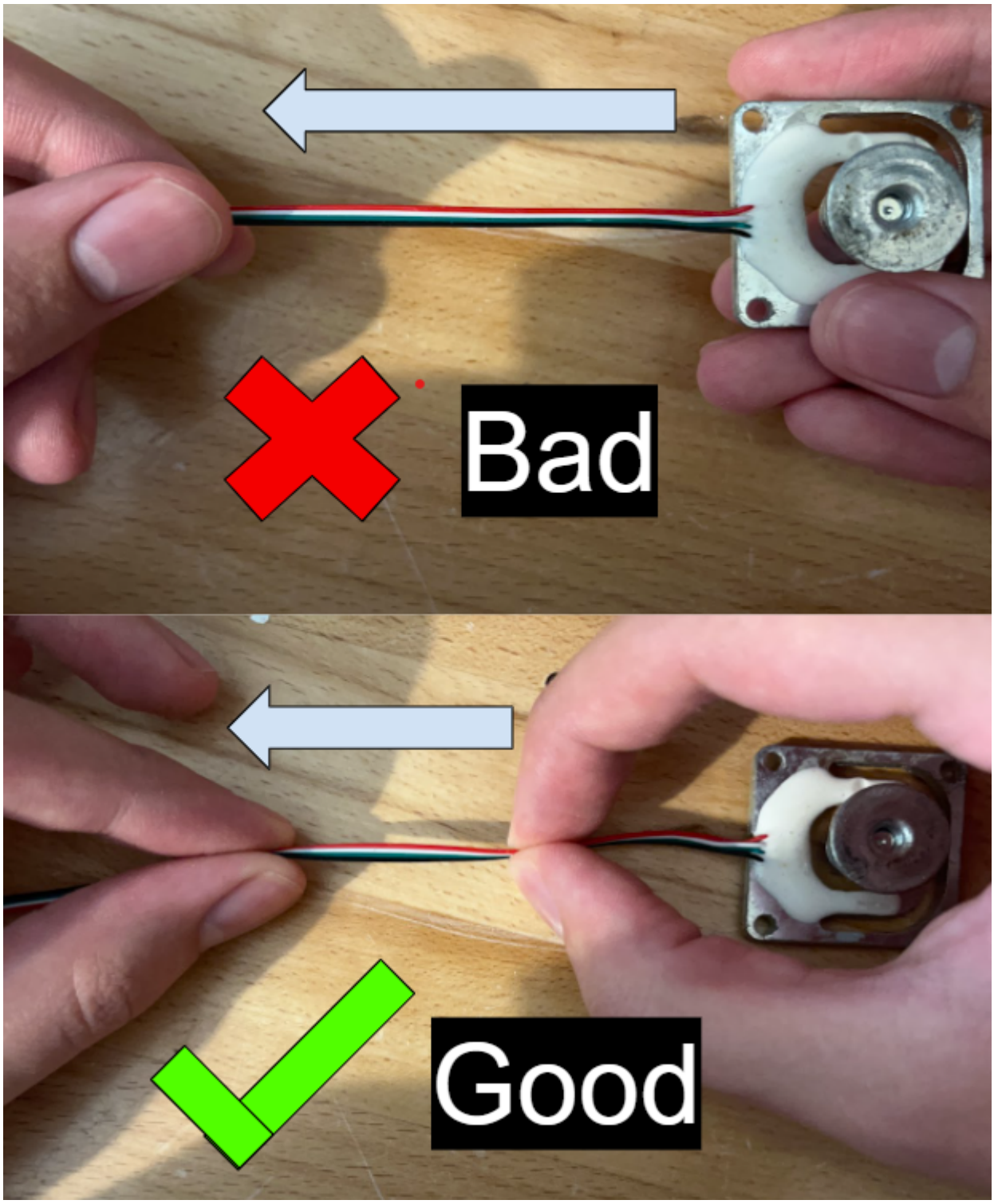
If you purchased a **W3 Unassembled-Calibrated** scale, all your electronics work is already done and you can jump straight to the next section : Scale Assembly

Warning

During the assembly process it is important to avoid putting any strain on the connections of the wires to the sensors directly, as if the connection breaks the sensors become UNREPAIRABLE. If it ends up being the case that the connections are broken you will have to request a new sensor(s) to be shipped to you.

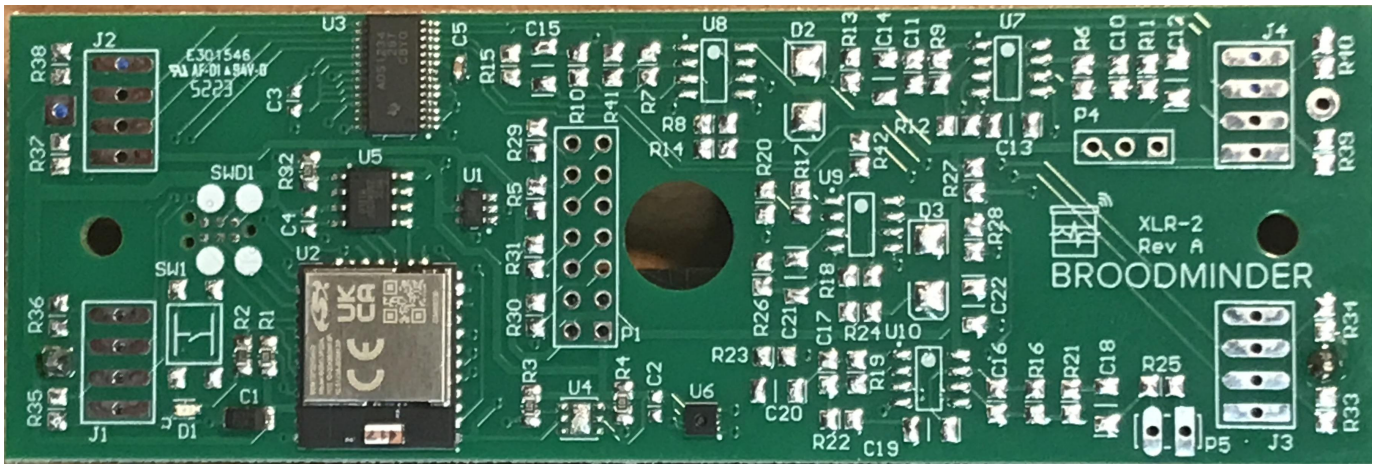
When working with the wires, it is recommended to use two points of contact as shown in the pictures below to avoid the connections being strained directly.

This is the most common problem with this kit, so please keep this in the front of your mind when constructing this kit.



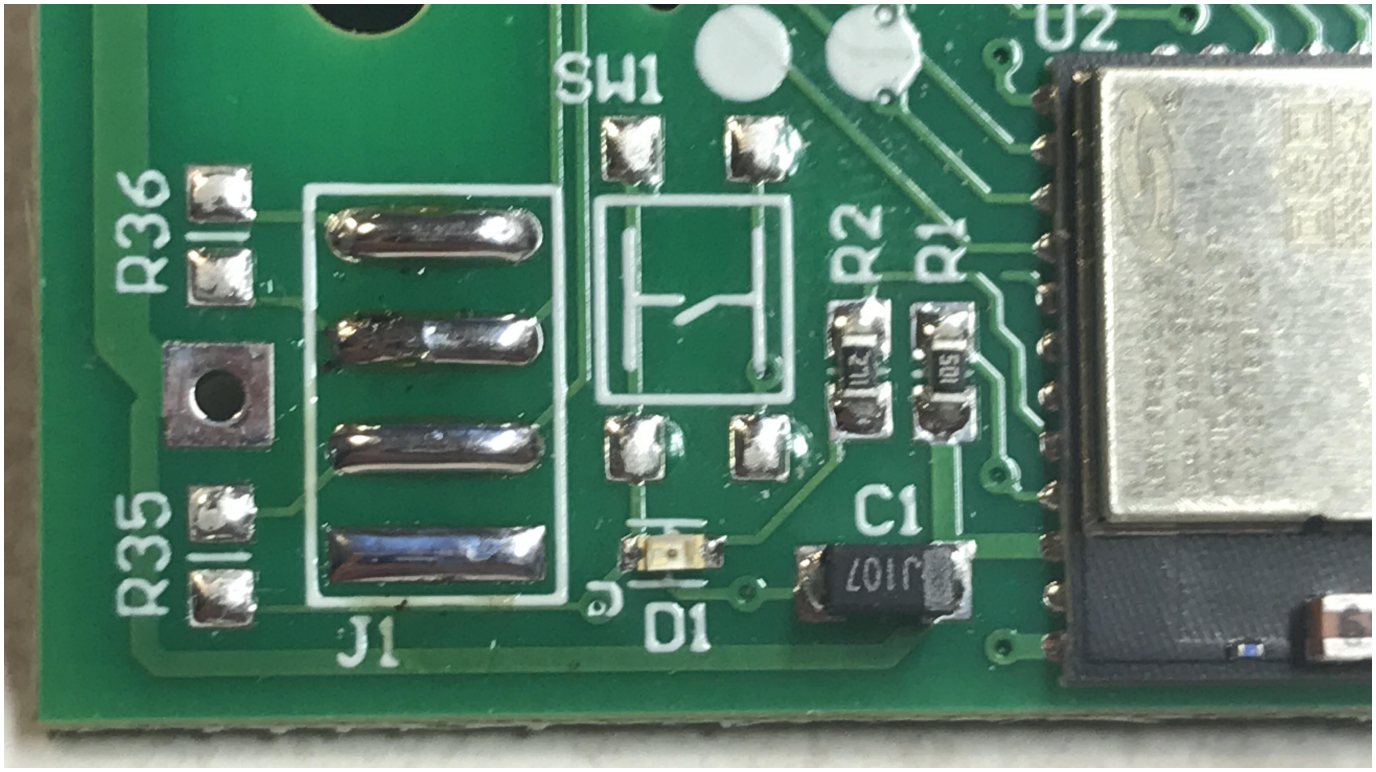
10.1 Get started with the circuit board

We are working here with the XLR2-L board. This is a multi purpose board and that's why there are so many components missing. Although for scales you only need the "-L" version shown below.

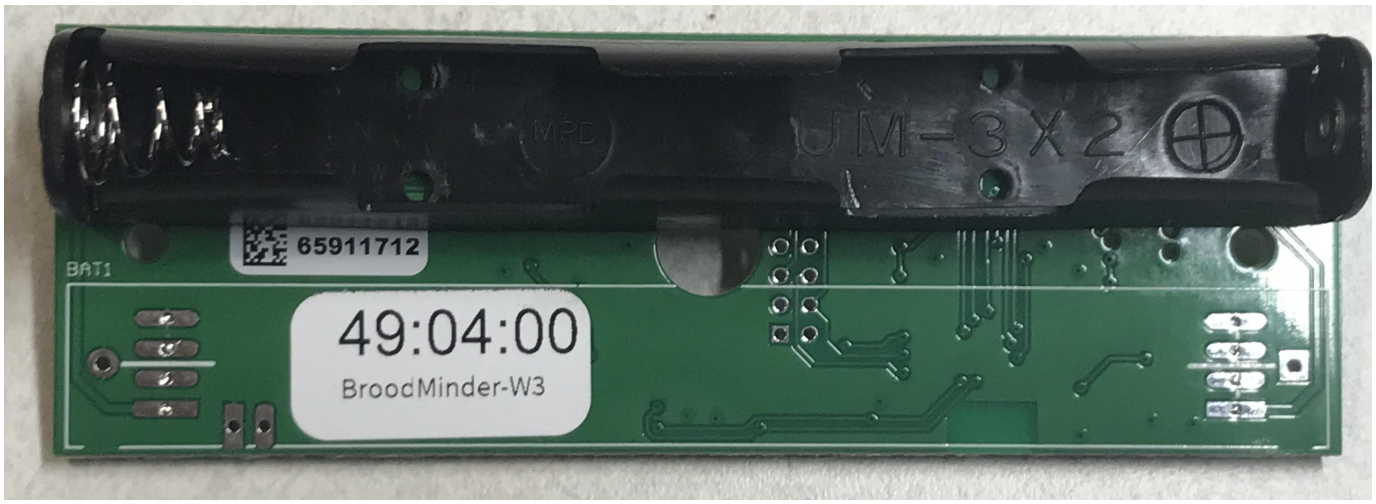


10.2 Prepare the board

- tin all 16 pads on a flat surface

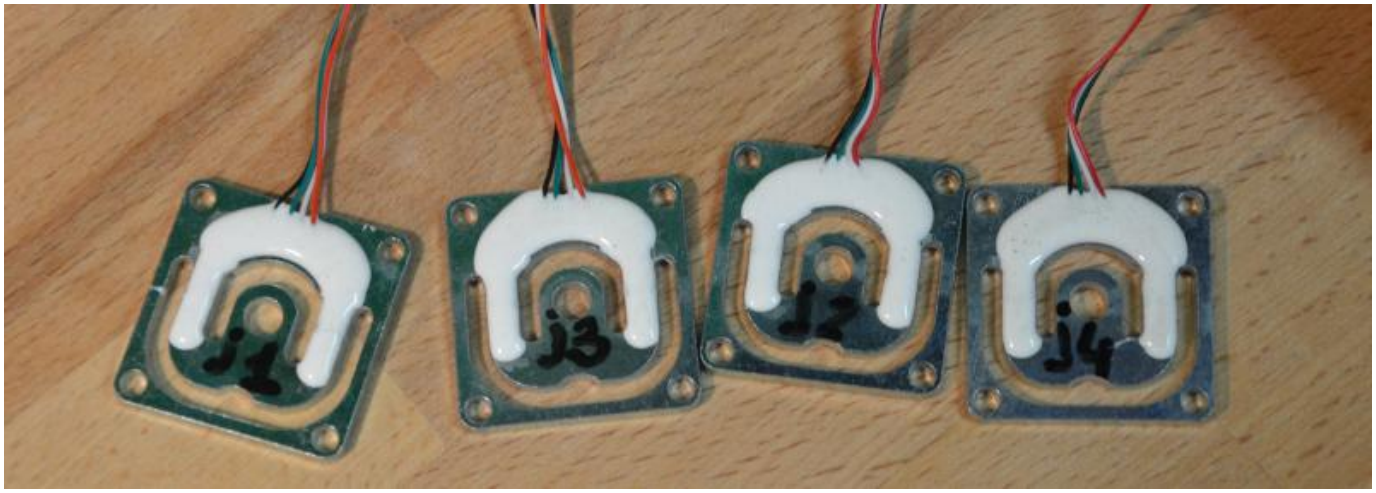


- solder the battery holder on the BAT2 slot (+ goes with the square pad)



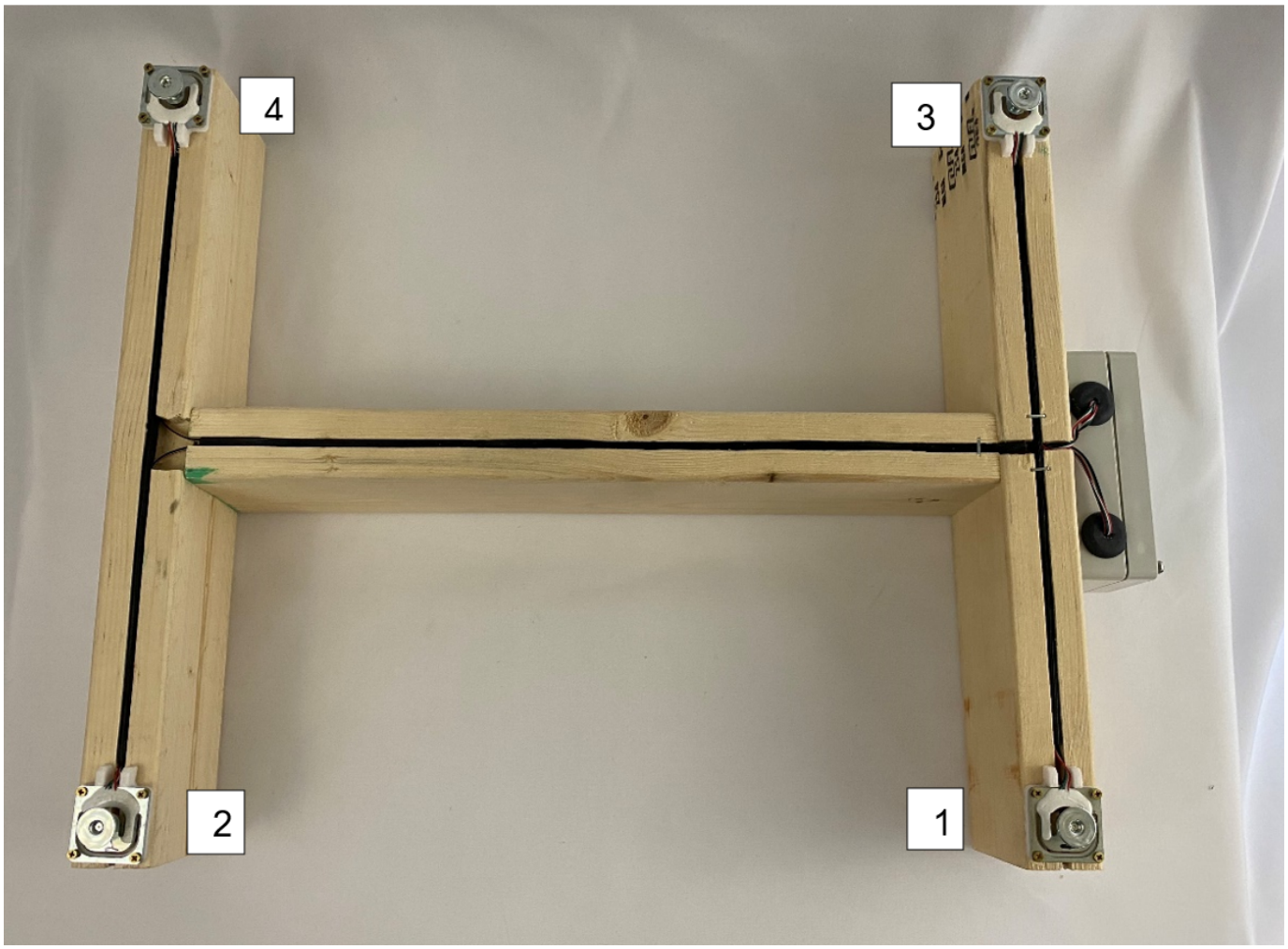
10.3 Prepare the load cells

Now with a permanent marker note the load cell position : J1, J2, J3, J4.

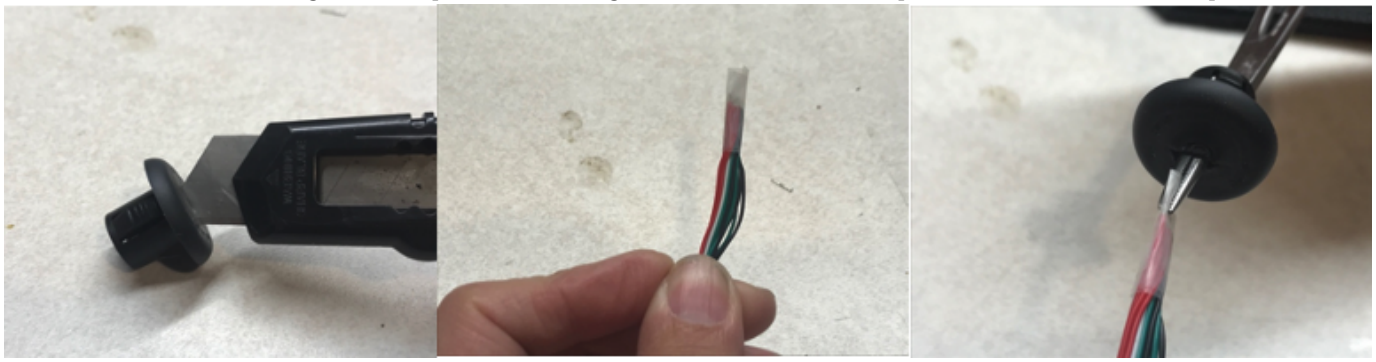


Remember :

	Left	Right
Rear	J4	J2
Front	J3	J1



Now cut a slit on the rubber grummit. tape the 4 wires together for each sensor and pull them with a hemostat or pliers.



Drill a hole in the box with a 1/2in (12mm) bit. Route the wires through the hole and solder on the board pads following the color order Black-Green-White-Red as shown in the picture below

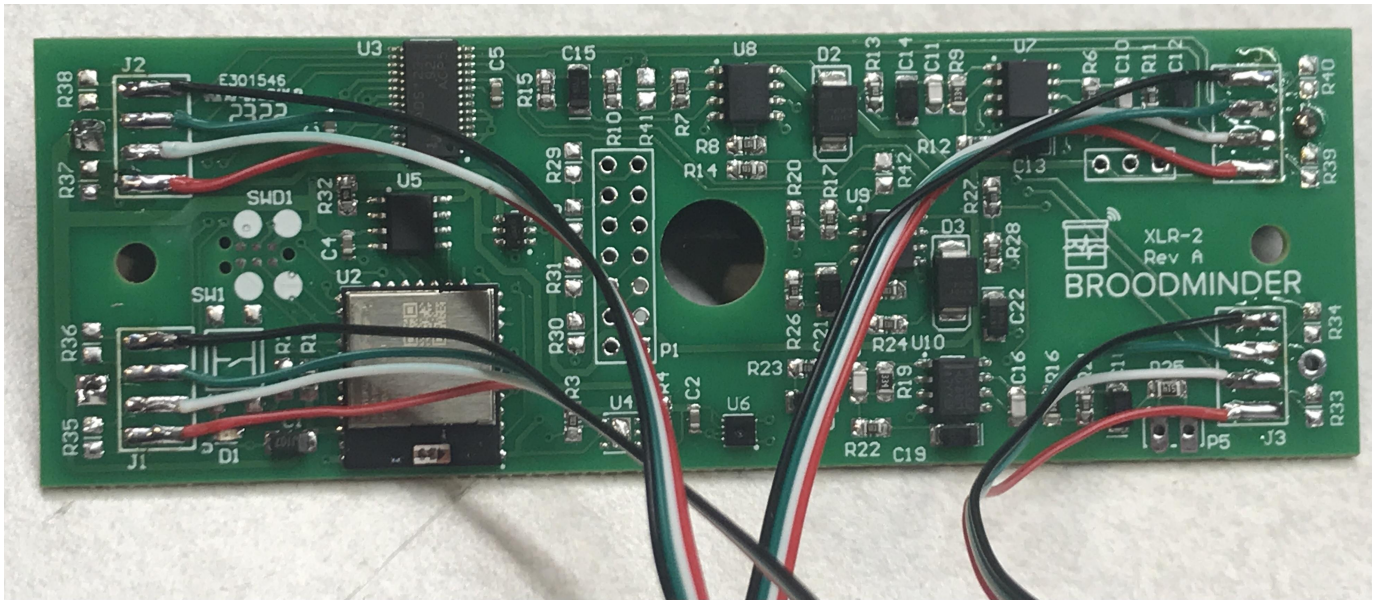
Note

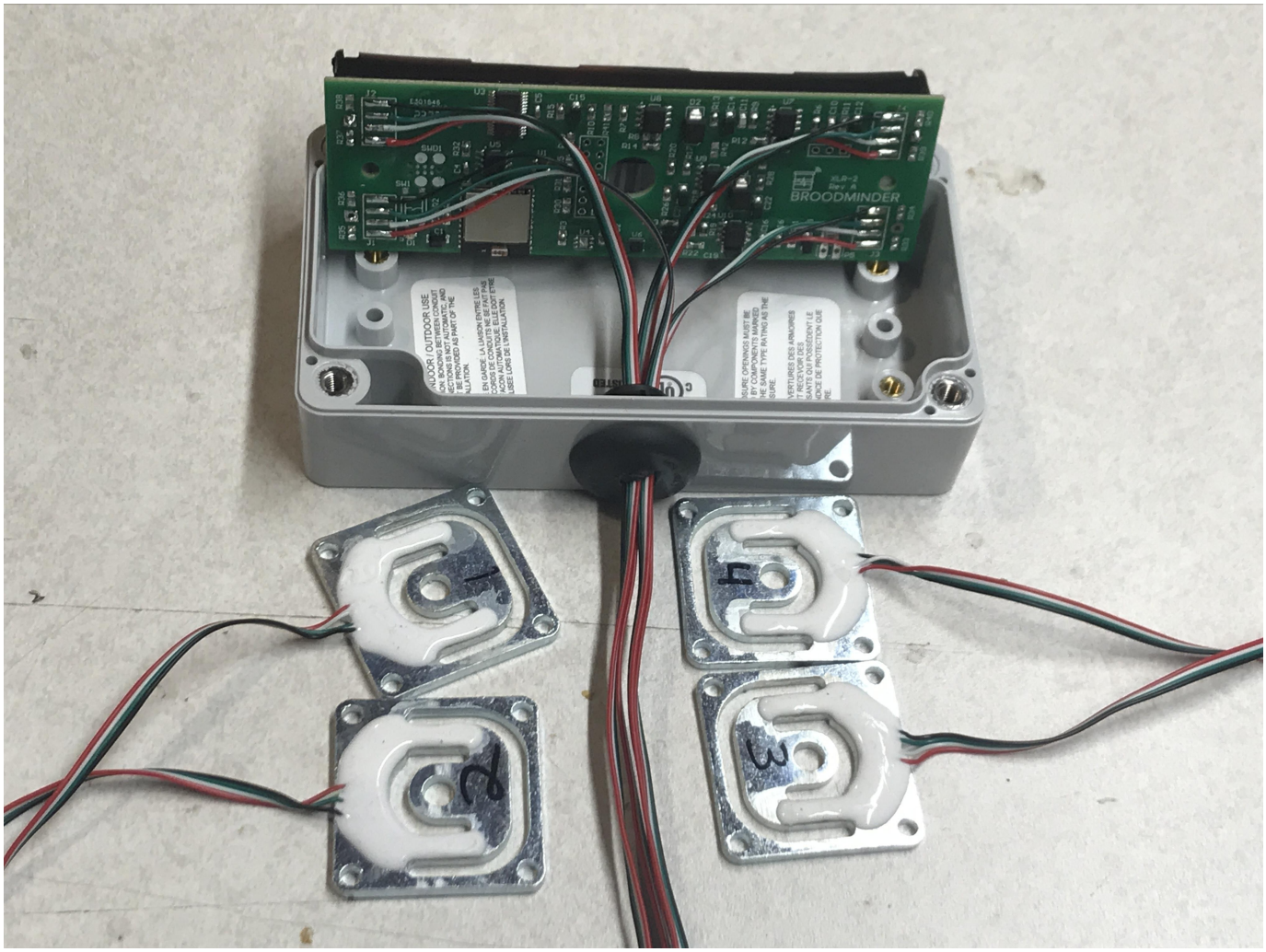
Make sure that before you solder the connections onto the board that the wires have been pulled through the grummit and that the grummit has been slotted into the electronics box.

If you solder the connections before the grummit has been slotted into the electronics box then you will have to un-solder all the connections otherwise the electronics box will not close correctly.

Note

Take care to associate each loadcell with its coresponding pad J[1-4] (This will be printed on the board in small text next to each pad).



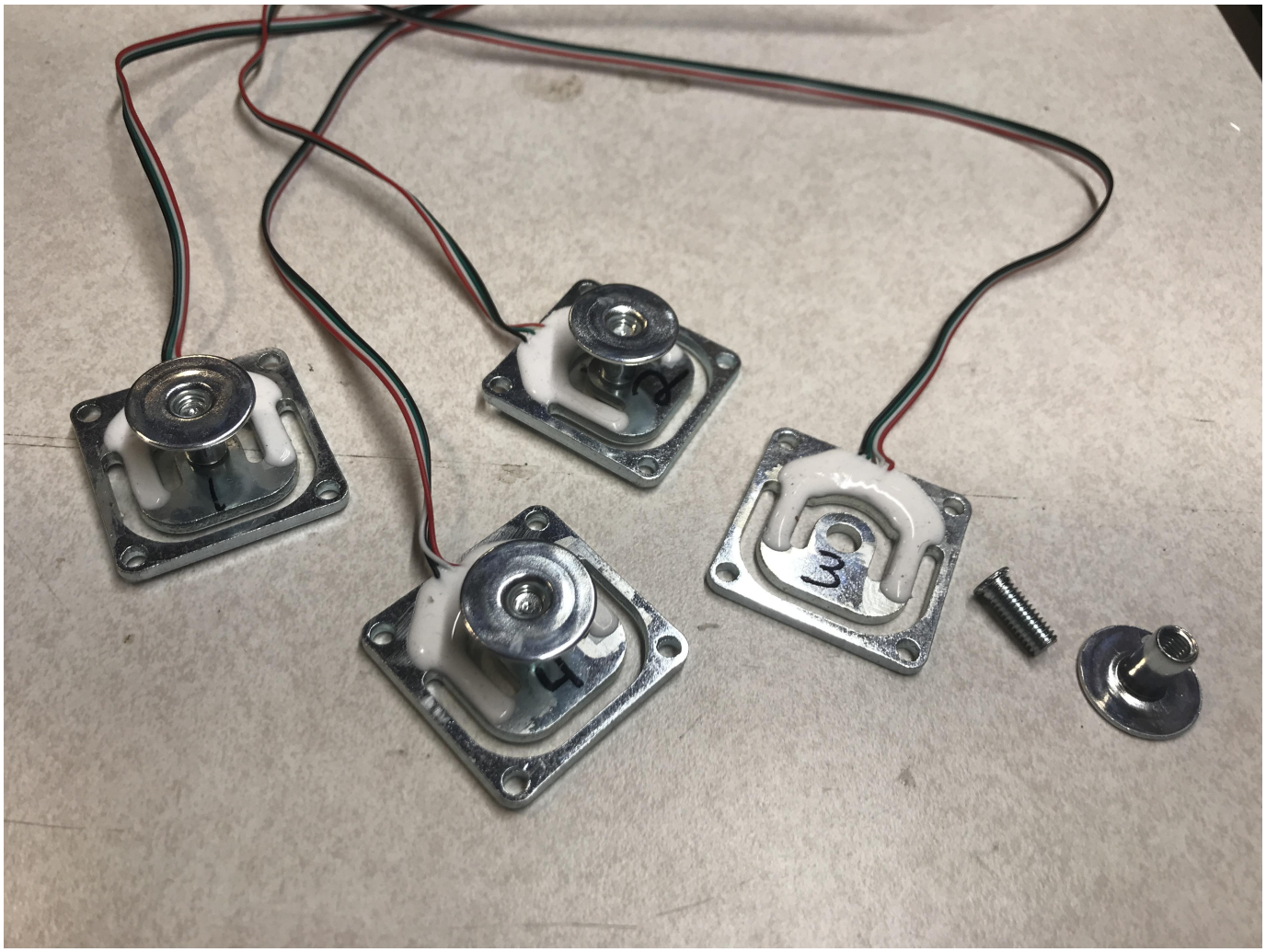


10.4 Mount the scale feet

To mount the feet, simply take the screw so that it is orientated as in the image below then screw on the top piece until tight.

Note

Be sure to use Loctite or a similar product on the screws to prevent them from coming loose over time. If this step is skipped it can cause the feet to become loose and cause the sensor to read inaccurate data.



10.5 Mount the scale structure

Go to next chapter : W3 Scale Assembly

11. BroodMinder-W3 Kit Guide

11.1 Overview

> **Tip**
>
> If you acquired a W3 uncalibrated-unassembled model you should first start with the Circuit board assembly about how to assemble (solder) board with loadcells.

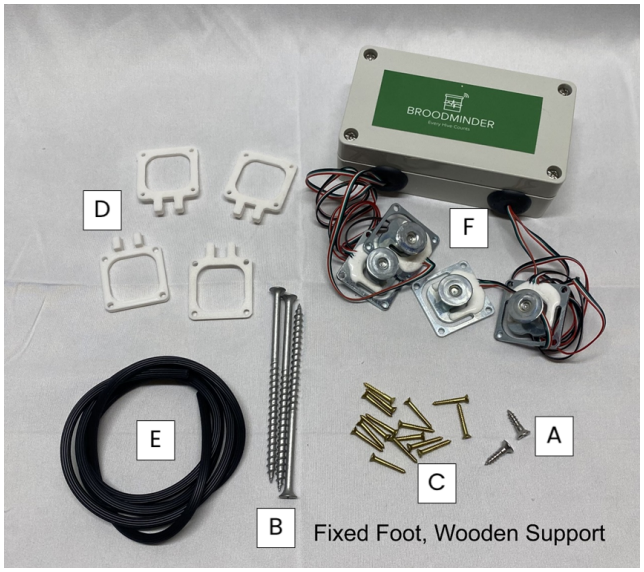
> **Tip**
>
> We suggest that you watch the videos from Section DIY/W3 in the video Library.

The first section of this document demonstrates the **fixed feet** version followed by the **swivel feet** version. There is also an appendix to explain modification for Fixed to Swivel W3.

11.2 BroodMinder-W3 Assembly - FIXED FEET

11.2 BroodMinder-W3 Assembly - FIXED FEET

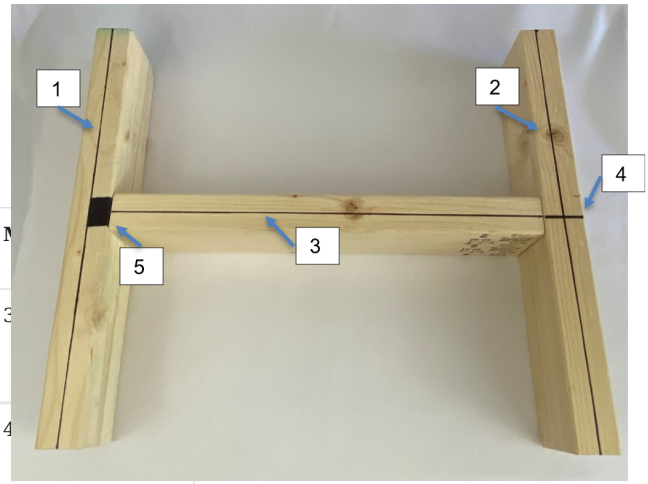
Hardware



Reference	Item Description	Qty	N
A	Phillips Flat Head # 7 x 5/8"	2	3
B	#8x4" Drywall Screw (W3PA & W3UA)	3	4
C	#3 3/4 Phil Brass Flat Wood Screw	16	3x20
D	Load Cell Custom Support	4	
E	Spline Material	1	
F	Electronics Assembly	1	
user provided	16.5 Inch Pine 2x4 (adjust for hive width)	2	430x40x60
user provided	15-16 Inch Pine 2x4	1	420x40x60

Prepare the frame members

- Cut your 2x4s to length.
- The length of the end boards should be enough to span the width of your beehive. We typically make them about 16.25”-16.50" long for a typical 10 frame Langstroth hive. The length of the connecting board is not critical but should be around 16”.
- Cut saw kerfs (1,2,3) as shown in the picture below. They should be around 0.4” -0.75” deep. These will hold the wires from the sensors.
- Cut kerf 4 for the wires to reach the electronics box. (see picture farther down).
- Test fit the spline and widen the kerfs if necessary.
- Remove the broad area (marked 5) with a chisel so that when the 2x4 tips it does not pinch the wire.

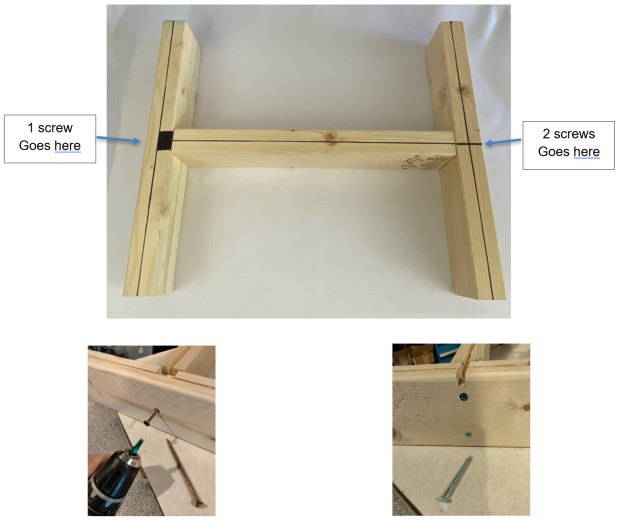


ne frame (Fixed Feet)

everything is where it needs to be, use 3
secure the boards together.

Note

ed to use a 5/32th drill bit or similar for
holes before drilling in the nails. A 1/8th
er may result in stripping the nail when
ent the nail from being fully drilled into

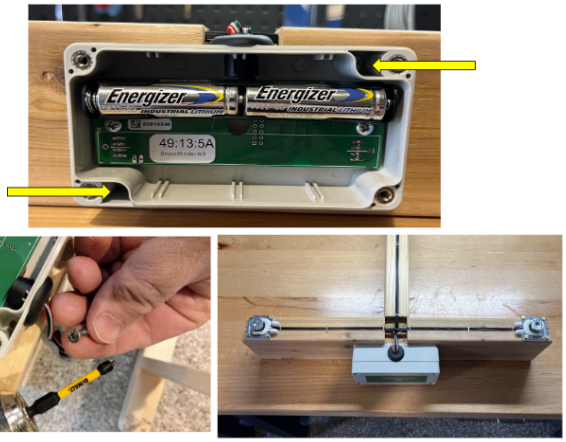


To assemble your frame, make sure you have a flat surface and ensure your pieces are square. Follow the picture above for the correct orientation of the boards.

Make sure not to completely drill in the side with one screw so that the board can pivot.

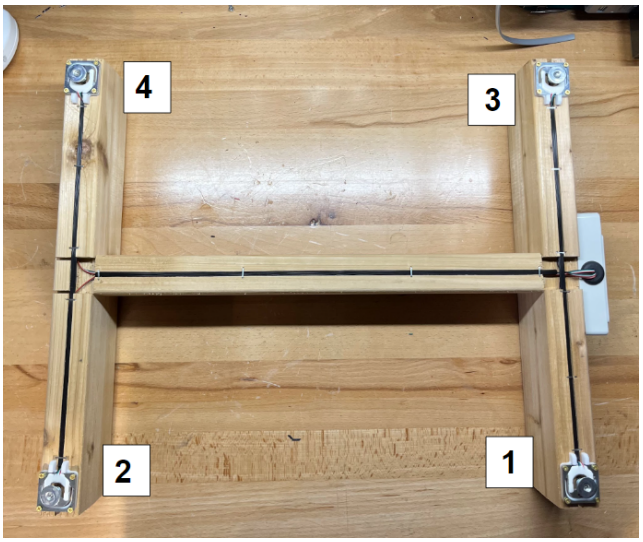
Attach the electronics box

Make sure the box is located center in the frame with the hole opening as shown. There should be a slight gap between the edge of the frame and the box as shown. Use (2) “A” screws which screw into the top right and bottom left of the electronics box.

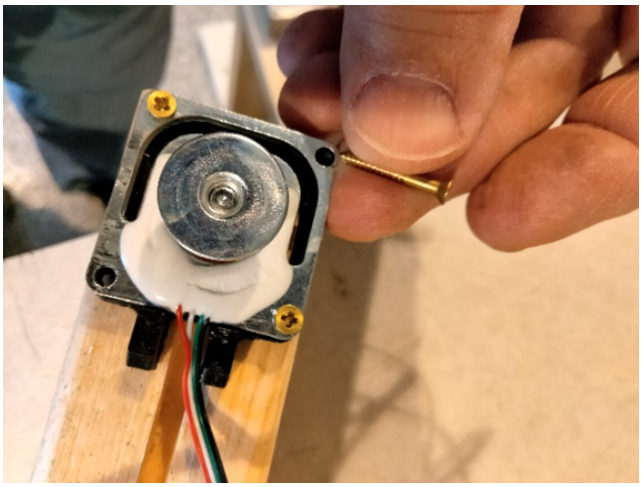


Sensor Mounting

Position sensors marked 1-4 as shown with mounts “D” as shown.



Use 4 “C” screws per sensor. Make sure that before you drill in the sensors to the wood that you put the load cell custom support () between the sensor and the wood to allow for the sensor to read correctly. If the mount is not installed, it can cause the sensors to record incorrect information.



IMPORTANT: Do not fully tighten these screws. Bending the senor will create a measurement error. Tighten then back off ½ turn.

Wire Routing

Once the sensors have been mounted, you can run the wires through the groves cut in the wood.

To deal with any extra wire:

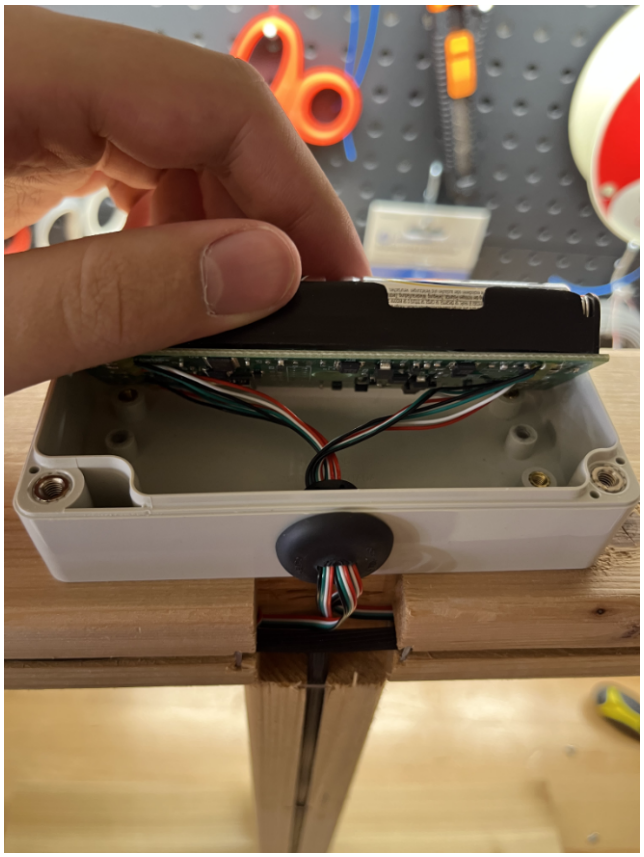
- Unmount the circuit board from the electronics box by removing the two screws on either end of the board.
- Pull the slack wire through the grummit and fold it so that it sits behind the circuit board.
- Remember not to put any stress directly on the connections for the wires if possible, as that has a high chance to cause the connections to come loose or disconnect entirely.
- Remount the circuit board to the electronics box with the same two screws.

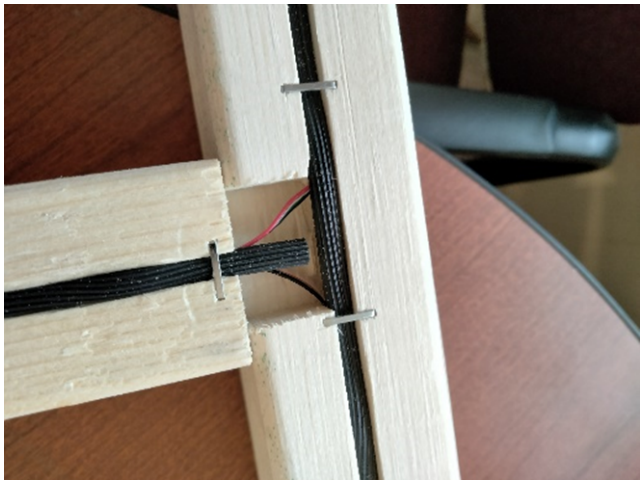
Once the wiring has been routed properly and any slack has been pulled into the back of the electronics box, you can secure/protect the wires using the spline material "E".

It is recommended to use a flat object to gently push the spline material into the groves so that they do not stick out (this does not take much force, gently tapping with a hammer works well). Once the spline material is in place, it can then be secured to the wood using staples to ensure it doesnt come loose or fall out in the future.

Note

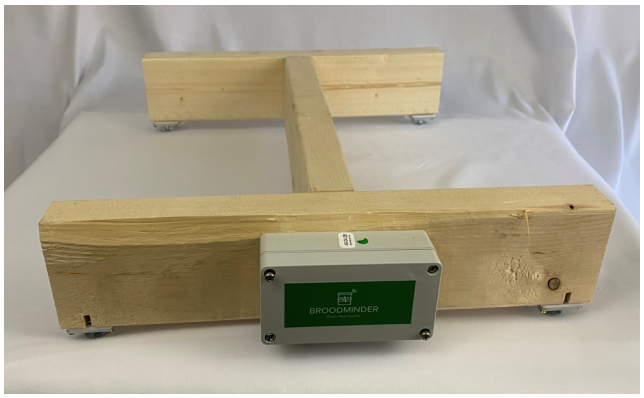
Be careful when stapling not to have a staple go directly through the spline material as that may cut the wires to the sensors.





Finish and Enjoy

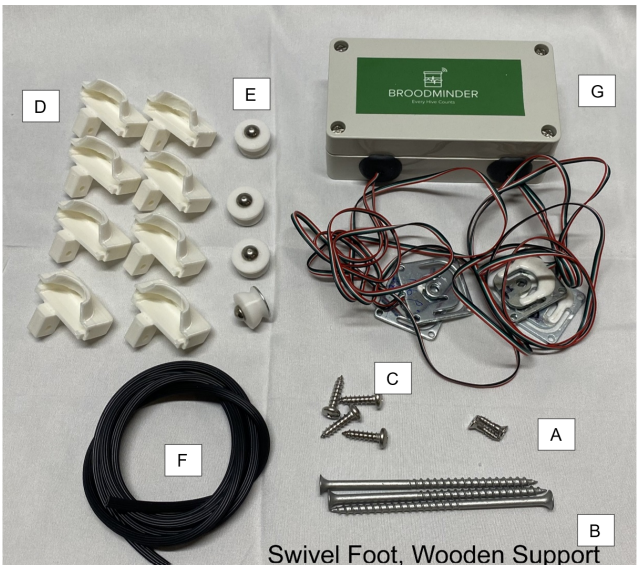
Now you can remove the battery tab and replace the lid on the electronics box and enjoy your new BroodMinder beehive scale.


BROODMINDER

11.3 BroodMinder-W3 Assembly - SWIVEL FEET

11.3 BroodMinder-W3 Assembly - SWIVEL FEET

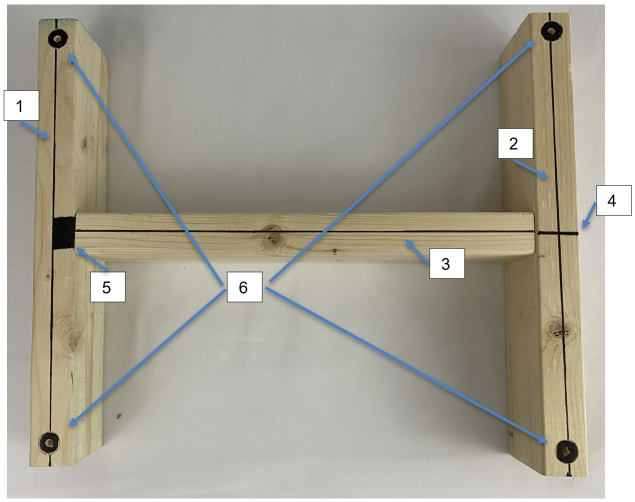
Hardware



Item Description	Qty
(Picture A) Phillips Flat Head # 7 x 5/8"	2
(Picture B) #8x4" Drywall Screw (W3PA & W3UA)	3
(Picture C) #10 ¾” SS Round Head Screw	4
(Picture D) Load Cell Custom Support	4
(Picture E) Swivel Feet	4
(Picture F) Spline Material	1
(Picture G) Electronics Assembly	1
16.5 Inch Pine 2x4 (User provided) (16.5 inch or adjust for hive width)	2
15-16 Inch Pine 2x4 (User provided)	1

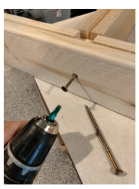
Prepare the frame members

- Cut your 2x4s to length.
- The length of the end boards should be enough to span the width of your beehive. We typically make them about 16.25”-16.50" long for a typical 10 frame Langstroth hive. The length of the connecting board is not critical but should be around 16”.
- Cut saw kerfs (1,2,3) as shown in the picture below. They should be around 0.4” -0.75” deep. These will hold the wires from the sensors.
- Cut kerf 4 for the wires to reach the electronics box. (see picture farther down).
- Test fit the spline and widen the kerfs if necessary.
- Remove the broad area (marked 5) with a chisel so that when the 2x4 tips it does not pinch the wire.
- Drill qty 4, ¾” holes. The centers should be ¾” from the edge and ¾” deep



Screw together the frame

Once you’re sure everything is where it needs to be, use 3 letter B screws to secure the boards together.

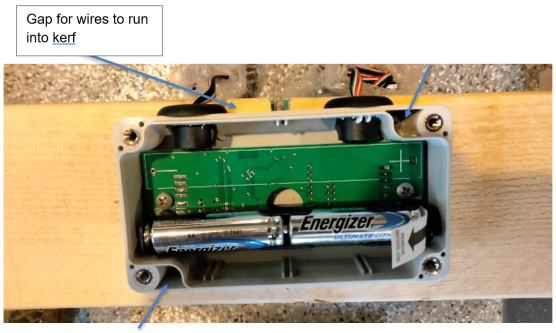


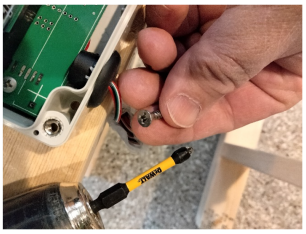
To assemble your frame, make sure you have a flat surface and ensure your pieces are square. Follow the picture above for the correct orientation of the boards.

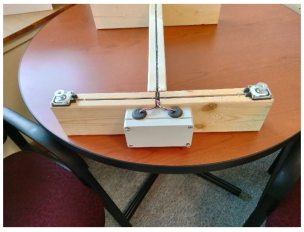
Leave the side with 1 screw very slightly loose so that the board may pivot.

Attach the electronics box

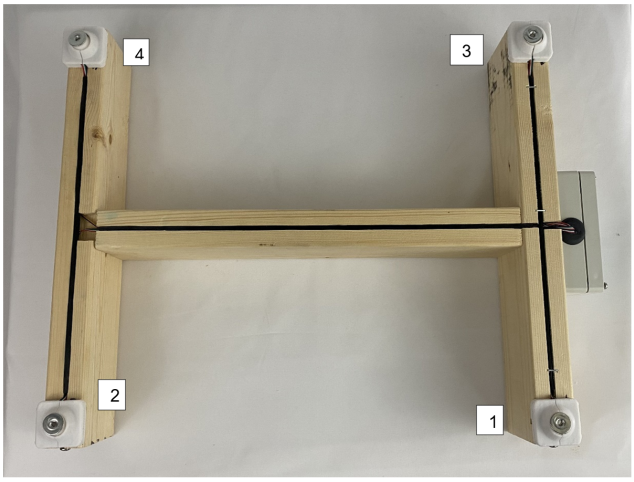
Make sure the box is located center in the frame with the hole opening as shown. There should be a slight gap between the edge of the frame and the box as shown. Use (2) “A” screws.



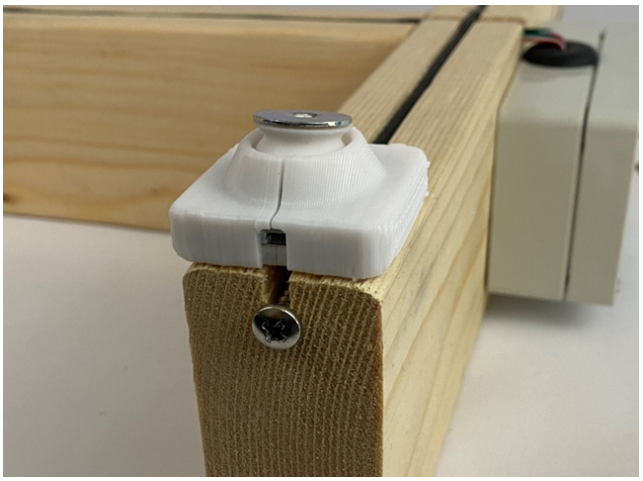




Sensor Mounting

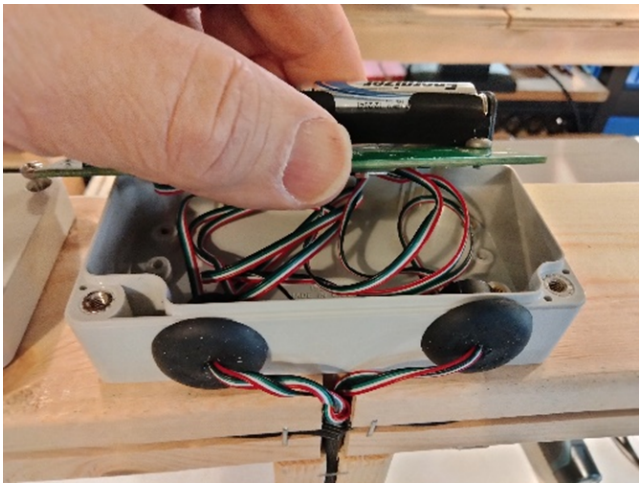


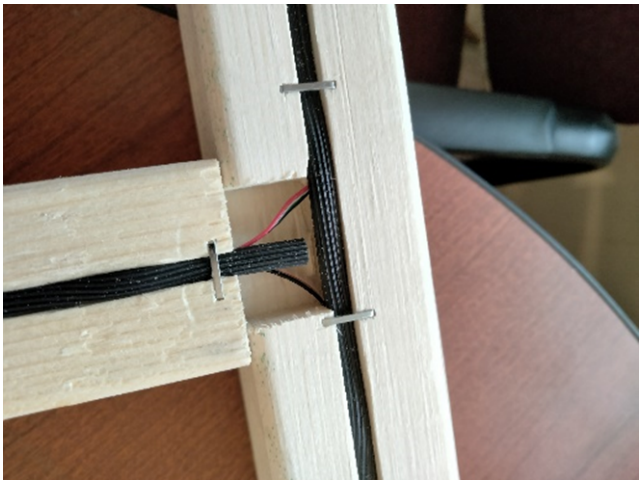
Use 1 “C” screws per sensor.



Wire Routing

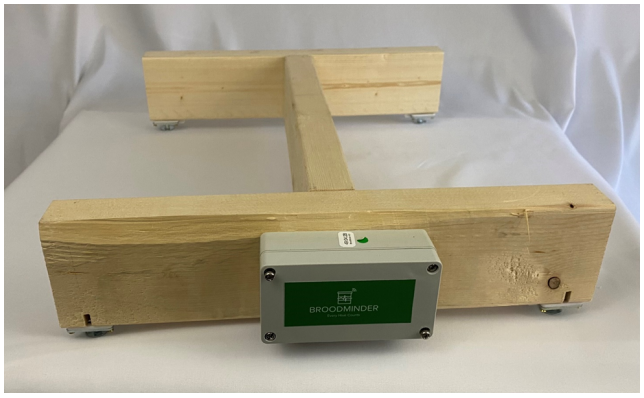
Tuck the wires into grooves and secure with spline material “E”. To secure spline material press into groove with flat object, this allows wires to move in the bottom of groove. Do not create stress on the wires. Remove (2) circuit board mounting screws. Pull the slack wire into electronics box and fold wire behind circuit board, reinstall mounting screws. Secure spline material with staples.





Finish and Enjoy

Now you can remove the battery tab and replace the lid on the electronics box and enjoy your new BroodMinder beehive scale.



Tip

If you acquired a W3 uncalibrated-unassembled model you still need to calibrate your scale. Jump to the Scale calibration section

11.4 Appendix: Update fixed feet W3 scales to swivel feet

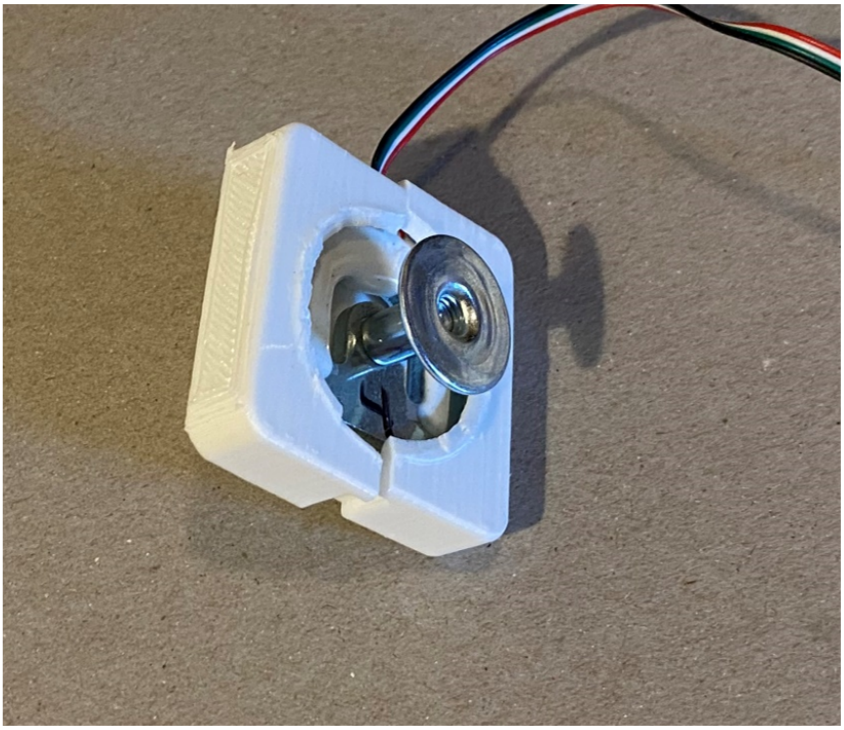
If you have an Apimaye hive, you may want to upgrade your W3 to include the swivel feet mounting.

This is quite easy except for one step. Removing the fixed feet from the W3 kit is quite difficult because there is no screw head to grab and the feet are fixed with permanent Loctite.

We have tried removing them here at Bees on Main and boy... they are difficult.

Therefore, we recommend modifying the load cell holder and using the load cells with fixed feet. The modification is needed so that the foot reaches the ground.

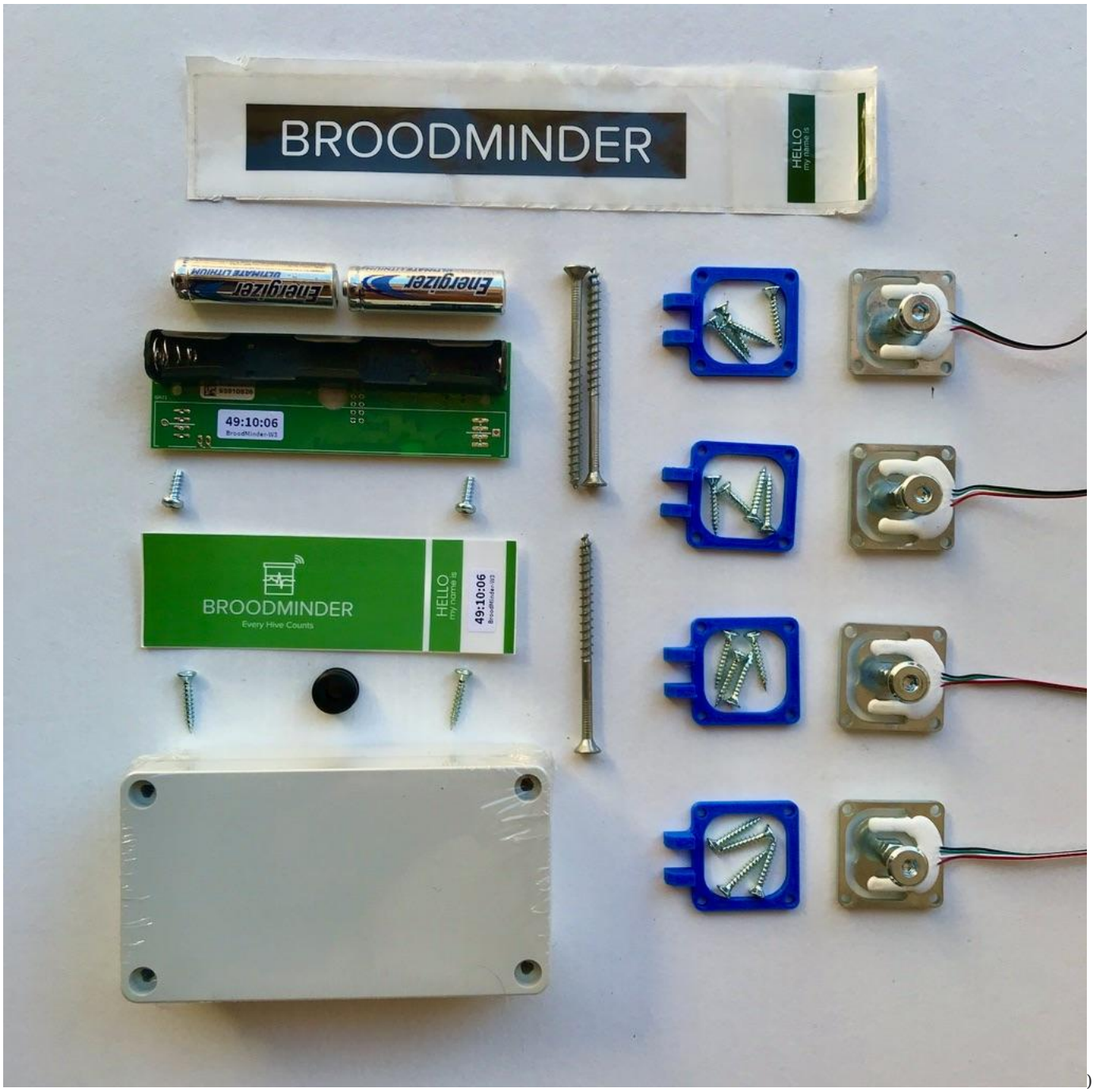
All that you must do is remove the skirt that captures the swivel foot.



11.5 Appendix: W3 Unassembled-Uncalibrated parts

Here are all the parts for a W3 scale H model type :

(only missing the Spline material)



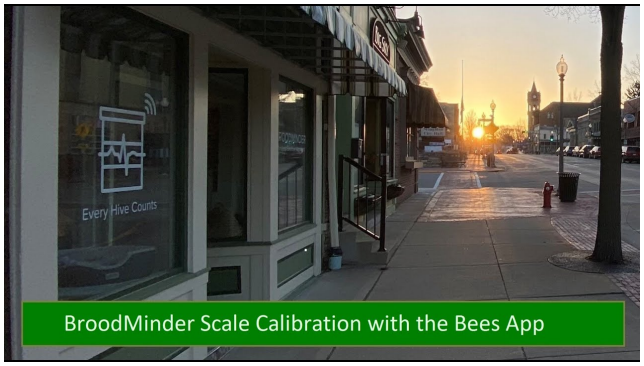
12. W3 and DIY circuit board calibration

What follow will explain you how to calibrate the hive scales BroodMinder-W3 model or for the BroodMinder-DIY

Calibration (DIY and W3UA Only)

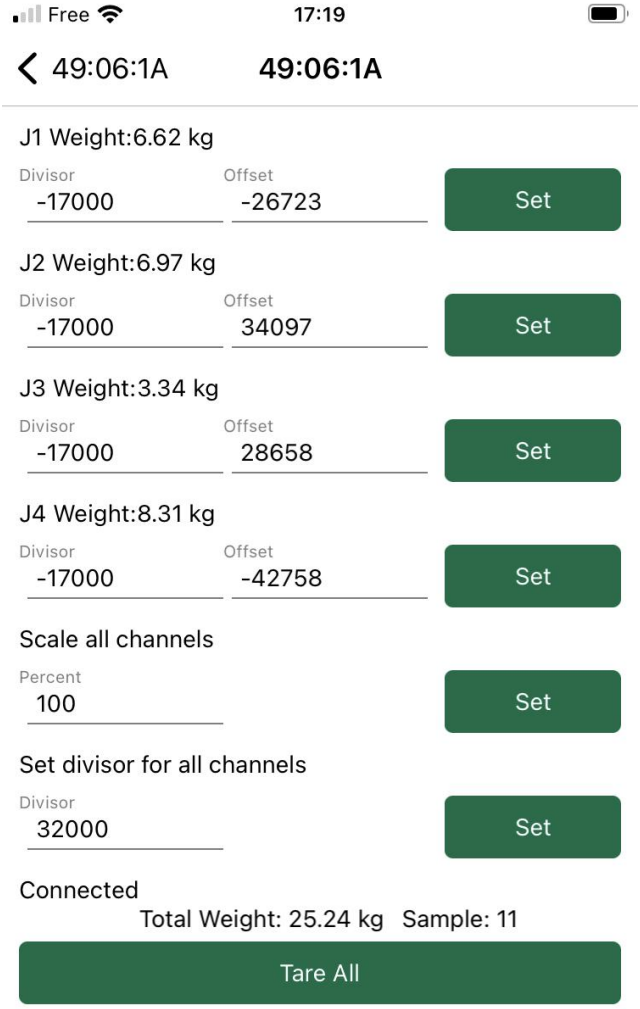
You will now calibrate your scale using the Bees App.

Watch the video to get you started :



The excel sheet for calibration is available here. You will need to make a copy in your own drive (`File > make a copy`)

You will find the calibration screen in the Bees App at `Devices Tab > [Device name] > ... > Show details > ... > Troubleshooting > Calibrate Scale`



Your objective is to find the actual four Divisors. Offsets are not concerned (automatic). A good divisor starting point is -32000 for 50kg load cells - -17000 for 100kg load cells - -9000 for 200kg load cells

13. BroodMinder BeeDar

New in 2023, the BroodMinder-BeeDar is an activity monitor for your hive.

- Radar is used to detect the number of flying bees. The radar emits from the square, green and gold sensor. This should be approximately over the entrance.
- Audio is used to detect the overall sound level of the hive. The audio sensor is mounted to the back of the box and couples to your beehive by screwing the BroodMinder-BeeDar to your hive box which then acts a bit like a guitar.

13.1 Background

The BeeDar was invented by Dr. Herb Aumann from the University of Maine and Main Biosensors LLC. There is a nice academic paper about it here.

https://www.researchgate.net/publication/349017653_Janus_A_Combined_Radar_and_Vibration_Sensor_for_Beehive_Monitoring

The BeeDar senses motion and is tuned to be particularly sensitive to bees. When it collects data, it will record the motion for 30 seconds and then take the average. By default this will happen every 15 minutes. Data is transferred to MyBroodMinder just like every other BroodMinder device.

13.2 Installation

- Remove the BeeDar lid and remove the 2 loose flat screws.
- Pull out the "Remove Before Use" tag. The LED on the circuit board should flash for several seconds. If it doesn't, then you might need to remove the one screw which holds the circuit board, take out the board and check the batteries. (Sometimes a part of the tag can rip and remain under the battery terminal.)
- Screw the BeeDar to your hive using the flat head screws and the holes that are in the upper right and lower left of the BeeDar.

- Replace the lid and tighten the screws making certain that the gasket is in place correctly.

The sensitivity of the BeeDar is a fan beam emanating from the radar sensor. The box should be mounded level and do not point it up by tipping the box backwards (such as on an angled landing board). This will do a good job of sensing rain falling which is not the goal.

Note

The BeeDar Audio will not work as well with a plastic hive as with a wooden hive due to the acoustic properties of plastic.

14. Do It Yourself Guide

14.1 Why DIY ?

We realize that many of our users are curious and want to invent things. Our DIY kit allows that creativity without the need to write 8 years of software.

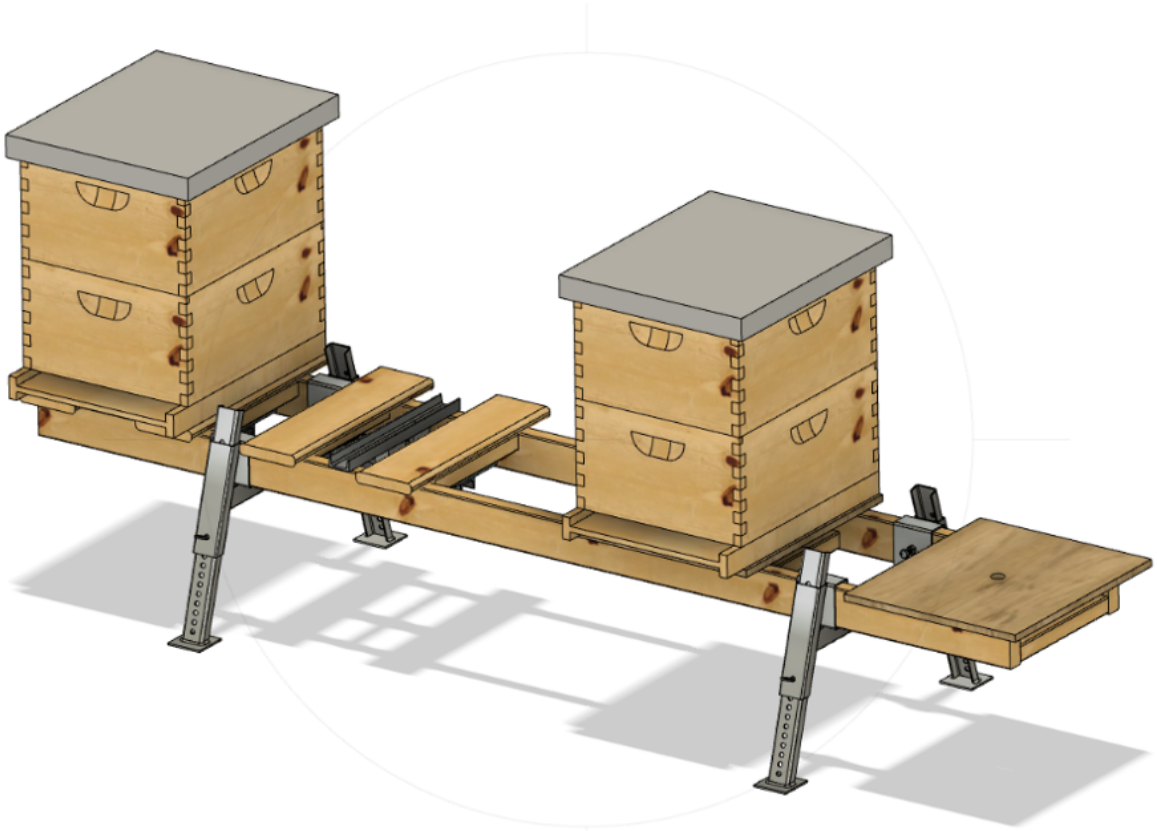
The DIY is the raw circuit board that we use in the BroodMinder-W2. We hope that this board allows many home crafters to create wonderful devices to monitor the hives. Be sure to share your designs with us and we will share them with the world.

- Proven design
- 5-year battery life
- **No software to write**
- Works with most standard load cells
- Integrates into the vast BroodMinder ecosystem
- Utilizes a 4 channel 24-bit load cell IC (TI ADS1234)
- Data is available by BLE advertising
- Stored data is readable by BroodMinder apps

In order to utilize the BroodMinder-DIY, you will need to add your own load cells. The board should work with most load cell available, but beware, there are many bad choices. For example, if you try to use normal “bathroom scales” load cells, you will find that they have tremendous “creep”. Under load, the output values can change 50% overnight.

Theo and Lorenzo have also created some examples which we have included in our public dropbox folder (https://www.dropbox.com/sh/nmhfpuy9s5x086f/AADkyDIcJrfsqsd9yUJ-7Lr6a?dl=0) . We will be posting many details including bills of materials and 3d models.

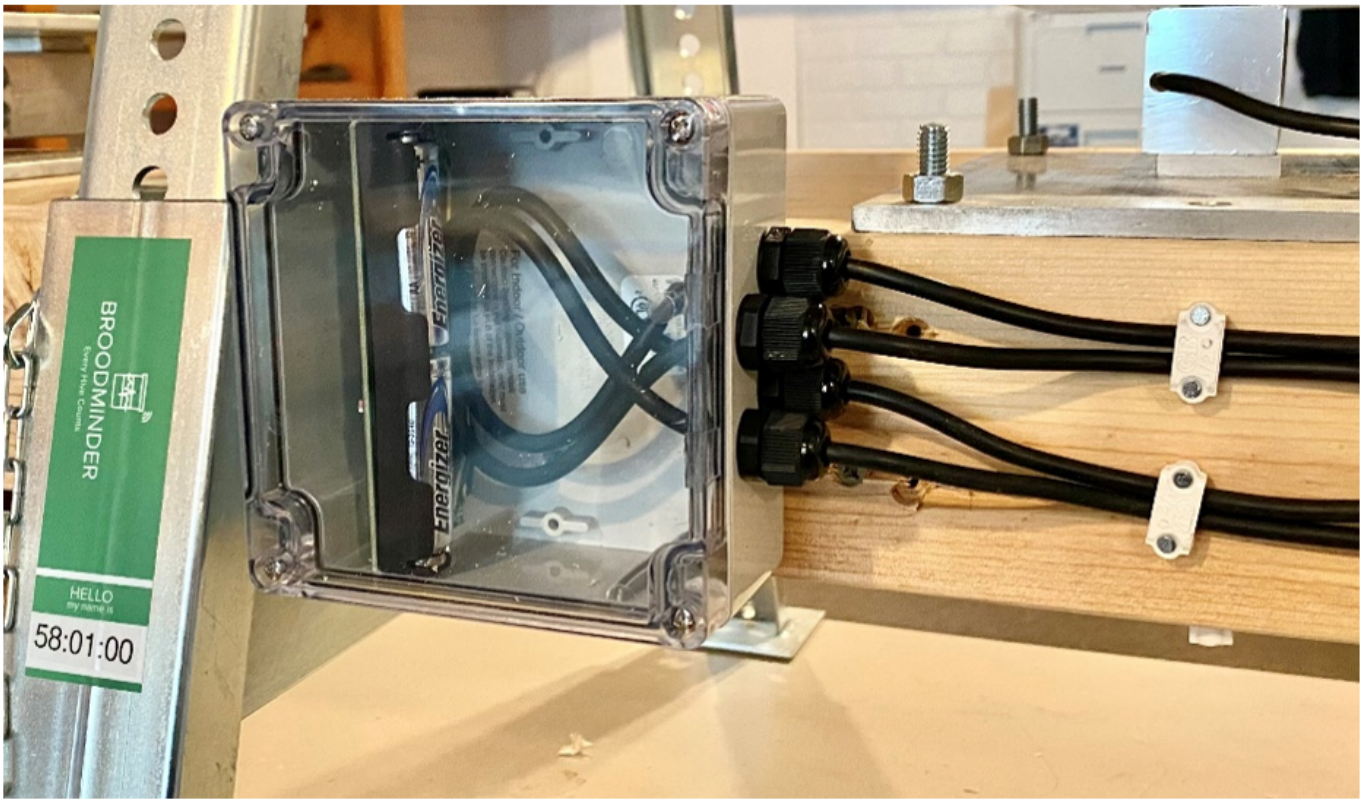
The metal hive stand is available from BetterBee: https://www.betterbee.com/wooden-hive-equipment-10-frame/LYHE4033.asp



Weather is your enemy, so you will also want a box and cable glands, we recommend the following available from Digikey.com

- Bud Industries PN-1322-CMB $11.20
- Waterproof box - Hammond 1554N2GYCL $22.83
- Smaller Hammond, fits circuit board nicely 1554C $10.00
- Not quite waterproof, but good size with ears - Hammond 1591CSFLBK $5.50
- Bud Industries cable gland IPG-2227 $0.50

Here is the Hammond 1554N2GYCL box installed on the Betterbee hive stand



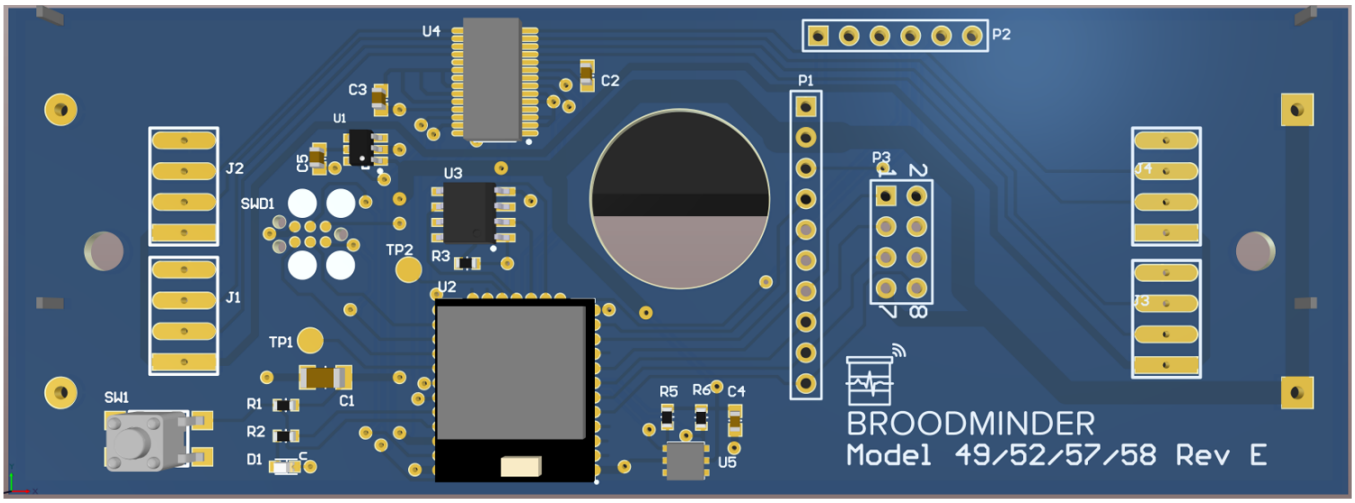
The board does not sport much in the way of electrical protection. We have found that in our configuration this is fine and we want to save as much cost as possible for our users. You may need or want to add additional protection circuits. We leave that to you.

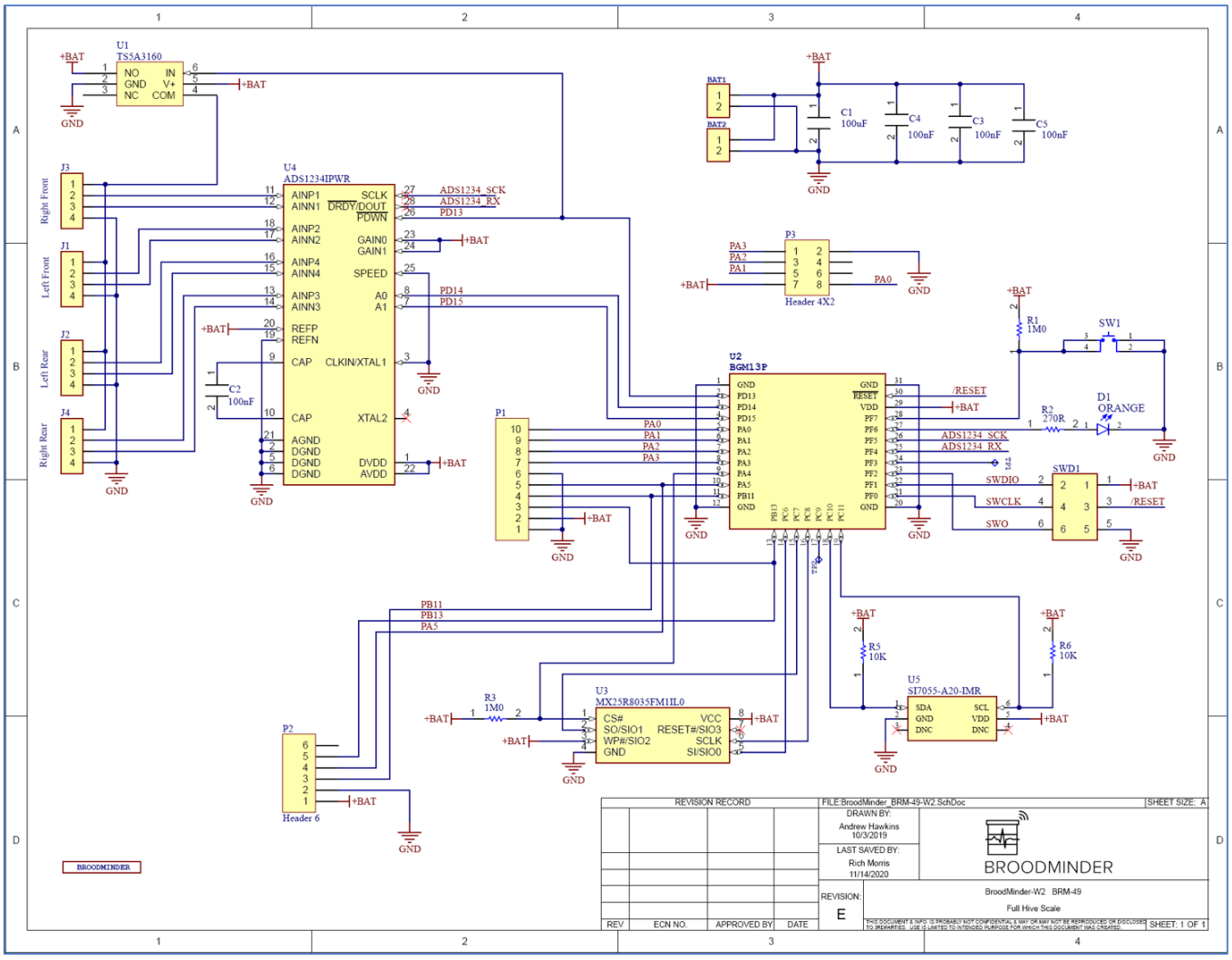
Warning

THE ABSOLUTE MAXIMUM VOLTAGE FOR THE DIY BOARD IS 3.8 VOLTS DC!

Digikey.com (or Silabs.com or TI.com) is a good place to start for gather the datasheets if you want to dig in deeper.

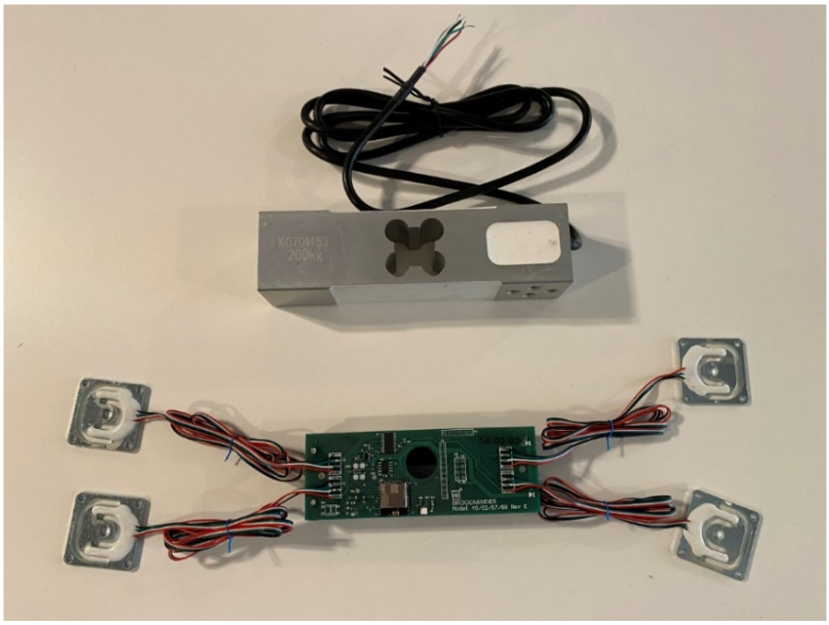
A final note, (stepping up on soap box), I (Rich Morris) hate connectors. They are almost always the first thing to fail. Personally, I try to solder everything but your milage may vary. (stepping down now)

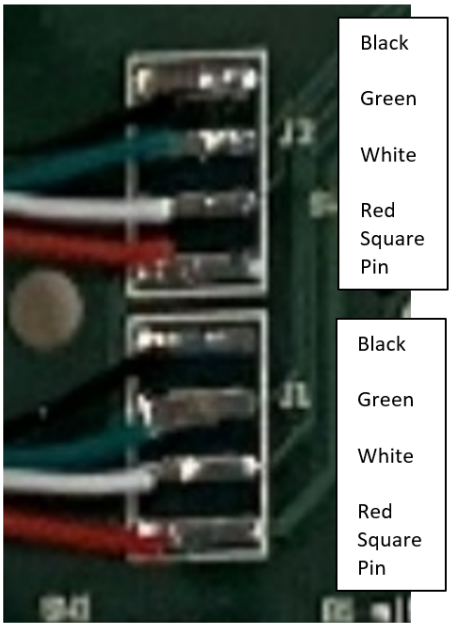


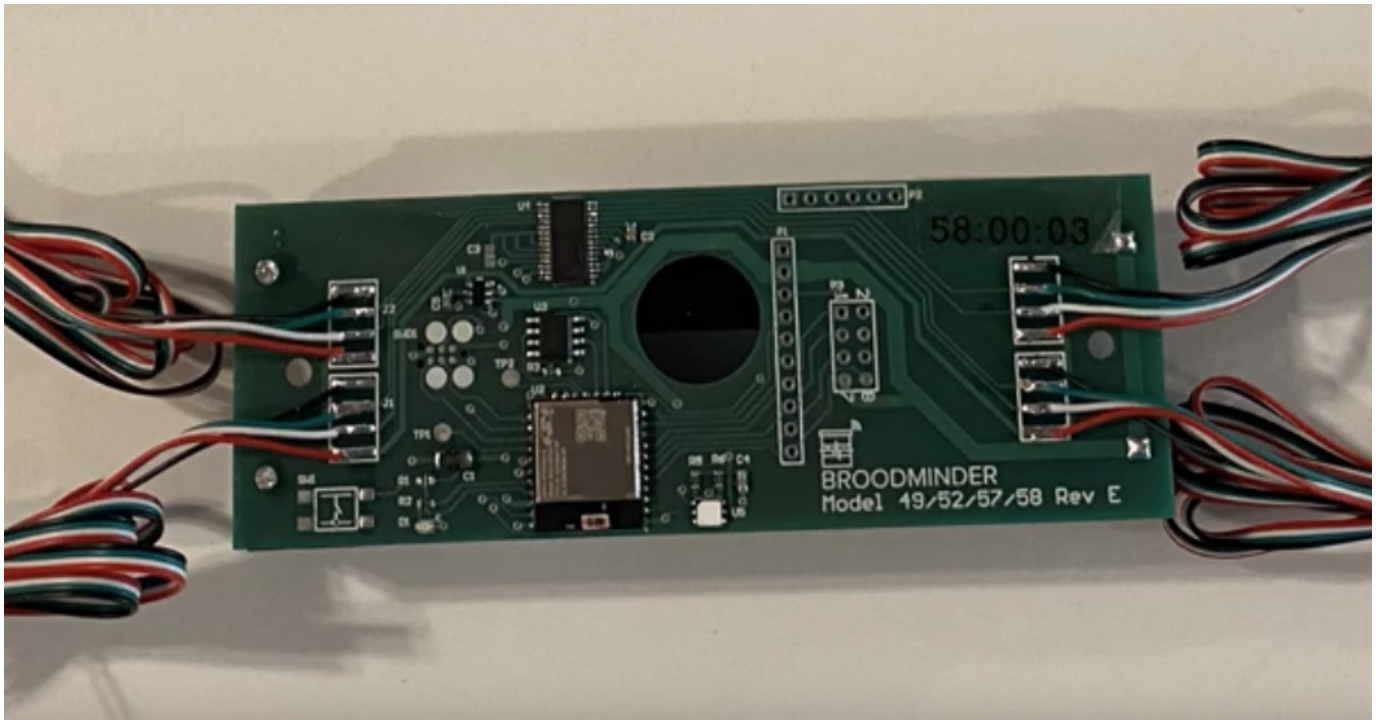


Note

On the next page you will find our circuitry. You may wonder why we share this... The truth is, the circuit doesn't get you very far. It requires lots and lots (and lots) of software to hold this all together. We hope the circuit helps you if you need it or want to learn more.







Here are two types of load cells (also called strain gauges). We are happy to provide you with either type. If you get your own, be sure that they are temperature compensated and have very low creep. The resistance of the 200KG load cell is roughly 300 ohms per leg. For the 50KG load cells it is around 750 ohms.

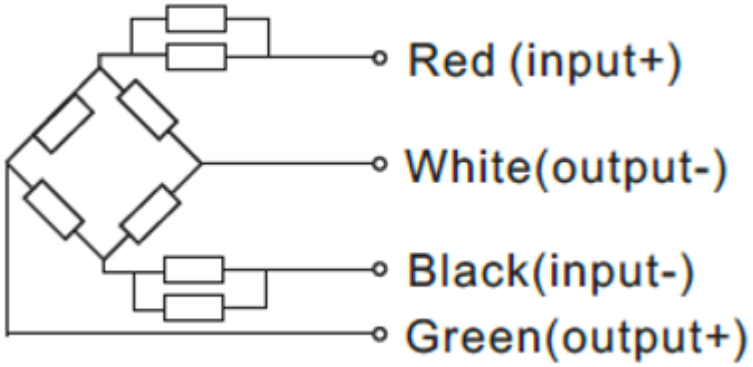
Most load cells seem to use this color scheme for the wires. If that is the case, then wire them like this.

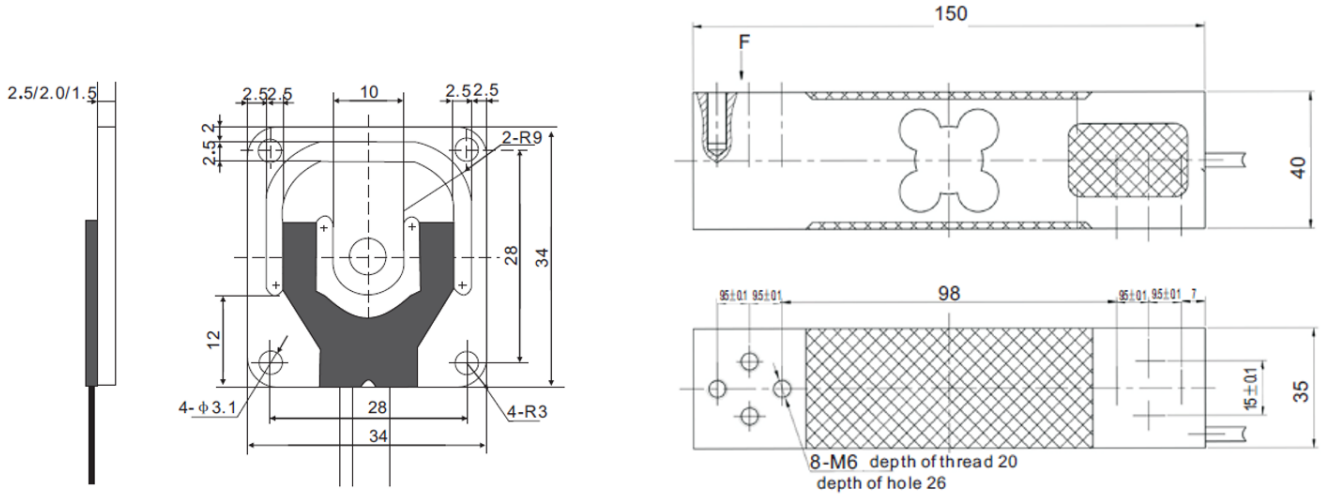
Black, Green, White, Red (from top to bottom).

Tip

red wire (+) always hooks to the Square pad.

The outputs are in the middle. If things are mixed up, usually it will be corrected during calibration.





Center hole of 50KG load cell is 5mm diameter

14.2 Calibration

Tip

We have now built new features into the Bees app for doing calibration. See the video here for more information.

Once you have your scale built, you will want to calibrate it. You do this by setting the offset and the scale factor for each ADC channel which are stored in flash memory in the processor. We are providing our in-house PC app to do this. Sorry, it is not available for Apple. However, it will run on a quite inexpensive PC. The PC App is available in our public Dropbox folder (https://www.dropbox.com/sh/nmhfpuy9s5x086f/AADkyDIcJrfsqsd9yUJ-7Lr6a?dl=0) .

Info

For BLE (Bluetooth Low Energy) communication you must have a Silicon Labs BLE112 dongle (Digikey 1446-1030-ND)

Many of the controls are explained by hovering the mouse over the control. This app was not designed for external use, so you must forgive us for the ugly nature of it. It does work, we have calibrated thousands of scales with it.

> **Note**
>
> you don't need to execute the next page if you are using a 4-sensor setup. That is, 4 sensors on one hive, one on each corner. You should go to the "CAL-W3" tab of the program.

> **Check the board model!**
>
> The DIY board is a model 58. If you have something different (e.g. 57:xx:xx) call us and we will work it out. The ID should start with 58!

Single-sensor scale

1. Start the app and see that the BroodMinder-DIY shows up on the advertising list.
2. Make sure the ID (58:xx:xx) is in the "Device to connect to" box
3. Select the configure tab, the BRM-58 should connect automatically.
4. At the start, the log period is 3600 seconds. Set the log period to 3 seconds and click `update log period`.
5. Press `Start real time`, you should see the logging start and "Elapsed" increase every 3 seconds.
6. With your load cells unloaded, press `Tare XLR` (XLR is our name for the board). All sensors should read 0.0 pounds after this.
7. Put a known weight on the scale.
8. Adjust the divisor for each channel and press the `Cal Jx Weight` buttons to transfer and store the scale factor.
9. Write down your divisor factors. At the current time, they can not be read from the BRM-58.

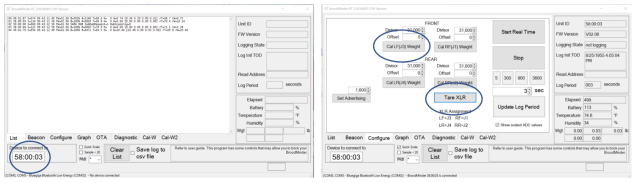
> **Note**
>
> if you are not using a channel, set the divisor to 0 and it will always read 0 weight.

The divisors are the values that convert the raw readings of the ADC to weight. 31,000 is a good starting place for the small load cells. The large one is more like 11,000. The readings that you see in this program are in pounds (with apologies to the MKS crowd). It is a simple matter to set the divisor to a value, then do a test weight. And then adjust the divisor appropriately. For example:

Real Weight = 30.0 pounds, Divisor = 31,000, BRM-58 readout is 20.0 pounds

Change the divisor to 31000 * 20.0 / 30.0 = 20,666 and the weight should correctly read 30.0

All offsets should remain 0 for BRM-58

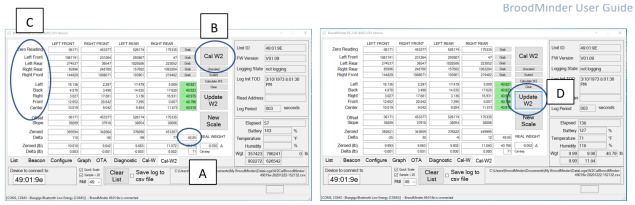


There are many other controls and features that we will not go into here. Feel free to explore.

That's it, you are done unless you are using 4 x 50KG sensors in one scale. For that we have to get a bit more exotic.

Four-sensor scale

If you are using 4 sensors together, then you should use the Cal-W3 tab as explained next.



A. Enter the true weight (in lbs) that you will use for calibration in the A zone. Be sure to include anything that will load the sensors (e.g. any extra boards that you use). Here we flip the scale on it's back and move the weight around on a piece of plywood sitting on the feet.

B. Remove all the weight from the load cells and press `Cal W3`. The first thing it will do is zero the system. You will see the raw ADC values show up in the zeroed row. After this step, you will see approximate weights shown in (lb) rows. This is based on the slope in the slope row. We use a default value for the -W2 sensors. You can play around with this to get close for your sensors.

C. Next you should move the calibration weight as directed on region C above. The program automatically advances when it sees a weight > 5 pounds on the appropriate sensor. After the 4 corners are complete, the program calculates the slope for each sensor and updates the Slope

line. The next 5 positions are used to verify the scale. If the value is within 0.5 the box lights up Green. ALTERNATIVELY you can press the “Grab” buttons to force the program to grab a weight. This might be necessary depending on the weight you are using.

D. After you are satisfied with the calibration, press `Update W3` and it will write the values to the circuit board. You know it is complete when the Weight (Wgt) values switch back to pounds.

Tip

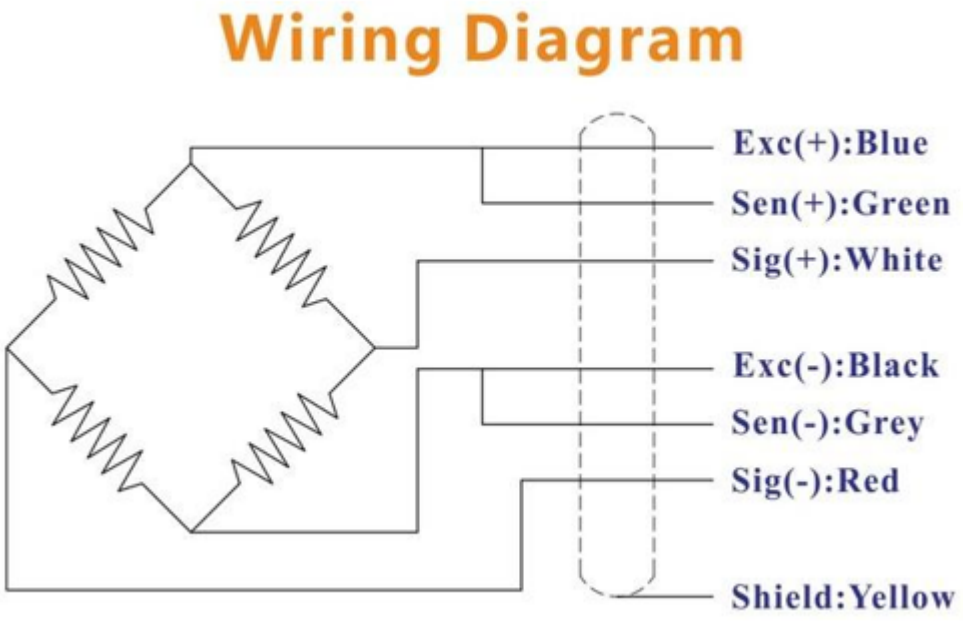
Basically what is happening here is we are using linear algebra to solve the simultaneous equations generated by the first 5 positions. After zeroing the sensors, there 4 weights and 4 variables (slopes). Through the magic of mathematics, we get the answers.

- You may want to use this board to run 4 hives, that is fine with us. If you use connectors, be certain that they are really good and weather resistant. They usually are the point of failure.
- Try to avoid anything that will result in friction or stiction. It is remarkable how a tiny rub will have a big impact. Do not use hinges, they are awful. Even ball bearings will result in significant errors. Pivots are good.

This is a very brief outline of how to proceed, I hope it is enough. If you need some more help or have additions we should add to this manual for the next user, contact Rich at Rich@BroodMinder.com.

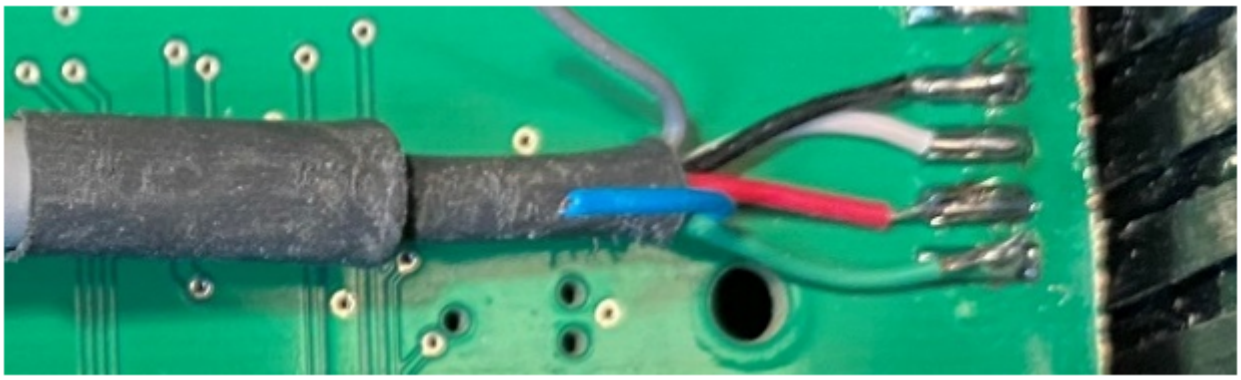
14.3 Converting a broken hive scale using DIY

It is easy to take an old broken hive scale and convert it to a BroodMinder enable scale. Here is an example. NOTE: This is not the same wiring as our load cells (colors are different).

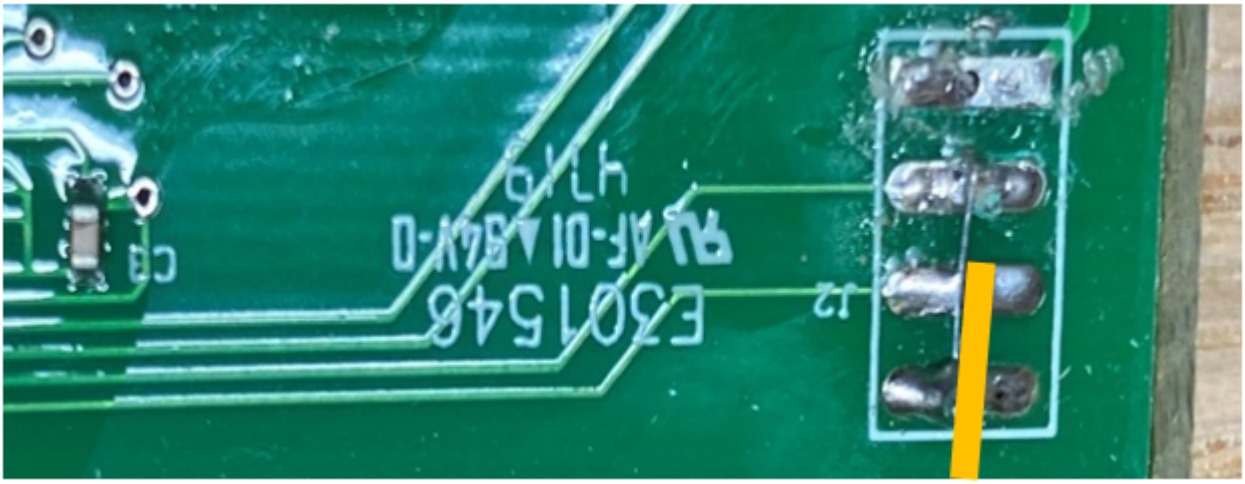


1. Cut the load cell wire to length
2. Carefully tin the leads. Old wire may be difficult to tin, use plenty of flux if this is the case.
3. Determine the wiring. In our example, this is the wiring of the load cell
4. Connect to the board. In our case, from the top

    a. Green – Exc - J1(1)
    b. Red – Sig(-) – J1(2)
    c. White – Sig(+) – J1(3)
    d. Black + Shield – Gnd – J1(4) or J2(4)

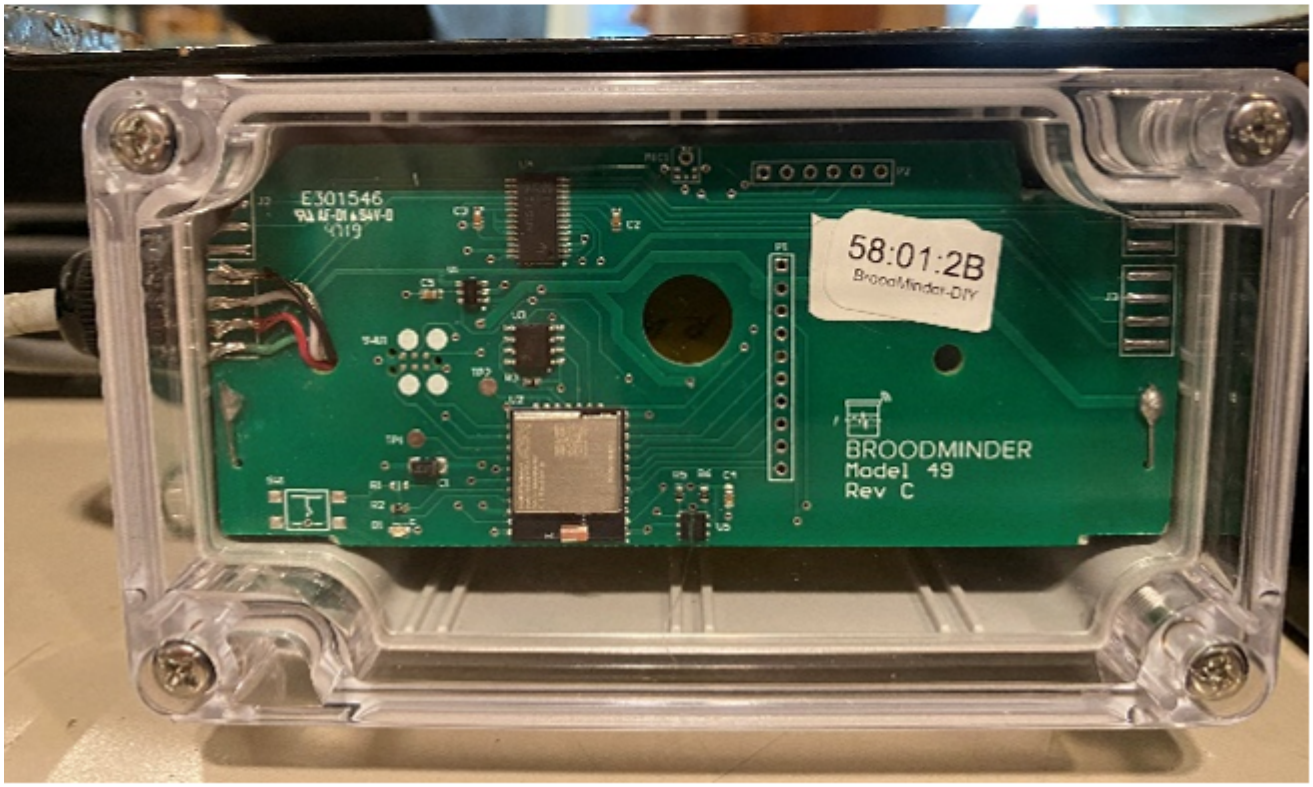


1. Connect pins 2, 3, & 4 of the unused channels (Gnd)



1. I do not recommend using a connector. I tried and the corrosion was a big problem. It worked for a while and then the calibration was way off.
2. Stabilize the wire with a tie wrap and cut a hole in the case (Bud Industries PN-1322-CMB $11.20 or Hammond 1591CSFLBK $5.50)
3. Ensure the box is sealed, silicone caulk works well if you use the cheaper Hammond box.

14.3 Converting a broken hive scale using DIY



1. If the box is tucked up in good spot, you might be able to get away with mounting without sealing the cable entry. Be certain to have a drip loop so that rain doesn't drip inside.

1. The BLE chip will work better if it is oriented so the circuit board is away from the metal frame.

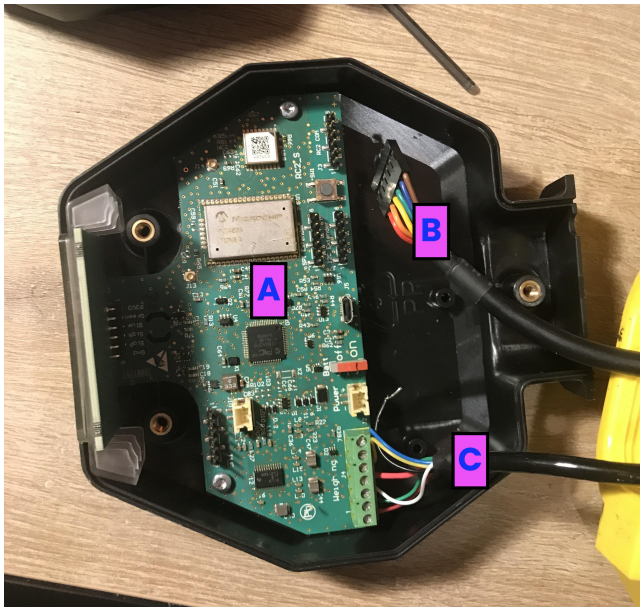
Good luck, let us know how it goes.

14.4 Retrofit "Label-Abeille" Hive Scale

Follow these instructions to bring to life again the hive scales from "Label-Abeille". The objective is to replace the old board with a BroodMinder-XLR board

Mechanical part

Put the scale upside down and rmove the lower yellow cover Then open the "head" black box placed on the Loadcell screws side (reference "S" in te picture below).

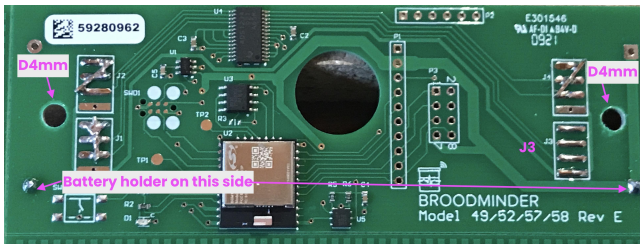


In the box remove the "A" board and the "B" harness. Unscrew the "C" harness from the board. This is the one coming from the load-cell to be soldered on the new XLR board.

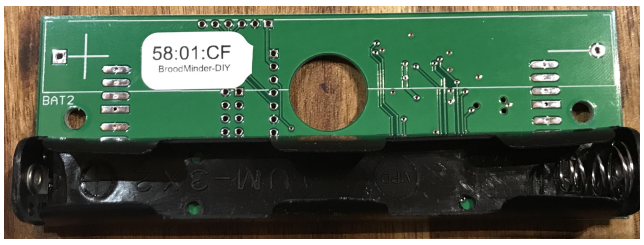
Now cut the central plot with a cutter to leave space to the XLR board

Like this

Now prepare the XLR board. We will only use chanel J3. Therefore we bridge channels J1,J2 and J4

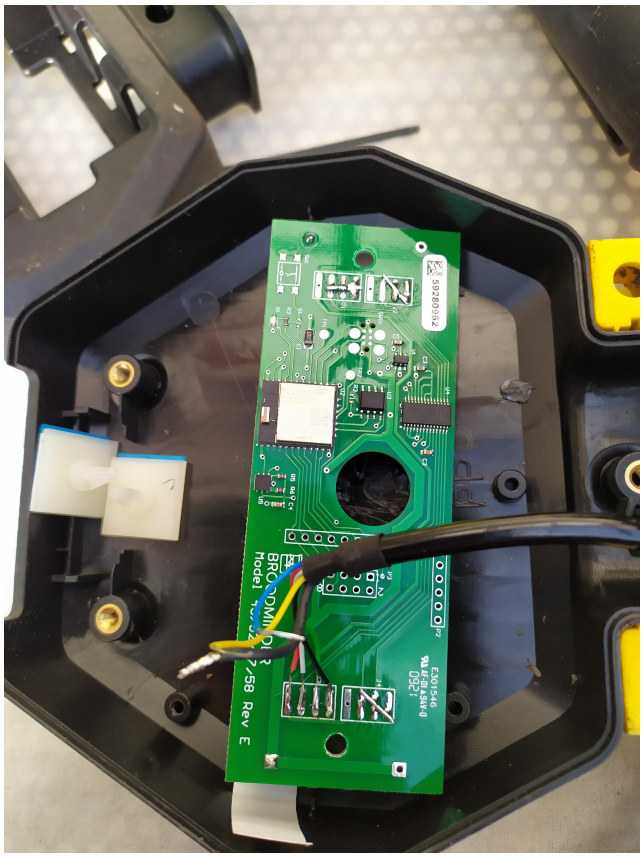


Solder the battery holder on this side (side is important to be able to have the batteries accessible once the casing will be mounted again.)



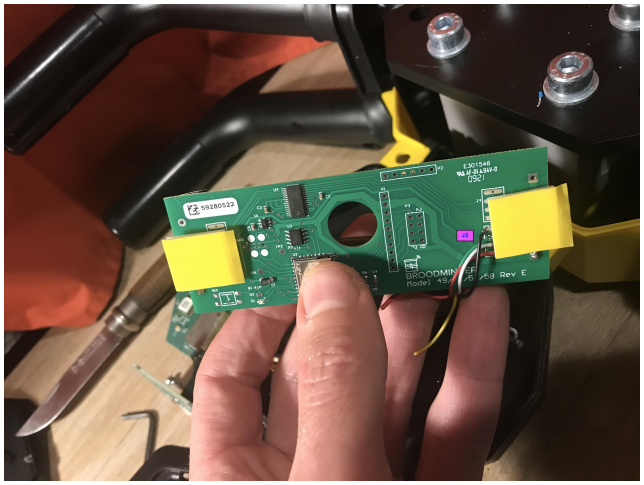
Now solder the cables on the J3 channel.

- The sequence is Black-Green-White-Red
- RED goes onto the square pad.
- Big Black is the shield wire. You can hook it to the scale structure if you wish.
- This loadcell has two other cables (yellow/blue) for voltage feedback (long wiring for industrial applications) : they are not needed here.

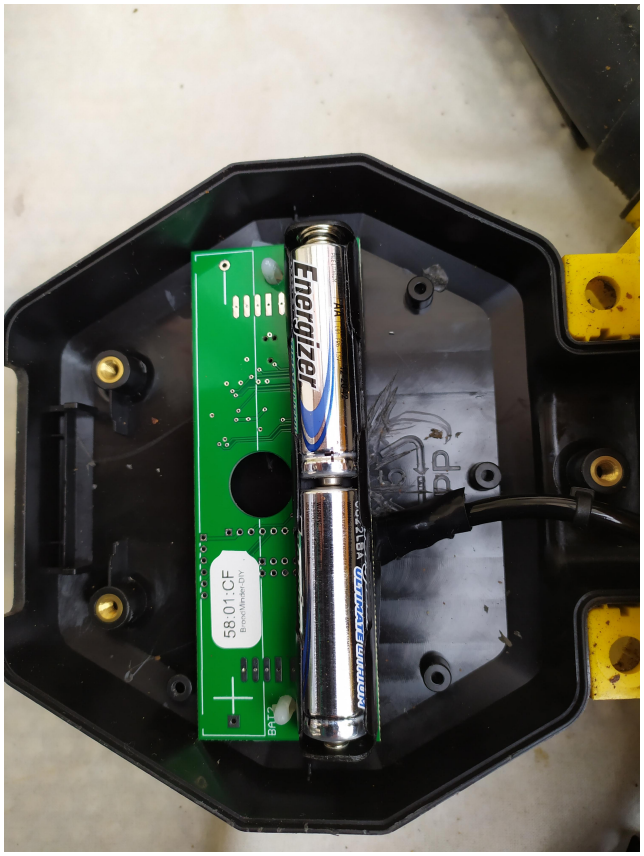


Now install batteries. You should see a blinking led.

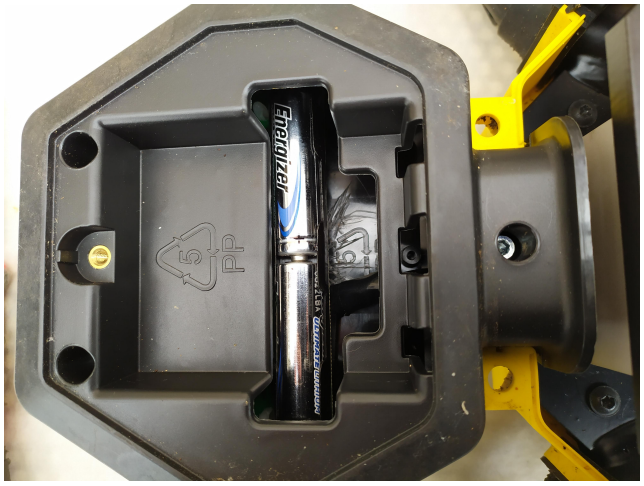
Add the sticky supports



Now you can place it in the box as shown



Take care batteries end up aligned with the box opening!



Now open BroodMinder-Bees on your phone and go to the `Devices` tab to find the scale. Check battery level, etc.

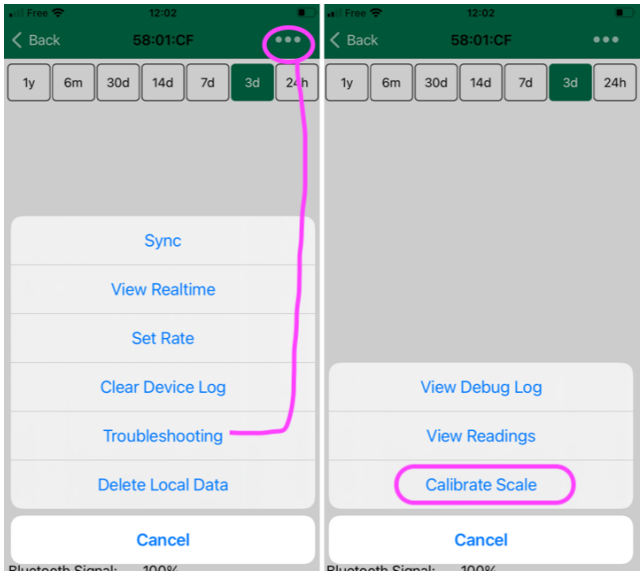
And you're done with the mechanical part!

Now let's move to calibration

Calibration

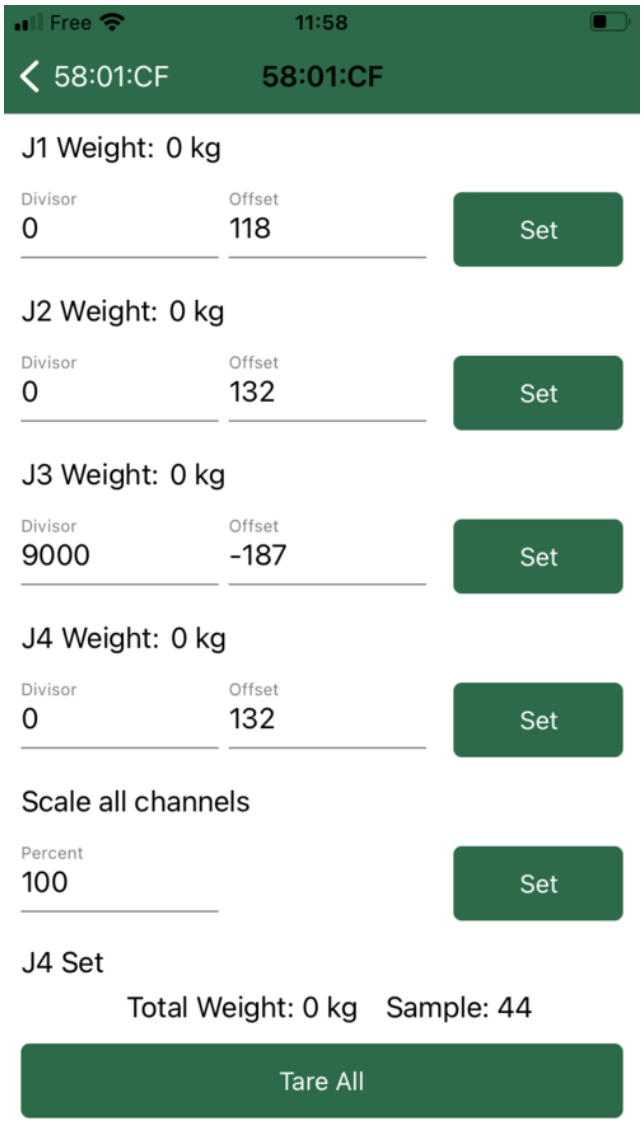
To calibrate the scale follow the process below. If you need help, you'll find more details in this page

Open Bees App, move to `Devices tab > locate the scale ID > ... > show details > ... (top right) > Troubleshooting > Calibrate scale`



Now follow the process :

1. Place the scale on the up-right position.
2. With empty scale weight: Hit the button `Tare Scale` (bottom button)
3. Now insert `Divisor = 0 for ALL chanels` (bottom of the screen)
4. Now enter `Divisor = -9000 for chanel J3` (NEGATIVE starting value)
5. NOTE : you **do not** have to worry about Offsets



You are done, congratulations !

1. Place a known weight on the scale > check "J3 Weight" displayed on the app > modify the divisor iteratively to find the actual weight on the display
2. Once you found the right divisor save and quit this interface

14.5 Troubleshooting

More often than not, the problem is simply wiring. Start by measuring between the load cell leads. You should see hundreds of ohms, not 0 and not infinity. Also be aware that we use plated through holes. If you drill them out (like Lorenzo did), the pads will no longer conduct from the top of the board to the bottom. You can solve this by solder jumper wires with the schematic as a guide.

15. Yolik devices

You can attach devices from Yolink to MyBroodMinder.com

The only think you'll need to do in order to hook them is to enter the device ID number in `Mybroodminder > Configure > Third party devices`

16. Hubs

All BroodMinder sensors transmit data via Bluetooth. There are several ways to collect the data - via your smartphone (see the Bees App section of the manual) or via a hub.

We uses hubs to monitor and send data to the cloud automatically every hour so that you can see your current hive status anywhere there is internet available. You can picture a bicycle wheel where your BroodMinder devices are the spokes and the hub listens to all of them and sends their data to the cloud.

We also have special cases for swarming. It will send a text or email notification within 10 minutes of the event.

- BroodMinder-T91 Naked Cell Hub - Cellular hub must be recharged every 6-14 months
- BroodMinder-T91 Solar Cell Hub - Cellular hub, solar powered, never needs recharging
- BroodMinder-WIFI Internal Antenna - WIFI hub for apiaries with good WIFI avaiable
- BroodMinder-WIFI External Antenna - WIFI hub with extended range
- BroodMinder-SubHub - This is a hub with no WIFI or Cellular. It can be used in remote locations to collect all sensor data into one device which makes downloading data to your cell phone very fast. It can also be used to connect remote (50-400 meters) hives to a shared BroodMinder-T91.
- BroodMinder-LoRa - In development. Estimated delivery Fall 2023

All of these hubs are monitored and set up using the BroodMinder Bees App.

All of the hubs sample the BroodMinder devices every 10 minutes.

We are happy to help you configure your system. The variety of apiary locations and installations is vast and it can be confusing to get everything working correctly. We have made these tools to be flexible and work in most situations, everywhere from downtown New York City to the rural Yukon Territory.

16.1 BroodMinder-T91 Cell Hub (BRM-54)

The BroodMinder-T91 Cell Hub is based on the Nordic "Thingy 91".

You will find an installation video here.


Every Hive Counts

Installation is super easy because we set everything up before shipping.

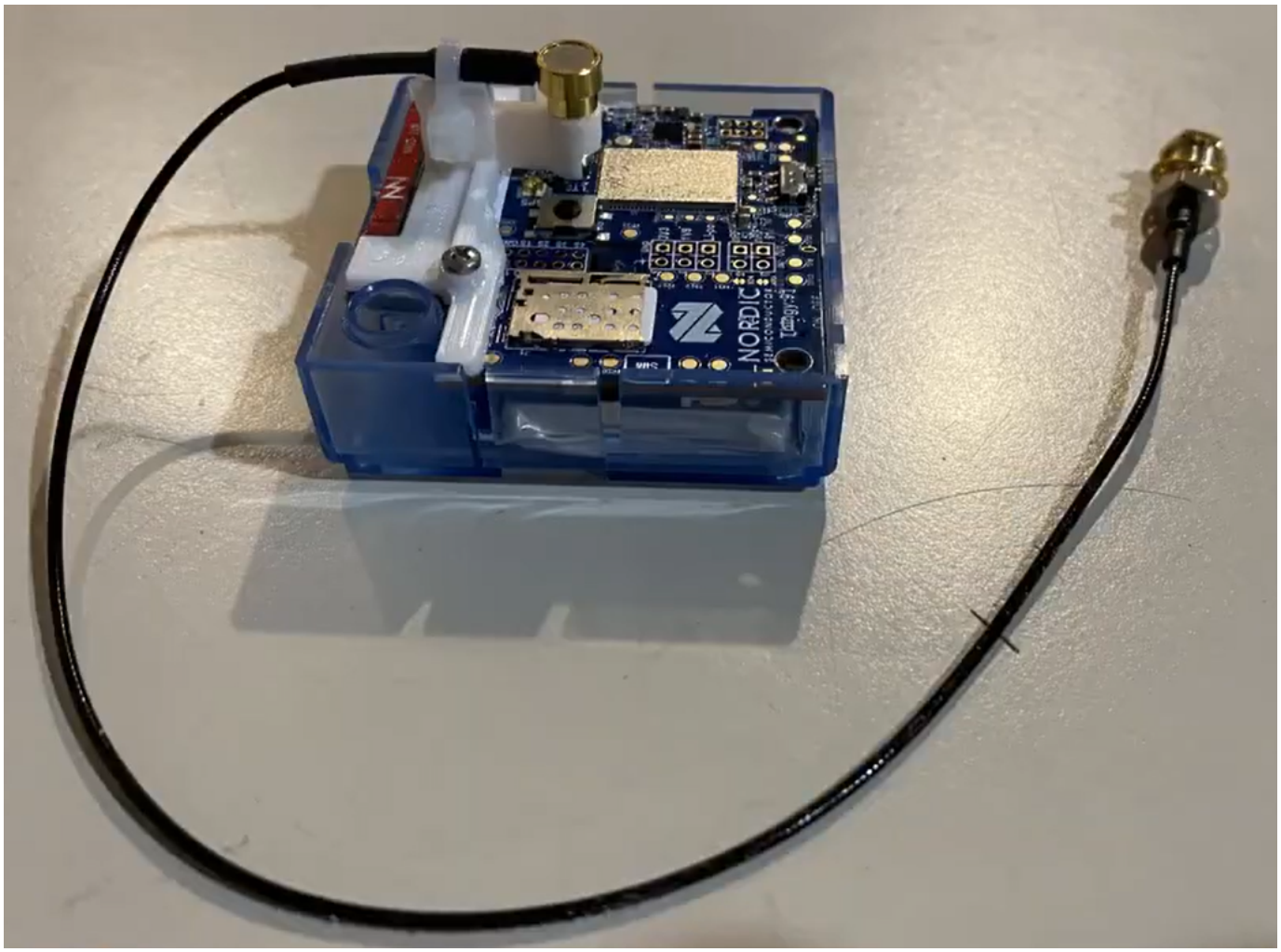
- We recommend you test everything before you take it to your apiary.
- You will get an email from BroodMinder when we ship the hub. If you don't then check your junk email folder, or contact us. The email has instructions on connecting the hub to your account. There are two cases.
- If there is a link in the email, then click it and you will be guided to connect the hub to your account and claim the one year token which is included with purchase.
- If there is not a link, then we assigned it to your account before shipping.
- When you get your hub, turn it on. There is a slide switch


FR01-S4-210
PCA20035
1.0.0
2019.28
IMEI:352656100438418
PIN:625209
400390
GPS
LTE
SIM
GND
3V3
1V8
Li-po
nRF52
nRF91
IN
OUT
SELECT
ON OFF
NORDIC
SEMICONDUCTOR

- Go to MyBroodMinder.com, choose "Configure" and expand the "Hubs" section. This is where you can manage your hub.
- Click on the Manage icon to assign or move it to an apiary.
- You must also assign a token. A token is a virtual coin that we use to pay for the 24/7 upload service. You should receive 1 year service with the hub. If you did not, then contact us at support@broodminder.com.
- After you see it working you can move it to your apiary.
- If you have a solar T91, then ensure that the gasket is seated correctly when you replace the lid. Also make certain that the solar panel is facing towards the sun for most of the day.
- If you have a naked T91, then ensure that it is in a weatherproof housing of some sort. We recommend the Lacrosse Solar Shield. We also recommend that you place the T91 in the mesh bag we include. This will keep out small bugs (such as earwigs) which are attracted to the slight warmth.
-

An external Antenna kit is available. The antenna plugs into the connector marked "LTE" on the Thingy91.

- Place the connector through the plastic mounting bracket
- Push the connector into the Thingy91 jack.
- Secure the bracket with the screw that we included.



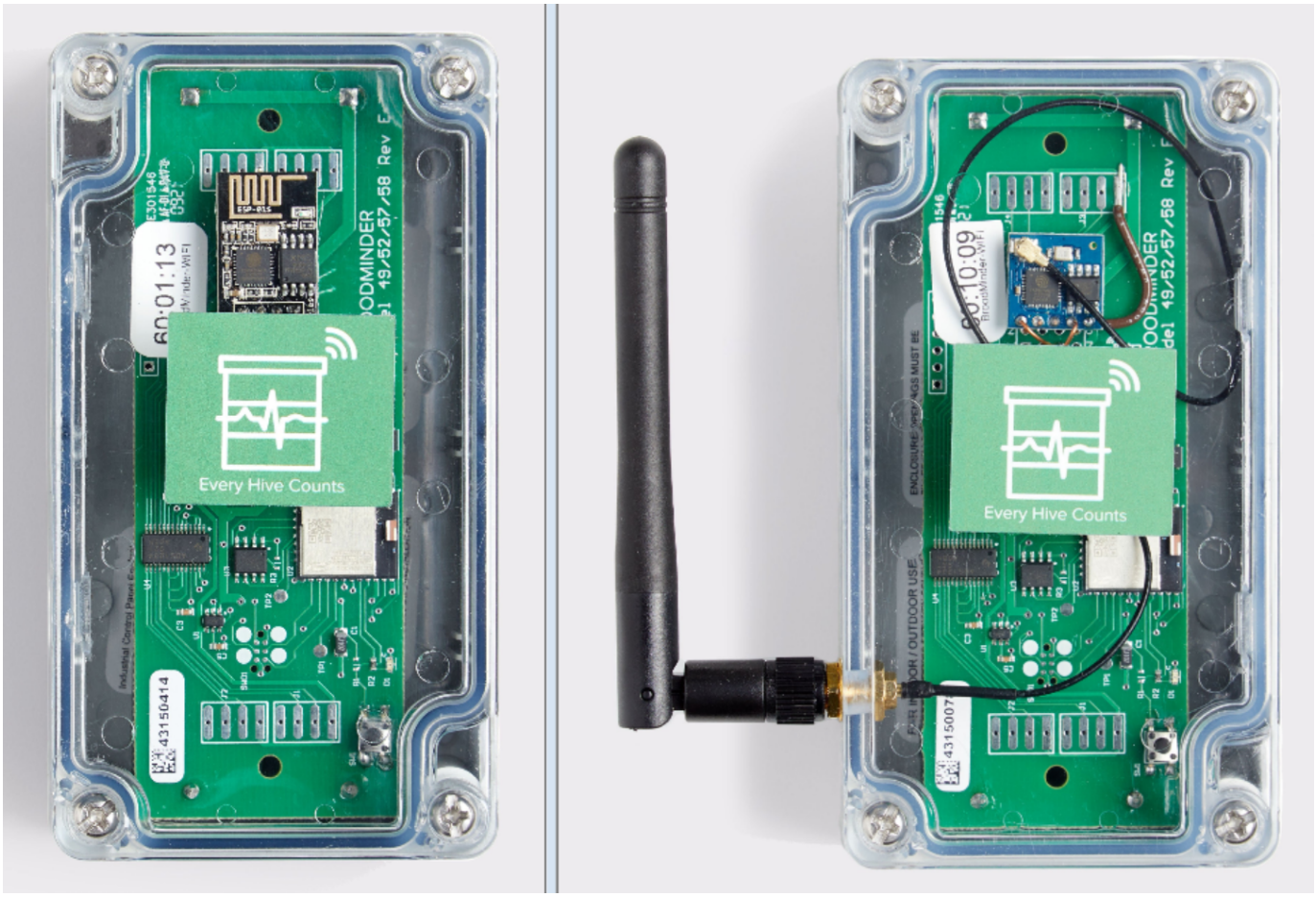
16.2 BroodMinder-WIFI Hub (BRM-60)

The BroodMinder-WIFI comes in two flavors. One with an internal antenna and one with an external antenna. If you have good WIFI in your apiary, the internal antenna version should work for you.

We recommend setting this up where there is strong WIFI and a nice work area prior to placing in your apiary.

You will find an installation video here

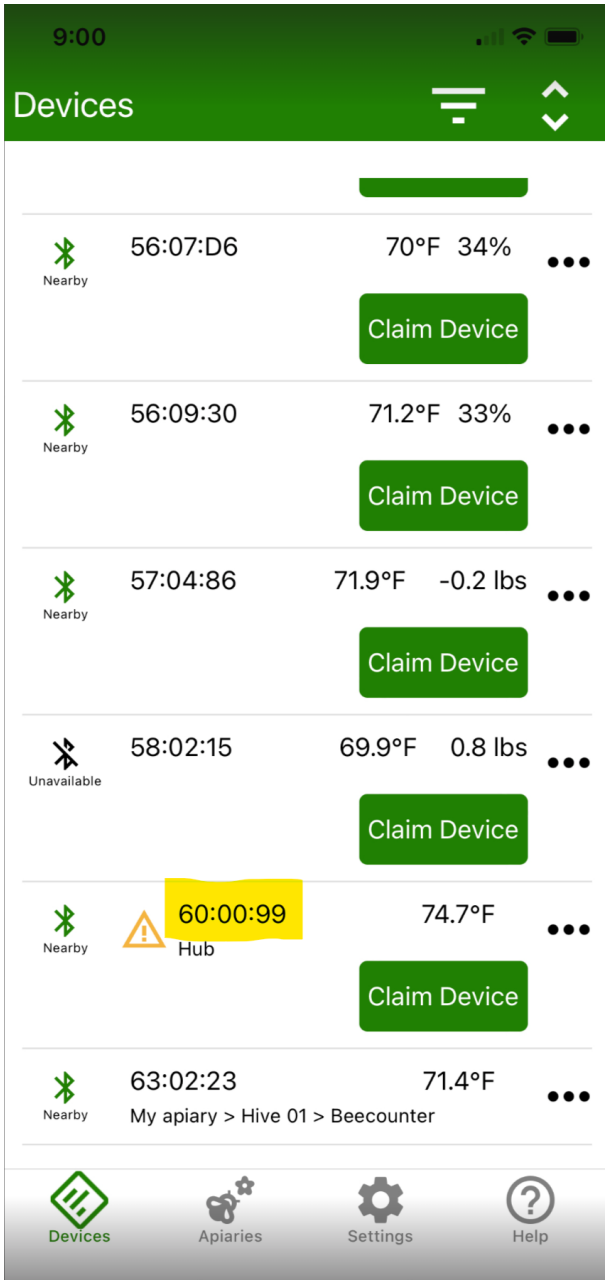
Installation



- We recommend you test everything before you take it to your apiary.
- You will get an email from BroodMinder when we ship the hub. If you don't then check your junk email folder, or contact us. The email has instructions on connecting the hub to your account. There are two cases.
- If there is a link in the email, then click it and you will be guided to connect the hub to your account and claim the one year token which is included with purchase.
- If there is not a link, then we assigned it to your account before shipping.
- Remove the cover and pull out the "Remove before use" tabs. The LED should flash for a few seconds.
- Now start up the Bees App on your phone or tablet and choose the Devices page. You should see the BroodMinder-WIFI show up on the list.

pic

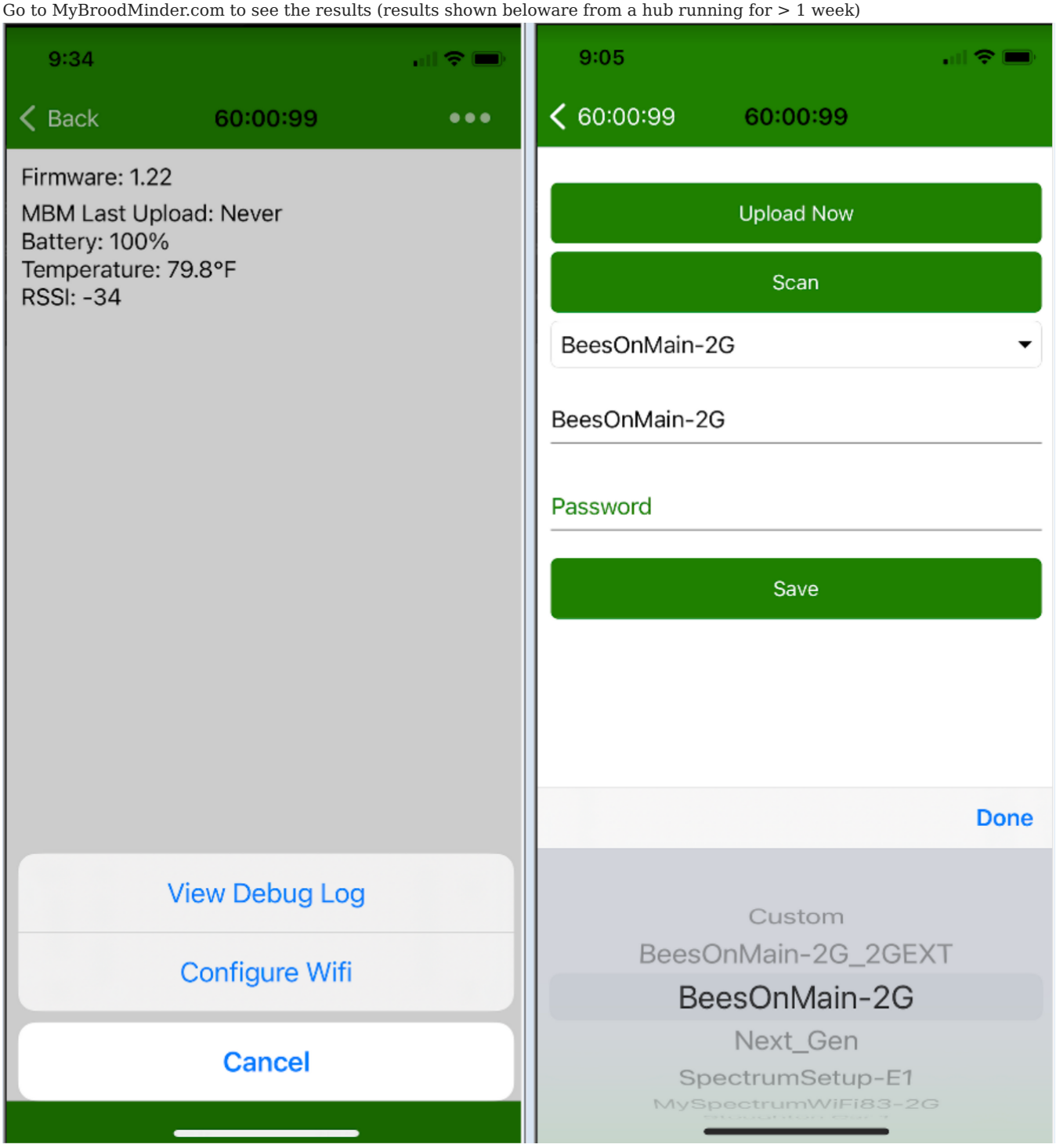
- Press the "Claim Device" button an

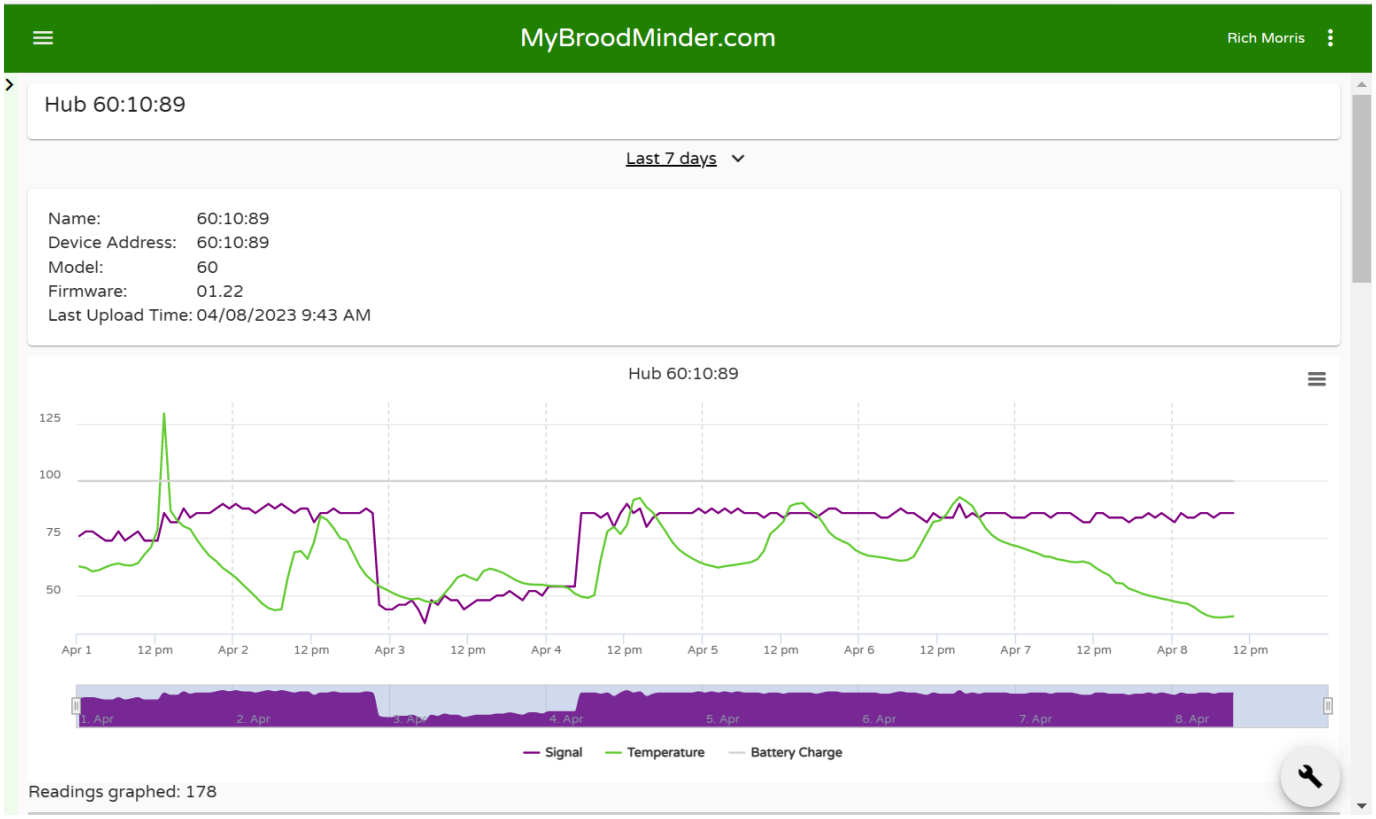


d follow the prompts to add it to your inventory.

- Click the "..." to the right of the WIFI hub and choose "Show Details"
- Choose the "..." at the top right corner and select "Configure Wifi"
- Now you can "Scan" and search for WIFI networks that the hub can see.
- After scanning, select your preferred hub
- Enter the password
- Save - the hub will now connect to your WIFI network
- Once connected, you can press the "Upload Now" button to send data immediately.
- You can also send data by pressing the button near the LED on the BroodMinder-WIFI circuit board.

- Go to MyBroodMinder.com to see the results (results shown beloware from a hub running for > 1 week)





16.3 BroodMinder-SubHub (BRM-52)

Installation

The video , BroodMinder-ASP (Apiary Starter Pack) Installation shows how this works together.

Installation is simple. Open the box and pull out the battery tabs and the -SubHub is running. You will see it show up in the phone app with an ID beginning with 52:. Once running, it will listen for other BroodMinder devices and add their data to it's internal log. The cool part is that the -SubHub will now advertise (send out) that data to be received by a BroodMinder-CELL, or a BroodMinder app.

> **Warning**
>
> Due to power constraints, the BroodMinder-WiFi does not operate with the BroodMinder-SubHub.

If you are watching with a BroodMinder app, you will see your devices show up on the list. Each device is advertised for 5 seconds, rolling through all the known devices one after the other. You will see them marked in the device list as coming via the -SubHub.

The BroodMinder-Bees app is the best tool to interact with your -SubHub. You can use it to setup and also to retrieve stored data.

You can also take an old cell phone, connect it to your local WiFi (or with a cell subscription) and run the BroodMinder Apiary app in Hub Mode. It will push the sensor data to MyBroodMinder.com every 10 minutes. Since the phone can be plugged into the wall for power it becomes very simple. Note that to do this you must have a BroodMinder-Premium account.

We have seen better performance with iOS (Apple) phones or tablets. Some of the older Android devices work find, but some have problems with Bluetooth locking up.

If your apiary spans a long distance, you can employ multiple -SubHubs, one for each group of hives. They do not daisy chain, but they work directly to the central -CELL or app.

Brief Explanation

It is a Bluetooth range extender and a high speed data vault in a box about the size of a TV remote.

The BroodMinder-SubHub will listen for all your BroodMinder devices and retransmit them using its long

range transmitter. This means you can ‘hear’ your BroodMinder devices over 1000 feet (330 meters) away.

Secondly, the -SubHub stores all of this data, and you can read the data using our new turbo-transfer protocol (releasing spring 2021). You can read a month's worth of data from 50 devices in 2 minutes.

And finally, it also records the temperature of itself, allowing you to see your apiaries micro-climate, or even place it inside a swarm box to see when bees move in.

The subhub is shipped in a non-waterproof case. If you want to mount it outside, we recommend installing inside a solar shield. The La Crosse Technology 925-1418 Sensor Protection Shield with Mount ($18) is a very good choice and the subhub fits perfectly in it. It also fits in the Acurite version (06054M $17). A third possibility is a Hammond 1554C2 ($11.57) waterproof box available at Digikey.com. You can also just put it in a zip lock bag as the least expensive solution. The -SubHub enclosure is 1.05” x 1.85” x 5.00” (47 x 26 x127 mm).

La Cross Solar Shield 

Hammond 1554C2 

Why does the BroodMinder-SubHub exist?

It’s all about maximizing the value of hive monitoring. From the data our citizen scientists have been collecting over the last six years, we have learned that internal temperature tells us the most. We have learned to detect brood rearing, swarms, hive strength, and mating flights. And this is only the start.

Fortunately, temperature is cheap and easy to measure. However, that data only does good if you can get it to the beekeeper. The -SubHub makes that easier. Here are a couple of scenarios.

Scenario 1

Setting: Your BroodMinder enabled hives are 500 feet from a building with power and you have an old cell phone.

Configuration: Put the -SubHub in the middle of your hives and the cell phone in the building. Run the apiary app in hub mode.

Outcome: Your hive data will be sent up every 10 minutes. In the event of a swarm, you will receive an email or text message as soon as it is detected.

Scenario 2

Setting: This apiary is remote and there is no power nearby. You are already set up with a BroodMinder-Hub, however some of your hives or swarm traps are 700 feet away.

Configuration: Put the -SubHub near the hives. Since the -SubHub also measures temperature, you can place it inside the swarm trap to detect when bees move in. You can have multiple -SubHubs feeding the BroodMinder-CELL/WIFI hub if you wish.

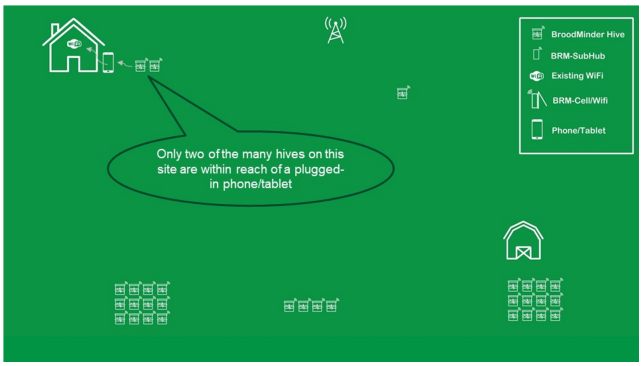
Outcome: More of your apiary can be monitored with minimal cost. Temperature increase in swarm traps will show on MyBroodMinder.com when bees move in.

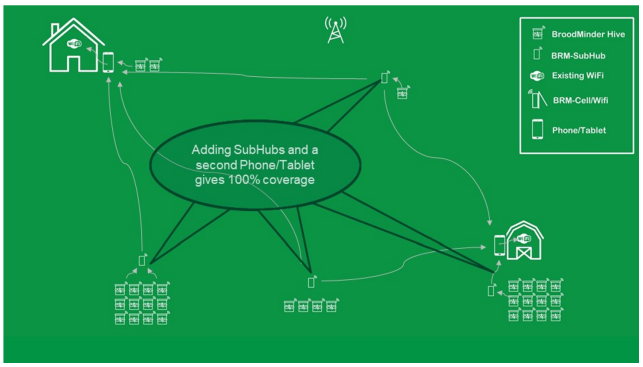
Scenario 3

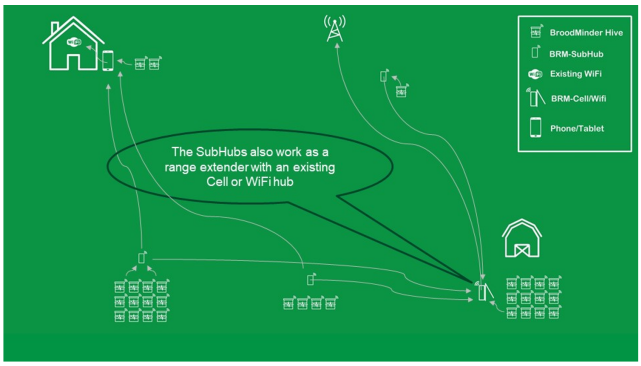
Setting: This apiary is remote and there is no power and no cell tower nearby..

Configuration: Put the -SubHub near the hives. It will record data from all the nearby BroodMinders.

Outcome: When you visit your apiary, you can read all of the the data from all of the hives, typically in less than a minute. You will be able to view this data with the new BroodMinder-Bees app in a manner similar to MyBroodMinder. Then you can send the data to MyBroodMinder when you arrive back in civilization.







How did you do all of this magic?

It wasn't easy. Our team has been working on the BroodMinder-SubHub and MyBroodMinder ecosystem for over a year. That time was split between solving the technical challenges and making the system flexible and easy to use. We feel it is a game changer and that you will love it.

For the folks that love all of the technical details, here they are.

The -SubHub is using the same circuitry that our BroodMinder-W2 uses. It uses a Silicon Labs, long range Bluetooth Low Energy (BLE) module. We have measured the advertising range of the module with an iPhone 11 at greater than 1000 feet. We got usable data at 1700 feet.

By using 4 AA batteries, we have much more power to play with. This enables us to listen for BroodMinder devices for 20 seconds every ten minutes with anticipated battery life greater than a year.

There is a one megabyte memory added to store the log data. This allows us to store 35,000 records or roughly data from 100 devices for two weeks (or less devices for longer, you can do the math). The -SubHub has the capacity to keep track of 128 BroodMinder devices at one time.

The data will be read using BLE SPP (Serial Port Profile). We have timed transferring the entire 35,000 record log to take about 120 seconds using iOS and less than that for new Android devices (longer for phones 4 or 5 years old). The new BroodMinder-Bees app supports this high speed transfer.

The final piece is in Advertising the data from the -SubHub. As mentioned above, the -SubHub listens for new data for 20 seconds every 10 minutes. It then modifies it's BLE advertisement packet to 'mock' all of the BroodMinder devices it heard. The -SubHub advertises a different device every 5 seconds thus allowing data from 12 BroodMinders to be sent every minute which means over 100 devices in 10 minutes.

We have established these parameters in order that the batteries last at least a year. While they will be adjustable for special circumstances, we feel that the standard setup will cover 99% of the cases.

That is basically how it works. Of course there are many, many details in making the pieces fit together seamlessly and to be supported by the equipment in the field. And, as always, during deployment we will be watching closely.

If you have a CELL or WIFI device, the subhub will amplify the data sent from the devices and extend the normal 10-15 foot range up to 300-500 feet (depending on obstacles in the way). Multiple subhubs can be located in the apiary to ensure complete coverage.

Range Testing

If you are going a long distance, we have a few hints for you.

1) The -SubHub's radio waves are directional. The batteries block the antenna. This means that the -SubHub circuit board should be on the side of the -Hub or phone receiving the data. 2) You can use the BroodMinder-Bees app to do your testing. Please watch the video BroodMinder-ASP (Apiary Starter Pack) Installation for the best information on this. 3) A super way to test the range is using an app and your phone. Nordic Semiconductor has an app called "nRF Connect" for both iOS and Android. It is the best Bluetooth app out there. Here are a couple of usage notes.

a. Go to Settings | Scanner | Scanner Timeout >> set to Never

b. Start scanning in the "Scanner" tab at the bottom of the app

c. BroodMinder sensors will be named by their ID (e.g. 57:01:01)

d. Press the up arrow beside "No Filter" and put a ":" in the Name field and flip the switch beside it. This will only show devices with a ":" (such as BroodMinder devices.). You can also limit it to a specific device this way.

e. Now select the RSSI Graph and you will see each time the phone gets an update from the BroodMinder.

f. There are many other great options in the program to explore if you like this sort of thing.

As a general note, detecting advertisements does not mean that you can connect to a device. Connections require stronger signals. This means that if you want to download the log, or update firmware, you may need at least a 40-50% signal level.

Good luck, we are very excited about the BroodMinder-SubHub and hope it will be of use to you.

16.4 BroodMinder-LoRa (BRM-65)

⚠ Work in progress

16.5 BroodMinder-Cell 3G (BRM-44-50)

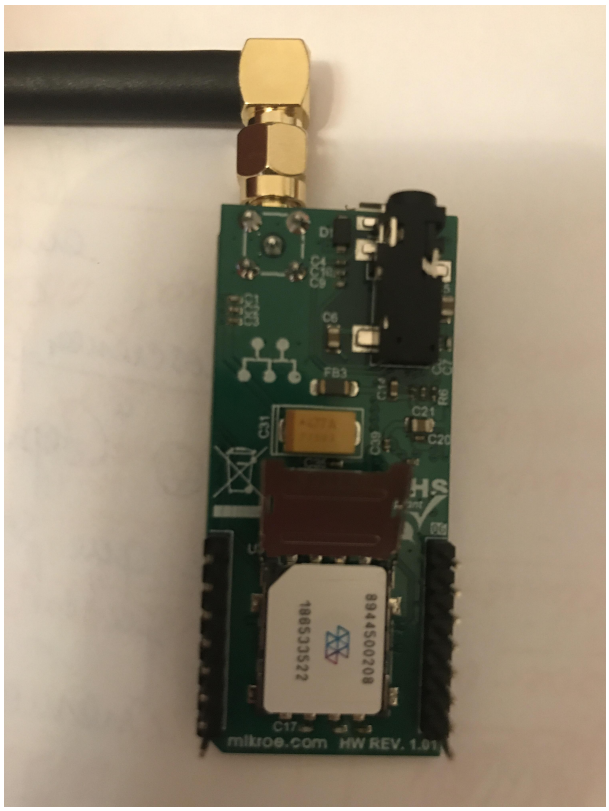
The 3G Cell hubs have been under operation since 2018. In some countries like USA they have been disconnected but they are still delivering a good service in many other places. What is described below is a troubleshooting guide for Cell Hub models 44 and 50.

These hubs are not configurable with the Broodminder Bees app. **You must install the Broodminder Cell App** Android, iOS to manage the settings.

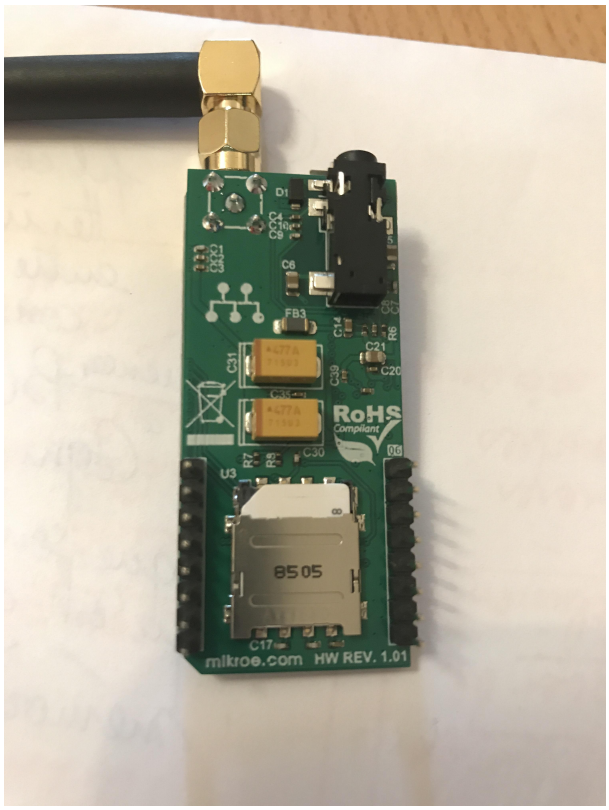
Install the SIM Card

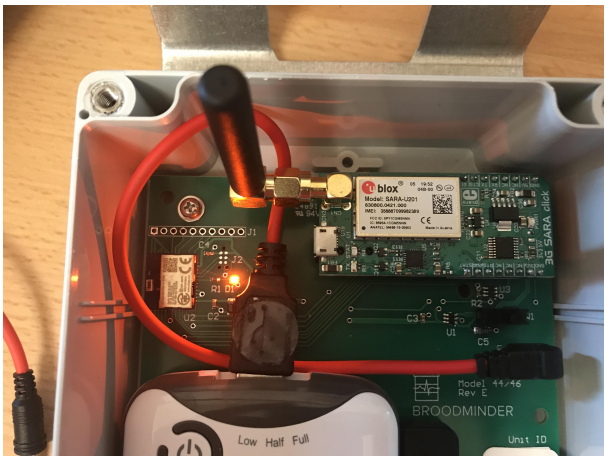
Here are the steps to install the SIM card:

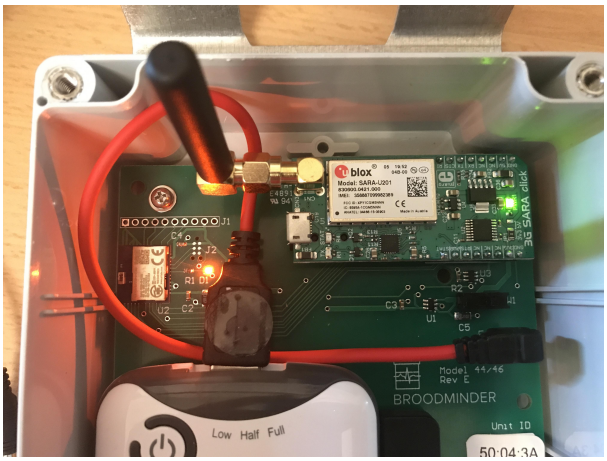
1. Unplug the 3G clicBoard.
2. Open the case: slide it upward through the antenna with your thumb, then pull it up to remove it.
3. Insert the SIM card in the correct position.



4. Pull down and slide down to lock.





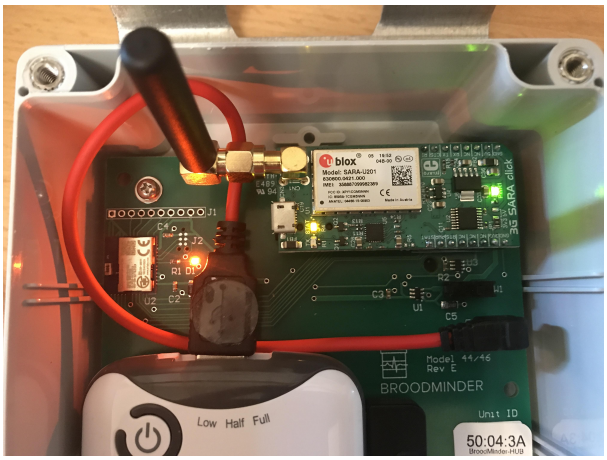


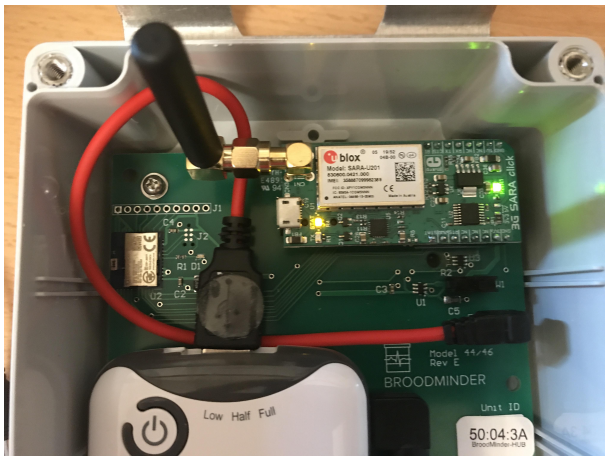
Typical Startup

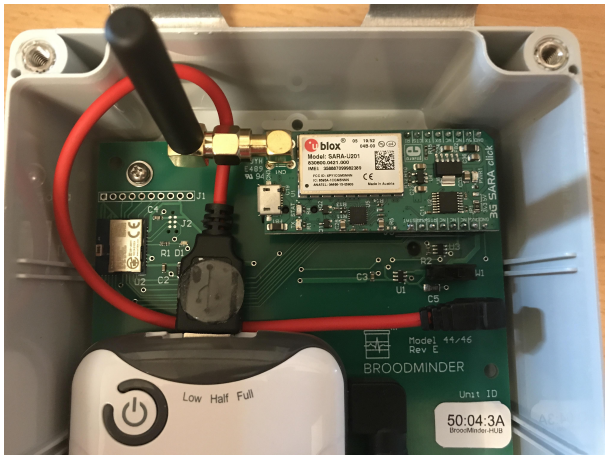
Turn on the hub. Upon startup, you should see:

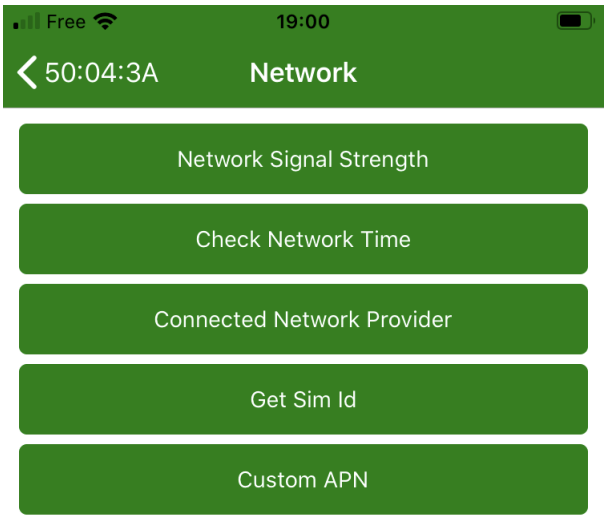
- LED D1 (orange) blinking several times.
- LED PWR1 (green) illuminated.
- LED STAT (yellow) illuminated.
- Then, after a while, when the network connection is established, everything turns off.

Note that every time you go to the Cell app in `Configure > Diagnostics > Cell network`, you should see the green LED PWR1 illuminated.



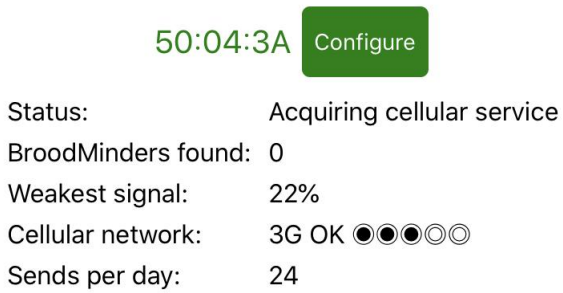






Connecting to the Cell Network

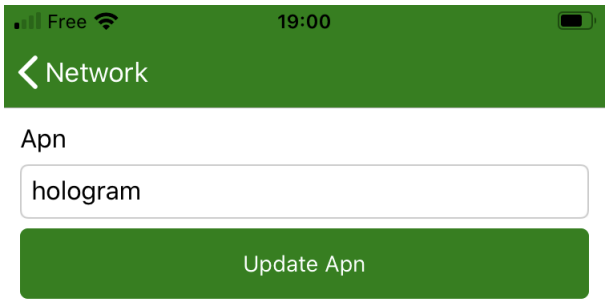
It may happen that your hub finds a 3G network but is unable to acquire the service.



To identify the issue, first check your APN code.

Verify You Have the Correct APN

Each SIM provider has its own Access Point Name (APN), which could be hologram, matooma.m2m, etc. Go to `Configure > Diagnostics > Cell network > Custom APN`.



Check Modem Communication and Trace

Right after turning on the hub, quickly go to `Configure > Diagnostics > Modem communication`. Here you can monitor the connection process. Let it run until it stops, then copy the result and send it to support.

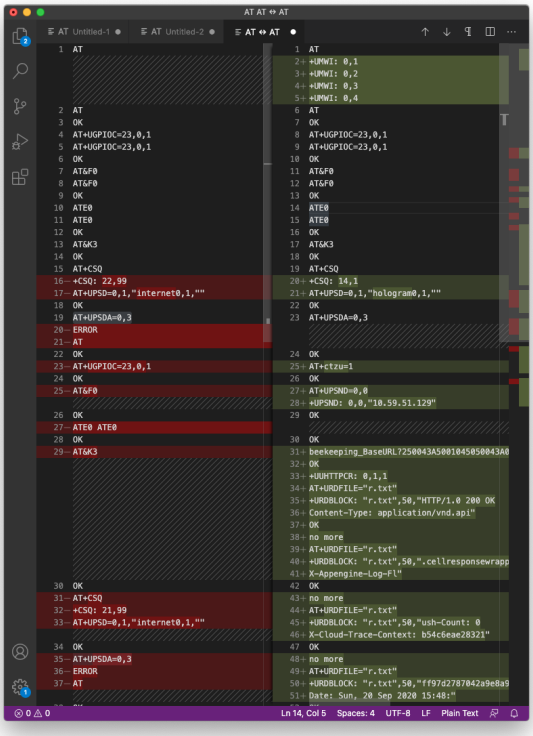
Here's a typical startup trace:

```
AT
+UMWI: 0,1
+UMWI: 0,2
+UMWI: 0,3
+UMWI: 0,4
AT
OK
AT+UGPIOC=23,0,1
AT+UGPIOC=23,0,1
OK
AT&F0
AT&F0
OK
ATE0
ATE0
OK
AT&K3
OK
AT+CSQ
+CSQ: 14,1
AT+UPSD=0,1,"hologram0,1,""
OK
```

```
AT+UPSDA=0,3
OK
AT+ctzu=1
OK
AT+UPSND=0,0
+UPSND: 0,0,"10.59.51.129"
OK
OK
beekeeping_BaseURL?
250043A5001045050043A0104000001000140000000000999999999999999.","r.txt"
OK
+UUHTTPCR: 0,1,1
AT+URDFILE="r.txt"
+URDBLOCK: "r.txt",50,"HTTP/1.0 200 OK
Content-Type: application/vnd.api"
OK
no more
AT+URDFILE="r.txt"
+URDBLOCK: "r.txt",50,".cellresponsewrappermedia+json
X-Appengine-Log-Fl"
OK
no more
AT+URDFILE="r.txt"
+URDBLOCK: "r.txt",50,"ush-Count: 0
X-Cloud-Trace-Context: b54c6eae28321"
OK
no more
AT+URDFILE="r.txt"
+URDBLOCK: "r.txt",50,"ff97d2787042a9e8a98
Date: Sun, 20 Sep 2020 15:48:"
OK
no more
AT+URDFILE="r.txt"
+URDBLOCK: "r.txt",50,"01 GMT
Server: Google Frontend
Content-Length: 4"
OK
no more
AT+URDFILE="r.txt"
+URDBLOCK: "r.txt",47,"2
{"code":"200","t":"[1600616881s2881h15]"}
"
OK
```

Typical Trace with Wrong APN

On the left is the wrong APN, on the right is OK.



17. Tokens

17.1 Why?

We have worked very hard for 8 years to create the BroodMinder eco system. While we wish we could provide all of this for free, the reality is that it takes a lot of work to keep things running and do improvements. We must also pay for cloud usage and data storage.

We will continue to provide basic functionality for free and only require subscriptions for advanced functionality.

The advance features we offer are:

- Advanced MyBroodMinder.com view and analytics
- 3rd party sensor support (YoLink LoRa devices)
- Real-time uploads from BroodMinder cell and WIFI hub devices

We administrate these subscriptions with our token system. This allows the use of debit/charge cards and leaves control of the charges in the hands of our customers.

Yes, it can be confusing. We will continue to improve and simplify the system, but it is surprising difficult to accomplish this. We appreciate your patience.

If you need help, please contact us at support@broodminder.com. We are happy to assist you and get you up and running.

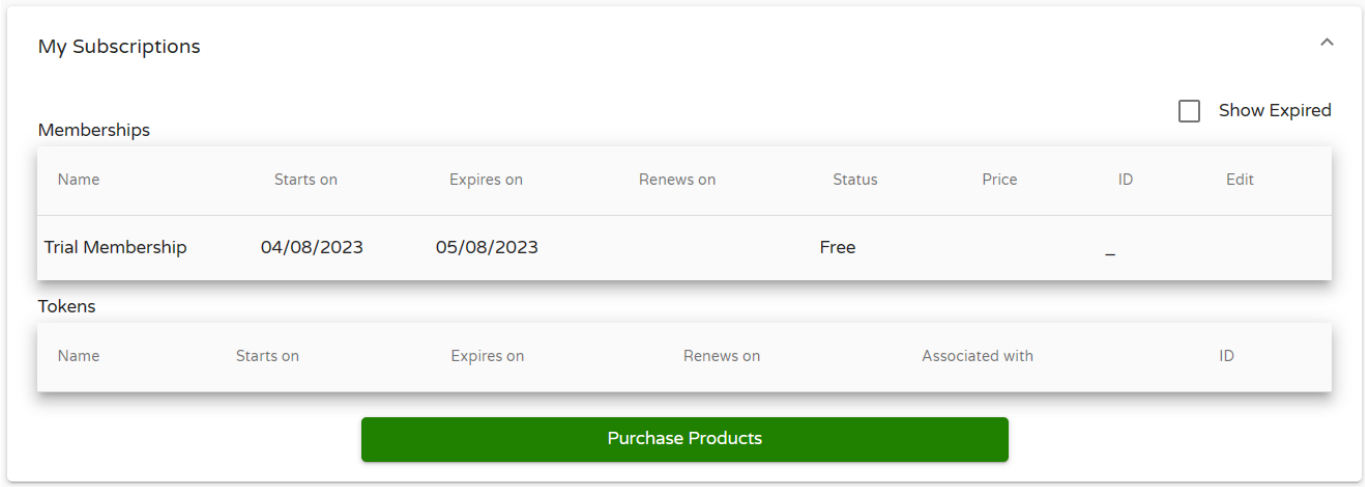
17.2 How?

We have several tokens that we use.

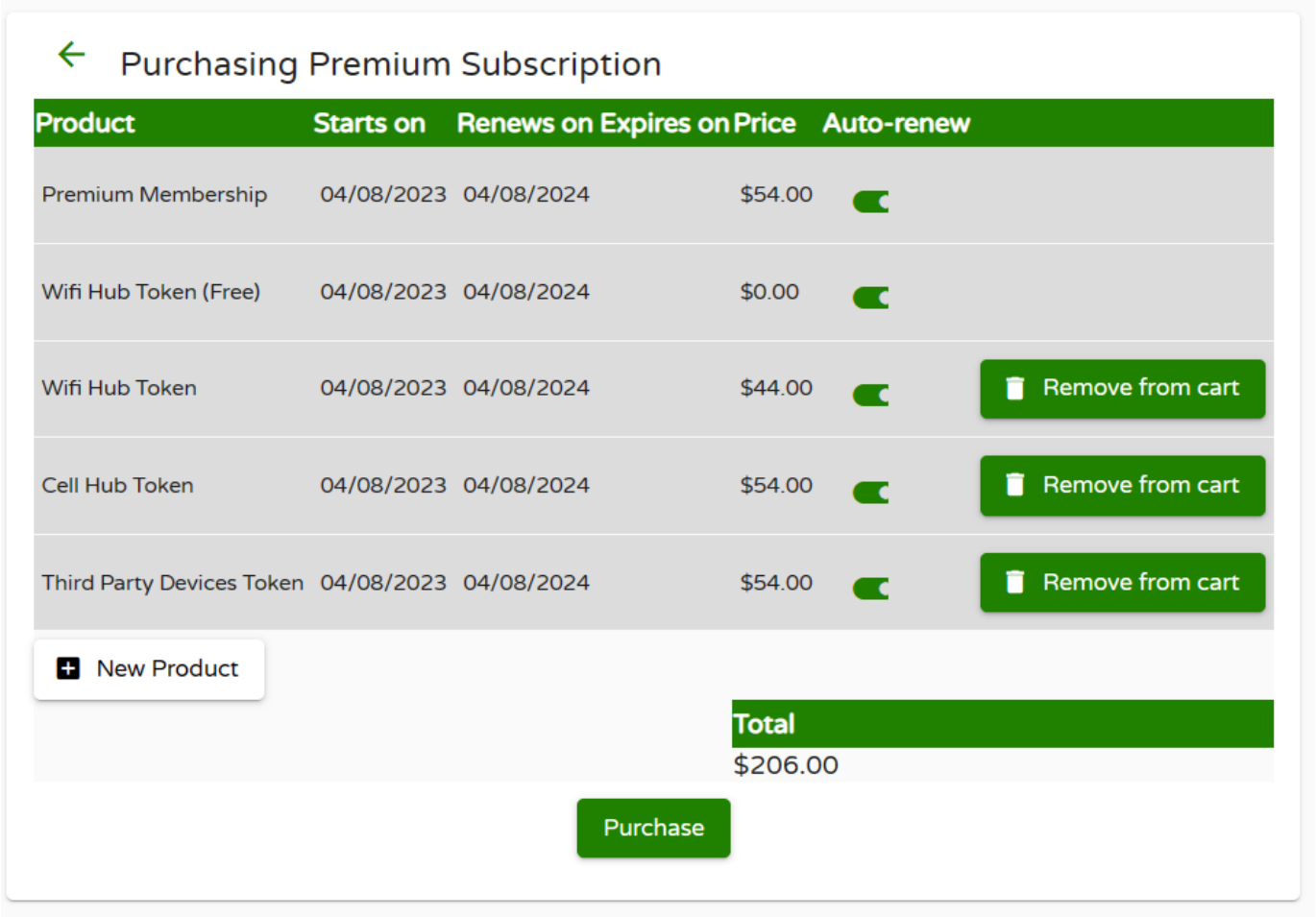
	HOBBY FREE	PREMIUM $54.00/Year
MYBROODMINDER & MELLISPHERA		
FREE STORAGE ON CLOUD	✓	✓
DATA DISPLAY	12 months	full history
PUBLIC APIARY ⓘ	✓	✓
PRIVATE APIARY	×	✓
MELLISPHERA VIEWS	✓	✓
MYBROODMINDER PREMIUM VIEWS ⓘ	×	✓
COLONY BROOD	✓	✓
COLONY FITNESS	✓	✓
DAILY ALERTS	×	✓
EMAIL SUMMARY	✓	✓
BROODMINDER DEVICES & APIARY APP		
UNLIMITED DEVICES	✓	✓
DATA UPLOADING	1 device at a time	all devices at once
HUB MODE ⓘ	×	✓
SUBHUB	✓	✓
WIFI HUB	×	✓
CELL HUB (*)	×	✓
THIRD PARTY DEVICES (**)	×	✓
REAL TIME ALERTS	×	✓
SUPPORT		
PREMIUM SUPPORT	×	✓

- **No Subscription** - If you do not have an active subscription you will have these features and limitations listed above.
- **Trial Membership** - When you sign up for an account, you are given MyBroodMinder-Premium features for one month.
- **MyBroodMinder-Premium** - This gives you access to additional data processing and display features. We include one free WIFI token with the Premium subscription.
- **Wifi Hub Token** - This token is required for each of your BroodMinder-WIFIs that are sending data 24/7.
- **Cell Hub Token** - Like the WIFI token except that we include a cellular data plan.
- **Third Party Devices Token** - MyBroodMinder supports receiving data from YoLink devices. Multiple devices are supported with one token.

To purchase tokens, go to "Configure" then "My Subscriptions" and press "Purchase Products"

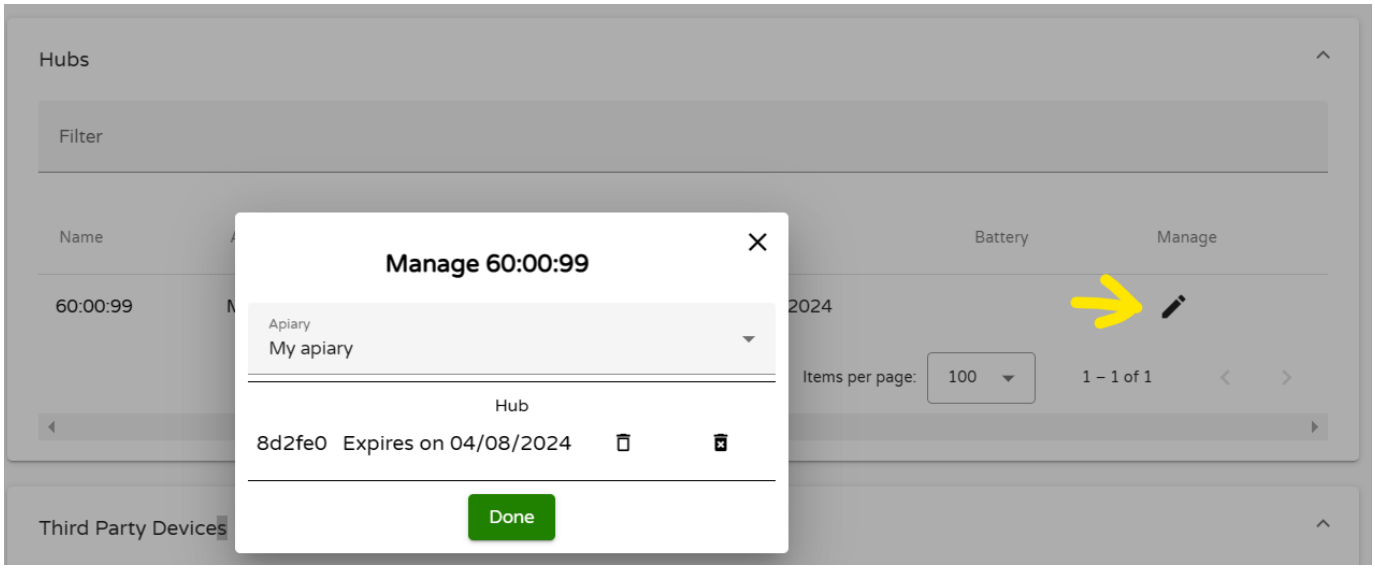


Choose the tokens that you need



When you press purchase, you will be taken to the service we use to collect and administrate credit card & paypal information. We do not store your CC information, we leave that to the pros. FYI that company is Braintree which is a Paypal company.

Once you have your tokens, you can assign them in the Hubs configuration screen.



18. Examples Uses of BroodMinders

18.1 Overview

The BroodMinder team is made up of passionate beekeepers. As we develop our products we get excited when we think of new cool things that we can do with what we have created. If you have cool ideas, let us know. We will share them here.

This section is always a work in progress.

18.2 Teaching Apiaries

18.3 Swarm Monitoring

18.4 Swarm Traps

18.5 QR Codes

18.6 Pollination Monitoring

18.7 Honey Production

Thanks and remember... Every Hive Counts

19. Data Interpretation

In this section, we present some initial findings from Theo's hives. We are still very much in the learning mode and will appreciate your observations shared on the BroodMinder forum at BroodMinder.com.

These reports were written in the summer of 2016. You can look directly at the data in MyBroodMinder.com by looking in the Claypoint apiary. This is available as a demo apiary.

19.1 Hive Weight Profiles

By Ray Walker, May 2016

Hive weight trend charts contain repetitive shapes or profiles, depending on the season, floral resources, rainfall, temperature, humidity and other variables. By studying weight profiles, beekeepers can learn more about their apiary's foraging resources, colony's status, health and performance. Daily, weekly and monthly profiles of each colony can be compared with "typical" weight profiles for an apiary's local environment (based on historical scale trend data).

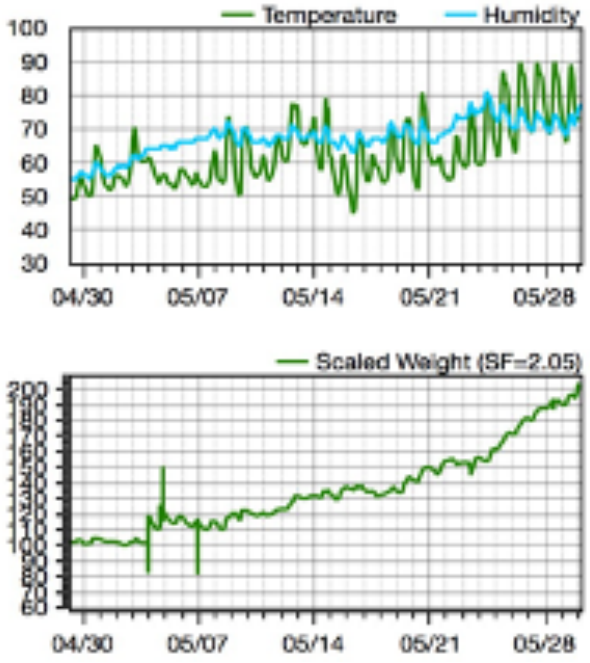
Hive weight trend data can be used to estimate bee populations, nectar collection and consumption rates, accumulated foraging hours, foraging performance and other colony characteristics.

During the past 3 years, I've been applying a variety of electronic hive scale systems to study and compile a library of "typical" weight profiles for my backyard apiary. Since the end of April, I've been using a BroodMinder hive scale prototype.

Monthly Profiles

The main nectar flows in northern Delaware occur during the months of May and June (typically about 50 days duration). For an overwintered nucleus colony to exploit the main flow, it's population must increase rapidly in March and April – peaking just before the flow begins.

Weather conditions have a big impact on how well the colony's foraging population collects nectar from the variety of available blooms. Flying conditions (rain, wind, temperature, humidity, etc.) must be ideal when blooms are pervasive to maximize monthly foraging rate. By examining the shapes of the monthly profiles and observing when specific blooms occur, the major nectar resources for the apiary location can be determined (and compared year-to-year).



Monthly Trend Chart

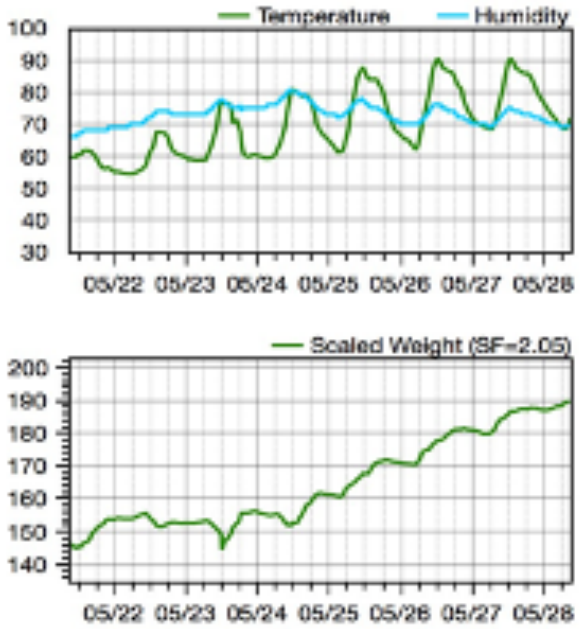
Early May's cooler temperatures (50-60's) and rain limited foraging rates.

Increased daytime temperatures (70-80's) and less rainfall improved flying conditions during the end of the month. Best foraging rates were obtained when the bloom's nectary had warm day-time and cool night-time temperature cycles. The colony foraged ~90 pounds of nectar in the month (~3 pounds per day). Black locust and tulip-tree were both blooming during the end of May.

Weekly Profiles

By charting the week of maximum nectar flow, a series of repetitive profiles show routine day-time weight gains as nectar is collected then night-time weight losses as nectar is evaporated and the colony is consumes nectar. By comparing this season's maximum weekly profile to previous season's maximum weekly profile, a relative comparison of colony foraging performance is obtained.

Weekly profiles of maximum weight gains can be added to a library of trend charts for evaluating an apiary's foraging capability to other apiary location's capability.



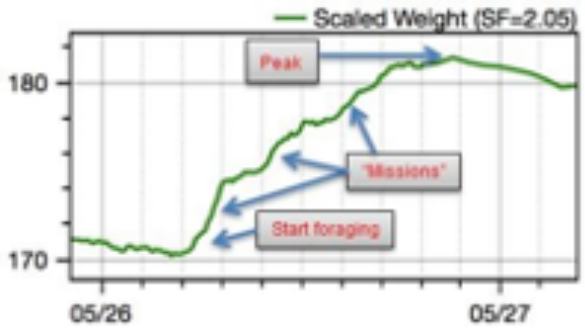
Weekly Trend Chart

Increased average temperature cycles with wider spreads in day & night temperatures as well as stable/lowest humidity produced the maximum nectar flow.

The average foraging rate for the best four days was about 10 pounds per day. This rate compares to previous year's foraging rates. However, the maximum nectar flow duration varies from year to year.

Daily Profiles

By charting the day(s) of maximum nectar flow, the typical daily routine of the colony can be studied. The colony's initial foraging flights occur at the same time each morning. Several foraging "missions" can be observed as the weight increases at various rates (depending on which blooms are available at different times of the day). Towards evening, the foraging force returns to the hive and the weight peaks for the day. During the night-time, moisture from the nectar is evaporated and bees consume nectar.



Daily Trend Chart

Daily profiles indicate which portions of the day-time hours the foragers are most active – providing the beekeeper insight when hive inspections would be most disruptive.

19.2 Swarm Detection with a BroodMinder TH in a Top Bar Hive

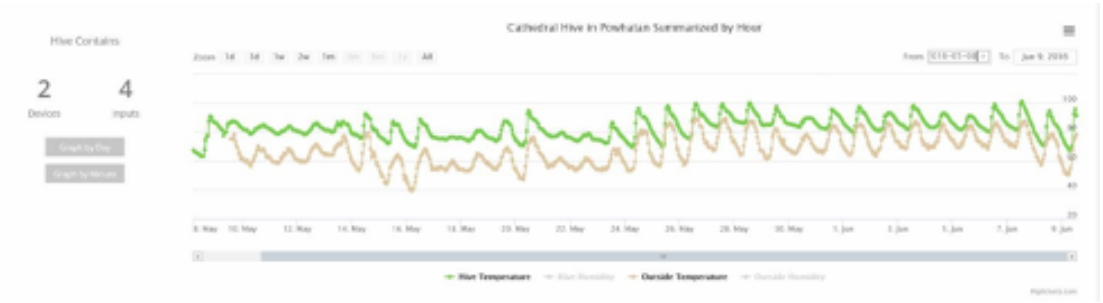
By Theo Hartmann, June 2016

This is a case where a BroodMinder TH device in a top bar hive was helpful in tracking the progress of the

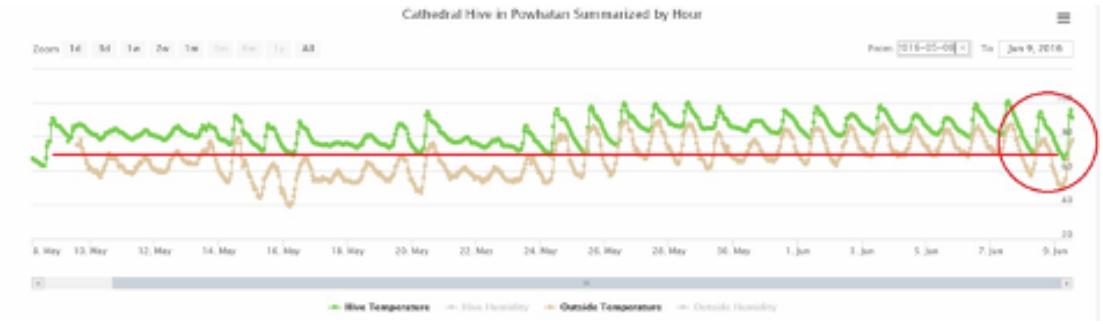
colony in a remote hive. The BroodMinder Temperature and Humidity Device was installed in a recess in the end board.

The colony was installed from a swarm into this hive and then moved to a remote location. My remote agent was kind enough to obtain the data from the BM device on a daily basis and upload it to MyBroodMinder.com

Below is a screen shot from MyBroodMinder.com showing the entire time period since the colony was in this hive:



Because of the nature of this hive and the location of the device at one end of the hive, it is not expected that the measured hive temperature stays at one level as it is the case in a Langstroth hive. What caught my eye were the last two days where the temperature dropped to the lowest level since the bees were introduced into this hive.



Granted, ambient temperature dropped, too but going back to May 16th, ambient temperatures were lower back then at the same or higher hive temperatures. I concluded from this that the colony had swarmed because lower temperature means less

heat generated means less bees inside the hive to generate heat and keep the hive temperature at a higher level at night. I went there for an inspection and this is what I found:

Few bees on the comb and two open swarm cells at the bottom of two combs.

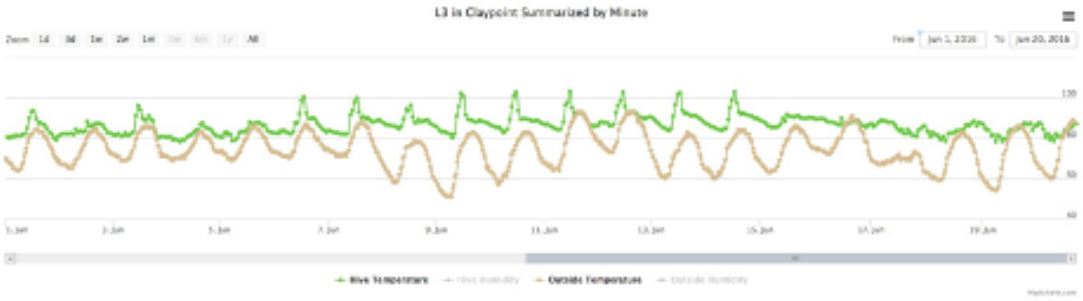
Clearly, a lot of bees have moved out to find a home elsewhere. This is not necessarily a bad thing because the bees which are left behind have ample resources in the hive (pollen, nectar, honey). The natural process of queen replacement has already begun since two new queens have hatched as evident from the open swarm cells. Also, the mite count in this hive will drop since the brood cycle has been interrupted.

The BroodMinder TH device together with a remote agent and MyBroodMinder.com proved to be effective tools to monitor this hive in a remote location.

19.3 Avoiding Excessive Heat in the Hive During Summer Months

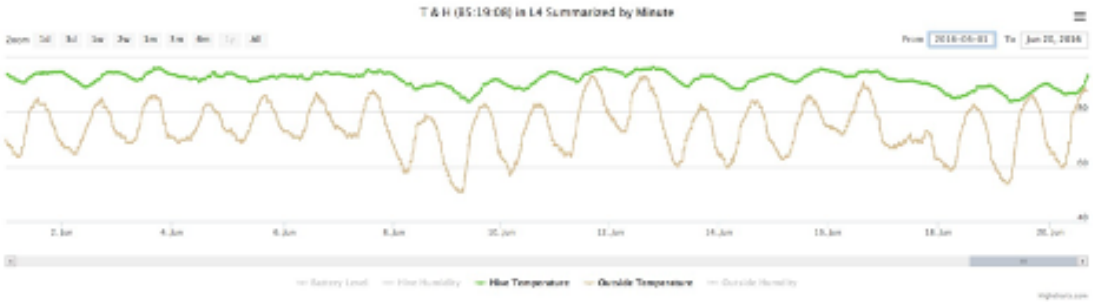
By Theo Hartmann, June 2016

This document describes findings on two hives which were started this spring. One was from package and the other one was a small swarm. Both colonies were introduced into Langstroth 8-frame deep box hives and were developing at a more on less identical pace and both hives were expanded to two brood boxes per hive pretty quickly. The BroodMinder Temperature and Humidity devices (TH) were placed on top of the upper brood box. There is no super above that, just the inner and outer covers. Temperature peaks started to appear on June 6th at times when the mid-day sun was hitting the outer cover of the hives as can be seen on the chart below.



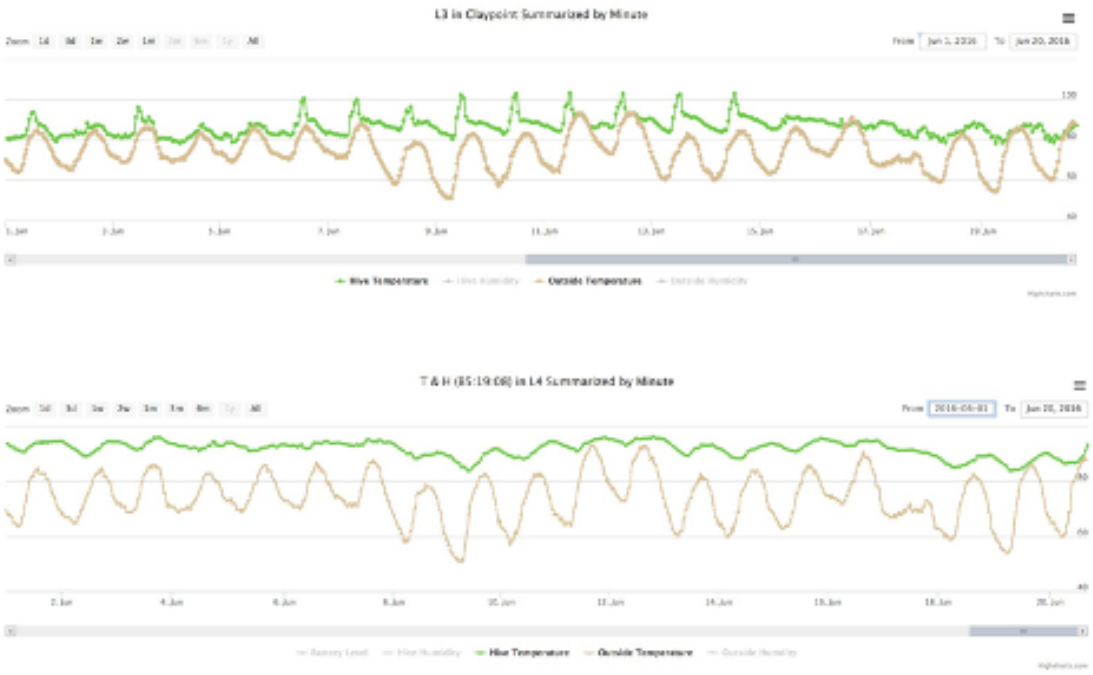
The peaks would reach 100+F almost every day between June 6th and June 15th. At times, these temperatures were 20F above ambient temperature and clearly, this must have put unnecessary stress on the bees. The hives essentially became greenhouses. This was surprising because both hives have screened bottom boards and screened and ventilated inner covers for the summer months. A 2" high density Styrofoam insulation was placed on top of the screened and ventilated inner cover on the starter hives on June 15th. This resulted in elimination of the temperature peaks.

For comparison, here is a temperature profile from a mature hive with honey supers:



No peaks and a more mellow change in temperature.

These same to charts are shown again below and a few additional things can be concluded from them:



Notice that the difference between the hive temperature and ambient temperature generally is smaller for the starter hive (top) compared to the established hive (bottom). The reason is the number of bees in the hive. The starter colony is affected much more by changes in ambient temperature than the established colony.

The more gradual change in temperature on the established hive can be attributed to the fact that there are two honey supers above the TH device. These supers shield the brood nest from the temperature peaks seen in the hive which does not have any supers. The very top of the hive with the supers sees the same temperature peaks observed in the starter hives but these peaks never make it down to the TH device.

This discovery and subsequent corrective action was only possible because:

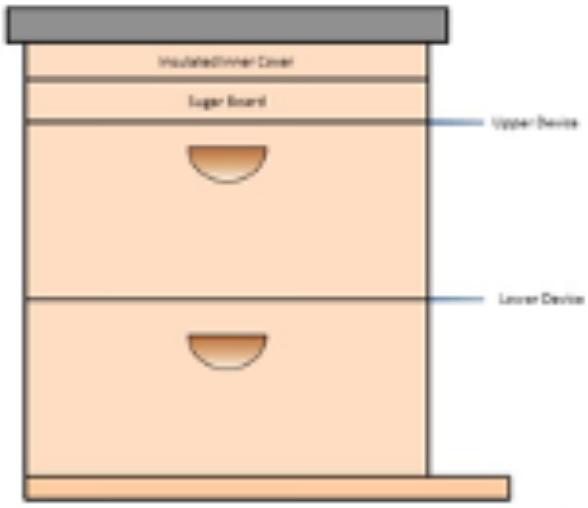
- BroodMinder TH devices are installed
- Data are collected on an hourly interval
- Plots of the data available instantly on MyBroodMinder.com
- Local weather data were added by MyBroodMinder.com for reference

The cost to do this analysis is the purchase price of the BroodMinder device, nothing more. All the other data and analysis tools are available to BroodMinder users for free.

19.4 Detection of Cluster/Queen Movement and Spring Brood Buildup

By Theo Hartmann, June 2016

This example shows how multiple BroodMinder devices in the same hive can be used to detect a number of things without actually opening the hive for physical inspection.

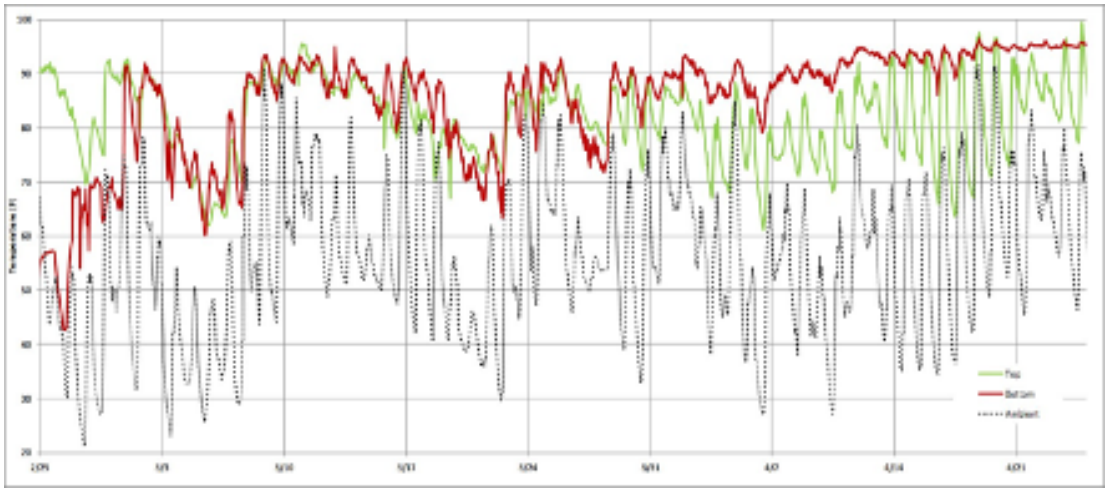


The setup is a 8-frame Langstorth hive with two deep brood boxes, screened (but closed) bottom board, sugar board with top entrance above the top box, insulated inner cover and outer cover.

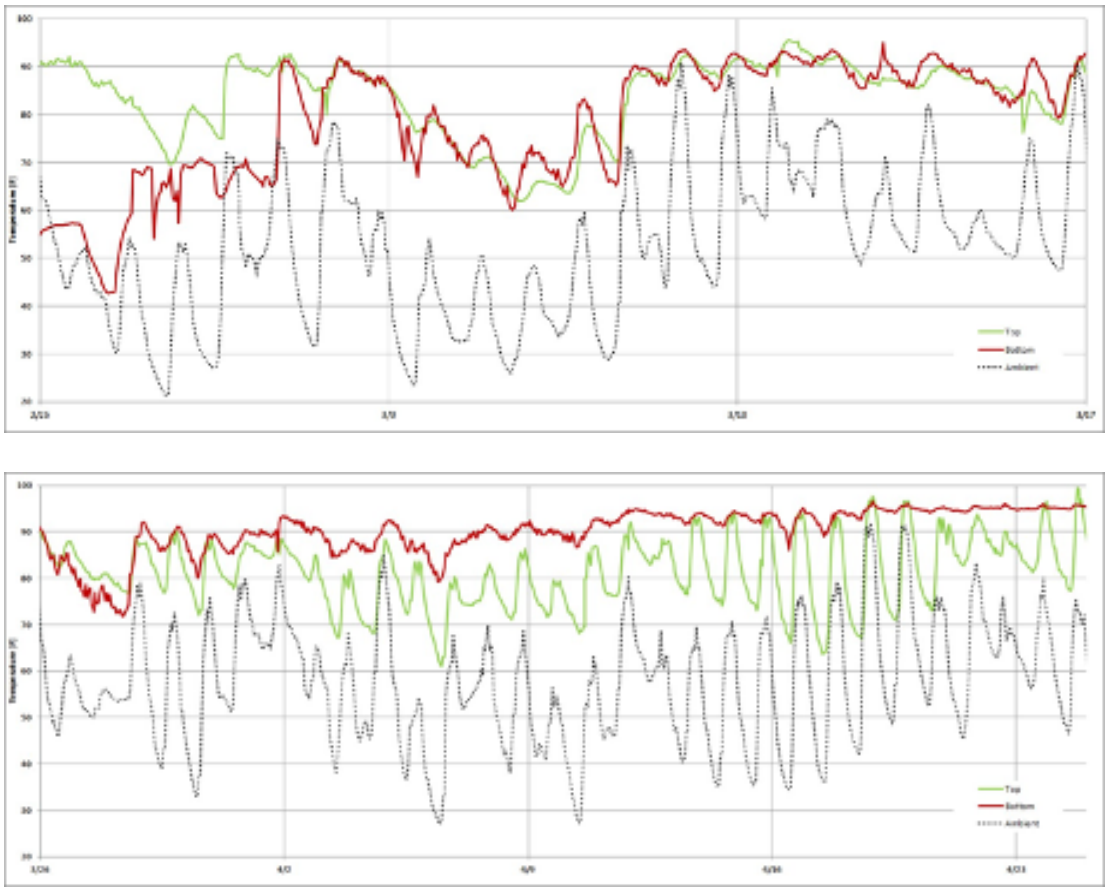
This was the configuration of the hive going into the winter. One BroodMinder TH device was installed between the top brood box and the sugar board and second BroodMinder T device was installed between the two brood boxes. MyBroodMinder.com was still in it's infancy at the time the test went underway and for this reason; another BroodMinder TH device was placed outside in a protected area to gather ambient conditions.

Here is an overview of the data collected. The green line represents the temperature above the top box, the red line the temperature of the bottom box and the dotted line is the ambient temperature.

- Higher temperatures in the top box indicated that the cluster is up there feeding on honey stores and sugar.
- Temperatures equalize between the boxes but are not high enough for brood to develop.
- Both boxes are getting warmer which could be a sign that the queen started lying, potentially in both boxes.



This chart is broken down in sections for a closer look at the data and corresponding analysis.



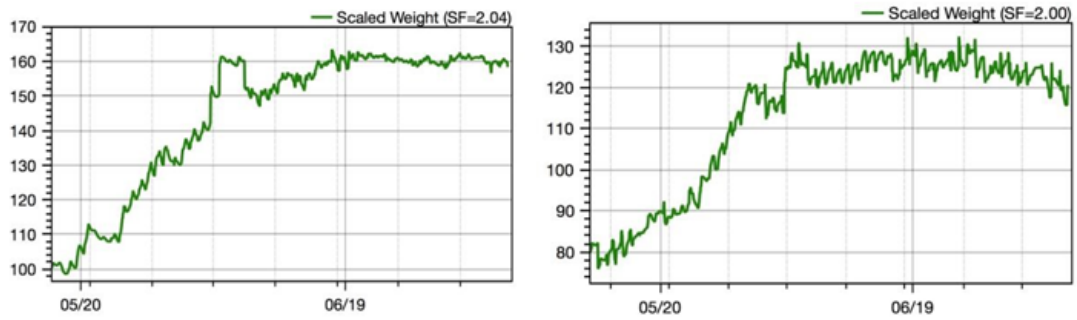
Here a switch happens and the bottom box begins to get many bees up there. The bottom box is now kept at 90+F. Perfect conditions for brood to develop. The top box follows the ambient temperature swings. Not warmer than the top indication that the queen has moved down into the lower box.

These data indicate a healthy hive and a subsequent inspection revealed that this is in fact the case and the colony is ready for the nectar flow.

19.5 Pull the Supers When the Dearth Hits

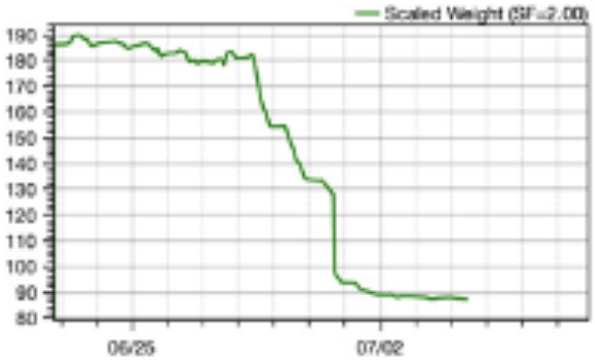
By Theo Hartmann, July 2016

Every spring it is a pleasure for beekeepers to watch the bees going on their daily excursions and bringing back pollen and nectar. As we all know, this is to both feed the larva and also to produce honey stores for the next winter for the colony to feed on. Having the hive weight available is a great help in making the decision when to harvest honey from the hive. There is a spring nectar flow which can produce large amounts of honey in a short time as seen in the charts copied from the mobile app below. The hive weight increased rapidly during the second part of May.



There are the daily ripples caused by the bees bringing in nectar during the day causing weight increase. Then, during the night, bees are busy reducing the water content and the hive weight decreases. There also are the larger jumps where the beekeeper added or removed frames or supers.

Longer term, the weight increase clearly ceased middle of June. The hive on the right even shows a decreasing trend in hive weight. This is a clear sign that the dearth has set in and there is not enough natural food available. The bees begin to consume the honey stores or ever worse, robbers grab what they can get. Below is a chart of such a situation.



The hive weighed a whopping 185lb when the dearth hit. Then, on June 28th the weight started to drop like a rock. It stabilized at about 155lb the next night. 30lb lost. The following day, again massive weight loss took place down to 133lb, another 22lb lost. The weight loss continued the following day until the beekeeper removed the honey supers and got the hive under control. The robbers knew exactly what they were doing after they discovered the venerable hive. Take out what we can the first day, take a rest and then go back for more, day after day. There was no other hive with a scale nearby otherwise we would probably see where the loot went!

The above makes it clear that honey supers should be removed when the dearth hits, latest when the hive weight starts to decline. The BroodMinder-W scale is of great help to time the removal of the honey super(s). This will not only mitigate the robbing risk but also increases the bee density in the hive and the ability for the colony to defend their hive. It is also the time to install an entrance reducer and/or screens and close off any top entrances. With these measures, the robbing risk is minimized.

Here is an additional tip for BroodMinder-W users:

Removal of a full honey super results in a reduction of the hive weight by 40-60lbs which is a significant portion of the total hive weight. This is an excellent opportunity to get information for adjustment of the hive scale factor in the mobile app. Therefore, weigh everything you have removed from the hive as accurate as you can with a bathroom scale, a postal scale etc. and record it. Visit the BroodMinder forum for advice on how to adjust the hive scale factor.

Getting back to the dearth, food is scarce for the bees during the dearth period and they may require supplemental feeding. Knowing the hive weight of established colonies is essential to determine if it is necessary or not. First year colonies require feeding irrespective of the hive weight.

On established colonies I would recommend to start feeding if the hive weight starts to drop. This will reduce stress in the colony since the food is readily available inside the hive. This is substitute food for the lack of nectar out there. Stop feeding when the hive weight increases. The bees have found another nectar flow.

When feeding in the summer I use 2:1 Sugar syrup. My thought is that a 1:1 is good for spring to get the queen thinking that there is a nectar flow and she will lay more eggs. In the summer and after the spring nectar flow is over, the bees are busy making honey out of the nectar they collected. During this process, the bees remove vast amounts of water from the honey before they can apply their seal of approval and cap the cells with an airtight wax cap. The last thing the beekeeper wants to do is give them more water. So, thicker syrup is better in the heat of the summer. Hint: Add 2 tbsp per gallon (1/2 tbsp per quart) of apple cider vinegar to the syrup. This lowers the PH to the level of honey and prevents black mold.

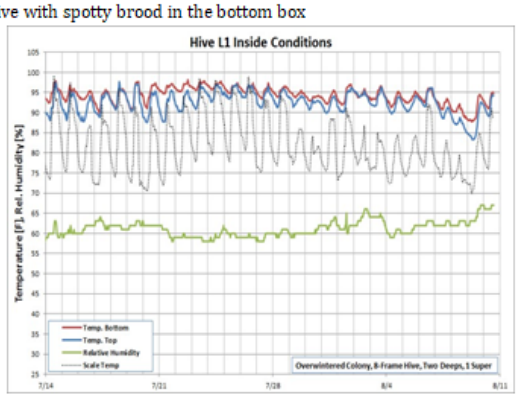
19.6 Promising Citizen Science Project Observations

By Theo Hartmann, August 2016

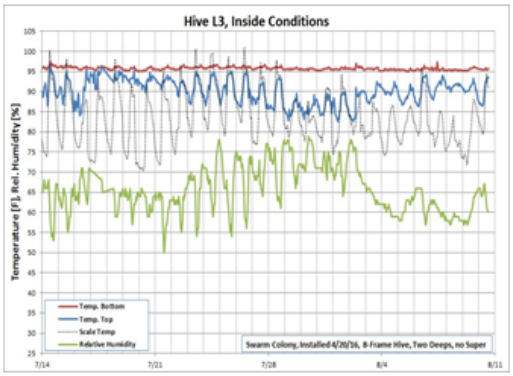
As an early adopter of the Citizen Science (CS) Project, I have seven hives set up in this configuration and data are collected on all of them on an hourly basis. This paper illustrates the power of this setup where multiple hives can be compared on an even basis to detect anomalies and define resulting actions.

True to their name, BroodMinder devices detect the presence of brood: The measured temperatures show that the bees hold the nest temperature at a constant 95-96°F when good brood is present. The charts below show both, the superb job the bees are doing raising babies and also the quality of the BM devices showing exact temperatures.

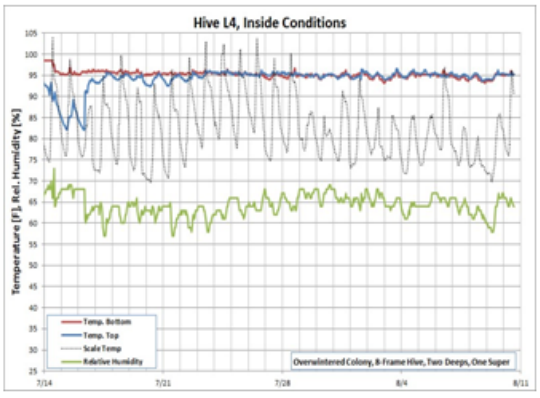
Hive with spotty brood in the bottom box



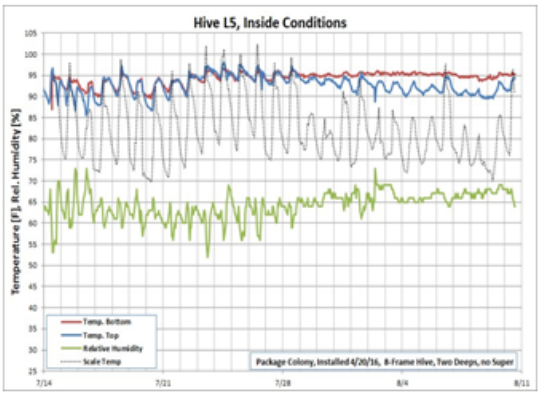
Hive with 5+ frames of solid brood in the bottom box



Hive with 5+ frames of brood in both brood boxes



Requeened hive finally coming "on-line" properly



19.7 Using BroodMinder Data to Optimize Hive Preparation for Winter

By Theo Hartmann, October 2016

This is the time of year when beekeepers are preparing their hives for the winter season. There are a few essential steps which typically take place:

1. Ensure adequate resource levels in the hives to be overwintered
2. Ensure that each hive has a laying queen and the brood nest in the bottom box and resources around and above it.
3. Consolidate weak hives for the winter and split them in the spring

Below are a few examples from my apiary showing how BroodMinder data help to plan the hive inspections and hive configuration changes to accomplish the above goals. The apiary discussed here has six active hives next to each other. Hive 2 is a control hive without bees. All hives are configured the same with two 8-frame deep boxes. Supers have been removed earlier and all colonies are fed with Boardman style entrance feeders. The combined weight of each hive hardware is just under 50lbs.

1. Using Measured Hive Weight to Determine Resource Allocation

The goal is to have about 60lb of resources in each hive going into the winter. This consists of capped and uncapped honey, pollen and supplemental food as needed. The situation as found after the summer is as follows:

Hive	**#**	**1**	**3**	**4**	**5**	**6**
Gross Weight	lb	100	130	70	100	80
Hardware	lb	50	50	50	50	50
Net Weight	lb	50	80	20	50	30
Over/Under	lb	(10)	20	(40)	(10)	(30)

Only hive 3 fulfills the 60lb resource requirement. All others need help. It was decided to remove some of the excess honey from hive 3 (4 frames) and put it in hive 4 (2 frames), hive 6 (1 frame) and hive 7 (1 frame). This resulted in this revised weight distribution:

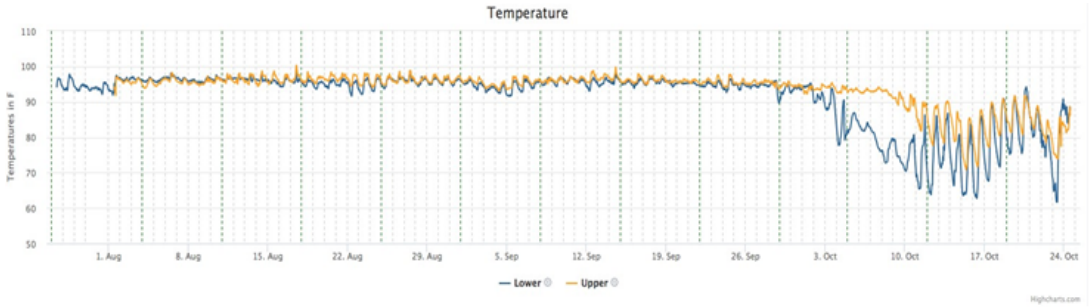
Hive	**#**	**1**	**3**	**4**	**5**	**6**
Gross Weight	lb	100	110	85	100	85
Hardware	lb	50	50	50	50	50
Net Weight	lb	50	60	35	50	35
Over/Under	lb	(10)	0	(25)	(10)	(25)

Most hives are still short of the 60lb resource goal.

1. Using Brood Box Temperature to Detect Queen Presence and Brood Nest Location

Hive temperatures indicate that the queens have slowed down their laying rates, which is normal for this time of year.

Below is an example to show this condition. The bee colony kept both brood boxes at around 96F until the end of September. Then the bottom box dropped off followed by the upper one. This would indicate that the queen stopped laying in the bottom box first followed by the top one. Beekeepers who use Oxalic acid to reduce the Varroah mite count in their hives can use this temperature drop as a trigger to start treating their hives because from that point forward there will be a minimal number of capped brood cells in the hive.



Taking a snapshot of the temperature levels before the queen laying rate started to decrease showed the following:

Hive	#	1	3	4	5	6
Upper Temp	F	<90	<90	>90	<90	>90
Lower Temp	F	<90	>90	>90	>90	<90

This was around the beginning of October

90F was taken as a threshold to determine brood/queen presence. The hive inspections confirmed open brood presence in the boxes indicated in green above and no or very little capped brood in the boxes shown in red.

1. Hive Reconfiguration and Consolidation

The following actions will be taken or were taken already:

- Hive 1: Queenless hive. The two boxes will be combined with hives 4 and 6. Hive 1 will be closed for the winter.
- Hive 3: No configuration change
- Hive 4: Combine brood from both boxes to the bottom box. This creates a smaller brood location, easier to keep warm
- Hive 5: No configuration change
- Hive 6: Move brood to the bottom box
- Hive 7: No configuration change

All live hives will get a 20lb sugar board with top entrance. This will take care of the missing resources. They also get a 2" Styrofoam hive top insulation. Bottom entrances will be reduced to ¾" width, screened bottom boards will be closed and the Boardman entrance feeders will be removed.

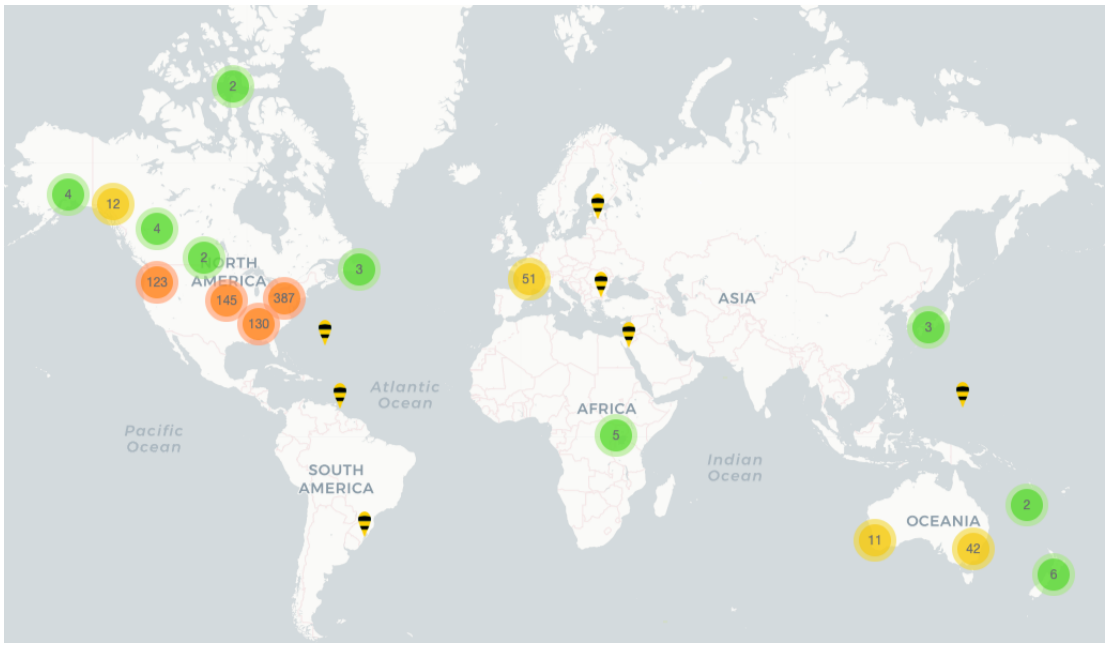
Good night girls. Sleep well and see you in the spring!

20. Citizen Science

Broodminder's public domain site is Beecounted.org. Our applications open up the possibility of sharing data with this international initiative.

Beecounted.org collects information from hundreds of beekeepers Citizen Scientists who share data from their hives with the community. This data is publicly accessible and helps researchers and scientists improve knowledge about bees.

Beecounted is also the way to go around the world of beehives. How are the colonies in Canada doing these days? Check it out!


2
4
12
4
2
123
NORTH AMERICA
145
387
130
3
51
ASIA
3
Atlantic Ocean
Pacific Ocean
AFRICA
5
Indian Ocean
SOUTH AMERICA
2
OCEANIA
11
42
6

21. Bee Life EU pollinator hub

BroodMinder, is collaborating with the Bee Life association through the European Union Pollinator Hub to share critical data related to bee colony health and behavior. This partnership aims to improve pollinator policy in the European Union by leveraging advanced technology and data-driven insights collected among beekepers all around the world to support the conservation and well-being of pollinators, particularly honeybees.

As a BroodMinder user you can choose to ** share your own hives** data with BeeLife.

21.1 The data being shared

- sharing is done at apiary level
- all raw measurements from devices in an apiary are shared.
- a rough location of the apiary based on postal code.

21.2 FAQ

When is my data sent?

Data is sent daily to BeeLife as far as the sharing is active

If I activate the sharing now, is past data being sent too

No, sending is done on a daily basis. No catch back is done (except for devices being synced manually)

What happens if I move a device out of this apiary?

data from this device won't be sent anymore

What happens if I move a new device into this apiary?

adding a device to that apiary will start to share the data from that moment

More information at https://www.bee-life.eu/eupollinatorhub

21.3 Rationale for Data Sharing

- Environmental Conservation: BroodMinder recognizes the vital role pollinators, especially honeybees, play in sustaining ecosystems and agriculture. By sharing data with the EU Pollinator Hub, BroodMinder aims to contribute to pollinator conservation efforts.
- Data-Driven Policy: The EU Pollinator Hub is dedicated to formulating policies that promote pollinator health and well-being. Access to real-time beehive data can provide valuable insights into the factors affecting pollinator populations and inform evidence-based policy decisions.
- Collaborative Approach: BroodMinder believes that collaboration between the private sector and governmental organizations is essential for addressing complex ecological challenges. Sharing data with the EU Pollinator Hub demonstrates a commitment to working together for a common cause.

21.4 Nature of Data Shared

BroodMinder shares anonymized and aggregated data collected from its beehive monitoring devices. This data includes temperature trends, humidity levels, hive weight fluctuations, and other relevant environmental conditions. Individual beekeepers' data remains confidential, with no personally identifiable information shared.

Benefits of Data Sharing:

- Informed Policy Decisions: The EU Pollinator Hub gains access to real-world data on bee colonies' health and behavior, allowing for more informed policy decisions to protect pollinators.
- Early Warning System: The data can serve as an early warning system, enabling rapid responses to issues such as hive diseases, climate change impacts, or pesticide exposures.
- Scientific Research: Researchers and scientists working with the EU Pollinator Hub can use the data to conduct studies that advance our understanding of pollinator dynamics.

21.5 Privacy and Ethical Considerations:

BroodMinder ensures that the data shared is anonymized and aggregated, preserving the privacy of individual beekeepers. Ethical considerations include obtaining informed consent from beekeepers and ensuring data security to prevent unauthorized access.

22. BroodMinder Device Firmware Updates

22.1 Overview

From time to time we make updates to improve the operation of our sensors. BroodMinder devices use OTA (Over The Air) firmware updates and are very simple to perform.

This procedure works with the following models (model is the first 2 characters of the ID, for example 47:12:34 is model 47)

Model 47,49, 51, 52, 56, 57, 58, 59, 60, & 63

22.2 Basic Process

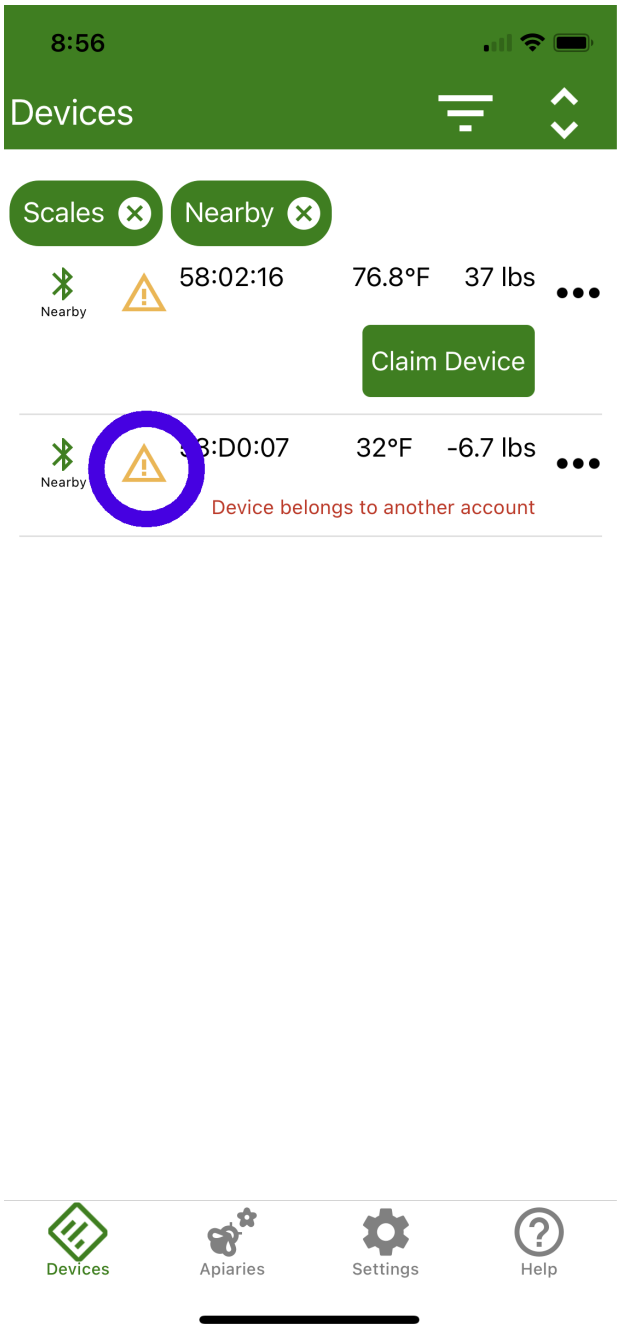
- Update Bees App
- Find and select Update Icon for the device in Bees App
- Press "Update Firmware" or "Sync and Update Firmware"
- Wait and watch for 2-3 minutes
- Verify

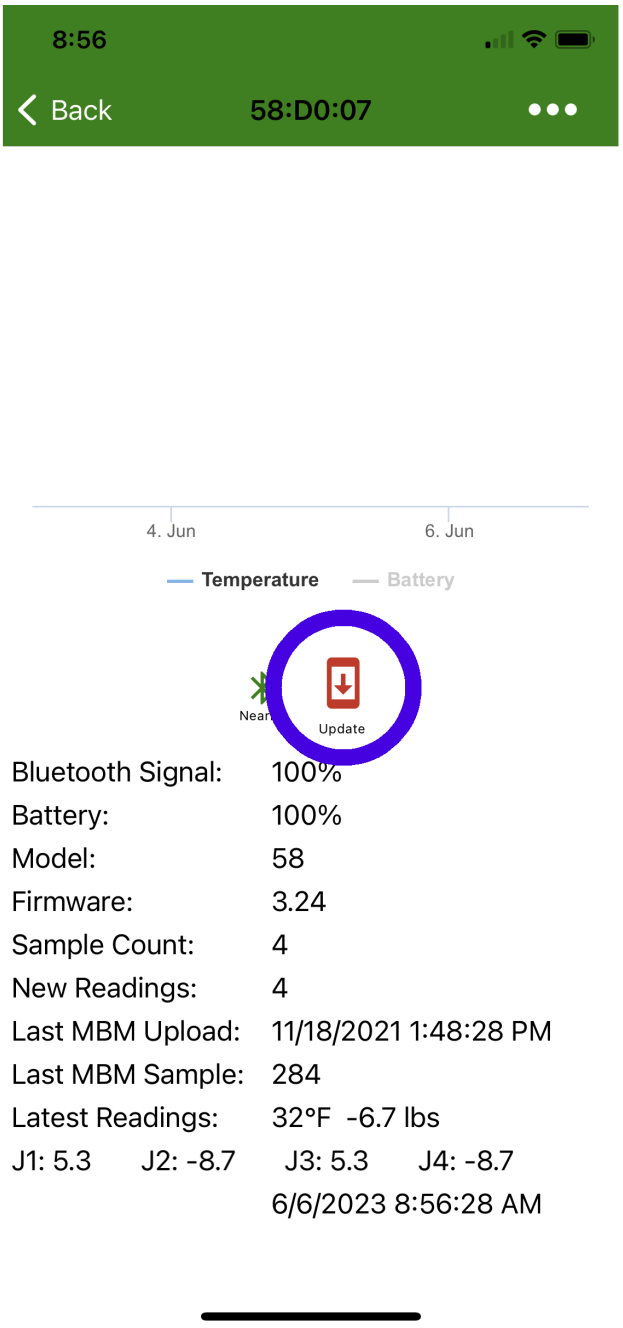
22.3 Bees App Update

Before beginning the firmware update, be certain to visit the Android Play Store or Apple App Store and update your Bees App. The app will contain the most current version of firmware for all of our devices.

22.4 Notification Icon

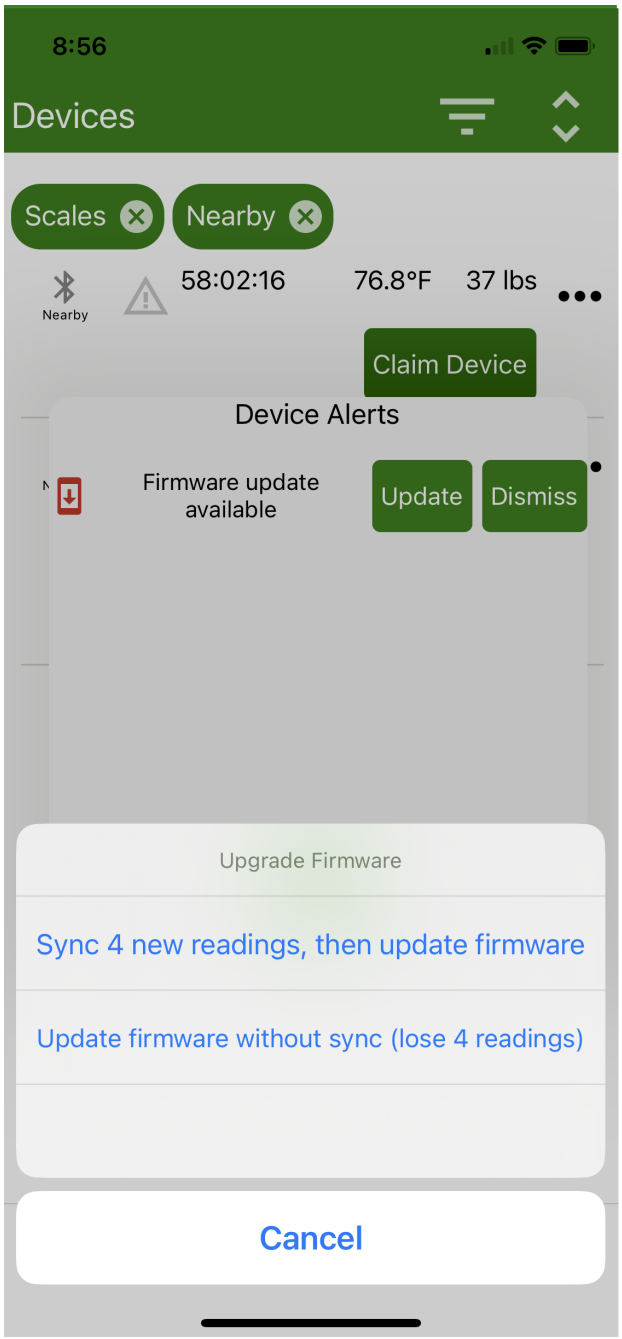
When you open the Bees App, you may see a symbol beside you device or in the details page. We will show both locations in the images below.

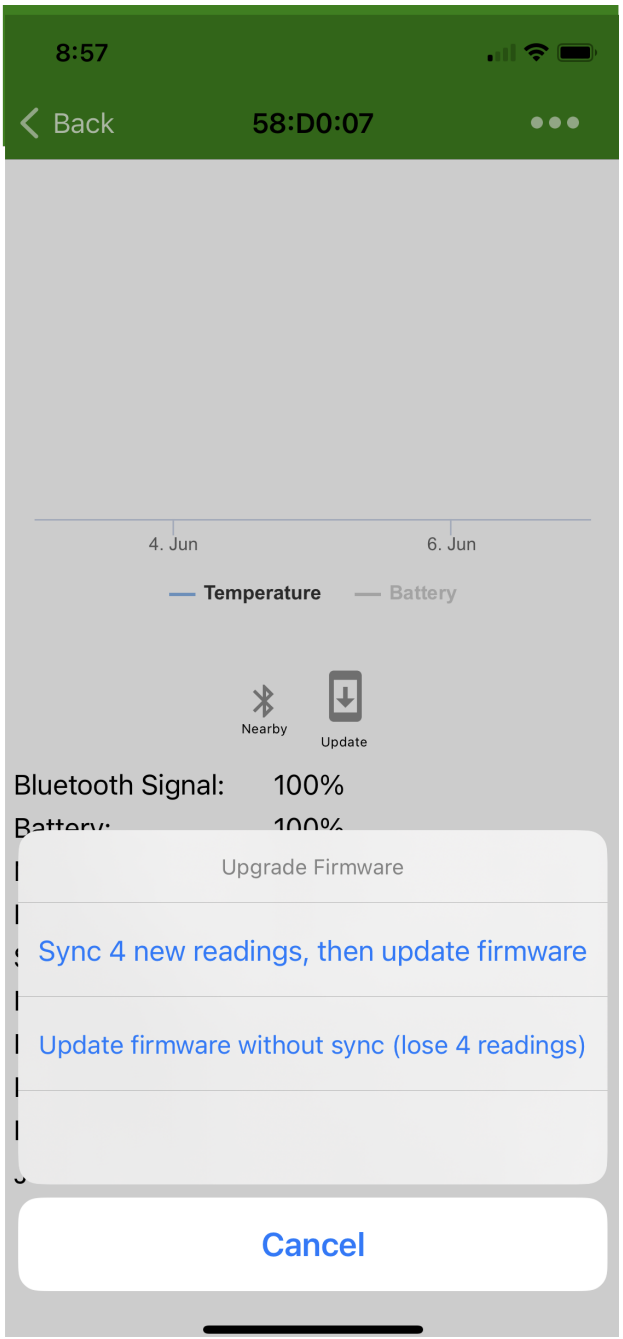




22.5 Updating the device

Press the symbol and you will be presented with an update page shown below.

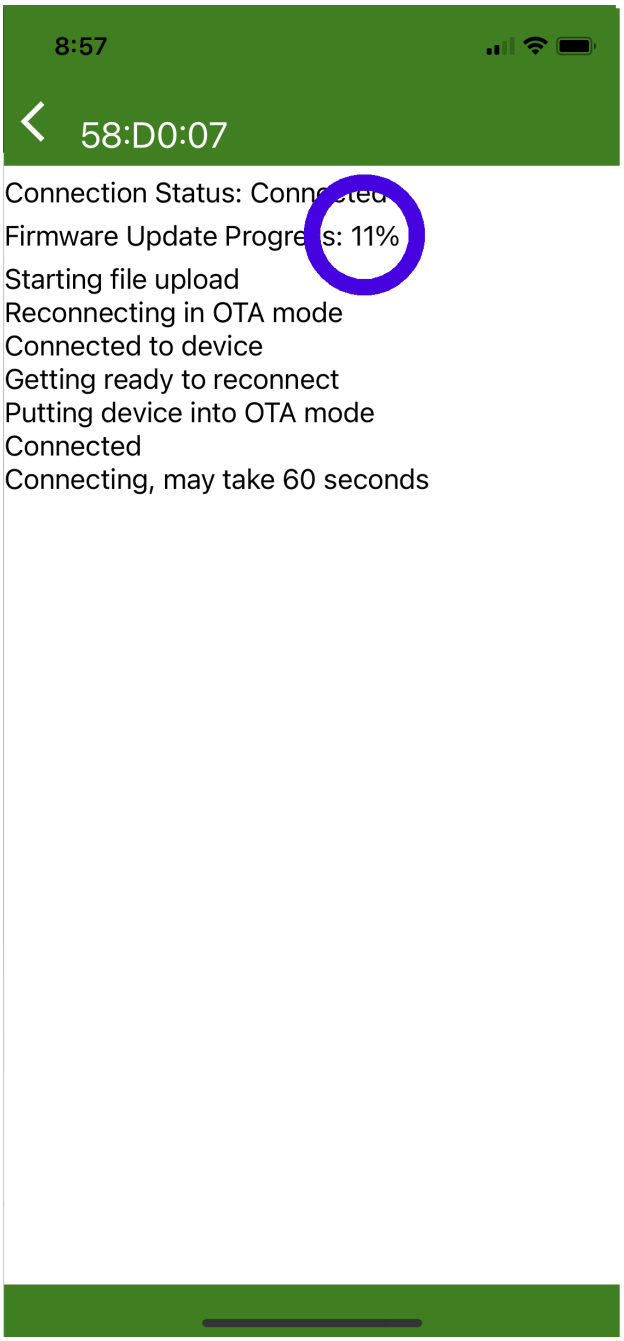


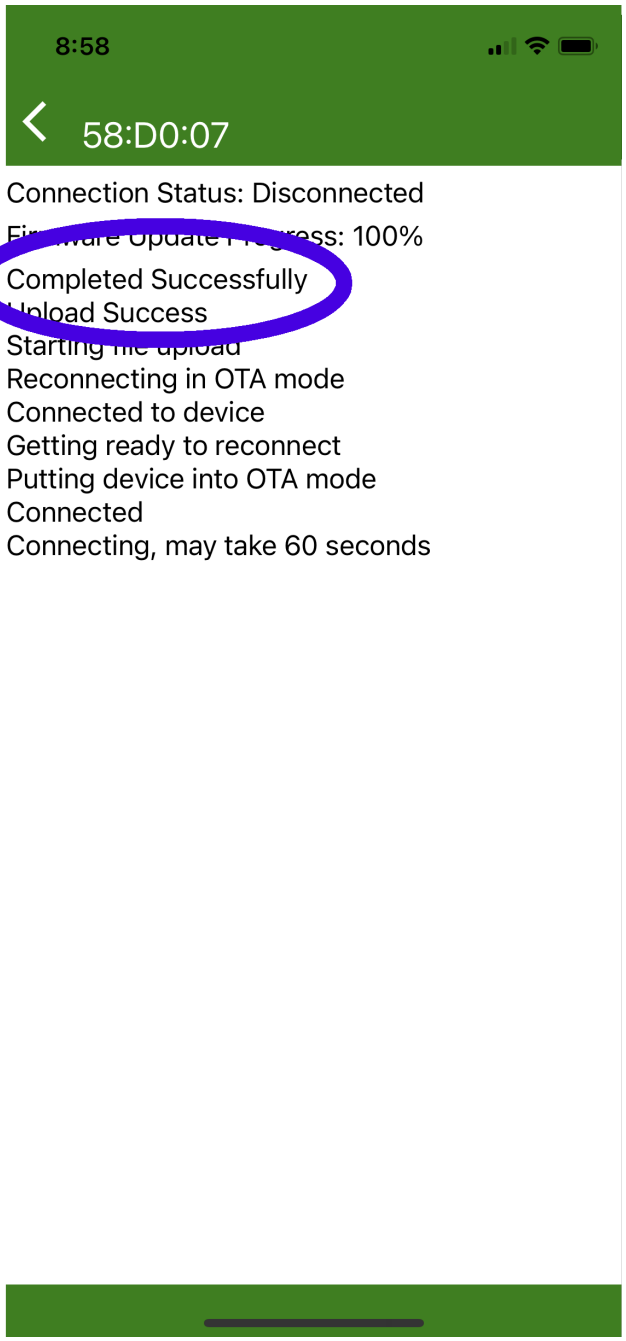


Now you have a choice. There is backup data stored on your BroodMinder device. Updating firmware will place the device in "Factory New" state which removes any backup data. Note: All data that you have already retrieved is safe.

1) If all of you data is up to date on MyBroodMinder, you can "Update firmware without sync". 2) If you are not certain, you can sync and then update. This will take longer since we read the entire data log before updating.

The update process will take 2-3 minutes.



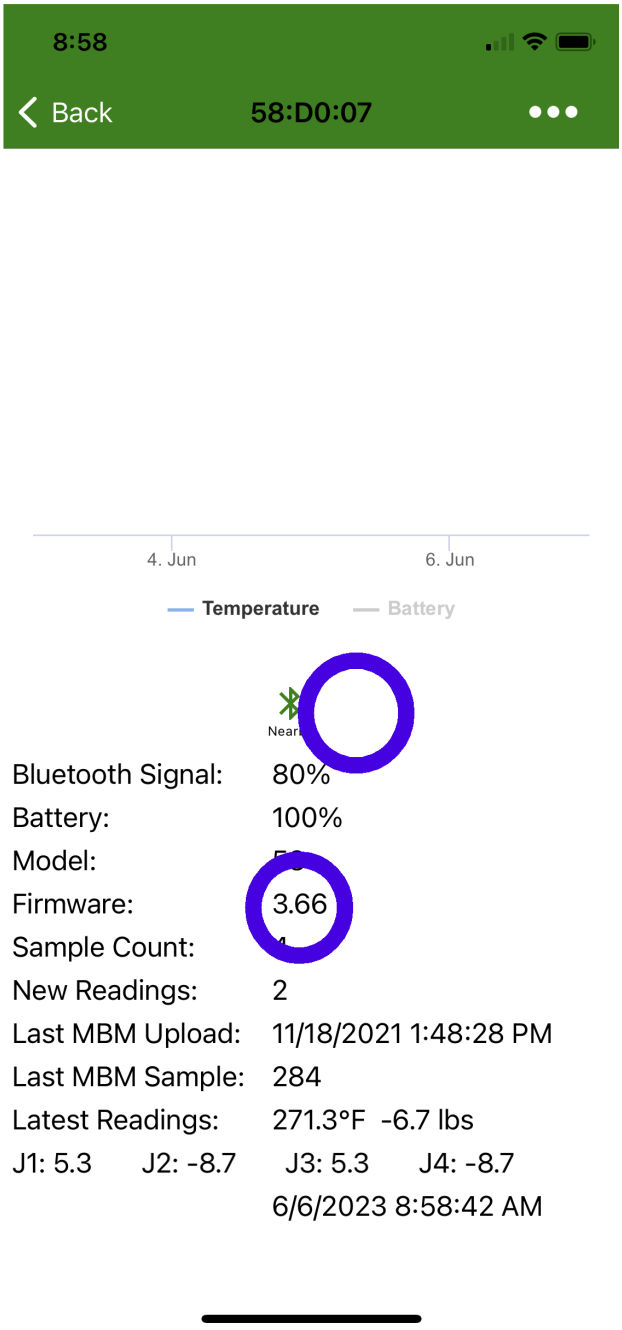


22.6 Verify

Once complete, you should see the firmware update icon is removed and the current version is updated.

If it did not update correctly, remove the batteries for 1 minute, replace the batteries and retry the update.

If you are still having difficulty contact us at support@broodminder.com


8:58
Back
58:D0:07
4. Jun
6. Jun
Temperature
Battery
Bluetooth Signal: 80%
Battery: 100%
Model:
Firmware: 3.66
Sample Count:
New Readings: 2
Last MBM Upload: 11/18/2021 1:48:28 PM
Last MBM Sample: 284
Latest Readings: 271.3°F -6.7 lbs
J1: 5.3 J2: -8.7 J3: 5.3 J4: -8.7
6/6/2023 8:58:42 AM

23. BroodMinder Hub Firmware Update

23.1 Overview

From time to time we make updates to improve the operation of our sensors. BroodMinder devices use OTA (Over The Air) firmware updates and are very simple to perform.

23.2 Updating BroodMinder-T91 Cell hub

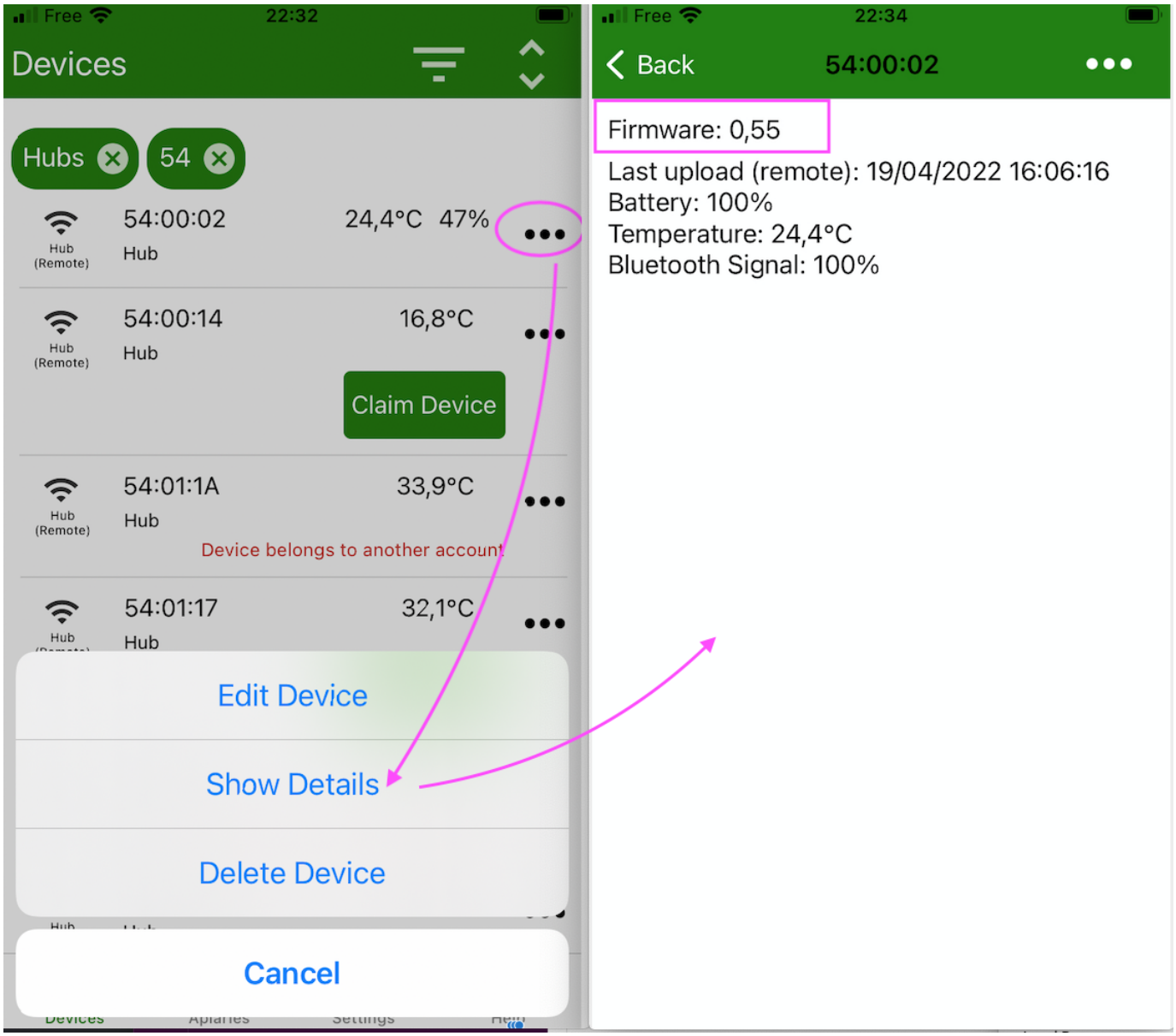
- Check current hub firmware installed with Bees App (see below)
- Trigger the upgrade (see below)
- Cycle power
- When the hub restarts it will go through a green then a blue light for 5 sec
- During that blue light, press the central button to trigger the upgrade
- Wait and watch for 2-3 minutes.
- The hub will reboot automatically
- Verify with Bees App that the firmware has upgraded

You're done.

23.3 Check the hub Firmware

Open Bees App and find your hub in the `Devices` tab. Go to the `...` menu in front of it and hit `Show Details`.

Now you see the current firmware version of your hub.



23.4 Trigger the upgrade

Cycle power and when the led becomes blue, push briefly the central button. The upgrade is now triggered. Wait for 2 minutes until it is installed and restarted

WATCH THE VIDEO 

Note

During the upgrade the hub pulls the new version over the air. **You need to be on a cell covered zone to upgrade your hub.**

23.5 Verify

Once complete, you should see the updated firmware version in the Hub details page (as you made it before)

23.6 Need help?

If you are still having difficulty contact us at support@broodminder.com

24. FAQ

24.1 Sensors & software

What are the different BroodMinder apps ?

You should be using the Bees App!

Every other App is part of the Broodminder legacy and described below. Those 'other' apps are still in service but not maintained.

2016-2018 : The BroodMinder app (also called BroodMinder Lite) was the basic free application. With this app, you can visualize your sensors, send your data by e-mail, see different graphs, annotate your inspections, etc. This app is Deprecated.

2018-2022 BroodMinder Apiary was a more powerful app. It makes it possible to download data from all your BroodMinder sensors in a single step. This is an efficient time-saver for users that have many sensors. The app is free but requires a subscription for productivity features. This app is Deprecated.

2018-nowadays BroodMinder Cell is the app for controlling Hubs models 44 and 50.

Retrieving data from sensors

Do the sensors record the measurements?

Each sensor has an internal memory. Every hour they measure data and store it in their memory. The storage capacity is about one year of measurements. We often see sensors with more than 7000 readings! (365*24=8760 readings/year). This memory can be emptied either by removing the battery for a few seconds or from the mobile application. Of course before doing this, make sure that you have synchronized the data with mybroodminder!

How do I recover data with a smartphone?

You must go to your apiary with a smartphone and the BroodMinder Bees App installed. If you have a free account, the synchronization will be done sensor by sensor. All sensors communicate via Bluetooth. The smartphone's coverage distance is a few meters.

How does data recovery from a Hub work?

The Hub provides you with real-time monitoring. You have access to all alerts and can anticipate your work on the apiary before you even get there. The Hub is available in two versions - Wifi & GSM - depending on your connectivity. This transmitter must be placed in the center of your apiary. It will collect and transmit data automatically, whether you have a single or dozens of sensors within a radius of about 20 meters.

What can I do if I can't synchronize my hives ?

The Bluetooth coverage distance depends on many factors. On some hives, this coverage can be limited. Position yourself as close as possible to the hive and try again following the instructions. If another failure occurs, contact us at support@mellisphera.com.

Battery

Is the battery replaceable?

Yes, all batteries are button type CR203 and can be found in any large store.

How long does the battery last?

Under normal conditions, the battery lasts more than a year. We recommended you to replace it during the autumn harvest. We will notify you when it is time to replace it.

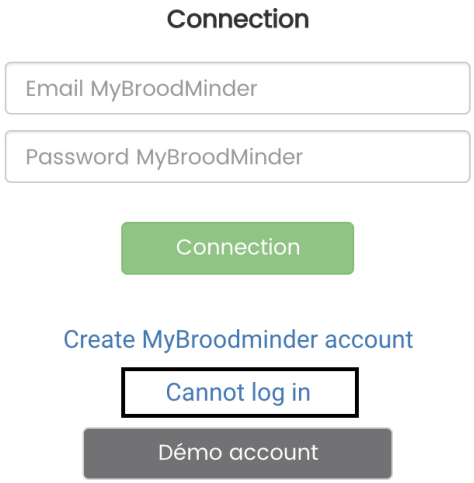
Do BroodMinder sensors last more than a year?

Don't worry as long as the battery is replaced. The sensors will last for many years.

24.2 Login & settings

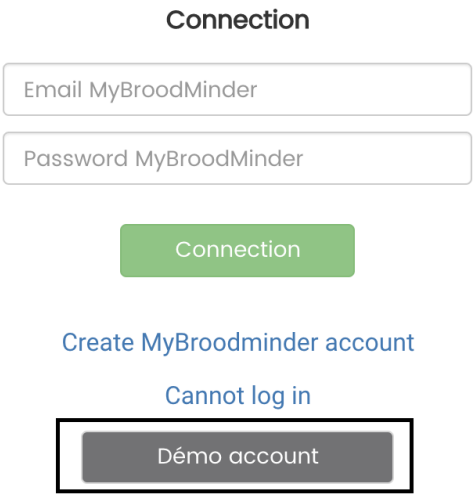
What can I do if I can't log in Mellisphera ?

Contact us via the link below the login button. We will help you as fast as possible.



I'd like to explore Mellisphera but I'm not equipped yet

You can use our demo account. You will visualize data from a few hives so you can see the solution functionalities. Browse and edit freely, we reset the account every night!



When is the data updated?

The hourly data is updated every hour if new data is available.

Daily data (weather, brood, weight, etc.) is updated twice a day so that every morning in Europe and America the data is available: between 6:30 and 7:30 and between 12:30 and 13:30 UTC.

Computing daily data :

Time UTC	Paris CET	NewYork EDT
6:00	7:00	1:00
12:00	13:00	7:00

(*) note that it may apply +1h in summer time.

Finally, we retrieve your missing data and readjust the data from devices and hives that have changed location over the day every night (between 1:00 and 3:00 UTC).

Can I share my apiaries with my beekeeper friends?

Yes, you have a few ways to share your data with your family and friends. Go to https://doc.mybroodminder.com/50_mybroodminder_v5/#sharing to find out the best one for your needs.

25. Video Library

We've made lots of videos over the years. Here is a list of them with links.

25.1 Installation

- Quick Start with CS Kit
- BroodMinder ASP Installation
- BroodMinder-SubHub
- BroodMinder-WIFI
- BroodMinder-CELL
- BroodMinder-BeeDar
- S1:E17 BroodMinder-W3 Full Hive Scale
- S1:E19 BroodMinder-DIY

25.2 MyBroodMinder (MBM)

- MBM V5 Feature Tour
- MBM V5 Alerts
- MBM V5 Configuration
- Cell, WIFI and Hub Monitoring
- MyBroodMinder.com Premium

25.3 Apps

- S1:E14 The BroodMinder-Bees App
- Apiary App - Hub Mode

25.4 Data Interpretation

- S1:E4 BroodMinder and Mellisphera
- S1:E3 Colony size vs temperature
- S1:E8 Swarm Detection presentation

25.5 Maintenance

- S1:E1 Hive Monitoring Spring Maintenance
- S1:E18 Batteries
- Troubleshooting T2 Power On

25.6 DIY/W3

- **BroodMinder-W3 Options** - We have some updates to our BroodMInder-W3 kits including an Apimaye kit.

- **BroodMinder W3 Assembly - Fixed Feet** - This is a detailed video on how to assemble the BroodMinder-W3, Partially Assembled, Fixed Feet scale.
- **BroodMinder W3 Assembly Swivel Feet** - This is a detailed video on how to assemble a BroodMinder-W3 with swivel feet.
- **W3 adapter kit for Apimaye hives** - Coming soon, a kit to make BroodMinder-W3 installation on an Apimaye hive super easy. This video will be replaced when the kit is complete.
- **BroodMinder Calibration with the Bees App** - We have added the ability to calibrate scales using the Bees app. This video shows how that works.
- **S1:E19 BroodMinder-DIY** - Here at BroodMinder we offer up our internal components for do it yourself enthusiasts.
- **S1:E20 W3/DIY Assembly and Calibration** - Rich instructs how to assemble and calibrates a W3 kit.

25.7 Other Videos

- **MyBroodMinder V5 Announcement** - In mid-April we will release a major upgrade to MyBroodMinder.com, our best in class hive monitoring web portal.
- **3 Minutes Of Mites** - Here is some of the MiteMinder video we collected in 2022.
- **BroodMinder-Mellisphera Merger** - BroodMinder and Mellisphera are merging into one brand to produce products in both USA and Europe.
- **BroodMinder-CELL Upgrade** - We show how to upgrade your 3G BroodMinder-CELL (2016-2021) to the new BroodMinder-T91 LET-M based Cell device.
- **MyBroodMinder.com Premium** - Explanation of what MyBroodMinder.com premium is all about.
- **BroodMinder-CELL (T91) Installation** - Here is how to install your BroodMinder-CELL device.
- **Troubleshooting Powering On BroodMinder-T2** - If you are having trouble getting your BroodMinder-T2 to turn on, watch this for a few suggestions.

25.8 BlogMinder Videos 2021

- **S1:E1 Spring Maintenance** - Here is a little information on preparing your sensors for the coming season.
- **S1:E2 Why measure hive temperature?** - Rich and Theo discuss why we think hive temperature is so
- **S1E3 Colony Population vs Temperature** -This week we look at honeybee population using temperature measurements.
- **S1:E4 BroodMinder and Mellisphera**- This week Rich speaks to Lorenzo about the terrific work Mellisphera is doing to interpret BroodMinder data for beehive monitoring.
- **S1:E5 Beehive Monitoring Facebook Group** - We introduce a new Hive Monitoring Facebook group dedicated to discussions about hive data interpretation.
- **S1:E6 SwarmMinder** - This week we talk to Rich Hogle and Theo Hartmann about SwarmMinder.
- **S1:E7 Dandelion Springs** - We take a field trip to see Theo's expansive apiary and BroodMinder setup.
- **S1:E8 Swarm Detection using Temperature** - Theo's presentation at the 4th International Bee and Hive Monitoring Conference.
- **S1:E9 BroodMinder Worker Bees** - This week we chat with Elizabeth and Josh about their rolls at BroodMinder.
- **S1:E10 Hiving Queen Karla's Swarm** - This week we watch Theo transfer a colony from a swarm trap to a hive.
- **S1:E15 Thingy91 (huh?)** - Announcing the BroodMinder-T91 with the generous help of Nordic Semiconductor.
- **S1:E16 Top Bar Hive Monitoring** - Theo tells us about his 4 top bar hives instrumented with BroodMinder-T2SM.
- **S1:E17 BroodMinder-W3 Full Hive Scale** - This week we introduce the BroodMinder-W3 full have scale, available in fully assembled or kit form.
- **S1:E18 Batteries** - Let's talk about batteries in your BroodMinders.
- **S1:E19 BroodMinder-DIY** - Here at BroodMinder we offer up our internal components for do it yourself enthusiasts.

- **S1:E20 W3/DIY Assembly and Calibration** - Rich instructs how to assemble and calibrates a W3 kit.

26. Training Sessions

Over the last few years the BroodMinder system has grown considerably and offers now a wide range of possibilities. Whether you are Professional beekeeper, Researcher or Hobbyist. Making honey, pollinating or even breeding bees. There is certainly an optimal usage of BroodMinder to help you draw the best outcome for your activity.

We do currently offer two training webinars and schedule a few sessions over the year. Check at our store for scheduled sessions.

27. MyBroodMinder

Introductory Webinar with Use Cases

Target Audience

- The training is intended for current Broodminder users wishing to deepen their knowledge. It's also open to those considering the system's use and wanting to explore its potential upstream their adoption.

Prerequisites

- You will draw the best if you are already familiar with BroodMinder hardware: scales, brood sensors, Beedar, Hubs.

Duration

- 1 hour 30 minutes

Content

- In this webinar, we will familiarize ourselves with MyBroodMinder.com web interface. Initially, we'll explore the main features and tools available and then apply them to specific use cases.
- The session aims to be interactive. You'll have the opportunity to ask questions as we go along.

Features

- Management of apiaries, hives, and sensors
- Associating sensors with hives and their life cycle
- Apiary view
- Weather service vs local weather / weather tab
- Classic dashboard
- Calendar view
- Beekeeper's toolbox
- Custom dashboards
- Alerts
- Notes

Use Cases

- Tracking honey flows during transhumance (BAQ)
- Forecasting honey flow progression using foraging/honey indices
- Feeding monitoring (LPO)
- Winter treatments / cessation of egg-laying
- Sharing of apiaries among users
- Assessment of the potential of various locations
- Monitored swarm hunting (Theo)

Conclusion

- Session summary
- Open questions requiring specific answers

28. Bees App

Introductory Webinar with Use Cases

The BeesApp sessions are not yet fully defined. One of the reasons is that we expect an important version upgrade this spring (2024) and we will start training on that newest version.

Target Audience

- The training is intended for current Broodminder users wishing to deepen their knowledge. It's also open to those considering the system's use and wanting to explore its potential upstream their adoption.

Prerequisites

- You will draw the best if you are already familiar with BroodMinder hardware: scales, brood sensors, Beedar, Hubs.

Duration

- 1 hour

Content

- In this webinar, we will familiarize ourselves with BroodMinder Bees mobile App (iOS and ANdroid).
- The session aims to be interactive. You'll have the opportunity to ask questions as we go along.

Features

- overall structure of the App and conventions
- Device view
- Managing of apiaries, hives and sensors
- Associating sensors with hives and their life cycle
- Management view with all metrics
- Alerts
- Notes

Use Cases

- Creating an apiary/hives
- associating and removing devices
- Taking notes and inspections
- Monitoring hives on a single sight
- ...

Conclusion

- Session summary
- Open questions requiring specific answers

29. Physics and Tech Stuff

We know a lot of you like to fiddle around. So, for the interested and motivated student, here is more information and DIY software stuff.

29.1 BLE Advertising Information

Note: If you have suggestions for improving the explanation, then us the details.

For those brave souls with the gumption to create their own data harvesting equipment, we provide information on the BLE advertising protocol that BroodMinder uses. Indeed our own BroodMinder-CELL, WiFi, and -SubHub uses the advertising to eavesdrop on the devices and then forward the data directly to MyBroodMinder.com.

There are several nice BLE Explorer programs available. Our favorites are:

- Android & iOS – nrfConnect by Nordic Semiconductor. The Android version is best, but we use both all of the time. It has a nice signal level graphing feature.
- PC – Bluetooth LE Explorer by Microsoft. Unfortunately, this program doesn't show the advertising data.
- Mac – BlueSee – This app seems to work nicely and it does show the manufacturers data in the advertising packet.

You will likely notice that the first 3 bytes of the device ID are always 06:09:16 then follows the particular device ID which is always Model:ID:ID. Some devices (iOS & Mac) hide the true ID, so we also include that in the name field in the extended advertising packet.

Advertising Packet Makeup for BroodMinder

When you read advertising packets from BLE, you can identify BroodMinder products by looking at the following.

The data will look something like this. – this example is from device 43:30:07

GAP Scan Response Event ----------

ble_evt_gap_scan_response: rssi=-77, packet_type=0, sender=[07 30 43 80 07 00], address_type=0, bond=255, data=[**02 01 06 02 0a 03 18 ff 8d 02 2b 15 02 00 02 21 00 d0 62 00 ff 7f 05 80 37 07 30 43 00 00 00**]

Note: Values are in decimal unless preceded with 0x

1) Check for "Manufacturer Specific Data" flag Bytes 6,7 = 0x18, 0xff

2) Check for IF, LLC as the manufacturer Bytes 8,9 = 0x8d, 0x02

Bytes 10-29 are the data from the BroodMinder as outlined below.
DeviceModelIFllc_1 = 0x2b (43d = scale)
DeviceVersionMinor_1 = 0x15 (21d) DeviceVersionMajor_1 = 0x02 (FW 2.21) Elapsed_2V2 = 0x21 (33d) Temperature_2V2 = 0x62d0 WeightL_2V2 = 0x7FFF WeightR_2V2 = 0x8005

The mapping for all models is on the next page

PRIMARY				
Byte	Type	Value	Parameter	
0	Ad field Length	02		
1	Field Type	01	Connectible	
2	Value	06	LE General Discovery, Connectible, Single Mode Device	
3	Ad field Length	02		
4	Field Type	0A	Xmit Power	
5	Value	03	Power in DB	
6	Ad field Length	24		
7	Field Type	FF	Manufacturer data	
8	Value	8d	IF, LLC = 0x028d, 653	
9	Value	02	IF, LLC = 0x028d, 653	
10	Value		Model	
11	Value		Version Minor	
12	Value		Version Major	
13	Value		Realtime Temp1	47/49/56/57/58 (SM&XLR)
14	Value		Battery	
15	Value		Elapsed	
16	Value		Elapsed	
17	Value		Temperature	47& above is centicenigrade + 5000
18	Value		Temperature	
19	Value		Realtime Temp2	47/49/56/57/58 (SM&XLR)
20	Value		WeightL	
21	Value		WeightL	
22	Value		WeightR	
23	Value		WeightR	
24	Value		Humidity	will be 0 for 41/47/49/52
25	Value		WeightL2/SM_Time0	49/57/58 (XLR)
26	Value		WeightL2/SM_Time1	49/57/58 (XLR)
27	Value		WeightR2/SM_Time2	49/57/58 (XLR)
28	Value		WeightR2/SM_Time3	49/57/58 (XLR)
29	Value			

PRIMARY			
		Realtime total weight / Swarm State	47/49/56/57/58 (SM&XLR)
30	Value	Realtime total weight	47/49/56/57/58 (SM&XLR)

SECONDARY			Extended Advertising Packet
Byte	Type	Value	Parameter
0	Ad field Length	09	
1	Type	09	Complete Local Name
2		4'	ascii name
3		2'	
4		:'	
5		0'	
6		0'	
7		:'	
8		0'	
9		0'	

Note: BRM52 BroodMinder-SubHub is different as explained below.

Here are the equations

```
if (ModelNumber == 41 | ModelNumber == 42 | ModelNumber == 43)
{
    temperatureDegreesF = e.data[byteNumAdvTemperature_2V2] +       (e.data[byteNumAdvTemperature_2V2 + 1] << 8);
    temperatureDegreesF = (temperatureDegreesF / Math.Pow(2, 16) * 165 - 40) * 9 / 5 + 32;
}
else
{
    double temperatureDegreesC = e.data[byteNumAdvTemperature_2V2] + (e.data[byteNumAdvTemperature_2V2 + 1] << 8);
    temperatureDegreesC = (temperatureDegreesC - 5000) / 100;
    temperatureDegreesF = temperatureDegreesC * 9 / 5 + 32;
}
    humidityPercent = e.data[byteNumAdvHumidity_1V2];
if (ModelNumber == 43)
{
    weightL = e.data[byteNumAdvWeightL_2V2 + 1] * 256 + e.data[byteNumAdvWeightL_2V2 + 0] - 32767;
    weightScaledL = weightL / 100;
    weightR = e.data[byteNumAdvWeightR_2V2 + 1] * 256 + e.data[byteNumAdvWeightR_2V2 + 0] - 32767;
    weightScaledR = weightR / 100;
}
else if (ModelNumber == 49 | ModelNumber == 57 | ModelNumber == 58)
{
    weightR = e.data[byteNumAdvWeightL_2V2 + 1] * 256 + e.data[byteNumAdvWeightL_2V2 + 0] - 32767;
    weightScaledR = weightR / 100;
    weightL = e.data[byteNumAdvWeightR_2V2 + 1] * 256 + e.data[byteNumAdvWeightR_2V2 + 0] - 32767;
    weightScaledL = weightL / 100;
    weightR2 = e.data[byteNumAdvWeightL2_2V2 + 1] * 256 + e.data[byteNumAdvWeightL2_2V2 + 0] - 32767;
    weightScaledR2 = weightR2 / 100;
    weightL2 = e.data[byteNumAdvWeightR2_2V2 + 1] * 256 + e.data[byteNumAdvWeightR2_2V2 + 0] - 32767;
    weightScaledL2 = weightL2 / 100;
}
realTimeTemperature = ((float)(e.data[byteNumAdvRealTimeTemperature2] * 256 + e.data[byteNumAdvRealTimeTemperature1] - 5000) / 100) * 9 / 5 + 32;

realTimeWeight = (float)(e.data[byteNumAdvRealTimeWeight2] * 256 + e.data[byteNumAdvRealTimeWeight1] - 32767 ) / 100 ;
```

SM_Time is the unix time of last temperature event. Time0 = LSB, Time3 = MSB, it will be time since boot if time has not been set in the device by a device sync.

BRM-52 BroodMinder-SubHub

The -SubHub does some tricky advertising. The advertising changes every 5 seconds to send out a different device. It will roll through all devices (including itself) and then repeat.

We call these Mock Advertisements. Depending on what operating system is being used, you may or may not (e.g. iOS) be able to see the true device ID (e.g. 06:09:16:52:01:23). That is why we place the device ID in the extended advertising byte. Also note that it is difficult to read the extended advertising for some devices, however for those, you typically can read the true device ID.

The Mock ID resides in byte 13, 19, and 30. That makes the process as follows:

1. Establish if this is a -SubHub by the ID (either the true ID or the ID in the extended advertising). It will always be 52:xx:xx.
2. If it is a “52” device, then parse bytes 13/19/30. E.g. 43/01/23 will be 43:01:23
3. Parse the rest of the advertising packet according to the device type based on the model byte (byte 10)

Easy Peasy ☺

29.2 BroodMinder-W physics

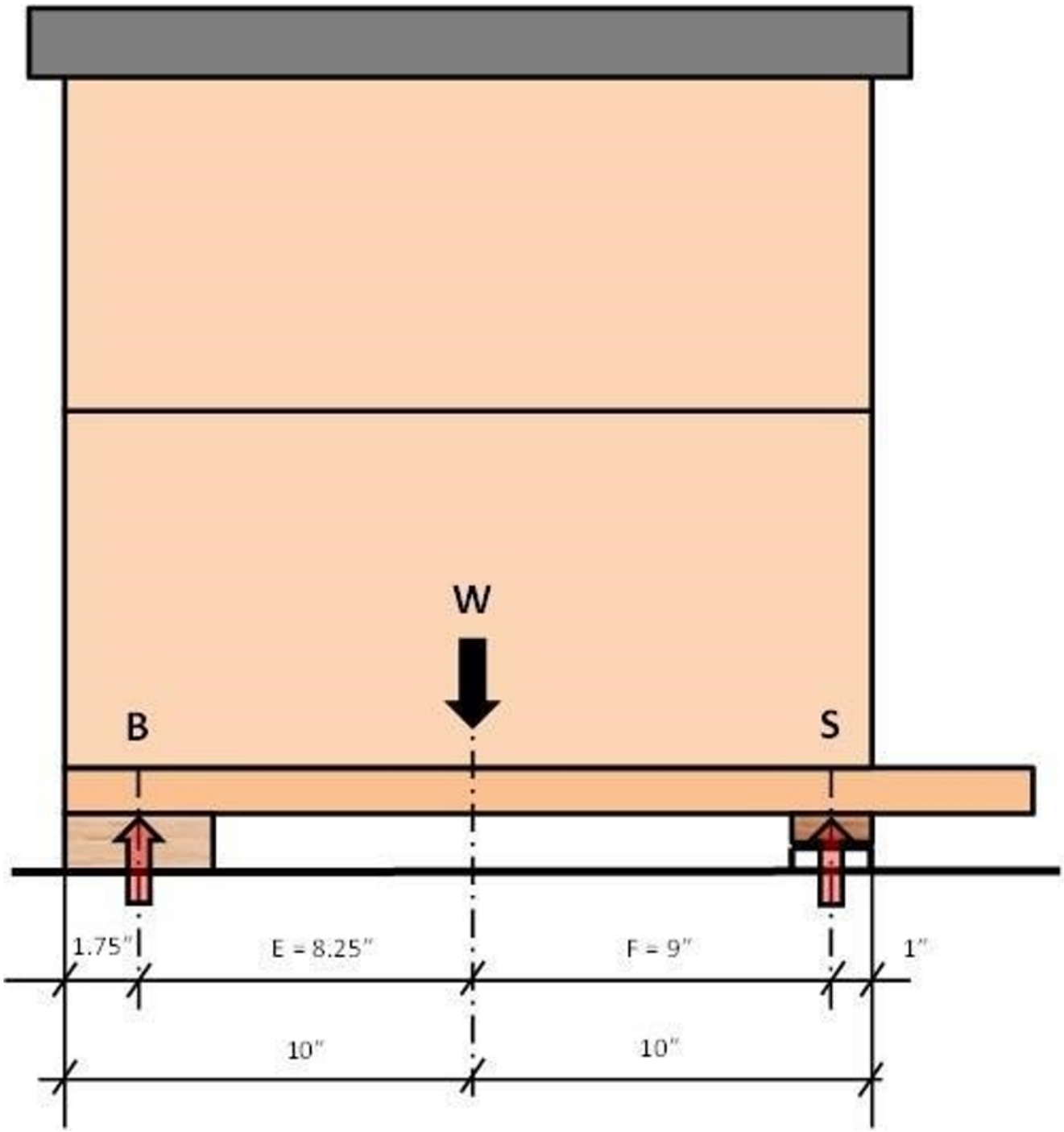
There are many ways the BroodMinder hive scale can be used and since it only measures a fraction of the total hive weight, the design and placement of the auxiliary support and the BroodMinder scale positioning becomes an integral part of the total hive weight measuring system. Generally, the more effort is put into this, the better the results will be. The hive support systems shown below start from the easiest to the most sophisticated with highest uncertainty to lowest. It is up the individual user to decide what to implement.

NOTE: the most typical error source is inadequate support under the scale. This can result in strange behavior as the hive flexes as it expands and contracts due to sun, rain, temperature, etc. Providing a flat support will improve results. An easy fix is to place a ¾” plywood sheet (or equivalent) under the scales.

ADDITIONAL NOTE: If all you want to see is honey flow, good support is not required. You will just have to ignore the daily fluctuations. You will still be able to observe the overall change in weight.

a) Default Arrangement

This is the default arrangement with the scale at the front of the hive and a 2×4 as an auxiliary support (fulcrum) at the back:



Here are some calculations surrounding the setup:

Assumptions

The hive weight W is distributed evenly and the center of gravity is in the middle of the hive. For simplicity, the front overhang of the bottom board is not considered. Hive weight is assumed to be 100%.

Calculations

$$\text{Scale Loading } S = \frac{W \times E}{E+F} = \frac{100\% \times 8.25"}{17.25"} = 47.83\%$$

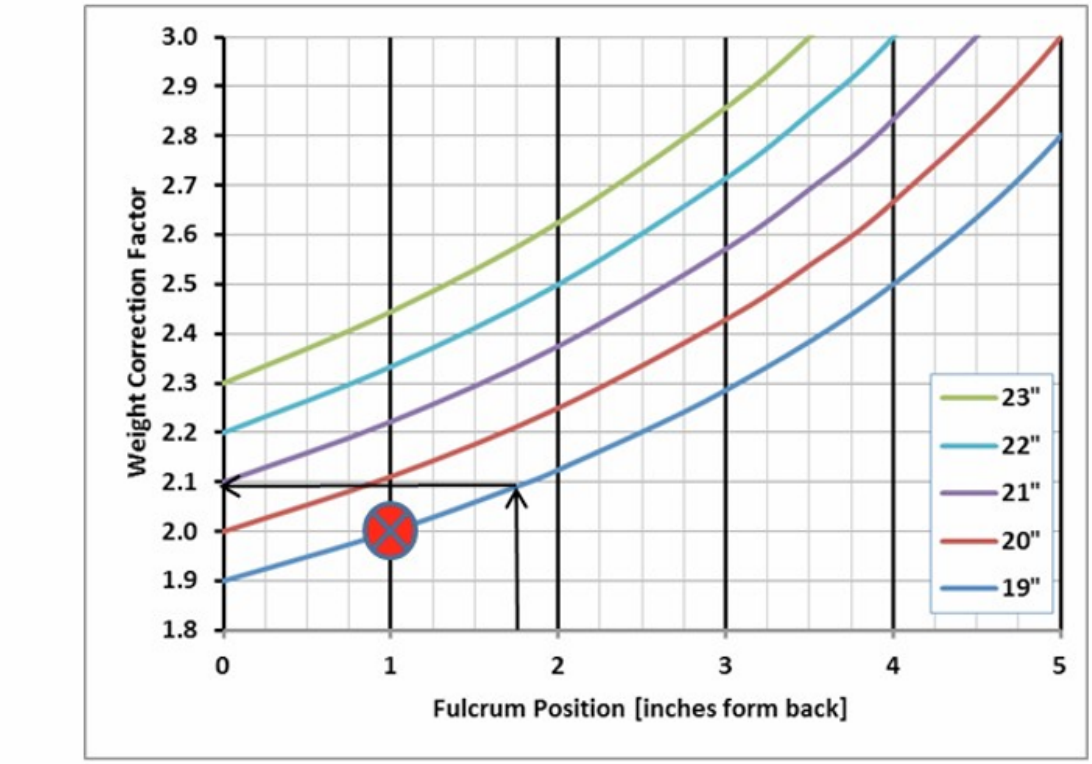
$$\text{Back Support Loading } B = \frac{W \times F}{E+F} = \frac{100\% \times 9"}{17.25"} = 52.17\%$$

When using standard 2×4 lumber as a back support and aligning it with the back of the hive, the total hive weight W can be calculated from the weight on the scale S as:

$$W = S \times \frac{(E+F)}{E} = S \times \frac{17.25}{8.25} = S \times 2.091$$

Therefore, use 2.09 as the default hive scale factor in the app if you are using this setup. This of course can be fine tuned once some weight measurement are available.

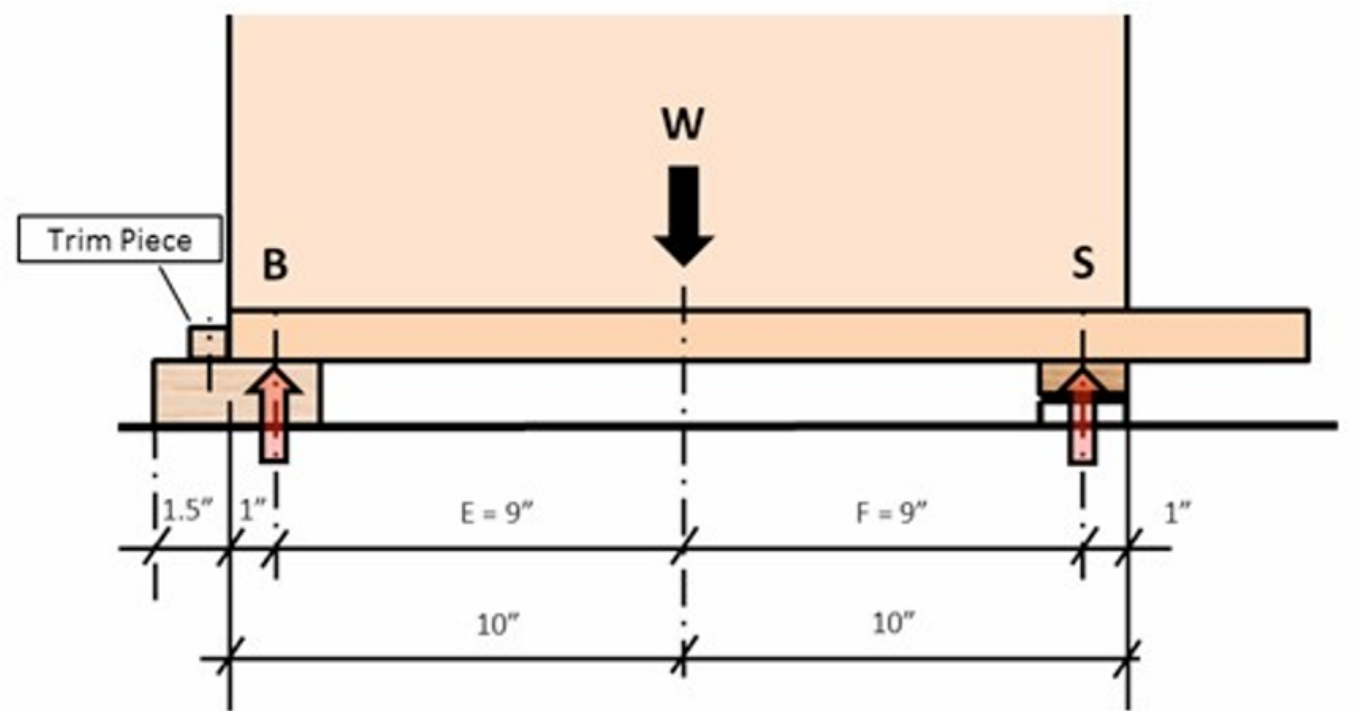
The chart below shows the scale correction factor for different scale and fulcrum arrangements. The X-Axis is the position of the fulcrum point in inches from the back of the hive. The different lines represent the scale centerline position in inches from the back of the hive. Arrows show the example above.



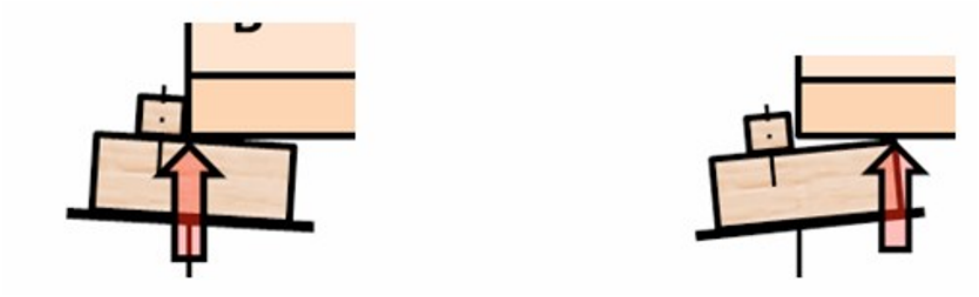
This depicts the ideal fulcrum and scale position resulting in a scale correction factor of 2.0.

b) Alternate Arrangement 1

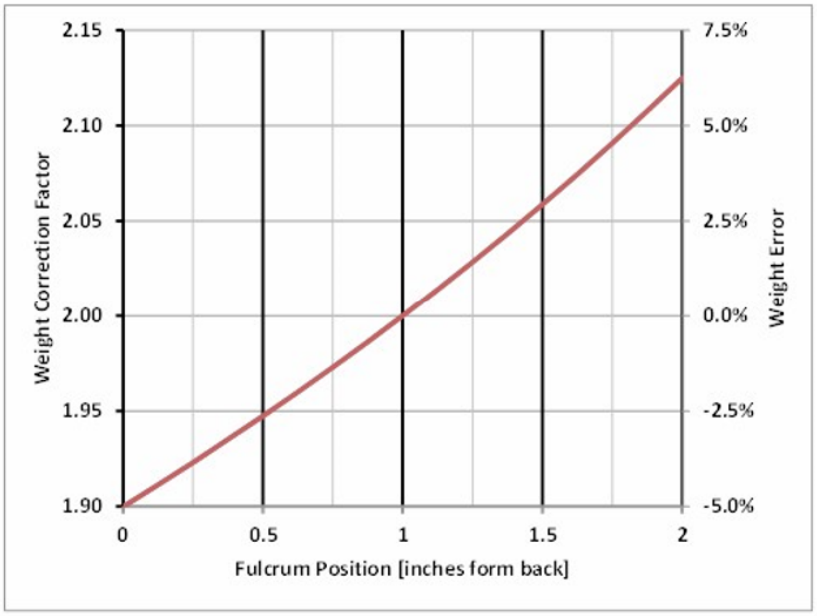
Based on the above, the auxiliary support should be placed 1” from the back of the hive. It is recommended to attach a trim piece on top of the 2×4. This will help for accurate positioning of the auxiliary support.



Now we have equal moment arms E and F and the hive scale correction factor becomes 2.0 which is the default in the mobile app. There are however some other influence factors which should not be overlooked. The real fulcrum point of the auxiliary support is anywhere between the back of the hive and the front of the aux support due to variations of the support system levelness and potential warpage of the 2×4 itself.



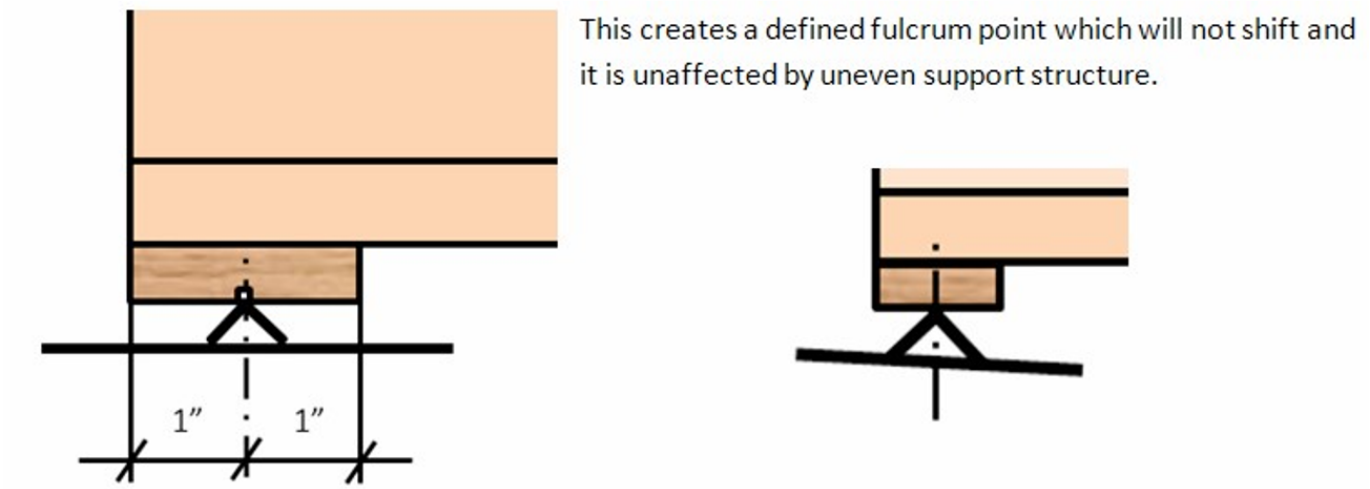
Given this, the uncertainty introduced is quite large and the scale correction factor is anywhere from 1.90 to 2.13 or -5% to +6.5% .



c) Alternate Arrangement 2

A different support system can be used which has a defined fulcrum point and is not affected by the alignment of the support structure:

Take a piece of pine or oak, about ¾” thick and 2” wide. Length needs to be the width of the hive. Cut a small kerf into it. The kerf needs to be as deep as the width of the saw blade. Attach this piece to the underside of the bottom board of the hive. Align it flush with the back. Then place a piece of 1” by 1/8” 6061 or 6063 aluminum angle, same length as the wood strip, under it to support the hive. The corner of the aluminum angle rests in the kerf. The total hight of the aluminum angle and the wood needs to be equal or slightly bigger than the scale height to ensure the hive is level or even slightly tilted forward to ensure water drainage away from the hive entrance.



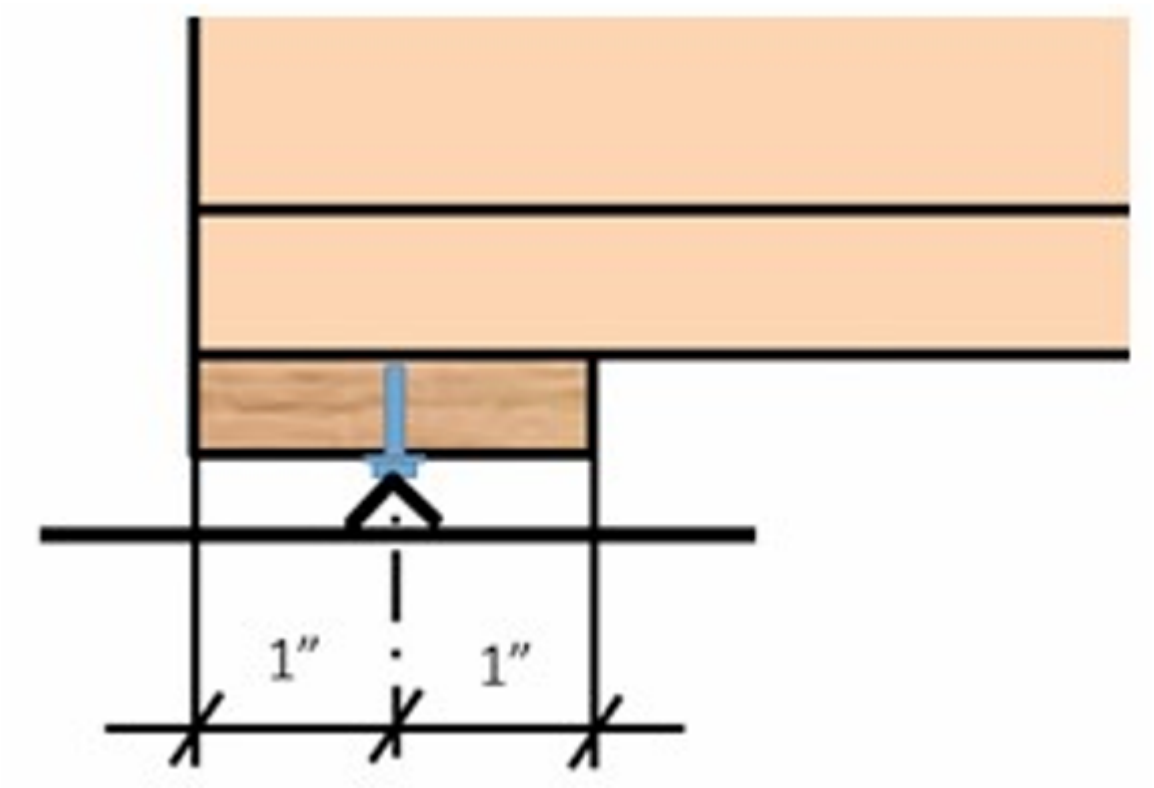
d) Lateral Balancing

All of the above support systems are affected by undefined lateral weight shift since the hive is resting on more than three points. There are two points at the front inside the hive scale and a linear support at the back of the hive. This could lead to overload on one of the load cells in the scale and therefore, lateral balancing is typically required if the support system under the hive is not one continuous platform, i.e. separate cinder blocks for the front and the back of the hive.

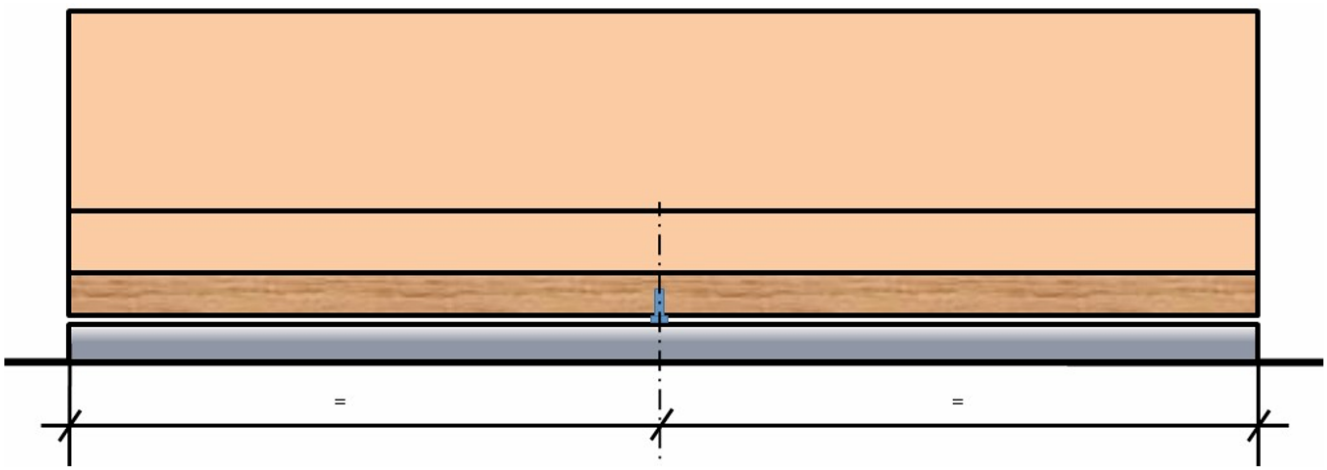
Read the weight from each load cell individually by switching to the real time display with the app. In this mode, the weight on the scale is shown as %Left, % Right. The right hand side of the scale is the side with the device identification sticker. No further action is required if the L/R difference is less than 10%.

If not then shim the scale on the side with the lower weight reading until the weight readings match. Alternatively, shimming can also be done under the back support on the opposite side of the low weight reading.

e) 3-Point Hive Support



There is a way to alleviate the need for lateral balancing by introducing a true 3-point support system. The parts are similar to the ones used in arrangement 2 but instead of using a 1” angle, for this arrangement you will need a ¾” angle. A 7/32” hole is drilled in the middle of the board instead of cutting a kerf. A ¼” x 0.5” slotted machine screw is used as center support. The screw will cut its own threads into the board. The slot in the screw head is aligned so that it can rest on the edge of the aluminum angle in a single point without sliding off.

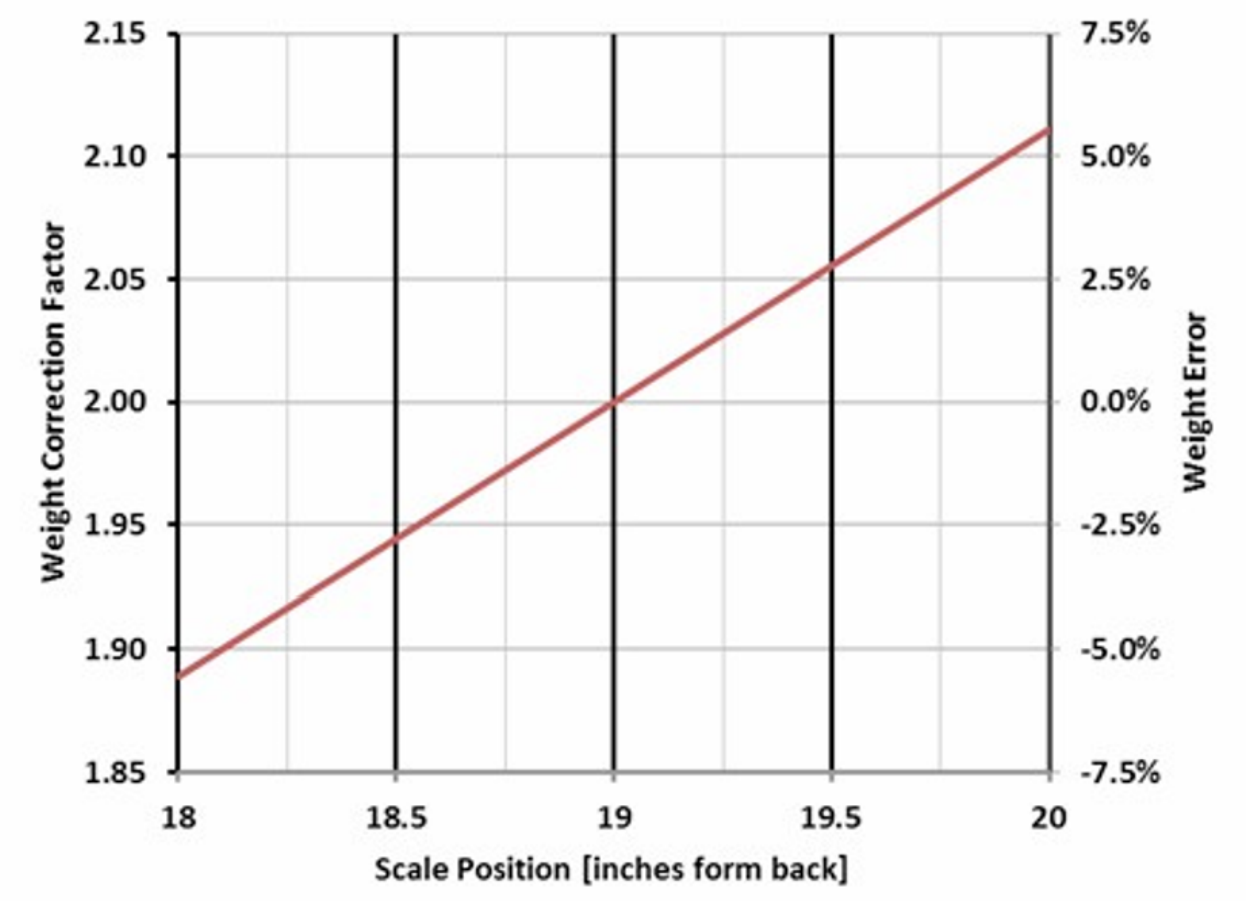


There is a small gap between the aluminum angle and the wood board. It has to be ensured that this gap is even width across the hive. The screw in the middle should be the only contact point. This will ensure that the correct weight is measured and at the same time it is the “safety net” against the hive falling over if excessive uneven loading is taking place, i.e during hive inspections.

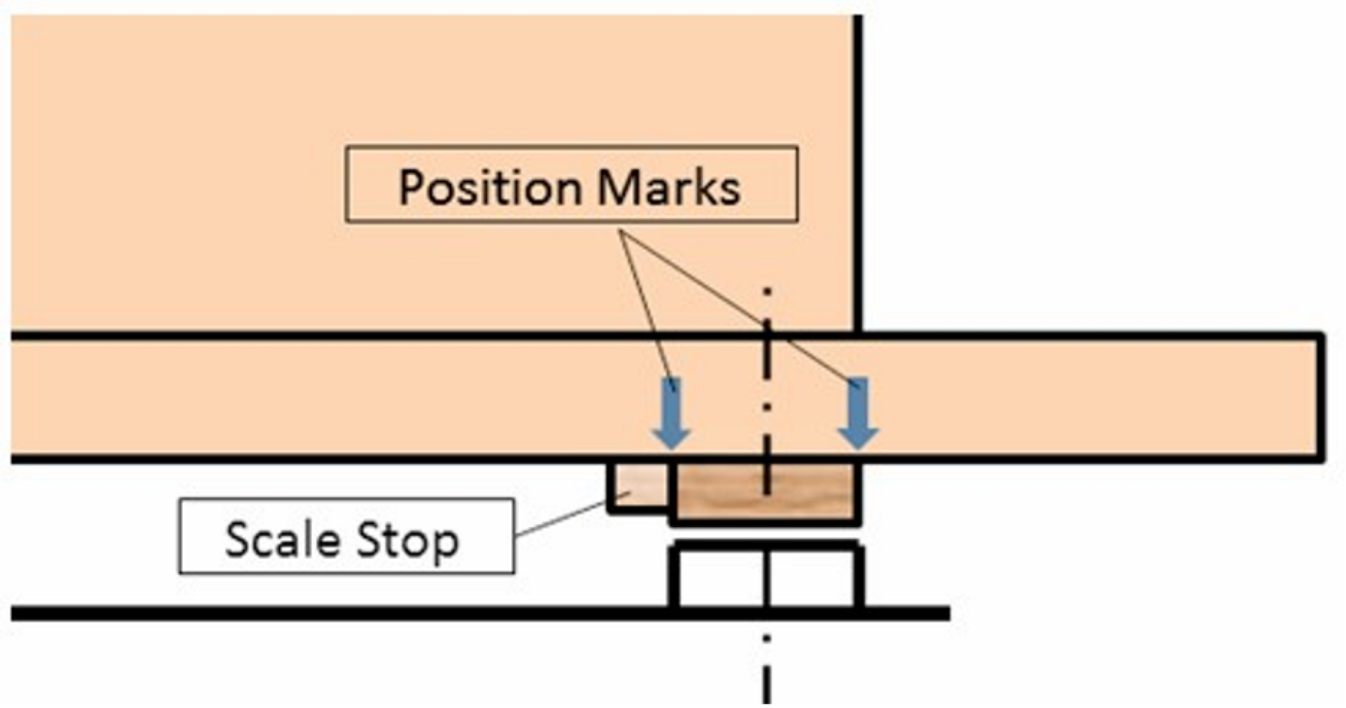
f) BroodMinder Scale Positioning

Most of the above has been dealing with the auxiliary support. Let’s focus now on the scale positioning.

As shown in the previous sections, it is desirable to have the front face of the scale placed in line with the front face of the hive body. Moving it further in would improve accuracy at the expense of hive stability and moving it further out would reduce accuracy with little improved hive stability.



This chart shows the influence of scale placement on the scale correction factor and scale error introduced due to inaccurate positioning of the scale. The influence is 5.6% per inch



It is advisable to mark the scale position on the bottom board of the hive or to attach a mechanical stop. This will help to put the scale back into the same location after it has been pulled for a battery change or some other reason.

30. Repair Guide

30.1 Overview

We want these sensors to last forever. However, installing them outside or inside a beehive puts special stress on the circuit boards. We encourage everyone to repair their own if they are capable.

If you would like us to do this for you go to BroodMinder-Refresh at BroodMinder.com. We will clean, test, add new batteries and housings. If something fails testing, then we will contact you and offer you a refurbished device at 50% the cost of a new device.

Here is a brief list of the most typical problems (we don't see many):

Most issues are software issues. In general, they get solved in the app or on MyBroodMinder.

- **Fast battery drain.** This is the most typical problem. Sensor batteries are all designed to last > 12 months. The cause is usually excessive moisture. 75% of the time it is repairable.
- **Weight errors.** Most are caused by installation errors. Next most prevalent caused by water infiltration due to broken housings.
- **CELL/WIFI problems**. If the unit was working and quit, then almost always due to water infiltration and the gasket being installed wrong. The second most common problem is lack of sunlight, particularly in the Pacific Northwest in the winter. You can get replacement batteries from Voltaicsystems.com. The V25 has replaced the V15. Once or twice we have seen problem with the modem connector to the circuit board. There are a lot of debugging features in the Cell App.
- **Battery holder breakage**. In devices with plastic battery holders the replacement part is MPD p/n BU2032SM-BT-GTR (https://www.digikey.com/en/products/detail/mpd-memory-protection-devices/BU2032SM-BT-GTR/2439521)
- **Battery no connect**. We don't see this often, but the battery holder can get gunk from the bees on it. You can clean the battery connectors with isopropyl alcohol.

30.2 General Notes:

- You can clean any components using 90% or greater isopropyl or ethanol alcohol. Warm it after aggressively cleaning to evaporate all moisture. This is a decent way to dry out a board since the alcohol will 'pick up' the extra moisture.
- Keep things dry. Cracked housings are the leading cause of scale problems. If you don't want to purchase new housings, then just tape the old one. There are lots of good tapes out there. Clear Gorilla tape is one of our favorites.
- I refer to Digikey a lot, but many supply houses have these parts.

30.3 **REPAIR - Fast Battery Drain **

Note

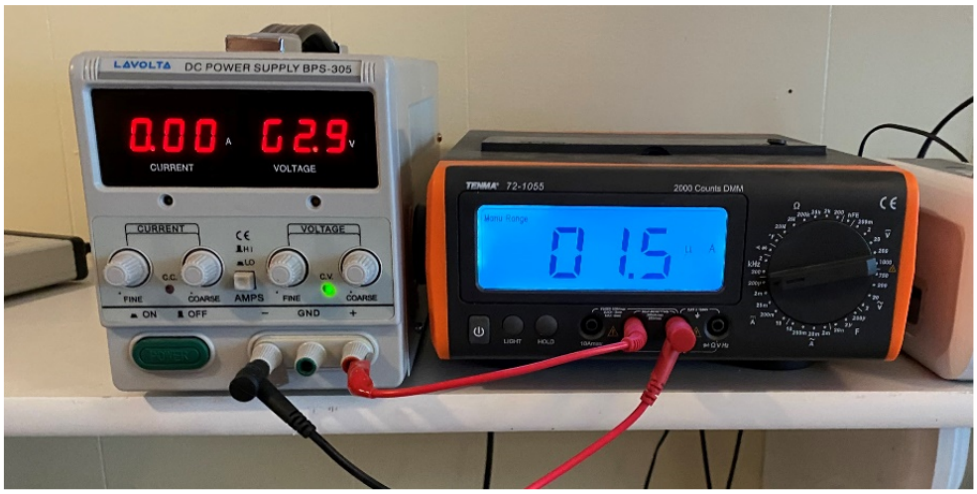
This chapter mainly applies to old boards `B42` shipped on TH (model 42) and W (model 43) from 2016 to 2019 (see picture below)

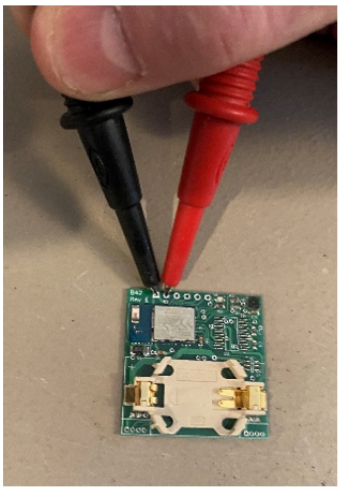
The typical cause for fast battery drain is a partially shorted decoupling capacitor. They are used to add a bit of life to the battery (ironic huh?) and to ensure stable supply voltage. As time as gone on, we have become more aggressive with conformal coating. I have been told by companies making solder, that the new, more environmentally formulations for flux are the root cause. In particular, moisture can get trapped underneath capacitors and create a current path between pads. (This has also led us to use larger components in more recent designs.)

This is easy to measure if you have a DVM (current meter) that reads into the uA range. A non-auto ranging meter is much easier to use because the circuit puts out advertising pulses every 1 or 5 seconds and that messes with the auto ranging. A good board requires < 5 uA at idle, however it will bounce between that and a few mA. Below is the setup that we use.

If you have a lot of devices, there is a new meter, the Nordic Power Profiler Kit (PPK2) and it works great and is about $100.

Note that the power may be applied on the connector as shown. Pin 1 (the square pad) is ground, pin 2 is 3.0 volts.





30.4 REPAIR – Will not respond– T2 (mod 47 gen with push button)

In this picture I have circled the typical capacitors which cause problems. Both may be removed with almost no change in performance. If you do want to replace them, here is the info. Start with the 100uF one on the left.

Large 100 uF Digikey: 478-8155-2-ND or equivalent

Small 0.1 uF Digikey: 399-5784-2-ND or equivalent

Sometimes it is a component on the BLE module (blue) that is not replaceable. Then the board is pretty much scrap.

It is a good idea to coat the components after replacing. You can use nail polish for this if you don't have conformal coating material. In general, I don't recommend paint or varnish unless you know it is OK via some other source.

More info on "Tin Whiskers" - https://nepp.nasa.gov/whisker/background/index.htm & https://www.eevblog.com/forum/projects/removing-tin-whiskers/

30.4 REPAIR – Will not respond– T2 (mod 47 gen with push button)

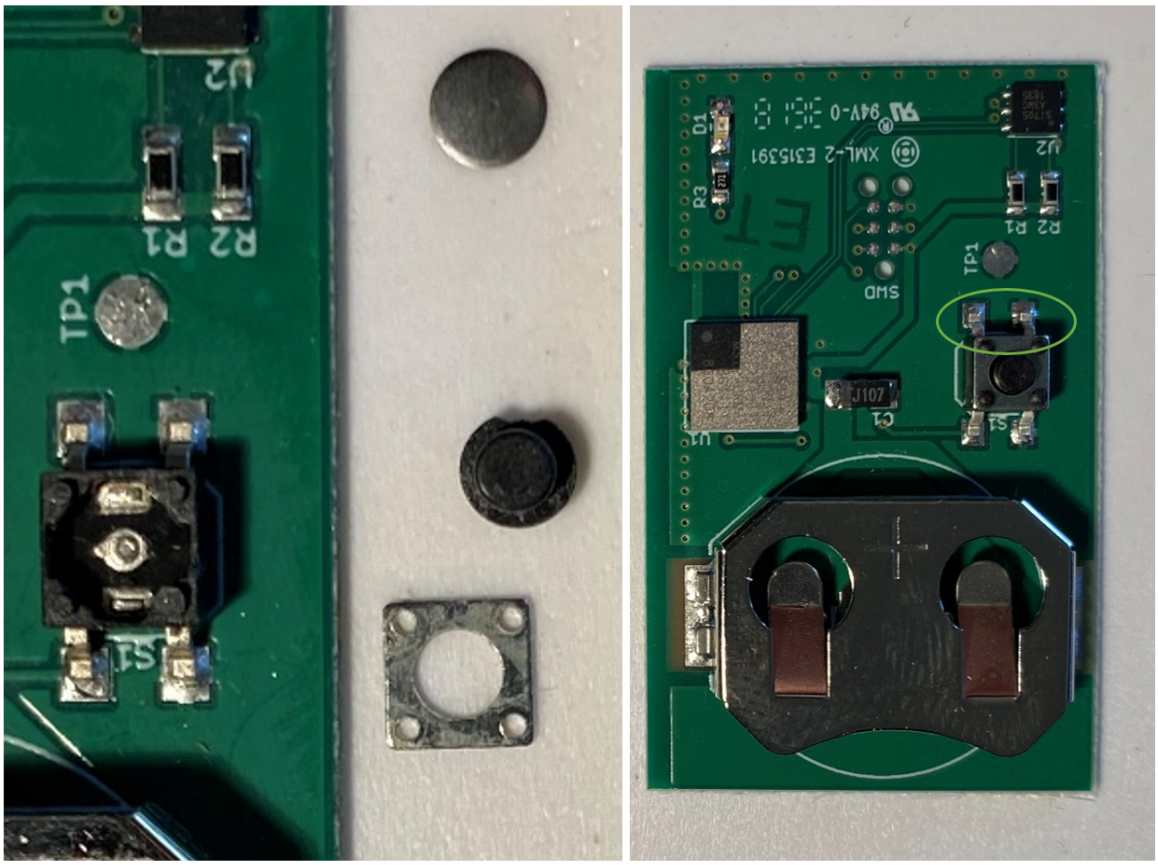
Note

This chapter applies to BroodMinder-T boards (model 41-47) with a push button. They where shipped from 2019 to 2023 (see picture below). New T (47) and TH (56) boards are without push button.

We try to get the best parts possible, but sometimes it doesn't work out. We have seen instances where it seems the T2 is dead and the only thing dead is the push button. It seems like the interior of the button may have develop a thin film on the connection disk (but we aren't certain). There are a couple of ways to deal with this.

1) Replace the button (E-Switch TL3305AF160QG Digikey EG5350CT-ND) 2) We have had good luck with restoring operation by pressing the button repeatedly. As soon as you see the LED flash you know you're on the right track. Push it quickly (3-4 times per second) for 30 seconds or so. We have seen most buttons work after this process. 3) Ignore the problem and use a knife to short across the switch terminals thus actuating the switch.

30.5 REPAIR – Assemble the BroodMinder-W+ BRM-57 (built after 2020)



You can see the switch guts on the board to the left. It is a “snap dome” switch which should be super reliable. Our best guess is that the dome was contaminated, and a thin film formed preventing contact. Aggressive repeated pressing seems to break through. YMMV.

30.5 REPAIR – Assemble the BroodMinder-W+ BRM-57 (built after 2020)

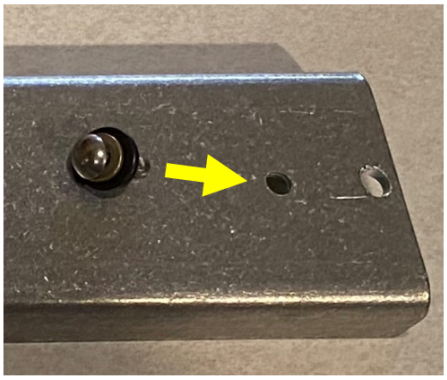
We now use the same sensors for the BRM-57 and we fix the aluminum base permanently to the wooden top. If you disassemble it, here is how to put it back together.

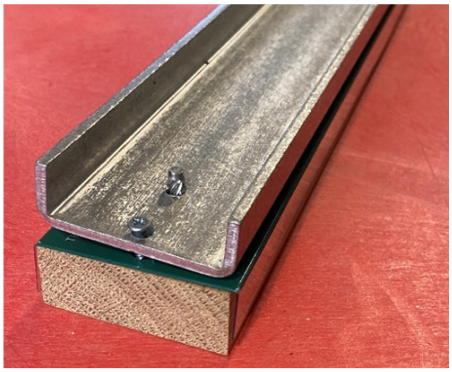
Mount the pins along with the two washers per pin in the holes indicated.

Secure the parts together with the screws, but do not tighten the screws.

Put the plastic rain shield back on.

30.6 REPAIR – Scale weight problems BRM-43, original BroodMinder-W





30.6 REPAIR – Scale weight problems BRM-43, original BroodMinder-W

The scales have also been reliable unless exposed to environmental problems, typically because the housing become cracked and rain enters. Usually, a good cleanup helps. I have not seen the ADC1234 fail. Typically, it is a capacitor (as discussed above) or the battery holder (MPD p/n BU2032SM-BT-GTR). The weight sensors are also available at Digikey, FX1901-0001-0100-L by TE Connectivity Measurement Specialties.

If you are going to do much with scale repair, it is a good idea to get the PC app and a Silicon labs BLED112 dongle (available at Digikey).

Once you repair the scale and need to recalibrate it, we suggest using the PC app and to adjust the divisor and offset for each channel by trial and error. See the DIY section above for a bit more info on the PC App (available at https://www.dropbox.com/sh/vj621467gak5bd7/AAAitrIE_vKsw07AGnlgopxha?dl=0 in directory PCApp).

· Note the divisor and offset values the appear when you connect. Write them down.

· Set the scale wooden side down with the aluminum and housings removed.

· Set the log period to 5 seconds (this is the fast it will go) press “Update Log Period’ and press ‘Start Real Time’

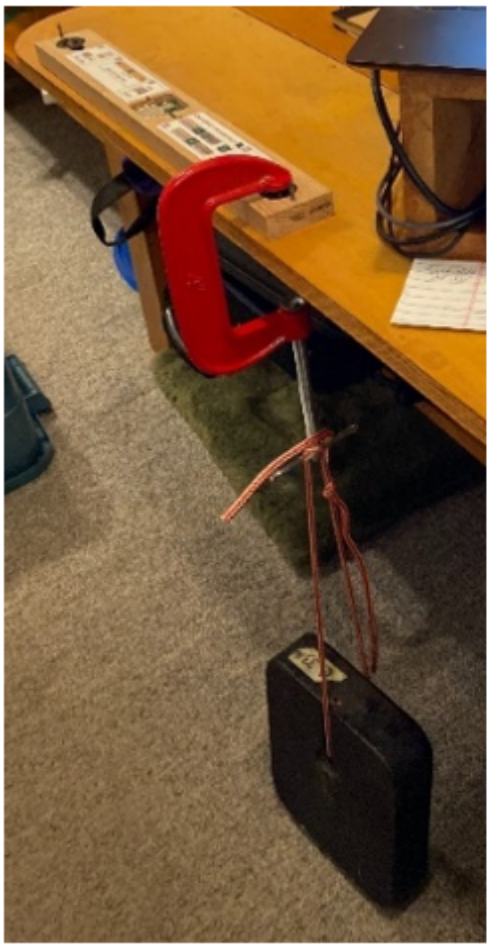
· With no load on the scale, adjust the Offset for left and right (front only for BroodMinder-W). The value can vary widely. + or -15,000 is not unusual.

· Apply a known weight. We suggest using a large c-clamp with a weight dangling. It should not touch the table or any part of the scale. Taping a small nut to the c-clamp will keep it situated on the sensor.

· Adjust the Divisor to read correctly. Generally, the Divisor value should be between 1,200 and 1,400.

· After values are set, you must press “Cal LF Weight” and Cal RF Weight” to store the values in the scale.

· Test using the BroodMinder-Lite app in “real-time” mode to ensure that the values are stored.



30.7 REPAIR – BroodMinder-W2

The W2 is pretty new, so we don’t know all of the failure modes yet. We will show you how to disassemble without destroying it.

This is what it looks like inside. It is pretty simple. The hard part is keeping bees inside and weather outside.

Battery Shield

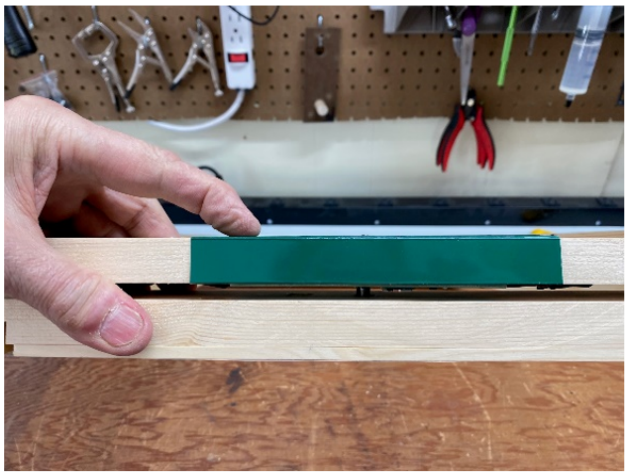
An upgrade we recommend for all of the original -W2 scales is to add a plastic water shield above the battery compartment. It turns out that moisture may drip down the inside of the hive and end up here. Sandwiching a shield between directly above the batteries and below the screwed on cover prevents this from happening.

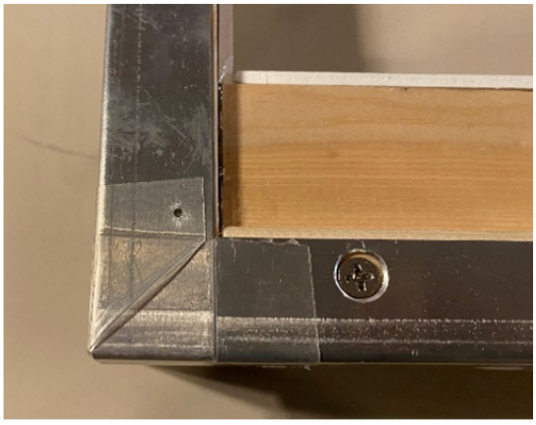
· Remove the battery cover

· Place the shield centered above the battery area

· Replace the battery cover

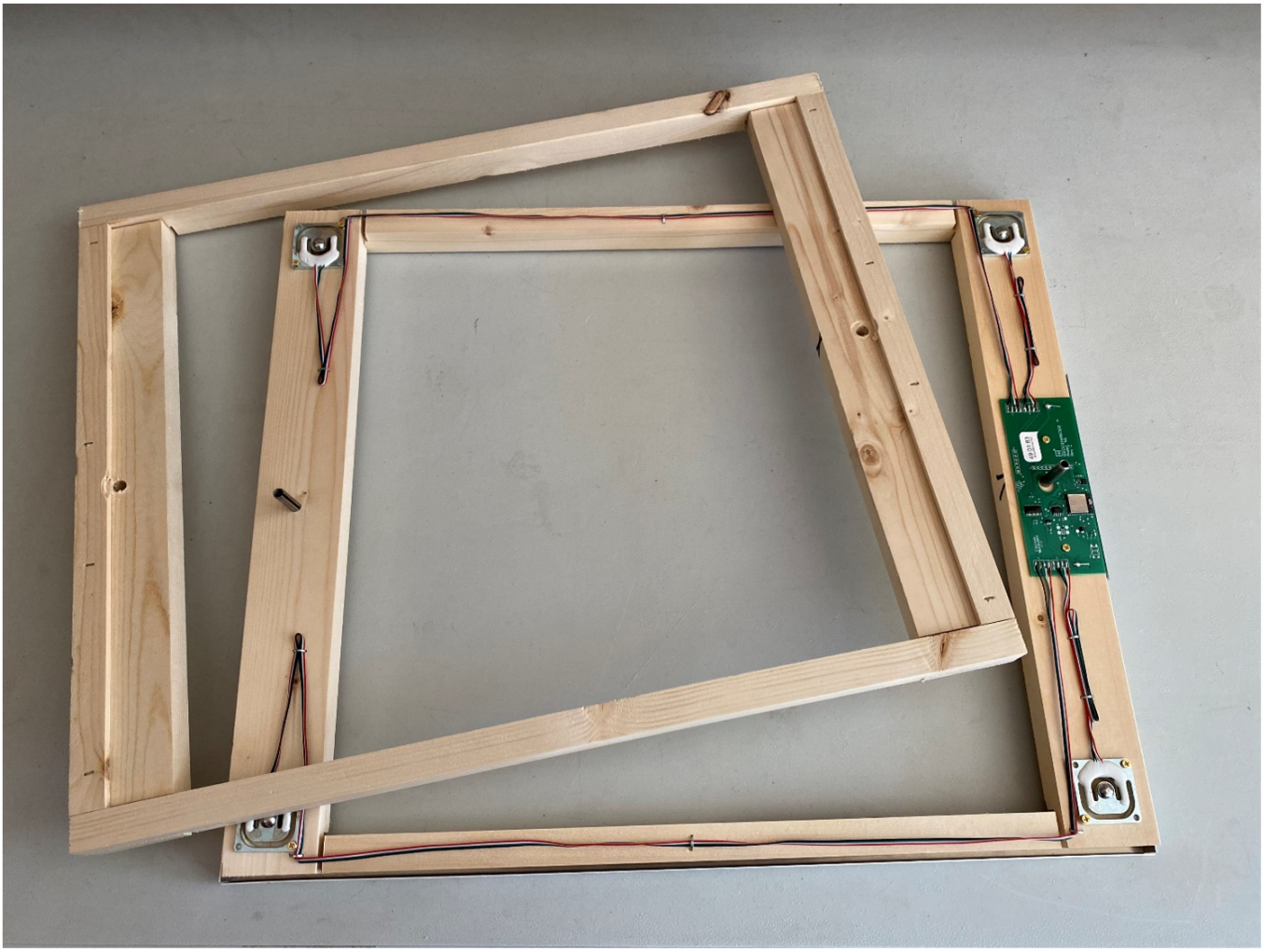
· Tape the corners to make watertight





W2 Disassembly

1) Remove the inner seal that is stapled in place. (be gentle) 2) Take off the two nuts holding the halves together.

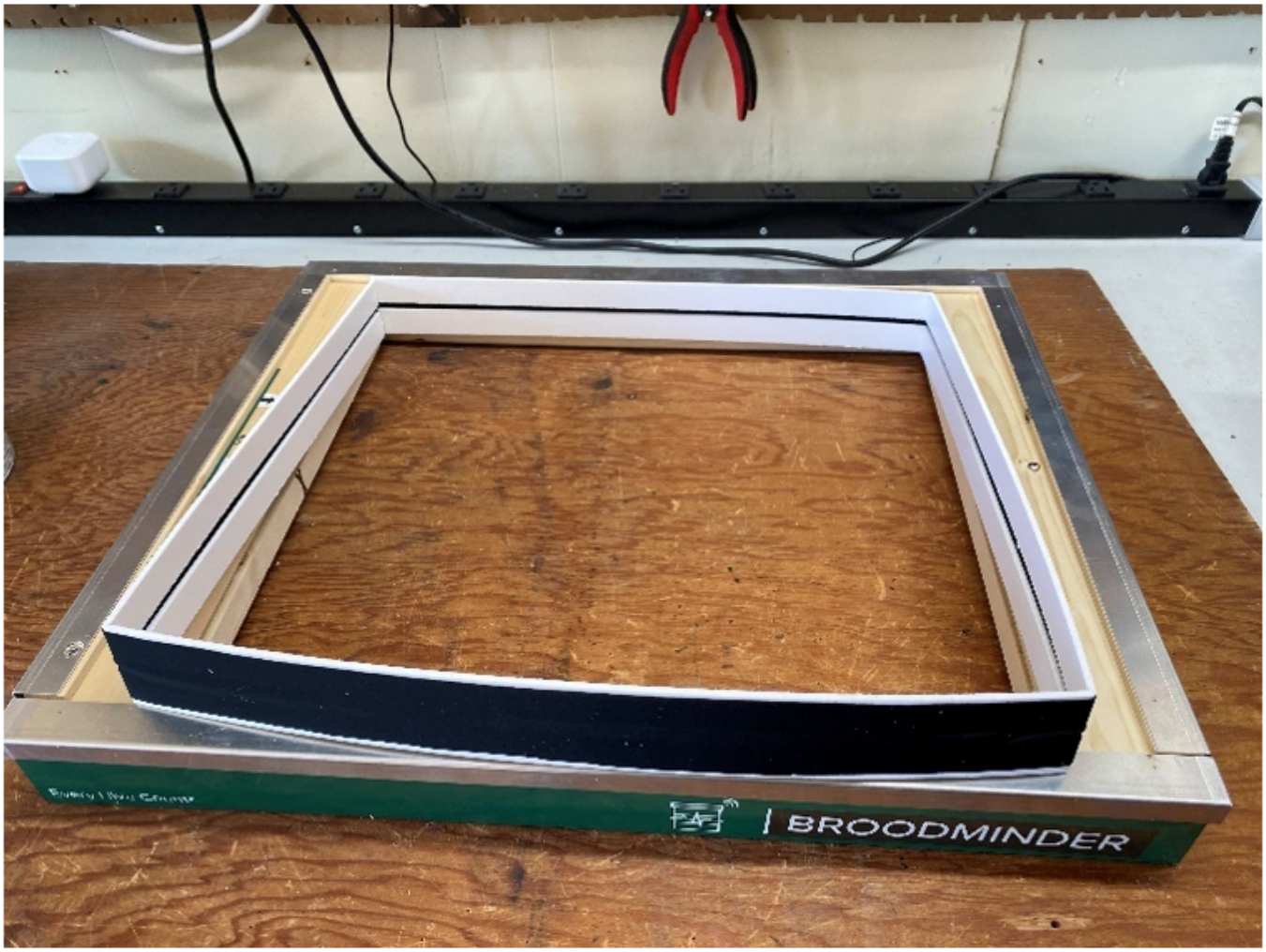


After removing the slatted rack, start by carefully prying loose the staples holding the inner seal in. Use a small putty knife if possible.

The inner seal is spandex mounted on expanded PVC. It is very flexible, but easy to poke a hole in with a knife.

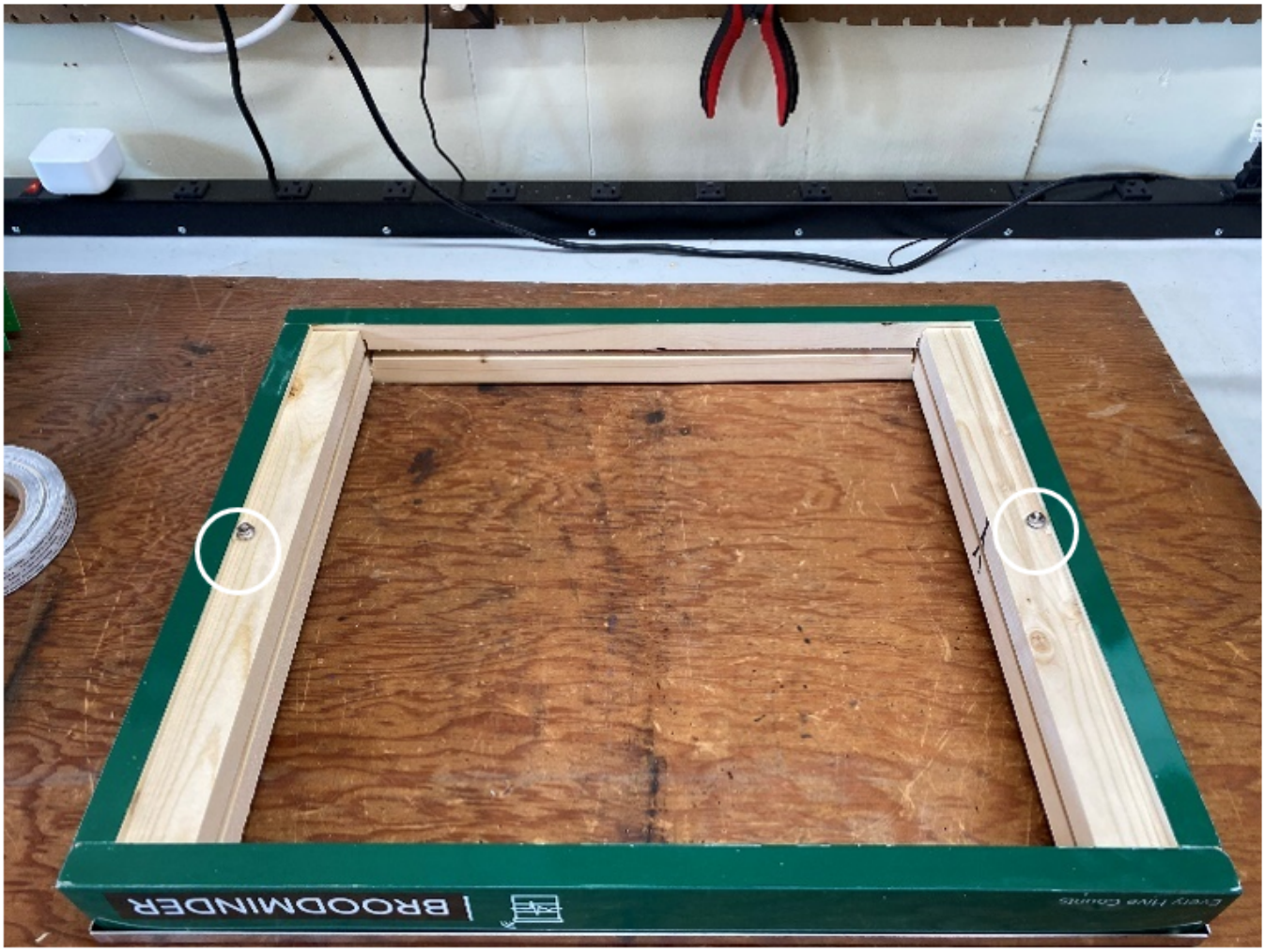
Remove the inner seal assembly.

Note that when you reassemble, don’t stretch the spandex, that will put force on the scale.



Remove the two nuts holding the top to the bottom frame.

Now you can separate the halves.



If you are replacing the housing, first lay down the double stick tape. We suggest making the short pieces run to the edge in order to bridge the two housing pieces and help to seal out water.

Installing the housing is all about making certain that it does not rub.

Install the long pieces first. Be certain that the housing is centered in the metal drip ledge. If it rubs on this aluminum part, it will affect the weight reading.

When installing the short pieces, be certain to pull the long piece towards the middle so that it is tight against the frame. Leave part of the housing double stick tape covered as shown. Carefully peel it off after get the housing situated on the frame.

It can be tricky to get the housing back in after you separate the halves. Patiently use a putty knife to do this.

We recommend a little blue locktite to secure the nuts.

30.8 16.3 Appendix D – Battery Power

In the winter of 2020/21, we worked to extend battery greater than 5 years. The following section provides measurement data for those interested in such matters.

In order to avoid connectors and wires, we have chosen the battery route. Our goal has always been to have batteries last between one and two years. In the absence of failures due to tin whiskers noted above, we have met that goal.

The major energy cost to BroodMinder devices is Bluetooth Low Energy (BLE) advertising. The advertisements, which contain current measurement values, are emitted once every 5 seconds (once every second for -W2). While the current draw is very short, it still adds up over the span of a year.

In early 2020, we decided to design and offer the BroodMinder-SubHub. Based on the same circuit as the BroodMinder-W2, the board can be outfitted with 4, AA batteries giving it a much larger power base to work with. With the -SubHub gathering data once every 10 minutes, it made possible to cut advertising time for the hive devices from 60 minutes to 10 minutes, cutting power consumption by nearly 75% and extending battery life to over 5 years.

The scaling for batteries in the 2020 and later boards is 0-100% represents 2.0-3.0 volts

Battery Energy CR2032 = 225 mAh AA (L91) = 3500 mAh AAA (L92) = 1200 mAh

Model Number	Model	Idle energy / 24h (uAh)	Advertising energy per adv. (uAh)	Adv energy per adv w/listener (uAh)	Sampling energy per sample (uAh)	Connection energy per sec (uAh)	Adv period (sec)	Sample Period (sec)	Advert energy (mAh)	Sampling Energy (mAh)	Connect Energy (mAh)	Total Energy (mAh)	Battery Energy	Battery Life (years)
BRM-42	BroodMinder-TH	0.033	0.016	0.018	0.021	0.917	5	3600	103	0.2	5.7	**109**	225	2.1
BRM-43	BroodMinder-W	0.048	0.014	0.016	0.388	0.9	5	3600	87	3.4	5.6	**96**	225	2.3
BRM-47	BroodMinder-T2SM	0.06	0.017	0.02	0	0.327	5	3600	107	0	2	**109**	225	2.1
BRM-49	BroodMinder-W2	0.06	0.018	0.02	0.307	0.508	1	3600	568	2.7	3.2	**574**	3500	6.1
BRM-56	BroodMinder-TH2	0.06	0.018	0.02	0	0.327	5	3600	114	0	2	**116**	225	1.9
BRM-57	BroodMinder-W+	0.06	0.019	0.02	0.217	0.513	1	3600	600	1.9	3.2	**605**	1200	2
							BATTERY SAVER MODE - 10 minutes advertising per hour							
BRM-47	BroodMinder-T2SM	0.06	0.017	0.02	0.042	0.327	5	3600	21	22.1	0	**43**	225	5.2
BRM-49	BroodMinder-W2	0.06	0.018	0.02	0.307	0.508	2	3600	316	2.7	0.1	**318**	3500	11
BRM-56	BroodMinder-TH2	0.06	0.017	0.02	0.042	0.327	5	3600	21	22.1	0	**43**	225	5.2
BRM-57	BroodMinder-W+	0.06	0.019	0.02	0.217	0.513	5	3600	126	1.9	0.1	**128**	1200	9.4

Model Number	Model	energy / 24h (uAh)	Advertising energy per adv. (uAh)	per adv w/listener (uAh)	energy per second (uAh)	energy no sample per sec (uAh)	Adv period (sec)	Listening period	Advert energy (mAh)	Sampling Energy (mAh)	Connect Energy (mAh)	Total Energy (mAh)	Battery Energy	Battery Life (years)
BRM-52	BroodMinder-SubHub	0.06	0.033	0.035	3.233	0.506	1	600	1034	3401.2	0.1	**4435**	7000	1.6

Note: Validation measurements were performed utilizing a new (wonderful) instrument. The crowdfunded Joulescope, DC Energy Analyzer was designed to make these types of low power DC measurements.

31. Distributor Information

31.1 Welcome to BroodMinder

We love our distributors and we are happy to get you set up for success. We are developing sales aids and we appreciate any ideas that you might have along these line.

31.2 Basics

Once we establish you as a distributor, we will give you a discount code to use in our Shopify web store. You will find that the discounts will apply to most products, but not to the items that we already discount for our customers. Once you enter the discount code, you will see the discount applied.

Any special requests can be entered into the order and Donna will be certain to take care of them. If you need literature or other items, just note it there and she will contact you.

31.3 Discounts Available

Our discounts are based primarily on marketing of the product. Our goal is to spread the word regarding beehive monitoring so featuring BroodMinder on your web presence gets the best discount. Note that the discounts are applied individually. The maximum available is 27%.

- BroodMinder featured on distributors home page (10%)
- Live data featured on distributor site (10%)
- Single order > $5000 (5%)
- Cash (2%)

31.4 Getting Set Up

It is easy to get set up. Just send us a note with your desired discount level and we will create code once we see your website.

- In Europe contact Lorenzo@BroodMinder.com
- Elsewhere contact Rich@BroodMinder.com

31.5 Ordering and Shipping

- Place the order at BroodMinder.com
- Add any special notes to Donna
- Apply the discount code
- Submit the order. You can either pay by card or other means such as check or funds transfer. Once we receive payment we will ship the order. We are happy to discuss payment terms after a couple of successful order.

Local Language Translations

Attention international distributors, all of our content is translation ready. If you would like to perform translations for your customers reach out to Lorenzo@BroodMinder.com.

31.6 Wrap Up

We can also perform drop shipping if you would like. Do do that we need to chat.

Thanks and remember... Every Hive Counts

32. Data upload

All BroodMinder sensors transmit data via Bluetooth. There are several ways to collect the recorded data - via your smartphone or via a hub.

32.1 Broominder - APIARY App

BroodMinder Apiary

Introduced in 2018, the BroodMinder-APIARY app is our most powerful app. We strongly recommend using it as opposed to the BroodMinder-Lite app.

For all users, you can see the current state of the sensors and also upload them easily to MyBroodMinder.com. It also allows basic control of the sensors as well as firmware updates.

For MyBroodMinder-Premium users, it will read and upload every BroodMinder device in your apiary directly to MyBroodMinder with a single keypress. It can also be used to automatically send your live data to MyBroodMinder.com every 10 minutes.

Once the data is transferred, review of data and keeping hive notes can be done directly on MyBroodMinder.com. We recommend this because of its ease of use.

Please note that this app only stores your hour by hour data in the cloud and does not keep a copy on your phone and/or tablet.

New features have been added in 2019-2020

- Many more device details displayed including hive name.
- Remote uploading – The apiary app now works with or without internet connectivity (premium users only).
- Hub mode – You can use any internet connected iOS or Android device to send data every 10 minutes from your apiary (premium users only).
- CELL wakeup – The BroodMinder-CELL device can be taken out of deep sleep.
- Change sample rate from 60 minutes to 15 minutes.
- T2 firmware updates to SwarmMinder.
- Power off control for T2.

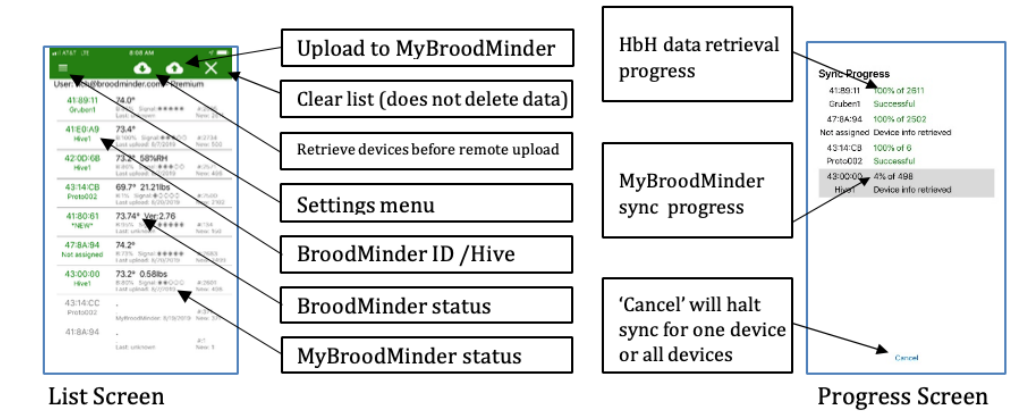
Usage of the app is super simple.

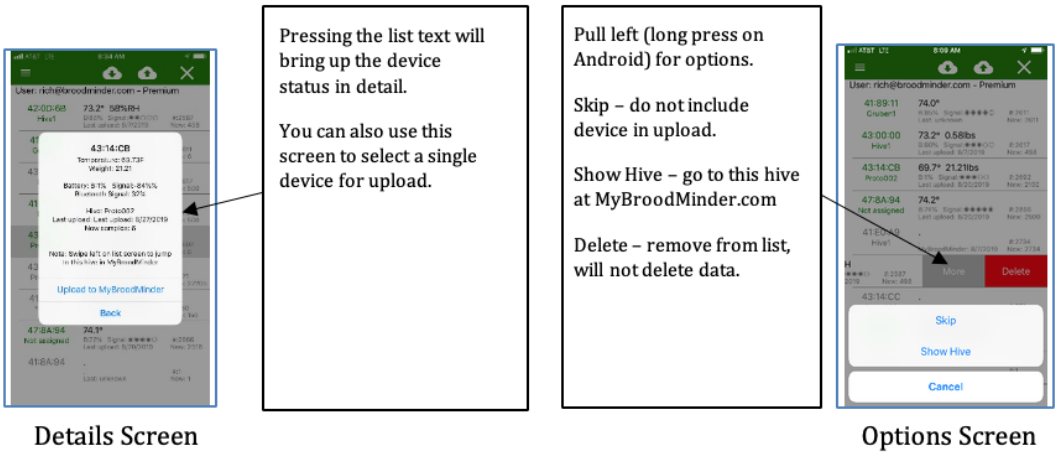
1. Go to MyBroodMinder.com and create an account (this is free).
2. Download BroodMinder-Apiary from your app store.
3. Start the app and press the gear icon and enter your MyBroodMinder credentials.
4. Return to the list screen and in a few seconds it will automatically find every BroodMinder device in the area and display them on the screen.
5. After the BroodMinder IDs turn green, press the cloud icon

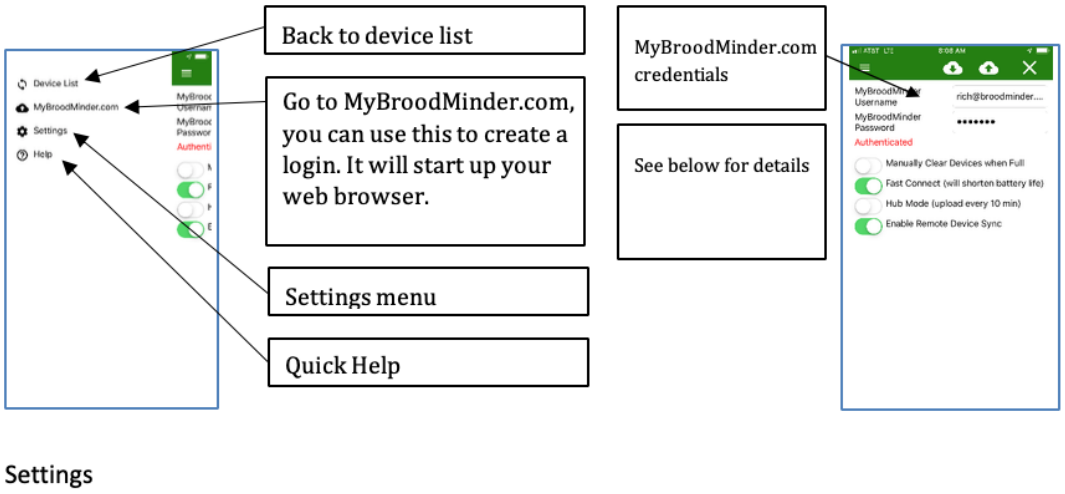
in the upper right of the screen to begin upload to MyBroodMinder.

6. Now the app will show you a upload progress screen. The top line is status while harvesting the BroodMinder data. The lower line shows the transfer to MyBroodMinder status. 6)After all of the devices have uploaded you will see a transfer complete message.

After the transfer is complete, the data will show up in MyBroodMinder. If you have already set up your devices, all you do is look. If these are new devices, you will need to find them in your MyBroodMinder "Device Inventory" and assign them to an apiary and to a hive. See the next section on MyBroodMinder.com for more on that.







Settings

- **Display in metric**
- **Fast connect** – This will speed up connection time by making the 'advertising rate' faster. This means the BroodMinder will send out a signal every one second instead of every 5 seconds. The downside is that it will

also shorten battery life. You might want to set this fast in the summer and slow in the winter.

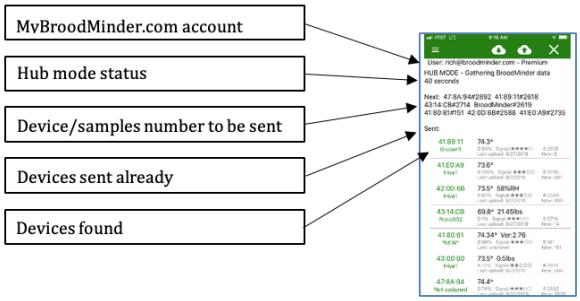
- **Hub mode** – See below.
- **Enable remote device sync** – You can retrieve data even when there is no internet connection or cell coverage in your apiary.
- Before going to the apiary – go to the device list and press the cloud with the down arrow

This will load the list with all of your devices and the last time data was retrieved. (If you don't do this, all of the data will be retrieved from your BroodMinder. This could be a full year of data!) .

- When in the field, sync your devices like normal. They will fail upload since you don't have internet, but that is OK.
- When your return to civilization, restart the app and it will suggest that you upload to the cloud now. Do this and MyBroodMinder.com will get updated.
- **Hub mode**

Hub mode lets you use and old phone or tablet to automatically send your BroodMinder data to MyBroodMinder once every 10 minutes. This way you can see how your bees are doing 24/7 from anywhere in the world.

Just enable hub mode and return to the list screen.



32.2 BroodMinder - LITE App

BroodMinder Lite

NOTE: We now recommend using the BroodMinder Apiary app. It is more reliable and will work for most people.

Device compatibility

Apple – iOS

The BroodMinder app will work with any Apples device that has Bluetooth Low Energy (BLE) available. It will work with iPhone model 4s or newer and with iPads 3rd generation or newer.

Android

Android is a bit more complicated. Android introduced BLE support in Version 4.3 (Jelly Bean, July 2012). Devices before that will not work. Devices after that may work. Most new devices (2015 or newer) do work. However, there are many flavors of phone and we have found a few that give us problems. If your device does not work, then contact us at Support@BroodMinder.com.

A new feature has been added to the app in version 2.97 to increase the "advertising rate" of your BroodMinder devices. As shipped, the BroodMinder sends a message out once every five seconds that contains temperature and weight information. The General Settings page now has a Bluetooth Config button which allows you to change the advertising rate to once per second. This will speed device connection and will make data retrieval faster. It will however reduce battery life to 3-6 months.

We have also added a "Reset Android Bluetooth" under the Bluetooth Config button. This will do a system reset of the Bluetooth function. We have found that on some phones this will help re-establish communication.

There is more information at MyBroodMinder.com/resources.

Installation

The BroodMinder app is available at the Apple App store, or the Android Play Store, or the Amazon Play Store, depending on your device. If you search for "BroodMinder", (it is called BroodMinder Lite on Android) you will find it. Install it just like you would any other app.

After it is installed, start the app. The app should present you with a warm and congratulatory welcome message. You can choose to watch our Queen Bee, Laura Davis demonstrate installation, or you can dismiss the message and let the app do its thing.

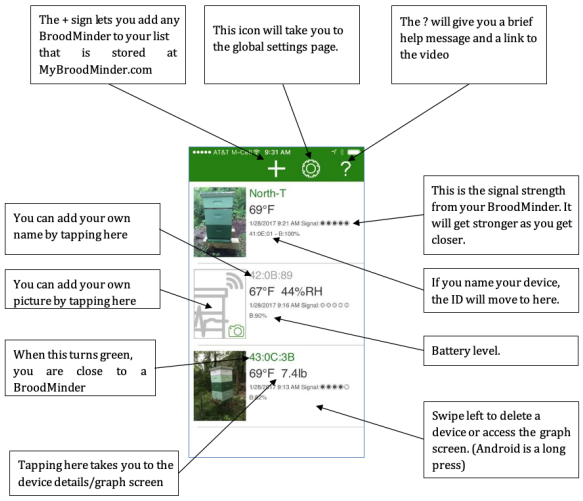
The app will start scanning for BroodMinder devices in the area and will automatically fill the screen with any that it finds within the area.

If none show up:

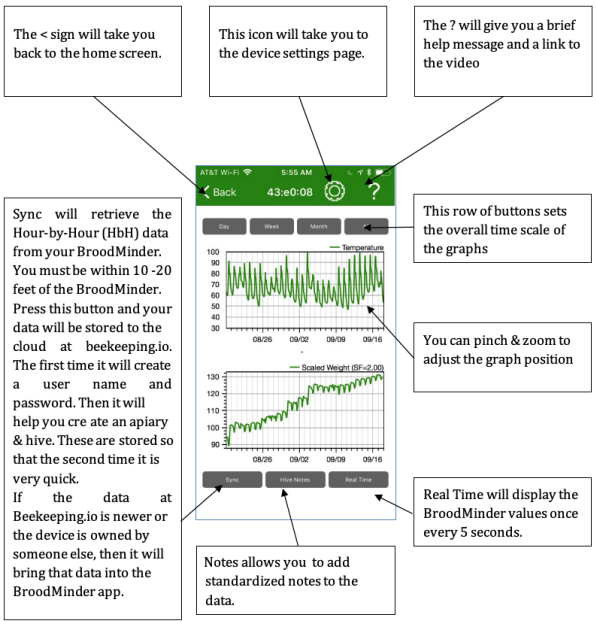
- Make sure that the battery tab has been removed from the BroodMinder-TH and make sure that the battery is pressed into place on the BroodMinder-W.
- Make sure that your phone/tablet has Bluetooth turned on.
- Make sure that you are within 10-20 feet of the BroodMinder device.

Home Screen of BroodMinder App

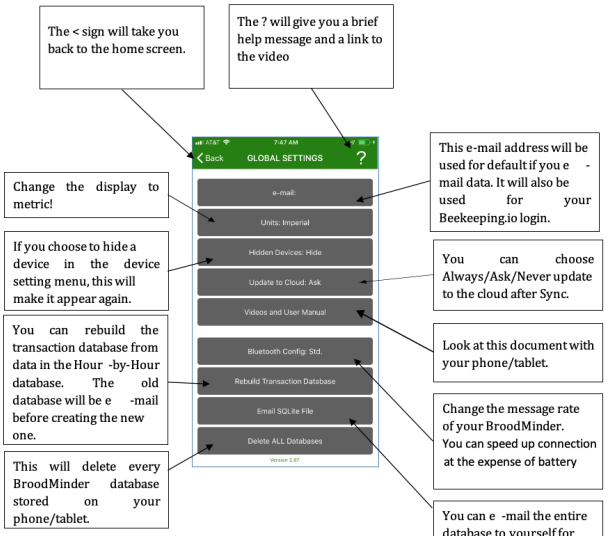
BroodMinder-T will display Temperature BroodMinder-TH will display Temperature & Humidity BroodMinder-W will display Temperature & Weight



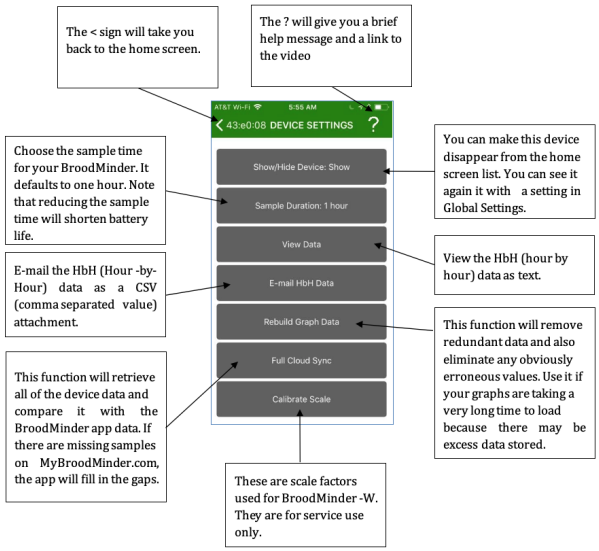
Details/Graph Screen of BroodMinder App



General Setting Page



Device Setting Page



Real Time Mode

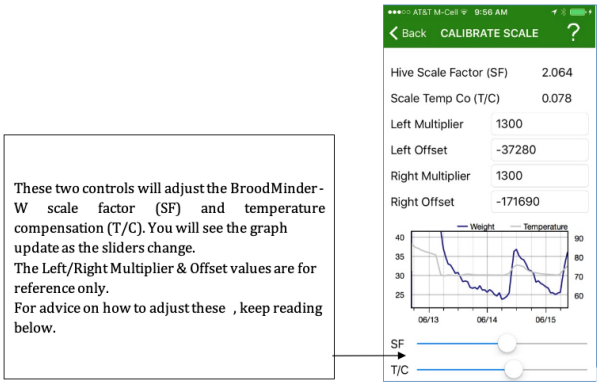
If you would like to see "Live" data, you can use the "Real Time" button on the Graph screen. Pressing this button will change the sampling rate to 5 seconds and then show a display of values in the lower section of the screen.

B: Battery level
T: Temperature (currently only F)
H: Relative Humidity in %
L/R: Balance between left and right sensors. Adds to 100% (-W scale only)
W: Total weight (currently only pounds) (-W scale only)
Delta: Change in weight from when Real-time started. (-W scale only)

This data will also be saved in the log file.

Pressing the "Real Time" button again will leave this mode and set the sampling rate back to 60 minutes.

Setting the Broodminder-W scale factor



By default, the BroodMinder-W scale factor is set to 2.0. This means that any weight the BroodMinder-W sees is doubled to reflect the full weight of the hive. From looking at the physics of the situation (see appendix below) we know that this is an approximation and not totally accurate. In most cases, it is close enough since small changes will still be seen and a 5-10% error in total weight is not important.

A more accurate total weight display can be obtained by adjusting the scale factor to account for the hive specific situation.

Go to the Graph Screen of the scale and press the real time button. In a few seconds, the app will begin to display the scale reading once every 5 seconds at the very bottom of the screen. You can also see the % load on each load cell.

Now add a known weight of 10-20 pounds to the top center of the hive. You should see this weight change in the app readout. Then you can adjust the scale factor to exactly match the weight change.

Example:

Weight	Delta Weight	Scale Factor	N
121.2	0.0	2.0	S T
132.2	11.0	2.0	W w

Now we go change the scale factor | Weight | Delta Weight | Scale Factor | Notes | | --- | --- | --- | --- | | 129.5 | 10.0 | 1.82 |

Now the calibration is closer | | 117.0 | 0 | 1.82 | After the weight is removed, we see the new more accurate hive weight |

Setting the BroodMinder-W temperature compensation

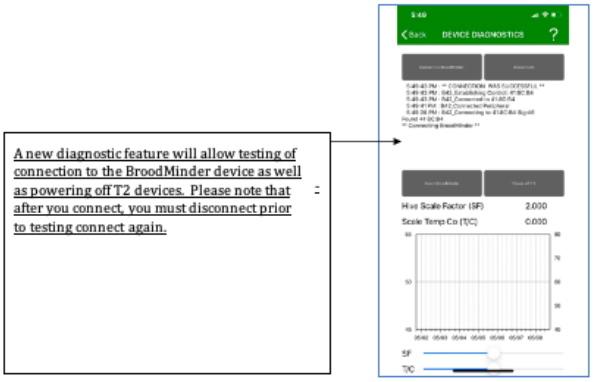
The sensors used in the BroodMinder-W are very high quality and exhibit little temperature effect. However, there is still variation from scale to scale and therefore we have provided a means to improve the accuracy through the adjustment of the scale temperature compensation – "Scale TempCo".

To adjust the TempCo, you should pick a portion of your weight graph in which you know there is little weight change due to bee activity. A cloudy day is a good time because we know that they are not foraging. There should also be a good outdoor temperature change of at least 20 degrees F in less than a day.

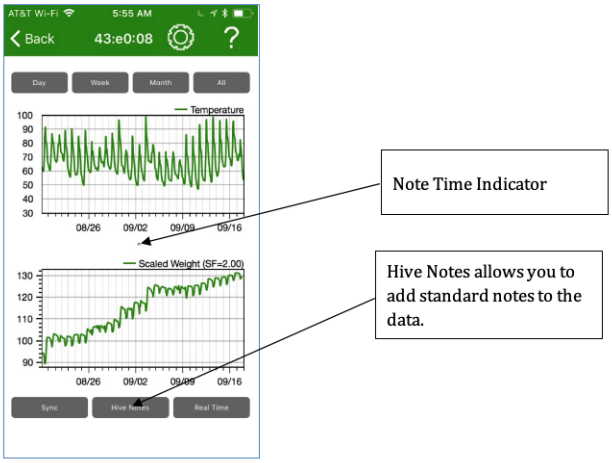
As you make small changes to the TempCo value, you will see the weight graph settle out to a uniform weight as one would expect.

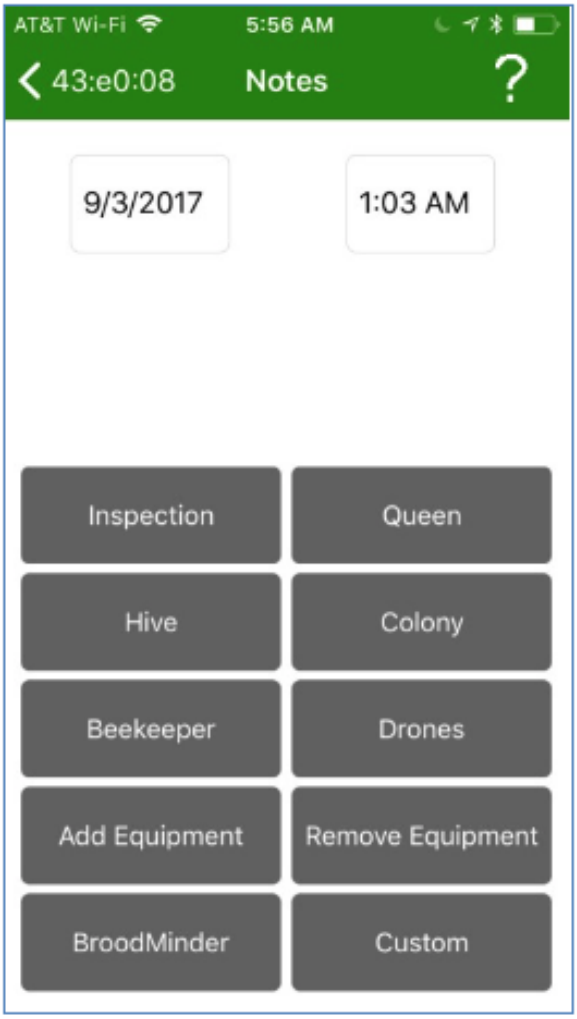
If you see weight spikes even after adjusting, then possibly it is due to the scale being in the sun. The sun can heat of the scale quite quickly and dramatically. This makes it very difficult for the TempCo to be effective.

Device diagnostics



Tagging Graphs





This button will bring up a sub-menu with eight groups of possible occurrences or actions. Select the one most appropriate for your situation and choose the corresponding tag. Use “Custom” if the list does not cover your situation. The selections in the app will be updated as time goes on to best reflect the tags most used.

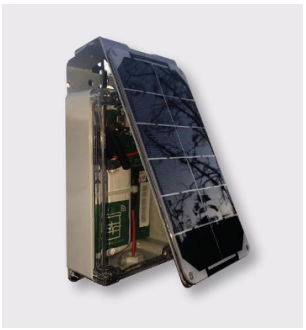
The time shown in the top half of the screen is the current time if the graphs have not been moved by pinching or swiping before the “Tag Graph” button has been pressed. It can be adjusted by clicking on it.

When noting a past event, it is useful to move the chart and line up the time of the event with the “Note Time Indicator” and then press Hive Notes. In this case, the note time in the notes window is the time at the “Notes Time Indicator” and not the current time.

Of particular interest is the "Inspection" button. This button will walk you through a 6 easy to answer questions about the state of the hive. The list was shared with us by Dick Rogers and we think it is a quick and effective way to document the hive.

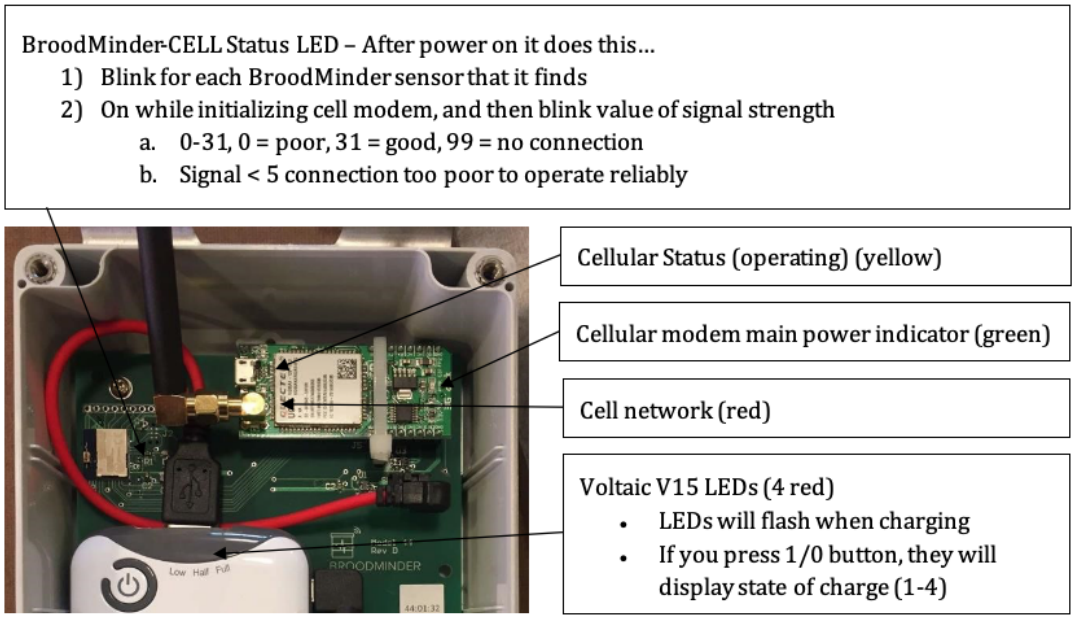
Pressing the Hive Notes button lets you add text to any point in time on the graph. This is useful to explain abrupt changes in the data or whenever you do a hive inspection.

32.3 BroodMinder Hub



BroodMinder-WIFI/CELL is an optional component which sits in your apiary and relays data from your BroodMinders directly to mybroodminder.com via a WIFI or CELL connection. We have designed the BroodMinder-WIFI/CELL to automatically begin working when power is turned on.

For best results, watch the installation video at BroodMinder.com/pages/videos



Quick Start Instructions

1. IMPORTANT: Sync all devices & **post to mybroodminder.com** before starting your BroodMinder-WIFI/CELL
2. Place the BroodMinder-WIFI/CELL in the apiary with the solar panel towards the sun
3. Get the BroodMinder-CELL app (even if it is a WIFI/CELL unit)
4. Start the app, your BroodMinder-WIFI/CELL should show up on the list.
5. Press exit deep sleep
6. WIFI/CELL only – Enter your WIFI/CELL network name and password (matching capitalization is important)
7. DONE! - Data should start showing up in mybroodminder.com in about an hour.

Installation

You can install your BroodMinder-WIFI/CELL in many different configurations depending on circumstances. The bracket on the back of the electronics enclosure may be flipped as shown in some of the examples.

Quick Start Instructions

1. IMPORTANT: Sync all devices & **post to mybroodminder.com** before starting your BroodMinder-WIFI/CELL
2. Place the BroodMinder-WIFI/CELL in the apiary with the solar panel towards the sun
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5. Press exit deep sleep
6. WIFI/CELL only – Enter your WIFI/CELL network name and password (matching capitalization is important)
7. DONE! - Data should start showing up in mybroodminder.com in about an hour.

Installation

You can install your BroodMinder-WIFI/CELL in many different configurations depending on circumstances. The bracket on the back of the electronics enclosure may be flipped as shown in some of the examples.

Here are a few installation considerations

- The solar panel will fully charge the battery with about 4 hours of good, direct sunlight.
- The battery should last 3-4 days with no good sunlight
- Wireless reception is hampered by trees. Mounting on a tree may be problematic if your signal is marginal.
- In extreme cases we can suggest a more sensitive antenna (Cellular only). Contact us at Support@BroodMinder.com.
- Tie wraps or pipe clamps may be used to secure the system
- A small 3' post like available at major hardware stores works well. They have tabs that can be slightly bent to allow the BroodMinder-WIFI/CELL to be inserted. Then, a tie wrap at the bottom secures the unit.

Solar Battery Always-On Mode

We ship BroodMinder-WIFI/CELL with the battery in **Always-On** mode. Under normal conditions, you will not need to open the electronics enclosure.

The solar battery is a Voltaic V15 and features two power modes.

- In **Always-on** mode, the V15 power never turns off
- In **Auto-off** mode, the V15 power automatically turns off after about 20 minutes

It is important to have the V15 in **Always-on** mode so that the BroodMinder-WIFI/CELL continues to work 24 hour per day.

Let us repeat: We ship BroodMinder-WIFI/CELL with the battery in **Always-On** mode. If you never hold the V15 (solar) power button for more than 5 seconds, you do not need to change anything.

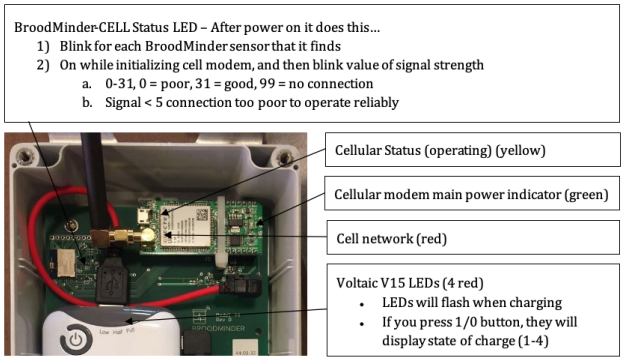
If you do hold the V15 power button for \> 6 seconds, it will change the mode. It alternates from **Alwayson** to Auto-off and back and it is a little tricky to figure out which mode it is in.

To tell the difference, watch the V15 lights AFTER the 3 flashes described below.

- Block the solar panel to make the lights less confusing
- Press and hold the power button
- After 6 seconds, the LEDs on the V15 will flash 3 times
- If the light stays on for a few more seconds, it is in **Always-on** mode. This is good!
- Release the power button

If after the 3 flashes, the V15 lights turn off, it is in Auto-off mode. This is not good. Try again and it should be correct this time.

Indicator Lights



32.4 BroodMinder CELL App

The BroodMinder Cell App allows you to closely watch how things are going. Some of the things that you can monitor include:

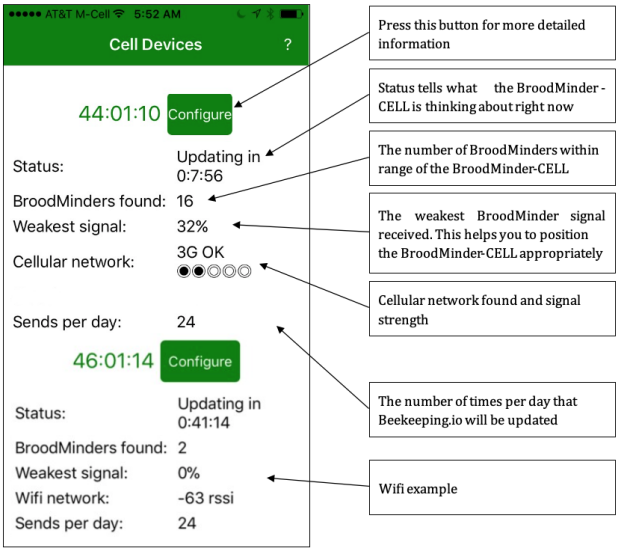
- Deep Sleep Mode – see below.
- Current status of BroodMinder-WIFI/CELL (Initializing, time until next data transfer, connecting to WIFI, sending data)
- Number of BroodMinders found in the apiary
- WIFIlular signal strength
- Lots of diagnostic features

We won't go into a lot of detail in the manual because there is not much to adjust with the app. In fact, the only things that you can adjust is when and how often data is transferred to Mybroodminder.com. The rest of the app is to aid our support personnel in diagnosing problems.

When you receive your BroodMinder-WIFI/CELL, it should be in Deep Sleep mode in order to conserve the battery during shipment. You will need the BroodMinder-CELL app to wake it up.

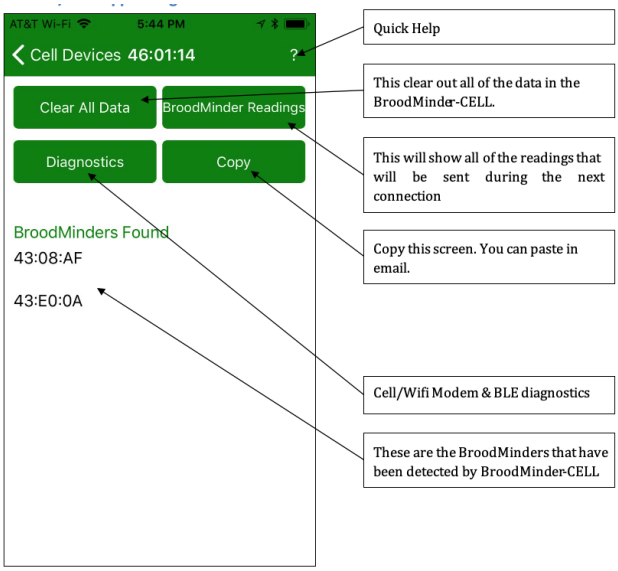
By default, the BroodMinder-WIFI/CELL will transfer data hourly.

App Home Screen

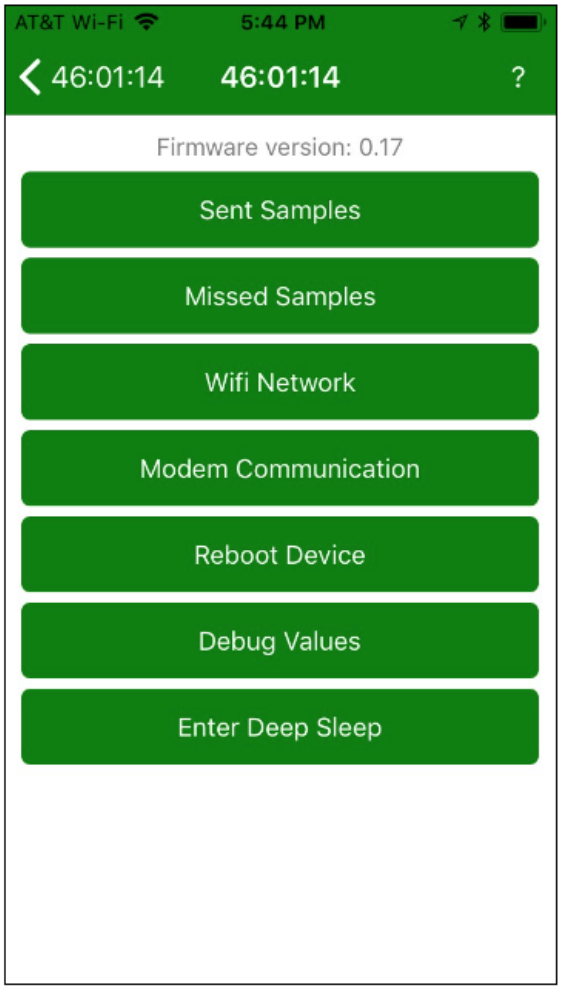


Note: if you left swipe on the screen you can delete unused BroodMinder-WIFI/CELL devices.

App Configure Screen

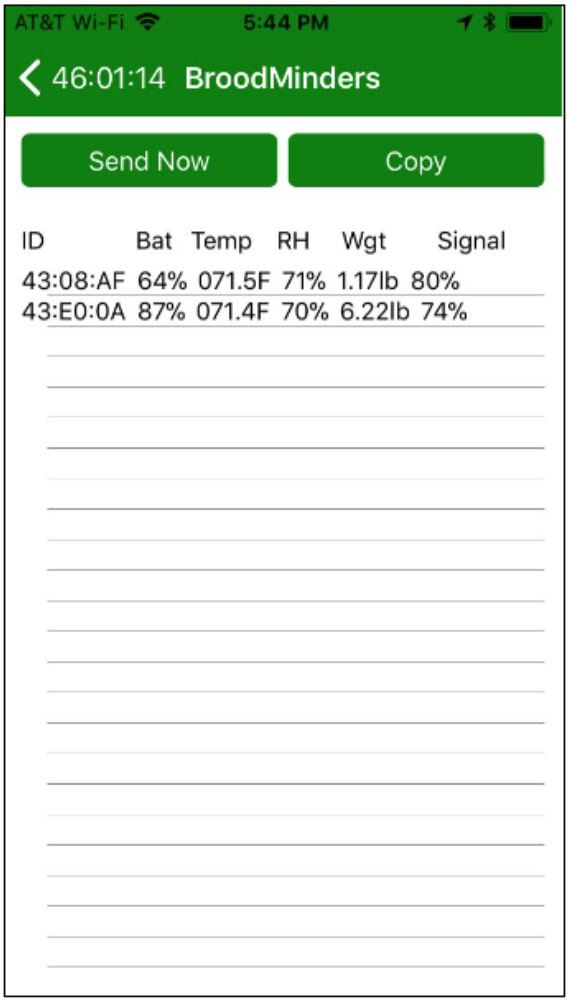


App Diagnostics Screen



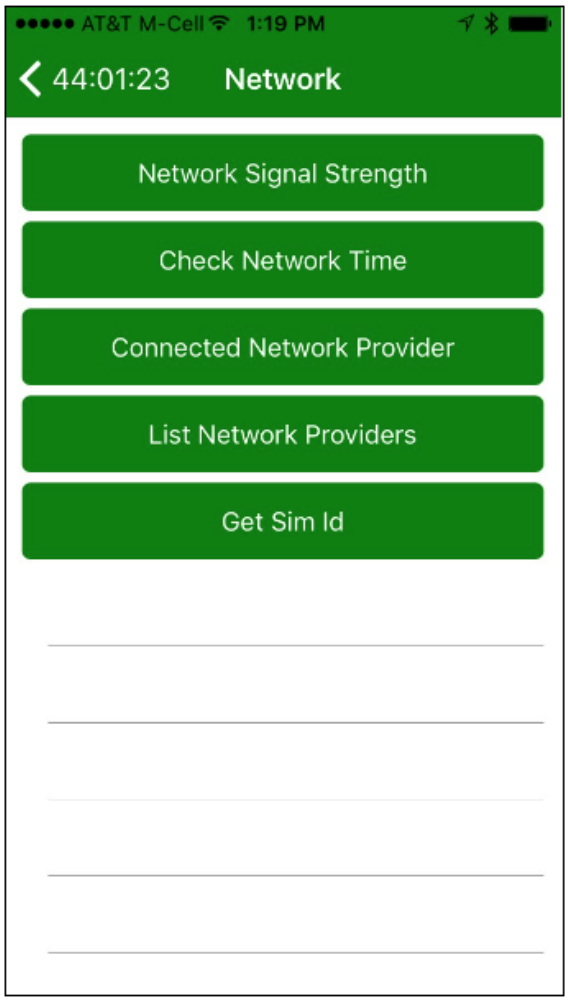
- **Firmware Version –** This shows the version of firmware in the BroodMinder. (e.g. 0.17)
- **Sent Samples –** The number of samples sent to Mybroodminder.com
- **Missed Samples –** The number of missed samples as indicated by missing sequence numbers.
- **WIFI/CELL Network –** WIFI/CELL diagnostics, see next page.
- **Modem Communication –** Watch the communications to the Wifi/Cell modem.
- **Reboot Device –** This will restart the BroodMinderWIFI/CELL and purge it of all stored data.
- **Debug Values –** These are Amanda's secret debug values.
- **Enter Deep Sleep –** When we ship the device, we put the -WIFI/CELL in deep sleep to suspend all WIFIular connection and thus save battery life so that when it show us, it is ready to go.

App Readings Screen



- **Send Now –** Immediately connect the modem and send this data to MyBroodminder.com
- **Copy –** Copy this screen. You can paste into e-mail

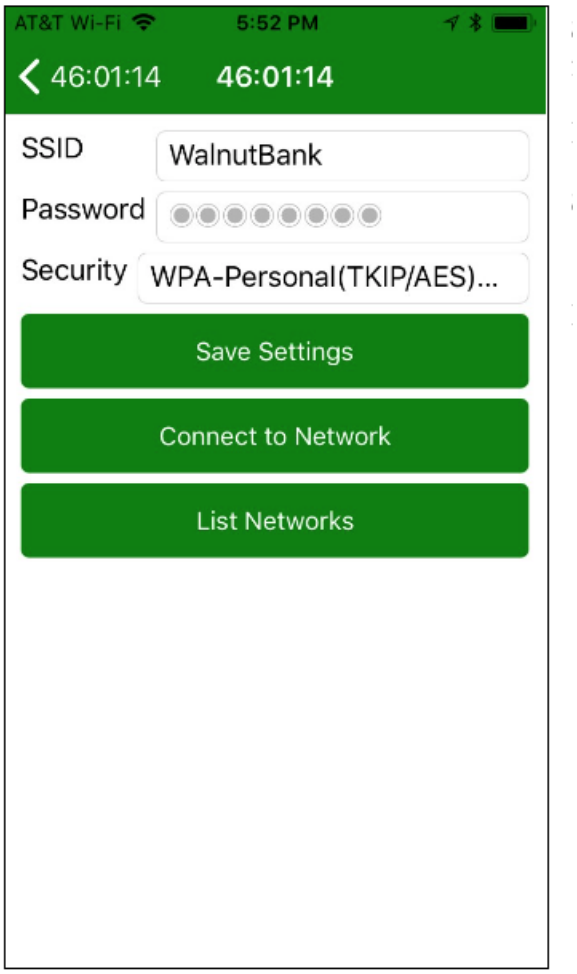
App Cell Network Screen



NOTE: These are commands to the CELL modem. See the next page for Wifi commands. If the modem is not on, invoking a command will turn it on. Give it a few seconds and then try the command again. The result will be printed at the bottom of the screen.

- **Network Signal Strength –** for reliable operation, it should be 4, (maybe 5) or more.
- **Check Network Time –** Time from the WIFI/CELL network.
- **Connected Network Provider –** Typically ATT but may be others.
- **List Network Providers –** See all the providers in the area.
- **Get SIM ID –** This should match the number stickered inside the enclosure.

App WIFI Network Screen



- **SSID –** Make sure that capitalization matches your network name.
- **Password –** Password for your network.
- **Security –** Typically WPA-Personal but may be none or WEP.
- **List Networks -** Lists all available networks.

32.5 Device compatibility

Apple – iOS

The BroodMinder app will work with any Apples device that has Bluetooth Low Energy (BLE) available. It will work with iPhone model 4s or newer and with iPads 3rd generation or newer.

Android

Android is a bit more complicated. Android introduced BLE support in Version 4.3 (Jelly Bean, July 2012). Devices before that will not work. Devices after that may work. Most new devices (2015 or newer) do work. However, there are many flavors of phone and we have found a few that give us problems. If your device does not work, then contact us at Support@BroodMinder.com.

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We have also added a "Reset Android Bluetooth" under the Bluetooth Config button. This will do a system reset of the Bluetooth function. We have found that on some phones this will help re-establish communication.

There is more information at MyBroodMinder.com/resources.

33. About this user manual

At BroodMinder we know how important documentation is. Having a structured, updated, comprehensive and easy to search documentation is important for all of us. That's why we're making a great effort to keep it updated in a moving environment where products and features are constantly evolving.

- In 2023 we made a big leap ahead moving from the pdf document (legacy manual 2015-2022) to the online 'web-oriented' documentation. This opened a large field of usage opportunites. But we kept strugling with updating documentation in multiple languages..
- In 2024 we are making a new leap by introducing AI and auto translation to every languages! We are excited at the idea to deliver native language documentation to every beekeeper!

34. How does it work

To use this doc you can :

- **navigate** on the left side bar through the topics you're searching for
- **use the search field** at the top bar with your keywords

35. Multi-languages

There is only one master documentation and it's the english version. Every other language is auto translated using AI. If you find words or expressions that seem wrong in your language, send us an email at support@broodminder.com we can certainly improve it!

Also, if you are missing your language, let us know !

36. Contributing

This documentation is open source and hosted online at https://github.com/broodminder/userguide Anyone can contribute by adding edits using the typical Github process..

Every edit is processed downstream and auto-translated to target languages.

Consider contributing and helping all the BroodMinder community !