



USER DOCUMENTATION

Welcome to the world of BroodMinder

None

None

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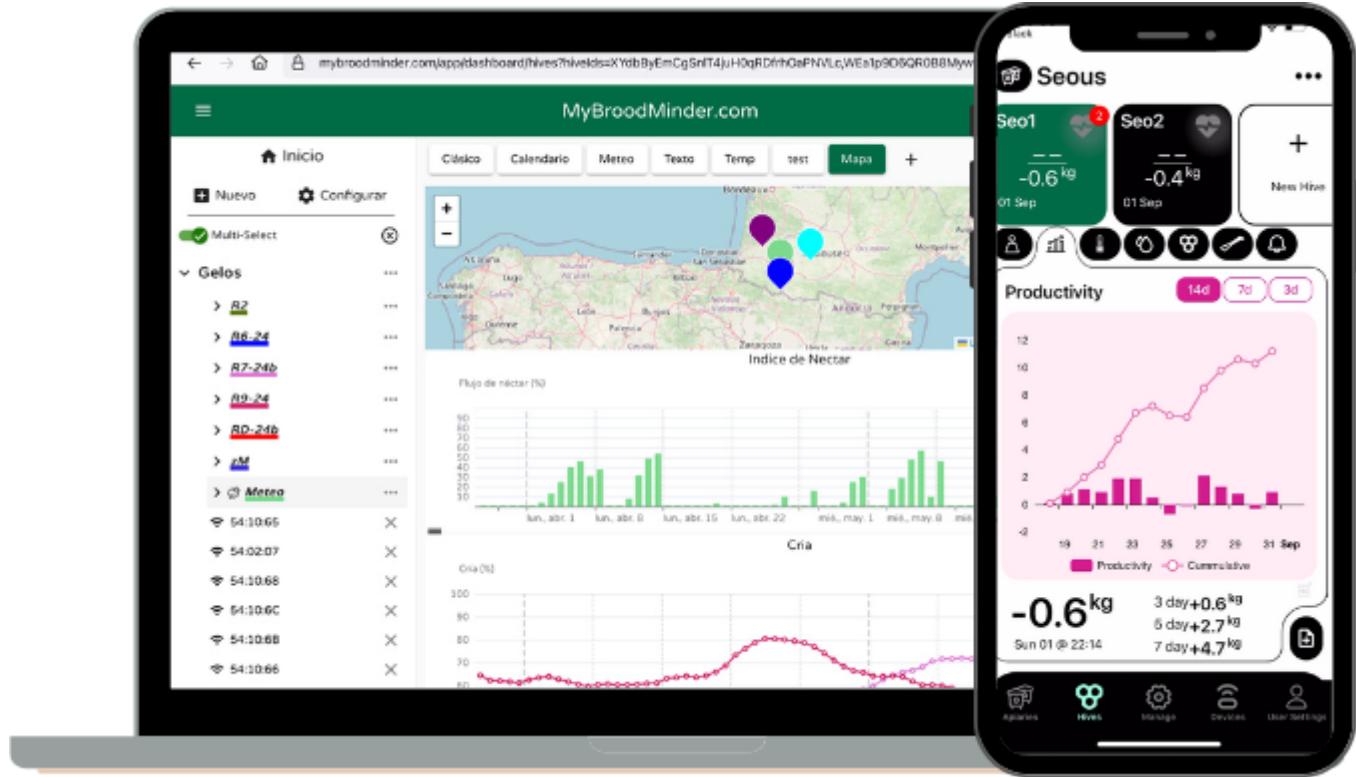
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1. Home

2. Introduction

2.1 Welcome to the world of Hive Monitoring!

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](#)

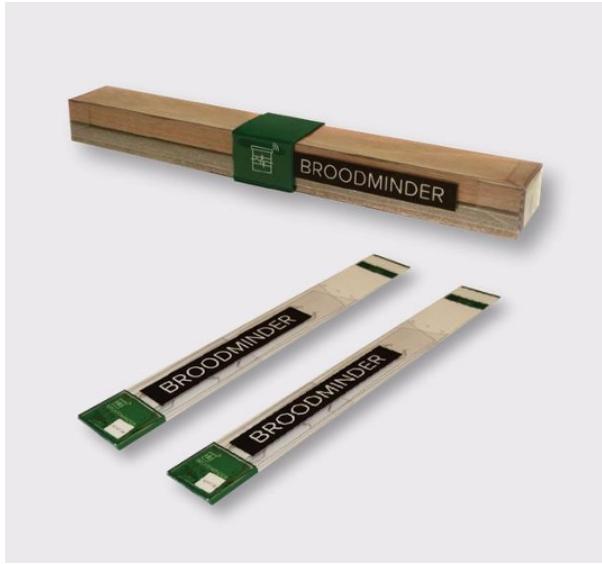
2.3 Overview of the system

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

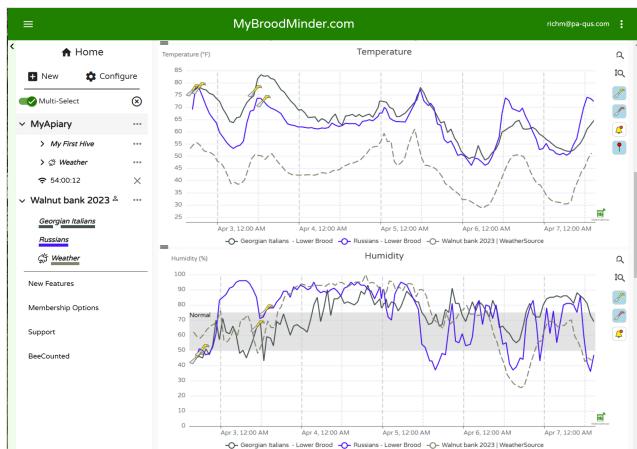
The 4th generation app for your phone or tablet is called the "Bees" app and is available for iPhone or Android. This is the quickest and easiest way to start collecting data from the sensors. Use it in the apiary to locate the sensors and to take hive/apiary notes by either typing or speaking to the 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.

 The screenshot shows the BroodMinder Bees App interface. At the top, it says 'Walnut bank 2023' with a sync button. Below that, there are two sections: 'Georgian Ita...' and 'Russians'. Each section lists four sensors with their status, ID, and data. At the bottom, there is a timestamp '54:02:01' and a navigation bar with icons for Devices, Apiaries, Settings, and Help.

Section	Sensor Type	Status	ID	Temperature	Humidity
Georgian Ita...	Scale Under Hive	Unavailable	43:e0:07	54.4°F	67.9 lbs
	Lower Brood	Unavailable	56:31:2F	64.6°F	69%
	Scale Under Hive (Back)	Unavailable	57:03:3b	59.1°F	74.5 lbs
	Beecounter	Unavailable	63:02:43	55.4°F	
Russians	Scale Under Hive	Unavailable	49:03:02	53.1°F	66.1 lbs
	Lower Brood	Unavailable	56:30:AF	72.4°F	47%
	Beecounter	Unavailable	63:02:39	60.1°F	

MyBroodMinder.com

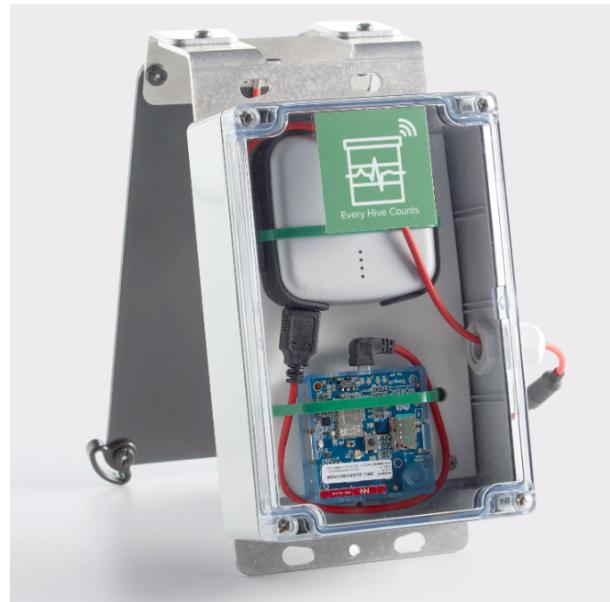
The data transmitted by your phone or by the hub arrives on the [Mybroodminder.com](https://www.mybroodminder.com) portal. In this space, you can configure your apiary, your hives and assign your sensors to them. You can also visualize the raw data on fluid and interactive graphs.



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

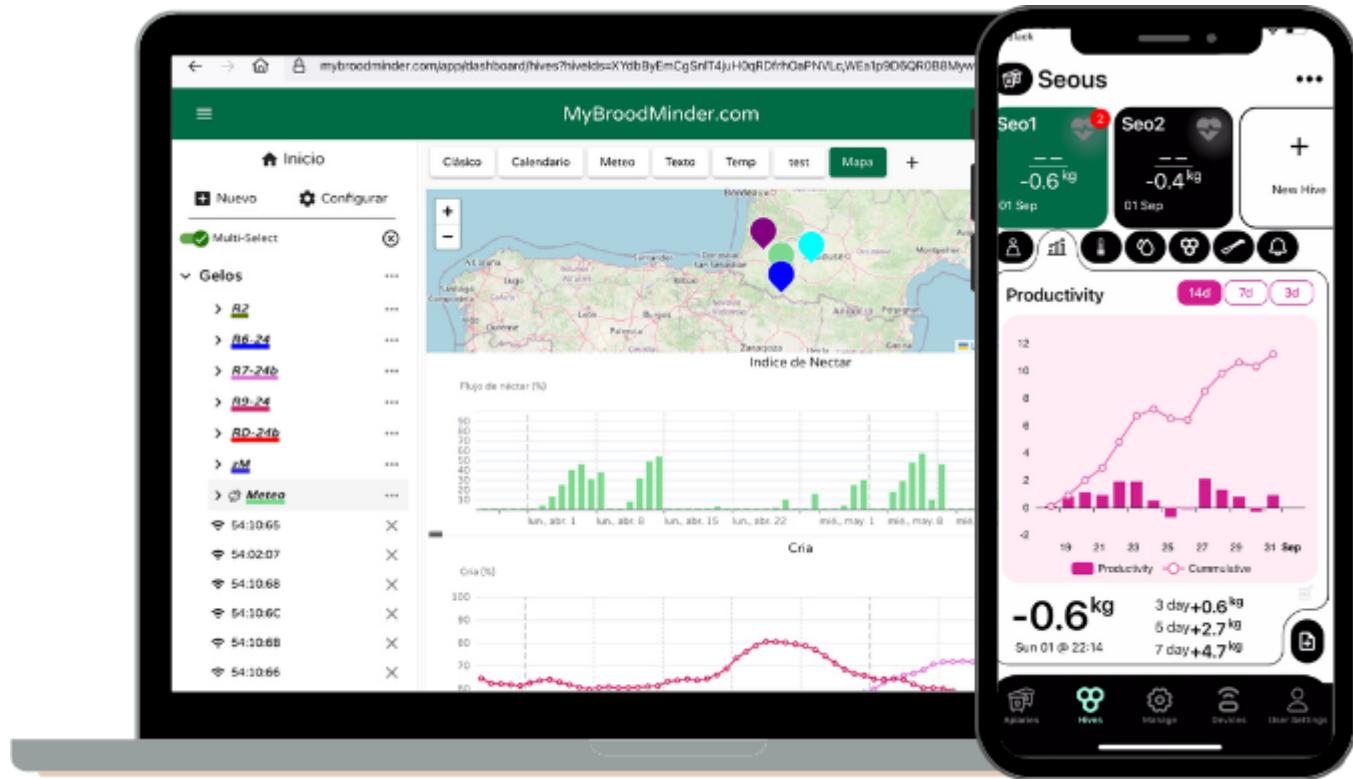
sensors and transmits them via the 3G/4G cellular network or WIFI to the cloud, where they are processed.



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.

3.1 Watch the videos

English	Spanish	French
Onboarding video	Primeros pasos con Broodminder	Démarrer avec BroodMinder

3.2 Read the doc

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

3.3 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.

Need help?

You can always contact us at support@broodminder.com.

3.4 START AT HOME



1. Install BroodMinder Bees App

Download [Broodminder Bees](#) from your AppStore or PlayStore.

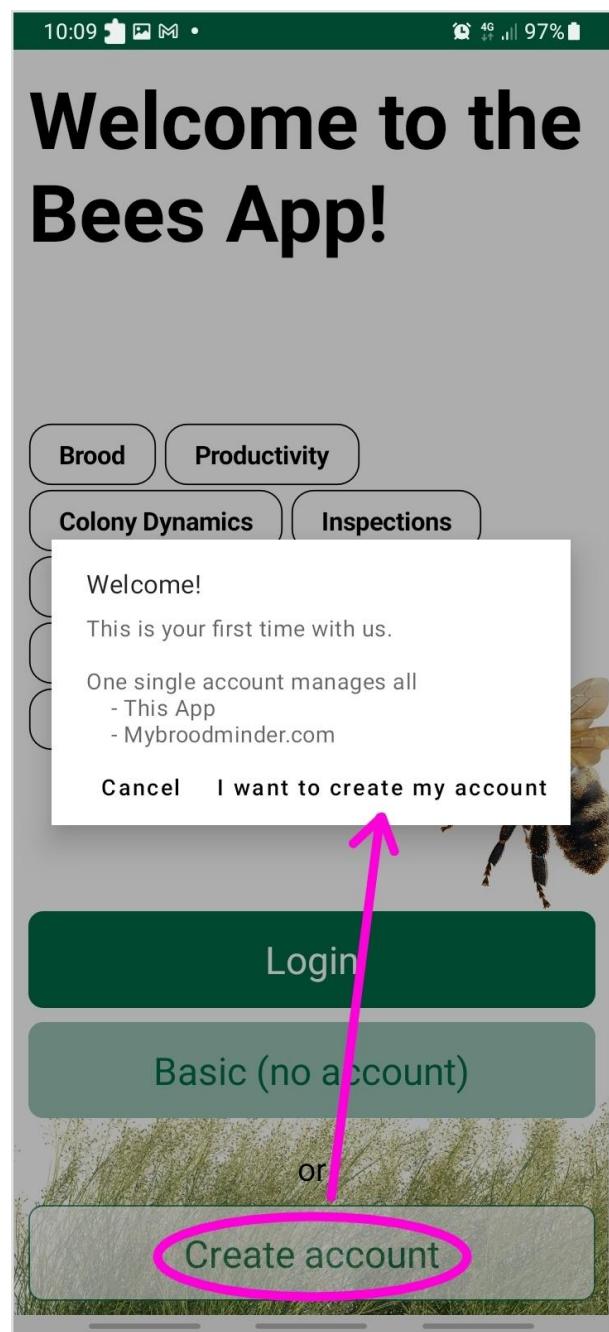
Scan this QR code to be headed to it :



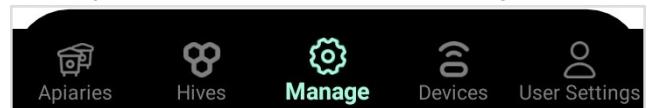
2. Create your account

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

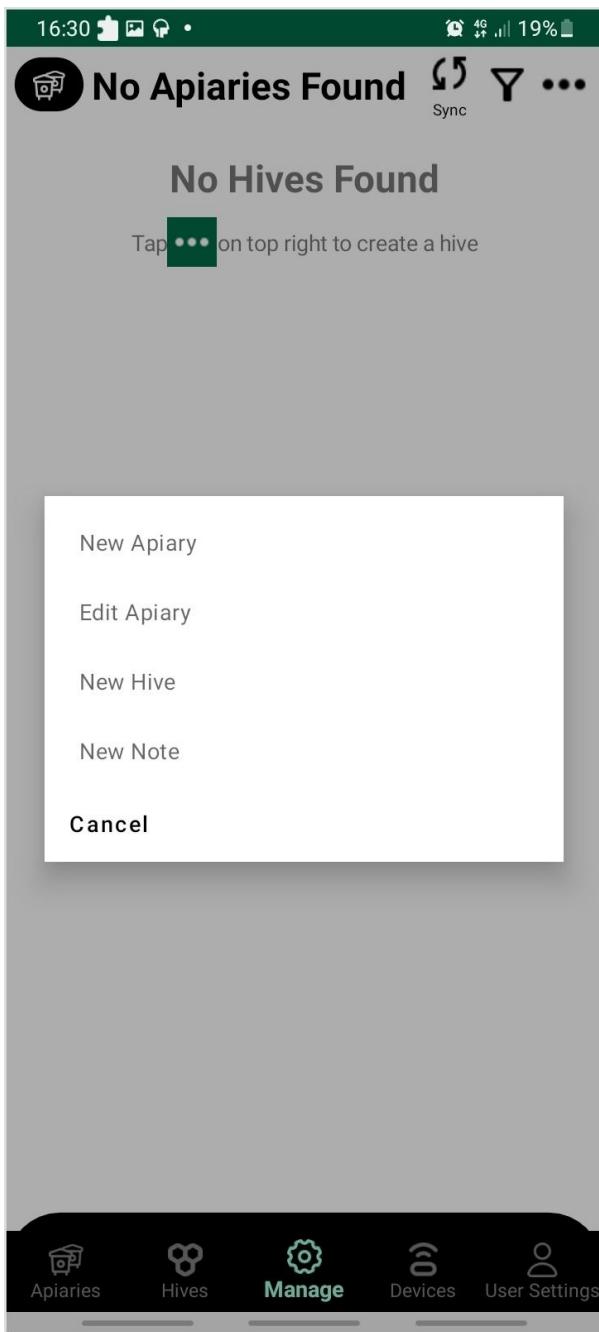
In BeesApp, on the Apiary tab, create your first apiary and your first hive, they will be needed for the next steps.



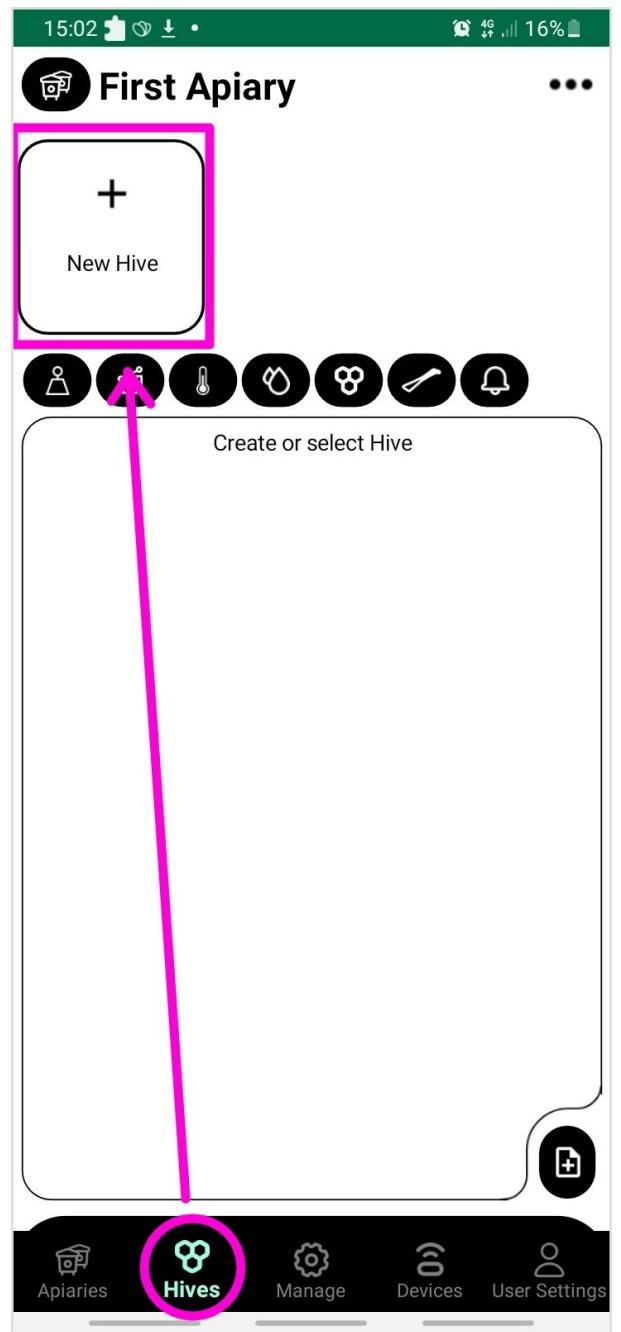
In Bees you have several tabs that we will navigate :



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



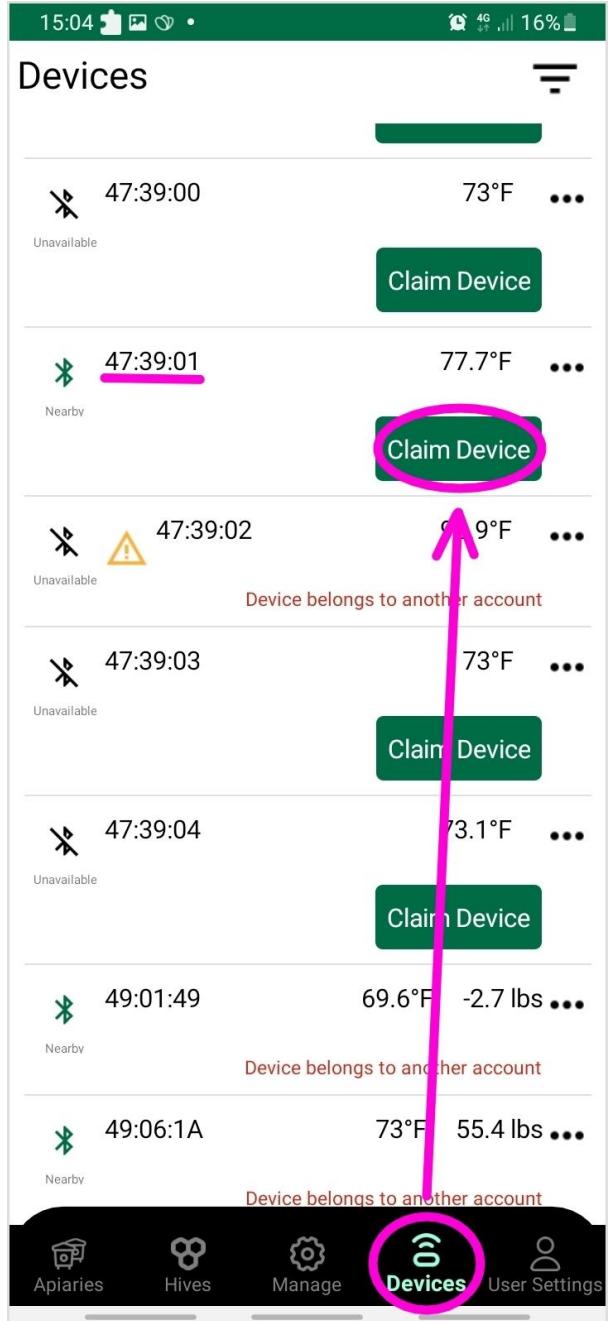
4. Assign devices to hives

⚠ Enable Location on Android

Android needs location services turned on to detect Bluetooth devices.
If you don't see any devices, make sure location is enabled in your settings.

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.



Device 47:39:01 was claimed successfully

Assign to hive now

Assign to hive later

15:05 4G 16%

Move to another hive

Apiary

Select Apiary

Hive

Select Hive

Location

Select Position

Start

6/18/2024 3:05 PM

Save

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.

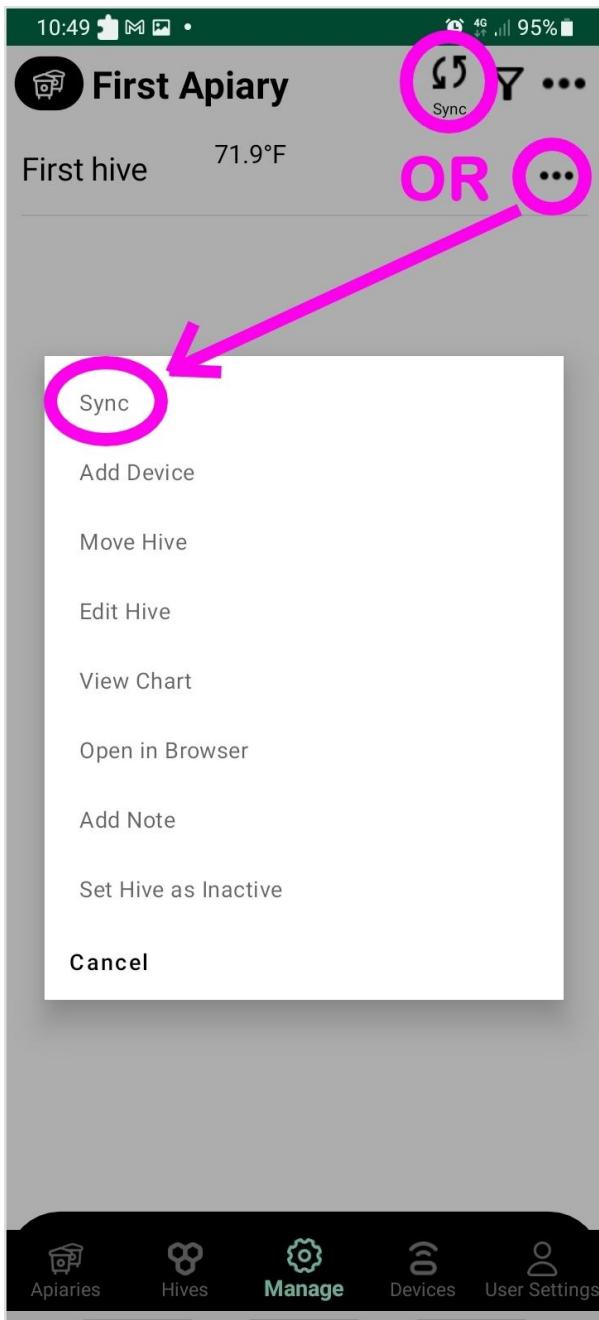
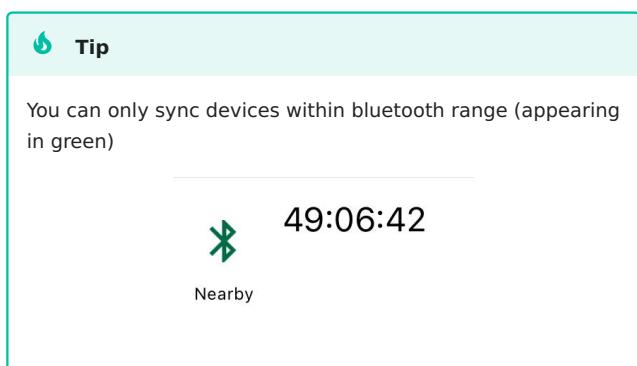
5. Make your first sync

First sync is important!

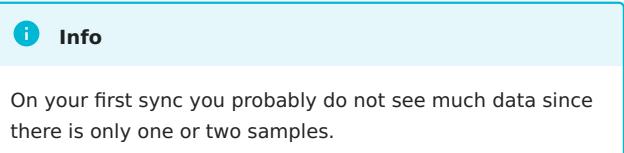
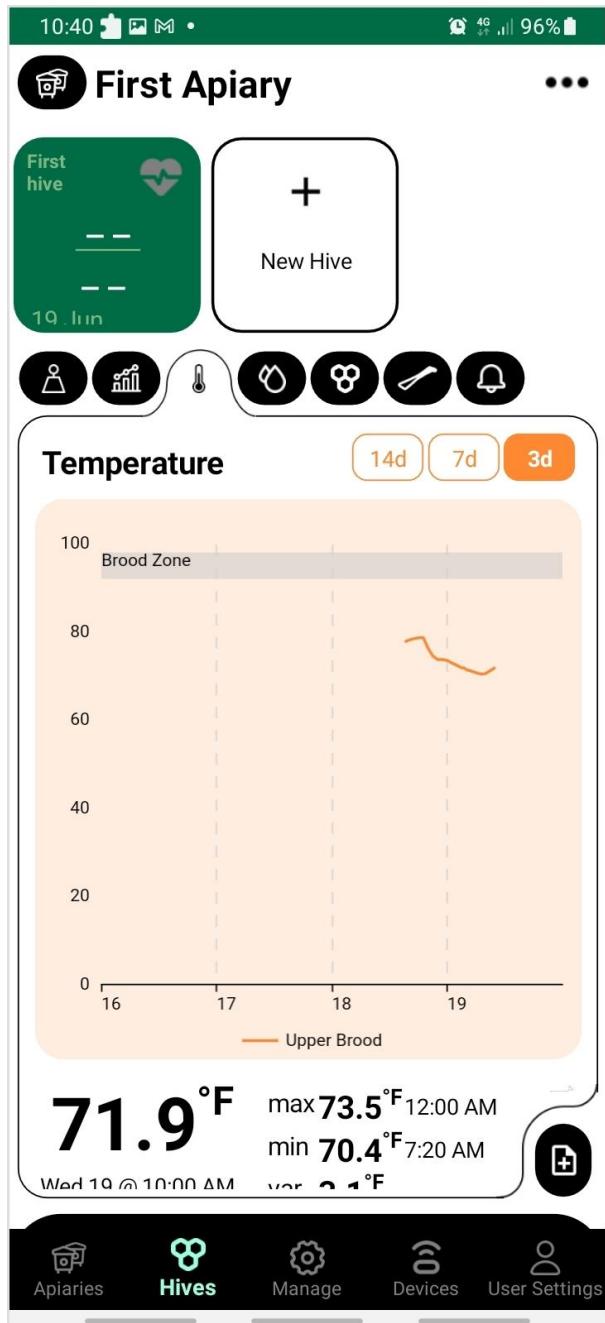
The first sync sets the device's date and time, ensuring that all recorded measurements are accurately timestamped. If you skip the sync when powering on the device, future syncs will still add timestamps, but earlier data may be shifted when calculated retroactively. For this reason, it's best practice to sync the device every time you power it on—such as after a battery change.

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



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



6. Power-On your Hub

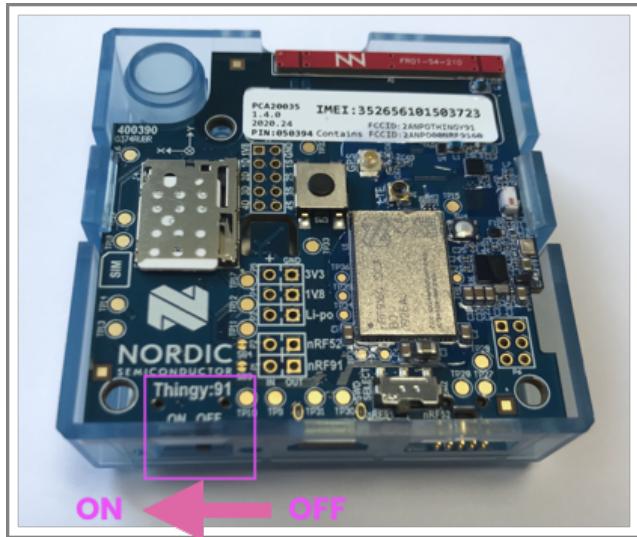
This stage is intended for those owning a Hub for real time monitoring. If you do not have a Hub, move to the [next chapter](#)

Remember from [Hubs page](#) that there are several hub versions:

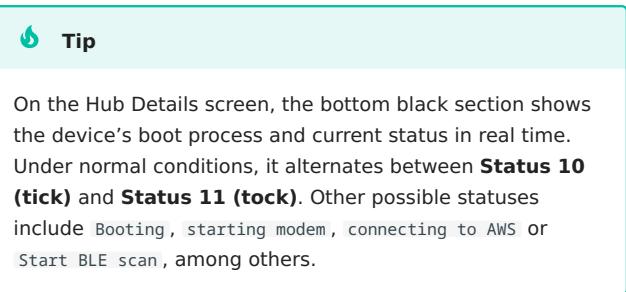
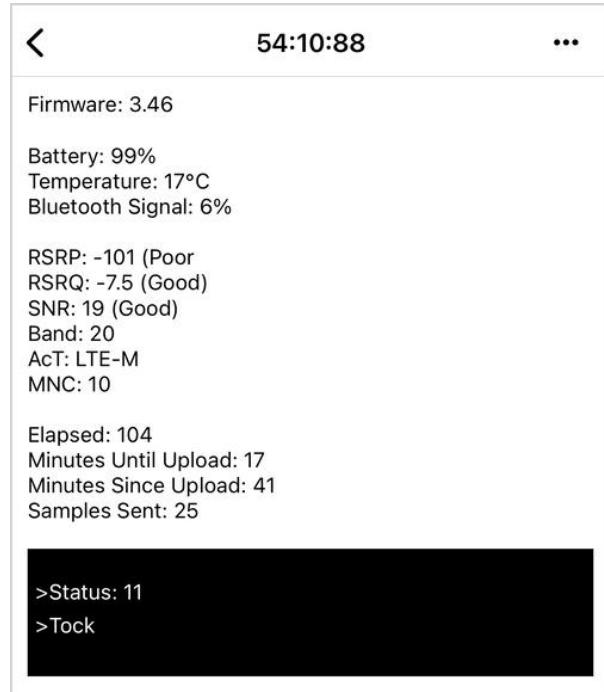
- Broodminder-T91 Cellular Hub [solar, weather, naked]
- BroodMinder-LoRa Hub
- BroodMinder-Wifi Hub
- BroodMinder-Sub-Hub

6.1 T91 Weather hub

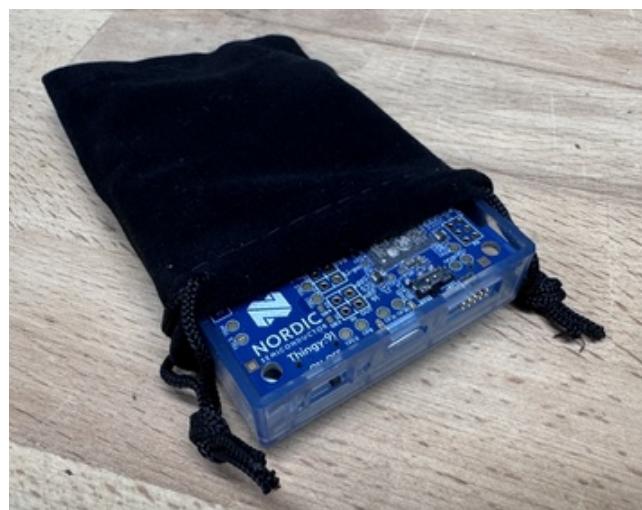
- Turn on the hub using the small black switch.



- The LED light will blink green, then turn solid blue for 5 seconds, and finally return to blinking green.
- 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.



- Install the velvet protective bag, making sure the power switch remains accessible through the opening.



⚠ The velvet bag is important!

The velvet bag serves two key purposes:

1. It prevents insects and bugs from nesting in your hub — the electronics are warm and can attract them.
2. It protects the electronics from direct sunlight, improving durability while still allowing airflow for temperature and humidity measurements.

- Insert the T91 within the weather shield .



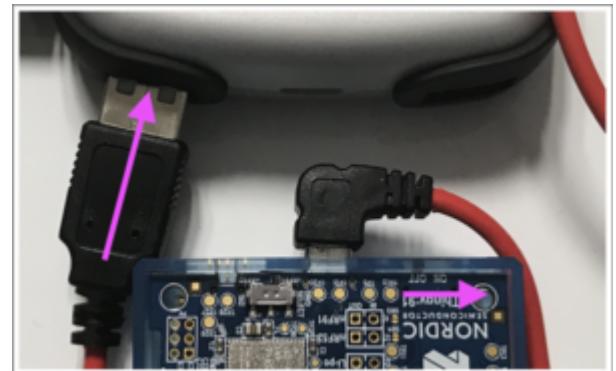
- Install the hub in your apiary using one of the available mounting options: tie wraps, screws, or an optional magnet.



6.2 T91 Solar hub version

Follow the same process as above, with the difference that you will have to plug in the USB to the battery (we ship unplugged 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.

3.5 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

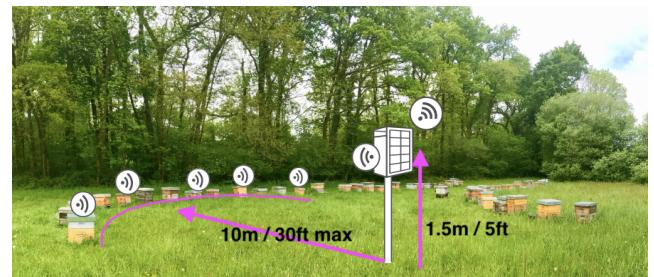
This step is optional and only applies to users with a Hub for real-time monitoring.

>About hub range and position

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 (~100ft)
- hubs should be installed at **1.5m (5ft) height from the ground** (Cellular and Wifi reception damps A LOT when close to the ground)

The best practice is to place the hub on a pod in the 10m range of your hives



An example using the weather shield magnet directly on a hive roof



Some examples with the solar version: on a pod, mural or even on hive



Once the hub is installed in its final location check again the connectivity

- Check hub connectivity with Bees App (in the devices Tab > hub ID > ... > Show details)
- You should have a "tick/tock" status.



9. Update start date/time

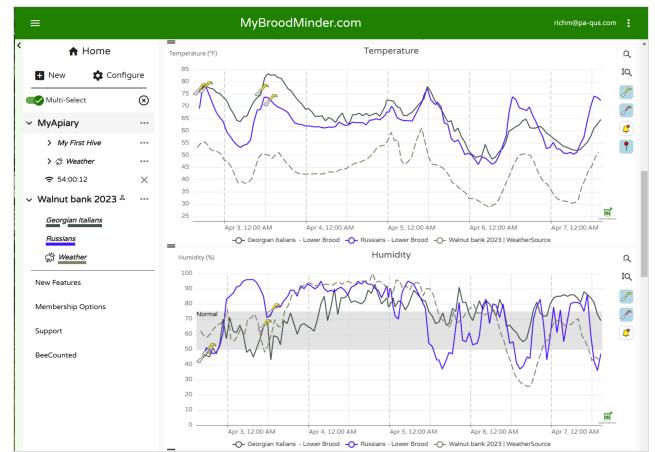
To avoid having measurements from outside the hive, change the start date of the sensors. To do so, go to BeesApp > Apiaries > unfold the hives to see the sensors > "..." > Change the current position. Edit the start date/time.



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.



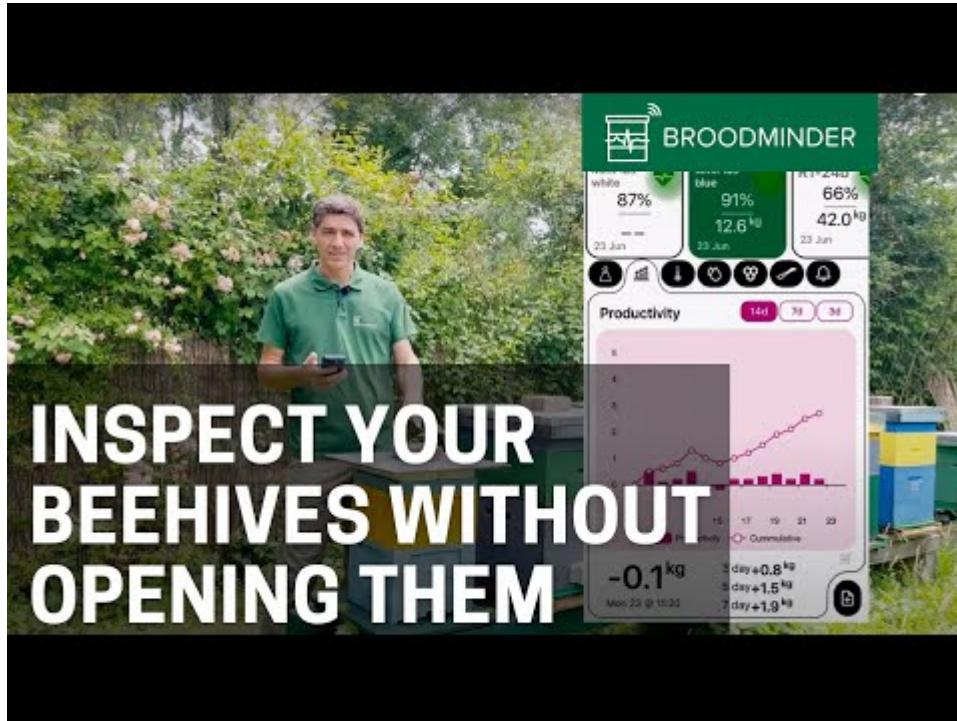
In this interface you will be able to follow the brood levels, the weight gains and losses, configure your alerts or even the past and forecasted weather as well as the nectar-flow indexes and much more!



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. Daily Use

The BroodMinder development team is made up of passionate beekeepers who have been using BroodMinder sensors in our own hives since 2015. Our apiaries vary in size, from just a few hives to over 75, all fully instrumented to enhance our beekeeping practices and make hive management more efficient. In this section, we will share how we utilize our devices and software, with the hope of providing valuable insights for your own colony management.

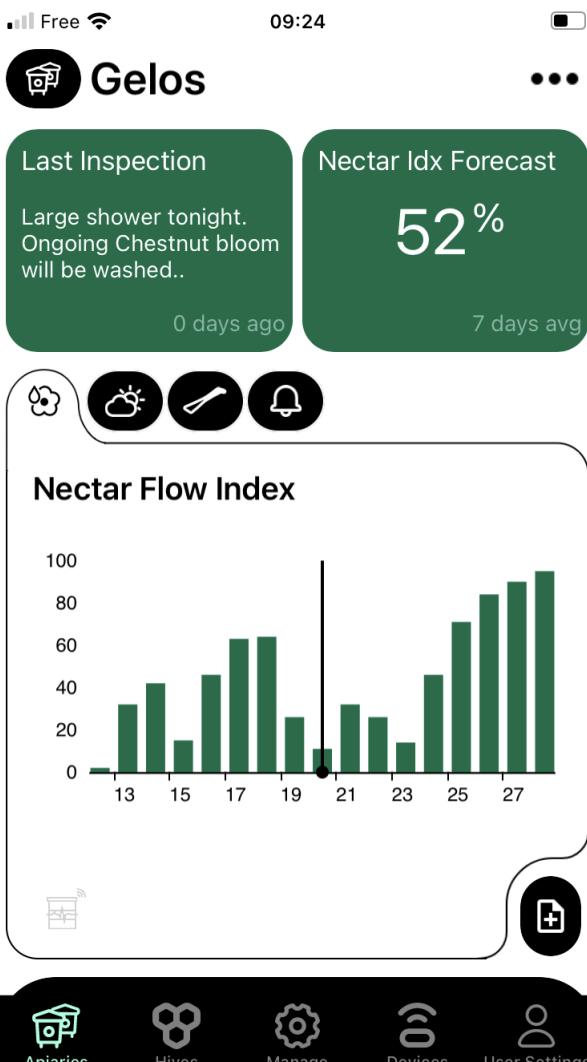


4.1 Typical Procedure for a Normal Checkup

In this guide, we will outline our usual procedure for a standard hive checkup, moving from general observations to more detailed inspections as needed.

Step 1: Check the Apiary

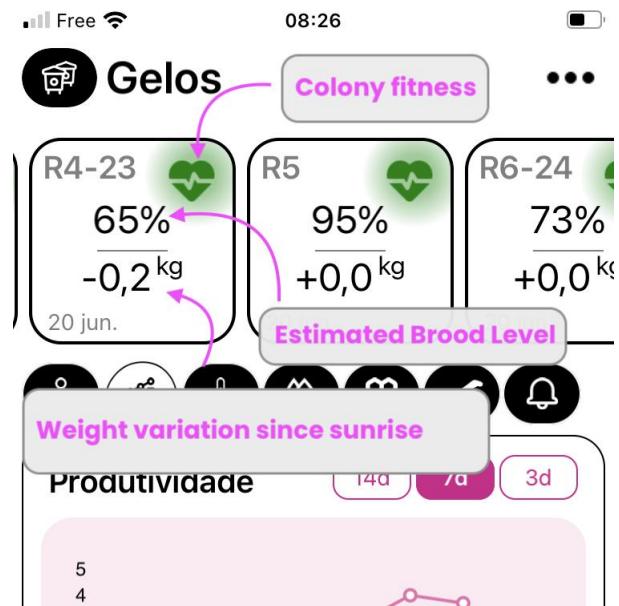
1. Check the Apiaries tab in Bees app.
2. Review the nectar flow index to see recent trends and upcoming conditions. This chart helps you decide whether to inspect, feed, or prepare for a nectar flow.
3. Review any apiary notes from your last visit and be aware of any alerts.



Step 2: Check Your Hives

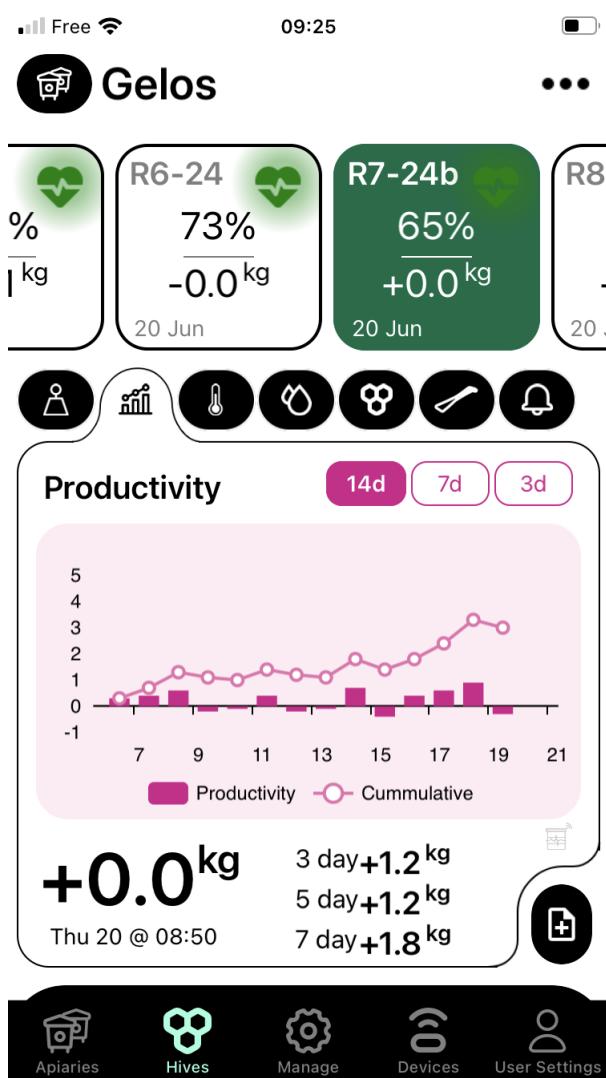
1. Move to the Hives tab, where all your hives are listed at the top. Each box represents a hive and displays key information:
2. **Estimated Brood Level:** Assesses colony strength.
3. **Weight Variation Since Sunrise:** Indicates daily activity.
4. **Hive Fitness:** A green/orange/red heart indicates the hive's health status. Notifications in the top right corner alert you to any abnormalities.

5. Review all hives and look for major disparities. Low brood levels can be normal in winter, but a single hive with low levels compared to others may need attention.



Step 3: Drill Down in the Hives That Need Attention

1. After getting an overall picture of the apiary and hives, focus on the hives that need detailed inspection.
2. Review available data to build a complete picture of each colony: weight, productivity, temperature, humidity, brood, your notes, and system alerts. Navigate through these tabs to diagnose each hive.



to assist in future workflows, such as queen replacement. Use voice-to-text on iOS and Android to speed up this task.

- Leave an apiary note with any items to check or cover during your next inspection.

Step 4: Update your Notes and Plan for the Next Inspection

- Once the inspection is complete, update the notes for each hive. We've simplified this process and included tags

4.2 Final Note

For a more detailed analysis, such as overlaying multiple hives or considering periods longer than 14 days, or comparing with weather conditions we recommend to use mybroodminder.com on a larger screen.

5. Sensors

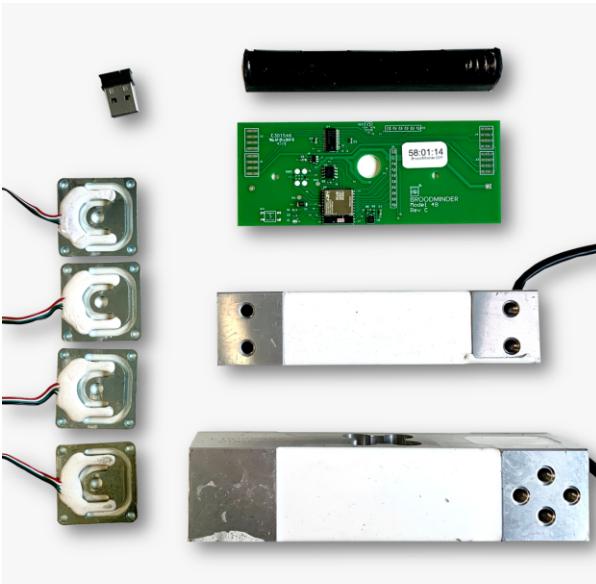
Before getting started let's get familiar with the different devices we will deal with.



Every device has a specific ID like for example '56:01:3f' the first two figures (56) are the model ID. In this case 56 corresponds to a Broodminder-TH device.



Product	Model	Name	Description
	47	Internal sensor T	Small sensor, big benefits. The best tool for monitoring hive dynamics.
	56	Internal sensor TH	Temperature and humidity, all in one.
	57, 43	Scale W	Ideal scale for hobby beekeeping. Best value for money.
	49	Scale W4	Scale for migratory beekeeping, adaptable to a wide range of

Product	Model	Name	Description
			supports. Tough as nails
	49	Scale DIY	A do-it-yourself kit for DIY beekeepers.
	63	BeeDar	A Radar to track bee activity during the day.
	52	SubHub	The subHub is both a data hub and a transmission relay.

Product	Model	Name	Description
			
	60	Hub Wifi	Ideal if your hives are close to a Wifi network.
	54	Hub 4G	Optimal connectivity with multi-operator SIM card.

Product	Model	Name	Description
	54	Hub 4G Weather	Two in one: Data transmission AND weather station (temperature, humidity and pressure)
	54	Hub 4G Solar	Endless autonomy with this version boosted with a solar kit.

..../assets/60_hubs.assets/WIFI_Hub.jpg

5.1 Installing your BroodMinder

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

The first BroodMinder -TH (Temperature and Humidity) is placed on top of the frames in the upper brood box. Insert centered from the back of the hive as far as it will go with the tab sticking out.

The second BroodMinder-TH or -T2 is placed on top of the frames in the lower brood box. Insert centered from the back of the hive as far as it will go with the tab sticking out.

Support the back of the hive with an auxiliary support

Place the Hive Scale under the front of the hive with the Device ID label facing to the right as seen from the back. Install on the shady side of the hive.



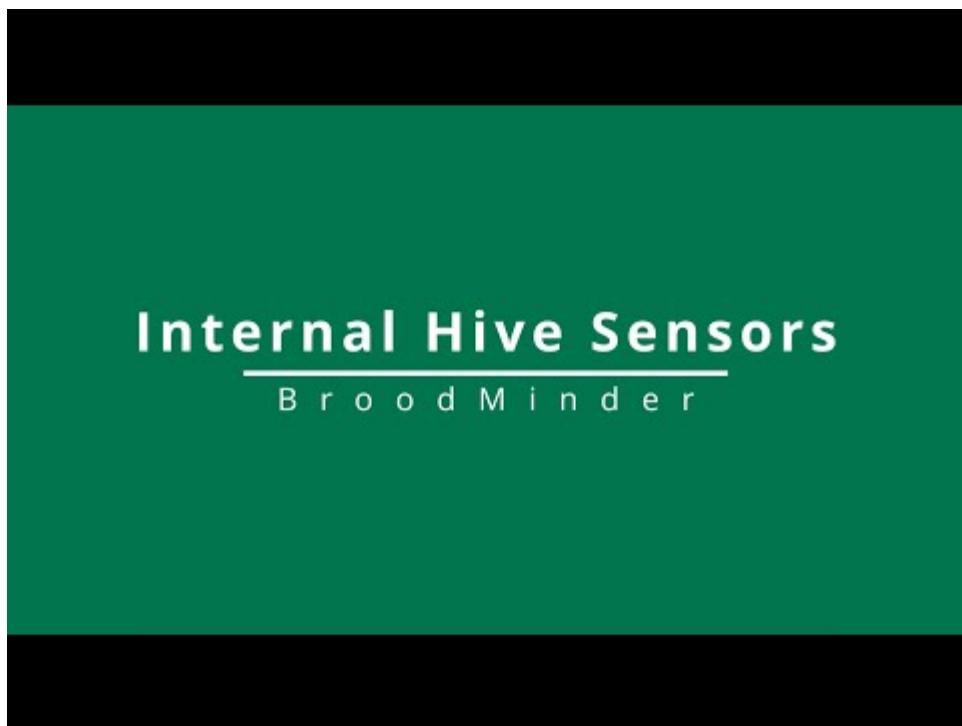
6. BroodMinder TH & T



6.1 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.

6.2 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).

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 scanning for sudden thermal variations. It enters a decision loop that depending on how in-hive conditions evolve, might end-up triggering a Temperature 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.

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.

6.3 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:

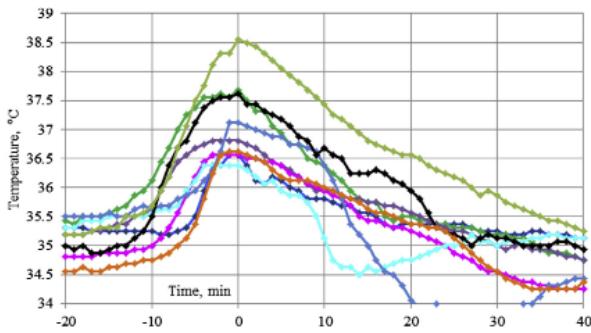


Fig. 2 – Summary of temperature dynamics during registered swarming events normalised by the moment of maximal temperature (time point zero).

And here is an actual swarm trace:

>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!)

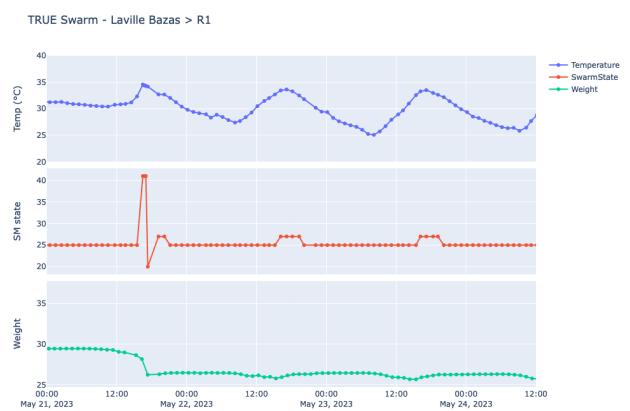
SwarmMinder

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.



We can note the temperature peak in the afternoon of May 21st. 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

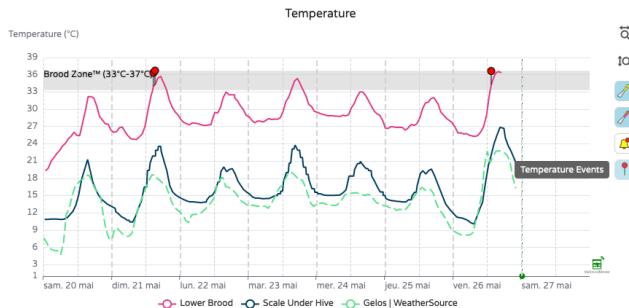
SwarmMinder delivers Temperature Events and not Swarm events because so far the events triggering might be from different sources, and not only swarms. Other SM triggers might be:

- a pre-swarm some days before
- a beekeeper inspection (exposing the internal sensor to the sun)
- a very steep ambient temperature variation and/or a low insulated hive

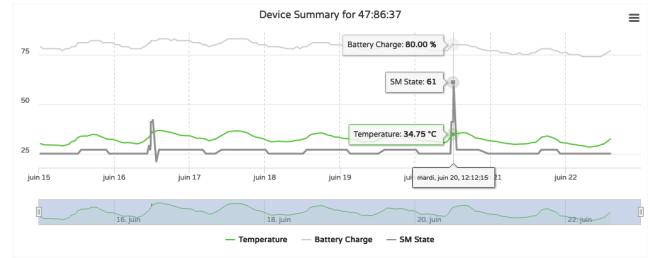
SwarmMinder events display

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 needles displayed on the temperature curve. And you can choose whether 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 whole 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.

Data Editor

Zoom chart or click point to filter readings below.

Select readings to remove in table below

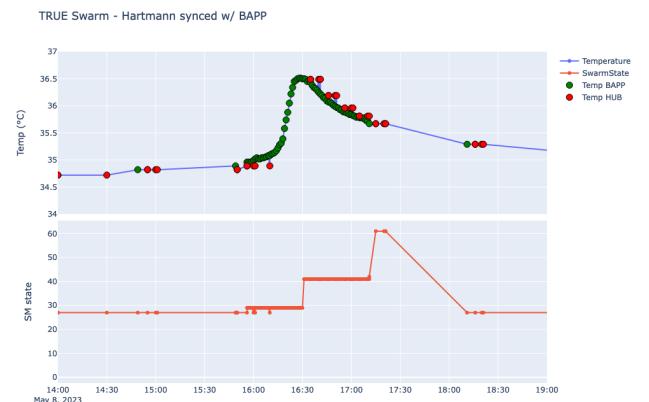
Remove	Epoch	Timestamp	Sample	Rssi	Source	Battery	Temp	SM State
<input type="checkbox"/>	1667435836	22/06/2023 14:10	4911	44	WFC	77%	32.38	25
<input type="checkbox"/>	1667432313	22/06/2023 13:11	4910	60	WFC	76%	31.15	25
<input type="checkbox"/>	1667428636	22/06/2023 12:10	4909	60	WFC	75%	29.94	25
<input type="checkbox"/>	1667425113	22/06/2023 11:11	4908	54	WFC	74%	29.52	25
<input type="checkbox"/>	1667421512	22/06/2023 10:11	4907	50	WFC	74%	28.85	25
<input type="checkbox"/>	1667417835	22/06/2023 09:10	4906	64	WFC	74%	28.75	25
<input type="checkbox"/>	1667414311	22/06/2023 08:11	4905	54	WFC	74%	28.44	25

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.

7. BroodMinder W



7.1 Broodminder-W (57)

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

The first W was released in 2017, it was model 43 and lasted for 5 years until 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 3/4" 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 $\frac{1}{2}$ 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

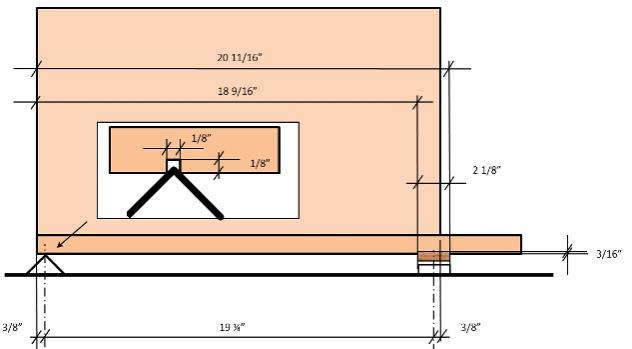
A better way to install will require a few modifications to your bottom board. You will make a couple of small cuts that will be used to accommodate precise and repeatable placement of the scale and support.

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 workaround 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](#).

8. Overview



Broodminder-W3 (49) This scale is a full hive scale that you can build yourself. It is the entry point to the DIY (Do It Yourself) in Broodminder.

It is available in 3 versions

1. Fully assembled
2. Partially-assembled & calibrated
3. Parts kit

The BroodMinder-W3 uses 4 force sensors to weigh the entire hive and sits on top of the bottom board for fast, convenient installation.

- 200kg (400lb) total hive weight measurement
- 0.01 pound (5 gram) resolution
- 4 Temperature compensated weight sensors. (4 @ 70cm (30") lead length)
- Stores weight once per hour for 5 years (user configurable)
- Replaceable 2xAA batteries last 5 years
- 16.5" x 20" x 2.25" Pine construction (assembled version only)

The "Fully assembled scale" is ready to place under the hive.

The "Partially assembled, calibrated, fixed feet" version contains all of the parts needed to assemble a hive scale except for the 2x4 support pieces. All of the soldering and electronics are assembled and calibrated in our workshops in Wisconsin/France.

Also a swivel foot version of that kit "Partially assembled, calibrated, wooden support, swivel feet"

We now have a "Partially assembled, calibrated, Apimaye swivel feet" version which works well for Apimaye hives. Watch the video here to understand the differences.

The "Parts kit, unassembled, uncalibrated" version contains all of the parts needed to assemble a hive scale except for the 2x4 support pieces. Soldering and calibration are required as described in the following user guide sections.

1. [Board Assembly](#)
2. [Mechanical Assembly](#)
3. [Scale calibration](#)

We know this can raise questions, feel free to reach out.

If you are thinking on another scale architecture that would better fit your needs, check the [BroodMinder-DIY](#) section for deeper considerations.

9. 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

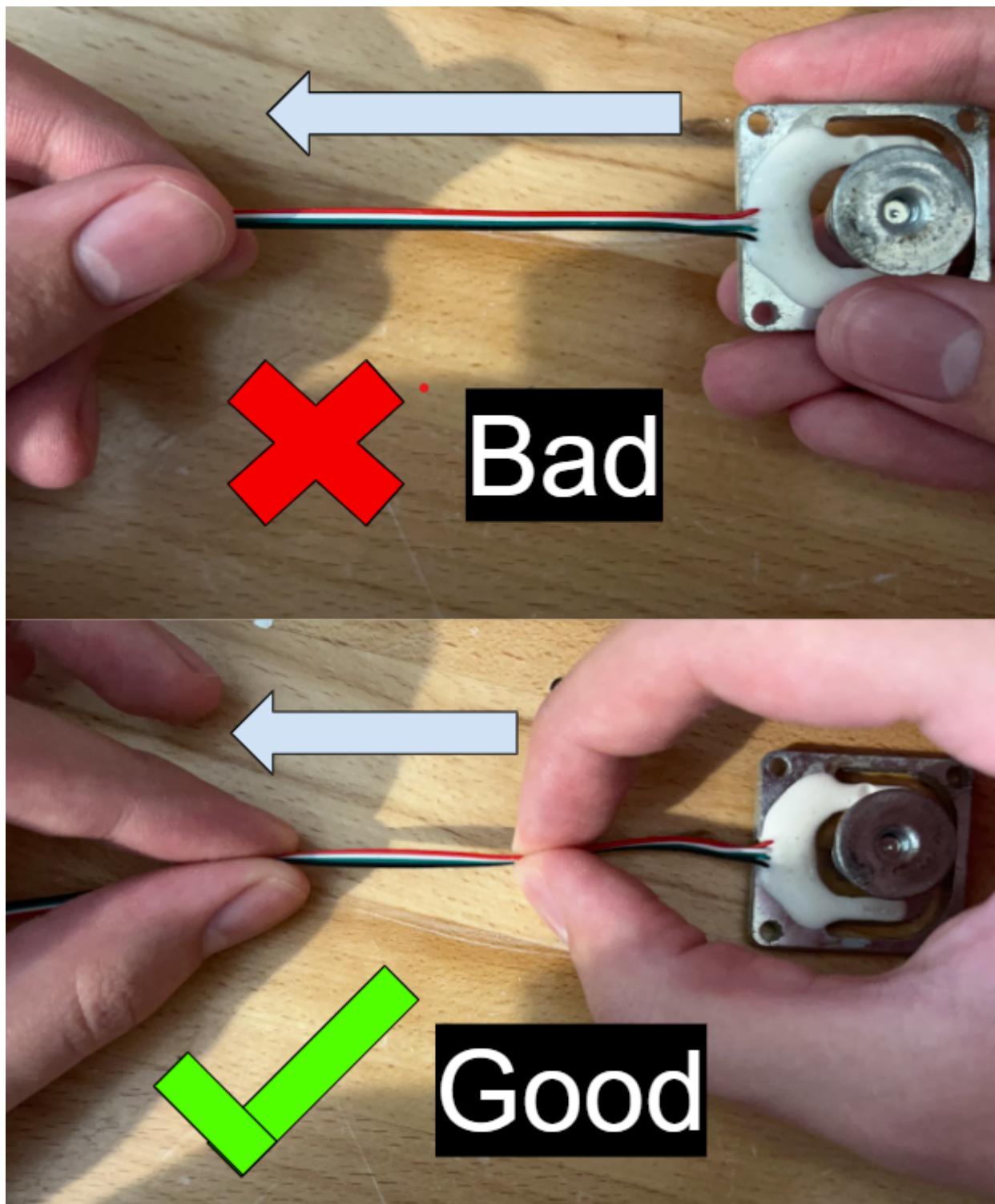
If you purchased a **W3 Unassembled-Calibrated** scale, all your electronics work is already done and you can jump straight to the next section : [Scale Assembly](#)

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.

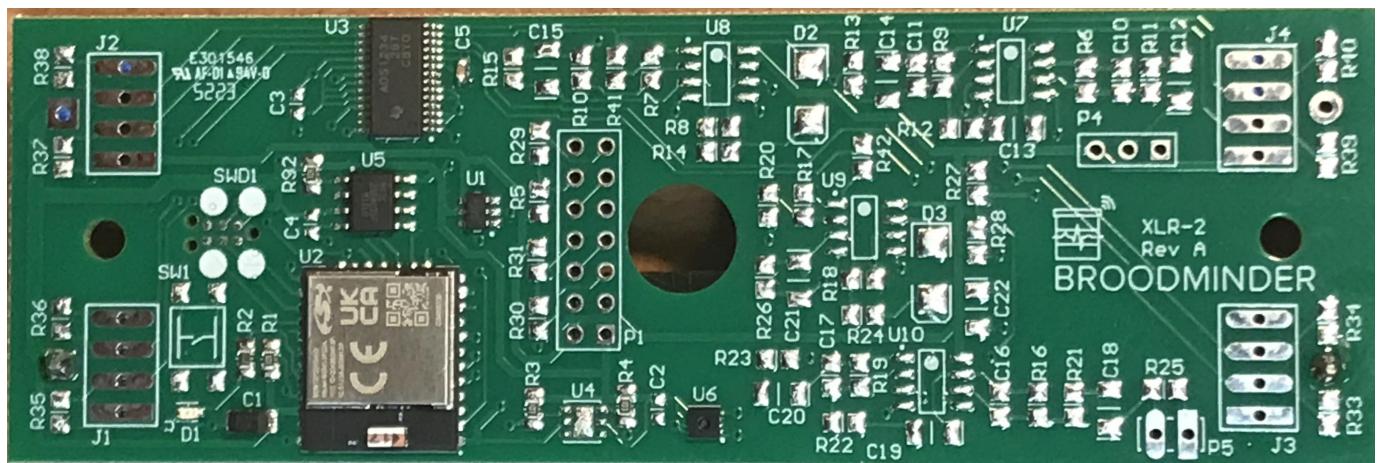
When working with the wires, it is recommended to use two points of contact as shown in the pictures below to avoid the connections being strained directly.

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



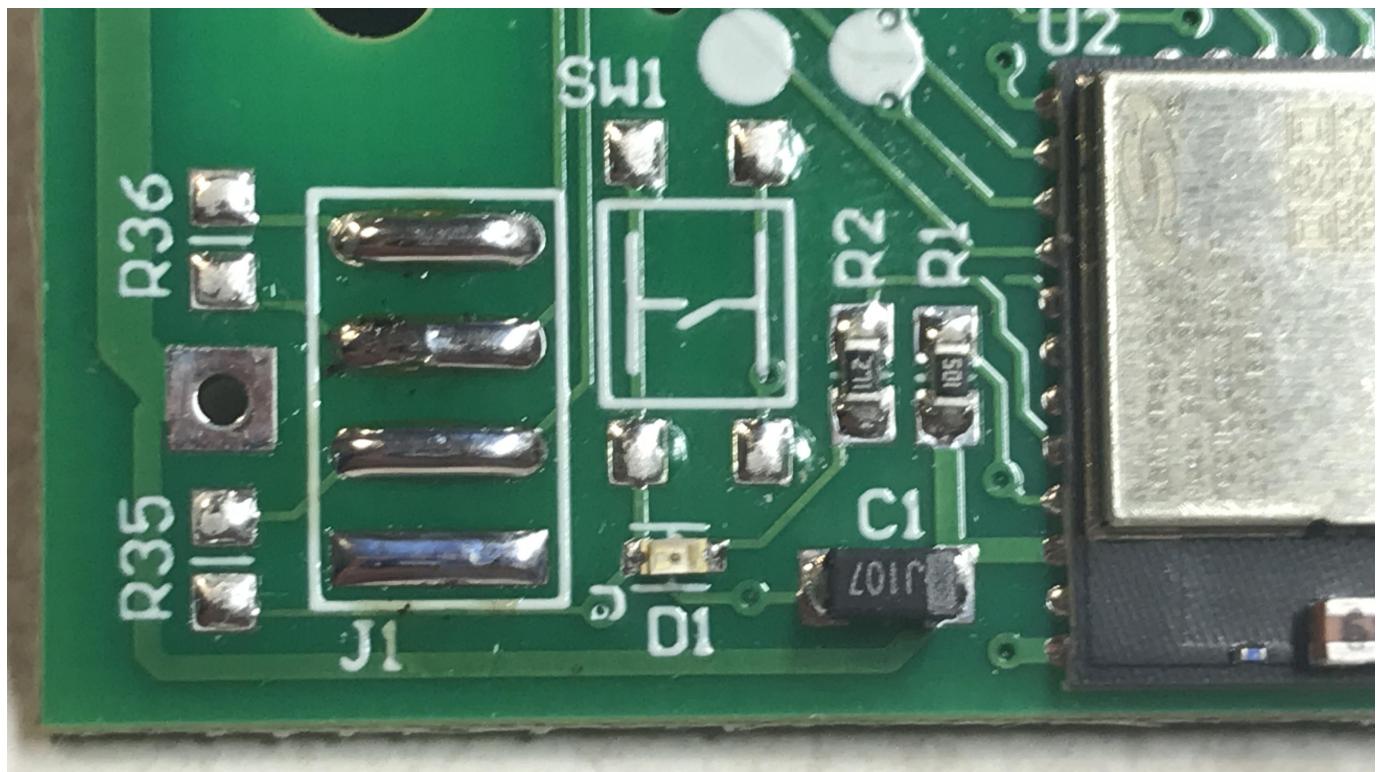
9.1 Get started with the circuit board

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.



9.2 Prepare the board

- tin all 16 pads on a flat surface

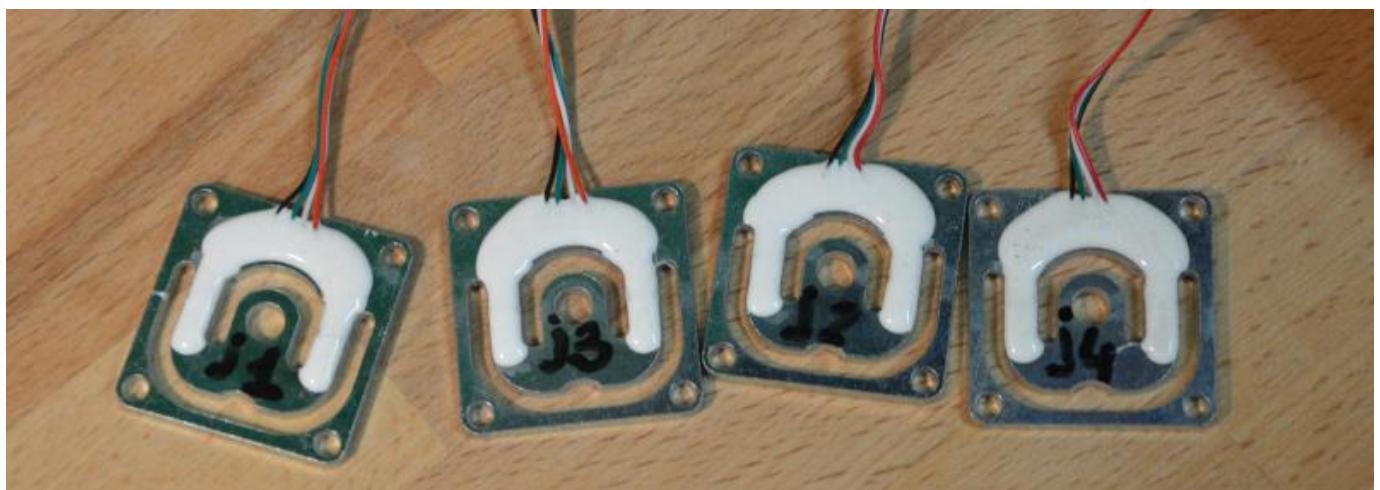


- solder the battery holder on the BAT2 slot (+ goes with the square pad)



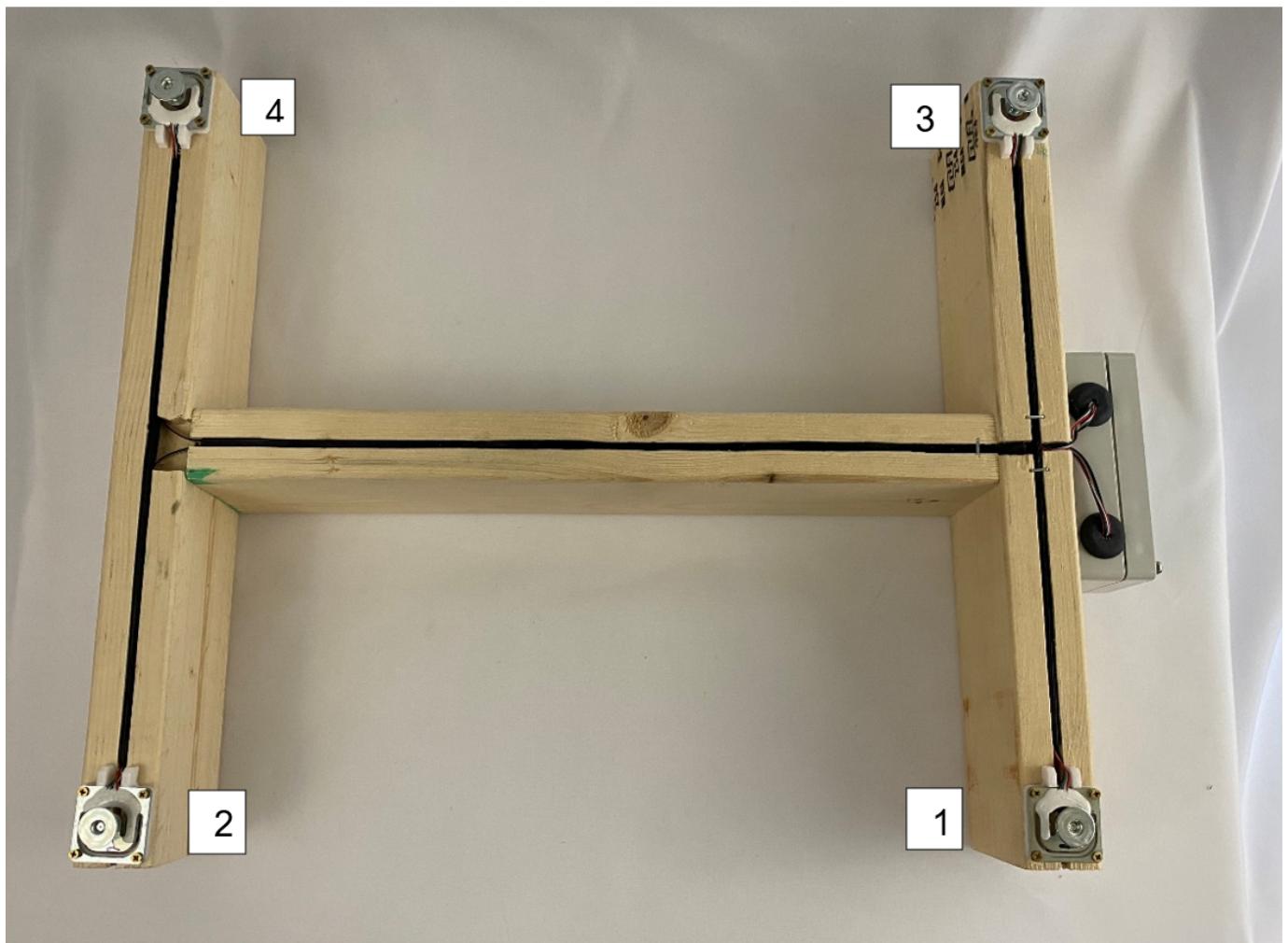
9.3 Prepare the load cells

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

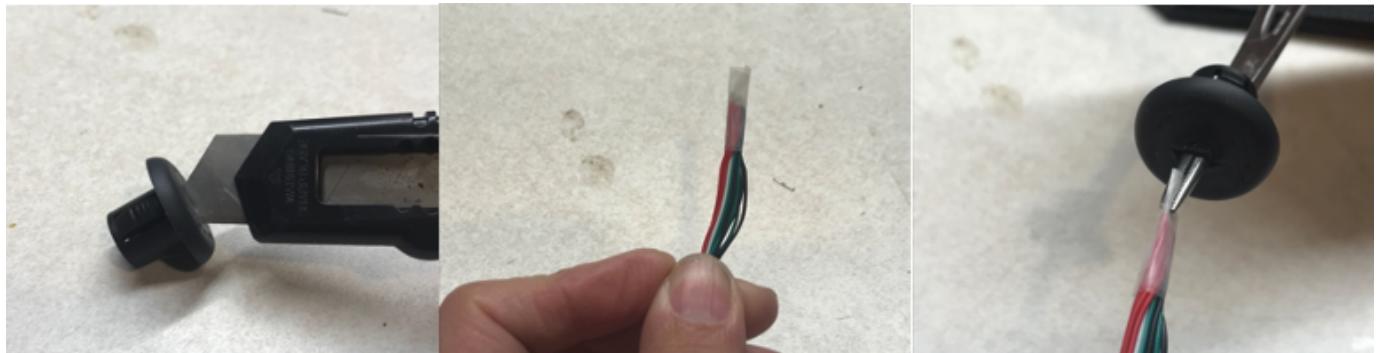


Remember :

	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

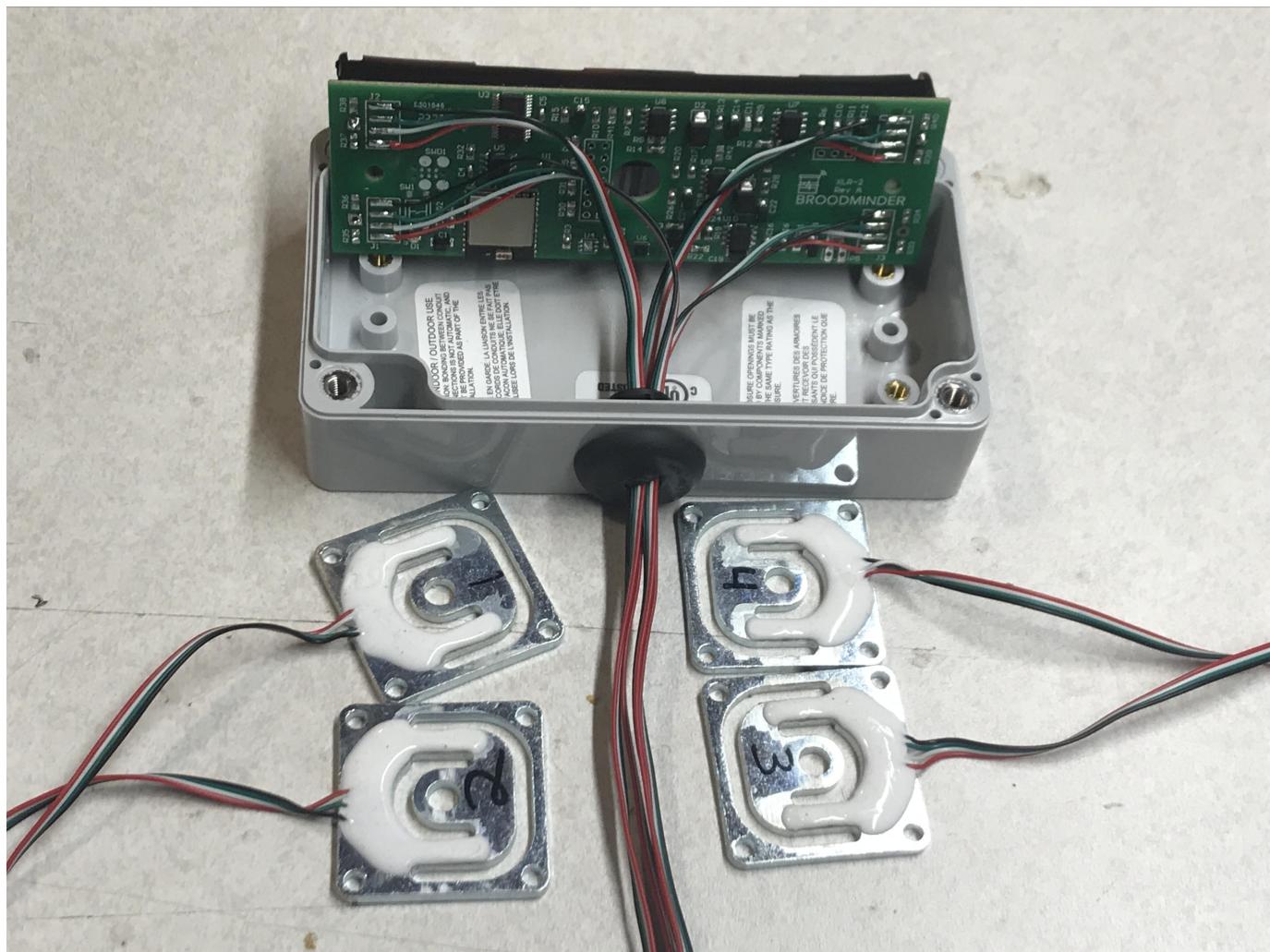
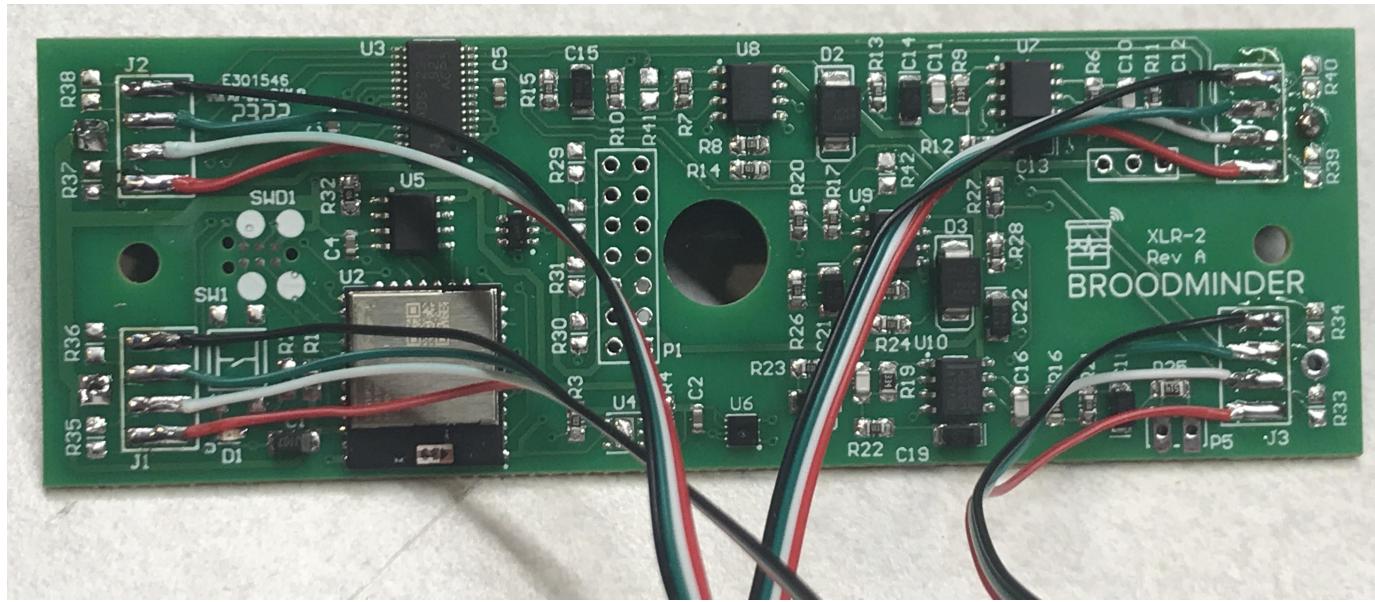
Note

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).

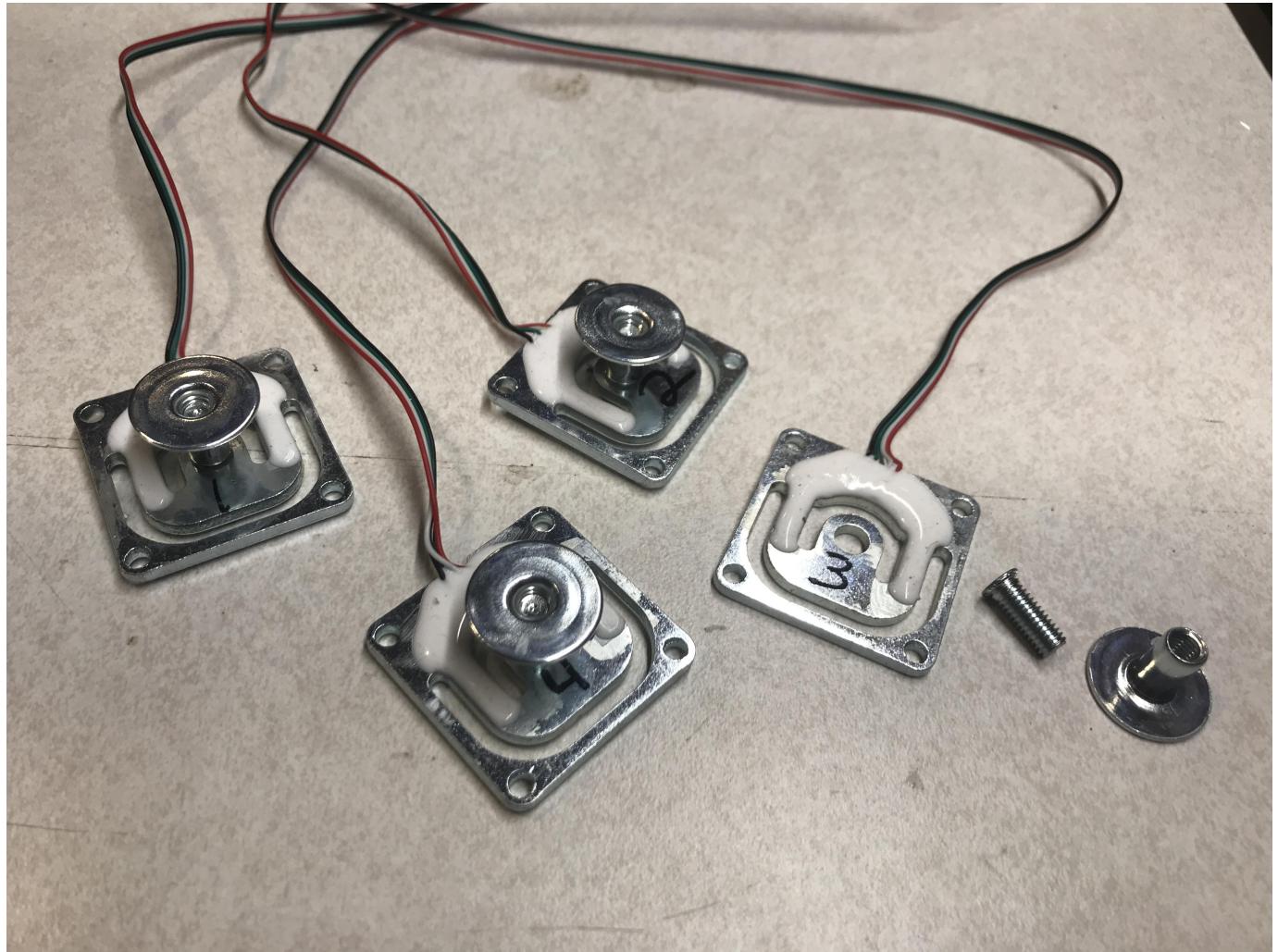


9.4 Mount the scale feet

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.



9.5 Mount the scale structure

Go to next chapter : [W3 Scale Assembly](#)

10. BroodMinder-W3 Kit Guide

10.1 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

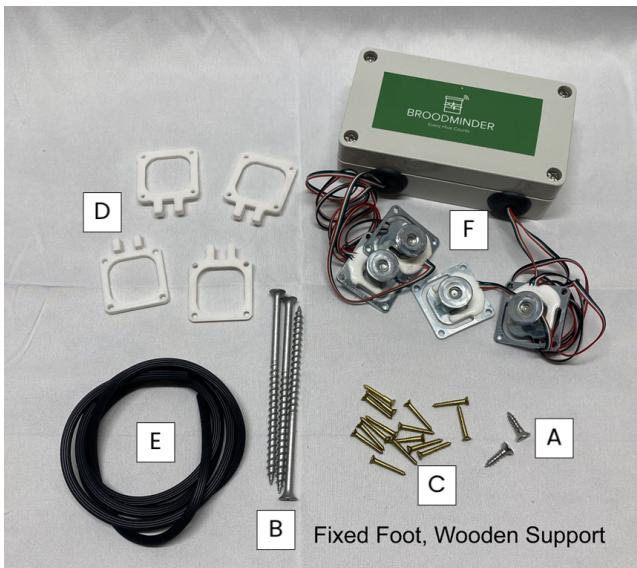
We suggest that you watch the videos from Section DIY/W3 in the [video Library](#).

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.



10.2 BroodMinder-W3 Assembly - FIXED FEET

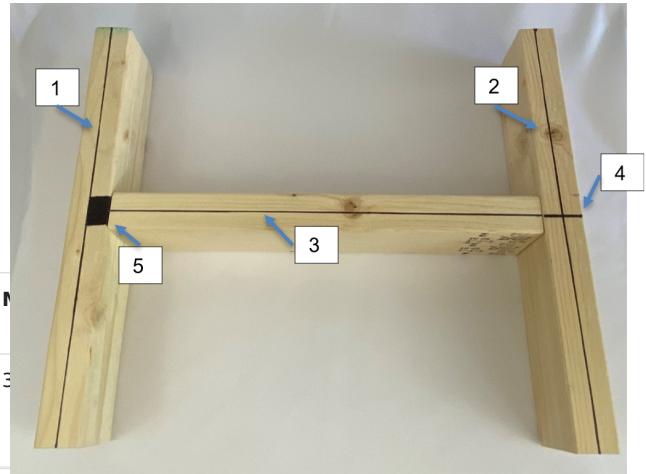
Hardware



Reference	Item Description	Qty	Notes
A	Phillips Flat Head # 7 x 5/8"	2	
B	#8x4" Drywall Screw (W3PA & W3UA)	3	4x70
C	#3 3/4 Phil Brass Flat Wood Screw	16	3x20
D	Load Cell Custom Support	4	 Note It is recommended to use a 5/32th drill bit or similar for holes before drilling in the nails. A 1/8th drill bit or similar may result in stripping the nail when attempting to drill the nail from being fully drilled into the wood.
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

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.



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

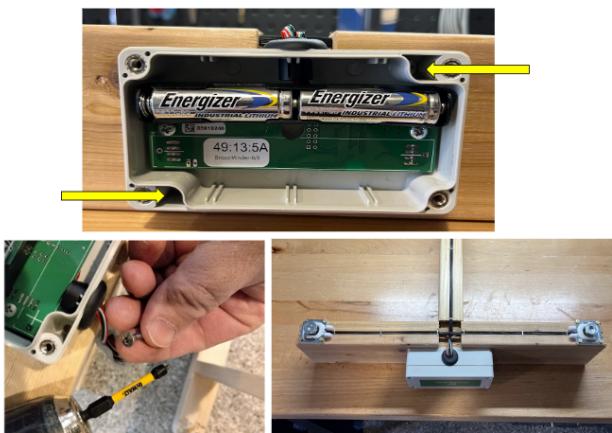


To assemble your frame, make sure you have a flat surface and ensure your pieces are square. Follow the picture above for the correct orientation of the boards.

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.

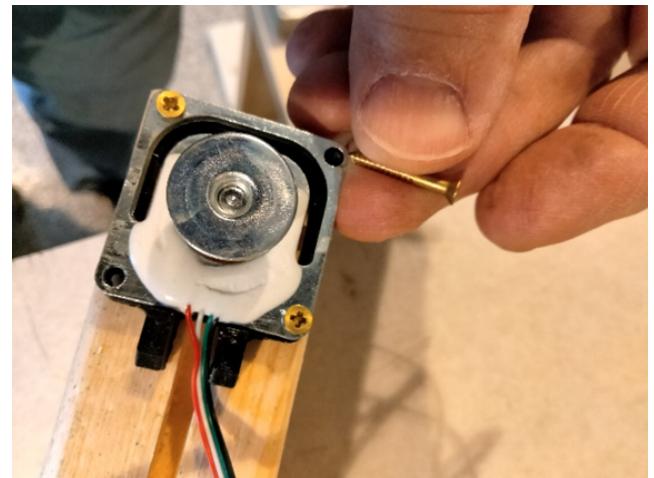


Sensor Mounting

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 sensor 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 grooves cut in the wood.

To deal with any extra wire:

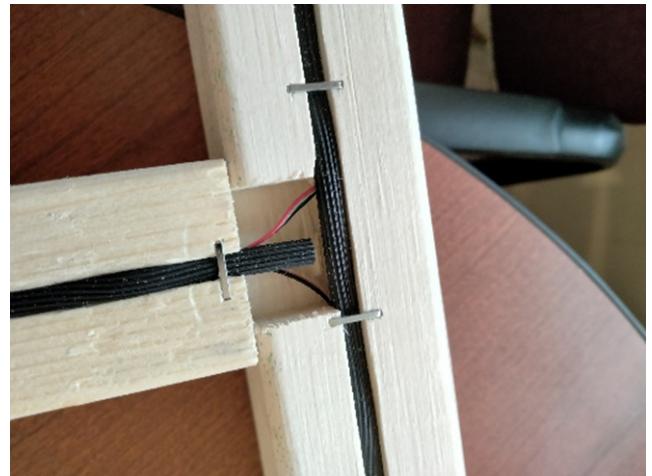
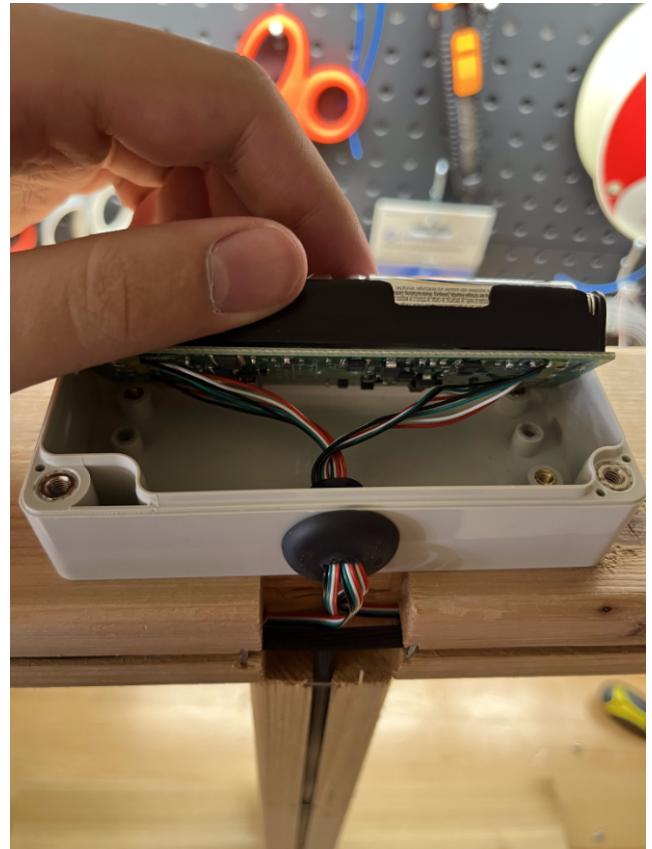
- Unmount the circuit board from the electronics box by removing the two screws on either end of the board.
- Pull the slack wire through the grummit and fold it so that it sits behind the circuit board.
- Remember not to put any stress directly on the connections for the wires if possible, as that has 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 grooves 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 doesn't come loose or fall out in the future.

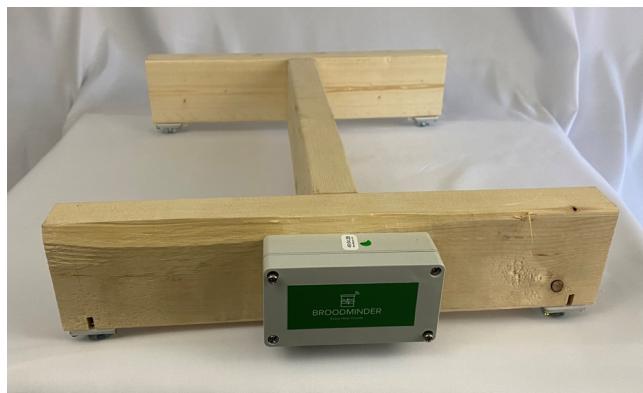
 **Note**

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



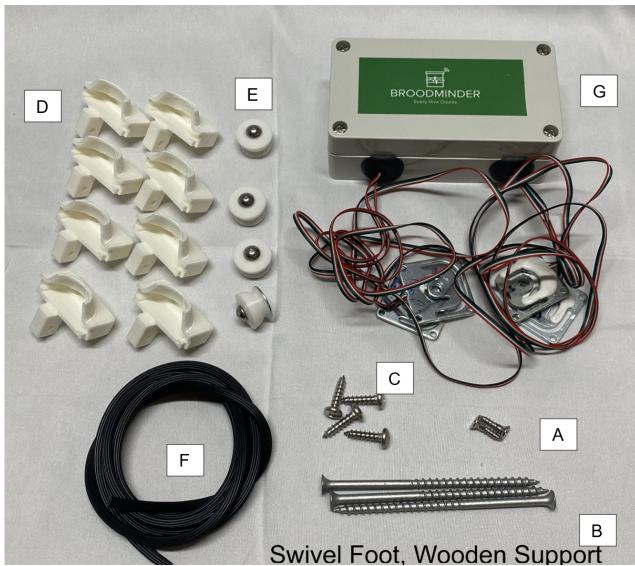
Finish and Enjoy

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



10.3 BroodMinder-W3 Assembly - SWIVEL FEET

Hardware

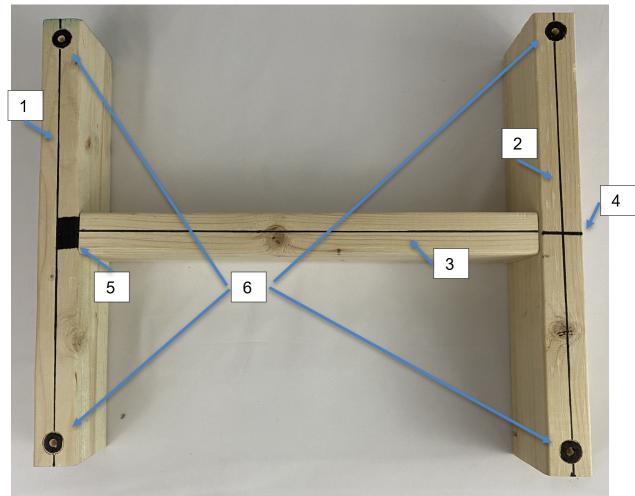


Item Description	Qty
(Picture A) Phillips Flat Head # 7 x 5/8"	2
(Picture B) #8x4" Drywall Screw (W3PA & W3UA)	3
(Picture C) #10 3/4" SS Round Head Screw	4
(Picture D) Load Cell Custom Support	4
(Picture E) Swivel Feet	4
(Picture F) Spline Material	1
(Picture G) Electronics Assembly	1
16.5 Inch Pine 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, $\frac{3}{4}$ " holes. The centers should be $\frac{3}{4}$ " from the edge and $\frac{3}{4}$ " 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.

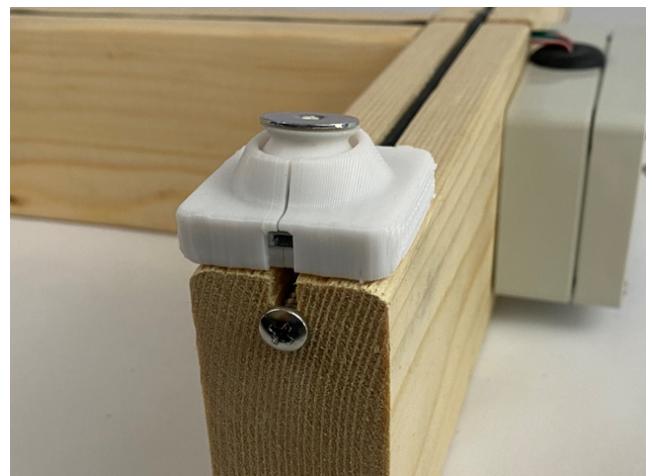


To assemble your frame, make sure you have a flat surface and ensure your pieces are square. Follow the picture above for the correct orientation of the boards.

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

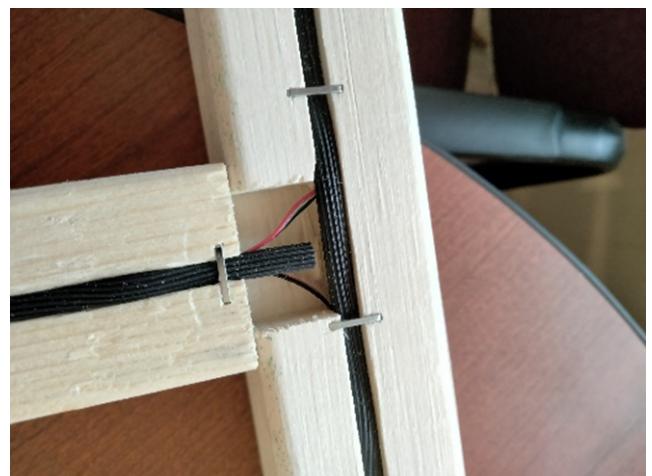
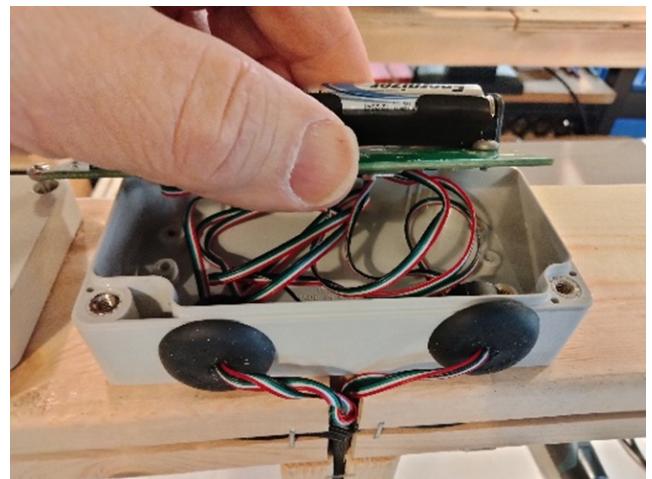
Attach the electronics box

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.

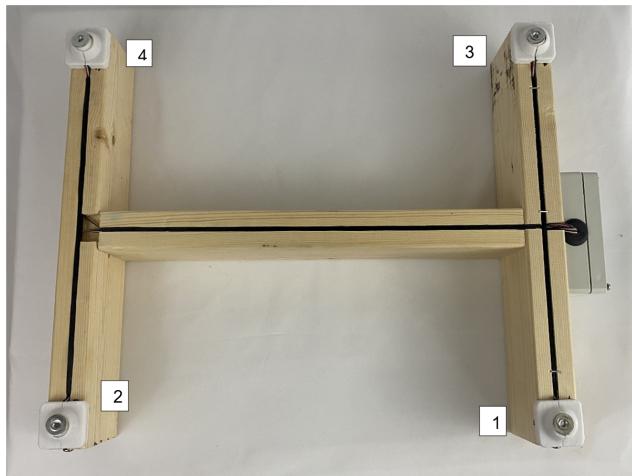


Wire Routing

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.



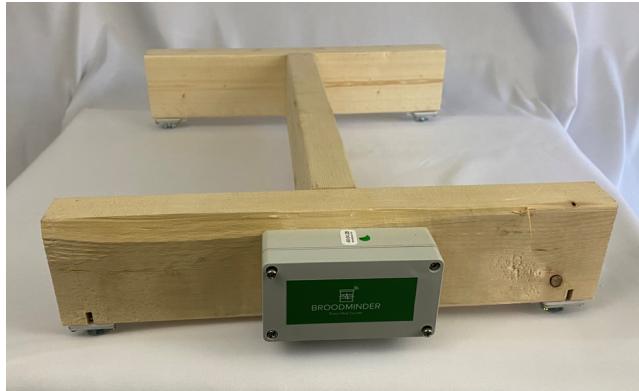
Sensor Mounting



Use 1 "C" screws per sensor.

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

10.4 Appendix: Update fixed feet W3 scales to swivel feet

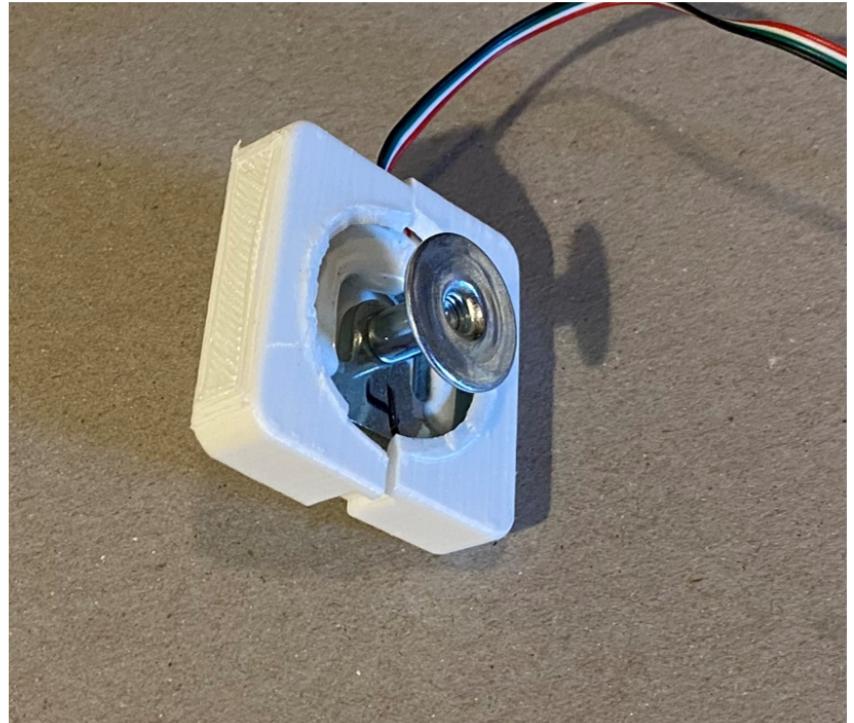
If you have an Apimaye hive, you may want to upgrade your W3 to include the swivel feet mounting.

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.

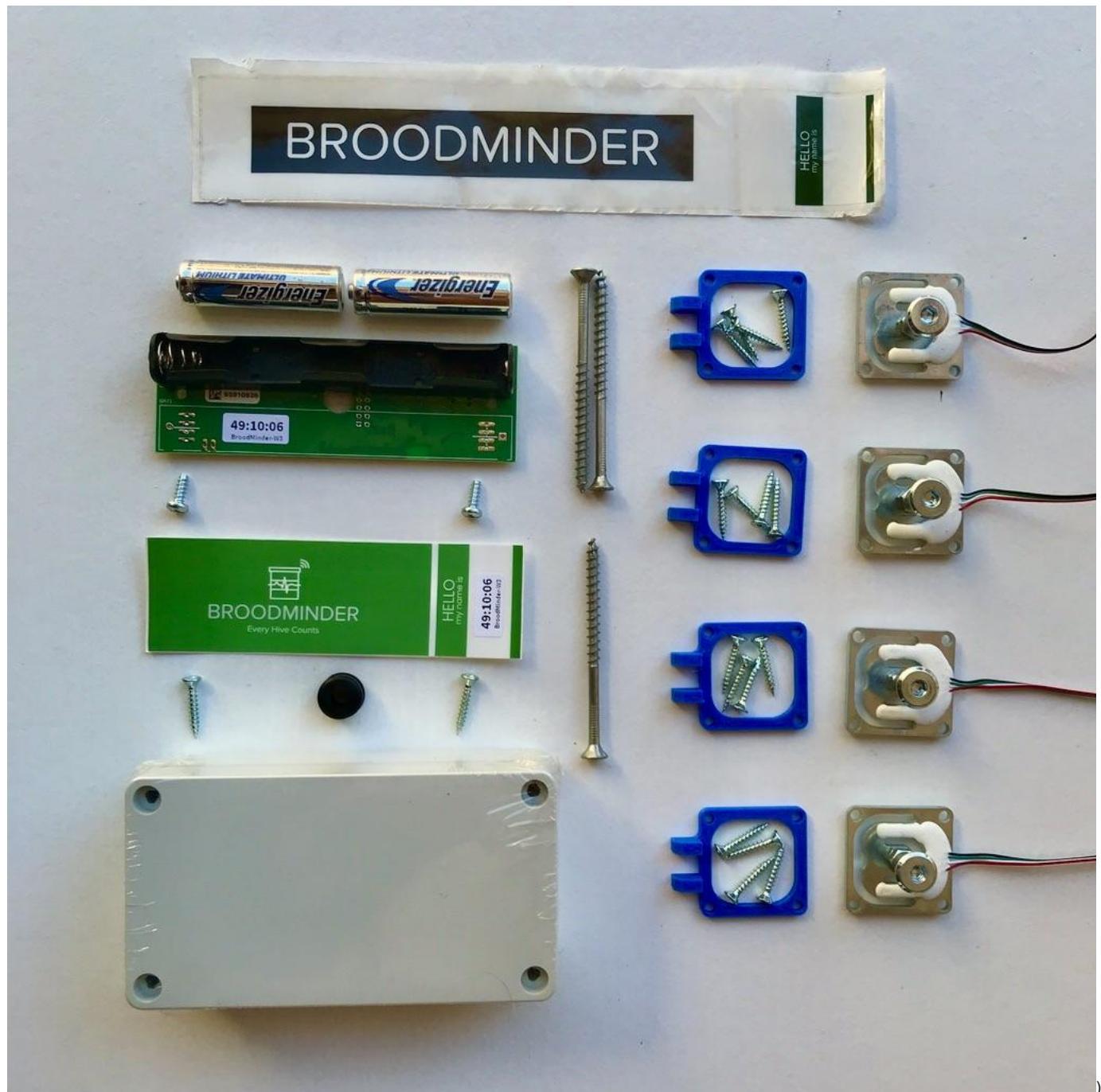
All that you must do is remove the skirt that captures the swivel foot.



10.5 Appendix: W3 Unassembled-Uncalibrated parts

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

(only missing the Spline material)



11. 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.

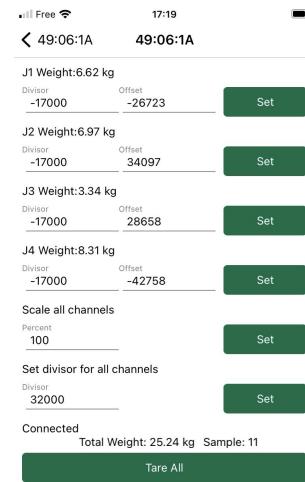
Watch the video to get you started :



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. A good divisor starting point is :

- 32000 for 50kg load cells
- -17000 for 100kg load cells (note the negative divisor)
- -9000 for 200kg load cells (note the negative divisor)

Tip

You do not need to take care of Offsets. They are automatically computed on Tare.

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.

12. BroodMinder W4



12.1 Broodminder-W4 (49)

 **Note**

W4 scale is only available in Europe.

BroodMinder-W4 is a professional grade hive scale specially designed for migratory beekeeping. It is a rugged, lightweight and high precision scale that can be installed in any kind of configuration. Insensitive to hive leveling or centering with its 4 x 100kg high precision load cells, it mounts easily on wooden or metal pallets.

As for any other of our hive scale models, W4 will accurately measure the slightest changes in beehive weight, allowing to detect nectar-flow startup and intensity. It also improves colony overwintering and spring growth management and gives precise description of foragers activity during the day.

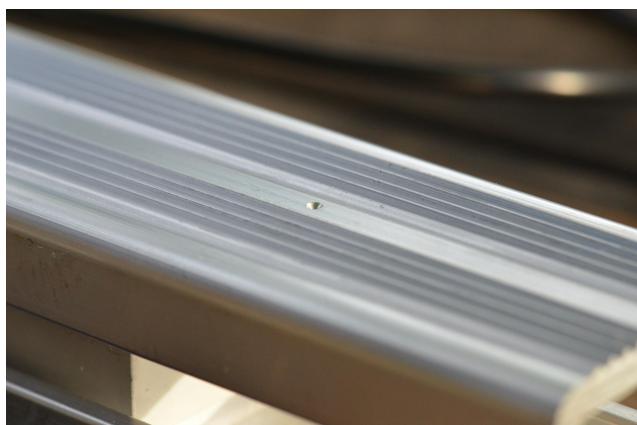
Recommended for migratory beekeepers to improve colony management while reducing time spent and transportation costs.

Installation

The W4 bars are 50cm long. You typically can mount them longitudinal to the hive (left/right) but also transversal (front/rear). It all depends on your preferences and constraints. The accuracy remains unchanged.



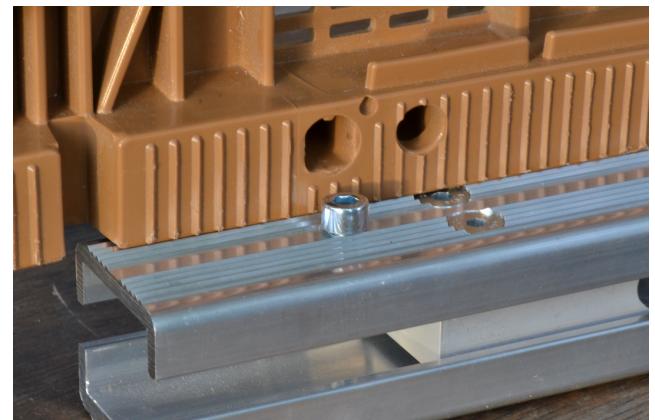
This scale is specially designed for migratory beekeepers. The aluminum structure is 4 mm thick and features grooved surfaces on the top and bottom to prevent the hive from slipping.



For those using Nicot(r) bottoms, the scale takes advantage of their features. The grooves are fitting the bottom, actually holding the hive from any slip.



There's also the possibility to mount centering pins on the scale using the pre-positioned mark for drilling (see picture above).



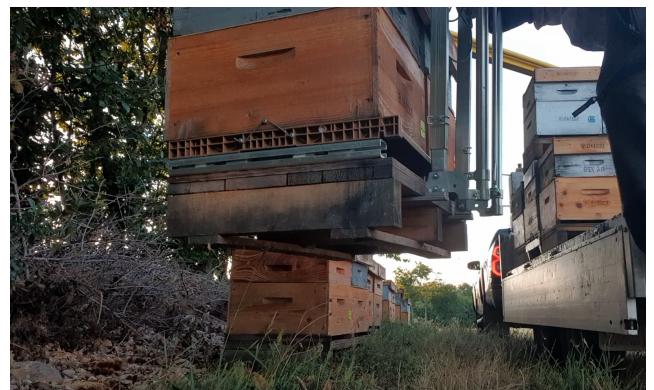
Mounting on pallets

If you are migrating your hives, you do not even need to remove the hive, you can let it installed. For this you will have to attach the scale to your pallets.

- On wooden pallets simply drill two holes on the bottom bar and screw them to the pallet



- on metal pallets, you can drill and use a pin



Once on your truck, you can strap without fear. The maximum nominal weight for this scale is 400kg. Strapping will raise the load to 150-200 kg.

Then you can securely handle and lift your pallets.



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 mounted 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. BroodMinder 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.

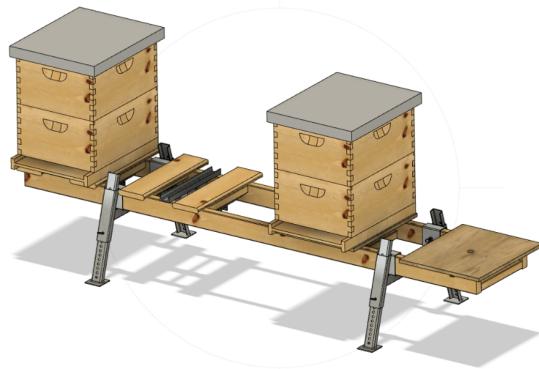
The DIY is the raw circuit board that we use in the BroodMinder-W2. We hope that this board allows many home crafters to create wonderful devices to monitor the hives. Be sure to share your designs with us and we will share them with the world.

- 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.

We are offering you here some proven concepts that you could adopt or inspire from. There are different categories you can explore

Multiscales



Multiscales are architectures of a single scale for multiple hives.

Multiscale1 and Multiscale2 are single and double loadcell architectures that allow for 4 scales onto a single board.

Retrofit

Retrofit cases for those that would own an old scale or from other vendor, that is not working anymore and are willing to bring it back to life into the BroodMinder ecosystem.

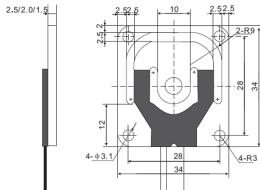
14.2 Getting started

Hardware

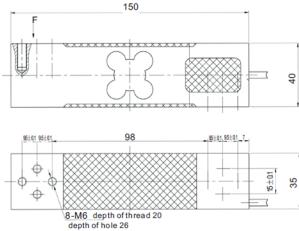
The starting point is getting a BroodMinder board. Here the choice is straight forward : there's a unique model of board for scales and we call it XLR:



Then you'll need a set of loadcells you have a choice of your loadcells depending on the architecture you target : 50, 100 and 200kg are the most common. On the display below you have the 'flat' 50kg side by side with the 'beam' 200kg type.



Center hole of 50KG load cell is 5mm diameter

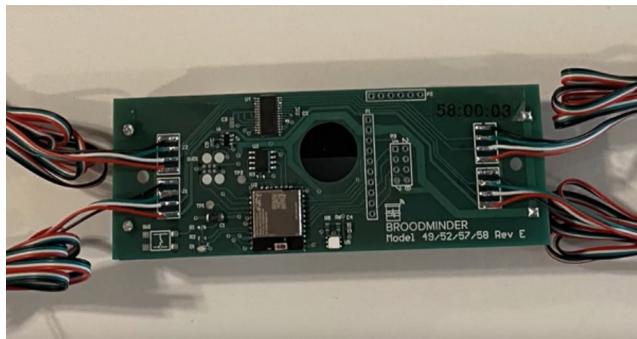


We are happy to provide you with either type. If you get your own, be sure that they are temperature compensated and have very low creep. The resistance of the 200KG load cell is roughly 300 ohms per leg. For the 50KG load cells it is around 750 ohms.

Then you will be assembling the boards and the loadcells into the architecture of your choice (more about this further). Achieving that point, weather is your enemy, so you will also want a box and cable glands. we recommend the following available from Digikey.com

- Hammond 1554C, fits circuit board nicely \$10.00
- Hammond 1555C, with ears fits circuit board nicely \$10.00
- Jacob Gmbh 50.007 PA7035 cable gland PG-7 \$0.70

Electronics & Wiring



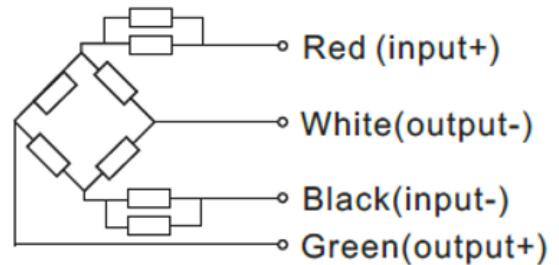
Most load cells seem to use this color scheme for the wires. If that is the case, then wire them like this.

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.



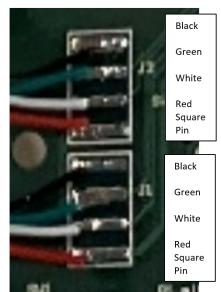
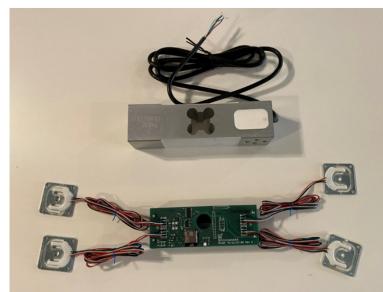
Note

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

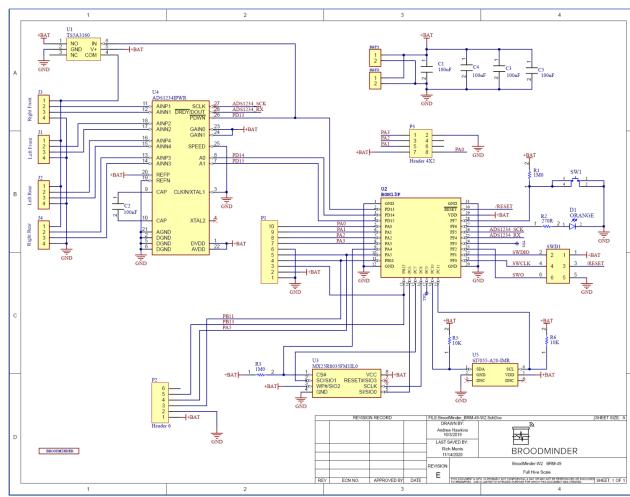
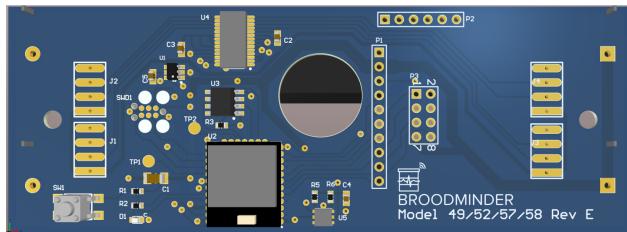
THE ABSOLUTE MAXIMUM VOLTAGE FOR THE DIY BOARD IS 3.8 VOLTS DC!

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 figure 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.



Calibration

Once you have your scale built, you will want to calibrate it. You do this by setting the scale factor for each ADC channel which are stored in flash memory in the processor.

We have now built new features into the Bees app for doing calibration. See the video [here](#) for more information.

⚠️ 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-loadcell scale

1. Open the Bees App calibration screen [Devices Tab](#) > [Device name] > ... > Show details > ... > Troubleshooting > Calibrate Scale
2. Enter a starting point Divisors in the channels you're willing to calibrate (eg. -9000)
3. Push on the Tare button to set the weight to zero
4. Load the scale with a known weight and read the output on the screen.

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 larger ones are more like 11,000. It is a simple matter to set the divisor to a value, then do a test weight. And then adjust the divisor appropriately.

Example

Real Weight = 30.0, Divisor = 31,000, BRM-58 readout is 20.0
Change the divisor to $31000 * 20.0 / 30.0 = 20,666$ and the weight should correctly read 30.0

Tip

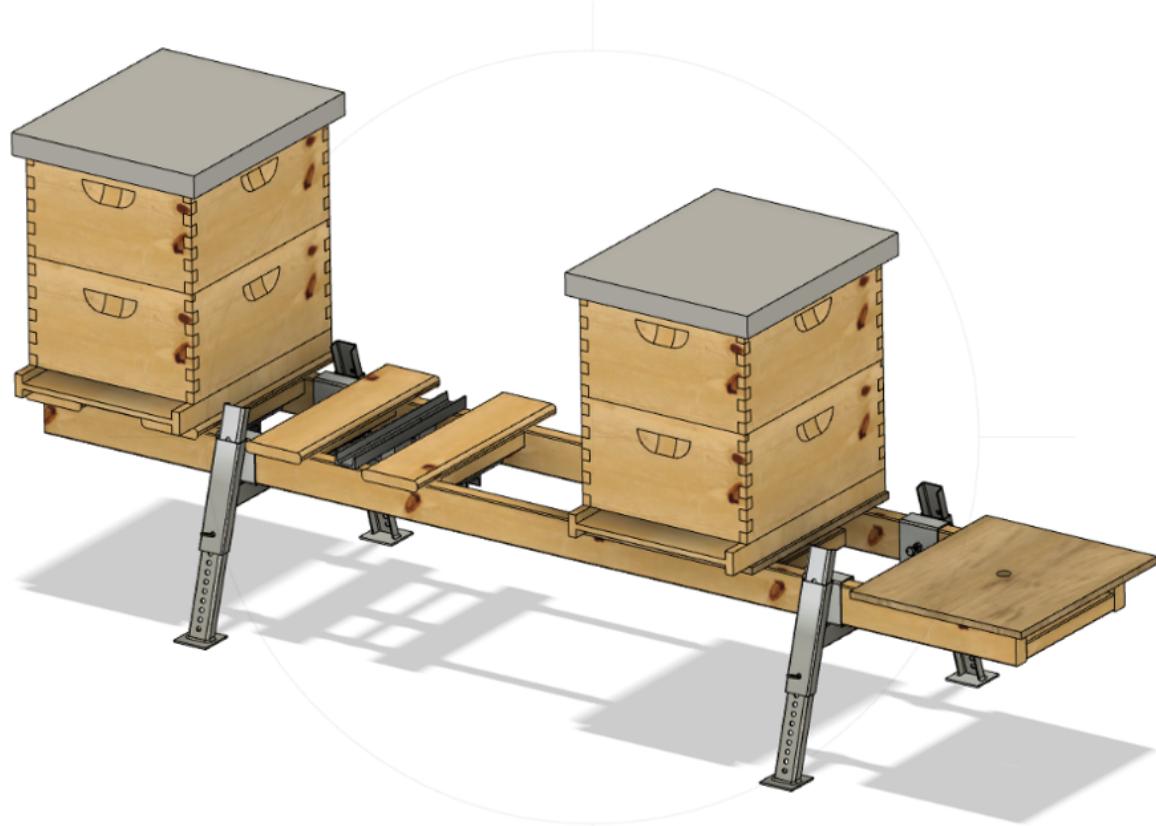
if you are NOT using a channel, set the divisor to 0 and it will always read 0 weight.

Four-loadcell scale

If you are using 4 loadcells together into a single scale, then you should follow the same procedure as for W3 Calibration described [here](#)

15. Build your custom Multiscale-1

Multiscale-1 is a multi hive scale that uses single load cells for each hive. The classical setup is a 4-hive stand with combined with 4x200kg loadcells and a single XLR board.



Above is an example build on a hive stand is available from [BetterBee](#)

Another similar set-up consisting on a 3 hive slots with single 200kg loadcell and plywood plate is described in the pictures below



Model	Pros	Cons
Multiscale1	Most accurate architecture, a single load cell is individually calibrated on a dedicated circuit board channel.	It rocks and it rolls. Having a single path to transfer all the stresses, results in an architecture that is not extremely stable. Once you touch the hive, it all starts to roll. Some bees do not like it and get aggressive.

16. Build your custom Multiscale-2



The Multiscale2 system utilizes a single XLR board and two 100 kg load cells per hive, enabling independent weight measurement for up to four hives.

This cost-effective design benefits from using a single electronics board, with one channel allocated per hive (up to four). Compared to the Multiscale 1, this setup offers a more stable structure with significantly less rocking. However, because the two load cells are combined into a single channel, every twin cells are calibrated as a whole rather than calibrating each cell individually. While this could slightly reduce accuracy, our experience shows that the results remain highly accurate while gaining on stand stability compared to single-load cell structures.

16.1 Mechanical part

In the example below we're displaying a 3-hive scale stand.



We're using W4 bars as top support and 100kg loadcells (one at the front and another at the rear). They are hooked to the wooden structure with an L shaped 5mm aluminium profile.

The routing of the cables to the board needs an extra lead that is soldered using a Control line, 4 x 0.14 mm², shielded, 25 m coil.

Model	Pros	Cons
Multiscale2	A very good compromise among accuracy and stability	Two load cells sharing a single channel result in a slight loss of accuracy, but using high-quality load cells helps minimize these differences.

17. Retrofit a SolutionBee scale

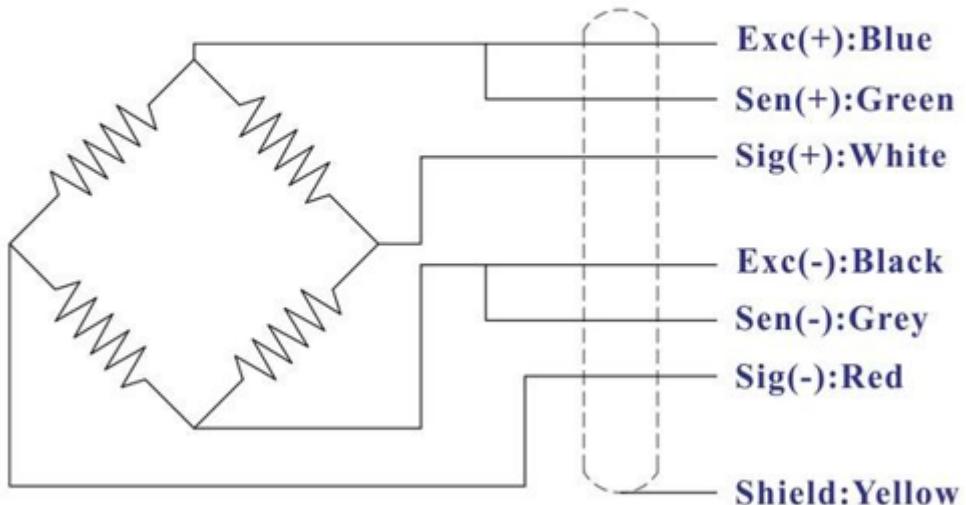


It is easy to take an old broken hive scale and convert it to a BroodMinder enable scale. Here is an example.

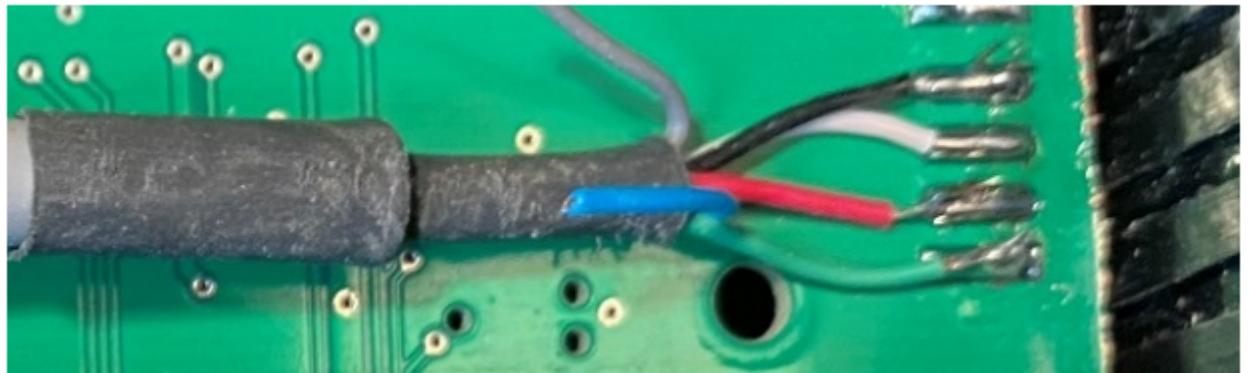
 **Note**

This is not the same wiring as our load cells (colors are different).

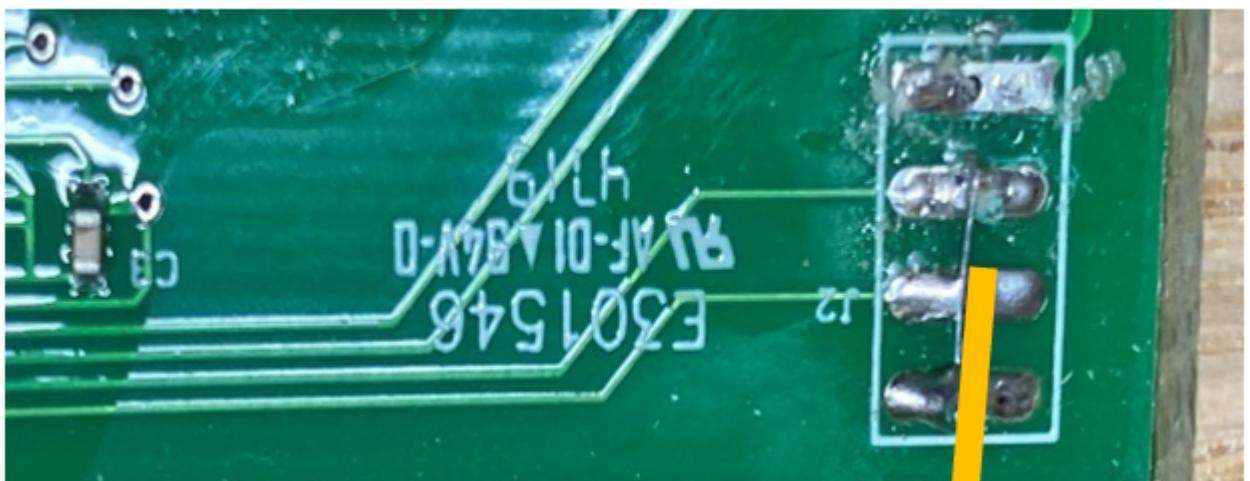
Wiring Diagram



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)



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



6. 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.
7. 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)

8. Ensure the box is sealed, silicone caulk works well if you use the cheaper Hammond box.



9. 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.



10. 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.

18. Retrofit a "Label-Abeille" Scale



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

18.1 Mechanical part

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



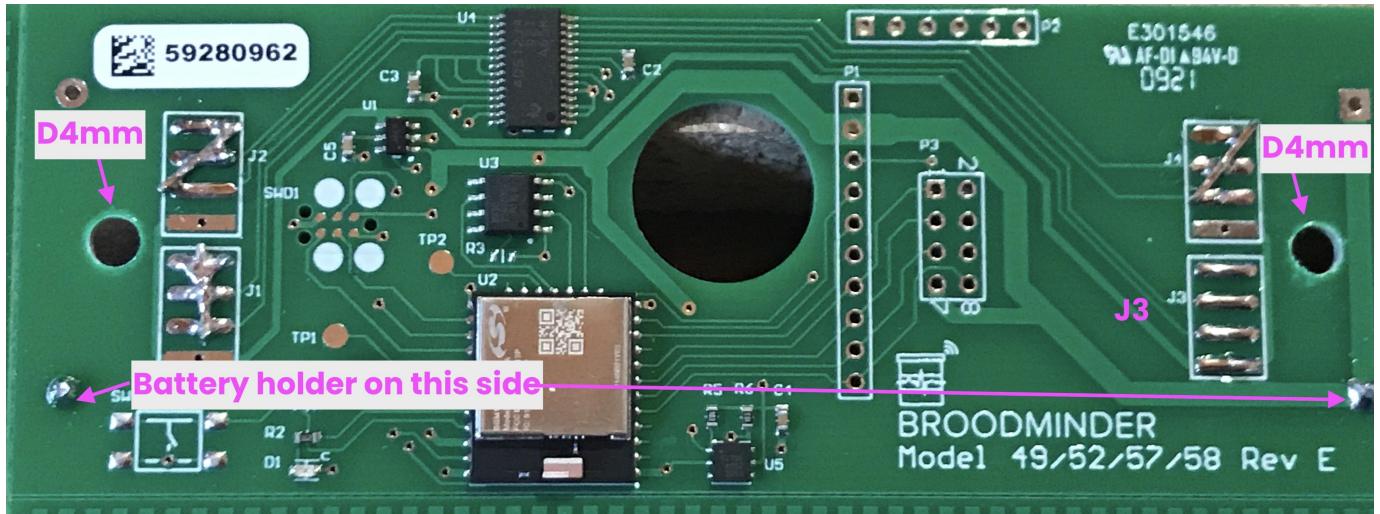
Now cut the central plot with a cutter to leave space to the XLR board



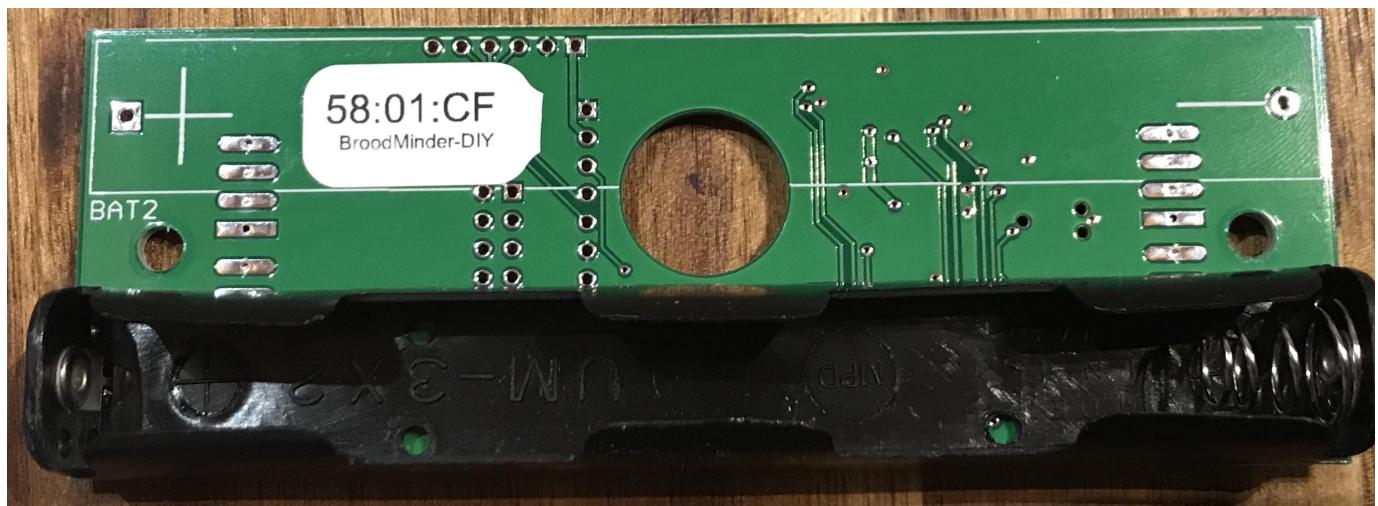
Like this



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

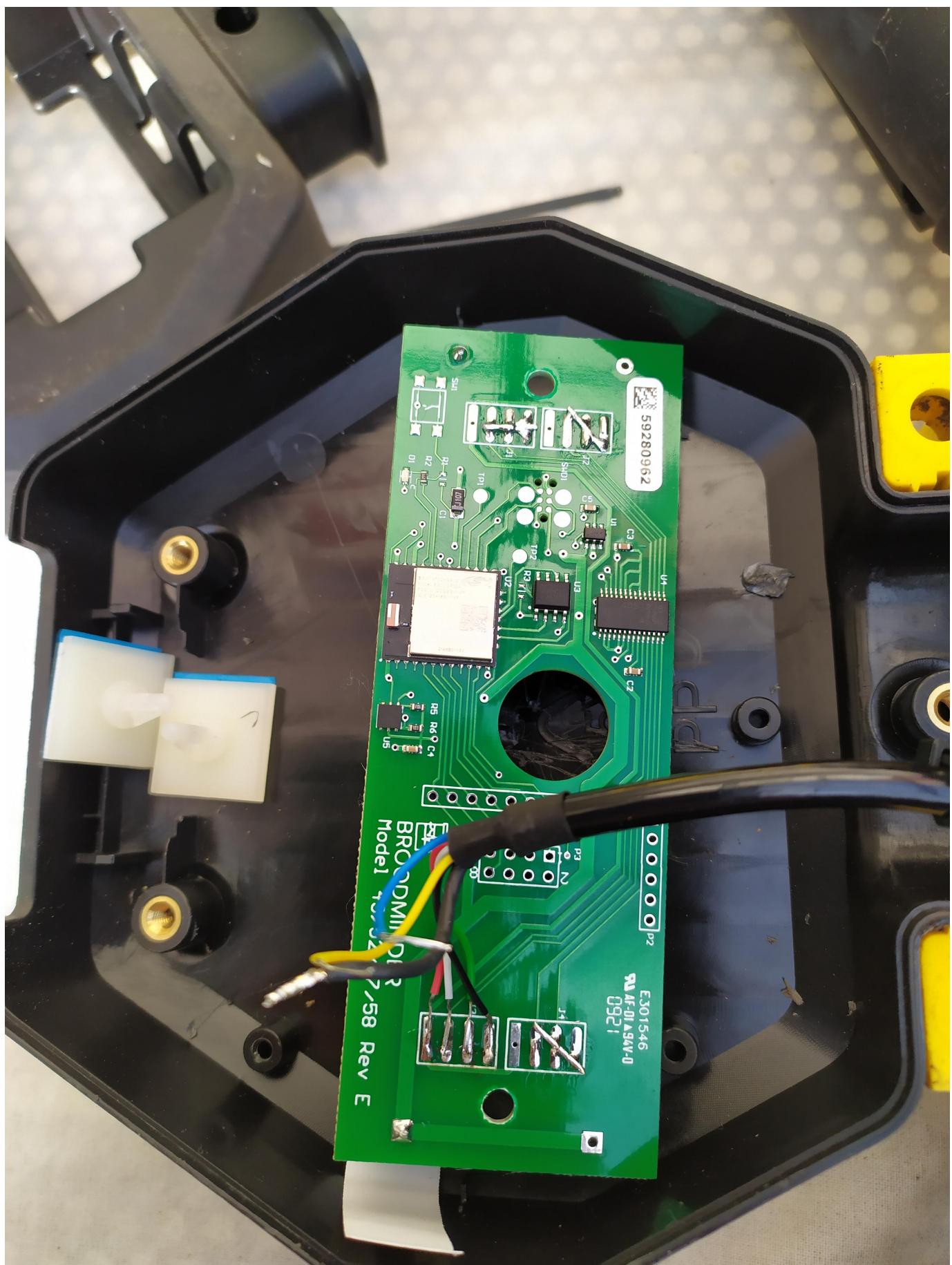


Solder the battery holder on this side (side is important to be able to have the batteries accessible once the casing will be mounted again.)



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.

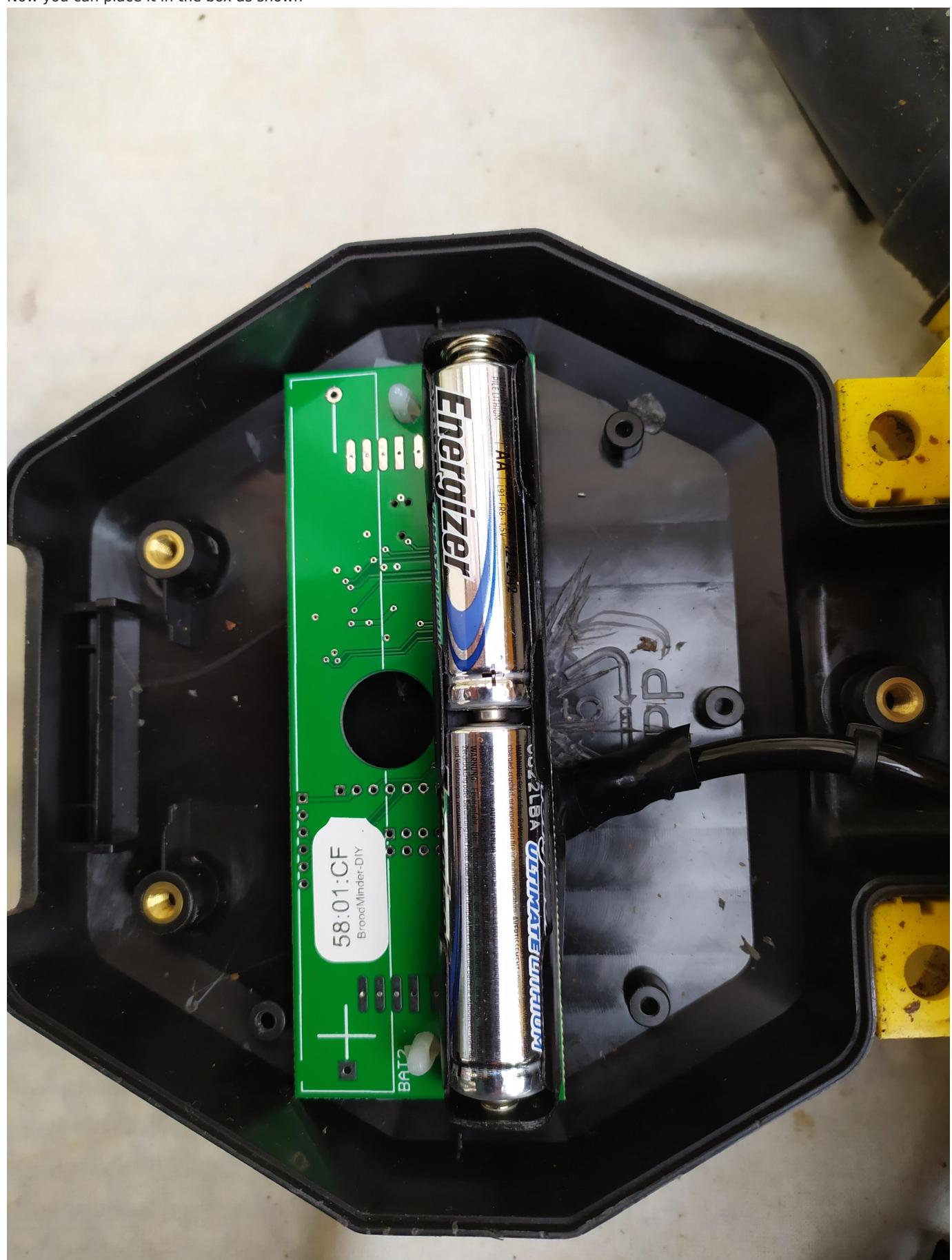


Now install batteries. You should see a blinking led.

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!

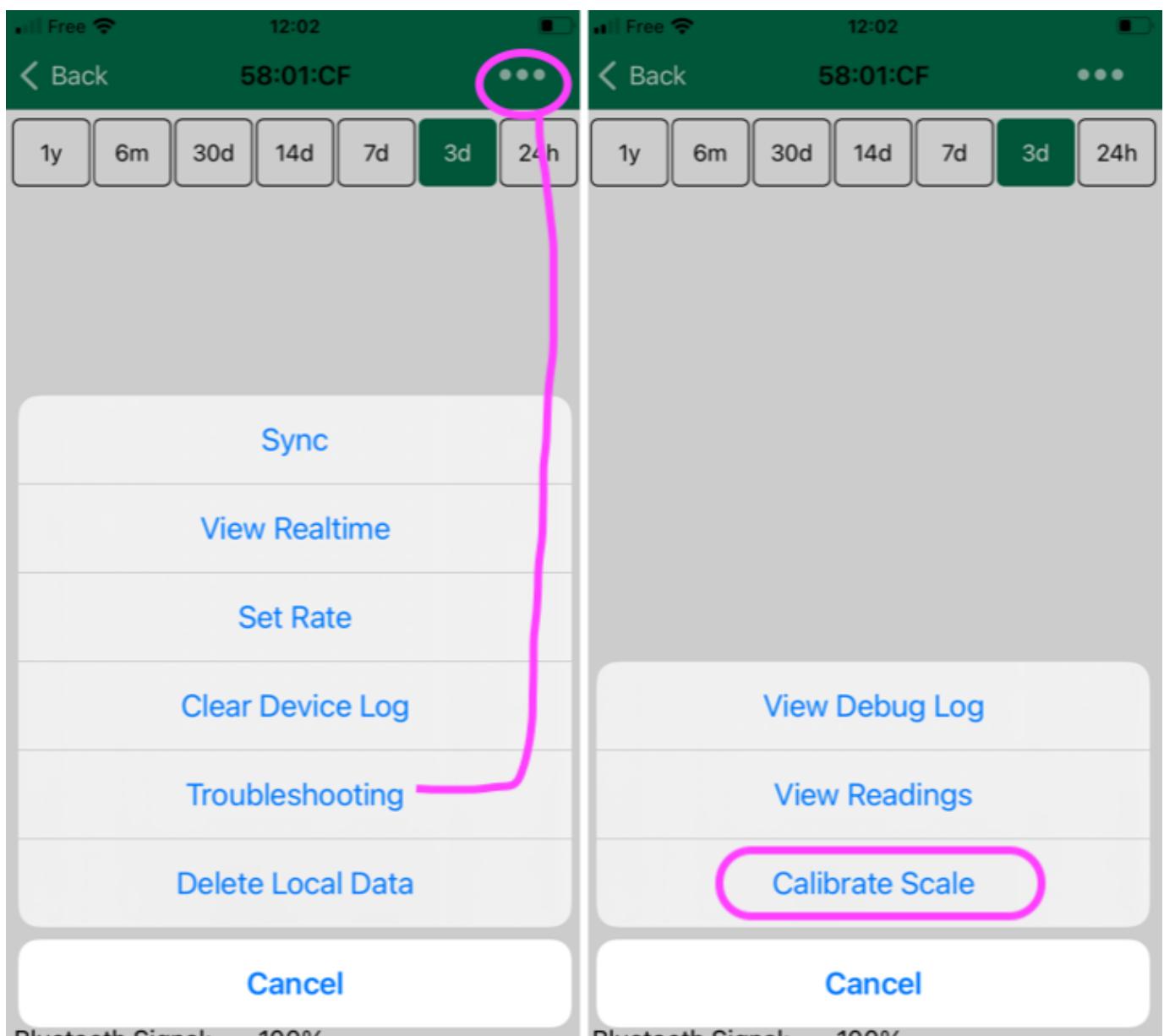


Now let's move to calibration

18.2 Calibration

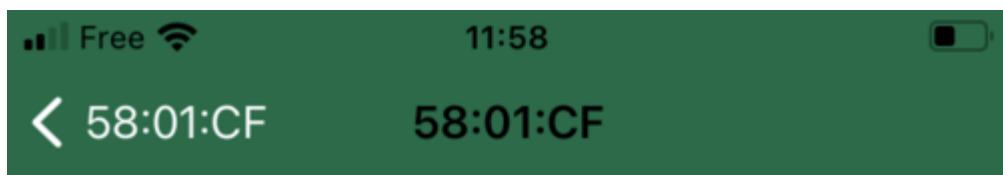
To calibrate the scale follow the process below. If you need help, you'll find more details in [this page](#)

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 channels (bottom of the screen)
4. Now enter `Divisor = -9000` for channel J3 (NEGATIVE starting value)
5. NOTE : you **do not** have to worry about Offsets



J1 Weight: 0 kg

Divisor
0

Offset
118

Set

J2 Weight: 0 kg

Divisor
0

Offset
132

Set

J3 Weight: 0 kg

Divisor
9000

Offset
-187

Set

J4 Weight: 0 kg

Divisor
0

Offset
132

Set

Scale all channels

Percent
100

Set

J4 Set

Total Weight: 0 kg Sample: 44

Tare All

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

You are done, congratulations !

18.3 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.



19. Yolik devices

You can attach devices from [Yolik](#) 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](#)

20. Introduction to BroodMinder Hubs

All BroodMinder sensors transmit data via Bluetooth. There are several ways to collect the data :

1. Via your smartphone (see the Bees App section of the manual) or via a hub.
2. We use 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.

We offer several technologies for data transmission. Depending on your use case, there might be one that fits better than the others.

- BroodMinder-T91 Naked Cell Hub - Cellular hub must be recharged every 6-14 months
- BroodMinder-WIFI - WIFI hub for apiaries with good WIFI available
- BroodMinder-LoRa - LoRa hub providing long range coverage solution for specific needs.
- 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.

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 or the Pyrénées mountains.

20.1 BroodMinder Hub Firmware Update

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.

Upgrading BroodMinder-T91 Cell hub

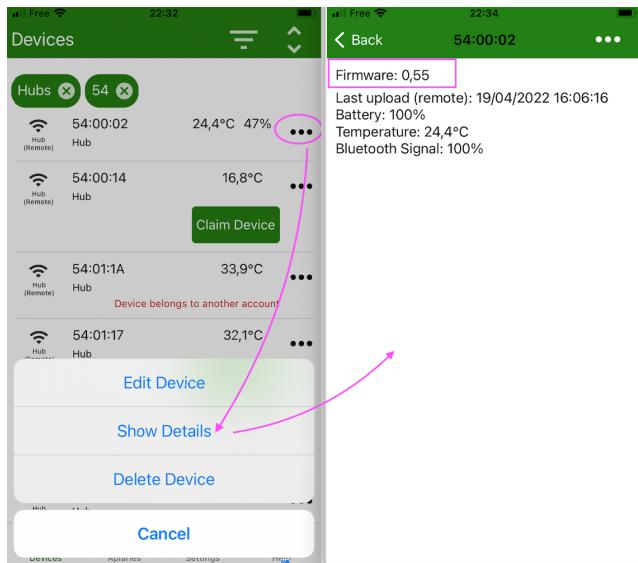
- Check current hub firmware installed with Bees App (see below)
- Trigger the upgrade (see below)
 - Cycle power
 - When the hub restarts it will go through a green then a blue light for 5 sec
 - During that blue light, press the central button to trigger the upgrade
 - Wait and watch for 2-3 minutes.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

You're done.

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.



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.**

Verify

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

Need help?

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

21. BroodMinder-Cell T91



The BroodMinder-T91 (BRM-54) Cell Hub is based on the Nordic "Thingy 91".

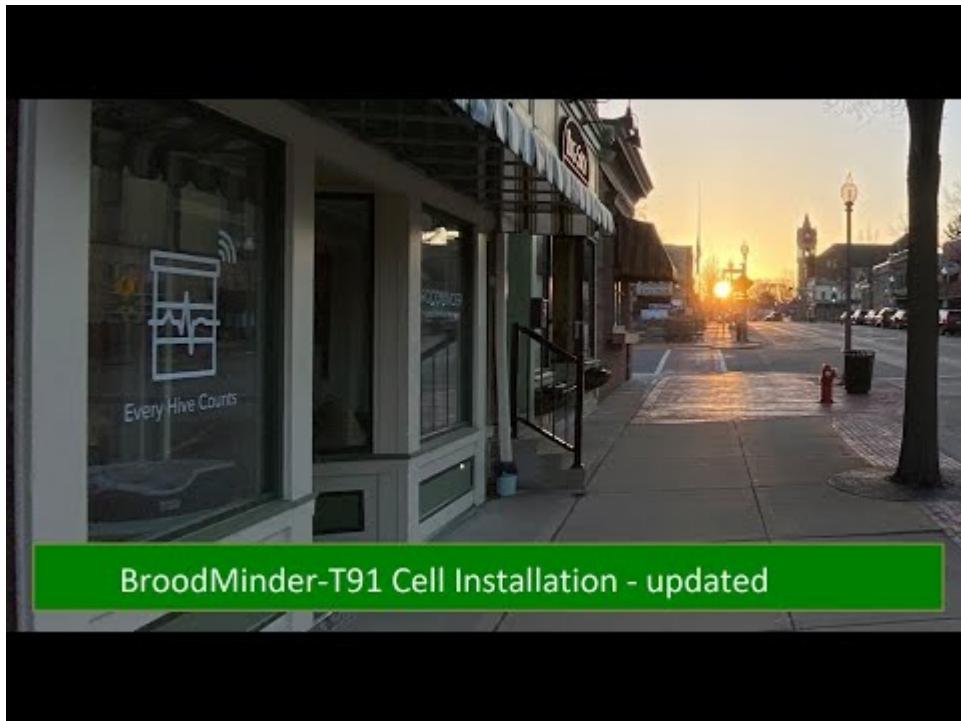
💡 **Important: Real-Time Data Requires a Premium Membership**

Real-time data streaming through a hub is a Premium feature in MyBroodMinder. To enable it, you must have an active Premium subscription.

Since the new membership model launched in January 2025, a single Premium membership allows you to use as many hubs as needed. Subscriptions are no longer linked to individual hubs—you only need one subscription per account, regardless of how many hubs you operate.

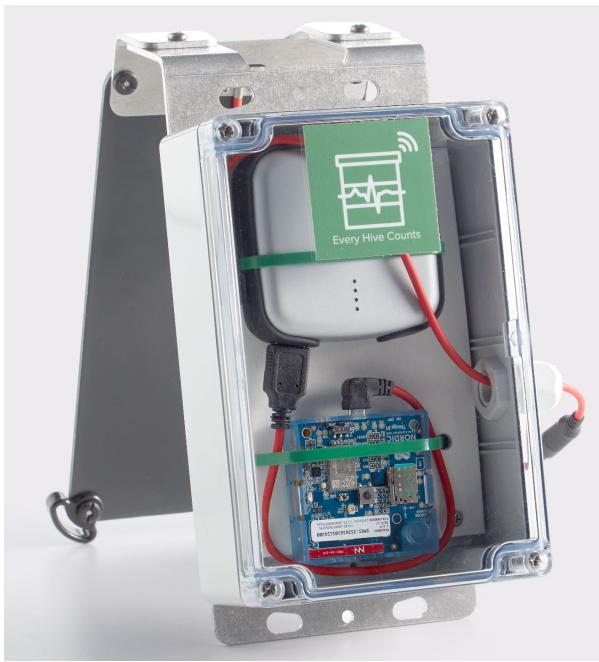
Note: When you receive a hub, it is not yet linked to your account. You'll need to claim it manually, just like any other BroodMinder device.

Watch the video to get started:



Solar version

Lifelong powered version



Weather version

Use the Weather Shield to protect the T91.

21.1 Steps to get your hub up and running

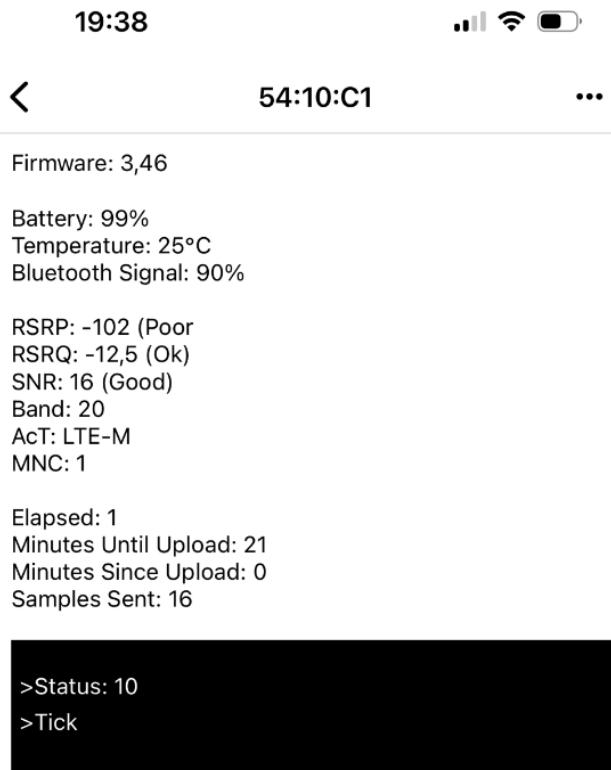
- We recommend you **test everything before taking it to your apiary**.
- Turn on the hub using the slide switch.



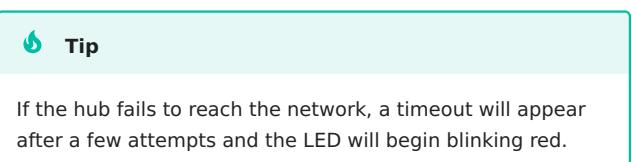
- In the Bees App, go to the `Devices` tab and, like every other sensor, claim your hub. This will assign it to your account.



- Enter the `... > Show details` menu.



- Here you can check some key elements of your hub such as the firmware version, network signal and quality metrics, and selected carrier.
- At the bottom of the screen, there is a black console box displaying the current status of the hub (you must be close to the hub with your smartphone—this data is sent via Bluetooth). You can watch it boot and connect to the cloud. Most of the time, its normal status will be `tick` or `tock`, indicating smooth operation.



- If you have a **solar T91**, ensure that the gasket is seated correctly when replacing the lid. Also, make sure the solar panel is facing the sun for most of the day.
- If you have a **naked T91**, it must be placed in a weatherproof housing. We recommend the **Lacrosse Solar Shield**, and placing the T91 in the provided **mesh bag** to prevent small insects (such as earwigs) from entering.
- Once you see it working properly, move it to your apiary. When in place, check the `tick/tock` status again to confirm proper operation and network quality at that location.

21.2 Assigning the hub to an apiary

By default, hubs are automatically assigned to the apiary of the devices they are transmitting data for. For example, if a scale is assigned to Hive 1 in Apiary 1, and the hub is sending data for that scale, it will automatically assign itself to Apiary 1.

⚠ It will **not** reassign itself again if moved — manual reassignment is required in MyBroodMinder.

- Go to [MyBroodMinder.com](#), choose `Configure`, and expand the `Hubs` section.
- Click on the `Edit` icon to assign or move the hub to an apiary.

21.3 Check a hub remotely

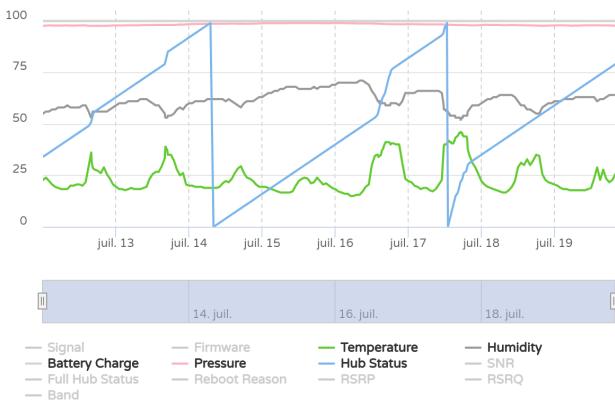
Over time, we have implemented advanced features in our hubs that allow you (and us) to monitor and troubleshoot remotely.

Networks can be unpredictable. Between multiple carriers, antenna types, protocols, geographic environments, and variations in signal strength and quality, it may occasionally happen that a hub runs into issues (less often than you'd expect, but it happens). When it does, having the ability to **monitor hub behavior remotely** is invaluable. In **MyBroodMinder**, you can access this by clicking on the hub name to view the **Hub Chart**.

By default, it displays key metrics such as:

- **Temperature**
- **Humidity**
- **Pressure**
- **Battery level**

These are generally self-explanatory.



Hub Status

- **Hub Status** is a simple counter: every time the hub sends data to the cloud, it increments by 1 until it reaches 100, then resets to 0.
- If a **Swarminder event** occurs during the hour, the hub sends that too — so the counter may increment faster as you can notice in the chart above.

• **A drop to zero before reaching 100** means the hub has **restarted unexpectedly** (e.g. low power, crash, or signal failure).

• **Gaps in the graph** mean the hub was **unable to send data** for some time (no network, SIM issue, or system freeze).

Now let's look at the remaining metrics on this chart, all related with network aspects.

21.4 Interpreting Cellular Network Metrics

Modern BroodMinder hubs report **3 key network quality metrics**:



SNR – Signal to Noise Ratio

- Measures the **clarity** of the signal received.
- High SNR means **low background noise**, which is excellent.
- A **negative value** means the noise is stronger than the signal.

Ideal: the **higher the better**

RSRQ – Reference Signal Received Quality

- Indicates the **overall quality** of the LTE connection, taking interference into account.
- Reflects both signal strength and cell congestion.
- Important when selecting between multiple nearby towers.

Ideal: the less negative the better

RSRP – Reference Signal Received Power

- Measures the **strength** of the LTE signal itself.
- Helps assess whether the antenna is getting enough signal from the base station.
- Think of it as **“how loud the signal is.”**

Ideal: the closer to 0 (in dBm), the better

Summary table of typical signal values

Metric	Excellent	Good
SNR	> 20 dB	13 to 20 dB
RSRQ	> -8 dB	-10 to -8 dB
RSRP	> -80 dBm	-90 to -80 dBm

Note: Some hubs work even with poor metrics, but **lower values increase the risk of data loss or reboot cycles.**

If your hub is showing consistently bad metrics and experiencing restarts or gaps, consider:

- Moving the hub to a better-exposed location.
- Using the **external LTE antenna.**
- Switching carriers (requires special configuration).

Need help interpreting your hub's behavior? → Contact us at

note: if the current firmware is too old, the unit must be returned to BroodMinder for reprogramming.

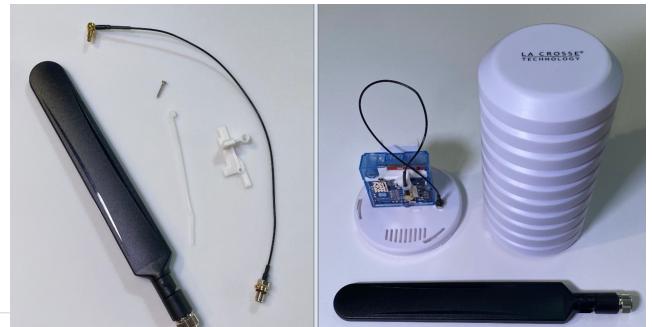
21.6 Extended range

If you are experiencing poor cell network coverage, an external antenna may improve the situation.

We may have several solutions for your location — contact us at support@broodminder.com.

One example is this **External Antenna Kit.**

The antenna plugs into the connector marked “**LTE**” on the Thingy91.



Acceptable	Poor / Issue likely	
1.		Missing mounting bracket.
5 to 13 dB	< 5 dB or negative	LTE jack.
-13 to -10 dB	< -13 dB	Bad screw.



21.5 Firmware Update

We may suggest updating your firmware depending on the situation. Please check with support@broodminder.com prior to doing this.

It is an easy process.

1. Turn the power off and back on the T91, the LED will light blue for 5 seconds
2. While the LED is blue press the silver and black push button in the middle of the unit.
3. The T91 will now begin the firmware update process. It will continue to flash blue for several minutes.
4. It will then flash green 10 times to indicate it has the firmware.
5. It will go dark for about minute while it writes the firmware and then restart.
6. All done

21.7 Replacing SIM card

Simply push in to extract the old SIM and again push in to introduce the new one.

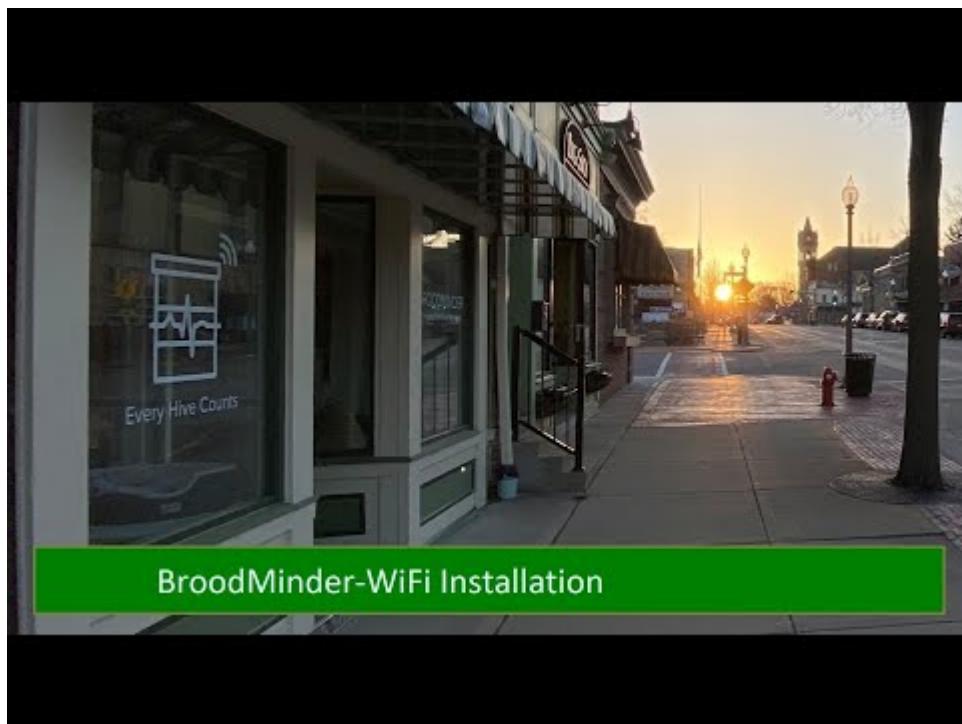


22. BroodMinder-WiFi



If you have good WIFI in your apiary, BroodMinder-WiFi 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.

Watch the video to get started:



⚠️ Warning

BroodMinder-WiFi is only compatible with 2.4GHz networks. It will not find, nor connect to 5GHz or mixed 2.4+5GHz networks

👉 Important: Real-Time Data Requires a Premium Membership

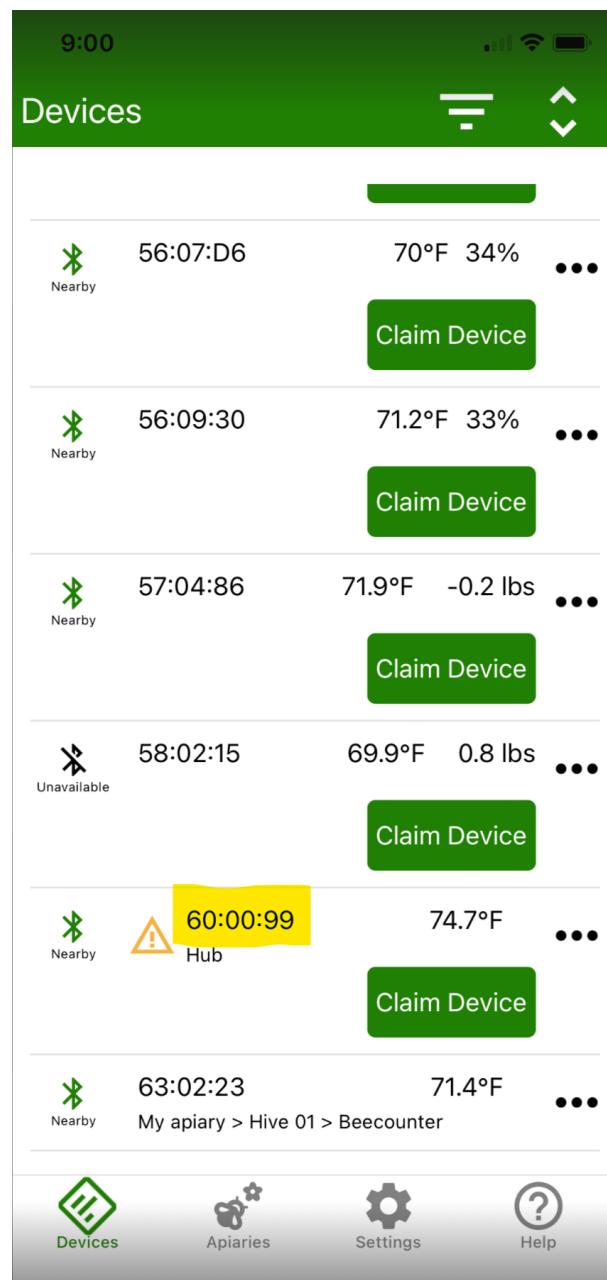
Real-time data streaming through a hub is a Premium feature in MyBroodMinder. To enable it, you must have an active Premium subscription.

Since the new membership model launched in January 2025, a single Premium membership allows you to use as many hubs as needed. Subscriptions are no longer linked to individual hubs—you only need one subscription per account, regardless of how many hubs you operate.

Note: When you receive a hub, it is not yet linked to your account. You'll need to claim it manually, just like any other BroodMinder device.

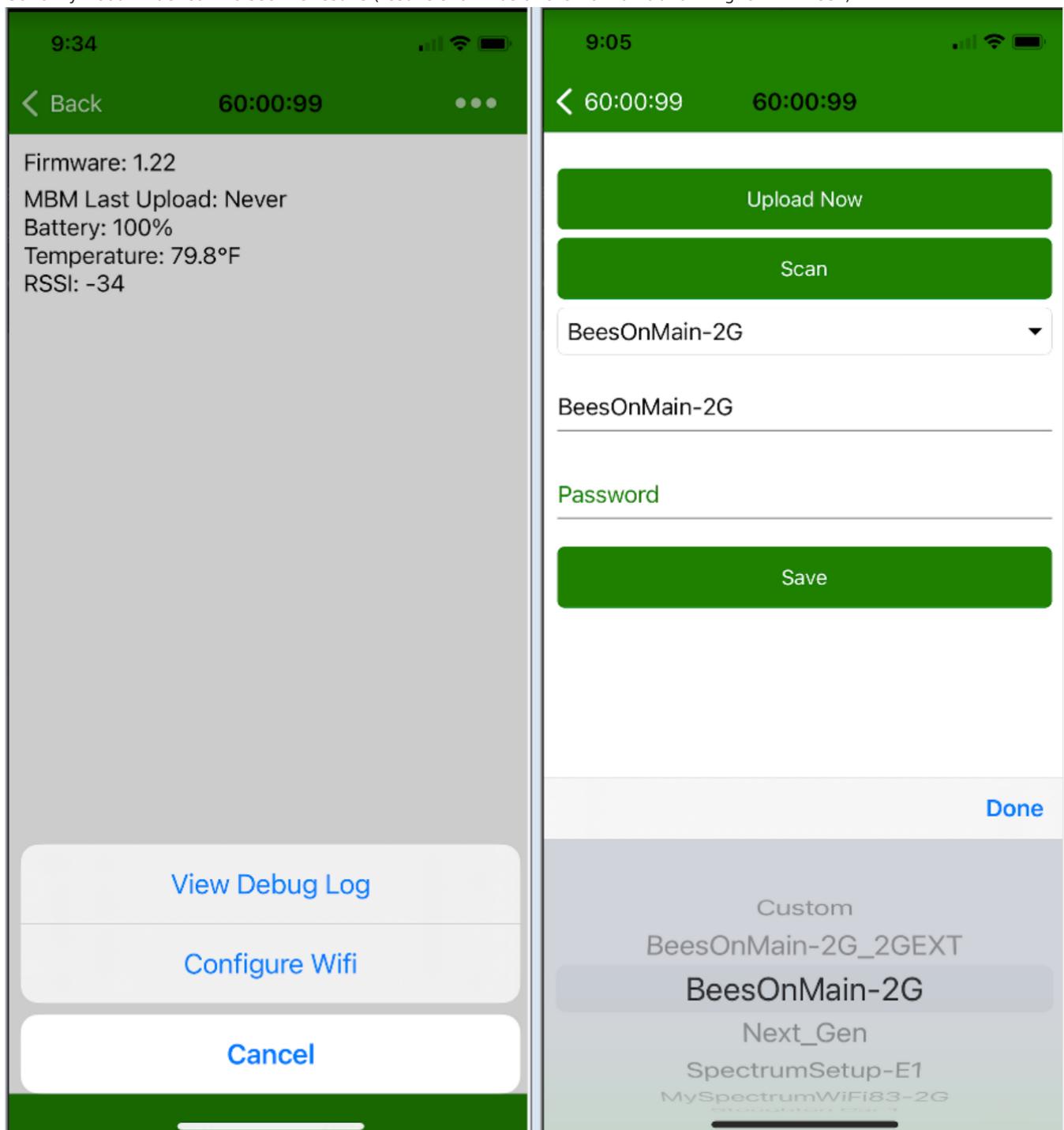
22.1 Installation

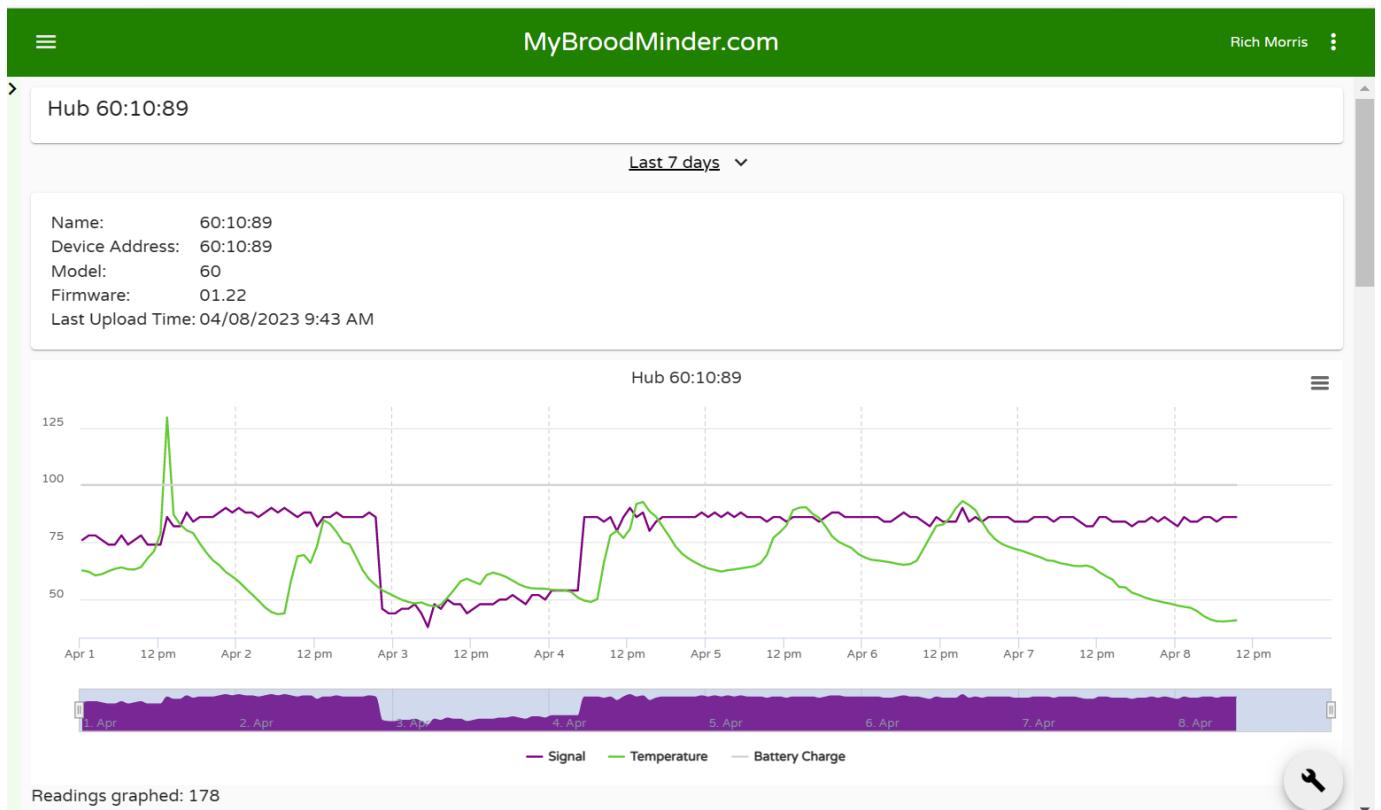
- We recommend you test everything before you take it to your apiary.
- Remove the cover and pull out the `Remove before use` tabs. The LED should flash for a few seconds.
- Now start up the Bees App on your phone or tablet and choose the `Devices` page. You should see the BroodMinder-WIFI show up on the list.
- Press the `Claim Device` button and 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 below are from a hub running for > 1 week)





23. BroodMinder-SubHub



23.1 BroodMinder-SubHub (BRM-52)

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 its 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 fine, 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.

23.2 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.

23.3 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 (150m) 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 hub if you wish.

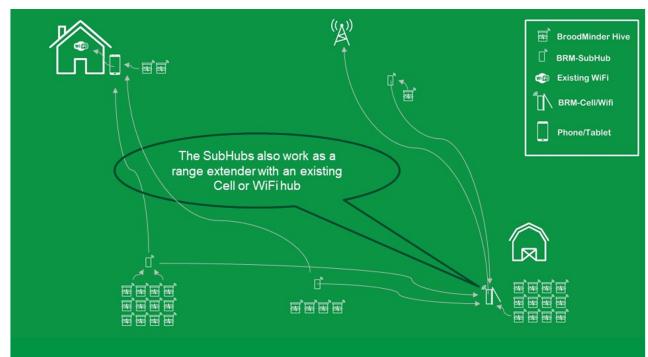
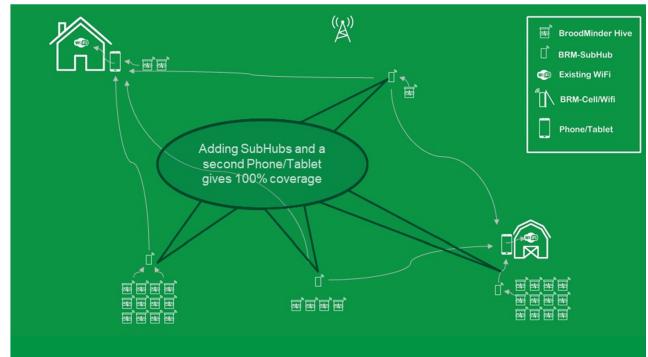
Outcome: More of your apiary can be monitored with minimal cost. Temperature increase in swarm traps will show on MyBroodMinder.com when bees move in.

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 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.



23.4 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.

- Go to `Settings > Scanner > Scanner Timeout >> set to Never`
- Start scanning in the `Scanner` tab at the bottom of the app
- BroodMinder sensors will be named by their ID (e.g. 57:01:01)
- 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.
- Now select the RSSI Graph and you will see each time the phone gets an update from the BroodMinder.
- 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.

23.5 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 its 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 BroodMindlers 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 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.

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

24. BroodMinder-LoRa



Important: Real-Time Data Requires a Premium Membership

Real-time data streaming through a hub is a Premium feature in MyBroodMinder. To enable it, you must have an active Premium subscription.

Since the new membership model launched in January 2025, a single Premium membership allows you to use as many hubs as needed. Subscriptions are no longer linked to individual hubs—you only need one subscription per account, regardless of how many hubs you operate.

24.1 BroodMinder-LoRa (BRM-65)

LoRa (Long Range) and LoRaWAN (Long Range Wide Area Network) are technologies designed for low-power, long-range wireless communication.

- LoRa is a physical layer (or radio modulation) that enables long-range, low-power communication between devices. It uses a spread-spectrum technique to achieve high sensitivity and range, allowing devices to communicate over several kilometers with minimal energy consumption.
- LoRaWAN is a network protocol built on top of LoRa. It defines the communication protocol and system architecture for a network of LoRa devices. LoRaWAN manages how data is transmitted over the network, including encryption, data rates, and network management. It facilitates communication between end-devices (sensors, actuators) and network gateways, which then connect to a central server or cloud application.

In summary, LoRa provides the physical layer for long-range communication, while LoRaWAN provides the network protocol and management to support scalable, low-power, wide-area networks.

24.2 LoRa Hub

The LoRa hub is working very similar to all other Cell or wifi hubs. It is tracking all the devices and sends any new data to the cloud every 10 minutes. The major difference is that instead of using a cellular network, it will use the radio frequency 915Mhz (US) and 868MHz (EU) dedicated to LoRa.

Tip

Note that having different frequencies in each continent, the hubs are specifically designed for those regions

24.3 LoRa Gateway (BRM-66)



At the other end of the emitter there should be a receiver. Depending on your location it could roam through different networks. Although you can also install a gateway that will be hooked to the internet.

This means that custom networks can be build using the pair Hub/Gateway to address specific configurations in zones with poor cellular coverage for example.

The distance between the gateway and the Hub can range from hundreds of meters to actually kilometers. In an area with little geographical relief the range can go up to 10-15km (20-30Mi).

 **Tip**

If you are considering this technology for your apiary, please contact us and we will advise the solution that could best fit your needs.

25. BroodMinder-Cell 3G (BRM-44 & BRM-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.

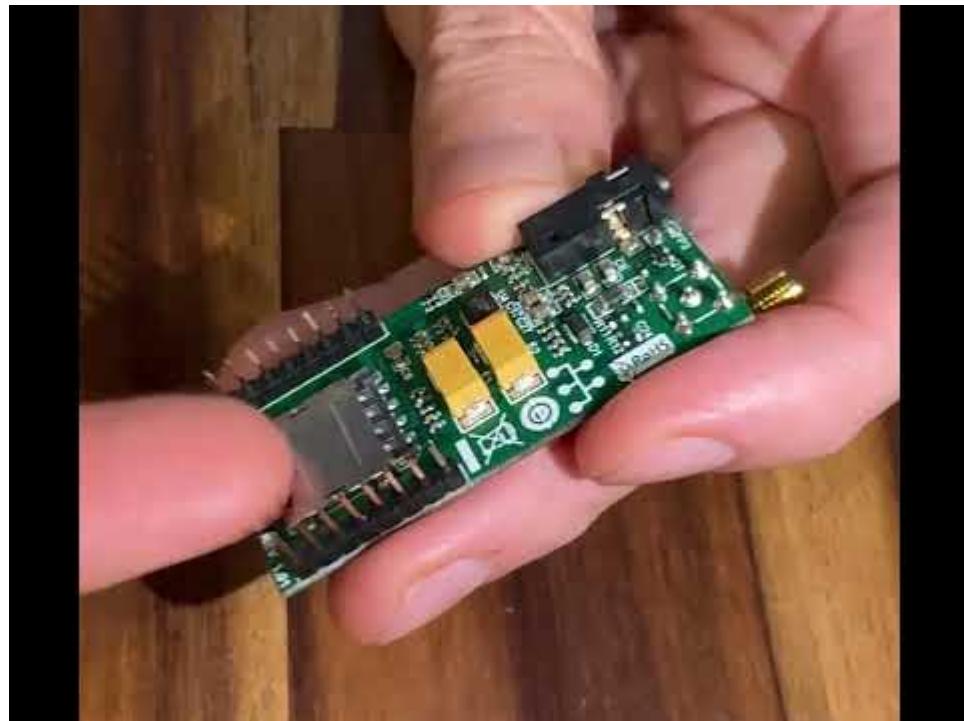
These hubs are not configurable with the Broodminder Bees app. **You must install the Broodminder Cell App** [Android](#), [iOS](#) to manage the settings.



25.1 Install the SIM Card

Here are the steps to install the SIM card:

Watch the video :



1. Unplug the 3G 'Clic' circuit board.
2. Open the SIM metal holder: slide it upward through the antenna with your thumb, then pull it up and remove the SIM.
3. Insert the SIM card in the right position.



4. Pull down and slide down to lock.

