



# External Antenna Installation Instructions

Beehive 1

BH1-SYS-EAll / Rev B

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# 1. Scope

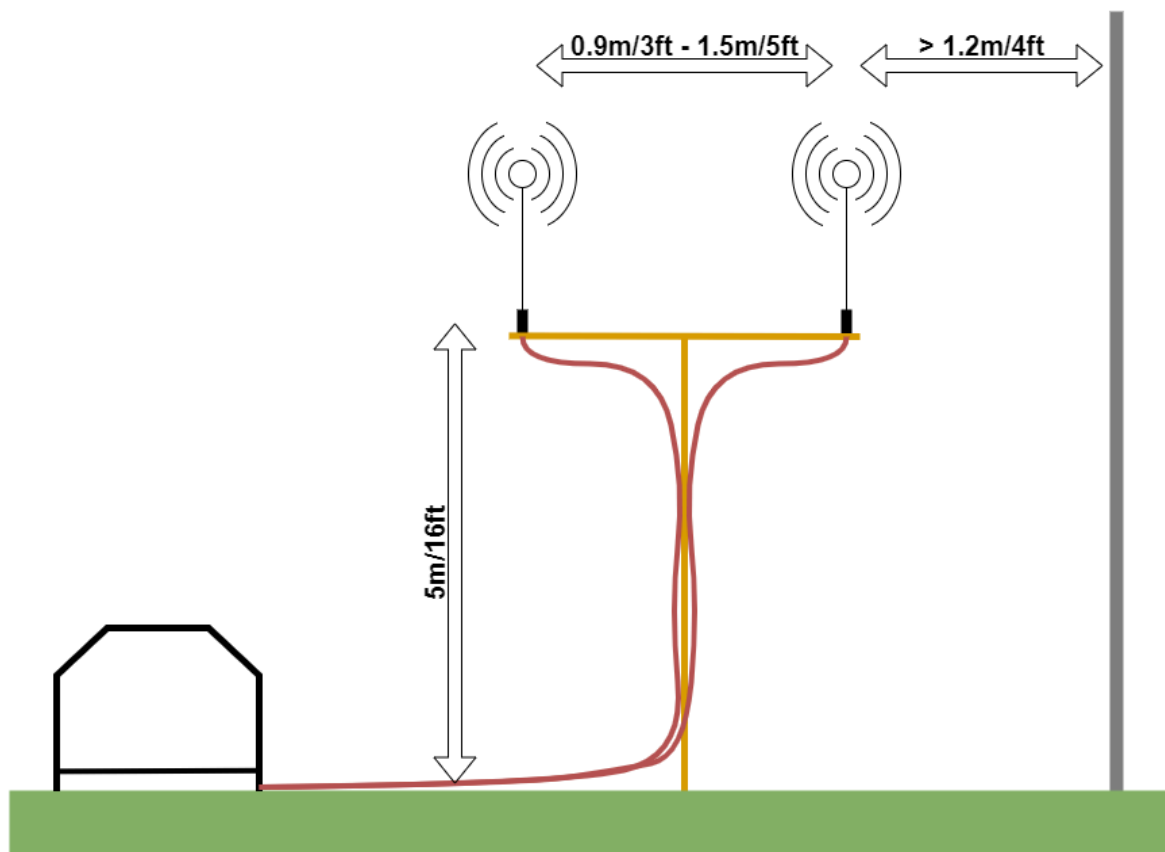
This document lists the installation steps and general recommendations for adding external antennas to the Hive unit of the Beehive 1 system.

Please note, the information provided in this document should be treated as best practice guidelines; local building and electrical regulations may apply.

## 2. Placement considerations

### 2.1. Antenna placement

- The SFL Beehive 1 uses two individual antennas to communicate. Both of the antennas of the Hive need to be routed out and attached when using the external antenna configuration.
- Each antenna needs to be installed vertically.
- Each antenna should be placed clear of any obstructions, especially metallic objects. Objects closer than 1.2m / 4ft can have a significant impact on the radio performance of the system.
- Large, dense or metallic objects in the vicinity will limit the radio performance of the system in a particular direction.
- There needs to be at least 0.6m / 2ft horizontal separation between the two antennas. Generally recommended spacing is between 0.9m / 3ft and 1.5m / 5ft. A larger spacing can be considered if there is a blocking obstruction in between which needs to be cleared.
- The antennas should be placed 5m / 16ft above ground or higher for optimal long range performance (3m / 10ft minimum). In case of installation on large flat roofs, this height is above the roof line.



## 2.2. Cable limitations

- High quality, low loss coax cable is required for the interconnect to the Hive. LMR-400 is generally recommended.
- The cable length should be kept to the minimum necessary. For LMR-400 the maximum limit is 25m / 82ft. If another cable type is used, the length scales for an equivalent maximum insertion loss.
- When routing the coax cable, take note not to damage the cable by excessive bending. For LMR-400 coax cable, the installed radius needs to be more than 25mm / 1in.

## 2.3. Lightning protection

Depending on the location specific placement, the installation of external antennas creates an increased risk of attracting lightning strikes. This risk depends on many factors, such as local weather patterns, any adjacent taller grounded objects, and height of the antenna above ground.

Adequate precautions are recommended, such as grounding metallic supporting masts and adding inline surge protection devices to the cable.

The included inline surge protection can be installed on either side of the coax cable, whichever side is easier to route the adequate grounding to. The installation instructions highlight both scenarios.

## 3. Installation

**Caution:**

Before disconnecting any of the antenna cables of the Hive, please ensure that the Hive has been fully shut down. Failure to do so may cause unexpected communication problems and may result in permanent damage to the Hive!

**Caution:**

Whenever handling parts or cables with exposed connectors, care should be taken to avoid debris from entering the connector, as this can permanently damage the parts.

**Caution:**

When routing the coax cables, care should be taken to avoid knots or tight bends in the coax cables, since this can permanently damage the cables, resulting in performance problems!

Excessive pressure can also permanently damage the coax cables, e.g., too much clamping force during installation.

**Caution:**

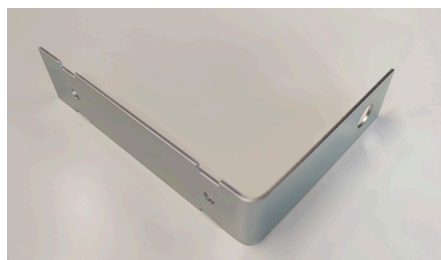
Whenever handling parts or cables with exposed connectors, care should be taken to avoid debris from entering the connector, as this can permanently damage the parts.

### 3.1. Required items

- SFL Antenna kit contents:
  - 2x Antenna ( SFL PN: 538-1006 )



- 2x Mounting Bracket ( SFL PN: 440-1019 )



- 2x 20m Coax Cable ( SFL PN: 530-1130 )



- 2x Hive Coax Cable Adapter (SFL PN: 530-1136 )



- 2x Surge Protector ( SFL PN: 590-1003 )



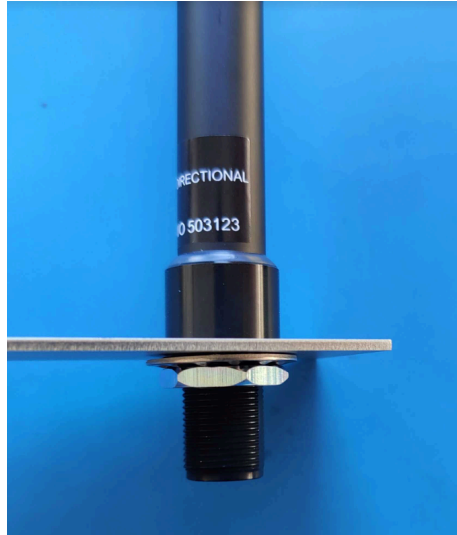
- Weather sealing tape ( SFL PN: 750-1006 )



- Zip ties

## 3.2. Installation steps

1. Fix the mounting brackets in the desired location.
2. Secure the antennas onto the mounting bracket.

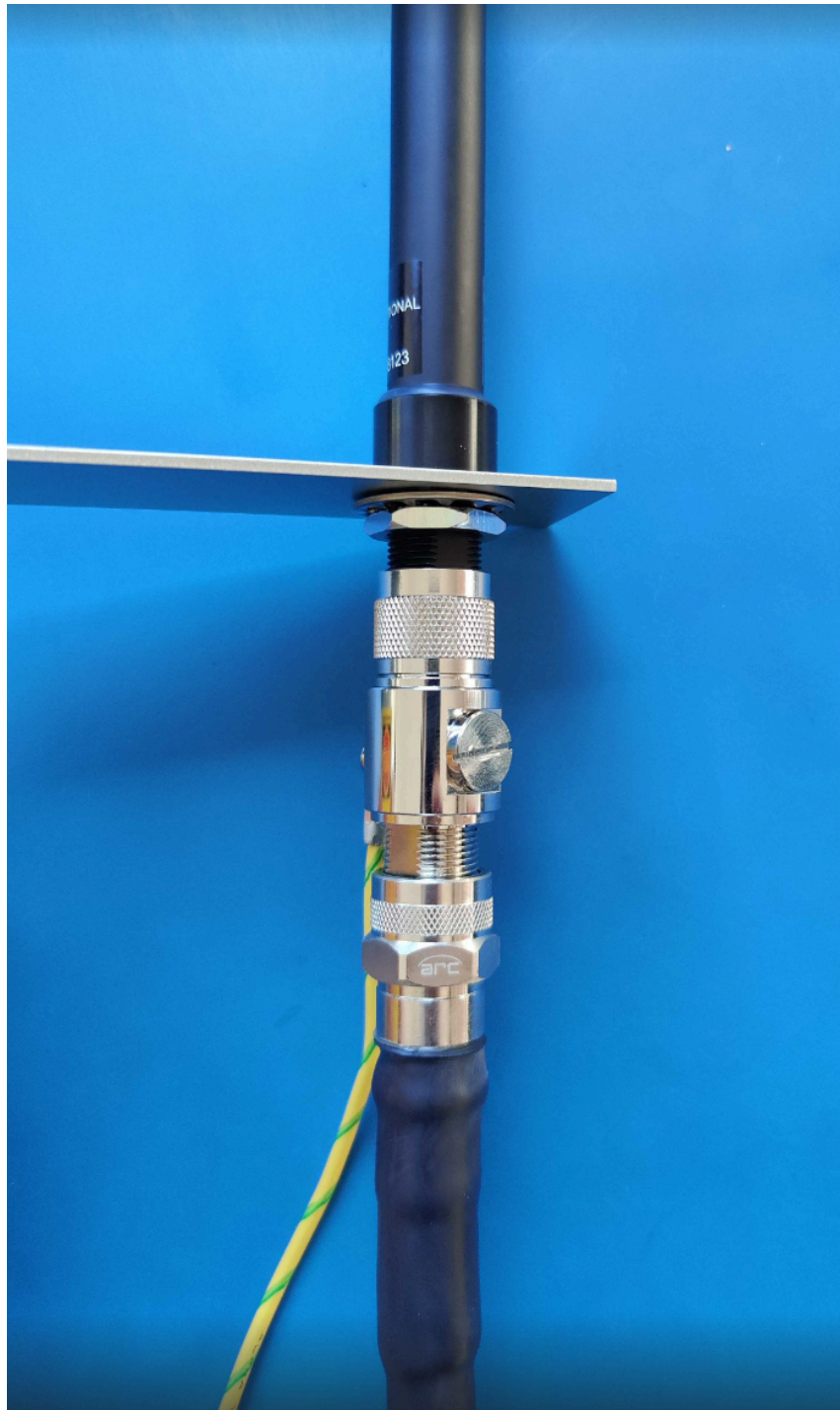


3. Install the Surge protectors at the antenna ports, crimp and attach the earth wire to an available earthing point.

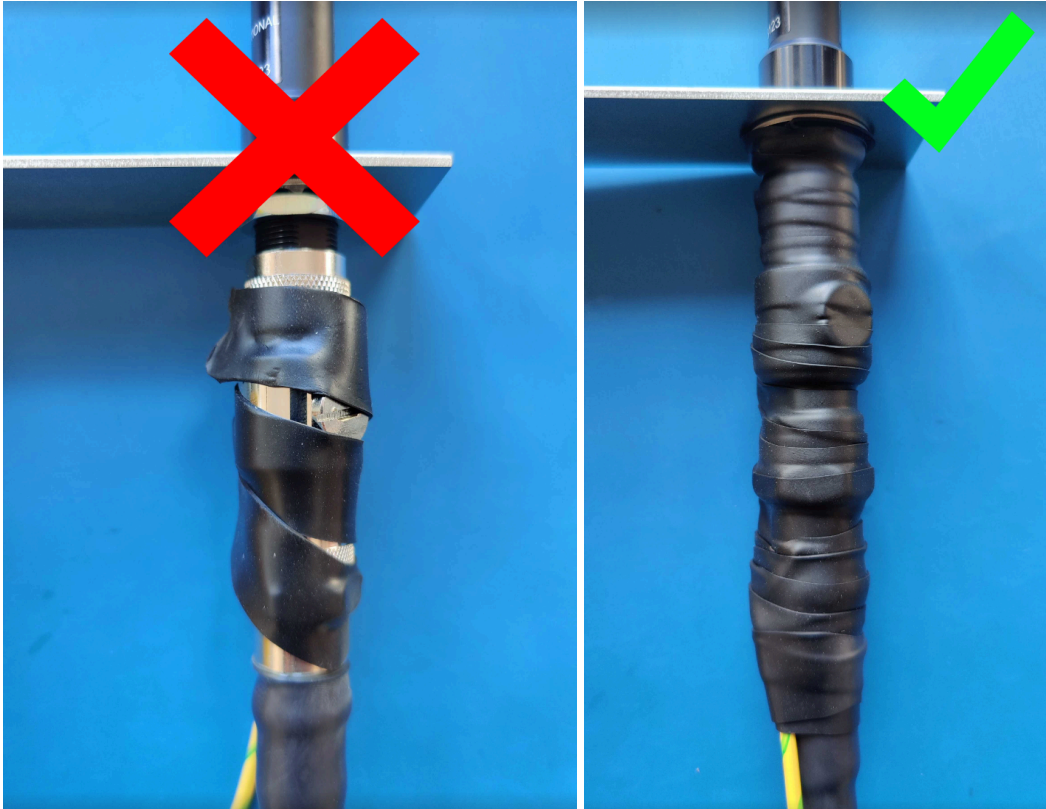
*If the location onto which the brackets are installed is metallic and earthed, this is generally the preferred position of Surge protector installation, since the earth wire length can be kept relatively short.*



4. Connect the Cables to the antenna port and ensure the connectors are sufficiently tightened.

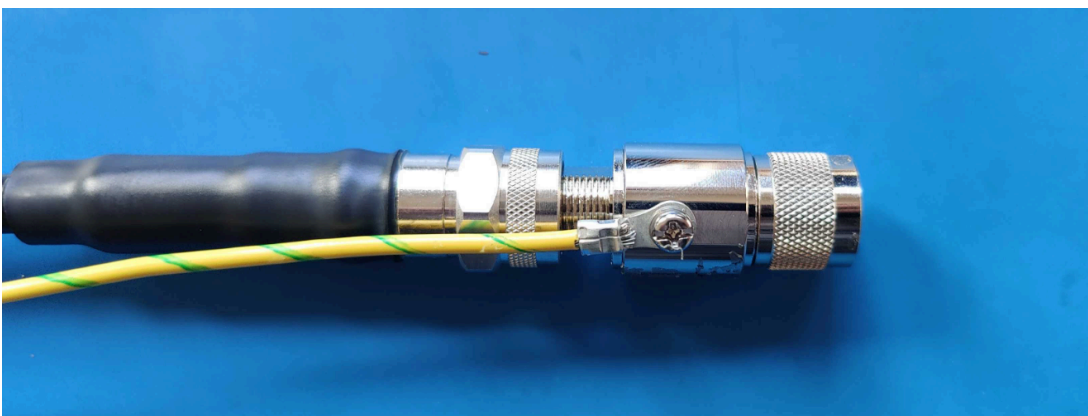


5. Seal the Antenna - Cable connections by tightly wrapping the exposed metal parts with weather sealing rubber tape. An approx. 10mm / 0.5" overlap with the cable is recommended.

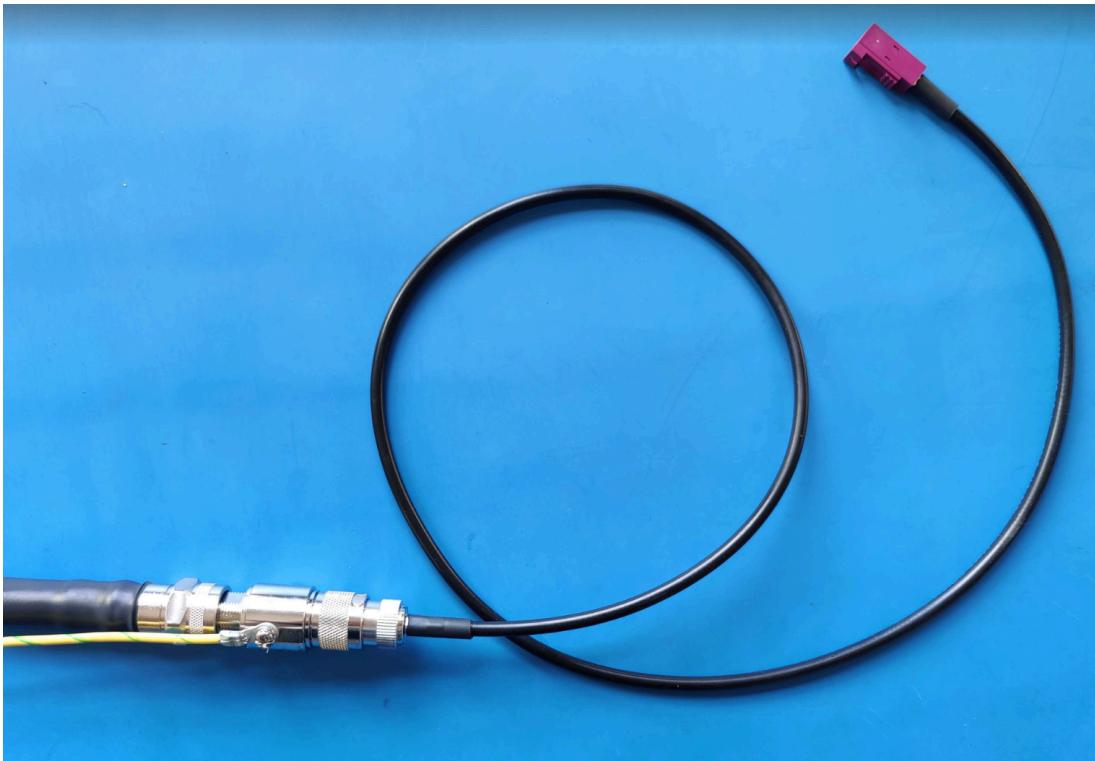


6. Route the cables along the desired path towards the Hive.
7. It is recommended to secure the cables at regular length intervals with wall mount brackets or with zip ties.
8. If **not** installed in [Step 3](#) above, now install the Surge protectors at the Hive-side cable end, crimp and attach the earth wire to an available earthing point.

If [Step 3](#) was performed, skip to the next step.



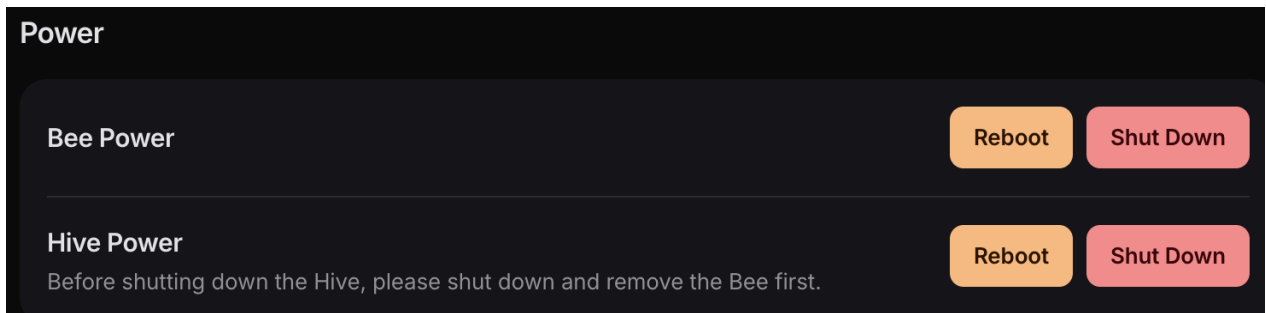
9. Connect the cables to the Hive cable adapters and ensure the connectors are sufficiently tightened.



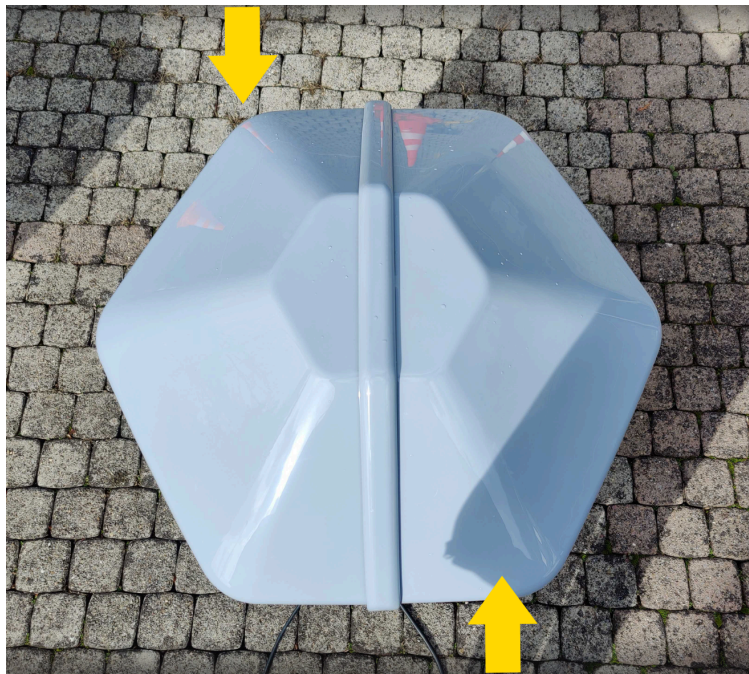
10. Seal the Cable - Hive adapter connections by tightly wrapping the exposed metal parts with weather sealing rubber tape. An approx. 10mm / 0.5" overlap with the cable is recommended.

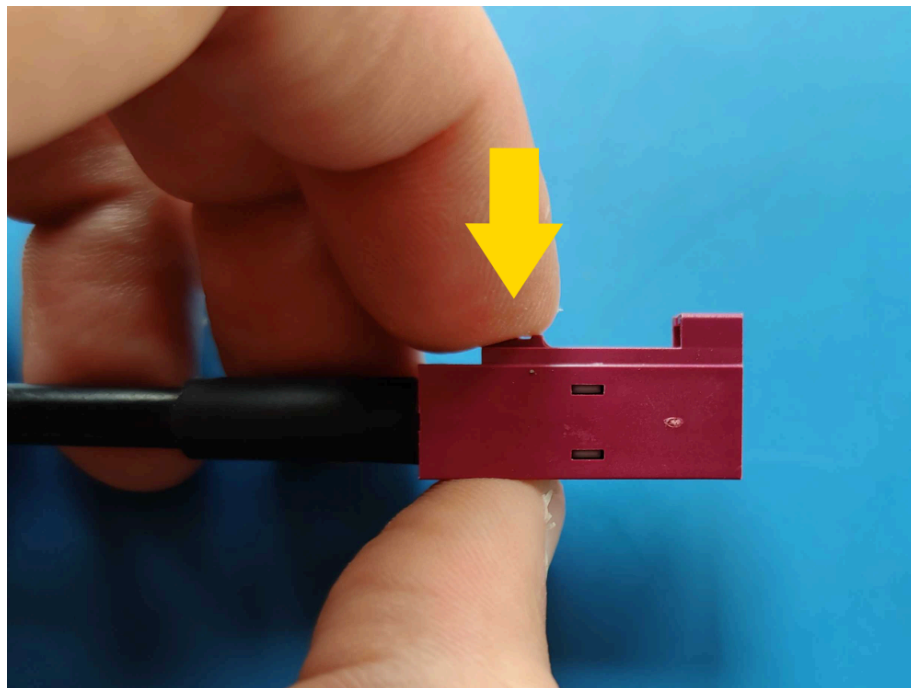
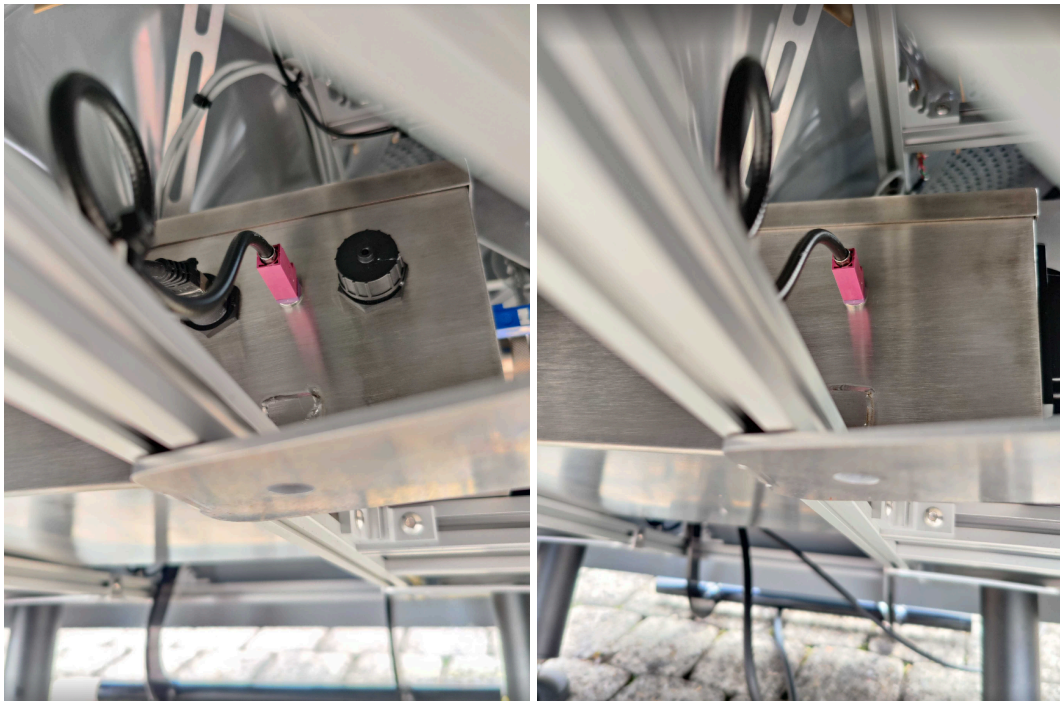


11. Open the Hive roof, remove the Bee, and turn off the Bee. Carefully set the Bee aside.
12. Navigate to **Settings**→**Power&Controls** in the control station and **Shut Down** the Hive. Remove the power connection from the Hive.



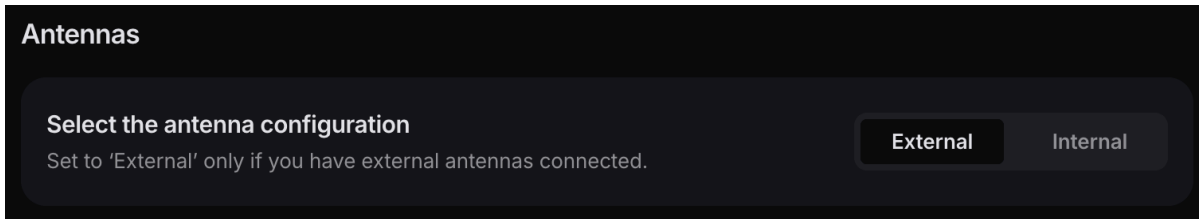
13. Disconnect the 2 violet connections from the Hive Brood Box by pressing on the locking latch at the top of the connector and pulling the connector backwards. It is recommended to apply some tape/covering to protect these connections in case the internal antennas are reconnected in the future.





14. Connect the 2 Hive cable adapters to the violet connections on the Brood Box. A “click” should be heard once the connectors are properly locked in place. The two connectors are interchangeable, so it does not matter which cable connects to which port.
15. In case of an excess cable length, this can be rolled up and hidden beneath the Hive. **Care should be taken that the minimum bend radius of the cable is observed, to avoid permanent damage! For LMR-400 cable, the installed radius needs to be more than 25mm / 1in.**

16. Power on the Hive by restoring power to it and wait for the Hive to power up.
17. Turn the Bee back on and place it in the Hive.
18. In the control station, navigate to **Settings**→**Radio** and turn the **Antennas** setting to **External**.



19. Perform a Checkout Flight prior to flying to existing observation points, to verify proper system operation. In case of unexpected issues, please contact SFL.

## 4. Acronyms/Terms

| Acronym   | Description                                |
|-----------|--------------------------------------------|
| Bee       | The Unmanned Aircraft (the UA)             |
| Brood Box | Main electronics enclosure within the Hive |
| Hive      | The ground station of the Beehive 1 system |
| SFL       | Sunflower Labs                             |

## 5. Record of Revisions

| Rev | Date        | Change Description                                                  |
|-----|-------------|---------------------------------------------------------------------|
| A   | 08 Jan 2025 | Initial release.                                                    |
| B   | 11 Mar 2025 | Updated with settings for external antennas in the control station. |