Positioning System — Client Setup Guide

What is in the kit

Item	Label	Quantity	Description
Wi-Fi Trilateration Unit (Beacon Box)	A B C D	4	Fixed UWB anchors + Wi-Fi FTM responders. Mount these at known positions in the space.
Wi-Fi Receiver Unit	—	1	The mobile unit. Attach this to the object being tracked (e.g. forklift). Has two labelled buttons: EKF and Telemetry.
Power cables	—	4	To connect each beacon box to a power source.

✓*Minimum requirement: At least 3 Wi-Fi Trilateration Unit boxes must be powered and visible to the Wi-Fi Receiver Unit for a position estimate. Using all 4 gives better accuracy.*

⚠ How to use this document: read each step completely before starting that step, if you encounter any issues, please refer to the troubleshooting on page 10.

Step 1 — Choose and measure your coordinate system

Before placing anything, decide on a **reference point (origin)**, typically a corner of the room or a marked spot on the floor. All positions will be measured from this point. See the example image on page 2.

- **X axis**: positive pointing right from the origin (along one wall).
- **Y axis**: positive pointing forward from the origin (along the adjacent wall).
- Measure in **millimetres (mm)**.
- Measure from the centre of the front of the **Beacon Box**. The power supply is on the back of the box.
- Arrange the **Beacon Boxes** in rectangle or square with side lengths between 5000mm and 10000mm (5m-10m) and have one **Beacon Box** be placed on the origin (this is highly recommended to make setup easier and improve accuracy).

⚠ Important*: The beacon boxes do not need to be at exactly the same height, but mounting them at a similar level (e.g. all around 2 m above the floor) reduces 2D positioning error. More importantly, each beacon must have a clear line of sight to the area where the Wi-Fi Receiver Unit will operate. Avoid obstructions such as shelving, walls, or machinery. Do not mount beacons on the floor if possible. Record each beacon's height as its Z value.*

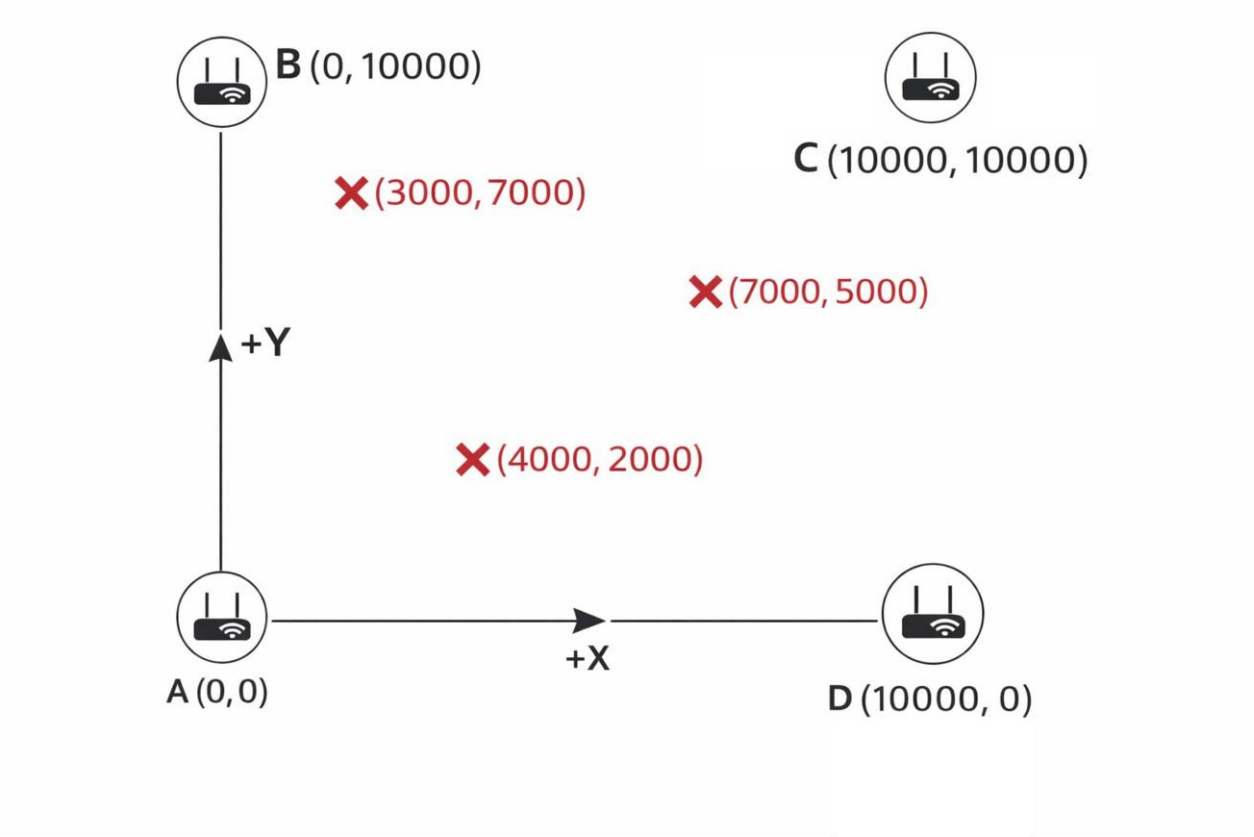
⚠ *Important:* Beacon A must be connected to power and visible to the other beacons in order for the UWB position measurements to occur.

Sketch your space and mark where each beacon box (A, B, C, D) will be placed before you start. Use the table below to record your measurements. Use the centre of the front of the box to make measurements. See the image on page 2 for an example of setup.

ID	Beacon	X (mm) from origin	Y (mm) from origin	Z (mm) — height from floor
1	A			
2	B			
3	C			
4	D			

✓*Placement tips: (1) Spread beacons around the perimeter of the tracked area — do not cluster them together. (2) Avoid placing beacons directly behind large metal objects or shelving. (3) Beacons should have a clear line of sight to where the Wi-Fi Receiver Unit will travel. (4) Avoid placing the beacons on the floor.*

Example Image (co-ordinates are in millimetres):



⚠ *Important:* Beacon A must be connected to power and visible to the other beacons in order for the UWB position measurements to occur.

Step 2 — Place and power the Wi-Fi Trilateration Units

1	Mount or place each box at its measured position. The label on the box (**A**, **B**, **C**, **D**) must match the position you recorded in Step 1. When mounting or placing the box, ensure that the front of the box is facing towards where the Wi-Fi Receiver Unit will be (the power input is on the back of the box).
2	Connect each box to a 220V power source. The beacon will power on automatically.
3	Wait **10–15 seconds** for all of the Wi-Fi Trilateration Units to fully start up. No further configuration is needed on them.

Step 3 — Power the Wi-Fi Receiver Unit box

1. Connect the Wi-Fi Receiver Unit box to a power bank or another power source using a USB type C cable.

⚠ *Important:* Power over USB Type-A to Type-C ONLY. Do not use with a Type-C to Type-C

2. Wait **10–15 seconds** for the device to boot.

⚠ *Important*: *If you encounter any problems, please consult the troubleshooting table on page 10.*

⚠ *Important: Both portals are toggled by their respective buttons — press once to open, press again to close. Only one portal can be active at a time from the same laptop (they share the same IP address — connect to the correct SSID first).*

Step 4 — Configure anchor positions (EKF)

In this step you will enter the measured coordinates of each beacon box into the Wi-Fi Receiver Unit.

Open the EKF configuration portal

1. Press the **EKF** button on the Wi-Fi Receiver Unit box once. The EKF device will start a Wi-Fi hotspot.

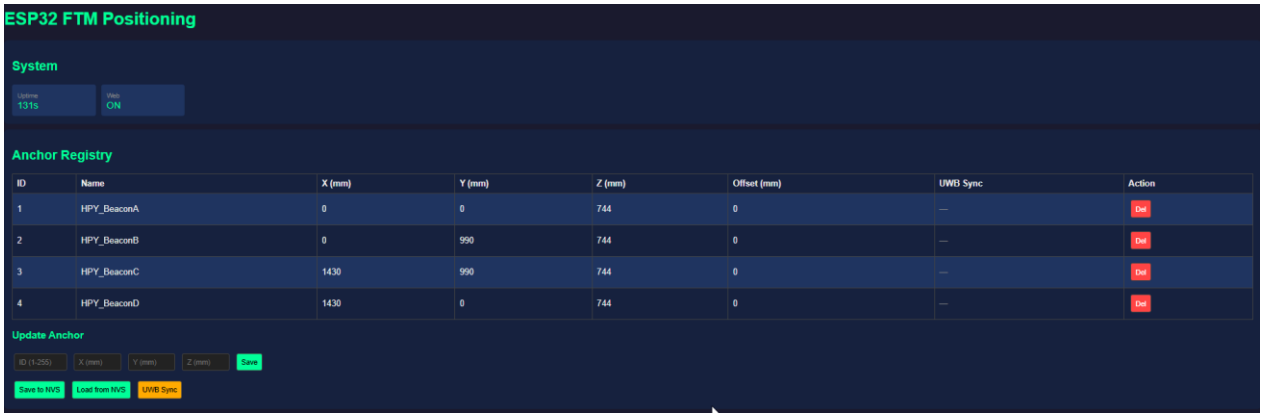
2. On your laptop, connect to the following Wi-Fi network:

Network (SSID)	`HPY_EKF_Config`
Password	`12345678`

3. Open a browser and go to: `http://192.168.4.1`
On the next page is a picture of what you should see when connected to `http://192.168.4.1`.

⚠ Important: If you cannot see `HPY_EKF_Config` , press the EKF button again and wait 10s and search again.

If you cannot connect to `HPY_EKF_Config` or `http://192.168.4.1` press the EKF button again, wait 3s and then press it again and try again.



Enter anchor positions

4	In the web page, navigate to the **Anchor Registry** section. The image below shows the **Anchor Registry**.

5	For each beacon box, add or edit an anchor entry. The **ID** corresponds to the letter on the box (A=1, B=2, C=3, D=4 — or as labelled). Enter the **X**, **Y**, and **Z** values in **millimetres** from your measurements in Step 1 into the boxes under **Update Anchor**. ⚠ Do not power off any devices during this step ⚠ Double-check each coordinate before saving. Wrong positions will produce incorrect location estimates.

6	After entering all four anchors, click **Save to NVS**. This stores the positions in flash memory so they survive a power cycle.

7	Next click **UWB Sync**. When the sync process completes, the table will show whether synchronisation was successful for each beacon. If a beacon was not synced, ensure that beacon is in the **Connected Beacons** table then press **UWB Sync** again.

8	If you are not doing calibration; press the **EKF** button on the Wi-Fi Receiver Unit box again to return it to normal operation.

Step 5 — Calibrate anchor offsets (recommended)

Calibration corrects systematic errors in the Wi-Fi FTM distance measurements. The system will work without calibration, but calibration improves the position accuracy.

> ✓*What you need: a tape measure and 3–5 reference points in the tracked area where you can measure exact (X, Y) coordinates from your origin.*

Prepare reference points

1. Mark 3–5 spots within the area covered by the beacons. Measure the **X** and **Y** distance of each spot from your origin. If possible, try to keep the reference points at the same height as normal operations of the Wi-Fi Receiver Unit. Write them down — you will enter them one at a time. An example of reference points is the red Xs on the image on page 2.

Open the EKF calibration tool

2. Ensure you are connected to `HPY_EKF_Config`, and open `http://192.168.4.1`.

3. Scroll down to the **Offset Calibration** section. Click **Clear Calibration** and **Zero All Offsets** to start a fresh calibration session if there are existing calibration values.
On the next page is an image of what you will see under **Offset Calibration.**

Measure each reference point

4 Enter the **X** and **Y** coordinates of the current position into the form and click **Measure from Position**. The system will automatically take **10 reading per beacon**. This takes approximately 30 seconds. Wait until the status updates before moving (the number of measurements will increase).
Repeat this 5 times in the same location.
⚠ Do not refresh this page. While taking measurements the EKF device switches off its Wi-Fi hotspot to range the beacons, so the page cannot be reloaded. If nothing happens after 30 seconds, check whether the green indicator light is visible through the box. If not press the EKF button once so that the green light is visible. Then connect to `HPY_EKF_Config` again.

5 Move the Wi-Fi Receiver Unit box to the next reference point, enter its coordinates, and click **Measure from Position** again. Repeat for all 3–5 reference points.
✓ Spread your reference points across the tracked area rather than clustering them. More positions = better calibration.

Apply offsets

6 After measuring all reference points, click **Compute & Apply Offsets**. The system calculates the correction for each anchor and applies it automatically.

7 Scroll down to the **Anchor Registry** section and click **Save to NVS** to store the calibrated offsets in flash memory.

8 Press the **EKF** button to return to normal operations.

⚠ *Repeat calibration any time a beacon box is moved to a new position or alternatively remove the calibration.*

Step 6 — Configure Wi-Fi and server (Telemetry)

In this step you will connect the Telemetry device to your local Wi-Fi network and point it at the server that will receive the data.

⚠ Important: If step 5 was skipped, press the EKF button once to return to normal functionality if it has not already been pressed.

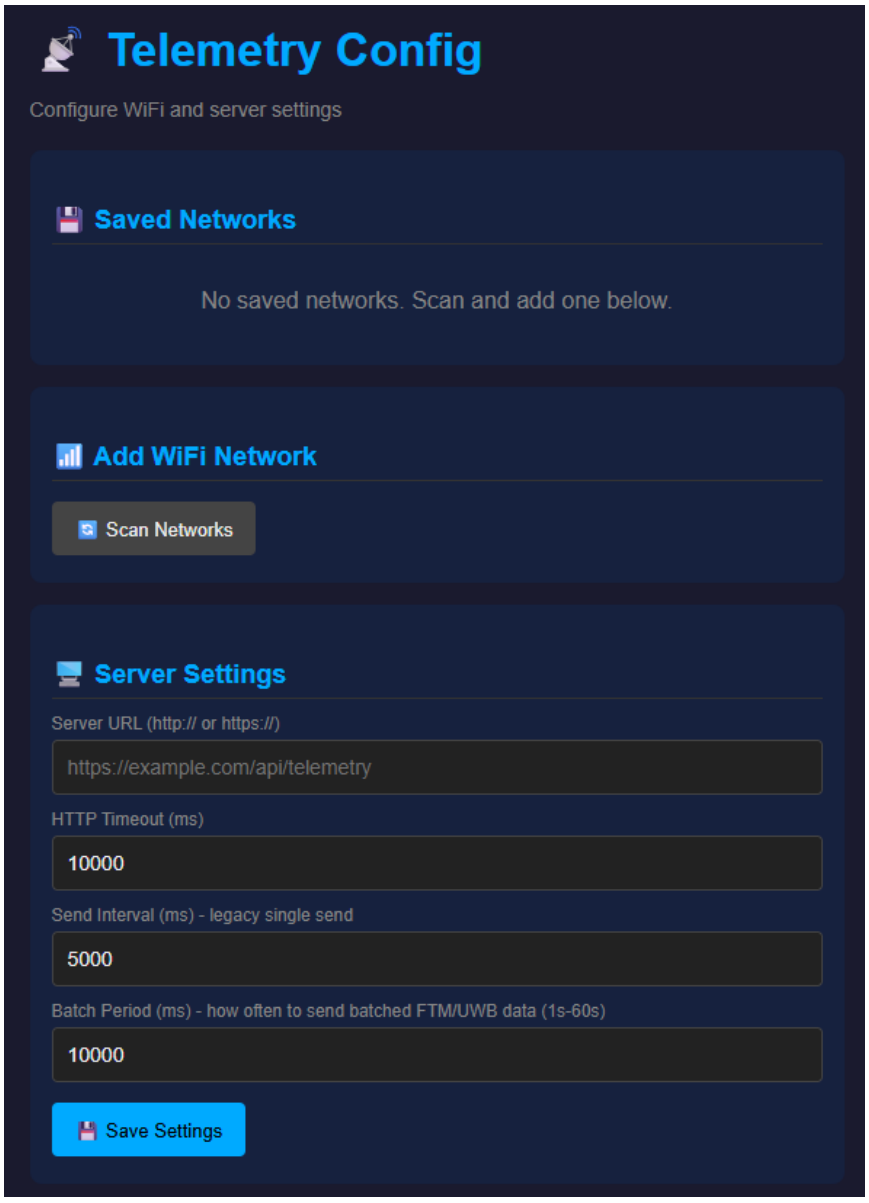
Open the Telemetry configuration portal

1 Press the **Telemetry** button on the Wi-Fi Receiver Unit box once.

2 On your laptop, connect to the following open (no password) Wi-Fi network:

Network (SSID)	`HPY_Tele_Config`
Password	none (open network)

3 Open a browser and go to: `http://192.168.4.1`
On the next page is an image of what you should see.



Connect to your Wi-Fi network

4 Click **Scan Networks**. Your local Wi-Fi networks will appear in the list.

5 Select your network from the list, enter the password, then click **Save & Connect**.

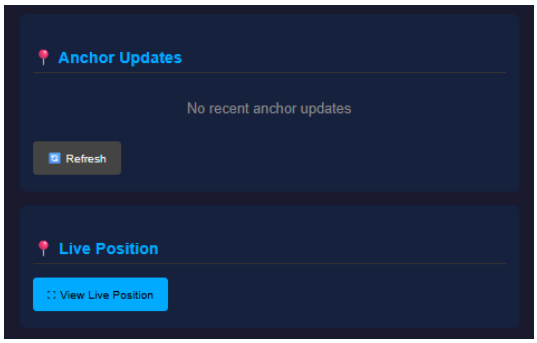
6	Wait about 15 seconds then ensure that your device is connected to `HPY_Tele_Config`. Then refresh your browser window and check the **Status** section on the page. It should show **CONNECTED** with an IP address. If it still shows disconnected, verify the password and try again.

Set the server URL

7	In the **Server Settings** section, enter the server URL provided to you:
Server URL	*(enter the URL you were given)*
HTTP Timeout	`10000` ms (default — leave unchanged)
Batch Period	`10000` ms (default — leave unchanged)

8	Click **Save Settings**.

Step 7 — Verify the system is running



0	If you are not connected to **HPY_Tele_Config** and it is not visible in your Wi-Fi networks, press the Telemetry button. Connect to it and open a browser and go to: `http://192.168.4.1`

1	Still in the `HPY_Tele_Config` scroll down and click **Refresh** under **Anchor Updates.**

2	Click **View Live Position** under **Live Position**, this will open a new tab in your web browser and show the current position estimate.

3	Ensure that the positions of the beacons/anchors match with the table on page 1, if they do not first try clicking **Refresh** under **Anchor Updates** again then refresh the live position page. If they still do not match, follow **Step 4** again for the beacons/anchors that are incorrect.

✓*The Wi-Fi Receiver Unit will produce a position estimate only when it can range to at least 3 beacon boxes. If fewer beacons are reachable, raw range data is still uploaded but no position will be computed.*

Re-configuring after a move or reset

If a Wi-Fi Trilateration Unit box is relocated, repeat **Step 4** to re-enter the affected anchor coordinates, then repeat **Step 5** (calibration) from the new position. Settings for anchors that have not moved do not need to be re-entered as their location did not change.

If the Wi-Fi network or server URL changes, repeat **Step 6**.

Quick reference — Wi-Fi access points

Device	Button on Wi-Fi Receiver Unit box	SSID	Password	Web address
EKF (positioning config)	EKF	HPY_EKF_Config	12345678	http://192.168.4.1
Telemetry (Wi-Fi & server config)	Telemetry	HPY_Tele_Config	none (open)	http://192.168.4.1

Troubleshooting

Symptom	Likely cause	Action
HPY_EKF_Config network does not appear	EKF device not booted yet, or portal not active	Wait 10 seconds then turn your WiFi off and then on, if it is still not there then press the EKF button again. Make sure the Wi-Fi Receiver Unit box is powered.
HPY_Tele_Config network does not appear	Telemetry device not booted yet, or portal not active	Wait 10 seconds then turn your WiFi off and then on, if it is still not there then press the Telemetry button again.
Browser cannot open http://192.168.4.1	Your device is not connected to the current WiFi network.	Confirm you are connected to the correct SSID (WiFi name) and there are no mobile data override. If still not working, press either the EKF or Telemetry button, wait 5s, press the same button again. Wait 5s then try to connect to the WiFi again.
An error popup message occurs on the http://192.168.4.1 webserver.	The webserver was briefly unable to be contacted as it was performing another function.	Wait 5s and then ensure that you are still connected to the WiFi.
Telemetry status shows DISCONNECTED	Wrong Wi-Fi password, or network out of range	Re-open the Telemetry portal, delete the saved network, and re-enter credentials.
No data reaching the server	Server URL incorrect, or Wi-Fi not connected	Re-open Telemetry portal and verify Status shows CONNECTED and server URL is correct.
Position estimate is wrong or jumps around	Anchor coordinates entered incorrectly, or fewer than 3 beacons visible	Re-check measurements and re-enter coordinates via EKF portal (Step 4). Ensure all beacon boxes are powered and within line-of-sight.

Position is consistently off by a fixed amount	Calibration not performed, or offsets not saved	Run calibration (Step 5): place Wi-Fi Receiver Unit at known positions, measure, then Compute & Apply Offsets, then Save to NVS.
EKF portal closes immediately after opening	Button pressed twice accidentally	Press the EKF button once to re-open.

Daily Use and Care

1. Note that when the any of the devices are power cycled (turn off and then on again) they will enter into normal operating mode, this means that if you are unsure of how many times you have pressed the EKF or Telemetry buttons, you can power cycle the **Wi-Fi Receiver Unit** to ensure AP mode is off.
2. In order to view the current estimated position, follow **Step 7**.
3. Once the initial setup is completed, the device will function as soon as it is powered on, no need to press any buttons.
4. Do not move the beacon boxes once configuration has been completed, if a beacon is moved, its position must be updated by repeating **Step 1**.
5. Moving the WiFi Receiver Unit is fine apart from during the measurement phase of calibration.
6. When the devices are not in use, they should be unplugged from the power supply.
7. The devices are not suitable for outdoor use.
8. The devices are not waterproof or dustproof.
9. The devices should be stored and operating in dry environments with no direct sunlight.
10. These devices are designed to operate within a temperature range of 0°C to 40°C; exposure to temperatures outside this range may negatively affect performance and measurement accuracy.

Updating Firmware Over Wi-Fi (OTA)

If updated firmware files are provided, you can flash them wirelessly — no USB cable or laptop tools required. The compiled binary files (.bin) will be supplied to you directly.

EKF (Wi-Fi Receiver Unit)

1. Press the EKF button once.
2. Connect your laptop to the Wi-Fi network HPY_EKF_Config (password: 12345678).
3. Open a browser and go to http://192.168.4.1
4. Find the “Firmware Update (OTA)” card and click Choose File.
5. Select the supplied file ekf_positioning.bin and click Upload & Flash.
6. The device reboots automatically. Press the EKF button once to return to normal operation.

Telemetry (Wi-Fi Receiver Unit — Telemetry module)

7. Press the Telemetry button once.
8. Connect to the Wi-Fi network HPY_Tele_Config (no password).
9. Open a browser and go to http://192.168.4.1
10. Find the “Firmware Update (OTA)” card, select telemetry_receiver.bin, and click Upload & Flash.
11. The device reboots automatically.

Beacons (Wi-Fi Trilateration Units A, B, C, D)

12. Connect to the beacon's Wi-Fi network (no password): Beacon A: HPY_BeaconA | Beacon B: HPY_BeaconB | Beacon C: HPY_BeaconC | Beacon D: HPY_BeaconD
13. Open a browser and go to http://192.168.5.1/update
14. Select the matching binary (e.g. beaconA.bin for Beacon A) and click Update.
15. The beacon reboots automatically. Repeat for each beacon.

Important: Only flash firmware files supplied by your system provider. Do not power off any device during an update.