**Emlid RS3 GNSS RTK Base & Rover setup**

**Initial setup steps**

Configuration - Emlid Flow App:

a. **Connect to Receiver**: Use your mobile device to connect to the RS3 receiver's Wi-Fi network. (Bluetooth also works but on March 9th, 2024, still an experimental feature) Name will be similar to: **reach:XX:XX,** and the password will be: emlidreach

b. **Open Emlid Flow App**: Launch the Emlid Flow app and connect to the base station receiver.

c. **Switch correction input to OFF.**

d. **Correction output**: Set the base output mode to LoRa, and tap on the i icon for coordinate and station info

RS3 Receiver Verification and Calibration:

a. **Signal Reception**: Verify that the RS3 receiver is receiving GNSS signals from satellites with good signal strength and accuracy.

Set up your base[​](https://docs.emlid.com/reachrs3/rtk-quickstart/reachrs3-kit/rtk-over-lora#set-up-your-base)

Now you need to configure RTK settings and communication over LoRa radio between the base and the rover. Let's start with the base, follow the steps below:

1. Connect to the base unit.
2. Go to *Settings* and tap *GNSS settings*. Pick each of the satellite systems.
3. Set the GNSS update rate at 5 Hz
4. Return to the *Receivers* screen. On the *Base settings* screen, go to *RTCM3 messages*.
5. Select to output RTCM3 messages as follows:
   * *ARP station coordinates* at **0.1 Hz**
   * Other MSM4 messages at **0.5 Hz**
6. Tap *Apply*.
7. Return to the *Receivers* screen. On the *Base output* screen, select *LoRa*.
8. Tap the *Edit* button in the *LoRa* cell. Select frequency and set the output power at **20 dBm**.
9. Set air data rate at **9.11 kb/s**. Tap *Save*.

Set up your rover[​](https://docs.emlid.com/reachrs3/rtk-quickstart/reachrs3-kit/rtk-over-lora#set-up-your-rover)

To complete configuring RTK settings and communication over LoRa radio between the base and the rover, you need to set up your rover. Follow the steps below:

1. Connect to the rover unit.
2. Go to *Settings* and tap *GNSS settings*.
3. Select the same GNSS systems as for the base and set 5 Hz GNSS update rate. Apply changes.
4. To configure LoRa radio on the rover unit to receive the corrections, return to the *Receivers* screen and tap *Correction input*.
5. Select *LoRa*. Set the same frequency and air data rate as for the base. Tap *Save*.

**Site Selection:**

**Choose Location**: Select a suitable location for the base station with a clear view of the sky and minimal obstructions that could interfere with GNSS signals. Higher elevation to site is preferred for RTK fix, but not mandatory.

**Accessibility**: Ensure that the chosen location is easily accessible and safe for setup and operation of the base station equipment.

**Fixed points:** Bring any fixed-point coordinates if available to input manually for base station

**Tripod Setup**:

a. **Find previous marked spot** (if available): make sure marked point is directly under base station.

- If creating a new known point, bring a rebar spike or similar equipment to mark the position.

b. **Extend Legs**: Extend the legs of the tripod to the desired height, ensuring stability and levelness of the setup.

c. **Secure Position**: Place the tripod on a stable surface and secure it in place to prevent movement or tipping during operation.

d. **Leveling**: Use a leveling tool to ensure that the tripod is level. Adjust the tripod legs as needed.

**RS3 Receiver Setup**:

a. **Mount Receiver**: Attach the Emlid RS3 receiver that has been designated as the base station to the mounting plate or adapter on top of the tripod, securing it firmly in place.

b. **Antenna Placement**: Mount the GNSS LoRa antenna onto the RS3 receiver, ensuring a clear line of sight to the sky without obstructions.

c. **Height:** Use measuring tape to measure the height from the ground to the bottom of the RS3, receiver height is calculated internally.

d. **Power On**: Power on the RS3 receiver and wait for 3 minutes for it to gather points or manually input marked coordinates if available

**Place Reach RS3 units**[**​**](https://docs.emlid.com/reachrs3/rtk-quickstart/reachrs3-kit/rtk-over-lora#place-reach-rs3-units) **(Skip if already configured)**

When you configured settings on both base and rover, you are ready to go outside to place the base and complete the setup process. For the field work, you will need a tripod and a survey pole. To place the units, follow the steps below:

Before placing the base, make sure that you are in an open area with a clear sky view. This will ensure good signal reception and a fair number of available satellites.

**Field-steps**

1. Mount Reach RS3 base.
2. Accurately level the tripod.
3. Put the rover on the pole.
4. A screenshot of a phone

   Description automatically generatedAttach LoRa antennas to both units.
5. Turn on the receivers.

After placing the base on the tripod, you can complete its setup:

This example uses the Average SINGLE base setup method. To learn more about methods of setting up the base, check the [Base setup](https://docs.emlid.com/reachrs3/base-setup/choosing-base-setup-method) guide.

1. Connect to the base.
2. On the *Receivers* screen, tap *Base settings*.
3. To configure base settings, tap the *Configure* button.
4. Select the base coordinates entry method and set averaging time to >20m. Tap *Save*.

CAUTION:

Do not move the base while Reach is accumulating data.

NOTE:

* Base position is averaged automatically every time the receiver turns on unless turned on.
* After accumulating the data, you will see averaged coordinates in the *Base marker* section. Now your base is set up and transmits corrections to the rover.

**View results**[**​**](https://docs.emlid.com/reachrs3/rtk-quickstart/reachrs3-kit/rtk-over-lora#view-results) **(refers to text in above image’s red box)**

When you completed your RTK setup over LoRa radio, you can see the current solution status in the top right corner of the Emlid Flow app:

* **SINGLE** means that the rover has found a solution relying on its own receiver and base corrections are not applied. Precision in standalone mode is usually at the several-meter level.
* **FLOAT** means that the rover receives corrections from the base but cannot resolve all ambiguities, and in this case, the precision is usually at the submeter-level.
* **FIX** means that the rover using corrections from the base resolved the ambiguities in its positional calculation and achieved the solution with the centimeter-level precision.

-If Fix is not being acquired, attempt extending the rover pole to its maximum height.

-You can also find the current solution status as well as your position in real time on the *Status* screen.

**DJI RTK drone and Reach RS3 base integration**

DJI RTK drones can use NTRIP to receive corrections which allows you to use Reach RS3 as a base station. Reach can send NTRIP corrections via the Local NTRIP option in Emlid Flow without connection to the internet.

**To set up your Reach RS3 as a base for DJI RTK drone, you will need the following:**

* DJI drone with RTK functionality as a rover (M300rtk, M350 rtk, Phantom 4rtk)
* Controller
* Reach RS3 as a base
* A smartphone or tablet with the Emlid Flow app installed

**Set up Reach RS3 as Base**

1. Open your mobile device to the wifi screen and connect to your base station’s wifi
2. Open Emlid Flow and connect to your Reach.
3. Tap *Base Output* and select the *Local NTRIP* option
4. Tap the *Information* button to access the page with rover credentials
5. Connect your controller to the same base station wifi network

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A screenshot of a computer

Description automatically generatedSetting up Drone as the Rover

* Connect the controller to your drone.
* Navigate to the drone camera view
* Open Settings by tapping the 3 dots icon in the top right corner.
* Go to the RTK Settings tab
* In RTK Service Type, choose Custom network RTK in the RTK service type dropdown and fill in the Local-NTRIP credentials form. (UI may differ between drones)
* Once saved, switch to the new Custom network RTK and reboot your drone. A restart is required any time a change in RTK source occurs.

**Additional tips**

If having trouble with connecting to base station RTK, check or try the following:

* RS3 station output is on local NTRIP mode
* Information from RS3 Local NTRIP credentials is correct on the drone
* Check the RTK source did change after reboot, if not, reboot again.
* The controller is within a 20-30m distance to the base station
* Move drone closer towards the base station.
* If all of above are not effective, follow the below:
  + In drone rtk settings, switch off RTK positioning.
  + Manually take off with the drone and ascend to ~50m AGL
  + Switch on RTK positioning again and wait for connection.

**Collecting and Using Manual Points with a Base and Rover Receiver SOP**

**Methods:**

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Description automatically generated**1: Static point collection**

This method is intended for gathering the initial data required to create a known point for the next site visit, as well as a temporary marker for drone flight if required.

1. Open the Emlid Flow app and connect to your Reach.
2. Go to *Base settings* of your Reach and tap *Configure*.
3. Tap *Coordinates entry method* and select Average SINGLE from the menu.
4. Measure the distance from the mark to the bottom of your Reach (h in Figure below)
5. Specify the measured distance in Emlid Flow. It will automatically calculate the antenna height.
6. Tap *Antenna height* to set the antenna height and save it.
7. Ensure the Base station’s logging has started recording within the *Logging Settings* menu
8. Wait for 4 hours for the base station to record its position
9. End recording once it has passed the 4 hour mark
10. Refer to the PPK workflow for creating a base marker.

**2: Import previously available coordinates**

When placing your Reach in the field, make sure your Reach device is placed precisely above the marked point on the tripod and leveled. When you are setting up base coordinates manually, you need to measure the antenna height offset. Follow the steps below:

1. Open the Emlid Flow app and connect to your Reach.
2. Go to *Base settings* of your Reach and tap *Configure*.
3. Tap *Coordinates entry method* and select *Manual* from the menu.
4. Measure the distance from the mark to the bottom of your Reach (h in Figure below)
5. Specify the measured distance in Emlid Flow. It will automatically calculate the antenna height.
6. Tap *Antenna height* to set the antenna height and save it.
7. Enter the geographic coordinates of your point in DD or DMS format or import a point from your Emlid project by tapping Choose from project.
8. A screen shot of a device

   Description automatically generatedEnter the geographic coordinates of your point in DD or DMS format, or import a point from your Emlid project by tapping *Choose from project*.
9. Once you’ve set the coordinates of the point, tap *Save* in the upper right corner.

TIP

If your known point has local coordinates, add it to your Emlid project and use the point picker option to set it as a base’s coordinates. Emlid Flow will convert this coordinates into geographic ones.

The coordinates of your base are now set, and you are ready to proceed with creating a project on your rover.

**3: Placing GCP’s & exporting points with Rover (with fix)**

1. After ensuring the LoRa connection is set up between the Base and Rover units, follow the steps below:
   * Check the IMU is enabled on the Rover station
     1. This means the rover pole will automatically calculate the tilt offset if it’s not perfectly level, and the pole tip is centered over the measured point.
   * Create a project in the survey option at the bottom of the Emlid flow app
   * Ensure the Project coordinate system is correct, for purposes of the project system should be **WGS 84 EPSG 26910**
2. Place GCP at desired positions, or carry GCPs to marked positions
3. Centre the Rover pole tip over the centre of the GCP
   * Tap the *Plus* button to open the *Collector* menu.
   * Name the point and hit collect.
   * If name contains a number, Emlid flow will automatically name the next point in ascending order, e.g. GCP 1 will turn GCP 2 and GCP 3 after each point collection
4. Points can be exported as a CSV file from the list of known points in the project.

NOTE:

Projects are saved locally to the mobile device that created it, therefor aim to use the same device for projects, or make a note what projects each device contains.

**4: Stop & Go (No FIX between base & rover)**

This method is used in the situation where there is insufficient line of sight, absence of an internet connection, non-availability of the NTRIP service, etc.

The workflow in the field involves the use of a base and a rover attending all unknown points and occupying each one for a short time. The technique can be compared to point collection in RTK, but precise positions of collected points are calculated afterward, not in real time.

Workflow:

1. Follow previous workflow for **setting up base** and power on
2. Open Emlid flow and connect to the **base**
3. Leave base receiver on average single (or manual if fixed point available) and let it log for as long as possible.
4. Open Emlid Flow and connect to the rover.
5. On the Receivers screen, tap Settings.
6. Go to GNSS settings and set the update rate at 1 Hz for the base and at 5 Hz for the **rover.**
7. Go back to the Receivers screen and tap Logging.
8. Tap the Recorded logs and settings button.
9. To configure logging, tap the Settings button.
10. Choose the required RINEX format in the Raw data section.
11. If you do not know which version of RINEX you need, we recommend using RINEX 3.03
12. While recording in the RINEX format, you can log the UBX file as a backup. UBX file can be used to adjust RINEX file settings in the Converter tool in Emlid Studio. You can enable logging in the UBX format in the logging settings in Emlid Flow.
13. Tap Show configuration and select the required satellite systems.
14. Make sure that you have chosen the same set of satellite systems both on the rover and the base.
15. Set the logging interval at Full rate.
16. Use antenna height and enter the measured height to the bottom of the receiver for the base. Don't use it for the rover.
17. Leave the Marker name field empty.
18. Tap Apply.
19. You can start recording automatically when your receiver is turned on. Check the corresponding field on the Raw data settings screen.
20. Enable log recording by tapping the Start recording button. The red recording icon will appear in the status bar.
21. Now you are ready to collect the points. To learn more, check the Collect points guide.
22. To finish recording logs, tap the End recording button.
23. Wait for data processing to finish.
24. Create a project survey and specify the correct coordinate system.
25. With the rover, walk over to each point collection spot and let it average for 3-5 minutes.
26. After each point is averaged, create a point on project survey and tap + to name and save.
27. Upon returning to office, download the logs of both base station and rover via emlid flow on a phone (only way as of 2024/04/08) to Files app and then transfer to OneDrive from there.
28. Follow the [Stop & Go emlid studio workflow](https://docs.emlid.com/emlid-studio/stop-n-go-with-ef-workflow/) for post-processing