

A step by step guide to place GCP's in Post Processed Kinematic (PPK) mode

Post Processed Kinematic method

Post-Processed Kinematic (PPK) is an alternative technique to Real-Time Kinematic (RTK). With PPK workflow, accurate positioning doesn't happen in real time, all algorithms are applied afterwards. Both base on the ground and rover record raw GNSS logs, which are then processed to receive an accurate positioning in the office.

More details: <https://docs.emlid.com/reachrs/tutorials/basics/ppk-introduction>

Here we will use “Stop & Go with RV3” method. See following information from EMLID tutorial;

Stop & Go with RV3

With the Stop & Go with RV3 feature, Emlid Studio allows you to get separate points from the track of measurements using raw data logs from a base and a rover and a CSV file from the ReachView 3 app. This technique can be compared to point collection, but all the required points are obtained after processing.

Stop & Go with RV3 involves the use of a base placed at a known point and a rover attending all unknown points and occupying each one for a short time. That is why this technique called "Stop & Go".

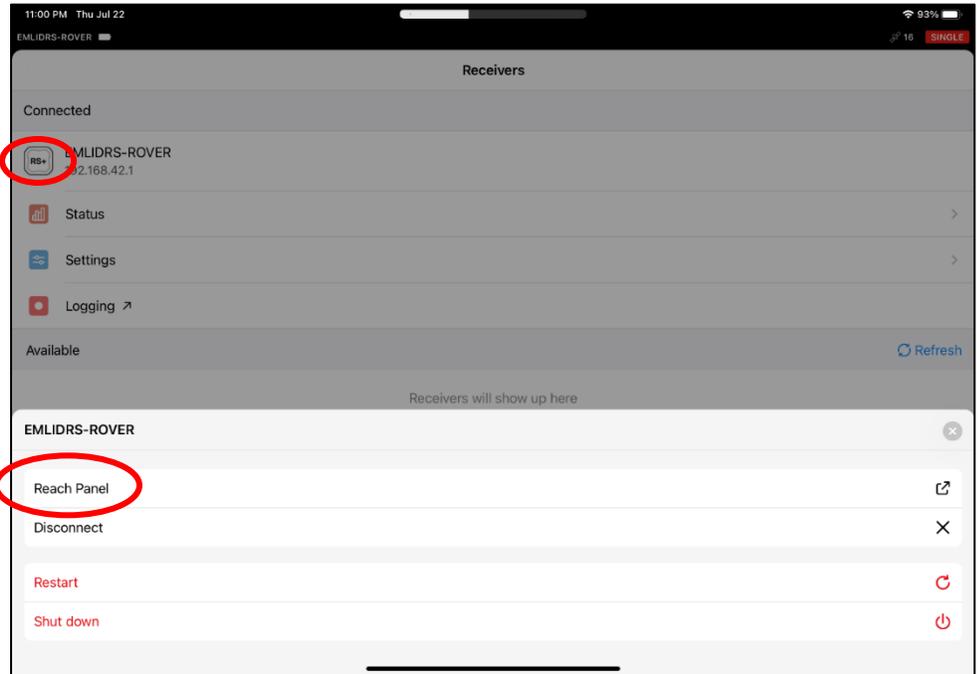
The advantage of this technique is that it can be used when it is impossible to provide a real-time correction link between the base and the rover due to insufficient LoRa line of sight range, absence of the Internet connection, non-availability of the NTRIP service, etc.

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NOTE: Please switch on and configure the ROVER first. Then the rover will be the wifi hotspot automatically and it will help to keep the connection between the rover and your iPad throughout the survey.

Configuring the rover (EMLID RS+ receiver)

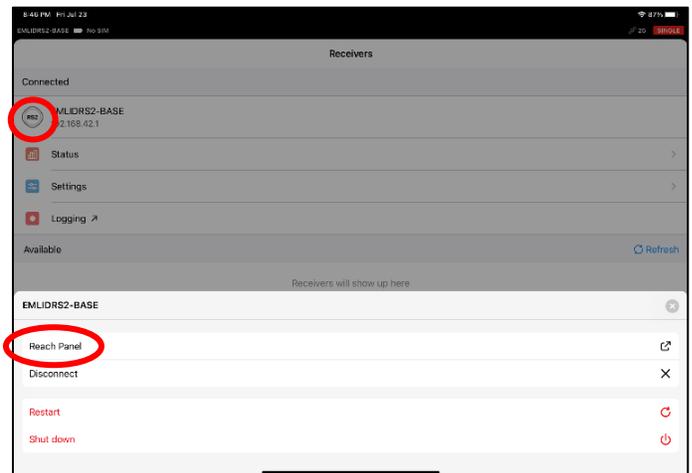
1. Switch on RS+ receiver and let it find its position, in the iPad, connect to the RS+ wifi network (password = emlidreach)
2. Once connected, click on the RS+ button, then a new panel will appear like below. Select Reach Panel.



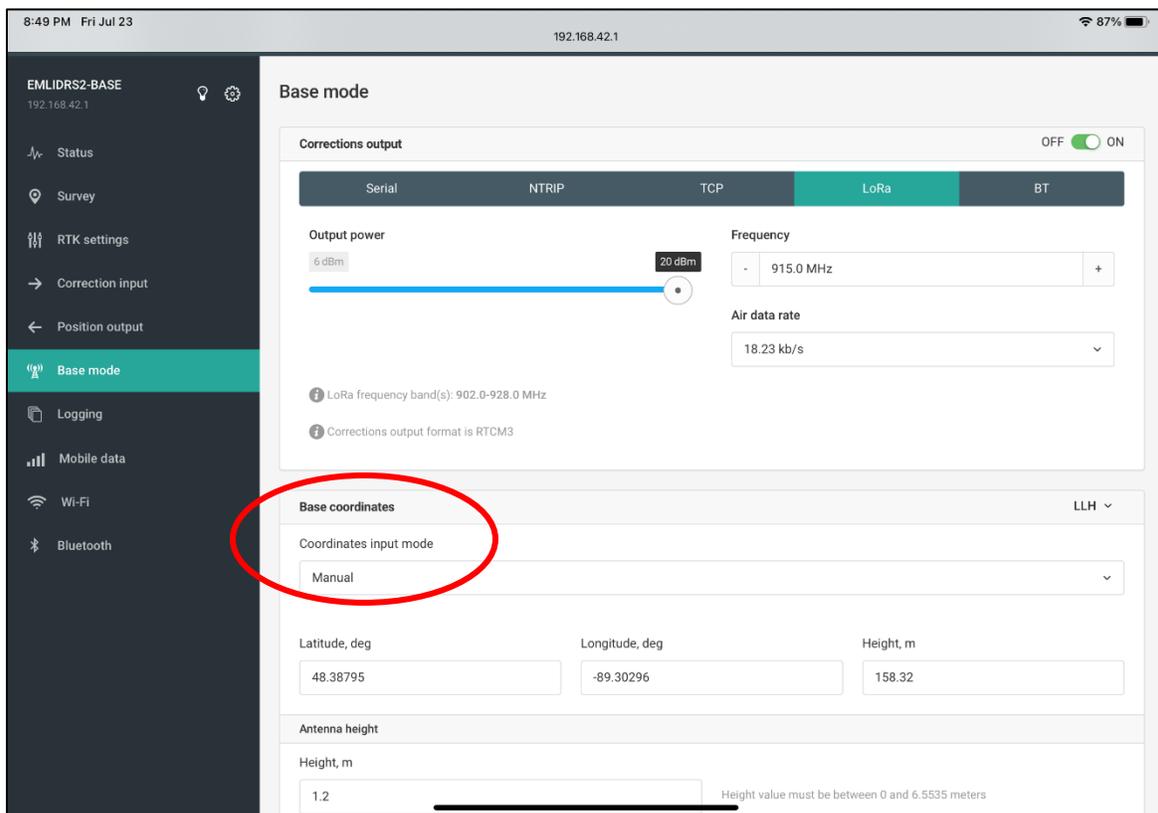
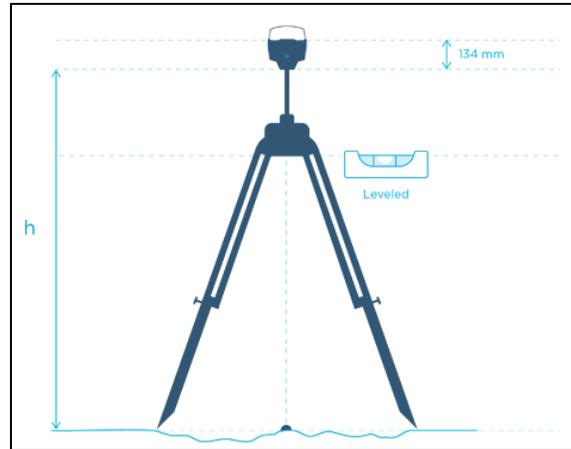
3. Go to the "Logging" tab, select "Raw data", and start logging. A raw data log contains GNSS observations from the receiver without the calculation of accurate coordinates. It can be recorded directly into UBX format.

Configuring Base receiver (EMLID RS2 receiver)

1. Set up the RS2 receiver at the known point as a base
2. Switch on RS2 receiver and let it find its position, in the iPad, connect to the available RS2 wifi network (password = emlidreach)



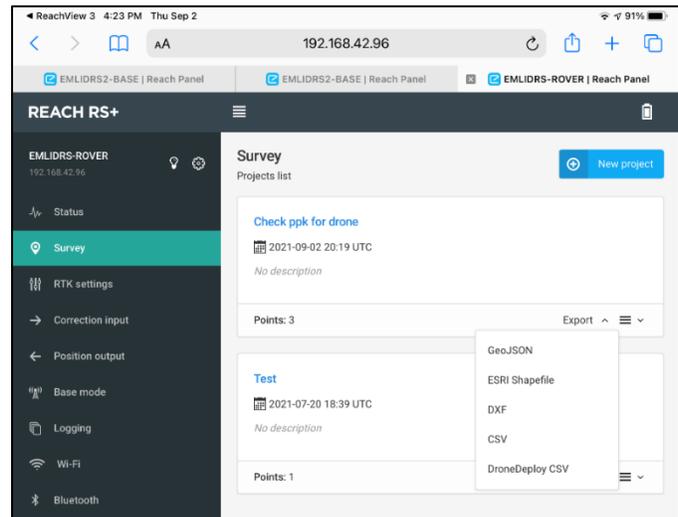
3. Open Reachview 3, you will see the base receiver under the “Receivers” tab, if not “Refresh” once
4. Once connected, click on the RS2 icon, it will open a new panel as below and select the Reach panel
5. In the “Base Mode” tab, switch off Correction output. Scroll down to “Base Coordinates” section → Coordinates Input Mode → Manual; enter the base station coordinates you measured earlier (**WGS 84 and decimal degree**). Set the Antenna height (h + 134 mm) and press Apply. It will take some time to calculate the position



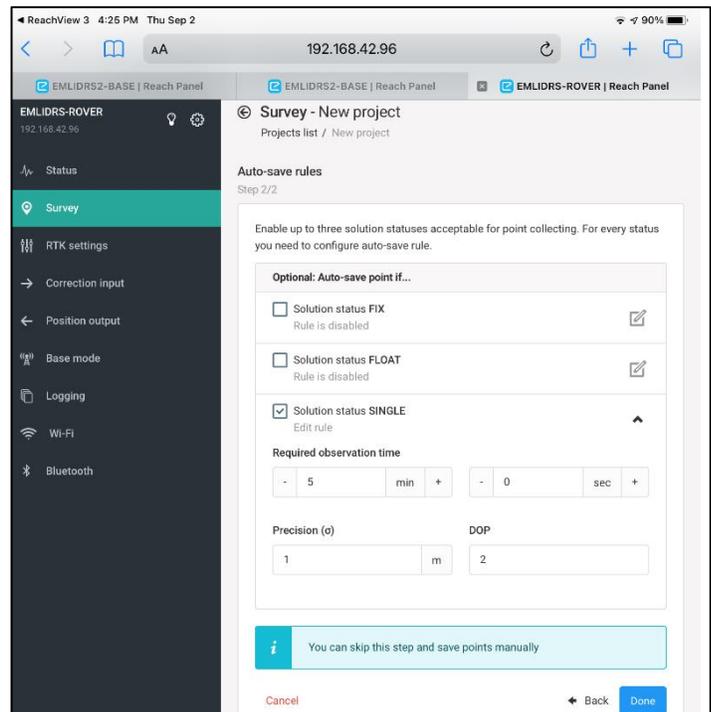
- To enable data logging, go to the “Logging” tab and turn on “raw” data logging in UBX format and “base correction” in RINEX format. Now the base is collecting data and we will set up a project in rover for data collection.

GCP Collection

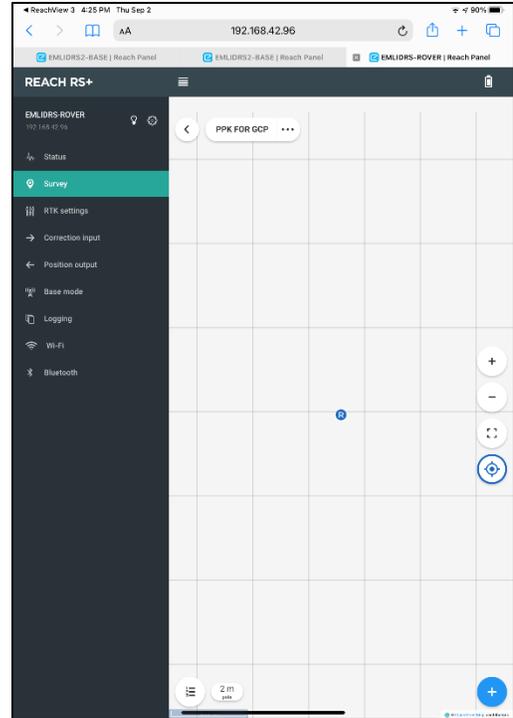
- Go back to Reach panel of the ROVER
- In the “Survey” tab → New project.
- Enter basic information and go next.



- You can skip next step and save points manually. However, if you select “solution status SINGLE” and required observation time = 15 min, it will save points automatically after 15 min. You can manually save anytime as well.



5. You will see the R icon showing receivers on the map and you are ready to take measurements.

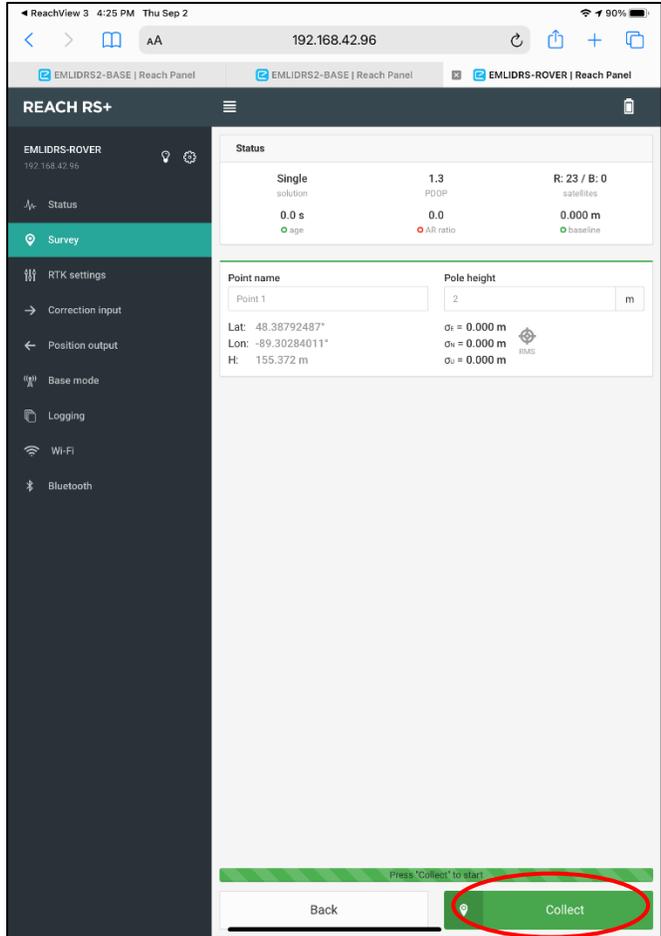


6. Hold your pole in the center of the target, click on the plus icon; fill in details. In the status bar, you will see the status and location information.



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7. When everything is ready, click the “Collect” button, it will start timing.



8. If you set up the automatic timing, once the time is up, you can click “save & go”. If you decided to do manually, after a certain time, click on “Accept”.



9. Measure each GCP position.

NOTE: It is better to have 10-15 minutes of observation time on the **first and the last GCP**. That will allow you to use the “Static start” method option when post processing, and it usually gives a more resilient fix.

Exporting data

1. Open Reachview3 app → Survey tab → your project → click on three dash button next to the project name and select “Export”
2. Select CSV format and share using any file sharing option available
3. Export both rover and base raw logging data as UBX, and base corrections as RINEX (both rover and base)

GPS Post-processing

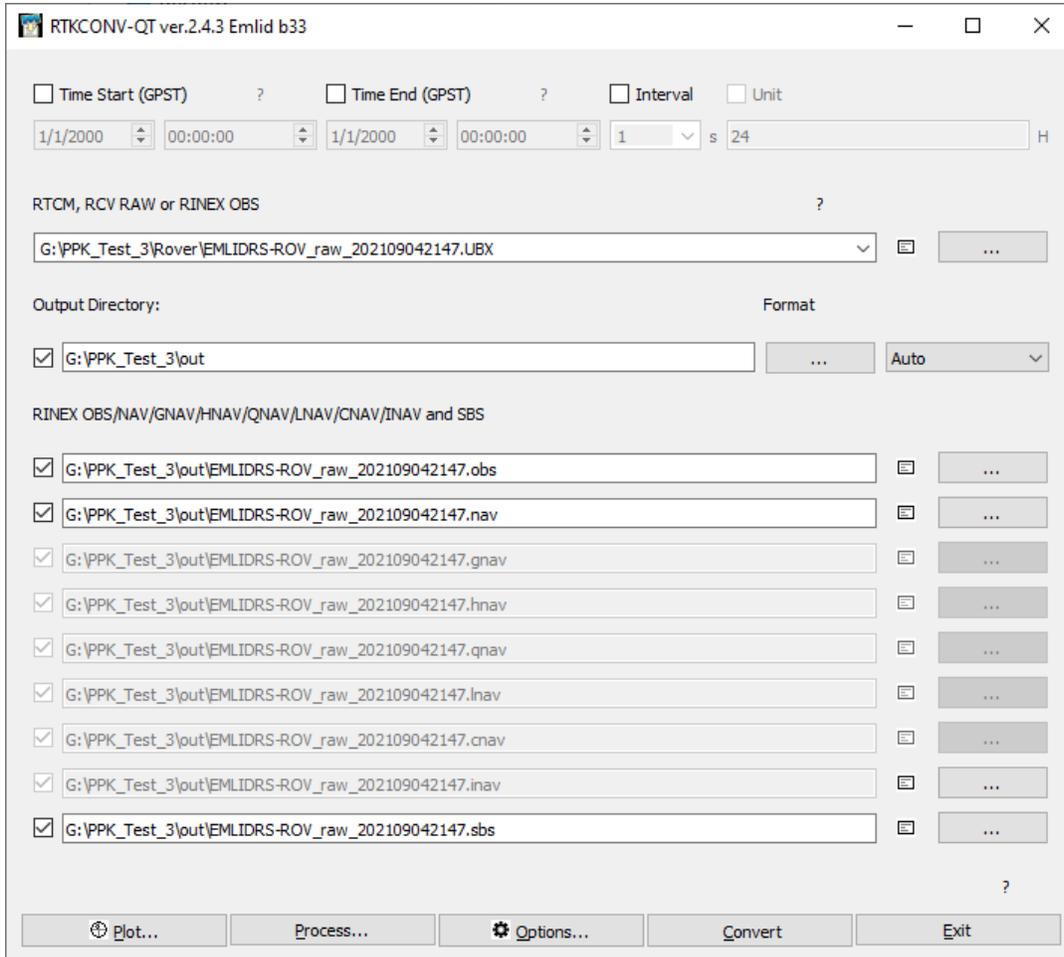
Data processing should be done in two different software packages. First you will apply base corrections to raw data as a track and then extract GCP's from corrected track loggings. For the first part you can use either RTKLIB Open Source software or EMLID Studio software to post process your data.

Required data for “PPK” processing method

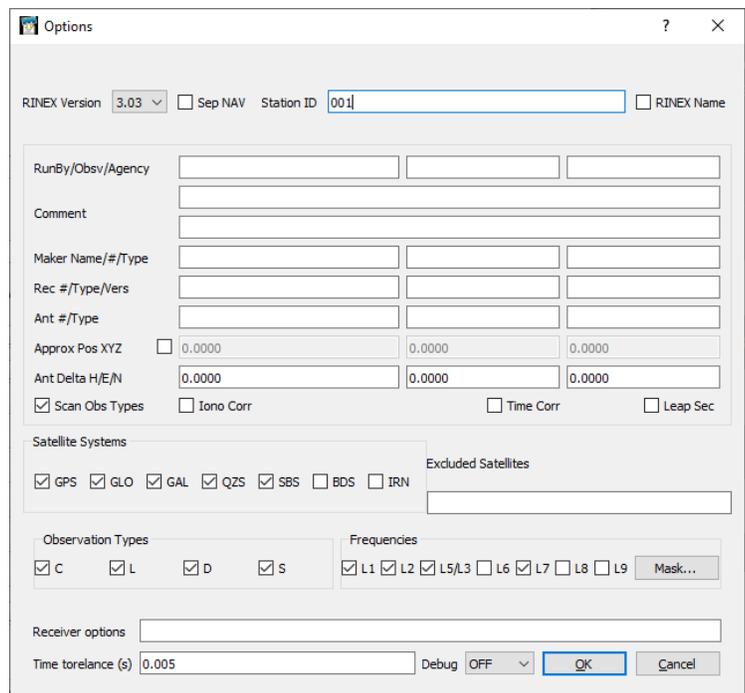
- RINEX base correction file from the base
- UBX raw observation file from the rover
- RINEX navigation file from the base/rover
- CSV file from ReachView3

Data pre-processing in RTKLIB - “RTKCONV”

1. Download RTKLIB package: <http://www.rtklib.com/> and unzip to your computer
2. This package needs rover and base data as “*.obs” files. We will convert our data into *.obs format using “RTKCONV” application within RTKLIB.
3. Open ““rtkconv_qt” application from the folder. Add rover raw logging in the first field (see screenshot next page);

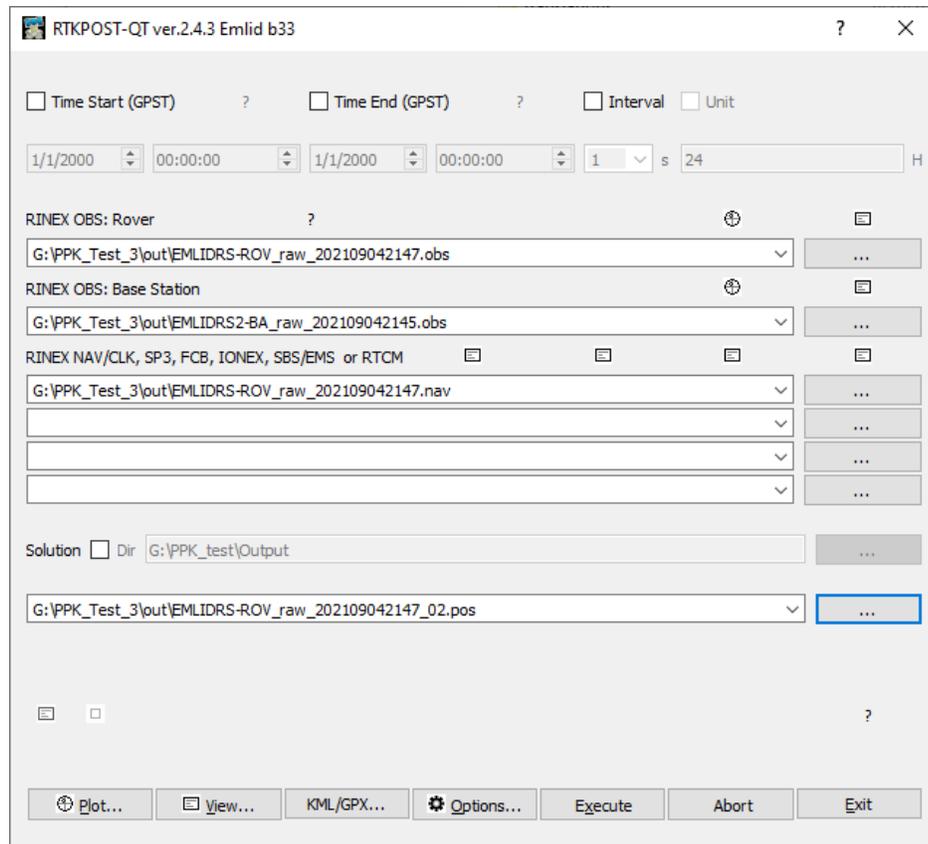


4. Go to “Options”; select RINEX version 3.03; check satellite systems you need and enable corresponding frequencies.
5. Accept changes and click “Convert” to convert the file, you will see a *.obs file in your output folder
6. Repeat the same for base correction file,

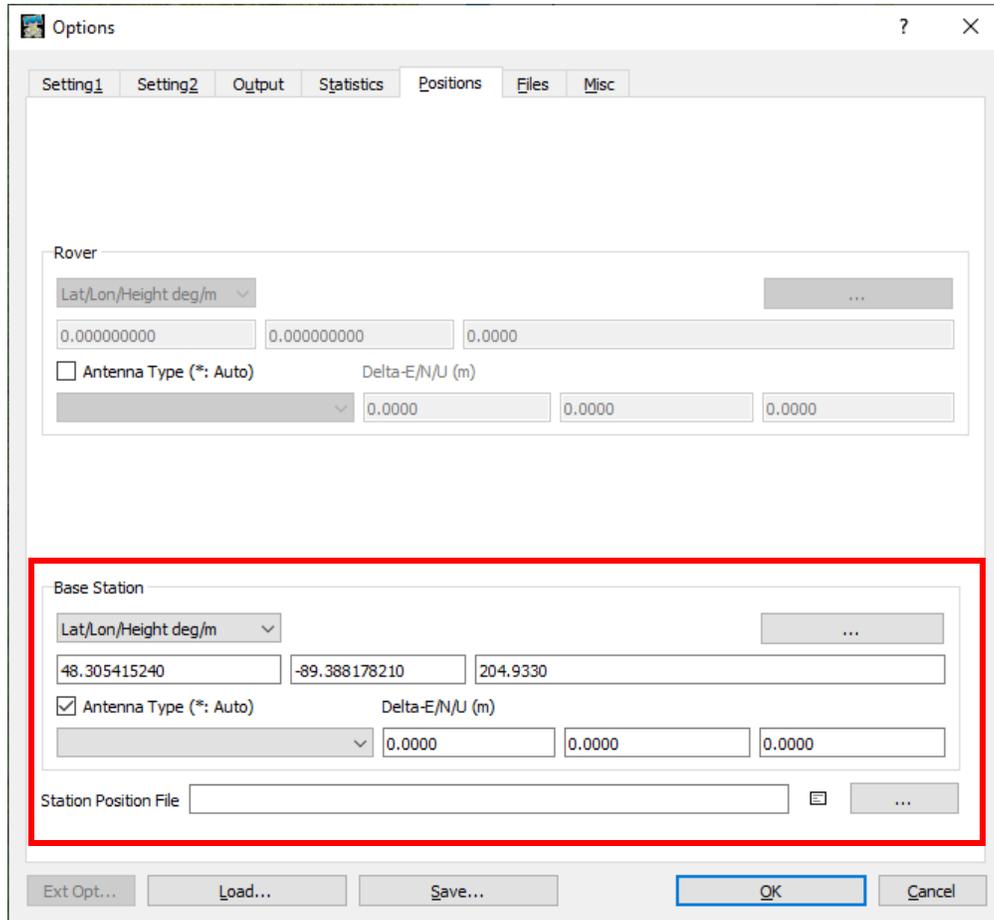


Post-processing in RTKPOST (PPK)

1. Start “rtkpost_qt” from the folder and add rover and base data.
 - Add rover .obs file for the Rover field (RINEX file from your rover)
 - Select base station .obs file for the Base Station field (RINEX file from your base)
 - Add rover .nav file in the third field



4. Go to “Options”;
 Positioning mode = kinematic (rover was moving); Elevation mask = 15°; Rec Dynamics = ON
 Go to the “Setting2” tab; Integer Ambiguity Res = **Fix and Hold**; AR Filtering = ON
 Go to the “Positions” tab; **Base Station = lat/lon/Height deg/m**; enter base station coordinates (**WGS84 decimal degree**)



4. Press OK to accept these changes.
5. Click “Execute”. You will see “raw file name.POS” file and “raw file name_events.POS” file in your output folder.

Extracting GCPs from corrected file

1. The software package we are going to use is called “posprocessor_v0.3.0”. This is developed by a volunteer in EMLID community. Download the software folder to your computer from here and unzip it:
https://drive.google.com/drive/folders/17DXHsJstwkgxhZC_nTUFzRykfMd_JuP?usp=sharing
2. Run the “electron” application.

Add the csv file from your survey project and corrected raw_rover_filename.pos file. Click OK and proceed to extraction.

CSV file configuration

Choose CSV columns with collection start and collection end times

Collection start time:

Collection end time:

Antenna height:

- Click “Batch process” or you can manually process. Export CSV file. **Latitude, longitude and elevation** cloumns show the coordiantes of the center point of corrected values at each GCP. Save them to a separate CSV file together with station id as GCP coordinates

| P | Q | R | S | T |
|-------------|-------|-------------|-------------|--------------|
| elevation | index | lateral rms | latitude | longititude |
| 156.2101035 | 1 | 0.2421 | 48.38790573 | -89.30298374 |
| 157.4868907 | 2 | 0.1817 | 48.3879075 | -89.30290159 |
| 157.7201358 | 3 | 0.1133 | 48.3878932 | -89.30287173 |
| 158.6161798 | 4 | 0.4036 | 48.38791493 | -89.30282534 |
| 158.6301379 | 5 | 0.1442 | 48.38795231 | -89.30285317 |
| 157.7757014 | 6 | 0.1737 | 48.38796371 | -89.30284868 |
| 157.3516052 | 7 | 0.164 | 48.3880079 | -89.3028477 |
| 156.7381082 | 8 | 0.1925 | 48.38801072 | -89.30291561 |



