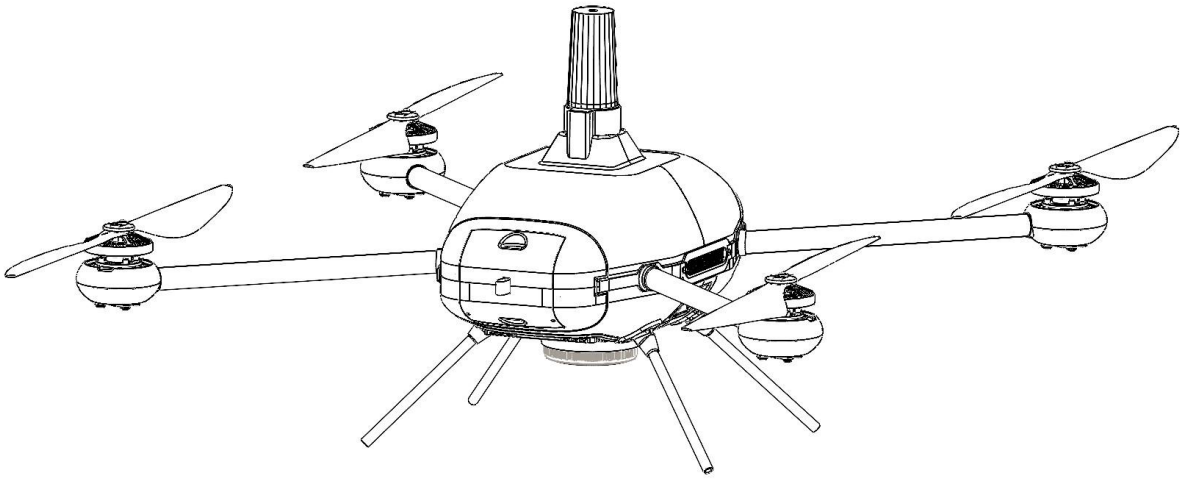
VEDANSH

Flight manual



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V1.0	17-12-2021	Avinash Kumar	Initial Draft
V2.0	20-07-2022	Avinash Kumar	GCS configuration changed
V2.1	14-08-2023	Avinash Kumar	Battery storage, documents No. added.
V2.2	24-12-2023	Avinash Kumar	Updated HIRF caution and shock absorbing

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Contents

1 Operating Manual 4
1.1 Warnings and Disclaimer 4
1.2 Cautions for Product Use 5
1.3 Legal Notice 6
1.4 Safety Notice 7
2 Batteries & Charging Procedures 7
2.1 Storing the Batteries 9
2.2 Checking the Battery 9
2.3 Battery Handling 10
3 Product Profile 11
3.1 Key Specification 11
3.2 Package Contents 13
4 System Overview 15
4.1 UAV Parts & Overview 15
4.2 Airframe 15
4.3 Payload 15
4.4 PPK GNSS 16
4.5 Transmitter 16
4.6 Autopilot 16
4.7 Modes of operation 16
4.8 AERO GCS KEA Ground control Station 17
4.9 Remote Controller 18
4.9.1 Powering Procedures 18
4.9.2 Charging Procedures 18
4.9.3 Changing the Flight Modes 18
4.9.4 Controls 19
4.9.5 Ground Control station 20
4.9.6 Special Situations 44
4.10 Operating Conditions 45
4.10.1 Weather Conditions 45
4.10.2 Operating Envelope 46
5 PPK module setup and post processing. 46

1 Operating Manual

1.1 Warnings and Disclaimer

VEDANSH is an excellent platform for aerial mapping and surveys. Despite VEDANSH having an onboard autopilot and our efforts in making it as safe as possible with batteries connected, we strongly recommend the users go through all the documents related to the maintenance and operation of VEDANSH. Make sure all connections are good and keep children and animals away from the aircraft. Aerosys Aviation accepts no liability for

damage(s) or injuries incurred directly or indirectly from the use of this product in any of the following conditions:

- Damage(s) or injuries incurred when the users are drunk, taking drugs, drug anesthesia, dizziness, fatigue, nausea or any other kind of physical or mental condition that could impair your ability.
- Damage(s) or injuries caused by subjective intentional operations.
- Any mental damage caused by the accident.
- Failure to follow the guidelines of the manual to assemble or operate.
- Malfunctions caused by refit or replacement of any component.
- Damage(s) or injuries caused by third-party products or fake Aerosys Aviation products.
- Damage(s) or injuries caused by mis operation.
- Damage(s) or injuries caused by mechanical failures due to erosion/aging caused due to not following the maintenance schedule.
- Damage(s) or injuries caused by intentionally flying in abnormal weather conditions.
- Damage(s) or injuries caused due to flying in magnetic interference area, radio interference area, or government-regulated no-fly zones.
- Damage(s) caused by using battery chargers other than that provided by the manufacturer.
- Damage(s) caused by the misuse of batteries or replacement of batteries.

1.2 Cautions for Product Use

Please check the following steps before every flight:

- Before the use of VEDANSH, please have some flight training (through simulators or professional trainers)
- Check that all the parts of the aircraft are in good condition. Do not fly with broken parts.
- Check that the propellers are installed correctly. Make sure that the rotation of each propeller is in accordance with the direction specified in the manual.
- Do not add any extra payload other than the one provided by the manufacturer.
- Make sure that the batteries and transmitters are fully charged.
- Make sure to switch on the transmitter first and then install the battery on the airframe.
- Try to avoid interference between the transmitter and other wireless equipment.
- The propellers can cause serious damage while rotating, therefore, maintain a safe distance from the aircraft during operation.
- Keep the aircraft and other equipment (transmitter, GCS) away from the reach of children and animals during operation and set up.
- Keep the compass module away from any magnet.
- DO NOT use VEDANSH with any other third-party remote control.
- DO NOT make any changes to the autopilot other than that allowed by the AEROGCS KEA (Ground control station) application.
- DO NOT use the magnetic screwdriver for the propeller fastening.
- DO NOT attempt to open/tamper with the drone, base, transmitter, or any other supplied equipment.

- DO NOT operate VEDANSH beyond its recommended operating conditions, in the rain, fog, high wind, snow, or high heat.
- Always fly in permitted areas only (Green Zones as per Drone Rules) and avoid flying in densely populated areas above public areas, near power lines, radio/cell towers or any other interference.
- DO NOT Insert or remove the SD cards when the system/drone/base/camera is powered on.

- UAS doesn't have **SHOCK ABSORBING mechanisms in landing gear** , please and carefully.

- UAS **does not have HIRF protection,** below steps to be followed.

    - Avoid operating in areas with known high intensity radiated sources.

    - Maintain a safe distance from powerful transmitters, radar installations, or other HIRF-emitting devices.

    - Implement regular checks on the UAS's shielding to ensure they meet HIRF protection standards.

    - Conduct pre-flight risk assessments to identify and mitigate potential HIRF exposure.

1.3 Legal Notice

- The vehicle must be operated in accordance with local laws and regulations.
- Change of any component of the system is not allowed. Any replacement should be done by the manufacturer.
- Aerosys Aviation or its affiliates cannot be held responsible for vehicles that have not been operated or maintained in accordance with the guidelines set forth in this manual or for behavior resulting from changes made to the vehicle.
- The software provided with the vehicle should only be used with the system.

1.4 Safety Notice

- Use a specific battery charger provided with the system to charge the batteries. Failure to do so may result in fire or hazard.
- Never leave batteries unattended while charging.
- In case the battery starts to swell. It should be removed and should not be used for any future flights.
- The batteries should be stored in a safe and dark location between 5 to 30 °C. The storage charge should be maintained at 50%.
- The system should be kept and dealt with from a safe distance while operating.

2 Batteries & Charging Procedures

Lithium-ion battery packs of 6 Cell and 3500 mah (2 packs of 3500 mah) are used in the UAV. Lithium batteries are manufactured using six 3.7 volts (nominal volt) 3500 mah lithium-ion cells connected in series.

1.4.1. Charging the Batteries

These batteries can be charged up to a maximum voltage of 24.9 volts. A charger is provided along with the drone kit which works on 220v AC.



Specificati ons of the Charger AC Input voltage 100-240v DC input voltage 11-18v Wattage 100w

Charge current	0.1-10 amps
Max cell counts	1-6s

The procedure to charge the batteries is as follows:

- Connecting the batteries to the charger
- The charger has a balance plug connector and an xt60 connector (yellow color).
- They are to be connected to the charger as depicted in the image below.



- Setting the Charger
    - Power on the charger and select battery A or battery B using the up and down arrow key depending on the side on which you have plugged in the battery (A is for the left side and B is for the right side).



○ Select li-Ion batt from the menu using the dec and inc keys. ○ Press Start.

○ Select li-ion balance from the menu using dec and inc keys.



- Press start and set the current to 1.5 amperes to 2 amperes using the dec and inc keys.
- Press start again and select the number of cells and set it to 6s using the inc and dec keys.
- Long press starts to start the charging process.

2.1 Storing the Batteries

In general, Lithium-ion batteries should not be stored for longer periods of time, either uncharged or fully charged. The best storage method is to store them at a low temperature, not below 0°C, at 40% to 50% capacity (22.2V). Storage at 20°C to 35°C is optimal. Since lithium batteries self-discharge, it is recommended that they must be charged every 6 months.

2.2 Checking the Battery

The battery pack should only be checked with the official battery checker provided in the kit. Use only the balance cable as indicated in the following image to check the battery voltage. The procedure to check the battery voltage is as follows:
Insert the balance cable into the battery checker all at once in the above-shown orientation.

The checker will detect the number of cells first and then the total voltage of the pack followed by the voltage of individual cells.

The operating voltage range of the packs should be **25V - 19.4V.** The batteries should never be drained below 19V.

2.3 Battery Handling

- Do not charge the battery under fire or extreme heat. Do not use or store the battery near a heat source (such as a fire or heater). If the battery leaks or emits a peculiar smell, immediately move it away from the open flame.
- When the battery swells up, leaks, etc., stop using it immediately.
- Do not put the battery in water or get it wet.
- Do not throw the battery into the fire or heat the battery.
- Do not connect the battery directly to a wall socket or car cigarette lighter socket.
- Do not short-circuit the positive and negative poles of the battery with wires or other metal objects. It is forbidden to transport or store the battery with necklaces, hairpins, or other metal objects.
- Do not knock, acupuncture, step on, modify, or expose the battery to the sun, and do not place the battery in a microwave or high-voltage environment.
- Do not hit, throw or subject the battery to mechanical shock.
- Use the lithium battery charger provided with the kit to charge the battery, do not use other types of battery chargers to charge the battery. ● Do not disassemble the battery in any way.
- Do not use the battery if it emits a peculiar smell, heat, deformation, discoloration, or any other abnormal phenomenon. If the battery is in use or charging, it should be removed from the electrical appliance or the charger immediately and stop using it.
- Do not use or place the battery under high temperatures (in the hot sun or in a very hot car), otherwise, it may cause the battery to overheat, catch fire, or function failure, and shorten its life.
- Discarded batteries should be covered with insulating paper to prevent fire and explosion and chemical waste procedures must be followed.
- In case you get a battery electrolyte in your eyes, do not rub and wash with clean water. Seek medical assistance quickly.
- Clean the terminals of the battery only with a dry non conducting cloth.

3 Product Profile

VEDANSH is a professional survey grade PPK Mapping Drone It's equipped with a highly reliable payload. VEDANSH is completely built of carbon composite material keeping its weight factor in consideration. Overall, VEDANSH has a highly reliable system integrated in it.

VEDANSH contains a highly reliable multi-redundant autopilot system for fully autonomous smart operations. It is equipped with multiple emergency failsafe functions to make a completely safe and hassle-free flight.

This section introduces the features and specs of VEDANSH.

3.1 Key Specification

1.	**Physical Characteristics**	**Specification**

a.	UAS Type	Multi-rotor.
b.	Maximum Take-off weight (with battery & payload)	<=2.15kg
c.	Feature	surveying mapping/professional grade
2.	**UAV Performance Characteristics**	**Specification/Remarks**
a	Endurance	40min+.
b.	Communication Range	3km (visual line of sight)
c.	GNSS Grade (Compatible	PPK Enabled with GNSS base station (GNSS station of L1 and L2 frequency)
d.	Maximum operating altitude	Maximum 120m AGL (above ground level)
e.	Operating temperature range	0 to 50 deg.
f.	Operational Wind Speed	Up to 8m/s for safer side
3.	**Operational characteristics**	**Specifications**
a.	Launch & Recovery	Autonomous Vertical Take-Off & Landing (VTOL)
b.	Flight Modes	● Fully autonomous from Take-off to Landing without using any R/C controller ● Altitude Hold. ● POS Hold
c.	Failsafe features	● Return to Home on communication failure ● Return to Home/Land on low battery ● GPS failure redundancy

d.	Packing and storage	● Carrying case provided by OEM. ● When you're storing it for a long time, remove the propeller. ● Charge the battery to the nominal Voltage and keep it in a safe place.
4.	**Payload characteristics**	**Specification**
a	Payload	High Resolution RGB sensor 24 MP
5.	**Communication Link Characteristics**	**Specification**
a.	Communication link	● Transmit control commands from GCS to UAV ● Transmit telemetry data from UAV to GCS
b.	Frequency band	2.4GHZ

3.2 Package Contents

The below list contains the typical package contents. This list may change as per the requirements and deliverables promised.

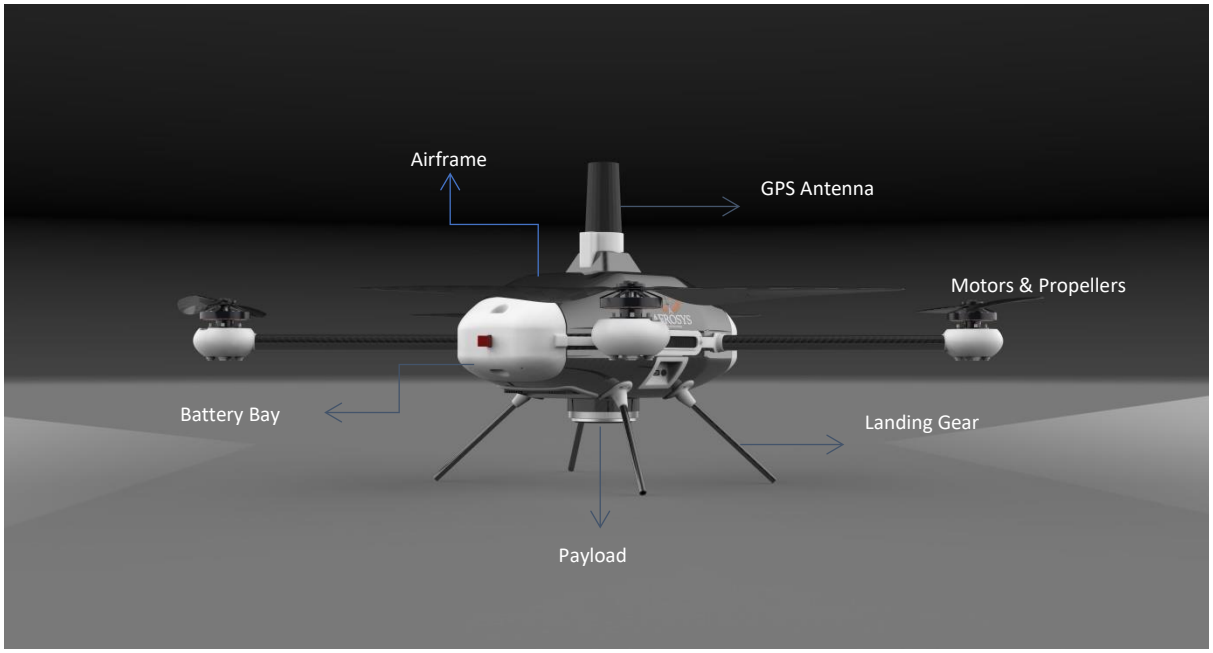
Sl. NO.	Description of items	Unit	Qty
1	VEDANSH UAV with integrate PPK Module and RGB Camera	NOS.	1
2	Radio Link Controller.	NOS.	1
3	Tool Kit.	NOS.	1
4	Battery charger	NOS.	1
5	Battery Pack	NOS.	2
6	Associated cable	Set.	1
7	Ergonomic Backpack	Set.	1
8	Logbook	Set.	1
9	Training	Person	2
10	Necessary Documentation in the form of user, Technical and Maintenance manuals	Set	1
11	Warranty One year or 500 Landings whichever is earlier.	Year	1

4 System Overview

The following are the key components of the drone, transmitter and the GCS Software.

4.1 UAV Parts & Overview

The UAV contains the Airframe, Payload, Motors, Propellers, Avionics, PPK GPS & Other Sensors.



4.2 Airframe

The Airframe of VEDANSH UAV is made of carbon fibre composite keeping the weight factor in mind. Airframe structure designed is rugged and has fatigue properties. The frame is designed to bear all the impacts of takeoff, landing, and the normal mission profile of the product. The Landing gears are a part of this airframe.

4.3 Payload

VEDANSH UAV is equipped with ADITI 24 MP camera. These payloads are configured to provide the best possible image quality and accuracy suited for multiple Indian environmental conditions.

4.4 PPK GNSS

VEDANSH contains a high precision global standard Emlid PPK GNSS receiver system to provide the utmost reliability in navigation as well as data acquisition accuracy. There is also a logging facility that logs the GNSS data and the precise geolocation of the images triggered.

4.5 Transmitter

Remote controller with built in 2.4Ghz Data telemetry. Equipped with flight mode functionality where pilots can select the flight mode according to their flying skills. Like (Auto take-off, Auto land, RTL, POSHOLD etc).

The Transmitter contains an inbuilt battery that can be charged with the microUSB cable and 5v power adapter. It can be connected to the GCS software (AEROGCS KEA) with the DATA port or Bluetooth.

It works on the 2.4 GHz wireless band to communicate with the drone.

4.6 Autopilot

The flight controller has several features like Autonomy, safety and failsafe. These features ensure safer and reliable Flight of VEDANSH UAV. VEDANSH UAV Autopilot has on board flight logging capability, and store each flight data. Autopilot of VEDANSH UAV is compatible only with AEROGCS KEA ground control station.

4.7 Modes of operation

The user has access to three regular flight modes. The details of each flight mode are as follows:

- **Auto Mode:** Auto mode is mostly used when using VEDANSH for survey and mapping. A mission can be pre-planned to survey an area that can be pre-fed to the flight controller. Once the VEDANSH is armed and switched to the auto mode it will start following the mission and return back to the launch location after mission completion. The auto mode can only be activated from the ground control station.
- **Loiter Mode:** In loiter mode the VEDANSH holds the current GPS position in the air. The transmitter sticks should remain centered to hold that position. The VEDNSH will follow the transmitter command till the sticks are centered again. It can only be triggered using the transmitter in case of manual intervention is required.
- **RTL Mode:** Apart from the other regular flight modes, RTL is another mode. When RTL is triggered, the VEDANSH will come back to the position of launch. This mode can be triggered manually from GCS or from the transmitter. In case you want to call back the VEDANSH this

mode is useful. This mode is also triggered automatically if the battery levels have reached below a certain level to ensure that the vehicle will land safely before running out of battery. The RTL will also trigger in case of communication loss between GCS and VEDANSH for more than 10 seconds. It will also trigger in case of a Geofence breach and is the default go-to-mode in case of any other failsafe is triggered.

4.8 AERO GCS KEA Ground control Station

AERO GCS Ground control station provides the user-friendly interface to control the VEDANSH UAV. It also allows user to plan the mission for aerial mapping application in the easiest way possible. Aero GCS allows user to continuously monitor the UAV while flying, user can easily calibrate the Accel as well as compass if there is a requirement.

4.9 Remote Controller

Remote controller with built in 2.4Ghz Data telemetry. Equipped with flight mode functionality where pilots can select the flight mode according to their flying skills.

Like (Auto take-off, Auto land, RTL, POSHOLD etc).

The Transmitter contains an inbuilt battery that can be charged with the micro-USB cable and 5v power adapter. It can be connected to the GCS software (AEROGCS KEA) with the DATA port or Bluetooth.

It works on the 2.4 GHz wireless band to communicate with the drone.



4.9.1 Powering Procedures

Before switching on the transmitter, kindly ensure that the antennas of the transmitter are unfolded at 90 deg. as shown in above figure.

To switch on the transmitter, long press the power switch for 5s and leave, then again press & hold until four white LED glow.

To switch off the transmitter long press the power button till all the light off.

4.9.2 Charging Procedures

The Transmitter contains an inbuilt battery that can be charged with the micro-USB cable and 5v power adapter.

While charging the transmitter kindly keep the transmitter OFF.

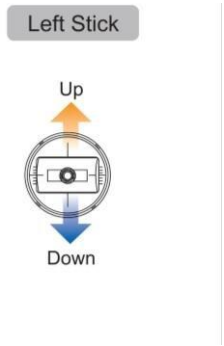
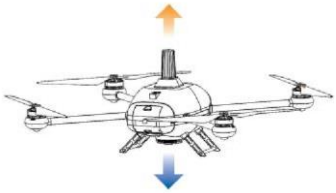
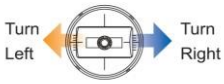
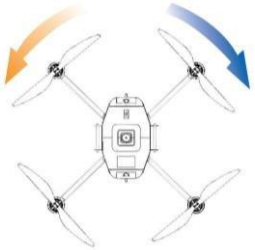
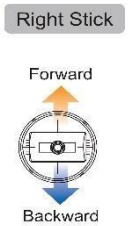
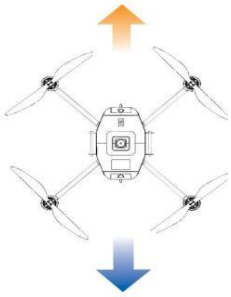
4.9.3 Changing the Flight Modes

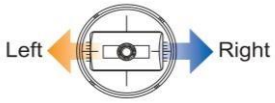
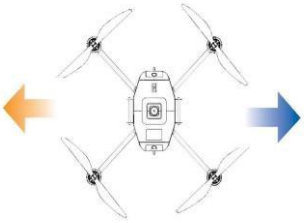
When the UAV is connected and flying, the flight modes (as described in the above section can be changed with the flight mode switch as shown in the diagram



4.9.4 Controls

The following table shows the basic flight commands and maneuvers for VEDANSH. It is highly recommended to accept flight training from Certified RPTO before operating the aircraft.

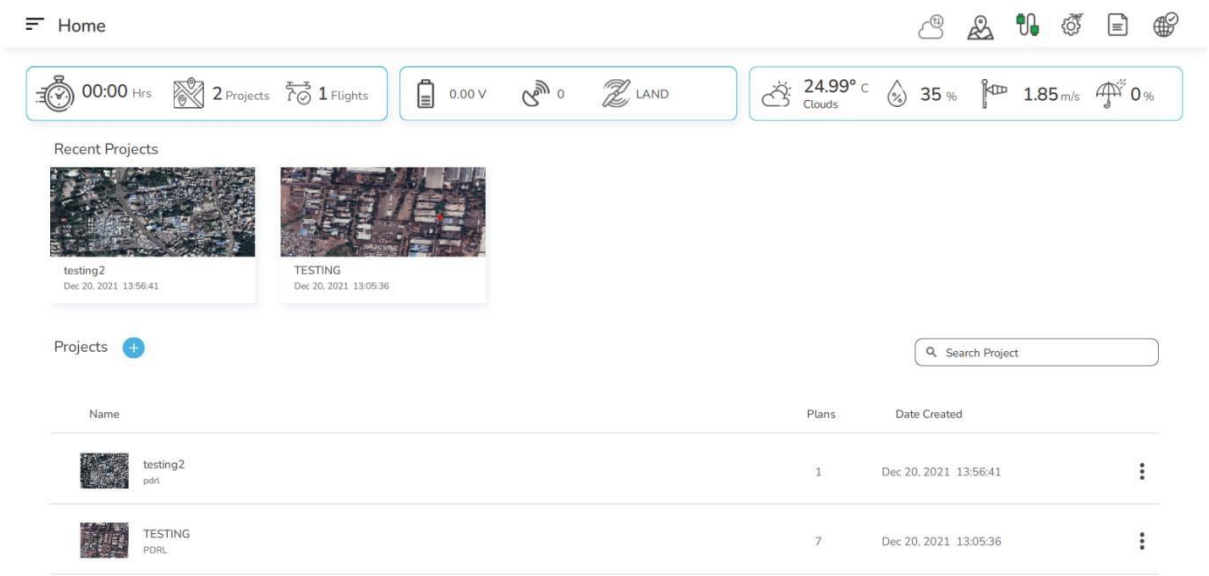
Transmitter Joystick control	**Aircraft**	**Description**
		The left stick(Throttle), when moved ups or Down,makes VEDANSH moves up or down without changing the attitude.
		The left stick, when moved right or left, makes VEDANSH to **Yaw** right or left without causing any change in transnational velocity.
		The Right stick, when moved up or down, makes **Pitch** forward or backward and translates in the same direction as well

		The Right stick when moved left or Right makes VEDANSH **roll Right or Roll left .**

4.9.5 Ground Control station

a) **Dashboard:** Whenever you login to the Aero GCS, you land on dashboard page. The dashboard page has various parameters for historical performance of the RPA and projects. RPA is a Remotely Piloted Aircraft. As it is remotely operated, the settings of various parameters to the specified values and conditions are mandatory before it comes into operation.

Once the logged in, the user may use shortcuts for handling the drone operations. Various options available on the dashboard indicated in the following image.



The Dashboard

Detailed information and use of these icons will be discussed in the following section.

Top-bar Options



4.9.5.1 1) Cloud Sync

This functionality is useful in team access management to upload the files on the cloud so that these can be shared easily with other team members. Details about this is explained in section 10 of this user manual.

4.9.5.2 2) Direct Fly view

This dashboard element shows the fly-view icon on the navigation bar. The user can go to the fly-view directly by pressing this button. The user can see all the data related to the device like latitude, longitude, speed, orientation, etc. The buttons displayed on a left-hand drawer, like take-off, land, RTL, resume, and pause will be disabled.

4.9.5.3 3) Connect a device

The connection between the GCS and the device will be established by using this option on dashboard. The drone or device should be properly connected to the GCS before an actual flight. Various communication protocols are provided by AeroGCS KEA. You have to select the proper and required communication protocol and connect the device properly. In the serial port setting user can connect the device using serial communication. Also, the user can set different baud rates as per the requirement and connect the device.

4.9.5.4 *4*) RPA Configuration

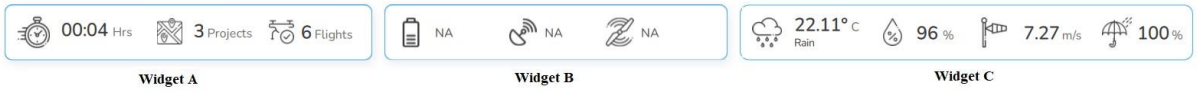
User can directly go to RPA settings from this option from dashboard. This is a shortcut for accessing the RPA configuration. Details about the RPA configuration is available in section 6 of the same documentation. ***5*) Notifications**

By clicking on this icon, you can directly have notifications containing all logs, flight logs, and warnings. This element shows overall warnings in AeroGCS during the operations. It shows NPNTrelated warnings as well as machine operation-related warming. After clicking on the warning, you can navigate to the details of all warnings. These logs can be downloaded in the form of a .json file. You can use these logs during the flight also. The user will have detailed information regarding the flight such as “flight guided mode command sent”, and “flight mission paused command is sent to device ” with the date and time particulars. Under the all logs tab, the user can see all logs, including flight logs and warnings. Under flight logs, the user can see logs about the flights. Under the ‘warns’ tab, prearmed warnings are displayed which include “flight plan received”, “arming motors”, etc., with date and time.

4.9.5.5 *6)* Internet Connectivity

On the AeroGCS dashboard the navigation bar Internet connectivity icon is there for the checking internet connection. If the internet is connected it will show the connected icon with a tick on it. If the internet is not connected it will show an icon with a cross on it.

4.9.5.6 Widgets



Widget A Widget B Widget C

Widgets View



4.9.5.7 7) Total Flight Time

The Total time taken by a flight to complete its plan is known as total flight time. Whenever any flight under any project is completed, the completed time of the flight is added to the total flights done by RPA. It is important for calculating the life of RPA. It shows data related to available projects only.

4.9.5.8 *8*) Total projects

It shows the total number of projects created and available in the AeroGCS. Any deleted project from the GCS would be removed from the total project count.

4.9.5.9 9) Completed Flights

It shows the total completed flights under all projects. The project can have planned and completed types of flights. It will show only completed flights. The completed flight means any flight for which a take-off command was issued. Even if RPA doesn't fly after take-off, it is also considered a completed flight.



4.9.5.10 10) Live Battery voltage

This dashboard element shows the live battery voltage. It shows the battery which is available in the device. For displaying the status of the battery, the device should be connected to the AeroGCS.

4.9.5.11 11) Live satellite count

This dashboard element shows the live satellite count. It shows the current satellite count of the device. If the GPS is connected to the device and has sufficient range, then it will show the GPS count.
Note: GPS is required to track the correct location of the device.

4.9.5.12 12) Live mode of the device

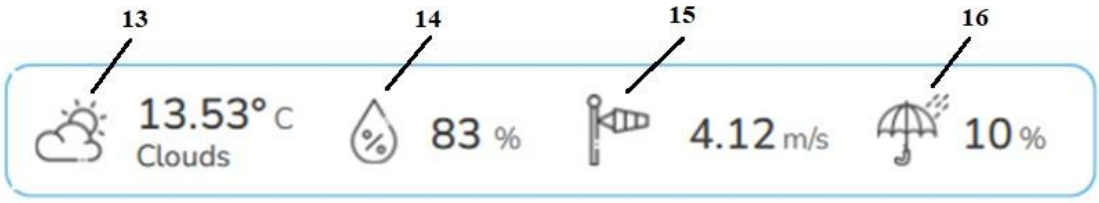
This dashboard element shows the live mode of the device. If the device is connected to AeroGCS and modes are assigned to a specific channel, then if the mode is changed from RC it will show the changed

mode. A radio-controlled aircraft (also known as an RC plane or RC plane) is a small flying vehicle that is controlled from the ground by a hand-held radio transmitter.

Weather forecast

Ambitions to increase drone operations may be hampered by the weather, which is a significant and difficult-to-resolve factor. The pilot should know the weather conditions for the place for a flight. Check the weather forecast before planning a flight of drones with the help of the Weather forecast option provided by AeroGCS KEA. The weather forecast shows the weather of a particular city.

Warning: Selection of a proper city is necessary before the actual flight



4.9.5.13 13) Temperature

After clicking on this icon you will get the details of variations in temperature in your area for the next 7 hours which will help you to schedule your flight. It also gives the details of humidity, wind speed, and expected percentage of rainfall. All these parameters are valuable for scheduling the flight of a drone. You cannot have a smooth flight in cloudy weather.

4.9.5.14 14) Precipitation

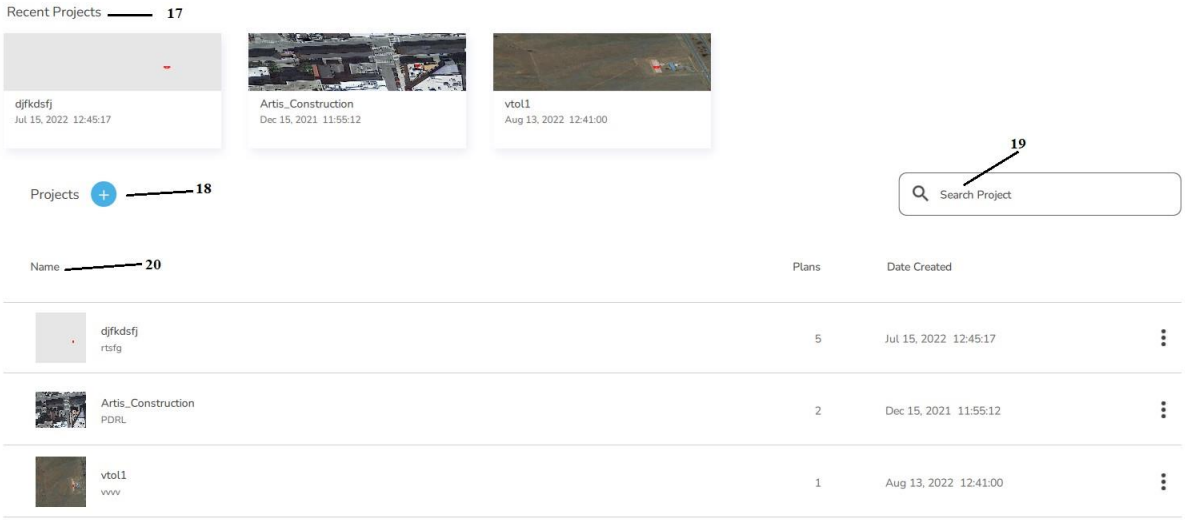
Normally, the drones are not waterproof. The internal electronic parts may get damaged due to moisture. Therefore, before flying a drone, you should consider the precipitation strength and probability. This will assist you in forecasting the optimum flying conditions for that day. Precipitation probability is a concept that describes the likelihood of precipitation at a given time and location.

4.9.5.15 15) Wind Speed

Knowing local wind conditions is crucial before flying a drone. Flying in winds more than what your drone can handle will result in a crash. Before taking off check the maximum attainable speed of your drone. Check the wind speed and its direction before take-off. Fly only if the wind speed is less than your drone's maximum speed by a comfortable margin. **16) Rain**

It is highly recommended to restrict the flights of drones in rainy or snowy weather. Internal components of a drone may damage due to moisture. The visibility may also affected due to rain and humidity of the air.

Projects:



Projects Option on Dashboard

4.9.5.16 17) Recent Projects

This gives details of the projects recently created or opened. It shows 5 recent projects which you can reuse by clicking on them. Also, it shows detailed information on recent projects created along with several plans, dates created, etc. **18) Create Project**

For creating a new project click on the '+' symbol present on the dashboard near to project. This tab allows us to create a new project with project details such as Project name, client name, and Plan name.

4.9.5.17 19) Search Project

For searching the project which is not available in this list you can search the project by using the search project option available on the dashboard.

20) List of Projects

The list of recently created projects will be displayed on the dashboard. Select any existing project to add a few plans to it or edit the plans from that project.

Once you have selected a plan available in the list then a new page will display details of that planned flight including name, mission type, vehicle type, flight time and date, and creation of the project. By clicking on the three dots on the right-hand side more options will be displayed such as Delete Plan, Export KML, Edit Plan, and View Logs.

Delete Plan: this will allow you to delete the said plan. Once you have deleted the plan every data related to the plan will be deleted which is non-recoverable. Be cautious before deleting the plan.

Export KML: after selecting this option pop-up window will appear on the screen indicating the location of the file saved.

Edit Plan: Once selected this option, you can edit the plan in terms of all the required parameters. If you want to keep the earlier parameter let it be as it is. You can just verify the parameters entered by you earlier.

View Logs: This will display the flight logs. You can download the log files. It will download two .csv files. One file gives detailed data related to flight such as take-off, time taken to complete intermediate tasks, etc. The second file contains details regarding altitude, longitude, latitude, velocity, etc.

2.2.6 CREATING NEW PROJECTS:

Allows creating a new project with all the details such as plan, flight type, mission, etc.

A Project is a collection of information required for handling the entire operations in any activities. To fly a drone safely and smoothly, a number of parameters, and settings are required to set at desired values. There should be a predefined plan and path for flying a drone. All these things are handled by the "Project" section.

The creation of a new project is an initial and required condition. No one can move forward without creating a project.

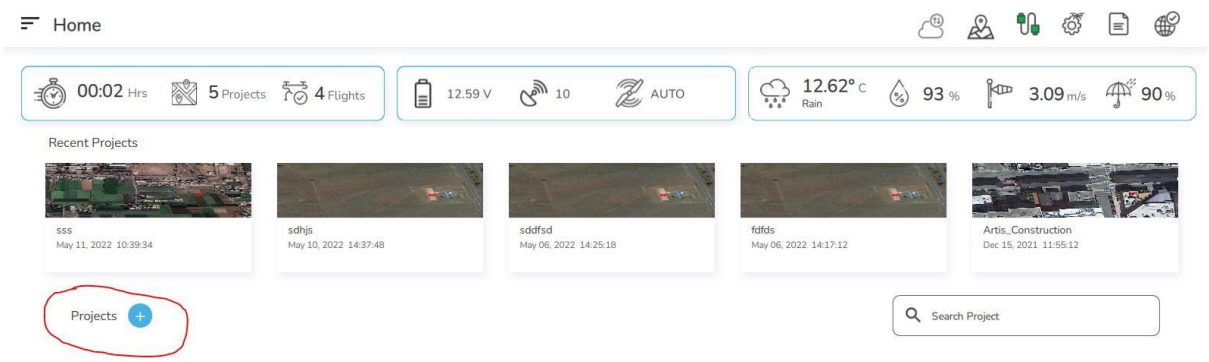
To Create New Project
Click on the '+' symbol --> Enter details --> Select Location --> Select flight type --> Set the fence and rally points (if required) --> Save the plan --> Fly the drone

This section provides the following options related to Project:

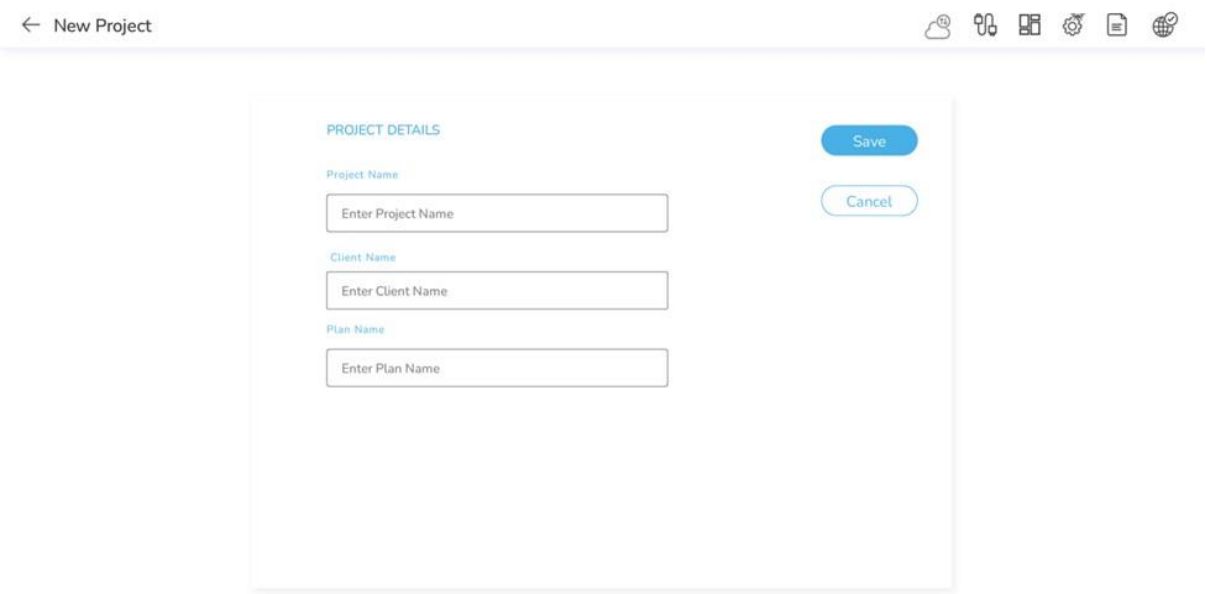
- Create a Project
- Set the Location for Flight
- Select a Flight Type
- Add a New Plan
- Use of an Existing Plan
- Edit the Plan
- Save Project
- Delete the Project

4.9.5.18 2.2.6.1 Create Project

For creating a new project click on the '+' symbol present on the dashboard near to project. This tab allows us to create a new project with project details such as Project name, client name, and Plan name.



Create new Project



Entering details of Project

Project creation requires you to enter three different data fields.

a) **Project Name:** This is the name of the project. Any alphabet with up to 50 characters long can be entered as the project name.

b) **Client Name:** This is the name of the client for whom the project is being done. The client name can be of alphabet characters up to 50 characters.

c) **Plan Name:** This is the plan name. You can define a proper plan name. For example, Field01 can be a plan name. This will be a character input of up to ten characters.

A newly created project may contain several plans with different types of vehicles and flight types. Plan can be created in offline mode also. Plans created in offline mode can be synchronized with the cloud so that the user can retrieve them whenever it's required. The user can create a number of plans with different vehicle types and flight types respectively.

4.9.5.19 2.2.6.2 Setting Location



Search Location for a project

Setting a proper location is mandatory for a weather forecast. If the location set on the map and the location of the actual flying drone is not matching then you may face some problems related to weather. There are chances of damage to the drone and you may not be able to complete the flight. Based on the location set on the map, temperature, wind speed, and precipitation, etc. will be displayed in the Widgets on the dashboard.

4.9.5.20 2.2.6.3 Flight Type

Select the proper flight type as an AeroGCS mission for the flight. The mission planning method involves creating a flight plan for every Drone available to guarantee that the maximum number of locations are recognized while keeping in mind their significance as indicated by the priority. Different flight types are available such as waypoint, survey, spraying, etc. Select any one at a time and move further to complete a plan.



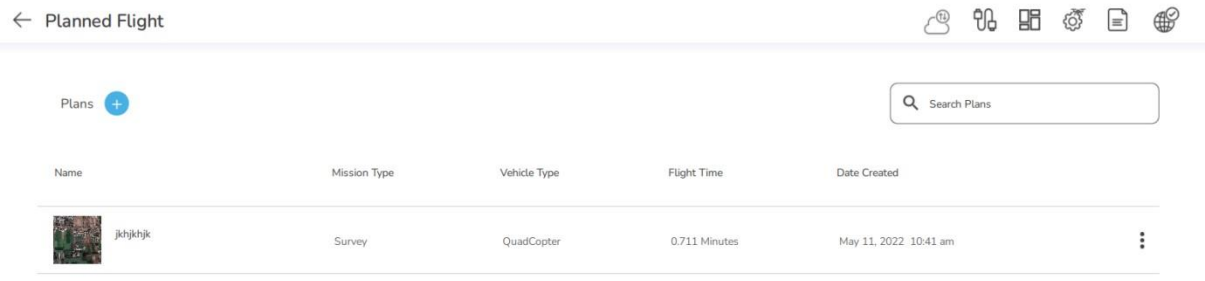
Selection of Flight Type

The user can set up a collection of points that define a plan or path for the UAV to follow or manually control the drone using these devices. They use conventional map technologies like Google Maps and provide a 2D view. In both circumstances, the application allows you to build a flight plan and have it instantly uploaded to a drone for a flight.
The objectives of choosing the right mission plan are:

- choose the shortest paths for the mission, to reduce fuel consumption.
- reduce the possibility of losing UAV.
- ensure that the mission can be finished when there are no additional threats to the UAVs.

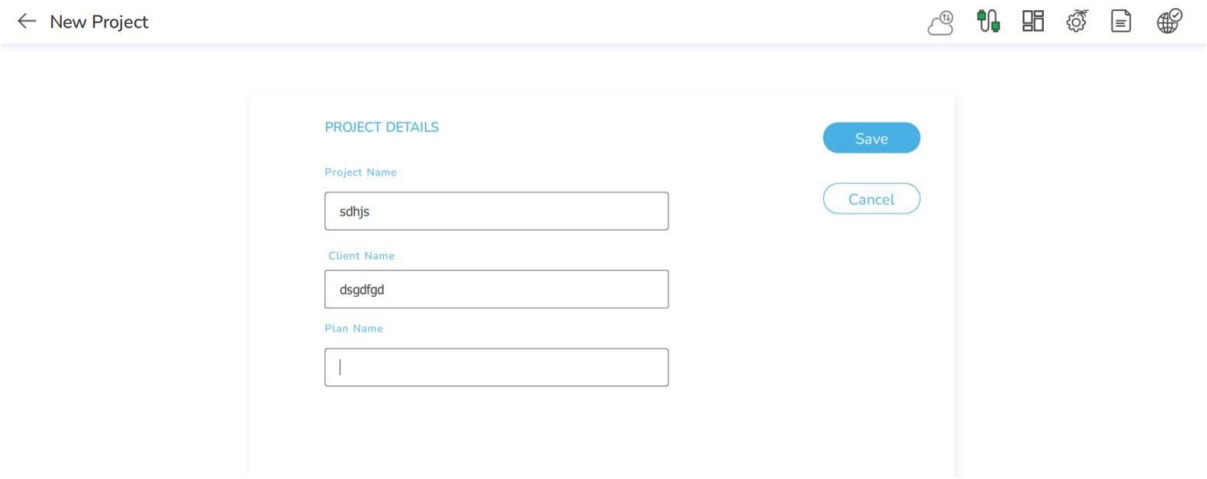
4.9.5.21 2.2.6.4 Add a New Plan

To add the new plan to the existing project, click on the project to which you want to add the new plan. Then the screen will be displayed as below:



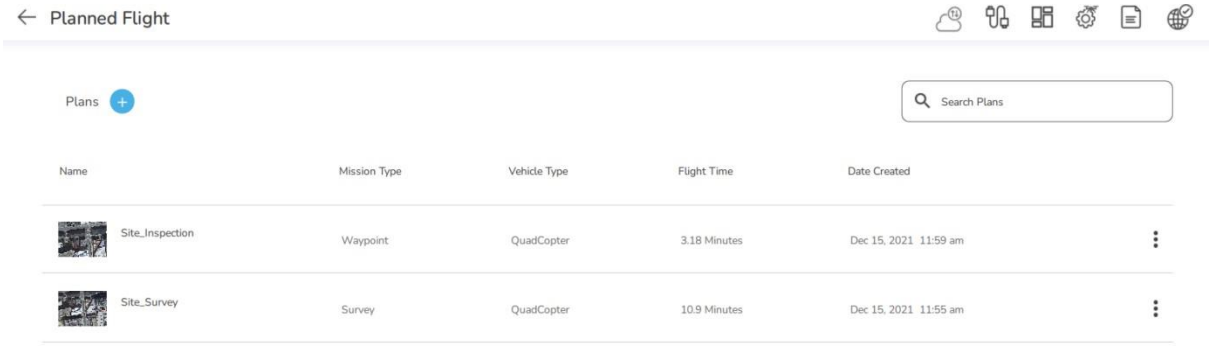
Adding a Plan to a project

Create a new plan by clicking on the '+'. Give the proper plan name. Now, this page will allow only to change of the plan name. Any alterations are not allowed in the name of the project name and client name.



Adding a new plan to an existing Project

After setting the plan name, repeat the process of creating a project with all the steps. A number of plans can be added in this manner.



Project with different mission types

Note: Creation of a number of plans with different flight types is allowed. One plan one flight type.



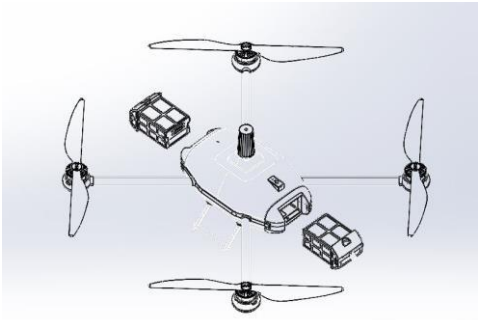
4.9.5.22 2.2.6.5 Save Project

Once all the desired and required parameters are set at proper values then proceed further. You can save the changes made by clicking on the 'Save' button.
All the changes will be stored once you have saved these. Once the parameters are saved for the particular plan these will be allotted to only that plan and project. The parameters and plans will remain unchanged unless and until these are changed forcibly. This feature provides the advantage to use the same plan for various purposes. If you proceed without saving the new parameters then previous or default parameters will be considered. No need to create a new plan and project every time.

2.2.7 Ready for flight:

Place the UAV in wide open space, with the rear facing you.

- Insert the Battery: Both battery ○ has locking mechanism so you ○ will get a clicking sound.
- Once both the batteries are inserted then your aircraft will be powered.
- Once the connection is established, connect aircraft with the Ground control station (GCS).
- Perform preflight checklist as given below:



	Pre-Flight Checklist		
	Pilot in command:	**DGCA Reg. NO.:**	**Date:**
	Co-pilot (optional):	**Location:**	
	UAV Model No:	**UAV UIN:**	**Purpose of Flight:**

Pre-Start Checklist: Complete all check list items in the order they are presented. If you cannot check off an item STOP! and correct the problem before continuing.			
NO	**Item**	**Acceptable Condition**	

1.	Airspace	● Unrestricted airspace or flight authorised. ● Potential obstructions near intended flight path identified	
2.	Weather	● Visibility >=2miles/400 ft. ● Wind <=15km/h.	
3.	Drone Maximum take-off weight.	● Should be <=2.15kg	
4.	Flight limit set	● Altitude<=120 mtrs. ● Distance<3km.	
5.	UAV Battery	● Sufficient for intended flight, not less than 85%. (Recommended full charge) ● Battery voltage:	
6.	Controller Battery	● Sufficient for intended flight, not less than 75%	
7.	GCS Battery	● Sufficient for intended flight.	
8.	Structural Check	● Inspect all components for visible Damage. ● Landing gear ● No structural defects visible ● All propeller screws perfectly ● GPS & telemetry mount screws perfectly	

9.	GCS	ON	
10	Controller power	ON	
11.	UAV Power	ON	
12	UAV strobe light	● Front: Flashing Green ● Back: Flashing Red	
13	Telemetry connection (GCS)	● Signal strength >85% ● Batt voltage not less than 23V ● Altitude should be Zero (Before take-off). ● GPS 3D fix ● Satellite count >15	
14	Compass Calibration	● Compass calibrated	
15	Payload	● Camera lens cover removed. ● Memory should have enough Space for Desire missions. ● Triggered camera manually through GCS.	

16	Mission Planning	● Mission planning as per requirement. ● Flying condition satisfied as per above point.	
17	Flight mode	● Loiter. ● Auto. ● POSHold	
18	Motor start checklist	● Arm in stabilize mode. ● motors start and run at idle, no abnormal noise. ● Set home point. ● Hover test (in loiter mode)	
19	Return to Home (RTH)	● Return to home altitude and path clearance should be decided by the operator.	
20			

Remarks:	

DO & DON'TS REGARDING OPERATION OF RPAS as per DGCA.

Do's

- Ensure your Drone (except Nano in uncontrolled airspace upto 50ft) is Digital Sky "No Permission- No Take off" (NPNT) Compliant.
- Obtain Unique Identification Number (UIN) from DGCA for operating in controlled airspace and affix it on your drone.
- Obtain Unmanned Aircraft Operator Permit (UAOP), if applicable from DGCA for commercial operations and keep it handy.
- Obtain Permission before each flight through Digital Sky Platform Ensure the drone is in good condition (not damaged) and fit for flying safely.
- Keep an eye on interference: Interference can be from mobile devices or blockage of signals, do watch out when flying your drone.
- Fly only during daylight (after sunrise to before sunset)
- Fly in good weather: good weather lets you not only fly your drone better but also keep track of it in the air.
- Fly in visual line of sight (VLOS): Always be within visual range of your drone.
- Make sure you clearly understand all operational and regulatory aspects.
- Be aware of Airspace Restrictions/ No Drone Zones.
- Do stay away from airports and heliports.
- Respect the privacy of people.
- Keep local police informed about your drone flying activity. If you are ever approached by the police, provide all requisite information.
- Do log your flights and intimate concerned authorities (like DGCA, local police etc.) of any incidents/ accidents.

Don'ts

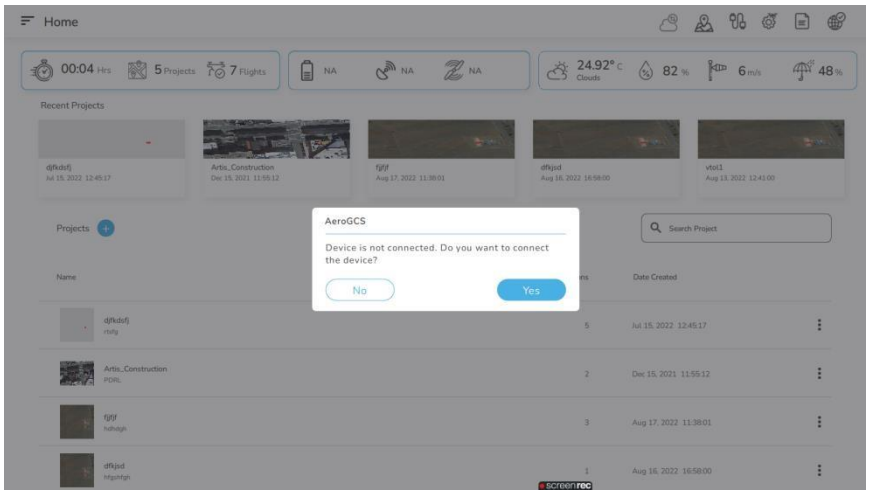
- Don't fly a Nano drone above 50ft (15m) from the ground level.
- Don't fly a Micro drone above 200ft (60m) from the ground level.
- Don't fly drones more than 400ft (120m) from the ground level.
- Don't fly drones near other aircraft (manned or unmanned).
- Don't fly drones near airports and heliports.
- Don't fly drones over groups of people, public events, or stadiums full of people without permission.
- Don't fly drones over government facilities/military bases or over/ near any no-drone zones.
- Don't fly drones over private property unless permission is given.
- Don't fly drones in controlled airspace near airports without filing a flight plan or AAI/ADC permission (at least 24 hours before actual operation).
- Don't drop or carry hazardous material.
- Don't fly drones under the influence of drugs or alcohol.
- Don't fly drones from a moving vehicle, ship or aircraft.

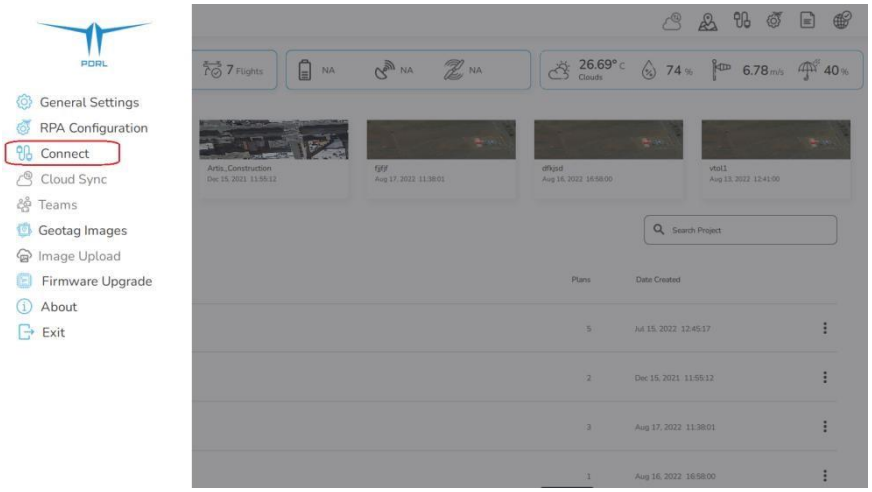
2.2.7.1 Connecting a Drone with GCS:

To have a successful flight, the drone should follow and respond to the commands given by RC. For this, a drone should be properly connected to the GCS. There should be proper communication between the drone and GCS and RC. Drone will be connected through a wireless connection. So the user has to provide the necessary information to establish the communication between drone

and software. The AeroGCS provides the following options for connecting a drone. You can connect a drone in the following ways:

- **From the dashboard:** Click on the icon on the top-bar options of the dashboard to connect the drone.
- **From Home menu:**





- **Connect a drone while creating a new**

Project: You have to connect a device before creating a new project. The AeroGCS will prompt you to connect a device before creating a project as shown in image:

Connect a Drone before creating a Project

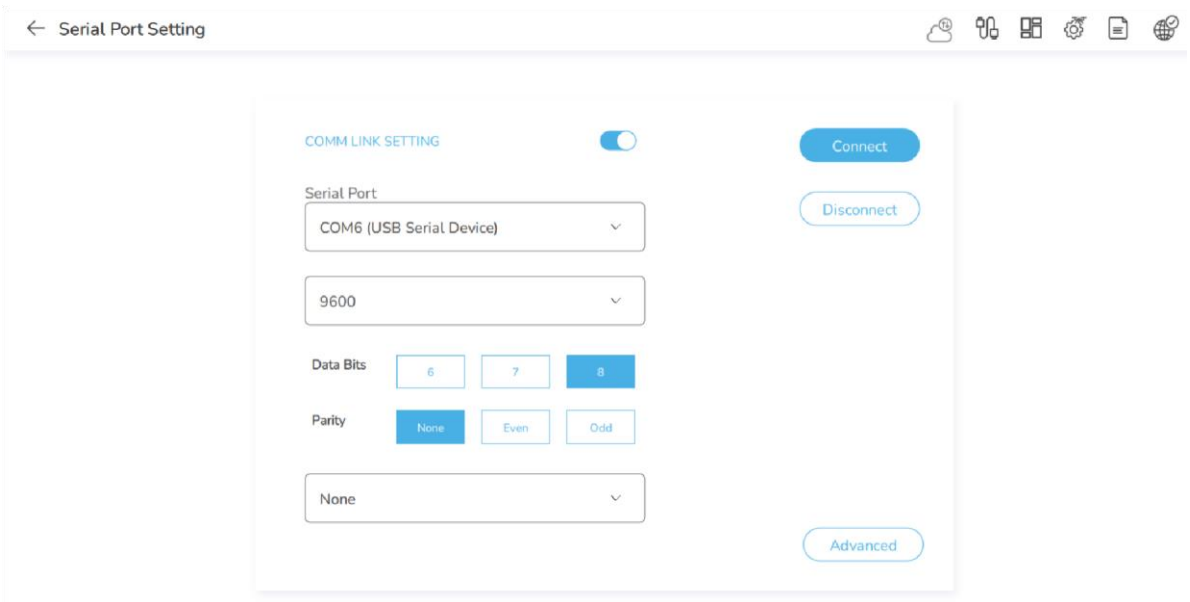
Click on "Yes" button to connect a drone so that you can upload the plan with desired settings into a drone.
Following are the steps for establishing the connection for any of these ways.

- **Set the Communication Link:**

Serial Port setting

4.9.5.22.1 Serial Port Setting

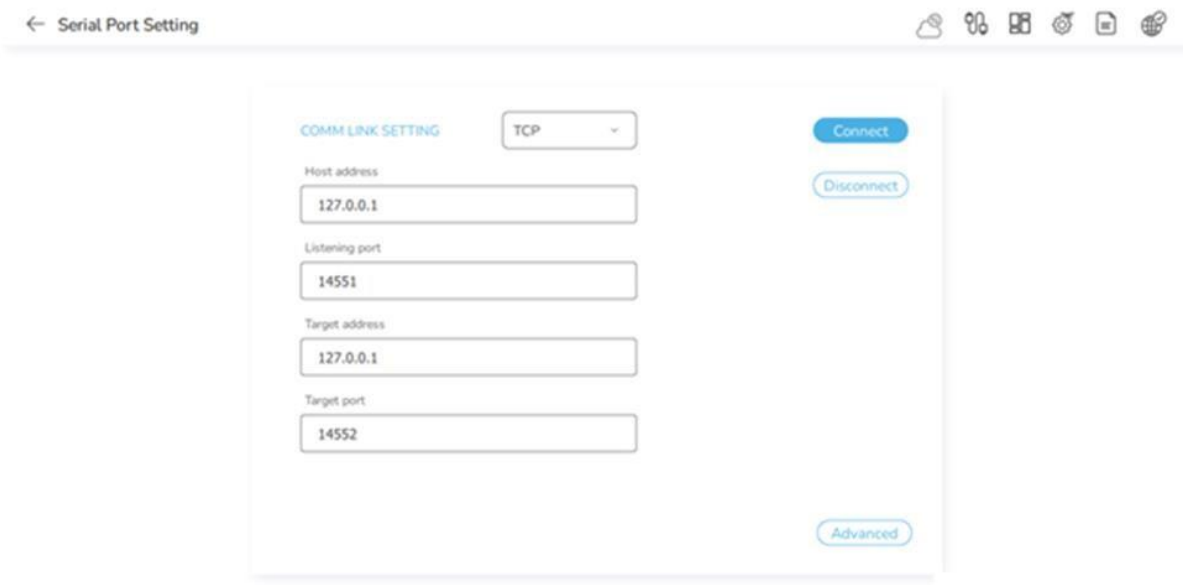
In the serial port setting user can connect the device using serial communication. Also, users can set different baud rates as per the requirement and connect the device.



- **Baud rate:** Computers communicate by transmitting bits of digital data from one device to another device through transmission media. You can send and receive data without worrying about setting up the details. The baud rate is the rate at which information is transferred in a communication channel. Baud rate is the rate at which the number of signal elements or changes to the signal occurs per second when it passes through a transmission medium. The higher the baud rate the faster is the data sent/received.

4.9.5.22.2 • Baud rate = number of signal elements/total time (in seconds)

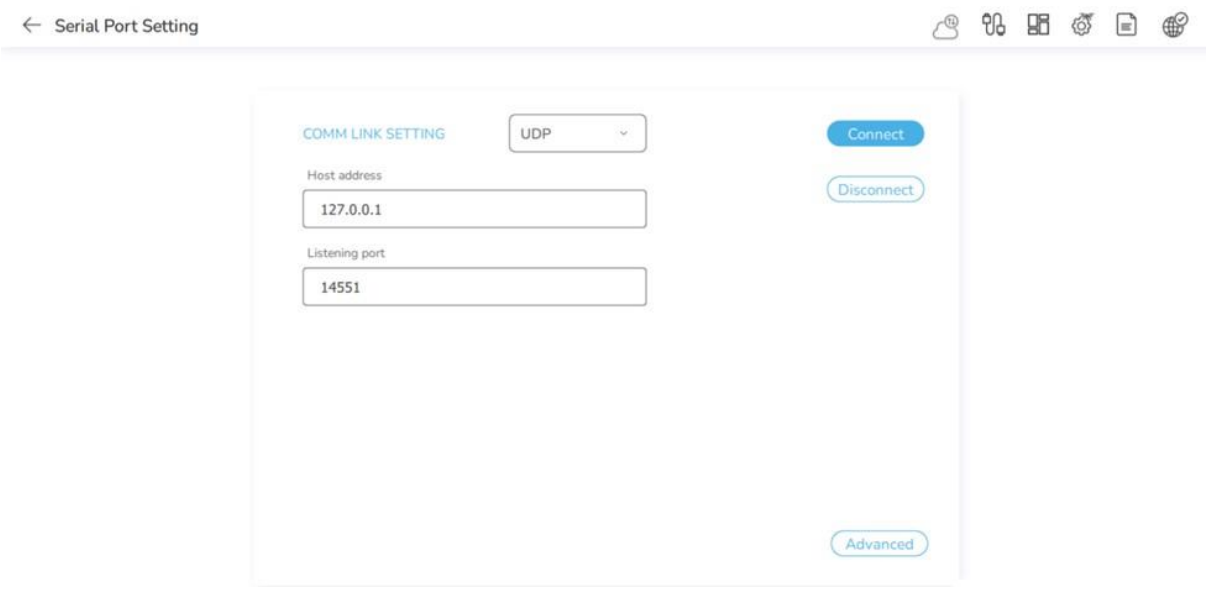
- Baud rate is important in the case of serial communication. In the serial port context, "9600 baud" means that the serial port is capable of transferring a maximum of 9600 bits per second.
- **Parity** is an error-checking procedure in which the number of 1s must always be the same - either even or odd - for each group of bits that is transmitted without error. In modem-tomodem communications, parity is often one of the parameters that must be agreed upon by sending parties and receiving parties before transmission can take place
- ***TCP***
- In the TCP communication setting, the user can set the host address, listing port, target address, and target port. The User can enter the desired values as per requirement or if the user wants to connect the herelink then can connect directly without changing the parameters.



Settings for TCP

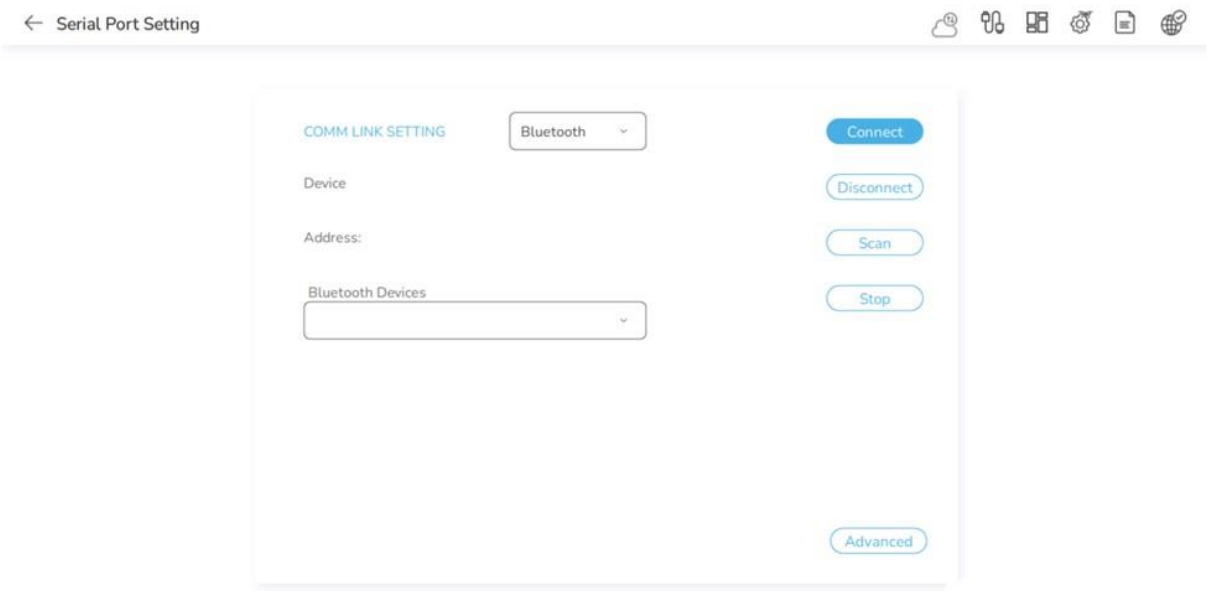
- **Host Address:** It is the address of the host computer through which the drone is controlled and monitored. If the user wants to change it he can, otherwise let it be as it is.
  - **Listening Port:** The address of the device to which the system is connected. You may change it or else let it be as it is.
  - **Target Address:** It may be the same as the address of the host computer.

- **UDP:**
- User Datagram Protocol (UDP) is a Transport Layer protocol. UDP is a part of the Internet Protocol suite, referred to as UDP/IP suite. Unlike TCP, it is an unreliable and connectionless protocol. So, there is no need to establish a connection before data transfer.



Settings for UDP

- **5. Bluetooth:**
- The user can connect devices that are Bluetooth based like skydroid. The User has to turn on the Bluetooth and location (if required) to connect the device.



Settings for Bluetooth

- The system will scan for the available Bluetooth devices if "Scan" button is pressed. It will scan all the devices and the list will be displayed in the "Bluetooth Devices" option. Select the required device to pair with GCS and proceed for connection.

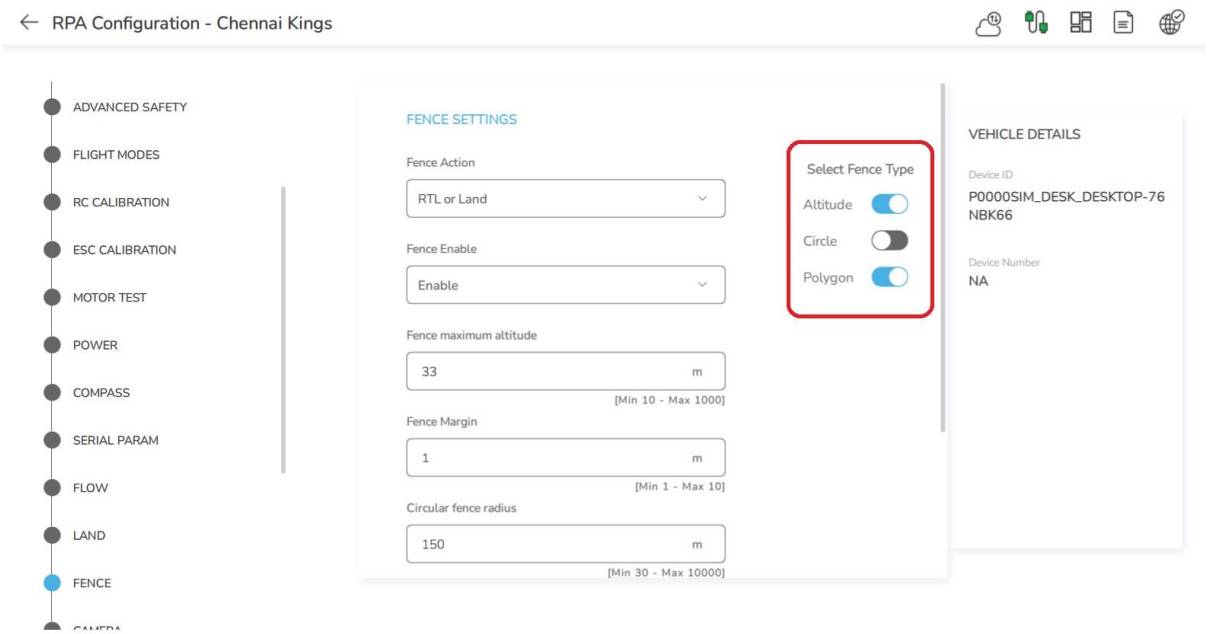
- Select "Stop" option to stop the "Scan" process for Bluetooth devices.

2.2.7.2 Fence as a Safety:

This section allows to you configure fence related parameters. Configuration options are as below.

1. **Fence Type**: Select the type of fence you want to apply as a security to the drone flight. The options available are:

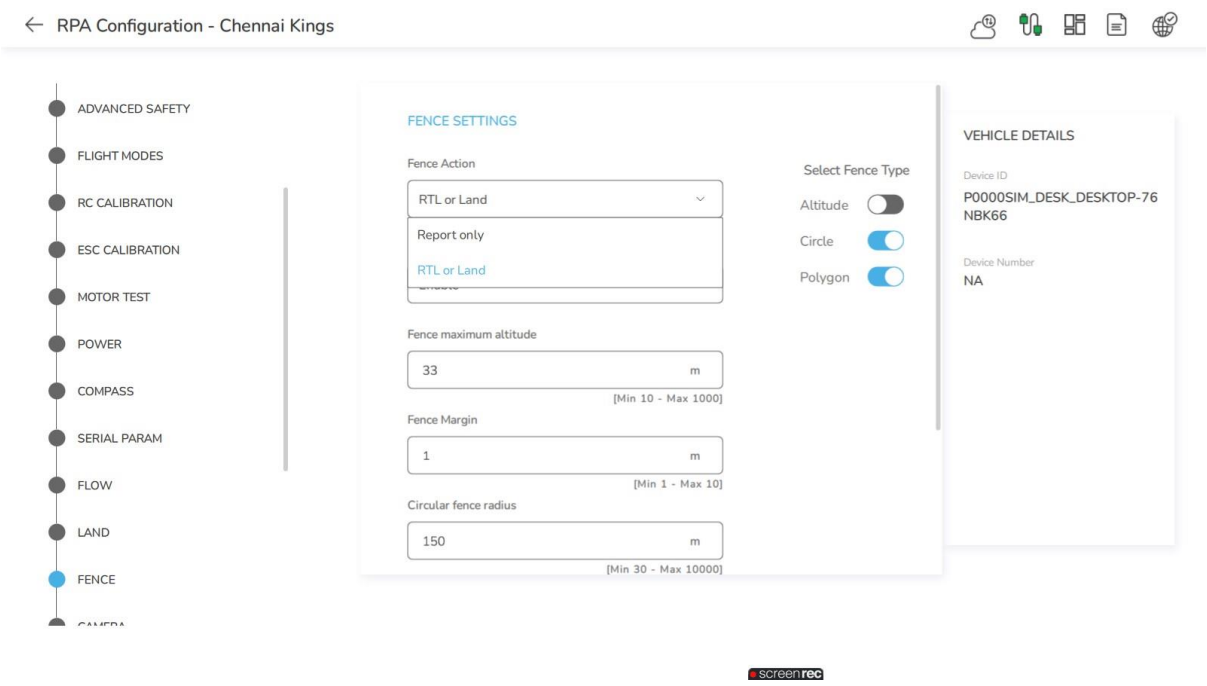
- **Altitude** – This allows to setup altitude fence so that RPA will be within defined altitude.
- **Circular** – This defines circular type of fence.
- **Polygon** – This defines polygon type of geo fence



Selecting a Fence Type

2. Fence Action – This allows you to set action on breach of the fence. AeroGCS allows you to set either of the following actions:

- **RTL or Land:** On the breach of fence, the drone will enter into either Return To Home or Return to Land whichever is closer and safer to land.
- **Report only:** This option will provide the report of breach of the fence only. No action will be performed



Fence Action

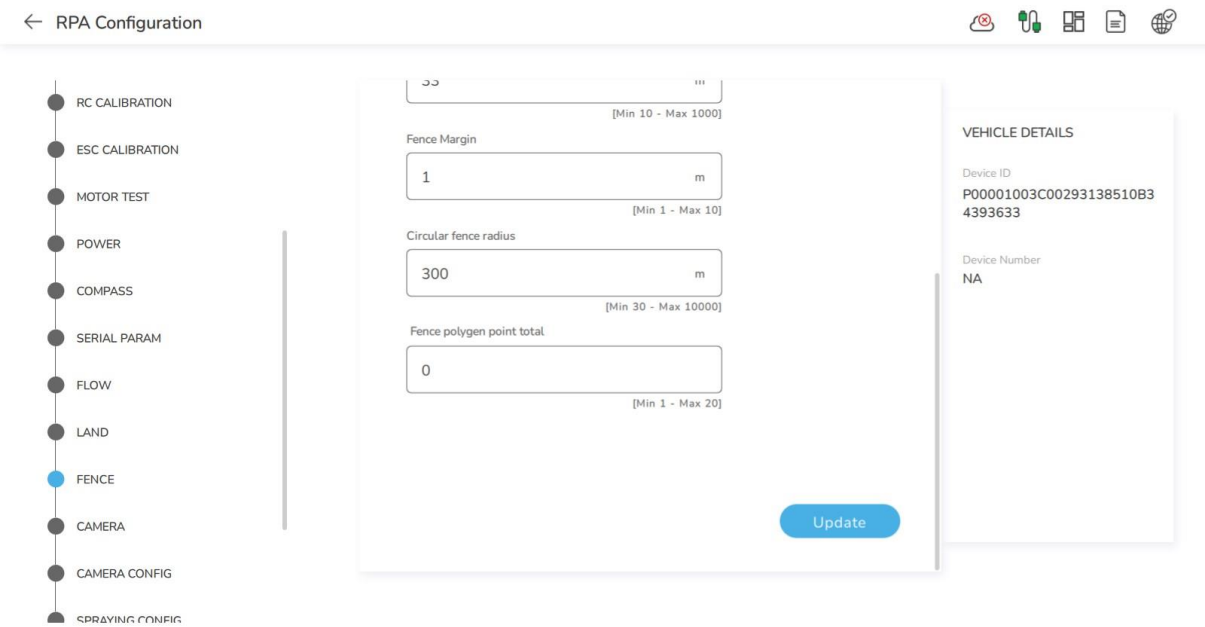
3. **Fence Enable –** This enables or disables fence to monitor and take action on breach of fence. If it is disabled, then RPA will not consider any fence. It is important to enable fence always.

4. **Fence maximum Altitude –** This is the maximum altitude then RPA should go. If this limit is crossed, then fence action should get activated. The user can set the Fence altitude as minimum of 10 and maximum of 1000 m.

5. **Fence Margin –** Distance that autopilots should maintain from the fence to avoid a breach. This is the safety margin of fence. The minimum allowed value for fence margin is 1 m whereas the maximum of 10 m is allowed.

6. **Circular Fence Radius –** Circle fence radius which when breached will cause an RTL. Here you can define maximum radius of a circular fence. The radius for circular fence may vary between 30 to 10000 m.

7. **Polygon Fence Total Points –** Here you can define maximum polygon points a fence should consider. Maximum of 20 polygon fence points are allowed.



RPA Configuration -Fence

1. Do all the checklists provided in the Ground control station(GCS).
2. Do all the checklists manually as per log book which is provided with this manual.
3. Plan the mission as per your requirement.
4. Go to camera settings and set camera parameters.
5. Once you are ready for the flight. please do check the propeller rotation.
6. Start logging for the rover module, follow the instructions given below at content 11.
7. RTH altitude set above the highest obstacle, RTH should be a predefined path.
8. Once Mission is uploaded Go for auto take-off and auto landing.

NOTE:-2-3 days standard training will be provided at your location by Aerosys Aviation India Pvt. Ltd.
Operational permissions from DGCA / local authorities to carry out drone flights to be obtained by Client.

4.9.6 Special Situations

4.9.6.1 Failsafe

In case of failsafe, VEDANSH will automatically turn to RTL mode and come back to the home location at the same altitude and start descending.

4.9.6.2 Manual RTL

In case of any other manual emergency, the user can press RTL button on GCS and the UAV will come back to home in RTL mode.

4.9.6.3 Loiter

In case the User needs to hover, the drone or take a manual override, switch the Flight mode switch on the transmitter to Loiter Position and it will start hovering. Drone can be commanded with sticks as per controls depicted in the Transmitter section above. To switch back from loiter to Auto mode, press the Auto mode on the AEROGCS again.

4.9.6.4 Data Link Loss

In case the Transmitter loses the connection with the drone, it will start Beeping to alert the pilot. In such situation, it will automatically turn to RTL mode under radio failsafe if connection is not regained for more than 10 sec. However, the pilot should raise the transmitter and align it towards the direction of the drone to attempt getting reconnected.

4.9.6.4.1 Emergency Procedures

- **In case of a crash**
  - Disarm the aircraft.
  - Disconnect the batteries.
  - Check the batteries for signs of damage and carefully take the batteries out of the airframe and keep them in a safe place.
- **In case of Battery over-inflation/overheating**
  - Carefully disconnect both the batteries.
  - Take the batteries off the airframe.
  - Safely dispose of the battery as chemical waste and use a new one for subsequent flights.
- **In case the aircraft catches fire on the ground**
  - Disarm the aircraft and use a fire extinguisher to put out the fire. Avoid using water for extinguishing, except in case of absence of fire extinguisher.
  - Once the fire is out, wait for the components to cool down.
  - Carefully remove the batteries and check for damage.

4.10 Operating Conditions

This section introduces the operating conditions for VEDANSH UAV.

4.10.1 Weather Conditions

To ensure the safe operation of the VEDANSH UAV , weather conditions should be monitored before the flight. Check the forecast on any app (eg. Windy) for the winds, rain or snow. Make sure that the following conditions are met:

- The continuous wind should not exceed 6 m/s and the gust should not exceed 15 m/s at any point of time during the flight. When the message for

heavy winds appears on the GCS please return the vehicle back to the home using RTL button.

- Do not fly the drone in case of rain, snow or fog.
- The ambient temperature should not be below -10 Deg C and should not exceed 50 Deg C.
- The flying height above mean sea level should not be more than 3000m.

4.10.2 Operating Envelope

During the flight operation following points should be taken care of:

- The drone should always be maintained in line of sight.
- The operator should not always rely on an automated battery failsafe and should manually trigger RTL in case of battery drops below a minimum threshold.
- The drone should not exceed the visual line of sight range at any point in time of flight.
- There should not be any magnetic interference in the entire flight profile.

5 PPK module setup and post processing.

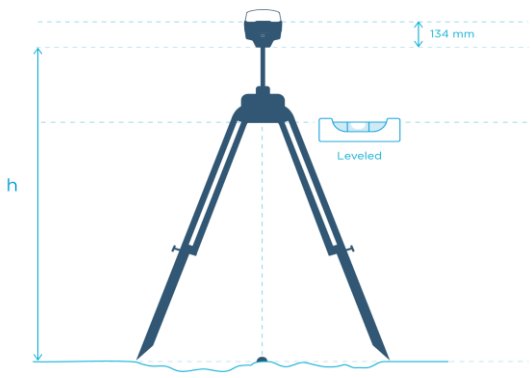
Post-Processed Kinematic or **PPK** is a GNSS data correction technology which is widely used in surveying and **mapping** to obtain high-precision positioning data or centimeter-level accuracy.

Specification:

- GNSS Grade: High accuracy L1 & L2 Frequency Band Enabled PPK.
- Logs RINEX at update rate up to 10 Hz. ● NTRIP and VRS support RTCM3.
- Logs RINEX at update rate up to 10 Hz.
- 22 hours on 1 charge

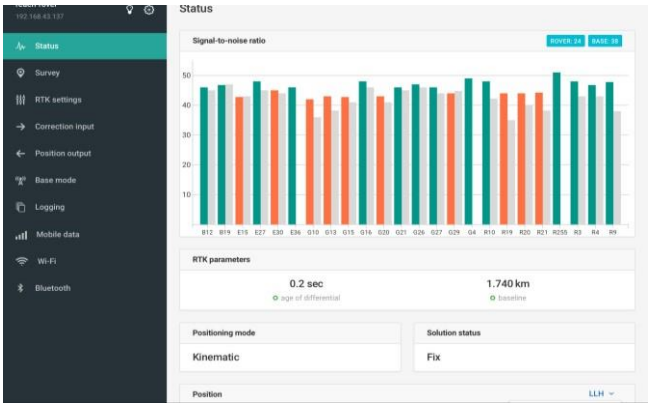
Base module setup:

- Clear sky view without any obstacles.
- Good environments for Reach placement (open field, top of the hill, rooftop).
- There should be no obstacles that could block the view like buildings, trees, cars, humans, laptops, etc.
- Take a look at the setup.



Note: Once the Setup is done **ON** the module 10 min before flight.
Base module has been configured ready to use.
Download the Reach View App and follow the instructions.

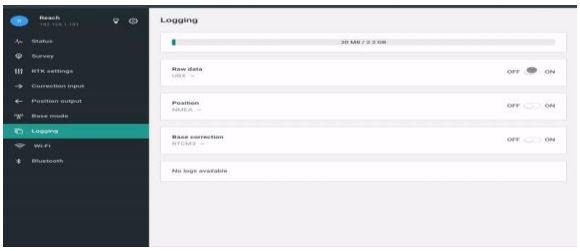
- Connect your reach view app through base module WI-FI, once it is connected you can see the dashboard.



- We can connect through the desktop also,connect your desktop with base module wifi or rover module wifi.
- IP address for base: 192.168.42.22
- IP address for rover: 192.168.42.1
- Save the antenna height as per your setup.

Start logging:

To enable logs recording, go to the "Logging" tab in the Reach Panel. Here you can see several logging options. Reach can record raw data, position log, and base corrections.



After completing the survey, you can save logs to your Mac, Windows, Linux or mobile device. You can do it in the same "Logging" tab in ReachView.

Off the Logging and download the log for post processing.

Rover module:

Rover Module is pre-configured with UAV from Aerosys Aviation side. Once you power the UAV, please connect Reach app or IP through rover wifi Start logging as instructed above for the base module.

Once the Mission is done and landed successfully, please disarm the UAV. Download the log from the rover module for post processing.

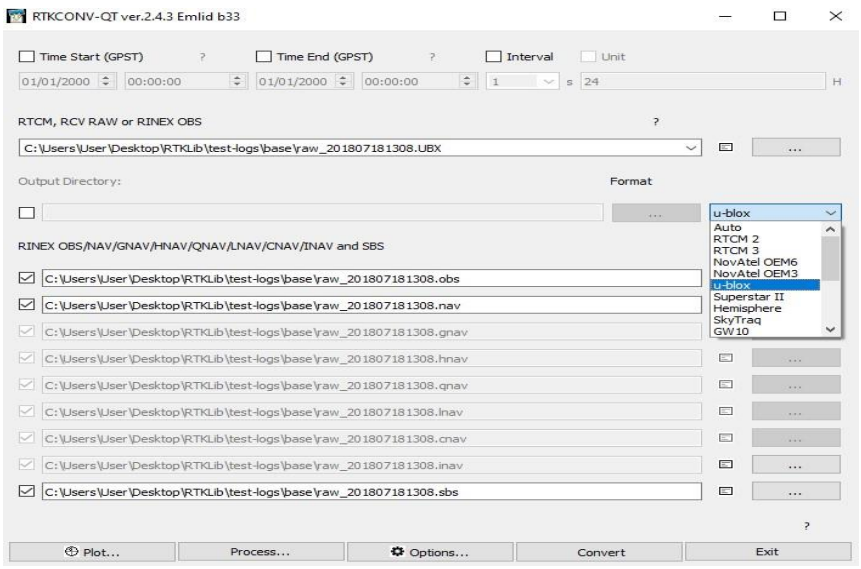


For more information refer the link: https://emlid.com/docs/

2.4.1 Post processing the data:

After the required mission is completed, please download the log file as instructed above, save the files on your local PC. The post processing is done using the rtklib software provided with the product.

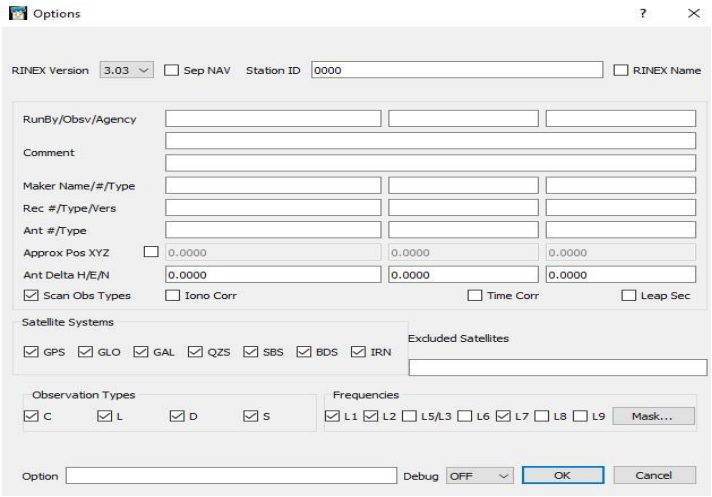
Converting raw logs to RINEX:



- Open the rtkconv.exe application in the rtklib

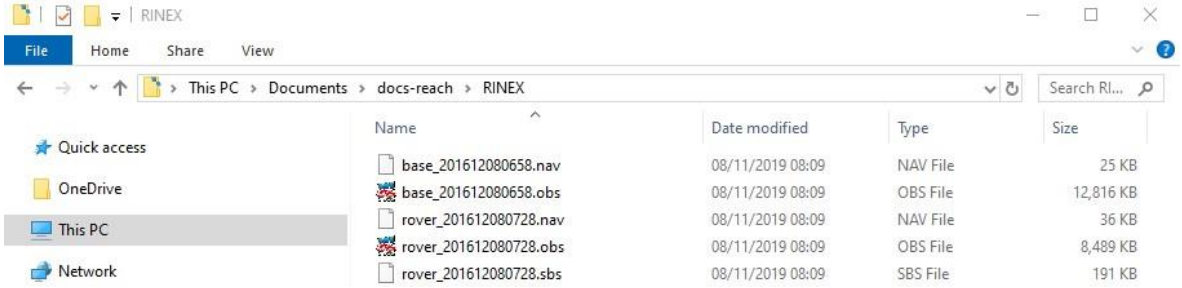
- Add your rover raw log(.ubx) in the first field and choose the output directory.
- Choose the format of your log in the pop-down menu, Set format to *u-blox.*
- Push *Options* button
- Choose RINEX Version 3.03
- Turn on Satellites Systems you need.

- Enable L1, L2 and L7 frequencies in the *Frequencies* panel



- Press *OK* and *Convert* after.

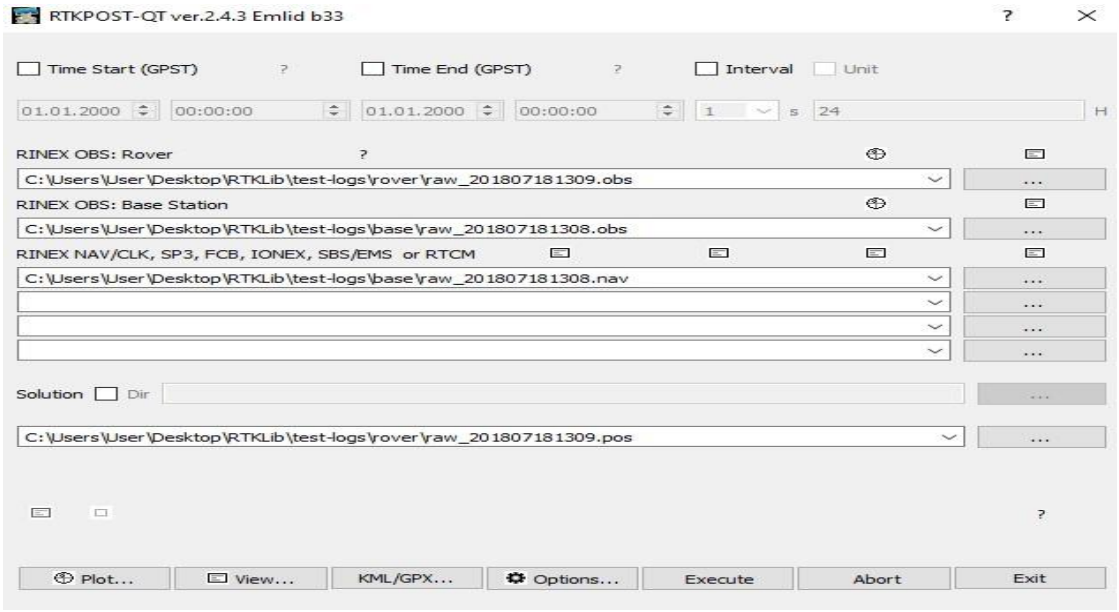
Now you should repeat the same with base log. Don't forget to change format. After that you'll see something similar in your output folder.



2.4.2 Processing in RTK Post:

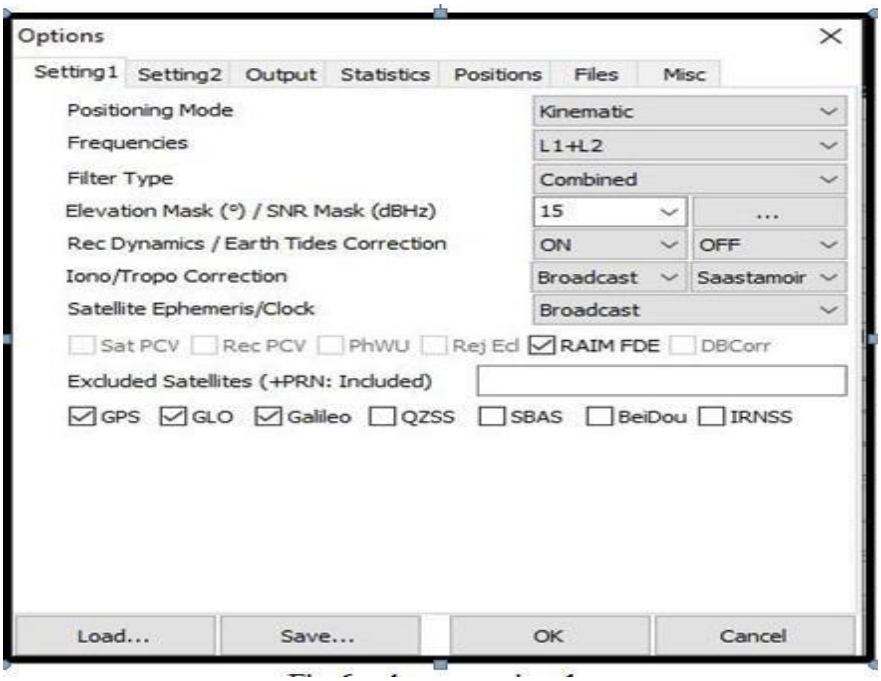
Start RTKLIB RTKPOST software and enter the fields as shown here. If running for the first time you will need to set mode to Kinematic or Static in the options to unlock the fields for base station data. You can skip the start time, it is not compulsory.

- Choose rover .obs file for the *Rover* field (RINEX file from your rover)



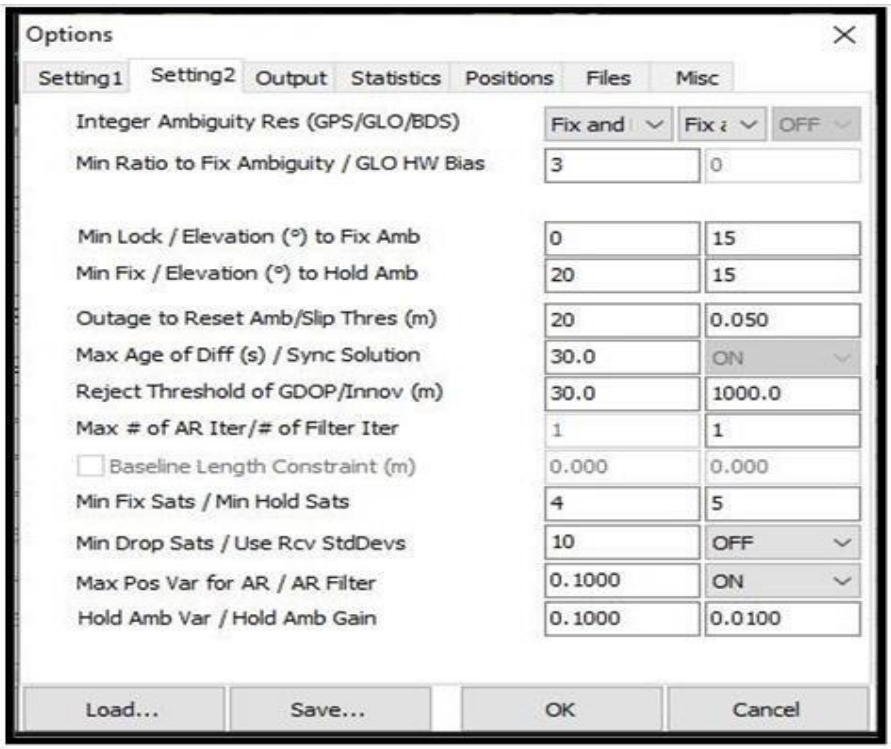
- Select base station .obs file for the *Base Station* field (RINEX file from your base) ● Put base or rover .nav file in the third field.

- Now proceed to the options by pushing *Options* button
- Set positioning mode you need. Usually, it's *Kinematic* or *Static*. *Kinematic* mode implies that the rover was moving during the positioning process. *Static* mode assumes that the rover was stationary, which helps to resolve the ambiguities faster as well as produce measurements with higher precision

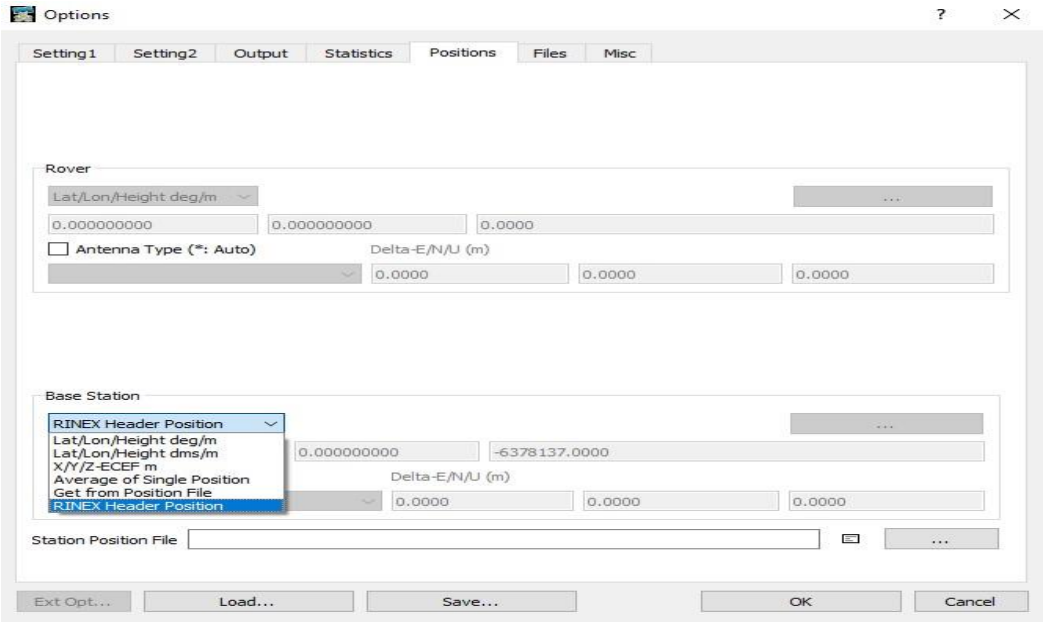


- Choose *Elevation Mask* value. Usually it's 15-20

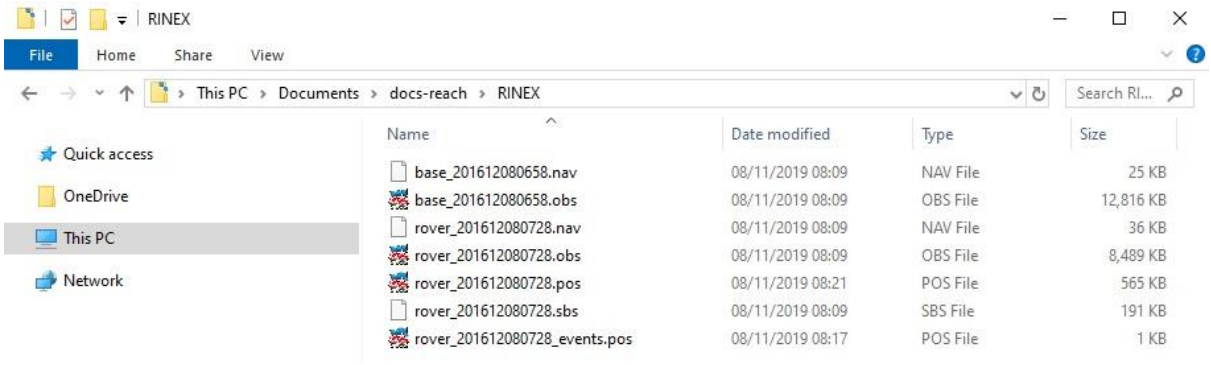
- Push the SNR *Mask* button and set the value you need. This will help you to avoid satellites with low signal strength
- Turn on *Rec Dynamics* to estimate receiver velocity and acceleration. Use it for DGPS/DGNSS or Kinematic modes.
- Set the parameters as shown in Fig for the "**Setting 2**" tab.



- Switch to *Positions* tab
- Select *Base Station*. Choose *Average of Single Position* for any log to average single point solution or *RINEX Header Position* to use approximate position in RINEX. obs header

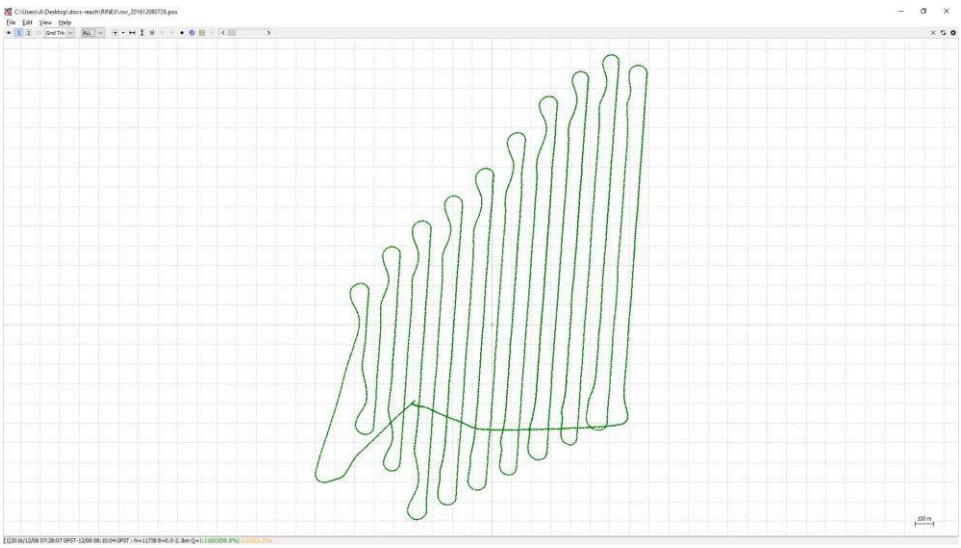


- If you already have a survey location for the base station then you can select the “Lat\Lon\Height” option and enter the latitude, longitude and height of the base module position.
- Press *OK* button and *Execute* in the main window
- After that you'll see something similar in your output folder. The .pos file with "__event" will contain timestamps if you had them during your job.



Result visualisation and analysis:

Open RTKLIB RTKPLOT and drag and drop your .pos file. If you see green points that mean that they're fixed (Q=1), orange mean float (Q=2), red - single (Q=5).



HAPPY FLYING