LiAirX4Plus

Autonomous Flight LiDAR

Acquisition System

User Manual



GreenValley International Inc.

Manual revision

Revised date	Revised times	Note
2026.03.14	1	First edition

User Instructions

This manual describes LiAirX4Plus from installation, collection, calculation, and maintenance. Please follow the operation instructions, advice, warnings or precautions provided by the manufacturer in this specification.

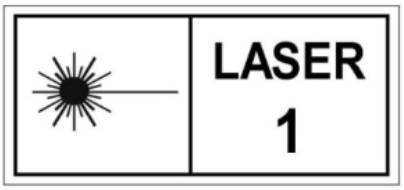
Symbolic tips

Note: Please read the information carefully during operation.

Warning: If you do not follow the instructions, it may cause equipment damage, data abnormalities and other conditions, please read it carefully.

Safety Precautions

1. LiAirX4Plus system uses Class 1 (IEC60825-1:2014) eye-safe laser sensors. If you have any concerns, please contact GVI for details.



2. Please stop using the system if you hear noticeable noises, warnings, or while the device is damaged. Contact the manufacturer's technicians for maintenance in time. Forcible use may cause permanent damage to the system.

3. Strictly follow the tutorials, advises, warnings, and other cautions included in this user guide as well as other documents provided by GVI.

4. Do NOT use any power supply outside the specified voltage range (12~28V，1.5A@24VDC). Incorrect voltage supply may cause permanent damages to the integrated instruments and other hazards. Damage caused by the use of an unauthorized power supply are not covered by the Product Warranty.

5. Keep the power, USB, network and other connector ports clean and dry, and do not insert other objects other than the connector.

6. Tampering with the product is strictly prohibited and will void the Product Warranty. Any repair, modification, or upgrade must be performed by GVI technician or authorized service provider.

7. This product is a high-precision mapping and surveying instrument that must be handled with care. This product should be stored and transported in the protective case provided with the LiAirX4Plus at the time of purchase or in a protective case authorized for use by GVI.

8. When not in use, store LiAirX4Plus system and accessories in a cool and dry environment. Make sure the device is powered off when performing maintenance and cleaning.

9. The working temperature of this equipment is -20℃~50℃. Below/exceeding this temperature range, it may cause wrong measurement results, data loss or equipment damage.

10. Before using the equipment, please ensure that the operating environment is far away from the source of electromagnetic interference.

11. There are corresponding specifications for battery use and storage. Please refer to the lithium battery use/storage specifications for details.

12. After the equipment is scrapped, please do not throw it directly into the trash can. It can be sent back to the manufacturer, and the manufacturer will handle it on your behalf.

GreenValley International Inc. reserves the right to explain the above terms.

GreenValley International Inc.

March 14, 2026

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Product overview

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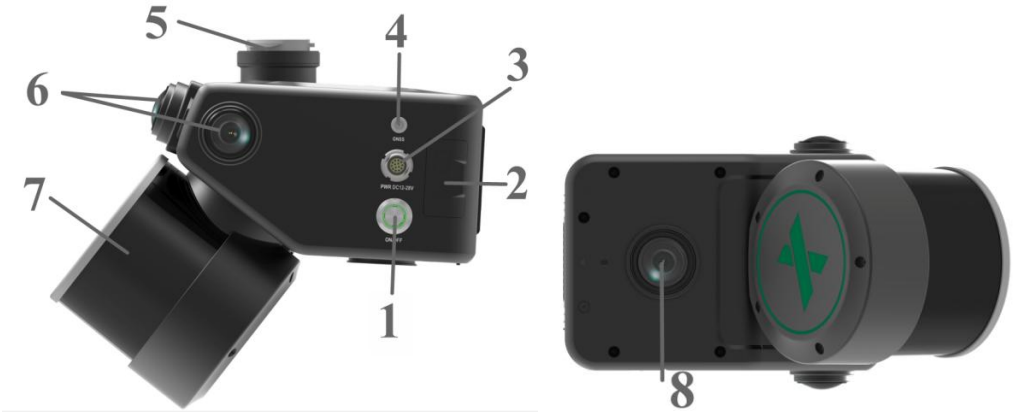
GreenValley APP(Liplan)

Product Introduction

LiAirX4Plus is a highly intelligent autonomous airborne LiDAR system developed by GVI. As a comprehensive upgrade to the LiAirX4, it retains autonomous flight capabilities and integrates the panoramic camera module internally for a more compact design and faster airborne/handheld switching. The system combines a lightweight 32-line LiDAR, high-precision INS, a 26-megapixel mapping camera, triple 12-megapixel panoramic cameras, and a high-performance edge computing platform. In handheld mode, the built-in SLAM algorithm captures high-precision 3D point clouds, achieving centimeter-level integration of airborne and handheld data for comprehensive 3D mapping.



Product Structure



1. Power button (ON/OFF) and indicator light: Device power-on and project creation button (shared), also displays device working status.
2. USB-C interface: Used to connect device to computer to do system upgrade, data download, etc. Memory card slot: Equipped with 512GB TF card for data storage.
3. Power connection port (PWR): Connect the OSDK communication cable to communicate with aircraft, or connect power cable to power the device.
4. GNSS interface: Connect the GNSS antenna to obtain GNSS signals.
5. Gimbal interface: DJI SKYPORT interface for device mounting and power supply.
6. Panoramic camera: Triple 12-megapixel on left, right and front side
7. Laser Scanner: XT32M2X, 32-channel.
8. Mapping camera: 26- megapixel, 16mm prime lens

Packing List

Airborne Mode list

	LiDAR System×1		DJI M300/M350RTK GNSS Antenna Mounting Bracket Set×1
	USB Cable×1		DJI M400 GNSS Antenna Mounting Bracket Set×1x1
	OSDK Communication Cable×1		512GB TF card×1
	GNSS Antenna×1		Card Reader×1
	USB drive×1		

Handheld Mode list

	SKYPORT Adapter×1		Smart Battery×2
	Base×1		Battery Charger×1
	GNSS Antenna Mounting Bracket Set ×1		

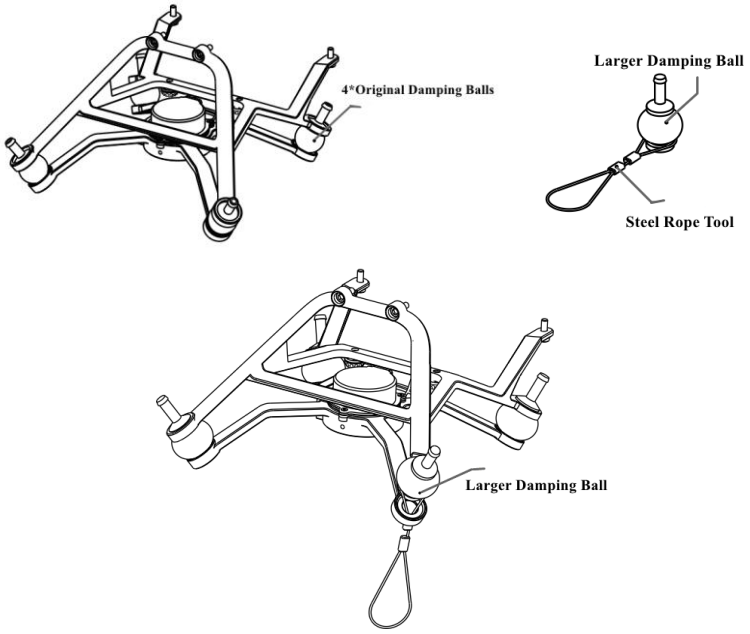
Note: The above materials include airborne accessories compatible with the DJI M300/M350RTK/M400 and handheld accessories. The actual product list shall be subject to the delivery.

Product Installation

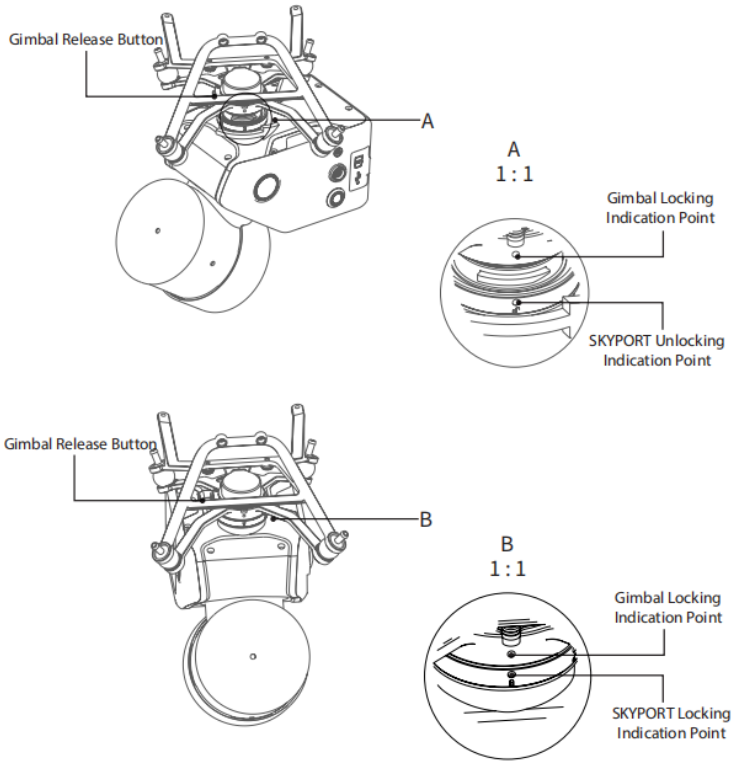
This product is equipped with DJI SKYPORT interface, supporting installation on the DJI M350/M300RTK/M400 UAV.

The installation procedure for the DJI M300/M350RTK aircraft is as follows:

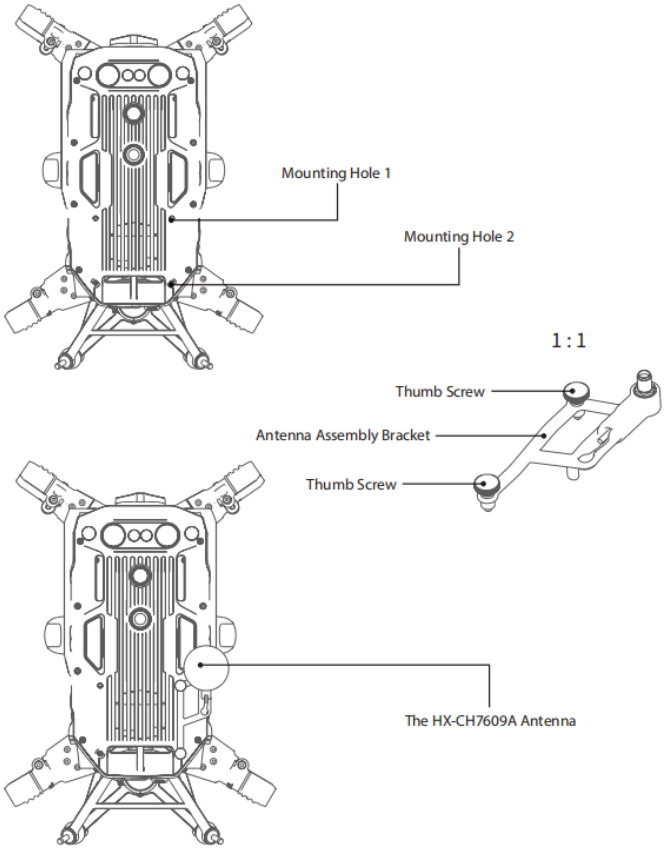
1. Replace the four original damping balls with larger damping balls.



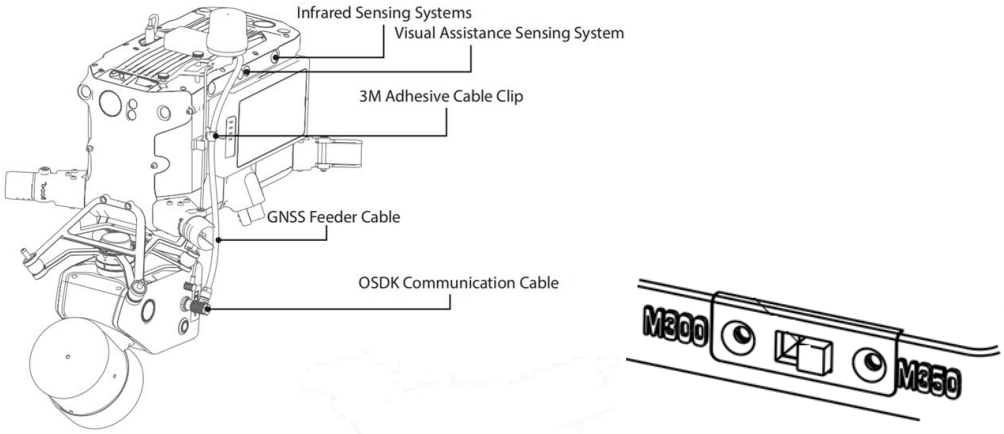
2. Align the white dot of the SKYPORT interface with the red dot of the aircraft gimbal connector, and rotate to fix the device (align the red dot).



3. Install the GNSS antenna bracket assembly and the GNSS antenna. Please set the DIP switch to the correct aircraft type according to the UAV model.



4. Connect the OSDK communication cable and the GNSS antenna feeder.

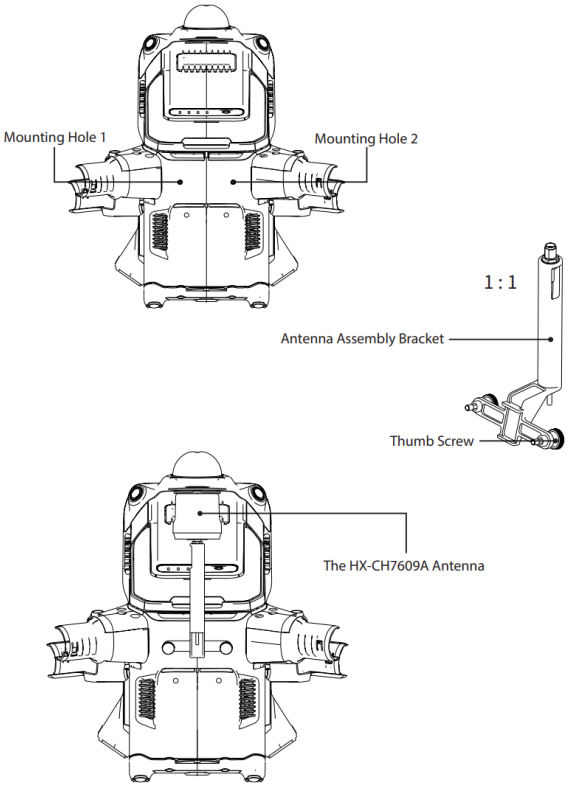


The installation procedure for the DJI M400 aircraft is as follows:

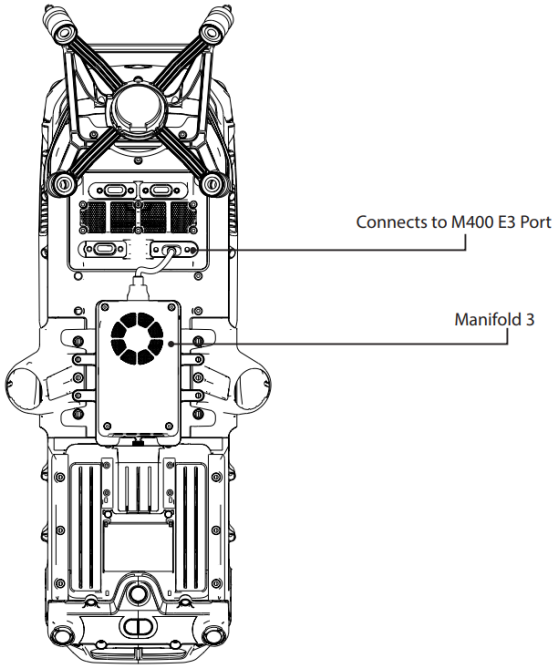
1. Remove the four original damping balls. Refer to the DJI M300/M350RTK aircraft installation procedure.

2. Install the device onto the aircraft gimbal. Refer to the DJI M300/M350RTK aircraft installation procedure.

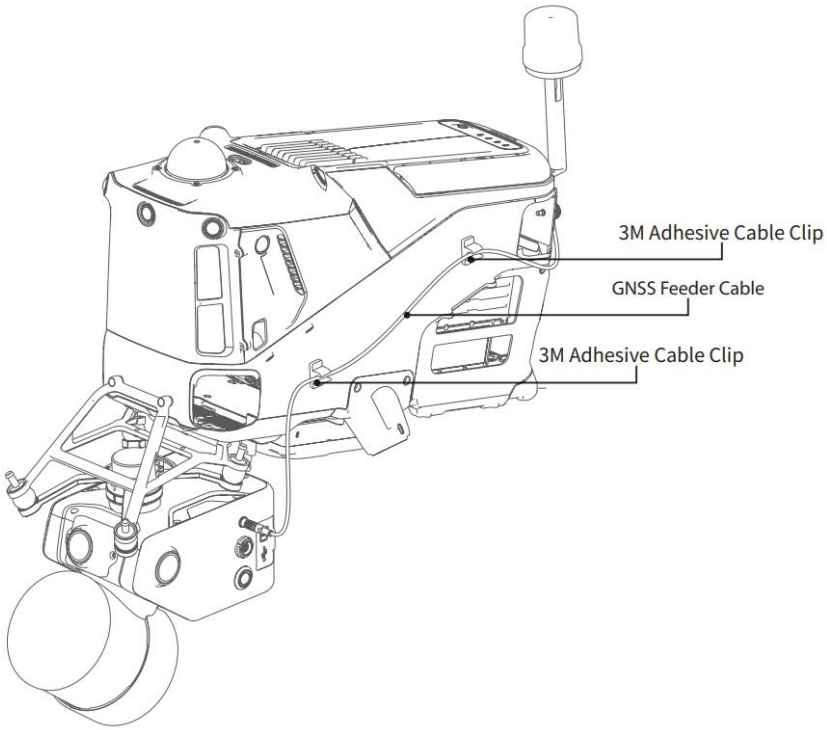
3. Place the antenna assembly bracket on the back of the aircraft. Align the holes and tighten the thumb screws. Screw in the antenna.



4. Install the Manifold3 module. It is only used for autonomous flight tasks and does not need to be installed for non-autonomous flight tasks.



5. Before taking off, make sure that all cables do not interfere with the aircraft blades and fix GNSS feeder cable with 3M adhesive cable clips.



Note:

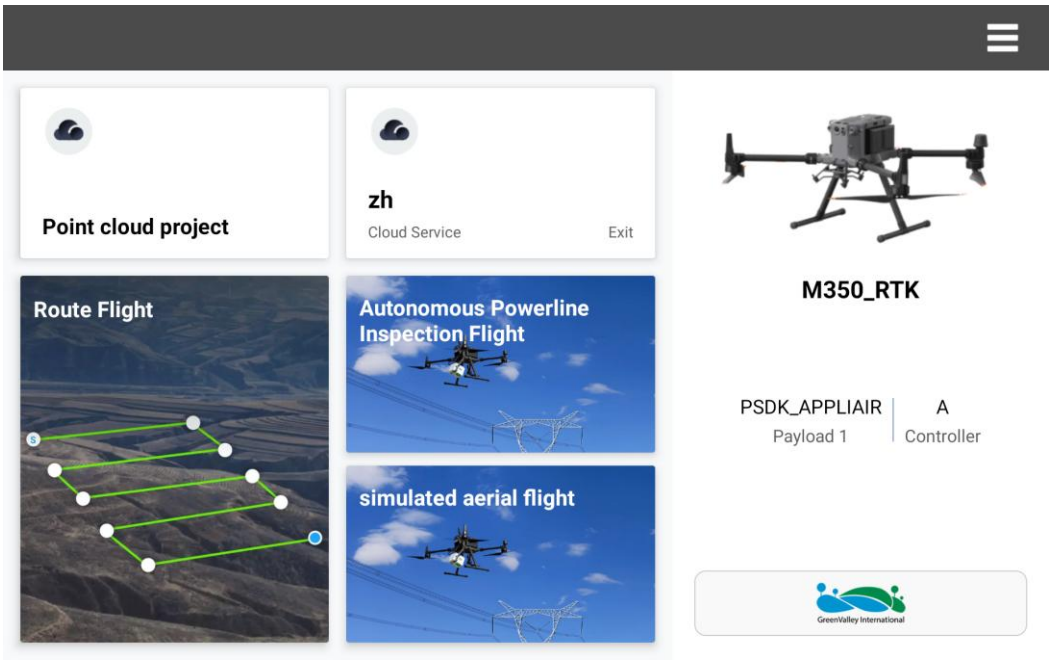
1. If the SKYPORT interface cannot be installed, please check whether the aircraft gimbal connector is accidentally reversed. If it is not flat, please manually flatten gimbal connector.
2. Make sure that all cables do not interfere with the blades of the aircraft, and use 3M adhesive cable clips to fix all the cables to ensure that the cables do not block the infrared sensing system and vision system on both sides of the aircraft.
3. Please turn off the aircraft before removing the device.
4. The system supports antenna-free mode for DJI M350/M300RTK/M400 UAV without installing external GNSS antenna and antenna feeder.
5. The OSDK communication cable for the DJI M300/M350RTK aircraft supports aircraft communication, control, and other functions. It must be connected whether operating in autonomous flight or route flight. The OSDK communication cable is equipped with a DIP switch to distinguish between the M300RTK and M350RTK models. Please set the switch to the correct position according to the aircraft model

being used.

6. When mounted on the DJI M400 aircraft, if autonomous flight function is required, the Manifold 3 accessories must be additionally installed, along with the corresponding Manifold 3 flight control firmware upgrade. Installation is not required if autonomous flight function is not used.

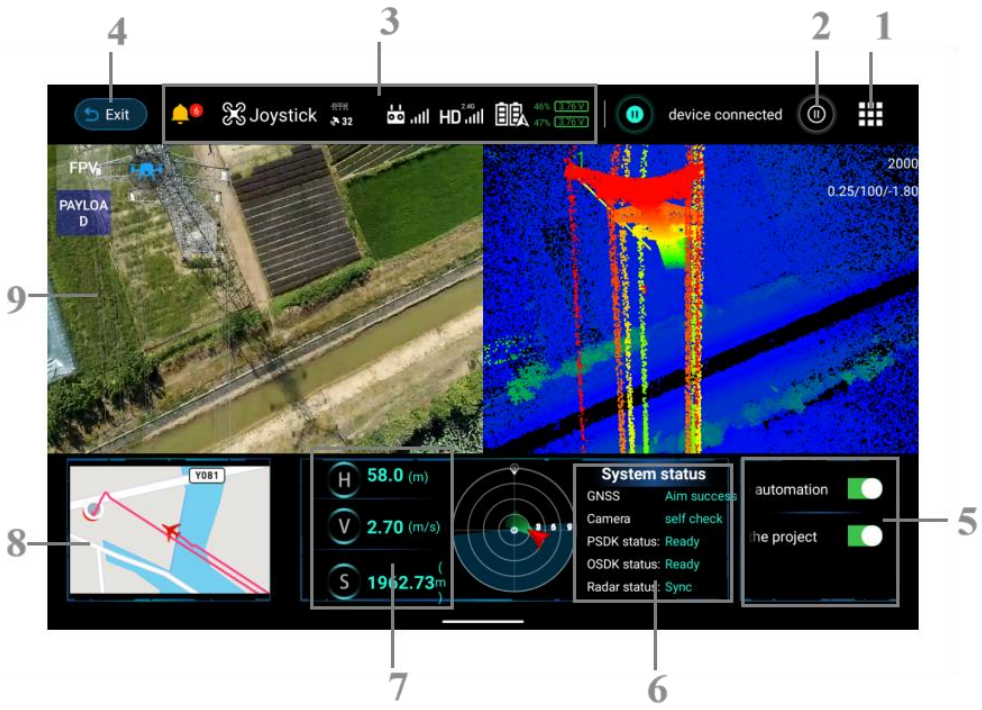
GreenValley APP(Liplan)

The product is equipped with the self-developed GreenValley APP(Liplan), which can perform route flight, autonomous powerline inspection flight, or terrain following flight to acquire point cloud data, set flight parameters, and view real-time color point cloud and camera video streams.



Note: Autonomous powerline inspection flight and terrain following flight must be performed using the GreenValley APP(Liplan). For detailed operation procedures, please refer to the APP user manual.

Autonomous powerline inspection flight



1. Setting Button

Click to enter the setting interface for parameter setting and status viewing.

2. Connecting Button

Click to connect or disconnect the communication between the device and the APP.

3. Status Bar

Display abnormal error report, remote control signal strength, battery power and other status information.

4. Exit Button

Click to return to the previous level interface.

5. Control Button

- Start/stop the autonomous flight. When the control mode is APP control, Use this button to control autonomous flight.
- Create/close project file.

6. System Status

Use to display the system status, including GNSS status, camera status, PSDK status, OSDK status, laser scanner status. When all the status are ready, the device is working normally.

7. Aircraft Status

Displays the flight altitude, flight speed and the distance from the takeoff point.

8. Map Window

Zoom in, Zoom out, and pan 2D maps in windows.

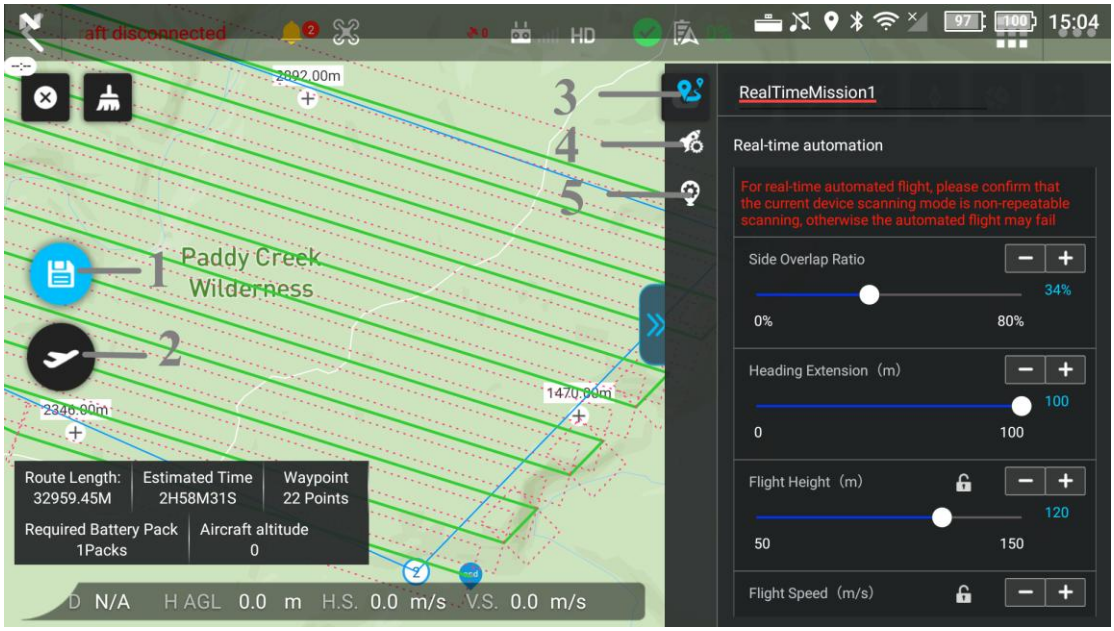
9. Video Window

Display the aircraft FPV and the system camera real-time video stream.

10. Point cloud window

Click to enter the real-time point-cloud browsing interface.

Terrain following flight



1. Save button: Save the route task.

2. Execution button: Upload the route and perform the flight mission.
3. Route setting button: lateral overlap rate, heading extension, flight altitude, flight speed, main route Angle, equipment model, return number, point density and completion action.
4. 8 figure setting: Set the number of 8 figure and radius.
5. Regional boundary point setting: Used to adjust the navigation point

Data Acquisition

Base Station Setup

Preparation

System Installation

Parameter Setting

Data Acquisition

Base Station Setup

Set up the base station on the selected base station point. For surveying and mapping projects or other projects with high precision requirements, a tripod should be erected in accordance with specifications, and the base station should be erected on the tripod. The base station needs to start collecting data 5 minutes before the flight operation, and stop collecting data 5 minutes after the operation ends.

- Open areas refer to those places which are not covered by high objects. The maximum elevation mask angle of surrounding objects should be less than 15°.

- The source of strong electromagnetic interference might be cellular base station, high voltage transmission lines, or objects with high reflectance (e.g., mirror, large water body) which may cause the multipath propagation.

Preparation

Device activation. The system is in an unactivated state when shipped from the factory. It needs to be activated through the GreenValley APP(Liplan) before normal use. For detailed activation procedures, please refer to the appendix 3.

System Installation

1. Mount the device on the DJI M300/M350RTK/M400 drone and make sure that the damping ball is intact.

2. Confirm the accompanying cables and GNSS antenna assembly bracket are securely connected.

3. Make sure there is enough space for the TF card of the device, and insert it into the device.

4. Remove the camera lens and laser scanner protector covers.

Note: When installing on the DJI M300/M350RTK aircraft, the OSDK

communication cable must be installed, and the DIP switch must be set to the correct aircraft model. Failure to do so will result in the device and App failing to communicate properly.

Parameter Setting

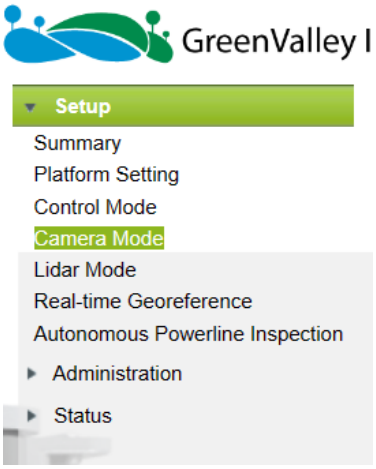
LiAirX4Plus will remember the parameters last set and you can skip this step if no modification is required. The LiAirX4Plus collection parameters mainly include laser parameters, camera parameters, and autonomous powerline flight parameters. The parameters can be modified by either logging into the Web client of the device or using GreenValley APP (Liplan).

1. Web Setting

(1) Establish the communication between the device and a computer or smart phone via WiFi network. After the device is powered on, search for the wireless network with the name LiAir_XXXXXX, click "Connect" and enter the password 66666666.



(2) Enter 192.168.1.88 in browser to open the LiAirX4 Plus Web Configuration page (username: root; password: 888888). Click "Setup" to set the device parameters.



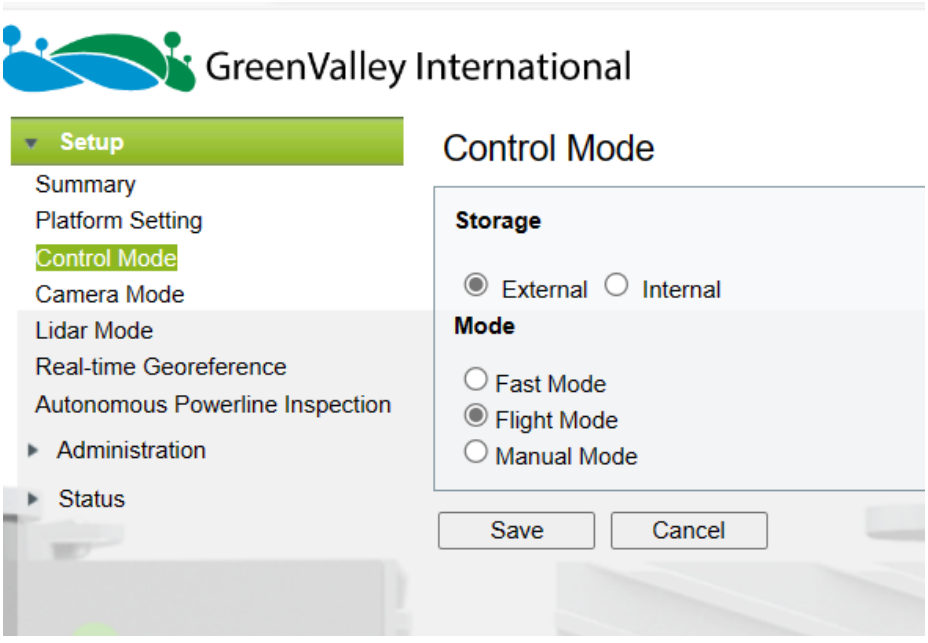
Note: we recommend to use Google Chrome or IE11.

(3) Set parameters

This manual only describes the main parameters. For the detailed information of parameters, refer to the LiAcquire-Web manual.

1) Control Modes

This section can be used to configure laser and camera data acquisition modes. LiAirX4 Plus has the following control modes available for data acquisition.



Storage : Used to select the storage path of project data. The default is "external".

External refers to storage in TF, and internal refers to storage in SSD inside the device. Only available for LiAirX4 and X4Plus.

Fast Mode: Click the power (ON/OFF) button, create new project, and synchronize the collection of both IMU data and LiDAR data simultaneously.

Flight mode: This mode is the ex-factory default setting. In this mode, when the device is stationary on the ground, the device does not collect point cloud data and photos, and automatically starts point cloud data and photo collection after the drone takes off into the air, and automatically stops point cloud data and photo collection when the drone is landed.

Manual mode: In this mode, the GreenValley APP(Liplan) autonomous powerline inspection flight interface will display a control button. You can click this button to start/stop point cloud data and photo collection.

Note: The Manual mode must be used with GreenValley APP(Liplan).

2) Camera Modes

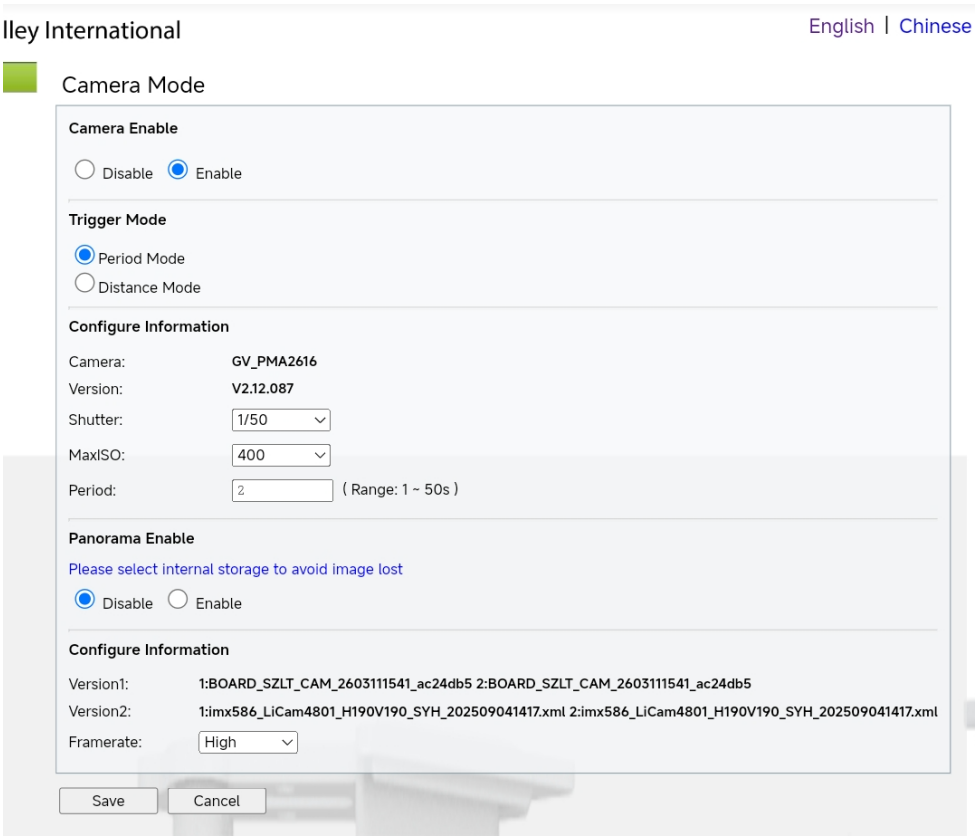
Camera Enable: To enable or disable the camera.

Trigger mode: Period mode, used to trigger the photo shooting at the preset fixed time interval (range: 1-50s, 2s by default). Distance mode, used to trigger the photo shooting at the preset fixed interval of distance (10m by default).

Configure Information: To set the interval of time or distance, shutter, ISO.

Panorama Enable: Used to activate the panoramic camera. After turning it on, please ensure the storage mode is set to internal (Only when mounted on aircraft); otherwise, photos may be lost.

Configure Information: Camera firmware version, and frame rate settings, including Hight and Medium options. The High option is more suitable for 3DGS (3D Gaussian Splatting) production.



3) Autonomous Powerline Inspection Interface

Only for LiAirX series devices, it is used to set autonomous powerline flight parameters.

Enable Autonomous Powerline Inspection: Turn on or off the autonomous powerline flight function.

Speed: Autonomous powerline flight speed. 6m/s by default.

Danger: The clearance distance from powerline to vegetation barriers when carrying out autonomous powerline flight. 3m by default.

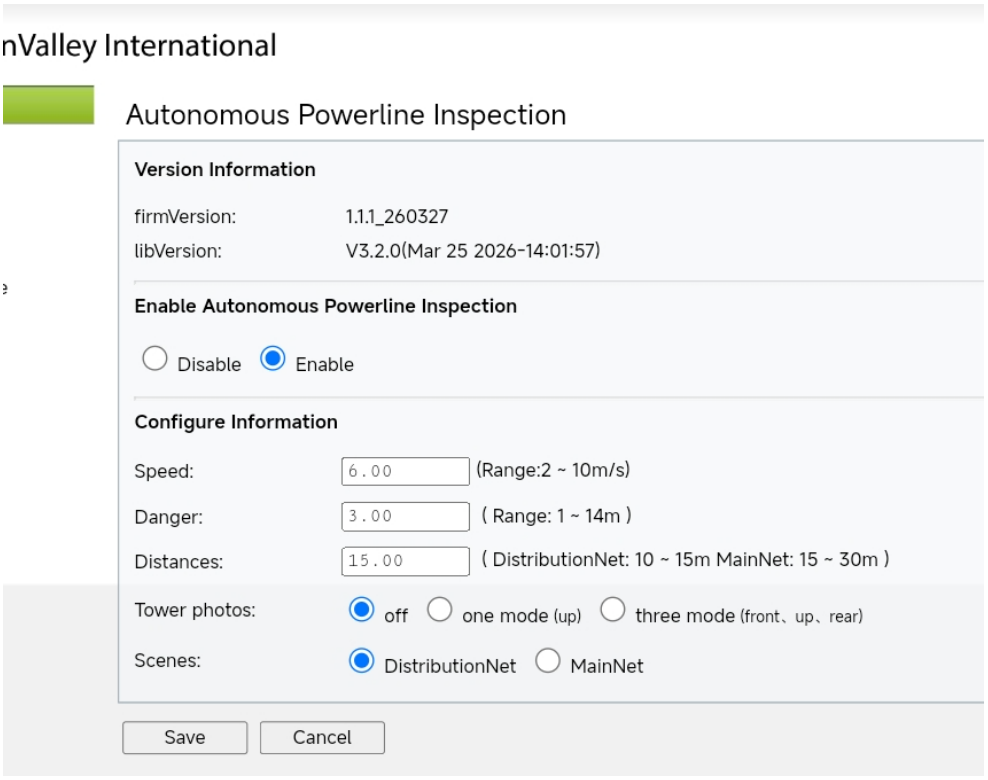
Distances: The distance from drone to powerline during autonomous powerline flight.

Tower photos: Turn on or off the dual gimbal camera.

One mode (top) means the device will hover on top of the tower and control the camera to take one pictures of the tower.

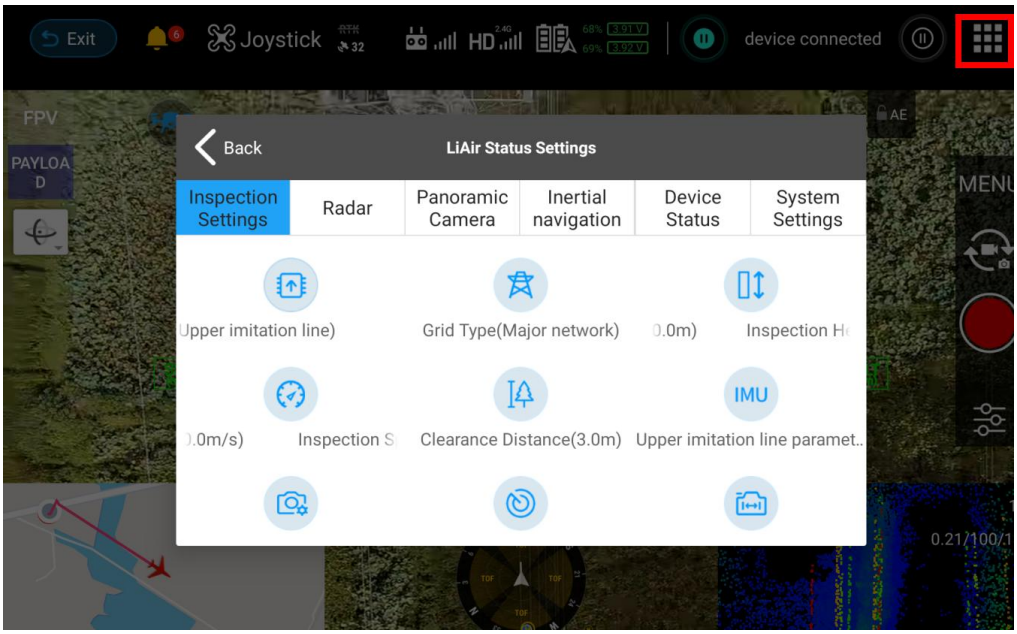
Three mode (front, top, rear) means the device will hover in front of /on top of/ behind of the tower and control the camera to take three pictures of the tower.

Scenes: Select the powerline type as the distribution network or the main network, and the default is the distribution network.



2. GreenValley APP (Liplan)Settings

Start the GreenValley APP(Liplan). Click the autonomous powerline inspection flight interface. Then click the setting button in the upper right corner to set the system parameters.



Data Acquisition

1. Press the device ON/OFF button for more than 3 seconds to power it on. Wait until the indicator is solid green.
2. Press the ON/OFF button for 0~2 seconds. The indicator blinks in green once per second. A project is created, with starting to record IMU data.
3. Turn on the remote control, start the GreenValley APP(Liplan), and log in to the LiCloud account.
4. Enter the "Autonomous powerline inspection flight " or "simulated aerial flight" interface and execute the task according to the corresponding procedure.
5. After the operation is completed, press the ON/OFF button for 0~2 seconds to stop IMU data recording and shut down the project. The indicator will be solid green.
6. Press the ON/OFF button for more than 3 seconds. The ON/OFF indicator is off and the system is powered off.

Meaning of status indicator :

LED	Color/Status	Description

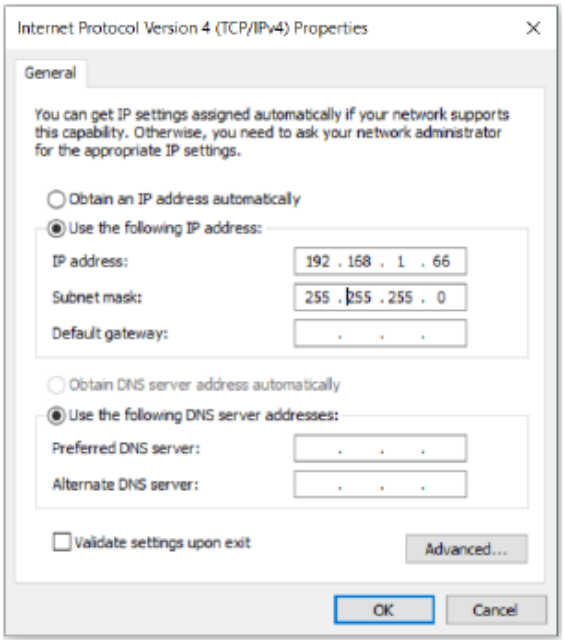
ON/OFF	Flashing Red (Four Times a Second)	System is powered on and initializing
	Solid Green	System initialization completed
	Flashing Green (Once per second)	The project has been created, the inertial navigation data is being recorded, and the system is working normally
	Flashing Red (Once per Second)	The project has been created, the inertial navigation data is being recorded, and the system is working abnormally
	Solid Red	The system status is abnormal, the reasons include: 1. TF card space is less than 15G 2. PSDK or OSDK or Manifold3 module is not connected 3. IMU misalignment 4. Camera self-test fails 5. The laser scanner is not synchronized

Data Download

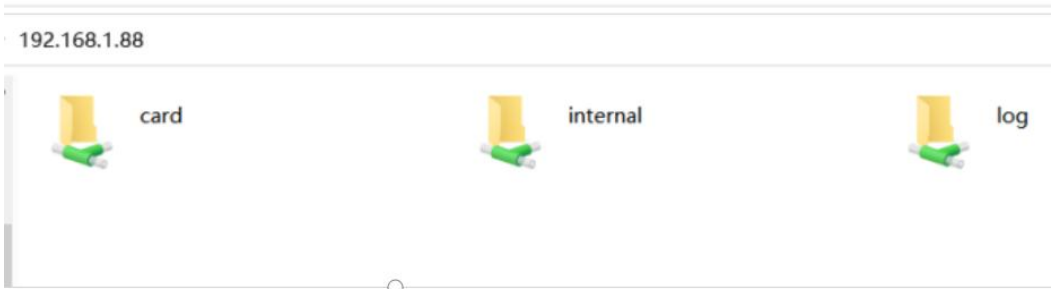
1. The data of LiAirX4Plus can be stored in TF card or internal SSD, including project files, point cloud data, IMU data, camera images and log files. You need to insert the TF card into the computer or use USB cable to copy the data from SSD (If the data is stored here） to the local hard disk.

Copy the data from SSD

(1) Use the USB cable to connect the computer and the device. After the computer recognizes the device network, Change the IP address to 192.168.1.66, and the subnet mask is 255.255.255.0.



(2) Open my computer or any file, enter \\192.168.1.88 in the address bar, find the corresponding project in the internal folder and copy it to the computer.



2. Copy the base station data to the Base folder under the project folder.

Data Georeferencing

Project Folder Structure

Opening Project

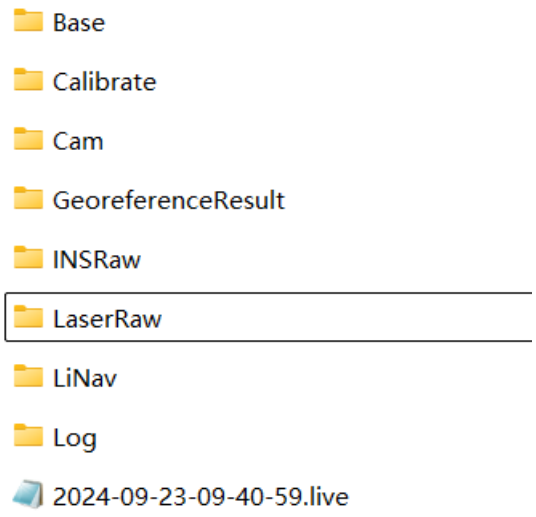
Configure Parameters

Georeferencing Point Cloud Data

Data Quality Assessment

The data solution of the LiAirX4Plus uses the LiGeoreference software, including functions such as real-time IMU data solution, POS data solution and accuracy assessment, point cloud data solution, point cloud preliminary quality assessment, image preliminary quality assessment, three-dimensional display of point cloud data, survey, and basic analysis. For detailed functions, see the LiGeoreference User Manual. This chapter mainly introduces the process of using LiGeoreference software to solve LiAirX4Plus data.

Project Folder Structure



Project folder is named with UTC Time, including:

-Base folder is used to store the ground GPS base station data.

-Calibrate folder is used to store calibrated files (*.cal). Please notice that: do not remove or delete this folder, otherwise, the performance of georeferencing will fail.

-Cam folder is used to store camera images and the information of exposure time, location, and attitude angles of each image (.cam), including mapping camera (stored in the Images folder) and panoramic camera images (if enabled, stored in the Panorama folder).

-GeoreferenceResult folder is used to store the post-processed point cloud data calculated by the LiGeoreference software.

-INSRaw folder is used to store the raw IMU data (*.rgps, *.imu,*.rnav).

-LaserRaw folder is used to store the raw data of laser scanner's point cloud (*.vpts) and rotlog file of encoder .

*Note: *.vpts is the default format developed by GVI.*

-LiNav folder is used to store the intermediate file when processing the data of integrated navigation system. What's more, the finial-georeferencing results of POS data are suitable to be stored as well.

-Log folder is used to store the log information of the project showing detailed operation process.

-*.Live (project file) is used to record the information of project organization, configuration values, etc.

Opening Project

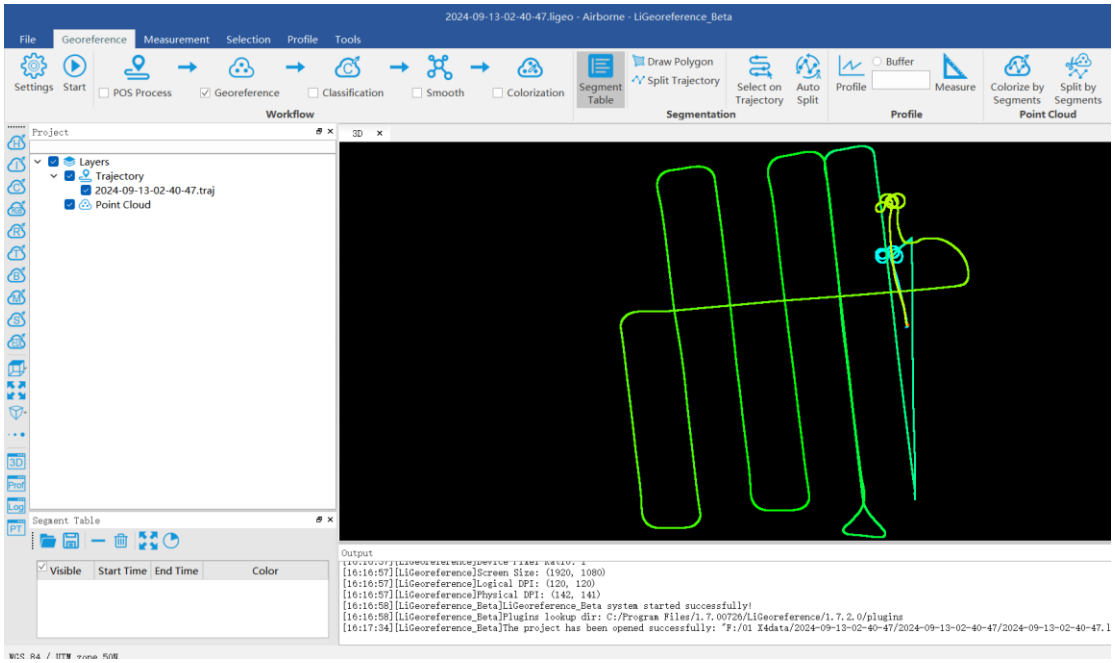
1. Open LiGeoreference software, Click "File" icon on the toolbar to open LiGeoreference project file (.live) through "Browse" icon.



2. Users can also open the project file via "Recent Projects" icon which refers to history projects opened before.



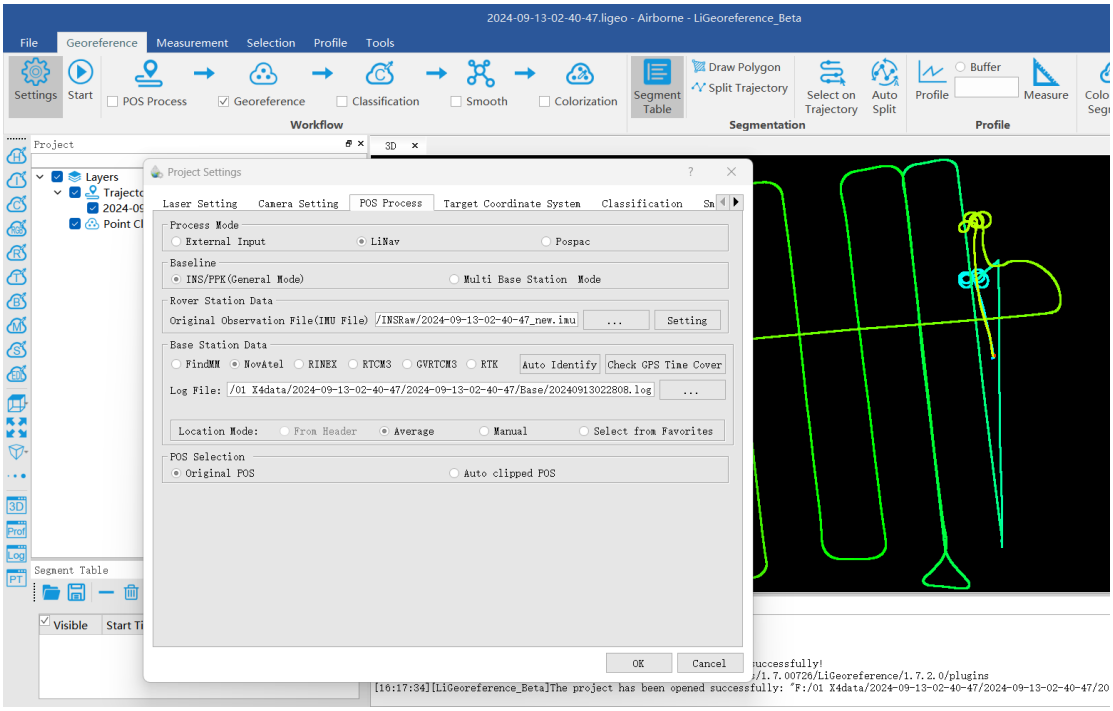
3. After opening the project, the georeferencing tool will automatically import the IMU file.



Configure Parameters

Before undertaking post-processing procedure, users can use the "Settings" function to set the calculation parameters, including laser settings, camera settings, POS process,

target coordinate system, classification, and smooth settings. Normally, users only need to set POS process settings.



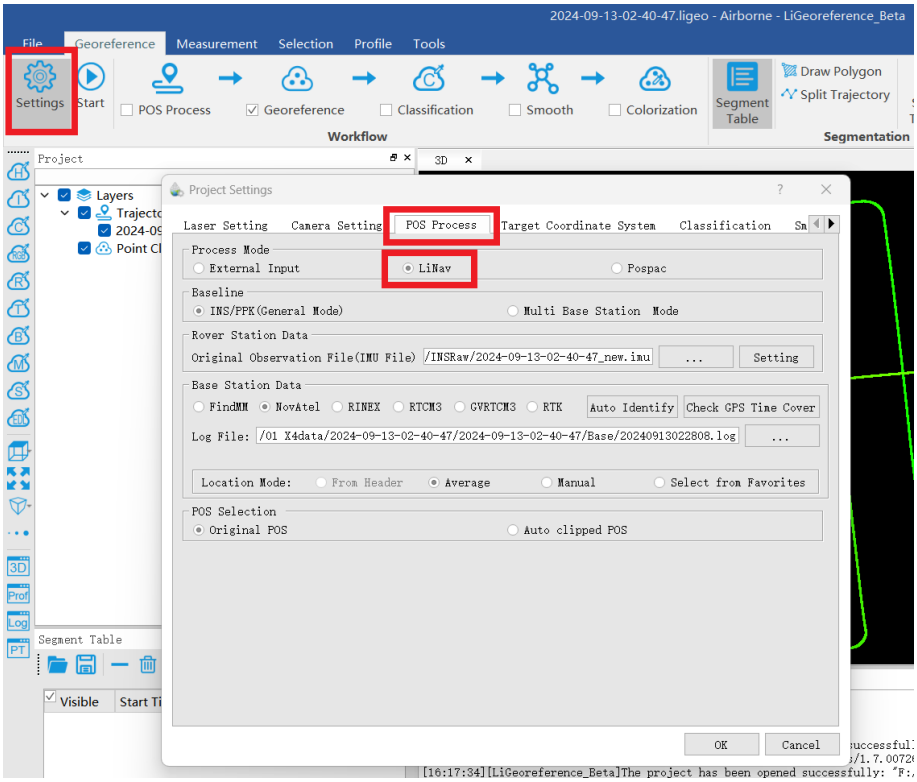
POS Processing Settings

LiGeoreference software has POS calculation and point cloud calculation functions. Users could directly use LiGeoreference software to calculate LiAirX4Plus's trajectory, or choose to use other third-party software to perform POS processing procedure.

1. Use LiGeoreference to Perform POS Processing

Click the "POS Process" button in the setting interface.

（1）Select the LiNav processing mode.

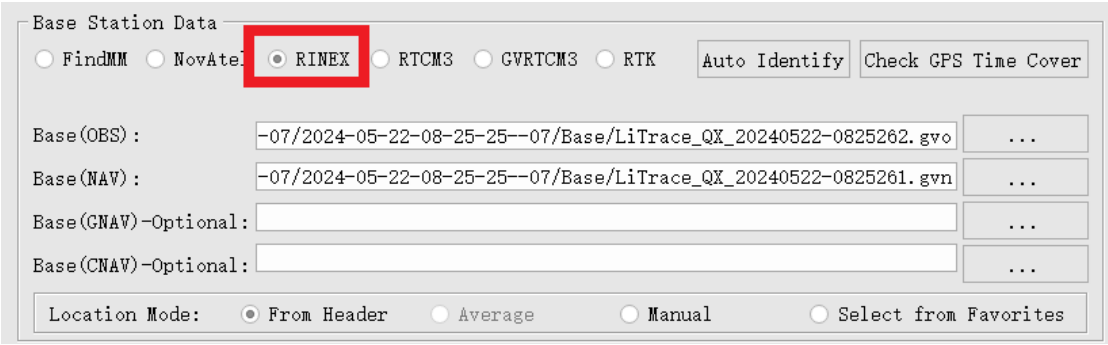


（2）Load rover station data. Under normal circumstances, the software will automatically read the rover station data under the project folder.

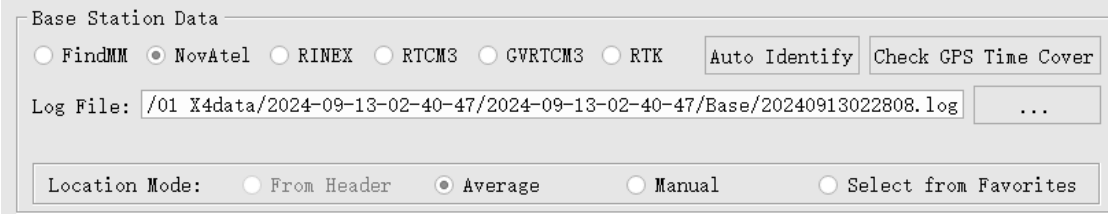
（3）Select base station data.

Under normal circumstances, the software will automatically read the base station data in the project folder, or manually load the base station data.

If the format of the local base station is the Rinex format, select the Rinex option to load the base station data.



If the local base station format is Log, select NovAtel.



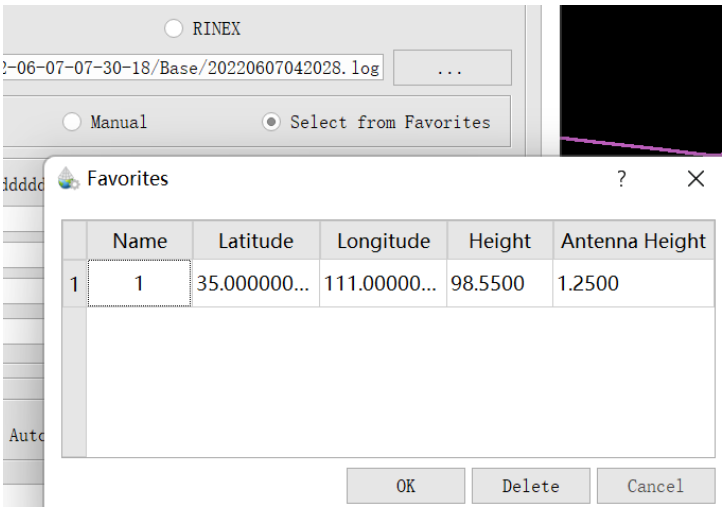
（4）Enter the base station coordinates.

- When there is no precise base station coordinate, users could select "Average" mode. And the positioning principle is single point positioning, which leads to meter-level errors between the point cloud coordinates calculated by this method and the true coordinates.

- When there are accurate base station coordinates, users could manually input the base station coordinates. Additionally, users could use "Save to Favorites" function to save the entered base station coordinates, and later can directly use the saved base station coordinates through "Select from Favorites".

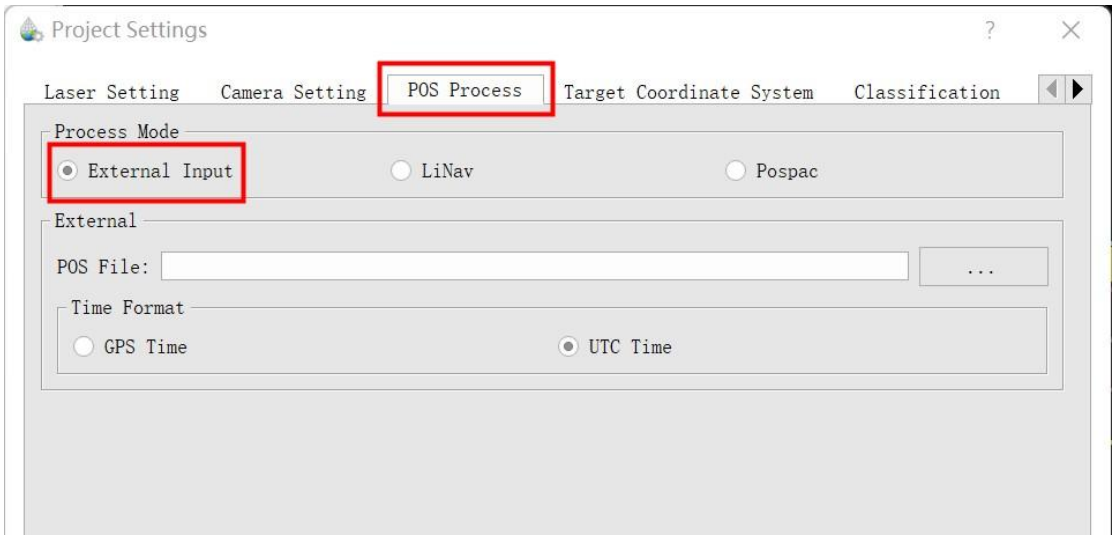
- Analyze from the data header: some base station files and base station coordinates are stored in the header file. "From Header" option needs to be clicked when users want to use this function. For example, Cloud Trajectory base station is normally stored in this mode.

- Select from favorites: Users could select the base station coordinates stored in the software.

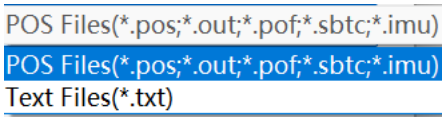


2. Import External IMU or Existing POS Data

Select "External Input" under Process Mode to import POS data. See the figure below.

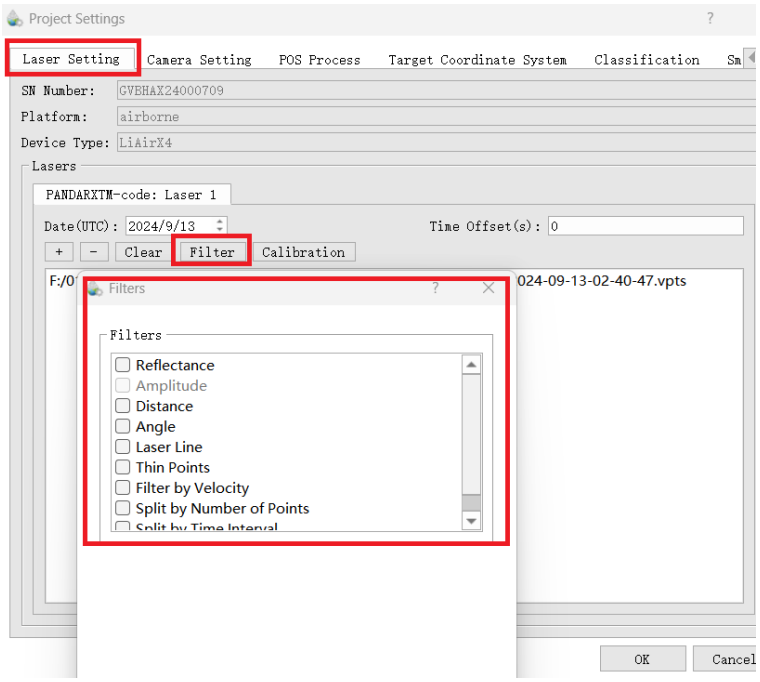


The external input function supports importing the original IMU data and the processed POS data, and the specific format includes *.pos, *.out, *.pof, *.sbtc, *.imu. See the figure below.



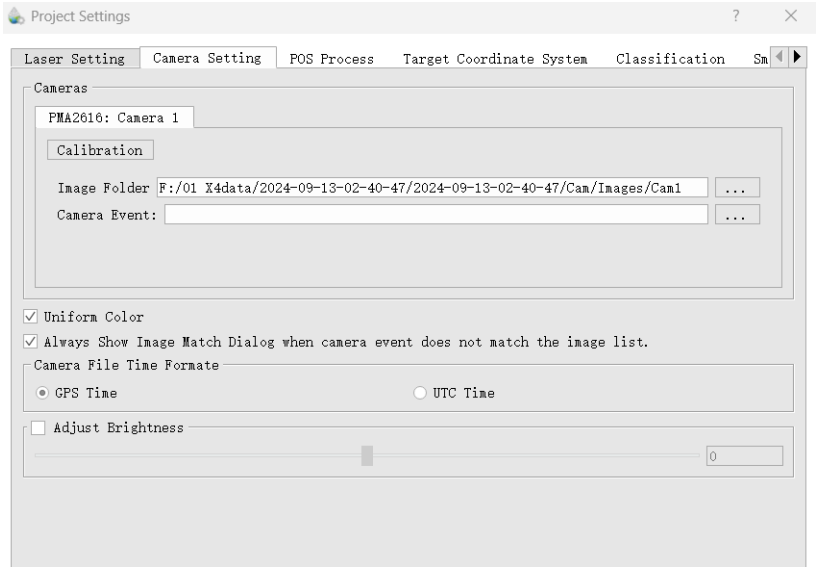
Laser Scanner Settings

Normally, the user does not need to change the parameters of the laser setting interface. If users want to limit the output power range by reflectivity, distance and scanning angle, users could change the range via clicking "Filter" to set the parameters. For more details, please visit LiGeoreference users guide.



Camera Settings

Normally, users do not need to change the parameters of the camera setting interface. Uniform Color Function: sometimes the shooting is affected by the light and the uniform color function will make the light and dark more uniform, but will blur the color slightly.

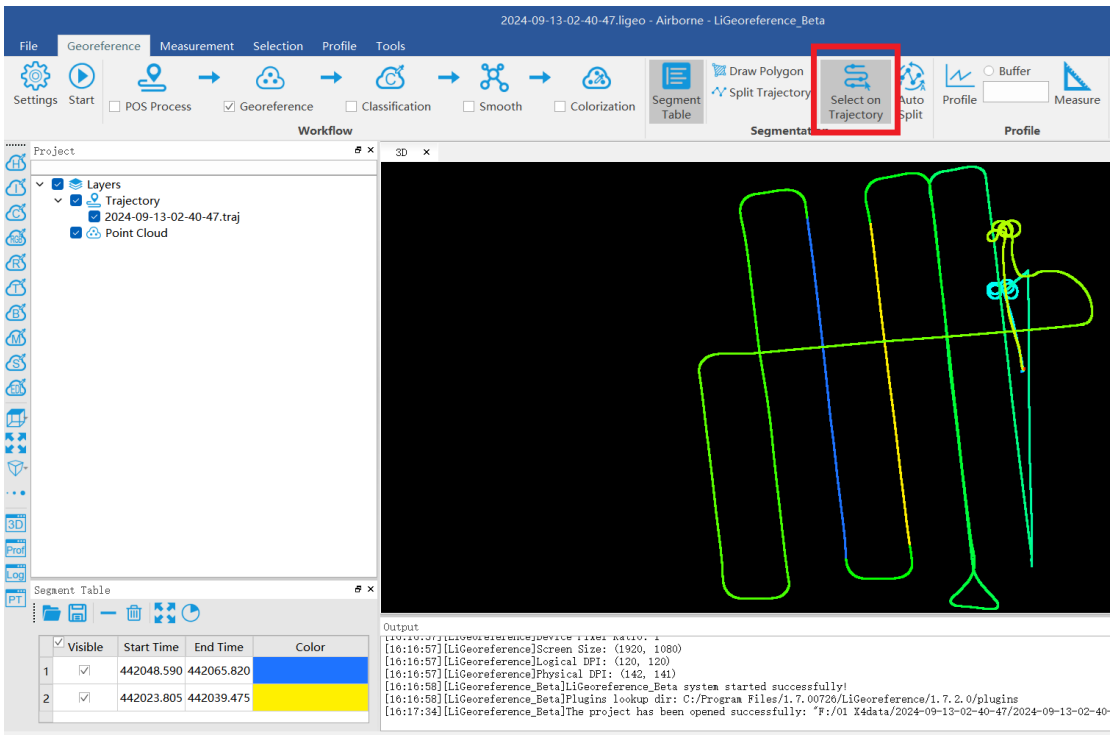


Georeferencing Point Cloud Data

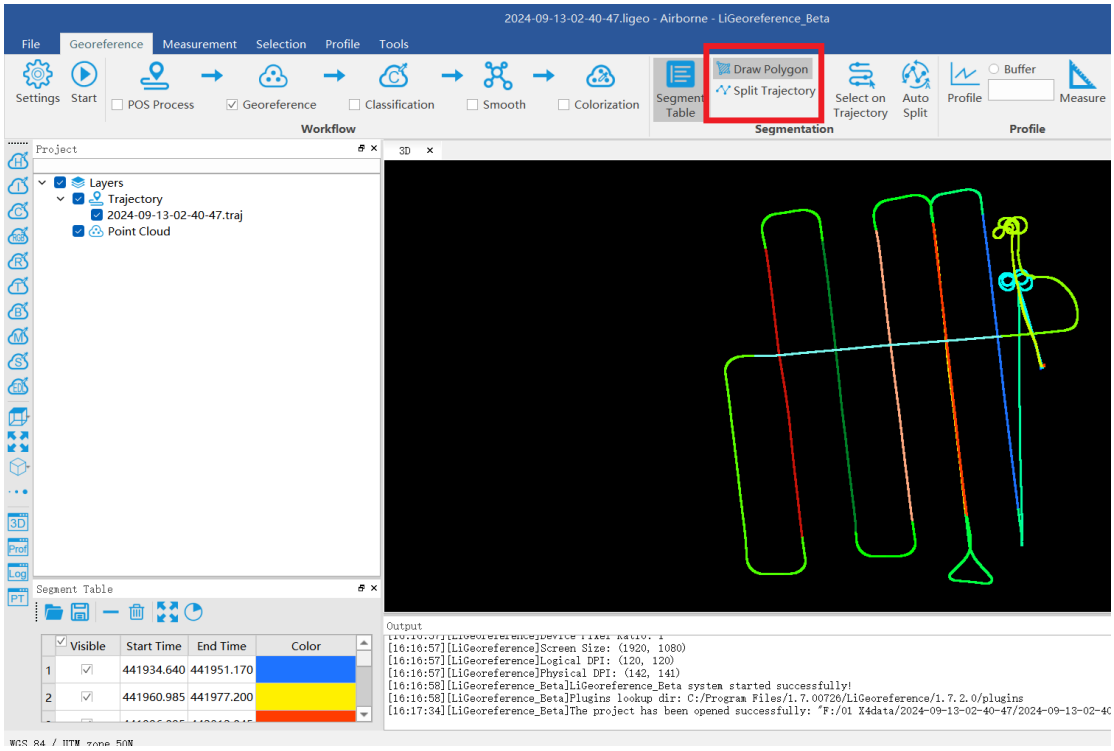
1. Select LiGeoreference Range

Users could select the range to be georeferenced as needed. And there are two modes to be selected, including "trajectory selection" or "draw polygon". And this document only introduces the operation process of using the "trajectory selection" tool. The way of "drawing polygon" could be found in the user manual of LiGeoreference software.

(1) Click the "Select On Trajectory" button on the main interface of the software, and a table will automatically pop up at the same time, select the trajectory which needs to be georeferenced, and click OK.

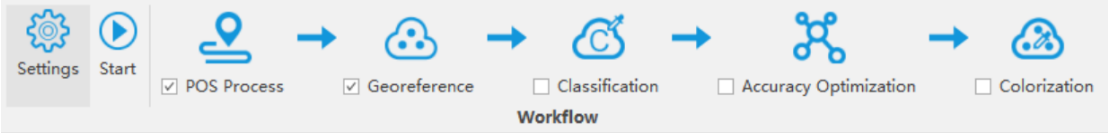


(2) If needed to select multiple trajectories, then repeat the above operation, and the selected trajectory segments will be displayed in the cutting table at the lower left corner.



2. Select processing module

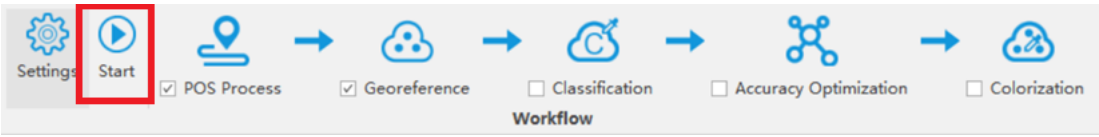
After opening the project, LiGeoreference will select "POS Process" and "Georeference" module by default. Users could check and re-choose the function modules as needed.



Note: If there is no image data, please do not choose "Colorization" module, otherwise the program will prompt an error.

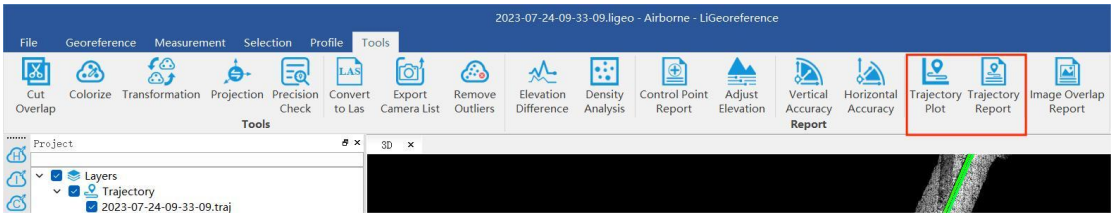
3. Data Georeferencing

Click "Start" button to start data calculation. After the calculation is completed, the point cloud is automatically displayed in the main window.



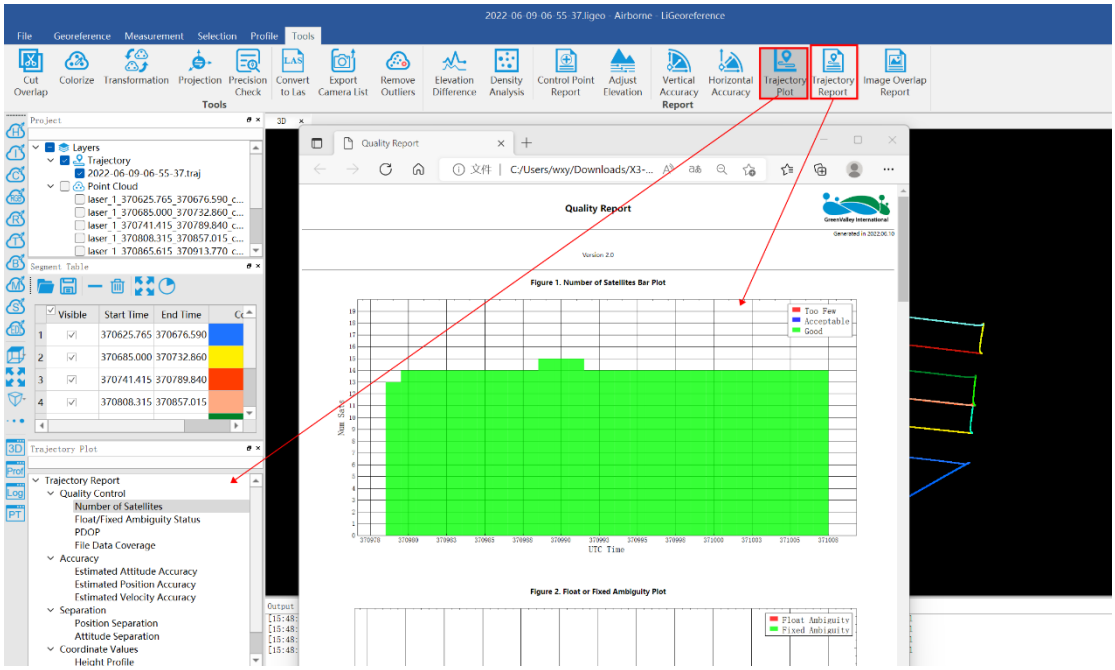
Data Quality Assessment

If the user needs to view the "Trajectory Report" and the "Image Overlap Report", click the "Trajectory Plot" (or " Trajectory Report ") or "Image Overlap Report" (only suitable for devices with cameras) under the "Tools" bar.

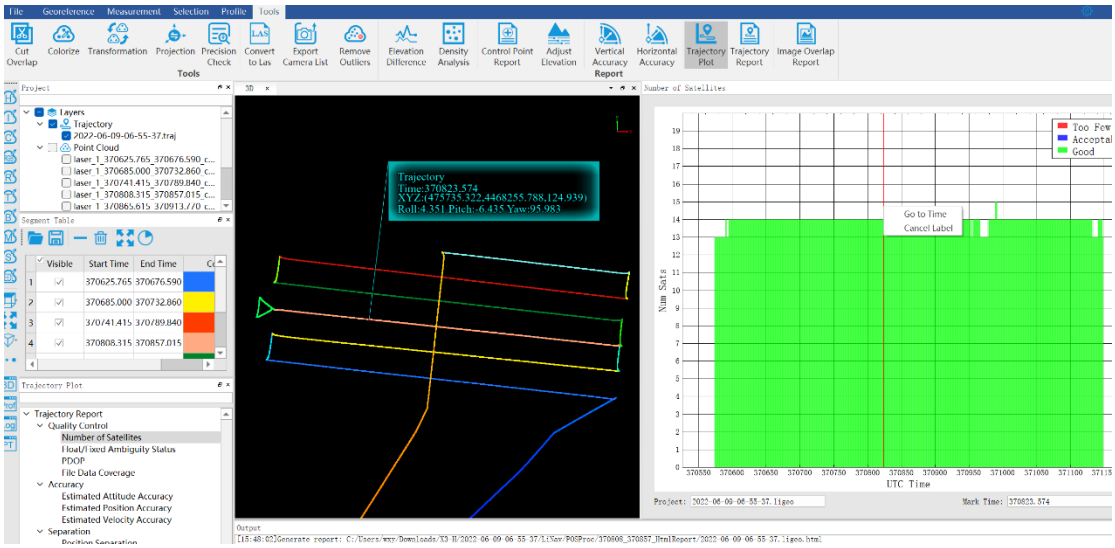


a) POS Track Report

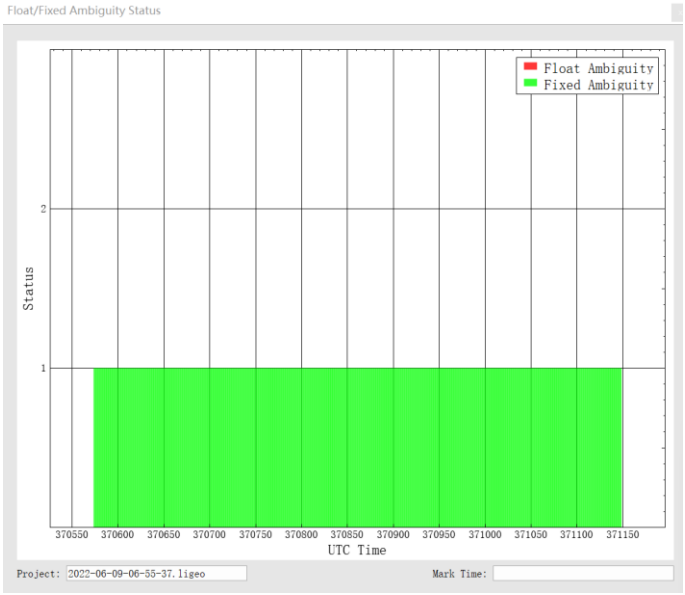
There are 11 POS accuracy evaluation criteria included in the software. Usually, the number of satellites, data coverage, estimated attitude accuracy, estimated position accuracy and PDOP value are mainly checked during data quality inspection. Users can click the evaluation index of a certain plot, or directly click "Trajectory Report" to generate a complete track accuracy report.



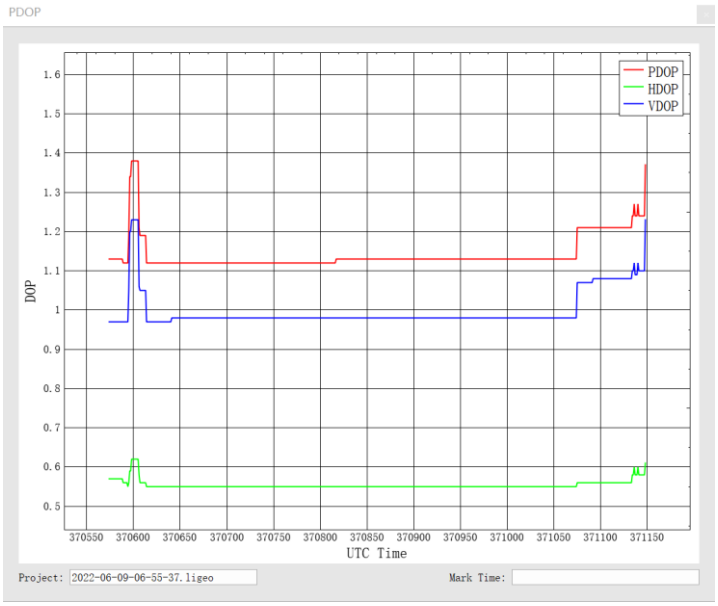
Satellites Number: Click to open the plot to show the relation between number of satellites, which can be reached, and the GPS time. This tool is used to show the number of satellites can be reached by the device each time during the data acquisition. Satellites number is shown on the Y-axis. The green part on the plot means the number of satellites is good at that time. The blue part on the plot means the number of satellites is just acceptable at that time. While the red part means the satellite number is too few to meet the requirement. The insufficient GNSS signal will result in poor data quality. If the number of satellites can be reached by the device is too few during a period of data acquisition, user can select the time period and right-click on that. Then click "Go to Time" button to find out the corresponding period on the trajectory.



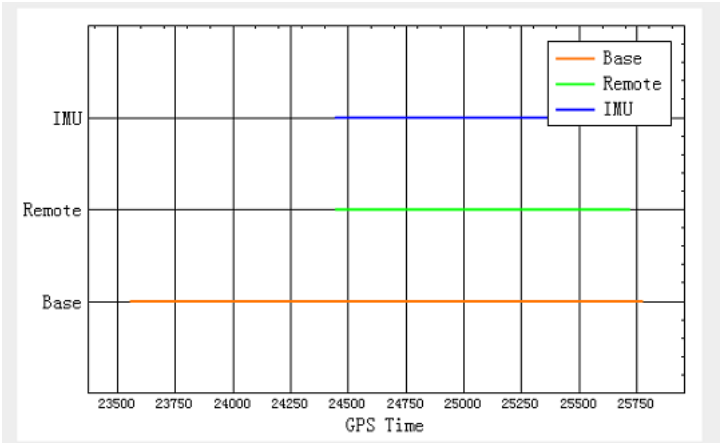
Floating/Fixed ambiguity status: Click to show the plot of ambiguity resolution status. This is used to show the situation of cycle ambiguity resolution. If the status is shown as green on the plot, it means the cycle ambiguity resolution is fixed. If it is red on the plot, it means the cycle ambiguity resolution is floating.



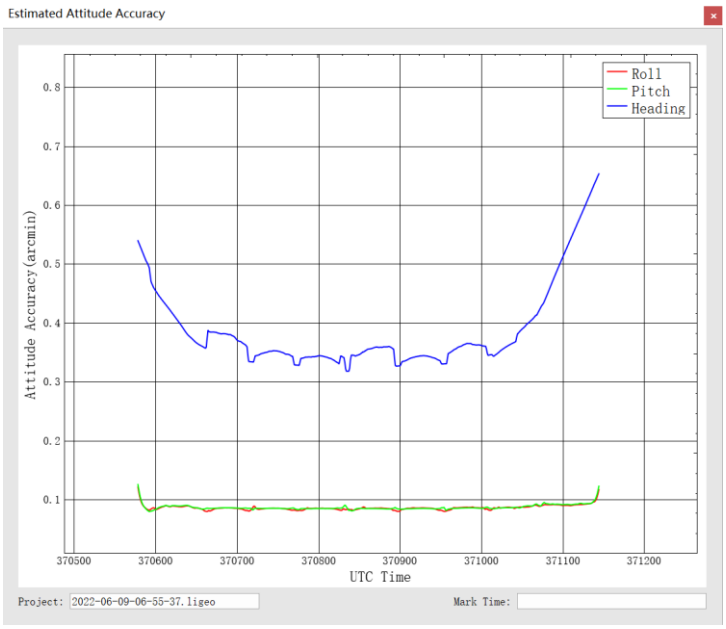
PDOP: Position dilution of precision, or PDOP, shows the distribution of the GNSS satellites. Click to show the plot of PDOP. The smaller PDOP is, the better the distribution is.



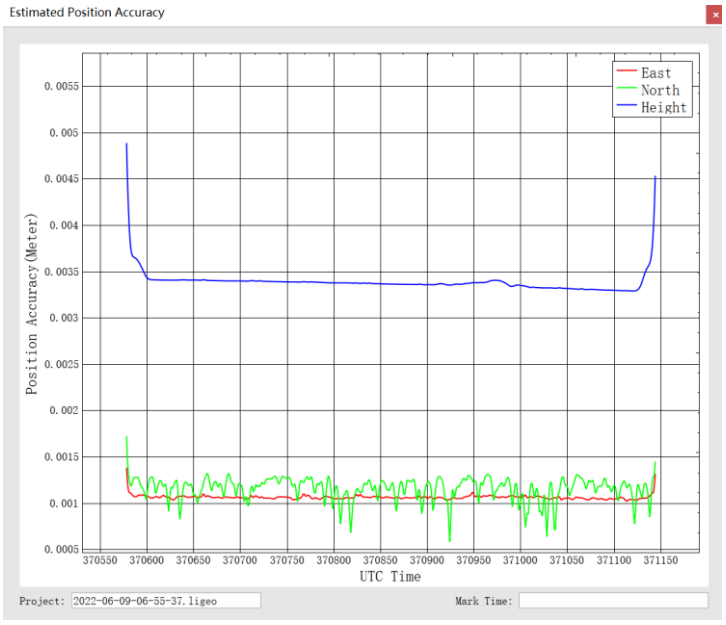
File Data Coverage: Click to show the plot of data coverage situation. This is used to show the data coverage relation among base station data, IMU data, and GNSS data of the moving device.



Estimated Attitude Accuracy: Click to show the plot of attitude accuracy. This plot is used to show that if the accuracy exceeds the limitation of the IMU accuracy. The X-axis shows the GPS time. The Y-axis shows the attitude accuracy. Red line is for changes in Roll direction. Green line shows the changes in Pitch direction. While the blue line shows the changes in the heading direction.

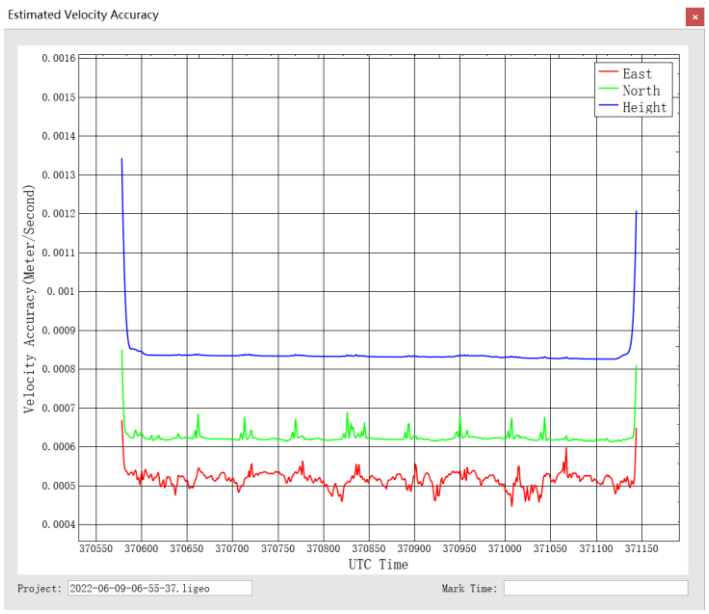


Estimated Position Accuracy: Click to plot the position accuracy. The X-axis shows the GPS time. The Y-axis shows the position accuracy. Red line is for position accuracy in East direction. Green line shows the position accuracy in North direction. While the blue line shows the position accuracy in height direction.

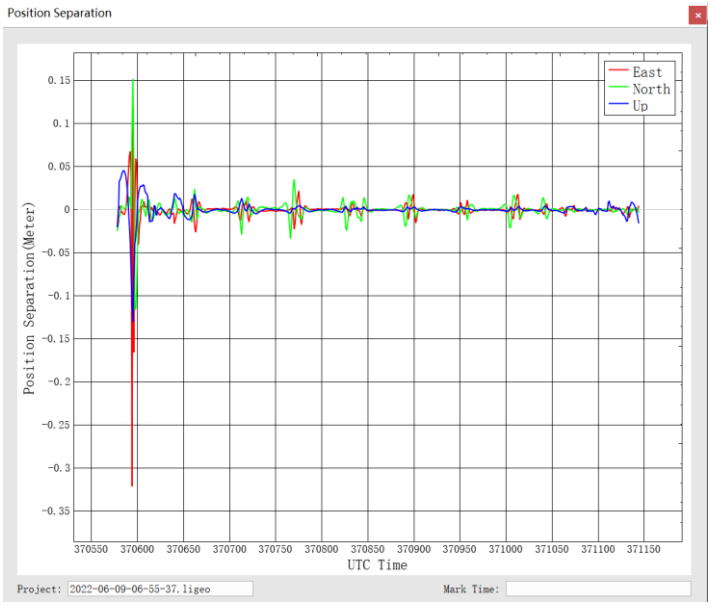


Estimated Velocity Accuracy: Click to plot the velocity accuracy. The X-axis shows the GPS time. The Y-axis shows the velocity accuracy. Red line is for velocity accuracy in East direction. Green line shows the velocity accuracy in North direction. While the

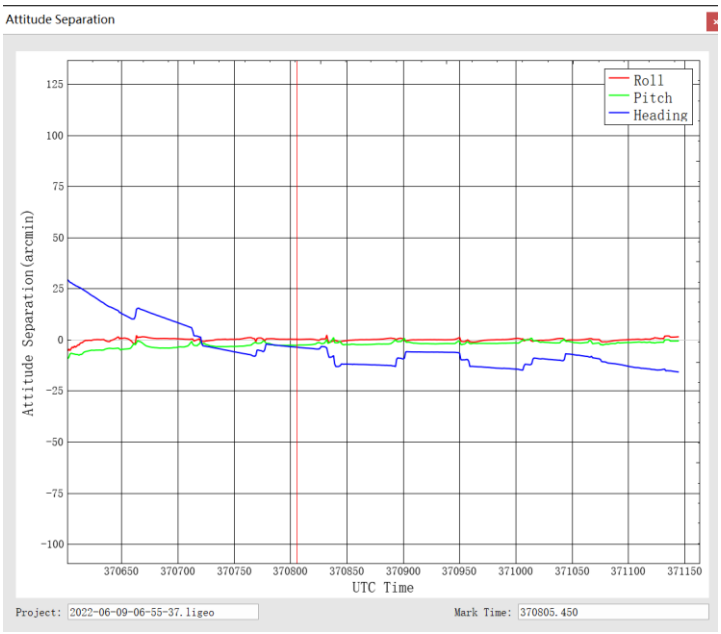
blue line shows the position velocity in height direction.



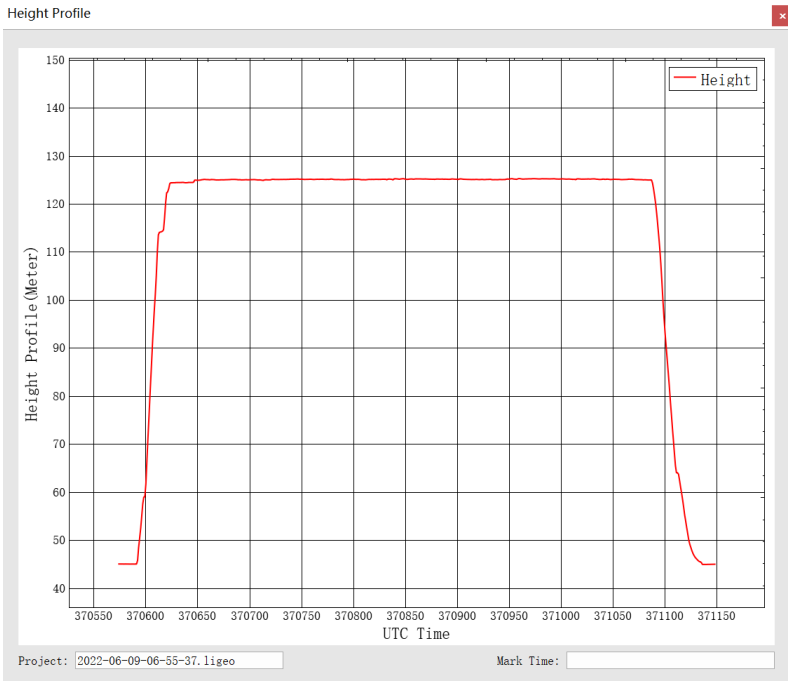
Position Separation: Click to plot the position separation. This plot shows the differences of position in East, North, and Up directions during the forward-backward processing.



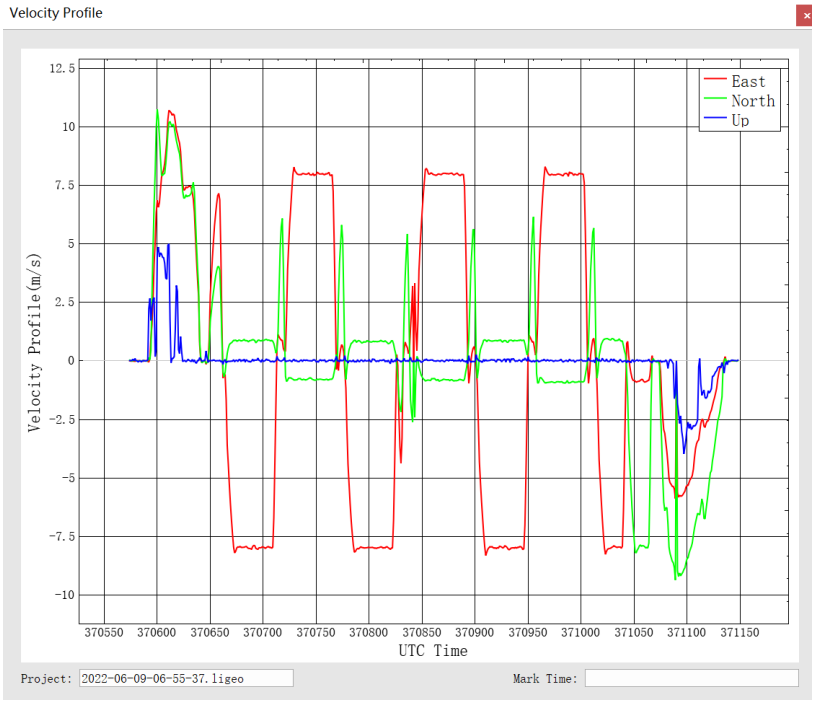
Attitude Separation: Click to show the plot of attitude separation. This plot is used to show the difference among the angles in Roll, Heading, and Pitch directions during the forward-backward processing. The smaller the value is, the better the matching degree of the forward-backward processing is.



Height Profile: This plot shows the changes in height during the data acquisition.

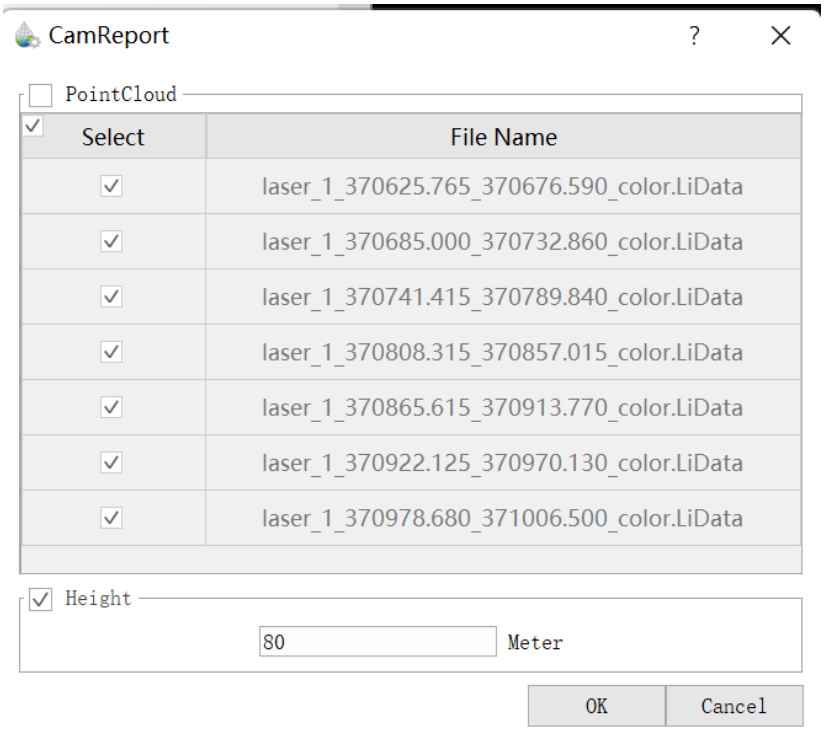


Velocity Profile: This plot shows the changes in velocity during the data acquisition. Red line is for the changes in East direction. Green shows the changes in North direction. While the blue line shows the changes in up direction to the ground.



b) Image overlap report (for equipment containing cameras)

The image report lists a graph of image overlap. You can check whether there is the film drop.



System Transportation and Maintenance

Operation Notice

To ensure the reliable use of the system and the safety of the operation personnel, please observe the following notices during installation, use and maintenance.

1. Pay attention to the protection of the scanning lens to prevent scratches.
2. Handle with care during installation to prevent the system from falling or being impacted.
3. Before scanning, please make sure the scanning lens is clean and dust-free.
4. Avoid sudden changes in temperature to prevent damage to the system.
5. During the operation, it is forbidden to directly contact the laser scanning lens with any part of the body.
6. If the system needs to be transported, it must be stored within appropriate packages.
7. The operating temperature of the system is -20℃~50℃. In case of rain, snow, fog, sand and other bad weather, the operation should be stopped. It can prevent equipment damage and on the other hand, it can ensure the measurement accuracy. In case of sudden bad weather during work, please move the device to a safe place in time.
8. When removing the OSDK communications cable and GNSS antenna feeder, hold the both ends of the connector. The removal should be gentle and appropriate.
9. Non-professionals, without permission, please do not try to disassemble the equipment, do not repair it without permission, so as to avoid accidents or aggravate the damage of the equipment. If the equipment is modified or disassembled not authorized by GVI, the warranty will be void.

Equipment Maintenance

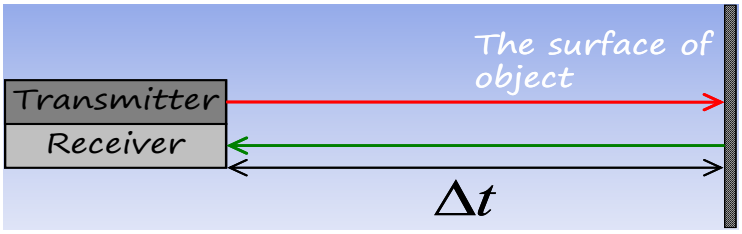
1. Before turning on the device, check whether the scanner lens is clean, if there are any stains, it should be cleaned immediately.
2. After the equipment is used, check whether the scanning window of the scanner is dirty. If it is dirty, it should be cleaned up immediately.
3. The storage temperature range of LiAirX4Plus is -30℃~+60℃, and the storage environment requires ventilation and dryness.
4. Make sure that all power is turned off before storage, and the equipment is stored in an appropriate box.
5. If the storage time is more than one month, the power-on test should be carried out.
6. During the transportation of LiAirX4Plus, the packing box equipped at the factory should be used.
7. If it needs to be packed separately due to special circumstances, please ensure that the packing box has a certain pressure resistance, and label the outside of the box with signs such as "**Precision Instrument**", "**Handle with Care**", "**Fragile**", etc. to avoid equipment damage.
8. The instrument is a precision instrument, avoid violent impact during transportation and handling, and avoid damage to the optical components in the instrument which may cause direction deviation.
9. During the warranty period, customers can enjoy free firmware update services. After the warranty period is expired, customers can purchase firmware update services.

Appendix 1 Sensor Introduction

Laser Scanner

The laser scanner is the core of the system. The LiDAR uses the laser as the emitting light source and the photoelectric detection sensor as the receiving element. According to the principle of laser ranging, the distance and angle are measured and recorded, so as to determine the azimuth information of the measured object.

The transmitter in the LiDAR emits a beam of ultra-short light pulses on the object and diffusely reflects back to the receiver. The speed of light is known, and the distance from the target object to the sensor is calculated by the flight time of the laser beam in the air.



LiDAR ranging equation:

$$S = \frac{1}{2} \times c \times \Delta t$$

Where: S is the distance from the sensor to the target; c is the light speed; and △t is the round-trip time of the laser beam.

LiAirX4Plus is integrated with HESAI XT32M2X laser, with 360° horizontal field of view (FOV) and 40.3° vertical FOV.



Laser Scanner Parameters

Scan Method	Rotating Motor
Number of Channels	32
Detection Range	80 m @ 10% reflectivity
Scan Rate	1,920,000 pts/s(Triple Return)
Scanning Frequency	5 Hz~20 Hz
FOV(Horizontal)	360°
FOV(Vertical)	-20.8°~+19.5°
Vertical Angle Resolution	1.3°
Laser Class	Class 1 Eye Safe
Number of Returns	3
Range Accuracy	1 cm

Note: The laser sensor cannot be directly irradiated with strong laser light (including two sensors facing the light), so as to avoid high-intensity laser damage to the receiving sensor.

Integrated Navigation System

The airborne Position Orientation System (POS) is an inertial measurement unit (IMU) and Global Navigation Satellite System (GNSS). POS systems are used to accurately determine system velocity, position, and attitude values at specific moments in time.

1. Global Navigation Satellite System (GNSS)

The Global Navigation Satellite System (GNSS) supported by LiAirX4Plus, mainly includes GPS (the U.S.), Galileo satellite navigation system (Europe), BeiDou Navigation Satellite System (China), and GLONASS (Russia). The GNSS of

LiAirX4Plus includes the aviation GNSS antenna and the base station antenna.

2. Inertial Measurement Unit (IMU)

Inertial measurement unit, or IMU, consists of a high-accuracy three-axis gyroscope and a high-accuracy three-axis accelerometer. It is the benchmark center of the LiDAR system. Its role is to get the position and orientation information without external reference data.

The LiAirX4Plus integrates a 3-axis MEMS (Micro-Electro-Mechanical System) gyroscope, 3-axis MEMS accelerometer and dual GNSS/BD receivers into one system, the POS system. Together the POS system components gather multi-reference parameters that provide accurate, effective and reliable data by optimization algorithm of integrated navigation system.

3. Inertial Navigation Accuracy

System Accuracy (post-processing)	Azimuth	0.038°(1σ)
	Attitude	0.008°(1σ)
Data Frequency	200 Hz	

Camera

This product has a built-in digital camera independently developed by GVI. The main parameters of the built-in camera are listed below:

Image Sensor	APS-C
Focal Length	16 mm fixed-focus length lens
Pixels	26 MP
Pixel size	3.76 um
Image Resolution	6252*4168

DFOV	83°

Appendix 2 System Specifications

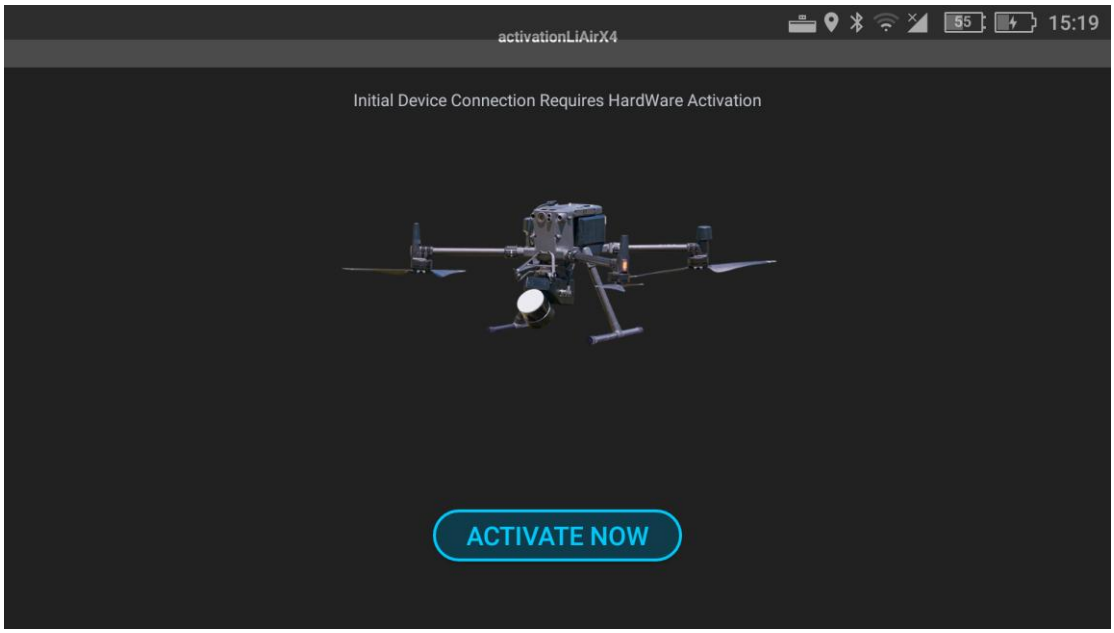
System Parameters	
Detection Range	80 m @ 10% reflectivity 200 m @ 54% reflectivity 300 m @ 90% reflectivity
System Accuracy（Vertical）	< 5cm @ 100m
Typical Flight Speed	8m/s
Storage	512 GB TF Card + 512 GB Internal SSD
Weight	1.6kg
Dimensions	208*120*184mm
Voltage	12-28V
Power Consumption	36W
Operating Temperature	-20~50℃
Storage Temperature	-30~60℃
LiDAR Sensor Parameters	
Wavelength	905nm
Number of Channels	32
Laser Class	Class1

FOV	360°(Horizontal)×40.3°(Vertical)
Number of Returns	3
Scan Rate	1,920,000 pts/s (Triple Return)
Inertial Navigation System	
GNSS	GPS、GLONASS、Galileo、BDS
Azimuth Accuracy	0.038°
Attitude Accuracy	0.008°
IMU Data Frequency	200Hz
Camera Parameters	
Pixels	26MP
Focal Length	16mm/24mm (Equiv. Focal Length)
Image Resolution	6252×4168
Panoramic Camera Parameters	
Pixels	12MP*2
FOV	H190°*V190°

Appendix 3 System Activation

1. Mount the device on the DJI M300/M350RTK/M400 drone.
2. Power on the drone and device.
3. Open the remote control and make sure it is online.
4. Open the GreenValley APP(Liplan)and log in to the Licloud account. The account

will automatically pop up the activation interface after login.



5. Click "ACTIVATE NOW " and the device will automatically complete the activation process and go back to the main interface.

6. Restart the device and connect the device to the APP according to the normal process

Note:

1. The remote control must always remain online during activation.

2. If you have already logged in to an LiCloud account, the activation window will automatically pop up when you open the GreenValley APP(Liplan).

3. Ensure that the device is in outdoor with GNSS signal during activation.

Appendix 4 Firmware Upgrade

The device supports online firmware upgrades. When the remote control is connected to the internet, opening the GreenValleyAPP (Liplan) software will automatically prompt an upgrade dialog. The APP can download the latest firmware version from the cloud to upgrade the device.

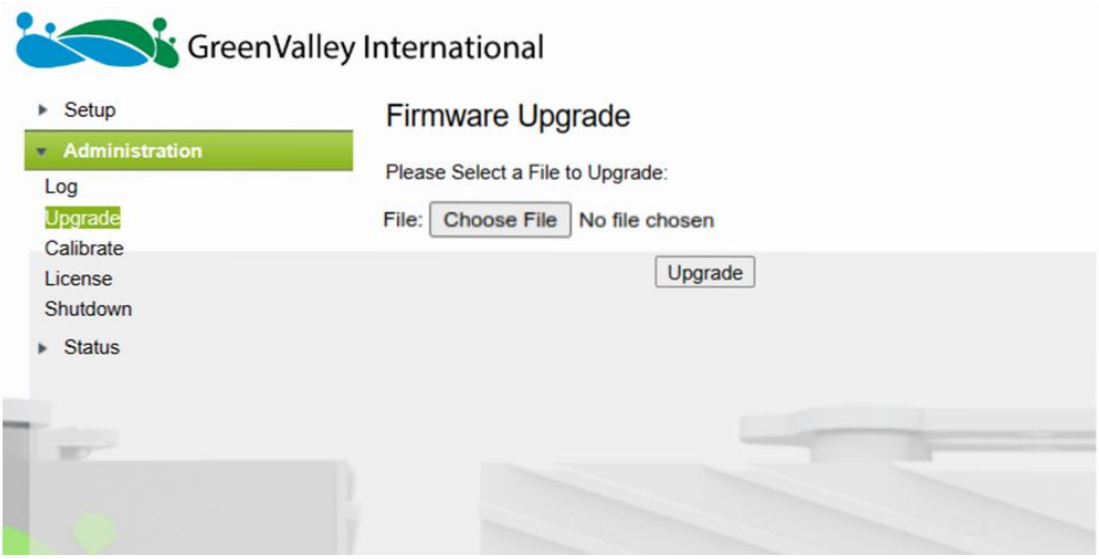
The device also supports firmware upgrades via the Web page.

1. Mount the device on the DJI M300/M350RTK/M400 UAV, turn on the aircraft power supply, and then long press the device power button to power the device.

2. Use the USB cable to connect the computer and the device, and change the computer IP address to 192.168.1.66 and Subnet Mask to 255.255.255.0.

3. Use the browser to access the web page (IP address :192.168.1.88, user name: root , password: 888888).

4. Choose "Administration-Upgrade", Click "Choose File" to upload the Firmware file, and then Click "Upgrade".



5. After the upgrade is completed, check whether the firmware version (Firmware Ver1) is correct on the home page.



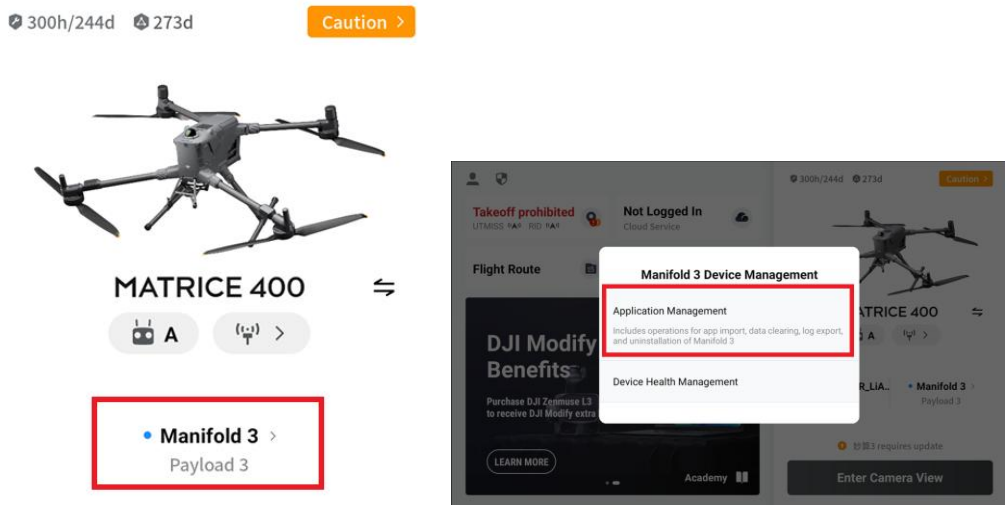
Appendix 5 Manifold 3

1. According to the installation process, correctly install the Manifold3 onto the aircraft and confirm that it is connected to the E-Port 3 port at the bottom of the aircraft.

2. Copy the Manifold3 flight control firmware (named GV-LiFlight V*****.dpk) to the microSD card of the remote controller, and ensure the card is properly inserted into the bottom of the remote controller.

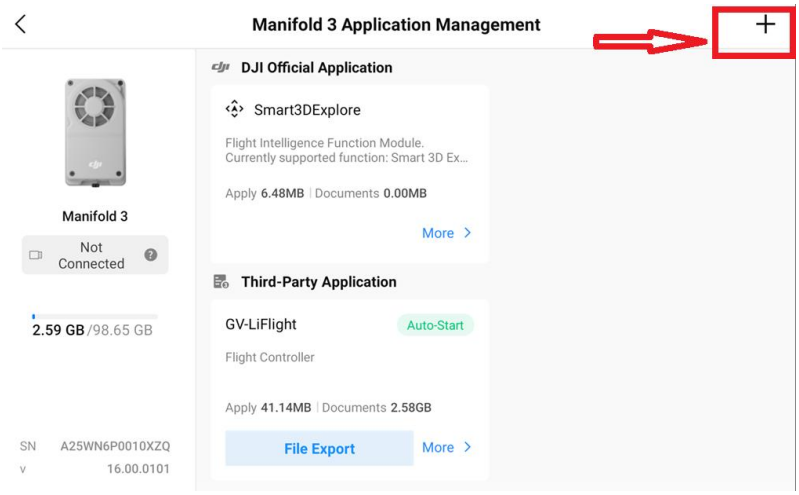


3. Power on the DJI M400 aircraft and remote controller normally, open the Pilot app, and wait for " Manifold3" to appear on the screen. Tap it to access the device management interface, then tap "Application Management."

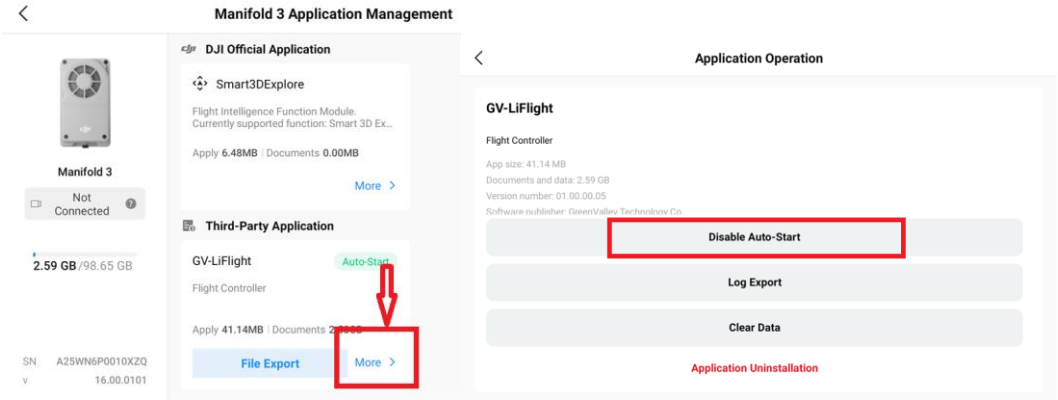


4. On the pop-up interface, tap the "+" icon in the upper-right corner to import third-party apps. Select the flight control firmware from the microSD card, and tap

"Confirm" in the upper-right corner.



5. After the import is complete, the interface will display the third-party app "GVI Flight Control." Tap "More" in the lower-right corner, and in the pop-up interface, tap "Set Auto-Start on Boot." This ensures that the GVI Flight Control app on the Manifold3 will automatically start every time the aircraft is powered on.



Notes:

1. The Manifold3 only needs to be installed when using the device's autonomous flight functions. Manual flight or route-based flight does not require installation.
2. The Manifold3 must be connected to the E-Port 3 interface.
3. The Manifold3 only supports one auto-start on boot. The app set last will have the auto-start privilege. If using the X4Plus's autonomous flight functions (such as line-following or terrain-following), auto-start on boot must be set.