ALPHA ARK-S USER MANUAL

Contents

Preface

USV, an industry that has only emerged in recent years, have broad prospects and their application value cannot be underestimated. Even in the current civilian field, which plays a supporting role, the demand for water quality monitoring, hydrological measurement and underwater mapping is already considerable. In the eyes of industry insiders, all kinds of dangerous or repetitive and boring work in rivers and seas will develop towards unmanned operation in the future. The use of USV has begun to bring revolutionary changes to the way of operation. It can be foreseen that domestic USV, with their low prices and convenient after-sales service advantages, will open up a new world in the fields of mapping, hydrology and water quality monitoring.

Chapter 1. Reading tips

1.1. Statement

Before using this product, any user should read this statement carefully. Once you use this product, it will be deemed that you have recognized and accepted all the contents of this statement.

This product is not suitable for minors.

When using this product, please stay away from people, fragile and dangerous items. When using this product, our company will not be liable for compensation for personal injury, property loss, etc. (including direct or indirect damage) caused by the following reasons:

(1) The driver causes damage under the condition of drinking, taking drugs, drug anesthesia, dizziness, fatigue, nausea, etc. and other physical or mental conditions.

(2) The driver's subjective intention to cause personal injury, property loss, etc. Compensation for any mental damage caused by the accident.

(3) Failed to assemble or operate this product according to the correct guidance of this manual.

(4) Other damages caused by self-modification or replacement of accessories or parts not produced by our company, resulting in poor operation of the entire unmanned boat.

(5) Damage caused by using products not produced by our company or imitating our products.

(6) Damage caused by driver's operating errors or subjective judgment errors.

(7) The unmanned boat itself is not operating properly due to natural wear and tear, corrosion, aging of the lines, etc.

(8) The unmanned boat issues an abnormal warning but still does not return, resulting in damage to the boat.

(9) Damage caused by forcibly driving the unmanned boat despite knowing that it is in an abnormal state (such as water or other unknown substances, not properly assembled, obvious failure of major components, obvious defects or missing accessories).

(10) Damage caused by driving the unmanned boat in a magnetic field interference area, radio interference area, prohibited area stipulated by the government, or when the driver's vision is backlit, blocked by obstacles, blurred vision, poor eyesight, etc., and other conditions that are not suitable for operation.

(11) Driving in bad weather, such as rain, wind, snow, hail, etc.

(12) The unmanned boat encounters collision, capsizing, fire, explosion, lightning strike, storm, tornado, heavy rain, flood, tsunami, ground subsidence, ice subsidence, cliff collapse, avalanche, hail, mudslide, landslide, earthquake, etc.

(13) Any data, audio or video materials obtained by the driver using the unmanned boat, and damages caused by infringement.

(14) Regarding batteries, such as damage caused by improper matching and use of protection circuits, battery packs, and chargers.

(15) Accident losses caused by failure to keep away from electromagnetic interference during use of the unmanned boat, friction and collision with other objects during use, aging or damage of parts but not timely replacement and repair, etc.

(16) Other losses that are not within the scope of our company's responsibility.

(17) Losses caused by illegal (unqualified) driving.

1.2. Cautions

- It is forbidden to use this product to engage in illegal activities.
- It is forbidden to use this product before carefully reading the entire content of this document.
- Non-professionals are forbidden to use this product.

1.3. Copyrights

1.4. Services

This manual is subject to update without prior notice.

You can check the latest version of the user manual on our official website.

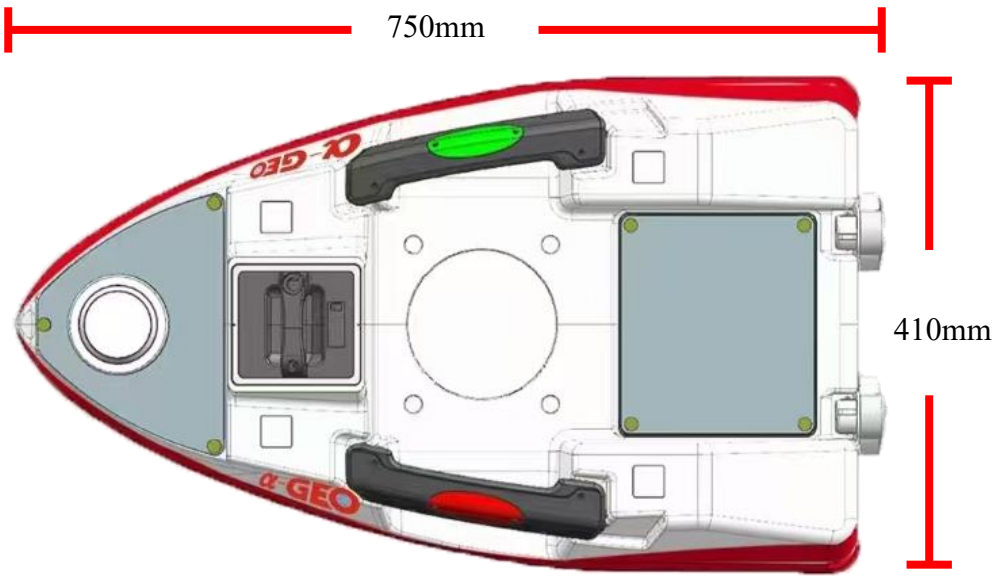
Chapter 2. Composition of ARK-S USV system

2.1. Composition of USV

The ARK-S unmanned boat measurement system is mainly composed of the boat hull, power supply system, control system, navigation system, communication system, power system, camera and onboard echo sounder.

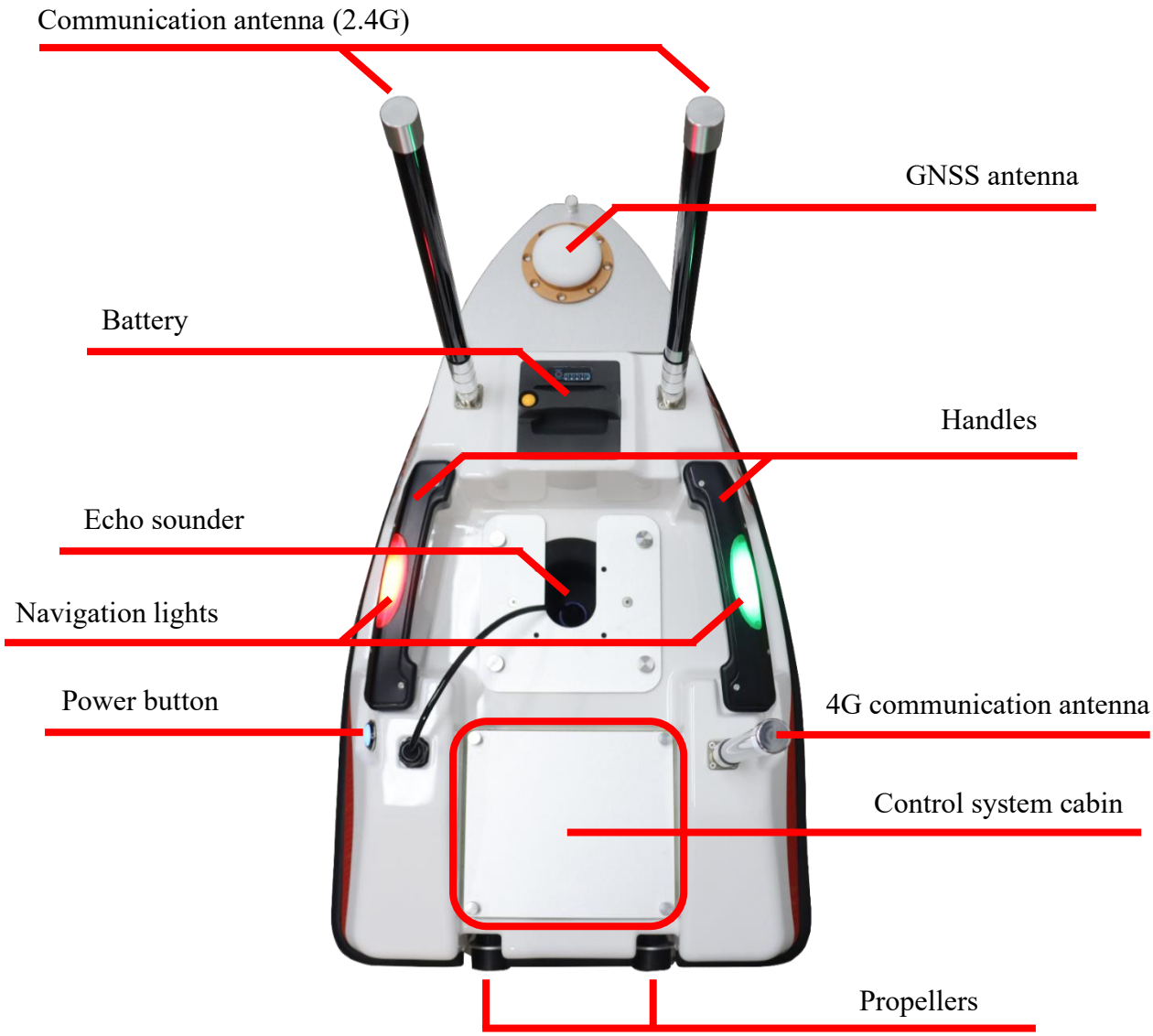
2.2. Hardware components

Dimensions




230mm

Components

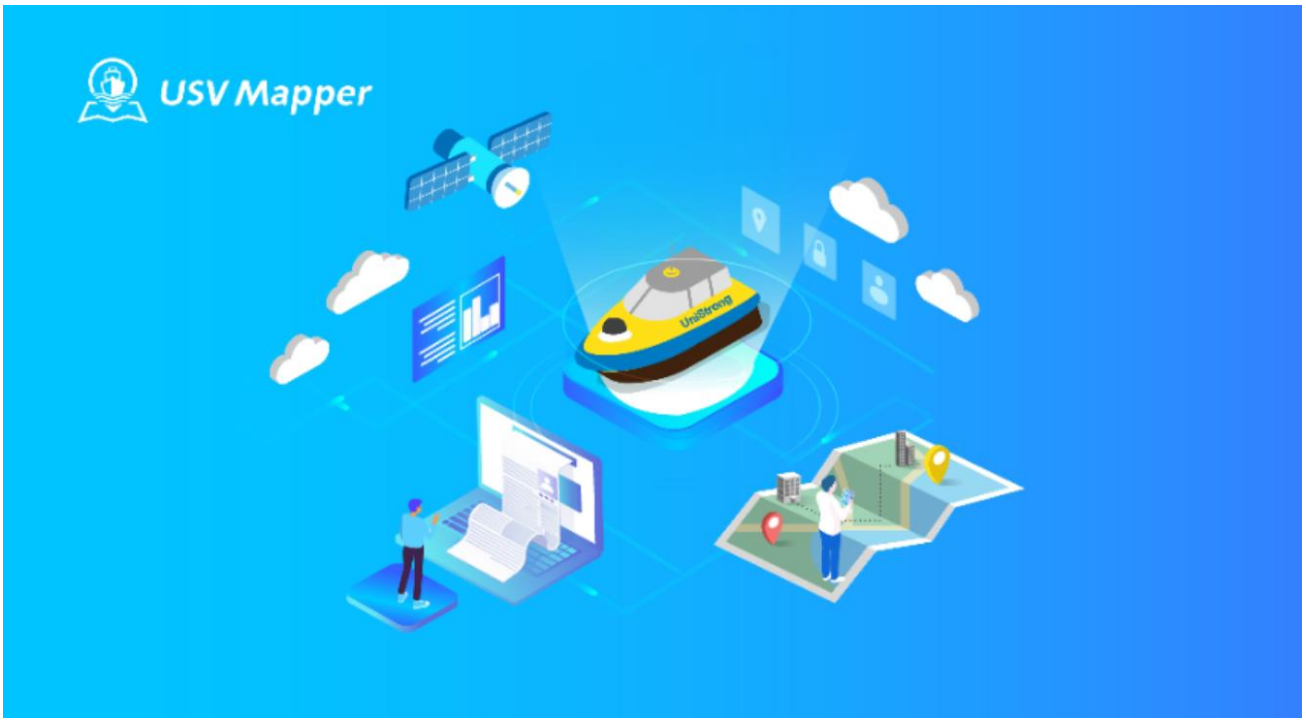

Communication antenna (2.4G)
GNSS antenna
Battery
Handles
Echo sounder
Navigation lights
Power button
4G communication antenna
Control system cabin
Propellers

2.3. Accessories list

ALPHA ARK-S Package List			
No.	Name	Quantity	Remark
Boat			
1	Boat hull	1	
2	Ducted propeller	2	
3	Warning light	1	
4	Camera	1	

5	Obstacle avoidance	1	
6	Boat control box	1	
7	Network communication module (4G)	1	
8	Network communication antenna (4G)	1	
9	Remote control antenna (2.4G)	2	
10	6S Solid-state battery (25.2V)	1	
11	Battery charger	1	
Remote control package			
1	Remote controller	1	
2	Controller cable	1	
3	Controller soft case	1	
1	Dongle key	1	
2	USVMapper	1	
Surveying system			
1	Single-beam Echo sounder	1	
Navigation system			
1	Built-in GNSS positioning module	1	

2.4. Control software



"USVMapper" is an industry application measurement and control software designed and developed for ARK-S small unmanned boat. It supports route import, hand-drawn routes, route planning and other modes. Hand-drawn routes are routes that users draw manually. Route planning is when users draw an area for planning. Importing files generates route tasks with one click. It supports surveying mode, hydrological mode, semi-automatic mode and fully automatic mode, allowing unmanned boat to automatically perform measurement operations and adapt to the complex needs of various scenarios.

Chapter 3. Sailing

3.1. Environment requirement

(1) You should choose a relatively clean area without large floating objects to avoid the propeller being entangled with garbage and causing the unmanned boat to stop sailing.

(2) Without application, it is prohibited to sail on the route or in the waters where navigation is prohibited by relevant departments.

3.2. Inspections and precautions of pre-sail

(1) Find a suitable place to launch the boat.

(2) Ensure that the battery of the boat and the controller battery are sufficient for navigation.

(3) Check whether the hull of the unmanned boat is damaged. If damaged, stop using it and contact the manufacturer in time.

(4) Check whether the antenna of the unmanned boat is installed correctly.

(5) Start the boat.

Try to keep the hull level when starting.

Turn on the controller power at first.

Then turn on the boat power, and wait for the boat to initialize (Along with beeps).

Then connect to the control software and check whether all parameters are displayed normally.

(6) Gently push the controller joystick to check whether the propeller of the boat is rotating. Put your hand 10cm away from the stern, when the two propellers are rotating, you can clearly feel the wind blowing backwards. Push the control lever to the left, the left propeller should rotate in the opposite direction, and feel it with your hand, there is no wind blowing backwards, at the same time, the right propeller should rotate faster, and feel the wind force increasing with your hand. Similarly, push the control lever to the right to check.

(7) Observe whether there are floating objects that are easy to entangle in the water area, and be careful to avoid them.

3.3. Basic sailing

(1) First, turn on the controller switch, and put the thruster control stick in the middle position, and keep the unlock switch in the upper position.

(2) Put the stern of the unmanned boat into the water first, then slowly put the entire unmanned boat into the water, turn on the power of the unmanned boat, and wait for the unmanned boat to initialize.

(3) When the screen shows that the initialization is complete, you can control the unmanned boat to sail through the controller.

(4) After finishing surveying job, slowly return the unmanned boat to the shore (to avoid collision), turn off the power of the unmanned boat, then turn off the controller, and recycle the unmanned boat for storage.

Chapter 4. Controller

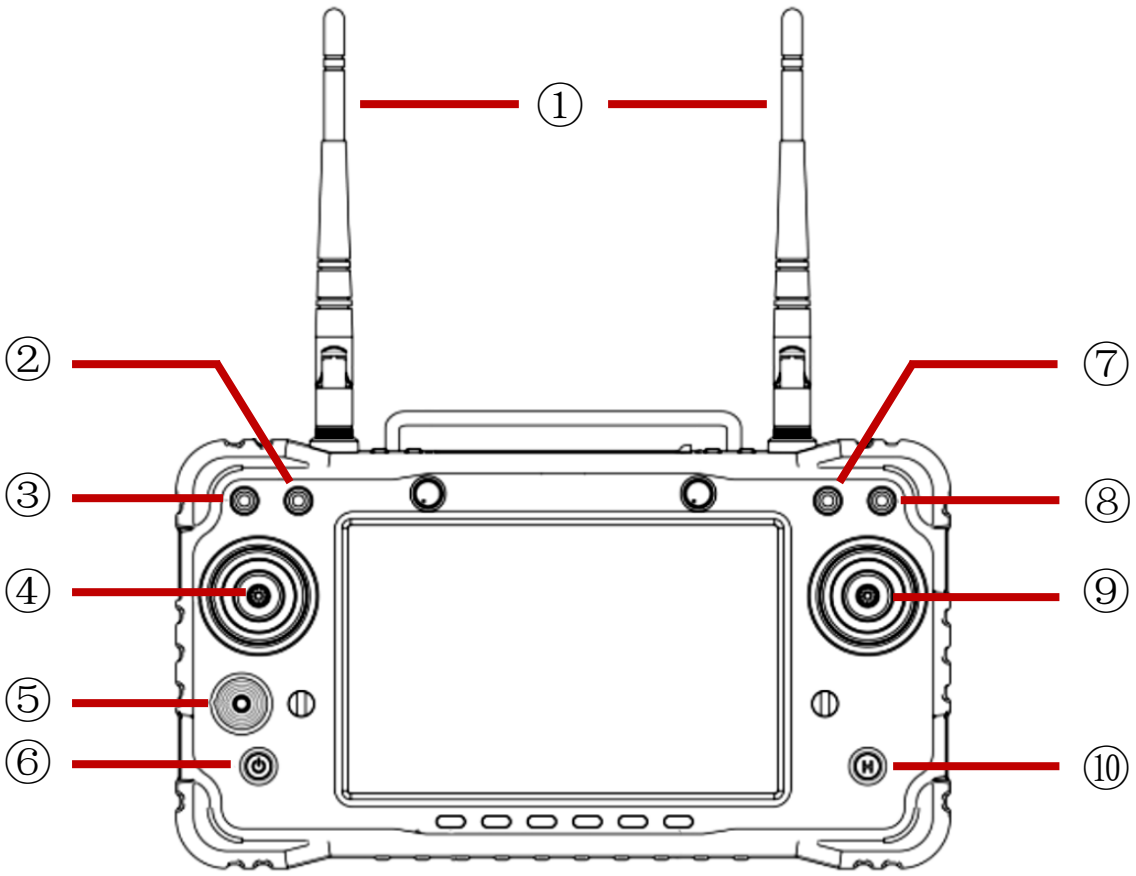
4.1. About controller

(1) The H16 controller uses a radio communication device operating in the 2.4GHz frequency band, and the controller and receiver must be paired for use. The factory default control mode of controller is that left hand control throttle. The controller complies with CE standards.

(2) The maximum communication distance of the controller is about 1000-1500 meters.

(3) There must be no obstacles between the controller antenna and the receiver antenna, otherwise the distance will be greatly shortened.

4.2. Buttons



NO.	Components	Descriptions
①	2.4G 3DB Antenna	Communicate with USV
②	SW2	Auto/Manual switch
③	SW1	Lock or unlock the controller to control USV
④	Left lever x1, y1	Engine control
⑤	Gimbal rocker x3, y3	Reserve lever for UAV
⑥	Power button	Power on/off controller
⑦	SW3	
⑧	SW4	
⑨	Right lever x2, y2	Direction control
⑩	Reserve button	

Long press on the power button to power on the controller.

Left lever x1, y1 is the engine control lever, push the lever upward to control the unmanned boat to move forward; push the lever downward to control the unmanned boat to move backward.

SW1, it is the lock/unlock switch, if the lever is in the middle or the lowest position, it is in a locked state., and the unmanned boat is locked, the propellers will stop immediately and cannot sail. When the SW1 lever is in the highest position, it is in an unlocked state, controller or ground station can control the boat to travel. In case of an emergency on the boat, this key can be used to lock the boat.

SW2, it is the navigation mode selection, if the SW2 lever is in the highest position, it is in automatic mode. In this mode, the navigation route can be planned. When the lever is in the lowest position, it is in manual mode, the operator can manually control the unmanned boat to move, but cannot perform operations such as route planning.

Right lever x2, y2 is the direction control lever, push the lever left and right to control the boat to turn left or right.

4.3. Power-on precautions

Before using the controller, please keep the controller switches should be in the following states:

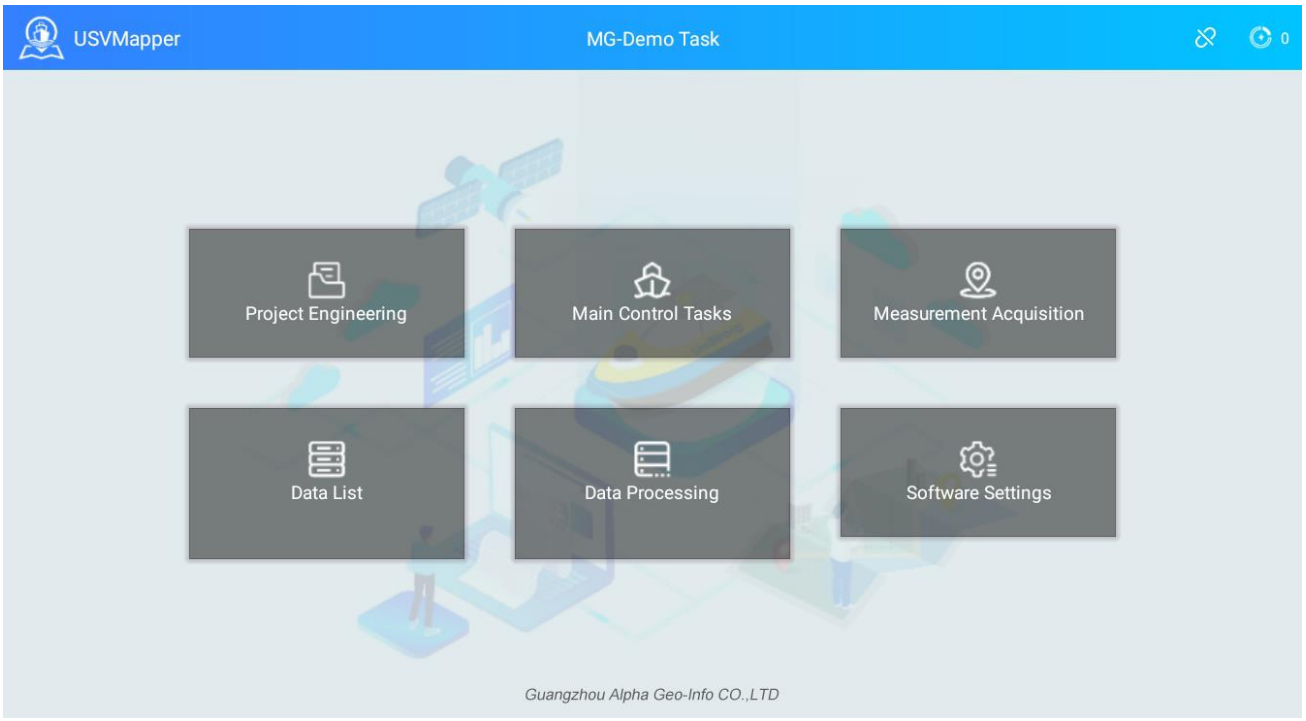
(1) The engine control lever is in the "middle" position.

(2) Keep the Lock/Unlock switch lever in the uppermost position, it is in the unlock state.

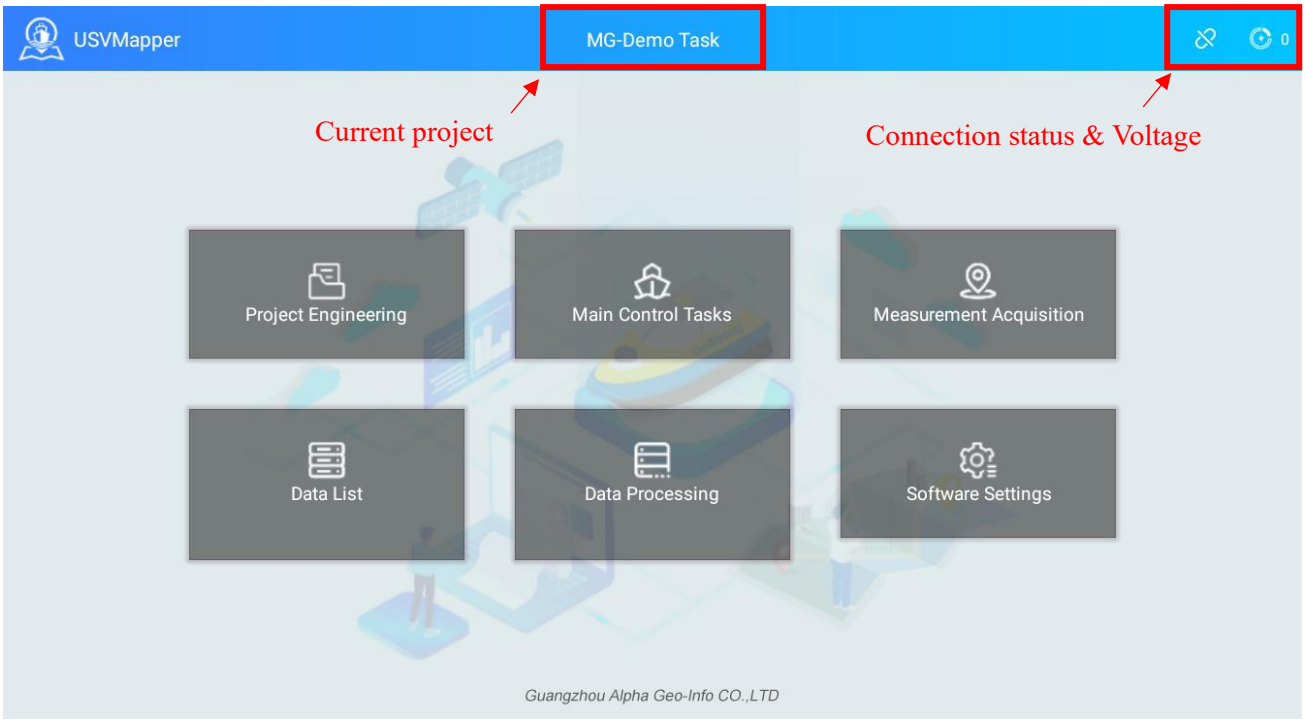
Chapter 5. USVMapper software

"USVMapper" is an industry application measurement and control software designed and developed for ARK-S small unmanned boat. It supports route import, hand-drawn routes, route planning and other modes. Hand-drawn routes are routes that users draw manually. Route planning is when users draw an area for planning. Importing files generates route tasks with one click. It supports surveying mode, hydrological mode, semi-automatic mode and fully automatic mode, allowing unmanned boat to automatically perform measurement operations and adapt to the complex needs of various scenarios.

5.1. Software main interface



The main interface displays 6 main function modules. At the middle of the top of main interface, the name of current project is displayed there. And the connection status between controller and unmanned boat and battery voltage of boat are displayed at the upper right corner of main interface.



(1) Project Engineering: Create and open engineering projects.

(2) Main Control Tasks: With vector map as the background, it supports route planning, return, cruise, hovering, obstacle avoidance and other operations.

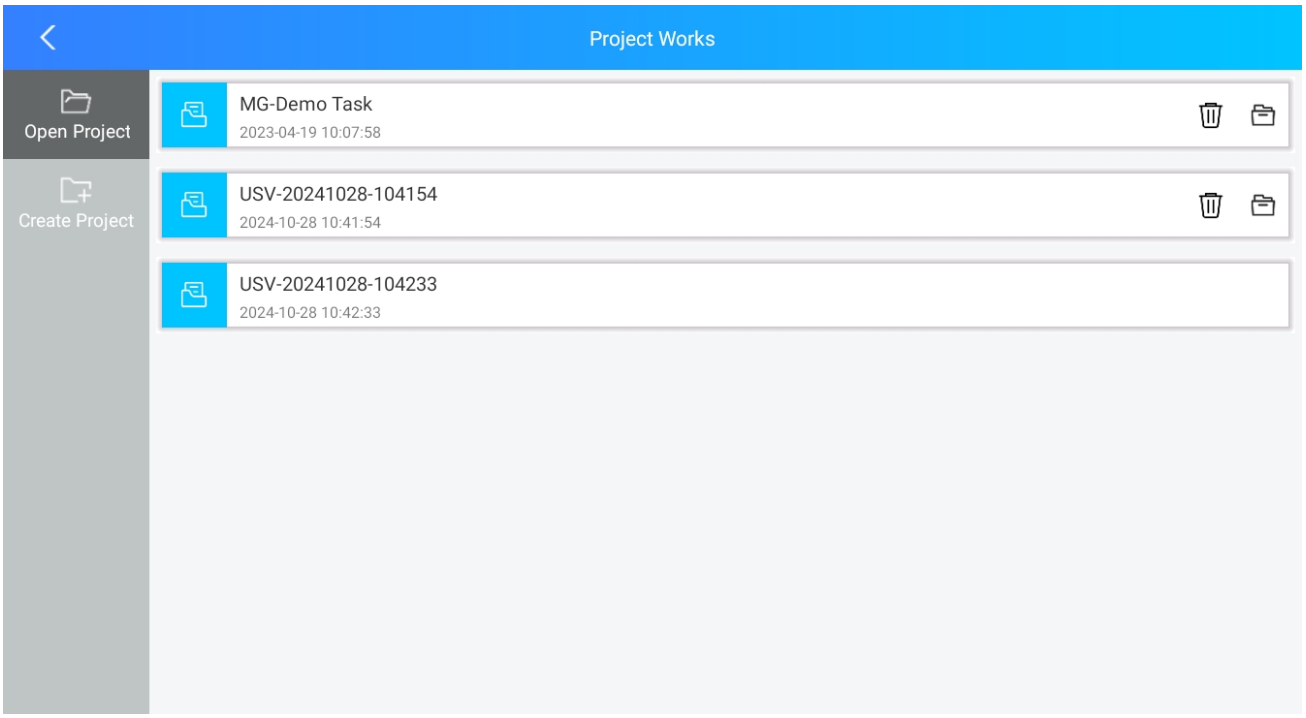
(3) Measurement and Acquisition: With vector map as the background, it supports adjusting boat speed, measurement and collection and other operations.

(4) Data List: Supports viewing historical data of measurements.

(5) Data Processing: Supports water depth sampling and data export.

(6) Software Settings: Supports coordinate system settings, connection settings, collection settings, instrument settings, hull settings, unit settings, CORS differential settings, video settings, and other settings.

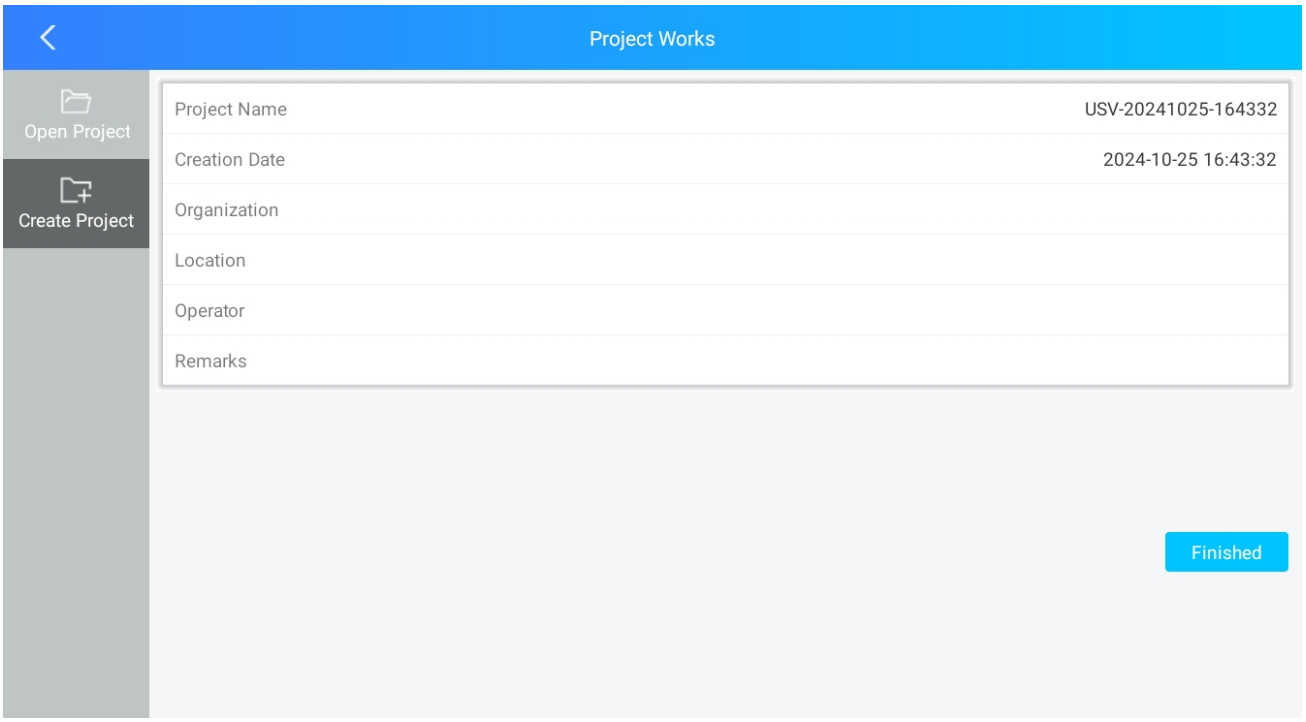
5.2. Project engineering



Open Project: The interface displays all projects. If there is no icon on the right side of the list, it means that the current project is in use.

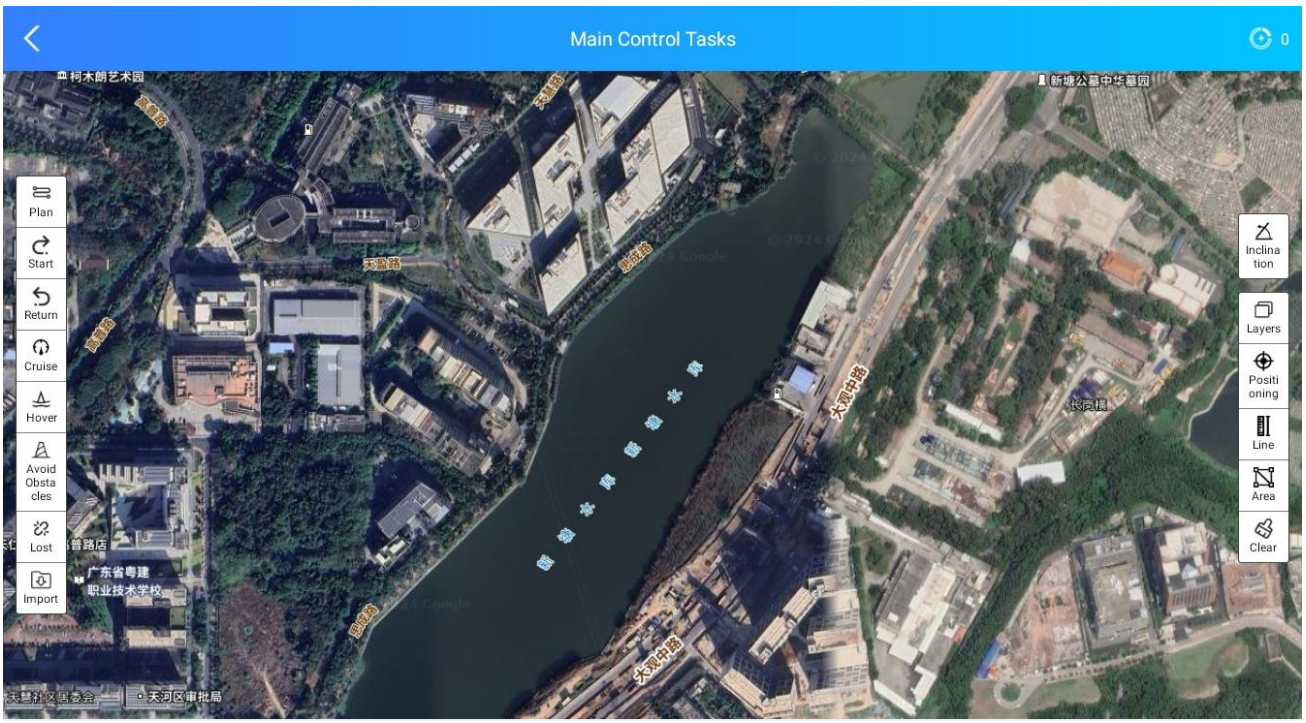
Click this button to delete the project.

Click this button to open the project.



Create Project: The project name is usually with the current date and time, which can better identify which day's data is, the other fields, you can select to input, then click the "Finish" button to create the project and automatically open it, after that the interface will jump to the software setting interface.

5.3. Main control tasks



(1) Plan: There are two modes for planning routes: 1. Draw an area manually, click “Plan Route”, and the software will automatically plan a route in the area based on the spacing and angle. The spacing and angle can be adjusted. After complete planning route, click “Save Route”. 2. Draw a route manually, and click “Save Route”.

(2) Start: After clicking “Start”, the saved route history will be displayed on the right, select any route, configure the startup parameters again, like starting point, auto return, speed and so on, and click [Confirm] to start the measurement.

(3) Return: Enter the coordinate selection mode, move the map to the return location, automatically obtain the current point coordinates, and click [Confirm].

(4) Cruise: You can adjust the cruise speed, click [Confirm].

(5) Hover: Enter the hover mode with one click.

(6) Obstacle avoidance: You can manually adjust the obstacle avoidance distance, click [Confirm].

(7) Lost: Select the loss of connection action, return if loss of connection, or wait if loss of connection.

(8) Import: Supports importing KML and dxf files, dxf is the route, kml is the boundary range.

(9) Layers: Controls the display of collected data.

(10) Map: Controls the display of vector maps and satellite maps.

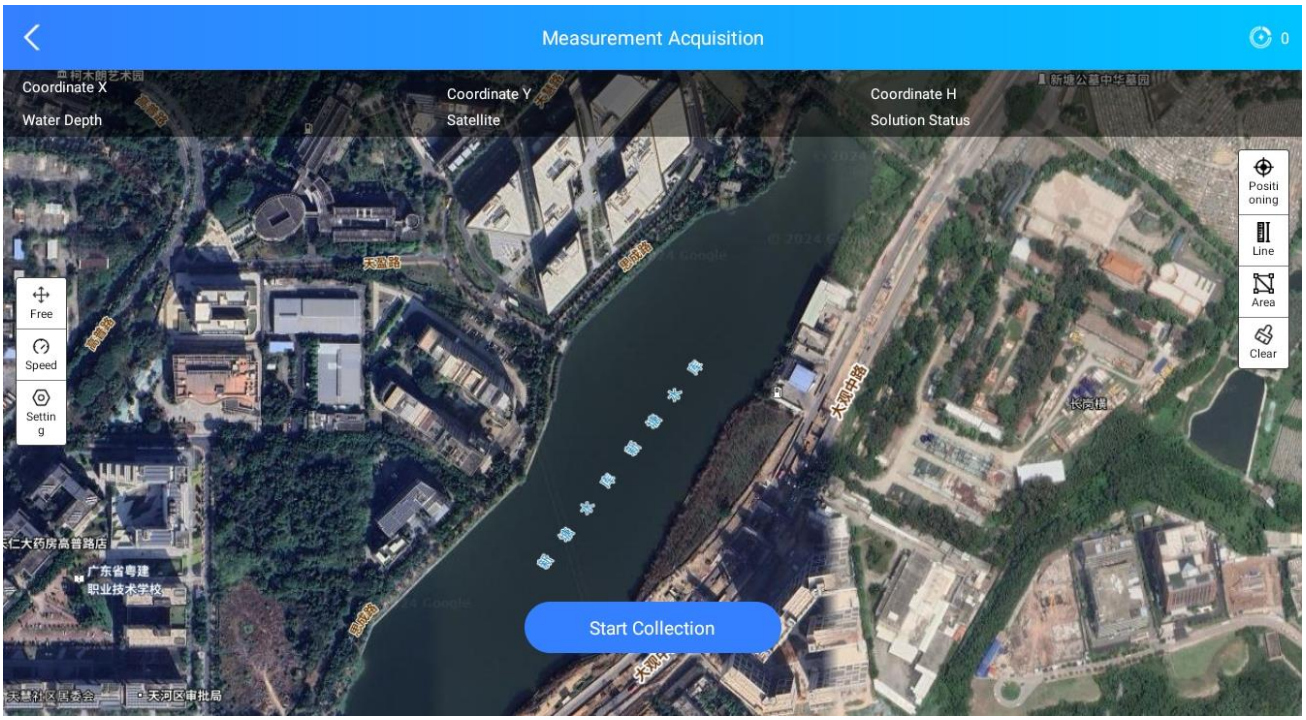
(11) Positioning: Locates the position of the unmanned ship.

(12) Line: Click to enter the line measurement mode, draw points on the map, and calculate the length.

(13) Area: Click to enter the area measurement mode, draw points on the map, and calculate the length and area.

(14) Clear: Clear the temporary map drawing.

5.4. Measurement acquisition



Click “Start Collection” to automatically start saving the measured points and water depth.

(1) Free: There are free and follow modes for the map. “Follow” means moving the map automatically to the center in real time according to the measured points.

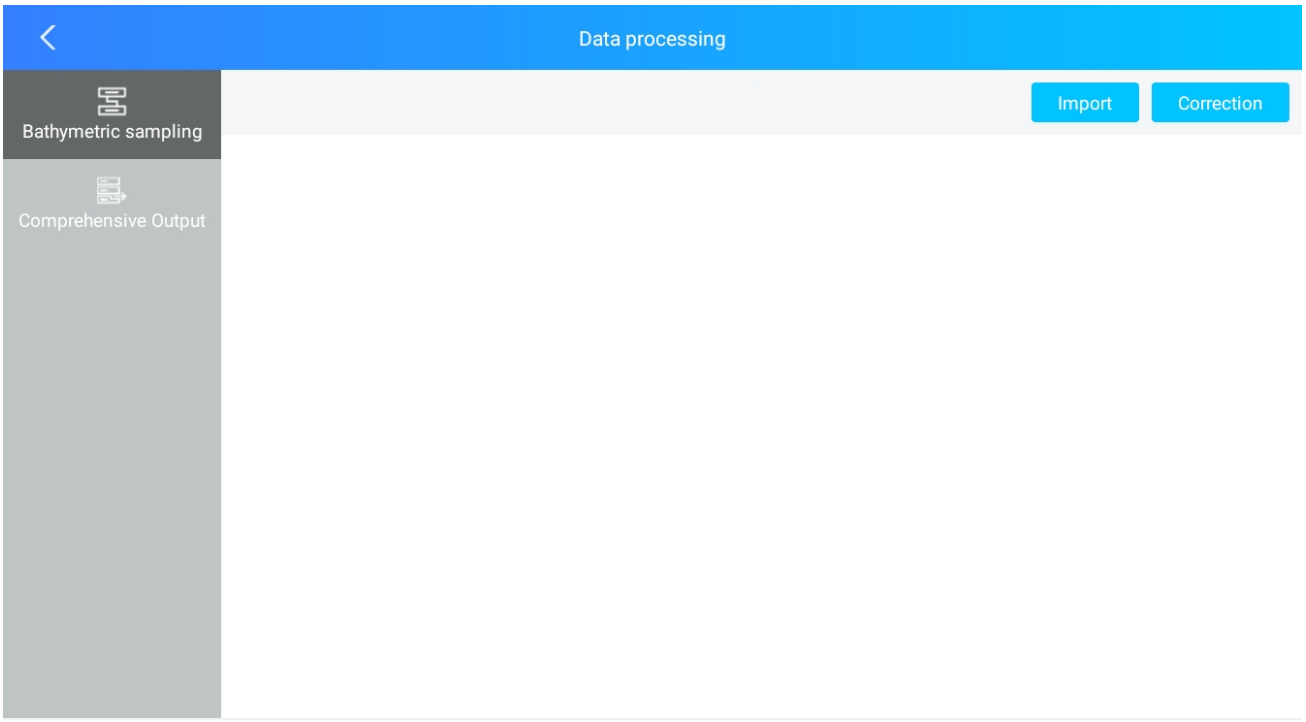
(2) Speed: Adjust the speed of the unmanned boat.

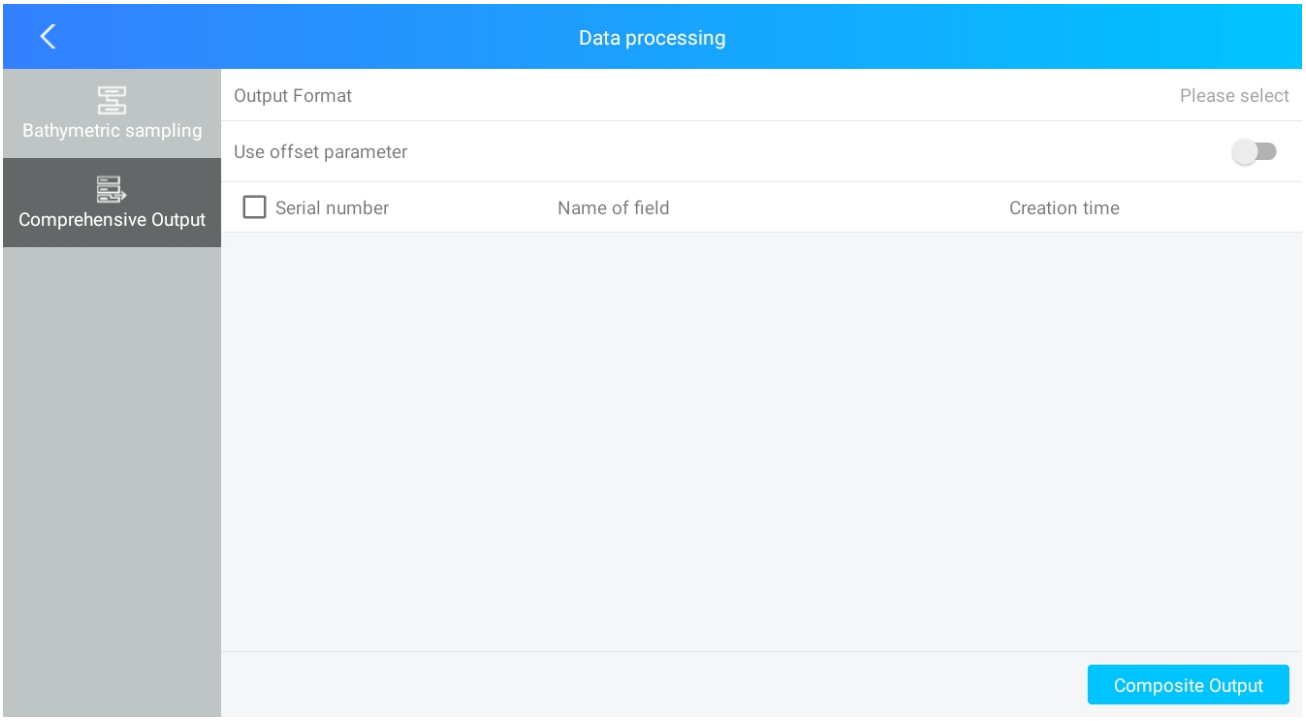
(3) Setting: Enter the collection settings interface.

5.5. Data list

Displays historical data of measurement. Select an item and long press it to view and delete it.

5.6. Data processing



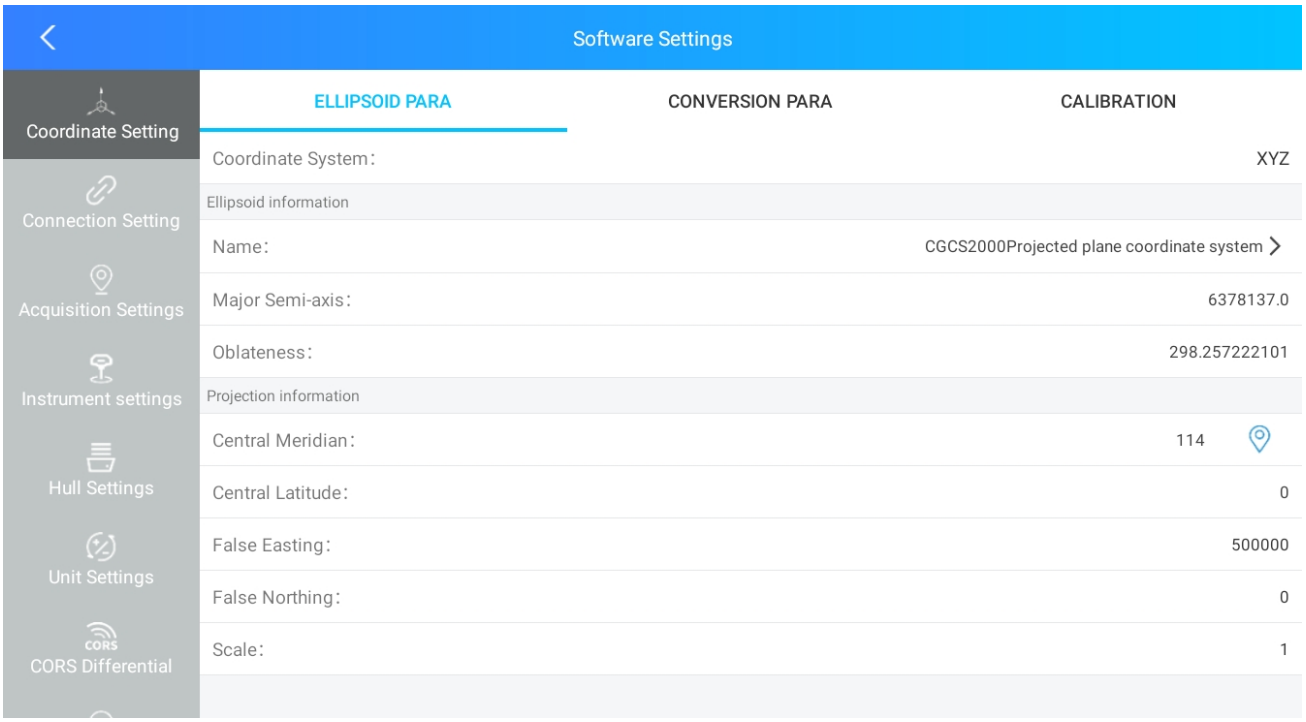


(1) Bathymetric sampling: Click “Import”, select the collected water depth data for display, and click “Correction” to automatically correct the values with large differences.

(2) Comprehensive output: Select the output format, and choose the output data, click “Comprehensive

Output" to export.

5.7. Software settings



(1) Coordinate setting: Set the current coordinate system, including ellipsoid parameters, projection, central meridian, etc.

(2) Connection setting: Enter the IP and port to connect to the unmanned boat.

(3) Collection setting: Set the collection conditions.

(4) Instrument setting: Set the antenna height and depth sounder draft value.

(5) Hull setting: Set the offset value of the positioning antenna and the switch of the navigation light.

(6) Unit setting: Set the unit type such as speed, distance, angle, etc.

(7) CORS difference: Set the correction data for unmanned boat via network Ntrip.

(8) Video settings: Enter the unmanned boat video address for real-time viewing.

(9) Other settings: Check the software version, and update the software and the control system.

Chapter 6. Battery system

6.1. Charging

After connecting the charger to the battery, plug the charger into a 220V power socket, at this time, the charging indicator light will turn red and the cooling fan inside the charger will start to rotate. The charging process takes about 5 hours.

When the battery is fully charged, the charger indicator light will turn green, unplug the charger. Press the button on the battery and the 5 indicators of battery life will light up to show 100% power capacity.

6.2. Working environments

(1) The charging temperature for normal temperature lithium batteries is 0℃~45℃, and the discharging temperature is -20℃~60℃, the storage temperature is -40℃~65℃.

(2) The charging temperature for low temperature lithium batteries is -20℃~25℃, and the discharging temperature is -20℃~35℃, the storage temperature is -40℃~65℃.

(3) Do not place the battery output terminals close to metal objects to prevent metal objects from touching the positive and negative poles of the battery, causing a short circuit, damaging the battery or even causing danger.

(4) Do not knock, puncture, step on, modify or expose the battery to sunlight at will. Do not place the battery in a microwave, high voltage environment.

(5) Please use the lithium battery charger specified by the manufacturer to charge the battery. Using a non-original charger will cause the charging protection system to be mismatched, which is likely to damage the battery or even cause danger.

6.3. Storage environments

(1) If the lithium battery is not used for a long time, it should be fully charged and removed from the device and stored in a dry and cool environment. It should be charged every 2 months to prevent self-discharge and low power, which may cause irreversible capacity loss.

(2) The self-discharge of lithium batteries is affected by temperature and humidity of the environment. High temperature and humidity will accelerate the self-discharge of the battery. It is recommended to store the battery in a dry environment of 0℃~20℃.

(3) The battery should be placed in an explosion-proof cabinet or explosion-proof bag when charging and should also be placed in an explosion-proof cabinet or explosion-proof bag when storing.

6.4. Emergency

When a lithium battery catches fire, we need to analyze the cause of the fire and extinguish the fire in time. We recommend the following solutions:

(1) If a small fire occurs, use a carbon dioxide or ABC dry powder fire extinguisher to extinguish the fire.

(2) When thoroughly checking the fire, do not touch any high-voltage components and always use insulating tools for inspection.

(3) If the high-voltage battery is bent, twisted, damaged, or in a mess during the fire, or if there is a problem with the battery, use a large amount of water to extinguish the fire and continue to cool the battery.

(4) When the battery fire is extinguished, flush it with water for 10 minutes to ensure that the high-voltage battery is completely cooled before the accident ends. Monitor the battery to see if it will reignite and move it to a safe area. Smoke indicates that the battery is still hot and monitoring should be continued until the battery stops smoking.

Chapter 7. Maintenance

7.1. Battery

(1) New lithium battery will only store 30% of power when it is shipped, and it must be fully charged before use.

(2) Do not over-discharge the battery, as this will cause irreversible capacity loss.

(3) To avoid affecting the battery life, the battery must not be overcharged or over-discharged, the voltage should not be lower than 22.5V after each operation.

When charging, the battery must be removed from USV. If it is not used for a long time, the battery must be stored at the storage voltage.

7.2. Propeller

(1) Please clean the aquatic plants and debris on the propellers after each use and rinse with water.

(2) After the unmanned boat is operated in the seawater environment, it needs to be rinsed with fresh water.

(3) Before the propellers enter the water, check that all fasteners are properly tightened to ensure that they can work normally after entering the water.

(4) Regularly check whether there is foreign matter in the propellers and the degree of wear of parts, and replace them with new ones as appropriate.

(5) Regularly check the wear of the propellers and whether it has fallen off.

7.3. Boat hull

(1) If the product is not used for a long time, it should be sealed. After packing, it should be stored in a cool, dry environment without corrosive gases.

(2) If the product has any abnormal phenomenon or failure, please contact the manufacturer's technicians or local dealers in time, and the product must be repaired by a dedicated person, unauthorized repair is not allowed.

(3) After each use, the hull can be wiped dry with an absorbent towel.

(4) The unmanned boat should be stored in a cool, dry place and kept ventilated.