CHCNAV

Stock Code: 300627

CHCNAV APACHE Series
Unmanned Surface Vessel
Product User Manual

Make Your Work More Efficient

Pre-reading tips

Description of the symbol

⚠ **Notes**

∅ **Warning**

Software downloads

Log in to the official website of CTI Navigation or https://www.huace.cn through this website

You can download EasySail Android software, AutoPlanner software and HydroSurvey software from [Service & Support] - [Download Center].

CONTENTS

1. Product Overview

1.1 Brief introduction

APACHE series unmanned surface vessel integrate control system, positioning system, bathymetry system, power system, 360° camera, millimeter wave obstacle avoidance module. Break the traditional underwater bathymetry operation mode and achieve high-efficiency and high-precision underwater topographic surveying and mapping.

1.2 Features:

With its advanced technology and innovative design, APACHE unmanned surface vessel of Shanghai Huace Navigation Technology Co., Ltd. has a leading position in the field of unmanned surface vessel, with the following significant product features:

1. **High-Precision Navigation System:** APACHE unmanned surface vessel is equipped with a highly accurate navigation system, including differential GPS, inertial navigation system and advanced navigation algorithms, to ensure that the vessel can accurately locate and navigate when performing tasks, and meet the navigation needs of various complex water environments.
2. **Intelligent Perception Technology:** The hull is equipped with advanced sensor technology, such as millimeter-wave obstacle avoidance radar and omnidirectional camera, to achieve multi-perception fusion. This enables unmanned vessels to perceive, analyze, and respond to surrounding conditions in real-time in a variety of environments, ensuring efficient and safe missions.
3. **Remote Monitoring And Control Platform:** APACHE's unmanned boat product suite is equipped with a powerful remote monitoring and control platform, and users can monitor the status of the vessel, navigation information and sensor data in real time through AutoPlanner and EasySail software. This convenient way to manage remotely provides users with full control.
4. **Modular Design:** The hull structure adopts a modular design, which allows users to freely match and replace various sensors, communication equipment and working loads according to different mission requirements. This flexible design improves the customizability of the system, making the APACHE unmanned surface vessel suitable for diverse application scenarios.
5. **Low Energy Consumption And High Battery Life:** The use of efficient energy management system and advanced electric power system enables APACHE unmanned surface vessel to achieve long-term endurance while maintaining excellent performance. This is particularly critical for long-cycle measurement tasks.

1.3 Unmanned surface vessel assembly

Equipment List: 1 unmanned surface vessel, 2 9S (red label) batteries, 2 RC&WIFI antennas, 1 4G antenna.

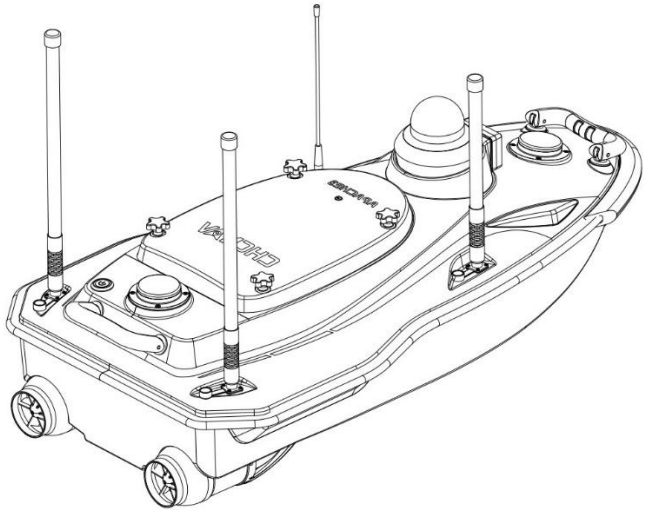
1. Open the hatch cover, install the connected battery, fix the battery, then close the hatch cover, and tighten the screw.
2. The antenna corresponds to the base tag one by one, and the external antenna (4G/RC) is screwed clockwise.
3. Turn on the switch of the unmanned surface vessel, and after the indicator light is on, the unmanned surface vessel will

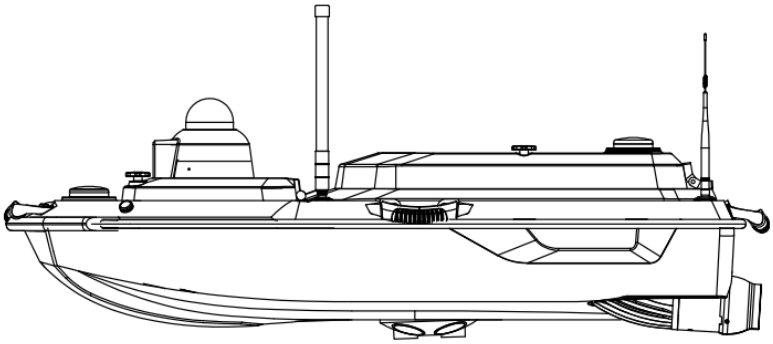
be turned on.

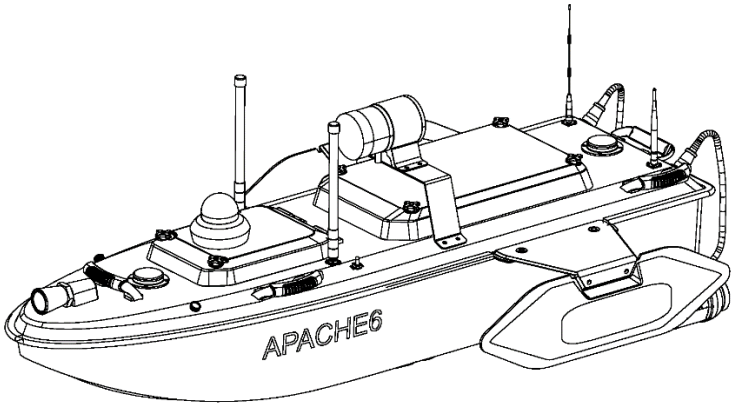
4. Long press the remote control switch in the lower left corner, release the screen when it lights up, and wait for the remote control to turn on.
5. Before launching, push the longitudinal rod of the remote control to test whether the wind direction and power of the motor are normal, and log in to the EasySail software at the same time to check the status of the unmanned boat, and then you can launch the operation after checking that it is normal.

Scan the QR code below and click [User Guide] - [EasySail Video Tutorial] to view the relevant video teaching.

2. Unmanned surface vessel

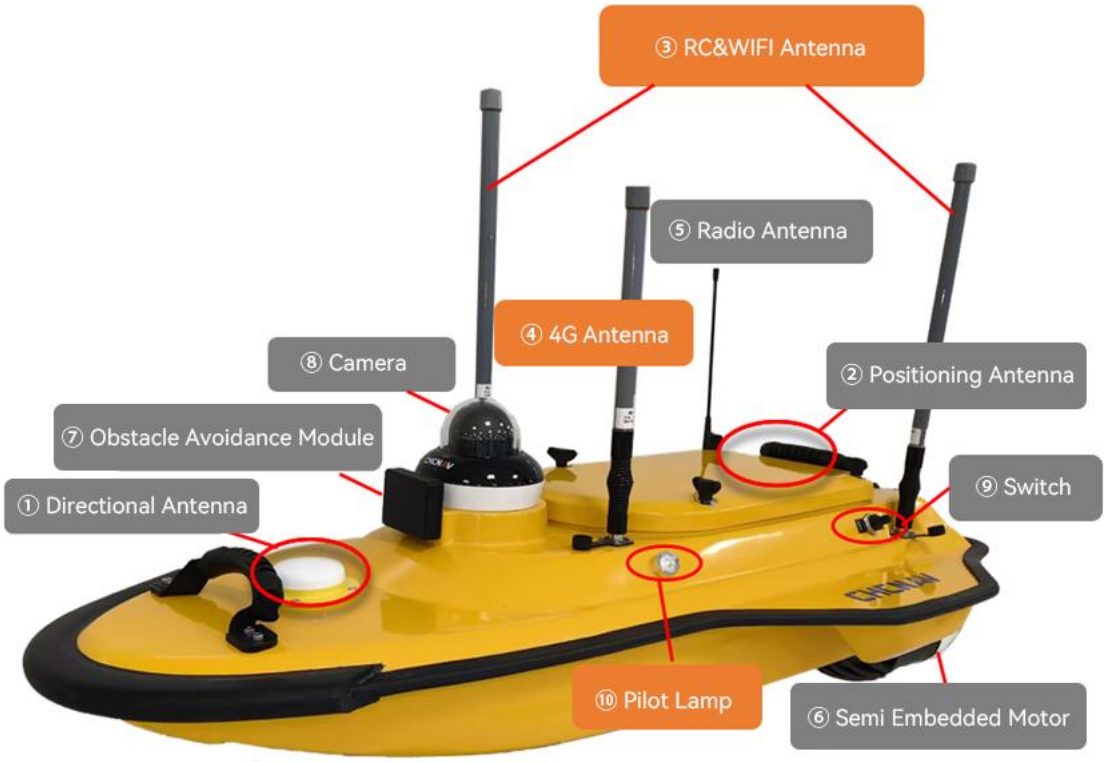




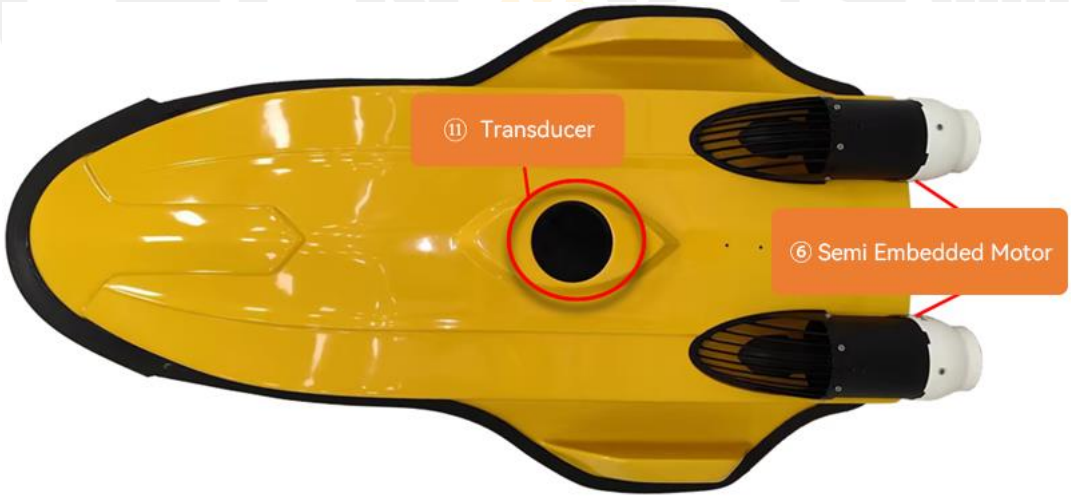


This section describes the systems in unmanned surface vessel and their functional characteristics

2.1 APACHE No. 3



Oblique view of APACHE No. 3

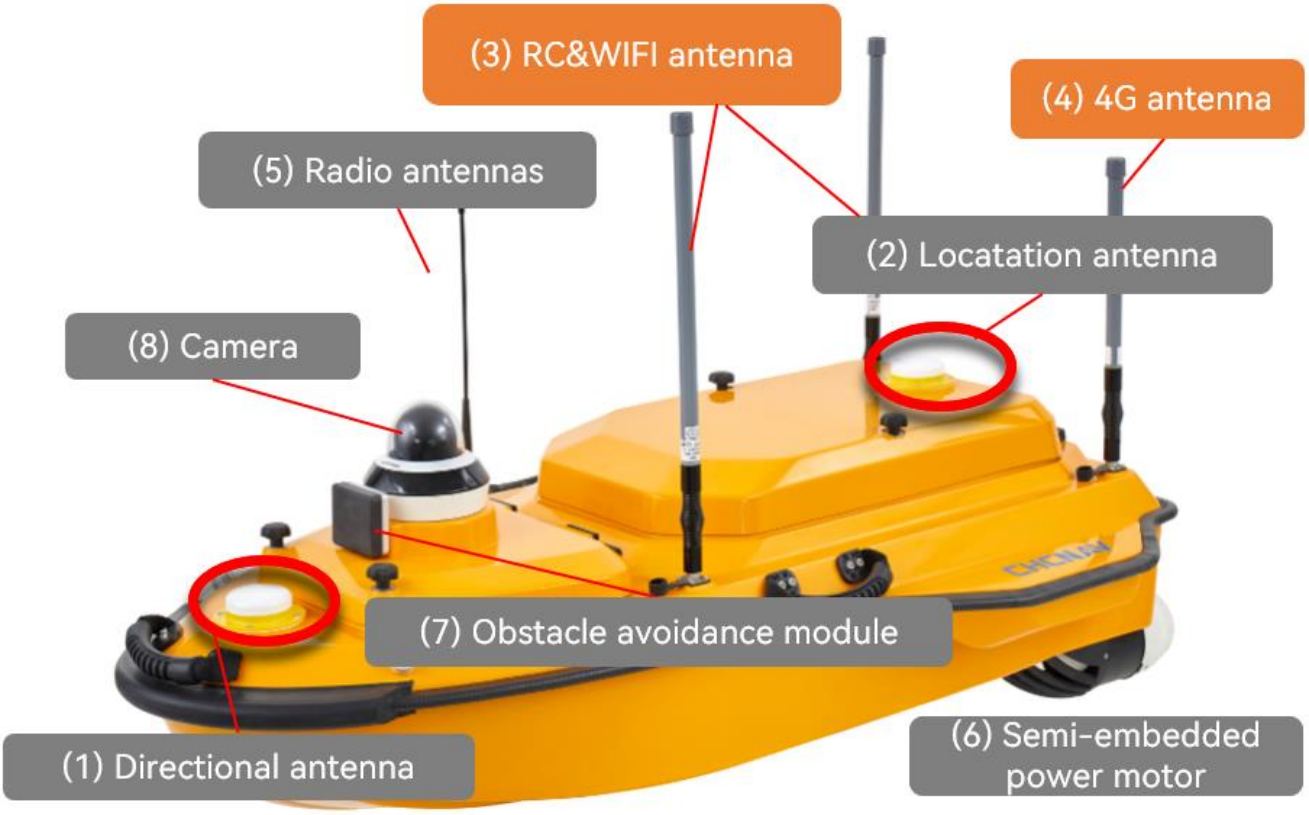


Bottom view of APACHE No. 3

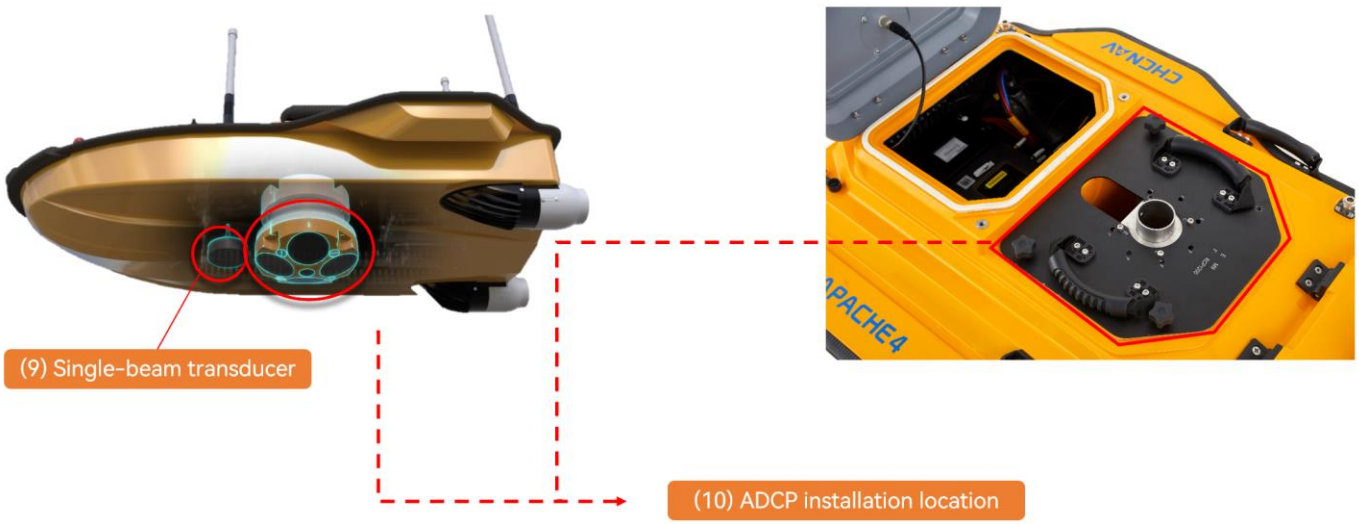
1) Directional antenna: provide real-time direction for unmanned surface vessel.
2) Positioning and satellite search antenna: provide real-time positioning for unmanned surface vessel.
3) Remote control antenna (rc&wifi): enhance the remote control signal of unmanned surface vessel.
4) 4G antenna: Enhance the 4G signal strength of unmanned surface vessel.
5) 4G mode is the most commonly used mode, which can transmit data through 4G and log in to CORS to obtain differential signals.

6) Radio antenna: enhance the radio signal of the unmanned surface vessel.
7) Receives differential signals from a GNSS reference station via a radio.
8) Semi-embedded motor: shallower draft, reduce scraping, and provide forward and backward power for unmanned surface vessel.
9) Obstacle avoidance module: provide obstacle avoidance function and support semi-automatic/fully automatic measurement of unmanned surface vessel.
10) Camera: It can transmit the front picture of the camera in real time, and supports 360° rotation.
11) Switch: There is a lever switch on each side of the hull, which is toggled to ON to start the unmanned surface vessel.
12) Indicator light: There is an indicator light on each side of the hull.
13) The red indicator on the left is the star search light, the red light is always on to indicate that the initialization is completed, the number of red light flashes represents the number of star searches, and the red light should be always on for normal operations;
14) The green indicator on the right is a differential signal light, a solid green light indicates a fixed solution, a flashing green light indicates a floating solution, and a non-light light indicates that no differential data is received.
15) Transducer: The single-beam transducer is integrated in the unmanned surface vessel and is used to transmit and receive acoustic signals.

2.2 APACHE No. 4



Oblique view of APACHE No. 4



1) Directional antenna: provide real-time direction for unmanned surface vessel.

2) Positioning and satellite search antenna: provide real-time positioning for unmanned surface vessel.

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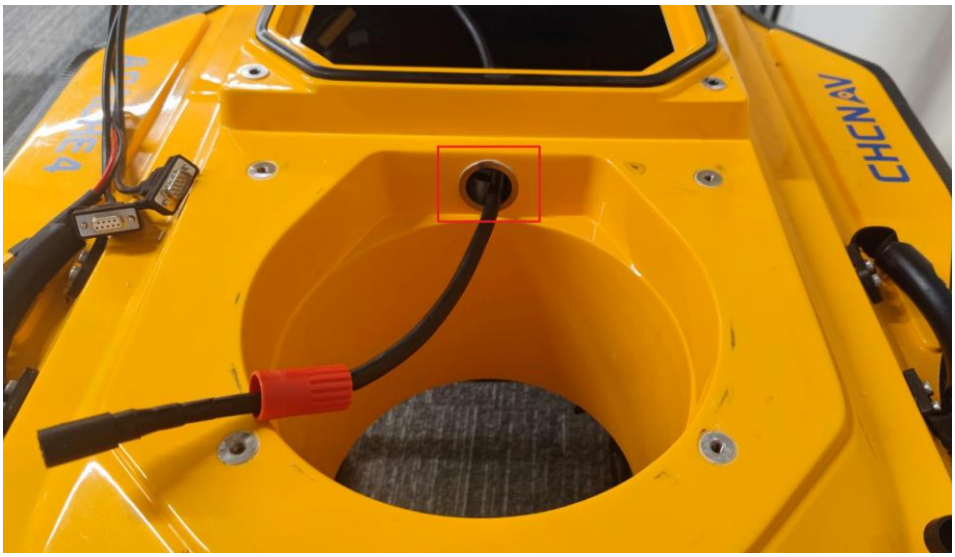
13) The green indicator on the right is a differential signal light, a solid green light indicates a fixed solution, a flashing green light indicates a floating solution, and a non-light light indicates that no differential data is received.
14) Single-beam transducer: The single-beam transducer is integrated on an unmanned surface vessel and is used to transmit and receive acoustic signals.
15) ADCP installation position: used to place and fix ADCP for hydrological testing.

2.3 The A4 is equipped with ADCP assembly

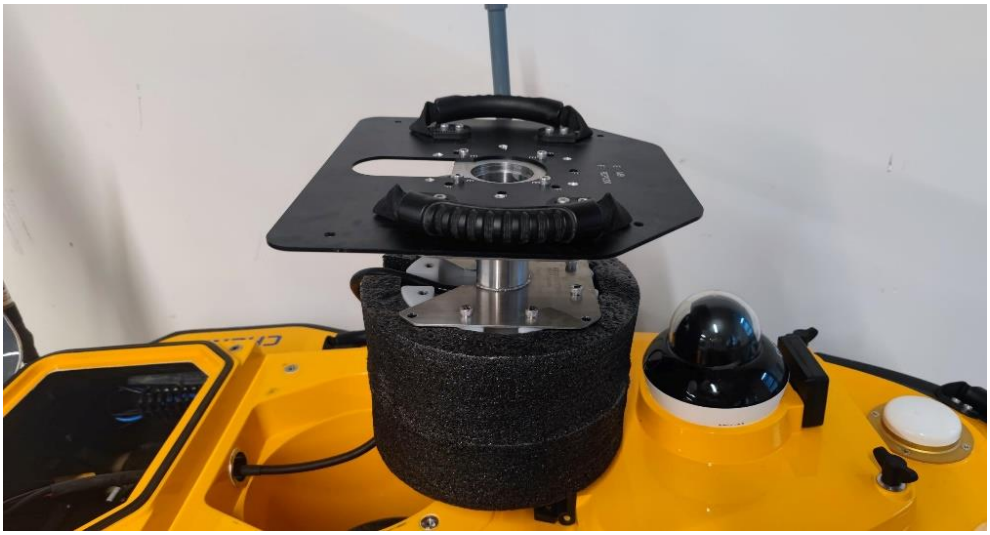
1. Open the rear hatch cover of the unmanned surface vessel, unscrew the 4 fastening screws on the black plate in the middle of the hull, remove the fixing plate, and remove the yellow protective cylinder in the middle of the hull, at this time the middle of the hull is connected up and down;

2. Remove the waterproof rubber plug from the inside of the aft cabin, and pass the cable through the reserved threading port from the cabin;

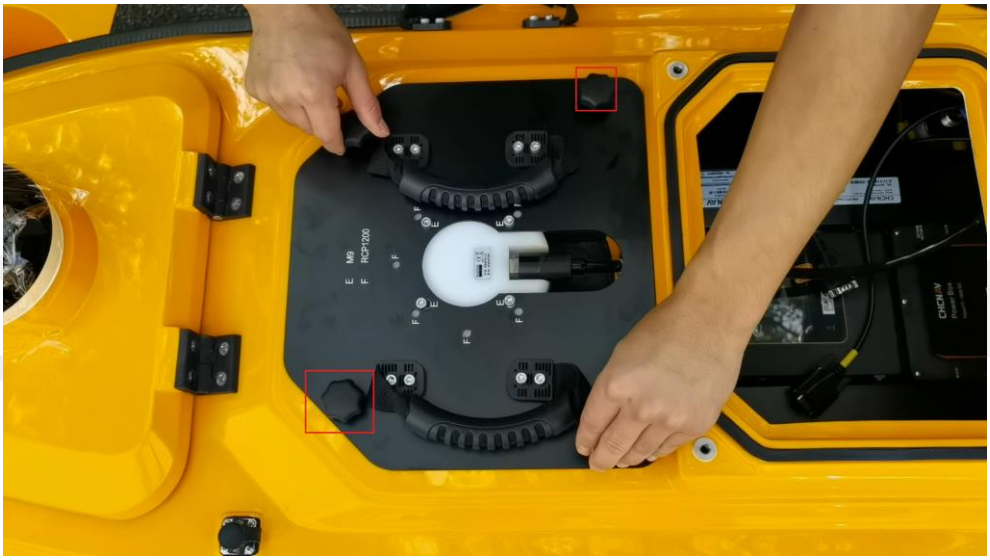


ADCP wiring

3. Find a water-blocking foam suitable for the size of the ADCP in the airbox of the unmanned surface vessel, install it on the ADCP, and pass the ADCP cable through the reserved opening from the cabin and connect it to the ADCP;



4. According to the ADCP model, find the mounting hole that is marked with the corresponding model on the mounting bracket, and connect the ADCP and the bracket tightly (the current bracket is a combined bracket, divided into three layers);



5. Assemble the bracket and fix the bracket to the boat, and at the same time, pay attention to the waterproof rubber plug after applying a certain amount of silicone grease;

Connection

6. Finally, connect the ADCP cable with the yellow XT60 power supply interface and RS232 interface inside the cabin.

2.4 GD100 main controller

Interface Definition:

GNSS1 connects to the rear antenna of the unmanned surface vessel；

GNSS2 connects to the antenna of the unmanned surface vessel;

POWER is the GD100 power supply line；

SIGNAL is used for data transmission and reception of unmanned surface vessel;

The SIM card slot can access the user's SIM card；

LAN1 network port is usually connected to the unmanned surface vessel camera to provide the network;

The RC interface is connected to the RC antenna base of the unmanned surface vessel；

4G interface is connected to the 4G antenna base;

RADIO interface is connected to the radio RADIO antenna base.

2.5 Unmanned surface vessel indicator

Description of unmanned surface vessel navigation indicator:

Solid red light: The initialization of the unmanned boat is complete, and the automatic mode can be switched for measurement.

Flashing red light: The initialization of the unmanned surface vessel is not completed, and the number of flashes indicates the number of star searches, and the operation cannot be carried out at this time.

Red light off: The unmanned surface vessel is not turned on, and the power supply needs to be checked, and the actual GD100 status indicator shall prevail.

The green light is always on: the positioning state of the unmanned surface vessel - fixed solution (the software shows that there is a delay of 5-8s from the fixed to the light state).

The green light flashes: the positioning status of the unmanned surface vessel - the floating solution.

Green light off: Unmanned surface vessel positioning status - single point solution.

Traffic lights flashing alternately: During the firmware upgrade, do not power off, the unmanned surface vessel will be automatically restarted if the upgrade is successful.

2.6 motor

2.6.1Motor usage guide

Notes：

1. The use of motors in turbid waters will reduce the life of motors and propellers to a certain extent;
2. Please refer to the official configuration to use the motor of the corresponding ship model;
3. The motor is a consumable product, and after the expiration of its service life, if necessary, please use the CTI Maintenance WeChat Mini Program to purchase it;
4. Always check the motor for foreign objects before each voyage;
5. Be sure to push the longitudinal lever of the remote control before each voyage to check the motor status. If there is any abnormality, check it before sailing;

2.6.2Replace the motor or paddle

1. Please use the standard wrench in the unmanned surface vessel toolbox to unscrew the nut from the inside of the cabin, unplug the three-phase wiring between the motor and the ESC, and pull out the motor.
2. If there is a foreign object in the propeller, you can use an Allen wrench to remove the white spout at the tail of the motor, then remove the fixing screw on the propeller, and pull out the propeller to remove the foreign object.

2.7 Camera

A 360° rotatable camera can be used to assist in observing the surrounding environment of the vessel.

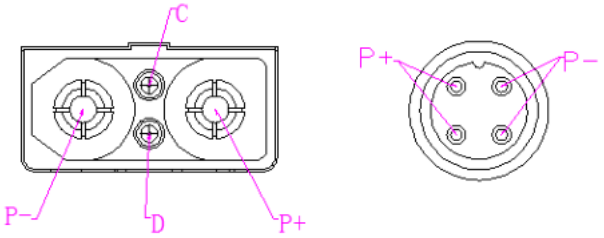
2.8 Millimeter wave obstacle avoidance module

When this obstacle avoidance function is activated, semi-automatic or fully automatic measurement modes can be used.

2.9 Battery box

2.9.1battery

The unmanned surface vessel battery is highly integrated, and the fuel monitoring is also encapsulated inside. The state-of-the-art impedance tracking algorithm is used to achieve a capacitance error of less than 1%. At the same time, there are accurate calculation methods for the aging and self-discharge of the battery in the process of use, and the remaining time can be accurately predicted for the different usage modes of electrical equipment. The product has high-precision capacity calculation and high-stability security guarantee, which fully guarantees the safety and reliability of users.



2.9.2Battery usage guide

If there is an inaccurate capacity or capacity jump during use, please charge the battery to 100% and wait for two hours, then use the battery to discharge, put the battery into the system to shut down, and then take out the battery and leave it for 5 hours. The battery is then powered by an external power source and recharged, and after a full cycle, the capacity is displayed accurately and without jumping.

⚠ Notes:

For safety considerations, do not short-circuit the positive and negative poles of the battery during use, and do not disassemble the battery or throw the battery into the fire without permission.

2.9.3Battery preservation

The product should be stored at room temperature, and the battery should be kept in a semi-charged state of about 30%~50%. To prevent over-discharge of the battery, it is best to charge the battery every six months during storage. For long-term storage, charge the battery with a current of 0.5C for about 1h so that it has partial power storage.

When a battery works, it uses the energy released by an electrochemical reaction to provide electrical energy, and it is actually a chemical product. Because of this, if the battery is stored for a long time and is not used, the performance of the battery will slowly decay, so it is important to recharge and discharge the battery after a period of storage to restore the battery energy.

2.9.4Battery charger use

1. Plug the AC plug of the charger into the power socket first, and the LED indicator of the charger is green, if the indicator light is not on, the traffic light is flashing, and the red light is always on, the charging should be stopped, and the charger output should be detected for short circuit, whether the input power plug is loose, etc.;
2. After the LED working indicator of the charger lights green, then insert the output plug of the charger into the jack of the battery device to be charged, and the indicator will turn red, indicating that the charger is charging the battery;
3. When the charging is completed (depending on the battery capacity and initial charge, this process may take 1~10 hours), the LED indicator will automatically turn green, indicating that the battery is fully charged and the charger enters the constant voltage charging state. Long-term constant voltage charging is safe and harmless to the battery pack;
4. When charging is finished, unplug the output plug of the charger and then the AC plug of the charger and place the charger in a safe place.

⚠ Notes:

1. Before charging, please confirm whether the charger used and the battery to be charged are compatible (this charger is sold and used in conjunction with the equipment that uses the battery, and it is forbidden to use this product to charge non-supporting equipment or battery packs);
2. The charger is for indoor use only, no water or rain is allowed;
3. There is high voltage electricity inside, and it is forbidden to open the shell;
4. The charger is forbidden to be charged in a high-temperature, flammable and explosive environment;
5. It is forbidden to charge a non-rechargeable battery with the charger;
6. If there is any quality problem in use, please contact CTI after-sales service directly, and it is forbidden to repair it privately

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2.9.5Charger performance

Input Characteristics:

AC voltage range: AC90~ 260V;

Rated working input AC voltage: AC100~240V;

Input working frequency: 50 ~ 60HZ;

Charger no-load input power: ≤20W

Rated input maximum power: ≤570W

Output Characteristics:

Charger no-load output voltage: DC37.4V-38.2V

Normal working output voltage) :D C27-37.8V;

Rated working output current (constant current): 5.4A-6.6A;

Charger Adaptation Battery Pack Specifications: 9 cells 8-40H;

Rated output power: ≤227W*2 double group

Charger working efficiency: ≥80%;

A red light indicates that the charger is charging;

The charging green light indicates that the charger is in the state of waiting to be charged or fully charged

Charging conditions for turning red to green: 0.30A < I<0.90A or Vout>37.8V;

Charging Red and Green Light Flashing Alternately Condition: Charger Abnormal Protection;

Protection features:

1. Over-current protection: When the current of the charger and the supporting equipment exceeds the rated working current, the charger will stop working immediately, and the charger can re-enter the working state after the fault is lifted;

2. Short-circuit protection: When the charger output positive and negative poles are short-circuited, the charger will automatically protect no output voltage, and the charger will work again after the short-circuit protection is removed.

Environmental Characteristics:

Normal working temperature : 0 ~ +40°C ;

Storage ambient temperature: -20 ~ +70°C;

Normal operating ambient humidity: < +95% RH

3. Remote Control

This section describes the remote control performance and its operation in detail

3.1 EC10 Remote Control Parameters

Display: 10.1 Industrial Touch Screen

Resolution: 1920*1200

Memory: 4GB

Storage Capacity: 64GB

Network Interface: RJ45*2

Serial Port Interface: TCP socket*2

Charging Interface: Type-C

Waterproof and Dustproof Rating: IP67

Operating Temperature: -10℃ to 55℃

Total Weight: 2kg

Battery Life: 5 hours

Battery Capacity: 20000mAh

Operating Frequency: 1.4GHz, 2.4GHz/800MHz

Channels: 16 channels

Total Dimensions: 361mm (L) * 393.2mm (W) * 102.4mm (H)

3.2 Introduction to remote control parts

(1) On/off key: remote control power on and off button, long press on/off.

(2) Forward/backward: Control the unmanned ship forward and backward. Only the front and back directions are valid, and the left and right directions are invalid.

(3) Left/right turn: control the steering of the unmanned ship. Only the left and right directions are valid, and the front and rear directions are not valid.

(4) Automatic/manual switching key: switch the mode of the unmanned ship.

Support manual and automatic modes.

(5) Hover button: control hovering.

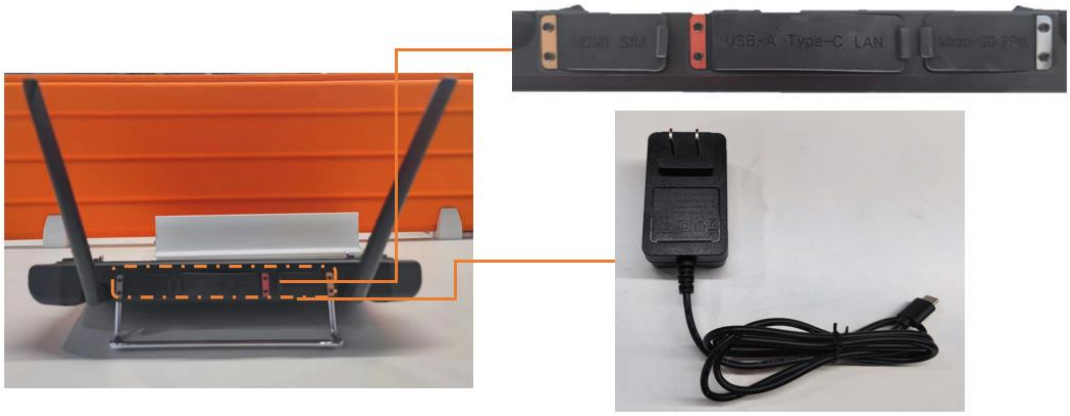
(6) Remote control antenna: used for remote control of unmanned ships, note that unmanned ships need to be installed with two corresponding RC antennas.

⚠ Notes:

1. The physical buttons are subject to actual factory delivery and are subject to change without notice
2. The joystick of the remote control is a sensitive device, and it is forbidden to bounce the lever, gravity press, etc.

3.3 Remote charging

THE EC10 REMOTE CONTROL HAS A BUILT-IN INTEGRATED RECHARGEABLE LITHIUM BATTERY, WHICH IS COMPATIBLE WITH THE MARKET'S STANDARD TYPE-C INTERFACE (SUCH AS USB CHARGERS FOR DIGITAL PRODUCTS SUCH AS MOBILE PHONES AND CAMERAS) FOR CHARGING. With the official standard Type-C charger, it takes 4 hours to fully charge in the normal shutdown state.



⚠ Notes:

1. Use an official standard charger to charge the remote control. If you do not use the original charger, it is recommended to use a USB charger that complies with PSE standards and has a specification of 9V / 4A
2. To keep the remote battery in tip-top condition, make sure the remote is fully charged every 3 months
3. If there is smoke, peculiar smell, or night leakage during charging at the ground terminal, please do not continue to charge the ground terminal, and please transfer it to the company for maintenance
4. Do not charge this product in the area touched by infants to avoid the risk of electric shock. Do not charge this product in an environment above 60°C.

3.4 Environmental conditions of use

a) Environmental temperature: -10 ° C to+45 ° C.
b) Storage temperature: -20 ° C to+50 ° C.
c) Relative humidity: Not exceeded 85%.
d) Atmospheric pressure: 86kPa~106kPa
e) the place of use is not allowed to have the risk of explosion of the medium, the surrounding medium should not contain corrosive metal and damage insulation gas and conductive medium, not allowed to be filled with water vapor and serious mold.

f) The place of use should have facilities to protect against rain, snow, wind, sand and ash.

3.5 Remote control maintenance and repair

Maintenance and maintenance when parked for a long time Store the remote control in a dry and ventilated place to reduce direct sunlight to prevent the battery from overheating. If it needs to be stored for more than a month, the remote control battery must be charged to 70-80% regularly to avoid battery drainage.

The recommended storage temperature range is +22°C~+28°C

Never store the battery below -20 degrees Celsius or above 45 degrees Celsius.

3.6 Remote-controlled transportation and storage

∅ Warning:

To avoid possible injury and loss, it is important to observe the following: As cables and small parts can be dangerous to children, it is important to keep children away from parts of the remote control.

⚠ Notes:

1. Do not immerse the remote control in water, if it enters the water, please wipe it with a soft dry cloth in time, and turn off the power immediately, and return to the company's after-sales service
2. It is forbidden to mechanically hit, crush, puncture the battery, and it is forbidden to drop the battery.

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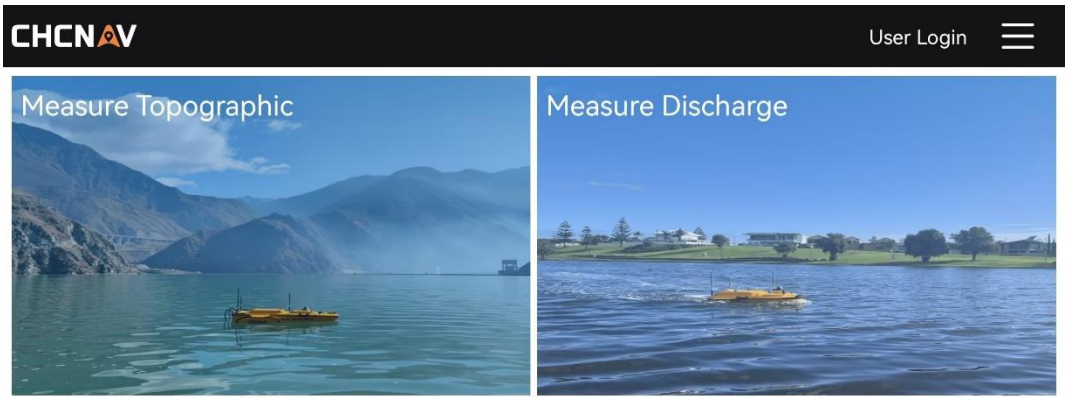
4. EasySail App

This section describes the functions of EasySail software in detail.

4.1 EasySail Software Overview

EasySail is an unmanned ship industry application measurement and control software independently developed by CTI, which is designed to be used by all unmanned ships in Huawei series. Support topographic and hydrographic surveys. Topographic surveys support surveying mode, hydrological mode, semi-automatic, and fully automatic survey modes. Hydrographic surveys support mapping and hydrographic models. Enables unmanned ships to automate measurement operations to adapt to the complex needs of various scenarios. At the same time, it supports 4G and data transmission connection, Doppler flow profiler, ADCP current measurement, single beam sounder, video video transmission, route planning, virtual hoverstick, CORS login, GNSS registration, SI unit switching, etc.



4.2 EasySail software runtime environment

The software only supports Android system, supports EC10 remote control and some tablets and mobile phones, Android 9 or above system, resolution 1920x1080.

Support products: Huawei series unmanned boat, CTI D270 sounder.

Support locale: Chinese simplified, Chinese traditional, English, Russian, the software will automatically switch languages according to the current system locale, switch the system locale during the software operation, you need to restart the app.

Notes:

1. At present, many functions of the software require a mobile network, and a network is also required for the use of unmanned ships to provide network RTK services.
2. The phone has not been adapted, and there will be problems with the use of some functions, such as flashbacks or location bugs.

4.3 EasySail Software install/uninstall/clear data

1. **Download and install**

   To download the software installation package, please visit the official website of CTI - [Service and Support] - [Download Center]: https://www.huace.cn, after downloading the APK file, you can directly double-click to install it

2. **Software Permissions**

   In order to ensure normal use, the current software requires customers to open some permissions, including location and storage permissions, and floating window permissions are also required to open the map interface.

3. **Uninstall instructions**

   Uninstalling the software will synchronously delete all data (engineering data, record control parameters, sounder parameters, etc.) including satellite map tile data, device connection information, custom server, route engineering, etc.;

4. **Clear the data description**

   Using Android to clear the history data will clear all cached application data of the software, including account login information, software engineering, CORS and SWAS information, permission acquisition, logs, etc., the software will be restored to the initial installation state, and you need to log in again, and SWAS and CORS also need to be actively connected.

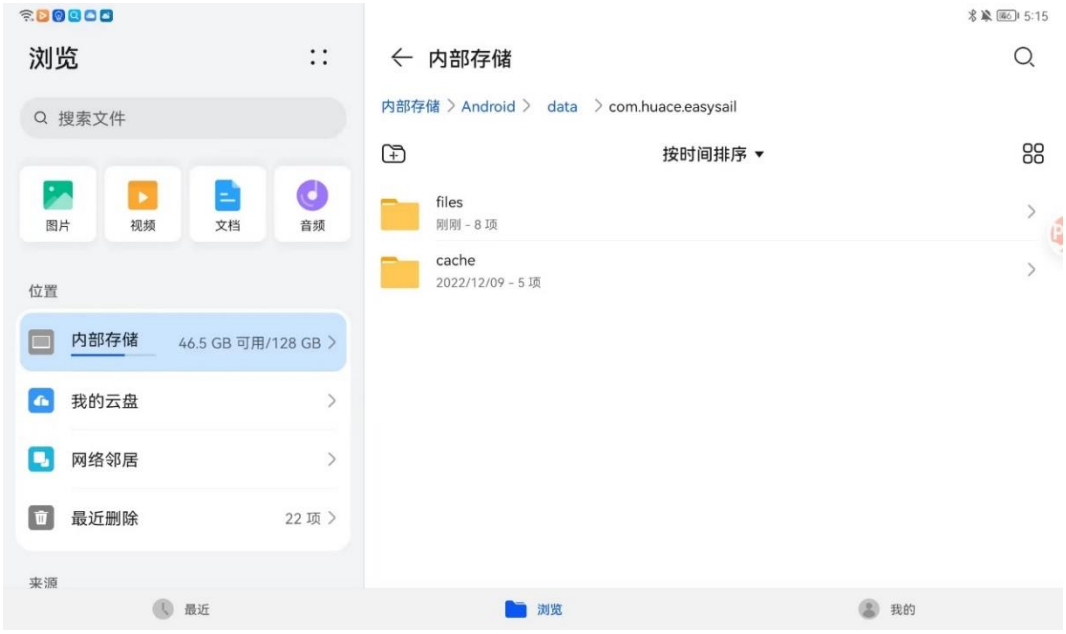
Notes:

1. In order to ensure the normal access to the location of the remote control, be sure to turn on the positioning permission and function;
2. In order to ensure normal data storage and recording and shooting functions, you need to turn on the file storage permission;

4.4 Software file description

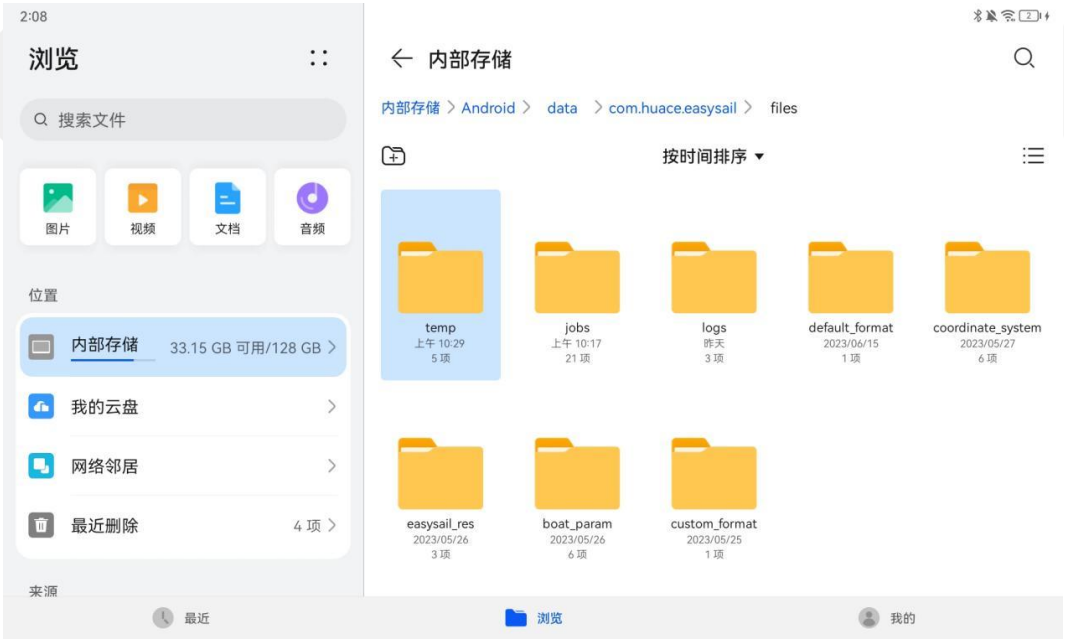
After the software is installed and used, the generated file storage address is as follows:

1. EC10 Android Remote: The EasySail folder in the root directory, including jobs and logs
2. Other Android devices: Android/data/com.huaceeasysail



"Cache": mainly stores cached map tile data, including plane data and map label data;

"files": Other data generated by the software during operation.



"easysail_res": software prototype and map configuration file;

"jobs": the directory of topographic survey projects, each route project is a folder, and the folder name is the route name;

"jobs_adcp": a directory of hydrographic survey projects, one folder for each test project;

"logs": software operation logs, which will be recorded in the log if there is an abnormality during the voyage;

"boat_param": store the ship control parameter file (*.param);

"coordinate_system": the directory where the files related to the coordinate system are stored;

"default_format": stores user-defined files

"temp": the package that has been shared

Notes:

After the project is saved, the result file of shooting and video recording is stored at the following path:

EC10 remote control: EasySail/jobs/project filename/fpv

Other Android devices: Android/data/com.huaceeasysail/jobs/projectfilename/fpv

The default path of the data post-processing file export and the file downloaded by the share code is as follows:

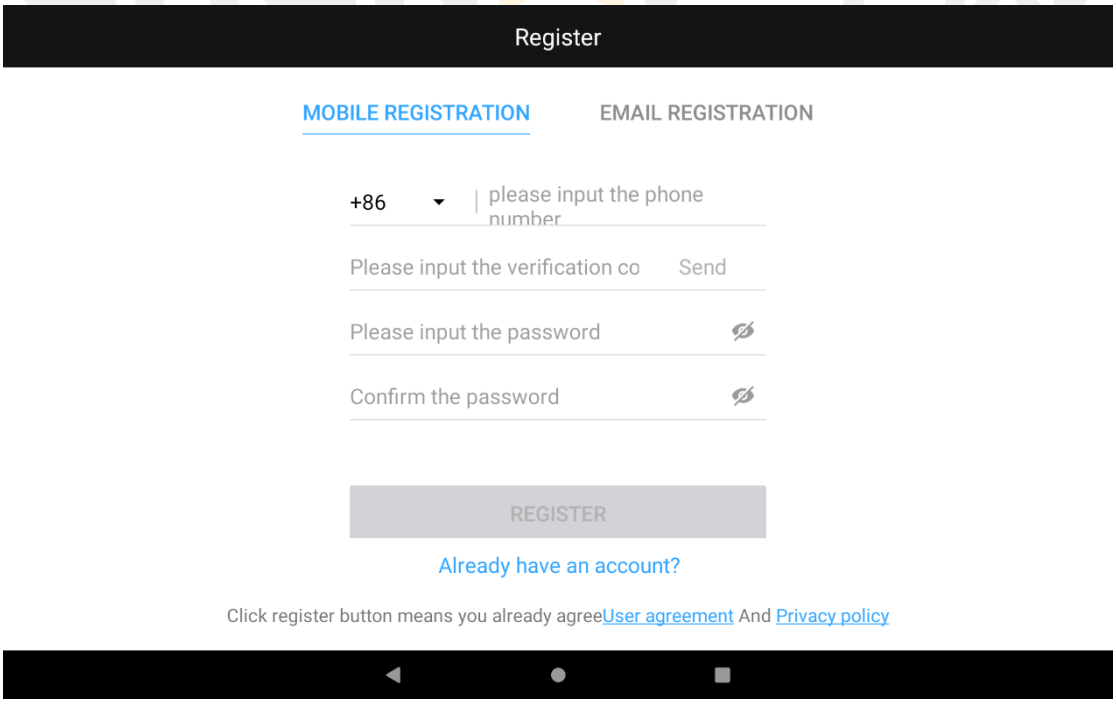
File export path: "1A CTI Export Folder" in the root directory

Sharing code download path: "1A CTI sharing code folder" in the root directory

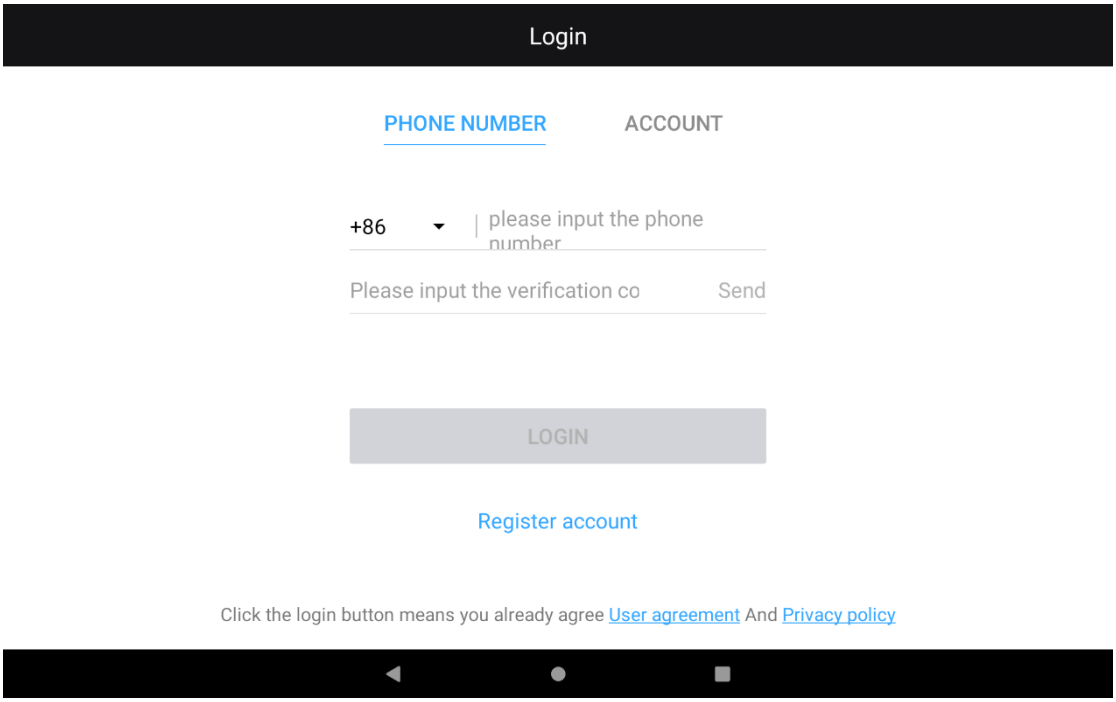
---

4.5 Account login

Under the premise that the network is available, you can directly use the mobile phone number verification code to register and log in, and click the "Settings" button on the right side of the main interface to enter the login interface.



Register



Log in

⚠ Note: If you have logged in for more than 30 days, you need to log in again.

4.6 Quick Start Guide

4.6.1 Topographic surveys are fast to work with

1 The unmanned boat is turned on, the remote control is turned on, and after waiting for 1-2 minutes, operate the remote control handle to check whether the motor is rotating;

2 After the connection is successful, the unmanned ship is launched, and the unmanned ship is manually controlled at full speed for 5 seconds to complete the initialization of the unmanned ship;

3 Then click "Topographic Survey" to enter the project list interface;

4 Create a new project or open an old project to enter the main interface of the satellite map;

5 View self-test information, connection status, etc.;

6 Plan the route and upload it;

7 Start Operation: Switch to automatic sailing mode and click [Start Recording Button] to officially start the measurement operation.

4.6.2 Hydrographic surveys are carried out quickly

1 The unmanned boat is turned on, the remote control is turned on, and after waiting for 1-2 minutes, operate the remote control handle to check whether the motor is rotating;

2 After the connection is successful, the unmanned ship is launched, and the unmanned ship is manually controlled at full speed for 5 seconds to complete the initialization of the unmanned ship;

3 Then click "Hydrological Survey" to enter the project list interface;

4 Create a new project or open an old project to enter the main interface of the satellite map;

5 View self-test information, ADCP connection status, etc., and switch the flow velocity profile to full screen;

6 Click "Start Transmission" to see if the flow velocity graph shows whether there is a data output, ;

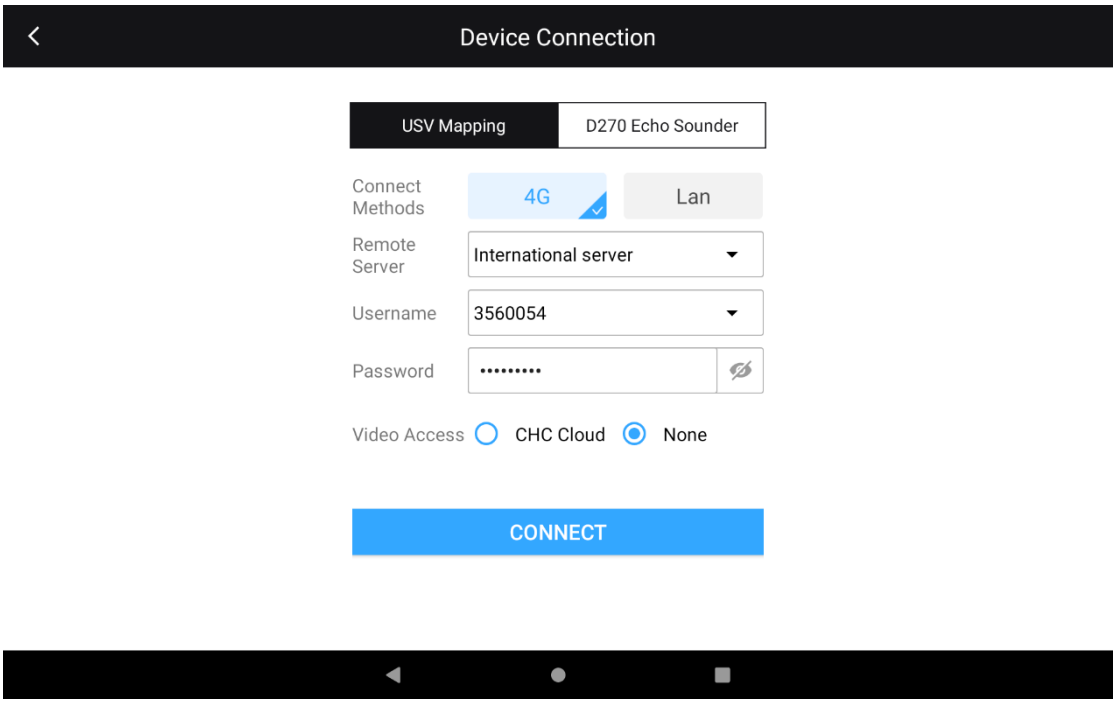
7 Plan the route and upload it;

8 When the unmanned boat travels to the target point, click the "Data Record" button to start recording the measurement data, and set the starting shore type and shore margin. When driving to the next task point, click the "End Recording" button and set the end type and shore distance to end the information collection of the current measurement

9 After recording 2 measurements, click the "Traffic Summary" icon to view the summary table and export the excel file

4.7 Device connection

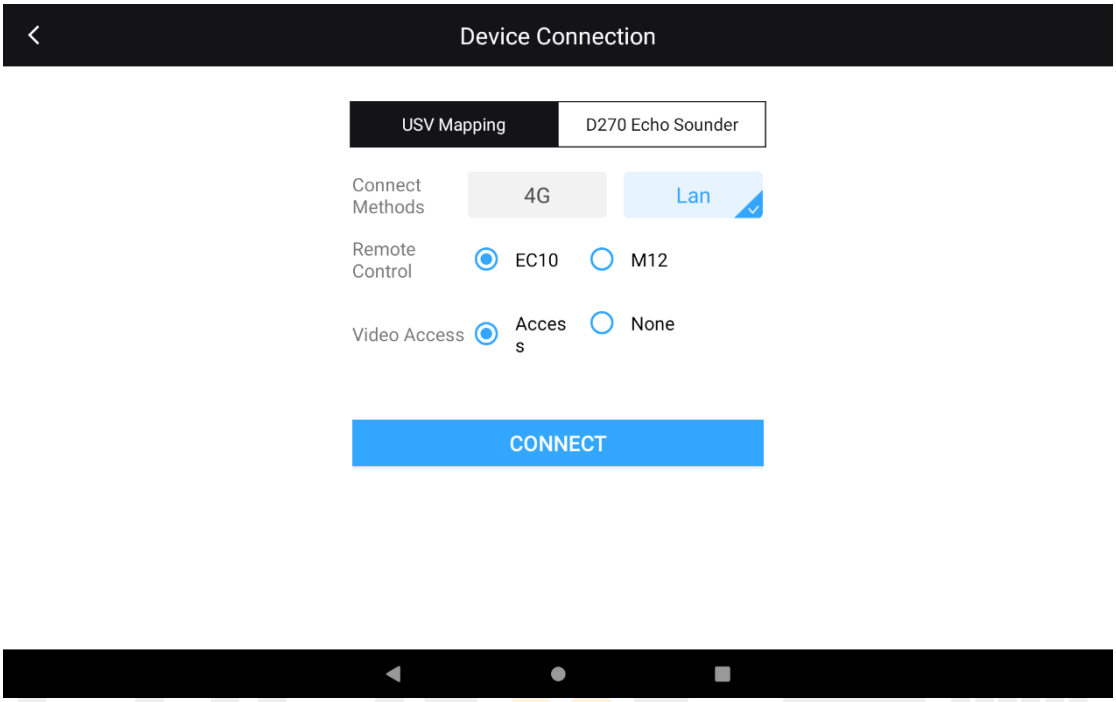
4.7.1Unmanned ship connection



USV connection-4G

4G Connection:

1. The remote control is connected to a 4G network, such as a mobile phone hotspot, to ensure that it can access the Internet normally;
2. Select the corresponding server, enter the SN number, password and other information, and click Connect.

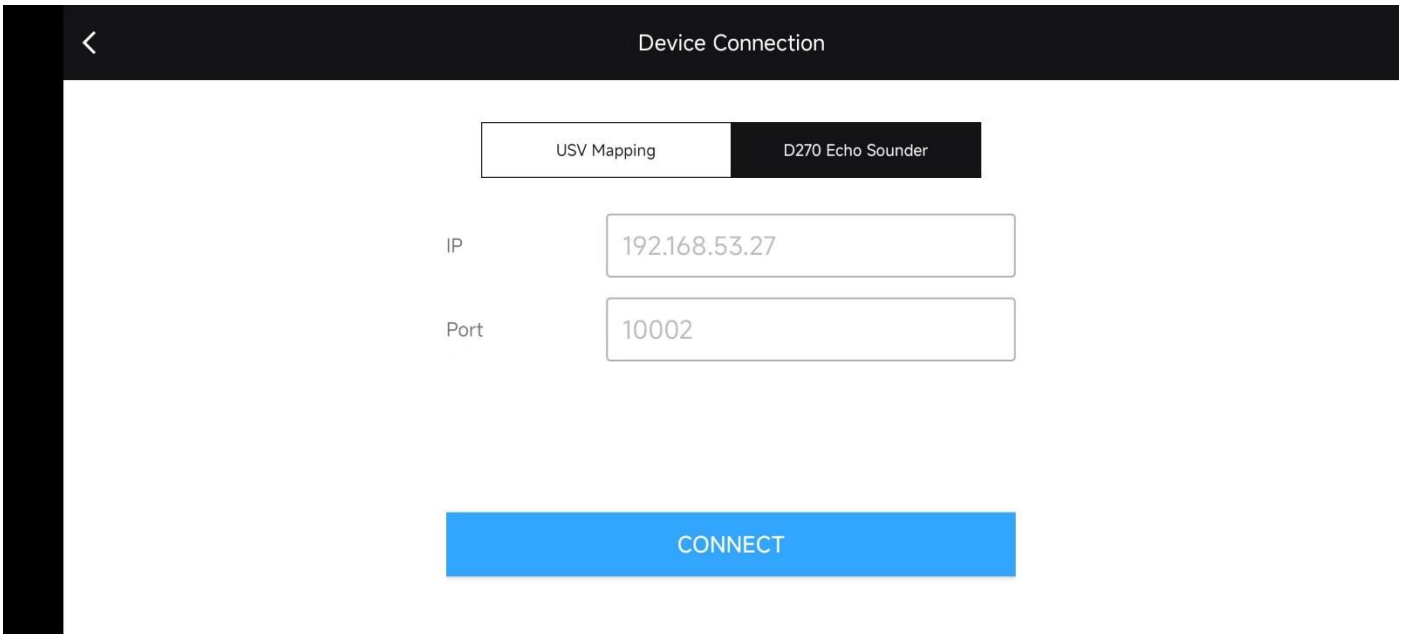


USV connection - data transmission

Data Transmission Connection:

1. If the current device is an EC10 remote control for Android, select the EC10 remote control type. Otherwise, choose M12 (need to connect to the wifi of the unmanned ship);
2. The remote control turns on the Ethernet switch, and the network segment must be 144;
3. Unmanned ships must be equipped with 2 RC antennas;
4. The 2 antennas on the remote control, to be upward, help to receive the signal;
5. In the straight direction of the unmanned boat and the remote control, there can be no blocking.

4.8 D270 connection



D270 sounder connection

1. Android device connected to D270 WIFI;
2. Just click the Connect button.

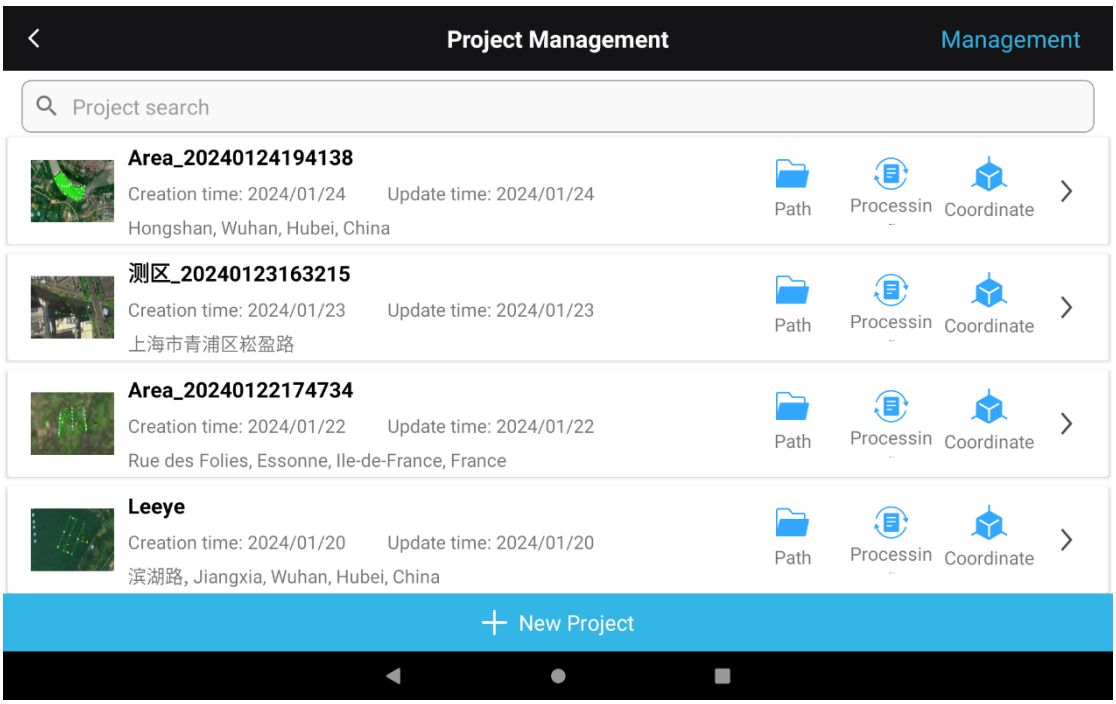
4.9 Hydrographic Survey-ADCP Connection

3. After connecting the unmanned ship, click "Hydrographic Survey", and the software will automatically connect to ADCP;
4. After entering the project, check the ADCP connection status, and if the connection is not successful, check whether the wiring is normal.
5. After checking the wiring, you need to manually click the "Launch" button to check whether the connection is successful. Or return to the above interface, click on the "Hydrological Survey" module, and reconnect.

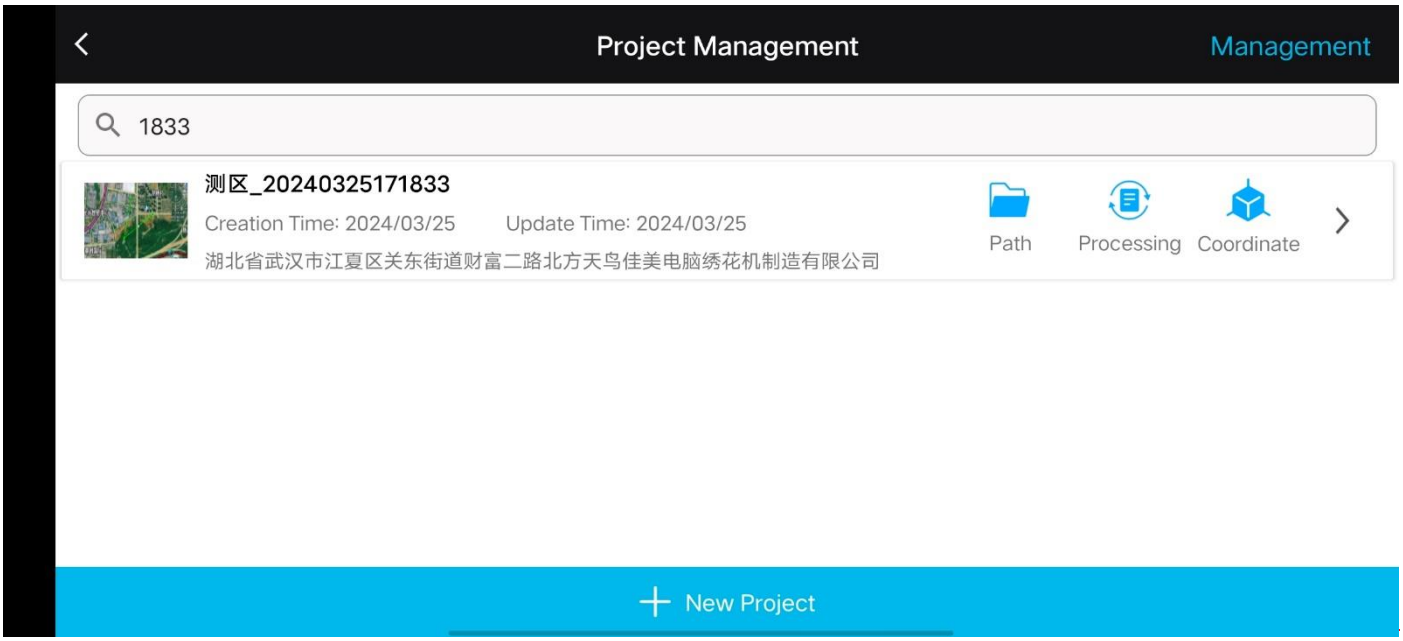
4.10project management

4.10.1 Basic engineering processing

The project management interface can display all the saved projects, click [Project Route] to enter the project management interface, the interface displays the list of all tasks that have been created, each route task label contains the name, route type, creation time, update time and operation location, click the label to open the route task, open the project to enter the map interface, you can enter the management mode through the [Manage] button, and multi-select/delete/copy/copy the project fileShare the action.



Search: When customers need to search for individual tasks, they can enter the name of the search box to search for the task, which supports fuzzy queries.



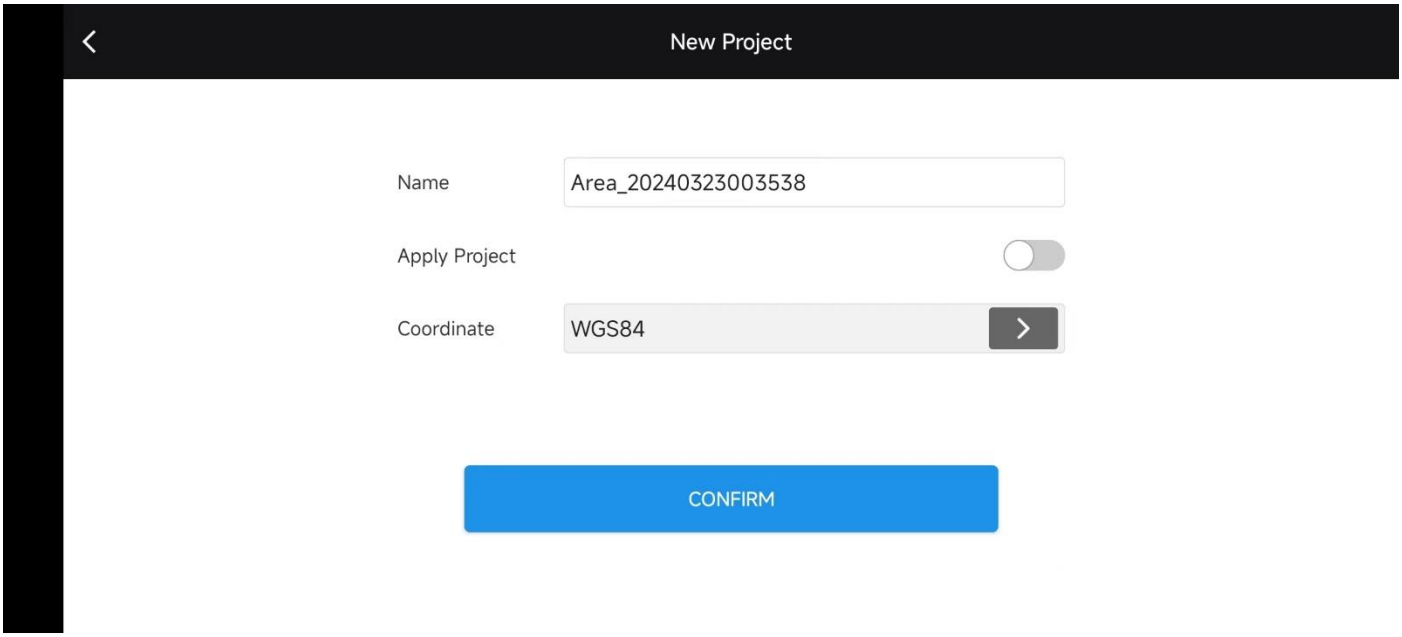
Copy and delete: By clicking [Manage], the task management will enter the copy and delete mode, and the create and import buttons below will become copy and delete, after selecting the task, click copy or delete to copy or delete the task, which can support multiple selection. When you're done copying or deleting, click Done to exit copy and delete mode.

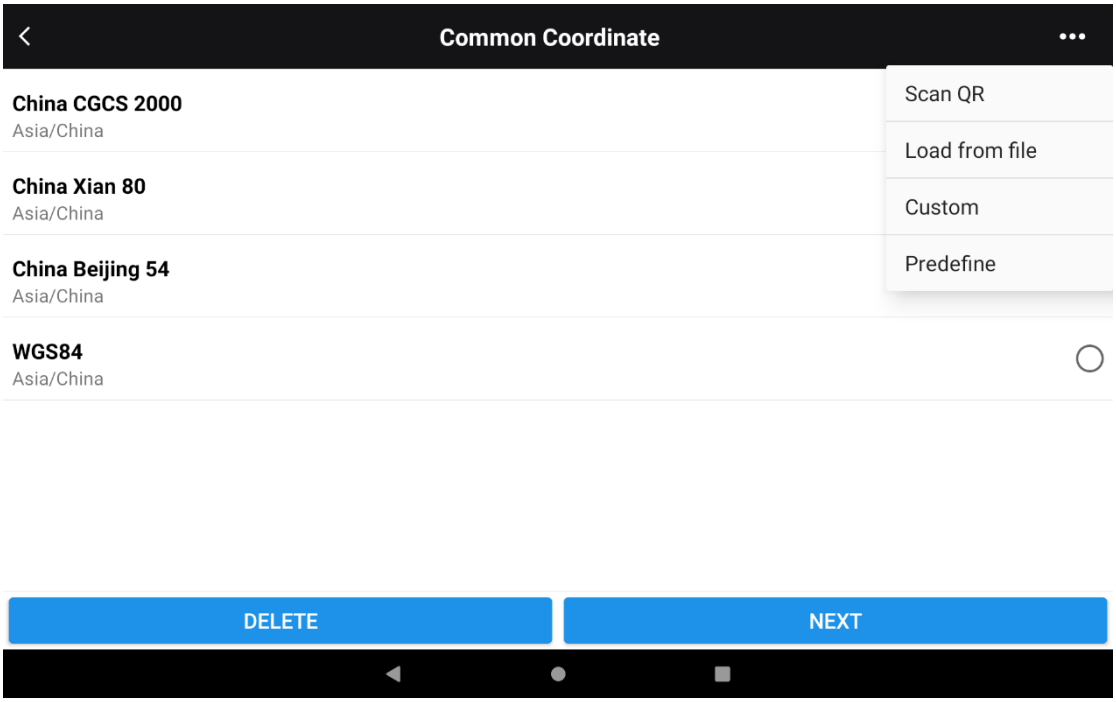
4.11Create a new project

4.11.1 Topographic survey of new construction

The steps of a new topographic survey project are as follows:

1. Click New Project to set the coordinate system, you can select the commonly used coordinate system, and you can select the saved common coordinate file in the Common Coordinate System interface, or you can delete the file
2. Scan the QR code: Scan the generated QR code to read the coordinate system parameters of other devices;
3. Customization: Enter the coordinate system parameters interface and set the coordinate system parameters according to your needs.
4. Predefined: Enter the predefined coordinate system interface, and select the required coordinate system according to the continent and region;
5. Import from File: Import a CRD or DC file to import a coordinate system





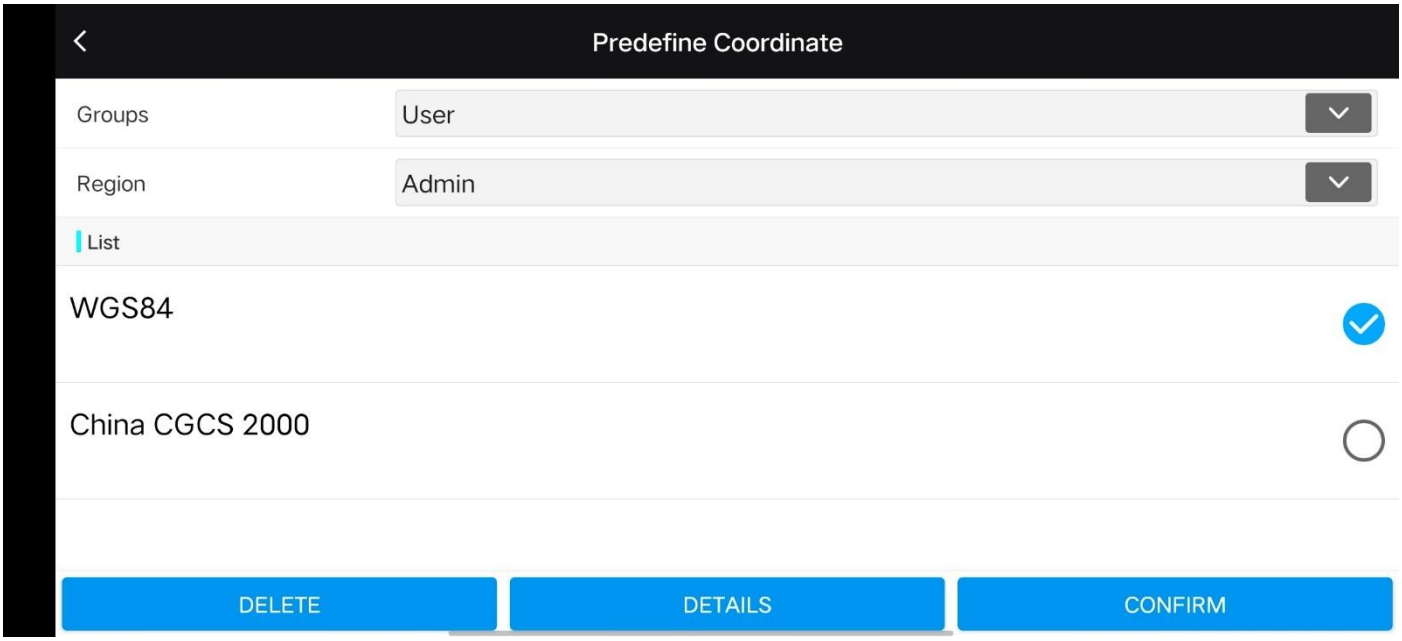
Common coordinate system interfaces

In the Common Coordinate System interface, you can select the saved common coordinate files, or delete the files.

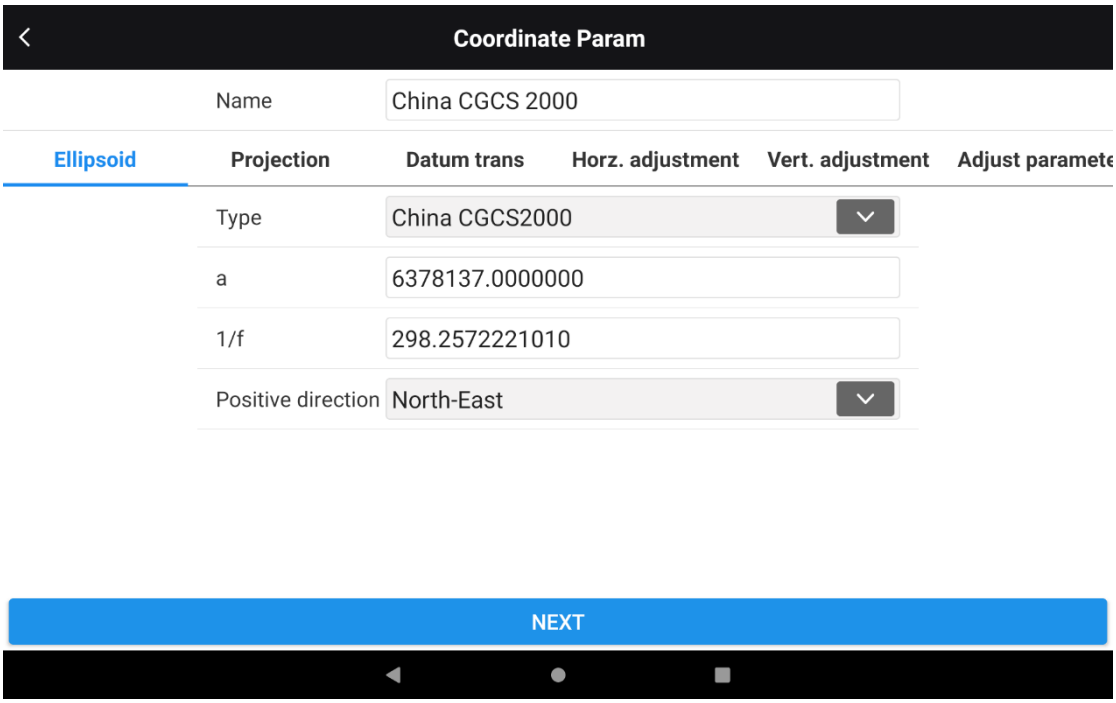
Scan the QR code: Scan the generated QR code to read the coordinate system parameters of other devices;

Customization: Enter the coordinate system parameters interface and set the coordinate system parameters according to your needs.

Predefined: Enter the predefined coordinate system interface, and select the required coordinate system according to the continent and region;



Predefined coordinate system interface



Custom settings for coordinate system parameters

The coordinate system parameter interface can be customized for the coordinate system, and the setting items are: ellipsoid, projection, datum conversion, plane correction, elevation fitting, and correction parameter setting, which can customize the coordinate system according to user needs;

Generate QR code: Generate a QR code for the currently set coordinate system;

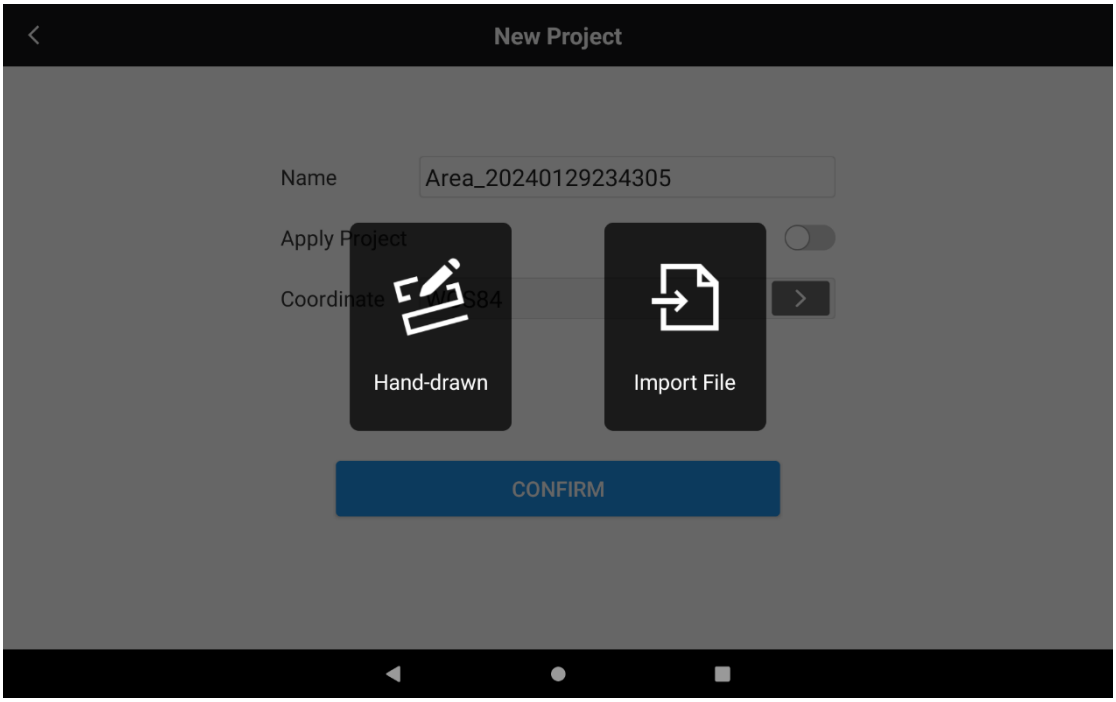
Scan the QR code: Scan the generated QR code to read the coordinate system parameters;

Load from Common Coordinate System: Enter the Common Coordinate System module, and you can directly select the commonly used coordinate system;

Save to Common Coordinate System: Save the current coordinate system parameters to the common coordinate system;

Import from file: import coordinate file from local directory to read directly, support file search;

Share the coordinate system: You need to log in to the CTI cloud account to share the coordinate system, generate a 4-digit sharing code, and use the CTI sharing code tool on the PC to read the shared coordinate system parameter file, and the sharing code is valid for 30 minutes;



New project: The new project supports two scenarios for route planning, namely, hand-drawn route and imported file.

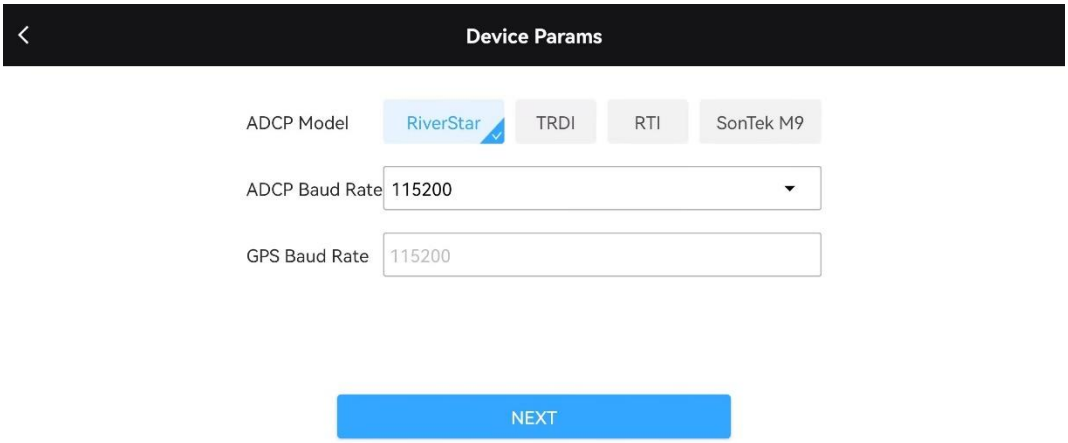
Import file: The current software import file supports waypoint files (*.). waypoints), polygon files (*.poly, *.kml, *.kmz, *.dwg, *.dxf) to create a route mission or polygon shape.

Notes:

The import file does not support too many waypoints (up to 500 points), the area is too large, any 2 points, greater than 10km, and cannot be generated.

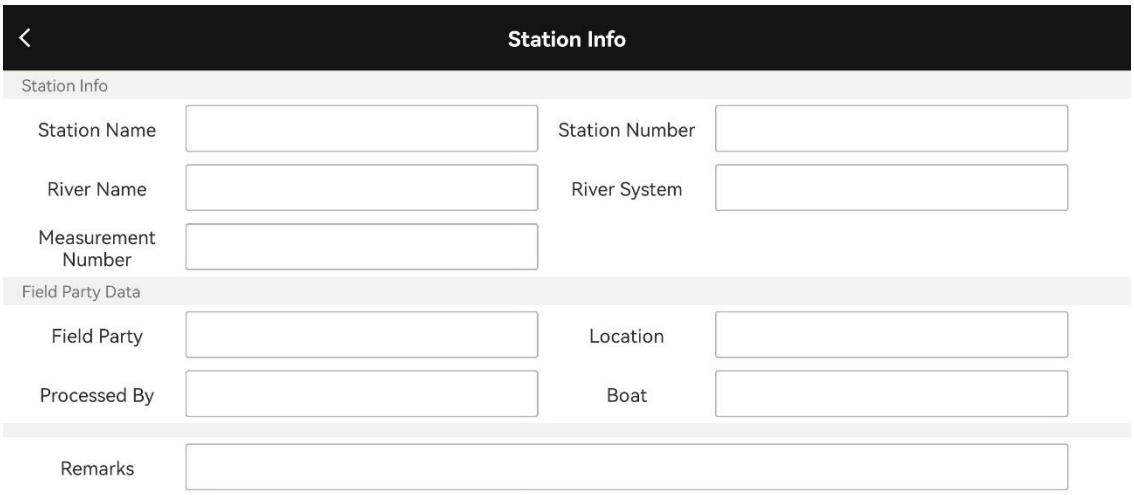
4.11.2 New hydrographic survey project

1. After connecting the unmanned ship, enter the hydrographic survey project management interface, and it will be automatically connected to ADCP.
2. Click the "New Project" button at the bottom. If the ADCP is not connected, the ADCP device parameter configuration page will be entered, and if it is connected, the site information page will be entered.
3. Connect to ADCP by setting the ADCP type, ADCP baud rate, GPS baud rate, and GPS network port parameters through the device parameter interface. If you select RiverStar as the ADCP model, click "Next" to enter the site information interface, and if you select other models, you will directly enter the topographic survey project.



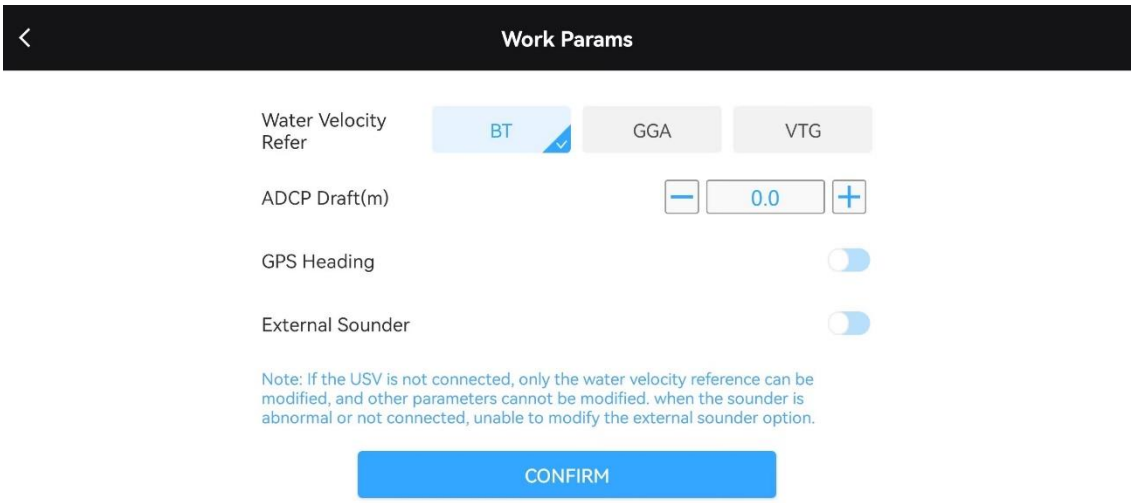
Device parameters interface

4. To enter the site information interface, you need to fill in the site name, station number, river name, water system, measurement unit, measurement location, operator, survey ship number and remarks information, after the information is filled, click "Next" to enter the working parameters interface.



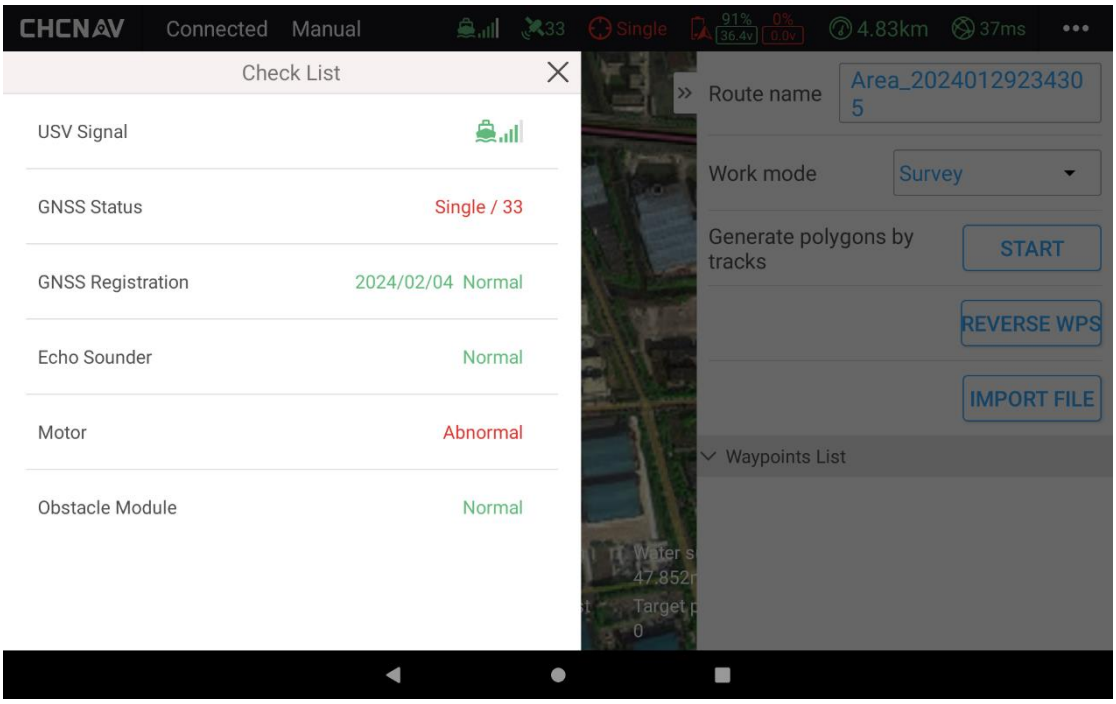
Site information interface

5. Enter the working parameters interface to set the working parameters of the ADCP, including flow rate reference, transducer draft, external compass, external compass offset, and whether to use an external sounder. After the work parameters are set, click "OK" to enter the map interface. In addition, it should be noted that if the unmanned ship is not connected, only the flow velocity reference can be modified, and other parameters cannot be modified. When the sounder is abnormal or not connected, the external sounder option cannot be modified.



Working Parameters Interface

4.12Device self-test



Device self-test interface

1. **Ship control 4G network signal:** real-time display of unmanned ship ship ship control network quality, >=95%, full grid (5 grids) display, >=95%, full grid (5 grids) display, >=85%, 4 grid display, >=70%, 3 grid display, >=60%, 2 grid display, >=50%, 1 grid display, other, 0 grid display.
2. **GNSS solution mode:** locate the solution state, including single point (red), floating (floating) and fixed (green) mode.
3. **GNSS registration:** if the expiration time is greater than or equal to 48 hours, it will display [Expiration Date + Normal], which means green, if the expiration time is less than or equal to 48 hours, it will display [Expire in 2 days + Expiration Date], which means yellow, and if the expiration time is less than or equal

to 24, it will display [Expire in 1 day + Expiration Date], which means yellow, and if it expires, it will display [Expired], which means red.

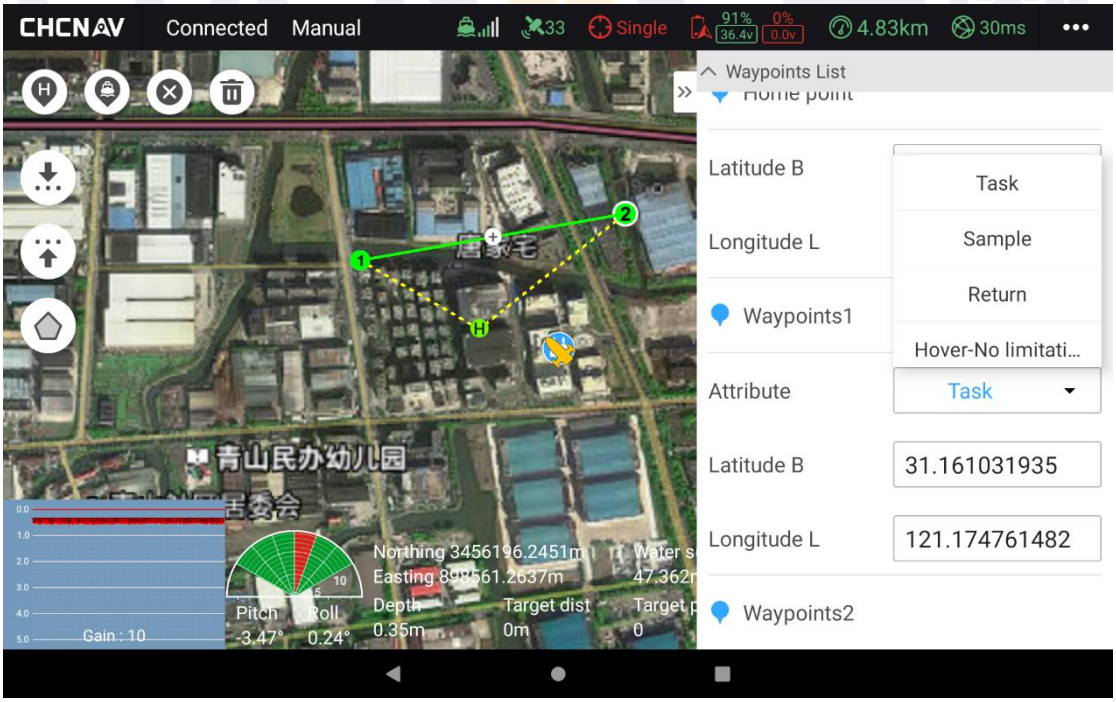
4. **Sounder :** Green display when the connection is successful.
5. **Motor:** green display when connected successfully, abnormal will be displayed for the first connection, push the longitudinal rod to check the wind direction and power of the motor, and then it will turn green.
6. **Obstacle avoidance module:** green display when the connection is successful.

4.13Route planning

4.13.1 Topographic survey, route planning

Hand drawn routes

At present, the operation steps of creating a new route are as follows: click the map once to generate a task point (generate a sample point during hydrological mode operation), click the map multiple times to generate the task point and confirm the navigation position and direction according to the order of clicking to generate, and you can add the mission point by dragging the [+] point on the route. You can also switch the task point properties [mission point (green), sampling point (purple), home point (red), hover point-unlimited (yellow), hover point-time (yellow), hover time can be set according to your needs] in the drop-down box of the route list point properties.



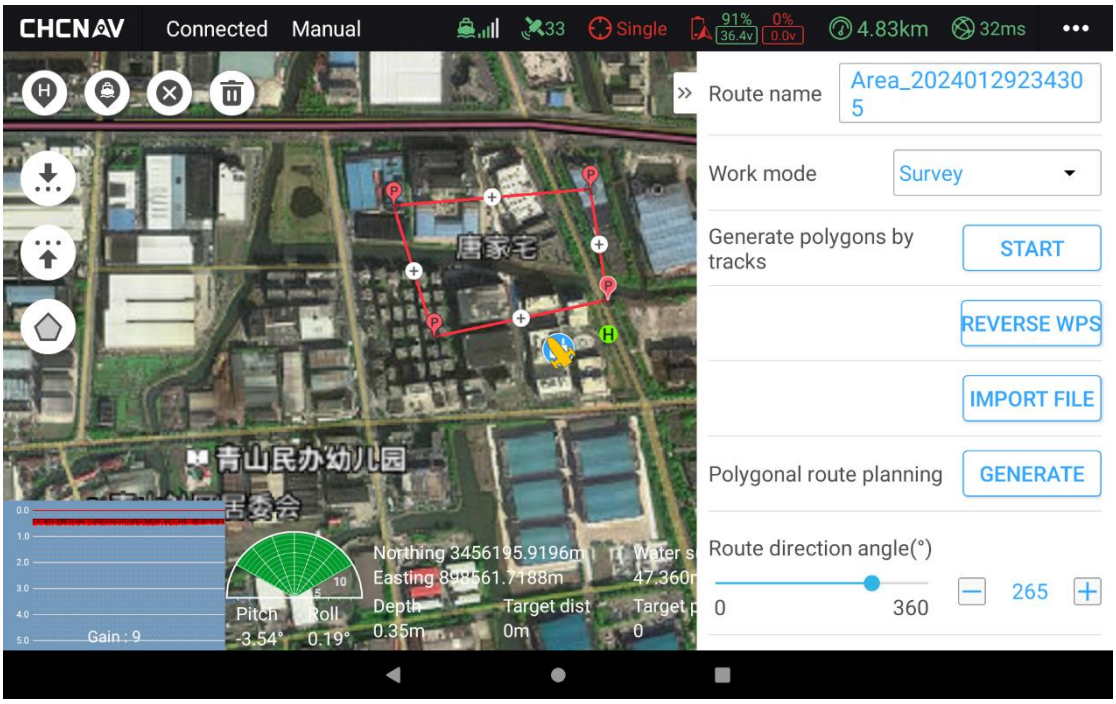
Point Properties

Notes:

Click the left button of [Waypoint List] to minimize the right side of the waypoint list value interface, and click the right button of [Bell] again to open the waypoint list again.

Polygon route drawing

The current logic of generating a route after creating a polygon is to click on the map once to generate a polygon boundary point, click three times in a row to generate a triangle, and click the map again to continue to add polygon boundary points. When the edit polygon button on the left is selected, you can move it by dragging and dropping, or you can delete the selected point (click to select the polygon point to delete the point, and click the single-point delete button).

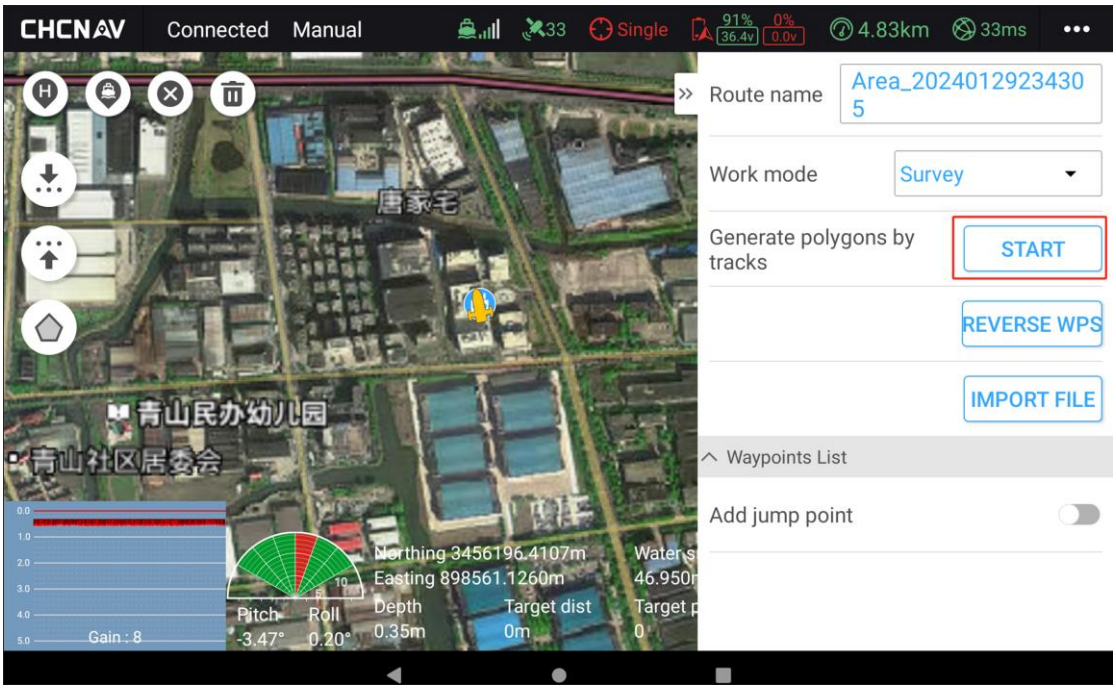


Polygon planning

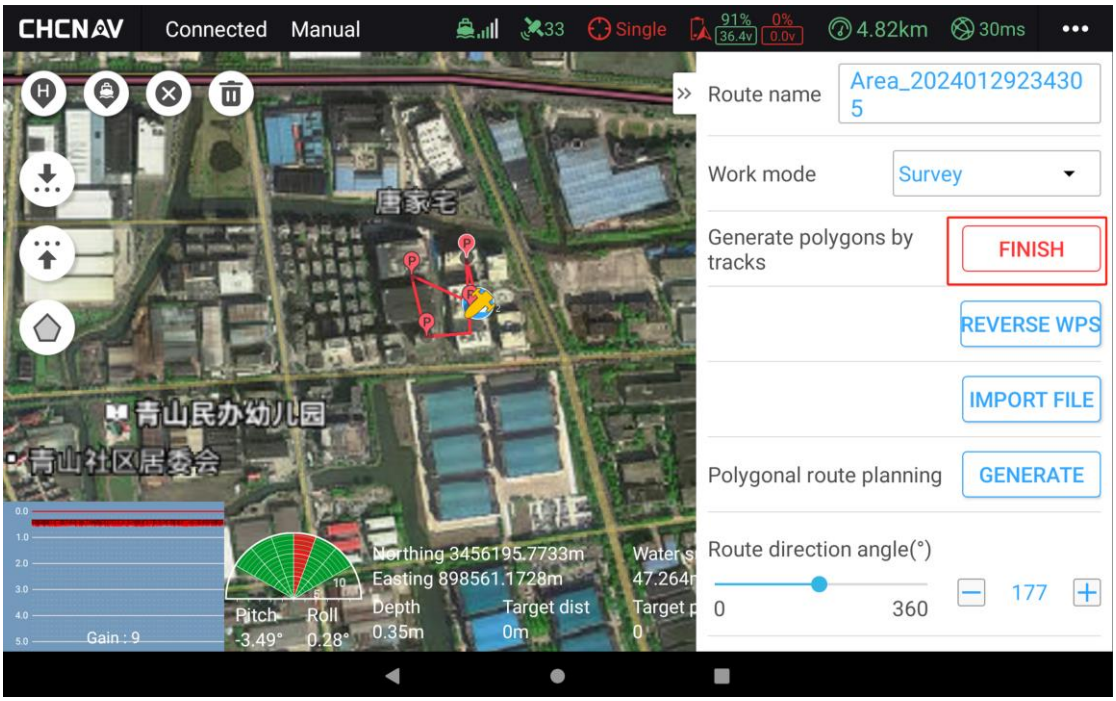
After confirming the polygon range, you can click the generate button on the right side to generate the default route. You can also modify the route by setting the route direction angle, route spacing, start point, and polygon expansion.

Tracks generate polygons

In the route editing mode, click the "Start" button on the right side of the trajectory generation polygon, and then manually control the unmanned boat to run a circle along the boundary of the survey area to automatically generate a closed polygon area.

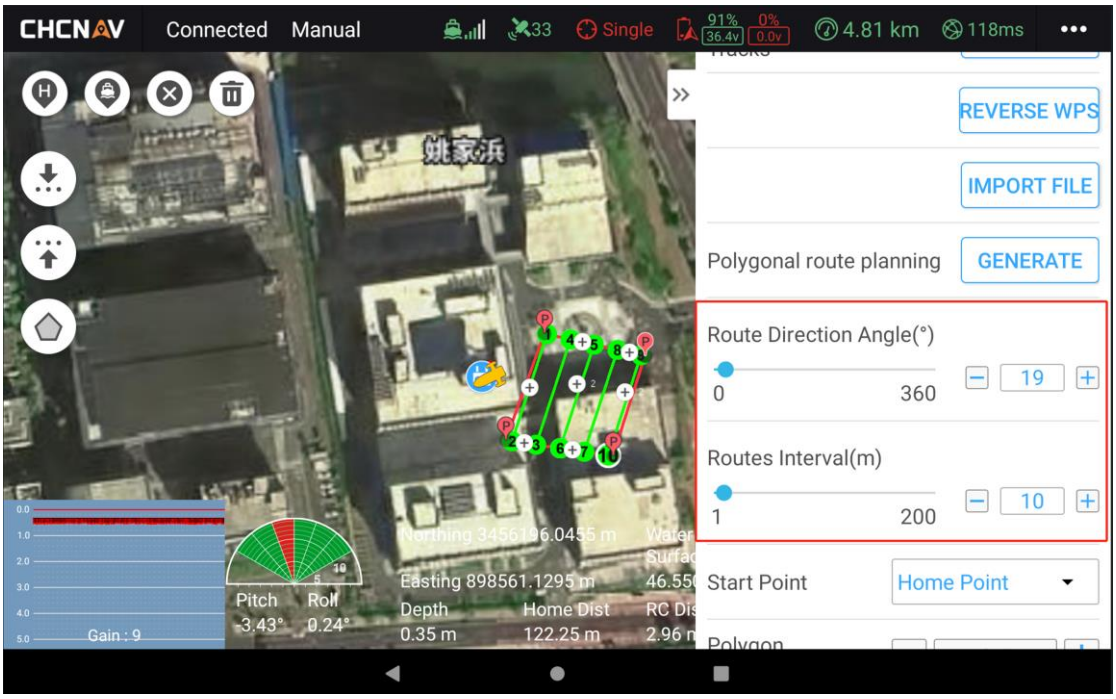


Trajectory Generation Polygon - Start



Trajectory Generate Polygon - End

Click the "End" button, then set the route direction angle and route spacing, and click the "Generate" button to generate a preset route within the polygon area.

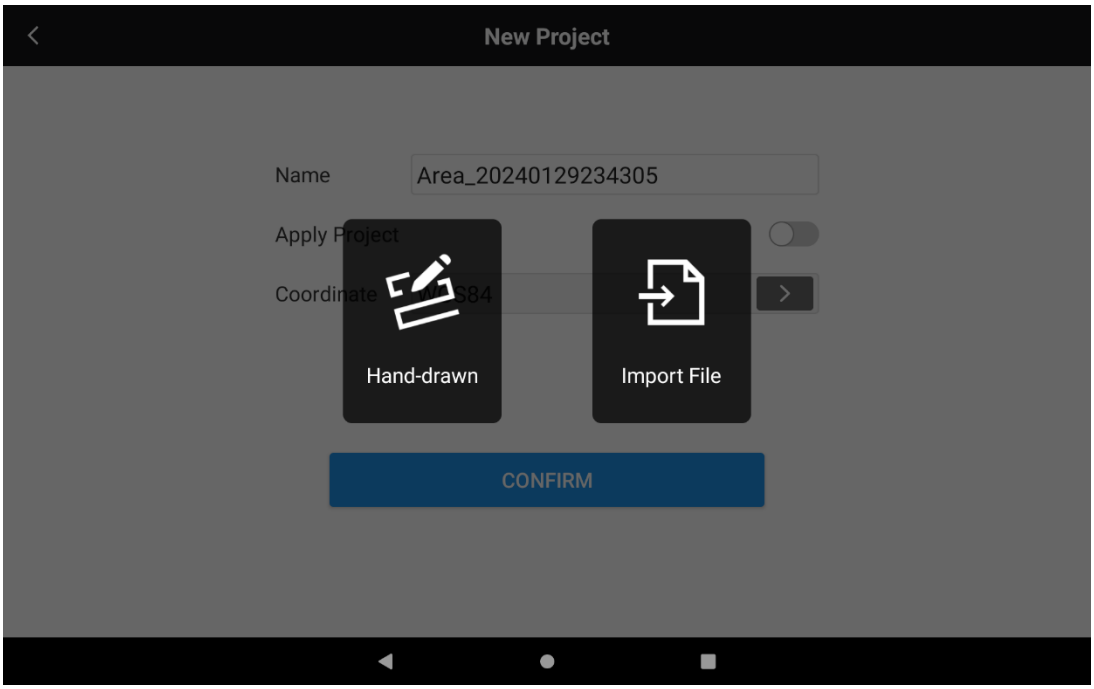


Adjust the direction angle/spacing of the route

Import the file

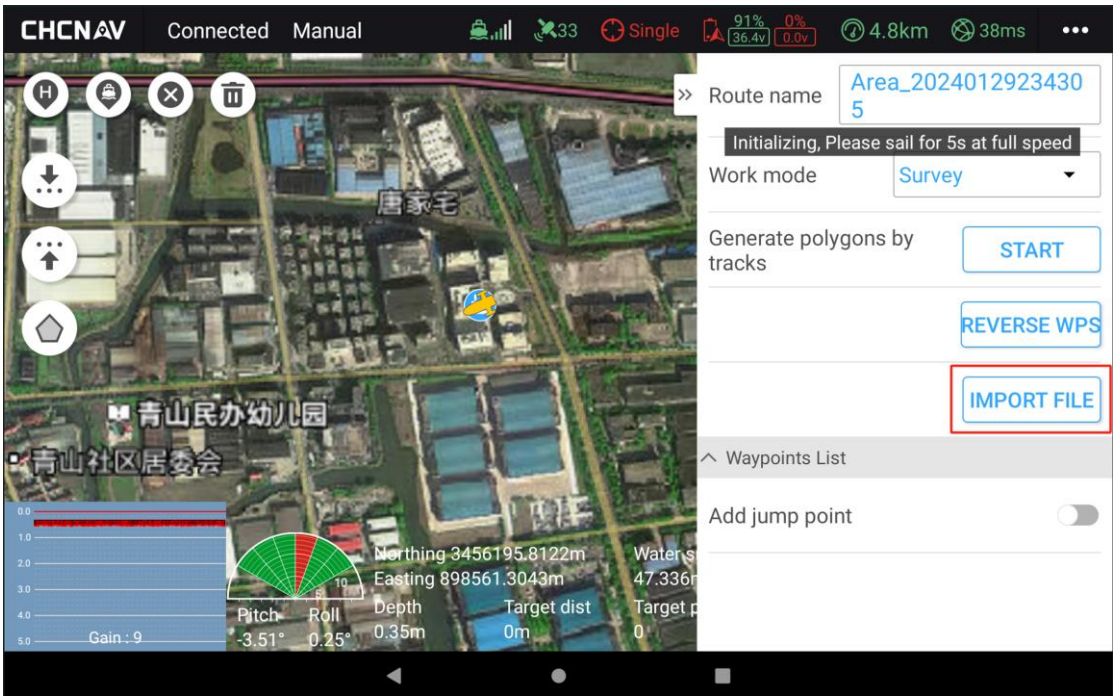
When creating a new project for the first time, select Import File, the current software import file format supports waypoint files (*.waypoints), polygon files (*.poly, *.kml, *.kmz, *.dwg, *.dxf) to create route tasks or polygon graphics;

⚠ Note: The import file does not support too many waypoints, and the maximum number of waypoints is 500.



Freehand drawn routes/import files

In addition, in edit mode, in the waypoint list on the right, click the "Import File" button to import the file.



Import files in edit mode

Route editing

1. Edit mode

   : Click to enter the edit mode, and you can draw waypoints.

2. Mark the Home point

: After entering the edit mode, click the button to switch to the selected state , and click the map again to generate the Home point.

3. Mark the point at the current position of the ship

: If the unmanned ship is connected and the software is in edit mode, click the button to generate a task point at the current unmanned ship location.

4. Delete a point,

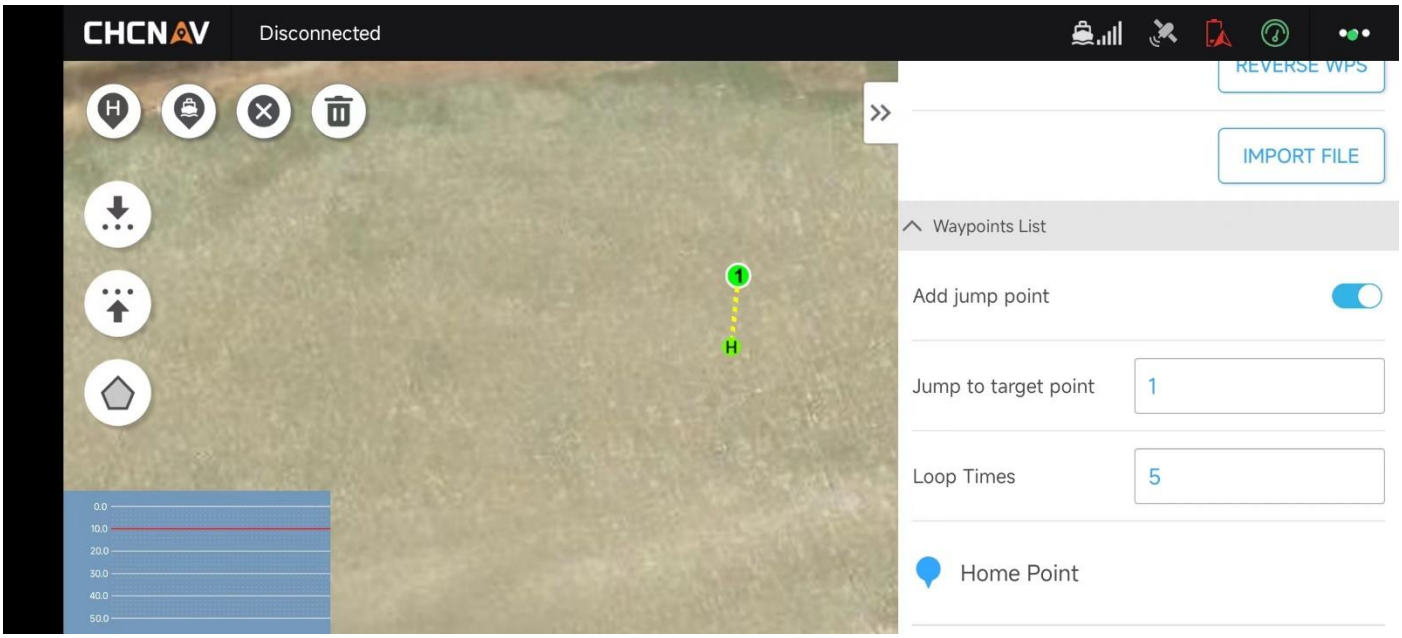
: After selecting a waypoint on the map or selecting a polygon boundary point in polygon drawing mode, the selected point is surrounded by a circle of white, and click the button to delete the point.

5. Clear all points

: Click to clarify all waypoints, polygon boundary points, home points, and jump points.

6. Add hop points

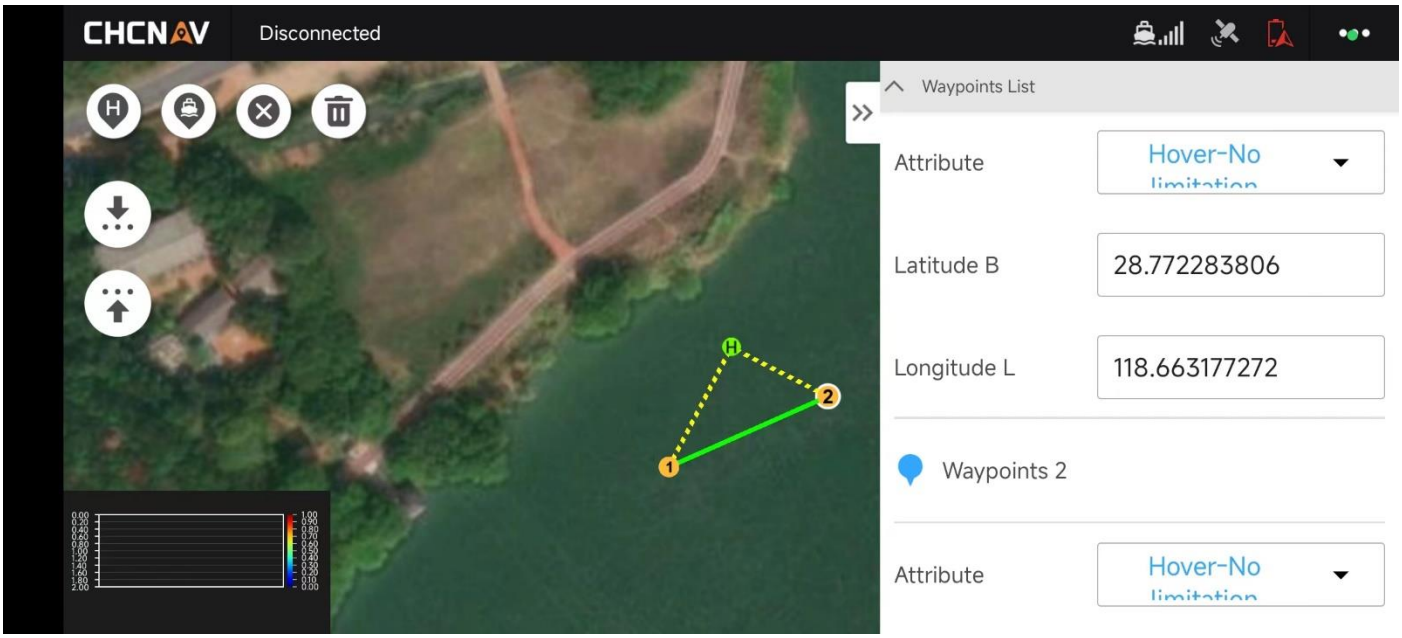
The hop point setting is located in the route list, and you can set its on-off state, and modify the starting point number and follow the number of rings.



Hop point information

4.13.2 Hydrographic survey route planning

The operation steps of the new route of hydrographic survey are as follows: click the map once to generate a hovering point, click twice to generate two hovering points, that is, a measurement, confirm the navigation position and direction according to the order of clicking to generate, and change the position by dragging the hovering point. The current operations on hover points include deleting one point and deleting all points, and you can also view the details of the points in the route list, and the waypoint properties are all hover points.



Hydrographic survey route planning interface

4.14Introduction to the use of interface tools

4.14.1 Topographic Survey Main Interface

Press and hold the icon to display the function information of the current icon.

The map is displayed in the sailing state

1. [Sailing to Home Point]: After clicking, the unmanned ship switches to the return state, and automatically sails to the set Home point;

2. [Sailing here]: After clicking the button, switch to the selected state  , click on the map, and the G-point will be generated, and the unmanned ship will switch to the guided mode and drive towards the G-point, and click the map again to change the location of the target point. Click the [Sail Here] button again and switch to unselected to turn off the navigation guidance setting, but the unmanned ship will complete the last guidance task.
3. [Set Target Point]: Click this button to display the current task point list in a drop-down manner, select the corresponding mission point number, and the unmanned ship will sail to the numbered position (Note: you need to switch to automatic mode).
4. [Next Target Point]: Click this button to sail the unmanned boat to the next target point.
5. [Remission]: Click this button to return to point 1, start the mission again, and sail from point 1 to the last mission point.
6. [Start/End Record]: Click this button to start/end the recording data, and the [Record Number] information below will display the number of the recording point in real time.
7. [Edit/Save Route]: Create a new project, enter the map interface, and at this time, it is in the edit route mode, and the user can operate the route (draw waypoints, delete waypoints, upload, download, etc.). Then click the button to save the route. After the route is saved, the measurement operation can be started normally.
8. [Map Settings]: Click the Change button to set map tracking and map rotation
9. [Layer]: Click this button to display the layer options, including Route Route and Record Point, which can be manually checked and canceled. If you cancel it, you won't be able to see the corresponding layer information on the map.
10. [Ruler]: Click the button to select it. At this time, you can click any 2 points on the map to see the record and direction angle between the 2 points in real time. Click the button again to cancel the display.
11. [Bell]: The real-time message will automatically pop up and display. There are two kinds of real-time messages: one is long-standing, such as system initialization, full speed navigation 5s, this message must be processed to automatically disappear within 5s, if you ignore it all the time, the message will always exist. The other is a temporary prompt, which will automatically disappear within 5s after popping up, such as [Shoal alarm, please drive away from the area]. Disappearing messages will appear in the bell message list. The list of messages can pop up by clicking the bell button, and if you want to close the list, you can click the bell button again.
12. [Auto/Manual Switching]: Toggle between automatic and manual sailing modes.
13. [Hover/Dishover Switching]: Toggle the hover and unhover modes.
14. [Real-time message]: Real-time message will automatically pop up. See No. 10.
15. [Suspension Joystick]: Control the throttle and direction of the unmanned ship. In the general settings bar, you can set the display and shade. This stick can only be displayed after the route has been saved.

16. [Sounder Waveform View]: Real-time display of the sounder waveform chart.
17. [Millimeter-wave radar view]: Real-time display of the angle and distance of obstacles ahead. Below is the sailing attitude of the unmanned ship: pitch and roll.
18. [Common sensor information column]: latitude and longitude, earth height, speed, water depth, target point distance, target point, record number.
19. [Camera]: Real-time preview of camera image transmission.
20. [Connection Status]: Displays the connection status of the current device in real time.
21. [Sailing Mode]: Displays the navigation mode information of the current unmanned ship in real time.
22. [Unmanned ship 4G signal]: Real-time display of the current 4G network signal quality of the unmanned ship.
23. [Star Search]: Real-time display of the number of GPS star searches.
24. [GPS solution state]: single point, inertial navigation, floating, fixed.
25. Battery level: Remaining power and battery voltage.
26. [Mileage]: The remaining power of the current battery and the mileage that can be supported.
27. Latency: The quality of the network communication connected to the current device. Unit-millisecond. If the network is within 300 ms, the network is good. 300-600ms, indicating network fluctuations, communication quality is average. If the network quality is higher than 600 ms, the network quality is poor.
28. [Device Setup Module]: Click this button to pop up a device setup interface, including record control, sounder settings, ship control settings, system settings, CORS login, GNSS registration, and general settings.

4.14.2 Hydrographic Survey Main Interface

As you can see, some of the interface tools are the same as topographic surveys, and the different interface tool parts are marked out in the image below.

1. [Site Traffic Measurement Information]: Click this button to pop up the test task panel, where you can view the test task and the measurement information under the currently selected task, and you can create a new test task.

Notes:

a. Don't reuse the same quiz task. For example, if you go to test the stream today, create a new test task. If you go to test the stream again tomorrow, create a new task.

b. After creating a new task, you can open this panel to view the recorded measurements during the data recording process. Once you've reviewed it, you can click "Continue to quiz".

---

2. [Switch Flow Rate Reference]: Click this button, the flow rate reference will be switched between bottom tracking, VTG, and GGA, and the icon will be displayed as the current flow rate reference.
3. [Traffic Summary Table]: Click this button to enter the traffic summary interface, where you can view the traffic summary table, traffic results table, measurement test record table, and share and export. You can view and export the traffic summary information of historical test tasks.
4. [ADCP Transmit/Stop]: Transmit or stop ADCP, start and end flow velocity measurement.
5. [Data Recording/Stopping]: Record and save the test data.
6. [Flow velocity amplitude map]: Realize the display of depth information and flow velocity information of the river bottom during the navigation of unmanned boats.
7. [Common sensor information column]: speed, heading, flow speed, flow direction, water depth, current

level, total flow, starting shore.

8. [ADCP Connection Status]: displays the connection status of the current ADCP in real time.

4.15Parameter settings

4.15.1 Hydrology - working parameter settings

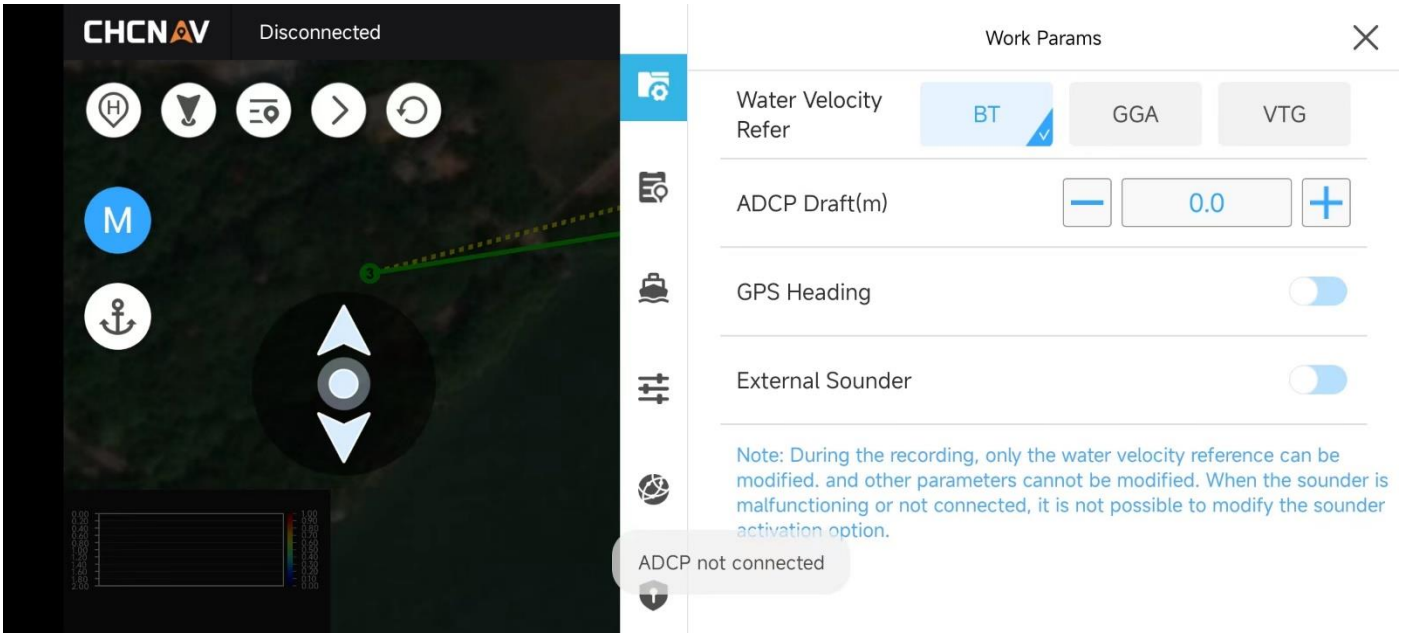
The working parameters of the ADCP can be set on the working parameter setting page to calculate the flow information. The working parameters can be manually set for flow rate reference, bottom tracking, GGA, VTG, transducer draft, whether to enable external compass, external compass offset, and whether to connect external sounder. The setting takes effect in real time, and after setting, you can view the corresponding flow velocity amplitude map change in the lower left corner of the map. In addition, during the data recording process, only the flow rate reference can be modified, and other parameters cannot be modified. When the sounder is abnormal or not connected, the external sounder option cannot be modified.

Flow rate reference: After the ADCP is successfully connected, you can manually switch between bottom tracking, GGA, and VTG.

Transducer draft: can be entered manually, in meters.

Outer Compass: When the outer compass is enabled, manually enter the offset of the outer compass.

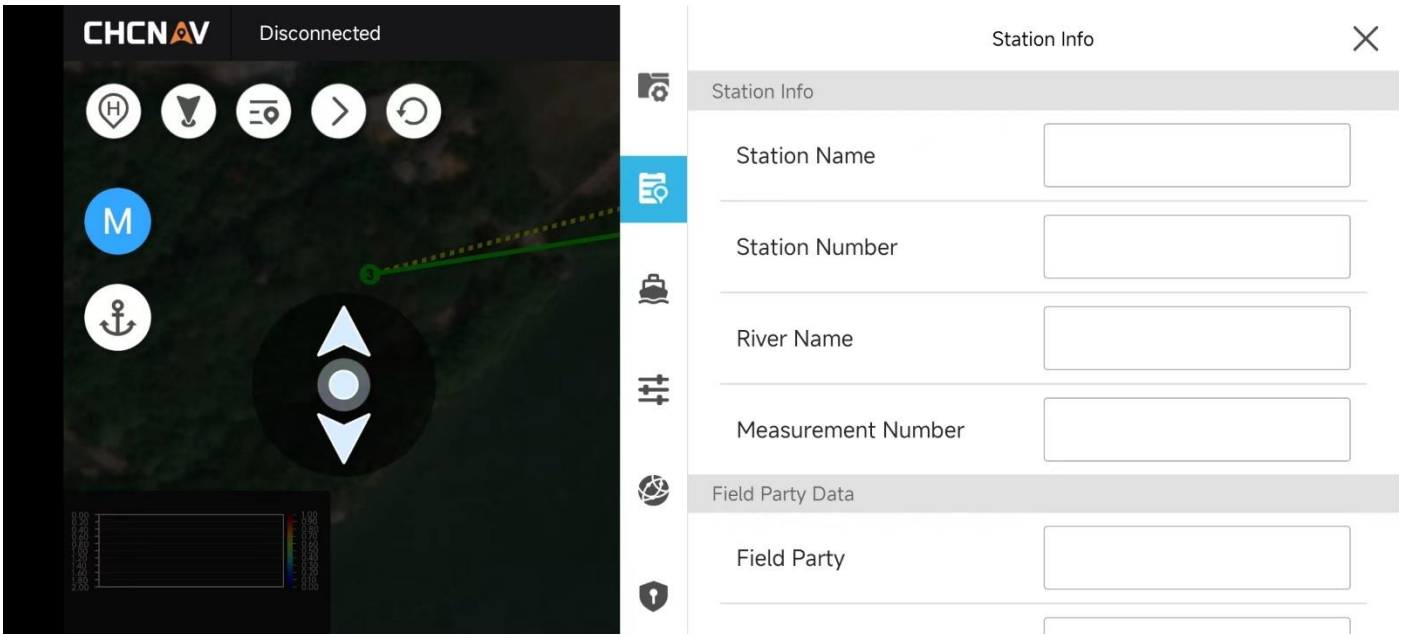
External sounder: When the external sounder is activated, the bathymetric data measured by the sounder is obtained, and when it is turned off, the bathymetry data measured by the ADCP is obtained.



ADCP working parameter setting interface

4.15.2 Hydrology - Site Information Settings

The Site Information Settings screen is used to set the details of a hydrological test item. You need to manually enter the relevant information of the site, including the station name, station number, river name, and measurement unit information, including the measurement unit, measurement location, operator, survey ship number, water system, and remarks information.



Site information settings screen

4.15.3 Terrain - Record control

Set the recording control parameters, and the data recorded in real time is recorded according to the current settings.

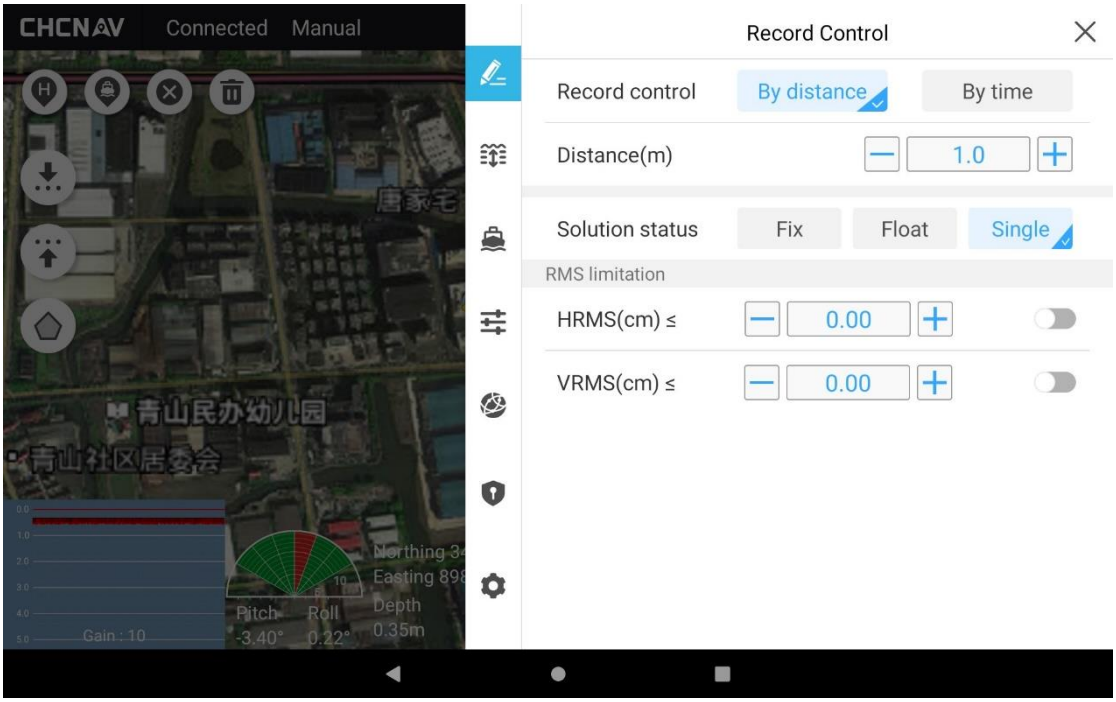
For example, if you record 1m according to the distance, the data recorded in the DEP file is 1m to record a point.

Solution Status: Select Fixed - Only the fixed solution and inertial navigation solution data will be recorded;

Select Float - only record fixed, floating and inertial navigation solution data;

Select Single Point - Record all data (fixed, floating, differential, inertial navigation, single point)

RMS Limit: Records RMS data that meets the set conditions.



4.15.4 Terrain - sounder settings

Set the sounder parameters, and manually set the range, gain, sound velocity, and depth filtering.

The setting takes effect in real time, and after setting, you can view the corresponding waveform changes in the lower left corner of the map.

Draft: If it is connected to an unmanned ship, the draft is bound to the ship type and cannot be manually modified. If the D270 is connected, it can be manually modified.

Sound velocity: can be manually entered, and both temperature and salinity can be used to calculate the sound velocity value.

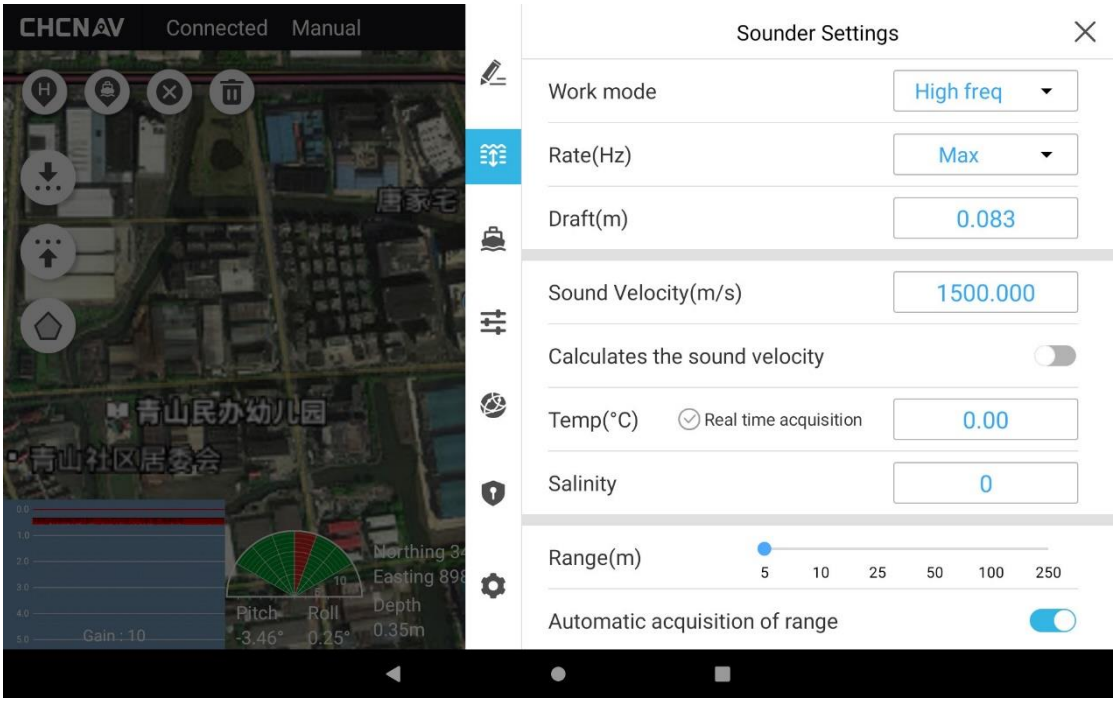
Salinity: Can be entered manually. Unit: thousandths

Temperature: Manual input or real-time acquisition of D270 sounder temperature sensor data.

Range: Support manual and automatic, and the current water depth range can be set.

Gain: Supports manual and automatic, and can set the sonic intensity of the current sounder transducer.

Depth Filtering: Filters clutter and noise data outside of range.

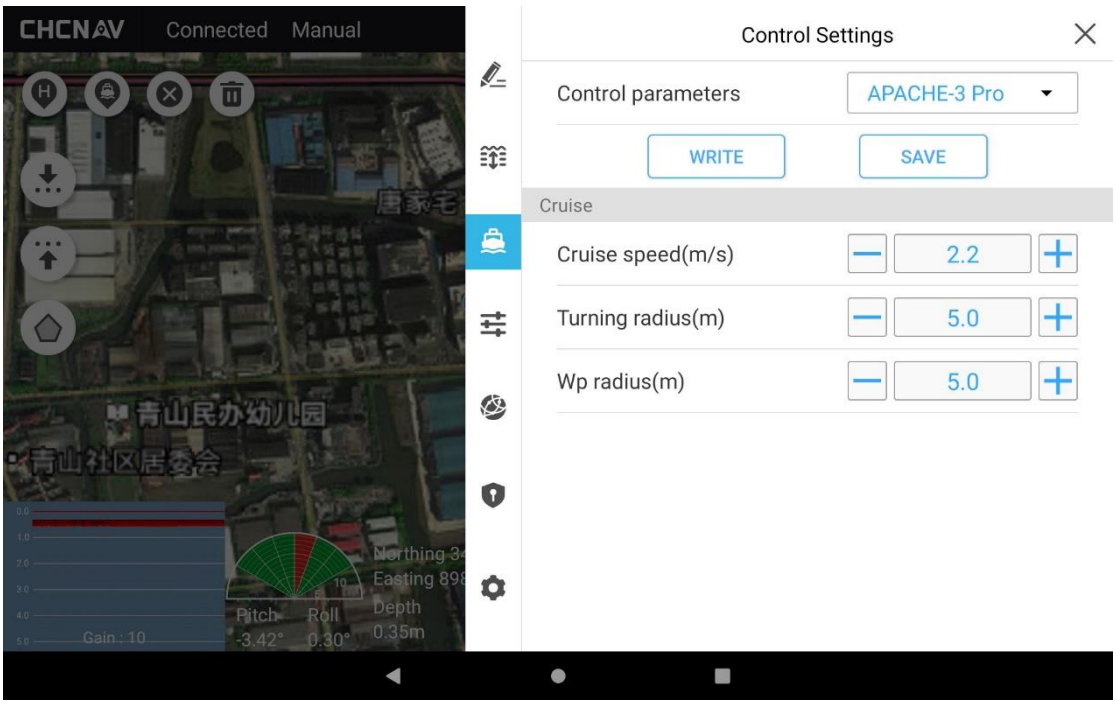


4.16Generic - Ship Control Setup

a Write Parameters: The drop-down list displays the name of the ship type parameter file (*.param), select the corresponding ship type name, and click [Write].

b Save parameters: Click the save button to save the current ship control parameters in a custom file (*.param).

c Ship control parameter setting: Click + or -, you can set the ship control parameters in real time, and support manual input. Takes effect immediately.



4.17General - System settings

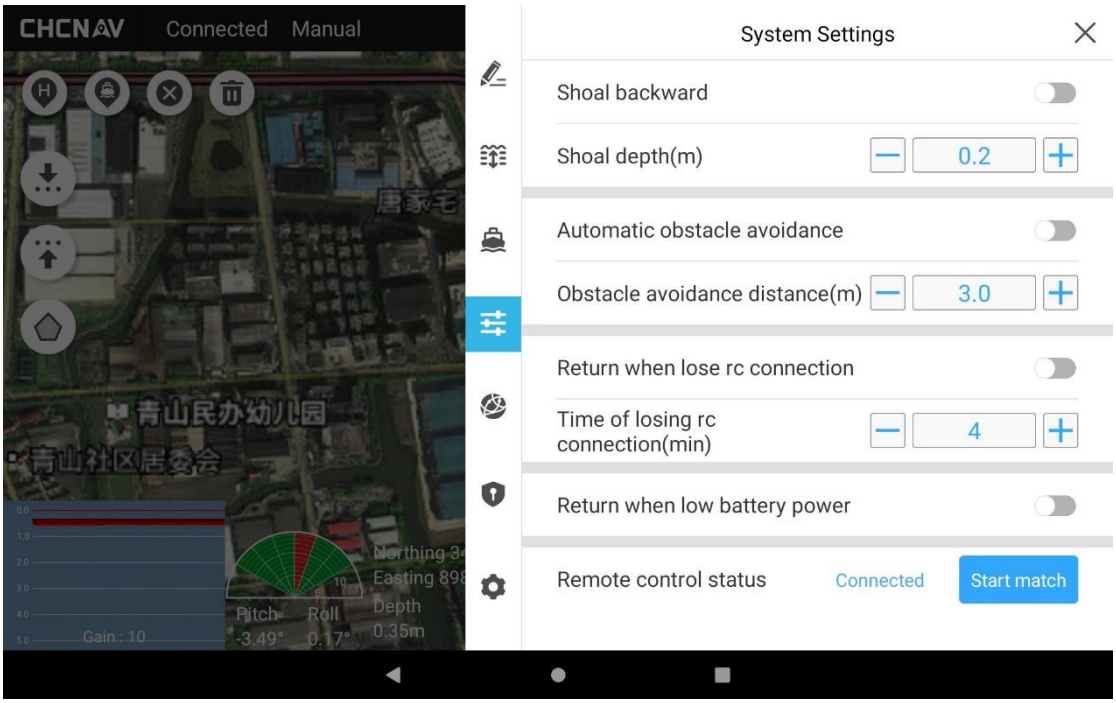
a Shoal retreat: Function switch, turn on this function, after the unmanned boat enters the shoal, it will automatically retreat and sail away.

b Automatic obstacle avoidance: function switch, turn on this function, the unmanned ship will automatically detour or stop when it finds an obstacle ahead.

c Lost contact return: function switch, turn on this function, once the remote control is disconnected (the distance between the remote control and the unmanned ship is far), after a period of time (lost contact time), it can automatically return home.

d Low battery return: function switch, turn on this function, if the battery power is low, the unmanned ship will automatically return home.

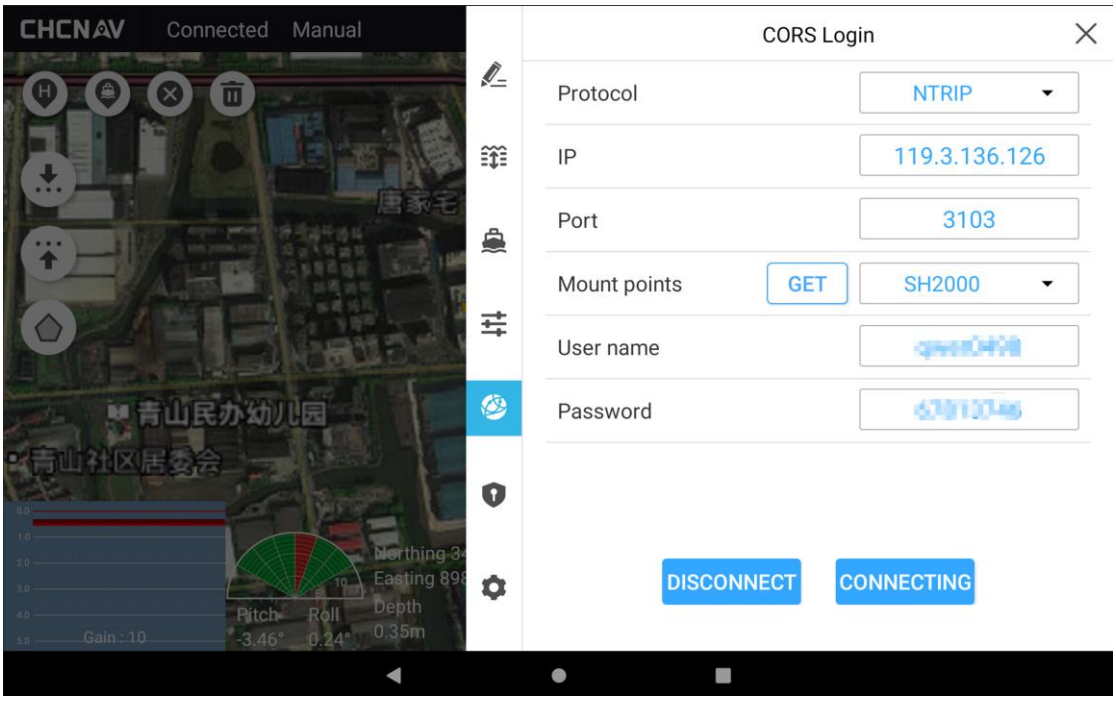
e Remote control pairing: After the remote control is turned on, if it is not paired with the boat. This button can be used to match the remote control.



System Settings Interface

4.18Generic -CORS login

On this page, you can view the login status of the current CORS. You can also manually enter parameter information to log in to CORS



CORS login interface

In the connection protocol section, you can drop down to select the SWAS built-in account, and click Connect directly.

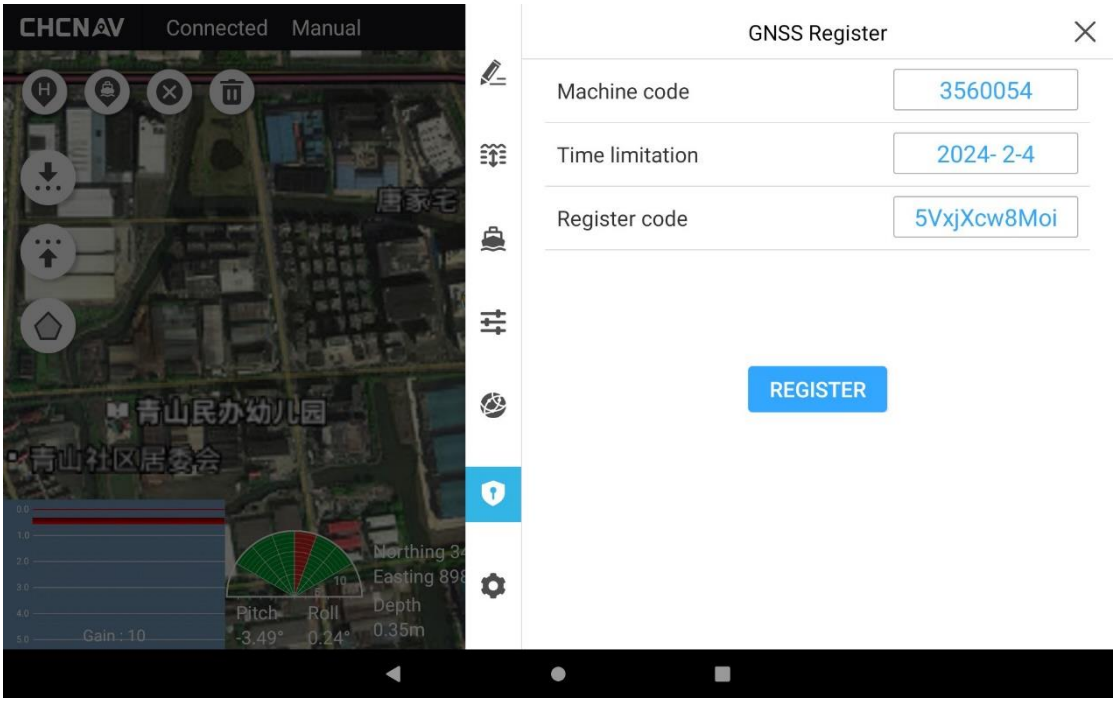
SWAS login interface

4.19Generic - GNSS registration

It can display the SN number, GNSS registration period, and registration code information of the current unmanned ship.

If GNSS expires, you can contact the technical application for a registration code, and then enter a new

registration code at the registration code position in the figure below, and click the registration button to complete the registration.



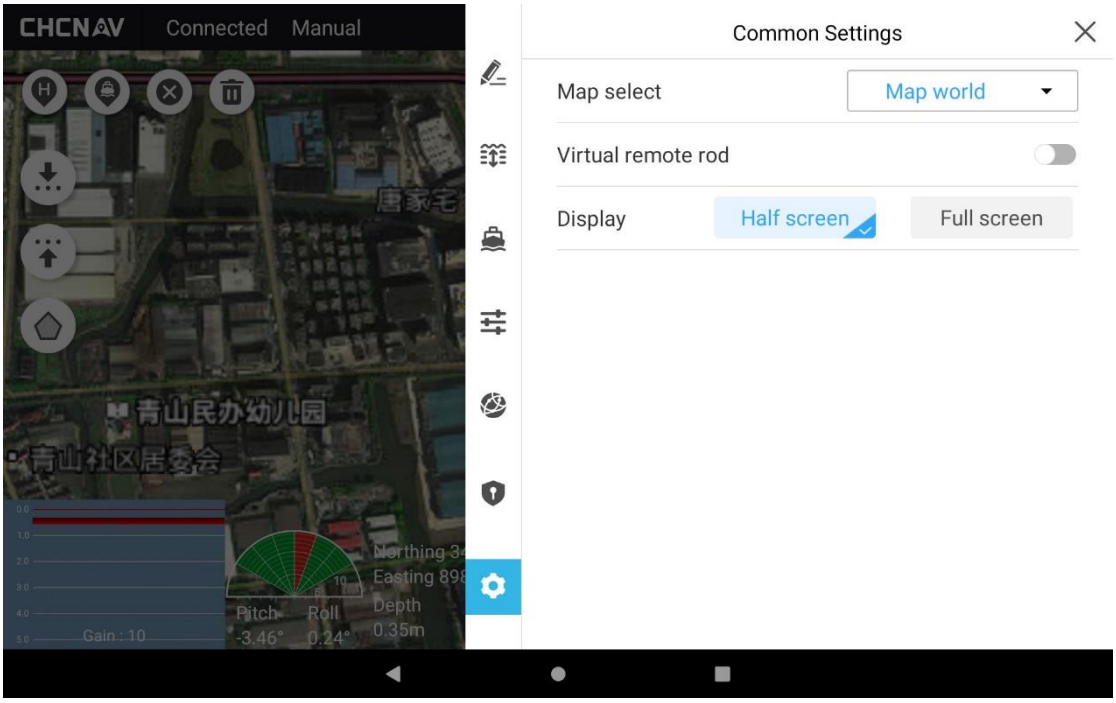
Registration code interface

4.20General - Map/Boom Settings

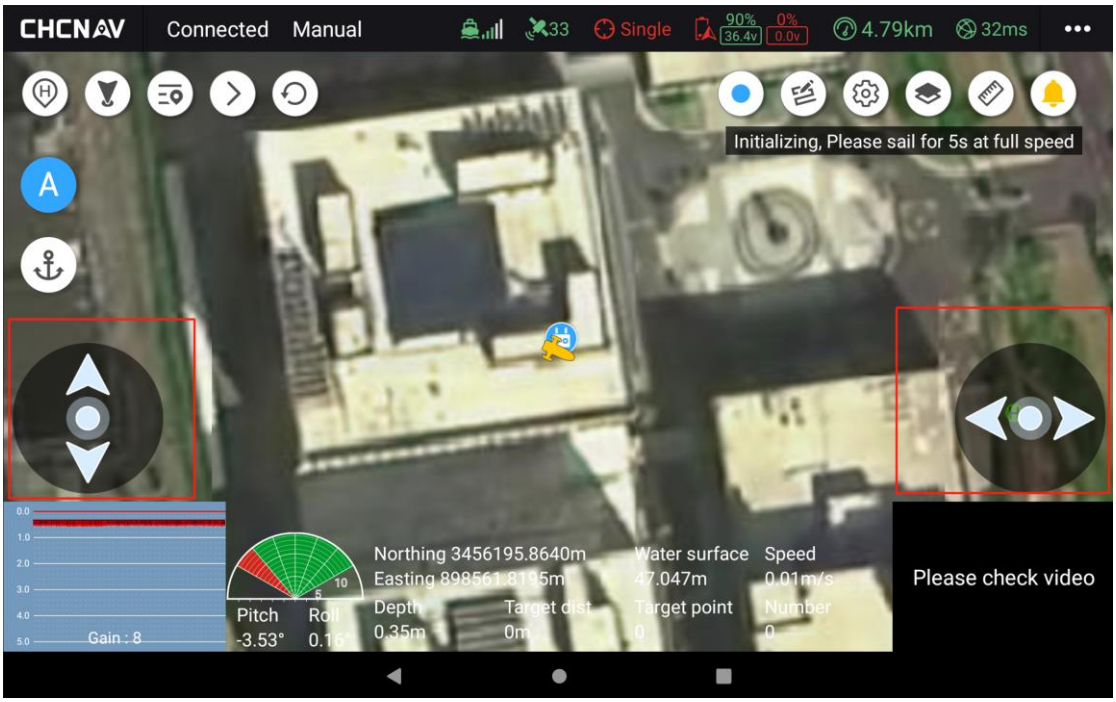
Map source: Support day map and ArcGIS and customization.

Virtual Stick: Set the display and hiding of the virtual joystick. It will only appear after the project is saved.

Display: View switch between map and video perspectives. Whether each switch is full-screen or half-screen.



General settings interface



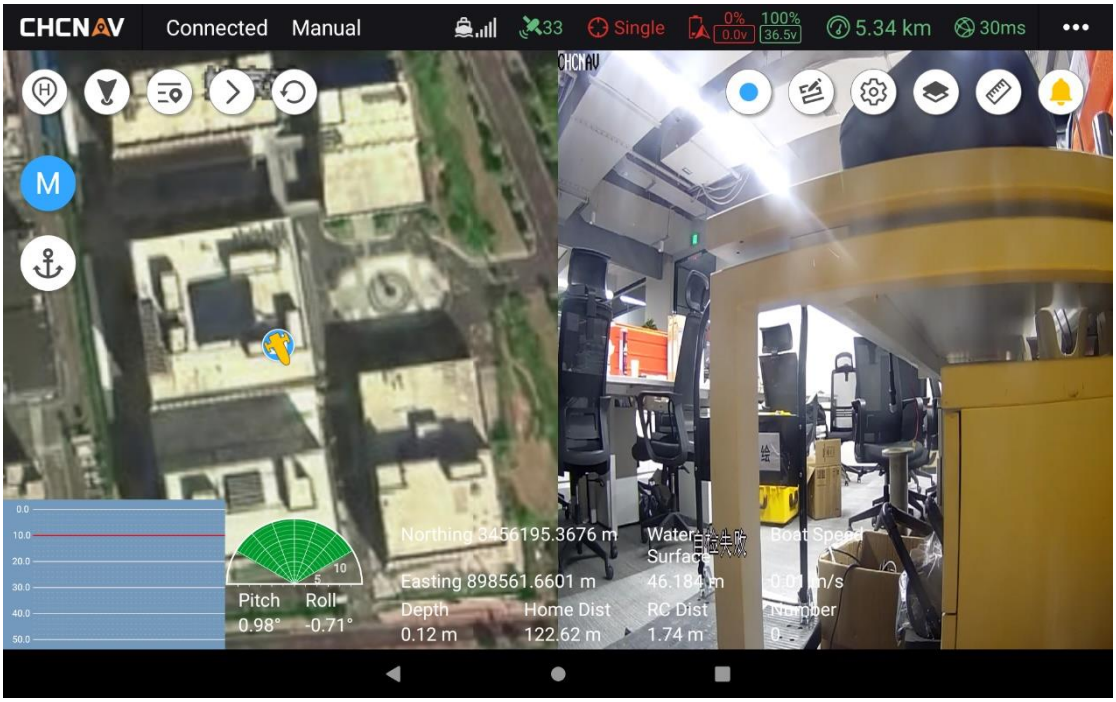
Virtual remote pole

4.21Map/video switching

Click the view box in the lower right corner to switch between the map and video interfaces. Half-screen switching and full-screen switching are supported. Half-screen and full-screen settings can be set on the [General Settings] interface.

Video full-screen interface, with platform rotation, photo and video recording functions on the right side. The photo and video files are stored in the FPV folder of the current project.

In the video view interface, there are play and close buttons in the center of the gimbal in the upper right corner, which can turn the video stream on and off freely.



Semi-folding interface

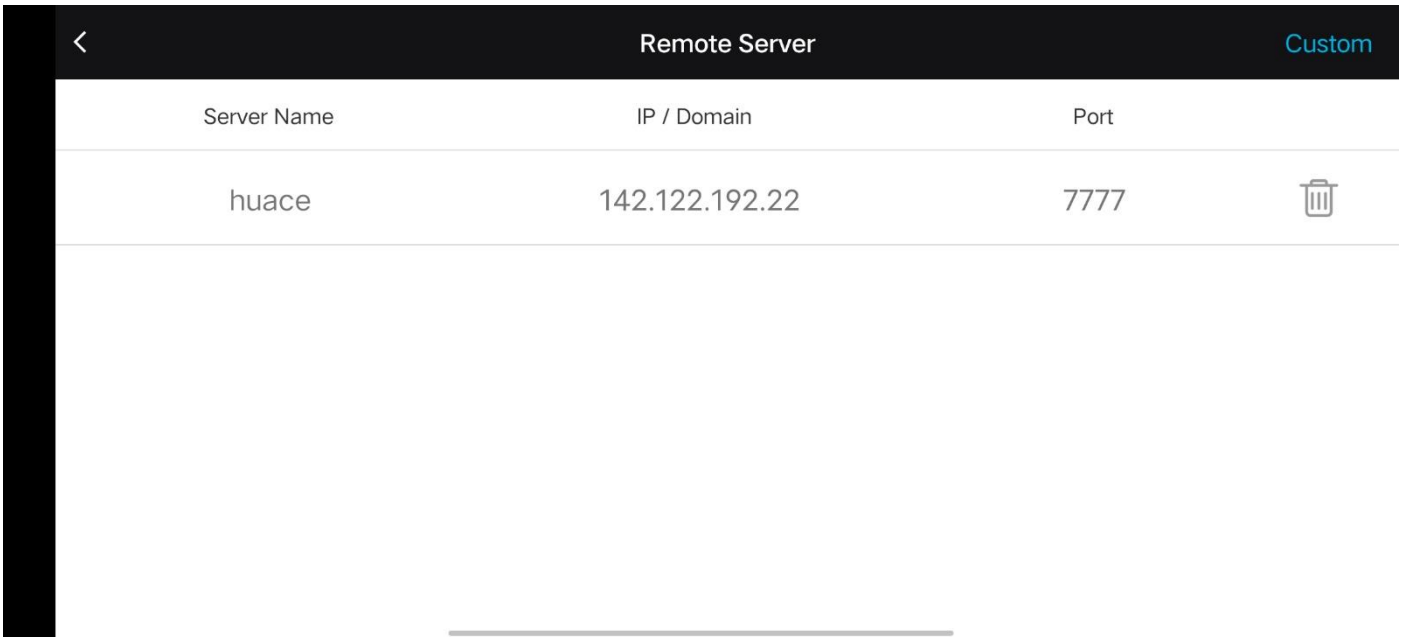
Full-screen interface for the camera

4.22Extended functionality

The software provides additional extended features, allowing users to learn how to use the software through video tutorials, share software logs, share code downloads, and customize services. The collection of these modules provides users with more options and flexibility to meet individual needs and enhance the experience of using the software. Click on the upper right corner of the main interface, and you can enter the above interface in the pop-up menu.

4.23Custom servers

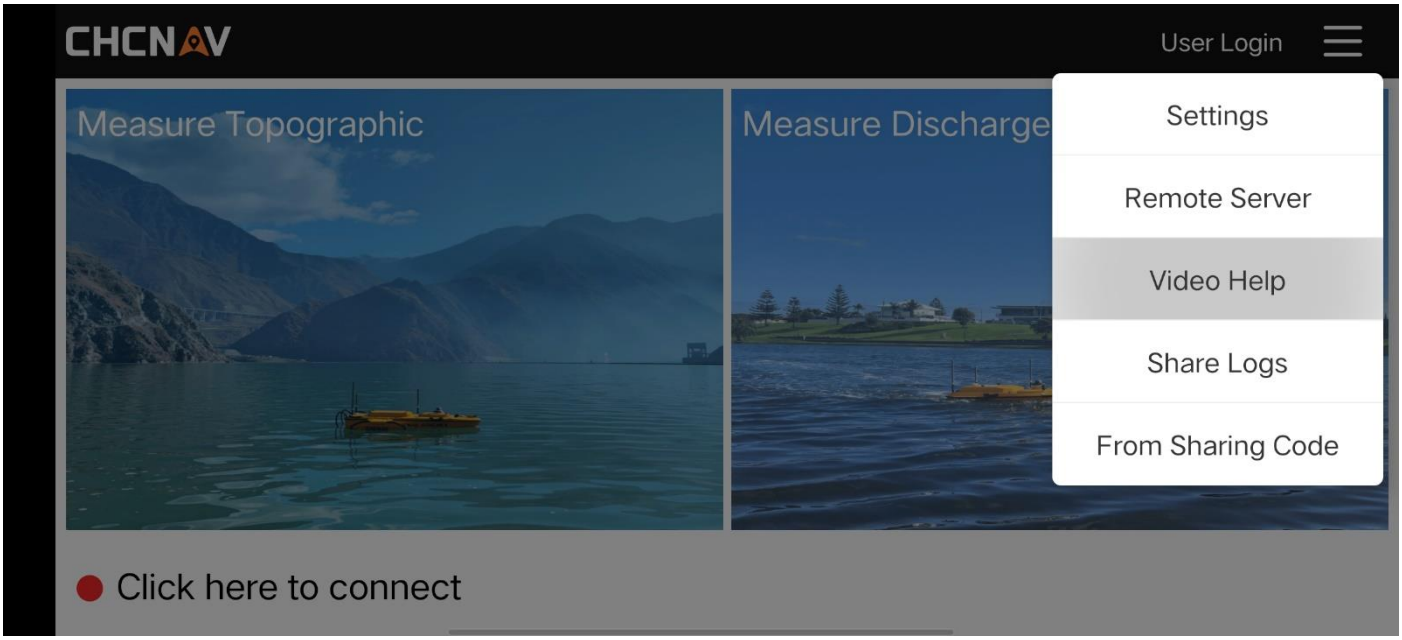
1. Click [Custom] in the upper right corner to add a server, including the server name, IP address, domain name, and port number;
2. The newly added server will be synchronously displayed in the server options of the [Device Connection] interface;
3. After customizing the server, the unmanned ship webpage should also be synchronized to add the same server (system settings-N2N settings).

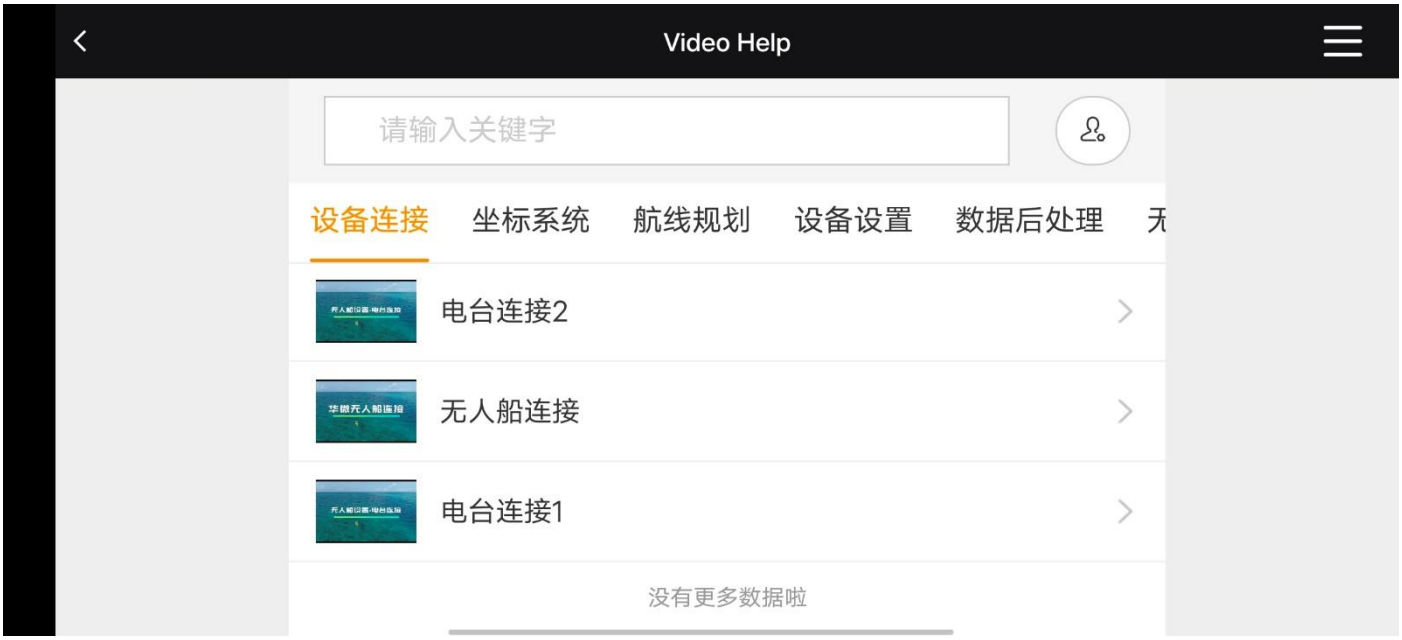


4.24Video tutorials

After entering the unmanned ship video tutorial interface, users can learn how to connect equipment, set the coordinate system, plan the route, set the equipment, and post-process the data. Video resources provide detailed demonstrations and instructions to help users quickly learn how to use the software.

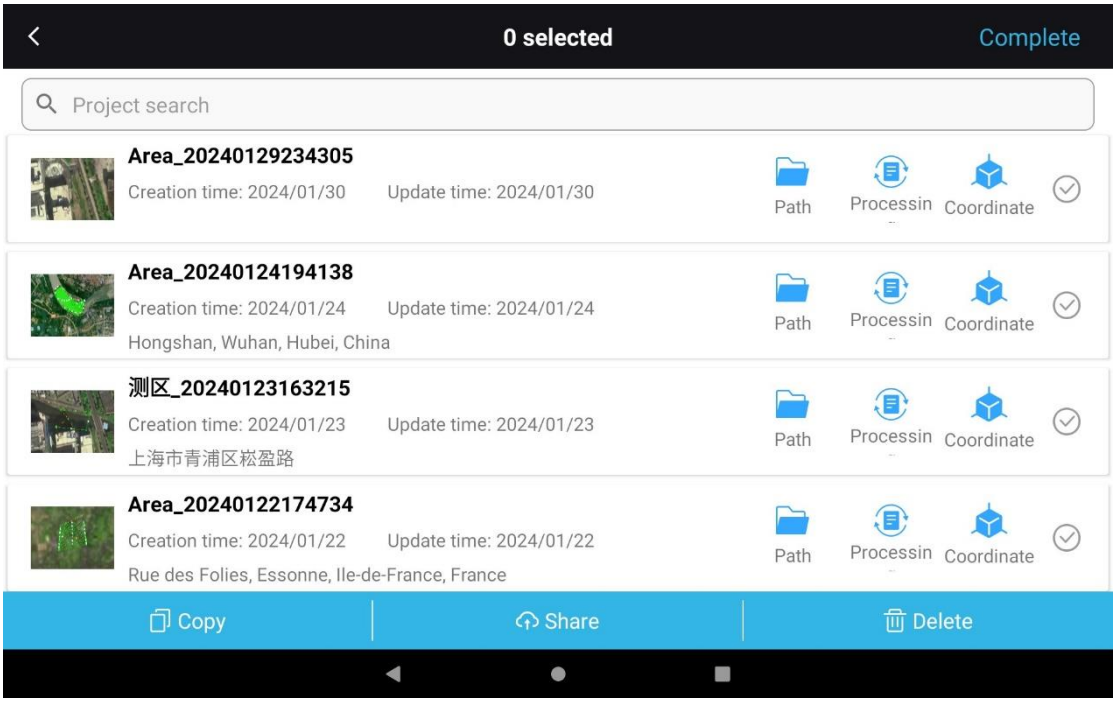
You can view the tutorials of different functions by clicking on different titles, you can like and favorite the video below, and click the button at the top right to refresh, clear the cache and generate a QR code to share with others.



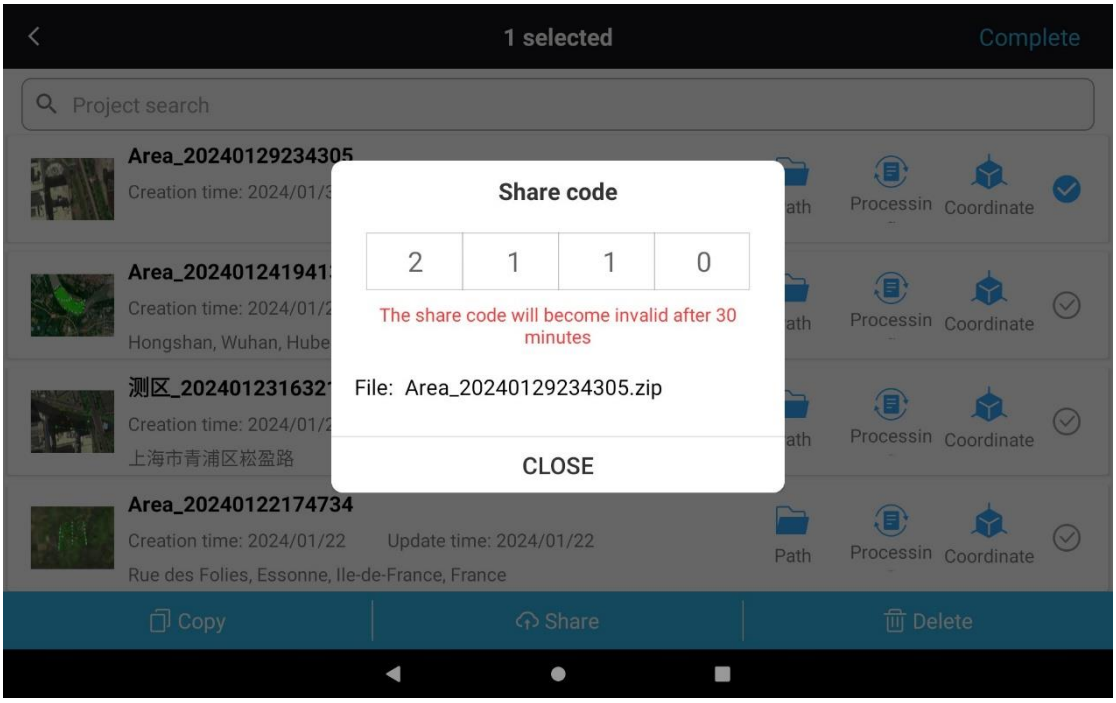


4.25 Share projects/logs

On the project management interface, click the word "Manage" in the upper right corner to copy, share, and delete the project.

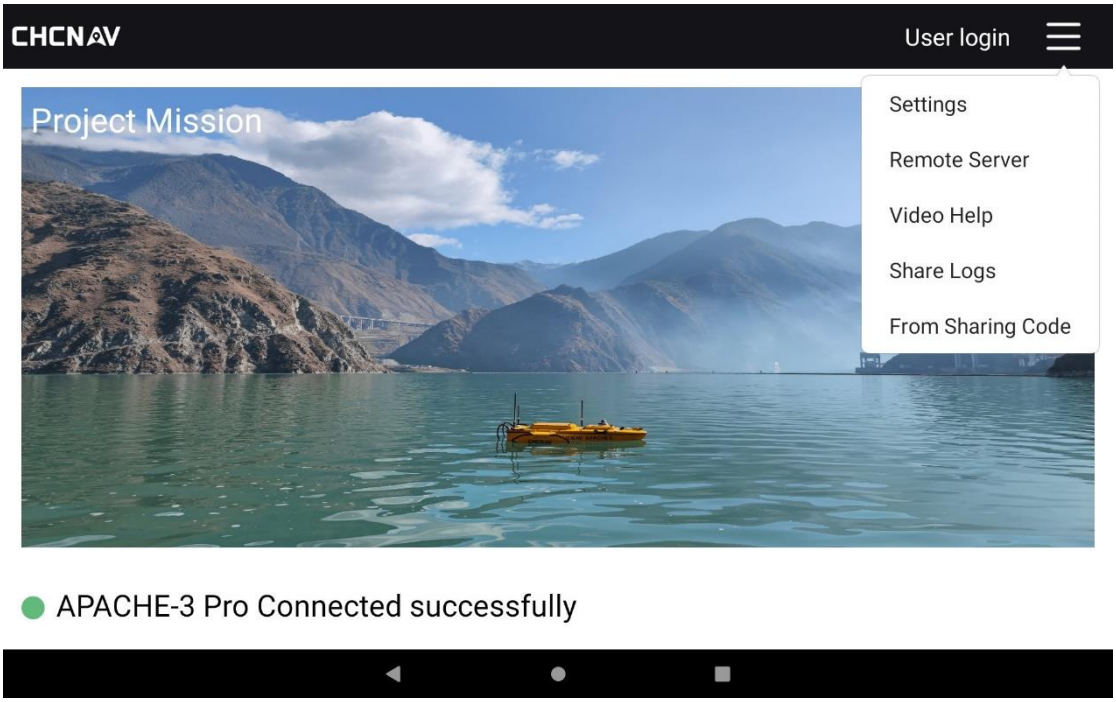


Admin interface



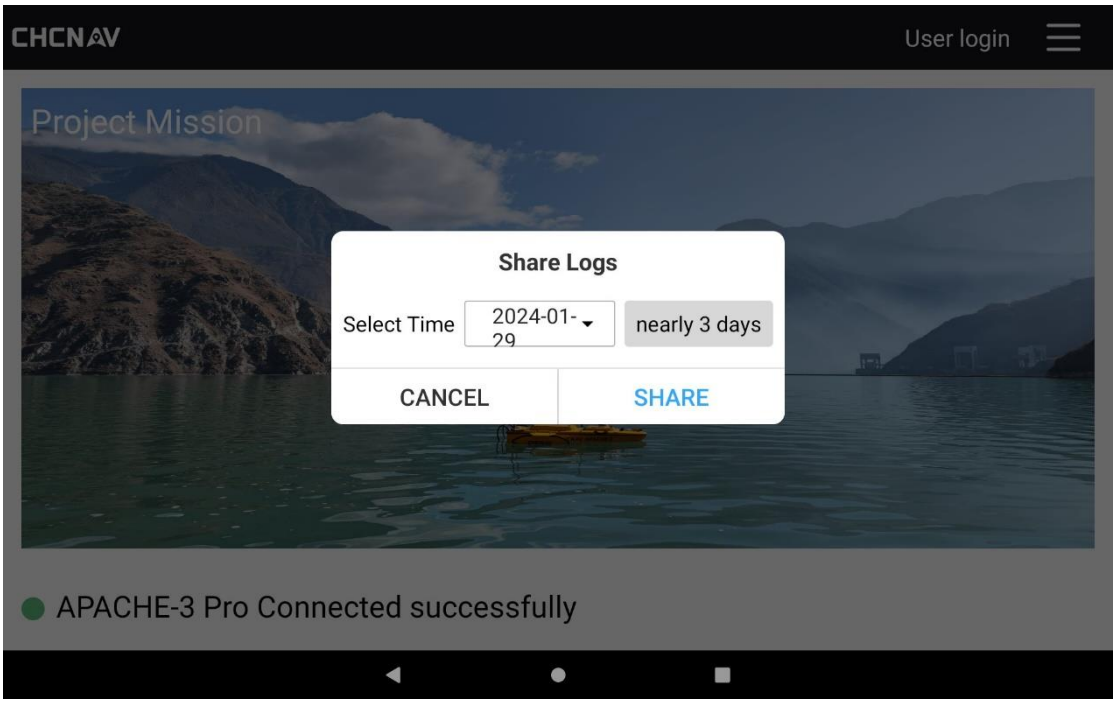
Share code interface

Click the three bars in the upper right corner of the initial interface, click Share Log, or click Share Code to download. Get engineering data.

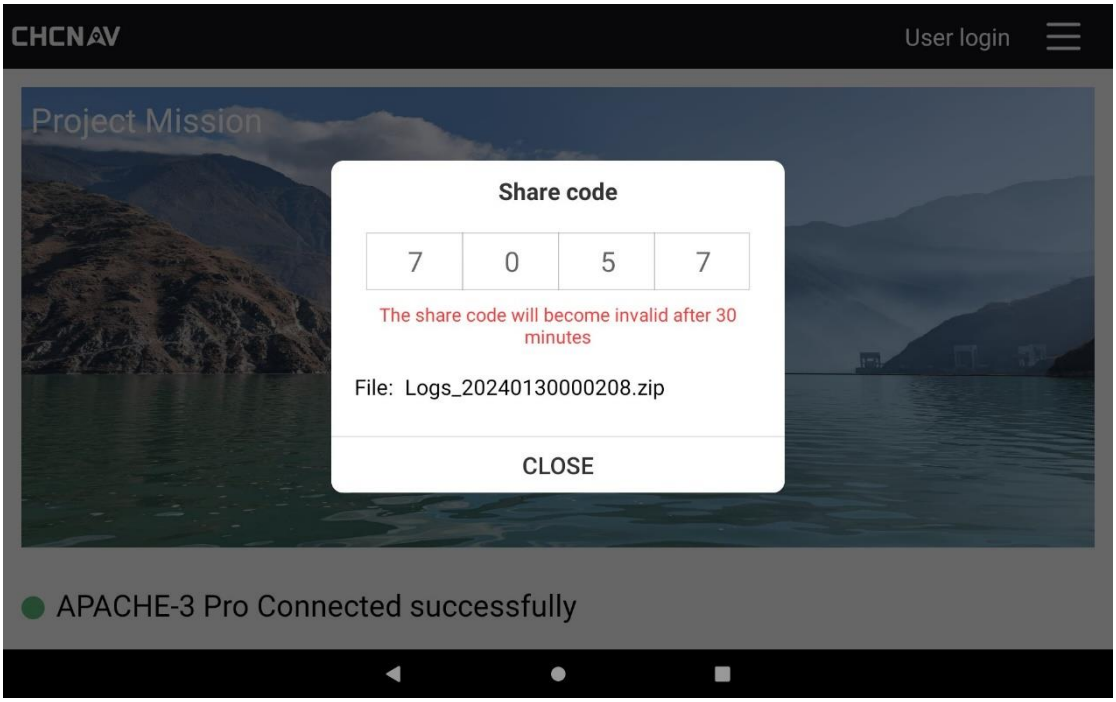


Main interface

Select the software log of the corresponding date and share it with the technician for analysis.



Log sharing page



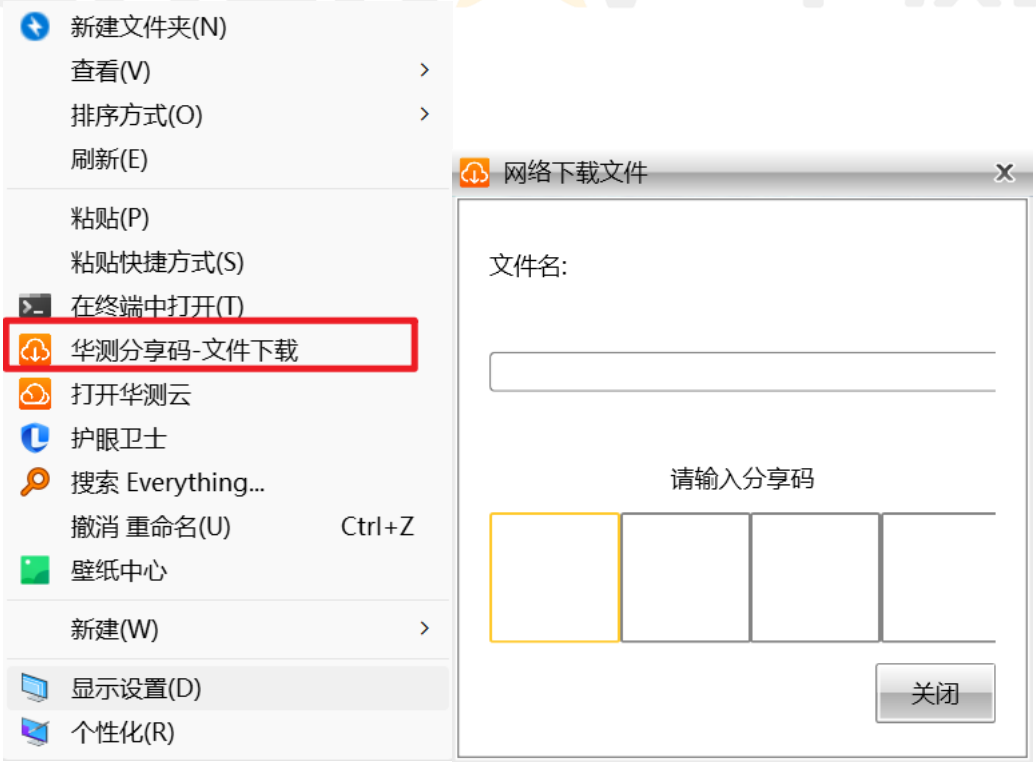
Share code interface

⚠ Note: When using the sharing function, you must first log in to your CHCNAV account, download the CHCNAV cloud sharing code tool from the official website, and use it together.

4.26Share code to obtain/download data

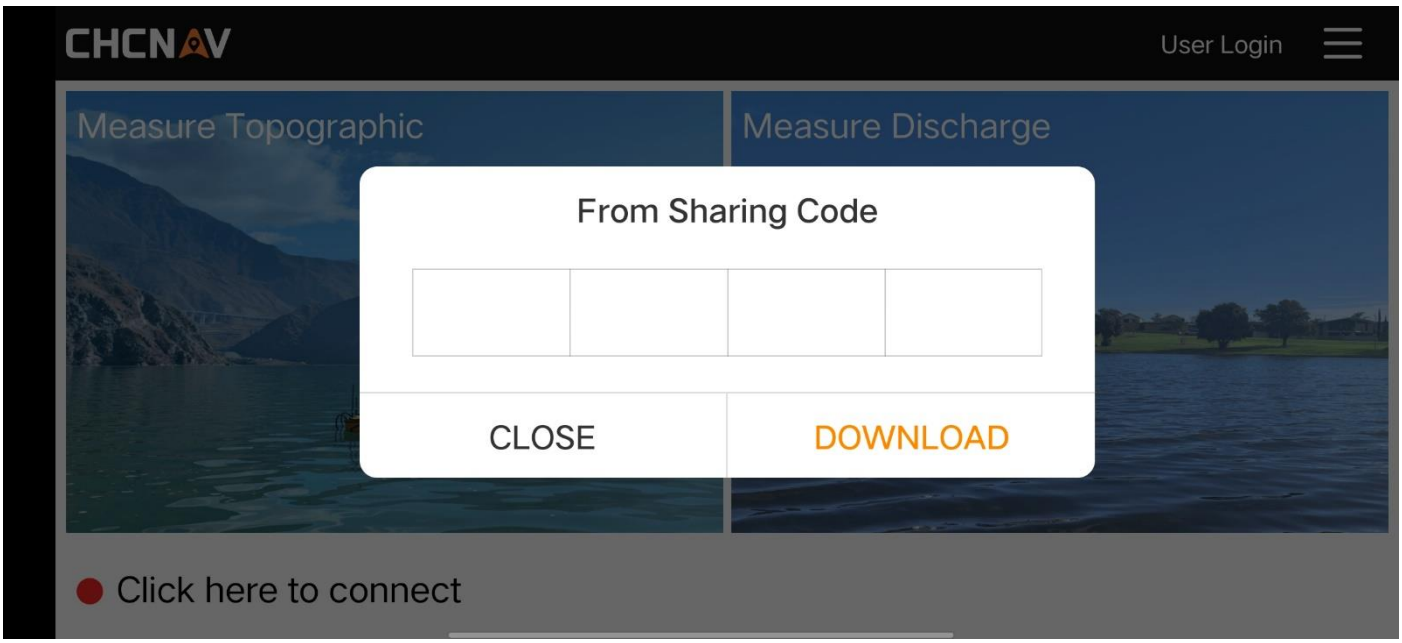
Open the official website of CTI, download the [Share Code Tool], and install it on your computer.

When EasySail software shares the corresponding project/achievement/log, a pop-up window will generate a 4-digit sharing code. Turn on the computer, right-click on the desktop, select [CTI Sharing Code - File Download], enter the corresponding sharing code, and enter the corresponding sharing code, and the file will be downloaded to the desktop in the form of a compressed package by default.



Through the sharing code download function, users can easily obtain other task type files, and other users

can share the file through the sharing function After generating the sharing code, enter the corresponding four-digit sharing code number in the sharing code download interface to complete the fast download of the file.



Share code download page

4.27Data output and processing

4.27.1 Hydrological data output and processing

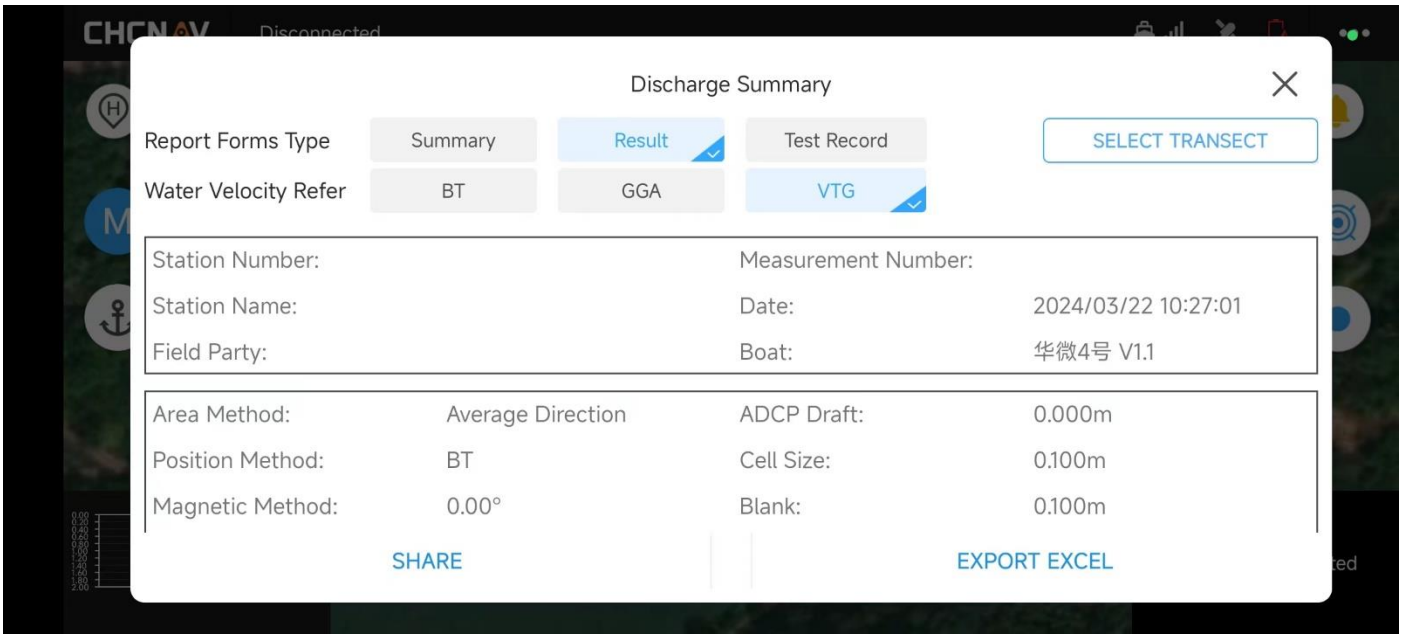
After the hydrological survey task, the recorded data is saved in "PD0" format, while a map of the flow velocity amplitude and some key parameters are displayed in real time at the bottom of the main interface. By clicking the Map Tool Flow Summary Table button, you can view the measurement test loading table, flow result table, and flow summary table specified in the "Acoustic Doppler Flow Test Specification", and at the same time, you can also export the excel sheet and share the test data.

4.27.2 Flow rate file

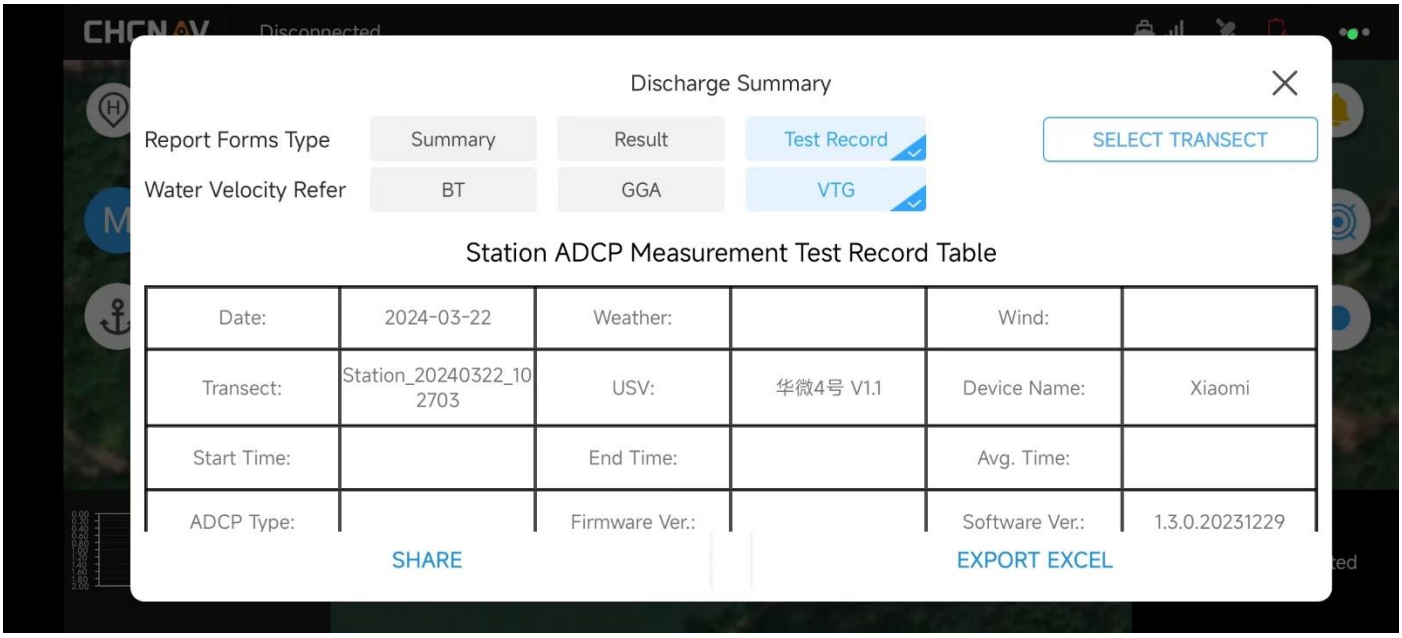
The flow rate file records the ADCP flow rate measurements and is saved in "PD0" format. It is stored in the file directory of the quiz task. Flow rate files are stored in binary mode, and the data includes flow rate data, flow data, basic information, and depth data.

4.27.3 Traffic aggregation

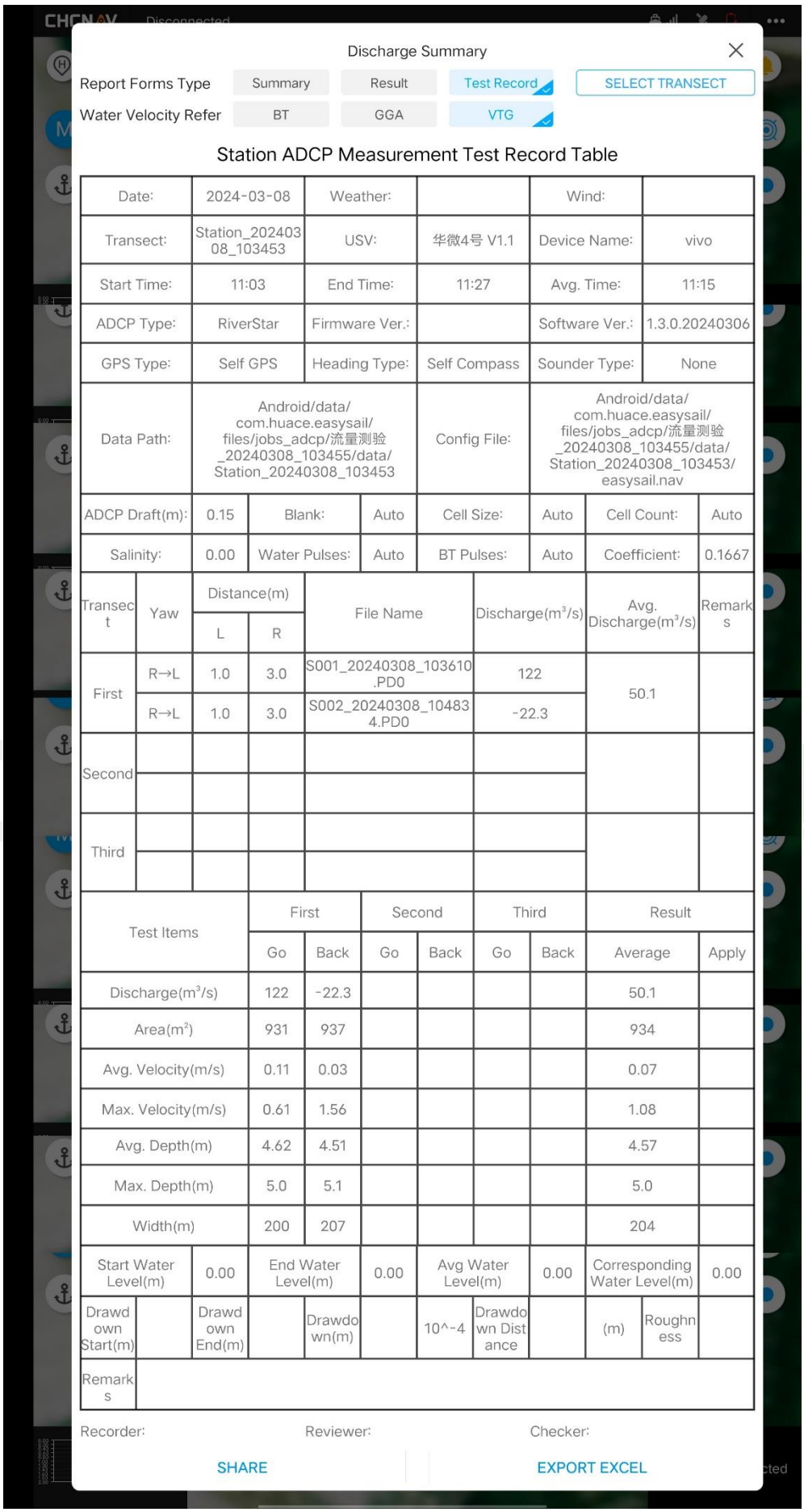
The software supports real-time generation of traffic reports, and at the same time, the corresponding tables are generated in real time according to the selected measurements. Click the "Traffic Results" button of the map interface tool to pop up the traffic summary page. The traffic summary interface contains three tables, namely the traffic summary table, the traffic results table, and the measurement test loading table. The user views the recorded measurements according to the traffic summary table and selects the measurement data that meets the requirements. Open the measurement selection interface through the "Select Measurement" button in the upper right corner, select the required measurement data, regenerate the table data, switch the "Report Type" to select the export process result table or the measurement test loading table, and switch different "Flow Rate Reference" to generate the data under the corresponding flow rate reference, and finally export and share the data.



Traffic summary page



Traffic results table interface



Discharge Summary

Report Forms Type: Summary | Result | Test Record | SELECT TRANSECT

Water Velocity Refer: BT | GGA | VTG

Station ADCP Measurement Test Record Table

Date:	2024-03-08	Weather:		Wind:	
Transect:	Station_20240308_103453	USV:	华微4号 V1.1	Device Name:	vivo
Start Time:	11:03	End Time:	11:27	Avg. Time:	11:15
ADCP Type:	RiverStar	Firmware Ver.:		Software Ver.:	1.3.0.20240306
GPS Type:	Self GPS	Heading Type:	Self Compass	Sounder Type:	None
Data Path:	Android/data/com.huace.easysail/files/jobs_adcp/流量测验_20240308_103455/data/Station_20240308_103453		Config File:	Android/data/com.huace.easysail/files/jobs_adcp/流量测验_20240308_103455/data/Station_20240308_103453/easysail.nav	

ADCP Draft(m):	0.15	Blank:	Auto	Cell Size:	Auto	Cell Count:	Auto
Salinity:	0.00	Water Pulses:	Auto	BT Pulses:	Auto	Coefficient:	0.1667

Transect	Yaw	Distance(m) L	Distance(m) R	File Name	Discharge(m^3/s)	Avg. Discharge(m^3/s)	Remarks
First	R→L	1.0	3.0	S001_20240308_103610.PD0	122	50.1	
	R→L	1.0	3.0	S002_20240308_104834.PD0	-22.3		
Second							
Third							

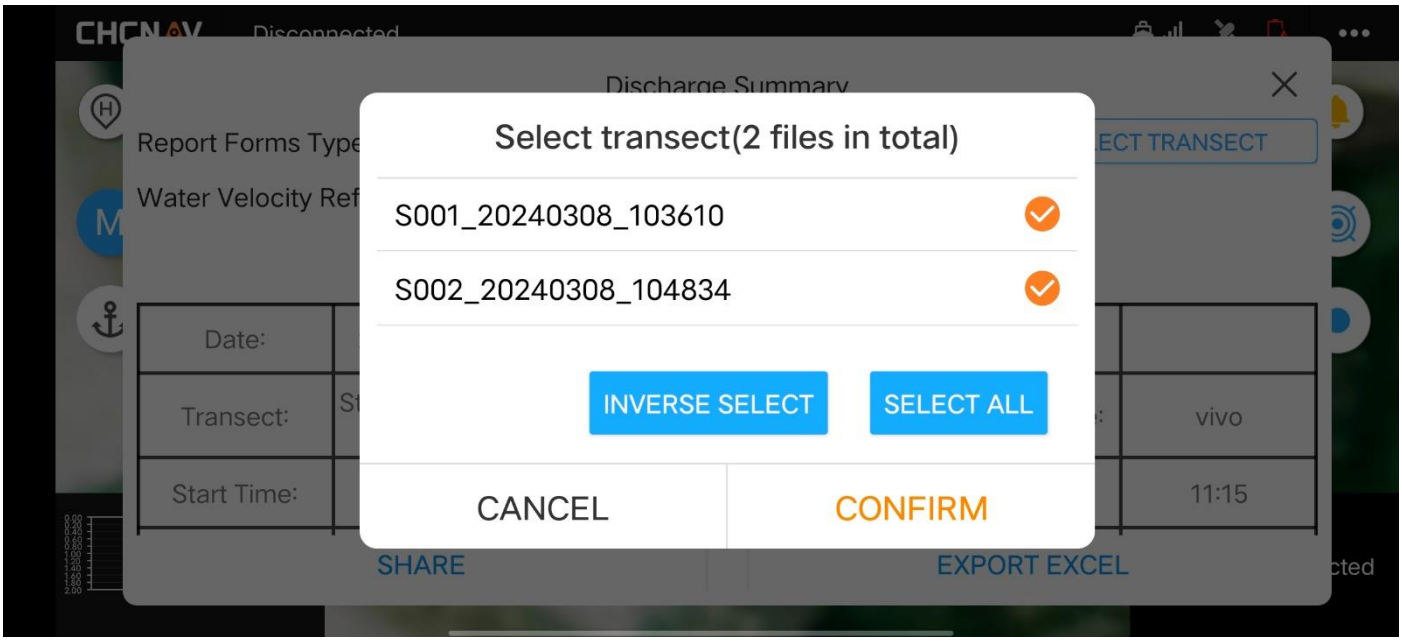
Test Items	First Go	First Back	Second Go	Second Back	Third Go	Third Back	Result Average	Result Apply
Discharge(m^3/s)	122	-22.3					50.1	
Area(m^2)	931	937					934	
Avg. Velocity(m/s)	0.11	0.03					0.07	
Max. Velocity(m/s)	0.61	1.56					1.08	
Avg. Depth(m)	4.62	4.51					4.57	
Max. Depth(m)	5.0	5.1					5.0	
Width(m)	200	207					204	

Start Water Level(m)	0.00	End Water Level(m)	0.00	Avg Water Level(m)	0.00	Corresponding Water Level(m)	0.00		
Drawdown Start(m)		Drawdown End(m)		Drawdown(m)		10^-4	Drawdown Distance		(m)	Roughness	
Remarks											

Recorder: Reviewer: Checker:

SHARE EXPORT EXCEL

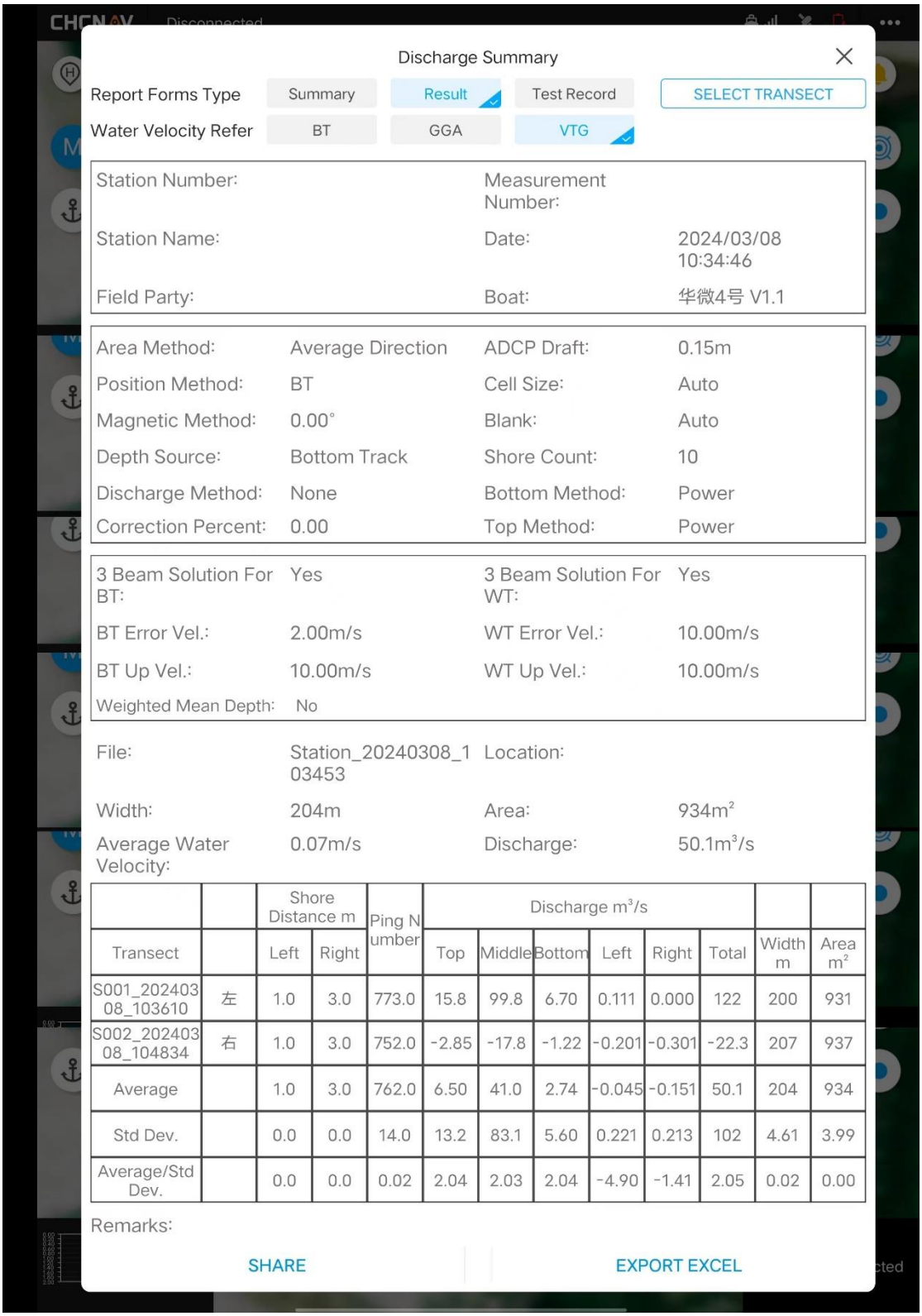
Measurement test record sheet interface



Measurement selection screen

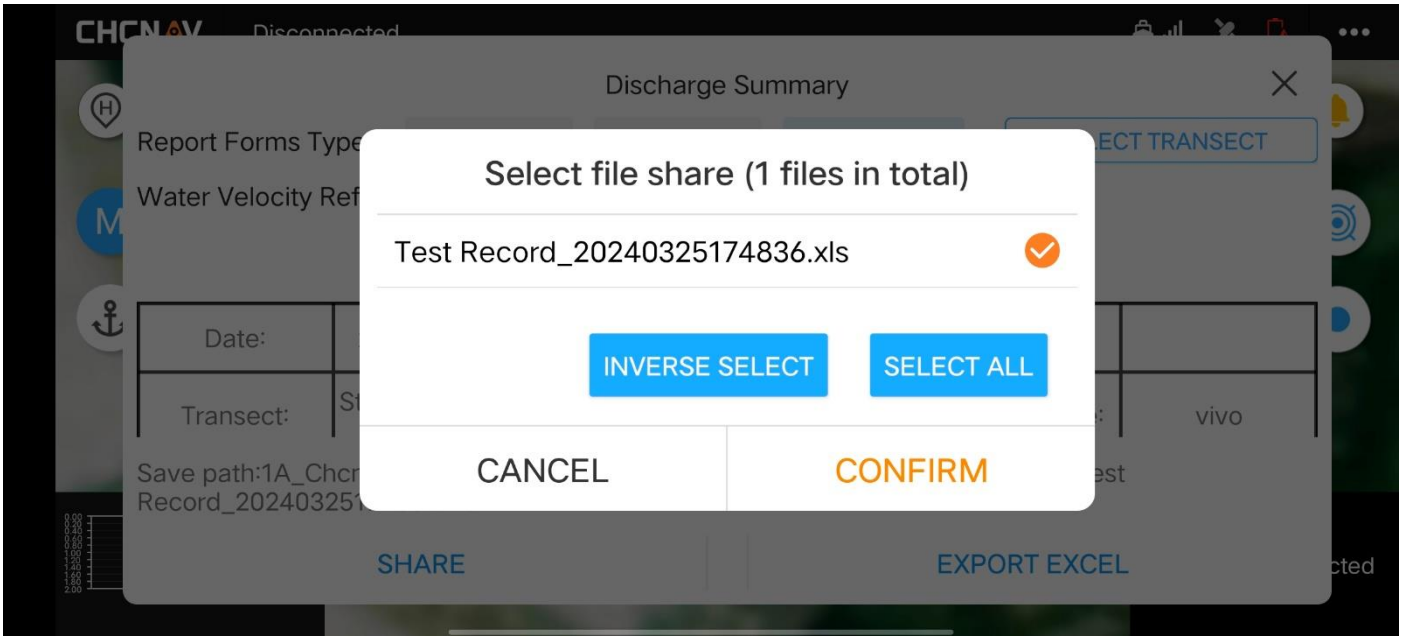
4.28Data export and sharing

The software provides tabular data export and sharing functions, after selecting the data that meets the requirements, the user selects the corresponding data table type and flow rate reference, and clicks the "Export Excel" button to pop up the corresponding data report to the Excel file, and there will be a "export successful" reminder after the export is completed, and the export file path is displayed at the bottom. After the export is successful, click the "Share" button to share the interface, select the Excel file to be shared, click the "OK" button, and share the Excel file through the generated four-digit sharing code.



Transect		Shore Distance m		Ping Number	Discharge m³/s						Width m	Area m²
		Left	Right		Top	Middle	Bottom	Left	Right	Total		
S001_20240308_103610	左	1.0	3.0	773.0	15.8	99.8	6.70	0.111	0.000	122	200	931
S002_20240308_104834	右	1.0	3.0	752.0	-2.85	-17.8	-1.22	-0.201	-0.301	-22.3	207	937
Average		1.0	3.0	762.0	6.50	41.0	2.74	-0.045	-0.151	50.1	204	934
Std Dev.		0.0	0.0	14.0	13.2	83.1	5.60	0.221	0.213	102	4.61	3.99
Average/Std Dev.		0.0	0.0	0.02	2.04	2.03	2.04	-4.90	-1.41	2.05	0.02	0.00

The export success page



Export the data sharing page

Station ADCP Measurement Test Record Table

Date:		2024-03-08		Weather:			Wind:		
Transect:		Station_20240308_1		USV:		华微4号 V1.1	Device Name:	vivo	
Start Time:		11:03		End Time:		11:27	Avg. Time:	11:15	
ADCP Type:		RiverStar		Firmware Ver.:			Software Ver.:	1.3.0.20240306	
GPS Type:		Self GPS		Heading Type:		Self Compass	Sounder Type:	None	
Data Path:		Android/data/com.huace.easysail/files/jobs_adcp/流量测验				Config File:	Android/data/com.huace.easysail/files/jobs_adcp/流量测验		
ADCP Draft(m):		0.15	Blank:		Auto	Cell Size:	Auto	Cell Count:	Auto
Salinity:		0.00	Water Pulses:		Auto	BT Pulses:	Auto	Coefficient:	0.1667

Transect	Yaw	Distance(m) L	Distance(m) R	File Name	Discharge(m³/s)	Avg. Discharge(m³/s)	Remarks
First	R→L	1.0	3.0	S001_20240308_103610.PD0	-3.68	4.65	
	R→L	1.0	3.0	S002_20240308_104834.PD0	13.0		
Second							
Third							

Test Items	First Go	First Back	Second Go	Second Back	Third Go	Third Back	Result Average	Result Apply
Discharge(m³/s)	-3.68	13.0					4.65	
Area(m²)	939	942					940	
Avg. Velocity(m/s)	0.01	0.02					0.01	
Max. Velocity(m/s)	0.40	1.60					1.00	
Avg. Depth(m)	4.62	4.51					4.57	
Max. Depth(m)	5.0	5.1					5.0	
Width(m)	202	208					205	

Start Water Level(m)	0.00	End Water Level(m)		0.00	Avg Water Level(m)		0.00	Corresponding	0.00
Drawdown Start(m)		Drawdown End(m)		Drawdown(m)		10^-4	Drawdown	(m)	Roughness
Remarks									

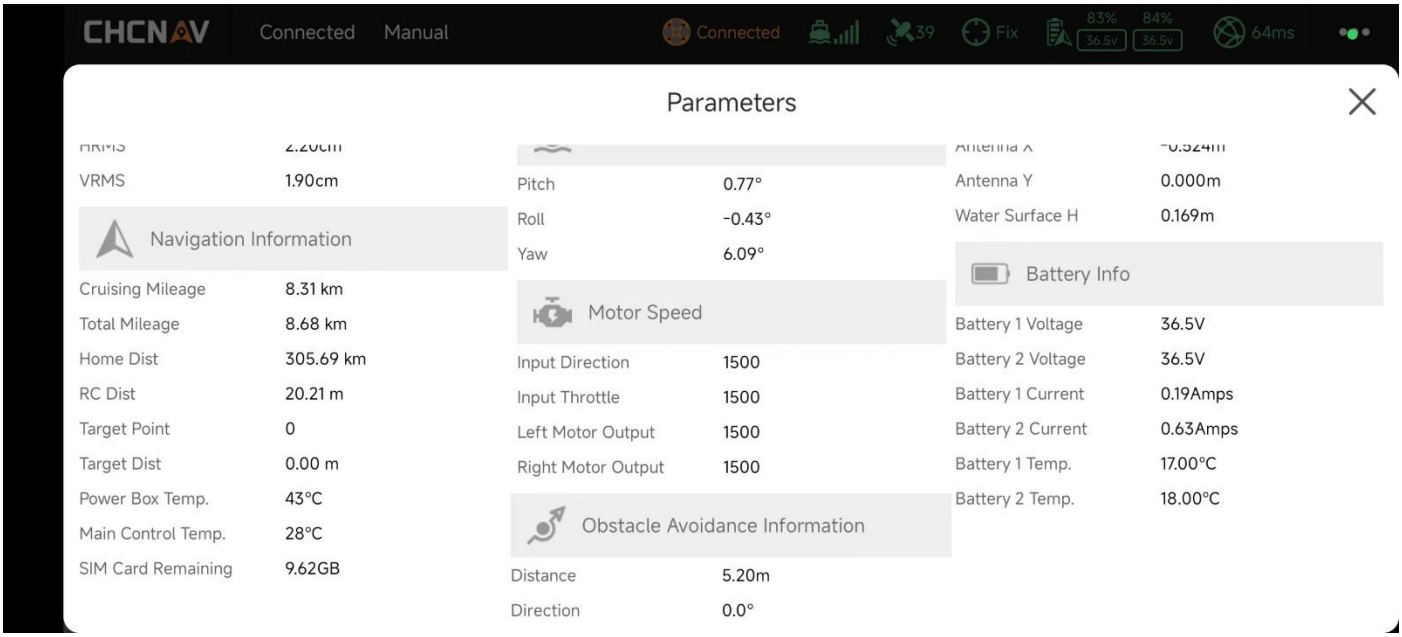
Recorder: Reviewer: Checker:

Export data to an Excel table

4.29Real-time output

The software provides the function of real-time display of flow velocity data, and the user can click on the flow velocity amplitude map window at the bottom left of the map interface to enlarge the window during the collection process, and the flow velocity amplitude map displays information in real time during the recording process, including water depth, flow velocity, surface depth, bottom depth, river bottom depth and other information, and randomly tests the task for dynamic changes. Click the parameters at the bottom of the map interface to enter the parameter detail interface, which displays data such as flow information, hydrological information, and ADCP information in real time.

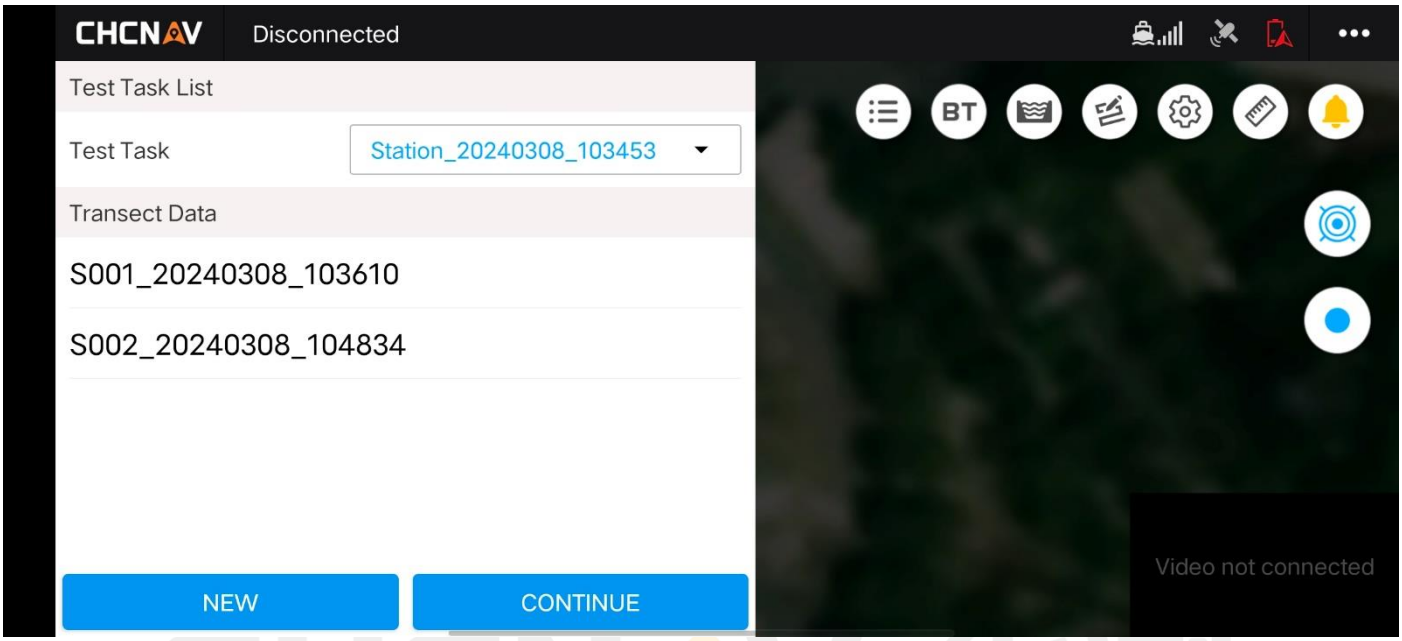
Flow velocity amplitude graph interface



Parameter details page

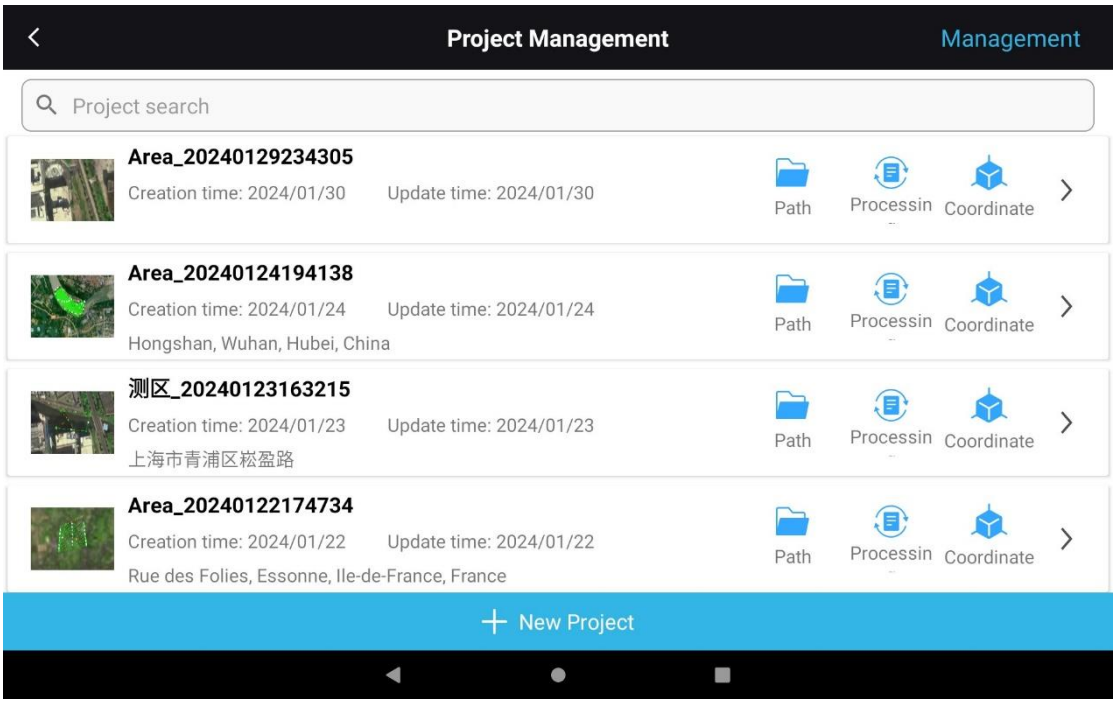
4.30Historical data backtracking

The software supports viewing the elapsed data of the last test, after entering the test project, select the test task, and then click the traffic summary button to view the last test data, note that you can only view the last recorded test data, for example, the first time two times recorded, the second time three times recorded, the third time after entering the test project to select the test task, you can only view the second test data, so it is generally recommended to create a new test task when starting a new test task.



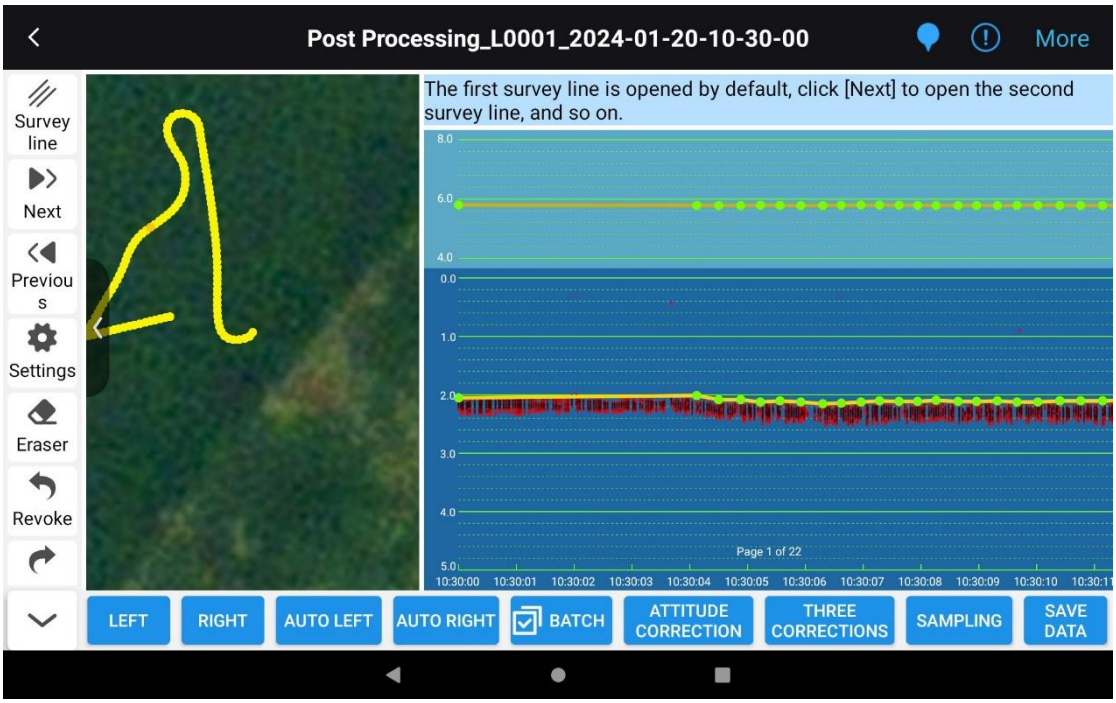
4.31Terrain data output and processing

On the project management interface, click the post-processing button of the corresponding project.

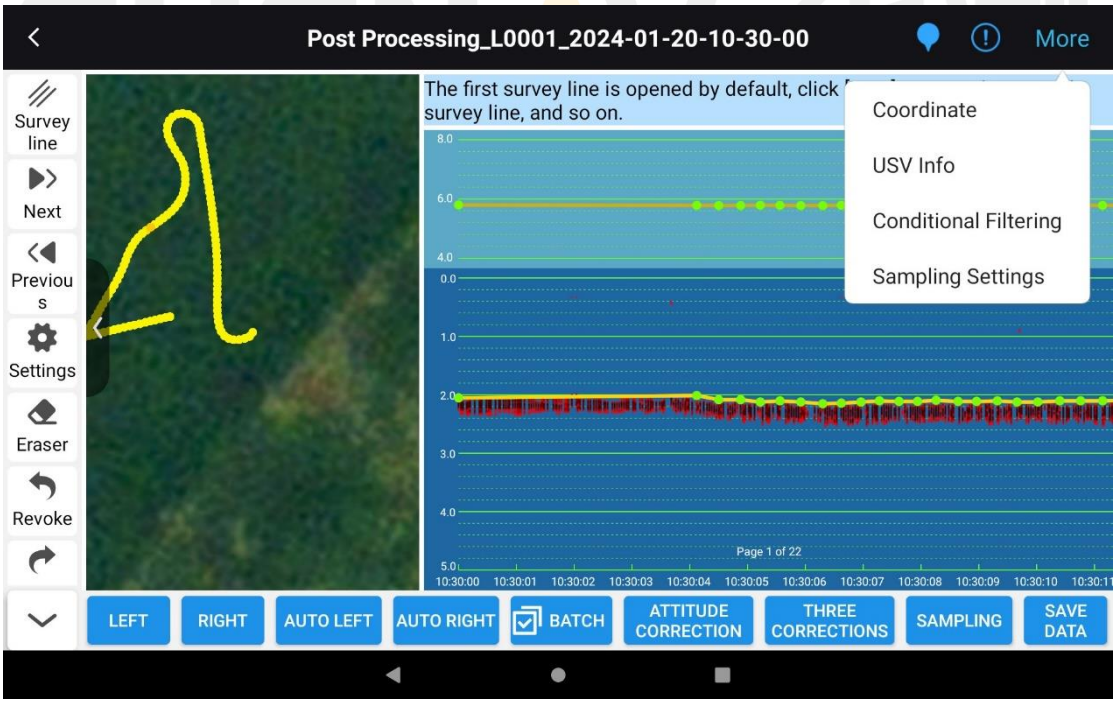


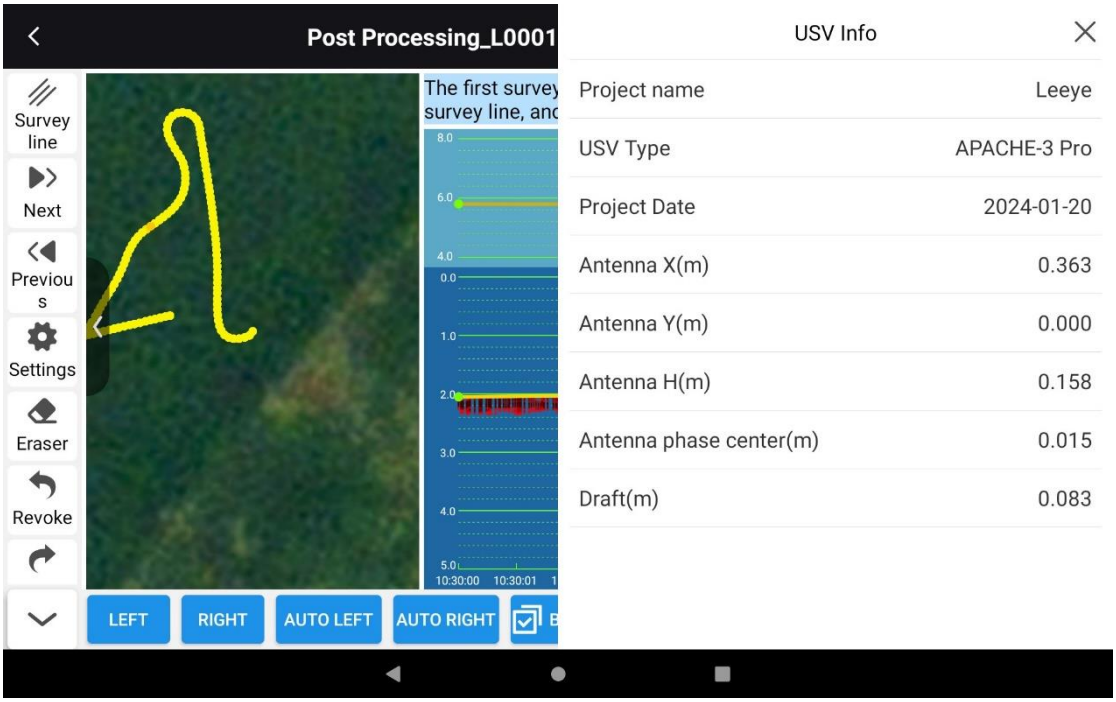
Click the line measurement button on the left list, select the test line to be processed, and click

"Next"/"Previous" to switch the test line processing.



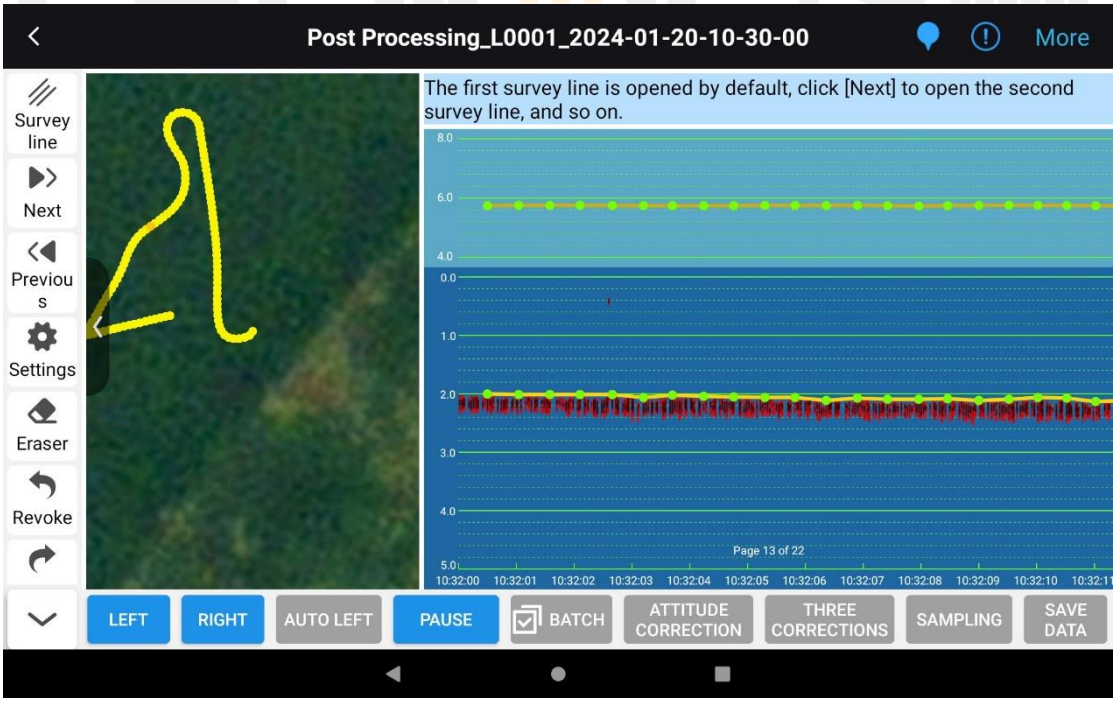
Click More in the upper right corner to check whether the "Coordinate System" and "Ship Type Information" are normal.





In the water depth interface, you can remove noise by dragging the water depth point to the correct position or clicking "Eraser".

Click directly below to move the bathymetric data laterally, such as Move Left/Move Right/Auto Move Left/Auto Move Right.

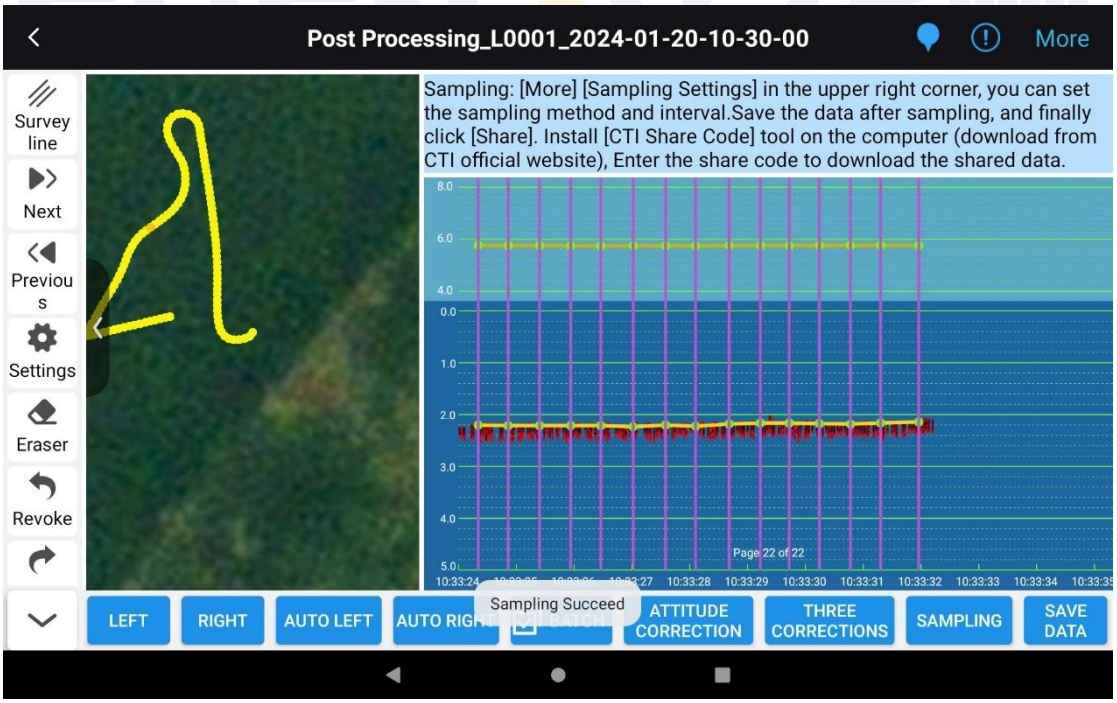


After deleting all the noise of the survey line in turn, click Batch, check the test line to be processed, and then click Attitude Correction or Three Corrections (Three Corrections include Attitude Correction, Sound Velocity Correction, and Delay Correction).

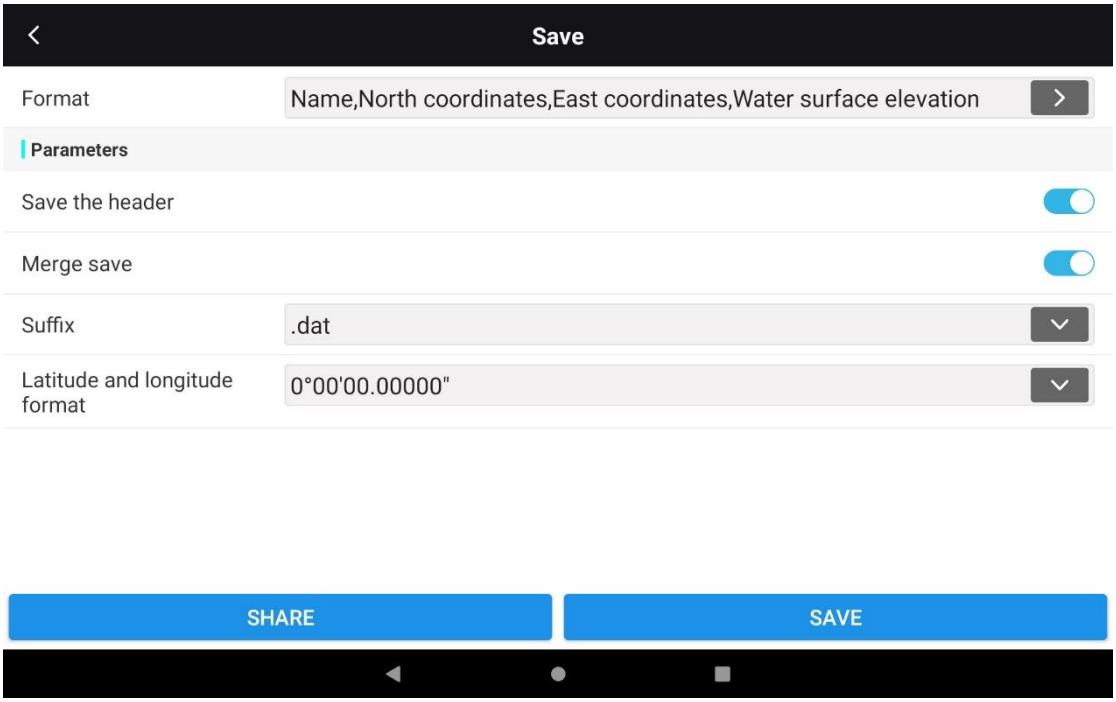
Click More in the upper right corner again, Sampling Settings, manually set the sampling interval, and click

Isometric sampling in the lower right corner.

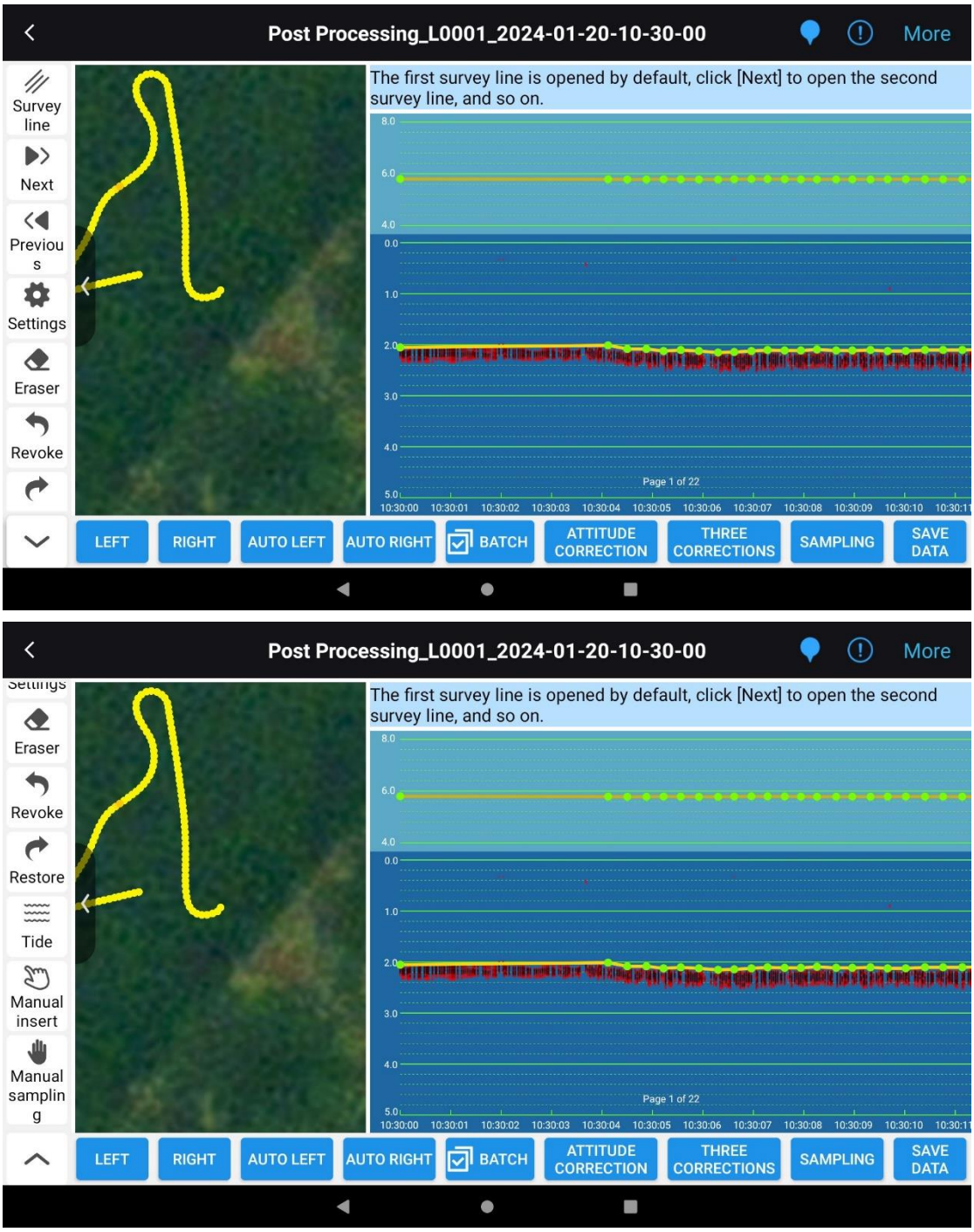
After the sampling is successful, a purple sampling line is generated on the water depth interface, and click to save the data again.



Select the data format and type to be exported, click Save, and the result file will be saved in the single-beam folder under the current project by default. Click Share to share the data.



4.32Detailed explanation of post-processing functions



Post-processing operation interface

Introduction to Views:

1. Record point color: the points of the fixed solution are shown green, the points of the floating solution and the inertial navigation solution are shown yellow, and the other points are shown in red. Depth point green display: a point is selected, the color of the point changes, and the color of the selected point is orange. At the same time, the corresponding points on the map track view will also be marked synchronously (white circles are highlighted). Manually interpolated points are rendered as purple dots,

and erased points erased by the eraser are grayed out and cannot be clicked again.

2. Map interface: You can drag and drop, zoom in, zoom in, and zoom out.
3. Map record point display: color rendering according to different water depths, and the grade degree is from light to dark: red, orange, yellow, green, blue, and purple.

Brief introduction of the function buttons on the left:

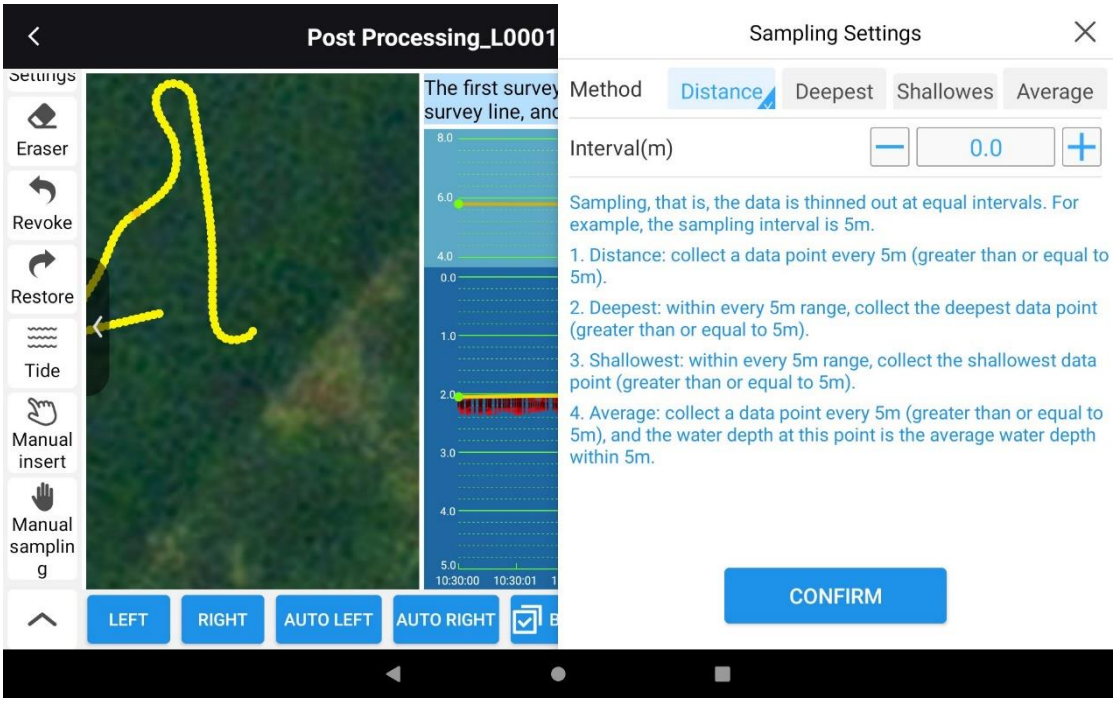
1. Open the tide test: import the tide test file (*.tid). The TID date and time are required to include the DEP date and time, and after importing, the water surface elevation is processed using the elevation data in the TID file.
2. Fixed Interpolation: Select this button to correct the elevation data of the non-fixed solution.
3. Eraser: Select this button, and then check or box select multiple depth points to delete the point.
4. Manual Interpolation: Manually interpolate data - Select this button and click any time in the bathymetric view to insert a new recording point at the corresponding time and depth location.
5. Manual sampling: Manually sample feature point data - after equidistant sampling. For non-equidistant sampling points only.

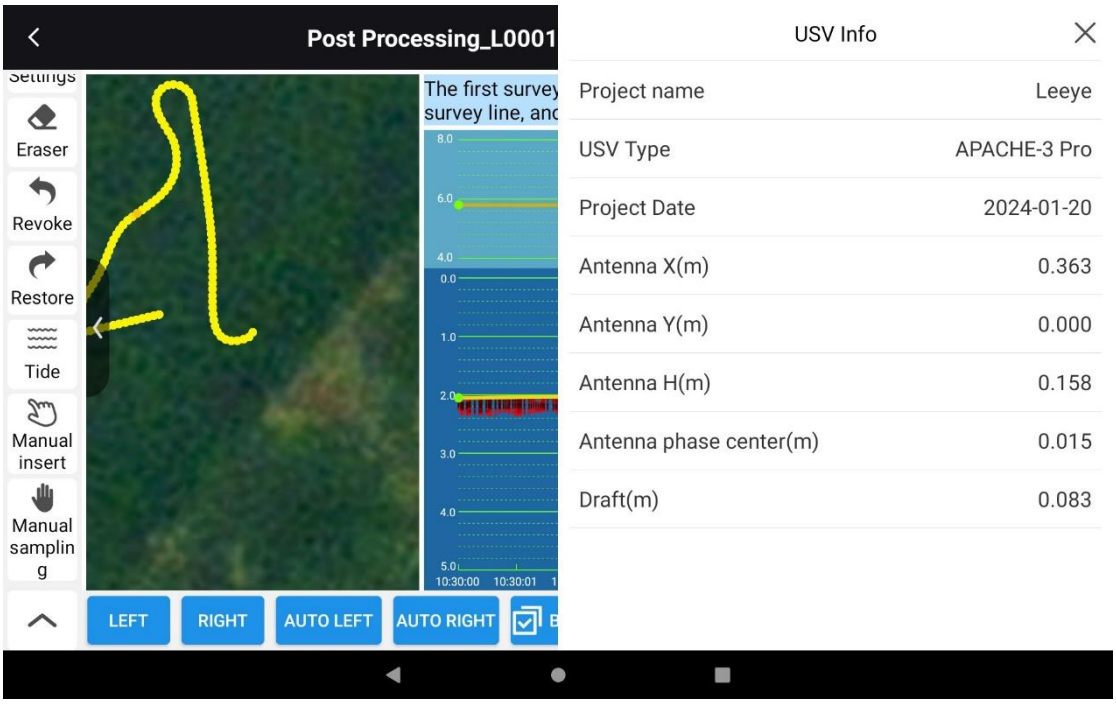
   After equidistant sampling, manual sampling can be performed for unsampled point data, that is, feature point sampling.

   Select this button, select a non-equidistant sampling point with the mouse, and a red sampling line will be automatically generated.
6. Undo: Go back to the previous step (drag the point/delete the point/add and delete the feature point sample line).
7. Restore: Resume the previous operation (drag the point/delete the point/add and delete the feature point sampling line).
8. Shrink button on the left side of the map: you can turn on/off the map interface display;
9. Survey line: display all survey line files recorded in the current project;
10. Settings:
    1) The water depth, time interval and time width multiples can be set, and the view interface can be modified;
    2) Selectable bathymetry editing mode: lock/single point up and down/multi-point continuous;
    3) fixed interpolation;
    4) Display data point information: After opening, click to select the measurement point/elevation point to display the point information;

A brief introduction to the following function buttons:

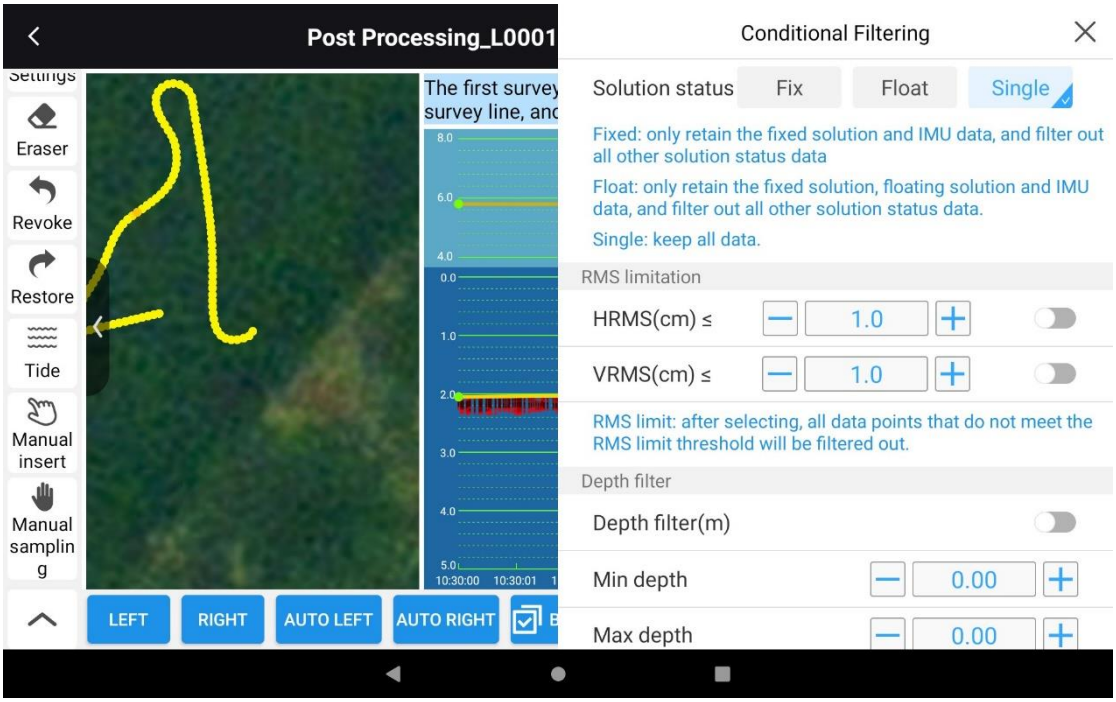
1. Shift Left/Right: Turn pages left and right on the water depth interface;
2. Automatic left/right shift: one-key page turning left and right, manual pause;
3. Batch: Support the selection of the test line. Select a few and process a few. Click the [Batch] button to pop up a list of test lines, and there is a checkbox on the right side of each test line. By default, all survey lines are selected. Click the [OK] button, and all the selected line data will be read;





Introduction to gesture operation:

1. Drag up and down on a single-point longitudinal axis: adjust the water depth.
2. The points in the water depth view can be edited, for example, if a single point is selected, you can move up and down to modify the water depth value, and you cannot move the current point left and right. However, when a point is selected, moving it left and right will modify all the points that its finger has passed.
3. The upper left side of the point slides the value to the lower right side: perform a point multi-selection operation, similar to the PC frame selection action.



Post-processing settings screen

Data processing operations:

a) Depth Height: The depth interval in the longitudinal direction of the bathymetric view;

b) Time Interval: The time interval between the view horizontal;

c) Time Width: The time width of the horizontal axis of the view is enlarged so that the points are not too dense to be selected;

d) Map: Double-click to open the location display of the DEP survey line;

e) Conditional Filtering: Select the selection box and then select the DEP test line in the line list to filter and display it in the view.Or select the DEP test line first, then select the filter conditions, and click the [OK] button to display it in real time.

f) Sampling Method & Sampling Interval X:

1. Distance sampling: Take a point every distance X (>=X);
2. Deepest (within equal spacing): Within the equal interval X distance, the deepest water depth point data is taken as the sampling point;
3. Shallowest (within equal spacing): Within the equal interval X distance, the shallowest water depth point data is taken as the sampling point;
4. Average value (within equal spacing): Within the equal interval X distance, the average value of all water depth data is taken as the water depth point, and the sampling point is determined according to the distance sampling;

g) Three corrections: sound velocity correction/delayed correction/attitude correction;

h) Posture correction: Posture correction only;

i) Isometric sampling: After the data is corrected and corrected, the sampling is carried out according to the sampling interval;

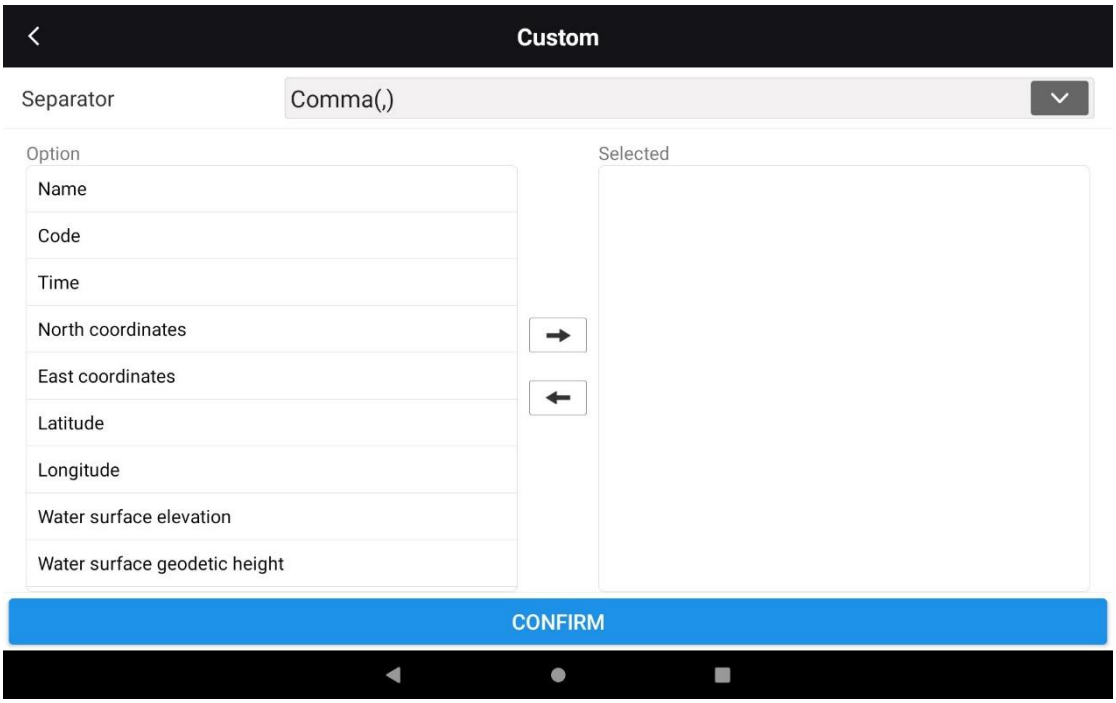
j) Retention of data:

5. You can choose the saving format, that is, save the header items;

6. Parameter setting: save header: display header information characters;
   Merge and save: Merge and save multiple lines to a summary file;
   Suffix: File suffix selection (.txt/.csv/.dat)
   Latitude and longitude format: Set the display of latitude and longitude of the saved file;

k) Sound velocity correction/delay correction/attitude correction；

1. "Sound velocity correction" can be based on three correction modes: "monosonic", "depth + sound velocity" and "depth + correction value". After the parameter input is completed, click "Sound Speed Correction" to complete the correction, or click "Skip" to enter "Delay Correction".
2. "Delayed Correction" Enter the delay time between the water depth and position, the position lag is positive, the water depth lag is negative, click "Delay Correction" to complete the correction or click "Skip" to enter "Attitude Correction".
3. "Attitude Correction" input transducer opening angle, transducer installation error, select automatic filtering method (median filtering, weighted filtering, sliding filtering), click "Delay Correction" to complete the data correction or click "Skip" not to correct.



Post-processing saves the formatting interface

4.33Software settings

In the software settings interface, you can log in to your CTI cloud account, switch SI units, view the version notes, upgrade the software, and other operations.

4.33.1 Common Settings - SI Unit Settings

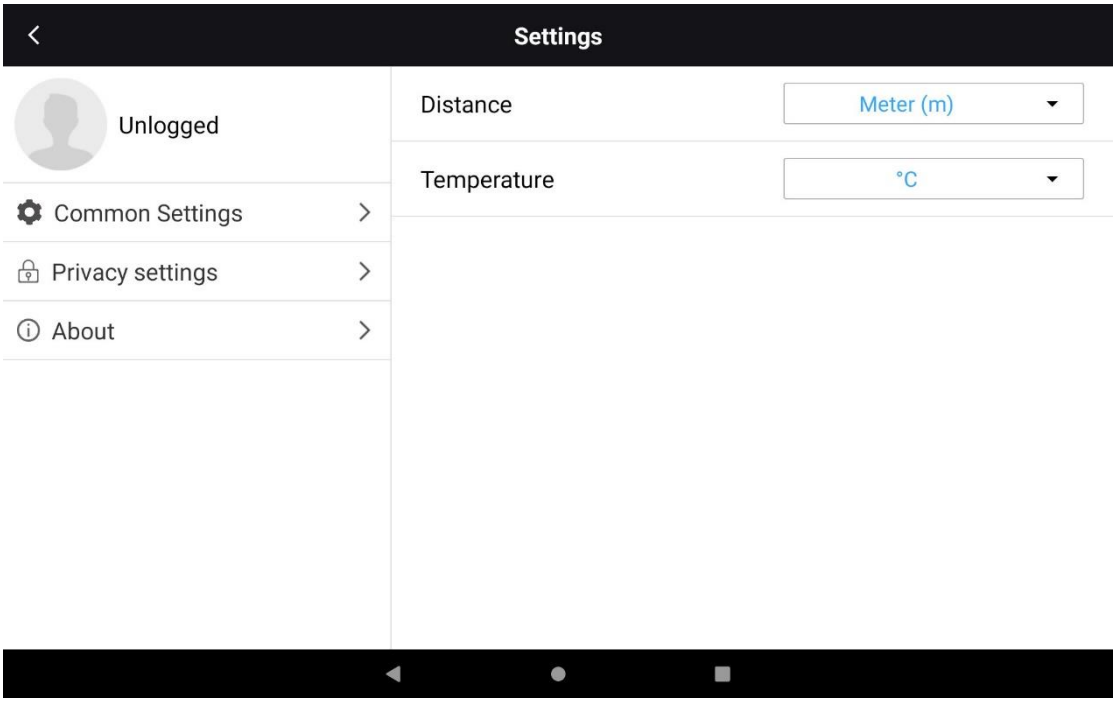
Temperature and distance units can be switched in the general settings interface.

Distance units: meters, international feet, US feet.

Temperature unit: Celsius °C, Fahrenheit °F can be set.

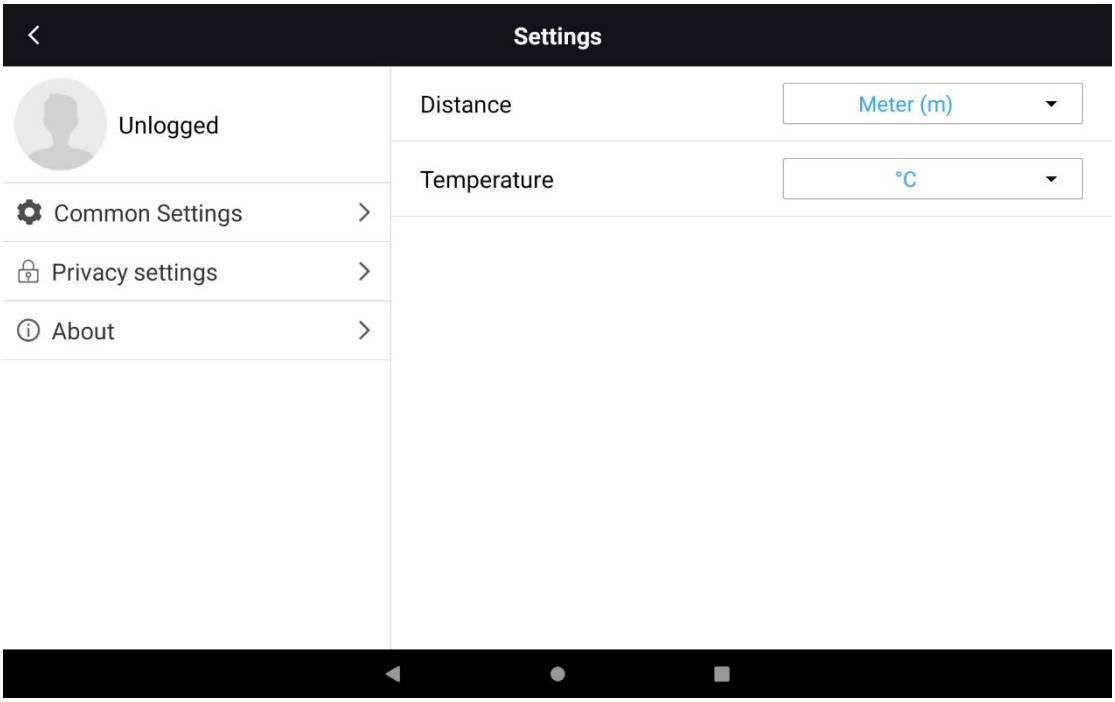
Flow units: cubic meters per second, cubic international feet per second, cubic US feet per second.

Units of area: square meters, square international feet, square US feet.



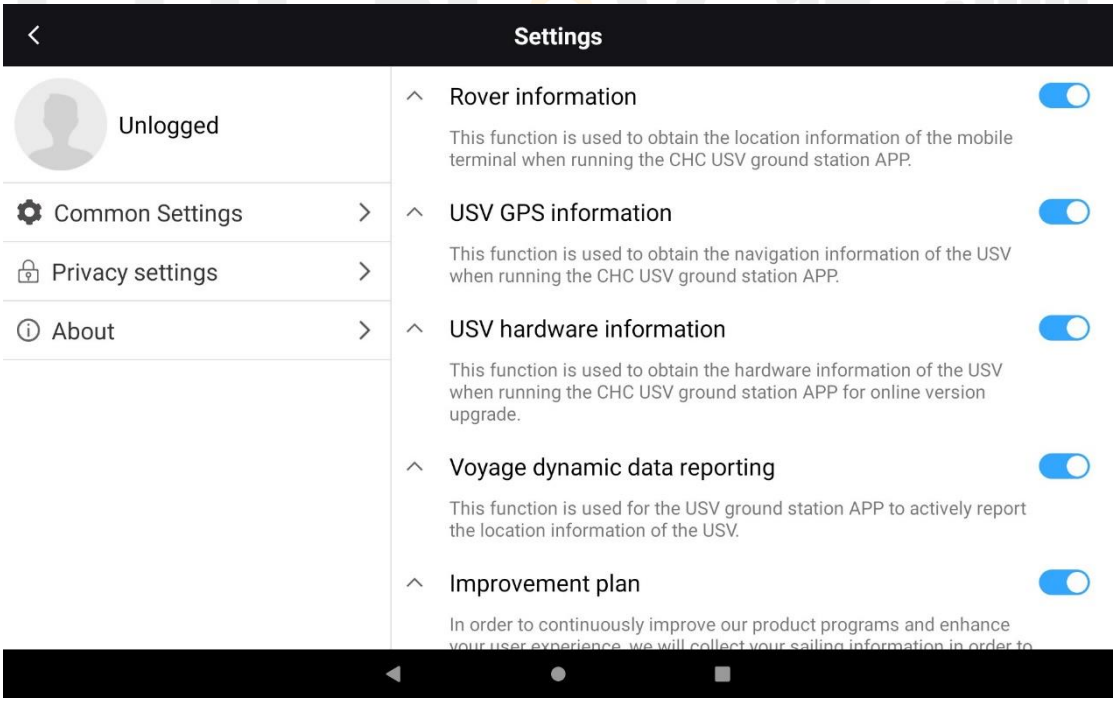
4.33.2 Privacy settings

Displays the necessary permissions and information necessary for the operation of this software.



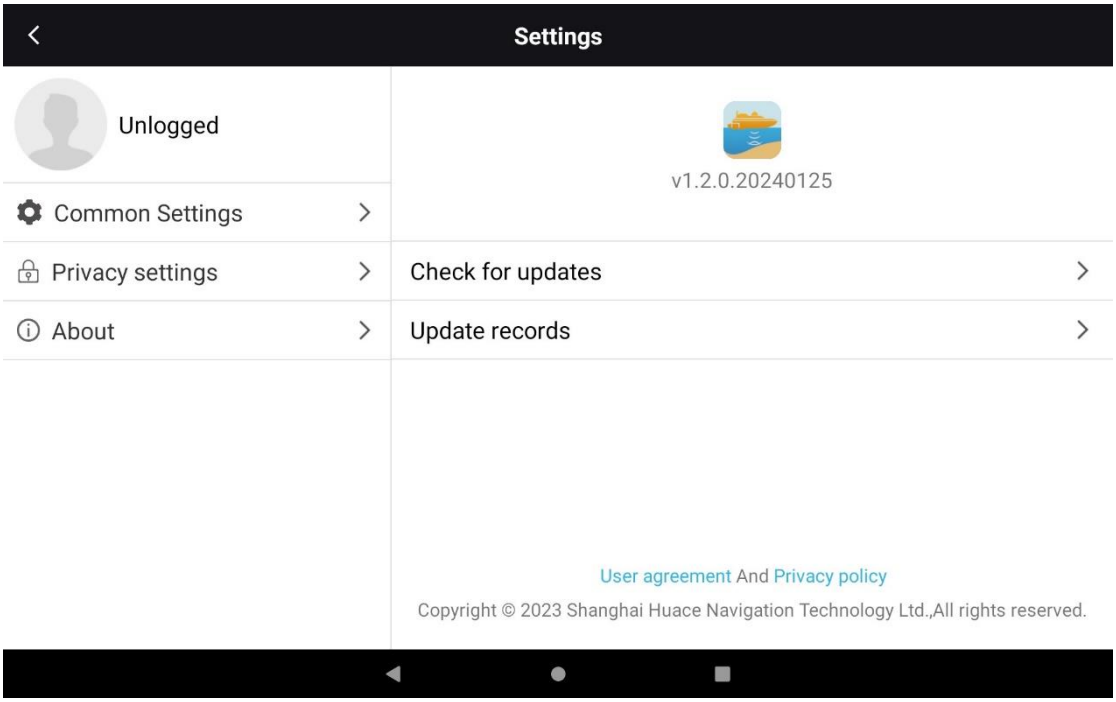
4.33.3 Check for updates

Check the update interface to check the app version number, sounder firmware version number, GD100 platform firmware version number, control firmware version number, check and update app version and firmware version.



4.33.4 Imprint

You can view the change notes for each version in the release notes.

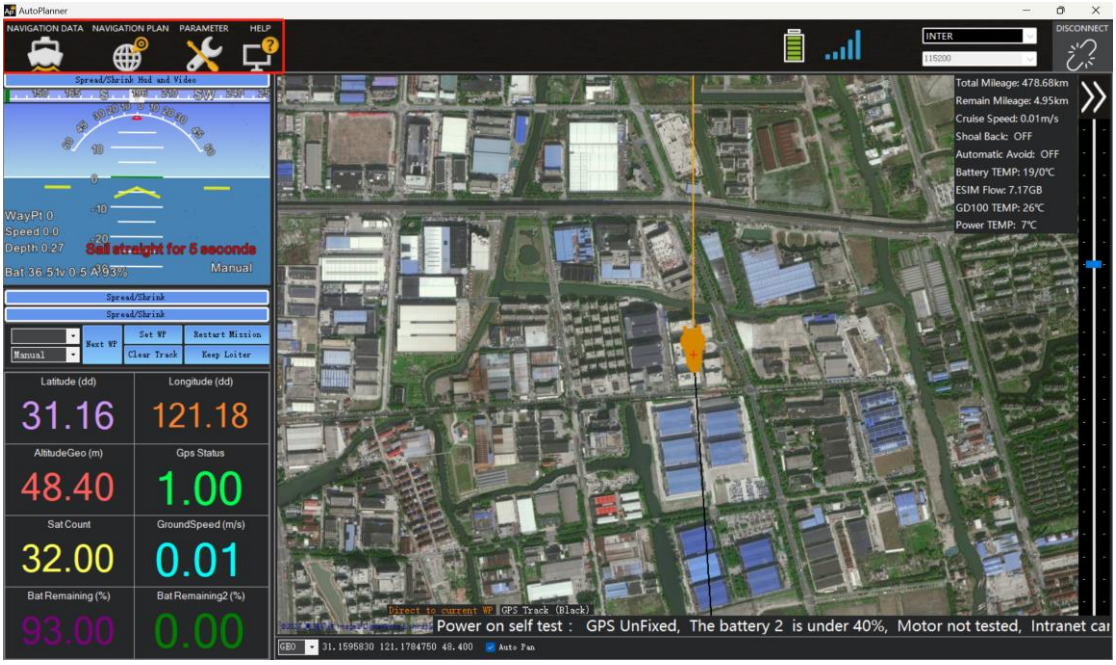


5. AutoPlanner

This section provides a detailed introduction to the AutoPlanner software functionality.

This software is designed for the Huawei series of unmanned ships and is used for ship control. It allows for navigation path planning and modification of basic ship parameters.

Open the software, the default interface is shown in the figure below. It consists of four sections: Navigation Data, Navigation Plan, Parameters, and Help. Below, we will provide a detailed introduction to each section:

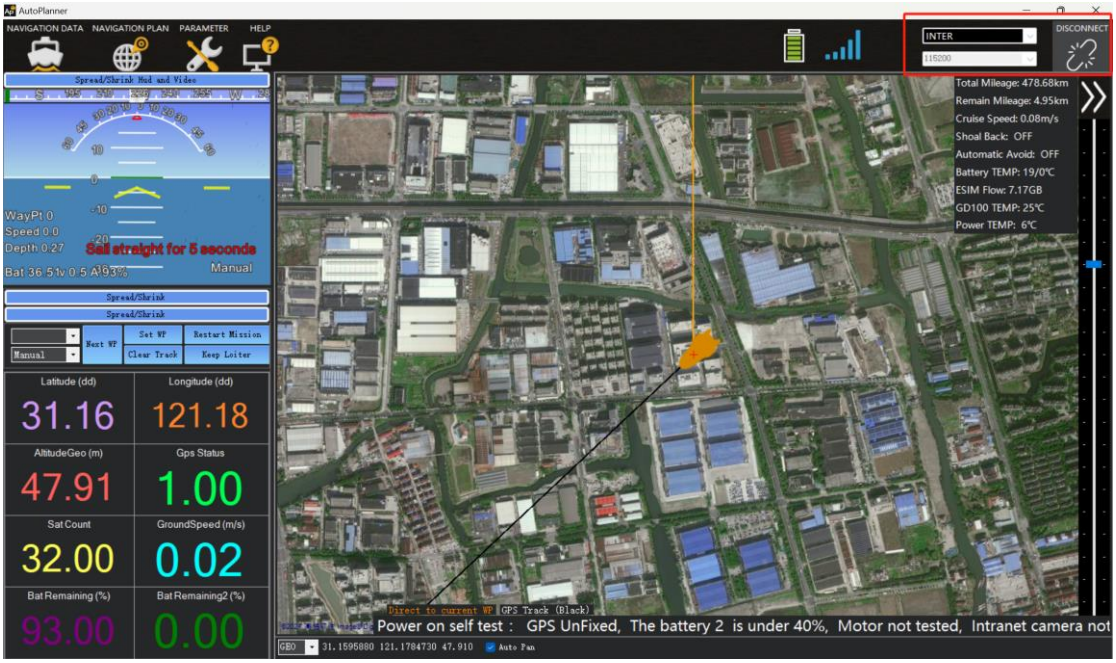


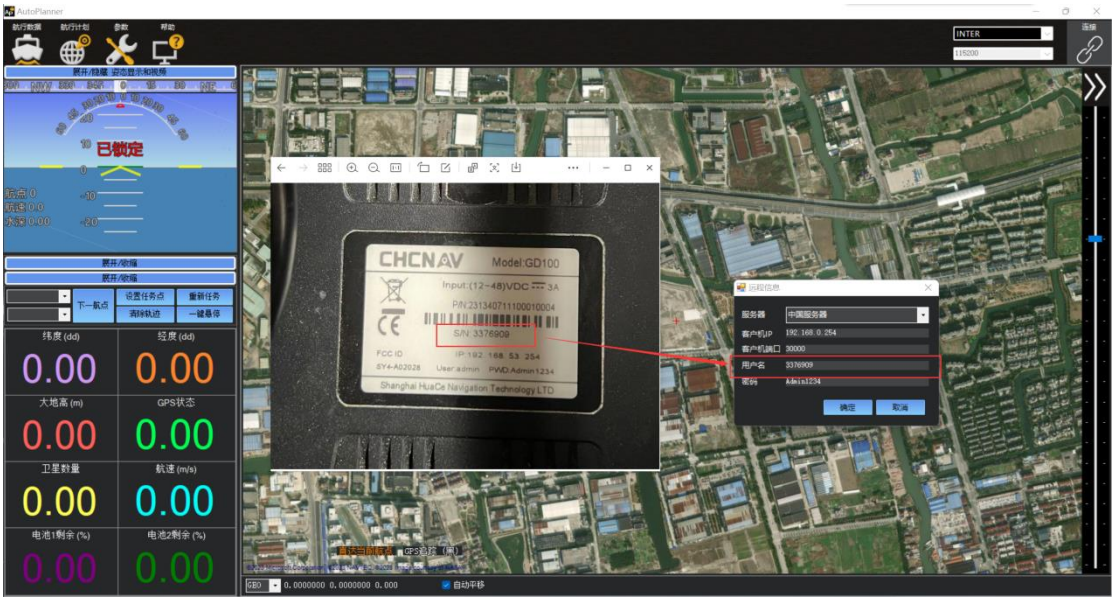
5.1 navigation Data

5.1.1Connect

The connection window offers two connection options: INTER (4G) and TCP (WiFi and network bridge). When using the 4G connection, the network in the area where the ship is located needs to be in good condition, and there are no restrictions on communication distance.

The TCP connection includes two options. One is to connect to the ship's WiFi, which has a shorter signal distance. This option is mainly used for debugging and is not suitable for operations. The other option is to connect through a bridge, which is suitable for areas with poor network signals. The distance is generally around 300-500 meters. Installing the bridge at a higher position will result in better signal reception.

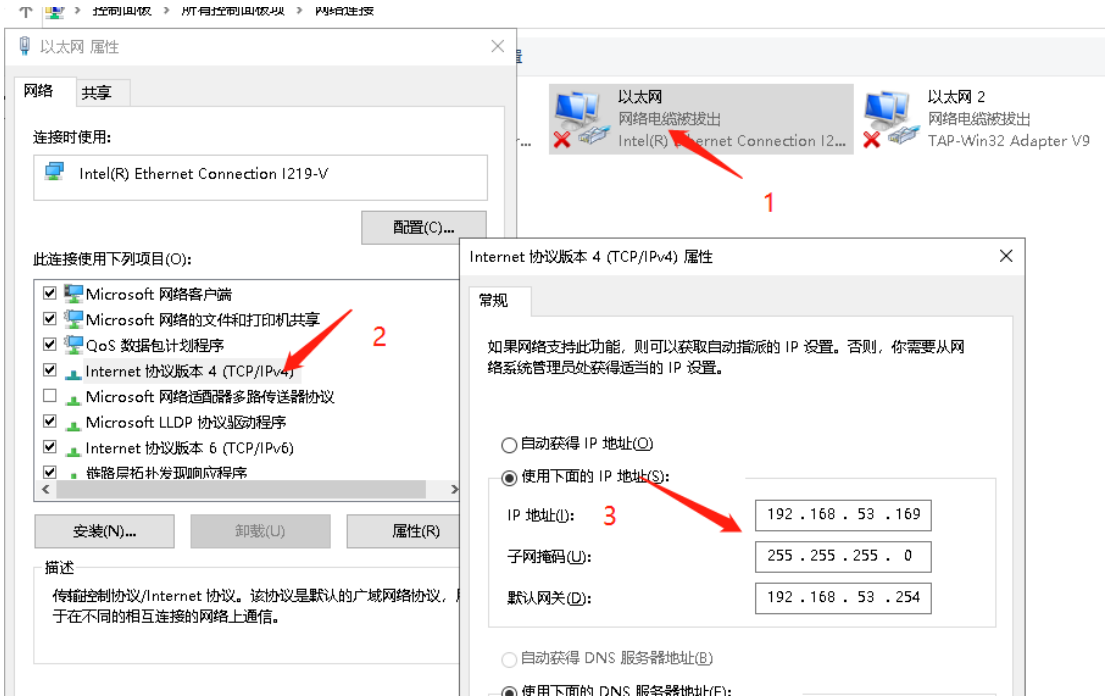




Using 4G connection as an example: Choose the INTER connection. The server will select it based on the actual situation. There is no need to change the client port. The username is the SN code on the firmware of the unmanned ship control GD100, and the password is Admin1234 (the client IP under 4G is 192.168.0.254; the IP for WiFi and bridge is 192.168.53.254. You can open the browser to view the current network signal strength, satellite status, etc.)

Note:

If you are using a bridge connection, you need to change your computer's IP address to the 53 subnet. However, you cannot use the following IP addresses: 192.168.53.254, 192.168.53.64, 192.168.53.20, 192.168.53.19 as they are already being used.

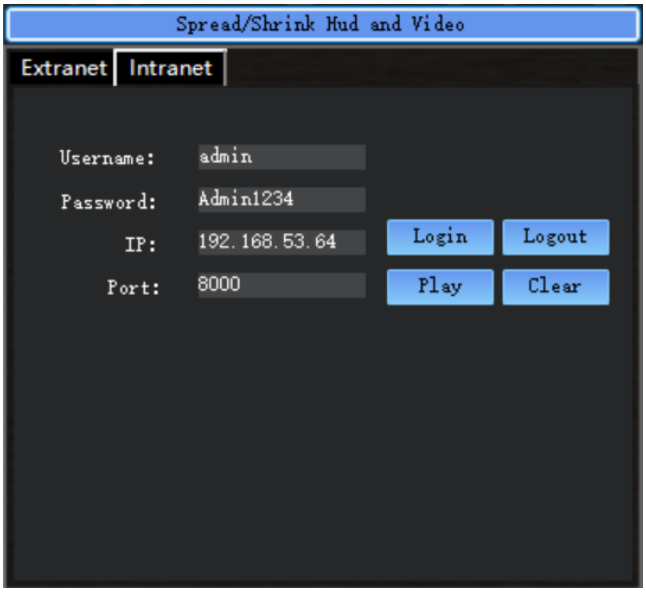


After the connection is established, you can find the current basic information in the bottom right corner of the homepage. It includes the longitude, latitude, altitude, GPS status, number of satellites, speed, status of battery 1, and status of battery 2. The current signal status is displayed in the top left corner.

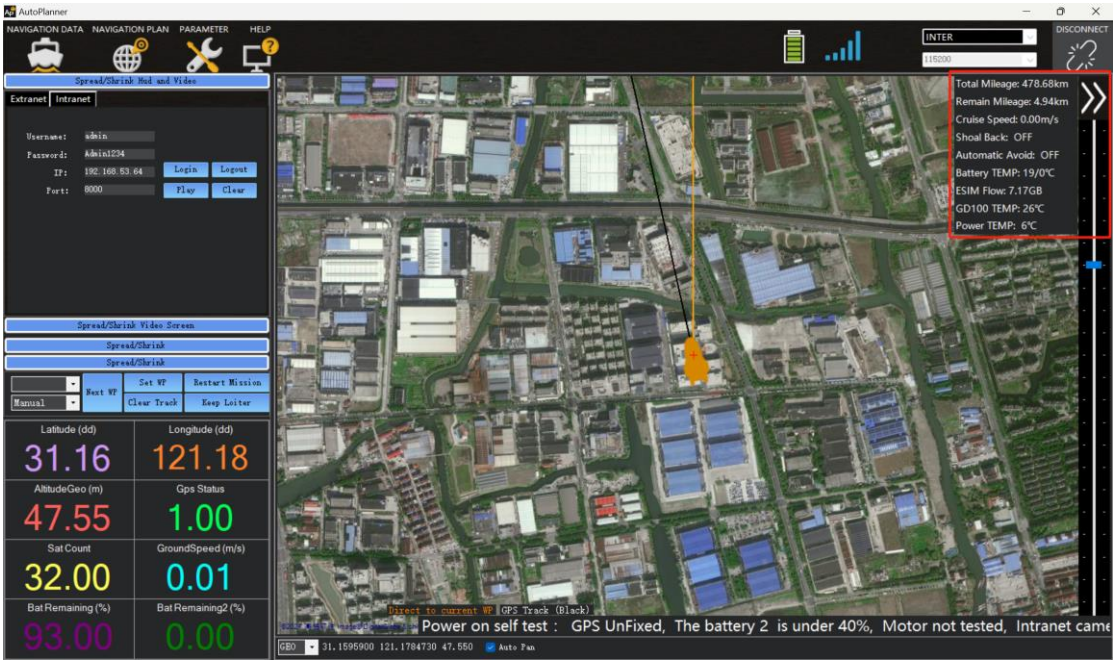
5.1.2Login Camera

Under 4G connection status (external network): Click on the Expand/Hide Attitude Display and Video in the upper left corner of the page, click on Intranet Network, enter the Username is admin, password is Admin1234, port is 8000, and the IP is 192.168.0.254 and then click on Start - Play to open the camera.

Under TCP connection status (internal network): Username is admin, password is Admin1234, port is 8000, and the IP is 192.168.53.64.

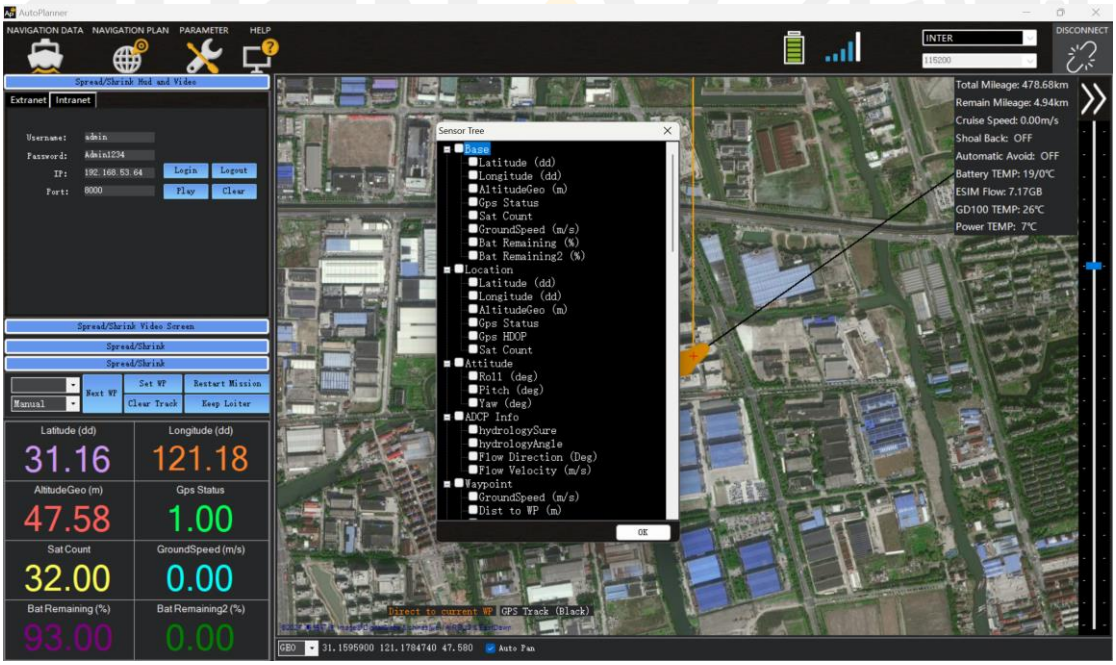


5.1.3Parameters Display



1. Expand/Collapse Attitude Display and Video：Displays the vessel's attitude, expand to show the camera;
2. Expand/Collapse Remote Control：Check button control, control the unmanned vessel using WASD, control the camera using up, down, left, and right;
3. Open/Close Auto Button： After setting the route and sending it to GD100, open the automatic mode, and the unmanned vessel will start operating on the preset route.
4. Expand/Collapse Settings：

5. Set Waypoint：Sets the initial waypoint of the unmanned vessel, which is the first point when the unmanned vessel is in automatic mode;
6. Next Waypoint：The next waypoint of the unmanned vessel in automatic mode;
7. Clear Track：Clears the current planned route on the base map;
8. Auto/Manual/Standby/Return/Guide：Switches the current working mode of the unmanned vessel;
9. One-Click Hover：Select the corresponding waypoint to switch between manual mode, automatic return, and hover;
10. Parameter information column：The display area for regular parameters, double-click to switch to the corresponding real-time display parameters;
11. Switch Map：Switches to different maps, such as Amap, Google Maps, Bing Maps, etc. Different image maps may have deviations in accuracy, choose the most suitable image map based on the field conditions. If the network is poor in the field measurement area, you can preload the satellite image indoors;
12. Auto Pan：When selected, the vessel remains centered;
13. Battery and Signal Strength Display：Displays the current battery level and network signal strength;
14. Hide：Shows or hides the current status information of the unmanned vessel;
15. Status Information Column：Displays the current status information of the unmanned vessel;
16. Zoom：Zooms the map display, scroll up to zoom in and scroll down to zoom out using the mouse wheel.



5.1.4Navigation Plan

Page Status Display

1. GEO, UTM, MGRS are different coordinate systems, which are respectively the geodetic coordinate system, the unified transverse Mercator projection system, and the UTM-based military grid reference

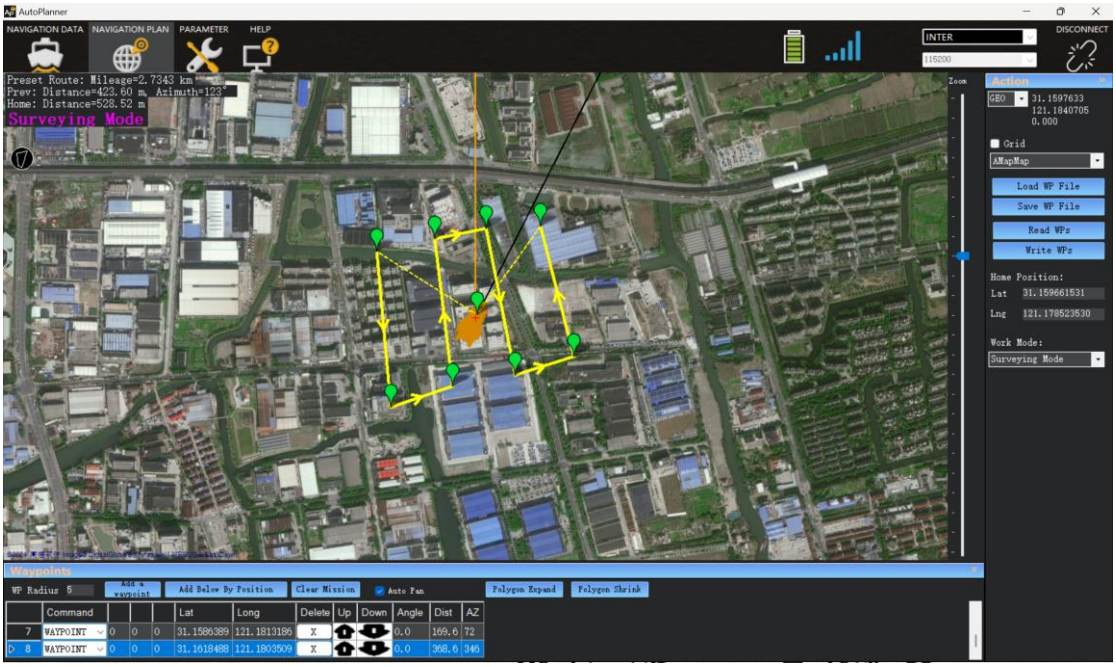
system (MGRS) latitude and longitude system. Generally, the default is latitude and longitude coordinates.

2. Check [Grid] to display grid lines.
3. Switch Map to switch to different maps, such as Amap, Google Maps, Bing Maps, etc. Different imagery maps may have deviations in accuracy. Choose the most suitable imagery map based on the field conditions. If the field survey area has poor network connectivity, pre-load satellite imagery indoors.
4. Load Task Point File to load previously saved task point files.
5. Save Task Point File to save the currently planned flight route.
6. Read Task Point to read the current task waypoints from the controller.
7. Write Task Point to transfer the planned waypoint data to the controller.

Note:

The file import does not support a large number of waypoints, with a maximum limit of 300.

8. Starting Position Coordinates Displays the coordinate information of the initial position;
9. Operating Mode Includes four modes: surveying, hydrological, fully automatic, and semi-automatic. (Only unmanned boats equipped with millimeter wave obstacle avoidance radar can use the fully automatic and semi-automatic functions, and the obstacle recognition angle needs to be >45°)
10. Pre-set Route The top left corner displays the route mileage, bearing information from the previous point, and distance from home;
11. Waypoint List Allows modification of point coordinates, deletion, and sorting;
12. Mark Waypoint at Boat's Location Adds a waypoint at the boat's current location; [Clear Mission] Clears all waypoints added on the current interface; [Auto Pan] When selected, the boat remains centered;
13. Polygon Expansion/Contraction Expands or contracts the polygon, clicking once expands internally or contracts externally by 0.5m;
14. Waypoint Left-click on the map to add waypoints, right-click on a selected waypoint to delete;



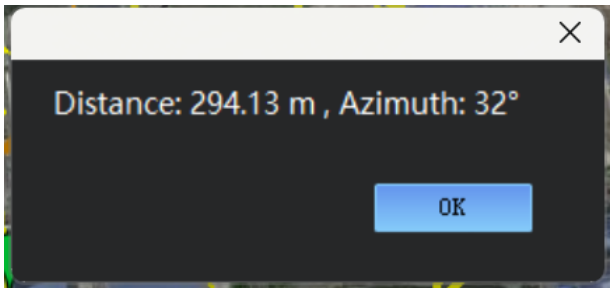
Right-Click Menu Bar Function

1. Insert/Delete Waypoints: Select the desired location to add a waypoint, and click the left mouse button to add the waypoint. To delete a selected waypoint, right-click on it.
2. Hover: Control the unmanned vessel to hover at a specific location.
3. Jump: After the unmanned vessel completes the preset route operation, it will continue to operate based on the preset jump points and repetition count. For example, if the operation includes waypoints 1-5 and the jump point is set to waypoint 2 with a repetition count of 3, the unmanned vessel will navigate from waypoint 5 to waypoint 2 after completing the normal preset route operation. It will then continue from waypoint 2 to waypoint 5. This process will repeat 3 times, and after that, the operation will end and the unmanned vessel will return to its home position.
4. Return: After the operation is complete, the unmanned vessel will return to its home position. To specify the return route, select the desired waypoint as the return point and right-click to add the return path that passes through this point.

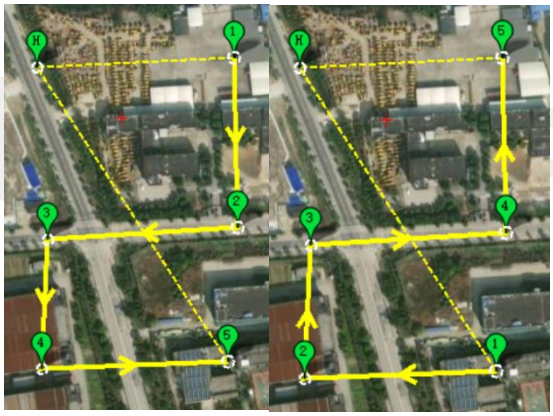
5. Points of Interest: Add points of interest and name them, which can display the latitude and longitude

information of the point.

6. Measure Distance Between Two Points: Right-click on a selected location to measure the distance between two points. Right-click on the target location to measure the distance between two points and display the distance and bearing between the two points.



7. Reverse Task Points: Reverse the sequence of the starting point and the ending point, i.e., reverse the trajectory of the route.



Loading/Overlaying KML: Right-click with the mouse to load KML. Select an existing KML or KMZ file to open and check the survey lines. Adjust them as needed and write them into the task points.

Swap Docking Menu Bar: Switch the task point information display bar below to the right side of the software.

Set Home Here: Set the position of home in a safe location to ensure the safe return of the unmanned vessel in case of disconnection.

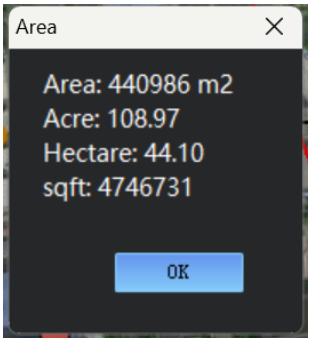
Polygon - Navigation Path Planning: Automatically plan the route based on the size of the polygon range.

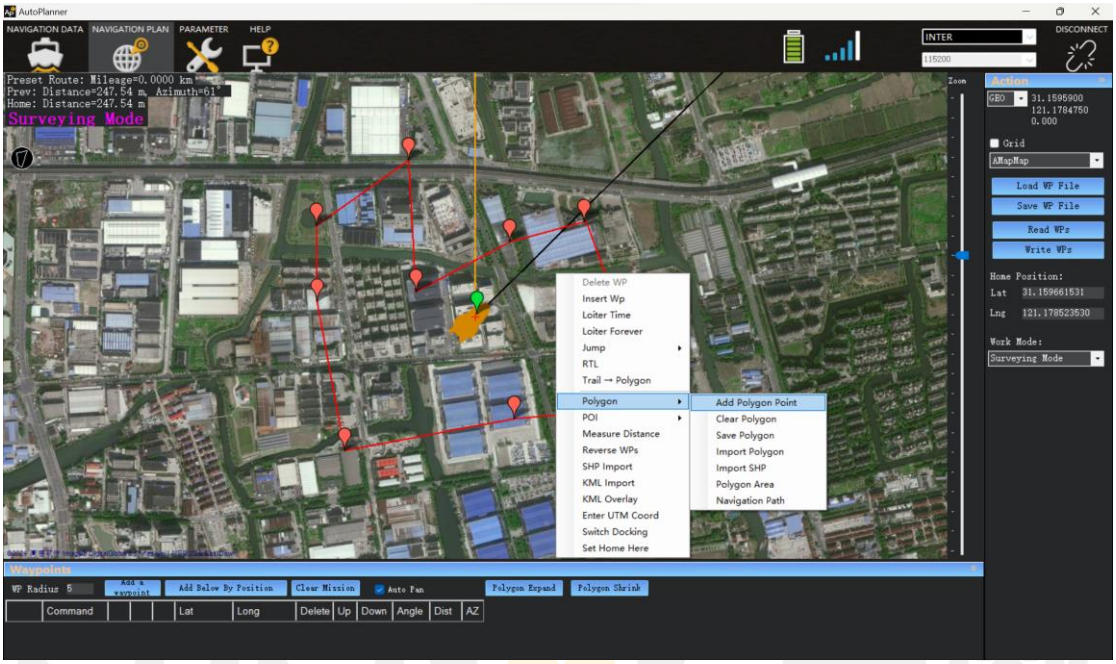
Polygon - Save Polygon: Save the current planned polygon to the computer.

Polygon - Import Polygon: Add a polygon from the computer to the base map.

Polygon - From SHP: Add an SHP file from the computer and automatically identify the polygon.

Polygon - Area: Calculate the area, acres, and other information of the current polygon.





【Polygon】 - 【Navigation Path Planning】:

【Add Polygon】: Add a polygon based on the survey area overview.

【Home Green Point】: Set the position of the home before each measurement to prevent the unmanned boat from losing connection.

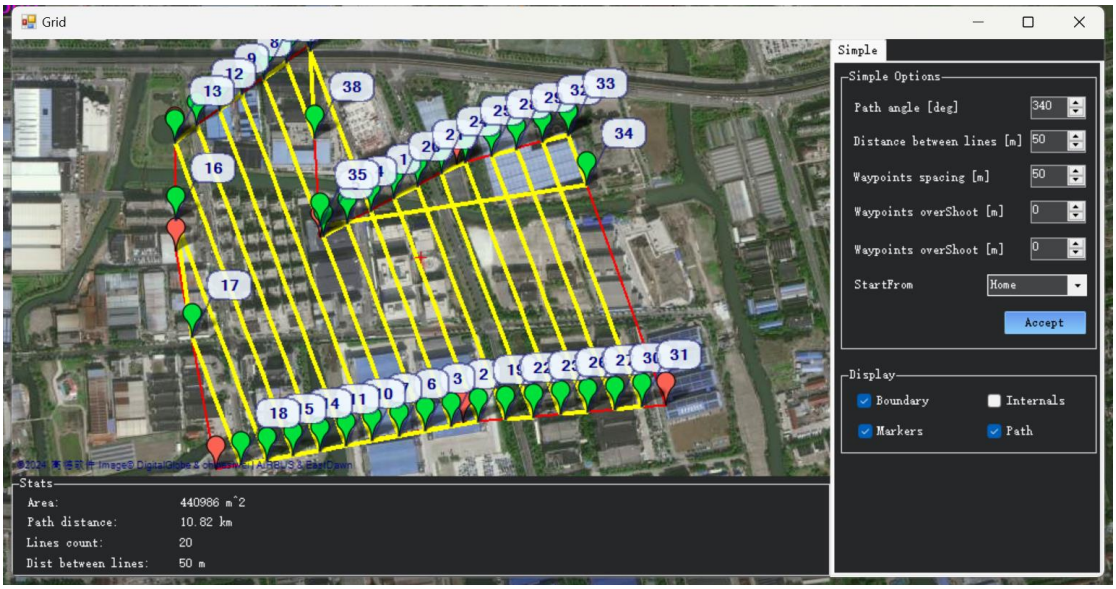
【Navigation Path Parameters Setting】: Adjust the heading angle, track line spacing, waypoint spacing, starting point, and fine-tune the left and right waypoint positions during the navigation process.

【Navigation Path Display Setting】: Select the content to display during the navigation process, including whether to show borders, internal waypoints, markers, and track lines.

Note:

Satellite imagery is not updated in real-time, so when planning work areas, pay attention to the safety of the area. The role of the home point: (1) The home point seves as the return point. (2) The logic for generation automatic flight routes is to generate waypoint 1 near the home point, and the rest of the waypoints are generated in sequence

---

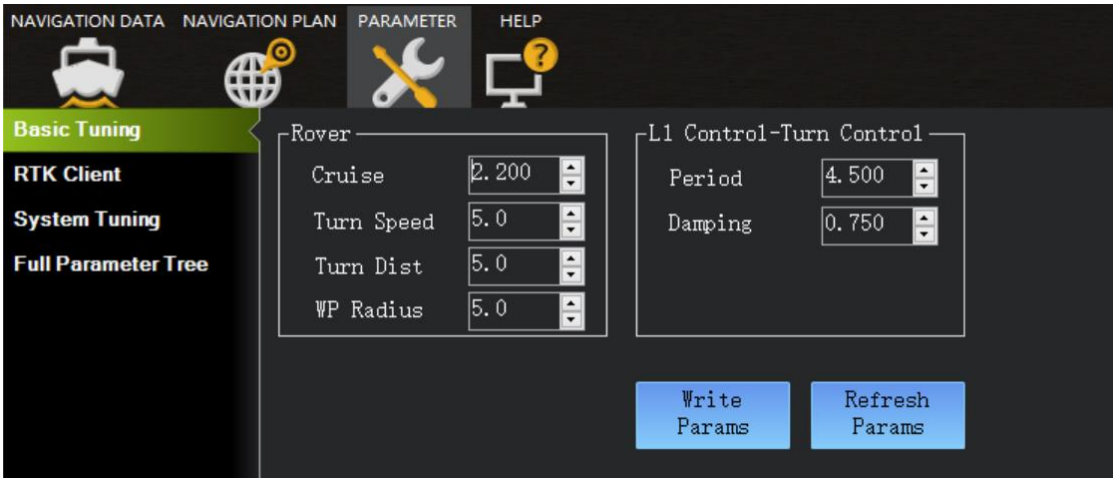


5.2 Parameter

5.2.1Basic Parameters

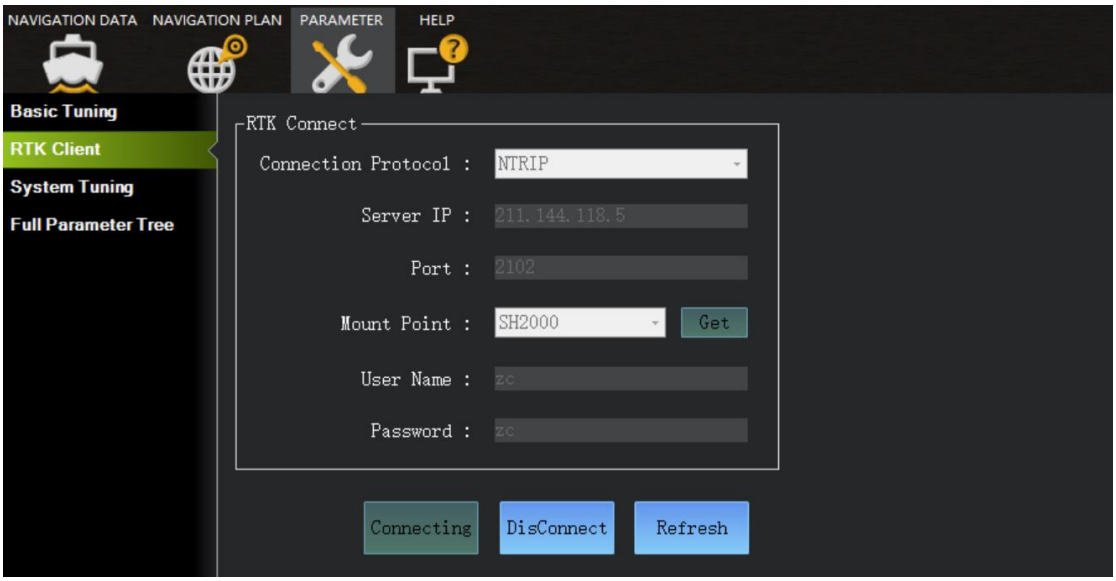
1 The parameters automatically configured by the AP software after connecting to the unmanned boat cannot be modified;

2 Cruise Speed should be written into the parameters according to the actual situation and can be modified in real-time;



5.2.2RTK Settings

[CORS Login] The new version of the AP software allows logging into the CORS account in the RTK settings.



5.2.3System Setting

1 Shallow: The unmanned boat will automatically reverse when the water depth at its current location is lower than the set depth.

2 Automatic Obstacle Avoidance: When the unmanned boat approaches a preset distance from an obstacle, it will automatically avoid the obstacle and continue along the preset path after bypassing it.

3 Low Battery Return: When the battery level is below a certain threshold, the unmanned boat will stop operations and return automatically.

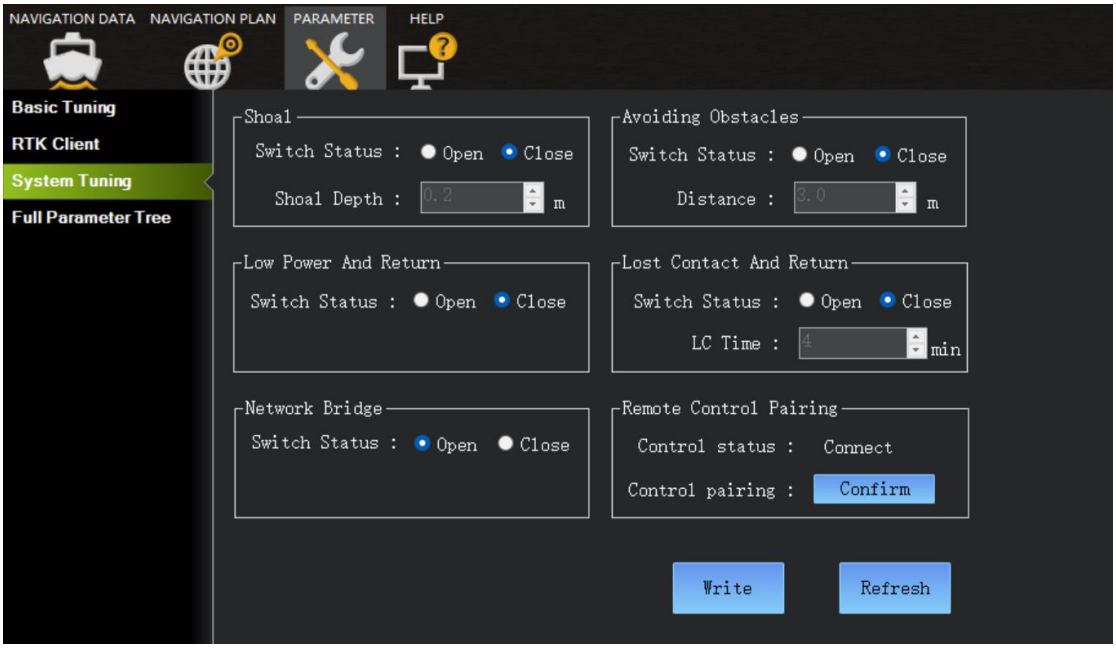
4 Lost Connection Return: If both the remote control and the AP software lose connection with the unmanned boat for a certain period of time, the boat will automatically return.

5 Bridge: Enabled by default.

6 Remote Controller: The default matched remote controller will automatically connect to the unmanned boat after it is turned on. If it is not the matched remote controller, first connect the AP software with the unmanned boat, then click "Enable Matching" and turn on the remote controller. Once you hear the boat's prompt sound, it means the matching is successful. Write/Refresh Parameters: After modifying the parameters, click "Write" and then refresh to apply the changes.

Note:

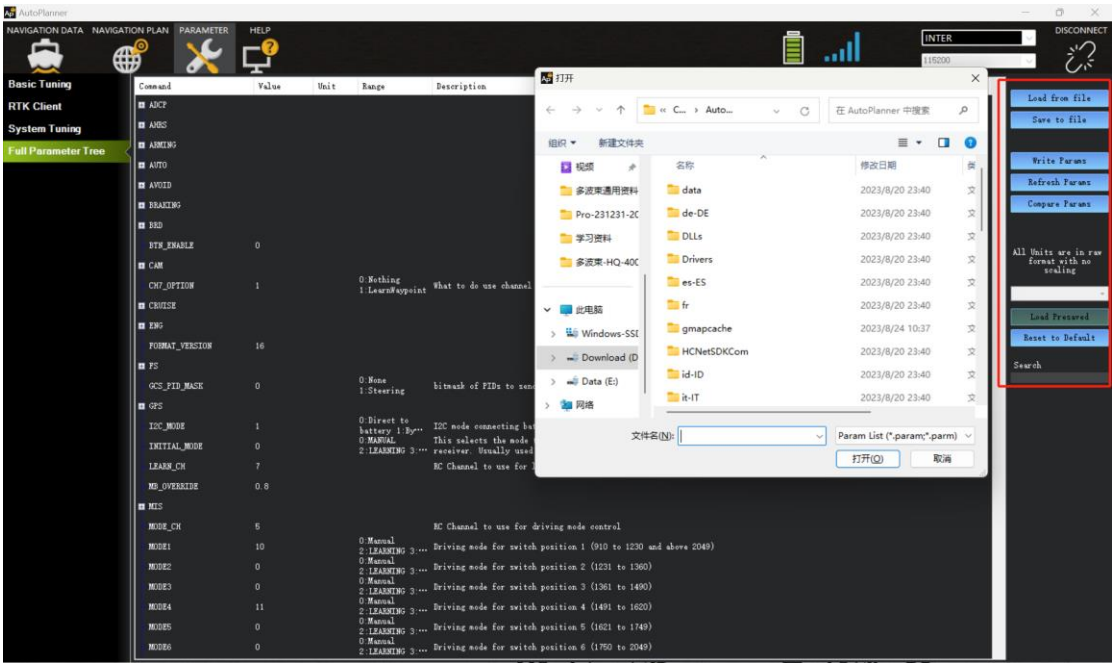
Shoal must be done under the condition that the depth sounder is working properly.



5.2.4Full Parameters

[Loading] In case of abnormal attitude of the hull, the corresponding hull parameters can be loaded to restore the factory parameter configuration. The parameter name is GD100-ship type, with a suffix of .param. The default storage path for parameters is in the main installation directory of the AP software. The parameter name for the new A3, A4 unmanned boats is GD100-ship type (V1.1).

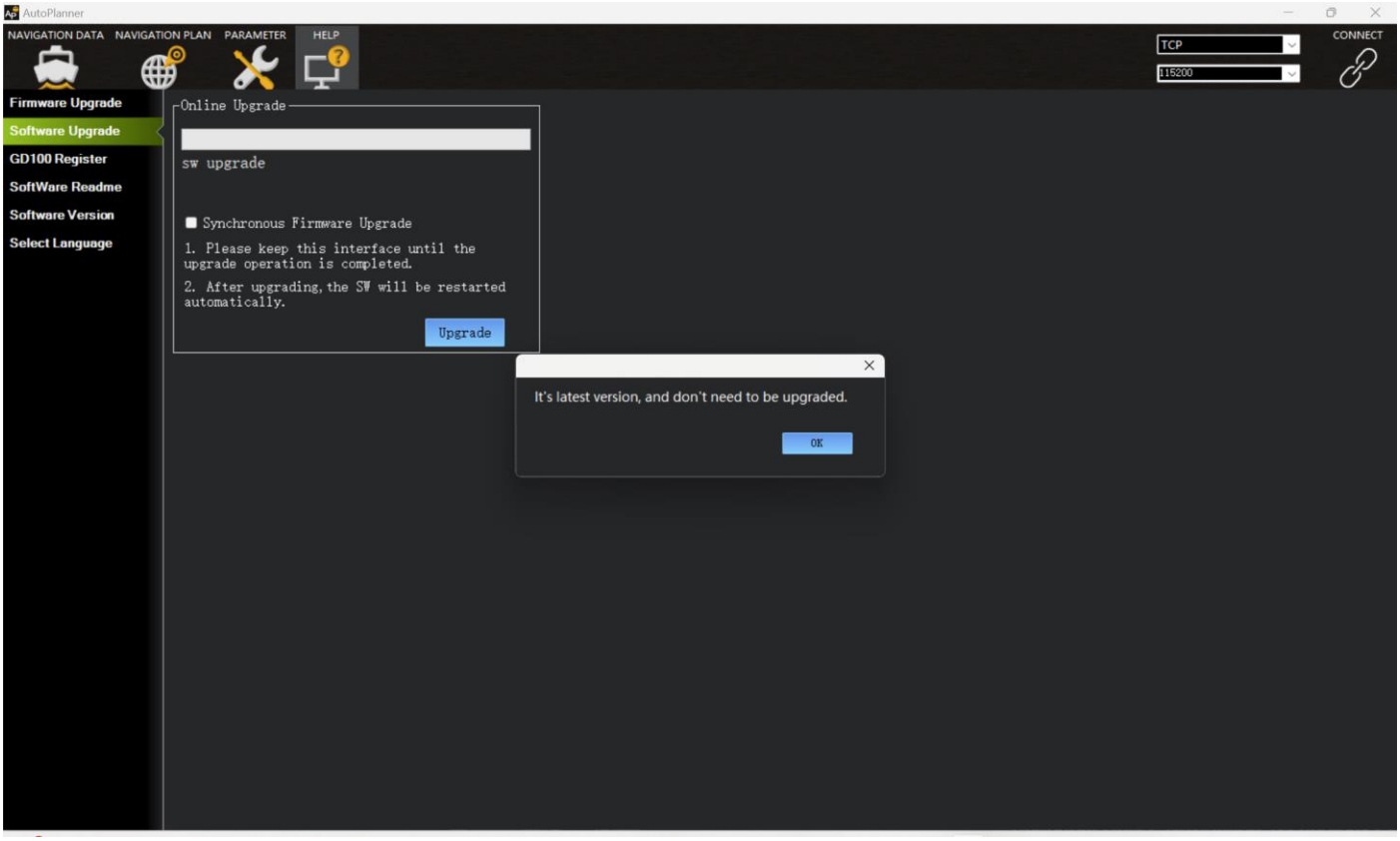
[Saving] Save the current parameters to the computer.



5.3 Help

5.3.1Software Update

Checking the firmware synchronization upgrade will update the AutoPlanner software and GD100 firmware to the latest version;

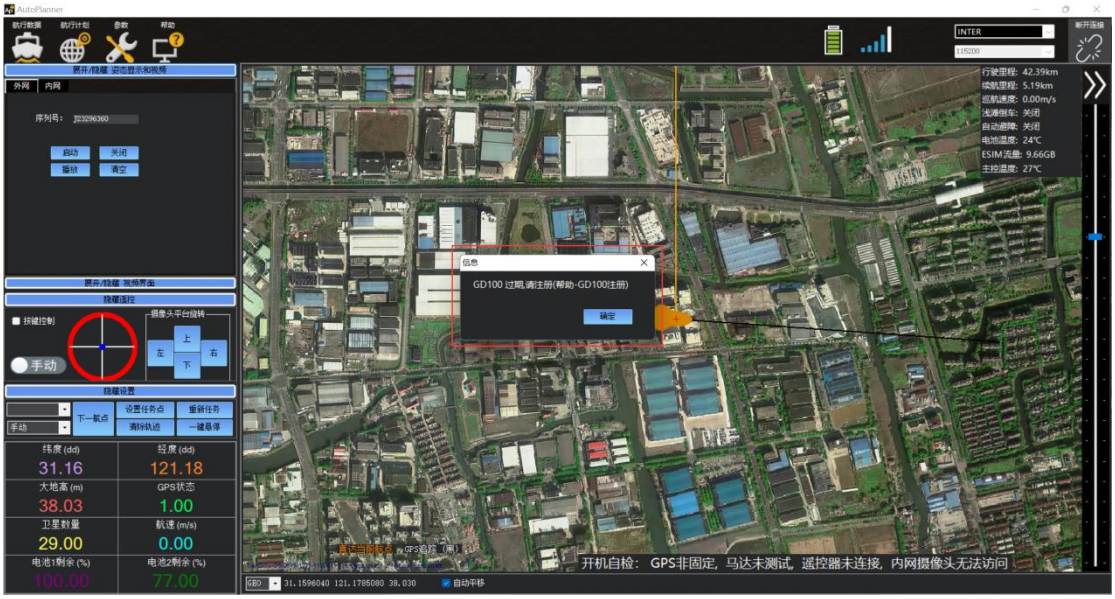


5.3.2GD100 Registration

If the GD100 registration has expired (as shown in the image), please provide the machine code to the salesperson to complete the GD100 registration using the registration code. You can find the registration code by going to "Help" > "GD100 Registration" to view the machine code and registration code.

Software update information

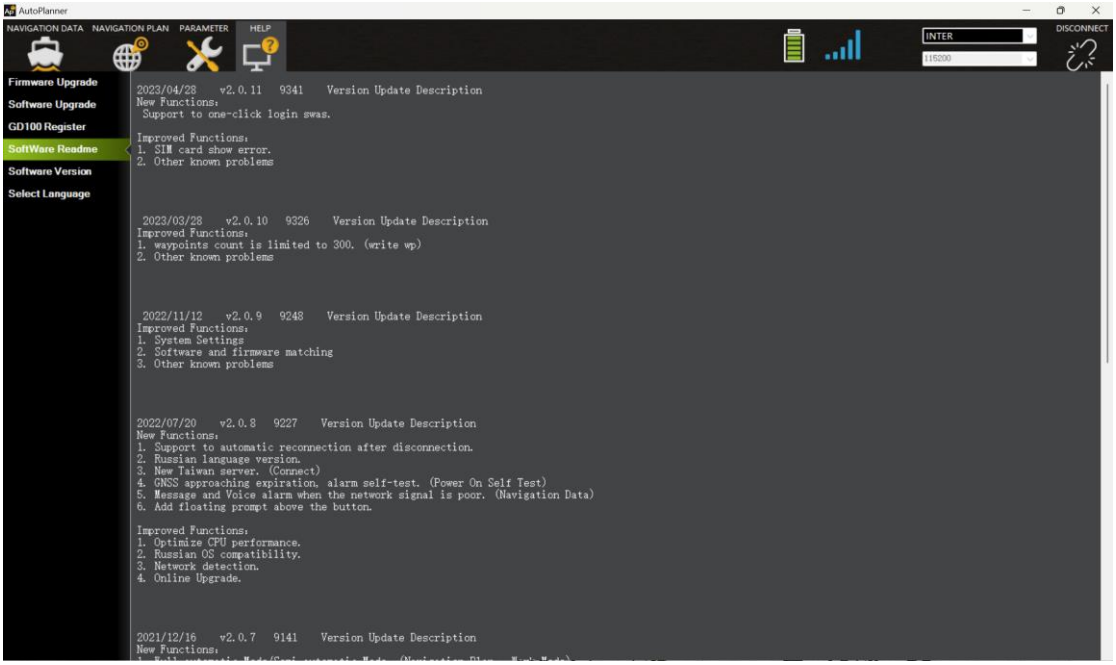
Each version update will have a corresponding update log to explain the changes made.



Software version information

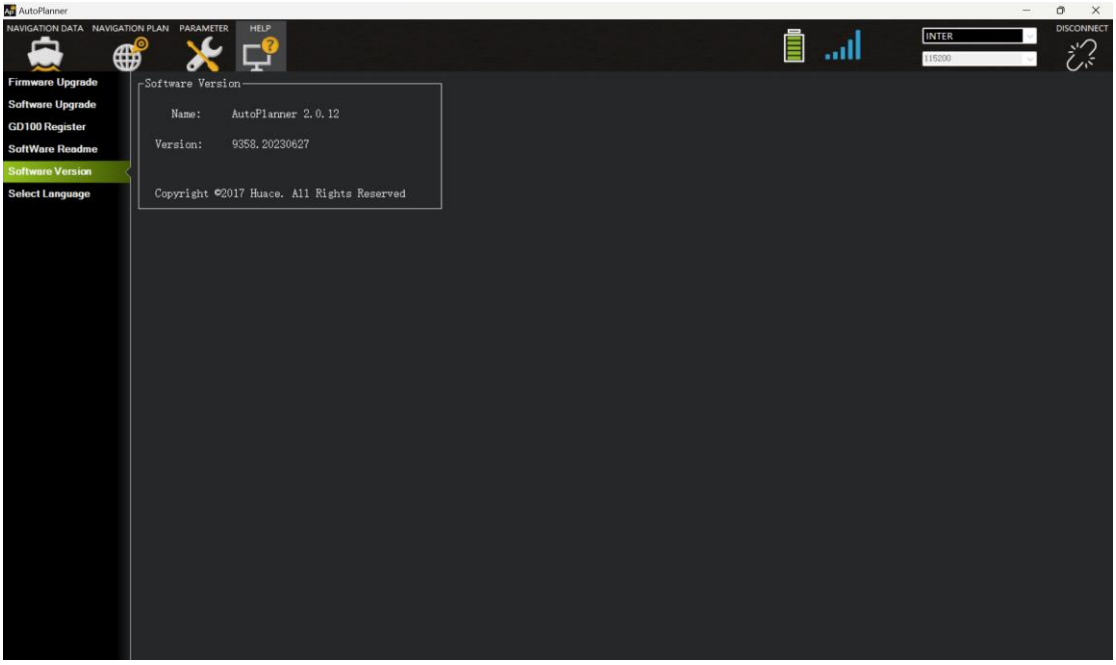
5.3.3Version Description

Explanation of update logs for each version update;



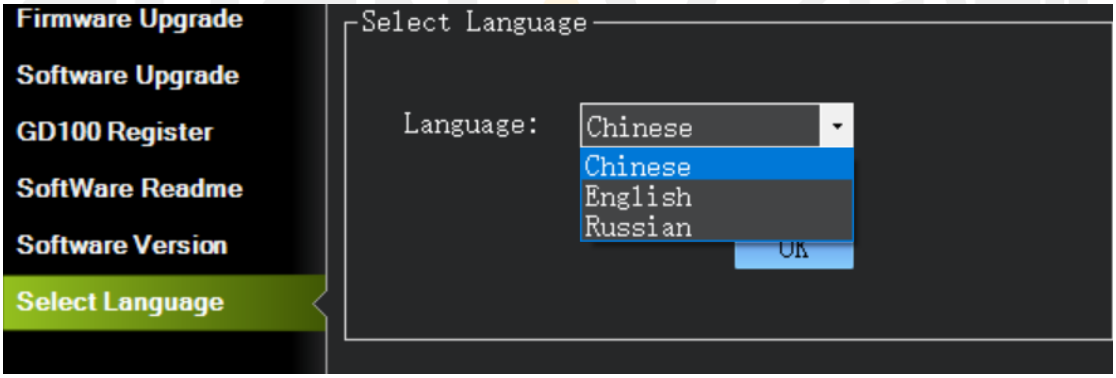
5.3.4Software version

Display the current version number of the AP software. If there are any issues with the software, please provide the corresponding version number for targeted troubleshooting.



1.1.1 Language

The current version supports Chinese/English/Russian languages. After switching, restarting the software will take effect



6. USV Web Management System

After establishing a connection with the unmanned vessel, you can access the USV web management system to view its status and control data output. There are two types of access methods:

Method 1: After connecting to AutoPlanner software through 4G (INTER), open a browser and enter 192.168.0.254 in the address bar to access it.

Method 2: Through TCP, the mobile device connects to the GD100 LAN1 network port or WIFI through a network cable, opens a browser, and enters 192.168.53.254 or 192.168.144.254 in the address bar to access it.

Note:

To connect via TCP, it is necessary to modify the device network segment to be consistent with GD100.

User name (default)：admin

Password (default)：Admin1234

6.1 USV Status

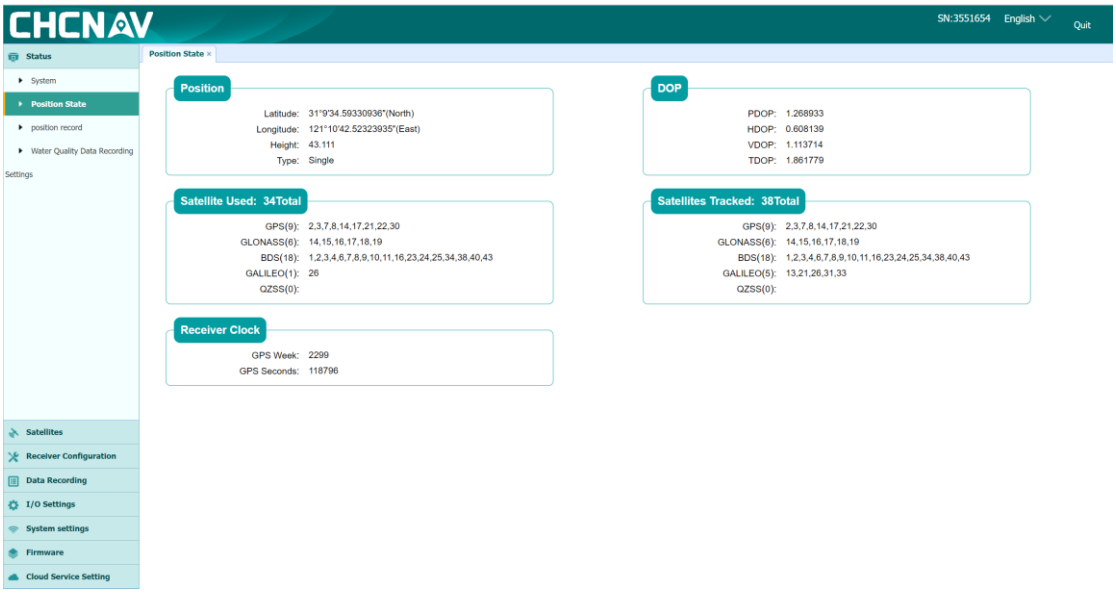
6.1.1System State

In the system status bar, you can check network status, GNSS information, battery status, activity status, control status, depth sounder status, and other information.

4G connection requires checking the network status bar, network signal strength, dialing status, and remaining ESIM traffic.

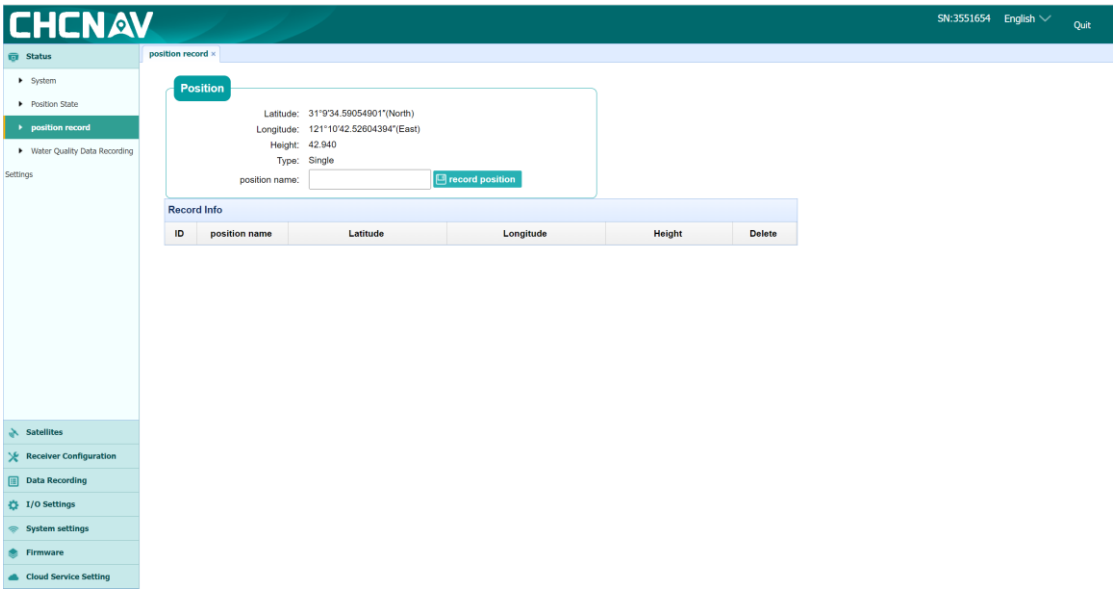
6.1.2Position Status

This interface is used to view relevant information such as the position of the antenna behind the USV GNSS.



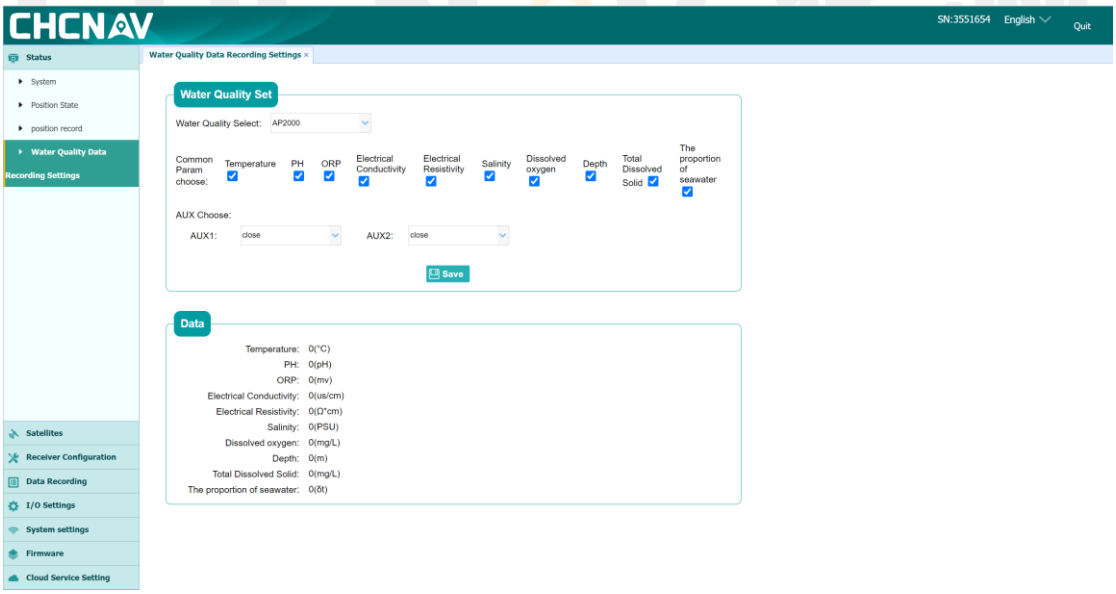
6.1.3Position Record

Enter the name and click on the measurement point to record the current position.



6.1.4Water Quality Data

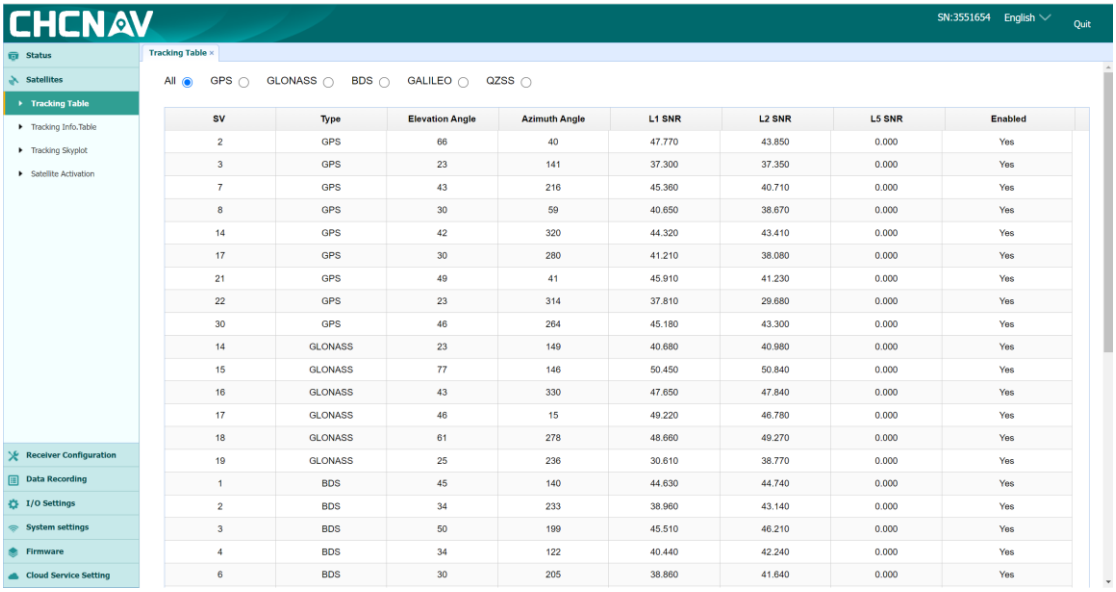
This interface is used for data transmission of water quality meters. Currently, water quality meter models support(AP2000, AP5000, AP7000, Y4000). Select the corresponding parameter output based on the hardware sensor of the water quality meter.



6.2 Satellite

6.2.1Tracking Table

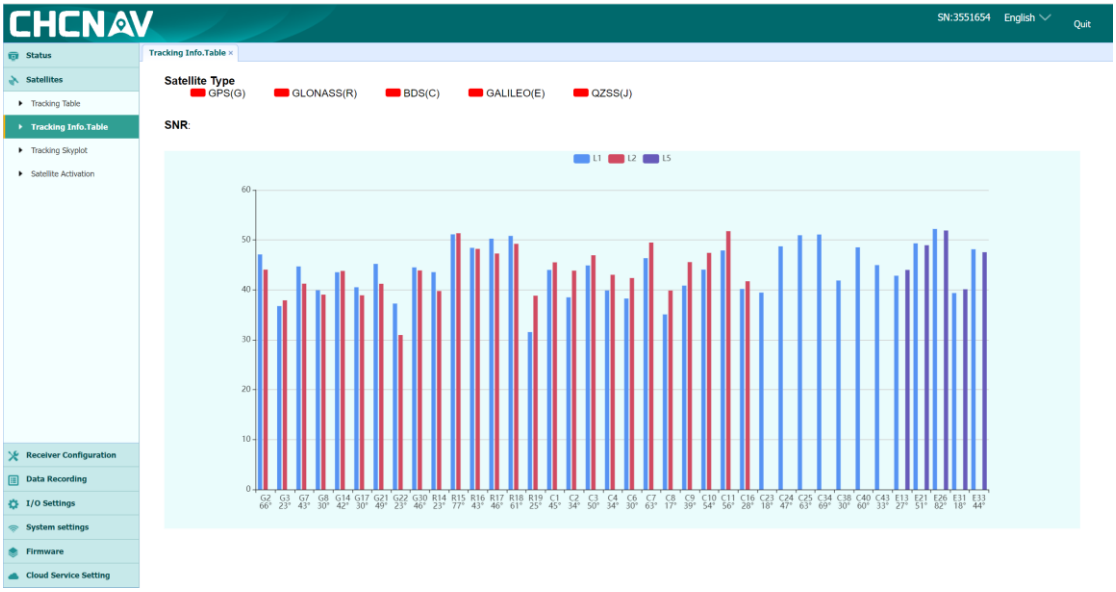
Satellite tracking map: This interface displays the information of the currently tracked satellites in the form of a table.



SV	Type	Elevation Angle	Azimuth Angle	L1 SNR	L2 SNR	L5 SNR	Enabled
2	GPS	66	40	47.770	43.850	0.000	Yes
3	GPS	23	141	37.300	37.350	0.000	Yes
7	GPS	43	216	45.360	40.710	0.000	Yes
8	GPS	30	59	40.650	38.670	0.000	Yes
14	GPS	42	320	44.320	43.410	0.000	Yes
17	GPS	30	280	41.210	38.080	0.000	Yes
21	GPS	49	41	45.910	41.230	0.000	Yes
22	GPS	23	314	37.810	29.680	0.000	Yes
30	GPS	46	264	45.180	43.300	0.000	Yes
14	GLONASS	23	149	40.680	40.980	0.000	Yes
15	GLONASS	77	146	50.450	50.840	0.000	Yes
16	GLONASS	43	330	47.650	47.840	0.000	Yes
17	GLONASS	46	15	49.220	46.780	0.000	Yes
18	GLONASS	61	278	48.660	49.270	0.000	Yes
19	GLONASS	25	236	30.610	38.770	0.000	Yes
1	BDS	45	140	44.630	44.740	0.000	Yes
2	BDS	34	233	38.960	43.140	0.000	Yes
3	BDS	50	199	45.510	46.210	0.000	Yes
4	BDS	34	122	40.440	42.240	0.000	Yes
6	BDS	30	205	38.860	41.640	0.000	Yes

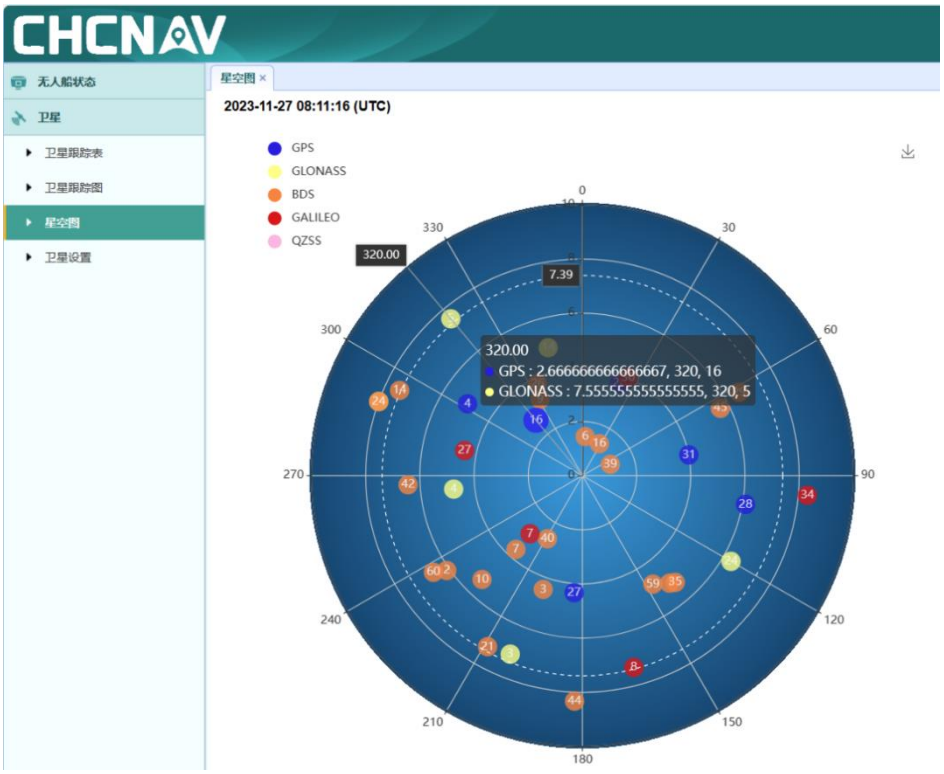
6.2.2Tracking Info. Table

This interface displays the information of the currently tracked satellites in the form of a histogram.



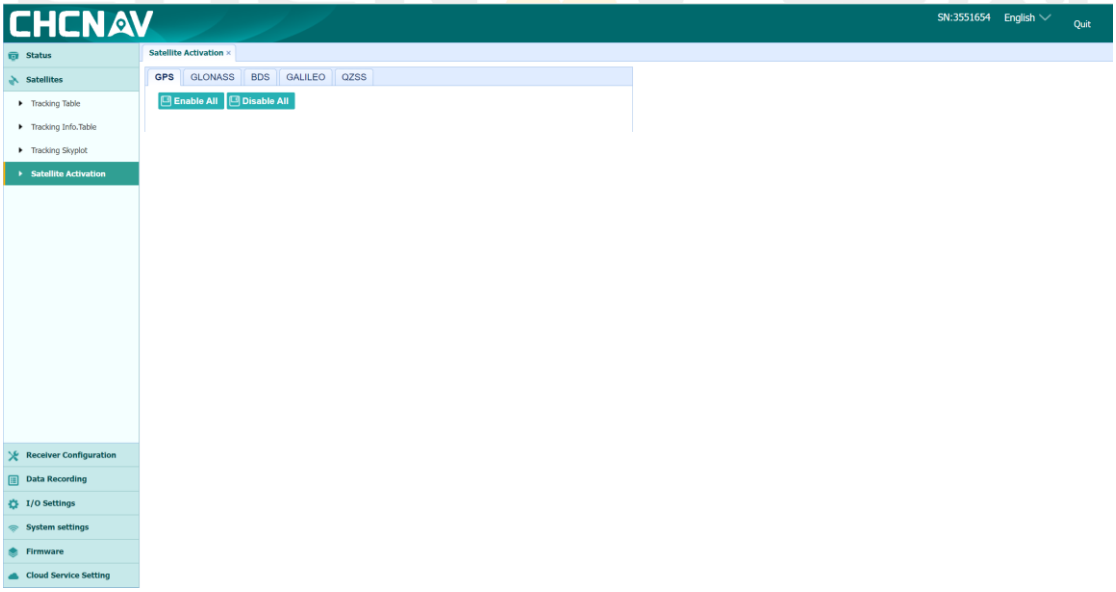
6.2.3Tracking Skyplot

This interface displays the satellite zenith map.



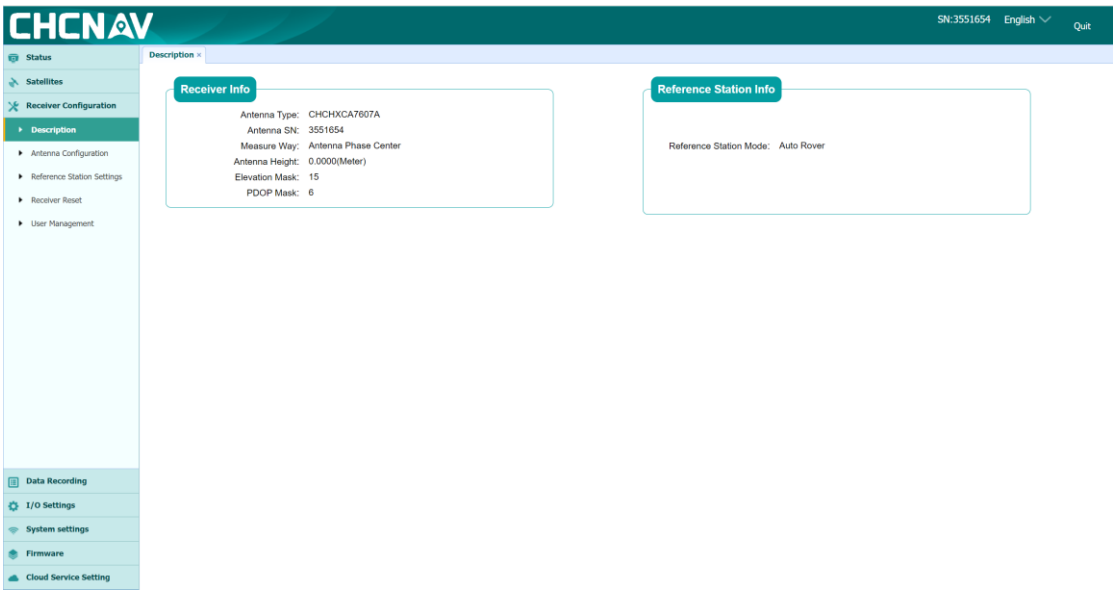
6.2.4Satellite Activation

This interface can disable or enable tracked satellites.



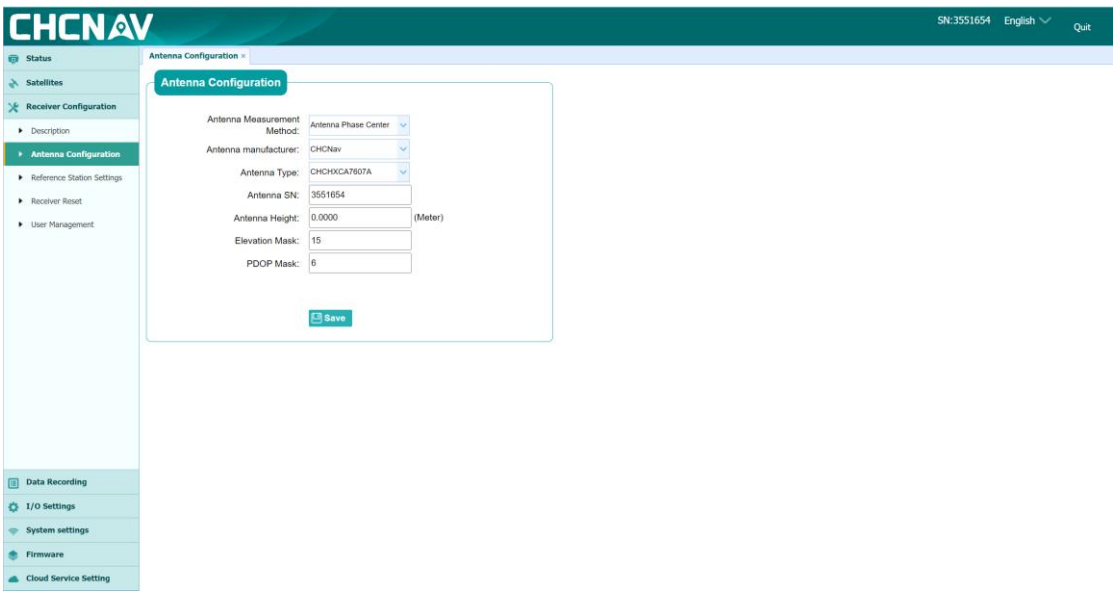
6.3 Receiver Configuration

6.3.1Description



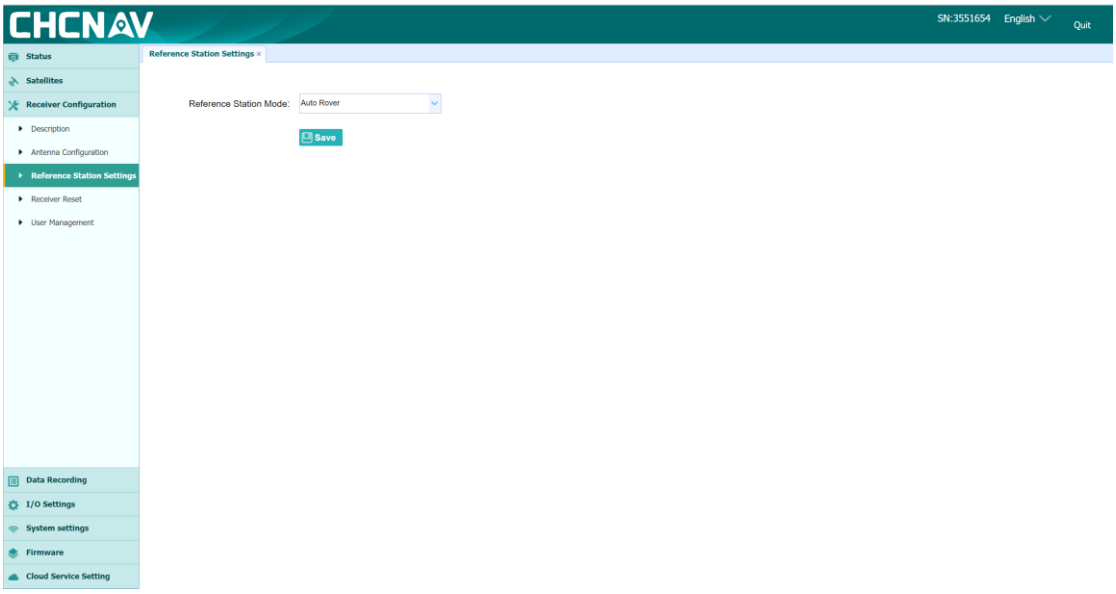
6.3.2Antenna Configuration

This interface is used for antenna parameter settings, measurement method (phase center/vertical height/oblique height), antenna manufacturer (supporting mainstream domestic and international), antenna type (adapted according to antenna manufacturer, if not available, can be customized), antenna number (default GD100 SN, do not modify)



6.3.3Reference Station Settings

The reference station mode only supports [self starting mobile station]

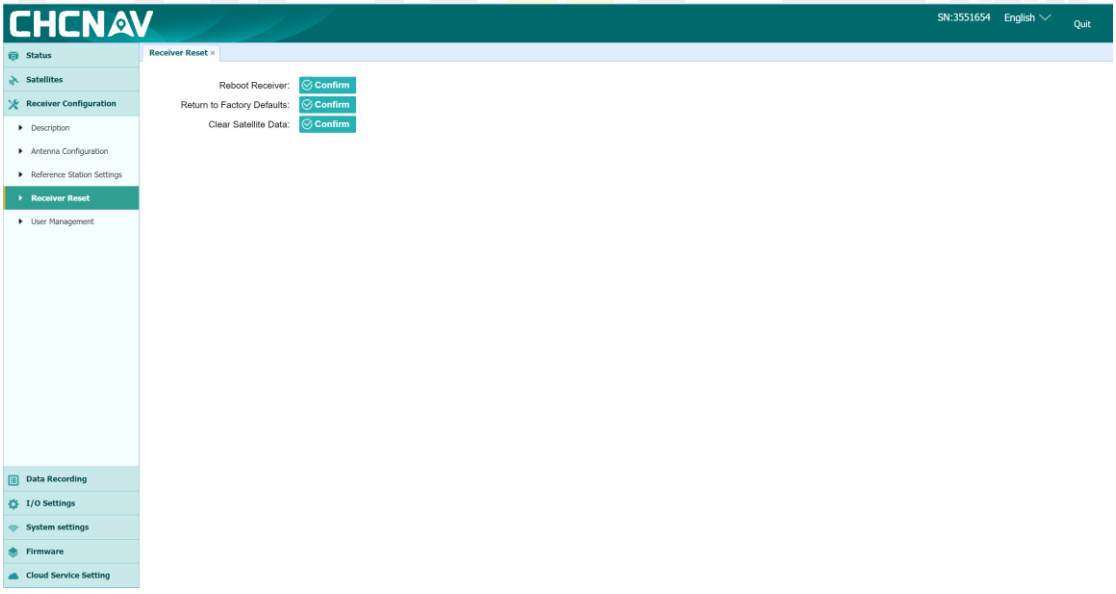


6.3.4Receiver Reset

Restart receiver: Restart GD100

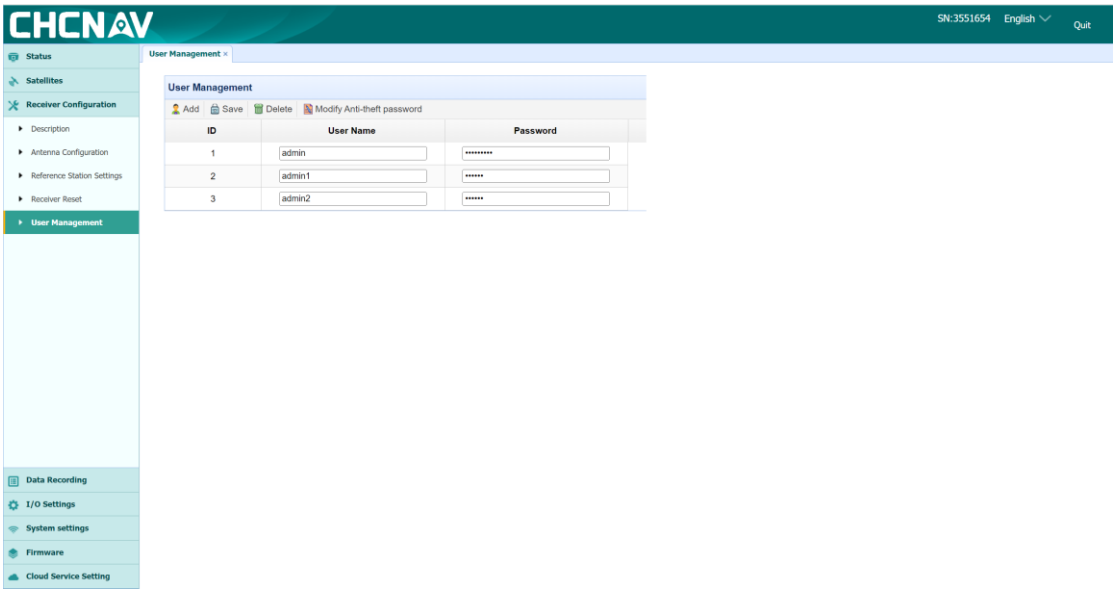
Restore factory settings: Restore the configuration parameters of GD100 to the default state

Clear satellite data: Clear board ephemeris data



6.4 Account Management

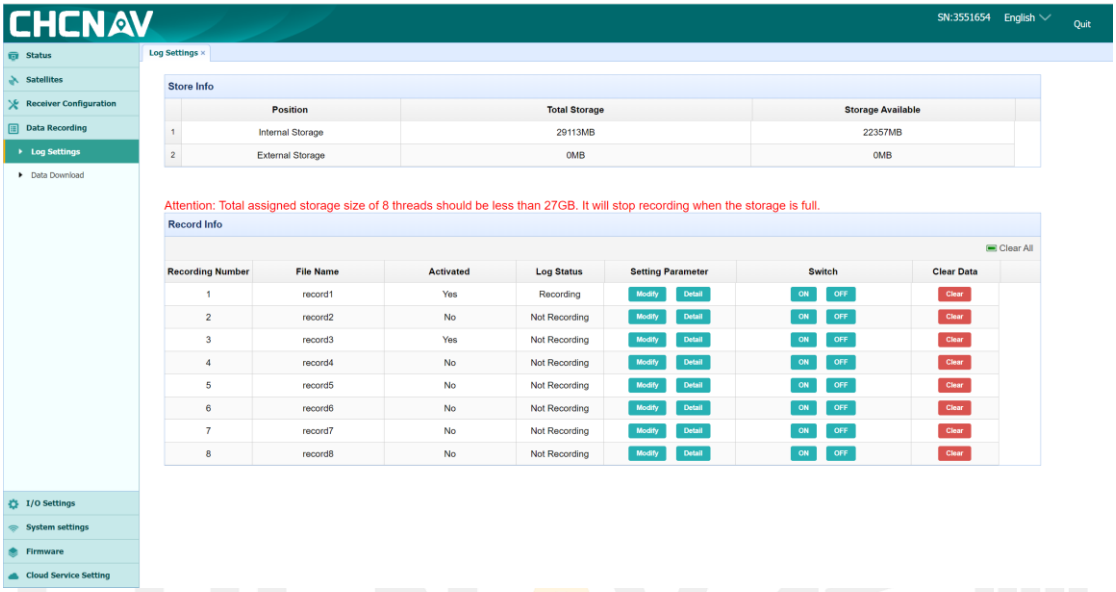
No modification required by default



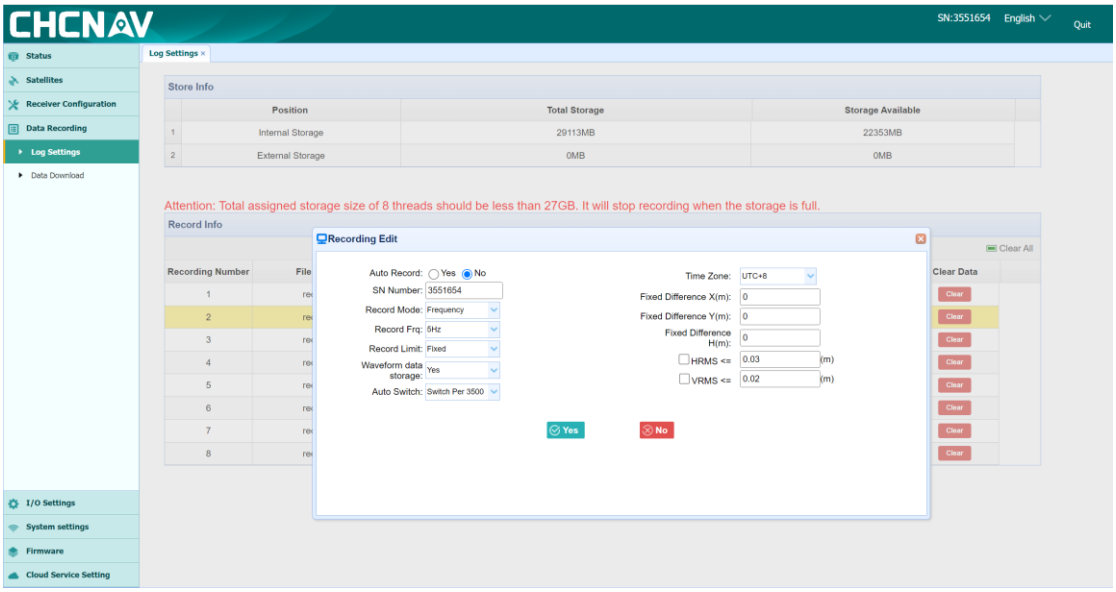
6.5 Data Recording

6.5.1Log Settings

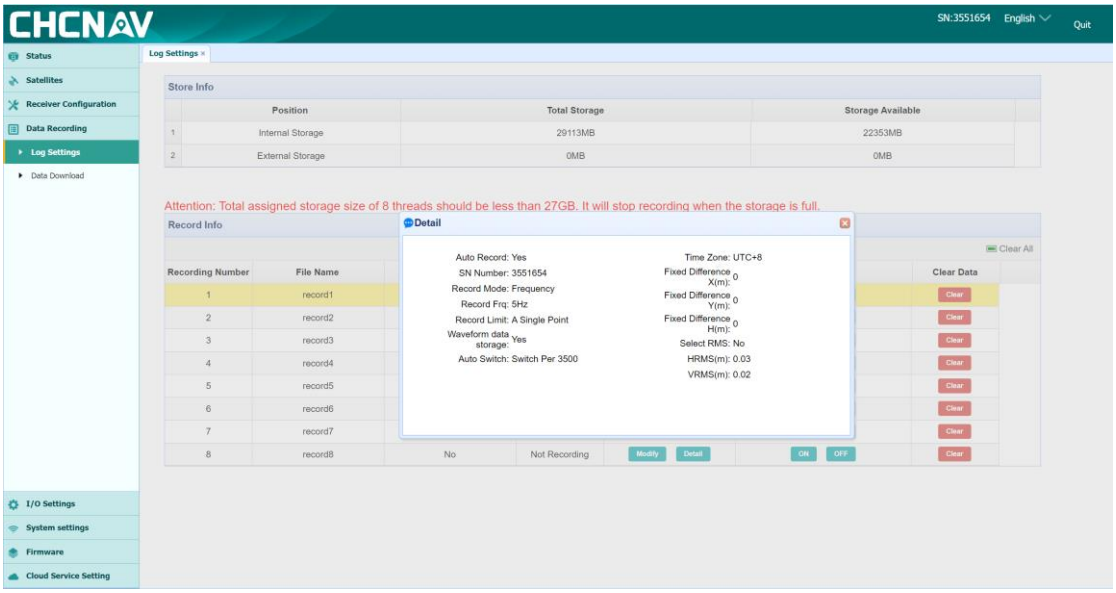
The default internal storage space of the USV GD100 is 28GB, divided into 8 record storage folders, record1 folder, which automatically records data when powered on by default, and record2 folder synchronizes with HydroSurvey and EasySave software for data recording.



When the corresponding record folder is closed, you can click the modify button in the parameter settings bar to modify the settings of the corresponding record folder.



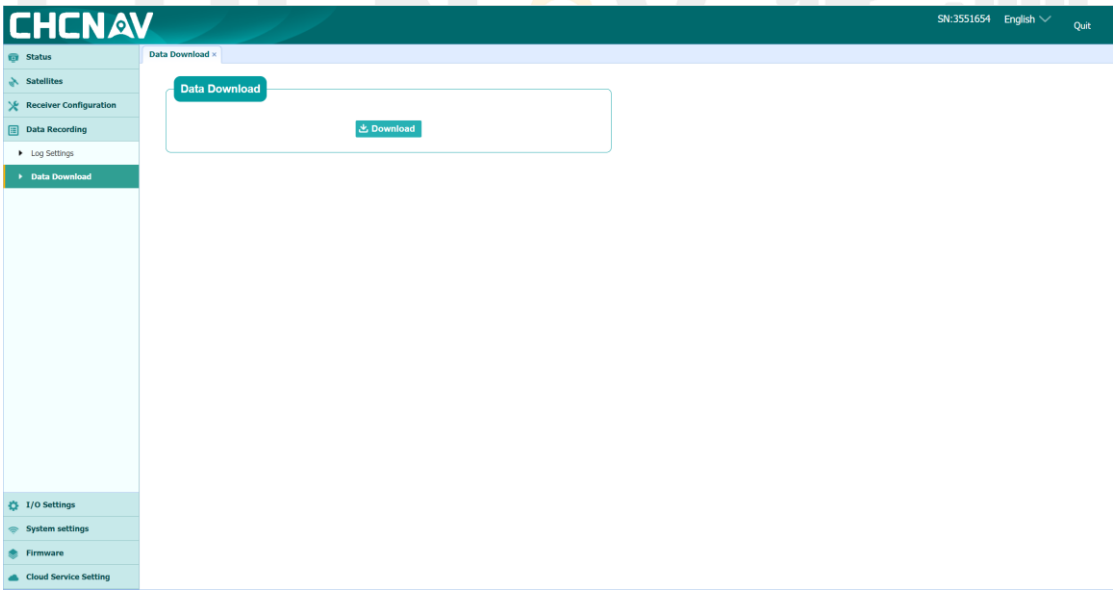
In the parameter settings column, click the details button to view the settings of the corresponding record folder.



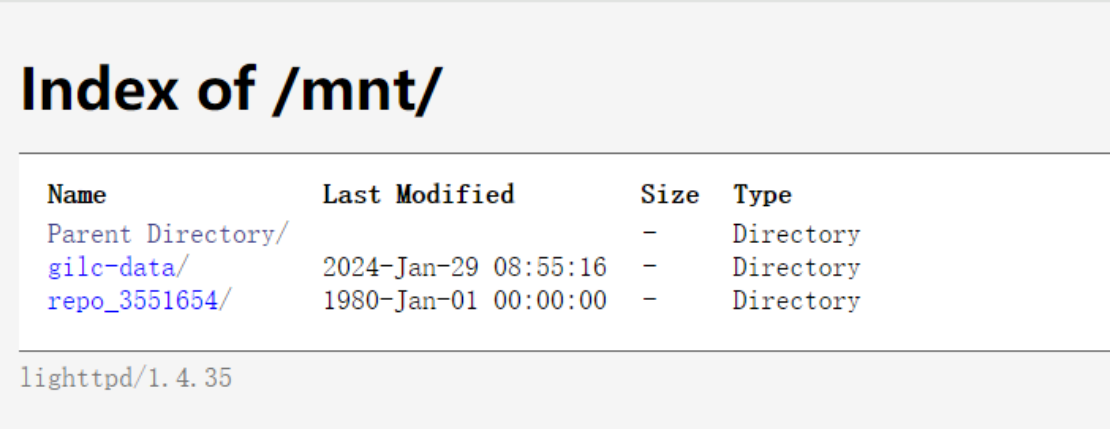
Click the clear button to clear the data in the current folder. Click clear all recorded data to clear the data.

6.5.2Data Download

The USV GD100 stores data internally to avoid data loss.



After clicking the download button, the browser will automatically open and enter this interface.



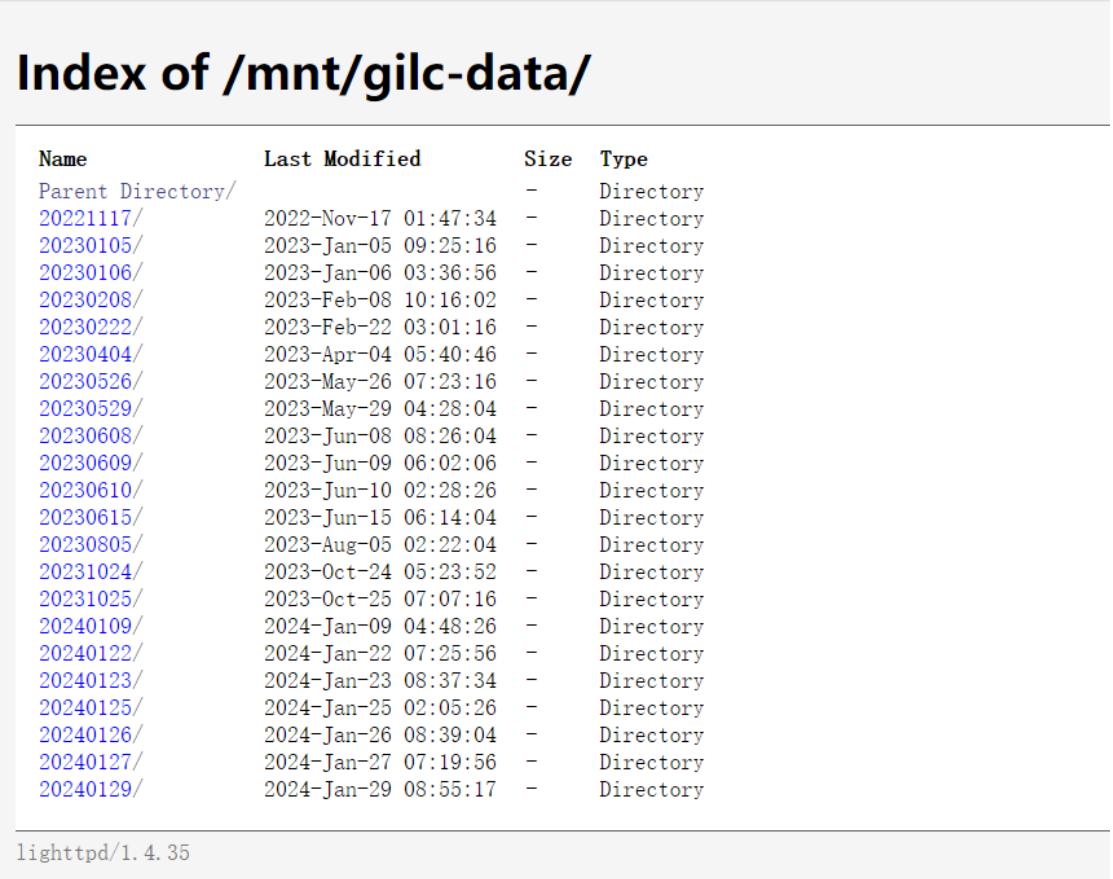
Index of /mnt/

Name	Last Modified	Size	Type
Parent Directory/		-	Directory
gilc-data/	2024-Jan-29 08:55:16	-	Directory
repo_3551654/	1980-Jan-01 00:00:00	-	Directory

lighttpd/1.4.35

After clicking on the Parent Directory, return to the directory one level above the current directory.

Click on gilc data to enter the following interface.



Index of /mnt/gilc-data/

Name	Last Modified	Size	Type
Parent Directory/		-	Directory
20221117/	2022-Nov-17 01:47:34	-	Directory
20230105/	2023-Jan-05 09:25:16	-	Directory
20230106/	2023-Jan-06 03:36:56	-	Directory
20230208/	2023-Feb-08 10:16:02	-	Directory
20230222/	2023-Feb-22 03:01:16	-	Directory
20230404/	2023-Apr-04 05:40:46	-	Directory
20230526/	2023-May-26 07:23:16	-	Directory
20230529/	2023-May-29 04:28:04	-	Directory
20230608/	2023-Jun-08 08:26:04	-	Directory
20230609/	2023-Jun-09 06:02:06	-	Directory
20230610/	2023-Jun-10 02:28:26	-	Directory
20230615/	2023-Jun-15 06:14:04	-	Directory
20230805/	2023-Aug-05 02:22:04	-	Directory
20231024/	2023-Oct-24 05:23:52	-	Directory
20231025/	2023-Oct-25 07:07:16	-	Directory
20240109/	2024-Jan-09 04:48:26	-	Directory
20240122/	2024-Jan-22 07:25:56	-	Directory
20240123/	2024-Jan-23 08:37:34	-	Directory
20240125/	2024-Jan-25 02:05:26	-	Directory
20240126/	2024-Jan-26 08:39:04	-	Directory
20240127/	2024-Jan-27 07:19:56	-	Directory
20240129/	2024-Jan-29 08:55:17	-	Directory

lighttpd/1.4.35

Click on any folder, taking the 20230105 folder as an example.

The following file is the data processed by the combination navigation algorithm, used by the R&D personnel to analyze the problem.

Index of /mnt/gilc-data/20230105/

Name	Last Modified	Size	Type
Parent Directory/		-	Directory
085755_com.txt	2023-Jan-05 09:06:00	962.9K	text/plain
085755_fifo.txt	2023-Jan-05 09:06:00	3.7M	text/plain
085756_ant_pos.nmea	2023-Jan-05 08:57:54	0.0K	application/octet-stream
085756_gps_pos.txt	2023-Jan-05 09:06:00	237.2K	text/plain
085756_ins_pos.txt	2023-Jan-05 08:57:54	0.0K	text/plain
085756_log.txt	2023-Jan-05 09:05:34	2.3K	text/plain
090854_com.txt	2023-Jan-05 09:21:44	1.5M	text/plain
090854_fifo.txt	2023-Jan-05 09:21:44	5.9M	text/plain
090855_ant_pos.nmea	2023-Jan-05 09:08:54	0.0K	application/octet-stream
090855_gps_pos.txt	2023-Jan-05 09:21:44	375.4K	text/plain
090855_ins_pos.txt	2023-Jan-05 09:08:54	0.0K	text/plain
090855_log.txt	2023-Jan-05 09:21:18	4.2K	text/plain
092246_com.txt	2023-Jan-05 09:23:18	61.7K	text/plain
092246_fifo.txt	2023-Jan-05 09:23:18	247.6K	text/plain
092247_ant_pos.nmea	2023-Jan-05 09:22:46	0.0K	application/octet-stream
092247_gps_pos.txt	2023-Jan-05 09:23:18	15.7K	text/plain
092247_ins_pos.txt	2023-Jan-05 09:22:46	0.0K	text/plain
092247_log.txt	2023-Jan-05 09:22:52	1.9K	text/plain
092516_com.txt	2023-Jan-05 09:38:22	1.5M	text/plain
092516_fifo.txt	2023-Jan-05 09:38:22	6.1M	text/plain
092517_ant_pos.nmea	2023-Jan-05 09:25:16	0.0K	application/octet-stream
092517_gps_pos.txt	2023-Jan-05 09:38:26	386.6K	text/plain
092517_ins_pos.txt	2023-Jan-05 09:25:16	0.0K	text/plain
092517_log.txt	2023-Jan-05 09:37:42	3.4K	text/plain

lighttpd/1.4.35

Click repo ******** to enter the following interface

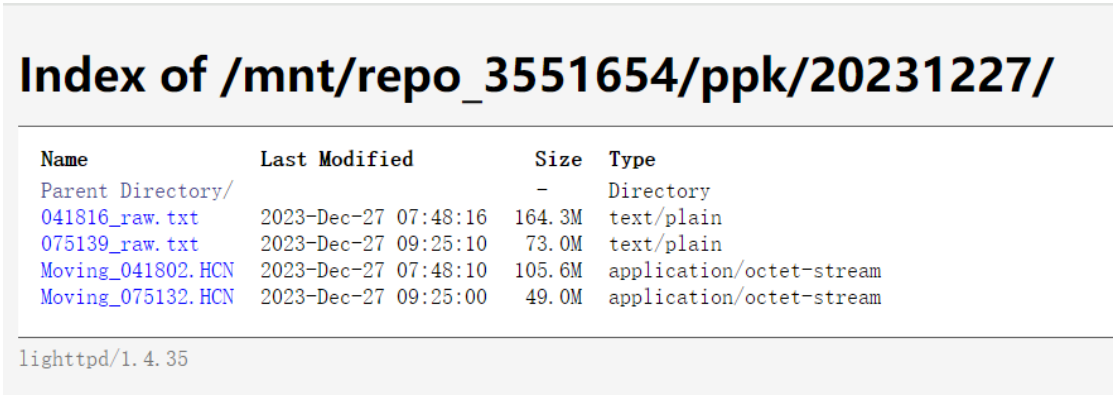
Index of /mnt/repo_3551654/

Name	Last Modified	Size	Type
Parent Directory/		-	Directory
ppk/	1970-Jan-01 00:00:15	-	Directory
push_log/	1980-Jan-01 00:00:00	-	Directory
record_1/	2024-Jan-29 09:06:57	-	Directory
record_2/	2024-Jan-27 07:31:28	-	Directory
record_3/	1980-Jan-01 00:00:00	-	Directory
record_4/	1980-Jan-01 00:00:00	-	Directory
record_5/	1980-Jan-01 00:00:00	-	Directory
record_6/	1980-Jan-01 00:00:00	-	Directory
record_7/	1980-Jan-01 00:00:00	-	Directory
record_8/	1980-Jan-01 00:00:00	-	Directory

lighttpd/1.4.35

Data stored in ppk folder

Each date named file contains both raw and HCN files.



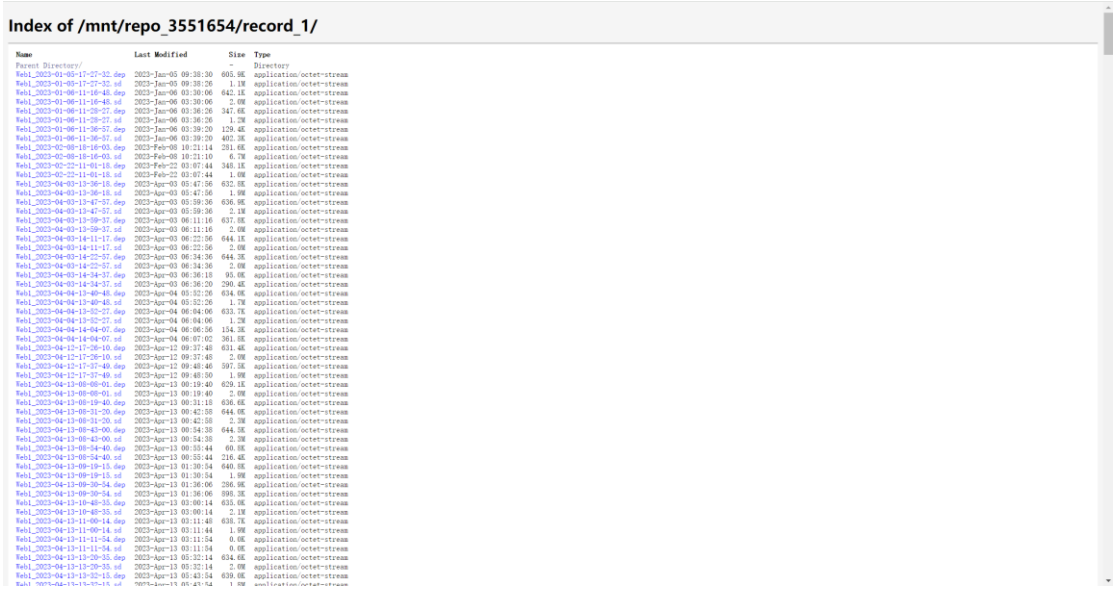
Index of /mnt/repo_3551654/ppk/20231227/

Name	Last Modified	Size	Type
Parent Directory/		-	Directory
041816_raw.txt	2023-Dec-27 07:48:16	164.3M	text/plain
075139_raw.txt	2023-Dec-27 09:25:10	73.0M	text/plain
Moving_041802.HCN	2023-Dec-27 07:48:10	105.6M	application/octet-stream
Moving_075132.HCN	2023-Dec-27 09:25:00	49.0M	application/octet-stream

lighttpd/1.4.35

Redord_* The folder, where record1 and record2 are commonly used,

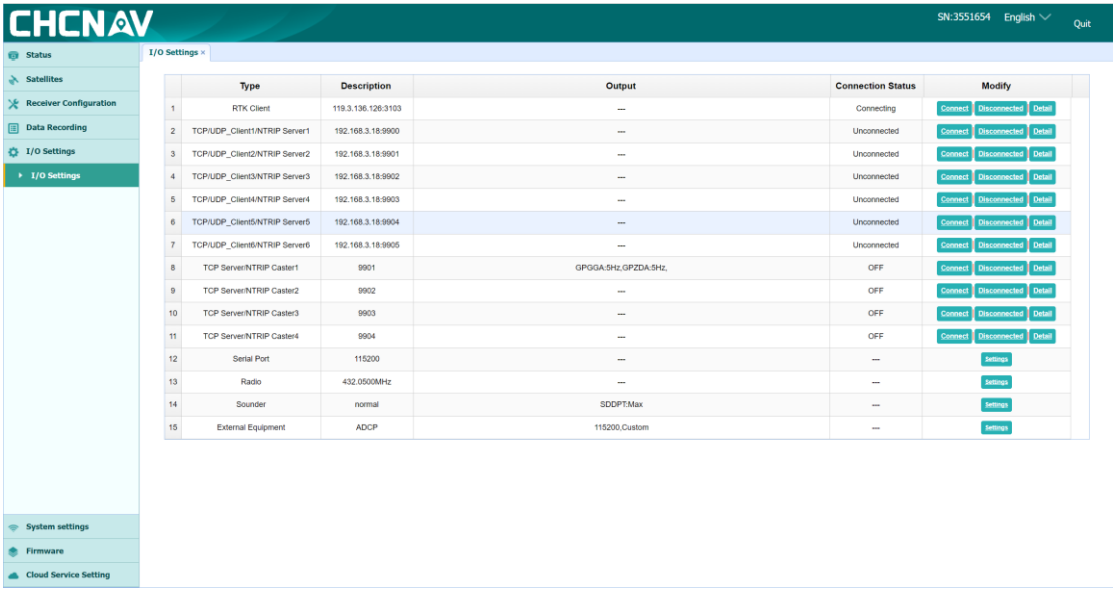
Taking record1 as an example, the folder contains. dep and. sd files, the dep file records coordinates and water depth information, and the sd file records waveform information.



Index of /mnt/repo_3551654/record_1/

6.6 I/O Settings

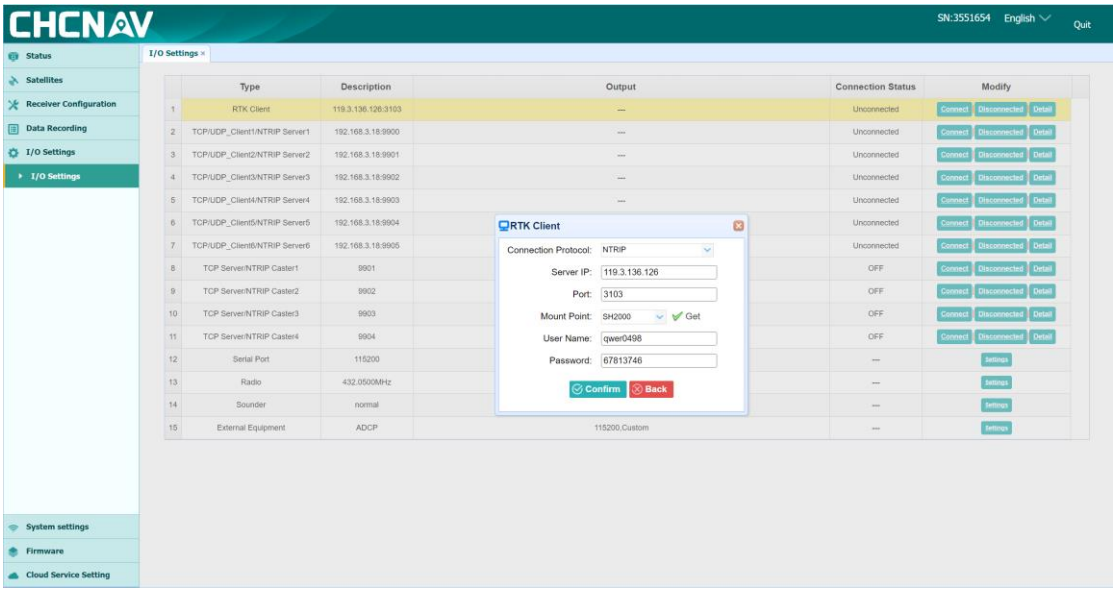
This interface is used for receiving and outputting data.



6.6.1RTK Client (CORS Login)

This item column can be used for CORS login.

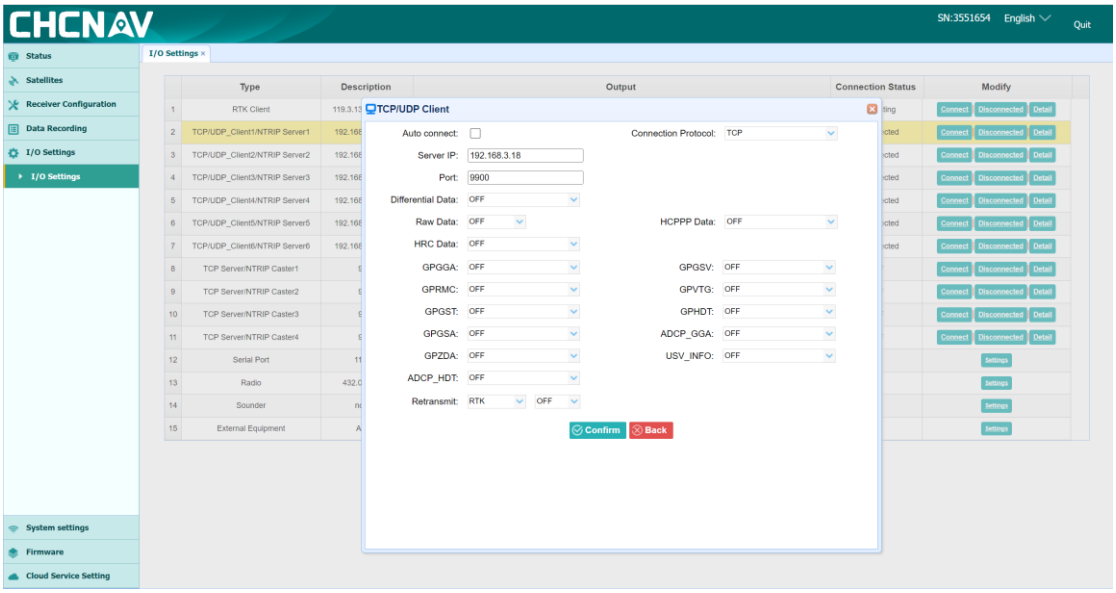
The connection protocol includes ntrip (CORS mode), APIs_ Rover (network 1+1), TCP and SWAs modes. SWAs is a one button fixed account exclusively owned by chinatest, which can only be used by USVs bound with chinatest SWAs account.



6.6.2Tcp/Udp_Client/Ntrip Server

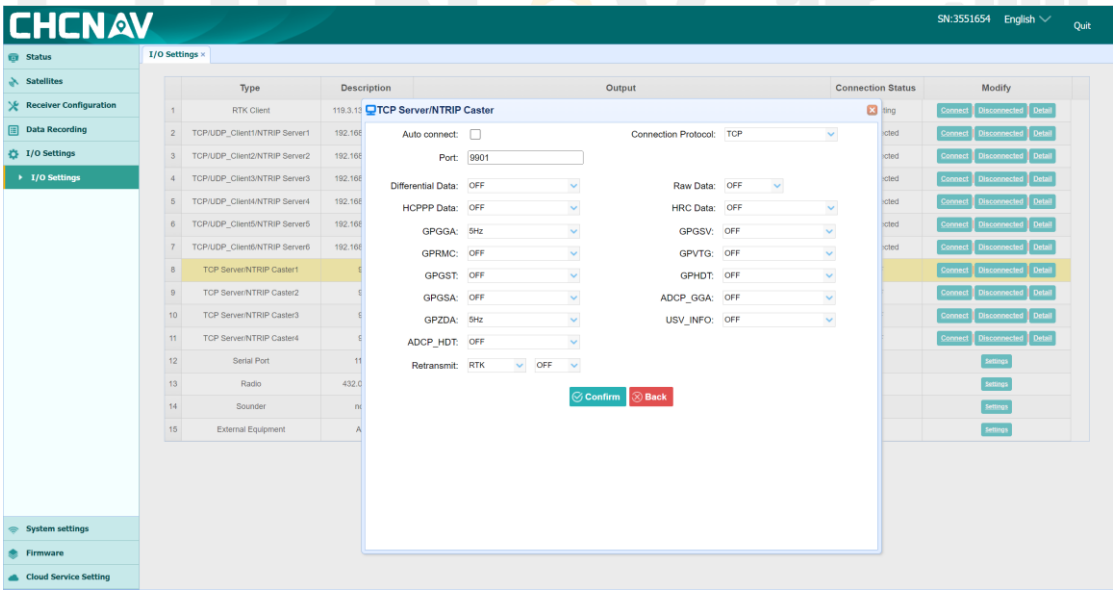
This interface is used to set the TCP client to forward NMEA data, differential data, positioning data, water

depth data, etc. of the USV to the server.



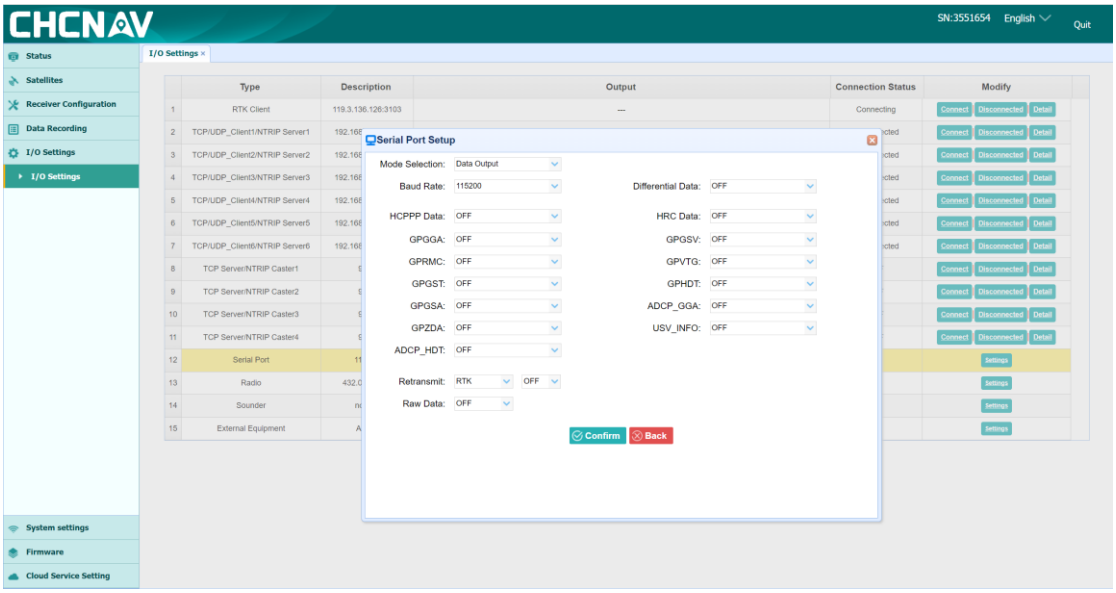
6.6.3Tcp Server/Ntrip Caster

This interface is used to open a server to broadcast NMEA data, differential data, positioning data, water depth data, etc. of the USV for user client connection.



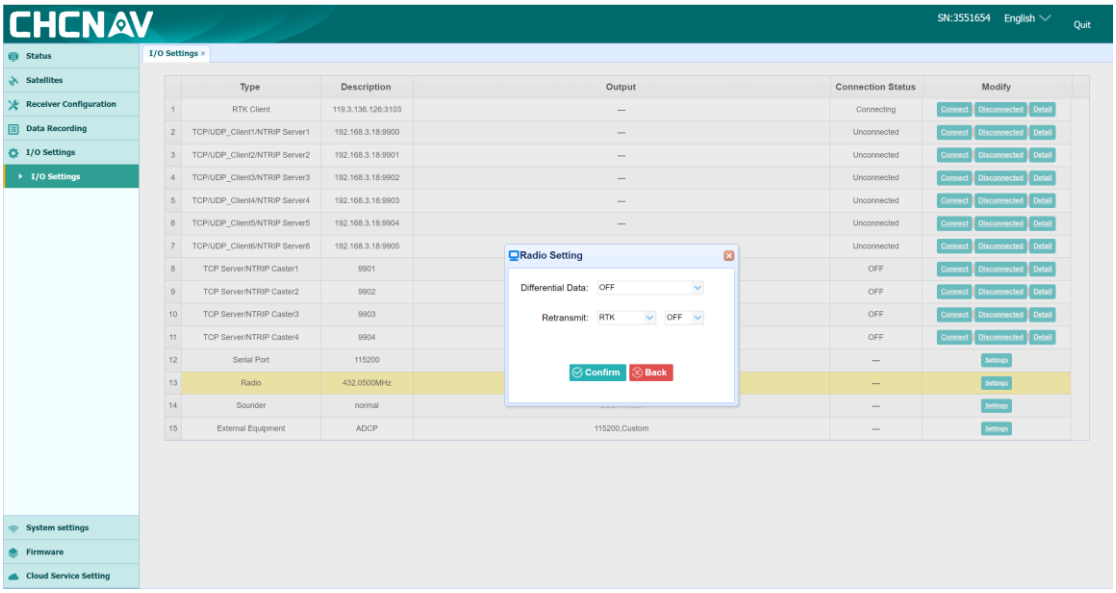
6.6.4Serial Port

This interface is used to set gd100 debug serial port to forward NMEA data, differential data, positioning data, water depth data, etc.



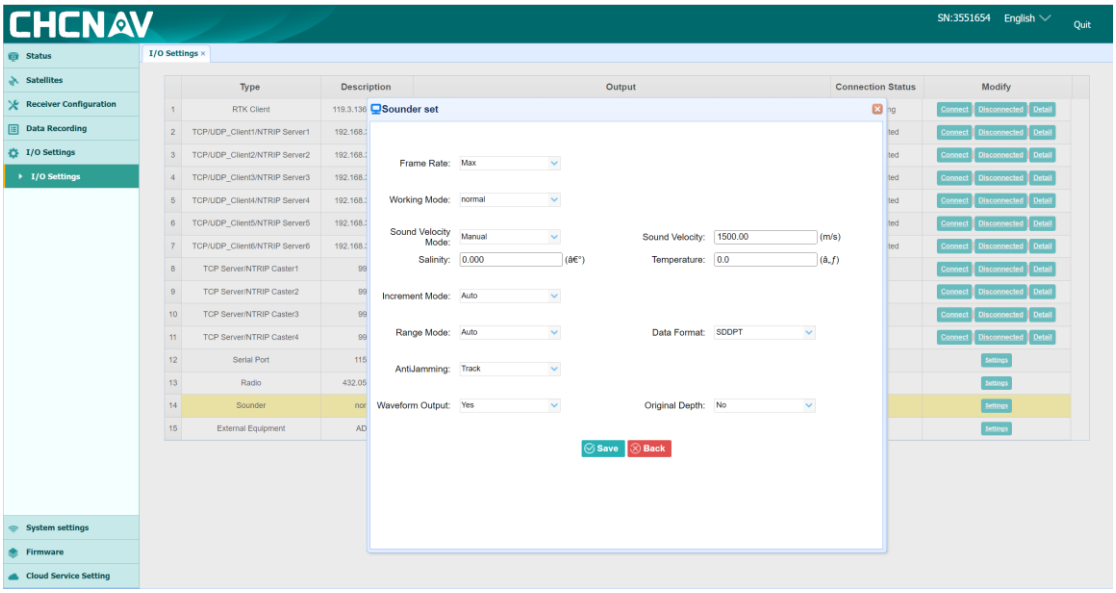
6.6.5Radio Station

This interface is used to configure the receiving station differential data



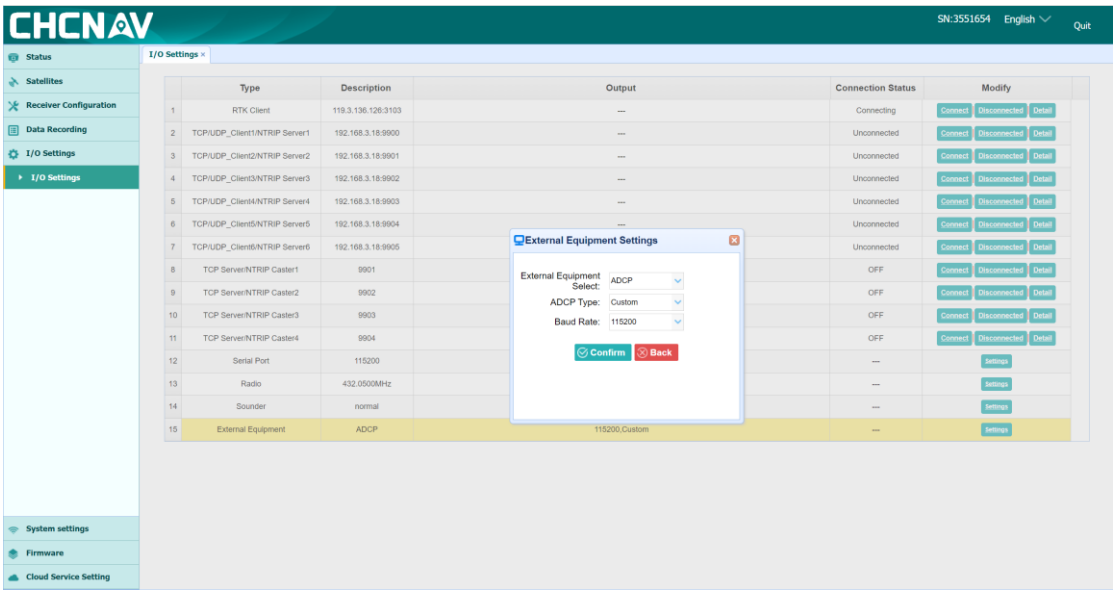
6.6.6Sounder

This interface is used to set the parameters of the depth sounder.



6.6.7External Devices

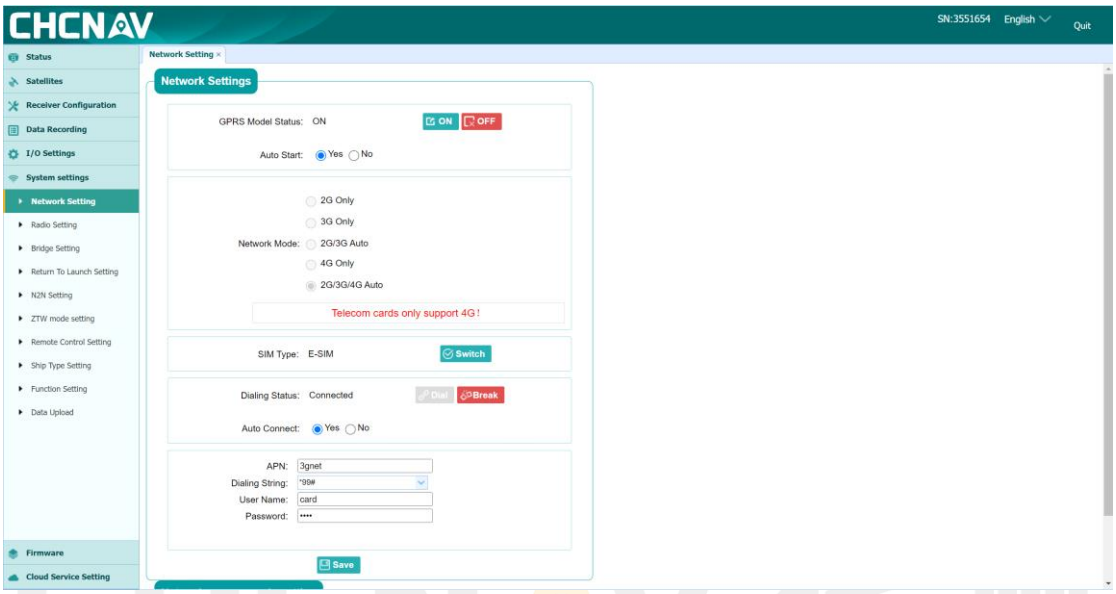
At present, external devices only support ADCP/water quality indicators. After connecting the external devices to the R232 serial port of the USV, the corresponding device type can be selected here.



6.7 System Settings

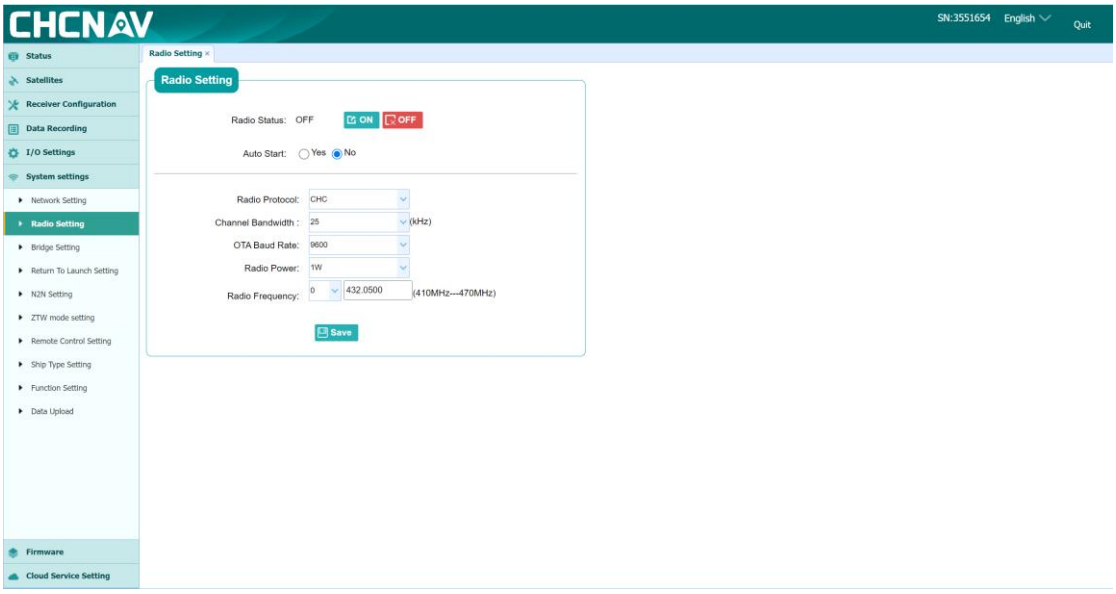
6.7.1Network Settings

After inserting their SIM card into the GD100 card slot, the user needs to log in to the interface, switch the card type to SIM, and dial successfully. The USV defaults to using the E-SIM card. Other parameters remain unchanged by default.



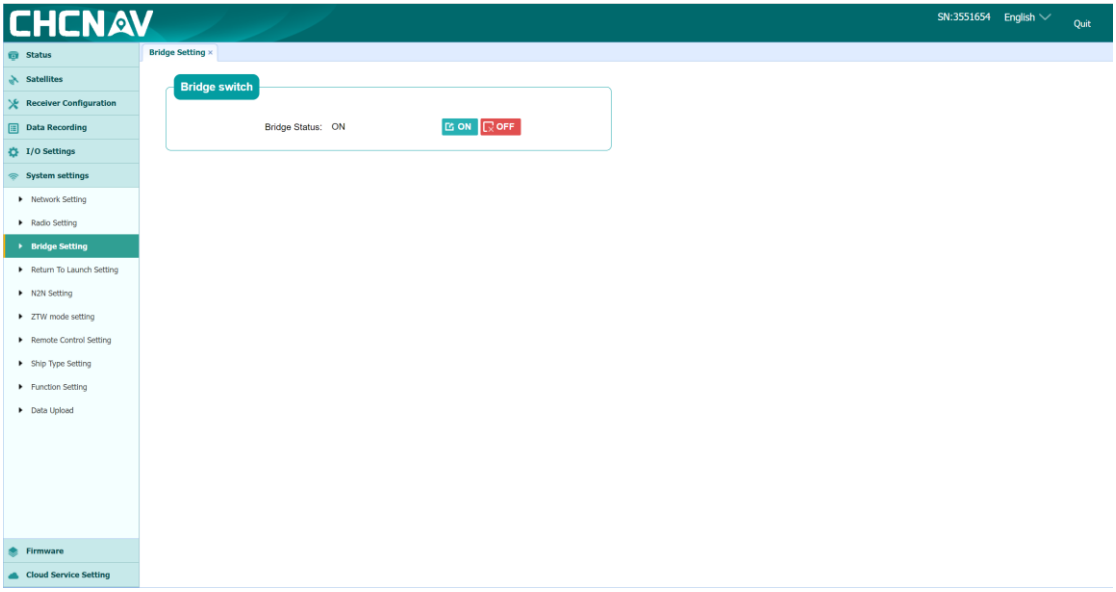
6.7.2Radio Settings

When using radio mode, the USV needs to connect an external radio antenna, turn on the switch, set the corresponding radio protocol, baud rate, and radio channel, and wait for the differential signal light of the USV to remain green to start operation.



6.7.3Network Bridge Settings

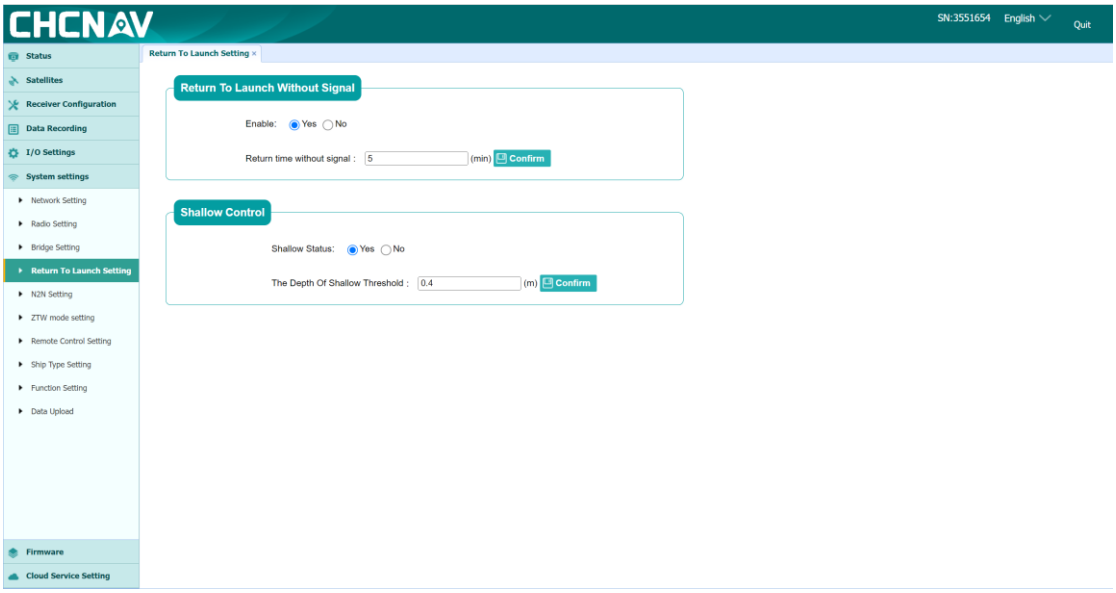
No modification is required by default. Before closing the bridge, ensure that the 4G network is normal, otherwise it cannot be closed.



6.7.4Return To Launch Setting

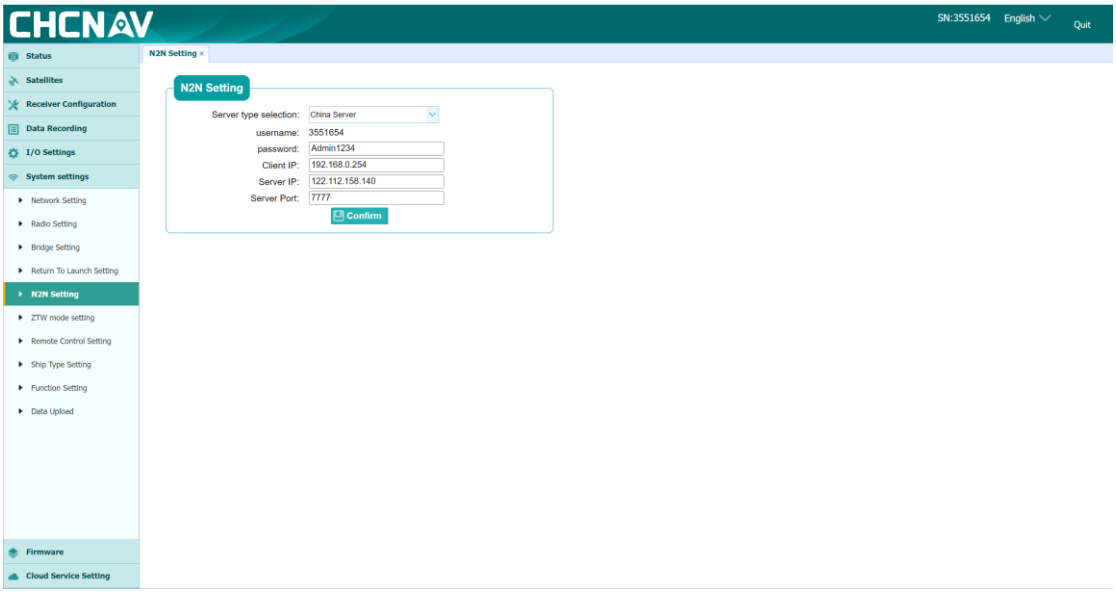
No signal return: When the remote control and hull control software (AutoPlanner or EasySail) of the USV are disconnected for a preset time, the USV will automatically return to the Home point.

Shallow control: Under normal working conditions of the depth sounder, when the measured water depth is lower than the preset shallow depth, it will reverse by 3 seconds, with a default shallow depth of 0.5m.



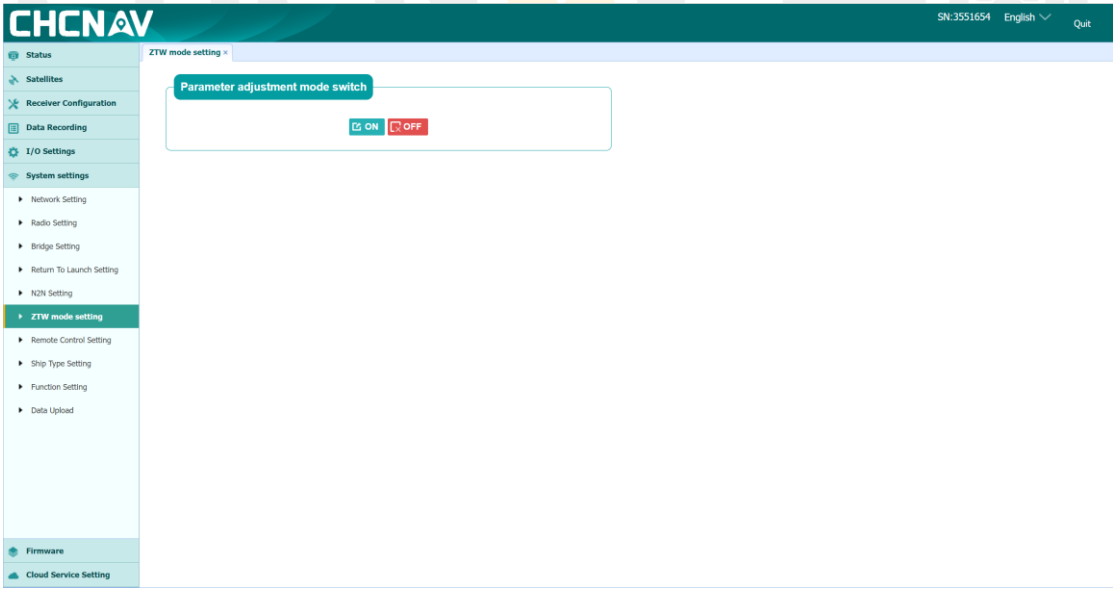
6.7.5N2N Settings

No modification is required by default, as the server types are different both domestically and internationally.

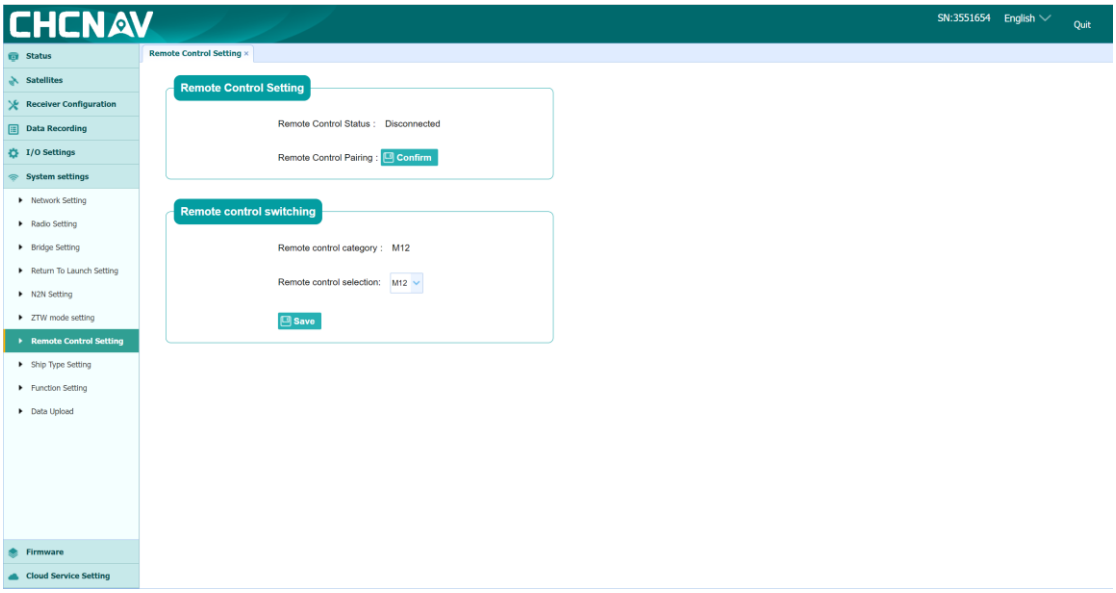


6.7.6Ztw Mode Setting

By default, there is no need to modify the configuration of the power box for USVs. If you need to adjust the electrical adjustment parameters, turn on this switch first, modify the electrical adjustment parameters, and restart the USV.

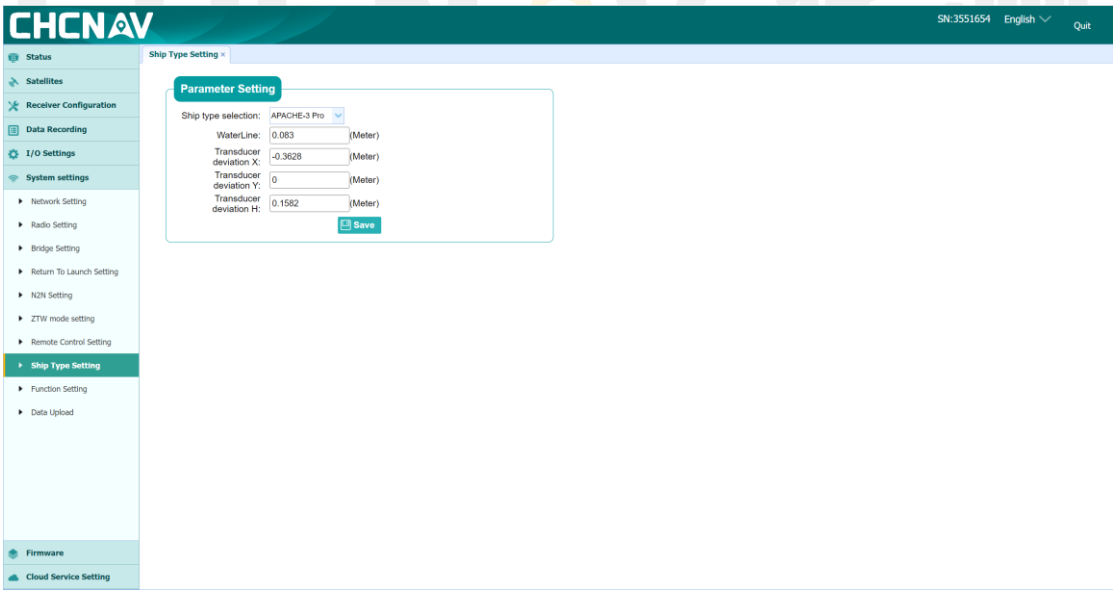


6.7.7Remote Control Settings



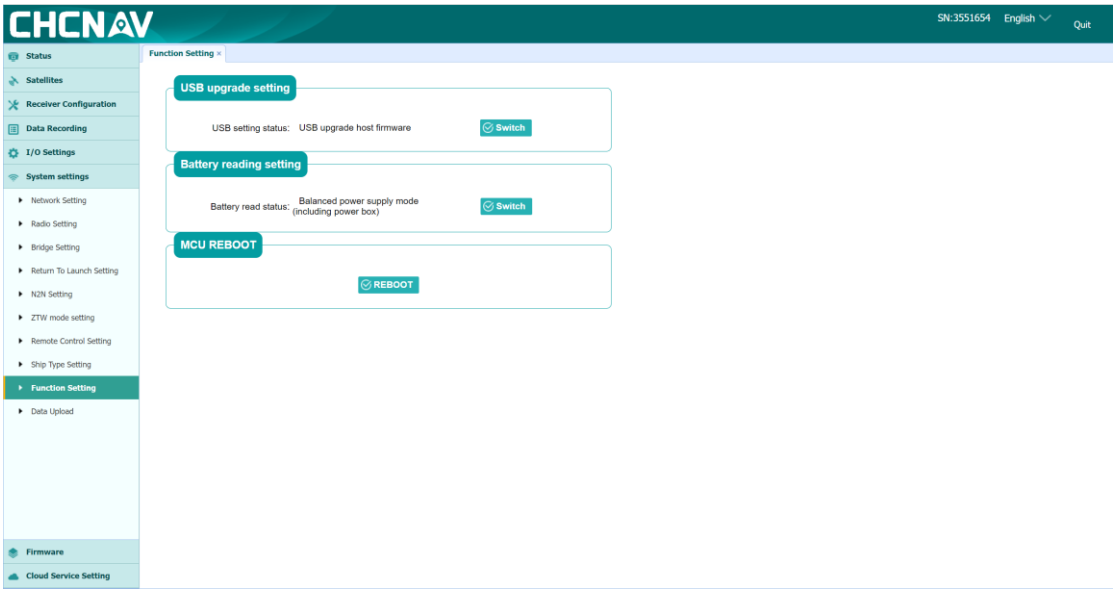
6.7.8Ship Type Setting

After the USV starts up and self checks, it will automatically recognize the current USV model and apply relative deviation in open and unobstructed conditions. If the ship type recognition is incorrect, the ship type can be manually selected.



6.7.9Function Settings

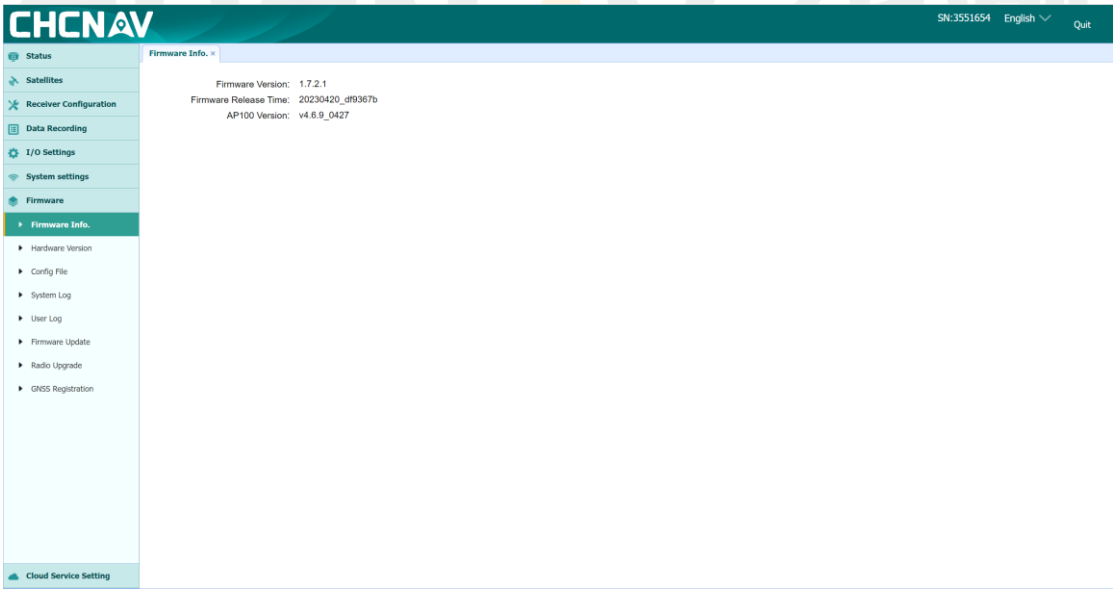
No modification is required by default, and can be used by R&D personnel for debugging.



6.8 Firmware

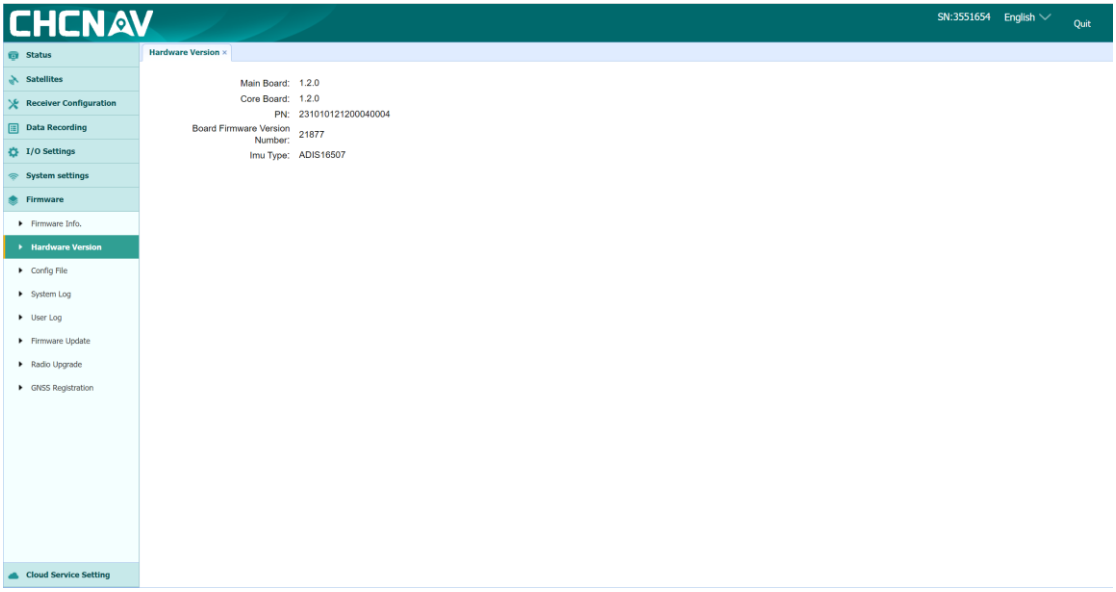
6.8.1Firmware Information

This interface allows you to view firmware version information.



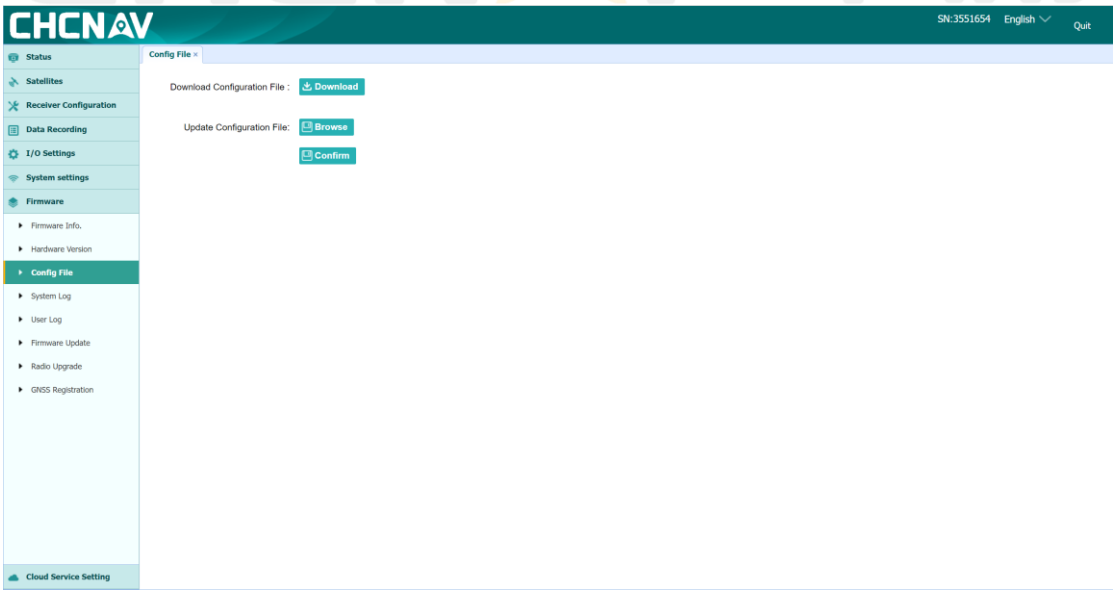
6.8.2Hardware Version

This interface allows you to view hardware version information.



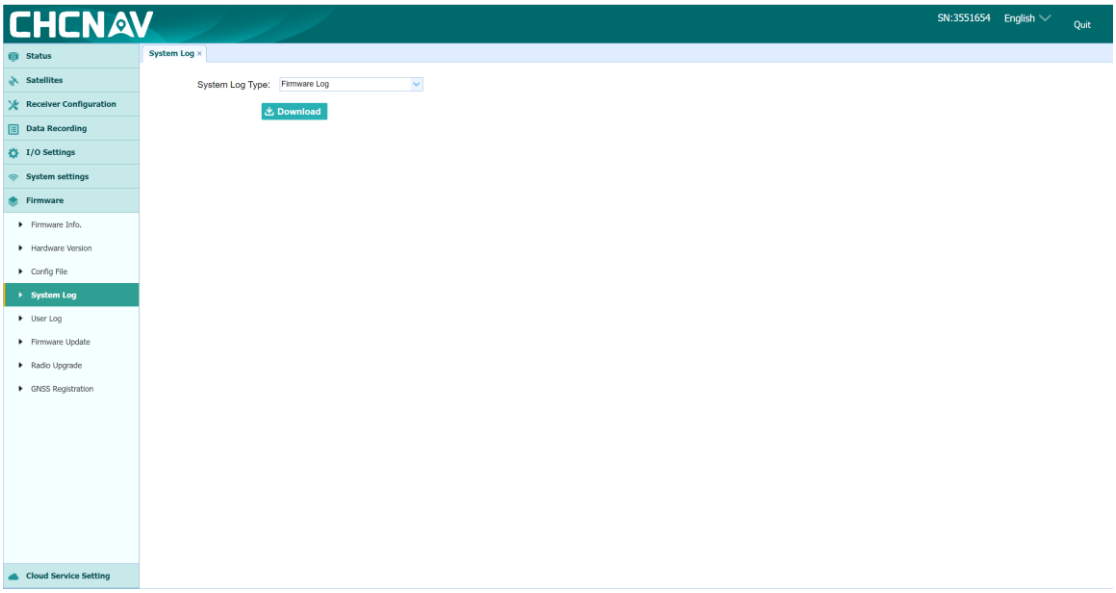
6.8.3Config File

This interface is used for downloading and updating configuration files, and no modification is required by default.



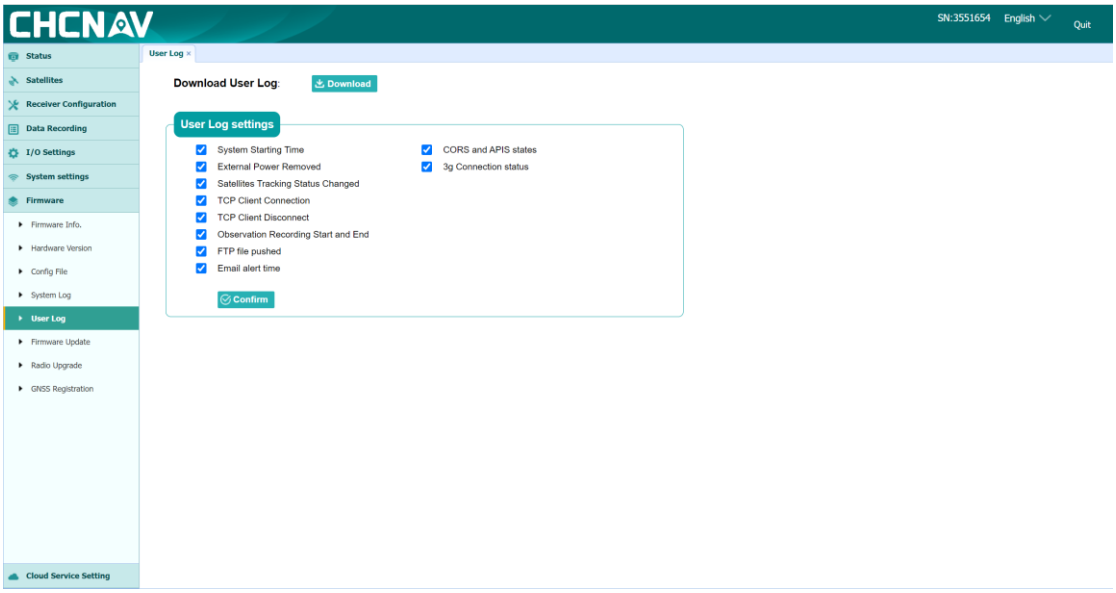
6.8.4System Log

This interface is used to download system logs for analysis by R&D personnel.



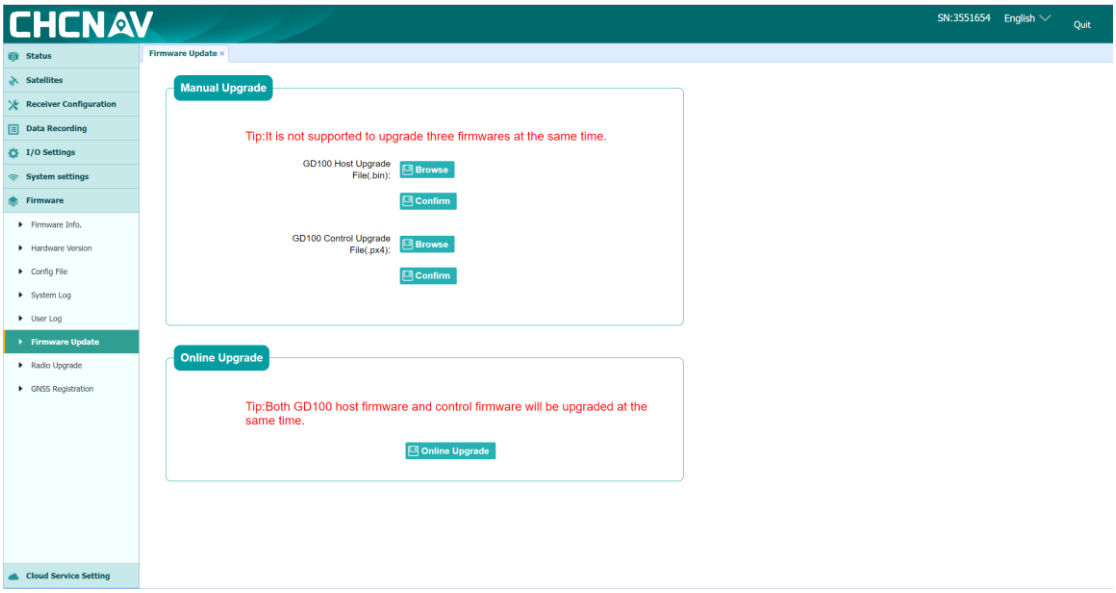
6.8.5User Log

This interface is used to download user logs for analysis by R&D personnel.



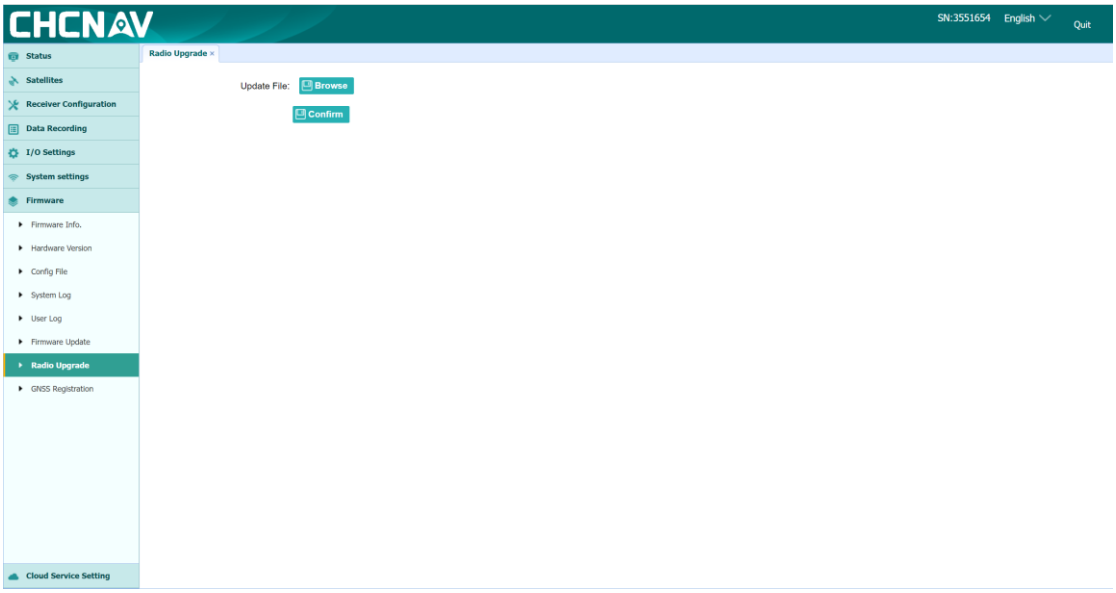
6.8.6Firmware Upgrade

This interface is used for firmware upgrade. Please refer to the appendix for details of firmware upgrade operations.



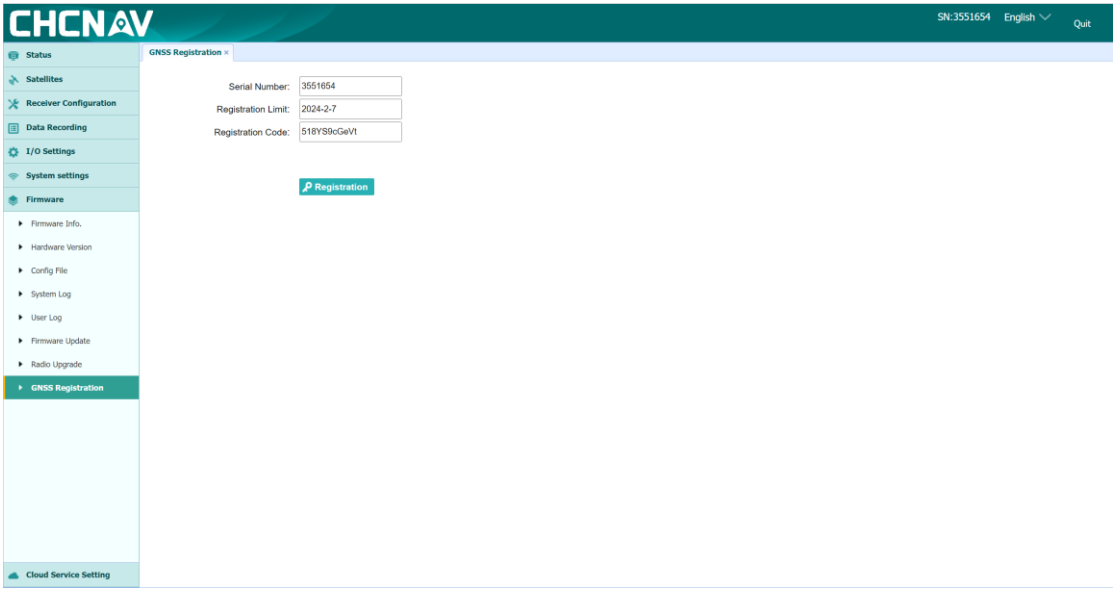
6.8.7Radio Upgrade

This interface is used for radio station upgrades and does not require modification by default.



6.8.8Receiver Registration

This interface is used for receiver registration. If the receiver expires and the device cannot be used normally, please contact Huace after-sales service to obtain the registration code.



7. HydroSurvey Software

Provide a detailed introduction to the features of HydroSurvey software

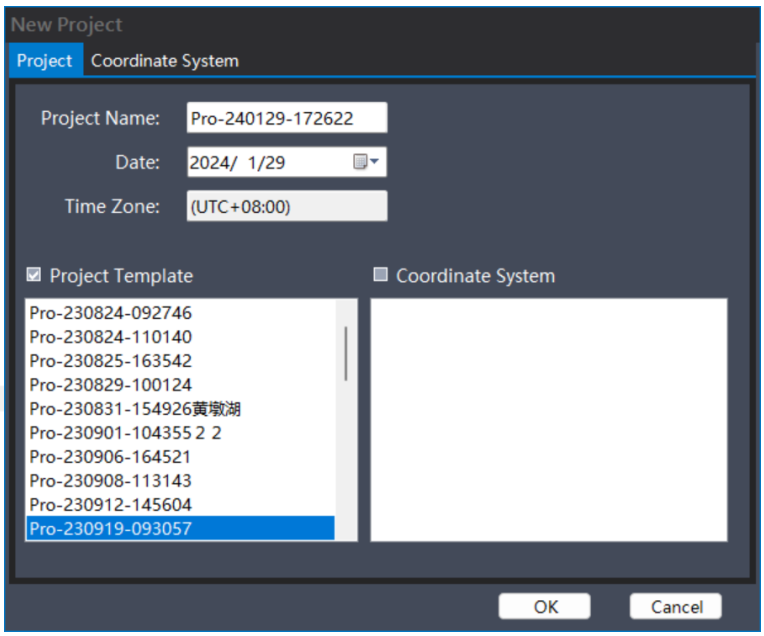
his software is used for Huawei series USVs and depth sounders, for single beam data recording and post-processing, and also has positioning and navigation functions.

7.1 Quick-access

7.1.1New project

Click "project - new project" in the navigation bar, or click the "new project" icon in the shortcut bar to create a new project.

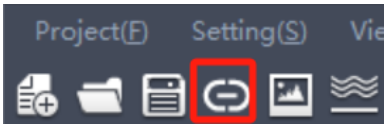
Enter the project information and set the coordinate system parameters. Click OK after checking to complete the new project.



7.1.2Device connection

APACHE Series USV

After successfully connecting the USV using the autoplaner software, click the "one click connection" icon of the Hydrosurvey software.



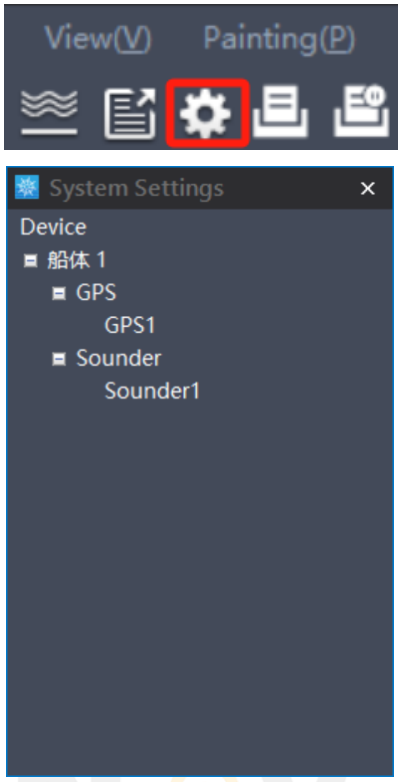
After the connection is successful, the real-time status of positioning data and water depth data is displayed.

Depth Sounder And Construction Vessel

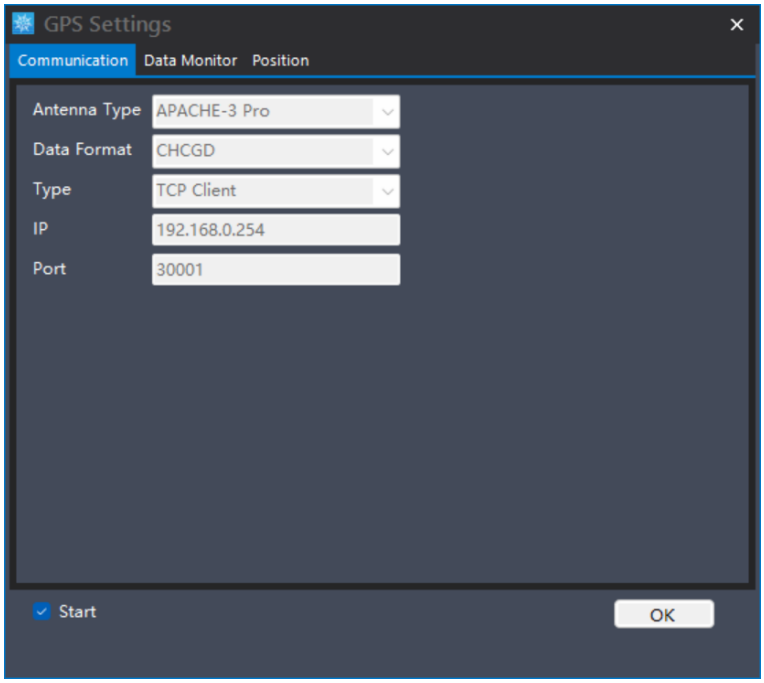
When a single beam bathymeter or construction ship uses the Hydrosurvey software, it is necessary to

manually set parameters for communication connection.

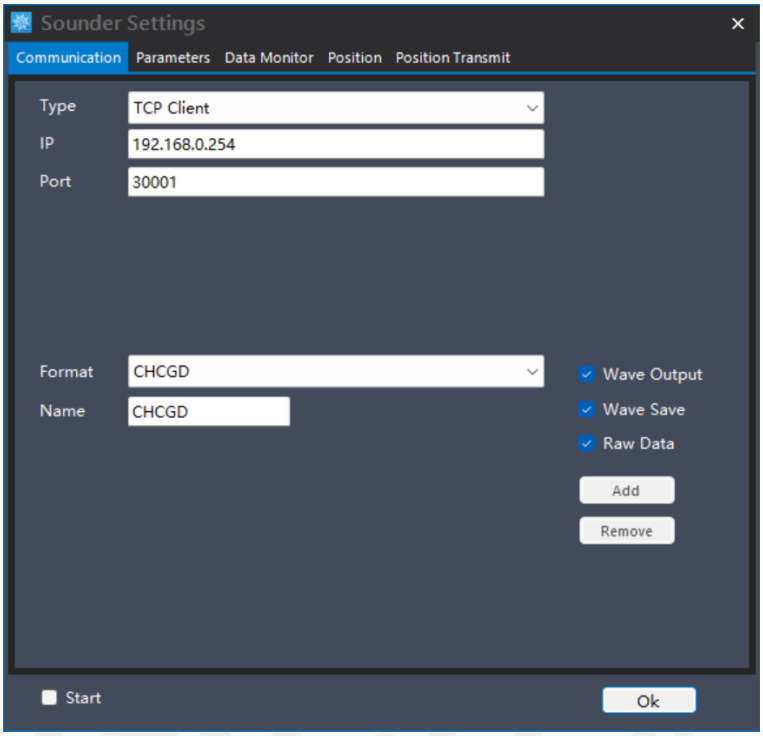
Click "Settings - system settings" (or click the "system settings" icon in the shortcut bar) to enter the system settings interface.



Double click "GPS 1" to enter the parameter setting interface of GPS device. Select the corresponding connection mode in "communication settings", enter "antenna coordinates", check "connection" in the lower left corner after setting, and click "OK" to complete GPS setting.



Double click "sounder 1" to enter the parameter setting interface of the bathymeter, select the connection mode in "communication setting" and change the draft in "parameter setting", check "connection" in the lower left corner after setting, and click "OK" in the lower right corner to complete the bathymeter setting.



7.1.3Record control

Set data collection parameters. Click "setting - record control" to enter the record control setting interface.

1. Recording mode

1) Record by distance: record data once every few meters;

2) Record by time: record data once in a few seconds;

3) Record by space: manually record data by pressing space once.

2. Solution state limit

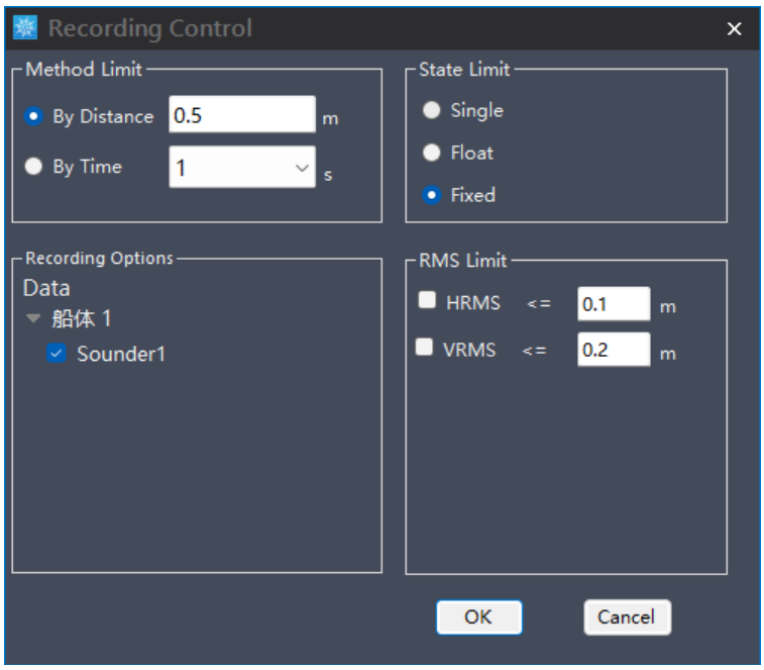
1) ① Single point solution: record "single point solution" and higher accuracy;

2) ② Differential resolution: record "differential resolution" and higher accuracy;

3) ③ Fixed solution: only "fixed solution" is recorded.

3. Record options

Select the device to record data.



7.1.4Measure

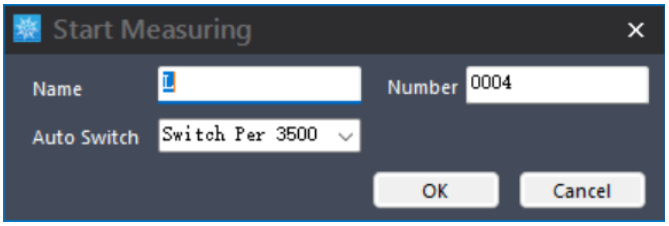
Start measurement

Click "measurement - start" (or click the "start" button in the shortcut bar) to set the parameters. After setting the parameters, click "OK" to start recording the measurement data.

Line name: prefix of DEP line name;

Line number: dep line number, with a step of 1, automatically added;

Automatic line change: each time a certain number of point data is recorded, a new dep line will be automatically regenerated. Line change modes include: no automatic line change, 1000 point automatic line change, 2000 point automatic line change, 3000 point automatic line change, 3500 point automatic line change (default), 4000 point automatic line change, 5000 point automatic line change, 6000 point automatic line change;



Pause measurement

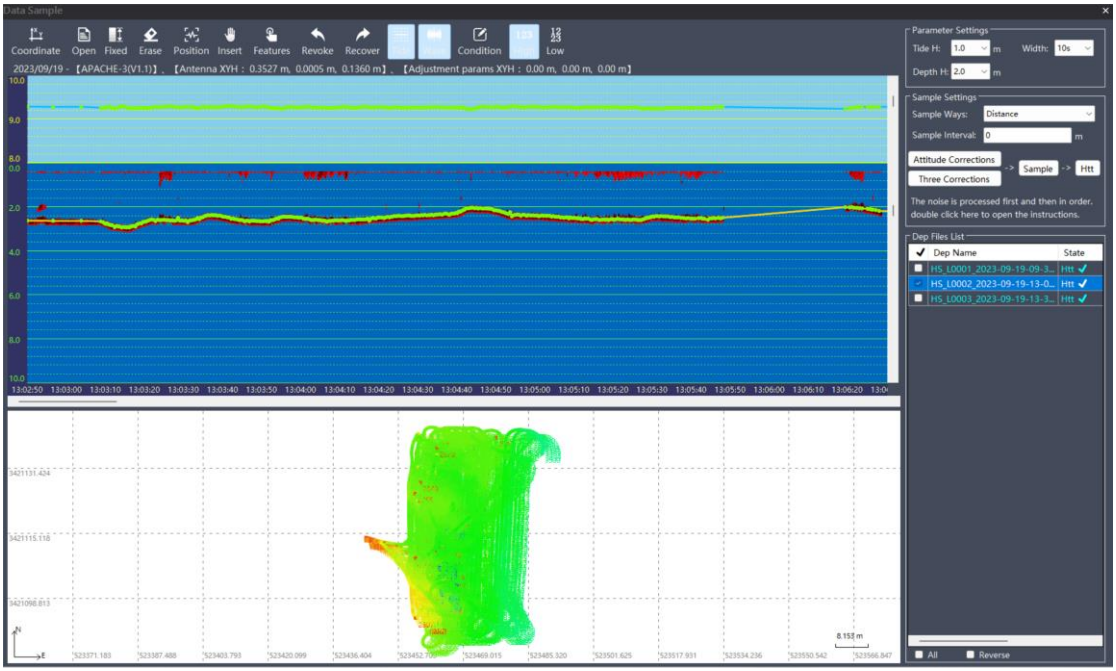
Click "measurement - pause" (or click the "pause" button in the shortcut bar) to pause the measurement.

End measurement

Click "measurement - end" (or click the "end" button in the shortcut bar ) to end the measurement.

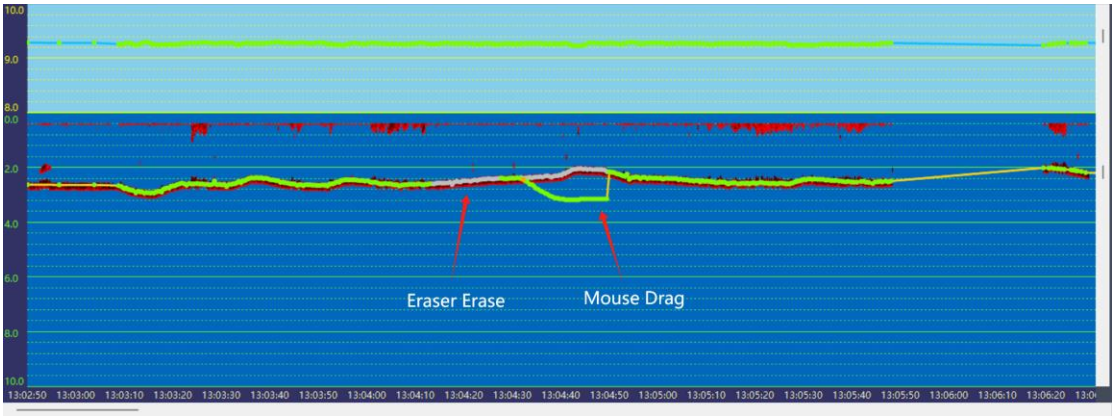
7.1.5Data processing

Click "data processing - water depth sampling" (or click the "water depth sampling" button in the shortcut bar ) Check/correct each survey line of field survey. Double click to open the line dep file, and then display the base map, water depth, waveform and other views.



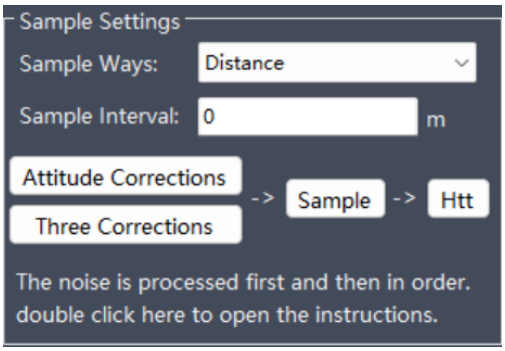
The main process of data processing (the steps in brackets are selected according to requirements): noise processing → (data interpolation) → data correction → equidistant sampling → (manual sampling) → htt generation.

Each survey line of field survey shall be inspected, de noised and thinned. According to the principle of terrain consistency, use an eraser to delete false water depth points that do not conform to the waveform, or drag the water depth points with the mouse until they are consistent with the waveform, as well as fixed interpolation operation and manual interpolation operation.



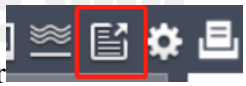
For attitude correction or three corrections, select one of the operations, and do not repeat the operation, so as to prevent the previously processed data from being overwritten. (for the three corrections, click "skip" directly for the content that does not need to be corrected.)

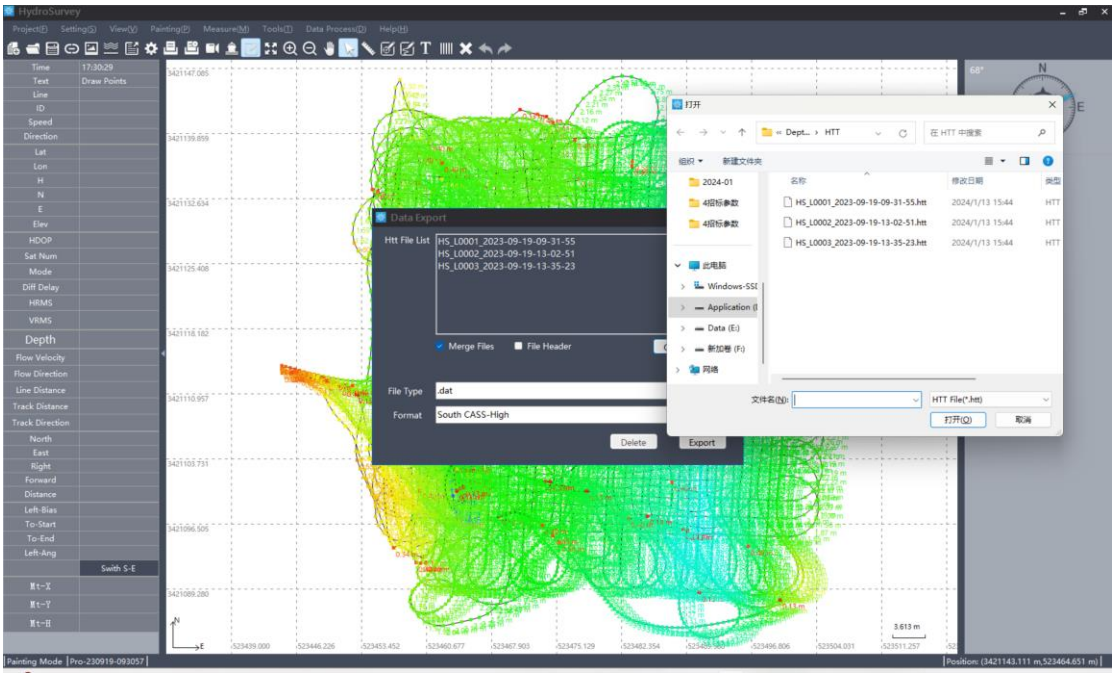
Select the sampling method and sampling interval as required, and click "equidistant sampling". If some areas are not sampled, you can click "manual sampling" to manually sample some feature points. If this function is not required, skip the manual sampling step.



Click the "generate htt" button to save to the *.htt file.

7.1.6Data export

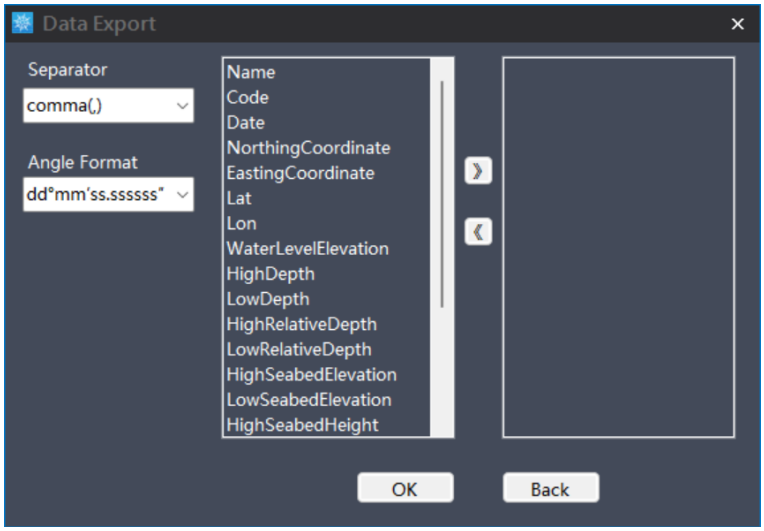
Click "data processing - Data Export" (or click "data export" in the shortcut bar  button) open the saved htt file, select the exported file type, select the format, and select the format from the drop-down list. Click "export" to export the selected format data.



The data format supports customization. At the same time, the separator and angle format can be selected for customization;

Check "file merge" to merge and export multiple htt data into one file;

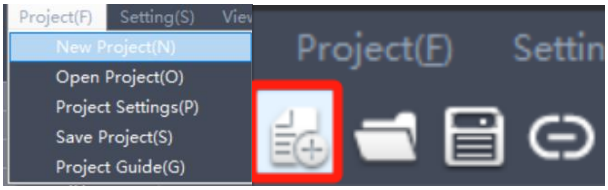
If export header is checked, the result file of data export supports header export;



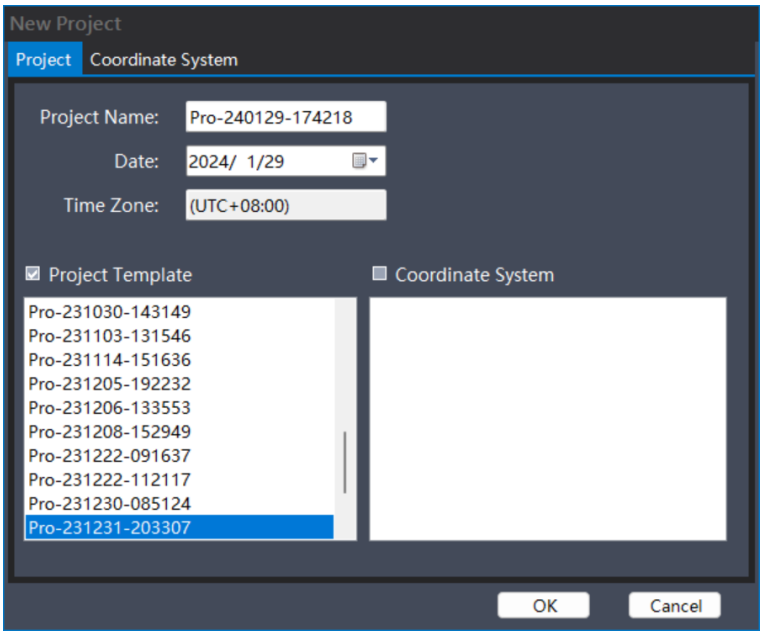
7.2 Project

7.2.1New project

Click "project - new project" in the navigation bar, or click the "new project" icon in the shortcut bar to create a new project.



Enter the project information and set the coordinate system parameters. Click OK after checking to complete the new project operation.



Project

Project Name: the default is pro computer system date computer system time, which can be customized as required.

Date: the default computer system date. You can click the drop-down menu to select.

Time zone: the software automatically identifies the time zone of the current computer system.

Apply project: all settings in a project can be applied. Including coordinate system settings/gps settings/sounder settings/record control settings/coordinate library information. Check "apply project" and select the project to be applied in the project list (blue check mark) to open the "coordinate system " in the upper left 

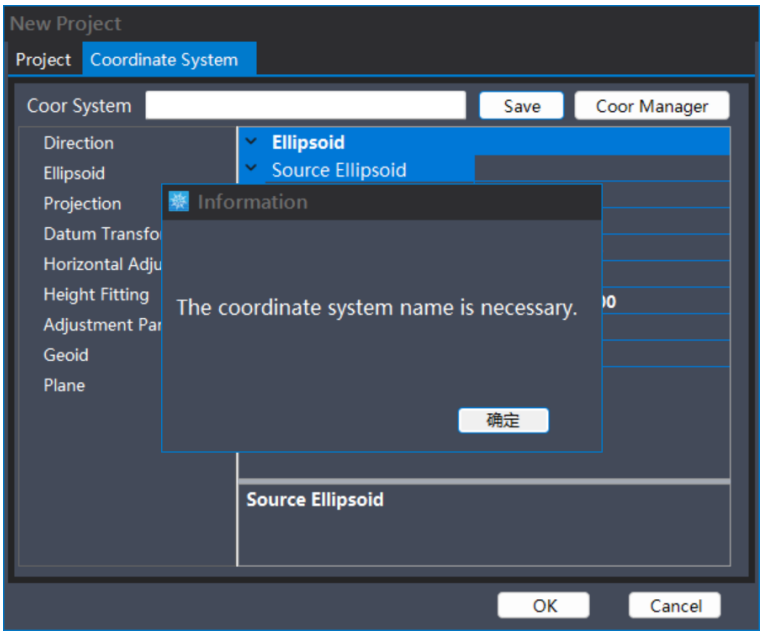
, check the applied coordinate system parameter information, and click OK.

Apply coordinate system template: you can apply the selected coordinate system parameters. Check "Project Template" 

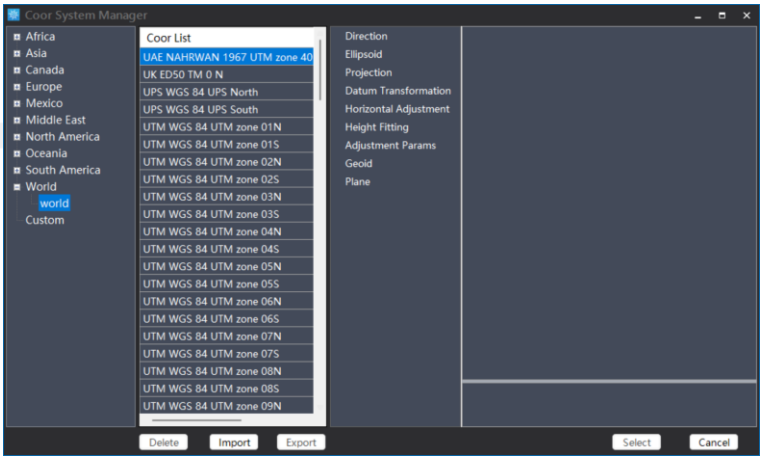
, select the template name applied in the template list, view the coordinate system parameter information in coordinate system settings, and click OK.

Coordinate System Settings

Save coordinate system: fill in the name of the coordinate system and click "save coordinate system" to save the current coordinate system parameters to the coordinate system template directory (\template), with the file suffix *.crd.



Coordinate system manager: you can select a more standardized coordinate system template in the coordinate manager, or you can customize coordinate system parameters, select and export them.



Import: externally import *.crd coordinate system parameter files, which are displayed in the user defined node list.

Export: export the selected coordinate system parameter information, the same as the "save coordinate system" function, and the export file format is *.crd.

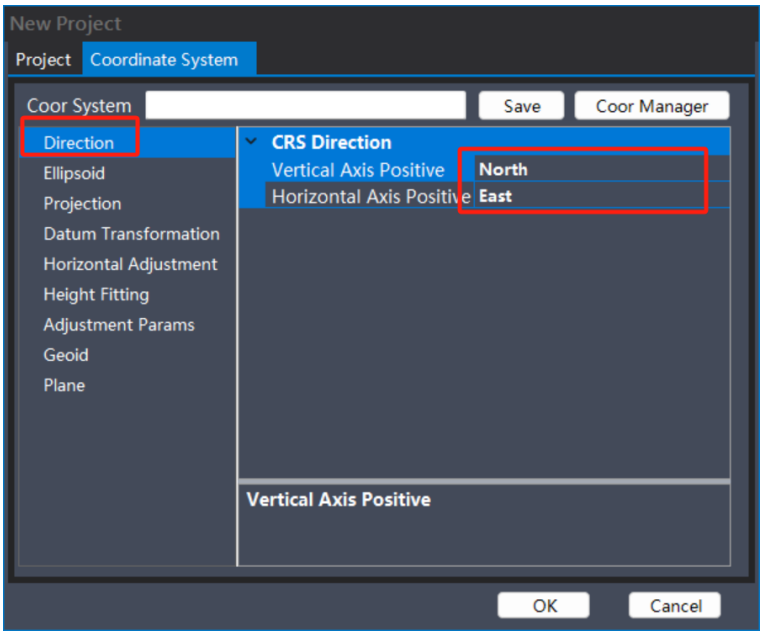
Delete: deletes the coordinate system of the custom node list.

Select: after selecting a coordinate system, click the "select" button to determine a coordinate system template for the new project.

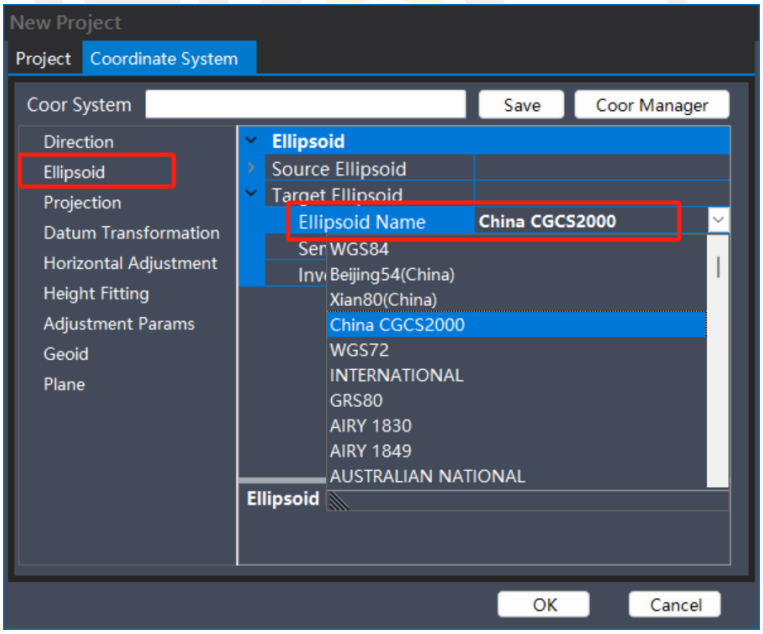
Cancel: cancel the operation and close the current interface.

Coordinate System Parameters

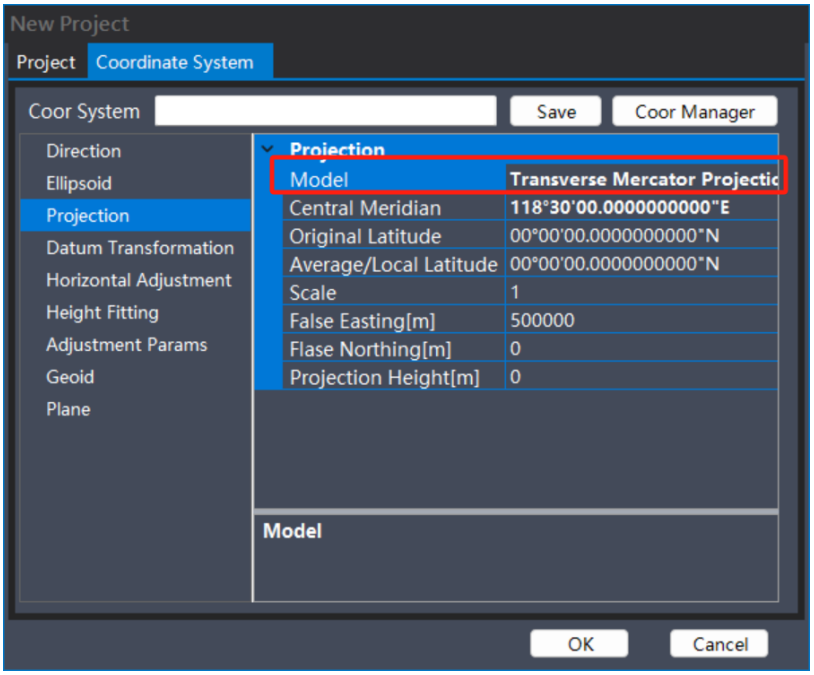
【direction】North East is the positive direction by default. Click the content bar (the red area in the following figure) to pop up the drop-down list button, and select from the drop-down list, the same below.



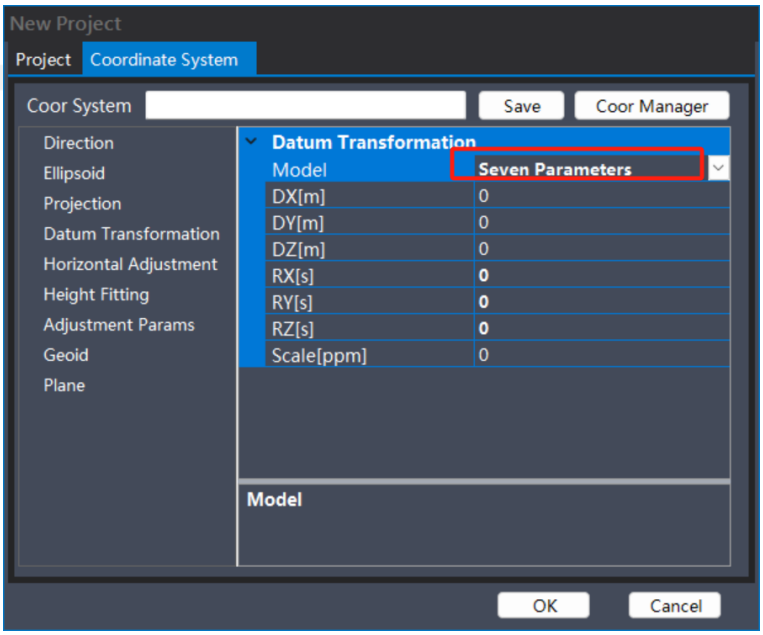
【ellipsoid】The source ellipsoid defaults to WGS84. (Generally, no changes are required. In special cases, other ellipsoids can be selected from the drop-down list.). Select the appropriate ellipsoid name from the drop-down list based on the engineering requirements for the target ellipsoid.



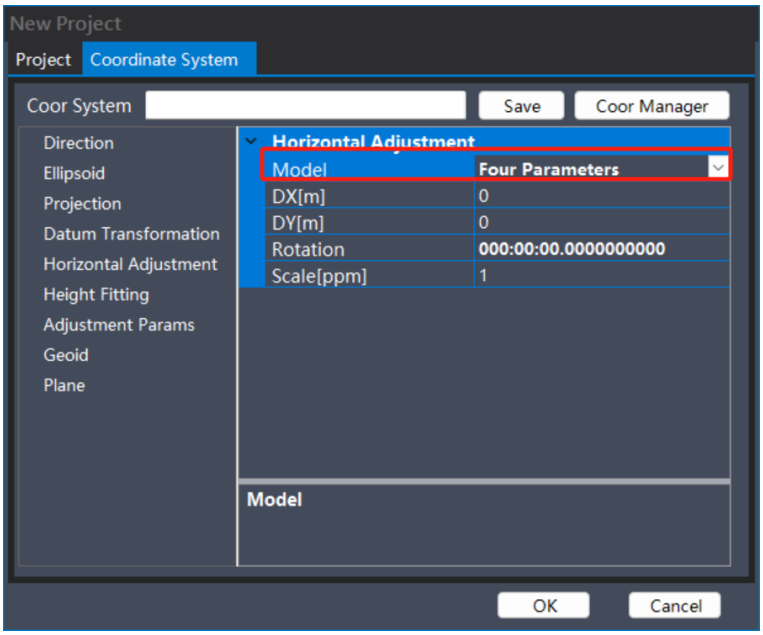
【projection】Select the projection method from the dropdown list as needed, change the central meridian, dimension origin, average latitude, length ratio, eastward constant, northward constant, and projection surface height.



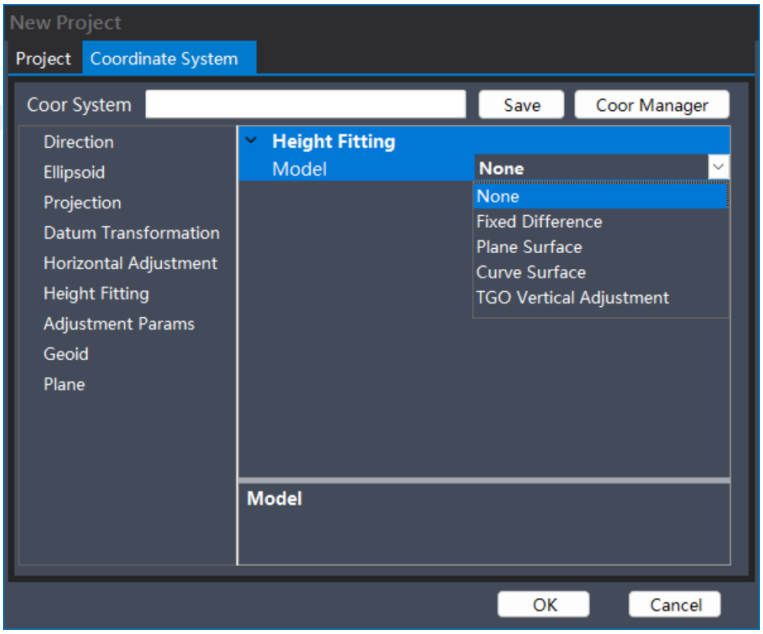
【Datum transformation】In the conversion model, you can choose Bursa-Wolf sevenparameter/three parameters/rigorous seven parameters/grid.



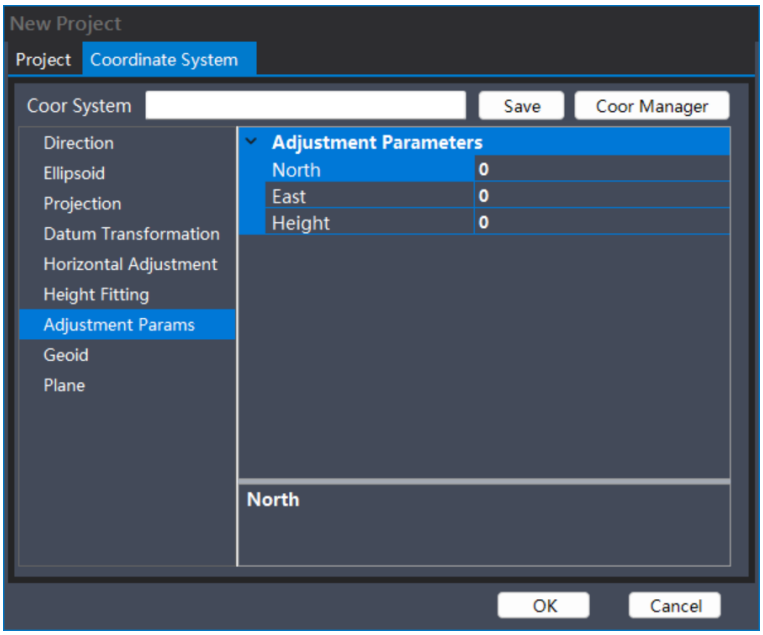
【Horizontal correction】The conversion model for horizontal adjustment can choose between ordinary four parameters and TGO horizontal adjustment.



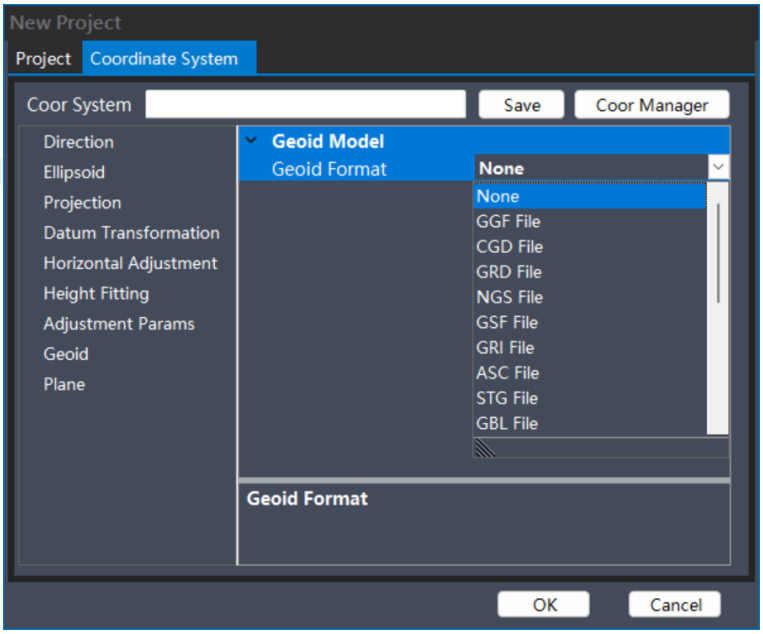
【height fitting】The fitting model can choose from fixed difference, plane fitting, surface fitting, and TGO vertical adjustment.



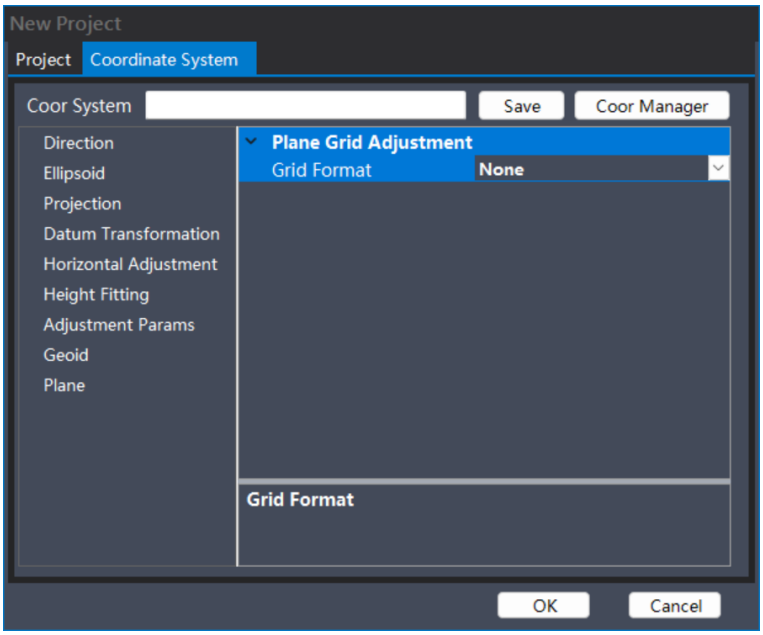
【Adjustment parameters】 You can set offset values such as north offset, east offset, and elevation.



【Geoid】 Select the corresponding format of the geoid model and process the elevation data.

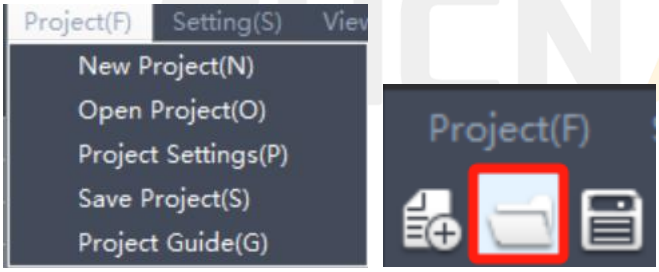


【planar grid】 Select the corresponding format of the flat grid and process the planar data.



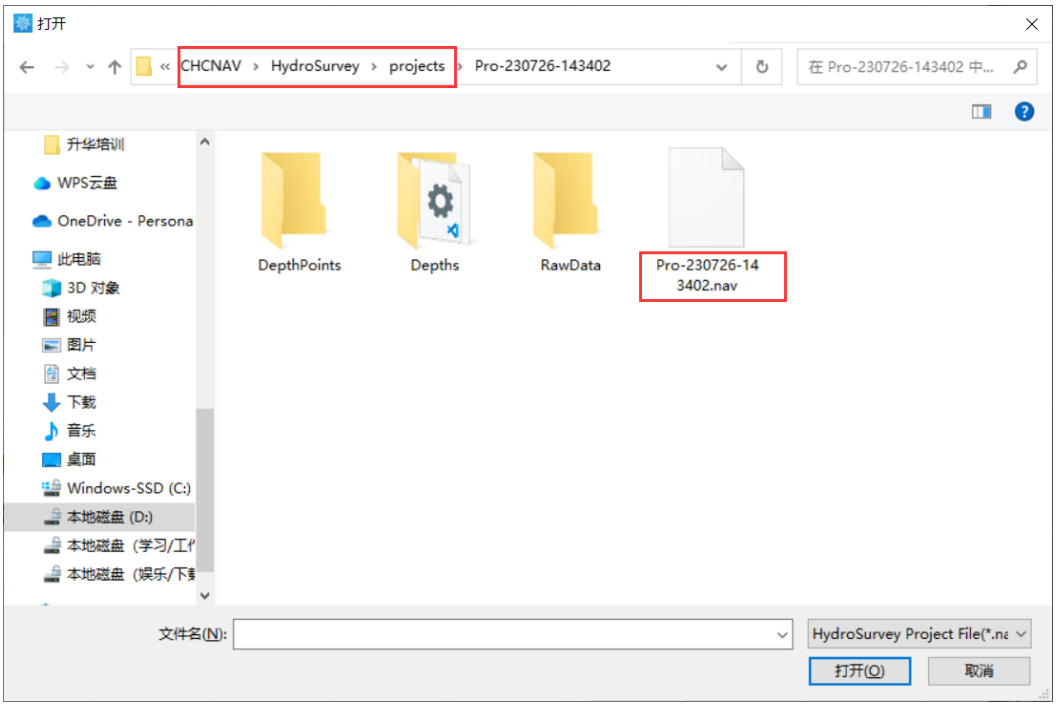
7.2.2Open project

Click on "Project - Open Project" (or click on the "Open Project" icon in the shortcut bar), select the project. nav file you want to open, and click "Open".



Explanation:

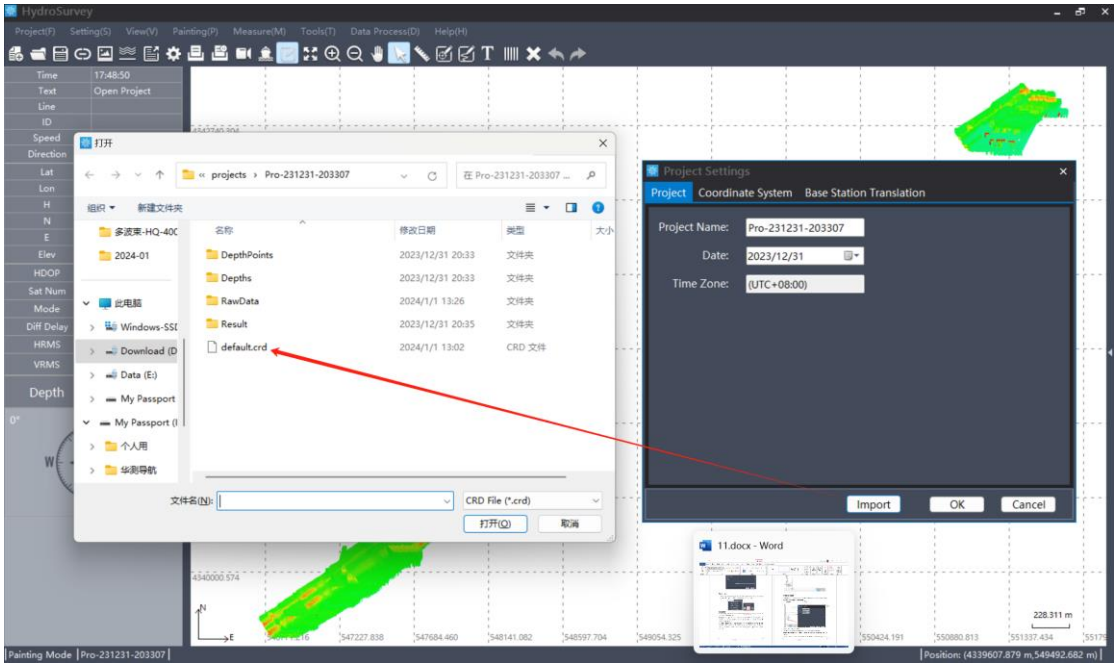
1. Engineering files are saved by default in the HydroSurvey \ projects folder of the software installation directory.
2. If project A is opened from an external directory, it will be automatically copied as project B in the \ projects directory, so the actual opened or saved project is project B in the \ projects directory.
3. If there is already a project named A in the \ projects directory, if you open the same named A project from outside, the original A project will be backed up in the \ Backup directory, and external project A will overwrite the original A project in the \ projects directory.



7.2.3Project parameters

Click "Projects – project parameters" to change the parameters of the current project, and click "OK" to complete the change.

Projects



Project name: Change as needed.

Date: Read the current system date and do not recommend any changes.

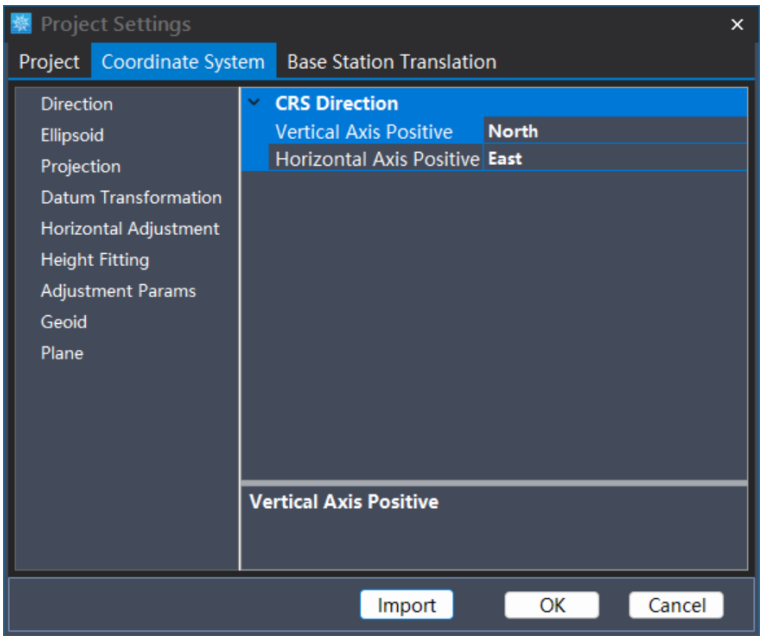
Time zone: Automatically recognizes system time zone information and cannot be changed.

Import coordinate system: Select the coordinate system parameter file. crd and click "Open". (The coordinate

system parameter file of Geodetic Software LS8 can be directly imported and used)

Coordinate System

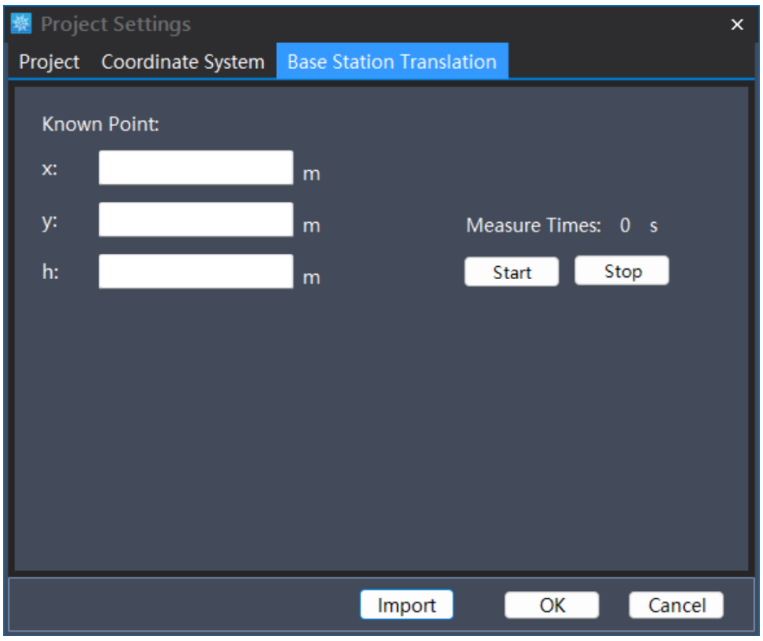
The coordinate system settings can be modified according to steps 1- (2).



Base Station Translation

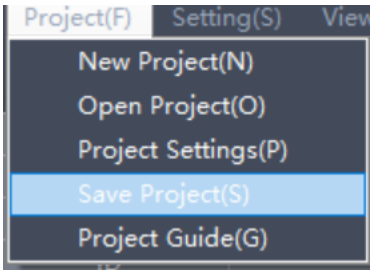
Enter the coordinates of the control points for a known point. (If the fixed difference above has been entered correctly, there is no need to fill in the coordinates)

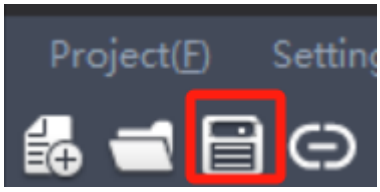
Place the RTK at a known point, click "Start" to collect the required time, and then click "Stop" to calculate the offset.



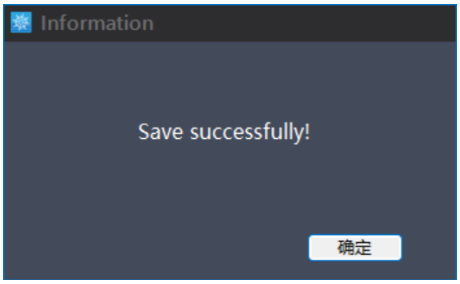
7.2.4Save project

Click "Project - Save Project" (or click on the "Save Project" icon in the shortcut bar) to save the current project.



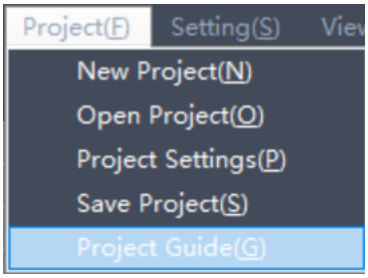


After clicking to save the project, the message "Save Successfully" will pop up to complete the save.



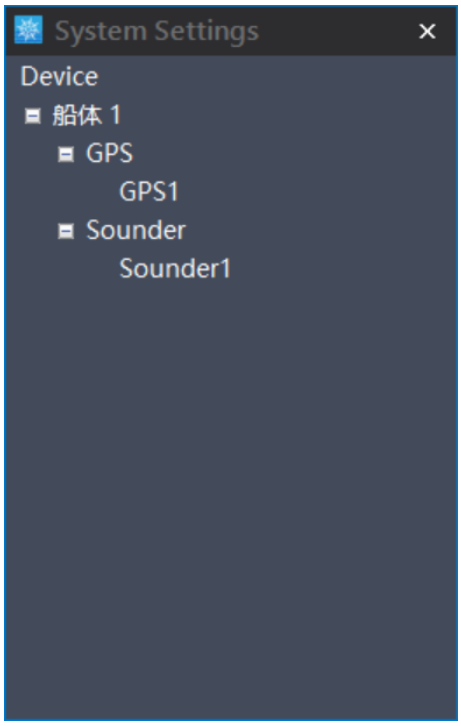
7.2.5Sounder Wizard

APACHE series USVs can be directly connected by clicking the "one click connection" icon, without the need for this function;



Click on "Engineering - Sounder Wizard" to automatically enter "System Settings". After completing the settings, close "System Settings";

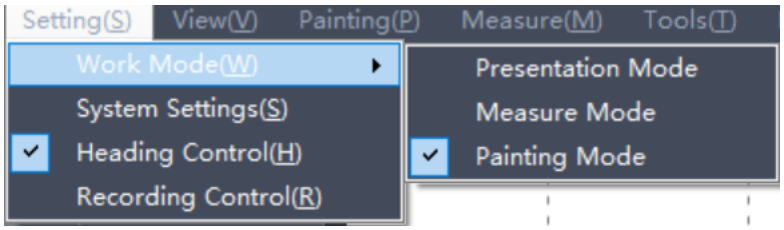
Subsequently, it will automatically enter "Record Control". After turning off "Record Control", it will automatically enter "Measurement Start" and click "OK" to start the measurement. (Specific settings will be explained in detail later)



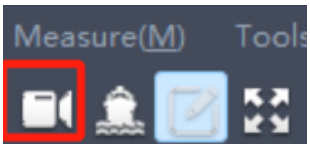
7.3 Settings

7.3.1Working mode

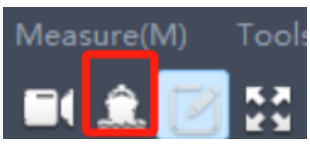
Click on "Settings - Working Mode" and select the software working mode from the drop-down list.



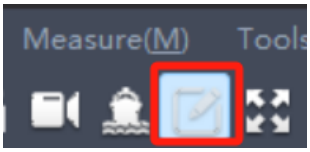
1) Demonstration mode: Simulate field measurement and learn and operate the software. (Click on the "Demonstration Mode" icon in the shortcut bar to enter this mode)



2) Measurement mode: Select this mode to perform measurements. (Click on the "Measurement Mode" icon in the shortcut bar to enter this mode)

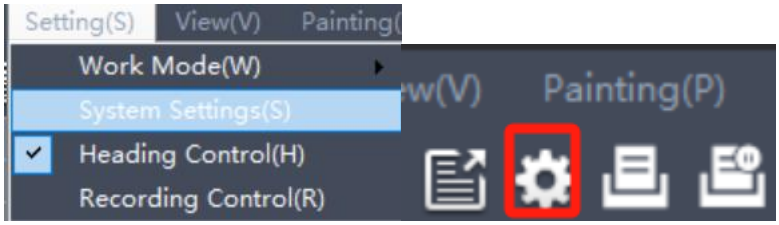


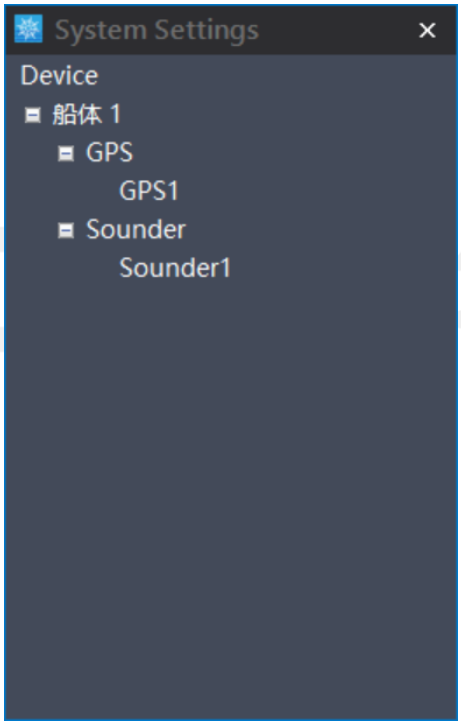
3) Drawing mode: Editing operations such as adding or deleting points and lines on the graph. (Click on the "Drawing Mode" icon in the shortcut bar to enter this mode)



7.3.2System settings

Click "Settings - System Settings" (or click on the "System Settings" icon in the shortcut bar) to enter the system settings interface.





Device

The ship and the measuring equipment carried on board will retain one ordinary hull by default, including two or more hulls. Any one of the hulls can be removed (the same below). Right click on "Equipment" to add "Ordinary Ship" or "USV".

Ordinary ships include GPS, depth sensors, and attitude sensors.

USVs include unmanned hulls.

hull

Right click on "Hull 1" and a dropdown list will pop up, which includes settings, renaming, folding (the

"unfold button" in the folding state, the same below), and removal.

1) Settings: Double click on "Hull 1" to enter the Hull Settings interface. The list of ship types includes APACHE 3/4/5/6, ordinary ships, and cutter suction boats.

Check "Fixed Ship Type" to show that the size of the ship remains fixed and unchanged.

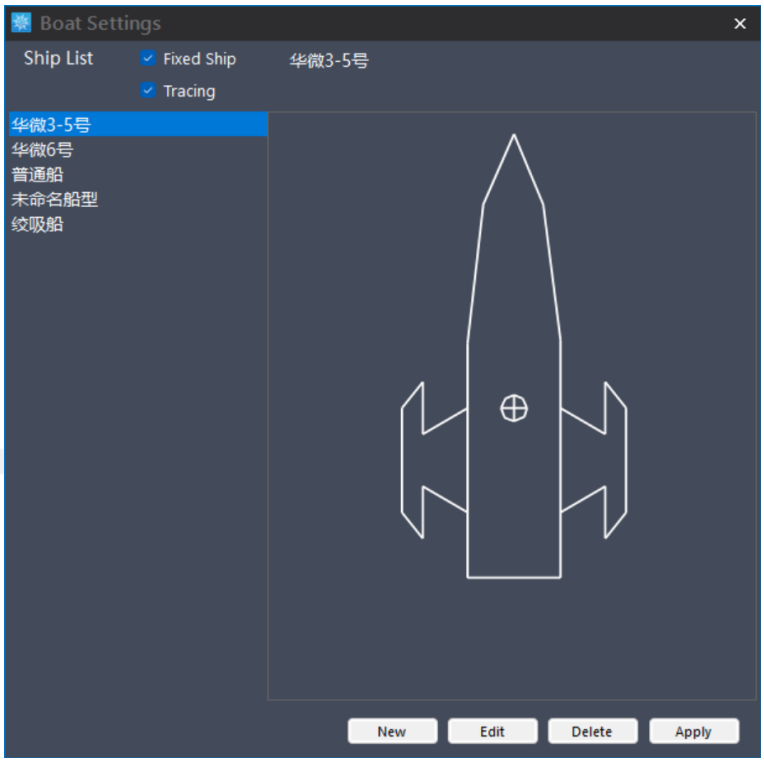
Check "Main Ship Tracking" to always display the position of the main ship.

"New" can draw ship types based on the size of the hull;

"Edit" the selected existing ship size;

"Delete" the selected ship type;

Apply all settings.

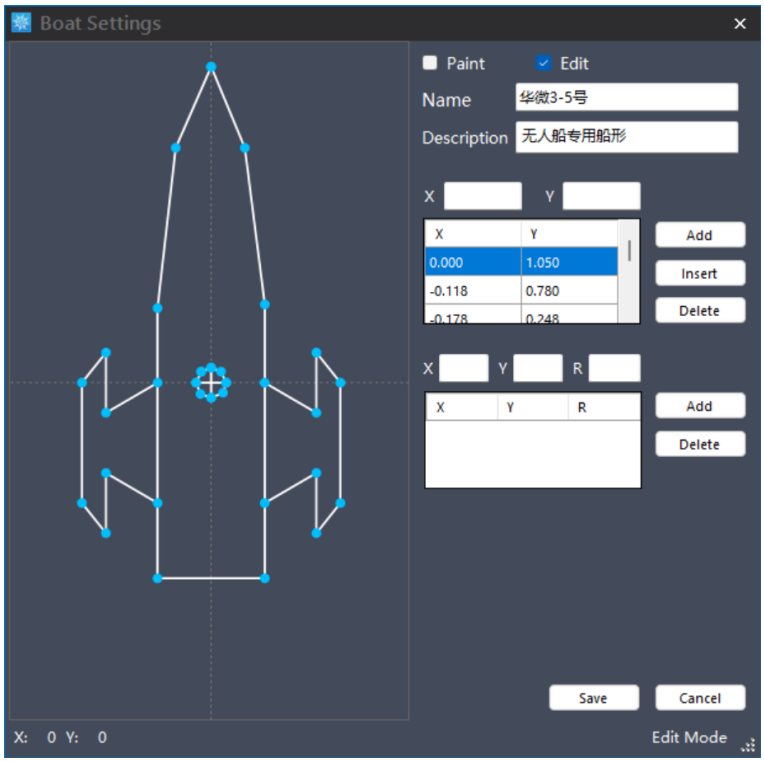


Click "New" or "Edit" to enter the ship type editing interface. Check "Drawing Mode" to draw the feature points of the ship with the left mouse button and end with the right mouse button. Check "Edit Mode" to select the drawn points and drag them. Enter the name of the ship type. Describe the introduction of the ship type.

Enter numerical values in X and Y and click "Add" to add a point; Insert inserts a point after the selected point in the list; Delete the selected point. The coordinates of the first and last points entered are consistent (with the hull closed).

Enter numerical values in X, Y, and radius R, click "Add" to add a circle, and "Delete" the selected circle in the list.

Click "Save" to exit the ship type editing interface, and a new ship type will be added to the ship type list; Click "Cancel" to exit editing.



2) Renaming: Renaming the hull name, the same below.

3) Folding: Hide the device name (you can click on the "+" or "-" before the name to open and collapse).

4) Remove: Delete the hull, the same below.

GPS

Double click on "GPS1" to enter the parameter setting interface of the GPS device, which includes "Communication Settings", "Port Monitoring", and "Antenna Coordinates". After setting up, check "Connect" in the bottom left corner and click "OK" in the bottom right corner to complete the GPS setup.

1) Communication settings

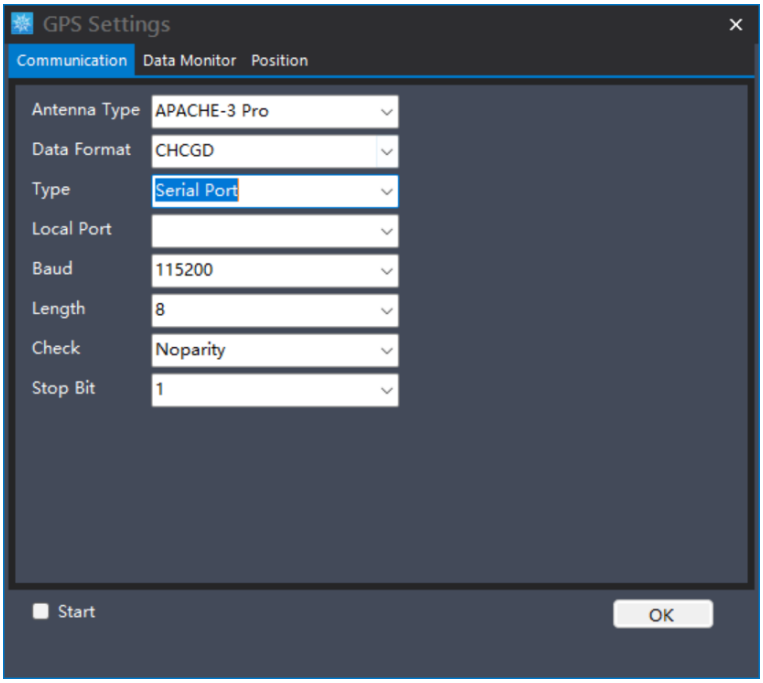
"Antenna Type" Select the "Antenna Model - USV Model (including corresponding antenna coordinate parameters)" (RTK model) to be used in the drop-down list, and select NONE for those not in the list.

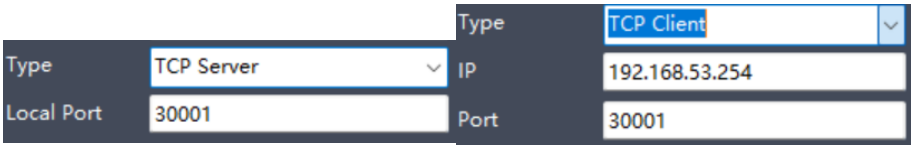
Select the GPS format for parsing processing in the drop-down list.

Select from the "Communication Method" dropdown list:

a) Serial port (select communication port and baud rate);

b) TCP and UDP (the server sets the listening port, and the client needs to input the IP address and port of the connecting device);

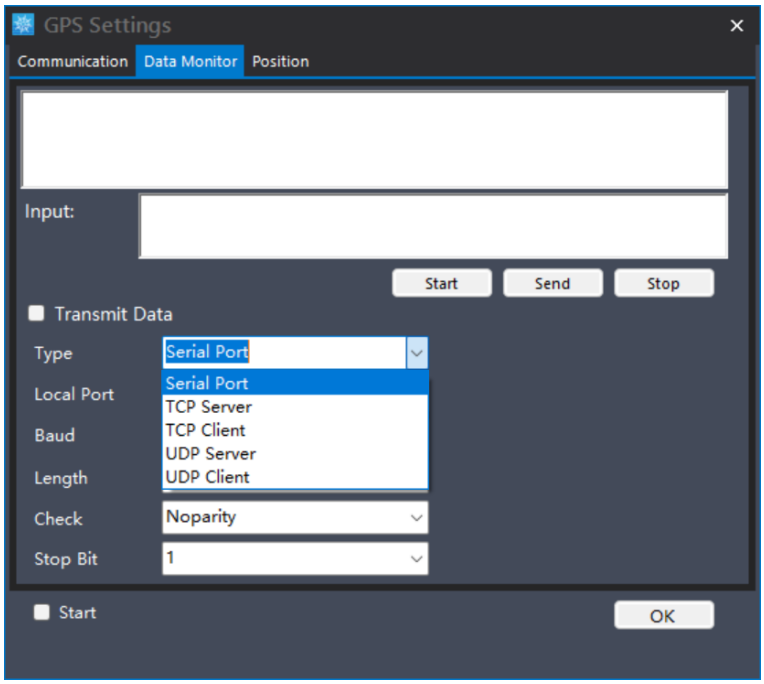




2) Port monitoring:

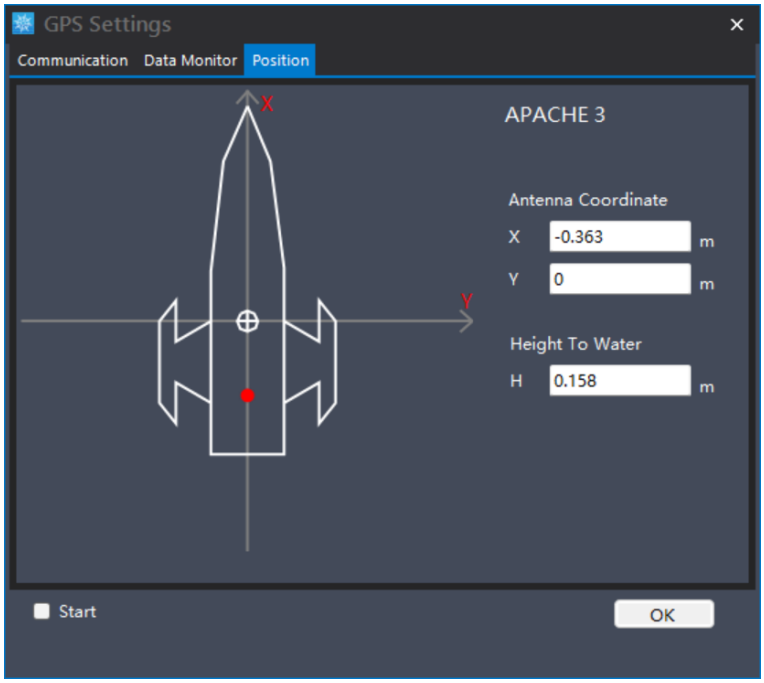
Click "Start" to display the port receiving data; Click the "Stop" button to stop displaying the data received by the port. Enter the command in the "Command Input" column and click the "Send" button to send the command to the device connected to the port.

Check "Data Forwarding" to forward the received data to other devices. Communication methods include serial port, TCP, and UDP, as set above.



3) Antenna coordinates: Input the position of the positioning antenna relative to the transducer (measurement point) in the ship's coordinate system; Input the distance from the bottom of the positioning antenna to the water surface as "base to water surface height".

When selecting NONE as the antenna type in the communication settings, the phase center height needs to be added.



Sounder

Double click on "Sounder1" to enter the parameter setting interface of the depth finder, which includes

"Communication Settings", "Parameter Settings", "Port Monitoring", "Instrument Coordinates", and "Position Forwarding"; After setting up, check the "Connect" button in the bottom left corner and click "OK" in the bottom right corner to complete the sounder setup.

1) Communication settings

① Select from the "Communication Method" dropdown list:

Serial port (select communication port and baud rate);

TCP and UDP (the server sets the listening port, and the client needs to input the IP address and port of the connecting device);

HydroSound (receiving data directly from the Sound software);

AutoPlanner (receiving data directly from AutoPlanner software).

② "Data Format": Select commonly used formats such as CHCSF, CHCGD (GD version for USVs), and SDDPT according to different depth measuring instrument models. Different formats will have corresponding format setting parameters, and default parameters can be used.

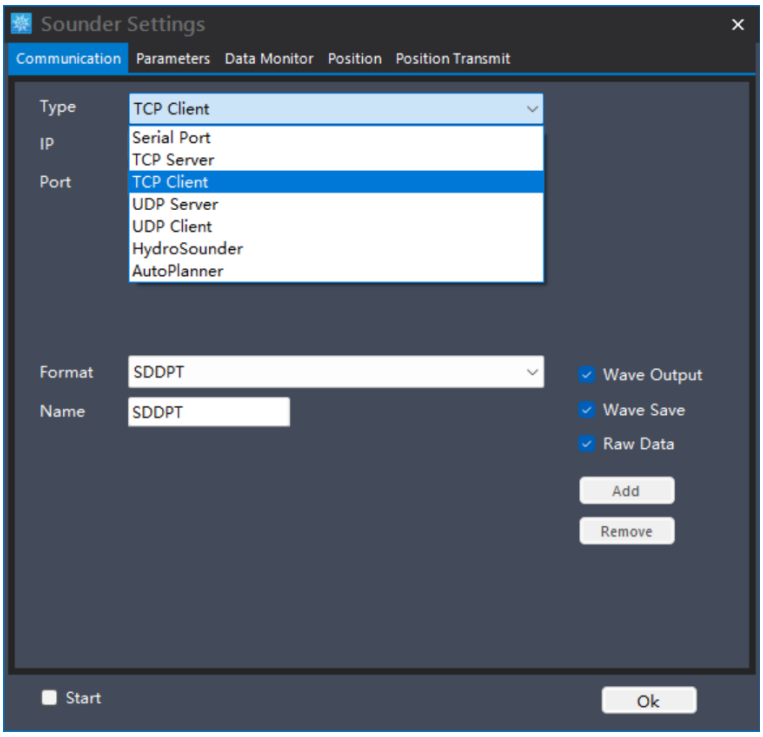
After selecting "Custom" to set the relevant parameters, click the "Add" button to add a new format, and "Remove" to delete the selected data format.

③ Waveform recording:

Check "Waveform Output" to display real-time waveforms on the main interface;

Check "Waveform Storage" to store real-time waveform data simultaneously. During data processing, it can be overlaid with water depth data to facilitate noise processing;

Check "Raw Data" to store the raw data of the depth sounder.



2) Parameter settings: Set the parameters of the depth finder in different measurement environments.

① Draft: The distance from the bottom of the transducer to the water surface;

② Working mode: includes three modes: normal (sonar operation), pause (sonar stop), and status (reading the sounder firmware);

③ Sound Speed: Enter the actual sound speed of the water at that time or check "Temperature and Salinity Calculation" to calculate the sound speed by modifying the temperature and salinity;

④ Gain: The energy gain of the transmitted beam, which can be adjusted in real time according to the actual measurement environment through "automatic" or manually inputted as a fixed value;

⑤ Frame rate: Sound wave emission frequency;

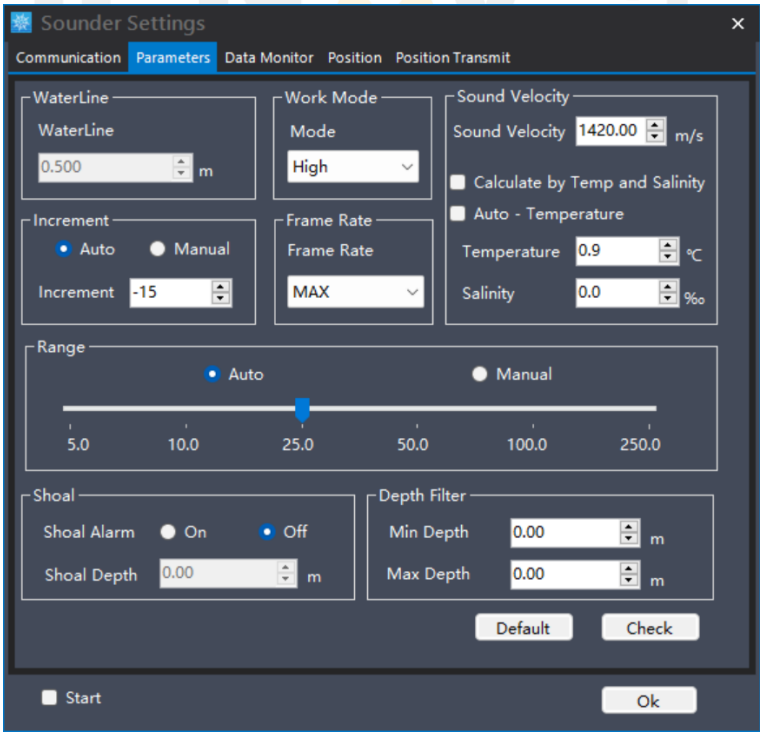
⑥ Range: The maximum water depth that the depth sounder can measure; When the maximum range is close to the actual water depth, the data accuracy is higher. "Automatic" will adjust in real-time based on water depth, and "manual" will select a fixed range;

⑦ Anti interference: Select "normal" or "tracking";

⑧ Water depth filtering: You can choose to collect data within the minimum and maximum water depth ranges;

⑨ Default: Click "Default" to restore the software default settings;

⑩ Self check: Clicking on the "Self check" software will check whether the depth sounder is functioning properly.



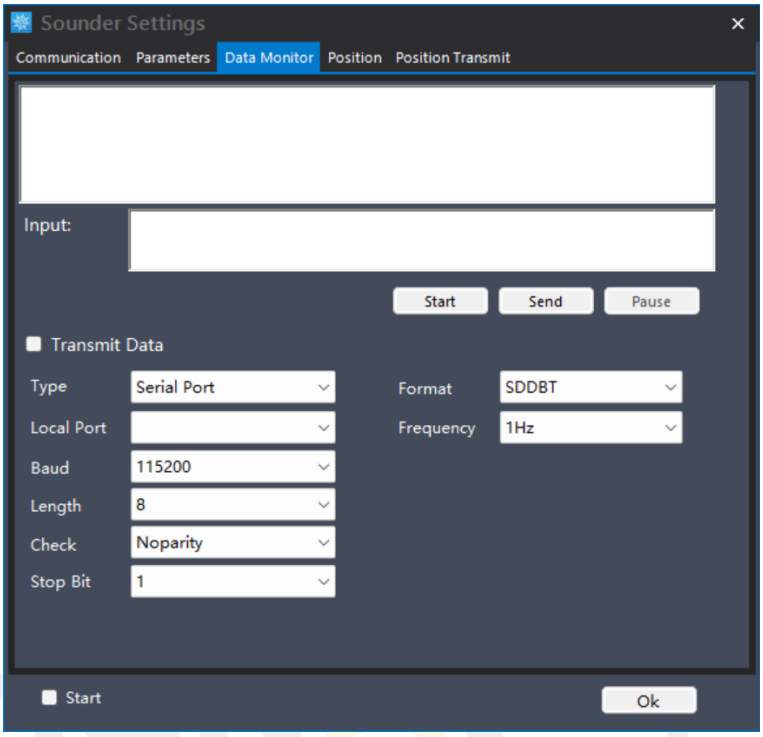
3）Port monitoring

Click the "Start" button to display the received data in real-time;

Click the "Stop" button to stop receiving;

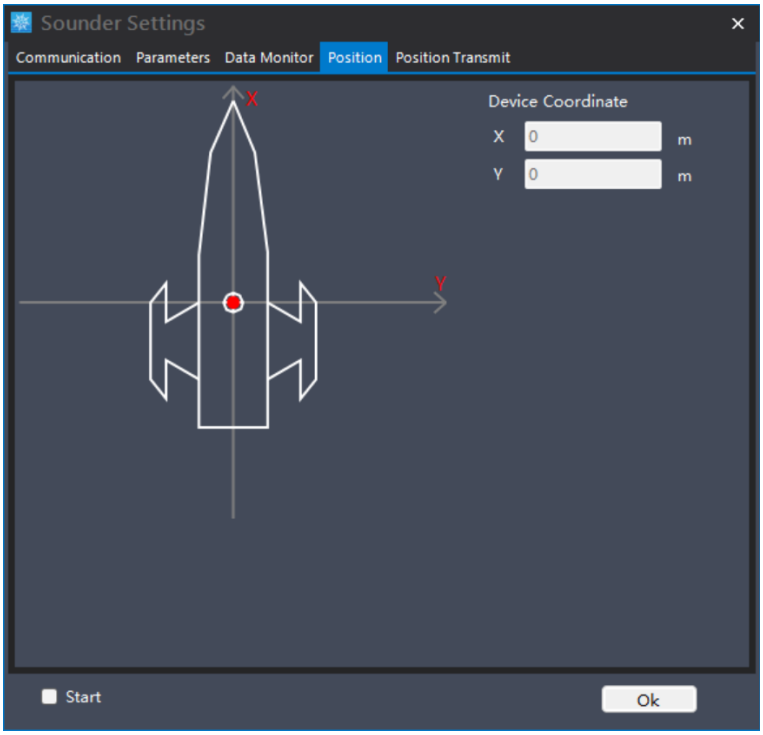
Click the "Send" button to send the commands in the "Command Input" area;

Check the "Data Forwarding" box to send the corresponding format of data to other devices at the set frequency. The communication method is the same as above (GPS port monitoring), and the single beam data forwarding format is SDDPT/SDDBT.



Instrument coordinates:

The installation position coordinates of the depth sounder (measuring point) cannot be modified. When drawing a boat, the installation position of the depth sounder (measuring point) should be taken as the origin, with coordinates (0,0).



5）Location forwarding: customized development of piling function

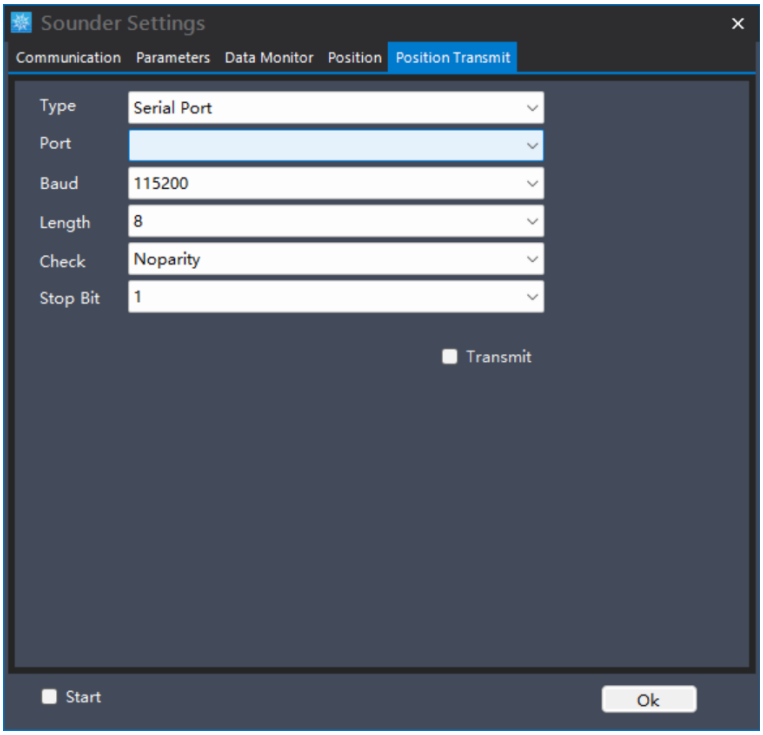
In point navigation mode, the plane coordinates of the measurement point are output $CHCDZ data at a frequency of 1Hz. The ship navigates to the pile point, with a distance of less than 0.02m (coordinate library interface, can be set by oneself). The measurement point turns green, indicating that the current measurement point has completed pile driving.

Data format: $CHCDZ, No, N, E, H, MN, ME, MH \ r \ n; 1Hz 8-bit;

N. E, H, MN, ME, MH: 12 digits do not include positive and negative signs, if not enough, fill in 0, unit: millimeters;

N. E, H: The position of the imported pile points;

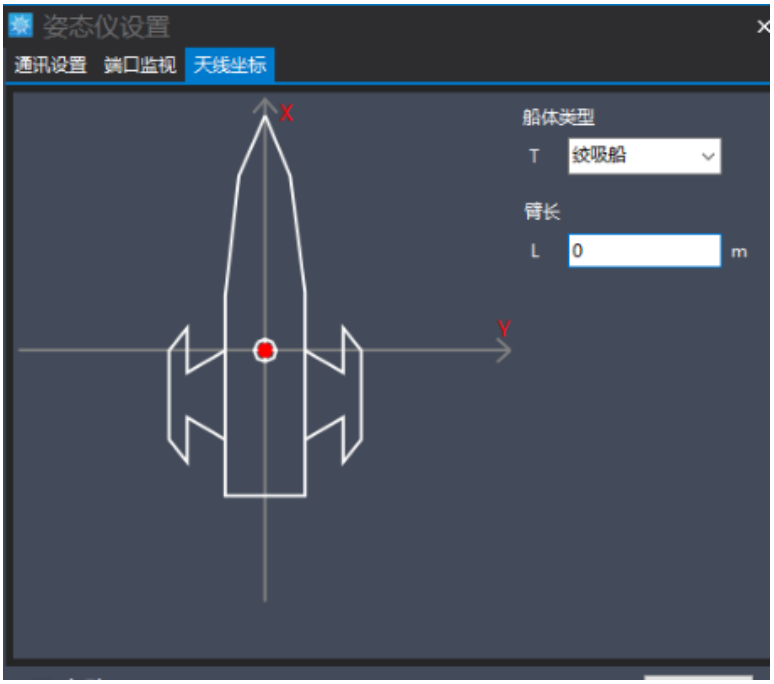
MN, ME, MH: the position of the ship at points 0,0;



Motion

Set the relevant parameters of the attitude meter by double clicking on "Motion1" to enter the parameter setting interface of the attitude meter, which includes "Communication Settings", "Port Monitoring", and "Antenna Coordinates". After setting, check "Connect" in the bottom left corner and click "OK" in the bottom right corner to complete the attitude meter setting.

The settings for "communication settings" and "port monitoring" are the same as above, and the "antenna coordinates" need to select "ship type" and "arm length" of the working arm.



Heading Control

Control the bow direction of the ship's hull. Click "Settings - Bow Control" to select the control method based on the actual device used. Usually, the default settings are sufficient for heading control.

Intelligent selection: Automatically adjust according to GPS motion direction;

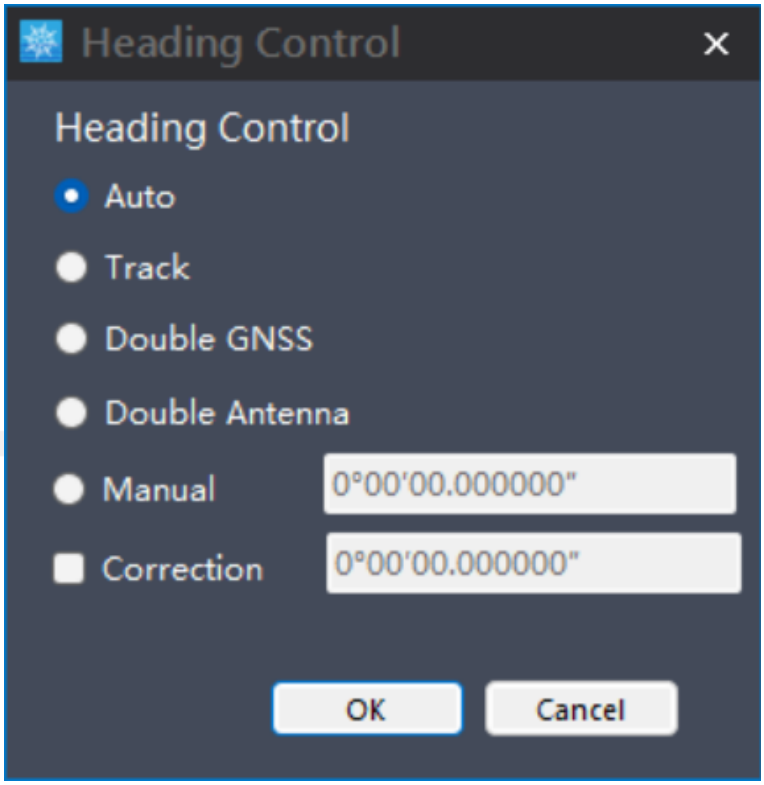
Calculate according to trajectory: Calculate according to the trajectory of the path;

Dual GPS: calculated based on the baseline direction of two GPS installations;

Dual antenna: calculated based on the azimuth angle output by the dual antenna device;

Manual input: Enter a fixed angle;

Bow correction: Correct the difference between the installation of the input device and the actual direction.



Record Control

Set data collection parameters. Click "Settings - Record Control" to enter the record control settings interface.

Recording method:

Record by distance: Record data every few meters;

Record by time: Record data every few seconds;

Record by Space: Manually record data by pressing a space once.

Unstate restrictions:

Single point solution: Record "single point solution" and higher accuracy;

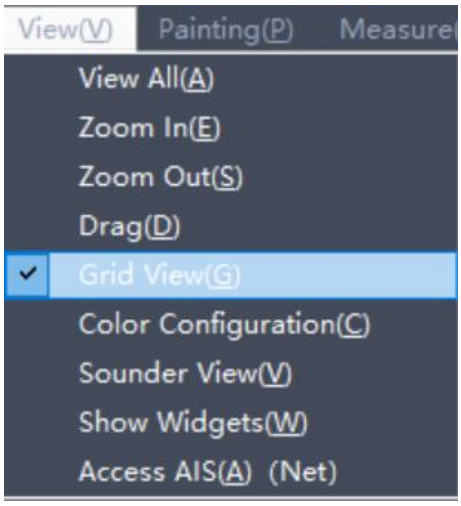
Differential decomposition: Record "differential decomposition" and higher accuracy;

"Fixed solution": Record the "fixed solution".

Recording options:

Select the device that needs to record data;

7.4 View



7.4.1Full image display

Click on "View - Full Image Display" (or click on the shortcut bar's "Full Image Display" icon) to fully display all graphics.

7.4.2Zoom in

Click "View - Zoom In" (or click the "Zoom In" icon on the shortcut bar) to zoom in on the graphic once.

7.4.3Zoom out

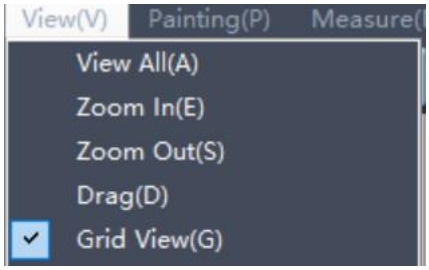
Click "View - Zoom Out" (or click the "Zoom Out" icon on the shortcut bar) to zoom out the graphic once.

7.4.4Drag the base map

Click on "View - Drag Bottom" (or click on the "Move" icon in the shortcut bar), hold down the left mouse button to drag the bottom.

7.4.5Show grid

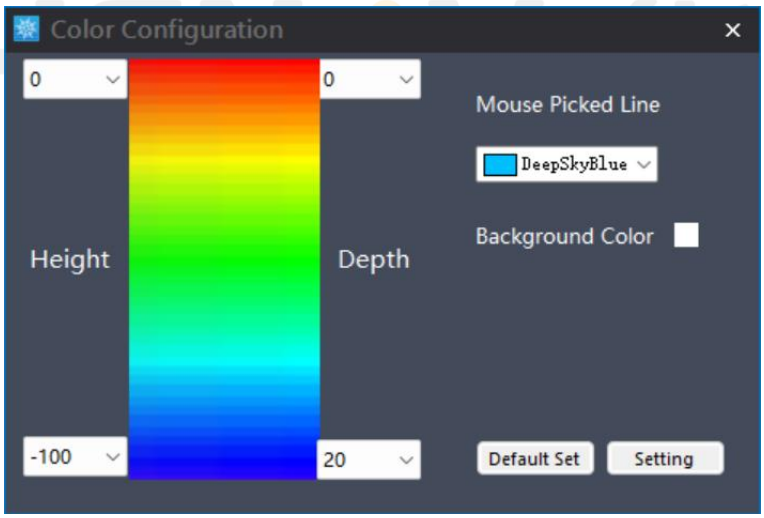
Clicking on the "View - Show Grid" checkbox will display the coordinate grid, allowing you to view the current scale bar.



7.4.6Color profile

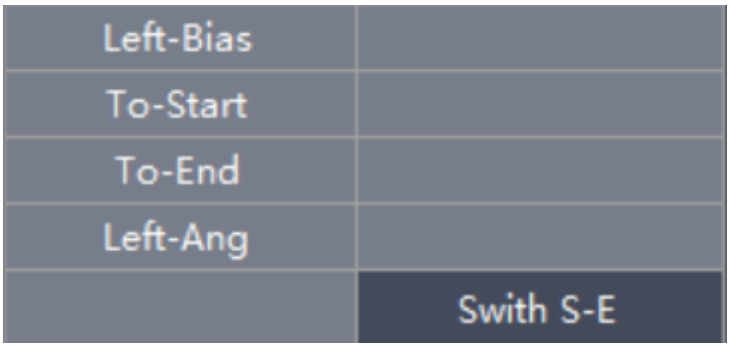
Click "View - Color Settings" to open the color settings interface. Select colors corresponding to different elevation and depth ranges separately;

Select the color of the selected line from the dropdown list of "Pick Line Segment with Mouse"; Select "background color" as black or white, click "settings" to save the changes, and click "default settings" to restore the software's default parameters.



7.4.7View of sounder

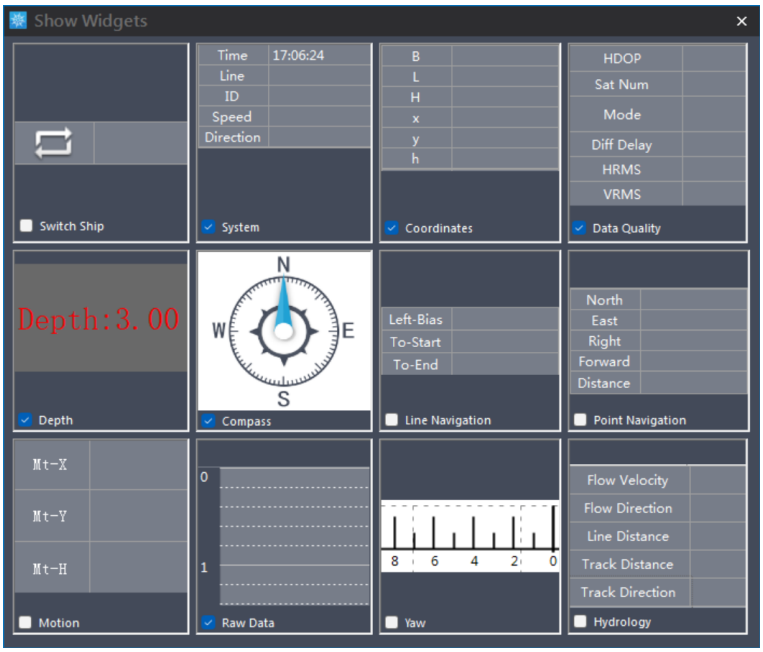
Directly display the default common view settings of the depth sounder in the bottom left corner of the main view.



7.4.8Small window options

Check the small window that needs to be displayed on the main interface.

1) Hull switching: switching display information between multiple hulls;
2) System: Display time, line name, point number, speed, and heading;
3) Coordinates: Display the current WGS84 longitude and latitude, water surface geodetic height, plane coordinates, and water surface elevation;
4) Data quality: HDOP value, number of satellites, and calculation status;
5) Water depth value window: displays real-time water depth figures;
6) Compass: Real time display of ship's bow direction;
7) Line navigation window: displays whether the ship is currently on the left or right side of the trajectory line (based on the direction from the starting point to the endpoint of the line segment), the distance from the starting point, and the distance from the endpoint (can be opened by clicking the "Line Navigation" button on the shortcut bar);
8) Point navigation window: displays information such as heading north, east, right, forward, and distance from the ship's hull to the target point (can be opened by clicking the "Point Navigation" button on the shortcut bar);
9) Attitude instrument coordinate window: displays the northeast elevation information of the attitude instrument;
10) Raw data: Display real-time water depth waveform of the depth sounder;
11) Yaw view: displays a yaw scale bar;
12) Hydrological view: displays hydrological information such as flow velocity, flow direction, and straight-line distance.



7.4.9Accessing AIS

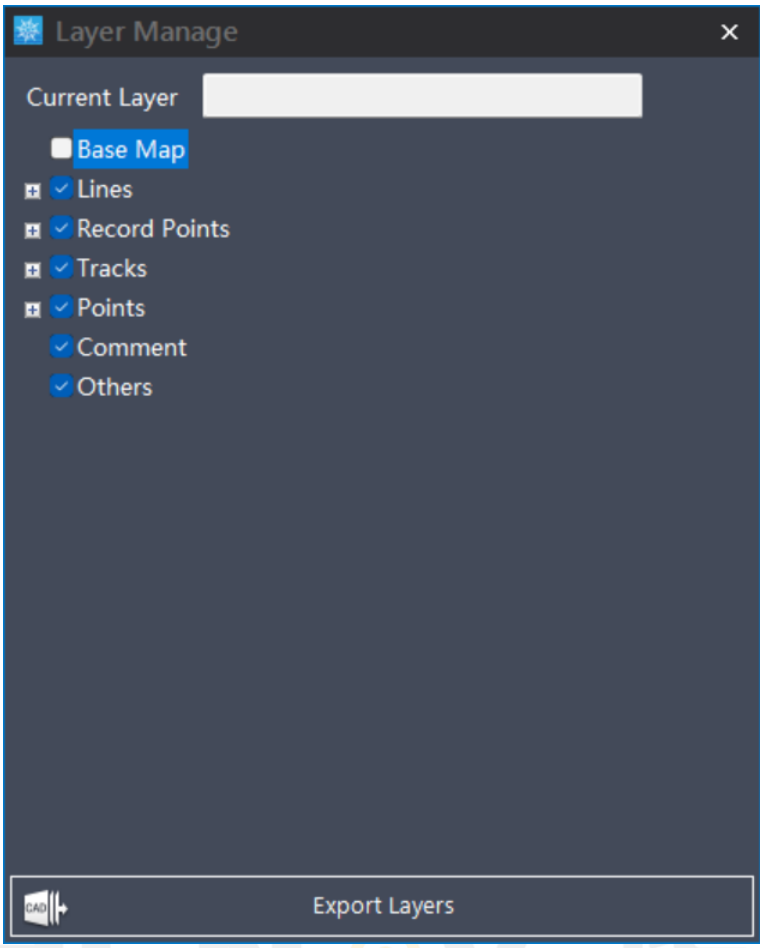
Clicking on "View - Access AIS" will redirect you to the AIS website to view the distribution of surrounding ships.

7.5 Draw

7.5.1Layer management

Click on "Drawing - Layer Management" or click on the "Layer Management" icon in the shortcut bar to enter the layer management interface.

Check the layer to display it, otherwise it will not be displayed. Click the "+" button to open the dropdown list, and click the "-" button to close the dropdown list.



7.5.2Base layer

Right click on "Bottom Layer" and click "Import" to select a. dxf or. dwg format bottom file. Right clicking on the imported base image file will pop up a drop-down list:

Click "Edit" to reselect the base image file;

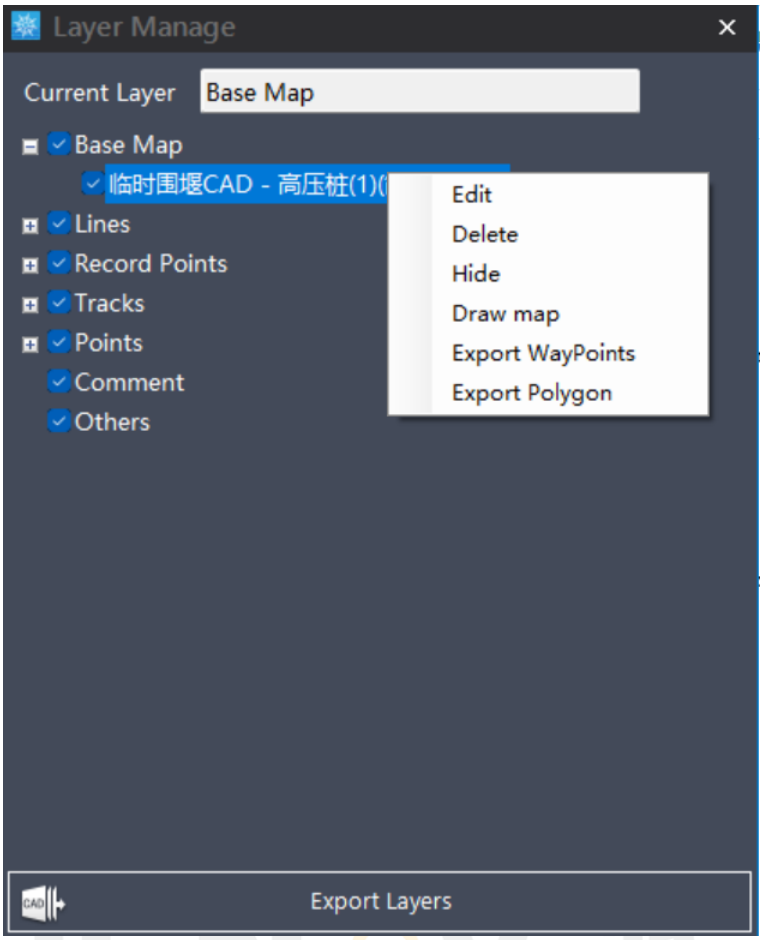
Click "Delete" to delete the imported base map;

Click "hide" to not display the base image;

Click "Draw Bottom Map" to draw the bottom map;

Click "Export WayPoints" to export the. waypoints waypoint file from AutoPlanner software;

Click "Export Polygons" to export the. poly polygon file from AutoPlanner software.



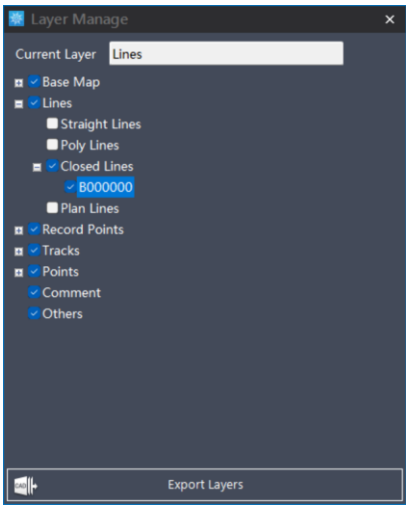
7.5.3Line layer

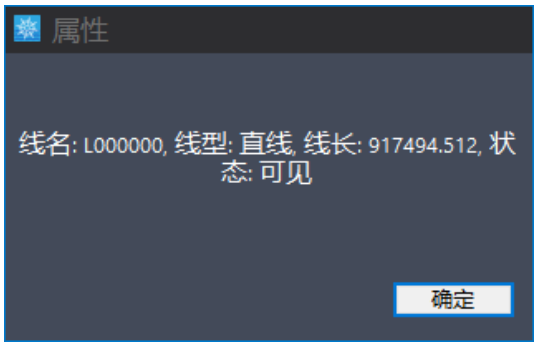
Right click on "Line Layer" to display the line name. The drop-down list includes "Line", "Polyline", "Closed Line", and "Plan Line".

Right click on "Line" and click "Delete" to delete all lines. Click "Hide" to not display all lines;

Right click on the selected line in the drop-down list, click "Delete" to delete the selected line, click "Hide" to not display the selected line, click "Properties" to display the attribute information of the selected line.

The operations for "Polyline", "Closed Line", "Plan Line", and "Line" are the same. (Right click on "Plan Line", click "Export WayPoints", and export the route file of AutoPlanner software)





7.5.4Trajectory line

Display the trajectory of data collection. Right click on "Trajectory Line", click "Import", select the. dep file to import existing trajectories, click "Enter Path", and enter the trajectory line storage path.

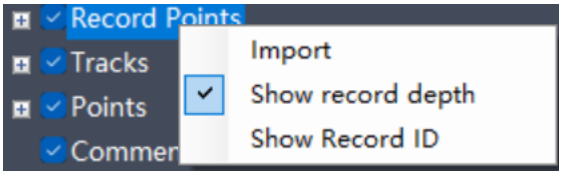
Right click on the file in the dropdown list, and the "delete" and "hide" functions are the same as above.

7.5.5Record point

Display the collected points. Right click on "Trajectory Line" and click "Import" to select the. dep file to import the collected points;

Click on "Water Depth Display" to display the water depth of the collection point.

Click "Record Point Name Display" to display the name of the collection point. Right click on the file in the dropdown list, and the "delete" and "hide" functions are the same as above.



7.5.6Point layer

Display manually added points. Right click on "Point Layer". Click "Open" to enter the coordinate library of the point. (Operation method, refer to the coordinate library in Section 2 of this chapter);

Click "Show Point Names" to display the name of the point. Right click on the file in the dropdown list, and the "delete" and "hide" functions are the same as above.

7.5.7Annotation Layer

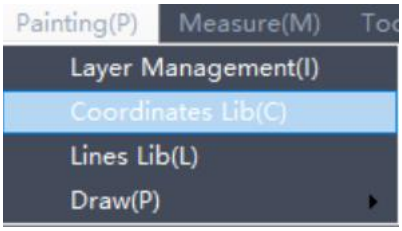
Display annotated text and other information. Right click on the file in the dropdown list, and the "delete" and "hide" functions are the same as above.

7.5.8Display layer export

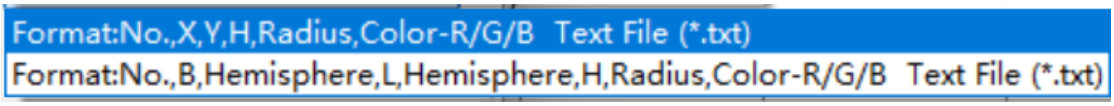
Manually drawn graphics can be exported to CAD files in dxf/dwg base format.

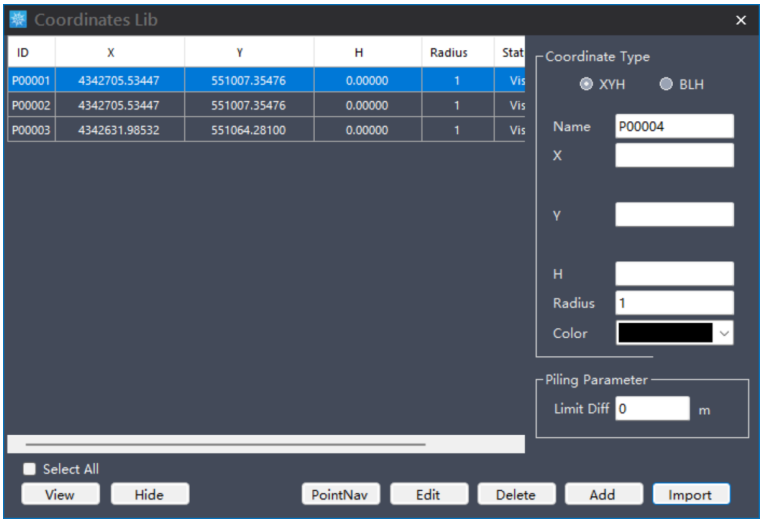
Coordinate Library

Click on "Draw Coordinate Library" and enter the coordinates and other information of the points to draw the points.



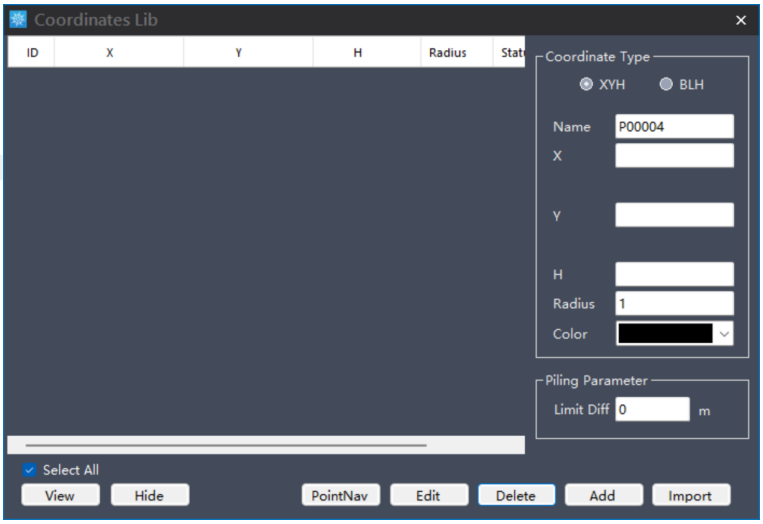
1) Coordinate type: Select projection coordinate XYH or geodetic coordinate BLH, enter point name, X (B), Y (L), H (H), radius (point symbol), and color. Simply enter the numerical value in BL, and it will automatically recognize the accuracy in minutes and seconds, selecting the corresponding hemisphere.
2) Pile driving parameters: Enter the pile driving tolerance.
3) Select All: Select all points in the list.
4) Display: Display the selected points in the list on the main interface.
5) Hide: Hides the selected points from the list on the main interface.
6) Point navigation: navigate to the selected point in the list, and the main interface will display a point navigation view.
7) Edit: Edits the selected points in the list.
8) Delete: Delete the selected point in the list.
9) Add: Add the edited points in "Coordinate Type".
10) Import: Import and edit a fixed format point file. The supported import formats are:





7.6 Line library

Click "Draw - Line Library" to display line information and draw lines based on the points in the coordinate library.



Click "Draw - Line Library" to display line information and draw lines based on the points in the coordinate library.

1) Select All: Select all lines in the list.
2) Display: Display the selected lines in the list on the main interface.
3) Hide: Hides the selected lines from the list on the main interface.
4) Delete: Delete the selected line from the list.
5) Coordinate library drawing lines:

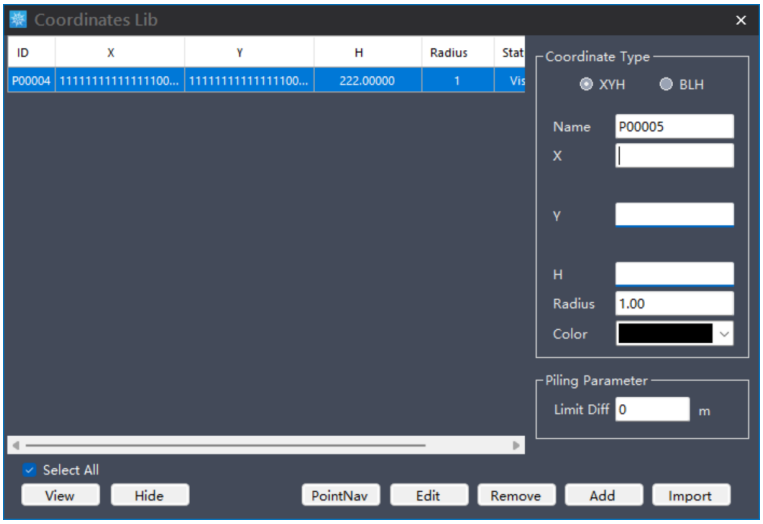
"Linear", select a straight line, polyline, or closed line from the drop-down list;

Select a numerical value from the dropdown list of "line weight";

Select from the "Color" dropdown list;

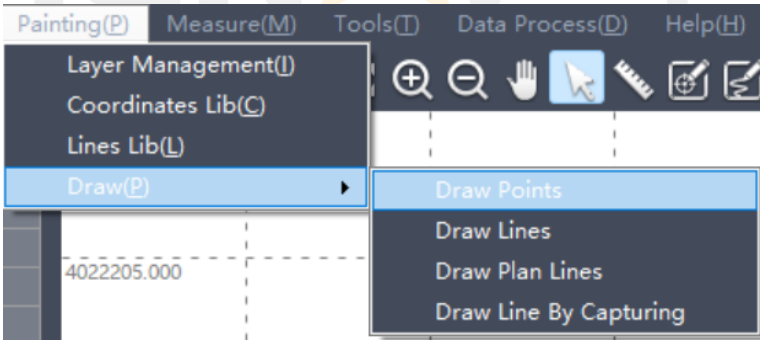
Select points in the point list in order from the starting point to the ending point. The order of selecting points is displayed on the right side. Click "OK" to connect them into a line based on the order of the points. Select 2 points for a straight line, and select more than 3 points for a polyline and a closed line.

Click "undo" to undo the selected point; Click "Back" to return to the line list.



7.7 Manual drawing

Click on "Draw - Manual Drawing" and select "Draw Points", "Draw Lines", "Draw Plan Lines", "Capture Lines" from the drop-down list

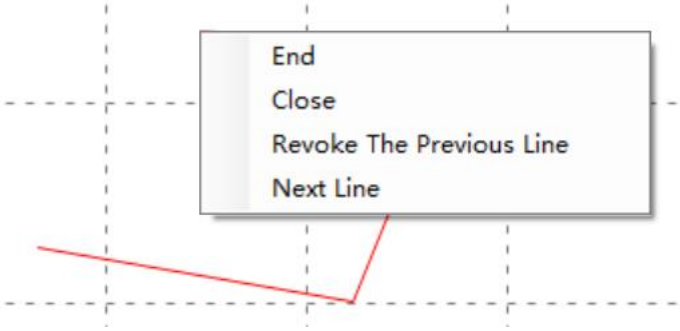


Draw dots

(Click on the "Draw Point" button in the shortcut bar ) Left click on the main interface to manually draw points.

Draw lines

(Click on the "Draw Line" button in the shortcut bar ) Left click on the node for manual drawing on the main interface, right-click and select "End" (End drawing), "Close" (Closed line), "Cancel previous point" (Redraw previous point), "Previous line" (End drawing previous line, start drawing next line).



Draw plan line

(Click on the "Draw Line" button in the shortcut bar ) Before drawing the plan line, draw a closed line in the measurement area. Select the closed line and the plan line parameter interface will pop up.

Rotate the measuring line clockwise in the north direction;

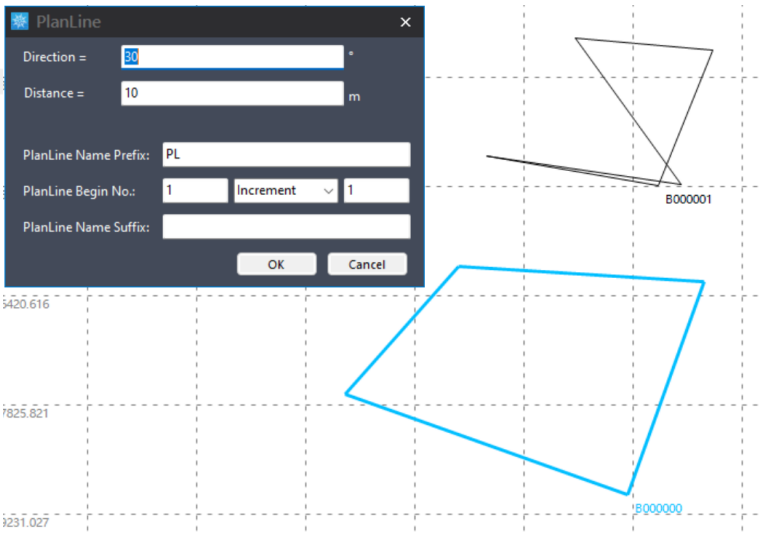
The width of the interval between the "line distance" lines;

Prefix is the prefix of the planned line name;

The number in the name of the "number" plan line;

Select "Increment", "Decrement", and "Fixed" from the drop-down list, and then enter the step value;

The suffix for the planned line name.

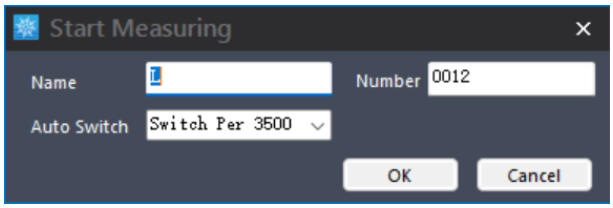


7.8 Measure

The measurement function can only be used by selecting "Demonstration Mode" or "Measurement Mode" in "Settings - Working Mode".

7.8.1Start

Click on "Measurement - Start" (or click on the shortcut "Start" button)  ）afterwards, settings will be made for "Line Name" (prefix), "Line Number" (automatically increasing with a number step of 1), and "Automatic Line Change Method" (no automatic line change, 500 point automatic line change, 1000 point automatic line change, 2000 point automatic line change).



7.8.2Pause

Click on "Measurement - Pause" (or click on the "Pause" button in the shortcut bar)  ）pause measurement.

7.8.3End

Click on "Measurement - End" (or click on the "End" button in the shortcut bar  ）end measurement.

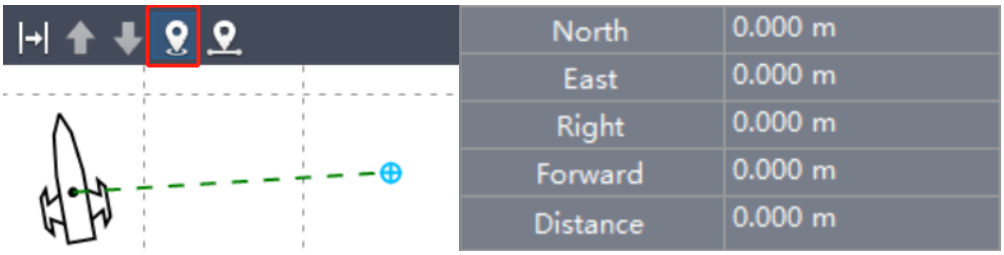
7.8.4Quick Line Change

Click on "Measurement - Quick Line Change" (or click on the "Quick Line Change" button in the shortcut bar)  ）In measurement mode, the current measurement line stops recording data and directly starts the measurement of the next measurement line.

7.8.5Click navigation

Click "Measurement - Point Navigation" (or click the "Point Navigation" button on the shortcut bar) to pop up a point navigation window, where the navigation point is highlighted in blue and the green dashed line represents the navigation line.

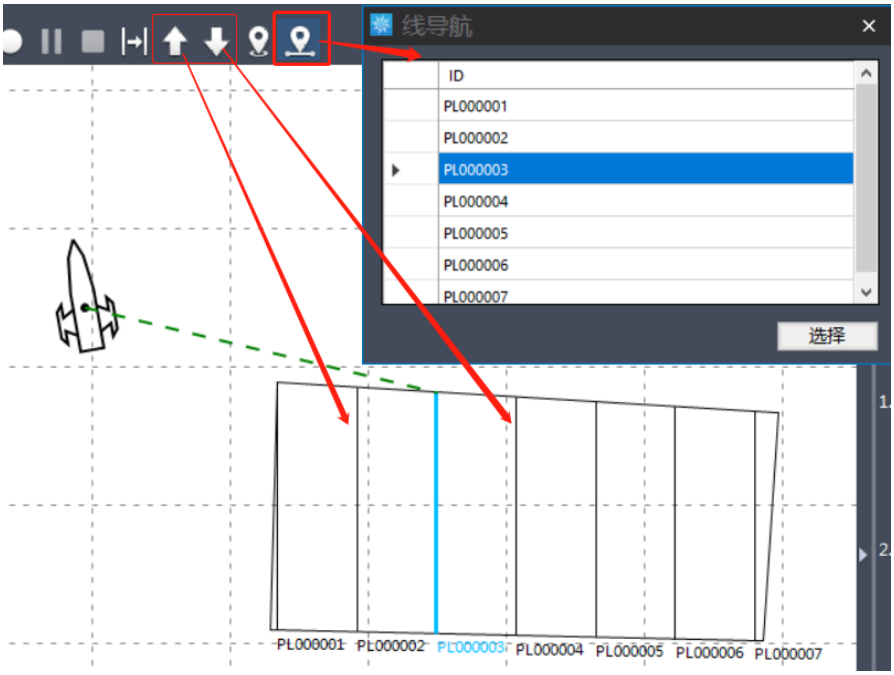
Point data and line data can be added by importing or manually drawing.



7.8.6Line navigation

Click on "Measurement - Line Navigation" (or click on the "Line Navigation" button in the shortcut bar) to pop up a line navigation window. The navigation line is highlighted in blue, and the green dashed line represents the navigation line;

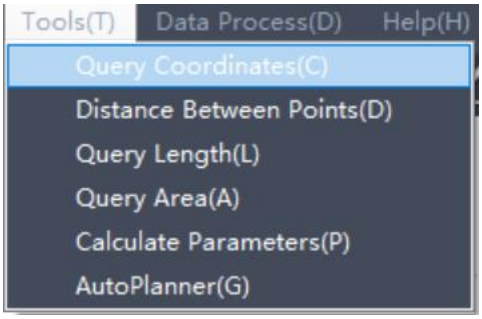
Click the "Navigation Previous Line" or "Navigation Next Line" button to switch navigation lines.



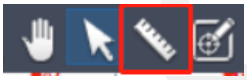
7.9 Tools

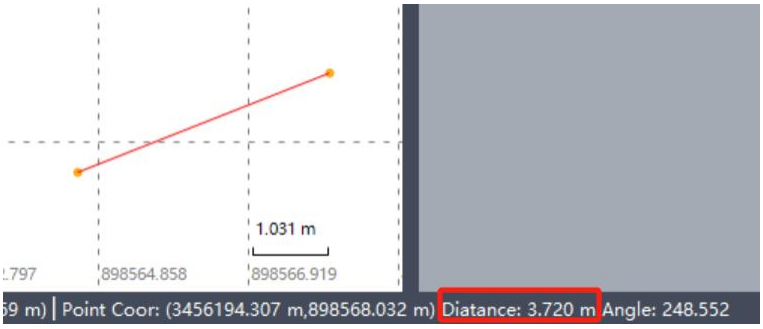
7.9.1Query point coordinates

Click on "Tools - Query Point Coordinates" to query the manually added point coordinates. Select the point and highlight it in blue, with the value displayed in the bottom right corner of the software.



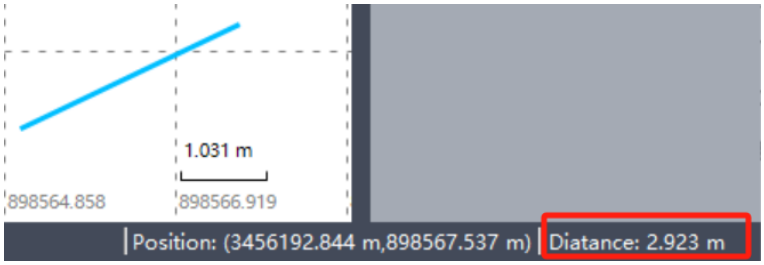
7.9.2Query the distance between two points

Click on "Tools - Query Two Point Distance" (or click on the "Two Point Distance" button in the shortcut bar)  Query the distance and azimuth of any two points on the base map, and display the values in the bottom right corner of the software.



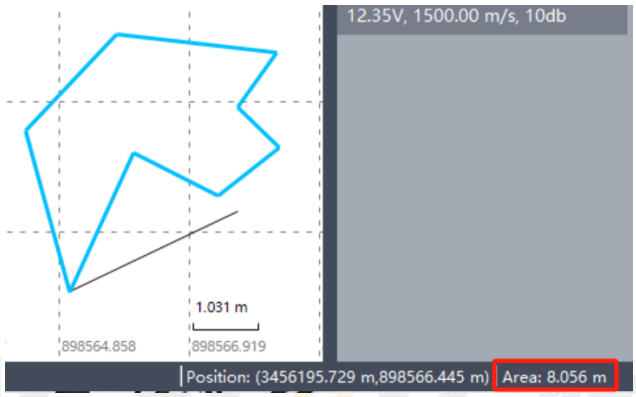
7.9.3Query Line Length

Click on "Tools - Query Line Length" to check the length of the manually added line. Select the line and highlight it in blue, with the value displayed in the bottom right corner of the software.



7.9.4Query area

Click "Tools - Query Area" to query the manually added closed line area, and the numerical value is displayed in the bottom right corner of the software.



7.9.5Calculate coordinate conversion parameters

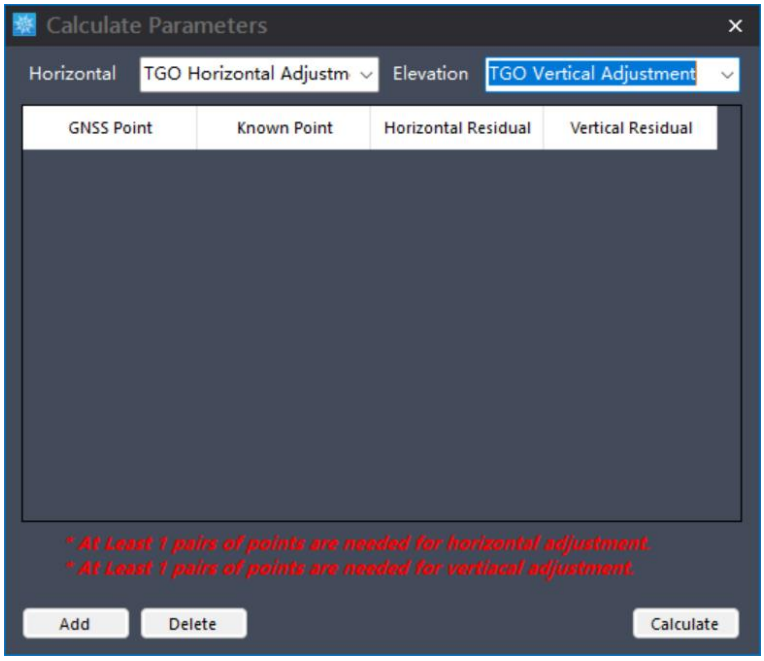
Click on "Tools - Calculate Coordinate Conversion Parameters" to input WGS 84 coordinates and local coordinates to calculate the conversion parameters. The horizontal transformation model includes TGO horizontal adjustment and ordinary four parameters; The vertical transformation model includes fixed difference, surface fitting, and TGO vertical adjustment.

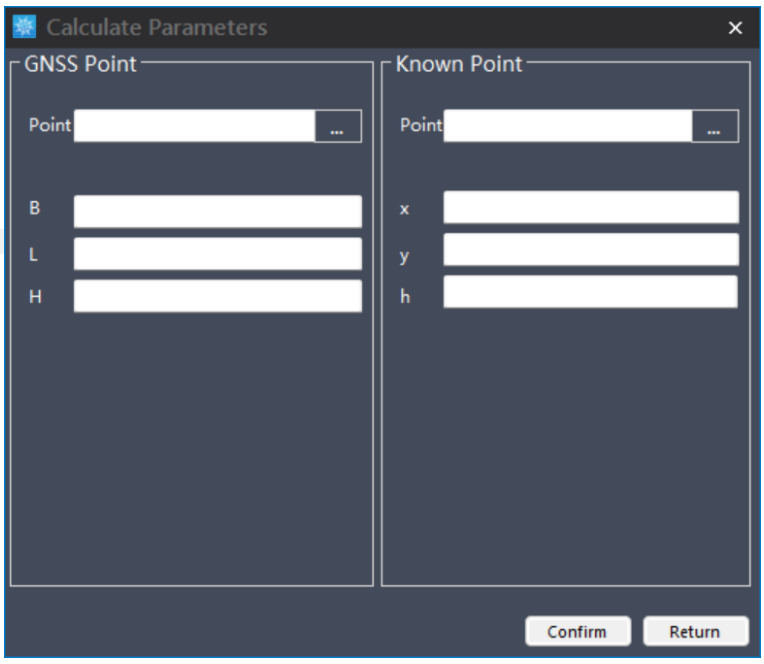
Click the "Add" button, the GNSS point is the WGS 84 coordinate, and the known point is the local plane coordinate.

Click the "List" button to select the corresponding point pairs in the coordinate library.

Click the "Delete" button to delete the selected point pairs from the list.

Click "Calculate" and then click "Apply" to remind whether to apply to the engineering coordinate system.

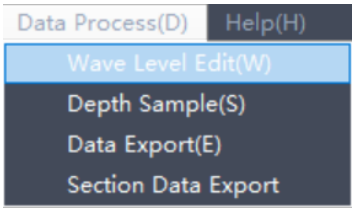


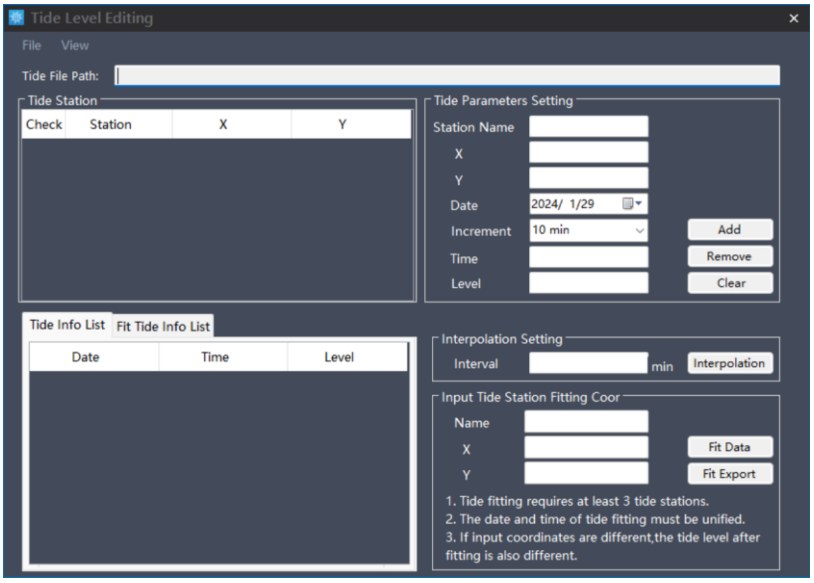


7.10Data processing

7.10.1 Tidal level editing

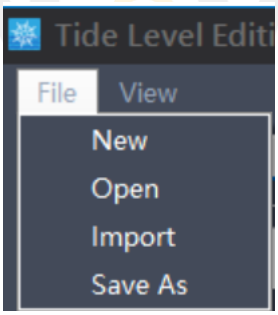
Click on "Data Processing - Tide Level Editing" to edit the tide level file, making it easier to correct the tide level during data processing.



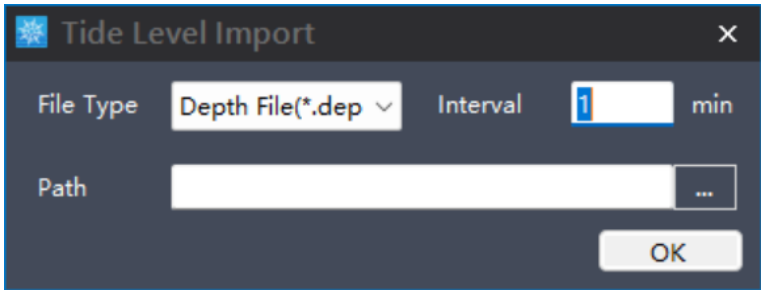


File

Select "File", the dropdown list includes "New", "Open Tidal Sounder", "Import Water Depth", and "Save As".



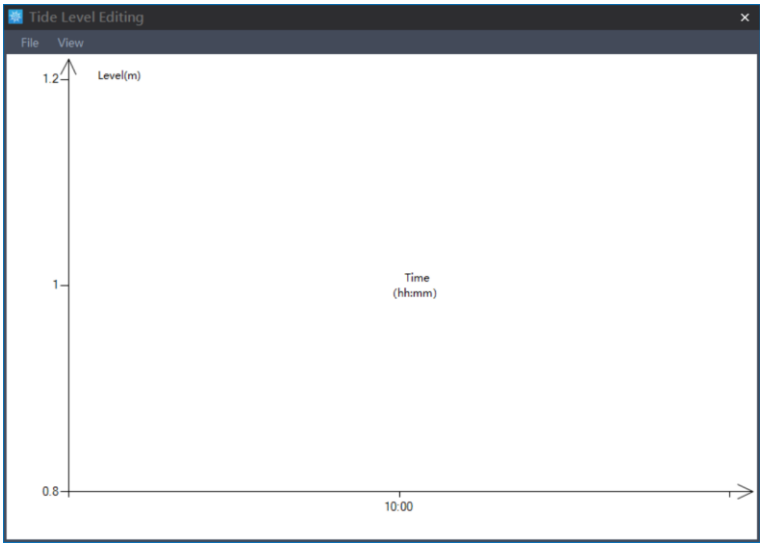
1) Click "New" to create a blank tide level editing table. After editing, a reminder will be given to save the edited tide level file;
2) Click "Open Tide Sounder" to open the edited tide level file;
3) Click "Import Water Depth", select the file type as dep, enter the sampling interval, select the file path, and extract the ground height of the water surface inside as the tide level;



4) Click "Save As" to save the edited tide level file.

Chart style

Select "Chart Style", the dropdown list includes "Chart Style" and "Table Style".



Tide measurement parameter settings

You can enter the site name, coordinates X and Y, select the date and step, and enter the tide level to record the time and tide level.

After completing the input, click "Add" to add a tidal level and start inputting the tidal level for the next time period. Repeat the above steps;

Click "Delete" to delete the selected data in the tide level information table;

Click "Clear" to clear all data in the tide level information table.

Interpolation settings

In the tide level information table, interpolate one tide level data at every interval (linear interpolation algorithm).

Fit site/coordinate input

Fit the data from multiple tidal stations into a curved surface, and based on the input coordinate positions, fit the tidal information for the corresponding positions.

Note:

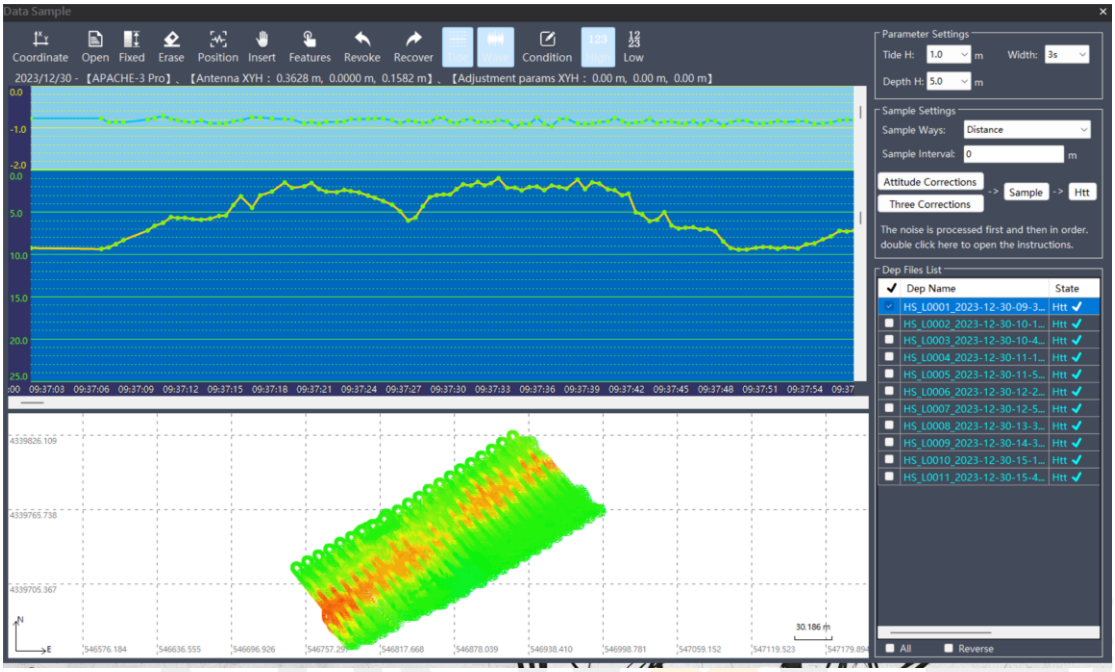
① At least 3 tidal stations are required for data fitting.

② The date and time of tidal level information from multiple tidal stations need to be consistent in order to perform the fitting function;

7.10.2 Water depth sampling

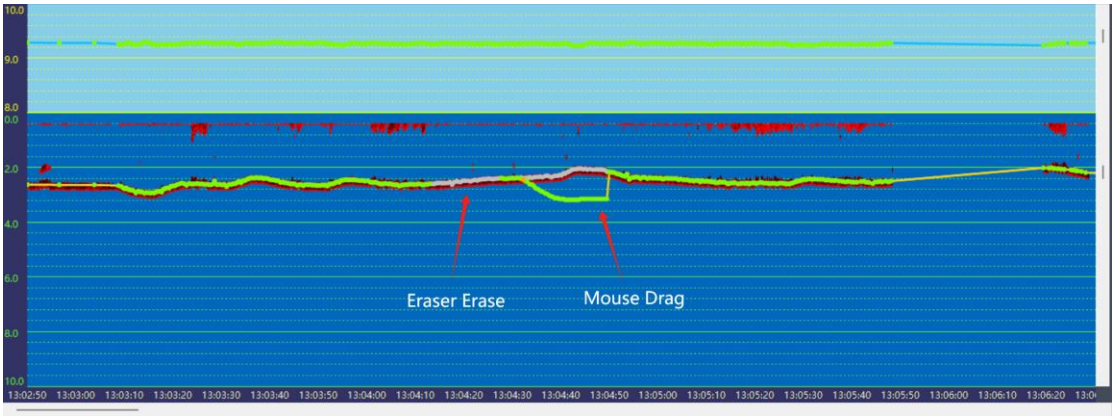
Fast Data Processing

1) Click on "Data Processing - Water Depth Sampling", or click on the "Water Depth Sampling" button in the shortcut bar ). Inspect/correct each measuring line in external measurement. Double click to open the survey line dep file, which will then display views such as base map, water depth, and waveform.



The main process of data processing (select the steps in parentheses as needed): noise processing → (data interpolation) → data correction → equidistant sampling → (manual sampling) → generate htt.

2) Inspect and denoise each measuring line for external measurement, and dilute it. According to the principle of terrain consistency, use an eraser to delete false water depth points that do not match the waveform, or drag the water depth points with the mouse until they match the waveform, as well as perform fixed interpolation and manual insertion operations.

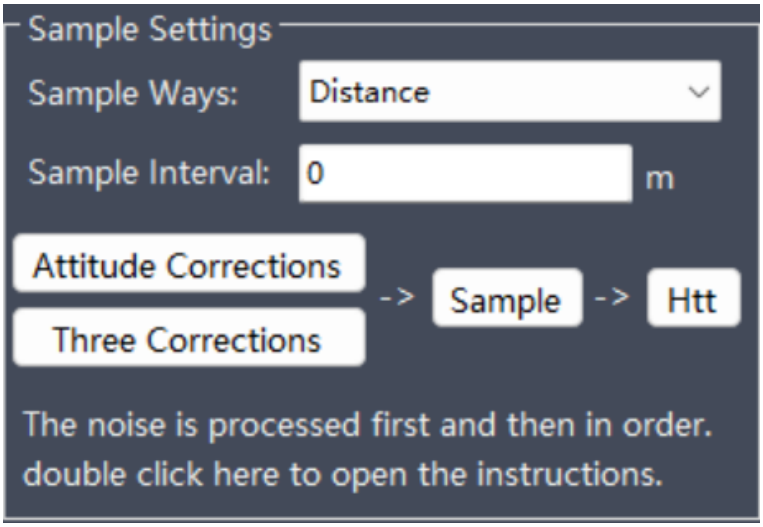


3) Posture correction or three corrections, choose one of the operations and do not repeat the operation to

avoid overwriting the previously processed data. (When making three corrections, simply click "skip" for the content that does not need to be corrected.)

4) Select the sampling method and sampling interval as needed, and click "Isometric Sampling".

If some areas are not sampled, you can click "Manual Sampling" to manually sample some feature points. If this function is not needed, skip the manual sampling step.



Click the "Generate htt" button to save to .htt file.

Top Toolbar Functions

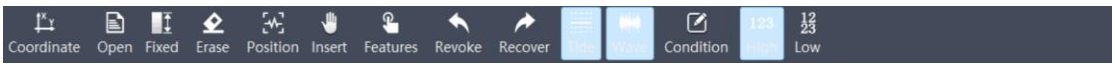
On the top toolbar, you can view the data collection date, antenna type, antenna deviation, and calibration parameters.

Measurement date: The date when the opened DEP file was collected.

Antenna type: The antenna type or USV type used in the opened DEP file.

Antenna deviation: The deviation between the antenna coordinates of the opened DEP file and the transducer coordinates.

Correction parameter: The northeast high offset of the coordinate parameters in the opened DEP file.

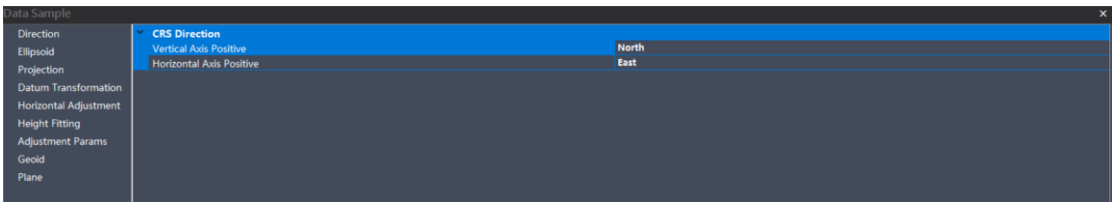


Note:

Before processing the data, it is necessary to check whether the ship type above corresponds to the USV model during measurement. If there is no corresponding model, the original dep file header needs to be manually modified before data processing.

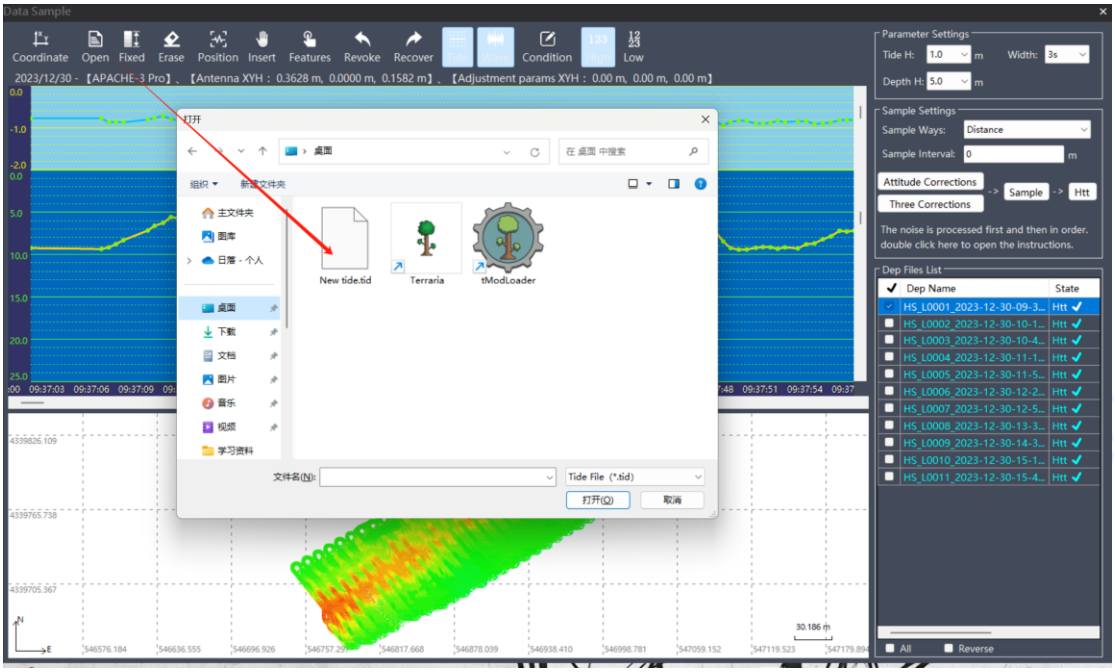
1) Coordinate parameters:

View the coordinate system parameters of the current open project, but cannot make parameter modifications.



2) Open tide sounder:

Import tide sounder files (*. tid). First, open the dep survey line, and then import the tid. The tid date and time should include the dep date and time. After importing, the water surface elevation will be processed using the elevation data in the tid file.



3) Fixed interpolation:

Automatically correct water surface elevation data for non fixed solutions. Double click to open the dep survey line and select this button.

4) Eraser:

After selecting this button, select or drag the water depth point with the mouse to delete the water depth data.

5) Waveform centered:

The red waveform is displayed in the center.

6) Manual insertion:

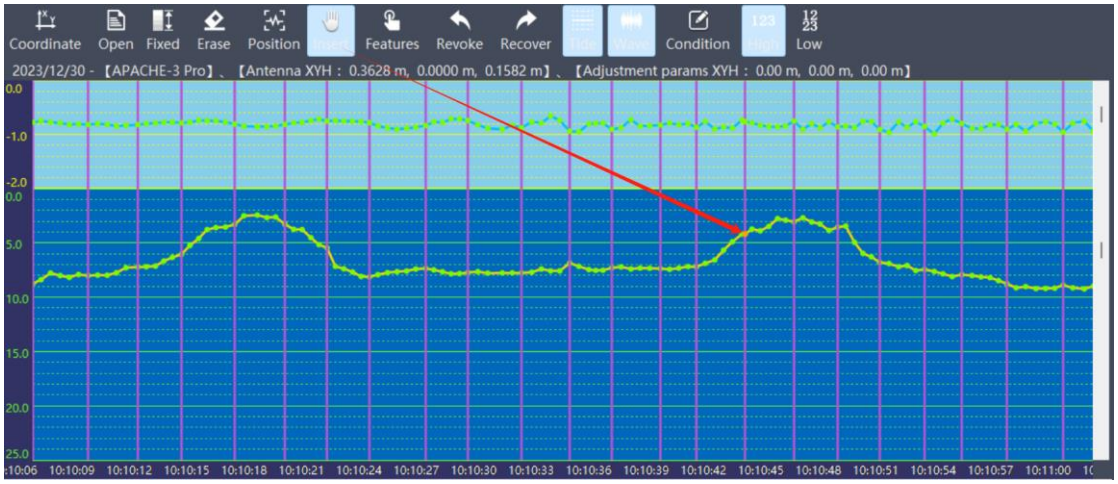
Manually insert custom record points before data correction operations.Within the depth view range, click on the waveform with the mouse to insert a new recording point at the corresponding time and water depth.

After inserting multiple points, post-processing can continue in order (data correction - isometric sampling - generating Htt).

7) Manual sampling:

After the equidistant sampling operation, for the point data that has not been sampled, manual sampling can be performed, that is, feature point sampling.

Select this button, select any non equidistant sampling point with the mouse, and a red sampling line will be automatically generated. After multiple operations, click "Generate Htt" finally.



8) Revoke:

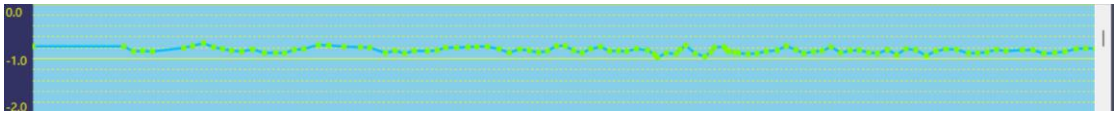
Return to the previous step (drag point/delete point/add/delete feature point sampling line).

9) Restore:

Restore the previous operation (drag point/delete point/add/delete feature point sampling line).

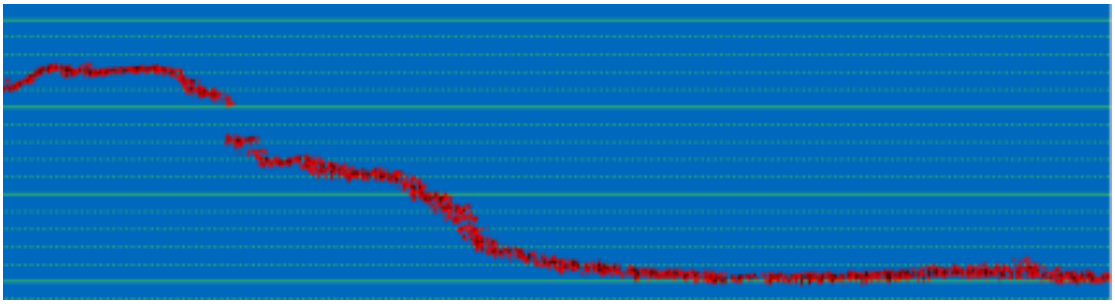
10) Tidal view:

displays the elevation view of the water surface.



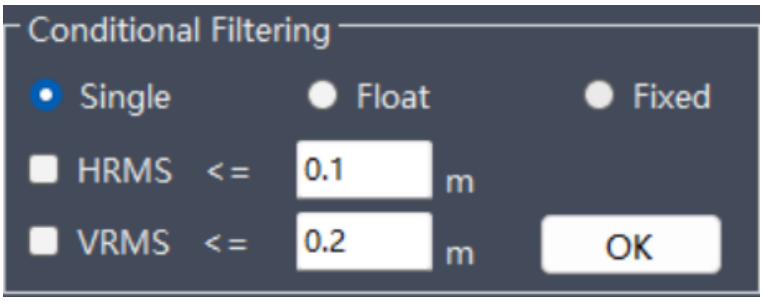
11) Display waveform:

Display the waveform of the same time recorded in the opened DEP file (waveform file is. sd, stored in the project folder - RawData folder).



12) Filter criteria:

Show/hide filter criteria.



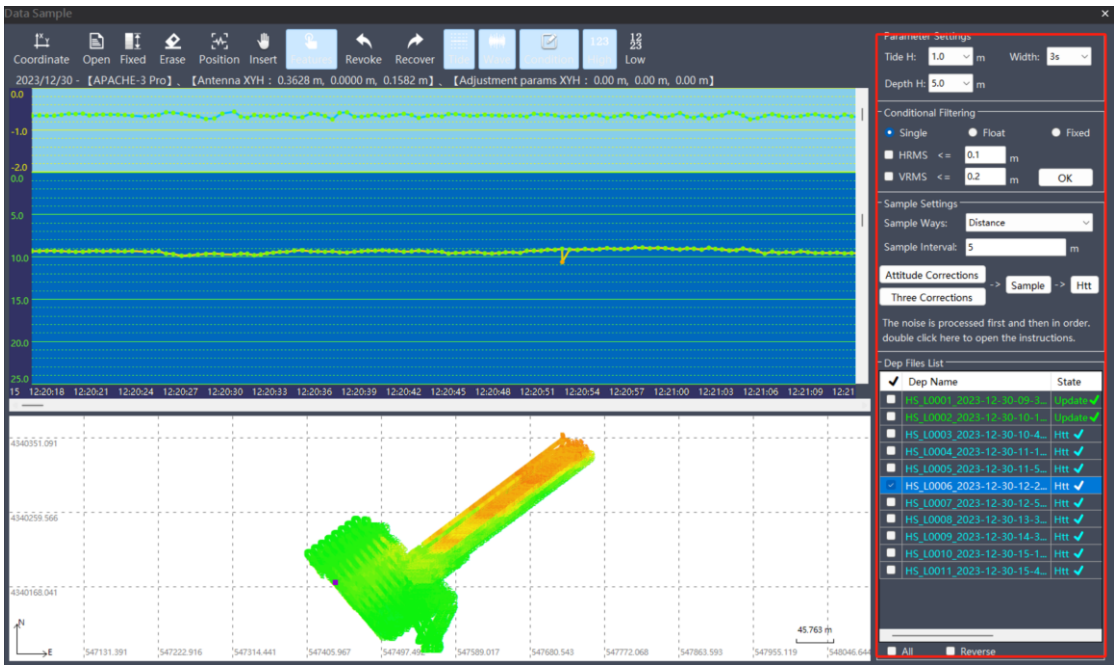
13) High frequency:

Single frequency sounder data (USV dep, D230, D270).

14) Low frequency:

Dual frequency depth sounder data (D580).

Right Parameter Bar Function



1) Parameter settings

① Tidal height measurement: the vertical elevation interval of the tidal view;

② Water depth vertical height: the water depth interval in the longitudinal direction of the water depth view;

③ Horizontal width: The horizontal time interval of the view. For dense data, the horizontal width can be reduced to make it easier to handle.

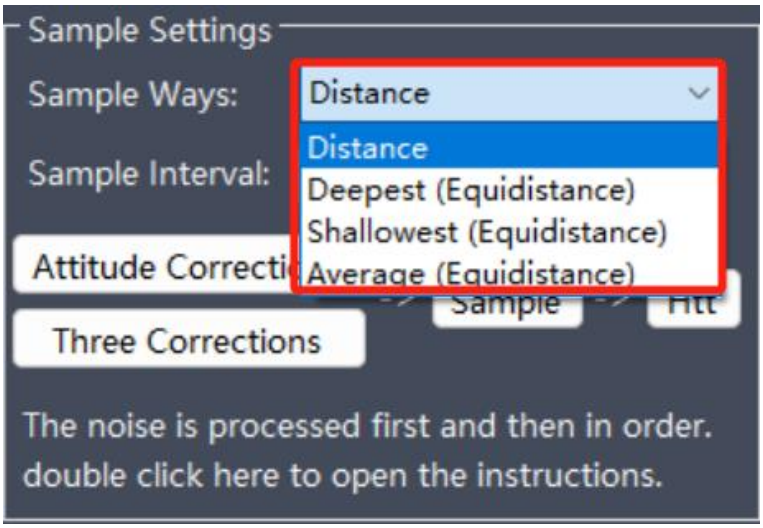
2) Conditional filtering

Set filtering parameters (solution status/RMS accuracy), then double-click on the dep line in the line list to

filter and display it in the view;

Alternatively, double-click on the dep line, select the filtering criteria, and click the "OK" button to display it in real-time.

3）Sampling settings



① Distance sampling: Take a point every X distance (>=X, unit: meters);

② Deepest (within equidistant intervals): Within equidistant distances X, take the deepest water depth point data as the sampling point;

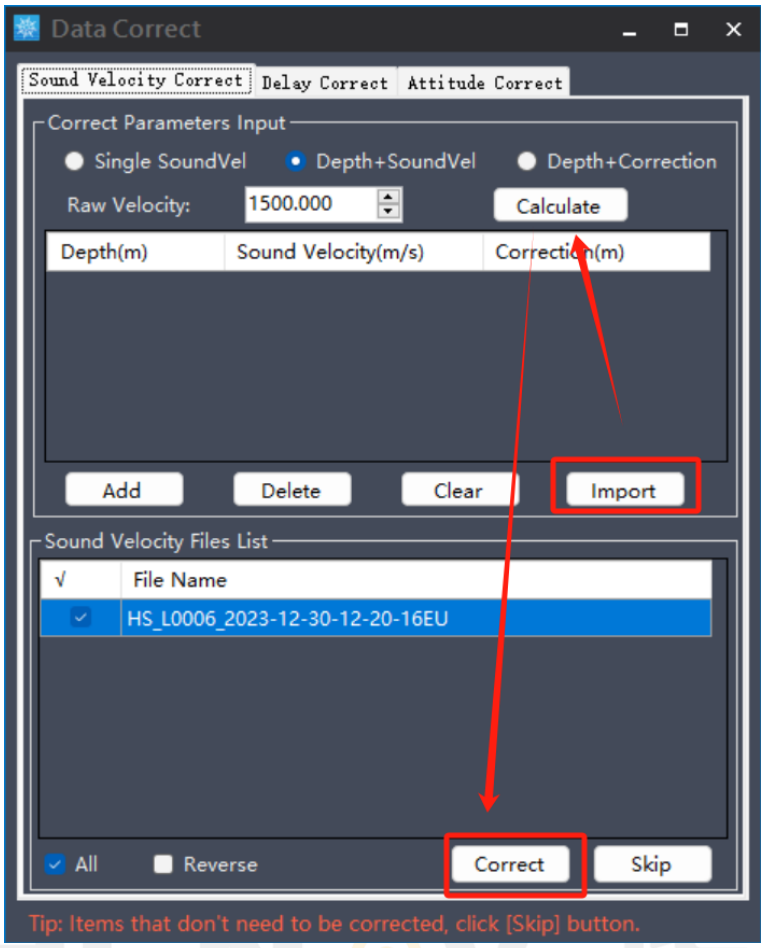
③ Shallow (within equal spacing): within equal spacing X distance, take the shallowest water depth point data as the sampling point;

④ Average value (within equal intervals): Within an equal interval of X distance, take the average of all water depth data as the water depth point, and the sampling point is determined by distance sampling;

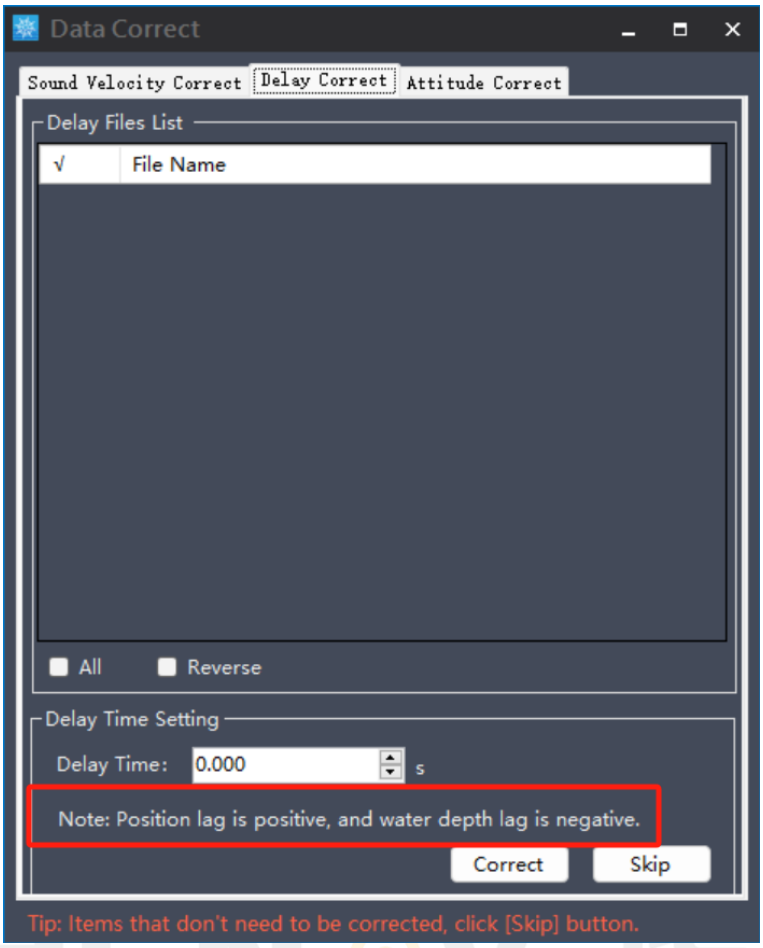
4) Attitude correction: only perform attitude compensation correction;

5) Three corrections: speed correction/delay correction/attitude correction;

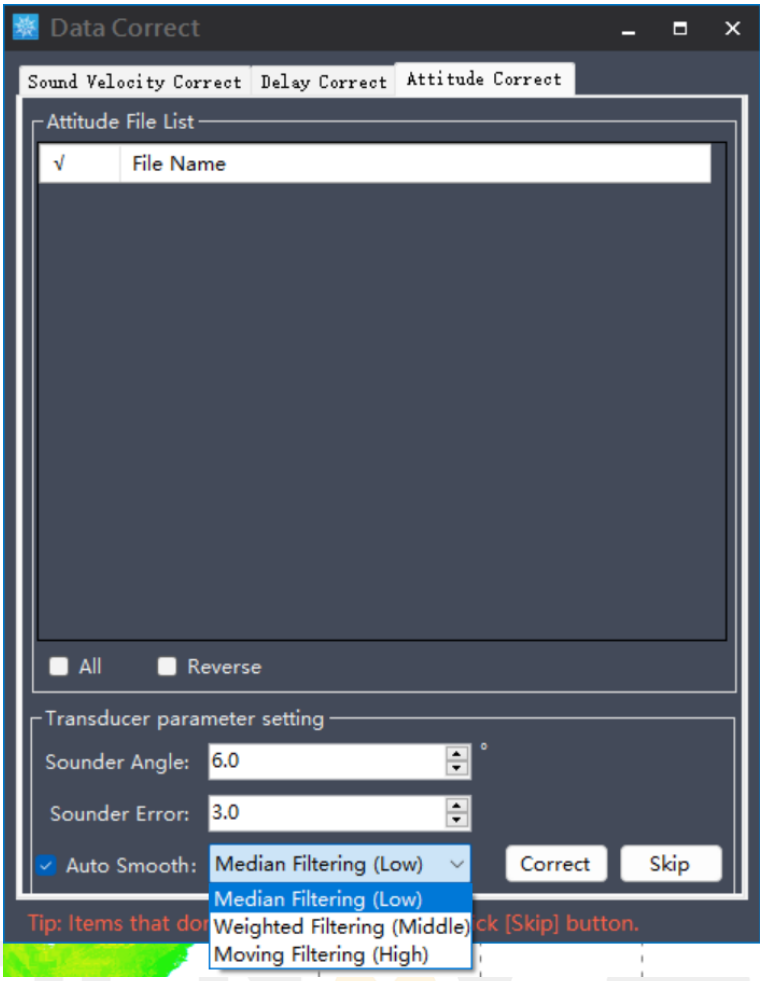
Sound speed correction: Three correction modes can be used: "single sound speed", "depth+sound speed", and "depth+correction value". After completing the parameter input, click "Sound Speed Correction" to complete the correction or click "Skip" to enter "Delay Correction".



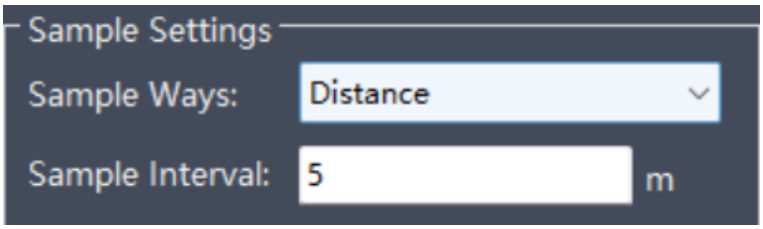
Delay correction: Enter the delay time for water depth and position. The position lag is positive and the water depth lag is negative. Click "Delay Correction" to complete the correction or "Skip" to enter "Attitude Correction".



Attitude correction: Input the opening angle of the transducer, the installation error of the transducer, select the automatic filtering method (median filtering, weighted filtering, sliding filtering), click "delay correction" to complete the data correction, or click "skip" to not make the correction.



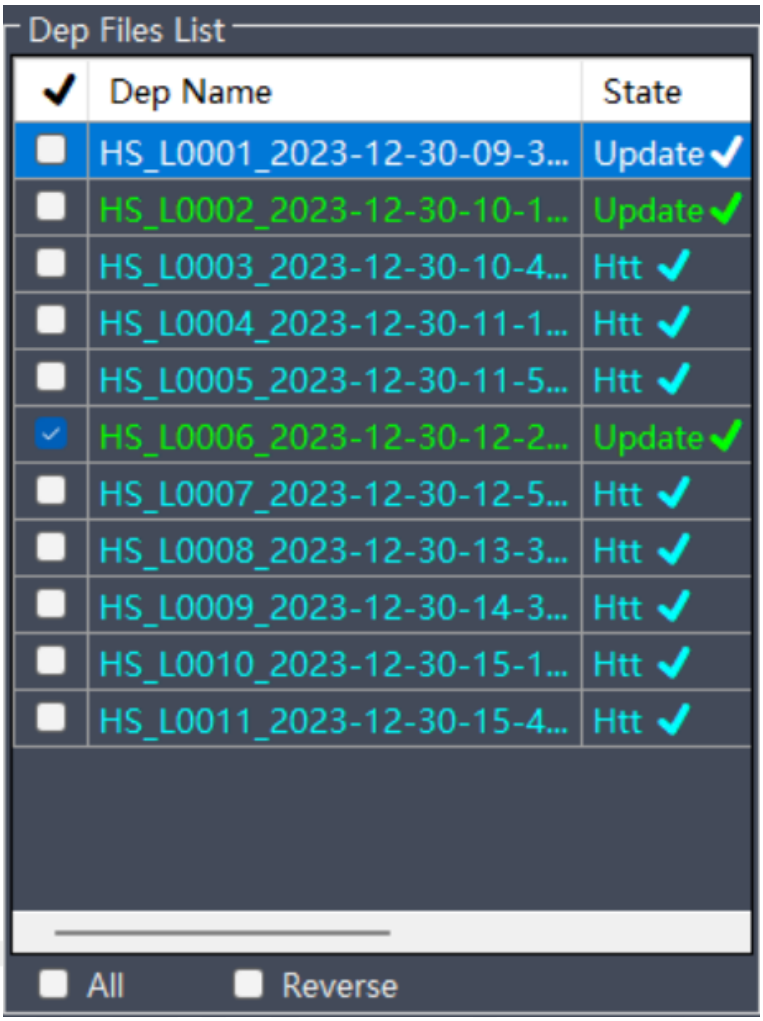
Equidistant sampling: After data correction and correction, sparse sampling is performed according to the sampling interval (the points on the pink line are equidistant sampling points);



7) Generate htt: Dilute the sampled data and record it in the HTT file (the data export function will automatically open this directory);

8) Line List: Display the line (DEP) files included in the task, as well as the line processing status. Double click to open the line.

After opening the survey line, the water depth data and elevation data will be displayed. Moving the mouse over the water depth point or elevation point will display detailed information.



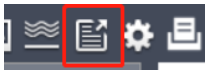
Precautions

1）Data post-processing must be executed in order. If it is found that noise needs to be reprocessed after isometric sampling is completed, it needs to be executed in order to take effect after the noise processing is completed. The main process of data processing is as follows (select the steps in parentheses):

Noise processing → (Data interpolation) → Data correction → Isometric sampling → (Manual sampling) → Generate htt.

2）When using tidal data, the time range of the measuring line data should be within the time range of the tid tide level. After importing the tide level file of tid, it is applicable to each measuring line. Secondly, after importing tid, the horizontal time range of its view is within the time range of tid.

7.11Data export

Click on "Data Processing - Data Export", or click on the "Export" button in the shortcut bar ) open the saved HTT file,

Check "File Merge" to merge and export multiple HTT data into one file;

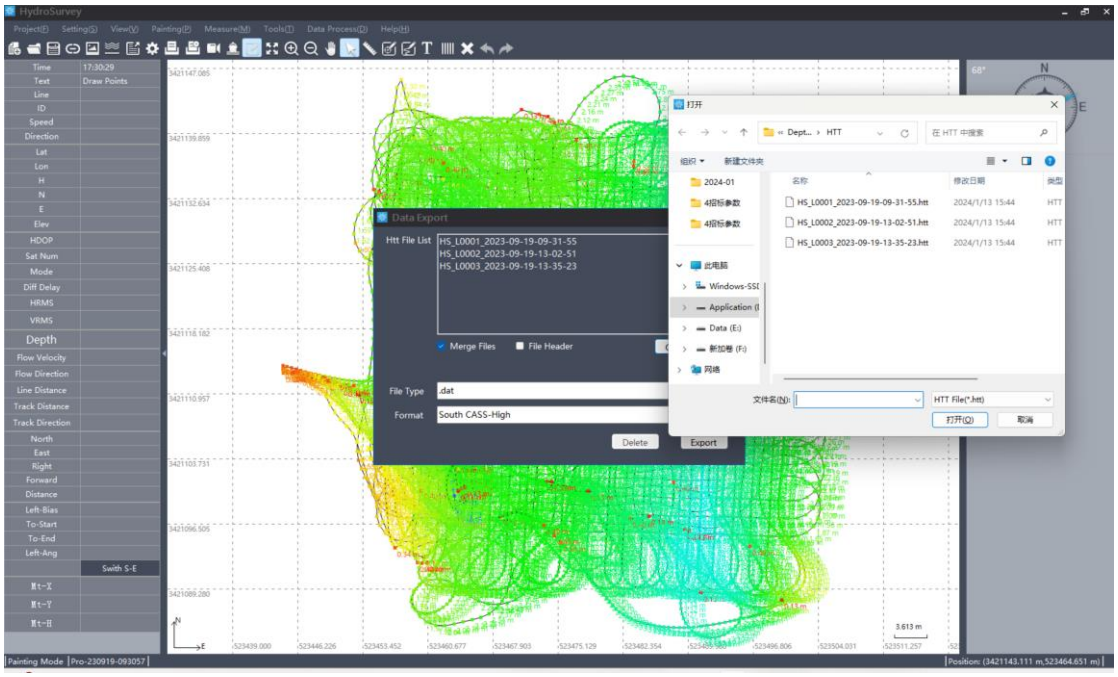
Check "Export Header" to export the result file of the data, supporting header export;

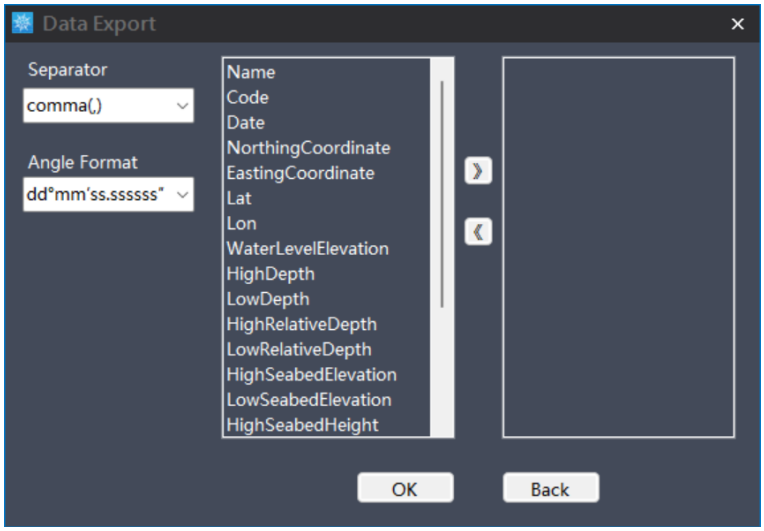
You can choose the file type to export, including dat, txt, CSV, and dxf types;

Format selection: Select a format from the drop-down list, and select the custom option to create a new format yourself;

Click "Export" to export the selected format data;

Click "Delete" to delete the selected format (only supports custom added data formats);





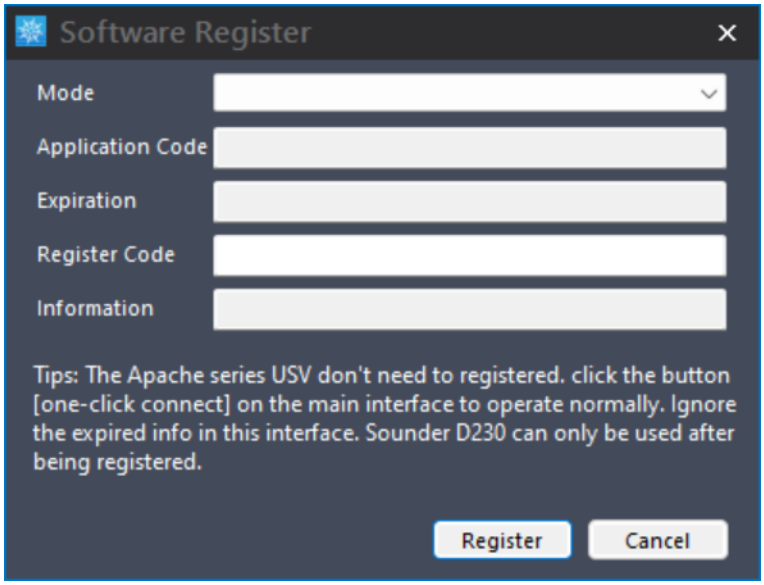
7.11.1 UAV cross-section export

Click "Data Processing - Drone Section Export", open the HTT file, fill in the relevant parameter information, and click "Table Export" to generate an xls file; Click "one click upload" to automatically upload to the drone flow measurement platform server, and generate flow measurement routes at the same time.

7.12Support

7.12.1 Software registration

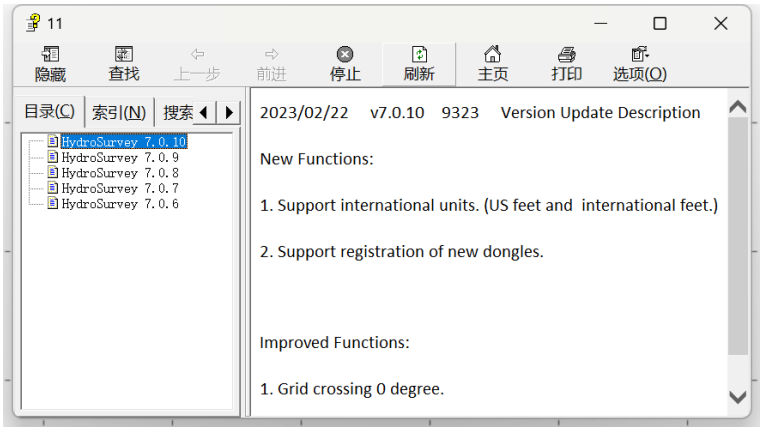
The CHCNAV series USV do not require registration. If using depth sounders and other positioning and navigation equipment, a software dog or machine code registration activation is required.



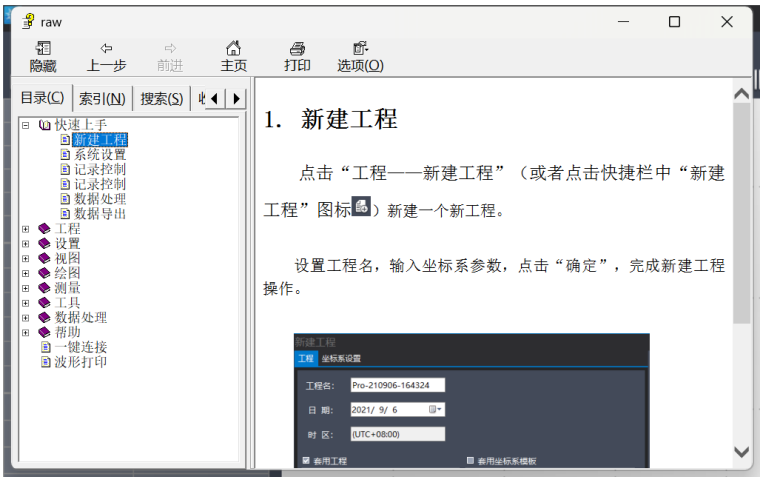
7.12.2 Online upgrade

Click on online upgrade to automatically detect the latest version of the software.

Release note



7.12.3 User's manual



7.12.4 Understanding Huawei

Click to learn about CHCNAV APCHE series USV, follow the [Huawei Tour World] official account by scanning the WeChat code, and check the operation manual/video/FAQ/technical bulletin online.

7.12.5 Language selection

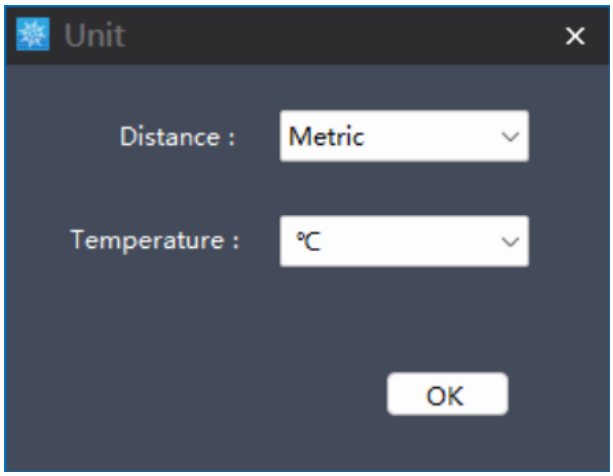
Supports switching between Chinese, English, and Russian languages, effective after restarting the software.

Unit selection

Supports switching between distance and temperature unit displays,

Distance: meters/US feet/International feet.

Temperature: Celsius/Fahrenheit.



7.12.6 About Software

View the current version of HydroSurvey software. When the depth sounder is turned on, the corresponding firmware version of the depth sounder can be displayed.

7.13Other functions

7.13.1 Waveform printing

This function requires connecting the printer (real-time printing and playback printing), installing the driver, and setting printer configuration parameters in order to print normally. When setting up PDF saving, it can be directly saved to a PDF file without the need for a connection.

Printer model: Brother PJ-763MFi

Printer driver: can be obtained by contacting technical personnel;

"Waveform Printing": Click on the "Waveform Printing" button in the shortcut bar  。

Printing methods: real-time printing, playback printing, PDF saving;

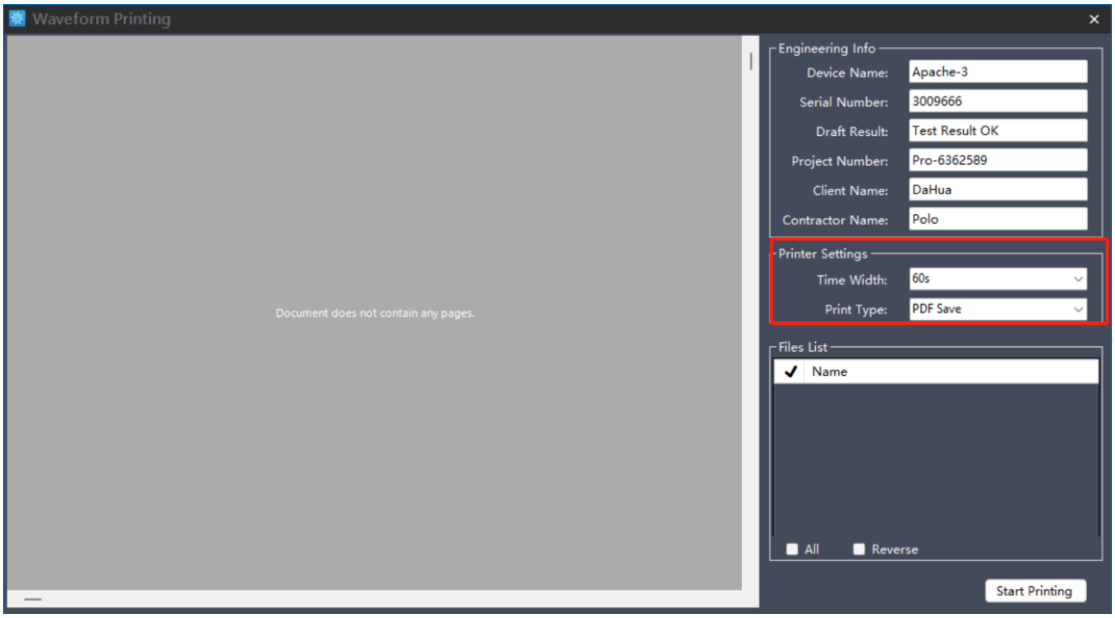
Engineering information: print head information;

Horizontal width: printing horizontal time intervals;

Real Time Printing

After setting the parameters, click the "Start Printing" button and "Start" recording to achieve real-time waveform printing while measuring and recording data;

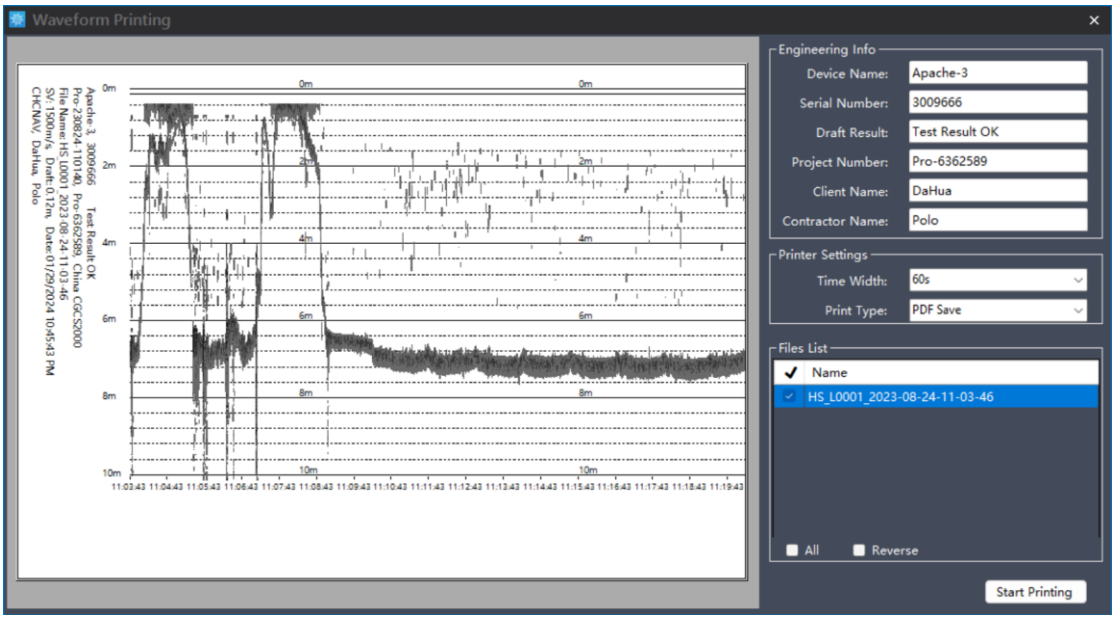
Real time printing, waveform renderings cannot be previewed;



Playback Printing

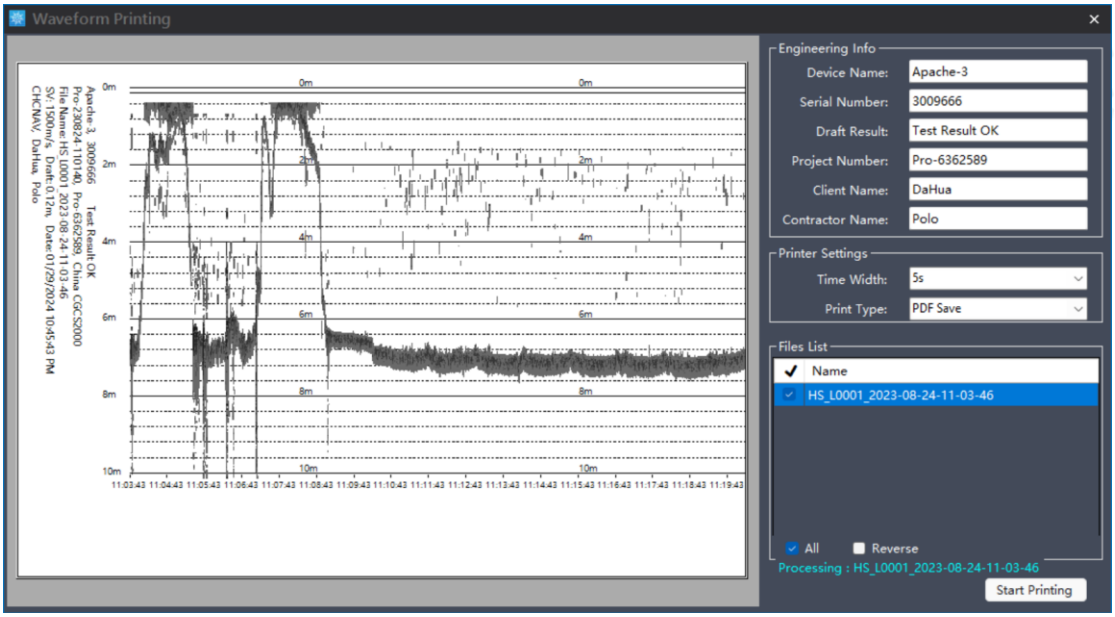
In the waveform file list, select the corresponding file and click the "Start Printing" button. Double click on the file to preview the waveform effect in the left view;

Attention: When the file is large, wait for a moment as uploading the data to the printer takes time;

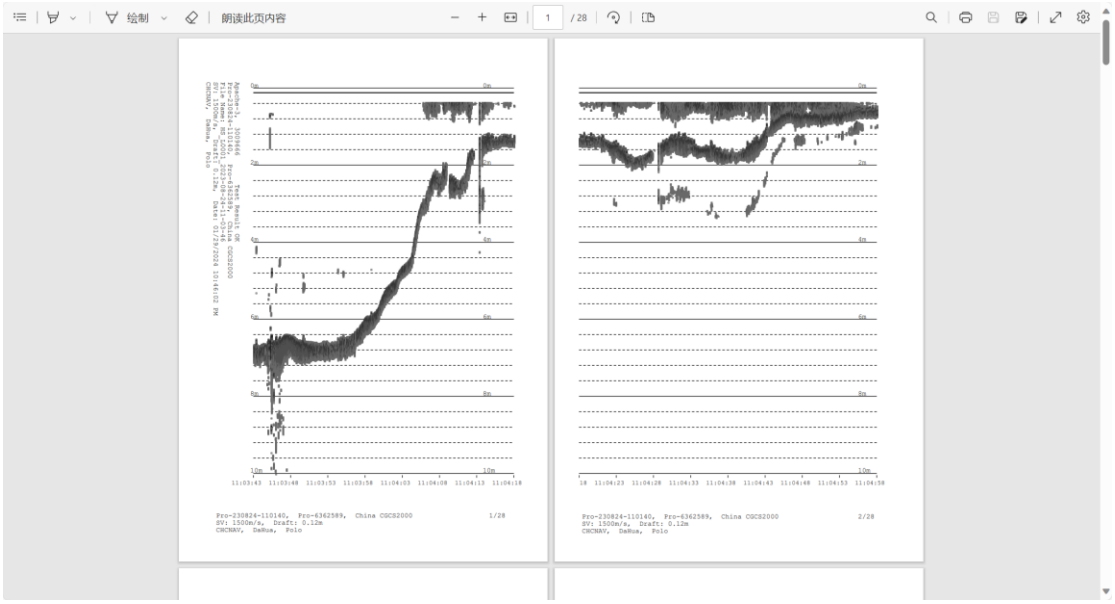


PDF Save

In the waveform file list, select the corresponding file and click "Start Printing". Below the file list, you can view the current progress of file processing.



The file is automatically stored in the Result directory under the current project, and the PDF file content is displayed:



End Printing

Click on the shortcut bar and click on the "End Printing" button  , end current real-time printing, invalid for playback printing function.

8. Navigation

Please install and operate the equipment under the guidance of Huace professional technicians after completing the training and teaching of Huace unmanned ships. When operating unmanned ships, please plan the path reasonably based on the on-site working environment and adopt appropriate methods for accurate and efficient measurement.

8.1 Navigation environment requirements

1. In extremely bad weather, to ensure the safety of work equipment and personnel, please do not conduct measurements.
2. Please avoid operating near high-voltage power lines, communication base stations, and signal towers, as the remote control may be affected by interference in this environment.
3. Please use with caution in complex aquatic environments such as turbulent water flow and navigation channels.

8.2 Pre homework check

1. Unmanned ships and remote control batteries are fully charged.
2. The unmanned ship antenna, hatch cover, etc. are all tightened in place
3. The motor rotates normally without any abnormal noise and the wind direction is correct.
4. The unmanned ship (4G/data transmission) has stable communication, and the depth sounder and positioning equipment are working properly.
5. If automatic navigation is required, check if the route is within the water area and if the Home point is reasonable.

9. APPENDIX

10.1Product Parameters

技术参数

船体	船体尺寸	1000mm*650 mm *300 mm
	材质	高分子聚酯碳纤维、凯夫拉布
	船体自重	7kg
	最大载重	25kg
	抗风浪等级	3级风，2级浪
	船型	三体船
	防水防尘	IP67
	吃水	10cm
	指示灯	双色灯，可指示定位信号状态和差分源
	视频	360°全向视频
	安全	浅滩自动倒车、毫米波自动避障和视频视察
	返航	低电量自动返航、失联自动返航（择近路径返航）
	防护措施	船身配备防撞条，安全可靠
动力	动力类型	电动
	电机类型	无刷电机
	转向类型	无舵机转向
	马达功率	单马达最大700W
	马达转速	最大7000转每分钟
	马达安装方式	插拔设计、易拆换
	防水草方式	半嵌入式涵道式设计、防水草罩、无外挂防剐蹭
	电池规格	32.4V 23.1Ah*4可充电锂电池、18650电芯
	续航时间	标配2组电池6h@2m/s，11h@1.5m/s 选配可达12h@2m/s，22h@1.5m/s
	续航里程	经济续航里程40km（以1:1000 10m航线间隔计算约0.4km²）
	最大船速	7m/s
遥控	显示屏	10.1寸工业触摸屏+阳光可视屏
	分辨率	1920*1200
	安卓系统	Android 9.1
	内存	运存 4GB，存储容量64GB
	通讯频率	800MHz/1.4GHz/2.4GHz
	通讯距离	数传电台常规2km，最大3km，4G无限制
	电池容量	20000mAh
	工作续航	5小时
	充电功率	36W快充，充电时长4小时
	接口	USB口、Nano SIM卡槽、LAN网口、音频接口、 HDMI接口、TF卡最大支持128GB、Type-C
	按键	主摇杆*2，次摇杆*2、旋钮*2、按键*8
	船体控制	物理按键控制手/自动，悬停控制，一体化软件控制船体、 规划航线、水下地形数据采集
控制	操作系统	Linux
	基站通讯	电台&网络&CORS
	数据通讯	标配4G（支持LTE-FDD、LTE-TDD、 UMTS、GSM全球网络制式）&电台
	视频通讯	4G&电台
	SIM卡槽	eSIM（赠送10G*36月网络流量）和Nano卡槽
	接口	2*RJ45网口,3*RS232串口,1*RS485串口,1*PPS,2*指示灯,1*蜂鸣器,1*WiFi
	内存	主控内置存储32GB
	船型识别	支持船型自动识别，并将各传感器安装偏差值 自动写入记录文件中

控制	控制模式	手动&半自动&免规划全自动
	主控防水防尘	IP67
	数据储存	本地储存（可多通道储存）和远程储存
软件系统	控制功能	任务规划、可实现自主导航、船体参数控制、总航行里程统计、 剩余里程提醒、多角度视频、支持物理&虚拟摇杆、电池温度显示
	底图加载	支持在线天地图、MapBox、ArcGis卫星影像加载
	数据采集功能	支持坐标转换、轨迹、水深、波形实时显示， 支持软件与无人船本地8通道存储
	数据后处理功能	支持单波束数据后处理，支持波形图叠加显示，支持姿态改正
	PPK解算	支持定位+水深数据PPK后差分解算
	自检	开机系统自检，异常提醒；巡航速度异常语音提醒； 流量监控与提醒
	升级	支持软固件在线推送升级
	返航逻辑	低电量自动返航、失联自动返航（择近路径返航）
	成果导出方式	U盘、Type-C线、分享码远程数据共享
定位系统	卫星系统	BDS B1I/B2I /B3I、GPS L1C/A/L2P(Y)/L2C/L5、 Galileo E1/E5a/E5b、GLONASS L1/L2、QZSS L1/L2/L5
	通道	1408通道
	冷启动	< 30s
	初始化时间	< 5s（典型值）
	单点定位精度	平面1.5m、垂直2.5m
	DGNSS定位精度	平面40cm+1ppm、垂直80cm+1ppm
	RTK定位精度	平面±8mm+1ppm、垂直±15mm+1ppm
	CORS差分源	支持网络CORS，赠送3年内置账号
	电台差分	支持华测协议/TT450协议/透明传输协议/南方协议、 Satel 3AS协议
	定向精度	0.1°（1m基线）
	惯导精度	6°/h；20S精度衰减1m，支持桥下持续自主导航及测量
	IMU更新率	200Hz
测深系统	数据类型	华测格式、NMEA SDDPT/SDDBT和原始波形
	主机重量	1.1kg
	测深范围	0.15-300m
	测深精度	±1cm+0.1%h（h为水深）
	分辨率	1cm
	最大采样率	30Hz
	频率	200kHz
	波束开角	6.5°±1°
	供电电压	10-30V DC或220V AC适配器
	最大发射功率	300W
	功耗	10W
	接口	RS232

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为提供尽可能准确的产品信息、参数数值，华测导航可能实时对本文件的文字表述、参数数值等内容进行调整和修正，以求与实际产品性能、规格等信息相匹配。由于产品批次和生产供应因素等实时变化，如却有必要进行前述修改和调整的，恕不专门通知，请以官网实时信息为准。

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CHCNAV 上海华测导航技术股份有限公司　www.chcnav.cn　400-620-6818

技术参数

船体	船体尺寸	1050 mm *550 mm *390 mm
	材质	高分子聚酯碳纤维、凯夫拉布
	船体自重	6kg
	最大载重	30kg
	抗风浪等级	3级风，2级浪
	船型	三体船
	GNSS	船体内置GNSS双天线，无需外接RTK
	防水防尘	IP67
	吃水	9cm
	指示灯	双色灯，可指示定位信号状态和差分源
	视频	360°全向视频
	安全	浅滩自动旋车、毫米波避障自动避障和视频视察，支持半自动和全自动测量
	避障距离	0.2-40m
	避障范围	俯仰*方位：14**112°，最多支持64个目标同时探测跟踪
	防护措施	船身配备防撞条，安全可靠，双层船壳防沉没
动力	动力类型	电动
	电机类型	无刷电机
	转向类型	无舵机转向，支持倒车
	马达功率	单马达最大800W
	马达转速	最大7200转每分钟
	马达安装方式	插拔设计、易拆换
	防水草方式	半嵌入式涵道式设计、防水草罩、无外挂防刷蹭
	电池规格	32.4V 23.1Ah*4可充电锂电池、18650电芯
	供电方式	支持单电池独立供电，双电池均衡供电
	电池更换	支持不关机热插拔更换
	续航时间	标配2组电池6h@2m/s，1lh@1.5m/s,选配可达12h@2m/s，22h@1.5m/s
	续航里程	经济续航里程40km（以1:1000 10m航线间隔计算约0.4km²）
	最大船速	8m/s,支持安全穿越4m/s流速断面
遥控	显示屏	10.1寸工业触摸屏+阳光可视屏
	分辨率	1920*1200
	安卓系统	Android 9.1
	内存	运存 4GB，存储容量64GB
	通讯频率	800MHz/1.4GHz/2.4GHz
	通讯距离	数传电台常规2km，极限3km，4G无限制
	电池容量	20000mAh
	工作续航	5小时
	充电功率	36W快充，充电时长4小时
	接口	USB口,Nano SIM卡槽,LAN网口,音频接口,HDMI接口,TF卡最大支持128GB,Type-C
	按键	主摇杆*2，次摇杆*2、旋钮*2、按键*8
	船体控制	物理按键控制手/自动，悬停控制，一体化软件控制船体、规划航线、水下地形数据采集
控制	操作系统	Linux
	基站通讯	电台&网络&CORS
	数据通讯	标配4G（支持LTE-FDD、LTE-TDD、UMTS、GSM全球网络制式）&电台
	视频通讯	4G&电台
	SIM卡槽	eSIM（赠送10G*36月网络流量）和Nano卡槽
	接口	2*RJ45网口,3*RS232串口,1*RS485串口,1*PPS,2*指示灯,1*蜂鸣器,1*WiFi
	内存	主控内置存储32GB
	船型识别	支持船型自动识别，并将各传感器安装偏差值自动写入记录文件中
	控制模式	手动&半自动&免规划全自动
	主控防水防尘	IP67

软件系统	控制功能	任务规划、可实现自主导航、船体参数控制、总航行里程统计、剩余里程提醒、多角度视频、支持物理&虚拟摇杆、电池温度显示
	底图加载	支持在线天地图、MapBox、ArcGis卫星影像加载
	数据采集功能	支持坐标转换、轨迹、水深、波形实时显示，支持软件与无人船本地8通道存储
	数据后处理功能	支持单波束数据后处理，支持波形图叠加显示，支持姿态改正
	PPK解算	支持定位+水深数据PPK后差分解算
	自检	开机系统自检，异常提醒；巡航速度异常语音提醒；流量监控与提醒
	升级	支持软固件在线推送升级
	返航逻辑	低电量自动返航、失联自动返航（择近路径返航）
	成果导出方式	U盘、Type-C线、分享码远程数据共享
定位系统	卫星系统	BDS B1I/B2I /B3I、GPS L1C/A/L2P(Y)/L2C/L5、Galileo E1/E5a/E5b、GLONASS L1/L2、QZSS L1/L2/L5
	通道	1408通道
	冷启动tt	< 30s
	初始化时间	< 5s（典型值）
	单点定位精度	平面1.5m、垂直2.5m
	DGNSS定位精度	平面40cm+1ppm、垂直80cm+1ppm
	RTK定位精度	平面±8mm+1ppm、垂直±15mm+1ppm
	CORS差分源	支持网络CORS，赠送3年内置账号
	电台差分	支持华测协议/TT450协议/透明传输协议/南方协议、Satel 3AS协议
	定向精度	0.1°（1m基线）
	惯导精度	6°/h；20S精度衰减1m，支持桥下持续自主导航及测量
	IMU更新率	200Hz
测深系统	数据类型	华测格式、NMEA SDDPT/SDDBT和原始波形
	操作系统	Linux
	液晶屏	1.46英寸，分辨率128 x 128
	WiFi	802.11n-2.4G
	蓝牙	BT5.0，向下兼容BT2.x
	主机重量	840g
	测深范围	0.15-300m
	测深精度	±1cm+0.1%h（h为水深）
	分辨率	1cm
	最大采样率	30Hz
	频率	200kHz
	水温传感器	-55℃~+100℃，实时修正声速
	波束开角	6.5°±1°
	声速调整范围	0m/s~1700m/s
	供电电压	10-36V DC或100-240V AC适配器
	防尘防水	IP67
	最大发射功率	300W
	功耗	10W

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技术参数

船体	船体尺寸	1200 mm *750 mm *400 mm
	材质	高分子聚酯碳纤维、凯夫拉布
	船体自重	13kg
	最大载重	40kg
	抗风浪等级	3级风，2级浪
	船型	三体船
	GNSS	船体内置GNSS双天线，无需外接RTK
	ADCP安装孔径	24cm
	ADCP兼容性	兼容搭载RCP、M9、RiverPro、RiverRay、RioGrande等走航式ADCP
	挂载设备	同时搭载ADCP和测深仪；可扩展取样、水质仪、侧扫
	防水防尘	IP67
	吃水	10cm
	指示灯	双色灯，可指示定位信号状态和差分源
	视频	360°全向视频
	安全	浅滩自动倒车、毫米波雷达自动避障和视频观察
	避障距离	0.2-40m
	避障范围	俯仰*方位：14°*112°，最多支持64个目标同时探测跟踪
	防护措施	船身配备防撞条，安全可靠，双层船壳防沉没
动力	动力类型	电动
	电机类型	无刷电机
	转向类型	无舵机转向，支持倒车
	马达功率	单马达最大1000W
	马达转速	最大7200转每分钟
	马达安装方式	插拔设计、易拆换
	防水草方式	半嵌入式涵道式设计、防水草罩、无外挂防刮蹭
	电池规格	32.4V 23.1Ah*2可充电锂电池、18650电芯
	供电方式	支持单电池独立供电，双电池均衡供电
	电池更换	支持不关机热插拔更换
	续航时间	8h@1.5m/s，选配可达12h@2m/s
	最大船速	7.5m/s
遥控	显示屏	10.1寸工业触摸屏+阳光可视屏
	分辨率	1920*1200
	安卓系统	Android 9.1
	内存	运存 4GB,存储容量64GB
	通讯频率	800MHz/1.4GHz/2.4GHz
	通讯距离	数传电台常规2km,极限3km,4G无限制
	电池容量	20000mAh
	工作续航	5小时
	充电功率	36W快充，充电时长4小时
	接口	USB口、Nano SIM卡槽、LAN网口、音频接口、HDMI接口、TF卡最大支持128GB、Type-C
	按键	主摇杆*2，次摇杆*2、旋钮*2、按键*8
	船体控制	物理按键控制手/自动，悬停控制，一体化软件控制船体、规划航线、水下地形数据采集
控制	操作系统	Linux
	基站通讯	电台&网络&CORS
	数据通讯	标配4G（支持LTE-FDD、LTE-TDD、UMTS、GSM全球网络制式）&电台
	视频通讯	4G&电台
	SIM卡槽	eSIM（赠送10G*36月网络流量）和Nano卡槽
	接口	2*RJ45网口,3*RS232串口,1*RS485串口,1*PPS,2*指示灯,1*蜂鸣器,1*WiFi
	内存	主控内置存储32GB
	船型识别	支持船型自动识别，并将各传感器安装偏差值自动写入记录文件中
	控制模式	手动&半自动&免规划全自动

控制	水文模式	自动悬停、自适应流速、自动规划航线
	主控防水防尘	IP67
	数据储存	本地储存（可多通道储存）和远程储存
软件系统	控制功能	任务规划、可实现自主导航、船体参数控制、总航行里程统计、剩余里程提醒、多角度视频、支持水文模式、ADCP一键配置、电池温度显示
	底图加载	支持在线天地图、MapBox、ArcGis卫星影像加载
	数据采集功能	支持坐标转换、轨迹、水深、波形实时显示，支持软件与无人船本地8通道存储
	数据后处理功能	支持单波束数据后处理，支持波形图叠加显示，支持姿态改正
	PPK解算	支持定位+水深数据PPK后差分解算
	自检	开机系统自检，异常提醒；巡航速度异常语音提醒；流量监控与提醒
	升级	支持软固件在线推送升级
	返航逻辑	低电量自动返航、失联自动返航（择近路径返航）
	成果导出方式	U盘、Type-C线、分享码远程数据共享
定位系统	卫星系统	BDS B1I/B2I /B3I、GPS L1C/A/L2P(Y)/L2C/L5、Galileo E1/E5a/E5b、GLONASS L1/L2、QZSS L1/L2/L5
	通道	1408通道
	冷启动	< 30s
	初始化时间	< 5s（典型值）
	单点定位精度	平面1.5m、垂直2.5m
	DGNSS定位精度	平面40cm+1ppm、垂直80cm+1ppm
	RTK定位精度	平面±8mm+1ppm、垂直±15mm+1ppm
	CORS差分源	支持网络CORS，赠送3年内置账号
	电台差分	支持华测协议/TT450协议/透明传输协议/南方协议、Satel 3AS协议
	定向精度	0.1°（1m基线）
	惯导精度	6°/h；20s精度衰减1m，支持桥下持续自主导航及测量
	IMU更新率	200Hz
测深系统	数据类型	华测格式、NMEA SDDPT/SDDBT和原始波形
	操作系统	Linux
	液晶屏	1.46英寸，分辨率128 x 128
	WiFi	802.11n-2.4G
	蓝牙	BT5.0，向下兼容BT2.x
	主机重量	840g
	测深范围	0.15-300m
	测深精度	±1cm+0.1%h（h为水深）
	分辨率	1cm
	最大采样率	30Hz
	频率	200kHz/25kHz双频
	水温传感器	-55℃~+100℃，实时修正声速
	波束开角	6.5°±1°/28°±1°（25kHz）
	声速调整范围	0m/s~1700m/s
	供电电压	10-36V DC或100-240V AC适配器
	防尘防水	IP67
	最大发射功率	300W
	功耗	10W

本文件所列出的各项参数数值均为理论值或华测导航测试人员在特定受控测试环境下测得值（请见各项具体说明），实际使用中可能因产品个体差异、固件版本、使用条件、使用方式和使用环境等不同使得结果或有不同程度的差异，请以实际使用的情况为准。

为提供尽可能准确的产品信息、参数数值，华测导航可能实时对本文件的文字表述、参数数值等内容进行调整和修正，以求与实际产品性能、规格等信息相匹配。由于产品批次和生产供应因素等实时变化，如却有必要进行前述修改和调整的，恕不专门通知，请以官网实时信息为准。

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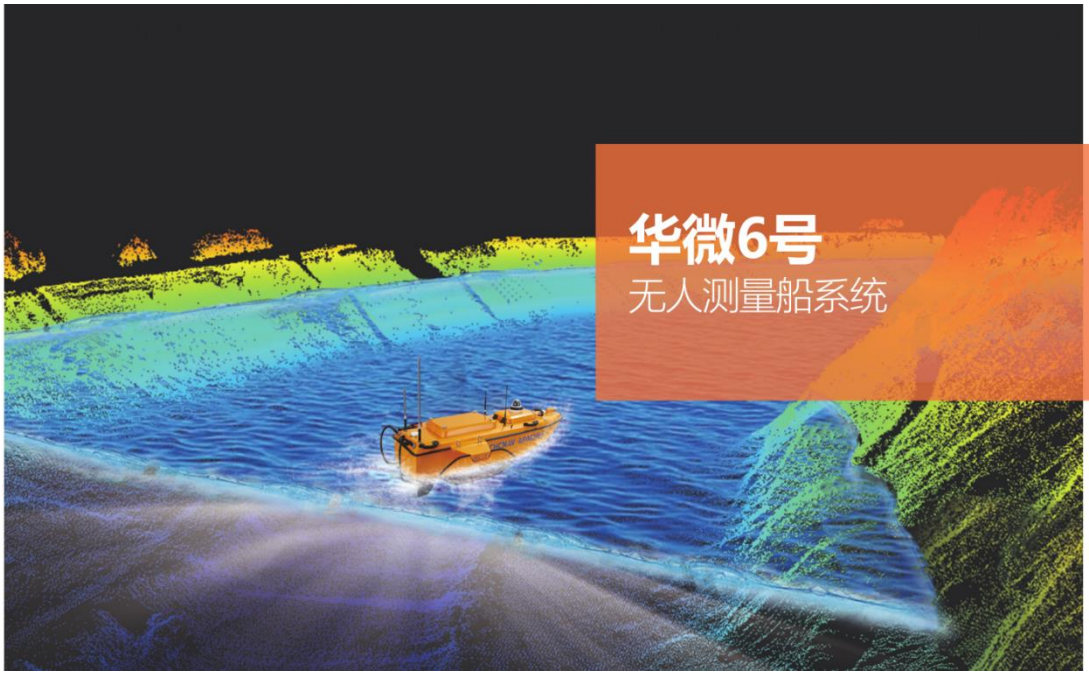

技术参数

船体	船体尺寸	1800 mm *500 mm *250 mm
	材质	高分子聚酯碳纤维、凯夫拉布
	船体自重	15kg
	最大载重	60kg
	抗风浪等级	6级风，4级浪
	船型	可拆卸式三体船
	防水防尘	IP65
	吃水	15cm
	指示灯	双色灯，可指示定位信号状态和差分源
	视频	360°全向视频，可实时回传
	安全	浅滩自动倒车、超声波避障和视频视察
	返航	低电量自动返航、失联自动返航（择近路径返航）
动力	动力类型	电动
	电机类型	无刷电机
	转向类型	无舵机转向
	马达功率	单马达最大700W
	马达转速	最大7000转每分钟
	马达安装方式	插拔设计、易拆换
	防水草方式	涵道式设计、防水草罩
	电池规格	32.4V 23.1Ah*9、可充电锂电池、18650电芯
	续航时间	6h@2m/s，选配可达12h@2m/s
	最大船速	6m/s
通讯控制	基站通讯	电台&网络&CORS
	数据通讯	标配4G&网桥&电台
	遥控通讯	2.4GHz电台&4G&网桥
	视频通讯	4G&网桥
	遥控距离	智能遥控2公里、4G无限制（视网络情况）和网桥2公里
	SIM卡槽	eSIM（赠送10G*36月网络流量）和Nano卡槽
	控制模式	手动&自动
	主控防水防尘	IP67
	数据存储	本地存储（可多通道存储）和远程存储
	软件	任务规划、数据采集和数据后处理等功能，可实现自主导航、船体参数控制、多角度视频显示和坐标转换等功能，支持卫星底图导入，方便规划测区。

定位系统	卫星系统	BDS B1I/B2I /B3I、GPS L1C/A/L2P(Y)/L2C/L5、Galileo E1/E5a/E5b、GLONASS L1/L2、QZSS L1/L2/L5
	通道	1408通道
	冷启动	＜30s
	初始化时间	＜5s（典型值）
	单点定位精度	平面1.5m、垂直2.5m
	DGNSS定位精度	平面40cm+1ppm、垂直80cm+1ppm
	RTK定位精度	平面±8mm+1ppm、垂直±15mm+1ppm
	CORS差分源	支持网络CORS，赠送3年内置账号
	电台差分	支持华测协议/TT450协议/透明传输协议/南方协议、Satel 3AS协议
	定向精度	0.1°（1m基线）
	惯导精度	6°/h；20S精度衰减1m，支持桥下持续自主导航及测量
	IMU更新率	200Hz
测深系统	数据类型	华测格式、NMEA SDDPT/SDDBT和原始波形
	主机重量	1.1kg
	测深范围	0.15-300m
	测深精度	±1cm+0.1%h（h为水深）
	分辨率	1cm
	频率	200kHz
	供电电压	10-30V DC或220V AC适配器
	波束开角	6.5°±1°
	功耗	10W
	脉冲功率	300W
	最大采样率	30Hz
	接口	RS232串口

本文件所列出的各项参数数值均为理论值或华测导航测试人员在特定受控测试环境下测得值（请见各项具体说明），实际使用中可能因产品个体差异、固件版本、使用条件、使用方式和使用环境等不同使得结果或有不同程度的差异，请以实际使用的情况为准。

为提供尽可能准确的产品信息、参数数值，华测导航可能实时对本文件的文字表述、参数数值等内容进行调整和修正，以求与实际产品性能、规格等信息相匹配。由于产品批次和生产供应因素等实时变化，如却有必要进行前述修改和调整的，恕不专门通知，请以官网实时信息为准。

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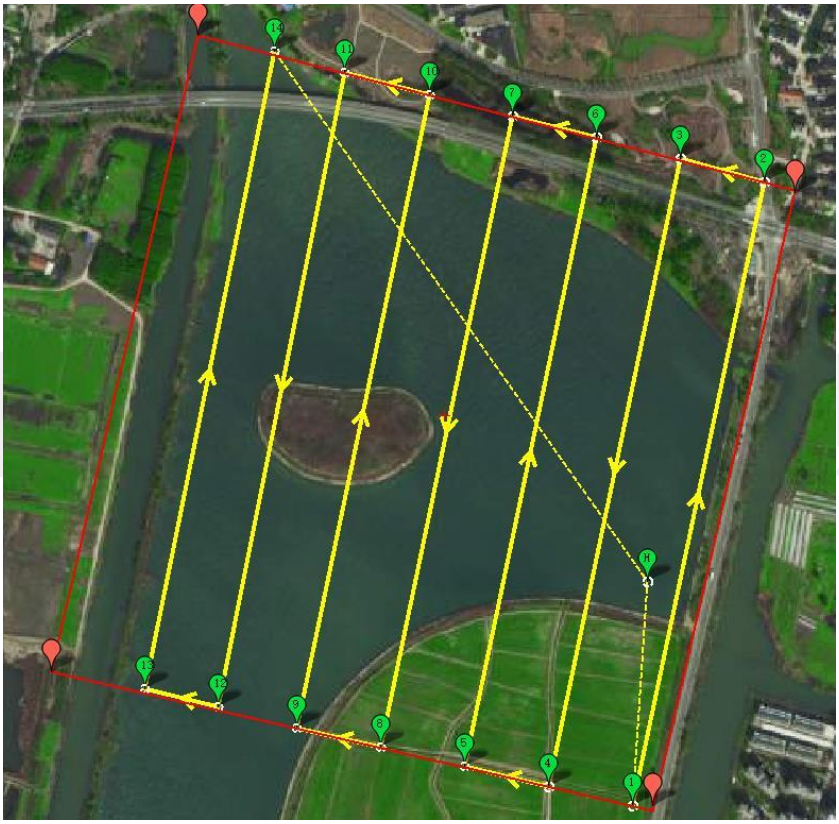
10.2Detailed Explanation of USV Operation Mode

Surveying mode: Conventional operation mode. After switching to automatic mode, the USV executes commands according to the preset route. After reaching the target task point, it automatically navigates towards the next task point.

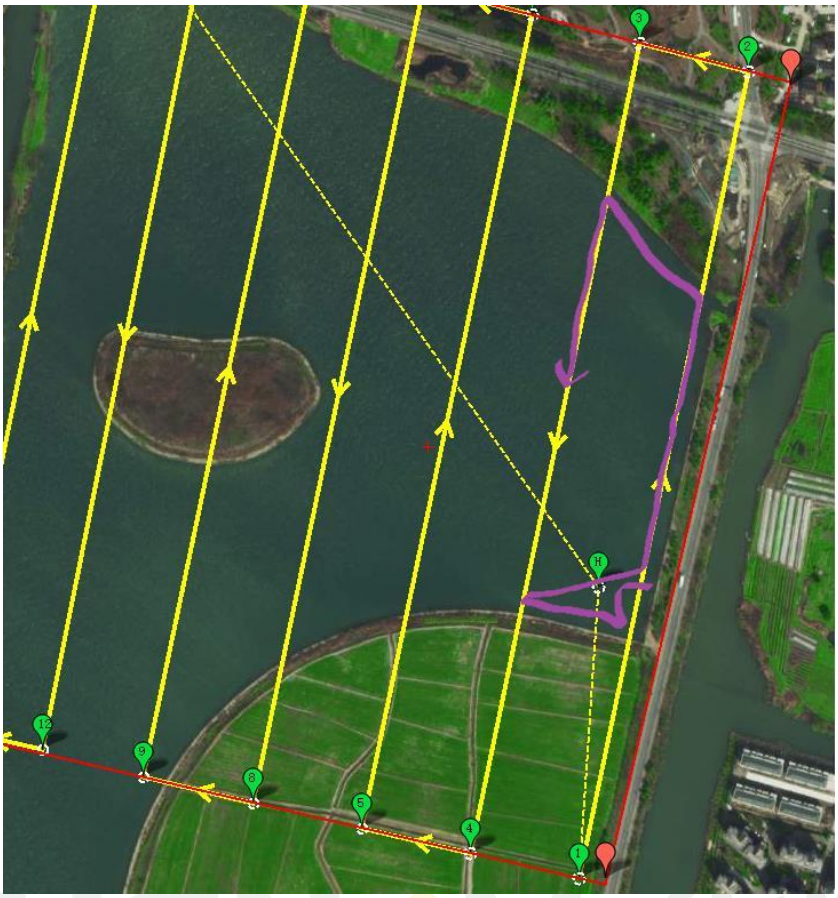
Hydrological mode: mainly used for hydrological testing. On the map, there are two points on the left and right banks of the river section. After the USV switches to automatic mode, it will travel back and forth along the line between the two points. When it reaches the task point, it will automatically hover and continue to travel after the hover is released.

10.2.1 Semi automatic mode: (manual rough route planning)



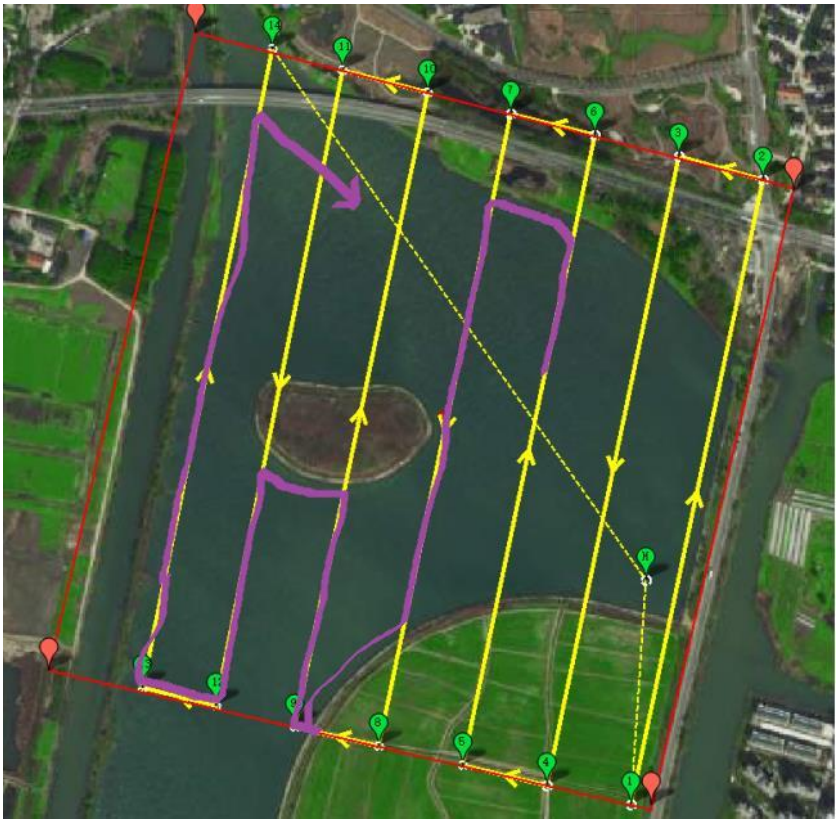
Cover the measuring water area, islands, and other obstacles with the polygonal range.

After the USV is launched, switch to automatic mode. For example, when the ship is launched from the Home position, the USV is sailing towards 1 o'clock, millimeter wave detects obstacles, and the USV is turning towards the rear route direction to try to bypass obstacles (in this case, turning right to try to bypass). When the ship continuously encounters obstacles and reaches the next survey line, it is judged as shore and abandoned waypoint 1 to waypoint 2.

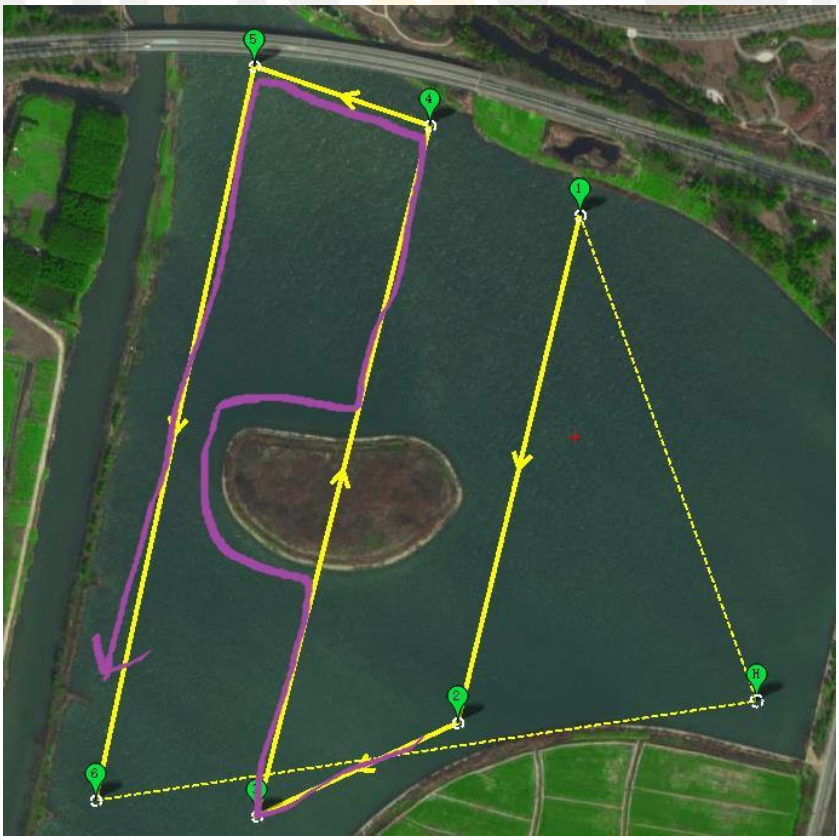


Encounter continuous obstacles at waypoint 2, and waypoint 3 is also under obstacle detection. Abandon waypoints 2 and 3 and go to waypoint 4 (as shown in the above picture).

The logic behind the waypoint is the same as above. The USV follows the route shown in Figure 3, because the USV cannot know the blank waters of the two survey lines behind the island. The blank waters near the two survey lines of waypoint 10 and route 11 need to be measured separately by setting up a route. (As shown in the figure below)



If the obstacle does not cover the next survey line, bypass the obstacle and continue the route (as shown in the figure below).



10.2.2 Full automatic mode:

After the USV is launched, it travels along the direction of the desired measurement route (as shown in the blue trajectory line in Figure 5), automatically enters the fully automatic measurement mode, and the software prompts "Please move the left and right joysticks to determine the direction of the next route" for voice synchronization broadcasting. The operator moves the remote control left joystick to determine the direction of the route (as shown in the blue arrow in Figure 5, the route will move to the left);

USVs automatically plan their routes in parallel directions, with millimeter wave and obstacle logic consistent with semi-automatic logic.

Note:

Semi automatic and fully automatic measurement modes are only available for USVs equipped with millimeter wave obstacle avoidance modules.
Cooperating with low battery automatic return logic, millimeter wave obstacle avoidance, and shallow beach recognition to avoid obstacles on the water surface and underwater, achieving automated measurement of large areas of water for USVs.

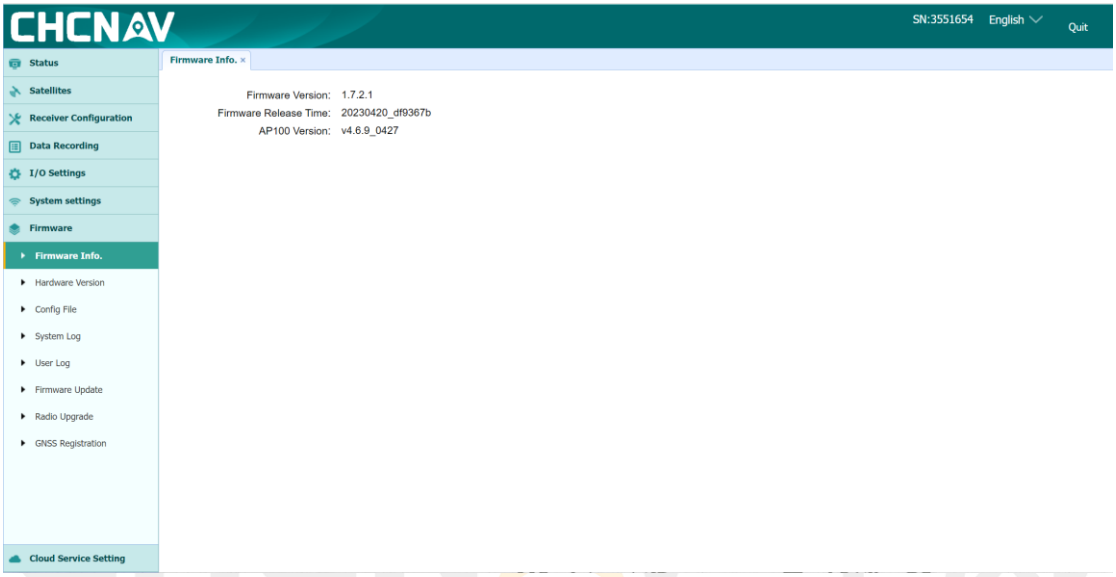
10.3Firmware Upgrade

Firmware (*.hex;*.px4;*.vrx;*.bin) The firmware has two formats: bin and px4, which can be upgraded separately.

There are two ways to upgrade the firmware of USV GD100, each of which includes manual upgrade and online upgrade.

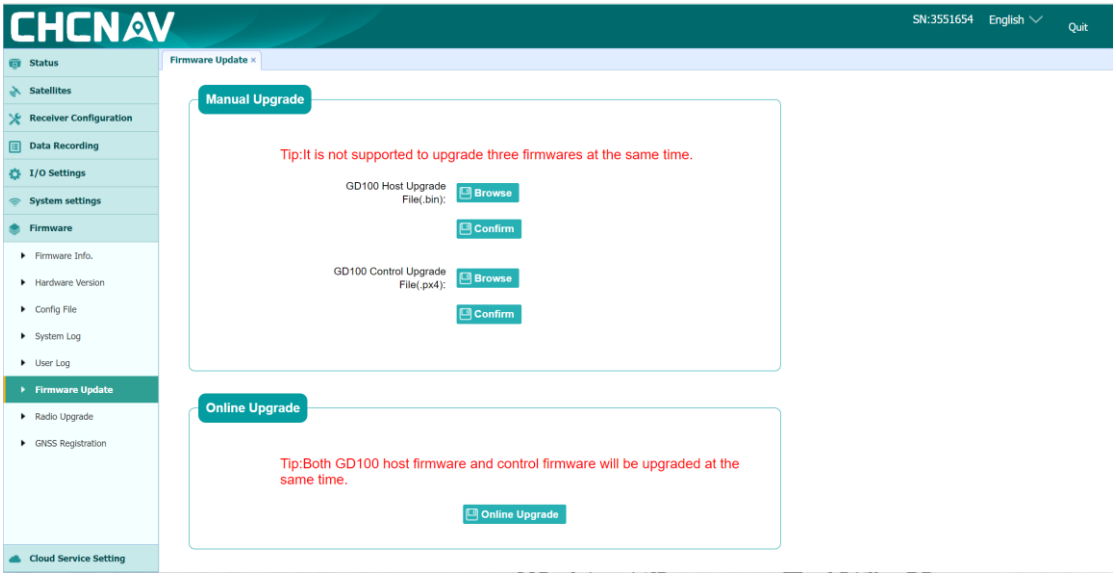
Method 1: Upgrade through GD100 web page.

In the GD100 webpage backend, go to [Firmware] - [Firmware Information] to view the current firmware version



Manual upgrade: Click browse, select the local firmware, and then click OK to upgrade the GD100 host firmware (bin) and control firmware (px4) in sequence.

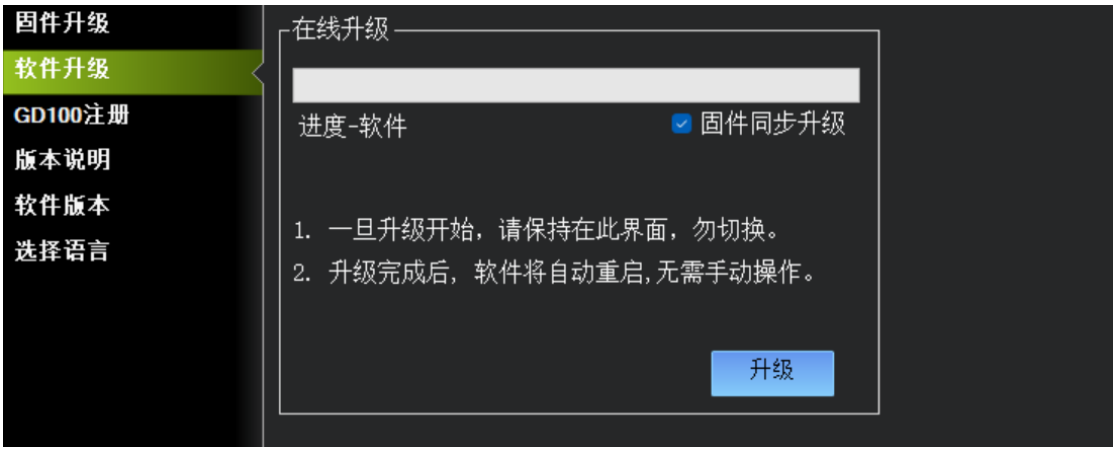
Online upgrade: When the network environment of the USV is stable, clicking on online upgrade will automatically upgrade the firmware to the server and upload the latest version.

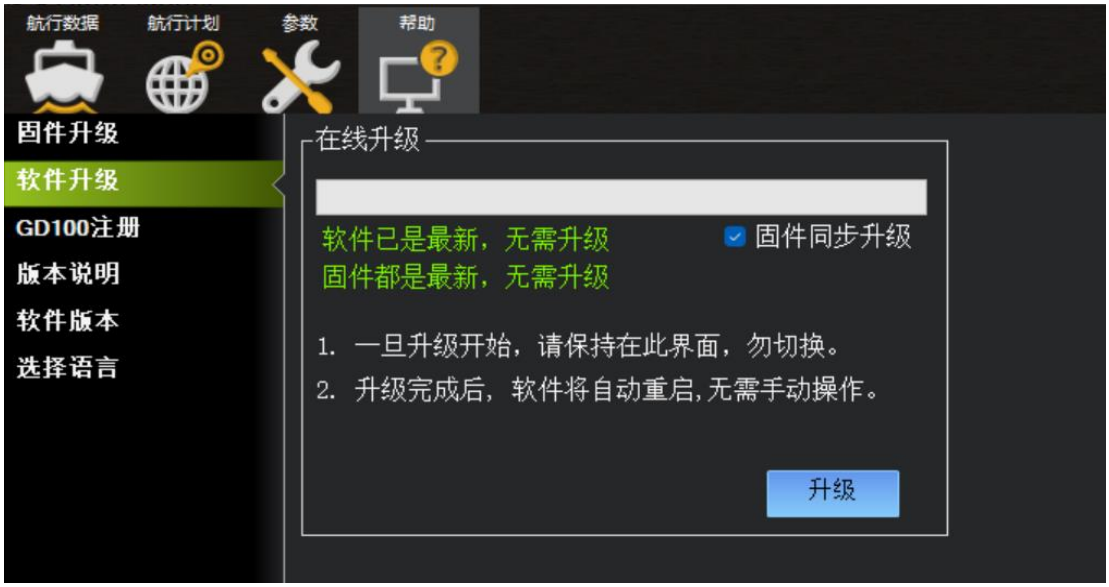


Method 2: Upgrade the software and firmware with just one click using AutoPlanner software.

Manual upgrade: After connecting to the USV, in the help interface, select [Firmware Upgrade]. This interface allows you to view the current firmware version and select [Upgrade Firmware (USB only)]

Online Upgrade: In the help interface, select [Software Upgrade], check [Firmware Sync Upgrade], click Upgrade to upgrade the AutoPlanner software and firmware to the server and upload the latest version.



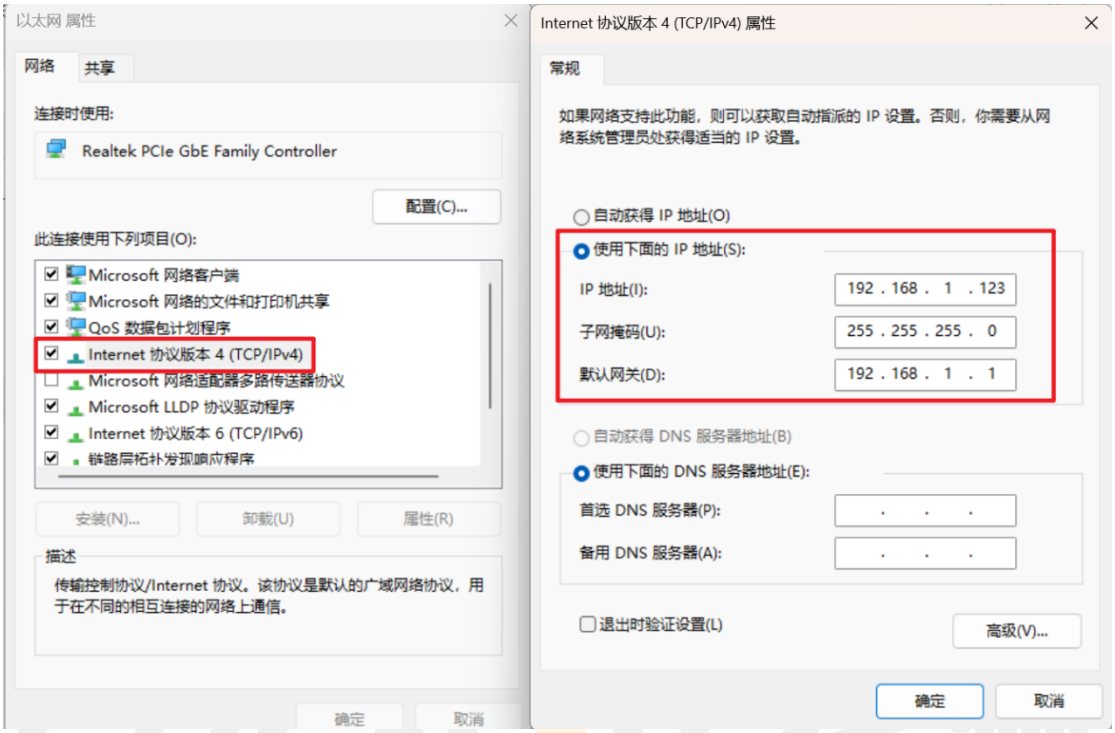


Note:

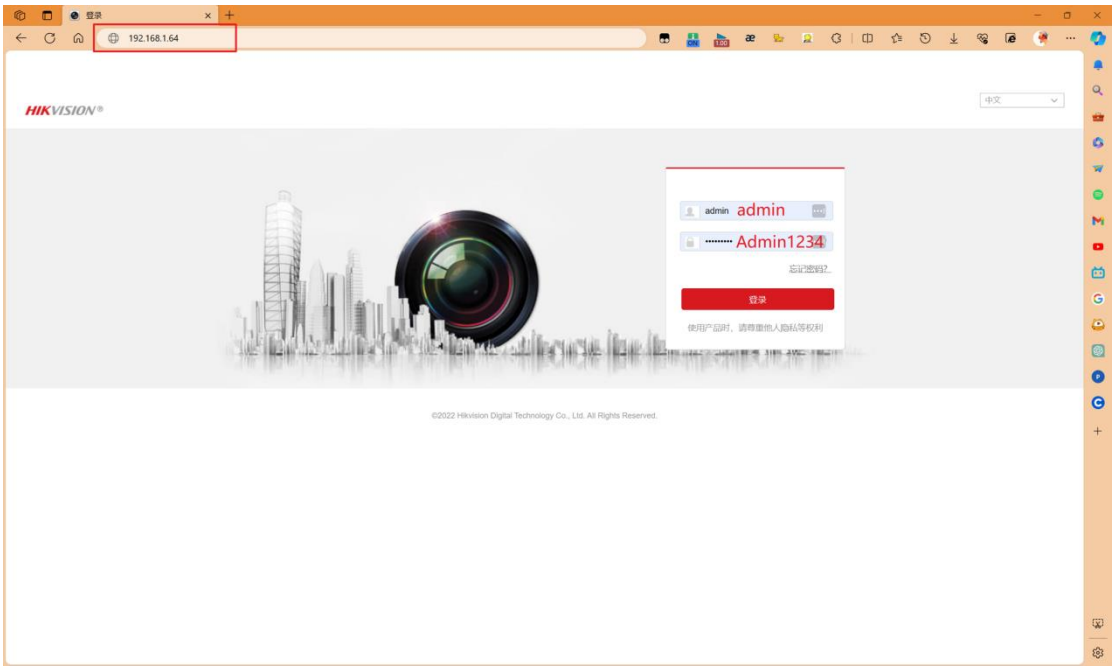
Upgrading using a 4G network is relatively slow. It is recommended to connect to the GD100 lan1 port through a network cable in data transmission mode. At this time, the upgrade time will be shortened to about 5 minutes.

10.4Camera debugging

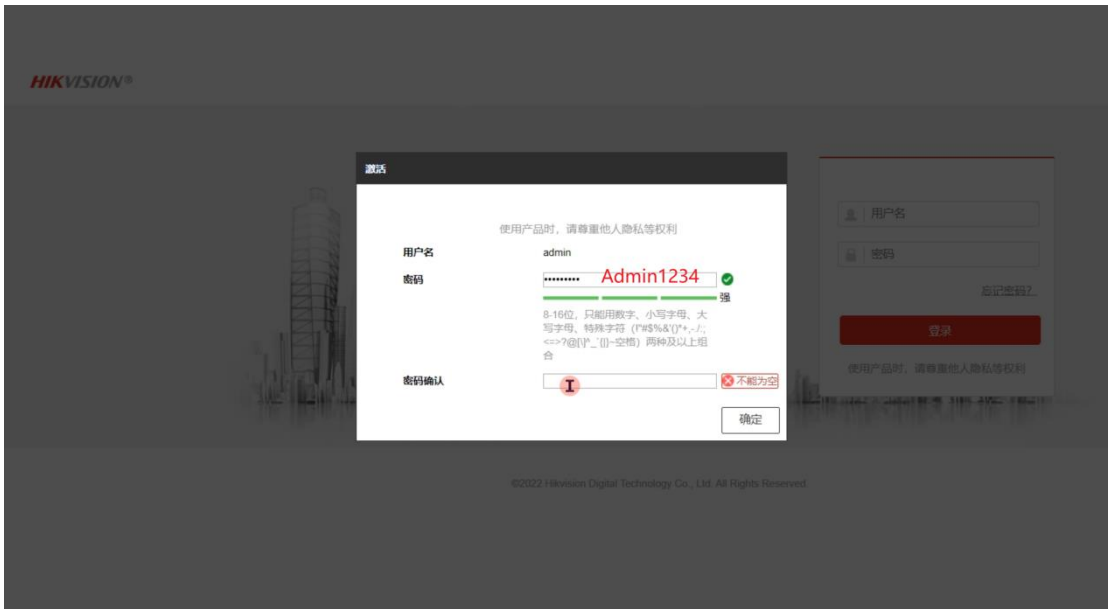
To replace the camera, the following methods can be used for debugging: connect the computer and camera through a network cable, modify the IPV4 protocol to the network segment 1



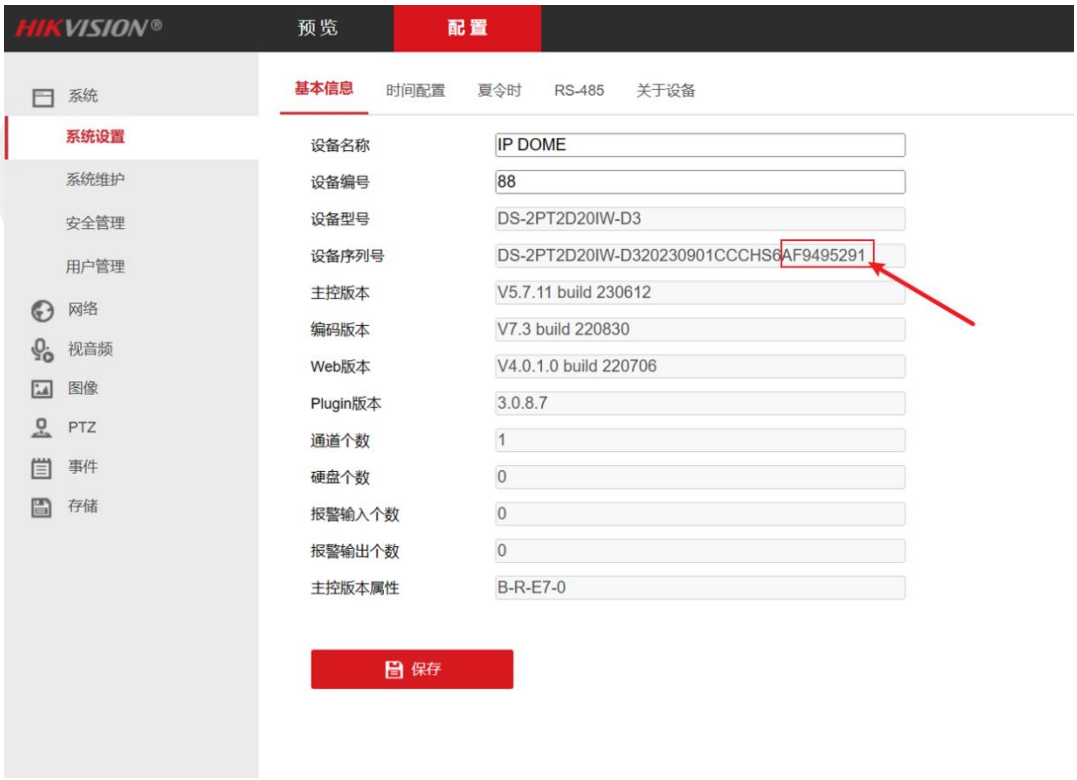
Open the Internet Explorer , enter 192.168.1.64 in the address bar, and enter the camera webpage management platform



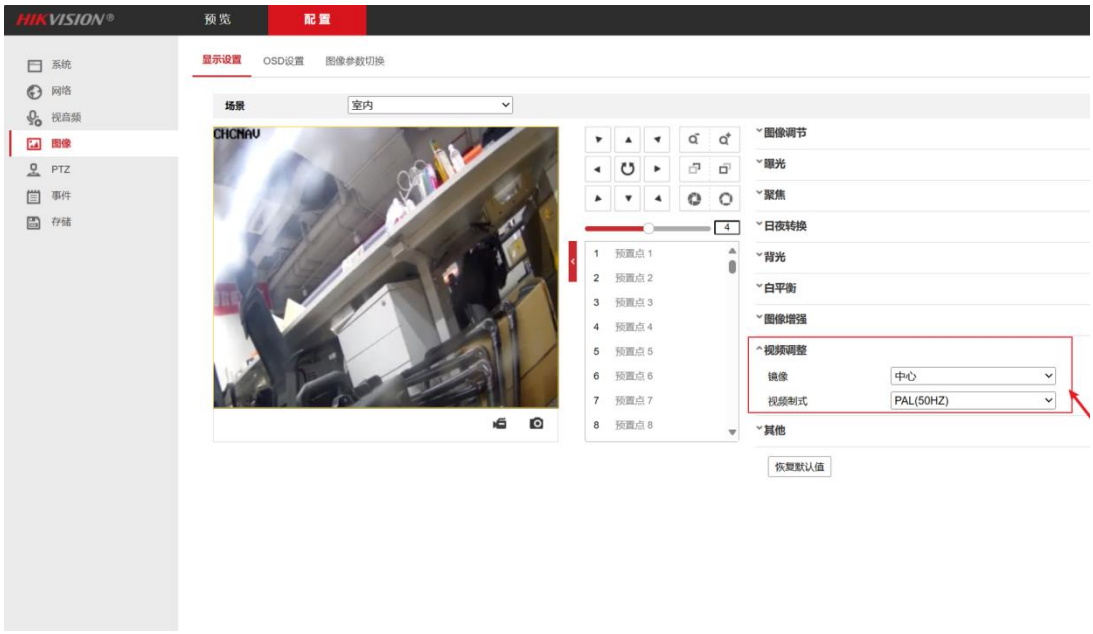
Enter the username: admin. and password: Admin1234



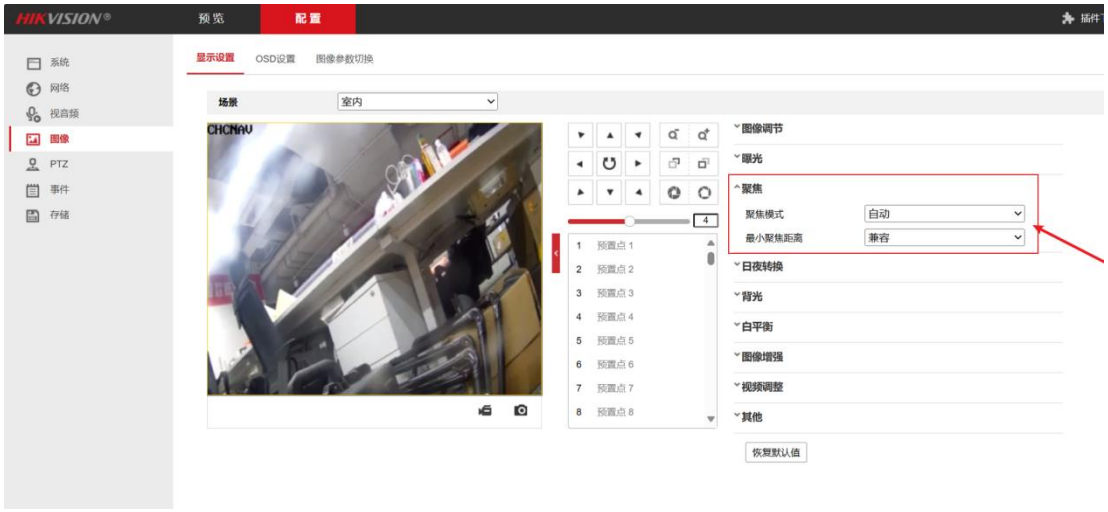
Click on the configuration interface, and in the [System] - [System Settings] interface, record the last 9 digits of the device serial number (mixed with letters and numbers)



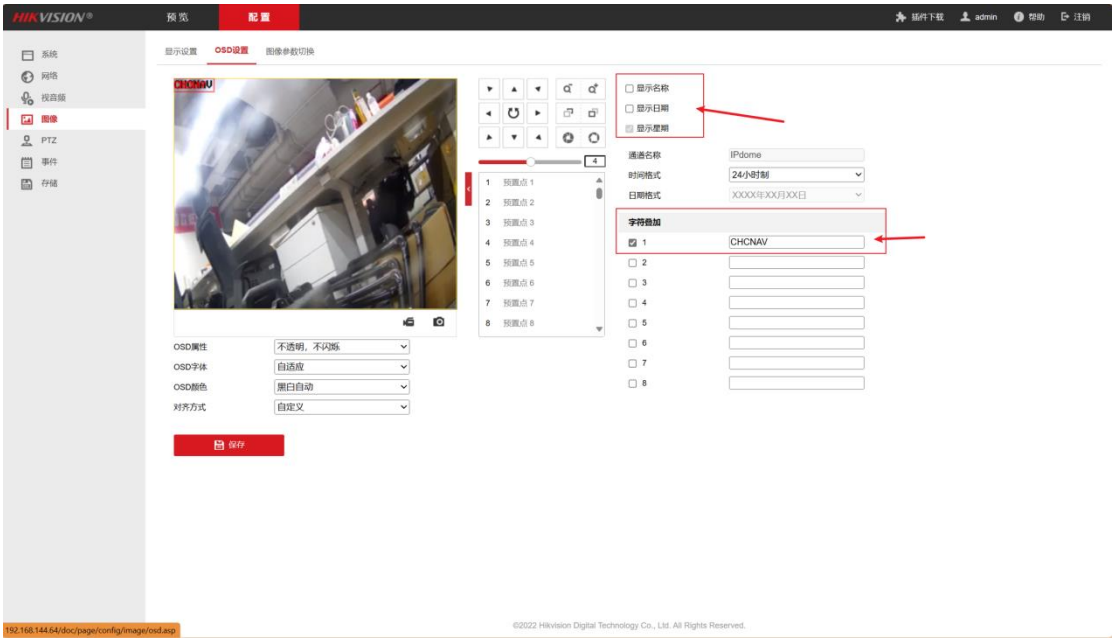
Click on 【 Image 】 - 【 Display Settings 】 - Right side list 【 Video Adjustment 】, and change the image to 【 Center 】.



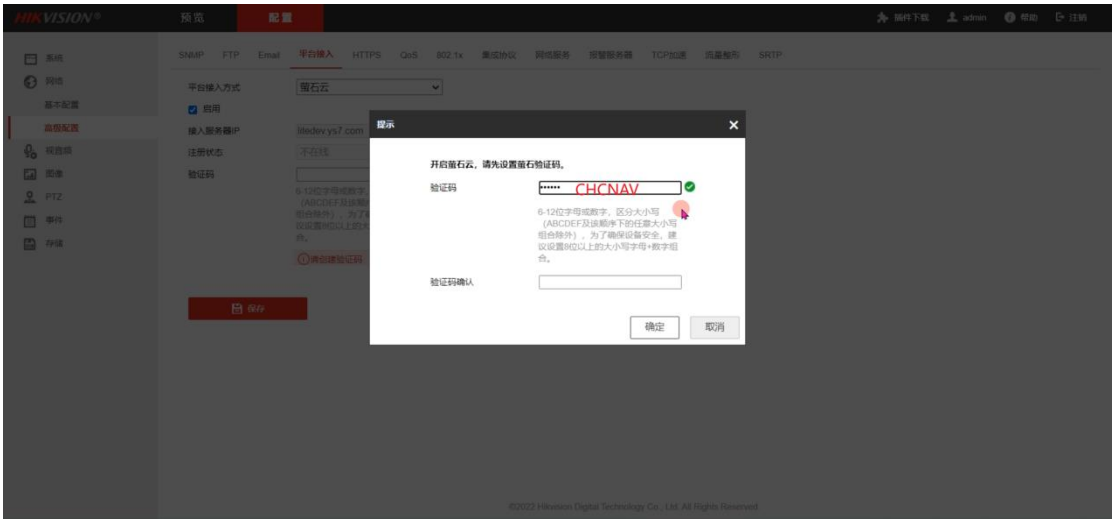
Click on the "Focus" option in the list, select "Auto" as the focus mode, and select "Compatible" as the minimum focus distance.



[Image] - [OSD Settings], uncheck display date, add character overlay 1 [CHCNAV]



Configuration interface,【 Advanced Configuration 】-【 Platform Access 】, select【 Firestone Cloud 】as the platform access method, and input the verification code into “CHCNAV”,



Configuration interface, [Basic Configuration], modify the IPV4 address of the device to 192.168.53.64, subnet mask 255.255.255.0, default gateway 192.168.53.254 for IPV4, click the save button, restart the device, and connect the network cable to the USV GD100 LAN1 network port.

10.5Electrical debugging

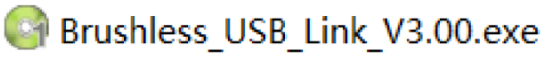
Replace with a new electrical regulator, power on the USV, and follow this step to configure the electrical regulator parameters:

USVs equipped with a PowerBox need to enter the USV web management system and turn on the electrical dispatch parameter switch. USVs without a PowerBox can skip step 1.

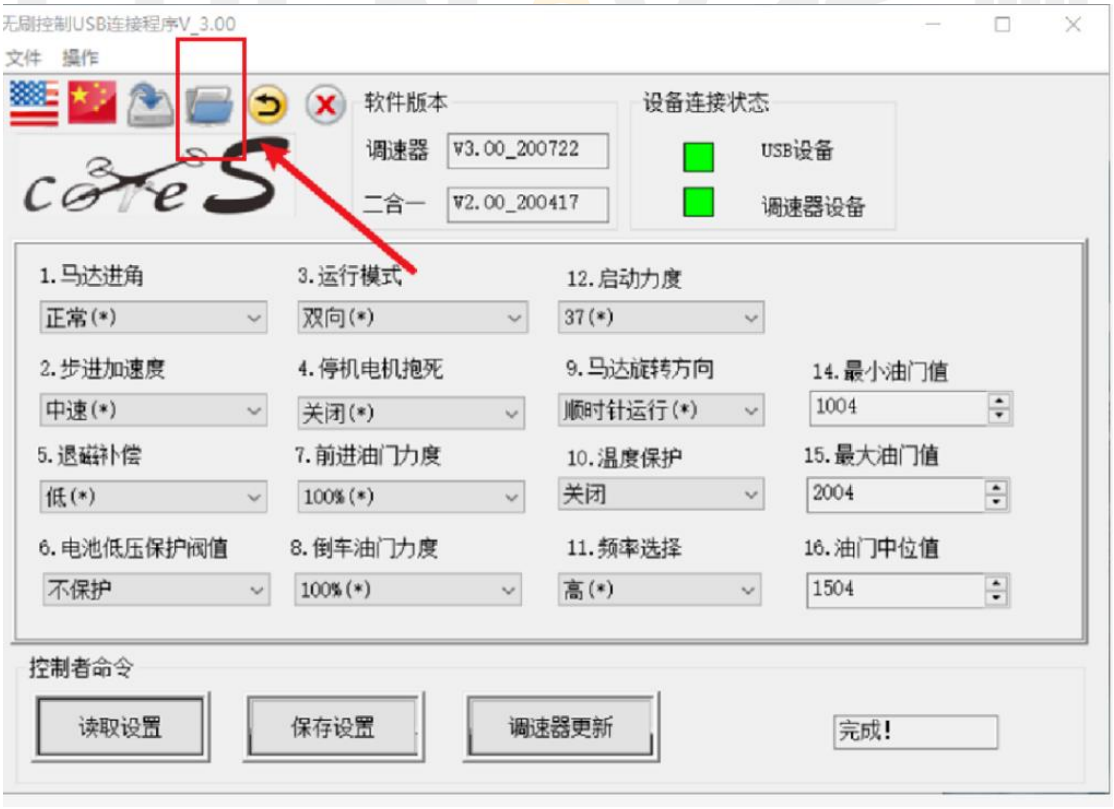
For USVs equipped with a PowerBox, adjust the left side electrical adjustment, connect the electrical adjustment parameter line to the PWM3 interface, and adjust the right side electrical adjustment to connect to the PWM4 interface.

USVs that are not equipped with a PowerBox can directly connect the electrical adjustment parameter line to the electrical adjustment.

Open the Brushless software.

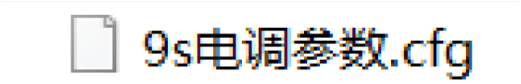


When the device is connected normally, the two status indicator lights in the device connection status bar display green. If they display red, please check if the connection interface and direction are correct.



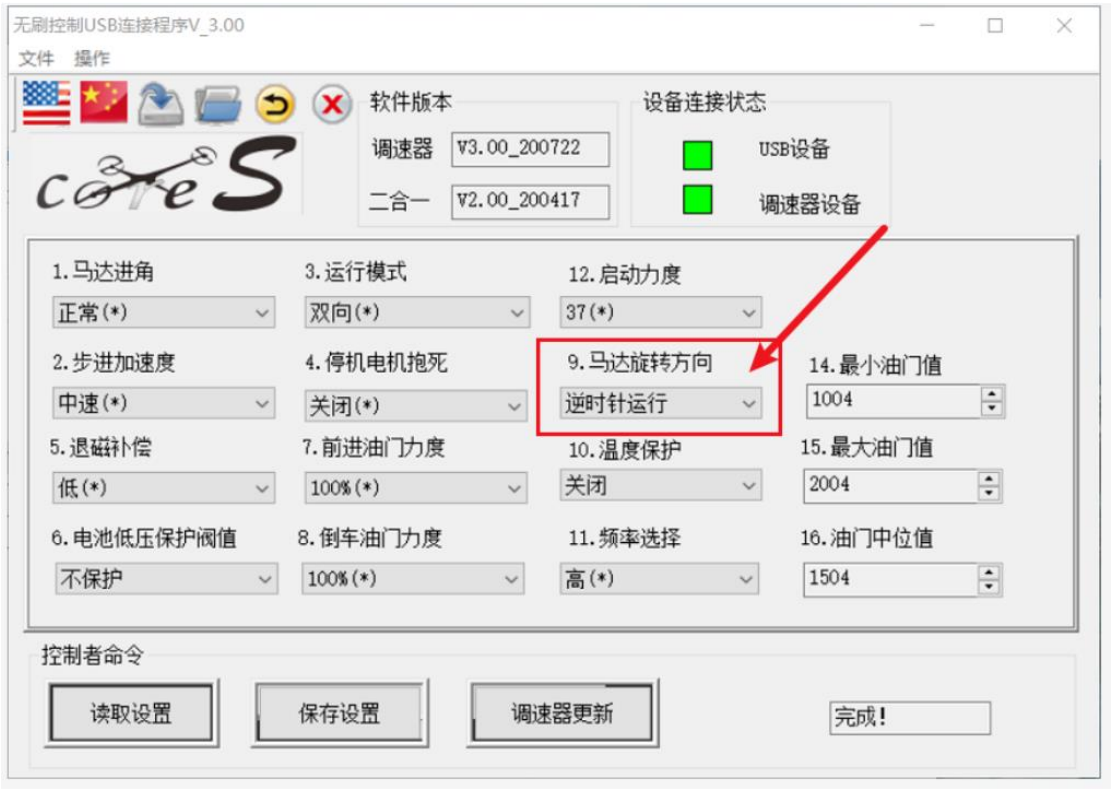
Click on "File Identification", select "9S Electric Adjustment Parameters", click on "Save", and the motor will "beep" prompt, indicating successful writing (the left and right electric adjustment settings are the same). After

successful parameter writing, the USV needs to be restarted.



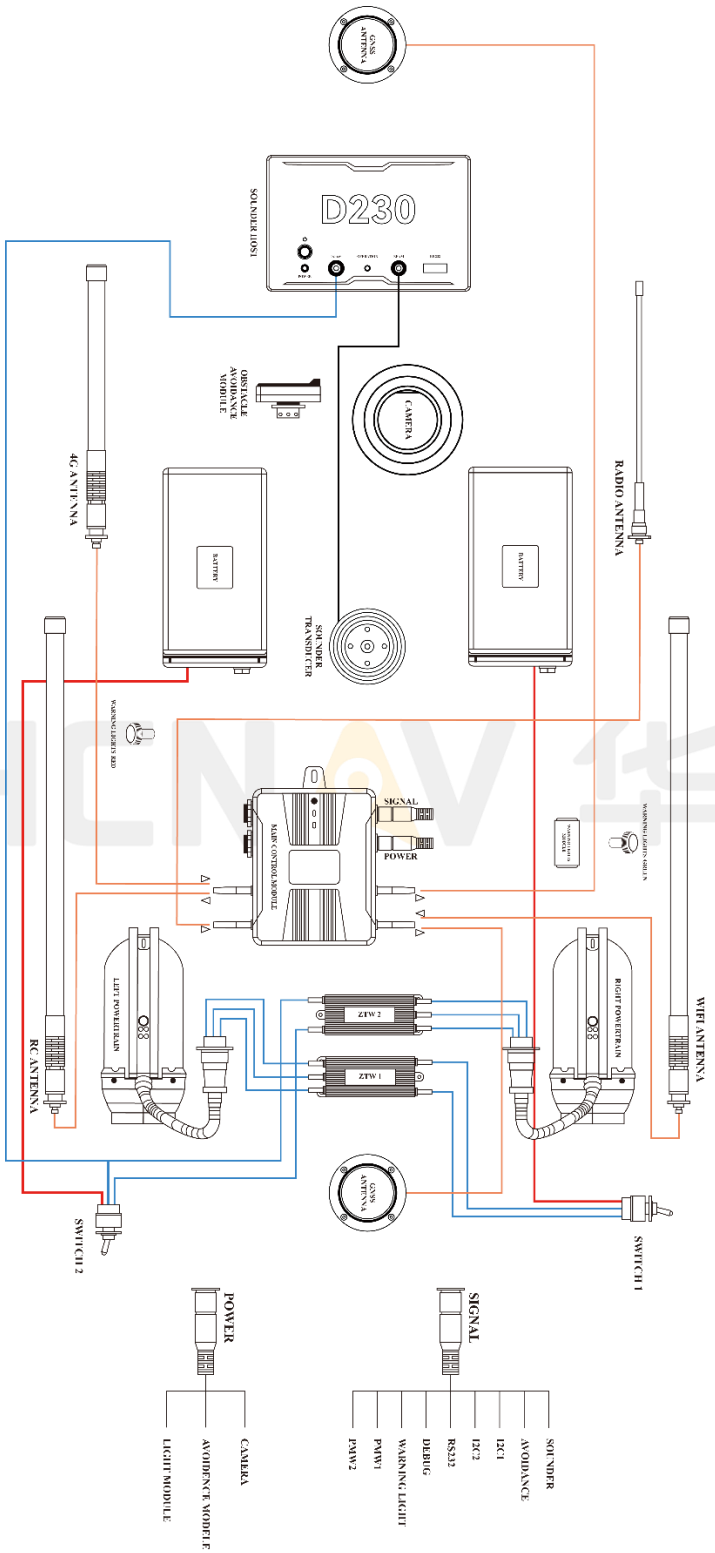
Check if the wind direction is correct, and remotely control the motor to turn left and right (forward, blow air backward from the left and right motors; backward, blow air forward from the left and right motors; left turn, blow air backward from the right motor, blow air forward from the left motor; right turn, blow air backward from the left motor, blow air forward from the right motor).

If the direction of blowing on one side is opposite, simply brush the motor on that side again to rotate in the correct direction.



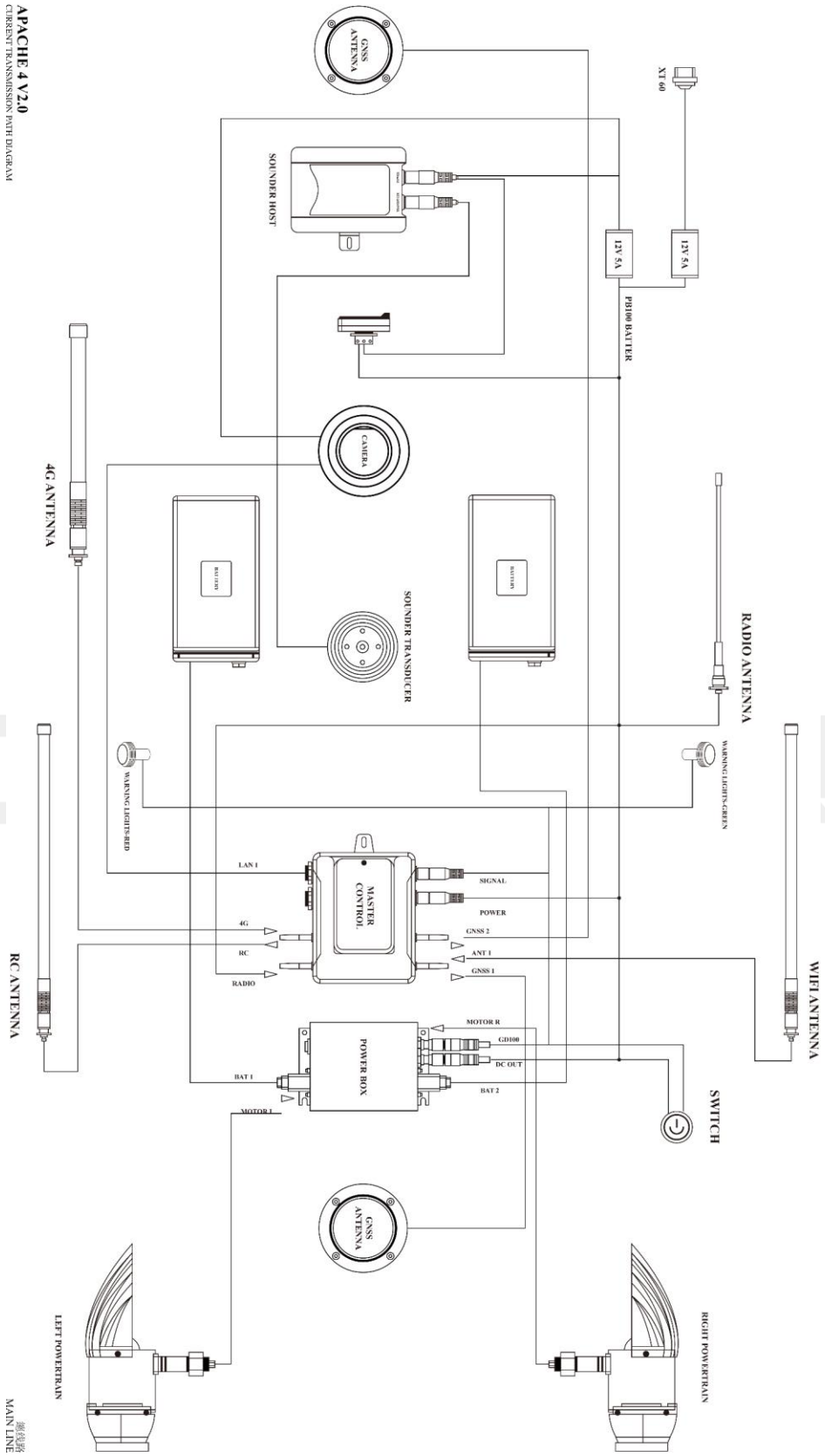
10.6 Wiring diagram

10.6.1 APACHE 3 USV Wiring Diagram

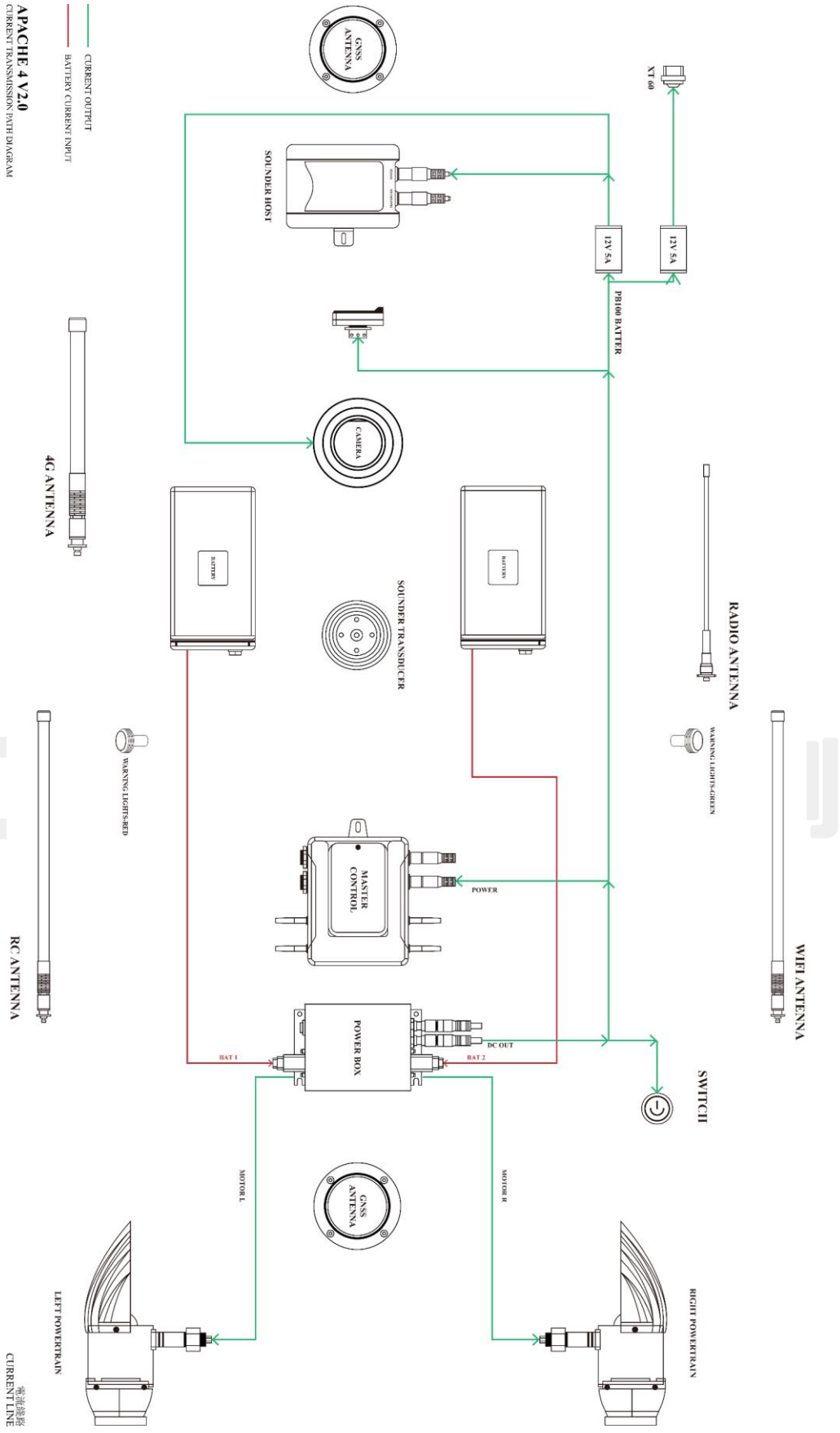


APACHE 3 USV Wiring Diagram

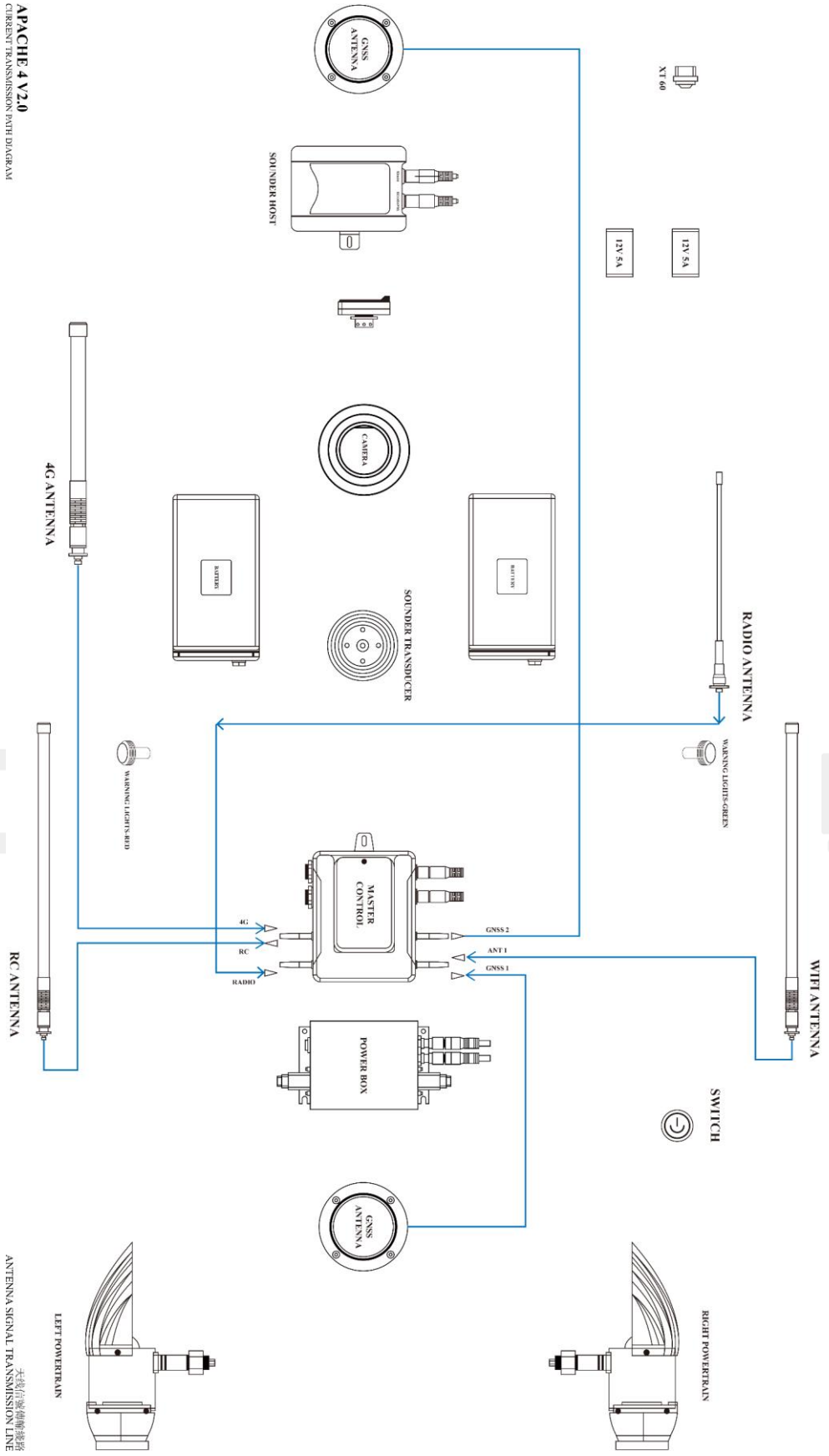
10.6.2 APACHE4 V2.0 USV Wiring Diagram



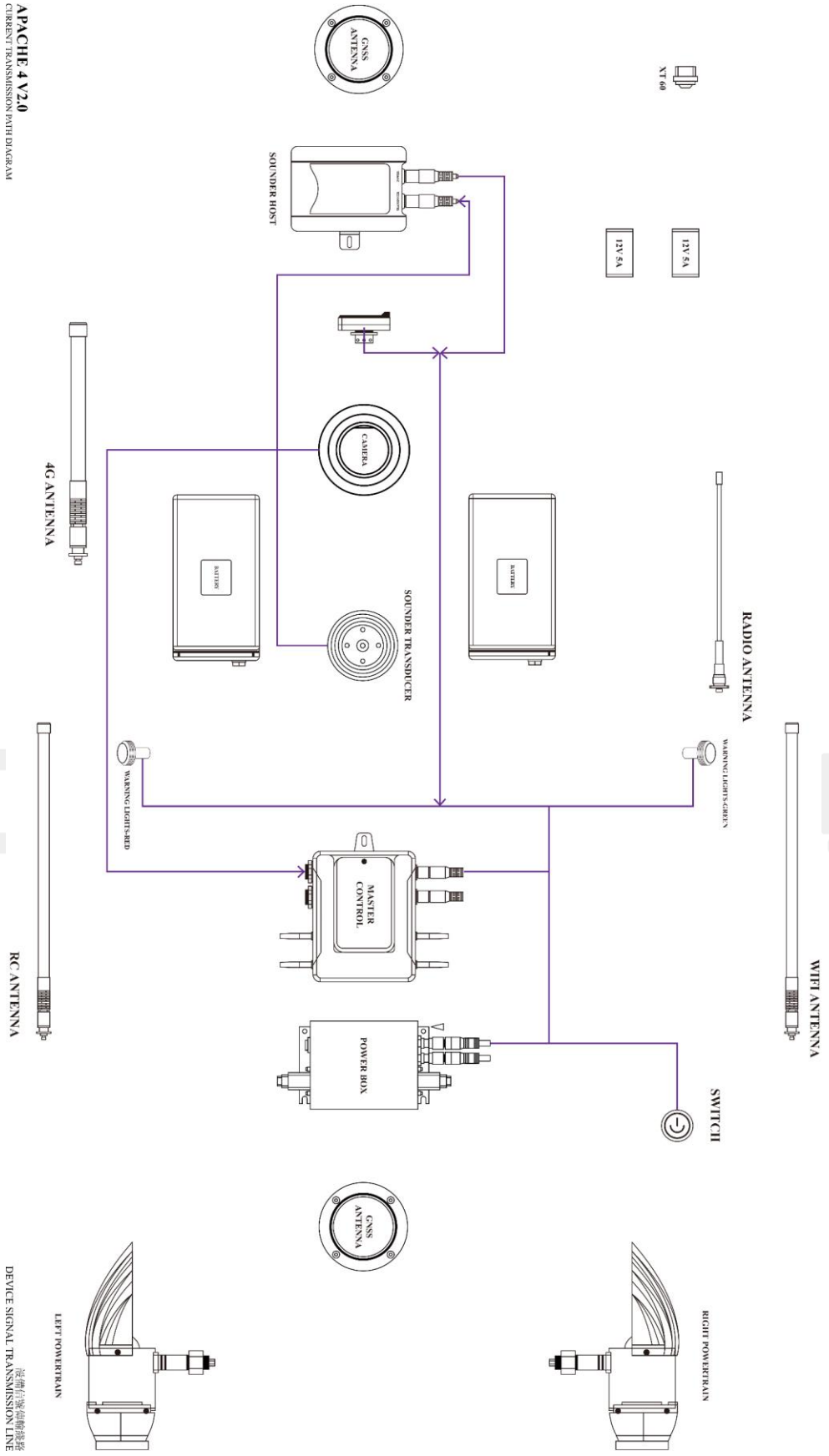
APACHE 4 V2.0 USV Overall Wiring Diagram



APACHE 4 V2.0 USV Current Line Diagram

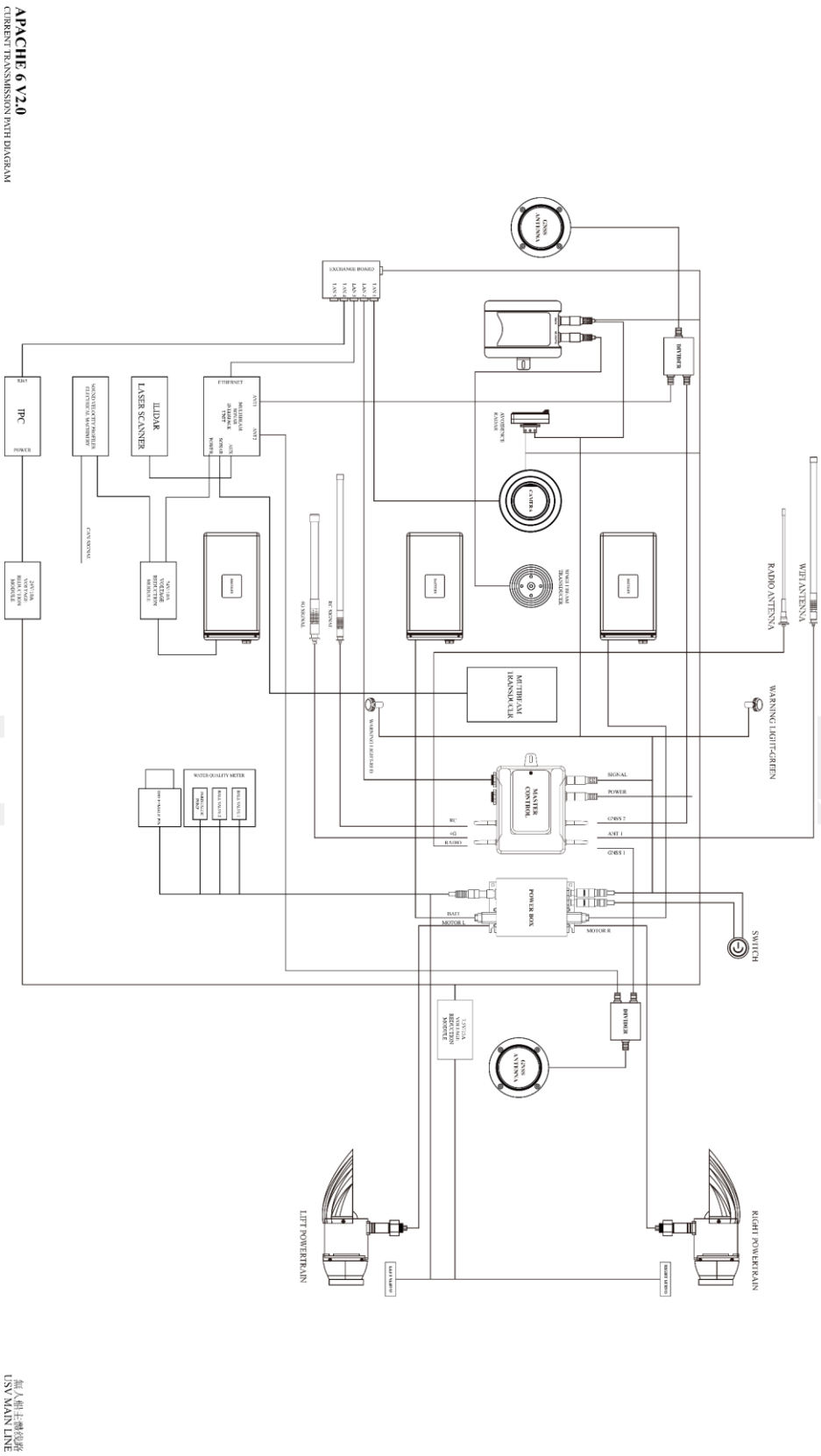


APACHE 4 V2.0 USV Antenna Transmission Signal Line Diagram

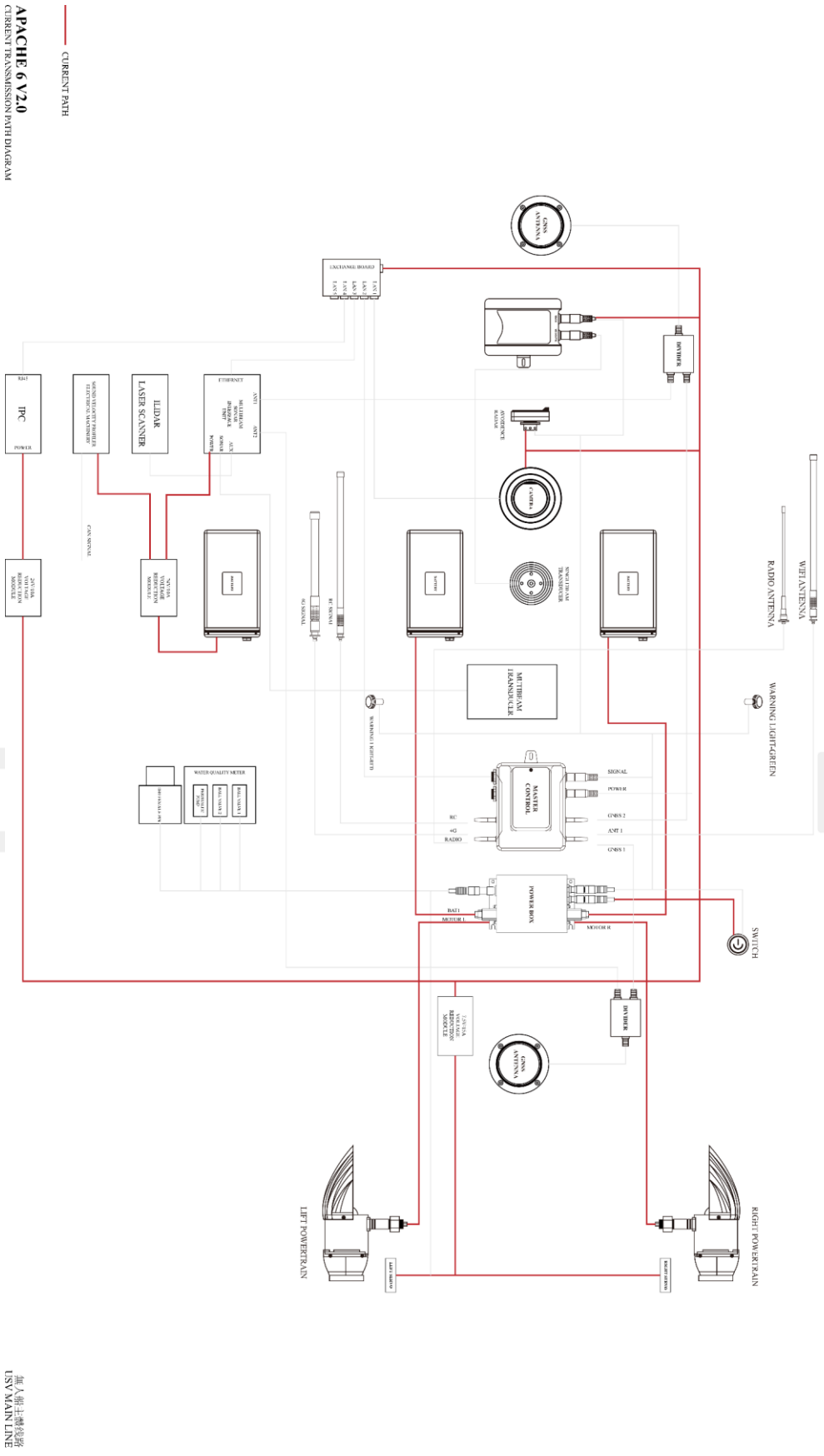


APACHE 4 V2.0 USV Device Transmission Signal Line Diagram

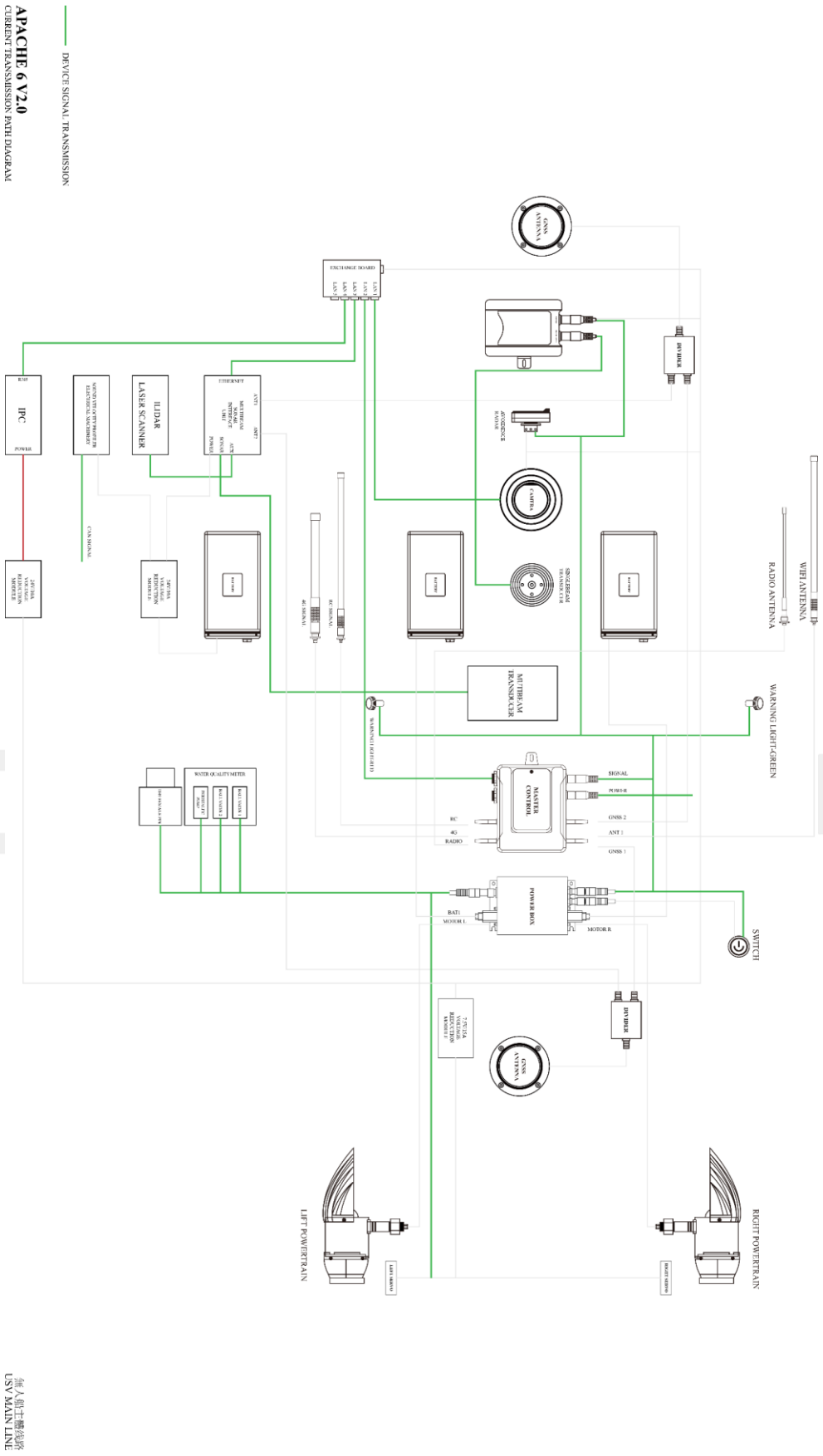
10.6.3 APACHE 6 V2.0 USV Wiring Diagram



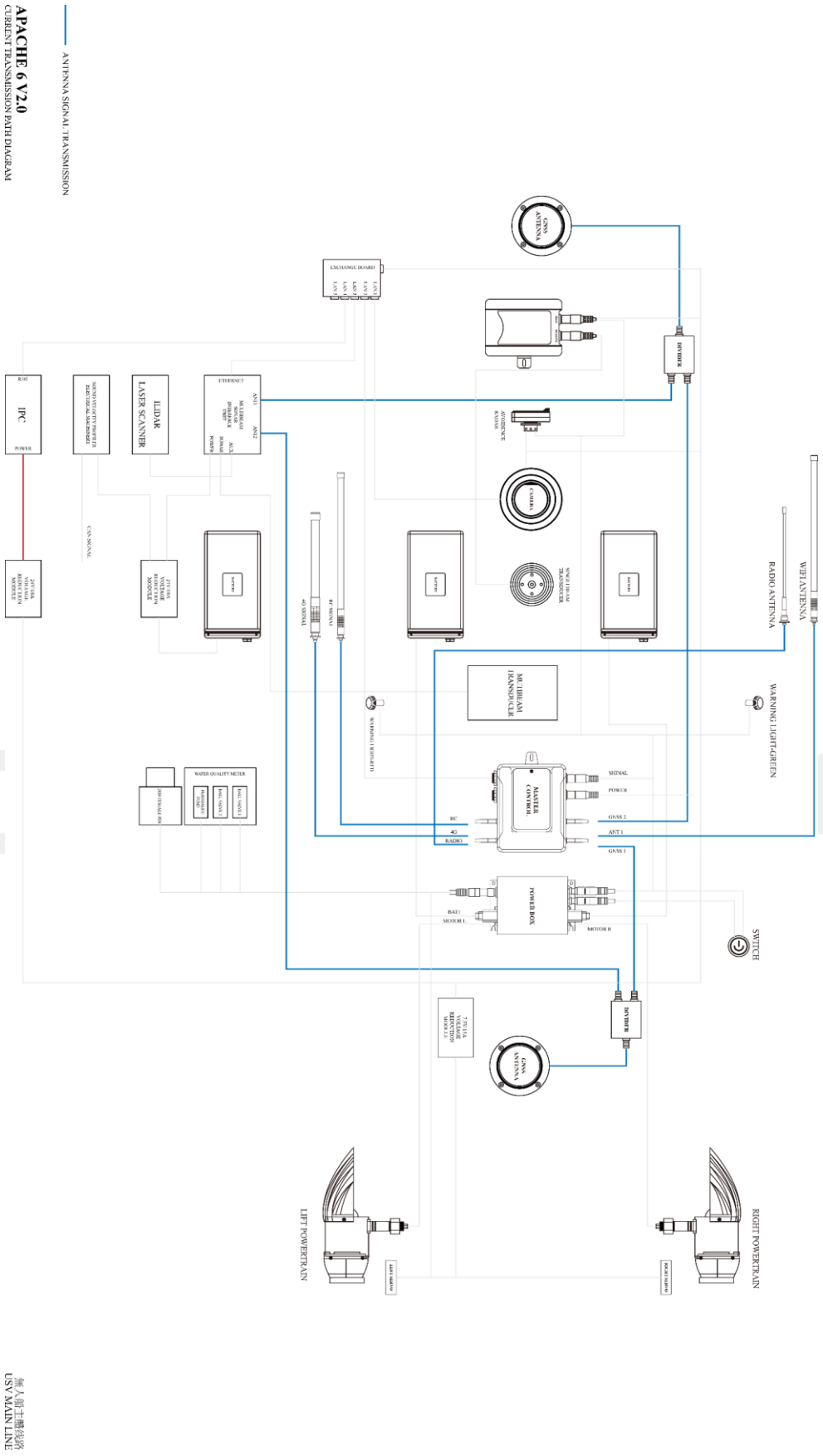
APACHE 6 V2.0 USV Wiring Main Line Diagram



APACHE 6 V2.0 USV Current Line Diagram

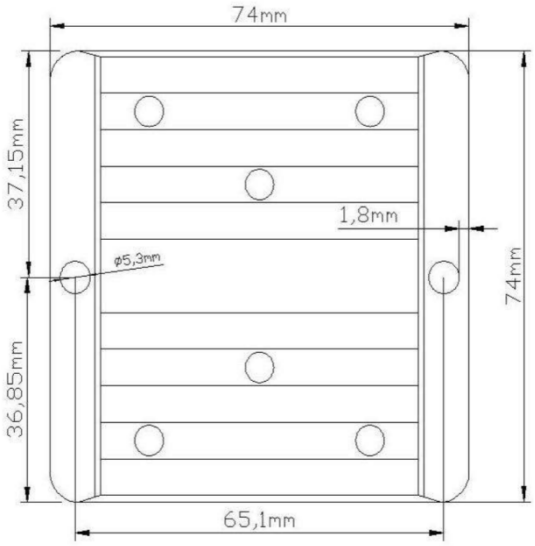


APACHE 6 V2.0 USV Device Signal Transmission Diagram



APACHE 6 V2.0 USV Antenna Signal Transmission Diagram

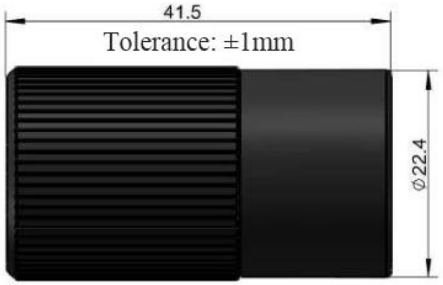
10.6.4 Wiring diagram of voltage reduction module

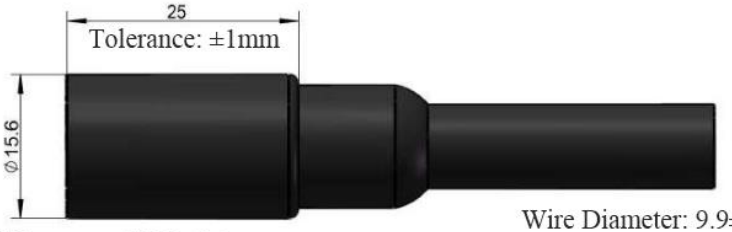


10.6.5 ADCP wiring specification diagram for APACHE USV

7.1.1.1 River Star Series Wiring Specification Diagram

Wiring Definition Table					Wire Harness Description Table				
Signal Description	CN1	CN2	CN3	CN4	Wire specifications	Color/Wire Number	on-resistance	Maximum current	notes
RXD(ADCP reception)	—		3		CN1-8-core sheathed wire at the fork (8C * 0.5mm2) CN1 comes with its own cable Fork CN2: 16AWG double parallel line Fork CN3: 28AWG Fork CN4: 28AWG	/	<20mΩ	CN1- fork: 8A Fork CN2: 8A Fork CN3:0.5A Fork CN4:0.5A	Unused wires are wrapped in heat shrink tubing to prevent short circuits
TXD (ADCP sending)	2		2			/			
POWER+	3	+				/			
RXD (ADCP reception)	5			2		/			
TXD(ADCP sending)	6			3		/			
POWER-/SIGNAL-	7		5	5		/			





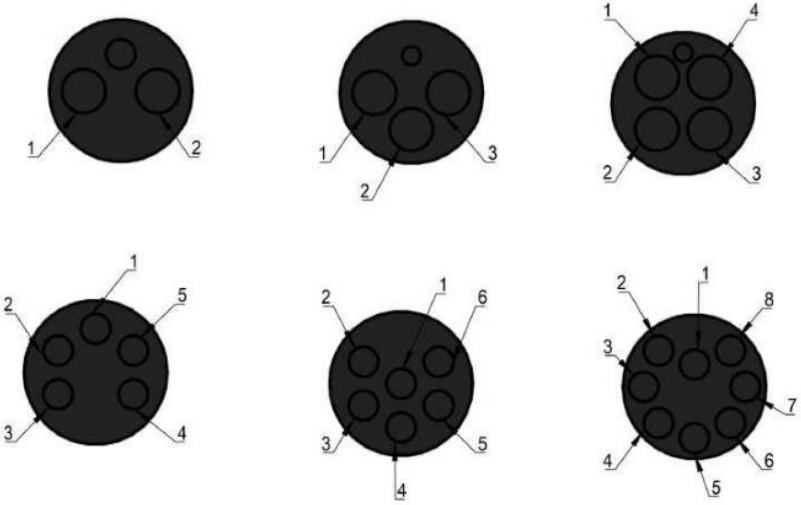
Wire Diameter: 9.9±0.3mm

Plug Diameter: 15.8±0.3mm

General Tolerance: ±0.3mm

2-4 cores, single core current 16-18A

5-8 cores, single core current 5-10A



Cell material: brass gold-plated

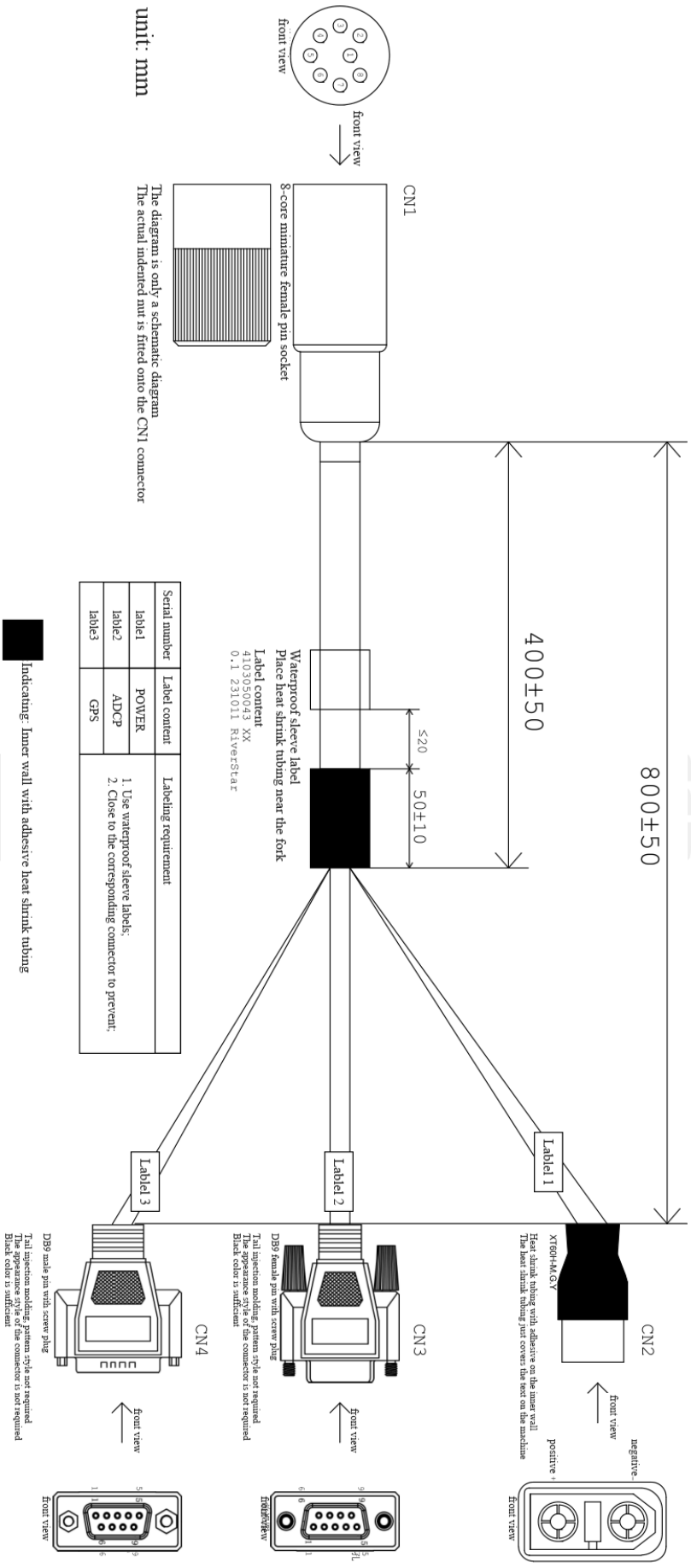
Shell material: stainless steel/sea copper/titanium

Sealing material: chloroprene rubber

Deep water pressure resistance: 10-70MPa

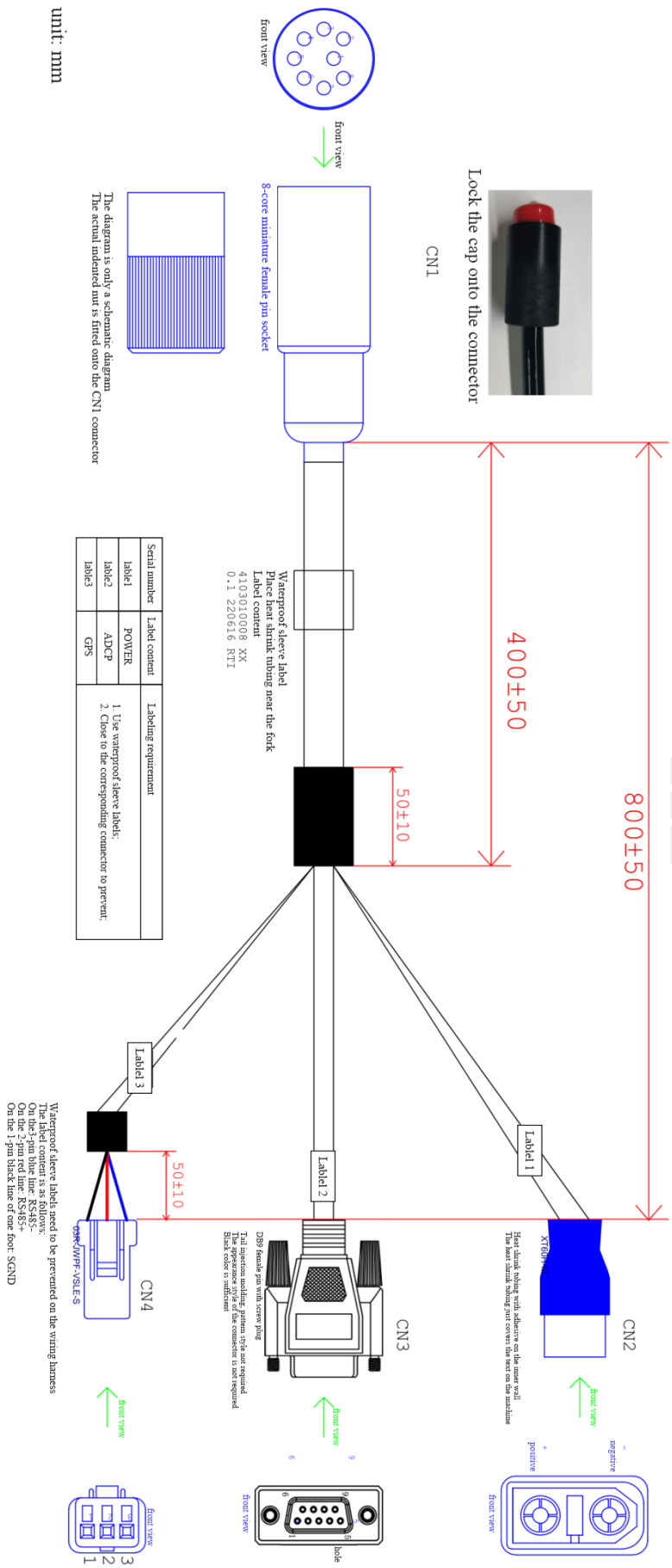
Cable tensile strength: 50kg

Installation thread: 7.16-20UNF-2A



7.1.1.2 RCP Series Wiring Specification Diagram

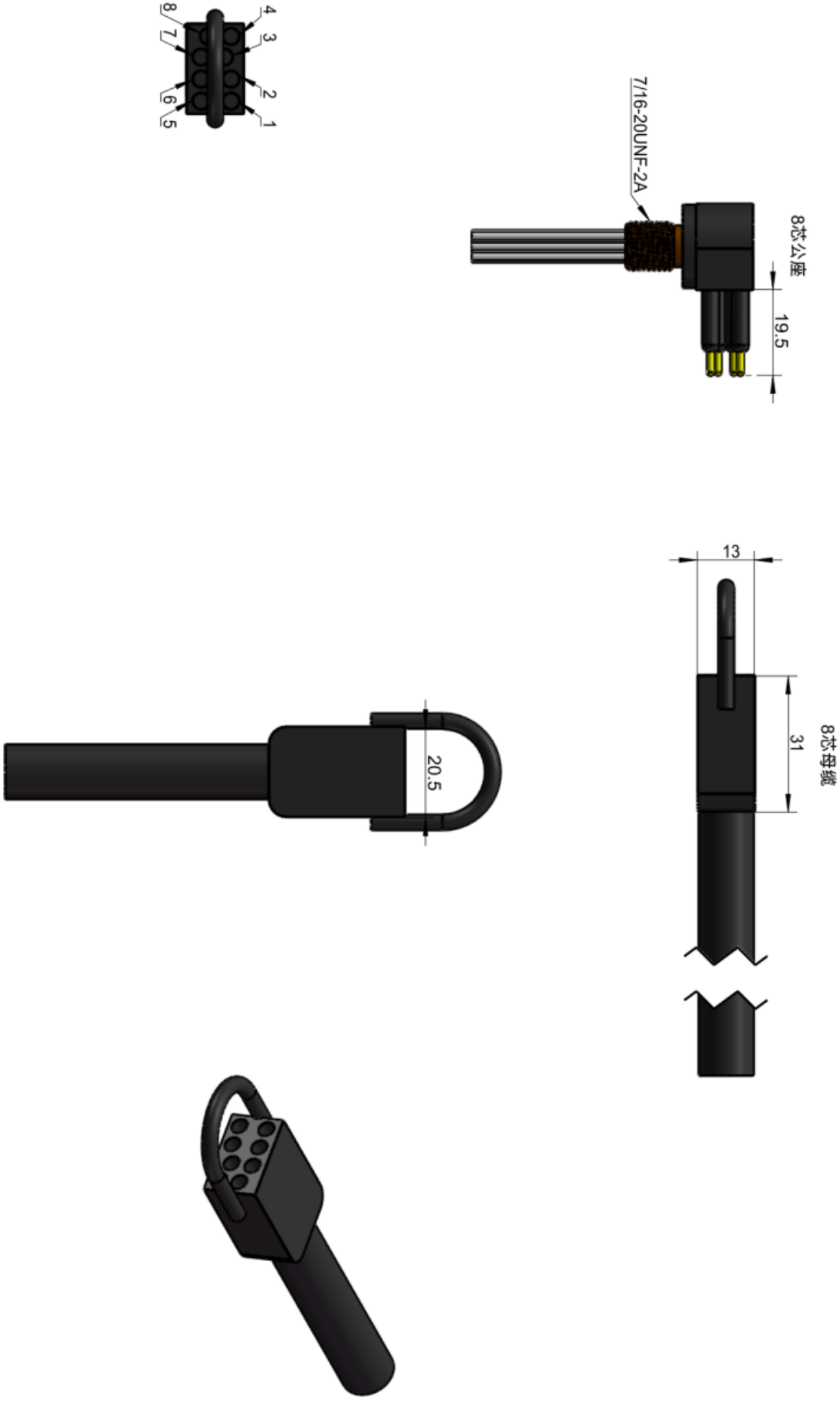
Wiring Definition Table					Wire Harness Description Table				
Signal Description	CN1	CN2	CN3	CN4	Wire harness specifications	Color	Contact impedance	Maximum current	notes
RXD	—		3		CN1-8-core sheathed wire at the fork (8C * 0.5mm2) CN1 comes with its own cable Fork CN2: 20AWG Fork CN3: 22AWG fork CN4: 22AWG	/	<2mΩ	CN1- fork 8A Fork CN2: 5A Fork CN3:1A Fork CN4:1A	
TXD	2		2			/			
POWER+	3	+				/			
SGND	4		5	—		Black			
RS485+	5			2		Red			
RS485-	6			3		Blue			
POWER-	7					/			

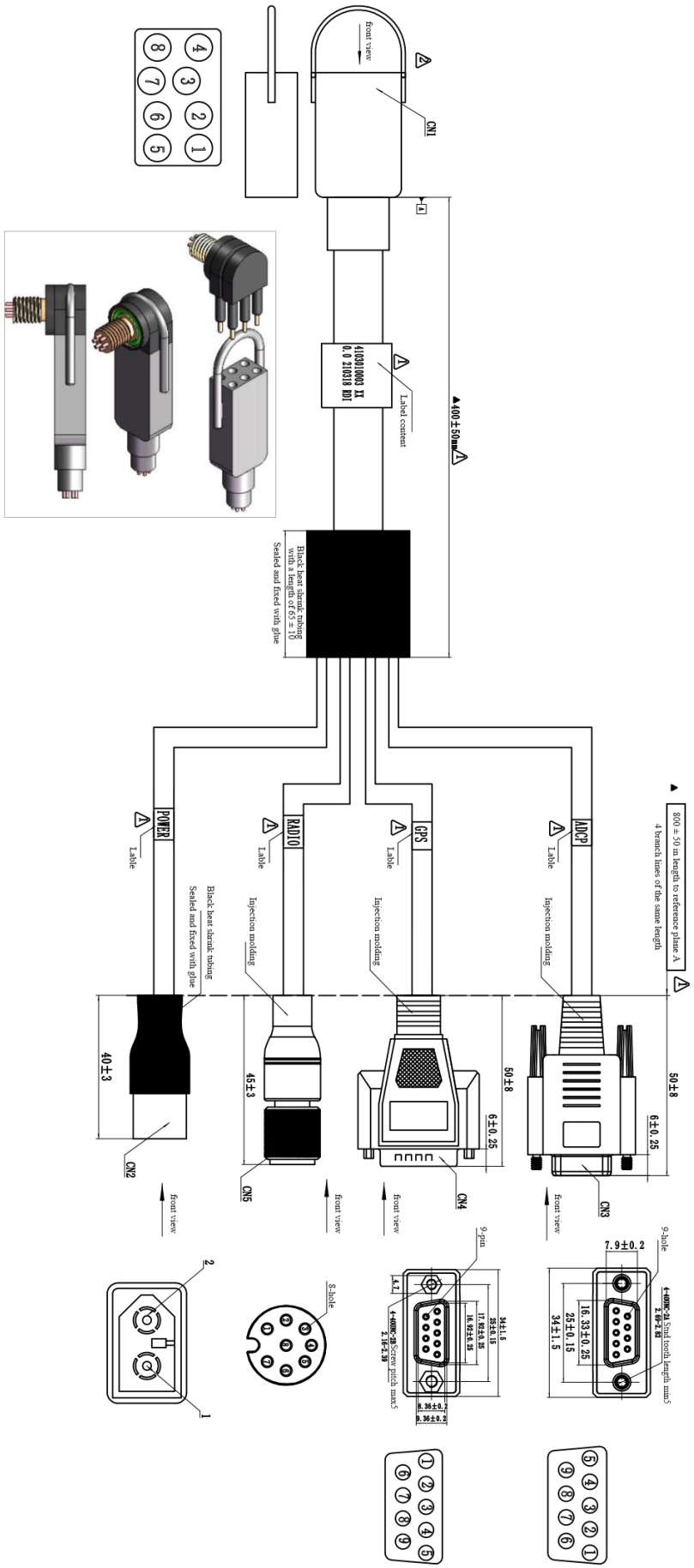


7.1.1.3 RDI Series (Riverpro/Riverray) Wiring Specification Diagram

Wiring Definition Table						Wire Harness Description Table				
Signal Description	CN1	CN2	CN3	CN4	CN5	Wire harness specifications	Color	Contact impedance	Maximum current	notes
RXD	1		3			24AWG	Not Making Comand	≤2mQ	1.7A	
TXD	2		2							
SGND	3		5	5						
POWER+	4	1				20AWG			4A	
RXD_GPS	5			2		24AWG			1.7A	
TXD_GPS	6			3						
POWER-	8	2				20AWG			4A	
RXD	1				1	22AWG			2.5A	
TXD	2				7					
SGND	3				5					
POWER+	4				8					
RXD_GPS	5				4					
TXD_GPS	6				3					
POWER-	8				2					

Note:
1. The outer layer of the cable must meet the flame retardant grade VW-1, be resistant to high and low temperatures of -40C-85C, and have a black color. External materials that meet the above requirements are acceptable, and specific grades are not specified.
2. If there is a requirement for twisted wire, there is no special requirement for the length of the twisted wire, only the appearance of the finished product line should be smooth and unobstructed without obvious deformation, bulging, scratches, and other defects.
3. If there is a wire harness woven mesh, there is no specific grade requirement, only it needs to meet the flame retardant grade VW-1, high and low temperature resistance -40C-85C, black color, smooth and unobstructed appearance of the wire without obvious deformation, bulging, scratches, and other defects.
4. All injection molded joints in the diagram do not specify specific structural shapes, and injection molds that meet the marked dimensions are acceptable.





7.1.1.4 SONTEK M9 wiring specification diagram

Wiring Definition Table					Wire Harness Description Table				
Signal Description	CN1	CN2	CN3	CN4	Wire harness specifications	Color	Contact impedance	Maximum current	notes
VCC	1	┼			22AWG	/	≤2mΩ	2.5A	
TXD	2		2			/	≤2mΩ	2.5A	
RXD	3		3			/	≤2mΩ	2.5A	
TXD_GPS	4			3		/	≤2mΩ	2.5A	
RXD_GPS	6			2		/	≤2mΩ	2.5A	
GND	8		5	5		/	≤2mΩ	2.5A	

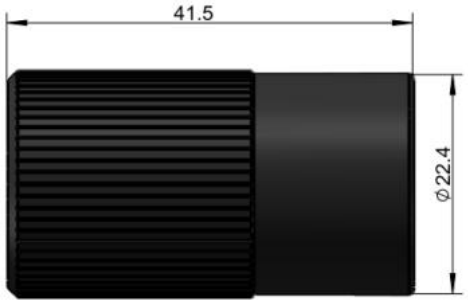
Note:

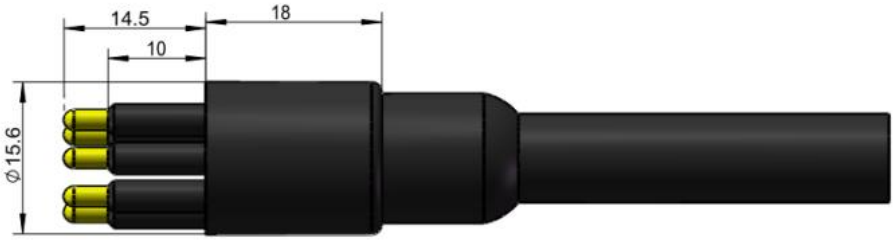
1. The outer layer of the cable needs to meet the following requirements: flame retardant grade VW-1, high and low temperature resistance -40C-85C, color: black. External materials that meet the above requirements are acceptable, and specific grades are not specified.

2. If there is a requirement for twisted wire, there is no special requirement for the length of the twisted wire, only the appearance of the finished product line should be smooth and unobstructed without obvious deformation, bulging, scratches, and other defects.

3. If there is a wire harness woven mesh, there is no specific grade requirement, only it needs to meet the flame retardant grade VW-1, high and low temperature resistance -40C-85C, black color, smooth and unobstructed appearance of the wire without obvious deformation, bulging, scratches, and other defects.

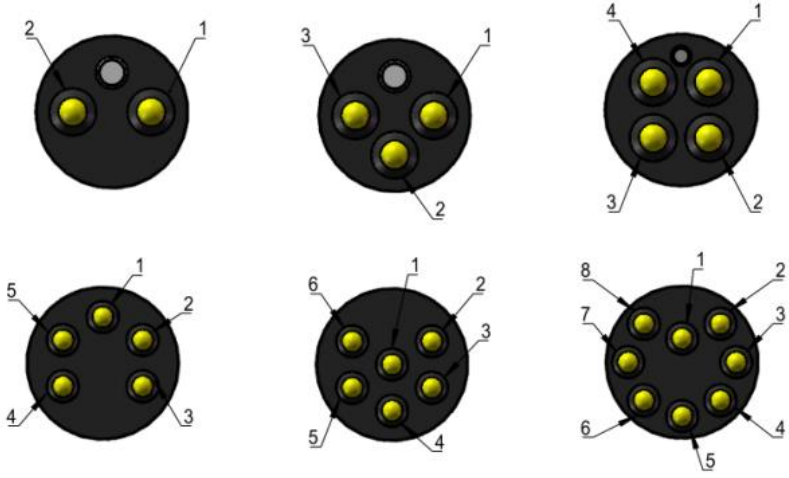
4. All injection molded joints in the diagram do not specify specific structural shapes, and injection molds that meet the marked dimensions are acceptable.





2-4 cores, single core current 16-18A

5-8 cores, single core current 5-10A



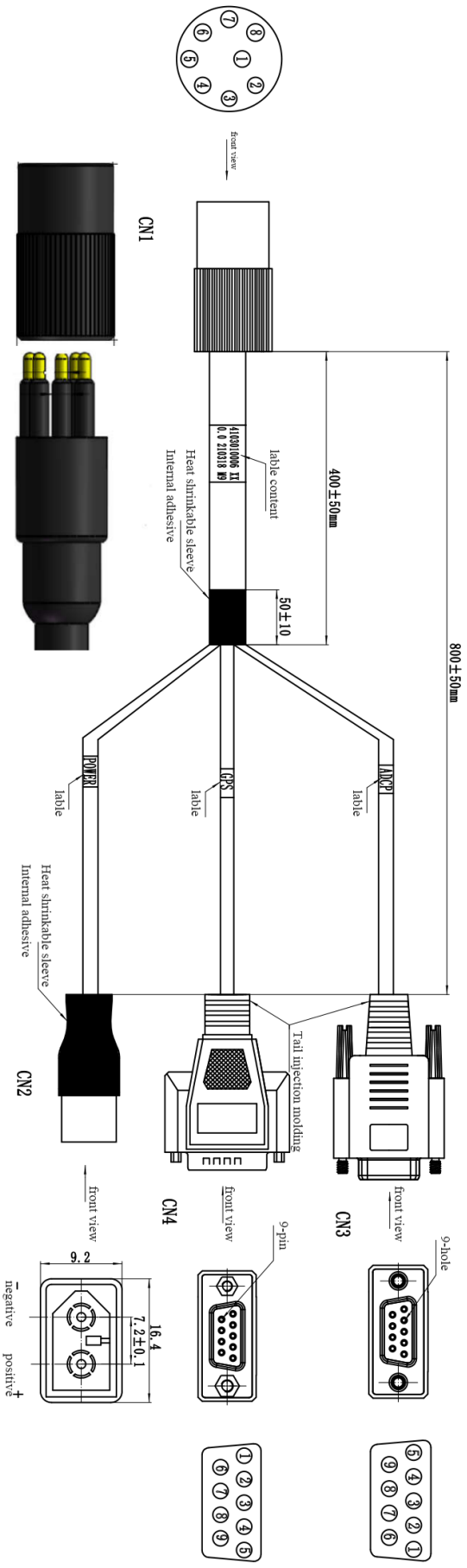
Cell material: brass gold-plated

Shell material: stainless steel/sea copper/titanium

Sealing material: chloroprene rubber

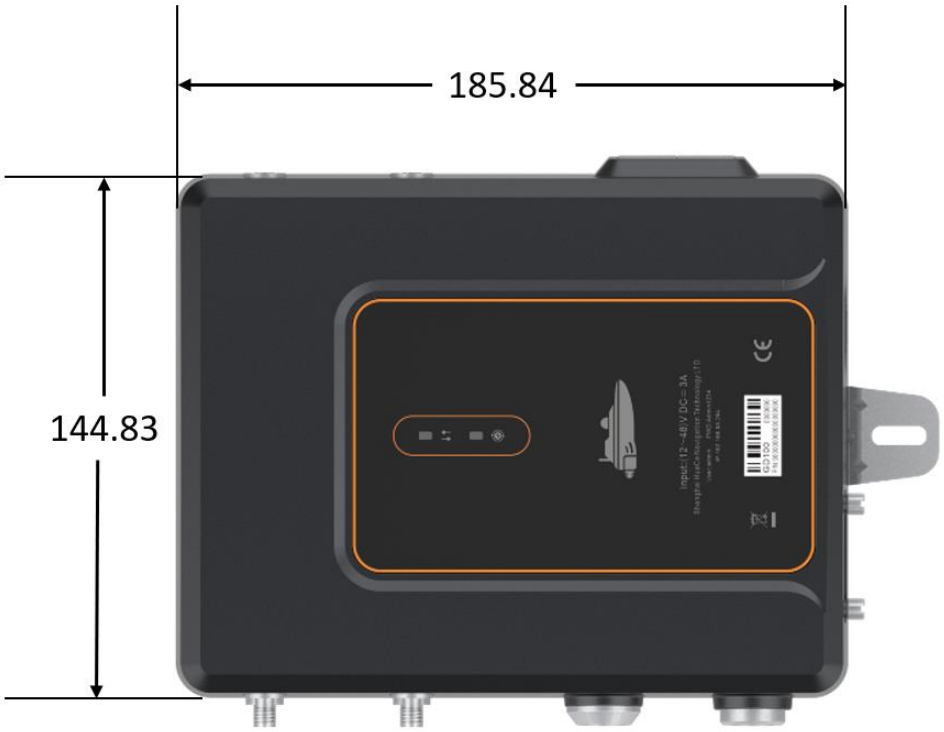
Deep water pressure resistance: 10-70MPa

Cable tensile strength: 50kg



10.7Dimensional specification drawing

10.7.1 GD100 Dimensional Drawing



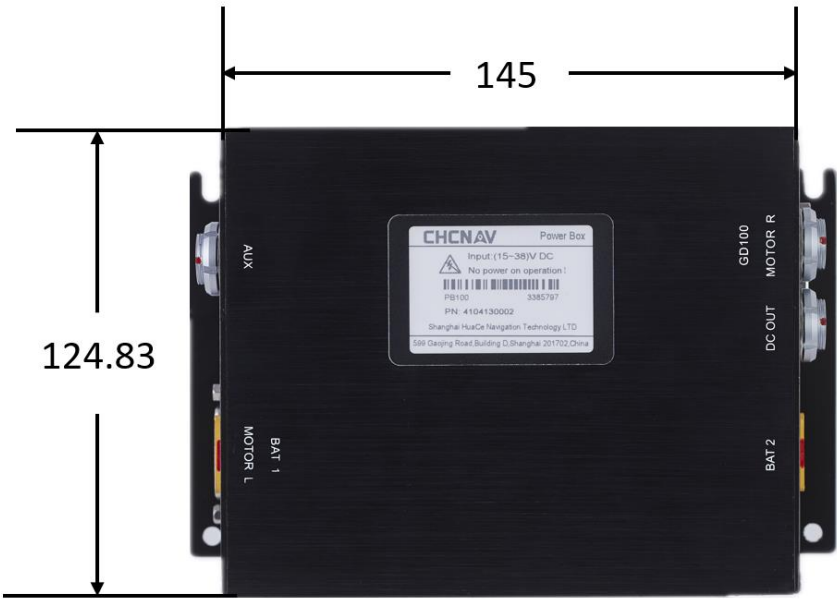
GD100 vertical view

unit mm

GD100 side view

unit mm

10.7.2 PB100 Dimensional Drawing



PB100 top view

Unit mm

PB100 side view

unit mm

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