User Manual for USV Ruide Mobula

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Menus

Chapter 1: Preface 1
1.1 Introduction 1
1.2 Disclaimer 1
1.3 Warning 2
1.4 Intellectual Property 2
Chapter2: Overview of Ruide Mobula 3
2.1 Introduction 3
2.1.1 Application 3
2.2 Hardware Components 3
2.3 Control system introduction 4
2.3.1 Function introduction 5
2.4 Specification 5
2.4.1 Parameters 5
2.4.2 Base station Wi-Fi 6
Chapter 3: Set up 7
3.1 Installation of ship 7
3.1.1 Antenna set up tips 7
3.1.2 Ship body assembly 8
3.2 Computer settings before installation of software 9
3.2.1 Local IP change 9
3.2.2. Virtual serial port settings 9
3.3 Ground Station Software 12
3.3.1 Overview of Ground Station Software 12
3.3.2 Installation of Ground Station Software 12
3.3.3 Language Selection of Ground Station Software 14
3.3.4 Introduction of Ground Station Software Function 15
3.4 Hysurvey Software 24
3.4.1 Overview of Hysurvey 24
3.4.2 Software debugging and connection 25
3.4.3 Data collection 30
3.4.4 Data process and export 31
Chapter 4: Remote controller 36
4.1 Description of the remote controller 36
4.2 Remote controller buttons 36
4.3 Precautions for turning on the remote control 37
Chapter 5. For Charging 37
5.1 Charging for USV battery 37
5.2 Charging for Remote controller 38
Chapter 6. Transportation and storage 38
Chapter 7. Maintenance 38
Chapter 8. Common troubleshooting (FAQ) 39

Chapter 1: Preface

1.1 Introduction

Welcome to SOUTH Surveying Instruments Co., Ltd, which is China's leading manufacturer of surveying equipment including GNSS receivers and Total Stations. To know more about SOUTH, please visit our official website: https://www.southinstrument.com//.

This manual takes Ruide Mobula for example, to explain how to install, set up and use the USV system, as well as the use of the accessories. We recommend that you read and follow all installation, operation, and maintenance information carefully before using the product.

1.2 Disclaimer

Disclaimer for all users. Please read this statement carefully before operation. Once using this product, it is regarded as the recognition and acceptance of the full content of this statement. Minors are not allowed to use this product. Keep away from the crowd, flammable, fragile and dangerous objects during operation. We do not assume any liability for personal injury and property loss (including direct or indirect damage) caused by the following reasons during the use of this product:

1. Damage caused by poor physical or mental conditions of the driver due to drinking, drug use, drug anesthesia, dizziness, fatigue, nausea, etc.
2. Personal injury, property damage, etc. caused by driver's deliberate actions, as well as compensation for related mental damages caused thereby.
3. The product has not been assembled or operated correctly according to the instructions in this manual.
4. Self-modification or replacement of accessories or parts not manufactured by our company, resulting in poor operation of this ship, and other damage caused thereby.
5. Damage caused by using products not produced by our company or imitating our products.
6. Damage caused by driver's operation error or subjective judgment.
7. The poor operation of ship caused by natural wear, corrosion, and line aging.
8. Damage caused by continue sailing while ship issued an abnormal warning.
9. forced the unmanned ship driving in an abnormal condition (such as water or other unidentified material and unnormal assembly, obvious component failure, obvious defects or absence of accessories).

Knowing that the ship is in an abnormal state (such as water or other unknown substances, failure to complete assembly, obvious failure of the main components and obvious defects or missing parts), the ship is still forced to drive and cause damages.
10. Damage caused by running ship in a magnetic field interference zone, a radio interference zone, a government prohibited zone, or when the driver's vision is blurred, poor eyesight, the version is backlist, blocked by obstacles or other conditions that are not suitable for controlling.
11. Operates in bad weather, such as rainy or windy (over level 6), snow, hail, and other bad weather.
12. The ship encounter collisions, capsized, fires, explosions, lightning strikes, storms, tornadoes, rainstorms, floods, tsunamis, land subsidence, ice subsidence, cliff collapses, avalanches, hailstorms, mudslides, landslides, earthquakes, etc.
13. Damage caused by infringement of any data, audio or video data obtained by using this ship.
14. Regarding the battery, such as damage caused by improper use of the protection circuit, battery pack, and charger.
15. unmanned ship in the process of use is not far away from the electromagnetic interference, the use process caused friction collision with other items, aging or damage to parts but not replaced in time and other accident losses.
Damage caused by running near from electromagnetic interference, or the ship has frictional collision with other objects during use, and the parts are aging or damaged but are not replaced and repaired in time.
16. Other losses that are not within the scope of our responsibility.
17. Loss caused by illegal (ineligible) driving.

1.3 Warning

It is prohibited to use this product to engage in illegal and criminal activities.
It is forbidden to use this product without carefully reading the entire contents of this document.
Non-professionals are prohibited from using this product.

1.4 Intellectual Property

The intellectual property rights of this product and manual are owned only by our company. Without written permission, no organization or individual may reprint, copy and publish in any form. If quoted or published, the source must be indicated as our company, and the manual shall not be quoted, abridged and modified contrary to the original intent.

Chapter2: Overview of Ruide Mobula

2.1 Introduction

With 15 years of extensive experience in hydrographic and marine projects and products, SOUTH has released a new generation USV solution – Ruide Mobula. It is a portable professional USV with a unique moon pool design: a separate hole is designed in the middle of the hull for easy replacement of equipment. Customers can freely replace other types of equipment. SU30 can be loaded with Echo Sounder, ADCP, portable SBP and some other survey equipment.

SOUTH SU30 is modular design, with a sturdy hull and stable performance. It combines network bridge, LTE 4G, and radio communications, high accurate automatic navigation algorithm and manual remote-control technology. SOUTH not only has the core technology of USV, SOUTH's own software and portable USV, but also has the ability to customized different software functions and larger size USV solutions for customers. SOUTH USV solution will bring you an efficient and safe project experience.

2.1.1 Application

- High – precision underwater topographical survey
- Hydrographic
- Water management
- Channel analysis
- Water depth data collection
- Difficult environment work
- Long time and large range automatic cruise

2.2 Hardware Components

① Ship body
② Boat battery
③ Two antennas for boat communication
④ Two antennas for network bridge
⑤ One antenna for manual remote
⑥ Network bridge
⑦ Remote controller
⑧ Battery adapter
⑨ SDE-18S
⑩ RTK
⑪ Moon pool fitting

2.3 Control system introduction

Ruide Mobula control system consists of GPS module, COMPASS module, remote controller, ground station, main control module and motor drive. Users can freely choose to use the remote control or ground station for control. Ruide Mobula has various functions such as autonomous navigation, constant speed cruise, automatic return, navigation planning, and status monitoring.

2.3.1 Function introduction

★ Automatically complete the set tasks and return.
★ Multiple navigation modes
★ Accurate navigation along the planned route
★ The number of waypoints can be set to be greater than 256
★ Adaptive adjustment of propeller power parameters
★ Bus support to facilitate the expansion of functional modules
★ Automatically return to home after low battery and loss of connection
★ With track reproduction function
★ Can be customized according to user needs

2.4 Specification

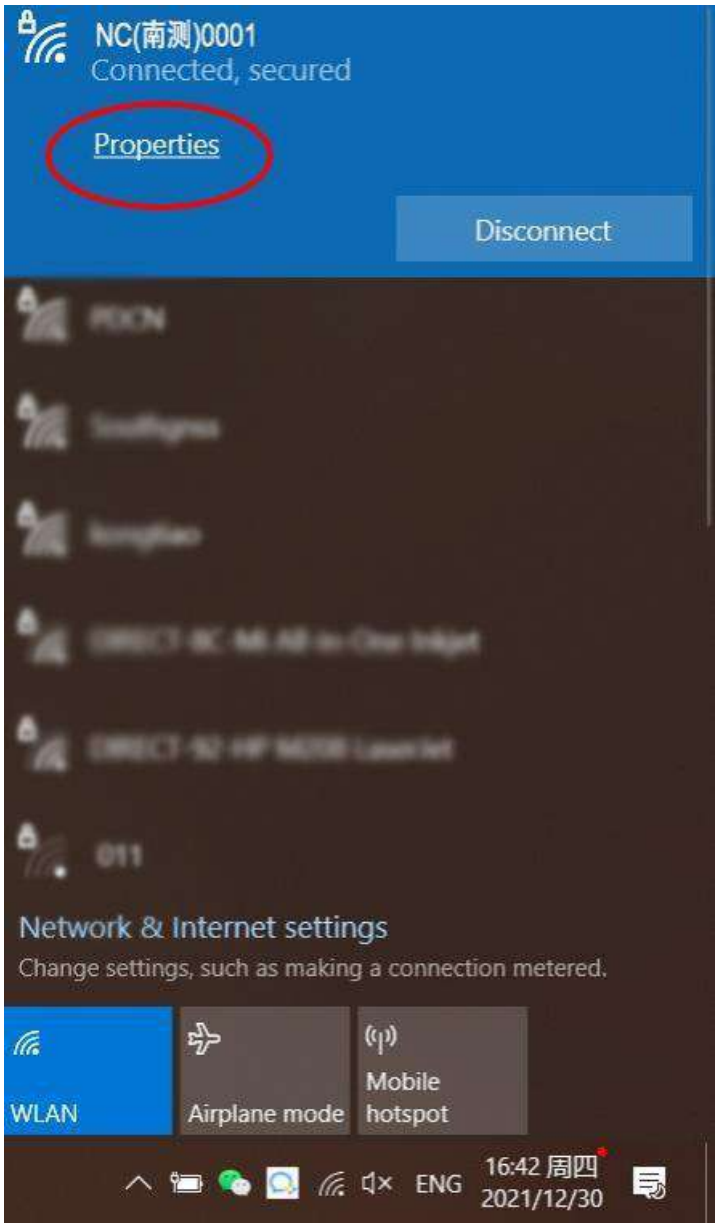
2.4.1 Parameters

Physical	
Dimensions	1205mm×560mm×440mm
Weight (no instrument)	7KG
Performance in wind and wave-resistance	≤smooth-wavelet 0.1~0.5m
	≤windspeed 3BF, 3.4~5.4m/s
Material Draught	High-impact GFRP
Maximum speed	≤15cm
Communication	6m/s
Methods	
R/C Range	Network bridge 5.8G, R/C 2.4G, LTE 4G (optional)
Battery	2KM
Type	
Power	Lithium polymer
Duration	29.4V 35Ah
Waterproof	4 hours with auto-pilot mode
Camera	IP68
Resolution	
Infrared Distance	1920×1080
Focus mode	≥20m
Digital zoom	Automatic / Semiautomatic / manual
Waterproof	16 times
	IP65

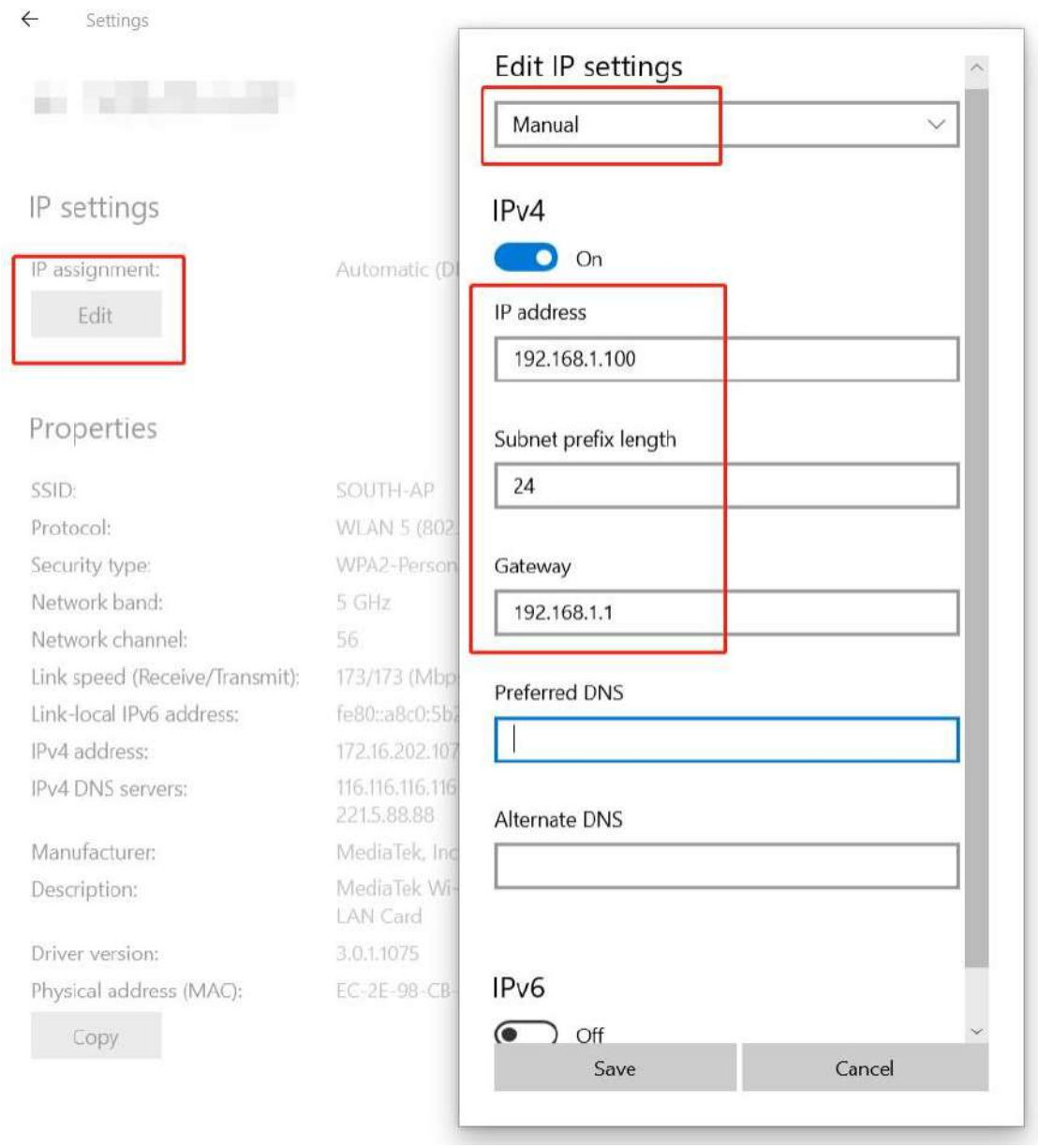
2.4.2 Base station Wi-Fi

WLAN name：NC(南测)0001 Password：
nc123456 or（nc12345678）

Select the pointed Wi-Fi and enter the Properties.



Change the “Edit IP settings” to “Manual” mode, and input the information as the following figure shows



After the setting, Wi-Fi can be connected successfully.

Chapter 3: Set up

3.1 Installation of ship

3.1.1 Antenna set up tips

Ship control system control information is transmitted by point-to-point data transmission, equipped with two 5.8G spring antennas, which are installed on the data transmission antenna base of the hull; the ground base station is

equipped with two 5.8G short antennas for point-to-point transmission of signals with the ship; remote control information Use 2.4GHz frequency band for transmission, equipped with a 2.4GHz antenna, install the antenna on the remote control receiving antenna base of the hull.
When installing or removing the antenna, please rotate the ring in the bottom of the antenna, do not rotate the whole antenna pole to avoid damage of it. Please keep no obstacles between the remote control/ground station and the ship during use, so as not to affect the communication distance.

3.1.2 Ship body assembly

1.Check each accessory according to the accessory list, and start the installation according to the installation steps if no problem found out in the first check. Before the installation, ensure that the battery, bridge and remote control are fully charged.

2. Installation
a. Put the accessory fitting into the moon pool, please note that the two ends of the diamond-shaped pattern in the bottom of the accessory fitting are parallel to the longitudinal center axis of Poseidon SU30. And make sure that the bottom of fitting and the bottom of the moon pool in the same plane. This can help reduce water flow resistance.
b. Put the 18S into the moon pool. Connect the cables of RTK and 18S to the ship control box. Please note that the interface must be connected accurately and steady.
c. Put the top (front cover with logo) on after cables are on the right places.
d. Set up the battery of ship, connect the three power supply interfaces on the battery, the two sides are power supply interfaces for the propeller, and the upper one is for ship control.
e. Set up the back cover (cover with RTK support rod). Please pass the RTK cable through the hole of the RTK support rod in order to connect to the RTK.
f. Connect the other end of the RTK cable to the 5e-pin port, and the RTK is installed.
g. Set up the antennas of communication and the antenna of remote controller.
h. Set up the antennas of network bridge on the top of the bridge, and also the WIFI antenna on the side of the bridge.
i. Turn on the battery power switch, wait for the completion of ship self-inspection.

3. Check each interface again. If there is any looseness, please reinstall and tighten it.

4. Before putting the ship into the water, please connect the ship to ground

station, debug the computer serial port, and connect ship control software and measurement software. Please wait patiently for the success of the ship self-inspection before operation.

5. Precautions
a. When the ship is operating, please keep away from shallow waters to avoid stranding, and please control and operate the ship under the condition of visibility.
b. When the remote control emits a beeping sound, it means that the ship is about to reach the farthest distance, please control the distance and return home in time.
c. The ship control software will display the real-time battery level. When the level is too low, please return the ship and recharge the battery in time.
d. Please study strictly according to the contents of the manual before operating the auto-pilot function, please avoid obstacles and shallow water areas during the routing plan.

Please refer to the installation video on YOUTUBE: (23) Installation Guide of SU30 Poseidon USV - YouTube

3.2 Computer settings before installation of software

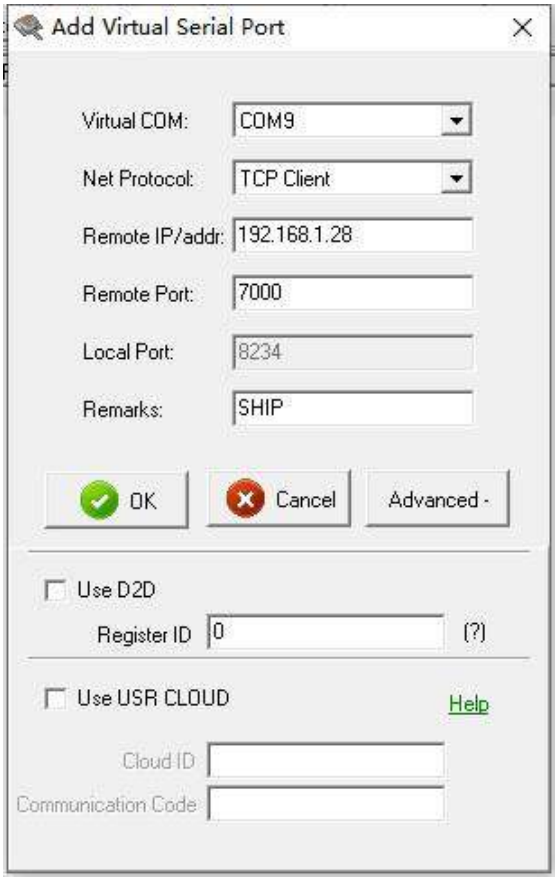
3.2.1 Local IP change

Please refer to Part 2 (2.4.2), input the IP address and details.

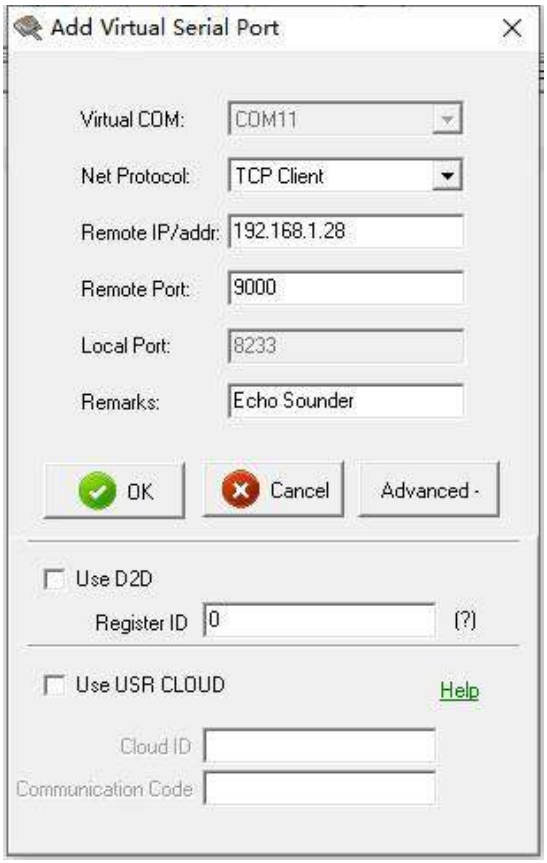
3.2.2. Virtual serial port settings

First download the human virtual serial port software (download address: http://www.usr.cn/Download/31.html), and install it on the local computer.
Open the virtual serial port software, click the add button, a window pops up is shown as following figure.

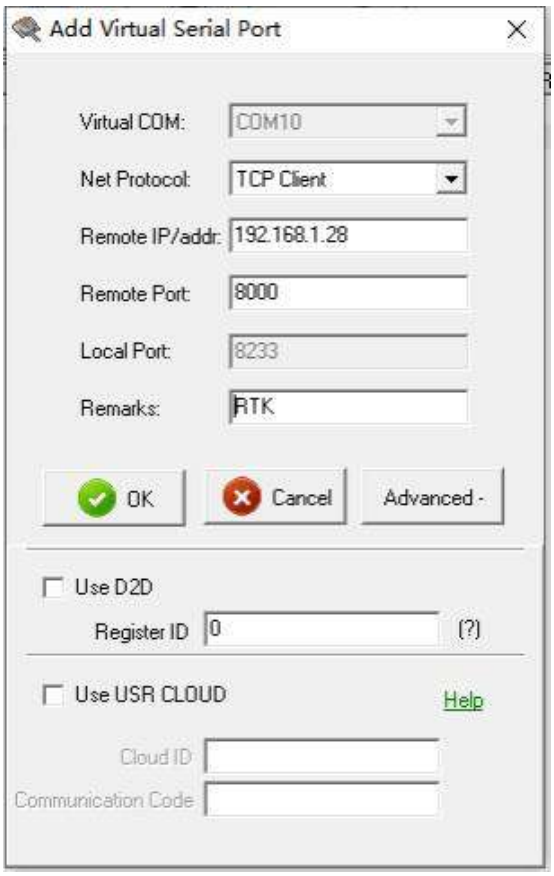
Add virtual serial ports respectively as follows (the serial port number can be freely selected)


Add Virtual Serial Port
Virtual COM:
COM9
Net Protocol:
TCP Client
Remote IP/addr:
192.168.1.28
Remote Port:
7000
Local Port:
8234
Remarks:
SHIP
OK
Cancel
Advanced -
Use D2D
Register ID
0
(?)
Use USR CLOUD
Help
Cloud ID
Communication Code

USV（IP）


Add Virtual Serial Port
Virtual COM:
COM11
Net Protocol:
TCP Client
Remote IP/addr:
192.168.1.28
Remote Port:
9000
Local Port:
8233
Remarks:
Echo Sounder
OK
Cancel
Advanced -
Use D2D
Register ID
0
(?)
Use USR CLOUD
Help
Cloud ID
Communication Code

RTK（IP）



Echo sounder (IP)

The overall IP settings are shown in the figure.

Note 1: The serial port number can be customized according to the actual situation, as long as it does not conflict with the computer's existing serial port.
Note 2: The port is associated with the serial number of each set of ship control and cannot be modified. For the specific port number, please refer to the instructions in the accompanying documentation.

3.3 Ground Station Software

3.3.1 Overview of Ground Station Software

South owns the independent R&D ground control software, masters the core technology. It can support tasks planning, paths management, data collection, etc. In the case of static water, the accuracy of the sailing path can be 0.1m, and the accuracy error will not exceed 1m in the case of level 2 sea condition (Smooth-wavelet).

3.3.2 Installation of Ground Station Software

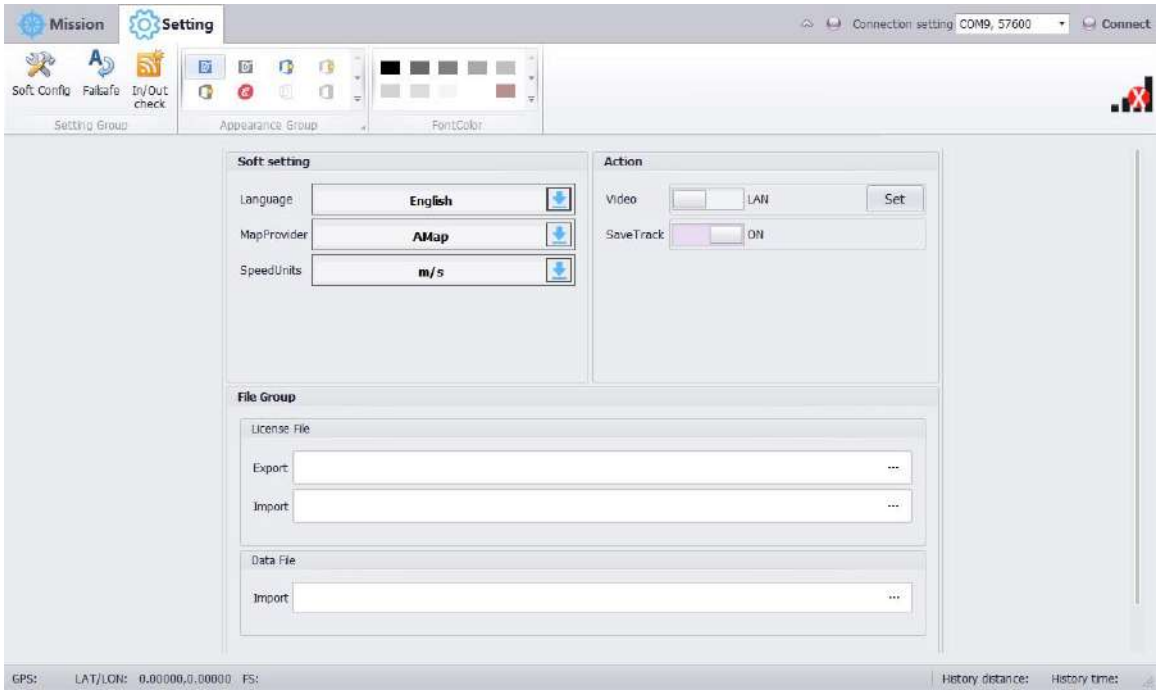
a. Open the ground station software installation file.
b. Enter the page of the installation wizard and click the "one-click installation" button to start the installation.

c. If you need to change the default installation location, click the “ ”button .

d. The program enters the installation progress interface.

e. The interface after installation is shown as the following figure. You can click the " 开始使用 " button to start the ground station program.

3.3.3 Language Selection of Ground Station Software



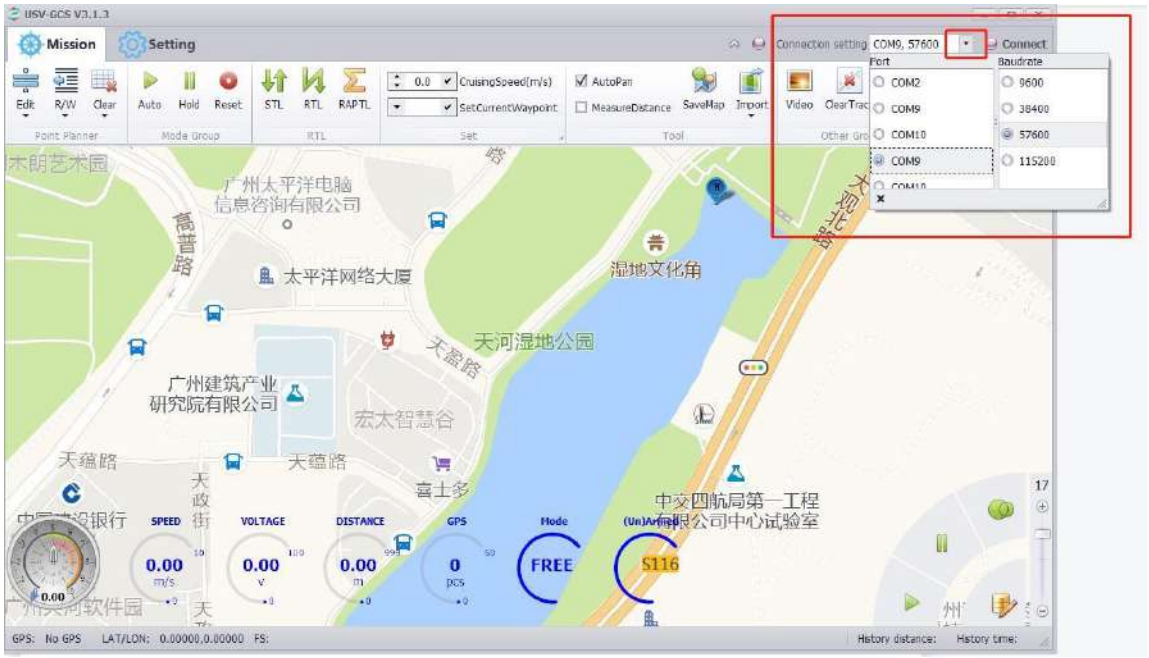
3.3.4 Introduction of Ground Station Software Function

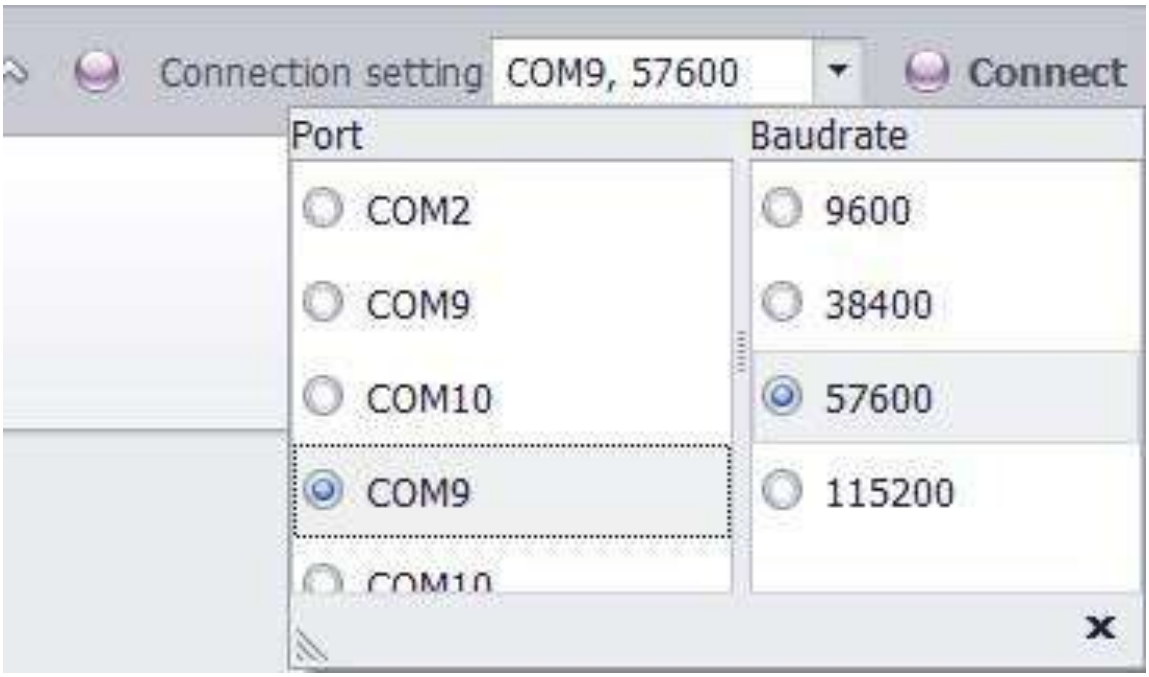
3.3.4.1 Start Hydra

Start the installed "Hydra Unmanned Ship Ground Station" software and enter the Ribbon style main interface.

3.3.4.2 Communication connection

The screen will display the "Connection setting" in the top right-hand corner. Select the communication port, the baud rate is 57600 (please ask technical support for specific baud rate); and then, click the "Connect" button to connect to the ship control.





3.3.4.3 Navigation control interface

The navigation control interface displays the navigation route and ship control status information of the unmanned ship, and it supports real-time control and real-time video viewing. The interface is mainly composed of "status information bar", "cruise speed setting", "map", "control button", etc., which will be explained separately below.

3.3.4.4 Button bar description

Button	meaning	Remark
(1) Operation		
Auto	Start the mission, the USV will perform the planned task.	After the task is planned and sent it to the ship control.
Stop	Pause the task in progress.	
Return home	After clicking the return button, the USV will automatically return to home according to the method set in the "return mode". The default is "backtracking".	Note: Use caution when there is an obstacle between the current position of the USV and the home point.
Reset task	Reset the task, starting from the first navigation point planned, or the current navigation point set in the plan.	
(2) Other		
Video monitoring	Real-time video monitoring.	Need to install the camera
Clear track	Clear the navigation track on the map	

3.3.4.5 Ship control status information bar

From left to right:

Dash board: The direction and speed information of the USV;

Current speed: the cruising speed of the USV, the default unit is m/s;

Voltage: The real-time voltage of the ship control, the operator can judge the battery level based on this data;

Distance: the distance from the current point to the next waypoint, it is in meters or kilometers;

GPS: GPS satellite coverage;

Operating mode: The current sailing mode of the USV: automatic, pause, return, manual.

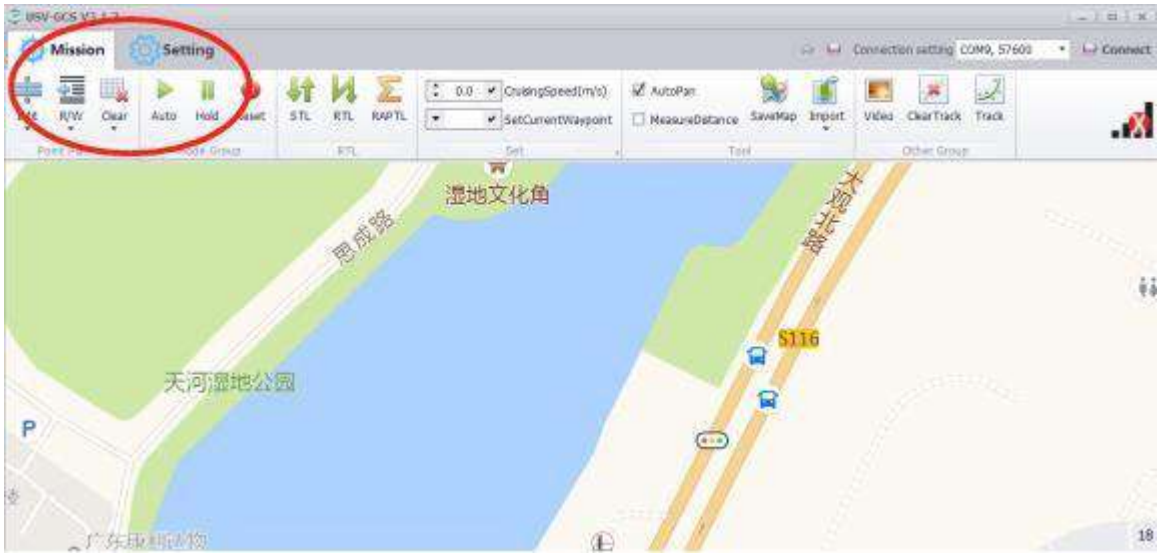
(Un) Armed: Check whether the ship is locked

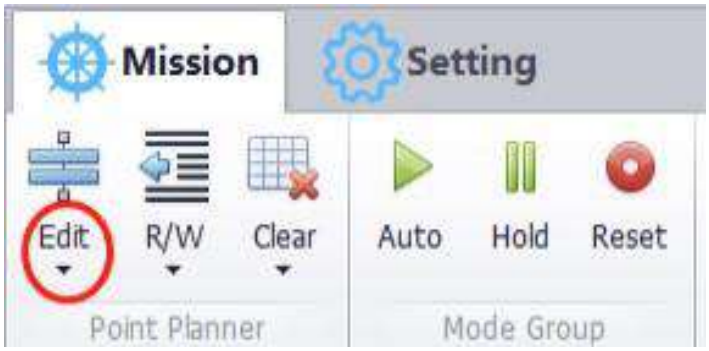
3.3.4.6 Mission planning

The mission planning interface is mainly used to plan the routes and missions of the USV.
Point planner: Support automatic or manual route planning, save or load planned waypoints and route data.

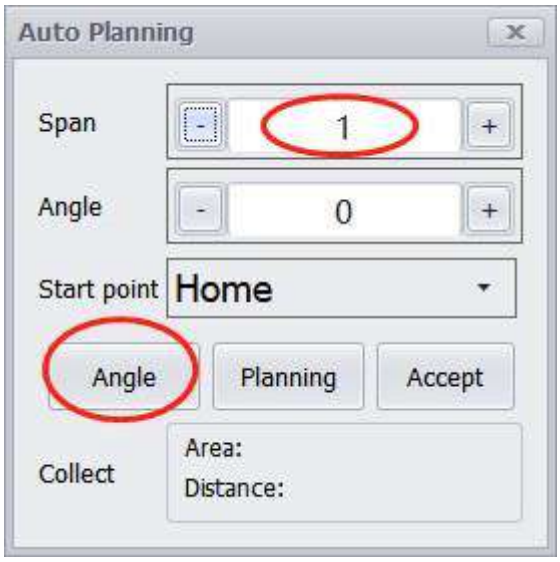
Tool: general map tools, such as distance measurement.

Manual route planning steps:



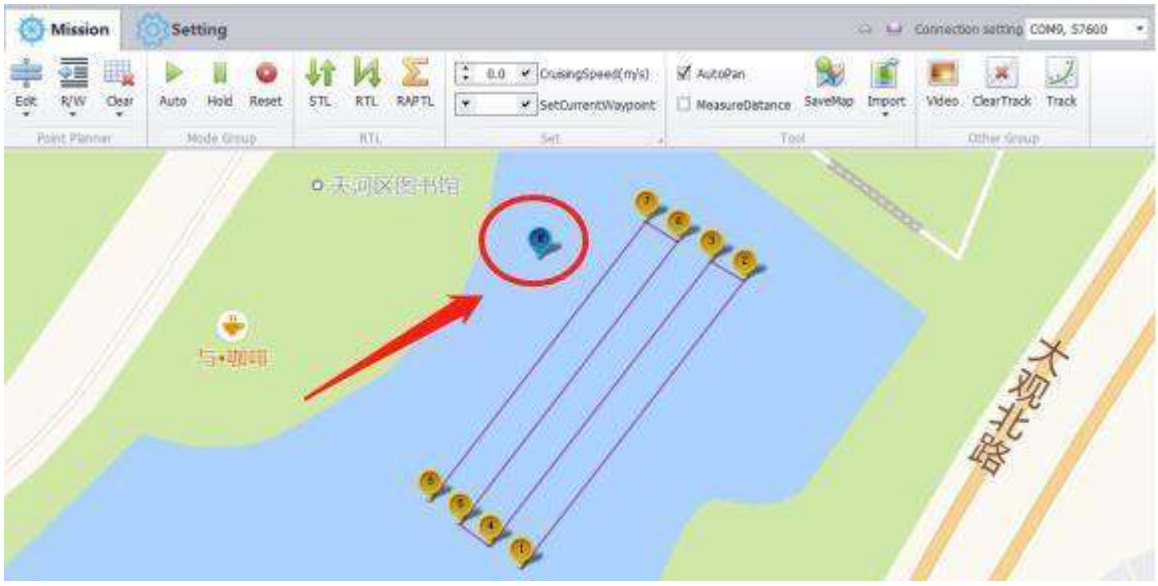


Enter the required route spacing in the figure (1 here is the default value).Then click the Angle button, the software will adapt to the best angle of your route.

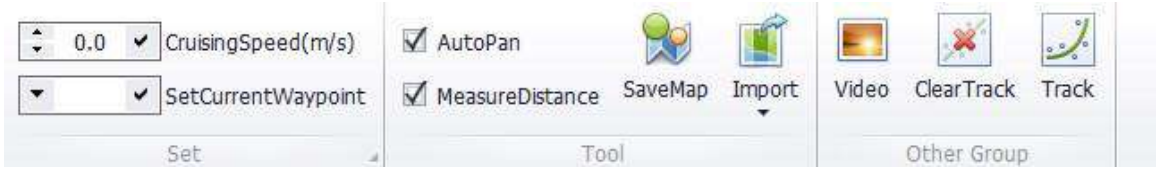


The planned route is shown in this figure. Please avoid obstacles and shallow water areas on the route. Please drag and set the home point on map. (The

home point set for this route).



3.3.4.7 The other option details:

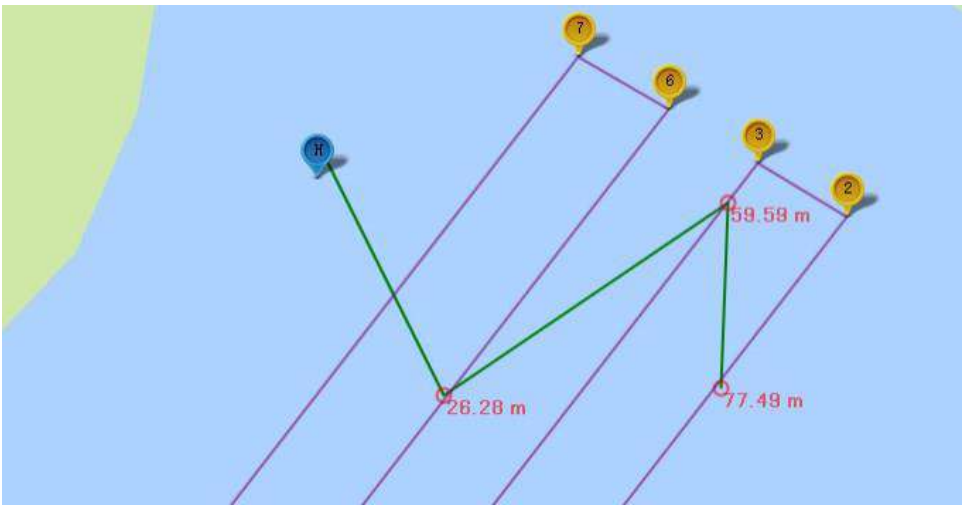


Set the speed of automatic cruising (1.8m/s is recommended for general operation).

Set the starting point of the route (you can avoid detours and save working time).

After turning on the “AutoPan” option, the map will move with the movement of the USV.

Measure the distance from any point on the map to another point, as shown below.



Cache the map, after the cache, the map can be presented without the network.

Import background images in two formats, DXF and KML.

Clear track and view historical track.

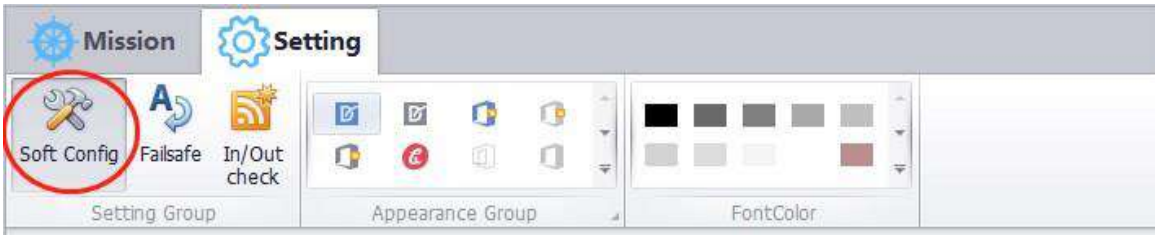
3.3.4.8 Parameter settings

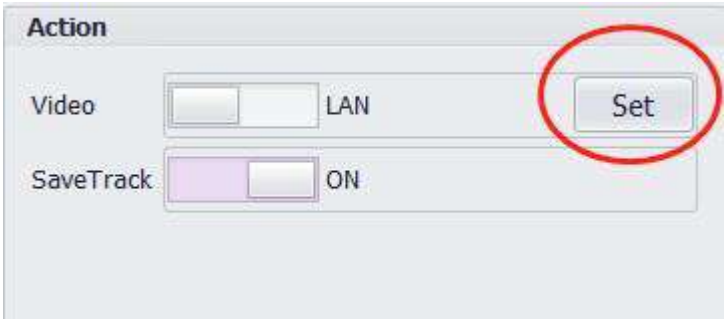
The parameter settings interface is used to set basic parameters and adapt to user habits.

Button	Meaning	Remark
Software settings		
language	Simplified Chinese; English	

Map source	Bing Maps, Bing Satellite Maps, AutoNavi Maps, AutoNavi Satellite Maps, Google China Maps, Google China Satellite Maps, Google China Hybrid Maps	Recommend Google Map
Speed unit	Meters/second; kilometers/hour; feet/second; miles/hour; knots/hour	
Action settings		
Map follow	After enabling map following, the map will move with the USV.	
Return home mode	Return home in a straight line, return home on the same route.	
Battery and fault protection		
Residual voltage	When the voltage is lower than the set value, the fault protection will be triggered.	Low voltage fault protection value setting suggestion: 8S battery 24v, 7S battery 21v

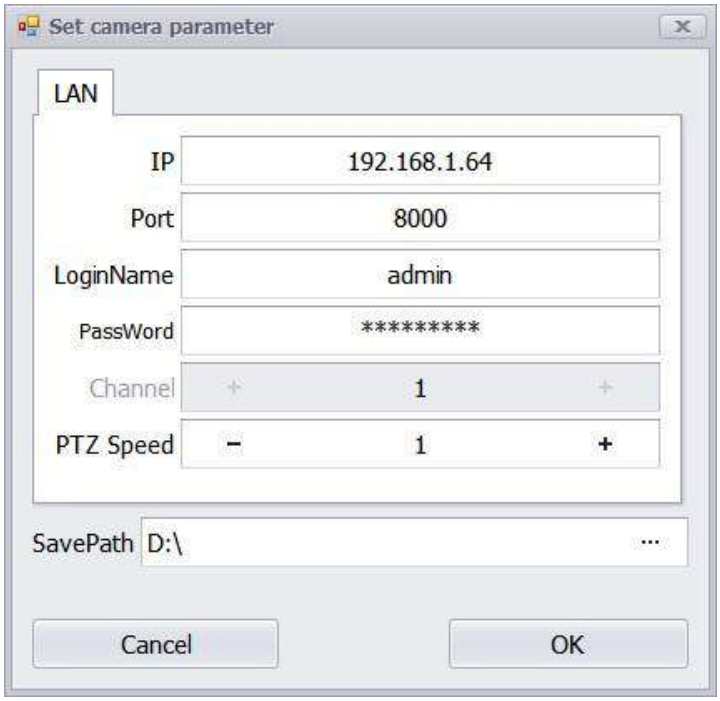
3.3.4.9 Video settings





Select "LAN" under “Software Configuration” in the "Settings" page, and then click "Set", the video parameter configuration window will pop up.

IP: 192.168.1.64
Port: 8000
Login Name: admin
Password: nc123456.



Video monitoring button: enable or disable video. When the video is enabled, a small video window will be opened on the screen, as shown in the figure below, the video window supports zooming.

3.4 Hysurvey Software

3.4.1 Overview of Hysurvey

Hysurvey software is a single beam echo sounder measurement software,

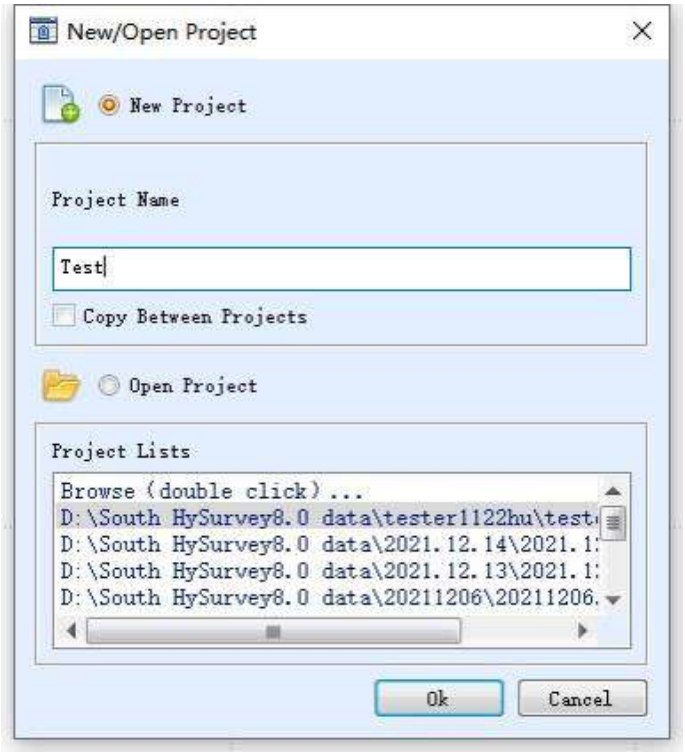
supporting Windows system. Simple operation, stable operation, professionalism and multi-function make Hysurvey one of the most widely used hydrographic software.

Ruide Hysurvey supports all types of GNSS receivers, supports the multiple sensor correction, such as SVP, tide station and so on. Hysurvey can process all the data and export the coordinate of water bottom. Hysurvey supports the output of data in a custom format, which is convenient for data export, and allowing users to perform data post-processing more quickly and conveniently.

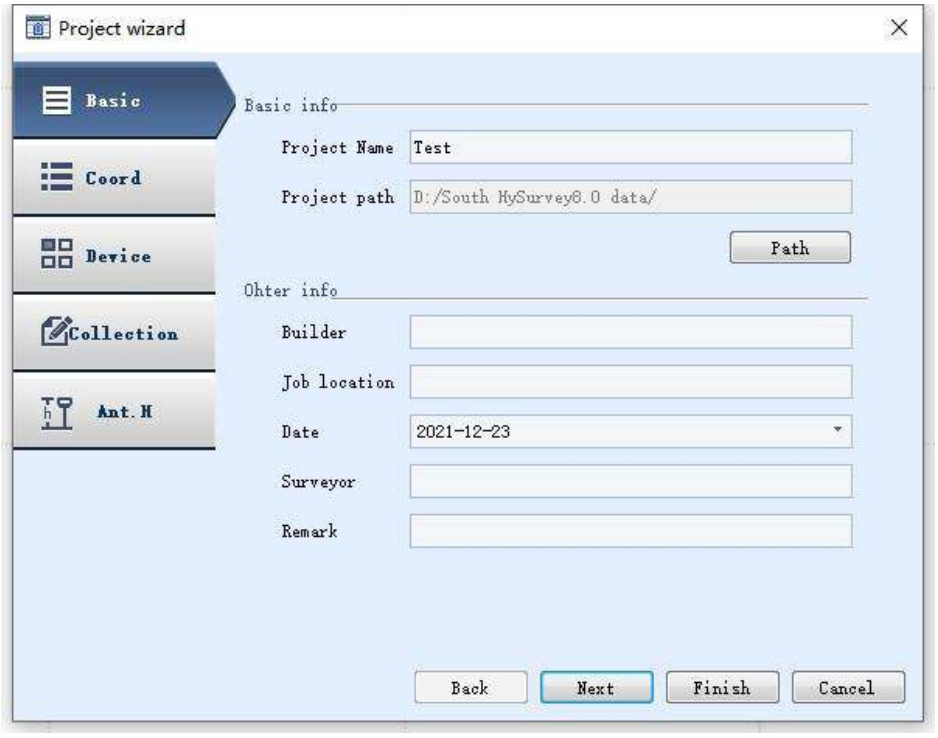
3.4.2 Software debugging and connection

Open the measurement software-HySurvey.

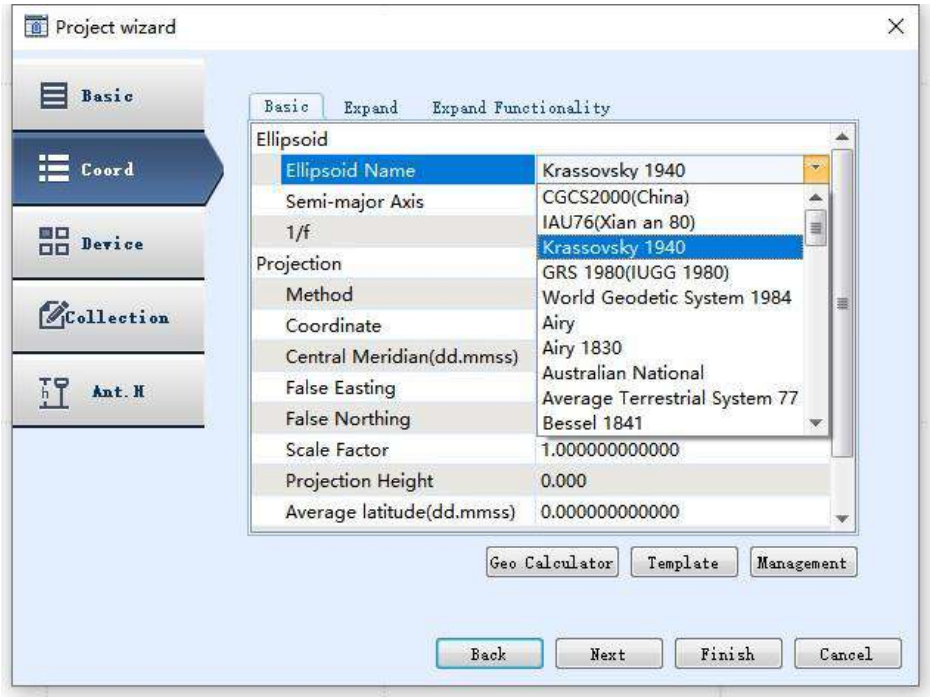
Create a new project. You can create a new project or open the project you have saved before.

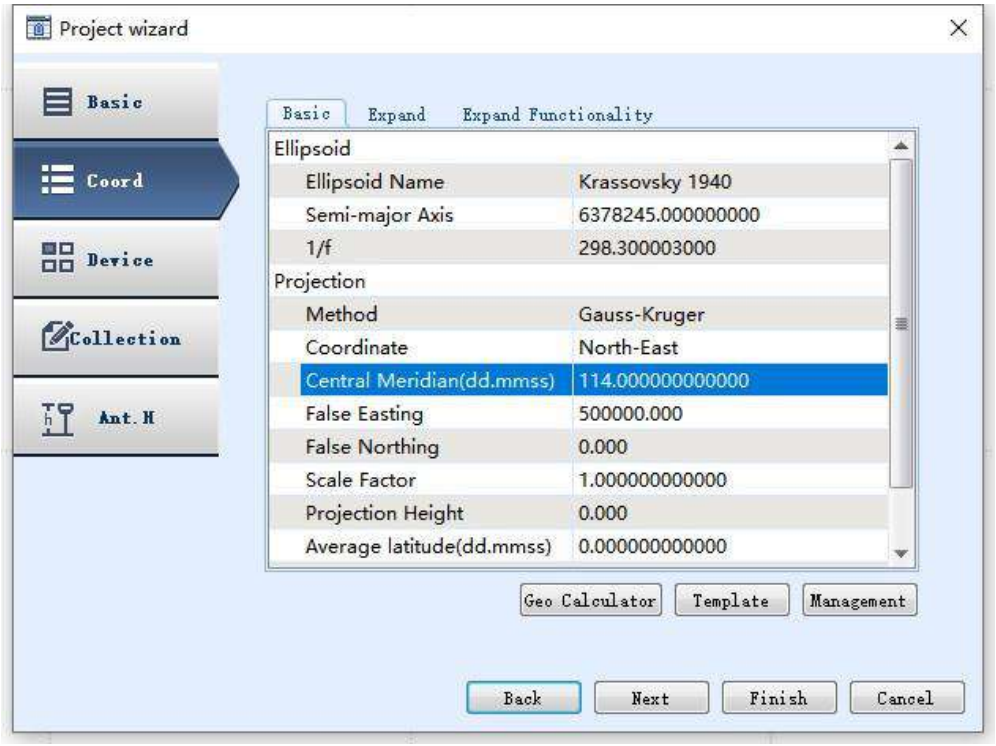


Enter the setting page



Select the coordinate parameters of the location

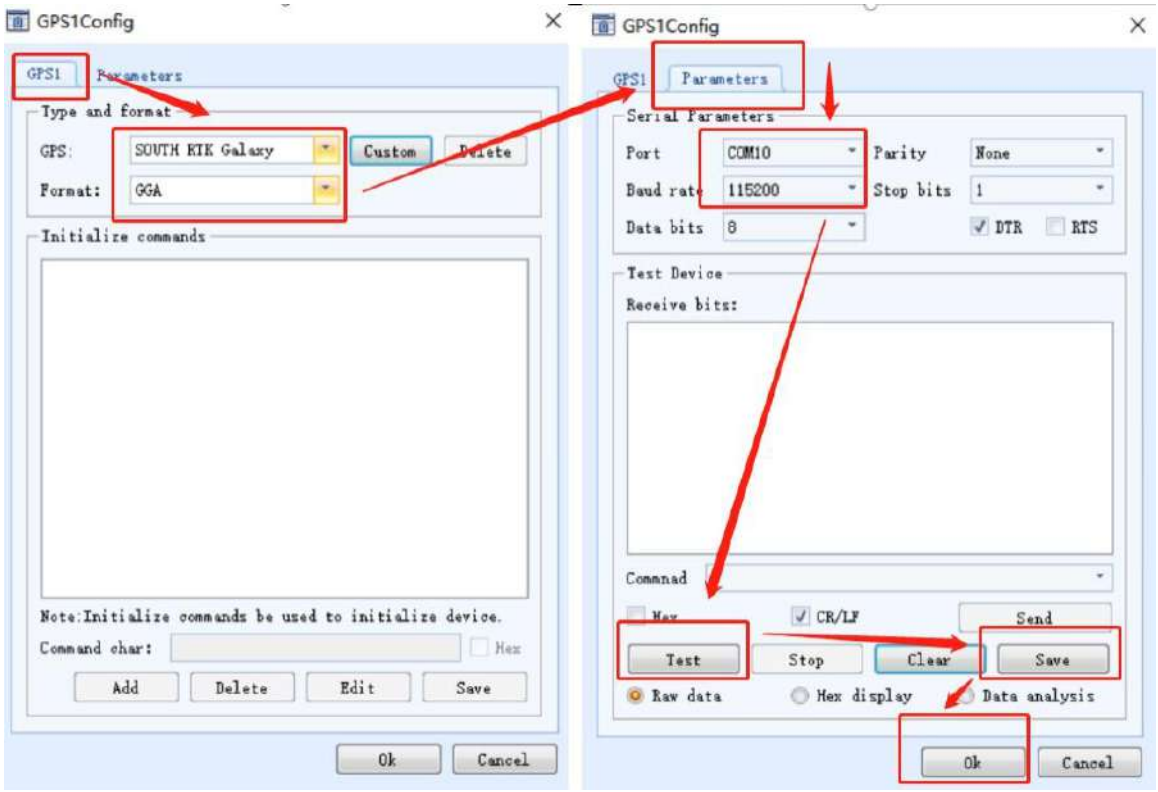


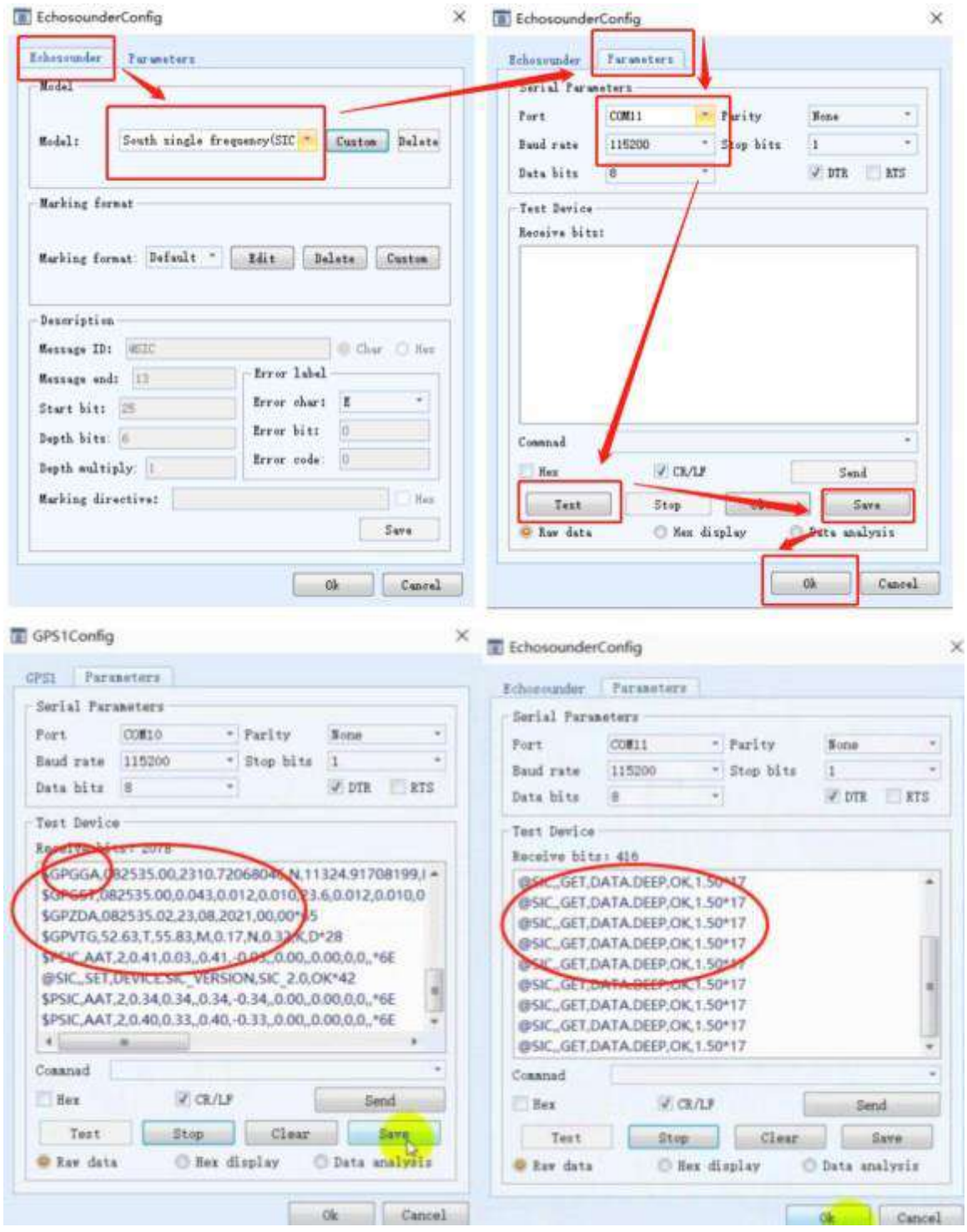


According to our previous IP settings, set the RTK and Echo sounder parameters.

Remarks	COM Name	Parameters	COM State	Net Protocol	Remote IP	Remote Port
SHIP	COM9		Not used	TCP Client	192.168.1.28	7000
RTK	COM10		Not used	TCP Client	192.168.1.28	8000
Echo shounder	COM11		Not used	TCP Client	192.168.1.28	9000

Project wizard
Basic
Coord
Device
Collection
GPS1: Enabled Serial COM10 Setup
Echosounder Enabled Serial COM11 Setup
GPS2: Enabled Serial COM5 Setup
Gyrocompass Enabled Serial COM5 Setup


GPS1Config
GPS1
Parameters
Type and format
GPS:
SOUTH RTK Galaxy
Custom
Delete
Format:
GGA
Initialize commands
Note:Initialize commands be used to initialize device.
Command char:
Hex
Add
Delete
Edit
Save
Ok
Cancel
GPS1Config
GPS1
Parameters
Serial Parameters
Port
COM10
Parity
None
Baud rate
115200
Stop bits
1
Data bits
8
DTR
RTS
Test Device
Receive bits:
Command
Hex
CR/LF
Send
Test
Stop
Clear
Save
Raw data
Hex display
Data analysis
Ok
Cancel

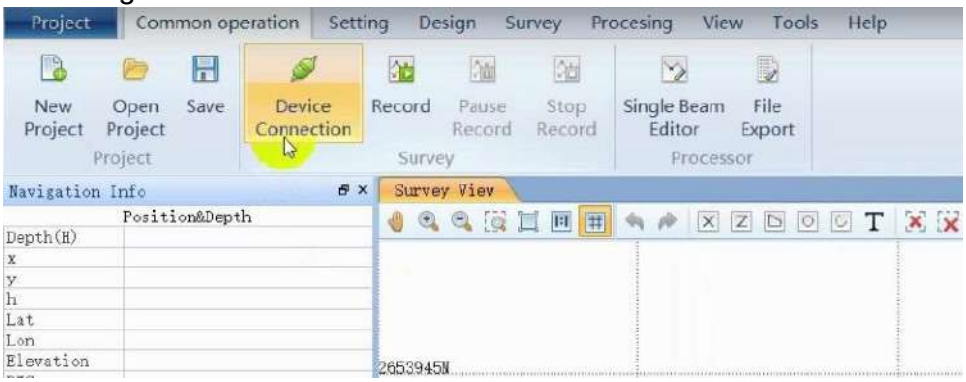


The test result shows that the device is successfully connected

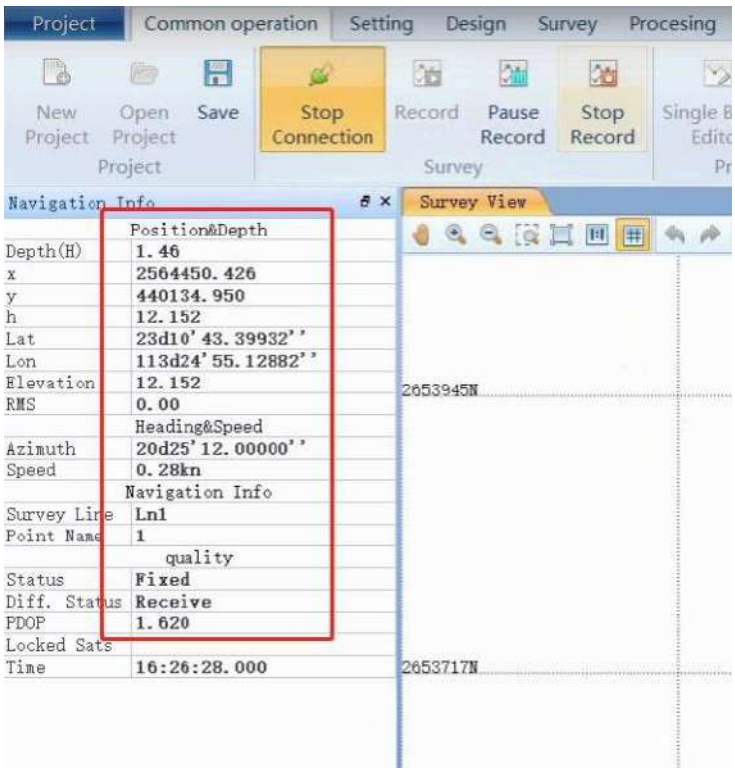
Set the solution status of RTK and the method of collecting data here.

3.4.3 Data collection

Enter the “Common operation” page, click “Device Connection” to start collecting data

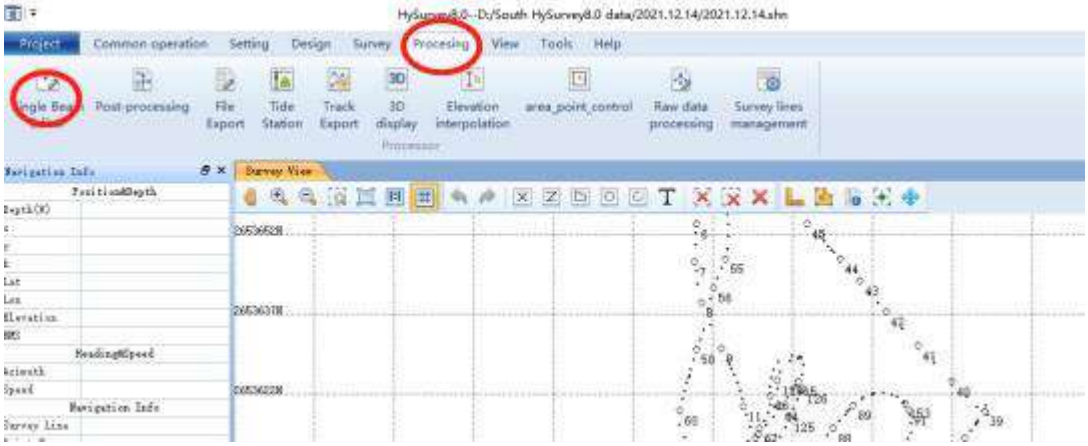


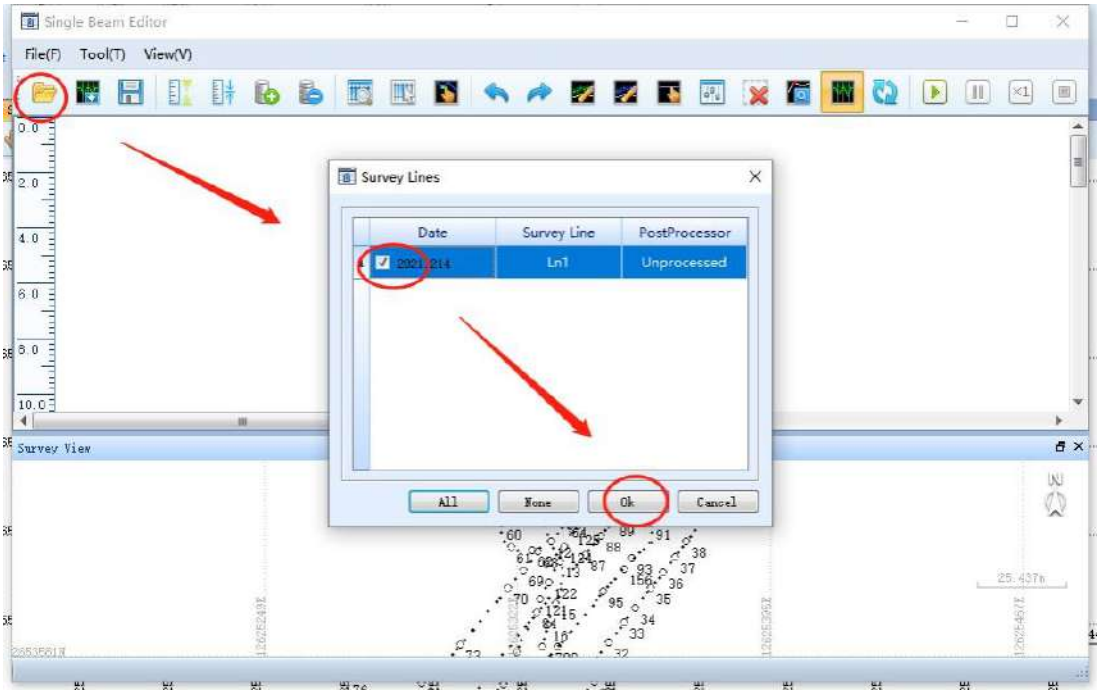
Real-time measurement data will appear on the left side of the screen.



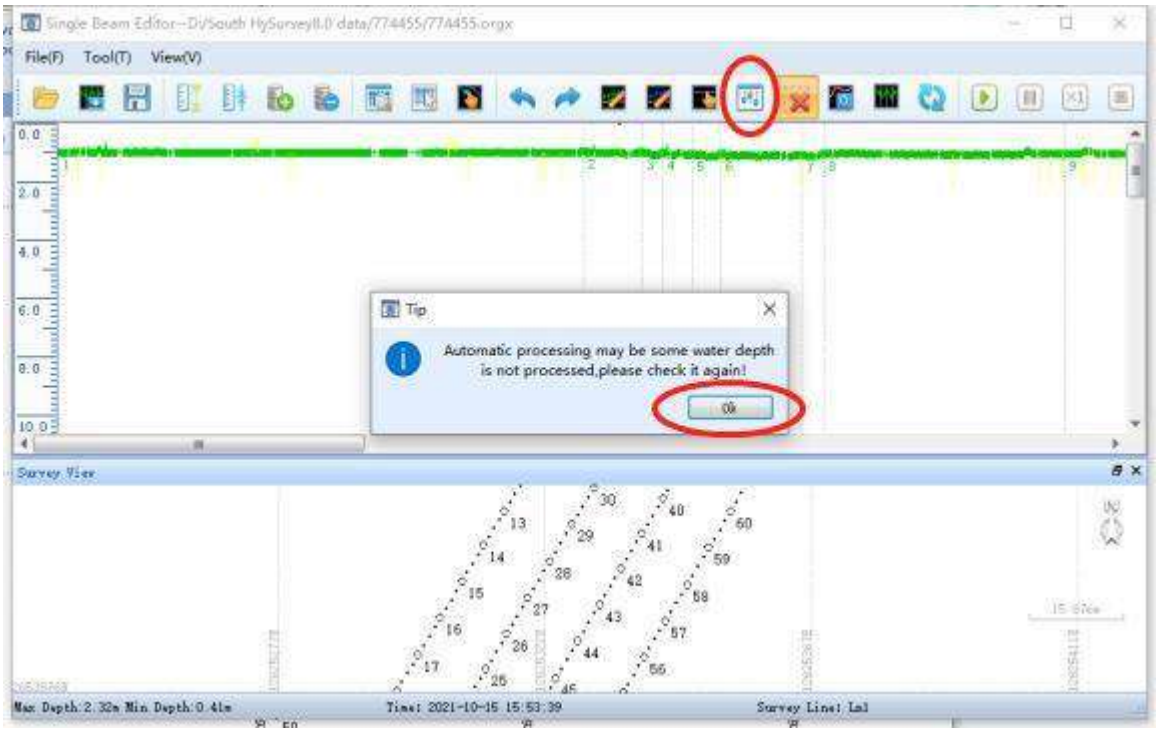
3.4.4 Data process and export

Enter the “Processing” page, select the “Single beam editor”, and click “OK” to import the data





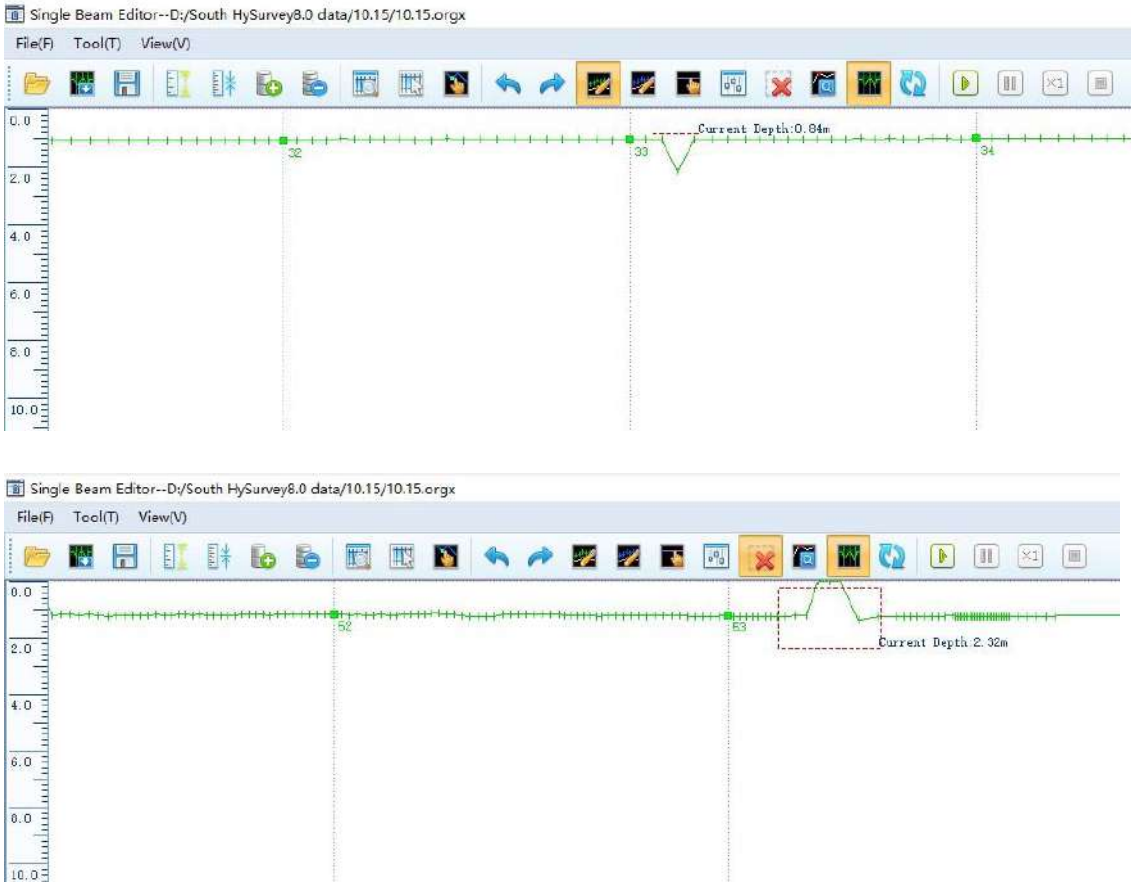
Click “Auto” button to process water depth data automatically.



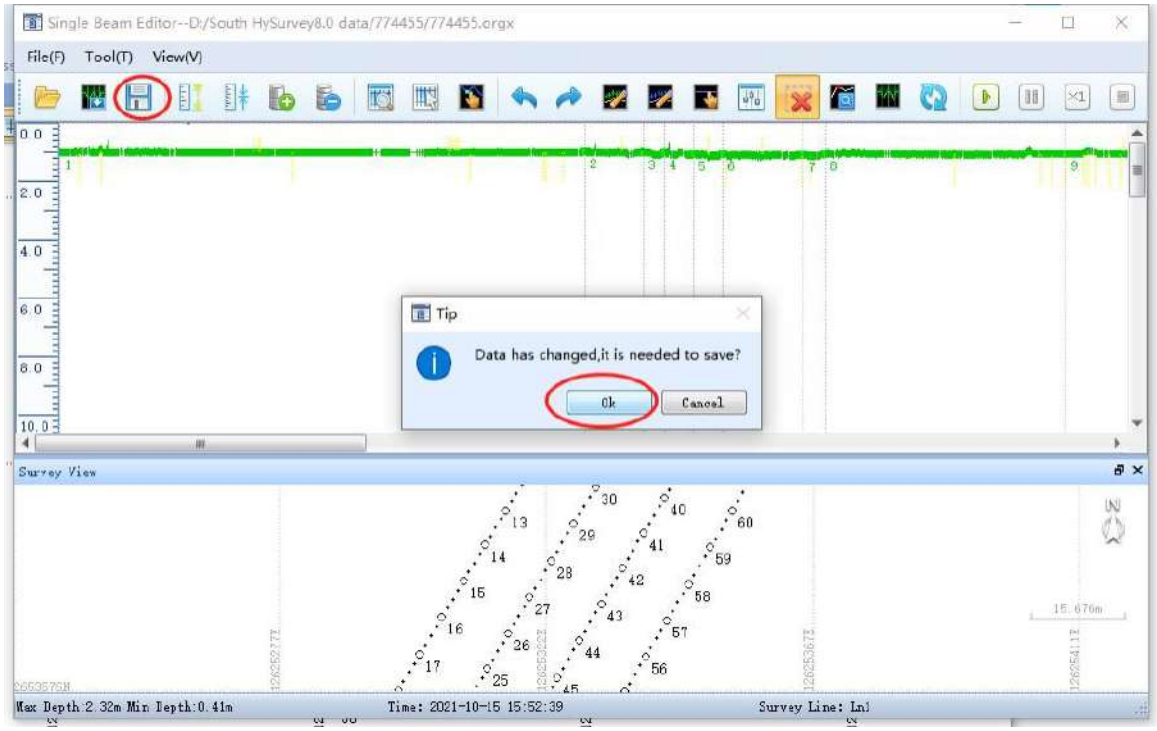
There are two ways to modify the wrong water depth data.

① Modify the wrong water depth data directly.

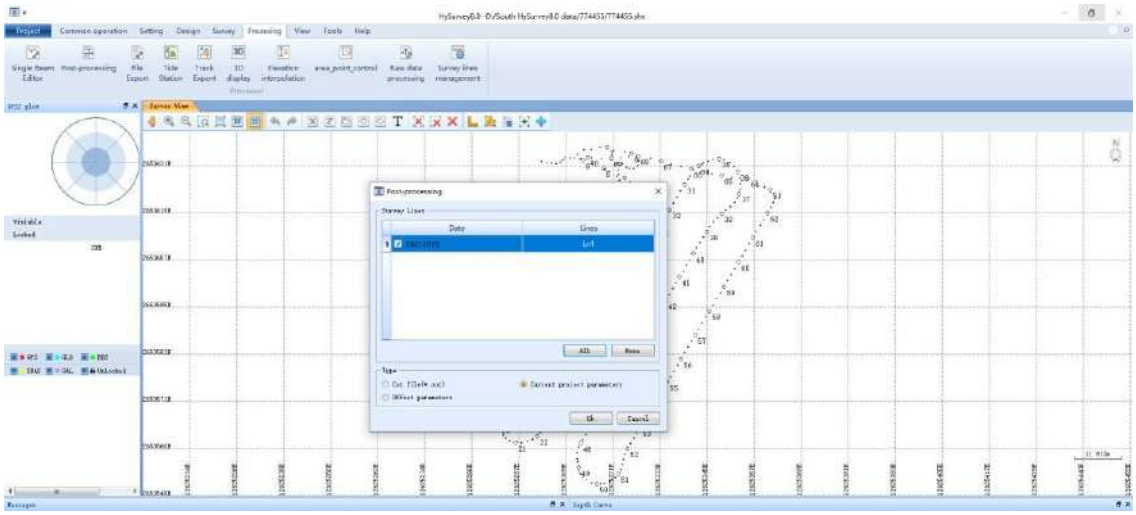
② Delete the error point.



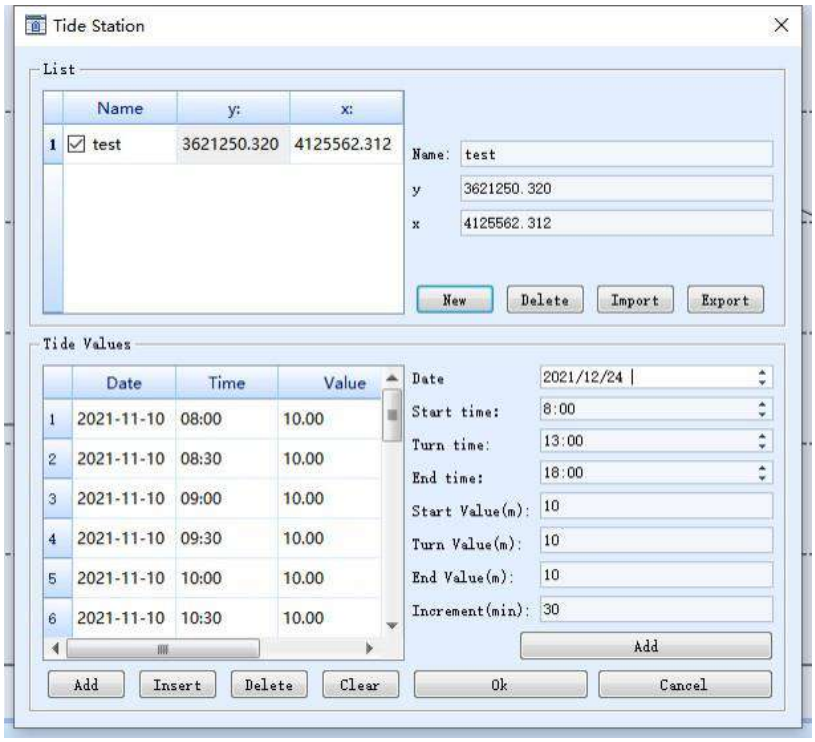
Click “ Save” and “Ok” to save the data.

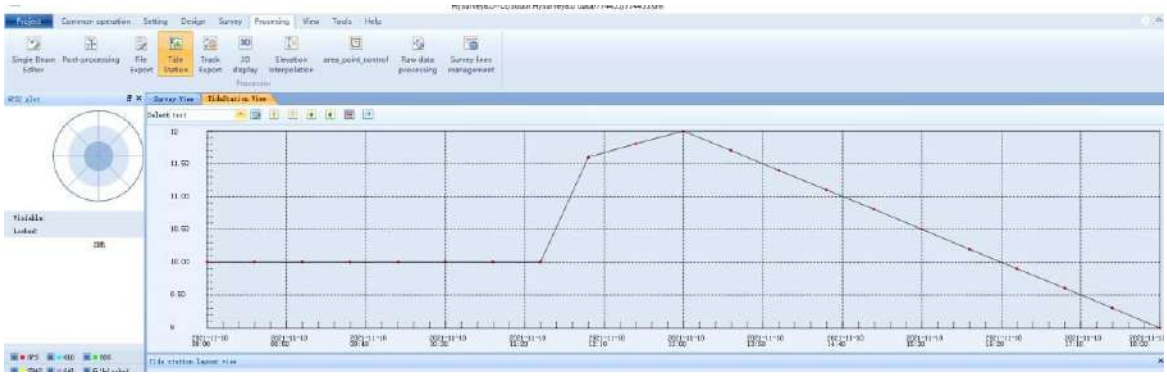


Automatically generate post-processing coordinate point information according to the selected project.

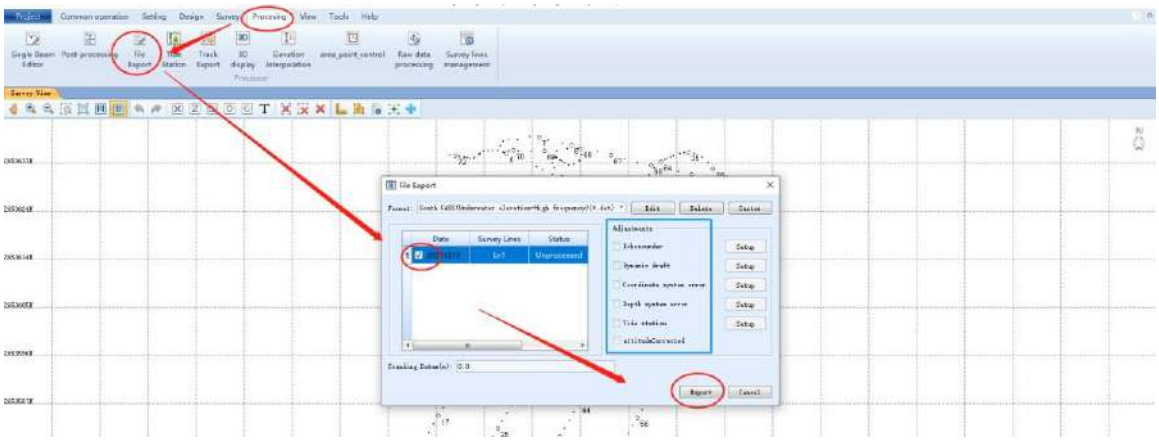


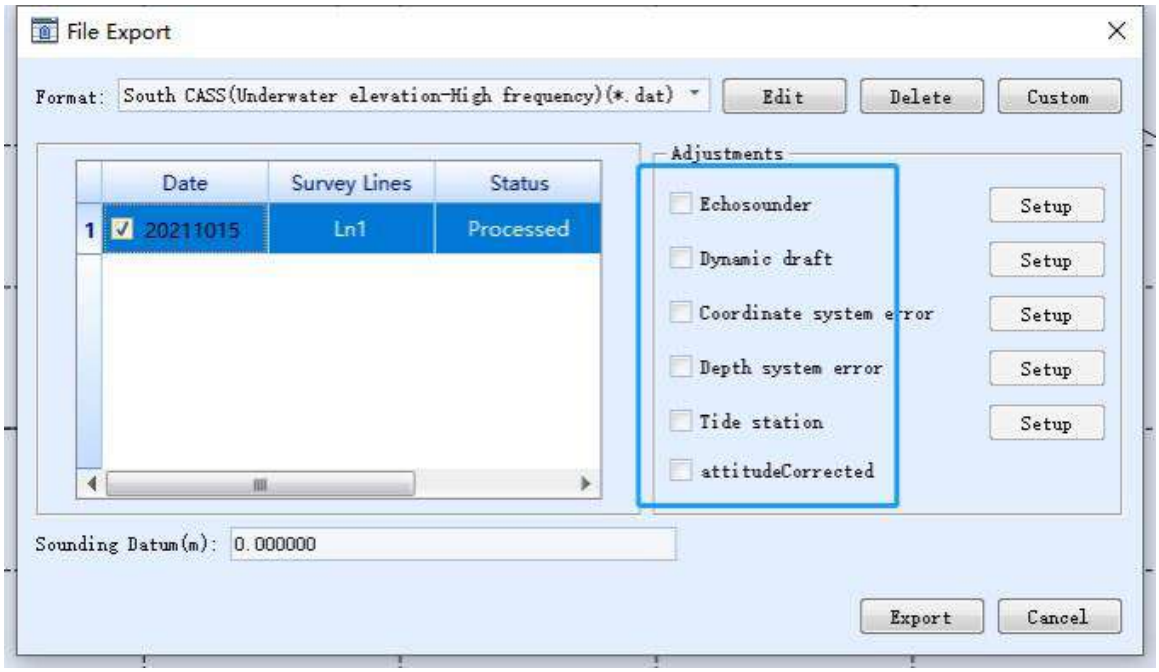
Tide position information collection and processing diagram.





Click “File Export” on “Processing” page to export the data.





When the data is from a fixed solution, the parameters on the right do not need to be selected.

Chapter 4: Remote controller

4.1 Description of the remote controller

The remote controller adopts radio communication equipment working in the 2.4GHz frequency band, and the remote controller and receiver must be paired use. The default remote controller operation mode at the factory is US hand (left hand throttle). The remote controller complies with CE standards. The maximum communication distance of the remote controller is 2000 meters.
There should be no obstacles between the remote controller antenna and the receiver antenna, otherwise the distance will be greatly shortened.

4.2 Remote controller buttons

The corresponding functions of the keys on the remote control are shown in the figure following:

① Lock Lever
Left: Neutral gear(N) /Middle: Lock /Right: Unlock
When the lever is in the left and middle position, it is in the locked state, the USV is locked, and it will stop immediately and cannot travel; when the lever is on the right, it is in the unlocked state, and the remote controller can control the

ship to move.
When the ship is in an emergency condition, this key can be used to lock the ship to avoid the damage.

② Shortcut Lever (Mode selection)
Left: Return to home (RTH)
Middle: Cruise control system (CCS)
Right: Manual control (MAN)
When the lever is on the left, it is in automatic return to home mode, and the ship will automatically return to the HOME point. When the lever is in the middle position, the cruise mode is at a constant speed, and the boat will move forward at a constant speed at the set speed. At this time, it can be controlled by the direction lever. When the lever is on the right, it is in manual mode, and the operator manually controls the unmanned ship.

③ Light Guide Level
Up: Off
Down: On

④ Propeller control lever
Push the lever up and down to control the USV to move forward or backward.

⑤ Direction control lever
Control the ship to turn left and right.

⑥ On-off: Press-and-Hold
One short press, and hold for about 3s, the indicator will light up one by one, until the four indicators are normal on.

4.3 Precautions for turning on the remote control

Before using the remote control, please keep the switches of the remote control in the following states:
1. Propeller control level ④, in the "middle" position;
2. Lock Lever ①, keep it on the right position.

Chapter 5. For Charging

5.1 Charging for USV battery

1. The indicator light of the charger is green after inserting the plug into the

socket.
2. Insert the cylindrical plug of the charger into the charging port of the battery, the indicator light of the charger will turn red, and the sound of the charger working can be heard.
3. When the battery is fully charged (about 4 hours), the charger indicator will turn green and the charger will stop working.

5.2 Charging for Remote controller

Method 1: Plug the charger into the back port of remote controller, the indicator light is red during the process, and turns green when fully charged (about 4 hours).
Method 2: Remove the battery from remote controller and insert it into the corresponding head

Chapter 6. Transportation and storage

1.The equipment for packing and transportation should be transported by conventional transportation methods.
2. Avoid violet impact, rain and sun exposure during transportation.
3.The packaged product should be stored in a well-ventilated room with the temperature of -5℃～55℃, relative humidity less than 90%, atmospheric pressure: 760hPa～1060hPa, and free corrosive gases.

Chapter 7. Maintenance

Both the main control module and the drive module are installed in the control cabin, and adequate waterproof measures have been taken before leaving the factory. Due to USV working on the water and under the influence of air humidity, hot and humid air will inevitably be generated in the control cabin. Therefore, in order to prevent hot and humid air damage to the control circuit, the regular maintenance is required.
1. For long time storage, it should be sealed up. Store in a cool, dry, free corrosive gases environment after packing.
2. If there are abnormal phenomena, malfunction or other problems in the use, be sure to get in touch with the manufacturer or local distributors in time, and the dedicated person will responsible for the maintenance. Please do not disassemble it by yourself.
3. After the operation, please wipe the ship in time to prevent from the erosion by dirt and sea water, and carry out regular ship maintenance.

4. When not using the ship for a long time, please keep the battery at least half of the charge to extend battery life.

Chapter 8. Common troubleshooting (FAQ)

1. What should I do if the ground station cannot be connected to the unmanned ship many times in a row?
Please check whether the data transmission equipment is working normally, and restart the PC client to reconnect.
2. The remote control cannot control the unmanned ship, what should I do?
Check whether the remote controller switch is turned on, and whether the unlock switch is in the unlock position. And restart the unmanned ship.
3. How to deal with the automatic return of the unmanned ship?
Check whether the data transmission communication is normal and whether the battery voltage is lower than the protection setting value.
4.The unmanned ship does not turn well or loses its steering function during navigation?
Check whether there is any foreign matter stuck in the motor of the unmanned ship.