

APACHE 3 PRO

User Guide



Marine Survey | Sep 2023

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Preface

Copyright

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Trademarks

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Safety Warnings

The Global Positioning System (GPS) is operated by the U.S. Government, which is solely responsible for the accuracy and maintenance of the GPS network. Accuracy can also be affected by poor satellite geometry and obstructions, like buildings and heavy canopy.

Introduction

The APACHE 3 PRO USV User Guide describes how to set up and use the CHC® APACHE 3 PRO USV. In this manual, “the USV” refers to the APACHE 3 PRO USV unless otherwise stated.

Even if you have used other Unmanned Surface Vessel before, CHC recommends that you spend some time reading this manual to learn about the special features of this product. If you are not familiar with USV, go to www.chcnav.com for an interactive look at CHC and USV safety information

Warnings and Cautions

An absence of specific alerts does not mean that there are no safety risks involved.

A Warning or Caution information is intended to minimize the risk of personal injury and/or damage to the equipment.



WARNING – batteries for USV should be full charged if the LED light on the battery have one light.



CAUTION –it is necessary to check the motors if work normally via the remote controller before put it on the water.

Regulations and Safety

The receivers contain a built-in wireless modem for signal communication through wireless technology. Regulations regarding the use of the wireless modem vary greatly from country to country. In some countries, the unit can be used without obtaining an end-user license. However, in some countries, the administrative permissions are required. For license information, consult your local dealer.

Before operating an APACHE 3 PRO USV, determine if authorization or a license to operate the unit is required in your country.

Use and Care

This APACHE 3 PRO is designed to withstand the rough environment that typically occurs in the field. However, the USV is high-precision electronic equipment and should be treated with reasonable care.



CAUTION - Operating or storing the USV outside the specified temperature range will cause irreversible damage.

Technical Support

If you have a problem and cannot find the information you need in this manual or CHC website (www.chcnav.com), contact your local CHC dealer from which you purchased the receiver(s).

If you need to contact CHC technical support, please contact us by email (support@chcnav.com) or Skype (chc_support).

Disclaimer

Before using the receiver, please make sure that you have read and understood this User Guide, as well as the safety information. CHC holds no responsibility for the wrong operation by users and for the losses incurred by the wrong understanding about this User Guide. However, CHC reserves the rights to update and optimize the contents in this guide regularly. Please contact your local CHC dealer for new information.

Your Comments

Your feedback about this user guide will help us to improve it in future revision. Please email your comments to support@chcnav.com.

1 Getting Started with APACHE 3 PRO

1.1 APACHE 3 PRO brief introduction



Featuring triple-hulled and the shallow draught design, the APACHE 3 PRO USV offers a portable remotely controlled platform in small lakes, inland rivers, and coastal water for bathymetric surveys. Its overall 1-meter length and 7 kg weight (without instrument) allows one person to operate the system easily.

Multiple data transfer options are available with RS232 connection and TCP protocols along with multi-channel and high bandwidth transmission. It can also carry single beam echo sounder, AP-2000 water quality and other instruments to meet diverse application requirements.

1.2 Product Basic Supply Accessories

Item	Quantity	Picture
APACHE 3 PRO Hull (integrated with RTK and echo sounder)	1	
M12 Pro Remote Controller	1	
Battery (24500mAh 32.6V)	4	
Battery (15000mAh 18.5V)	1	

Lithium Battery Charger	3	
Hand Toolbox	1	
2.4G Network bridge Host	1	
CAT6E Cable (5m)	1	
POE Cable 1.2m	1	
UHF Whip Antenna (450 MHz - 470 MHz)	1	
GPRS Antenna	1	
RC&WIFI Antenna	4	
Tripod For Network bridge Antenna	1	

Backpack	1	
Shipping Case	1	

2 Hardware Installation

2.1 Preparing for conducting the survey

It is necessary to have an accumulator to supply power for external radio if you use external radio mode. Full charge the remote controller and batteries with standard charger. Figure 2-1 is about how to charge the batteries.



Figure 2-1 and 2-2 Battery connection during charging

Firstly we connect the charger to the battery interface, pay attention to tighten the nut, and then connect to 220v AC power supply. When the battery is not connected, only the POWER LED of the charger lights up, the CHARGE LED lights up red when connected to the battery, and turns green when fully charged.

Maintenance instructions for batteries:

1. For the new arrival battery, please fully charge it as soon as possible.
2. Please charge the battery in time if the remaining power is less than 25% left.
3. Fully charged battery can be placed for 6 months. Please charge it in time if not being used.

2.2 Setup RTK Base Station and Onshore Data Receiving System

Set RTK base station:

1.External radio mode

Prepare GNSS Base receiver, external radio and transmitting antenna, tripod, etc.
Configure base receiver to send RTCM3.2 via external radio.

2.Ntrip mode

For detailed operation, please check **3.3.4 Rover Configuration**



Figure 2-3 Set RTK Base Station

Check the accuracy of the rover station: Under the fixed solution state, compare the accuracy of the RTK rover station with the coordinates of the known points to ensure that the accuracy meets the measurement requirements before proceeding to the next operation.

2.3 Install Accessories for the USV System

2.3.1 Install the accessories of the boat



Figure 2-4 Install the accessories on the boat



Figure 2-5 Insert a Nano card

2.3.2 Debug before launching the boat

1). Boot the boat

Long press three seconds the switch on tail of the boat. Pay attention to the lights on both sides, when the red satellite lights and green differential signal lights are always on, they are in normal working condition.

2). Turn on the remote control

The switch button is in the lower left corner. Press the key first, then long press quickly, and wait until the indicator lights up gradually, showing that it has been successful booted. The indicator light represents the power of the remote control. The operation of powering off the remote control shutdown is the same.



Figure 2-6 Remote control

3). Debug the motors

Use the remote control to check whether the motors are working properly.



Figure 2-7 Debug the motors

3 Software Operation for the USV System

3.1 Install the software

There are two software for the USV system, AutoPlanner and HydroSurvey.

1) When installing the AutoPlanner software, double-click the installation package, click Next until the installation driver and plug-in interface appears, tick 'Install Tap



Driver' and 'Install Ezopen Plugin', and then click Next until the installation is OK.

Figure 3-1 Install the software

2) When installing the HydroSurvey software, double-click the installation package and click Next until the installation is complete.

3.2 AP Software Configurations

3.2.1 Configure the computer IP

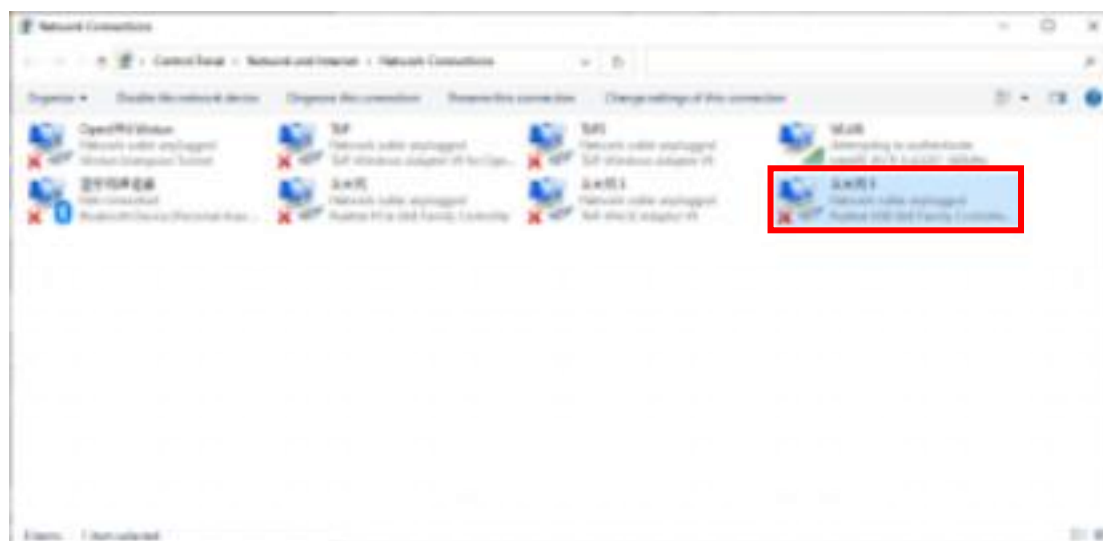


Figure 3-2 Change International Server

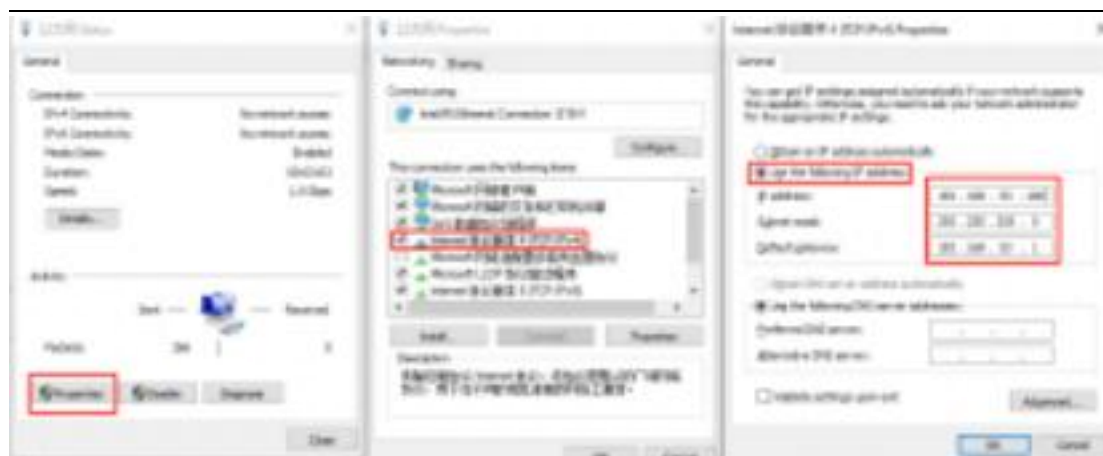


Figure 3-3 Configure the computer IP

3.2.2 TCP Connection for AP Software

Double-click the AP software icon to open it, select **[TCP]**, and click **[Connect]**.



Figure 3-3 INTER connection

3.2.3 Plan Route for AP Software

(1) Connect the computer to the network, and load the surrounding satellite image maps through the positioning of the boat. Select **[NAVIGATION PLAN]** on the main interface, and select the appropriate satellite image map. Commonly used are Bing satellite maps and Google satellite maps.

(2) Plan work area

1) The satellite image is not updated in real time, so pay attention to the actual area when planning the polygon.

2) The role of the home point: a. The home point is the return point. b. The logic for generating the automatic route is to generate the waypoint 1 near the home point, and the other waypoints are generated in sequence.

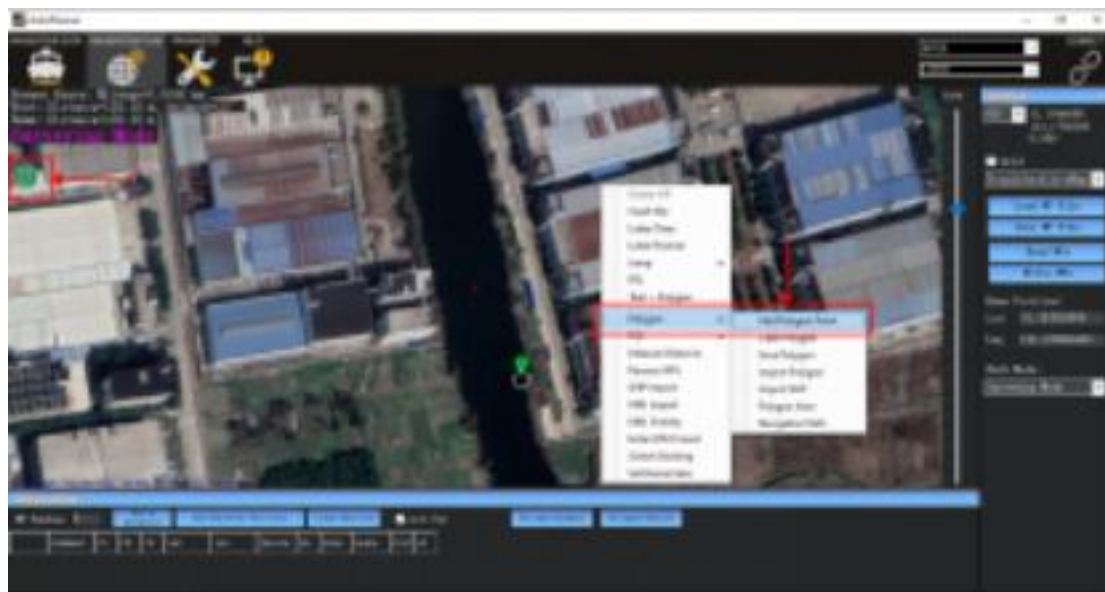


Figure 3-4 Plan work area



Figure 3-5 Plan work area

(3) Edit auto waypoints

Right click the interface and select **[Polygon]** → **[Navigation Path]**.



Figure 3-6 Set Navigation Path



Figure 3-7 Set Navigation Path

[Path angle]: Adjust the angle of the route.

[Distance between lines]: The distance between routes.

[Waypoints spacing]: The distance between points on the route, the value set should be greater than the true distance of the route, so as to ensure that there are only two points on a route. **The automatic waypoint spacing here is not the same as the data collection spacing.**

(4) Write waypoints to boat

[Load WP File]: Load the WP file from computer.

[Save WP File]: Save the currently planned route to computer.

[Read WPs]: Read the current mission waypoint from the boat.

[Write WPs]: Write the planned waypoints data to the central control.



Figure 3-8 Write WP into boat

3.2.4 Semi-automatic measurement mode

A. Launch the unmanned ship, control the successful initialization of the unmanned ship (the red light is always on), the navigation plan interface, the right side of the middle operation mode select semi-automatic mode.

B. Create a polygonal working area (which can be larger than the actual survey area and can include non-water areas), Right click on the satellite image map, select **[Polygon]** → **[Navigation Path]** in the pop-up interface for route editing, by adjusting the angle to change the direction of the route, trajectory spacing, then click the Write WPs.

C. Switch to automatic mode and wait for the measurement to end.

Note:

1.This mode is used with millimeter wave obstacle avoidance radar, and the actual use is judged according to the field environment, if the shore slope is low or the shoal area is not recommended.

2.Waypoint 1 shall be set in water.

3. Try to sail from outside the survey area to waypoint 1, do not cross the route to point 1.



Figure 3-9 Semi-automatic mode

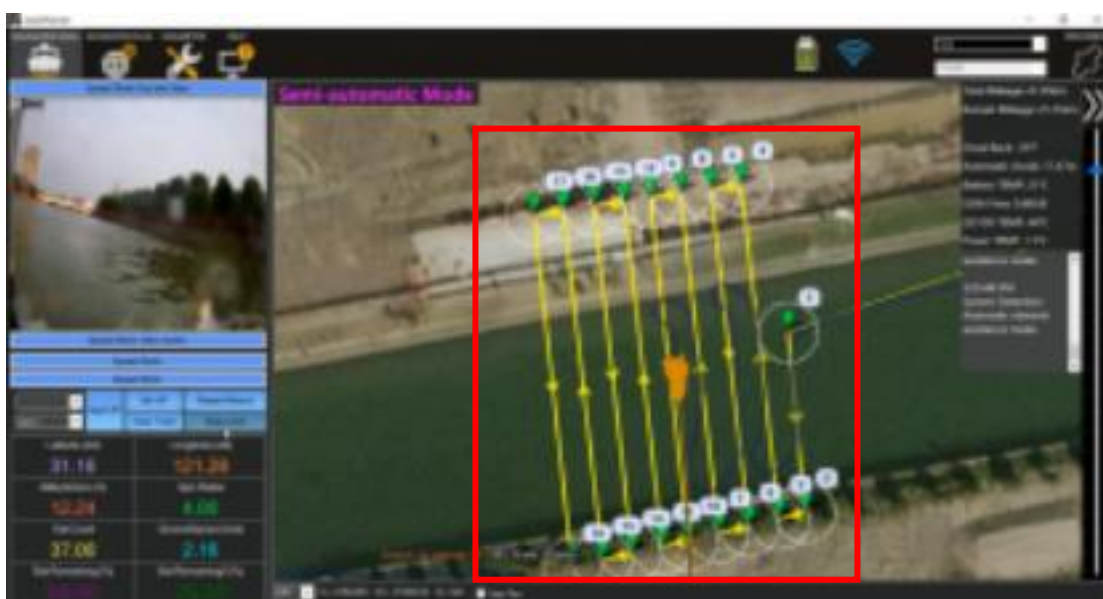


Figure 3-10 Semi-automatic mode

3.2.5 Full-automatic measurement mode

3.2.5.1 Full-automatic measurement mode (Software)

- A. USV launched, control ship initialization success(the red light is always on).
- B. Select the full-automatic measurement mode in the AutoPlanner software.
- C. Setting the distance between routes, the direction of routes and the measuring area;then click the Write WPs.
- D. Switching to auto mode.
- E. Wait for the measurement to end.

3.2.5.2 Full-automatic measurement mode (Remote Control)

- A. USV launched, control ship initialization success (the red light is always on).
- B. Select full-automatic measurement mode in the navigation plan in AutoPlanner software, select remote control mode of operation, and set the course distance, then click the Write WPs.
- C. Push forward the ship (above 3s) in a straight line, determine the direction of the route, and switch to auto mode.
- D. Push the left or right rocker (more than 3s) to determine the measurement area;
- E. Wait for the measurement to end.

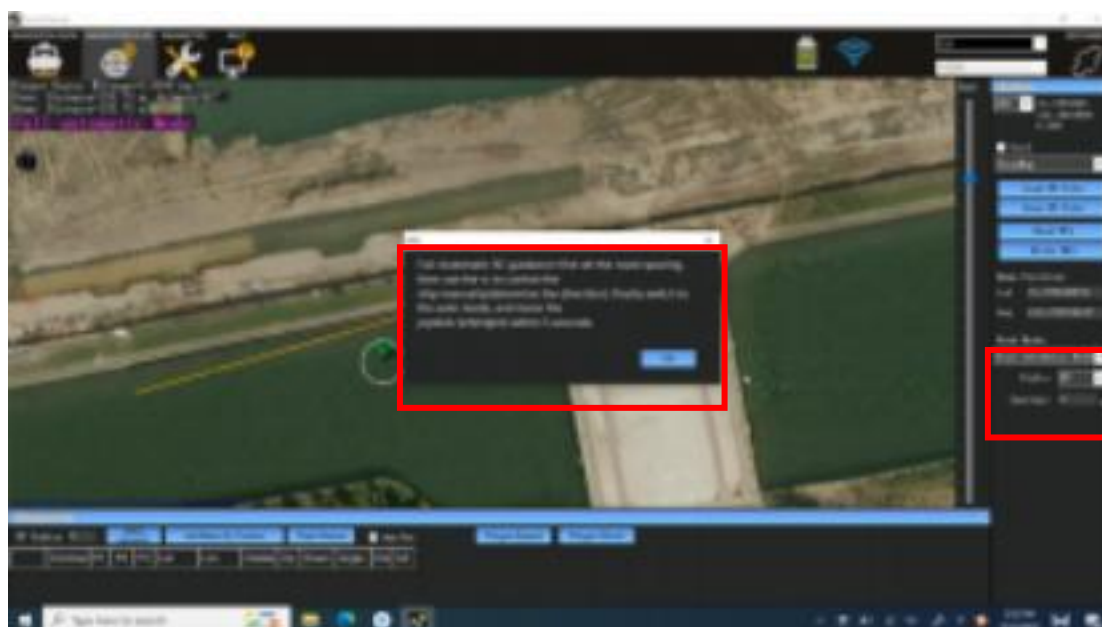


Figure 3-11 Full-automatic mode

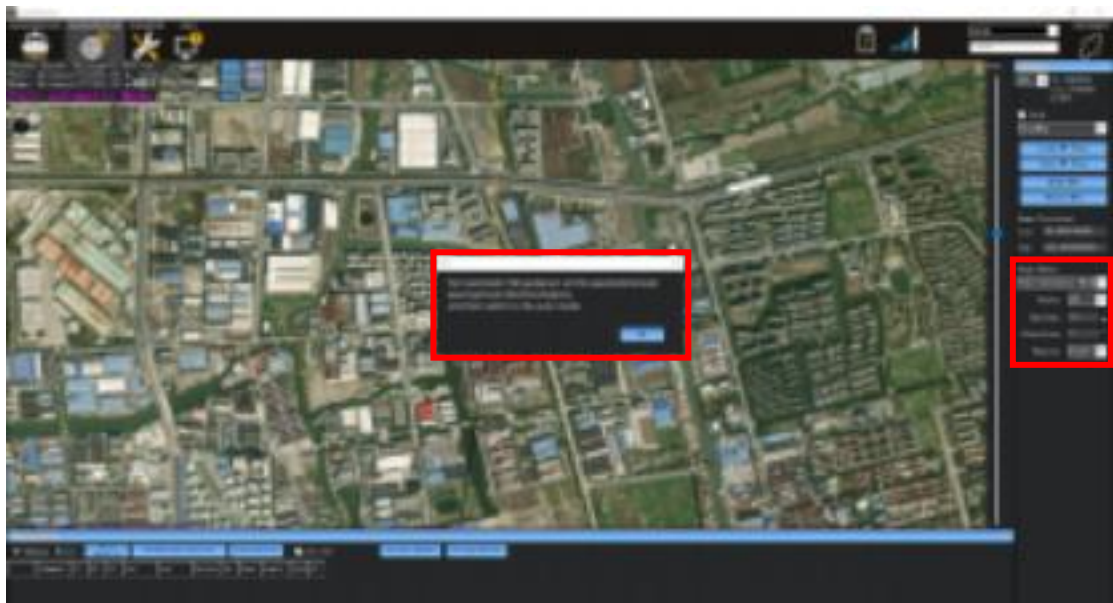


Figure 3-12 Full-automatic mode

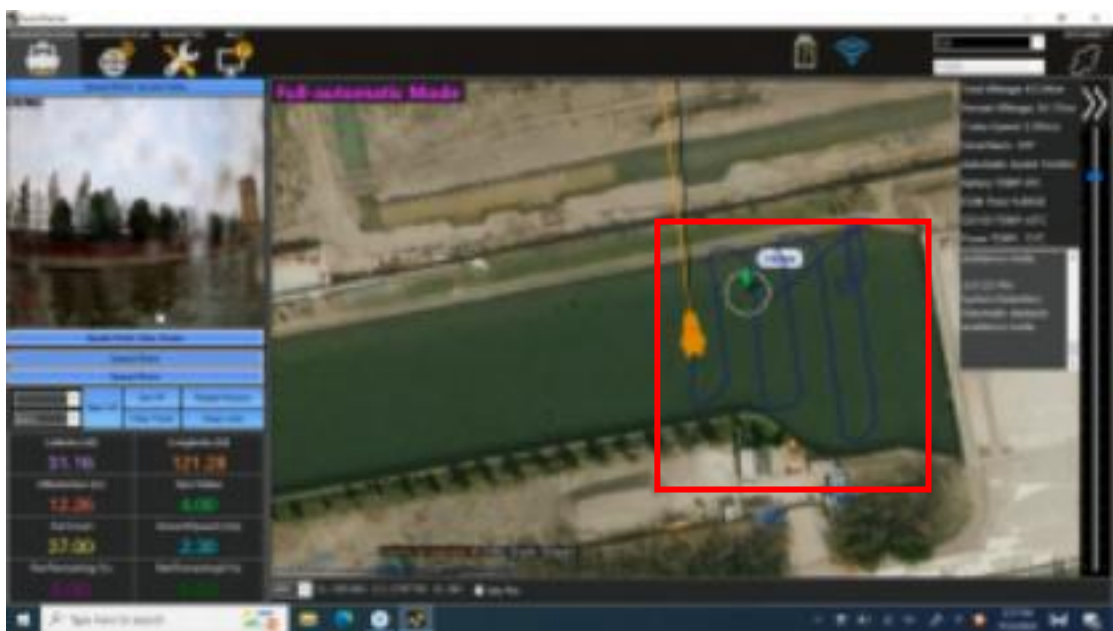


Figure 3-13 Full-automatic mode

3.2.6 Login HD Camera for AP Software

- a. Click **[Navigation Data]** → **[Spread/Shrink Hud and Video]** → **[Intranet]**

Username: admin

Password: Admin1234

IP: 192.168.53.64

Port: 8000

- c. Click **[Login]** first, click **[Play]** while you have logged successfully



Figure 3-14 Login HD camera



Figure 3-15 Login HD camera

3.2.5 Other common functions for AP Software

1. Control USV via AP software



Click **[Shrink Remote-Control]**, remotely control USV by dragging the blue dot.

Figure 3-16 Control USV via AP software

2. Useful functions

[Set WP]: Set a new waypoint quickly without clicking the navigation plan interface.

[Restart mission]: back to the first point and start a new mission.

[Clear track]: clear the track line of the interface you have run.

[Keep loiter]: change the state of the boat.



Figure 3-17 Other functions

3. Convenient switch

Now we can turn on the switch when you need in software instead of Web page.

[Shoal]: set a shoal depth to ensure your boat's safety.

[Avoid Obstacles]: set a distance to ensure your boat will not crash into some objects in water.

[Low Power And Return]: makes you boat return to home point automatically.

[Lost Connection And Return]: makes you boat return to home point automatically when your boat has lost connection for few times.



Figure 3-18 Convenient switch

3.3 Webpage Setting for GD100

3.3.1 Login webpage

Input 192.168.0.254 on the browser.

Username: admin

Password: Admin1234



Figure 3-19 Login webpage of the GD100

3.3.2. Register the receiver

Click **[Firmware][GNSS Registration]**. Send the receiver SN to the dealer or sales branch to obtain the registration code. Enter and apply the correct registration code.



Figure 3-20 Register the receiver

3.2.4 3.3.3. Configure the I/O of rover station

There are two kinds of working modes for rover station:

1) CORS mode. 2) Internal radio mode

1. Set CORS mode. Click **[I/O Setting][RTK Client][Connect]**. Select **[Connection Protocol]** as NTRIP protocol, input the CORS parameters. Then click **[Confirm]**.



Figure 3-21 Set CORS mode

2. Set internal radio mode. **[System Setup][Radio Settings]**



Figure 3-22 Set internal radio mode

3.2.5 System State

Click **[Unmanned Ship Status][System State]**

The status of USV, positioning status, battery status, sounder status, etc. can be viewed in this Interface.



Figure 3-23 System state

3.2.6 Firmware upgrade

We have updated the firmware frequently, you can upgrade the control firmware, host firmware and Echo Sounder control firmware when you need.



Figure 3-24 Firmware upgrade

3.4 Set Hydrosurvey


3.4.1 New project and connect to the boat


1)Open HydroSurvey 7 , click on [Project] - [New Project].

"Project name" is default and can be renamed if you need. And it also can be saved as

a template via clicking [Save coord template]. It is important to input the deviation if you perform the base shift.

Figure 3-20 and 3-22 Create a new project and set coordinate system

2) click  to connect the GPS and the sounder after you have connected the boat via AutoPlanner.

3) When you set it up, click  in the menu bar and then all the data are displayed in the left of interface.

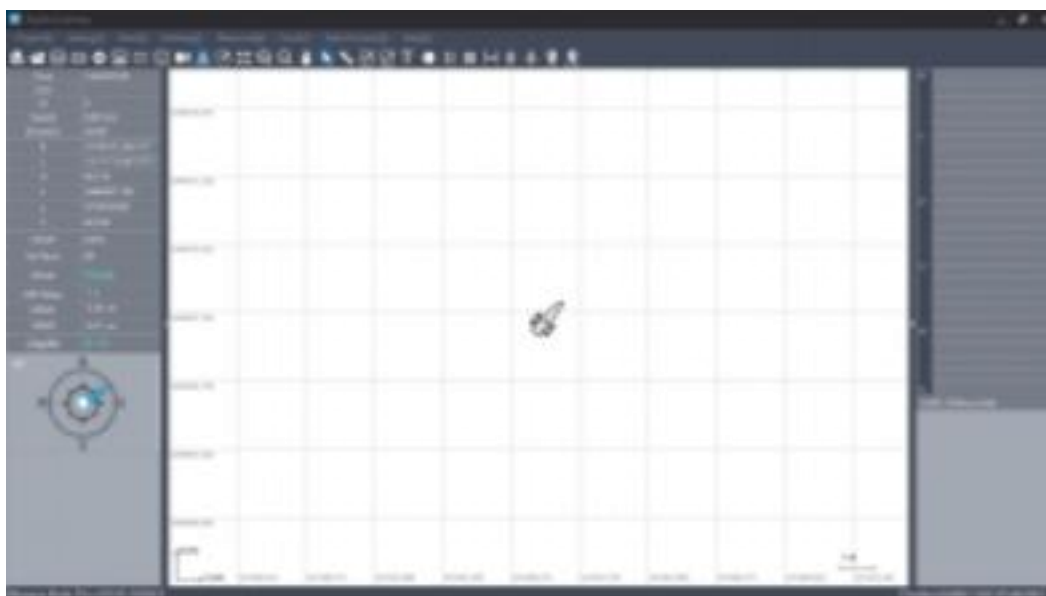


Figure 3-25 Main interface

3.4.2 Record control

As shown in the following figure 3-27, click on [Setting] – [Record control]. If [By Distance] is set to 1 M, a point will be recorded for every meter; if [By Time] is set to 1 S, a point will be recorded for every second; if [By Space] is ticked, a point will be recorded once you click the space bar.

In terms of Limitation selection, [Fixed] is recommended when RTK is used and [Float] is recommended when beacon is used.

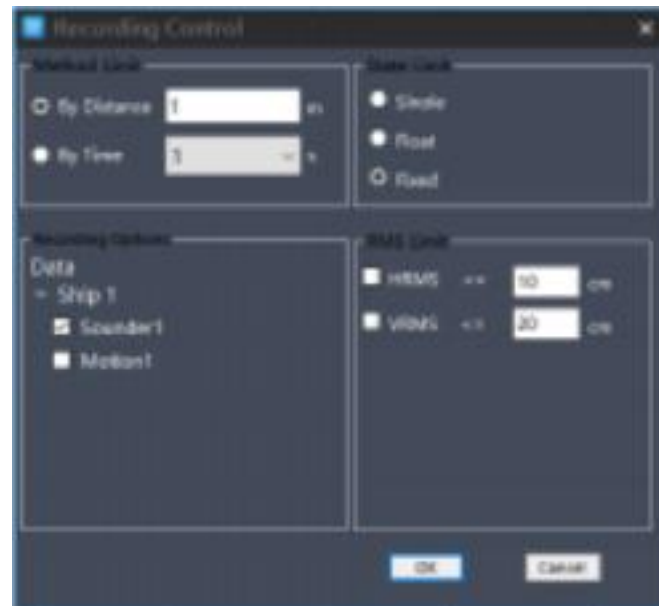



Figure 3-26 Record control

3.4.3 start work

When the new projects, parameters, data, settings and other preparations are done well, data can be recorded.

① Choose [measure mode]

② Toolbar  indicates the start, pause, and stop the record. Meantime, line name could be entered at the beginning of measuring.

③ In order to facilitate post processing and prevent massive loss of data in unexpected cases, it is suggested to change a line every 300 or 500 points.

④ When the data in the test area is measured, click on [stop] and then to save the

project by clicking [Project] – [Save Project] before close the software.

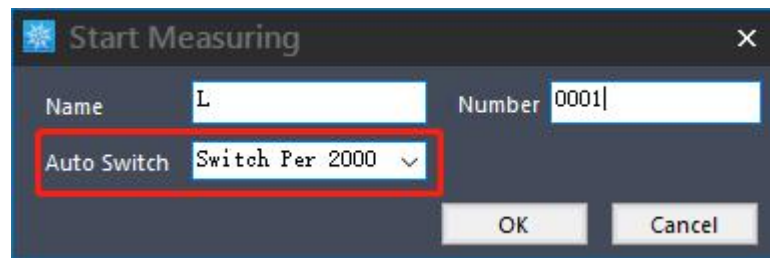


Figure 3-27 Import background map

When the unmanned boat travels to the designated route to be measured, click **[Measure]** → **[Start]** then pop up the setting line information interface. The line name and line number are set by default. The auto switch selects 2000 points for automatic line change.

Click **[Measure]** → **[End]** after the measurement area task is completed
Stop here, you can start you measuring work.

3.4.4 Download depth file from boat (skip this step if you need not)

1. connect the wifi of boat(serial number of the boat)



Figure 3-28 Connect Wifi

Open a file maybe 'This PC' on your computer, and input IP:
ftp://192.168.53.254



Figure 3-29 Input IP address

3. Username: admin
Password: Admin1234

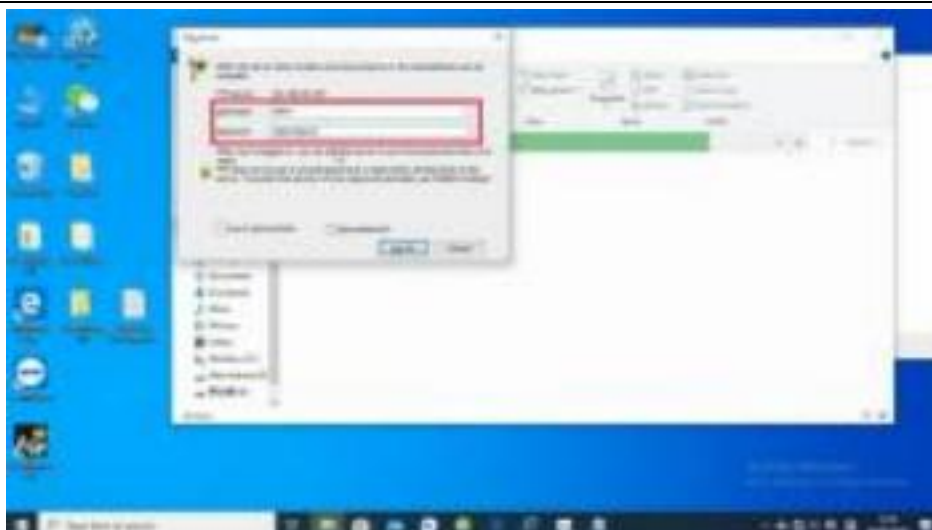


Figure 3-30 Input username and password

4. Copy the files from record2 file
Dep files record the original data.
Sd files record the waveform.

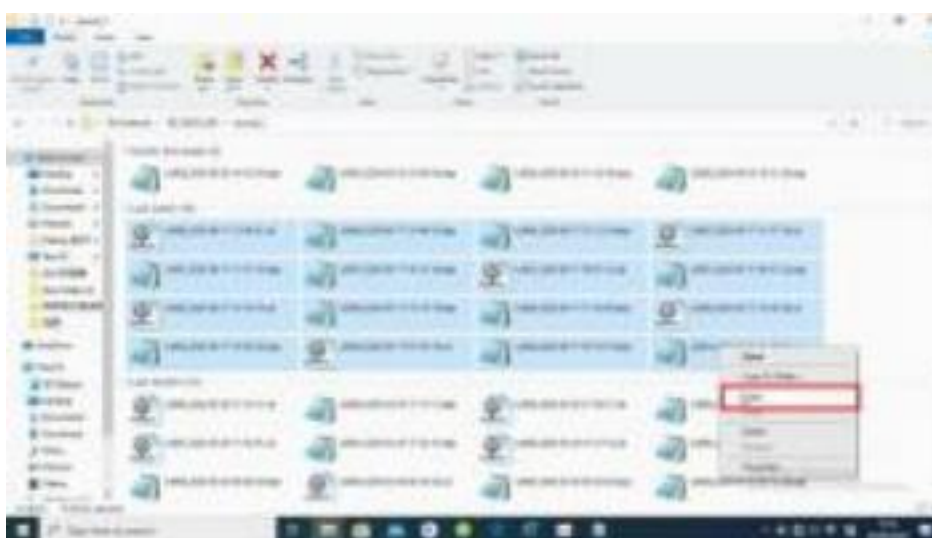


Figure 3-31 Copy files from record2

5. process the dep files via Hydrosurvey



Figure 3-32 Copy dep files to project of Hydrosurvey

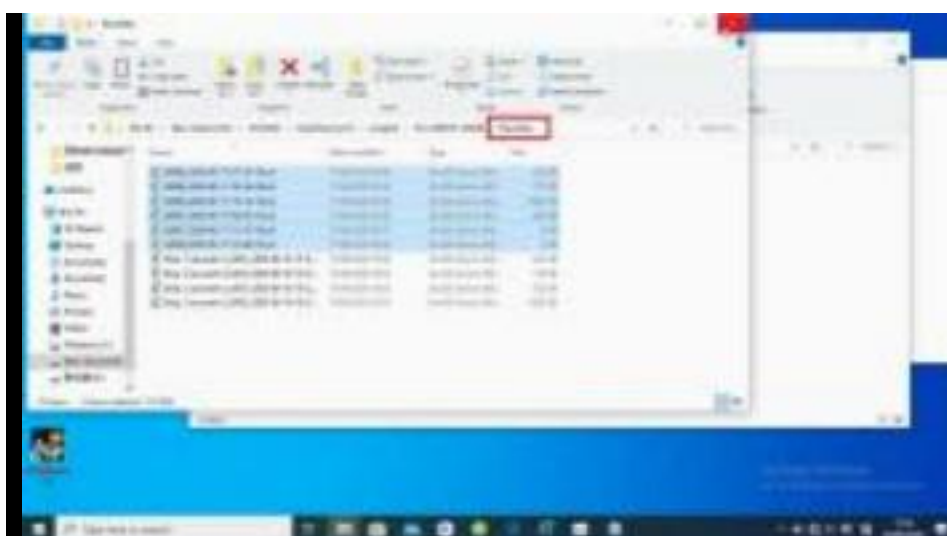


Figure 3-33 Copy .sd files to project of Hydrosurvey

4 Data Processing

4.1 Water depth sampling

Water depth sampling is a process that correct the depth data and handle the wrong depth data. We will get a **Htt** file including all data that can be select in the data export section after sampling. This process will be divided into four steps.

1. Correct the depth via sound velocity correction

tick **[All]**, select **[Three Corrections]** to get the edit interface.

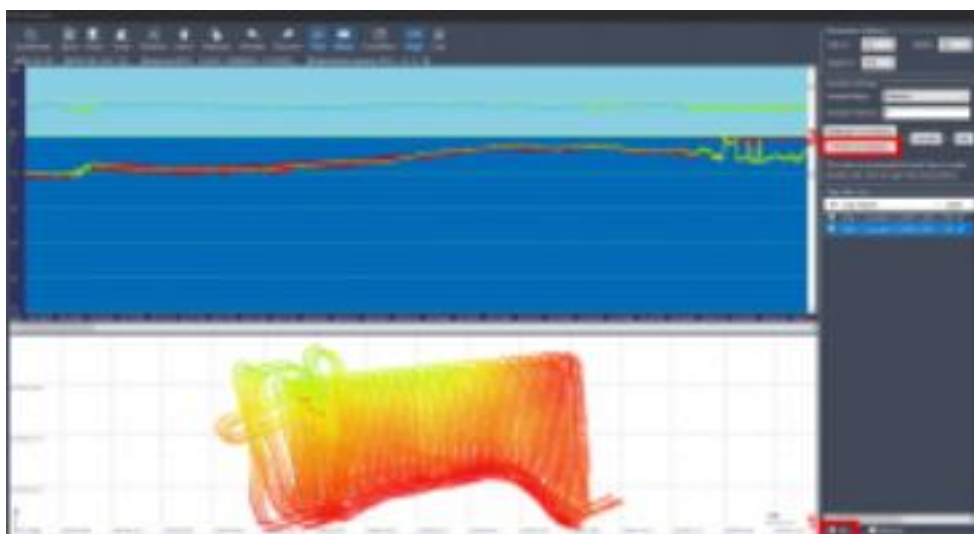


Figure 4-1 Main interface



Figure 4-2 Sound velocity correction

As the figure 4-2 shows, there are three ways to correct the sound velocity: Single Sound velocity, Depth +Sound velocity, Depth+ Correction. Take the second method as an example

- (1) Import the sound velocity file via clicking [Import] button, the format should be as follows:

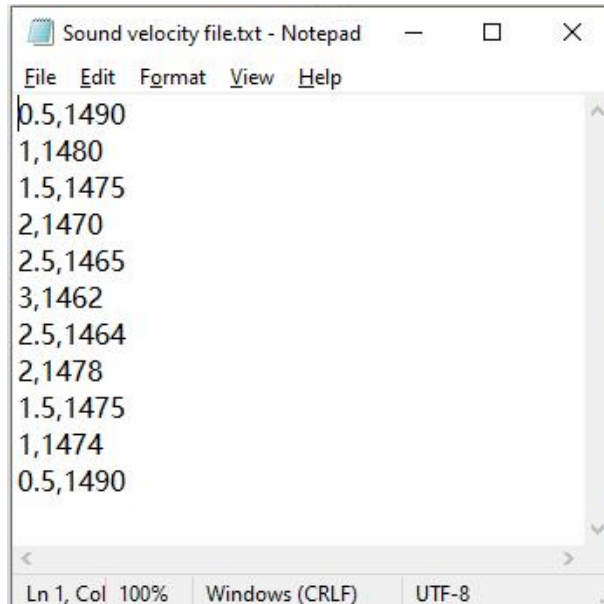


Figure 4-3 Sound velocity file

The first column is depth, and the second one is the sound velocity.

- (2) the imported sound velocity will be shown in the list.



Figure 4-3 Imported sound velocity file

- (3) Calculate correction and apply it to all raw data.

Click [Correct] button, then it will pop up successfully applying information

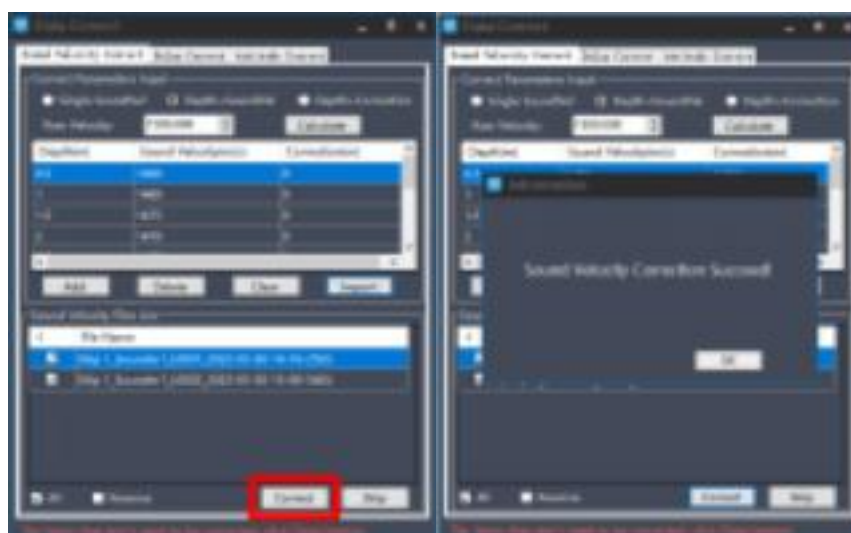


Figure 4-4 Apply sound velocity file

(4) Skip Delay correct and attitude correct

The delay correct is the correction for GPS and depth transmission delay. The impact of time delay on bathymetric data can be reduced. The time delay value for the whole system is a fixed. Enter a known time delay value or calculate it via a special method if necessary. Hydrosurvey also support adjust the beam angle to recalculate depth. For more detail, please directly contact with technical support engineer of CHC.

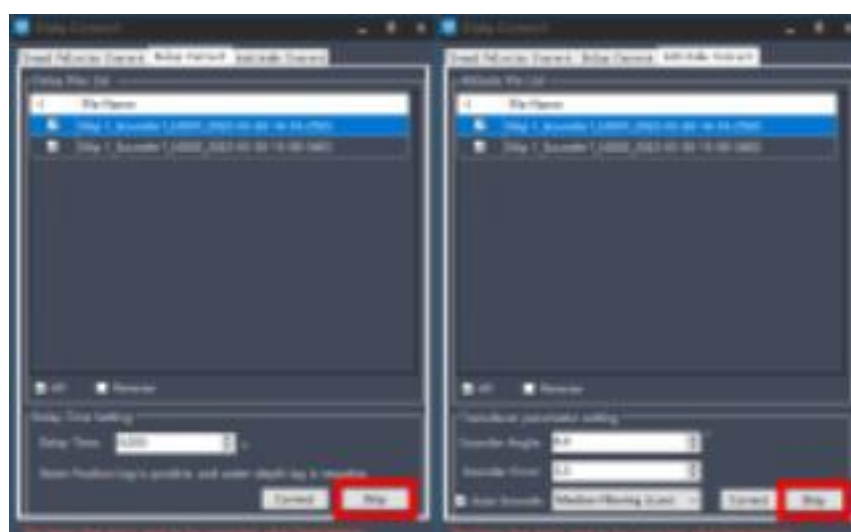


Figure 4-5 Skip delay correct and attitude correct

2. Handle the depth data

Double click a depth file in the depth file list.

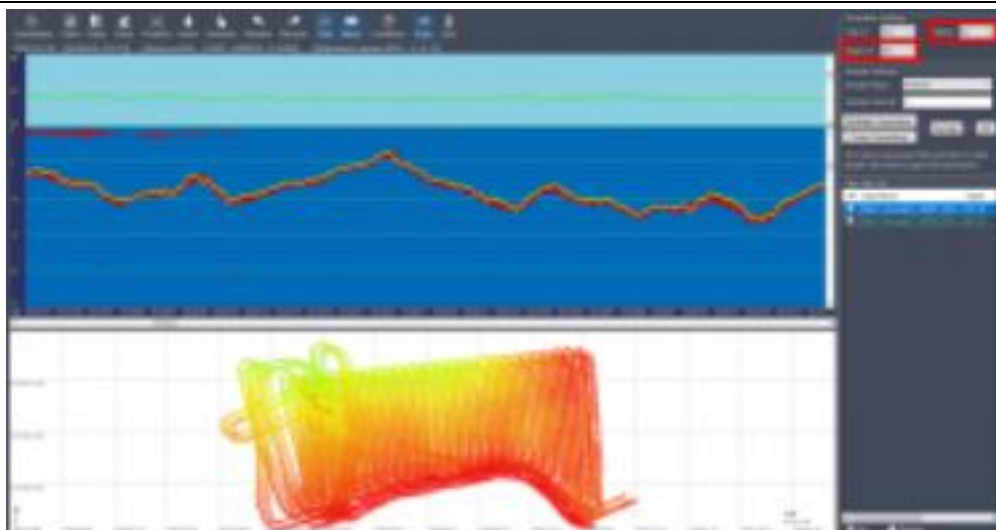


Figure 4-6 Depth sampling interface

As the figure 4-6 shows, the green line on the top of main interface shows the elevation of surface of water and fixed state (yellow represent floating and red represent a single point), the main interface can be changed by adjusting the [Depth H] and [Width]. the green line displayed on the bottom interface shows depth, the red line is simulative echo signal. If these two match well, the depth can be trusted and accurate. If not, just select the wrong depth points, then click [Eraser] to delete the points. It is suggested that the dep files should be handled in turns.

3. Select a proper [Interval]

Choose a interval for exporting the data. Select a value in the [interval] setting, then click [2.Interval]

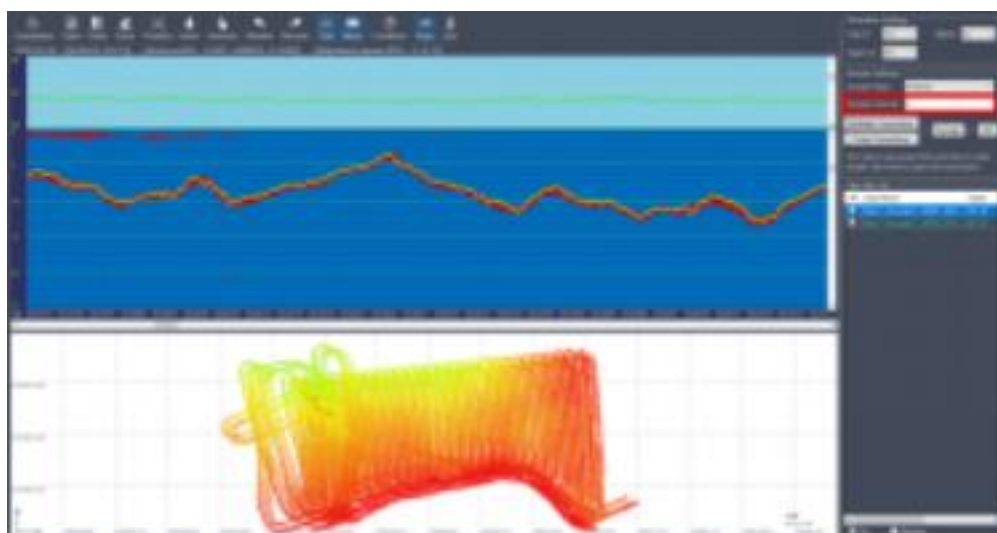


Figure 4-7 Interval setting

4. You also can change the interval via clicking [Manual] button.

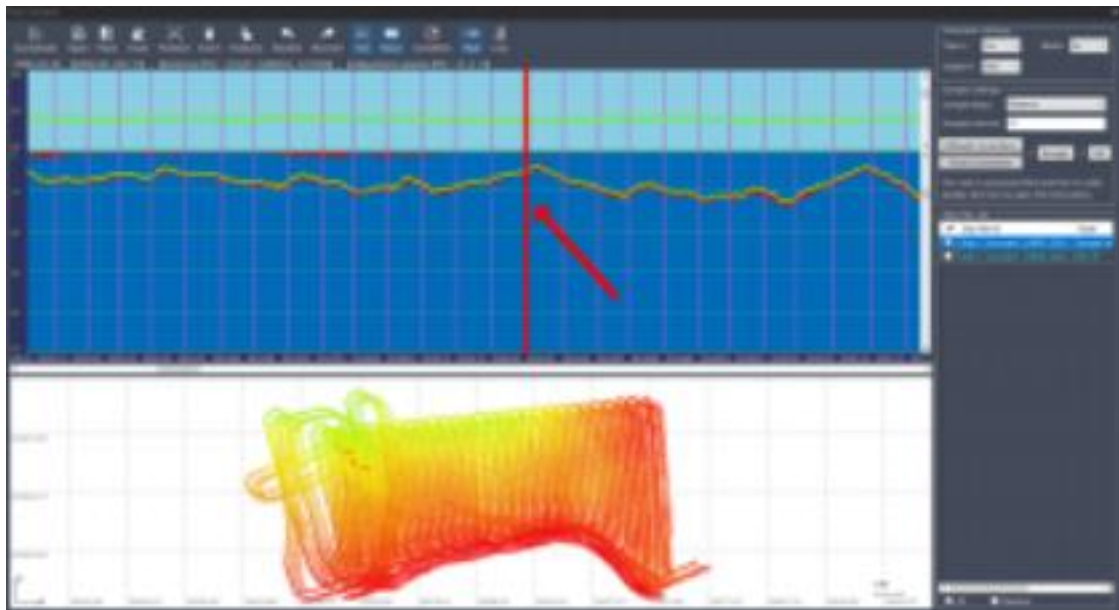


Figure 4-8 Manually change interval

5. Click [4.Export htt]

When the interval setting is complete, click [4.Export htt] to save htt files

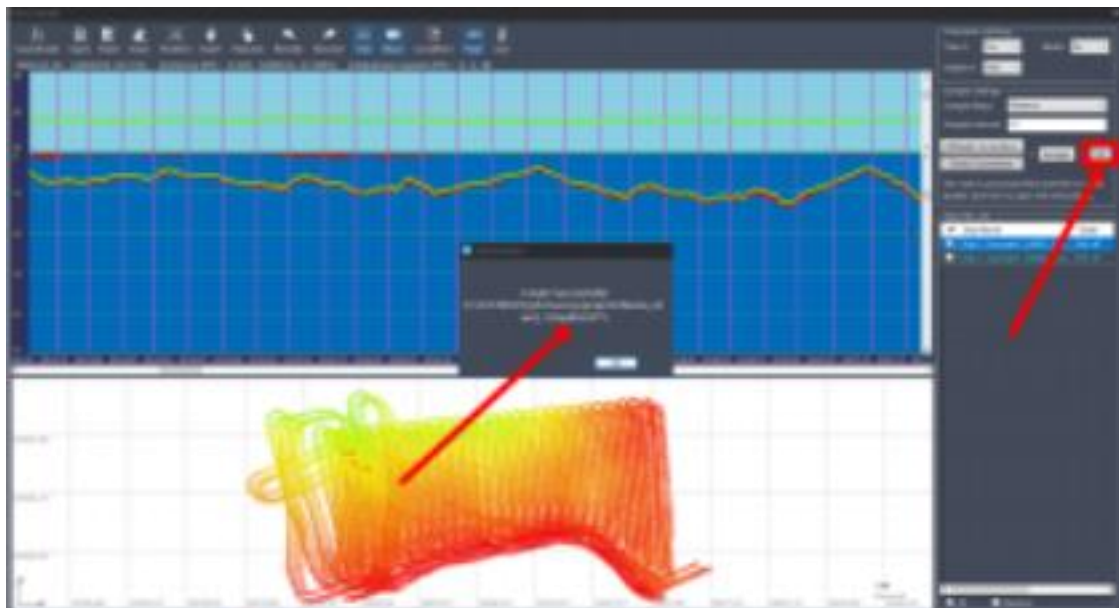


Figure 4-9 Export htt files

4.2 Data export

Click on [Data processing] – [Data Export], Select the Htt files and choose a file type,

there are some default format for option, and the format also can be modified via [Customer]. At last export data to desktop via clicking [Export].

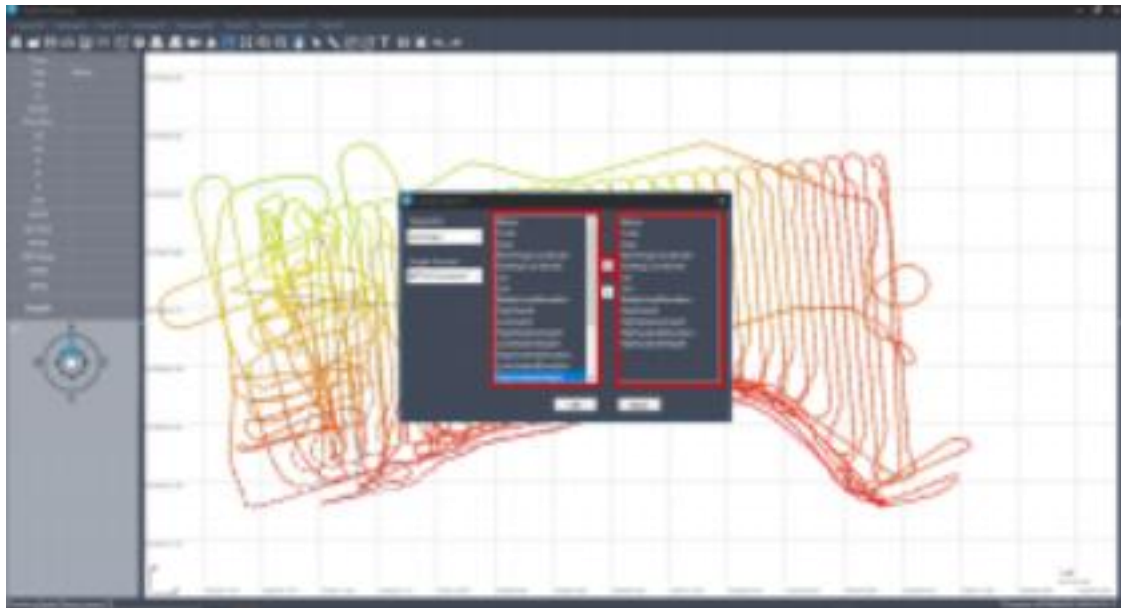


Figure 4-10 Customer the format

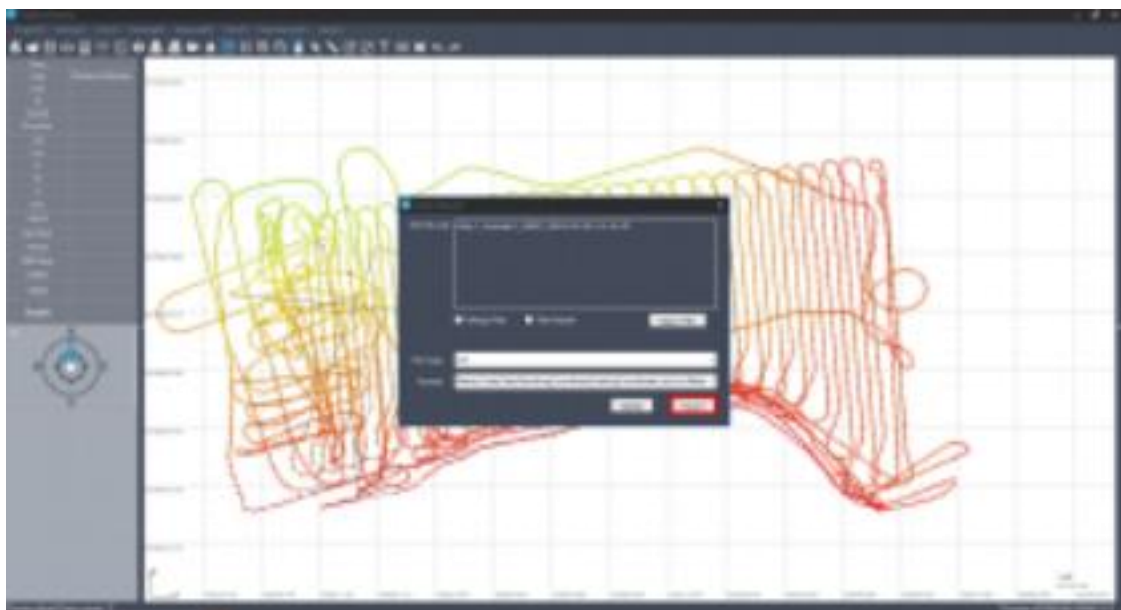


Figure 4-11 Data export

Select the [Save Path] and click on [Export], the final result will be acquired.



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Make your work more efficient