SDE-28S Digital Echo Sounder

User Manual

Contents

Chapter 1 Preview

1.1, Introduction

KOLIDA SDE-28S+ echo sounder is a kind of industrial control and digital echo sounder which is integrated with the 12.1-inch TFT-LCD color screen, industrial control unit, echo sounding unit, data processor, internal memory unit and kinds of interfaces and I/O devices. The special design can protect it from dust, water, and strong vibration. It collects depth measurement, graphical navigation, positioning data, water depth data acquisition together. All these features make the instrument strong compatibility, stable performance and reliable accuracy. The machine comes with a12.1-inch TFT-LCD color touch-screen which supports clearly visible under bright light. It has a built-in operating system embedded WIN XP，which can connect to external keyboard, mouse and other external USB devices. Dominant frequency of the CPU is 1.6GHZ with 2GB internal memory and built-in 8GB SSD storage. SED-28S+ can connect to GPS from any manufacturers for positioning, also the users can run different hydrographic surveying softwares (support embedded Win XP version) on it. It is an ideal instrument for sea, river, or lake water depth measurement together with the port, waterway dredging project.

1.2, Echo Sounding Principles

The principle of echo sounder is to use ultrasound spread through dielectric, and on different media surface produce reflective phenomenon, using ultrasonic transducer (probe) launches ultrasound, and then measure delta-T between the emission wave and the reflected wave.

Acoustic propagation velocity in water is V, transducer (probe) transmits ultrasound, acoustic emission by the probe to the bottom of the sea, reflected back by the bottom and received by the transducer, then measure the round trip time the acoustic experienced by t, then: Z = Vt / 2; At the same time, read the scale on the junction pole to get the value of the draft(draft is the value between the water surface and the bottom of the transducer), as Fig.1-1.

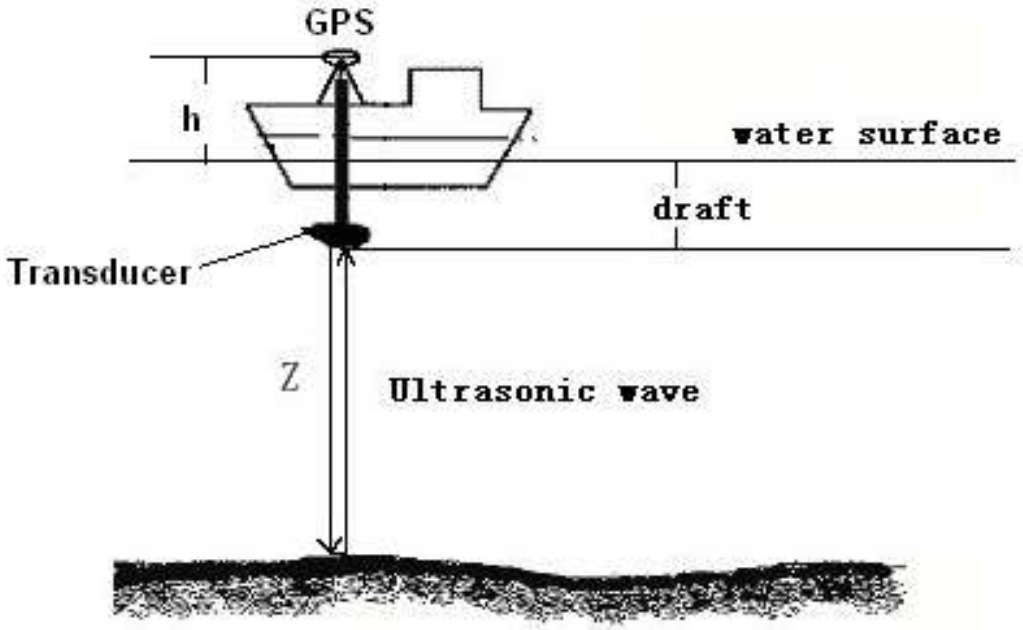


Fig.1-1 Echo Sounding Principles

The signal frequency of the high-frequency transducer is about 200KHz, that of the low-frequency transducer is about 20KHz. Low frequency signal has a longer wavelength, strong diffraction function, so strong penetration capacity, the general penetrate a certain thickness of silt.

Chapter 2 SDE-28S+ Hardware

Reading this chapter, you will grasp the detail information about every hardware component of SDE-28S+.

2.1, Front components

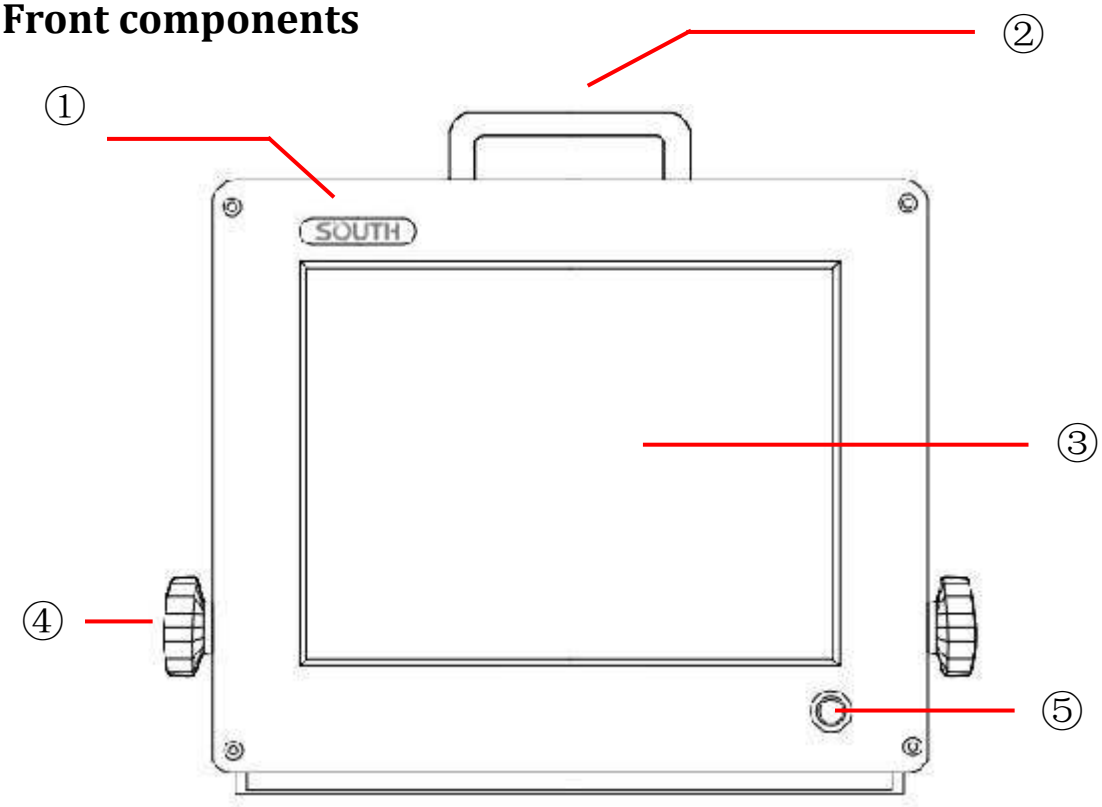


Fig.2-1 Front components

Ref	Component	Description
①	Logo	Brand logo label
②	Handle	Carry the device
③	Screen	Display the operation contents
④	Base adjustment	Fix the device at a certain angle
⑤	Power button	Switch on/off device

2.2, Side components

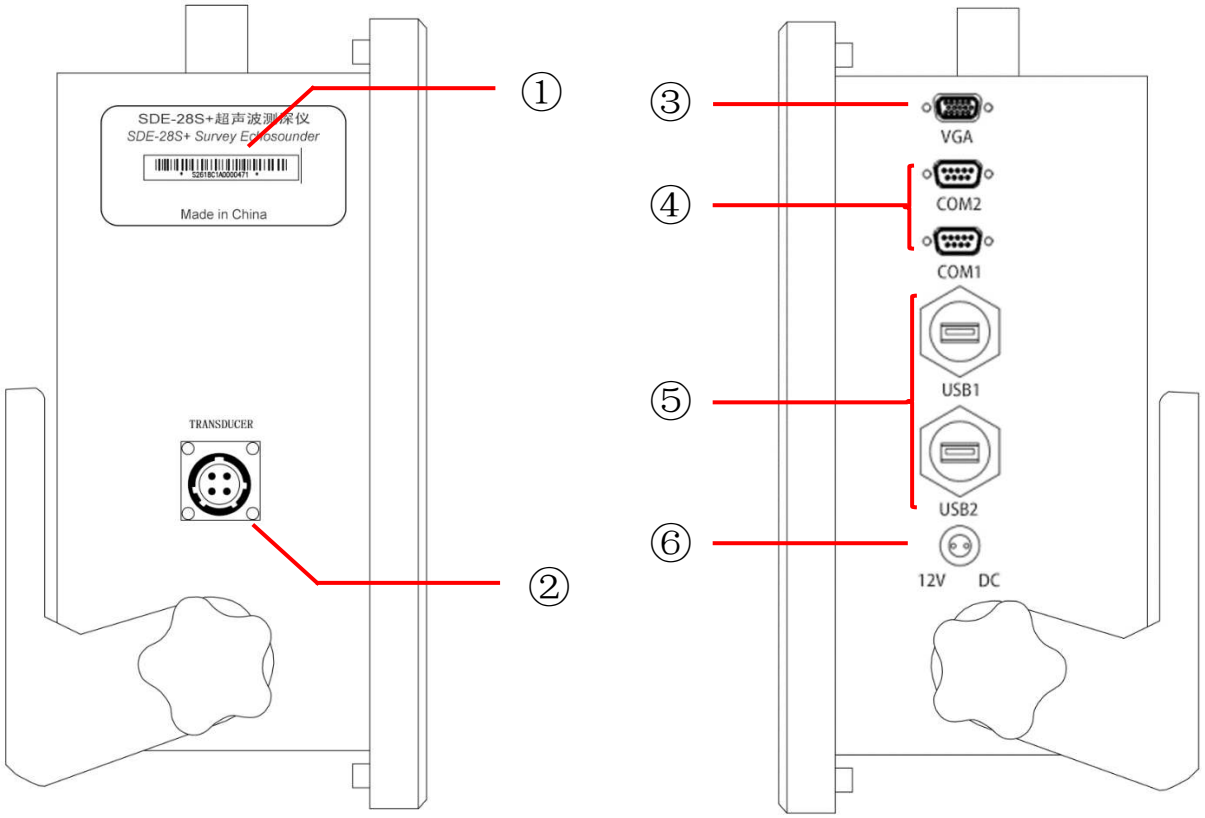


Fig.2-2 Side components

Ref	Component	Description
①	SN label	Serial number of device and the bar code
②	Transducer port	Connect the transducer to echo sounder
③	VGA port	Connect to external display
④	RS232 port	Connect to the GNSS receiver
⑤	USB port	Connect with the USB devices
⑥	Power supply port	Connect with AC or DC power

2.3, Accessories

2.3.1, Transducer

The transducer is a hardware that can transmit ultrasonic waves and receive the reflected ultrasonic waves. The echo sounder is to use the ultrasonic waves speed and the delta t between the transmitting wave and reflected wave to calculate the depth of water.

Transducers are divided into single-frequency and dual-frequency according to the purposes or applications, since SDE-28S+ is a single-frequency echo sounder, it is equipped with the single-frequency transducer.

Fig.2-3 Single-frequency transducer

2.3.2, Transducer pole

The poles are use for connecting the transducer and sinking it into water. The poles are divided into 3 parts in order to facilitate transport.

Fig.2-4 Transducer pole

2.3.3, Power supply cable/adapter

The cable with red/black clips is used for connecting with 12V external accumulator. Please pay more attention to this cable that while using it, the red clip should be connect to the positive of the accumulator, and the black clip connects to negative, otherwise, the instrument would be burn if the cable connects to wrong node.

The adapter is mainly used to connect to the AC power supply.

Fig.2-5 Power supply cable/adapter

2.3.4, I/O devices

Keyboard and mouse are convenient for input operations on the instrument, such as new project, setting parameters, etc.

Fig.2-6 Keyboard/mouse

2.3.5, Instrument case

The instrument case for SDE-28S+ contains two layers of packing: the inner layer is filled with anti-collision foam, the host and other accessories can be dispersed and embedded; the outer layer is a hard instrument case, sealing-strong, wear-resistant anti-wrestling. This instrument case can effectively protect the instrument from vibration, and convenient to carry it.

Fig.2-7 Instrument case

Chapter 3 Software

The software on SDE-28S+ contains **EchoSounder** and **Hysurvey**, doing the marine survey job, EchoSounder is mainly for depth measurement and Hysurvey is mainly for the project. In this chapter, there would be detail description for these 2 pieces of software.

3.1, EchoSounder

3.1.1, EchoSounder main interface

EchoSounder software is mainly used for configuring the transducer sounding parameters, collecting the echo wave raw data, transmitting the data depth data to the Hysurvey software. Below is the main interface of EchoSounder.

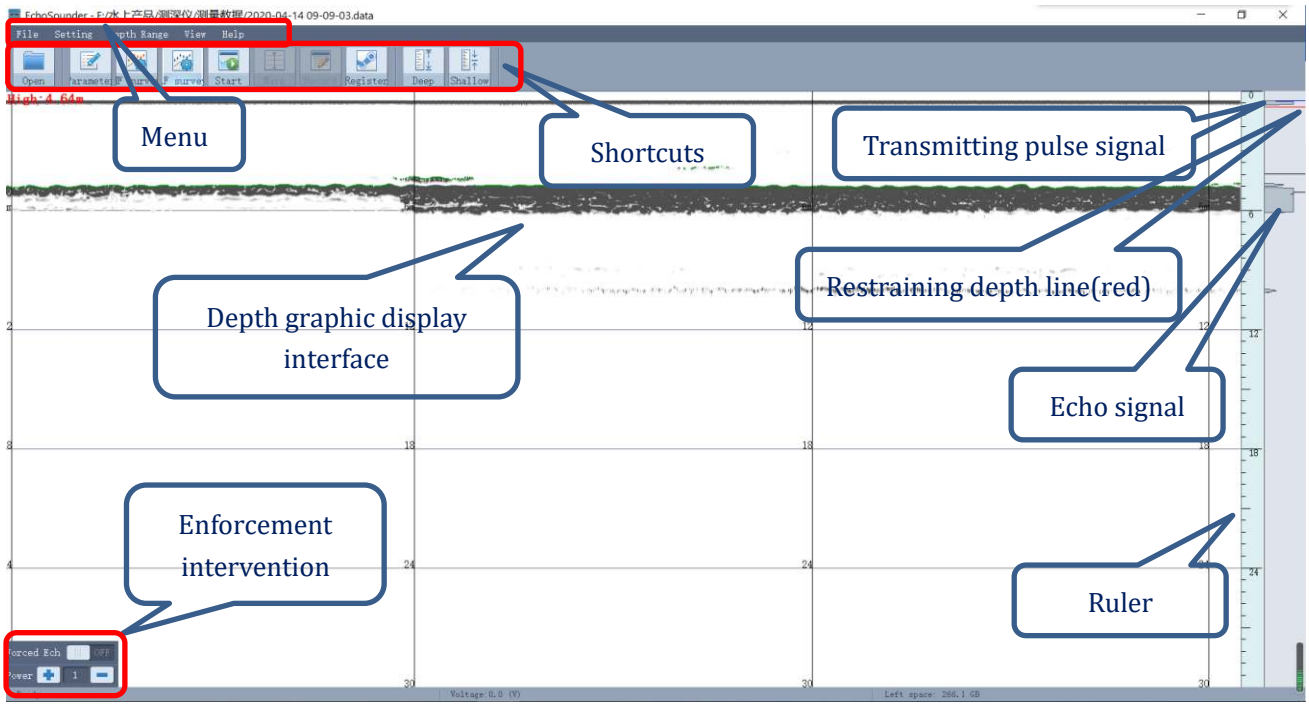


Fig.3-1 EchoSounder main interface

Menu

The menu here contains File, Setting, Depth range, View and Help.

Shortcuts

The shortcuts include Open file, Parameter, HF survey, LF survey, Start/Stop, Mark, Record, Register, Deep and Shallow.

Depth graphic display interface

The depth graphic according to the echo is displaying on this window, and the depth measured by high frequency waves would be display intuitively.

Enforcement intervention

The enforcement intervention operation is mainly used in some tough environments, then adjust the transmitting power of pulse according to the different environment.

Ruler

The ruler can indicate the depth value from the reflected waves, and the scale of which can be zoomed in and out.

Transmitting pulse signal

The long and narrow window at the right side is for the transmitting pulse signal strength transmitted by the transducer.

Restraining depth line

There is a red line under the transmitting pulse signal, it is for eliminating the aftereffects of transmitting pulse.

Echo signal

Echo pulse waveform indication, and the signal amplitude. The echo can reflect the depth.

3.1.2, Menu

The menu includes File, Setting, Depth Range, View and Help.

Fig.3-2 Menu

3.1.2.1, File

Under File menu, there are New, Recently opened files, Page Setup, Print preview, Print to PDF, Print and Exit. The file menu is mainly to use to create a new depth file and print the depth file.

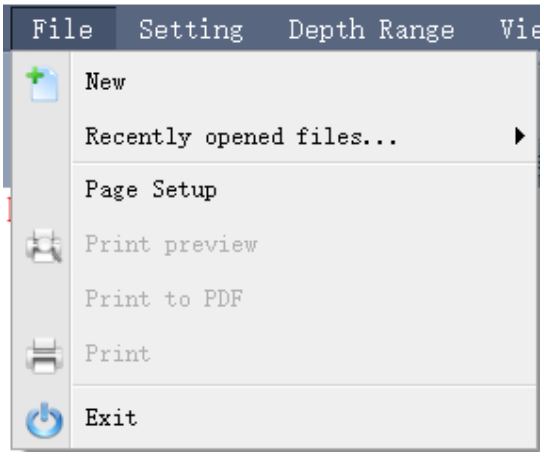


Fig.3-3 File menu

New—click on this option, a new file dialog pop-up, input a name for the file, and click save button to save the file. Please notice that the depth data file format is with .data extension name.

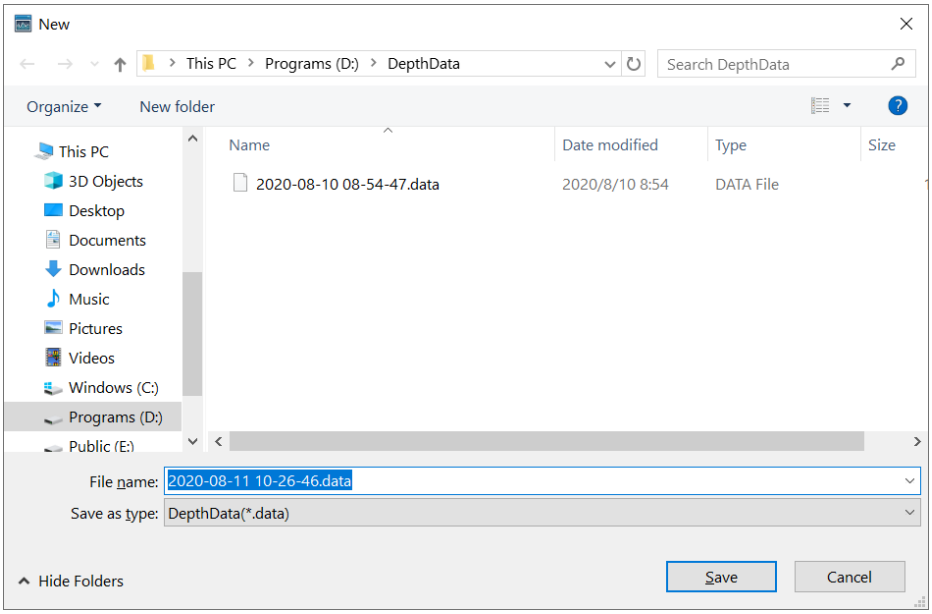


Fig.3-4 New file

Recently opened files—move the mouse cursor onto this option, there would list the recently opened files at the right side, move the mouse cursor on the file and click on it to open the file.

Page Setup—click on page setup option, a print settings dialog would pop-up, it is mainly for the data files print settings.

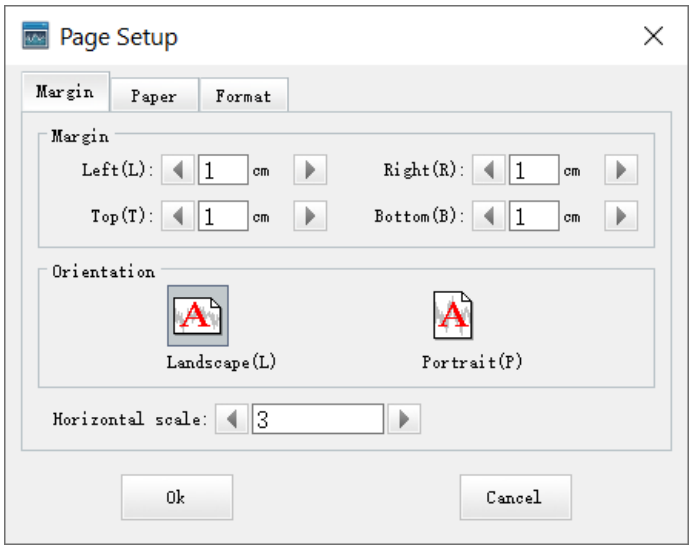


Fig.3-5 Page setup

Print preview—preview the echo wave print.

Print to PDF—print the data file as pdf format.

Print—click on it to print the data file directly.

Exit—exit the software.

3.1.2.2, Setting

Under setting menu, there are Survey Setting, Communication Setting, Device Setting, Rec Speed, Unit, Device Type and System setting. The Setting menu is a very important menu that it is related to whether the echo sounder can work properly or not.

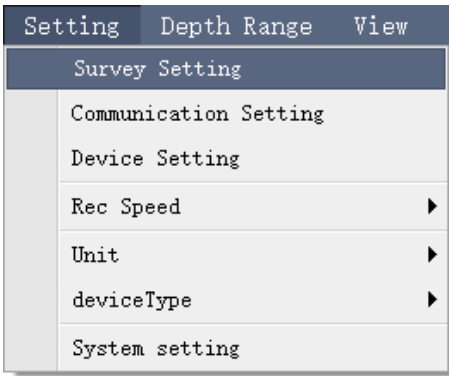


Fig.3-6 Setting

Survey Setting—click this option, there is a dialog pop-up, the draught value, sound velocity, shallow alarm and echo alarm parameters can be set on this dialog.

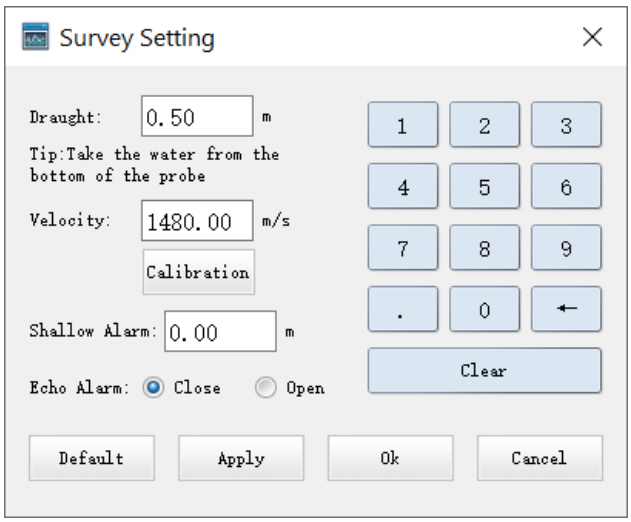


Fig.3-7 Survey setting

1, **Draught**, it is the depth of transducer sank into water, the value should be measured from the water surface to the bottom of transducer. The draught is about 0.5m usually, however, to prevent the fake depth caused by bubbles generated by the movement of transducer in the water, the draught should be increased if the ship speed is too fast.

2, **Velocity**, this is the sound velocity, in different seasons and different waters (including different temperature) will have a different velocity, the velocity of fresh water and sea water are different, so requests to check the echo sounder before each measurement. There are various ways for this check, but the common is two ways: one is Check bar which will be introduced in followed sections. The other way is to measure the sound velocity by sound velocimeter on the spot，sound velocimeter not only measure the sound velocity but also the water depth, then together with the water temperature and depth the user can get the sound velocity after calculation，then input this sound velocity into the software.

The following table is a reference sound velocity according to the different temperature.

Temperature （℃）	Sound velocity （m/s）	Temperature （℃）	Sound velocity （m/s）	Temperature （℃）	Sound velocity （m/s）
0	1402.74	18	1476.35	36	1522.06
1	1407.71	19	1479.55	37	1523.93
2	1412.57	20	1482.66	38	1525.74

3	1417.32	21	1485.69	39	1527.49
4	1421.96	22	1488.63	40	1529.18
5	1426.50	23	1491.50	41	1530.80
6	1430.92	24	1494.20	42	1532.37
7	1435.24	25	1497.00	43	1533.88
8	1439.46	26	1499.64	44	1535.33
9	1443.58	27	1502.20	45	1536.72
10	1447.59	28	1504.68	46	1538.06
11	1451.51	29	1507.10	47	1539.84
12	1455.34	30	1509.44	48	1540.57
13	1459.07	31	1511.71	49	1541.74
14	1462.70	32	1513.91	50	1542.87
15	1466.25	33	1516.05		
16	1469.70	34	1518.12		
17	1473.07	35	1520.12		

3, **Shallow alarm**, this is a protecting depth value for echo sounder, if the measurement depth is lower than this input value, the echo sounder would alarm, this is mainly to protect the transducer from the shallow.

4, **Echo alarm**, this is the function to setup an alarm for echo sounder, activate this function, echo sounder would sound an alarm if there is no echo received by transducer under the situation of incorrect parameters setting, too large tilt angle of transducer, or the measured depth exceeds the range measured by the echo sounder.

Communication Setting—click this option to enter the setting dialog, output depth, heave sensor, tide gauge, mark style and sounder parameters can be set here.

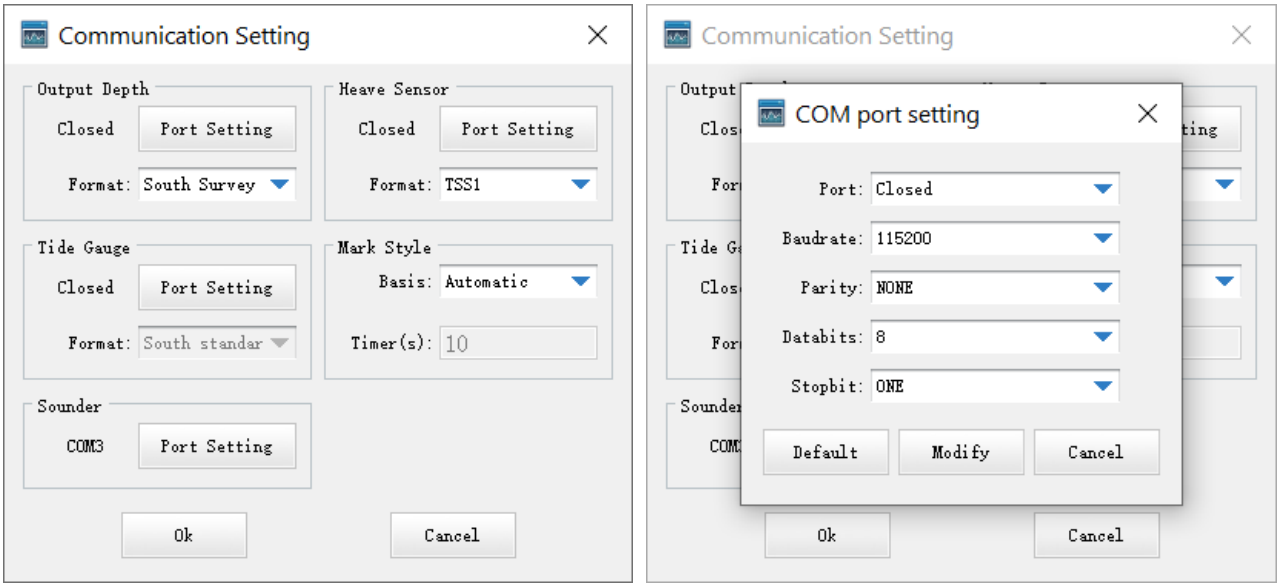


Fig.3-8 Communication setting

1、Output Depth, there are two cases here.

At first, when the customer connects GNSS receiver to echo sounder, the echo sounder works as a computer to run the EchoSounder and Hysurvey software, both of these pieces of software communicate each other through processes, so we don't need to do any settings on this part.

Second, if customer runs EchoSounder and Hysurvey software on a laptop or desktop computer, the echo sounder works as a depth data output device, then the depth data output port should be set as an external serial port behind the instrument, such as COM11.

2、Heave Sensor, connect with heave sensor device to correct heave real time for customer, after connecting to the sensor, click on port setting to set the port parameters and click modify button to apply this port, then choose the correct data format.

3、Tide Gauge, connect with radio tide gauge to monitor tide real time for customer, after connecting to the sensor, click on port setting to set the port parameters and click modify button to apply this port, then choose the correct data format.

4、Mark Style, it is to set the mode for mark, here are manual, automatic and timer for option.

5、Sounder, it is the inner port for data transfer between the internal boards.

Device Setting—click on this option to enter the dialog of settings, Survey Mode Setting, Transmitted intensity and Received intensity are included. It is also a most important setting for the surveying job.

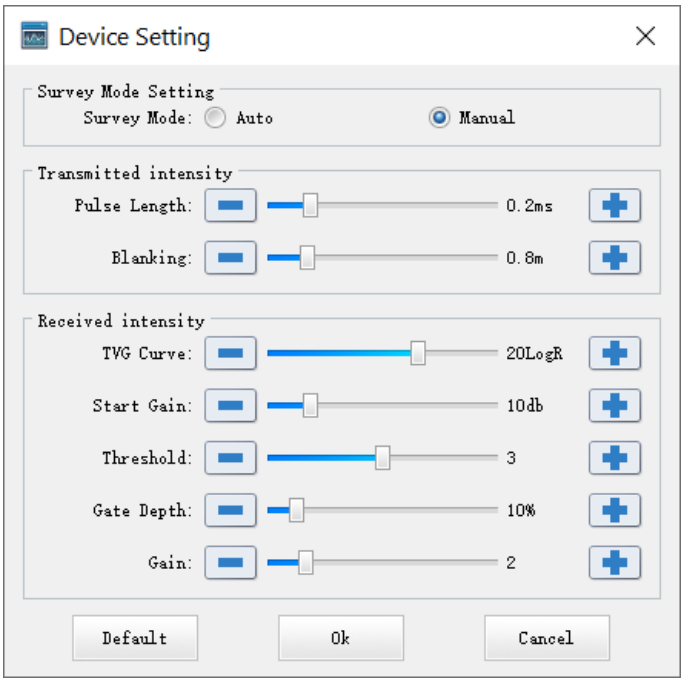


Fig.3-9 Device setting

Ⅰ, Survey Mode Setting, there are auto and manual for option.

Ⅱ, Transmitted intensity, it includes the adjust of pulse length and blanking.

Pulse length, pulse length indicates the transmitted pulse duration with the millisecond unit, and its value ranges from 0.01 to 1.2. The intensity of the transmitted pulse becomes stronger along with longer pulse. The figure width of the transmitted / received pulse means the pulse intensity, and the figure length of the transmitted / received pulse means the pulse length.

If the pulse length is too long, the signal duration is too long, it may cause the error because of the overlap of the transmitted pulse and the echo wave when measure in shallow water.

If the pulse length is too short, then the signal duration time is too short, when measure in deep water or the absorption power of the water is too strong, may appear no echo because the transducer can't receive strong enough echo signal. So, we should adjust the pulse length value according to depth real time. The default value of pulse length is 0.1ms. If we work on the sea, we should increase the pulse length properly, since the higher salinity water absorbs ultrasound strongly.

Blanking, the experiment proves that the ultrasonic lasts out even if the Pulse Length time is over, and that is said remaining ultrasonic signal. And this signal will affect the return signal from the bottom, and the blanking pulse length can clear the remaining signal to get precise depth.

Blanking Pulse Length must be one millisecond longer than the Pulse Length except extreme case.

Ⅲ, Received intensity, it contains TVG curve, start gain, threshold, gate depth and gain.

TVG Curve, when the sound waves propagate in water, the sound intensity attenuates exponentially, in order to keep the signal amplitude stable, TVG will control the receiving amplifier to increase the amplification factor according to the opposite law, which is the time gain control.

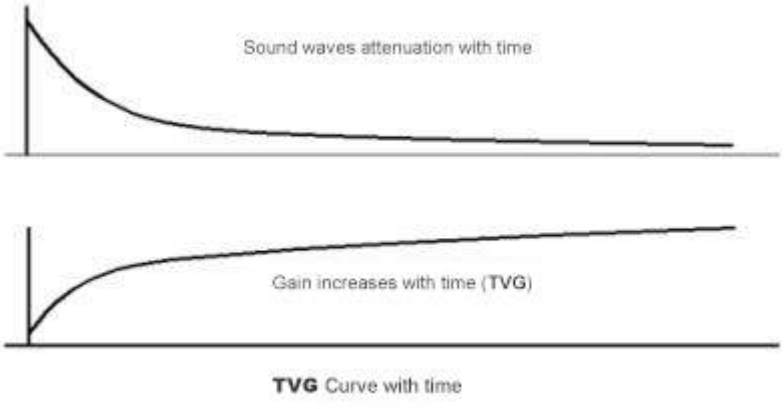


Fig.3-10 TVG curve

Start Gain, in actual work, due to the weakness of the echo signal, the signal must be amplified before processing, that is to increase the amplitudes of signal by amplifier circuit. This function is not only to enlarge the echo signal, clutter also enlarge together, so an appropriate value is necessary to be set in order to make the instrument can maximum identify the effective echo signal.

Threshold, it decides when the timer using for accumulating the echo continuous time stops working, and to start picking up return signal. When increasing the threshold value, feebler signal may be picked up, but the signal is more possible unwanted.

Gate Depth, the purpose of this parameter is to control the rate of change of two adjacent measurements. In generally speaking, we can think about that the bottom of water change is continuous, as long as the time interval between the two measurements is relatively short, the change of the depth will not too big, then the received echo time difference too big as well, so this can be set a percentage, such as 10%.

Gain, gain value means the enlargement factor of the return signal. It is useful to increase the gain when the return signal is feeble, but the noise is enlarged as the gain is increased. So the

gain must be set considering the vantage and disadvantage. The Gain should be increased or decreased until the digitizer finds the correct bottom.

Depth range	transmitted intensity			Sensitivity		**Filter setting**
	Pulse length	Blanking pulse	**Power**	**Gain**	**threshold**	**Gate depth**
1—20m	0.2ms	1.4ms	Low	2	1	10%
20-50m	0.3ms	1.6ms	Low	3	1	10%
50-100m	0.5ms	1.6ms	High	3	1	10%
100-300m	0.6ms	1.8ms	High	3	1	10%

Rec Speed—the default recording speed of the software is ×1, when ×2 is selected, the software will record echo data at double speed.

Fig.3-11 Rec speed

Unit—select the unit for depth, here are metric and inch for option.

Fig.3-12 Unit

Device Type—select the correct device type here according to the using echo sounder, and the EchoSounder software would display the corresponding interface.

Fig.3-13 Device type

System setting—here is mainly to set the font size and the font color for depth.

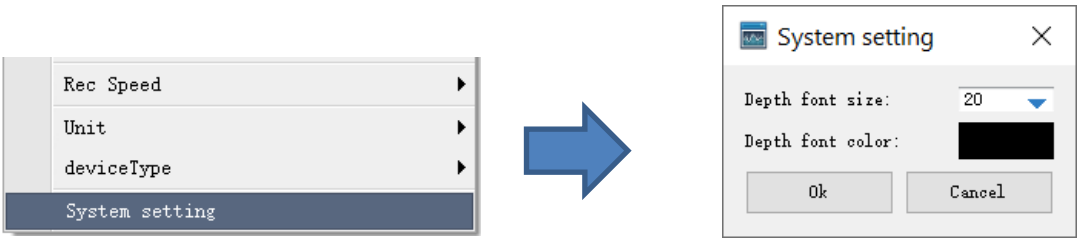


Fig.3-14 System setting

3.1.2.3, Depth Range

In the depth measurement, different depth measurement use different frequency, in order to obtain higher sampling rate and echo image resolution, an appropriate depth gear should be selected as far as possible, If the selected gear is less than the actual water depth, the system will automatically adjust the transmission frequency to a suitable gear, in this case, the underwater section diagram cannot be fully displayed on the screen, while the scale is still fixed at the current gear, but the accuracy of the measurement results is not affected by anything.

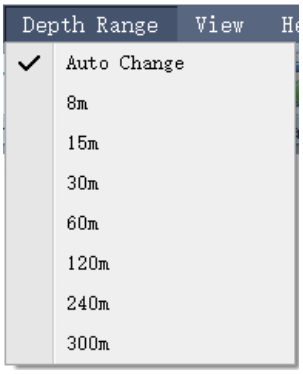


Fig.3-15 Depth range

3.1.2.4, View

There are color mode, display setting, ruler increment and status bar under View menu.

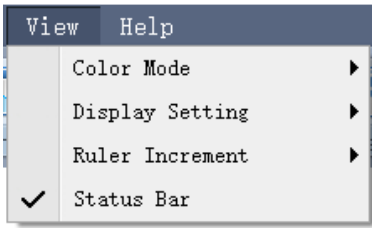


Fig.3-16 View

Color Mode—this is the color setting for signals, here are gray and color for option.

Fig.3-17 Color mode

Display Setting—clear the screen before replay, hide the mark information when replay, display parameter and display digitized line are contained in this menu, select the proper option according to the need.

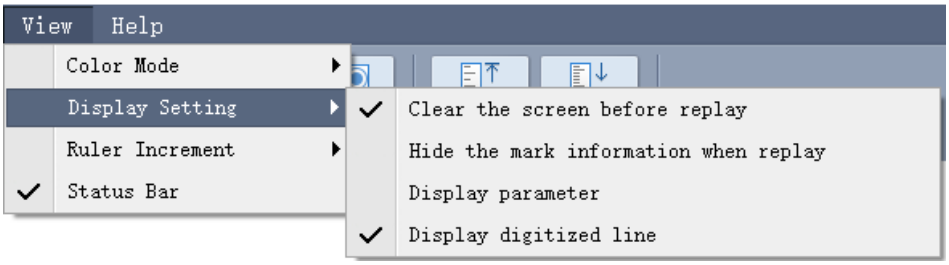


Fig.3-18 Display setting

Ruler Increment—select the time for ruler increment, the software will mark automatically according to the setting time.

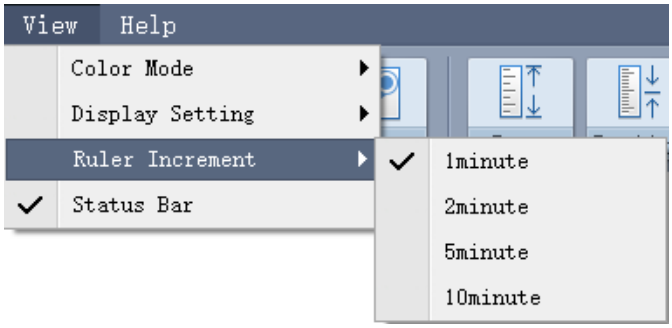


Fig.3-19 Ruler setting

Status Bar—check or uncheck on this option to display or hide the status bar.

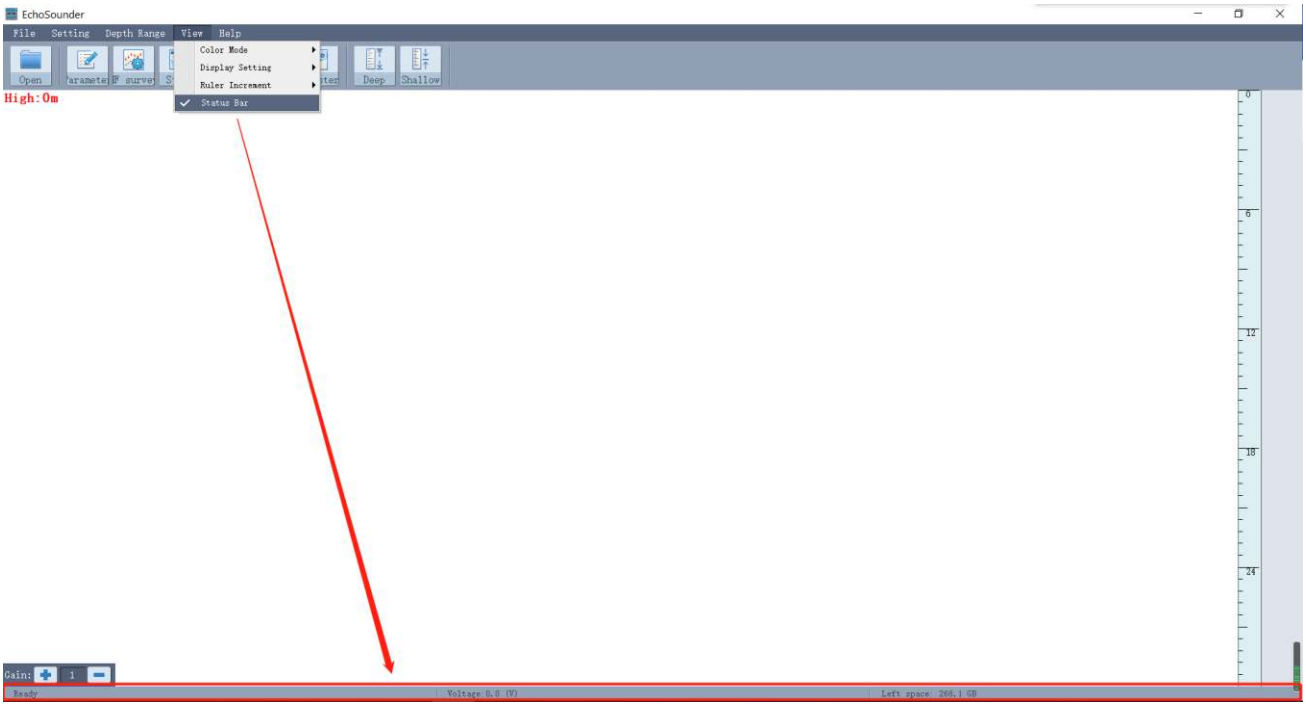


Fig.3-20 Status bar

3.1.2.5, Help

Under help menu, there are register and device information.

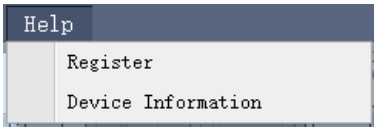


Fig.3-21 Help

Register—registration is the process of registering each instrument for use, after user receives the echo sounder, there will be around 30 hours for trial period, so before it expires, please register the instrument for further use.

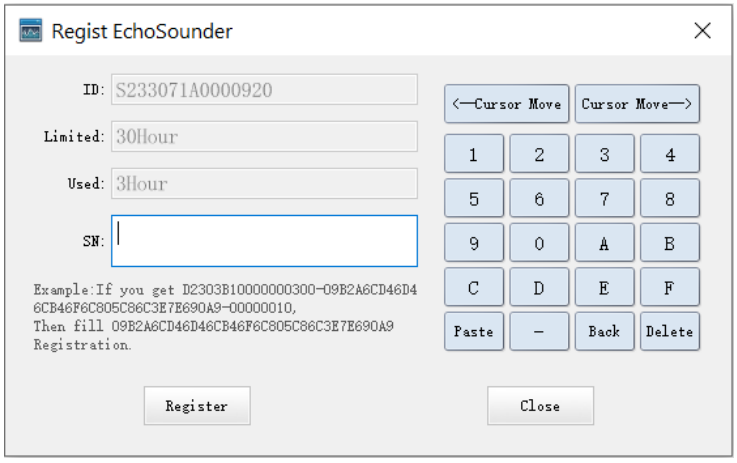


Fig.3-22 Register

Enter the register echo sounder dialog, there is the software ID, and remaining use time, and the used time, if the trial period is going to expire, contact with KOLIDA staff and ask for the license, then enter it into SN blank.

Device Information—click on this option to check the device information on the pop-up dialog, like disk space, hardware information, and the software information as well.

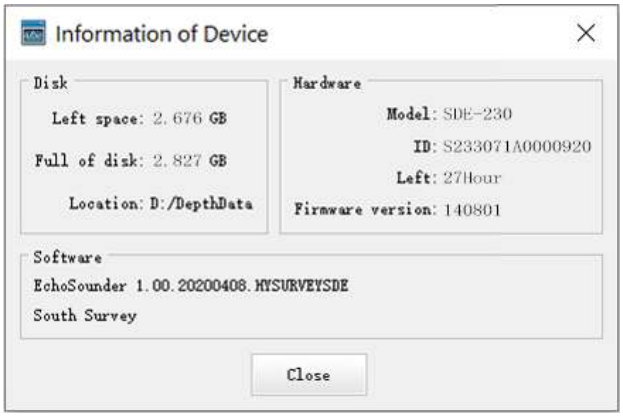


Fig.3-23 Device information

3.1.3, Toolbar

Below the menu, a series of shortcut buttons are listed in the shortcut menu, they are open, parameter, HF survey, start/stop, mark, record, register, deep and shallow. Click on the corresponding button, we can enter the setting dialog quickly.

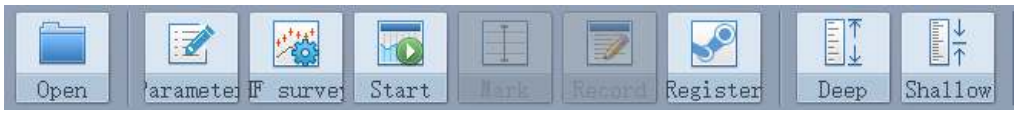


Fig.3-24 Toolbar

Click on this button to open the depth data file saved in DepthData folder on device. Open the file for replaying, checking and appending the record.

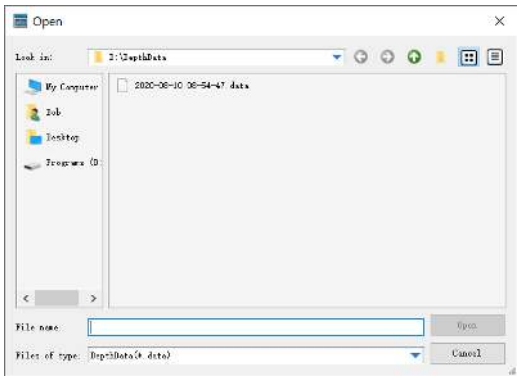


Fig.3-25 Open

Click on this button to enter the survey setting dialog, and set the parameter for draught, sound velocity, shallow alarm and echo alarm.

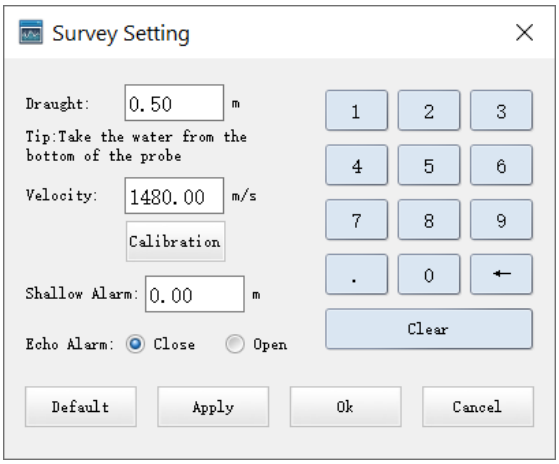


Fig.3-26 Survey setting

Click on this button to enter the device setting dialog, make the corresponding settings according to the actual work.

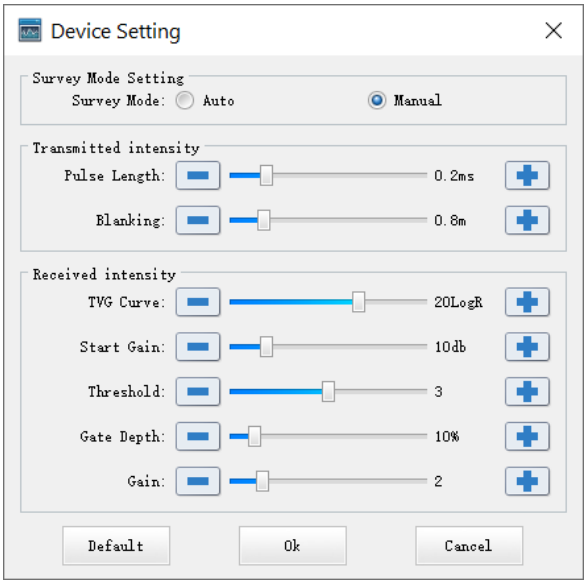


Fig.3-27 Device setting

After the correct parameters have been set, such as draught, sound velocity and so on, click this button to start the measurement.

It is the button to mark the user graphic file with an event mark manually, the software will mark on the screen once if click on this button one time.

Click on this record button to save the data of transmitting wave, echo, device parameters and so on after starting the measurement, and the file name would be saved as the current date,

in order to print and look up in the future.

Click on this button to quickly enter the registration dialog.

If the measuring depth is out of range, the graphic may not be fully displayed on the screen, so click on this button to quickly extend the depth range.

Click on this button to shrink the depth range.

3.2, HySurvey

Hysurvey is KOLIDA new generation of measurement software integrating water depth data collection and post-processing, easy to use. And the operation flow is completely consistent with the user's actual work flow. Its strong scalability can let it connect to all kinds of GPS receivers and depth sounding equipment. HySurvey is a good choice for ocean depth surveying, river channel surveying, engineering exploration positioning, piling, reef blasting, geophysical drilling and seismic lofting.

3.2.1, Main interface

Below is the main interface of HySurvey software.

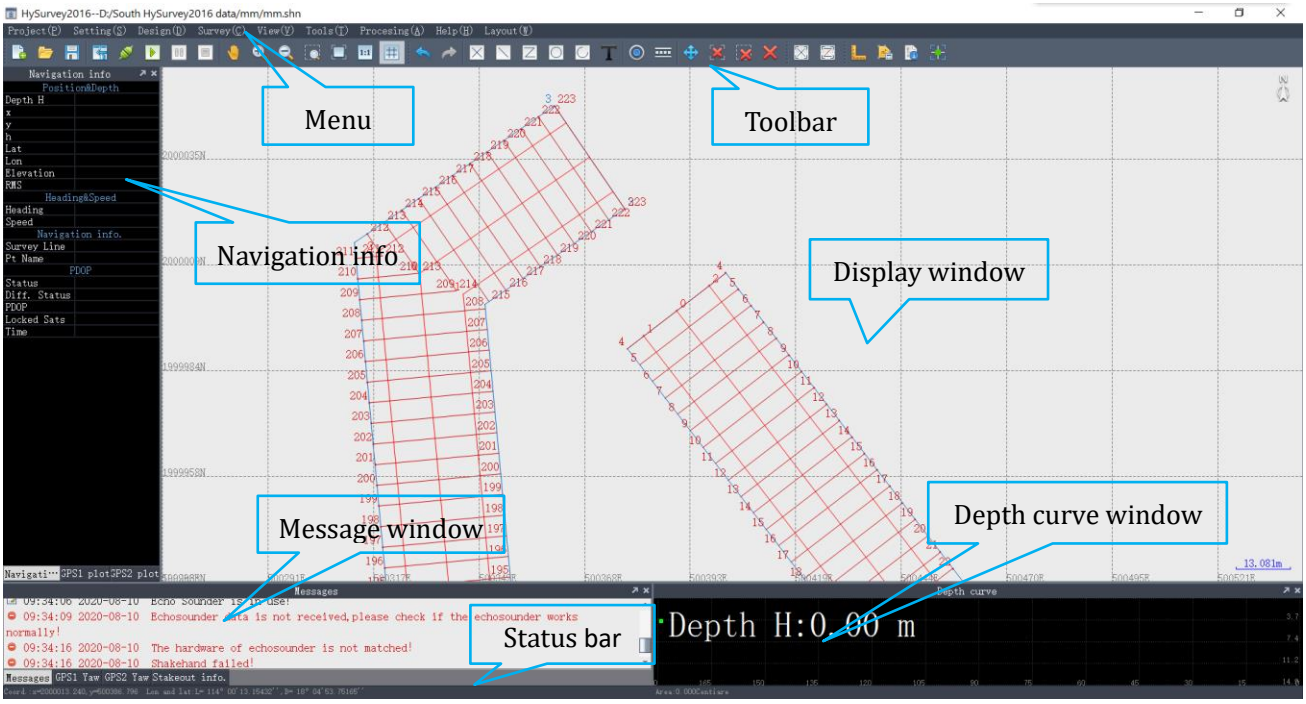


Fig.3-28 Main interface

3.2.2, Menu

All the corresponding functions and settings are contained in the menu, like project, setting, design, survey, view, tools, processing, help and layout.

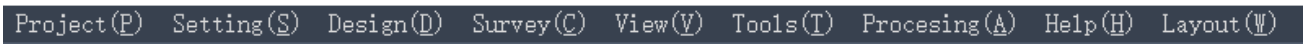


Fig.3-29 Menu

3.2.2.1, Project

Under the project menu, there including new project, open project, modify project, import, export, save and exit.

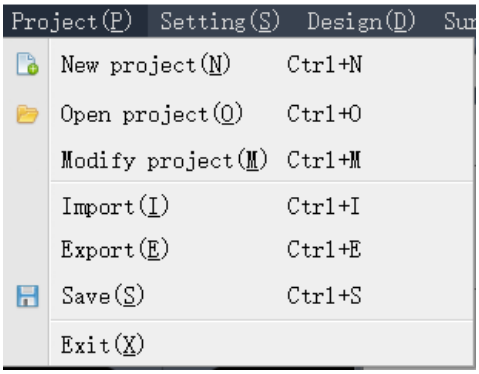


Fig.3-30 Project

New project—Click on this option to create a new project on the pop-up dialog, enter the project name and click OK button, and start to configure parameters for the project on the project wizard.

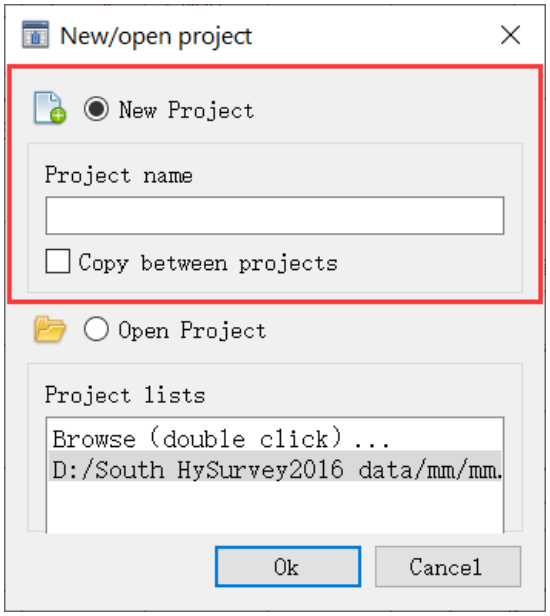


Fig.3-31 New/Open project

At the Basic tap, enter the information for the project, change the storage path, builder, location, project date, operator and something else, then click Next button to the next parameter configuration.

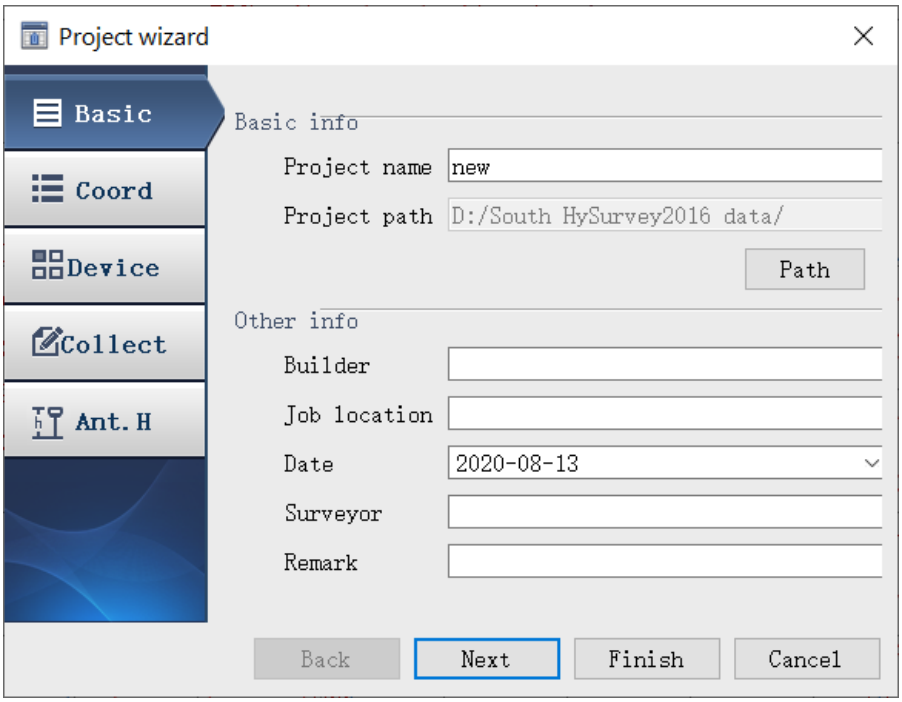


Fig.3-32 Basic info

At Coord tap, if there are no the local coordinate system in the list, click New button to create the local coordinate system.

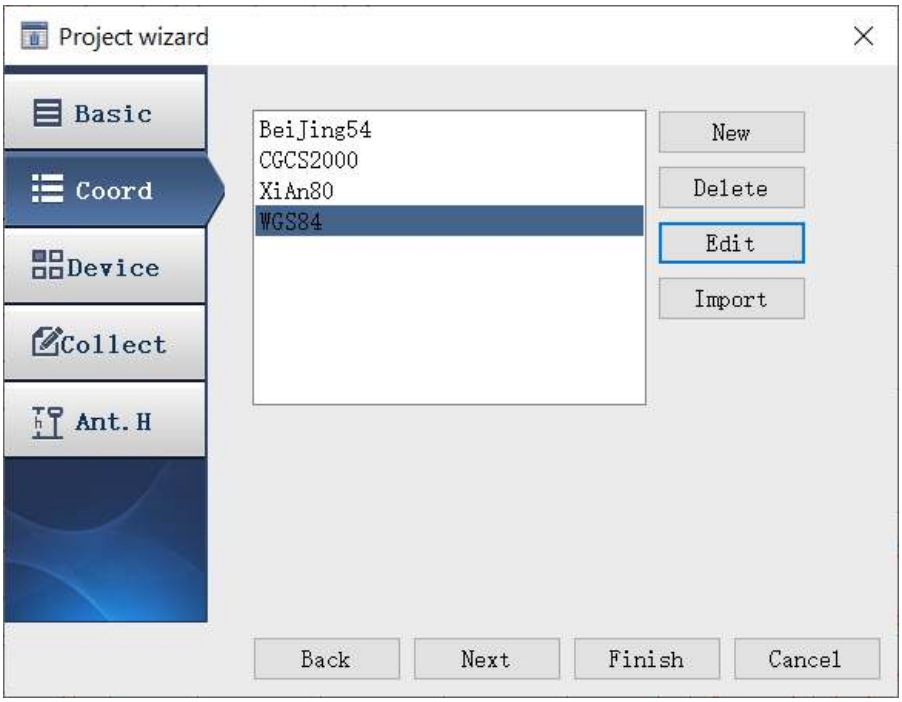


Fig.3-33 Coordinate system

Enter a name for local system in order to identify easily, then choose the correct ellipsoid, projection type, and the projection parameters. If there are the transformation parameters for the local system, click Parameters button to enter the dialog and input the parameters.

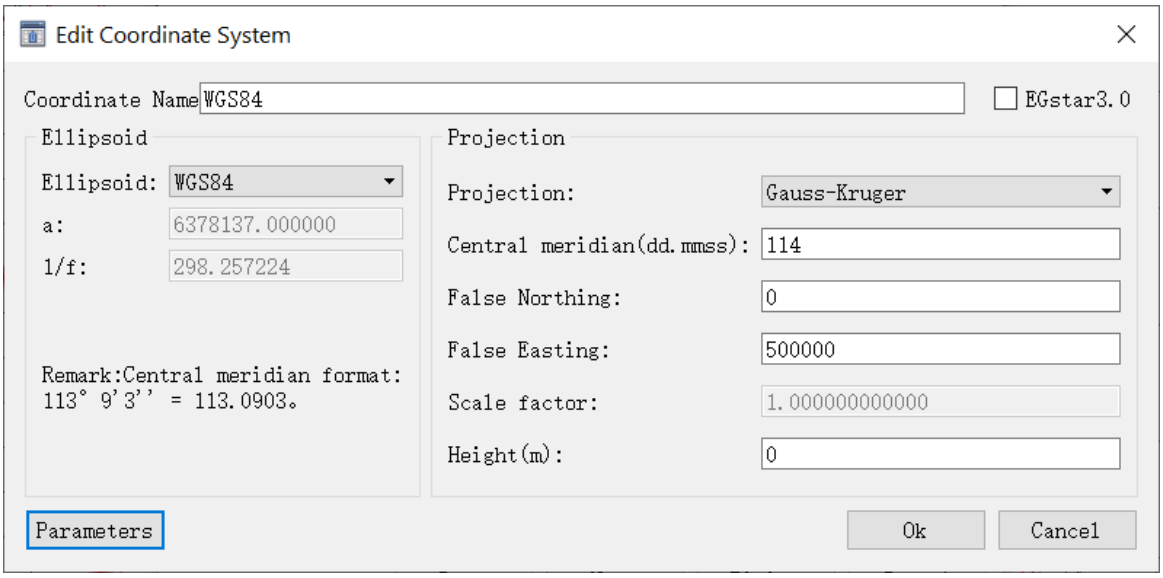


Fig.3-34 Edit coordinate system

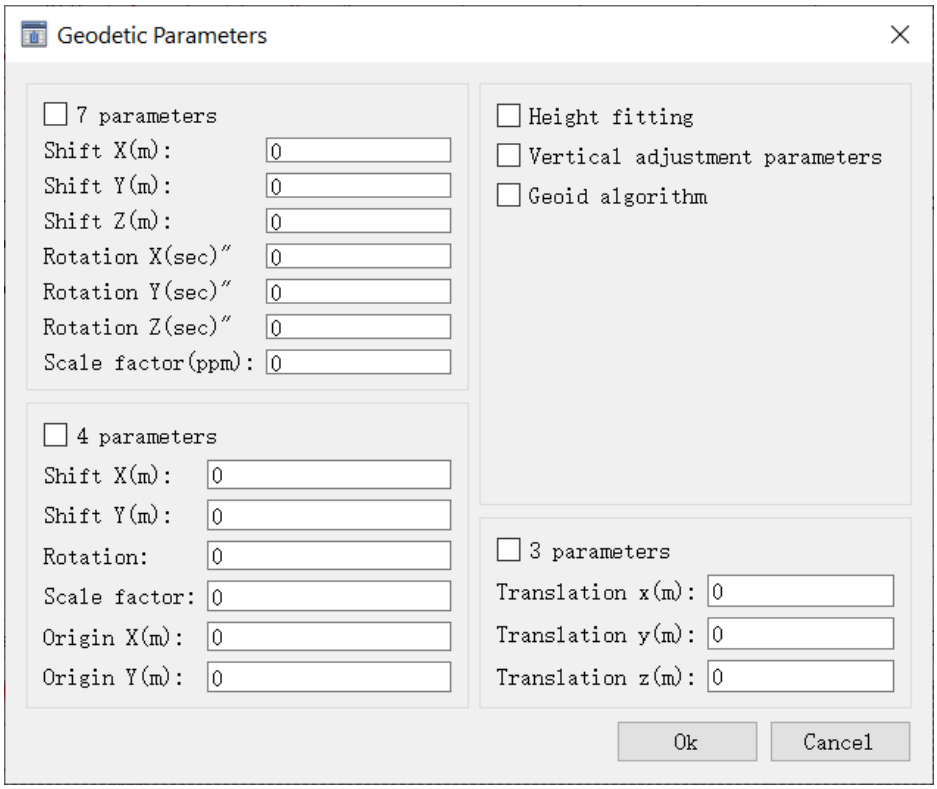


Fig.3-35 Parameters

After finishing the coordinate system settings, click Next button to go to Device tap, here choose the correct COM port for GPS1 and Echosounder, then check the box of Enabled.

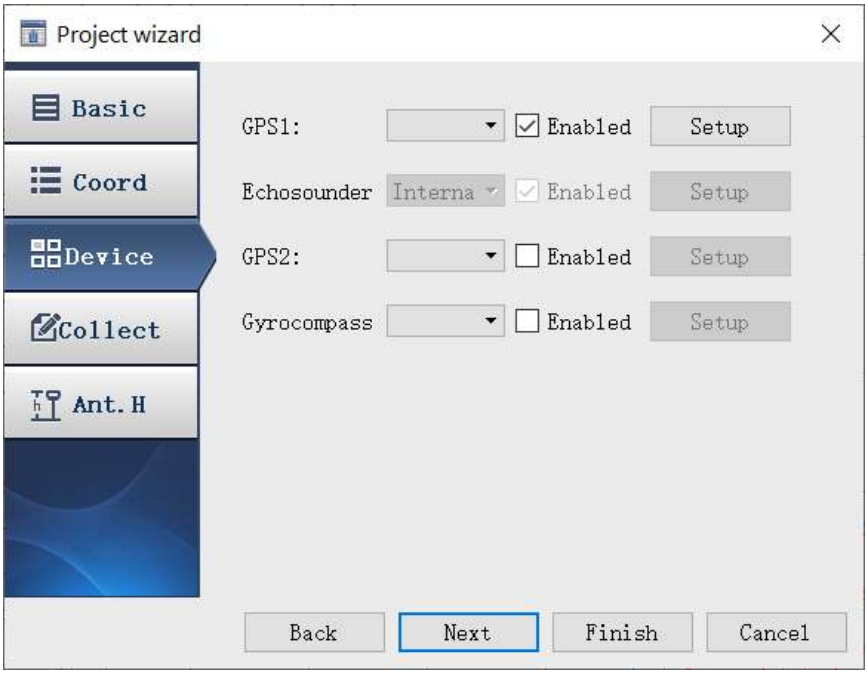


Fig.3-36 Device

GPS1 config, click Setup button to enter the dialog, choose GNSS type under the dropdown list, if the GNSS receiver is an unknown type, choose other option, and use the default data format. Move to serial parameter tap, choose the correct COM port and baudrate. The parameters of Parity, Stop bits and Data bits modification should be under the guidance of the professional technician, generally, all of these parameters are used as default. After that, click Test button to check if there is data stream comes from GNSS receiver.

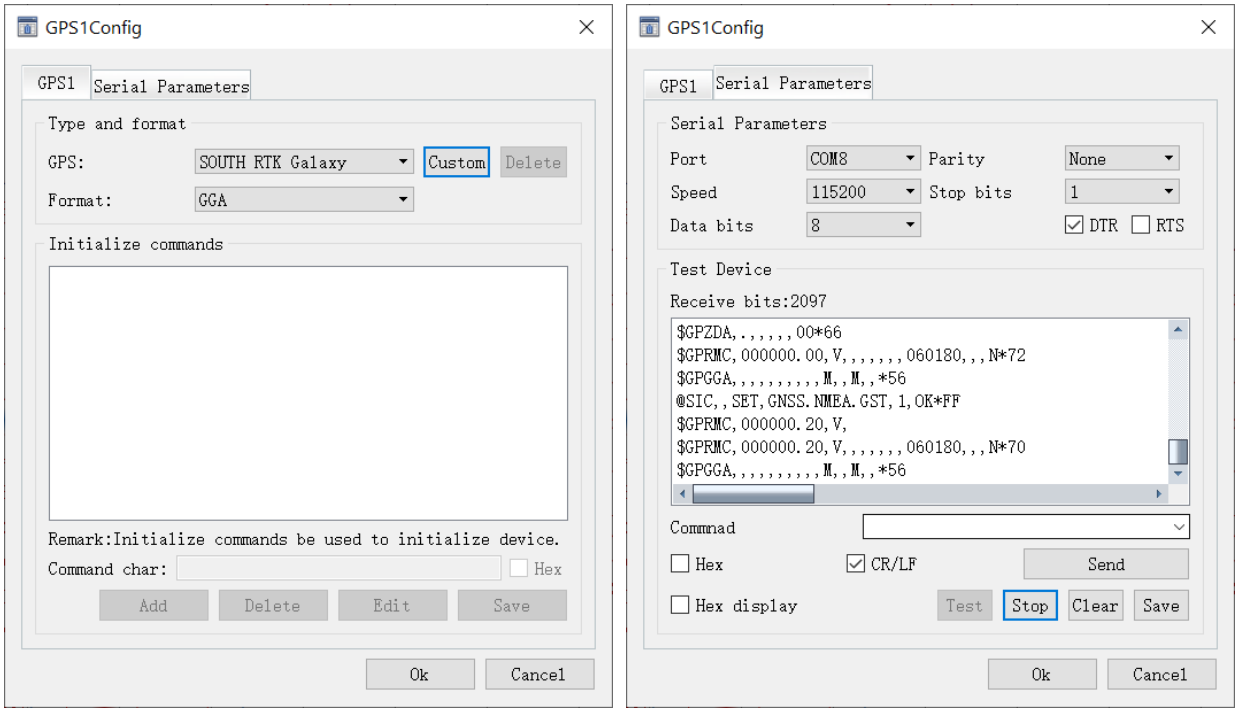


Fig.3-37 Device setup

Echosounder config, on SDE-28S+ echo sounder, the echosounder config would be default as using the internal device.

Click the Next button or the collect tap at the right side to go to configure the data collection conditions. According to the connected GNSS receiver positioning accuracy, for example, we choose RTK option if we connect an RTK receiver. And the mark method would be auto and manual (using space button), and mark interval can be with time or distance, distance interval is generally used, the coordinate and depth would be marked in every assigned distance. Auto and manual mark method can be chosen together.

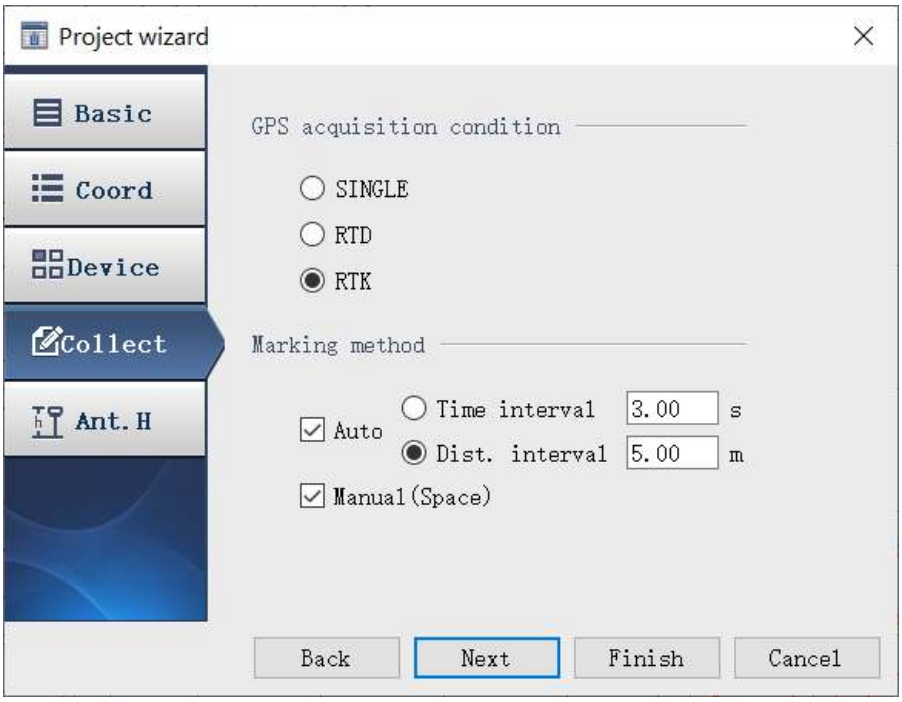


Fig.3-38 Collection condition

Click Next button to go to the Ant.H interface to configure the antenna height for the connected GNSS receiver, then click Finish button to complete creating a new project.

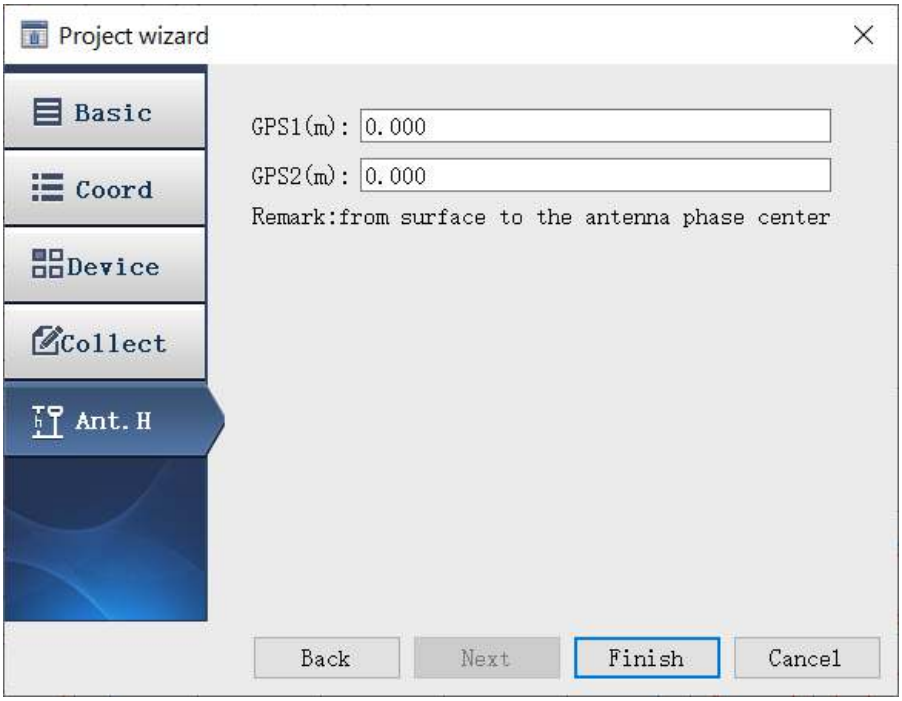


Fig.3-39 Antenna height

Open project—Click on this option, choose the project file which saved in the instrument, then click OK button to open it, or double click on the data file to open it.

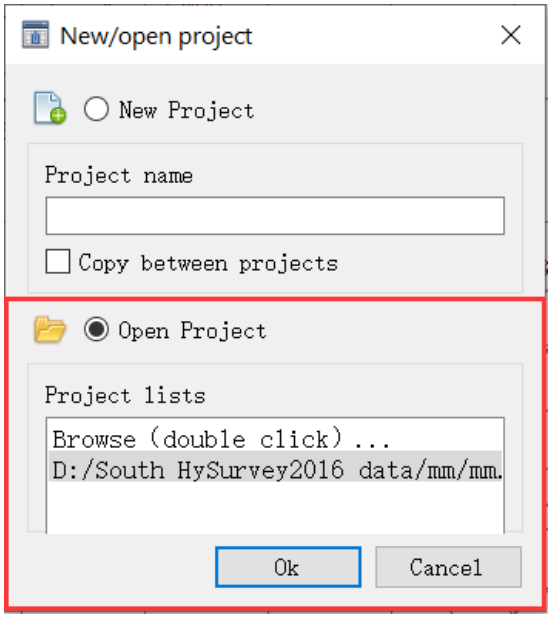


Fig.3-40 Open project

Modify project—Click on this option to enter the project wizard, basic information, coordinate system, device, collection and antenna height parameters can be modified here for the current project.

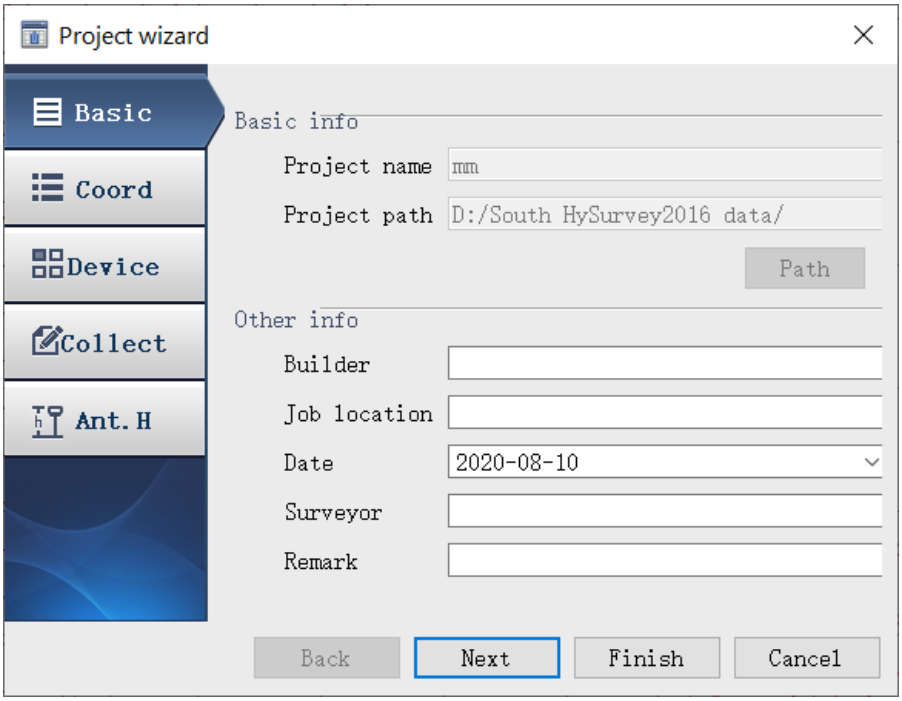


Fig.3-41 Modify project

Import—Here can import the base map into project, HySurvey supports CAD2000 dxf format, KOLIDA dat and ssd format, Hypack xyz and mtx format, as well as S57 format electronic chart.

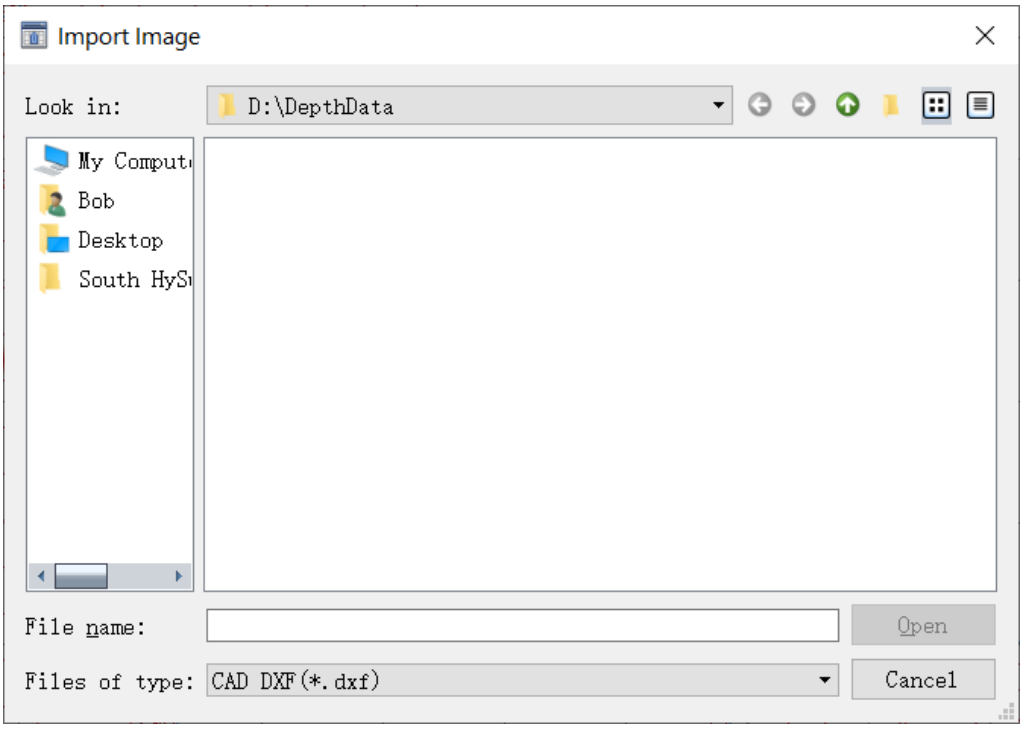


Fig.3-42 Import

Export—This function is able to export the base map as CAD2000 dxf graphic, the elements exported including points, lines curves, broken lines and the planned lines.

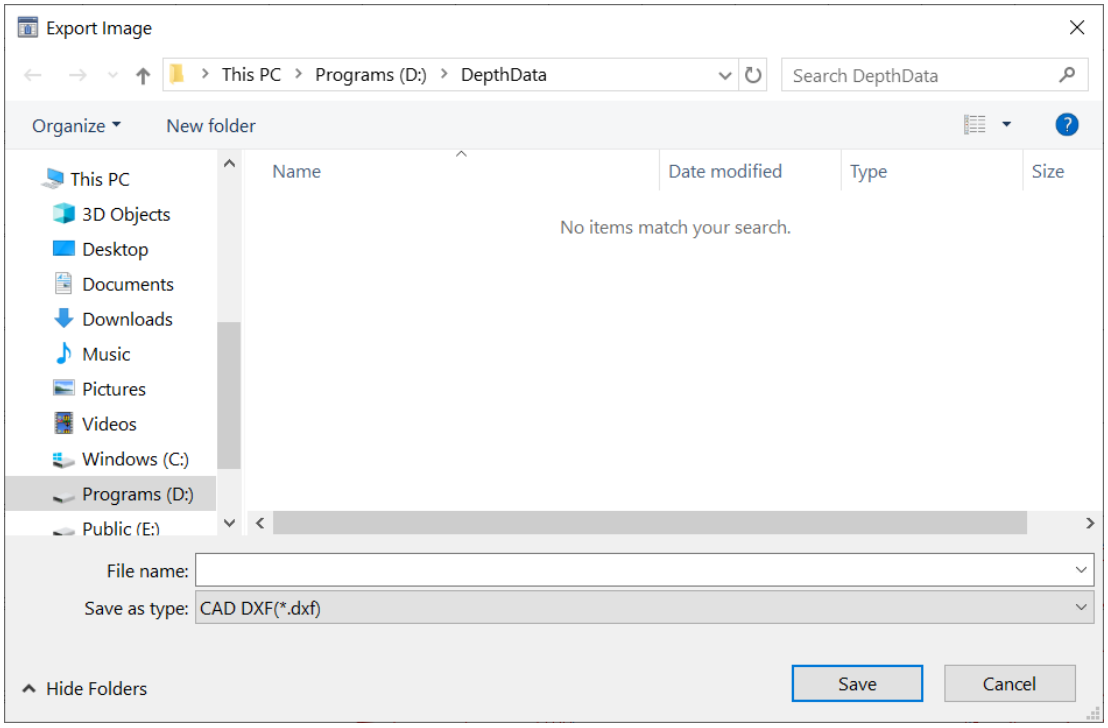


Fig.3-43 Export

Exit—Exit the HySurvey software.

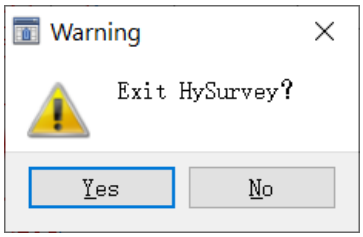


Fig.3-44 Exit

3.2.2.2, Setting

Setting menu contains all kinds of settings, like coordinate system, survey devices, data collection, store setting, data transmit and so on.

Coordinate system—New a local coordinate system for current project, including system name modification, ellipsoid, central meridian and the transformation parameters.

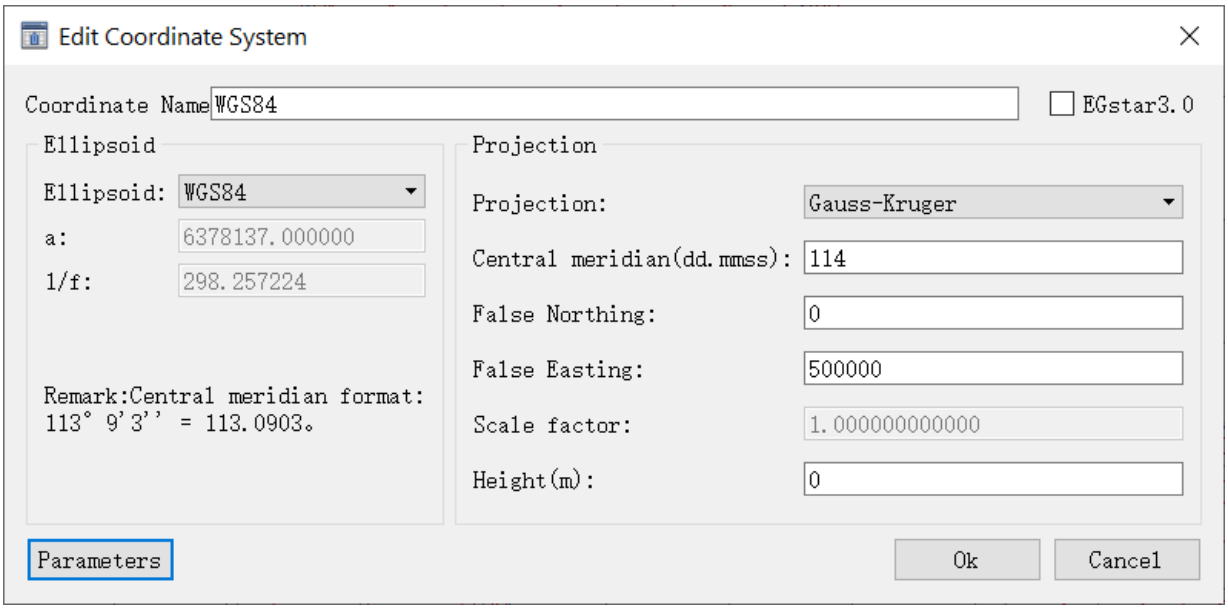


Fig.3-45 Coordinate system

Survey devices—Here can make the connection settings for connected GNSS receiver and echo sounder, like the COM port and baudrate, then click setup button to test the communications.

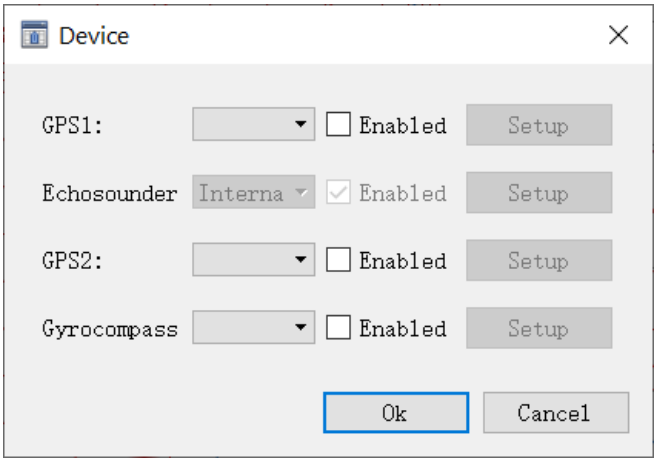


Fig.3-46 Survey devices

Data collection—Like on the project wizard, here is able to set the data collection conditions.

GPS acquisition condition:

According to the connected GNSS receiver positioning accuracy, for example, we choose RTK option if we connect an RTK receiver.

Marking method:

Mark method would be auto and manual(using space button), and mark interval can be with time or distance, distance interval is generally used, the coordinate and depth would be marked in every assigned distance. Auto and manual mark method can be chosen together.

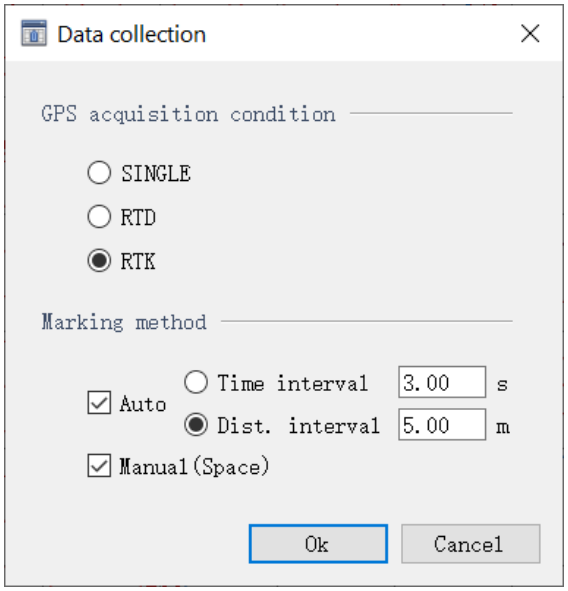


Fig.3-47 Collection condition

Store setting—In this store setting interface, we can set the line name, line number and naming method of points for measurement file according to our needs.

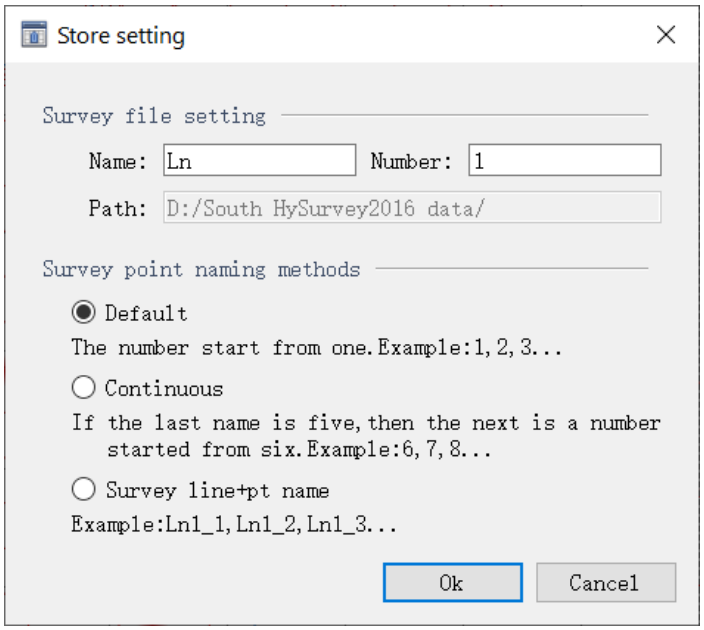


Fig.3-48 Store setting

Name: The line name represents the command prefix for the file, and along with line number forms the file name.

Number: The line number indicates which file is to be measured, and along with line name to form the file name, for example, Ln1 and Ln2, where Ln is the line name, and number 1 and number 2 are the line number.

Default: Each time clicking on the measure button, the line number will increase by one, and the point number in the file will be counted again from 1, as shown in the figure below, there are 3

files measured, Ln1, Ln2 and Ln3.

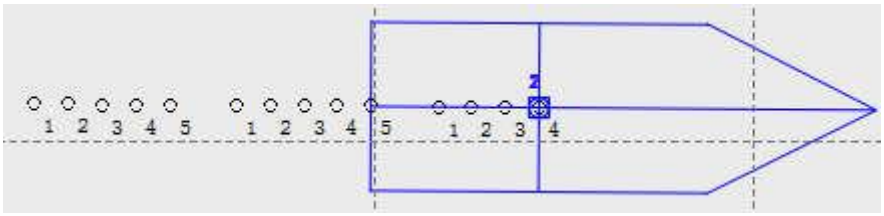


Fig.3-49 Default naming

Continuous: Each time clicking on the measure button, the line number will increase by one, and the point number in the file will increase according to the last point name. As shown in the figure below, there are 3 files measured, Ln1, Ln2 and Ln3, in file Ln1, 3 points were measured and the point number would be 1, 2, 3; then in file Ln2, there are 4 points and the point number starts from 4, then increase to 5, 6,7; in file Ln3, 4 points were measured and the point number would be 8, 9, 10, 11.

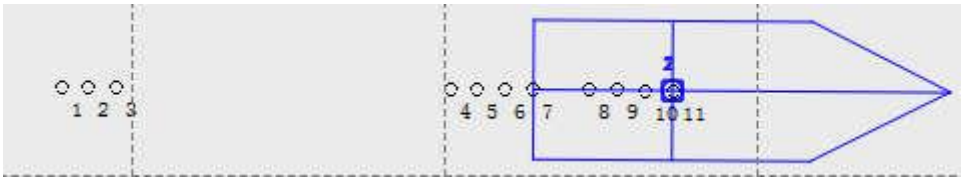


Fig.3-50 Continuous naming

Survey line+pt name: Each time clicking on the measure button, the line number will increase by one, and the point name will increase by line number + point name, for example, as shown in the figure below, there are 3 files, the point number is Ln1_1, Ln1_2, Ln1_3 in file Ln1, and Ln2_1, Ln2_2, Ln2_3 in file Ln2.

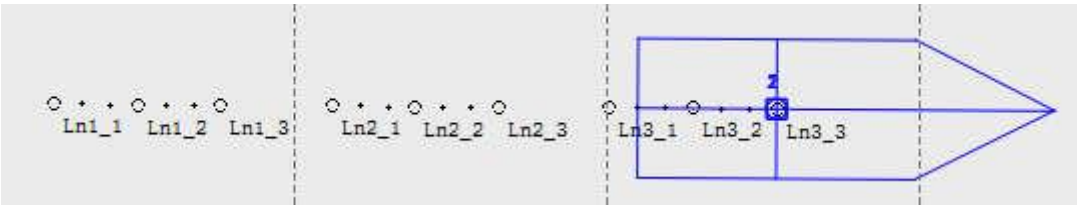


Fig.3-51 Survey line + pt name

Data transmit—It means that the software transfer the acquired GNSS data to the other port or network server through the serial port or network, for the other software or devices use. Here are 3 kinds of data source for transferring, GPS1 data, GPS2 data and custom string data. Which data source needs to be transferred, check the enable box and click Setup button for further settings.

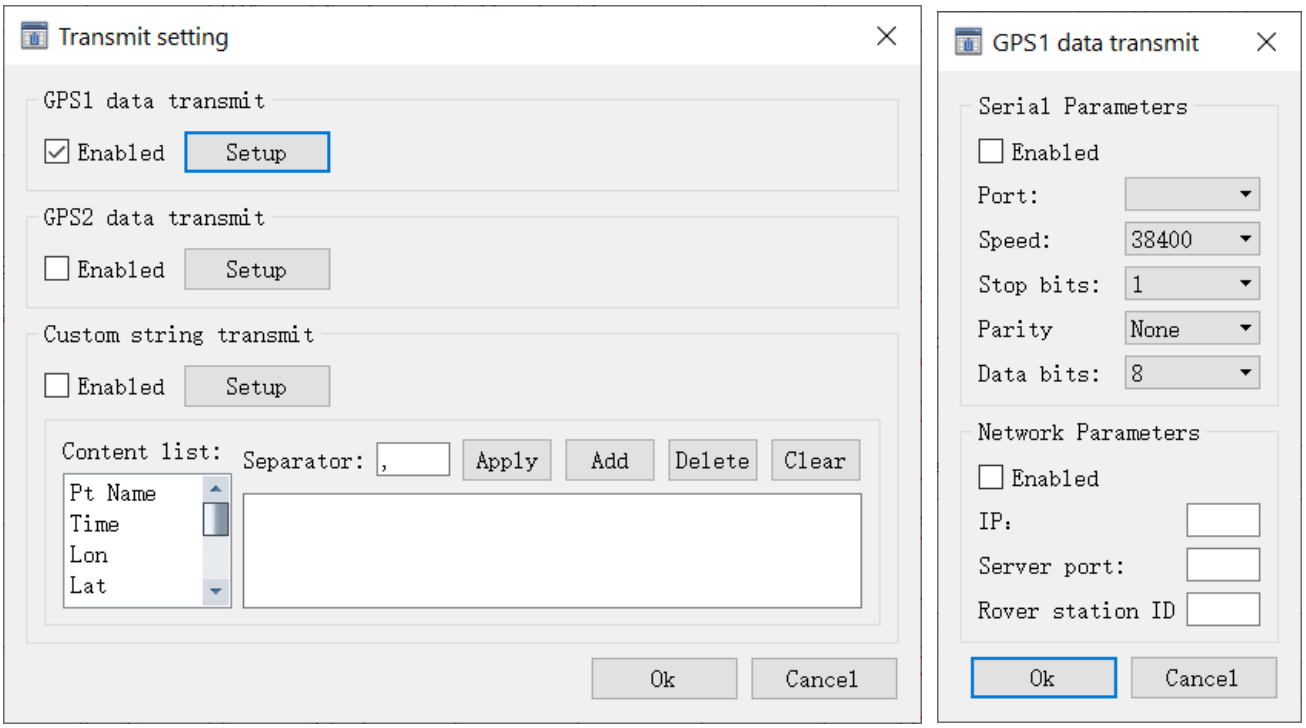


Fig.3-52 Transmit setting

EchoSounder path—It is the location where EchoSounder software installed.

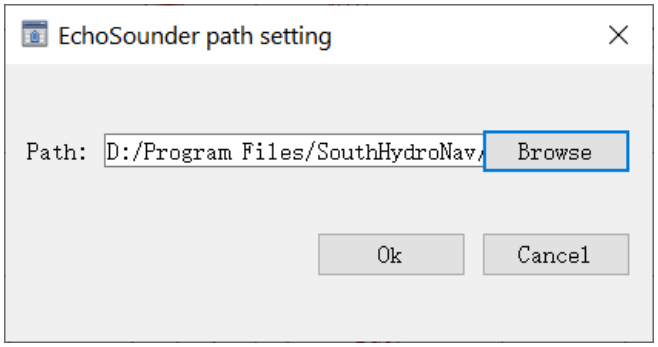


Fig.3-53 Echosounder path

Correction wizard—The purpose of correction is to correct the base coordinate from the other coordinate system to local coordinate system. To activate this function, a GNSS receiver should be connected and used.

Offsets—The offset setting is to set the relative offset of the GNSS receiver antenna and the measuring point in the ship center coordinate system. After the ship's center coordinate system is established, the position of the GNSS antenna and GNSS measurement point needs to be calculated into the ship's center coordinate system. In general, if there are 2 GNSS receivers, the one set at rear of the ship is GPS1, and the one set at front of the ship is GPS2.

Please note that if there are 2 GNSS receivers used to determine the ship’s course, no matter how

GPS1 and GPS2 are placed, the final course is from the stern to the bow, and the offset of the 2 antennas in the coordinate system needs to be accurately measured and filled into the offset setting.

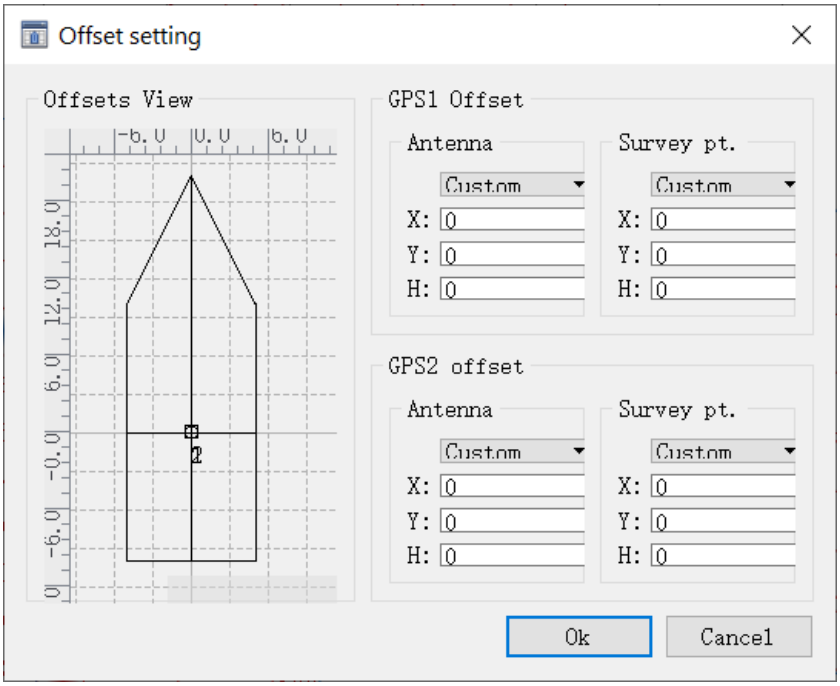


Fig.3-54 Offset setting

Beacon—It is to configure the beacon signal as long as the V series of compass is connected.

Antenna—Here can set the antenna height for GPS1, and this height is the vertical height, which is the distance from measurement point to receiver antenna phase center.

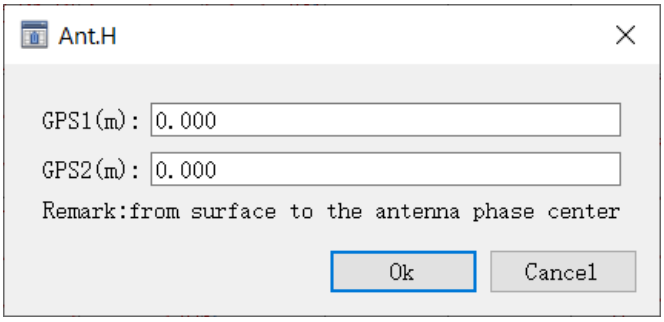


Fig.3-55 Ant.H

Shallow alarm—It is to set a threshold of shallow water alarm, enter a proper value for the threshold and check the box of Enabled to apply the settings, while the measuring depth is less than the assigned value, the shallow water alarm will be triggered, and the alarm information would display in the message window.

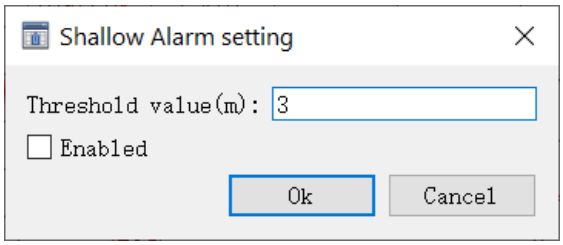


Fig.3-56 Shallow alarm

Device latency—When using a single-beam echo sounder for depth measurement, since the positioning system and the sounding system are two independent systems, a systematic delay is generated and becomes an error in the depth measurement. So this setting is a compensation for this delay.

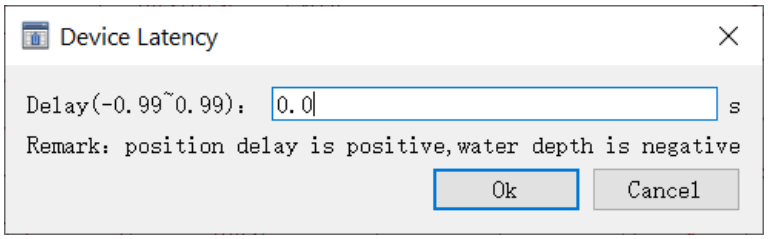


Fig.3-57 Device latency

Ship mode setting—Here is for the configuration of vessel display on the screen.

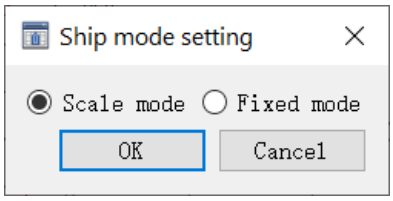


Fig.3-58 Ship mode setting

Orientation mode—It is a setting of ship's position displayed on the screen, there would be 4 modes for option, center, heading up, center beyond the screen and none.

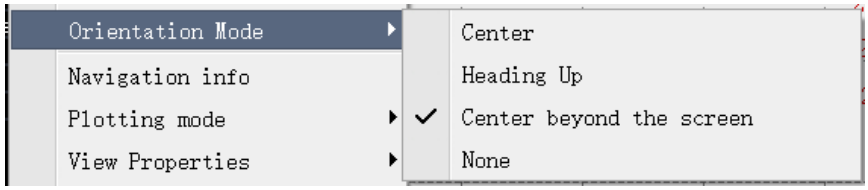


Fig.3-59 Orientation mode

Center: The ship will always display in the center of screen, while its azimuth would be update.

Heading up: The bow will always face directly above the screen, and the ship's position will move with the changes of GNSS receiver coordinates.

Center beyond the screen: The position and direction of the ship displayed on the screen will

change with the changes of GNSS receiver coordinates, if the ship's position is out of the screen, the ship will return to the center of screen and continue.

None: At the beginning, the ship will move with the coordinates within the screen, when the ship's position is out of the screen, the software will no longer move the ship to the screen automatically.

Navigation info—This is able to set the display items and the font for the navigation info window which locates at the left side of main screen, as well as the content color.

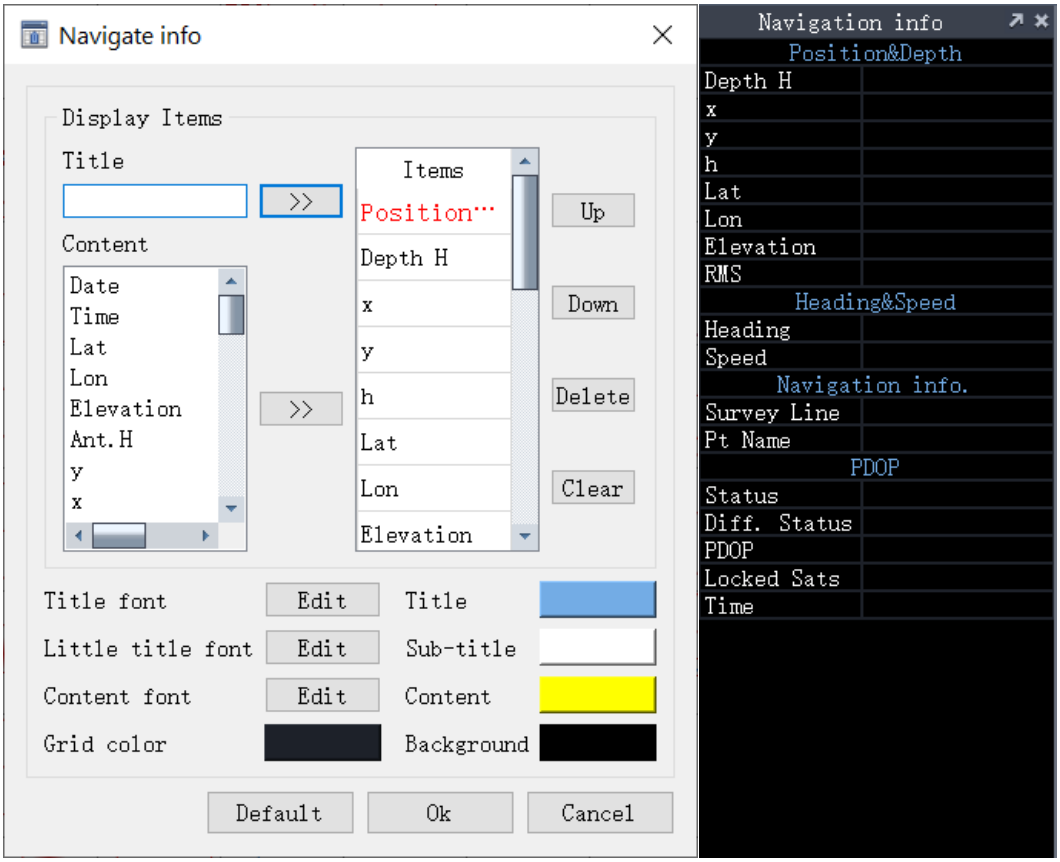


Fig.3-60 Navigation info

Plotting mode—Here are two methods for plotting, one is point lofting and the other one is by coordinate. If choose point lofting, points, lines, broken lines, circles, curves can be drawn by the mouse moving or clicking on the screen. If choose by coordinate, enter the corresponding information on the pop-up dialog for drawing the points, lines, broken lines circles and curves.

Fig.3-61 Plotting mode

View properties—There are the object snap and filter for option.

Fig.3-62 View properties

Object snap: Choose this option, while choose properties under tools menu, then use the mouse to select the point, line including straight line and broken line, the software will pop up a dialog which displays coordinate, type, color and layer about the object.

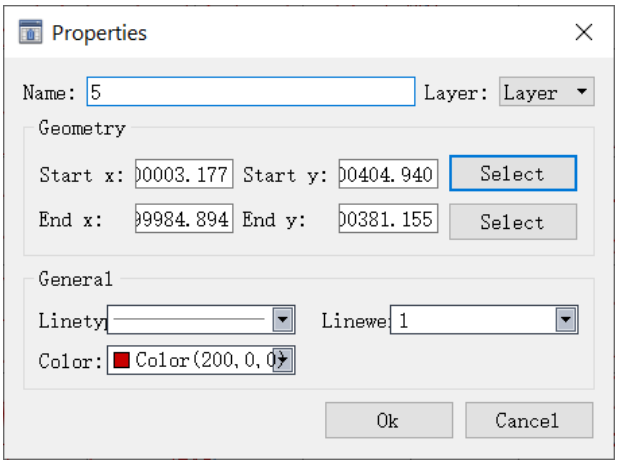


Fig.3-63 Object snap mode

Filter: If choose this for the view mode, while click properties under tools menu, the software will pop up a query dialog, enter the entity name, choose the layer and type, click Query button to check the information of the entity.

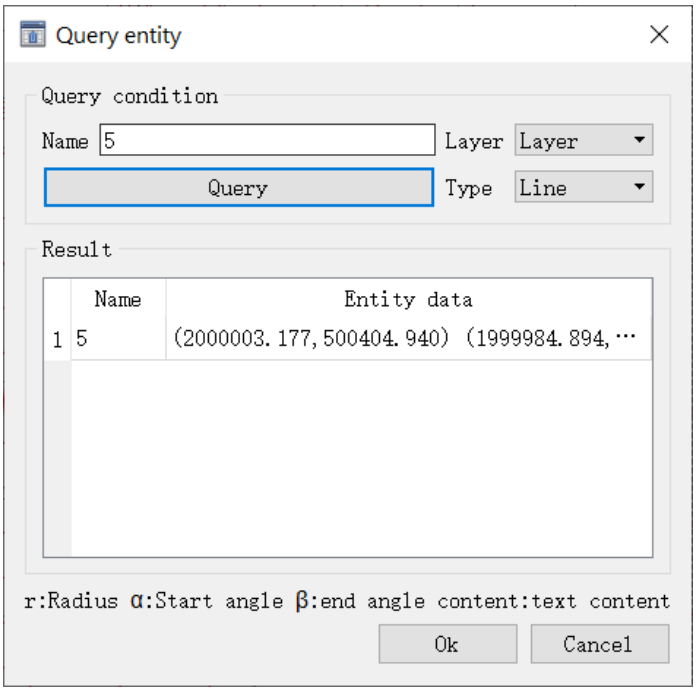


Fig.3-64 Filter mode

Object snap—If the plan lines are going to be drawn manually, such as the border of a complex area, and the most of reference points should be considered, choose this function to make the plan lines.

Fig.3-65 Object snap

Object snap mode—The object snap mode includes endpoint, midpoint, perpendicular and nearest.

Fig.3-66 Object snap mode

Endpoint: Capture the node of the element.

Midpoint: Capture the central point of the element.

Perpendicular: Capture the points perpendicular to an existing element.

Nearest: Capture the points of the mouse to an existing element.

Speed unit—This is the unit for the speed of ship, there are Kn, Km/h and m/s for option. Choose one of the units, the speed would display on the navigation info window with the corresponding unit.

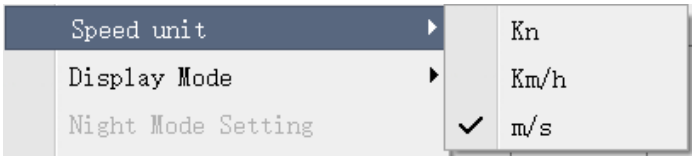


Fig.3-67 Speed unit

Display mode—The software has normal and night mode for the display mode.

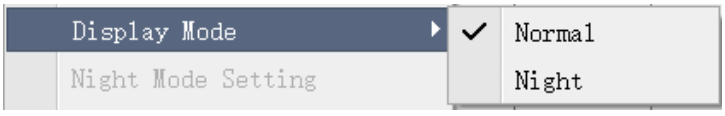


Fig.3-68 Display mode

Night mode setting—As long as night mode is selected, this option would be activated, then click on this option to set the brightness for the screen.

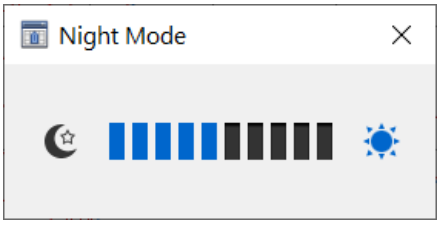


Fig.3-69 Night mode

System setting—It can set the background color of the software, color of ship on the screen, depth font size and color, and the measurement point, etc., at the meantime, the mark key can be customized here, as well as software automatic start, automatic open the recent project when the software starts. When “Use color table” is checked, the depth data will display with different color according to the different depths.

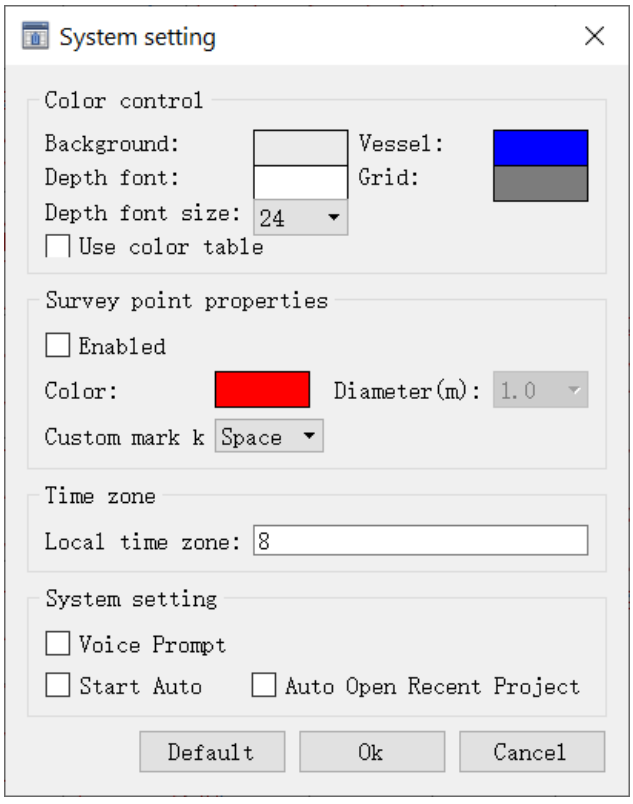


Fig.3-70 System setting

Workspace switching—This is used to set the software working interface, here are classic and simple for option.

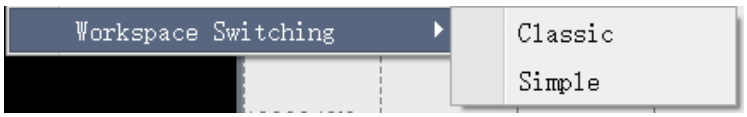


Fig.3-71 Wordspace switching

3.2.2.3, Design

The design menu is mainly use for drawing and planned lines design.

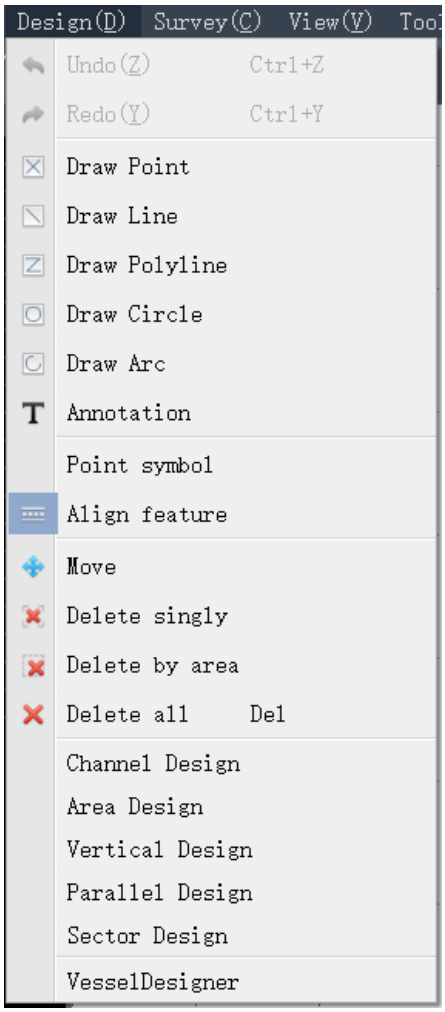


Fig.3-72 Design menu

Undo—Return to the previous step if there is an operation error, use undo to return to the previous operation interface.

Redo—If click the undo button, use redo to return to the previous operation interface.

Draw point—This is used for drawing the auxiliary mark points with mouse or coordinate. If choosing coordinate method(choose coordinate option in plotting setting under setting menu) for drawing points, the point name, coordinate, elevation and the other parameters are required, and the layer, line type, line width, color should be defined. Or select the point from the library.

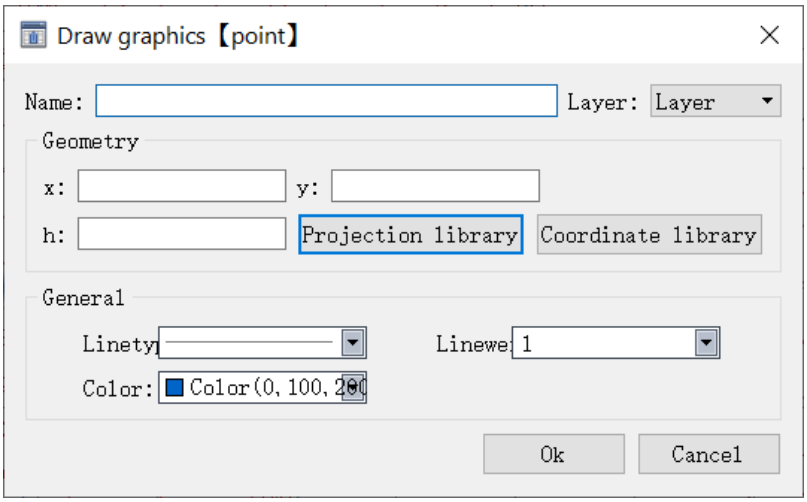


Fig.3-73 Draw point

Draw line—It is used to draw a straight line with mouse or coordinate. If choosing coordinate method(choose coordinate option in plotting setting under setting menu) for drawing line, enter the line name, starting point, ending point and the other parameters, and select the corresponding properties for the line, such as layer, type, width and color, then click OK button, the software will draw a straight line according to the settings.

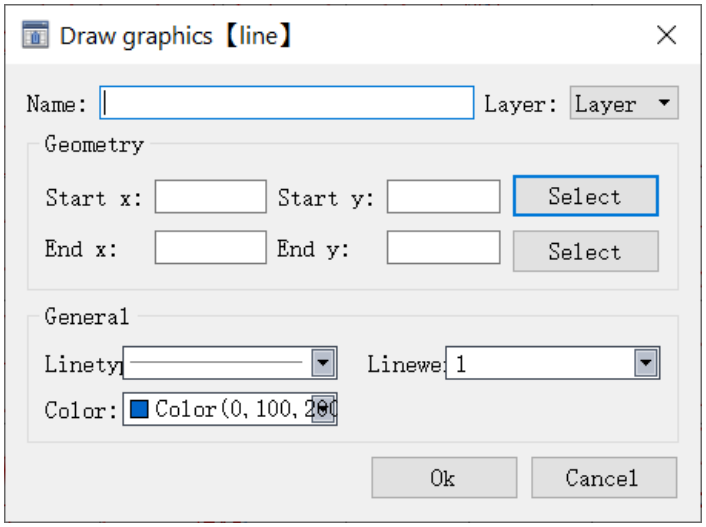


Fig.3-74 Draw line

Draw polyline—It is used to draw a polyline mouse or coordinate. If choosing coordinate method(choose coordinate option in plotting setting under setting menu) for drawing the line, enter the line name, points coordinate and the other parameters, click Up or Down button to adjust position of point, and add or delete point for polyline. After that select the corresponding properties for the line, such as layer, type, width and color, then click OK button, the software will draw a polyline according to the settings.

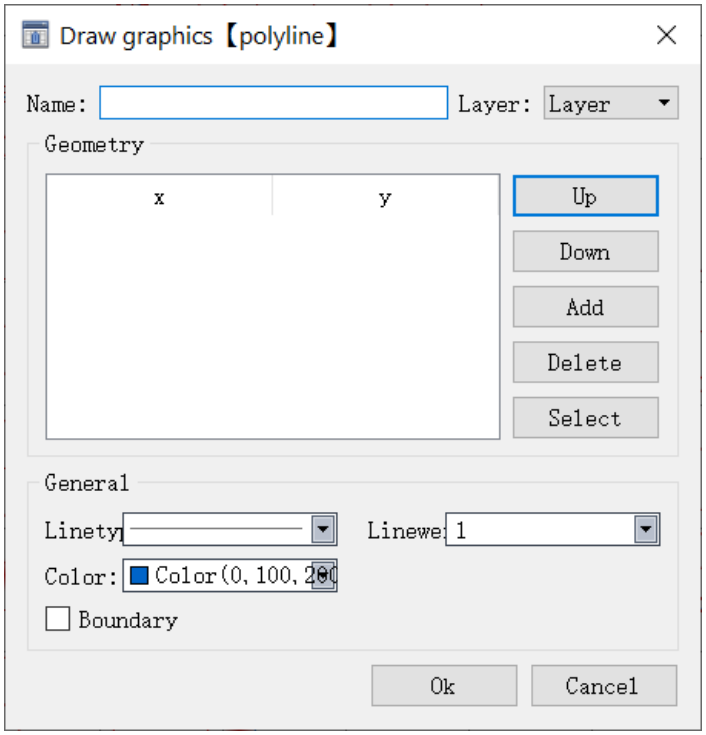


Fig.3-75 Draw polyline

Draw circle—It is used to draw an auxiliary circle with mouse or coordinate. If choosing coordinate method (choose coordinate option in plotting setting under setting menu) for drawing the circle, enter the circle name, center point coordinate and the radius. After that select the corresponding properties for the line, such as layer, type, width and color, then click OK button, the software will draw a circle according to the settings.

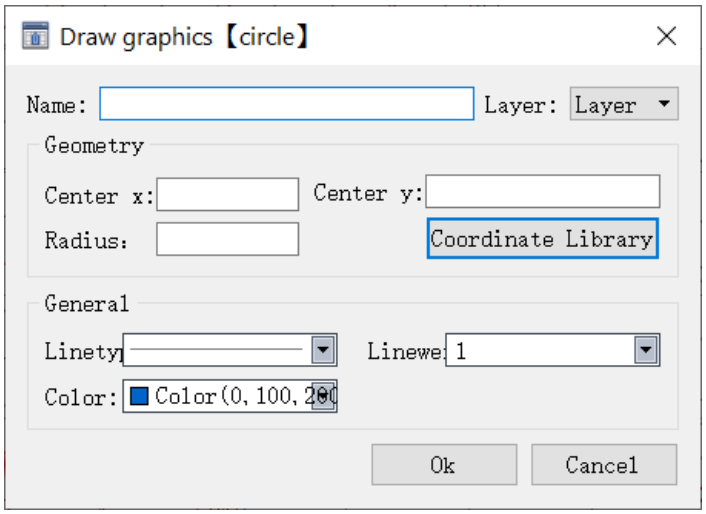


Fig.3-76 Draw circle

Draw arc—It is used to draw an auxiliary arc with mouse or coordinate. If choosing coordinate method (choose coordinate option in plotting setting under setting menu) for drawing the arc,

enter the arc name, center point coordinate, radius and the starting angle and ending angle. After that select the corresponding properties for the line, such as layer, type, width and color, then click OK button, the software will draw an arc according to the settings.

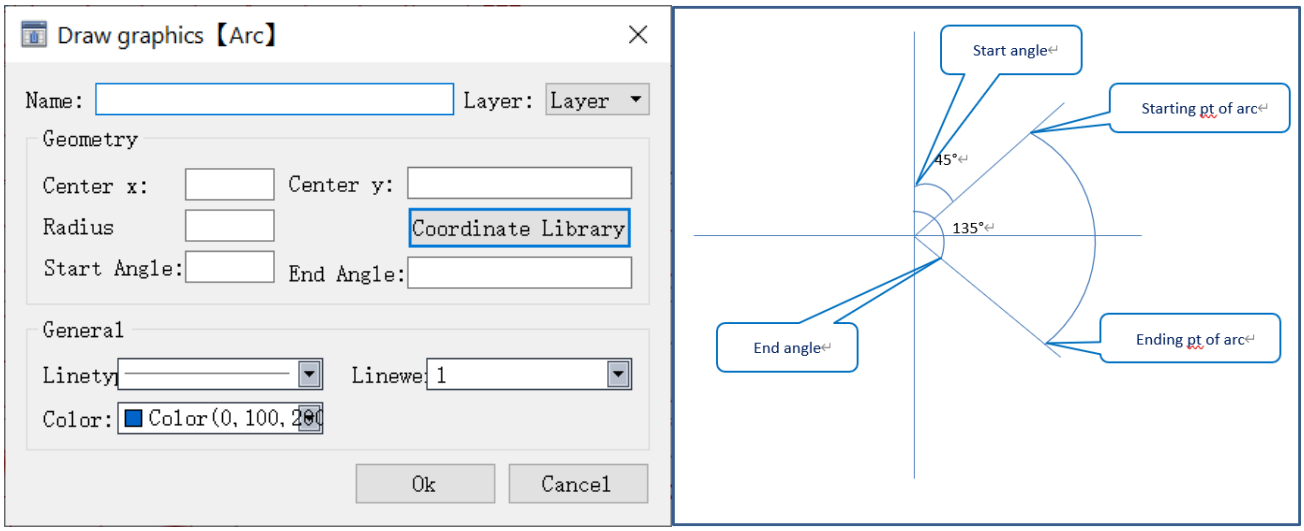


Fig.3-77 Draw arc

Annotation—It is able to annotate the elements on the map with mouse or coordinate. Enter the content of the text, coordinate, layer and the annotation style, or self-define the coordinate by clicking on Select button.

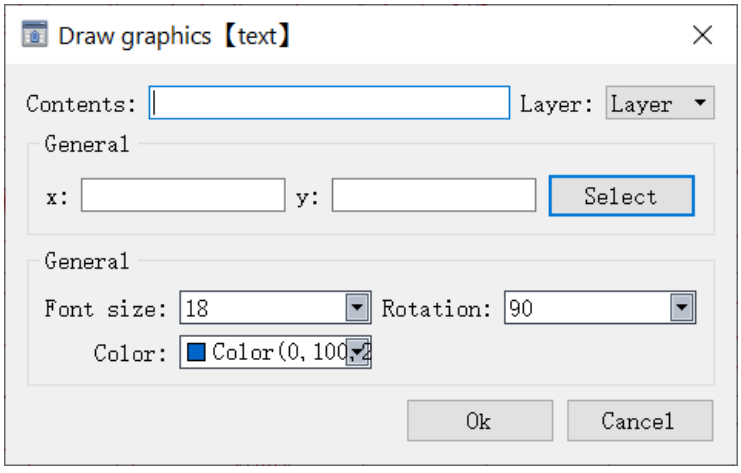


Fig.3-78 Annotation

Point symbol—It is able to draw a variety of point symbols, such as measurement points, buoys, bright reefs and so on. Click on this option, the software pops up a dialog, then enter the point name, coordinate, or select the point from library, and then select the corresponding properties.

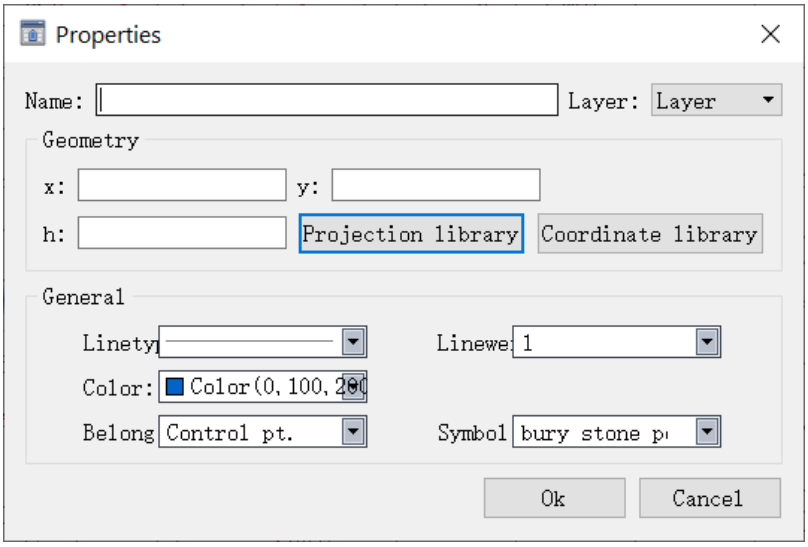


Fig.3-79 Point symbol

Align feature—It is able to draw various linear symbols, such as ridges, coastlines, seawalls and so on. Click on this option, then enter the line name, nodes coordinate, or select the point from library, and then select the corresponding properties, like line type, width, color, attribution and symbol.

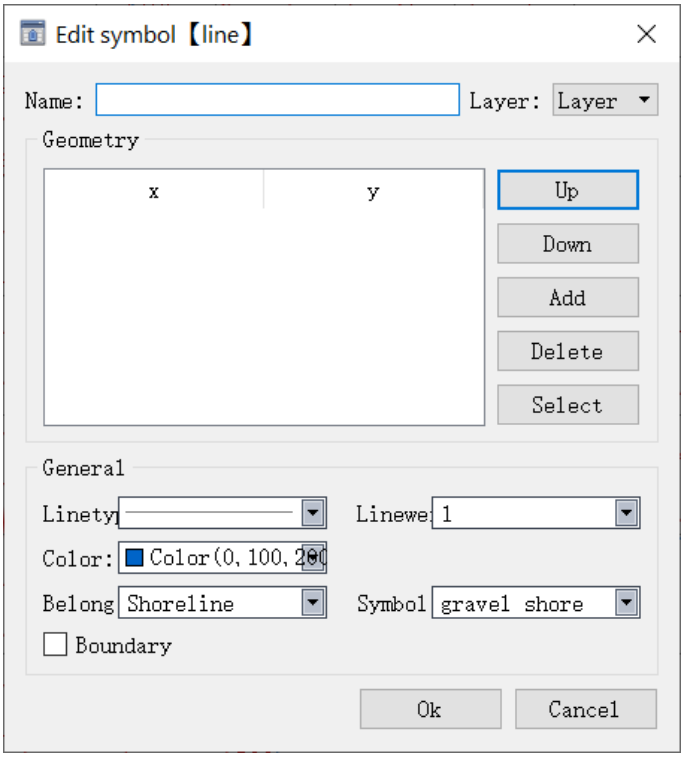


Fig.3-80 Align feature

Move—This is used for moving the element's position on the map.

Delete singly—Delete the drawn point, line, straight line, curve, point symbol and the other graphic data one by one.

Delete by area—Delete the drawn point, line, straight line, curve, point symbol and the other graphic data within the selected frame.

Delete all—Delete all the drawn point, line, straight line, curve, point symbol and the other graphic data.

Channel design—This channel design is mostly used for the depth survey in inland waterways. This way only needs to draw the central axis, then the working lines would automatically generate according to the input channel width and survey width, as well as the line spacing. There are 3 ways to draw the channel central axis, (1), enter the nodes coordinate and click Add button; (2), use mouse to draw the axis on the screen; (3), select the existing channel axis on the screen by clicking Select button.

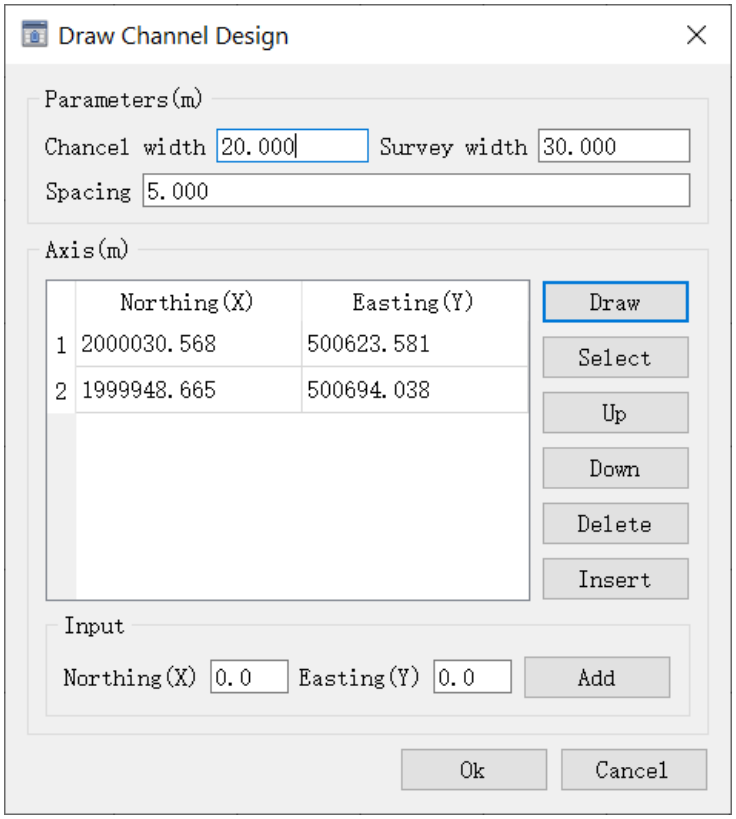


Fig.3-81 Channel design

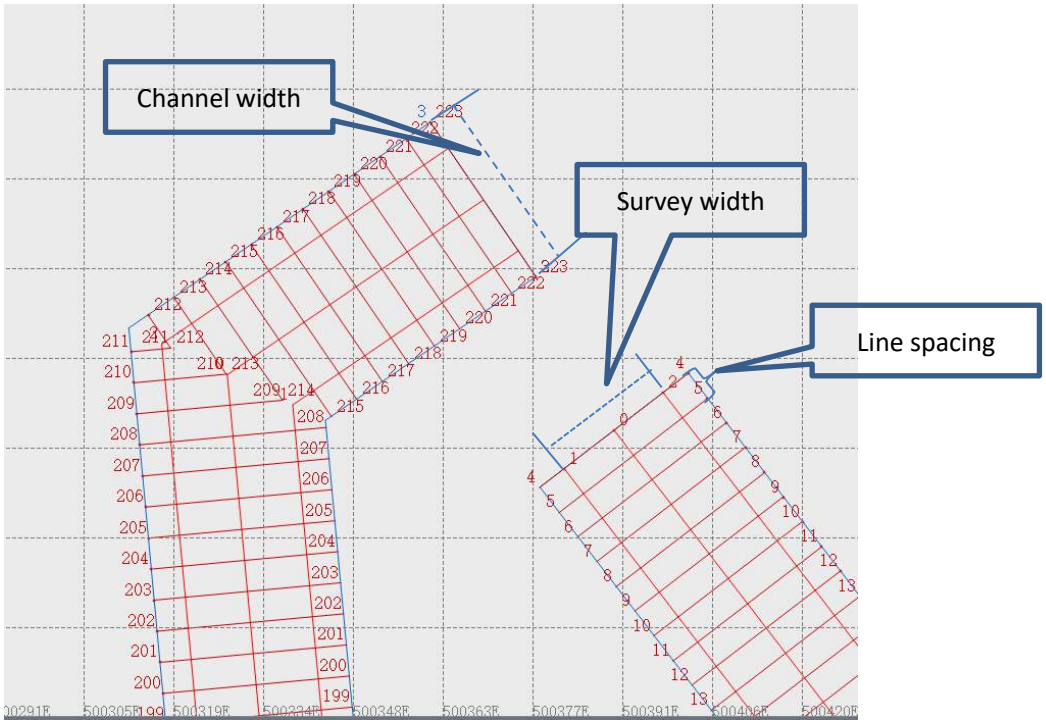
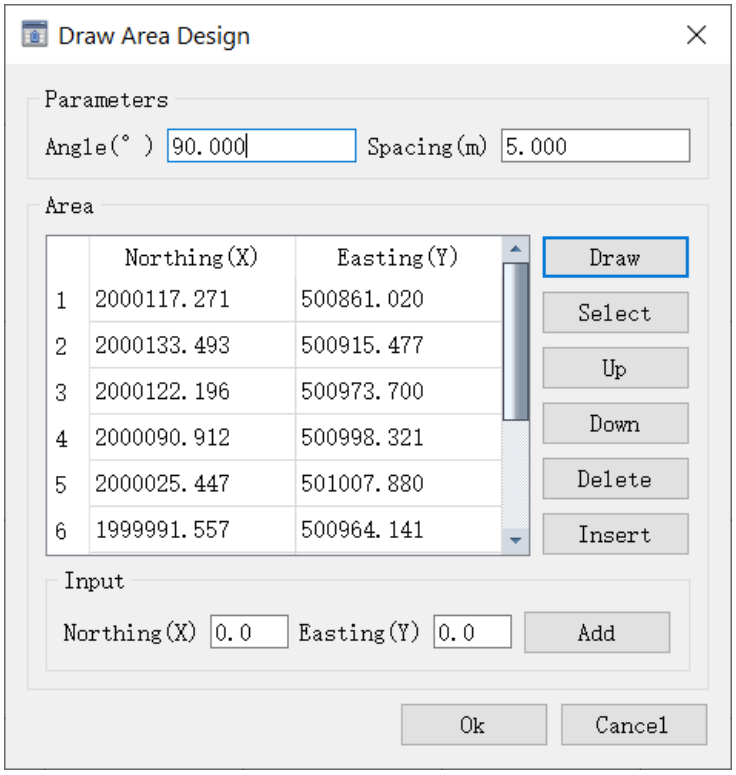


Fig.3-82 Channel design

Area design—It is suitable to the reservoir, or the specific enclosed areas. On the pop-up dialog, enter the boundary point coordinates, or click Draw button to draw the boundary lines, or click Select button to select the existing lines on the screen, then enter the inclination angle and spacing. (0°--north; 90°--east; 180°--KOLIDA; 270°--west)



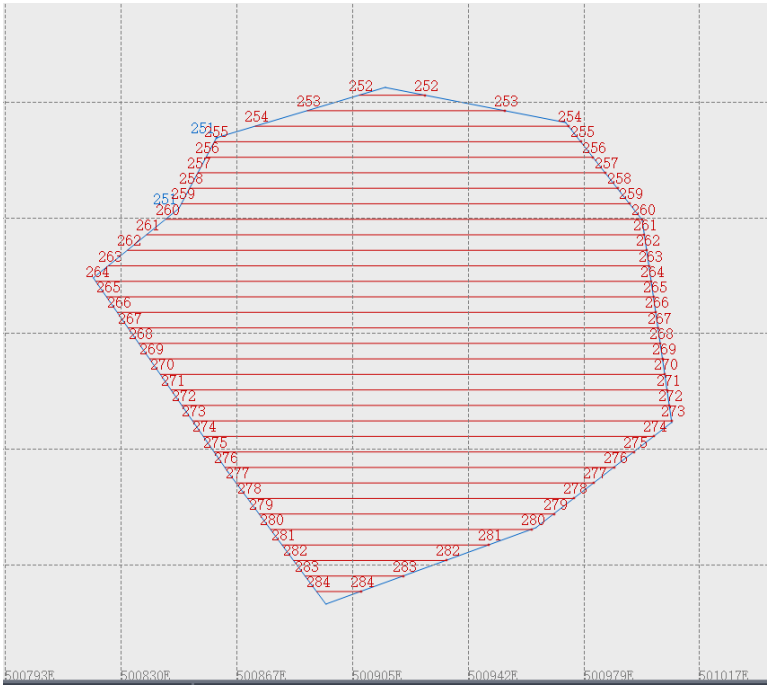
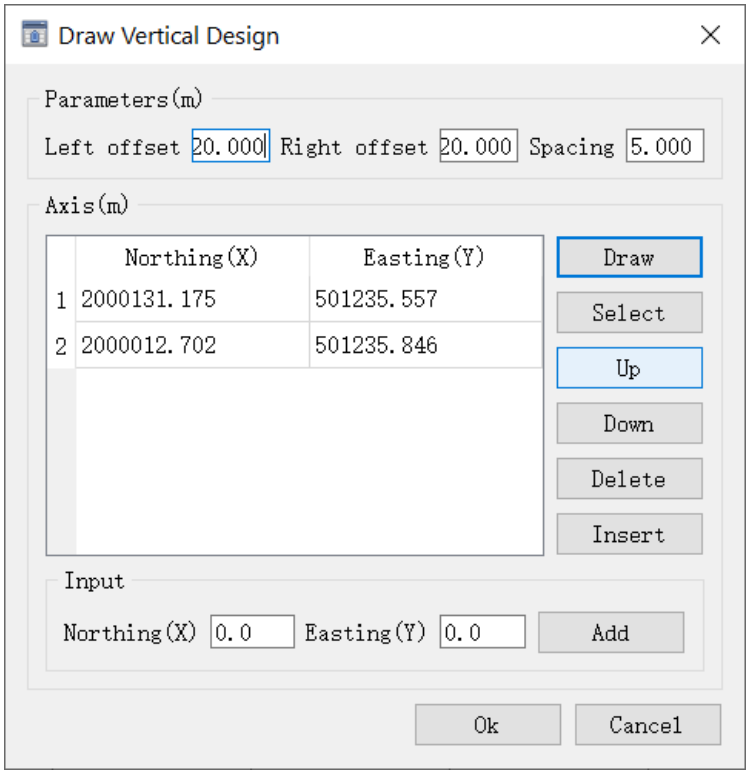


Fig.3-83 Area design

Vertical design—This is similar to the channel design, and the difference is that the width of channel design is same on the left and right, and the corners were processed. Vertical design is simpler that it draws the vertical parallel lines only according to the specific baseline and the spacing, and the width of left and right can be different. It is suitable to the project plan line design which only knows one side coordinates.



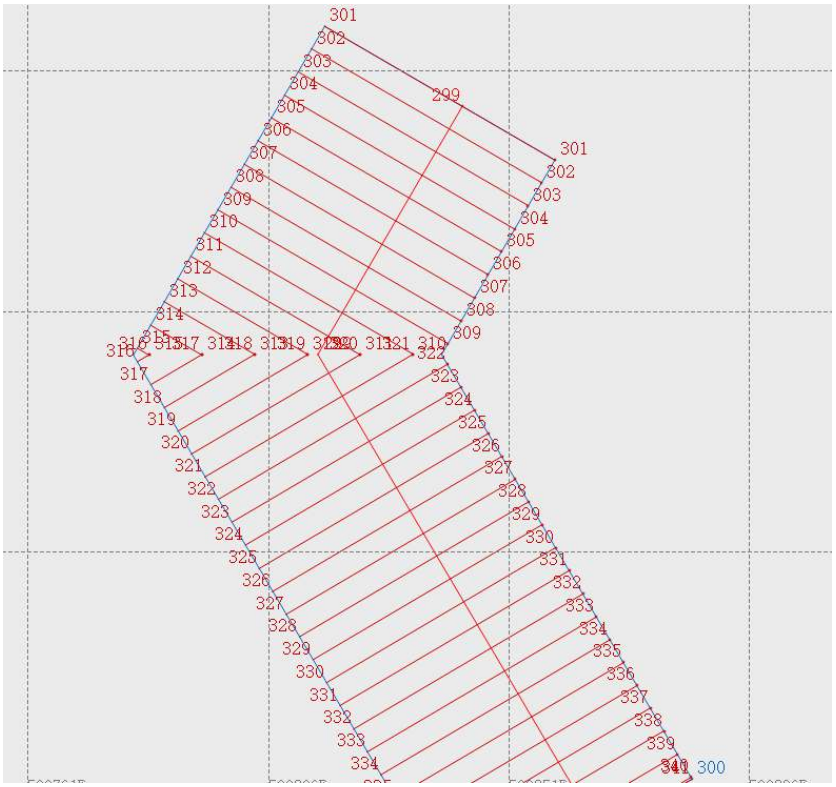
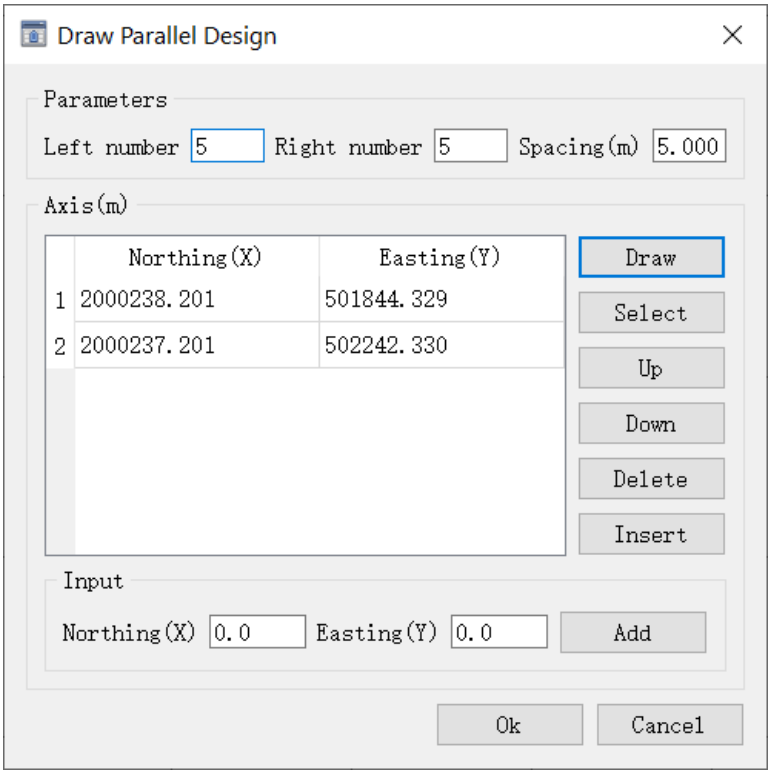


Fig.3-84 Vertical design

Parallel design—This is to draw the planned lines on both sides base on the drawing central axis. On the pop-up dialog, enter the nodes coordinate for the axis, and the number of planned lines on the both sides, and the line spacing.



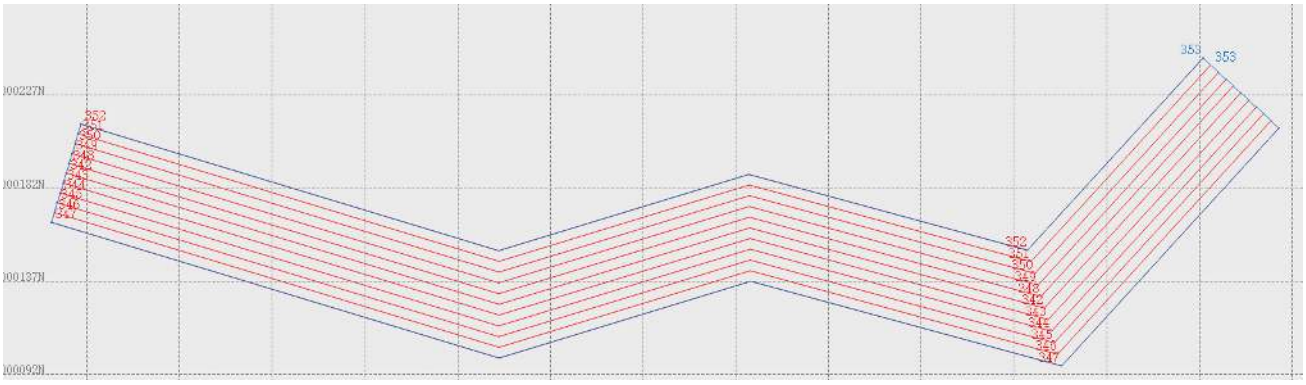


Fig.3-85 Parallel design

Sector design—This is more convenient for curve channel planned line design. Only need to know the center point coordinates and the inner and outer radius to determine the position of the planned lines, then enter the starting and ending angles, and the left and right offsets of the sector from the center line. The starting angle of the axis is the angle between the starting edge and the true north, and same definition to the ending angle.

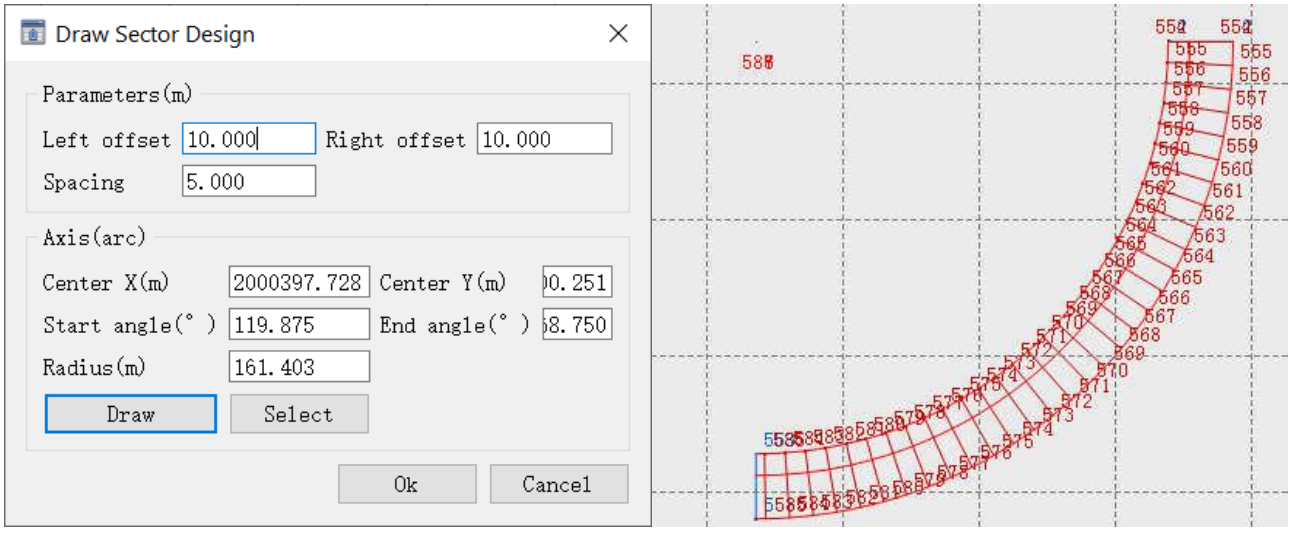


Fig.3-86 Sector design

VesselDesigner—This includes the vessel data, anchor and offsets. It is in order to better simulate the shape of the ship, and determine the relative spatial position between anchor, GPS antenna position and the measurement points, which can intuitively and comprehensively reflect the status of the entire measurement system.

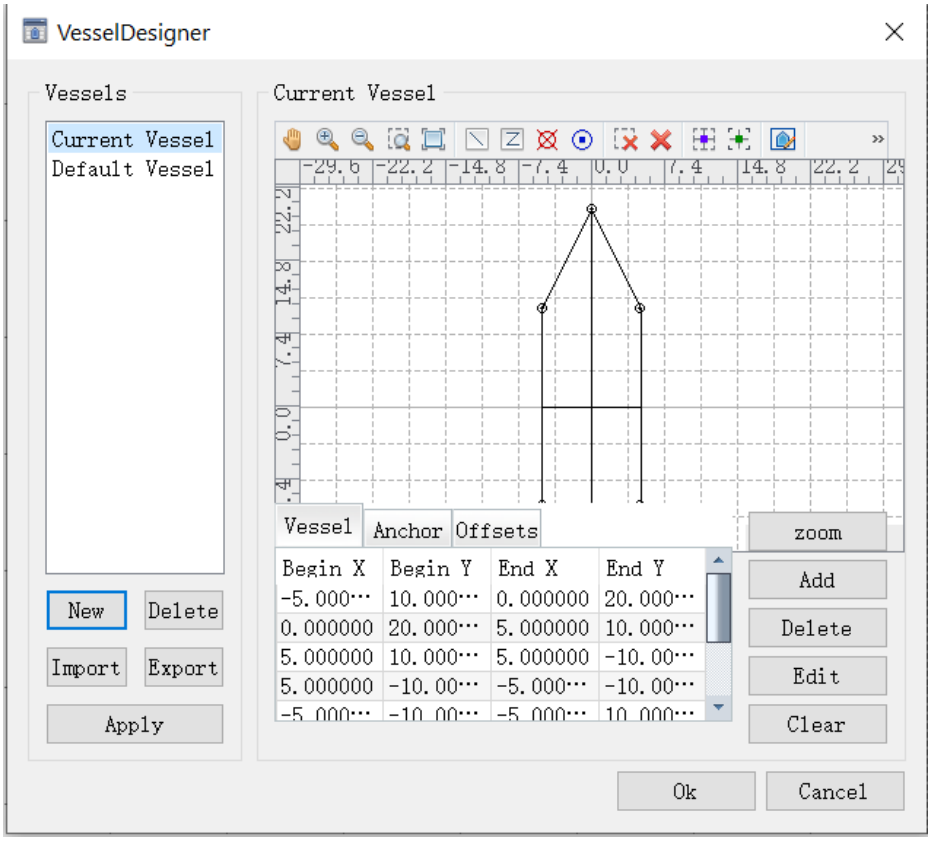


Fig.3-87 Vessel designer

3.2.2.4, Survey

Under the survey menu, there are some operations related to the measurement, such as re-handshake, device connection, record, pause_survey, stop record, auto record, stakeout point, stakeout line, heading, compass and replay.

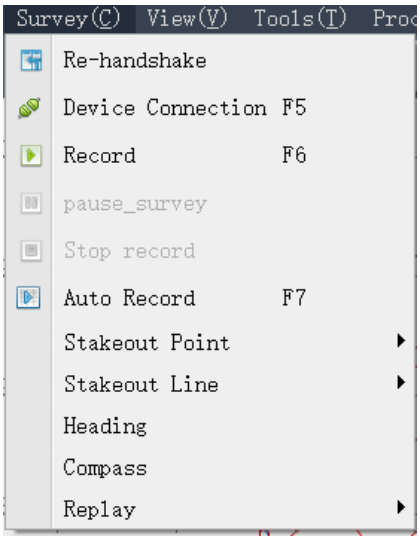


Fig.3-88 Survey meni

Re-handshake—Reconnect the devices.

Device connection—If user configured correct COM port and baudrate for GNSS receiver and echo sounder in new project or survey devices, click this option to establish communication with devices, and the receiver coordinate will display on the navigation info window, and the vessel will appear on the screen.

Record—Clicking on this option, the software will collect the coordinates and depth data according to the GPS collection conditions and marking methods set by user, and send marking commands to the echo sounder software.

Pause_survey—Pause recording the data.

Stop record—Stop recording the data.

Auto record—The software will automatically collect data in the planned area according to preset conditions while the ship moves to the area, like in the area of channel design or parallel design. If the ship goes out of the area, the software will stop recording data.

Stakeout point—Stakeout the point by mouse select or coordinate. And the stakeout point information will display at the bottom left of the main interface.

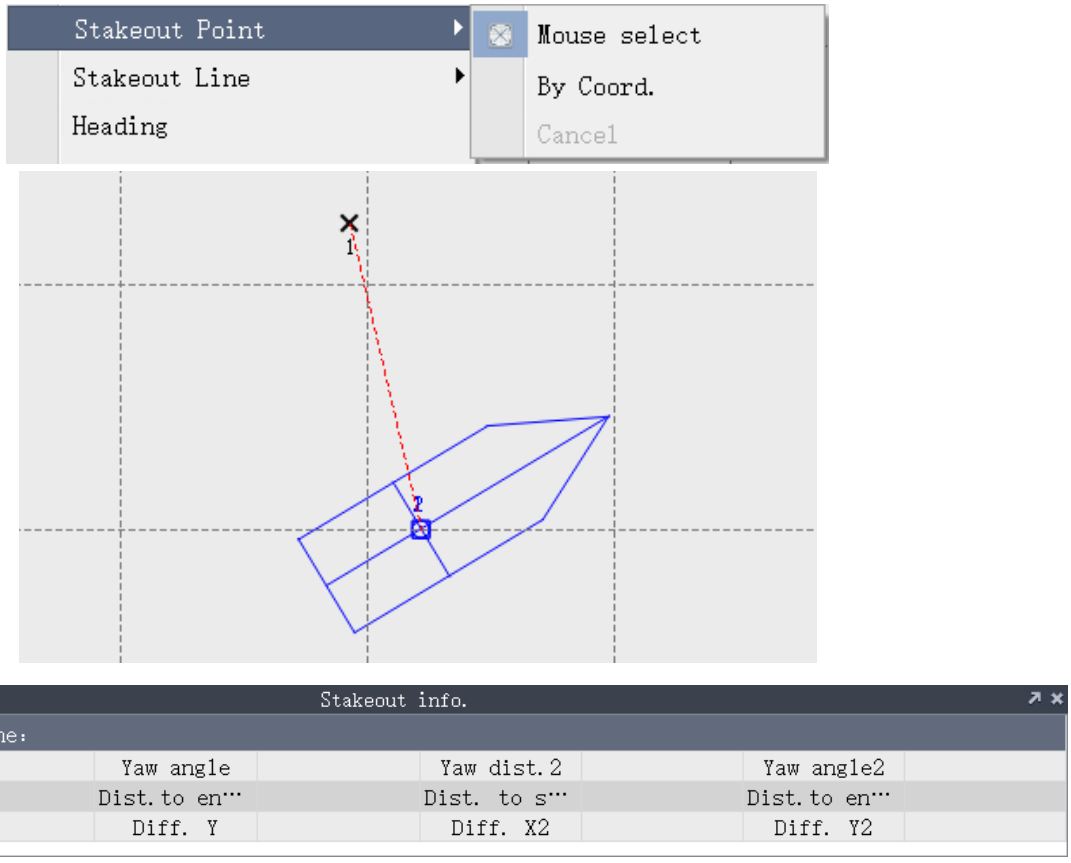


Fig.3-89 Stakeout point

Stakeout line—Stakeout the line by auto or manual.

Fig.3-90 Stakeout line menu

Auto: In this mode, user needs to set the locked distance that if the vertical distance between GPS measurement point to the planned line less than the locked distance, the planned line would be locked as the current measurement line.

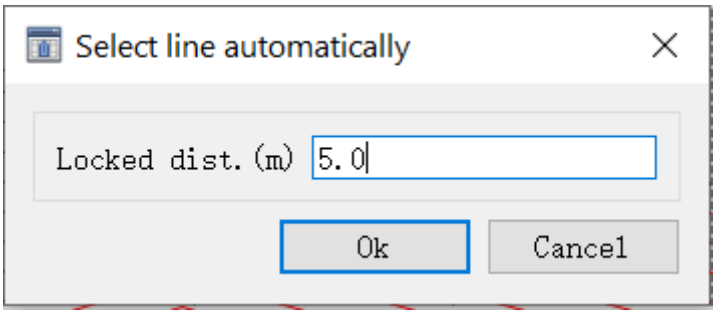
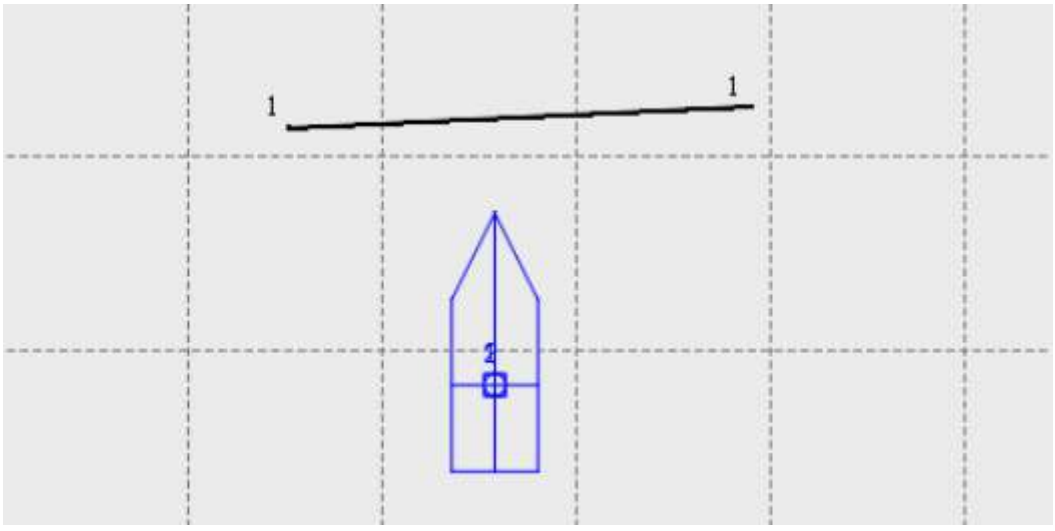


Fig.3-91 Auto mode setting

Mouse select: In this mode, the mouse cursor as a small box, use this box to select a planned line as a measurement line. And the stakeout line information will display at the bottom left of the main interface.



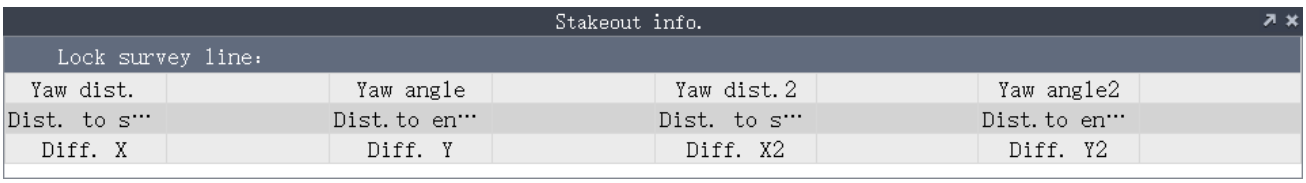


Fig.3-92 Mouse select mode

Heading—It is for self-define the heading.

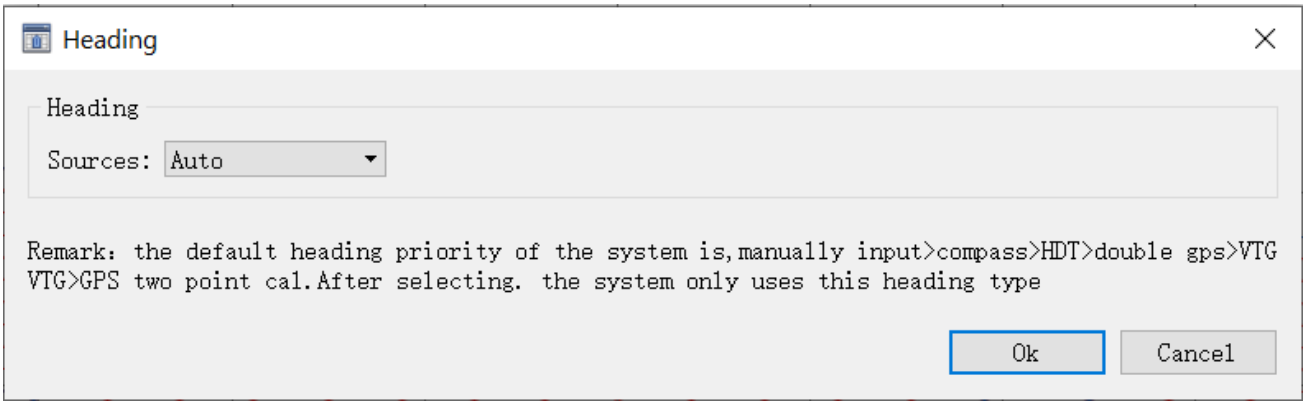


Fig.3-93 Heading

Compass—Display the compass on the main interface.

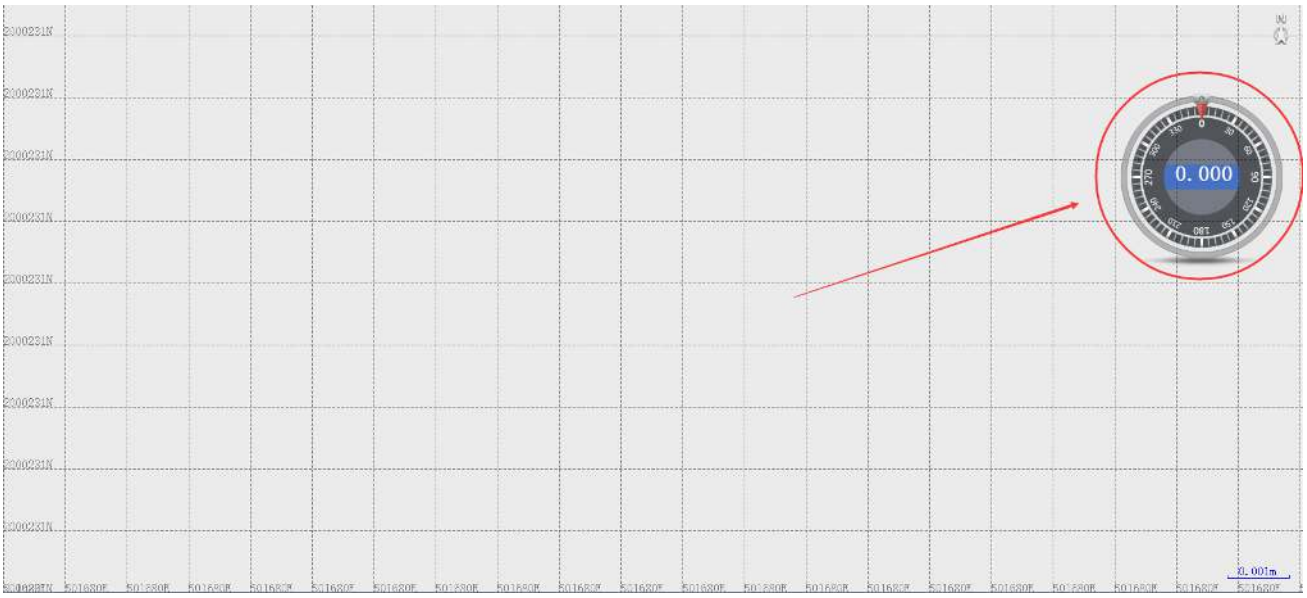


Fig.3-94 Compass

Replay—The software will replay the coordinate data measured in the current project and the ship's trajectory, etc.

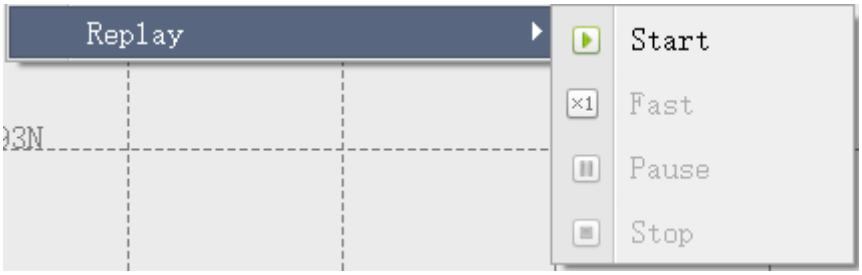


Fig.3-95 Replay

3.2.2.5, View

Under view menu, there are the operations for the graphic, such as pan, zoom in, zoom out, rotate to degree, display trackpoint and so on.

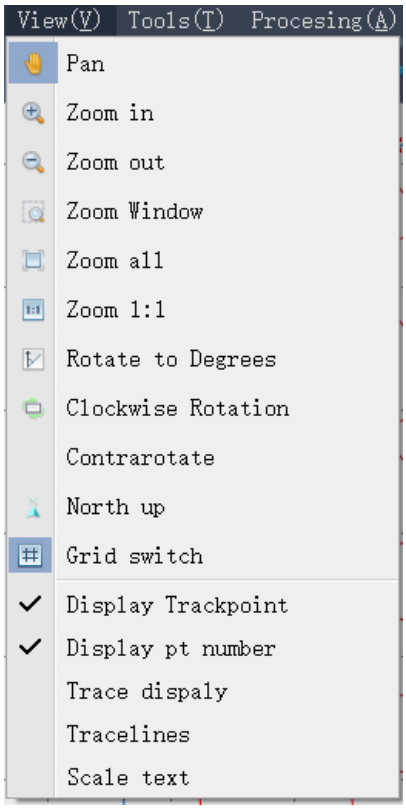


Fig.3-96 View menu

Pan—Click on this option, the mouse cursor will turn into a hand shape, then press and hold the left button at one point on the screen, move the mouse and the mouse movement direction represents the screen movement direction, and then release the left button at another point. To exit the pan operation, right-click in the view window.

Zoom in—Use this screen to zoom in the screen, the screen will zoom in at the center while clicking on it each time.

Zoom out—Use this screen to zoom out the screen, the screen will zoom out at the center while clicking on it each time.

Zoom window—Click on this option, the mouse cursor will turn into a cross shape, then press and hold the left button at the upper left corner of the area to be enlarged, move the mouse, and release the left mouse button at the lower right corner, the contents of this rectangular area will be enlarged. To exit the zoom window operation, right-click in the view window.

Zoom all—Click on this option, all the graphics will be displayed on the screen.

Zoom 1:1—Click on this option, the view window will be displayed on a scale of 10 meters per square.

Rotate to degree—Rotate the map by entering a rotation angle, enter a proper angle, then click OK button, the map will rotate counterclockwise according to the input angle.

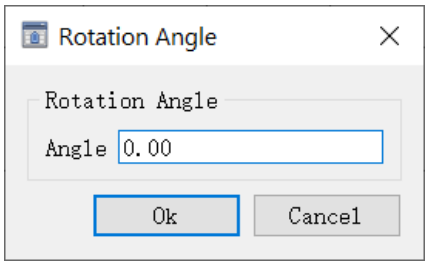


Fig.3-97 Rotation angle

Clockwise rotation—Each time click on this option, the base map will rotate clockwise by 10°.

Contra rotate—Each time click on this option, the base map will rotate counterclockwise by 10°.

North up—Click on this option, the rotated map will recover to true north.

Grid switch—The grid function is to display the coordinate ratio of the entire graph and provide a reference for the base map in the software. The grid function is default turned on, to hide the grid lines, click this option or the shortcut tool on the toolbar.

Fig.3-98 Grid

Display trackpoint—Click on this option, the track of the ship's movement will be displayed in the form of small black dots. As shown in the figure below, the small black dots between point 1 and point 2 are the track of ship.

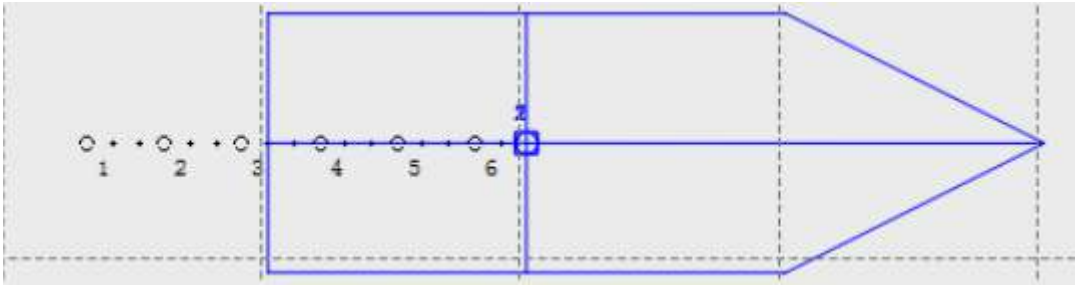


Fig.3-99 Display track point

Display pt number—Click on this option to display the point number or hide the point number. As shown in the figures below.

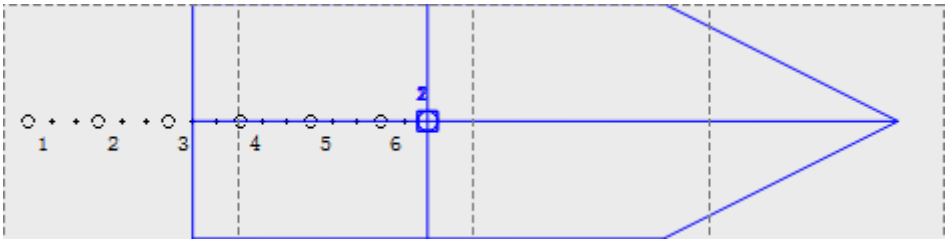


Fig.3-100 Display point number

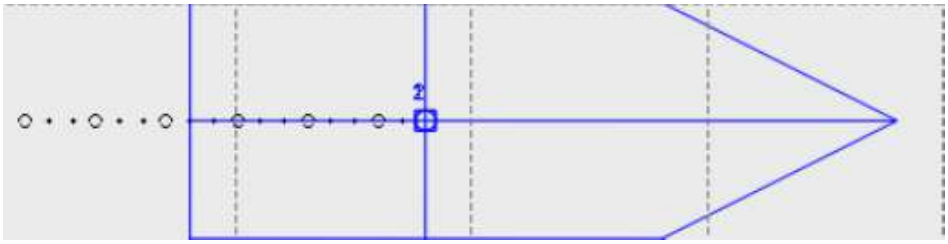


Fig.3-101 Hide point number

Trace display—Click on this option, the software will pop up the survey line selection window. Choose a line in the list then click OK, and the navigation track of the selected survey line will be displayed on the screen.

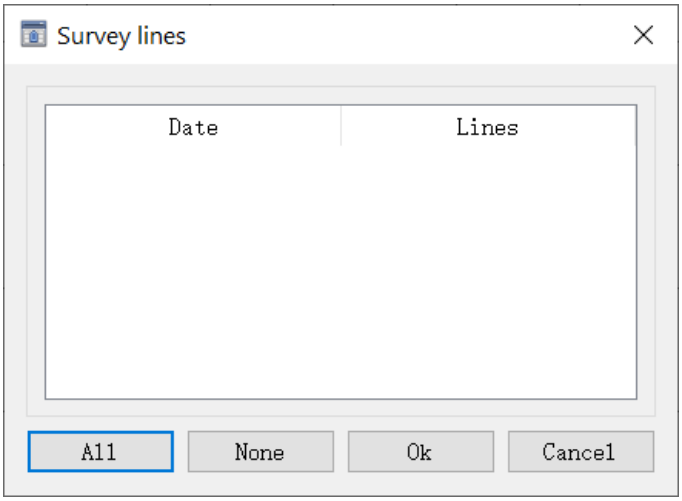


Fig.3-102 Trace display

Tracelines—Click on this option, the software will connect the sailing track of the ship with line segments, as shown in the figure below.

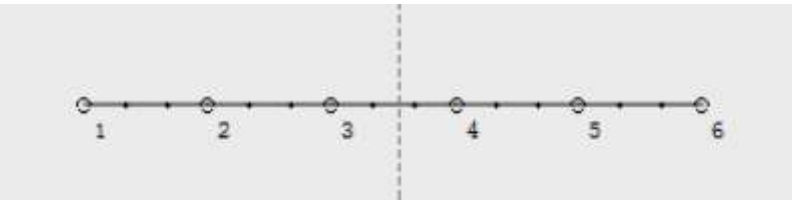


Fig.3-103 Tracelines

Scale text—The scale text function can uniformly zoom the text displayed in the project, as shown in the figure below, drag the middle slider to scale the text.

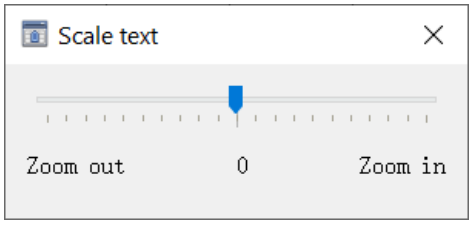


Fig.3-104 Scale text

3.2.2.6, Tool

The tool menu contains many kinds of utilities, like the coordinate conversion, system parameters, measure, properties view and so on.

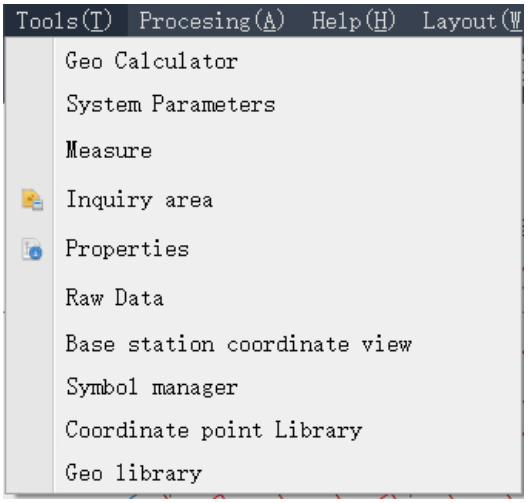


Fig.3-105 Tool menu

Geo calculator—This calculator can complete the conversion between the geodetic coordinate, spatial coordinate and the local coordinate.

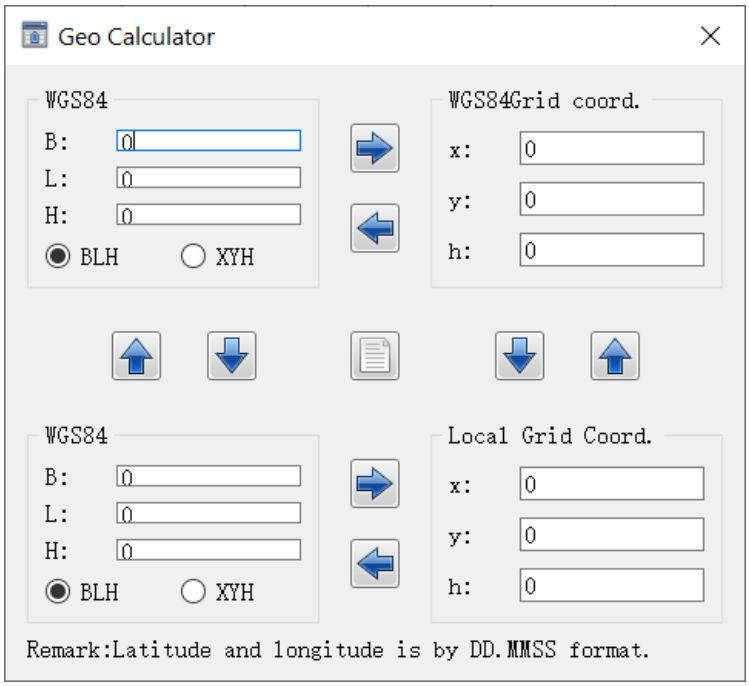


Fig.3-106 Geo calculator

System parameters—Click this option to check the projection parameters, 4 parameters, correction parameters, 7 parameters and the fitting parameters or the current project.

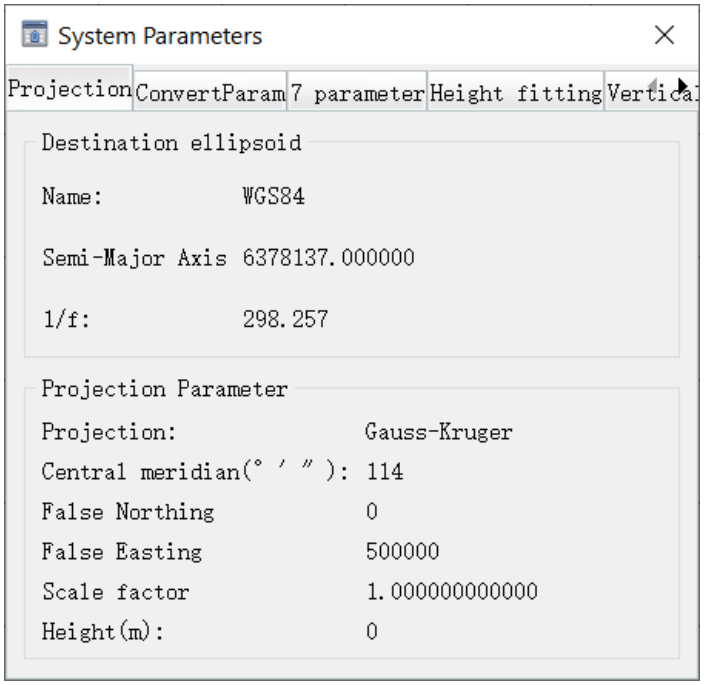


Fig.3-107 System parameters

Measure—This is one of the commonly used tools, it can conveniently measure the azimuth angle and distance between points, lines, and points to the lines on the screen. To cancel the measure, right-click in the view window.

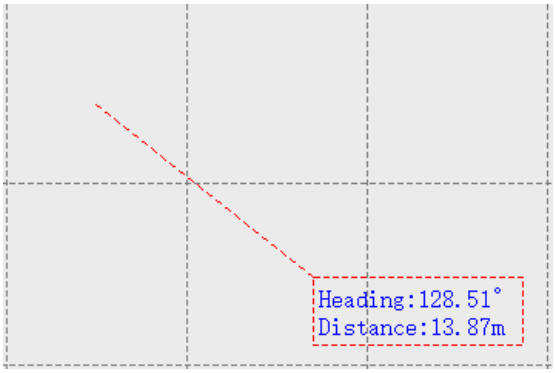


Fig.3-108 Measure

Inquiry area—This is a tool to calculate the area. To cancel this tool, right-click in the view window.

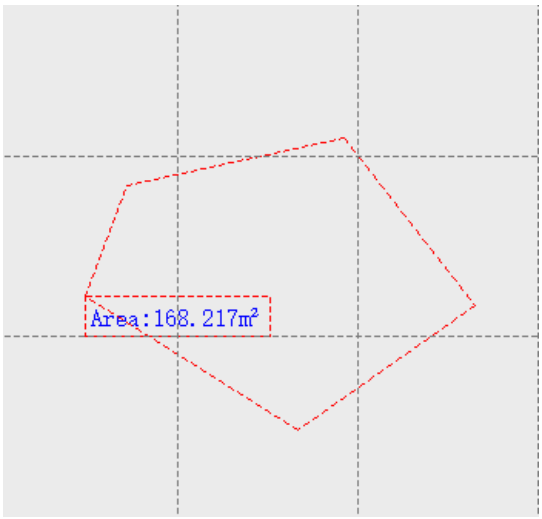


Fig.3-109 Inquiry area

Properties—Click on this option, the mouse will turn into a small red box. Use it to click on the point, line, arc, circle and other graphics on the screen, the software will pop up a window to display various attributes of the graphics, such as the name, the starting point coordinates, end point coordinates, type, width, color and other elements.

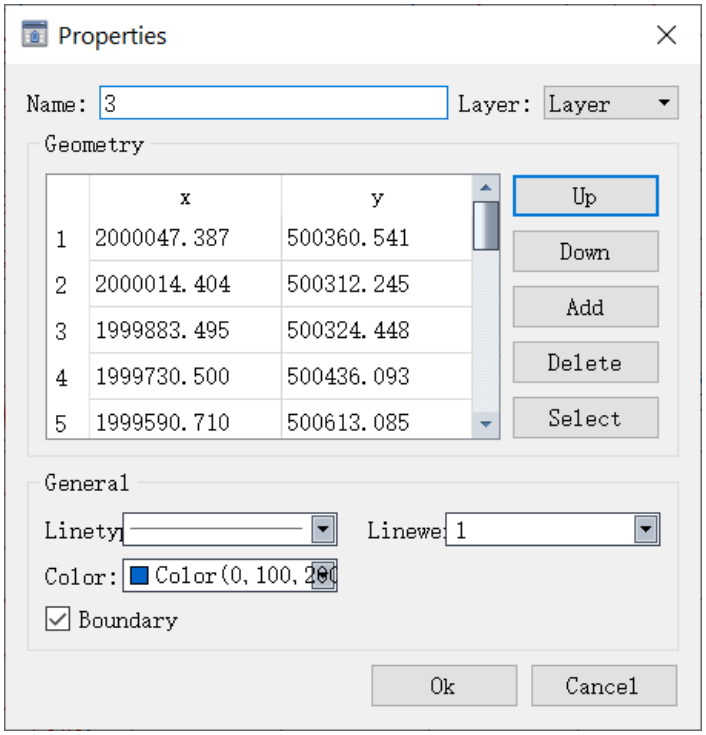


Fig.3-110 Properties

Raw data—Click on this option, the software will pop up the survey line selection dialog, select a line in the list and click OK button, the raw data of the selected line can be displayed. The raw data includes survey line, collection time, point name, longitude, latitude, altitude, X, Y, h, heading, high frequency measuring depth, low frequency measuring depth, solution status, HRMS, VRMS and other information. At the same time, the software also supports the export of raw data, and the export formats include txt, org, csv, etc.

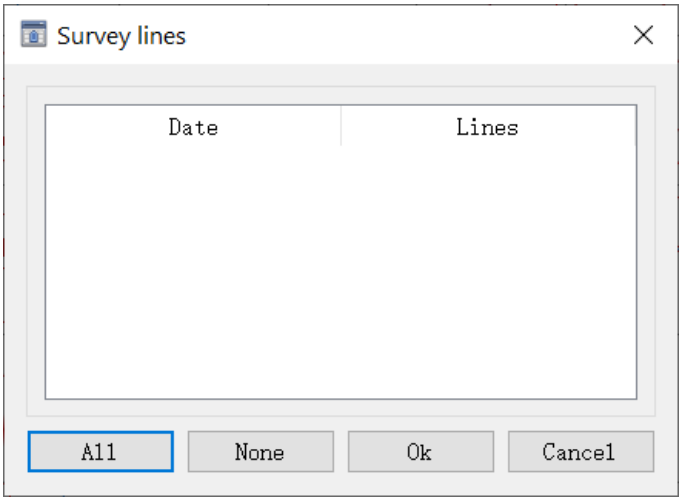


Fig.3-111 Raw data

Base station coordinate view—Click on this option to check the base station coordinate.

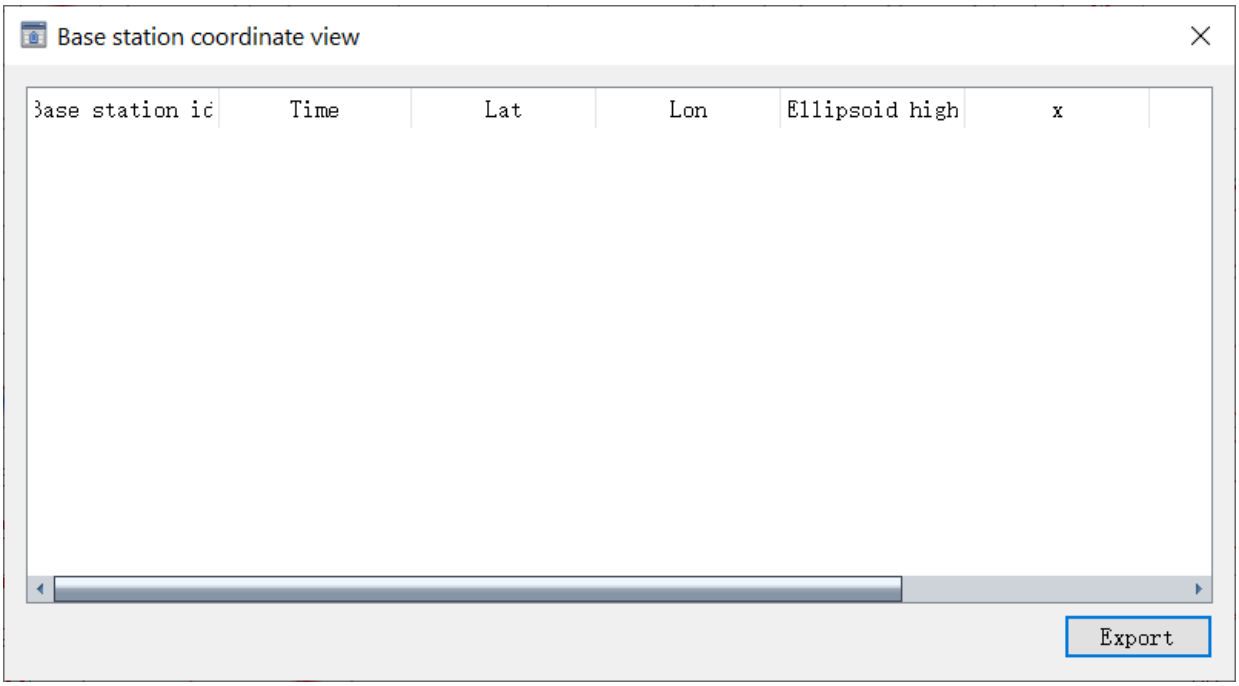


Fig.3-112 Base coordinate view

Symbol manager—This option is able to add, delete and edit the symbols of point or line.

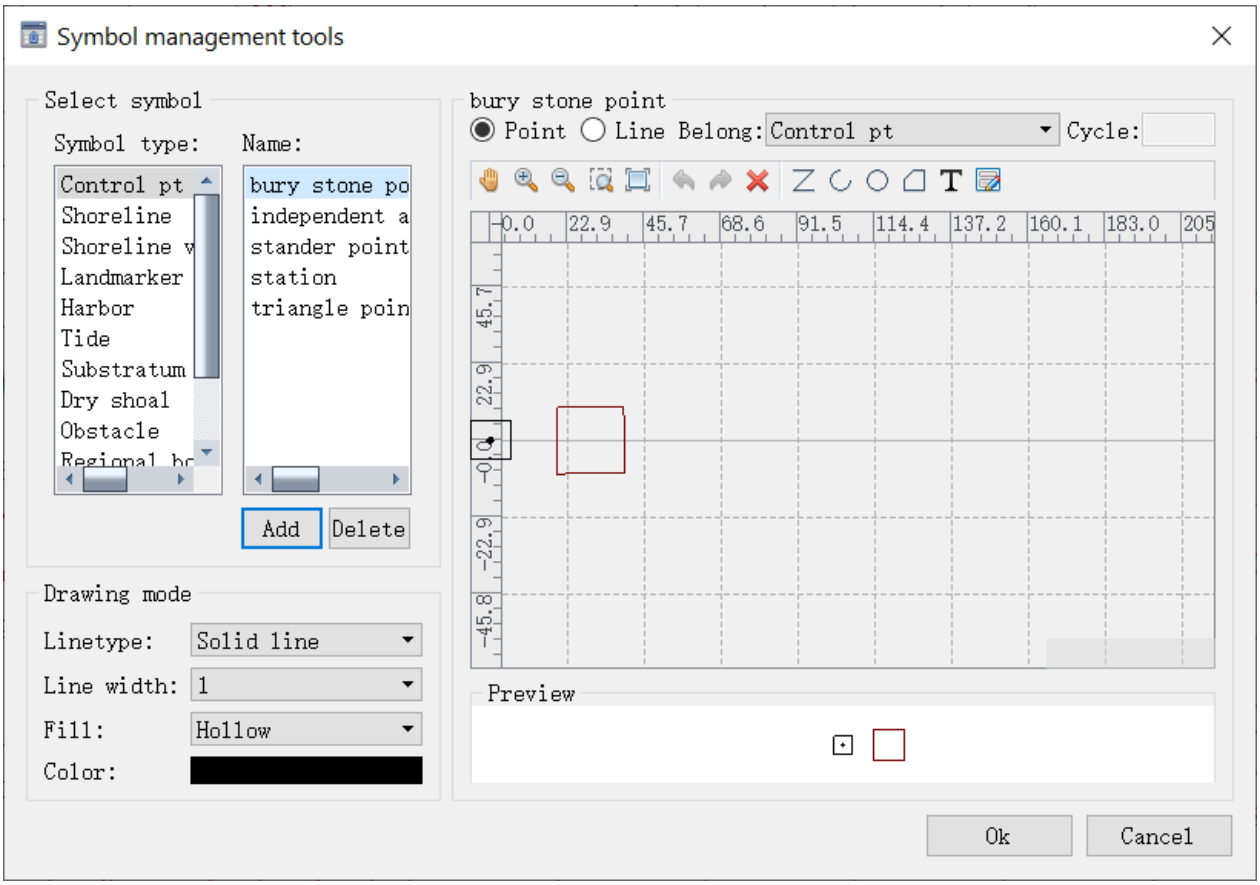


Fig.3-113 Symbol manager

Coordinate point library—Click this option to enter the local coordinate library, and it also can add, delete, edit the local coordinate here, and the other operations.

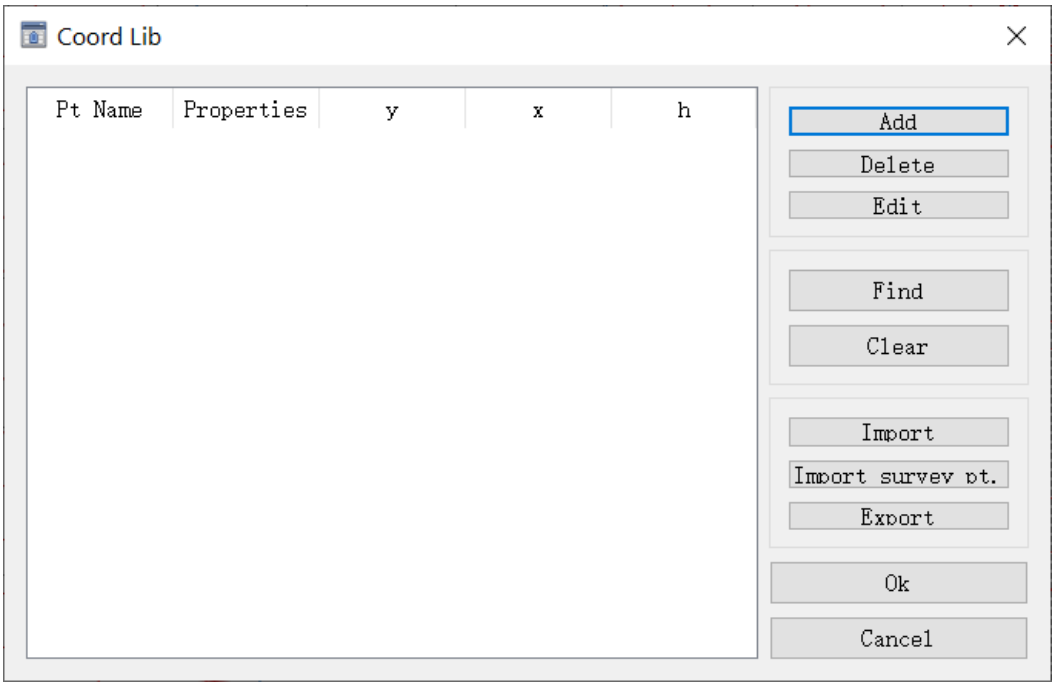


Fig.3-114 Local coordinates

Geo library—This is the place where the geodetic coordinates are saved.

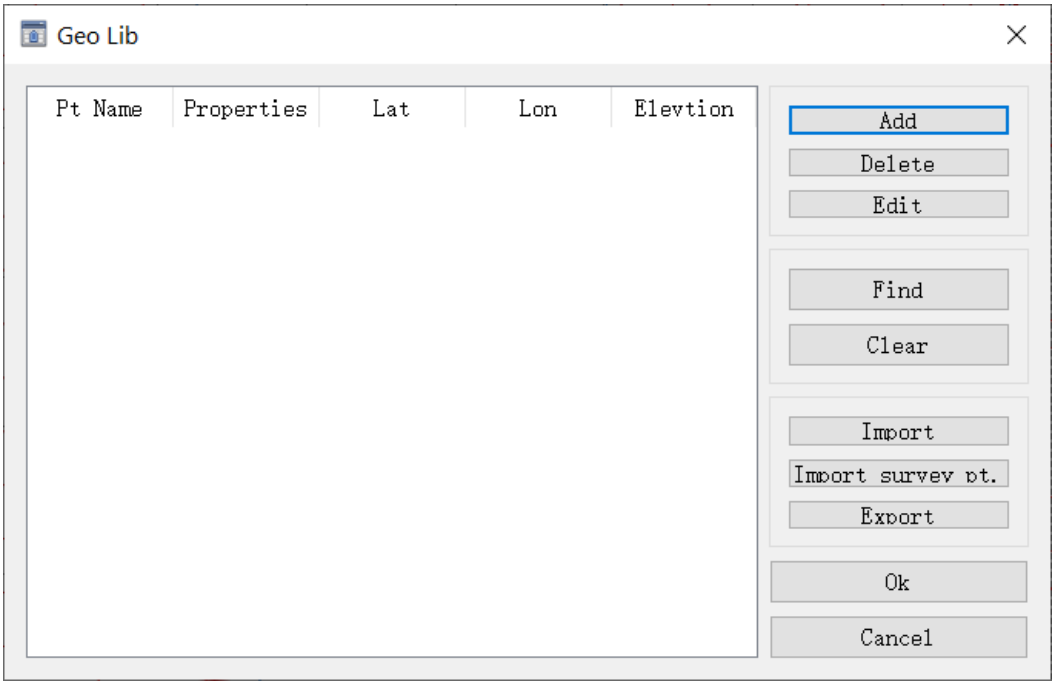


Fig.3-115 Geodetic coordinates

3.2.2.7, Processing

Single beam editor, post-processing, file export, tide station and trace export are contained in processing menu.

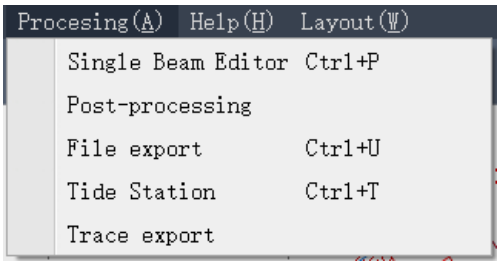


Fig.3-116 Processing menu

Single beam editor—This editor is able to modify the problematic values in the original measured depth data, and take out the required coordinates and depth values according to the assigned sampling method and interval.

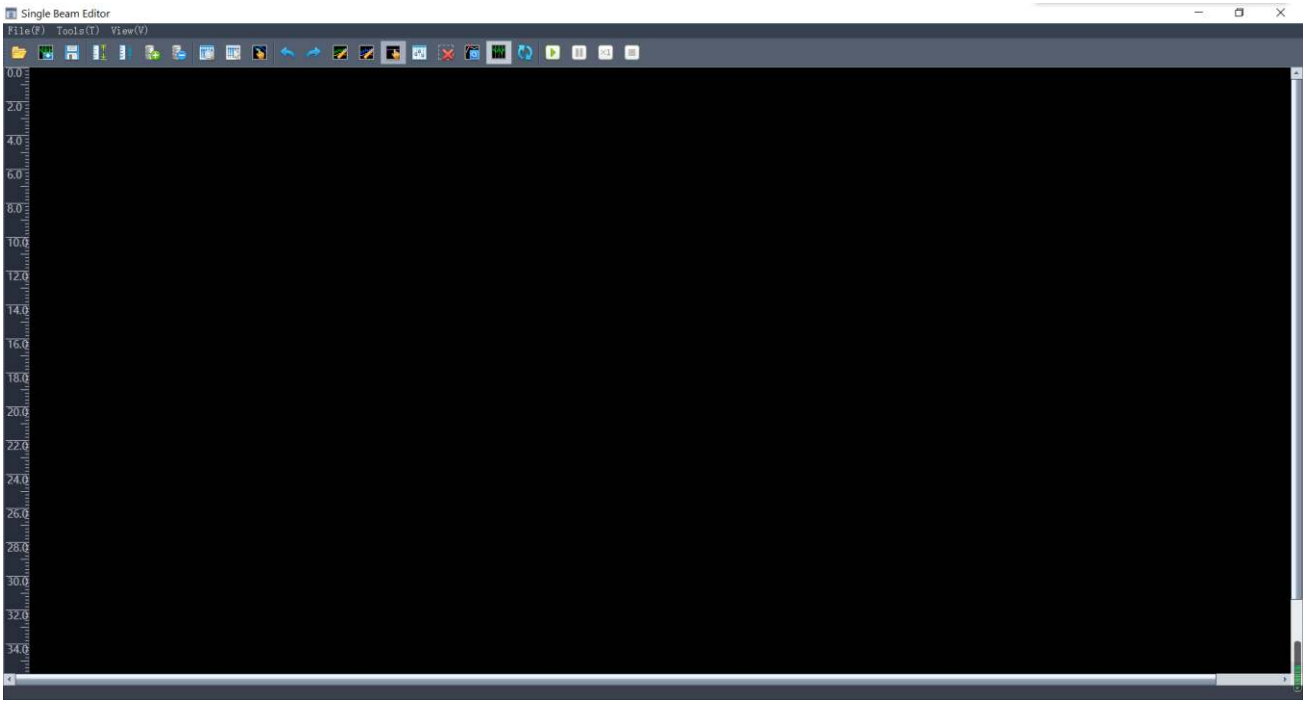


Fig.3-117 Single beam editor

Edit depth(H): This is used for the modification of depth measured by high frequency. If there are some abnormal depth points, use the mouse to flatten the abnormal depth points according to the changing trend of the depth.

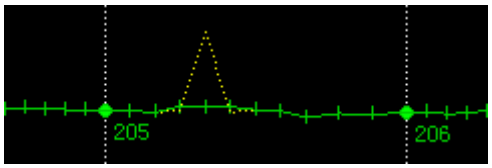


Fig.3-118 Edit depth

Post-processing—The software will record the detail information of the points in the survey line file during the measurement, including the WGS84 coordinates of the measuring point. Generally, the coordinate conversion should be completed before the measurement, in the case of incorrect parameters were used, the coordinate conversion can be performed through the post-processing. And there are 2 methods for the processing, one is to use parameters file(*.cot), the other one is to use the current project parameters.

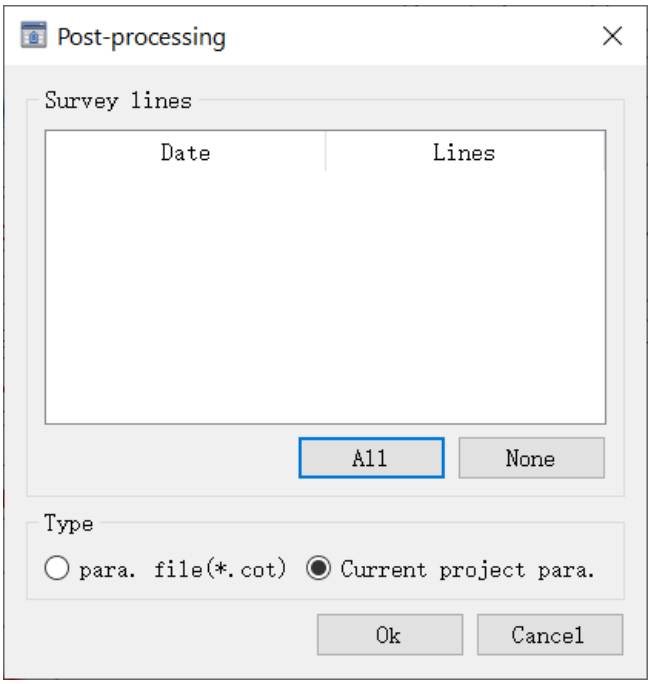


Fig.3-119 Post-processing

File export—The survey line saves all the original data of the survey point, such as point name, date, time, coordinates, satellite number and solution status, etc. At the same time, the data should be adjusted according to the requirement, such as echosounder adjustment, dynamic draft adjustment and so on. After the survey line data is corrected, not all the information is needed.

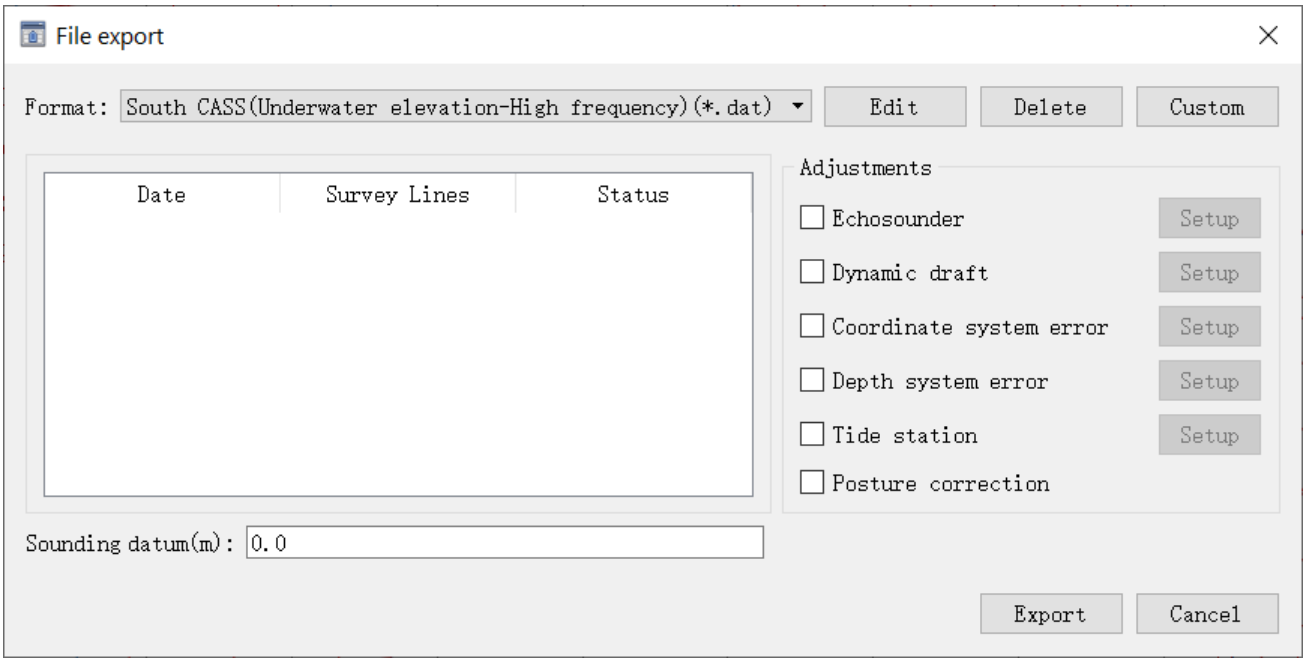


Fig.3-120 File export

Click on this option, the software will pop up a dialog, then select or customize the output format of the results according to the requirement. After that, choose the measurement line and adjustment items, and click Export button. A dialog will pop up, then select the name and path of the result and click Save.

Echosounder: With the different depth, the error of the depth value measured by the echosounder is also different, enter the depth value and the corresponding correction number in the list.

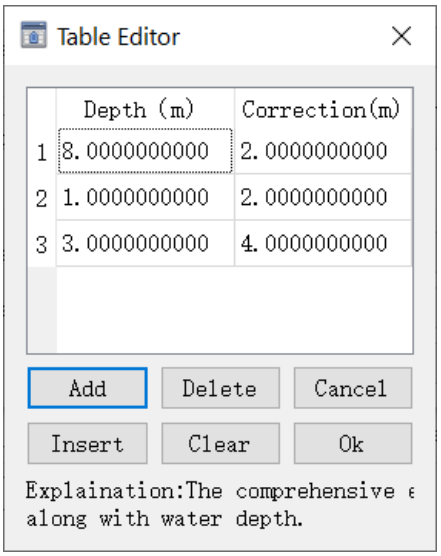


Fig.3-121 Echosounder adjustment

Dynamic draft: During the measurement, the ship has different drafts with different speeds, the user can use the error parameters obtained from field measurement or look-up tables to enter the speed and the corresponding positive draft in the list.

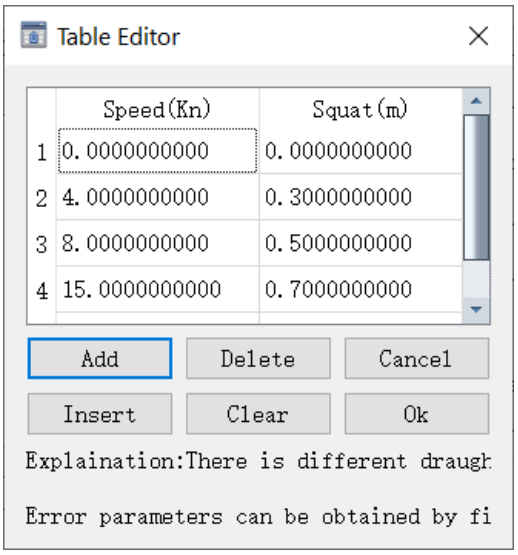


Fig.3-122 Dynamic draft

Coordinate system error: In the actual work, user can work in a custom coordinate system, then correct the custom coordinate system to the standard coordinate system through the coordinate system error correction.

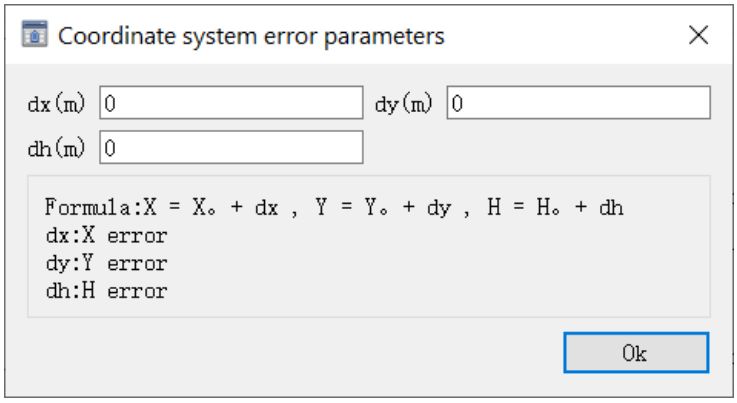


Fig.3-123 Coordinate system error

Depth system error: If there is a fixed error in the entire depth measurement, enter the correction value in the ds box. If there is a multiple relationship between the depth error and the depth value during the entire depth measurement, enter the multiplier in the dMs box.

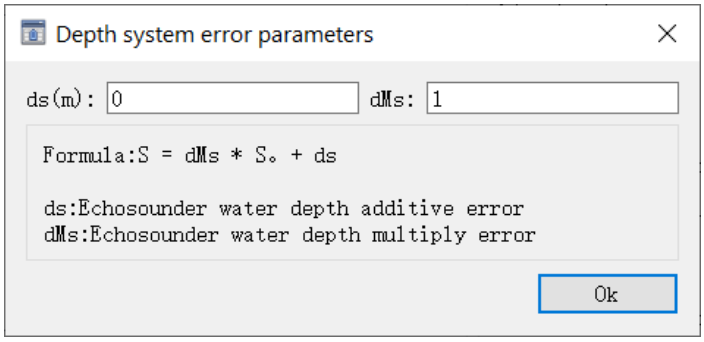


Fig.3-124 Depth system error

Tide station: It is able to choose an edited tide gauge station to correct the depth data.

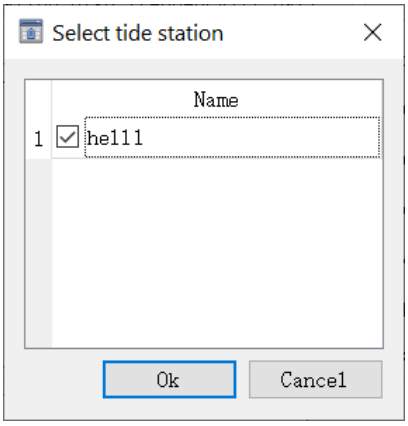


Fig.3-125 Tide station adjustment

Tide station—Here is to new or edit a tide gauge station data.

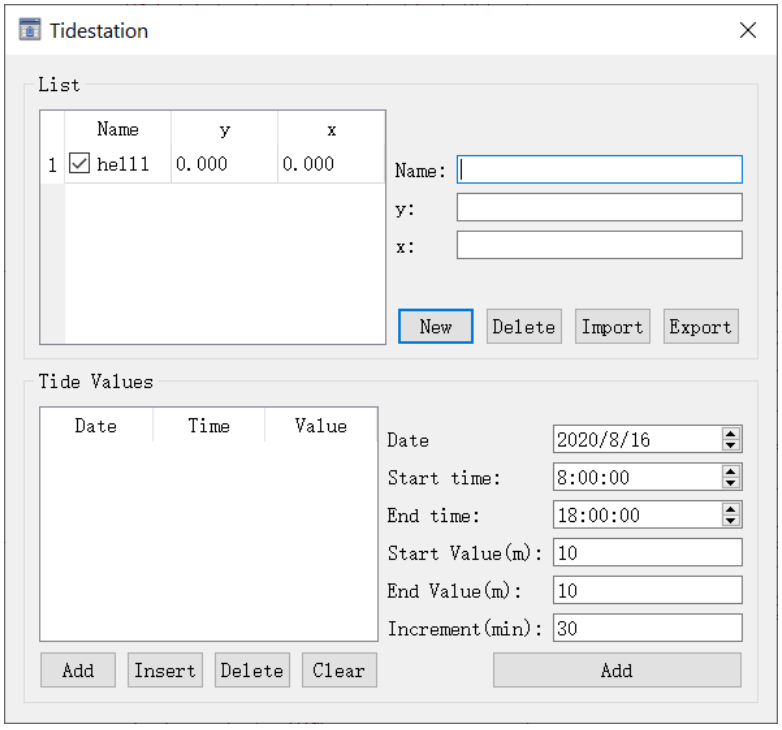


Fig.3-126 Tide station edit

Trace export—It is to export the coordinate of measurement lines, choose the line and click OK button to export a dat format file.

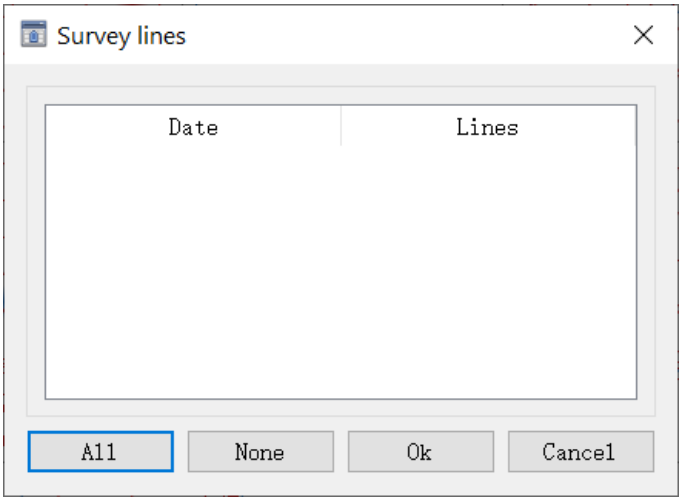


Fig.3-127 Trace export

3.2.2.8, Help

The About interface contains the information of software version, expire date, copyright, company website and email

Fig.3-128 About

3.2.2.9, Layout

This is to define the information window display or hide.

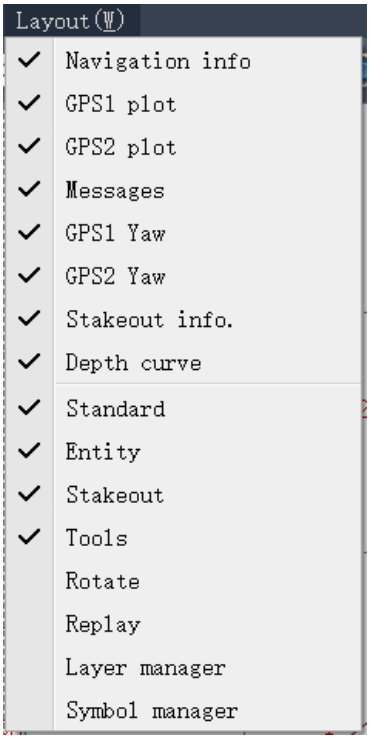


Fig.3-129 Layout

3.2.3, Toolbar

The toolbar contains a variety of shortcuts.

shortcuts	Description
	New project
	Open the existing project
	Save the graphic
	Re-handshake, for reconnecting the device
	Connect to the device
	Start measurement

	Pause measurement
	Stop measurement
	Move the screen
	Zoom in
	Zoom out
	Zoom window
	Zoom all
	Zoom 1:1
	Grid switch
	Undo
	Redo
	Draw point
	Draw line
	Draw polyline
	Draw circle
	Draw arc
	Annotation
	Point symbol
	Align feature
	Move the elements
	Delete singly
	Delete by area

	Delete all
	Select point by mouse
	Select line by mouse
	Measure distance and azimuth
	Inquiry area
	Property information
	Object snap

3.2.4, Navigation info/GPS1 plot

Navigation info window and GPS plot window are located at the left site of the main interface. This window displays position coordinate, depth, heading, ship speed, solution type of GNSS, locked satellites, satellites SNR and the other information.

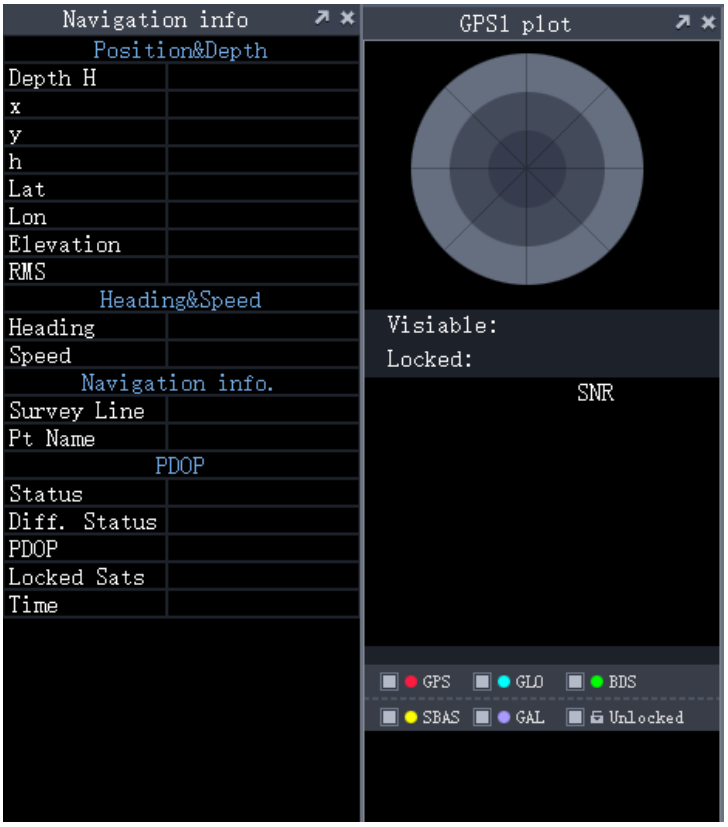


Fig.3-130 Navigation info/GPS plot

3.2.5, Message window

The message window is located at the bottom left corner of software, it is mainly for the operation log.

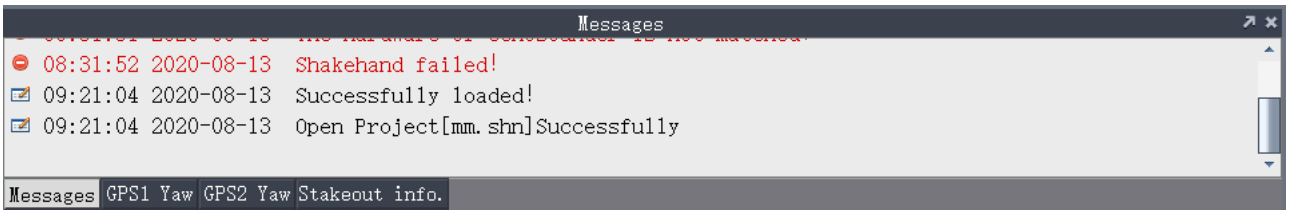


Fig.3-131 Message window

The GPS1 Yaw and GPS2 Yaw windows are at the same place with message window, they reflect the information of GPS receiver speed, yaw angle and distance.

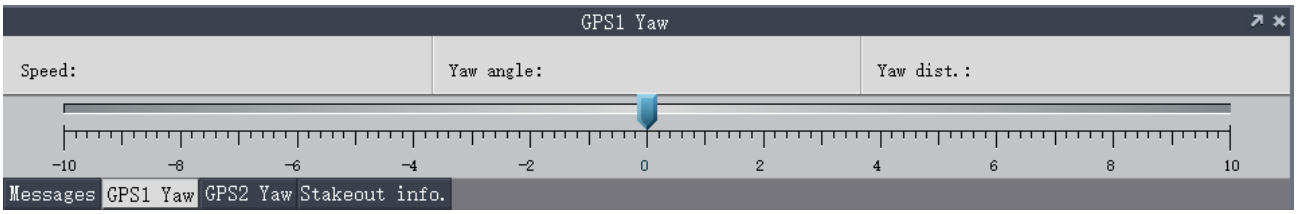


Fig.3-132 GPS Yaw

While stakeout points or lines, this window can display the stakeout information, such as the yaw distance and angle, distance to the starting point, distance to the ending point, difference of X and Y coordinates.

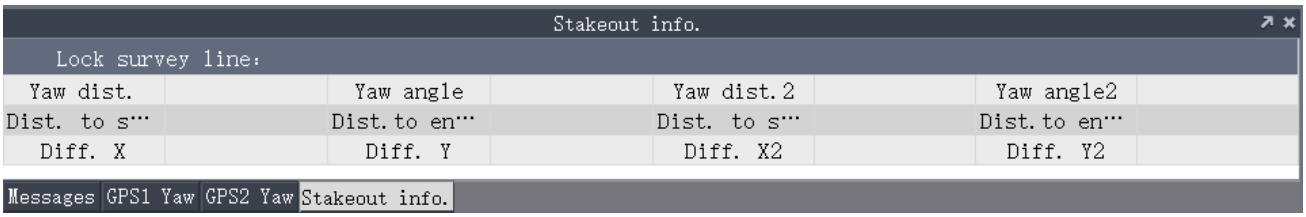


Fig.3-133 Stakeout info

3.2.6, Depth curve window

This window can display depth value and curve real-time.

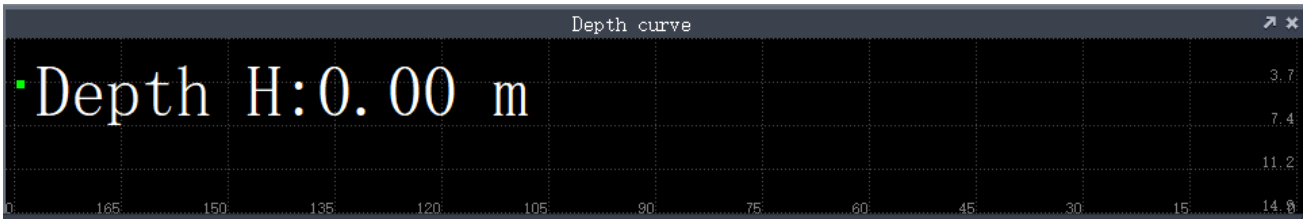


Fig.3-134 Depth curve window

Chapter 4 Hardware installation

4.1, Transducer installation

The location of the transducer is very important for maintaining reliable bottom tracking performance of the equipment. Avoid installing transducers in locations where the transducer will be subjected to turbulent water, air bubbles, or vibration. It is preferable to mount the transducer on the side of the hull where the propeller blades are normally moving downwards. The upward motion of the propeller can generate pressure waves, which push air bubbles up against the hull. By mounting the transducer on the downward side, the hull will tend to protect the transducer from this effect. The transducer should be mounted on, or adjacent to, the ship's centerline. Wherever practical, the transducer face should be parallel to the waterline. In addition, there should be sufficient room to permit use of the necessary tools to facilitate the installation-mounting requirements.

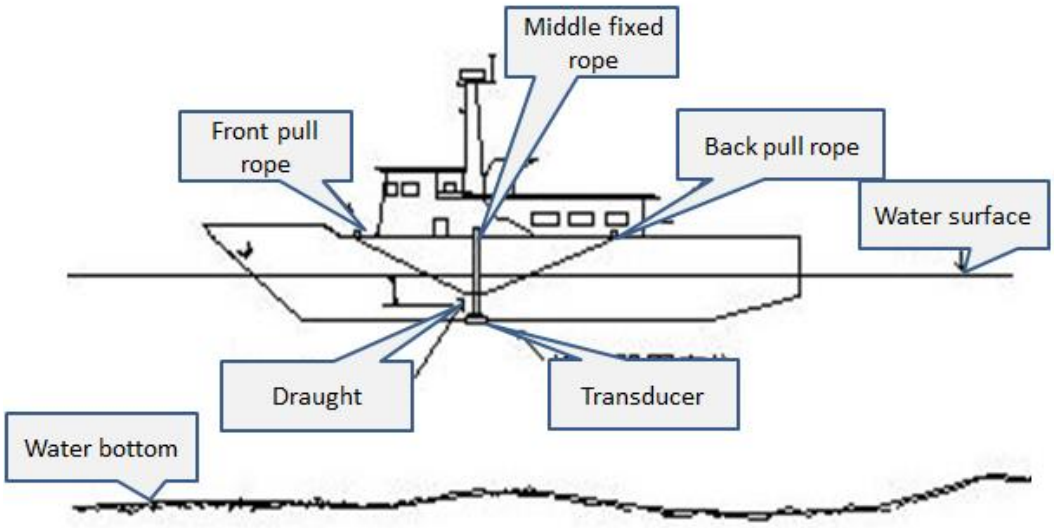


Fig.4-1 Transducer installation

To fix the transducer, the best location is in the middle side of the hull, thus reducing the influence and interference of the traffic surge to the transducer. When the speed of the ship is fast, then the juction pole connected with the transducer must be tilted slightly backwards, which is carried

out by increasing the reinforcement of the forward rope and the backward rope, considering the drag force from the flow and the gesture of the driving boat. Working at sea, to put the transducer into water a bit deeper is necessary; faster the boat, the deeper the transducer into water. In general, working at sea, the transducer draft is better between 1.2 and 1.4 meters; in inland river, the transducer draft is more than 0.5 meters (considering the length of pole and the operational needs). At sea, if measure under larger surge conditions, transducer draft muse be deepened, to avoid massive depth errors caused by surges. When mounting the transducer, must keep the juction pole vertical, reinforce and prevent loosening of the probe.

4.2, GNSS receiver connection

Mount the GNSS receiver onto the pole, then connect it to COM1 or COM2 on SDE-28S+ via serial cable. Switch on the receiver and configure it to achieve the reliable solution, then go to the HySurvey software to configure parameters to receive data stream from GNSS receiver.

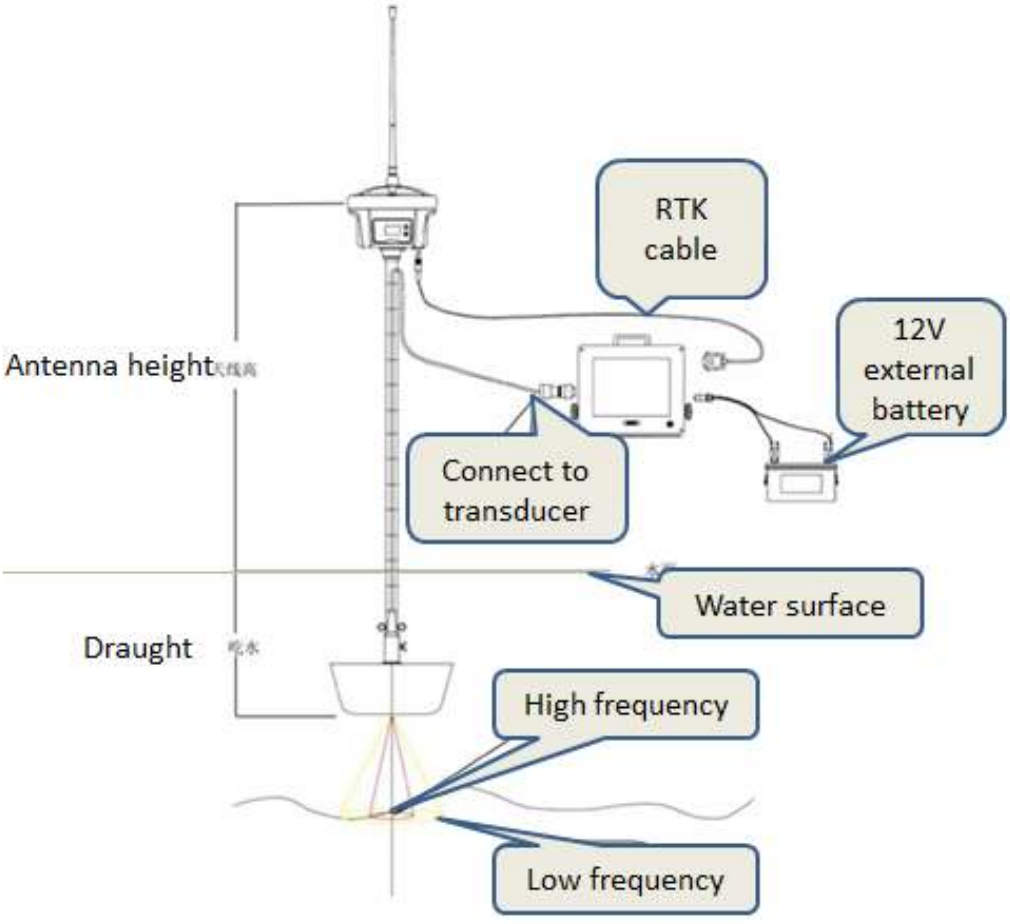


Fig.4-2 GNSS receiver installation

Chapter 5 Specifications

Measurements	
Frequency	200 KHz
Beam Angle	5°
Depth Resolution	0.01m/0.1ft
Accuracy	±0.01m±0.1%D(0.1% of depth value)
Ping Rate	Adjustable, Maximum 30Hz
Sound Velocity	1300m/s～1700m/s
Depth Range	8m, 15m, 30m, 60m, 120m, 240m, 300m, Automatic shift
Draft	0.0m～20m
Gain Control	AGC and TVG, depth and gain, a double door tracking
Output data format	KOLIDA, SDH-13D, DES025, INN455, ODOM etc.
Physical	
Operating Temperature	-30℃～60℃
Output Power	Up to 300W
Power Supply	10V～30V DC; 110V～260V AC, 50～60Hz
Waterproof/Dustproof	IP67
Humidity	5%～90%　non-condensing
Dimension	340mm×280mm×130mm
Weight	6.5kg
Hardware	
System	Windows XPE
CPU	1.6GHz Dual-core

Internal Memory	2G DDR3, 800MHz
Storage	8G high-speed Solid State Disk (SSD), supports to extend higher
USB	3x standard USB2.0
Serial Port	2x RS-232
VGA Interface	1x VGA
Display	12.1-inch color LCD touch screen
Protection	Interface protection
Transducer	
Cable	15m standard (customized)
Pole	2m standard (customized)