



# Hydro-Tech Dual Frequency SSS SS3060 / SS4090 User Manual



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Beijing Hydro-Tech Marine Technology Co., Ltd.

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## 1. Introduction

### 1.1. Product Introduction

SS3060 or SS4090 (Seagull) is a dual frequency broadband high-definition side scan sonar designed for various customers and fulfil a general purpose of applications. It can support to output CW or Chirp signal at dual frequency of 300kHz & 600kHz or 400kHz & 900kHz (SS4090) at the same time. Thus operation make sure the wide scanning range and also guarantee the high resolution of the scanning image.

This product adopts our company's broadband signal processing, variable aperture and auto zoom technology to enhance the depth of field, which help the near field and far away picture to be clear enough. At the same time, its hardware uses 24bit high accuracy A/D chip and high performance FPGA+DSP signal processing technology, combining with image equalization and 4K HD display technology, it can display the terrain in full scale completely.

It also built in interna IMU and is able to measure the side scan sonar's heading, roll & pitch, then its attitude can be calibrated real-time. SS3060 & SS4090 has been widely used in shallow water applications of underwater engineering inspection, pipeline investigation, objects searching and rescue, underwater archaeological survey, marine pasture investigation and environmental protection of hidden pipe inspection etc.

## 1.2. How to use this Manual

This manual introduces main technical specification, system framework & functions, installation, operation and safety precautions of SS3060 & SS4090 high-definition side scan sonar system. It is recommended that users had better read this manual carefully before installation or operation of the equipment to avoid unnecessary injury to equipment and personnel.

- 1) For users who use SS3060 & SS4090 for the first time, please read Part 3 “Safety” of this manual to prevent any damage to equipment or injury to personnel during wrong operation;



- 2) For the users who install SS3060 or SS4090 for the first time, please refer to Part 4 of “System Installation” for preparation and installation of the device.
- 3) If you have known how to install the system, but not familiar with the operation, please read Part 5 of “System Operation” in this manual to learn how to operate in details.
- 4) If you have known the hardware well, but not familiar with software, please read the manual of Hydro-Sonar to learn how to display and control side scan sonar working status.

## 2. System Specifications

### 2.1. Technical Specifications

Working Frequency	300kHz & 600kHz (SS3060) 400kHz & 900kHz (SS4090)
Max. Slope Range	230m@300kHz / 120m@600kHz 150m@400kHz / 75m@900kHz
Parallel Beam Width	0.28°@300kHz / 0.26°@600kHz 0.21°@400kHz / 0.2°@900kHz
Vertical Beam Width	50°
Along Track Resolution	300kHz: 0.24m@50m;0.49m@ 100m; 0.73m@150m 600kHz: 0.09m@20m; 0.23m@50m; 0.34m@75m 400kHz: 0.18m@50m; 0.27m@ 75m; 0.37m@100m 900kHz: 0.07m@20m; 0.17m@50m; 0.26m@75m
Across Track Resolution	2.5cm@300kHz / 1.25cm@600kHz 1.25cm @400kHz / 1cm @900kHz
Signal Bandwidth	60kHz
Signal Type	CW/Chirp (Self-adaption)
Max. Working Depth	300m

### 2.2. Physical Specifications

Towfish Size	Φ100mm x 1200mm
Towfish Weight	25kg (In air) 12kg (In water)
Deck Unit Size	208mm×127mm×66mm
Deck Unit Weight	1.3kg

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Working Temperature	-2° ~ 45°C
Storage Temperature	-20 ~ 55°C
Power Supply	DC 20V - 36V AC 110V - 240V
Power Consumption	60W
Towing Cable Length	50m (Optional for 200m)
Software	HydroSonar as Standard Compatible with Hypack, SonarWiz etc.

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### 3. Safety



In order to ensure the personal and equipment safety during SS3060 or SS4090 operation, please read the following details before operation.

#### 3.1. Equipment Safety

- 1) During transportation, please pack the transport box properly and avoid any possible damage of vibration;
- 2) Check whether the transporting carton is damaged before unpacking;
- 3) Confirm whether main unit or other accessories are in good condition before installation;
- 4) Side scan sonar or other parts shall not be dropped down;
- 5) Not plug in or pull out any cable when the side scan sonar is in operation;
- 6) All cables of the system shall not be folded, pressed, squeezed, pulled, cut or other operations that may cause physical injury;
- 7) The deck unit and all connectors shall not be immersed in water or splashed by rain and cause water leak.
- 8) The towfish will lose speed and drop down when the vessel turn around or slow down. Please watch to the real-time image and pay attention to roll back the towing cable to avoid towfish collide to the terrain ground.
- 9) When towfish working in water, make sure to tighten the towing cable to towfish and not loose the it.
- 10) Not exceed the operating and storage temperature limits;

#### 3.2. Cleaning & Maintenance

When using or storing acoustic transducers, please adapt the following steps to protect it for better maintenance:

- 1) Clean the outside with clean fresh water and soft brush if needed;
- 2) Wash transducer with fresh water after operation each time;
- 3) It is forbidden to use any antifouling paint to coat the acoustic transducer;
- 4) It is forbidden to expose the surface of transducer under Sun to prevent any damage to the transduce.

## 4. System Components

SS3060 or SS4090 side scan sonar is made up of towfish with transducer on each side, sonar interface module (Or called deck unit) and together with various towing, power & data cables. Among them, the towfish is the most complicated part. Below is the illustration of each part.

### 4.1. Towfish

The towfish has two long transducers on each side, both of them include functions of projecting and receiving acoustic sounding signals of side scan sonar. It projects high frequency acoustic pulses at fixed intervals, which will be reflected and return to the receiving arrays after meeting the bottom or other obstacles. Below figure shows each component of SS3060 or SS4090 side scan sonar.

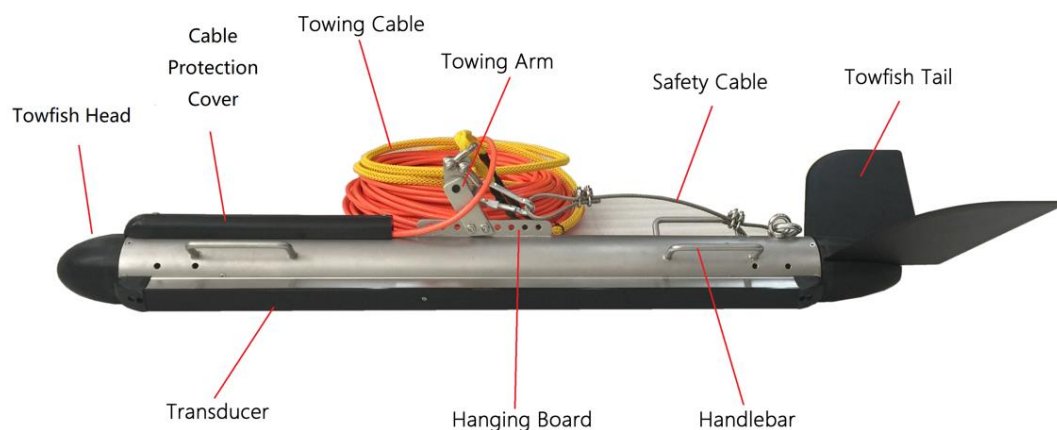


Figure 4.1 SS3060 or SS4090 Towfish

### 4.2. Deck Unit

The SS3060 and SS4090 deck unit provides power supply and sends control commands to the underwater towfish through the towing cable, and at the

same time receives the acoustic sounding data and other attitude information of the towfish. Below figure is the deck unit.



Figure 4.2 Deck Unit

### 4.3. HydroSonar Software

SS3060 and SS4090 side scan sonar's data is to be displayed in HydroSonar software, which has the functions of working parameter control, acoustic sounding data display, navigation, data acquisition & storage and playback etc.

The sonar data is transmitted to HydroSonar software at high speed through the Ethernet protocol TCP/IP. At the same time, the positioning information is also sent to HydroSonar through serial port directly. Following figure shows the main menu of HydroSonar. Please refer to the HydroSonar Manual for its detailed operation.

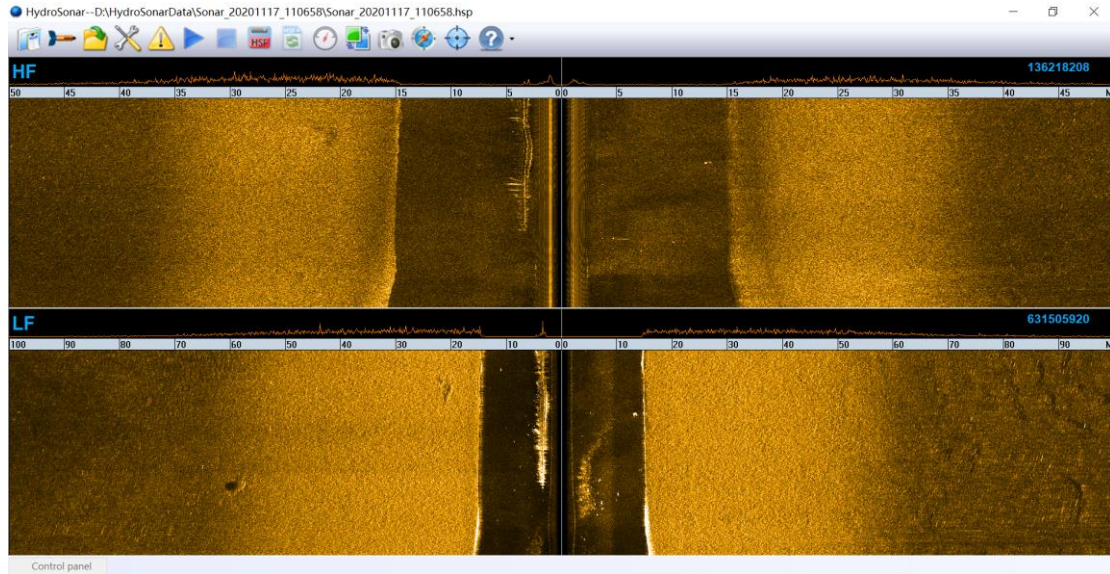


Figure 4.3 HydroSonar Main Menu

#### 4.4. Towing Cable and Others

SS3060 & SS4090 towing cables are used not only for data communication and power supply, but also dragging the towfish. There are two options of 50m length as standard and 200m for optional. Users can choose according to their specific application environment and water depth to decide the towing cable length.

If needed, the towfish side scan sonar can also be equipped with a winch for towing operation. There are options of electric winch or hand winch.

## 5. System Installation

In this part, we will introduce the installation and operation of SS3060 & SS4090 side scan sonar system step by step.

The standard system consists of 2 parts, one is the carrying case packing towfish & deck unit, the other one is the box packing towing cable and other accessories.



Figure 5.1 SS3060 or SS4090 Towfish



Figure 5.2 SS3060 Towing cable and Towfish Tail

### 5.1. Towfish Installation

Among the components of the towfish side scan sonar, there are many

structures and accessories related to towfish, which is relatively complicated part to install. Please refer to the below figure to learn more about its structures and accessories.

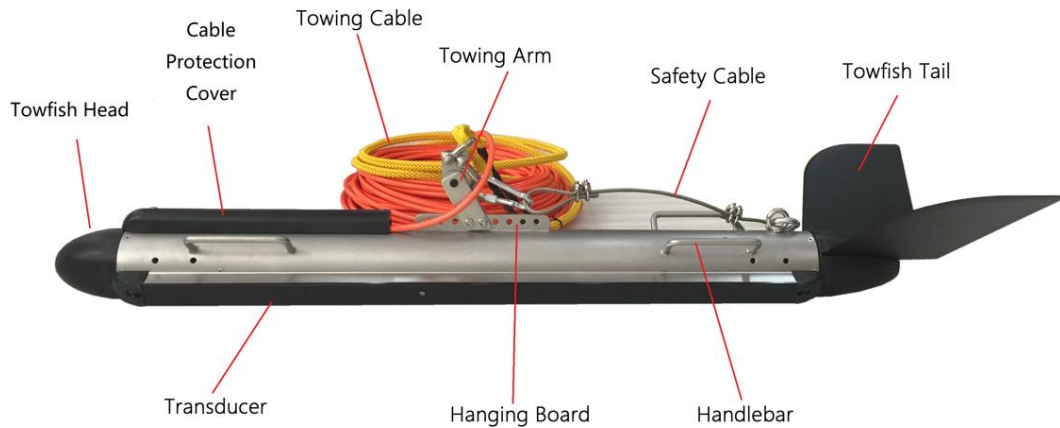


Figure 5.3 Towfish Structure

SS3060 & SS4090's working mode is towed scanning mainly. Below will introduce the installation method of towing operation.

- 1) Take the towfish out of the transportation case, place it on a flat area, and prepare screwdriver and other tools;
- 2) Use a screwdriver to remove the cable protection cover of towfish, as shown in Figure 5.4;

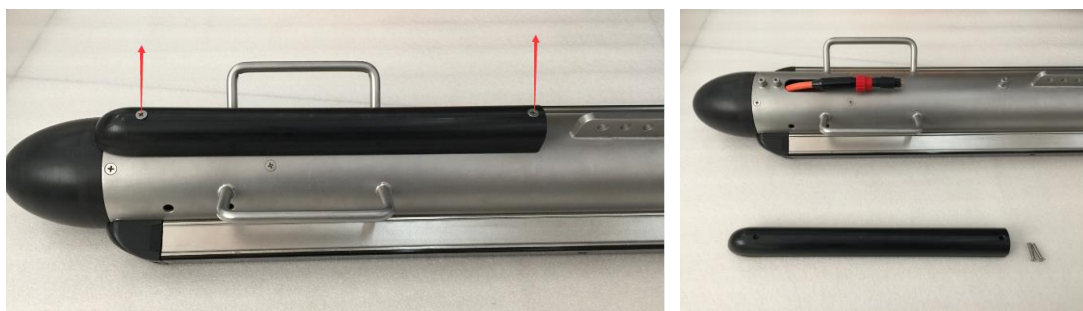


Figure 5.4 Remove Cable Protection Cover

- 3) Take out the waterproof silicone grease from the gadget box, apply to the cable connector, and then plug two connectors tightly as shown in below figures.



Figure 5.5 Apply Waterproof Silicone Grease



Figure 5.6 Plug Towing Cable Connectors

- 4) After connecting towing cable connectors, reinstall the cable protection cover and fix it tightly. It will protect the towing cable.





Figure 5.7 Cable Protection Cover Installation

- 5) Take out the towing arm and fix it on the hanging board. Please be noted that the towing arm has direction of front and rear. When installing, be careful not to install it in reverse. Pay attention to the figure below of the front and rear direction of the towing arm.

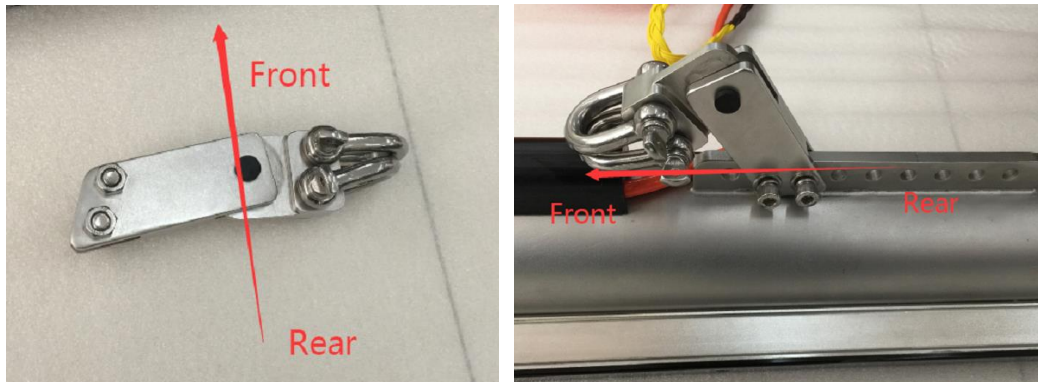


Figure 5.8 Towing Arm Direction and Installation

Notice: There are 9 equidistant holes on the hanging board to install. During usage, choose the appropriate installation hole according to the working depth of towfish. Generally speaking, the deeper the towfish to work, the more rear to mount on the installation hole.

- 6) There are two shackle rings on the towing arm. Open the front shackle and hang the traction net of towing cable into it. Then tighten the shackle as shown in following figure.



Figure 5.9 Fix Traction Net into Shackle

- 7) Take out the safety cable, fix both ends on the rear shackle of the towing arm and the safety ring near the towfish tail respectively. The installation method is shown in the figure below.



Figure 5.10 Safety Cable Installation

- 8) Take out the towfish tail wings and install them together first, then it will be shown in figure below.

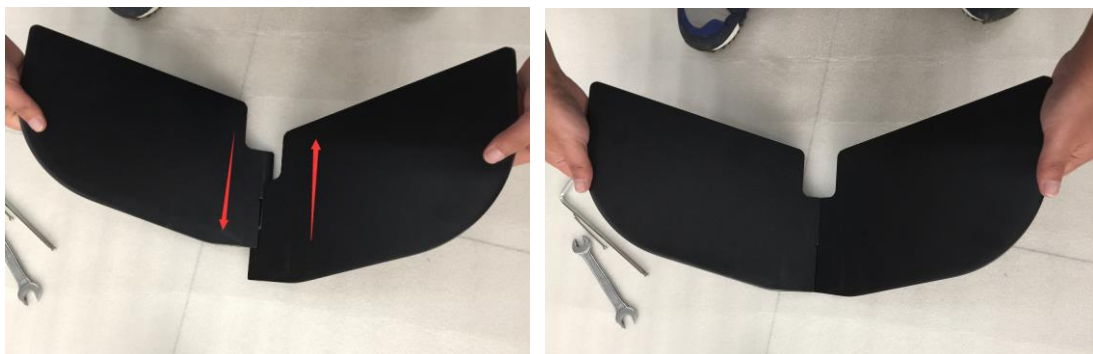


Figure 5.11 Tails Installation

Then install the two tail wings into the end of towfish as shown in figure below.

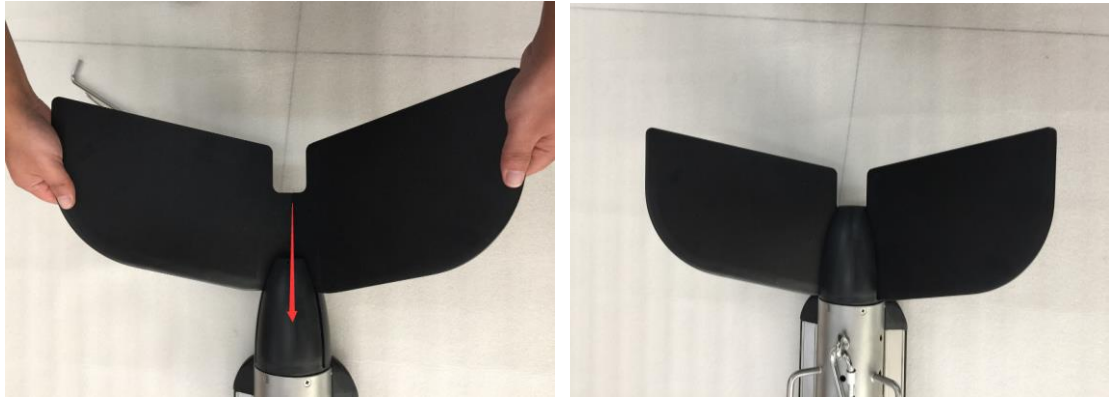


Figure 5.12 Tail Wings Installation

At last, plug in the pin and break off the pin tail to avoid it dropping down as shown in below figure.

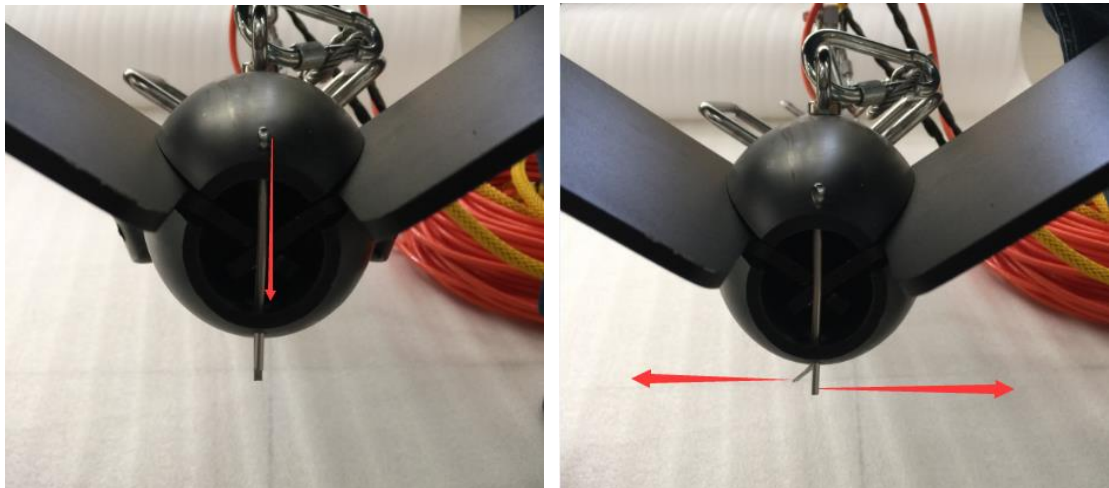


Figure 5.13 Pin Fix Tail Wing

## 5.2. Deck Unit Installation

The installation of the deck unit mainly includes the connecting deck unit to underwater towfish and the connecting deck unit to computer running HydroSonar for real-time navigation and data collection.

- 1) Install deck unit and computer in cabinet and avoid them dropping to deck during vessel sailing;
- 2) Connect towing cable to deck unit as shown in following figure.



Figure 5.14 Deck Unit Cable Connection

3) Connect deck unit to computer via Ethernet cable.

4) If needed, install the counterweight to appropriate position according to the request of counterweight.

Then just run the HydroSonar on the computer to control SS3060 & SS4090 working status and collect data. Please refer to the HydroSonar Manual for detail operation procedure.

## **6. Side Scan Sonar Operation**

### **6.1. Preparation Before Survey**

#### **6.1.1. Equipment Inspection**

Prepare and check the equipment before survey and conduct safety inspection according to the “Part 3 Safety” in this manual.

#### **6.1.2. System Installation**

Install the system according to the “Part 5 System Installation” in this manual and prepare the winch and towing cable etc.

### **6.2. Run the Software of HydroSonar**

#### **6.2.1. Computer IP Setting**

Modify the local IP address of computer to ensure that the IP address of computer is 192.168.1.\*\* (From 21 to 255) section.

#### **6.2.2. Run HydroSonar**

Click shortcut of HydroSonar, then its main menu will show as Figure below.

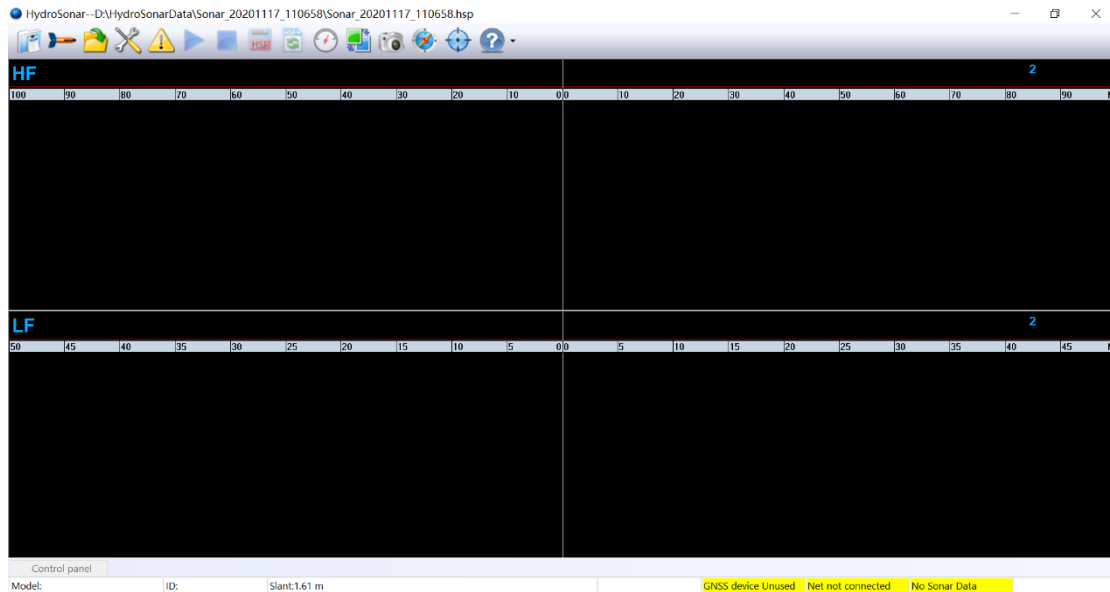



Figure 6.1 HydroSonar Main Menu

After running the software, judge whether the system runs normally through the connection status information in the working parameter window.

### 6.2.3. New Project

When we do side scan sonar measurement of a project for the first time, we

first need create a new project. We can click the button of  (In the Toolbar - Project) to pop up the Project dialog box as shown in following Figure:

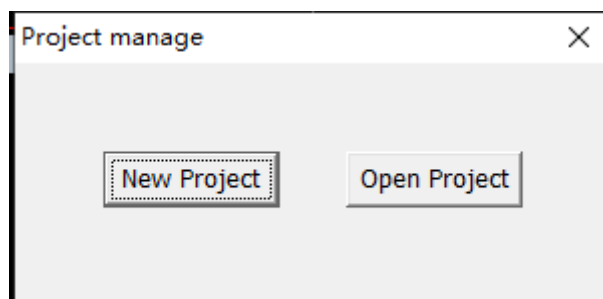


Figure 6.2 Project Manager

Click "New Project" in the Project Manager box. Then in the pop-up New Project dialog box, set up the project name and saving path. Click "OK" as shown in Figure below.

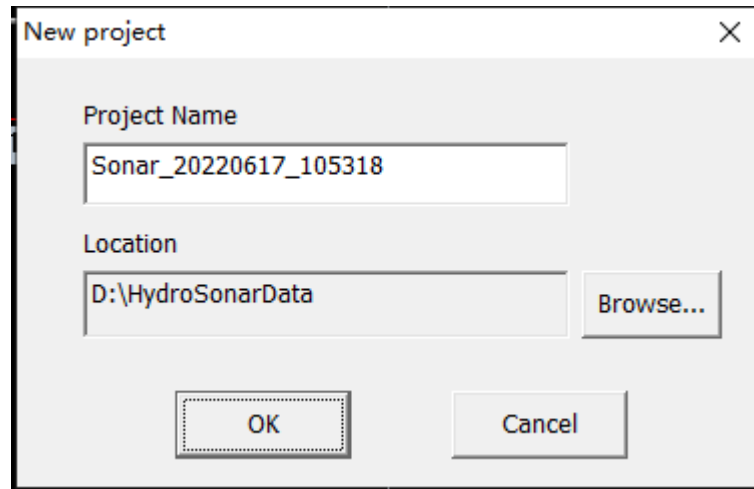


Figure 6.3 New Project

#### 6.2.4. Connect Device


After a new project is created, click the button of  (In Menu Toolbar - Connect Device). HydroSonar software will automatically connect the devices. When the side scan sonar is successfully connected, the software will automatically pop up the dialog box of Successful Connection.



Figure 6.4 Sonar Connected Successfully

If the device connection fails, the software will pop up the dialog box of device

connection failure as shown in Figure below. At the same time, check whether the power cable and Ethernet cable is connected correctly, whether the IP setting is correct etc.

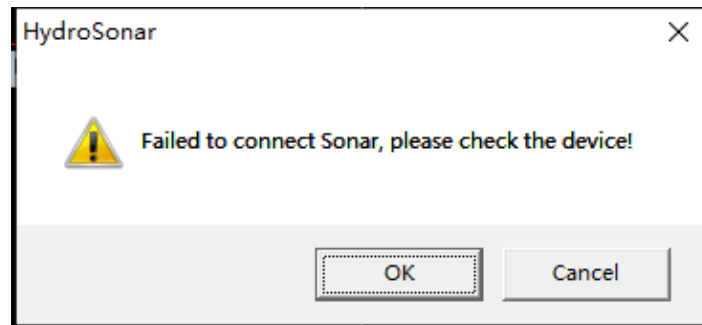



Figure 6.5 Device Connection Failure

### 6.3. GNSS Connection Setting



Click the button of  (In Menu Toolbar - Device Parameter Setting), there will pop up setting dialog box. User can set up the serial port number, baud rate and other information of GNSS input, and then click to open serial port. At the same time, the open serial port button changes to the close button. The GNSS setting column turns gray and its status can not be modified any more. Below Figure 7.6 shows the GNSS setting.



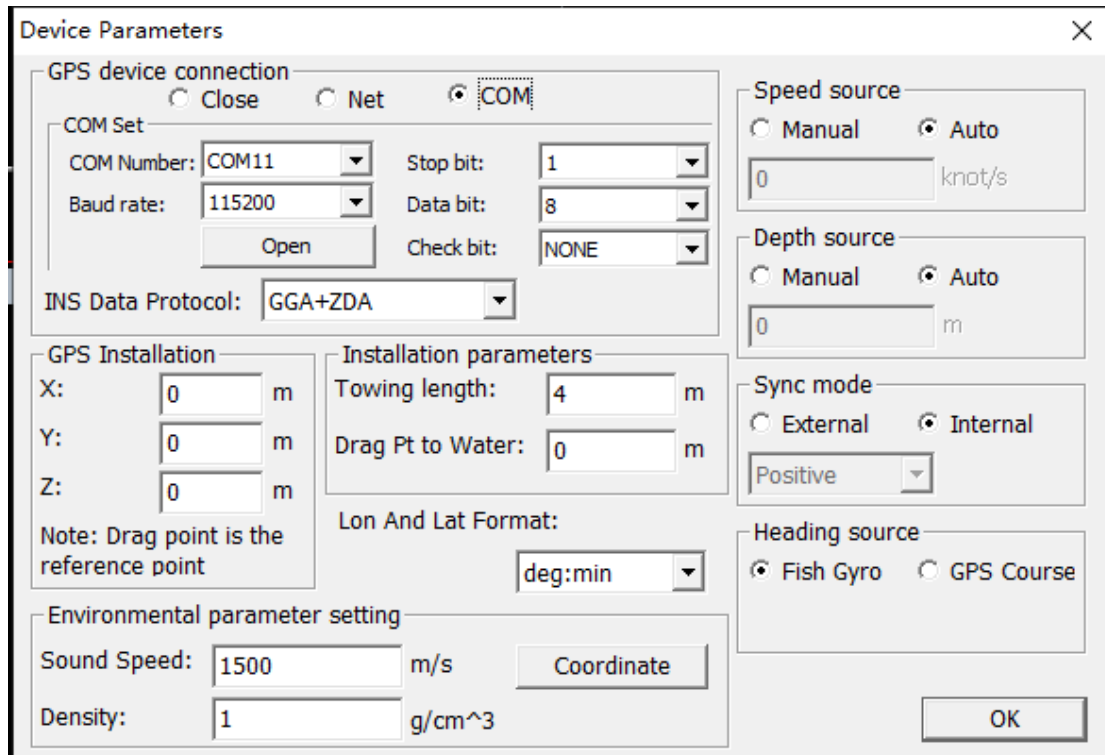


Figure 6.6 GNSS Connection

## 6.4. Coordinate System Setting

In the device parameter setting dialog box (Figure 6.6), click “Coordinate” to pop up Coordinate System Setting (Figure 6.7), we can set up the coordinate system, including ellipsoid parameters, conversion parameters, projection mode, central meridian and other information as shown in Figure below.

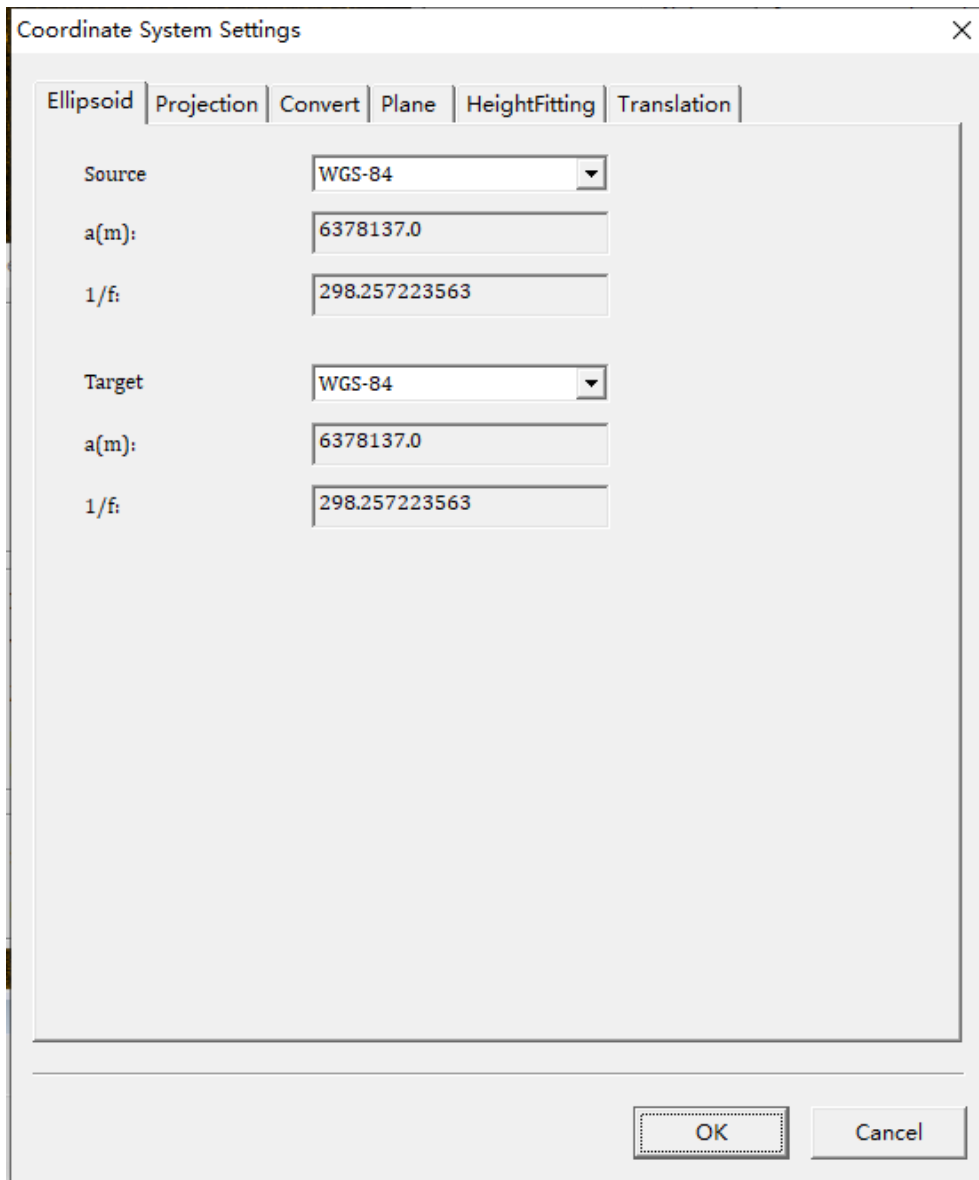



Figure 6.7 Coordinate System Setting

## 6.5. Pressure Calibration

When the device is well connected, please do the "Pressure Calibration" before dragging towfish into water. Click the button of  (Toolbar – Pressure Calibration) to pop up Pressure Calibration dialogue.

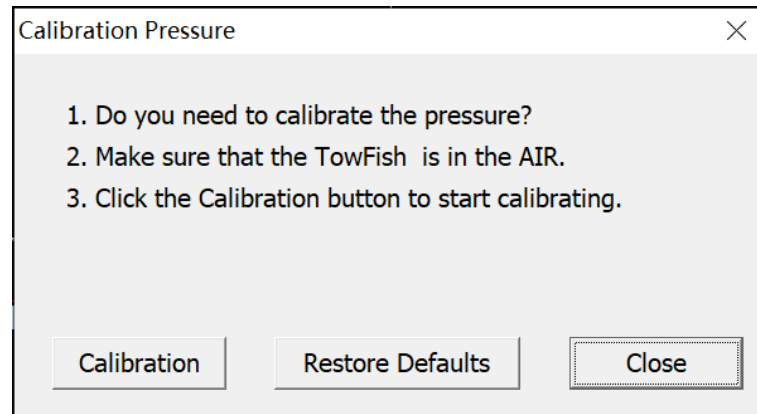


Figure 6.8 Pressure Calibration

If it is determined to do the pressure calibration, just click the calibration button on the left and enter the calibration waiting dialogue. At the same time, it will show as Figure t.9 for the calibration waiting status.

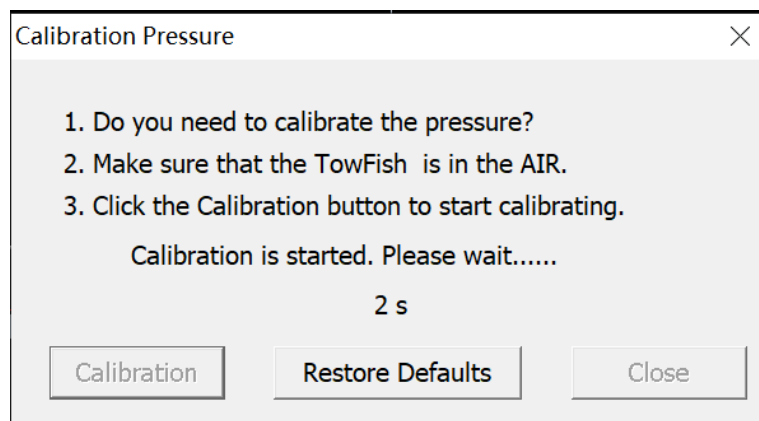


Figure 6.9 Calibration Waiting

After the calibration is completed, the software prompts that the calibration is complete, and the pressure calibration interface displays that the calibration is successful and displays the current atmospheric pressure value as shown in Figure 6.10:

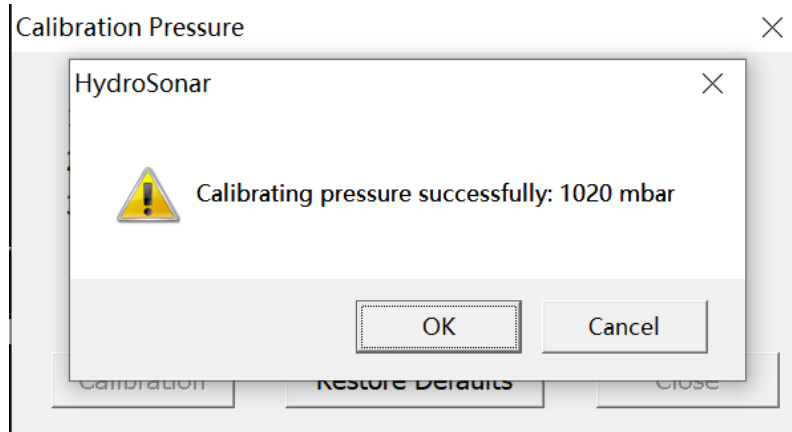



Figure 6.10 Calibration Finished

## 6.6. Alarm Setting



Click the button of  from the menubar. It is mainly used to set up to alarm the project status especially when the GNSS data quality during the operation is not good enough. Below figure is the alarm Setting dialog window.

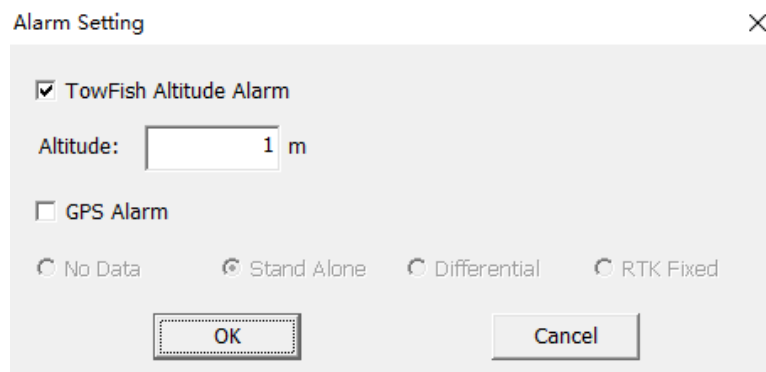



Figure 6.11 Alarm Setting

## 6.7. Roll Down the Towfish

After all the above parameters are set up, drive the vessel to the survey area or other safe area. Roll down the towfish via winch or other lowering machine to put towfish into water. Try to ensure the vessel sail in a straight line at a uniform speed.

Notice: It is strictly forbidden to put towfish down when the ship is moored or in unsafe waters (except debugging in water when mooring).

## 6.8. Start Work

After the towfish is put down into water, click the button of  from the toolbar. The side scan sonar will start to work and display scanning data in the software. Please adjust the towing cable length and vessel speed to have towfish working at suitable depth.

## 6.9. Control Panel

When the towfish working and suitable depth, open the control panel to set up the side scan sonar operating parameters, such as range, pulse width, gain of high and low frequency in order to have the SSS devices work at the best status.

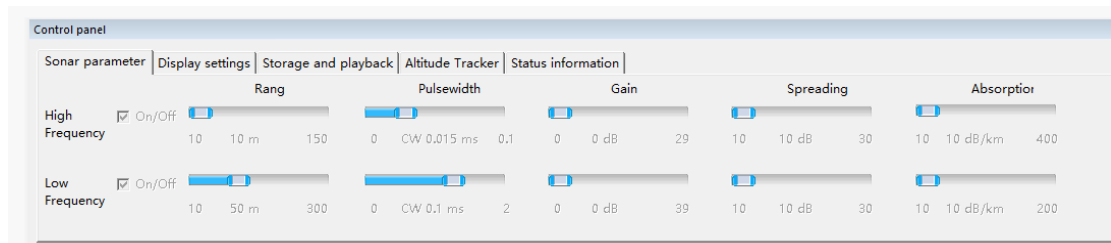



Figure 6.12 Control Panel

Then we can click the button of “Survey Line Editor” to create the survey lines needed in the project.

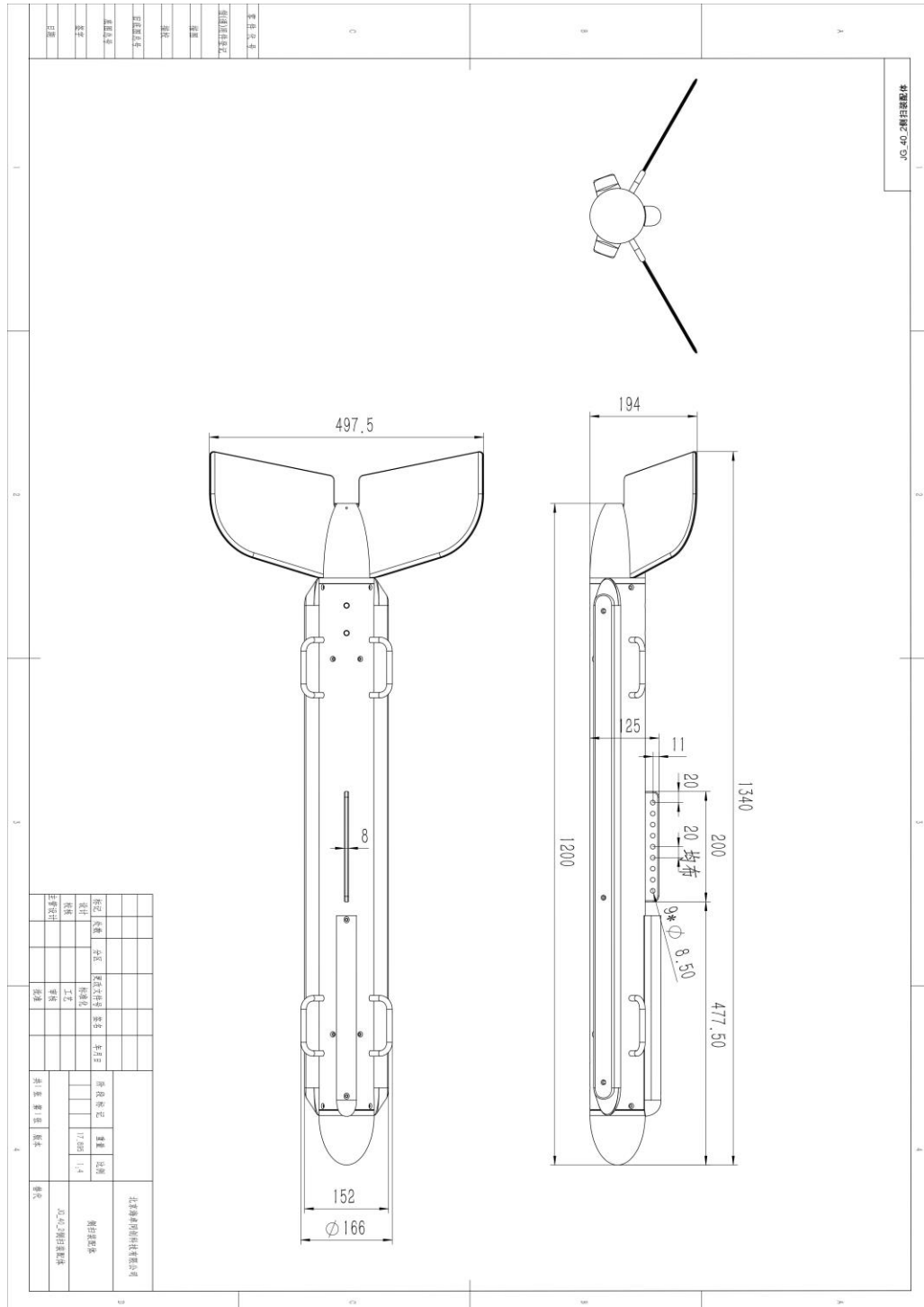
After vessel drive into the survey area, click the HSF or XTF file button, then the software will start to record sonar data. And the button will change to green.



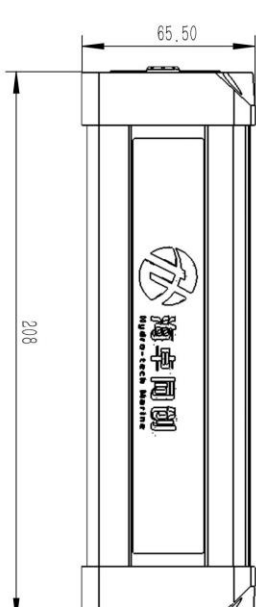
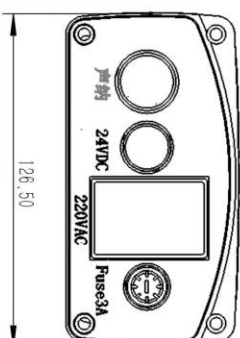
Click  to stop recording. HydroSonar stop work. Then we can drag towfish back after all project fished.

After all the survey work and return to marina, please wash and clean the towfish. Then disassemble it and pack every part back to transportation case.

## Appendix 1 Towfish Mechanical Drawing



## Appendix 2 Deck Unit Mechanical Drawing

												<p>JG_40_1侧扫机箱盒</p>									
零件代号																					
借(通)用件登记																					
旧底图总号																					
底图总号																					
签字																					
日期																					

北京海卓同创科技有限公司						阶段标记		质量		比例		图纸1 JG_40_1侧扫机箱盒	
								0.887		1:2			
						共1张		第1张		版本		替代	
设计		处数		分区		更改文件号		签名		年月日			
校核						标准化							
主管设计						工艺		审核					
						批准							



## Appendix 3 Towfish Sonar Cable Definition

A End	Q'ty	Cable Length / Definition	B End	Q'ty
MCIL6F (Connector tail cable 20 ± 2cm)	1	5000cm/6 cores Kevlar cable requirement: Waterproof connector stripping wire length less than 3cm	FGG.3B.308.CLAD9 2	1
Pin #	Wire Color	Waterproof cable wire color	Pin#	Signal
1	Black	Thick Red	1	48V
2	White	Thick Black	2	GND
3	Red	Thin Red	3	T+
4	Green	Thin Blue	4	T-
		Red & Blue Shielding	5	Device Cover
5	Orange	Thin Brown / Yellow	6	R+
6	Blue	Thin Black / Green	7	R-
	Blue	Brawn & Black Shielding	8	Device Cover

## Appendix 4 FAQ

### **Q1: What is the suitable vessel speed during towfish SSS working?**

A: Usually it is better to control the vessel sailing at the speed of 2 – 6 knots.

### **Q2: How to control the towfish?**

A: Typically, the scanning width of a side scan sonar is 5 to 10 times of the height that the towfish is to the bottom. Of course, the height of the towfish should be better to keep at one-tenth of the scanning width in order to obtain more valuable information. And the height of the towed fish should also be kept as consistent as possible throughout the scanning process.

### **Q3: How to control the towing cable length rolling down to water?**

A: The major function of rolling down towing cable is to control the height of the towfish to the water bottom. When the vessel speed is 5 knots, the towing cable rolling down length shall be about 2 - 3.5 times of the sinking depth. Of course, sometimes it is longer. For example, if the water depth is 50m while the scanning width is 100 meters, then the height of the towfish should be 10-20 meters, that is the depth from towfish to water surface should be 30-40 meters, so the length of the towline should be controlled around 100 meters.

### **Q4: How to choose a winch?**

A: Generally, when working on small boats in shallow water area, the towing cable length does not need to be too long. Then hand winch is suggested, which is small, light and more flexible in operation. When used on deep-sea large vessel, longer towing cable is required, then an electric or hydraulic winches can be selected.