

Hydro-Tech MS400U

Multibeam

Echo Sounder



Beijing Hydro-Tech Marine Technology Co., Ltd.

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Customer Supports

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1. Introduction

1.1. Product Introduction

MS400U Multi-beam echo sounder includes of two parts: Transducer and Sonar Interface Module. The system block diagram of MS400U is shown in Figure 1.1.

Its system software consists of Display & Control software Hydroquest and Navigation & Data Acquisition software HydroNavi.

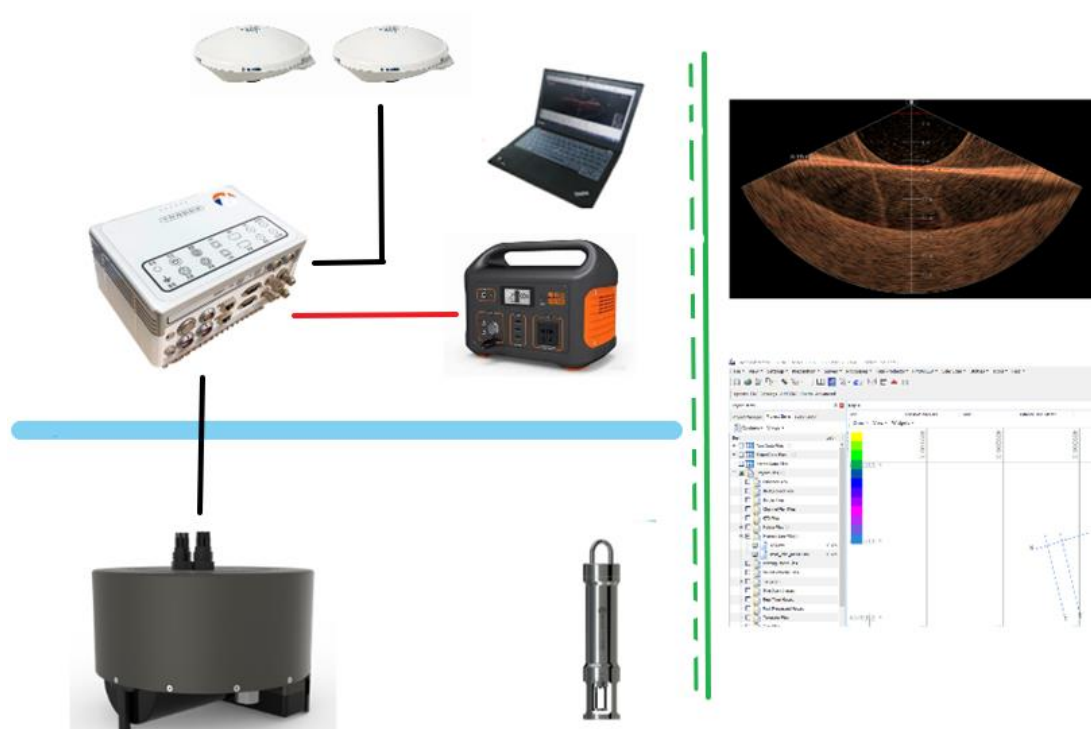


Figure 1.1 System Diagram

It works together with system software, including display and control software named “HydroQuest” and navigation & data acquisition software named “HydroNavi”.

2. System Specifications

2.1. System Specifications

Working Frequency	400kHz
Depth Resolution	0.75cm
No. of Beams	512
Working Modes	Equiangular or Equidistance
Vertical Receiving Beam Width	1°
Parallel Projecting Beam Width	2°
Max. Ping Rate	60kHz
Signal Type	CW or Chirp
Swath Sector	143°
Pulse Width	30μs ~ 8ms (CW Signal)
Sounding Range	0.2~150m
Max. Working Depth	50m
Near Field Focus	Yes
Water Column Image	Yes
Realtime Roll Stabilization	Yes
Positioning Accuracy	±8mm+1ppm (RTK)
Heading accuracy	0.06° (4m baseline)
Attitude accuracy	0.03° (Real-time) / 0.025° (Post-processing)
Heave accuracy	5cm or 5% Range / 2cm or 2% Range (Truehave)

2.2. Physical Specifications

Transducer Size	φ220mm×181mm (Round Version) 205×205×181mm (Square Version)
Transducer Weight	~5.9kg (Round Version) ~6.5kg (Square Version)
Sonar Interface Module Size	231mm×145mm×107mm
Sonar Interface Module Weight	~2.5Kg
Working Temperature	-2° ~ 40°C
Storage Temperature	-20°C ~ 55°C

2.3. Electrical Specifications

Power Supply	DC10V-32V AC110V-240V
Power Consumption	<80W (Standard) 60W (Low Consumption Mode)
Data Interface Port	Gigabit Ethernet
Synchronization Output	5VTTL
Auxiliary Device Port	RS232
Deck Cable Length	1.5m or Customized

2.4. Compatible Software

- ◆ HydroQuest: Display and Control Software;
- ◆ HydroNavi: Navigation and Data Collection Software;
- ◆ Compatible with Hypack data collection software and Hypack & Caris post processing software.

2.5. Auxiliary Measuring Devices

- ◆ Sound Velocity Sensor: Standard coming with SVS1500
- ◆ Sound Velocity Profiler: Optional SVP1500
- ◆ INS: Standard internal and optional external
- ◆ GNSS: Standard internal and optional external

3. Safety



In order to ensure the personal and equipment safety during MS400U 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) Check whether each part of the system is damaged before installation;
- (4) Main unit or transducer and other accessories shall not be dropped down;
- (5) It is forbidden to plug or unplug any connecting cable during equipment working operation;
- (6) All plug-in or unplug cables of sonar interface module shall not be exposed to rain or water;
- (7) The sonar interface module shall not be exposed to rain or water to prevent any damage to internal electrical components;
- (8) When underwater transducer is not put into water, the whole sounding system shall not be powered on for testing or any other operation;
- (9) It is forbidden to place the underwater transducer directly downward to the ground without protection, especially it is forbidden to scratch the surface of transducer part with hard or sharp objects;
- (10) All cables of the system shall not be folded, pressed, squeezed, pulled, cut or other operations that may cause physical injury;
- (11) Not exceed the operating and storage temperature limits;

3.2. Maintenance

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

- (1) Cleaning: clean with mild and clean fresh water, and soft brush the outside if needed.
- (2) Wash the underwater 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 the transducer under the sun to prevent any damage to the transducer;

4. Transducer Operation

The appearance of MS400U transducer round version and square version is shown in Figure 4.1 & 4.2.



Figure 4.1 MS400U Transducer Round Version



Figure 4.1 MS400U Transducer Square Version

The direction indicated by the arrow is the forward direction of sounding measurement. When installing the transducer, pay attention to its direction. The watertight cable is drawn from the center hole and passes through the connecting flange. Design the adapter flange and installation according to the actual situation of the surveying ship and the mechanical drawing of the acoustic transducer (See Appendix 1 & 2). Connect with the bracket to fix the acoustic transducer on the measuring boat or mounting pole.

5. Sonar Interface Module Operation

5.1. Sonar Interface Module Introduction

The Sonar Interface Module of MS400U is the data processing center of the multibeam echo sounding system, which mainly includes transducer interface, auxiliary device, display & control software, navigation and data acquisition software and main control computer.

The appearance of sonar interface module is shown in Figure 5.1. See Appendix 3 for its mechanical drawing.



Figure 5.1 Sonar Interface Module

The main functions of the sonar interface module include the following aspects:

First, the main control computer software sends commands to the auxiliary devices' information acquisition part and acoustic transducer through Ethernet interface;

Second, the sounding results and status of the acoustic transducer are transmitted to the data display and control computer through the Ethernet;

Third, auxiliary devices' information acquisition module establishes a local time system according to the time information provided by GNSS, and sends other auxiliary devices' information to the computer and acoustic transducer.

5.2. Sonar Interface Module Connecters and Indicators

5.2.1. Front Panel

The front panel of MS400U multibeam echo sounder consists of multiple indicator lights, as shown in the Figure 5.2 below.

The three indicators on the left represent PPS signal, synchronization signal and working status of the sound velocity sensor respectively. The three indicators on the right represent the GNSS differential signal, the attitude measurement equipment and the GNSS working status respectively.

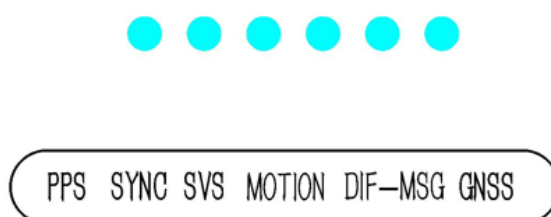


Figure 5.2 Sonar Interface Module Front Panel

Below is the indicator status introduction.

Indicator	Normal Status	Abnormal Status
PPS	Blinks every 1s	Off or abnormal blinking rate
SYNC	Blinks at the rate of PING rate	Off or abnormal blinking rate
SVS	Blinks at the rate of sound velocity output rate, default is 8Hz	Off
MOTION	Blinks at the rate of attitude output rate, default is 100Hz	Off
DIF-MSG	Blinks at the rate of GNSS differential signal, default is 1Hz	Off
GNSS	Blinks at the rate of GNSS output rate, default is 1Hz	Off

5.2.2. Back Panel

The back panel of the sonar interface module is mainly composed of power module, Ethernet connector, auxiliary device connectors, PPS connector, synchronization connector, GNSS antenna connectors, sound velocity sensor connector and sonar transducer watertight cable connector, as shown in Figure 5.3 and 5.4



Figure 5.3 Sonar Interface Module Back Panel

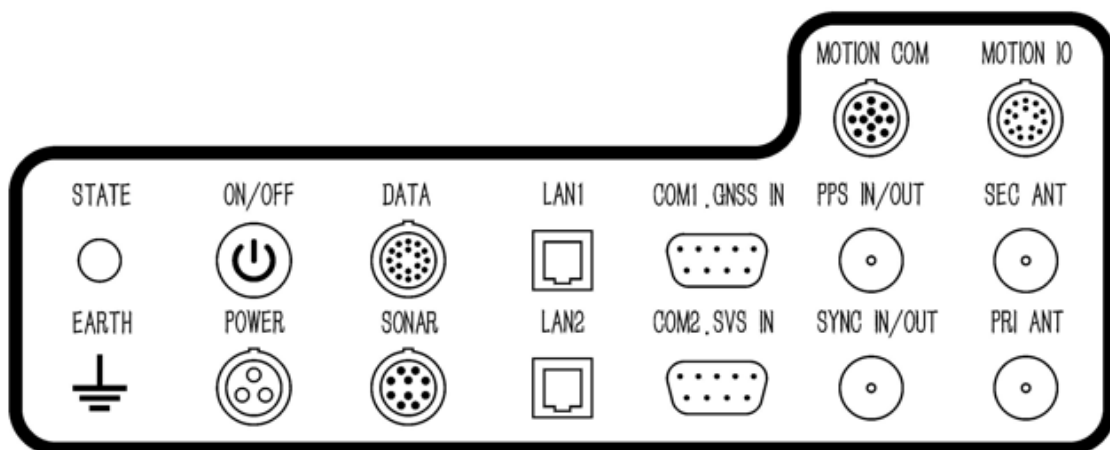


Figure 5.4 Sonar Interface Module Back Panel

The exact usage of each connector is listed as below.

Indication & Connectors	Function
Status	Indicator of the device status
Earth	Connect the device with earth
On/Off	Power switch of the device
Power	Connect with DC or AC power supply
Data	Data input / output connector
Sonar	Connect with transducer
LAN1	Ethernet port to connect with display and control or navigation PC
LAN2	Ethernet port to connect with display and control or navigation PC

GNSS	Connect with external GNSS Receiver
SVS	Connect with sound velocity sensor SVS1500 for power supply and input sound velocity data
PPS	PPS signal input or output
SYNC	Synchronization signal input or output
SEC ANT	Connect with the front GNSS antenna for heading
PRI ANT	Connect with the primary GNSS antenna for position
MOTION COM	Built in attitude data and PPS data output interface
MOTION IO	Positioning data output interface

Among them, the connectors are for extending data ports. Below is the introduction of the indicator status and data extending ports.

Indicator and Connectors	Status and Function Introduction
Status	Red: Sonar Interface Module is not connected or mis-connected.
	Yellow: The device is in preparation.
	Green: The device is normal and ready to start up operation.
COM1 (GNSS COM)	External GNSS input, 9600 ~ 115200bps auto adaptive
COM2 (SVS COM)	Sound Velocity Sensor data input, the Pin 7 supports 12V power output, 9600 ~ 115200bps auto adaptive
COM3 (Extended data cable connecting out)	External RS232 data input, 9600 ~ 115200bps auto adaptive
COM4 (Extended data cable connecting out)	External RS232 data input, 9600 ~ 115200bps auto adaptive
COM5 (Extended data cable connecting out)	External RS232 data input, 9600 ~ 115200bps auto adaptive
COM6 (Extended data cable connecting out)	External RS232 data input, 9600 ~ 115200bps auto adaptive

6. System Installation and Configuration

MS400U multibeam echo sounder consists of underwater acoustic transducer and sonar interface module. Below we will introduce the composition of the whole system and explain the system installation involving underwater parts and above-water units respectively.

The components of MS400U system are put into two layers in the carrying case. Figure 6.1 shows the top 1st layer and Figure 6.2 shows the second layer storing units and accessories.



Figure 6.1 MS400U Multibeam Echo Sounder Carrying Case 1st Layer



Figure 6.1 MS400U Multibeam Echo Sounder Carrying Case 2nd Layer

6.1. Underwater Transducer Installation

Underwater parts include acoustic transducer with build-in sound velocity sensor, transducer cable, SVS cable, which have been assembled in factory. Users do not need to fix by themselves. The underwater parts look like Figure 6.3.



Figure 6.3 Underwater Transducer Unit

6.1.1. Underwater Transducer Installation

The installation of sonar transducer is matched with external support of USV. The specific installation methods are as follows:

- (1) The sonar head is fixedly connected with customized adapter flange;
- (2) Pass connecting cable through adapter flange and make necessary anti cutting protection;
- (3) Fix adapter flange on USV to avoid shaking of transducer and sonar interface module during sounding measurement;

6.1.2. Underwater Installation Precautions

(1) When selecting installation position of sonar head, the safety of equipment shall be considered. Avoid possible collision of sonar transducer to obstacles in water, such as wharf wall and shoal;

(2) When choosing installing location of the acoustic transducer, consider the influence of surrounding objects on the measurement. Make sure away from propeller, water outlet and select right installation depth to avoid vessel

bottom shielding.

(3) During the installation process, correspondingly protect the surface of the transducer to prevent scratching by hard objects;

(4) It is not suitable for sounding operations in areas where the water is not deep enough to prevent damage to the transducer;

(5) It is not suitable for sounding operations when there are too many objects, such as twigs, fishing nets, in water to prevent damage to transducer;

(6) The underwater transducer installation shall ensure solid, avoid vibration, shaking, shock or deformation;

(7) For other precautions, please refer to the Part 3. Safety in this manual;

6.2. Sonar Interface Module Installation

Sonar Interface Module need connect with underwater transducer, display & control computer and other accessories if there are.

6.2.1. Sonar Interface Module Introduction

(1) Sonar Interface Module:

Its connectors are shown as Figure 6.4. For details, please refer to the Part 5. Sonar Interface Module Operation in this manual.



Figure 6.4 Sonar Interface Module Back Panel

(2) GNSS antenna:

Two GNSS antennas are used for attitude and heading measurement, they are as shown in Figure 6.5.



Figure 6.5 GNSS Positioning & Heading Antenna

GNSS antenna need install on magnetic mounting pole as shown in Figure 6.6.



Figure 6.6 GNSS Antenna and Magnetic Mounting Pole

(3) Display and Control Computer (Not include in MS400U):

It is used to collect the data of sounding result, control echo sounder working modes as shown in Figure 6.7.



Figure 6.7 Display & Control Computer

(4) GNSS Antenna cable:

It is used to connect GNSS antenna and Sonar Interface Module as shown in Figure 6.8.



Figure 6.8 GNSS Antenna Cable

(5) Power Cable:

It is used to connect sonar interface module with power supply, including DC and AC power cables, as shown in the Figure 6.9 is 220V AC power cable and Figure 6.10 is 24V DC power cable.



Figure 6.9 220V AC Power Cable

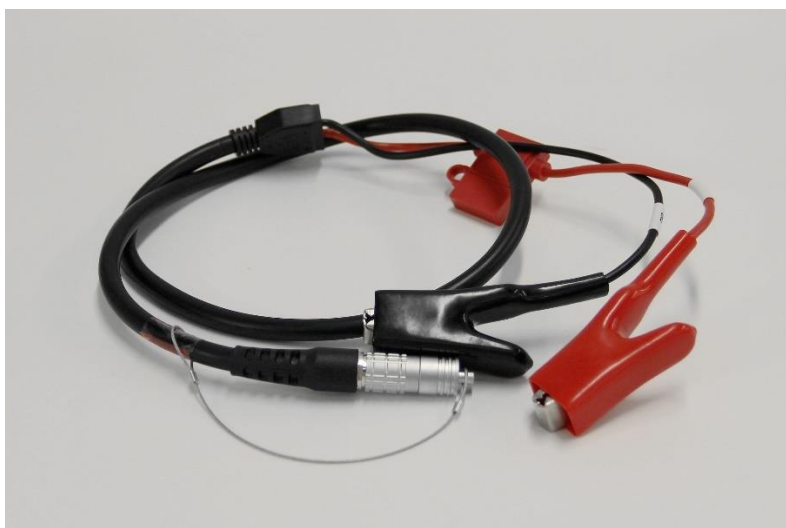


Figure 6.10 24V DC Power Cable

- (6) Type 7 Dual Shielding Ethernet Cable:
Used to connect Sonar Interface Module with display & control PC,
which is same as show in Figure 6.11.



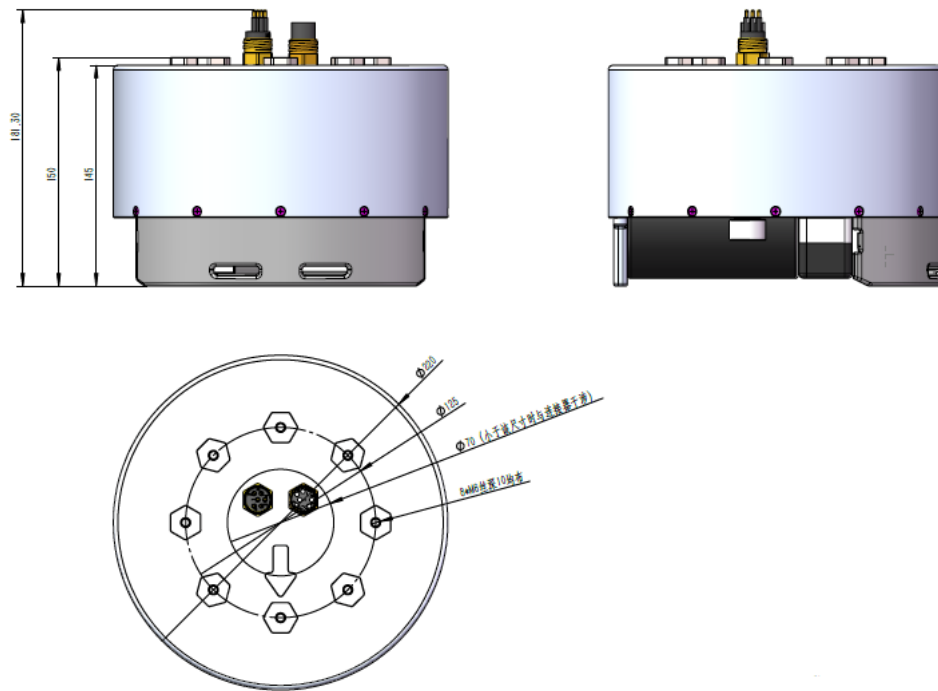
Figure 6.11 Type 7 Dual Shielding Ethernet Cable

6.2.1. Sonar Interface Module Installation

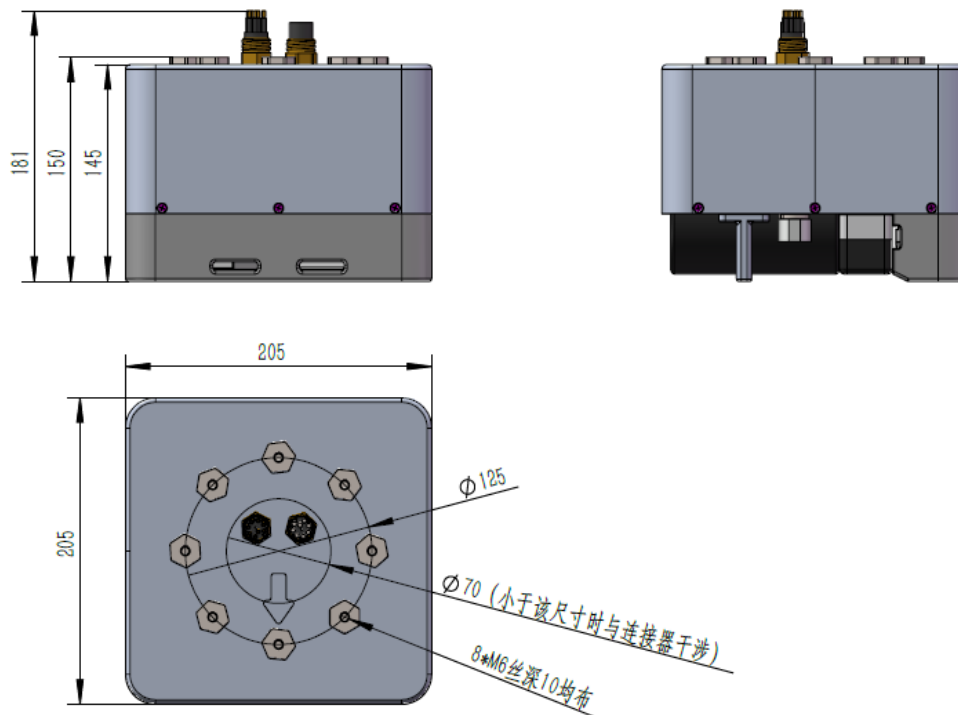
- (1) Fix sonar interface module in a suitable area in the USV to prevent slipping during operation;
- (2) Connect the watertight cables of underwater transducer and sound velocity sensor to the corresponding connectors of sonar interface module through the reserved waterproof hole of the USV;
- (3) Insert the power supply of USV to power connector of sonar interface module;
- (4) Connect sonar interface module with the control computer in the USV by Ethernet cable;
- (5) Use the remote control software to connect the control computer in the USV, and run the corresponding software for measurement.

Note: For the corresponding connector information, please refer to Part 5.2.2 Back Panel.

Appendix 1 Underwater Transducer Drawing

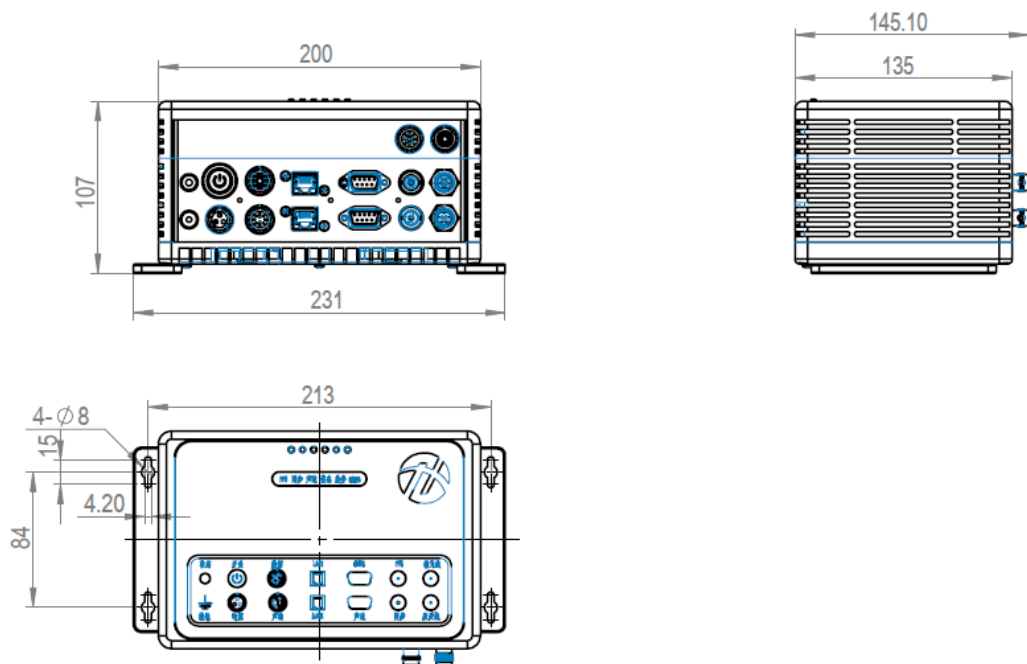


Round Version

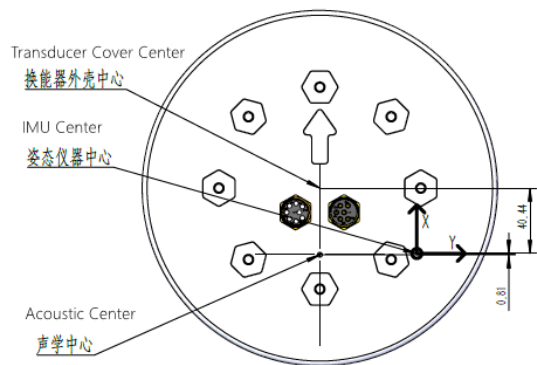
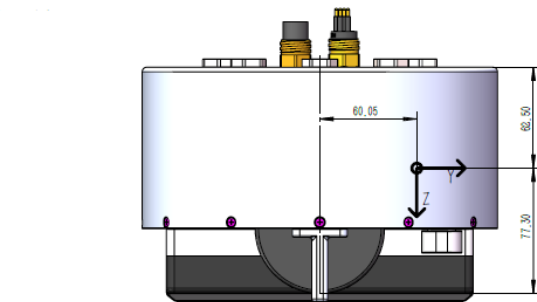


Square Version

Appendix 2 Sonar Interface Module Drawing



Appendix 3 Transducer Center vs IMU Center



Refer to IMU, Acoustic Center's coordinate is as below:

以姿态仪为参考，声学中心和姿态仪的三坐标为：

X: -0.81

Y: -60.05

Z: 77.30

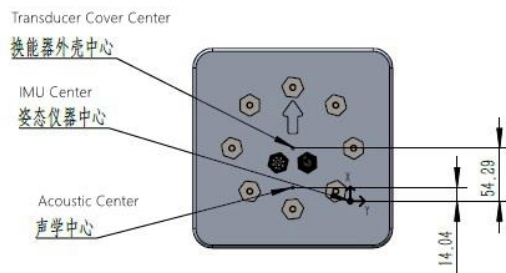
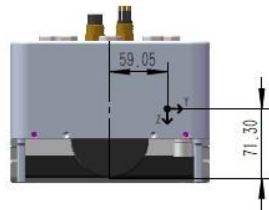
以姿态仪为参考，换能器外壳和姿态仪的三坐标为：

X: 40.44

Y: -60.05

Z: -62.50

Refer to IMU, Transducer Center's coordinate is as above.



Refer to IMU, Acoustic's coordinate is as below:

以姿态仪为参考，声学中心和姿态仪的三坐标为：

X: 14.04

Y: -59.05

Z: 71.30

以姿态仪为参考，换能器外壳和姿态仪的三坐标为：

X: 54.29

Y: -59.05

Z: 68.7

Refer to IMU, Transducer Center's coordinate is as above.