



SVP1500

Sound Velocity Profiler

User Manual



Beijing Hydro-Tech Marine Technology Co., Ltd.

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1. Introduction

1.1. Product Introduction

Sound velocity profiling is an important physical parameter for the underwater work of many sonar equipment. So sound velocity profiler is widely used in many applications including marine survey, underwater engineering, underwater terrain mapping, underwater navigation and positioning.

SVP1500 sound velocity profiler adopts "time leap" technology for sound velocity measurement. The sound velocity measuring accuracy reaches 0.05m/s. It has integrated a high-precision pressure sensor. The depth accuracy can reach 0.15m. All these specifications have reached the world leading level.

- The main Features of SVP1500 are listed as below.
- High Accuracy: With "Time-of-Flight" technology, SVP1500's accuracy was enhanced to 0.05m/s. Build-in high-precision pressure sensor, depth accuracy reaches 0.15m.
- Long Working Hours: Built-in high-performance lithium battery, continuous working life is longer than 8 hours. It is much easier to maintain.
- High Sampling Rate: The sound velocity measuring time interval is shorter, which improves the data collection efficiency and greatly reduces the measuring time of a single sound velocity profiling.
- Big Memory: 16GB massive storage space, which can store at least 4000 hours of data.
- Advanced Structure: It adopts advanced structural design and high-performance materials, which has the characteristics of small size, light weight, easy carrying and corrosion resistance.

1.2. How to Use This Manual

This manual introduces main technical specification, system functions, installation, operation and safety precautions. It is strongly recommended that users had better read this manual carefully before installing or operating the equipment to avoid unnecessary injury to equipment and personnel.

For the users who use SVP1500 for the first time, please read this manual Part 3. of “Safety” to prevent any damage to equipment or injury to personnel during wrong operation.



2. System Specifications

2.1. System Specifications

Sound Velocity Range	1400m/s ~ 1600m/s
Sound Velocity Resolution	0.01m/s
Sound Velocity Accuracy	+0.1m/s
Sound Frequency	2MHz
Sampling Rate	1-30Hz customizable
Max. Working Depth	300m
Depth Accuracy	15cm
Depth Resolution	1cm
Temperature Sensor Type	PT1000
Temperature Resolution	0.01°C
Temperature Accuracy	0.05°C
Working Hours	8h

2.2 . Physical Specification

Cover Material	316L Stainless Steel
Weight	3.2kg (In the air) / 1.8kg (In water)
Size	Φ75mm x 425mm
Data Cable	1.5m Standard
Working Temperature	-2° ~ 45°C
Storage Temperature	-20°C ~ 55°C

2.3. Electrical Specification

Data Interface	USB 2.0
Power Supply	Internal Lithium Battery
Recharging Voltage	12.6VDC

3. Safety

In order to ensure the personal and equipment safety during SVP1500 operation, please read the following details before operation.

3.1. Transportation & 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 and other accessories shall not be dropped down;
- (5) When recharge the SVP1500, please keep the environment temperature at 0 - 45°C;
- (6) SVP1500 has internal lithium battery @ 3.24Wh, please arrange delivery by land transportation.

3.2. Maintenance

When using or storing SVP1500, 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 SVP1500 with fresh water after operation each time;
- (3) It is forbidden to use any antifouling paint to coat the SVP1500;
- (4) Please recharge SVP1500 regularly; charging inspection regularly;
- (5) Check the silicone rubber ring (and its installation groove) of the equipment regularly to ensure that there is no dust or other objects inside.

3.3. Charging

SVP1500 is a self-containing device with internal lithium battery. Please charge it before operation. Below is the recharging steps.

- (1) Open the upper cover of the SVP1500;

- (2) Insert the device charging adapter into the power connector;
- (3) Insert the AC plug of the adapter into the AC 220V socket, then the indicator light of the adapter turns red;
- (4) When the adapter indicator turns from red to green, it is fully charged.

4. System & Interface

4.1. Sound Velocity Profiler System

It consists of the following parts.

- 1) Main unit;
- 2) Power adapter charger;
- 3) USB data cable;
- 4) Gadget Box including backup silicone rubber ring & Screws;
- 5) Software and user manual in U Disk.



Figure 4.1 Sound Velocity Profiler Carrying Case



Figure 4.2 Power Adapter Charger and USB Data Cable

4.2. Sound Velocity Profiler

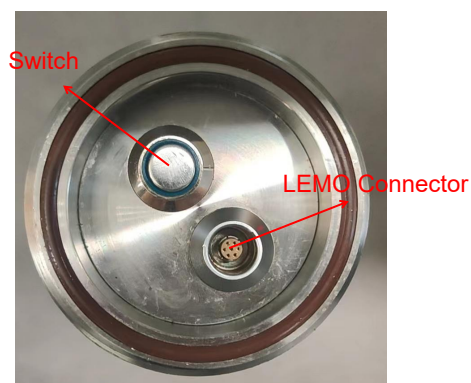


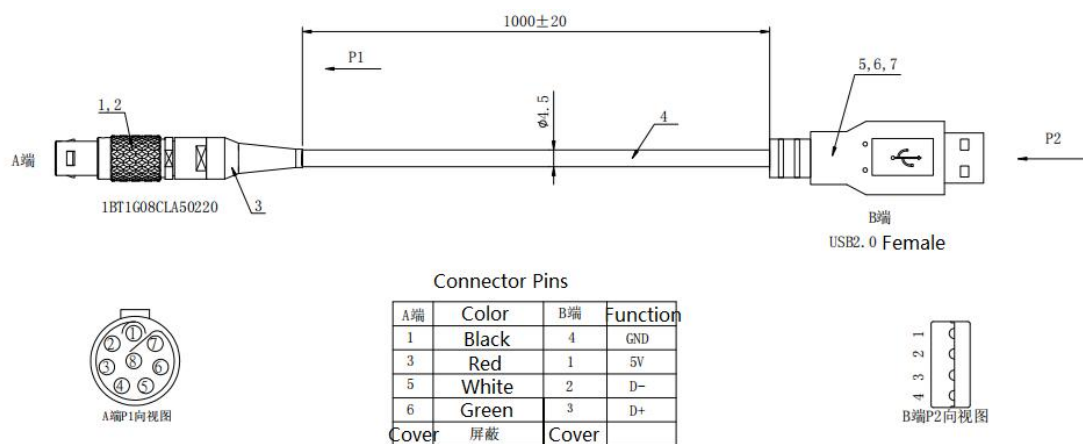
Figure 4.3 Top Panel

There is Switch and LEMO Connector in the top panel;

Switch: Indicate SVP1500 working status.

LEMO Connector: Communicate with PC and for recharging

Below is the introduction of the data cable pin definition.



5. HydroSVP Introduction

This part introduces the function, display window and operation method of HydroSVP software developed for SVP1500 sound velocity profiler.

5.1. HydroSVP Installation

5.1.1. System Requirements

Computer hardware configuration requirements:

- (1) CPU: Central processor above 1.8GHz.
- (2) Memory: At least 1GB of memory, more than 2GB is recommended.
- (3) Hard disk: Space is more than 200GB.
- (4) Video memory: More than 256MB. If you prefer faster speed, it is recommended to use more than 1GB video memory.
- (5) Display: Graphics card shall have minimum 1024 × 768 resolution display capability.

Computer operating system requirements:

This software can be applied to Windows XP, win7 and above operating systems.

5.1.2. Driver Installation

During the operation of SVP1500 and HydroSVP, we also need to install the corresponding driver, which shall be installed under the "Driver" folder.

Double click to run "ftdi_ft232_drive.exe", it will show "FTDI CDM Driver Installation process completed" in the installation interface as shown in Figure 5.1;

```
64-bit OS detected
"C:\Users\xue\AppData\Local\Temp\ckz_NAHZ\DPInstx64.exe"
Installing driver..

FTDI CDM Driver Installation process completed.

Press enter. █
```

Figure 5.1 Driver Installation

5.1.3. HydroSVP Installation

- (1) Run “HydroSvp.msi” and enter into the installation process as shown in Figure 5.2 as below.



Figure 5.2 HydroSVP Installation

- (2) Click “Next” and then select installation path as show as in Figure 5.3.

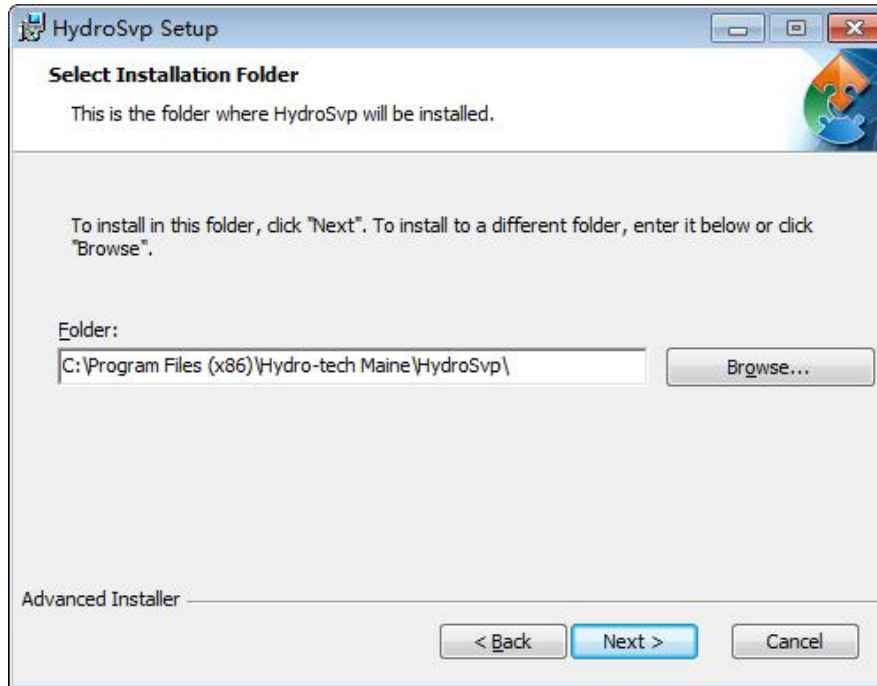


Figure 5.3 Installation Path

- (3) Click the button of “Install” and follow the other steps to finish the installation.

5.2. HydroSVP Function

HydroSVP software has two functions. One is depth, sound velocity and temperature data acquisition & storage. The other is post processing.

Device related functions include: Device Connected, Settings, Read Device Time, Memory Management, Files Operations;

File processing related functions include: Open Raw File, Open Fitting File, Open Average File and corresponding File Saving and Deletion, Data Analysis and Export functions.

5.2.1. Main Menu

After software installation, double click the desktop shortcut to enter the main control interface of the software as shown in Figure 5.5:

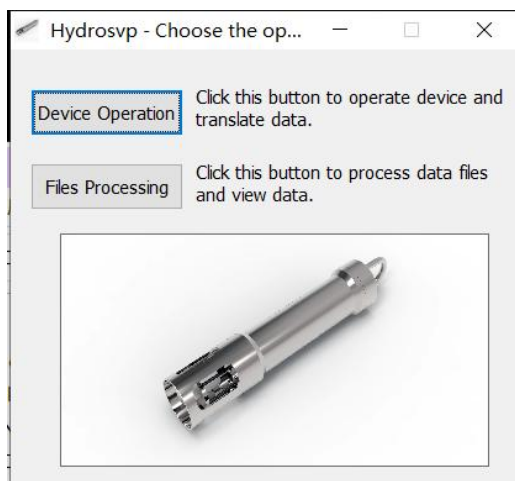


Figure 5.5 Main Control Interface

There are two buttons. One is Device Operation to open the menu to operate the device. The other is Files Processing using for file processing operation.

5.2.2. Device Operation

In the main control menu, click the button of “Device Operation” and enter into the menu of device operation named HydroSVPDevice as shown in Figure 5.6.

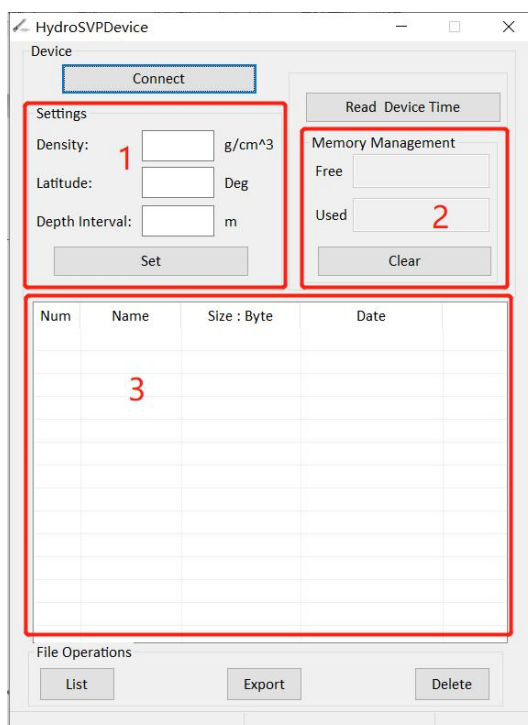


Figure 5.6 Device Operation Menu

The "Connect" button is used to connect SVP1500 to the computer.

Block 1: The boxes after Density, Latitude and Depth interval are used to set the measurement parameters before use the equipment.

The button of "Read device time" is used to read the internal time of the device after the device is successfully connected.

Block 2: In the boxes below "Memory Management", Free shows how much memory is available inside the current device, and Used shows how much memory is used by the current device. The "clear" button is used to empty all files in the device memory.

Block 3: File Operations is used to display the file information stored in the device memory.

Click the "List" button, the File List box will display all the files stored in the device memory when the device is successfully connected.

The "export" button is used to export files from the device memory to the local hard disk when the device is successfully connected.

The "delete" button is used to delete files from the device memory when the device is successfully connected.

5.2.2.1. Device Connection

After the data cable of SVP1500 is connected to the PC, click the "Connect" button to connect SVP1500 with software as shown in Figure 5.7.

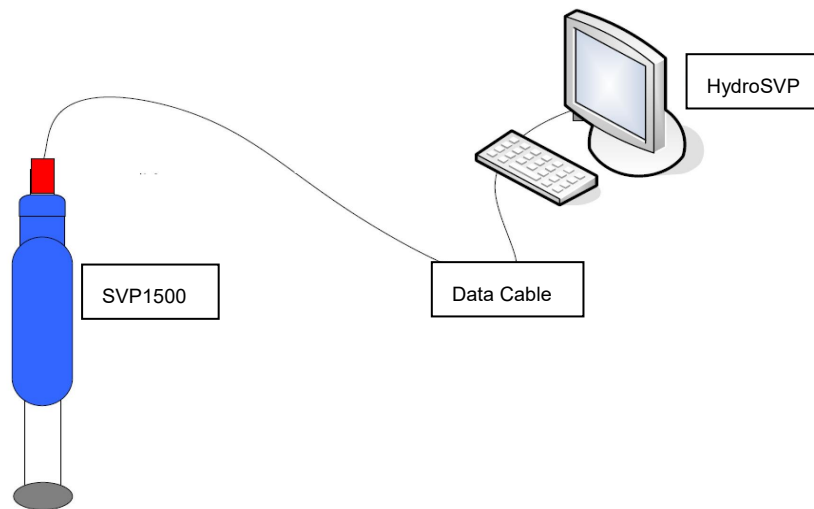


Figure 5.7 SVP1500 Connect with PC

Memory Management block will show Free Memory and Used Memory.

After the device is successfully connected, the Device ID and Firmware Version will be displayed in the title bar, the device Voltage will be displayed on the left side of the status bar, and the Device Connected or Device Connect Failed will be displayed on the right side!

Tip: If "Device Connection Failed!" pops up, please wait for 5 seconds since the device needs to initial internally. Then double confirm that the device has been connected to computer, then click "Connect" button again. The functions of Read Device Time, Settings, Clear, File Operations, Export and Delete operations are available after the device is successfully connected by default.

5.2.2.2. Parameter Setting

Enter the parameter into the boxes of "Density", "Latitude" and "Depth Interval", and click "Set" to write into SVP1500.

Then a box will pop up to remind that this operation will synchronize the time between SVP1500 and computer. User can choose whether to synchronize according to the actual operation situation.

Tip: The parameter setting may affect the measurement accuracy, please fill in carefully.

5.2.2.3. Read Device Time

Click the button of "Read Device Time" to read the current time inside SVP1500. It will be displayed in the popping up box and on the right side of Status Bar.

5.2.2.4. Clear Memory

When the internal files of SVP1500 have been backed up and there are too many files, which is not convenient to find the files to be exported, you can empty the memory of SVP1500. Just click the button of "Clear", then the internal memory will be formatted.

Warning: After Clear the memory, all files will be deleted and cannot be recovered. Please make sure that all useful files have been backed up already.

5.2.2.5. File List

Click the button of "List", all files inside SVP1500 will be displayed in the File List block. It will display the information of Number, Name, Size and Date etc.

5.2.2.6. Export Files

Select the files that need to be exported, and the file will be highlighted after being selected. Click the "Export" button to export the selected file to the data folder under the installation directory of the local computer.

Because the files may be very big, the interface button is disabled during the exporting process to ensure the smooth exporting until successful

completion. At the same time, the files exporting progress will be displayed on the right side of the Status Bar. After the files exporting is completed, there will pop up message to remind the Files Export has finished.

5.2.2.7. Files Deletion

Click the "Delete" button to delete the selected files from SVP1500 and update the files displayed in the File List.

Tip: Deleting a file will delete it from SVP1500 and cannot be recovered after deletion. Please confirm that it is no use or has been backed up.

Notice: "Export" and "Delete" support multiple choices. Users can hold the "CTRL" key and click the selected file with the mouse left button. Or hold the "SHIFT" key, and select the files in the continuous interval with the left mouse button.

5.2.3. File Operation

Click the "Files Processing" button in the Main Control Interface to pop up the file operation interface as shown in Figure 5.8:

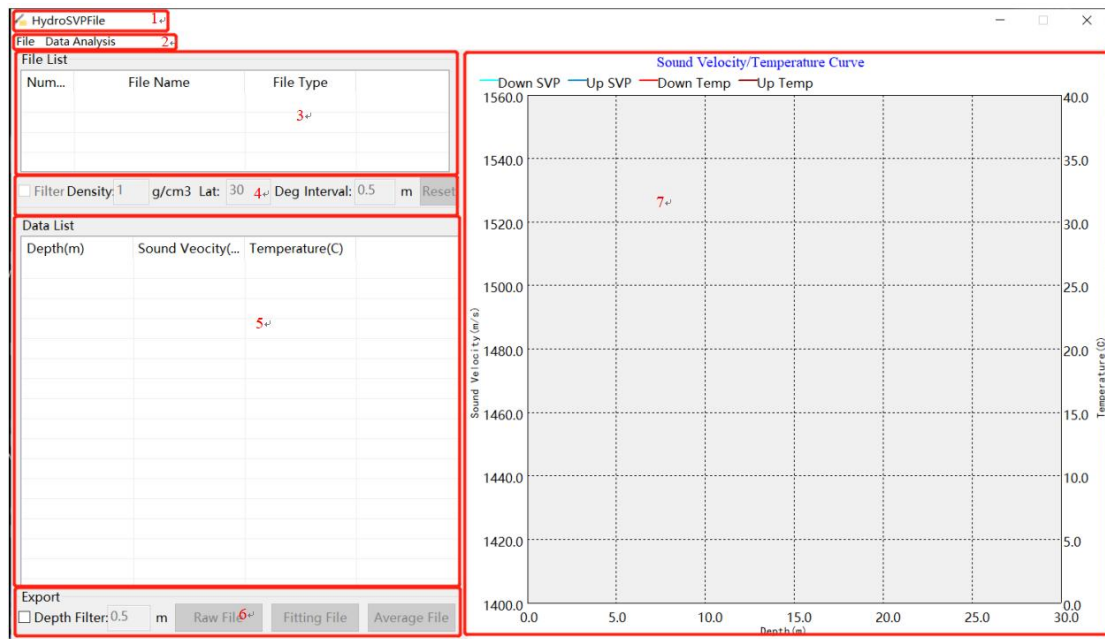


Figure 5.8 File Operation

Block 1: This is the Title Bar on the top. It is used to display the software name or the Device ID and Firmware Version of the opened Raw File.

Block 2: Below the Title Bar, there is the Menu Bar, which contains the menu of "File" and "Data Analysis". The "File" menu bar is mainly used for the operations of Open File, Save File and Delete File. The menu items are shown in Figure 5.9:

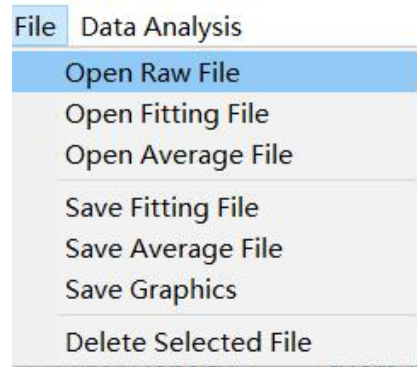


Figure 5.9 File Menu Column

"Data Analysis" menu is used to control the display of graphics in the drawing area, including menu items as shown in Figure 5.10.

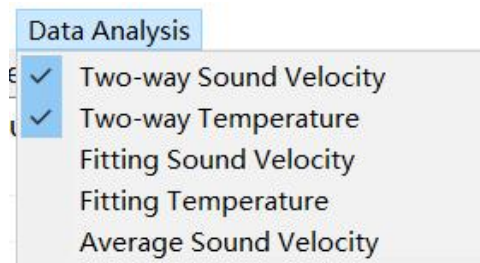


Figure 5.10 Data Analysis

Block 3: It is the area of File List, which is used to display the files loaded into the software.

Block 4: Below the File List is the file information, which is used to display the information contained in the original data file.

Block 5: Below the file information is the Data List. Double click the file in the File List to display the file data.

Block 6: Below the Data List is the Export option, including Depth Filter,

Raw File, Fitting File and Average File.

Block 7: The right side of the interface is the drawing area, which is used to display file data graphics.

5.2.3.1. Open Raw File

Click the "Open Raw File" menu item under the "File" menu bar, then pop up the open file dialog box. Select the original data file with the suffix as BIN or bin, then click the "Open" button. The file will be loaded into the File List, which displays the Number, File name, File Type and other information of the file.

5.2.3.2. Open Fitting File

Click the "Open Fitting File" menu item under the "File" menu bar to pop up the open file dialog box. Select the fitting data file with the suffix prf as shown in Figure 5.11. Click the "Open" button, and the file will be loaded into the File List.



Figure 5.11 Fitting File

5.2.3.3. Open Average File

Click the "Open Average File" menu item under the "File" menu bar to pop up the open file dialog box. Select the average sound velocity data file with the suffix asvf as shown in Figure 5.12. Click the "open" button, and the file will be loaded into the file list.



Figure 5.12 Average File

5.2.3.4. Save Fitting File

Select the original data file name and double-click it to display the file data in the Data List, then the fitting data file will be generated, and the fitting data can be saved at the same time.

Select the Fitting File name and double-click to display the file data in the Data List. You can double-click some selected data item in the Data List to modify it directly. After modification, you can click the "Save Fitting File" menu item under the "File" menu bar to save the fitting data in the data folder under the current directory.

5.2.3.5. Save Average File

Select the original data file and double-click to display the file data in the Data List. Click the "Average Sound Velocity" menu item under the "Data Analysis" menu bar to pop up the average sound velocity dialog box. Set the Initial Depth, click "OK" to close the dialog box.

Then it will pop up the Maximum Depth and Average Sound Velocity information boxes, and generate the average sound velocity data at the same time. At this time, click the "Save Average File" menu item under the "File" menu bar to save the average sound velocity data file in the data folder under the current directory.

5.2.3.6. Save Graphics

The data is displayed not only in the Data List, but also the drawing, which is controlled by the menu items under the "Data Analysis" menu bar. Users can save the corresponding graphic files according to specific needs. Click the "Save Graphics" menu item under the "File" menu bar to save the graphics drawing on the right side of the interface. The file suffix is bmp format.

5.2.3.7. Delete Selected File

Select the file in the File List and then click the "Delete Selected File" menu item under the "File" menu bar to delete the selected file from the File List.

5.2.3.8. Reset

Double click the original data file in the File List, and the original data file information will be displayed below. User can "Enable" to modify the Filter Density, Lat and Deg Interval. After modification, click the "Reset" button, and the Data List will update the data displayed according to the user's modification. Notice: The "Reset" button is available only if the original data file type is selected. If the file type is Fitted File or Average File, the "Enable" check box and the "Reset" button are grayed out because these two files do not have file information parameters.

5.2.3.9. Depth Filter

Depth Filter can filter the data information displayed in the Data List again. You can control the data export by checking or unchecking.

5.2.3.10. Export Raw Data

Double click raw data in the File List to display the file data in the Data List.

You can set Depth Filter or not. Click raw file to export the data in the data list to the data folder under the installation directory. The file can be exported in three formats: csv, HYPACK vel and txt.

5.2.3.11. Export Fitting Data

Double click the selected Raw Data or Fitting Data, then the file data will be displayed in the File List. After modifying the data through the Depth Filter or directly in the Data List, click the "Fitting File" button to export the fitting data to the data folder under the installation directory.

5.2.3.12. Export Average File

If the file selected is Raw Data, Fitting Data or Average Velocity Data, then Average File can be exported. The average sound velocity data is exported to the data folder under the installation directory.

Remarks:

Raw data can be exported to Raw File, Fitting File and Average File;

Fitting data can be exported to Fitting File and Average File;

Average velocity can be exported to Average File.

Raw file can be exported to the formats of csv, vel and txt.

Average file can be exported to the formats of csv, vel and txt.

Fitting data can be exported to the formats of csv and txt.

5.2.3.13. Sound Velocity Curve

Double click the selected file. Control its sound velocity curve graphics through the menu items under the "Data Analysis" menu bar.

6. HydroSVP Operation

6.1. Preparation before Launching into Water

Before measurement, check whether SVP status, whether data cable connection is correct and software is installed. The interface after running HydroSVP is shown in Figure 6.1.

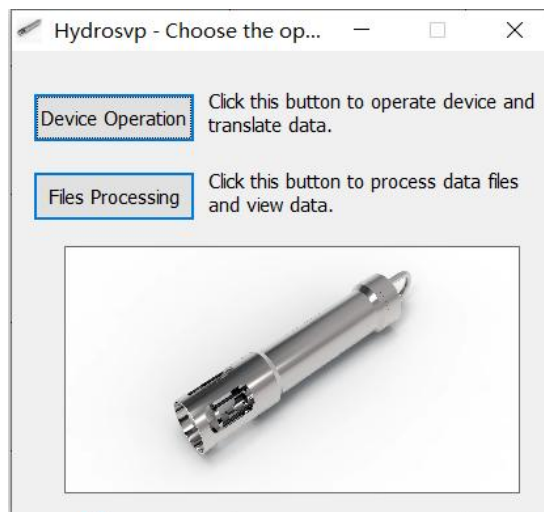


Figure 6.1 HydroSVP Interface

6.1.1. Run the Software of HydroSvpDevice

Click the button of “Device Operation”, enter into the device operation interface as shown in Figure 6.2.

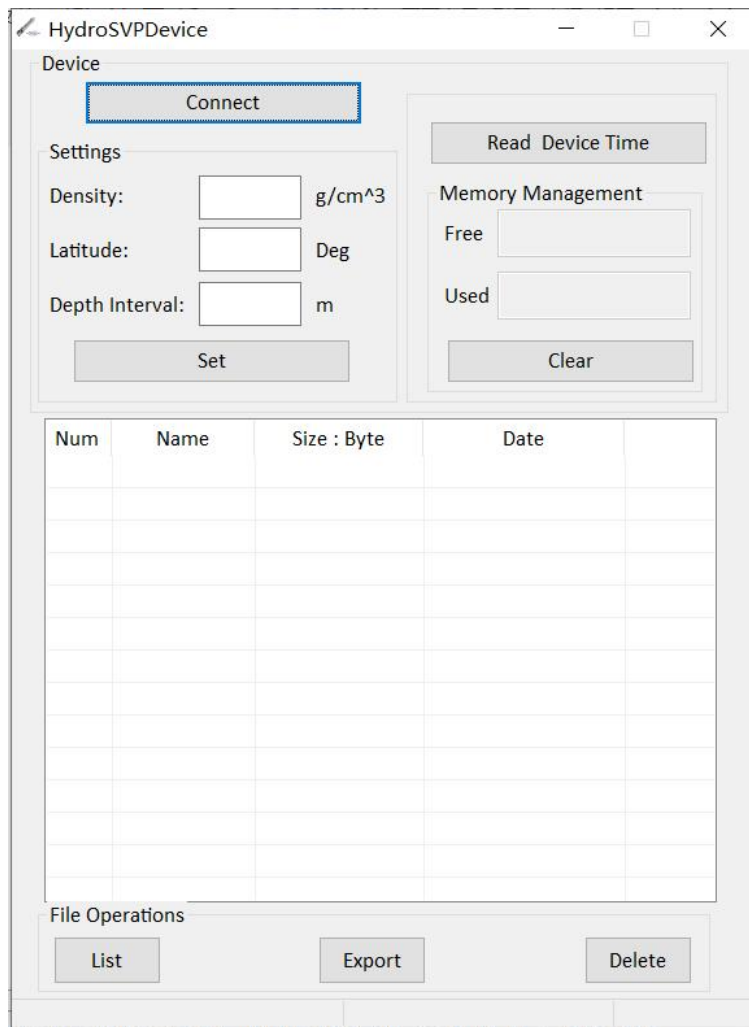


Figure 6.2 HydroSvpDevice Interface

6.1.2. Device Connection

Insert the USB end of the data cable into the computer, and connect SVP1500 at the other end. After the device is connected, click the "Connect" button, then the interface will be shown as Figure 6.3:

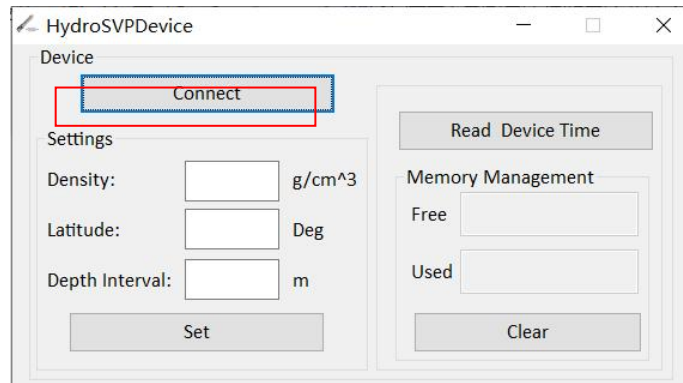


Figure 6.3 Device Connection

Pop up successful message box of "Device Connected!" as shown in Figure 6.4. Click the "OK" button.



Figure 6.4 Successful Device Connection

After connection, the information of Device ID, Firmware Version, Memory Management, Device Connected will be listed as Figure 6.5.

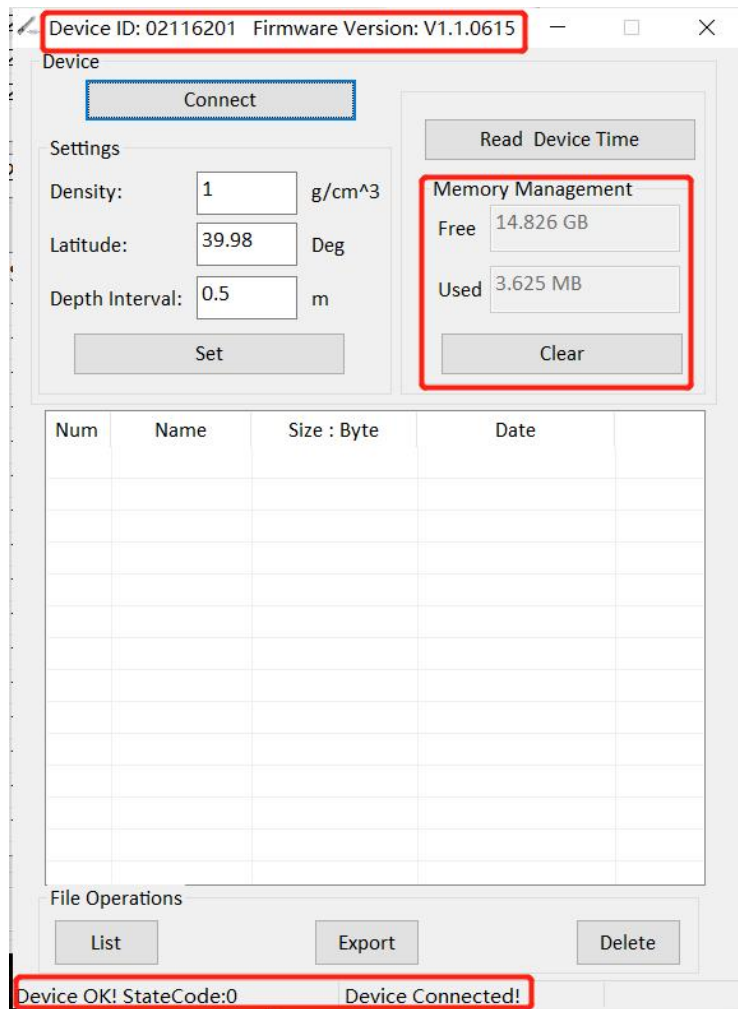


Figure 6.5 Device Information

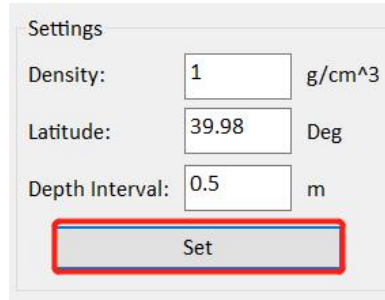
The meaning of the StateCode is listed as below:

- 1: Low Voltage;
- 8: File Reading Error;
- 10: Memory Not Enough.

6.1.3. Parameter Setting

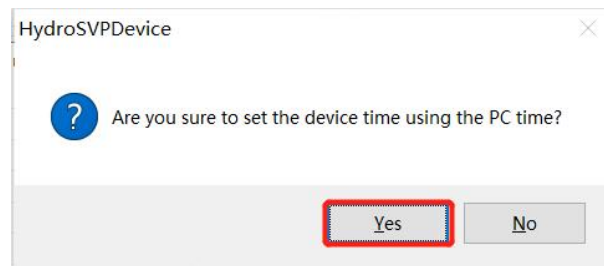
After the device is successfully connected, enter Density, Latitude and Depth Interval in the related box, then click "set" button as shown in Figure 6.6.

After clicking, there will pop up a box asking "Are you sure to set the device time using the PC time". If click "Yes", the setting will be carried out. If click "No", the setting will not be carried out as shown in Figure 6.7.



The image shows a 'Settings' dialog box with three input fields and a 'Set' button. The 'Density' field contains '1' with units 'g/cm^3'. The 'Latitude' field contains '39.98' with units 'Deg'. The 'Depth Interval' field contains '0.5' with units 'm'. The 'Set' button is highlighted with a red rectangle.

Figure 6.6 Parameters Setting



The image shows a confirmation dialog box titled 'HydroSVPDevice'. It contains a question mark icon and the text 'Are you sure to set the device time using the PC time?'. At the bottom, there are two buttons: 'Yes' and 'No'. The 'Yes' button is highlighted with a red rectangle.

Figure 6.7 Confirm whether to use the PC time

6.2. Underwater Measurement

After the above steps, the preparation before SVP1500 underwater measurement has been completed. Disconnect connecting cable, press to power on SVP1500. When the device light changes from constant blue shining to flashing, it means SVP1500 are ready to be launched into water for measurement. Then make sure that the plug is covered and tightened, put SVP1500 into water.

Notice: Before covering the plug, make sure that the silicone rubber ring on the plug and the silicone rubber on the upper part are in good condition. And they are coated with silicone grease as shown in Figure 6.8; The equipment plug and upper part shall be maintained and cleaned regularly.

In the process of SVP1500 launching, first immerse it in the water for about

half a minute, then launch it slowly. The launching speed is preferably within 0.2m/s;

Once switching on SVP1500, it can collect multiple files of sound velocity data by putting into water again and again after being out of water for more than 10 seconds.



Figure 6.8 SVP1500 Upper Part and Silicone Rubber

6.3. Export Data

After measuring the device, open the upper cover. Pay attention to avoid water dropping into the indicator and connector. After connecting SVP1500 with the PC, click the "Connect" button. After connecting the device successfully, you can read Device Time, List, Export, Delete and Clear.

6.3.1. Read Device Time

Click the "Read Device Time" button to pop up the time information message box as shown in Figure 6.9. Click "OK" to close the message box.



Figure 6.9 Read Device Time

6.3.2. File List

Click the "List" button, all the files contained in the device will be displayed in the File List as shown in Figure 6.10.

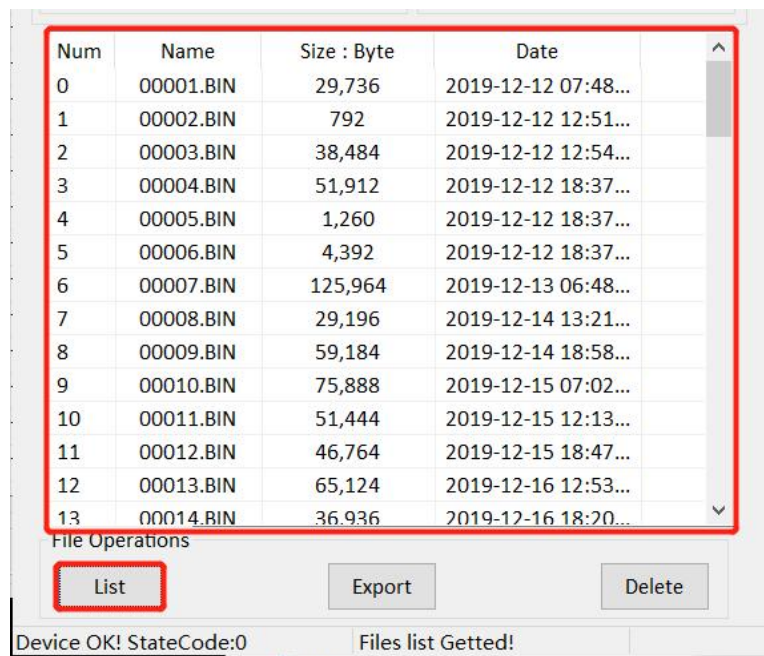


Figure 6.10 File List

6.3.3. Export File

Select the file you want to export from the File List and click "Export" as shown in Figure 6.11. The file will be exported to the data folder of the installation directory. At the same time, the Status Bar will display the current exporting information. After the export is completed, the message box of file export

successfully will pop up.

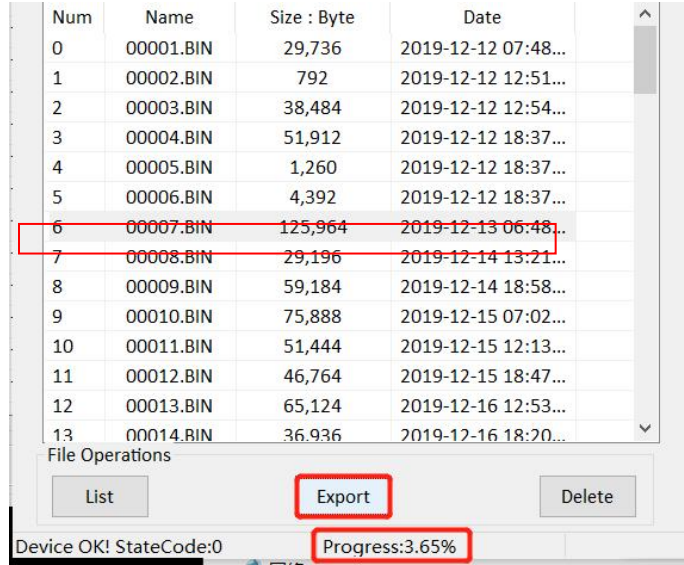


Figure 6.11 Export File Operation

6.3.4.Delete File

Select the file you want to delete in the File List, click "Delete" button as shown in Figure 6.12. There will pop up a confirming message of "Are you sure to delete the selected files?". Click "OK" as shown in Figure 6.13 to delete files from the File List and SVP1500 as shown in Figure 6.14. Click "Cancel" to cancel the deletion.

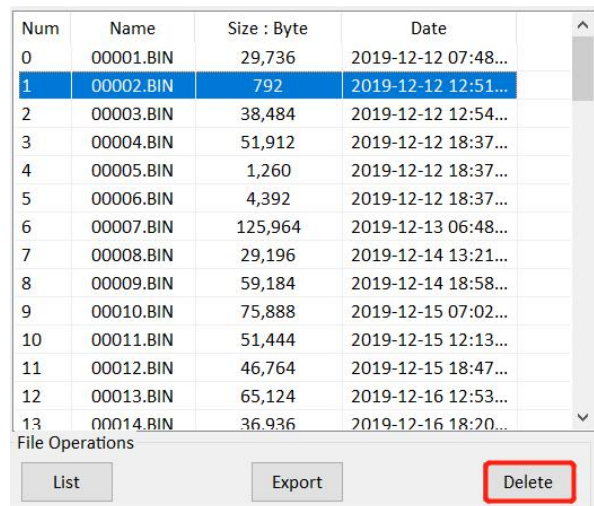


Figure 6.12 File Deletion Operation

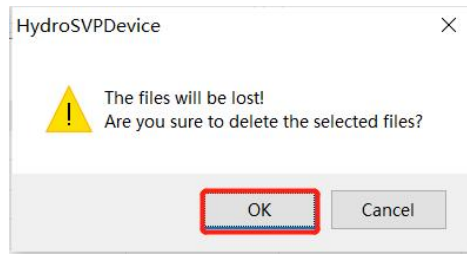


Figure 6.13 Deletion Confirming Message

Num	Name	Size : Byte	Date
0	00001.BIN	29,736	2019-12-12 07:48...
1	00003.BIN	38,484	2019-12-12 12:54...
2	00004.BIN	51,912	2019-12-12 18:37...
3	00005.BIN	1,260	2019-12-12 18:37...
4	00006.BIN	4,392	2019-12-12 18:37...
5	00007.BIN	125,964	2019-12-12 06:48...

Figure 6.14 The file had been deleted

6.3.5. Clear Memory

Click the "clear" button as shown in Figure 6.15. There will pop up a confirming message box of "All files will be lost" as shown in Figure 6.16. Click the "OK" button to delete all files in the device.

At the same time, the available memory of memory management is restored. The used memory is displayed as 0 as shown in Figure 6.17. The data in the File List has been cleared as shown in Figure 6.18. Click the "Cancel" button to cancel this operation.



Figure 6.15 Clear Operation

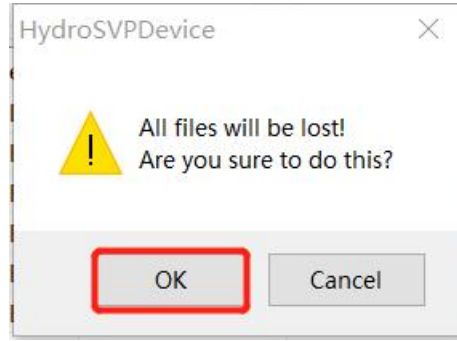


Figure 6.16 Clear Confirming Message

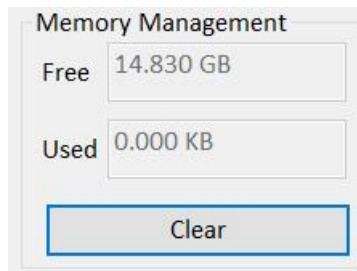


Figure 6.17 Memory Management

Num	Name	Size : Byte	Date	

Figure 6.18 Files List has been Cleared

6.4. File Processing

After the above steps, the measurement data file has been exported to computer. After the data file is exported locally, the HydroSVPfile module can be

used for data processing. The following are the general steps of data processing.

Click "Files Processing" on the HydroSVP interface to enter the HydroSVPfile software interface.

6.4.1. Open Raw File

Click "Open Raw File" menu item under the "File" menu bar as shown in Figure 6.19. Then open file dialog box will pop up, select the original data file to be opened and click Open. Add the file to the File List as shown in Figure 6.20.

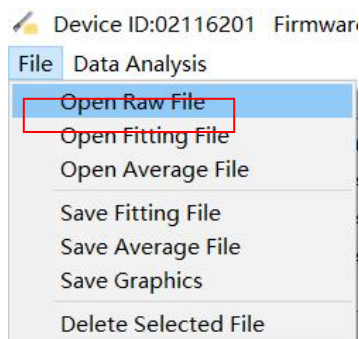


Figure 6.19 Open Raw File

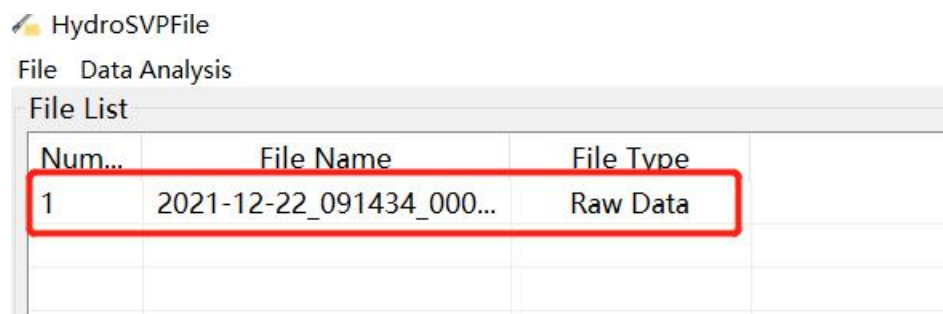


Figure 6.20 File List

Double click the original data file, the file information will be displayed in the box below the File List as shown in Figure 6.21.

The file data will be displayed in the Data List and the file data graphics will be displayed in the drawing area of the dialog box.

By default, Two-way Sound Velocity and Two-way Temperature graphics will be displayed as shown in Figure 6.22.

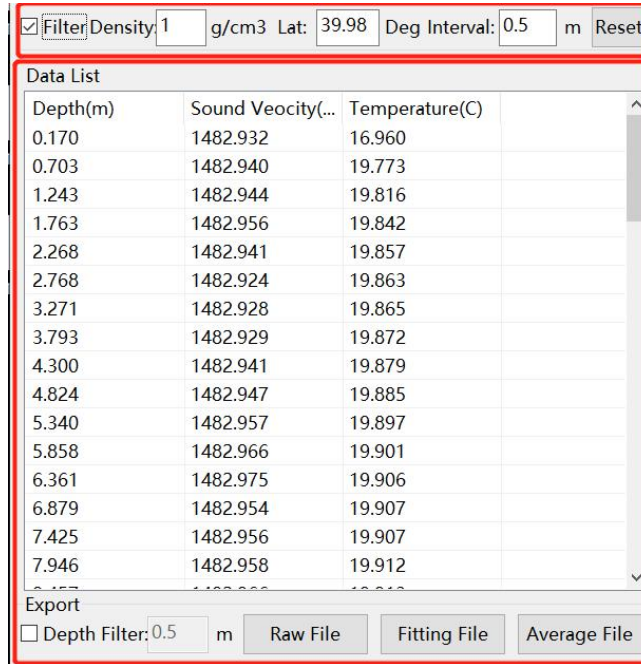


Figure 6.21 File Information and Data

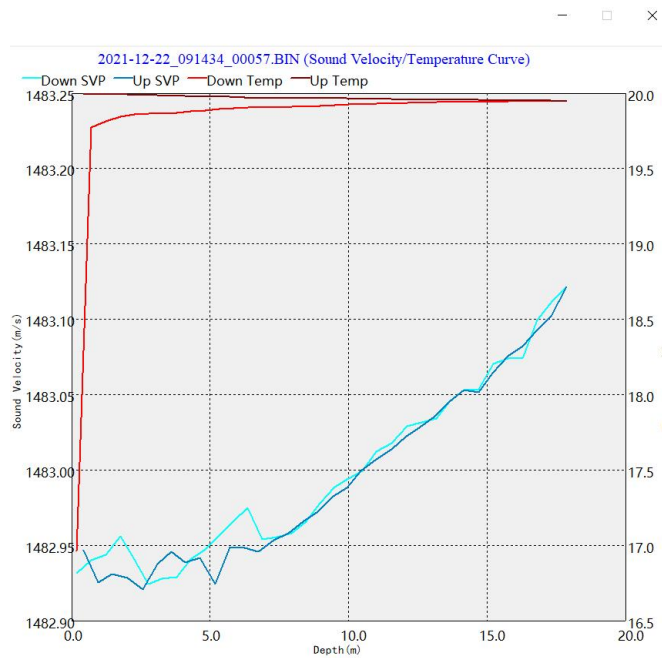


Figure 6.22 File Graphics

6.4.2. Parameter Reset

If you need modify the information displayed in the file, enter the modified value in the file information editing box and click the "Reset" button to modify the setting. The modified data will be updated in the Data List as shown in Figure 6.23.

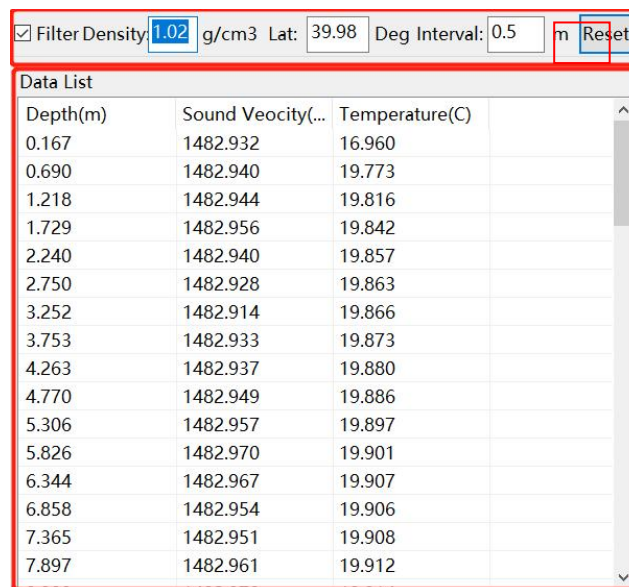


Figure 6.23 Parameter Reset and Data Display

6.4.3. Data Modification

In addition to modifying the file information, you can also modify the file data directly. Double click the data item in the Data List to edit the data when it is editable. After editing, click other position. Then the editing box lose focus, that mean the data modification is completed.

6.4.4. Save Fitting File

If you approve the data information displayed in the Data List, you can click the "Fitting File" menu item to save the fitting data and the file suffix is prf.

6.4.5. Export Data

The data displayed in the Data List can be exported to a local file. You can use or not use by checking or unchecking the previous Depth Filter option. Depending on the File Type selected in the File List, the file data can be exported is related file.

6.4.6. Data Analysis

Control the graphics you want to display in the drawing area by controlling the menu items under the "Data Analysis" menu bar. If checked, corresponding graphics will be displayed. If unchecked, corresponding graphics will not be displayed. Different File Types can display different graphic information.

Raw Data can display Two-way Sound Velocity, Two-way Temperature, Fitting Sound Velocity, Fitting Temperature and Average Sound Velocity graphic.

Fitting Data can display Fitting Sound Velocity, Fitting Temperature, Average Sound Velocity graphic.

Average Velocity can display Average Sound Velocity graphic.

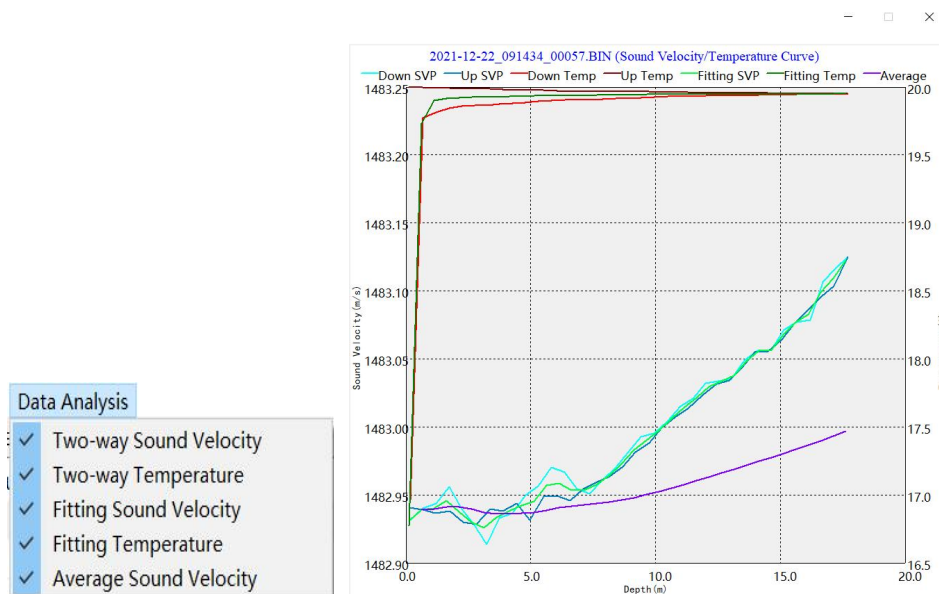


Figure 6.24 Data Analysis Graphic

6.4.7. Save Current Graphic File

You can control the graphic displayed in the drawing area through the menu item under the "Data Analysis" menu bar. Click the "Save Graphics" menu item under the "File" menu bar, there will pop up the save file dialog box. Enter the saving file name, and click the "Save" button to save the graphics in the drawing area in bitmap format with the suffix bmp format.

So far, a simple file processing flow is completed.