Contents

1. Introduction

The SDZ-A Series Digital Engineering Seismograph is a true 24-bit digital seismometer independently developed by Shanghai Weiqi Equipment Technology Co., Ltd. for operation on Chinese Windows 10 and Windows 7 systems. Incorporating advanced electronic technologies and design concepts from both domestic and international sources, it integrates the usage habits of numerous global users to create a multifunctional instrument featuring high precision, high speed, and high reliability. It offers an intuitive human-machine interface and expandability. The instrument can utilize hammer strikes, drop weights, electric sparks, detonator (explosive) blasts, and other methods as excitation sources, achieving exploration depths of up to thousands of meters. Field exploration methods include: reflection seismic, refraction seismic, surface wave (Rayleigh wave) seismic, multi-wave seismic imaging, ground motion (conventional microtremor) measurement, seismic safety assessment for buildings and sites, pile foundation testing, cross-hole tomography (CT) measurement, and borehole shear wave measurement. It serves as an ideal instrument for addressing engineering geological challenges in sectors such as geological exploration, water conservancy, power generation, road and bridge construction, urban development, and transportation. It is also employed in the exploration of resources including petroleum, coalfields, minerals, and groundwater.

2. Main Functions and Technical Specifications

Instrument Package: Flat panel or computer, main unit, power cable, detector, external trigger device, and other accessories

Flat Panel or Computer Requirements: 64-bit Windows 10 or Windows 7 operating system, CPU speed of 1GHz or higher, equipped with wireless network card, memory of 2GB or higher, hard disk space of 20GB or higher, screen size of 8 inches or larger

2.1 Primary Functions

✧ Traditional shallow seismic exploration, including reflection, refraction, and

surface wave methods;

✧ Passive-source surface wave exploration (advanced surface wave exploration);

✧ High-density seismic imaging exploration;

✧ Engineering quality inspection for pile foundations and civil structures;

✧ Routine microtremor measurements for sites;

✧ Blasting safety assessments for buildings and structures;

✧ Shear wave testing (single-hole, cross-hole, etc.);

✧ Cross-hole tomography for geological analysis.

2.2 Key Features of the Instrument

✧ Continuous, leak-free sampling monitoring.

✧ Real-time full-frequency noise monitoring ensures more accurate and reliable data acquisition.

✧ Utilizes the latest high-speed, high-precision true 24-bit A/D converter, achieving a maximum sampling rate of 10μs during simultaneous 48-channel sampling.

✧ Built-in high-capacity lithium battery enables over 15 hours of continuous operation on a full charge without external power.

✧ Compatible with our company's coverage switch for enhanced field exploration convenience, significantly boosting fieldwork efficiency.

✧ Built-in self-diagnostic system: Automatically checks noise, crosstalk, consistency, and generates self-test reports.

✧ Advanced filters with ultra-low distortion and out-of-band suppression, complemented by various digital filters in the software.

✧ New ergonomic design with handheld tablet operation and Wi-Fi communication up to 100 meters for convenience and efficiency.

✧ Built-in coverage measurement capability: SDZ-48A and SDZ-24A support 24-channel and 12-channel coverage measurements without additional configuration.

✧ Data storage files use standard Seg2 and SegY formats, compatible with

various domestic and international processing software. Data can also be saved in text format for user-independent processing.

2.3 Key Technical Specifications

- ✧ Operating Platform: Tablet or laptop running Windows 10 or Windows 7
- ✧ Frequency Response Range: 0.1Hz to 8kHz
- ✧ Sampling Delay: 0 to 9999ms
- ✧ Noise: <0.5μV at full frequency
- ✧ Crosstalk: >80dB
- ✧ Amplitude Consistency: >±0.1%; Phase Consistency: >±10μs
- ✧ Dynamic Range: >138dB
- ✧ Triggering Methods: Threshold trigger, internal trigger, external trigger (short circuit, open circuit, signal, etc.)
- ✧ Sampling rate: 10μs, 20μs, 50μs, 100μs, 200μs, 500μs, 1 ms, 2 ms, 5 ms, 10 ms, 20 ms, etc.
- ✧ Sample points: 512, 1024, 2048, 4096, 8192, 16384, etc., with maximum record length up to 32768;
- ✧ AD converter: Utilizes the latest ultra-high-speed Σ-Δ 24-bit A/D converter;
- ✧ False Frequency Filter: Automatically tracks sampling rate with various digital filters
- ✧ Amplification: Selectable 1×, 4×, 16×, 64×, 128× (1/8×, 1/4×, 1/2× available upon request)
- ✧ Data Format: SEG-2, SEG-Y, TXT
- ✧ Power Supply: SDZ-48B with built-in 12V/18AH lithium battery; SDZ-24B with 9AH, SDZ-12A/SDZ-6A with built-in 12V/6AH lithium battery; also supports external 12V battery power
- ✧ Operating Current: <1A for 48 channels, <0.6A for 24 channels, <0.5A for 12/6 channels
- ✧ Operating Environment: -10°C to +60°C; Humidity <90% RH
- ✧ Dimensions: SDZ-48B, SDZ-24B: 380×200×200mm; SDZ-12A, SDZ-6A:

360×300×160mm

- ✧ Weight: 48-channel model: 6kg

3 Instrument Structure

3.1 Main Unit

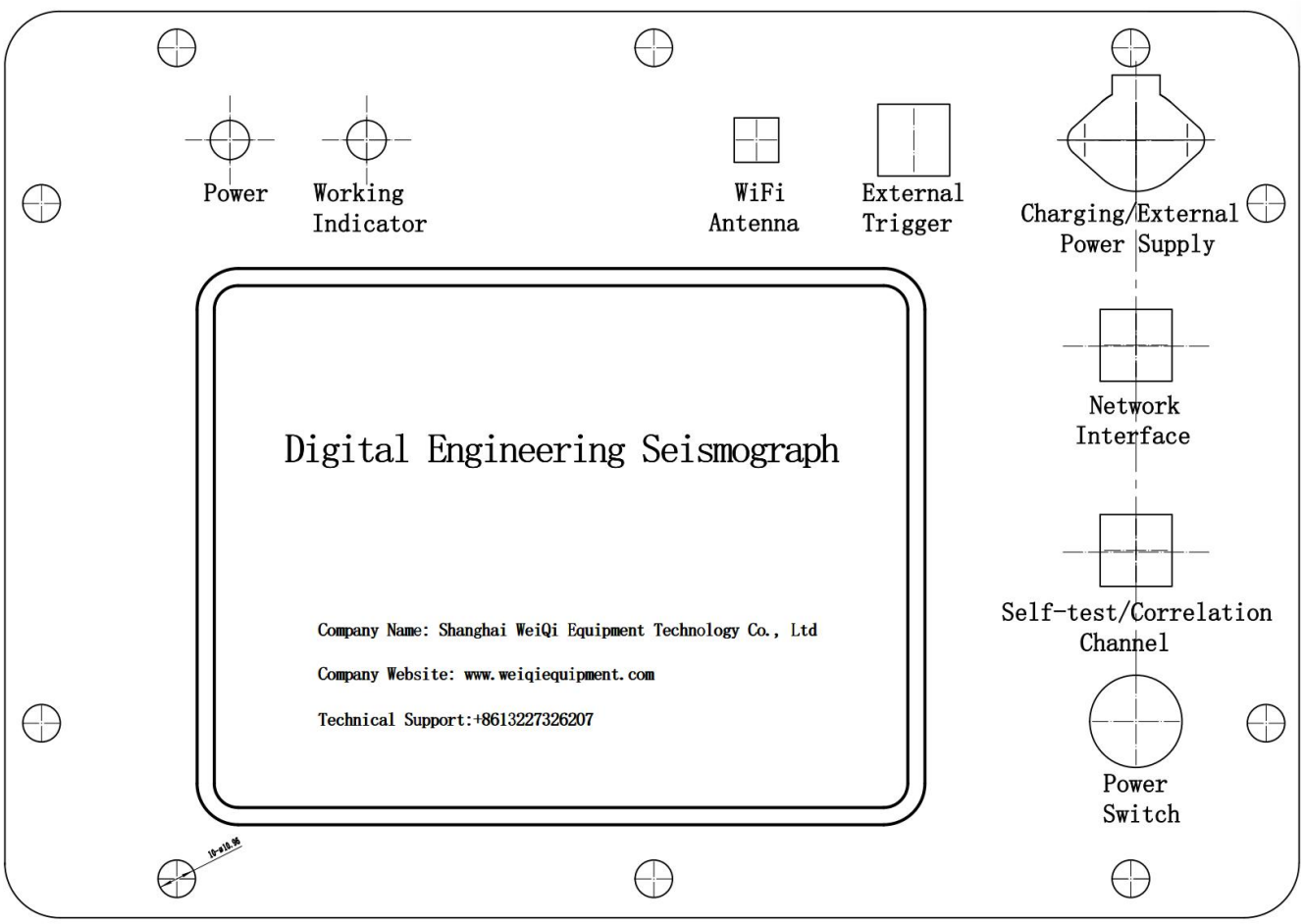
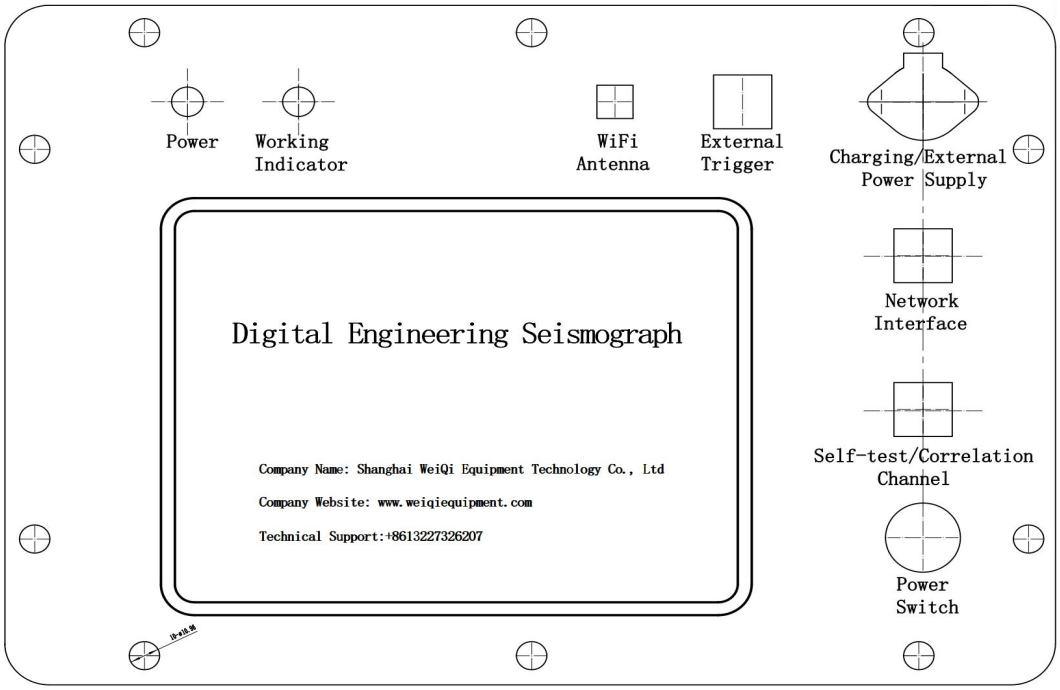


Figure 3-1 SDZ-12A/SDZ-6A Panel Diagram and Left-Side Interface Diagram of the Enclosure



1——Power indicator light: Solid red when voltage is normal; flashing red when undervoltage occurs.

2——Operational indicator light: Flashes blue during communication with host computer; extinguished when no communication.

3——WiFi antenna;

4——External trigger interface: Supports hammer switch, open circuit, short circuit, signal, threshold, and other external trigger inputs;

5——Charging/External power: Interface for charging the device using the included charger, or for supplying power via an external 12V power source;

6——Network Interface: When WiFi connection is interfered by other wireless signals and data transmission is unstable, connect directly to the computer's Ethernet port via a network cable. A dedicated wired network cable is included in the factory configuration.

7——Self-Test/Related Channel: Sine wave output port during instrument self-test;

8——Power Switch: Main power switch for the instrument.

3.2 Definition of signal input port

	SDZ-48A signal input port definition				SDZ-24A signal input port definition	
27-core base (pin)	01-12	13-24	25-36	37-48	01-12	13-24
1	CH12+	CH24+	CH25+	CH37+	CH12+	CH13+
2	CH12-	CH24-	CH25-	CH37-	CH12-	CH13-
3	CH11+	CH23+	CH26+	CH38+	CH11+	CH14+
4	CH11-	CH23-	CH26-	CH38-	CH11-	CH14-
5	CH10+	CH22+	CH27+	CH39+	CH10+	CH15+
6	CH10-	CH22-	CH27-	CH39-	CH10-	CH15-
7	CH9+	CH21+	CH28+	CH40+	CH9+	CH16+
8	CH9-	CH21-	CH28-	CH40-	CH9-	CH16-
9	CH8+	CH20+	CH29+	CH41+	CH8+	CH17+
10	CH8-	CH20-	CH29-	CH41-	CH8-	CH17-
11	CH7+	CH19+	CH30+	CH42+	CH7+	CH18+
12	CH7-	CH19-	CH30-	CH42-	CH7-	CH18-
13	CH6+	CH18+	CH31+	CH43+	CH6+	CH19+
14	CH6-	CH18-	CH31-	CH43-	CH6-	CH19-
15	CH5+	CH17+	CH32+	CH44+	CH5+	CH20+
16	CH5-	CH17-	CH32-	CH44-	CH5-	CH20-
17	CH4+	CH16+	CH33+	CH45+	CH4+	CH21+
18	CH4-	CH16-	CH33-	CH45-	CH4-	CH21-
19	CH3+	CH15+	CH34+	CH46+	CH3+	CH22+
20	CH3-	CH15-	CH34-	CH46-	CH3-	CH22-
21	CH2+	CH14+	CH35+	CH47+	CH2+	CH23+
22	CH2-	CH14-	CH35-	CH47-	CH2-	CH23-
23	CH1+	CH13+	CH36+	CH48+	CH1+	CH24+
24	CH1-	CH13-	CH36-	CH48-	CH1-	CH24-
25、26、27	hang in the air	hang in the air	hang in the air	hang in the air	hang in the air	hang in the air

	SDZ-12A signal input port definition	SDZ-6A signal input port definition
27-core base (pin)	01-12	01-06
1	CH12+	hang in the air
2	CH12-	hang in the air
3	CH11+	hang in the air
4	CH11-	hang in the air
5	CH10+	hang in the air
6	CH10-	hang in the air
7	CH9+	hang in the air
8	CH9-	hang in the air
9	CH8+	hang in the air
10	CH8-	hang in the air
11	CH7+	hang in the air

12	CH7-	hang in the air
13	CH6+	CH6+
14	CH6-	CH6-
15	CH5+	CH5+
16	CH5-	CH5-
17	CH4+	CH4+
18	CH4-	CH4-
19	CH3+	CH3+
20	CH3-	CH3-
21	CH2+	CH2+
22	CH2-	CH2-
23	CH1+	CH1+
24	CH1-	CH1-
25、26、27	hang in the air	hang in the air

4 Software Operation

4.1 Software Installation and Setup

1. Install the software by clicking “SDA-1 Self-Extracting File.exe” to extract it to your desired directory. (If no installation package is available, copy SDA-1.exe to your desired directory and create a shortcut on your computer desktop.)

2. Turn on the instrument power.

3. Click the network icon on your computer (or tablet). The interface shown in Figure 4.1a will appear. Select and click the seismic device you wish to connect to. Ensure the SSID matches the “Factory Serial Number” on the device nameplate, such as “SDZ-24A” shown in Figure 1. Click “Connect.” For the first connection, enter the password ‘12345678’ (as shown in Figure 4.1b), then click “Next.” Since no external network is connected, a connection waiting screen may appear—ignore this and directly open the acquisition software. The startup screen (Figure 4.1c) indicates successful computer-device connection, allowing you to proceed with data acquisition. If the message “Failed to connect to lower-level machine! Software will run in offline mode with 48 channels!” appears (as shown in Figure 4.1d), this indicates incorrect network parameter settings in the software. Proceed to Step 4 for configuration.

Figure4.1a

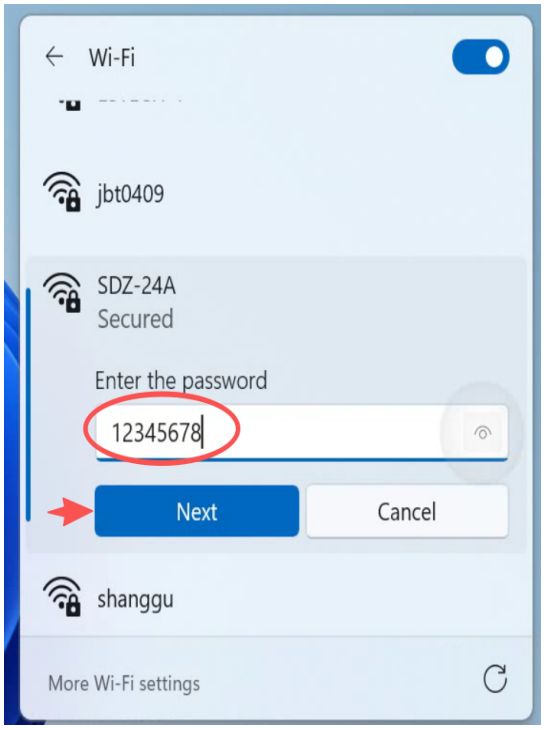


Figure 4.1b

Figure 4.1c Software startup interface

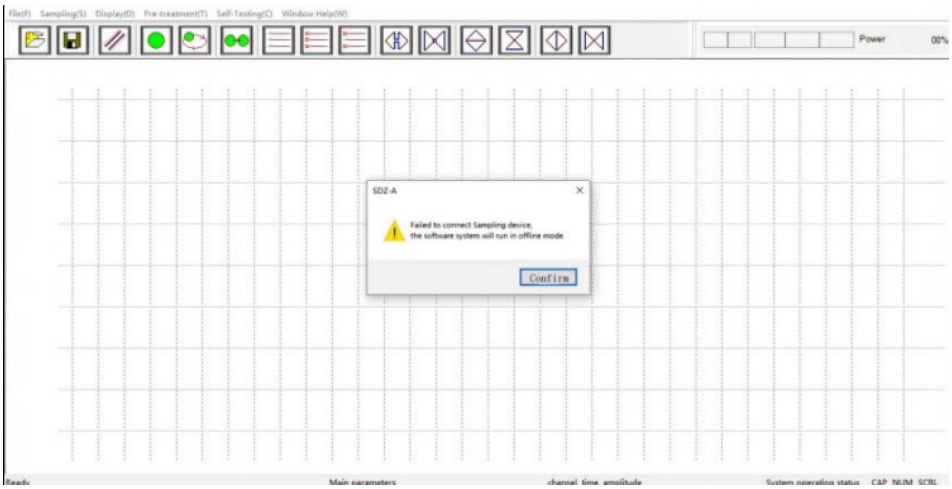


Figure 4.1d

4. Click "OK" on the interface of Figure 4.1d, and wait for several seconds until the software enters the main interface of acquisition, as shown in Figure 4.1e. Click "OK".

5.Then click "Sampling"> "Network parameter Settings" one by one, and Figure 4.1f will pop up. After clicking "OK" according to the content of Figure 4.1f, the software can be closed and reopened to collect data normally.

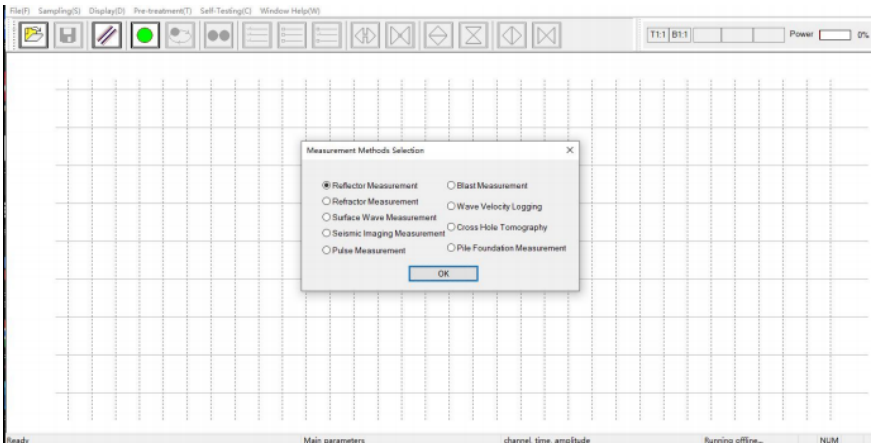


Figure 4.1e

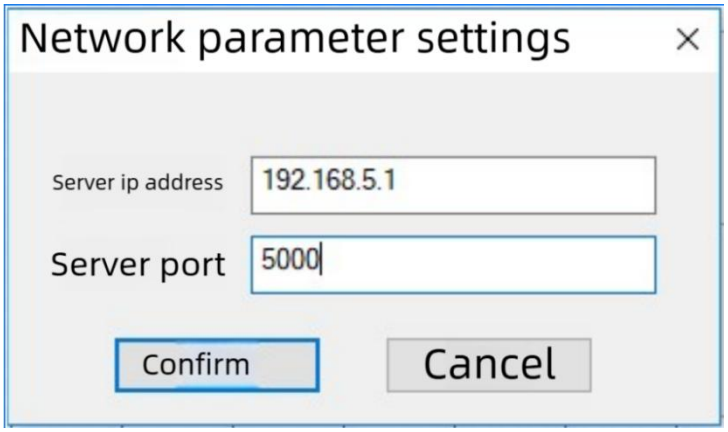


Figure 4.1f

6. Wired Network Usage Guide. If unstable performance occurs due to external interference with the WIFI signal, users can troubleshoot by connecting a wired cable (computer's RJ45 port to seismograph's 4-pin connector). After powering on the seismograph, wait until the indicator light starts blinking. Then launch the "SDA-1" software. Once properly connected, the indicator will stop flashing.

Note: If you use a wired network connection, disconnect the WIFI connection and do not select "automatic connection" for WIFI, so that the WIFI automatically

connects to the device when using the wired network, which may cause abnormal operation of the device.

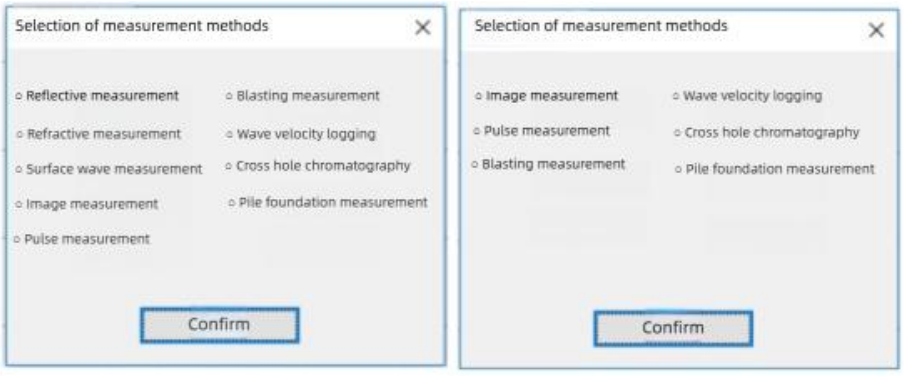
4.2 Work software

Turn on the host and tablet, run the working software, and display the startup interface as shown in Figure 4.1c. The interface will be displayed after 5 seconds or any key to select the working method dialog box.

The instrument model on the interface corresponds to the main engine. The 48-channel instrument, 24-channel instrument, 12-channel instrument and 6-channel instrument correspond to the SDZ-48A/B, SDZ-24A/B, SDZ-12A/B and SDZ-6Bdigitalengineering seismometer.

4.3 Workplace options

Select the appropriate working method and enter the software.



SDZ-48A/24A/12A digital engineering seismometer SDZ-6ABdigital engineering seismometer
Figure 4.2 Dialog box for selection of working methods

4.4 Software Menu

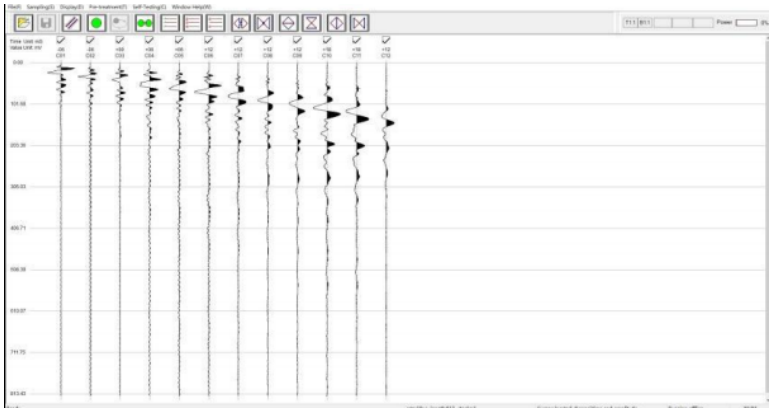


Figure 4.3 Software interface

✧ Title bar: LOGO, instrument model and name, working method, file name (if there is * in front, it means not saved)

✧ Menu bar: File, Sampling, Display, Preprocessing, Tool Self-Check, Window Help

✧ Toolbars: open file, save file, parameter setting, single sampling, over sampling, single overlay, channel full selection, channel optional, channel special selection, gain amplification, gain reduction, time amplification, time reduction, baseline amplification, baseline reduction;

✧ Ratio column: time ratio, baseline ratio, T1, T2, ΔT, instrument power

✧ Status bar: Sampling rate, sampling length, number of superimposition; channel, time, amplitude at the mouse position

4.4.1 Document menu

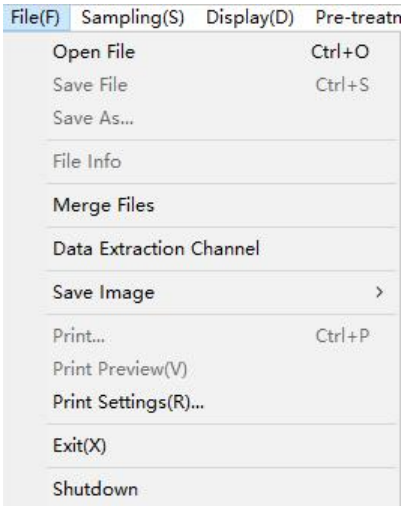


Figure 4.4 File menu

Open-file：

Open the saved data file, and the default path is the saved path of the current working method;

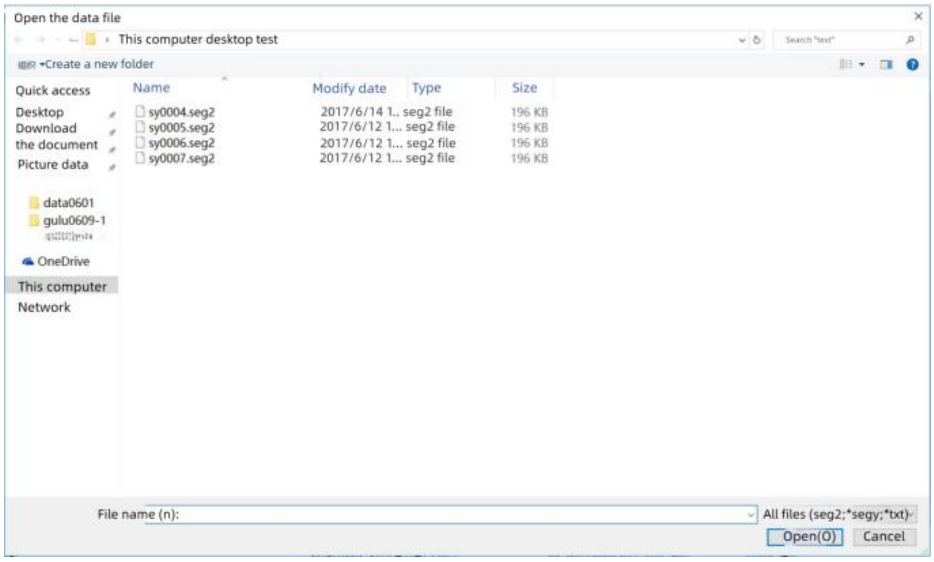


Figure 4.5 Opening a file

Save file：

Save the current file according to the data file name, format and storage path set by the parameter;

Save as：

In addition, the current data file is stored in the default path as the save path of the current working method;

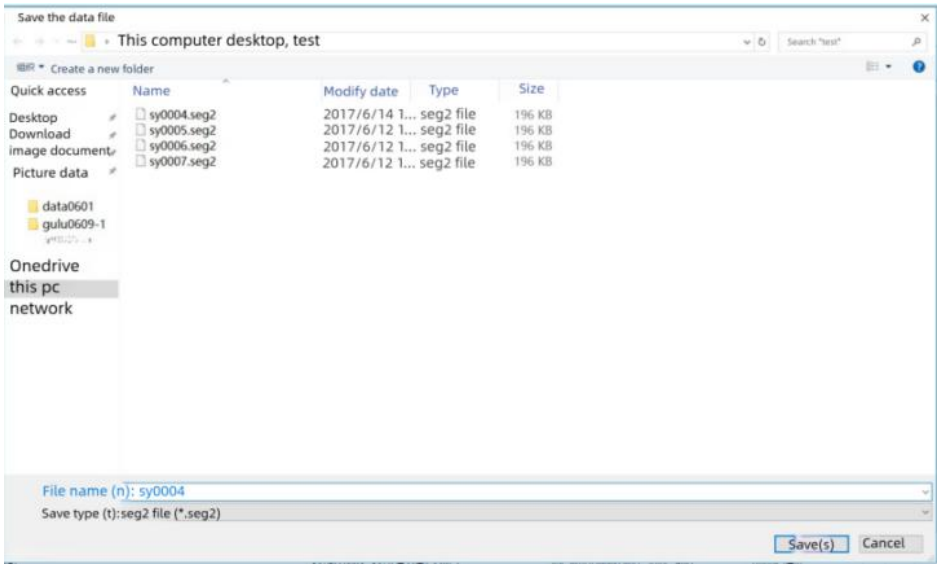


Figure 4.6 Other existing documentation

File information:

The collection and location information of the current file (must be a saved or opened data file, if the current file is not saved, this item is gray and unavailable). If you want to modify the location information, click modify, modify the correct

location information and confirm;

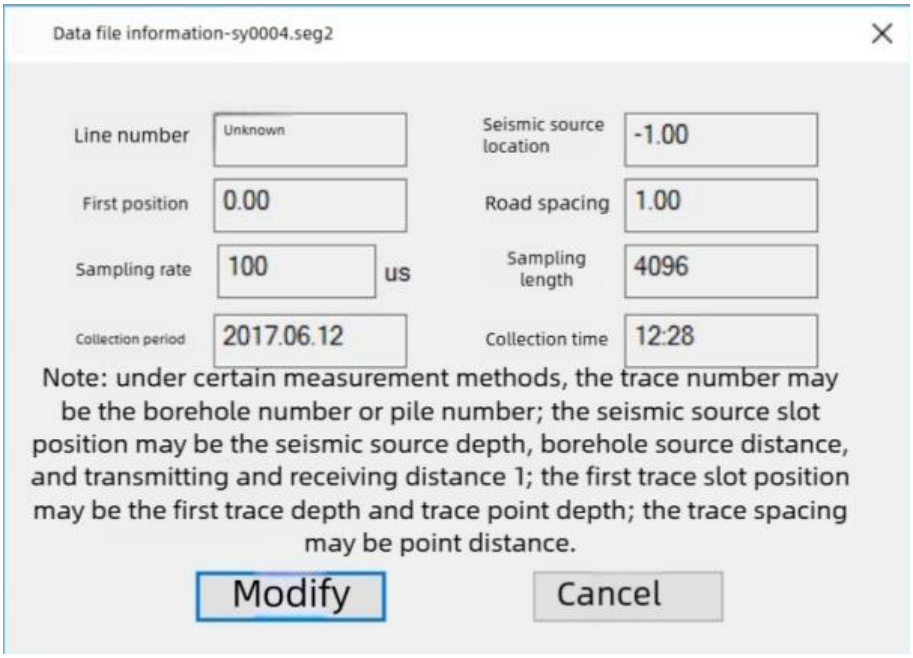


Figure 4.7 File information

File stitching:

Add and delete multiple files with the same sampling rate and sampling length, move the files up and down, input the name of the merged file, click merge, and then merge all the files in the list in order to save them as a new data file according to the parameters of the first file;

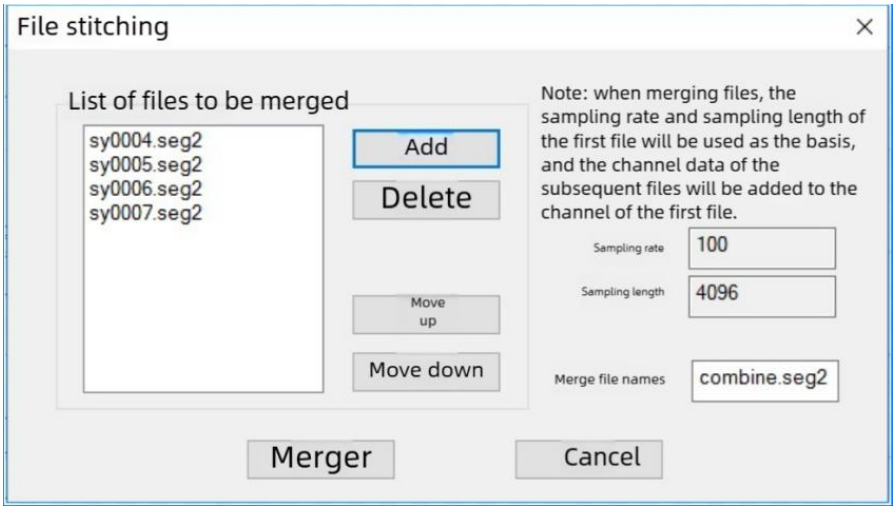


Figure 4.8 File stitching

Data extraction:

Select some of the channels of one or more files, and save all the extracted channels of the files in sequence according to the parameters of the first file;

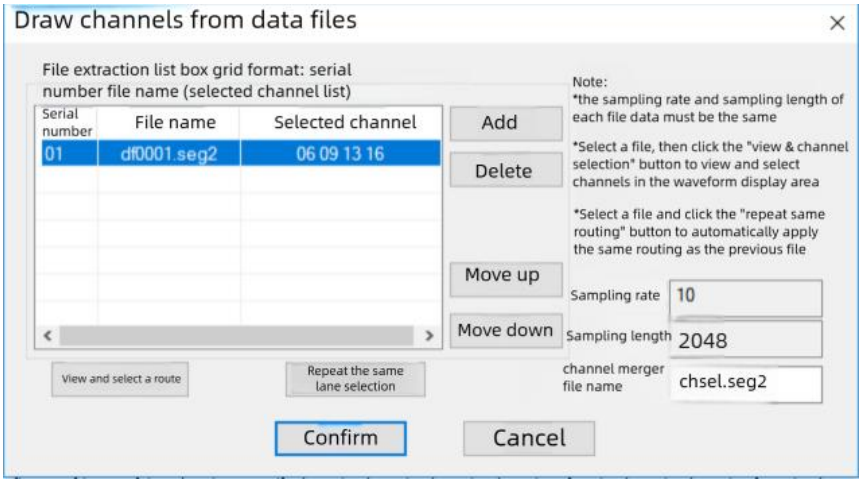


Figure 4.9 Data extraction

✧ Add: Add one file at a time. Starting from the second file, the sampling rate and sampling length of the data file must be the same as the first file, otherwise the file mismatch dialog box will be prompted.

✧ Delete: Delete a file that has been added.

✧ Up and down: Move the order of the files.

✧ View and select a track: Select a file, click this item to open the file at the bottom of the window, and check the box above the track you want to extract to indicate that you have selected the track.

✧ Repeat the same lane: Take all the selected lanes from the previous file as the selected lanes for this file. If there are already selected lanes in this file that are different from those in the previous file, select the selected lanes of this file and all the selected lanes from the previous file.

✧ Channel merge file name: Enter the merged file name.

✧ Determine: Save the new file under the current default path with a merged filename and close the dialog box.

✧ Cancel: Do nothing and close this dialog box.

Save image:

Screenshot: Save the current window data as an image file

File to image: Save the current data file as an image file

Print, print Preview, Print Settings:

Set the printer, preview and print the current data file;

Exit:

Exit the software;

Shut down ：

Call the system shutdown command to shut down the tablet or computer.

4.4.2 Sampling menu

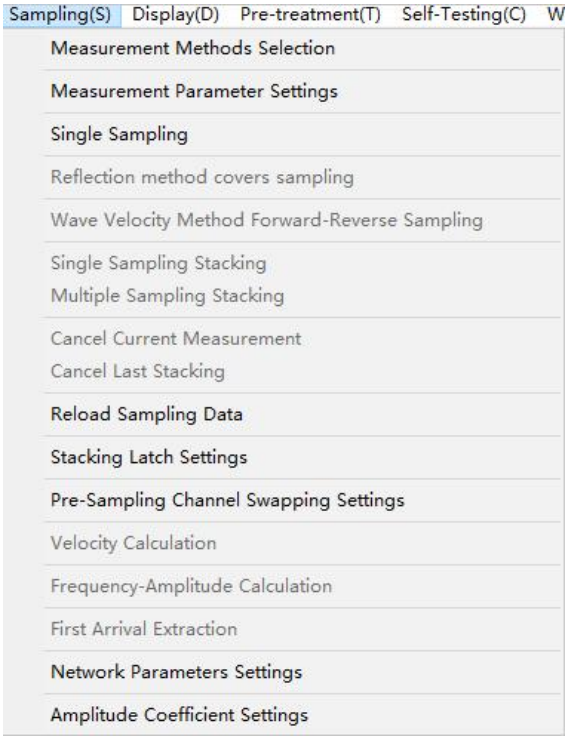


Figure 4.10 Sampling menu

4.4.2.1 Measurement method selection

Refer to Figure 4.2

4.2.2.2 parameter setting

a.Reflective measurement

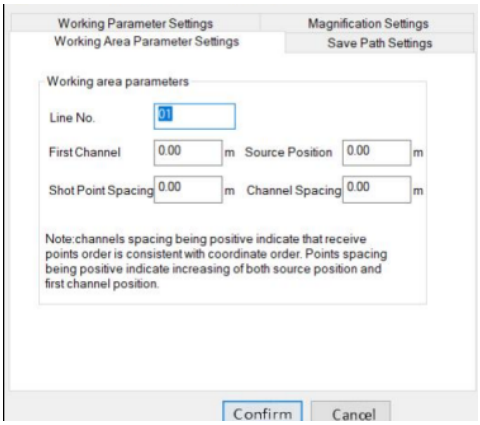


Figure 4.11a Reflection measurement-working area parameters

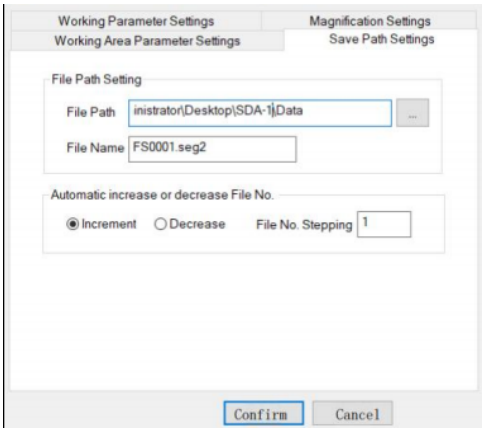


Figure 4.11b Reflection measurement-storage Settings

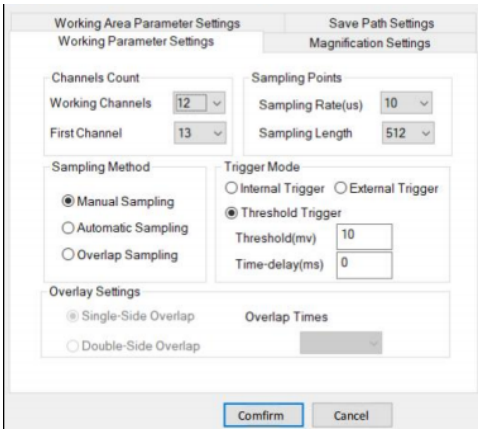


Figure 4.11c Reflection measurement--working parameters

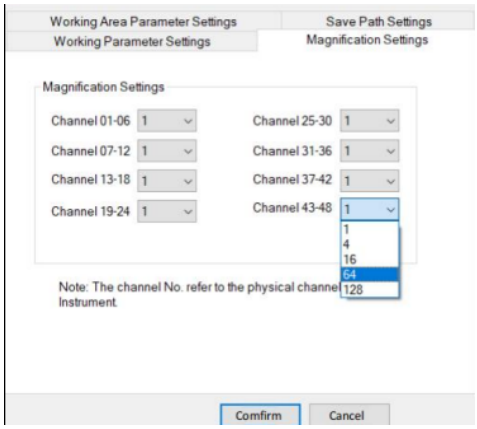


Figure 4.11d Reflection measurement--magnification

Figure 4.11 Parameter Settings-Reflection measurements

- **Plant parameters: Figure 4.11a**

Survey line number: the number of field exploration profile, composed of letters, numbers, Chinese, etc. The survey line number is only useful for this software and can not be recognized by other software;

First track position: one-dimensional coordinate information of the first track

detector in the current working exploration profile;

Source location: one-dimensional coordinate information of the current arranged source on the current working exploration profile;

Shot spacing: the distance between the current and next seismic sources during reflection. When this value is positive, it indicates that the seismic source position moves from small to large coordinates; when it is negative, it moves in the opposite direction. The software uses this parameter to automatically calculate the seismic source position and first path position of the next sequence;

Data distance: the distance between two adjacent detectors in the current arrangement. When this value is positive, it means that the coordinate number of the first track position in the current arrangement is smaller than that of the second track, and when it is negative, it is reversed.

- **Save path: Figure 4.11b**

Path: the storage path of the data file. Click the back... to select an existing path or create a new folder and select it;

File name: The file name of the current record, with the last four digits being numeric

File name increment or decrement: a change in the number of digits at the end of the file name of the next record, depending on the increment or decrement;

Add/subtract: The amount of change in the file name, with a minimum of 1.

- **Working parameters: Figure 4.11c**

Number of working days: the number of effective working days; depending on the working method, there are 1, 2, 3, 6, 12,24,36,48 and other different options;

Serial number: the serial number of the first working channel in the instrument; different methods have different options, ranging from 1 to 37;

Sampling rate: data sampling interval time; sampling rate has: 10us, 20us, 50us, 100us, 200us, 500us, 1ms, 2ms, 5ms, 10ms, 20ms and other options;

Sampling length: the total number of recorded points per data record; sampling rate * sampling length = data recording time; there are 512,1024,2048,4096,8192, 16384,32768 and other options;

Manual sampling: each time manual sampling is required, the instrument will carry out sampling or wait for sampling status, and data recording needs to be saved manually;

Automatic Sampling: The process begins with manual initiation. After the instrument completes sampling according to preset parameters, it automatically saves data, generates files with predefined naming conventions, and initiates subsequent sampling cycles. Users can interrupt automatic operations at any stage, with final data requiring manual saving. Reflection-based automatic sampling is primarily used in underwater seismic reflection surveys. This method involves deploying a towed floating cable at a constant speed, triggering seismic sources periodically to collect and automatically save recordings.

Cover sampling: a quick working method of field reflection work, each record uses the number of channels of some instruments, rolling measurement, can reduce the number of field wiring and arrangement of detector;

Threshold triggering: set the threshold. After clicking sampling, the instrument starts to record data according to parameters when the signal of threshold detector (or other threshold device) reaches the threshold;

Internal trigger: After clicking the sampling, the instrument directly records the data according to the parameters. This function is mainly used for indoor debugging and testing, ground pulse motion and advanced surface wave measurement.

External trigger: Most field data collection records use this function, supporting open circuit, short circuit, positive and negative pulse, level signal and other methods;

Delay (ms): used for threshold triggering and external triggering when recording data, input value ranges from 0 to 9999ms;

Single-sided coverage and double-sided coverage: the instrument works in two kinds of coverage methods during the sampling of reflection measurement, and the first number of each work is automatically adjusted according to the subsequent coverage times;

Coverage times: S=NK/2n, depending on the total number of instrument channels, there are 1, 2, 3, 4, 6, 9, 12,18 and so on

S-Number of coverage

N-Number of working tracks

K--coefficient, 1 for unilateral and 2 for bilateral

n--Number of moves per cycle

◆ **Magnification: Figure 2.11d**

The multiplier selection of the preamplifier is grouped every six, with options such as 1, 4, 16,64, and 128 times. Options such as 1/8, 1/4, and 1/2 times are not available and can be opened separately for users who need them.

b.Refraction measurement

Refraction measurement parameter input reference reflection, only the working parameter interface is different, no coverage sampling and corresponding options, as shown in Figure 4.12

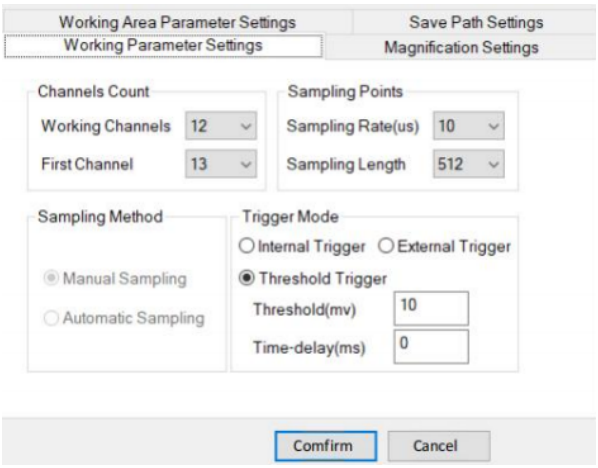


Figure 4.12 Refraction measurement-working parameters

c.Surface wave measurement: refer to refractive measurement;

d.Imaging measurements

Imaging measurement is a special measurement method of reflection. It uses the synchronous movement of receiver and source to analyze underground geological structures. Due to the interference of low-frequency plane waves, high-frequency detectors are generally used to filter low-frequency and receive data, which limits the measurement depth.

The parameter input reflection measurement is only different in the parameter interface of the working area, as shown in Figure 2.13. Since the reflection

measurement is synchronized between the source and the detector, and one profile is saved as a file, the parameter is the moving step. If it is only one work, the track spacing is set to 0;

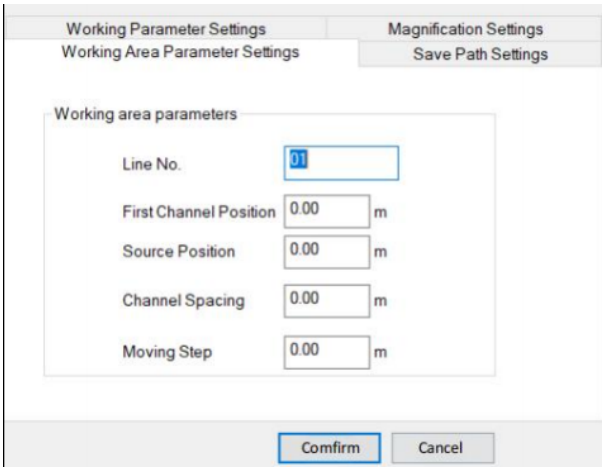


Figure 4.13 Image measurement-site parameters

e. Pulse measurements

Site Parameters: Pulsation measurement detectors are typically three-component detectors. In site parameters, the first detection point corresponds to the initial three-component measurement position. For single three-component detectors, the point distance is 0. For multiple detectors, the point distance equals the spacing between them. These parameters are exclusively applicable to this software and may not be recognized by other processing systems, requiring users to re-enter the corresponding parameters.

Working parameters: When sampling manually, one data record is made according to the set parameters and manually saved;

During automatic sampling, different regular sampling is performed at fixed time intervals, and the files are automatically saved according to the date and time as the file name. The specific Settings are as follows:

If the sampling duration and sampling interval are both 0, the sampling will be continuous without stopping and the data will be saved according to the set parameters;

Sampling duration is set, sampling interval is not set: continuous sampling according to the set parameters, and the total time is not large or small.

The sampling duration and sampling interval are set as follows:(the sampling interval must be greater than the recording time length of a single record in the setting parameter) Data is recorded every sampling interval, and the total time is not greater than the set sampling duration.

Save setting and magnification setting: Refer to the corresponding parameters of reflection. The setting of the file name in this save setting does not affect the automatic sampling of this measurement method.

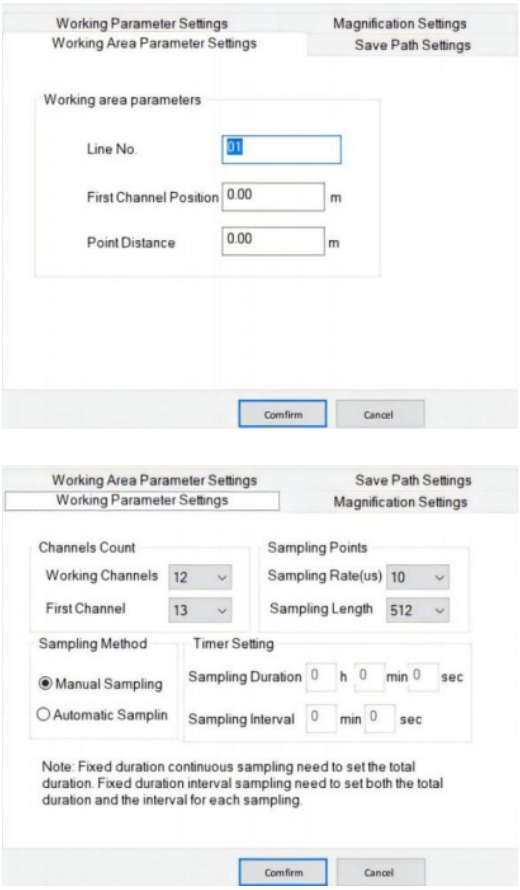


Figure 4.14 Pulse measurement-working area parameters and working parameters

f.Explosive measurements

The parameters of the working area refer to the pulse measurement, and other parameters refer to the refraction measurement;

g.Pulse-velocity logging

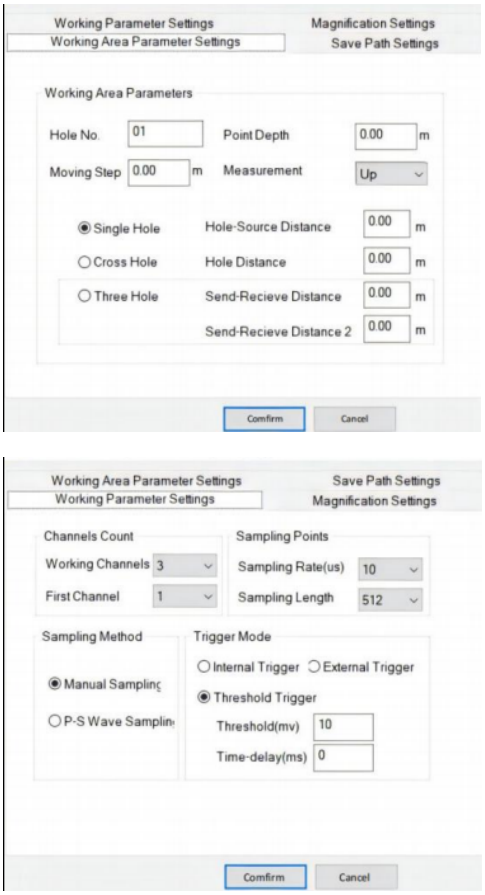


Figure 4.15 Wave velocity logging-zone parameters and working parameters

Because of the downhole measurement, the parameters of wave velocity logging are different from those of the previous ground measurement, and there are single hole, cross hole, three hole measurement, etc.

Geophysical logging parameters include measurement point depth, moving step distance, borehole source distance (single borehole), borehole spacing (transverse borehole), and transmit-receive distance 1 and transmit-receive distance 2 (three-borehole configuration). The measurement direction can be configured as either top-down or bottom-up, with the bottom-up approach being the standard practice. While these parameters work seamlessly in this software, they may not be recognized by other processing tools, requiring manual re-entry during data processing.

Working Parameters: Unlike previous measurement methods, this system employs longitudinal and transverse wave sampling. Users are prompted to tap the positive and negative longitudinal/transverse waves respectively, with both signals being recorded in a single data file. Notably, the longitudinal-transverse wave

measurement process is limited to a single three-component geophone per borehole, where the longitudinal sensor operates as the first track while horizontal sensors function as the second and third tracks.

h.Cross-flow chromatography

The cross-hole chromatography measurement is a special case of the synthesis of direct wave, refracted wave and transmitted wave. In the double-hole measurement, a source is placed in one hole and a detector is placed in the other hole. The data are recorded by moving the source and detector, and the formation structure between the two holes is analyzed by processing software.

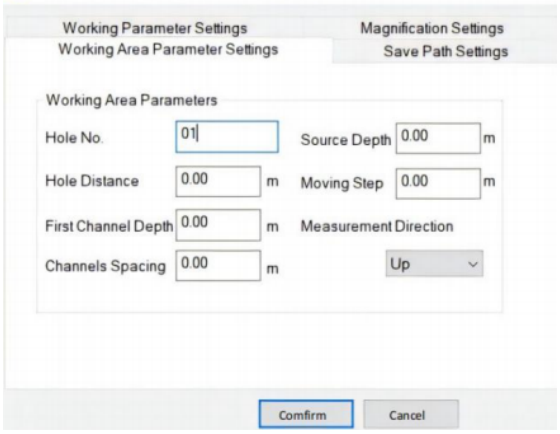
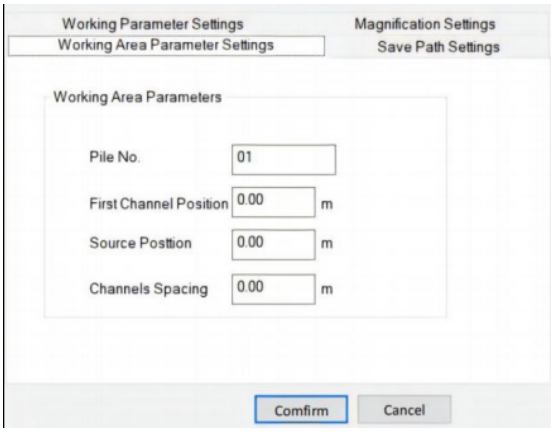


Figure 4.16 Cross-porosity chromatography-zone parameters

Workplace parameters: hole spacing, source depth, first depth, track spacing, moving step and measurement direction;

Other parameter settings refer to the setting of refractive parameters;

i.Pile foundation survey



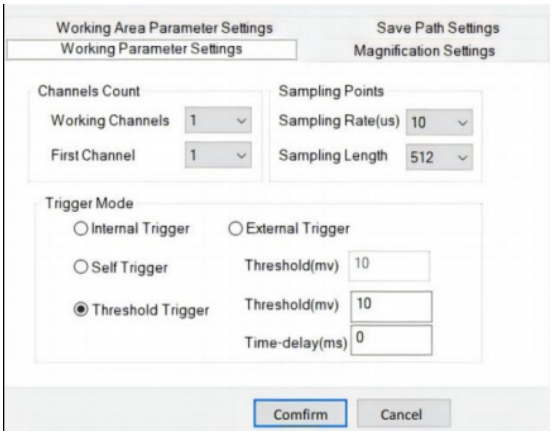


Figure 4.17 Pile foundation measurement--site parameters, working parameters

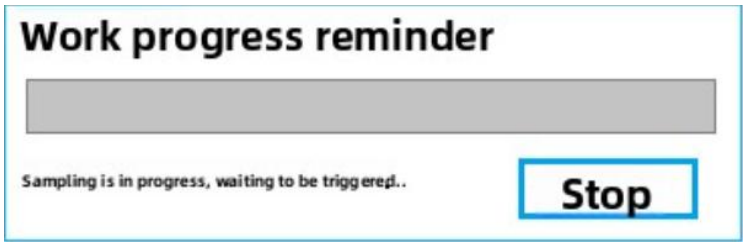
Pile foundation measurement is also a special case of reflection method. Since it is measured on the pile foundation, there is no interference of surface wave, and the source and receiving point are relatively close, the direct wave will arrive first, so self-trigger mode is generally used.

Workplace parameters: pile number, source location, first path location, path spacing and other parameters;

Working parameters: Compared with other working methods, there is one more self-triggering function, that is, when the signal amplitude received by the detector reaches a certain threshold, the instrument starts to record data according to the set parameters.

4.4.2.3 Single sampling

In the general menu, after clicking single sampling, if it's an internal trigger, the system directly collects data according to parameters. For other triggering methods, the instrument displays noise at a 10ms sampling rate until a trigger signal arrives. Noise is not displayed in automatic sampling mode or in imaging measurement and P/SW longitudinal/directional wave sampling modes. During the wait for a trigger, you can press "Stop" to interrupt the current sampling. Once a trigger signal is received, the sampling progress bar will appear, as shown in Figure 4.18.



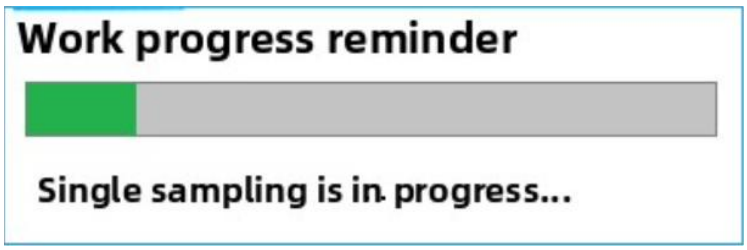


Figure 4.18 Single sampling progress bar

4.4.2.4 Reflective method covers sampling

Cover sampling is a specialized measurement technique in reflection methods, designed to minimize the frequency of moving large lines and instruments during fieldwork, thereby reducing field workload and improving efficiency. This sampling mode only applies to 24-channel and 48-channel instruments. After correctly configuring parameters, clicking "Cover Sampling" will display the following dialog box. Upon confirmation, Figure 2.17 dialog box will appear. If data has not been saved before clicking "Cover Sampling", the system will prompt to save the data first. After saving, the following figure will pop up. If no data is saved, the working channel remains unchanged.

Figure 4.19 Coverage sampling working channel prompt diagram

When all channels have been rolled, clicking over-sampling again will prompt you to rearrange the main line or set parameters again, as shown in the figure below. After rearranging the wiring, select from the first track or from the non-first track according to the wiring situation, and then perform the next round of over-sampling.

4.4.2.5 Forward and reverse sampling of wave velocity

This sampling item is dedicated to longitudinal and transverse wave sampling of velocity. It only turns black when the velocity parameter is set to longitudinal and transverse wave sampling, while other methods remain gray and unavailable. First,

select "Longitudinal and Transverse Wave Sampling" in the configuration interface of Figure 4.15, then click "Sampling"> "Positive and Negative Sampling of Velocity Method". The menu will pop up as shown in the following figure:

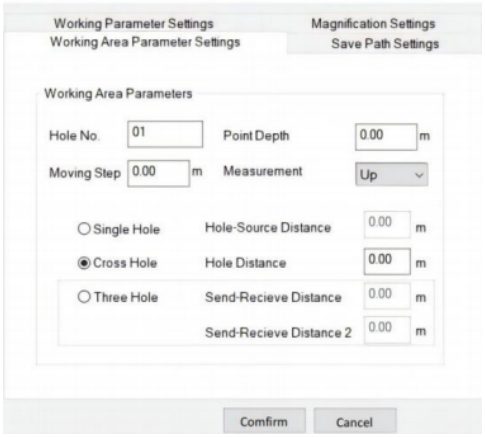


Figure 4.20 Selection of longitudinal and transverse wave sampling

Selecting the wave sampling, only the first data is collected and displayed in the first row;

If the forward sampling of shear wave is selected, only 2 or 3 channels are collected and displayed on 3 or 5 channels;

If the negative sampling of shear wave is selected, only 2 or 3 channels are collected and displayed on 2 or 4 channels;

If the data is not saved, a prompt to save will be given when you click again. If you do not save, select the corresponding channel according to the selection and overwrite the original corresponding channel data until you save or exit.

4.4.2.6 Single pass sampling

During data acquisition, if the amplitude of a useful signal is too low, you can click this item to perform a superposition (add two data). The number of times the data has been superimposed is displayed in the status bar;

4.4.2.7 Multiple overlapping samples

During data acquisition, if the amplitude of the useful signal is too low, you can click this item to superimpose it for several times until the signal amplitude reaches the required level and stop;

4.4.2.8 Cancel this measurement (imaging method)

This is for image measurement. If you think the data of this measurement is not

correct, you can cancel the measurement and then measure again. You can cancel the measurement up to 10 times;

4.4.2.9 Cancel last overlay

If you think the data added this time is incorrect, you can cancel this time, and then add again. You can cancel up to 10 times;

4.4.2.10 Stacked latch setting

The amplitude of each channel can be set in advance. When the signal is superimposed on this value, the corresponding channel will no longer participate in the superposition. The channels that do not reach the set value can continue to be superimposed. All channels are assumed as default and the gain is 36dB.

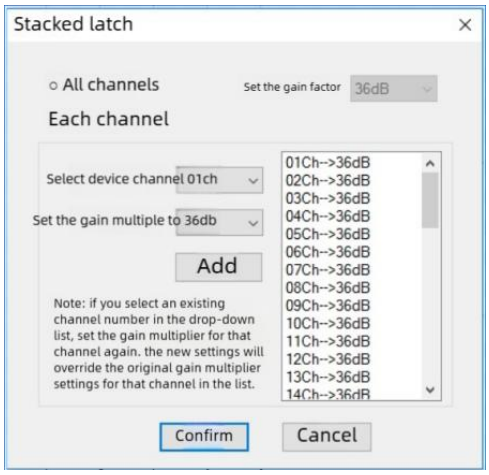


Figure 4.21 Overlay latch configuration

4.4.2.11 Measure the channel switching setup prior to the channel

If you use a large line that is not compatible with this instrument, the channel may not correspond. This function can be set to the correct channel arrangement according to the actual situation before working. Before reconfiguration or software exit, the instrument displays data and records according to the arrangement of channels set in this parameter, and defaults to no exchange.

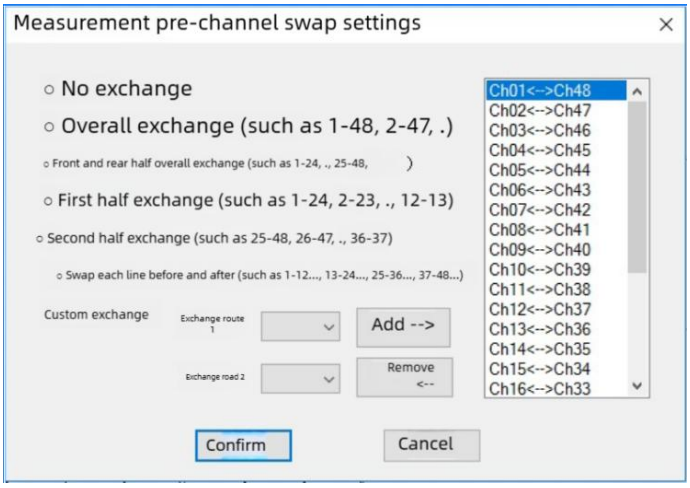


Figure 4.22 Measurement of pre-channel switching Settings

4.4.2.12 velocity calculation

This function is exclusively applicable to reflection and refraction measurements. For reflection measurements, it calculates the velocity of the reflection axis, corresponding depth, and tilt angle of the reflective layer, with the computed reflection axis curve marked in red. When two points are measured, no tilt angle value is calculated; only when three points are measured does the tilt angle become available. Multiple measurement points can be selected, but only the final three points are processed. For refraction measurements, it uses two points to calculate the velocity of refraction waves or direct waves, with the phase axis curve of these waves marked in red. Depth calculation is not performed, and multiple measurement points can be selected, but only the final two points are processed.

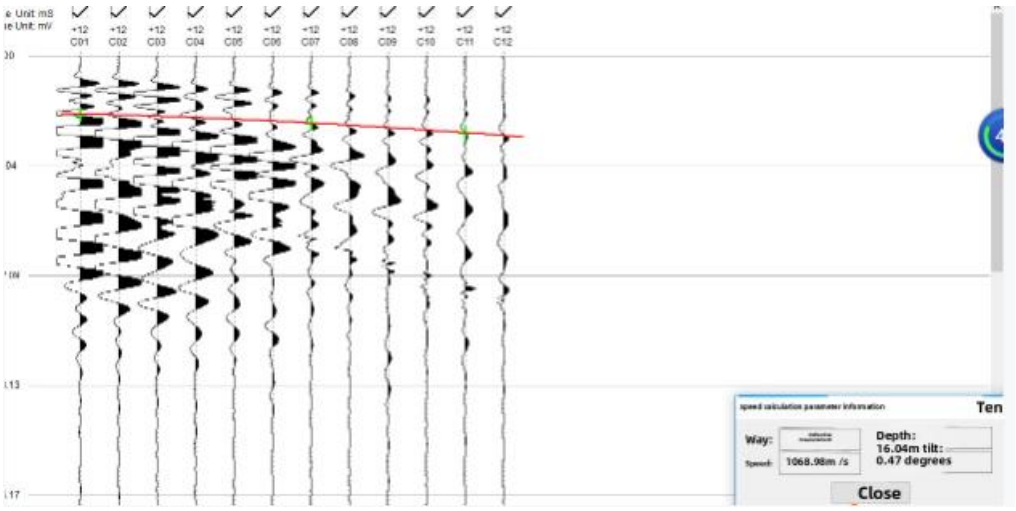


Figure 4.23 Speed calculation

4.4.2.13 Frequency spectrum calculations

When saving or opening data, clicking this option allows the software to calculate and display the main frequency and corresponding amplitude of each channel. The "Save" button enables saving as a text file for future development. To facilitate documentation, the software automatically adds _VF to file names, which users can customize as needed.

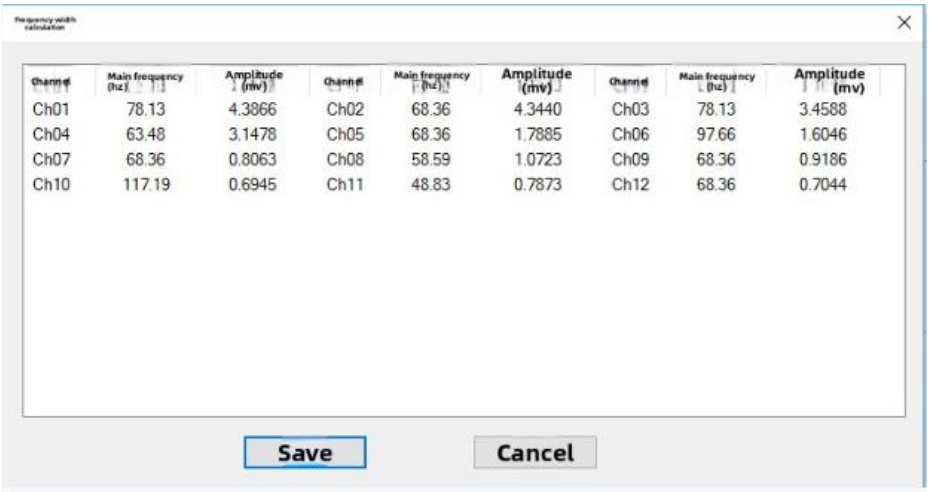


Figure 4.24 calculation

4.4.2.14 Initial to extraction

When the software detects data that has been saved or opened, clicking this option will calculate and display the initial pulse jump values for each channel. Users can modify these values by selecting corresponding channels, and clicking "Save" creates a text file for future development. To facilitate documentation, the software automatically adds _frt to file names. Users may customize these filenames as shown in the figure:

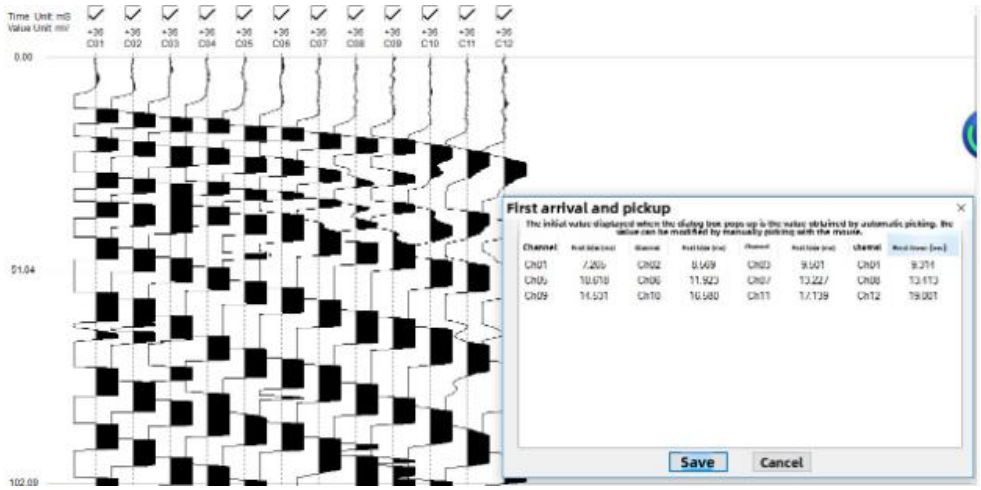


Figure 4.25 Initial to extraction

4.4.2.15 Network parameters Settings

Manual input of network parameters, this function is not working for the time being.

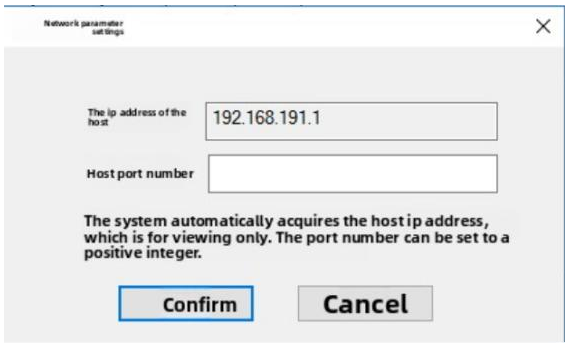


Figure 4.26 Network log settings

4.4.3 Display menu

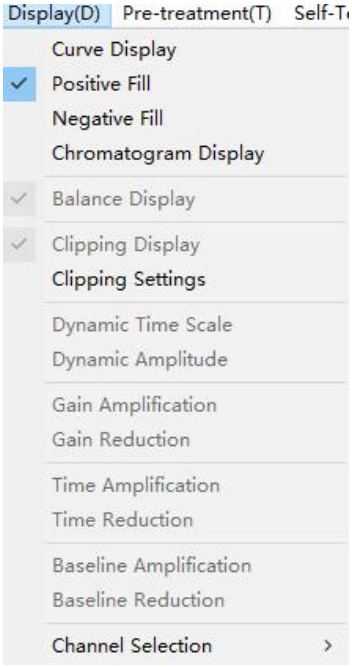


Figure 4.27 Display menu

4.4.3.1 Curve display, forward fill, negative fill, chromatographic display

The data curve can be shown as a curve, positive fill (with the baseline as the criterion, positive amplitude fill), reverse fill, or chromatogram. Only one of these can be selected.

4.4.3.2 Balanced display

The display window automatically adjusts the display gain according to the amplitude of the signal

4.4.3.3 Clipping display, clipping Settings

When the signal amplitude is greater than the set standard, the clipping display is used to enhance visibility.

Clipping setting: set the clipping range based on two adjacent baselines, with options such as 0.6, 0.9, 1.2, and 1.5 times

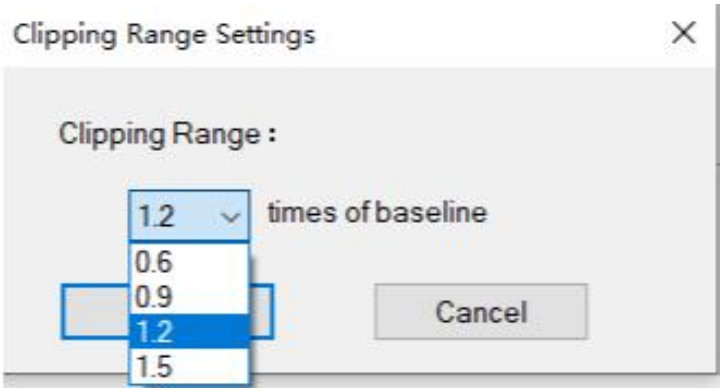


Figure 4.28 Wave damping range setting

4.4.3.4 Dynamic time markers

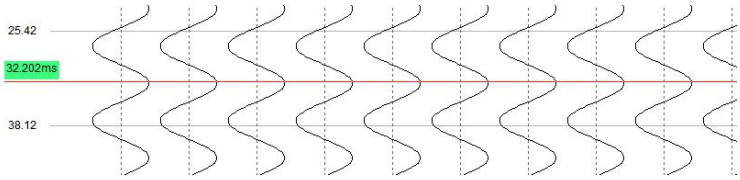


Figure 4.29 Dynamic time scale

Dynamic time marker displays the selected item, showing the time of the current cursor position in ms.

4.4.3.5 Dynamic amplitude

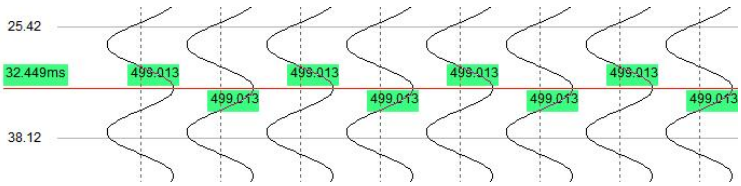


Figure 4.30 Dynamic amplitude

Dynamic amplitude display option displays the amplitude value of all channels at the time of the cursor, in units mv, displayed on both sides of the horizontal cursor line.

4.4.3.6 Gain amplification, gain reduction

All selected channels are displayed with an increase or decrease of 6dB.

4.4.3.7 Time magnification, time reduction

The timeline of the data file can be enlarged or reduced by one time. If it cannot be displayed on one screen, it can be displayed in a split screen. At the same time, the magnification ratio can be displayed in the toolbar. The maximum magnification is 8 times and the maximum reduction is 32 times.

4.4.3.8 Baseline amplification, baseline reduction

The data file baseline is enlarged or reduced by one time. If the display is not enough on a screen, it is displayed in a split screen, and the magnification ratio is displayed in the toolbar at the same time. The maximum magnification is 16 times, and the maximum reduction is 64 times.

4.4.3.9 channel selection

There are three options: full selection, optional selection and rule selection. Full selection: all the data channels are selected; optional selection: manual selection; rule selection: select the data channels according to certain rules.

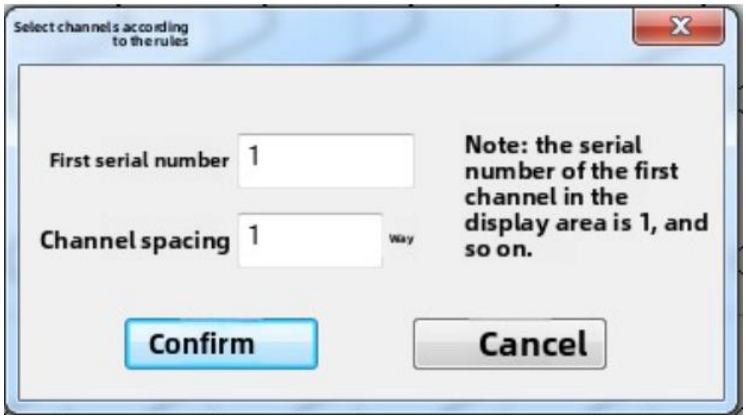


Figure 4.31 Rule-based lane selection

4.4.4 Prepared menu

Figure 4.32 Pre-processing menu

4.4.4.1 frequency analysis

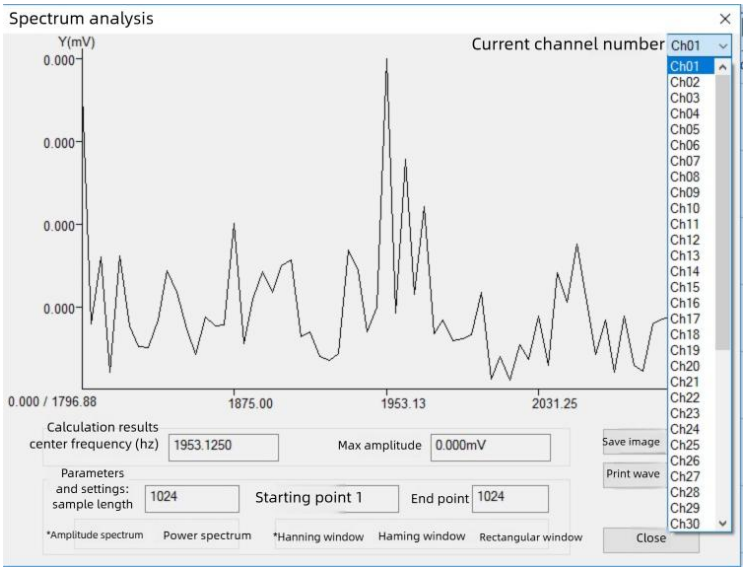


Figure 4.33 Spectrum analysis

This feature enables amplitude and power spectrum analysis for all data channels, providing analytical results through various window types including Hanning, Hamming, and Diffractive windows. The analysis outcomes can be directly printed or saved as PNG images. For enhanced convenience, users can conveniently select specific channels to analyze through the channel dropdown menu within the window interface.

4.4.4.2 digital filtering

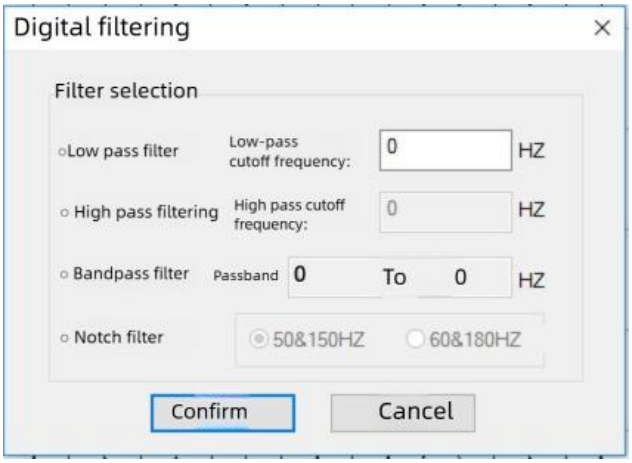


Figure 4.34 Digital filtering

This function can filter the current data file in various ways.

Low pass filter, high pass filter, band pass filter: the input cut frequency point is required, and the software filters at the cut frequency point with a steepness of-18dB.

Circuit filtering: select the corresponding circuit filtering frequency according to the industrial power frequency of the working site.

4.4.4..3 Go Zero Drift

This function performs zero calibration on the data.

4.4.4.4 Waveform reversal

This function applies a positive or negative reversal of amplitude to all selected channels.

4.4.4.5 Data scaling

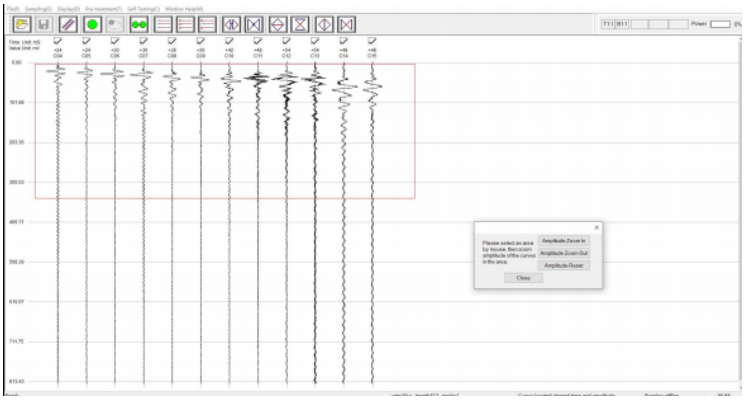


Figure 4.35 Data scaling

This function can zoom in, zoom out and clear the selected area.

4.4.4.6 Channel Data Exchange

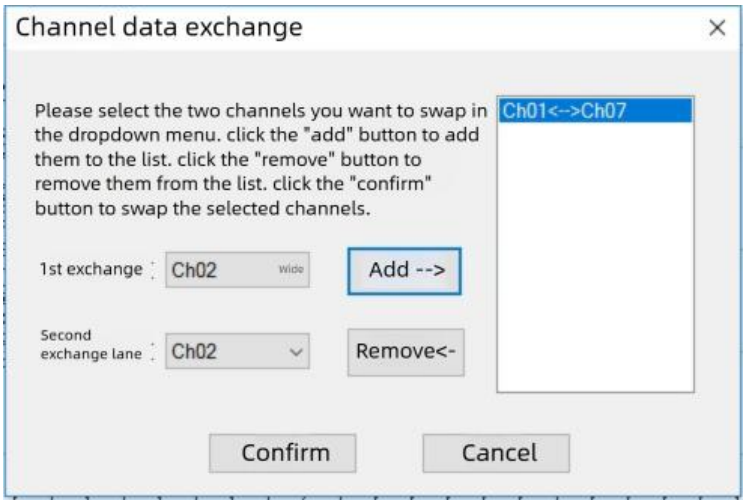


Figure 4.36 Channel data exchange

In the field, incorrect connections or using cables from different manufacturers may cause channel errors. If not corrected promptly, you can perform channel switching at this stage. The procedure is as follows: Select two channels to be swapped and add them to the right-side dialog box. Multiple channels can be added simultaneously. When identifying errors, click the incorrect switching channel to remove it. Click OK to execute the switch according to the rules listed in the dialog.

4.4.4.7 Cancel last operation

If an error is found during the processing of data, the function can undo the previous operation, up to 10 recent operations.

4.4.4.8 Restore initial data

Restore the data to the original data.

4.4.5 Tool self-check menu

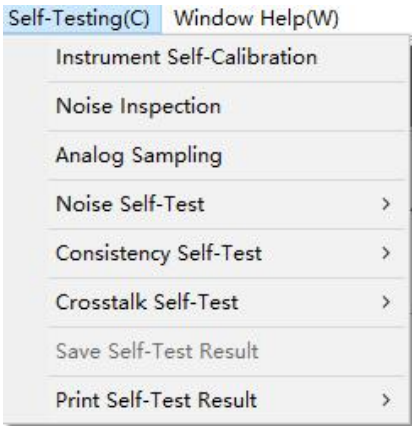


Figure 4.37 Tool Self-Check Menu

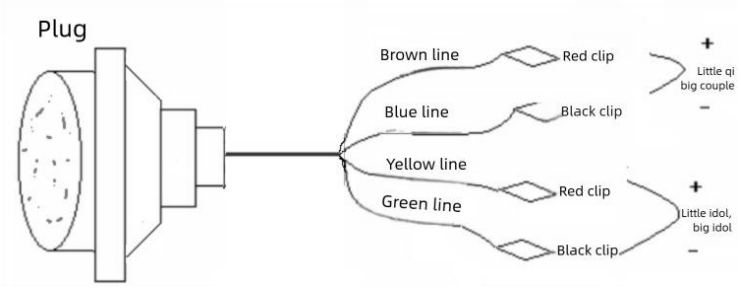


Figure 4.38 Self-test plug

4.4.5.1 Instrument self-training

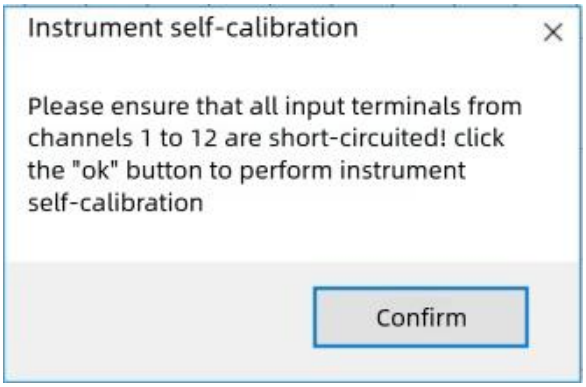


Figure 4.39 Instrument self-calibration

Click the instrument self-calibration, as shown in the dialog box above, and confirm after the short circuit head is connected. After the instrument collects 1-12 tracks, prompt the short circuit 13-24 tracks, and complete the low-order collection of all tracks and complete the self-calibration.

In order to obtain higher quality raw data, it is recommended that each working area and each time the sampling parameters are changed, the instrument should be self-calibrated.

4.4.5.2 Noise inspection

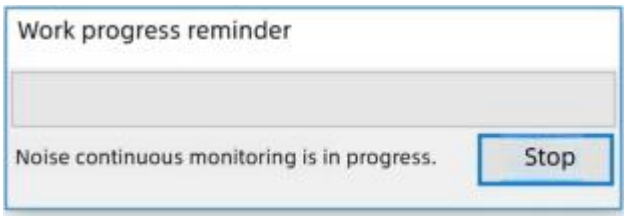


Figure 4.40 Noise inspection

Click this item, and the dialog box above will pop up. The instrument will continue to sample at a sampling rate of 10ms and display it scrolling. You can check the noise on the working ground. Press the stop button to stop the check.

4.4.5.3 analog sampling

Click this item, the software automatically generates a 100Hz/1Vpp sinusoidal wave signal according to the set parameters. The data is not processed by the hardware system, but completely generated by software simulation.

4.4.5.4 Noise self-inspection

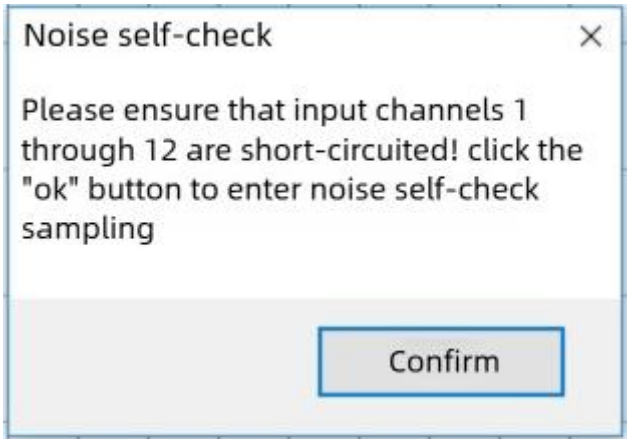


Figure 4.41 Noise self-test

Noise self-test, consistency self-test and crosstalk self-test are recommended to be checked in a quiet place without noise interference.

Noise self-test: Click this item, short circuit all input channels in turn according to the prompt, check the results after completion, you can click to view the self-test results. The result noise is less than 0.5uV is qualified.

4.4.5.5 Consistency self-check

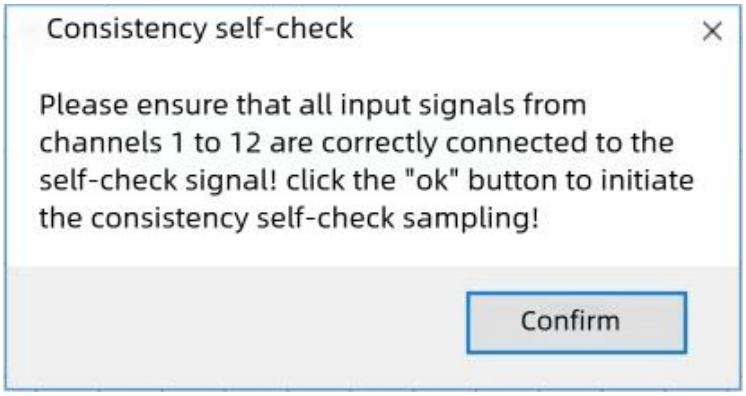


Figure 4.42 Consistency self-check

Consistency self-test: Click this item and connect the output of the self-test channel to all input channels according to the prompts. After the inspection is completed, you can click to view the results of phase and amplitude consistency

self-test. The amplitude consistency is qualified if it is less than 0.1%, and the phase consistency is qualified if it is less than 10us.

4.4.5.6 Crosstalk self-test

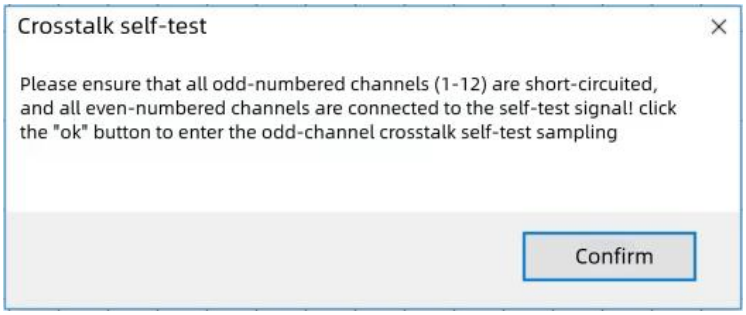


Figure 4.43 Crosstalk self-test

Crosstalk self-test: Click this item and connect the output of the self-test channel to the parity input channel one by one as prompted. After the check is completed, you can click to view the crosstalk self-test results.

During self-test of crosstalk, it is necessary to pay attention to the opposite parity between the small half input channel and the large half input channel of the instrument.

4.4.5.7 Save self-test results

Save the self-test results as a text document.

4.4.5.8 Print self-test results

Preview and print self-test results.

4.4.6 Window Help menu

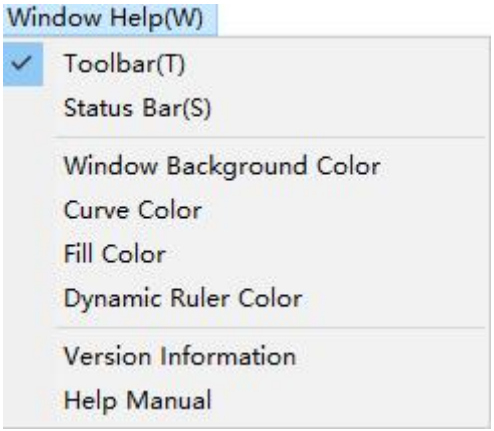


Figure 4.44 Window Help menu

- ✧ tool bar :Tool bar close, close options
- ✧ status bar :Status bar open and close options

✧ Window background color:The default background color of the window is white

✧ Curve color:The color selection of the data curve is black

✧ Filling color:Color selection for curve fill is black by default

✧ Color of dynamic ruler:Dynamic scale color selection, by default red

✧ Version information:Work software version information

✧ Guide to Help:Help files

4.4.7 Right-click menu

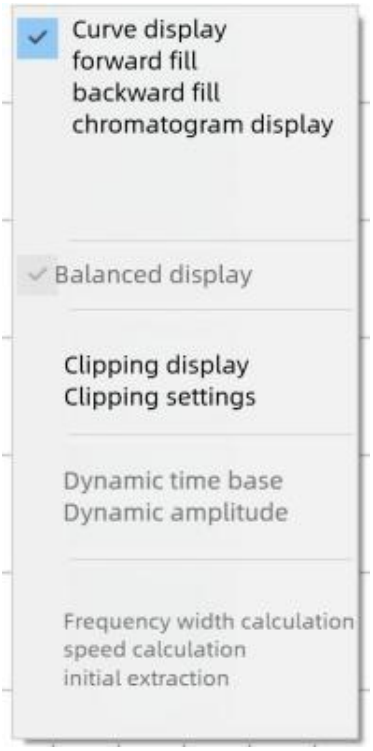


Figure 4.45 Right-click menu

The right-click menu can only be displayed when the mouse or connected tablet is connected. The right-click menu cannot be displayed temporarily on the screen touch.

The function items of the right-click menu refer to the corresponding "Sampling" and "Display" menu functions, which are not repeated.

5. Instrument maintenance and common problems

5.1 Instrument maintenance

This instrument is a kind of high precision and valuable instrument. In the

process of carrying and using, it should avoid collision, vibration, impact, etc., and try to prevent the instrument from wind, sun, rain, etc. Regular maintenance and maintenance should be carried out for the instrument and its accessories.

Usage environment: temperature-10℃ ～+60℃; humidity <90%RH

Long-term storage: the instrument should be stored in a dry and ventilated environment when not in use, the ambient temperature should be-20℃ ～+60℃, humidity <50%RH, it should be fully charged every half a month and turned on for more than one hour.

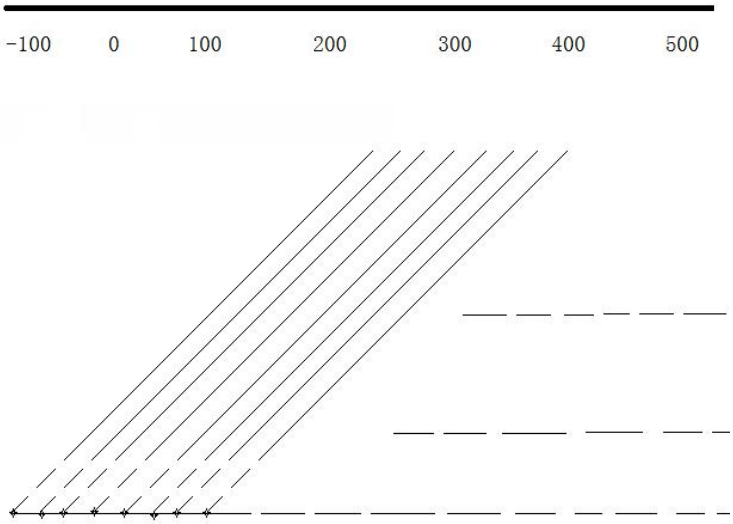
Tablet computer maintenance: please refer to the tablet computer user manual and maintenance methods.

File management: The test data after field construction should be backed up with other storage tools on the same day, and unused files should be deleted at any time.

5.2 frequently asked questions

order number	frequently asked questions	Cause and solution
1	The instrument won't turn on	Built-in battery is dead, charge
2	Software doesn't open	The WIFI of the tablet or computer is not turned on, the distance is too far, or it is subjected to electromagnetic interference. Turn on the WIFI, remove or get away from the source of interference, and shorten the distance between the tablet and the instrument
3	Software dies during collection	If the WIFI is disconnected or subjected to electromagnetic interference, close the distance between the tablet and the instrument, remove or move away from the interference source, and restart the host and the tablet when necessary.
4	No signal in the collected data	Check the parameter setting, whether the working channel error is set, and whether the main line and detector are connected.

Appendix I reflection measurement parameter setting and field wiring method routine



The length of a section is 400 meters. As shown in the figure, the working parameters obtained from the preliminary test are: offset distance 50 meters, track spacing 3 meters, sampling rate 200us, sampling length 2048, and working requirement 6 times coverage.

Using the 24-channel coverage method of the reflection function of the SDZ-48B instrument, the first instrument parameters are:

Workplace parameters: Line number: XX First position: -5 Source position: -55 Blast point distance: 6 Lane distance: 3

Save path setting: Path: c:\user\df data File name: FSxx001.seg2 File name increment, increment is 1

Working parameters: coverage sampling, external trigger, unilateral coverage, 6 coverage times, 24 working channels, first channel number 1, sampling rate (us) 200, sampling length 2048

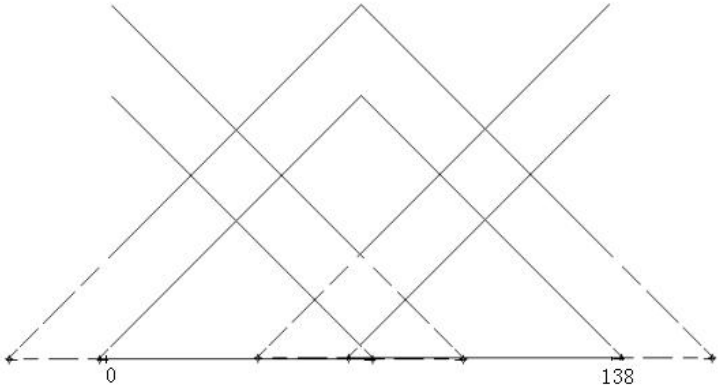
Magnification setting: all 64

The seismic source, main line and detector are arranged according to the above parameters and correctly connected to the instrument. Click sampling--cover sampling, the prompt working channel is 1-24, and then wait for sampling after confirmation.

After the first sampling, click save data, move the seismic source to-49 position, click cover sampling, the prompt work channel is 3-26, confirm and wait for sampling.

After collecting 13 consecutive data points, the 1st-24th major lines and detectors were moved to the tail end for proper positioning. The instrument was then relocated to the central position and connected. Clicking the overlay sampling button, users selected "starting from non-first track" as prompted and continued operations until completing the profile. A total of 72 files were collected, categorized as follows: -30 to-1.5 as 1-5 overlay tracks, 0-400.5 as 6 overlay tracks, and 402-430.5 as 5-1 overlay tracks.

Appendix II. Setting of refraction measurement parameters and field wiring method routine



The length of a refracted profile is 120 meters, and the track spacing is required to be 3 meters.

Using the refraction function of SDZ-24B instrument, since the source of far shot data in refraction is derived from the analysis of near shot data, it is necessary to input the working area parameters for each record. The track spacing is 3 meters, which requires two arrangements to complete, and a total of 8 data files need to be made.

The preliminary test results show that the sampling rate is 200us, the sampling length is 1024, the sampling is manual, the external trigger is 24 working channels, the first channel number is 1, and the amplification factor is 64.

Record 1: focal point position-3, first path position 0, shot point spacing 0, track spacing 3

Record 2: Focus location-50, first path position 0, shot point spacing 0, track spacing 3

Record 3: focal point 72, first path 0, shot spacing 0, track spacing 3

Record 4: focal point 100, first path 0, shot spacing 0, track spacing 3

Record 5: focal point 65, first path 69, shot spacing 0, track spacing 3

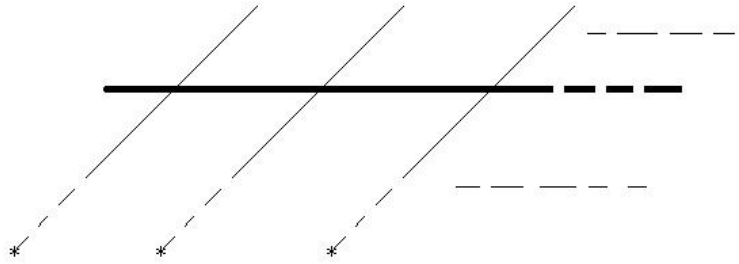
Record 6: focal point 20, first path 69, shot spacing 0, track spacing 3

Record 7: focal point 141, first path 69, shot spacing 0, track spacing 3

Record 8: Focus location 180, first path 69, shot spacing 0, track spacing 3

Appendix 3. Face wave measurement parameter setting and field wiring method routine

Normal face wave:



The velocity layer analysis of surface wave test is arranged at the midpoint, so the surface wave is generally arranged with the measurement point as the midpoint. If there are multiple measurement points on a section, a velocity depth profile can be output.

As shown in the figure above, to conduct multiple surface wave measurement points on a single profile with 20-meter spacing and a 100-meter profile length, six surface wave measurement points are required. Using 12 seismometers equipped with 4Hz vertical detectors, preliminary testing determined the sampling rate to be 500us, a sampling length of 1024, manual sampling, external triggering, 12 operational channels, first channel number 1, and an amplification factor of 64.

Record 1: focal point position-26.5, first path position-16.5, shot spacing 20, track spacing 3

Record 2: Focus location-6.5, first path position 3.5, shot point spacing 20, track spacing 3

Record 3: focal point 13.5, first path 23.5, shot spacing 20, track spacing 3

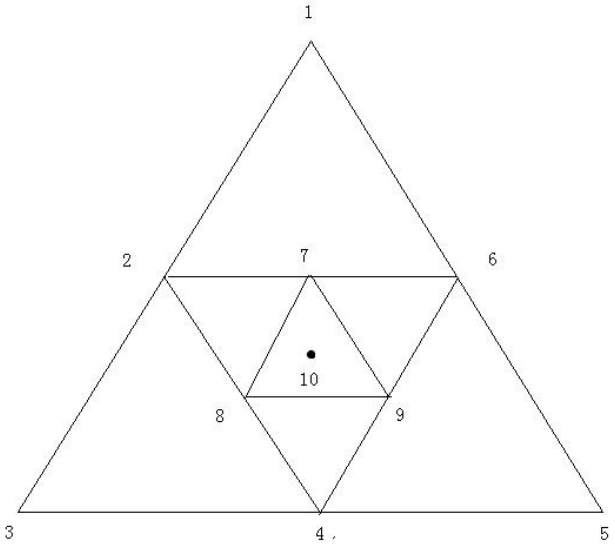
Record 4: focal point 33.5, first path 43.5, shot spacing 20, track spacing 3

Record 5: focal point 53.5, first shot position 63.5, shot spacing 20, shot spacing 3

Record 6: focal point 73.5, first path 83.5, shot spacing 20, track spacing 3

High surface wave (passive source surface wave):

Passive source surface waves are the vibrations generated by nature and human activities. The velocity structure of transverse waves in the ground can be inferred by analyzing the dispersion characteristics of passive source surface waves.

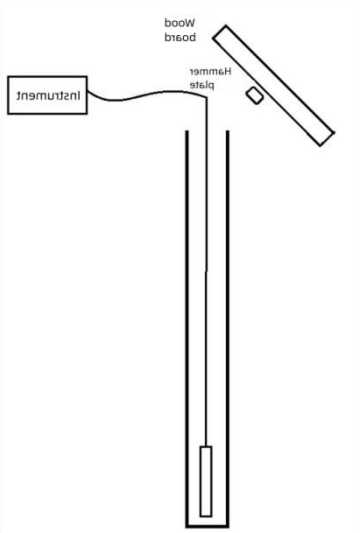


The advanced surface wave patterns include circular, triangular, linear, and L-shaped configurations, with the triangular pattern being the most commonly used (as shown in the figure). Since the geophones are arranged in a two-dimensional grid and the acquisition software lacks two-dimensional parameter input capabilities, it is recommended to use field notebooks to document the positions of each geophone when employing this survey method.

Parameter Settings: 12 working channels (the two extra channels can be invalid processed in the processing software or the data extraction function of this software can be used to extract the data of the first 10 channels), detector uses 2.5Hz vertical, sampling rate uses 1000us, sampling length 32768, manual sampling, amplification factor 64, record data not less than 10.

Appendix 4 Single-hole wave velocity measurement parameter setting and field wiring method routine

Kong Shen: 50 meters, requiring 2 meters to be measured, the test results show that the sampling rate is 200us, the sampling length is 1024, the center of the board is 2 meters away from the center of the wellhead, and the board is weighted with more than 500Kg.



Six seismographs are used and the instrument parameters are:

Workplace parameters: Well measurement number: XX123, depth of measurement point: 50, moving step: 2, measurement direction: upward

Single hole measurement, hole source distance: 2

Save parameters: omitted

Working parameters: working channel: 3, first channel number: 1, sampling rate: 200, sampling length: 1024, manual sampling, external trigger

Magnification: Total 64

Since measuring wave velocity requires three data points at a single location – two horizontal measurements and one vertical measurement – the input parameters may not be recognized by the processing software. Therefore, the depth and measurement components are typically displayed in the saved file name. For example: BSXX050S1.seg2: At 50 meters depth of borehole XX, horizontal measurement 1,

BSXX050S2.seg2: Horizontal measurement at 50 meters from hole XX, 2

BSXX0050P.seg2: Vertical measurement at 50 meters from hole XX.

When parameters are entered, you can enter a maximum of 5 characters and 3 digits for the file name. You can use save to input the name of the file to be saved.

List of supporting documents

order number	name	quantity
1	main engine	1 unit
2	panel computer	1 set
3	Host charger	1 set
4	WIFI antenna	1
5	Self-checking plug	1
6	Self-test signal line (2 cores)	1 root
7	Network cables	1 root
8	Trigger wire (3 cores)	1 root
9	Data acquisition software	

Company:Shanghai Weiqi Equipment Technology Co., Ltd.

Technical support: +8613227326207 (Allen)

Web: www.weiqiequipment.com