Gaotiejian

GTJ-900 Concrete Ultrasonic Detector

Operation Manual

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Contents

This manual stipulates:

1. The text with gray shading and squares indicates a button on the screen, such as a new project.
2. Text with a gray shading indicates what the edit box represents, such as the project name.
3. In addition to the contents described in this manual, the user will automatically display some prompt information during the process of using the user. Please follow the prompt information.

Chapter Ⅰ Instrument Functions and Introduction

1.1 Instrument introduction

The Concrete Ultrasonic Detector is an intelligent instrument for non-destructive testing of non-metallic materials and components such as concrete, rock, ceramics, graphite, plastics, etc. using ultrasonic pulse detection technology. It combines ultrasonic transmission, dual-channel synchronous reception, high-speed digital signal acquisition, automatic measurement of acoustic parameters, digital analysis processing, real-time display of results, digital storage and output. It can be used for concrete pile integrity testing, strength testing, structural internal defect detection and crack detection.
The GTJ-U900 Concrete Ultrasonic Detector includes the following functional modules:
(1) Sound wave transmission method to detect the integrity of the pile (referred to as "measuring pile");
(2) Ultrasonic method is not dense and cavity detection (referred to as "measurement");
(3) Ultrasonic rebound comprehensive method for testing concrete strength (referred to as "measured strength");
(4) Ultrasonic flat test method for detecting concrete crack depth (referred to as "sampling");

1.2 Relevant testing procedures

(1) "Ultrasonic Method for Testing Concrete Defects" - CECS 21:000
(2) Technical Specification for Ultrasonic Rebound Comprehensive Method for Testing Concrete Strength-CECS 02:2005
(3) "Code for Testing Concrete Strength of Railway Engineering Structures"-TB 10426-2004
(4) Technical Regulations for Concrete Structure Detection of Water Transportation Engineering-JTS 239-2015
(5) "Technical Regulations for Strength Testing of High Strength Concrete"-JGJ/T294-2013
(6) Technical Specifications for Rebound Method and Ultrasonic Rebound Comprehensive Method for Testing Pumped Concrete Strength-DBJ/T01-78-2003
(7) Technical Specification for Ultrasonic Rebound Comprehensive Method for Testing Concrete Strength-DB37/T 2361-2013
(8) "Technical Regulations for Testing Concrete Compressive Strength"-DG/TJ08-2020-2007
(9) Technical Specification for Ultrasonic Rebound Comprehensive Method for Testing Concrete Strength-DBJ53/T-53-2013
(10) Technical Specification for Ultrasonic Rebound Comprehensive Method for Testing Concrete Strength of Highway Engineering-DB51/T1996-2015
(11) "Technical Specifications for Building Pile Testing" - JGJ 106-2014

(12) "Technical Regulations for Dynamic Testing of Foundation Piles in Highway Engineering"-JTG/T F81-01-2004
(13) "Technical Regulations for Testing Pile Foundations of Railway Engineering"-TB 10218-2008
(14) "Code for Building Foundation Testing" - DBJ 15-60-2008
(15) "Shenzhen Building Pile Testing Procedures"-SJG09-2015
(16) "Technical Specifications for Building Pile Testing"-DGJ08-218-2003

1.3 Instrument configuration

See the list of items in the box of the instrument main unit.

1.4 Main performance indicators

Item	Indicator
Acoustic reading accuracy(us)	0.05
Acoustic reading range(us)	±1677700
Dynamic range(dB)	146
Band width (kHz)	1~500
Receiving sensitivity(uV)	≤10
Sampling period(us)	0.05~409.6
Maximum sampling length	4096
Signal acquisition method	single, dual channel automatic continuous fast acquisition
Number of channels	1 transmit 2 receive / 1 transmit 1 receive
Emission voltage(V)	65, 250, 500, 1000
Power supply mode	Built-in lithium battery, external 220V ～ 16V AC / DC
Host weight(kg)	2.2
Machine volume (mm)	300×200×55
Display	10.1-inch, high-brightness, TFT color LCD capacitive scre en
Memory	built-in electronic hard disk (≥8GB) + large capacity U disk
Interface	USB, Bluetooth

1.5 Precautions

(1) Avoid water ingress;
(2) Avoid high temperature (>50 ° C);
(3) Avoid close to strong magnetic fields, such as large electromagnets, large transformers, etc.;
(4) to avoid the violent impact of the transducer;
(5) The necessary protective measures should be taken when using in humid, dusty or corrosive gas environment;
(6) The instrument should be stored in a ventilated, cool, dry place;
(7) When the instrument is not used for a long time, the rechargeable battery will naturally discharge, resulting in a decrease in power. It is recommended to recharge before use;
(8) Do not open the instrument case without permission;
(9) Please connect the signal line and the transducer in the off state, and pay attention to confirm the order of the plane transducer receiving and transmitting lines to avoid the wrong insertion;

Chapter II Description of Common Modules

2.1 start up interface

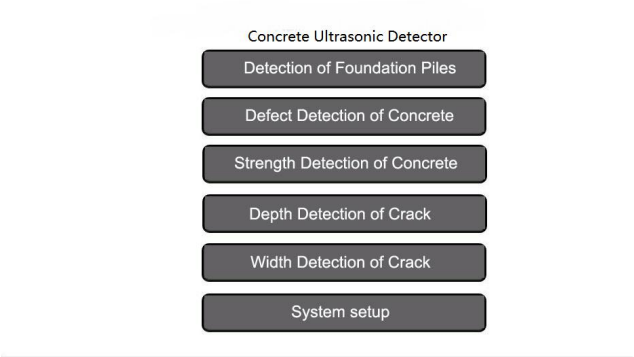


Figure 2-1 Start up interface

Press the instrument power switch, power on the instrument, display the power-on icon, wait for a while, after the startup is complete, enter the startup interface shown in Figure 2-1, display the system date and time, battery power and multiple function buttons, the user can click different buttons Take the appropriate action.

2.2 Introduction to Controls

The dialogs used in the software include a variety of commonly used controls, which are briefly described in Table 2.1.

Table 2.1

name	description
Push button	Click the corresponding function operation
Edit box	Click the pop-up soft keyboard to make changes to the content
Drop-down list box	Click the pop-up drop-down box to select the appropriate
Multiple choice box	Tap to switch between different items
Check box	Tap to select or deselect the options

2.3 Soft keyboard

2.3.1 Character input

When you need to enter characters (such as project name, base name, etc.), click the edit box that follows to bring up the soft keyboard shown in Figure 2-2. The title bar displays the name of the item to be entered and its maximum number of characters, and the current character is displayed in the edit box.

Ultrasonic transmission method

a) English input

Ultrasonic transmission method

b) Pinyin input

Figure 2-2 Character Soft Keyboard

(1) Click on the button where a character or number is located, then display the character or number in the edit box above;

(2) If you want to insert a character before a character of the input character, first click on the front position of the character, insert the cursor in front of it and then click the character to be inserted;

(3) Click the ← button to delete a character in front of the cursor position;

(4) Click the ↑ button to switch to the uppercase state;

(5) Click the English button to switch to the Chinese input state shown in 2.2b. At the same time, the button becomes a spell. At this time, the Chinese characters can be input in pinyin. After inputting pinyin, the Chinese characters to be selected are displayed at the bottom of the input box (when more Chinese characters are selected, you can click the 《,》" button to display other Chinese characters), click the corresponding number button

to enter the Chinese character, and click the spell button to switch to 2.2a. The character state shown;
(6) Click the enter button, the input is valid and the soft keyboard is closed; if the entered characters are illegal or unreasonable, the corresponding prompt message will pop up;
(7) Click the cancel button, the input is invalid and the soft keyboard is closed;

2.3.2 Digital Input

When you need to input numbers (such as starting height, tube spacing, etc.), click on the edit box that follows, the soft keyboard shown in Figure 2-3 will pop up. The title bar will display the name of the item to be entered and its reasonable range. Displays the current number.

Ultrasonic transmission method

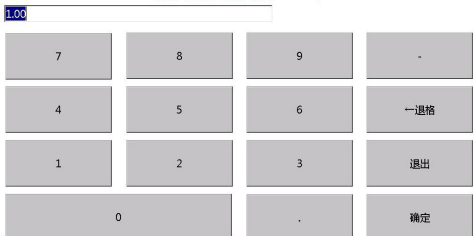


Figure 2-3 Digital soft keyboard

(1) Click the button where a certain number is located, and then display the number of points in the edit box above;
(2) To insert a number before a certain number of digits has been entered, first click on the front position of the number, insert the cursor in front of it and then click on the number to be inserted;
(3) Click the ← button to delete a number in front of the cursor position;
(4) Click the enter button, the input is valid and the soft keyboard is closed; if the entered number is illegal or unreasonable, the corresponding prompt message will pop up;
(5) Click the cancel button, the input is invalid and the soft keyboard is closed;

2.4 Waveform display and operation

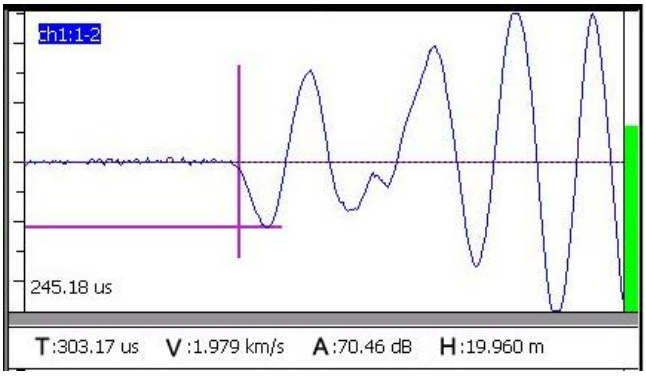


Figure 2-4 Waveform diagram

The single-channel waveform area is used to display the waveforms and acoustic parameters of the current measurement point, as shown in Figure 2-4. The name of the

section is displayed in the upper left corner of the single-track waveform area of the test pile. The other values are the same as the force-measuring, missing and seam-measuring. The bottom row of the single-channel waveform area shows parameters such as the first wave's acoustic parameters and the zero-acoustic time value.

The vertical progress bar on the right side of the single-channel waveform indicates the magnitude of the gain. When the gain is increased, the progress bar grows upward. When the gain is decreased, the progress bar decreases downward.

(1) **Sound time**: the time taken by the ultrasonic wave to transmit from the transmitting transducer to the receiving transducer, in units of us, when the system has already deducted the system zero sound;

(2) **Wave speed**: the speed at which ultrasonic waves propagate in concrete, calculated from the acoustic time and the test distance, in units of km/s;

(3) **Amplitude**: the amplitude value of the received first wave of the ultrasonic wave, used to measure the energy of the ultrasonic wave, in dB;

2.5 nouns, terms

(1) **Dynamic sampling**: refers to the process in which the ultrasound system continuously repeats the transmission, acquisition, processing, interpretation and display of waveforms and acoustic parameters;

(2) **Dynamic waveform**: refers to the waveform that is continuously refreshed in the single-channel waveform area on the screen in the dynamic sampling state;

(3) **Static waveform**: refers to the waveform of the single-channel waveform area on the screen when the sampling state is stopped;

(4) **First wave (first arrival wave)**: the first peak or trough of the waveform received by the instrument;

(5) **Baseline**: The approximate straight line segment before the first wave of the waveform. a center line of a single-channel waveform that is symmetrical upward and downward;

(6) **Automatic sound interpretation line**: used to indicate the marking line of the position where the ultrasound system automatically reads the first wave sound;

(7) **Amplitude automatic interpretation line**: used to indicate the marking line of the ultrasonic instrument automatically reading the amplitude position of the first wave;

(8) **Gain**: the magnification of the received signal by the system;

(9) **Sampling interval**: is the time interval between two adjacent sampling points in the waveform data, which are divided into 0.05uS, 0.10uS, 0.20uS, 0.40uS, 0.80uS, 1.60uS, 3.20uS, 6.40uS sampling time interval. The selection principle is such that it is not greater than or equal to 1% of the measured sound;

(10) **Sampling length**: the number of points of the sampled waveform, there are two choices of 2048, 4096;

(11) **Delay length**: the starting point of the waveform sampling relative to the starting point of the emission, used to adjust the horizontal position of the waveform;

2.6 Waveform operation

2.6.1 Dynamic Waveform Operation

In the dynamic sampling state, select the corresponding waveform area as shown in Figure 2-5, click the operation area button on the right side of the screen as shown in Figure 2-6, you can operate the waveform accordingly.

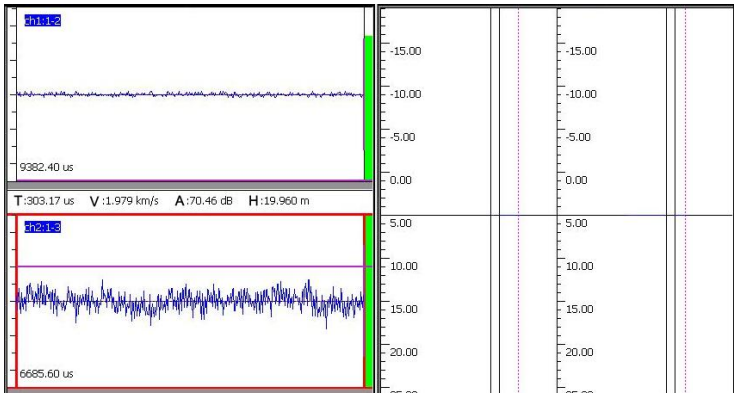


Figure 2-5 Waveform area selection

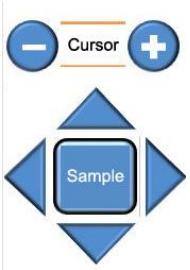


Figure 2-6 Operating area

(1) **Gain adjustment**: Click the ▲, ▼ button to increase or decrease the gain;

(2) **Moving the dynamic waveform**: Click the ◄, ► button to move the dynamic waveform to the left or right, thereby reducing or increasing the number of delay points;

2.6.2 Static Waveform Operation

In the static waveform state, select the corresponding waveform area as shown in Figure 2-5, click the operation area button on the right side of the screen as shown in Figure 2-6, you can operate the waveform accordingly.

(1) **Move the cursor left and right**: Click the +, - button to move the vertical (sound) cursor and display the sound time value of the cursor position in the cursor parameter area;

(2) **Move the cursor up and down**: Click the ▲, ▼ button to move the horizontal (amplitude) cursor, and display the amplitude value of the cursor position in the cursor parameter area;

(3) **Moving the static waveform**: Click the ◄, ► button to move the current waveform to the left or right;

2.7 Data Management

Data management is mainly used to view the measured projects and files, and can be copied to a USB flash drive or deleted after selecting a project or file.
The data management interface is shown in Figure 2-7. The left part of the interface is the project list, and the right part is the list of all components in the current project (the pile data management also has a pile file list), and the lower part of the interface is the function button area. When there is more content in the data list, a scroll bar will appear on the side of the list box. If you drag the scroll bar, you can flip the page, or you can swipe up and down in the list area to scroll.

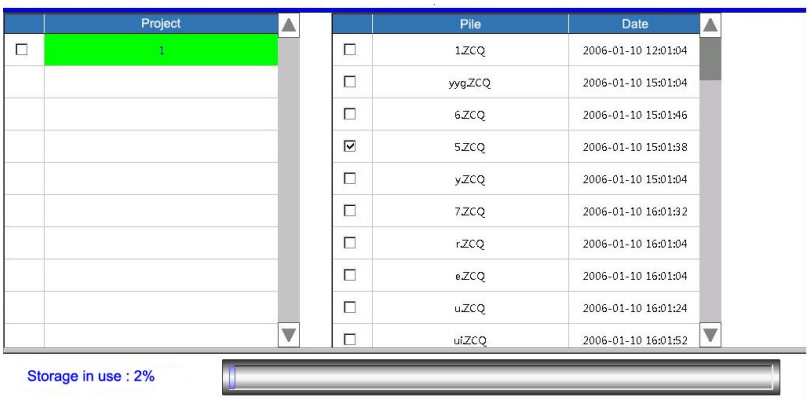


Figure 2-7 Data Management Interface

2.7.1 Operation method

(1) After clicking a project in the project list, all the files in the project will be listed in the file list (if the pile test module will list all the pile files in the pile list, click on a pile file) Will list all the files in the list of measurements), click on the checkbox in front of a file in the file list to select the file;
(2) Double-click the list area to check or cancel all the check boxes in front of the project or file.

2.7.2 Opening a file

After selecting a file in the file list area and clicking the Open button, the selected file will be opened and returned to the main interface to display the waveforms, curves, etc. stored in the file (the two functions can be selected at the same time in the pile function, other functions only Can choose to open a file).

2.7.3 Project and document export

Insert the USB flash drive, the U disk icon appears in the upper right corner of the screen, select the project or file you want to export and click the Export button to copy all the files in the selected project to the USB flash drive.

When the project or file is not checked, a message will be given. When exporting a project or file, a folder with the corresponding function name such as “measured pile”, “measured”, etc. will be created on the USB flash drive, and a subfolder will be created with the project name, and then all files or selected files in the project will be created. Copy to this subfolder (the pile function also creates a stub folder).
Before copying the file, check whether the USB flash drive exists. If it does not exist, prompt the user to insert the USB flash drive before copying.

2.7.4 Deletion of works and documents

After checking one or more projects, click the delete button to delete the selected project and all the files in it; if you select one or more files and click the delete button, the selected file will be deleted. When the project or file is not checked, a message will be given.
Before deleting a project or file, you will be asked if you want to delete the selected project or file.
Press the enter button to delete, otherwise it will not be deleted.

2.8 zero adjustment

Zero sound refers to the sound delay of the ultrasound system and the transmitting and receiving transducer system. The measured sound time value must eliminate zero sound. Zeroing refers to when zero sound is obtained through testing. This should be done the first time you use the ultrasound system, replace the sensor, or signal cable.

2.8.1 Manual zero adjustment

After the sound is read on the waveform, the zero sound option is found in the parameter interface, and the zero sound that can be read can be directly input manually.

2.8.2 Automatic zero adjustment

In addition to the pile measurement function, other functions are automatically zeroed. After entering the corresponding function module from the main interface, the zero adjustment button will be displayed in the upper left corner. Click the zero adjustment button to pop up the zero adjustment interface shown in Figure 2-8.

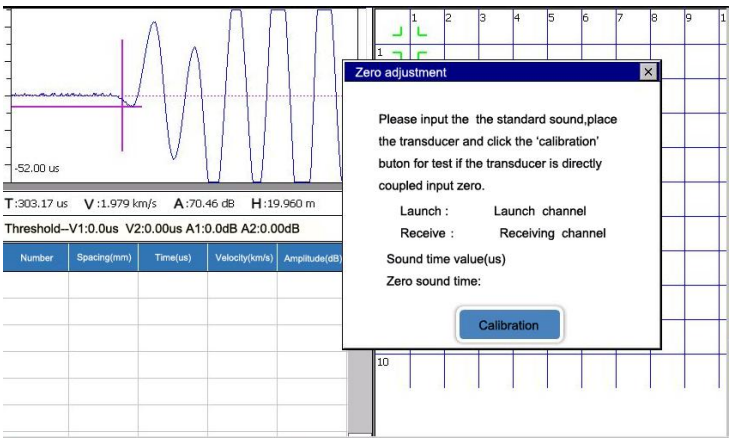


Figure 2-8 Zeroing interface

(1) After selecting the channel to be zeroed, input the standard sound according to the prompt (if using the standard rod for zero adjustment, enter the standard sound time value of the standard rod. If the direct river transducer is zeroed, enter 0.);

(2) After coupling the transducer according to the prompt, click the zero adjustment button to start sampling automatically, display the waveform in the waveform area, and automatically search for the first wave.

(3) Adjust the waveform on the main interface, find the first wave and click the stop button to stop sampling. At this time, the software automatically calculates the new zero sound and displays it. When the sound time value is automatically set to zero, write it. In the parameter file, click × to close the Zero Time dialog box.

2.9 Battery power

The battery level icon is displayed in the upper right corner of the screen, and different status icons are displayed according to the remaining battery capacity, as shown in Figure 2-9. After the battery alarm, save the data and charge it.

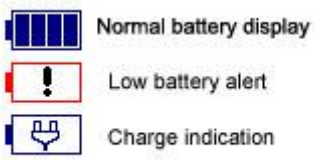


Figure 2-9 Battery Power

2.10 System Settings

The system setting function is mainly used to set the instrument information, common parameters, etc., as shown in Figure 2-10. After the modification is completed, click the OK button to save the new parameters.

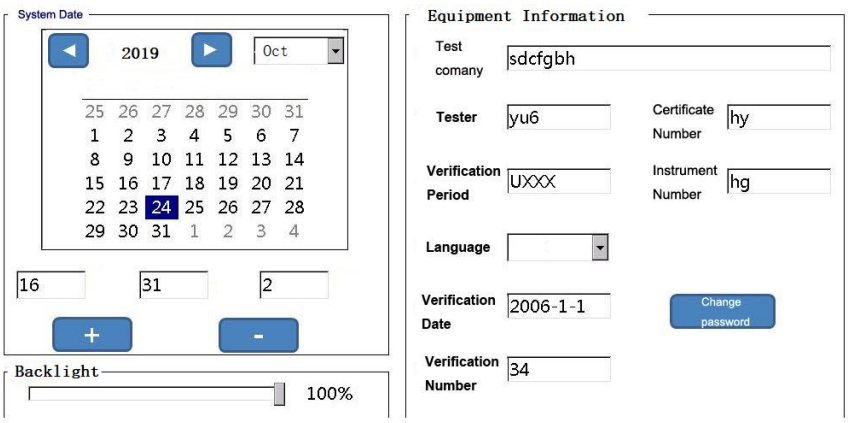


Figure 2-10 System Settings Interface

2.10.1 System Date and Time

In the system date and time label box, you can set the current instrument time information. You can set the system's year, month, and day by clicking different buttons in the calendar. After selecting the hour, minute, and second input boxes, you can adjust by clicking the +, - buttons. Current display time.

2.10.2 Backlight adjustment

Drag the backlit scroll bar to adjust the backlight brightness of the screen.

2.10.3 Device Information

In the device information tab, you can set the detection information and check the instrument number, license number, and so on. To change this information, you need to enter a password. The default factory password is "1234". The user can modify the original password by clicking the Change Password button.

2.10.4 Touch screen calibration

Click the touch calibration button to pop up the touch screen calibration interface as shown in Figure 2-11. The user needs to click on the corresponding cursor position according to the text description to obtain the new calibration coordinates.

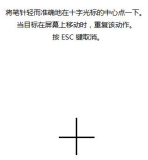


Figure 2-11 Touch calibration interface

2.10.5 Software Upgrade

Copy the upgrade program to the USB flash drive, insert the USB flash drive, and after the USB flash drive icon is displayed in the upper right corner, click the software upgrade button. The system will update the program in the machine. If there is no upgrade program in the USB flash drive or the USB flash drive is not inserted, A corresponding prompt box will pop up.

2.10.6 Software Version

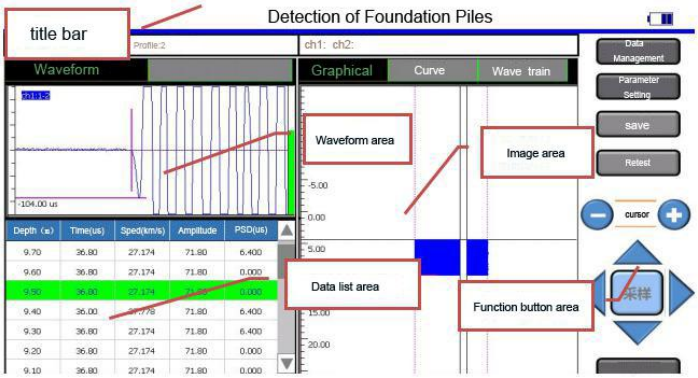
Click the software version button, the current software version information will pop up, as shown in Figure 2-12.

Figure 2-12 Software version

Chapter III Sound Wave Transmission Method

3.1 main interface

The main interface of the test pile software is shown in Figure 3-1. The interface consists of four parts: function button area, waveform area, image area and title bar. The waveform area and image area are composed of different label items. Click on different Tags can be switched between different views.



Single channel interface

Figure 3-1 Main interface of the test pile

(1) **Function button area**: It is mainly composed of function buttons such as data management and parameter setting, and control buttons for controlling sampling and waveform movement. When the button font color is grayed out, it indicates that the button is invalid in the current state;

(2) **Waveform area**: divided into two columns: waveform display and data list. The former is used to display the waveforms and acoustic parameters of the current measurement points of each section, and the latter is used to display the list of sound parameters of each measurement point;

(3) **Image area**: divided into three tabs: graph, curve and wave train, which are used to display the histogram, graph, wave map and other views of each section;

(4) **Title bar**: used to display the project name, the name of the pile, the name of the section, etc.;

3.2 Parameter settings

Click the parameter setting button on the main interface of the test pile, and the parameter setting interface shown in Figure 3-2 pops up. The default value of each parameter is the value set last time.

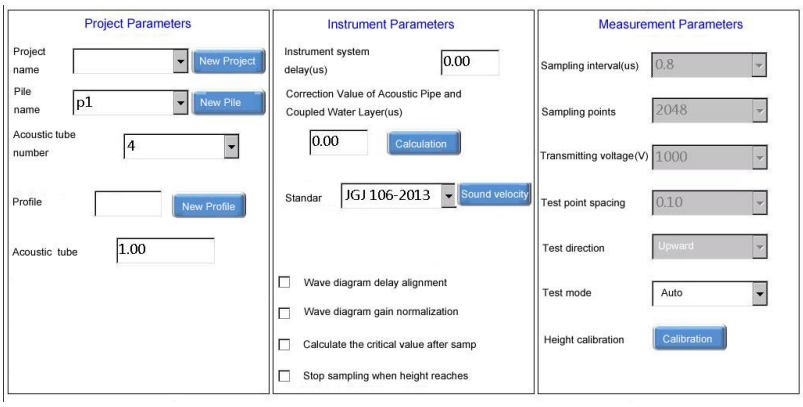


Figure 3-2 Parameter setting interface

After setting all the parameters, press the enter button to save the set parameters and return to the main interface; press the Back button to save the parameters and return to the main interface.

3.2.1 Engineering parameters

In the engineering parameters, you can create a new project name and pile name, and set parameters such as the number of sound tubes.

New project or select existing project

Click the New Project button to pop up the character input soft keyboard. After entering the project name, the subfolder will be created with the project name. All the data files of all the piles tested will be saved in this folder. When creating a folder, if a project with the same name already exists, a corresponding prompt message will pop up.

Click the ▼ button after the project name drop-down list box to list all the tested projects. You can select a measured project from the project list, and the pile data file tested later will be saved in the project.

New pile or select existing pile

If you are testing a new pile, click the New Pile button and enter the new pile name in the pop-up character input soft keyboard. If you find the same name pile file, the corresponding prompt message will pop up.

Click the ▼ button after the pile name drop-down list box to list all existing pile names. You can select a measured pile from the project list, and the profile data file tested later will be saved in the pile folder.

Number of sound tubes

Click the ▼ button after the sound tube number drop-down list box to select the 2, 3, and 4 tubes. This value is set according to the number of sound tubes that are embedded in the pile to be tested.

New profile

Click the New Section button of Channel 1, Channel 2 to pop up the section selection dialog box. Different sound tube diagrams will be displayed depending on the number of sound tube settings. On the right side of the dialog box, select the number of the sound tube corresponding to the section to be tested. Click the enter button to create the new section. If the section already exists, the corresponding prompt will pop up.

Sound tube spacing

The net spacing of the outer wall of the acoustic tube, in meters (m). Click the edit box behind the corresponding sound tube spacing to set the sound tube spacing in the pop-up numeric soft keyboard.

3.2.2 Instrument parameters

Channel selection

Click the ▼ button after the channel selection drop-down list box to select the channel used for the test. There will be corresponding changes in the engineering parameters depending on the selected channel.

Instrument delay parameter

When the instrument system delay is used to set the zero sound of the two channels of the instrument, you can set these two values to 0 first when zeroing, and then get the zero sound of channel 1 and channel 2 by the "2.8.1 manual zero adjustment" method. When you finally get the zero sound input, you can.

When measuring the pile by the acoustic wave transmission method, in addition to deducting instrument system delay, it is necessary to deduct the sound of the acoustic wave in the sound wall and water, that is, the sound tube and the sound layer correction time.

Click the calculation button to enter the interface shown in Figure 3-3. You can set the acoustic tube inner diameter, the acoustic tube outer diameter, the transducer outer diameter, the acoustic tube sound velocity and the water sound velocity. After inputting, click on the calculation in the dialog box. The button system calculates the correction value when the sound is clicked, and the current value is replaced by the new calculated value after clicking the enter button.

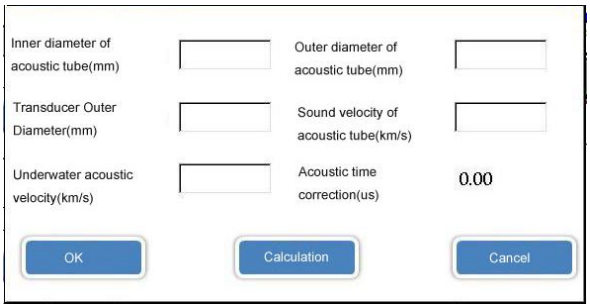


Figure 3-3 Correction value of acoustic tube and coupled water layer sound

Wave chart parameters

When you select the wave chart delay alignment, you can make the display start time of all waveforms the same. Once the wave map gain is normalized, the gains of all waveforms can be normalized to make the amplitudes of all waveforms comparable.

Calculation parameter

When the threshold is calculated after stopping sampling, the graph area will only refresh the sampling threshold after the sampling ends. Selecting the transducer zero-crossing to stop sampling can automatically stop sampling when the pile length reaches zero during the sampling process.

3.2.3 Measurement parameters

Sampling interval

Click the ▼ button after the sample interval drop-down list box, there are a variety of parameters to choose from, suitable for most measurement occasions.

Sampling points

The number of samples of a single waveform collected each time, if there is no special need, do not choose a larger value, otherwise it will affect the speed of dynamic acquisition.

Emission voltage

The value of the excitation voltage when the ultrasonic transducer is excited by the transducer to generate the ultrasonic pulse is selected. When the other test conditions are constant, the higher the emission voltage, the stronger the received signal.

Test direction

You can choose to test up or down. The default is up. When testing upwards, first place the transducers in each acoustic tube to the bottom of the pile and then test during the upward lifting; when testing down, first place the transducers into the pile head and then down. Test during the process.

Test mode

Manual and automatic modes can be selected. If the recording and recording device is not equipped, the manual mode must be selected. Each measuring point needs to be saved manually. If equipped with a deep recording device, the automatic mode can be selected, and each measuring point is automatically saved.

Increase accuracy

When the lift position displayed by the pile system is not accurate, it is necessary to calibrate the system to improve the accuracy. You can click the recalibration button to pop up the calibration window, as shown in Figure 3-4.

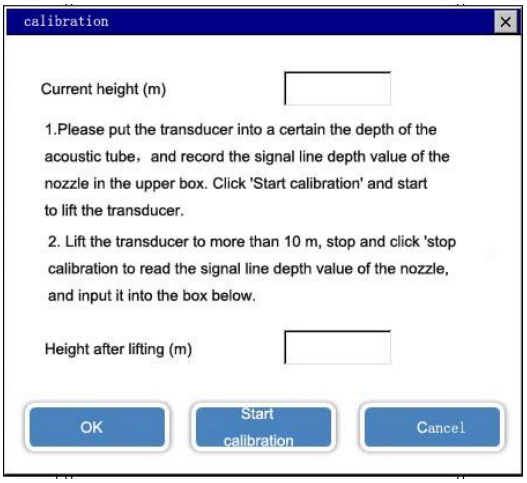


Figure 3-4 Lifting device calibration interface

(1) Place the transducer into a position in the sound tube as prompted, read the depth value of the transducer signal line on the nozzle, click the transducer current height edit box, and enter it in the pop-up numeric keypad. Current transducer depth value, then click to start calibration;

(2) Put the transducer signal line into the slot of the counting wheel and start lifting;
(3) After lifting 10 to 30 meters, stop lifting, read the depth value on the transducer signal line of the nozzle again, input its value into the boosted transducer height box, and then press the enter button to complete the lifting. Accuracy correction, press the cancel button, the calibration is invalid;
(4) If the lifting accuracy still does not meet the requirements, repeat the above steps to recalibrate;

3.3 Start testing

3.3.1 Start sampling

After setting the parameters, click the enter button to return to the main interface. Place each transducer, then press the Sampling button and the system will automatically adjust the gain search first wave.
After adjusting the waveform of the first measuring point of each section and pressing the save, the setting of the length of the pile as shown in Figure 3-5 is displayed, prompting the input of the depth (height) value of the first measuring point. This value is obtained by the depth mark of the signal line of the transducer.

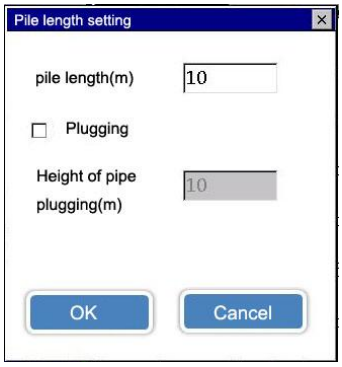


Figure 3-5 Setting the pile length interface

The starting point of the test is the depth (height) value of the first measuring point. After the transducer is placed at the bottom of the pile, the depth mark value of the signal line at the mouth of the acoustic tube is read.
If the acoustic tube is blocked (ie, the transducer cannot be placed at the bottom of the pile), you can check the blocking status of each acoustic tube by checking the Block setting check box in Figure 3-5. If the tube is not blocked, the depth values of the sound tubes should be equal. If a sound tube is blocked, the depth value will be smaller than other sound tubes. In this case, click the edit box after the sound tube to enter the actual depth value. can.
If there is a pipe plugging phenomenon, in the data acquisition, first remove the transducer cable from the sounding tube from the lifting device, and then switch the transducer cable in the sounding tube when other sections are tested to the blocking position. Put it in the lifting device and lift it together.
After saving the first measuring point, click the sampling button again to enter the fast

mining mode. At this time, the transducers need to be synchronized, uniformly raised or lowered, and the pile measuring system will automatically record the data of each measuring point. Do not raise or lower the speed too fast, and do not suddenly accelerate or decelerate.

When the lifting or lowering speed is too fast and the system is too late to respond, a prompt box will appear on the screen prompting you to return the transducer to a certain position, as shown in Figure 3-6. At this point, you need to put the transducer back to the specified position, and then click the enter button in the prompt box to close the prompt box. At this point, you can continue to raise or lower the transducer until the test of the profile is completed.

Figure 3-6 Lifting too fast

If the manual test mode is used, the save button must be pressed once after each measurement point is measured, and then the transducer is moved to the next measurement point to continue the test, and the height value of the next measurement point will appear in the title bar.

3.3.2 Stop sampling

After all the measuring points have been collected, you can stop the sampling by pressing the stop button, and the stop button will become the sampling button.

3.3.3 Storing data

After the acquisition is completed, click the save button in the stop sampling state, the system will save the current test data to the disk.

3.3.4 Retest

Retesting refers to retesting some or all of the data that has been tested. Unsatisfactory data can be re-tested at any time during the sampling process.

Click the retest button in the fast mining stage, and the pop-up setting re-test starting point dialog box is shown in Figure 3-7. Select the channel to be re-tested according to the need and set the re-test starting point and click the enter button to enter the re-test mode.

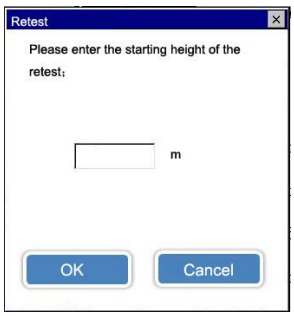


Figure 3-7 Setting the retest starting point interface

Click the sampling button in the retest mode, and the prompt box will pop up as shown in Figure 3-8. Prompt to place the transducer at the height of the retest starting point. After the transducer is placed, click the enter button to start sampling. At this time, the transducer is boosted. The new data will automatically overwrite the previous data.

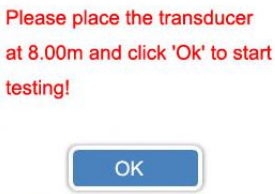


Figure 3-8 Retest sampling tips

After the retest is completed, click the exit retest button to automatically exit the retest mode. At this time, the exit retest button will be changed to the retest button.

3.4 View Switching

Click on each tab item in the main interface of the test pile to switch between different views as shown in Figure 3-9. When you click on the corresponding view area, the view will be rendered with a red border.

Figure 3-9 View switch label

3.4.1 Waveform display

Please refer to 2.4 Waveform Display and Operation section.

3.4.2 Data List

Displays all the measurement data of the current profile, as shown in Figure 3-10. Click on the data list area, select the measurement point line to display in green, and select the current measurement point in the other view area.

Depth (m)	Time(us)	Speed(km/s)	Amplitude	PSD(us^2/
9.70	36.80	27.174	71.80	6.400
9.60	36.80	27.174	71.80	0.000
9.50	36.80	27.174	71.80	0.000
9.40	36.00	27.778	71.80	6.400
9.30	36.80	27.174	71.80	6.400
9.20	36.80	27.174	71.80	0.000
9.10	36.80	27.174	71.80	0.000

Figure 3-10 Data List

3.4.3 Graphics

The graphical display is shown in Figure 3-11. It displays a histogram of the sound velocity-depth curve and the amplitude-depth curve of each measurement point of the profile, and dynamically refreshes it in real time during the test, so that you can observe the test results of the entire profile at any time. . The upper part of the curve corresponds to the pile head and the lower part corresponds to the bottom of the pile. The sound speed-depth histogram is shown on the left and the amplitude-depth histogram is shown on the right. The blue area represents the normal value. The flooding indicates that there is an abnormality in the area. The larger the red area, the more serious the abnormality. You can view a graphical view at different locations by swiping up and down on the left scale area.

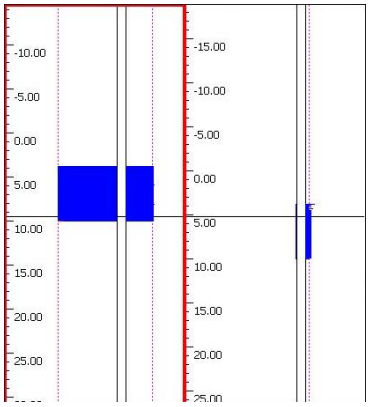


Figure 3-11 Graphical view

In the middle of the histogram there is a dark rectangular block called the transducer position indicator, which moves with the movement of the transducer during the test, showing where the transducer is in the sonic tube.

When the sampling state is stopped, a horizontal cursor appears in the graph area, indicating that the current measuring point is selected, and other views are also linked to select the current measuring point. In the selected state of the graph, you can view the different measuring point data by clicking the ▲, ▼ buttons on the right function button area to move the cursor.

3.4.4 Curve

The curve view shows the depth-PSD, depth-sound speed, depth-amplitude curve of each section in the same coordinate system, as shown in Figure 3-12. The PSD curve is represented by red, the sound velocity curve is represented by green, and the amplitude curve is represented by blue. You can view the curve view at different locations by swiping up and down on the left scale area.

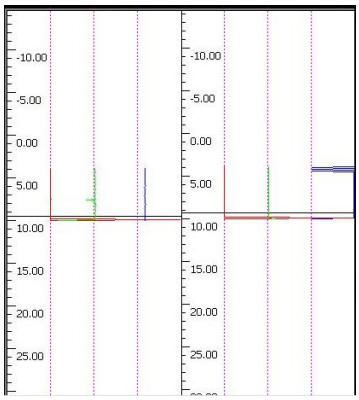


Figure 3-12 Curve view

When the sampling state is stopped, a horizontal cursor appears in the curve area, indicating that the current measuring point is selected, and other views are also linked to select the current measuring point. In the selected state of the graph, you can view the different measuring point data by clicking the ▲, ▼ buttons on the right function button area to move the cursor.

3.4.5 Wave train

The wave train view displays the waveforms of all the measuring points in each section according to the height position, as shown in Figure 3-13. The blue cursor indicates the first wave interpretation line of each measuring point waveform. You can view the wave train view at different locations by swiping up and down on the left scale area.

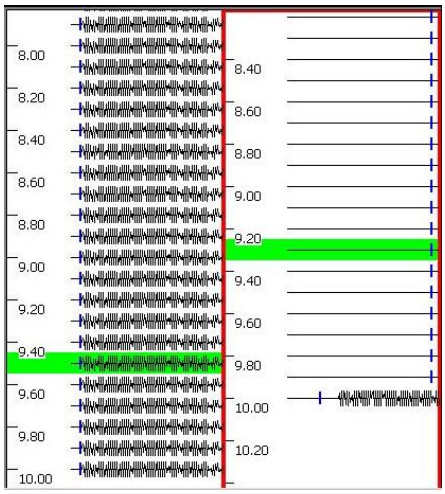


Figure 3-13 Wave column view

When the sampling state is stopped, the waveform of the current measuring point in the wave column area will be selected, and other views will also be linked to select the current measuring point. In the selected state of the graph, you can view the waveforms of different measuring points by clicking the ▲, ▼ buttons on the function button area on the right to move the cursor.

3.5 Exit

Click Exit on the main interface to close the test pile software and return to the system startup interface. Please check if the test data has been saved before exiting. If it is not saved, please click the save button to save.

Chapter IV Ultrasonic Non-compacting Area and Cavity Detection

4.1 main interface

The main interface of the missing software is shown in Figure 4-1. It consists of five parts: function button area, waveform area, data list area, defect schematic area and title bar.

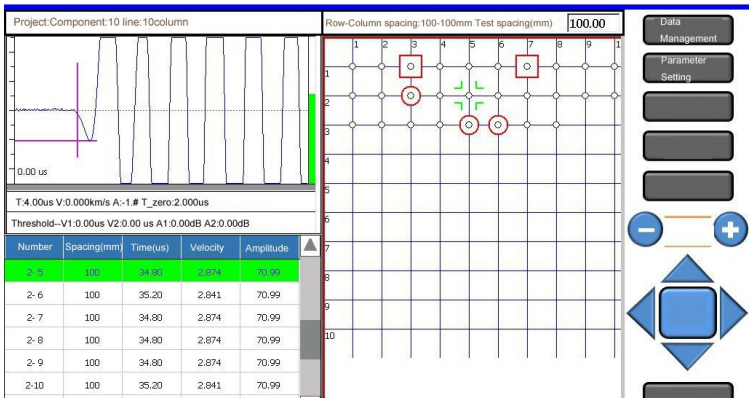


Figure 4-1 The main interface of the missing measurement

(1) **Function button area**: It is mainly composed of function buttons such as data management and parameter setting, and control buttons for controlling sampling and waveform movement. When the button font color is grayed out, it indicates that the button is invalid in the current state;

(2) **Waveform area**: used to display the waveforms and acoustic parameters of the current measuring point;

(3) **Data list area**: used to display ultrasound data for each measurement point;

(4) **Defect map area**: used to display the network layout of the test area and the distribution of suspicious points;

(5) **Title bar**: used to display the project name, component name, spacing, etc.;

4.2 Parameter Settings

Click the parameter setting button, and the dialog box shown in Figure 4-2 will pop up. The default value of each parameter is the last saved parameter value. After setting all the parameters, click the enter button, the new setting parameters will be saved and return to the main interface. If you click the back button, the parameter settings will be invalid and return to the main interface.

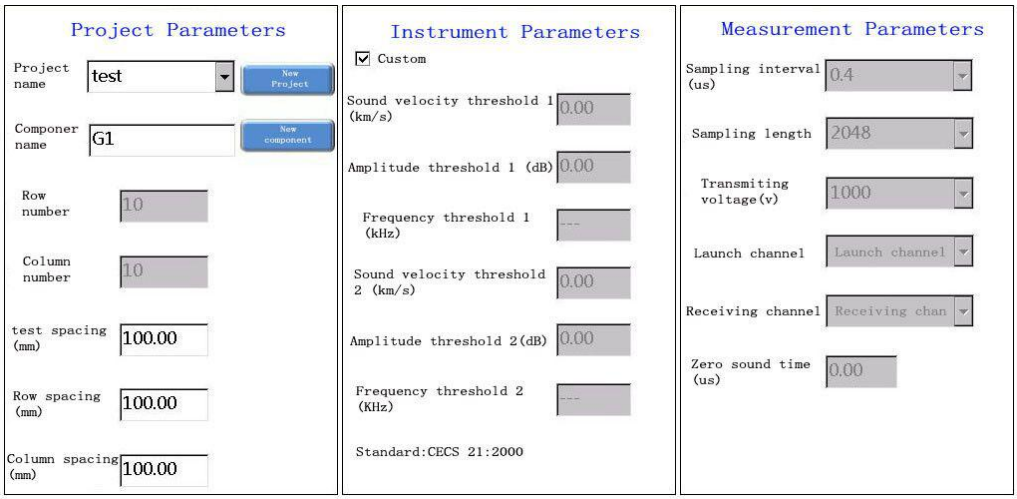


Figure 4-2 Parameter setting interface

4.2.1 Engineering parameters

New project or select existing project

Click the New Project button to pop up the character input soft keyboard. After entering the project name, the subfolder will be created with the project name, and the data files of all the components tested will be saved in this folder. When creating a folder, if a project with the same name already exists, a corresponding prompt message will pop up.

Click the ▼ button after the project name drop-down list box to list all the tested projects. You can select a measured project from the project list, and the component data of the test will be saved in the project.

New component

After testing a component, to test the next component, you can click the new component button after the component name, pop up the character soft keyboard, enter the name of the component to be tested, and complete the new component. If a component with the same name is found, a corresponding prompt message will pop up.

Row and column parameters

The number of rows refers to the total number of horizontal lines of the grid arranged on the member to be inspected, and the input range is 1 to 50. The number of columns refers to the total number of vertical lines of the grid arranged on the member to be inspected, and the input range is 1 to 50.

The line spacing refers to the distance between two adjacent measuring points divided in one line, and the column spacing refers to the distance between two adjacent measuring points in a column.

Ranging

Ranging refers to the distance traveled by sound waves and the center distance of the transmitting and receiving transducers, that is, the distance between the two test faces of the tested component, which is generally the thickness value.

4.2.2 Calculation parameters

There are two ways to obtain the critical value: default, reference, and the reference selection box is not specified when it is checked. The critical value of the acoustic parameter is calculated by the system according to the measurement and deficiency procedure, and the user cannot modify it; when selecting the reference, the user can Edit and modify the critical values of all acoustic parameters.
There are two critical values for each acoustic parameter, namely the critical value 1, the critical value 2. The critical value 1 is used to determine the abnormality of all the measuring points, and the critical value 2 is used to determine the abnormality of the measuring points around the abnormal point. The critical value 2 should be greater than the critical value of 1.

4.2.3 Measurement parameters

Receiving channel
Click the ▼ button after the Receive Channel drop-down list box to select the channel used to receive the transducer.
Zero sound
Refers to the acoustic time delay of the ultrasound system and the transmitting and receiving transducer systems. It can be entered manually here or by the zeroing method shown in 2.8.
For the meaning of other measurement parameters, please refer to the contents of the measurement parameters in Section 3.2.3.

4.3 Start the test

4.3.1 Start sampling

After the parameters are set, the two planar transducers are respectively connected to the transmitting channel and the receiving channel of the instrument by the signal line, and the transducers are respectively coupled to the first test of the two opposite test faces of the member to be tested. On the first measurement point of the line, click the sampling button in the function button area of the main interface, the system will automatically adjust the gain to find the first wave, and the sampling button will become the stop button.
After adjusting the waveform of the first measuring point, click the save button to save the first measuring point data. The data list area will display the data just saved in the row, and the first measuring point will appear in the defect schematic area.
After saving the first measuring point, move the two transducers to the next measuring point at the same time. After adjusting the waveform, click the save button and repeat it to know that all the measuring points have been tested.
In the dynamic sampling state, click the Insert Empty button in the function button area to

insert an empty measurement point. The empty measurement point data is displayed by "---", and the empty measurement point data is not involved in the calculation. The air measurement in the defect schematic area Points are indicated by dashed lines.
If you need to change the ranging during the sampling process, you can click the ranging input box on the title bar. After inputting the new ranging, the subsequent sampling data will be calculated using the new ranging value.

4.3.2 Stop sampling

During the sampling process, you can stop the sampling by clicking the stop button, and the stop button becomes the sampling button. After the sampling stops, click the save button and the current component data will be stored on the disk.

4.3.3 Retest

Retesting refers to retesting some or all of the data that has been tested.
Click the retest button during the test to enter the retest mode. Click the sampling button to start sampling, click the measuring point to be retested in the defect schematic area, make the measuring point selected, move the receiving and transmitting transducer to the measuring point and re-test, adjust the waveform and click the save button. The new data will overwrite the original data. Then select other points that need to be retested and repeat the test according to the above method.
After the retest is completed, click the exit retest button to automatically exit the retest mode. At this time, the exit retest button will be changed to the retest button.

4.4 Ultrasound data list area

The ultrasonic data list area displays the serial number, ranging, and acoustic parameters of each measuring point of the current component, as shown in Figure 4-3.

Number	Spacing(mm)	Time(us)	Velocity	Amplitude
1- 7	100	35.60	2.809	70.99
1- 8	100	35.20	2.841	70.99
1- 9	100	34.80	2.874	70.99
1-10	100	34.80	2.874	70.99
2- 1	100	34.80	2.874	70.99
2- 2	100	35.20	2.841	70.99

Figure 4-3 List of ultrasound data

In the ultrasound data list area, the selected data line is displayed in green, the waveform of the waveform area becomes the waveform of the measurement point, and the measurement point of the defect map area will also be selected.

4.5 Defect schematic area

The defect schematic area is located on the right side of the main interface, and the measurement point layout diagram of the current component is displayed in a grid manner. Each grid node represents a measurement point. During the test, the measured points are represented by dots.

After the test is completed, the measured points can be automatically calculated and judged according to the missing test procedure, and then the sound time, amplitude and abnormal point distribution maps are displayed with different symbols, as shown in Figure 4-4.

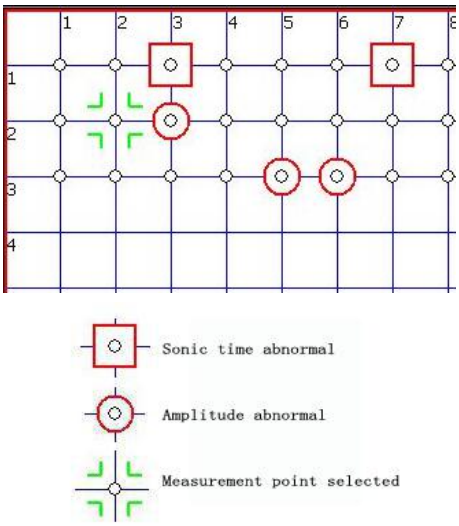


Figure 4-4 Defect diagram area

In the left side of the defect schematic area and the top row and column number area slide, you can move the grid up and down and left and right. When you click a measurement point on the grid, the selected point will appear as shown in Figure 4-4. The data of the area and the data list area will also be linked to display the data of the measurement point.

4.6 Exit

Click Exit on the main interface to close the missing software and return to the system startup interface. Please check if the test data has been saved before exiting. If it is not saved, please click the **save** button to save.

Chapter V Ultrasonic rebound comprehensive strength measurement

5.1 main interface

The main interface of the strength measurement software is shown in Figure 5-1. It consists of five parts: function button area, waveform area, data list area, schematic area and title bar.

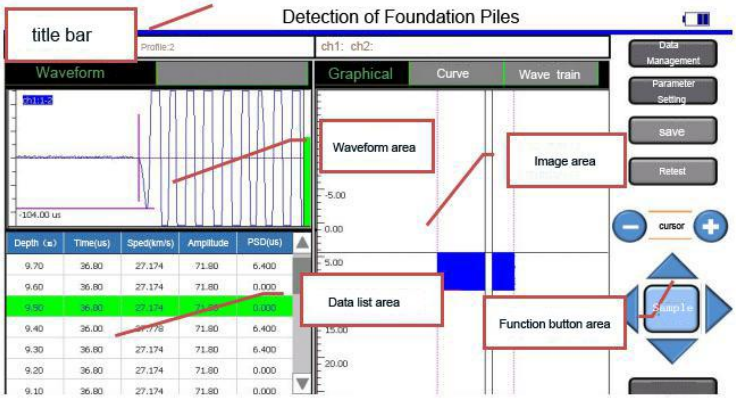


Figure 5-1 The main interface of the missing measurement

(1) **Function button area**: It is mainly composed of function buttons such as data management and parameter setting, and control buttons for controlling sampling and waveform movement. When the button font color is grayed out, it indicates that the button is invalid in the current state;

(2) **Waveform area**: used to display the waveforms and acoustic parameters of the current measuring point;

(3) **Data list area**: used to display ultrasound data for each measurement point;

(4) **Defect map area**: used to display the network layout of the test area and the distribution of suspicious points;

(5) **Title bar**: used to display the project name, component name, spacing, etc.;

5.2 Parameter settings

Click the parameter setting button, and the dialog box shown in Figure 5-2 will pop up. The default value of each parameter is the last saved parameter value. After setting all the parameters, click the enter button, the new setting parameters will be saved and return to the main interface. If you click the back button, the parameter settings will be invalid and return to the main interface.

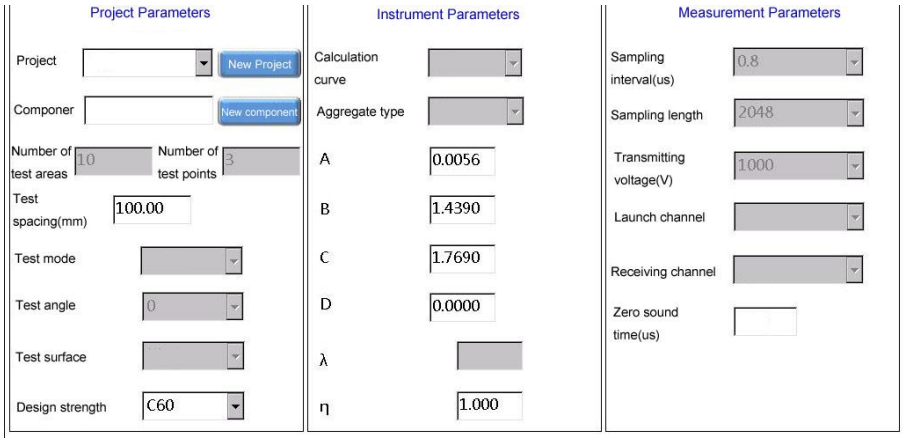


Figure 5-2 Parameter setting interface

5.2.1 Engineering parameters

For new construction and new construction, refer to the introduction in 4.2.1 Engineering Parameters in the section on measurement.

Number of zones

The number of measurement areas refers to the total number of measurement areas arranged on the component to be inspected, and the input range is 1 to 50.

Number of points

The number of measuring points refers to the total number of measuring points arranged in each measuring area. The value is determined by the selected procedure curve, and the user does not need to modify it.

Ranging

Distance measurement refers to the propagation distance of sound waves, and the center distance of the transmitting and receiving transducers. When the range is 1~5000mm, the measurement method can be used for the measurement, angle measurement and flat measurement. For the measurement, the distance is the distance between the two test faces of the component, which is generally the thickness value. When measuring flat, the distance between the two transducers is generally 350~450mm. The angle measurement is the distance of the hypotenuse, that is, the square root of the two right angle sides.

Detection method

When the comprehensive method measures strength, it can adopt three methods: measurement, angle measurement and flat measurement.

Test angle

The angle between the rebound rod and the test surface of the member to be tested during the rebound test.

Test surface

The type of test surface of the tested component can be selected from the side, the top surface and the bottom surface.

Design intensity

The design strength level of the member to be tested.

5.2.2 Calculation parameters

Protocol curve

When a different protocol curve is selected, the system will automatically display its coefficients in the following coefficients A, B, C, and D. In addition to the national unified curve, other provinces and cities have also developed regional regulations, and the coefficients in the calculation formulas of different provinces and cities are different.

Aggregate type

The type of coarse aggregate used for the member to be tested can be selected from pebbles and gravel.

Correction factor

The correction factors λ and η shall be calculated according to the definition in CECS02-2005 Technical Specifications for Testing Concrete Strength by Ultrasonic Resilience Comprehensive Method. The default value is 1.

5.2.3 Measurement parameters

For the meaning of the measurement parameters, please refer to the contents of the measurement parameters in Section 4.2.3.

5.3 Start testing

5.3.1 Start sampling

After the parameter is set, the two planar transducers are respectively connected to the transmitting channel and the receiving channel of the instrument by the signal line, and the transducers are respectively coupled to the first measuring area of the two test faces of the member to be tested. On the first measurement point, click the sampling button in the function button area of the main interface, the system will automatically adjust the gain to find the first wave, at this time the sampling button becomes the stop button.

After adjusting the waveform of the first measuring point, click the storage button to save the first measuring point data. The data list area will display the data just saved in the row, and the first measuring point will appear in the defect schematic area.

After saving the first measuring point, move the two transducers to the next measuring point at the same time. After adjusting the waveform, click the save button to display the current measuring point data in the data list area. When the measuring area is measured. When the last measurement data is clicked on the save button, the rebound test dialog box will pop up, as shown in Figure 5-3.

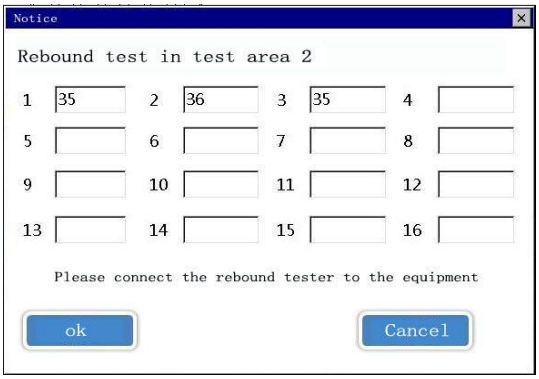


Figure 5-3 rebound test interface

At this time, if equipped with a rebounder, connect the hammer to the instrument interface and perform a rebound test. The interface will upload the rebound value each time in real time. If the rebounder is not connected, the user can also manually input the rebound value into the rebound test interface. When you are done, click the enter button and the system will automatically calculate the average rebound value and return the result to the data list area. If the rebound test is not performed for a while, you can click the Cancel button to return directly to the main interface for later modification.

After a test of the test area is completed, the sampling stops automatically, and the system estimates the strength of the test area and displays it in the data list. Click the sampling button again to start testing the next measurement area, and repeat until the measurement points of all the measurement areas are tested.

If you need to change the ranging during the sampling process, you can click the ranging input box on the title bar. After inputting the new ranging, the subsequent sampling data will be calculated using the new ranging value.

5.3.2 Stop sampling

When a test area is tested, the system will automatically stop sampling. However, if the user stops the sampling by clicking the stop button during the acquisition process, the system will automatically fill in the unmeasured measurement points of the current measurement area and display them in the data list with "---".

After the sampling stops, click the save button and the current component data will be stored on the disk.

5.3.3 Retest

Retesting refers to retesting some or all of the data that has been tested.

Click the retest button during the test to enter the retest mode. Click the sampling button to start sampling, click the measuring point to be retested in the data list area, make the measuring point selected, move the receiving and transmitting transducer to the measuring point and re-test, adjust the waveform and click the save button. The new measured data will overwrite the original data, and then select other measuring points that need to be retested according to the above method for retesting. If the retest point is the last measurement point in the survey area, the rebound test interface will pop up after

clicking the save button, and the rebound value of the test area can be retested.
After the retest is completed, click the exit retest button to automatically exit the retest mode. At this time, the exit retest button will be changed to the retest button.

5.4 Data list area

The data list area shows the serial number, ranging, and acoustic parameters of each measuring point of the current component, as shown in Figure 5-4.

No.	Spacing(mm)	Time(us)	Sped 1(km/s)	Speed 2(km/s)	Rebound 1	Rebound 2	Carbonization	Strength(MPa)
1- 1	100	27.60	3.62	3.62	0.00	0.00	---	0.00
1- 2	100	27.60	3.62	3.62	0.00	0.00	---	0.00
1- 3	100	27.60	3.62	3.62	0.00	0.00	---	0.00

Figure 5-4 Data list area

In the data list area, the selected data line is displayed in green, the waveform of the waveform area becomes the waveform of the measurement point, and the measurement point of the defect map area will also be selected.
The data in the data list area can also be changed. Double-clicking on a data line will pop up the data change dialog box shown in Figure 5-5, which can modify the three values of the current measurement point ranging, average rebound, and carbonization depth. When modifying the average rebound value, clicking the average rebound edit box will pop up the rebound test dialog box, and the user can modify the various rebound values of the survey area. After the modification, click the enter button to automatically pop up the modification interface of the next measurement area data. Repeat this until you have modified all the survey data. Click the Cancel button or the × button to exit the Modify dialog box.

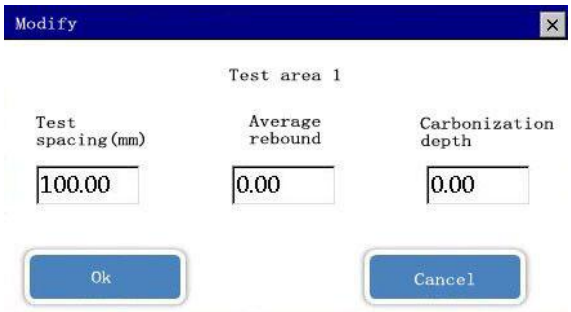


Figure 5-5 Change data

Here, the ranging, average rebound and carbonization depth values of all the measuring points in one measuring area must be the same. Modifying the ranging, average rebound and carbonization depth values of one measuring point, the ranging of all other measuring points in the measuring area The average rebound and carbonization depth values change accordingly. When the data is modified, other parameters will be recalculated.

5.5 Schematic area

The schematic area is used to display parameters such as test mode, estimated value, minimum zone strength, intensity average, and intensity standard deviation, as shown in Figure 5-6. The displayed values will change as the results of the test chang.

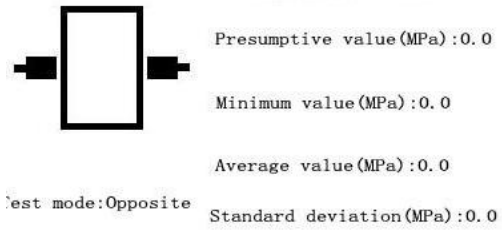


Figure 5-6 Schematic area

5.6 Exit

Click Exit on the main interface to close the strength testing software and return to the system startup interface. Please check if the test data has been saved before exiting. If it is not saved, please click the save button to save.

Chapter VI Ultrasonic Crack Depth Detection

6.1 main interface

The main interface of the seam testing software is shown in Figure 6-1. It consists of six parts: function button area, waveform area, measuring point data list area, crack data list area, regression curve area and title bar.

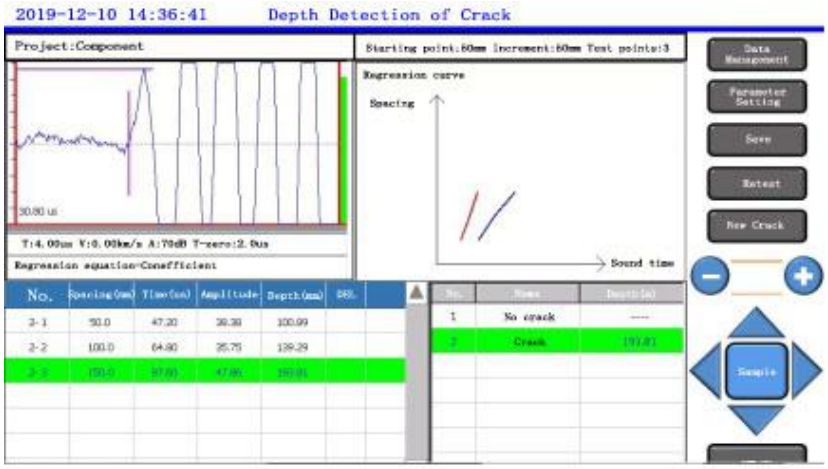


Figure 6-1 The main interface of the missing measurement

(1) **Function button area**: It is mainly composed of function buttons such as data management and parameter setting, and control buttons for controlling sampling and waveform movement. When the button font color is grayed out, it indicates that the button is invalid in the current state, and the new crack button is New seam function, the new seam default name is “crack” + serial number, in which each new crack number is automatically added 1;

(2) **Waveform area**: used to display the waveforms and acoustic parameters of the current measuring point;

(3) **Measuring point data list area**: used to display the original detection data and intermediate results of each measuring point of the current crack, and can set reverse point and reject data in the data list area;

(4) **Crack data list area**: used to display all crack information of the current component;

(5) **Regression curve area**: the solid blue line represents the acoustic time-ranging curve of each measuring point across the seam, and the red solid line represents the acoustic time-ranging curve of each measuring point that does not span the seam. During the test, the dynamic real-time refresh can be used to observe the test result of the current seam at any time, and the current estimated seam depth value is displayed at the upper right of the curve;

(6) **Title bar**: used to display the project name, component name, spacing, etc.;

6.2 Parameter settings

Click the parameter setting button, and the dialog box shown in Figure 6-2 will pop up. The default value of each parameter is the last saved parameter value. After setting all the parameters, click the enter button, the new setting parameters will be saved and return to the main interface. If you click the back button, the parameter settings will be invalid and return to the main interface.

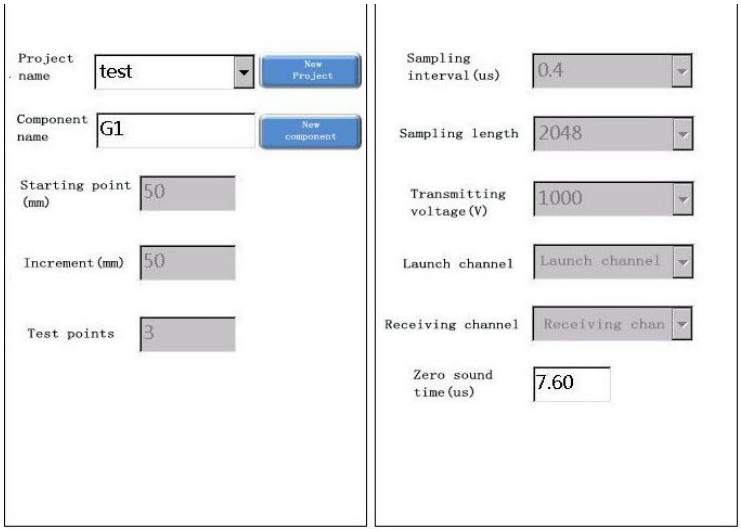


Figure 6-2 Parameter setting interface

6.2.1 Engineering parameters

For new construction and new construction, refer to the introduction in 4.2.1 Engineering Parameters in the section on measurement.

Starting point spacing

The starting point spacing is the distance between the transmitting and receiving transducer inner edges of the first measuring point, typically 100 mm.

Step

The distance between the transmitting and receiving transducers relative to each movement is generally 50 mm.

Preset measuring point

The number of measuring points for each crack measurement needs to be greater than three.

6.2.2 Measurement parameters

For the meaning of the measurement parameters, please refer to the contents of the measurement parameters in Section 4.2.3.

6.3 Start testing

6.3.1 Start sampling

In the crack test, the data must be tested without cross-slit, and then the cross-slit data is measured. After the new component is built, the first default measurement is that there is no cross-slit data, and there is no cross-slit test without cross-slit data.
After setting the parameters of the parameters, arrange one of the cross-sew line and the cross-slot line on the member to be tested, and arrange the measuring points on each line (the measuring points of the cross-seam line must be symmetric on both sides of the seam) Arrangement).
The two planar transducers are respectively connected to the transmitting channel and the receiving channel of the instrument by signal lines, and the transducers are respectively coupled to the two measuring points of the member to be tested that are not closest to the seam measuring line (transducer) The inner edge is tangent to the measuring point), and then click the sampling button in the function button area of the main interface, the system will automatically adjust the gain to find the first wave, at this time the sampling button becomes the stop button.
After adjusting the waveform of the first measuring point, click the save button to save the first measuring point data. The data in the measuring point data list will display the data just saved in one row. At this time, the system will stop sampling automatically.
After saving the first measuring point, move the two transducers to the next measuring point at the same time, and click the sampling button again to start sampling the second measuring point, and repeat until all the measuring points are tested.
After the cross-stitch test is completed, click the new crack button, a new crack will appear in the data list area, and then the test points of the crack will be tested in turn according to the above steps, and the estimated crack depth value can be obtained.

6.3.2 Stop sampling

When a test point is tested and the save button is clicked to update the data, the system will automatically stop sampling. At the same time, the user can also stop sampling by clicking the stop button during the acquisition process.
After the sampling stops, click the save button and the current component data will be stored on the disk.

6.3.3 Retest

Retesting refers to retesting some or all of the data that has been tested.
Click the retest button during the test to enter the retest mode. Click the sampling button to start sampling, click the measuring point to be retested in the measuring point data list area, make the measuring point be selected, move the receiving and transmitting

transducer to the measuring point position and re-test, adjust the waveform and click save Button, the new measured data will overwrite the original data, and then select other measuring points that need to be retested according to the above method for retesting.
After the retest is completed, click the exit retest button to automatically exit the retest mode. At this time, the exit retest button will be changed to the retest button.

6.4 Point data list area

The measurement point data list area is used to display the original detection data (ranging, sound time, etc.) and intermediate results (calculation seam depth, etc.) of each measurement point of the current crack, as shown in Figure 6-3. When a certain data line is clicked in the area, the data line turns green, the current measuring point is selected, and the waveform area displays the measuring point waveform.

No.	Spacing(mm)	Time(us)	Amplitude	Depth(mm)	DEL	▼▲
2-1	50.0	47.20	38.38	100.89		
2-2	100.0	64.80	35.75	139.29		
2-3	150.0	87.60	47.86	193.81		

Figure 6-3 Measurement point data list area

Double-clicking on a row of measurement data will pop up a data change dialog box. Users can set reverse point and delete operations in the dialog box, as shown in Figure 6-4.

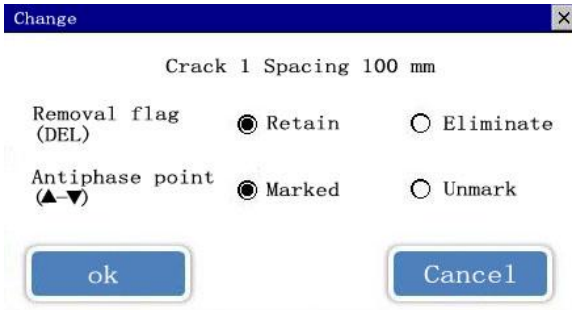


Figure 6-4 Data change

The user can save or reject the selected measuring point in the data change interface. If the save item is selected, the data is valid. If the reject item is selected, the measuring point will not participate in the average calculation, and only the average value of the depth value of the retained measuring point is used as the crack. The calculated depth.
The Mark/Remove Reverse Point function is only effective when the current data is spanned. Each crack has at most one inversion point, so after a certain measuring point is marked as an inversion point, the previously set reverse point mark is removed. A “*” sign will be displayed before the measurement point number of the reverse point.
After the measurement of the measurement point data is completed, click the enter button, the new change will take effect, and the measurement data list area will update the status of the current measurement point.

6.5 Crack data list area

The seam data table area mainly displays the basic information of all seams of the current component, including: serial number, name, and seam depth parameters, as shown in Figure 6-5.

NO.	Name	Depth(mm)
1	No crack	----
2	Crack 1	50.7
3	Crack 2	

Figure 6-5 Crack data list area

After clicking on a data line, the seam is set to the current seam, and the data of all the measurement points is displayed in the measurement point data list area.

6.6 Regression curve area

The regression curve area mainly displays the “time-distance” curve of the cross-slit data and the currently selected cross-slit data, as shown in Figure 6-6. The solid blue line represents the acoustic-ranging curve of each measuring point of the current span. The red solid line represents the acoustic time-ranging curve of each measuring point that does not span the seam. During the test, the dynamic real-time refresh can be used to observe the test result of the current seam at any time, and the current estimated seam depth value is displayed at the upper right of the curve.

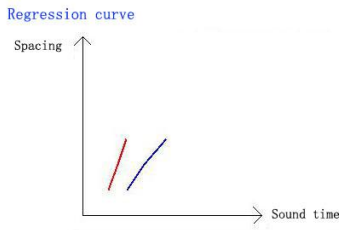


Figure 6-6 Regression curve area

6.7 Exit

Click Exit on the main screen to close the seam measurement software and return to the system startup interface. Please check if the test data has been saved before exiting. If it is not saved, please click the save button to save.

Chapter VII Crack Width Detection

7.1 main interface

The main interface of the seam width software is shown in Figure 7-1. It consists of five parts: function button area, image area, measuring point list area, timing setting area and title bar.

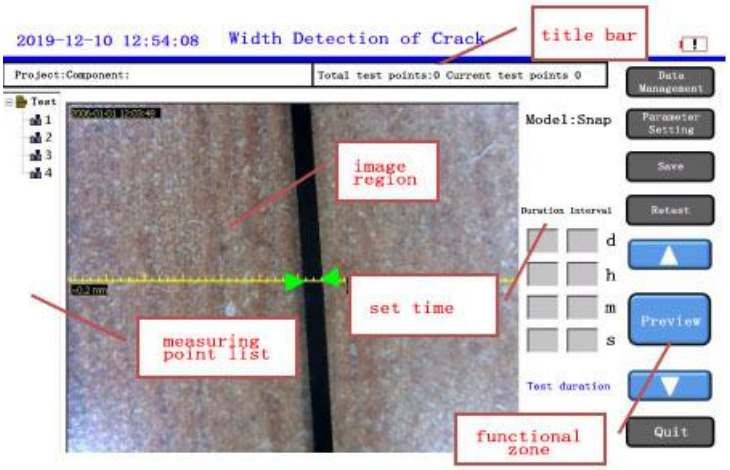


Figure 7-1 Measuring width main interface

(1) **Function button area**: mainly consists of function buttons such as data management, parameter setting, and control buttons for controlling sampling and image preview. When the button font color is grayed out, it indicates that the button is invalid in the current state;

(2) **Image area**: used to display the crack width image of the current measuring point. During the test, the software will automatically mark the crack position with the green arrow. After stopping the preview, the user can click the arrow area to move the arrow mark position. At this time, the slit width will also change according to the arrow. The middle yellow tick mark shows a 0.2mm scale for user comparison. The upper left corner shows the shooting time of the current measurement point.

(3) **Measuring point list area**: used to display the measuring points included in the current crack component. You can click on the corresponding measurement point number to view it;

(4) **Timing setting area**: used to set timing time and interval information in the timing monitoring mode;

(5) **Title bar**: used to display information such as project name, component name, and number of measurement points;

7.2 Parameter settings

Click the parameter setting button, and the dialog box shown in Figure 7-2 will pop up. The default value of each parameter is the last saved parameter value. After setting all the parameters, click the enter button, the new setting parameters will be saved and return to

the main interface. If you click the back button, the parameter settings will be invalid and return to the main interface.

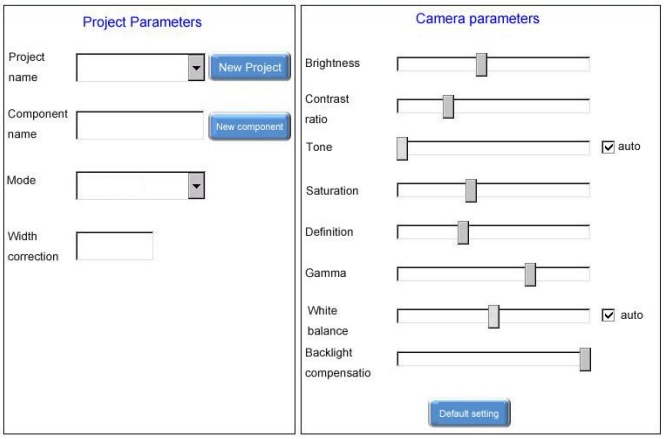


Figure 7-2 Parameter setting interface

7.2.1 Engineering parameters

For new construction and new construction, refer to the introduction in 4.2.1 Engineering Parameters in the section on measurement.

Test mode

Including the camera preview and timing monitoring, wherein the former is manually clicked by the user to store the measurement points, and the latter automatically saves the measurement points according to the user's set photo interval within a prescribed time period.

Width correction

This value is used to correct the difference between the actual measurement width and the display width. Generally, the camera has been set at the factory without modification. If it needs to be modified, it can be adjusted according to the calibration sheet matched with the instrument.

7.2.2 Camera parameters

The camera parameters are used to control the display effect of the camera. If you encounter the environment to make the image displayed by the camera unclear, you can manually adjust the set of parameters to achieve better image quality. Click the Default Settings button to return the group parameters to their default values.

7.3 Start testing

Connect the camera to the corresponding jack of the host before starting the test, otherwise you will be prompted not to find the camera.

7.3.1 Photo preview

Click the preview button in the photo preview mode to start the camera. At this time, the preview button becomes the stop button. The image area displays the image uploaded by the camera. The software automatically locks the width of the crack and marks the position of the crack width with a green arrow.
When the crack width is recognized and the save button is clicked, the camera stops previewing, and the current image is saved as a new measuring point, and the measuring point number is incremented by one. If you click the stop button, the camera also stops previewing, but the current image is not saved.

7.3.2 Timing monitoring

In the timing monitoring mode, the timing duration and the photographing interval must be set first, and the corresponding timing time is input in the day, hour, minute, and second setting boxes in the timing parameter area. After the setting is completed, click the preview button. At this time, the preview button becomes the stop button, the image area displays the image uploaded by the camera, and the measured time shows the time when the test has started. When the set time of the photographing interval is reached, the software automatically stores the image as a new measuring point.
When the timing is reached or the user clicks the stop button, the software stops the timing status and monitoring.

7.3.3 Retest

If the test point that has been tested needs to be retested, you can click the retest button to enter the retest mode. At this time, the retest becomes the exit retest button. Select the measuring point that you want to retest, click the preview button to start the retest, and after identifying the crack width, click the save button, the new measured data will overwrite the original data, and then select other measuring points that need to be retested according to the above method. retest.
After the retest is completed, click the exit retest button to automatically exit the retest mode. At this time, the exit retest button will be changed to the retest button.

7.4 Exit

Click Exit on the main screen to close the seam measurement software and return to the system startup interface. Please check if the test data has been saved before exiting. If it is not saved, please click the save button to save.

Appendix 1 Field Test Quick Operation Guide

1.1 Acoustic transmission method to detect the integrity of piles

1.1.1 Site preparation

First, the inspection personnel are divided into divisions. The general instrument operation and on-site recording are one person, and the measurement and retracting transducer is one person.

Understand or view engineering and geological data, foundation design drawings, construction records, supervision logs, etc.; understand the abnormalities in the construction process and construction process, understand and record (recorded in the table in the appendix) engineering information, pile information (pile No., pile length, pile diameter, pile type, etc., to understand and record the information of the relevant units of the foundation pile project (construction, construction, supervision, etc.).

According to the requirements of the "measuring pile specification JGJ106":

(1) Fill each sound tube with clean water, check the smooth condition of the sound tube, and the transducer should be able to rise and fall smoothly within the whole range;

(2) Number the acoustic tube (for the numbering method, see Appendix H of the JGJ106). Generally, the acoustic tube near the north is used as the 1# tube and numbered in a clockwise direction.

(3) measuring and recording the clear spacing between the outer walls of each acoustic tube;

(4) Measure and record the height of each sound tube nozzle to the actual pile head;

(5) Using a vernier caliper to measure the outer diameter of the transducer, the outer diameter of the acoustic tube, and the inner diameter d of the acoustic tube (accurate to 1 mm);

(6) Place a nozzle pulley on each nozzle of each acoustic tube, and place each transducer into a different acoustic tube, and place it along the nozzle pulley to the bottom of the pile.

1.1.2 Instrument connection

(1) Adjust the tripod to a suitable height and mount the depth recording device on the platform of the tripod with the two guide posts facing the direction of the pile being tested.

(2) Adjust the transducers in each acoustic tube to the same height (based on the height of the sound tube exposed to the pile head and the depth mark on the transducer signal line), record the actual measured section depth, and open the depth recording device. Press the upper pressure roller, then place multiple signal wires into the depth recording pulley groove and lower the pressure roller.

(3) Connect the transducer signal lines in each acoustic tube to the corresponding

channels on the front panel of the piler.

1.1.3 booting

Press the power switch of the pile tester, the instrument starts to start, display the company LOGO, wait a while, enter the system startup interface, click the sonic transmission method to measure the pile, enter the main interface of the test pile software

1.1.4 Parameter Settings

Set the parameters by referring to the contents of the parameter setting in the section.

1.1.5 Start sampling

Click Sampling on the main screen to start continuous sampling. The instrument collects and displays the waveforms of each profile in each single-channel waveform area. You can find and locate the first wave start point and the first wave peak (valley) position by adjusting the gain and adjusting the delay.
After the waveforms of each section are adjusted, click on the save in the pop-up dialog box to enter the first measurement point, which is the elevation of the test starting point. After confirming, the system returns to the main interface and clicks on sampling again to start collecting and displaying waveforms continuously.
The tester synchronizes and adjusts the transducers at a constant speed. The pile measuring system will automatically record the data and waveforms of each measuring point according to the predetermined interval. During the testing process, the waveform changes will be concerned and adjusted in time to ensure the first wave of the test signal appears. On the screen (except for severe defects, unmeasurable waveforms) until all points have been tested.

1.1.6 Waveform adjustment

In the dynamic sampling state, you can click the waveform of a certain section in the single-channel waveform area to make it the focus, and then click the corresponding button on the pop-up dynamic waveform control panel to adjust the gain, delay, and so on.

1.1.7 Automatic retest

During the dynamic sampling process, if a suspicious measuring point appears in the pile body schematic, the transducer can be played back to the position of the suspected measuring point at any time, and then raised, then the test is automatically re-tested from the position and the original data is overwritten. .

1.1.8 Stop sampling

After collecting all the measurement points, click the stop button to stop sampling, and click the save button to store the data in the file. After completing the test of the current profile, adjust the transducer to another acoustic tube and test as described above until all sections of the pile have been tested. After completing the test of the current pile, you can start the test of the other pile according to the above steps.

note:

After each test, you cannot directly force the power off, otherwise the test data may be lost.

1.1.9 Exporting Data Files

Insert the USB flash drive into the USB interface of the instrument, click Data Management on the main interface, enter the data management interface, select the file to be exported and click Export. The test pile file will be copied to the USB flash drive.

1.1.10 Data Processing

Copy the U disk data to the computer where the ultrasound machine PC software is installed, run the software and select “ultrasonic test pile software”, select the file path in the file menu, find the data just exported and open it. Test data for analysis, viewing, modification, and report generation.

1.2 Ultrasonic method is not dense and cavity detection

1.2.1 Site preparation

First, the inspectors are divided into divisions. The general instrument operation and on-site recording are one person, the transmitting transducer is placed as one person, and the receiving transducer is placed in one person.

On-site data collection, understanding of site function name, design, construction, construction and commissioning unit name, testing purpose and requirements, concrete material types and specifications, formwork type, concrete forming date and pouring and curing conditions, component size and reinforcement construction drawings or Reinforced concealed drawings, component appearance quality and existing problems.

According to the test requirements and test operating conditions, determine the location of the defect test. When testing the uncompacted area and the cavity, the measured part of the component should meet the following requirements:

(1) The part to be tested shall have a pair (or two pairs) of test faces parallel to each other. Try to select two directions to locate the defect space;

(2) The test area covers normal and suspicious areas, and the normal area should be

larger than the defect area; the range of the test area should be larger than the suspected area, and the normal concrete should be compared with the same conditions, and the number of comparison points should not be less. At 20;

(3) The concrete surface of the survey area should be clean and flat. If necessary, it can be smoothed with a grinding wheel or smoothed with high-strength quick-setting mortar. The smoothing mortar must be well bonded to the concrete;

According to the actual situation of the structure to be tested, the measuring points can be arranged according to one of the following methods:

(1) When the member has two pairs of mutually parallel test faces, the opposite test method can be used, and the test method is as shown in Fig. 1.1. In the two pairs of mutually parallel test surfaces of the survey area, draw equally spaced grids (grid spacing: 100-300mm for industrial and civil buildings, other large structures can be appropriately relaxed), and numbered to determine the corresponding measuring point position. ;

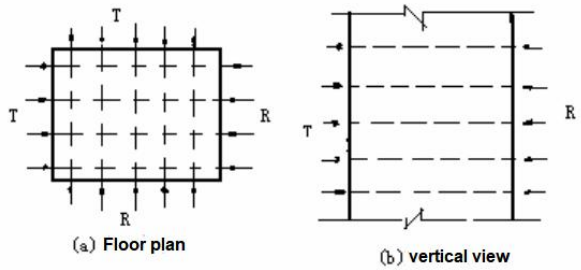


Figure 1.1 Schematic diagram of the test method

(2) When the member has only one pair of test faces that are parallel to each other, a combination of the measurement and the oblique measurement can be employed. As shown in Figure 1.2, the grid lines are drawn on two mutually parallel test surfaces of the positioning, and the cross-slope measurement can be performed on the basis of the measurement;

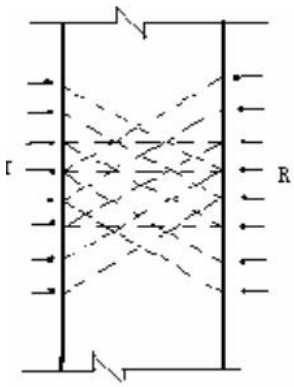


Figure 1.2 Oblique elevation diagram

(3) When the distance measurement is large, drilling or pre-buried tube measurement can be used. As shown in Figure 1.3, in the positioning of the pre-buried acoustic tube or drill vertical test hole, the diameter of the pre-buried tube or the diameter of the bore should be 5 ~ 10mm larger than the diameter of the transducer. The distance between the buried tube or the hole should be 2 ~3m, its depth can be determined according to the test needs. Two radial vibrating transducers can be placed in the two measuring holes for testing, or a radial vibrating type and a thickness vibrating transducer can be placed in the measuring

hole and parallel to the measuring hole. Test on the side.

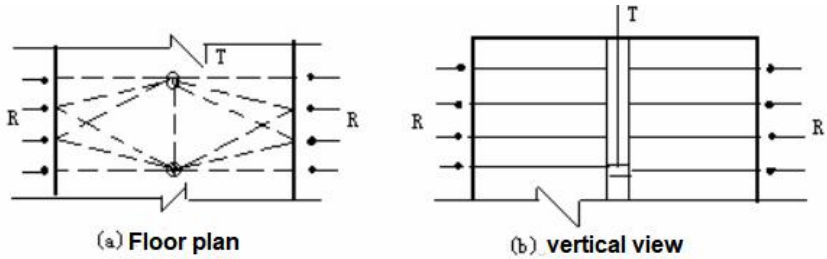


Figure 1.3 Schematic diagram of the drilling method

1.2.2 Test requirements

(1) The surface of the measuring point should be treated to make better use of the amplitude parameter;
(2) Keep the measurement system and measurement parameters unchanged during the test;
(3) The concrete surface of the survey area should be clean and flat. If necessary, it can be smoothed with a grinding wheel or smoothed with high-strength quick-setting mortar. The smoothing mortar must be well bonded to the concrete;
(4) Under the condition that the first wave amplitude reading accuracy is satisfied, a higher frequency transducer should be selected;
(5) The transducer should be tightly coupled to the concrete test surface by the coupling agent, and the coupling layer should not be mixed with mud or air;
(6) The ultrasonic propagation path should be avoided parallel to the adjacent steel bar axis. If it is unavoidable, the shortest distance between the two transducer wires and the steel bar should be no less than 1/6 of the ultrasonic distance measurement;
(7) If suspicious data appears in the test, it should be found in time, and if necessary, retest or check the test;

1.2.3 Test Preparation

(1) Turn on the power of the instrument and enter the ultrasonic measurement interface;
(2) connecting the signal lines of the transmitting and receiving transducers to the transmitting and receiving channels of the instrument;
(3) Refer to the parameter setting in the section of the measurement missing section, and enter the parameter setting interface to set the parameters;

1.2.4 Start sampling

(1) Coupling the receiving and transmitting transducers with butter to the first measuring point of the first line on the two test faces of the member (that is, the intersection of the first horizontal line and the first vertical line));
(2) Perform sampling, automatic or manual adjustment, so that the first wave of the first

measuring point appears on the instrument screen; press the save key to record the data of the first measuring point.
(3) Move the receiving and transmitting transducers to the next measuring point (that is, the intersection of the 1st horizontal line and the 2nd vertical line) and couple them with butter to sample and adjust the waveform. Press the save button to record;
(4) Repeat step 3 until all points have been tested.

1.2.5 Stop sampling

After collecting all the measurement points, click the stop button to stop sampling, and click the save button to store the data in the file.

1.2.6 Data Processing

Copy the U disk data to the computer where the ultrasound machine PC software is installed, run the software and select “Ultrasound Software”, select the file path in the file menu, find the data just exported and open it. Test data for analysis, viewing, modification, and report generation.

1.3 Ultrasonic rebound comprehensive strength measurement

1.3.1 Preparation before testing

First, the inspectors are divided into divisions. The general instrument (including the ultrasound system and the rebounding instrument) is operated and recorded on the spot as one person, the transmitting transducer is placed in one person, and the receiving transducer is placed in one person.
On-site data collection, including project name, design, construction, construction and commissioned unit name, construction drawings, structural or structural part name and concrete design strength grade, cement type, dosage, stone, sand type specification, particle size, admixture or Admixture variety, dosage, concrete mix ratio, formwork type, concrete molding date, and pouring and curing conditions, structural or structural parts detection reasons.

1.3.2 Preparation of the tested structure

According to the detection of a single component, the measuring area is evenly arranged on the member, and the number of measuring areas on each member is not less than 10; if the dimension in one direction is <4.5m, and the dimension in the other direction is ≤0.3m, the number of measuring areas is quite large. In 5th.
According to the batch component sampling test, the number of components sampled is not less than 30% of the same batch of components, and not less than 10 components.

The same batch of components must meet the following conditions: the same concrete strength grade; concrete raw materials, mix ratio, molding process, curing conditions The ages are basically the same; the types of components are the same; the state of construction is the same.

1.3.3 Survey area layout

(1) The conditions permit, the measurement area is preferentially arranged on the side of the concrete pouring direction of the component, and the measurement area can be arranged on two corresponding faces of the component, adjacent faces (angle measurement) or the same face (flat measurement);
(2) Uniform distribution, the spacing between two adjacent test areas should not be greater than 2m;
(3) Avoiding densely populated areas and embedded parts;
(4) The measuring area should be 200mm×200mm; the flat measuring should be 400mm×400mm;
(5) The test surface should be clean, smooth and dry. There should be no joints, construction joints, veneer layers, floating pulp and grease stains, and avoid the honeycomb and pockmark parts. If necessary, the grinding wheel can be used to remove debris and grind. Clean and remove residual dust;
(6) The number of the test area on the structure or component is noted, and the location and appearance quality of the survey area are recorded.
(7) When testing with the test method, it must be ensured that the test areas arranged on the two test faces are facing each other.

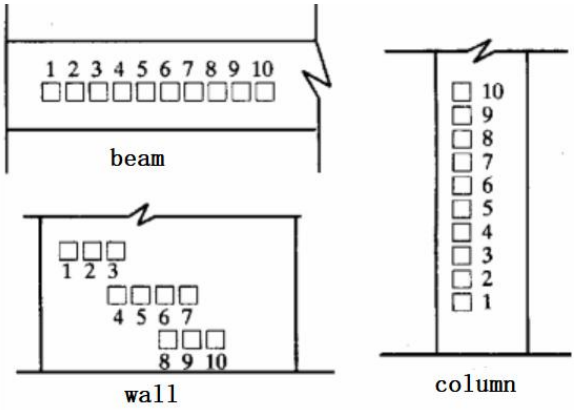


Figure 1.4 Schematic diagram of the measurement area of the comprehensive method

1.3.4 Ultrasonic testing requirements

(1) The ultrasonic measuring points are arranged in the same measuring area of the rebound test, and each measuring area is arranged with three measuring points, as shown in Fig. 1.5;

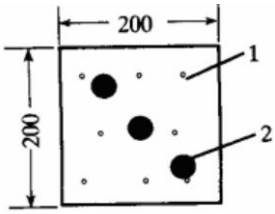


Figure 1.5 Schematic diagram of the distribution of test points

(2) Priority is given to the measurement or angle measurement, and when unconditional, single-sided flat measurement is adopted;

(3) The transducer is well coupled to the concrete;

(4) The sound time value of the test should be accurate to 0.1us. The measurement of ultrasonic ranging is accurate to 1.0mm, the error is not more than ±1%, and the sound velocity is calculated to be accurate to 0.01km/s;

1.3.5 Ultrasonic test preparation

(1) Turn on the power of the instrument and enter the strength measurement interface;

(2) connecting the signal lines of the transmitting and receiving transducers to the transmitting and receiving channels of the instrument;

(3) Enter the parameter setting interface, set the project name, component name, ranging, measuring area, measuring point and other parameters; if necessary, set the parameters such as emission voltage and sampling interval;

1.3.6 Start sampling

(1) Coupling the receiving and transmitting transducers with the butter on the first measuring point of the first measuring zone on the two test faces of the component; (if it is an angle test or a flat test, respectively coupled to the first test piece On the two measuring points of the line);

(2) Perform sampling, automatic or manual adjustment, so that the first wave of the first measuring point appears on the instrument screen; press the save key to save the data of the first measuring point;

(3) Move the receiving and transmitting transducers to the next measuring point at the same time and couple them with butter, sample them, adjust the waveform, press the save button to save after appropriate;

(4) Repeat step 3 until all points have been tested.

1.3.7 Rebound value measurement and calculation

(1) After the ultrasonic test of one test area is completed, the rebound test dialog box will pop up, and the rebound tester can be connected with the instrument for rebound test;

(2) The axis of the hammer is perpendicular to the concrete test surface;

(3) It is advisable to first select the side of the concrete pouring direction for horizontal

testing. If the conditions of the lateral test of the pouring direction are not available, the non-horizontal state test may be used, or the top or bottom surface of the concrete pouring may be tested;
(4) The measured rebound value shall be 8 points of the ultrasonic wave launching and receiving surface in the component measurement area as shown in Figure 1.8; when the single-sided flat test is performed, the ultrasonic wave may be bounced between the transmitting and receiving measuring points. point. The rebound value of each measuring point, the reading accuracy is 1;
(5) The measuring points should be evenly arranged within the measuring area, but they should not be placed on the vents or exposed stones.
(6) The calculation of rebound value is the same as the requirement of “Resilience detection concrete strength”: first remove 3 minimum and 3 maximum, take the average value of the remaining rebound value; then perform angle correction and pouring surface correction to obtain the final return. Bomb value. (The calculation of the rebound value is automatically calculated after the test is completed)

1.3.8 End the test

After completing all the test areas in the above steps, click the Save button to save the test results to a file.

1.3.9 Data Processing

Copy the U disk data to the computer where the ultrasound machine PC software is installed, run the software and select “Ultrasonic Strength Software”, select the file path in the file menu, find the data just exported and open it. Test data for analysis, viewing, modification, and report generation.

1.4 Ultrasonic crack depth detection

1.4.1 Preparation before testing

First, the inspectors are divided into divisions. The general instrument operation and on-site recording are one person, the transmitting transducer is placed as one person, and the receiving transducer is placed in one person.
On-site data collection, including project name, design, construction, construction and commissioning unit name, testing purpose and requirements, concrete raw material varieties and specifications, template northbound, concrete forming date, and pouring and curing conditions, component size and reinforcement construction drawings Or steel concealed drawings, the appearance quality of the components and existing problems.

1.4.2 Line and point arrangement

It should be noted that the test is only applicable to cracks with a depth of less than 500 mm. The cracks must not be filled with water or mud, and the transducer connections should avoid the steel axis or become 45 degrees.

During the flat test, the measurement should be made at the measured part of the crack with different ranging, and the measuring points should be arranged according to the span and no span (the influence of the steel should be avoided when the measuring point is arranged).

(1) Find a clean, flat surface (with a grinding wheel if necessary) in the crack-free area of the component, draw a diagonal line to make it at an angle to the axis of the steel bar, and then draw 3 as shown on the left side of Figure 1.6. 6 measuring points (at least 3 points, otherwise it can not be calculated), so that the spacing between the 1 and 2 measuring points is 100mm, and the spacing of the remaining measuring points is 50mm;

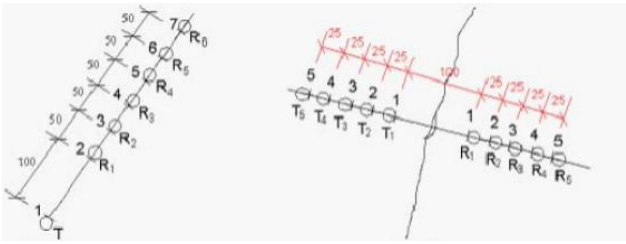


Figure 1.6 Schematic diagram of measuring line and measuring point

(2) Find the widest position on the crack to be tested, measure the normal direction of the seam at the widest point, draw a line, and make it at an angle to the axis of the steel bar, and then sew it as shown on the right side of Figure 1.9. Draw three to five measuring points symmetrically on both sides, the first pair of measuring points is 100mm, the second pair of measuring points is 150mm, the third pair of measuring points is 200mm... and so on;

1.4.3 Test Requirements

(1) Keep the measurement system and measurement parameters unchanged during the test;

(2) The transducer should be tightly coupled to the concrete test surface by the coupling agent, and the coupling layer should not be mixed with mud or air;

(3) The ultrasonic propagation path should be avoided parallel to the adjacent steel bar axis. If it is unavoidable, the shortest distance between the two transducer wires and the steel bar should be no less than 1/6 of the ultrasonic distance measurement.

(4) If unreasonable data occurs during the test (when the sound of the large span is less than the sound of the small span, the sound of the cross-slit of the same distance is less than the sound of the non-slot, etc.), the cause should be found in time, and if necessary, the fault should be repeated. Test the core.

(5) During the test, it must be ensured that the inner edge of the receiving and transmitting transducer is tangent to the measured point.

1.4.4 Test Preparation

(1) Turn on the power of the instrument, select “Surface Crack Detection” on the startup interface, and enter the ultrasonic seam testing software;
(2) connecting the signal lines of the transmitting and receiving transducers to the transmitting and receiving channels of the instrument;
(3) Enter the parameter setting interface, set the project name, component name, slot number, starting point, spacing and other parameters; if necessary, set the parameters such as the transmitting voltage and sampling interval;

1.4.5 No cross-slit test

(1) coupling the transmitting transducer to the first measuring point of the cross-slit line with butter, and the receiving transducer is coupled to the second measuring point that does not span the stitching line;
(2) Sampling, automatic or manual adjustment, so that the first wave of the first measuring point appears on the instrument screen; press the save button to save the data of the first measuring point.
(3) The transmitting transducer does not move, move the receiving transducer to the next measuring point and couple it with butter, perform sampling, adjust the waveform, and press the save button to save it;
(4) Repeat step 3 until all points that do not span the seam line are tested.

1.4.6 Cross-slit test

(1) Coupling the receiving and transmitting transducers with butter on the first measuring point on both sides of the cross-slit line;
(2) Sampling, automatic or manual adjustment, so that the first wave of the first measuring point appears on the instrument screen; press the save button to save the data of the first measuring point.
(3) Move the two transducers to the next measuring point at the same time and couple them with butter, sample them, adjust the waveform, and press the save button to save;
(4) Repeat step 3 until all points of the cross-slit line are tested.
(5) Check whether the first wave of each measuring point is accurately interpreted. If the reading is incorrect, manually read it again;
(6) If the first wave of a measuring point is inverted, the measuring point should be set to the inverting point.

1.4.7 End the test

After completing all the test areas in the above steps, click the Save button to save the test results to a file.

1.4.8 Data Processing

Copy the U disk data to the computer where the ultrasound machine PC software is installed, run the software and select “Ultrasonic Strength Software”, select the file path in the file menu, find the data just exported and open it. Test data for analysis, viewing, modification, and report generation.

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