



UT-80 Ultrasonic Flaw Detector

Instruction Manual



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1.Instrument Appearance and Display Menu

1.1Instrument Appearance

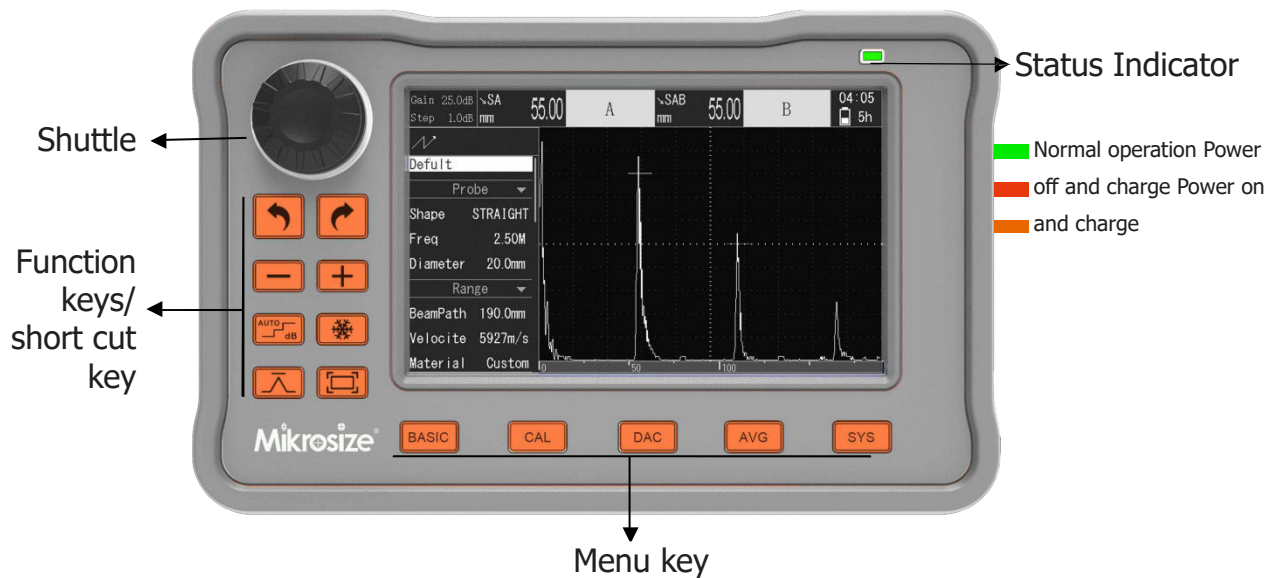


Figure 1 Instrument Main View

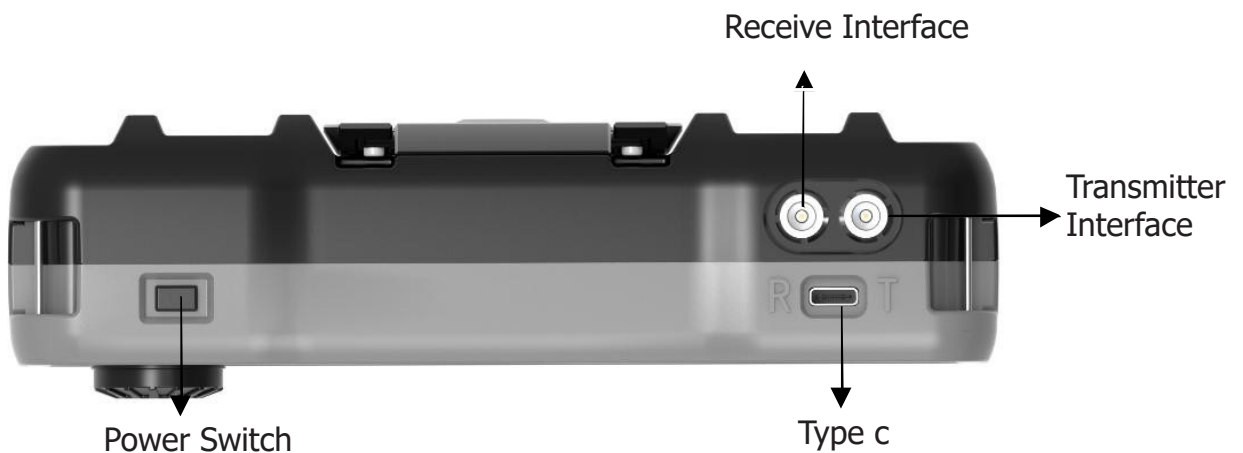


Figure2 Instrument Top View

1. Instrument Appearance and Display Menu

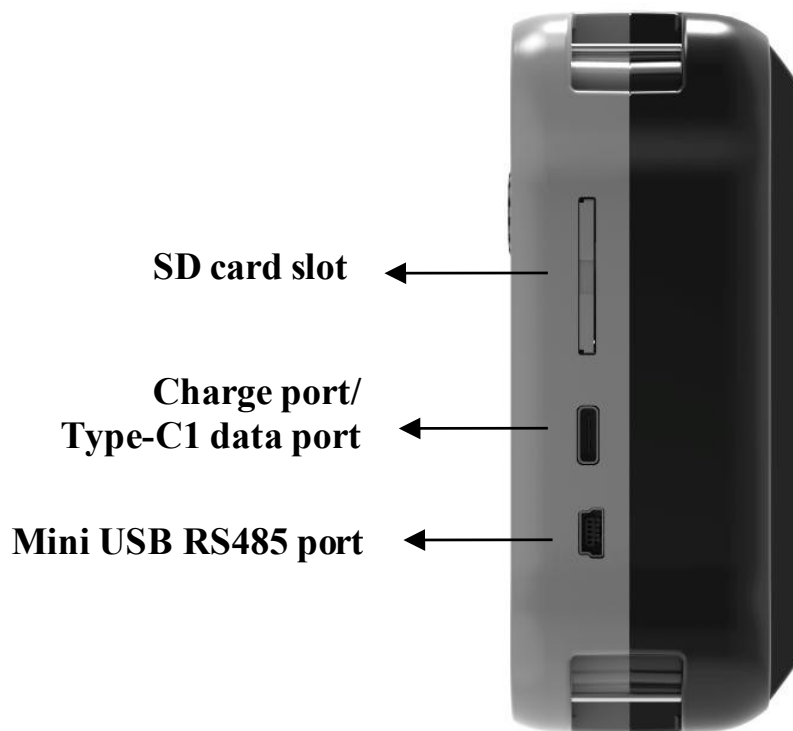


Figure3 Instrument Side View



Figure4 Instrument back view

1.Instrument Appearance and Display Menu

1.2Display Interface

After the instrument is turned on, it directly enters the basic menu interface, as shown in the Figure 5.

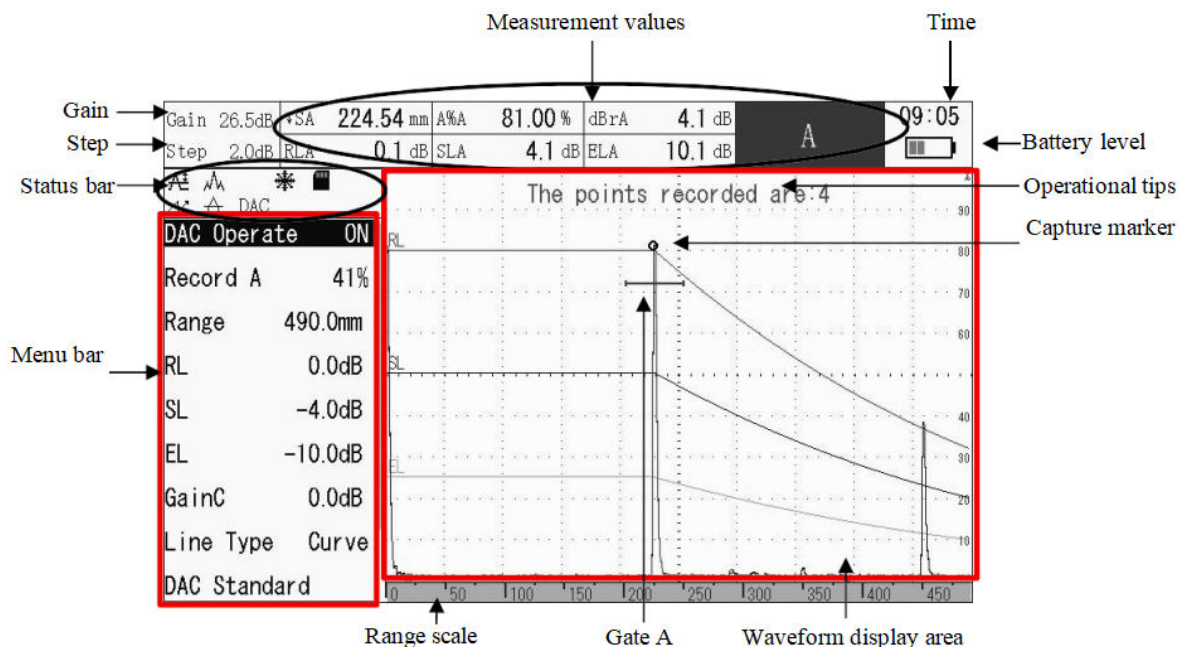


Figure4 Instrument back view

Instrument function icon:

Table 1 Function Description of Shortcut button

	Freeze mode on		Record mode on
	Restrained function on		SD card storage
	Dual-crystal mode		Single-crystal mode
	Echo envelope		Peak memory
	Gate track		Gate expansion
	Straight probe		Angle probe
	Creeping wave probe		Dual-crystal straight probe

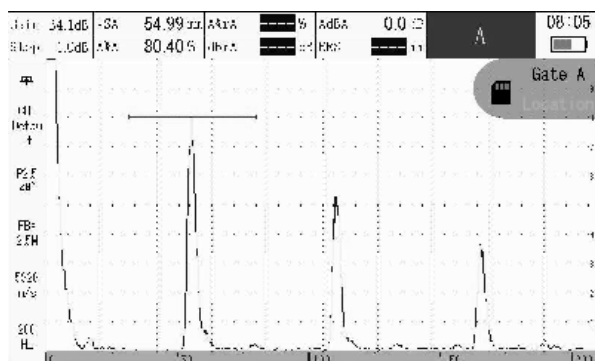


Figure6 Full screen display

2.Basic Instrument Operation

2.1 Common buttons, Knob, Touch and Virtual Keyboard

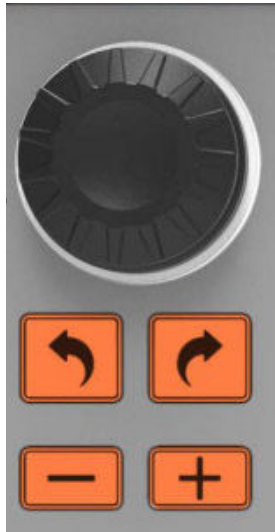


Figure7 button

This instrument has "+" " − " gain adjustment button, ↶ button, ↷ button, and Knob. These universal buttons are used regardless of the mode or function of the instrument.

1)"+" is gain+ button

2)"-" is gain- button

3)↶ button is the confirmation button identification and has three main functions:

When a submenu is highlighted, press ↶ will expand the display parameters.

When an adjustable parameter is highlighted, press ↶ to select the parameter. Then, the parameter value will display with a white background (dark theme) or black background (light theme) (Figure 9). Pressing ↶ again will change the parameter value background to black (Figure 10), indicating that the parameter is now in an editable state.

Long press ↶ is a shortcut button to create a new channel.

Range ▼	
Range	100.0mm
Velocity	5920m/s
Material	Custom
Delay	0.0mm

Figure8 Range not selected

Range ▼	
Range	100.0mm
Velocity	5920m/s
Material	Custom
Delay	0.0mm

Figure9 Range selected

Range ▼	
Range	100.0mm
Velocity	5920m/s
Material	Custom
Delay	0.0mm

Figure10 Adjust range value

2.Basic Instrument Operation

 button is the Return button identification and has three main functions:

When the parameters in the submenu are highlighted, press  will collapse the submenu.

When a certain parameter value is selected (value background is displayed in black), press  to exit the parameter adjustment mode.

Long press  button is a shortcut button of Resume channel.

5)Knob has three main functions:

Short press: When the parameter is not selected, short press the Knob button to enter the parameter adjustment; after the parameter is selected, short press the Knob button to exit the parameter adjustment.

Long press:

When parameter is not selected: Long-press Knob to switch gain step. The current step value is displayed at the top-left corner of the screen, supporting 5 adjustable levels: 0.1dB, 0.6dB, 1dB, 2dB and 6dB.

When parameter is selected: Long-press Knob to activate the special step function for the value parameter. An asterisk * will appear after the parameter name.

Rotate operation: Left and right rotation defaults to moving the cursor; When a parameter is selected, rotate left and right to increase or decrease numerical values and switch modes.

6)Touch function: Control turning on and off the touch function by toggling the Touch switch (System Menu → Function → Device Management → Touch).

Gesture Controls on Waveform Interface

Drag the waveform upward to increase the gain value; drag it downward to decrease the gain value. Drag the waveform rightward to reduce the range; drag it leftward to extend the range.

Sliding Operation in Parameter Menu

2.Basic Instrument Operation

Swipe the screen up and down in the parameter menu to browse and select different parameters.

Virtual Keyboard Input

Click on the range or sound velocity parameter to bring up the virtual keyboard. You can either enter values directly by tapping the numbers on the keyboard, or modify them by moving the cursor with the shuttle knob to select the target numbers.

Full-Screen Mode Toggle

Double-tap anywhere on the screen to enter or exit full-screen mode

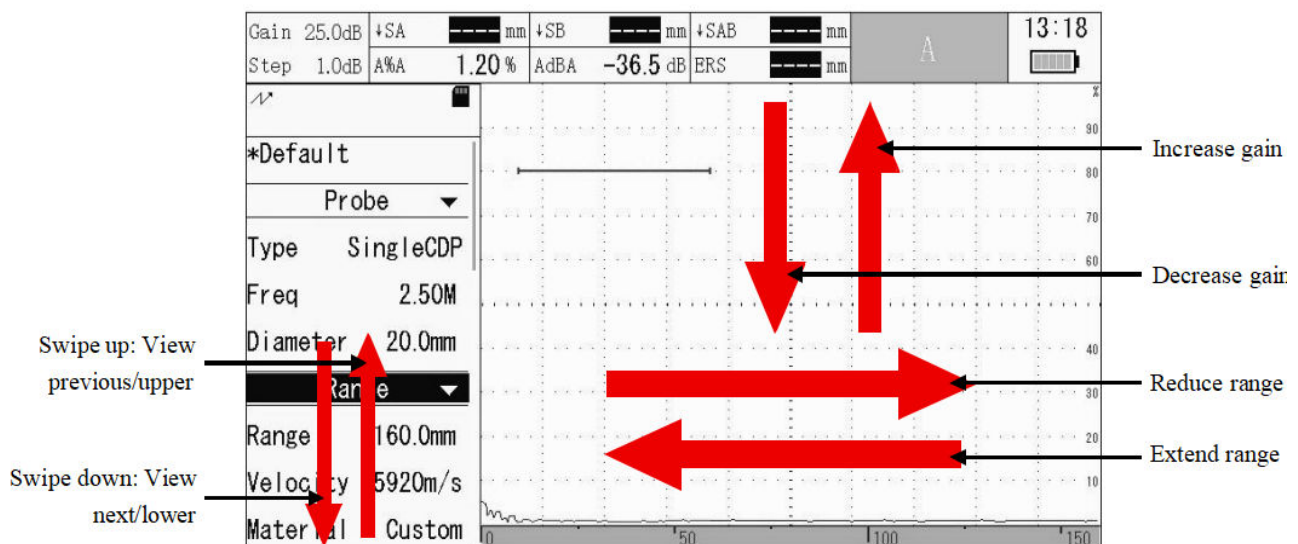


Figure11 Touch operation gestures diagram

7) Virtual Keyboard: Supports two input methods: directly tapping the key values, or adjusting the shuttle to move the cursor and select key values for editing.

←: Delete key, delete input content.

✓: Confirm key, save content in the current text box.

×: Close key, close the virtual keyboard. The keyboard can also be closed by tapping other areas on the screen (outside the prompt box).

2.Basic Instrument Operation

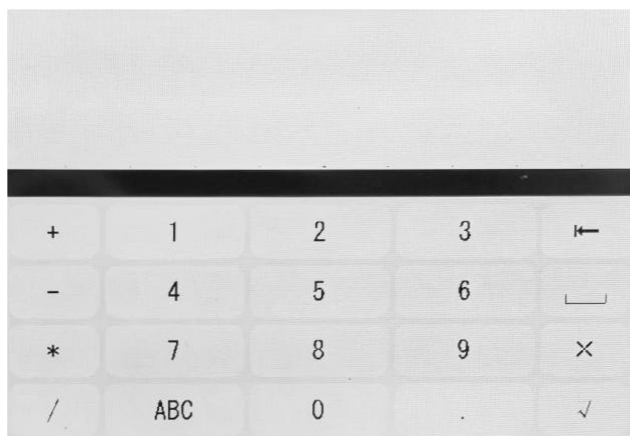


Figure12 Digital Virtual Keyboard

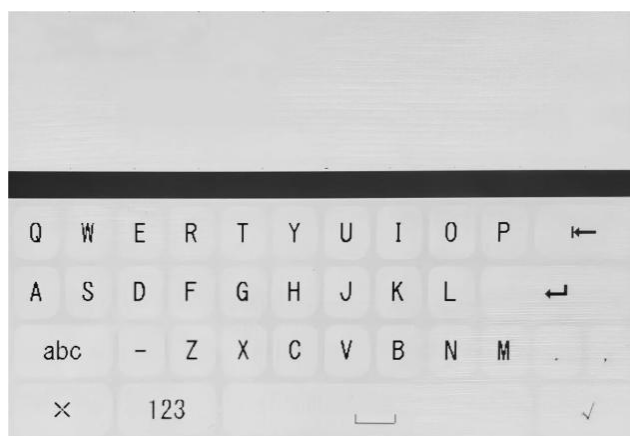


Figure13 English Virtual Keyboard

Enable touch function, tap to modify Range/ Velocity parameters to bring up the virtual keyboard. Enter target values in the text box above, tap "✓" to confirm and update parameters. Tap "×" or the area outside the prompt box to close the keyboard after modification.

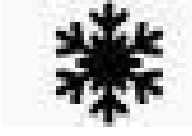
In addition, the virtual keyboard activates automatically for file renaming when saving single-frame/multi-frame data, screenshots, or channel settings.

2.2Shortcut button Area

The shortcut buttons include 4 function buttons and 5 menu buttons, which are arranged on the left and bottom of the display screen respectively. Press the Basic Menu button, you can enter the basic menu setting interface and activate the corresponding functions.

2.Basic Instrument Operation

Table 2 Shortcut button function description table

	Long press for the recording function. When the recording flag is valid, 500 frames of data will be saved by default and then exit the recording mode. When the recording flag is valid, press this button again to end the recording and save in advance and exit the recording function.
	When the button is pressed shortly, the freeze function will keep the displayed waveform on the screen, and the long press during the freeze period is the save function. To continue testing, press the freeze shortcut button again.
	The highest echo in the gate is automatically adjusted to the echo amplitude set by the "Auto Peak" parameter, which is 80% by default.
	Long press for screenshot function.
	Short press to enable or disable full-screen mode.
	Long press for gate expansion function.
	Short press for echo memory function.
Basic Menu	Basic parameter menu shortcut buttons.
Calibration Menu	Auto, sound velocity + zero point, angle probe calibration menu shortcut buttons.
DAC	DAC menu shortcut button.
AVG	AVG menu shortcut button.
System Menu	System settings menu shortcut button.

2.Basic Instrument Operation

2.3Full-screen display

In the main menu display interface, short press  or double-click the screen (when the touch function is turned on) to display the A-scan waveform in full screen. Performing the same operation again will exit the mode. In full-screen mode, use the + / - keys to adjust gain quickly. A blue prompt in the upper right corner shows the current function of knob (e.g., Range, Gate A). Short-press knob to cycle through these functions.

1)When the blue prompt box in the upper right corner shows Range, the current number is displayed as the value of the Range. Rotate the Knob to adjust, or drag the waveform to change the Range (when touch is turned on). Press  to enable the special step pace for Range.

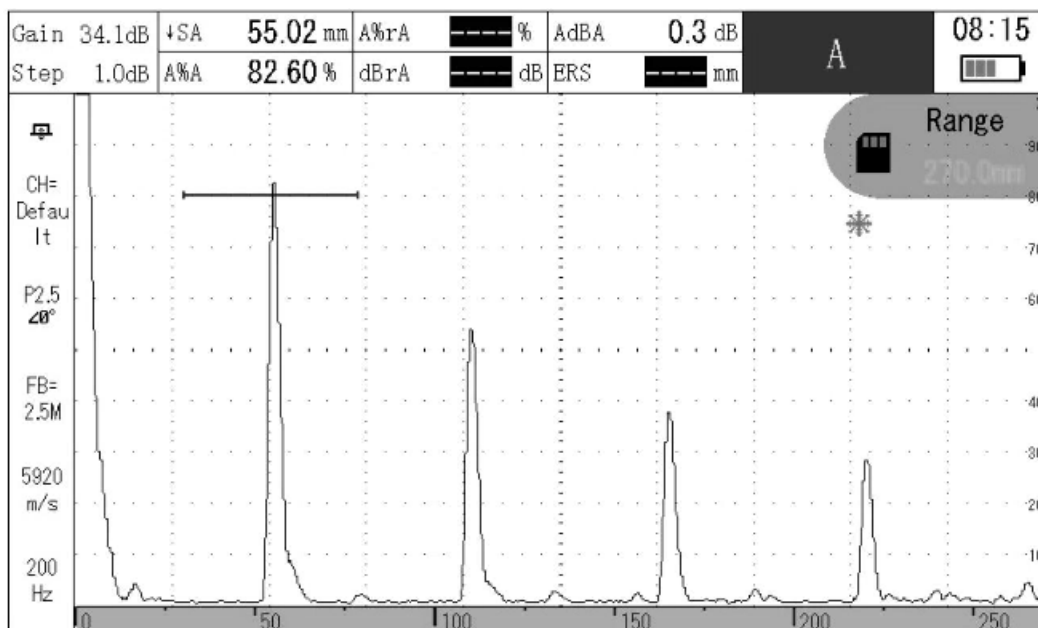


Figure14 Full screen display-Knob function is to adjust the Range

When the blue prompt box in the upper right corner shows Gate A, press ,  buttons to switch the location, Width and Height of Gate A. After selecting it, adjust the parameter values of Gate A through the Knob. the location, Width and Height of Gate A. After selecting it, adjust the parameter values of Gate A through the Knob.

2.Basic Instrument Operation

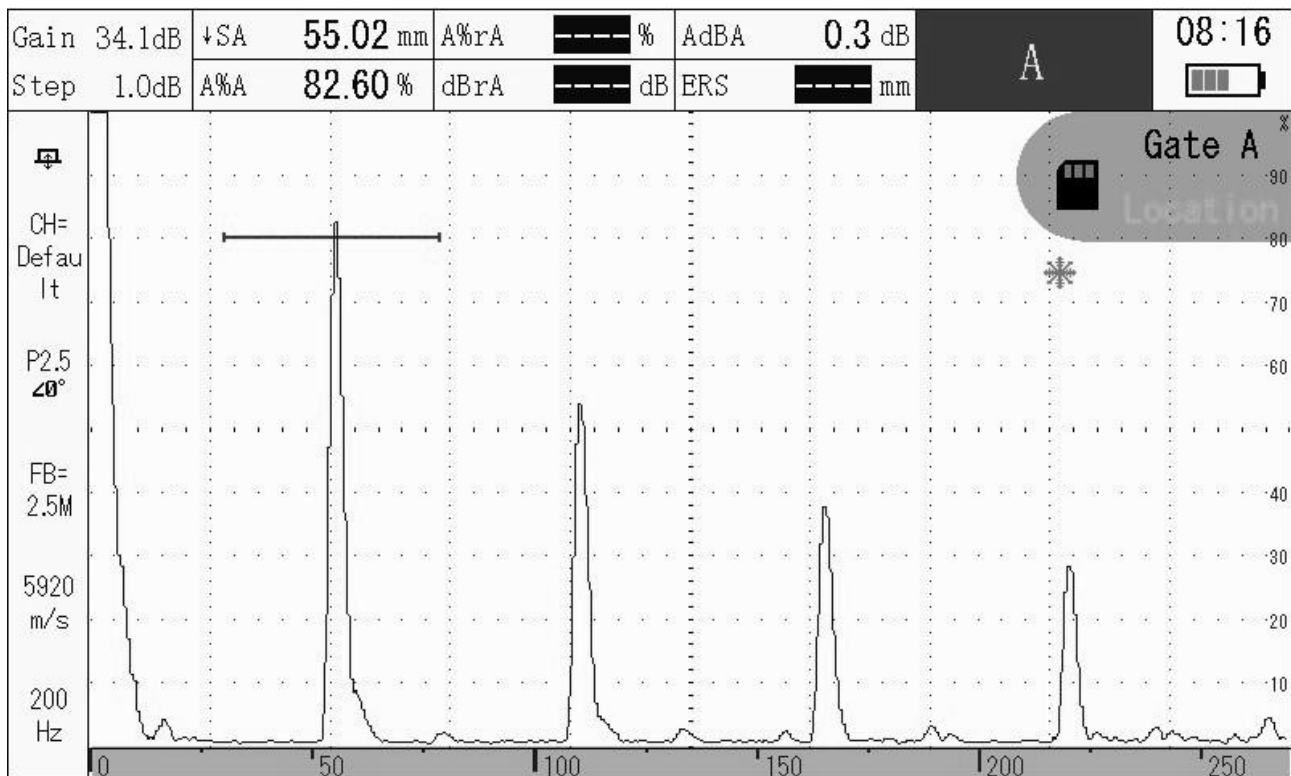


Figure 15 Full screen display-The Knob function is to adjust the height of gate A

3)When short press  button, as shown in Figure 14, the freeze indicator is displayed at this position. When long press  button, trigger the recording function and display the indicator. In full screen mode, long press  button to take a screenshot.

2.Basic Instrument Operation

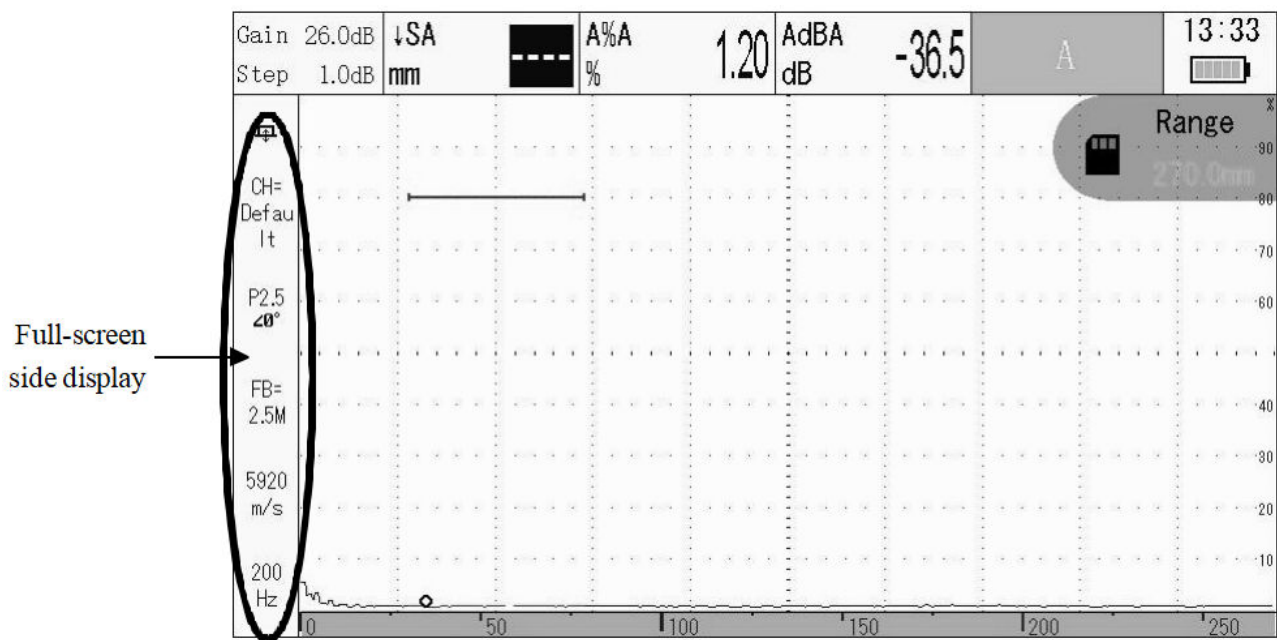


Figure 16 Full-screen side display

4) In full-screen mode, the sidebar of the interface will centrally display main parameters for users to quickly grasp the current configuration. This display function can be flexibly enabled or disabled in System Menu → Configuration → Full-screen Side Display:

Probe type (☐: Straight probe, ▣: Angle probe, ▢: Dual straight probe, ▧: Creeping wave probe);

Channel name: Default;

Probe frequency and angle: The figure shows 2.5M, angle 0°;

Filter frequency band: The figure shows 2.5M;

Sound velocity: The figure shows 5925m/s;

Pulse repetition frequency: The figure shows 200Hz.

3.Instrument Parameter Settings

Press and hold the power button for a long time. After hearing a beep, the instrument will start up.

Interface Navigation: There are five menus at the bottom of the screen, which are the basic menu, calibration menu, DAC menu, AVG menu, and setting menu. Press  in any menu can enter the main menu, which is easy for users to realise one-handed operation.

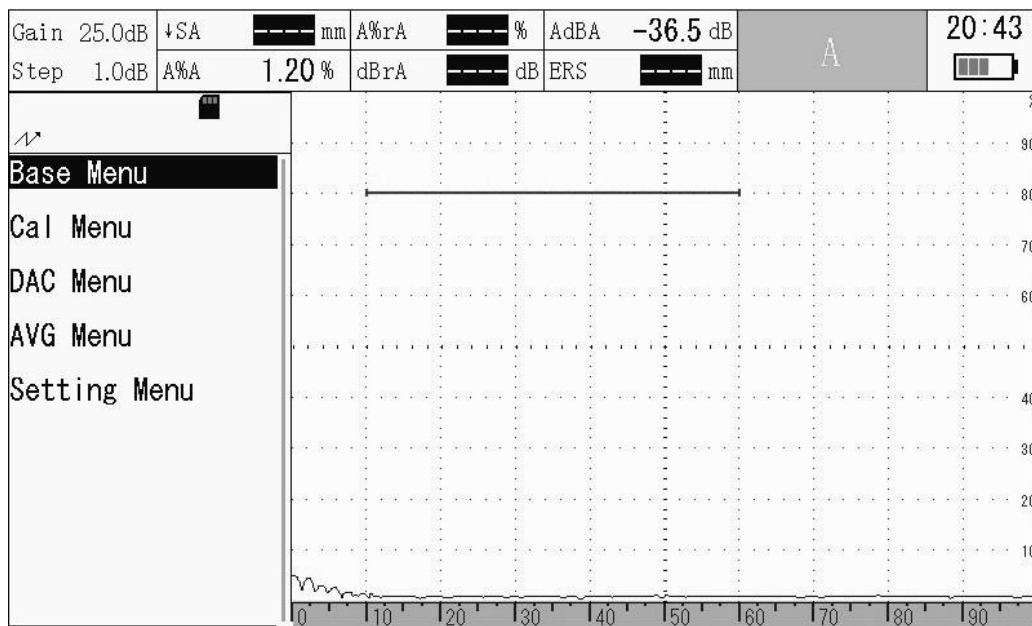


Figure17 Main menu

3.1Basic Menu

There are five submenus in Basic menu, include Probe, Range, Gate, Receive, and Emit.

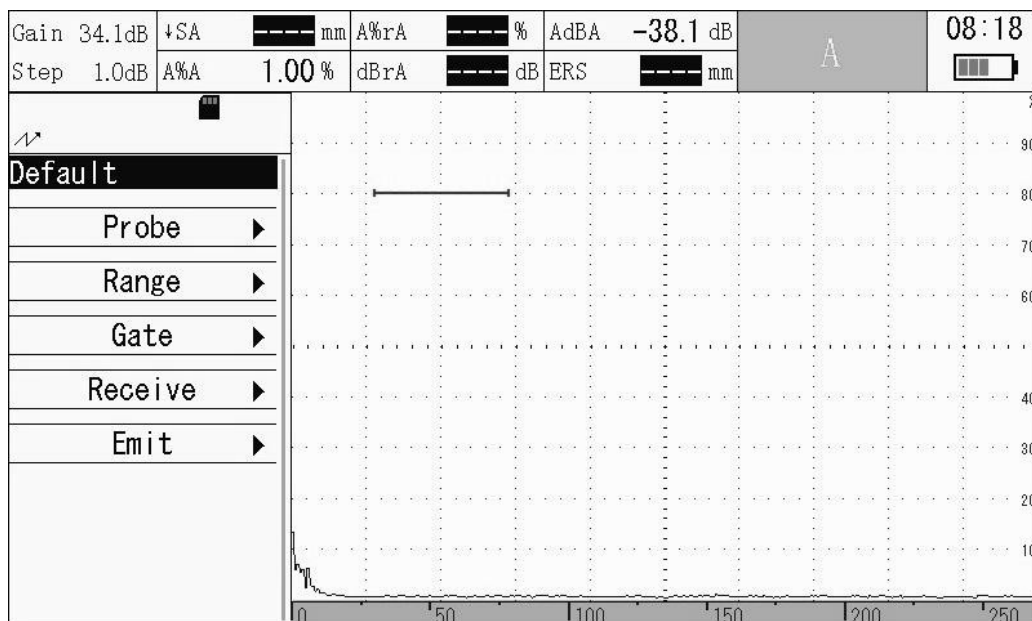


Figure18 Basic menu

3.Instrument Parameter Settings

The first parameter "Default" is the channel name. Press the Knob or  button to open the saved channel list, move the cursor to select the channel name, and press the Knob or  button to call up the channel information.

3.1.1Probe

The function of the menu is to configure the probe parameters, when the probe parameters are set to match the probe, the instrument will automatically adapt the receiving and transmitting parameters.

1.Type: Switch between straight, angle, double straight and crawling wave probes.

2.Straight / double straight probe: It can set the frequency (after selecting the parameter and pressing  button again, the * mark appears after the frequency to enter the fine-tuning step of 0.05MHz) and diameter.

3.Angle / crawling wave probe: It can set the frequency, angle, K-value, front edge, size a/ b, and workpiece thickness (after selecting the parameter and pressing  button, * mark appears after the frequency to enter the fine-tuning step).

4.Switching measured value display:

◆ When switching from type "straight/ double straight" to "angle/ crawling wave", the value display parameter above the waveform automatically switches to ↘ SA、RLA、↓DA、SLA、→PA、ELA、A_LED.

◆ When switching from type "angle / crawling wave" to "straight / double straight", the value display parameter above the waveform automatically switches to ↓SA、A%A、A%rA、dBrA、AdBA、ERS、A_LED.

↓SA	mm	A%rA	%	AdBA	-38.1 dB	A
A%A	1.00 %	dBrA	dB	ERS	mm	

Figure19 Straight probe parameter

↘SA	mm	↓DA	mm	→PA	mm	A
RLA	dB	SLA	dB	ELA	dB	

Figure20 Angle probe parameter

3.Instrument Parameter Settings

3.1.2Range

1.Range: The parameter is the X-axis display value of the screen, and the maximum Range value is 20000.0mm.

◆ Enter/Exit Adjustment: Move the cursor to Range and press the Knob button or  button to enter the parameter adjustment, select and press the Knob button or  button to exit the parameter adjustment.

◆ Adjustment Methods:

- Rotate the shuttle knob: Adjust in 10 mm steps.
- Fine-tuning mode: Select the range and then long-press the shuttle knob. An asterisk (*) will be displayed after the parameter, indicating that the fine- tuning state is activated.
- Touch Adjustment (Valid when touchscreen is enabled):
- Drag the waveform left or right to quickly adjust the range.
- Double-tap the range value to open the virtual keyboard and directly enter the target value for modification.

Table 3 Range Step Size Adjustment Table

Range	Shuttle Knob Coarse Adjustment & Touch Step (mm)	Shuttle Knob Fine Adjustment Step mm
Less than 50 mm	1	0.1
50-100mm	5	0.5
100-500mm	10	1
500-1000mm	50	5
More than 1000 mm	100	10

Table 4 Suggested detection range setting table

Workpiece thickness(mm)	Suggested detection range(mm)
≤ 20	2-3× workpiece thickness
$>20, \leq 50$	4-5× workpiece thickness
$>50, \leq 200$	3× workpiece thickness
>200	1.5× workpiece thickness

3.Instrument Parameter Settings

Note: The above table is only a suggested setting, the inspector should choose a suitable detection range according to the actual situation, generally should cover the thickness of the workpiece or the observed echo region with a certain margin.

2.Sound Velocity: This parameter is a key factor affecting defect positioning accuracy. It must be set according to the actual sound velocity of the inspected workpiece for matching.

- Enter/Exit Adjustment: Move the cursor to the Sound Velocity item and press the shuttle knob or  button to enter adjustment mode; press again to exit.

- Adjustment Methods:

Rotate the shuttle knob: Adjust in 100 m/s steps by default.

Accuracy Switch: Long-press the shuttle knob to switch to 1 m/s steps (an asterisk * will be displayed after the sound velocity value at this time).

- Touch Input (when touchscreen is enabled): Double-tap the sound velocity value to bring up the virtual keyboard and directly enter the desired value for modification.

- Default Sound Velocity:

Straight Probe / Dual Crystal Straight Probe: 5920 m/s

Angle Probe / Creeping Wave Probe: 3240 m/s

3.Material: The theoretical sound velocity values of many materials have been solidified inside the instrument. Before using the instrument, simply move the cursor to "Materials" and press the Knob button or  button to enter the parameter adjustment, and then press again to exit after selection. The instrument has built-in sound velocities for the following materials: Mild Steel (5900m/s), Mild Steel (Shear Wave,3200m/s), Stainless Steel (5800m/s), Stainless Steel (Shear Wave,3100m/s), Copper (4660m/s), Copper (Shear Wave,2260m/s), Aluminum (6300m/s), Aluminum (Shear Wave,3100m/s), Aluminum Oxide (9900m/s), Aluminum Oxide (Shear Wave,5800m/s). The calibrated sound velocity is saved in the

3.Instrument Parameter Settings

Custom mode.

4.Delay: Used to adjust the horizontal starting position of the A-scan waveform on the screen.

Enter/Exit Adjustment: Move the cursor to the Delay item and press the knob or  to enter adjustment mode; press again to exit.

Adjustment Methods:

Rotate the knob: Adjust the delay in 10mm steps by default.

Accuracy Switch: Select the parameter and long-press the shuttle knob to switch to the fine adjustment step of 0.1mm (an asterisk * will be displayed after the parameter at this time).

5.Zero Point: Used to calibrate the ultrasonic propagation time between the probe wafer and the incident point.

Enter/Exit Adjustment: Move the cursor to Zero Point and press knob or  to enter parameter adjustment mode; press again to exit.

Adjustment Methods:

Rotate the shuttle knob: Adjust in 1.0us steps by default.

Fine-tuning Mode: Select the parameter and long-press the shuttle knob. An asterisk (*) will be displayed after the parameter name, indicating entry into fine-tuning mode with step of 0.01us.

3.1.3Gate

This menu includes the following adjustable parameters: Gate Mode, Gate (displayed only when Gate Mode is set to Dual), Gate Start Point, Gate Width and Gate Height.

1.Gate Mode : Single Gate or Dual Gate can be selected.

2.Gate : Gate A or Gate B can be selected. When Gate A is selected, the following three parameters apply to Gate A. When Gate B is selected, the following three parameters

3.Instrument Parameter Settings

apply to Gate B.

3.A/B Start Point : Used to adjust the start point of Gate A or Gate B.

4.A/B Width : Used to adjust the width of Gate A or Gate B.

5.A/B Height : Used to adjust the height of Gate A or Gate B. The gate height cannot be adjusted when Gate Tracking is enabled.

3.1.4Receive

There are five parameters in this submenu: bicrystal mode, filter, detector, average and restrain. When the cursor moves to the adjustable parameter in the receive menu, press the Knob button or  to enter the parameter adjustment. Press again to confirm the current value and exit.

1.Dual Crystal Mode: There are two options for selection in this function.

On: Applicable to dual crystal probe.

Off: Applicable to single crystal probe.

2.Filter: It should generally be set to the nominal frequency of the probe.

3.Detection: Select the detection mode in this option, which includes five display modes: RF wave, positive half wave, negative half wave, full wave, and envelope. The default setting is full wave mode.

4.Restrain: Used to set the display threshold of the waveform on the screen. Echoes below the set value will be hidden, with an adjustable range of 0%–80% of the full-screen height. Increasing the restrain level only affects waveforms below the threshold and will not compress or alter the amplitude linearity of signals above the threshold. You can opt to hide waveforms with amplitudes below the restrain value from the screen, with an adjustable range of 0%–80% of the full-screen height. Increasing the restrain level has no impact on the amplitude of signals above the restrain level.

5.Average: The A-scan waveform is processed by a real-time averaging algorithm to

3.Instrument Parameter Settings

eliminate noise signals; the averaging level is set to 1 by default.

3.1.5 Emit

Used to adjust the energy of the instrument for exciting the probe, including six adjustable parameters. When the probe type is Straight, the default emission parameters are: Frequency Mode "Auto Low", Repeat Frequency 200Hz, Damping 500 Ω , Energy High, and Voltage Medium.

Table 5 Reference table for peak mode emission options

Probe type	Workpiece thickness T (mm)	Suggested emission parameter adjustment (pulse mode: peak)
Straight/ Double Straight Probe	$t \leq 50$	Energy: low, Voltage:low/medium, Damping: strong
	$50 < t \leq 200$	Energy: low, Voltage:medium, Damping: strong/weak
	$t > 200$	Energy: high, Voltage:medium/high, Damping: weak
Angle/Crawling Wave Probe	--	Energy: high, Voltage:medium/high, Damping: weak/strong

Note: The above table is only a recommended setting.

1.Frequency Mode: Auto and Manual.

Auto Mode: The instrument automatically calculates the optimal pulse repetition frequency based on the currently set range parameters.

Manual Mode: Users can directly input a specific value in the pulse repetition frequency parameter.

Mode Switching: Rotate the shuttle knob to switch between Auto and Manual modes.

2.Pulse Repetition Frequency (PRF)

Auto Mode: When Frequency Mode is set to Auto, this field displays the PRF value automatically generated by the instrument based on the current range and sound velocity.

Manual Mode: When Frequency Mode is set to Manual, the value can be adjusted by rotating the shuttle knob. The default step size is 100Hz. Select the parameter and long-

3.Instrument Parameter Settings

press the shuttle knob; an asterisk * will be displayed after the PRF value, indicating entry into fine-tuning mode with a step size of 10Hz.

Frequency Range: 0-10000 Hz. Waveform refresh stops when set to 0Hz.

Recommendation: For workpieces with small cross-sections, it is recommended to appropriately reduce the PRF to minimize echo crosstalk.

3.Damping: Used to match probe characteristics and testing requirements. Two levels are available: 500Ω and 50Ω, adjustable via the shuttle knob.

High Sensitivity Setup: Suitable for testing large workpieces, coarse-grained materials, or scenarios requiring high sensitivity. Recommended settings:

Pulse Energy: Medium/High Damping: 500Ω

High Resolution Setup: Suitable for thin workpieces or high-resolution testing.

Recommended settings:

Pulse Energy: Low Damping: 50Ω

⚠ Note: This setup will reduce the testing sensitivity accordingly.

Extended Optimization: If using a narrow pulse probe, set the detection to positive half-wave or negative half-wave to further improve resolution.

4.Energy/Pulse Width

Energy: Displayed as Energy when the pulse mode is set to Spike, adjustable via the shuttle knob. Two levels are available: High and Low.

Pulse Width: Displayed as Pulse Width when the pulse mode is set to Square Wave. The recommended pulse width value can be calculated using the formula: $\text{Pulse Width} = 1000 / (2 \times f)$. Where f is the probe frequency in MHz. The minimum adjustment step size of pulse width is 5ns. Example: For a 2.5MHz probe, the corresponding pulse width should be set to 200ns.

3. Instrument Parameter Settings

5. Transmission Voltage

Spike Pulse Mode: Transmission Voltage and Pulse Energy offer three fixed levels: High, Medium, and Low, selectable via the shuttle knob.

Square Wave Pulse Mode: Transmission Voltage can be adjusted between 25V– 300V via the shuttle knob, with an adjustment step size of 25V.

3.2 Calibration Menu

Press the Calibration Menu button to enter the interface. There are three sub- menus in the modes, Auto, Zero + Sound Velocity and Angle Calibration modes (set the probe type to angle). Move the cursor to the adjustable parameter, press the Knob button or  button to enter the parameter adjustment, and press again to exit the parameter adjustment.

1) Auto-Calibration Mode: In this mode, the instrument automatically locks onto the first and second echoes, and completes zero point and sound velocity calibration synchronously. Set the thickness of the calibration workpiece (see Figure 21), adjust the range to display the first and second echoes. Then select Calibration and press  button. The instrument will complete zero point + sound velocity calibration and pop up the results (see Figure 22). At this point, press  to apply the results, or press  to cancel.

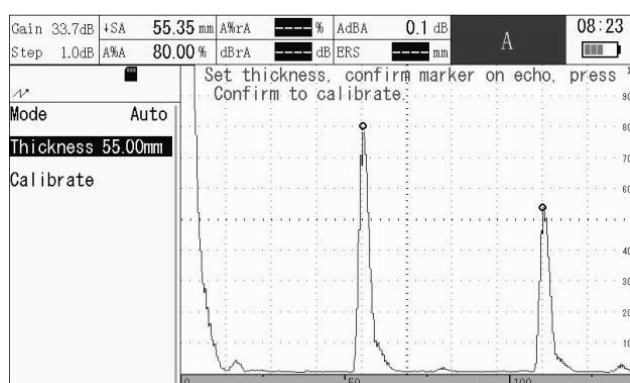


Figure 21 Auto-Calibration Interface

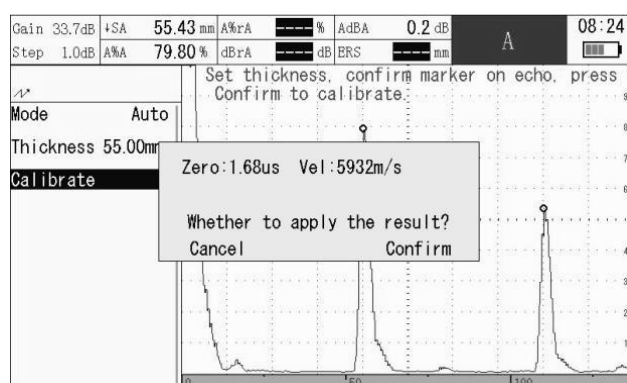


Figure 22 Confirm Calibration Results

2) Zero+Sound velocity calibration mode: manually adjust the Gate for zero+ sound velocity calibration mode.

3.Instrument Parameter Settings

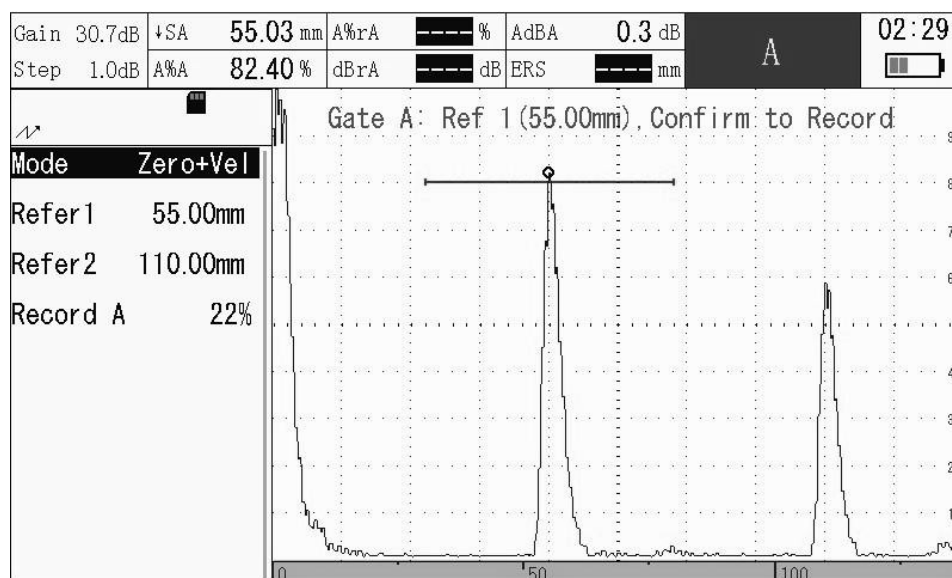


Figure23 Manual calibration interface

Example1: Perform sound velocity and zero-point calibration using the 1st and 2nd echoes of the 2.5Z20N probe.

Operating Steps:

① Set Reference 1

Enter the Reference 1 submenu and set it to the actual thickness of the calibration block. The default adjustment step is 1mm; select the value and long press the Knob to switch to the fine adjustment step of 0.01mm.

② Set Reference 2

Enter the Reference 2 submenu and set it to twice the actual thickness of the calibration block; the system defaults to twice the value of Reference 1.

③ Record Reference 1 Waveform

Adjust the start point of Gate A to cover the 1st echo of the calibration block, and adjust gain or press AUTO_{dB} to set the echo amplitude to approximately 80%. Select the option and press to A record the waveform information of Reference 1.

④ Record Reference 2 Waveform

Refer to the method in Step ③, adjust the start point of Gate A to cover the 2nd echo of

3.Instrument Parameter Settings

the calibration block, and adjust the gain to set the echo amplitude to approximately 80%.

Press  to record the waveform information of Reference 2; the screen will display the calibration results of zero point and sound velocity.

Press  to apply the results; Press  to abort the application.

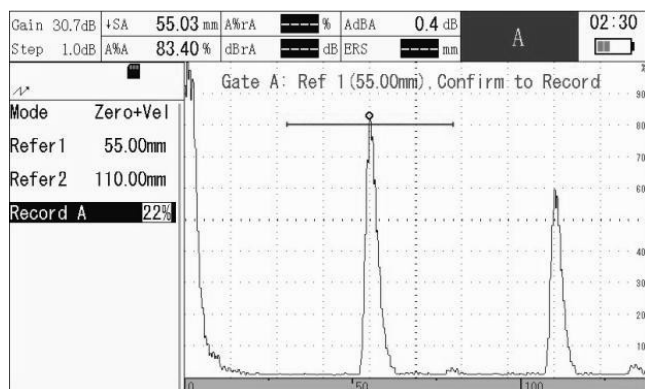


Figure 24 Record Reference 1

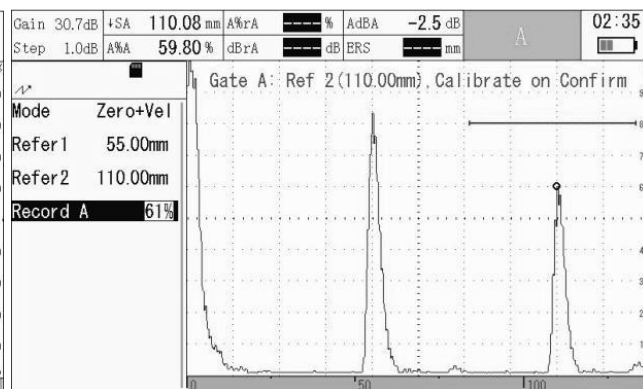


Figure 25 Record Reference 2

Example 2: Use the CSK-IA test block to calibrate the sound velocity and zero point of the angle probe, and place the angle probe at the position shown in Figure 26.

Operating steps:

- ① Select the Reference1 parameter and adjust it to the actual range of R50 arc echo 50mm;
- ② Select the Reference2 parameter and adjust it to the actual range of R100 arc echo 100mm;
- ③ Move the probe so that the R100 arc reflection echo is the highest and about 80% of the full screen amplitude, while the R50 arc reflection echo amplitude is above 20% of the full screen amplitude (if the R50 arc echo amplitude is less than 20%, the echo amplitude can be increased by shifting the probe towards the R50 arc side);
- ④ Adjust the start point of Gate A to enclose the echo from the R50 arc, adjust the gain or press  to set the echo amplitude to approximately 80%, then press  to record the echo information of Reference 1.

3.Instrument Parameter Settings

5 Refer to the method in Step 4, adjust the gate to enclose the echo from the R100 arc, adjust the gain to set the echo amplitude to approximately 80%, press  to record the waveform information of Reference 2, and the screen will display the calibration results of the zero point and sound velocity.

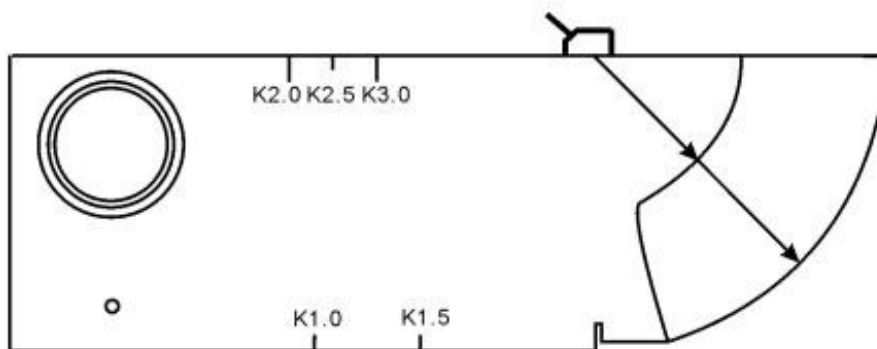


Figure26 Schematic diagram of angle probe calibration

6 Measuring the front edge of the angle probe

Scan the R100 arc of the CSK-IA test block with an angle probe, locate the maximum echo and then fix the probe position. Obtain the front edge value by either of the following methods:

Direct Reading: Directly read the scale value corresponding to the "incident point" mark of the test block on the probe scale;

Indirect Measurement: Measure the distance A from the probe front edge to the end of the test block with a straight ruler, then front edge value = $100 - A$.

Enter the measured front edge value in the angle probe menu.

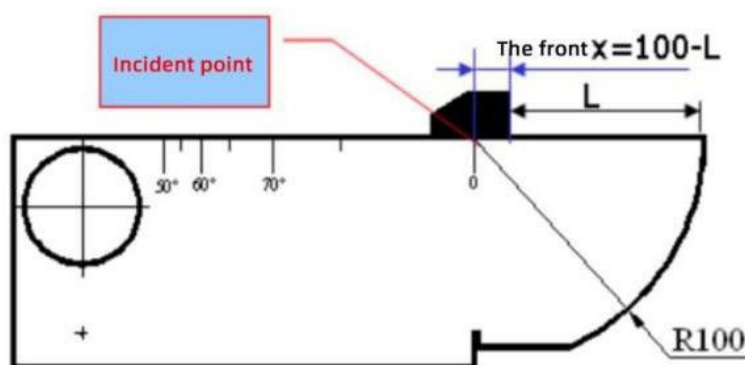


Figure27 Schematic diagram of measuring the front edge value of the angle probe

3.Instrument Parameter Settings

3)Angle Calibration

Note1: In order to ensure the accuracy of the measurement, the instrument must be calibrated before the angle measurement (see zero point + sound velocity calibration function).

Note2: When measuring angles, the range between the probe and the reflection hole must be greater than twice the distance in the near field of the probe to avoid measurement caused by the influence of the near field.

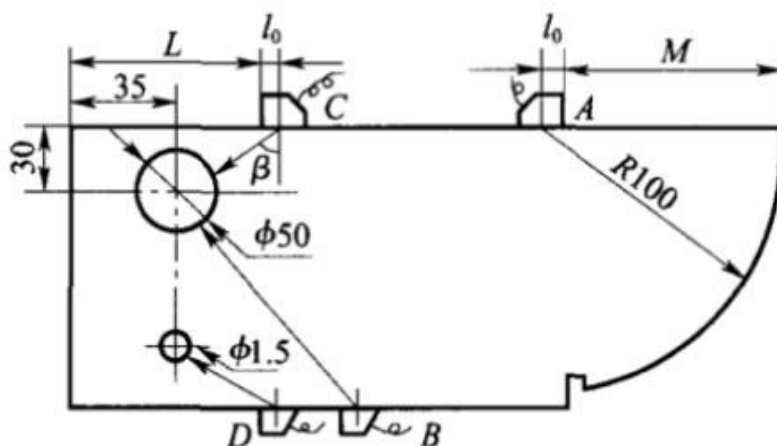


Figure28 Schematic diagram of angle measurement

Measure the angle probe K value or refraction angle β S

- (1)The probe is placed at position B, the measured β S is $35^{\circ} \sim 60^{\circ}$ ($K=0.7 \sim 1.73$);
- (2)The probe is placed at position C, the measured β S is $60^{\circ} \sim 75^{\circ}$ ($K=1.73 \sim 3.73$);
- (3)The probe is placed at position D, the measured β S is $75^{\circ} \sim 80^{\circ}$ ($K=3.73 \sim 5.67$).

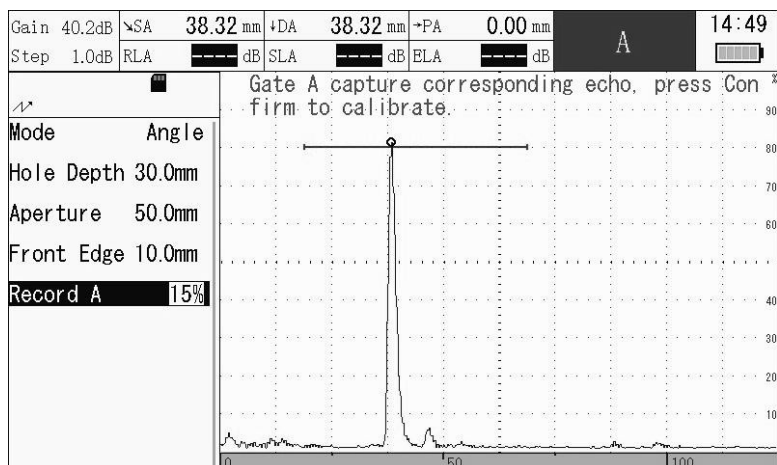


Figure29 Angle calibration

3. Instrument Parameter Settings

Operating steps:

① Enter Angle Calibration Mode

Press the calibration menu button and select the angle mode (set the probe type to angle, and enter the probe frequency and dimensions correctly).

② Set Test Block Parameters

Select the hole depth parameter and set it to the actual depth value of the reflective hole in the test block used;

Select the hole diameter parameter and set it to the actual diameter value of the reflective hole in the test block used.

③ Capture Echo

Adjust the start point of Gate A to enclose the echo from the reflective hole. Move the probe back and forth to locate the position with the maximum echo amplitude. Adjust the gain or press  to stabilize the echo amplitude at 80% of the full screen amplitude, press  to record the waveform information, and the screen will display the angle calibration results.

Example: Angle probe 2.5Z10×10K2 uses $\Phi 50$ reflection hole on the upper surface of CSK-IA test block to measure the angle, and place the probe according to point C in Figure 28.

① Preparation

First, complete the zero-point, material sound velocity and front edge calibration of the angle probe.

② Enter Angle Calibration Mode

Press the calibration menu button and select the angle mode; the system will enter the angle measurement submenu.

③ Set Test Block Parameters

3.Instrument Parameter Settings

Set the hole depth parameter to 30 mm, the depth value of the $\Phi 50$ reflective hole;

Set the hole diameter parameter to 50 mm, the diameter value of the $\Phi 50$ reflective hole;

4 Capture the Echo

Adjust the recording parameters to enclose the echo from the reflective hole with the gate; press $\curvearrowright$ to activate the peak memory function, move the probe left and right to maximize the amplitude of the echo from the reflective hole; adjust the gain or press AUTO_{dB} to stabilize the echo amplitude at approximately 80% of the full screen amplitude, press RECORD to record the waveform information, and the screen will display the angle calibration results.

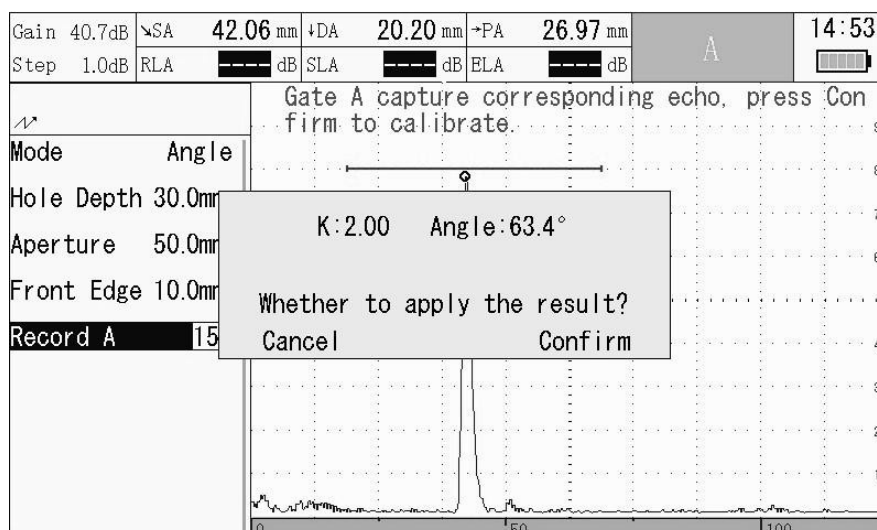


Figure 30 Angle Calibration Successful

3.3DAC Curve

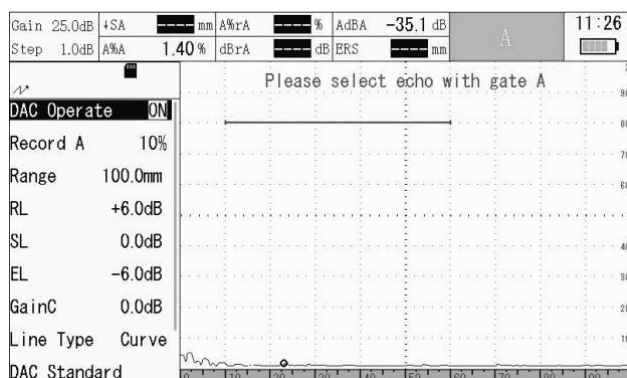


Figure31 Ready for DAC Curve Creation

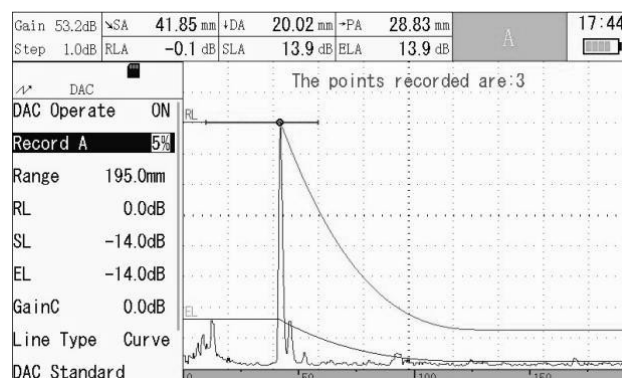


Figure32 DAC Curve Creation Completed

3.Instrument Parameter Settings

Curve making

Operating steps:

① Enter the Curve Menu

Press the curve menu button, move the cursor to the DAC menu and press . If the system prompts that an AVG curve already exists, delete it first before creating the DAC curve.

② Activate DAC Curve Operation

Select the DAC curve operation submenu and set it to On, press the Knob or  to confirm; the cursor will automatically jump to the Gate A start point parameter.

③ Enable Peak Memory Function

Place the angle probe on the test block for DAC curve creation, press  to activate echo memory to assist in locating the maximum echo.

④ Record the Echo

Adjust the start point of Gate A to enclose the target echo, adjust the gain or press  to set the echo amplitude to approximately 80%, press the shuttle or to  record the echo. After successful recording, the number of echoes recorded so far will be displayed above the waveform area on the screen.

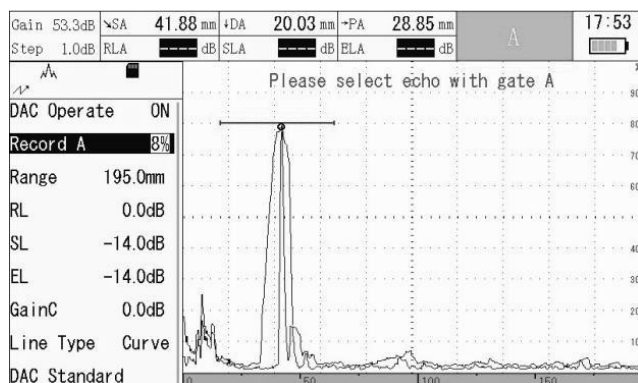


Figure33 Step③ locate the Maximum Wave

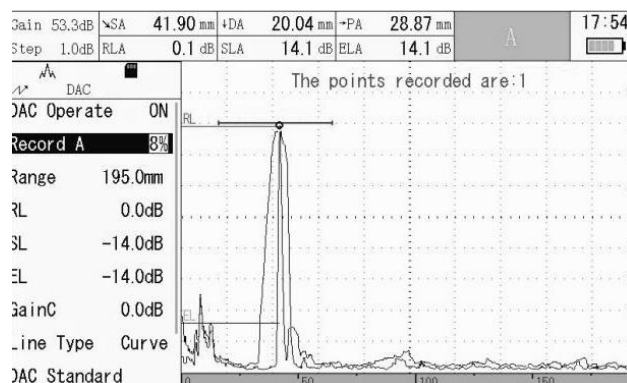


Figure34 Step④ record the Echo

3.Instrument Parameter Settings

5 Continue Recording

Repeat Step 4 until all target echoes are recorded. The system supports a maximum of 16 echoes for recording.

6 Hide DAC Curve

If the DAC curve does not need to be displayed, select Off in the curve operation submenu to hide the current curve.

Select Line Type

Select the Line Type submenu to select whether the DAC curve is displayed as a polyline, smooth curve, or polynomial. The DAC curve line type can be selected before the curve is made, or it can be selected after the curve is made.

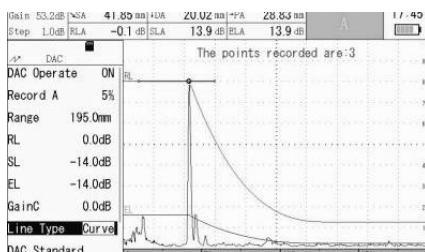


Figure 35 Line Type – Curve

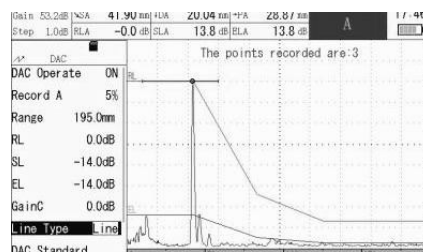


Figure 36 Line Type – Line

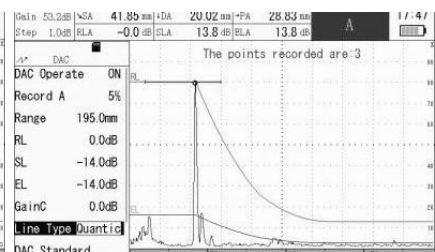


Figure 37 Line Type – Polynomial

Application standard

1 Custom Mode:

Users can directly set specific dB values for the rejection line, quantitative line, and evaluation line respectively. Enter the corresponding submenus in sequence and adjust the values to complete the settings.

2 Standard Mode:

Select the DAC Standard Parameters and press  to enter the menu.

Select the required standard by setting parameters such as Standard Name, Standard Level, Thickness Range, and Defect Length in sequence.

Press  and the system will automatically generate the corresponding curve based on the

3. Instrument Parameter Settings

selected standard.

Record Point: Used to select the number of points that have been recorded, and to adjust the gain compensation of the current point.

Record Point Compensation: The gain compensation value of the selected reference point can be fine-tuned to correct the recording error of the point caused by factors such as operating techniques.

Application Example:

As in Figure 38, after making the DAC curve, verify the wave height of 20mm hole depth. Verification found that the wave height is higher than the curve, appropriate adjustment of the compensation value of the recording point 1, compensation of 5% as shown in Figure 39, the highest point of the wave height just coincide with the curve.

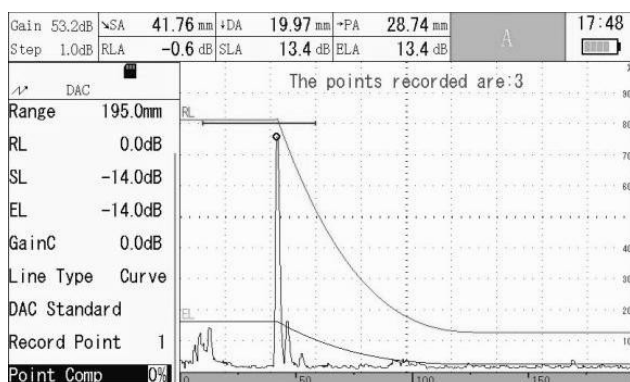


Figure 38 Record point compensation value 0%

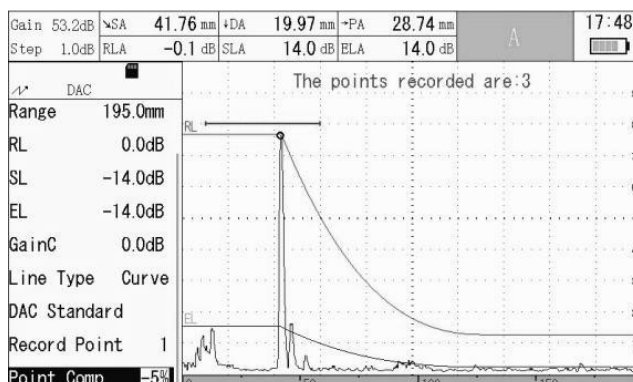


Figure 39 Record point compensation value -5%

Curve delete

Enter the curve menu and switch to the DAC main menu interface.

Select the DAC curve operation submenu and set it to Delete.

Press , Prompt: "Do you want to delete curves?" Press  to delete the entire curve, and press  to cancel the deletion.

Curve fallback

If a mistake is made during curve creation, the rollback function can be used to Recover

3.Instrument Parameter Settings

the DAC curve to the state before the last point was recorded.

In the DAC curve operation submenu, set the option to Rollback.

When the rollback option is in the blue background reverse display state, press  or Knob to roll back the curve to the state before the point was recorded.

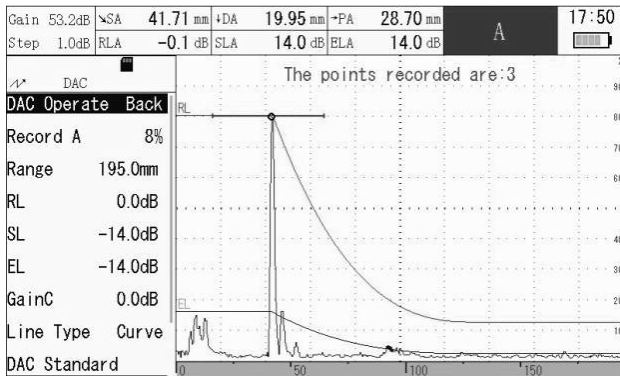


Figure 40 Before Curve Rollback

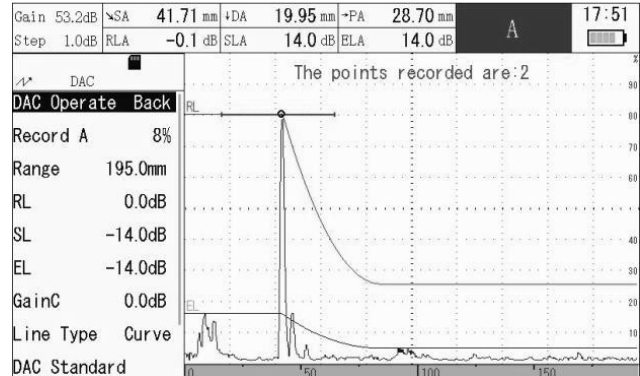


Figure 41 After Curve Rollback

3.4AVG Curve

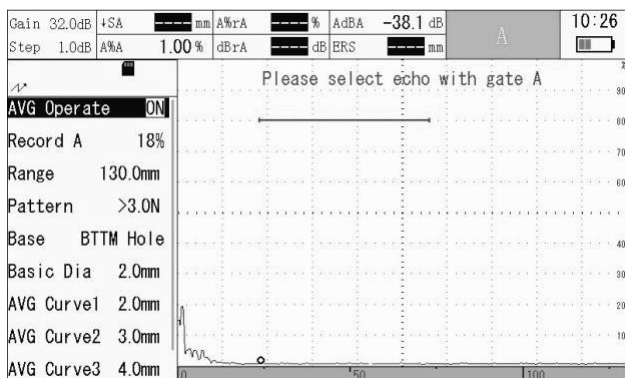


Figure 42 AVG Curve Interface

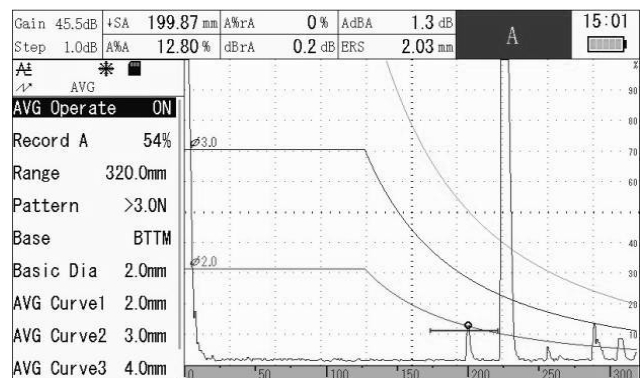


Figure 43 225mm Large Flat-Bottom Hole Curve

AVG Curve Creation

Process Preparation

Probe Settings: In the basic menu, correctly set the frequency and diameter of the straight probe.

System Calibration: Before using the AVG function, complete the instrument calibration as described in Section 3.2.

3. Instrument Parameter Settings

Enter the AVG Curve Menu

Press the curve menu button and select the AVG menu to enter the main interface.

If the system prompts that a DAC curve has been generated, delete the DAC curve first before proceeding with AVG curve creation.

Enable AVG Curve Operation

In the AVG curve operation submenu, set the option to On.

Select AVG Mode and Reference

>0.1N Mode: Applicable to the standard 2.5Z20N straight probe; generates a probe-fitted near-field AVG curve. Deviations may occur if the probe is replaced.

>3.0N Mode: Calculated based on theoretical formulas, valid only beyond 3 times the near-field length (N); represented by a straight line within 3 times the near-field length.

For curve calibration workpieces, the reference can be selected as large flat- bottom hole or flat-bottom hole.

Set Flat-Bottom Hole Equivalent for AVG Curves

In the submenus of AVG Curve 1, AVG Curve 2, and AVG Curve 3 respectively, input the equivalent hole diameters corresponding to the three curves.

Transmission Correction (Optional)

Used to compensate for the difference between the echo amplitude of the reference test block/workpiece and the theoretical value, commonly applied in scenarios where the large flat-bottom hole echo is used as the reference.

The echo amplitude of a large flat-bottom hole usually cannot reach the theoretical difference from a flat-bottom hole at the same distance; using it directly as a reference will lead to inaccurate flat-bottom hole equivalent calculation.

It is recommended to measure the actual amplitude difference between the large flat-bottom hole and the flat-bottom hole echo, and input the error between this actual

3.Instrument Parameter Settings

difference and the theoretical difference as the compensation value to improve calculation accuracy.

Record Echoes and Generate Curves

Adjust the gate to enclose the target echo, and adjust the gain or press the corresponding button to set the echo amplitude to approximately 80%.

Press the record button to save the echo; the instrument will automatically generate the AVG curve.

Hide AVG Curve

If the AVG curve does not need to be displayed, select Off in the curve operation submenu to hide the current curve.

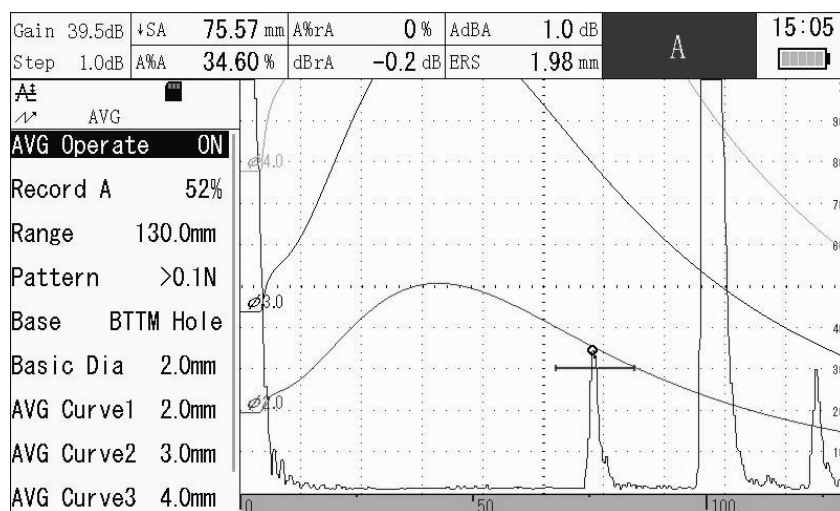


Figure44 Making AVG curve of $\phi 2$ flat bottom hole

Curve delete

Press the curve menu button to switch to the AVG main menu;

Select the AVG curve operation submenu and then choose the Delete function;

Press  and the system will prompt whether to delete the curve;

Press  again to complete the curve deletion;

Press  to cancel the deletion operation.

3.Instrument Parameter Settings

3.5System Menu

Software Shutdown : Select the Shutdown option and press  button; the system will pop up a Shutdown Confirmation Prompt asking "Shut down?". Press  button to shut down the device, or press  button to abort the operation. You can also press and hold the power button to shut down directly.

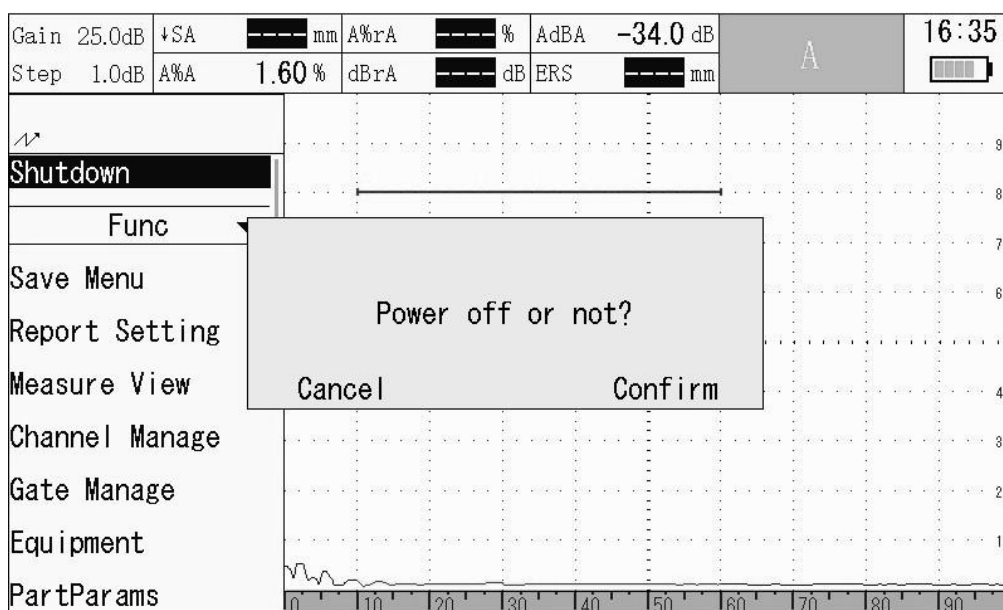


Figure45 Shutdown Prompt

3.5.1Storage Management

This submenu contains five operable file types: Single-frame Data, Multi-frame Data, Screenshot Files, Report Files, Channel Files.

Two naming methods are supported for file saving:

If the user names the file, the custom name will be used;

If no name is specified, the system will automatically use the instrument system time at the time of saving as the file name.

3.Instrument Parameter Settings

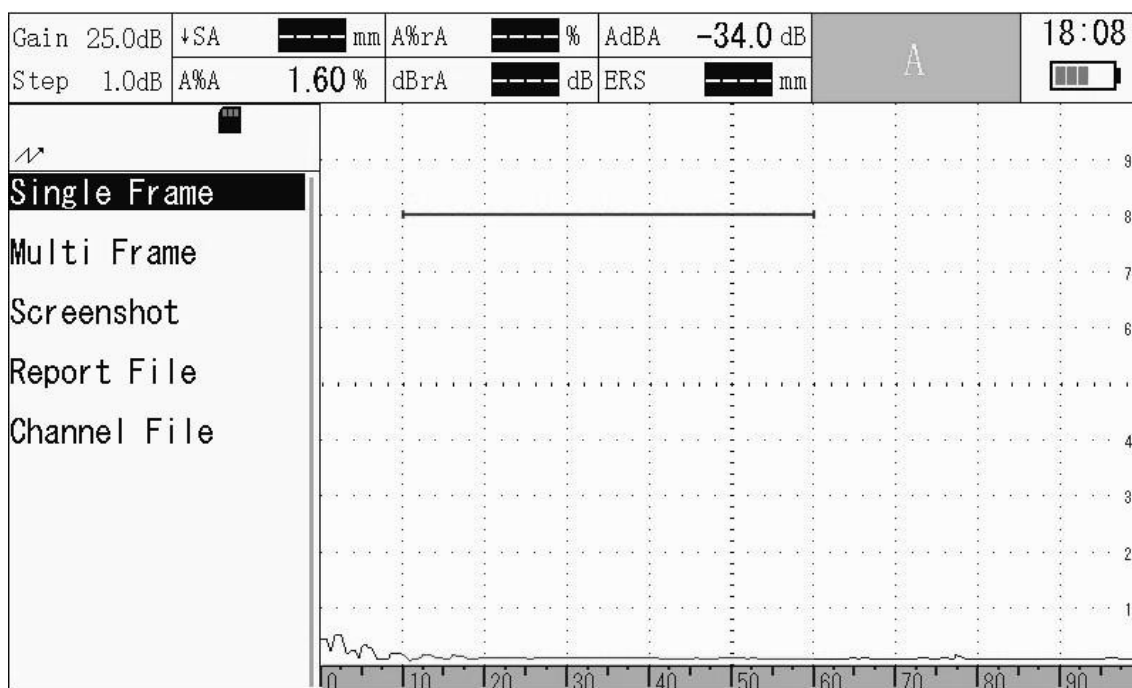


Figure46 Storage Management Interface

File Naming Rule Examples

- 1)Screenshot File: The file name 0819170341-R.BMP indicates that the file was saved at 17:03:41 on August 19th; the suffix -R identifies it as a screenshot file.
- 2)Single-frame Data: The file name 08191700.03 indicates that the file was saved at 17:00:03 on August 19th.

3.5.1.1Single-frame Data

Used to store the waveform information at the moment of freezing. The saving method is as follows:

- 1.Short-press **⌘** to freeze the current waveform, then long-press **⌘** to enter the saving process;
- 2.The system will automatically pop up a virtual keyboard, and you can perform either of the following operations:

Manual Naming: Enter a custom file name (maximum 16 characters). After completion,

3.Instrument Parameter Settings

select the ✓ symbol on the keyboard or click the blank area above the text box to save;

Automatic Naming: Directly select the ✓ symbol on the keyboard or click the blank area above the text box, and the system will automatically generate a file name based on the current instrument time.

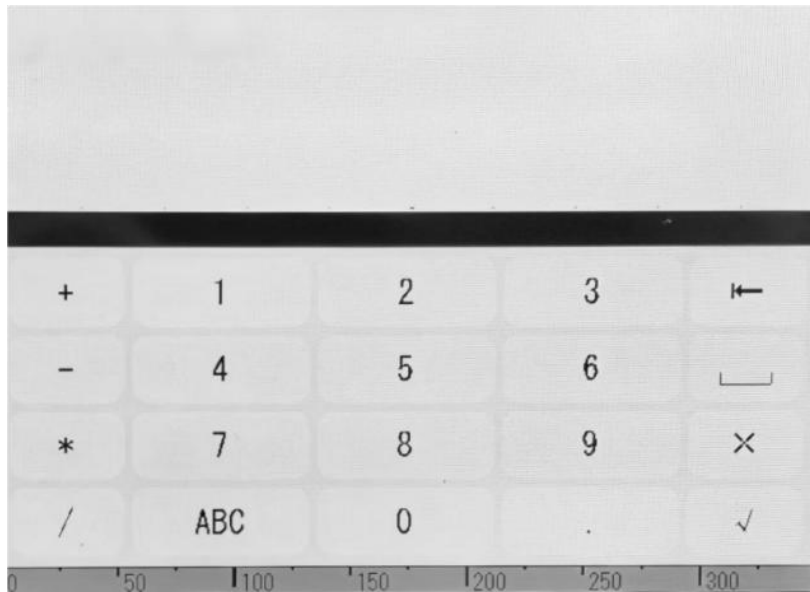


Figure47 Virtual Keyboard

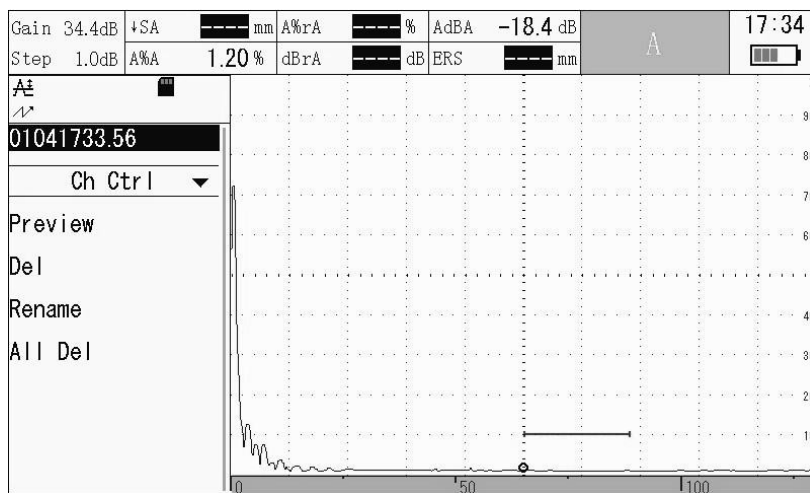


Figure48 Single frame data Interface

File Management

1)Selection & Viewing: The first parameter displays the file name. Press the Knob or  to open the list of saved single-frame data. Move the cursor to select the target file, then press the Knob or  again to view the waveform and configuration information of the file.

3.Instrument Parameter Settings

2)Preview: The waveform and corresponding configuration of the current single- frame data can be previewed. Press  to exit and return during preview.

3)Delete: Delete the currently selected single-frame data file.

4)Rename: Support renaming the currently selected single-frame data file.

5)Delete All: Delete all saved single-frame data files with one click.

3.5.1.2Multi-frame Data

Used to store waveform recording videos. The saving method is as follows:

1.Start Recording: Long-press  to initiate recording, and the system will collect waveform data continuously;

2.Stop Recording:

Auto Stop: Recording will stop and save automatically after capturing 500 frames;

Manual Stop: Press  again during recording to stop and save in advance;

3.File Naming: The naming rules are consistent with those of Single-frame Data files; please refer to the corresponding previous section for details.

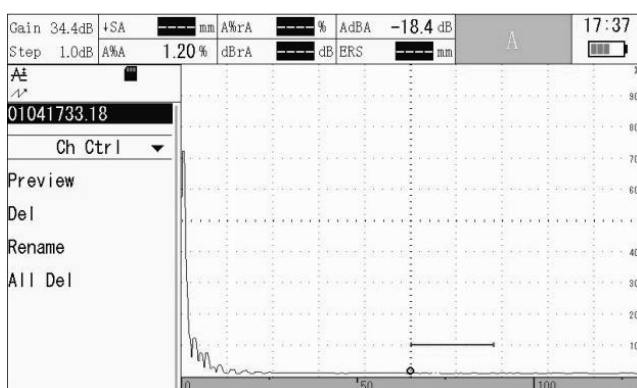


Figure 49 Multi-Frame Data Interface

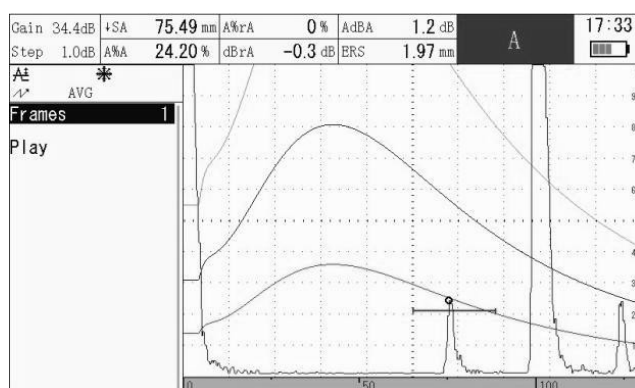


Figure 50 Multi-Frame Data Preview Interface

File Management

1)File Selection & Playback

The first parameter displays the file name. Press the Knob or the designated button to

3.Instrument Parameter Settings

open the list of saved multi-frame data. Move the cursor to select the target file, then press the Knob or  again to view the file content.

After opening the file, the adjustable parameters in the left menu include Frame Number and Playback; the remaining parameters are the original configurations set during recording.

Playback Control Methods:

Press  or select the Playback parameter to play the video automatically; Or manually control the frame number by adjusting the Knob.

2)Preview: Preview the waveform and configuration information of the current multi- frame data; press  to end the preview.

3)Delete: Delete the currently selected multi-frame data file.

4)Rename: Rename the currently selected multi-frame data file.

5)Delete All: Delete all saved multi-frame data files with one click.

3.5.1.3Screenshot Files

Used to store screen capture information. The saving method is as follows:

1.Screen Capture Operation: Long-press to capture the current screen content and save it as a file in the format of xxx-R.BMP;

2.File Naming: The naming rules are consistent with those of Single-frame Data files; please refer to the corresponding previous section for details;

3.File Reading: After connecting to a computer in USB Disk Mode, all screenshot files can be viewed in the PICTURE folder.

3.Instrument Parameter Settings

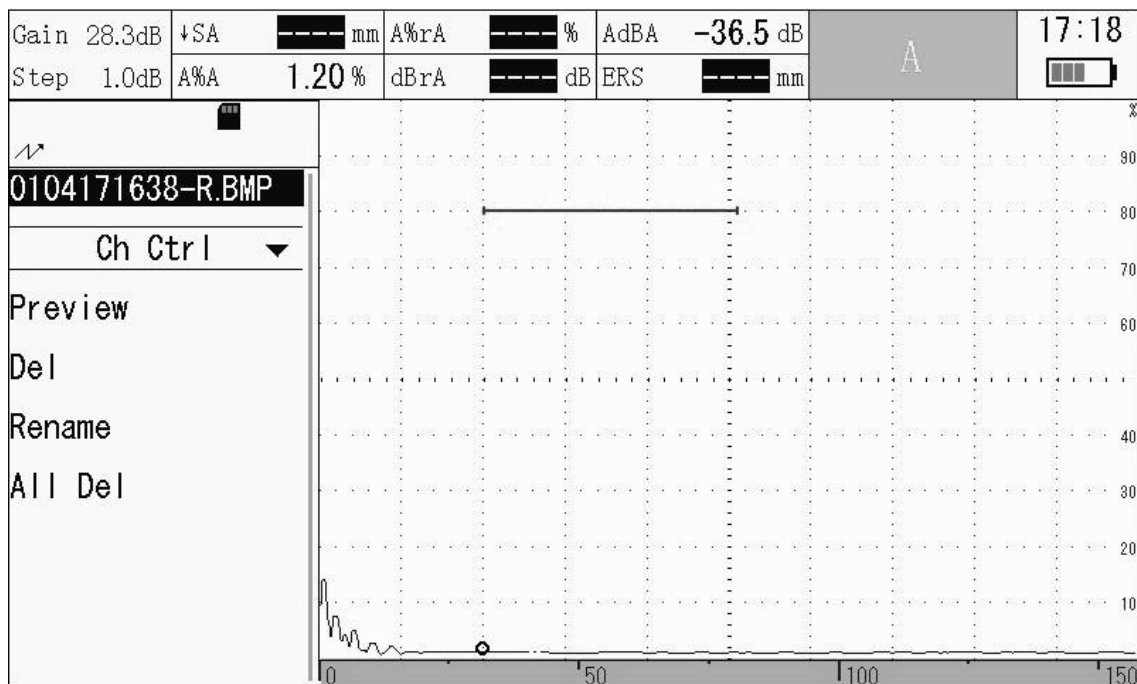


Figure 51 Screenshot File Interface

File Management

1)File Selection & Viewing

The first parameter displays the file name. Press the Knob or  to open the list of saved screenshot files. Move the cursor to select the target file, then press the Knob or  again to view the screenshot content.

2)Preview: Preview the currently selected screenshot file; press any button to exit the preview mode.

3)Delete: Delete the currently selected screenshot file.

4)Rename: Rename the currently selected screenshot file. When renaming a screenshot file, the system will automatically update the name of the associated report file with the same name to ensure the consistency of the file association.

5)Delete All: Delete all saved screenshot files with one click.

3.5.1.4Report Files

Used to store inspection reports generated by the device. The saving method is as follows:

3.Instrument Parameter Settings

First, complete all report information in System Menu → Functions → Report Settings. Finally, when long-pressing to generate a screenshot file, the system will automatically create a report file with the same name. After connecting to a computer in USB Disk Mode, the corresponding report files can be read in the device's REPORT folder.

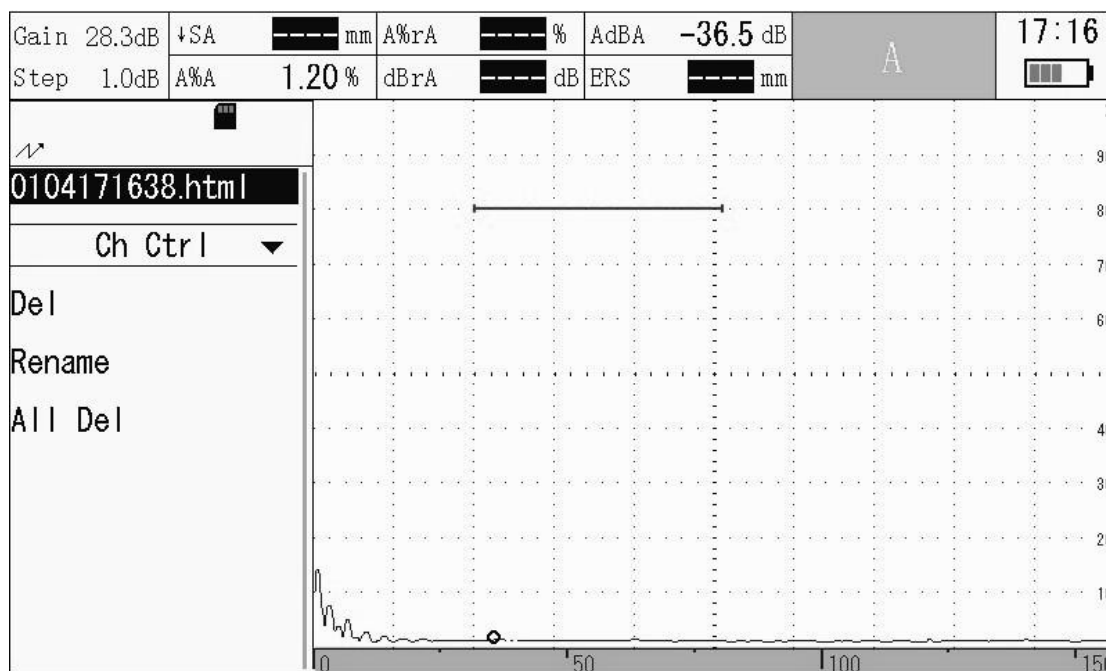


Figure52 Report File Interface

Report File Management

Steps for Viewing Report Files:

1. Enter the path: System Menu → Function → Device Management, and set the Type-C port to USB flash drive mode.
2. Connect the instrument to a computer via the Type-C data interface.
3. On the computer side, open My Computer (see Figure53 for the operation interface diagram).
4. Access the removable disk corresponding to the instrument, then enter the REPORT folder to view the report files.

3.Instrument Parameter Settings

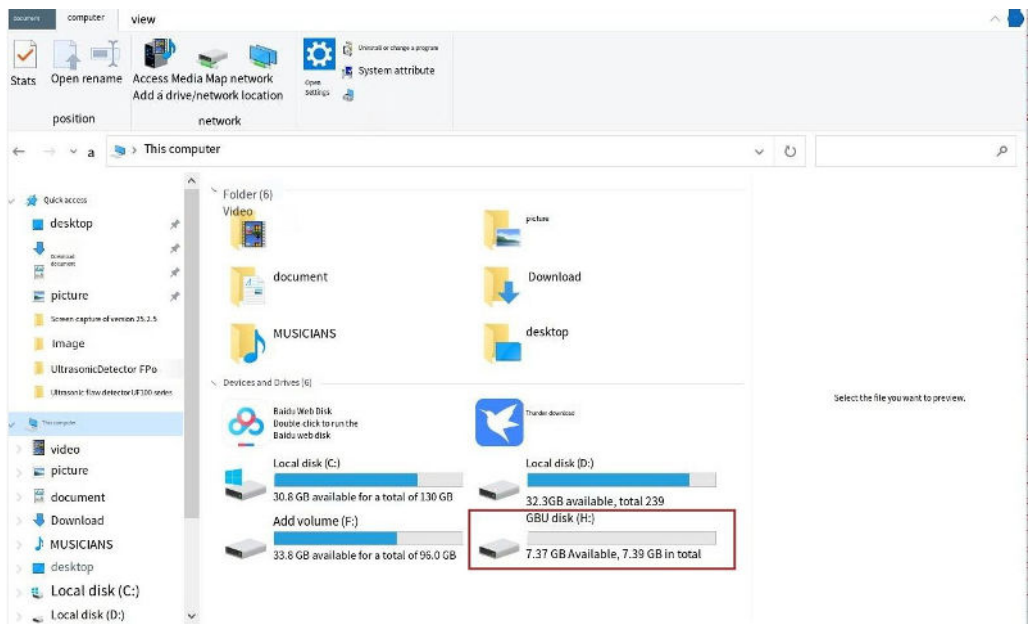


Figure53 USB flash disk mode

USB Flash Drive File Directory Description

Double-click to open the USB flash drive; its directory structure is shown in Figure 54. The functions of each folder are as follows:

CHANNEL: Used to save the instrument channel configuration information.

REPORT: Used to store the generated inspection report files.

PICTURE: Used to save the screen capture files related to reports.

Folder	2017/9/23 8:09
BSCAN	2017/8/23 10:59
CHANNEL	2017/9/23 8:09
CONFIGURATION	2017/9/23 8:09
PICTURE	2017/9/23 8:09
RECORD	2017/9/23 8:09
REPORT	2017/9/23 8:09
WAVEFORM	2017/9/23 8:09
BSCAN.CNT	2017/8/13 15:12
BSPHOTO.CNT	2017/8/13 15:12
FULL.CNT	2017/9/11 1:37
IMG.CNT	2017/8/14 16:44
KEEP.CNT	2017/8/16 5:40
RECORD.CNT	2017/8/22 6:51
REPORT.CNT	2017/8/14 16:44
ReportView.exe	2024/8/10 17:25
SCREENSHOT.CNT	2017/8/14 16:45

Figure54 USB flash disk file

3.Instrument Parameter Settings

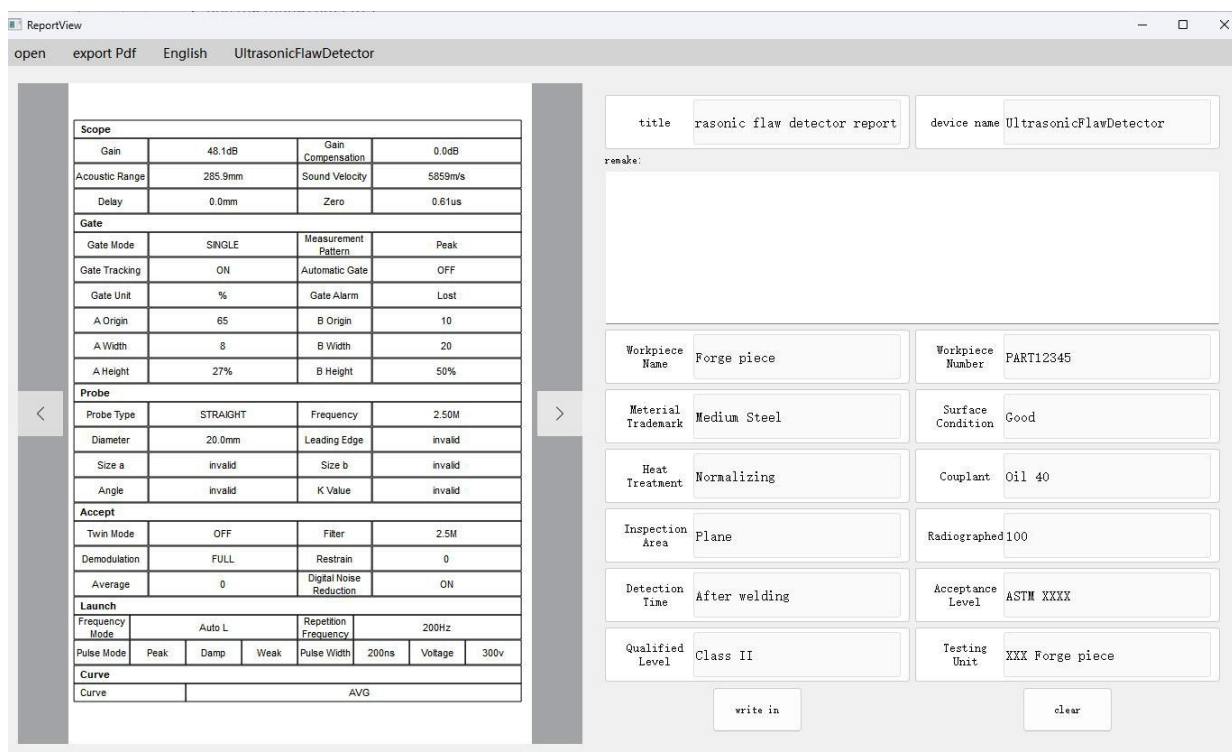
After launching the ReportView.exe report software, load the target report file via the Open option in the menu bar to edit the content and adjust the format.



Figure55 Report software

Report File Editing Process

- 1.Launch the ReportView.exe report software; the interface is shown in Figure 56.
- 2.Click the Open button and select the instrument's USB flash drive file (the instrument must be connected to the computer via the Type-C interface in advance, as shown in Figure 57).
- 3.Enter the REPORT folder in the USB flash drive (Figure 58) and select the report file to be edited.
- 4.After selecting the file, you can view and edit the report content in the ReportView.exe software.



Scope			
Gain	48.1dB	Gain Compensation	0.0dB
Acoustic Range	285.9mm	Sound Velocity	5859m/s
Delay	0.0mm	Zero	0.61us

Gate			
Gate Mode	SINGLE	Measurement Pattern	Peak
Gate Tracking	ON	Automatic Gate	OFF
Gate Unit	%	Gate Alarm	Lost
A Origin	65	B Origin	10
A Width	8	B Width	20
A Height	27%	B Height	50%

Probe			
Probe Type	STRAIGHT	Frequency	2.50M
Diameter	20.0mm	Leading Edge	invalid
Size a	invalid	Size b	invalid
Angle	invalid	K Value	invalid

Accept			
Twin Mode	OFF	Filter	2.5M
Demodulation	FULL	Restrain	0
Average	0	Digital Noise Reduction	ON

Launch			
Frequency Mode	Auto L	Repetition Frequency	200Hz
Pulse Mode	Peak	Damp	Weak
Pulse Width	200ns	Voltage	300v

Curve	
Curve	AVG

title: rasonic flaw detector report

device name: UltrasonicFlawDetector

Workpiece Name: Forge piece

Workpiece Number: PART12345

Material Trademark: Medium Steel

Surface Condition: Good

Heat Treatment: Normalizing

Couplant: Oil 40

Inspection Area: Plane

Radiographed: 100

Detection Time: After welding

Acceptance Level: ASTM XXXX

Qualified Level: Class II

Testing Unit: XXX Forge piece

write in

clear

Figure56 Reporting Software Interface

3.Instrument Parameter Settings

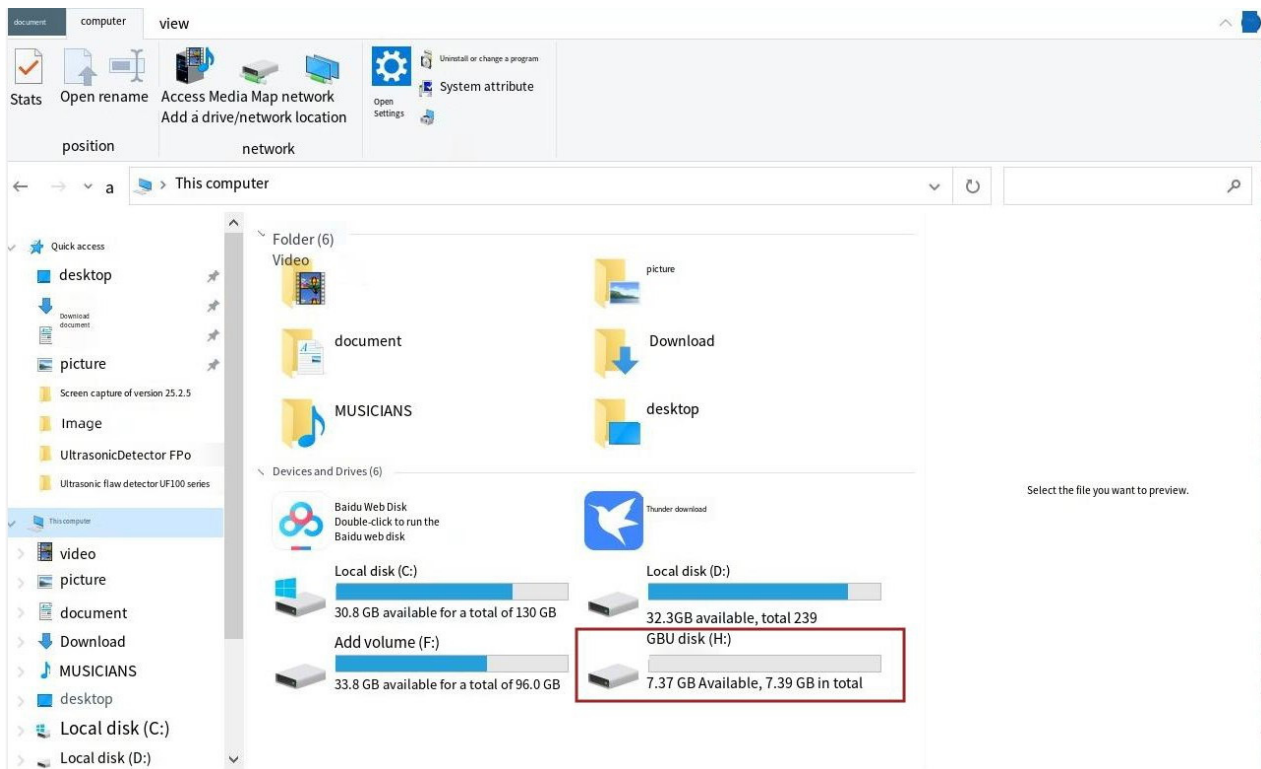


Figure57 Open USB flash disk file

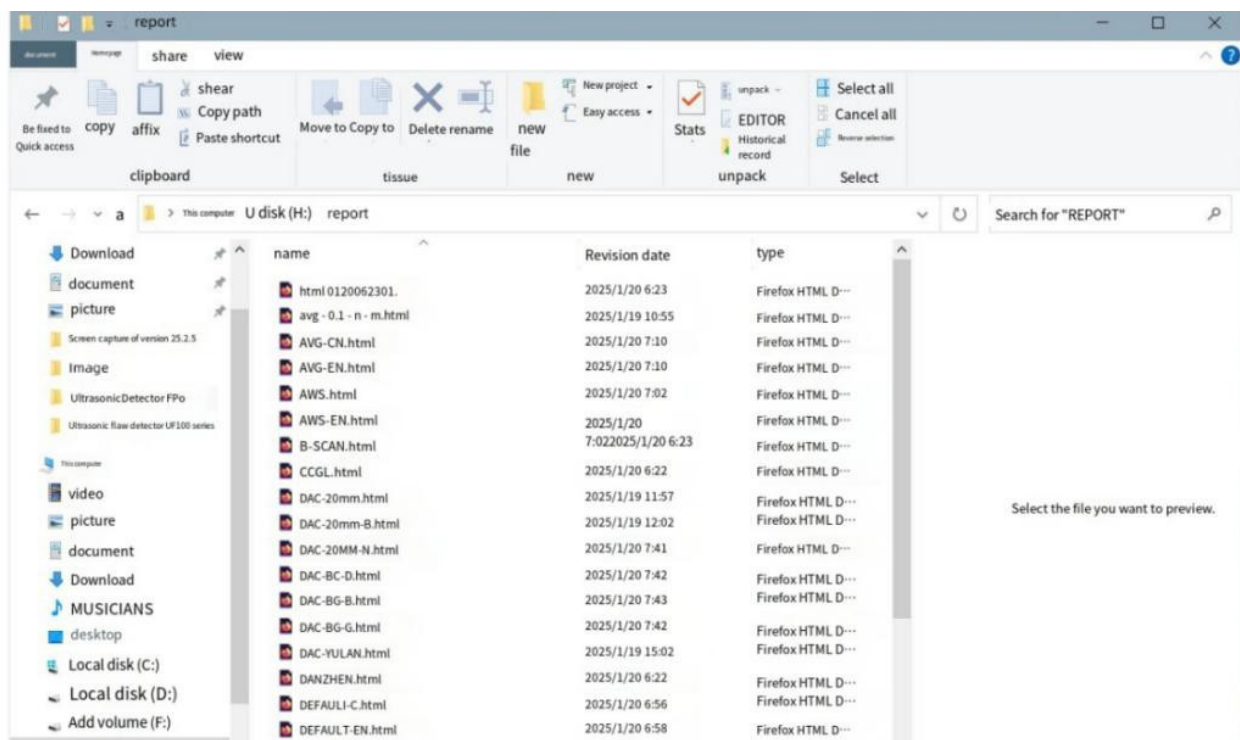


Figure58 REPORT folder

3.Instrument Parameter Settings

Report Editing & Export

Figure58 REPORT folder

Report title, device name, remark information

Workpiece name, material grade, heat treatment condition

Inspection position, inspection time, qualification grade

Workpiece number, surface condition, couplant type

Inspection ratio, acceptance standard, inspection unit

You can click Preview at any time during editing to view the report effect in the left window; after confirming there are no errors, click Export as PDF to generate the final report.

Important Note: Do not save the exported PDF report to the instrument's USB flash drive.

It is recommended to store it on the local computer or other external storage devices.

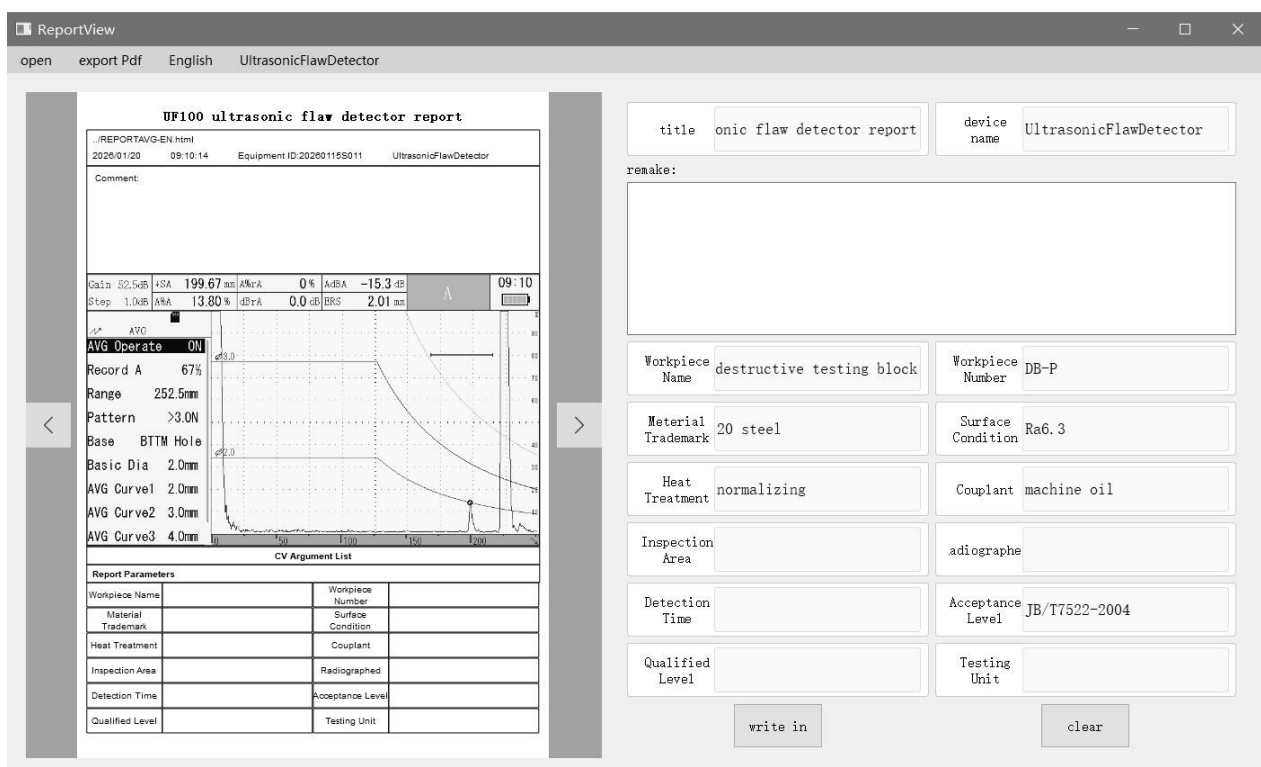


Figure59 ReportView.exe Software Interface

3.Instrument Parameter Settings

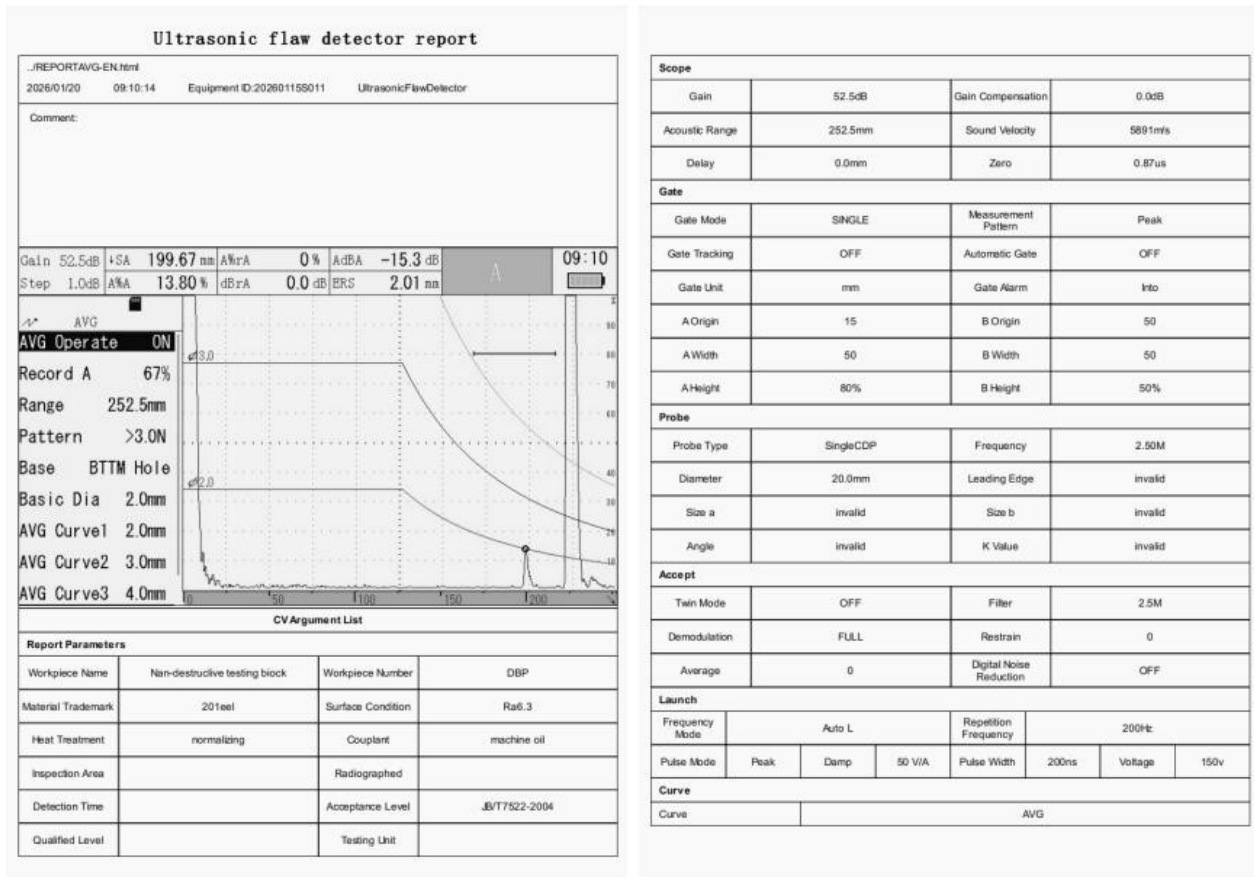


Figure60 Report File Preview

Report Preview and File Management

The report preview interface is shown in Figure60, which consists of the following components:

Information Bar: Displays the report save path, generation time, and related instrument information.

Image Area: Shows the A-scan waveform corresponding to the time of report generation.

CV (Conventional Ultrasonic) Parameter Table: Contains the complete set of parameters configured in the system, covering parameters in menus such as report settings, range, gate, probe, reception, transmission, and curves.

File Management Functions

Delete: Removes the currently selected report file.

3.Instrument Parameter Settings

Rename: Modifies the name of the current report file. When renaming a report file, the system will automatically update the name of the associated screenshot file with the same name to ensure the consistency of the file association.

Delete All: Clears all saved report files.

3.5.1.5Channel Files

Used to store the instrument's channel configuration information. The saving method is as follows:

Enter the System Menu → Functions → Channel Management parameter, select the Export Channel function, and all channel configurations in the current instrument can be exported to the SD card. After connecting to a computer in USB Disk Mode, the channel files can be read in the CHANNEL folder, and file operations such as direct copy and paste are supported.

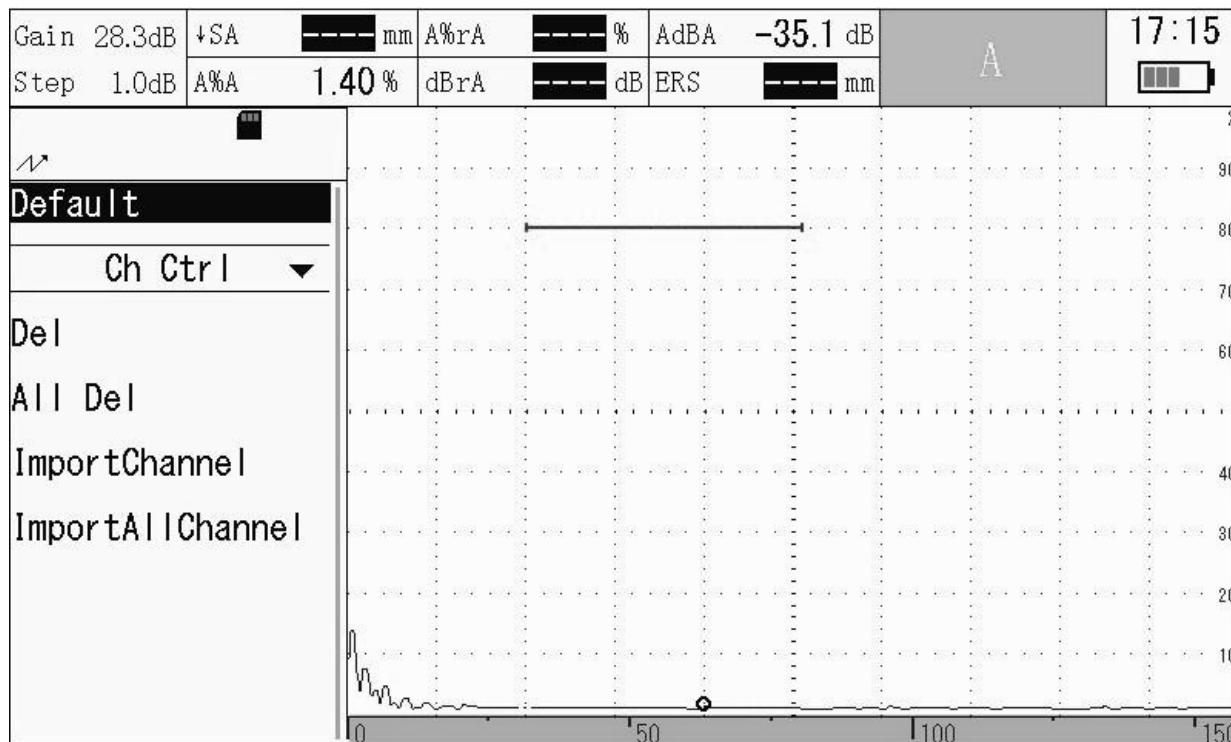


Figure61 Channel File Interface

3.Instrument Parameter Settings

Channel File Operations

Delete: Remove the currently selected channel file.

Delete All: Clear all saved channel files.

Import Current Channel: Load the channel configuration displayed at the top of the current operation interface into the instrument.

Import All Channels: Batch import all channel configurations from the SD card into the instrument (Note: Files with the same names as the existing channels in the instrument will be overwritten).

3.5.2Report Setting

Used to configure various parameter information of the inspection report, including the following settable items: Inspection Unit, Workpiece Name, Workpiece Number, Material Grade, Surface Condition, Heat Treatment, Couplant, Inspection Location, Inspection Ratio, Inspection Timing, Acceptance Standard, Qualification Grade.

Setting Method:

- 1.Move the cursor to the input box below the parameter, and short-press the Knob  or to bring up the virtual keyboard;
- 2.Enter the parameter content (a maximum of 16 characters is supported);
- 3.Select the  icon on the keyboard to confirm the input and exit the virtual keyboard.

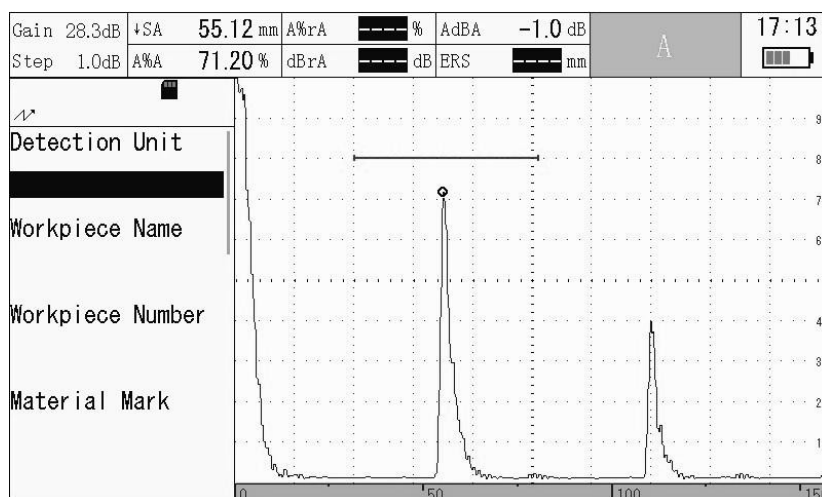


Figure62 Report Setup

3.Instrument Parameter Settings

3.5.3 Measured value display

The parameters of reflected wave in the gate are displayed at the top of the screen when the measurement mode is set.

Hover Window: Hovering in the upper right corner of the screen, the measurement value in large font is displayed as shown in Figure63.

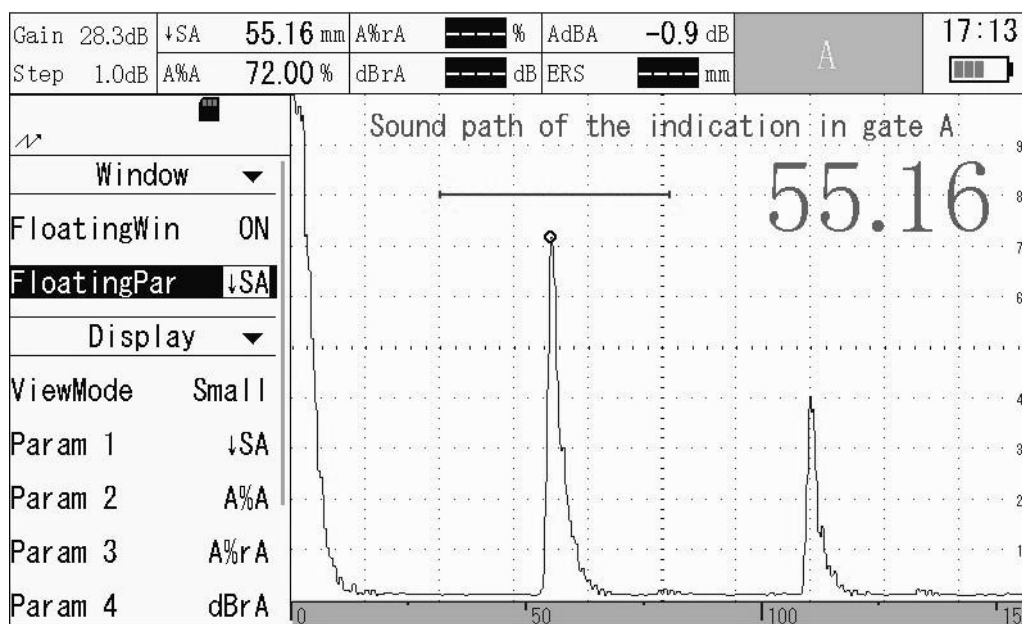


Figure63 Hover window display

Floating Window Settings

Figure63 Hover window display

1) Floating Window: Used to control the display and hiding of the on-screen floating window.

2) Floating Parameters: The types of parameters displayed in the floating window can be configured, supporting switching between the following parameters:

AdBA, AdBB

dBrA, dBrB

↓SA (Normal Probe) / ↘ SA (Angle Probe) ↓DA, →PA, →RA

↓SB (Normal Probe) / ↘ SB (Angle Probe) ↓DB, →PB, →RB

3.Instrument Parameter Settings

↓SAB, A%A, A%B A%rA, A%rB

A, B, C, D

RLA, SLA, ELA RLB, SLB, ELB ERS

Display Parameter Settings

Parameters 1 to 7 correspond to the 7 display boxes at the top of the screen in the measurement mode. Users can customize the data to be displayed in each box. For specific settings, select the corresponding parameter in the Measured Value Display Menu.

1)Display Mode

Large Mode: Only 4 measured value boxes are displayed at the top of the screen, and Parameters 4, 5, and 6 are unavailable.

Small Mode: All 7 measured value boxes are displayed at the top of the screen. Note: Only Parameter 7 supports setting the gate alarm status (A_LED,B_LED). For the display effect, refer to Figure 64 and Figure 65.

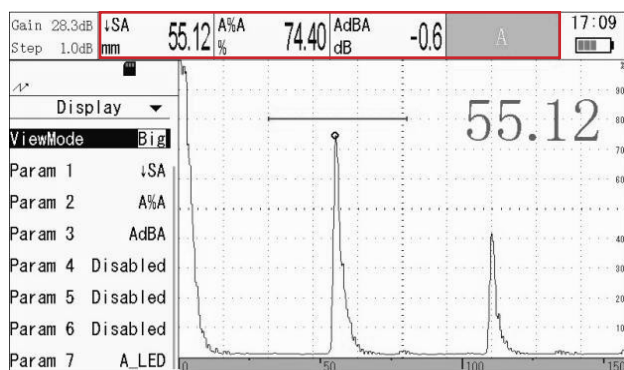


Figure64 Large Value Display Mode

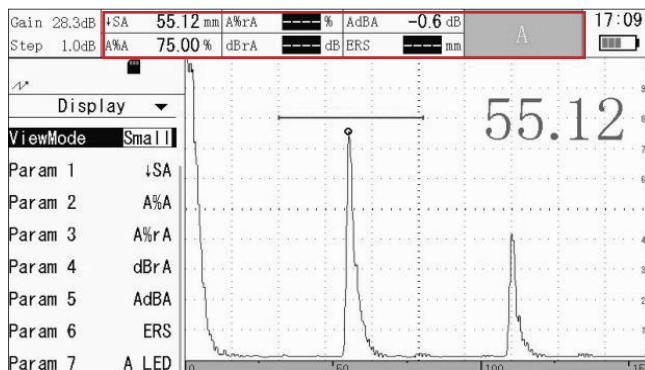


Figure65 Small Value Display Mode

2)Measured Value Parameter Description

Amplitude-Related Parameters

AdBA: The dB difference between the peak amplitude in Gate A and the gate threshold amplitude.

AdBB: The dB difference between the peak amplitude in Gate B and the gate threshold

3. Instrument Parameter Settings

amplitude.

dBrA: The dB difference between the peak amplitude in Gate A and the reference signal amplitude.

dBrB: The dB difference between the peak amplitude in Gate B and the reference signal amplitude.

A%A: The peak signal amplitude in Gate A.

A%B: The peak signal amplitude in Gate B.

A%rA: The percentage of the echo amplitude in Gate A relative to the reference amplitude.

A%rB: The percentage of the echo amplitude in Gate B relative to the reference amplitude.

Range and Depth Parameters

↘ SA: Range from the angle probe's sound beam exit point to the defect in Gate A.

↓ SA: Range from the normal probe's sound beam exit point to the defect in Gate A.

↘ SB: Range from the angle probe's sound beam exit point to the defect in Gate B.

↓ SB: Range from the normal probe's sound beam exit point to the defect in Gate B.

↓ DA: Depth of the defect in Gate A within the workpiece. ↓ DB: Depth of the defect in Gate B within the workpiece.

→ PA: Horizontal distance from the front surface of the probe to the defect in Gate A.

→ PB: Horizontal distance from the front surface of the probe to the defect in Gate B.

→ RA: Distance from the sound beam exit point to the signal indication in Gate A.

→ RB: Distance from the sound beam exit point to the signal indication in Gate B.

↓ SAB: Range of the echo measurement points in Gate A and Gate B.

AWS Standard Parameters

A: AWS AInd - Discontinuity signal indication level. B: AWS BRef - Reference signal

3.Instrument Parameter Settings

indication level.

C: AWS Catt - Attenuation factor: $2 \times (\text{Range in inches} - 1 \text{ inch})$. D: AWS DRating - Signal indication rating.

Evaluation Line Difference Parameters

RLA: The dB difference between the echo amplitude in Gate A and the RL line. SLA: The dB difference between the echo amplitude in Gate A and the SL line. ELA: The dB difference between the echo amplitude in Gate A and the EL line. RLB: The dB difference between the echo amplitude in Gate B and the RL line. SLB: The dB difference between the echo amplitude in Gate B and the SL line. ELB: The dB difference between the echo amplitude in Gate B and the EL line.

Special Parameters

ERS: Flat-bottom hole equivalent of the echo in the gate under the AVG curve.

Alarm Indication Parameters

A_LED: Gate A alarm indication (echo-on / echo-off mode). B_LED: Gate B alarm indication (echo-on / echo-off mode).

Notes

- 1)Reference Signal Description: The reference signal for the DAC curve is the quantitative line amplitude; the reference signal for the AVG curve is the reference aperture amplitude.
- 2)Alarm Logic: The echo-on mode detects reflected waves above the threshold; the echo-off mode detects reflected waves below the threshold.
- 3)Alarm Color: Red indicates an alarm state; green indicates a normal state.
- 4)Abnormal Display Handling: When parameters such as $\searrow$ SA(SB), $\downarrow$ DA(DB), $\rightarrow$ PA(PB), $\downarrow$ SAB, SLA, ERS are displayed with a green reverse background, it means there is no qualified waveform in the corresponding gate. This issue can be resolved by adjusting the gate position and gain value (to make the waveform height greater than 10% of the

3.Instrument Parameter Settings

screen).

Application Example

As shown in Figure66: The gate alarm is set to echo-on mode. There is no waveform information within the range of Gate A. The ↓SA displays a Range value of 55.05 mm, and the A_LED is green, indicating that the gate does not properly enclose the echo.

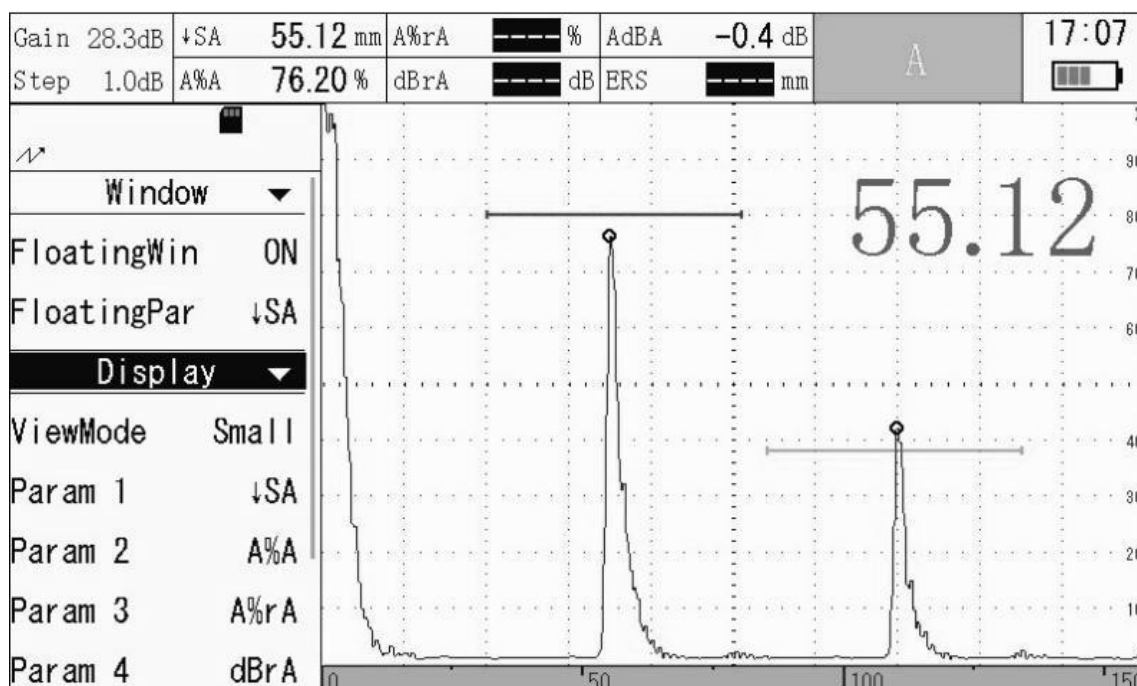


Figure66 Measurement value display explanation

3.5.4Channel management

This function is used to save complete configuration information under different inspection modes. Channel files store the following parameters:

Key Parameters

Curve Information (The DAC curve saves curve dB values, line types, and DAC standards; the AVG curve saves curve references).

Gain settings and gain compensation values.

Basic parameters including range, sound velocity, time delay, and zero point.

3.Instrument Parameter Settings

Probe and Waveform Settings

Gate tracking, waveform filling, digital noise reduction

Gate unit, gate alarm

Measurement mode, dual-crystal mode

Filter, averaging, suppression, detection settings

Transmission and Reception Parameters

Frequency mode, repetition frequency

Pulse mode, energy, voltage, damping

Probe Configuration

Type, diameter, frequency

Angle, K-value, front edge

Probe dimensions a/b, workpiece thickness

Channel Management Function Description

Channel Selection and Status Indication

Channel Name: Move the cursor to this parameter and press  to browse the list of saved channels. Select the target channel and press  again to load the channel configuration and return to the channel parameter menu.

Status Prompt: When an asterisk (*) is displayed after the channel name, it indicates that the current parameters have been modified but not saved.

Channel Creation and Saving

Create New Channel

1)Operation Method: Press and hold  (shortcut button).

2)Process: After confirming the new channel prompt, enter the channel name (maximum 16 characters) via the virtual keyboard.

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3)Saving Method: After completing the configuration, select the overwrite save function, or the current configuration will be automatically saved when creating another new channel.

Channel Maintenance and Management

Preview: View the complete configuration information of the current channel; press the specified key to exit the preview mode.

Recover: Press and hold the specified key to recover the current channel to its original configuration (operation confirmation required).

Rename: Modify the name of the current channel.

Delete: Remove the currently selected channel.

Delete All: Clear all saved channel configurations.

Export Channel: Export the channel files in the instrument to the SD memory card.

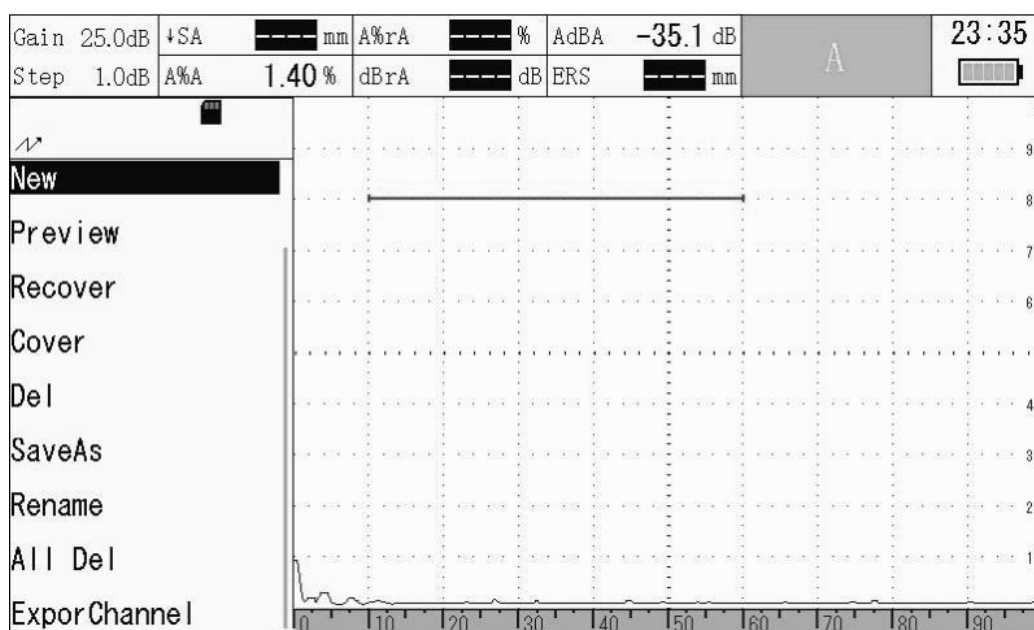


Figure67 Channel Management Interface

Export to SD card

Confirm the storage directory: Go to Settings menu → Functions → Storage Management → Channel Files. The directory list is empty by default (Figure70).

Select and export the channel: Return to the channel management interface, select the

3. Instrument Parameter Settings

target channel (e.g., the Default channel in Figure68), and execute the channel export function. Press the shuttle or  confirm to export the channel file to the specified directory on the SD card (e.g., Figure69).

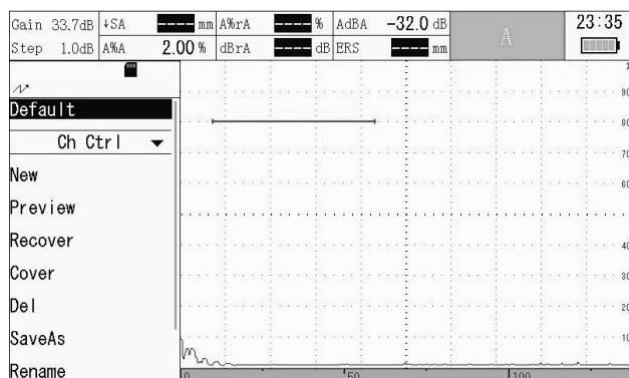


Figure68 Export Default channel

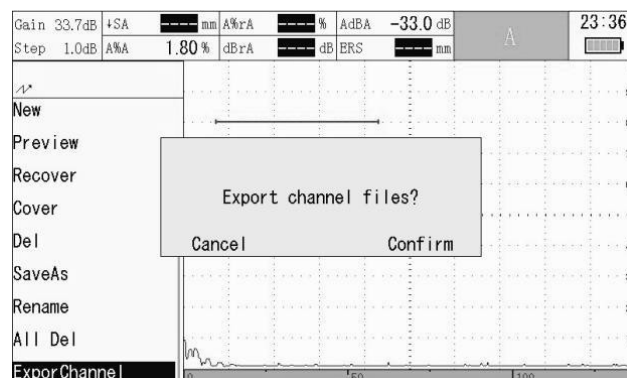


Figure69 Confirm channel export

Verify export results: Go to Storage Management → Channel File Directory again. If the exported channel name (e.g., Default channel in Figure 71) appears in the list, the export is successful.



Figure70 Channel file is empty

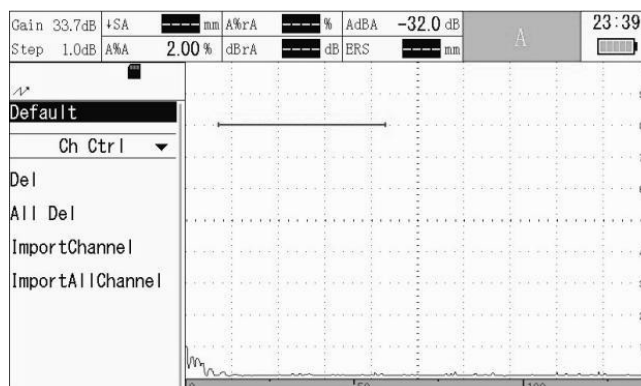


Figure71 Export succeeded

Access and share via computer (optional):

Connect the instrument to the computer using a Type-C to USB data cable, and it will be recognized as an external storage device.

On your computer, navigate to the device's G:\CHANNEL\ directory (Figure72 shows G as the drive letter, which may vary depending on your computer's configuration) to view the exported channel file.

3.Instrument Parameter Settings

Users can directly copy channel files from this directory to share. To ensure the device recognizes them correctly, always save the files in the G:\CHANNEL directory.

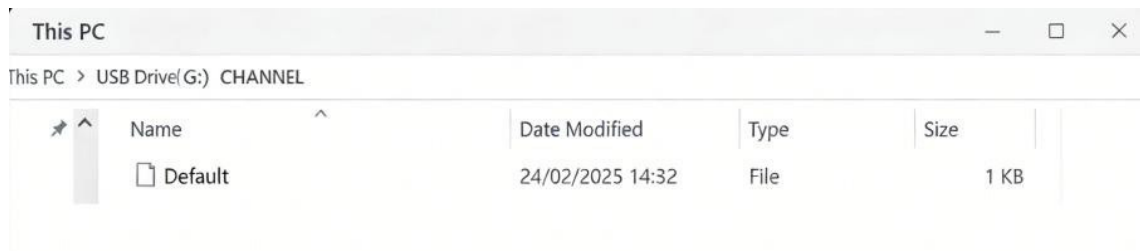


Figure 72 G: \CHANNEL\directory

Import channel to Host

1)Prepare channel files: Ensure the channel files to be imported (e.g., TEST) are stored in the G:\CHANNEL\ directory on the SD card or the instrument's internal storage.

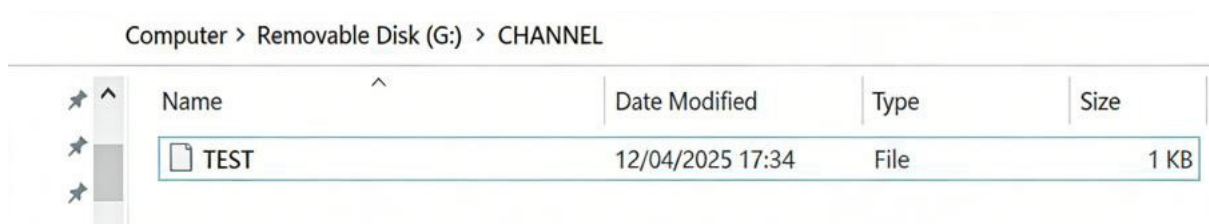


Figure 73 saves channel files to the G:\CHANNEL directory

Note: To ensure the imported channel configuration takes effect, restart the instrument host after successful import.

2)Perform import operation: On the instrument, navigate to the Settings menu → Functions → Storage Management → Channel Files, select the target channel file in the list (e.g.,TEST channel in Figure 74), execute the current channel import function, and confirm by pressing the Knob or  prompts (as shown in Figure 74).

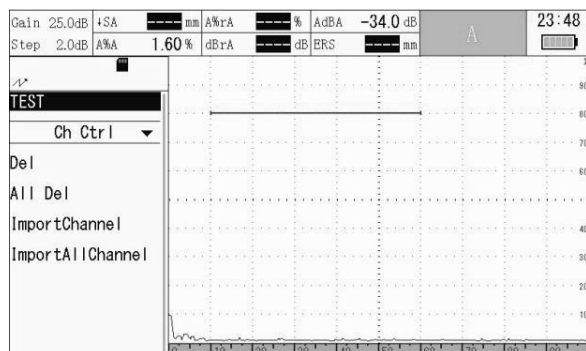


Figure74 channel saved successfully

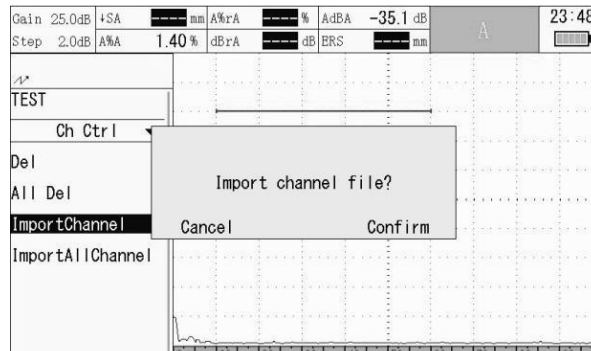


Figure75 Channel import into the host

3.Instrument Parameter Settings

3)Verify import results: After completing the operation, go to the channel management interface. If the newly imported channel (e.g., TEST) appears in the list, the import is successful.

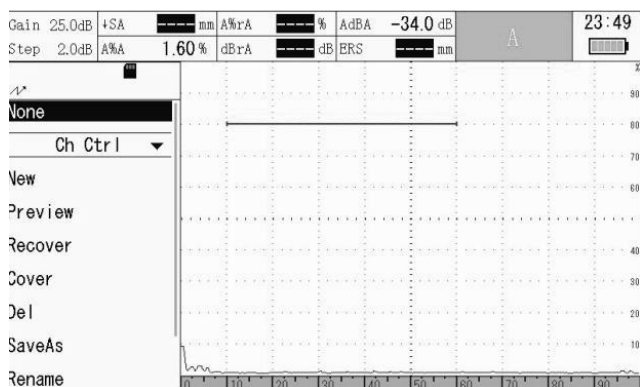


Figure76 No channel file imported

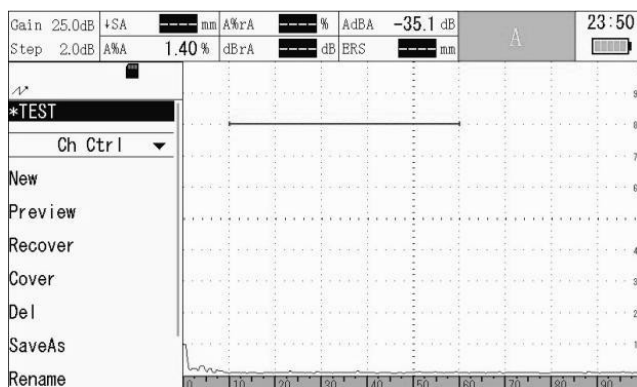


Figure77 Channel file import successful

Channel status indication

As shown in Figure78, the instrument is initially loaded with the default channel's original parameter configuration. When the probe type of this channel is modified from the default setting to oblique, the channel name will display an asterisk (*) (Figure79), indicating that the current instrument parameters are inconsistent with the configuration saved in the original channel.

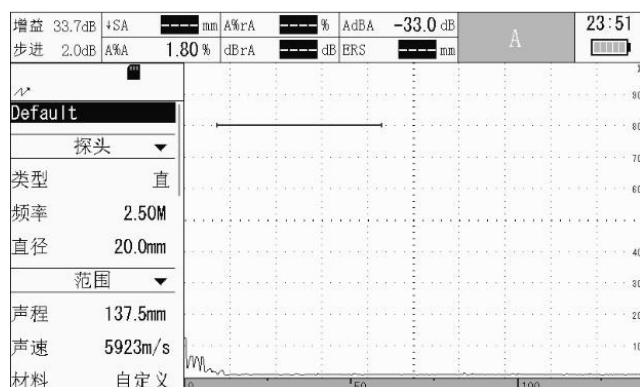


Figure78 Default channel

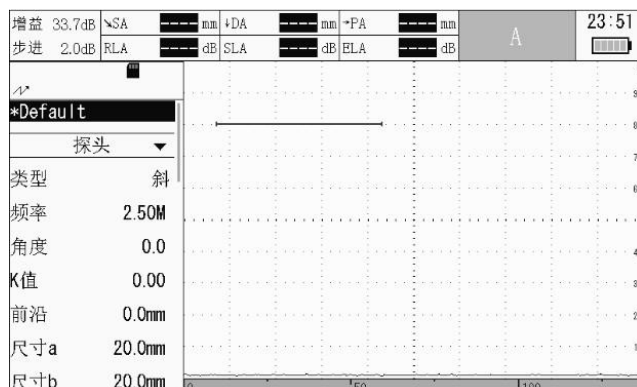


Figure79 Modify Default Channel

3.5.5Gate management

Gate expansion: The acoustic path region within the gate range is magnified to facilitate

3.Instrument Parameter Settings

detailed observation of waveform inside the gate.

Operation: Long press to quickly turn on/off (shortcut key).

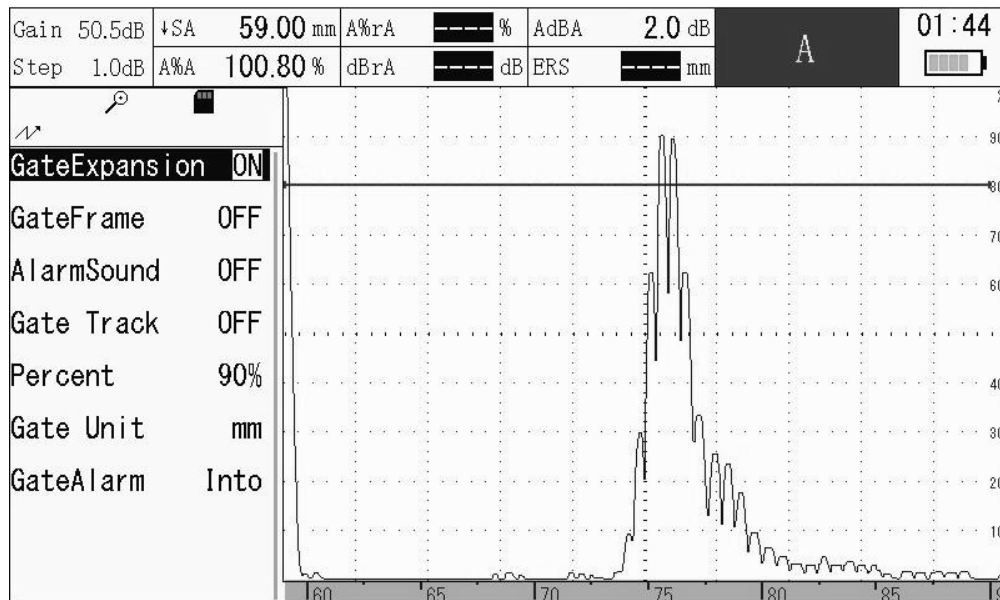


Figure80 Gate Extension Function

Alarm sound: controls the activation and deactivation of the alarm buzzer.

Gate tracking: Automatic Gate Height Following the Amplitude Change of the Gate's Internal Reflection Wave

- 1)Set the tracking amplitude ratio using the percentage parameter.
- 2)Set specific tracking thresholds by monitoring height parameters.

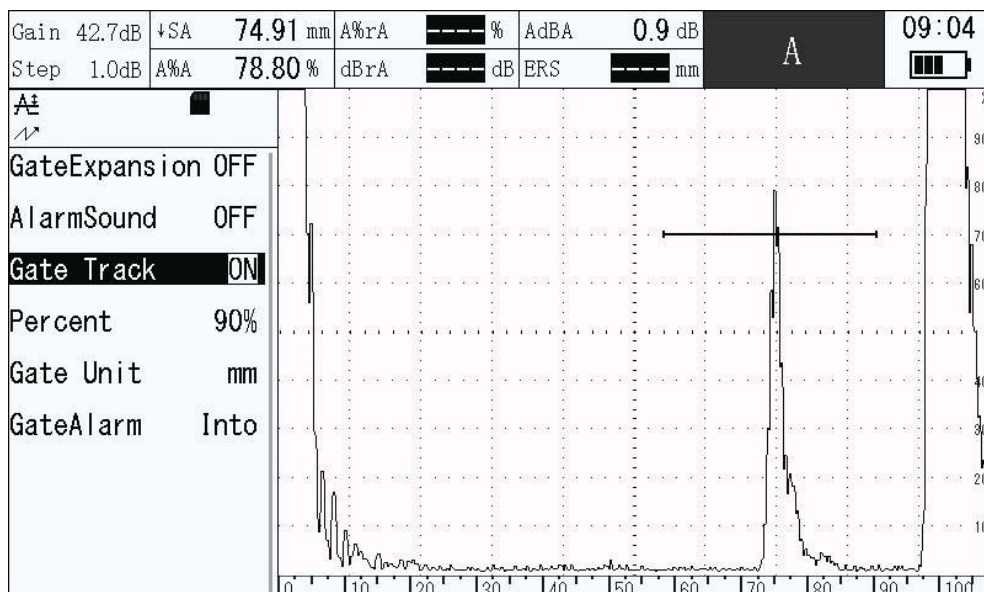


Figure81 Gate tracking activated, with the gate height fixed at 90% of the wave height.

3.Instrument Parameter Settings

Gate unit

1)When set to%: The gate position and width are calculated as a percentage of the screen waveform area.

2)When set to mm: The gate position and width automatically adjust with the Range.

Note: The gate height is fixed in% units.

Gate alarm

1)Wave mode: Detects reflected waves above the threshold.

2)Wave loss mode: Detects reflections below the threshold.

3)Display settings: Set to A_LED/B_LED in System Menu → Functions → Measurement Display → Parameter 7.

4)Status indicator: White-Alarm, Black-Normal.

3.5.6Device management

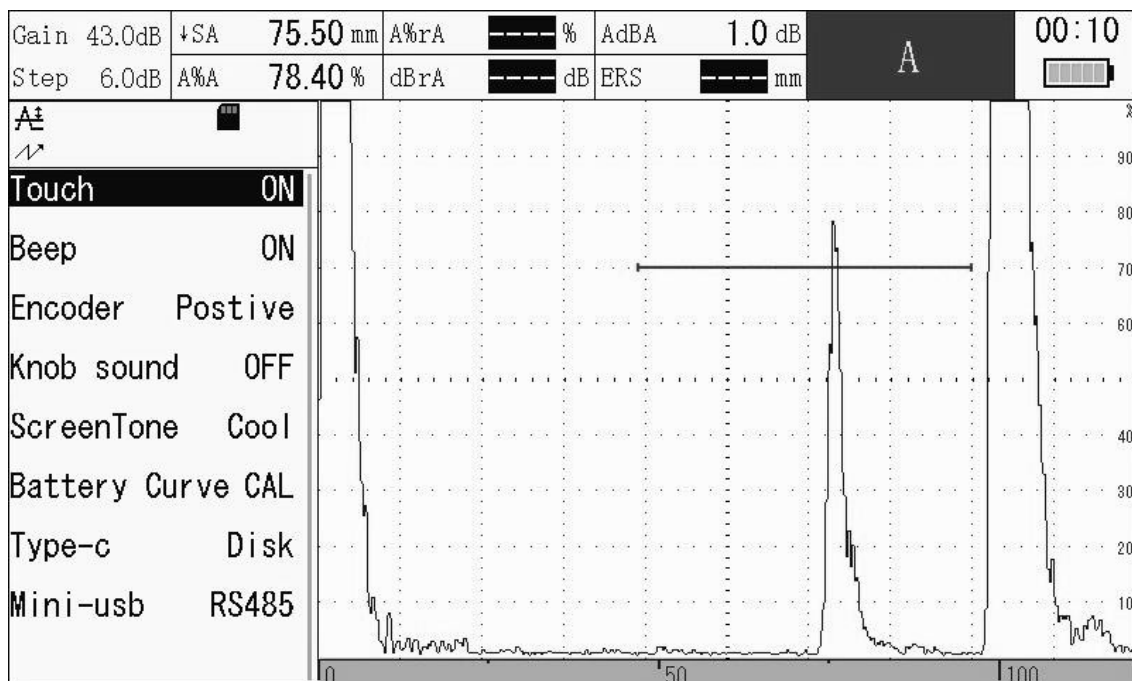


Figure82 Device Management Interface

Touch: Control the touch screen functions.

Buzzer: controls the on/off status of gate alarm and shutdown notification sound; the

3.Instrument Parameter Settings

startup notification sound remains active.

Direction of the knob: Configures the flywheel knob's rotation direction based on user preferences.

Knob sound: When enabled, the buzzer will emit a sound when you turn the knob.

Screen tone: Switch between cool and warm tones to match your theme and brightness settings, adapting to visual needs in various working environments.

Battery curve: Manually calibrates the power-voltage relationship of the battery to correct power display errors caused by environmental temperature changes.

Type-C: Set the output mode for the Type-C port:

1)USB mode: Switch to this mode when connecting to a computer to view reports, screenshots, or other files.

2)Serial mode: For data transfer and command control with computers.

Mini-USB: Set the output mode for the Mini-USB port:

1)RS485 mode: Enables multi-point communication,ideal for long-distance, interference-resistant data transmission in industrial environments.

2)UART mode: Provides a standard serial communication protocol.

3.5.7AWS D1.1/D1.5 Weld Grade

Calculation of weld grade for steel structure welds (D1.1) and bridge welds (D1.5) as specified by the American Welding Society (AWS).

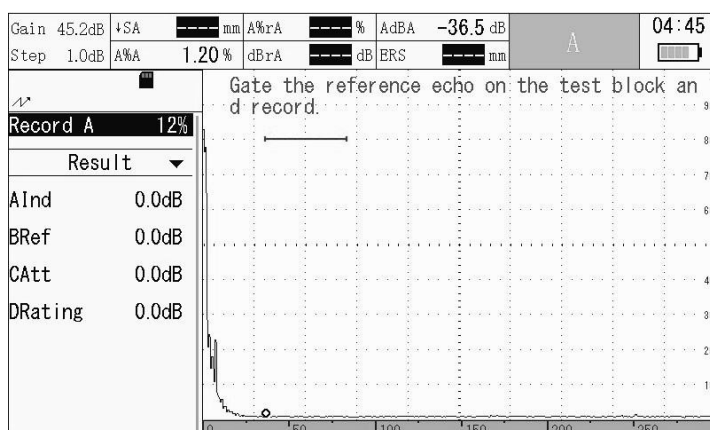


Figure83 AWS D1.1/D1.5 Weld Grade Measurement Interface

3. Instrument Parameter Settings

Operating steps:

- 1) Select appropriate probes and standard test blocks in accordance with AWS D1.1/D1.5 specifications, ensuring that the instrument and probe are calibrated for probe zero, sound velocity, and angle.
- 2) Access the System menu → Function → AWS D1.1/D1.5 interface.
- 3) Place the oblique probe on the reference specimen, then adjust the probe to position the echo signal peak of the reference reflector on the specimen inside the gate (if not, adjust the recording).
- 4) Adjust the gain of the instrument to make the peak height of the echo signal within the range of 10%~90% of the screen height.
- 5) Press  (selecting the gate A starting point with the cursor) to record the reference wave gain value as BRef. The recorded result will  appear in the BRef menu. Each time the cursor selects the gate A starting point, pressing the button updates the BRef value.
- 6) Record the gain of the defect wave: Place the oblique probe on the workpiece to be tested, then move the probe so that the peak of the defect echo signal appears inside the gate (if not, adjust the gate position).
- 7) Maintain probe stability. The basic gain at this point corresponds to the AInd value in AWS standards. The instrument automatically reads the current echo's distance Range value (the system converts it to inches) and calculates the attenuation correction value (CAtt) using the AWS standard formula $C = (A - 1) \times 2$ (inches).
- 8) After the calculation is complete, the screen will display the final result of D (DRating) = A-B-C. Users can record this value and enter it into the flaw detection report.

Note 1: All calculations are based on AWS D1.1-2006 and AWS D1.5-2002.

3.Instrument Parameter Settings

3.5.8configure

Automatic Peak: Sets the maximum echo inside the gate to a specified level. After  setting the target level, press the button. The system automatically adjusts the gain to achieve the set level.

For example, if the automatic wave peak  is set to 80%, the highest echo inside the gate will automatically adjust to 80% of the screen height when the button is pressed.

Capture mark: Marks the captured peak position as a white circle. This feature is enabled by default during calibration and curve generation.

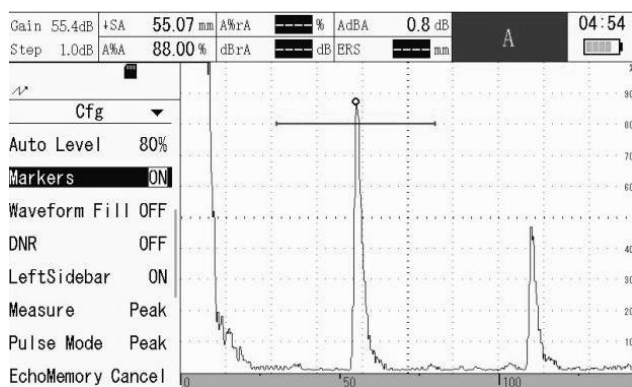


Figure84 Open Capture Mark

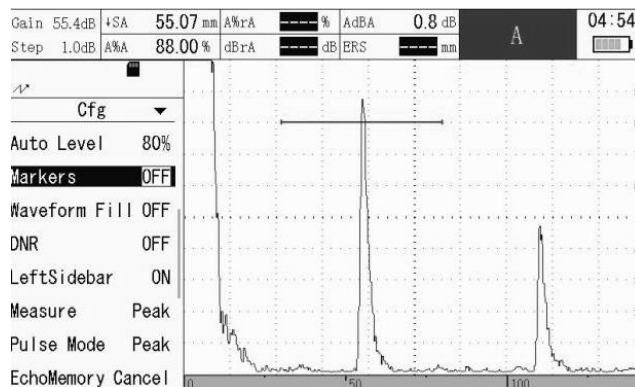


Figure85 Close Capture Mark

Waveform fill: When enabled in positive half-wave, negative half-wave, or full-wave detection modes, it fills the empty areas of the waveform with color to improve visual clarity.

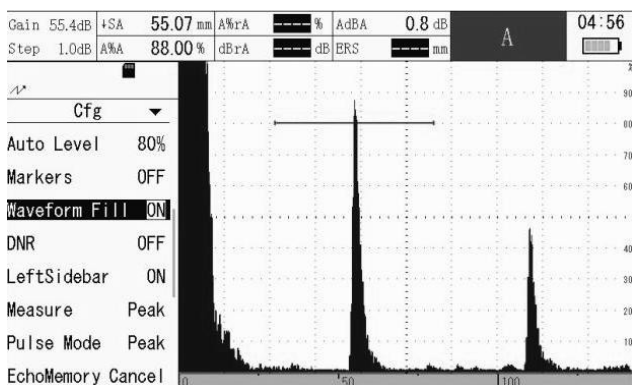


Figure86 Open waveform fill

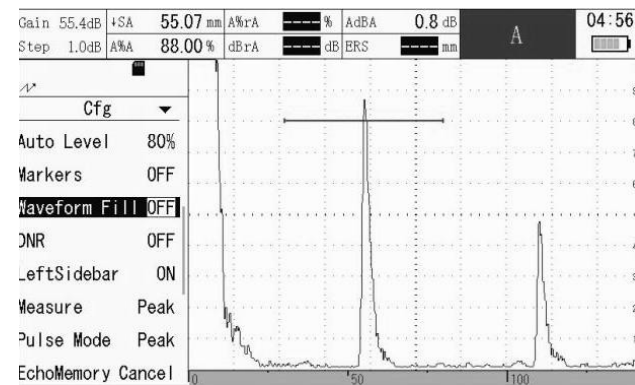


Figure87 Closed Waveform Filling

3.Instrument Parameter Settings

Digital noise reduction: Eliminates noise interference in A-scan signals through digital filtering technology, enhancing signal purity.

Full-screen sidebar: Controls the display and hiding of sidebar parameters in full- screen mode.

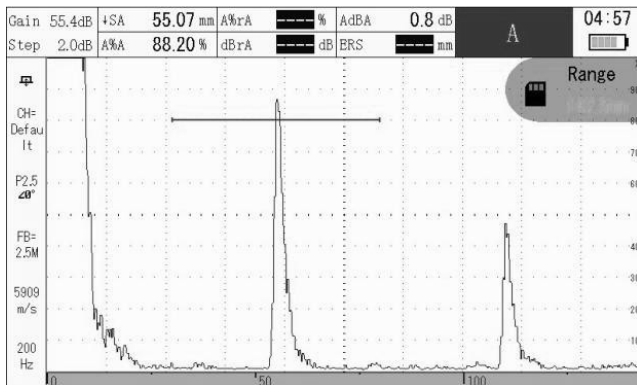


Figure88 Full-screen side display

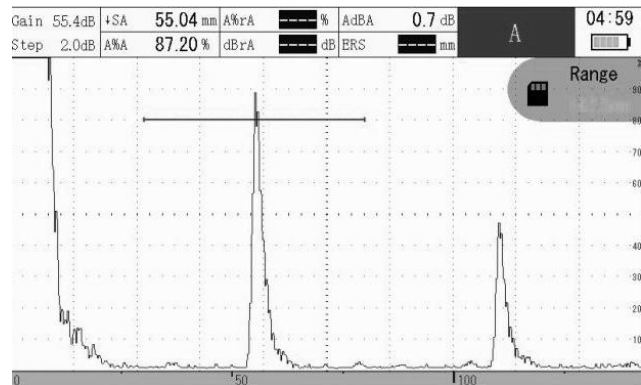


Figure89 Full-screen side display off

Measurement pattern

Three echo measurement modes are provided, and the calculation rules of Range and amplitude differ under different modes:

Measurement pattern	Range calculation datum	Scale calculation basis
Peak value	Highest echo point inside the gate	Highest echo point inside the gate
Forward position	The intersection point of the initial boundary of the gate and the echo	Highest echo point inside the gate
J forward position	The intersection point of the initial boundary of the gate and the echo	Peak point of the echo at the intersection point

Example (see Figure90)

- 1)Peak mode: Range = x_c , amplitude = y_c .
- 2)Advanced mode: Range = x_a , amplitude = y_c .
- 3)J Frontier Mode: Range = x_a , amplitude = y_b .

3.Instrument Parameter Settings

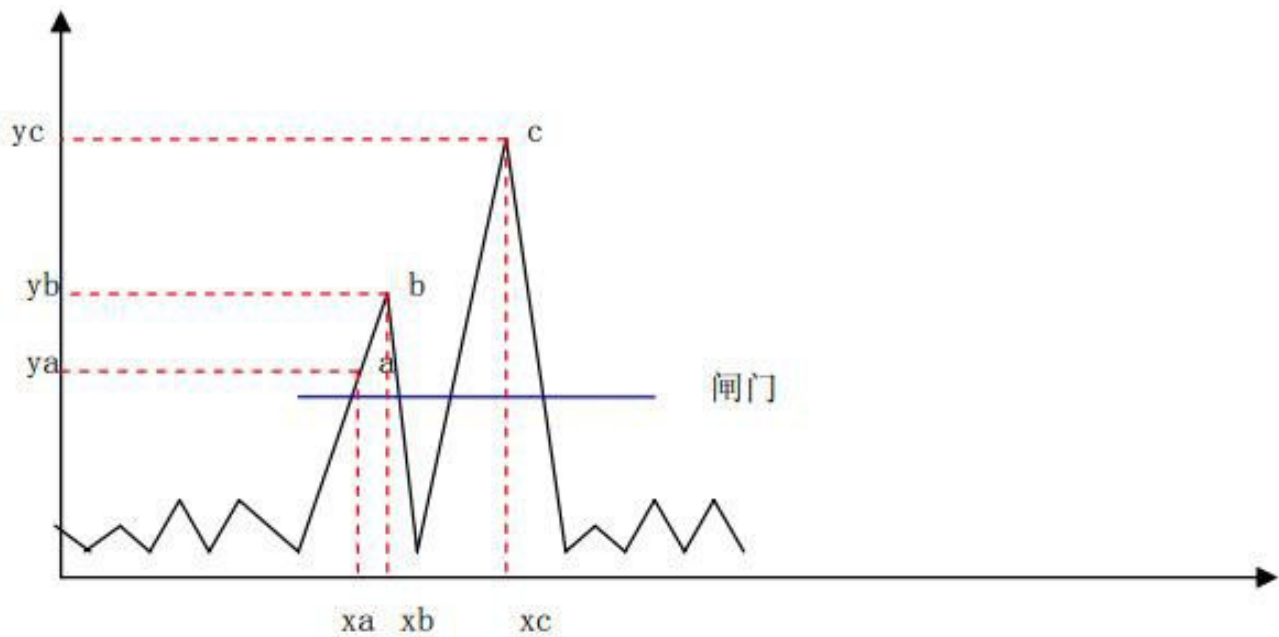


Figure90 Differences in measurement values at different measurement points

Pulse mode: Provides two operating modes: spike and square wave.

1)Peak mode (default instrument setting):

The pulse energy is set in two levels: high and low;

The launch voltage is set in high, medium, and low three levels.

2)Square wave pattern:

The pulse width is continuously adjustable within the range of 0ns to 1000ns, enabling easy matching with probes of different frequencies.

The voltage is continuously adjustable within the range of 25V to 300V, with a step increment of 25V.

3)Recommendations:

Routine testing is recommended to use spike mode.

For applications requiring strict control of emission voltage or pulse width, square wave mode is recommended.

Echo memory: A waveform $\wedge$ recording method for setting keys, providing both envelope

3.Instrument Parameter Settings

and peak modes to facilitate the capture and analysis of maximum defect echoes during actual detection.

1)Envelope mode: During the movement of the probe, the complete envelope range of the reflected wave from its minimum to maximum value is continuously displayed, facilitating the observation of signal trend changes.

2)Peak mode: Automatically captures and records the highest wave peak in the dynamic echo within the screen door, and maintains display on the screen. The recorded wave peak information remains even after the probe is removed, facilitating subsequent analysis.

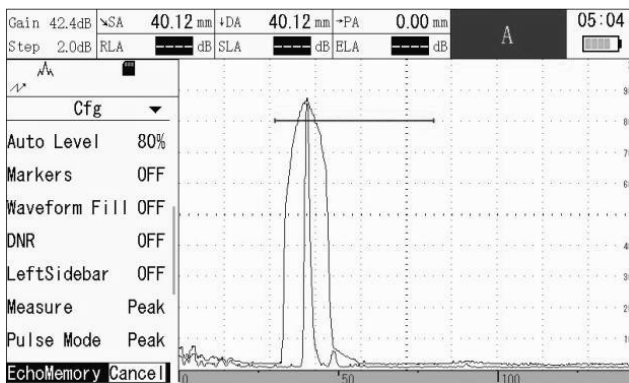


Figure91 Echo Memory-Envelope Mode

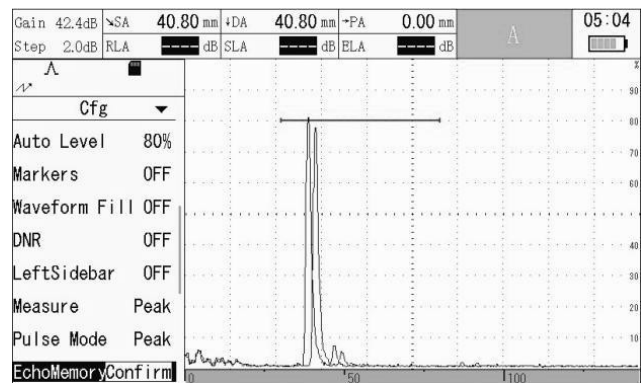


Figure92 Echo Memory-Wave Peak Mode

3.5.9system

1)Unit: Supports switching between metric and imperial units.

2)Language: Supports switching between Simplified Chinese, English, and Russian.

3)Brightness: Adjust the screen brightness.

4)Theme: Provides dark and light themes to adapt to different lighting conditions.

Dark theme (default): Soft visual effect for indoor environments.

Light theme: Suitable for outdoor bright light environments for clearer display, but with higher power consumption.

3.Instrument Parameter Settings

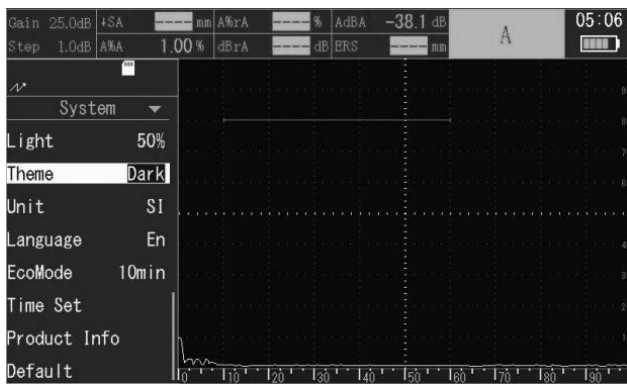


Figure93 Dark Theme

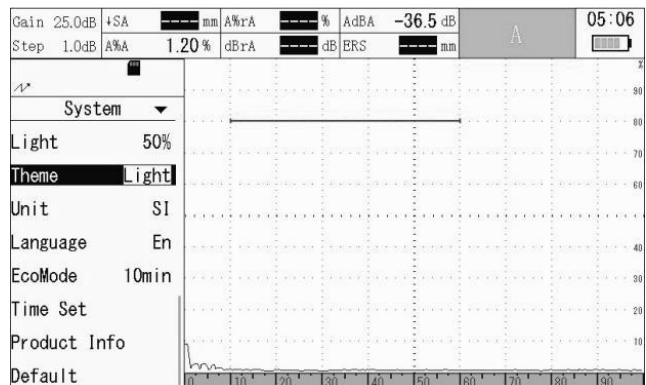


Figure94 Light Theme Interface

5)Power-saving mode: Sets the waiting time before the device enters sleep mode without operation. If no operation is detected for 5 minutes after the device enters sleep mode, it will automatically shut down to prevent battery depletion due to prolonged inactivity. When the device enters sleep mode, a red breathing light will illuminate in the upper right corner as a reminder.

Off: Disables sleep mode. The device will not automatically enter sleep mode.

1-30: The device can be set to enter sleep mode after 1~30 minutes of inactivity.

6)Time setting: Sets the system time of the instrument.

7)Product information: View product details for this device.

8)Recover default settings: Reset all instrument settings to factory defaults.

4.Example of Angle Probe Welding Detection

Angle probe detection

Use the 2.5 Z 10 ×10K 2 probe to detect the butt welds of 20 mm thick steel plates.

4.1Parameter Setting

- 1) Press and hold button to create a new channel and name it DAC.
- 2) Enter the path: Basic Menu → Probe Menu. Set the probe type to Angle Probe, frequency to 2.5 MHz, dimensions a and b both to 10 mm, and workpiece thickness to 70 mm (for DAC curve creation in third-wave flaw detection of 20 mm thick plates).
- 3) Enter the Range Menu and set the range to 200 mm (the weld inspection range should generally be greater than twice the plate thickness).
- 4) Keep the rest of the basic parameters at their default values. Refer to Section 3.1 Parameter Setting Instructions for adjustments if necessary.

4.2Manual Calibration

- 1) Zero Point & Material Sound Velocity Calibration
 - a. Enter the Calibration Menu → set Mode to Sound Velocity + Zero Point.
 - b. Use an angle probe to scan the R50 arc of the CSK-IA test block. Adjust the start point of Gate A to enclose the echo, locate the highest echo, adjust the amplitude to 80%, and record Reference Value 1.
 - c. Scan the R100 arc, repeat the above steps, and record Reference Value 2.
 - d. After recording Reference Value 2, press to perform calibration. Once calibration is complete, a pop-up window will display the sound velocity and zero point results.
- 2) Probe Leading Edge Calibration
 - a. Scan the R100 arc of the CSK-IA test block. Locate the highest echo, then fix the probe and read the probe scale value as the Leading Edge Value.

4.Example of Angle Probe Welding Detection

b.Enter this value in Basic Menu → Probe → Leading Edge.

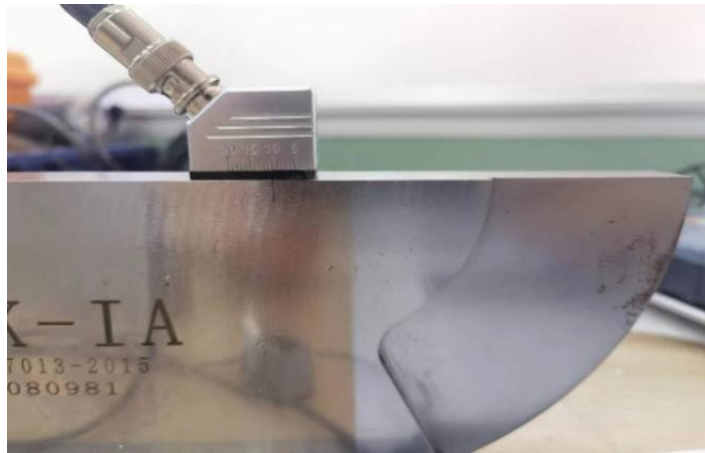


Figure95 Measurement of angle probe fronts

3)K-Value Measurement

a.Enter the Calibration Menu → set Mode to Angle.

b.Set the Hole Depth to 30mm and Hole Diameter to 3mm, then input the Leading Edge Value measured in Step 2).

c.Scan the $\Phi 3$ transverse hole (30mm depth) of the RB-3 test block. Press  to activate the Echo Memory → Envelope function. Move the probe forward and backward to locate the highest echo, adjust the start point of Gate A to enclose the echo, press  to jump to calibration execution, and press  again to complete angle calibration. The K-value and angle will be displayed on the screen; press  to save.

d.The $\Phi 3$ hole (20mm depth) can be used for verification.

4.3DAC Curve Making

a.Enter the path: Curve Menu → DAC Interface, and set the DAC Curve Operation to On.

b.Scan the RB-2 or RB-3 reference block with the calibrated probe. Adjust the gate start point and combine the $\downarrow$ DA parameter to enclose the echo from the $\Phi 3$ side- drilled hole at a certain depth (e.g., 20 mm). Move the probe to find the maximum echo amplitude, adjust the amplitude to 80%, and press  (ensure the cursor is selected on the Record

4.Example of Angle Probe Welding Detection

Parameter Value option) to save this point.

c.Repeat the above steps to record the reference echoes at other depths (e.g., 40 mm, 60 mm) in sequence, so as to generate a complete DAC curve. Set the dB values of the Evaluation Line, Quantitative Line, and Rejection Line according to the DAC inspection standards.

d.Enter the path: Settings Menu → Function → Channel Management and overwrite the DAC channel.

4.4DAC Curve Saving

1)Enter the path: System Menu → Function → Measured Value Display, and set the parameters as follows:

Parameter 1: ↘ SA

Parameter 2: RLA

Parameter 3: ↓DA

Parameter 4: SLA

Parameter 5: →PA

Parameter 6: ELA

Parameter 7: A_LED

2)Enter the path: System Menu → Function → Channel Management, select the Overwrite function, and save the current settings and the DAC curve.

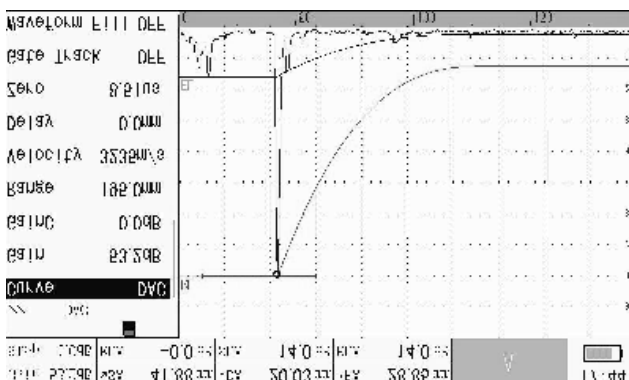


Figure96 DAC channel parameter preview

4.Example of Angle Probe Welding Detection

4.5DAC Function Calibration

1)During on-site inspection, select the DAC file from the first item in the Basic Menu and press the corresponding button to load the curve.

2)Enter the path: Basic Menu → Probe, and set the workpiece thickness to 20 mm.

3)When a suspicious echo appears within the DAC curve range, enclose the echo with the gate. The instrument will automatically display the following data:

Defect depth (↓DA)

Horizontal distance from the probe front edge (→PA)

dB difference between the defect echo and the Quantitative Line (SLA)

5.Example of Straight Probe Detection

Straight angle detection

Taking the 2.5Z20N straight probe as an example, make the φ2 flat bottom hole AVG curve of the flat bottom hole on the CS-1-5# standard industrial flaw detection test block.

5.1Parameter Settings

1)Press to create a new channel and name it AVG.

2)Enter the path: Basic Menu → Probe Submenu, and set the following parameters: Type: Normal Probe

Frequency: 2.5 MHz

Diameter: 20 mm

3)Enter the Range Menu and set the Range to 250 mm (the calibration inspection range usually needs to be greater than twice the workpiece thickness).

4)Keep the rest of the basic parameters at their default values. Refer to Section 3.1

5.Example of Straight Probe Detection

Parameter Setting Instructions for adjustments if necessary.

5.2Automatic Calibration

- 1) Couple the normal probe to the surface of the CSK-IA reference block.
- 2) Enter the Calibration Menu and set the mode to Auto.
- 3) Set Reference 1 to 100 mm and Reference 2 to 200 mm.
- 4) Adjust the gain to clearly display the back wall echo, then press button to increase the amplitude of the first echo to 80% of the screen height.
- 5) Move the cursor to the Execute Parameter, select Calibrate and press . The instrument will automatically complete the zero point and sound velocity calibration.

5.3AVG Curve Making

- 1) Enter the path: Curve Menu → AVG Interface, set the AVG Curve Operation to On, then press and the cursor will automatically jump to the Record Parameter.
- 2) Method 1: Use $\phi 2$ flat bottom holes to create AVG curves.
 - a. Adjust the reference parameter to $>3.0N$, flat bottom hole; reference diameter to 2mm.
 - b. Place the probe on the CS-1-5 # test block near the center of the circle to detect a depth of 200mm $\phi 2$ flat hole.
 - c. Find the highest point of the echo, make the gate cover the echo, adjust the echo height to 80%, press, and at this point, draw the AVG curve of $\phi 2$ flat bottom hole.
- 3) Method 2: Use large flat bottom to create an AVG curve.
 - a. Set the Mode to $>3.0N$ and the Reference to Large Flat Bottom.
 - b. Place the probe on the CS-1-5 test block at a position away from the center, and detect the 1st bottom echo at a depth of 225mm.
 - c. After locating the highest echo, move the record to enclose it with the gate, adjust the amplitude to 80%, and press when the record is selected by the cursor to generate the Large Flat Bottom AVG Curve.
 - d. Note: During actual inspection, the transmission correction parameter can be adjusted

5.Example of Straight Probe Detection

according to the waveform to modify the instrument sensitivity.

5.4AVG Curve Saving

After the AVG curve is created, enter the path: System Menu → Function → Display Parameter and make the following settings to clearly view key data on the inspection interface:

Display Mode: Large Parameter 1: ↓SA

Parameter 2: A%A

Parameter 3: ERS

Parameter 7: A_LED

System Menu → Function → Gate Management, and set the gate alarm to echo- off mode.

System Menu → Function → Channel Management, select the Overwrite function, and save the current settings and the AVG curve.

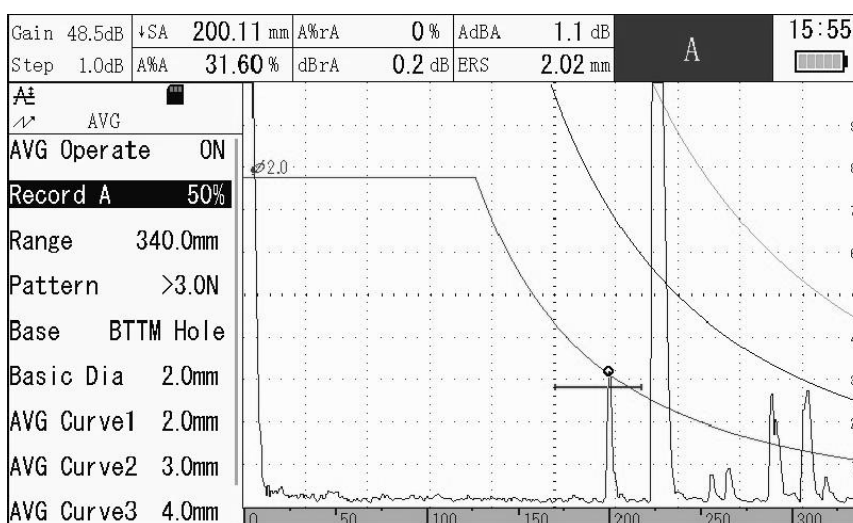


Figure97 AVG Curve Operation Interface

5.5AVG Curve Verification

After loading the AVG curve, detect the flat-bottom hole on the CS-1-5 reference block. Enclose the echo with the gate and verify the curve accuracy by observing the relative position of the echo to the curve and the ERS reading.

During on-site inspection, the saved AVG curve and its matching settings can be retrieved from the Channel Management Menu at any time.

Appendix: Technical Parameters

Bandwidth	0.1MHz~20MHz
Gain	120dB,pace 0.1dB ,0.6dB ,1dB ,2dB,6dB
Wave filter	Broadband,1M,1.25M,2.5M,5M,10M,15M,1M-8M
Sampling rate	Hardware sampling rate 100MSPS, equivalent sampling rate 400MSPS
Detection mode	Full wave, envelope positive,half,wave,negative,half,wave,RF,
Detection range	20 meters (longitudinal wave carbon steel), pace 100mm, 10mm, 0. 1mm
Sound velocity range	250~16000 m/s
Launch damping	50Ω, 500Ω
Pulse mode	Sharp pulse, square wave
Pulse voltage	25V~300V,25V pace
Pulse width	0ns~1000ns continuously adjustable, 5ns pace
Pulse frequency	Automatic or manual, automatic range (200Hz-1KHz), manual range (0-10KHz)
Probe channel	200 groups, supporting operations such a s creating, previewing, deleting, renaming, overwriting, and restoring
Gate alarm	Gate A and B alarm, lost wave / incoming wave
Gate mode	Independent gate A, gate B
Measurement mode	Peak, Front edge, J Front edge
Quantitative mode	DAC curve, AVG (DGS) curve
Flaw detection standards	AWS D1.1/D1.5, NB/T 47013, GB/T 29712, GB/T 11345
Save content	Single frame, multi-frame recording (≤ 500 frames), screenshot, flaw report
Auxiliary functions	Capture Mark, Full-screen Side Display, Auto Gain, Echo Envelope, Peak Hold, Waveform Freeze, Channel Management, Gate Alarm, Gate Expansion, Full-screen Touch, Virtual Keyboard,, Quick Screenshot, Flaw Detection Report, Channel Import/ Export

Appendix: Technical Parameters

Display screen	High definition 5.0 inch 800×480 IPS_LCD
Probe interface	Dual LEMO-00 C5
Output interface	Type-C1, MINI USB
Input interface	Type-C2
Data storage	16GB SD card
Charger	PD fast charging ,standard Type-C interface (100~240V, 50~60Hz)
Size	183mm×113mm×45mm
Weight	840g
Language	Chinese, English, Russian
Unit	Metric system, imperial syetem
Battery	7.4V 8000mAh Lithium battery, 12 hours of battery life
Operation temperature	-10°C ~ 55°C
Relative humidity	(20-95) %RH
IP Rating	IP53
Resolution	35dB (5P14) (Metrological performance requirements:≥26dB)
Dynamic range	40dB (Metrological performance requirements:≥26dB)
Sensitivity margin	52dB (2.5Z20N) (Metrological performanc requirements:≥42dB)
Vertical linearity	2.2% (Metrological performance requirements:≤6%)
Horizontal linearity	0.5% (Metrological performance requirements:≤2%)

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