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**UFD-T680
Ultrasonic Flaw Detector
OPERATION MANUAL**

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1 Introduction

1.1 Features of the Instrument

The core hardware is designed with ARM+FPGA, and the software uses a highly reliable multitasking operating system, which greatly improves the function, portability, durability and reliability of the instrument.

This instrument uses a master-slave menu, and is designed with shortcut keys and a digital rotary knob. The instrument is light and portable, and can be held with one hand.

Display

Full-digital multi-color high-resolution (640×480 pixels) multi-color TFT LCD display. The waveform display is more delicate and humane.

4 operating interface styles can be selected according to the environment.

The LCD with fast 60 Hz update. Able to display subtle waveform changes.

The LCD brightness can be set freely.

Shape

The all-aluminum metal shell is strong and durable, and the electromagnetic shielding performance is very good.

360-degree rotating damping bracket and rubber sheath are easy to use.

Tempered glass panel, extremely hard, wear-resistant and scratch-resistant

Screenshot and PDF flaw detection report

Real-time screenshots of all pages and flaw detection reports, and save them as BMP pictures to U disk, which can be set as color or grayscale pictures.

Export the flaw detection report as a PDF file and save it to a U disk for easy archiving and printing.

All contents of the PDF file can be customized according to user needs.

BMP pictures and PDF files can be viewed on a computer or mobile phone.

Range

Up to 9999 mm in steel; range selectable in fixed steps or continuously variable. Suitable for use on large work pieces and in high-resolution measurements.

Pulser

Pulse Energy selectable among 100V, 200V, 250V, 300V, 350V, 400V and 500V.

Pulse Width tunable from 0.1μs to 0.5 μs to match the probes with different frequency.

Pulse Repetition Frequency adjustable from 20 Hz to 2 KHz.

Damping selectable among 50Ω、150Ω、250Ω and 500Ω for optimum probe performance

Probe selection: single crystal probe, dual crystal probe, special angle probe, penetrating probe, climbing probe.

Receiver

Sampling: 16 digit AD Converter at the sampling speed of 320 MHz

Rectification: Positive Halfwave, Negative Halfwave, Fullwave and RF

Analog Bandwidth: 1.0MHz to 20MHz capability with selectable frequency ranges (automatically set by the instrument) to match probe for optimum performance.

Gain: 0 dB to 110 dB adjustable in selectable steps 0.1 dB, 2 dB, 6 dB.

Gates

Two fully independent gates offer a range of measurement options for signal height or distance using peak triggering.

The echo-to-echo mode allows accurate gate positioning for signals which are extremely close together.

Gate Start: Variable over entire displayed range

Gate Width: Variable from Gate Start to end of displayed range

Gate Height: Variable from 0 to 99% Full Screen Height

Alarms: Threshold positive/negative with LED Flash.

Memory

The instrument has a built-in large-capacity memory, and data and

files will not be lost due to power failure of the instrument.
Memory of 500 channel files to store calibration setups and probe parameter.
Memory of 1000 wave report files to store A-Scan wave and settings.
All the files can be stored, recalled and cleared.
The channel settings and report files can be exported via U disk, and the information can also be stored in unlimited amounts via USB memory.

Video Recorder

Video Recorder is useful in many situations, it is very convenient for those who want to analyze the probing activities later.
The instrument can record the test process and save it as a video file, which can be played back through the instrument or special software. It supports up to 10 video files, and each video file can be up to 5 minutes long.
If you choose to save the video file to the U disk, the number and duration of the video file will not be limited.
Recording and replaying the testing process provides great convenience for future study and analysis of flaw detection.
Video playback supports pause, fast forward, fast rewind, and stop functions.

Functions

- Flaw detection standard: Built-in common flaw detection standards, direct call, convenient and fast.
- Auto calibration: Automated calibration of probe zero offset, probe angle (K value) and material velocity.
- Flaw Locating: Live display Sound-path, Projection (surface distance), Depth, Amplitude.
- Flaw sizing: Automatic flaw sizing using AVG or DAC, speeds reporting of defect acceptance or rejection.
- Digital Readout and Trig. Function: Thickness/Depth can be displayed in digital readout when using a normal probe and Surface Distance and Depth are directly displayed when angle probe is in use.
- DAC/AVG: The curve is automatically generated, and the sampling points can be compensated and corrected. The curve automatically floats with the gain, automatically expands with the detection distance, and automatically moves with the delay time. It can display the AVG curve of any aperture.

- AWS D1.1. Choosing this standard can reduce manual calculations and improve detection efficiency.
- Curved Surface Correction feature.
- Crack Height Measure function.
- Gate Magnify : spreading of the gate range over the entire screen width.
- Video Recording and playback.
- Auto-gain function
- Envelope: Simultaneous display of live A-scan at 60 Hz update rate and envelope of A-scan display
- Peak Hold: Compare frozen peak waveforms to live A-Scans to easily interpret test results.
- Peak mark: capture and mark the peak in real time
- Echo coding: display 1~9 echo display area in different colors, used to analyze the defect position.
- A Scan Freeze: Display freeze holds waveform and test distance data.
- B Scan display feature. Intuitively display the defect shape of the workpiece and the detection result is more intuitive.

Real Time Clock

The instrument clock keeps running tracking the time.

Communication

Two High speed USB2.0 port. Two USB modes can be selected: U-DISK and U-BRIDGE. In U-DISK mode, channel Configuration files, flaw report files, screenshot pictures and recorded movies can be saved to U-DISK. In U-BRIDGE mode, the instrument exchanges data with DataPro Software.

Battery

Built-in large-capacity and high-performance lithium-ion battery. The continuous working time more than 12 hours. 4-6 hours typical recharge time.

Knob

Operating adjustments are easily and quickly made using the rotary knob.

software upgrade

The software can be easily upgraded through U-DISK. The upgrade will not cause damage to the machine.

1.2 Specifications

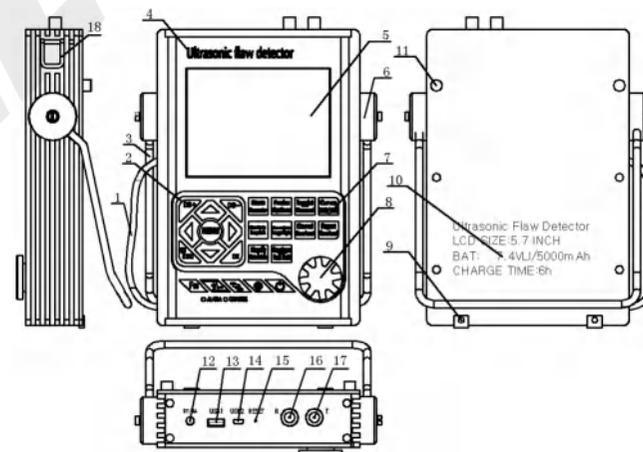
- ◆ Measuring Range: 0 to 15000 mm, at steel velocity
- ◆ Material Velocity: 100 to 20000m/s
- ◆ Gain: 110 dB max in selectable resolution 0.1, 1.0, 2.0, 6.0 dB.
- ◆ System Linearity: Horizontal: ≤1.0% FSW, Vertical: 1.5% FSH, Amplifier Accuracy +/-1 dB.
- ◆ Sensitivity Leavings: more 65dB(Deep 200mmΦ2 flat-bottomed hole)
- ◆ Dynamic range: more 36dB
- ◆ Bandwidth (amplifier bandpass): 1.0 to 20 MHZ
- ◆ Pulse Displacement: more 32dB
- ◆ Resolving Power: more 42dB
- ◆ Noise: less than10%
- ◆ Display Delay: -20 to 3400 μs
- ◆ Probe Delay/Zero Offset : 0 to 99.99μs
- ◆ est Modes: Pulse echo, dual element and thru-transmission
- ◆ Pulser: Tunable Wave Pulser
- ◆ Pulse Repetition Frequency ranges from 20 Hz to 2000 Hz
- ◆ Pulse Energy: 100V, 200V, 250V, 300V, 500V selectable
- ◆ Gate Monitors: Two independent gates controllable over entire sweep range
- ◆ Rectification: Positive half wave, negative half wave, full wave, RF
- ◆ Reject (suppression): 0 to 80% full screen height
- ◆ Units: Inch or millimeter
- ◆ Transducer Connections: BNC or LEMO
- ◆ Power Requirements: AC Mains 100-240 VAC, 50-60 Hz
- ◆ Operating Temperature: -10°C to 50°C
- ◆ Storage Temperature: -30°C to 50°C

1.3 Base Instrument Package

- Portable Ultrasonic Flaw Detector with multi-color TFT LCD Display
- Straight Beam Transducer (2.5 MHz, Φ10)
- Angle Beam Transducer (4 MHz, 8 mm×9 mm, 60°)
- Interconnect Cable for the transducer (BNC-BNC, or optional BNC-C5)
- Power supply/charger unit
- Operating Manual in English

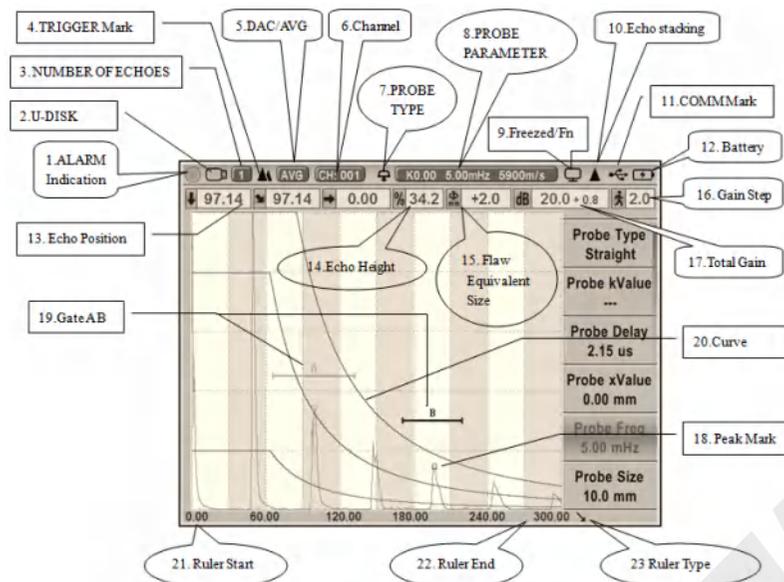
2 Feature

The Main Unit



- 1, Belt 2, Keypad 3, Rotating bracket 4, LOGO pad
- 5, LCD Display 6, Damping turntable 7, Shortcut Keys
- 8, Rotary Knob 9, Support block 10, Product Label
- 11, Thumb screw 12, Power adapter port
- 13, USB Socket of U-DISK 14, USB Socket of Comm
- 15, Reset Key 16, Probe CablePort(Receive)
- 17, Probe Cable Port (Transmit) 18, Lifting lug 19, Alarm LED
- 20, Power LED

Screen Display



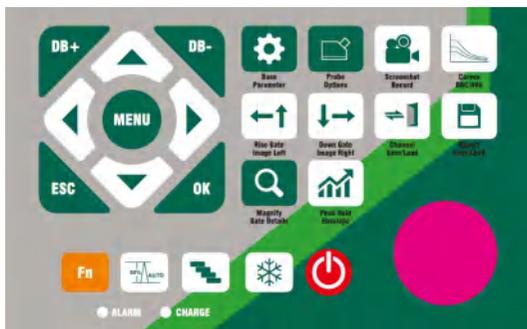
1. ALARM indication: Alarm state: red, Normal state: green
2. U-DISK indication: Display when inserting U disk
3. NUMBER OF ECHOES: Display the number of echoes when using an angle probe
4. TRIGGER Mark: Peak trigger ▲, Edge trigger ▮
5. DAC/AVG: Curve type
6. CHANNEL: Display the current channel number
7. PROBE TYPE:
 - ☞ single-element straight transducer,
 - ☞ dual-element (TR) straight probes,
 - ☞ single-element angle transducer,
 - ☞ dual-element (TR) angle probes,
 - ☞ Through-transmission mode for the use with two single-element probes; the receiver is connected with right, the pulser is connected with left.
8. PROBE PARAMETERS: Display probe angle (or K value), probe frequency and sound velocity

9. Freeze: Show icons when the screen is frozen
10. Echo stacking: * Envelope function on, ▲ Peak hold function on
11. USB indication: Show icon when communicating
12. Battery Capacity:
13. Echo Position: ↓Depth, ↗Sound path, →Projection
14. Echo Height: 18.0%. It means that the peak echo height inside the current selected gate is 18.0% FSH (Full Screen Height of the wave area).
15. Flaw equivalent Size Value: When AVG curve is on, ERS (Equivalent Reflector Size) of the reflector signal inside the current selected gate
 - Φ Hole dB,
 - Φ Hole diameter
 When DAC curve is on, this value will be displayed as the dB offset of the peak echo inside the current selected gate to the reference DAC curve (DAC→OFFSET→SIZE REF)

RL dB	Rubbish Line	EL dB	Evaluation Line
SL dB	Scalar Line	GL dB	general Line
16. Gain Step: Display the minimum distance of gain change
17. Total Gain: 28+0.5: Basic gain + compensation gain
18. Peak Mark: Capture and display the highest point of echo in the current selected gate.
19. Gate: A gate or B gate.
20. Curve: DAC or AVG
21. Ruler Start Scale: Unit: mm
22. Ruler End Scale: Unit: mm
23. Ruler Type: ↓Depth, ↗Sound path, →Projection

Keys and Rotary Knob Features

The keyboard of this instrument has two modes of operation: "shortcut keys" and "Rotary Knob". Some keys have two functions. You can select the second function by "double-clicking" or pressing the "Fn" key. The key positions are shown in the figure below. This design allows direct access to important instrument set-up parameters and provides easy and fast operating in difficult inspection environments.



"Fn" key is invalid	←→	Adjust the width of the gate A
	Rotary knob	Adjust the position of the gate A
	Rise Gate	Adjust the height of the gate A
	Down Gate	
"Fn" key is valid	←→	Adjust the width of the gate B
	Rotary knob	Adjust the position of the gate B
	Rise Gate	Adjust the height of the gate B
	Down Gate	

Under the main page, if there is a single gate, the "left and right direction keys" adjust the width of the gate, the "Rotary knob" adjusts the position of the gate, and the "gate raise" and "gate lower" adjust the height of the gate. If it is a double gate, press the above button to adjust gate A.

Functions of the keys:

	Press and hold for 2 seconds to turning the instrument On/Off.
	Enter the menu page. Returns to the main screen
	Increase/decrease gain
	Cancel key Home page status switch full screen
	Confirm key

	Probe function selecting
	Base function selecting
	Clicking the button under any page is the "screenshot" function. Double-click or "FN+this button" to enter the "Record" function
	Click to switch between "DAC function group" and "AVG function group"
	Single gate, "Fn" is invalid: the gate is raised Single gate, "Fn" is valid: the image moves to the left Double gate, "Fn" is invalid: gate A is raised Double gate, "Fn" is valid: gate B is raised
	Single gate, "Fn" is invalid: the gate is lowered Single gate, "Fn" is valid: the image moves to the right Double gate, "Fn" is invalid: gate A is lowered Double gate, "Fn" is valid: gate B is lowered
	"Fn" is invalid: Save the channel "Fn" valid: Load the channel
	"Fn" is invalid: Save the report "Fn" valid: Load the report
	Magnify the waveform in the current gate to the full screen
	"Fn" is invalid: Switch Envelope function ON / OFF "Fn" is valid: Switch Peak-Hold function ON / OFF
	The second function key can achieve more functions in conjunction with other keys
	Auto-Gain key starts or stops the Auto-Gain function
	Switch the dB step
	Switch freezes function ON / OFF

Rotary knob

Turn clockwise: increase the selected parameter, or change the selection.
 Turn counter-clockwise: decrease the selected parameter, or change the item selection.
 Single press: Equivalent to the OK key.

Alarm Lights

Two alarm lights appear at the below the the instrument's keypad. One alarm light is marked as ALARM, which is assigned to the gate alarm. When a gate alarm is triggered, this light will illuminate. The other light is marked as CHARGE indicating battery status.

STATUS	ALARM LED	CHARGE
Gate alarm	Red on	x
Battery charging	x	Yellow on
Battery charge completed	x	Blue on
No external power	x	x

Rotating bracket

During flaw detection, you can adjust the rotation angle of the rotating bracket to obtain a proper viewing angle, so as to control the instrument more conveniently and comfortably.
 Two set screws are used to fix the bracket and generate a certain rotational torque. If the torque of the rotating bracket needs to be adjusted, it can be achieved by tightening or loosening these two set screws.

Parameter Item Selection

Any parameter item can be selected using shortcut key, function group selection key and function item selection key.
 Press the  key on the main interface to select parameter items.



Press the "OK" key or press the rotary knob key, the instrument will pop up the parameter dialog box, as shown in the figure below



Parameter setting

Parameter values can be changed by turning Rotary knob after the parameter item is selected. The values will take effect immediately. Parameters of the device are interrelated, if there is incorrect parameter, device will correct it immediately, or pop up error message.

For dialogs with numerical values, move the cursor with the "left or right" key, change the numerical value with the wheel key, "OK" key to change the parameter, and "ESC" to cancel the change.



For dialog boxes with options, move the options through the "up or down" key or "turn the wheel", "OK" key to change the parameter, and "ESC" to cancel the change.



For dialog boxes with switch options, move the options through the "left or right" key or "rotation knob", "OK" key to change the parameter, and "ESC" to cancel the change.



3 Function

The menu page displays the icons of all function groups. Select the corresponding function group icon to enter the function group. The following is a detailed description of how to use each functional group.



3.1 Channel Function Group

Implement: “MENU” Key--->>Select the "Channel" icon
 Hot key:

When Fn is invalid, the parameters saved to the current channel,
 When Fn is valid, load all channel lists

Explanation: Because it is often necessary to detect multiple workpieces and replace multiple probes during on-site flaw detection, it is necessary to test and store multiple sets of flaw detection settings according to different situations when the instrument is adjusted. One channel can store a set of flaw detection process data, and multiple channels can pre-test and store multiple sets of different flaw detection settings, which can be directly recalled on site without the need to debug the instrument. The channel number is displayed with the CHxxx icon at the top of the screen.

ItemsList: Select Ch Save Ch Rename Ch Delete Ch Delete All Export Ch Import Ch ExportAll Import All

3.1.1 Select Ch

CH No: Number of channels 1-500

CH NAME: Channel name, can be modified

STATUS:

No Set-- This channel has no user parameters, only the factory configured default parameters

Saved--This channel already has channel parameters saved by the user

MODIFY: Date and time when the user saved the channel

CH No	CH NAME	STATUS	MODIFY
001	CHANNEL	Saved	2021.09.02 09:47
002	Ch002	Saved	2021.09.02 09:48
003		No Set	
004		No Set	
005		No Set	
006		No Set	
007		No Set	
008		No Set	
009		No Set	
010		No Set	

CH No	CH NAME	STATUS	MODIFY
001	CHANNEL	Saved	2021.09.02 09:47
002	Ch002	Saved	2021.09.02 09:48
003		No Set	
004		No Set	
005		No Set	
006		No Set	
007		No Set	
008		No Set	
009		No Set	
010		No Set	

3.1.2 Save Ch

Save the current detection parameters to any one of the 500 channels, press the "OK" key to save, and the "ESC" key to close the channel list.

3.1.3 Rename Ch

Select a channel in the list, press the "OK" key to rename it, and the "ESC" key to close the channel list.

"DB+"key to switch between upper and lower case,

"DB-" key to delete

Channels that have not been set up cannot be renamed

3.1.4 Delete Ch

Select a channel in the list, press the "OK" key to delete it, and the "ESC" key to close the channel list.

3.1.5 Export Ch

Select a channel in the channel list, press the "OK" key to export the channel parameters to the U disk, and the "ESC" key to close the channel list.

This function is used to transfer the parameters of one instrument to the second instrument via a USB flash drive, without the need to debug the second instrument.

3.1.6 Import Ch

Select a channel in the list, press the "OK" key to import the parameters from the U disk to this channel, and the "ESC" key to close the channel list.



3.1.7 Export All

Export all channel parameters to U disk and press "OK" to confirm the export.

This function is used to backup instrument parameters, or to transfer parameters between two instruments.



3.1.8 Import All

Import all the channel parameters from the U disk to the instrument, and press the "OK" key to confirm the import.

3.2 Probe Function Group

Implement: "MENU" Key--->>Select the "Probe" icon

Hot key:

Explanation: Set all options about the probe.

ItemsList: Probe Type Probe kValue Probe Delay Probe xValue Probe Freq Probe Size Probe Damp Calibrate Probe Name

3.2.1. Probe Type

- ☐ single-element straight transducer,
- ☒ dual-element (TR) straight probes,
- ☒ single-element angle transducer,
- ☒ dual-element (TR) angle probes,
- ☐ Through-transmission mode for the use with two single-element probes; the receiver is connected with right, the pulser is connected with left.



3.2.2 Probe k Value

There are three nominal methods for angle probes:

1. Nominal by the incident angle α ;
2. Nominal by the shear wave refraction angle β ;
3. Nominal by the K value ($K = \tan \beta$).

This instrument uses the latter two.

The K value of the probe and the refraction angle are related to each other. Different angle probes have different refraction angles, and their K values are also different. For example, K2 indicates that the K value of the angle probe is equal to 2, and its refraction angle is 63.4°; the refraction angle corresponding to K1 is 45°; the refraction angle corresponding to K1.5 is 56.3°. The refraction angle of the straight probe is 0°, the K value is also 0, so the straight probe does not need K value calibration.

Each probe has a set of data symbols to illustrate its "identity". 2.5P13×13K2 is an angle probe, K represents the slope, and its value is 2. The piezoelectric chip used is a square chip with a size of 13×13mm and the frequency is 2.5MHz. The corresponding parameters can be input into the instrument according to the "identity" value of the probe. The "identity" value of the probe, especially the K value, has a certain error with the actual value. In order to accurately locate the position of the defect during flaw detection, the probe can be accurately calibrated.



3.2.3 Probe Delay (Zero Point)

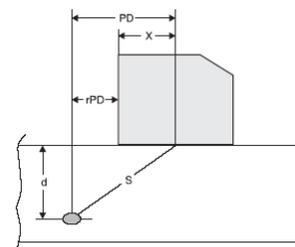
"Probe delay" is the distance between the transducer element and the coupling face (including the thickness of the probe protective film and the thickness of the couplant). The unit is microseconds. In order to accurately locate the defect of the workpiece, the probe should be calibrated before testing, and the actual "probe delay" should be measured.

Notice:

After replacing the probe, the zero point must be adjusted;
After the probe is calibrated, do not change it at will, otherwise it will affect the measurement accuracy.
Setting range: 0us ~ 99.99us

3.2.4 Probe xValue

xValue: The distance X from the incident point of the angle probe to the foremost end of the probe. As shown below.



The xValue can be entered when calibrating the probe or in the function menu.

Note: If the xValue has been entered, the horizontal distance value (rPD) in the display area will be the value minus the xValue. If the xValue parameter input is inaccurate, it will affect the horizontal position value of the defect.
Setting range: 0~99.99 mm

3.2.5 Probe Freq

Probe frequency: The natural (resonant) frequency of the piezoelectric chip in the probe. The higher the probe frequency, the higher the frequency and the smaller the wavelength of the generated ultrasonic signal, which can detect smaller defects; However, the higher the frequency of the probe, the greater the sound attenuation of the ultrasonic signal it generates when propagating in the material, and the weaker the echo signal. The instrument must input the correct probe frequency to match the filter frequency band of the system. The correct frequency value will obtain the best signal-to-noise ratio and resolution. Incorrect frequency values will produce unpredictable detection errors!
Setting range: 1.0MHz ~20MHz

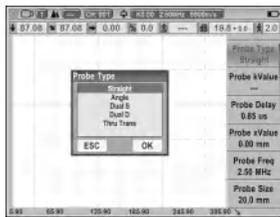
1:**Detection Purpose:** To confirm whether the actual operating frequency of the probe matches the nominal frequency, as the frequency affects the resolution, penetration ability, and detection accuracy of flaw detection, etc. If the frequency deviation is too large, it may lead to inaccurate flaw detection results.

2:Detection Method: Spectrum Analysis Method

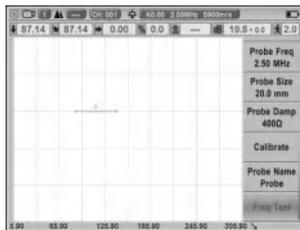
Input a specific electrical signal to the probe through the flaw detector to make it emit ultrasonic waves. Then, perform spectrum analysis on the received electrical signals to determine the main frequency components, thereby obtaining the actual frequency of the probe.

3: Detailed Steps for Probe Frequency Detection:

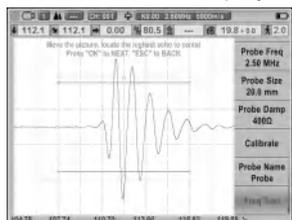
3.1: Click the [Probe Setting] shortcut key (or click [MENU] -> [Probe]), and select [Probe Type] corresponding to the probe. Here we take a single-crystal straight probe as an example.



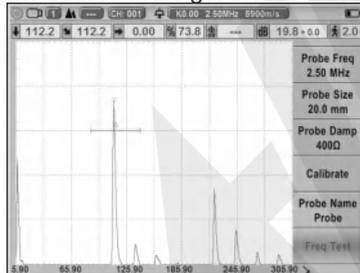
3.2: Scroll to the bottom and find [Probe Frequency Check].



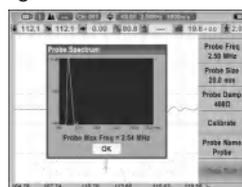
3.4: Click [Probe Frequency Check] and adjust the gain as prompted to make the waveform located within the display area.



3.3: At this time, connect the instrument to the probe under test, place the probe on any workpiece to generate a waveform (pay special attention that the probe initial wave cannot be used here), and make the gate intersect with the generated waveform.



3.5: Click the OK button to display the maximum frequency of the probe and the image of the bandwidth!



3.2.6 Probe Size

The probe size refers to the size of the crystal in the probe. Straight probe is expressed by diameter. For example, Φ20 means that the crystal diameter of the straight probe is 20mm.

Angle probe is expressed by length×width, such as "12×9K2" means that the length of the crystal is 12mm, the width is 9mm, and the K value is 2. The probe frequency and probe size determine the length of the near-field zone, which are important parameters for making the AVG curve, and must be entered correctly. These two parameters also need to be entered in the wizard for making AVG curves.



3.2.7 Probe Damp

The probe damping is used to match the ultrasonic probe, and the damping is adjusted to adapt to the sound impedance of the measured material, thereby improving the amplitude, width and resolution of the echo signal display. Setting range: 50Ω、100Ω、300Ω、400Ω.

3.2.8 Probe Name

Used to display the name of the probe in the flaw detection report.

3.2.9 Probe Calibrate

The probe needs to be calibrated when it is used for the first time. This instrument uses the wizard mode for calibration, and the instrument automatically selects the calibration method according to the probe type.

Note: The dual crystal probe has a focal depth. When measuring the zero point and sound velocity, pay attention to selecting a test block close to the focal depth for measurement, otherwise the measured zero point and sound velocity may have a large error.

For the detailed steps of probe calibration, please refer to the subsequent introduction.

3.3 Setting function group

Implement: "MENU" Key--->>Select the "Setting" icon

Explanation: Related options for the parameters of this instrument

3.3.1 Language

Language selection: Chinese or English

3.3.2 Test Unit

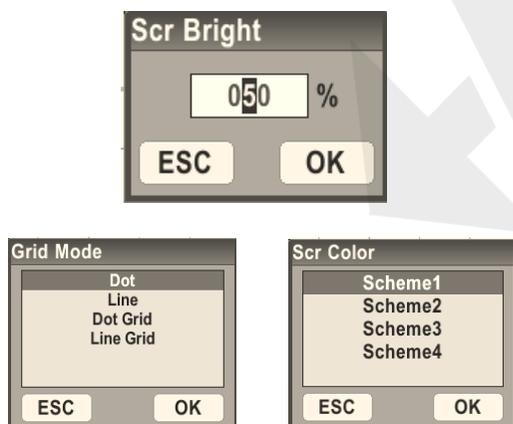
Metric or Inch

3.3.3 Grid Mode

Set the coordinate and grid display mode.

3.3.4 Scr Bright

It can be adjusted continuously from 20% to 100%. The difference in screen brightness will affect the battery's standby time and continuous working time.



3.3.5 Scr Color

There are 4 display styles to choose from.

3.3.6 Key Sound

On or Off

3.3.7 Alarm Sound

On or Off



3.3.8 Date Time

Press the "Left" or "Right" key to switch options, and turn the wheel to change the value.

3.3.9 Comm Port

Please set it to off, it will not affect normal communication.

3.3.10 Format Mem

The internal memory of the instrument contains channel data, report data, video data, etc. When storage errors occur, the memory needs to be formatted. Formatting the memory will clear all data.



3.3.11 ScrShor Mode

The screenshot picture can be set as a grayscale picture or a color picture.

Press the "Screenshot/Video" shortcut key to convert the screen image into a picture file in BMP format and save it to the U disk.

3.4 DAC function Group

Implement: "MENU" Key--->>Select the "DAC" icon

Hot key:

Explanation: Distance Amplitude Curve (DAC) function

DAC is a curve that describes the relationship between the distance from the reflection point to the wave source, the echo height, and the equivalent size. Defects of the same size have different echo heights due to different distances. Therefore, the DAC curve is very useful for the determination of flaw detection.

A DAC curve is programmed using a series of same-reflector echoes at various depths covering the range of depths to be inspected in the test material. Because near field and beam spread vary according to transducer size and frequency, and materials vary in attenuation and velocity, DAC must be programmed differently for different applications. A DAC curve can be based on up to 16 data points (material depths). These points are recorded from the DAC menu as described below.

ItemsList: DAC set Standard DAC Build DAC Edit Size Ref Curve RL Curve SI Curve EL Curve No4 Curve No5 Curve No6

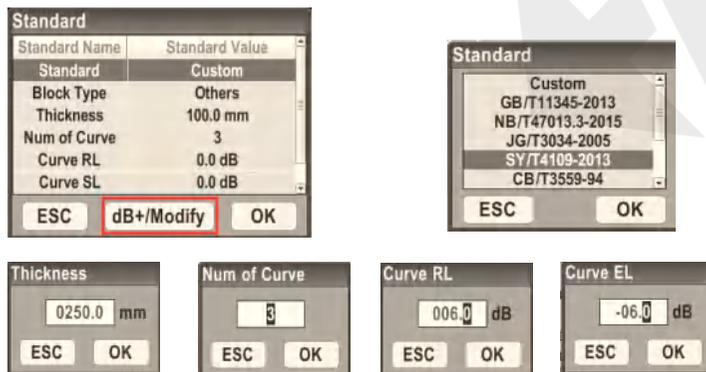
3.4.1 DAC Set

On or Off

The DAC curve can be build and edit only when the DAC is on. After the DAC is on, an DAC icon will be displayed at the top of the screen. DAC curve build may use shortcut keys to adjust gain, gate position/width/height, peak memory, etc.

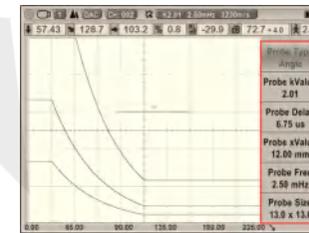
3.4.2 Standard

"Up and down" keys move options, and "dB+" keys change options. Other options can only be changed when "Custom" is selected as the standard.

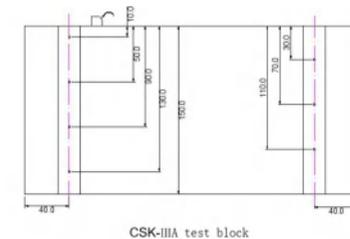


3.4.3 DAC Build

First input the probe frequency correctly, then calibrate the probe zero point, sound velocity and angle, and then enter the DAC curve build wizard.



DAC Curve points are typically taken from a standard with equally sized reflectors (holes) located at various material depths. The primary echo from each of these points (for up to a total of 16 echoes) are recorded. When DAC is active, the instrument displays a curve that represents echo peaks for constant reflectors at varying material depth.



Take 2.5M angle probe and CSK-III test block as an example to make DAC curve.

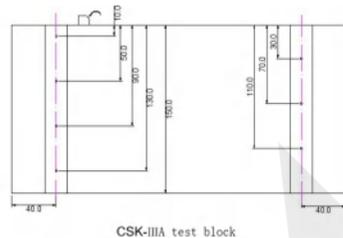
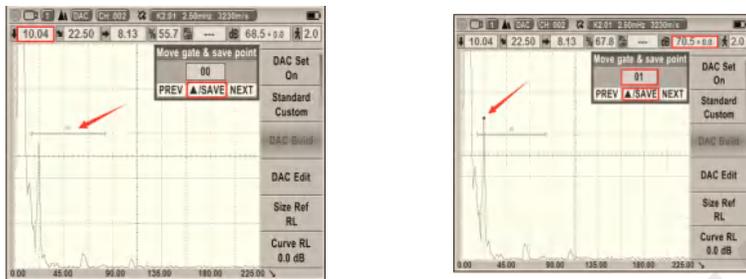
Step 1: DAC Set On

Step 2: Perform DAC build



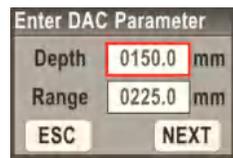
Enter the maximum depth of the test block as prompted by the display screen. The height of the test block for CSK-3A is 150mm. After entering 150mm, press the "OK" key to enter the next step.

Step 3:
The screen prompts that the reference point is 0. Place the angle probe on the CSK-3A test block so that it faces the short horizontal hole 10mm deep and place it on a suitable horizontal position. Move the probe repeatedly to find the highest echo of the hole.



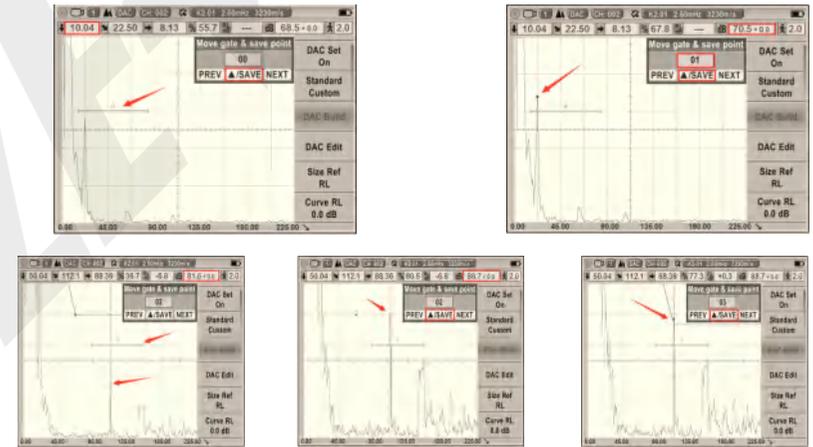
Take 2.5M angle probe and CSK-III A test block as an example to make DAC curve.

Step 1: DAC Set On
Step 2: Perform DAC build



Enter the maximum depth of the test block as prompted by the display screen. The height of the test block for CSK-3A is 150mm. After entering 150mm, press the "OK" key to enter the next step.

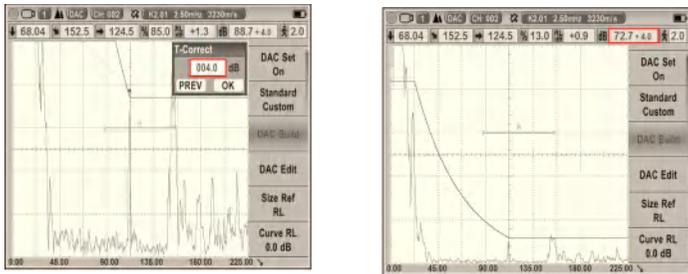
Step 3:
The screen prompts that the reference point is 0. Place the angle probe on the CSK-3A test block so that it faces the short horizontal hole 10mm deep and place it on a suitable horizontal position. Move the probe repeatedly to find the highest echo of the hole.



Use the rotary wheel to adjust the gate width so that it covers the highest echo. Press \square Auto gain the echo height to 80%. According to the screen prompts, press the " \diamond " key to save the reference point. The screen prompts that the reference point is 3. Indicates that three reference point has been successfully entered. There are 16 reference points for the DAC curve at most. According to the actual situation, 3~5 points are enough.

press the "OK" key to enter the next step.

Step 6: After the 3 reference point collection is completed, you can continue to collect more reference points, or you can press the "OK" button to complete the collection and enter the next step, enter the surface compensation gain value "T-Correct", generally 4db. Press the "OK" button to complete the DAC reference point data collection. The curve displayed at this time is the original DAC curve (0dB-Curve) of $\Phi 1 \times 6$ mm.

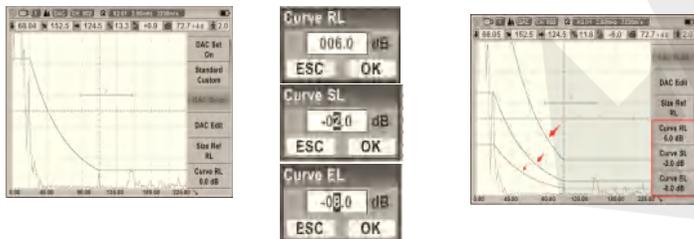


If you need to modify the reference point of the DAC curve, you can follow the DAC edit prompts.

Step 7: Select "Size Ref", the screen prompts



Step 8: Set RL SL EL
When operating with DAC turned on, three DAC curves including RL, SL and EL are typically displayed. The three curves can be offset from the original DAC curve (ML) by a user-inputted amount.



Step 9: Press the  key to save the curves parameters to the current channel.

Echo Evaluation with DAC

In order to be able to evaluate a flaw indication by means of the DAC, certain conditions must be met.

- The DAC curve must already be recorded.

*It only applies to the same probe that was used when recording the curve. Not even another probe of the same type must be used.

*The DAC only apply to the material corresponding to the material of the reference block.

*All functions affecting the echo amplitude must be set the same way as they were when the curve was recorded.

3. 4. 4 DAC Edit

If the deviation between the DAC curve and the actual echo is large, the edit function can be used to make partial adjustments. Please follow the instructions displayed on the wizard.



If you need to modify the reference point of the DAC curve, you can follow the DAC edit prompts.

Step 7: Select "Size Ref", the screen prompts

3.5 AVG Function Group

Implement: “MENU” Key--->>Select the "AVG" icon

Hot key:

Explanation:

Using the AVG (the same as DGS) function, you can compare the reflecting power of a natural flaw in the test object with that of a theoretical flaw (circular disk-shaped equivalent reflector) at the same depth.

Note: You are comparing the reflecting power of a natural flaw with that of a theoretical flaw. No definite conclusions may be drawn on the natural flaw (roughness, inclined position, etc.).

The so-called AVG diagram forms the basis for this comparison of the reflecting power. This diagram consists of a set of curves showing the correlation of three influencing variables:

*Difference in gain between various large circular disk-shaped equivalent reflectors and an infinitely large backwall

*Size of the circular disk-shaped equivalent reflector. The influencing variable always remains constant for one curve of the set of curves.

*The advantage of the AVG method lies in the fact that you can carry out reproducible evaluations of small discontinuities. The reproducibility is most of all important, for example, whenever you aim to carry out an acceptance test.

Apart from the influencing variables already mentioned, there are other factors determining the curve shape: sound attenuation, transfer losses, amplitude correction value, probe and etc.

The following probe parameters affect the curve shape:

- Element or crystal diameter
- Frequency
- Delay length
- Delay velocity

You can adjust these parameters on the instrument in such a way that you can use the AVG method with many different probes and on different materials.

Note: Before setting the AVG function, the instrument must first be calibrated because all functions affecting the AVG evaluation mode (VEL, P-DELAY, DAMPING, ENERGY, P-WIDTH, FREQ, DIAMETER, RECTIFY) can no longer be changed after the reference echo has been recorded.

3.5.1 AVG Set

On or Off

The AVG curve can be build and edit only when the AVG is on. After the AVG is on, an AVG icon will be displayed at the top of the screen. AVG curve build may use shortcut keys to adjust gain, gate position/width/height, peak memory, etc.

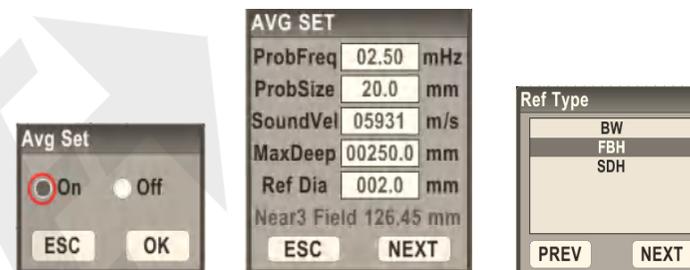
3.5.2 AVG Build

First input the probe frequency correctly, then calibrate the probe zero point, sound velocity and angle, and then enter the AVG curve build wizard.

Take 2.5M Straight probe and CSK-1-5 test block as an example to make AVG curve.

Step 1: AVG Set On

Step 2: Perform AVG build



Before using the AVG feature to evaluate reflectors in test pieces, the characteristics of the attached probe must be specified, certain characteristics of the reference standard must be input, and a reference echo must be stored. You must input the characteristics for the probe you've connected including:
 ProbeFreq- The probe's frequency rating
 ProbeSize – The probe element's effective diameter rating.
 Ref Dia– The probe
 MaxDeep–Must be greater than the thickness of the CSK-1-5 test block

Ref Type

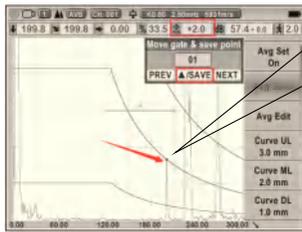
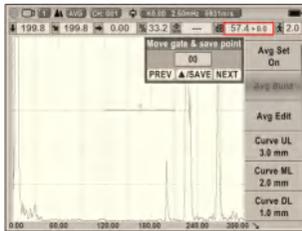
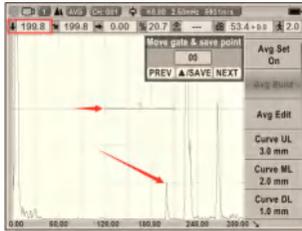
BW – Backwall echo with reference defect size defined as infinity

FBH – Flat Bottom Hole with a reference defect size equal to the hole's facial diameter.

SDH – Side Drilled Hole with a reference defect size defined as the hole's diameter.

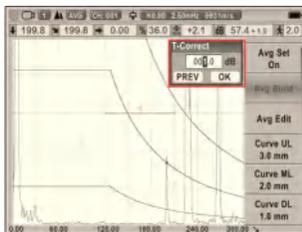
Step 3: Couple the probe to the CSK-1-5 standard test block, capture the reference flaw so that its reflected echo is displayed on the instrument's A-Scan, and adjust selected Gate's starting point to ensure that the resulting echo triggers the gate.

Step 4: Adjust the gain until the reference flaw's A-Scan peak measures 60% of FSH (Full Screen Height).



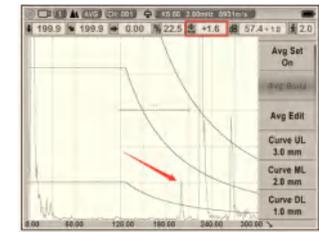
Measurement points less than the near-field cannot be saved

Step 5: Input surface compensation gain(T-Correct)



Step 6: Press “OK” to complete the AVG curve build. Press the  key to save the curves parameters to the current channel.

Once the AVG curve is recorded and displayed, the instrument automatically calculates the straight value and position of the defect, and displays it on the status bar in real time. Echoes are automatically compared to the AVG curve and evaluated based on the recorded reference. The result is shown as ERS (Equivalent Reflector Size), which evaluates the reflected echo and calculates the equivalent reflector size.



When building the AVG curve, you must pay attention to whether the frequency of the straight probe and the size of the chip are correct. This instrument only calculates the value after the near-field area, and only displays the value before the near-field area as a straight line. If the thickness of the test block used is small, it is necessary to use multiple echoes to select the test point so that the desired echo is behind the near-field area.

3.5.3AVG Edit

If the deviation between the AVG curve and the actual echo is large, the edit function can be used to make partial adjustments. Please



3.5.4 AVG UL, AVG ML, AVG DL



3.5.1 Size Type



Basic Function Group

Implement: "MENU" Key--->>Select the "Basic" icon

Hot key:

Explanation: Basic settings before testing

3.6.1 Range

The detection range should be adjusted according to the thickness of the workpiece. After the detection range changes, the echo position displayed on the screen will change accordingly. If the DAC/AVG curve is turned on, the DAC/AVG curve will also change accordingly. Setting limit: 2.5mm~15000mm (speed of sound 5900m/s)



3.6.2 Sound Vel

Sound velocity of test object is an important parameter in flaw detection. Always ensure that the Sound velocity is correctly set. The instrument calculates all range and distance indications on the basis of the value adjusted here.

The material sound velocity is divided into longitudinal wave sound velocity and transverse wave sound velocity. Straight probe uses longitudinal wave flaw detection, and angle probe uses transverse wave flaw detection. When the speed of velocity changes, the maximum detection range also changes.

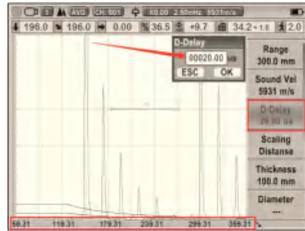
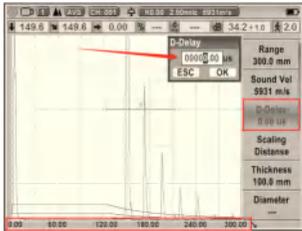
The following is the sound velocity of commonly used materials

2260m/s	0.089 in / μ s	Transverse sound velocity in Copper
2730m/s	0.107 in / μ s	Longitudinal sound velocity in plexiglass
3080m/s	0.121 in / μ s	Transverse sound velocity in Aluminum
3230m/s	0.127 in / μ s	Transverse sound velocity in steel
4700m/s	0.185 in / μ s	Longitudinal sound velocity in copper
5920m/s	0.233 in / μ s	Longitudinal sound velocity in steel
6300m/s	0.248 in / μ s	Longitudinal sound velocity in aluminum
Sound Velocity limit: 100m/s~20000m/s (measurement range:200mm)		

3.6.3 Image movement(D-Delay)

The image movement operation can move the display position of the echoes left and right without changing the relative position and amplitude between the echoes. The echoes that are not of interest can be adjusted to the outside of the screen to focus and display the echo area of interest.

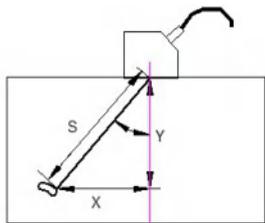
Here you can choose whether to display the adjusted range (for example 300 mm) starting from the surface of the test object, or in a section of the test object starting at a later point. This allows you to shift the complete screen display and consequently also the display zero. If the display should for example start from the surface of the test object, the value in D-DELAY must be set to 0.



D-Delay limit: -20uS ~ 10000uS

3.6.4 Scaling

The sound path indicates the transmission distance of the ultrasonic wave in the detected object. According to geometric relationship, the sound path is divided into three types:
 Distance sound path (S),
 Vertical sound path (Y)
 Horizontal sound path (X)



3.6.5 Thickness

The thickness of the detected object is an important input parameter for the calculation of the number of echoes. thickness Limit: 1mm ~ 1000mm

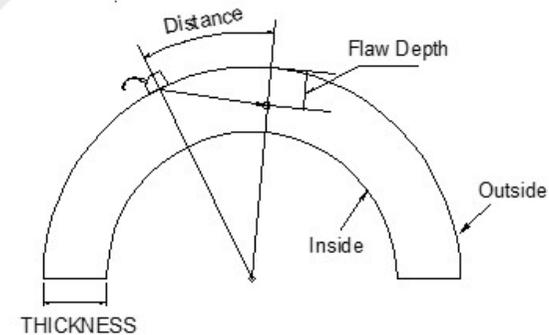
3.6.6 Diameter

Diameter of the detected object can be set only when the Curved

correction to an inner surface or an outer surface. for example when testing longitudinally welded tubes. In order to make the instrument carry out the corresponding correction of (reduced) projection distance and depth, you should enter the outside diameter of your test object in this function. Diameter Limit: 0mm ~ 5000mm

3.6.7 Curved surface Correct

When using angle probe on a curved surface the instrument will calculate the surface distance and depth of defect, taking into account the internal or external radius. Cured Correction function : Inner or Outer
 Thickness: the material's wall thickness. This value is required for the automatic calculation of the real depth.
 Diameter: the material's Diameter



3.7 Memory Function Group

Implement: “MENU” Key--->>Select the "Memory" icon
 Hot key: 
 Explanation: Flaw detection report related functions

3.7.1 Search By Order



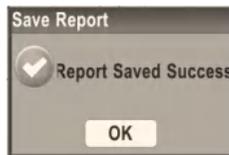
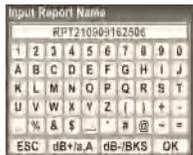
3.7.2 Search by Name



3.7.3 Search by Date



3.7.4 Save report

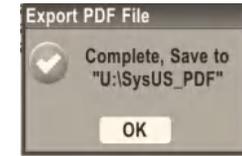


3.7.5 Delete All



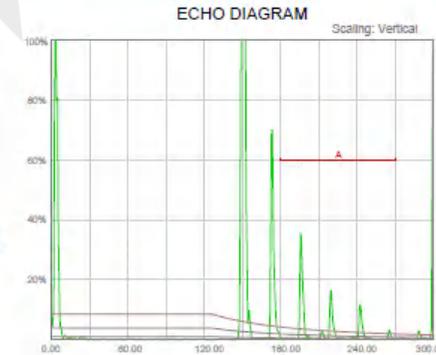
3.7.1 Export PDF

First select a report, and then press the "OK" button to convert the report into a PDF file and store it in the U disk (SysUS_PDF directory). The name of the exported PDF file is the same as the name of the report.



REPORT

- NAME
RPT210913111303
- DATE
2021.09.13 11:13:03
- PROBE
Probe
- RESULT
S_VALUE = 196.0 mm
D_VALUE = 196.0 mm
P_VALUE = 0.00 mm
H_VALUE = 35.2 %
V_ERS = 9.5 mm
UNIT = Metric



• PARAMETER

ProbType	Straight	Range	300.0 mm	Trigger	Peak	Standard	---
PROBE VK	0.00	Sound Vel	5931 m/s	Base Gain	34.2 dB	ERS-REF	Hole
P-Delay	2.96 us	D-Delay	0.00 us	Scan Gain	0.0 dB	AVG-UL	3.0 mm
ProbFreq	2.50 mHz	Thickness	100.0 mm	Comp Gain	1.0 dB	AVG-ML	2.0 mm
X-Value	0.00 mm	Diameter	---	PulsAmp	400 V	AVG-D:	1.0 mm
ProbDamp	400 ohm	Correct	Off	PulsWidth	250 nS		
Rectify	Full	Reject	Close	PulsFreq	200 Hz		
ProbSize	20.0 mm	Gate Sel	Gate_A	CurveType	AVG		

3.7.7 Export All

Export all reports to a USB flash drive. This function is used to export the report on one instrument to another instrument for viewing. You can also view the report from the data management software. The save directory and file name of the report:



3.7.8 Import All



3.8 Gate Function Group

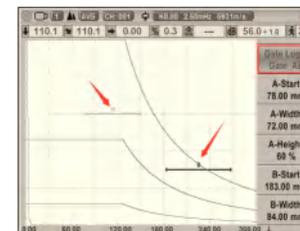
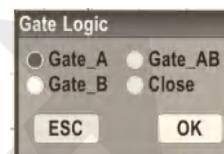
Implement: "MENU" Key--->>Select the "Gate" icon
Hot key:  

Explanation:
Use the "gate" to lock the echo to be measured, and display all the parameters of the highest echo in real time (the sound path distance, the horizontal distance and the vertical distance, and the echo height, etc.).

This instrument has two gates: gate A and gate B. Use "Gate Logic" to choose single use or double gate use. When using any one of the gates, the functions of gate B and gate A are the same (the operation mode is the same, the measurement calculation is the same), and the reading method is a single gate. When double gates are used, the reading method and calculation are double gates.

The start of the gate, the width of the gate, and the height of the gate are generally convenient to adjust with shortcut keys.

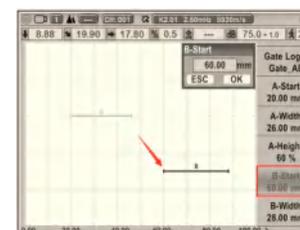
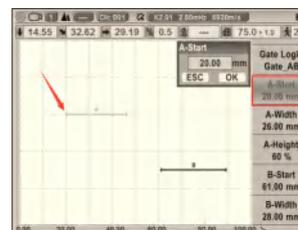
3.8.1 Gate Logic



3.8.2 Gate Start

Adjust the starting position of the gate currently in use, and move the gate to the desired position as needed to lock the echo to be measured.

Turn the wheel to move in units of each pixel, and the "left and right" arrow keys take every 10 pixels as the unit.



3.8.3 Gate Width

Turn the wheel to move in units of each pixel, and the "left and right" arrow keys take every 10 pixels as the unit.



3.8.4 Gate Height

The gate height refers to the percentage of the gate relative to the full width of the echo display area.
The adjustment range is 5 to 90%. U:\SysUS_System\report.bin



3.8.5 Gate Alarm

Positive Alarm: When the echo value in the gate is higher than the gate height, the alarm will start.
Negative Alarm: When the echo value in the gate is lower than the gate height, the alarm will start.
Alarm prompt: ALARM LED and audible alarm



3.8.6 Trigger

Peak Trigger: The echo position and echo height are the echo data with the highest amplitude in the gate.
Edge Trigger: The echo position and echo height are the data at the intersection of the front edge of the echo in the gate and the gate.

When the trigger mode is edge, it does not affect the echo envelope, peak memory, and echo height.



3.9 Pulser Function Group

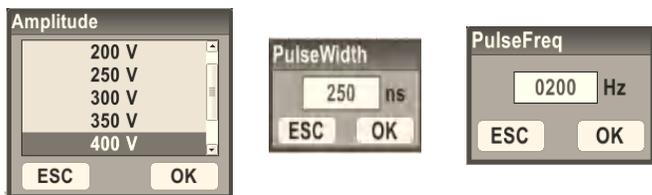
Implement: “MENU” Key--->>Select the "Pulser" icon
Explanation: Transmit pulse signal related options.
Inside the instrument, the ultrasonic transmitter circuit generates a large electric voltage pulse and sends it to the ultrasonic probe, which stimulates the probe to emit ultrasonic pulses and enter the material to be inspected. The size of the transmitted pulse amplitude (pulse voltage) and duration (pulse width) determine the size of the emission intensity (also known as emission power, emission energy).

3.9.1 Amplitude of Pulse Signal

The voltage value of the pulse signal.
Options::100V、200V、250V、300V、350V、400V、450V、500V。
Generally set to 400V

3.9.2 Pulse Width

By adjusting the value of the pulse width, you can match probes of different frequencies.
Increasing the pulse width increases the emission energy and the penetration distance, but the resolution will decrease.
In the case where high resolution is required, especially near-surface resolution, too large pulse width and pulse amplitude should not be used.
The resolution requirements and the specific conditions of the inspected materials (such as the size of the sound wave attenuation) must be considered for comprehensive consideration.
Range: 30nS ~ 510nS

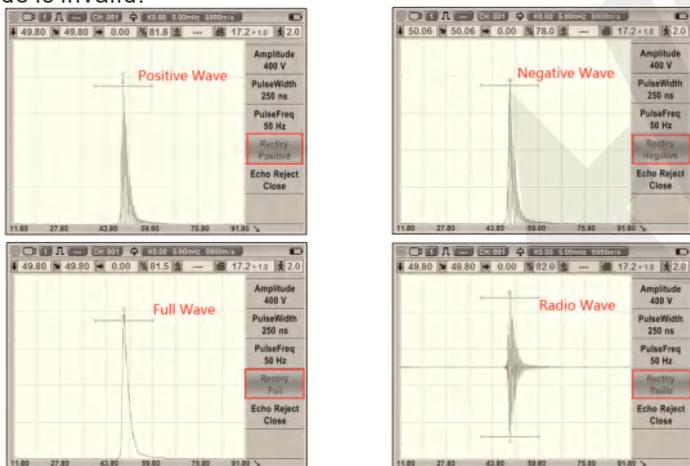


3.9.4 Pulse Freq

PRF: The number of pulses that excite the probe element per second is called the pulse repetition frequency. When the scanning speed is faster, a higher repetition frequency should be selected to prevent the defect from being missed; when the scanning speed is slow, setting a lower emission repetition frequency can reduce the power consumption of the instrument. Range: 20Hz ~ 2000Hz, general setting (30~200) Hz.

3.9.5 Rectiry

For flaw detection tasks, the most commonly used is full wave detection. However, in some special applications, it may be more advantageous to choose positive half-wave or negative half-wave detection due to different purposes. When the DAC\AVG curve is set to on, the radio frequency detection mode is invalid.

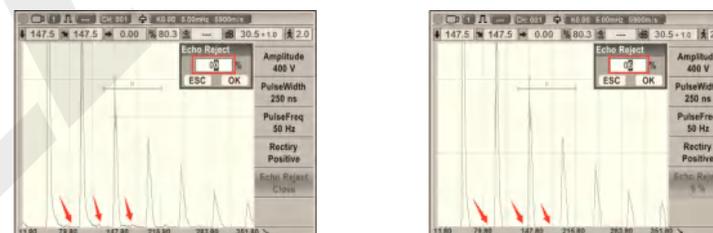


3.9.5 Echo Reject

This function is used to limit the display of clutter (noise) to improve the signal-to-noise ratio. This makes the effective echo displayed on the screen clearer.

The instrument directly digitally displays the restricted percentage value.

Function introduction: With the increase of the limit value, the "Reject" effect has been added. At this time, the clutter smaller than the set value is filtered out and not displayed, and the echo larger than the set value is not changed, so the signal-to-noise ratio is



Note: As the reject effect increases, the dynamic range of the instrument will become smaller, so please turn off this function in time after using this function.

3.10 Gain Function Group

Implement: "MENU" Key--->>Select the "Gain" icon

Hot key: DB+ DB-

Explanation:

The gain is used to adjust the echo amplitude.

As the gain increases, the echo amplitude increases.

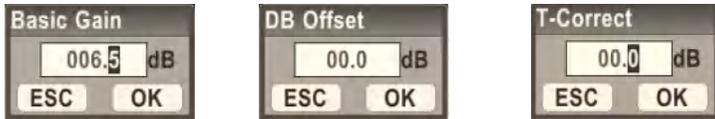
The gain decreases and the echo amplitude decreases.

In flaw detection, gain adjustment can be used to control the sensitivity of the instrument, measure the relative height of the signal, determine the size of the defect or measure the attenuation performance of the material, etc.

Unit: dB.

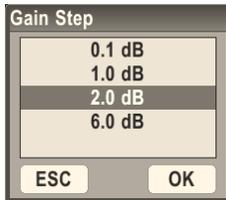
3.10.1 Basic Gain

When the basic gain changes, the DAC/AVG curve and the echo amplitude change simultaneously.
Adjustment range :0~110dB



3.10.2 Gain Step

The minimum gain step for each press of the "dB+" or "dB-" shortcut key.



Adjustment range: 0.1dB ~ 6dB

3.10.3 DB Offset

Surface compensation gain (DB Offset) refers to the compensation for flaw detection sensitivity due to the influence of the surface roughness of the workpiece.

Adjustment range: -30dB ~ 50dB

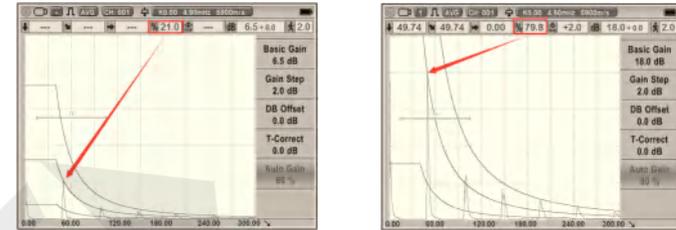
3.10.4 T-Correct

T-Correct scan gain can increase or decrease the echo in the gate.

Adjustment range: -30dB ~ 50dB

3.10.5 Auto Gain

Pre-set the waveform height value, press the  auto gain control shortcut key, the echo in the gate quickly reaches the preset height.



3.11 Record Function Group

Implement: "MENU" Key--->>Select the "Record" icon
Hot key: 

Explanation:

This instrument can take a screenshot of the defect echo in real time on the spot to facilitate detailed identification and analysis of the size and location of the defect in the future. It can also record defect echo continuously, and the record file can be stored in the instrument memory or U disk. The record file can be played with the instrument or through the software.

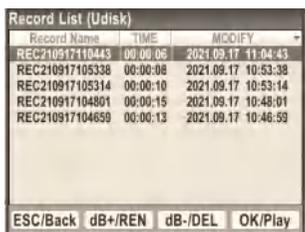
3.11.1 Recording

The instrument has whether to open the recording dialog box and whether to stop the recording dialog box. The video has a time progress prompt. During the recording process, the shortcut keys can be operated normally. The detection range can be adjusted in this menu.



3.10.2 Play/Delete

Function	Method of operation
Play	Open the video list, use the arrow keys to select the file and then press the "OK" key to start playback. The time progress prompt for playback.
Stop	Select the "Playback" column and press the "OK" button dialog box pops up whether to stop the playback.
Pause	Press the "Menu" button to pause playback, and press "Menu" button again to resume playback.
Fast forward	Turn the wheel clockwise.
Backward	Turn the wheel counterclockwise.
Renamefile	DB+
Delte	DB-



3.11.3 Storage location

You can choose instrument memory or external U disk. If the instrument memory is selected, a maximum of 10 video files can be saved, and each video recording time is no more than 5 minutes. If you choose to store in an external U disk, there is no limit on the number of recordings and time.



3.11.4 Export Rec

This function is used to export the video recorded on one instrument to a USB flash drive, and play it on another instrument or in the software.



3.11.6 Delete All



3.12 Auxiliary function Group

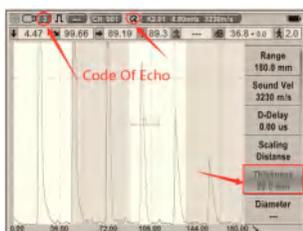
Implement: "MENU" Key--->>Select the "Auxiliary" icon
 Explanation:
 The purpose of flaw detection is to determine the location and size of the defect in the inspected workpiece, and then analyze the nature of the defect. In order to improve the accuracy of detection, this instrument is designed with related digital processing and management functions for the detection data, which will greatly reduce the intensity of flaw detection work, which is conducive to the correct judgment of the location, quantification and nature of defects.

3.12.1 Echo Code

The echo code function is used to identify how many times the echo signal is the first echo. In addition to displaying the echo code in a histogram, there is also a digital display at the top of the screen.

This function should meet the following 3 conditions:

1. Echo code is set to "On".
2. The probe is set as an angle probe.
3. The thickness of the workpiece is set correctly.



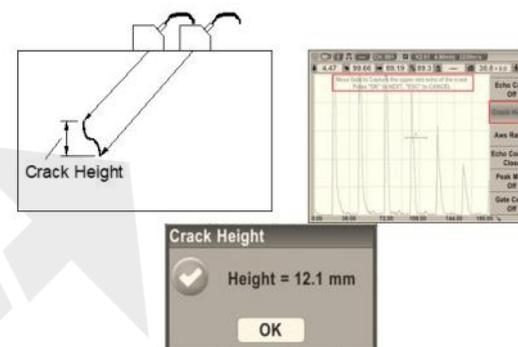
3.12.2 Crack Height Measuring Feature

This feature allows measuring the height of a crack found inside the workpiece.

Before starting to use the Crack Height Measure function, the instrument and the probe must be correctly calibrated.

Determine the position of end point A (the upper end of the crack): move the probe, lock the defect echo with the current gate, find the peak value of the defect echo, and then press the "OK" key. The instrument automatically locks and records the echo peak position P1.

Determine the position of end point B (the lower end of the crack): continue to move the probe, find the defect echo at the lower end of the crack, and lock the peak of the echo, press the "OK" key, the instrument will automatically lock and record the peak position of the echo P2, And calculate the result.



3.12.3 AWS D1.1 weld Rating

This feature allows analysis of welds according to AWS specification D1.1 and provides a D1.1 rating. The AWS D1.1 feature utilizes four AWS-specified variables including:

1. INDICAT – Gain (in dB) required to position an A-Scan echo's peak (from the measured reflector) at 50% of full screen height (FSH).
2. REFRNCE – Gain (in dB) required to position an A-Scan echo's peak (from the reference reflector) at 50% of FSH.
3. ATTEN – Determined by subtracting 1 inch from the sound path distance to the discontinuity, using the equation: $ATTEN=(SA-1)\times 2$. This compensates for sound loss from material attenuation along the sound path to the discontinuity.
4. RATING – Calculated based on the AWS formula:
 $.RATING=INDICAT-REFRNC-ATTEN$.

Before activating the AWS D1.1 weld rating feature, make sure that the angle probe has been calibrated.

The steps are as follows:

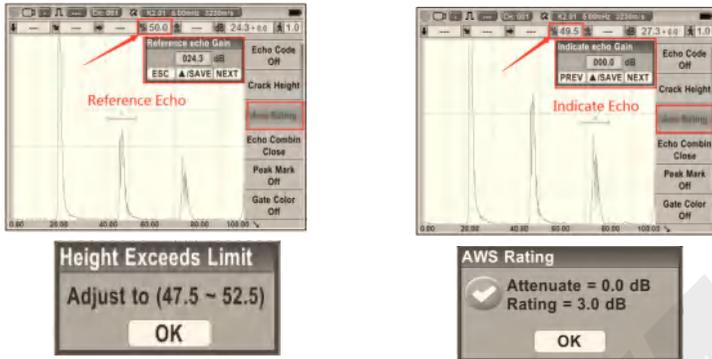
Step 1: Press "OK" to open the "reference echo gain" dialog box.

Step 2: Couple the probe to a suitable reference test standard.

Step 3: Ensure that the A-Gate is positioned over the desired echo.

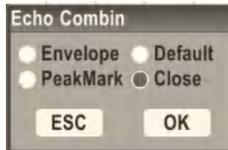
Then adjust the gain until the peak of the desired reference echo reaches 50% of full screen height (FSH). Note that if the echo's peak amplitude does not fall between 47.5% and 52.5%, the inputted point will not be accepted.

Step 4: Press Save data of reference echo gain.
 Step 5: Press "OK" key to open the "Indicate echo gain: dialog box.
 Step 6: Couple the probe to the workpiece to be tested.
 Step 7: Adjust the gain until the peak of the workpiece echo reaches 50% of full screen height (FSH). Note that if the echo's peak amplitude does not fall between 47.5% and 52.5%, the inputted point will not be accepted.
 Step 8: Press Save data of indicate echo gain and calculate the result.
 To evaluate additional reflectors against the recorded reference, simply repeat Steps 5 to 8.



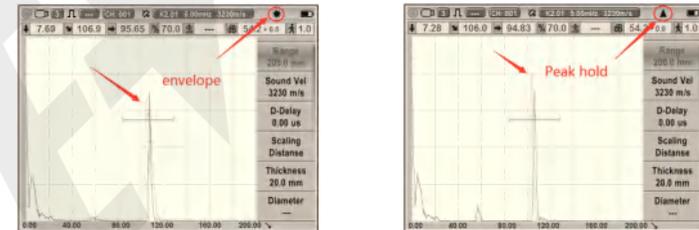
3.12.4 Echo Combin

Note: Echo envelope and peak hold cannot be effective at the same time.
 The instrument has "Envelope/Peak" shortcut keys for easy setting.



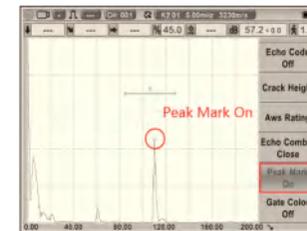
The echo envelope function is mainly for angle probes. Its function is to memorize the peak display points of multiple consecutive echoes in the current gate when the probe moves on the workpiece, and connect them into an envelope line to display on the screen. According to the envelope shape, the highest echo of the defect can be easily found, and it can provide a basis for judging the nature of the defect.

The peak hold is to capture the highest peak echo (wave height and position) of the dynamic echo in the gate and display it on the screen. After the probe is removed, the gate capture information is still maintained. In actual flaw detection, this helps to search for the largest flaw echo.



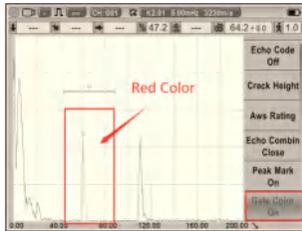
3.12.5 Peak Mark

In actual flaw detection, marking the peak point helps to find the highest echo. You can choose to On or Off.

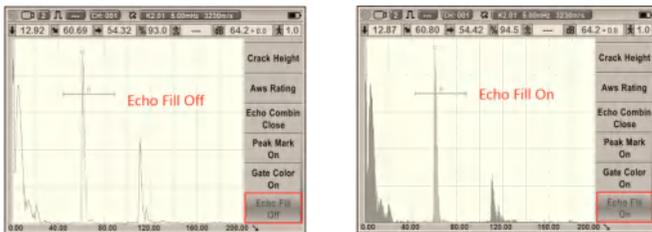


3.12.6 Gate Color

When the function is on, the echo colors inside and outside the gate will be displayed in different colors. In the actual flaw detection, it is helpful to distinguish the echo inside the gate.

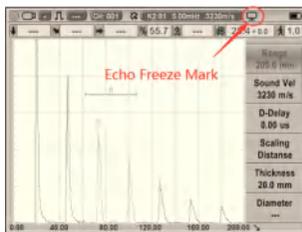


3.12.7 Echo Fill



3.12.8 Echo Freeze

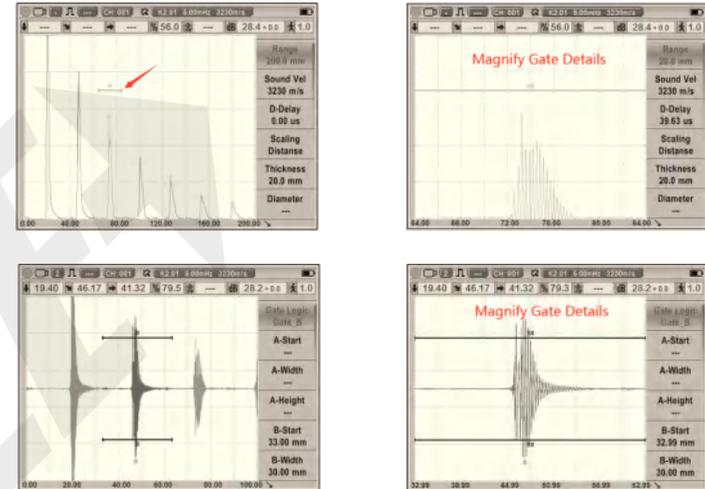
Press the  shortcut key to freeze the echo and data displayed on the screen, and press this key again to release the freeze. After the echo freeze is valid,  icon flashes on the screen, and the



3.12.9 Magnify Gate Details

Press the  shortcut key to enlarge the echo within the current gate range to the entire waveform display area, and press this key again to restore the display state.

After the gate is magnify, gate A is marked AX and gate B is marked BX.



3.12.10 Screenshot

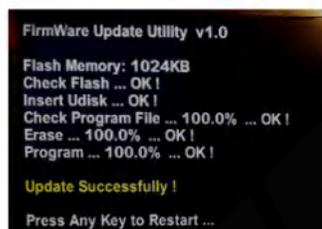
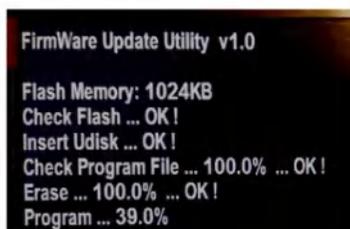
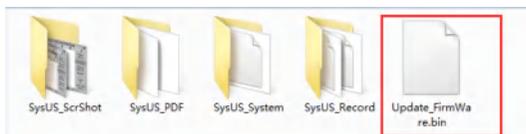
Press the  shortcut key to save the image displayed on the screen as a BMP format picture and store it on the U disk. The storage directory is the U disk folder "SysUS_ScrShot". The picture color can be set to grayscale or color. The grayscale image file is relatively small, which is convenient for document editing and printing. Before taking the screenshot, a dialog box for entering the BMP file name will pop up. If you do not change the file name, just press the "OK" button. If you want to take a screenshot quickly, press the  button continuously.

3.13.11 Program Firmware Upgrade

The instrument can upgrade the program through a U disk, and the user can upgrade the program to the latest version by himself. It is convenient to increase the function of the instrument.

Program upgrade steps:

1. Copy the upgrade file "Update_Firmware.bin" to the root directory of the U disk.
 2. Insert the USB flash drive.
 3. Turn on the instrument while holding down the Fn key, the instrument will automatically complete the upgrade and there will be progress prompts.
- The upgrade process is relatively fast, usually within ten seconds to complete the upgrade. During the upgrade process, try to ensure sufficient power, and do not plug or unplug the U disk. If there is a power failure or U disk error, repeat the above steps.



3.13 B Scan Function

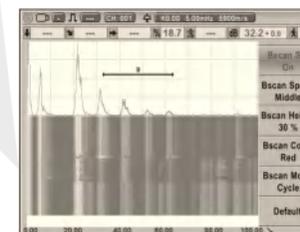
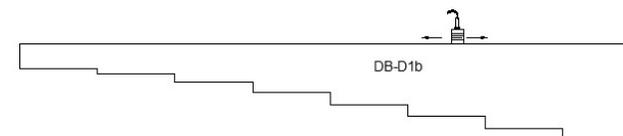
Implement: "MENU" Key--->>Select the "B Scan" icon

Explanation:

In B-SCAN mode, the instrument displays a graphical cross-section of the workpiece.

This instrument supports color-coded B-scan, using the depth of color to express the intensity of the echo, making the scanned image more intuitive.

Take the DB-D1b ladder test block as an example, first change the gain so that the echo can be clearly displayed in the B-scan area. Place the probe on the test block and move the probe left and right to scan the echo intensity graph of the test block, as shown in the figure below:



3.13.1 B Scan Set

3.13.2 B Scan Speed

3.13.3 B Scan Height

Range: 10% ~ 80%, the higher the value, the darker the B-scan color



3.13.4 B Scan Color



3.13.6 B Scan Mode

If it is set to single, only scan one screen, and then stop scanning again, which helps to fix the image for easy analysis and evaluation.

3.13.7 Default

If the scan parameters are unknown, you can restore the default settings.

3.13.8 Connecting to a Computer

The instrument is equipped with a communication port. The PC can be connected with the communication port. A-Scan display, instrument settings, and videos stored in the memory of the instrument can be transferred to the computer through the communication port. Detailed information of the communication software and its usage refer to the DataPro software manual.

4 Faults and solutions

4.1 The instrument cannot be turned on.

- (1) Check whether the battery power is sufficient, whether the installation is reliable, or directly connect to the power adapter and turn on the machine;
- (2) Press the power button many times, but the interval should not be less than half a minute;
- (3) Connect the power adapter and repeatedly turn on the power switch of the instrument.
- (4) If the above method does not work, connect the power adapter to charge the battery for half an hour and then turn it on.

4.2 The instrument shuts down automatically

The instrument has the ability to detect battery power. When the battery power is too low, the instrument will automatically shut down. You can charge the battery for a period of time, or connect it directly to the power adapter, and then turn it on.

4.3 No Echo

- (1) Whether the probe is connected correctly;
- (2) Whether the probe method is appropriate, if the probe is set to dual crystal or penetrating probe, and the single probe is connected, there will be no echo;
- (3) Whether the probe wire is normal, whether the probe and the probe wire are in normal contact, a tweezers (metal) can be used to touch the inner core of the probe base. If there is noise, the instrument is in good condition, and the probe wire should be damaged.
- (4) Whether the parameters such as gain, display shift, probe zero, signal suppression, etc. are set correctly.
- (5) Simple processing method when there is no echo: load a default channel, then connect a straight probe with a new probe cable, and probe on a well-coupled thin test block. If there is an echo, the original parameters may be set incorrectly or The probe wire is in poor contact.

4.4 Keyboard failure

- (1) The keyboard is locked (that is, this key should not be operated at this time);
- (2) The touch point in the keyboard is not pressed;
- (3) Operate the keyboard without following the on-screen prompts; Set "Key Sound" to "On", press the instrument keyboard to see if there is a key buzzer. If there is a key buzzer, the key is normal.

4.5 Clutter interference is large or the echo moves left and right or suddenly disappears

- (1) The probe is in poor contact with the probe cable. Remove the probe cable at this time and the phenomenon should disappear.
- (2) The power cord or power adapter has interference. Remove the charger and use the battery directly. The phenomenon should disappear.
- (3) The probe or the probe wire is too close to the screen, causing radiation.

4.6 Unable to build DAC curve

- (1) The detection mode of the instrument is in the radio frequency state, so you should switch to other detection modes first.
- (2) The displayed echo amplitude is too low and does not reach above the gate height (when the echo amplitude is lower than the gate height, the automatic search echo signal function cannot be realized).

4.7 Crash

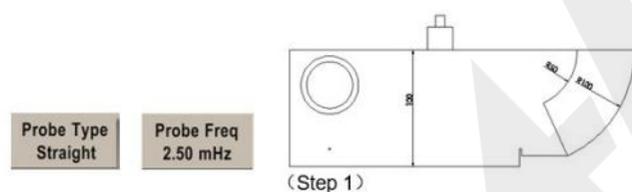
There is a reset hole at the top of the instrument, and lightly touch the reset hole with a needle such as a toothpick.

5 Calibration

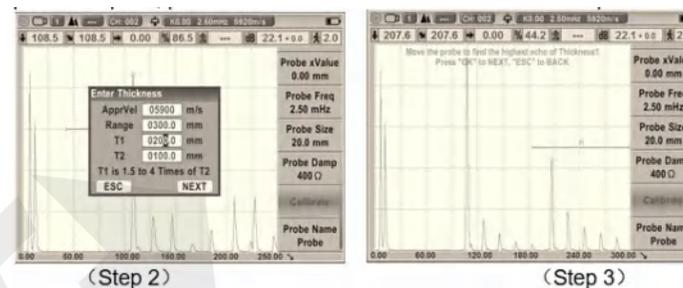
5.1 2.5M straight probe calibration method

Element :CS-1A test block and 2.5M straight probe
 Method: echo-echo method, the operation is as follows:

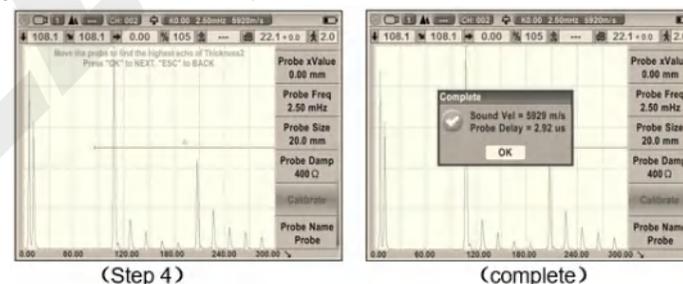
Step 1: The probe type is selected as a straight probe, and the probe frequency 2.5M must be input correctly.
 Place the probe on the CSK-1A test block as shown in the figure below and select "Calibrate".



Step 2: Select "Calibration" and enter, as shown in the figure below. T1 is the thickness value of the second echo, input 200mm, T2 is the thickness value of the first echo, input 100mm, the Appvel (approximate Velocity) defaults to 5900, the Range changes with the set value of T1, or you can enter it manually. After the input is complete, press the "OK" button to enter the "NEXT" step.



Step 3: Adjust the gain so that both the first echo and the second echo appear on the screen. Follow the instructions on the screen, move the gate and cover the "T1 (200mm)" echo, and press the "OK" key to enter the next step.



Step 4: Follow the instructions on the screen, move the gate and cover the "T2 (100mm)" echo, and press the "OK" key to complete the calibration.
 Step 5: Press the  key to save the calibrated probe parameters to the current channel.

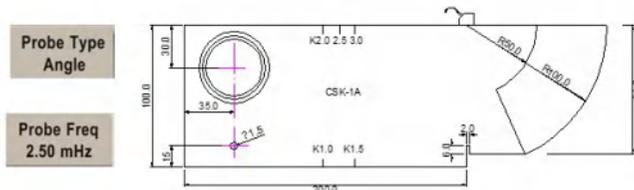
5.2 5.0M straight probe calibration method

Element :CS-1-5 test block and 5.0M straight probe
 Method: echo-echo method, the operation is as follows:

Step 1: The probe type is selected as a straight probe, and the probe frequency 2.5M must be input correctly.
 Place the probe on the CS-1-5 test block as shown in the figure below and select "Calibrate".

The operation is as follows:

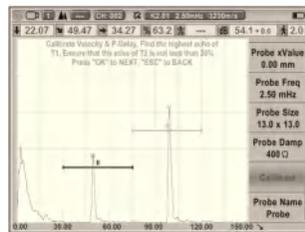
Step 1: Select the angle probe as the probe type, and input the probe frequency correctly. Place the probe on the test block, as shown in the figure below, select "Calibrate" and enter.



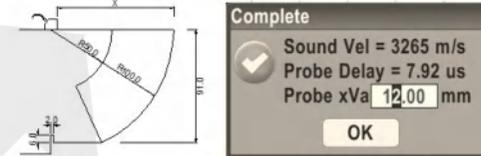
Step 2: First select "Calibrate zero point and sound velocity", input "T1" as 100mm and "T2" as 50mm (T1=R100mm, T2=R50mm). If it is a steel material, the ApprVel (approximate Velocity) is 3230, no need to adjust. test block as shown in the figure below and select "Calibrate".



Step 3: Adjust the gain so that both the R50 echo and R100 echo appear on the screen. Follow the instructions prompt information on the screen, move the gate A and cover the "T1 (100mm)" echo, move the gate B and cover the "T2 (50mm)" echo, and press the "OK" key to enter the next step.



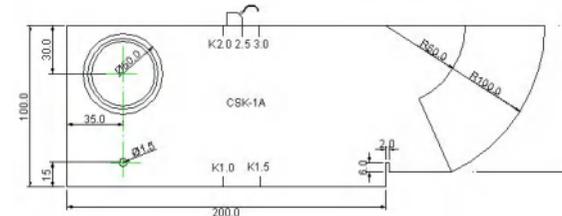
Step 4: Keep the probe still, use a ruler to measure the distance X from the tip of the probe to the top of the R100 arc of the CSK-1A test block, then use 100-X to calculate the xValue of the probe, and enter the value in the dialog box, and press OK to finish calibration.



Step 5: Select "Calibration Angle", and input "Range", "Hole Depth" and "Aperture". The diameter of the CSK-1A standard test block is $\Phi 50$, and the vertical distance between the center of the hole and the detection surface is 30mm, press "OK" to enter the next step.



Step 6: Place the probe on the test block, as shown in the figure below. Because the nominal K value of the probe is 2, we place the probe near the K2 marking line of the CSK-1A test block, aim the probe on the 50mm diameter circular hole, and slowly move the probe to find the highest echo of the 50mm diameter circular hole. You can press the  shortcut key and use the "Peak Memory" function to search for the highest echo.



Step 7: After finding the highest echo, press "OK" to complete the calibration.

