USER MANUAL

ULTRASONIC FLAW DETECTOR

PCE-UFD 50

ENGLISH



User manuals in various languages (français, italiano, español, português, nederlands, türk, polski) can be found via our product search on:
www.pce-instruments.com

PREFACE

Thank you for using our company's products, you can become our user, it is our great honor. It is an intelligent digital ultrasonic flaw detector produced by the company. It adopts the most advanced digital integration technology and new EL display technology. Its performance indicators have reached or exceeded the domestic advanced level and are at the forefront of the international community. The instrument uses artificial intelligence technology, which is powerful and easy to use. In order to enable you to grasp the operation process as soon as possible, we have provided a detailed operation manual, please be sure to read this manual and other information provided with the machine before using the machine. This will help you to become familiar with the necessary help.

Statement

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Security

- Do not use this instrument in heavy dust, moisture, strong magnetic fields, oil or corrosive environments.
- It is forbidden to wipe the case with a soluble substance.
- Use our company's power supply to charge the instrument.
- When the instrument is not working for a long period of time, charge and discharge should be performed regularly, and it is recommended that once a month.
- When connecting to an external device (printer, PC), it must be done after turning off the power of the instrument.
- Do not disassemble the instrument without authorization. In case of repair, please contact the dealer or the company.
- The instrument should be stored in a dry and clean place to avoid strong vibrations.

Features

- Measurement display mode: A type display mode;
- It has a linear suppression function, the maximum inhibition is 80% of the screen height;
- It can switch between single crystal probe, double crystal probe and two inspection modes;
- It has a gate setting and alarm function. The position and width of the gate can be arbitrarily set on the screen, and an incoming wave alarm can be set;
- 500 independent detection channels, each channel set a separate set of testing parameters, DAC curve;
- Two display modes with angle and K value;
- The DAC curve is generated automatically, and up to 10 points can be recorded, with four additional adjustable offset curves;
- AVG curve is generated automatically, and two types of defects can be customized;
- Automatic probe calibration function;
- With storage function, it can store 100 A sweep patterns, parameters and DAC curve;
- Has a storage graphics playback function, the stored A-scan graphics from the storage area and displayed on the screen;
- Has a delete function to delete the specified content (represented by the storage group number) from the storage area;
- Peak memory function;
- Freeze and thaw functions with waveform and inspection parameters;
- With sound path measurement and echo frequency analysis function;
- Real-time power status indication function;
- Support Wifi communication interface;

Indicator
The performance indicators and technical parameters are shown in the following table:

Name	Technical data
Scan range	0 ... 10000mm Grades: 2.5,5,10,20, 30,40,50,60,70,80,90, 100,150,200, 250, 300, 350, 400, 450,500,600,700,800,900,1000,2000,3000,4000,5000, 6000,7000,8000,9000, 10000. Adjusting step distance: 1mm
Pulse shift	-20 ... +3400μs Grades: -20, -10, 0.0, 10, 20, 50, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600,700,800,900,1000,1500,2000,2500,3000,3400. Adjustment step: 0.1 (-20 s ... 999.9 s), 1 (1000 s ... 3400 s)
Probe zero point	0.0 ... 99.99μs Adjust the step: 0.01
Material sound speed	1000 ... 15000m/s 7 fixed sound speeds: 2260,2730,3080,3230,4700,5900,6300 Adjust the step: 1
Working methods	Single probe (receive and send), dual probes (one for receiving one for sending)
Frequency Range	0.5 ... 20 MHz
Gain adjustment	0 ... 130 dB Adjust the step: 1, 2, 6, 12
Linear inhibition	Screen height 0% ... 80%, step size: 1%
Vertical linearity error	Vertical linear error is no more than 3%
Horizontal linear error	Within the scan range, no more than 0.2%
Flaw detection sensitivity margin	≥60dB
Dynamic Range	≥32dB
Display screen	High-brightness color flat panel display
A-Scan display area	Full screen or local A-Scan shows freeze and thaw A-Scan fills
Flaw detection channel	500
Data storage	100 A-Scan graphics

Name	Technical data
PC communication interface standard	USB
Units of measurement	Mm
Power Adapter	Enter 100V ... 240V/50Hz ... 60Hz Output 9V/1.5A
Battery	Lithium (Li) Battery 4 x 3.6V 4800mAh
Working temperature	-10 ... 50°C
Working humidity	20% ... 90% RH
Interface Type	BNC
Dimensions	238 x 160 x 48mm
Weight	1kg

USE OF THE INSTRUMENT

Describtion of device

1 - Display
2 - Wristlet
3 - Keyboard
4 - Knob



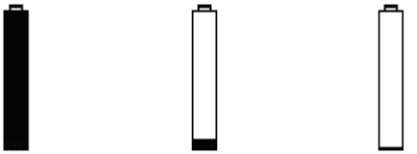
Operation Keyboard Description
The keyboard layout is reasonable. The common keys are located at the left thumb position. Keeping your left hand in a natural position allows you to easily adjust all instrument settings.
In order to facilitate the operator to recognize the keyboard functional characteristics, all the keys are grouped and marked with different colors according to their operating characteristics. The left side of the keypad is a common key. The right keypad is a shortcut menu key, which is used to quickly switch to the menu of the corresponding function, and also embodies the operation flow of the instrument. The lower left area is a shortcut function key for quickly implementing common functions.

The operation flow of this instrument:
Select the flaw detection channel > Select the probe type > Automatic calibrate the probe and other parameters > Make curves (DAC, AVG) > Deposit channel > Spot detection(Automatic gain and peak memory are the most common function keys during the above typical operation, so put in this area)

Power Usage
It can be operated with a plug-in power supply (AC.DC adapter) or battery.
When using the power adapter as a working power source, the instrument automatically detects and switches to the adapter power supply after plugging in the power adapter.
When the battery is used as a working power source, the instrument automatically detects and switches to battery power after unplugging the power adapter.
With the battery installed, the battery can be charged when connected to the power adapter power supply system.

Use AC powered equipment to power
Connect to AC power through a dedicated AC adapter.
Do not forces unplug the power while the instrument is working, because if the battery is low, the instrument will automatically power off and cannot shut down was properly. The correct method is to turn off the instrument and then unplug the power

Working with Batteries
When using a battery, use our recommended battery product.
The battery box is on the back of the instrument. Use a screwdriver to open the lid of the battery compartment. Put the battery into the battery compartment. Insert the battery plug into the battery outlet and cover the battery compartment lid.
There is a battery level symbol above the waveform display area, as shown below:



Battery enough Low battery Go off

If there is a sign of go off, you should immediately stop the inspection, replace the battery, or charge it.
Note: If you need to perform on-site measurements, bring a spare battery with you

Lithium battery charging
An external battery charger can be used to charge the lithium battery. It is recommended to use the power adapter in the instrument's standard housing for charging. Before using the charger, read its instructions carefully. Lithium (4Ah) batteries require approximately 4 to 5 hours of continuous charging time. The charge lamp goes out after charging is complete.

Probe Connection
When using the test, it is necessary to connect a suitable probe. As long as there is a suitable cable and the operating frequency is within the proper range, any of the probes produced by our company are suitable for use. The probe connector is BNC.
The probe should be connected to the socket above the instrument housing. In single probe mode, only the launch socket is valid. Connecting twin crystal links can be freely connected.

INSTRUMENT OPERATION

The basic operating procedure

» Ready to test the work piece;

» Insert the probe cable plug into the socket on the top of the main unit, and tighten the plug;

» Select a good working power source according to „Power Usage“, press <switch key>, and turn on the computer;

» Program loading and power-on self-test;

» Normally, it will automatically enter the state of the last shutdown. The instrument parameters are the same as those when the instrument was turned off last time, but the waveforms at the time of the last shutdown are not displayed. When the power-on self-test is abnormal, it can be shut down and then restarted. If the self-test still fails, you can force reset to the factory state.

» Check the battery voltage. The battery charge detection icon as shown in „Working with Batteries“ shows that the battery power is insufficient;

» Whether it is necessary to calibrate the instrument and draw the DAC or AVG curve, and if necessary, professional technicians to perform related operations (see Chapter „Calibration and Measurement“);

» Call out the corresponding detection channel parameter settings;

» Measurement;

» Store the data that needs to be saved;

» Shutdown;

Starting the instrument

Press <START> to start the screen after the start-up tone and enter the program loading process. The entire loading process takes about 4 ... 5 seconds. After the program is loaded, the system performs self-test and enters the operation interface.

Screen Display Description

The interface is divided into the right menu and the lower menu. In the interface, H is the value of the wave height in the gate, and S is the sound path value of the wound wave trapped by the gate. When a menu is selected, the interface will be displayed in reverse color to indicate that a certain menu is focused. The upper left corner of the menu is the instrument's current gain value. In the interface, horizontal and vertical are for the oblique probe. When the calibration of the oblique probe is completed, the instrument will automatically calculate the vertical depth and horizontal distance of the probe relative to the probe according to the angle of the probe. The step in the interface is to change the minimum range of the instrument parameters each time, and the step change can quickly get the desired parameters.

Function Display Items

The names of the sixteen function groups are displayed in four pages at the bottom of the screen. The currently selected function group is highlighted, and the currently selected function menu in the current function group is also highlighted. In A sweep mode, the function group display disappears, and the currently selected function menu and parameters appear above the graph display area.

Description of other indicators
In addition to the status bar data and symbols showing some of the settings, readings, and status flags, the top of the function menu shows the highlighted measurement values and some status indications for the current operation. There is a freeze and communication indicator next to the battery level indicator.

Mark	Name	Meaning
S	Sound path value flag	The distance from the incident point to the reflection point.
H	Waveform value flag	The waveform height from the incident point to the reflection point.

Function Overview
The function is divided into sixteen menu-style function groups and several special functions.
16 menu function groups are distributed in 4 function pages, including BASE, PROBE, CHAN, MEM, GATE, self-calibration, DAC1, DAC2, AVG1, AVG2, Launch, Gain, B-Scan, Setup 1, Setup 2. See the table below for features of AWS functional groups.

Page	Function Group	Function	Description
1	Basic	Detection range, material sound velocity, pulse displacement, gate set	Display adjustment items for the required basic parameters
1	Probe	Probe Angle / Probe K Value, D-Delay,Scale Mode / Work piece Diameter	Probe related settings
1	SET 1	Buzzer, AWS, Restrain, Repeat	
1	WAVE	Fill, Frozen,Colour, B sacan	
2	Gate 1	A gate start, A gate width, A gate height	Gate settings related items
2	Gate 2	B gate start, B gate width, B gate height	Gate settings related items
2	OTHER	Wifi set, Conncet with software, Langue set, Auto DB	
2	DAC	DAC curve/calibration correction, DAC calibration point/Cal Gate, DAC Mode	DAC curve settings
3	DAC SET	Scrap, Ratton, Judge,Standard	DAC Curve settings
3	AVG	AVG curve,Refer,Cal Gate	AVG Curve settings
3	AVG SET	Standard,Pro Freq,Pro Diam,Sta Disp	AVG Curve settings
3	CHANNEL	Channel set,save, delete,init	Channel related settings

Page	Function Group	Function	Description
4	WAV SAVE	Number,Wave open, save and delete	Display adjustment items for the required basic parameters
4	PRO CAL1	Angle probe cal start, deplay, angle,start	Probe related settings
4	PRO CAL2	Straight probe cal start, block thickness, start	
4	VIDEO	Videl number, open, save and delete	

Other special functions can be achieved through special function keys. The function of each special function key is described in the following table:

Special function	Functional description
Freeze	Waveform freeze
Peak memory	Keep the curve maximum at each pixel line along the horizontal direction of the screen
Measurement display	Select how the measurement is displayed on the screen
Enter	Multiplex function menu switching, parameter weight adjustment switching, function confirmation, etc.

Basic Operation Method
You can use the <left and right button> to complete the selection of the function group; use the up and down keys to complete the selection of a specific function menu; this time through the <knob> can change the parameters of this function menu. In addition, some function menus are multiplexed by two functions. When a function has been selected, pressing <OK> (Knob Press) can be converted to another function.

Rough and Fine Adjustment of Functions
For some functions, rough and fine adjustment are available. By pressing down the corresponding Enter key, you can shift between these two adjusting modes. With a symbol ` * ` in front of the function item that means it is in fine adjustment mode.
The following are the functional items with optional rough and fine adjustment

Functions	Functional Group
RANGE	BASE
MTLVEL	BASE
D-DELAY	BASE
T-VALUE	BASE

Example of Function Operation
Suppose that the function of RANGE in BASE functional group is selected currently, and you want to select ALARM under GATE, what to do?
Firstly Select the GATE group by t Right/Left key, and then select GATE LOGIC/ALARM functional menu by up / down key. This functional menu is multipurpose gate logic and alarm way, so user has to shift the two functions as he needs. if it displays ALARM way, the operation completes; if it displays GATE LOGIC, shift it toGATE LOGIC way by key Enter (Press the rotary knob) and now the operation of function selection is completed.

FUNCTION DESCRIPTION AND OPERATION METHOD

Ajustment of BASE Group
In the BASE functional group, users can adjust and set the functional items relative with the display range, including RANGE, MTLVEL, D-DELAY and T-VALUE.
During the detection, the display range of screen is in great relation to the material of workpiece and probe's nature. The workpiece material will influence the transmission velocity of ultrasonic wave.

Detection Range (RANGE)
It is to set the measuring range for screen display during detection
Range: 0 ... 1000mm / 0.1 ... 400in
If what selected currently is RANGE functional menu, then by pressing <enter>, it is allowed to shift between Rough and Fine adjustment.

Rough adjustment: 2.5mm, 5mm, 10mm, 20mm, 30mm, 40mm, 50mm, 60mm, 70mm, 80mm, 90mm, 100mm, 150mm, 200mm, 250mm, 300mm, 350mm, 400mm, 450mm, 500mm, 600mm, 700mm, 800mm, 900mm, 1000mm, 2000mm, 3000mm, 4000mm, 5000mm, 6000mm, 7000mm, 8000mm, 9000mm, 10000mm

Fine adjustment:	Range	Step graduation
	≤100.0mm	0.1mm
	>100mm	1mm

Operation:
- By <Next Page > key, switch the function page.
- By <range> keyselect the functional menu for RANGE, and then adjust parameters for RANGE by the rotary knob.
- Users can shift the Rough and Fine adjusting mode by the <Enter> key

Material Velocity (MTLVEL)
Users are allowed to set the transmission velocity of ultrasonic wave in workpiece.
Range: 1,000 ... 15000m/s or 0.0394 ... 0.3937in/µs
If what selected currently is MTLVEL function menu, then by the key <enter>, it is allowed to shift between Rough and Fine adjustment.

Rough adjustment:

2,260m/s	0.089 in /µs	Sound velocity of transverse wave in copper
2,730m/s	0.107 in /µs	Sound velocity of longitudinal wave in organic glass
3,080m/s	0.121 in /µs	Sound velocity of transverse wave in aluminum
3,230m/s	0.127 in /µs	Sound velocity of transverse wave in steel
4,700m/s	0.185 in /µs	Sound velocity of longitudinal wave in copper
5,900m/s	0.233 in /µs	Sound velocity of longitudinal wave in steel
6,300m/s	0.248 in /µs	Sound velocity of longitudinal wave in aluminum

Fine adjustment: Step is 1m/s or 0.0001in/µs

Operation:
» Select BASE functional group By < range > key, and by up/down key, select the functional menu for MTLVEL, and then adjust parameters for MTLVEL by the rotary knob.

» Users can shift the Rough and Fine adjusting mode by the <Enter> key.

Remarks: Do guarantee the correctness of sound velocity (level), because partial measuring results displayed in the status lines of the instrument are calculated based on the sound velocity.

Display Starting Point (D-DELAY)
Can set the pulse shift during detection, viz. D delay. By which, users are allowed to adjust the starting position for waveform, as well as adjusting the zero point of pulse, so as to make sure that it is at the surface or a starting face inside the workpiece. If the pulse has to be started from the surface of workpiece, D delay must be set to 0.
Range: -15 ... 3400µs
Step: 1µs

Operation:
» Select BASE functional group By < range > key, and by up/down key, select the functional menu for D-DELAY, and then adjust parameters for D-DELAY by the rotary knob.

Thickness of Workpiece (T-VALUE)
It is to set the thickness of workpiece during detection.
Thickness range: 1 ... 1000mm
Rough and Fine adjustment can be switched by the <Enter> key.

Rough adjustment:	1mm,5 mm, 10 mm, 20 mm, 50mm, 100mm, 200mm, 300mm, 400mm, 500mm, 600mm, 700mm, 800mm, 900mm and 1000mm
Fine adjustment:	0.1mm <100 mm 1mm >100 mm

Operation:
- Select BASE functional group By < range > key, and by up/down key, select the functional menu for T-VALUE, and then adjust parameters for T-VALUE by the rotary knob.
- Users can shift the Rough and Fine adjusting mode by the <Enter> key.

Adjustment of PROBE Group
With this functional group, it is allowed to adjust and set the functional items in relation to ultrasonic sending and receiving, including PROBE TYPE/ PROBE POS, ANGLE/K-VALUE , P-DELAY/ X-VALUE, X-COORD/ PART DIA

PROBE TYPE/PROBE POS
This menu is multipurpose for setting probe type and probe pos. By the <Enter> key , shift between probe type and probe pos.

PROBE TYPE:
Setting of ultrasonic probe. If the current probe is an echo probe, then set it to single; if it is a double-wafer probe, set it to DUAL, and if it is a through transmission probe, set it to THRU.

Options: STRAIGHT: Single straight element transducers. Use connector acts as a transmitter (T)
ANGLE : Angle straight element transducers.Use connector acts as a transmitter (T)
DUAL: Daul element transducers. One connector acts as a transmitter (T), the other acts as a receiver (R).
THRU: Two separate transducers, typically on opposite sides of the test specimen. Use the T transducer connector as the transmitter. The R transducer connector is designated as the receiver.

Operation procedure:
- Select PROBE functional group By < Probe > key, and by up/down key, select the functional menu for PROBE TYPE, and then adjust parameters for PROBE TYPE by the rotary knob.

PROBE POS:
Select position of probe when we detect a pipe.
Options: Outside surface: Probe is placed on the outside surface of pipe, Now the corrected d value show the depth of the flaw from the outside surface of pipe,L value show the distance between flaw and probe front edge follow outside surface.
Inside surface: Probe is placed on the inside surface of pipe, Now the corrected d value show the depth of the flaw from the inside surface of pipe,L value show the distance between flaw and probe front edge follow inside surface.
Operation:
» Select PROBE functional group By < Probe > key, and by up/down key, select the functional menu for PROBE POS, and then adjust parameters for PROBE POS by the rotary knob.

Probe Angle (ANGLE) / Probe K Value (K-VALUE)
This menu is multipurpose for setting probe angle and probe k value. By the <Enter> key, shift between ANGLE and K-VALUE.

ANGLE:
It is to adjust the angle of a probe.
Range: 0.0° ... 89.0°
Step: 0.1°

Operation:
» Select PROBE functional group By < Probe > key, and by up/down key, select the functional menu for ANGLE, and then adjust parameters for ANGLE by the rotary knob.

K-VALUE:
Range: 0.00 ... 57.29
Step: 0.01

Operation:
» Select PROBE functional group By < Probe > key, and by up/down key, select the functional menu for K-VALUE, and then adjust parameters for K-VALUE by the rotary knob.

P-DELAY/X-VALUE

X-VALUE:
It is to set the front edge of probe.
Range: 0.00 ... 50.0mm
Step: 0.1mm

Operation:
» Select PROBE functional group By < Probe > key, and by up/down key, select the functional menu for X-VALUE, and then adjust parameters for X-VALUE by the rotary knob.

P-DELAY:
Can set the zero point of probe during detection, viz. P Delay. It is necessary to compensate the delay in probe resulted from acoustic beam in the pitch interval from energy exchanger to workpiece by P Delay.
Range: 0 ... 9.99μs
Step graduation: 0.01μs

Operation:
» Select PROBE functional group By < Probe > key, and by up/down key, select the functional menu for P-DELAY, and then adjust parameters for P-DELAY by the rotary knob.

Remarks: If P Delay is unknown, please do refer to Chapter V Calibration of Instrument.

X-COORD/PART DIA

PART DIA:
When we detect a pipe,we must input the outside diameter of part and thickness exactly. Part diameter is the outside diameter of pipe.
Range: 5.0 ... 5000mm
Step: <100 mm 0.1mm
>100 mm 1.0mm
Operation:
» Select PROBE functional group By < Probe > key, and by up/down key, select the functional menu for PART DIA, and then adjust parameters for PART DIA by the rotary knob.

X-COORD:
Coordinate mode means the definition of the horizontal coordinate line, including “S-PATH” “P-VAL” and “DEPTH”, when the refraction angle is not zero, the function above is effective, when it is zero, the coordinate is defined as S-PATH.

Options: S-PATH, P-VAL, DEPTH
Operation:
» Select PROBE functional group By < Probe > key, and by up/down key, select the functional menu for X-COORD, and then adjust parameters for X-COORD by the rotary knob.

Adjustments of channel settings
Setting Group is used for Operations of detection setting.. It includes SETTING, COPY, SAVE/MODIFY , DELETE/CLEAR ALL

Channel Settings

SETTING:
During the detecting in scene, users usually need to do the detection on several kinds of work piece or change the probe, thus they need to calibrate the instrument time after time. To solve this problem, 100 detecting settings are available in AFD100. Users can set 100 different settings and save them, switch among the settings when it needed. When choose the different setting number, the system will use the new setting. If no customer saved setting is choose, the system will use the default setting.

Parameter range: NO.1 ... NO.500
Operation procedure:
» Select Setting functional group By < Setting > key, select the functional menu for SETTING, and then adjust parameters for SETTING No. by the rotary knob.

SET COPY:
It use to copy the channel parametes from one channel to anther channel.
Operation:
» Press<F3> to choice channel group, and then choice SET COPY by up/down key., adjust the targeted channel No by the rotary knob.

» After set up the targeted channel NO., press<FREEZE> to copy the channel

Note: If there are some data in the targetd channel, or there is no setting parameters in the channel,It will show that “wrong operation”

Saving Settings (SAVE) / Modify Settings (Modify)
This menu is multipurpose for Modify and SAVE. Users can shift the functions for Modify and SAVE by the <Enter> key.

SAVE:
This functional menu is for saving setting.
Operation procedure:
» Select Setting functional group By < Setting > key, and by up/down key, select the functional menu for SAVE, and save the setting by the rotary knob.

Note:
» A symbol ` * ` appears before the setting number means that this setting has been set.

» The new setting will replace the old one in the setting which has been set before.

» The new setting saved will not include DAC parameter setting which is auto-saved in the current setting .

» If the current setting is locked, the saving of setting will not work.

Modify:
Modify the setting in detection setting, when it is completed successfully, the current setting will be modify by the current detection parameters.

Operation:
» Select Setting functional group By < Setting > key, and by up/down key, select the functional menu for Modify, and then recall the setting by the rotary knob.

Delete Settings (DELETE)
This menu is multipurpose for DELETE and CLEAR ALL. Users can shift the functions for DELETE and CLEAR ALL by the <Enter> key.

DELETE:
Operation:
» Select Setting functional group By < Setting > key, and by up/down key, select the functional menu for DELETE, and delete the setting by the rotary knob.

» If current setting has no setting, by the rotary knob, this functional menu will always display OFF; if it has any setting, by the rotary knob , it will show “Yes/No”, if you press the <Enter> key then you will delete setting. And by pressing any other key, you will cancel the delete.

Adjustment of MEM Group
This is for adjusting the memorizing modes, calling out, deleting and saving the configured data and detection parameters. It includes such functional menus as DATA NO, RECALL, SAVE and DELETE.

Note: When the MEM mode is waveform memory, the data saved includes waveform data of A-scan at that time and present detection parameters and DAC curve. This means, when calling a set of saved data, not only the waveform displayed currently will change into the waveform saved, but also current instrument’s detection parameters will also change into the saved data.

Function group MEM (DATA NO.)
It is for setting the MEM group No.
Range: waveform save, 1 ... 500

Operation:
» By <Next Page > key switch the function page.

» By Left/Right key select MEM functional group, and by Up/Down key, select the functional menu for DATA NO, and then set group no. by the rotary knob.

Remarks: Under Waveform Save mode, if * appears before group No. that means there has been data stored in; if it displays ¥ before group No., that means data has exist in this group and it has been locked;

Recalling the data (RECALL)
It is to recall data under Waveform Save mode, and call out the data corresponding to current group No. When the recalling succeeds, the current waveform and detection parameters will be substituted by the saved waveform and detection parameters, and the waveform is frozen.

Operation procedure:
» By <Next Page > key switch the function page.

» By Left/Right key select MEM functional group, and by Up/Down key, select the functional menu for RECALL.

» If current group no. has no data in it, by the rotary knob, this functional menu will always display OFF; if there is data existing in the group, by the rotary knob, it will show "Yes/No", and now press the <Enter> key, the data will be recalled, and press any other key to cancel recalling.

SAVE
This functional menu is for saving data.
Operation:
» By <Next Page > key switch the function page.

» By Left/Right key select MEM functional group, and by Up/Down key, select the functional menu for SAVE, and then set group no. by the rotary knob.

Note:
» Before saving data, do make sure that there is no data in the data group corresponding to current group no, otherwise it will not work.

» Set the current saving mode correctly.

» If you need to upload the DAC curve to PC, please adjust the settings and DAC parameters firstly, and then save the data.

DELETE
It is to delete data. This is to delete the data corresponding to current group No. When the deletion succeeds, `*` before this group no. disappears.

Adjustment of GATE Group
It is used for adjustment of gate settings, including Gate logic, Gate alarm, Gate start, Gate width and Gate height.
Functions of gate during detection:
» To monitor whether the job has flaws in the set logic and range, if yes, it will alarm.

» To measure the position and size of flaw echo.

The device is equipped with double-gate function: Gate A and Gate B, normally Gate A is used alone for detecting the workpiece flaw, and the double-gate is usually used in the measuring and calibration of multi-echo, eg. Measuring the distance between surface echo and first echo during thickness measurement.

GATE LOGIC/ALARM
This menu is multipurpose for gate logic and gate alarm. Users can shift the functions for GATE LOGIC and ALARM by the <Enter > key.

GATE LOGIC:
Gate logic has four options: NONE, POS, NEG, MUL.
Options: NONE: gate monitoring is off
POS: when the echo amplitude is higher than the preset threshold of the gate, it will alarm
NEG: when the echo amplitude is lower than the preset threshold of the gate, it will alarm
MUL: state of double gates
Operation:
» By the <Gate> key select GATE functional group, and by Up/Down key, select the functional menu for GATE LOGIC, and then adjust the gate logic by the rotary knob.

ALARM:
Setting of gate alarm.
It can be used for alarm of forbidden wave and loss wave depending on the setting of Gate Logic. That is, if the gate is at positive logic, when the echo amplitude is higher than the threshold, the buzzer alarms; if the gate is at negative logic, when the echo amplitude is lower than the threshold, the buzzer alarms.When the DAC is opened,the DAC-REF is instead of gate to determine alarms.
Options: ON: the buzzer is on
OFF: the buzzer is off

Operation procedure:
» By the <Gate> key select GATE functional group, and by Up/Down key, select the functional menu for ALARM, and then adjust the ALARM by the rotary knob.

Starting point of gates (aSTART/bSTART)
This functional menu is multipurpose for Start of Gate A and Gate B. Users can shift the functions for aSTART and bSTART by the <Enter > key.

aSTART:
Operation procedure:
» By the <Gate> key select GATE functional group, and by Up/Down key, select the functional menu for aSTART, and then adjust the aSTART by the rotary knob.

bSTART:
Operation procedure:
» By the <Gate> key select GATE functional group, and by Up/Down key, select the functional menu for bSTART, and then adjust the bSTART by the rotary knob.

Remarks: Gate B is independent from Gate A. The three gate parameters: Gate Start, Gate Width and Gate Height can be adjusted separately without disturbing each other.

Width of gates (aWIDTH/bWIDTH)
This functional menu is multipurpose for Width of Gate A and Gate B, when this menu is selected, by the <Enter > key, you can shift the two functions.

aWIDTH:
Operation procedure:
» By the <Gate> key select GATE functional group, and by Up/Down key, select the functional menu for aWIDTH, and then adjust the aWIDTH by the rotary knob.

Measurement threshold (aTHRESH/bTHRESH)
By the <Gate> key select GATE functional group, and by Up/Down key, select the functional menu for bWIDTH, and then adjust the bWIDTH by the rotary knob Response and Measurement threshold(aTHRESH/bTHRESH)
This functional menu is multipurpose for Threshold of Gate A and Gate B, when this menu is selected, by the <Enter > key, you can shift the two functions.

aTHRESH:
It is to set the threshold of Gate A. The parameter is expressed in percentage, i.e. the percentage in relative to the full amplitude.
Parameter range: 2 ... 90%

Operation procedure:
» By the <Gate> key select GATE functional group, and by Up/Down key, select the functional menu for aTHRESH, and then adjust the aTHRESH by the rotary knob.

bTHRESH:
It is to set the threshold of Gate B. The parameter is expressed in percentage, i.e. the percentage in relative to the full amplitude.
Parameter range: 2 ... 90%

Operation procedure:
» By the <Gate> key select GATE functional group, and by Up/Down key, select the functional menu for bTHRESH, and then adjust the bTHRESH by the rotary knob.

Adjustment of automated calibration of probe

Calibration of Straight Probe

For the convenience of user's calibration of probe zero and material velocity, the function of calibration is built in the machine. Using this function, users can finish the calibration of straight probe. The function is located in the menu of AUTO CALIBRATE.

For example, the standard single straight probe which is 2.5MHz, diameter 20 mm. Two test blocks which are the same material with different known thickness are needed.

Now use the block which thickness is 100mm to calibrate the probe.

The operation steps are as following:

» Set the sound speed value to 5900 approximately

» Press "AUTO CALIBRATE" key, and then choice straight probe calibrate, open the auto calibration function (dispay: is it valid, choice "YES")

» Set up the workpiece thickness(needs to higher than the known thickness)

» Connect the probe, and couple it onish n the test block(100mm) to find the echo

» Choice calibrate gate, using the gate to lock the echo, press "AUTO CALIBRATE", the echo height will be equal 80% of the screen, then press "Enter" to fithe straight probe calibration.

Note: The function of auto-calibration can also be used in a single thickness determinate test block. Users can do that by repetitious echoes, moving gate A to each echo and entering the correct thickness value.

Calibration of angle probe

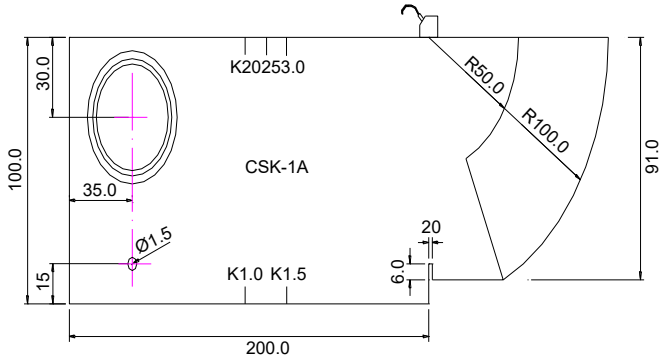
For the convenience of user's calibration of probe angle, D-Delay, zero point and material velocity, the function of calibration is built in the machine. Using this function, users can finish the calibration of angle probe. The function is located in the menu of AUTO CALIBRATE.

1. CSK-1A

For example of the standard angle probe which is 2.5MHz, 13x13mm, K 2. We can use CSK-1A block to calibrate angle probe. You do not need to input any specifications before calibration.

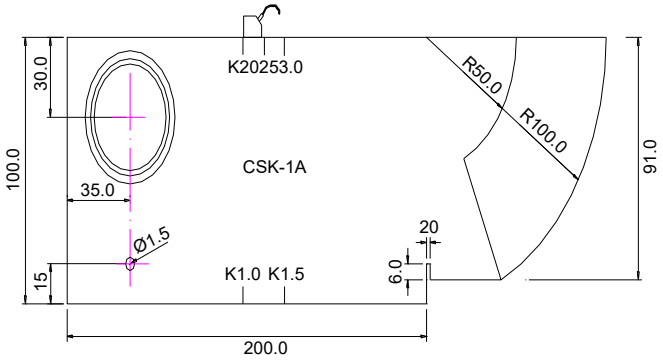
» Press "AUTO CALIBRATE" key, and then choice angle probe calibrate, open the auto calibration function (display: is it valid, choice "YES")

» Connect the probe and put the probe as below. The machine will adjust the gates to double gates, set up the detect range automatically. And move the probe around the center of the circle to find the highest echo of R100. At the same time, make sure R50's echo is more than 15%. Press "Enter" key twice.



» Press the <Enter > key, you will see x (front edge)=XXX.XXmm, please read it (it is the value from probe to the center of circle) and input it.

» Then put the probe as below, and find the highest echo around K2, lock it by gate, press “Enter” key to finish the calibration.



In the calibration, users do not need to adjust the range and gate by manual, just need to find the highest echo, and press “Enter”.

Strating of A gate / Width of A gate
This menu is multipurpose for Start of Gate A and Width of the gate A, the reason for setting Gate A here again is to make it easy for DAC recording under manual mode; by the <Enter > key, shift the two functions.

Types of Calibration
CSK-1A

Adjustment of DAC1 Group
The DAC1 group is for setting the parameters necessary for plotting a DAC curve. It includes DAC/REVISE, RECORD/REVISE POS, aSTART/aWIDTH, SHOW MARK, DAC MODE.

DAC Curve/TCG
This menu is multipurpose for DAC display control and TCG display control.

DAC Curve:
It is to turn on/off the DAC display. It will be ineffective when B-scan is on
Options: ON, OFF

Operation:
» By the <DAC/AVG> key select DAC1 functional group, select the functional menu for DAC, and then adjust the DAC by the rotary knob.

Note: DAC Display ON/OFF will work only when it has at least 3 DAC record points. The maximum is 10 DAC record points.

TCG:
It is to turn on/off the TCG display. It will be ineffective when B-scan, AVG, DAC is on.
Options: ON, OFF

Operation:
» By the <DAC/AVG> key select DAC1 functional group, and by the <Enter> key, select the functional menu for TCG, and then adjust the TCG by the rotary knob.

DAC Plotting Point (RECORD) / DAC Revise Position (REVISE POS)
This menu is multipurpose for DAC plotting point and DAC revise position.
DAC plot is used for recording the echo information necessary for making DAC curve, and DAC revise position is used for positioning the plotting point who needs revising.

RECORD:
Range: 1 ... 30

Operation:
» Confirm the gate is understand single gate

» Use <Left and Right Key > to find the functions page

» By the DAC shortcut key to select DAC functional group, and by Up/Down key, select the functional menu for RECORD.

» Make sure that the reference echo is located within the gate, then adjust calibrate gate by Enter key to add a plotting point. Using the same way to add other plotting point.

» Users can shift the functions for RECORD and REVISE POS by the <Enter> key.

Notes: When make the wrong record, please reopen the curve, and record again.

Starting of A gate/ Gate Width
This menu is multipurpose keys for Start of Gate A and Gate Width.

Operation:
» By the DAC shortcut key to select DAC functional group, and by Up/Down key, select the functional menu for Show Marks

» Using Enter key to switch Show marks and DAC curve mode

Curve mode:
The connection mode between DAC marks.
Option: beelin,curve

Operation:
» Use <Left and Right> key to switch to the function page

» By the DAC shortcut key to select DAC functional group, and by Up/Down key, select the functional menu for Curve mode

» Using Enter key to switch Show marks and DAC curve mode

Adjustment of DAC2 Group

DAC Group is used for adjusting the relative parameters necessary for plotting a DAC curve. It includes DAC-EL/ERS-REF, DAC-SL, DAC-RL, CORRECT.

In order to meet the standard for plotting DAC curve in different industries, the instrument is equipped with three DAC curves with adjustable offsets, which are DAC-EL (evaluating line), DAC-SL (quantifying line), DAC-RL (reject-judging line). In addition, in order that DAC curve can be adaptive to different ambient conditions, Gain Compensation function is provided. The three offset curves are all generated from generatrix, and the generatrix is drawn according to the plotting points and the ultrasonic attenuation. According to their different functions, they appear separately as DAC-RL, DAC-SL and DAC-EL on the screen from top to bottom. CORRECT works for compensating the difference between the surfaces of test block and detected object which will influence the ultrasonic transmission between them. When the CORRECT gets increased, the three DAC offset curve will get lower correspondingly, and contrarily they will get higher.

DAC Evaluating Line / DAC-REF

This menu is multipurpose for DAC-RL and DAC-REF; by , shift the two functions.
It is to set the offset of DAC reject-judging line.
Parameter range: -50 ... 50dB

Operation procedure:

» By <Left and Right> key switch the function page.

» By <Left and Right> key select DAC2 functional group, and by "↑" or "↓" key, select the functional menu for DAC-EL, and then set up DAC evaluating line bias value by the knob

» Use Enter key to switch DAC EL and DAC-REF functions.

DAC-REF:

DAC-REF means the curve which flaw echo confirm to as standard, "generatrix" or "quantify" is often used, in which generatrix means the primary plotting curve of DAC, another available three standards are all DAC offset. The standard above works only when the DAC is well completed.
Options: GL, RL, SL, EL

Operation procedure:

» By <Left and Right> key switch the function page.

» By <Left and Right> key select DAC2 functional group, and by "↑" or "↓" key, select the functional menu for DAC-REF, and then set up DAC REF curve by the knob

» Use Enter key to switch DAC EL and DAC-REF functions.

DAC Quantifying Line (DAC-SL)
It is to set the offset of DAC quantifying line.
Parameter range: -50 ... 50dB

Operation procedure:
» By <Left and Right> key switch the function page.

» By the <Left and Right> key select DAC2 functional group, and by "↑" or "↓" key, select the functional menu for DAC-SL, and then set up DAC SL bias value by the knob

DAC Evaluating Line (DAC-EL)
It is to set the offset of DAC evaluating line.
Range: -50 ... 50dB

Operation procedure:
» By <Left and Right> key switch the function page.

» By the <Left and Right> key select DAC2 functional group, and by "↑" or "↓" key, select the functional menu for DAC-EL, and then set up DAC EL bias value by the knob

TEST STANDARDS
There are 14 standards in AFD100. „Custom ,GB/T 11345-89A ,GB/T 11345-89B,GB/T 11345-89C, JB/T 4730-2005, JG/T 3034.1/2, SY/T 4109-2005, GB/T 3559-94,ASME-3, DL-T 820-2002 A,DL-T 820-2002 B,DL-T 820-2002 C,TB 10212-98D(butt welds) , TB 10212-98J(fillet welds)". User can set Custom freely, and other standard is fixed. On the option, user press enter key (press the rotary knob) can enter standards set menu, in the menu, we can adjust thickness of workpiece and test block.

Operation procedure:
» By <Left and Right> key switch the function page.

» By the <Left and Right> key select DAC2 functional group, and by ↑ or ↓ key, select the functional menu for TEST STANDARDS, and then set up echo curve bias value by the knob

Adjustment of AVG1 Group
AVG1 Group is used for adjusting the relative parameters necessary for a AVG curve. It includes AVG MODE/ CHOCK VEL, PROBE NAME, FREQUENCY/DIAMETER, REF TYPE/REF SIZE

AVG MODE
This menu is multipurpose for AVG MODE and CHOCK VEL; By the <Enter> key, shift the two functions.

It is to turn on/off the AVG display. It will be ineffective when B-scan is on.
Options: ON, OFF

Operation:
» By <Left and Right> key switch the function page.

» By the AVG shortcut key select AVG functional group, and by "↑" or "↓" key, select the functional menu for AVG, and then set up echo curve by the knob

» By the AVG shortcut key select AVG1 functional group, and by "↑" or "↓" key, select the functional menu for velocity, and then switch to AVG mode by Enter key

PROBE FREQUENCY / DIAMETER
This menu is multipurpose for FREQUENCY and DIAMETER;

FREQUENCY:
Probe frequency can be input.
Range: 0.5 ... 10MHz

Operation:
» By <Left and Right> key switch the function page.

» By the AVG shortcut key select AVG functional group, and by "↑" or "↓" key, select the functional menu for Probe Frequency, and then set up the frequency by the knob

» Use Enter key to switch Probe Frequency and Diameter functions.

DIAMETER
The diameter of probe can be input according to sign.
Range: 3.00 ... 35.00mm

Operation:
» By <Left and Right> key switch the function page.

» By the AVG shortcut key select AVG1 functional group, and by "↑" or "↓" key, select the functional menu for diameter, and then set up the size by the knob

» Use Enter key to switch Probe Frequency and Diameter functions.

REF TYPE / REF SIZE
This menu is multipurpose for REF TYPE/REF SIZE; By the <Enter> key, shift the two functions.

REF TYPE:
We must select reflector style on the standard block.

Option:
» Flat bottom hole (FBH): It is a columnar hole in the bottom and its diameter is equal to the size of the reference flaw.

» Wide bottom (BW): The reflector is equal to infinite flat bottom approximately.

Operation:
» By the AVG shortcut key select AVG1 functional group, select the functional menu for REF TYPE by up and down key, and then set reference type by the rotary knob.

» Use Enter key to switch REF TYPE and REF SIZE functions.

REF SIZE:
The size of reflector in standard block.
Range: 0.50 ... 10.00mm

Operation:
» By <Left and Right> key switch the function page.

» By the <F4> key select AVG functional group, select the functional menu for REF SIZE by up and down key, and then set reference type by the rotary knob.

» Use Enter key to switch REF TYPE and REF SIZE functions.

Start of Gate A / AVG Curve
This menu is multipurpose for Start of Gate A/AVG Curve; By the <Enter> key, shift the two functions.

Start of Gate A:
Please refer to „SET COPY“

AVG Curve:
AVG Curve is made according to standard reflector, but when the size of standard reflector cannot meet your work, you can adjust its value.
Range: 0.30 ... 20.00mm

Operation:
» By the <Left and Right> key select AVG2 functional group, select the functional menu for AVG Curve by up and down key, and then set reference type by the rotary knob

» Use Enter key to switch Start of Gate A and AVG Curve functions.

RECORD REF
The function is used for plotting AVG curve.
Option: 0 (no record) , 1 (recorded)

Operation:
» To make sure that the system is in single gate mode.

» By <Left and Right> key switch the function page

» By the <Left and Right> key select AVG functional group, select the functional menu for RECORD REF by up and down key

» Move gate A to echo we need

» Adjust gain to make echo amplitude equal to 80% of screen.

» Demarcate the AVG curve reference value by right key

» We can revise the value by deleting it(by left key) to recording it again

Adjustment of GAIN Group
The Angle Probe group is used for adjusting and setting the parameters for system gain. It includes AUTO GAIN.

Auto Gain
Adjust the amplitude of the echo in gate to 80% of the screen height automatically.

Operation:
» By <Left and Right > key switch the function page.

» By Left/Right key select GAIN functional group, and by Up/Down key, select the functional menu for AUTO GAIN, and then set X % by the rotary knob.

VIDEO / REVIEW
We can make and play the video of test process on the screen through this function.

VIDEO NO. / DELETE
It is for setting the VIDEO NO.

Notes: This function is come ture the video and report on the software.

Adjusting of Setting 1 Functions

Measuring Way (DETECT) / Reject (REJECT)
This functional menu is multipurpose for Measuring way and Reject(REJECT).

DETECT:
To select measuring way.
Option: PEAK, FLANK

Operation:
» By <Left and Right > key switch the function page

» By the <System Config> key select CFG1 functional group, select the functional menu for DETECT by up and down key, and then select measuring way by the rotary knob .

» Users can shift the functions for DETECT and REJECT by Enter key.

REJECT:
This menu is used to reject the echo's display amplitude, for example, to remove the structural noise in the job. It is to reject the display of echo whose amplitude is lower than the setting value by setting a percentage (i.e. percentage at full amplitude).
The suppressing percentage (i.e. percentage at full amplitude) indicates the min. echo height to be displayed. Any echo amplitude lower than this height will be neglected and recorded as zero amplitude.
Parameter range: 0 ... 80%
Step graduation: 1%

Operation procedure:
» By the <System Config> key select CFG1 functional group, select the functional menu for REJECT by up and down key, and then adjust suppression percentage by the rotary knob .

Note: Please be cautious in using this function, in case that the wave of defect is also suppressed. Additionally, this function is forbidden in some norm for detection.

Adjustment of Setting Functions

Color Set
This menu is for COLOR SET;
COLOR: (Only for colorful display)
There are five projects of color for our system.
Option: 0,1,2,3,4

Operation:
» By <Left and Right > key switch the function page

» By the <System Config> key select CFG2 functional group, select the functional menu for COLOR SET by up and down key, and then select color set by the rotary knob.

» Users can shift the functions for software version and color set by Enter key.

WIFI Connect with PC
Enter this mode, can connect with PC and upload the data

Adjustment of Special Functions

Gain Step
Options: 1.0dB, 2.0dB, 6.0dB, 100.0dB

Operation procedure:
» By pressing the <Gain> key, the gain step will be highlight.

» By the rotary knob, the gain's step graduation will change cyclically in the option.

Gain Value
Parameter range: 0 ... 130dB

Operation procedure:
» By pressing the <Gain> key, the gain value will be highlight.

» By the rotary knob, the gain value will be adjusted.

Freeze
It is used to freeze the waveform.

Operation procedure:
» The gauge can be switched between freezing and non-freezing by the Freeze key.

» Under Freeze state, prompting icon * appears in the status line.

Note: Under Freeze state, both the functions for Gate Group and MEM Group of the instrument are effective, DAC On/Off can switch over. The functions of other functional groups will not work.

Peak Memory
Peaks Memory is used for users to conveniently find out the flaw peak and estimate the flaw accurately.

Operation:
» By pressing < Peak Memory > key, we can open and close the function.

» Under peaks memory state, prompting icon 'P' appears in the status line.

Video Function
On/off Dynamic record, make video of test process.

Test Data Display
We can select display method of measure result on the top right corner of display area. One of S-path, Projection and Depth will be displayed here and the other two will appear in the status bar. When dB is displayed, values S-path data got from DAC curve will appear on the screen. If DAC curve is turned off or the waveform in gate is over the screen, dB will appear as ` * `
Options: S-PATH, P-VAL, DEPTH, VAL-SZ, VAL-mm

Operation:
» Press “Measure Display” key to select display method of measure result.

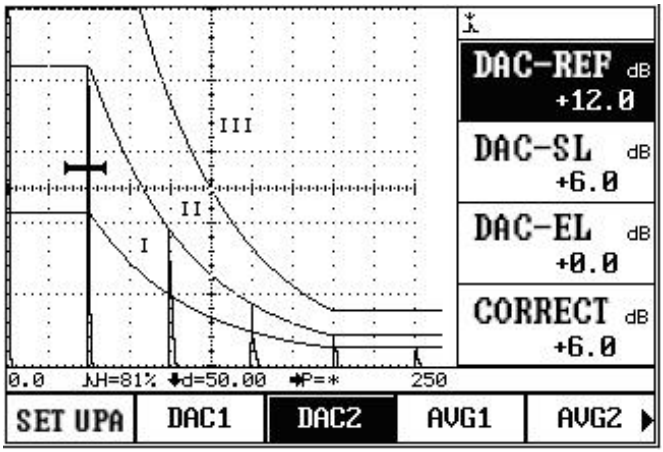
Shortcut key
Range: Gate A, Gate B are always be used, so set up the shortcut key for them

Resetting the Ex-factory Setting
Users can recover the ex-factory parameter setting when turning on the machine if necessary.

Application of DAC Cure

DAC curve is used for distinguishing the reflectors with the same size and different distance. Normally, in work piece, reflectors with the same size and different distance cause change in amplitude because of the attenuation of material and pervasion of beam. The DAC curve compensate for attenuation of material, magnetic field influence, pervasion of beam and surface smoothness in the way of graph. Normally, the echo peak points are all located in the same DAC curve. And in the same way, the echo created by smaller reflectors will be located under this DAC curve, and the bigger one will be above the curve.

- Selection of detecting setting. Select the setting function group by the key <Setting>, adjust the detecting setting number, choose one as the current instrument setting, for example, No.1, (**Note:** One group of DAC plotting points can be saved in one setting, and they are saved automatically, not needing any operation, if you want to save the parameter setting at the same time, turn to the operation "SAVE".)
- Turning on DAC curve function. Select the DAC1 function group through shortcut key, and then select the DAC curve function through up/down keys, (if the DAC curve function doesn't lie in the current menu, please switch it by the <Enter> , plot the revision function), set the DAC curve switch By the rotary knob.
- Making DAC curve. Select the DAC1 function group through shortcut key, Add plotting points according to „DAC Plotting Point(RECORD)/DAC REvise Position(REVISE POS)", when two plotting points are finished, the DAC curve will be protracted automatically.
  (**Note:** Plot the points in the order of small to large according to the detecting range, and the echo height of latter one must not be higher than the fore one, otherwise, the DAC curve will be a beeline.)
- Adjust the offset of the three offset curves. Select the DAC2 function group, adjust the three offset curves viz. DAC-EL, DAC-SL and DAC-RL to proper settings.
- The completed DAC curve:



The screen is divided into three areas, I , II and III. The three curves will be drawn on the screen during the detecting, users can determine the flaw character by the height of the echoes.

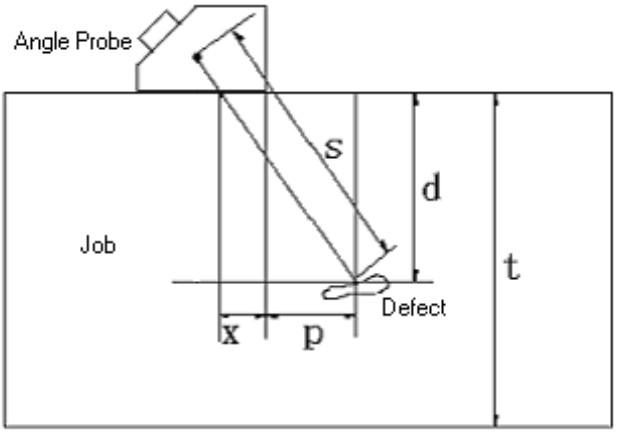
Contents of Measurement

To use the detector for measuring, you shall carry out the following works:
Set the start of gate, gate width, gate threshold and gate alarming way.

Contents of measurement are:

S	Pitch interval
H(%)	Relative value of echo height in gate range (relative to the screen height)
h	Absolute value (in pixel) of echo height in gate range
d	Depth of defect
D(%)	Relative value of defect depth (relative to job's thickness)
P	Horizontal distance of the defect from the probe's front edge

As for the meanings of above parameters, please refer to the following figure.



Where:

s:	Pitch interval;
d:	Depth of defect;
t:	Thickness of job;
x:	Distance of ultrasonic source to the probe's front edge;
p:	Horizontal distance of the defect from the probe's front edge;
D:	Is the relative value of defect depth, it is obtained by the following formula:

$$D = \frac{d}{t}$$

Matters needing attention before measuring:
The calibration including sound speed and P delay shall be completed, and the measuring way can be selected as front-edge and peak way. The wave amplitude measured is the max. echo amplitude within the gate. With front-edge measuring way, the pitch interval measured is the pitch interval at front edge of echo within gate (up line of echo waveform curve).Therefore, when front-edge way is selected, the measurement on echo amplitude in the gate is influenced by the gate threshold (height).
The measurement of pitch interval can be done only when the gate is open, before measuring, you should select the measuring way: edge way and peak way. Then select single or double gate way. Under single-gate way, the measurement is the pitch interval at echo's front edge or peak in the gate. Under double-gate way, the measurement is the pitch interval starting from the echo within gate A and ending at the echo in the gate B.

MAINTENANCE AND REPAIRING

Requirement on Environment
Avoid seriously bumping, heavy dust, damp, strong magnetic field and greasy dirt, etc.
It is strictly forbidden to wipe the casing with any solvent substance.

Charging the Battery
The status sign for battery on ELD reflects in real time the condition of battery voltage. When the battery voltage is to low, i.e. when the status sign for battery on ELD becomes the sign of under voltage in the following, you have to charge the instrument as soon as possible.

The charging way is as follows (you can charge either with the instrument on or off):
- Insert the power plug of the power adaptor into the charging socket;
- Connect the power adaptor with 220V/50Hz local power supply, both the Charging indicator lamp (red) and rapid charging indicator lamp (green) light up;
- When the rapid charging indicator lamp (green) goes out, the battery is fully charged. In a normal case, you can charge full the battery in about 4.5h.
- Pull off the charging plug, the charging ends.

Tip
- The input voltage of the power adaptor is 220V, its output is 9V DC, the max. current is about 1000mA, the max. charging time is about 6h.
- This instrument uses Li ion battery, therefore when sign of under voltage appears, you have to charge timely, and over discharge will damage the battery.
- If the instrument will not be used for a long time, it must be charged once a month to avoid over-discharging and damage the battery.
- If the battery cannot work anymore for over discharging (battery with no power and the charging indicator don't work), pull out the charger and wait for about two minutes then plug it again, repeat it several times, the battery will refresh on top of that.
- The instrument can work while charging.

Troubleshooting
If the following failures occur, the user shall not open the instrument and repair it by himself. After filling the Warranty Card, please send the instrument to the Maintenance Dep. of our company for executing the warranty regulations.
If you can brief the failure and send us the description, we'll be very gratified.

- The Instrument can't turn off automatically;
- Can't measure;
- The keys don't work;
- The measurements change frequently,

Tips on Safety
The design of the instrument meets relative safety standard. During the operation, it shall meet the specified external ambient condition, and the operator shall be furnished with concerned technology background, so as to guarantee safe operation. Before putting the instrument into operation, please read carefully the following tips on safety:

Note:
- This instrument is a non-destructive inspection instrument for inspecting material, it is not allowed to use as a medical instrument.
- The instrument is limited to be used in lab and industrial environment.

System Power Supply
The instrument can be supplied power either with external power adaptor or Li ion battery. When selecting power adaptor and battery, please use the products recommended by us.
For charging and replacing battery, please follow our operation procedures.

System Software
Any software may have error, but we have done our best to minimize the probability for this kind of error. The software of this instrument has passed overall and strict test.

Unexpected Fault
When the following abnormal situation happens, it means there is fault in the instrument, please turn off it and take out the battery if necessary. And send the instrument to a specified service point for repairing.

- The instrument has suffered obvious mechanical damage (e.g. serious extrusion or collision during transportation);
- The instrument keyboard or screen display is abnormal;
- It is stored in an environment with high temperature, high humidity or that is corrosive;

APPENDIX I NOTICES TO USER

- After purchasing product from our company, please fill carefully the Warranty Registration Card and seal your official stamp on it. Please send copy (I) and the copy of invoice to the User Service Dep. of our company, or you can ask the seller to send that on your behalf. The copy (II) will be sent to (left at) the maintenance station of local branch for going through registration formalities. For any area without maintenance station, please send copy (I) and (II) back to the User Service Dep. of our company. When the formalities are not complete, we can only maintain but offer no warranty service.
- For any product from our company, since the date the user purchases it, if it has any fault in term of quality (except for non-warranty parts), please contact the maintenance stations of local branches at different areas of our company for repairing, replacing or returning by using the "Warranty Card" (the copy kept by the user himself) or the copy of the invoice issued when purchasing the product. During the warranty period, if one has no way to show the warranty card or the copy of the invoice, we will count the warranty period based on the shipping date, and the period is one year.
- If any product of our company has fault after the warranty period, the maintenance stations at different areas will be responsible for the after-sale service, maintaining the product and charging the maintenance cost according to prescription of our company.
- The "special configuration" (shaped probe, special-purpose software, etc.) beyond our established product will be charged according to concerned criteria.
- Our company will not warranty any product which is damaged because the user has disassembled by himself, due to improper transportation and storage or incorrect operation not following the "Operation Instructions", as well as for which one has altered the Warranty Card and one has no Purchasing Proof, etc.

APPENDIX II LIST OF OPERATIONS

All operations are realized by direct triggering of different key(s) on the panel or combination of them. The following list shows the concrete icons, names and functions of panel keys.

Figure	Name	Function
	Direction	At normal mode, Press Left/Right key to select function group; Press Up/Down key to select the functional menu. At full screen mode, Press Left/Right key to move the gate; Press Up/Down key to adjust the gain value.
	Knob	Press “Enter” key for switch of multi-used function item. Primary or fine adjustment of function items (if available) can be selected via “Enter” key.
	Gain	To adjust the gain step and the gain value by the rotary knob. Press Left/Right key to select the gain step and the gain value. Gain adjustment range is 0 ... 120dB. the gain step will display 12.0dB, 6.0dB, 2.0dB, 1.0dB, 0.5dB, 0.1dB and 0dB in cycle. Select suitable gain step for fast adjustment of gain.
	Gate	Press “Gate A” key to switch to gate A menu quickly. Press this key continually to select Gate A start, Gate A width or Gate A height for adjustment of corresponding functions.
	Next Page	All function groups are arranged in different pages, press “Next page” key to go to expected page.
	Full Screen	In ASCAN mode, press “Full Screen” key to select normal mode and amplified mode of display.
	Auto Gain	Adjust the amplitude of the echo in gate to 80% of the screen height automatically. The range is 10 ... 100%
	Peak Memory	Press “Peak Memory” key to enable/disenable peak memory.
	Softpower switch	Start/shutdown the machine.

APPENDIX III TERMS

This Appendix has listed the terms concerning ultrasonic non-destructive inspection involved in the Instructions, a good understanding of the exact meaning of these terms will be helpful for using the Instructions better.

- Pulse amplitude: voltage amplitude of a pulse signal. When type A display is used, normally it is the height from time base to the pulse peak.
- Pulse length: duration of a pulse in term of time or no. of cycles.
- dB: the logarithmic expression of the ratio of two amplitudes or strengths.
- Sound impedance: ratio of sound voltage of acoustic wave to a particle's vibration speed, normally it is expressed by the product of density p times by velocity c of the media.
- Matching of sound impedance: coupling of two media equivalent to the sound impedance.
- Attenuation: the phenomenon that the sound voltage weakens gradually when an ultrasonic wave propagates in the media as the propagation distance increases.
- Total attenuation: the weakening in sound voltage in special waveform for ultrasonic beams of any shape that is caused jointly by scattering, absorbing and diffuse of acoustic beam, etc. as the propagation distance increases.
- Attenuation coefficient: loss of sound voltage in unit distance due to material scattering when the ultrasonic wave is propagating in media, normally it is expressed by dB/cm.
- Defect: discontinuity whose size, shape, direction, position or nature will damage the effective use of a work piece, or that doesn't meet the specified acceptance standard.
- Type A display: a kind of way for expressing information where horizontal base (X axis) is used for expressing distance or time, and the deflection which is vertical to the base (Y axis) is used to express the amplitude.
- Sending pulse: electric pulse added to the energy exchanger for producing ultrasonic wave.
- Time-base line: horizontal scan line expressing time or distance in type A display fluorescent screen.
- Scan: the repeated movement of the same style from electronic beams that runs cross the detector's fluorescent screen.
- Scan range: Max. pitch interval that can be displayed on the time base line of the fluorescent screen.
- Scan speed: ratio of cross axis to corresponding pitch interval on the fluorescent screen.
- Delayed scan: a kind of scanning way where the starting part of the time base will not show in type A or B display.
- Horizontal linearity: the extent for the signal displayed on the time or distance axis of the ultrasonic detector's fluorescent screen to be proportional to the signal entered into the receiver (multiple echoes from the calibrated time generator or from a plate whose thickness is known).
- Vertical linearity: the extent for the signal displayed on the time or distance axis of the ultrasonic detector's fluorescent screen to be proportional to the amplitude of signal entered into the receiver.

- Dynamic range: with constant gain adjustment, ratio of wave height of the max. to the min. reflection area that can be identified on the ultrasonic detector fluorescent screen. It is normally expressed by dB.
- Repeating frequency of pulse: no. of pulses the pulse generator uses for exciting the probe's wafer per second to generate the ultrasonic wave.
- Inspection frequency: frequency of ultrasonic wave used during ultrasonic inspection. Normally it is 0.4 MHz ~15MHz.
- Frequency of echo: inverse of time of peak interval obtained by observing when the echo extends on the time axis.
- Sensitivity: a kind of dimension for the min. ultrasonic signal identifiable that is generated on the ultrasonic detector's fluorescent screen.
- Allowance of sensitivity: difference between the standard and max. defect-detecting sensitivity in term of certain electric level in an ultrasonic detection system.
- Resolution: capability of an ultrasonic detecting system for extinguishing two adjacent defects of certain size that are most close to each other in transverse, longitudinal or depth direction.
- Suppress: a kind of controlling way to reduce or remove signal of low amplitude (electric noise or noise from material) so as to highlight the high signal in an ultrasonic detector.
- Gate: An electronic method for selecting a time range for monitoring the detecting signal or for further processing.
- Attenuator: a unit changing quantitatively the signal voltage (sound voltage). The attenuated volume is expressed by dB.
- S/N ratio: ratio of ultrasonic signal's amplitude to the max. background noise's amplitude. It is normally expressed by dB.
- Blockage: a phenomenon occurred in the moment after the receiver receives the sending pulse or strong pulse signal where its sensitivity drops or it fails.
- Gain: the log form of voltage amplification of the receiving amplifier of the ultrasonic detector. It is expressed by dB.
- Distance-amplitude curve (DAC): a set of curve plotted according to specified condition by three parameters, i.e. distance of the known reflector, gain of the detector and size of the reflector that generates echo. During the actual detection, one can estimate the equivalent size of defect from this curve based on the measured defect distance and gain.
- Coupling: action that transmits acoustic wave between the probe and the inspected part.
- Test block: a sample for determining the features and the detecting sensitivity of an ultrasonic detection system.

- Standard test block: a test block whose material, shape and size are calibrated by a body in charge or authoritative institute. It is used for testing the performance and adjusting sensitivity of an ultrasonic detection unit or system.
- Comparing test block: the test block used for adjusting the sensitivity of an ultrasonic detection system or comparing the defect. Generally, it is made of the material similar with the material to be detected.
- Probe: electric sound converting component for sending or receiving (or both) ultrasonic energy. This kind of device normally consists of trademark, plug, casing, back lining, piezoelectric component, protective film or wedge.
- Straight probe: a probe for vertical flaw detection, which is mainly for detecting longitudinal wave.
- Angle probe: a probe for angle-sending flaw detection, which is mainly for detecting transversal wave.

DISPOSAL

For the disposal of batteries in the EU, the (EU) 2023/1542 directive of the European Parliament applies. Due to the contained pollutants, batteries must not be disposed of as household waste. They must be given to collection points designed for that purpose. In order to comply with the EU directive 2012/19/EU we take our devices back. We either re-use them or give them to a recycling company which disposes of the devices in line with law. For countries outside the EU, batteries and devices should be disposed of in accordance with your local waste regulations. If you have any questions, please contact PCE Instruments.

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