

# Ultrasonic Flaw Detector DFD30

## Operation Instructions



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# Chapter I Overview

This is a portable industrial non-destructive flaw detector, which can rapidly, easily and accurately inspect, locate, evaluate and diagnose various defects (crack, inclusion and pinhole, etc.) in a workpiece without destruction. It can be used both in a lab and field. The instrument can be widely used in any fields that need defect inspection and quality controlling e.g. manufacturing industry, iron & steel metallurgical industry, metalworking, chemical industry, etc., also be broadly used in the active safety inspection and service-life evaluation in such fields as aerospace, railway transportation and boiler pressure vessels, etc. It is an essential instrument for non-destructive inspection industry.

When the ultrasonic wave propagates in a job, one can detect the defect in it by the influence on the propagation of ultrasonic wave based on the acoustic characteristic demonstrated by the defect in the material. Based on this principle, by using ultrasonic wave one can measure such defects as crack, pinhole and inclusion in such media as metal, non metal and composite, etc.

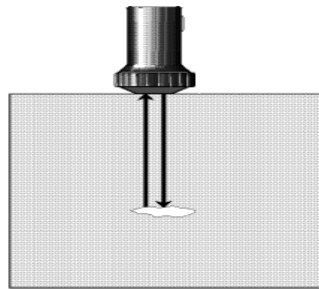


Fig. 1.1 Basic working principle for ultrasonic detection

## 1. How to use the operation instructions

It is necessary to read chapter 1, 2, 3 and 4 of the Instructions before operating instrument for the 1st time. The descriptions in the chapters are necessary preparation for operating the instrument, which will describe all keys and displays on screen, and explain the operation principle.

By following the directions, you can avoid error or failure due to operation mistake and can have a clear concept about all functions of the instrument.

## Chapter II Technical Parameters

### 2.1 Technical Specifications

Frequency Range	0.4-10MHz
Gain Range	0dB ~110 dB
D-Delay	-20 ~ +3400 $\mu$ s
P-Delay	0 $\mu$ s ~ 99.99 $\mu$ s
Measurement Range	Scan: 0 mm ~6000.0 mm Thickness: 5.0 mm ~1000.0 mm
Dynamic Range	> 32dB
Vertical linear error	< 3.0%
Horizontal linear error	< 0.1%
Sensitivity leavigns	> 58dB
Reject	0% ~ 90%
Rectification	Positive half wave, negative wave, full wave and RF
Test Mode	Pulse-echo, dual, through transmission
Power Supply	Li battery
Charging Time	4-5 hours
Continuous Work	More than 8 hours
Weight	0.42Kg
Overall Dimension	141×87×40mm

### 2.2 Standard Delivery

Item	Quantity
Main unit	1
2.5A/4.2V power adaptor	1
probe connecting cable	1
Straight probe	2.5MHz $\Phi$ 20mm (One)
Angle probe	4MHz 8×9 60° (One)
Software and cable	1
Neck and Wrist strap	1
Instruction manual	1
Calibration certificate	1

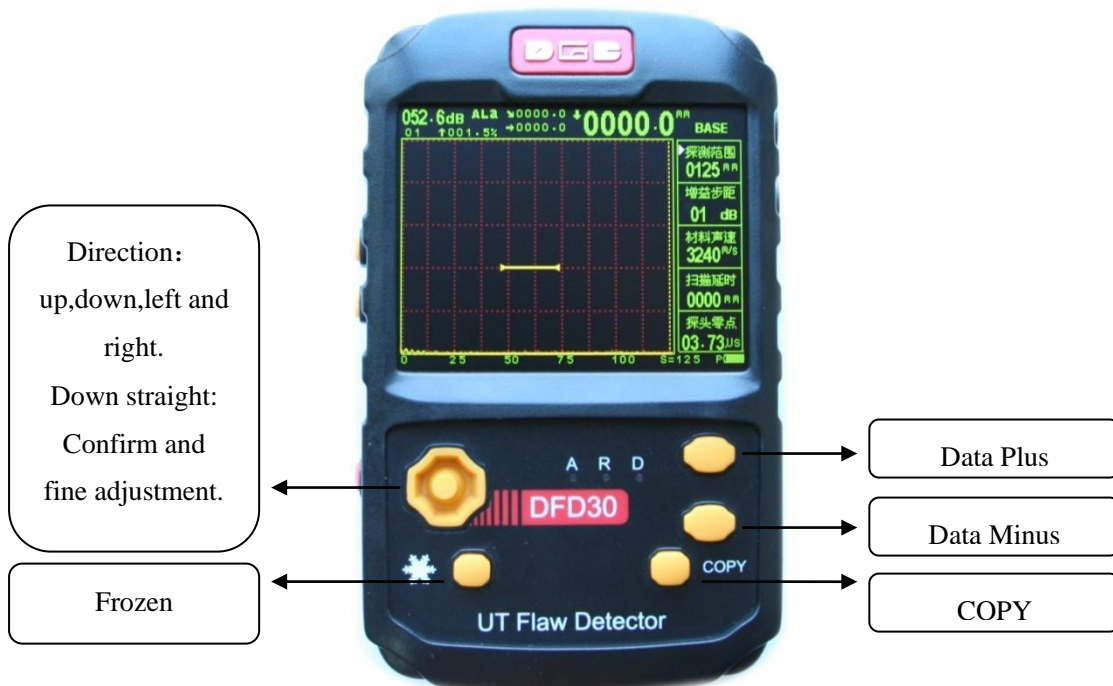
Item	Quantity
Carrying case	1

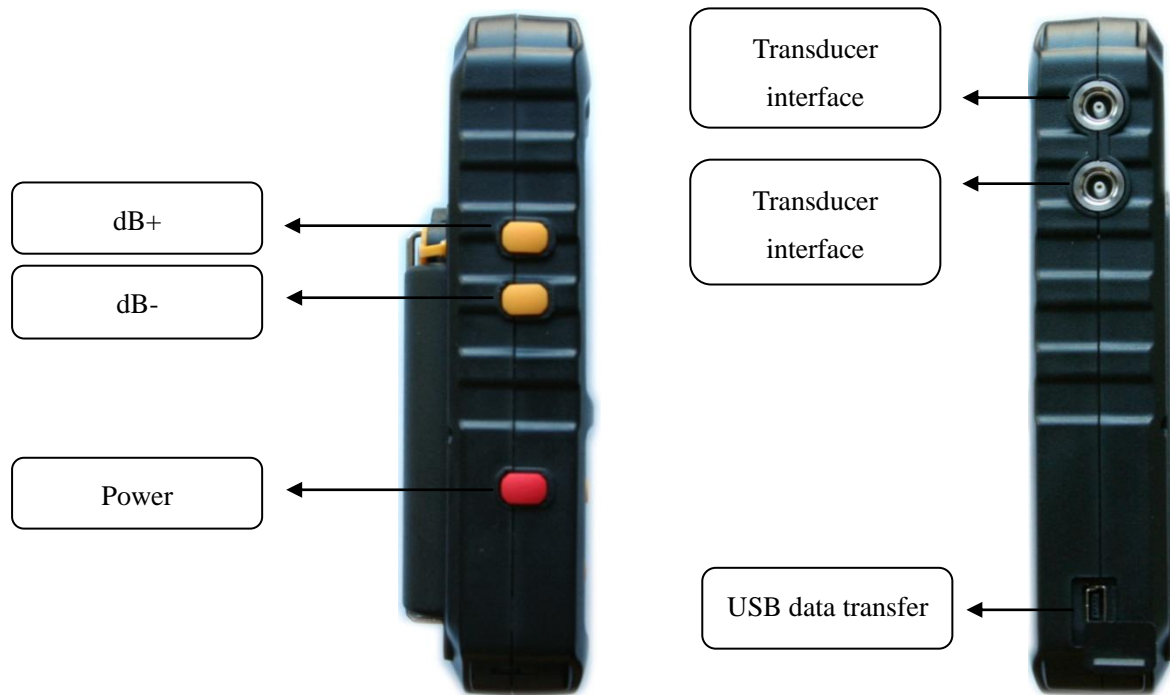
### 2.3 Optional Accessory

Item
Different straight and angle beam
Different cables
Different test blocks

## Chapter III Preparation

### 3.1 Overview of Instrument





## 3.2 Operation

### 3.2.1 Preparation

- Connect to probes and insert into correct socket. It is mention in 3.1.4.
- Press power key to turn on the main unit.
- It carries out self-check. After self-check, it automatically enters into the testing statues and the setting is kept with that you turned off last time.
- Check voltage of the battery. If the power monitor shows that the voltage is low, please charge ASAP.

### 3.2.2 Turn on or off

**Turn on:** Please make sure there is enough power of battery and press power key for about 3 seconds. Then users would hear a long buzzer, meanwhile main unit is in working condition.

#### **Notice:**

when users turn on the instrument, the setting is the same as the one users turn off last time.

**Turn off:** Please make sure all data necessary is stored; then press power key for about 3 seconds again and main unit turns off.

### 3.2.3 Usage of power supply

DFD30 can work with plug-in power supply (AC, DC adaptor) or battery.

The detector uses the power supply to adapter automatically when the power supply adapter is connected. In the other hand, the detector uses the power supply to battery automatically when the power supply adapter is not connected.

### 3.2.4 Connect to probes

There is suitable cable to connect main unit and probe. On the top and side of main unit, there are 2 lemo00 interfaces.

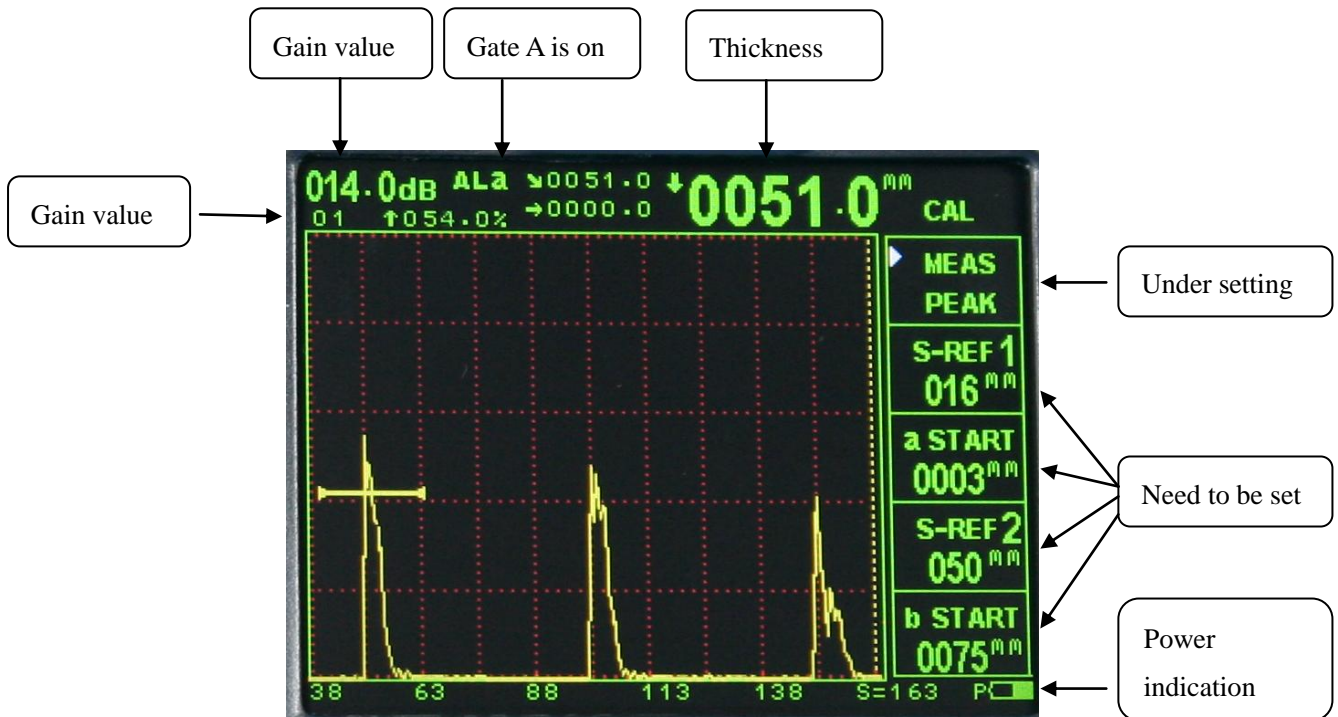
Proper probe shall be connected when using DDFD30 to inspect. So long that you have a proper cable, and the working frequency is within proper range, any probe made by our company is suitable for DDFD30.

The probe shall be connected to the socket at side of the instrument. Both connector sockets have different function, the socket on the top that sends the echo, the bottom, receiving the echo. Under single probe mode, the socket that sends echo can be used only. When connecting with dual, TR or two probes (one for sending, the other for receiving), please make sure to the right socket; otherwise, it may result in loss or disorder echo waveform.

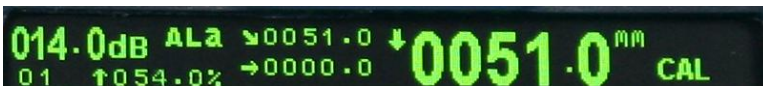
**Notice:**

1. Bad quality of cables and probes has great impact on the test results. Please be sure good condition of cable and probe is used.
2. When using dual probe, please pay attention to the connecting order of probe; otherwise lead to echo power consumption and not right echo display.

**3.3 Display**



**In detail**



**3.4 Overall of main menu**

Main functions of DFD30 are included in functional groups and several special functions.

The functional groups include BASE, P/R, GATE, CHAN, AGLEY, GAIN DAC1, DAC2, AVG1, AVG1,BSCAN, SCR, MEM, CFG, ADV they will be introduced in the following table.

No.	group	Functions	Description
1	BASE	RANGE, db-STEP, MTLVEL, D-DELAY , P-ZERO	Basic adjustment items necessary for the display range
2	a GATE	a START, a WIDTH, a THRESH, a LOGIC, E to E	Relative items for gate configuration
3	bGATE	b START, b WIDTH, b THRESH, b LOGIC, b GATE	Relative items for gate configuration
4	PULS	PROBE TYPE, REJECT, PRF, FINE G, T-SCAN	Sending and receiving the adjustment items needed
5	CAL	MEAS, S-REF1,a START, S-REF2, b START	Basic adjustment items necessary for the display range
6	DAC	DAC3, DGS, AWS	Plotting DAC curve
7	PK MEM	PK MEM, ENVLOP, SHADOW, AGC 80%	Advanced function
8	TRIG	ANGLE, X-VALUE, MTL THK	Setting relative with angle probe
9	WELD	WELD, W WIDTH, W DIST, W DISP	Advanced function
10	SET	HORN, BRIGHT, UNIT, DATE, TIME	Advanced function

Other special functions can be realized by Special Function (SF) keys. The functions of each SF keys are introduced in the following table.

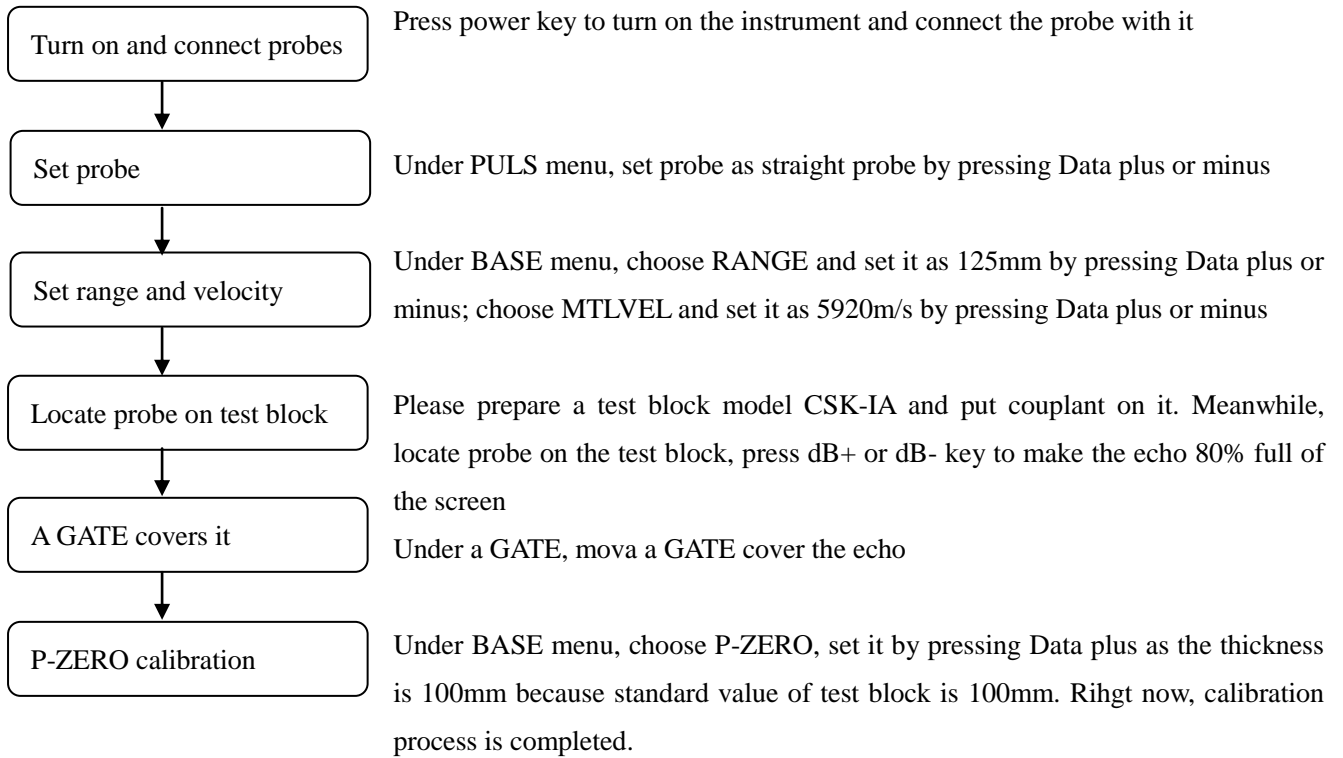
Special Functions	Description of function
Gain step	To adjust the gain step
dB+, dB-	To adjust the gain
Freeze	To freeze waveform
Memory Peaks	Capture the max value of echo on the screen
Measure display	Select the display mode of measure result on the screen

## Chapter IV Shortcut operation of main unit

Here is shortcut of operation for user reference. Please check below in detail:

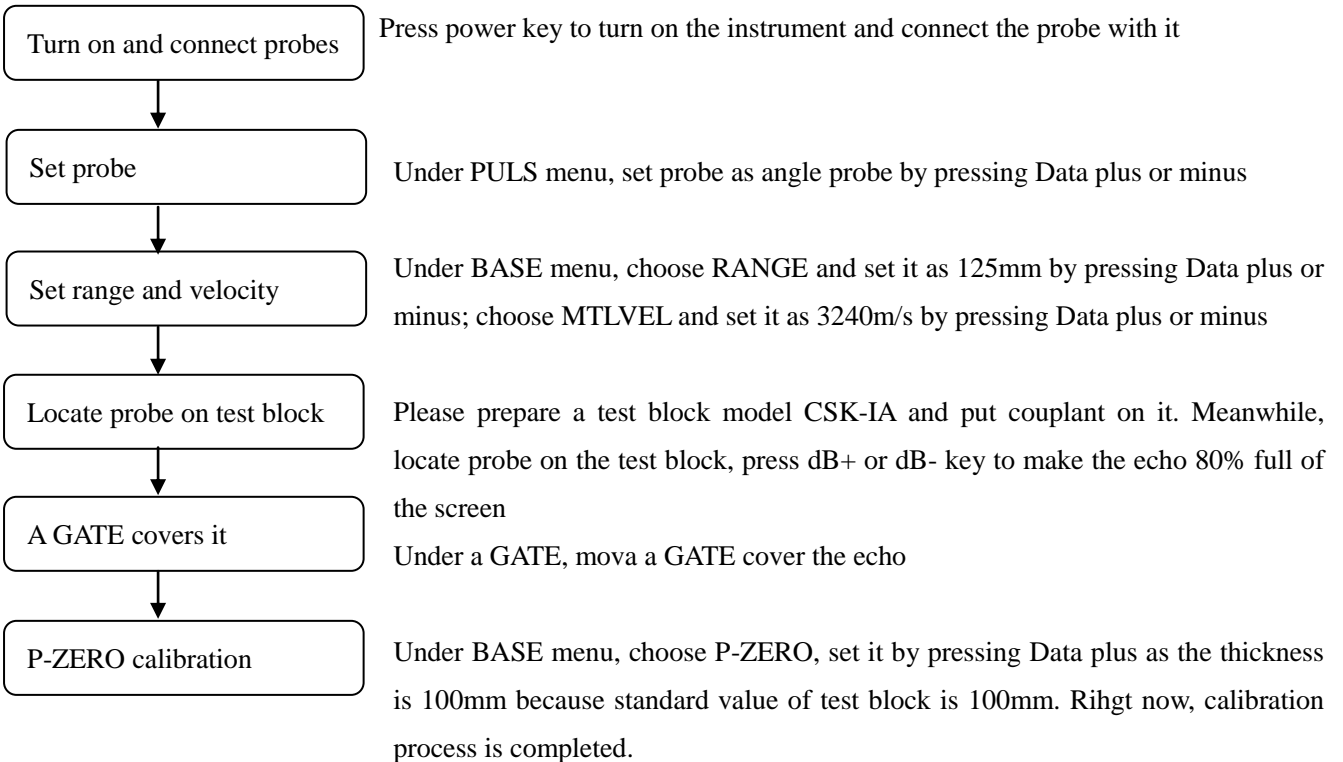


**4.1 Calibration of straight probe**



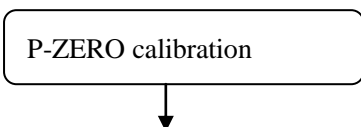
**4.2 Calibration of angle probe**

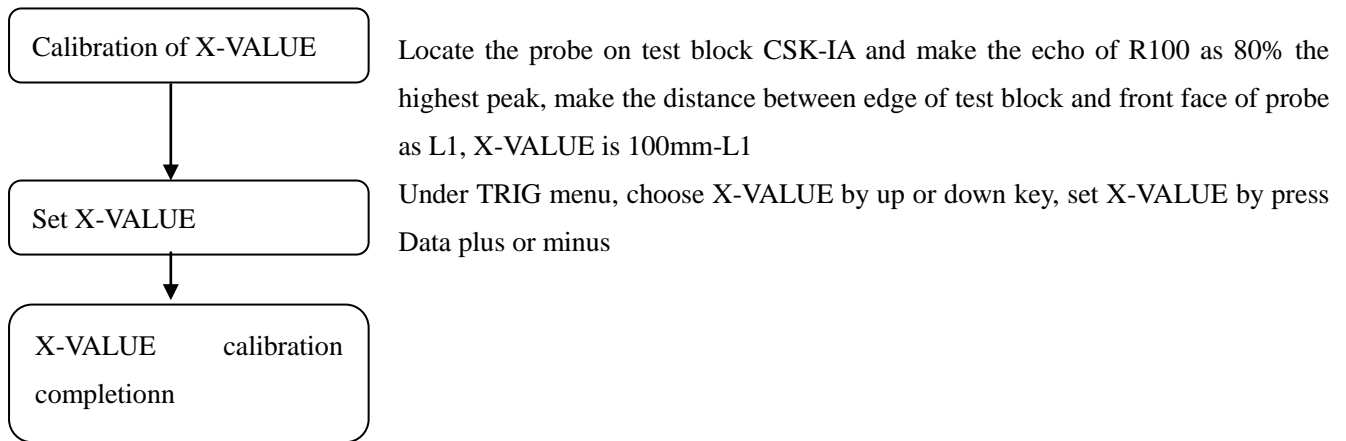
**4.2.1 P-ZERP calibration**



**4.2.2 X-VALUE calibration**

When P-ZERO calibration process is completed, next we move to X-VALUE calibration.





## Chapter V Parameter setting

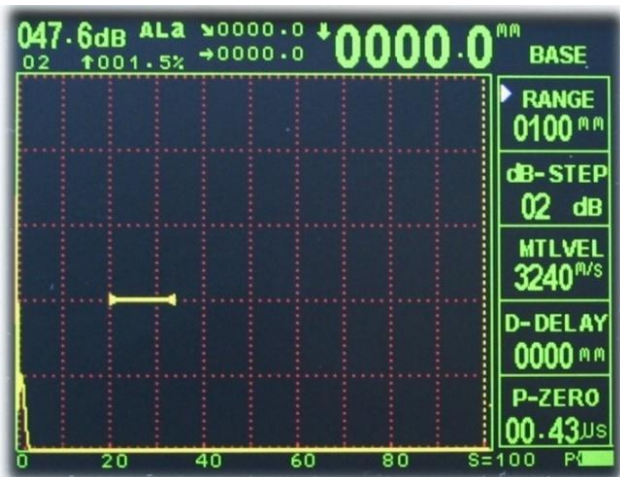
### 5.1 Setting of BASE

In the BASE functional group, users can adjust and set the functional items relative with the display range, including **RANGE, dB-STEP,MTVEL, D-DELAY and P-ZERO.**

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, and the character of probe determines the P-DELAY.

**Notice:** In order to set the sound velocity of ultrasonic wave in workpiece and P-DELAY, please refer to Chapter VI Calibration of Instrument.

Under A-Scan mode, press left or right direction key to set a or b GATE.



#### 5.1.1 RANGE

Press left or right key to enter into BASE SETTING, then press up or down key to choose RANGE.

Range: 0mm ~ 6000mm/0.1 " ~ 200 "

If RANGE is selected, there are two ways to change. They are Rough and Fine adjustment.

Under RANGE, press + or -key

Rough adjustment: 25mm, 50mm, 100mm, 125mm, 200mm, 250mm, 500mm, 1000mm, 2000mm, 4000mm, 6000mm.

Fine adjustment: +1 or -1mm

Under RANGE, press down key. Right now, there are two tri-angle appear. Under this condition, press + or – key to realize fine adjustment.

### 5.1.2 db-STEP

Press left or right key to enter into BASE SETTING, then press up or down key to choose db-STEP.

Press + or – key to change from 01db, 02db, 06db and 12db.

### 5.1.3 MVTEL

Users are allowed to set the transmission velocity of ultrasonic wave in workpiece. There are two velocities stored in main unit. They are:

3,240m/s	0.127 in / $\mu$ s	Sound velocity of transverse wave in steel
5,920m/s	0.233 in / $\mu$ s	Sound velocity of longitudinal wave in steel

Users are also allowed to carry out fine adjustment.

Under MVTEL, press down key. Right now, there are two tri-angle appear. Under this condition, press + or – key to realize fine adjustment.

Fine adjustment: Step is 1m/s 0.0001in/ $\mu$ s

### 5.1.4 D-DELAY

Users could set the pulse shift during detection, via. 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: 0-512mm

Step: 1mm

There are two ways of adjustment, Rough and fine.

Rough adjustment

Under D-DISPLAY menu, press down key. Right now, there are two tri-angle appear. Under this condition, press + or – key to realize rough adjustment.

Fine adjustment

Under D-DISPLAY menu, press + or – key directly to realize fine adjustment.

### 5.1.5 P-ZERO

Range: 0-9.99 $\mu$ s

Step: 0.1 $\mu$ s

There are two ways of adjustment, Rough and fine.

Rough adjustment

Under D-DISPLAY menu, press down key. Right now, there are two tri-angle appear. Under this condition, press + or – key to realize rough adjustment.

Fine adjustment

Under D-DISPLAY menu, press + or – key directly to realize fine adjustment.

### 5.2 Setting of a and b GATE

It is used for adjustment of gate settings, including Gate logic, Gate alarm, Gate start, Gate width and Gate height.

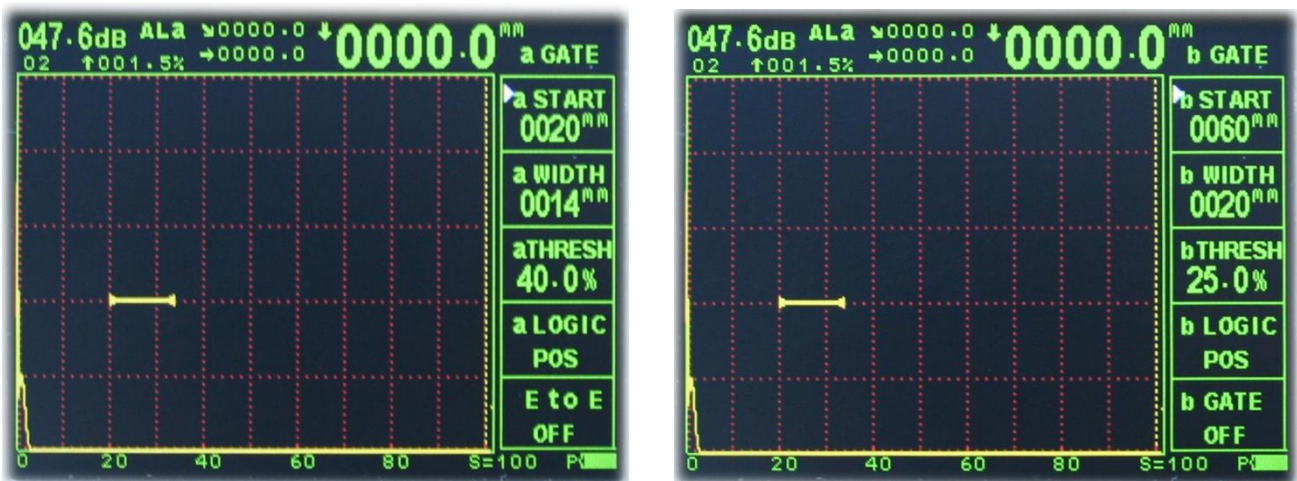
Functions of gate during detection:

- 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.

DFD30 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 B could be open if E to E function is used under menu a Gate and set E to E as on or b-GATE is set on. Under this condition, Gate B appears on the display.

Under A-Scan mode, press left or right direction key to set a or b GATE.



#### 5.2.1 a START and b START

This functional menu is multipurpose for Start of Gate A and Gate B.

Under a GATE and b GATE, press up or down key to choose a START and b START, press + or – key to make change.

**Notice:** 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.

#### 5.2.2 a WIDTH and b WIDTH

This functional menu is multipurpose for Width of Gate A and Gate B.

Under a GATE and b GATE, press up or down key to choose a WIDTH and b WIDTH, press + or – key to make change.

#### 5.2.3 a THRESH and b THRESH

This functional menu is multipurpose for Threshold of Gate A and Gate B.

Under a GATE and b GATE, press up or down key to choose a THRESH and b THRESH, press + or – key to make change.

Parameter ange: 3.5%-96.5%

## 5.2.4 a LOGIC and b LOGIC

This menu is multipurpose for gate logic.

### GATE LOGIC:

Gate logic has four options: NONE, POS, NEG, MUL.

Options:

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

Under a GATE and b GATE, press up or down key to choose a LOGIC and b LOGIC, press + or – key to make change.

## 5.2.5 E to E

This function menu is for mode of E to E. If it is set on, GATE b appears on the display and achieves E to E function.

Under a GATE and b GATE, press up or down key to choose E to E, press + or – key to choose on or off.

## 5.3 Setting of PULS

Under A-Scan mode, press left or right direction key to set PULS.



### 5.3.1 TYPE

This functional menu is to set probe type.

#### PROBE TYPE:

Set 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 probe: Single transducer.

Angle probe: Single transducer.

Dual: One connector acts as a transmitter, the other acts as a receiver. The top transducer connector is designated as the transmitter. The bottom transducer connector is designated as the receiver.

Thru: Two separate transducers, typically on opposite sides of the test specimen. Use the top transducer connector as the transmitter. The bottom transducer connector is designated as the receiver.

Under PULS, press up or down key to choose PROBE TYPE, press + or – key to make change.

**Notice:** Probe setting plays an important role in flaw detecting. Please choose right probe according to the setting.

### 5.3.2 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%~90%

Step graduation: 1%

Under PULS, press up or down key to choose REJECT, press + or – key to make change.

### 5.3.3 PRF

This model is equipped with an adjustable pulse repetition reate, with adjustable settings of 10, 25, 50, 100, 250, 500, 750 and 1000Hz. The primary purpose is to control how fast the pulser is firing. The repetition rate is tied into the alarm LEDS. Therefore, when scanning at higher speed, a higher repetition rate will make the alarm trigger more responsive.

Under PULS, press up or down key to choose PRF press + or – key to make change.

### 5.3.4 FINE G

This menu is to adjust the gain in fine status.

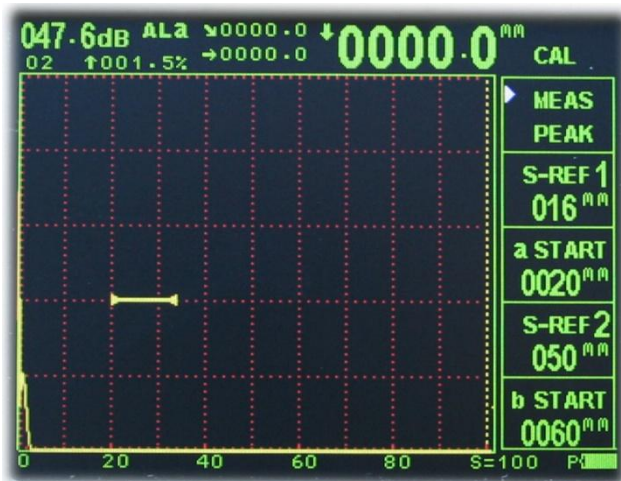
Under PULS, press up or down key to choose PRF press + or – key to make change.

### 5.3.5 T-SCAN

This menu is multipurpose for SCAN WAY.

## 5.4 Setting of CAL

Under A-Scan mode, press left or right direction key to set CAL.



### 5.4.1 MEAS

There are two styles: PEAK and FLANK.

PEAK: The detection occurs at the highest peak in the gate.

FLANK: The detection occurs as the first half cycle left edge rises and breaks the threshold.

### 5.4.2 S-REF1

This feature offers users setting a reference thickness from 0 to 250mm.

### 5.4.3 a START

This setting is the same as a Gate setting. Please check 4.2.4.

### 5.4.4 S-REF2

This feature offers users setting a reference thickness from 0 to 250mm.

### 5.4.5 b START

The setting of b Gate will be displayed here.

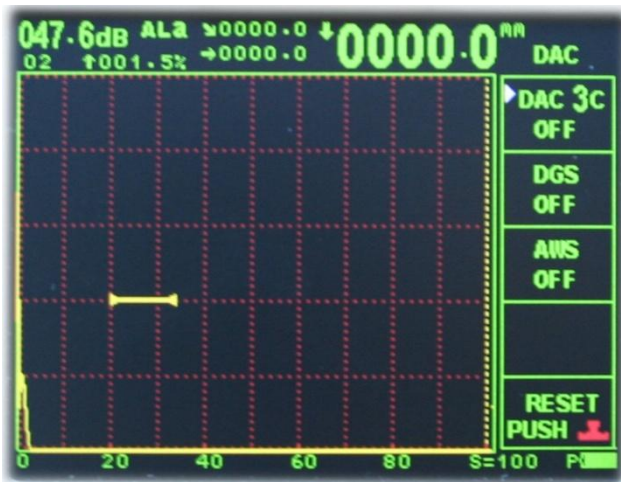
## 5.5 Setting of DAC

### 5.5.1 DAC 3C

This feature toggles the DAC feature on/off. A Distance Amplitude Correction (DAC) curve is used to configure a variable threshold for the gate, using the same size reflector at different distances.

Under A-Scan mode, press left or right direction key to set **DAC**.





## Making of DAC curve

1. Please do calibration of Probe zero, X-value as well as K-value of angle beam. According to specific condition, please do set the range, for example reference test block, take a hole of 10mm in depth and let the echo at the highest peak to be 90% full of screen.
2. Use left or right arrow key and choose DAC3C function, then set it as on. Meanwhile, there is a small cross on the top.
3. Move a Gate to the highest peak and trap it.
4. Press Frozen key to confirm the first point.
5. Repeat step 3 and 4 to accomplish the other points, at least 3 points, at most 6 points. Regarding to depth, it is recommend to 20mm, 30mm, 40mm or according to specific requirement of users.
6. Press arrow key down, the DAC curve displays on the screen. Under this condition RL, SL and EL curve could be set. Please check the detail below.
7. Set the menu \* POINT as ON, 3 curves show on the screen.

**Notice:** Explanation of RL, SL and EL curve.

DAC Group is used for adjusting the relative parameters necessary for plotting a DAC curve. It includes RL, SL and EL curve as well as DAC REF.

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 curve 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.

Quit making of DAC

During Step 1-6 mention above of DAC curve making, press COPY key to quit of DAC curve making.



### 5.5.2 DGS

This feature toggles the DGS feature on/off. Distance Gain Size (DGS) curve is used to configure a variable threshold for the gate using a single reflector using an empirically derived set of curves.

### 5.5.3 AWS

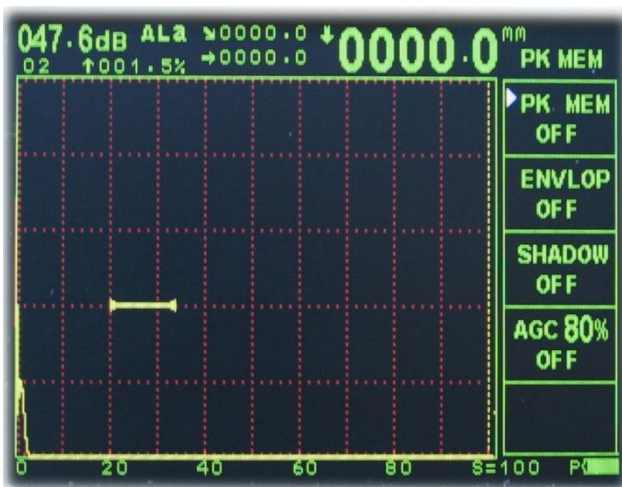
This feature toggles the AWS feature on/off. Used in the analysis of welds and calculating the indication rating.

### 5.5.4 RESET

This feature provides users to reset the basic setting in detection.

## 5.6 PK MEM

Under A-Scan mode, press left or right direction key to set **PK MEM**.



### 5.6.1 PK MEM

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

### 5.6.2 ENVLOP

This is especially for Angle beam probe. When users move the probe on a workpiece, there are multiple echos memorized, and main unit makes a line, then shows on the screen. According to this line, users easily find the echo of flaw.

### 5.6.3 SHADOW

Making use of this function, echo is filled with color. Users easily check the echo.

### 5.6.4 AGC 80%

We can use the function to adjust the gain automatically to make amplitude of the largest echo in gate equal 80% of the screen

Options: ON, OFF

## 5.7 TRIG

Under A-Scan mode, press left or right direction key to set **TRIG**.



### 5.7.1 ANGLE

It is to adjust the angle of a probe.

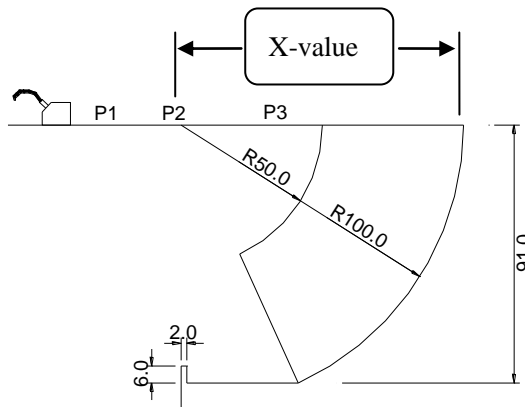
Range: 0.0°-90.0°

Under TRIG, press up or down key to choose ANGLE, press + or – key to make change.

### 5.7.2 X-VALUE

It is used to calculate the surface distance in the trigonometry function, as is a physical measurement from the index point of the probe to the front of the wedge. like the graph below:

Probe is set to P2, then use 100 minus the distance in horizontal shown on display.



Range: 0.00-50.0mm

Step: 0.1mm

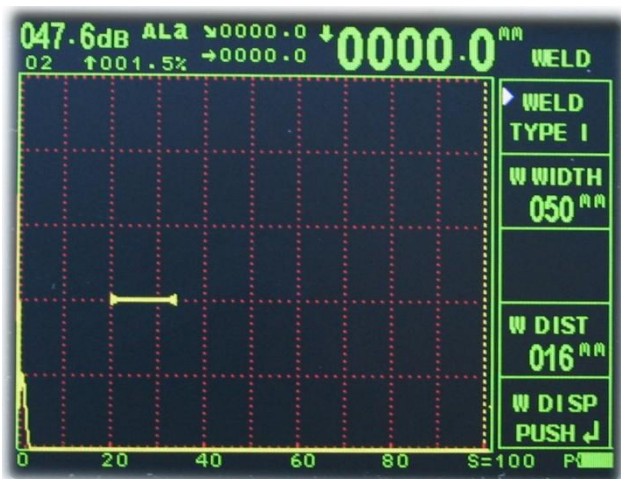
Under TRIG, press up or down key to choose X-VALUE, press + or – key to make change.

### 5.7.3 MTL THK

It is used to set the thickness of the test material. The thickness will be used to determine which workpiece is detecting on.

### 5.8 WELD

Under A-Scan mode, press left or right direction key to set **WELD**.



### 5.8.1 WELD

There are several types of weld detection stored in the main unit, such as Type I, Type V, Type U and Type X. Take Type I as an example, weld width, weld distance show on the display. Users could make change according to different condition.

### 5.8.2 W WIDTH

This feature offers users to set the width of weld.

### 5.8.3 W DIST

This feature offers users to set the distance of weld to the surface.

## 5.9 SET

Under A-Scan mode, press left or right direction key to set **SET**.



### 5.9.1 HORN

This menu is used to set HORN on or off.

Under menu of SET, press up or down key to choose HORN, press + or – key to make change.

### 5.9.2 BRIGHT

This menu is convenient for users operate in dark or sunlight places. So, it offers two modes: Low and High.

Under menu of SET, press up or down key to choose BRIGHT, press + or – key to make change.

### 5.9.3 UNIT

It is selectable between Metric and English.

### 5.9.4 DATE

This menu offers to record and check time.

Under menu of SET, press up or down key to choose DATE, press down key to move the cursor, + or – key to make change.

It shows like XX month XXdayXXyear. After confirmation, press up or down arrow key.

### 5.9.5 TIME

This menu offers to record and check time.

Under menu of SET, press up or down key to choose TIME, press down key to move the cursor, + or – key to make change.

It shows like XX hourXXminutes. After confirmation, press up or down arrow key.

## Chapter VI Calibration of straight and angle beam probe

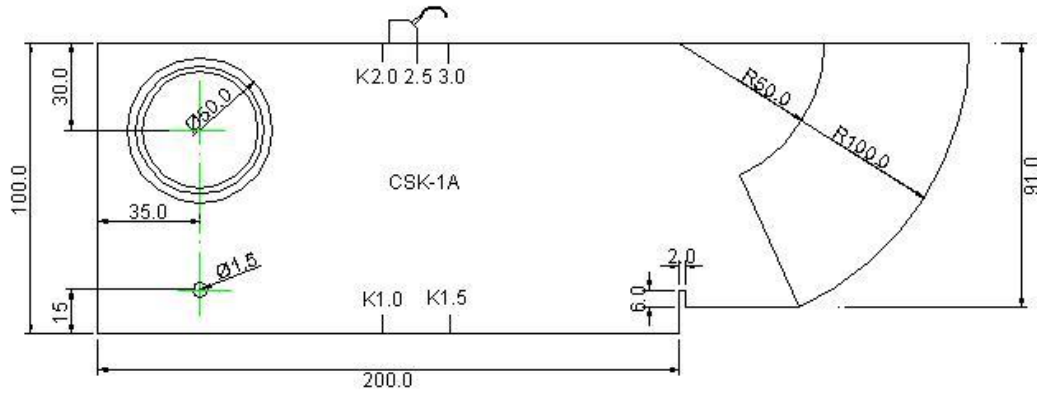
### 6.1 Calibration of straight probe

For the convenience of user's calibration of probe zero point, the function of calibration is built in the gauge. Furthermore, users can also do the calibration of probe as what is shown here. Straight probe can be calibrated with the following method.

For example of the standard straight probe which is frequency 2.5MHz, diameter 20mm and one test block CSK-IA (shown below) with thickness determinate are needed.

The operation steps are as following:

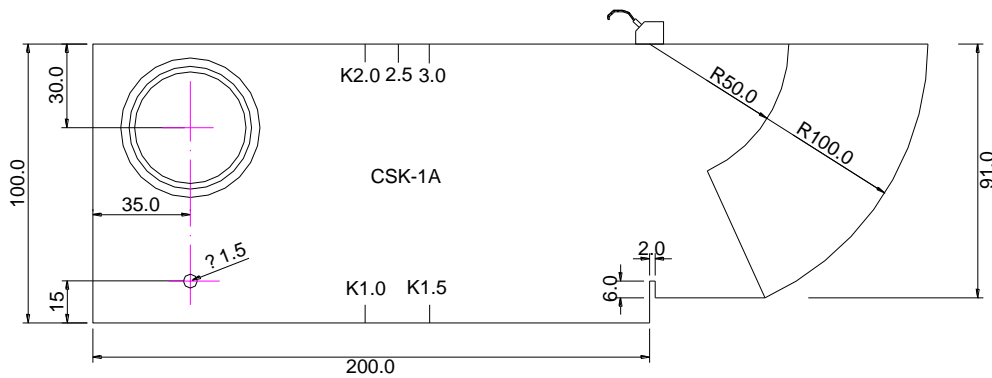
- (1) Turn on the instrument and connect with a straight probe
- (2) Under PULS menu, set the probe as straight probe by pressing Data plus or minus key
- (3) Under BASE menu, set the range as 125mm and sound speed value as 5920m/s, as well as dB as around 20
- (4) Put couplant on the surface of the test block and locate the probe on it; it would be better that the echo is around 80% height of full screen
- (5) Move gate A start to echo and cover with it
- (6) Finally, under BASE menu, choose P-ZERO menu through up or down key, make the thickness value as 100mm by pressing Data plus key as the standard thickness of this test block is 100mm. Meanwhile, the calibration process is completed.



### 6.2 Calibration of angle beam probe

For the convenience of user’s calibration of probe angle、 front edge、 zero point, the function of calibration is built in the gauge. Furthermore, users can also do the calibration of probe as what is shown here.Angle probe can be calibrated with the following method:

A standard angle probe which is frequency 5MHz, wafer 8mm×9mm , single and angle 60° and CSK-IA block (shows below) is also used to calibrate angle probe.



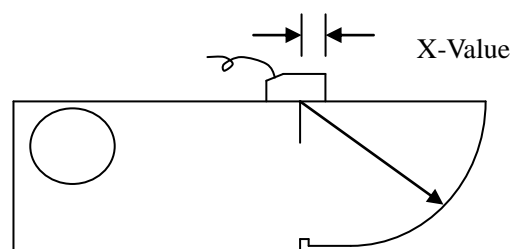
The operation steps are as following:

- (1) Turn on the instrument and connect with a straight probe
- (2) Under PULS menu,set the probe as angle probe by pressing Data plus or minus key
- (3) Under BASE menu, set the range as 125mm and sound speed value as 3240m/s, as well as dB as around 20
- (4) Put couplant on the surface of the test block and locate the probe on it (as shown on the graph above); it would be better that the echo is around 80% height of full screen
- (5) Move gate A start to echo and cover with it
- (6) Finally, under BASE menu, choose P-ZERO menu through up or down key, make the thicknee value as 100mm by pressing Data plus key as the standard thickness of this test block is 100mm. Meanwhile, the calibration process is completed.

#### Calibrating of angle beam probe is usually as following:

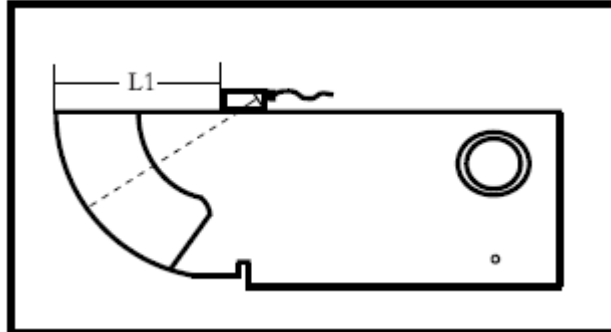
- (1) calibration of incidence angle (X-Value);

After calibration of probe zero point, then calibration of incidence angle (X-Value): Test the probe zero point with II W test block (Holland test block) or CSK- I A test block. While calibration of



probe zero point, when users receive the highest peak of echo as R100, as the graph shows below, the distance between edge of test bloce and front face of the probe as L1.  $X\text{-Value} = 100 - L1$ .

- (2) Under TRIG menu, choose X-value through up or down key, set X-value by pressing Data plus key as calculated above.
- (3) Right now, calibration of angle beam is completed.

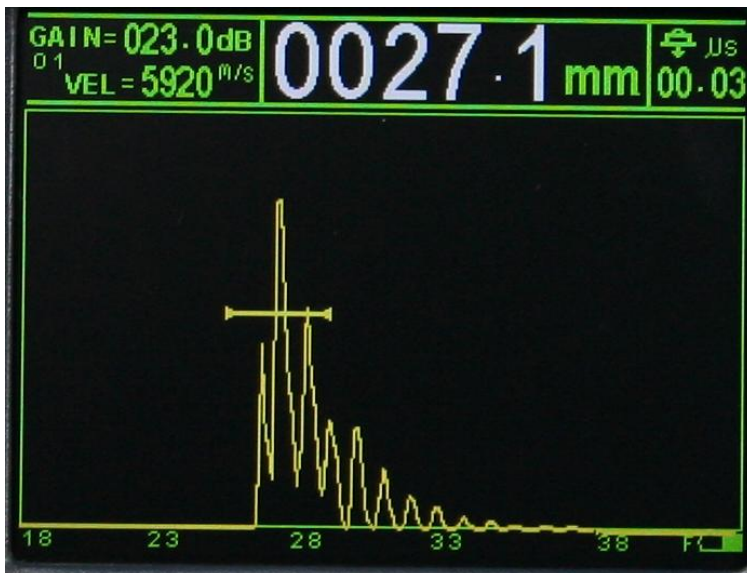


## Chapter VII Thickness Measurement Function

Beside flaw detector, there is an extra function of thickness measurement. Its measuring range is from 5-1000mm, resolution is 0.1mm.

### 7.1 How to enter thickness measurement

Under arbitrary menu of flaw detection, press FREEZE key, then press COPY again, then users have entered into thickness measurement display. Please check below:



Under this menu, press UP or DOWN arrow key to check the wave and thickness value; press LEFT or RIGHT key to move a GATE.

Press COPY key to choose probe type as straight probe or dual probe easily.

### 7.2 How to back flaw detection

If users want to come back flaw detection, it is easy. Users just press FREEZE key for 2 times. Then it changes back

to flaw detection.

## Chapter VIII Data storage and Communication with PC

It is introduced in a file of software installation.

## Chapter IX Maintenance

### Indication of Power

On the right down corner, there is indication of power, totally 5 phrases.



When the power indicator shows empty like the 5<sup>th</sup> graph above, the main unit still works about 20 minutes. There is sound indication if battery power wears out and a prompt on the screen “Low battery, please turn off”. For good protection of main unit and battery, please power off the main.

### Date and Time

Date and Time will be displayed on the function area of LCD. It shows like the order ××month××day ××year××hour××minute, for example 10-28-14 10:48

Please make change if it is not real date and time. It changes like this:

1. Power on the main unit
2. Press direction key to choose date

### Instruction light and buzzer

There are 3 instructions light on the keyboard called A, D, R as well as a beeper inside, which remind users working condition of this main unit.

### Usage and maintenance of battery

DFD30 is equipped with easy movable Li-battery. The power of battery displays on the right down corner. If the power is too low, following condition happens: white screen, or re-open, or failure in power on. “Low battery, please power off” shows on the screen if power of battery is too low or even power off automatically for protection of the main unit.

Notice:

1. Please save the data needed and charge when “Low battery, please power off” shows on the screen.
2. Please charge 1 time per month in case users do not use the main unit for good protection of the battery.
3. Battery power could change sharply owing to power change or transferring period between 2 borders of battery power, which do not have any impact on usage of main unit.
4. The validity of Li-battery is 6 months and please charge periodically, otherwise leads to the broken of battery. It

is out of validity if users do not use the charger in the standard delivery to charge the battery.

### **Charge to the battery**

DFD30 is equipped with Li-battery. It will charge automatically when users connect the charger and main unit. The process is quick charge until 80% of full power and then slow charge to full power. It is full if lightf turns from red to green. It is guaranteed that 8 hours continuous usage after full charge.

### **Notice:**

1. The first 3 charge times should be 12 hours and users try to consume all the power of battery.
2. Longevity of battery is 500 times charge.

### **Light**

Light A: Warning light

When power on, light A shows bright. It will turn off until users enter into menu system.

Light D: Instruction for probes

Type of probe should be set as dual or thru probe. Meanwhile, light D shows bright.

Light R:

When rejection is more than 00%, light R is in bright, which reminds users that there is rejection in testing in checking possible flaws.

### **Warm notice:**

Instruction light will be bright as following conditions are:

1. Power is in shortage or main unit turns off automatically.
2. Users set height of echo higher than the limit.
3. Users set height of echo lower than the limit.
4. Users set height of echo higher than the limit as function of DAC or AVG curve is using.
5. Users set height of echo lower than the limit as function of DAC or AVG curve is using.
6. Mal-operation is done or data exceeding.

Buzzer

The buzzer rings when following conditions happen:

1. Users turn on or off the main unit.
2. When battery power is in shortage and it is close to power off.



## Appendix

### Appendix I Notice to Users

1. 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.
2. 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.
3. 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.
4. The “special configuration” (shaped probe, special-purpose software, etc.) beyond our established product will be charged according to concerned criteria.
5. 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 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.

1. 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.
2. Pulse length: duration of a pulse in term of time or no. of cycles.
3. dB: the logarithmic expression of the ratio of two amplitudes or strengths.
4. Sound impedance: ratio of sound voltage of acoustic wave to a particle's vibration speed, normally it is expressed by the product of density  $\rho$  times by velocity  $c$  of the media.
5. Matching of sound impedance: coupling of two media equivalent to the sound impedance.
6. Attenuation: the phenomenon that the sound voltage weakens gradually when an ultrasonic wave propagates in the media as the propagation distance increases.
7. 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.
8. 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.
9. 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.
10. 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.
11. Sending pulse: electric pulse added to the energy exchanger for producing ultrasonic wave.
12. Time-base line: horizontal scan line expressing time or distance in type A display fluorescent screen.
13. Scan: the repeated movement of the same style from electronic beams that runs cross the detector's fluorescent screen.
14. Scan range: Max. pitch interval that can be displayed on the time base line of the fluorescent screen.
15. Scan speed: ratio of cross axis to corresponding pitch interval on the fluorescent screen.
16. Delayed scan: a kind of scanning way where the starting part of the time base will not show in type A or B display.
17. 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).
18. 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.
19. 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.
20. Repeating frequency of pulse: no. of pulses the pulse generator uses for exciting the probe's wafer per second to generate the ultrasonic wave.
21. Inspection frequency: frequency of ultrasonic wave used during ultrasonic inspection. Normally it is 0.4 MHz ~15MHz.

22. Frequency of echo: inverse of time of peak interval obtained by observing when the echo extends on the time axis.
23. Sensitivity: a kind of dimension for the min. ultrasonic signal identifiable that is generated on the ultrasonic detector's fluorescent screen.
24. Allowance of sensitivity: difference between the standard and max. defect-detecting sensitivity in term of certain electric level in an ultrasonic detection system.
25. 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.
26. 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.
27. Gate: An electronic method for selecting a time range for monitoring the detecting signal or for further processing.
28. Attenuator: a unit changing quantitatively the signal voltage (sound voltage). The attenuated volume is expressed by dB.
29. S/N ratio: ratio of ultrasonic signal's amplitude to the max. background noise's amplitude. It is normally expressed by dB.
30. 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.
31. Gain: the log form of voltage amplification of the receiving amplifier of the ultrasonic detector. It is expressed by dB.
32. 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.
33. Coupling: action that transmits acoustic wave between the probe and the inspected part.
34. Test block: a sample for determining the features and the detecting sensitivity of an ultrasonic detection system.
35. 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.
36. 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.
37. 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.
38. Straight probe: a probe for vertical flaw detection, which is mainly for detecting longitudinal wave.
39. Angle probe: a probe for angle-sending flaw detection, which is mainly for detecting transversal wave.