1 Overview

The model is a digital ultrasonic thickness gauge. Based on the same operating principles as SONAR, the thickness gauge is capable of measuring the thickness of various materials with accuracy as high as 0.01 millimeters, or 0.001inches. It is suitable for a variety of metallic and non-metallic materials.

1.1 Product Specifications

1) Display: 128×64 dot matrix LCD with EL backlight.
2) Measuring Range: 0.75~300mm (in Steel, depending on the probe).
3) Sound Velocity Range:300~19999 m/s.
4) Resolution: 0.1/0.01mm (selectable).
5) Accuracy: ±(0.5%Thickness+0.01) mm
6) Units: Metric/Imperial unit selectable.
7) Four measurements readings per second in normal testing mode, and ten per second in Scan Mode.
8) Memory: 100 files (up to 100 records for each file).
9) Top and bottom limit can be pre-set. It will alarm automatically when the test result exceeds the limit.
10) Power Supply: Two "AA" size, 1.5 volt alkaline batteries. 100 hours typical operating time (EL backlight off).
11) Communication: USB2.0.
12) Case: Extruded aluminum body suitable for use under poor working conditions.
13) Outline dimensions: 132H X 76.2W mm.
14) Weight: 345g

1.2 Main Functions

1) Capable of performing measurements on a wide range of material, including metals, plastic, ceramics, composites, epoxies, glass and other ultrasonic wave well-conductive materials.
2) Four transducer models are available for special applications, including coarse grain material and high temperature applications.
3) Probe-Zero function.
4) Two-Point Calibration feature.
5) Scan mode feature.
6) Coupling status indicator showing the coupling status.
7) Battery information indicates the rest capacity of the battery.
8) Auto sleep and auto power off function to conserve battery life.
9) Optional PC software to process the memory records.

1.3 Measuring Principle

The digital ultrasonic thickness gauge determines the thickness of a part or structure by accurately measuring the time required for a short ultrasonic pulse generated by a transducer to travel through the thickness of the material, reflect from the back or inside surface, and be returned to the transducer. The measured two-way transit time is divided by two to account for the down-and-back travel path, and then multiplied by the velocity of sound in the material. The result is expressed in the well-known relationship:

$$H = \frac{v \times t}{2}$$

Where: H—Thickness of the test piece.
v—Sound Velocity in the material.
t—The measured round-trip transit time.

1.4 Configuration

Table 1-1

	No.	Item	Qty.	Note
Standard Configuration	1	Main Unit	1	
	2	Transducer	1	Model: N05/90°
	3	Couplant	1	
	4	Carry Case	1	
	5	Operating Manual	1	
	6	Screwdriver	1	
	7	Alkaline battery	2	AA size
	8			
Optional Configuration	9	Transducer: N02		See Table3-1
	10	Transducer: N07		
	11	Transducer: HT5		
	12	DataPro for Thickness Gauge	1	PC Software
	13	Communication Cable	1	LEMO to USB-A
	14			

1.5 Operating Conditions

Operating Temperature: －10～+60℃;

Storage Temperature：-30℃～+70℃

Relative Humidity ≤90%;

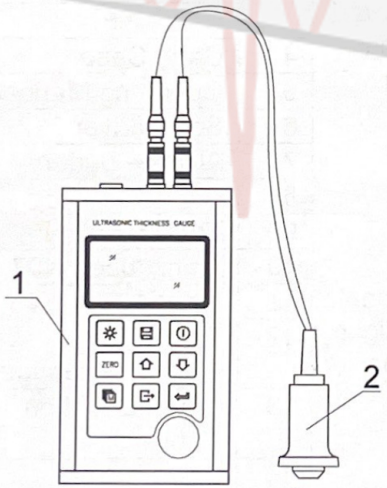
The surrounding environment should avoid of vibration, strong magnetic field, corrosive medium and heavy dust.

2 Structure Feature

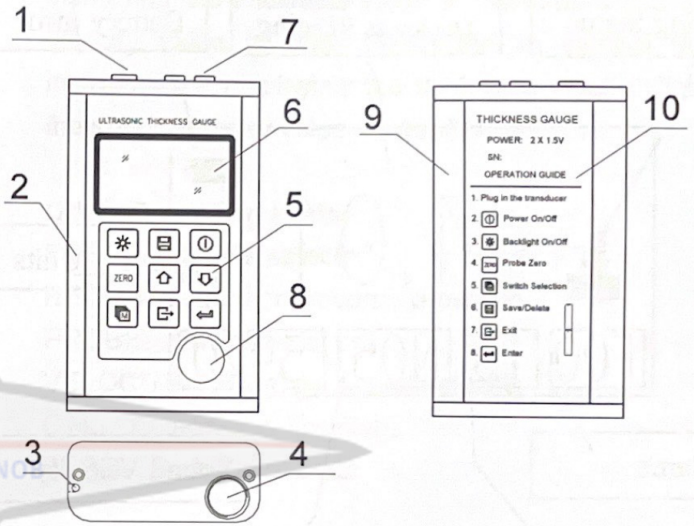
2.1 Instrument Appearance

1 Main Unit

2Transducer (Probe)



2.2 Parts of the Main Unit



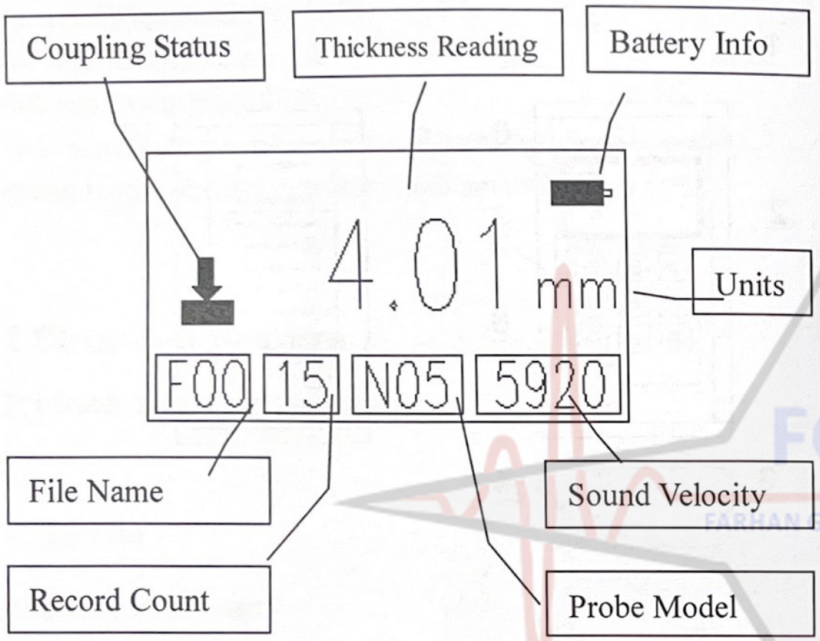
1 Communication Socket 2 Aluminum Case 3 Belt Hole

4 Battery Cover 5 Keypad 6 LCD Display

7 Socket of Transducer (no polarity) 8 Probe zero disc

9 Aluminum Case 10 Label

2.3 Main Screen



Battery Information: Capacity status of the battery.

Coupling Status: Indicate the coupling status. While the gauge is taking a measurement, the coupling status should be on. If it is not on, the gauge is having difficulty achieving a stable measurement, and the thickness value displayed will most likely be erroneous.

File Name: Show current file name.

Record Count: Total record count in current file.

Probe Model: Probe model setting in the instrument.

Sound Velocity: Sound velocity setting inside.

Thickness Reading: Thickness measurement result.

Unit: When the **mm** symbol is on, the instrument is displaying the thickness value in millimeters and the sound velocity value in **m/s**. When the **in** symbol is on, the instrument is displaying the thickness value in inches and the sound velocity value in **inch/us**.

Other Operating Hints:

FILE: Current file selected;

RECORD: Memory records browsing;

PROBE: Transducer set;

VELOCITY: Change sound velocity;

CAL: Two-point calibration;

ZERO: Probe zero state

2.4 Keypad Definition

⏻	Turn the instrument on/off; Exit /Cancel	⏎	Exit/Cancel
☼	Turn on/off the EL backlight	↵	Enter/Confirm
ZERO	Probe Zero operation; Clear files/records	↑	Increase or scroll up
M	Switch selection among items	↓	Decrease or scroll down
💾	Save/Delete file/record		

3 Preparation

3.1 Transducer Selection

The gauge is inherently capable of performing measurements on a wide range of materials, from various metals to glass and plastics. Different types of material, however, will require the use of different transducers. Choosing the correct transducer for a job is critical to being able to easily perform accurate and reliable measurement. The following paragraphs highlight the important properties of transducers, which should be considered when selecting a transducer for a specific job.

Generally speaking, the best transducer for a job is one that sends sufficient ultrasonic energy into the material being measured such that a strong, stable echo is received by the gauge. Several factors affect the strength of ultrasound as it travels. These are outlined below:

Initial Signal Strength. The stronger a signal is to begin with, the stronger its return echo will be. Initial signal strength is largely a factor of the size of the ultrasound emitter in the transducer. A large emitting area will send more energy into the material being measured than a small emitting area. Thus, a so-called “1/2 inch” transducer will emit a stronger signal than a “1/4 inch” transducer.

Absorption and Scattering. As ultrasound travels through any material, it is partly absorbed. If the material through which the sound travels has any grain structure, the sound waves will experience scattering. Both of these

effects reduce the strength of the waves, and thus, the gauge’s ability to detect the returning echo. Higher frequency ultrasound is absorbed and scattered more than ultrasound of a lower frequency. While it may seem that using a lower frequency transducer might be better in every instance, low frequencies are less directional than high frequencies. Thus, a higher frequency transducer would be a better choice for detecting the exact location of small pits or flaws in the material being measured.

Geometry of the transducer. The physical constraints of the measuring environment sometimes determine a transducer’s suitability for a given job. Some transducers may simply be too large to be used in tightly confined areas. Also, the surface area available for contacting with the transducer may be limited, requiring the use of a transducer with a small wearface. Measuring on a curved surface, such as an engine cylinder wall, may require the use of a transducer with a matching curved wearface.

Temperature of the material. When it is necessary to measure on surfaces that are exceedingly hot, high temperature transducers must be used. These transducers are built using special materials and techniques that allow them to withstand high temperatures without damage. Additionally, care must be taken when performing a “Probe-Zero” or “Calibration to Known Thickness” with a high temperature transducer.

Selection of the proper transducer is often a matter of tradeoffs between various characteristics. It may be

necessary to experiment with a variety of transducers in order to find one that works well for a given job.

The transducer is the "business end" of the instrument. It transmits and receives ultrasonic sound waves that the instrument uses to calculate the thickness of the material being measured. The transducer connects to the instrument via the attached cable, and two coaxial connectors. When using transducers, the orientation of the dual coaxial connectors is not critical: either plug may be fitted to either socket in the instrument.

The transducer must be used correctly in order for the instrument to produce accurate, reliable measurements. Below is a short description of the transducer, followed by instructions for its use.

Left figure is a bottom view of a typical transducer. The two semicircles of the wearface are visible, as is the barrier separating them. One of the semicircles is responsible for conducting ultrasonic sound into the material being measured, and the other semicircle is responsible for conducting the echoed sound back into the transducer. When the transducer is placed against the material being measured, it is the area directly beneath the center of the wearface that is being measured.

Right figure is a top view of a typical transducer. Press against the top with the thumb or index finger to hold the

transducer in place. Moderate pressure is sufficient, as it is only necessary to keep the transducer stationary, and the wearface seated flat against the surface of the material being measured.

Table 3-1 Transducer Selection

Model	Freq MHz	Diam mm	Measuring Range	Lower limit	Description
N02	2.5	14	3.0mm～300.0mm（In Steel） 40mm (in Gray Cast Iron HT200)	20	for thick, highly attenuating, or highly scattering materials
N05	5	10	1.2mm～230.0mm（In Steel）	Φ20mm×3.0mm	Normal applications
N05 /90°	5	10	1.2mm～230.0mm（In Steel）	Φ20mm×3.0mm	Normal applications
N07	7	6	0.75mm～80.0mm（In Steel）	Φ15mm×2.0mm	For thin pipe wall or small curvature pipe wall applications
HT5	5	12	3～200mm（In Steel）	30	For high temperature (lower than 300℃) applications.

3.2 Condition and Preparation of Surfaces

In any ultrasonic measurement scenario, the shape and roughness of the test surface are of paramount importance. Rough, uneven surfaces may limit the penetration of ultrasound through the material, and result in unstable, and therefore unreliable, measurements. The surface being measured should be clean, and free of any small particulate matter, rust, or scale. The presence of such obstructions will prevent the transducer from seating properly against the surface. Often, a wire brush or scraper will be helpful in cleaning surfaces. In more extreme cases, rotary sanders or grinding wheels may be used, though care must be taken to prevent surface gouging, which will inhibit proper transducer coupling.

Extremely rough surfaces, such as the pebble-like finish of some cast iron, will prove most difficult to measure. These kinds of surfaces act on the sound beam like frosted glass on light, the beam becomes diffused and scattered in all directions.

In addition to posing obstacles to measurement, rough surfaces contribute to excessive wear of the transducer, particularly in situations where the transducer is “scrubbed” along the surface. Transducers should be inspected on a regular basis, for signs of uneven wear of the wearface. If the wearface is worn on one side more than another, the sound beam penetrating the test material may no longer be perpendicular to the material surface. In this case, it will be difficult to exactly locate tiny irregularities in the material

being measured, as the focus of the sound beam no longer lies directly beneath the transducer.

4 Operation

4.1 Power On/Off

The instrument is turned on by simply pressing ⏻ key. When the gauge is initially turned on, the model type, the manufacture information and the serial number will be displayed prior to entering into the main screen.

The gauge is turned off by keeping pressing down ⏻ key for over two seconds. The tool has a special memory that retains all of its settings even when the power is off.

4.2 Probe Set

The model of the probe should be pre-set to the instrument before measuring operation. This enables the user to select the probe model among supported transducers according to frequency and diameter depending on application requirements. Use the following steps to select your transducer model:

1) On the main screen, press ⧉ key multiple times to activate the 【Probe Model】tab.
2) Press ⇧ or ⇩ key to switch to the desired transducer model.
3) Press ↵ key to confirm the change. Or press ⎋ key to cancel the change.

You can also change the probe model setting by menu operation. Please refer to chapter 5 for the help of menu

operation.

4.3 Probe Zeroing

The PRB key is used to "zero" the instrument in much the same way that a mechanical micrometer is zeroed. If the gauge is not zeroed correctly, all the measurements that the gauge makes may be in error by some fixed value. When the instrument is "zeroed", this fixed error value is measured and automatically corrected for all subsequent measurements. The instrument may be "zeroed " by performing the following procedure.:

1) Plug the transducer into the instrument. Make sure that the connectors are fully engaged. Check that the wearface of the transducer is clean and free of any debris.
2) Change the model of the probe set in the instrument to the model currently using.
3) Apply a single droplet of ultrasonic couplant to the surface of the attached probe-zero disc.
4) Press the transducer against the probe-zero disc, making sure that the transducer sits flat against the surface.
5) While the transducer is firmly coupled to the probe disc, press PRB on the keypad. The instrument will display "ZERO XXX" on the display while it is calculating its zero point. "XXX" stands for the probe model.
6) After the "ZERO XXX" characters disappear, remove the transducer from the probe disc.

At this point, the instrument has successfully calculated its internal error factor, and will compensate for this value in any subsequent measurements. When performing a "probe zero", the instrument will always use the sound velocity value of the built-in probe-zero disc, even if some other velocity value has been entered for making actual measurements. Though the instrument will remember the last "probe zero" performed, it is generally a good idea to perform a "probe zero" whenever the gauge is turned on, as well as any time a different transducer is used. This will ensure that the instrument is always correctly zeroed.

Press PRB key while in probe zeroing state will stop current probe zeroing operation.

4.4 Sound Velocity

In order for the gauge to make accurate measurements, it must be set to the correct sound velocity for the material being measured. Different types of material have different inherent sound velocities. If the gauge is not set to the correct sound velocity, all of the measurements the gauge makes will be erroneous by some fixed percentage. The **One-Point** calibration is the simplest and most commonly used calibration procedure optimizing linearity over large ranges. The **Two-point** calibration allows for greater accuracy over small ranges by calculating the probe zero and velocity.

Note: **One** and **Two** point calibrations must be performed on material with the paint or coating removed. Failure to

remove the paint or coating prior to calibration will result in a multi material velocity calculation that may be different from the actual material velocity intended to be measured.

4.4.1 Calibration to a known thickness

One point calibration applies to this situation. Note: This procedure requires a sample piece of the specific material to be measured, the exact thickness of which is known, e.g. from having been measured by some other means.

1) Perform a Probe-Zero on the attached probe-zero disc.
2) Apply couplant to the sample piece.
3) Press the transducer against the sample piece, making sure that the transducer sits flat against the surface of the sample. The display should show some thickness value, and the coupling status indicator should appear.
4) Having achieved a stable reading, remove the transducer. If the displayed thickness changes from the value shown while the transducer was coupled, repeat step 3.
5) Press [▲] or [▼] key to trigger the calibration process. Use [▲] [▼] and [M] keys to adjust the displayed thickness up or down, until it matches the thickness of the sample piece.
6) Press [↵] key to confirm the adjustment. The gauge is now displaying the calibrated sound velocity value it has calculated based on the thickness value that was entered. The gauge is now ready to perform measurements.

4.4.2 Calibration to a known velocity

Note: This procedure requires that the operator knows the sound velocity of the material to be measured. A list of common materials and their sound velocities can be found in Appendix A of this manual.

1) On the main screen, press [M] key multiple times to highlight the sound velocity item.
2) Press [▲] or [▼] key to open the【Set Velocity】dialog.
3) Press [M] [▲] and [▼] keys to adjust the sound velocity value, until it matches the sound velocity of the material to be measured. Or press [≡] key to select among the preset commonly using velocities.
4) Press [↵] key to confirm the change. Or press [⎋] key to cancel the change. The gauge is now ready to perform measurements.

Another method to set the instrument with a known sound velocity is as following:

1) Open【Test Settings】—>【Velocity Set】submenu, press [↵] to enter the sound velocity set dialog.
2) Use [M] [▲] and [▼] keys to adjust the sound velocity value up or down, until it matches the sound velocity of the material to be measured. Or press [≡] key to select among the preset commonly using velocities.
3) Press [↵] key to confirm the change. Or press [⎋] key to cancel the change.

To achieve the most accurate measurements possible, it is generally advisable to always calibrate the gauge to a sample piece of known thickness. Material composition

(and thus, its sound velocity) sometimes varies from lot to lot and from manufacturer to manufacturer. Calibration to a sample of known thickness will ensure that the gauge is set as closely as possible to the sound velocity of the material to be measured.

4.5 Making Measurements

When the tool is displaying thickness measurements, the display will hold the last value measured, until a new measurement is made.

In order for the transducer to do its job, there must be no air gaps between the wear-face and the surface of the material being measured. This is accomplished with the use of a "coupling" fluid, commonly called "couplant". This fluid serves to "couple", or transfer, the ultrasonic sound waves from the transducer, into the material, and back again. Before attempting to make a measurement, a small amount of couplant should be applied to the surface of the material being measured. Typically, a single droplet of couplant is sufficient.

After applying couplant, press the transducer (wearface down) firmly against the area to be measured. The coupling status indicator should appear, and a number should appear in the display. If the instrument has been properly "zeroed" and set to the correct sound velocity, the number in the display will indicate the actual thickness of the material directly beneath the transducer.

If the coupling status indicator does not appear, or the

numbers on the display seem erratic, firstly check to make sure that there is an adequate film of couplant beneath the transducer, and that the transducer is seated flat against the material. If the condition persists, it may be necessary to select a different transducer (size or frequency) for the material being measured.

While the transducer is in contact with the material that is being measured, the instrument will perform four measurements every second, updating its display as it does so. When the transducer is removed from the surface, the display will hold the last measurement made.

Note: Occasionally, a small film of couplant will be drawn out between the transducer and the surface as the transducer is removed. When this happens, the gauge may perform a measurement through this couplant film, resulting in a measurement that is larger or smaller than it should be. This phenomenon is obvious when one thickness value is observed while the transducer is in place, and another value is observed after the transducer is removed. In addition, measurements through very thick paint or coatings may result in the paint or coating being measured rather than the actual material intended. The responsibility for proper use of the instrument, and recognition of these types of phenomenon, rest solely with the user of the instrument.

4.6 Two Point Calibration

Note: This procedure requires that the operator has two

known thickness points on the test piece or two test pieces that are representative of the range to be measured. Following are the steps of Two-Point Calibration,

1) Perform a Probe-Zero on the built-in probe-zero disc.
2) Apply couplant to the sample piece. Press the transducer against the sample piece, at the first/second calibration point, making sure that the transducer sits flat against the surface of the sample. The display should show some (probably incorrect) thickness value, and the coupling status indicator should appear. Having achieved a stable reading, remove the transducer. If the displayed thickness changes from the value shown while the transducer was coupled, repeat this operation.
3) Press ⇧ or ⇩ key to open the thickness calibration dialog. Use M ⇧ and ⇩ keys to adjust the thickness value up or down, until it matches the nominal thickness of the sample piece at that point.
4) Press PRB key to confirm and continue the calibration to the next point. You many notice the "CAL" characters, which indicating the process of Two-Point calibration, displaying in the sound velocity area of the main screen.
5) Repeat steps 2 through 3 for the calibration of the second test point.
6) Finally press ↵ to complete the calibration. It will automatically calculate the sound velocity of the sample material, which will be applied in subsequent measurement.

The gauge is now ready to perform measurements

within this range.

4.7 Scan mode

While the gauge excels at making single point measurements, it is sometimes desirable to examine a larger region, searching for the thinnest point. The gauge includes a feature, called Scan Mode, which allows it to do just that.

In normal operation, the gauge performs and displays four measurements every second, which is quite adequate for single measurements. In Scan Mode, however, the gauge performs ten measurements every second, and displays the readings while scanning. While the transducer is in contact with the material being measured, the gauge is keeping track of the lowest measurement it finds. The transducer may be “scrubbed” across a surface, and any brief interruptions in the signal will be ignored. When the transducer is removed from the material being scanned, the minimum and maximum measurement will be retained.

Go to 【Test Settings】—>【Scan Mode】menu, press ↵ to toggle between 【On】and【Off】of the Scan Mode function.

While in scan mode, press ⎘ key will clear recent tracking records.

4.8 Limit Set

The Limit feature of the gauge allows the user to set an audible parameter when taking measurements. If a

measurement is beyond the limit range, set by the user, the beeper will sound, if enabled. This improves the speed and efficiency of the inspection process by eliminating constant viewing of the actual reading displayed. The following section outline how to enable and set up this feature:

1) Open 【Test Settings】-> 【Top Limit】.
2) Use [M] [▲] and [▼] keys to change the top limit value to the desired values.
3) Press [↵] key to confirm the change and return to the previous screen, or press [ESC] key to cancel the change.

The operation of setting 【Bottom Limit】follows the same way. If the bottom limit is larger than the upper limit, it will prompts an error information.

4.9 Resolution

The gauge has selectable display resolution, which is 0.1mm and 0.01mm.

Open 【Test Setting】-> 【Resolution】, and select the resolution between the two options.

4.10 Memory Management

4.10.1 Storing a Record

The non-volatile memory space of the gauge is divided into many sections, which are called as files. There are 100 files (F00-F99) that can be used to store the measurement values inside the gauge. At most 100 records can be stored to each file. The following procedures outline this storing process:

1) Perform a measurement on the workpiece.
2) After a new measurement reading appears, press [SAVE] key to save the measurement value to current file.

4.10.2 Managing the Files/Records

On the main screen, press [M] key to highlight the 【File Name】item. Then press [▲] or [▼] key to open the browsing file dialog, where the following operations can be applied,

- Press [CLR] will clear the highlighted file.
- Press [PRG] will clear all the files.
- Press [M] or [↵] will set the highlighted file as current file (marked with a '*' prefix), which will be used as the target file in subsequent storing operations.
- Press [ESC] will exit from the dialog.

On the main screen, press [M] key multiple times until the 【Record Count】 item is highlighted. Then press [▲] or [▼] key to open the browsing records dialog, where the following operations can be applied,

- Press [CLR] will delete the highlighted record.
- Press [PRG] will delete all the records of in the specified file.
- Press [↵] or [ESC] will exit from the dialog.

Another way to browse/manage the stored files/records is by menu operations. Move to the 【Memory Manager】 menu item, then press [↵] to open the files managing dialog

as following,

In the files managing dialog,

- Press [DEL] will clear the highlighted file.
- Press [PRG] will clear all the files.
- Press [M] will set the highlighted file as current file (marked with a '*' icon).
- Press [ENT] will open the records managing dialog.

Files

*F00	4/100
F01	0/100
F02	0/100
F03	0/100
F04	0/100
F05	0/100

In the records managing dialog,

- Press [DEL] will delete the highlighted record.
- Press [PRG] will delete all the records of in the specified file.
- Press [ENT] or [ESC] will exit from the dialog

Records

No.1	12.00mm
No.2	18.95mm
No.3	23.94mm
No.4	29.95mm

4.11 System Set

From the main menu, press [ENT] on the 【System Configuration】item and open its submenus.

1) When 【Key Sound】 is set to 【On】, the buzzer would make a short hoot while press the key each time.
2) When 【Warn Sound】 is set to 【On】, if the measured value exceeds the limit range, the buzzer would make a long hoot.
3) LCD Contrast: In the 【LCD Contrast】dialog, press [▲] to enhance the contrast, or press [▼] to weaken the contrast. Finally press [ENT] to confirm the change, or press [ESC] to cancel the change.
4) Unit System. When the 【Unit System】item is highlighted, press [ENT] key to switch between Imperial and Metric unit system.
5) Date/Time Set. For a correct documentation, make sure to set the correct date and time for the gauge. Once set, the internal clock of the instrument will maintain the current date and time.
6) Language Selection. Two languages optional: Chinese and English.

4.12 Product information

This 【product information】 dialog will display some specific information about the main unit. Some of the information would change with the firmware upgrading.

4.13 EL Backlight

With the background light, it is convenient to work under dark conditions. Press [☼] to switch on/off the background light at any moment as you need after turning on. Since the EL light will consume much power, switch it on only when necessary.

4.14 Auto Power Off

The instrument features an auto power off function designed to conserve battery life. If the tool is idle, without any key operation or measurement, over a specified period of time, it will turn itself off. If the batteries is almost exhausted, it will shut off immediately.

Four options for this function are available: 2 Minutes, 5 Minutes, 10 Minutes and Disable.

4.15 System Reset

Press down the key while turning on the instrument, or trigger the 【System Reset】function through menu operation, will restore factory defaults. All the memory data will be cleared during system reset. The only time this might possibly helpful is if the parameter in the gauge was somehow corrupted.

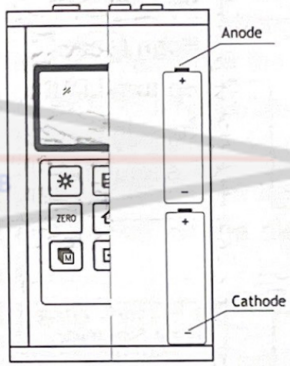
4.16 Connecting to a Computer

The gauge is equipped with an USB2.0 full-speed communication port. Using the accessory cable, the gauge has the ability to connect to a computer. Records data stored in the memory of the gauge can be transferred to the computer through the USB port. Detailed information of the communication software and its usage refer to the software manual.

4.17 Battery Replacement

Two AA size alkaline batteries are needed as the power source. After several hours' usage of the preset batteries, the battery symbol on the screen will be shown as . The more of dark part indicates the more close to full. When the battery capacity runs out, the battery symbol will be shown as . When this occurs, the batteries should be replaced.

Refer to the sketch below during battery replacement. Please pay much attention to the polarity of the battery.

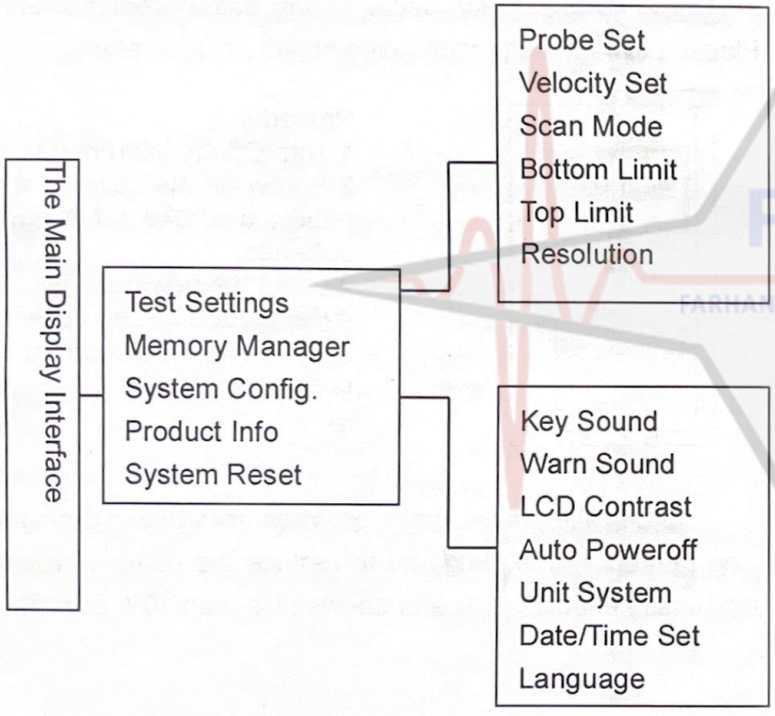


Procedure:
1 Turn Off the instrument,
2 Screw off the cover of the battery and take out the two batteries,
3 Insert the new batteries,
4 Replug the battery cover,
5 Turn on the instrument to check.

Please take out the batteries when not working during a long period of time. Suggest to replace the batteries when the battery capacity indicator shows less than 10% capacity.

5 Menu Operation

Both presetting system parameters and the additional function could come true by menu operation. At the main screen, press key into the main menu.



5.1 Enter the Main Menu

To enter the main menu, just press key to activate the menu items tab while on the main screen. To return back to the previous screen, press key.

5.2 Enter the Sub menu

Press key to enter the submenu screen while the submenu item is selected.

5.3 Change the Parameter

Press key to change the value of a parameter while the item is selected on the parameter set screen.

5.4 Numeric Digit Input

Press key multiple times to highlight the numeric digit to be changed; Press / key to increase/decrease numeric values on the display until it matches the desired value.

5.5 Save and Exit

Press key to confirm the modifying and return back to the previous screen.

5.6 Cancel and Exit

Press key to cancel the change and return back to the previous screen.

6 Servicing

When the hardness tester appears some other abnormal phenomena, please do not dismantle or adjust any fixedly assembled parts. Fill in and present the warranty card to us. The warranty service can be carried on.

7 Transport and Storage

1) Keep it away from vibration, strong magnetic field, corrosive medium, dumpiness and dust. Storage in ordinary temperature.
2) With original packing, transport is allowed on the third grade highway.

Appendix A Sound Velocities

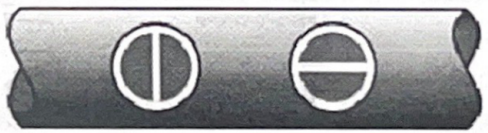
Material	Sound Velocity	
	In/us	m/s
Aluminum	0.250	6340-6400
Steel, common	0.233	5920
Steel, stainless	0.226	5740
Brass	0.173	4399
Copper	0.186	4720
Iron	0.233	5930
Cast Iron	0.173-0.229	4400—5820
Lead	0.094	2400
Nylon	0.105	2680
Silver	0.142	3607
Gold	0.128	3251
Zinc	0.164	4170
Titanium	0.236	5990
Tin	0.117	2960
	0.109	2760
Epoxy resin	0.100	2540
Ice	0.157	3988
Nickel	0.222	5639

Plexiglass	0.106	2692
Polystyrene	0.092	2337
Porcelain	0.230	5842
PVC	0.094	2388
Quartz glass	0.222	5639
Rubber, vulcanized	0.091	2311
Teflon	0.056	1422
Water	0.058	1473

Appendix B Applications Notes

Measuring pipe and tubing.

When measuring a piece of pipe to determine the thickness of the pipe wall, orientation of the transducers is important. If the diameter of the pipe is larger than approximately 4 inches, measurements should be made with the transducer oriented so that the gap in the wearface is perpendicular (at right angle) to the long axis of the pipe. For smaller pipe diameters, two measurements should be performed, one with the wearface gap perpendicular, another with the gap parallel to the long axis of the pipe. The smaller of the two displayed values should then be taken as the thickness at that point.



Perpendicular Parallel

Measuring hot surfaces

The velocity of sound through a substance is dependant upon its temperature. As materials heat up, the velocity of sound through them decreases. In most applications with surface temperatures less than about 100℃, no special procedures must be observed. At temperatures above this point, the change in sound velocity of the material being

measured starts to have a noticeable effect upon ultrasonic measurement. At such elevated temperatures, it is recommended that the user perform a calibration procedure on a sample piece of known thickness, which is at or near the temperature of the material to be measured. This will allow the gauge to correctly calculate the velocity of sound through the hot material.

When performing measurements on hot surfaces, it may also be necessary to use a specially constructed high-temperature transducer. These transducers are built using materials which can withstand high temperatures. Even so, it is recommended that the probe be left in contact with the surface for as short a time as needed to acquire a stable measurement. While the transducer is in contact with a hot surface, it will begin to heat up, and through thermal expansion and other effects, may begin to adversely affect the accuracy of measurements.

Measuring laminated materials.

Laminated materials are unique in that their density (and therefore sound-velocity) may vary considerably from one piece to another. Some laminated materials may even exhibit noticeable changes in sound-velocity across a single surface. The only way to reliably measure such materials is by performing a calibration procedure on a sample piece of known thickness. Ideally, this sample material should be a part of the same piece being measured, or at least from the same lamination batch. By calibrating to each test piece individually, the effects of variation of sound-velocity will be

minimized.

An additional important consideration when measuring laminates, is that any included air gaps or pockets will cause an early reflection of the ultrasound beam. This effect will be noticed as a sudden decrease in thickness in an otherwise regular surface. While this may impede accurate measurement of total material thickness, it does provide the user with positive indication of air gaps in the laminate.

Suitability of materials

Ultrasonic thickness measurements rely on passing a sound wave through the material being measured. Not all materials are good at transmitting sound. Ultrasonic thickness measurement is practical in a wide variety of materials including metals, plastics, and glass. Materials that are difficult include some cast materials, concrete, wood, fiberglass, and some rubber.

Couplants

All ultrasonic applications require some medium to couple the sound from the transducer to the test piece. Typically a high viscosity liquid is used as the medium. The sound used in ultrasonic thickness measurement does not travel through air efficiently.

A wide variety of couplant materials may be used in ultrasonic gauging. Propylene glycol is suitable for most applications. In difficult applications where maximum transfer of sound energy is required, glycerin is recommended. However, on some metals glycerin can promote corrosion by means of water absorption and thus

may be undesirable. Other suitable couplants for measurements at normal temperatures may include water, various oils and greases, gels, and silicone fluids. Measurements at elevated temperatures will require specially formulated high temperature couplants.

Inherent in ultrasonic thickness measurement is the possibility that the instrument will use the second rather than the first echo from the back surface of the material being measured while in standard pulse-echo mode. This may result in a thickness reading that is TWICE what it should be. The Responsibility for proper use of the instrument and recognition of these types of phenomenons rest solely with the user of the instrument.