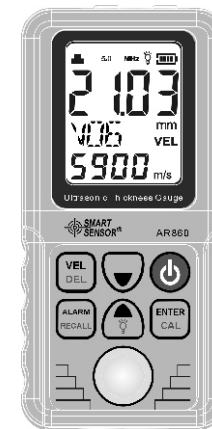


**SMART
SENSOR®**

MODEL: AR860

**Ultrasonic Thickness Gauge
Instruction Manual**



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8. Table of sound velocity

Sound velocity of common materials

Material	Velocity(m/s)	Material	Velocity(m/s)
Aluminum	6320	Acetate resin	2670
Zinc	4170	Phosphor bronze	3530
Silver	3600	Turpentine	4430
Glod	3240	Glass	5440
Tin	3230	Incoloy alloy	5720
Iron/Steel	5900	Magnesium	6310
Brass	4640	Monel alloy	6020
Copper	4700	Nickle	5630
SUS	5790	Steel 4330 (mild)	5850
Acrylic resin	2730	Steel 330	5660
Water (20°C)	1480	Titanium	6070
Glycerinl	1920	Zirconium	4650
soluble glass	2350	Nylon	2620

Specific Declarations:

- a. The product design and the manual updating, repairing by technician authorized by us, do not try any alternations or repair attempts.
- B. Dispose of battery should in accordance with local laws and regulations.



6.6 When the tolerance is over than stated in this manual, please refer to the 3, 4, 5 chapter, in this manual.

6.7 Please contact us or distributor if the following occurs:

- A. Component being destroyed, enable to measure.
- B. Abnormal LCD display.
- C. The tolerance is too big in proper operation.
- D. Malfunction of keypad.

6.8 This gauge is a advanced technology product, the repair-ring only by technician authorized by us, do not try any alterations or repair attempts.

7. Notice

7.1. Warranty policy

Please fill the warranty card with your cachet/chop after purchasing this products, the warranty period for repaired is 12 months form the date of original purchase. During warranty period, product must be returned with the invoice(copy) and warranty card to our customer service department. The product will not be warranted which without the warranty card.

Over warranty period, any repairing / maintenance will charge the fee on the buyer in standard rate by local distributor. The standard rate is not including the accessories which not packing in standard package(For example, abnormality transducer, lengthen lead-wire, special software) .

We disclaims any liability due to: transportation damages; incorrect use or operation; manipulation, alterations or repair attempts; without warranty card, invoice.

7.2. Non-warranty list

LCD, battery, probe, sample block, plastic case, coupling agent

1. Introduction

This unit is an intelligent handheld product, which adopts ultrasonic measuring principle, and is controlled by micro processor, provides quick and precise measurement of thickness for most of industrial material. This unit is widely used in various precise measurement for different hardware / parts in industrial realm; one of its important application is to monitor the level of thickness-decreasing during operation of various and pressure container. Diffusely applied in manufacture fields, metal processing, and commercial inspection.

1. 1 Scope of application

This unit is suitable for measuring materials that are good ultrasonic conductor such as metal, plastic, ceramic, glass etc., as long as the measured part in two parallel surfaces for measurement of thickness. This unit is not suitable for cast iron due to its big crystalloid composition.

1.2 Standard Pack and Diagram of the unit

1.2.1 Standard Pack

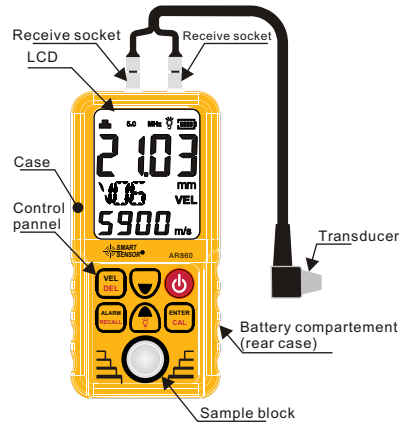
Ultrasonic Thickness Gauge: 1 PCS

Transducer: 2 PCS (Φ10mm 5MHz , Φ6mm 5MHz)

Coupling agent: 1 PCS (50ml)

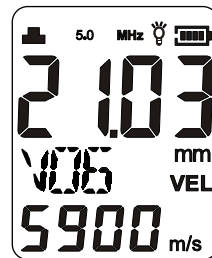
Standard sample block: 4mm 1PCS

1. 2.2 Diagram of the unit



1.3 LCD display:

- Battery power
- Coupling indicator
- m/s ---- Sound velocity unit
- mm ---- Thickness unit
- VEL ---- Sound velocity indicator
- Back light icon
- 5.0 MHz ---- Transducer Frequency
- Velocity stored unit



LCD display

6. Maintain

6.1 Battery replacement

When low battery icon is showed, please replace the batteries.

- A. Press to turn off.
- B. Open the battery door properly.
- C. Replace the low power batteries by new batteries.

When the gauge is not use for long period, please take out the batteries.

6.2 Protection of transducer

Because the wearface of transducer is propylene material which easy to be scratched. During taking measurement on rough material, please using the transducer in gentle motion. The temperature of the hardware should not over 60°C, otherwise it will cause damage on the transducer. Adhering oil, dust on the wear face will speed up aging of transducer and lead to rupture. Clean the lead-wire & transducer after use.

6.3 Cleaning the cabinet

Do not use solvent/alcohol for cleaning which erode the cabinet & LCD window, brush and sweep only with a moist cotton cloth.

6.4 Cleaning the sample block

Because of coupling agent should be put on the sample block during calibration, after use the sample block should be cleaned for preventing rust. In higher temperature environment, be sure protect the block from the droplet of water. If the gauge is not use for a long period, please apply some antirust on the sample block.

6.5 Avoid shocking/impact. Do not store the unit in high humidity environment.

5.6 Multilayer / composite material

It is impossible to read out the thickness of the uncoupled multilayer for the ultrasonic wave cannot go through the uncoupled space. Further more, the sonic wave cannot travel in the composite material at an even speed, so ultrasonic reflect principle cannot be applied to measure the multilayer/composite material.

5.7 Influence from the oxidized surface

For some metals, such as aluminum a layer of oxide being generated on their surface. The oxidized layer combined with the substrate tightly, but the sonic wave travel within 2 different material which will lead to error reading, the more oxidized layer the reading will be more tolerant. Please calibrated the unit with the sample block that pick up along the hardware to be measured, and obtain the thick of sample block by using micrometer.

5.8 Abnormal reading







A seasoned operator should be capable to distinguish the abnormal reading, practically result from rusting, erosive recess surface / incorrect calibrate sample block/the inner flaw of material.

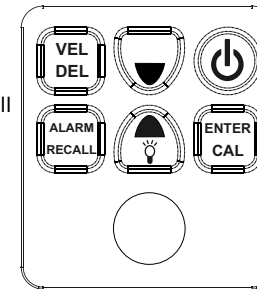
5.9 Choose and using coupling agent

Coupling agent serves the high frequency ultrasonic wave transmitting between the transducer to the hardware. Choose incorrect agent or wrong operation may cause error or poor coupling which lead to failure of measuring. The coupling agent should be used in proper way, typically, a single droplet of agent is sufficient.

It is important to use proper coupling agent, low viscosity agent (the provided agent / machining oil) is suitable for smooth surface. For rough / vertical / aluminum surface, high viscosity agent like glycerin and lubrication grease is applicable. All kinds of coupling agent is available in local market, you can buy it from local distributor as well.

1.4 Control Panel:

-  -- ON/OFF
-  -- Alarm set-up/Data recall
-  -- Velocity set-up/ Select / Stored data select
-  -- Enter / Calibration
-  -- Velocity / Thickness / Alarm adjust
-  -- Velocity / Thickness / Alarm adjust and Back light ON/OFF



Control Panel

1.5 Features and Functions

- ① Auto calibration to assure the accuracy
- ② Sound velocity measurement: with a given thickness to measure the sound velocity to improve accuracy
- ③ 12 sound velocities for different material
- ④ Coupling status indication
- ⑤ 12 thickness measurement data store and recall
- ⑥ Thickness alarm setup
- ⑦ Back light function
- ⑧ Low battery indication
- ⑨ Auto power off

2. Specification

- ① Measuring range: 1.00 to 300.0mm(steel)
- ② Accuracy: $\pm(1\%H+0.1\text{mm})$
- ③ Resolution: 0.01mm(1.00 to 99.99mm)
0.1mm(100 to 300mm)
- ④ Minimum limit for tube measuring (steel) :
 $\Phi 15*2.0\text{mm}(\Phi 6 \text{ transducer})$
 $\Phi 20*3.0\text{mm}(\Phi 10 \text{ transducer})$
- ⑤ Sound velocity: 1000 to 9999m/s
Thickness $\leq 20\text{mm}$, accuracy of velocity: $\pm 1\text{mm}/H * 100\%$
Thickness $\geq 20\text{mm}$ 时, accuracy of velocity: $\pm 5\%$
- ⑥ Operating environment :
Operation temperature: 0 to 40°C
Temperature of workpiece: $<60^\circ\text{C}$
Relative Humidity: $<90\%$
Do not apply in violent vibration / erosive material
Avoid impact and humidity
- ⑦ Power supply: 1.5V AAA * 3 PCS
- ⑧ Operation current: $\leq 35\text{mA}$ (with back light on)

4.10 The wear of the transducer will effect the measurement, when below situation happen, please replace the transducer:
A) only display one reading when measured different thickness
B) reading display without take measurement

4.11. Selection of transducer

ITEM	Characteristic	Range	Operation temperature
5MHZ $\Phi 10\text{mm}$	General-purpose	1.00mm to 300.0mm(steel)	-10 to 60°C
5MHZ $\Phi 6\text{mm}$	Thin workpeice	1.00mm to 50.0mm(steel)	-10 to 60°C
2.5MHZ $\Phi 10\text{mm}$	General-purpose	1.00mm to 300.0mm(steel)	-10 to 60°C

5. Precautions for accuracy

5.1 For very thin material

Any ultrasonic thickness gauge, when the thickness of the material to be measured is less than the minimum limit the fault reading will occurs. Using sample block compare method to get a minimum limit of this material.

5.2 For stained, rusting surface

The stained/rusting surface on the contra side will occurs the ruleless wrong readings. Sometimes a small stained spot is hard to find out. Take care for measurement while measuring the known rusting spot/suspicious area. Or using sound insulation board celotex to locates the spot in different testing angles.

5.3 Identify different velocity with vary material

A fault reading would obtains, when measuring the hardware with the velocity calibrated by prior material. So a correct velocity should be adopted. The fault reading may also result form the difference between the actual velocity with the calibrated value.

5.4 Abrasion fo the transducer

Because the transducer is made of propylene, long period use will cause the surface of transducer became more rough which will decline the sensitivity lead to the wrong reading. Please polish the surface with sand paper or whetstone to assure the smoothness and parallel. If the reading still unsteady, the transducer should be replaced with new one.

5.5 ZERO function

ZERO(calibration) is used to calibrate the unit with the standard block on the panel, do press this key for calibration with other materials or will the wrong measuring will take place.

4.7 Influence of the material temperature

The size & sound velocity of material will change with the temperature, when the precision is critical, please make measurement in 2 samples of the material under the same temperature to determine the proper reading resulting from the temperature. When taking measurement for steel parts in high temperature, this method may be adopted to obtain the correct reading.

4.8 High acoustic reduction material

For materials in fiber, poriferous or big granular, acoustic dispersion will cause the energy attenuation that may result in abnormal readings (practically the reading less than the actual thickness), in this case the material is not suitable for the unit.


4.9 Reference sample block

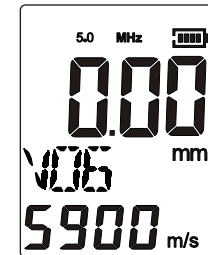
For calibration for the gauge, a given thickness or sound velocity of the material is very important. Calibration needs at least one referring standard sample block. This gauge is provided with a 4.0mm sample block, please check for calibration operations. In different material & situation, only one sample block may not satisfy every calibration. The more similar sample block, the more exact reading obtained. Ideally, referring block is a group of different thickness and same material, by calibrating to the referring block, the effect of variation of sound velocity will be minimized. To get the most exact measure, a set of referring block is very important.

When measuring thin material which thickness close to the minimum limit range of this unit, please use a referring block to define exact limit of this material. Do not measuring the material that the thickness under the minimum limit.

3. Operation Instruction





3.1. Before measurement

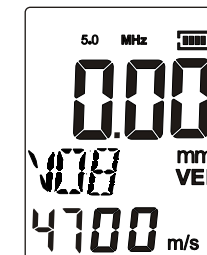
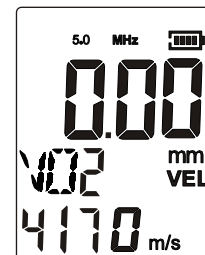
(1). Connect the transducer with the unit, press  to turn on, LCD with full screen display with back light for 0.5 second, then LCD display the last applied sound velocity, now the unit is ready for use.



Ready to use





(2). Sound velocity selection

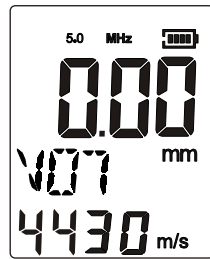
Press  twice to enter sound velocity adjustment with **VEL** icon blinking, press  and  to select your desired velocity, to finish the selection by press .



Velocity selection

(3) Sound velocity adjustment

Press  one time to enter velocity adjustment with stored velocity unit blinking, press  and  to adjust the velocity to obtain desired value then press  to finish the adjustment. The revised velocity will be saved into the unit.



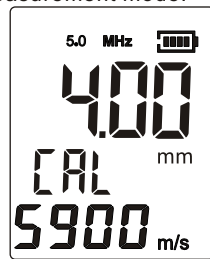
Before adjustment



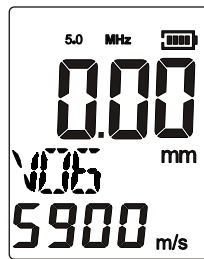
After adjustment

3.2. Calibration

On normal status, press  for 3 second CAL symbol shows in LCD with 5900 m/s velocity and 4.00 mm display. Use the standard sample block for calibration, until CAL symbol disappeared, press  or  to enter measurement mode.



Ready to calibration



Ready to use

4. Measurement Tips

4.1 Cleaning surface

Before measuring, the dust, dirt, rusting and grease etc that adheres on the hardware/workpiece must be removed off and cleaned.

4.2 Decreasing the roughness of surface

Too rough surface may result in measure error/ fault reading. Please try to make the surface smooth by milling, polishing, filling or using high viscosity coupling agent.

4.3 Rough machining surface

The regular tiny texture/slots resulting from rough machining process may cause error, and the compensation method is the same as in 4.2, adjusting the angle between the crosstalk segregating board of the transducer a metal membrane crossing the detector bottom centre and linear texture/slots (parallel or vertically) may also get a better result.

4.4 Measuring pipe and tubing

When measuring cylindrical parts to determine the thickness of the pipe wall, orientation of the transducers is important. If the diameter of the pipe is large 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 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.


4.5 Complex shape material

For complex shape material measurement, please refer to the 4.4, the smaller of the two reading should then be taken as the thickness.

4.6 Non-parallel surface

To get a satisfying ultrasonic response, the surface must have its one measuring side parallel with another, otherwise will obtain wrong result.

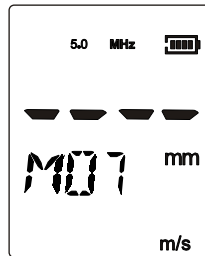
3.8. Data delete:

(1) Press  for 3 second will clear all stored data, [L- symbol will show on LCD.

(2) In data recall mode, press  will delete current stored data. After delete data, the vacant memory will display ---- on the LCD.



Clear all data






Delete current data



3.9. Low battery indication

When battery power down to $3.3V \pm 0.2V$, the low battery icon will display, please replace the batteries for further measurement.



3.10. Back light selection

In power off status, press  +  to turn on the unit, select back light on/off function. The back light will be activated for 10 seconds in operations.

3.11. Turn off: Press  to turn off/on the unit. The unit will be auto turn off in 1 minute without any operation.

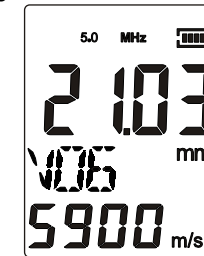
Remark: Press  and  to adjust/select different velocity or thickness.

3.3 Thickness measurement

Put few coupling agent on the area to be measured to couple the transducer with the hardware/workpiece, LCD will display the thickness reading. During measurement,  indicates a well coupling, if the icon flashed or not shows means a poor coupling, after remove transducer, the reading will hold without .



In a well coupling measurement






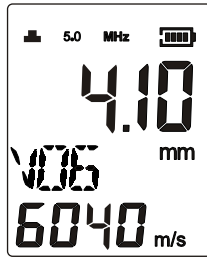
Measurement accomplished

REMARK: (1) To select / adjust the velocity as the table of sound velocity for thickness measurement, but the actual velocity in the hardware / workpiece will slightly different, in this case the reading of thickness not very accurately.

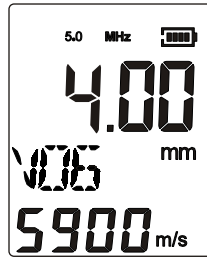
(2) Select a sample block with same material to the hardware or workpiece to be measured to read out the velocity, then apply this velocity for thickness measurement, in this way the reading of thickness much more accurately.

3.4. Velocity measurement

With a given thickness to read out velocity of material: Obtain the thickness of material by using vernier caliper / micrometer, then couple the transducer with that sample material until a thickness displays, press  or  to adjust the reading match the thickness by caliper/micrometer, then press  to display the velocity and save in current velocity memory unit.



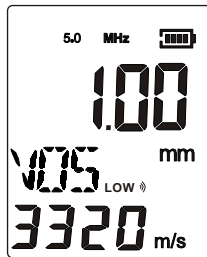
Thickness measurement



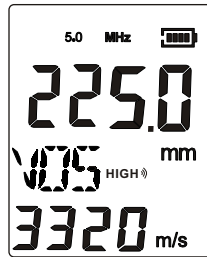
Velocity measurement

3.5. Thickness alarm set-up

Press will enter LOW thickness alarm set-up, press and to adjust the limit, then press to confirmed. Then will turn into HIGH thickness alarm set-up, press to save the setting as default alarm. During measurement, if the thickness over/under the setting limit, BIBI sounds and HIGH/LOW will indicate for alarming.



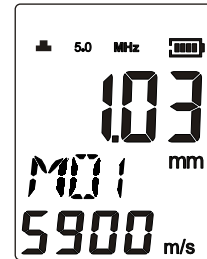
Low Limit set-up



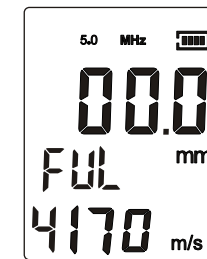
High Limit set-up

3.6. Thickness data storage

During measurement, press once to save the thickness reading, if a FUL symbol show in the LCD that indicates the memory is full.



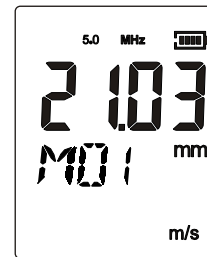
Data store



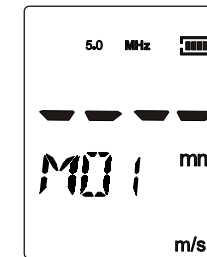
Memory full

3.7. Store thickness data record

Press for 3 seconds to enter data record mode, press and to review M01 to M12 stored data. If the memory unit is vacant, LCD will display ----, press again turn to normal status.



Data recall



Vacant Memory