MODEL: GT1201

Ultrasonic Thickness Gauge
Instruction Manual

CONTENTS

A. Introduction

The intelligent and hand-held ultrasonic thickness gauge is controlled by a microprocessor, which can measure thickness and sound speed of various materials quickly, accurately and without damage by ultrasonic measurement. This instrument is capable of accurate measurement for different materials or parts in industrial production, as well as monitoring pipelines and pressure vessels of production equipment, and corrosion degree of various parts in use. It can also be widely used in manufacturing, metal processing, commodity inspection and other testing areas. Any material that allows ultrasonic to transmit at a constant speed and that is distinguishable from waves reflected from the back side is applicable to this instrument.

Application scope:

The thickness of any good conductor for ultrasonic waves with top and bottom surfaces parallel to each other, like metal, plastic, ceramic and glass, can be measured with the instrument. For example: aluminum, copper, gold, resin, water, glycerin, etc.

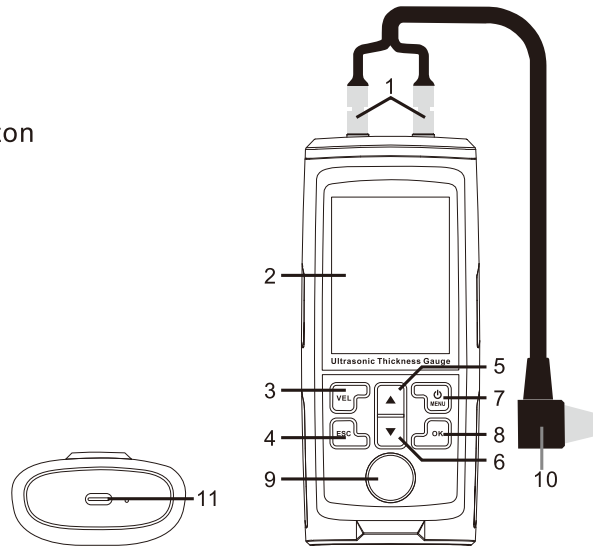
The internal particles of cast iron are too big for this instrument!

B. Feature

1. Measure thickness of various materials with different sound velocities. 12 preset material sound velocities, 3 custom sound velocities available.
2. Adapted probe: 5Md10, 5Md6, 2.5M, high temperature
3. Manual/automatic storage
4. Exceeding high/low limit triggers alarm with a beep sound when the alarm sound is enabled; measurement value displayed in red.
5. When the high/low limit is exceeded, the alarm will sound when the alarm tone is turned on, and the measurement value will be displayed in red.
6. Automatic shutdown can be set: 5 minutes, 10 minutes, 30 minutes, never.
7. LCD backlight: constant backlight, high brightness.
8. Maximum/minimum/average

C. Name of parts

1. Probe socket
2. Display
3. VEL button: Sound speed adjustment button
4. ESC: Exit button
5. ▲ button: Up button/Value increased
6. ▼ button: Down button/value decreases
7. ⏻ /MENU button: Power/MENU button
8. OK button: Confirm button
9. Calibration sample
10. Probe
11. USB port



D. Technical parameters

Measurement range	1.00~300.0mm(steel)
Data storage	1500
Operation frequency	5MHz / 2.5MHz
Measurement error	±(0.5%H+0.05)mm
Measurement resolution	0.01mm(1.00~99.99mm) / 0.1mm(100~300mm)
Lower limit of pipe	Φ20x3mm(steel)
Sound speed measurement	1000~9999m/s
Operating temperature	0~40℃
Battery	1000mAh 3.7V Lithium battery
USB charging	5V 1A
Dimensions	150.6*65.3*35mm
Weight	158g

Probe	Range	Notes
5Md10	1.00~300.0mm(steel)	Factory standard configuration
5Md6	1.0~50.0mm(steel)	Selective configuration
2.5M	1.2~300.0mm(steel)	Selective configuration
High temperature	1.2~300.0mm(steel)	Selective configuration

*Out of measurement range, display [OL].

E. Operation instructions

1. Power on/off

(1) Power on: When shutting down, short press ⏻/MENU button to turn on.

(2) Shutdown: When turning on, long press ⏻/MENU button to shut down.

2. Measurement

(1) Turn on the machine and correctly connect the host and the probe.

(2) Apply coupling agent evenly on the surface of the object to be measured, and gently press the probe on the surface of the object with coupling agent applied to measure the thickness of the object.

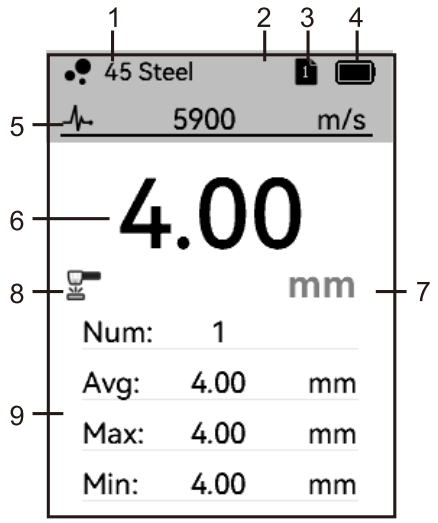
⚠ Notice:

a. After connecting the probe, enter the main menu and select the corresponding material sound velocity and probe, otherwise the measurement results will be affected.

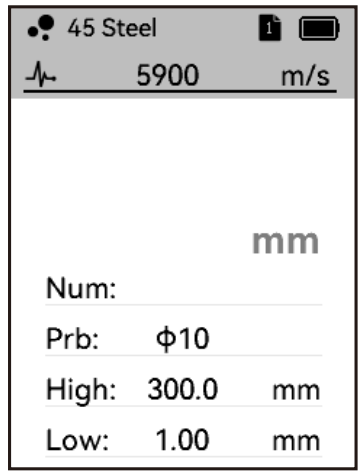
b. When measuring, pay attention to the battery power. If the power is low, please charge it in time to avoid affecting the measurement results.

F. Measurement interface

1. Selected material
2. Automatic save icon
3. File number
4. Battery level
5. Material sound velocity
6. Measurement value
7. Measurement unit
8. Coupling icon
9. Measurement information: During measurement, short press ▲/▼ button to switch between measurement interface 1/measurement interface 2



Measurement interface 1



Measurement interface 2

(1) Measurement interface 1

a. Count: number of measurements.

b. Average/Maximum/Minimum:average / maximum / minimum value of single data set.

(2) Measurement interface 2

a. Probe: select connected probe in main menu.

b. High limit/Low limit: values set in main menu.

G. Measurement interface menu operation

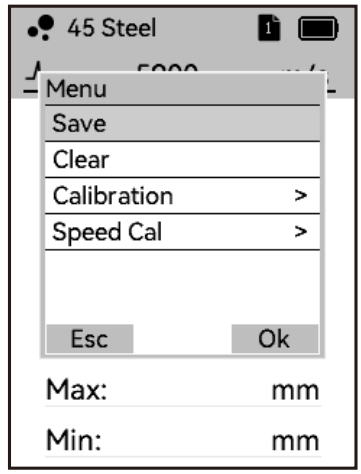
1. In measurement interface, short press ESC button to enter measurement interface menu, short press ESC button again to exit measurement interface menu.

2. Save:

Use this option to manually save the current measurement value to the selected file after measurement. If the selected file is used up, it will not be automatically stored to another file. Select a file with sufficient space to save the file.

3. Clear:

Only the measured data on the test page is cleared. The data saved in the file is not cleared.



Measurement interface menu

4. Calibration: Calibrate the instrument.

a. Connect the probe and apply an appropriate amount of coupling agent on the calibration block of the host.

b. Enter the calibration interface: enter the measurement interface menu - calibration interface, calibrate the velocity to 5900m/s, and calibrate the thickness to 4mm.

c. Gently press the probe on the calibration block, wait for the progress bar below the interface to fill up, and the calibration is completed. The interface will automatically switch to the measurement interface.

5. Sound velocity calibration: Sound velocity calibration of the material.

(1) Applicable Scenario: The materials built into the machine have a reference sound velocity. In actual measurement, the sound velocity of the material may deviate from the built-in velocity, or the measured material may not be in the built-in material list. At this time, you can choose a similar material or customize the sound velocity for sound velocity calibration to obtain a more accurate sound velocity of the measured material.

(2) Preparations before sound velocity calibration:

a. A measured material with a known thickness, with a thickness of over 20mm is needed.

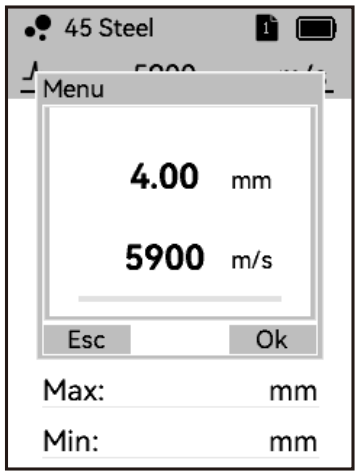
b. Select a similar material or sound velocity for one measurement first.

c. Perform sound velocity calibration.

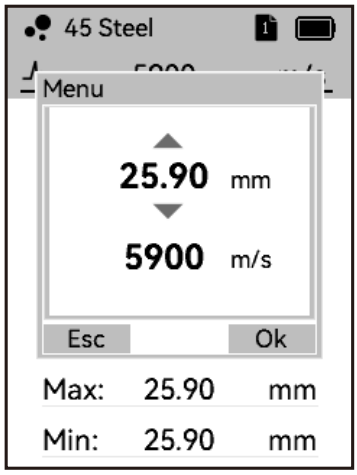
(3) Performing sound velocity calibration: Measurement interface menu - Sound velocity calibration interface. Assuming the known material is steel with a thickness of 25mm, you can select the preset material "45 steel" with a velocity of 5900m/s for one measurement, and the measurement result is 25.9mm.

a. According to the assumptions, enter the sound velocity calibration (as shown in the "Sound Velocity Calibration Interface" diagram).

b. Short press the ▼ button at this time to adjust the displayed value to 25mm. The sound velocity value below will change according to the adjusted value. After the adjustment is completed, short press the OK button to complete the sound velocity calibration.



Calibration interface



Sound velocity calibration

H. Main menu function operation

1. Operation:

(1) Enter the main menu: In the measurement interface, short press the ⏻/MENU button to enter the main menu.

(2) Select menu item: In the menu interface, short press the ▲ / ▼button to select the menu item.

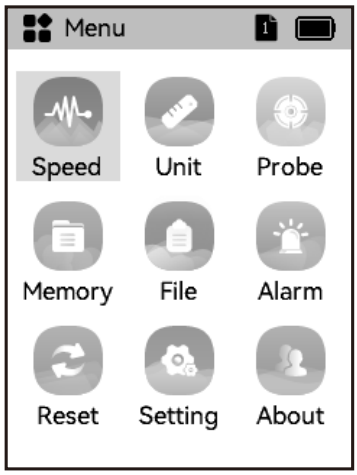
(3) Enter menu item: Short press the OK button to enter the selected menu item.

(4) Exit menu item: Short press the ESC button to return to the previous level menu.

2. Sound Velocity:

(1) In the measurement interface, short press the VEL button to quickly enter the sound velocity selection.

(2) In the main menu interface, short press the OK button to select, short press the ▲ / ▼ button to set the sound velocity value (long press to quickly adjust the value),



Main menu interface

short press the ESC button to confirm and exit the sound velocity setting.

(3) 12 preset material sound velocities, 3 custom sound velocities available.

(4) The selected sound velocity will be displayed on the measurement interface, sound velocity unit: m/s.

3. Units:

Thickness unit, short press the ▲ / ▼ button to switch between millimeters (mm)/inches (in), short press OK button to confirm, short press ESC button to exit.

4. Probe:

Short press the ▲ / ▼ button to switch between 5Md10, 5Md6, 2.5M, high temperature.

5. Storage:

(1) Save file: Short press the ▲ / ▼ button to select the storage file number (1~15); each file can store up to 100 data entries.

(2) Clear file: Short press the ▲ / ▼ button to select the storage file number, short press OK button to clear the selected file data.

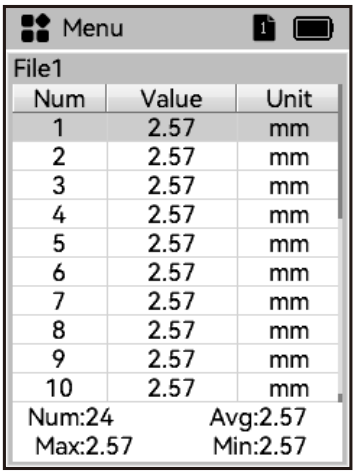
(3) Auto-save: Short press OK button to enable/disable automatic data storage (if enabled, measured values are automatically saved to the selected file).

6. File:

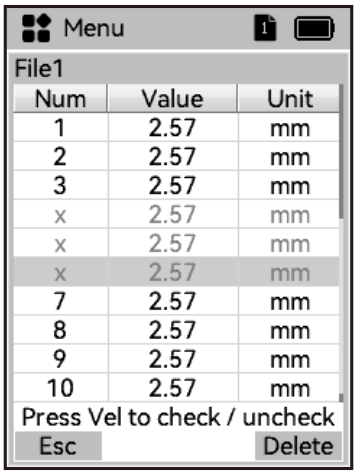
(1) View maximum, minimum, and average values of stored file data.

(2) Short press the VEL button to select data for deletion, short press OK button to delete the selected data.

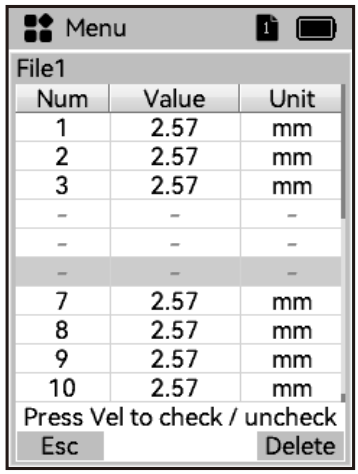
(3) Maximum of 15 files can be stored, each file can save up to 100 data entries.



Check file



Select the data to be deleted



Delete the selected data

7. Alarm:

(1) Alarm sound: Short press OK button to enable/disable the alarm sound; when the alarm sound is enabled, exceeding the high/low limit results in a beep sound.

(2) High limit/low limit: Short press OK button to select, short press the ▲ / ▼ button to set the sound velocity value (long press for quick adjustment); during measurement, exceeding the high/low limit results in the value displayed in red.

8. Reset: Restore factory settings.

9. Settings:
(1) Language: Choose between Chinese and English.
(2) Shutdown time: Set automatic shutdown time: 5 minutes, 10 minutes, 30 minutes, never.
(3) Keypad sound: Enable/disable keypad sound.
(4) Backlight: Choose between constant backlight, high brightness.

10. About: View the version number of this machine.

I. PC software

Enter the website "www.benetechco.net" in the browser, press enter and enter the page to find the menu "Support"-"Download Catalog".Click into the page to find the software installation package "Ultrasonic Thickness Gauge 1201.zip". Click the download button to directly extract the "zip package" after downloading. Double click on "setup_Ultrasonic Thickness Gauge.exe" to install.

J. Technology of measurement

1. Clean surface

Before measurement, all the dust, dirt and rust on the surface of the object to be tested should be cleaned, and the covering such as paint should be removed.

2. Reduce roughness

Excessively rough surfaces can cause measurement errors or no readings on the instrument. Before measurement, the material surface should be as smooth as possible through sanding, grinding, polishing, rasping, or using high-viscosity coupling agent.

3. Surface made by crude machinery:

Regular fine grooves on surfaces made by crude machinery (such as lathe or planer) can also cause measurement errors,and the correction way is the same as "J. Technology of measurement - 2.Reduce roughness"; besides, adjust the angle between the crosstalk spacer of probe (metal folium in the middle of the probe bottom) and the fine groove of the tested material (orthogonal or parallel) may also achieve better results.

4. Measurement of cylindrical surface:

To measure cylindrical objects, such as pipes, oil drums and so on, it is important to adjust the angle between the crosstalk spacer of probe and the axis of the tested material. Briefly,coupling the probe to the tested material, the crosstalk spacer of probe is parallel or perpendicular to the axis of the tested material. Slowly move the probe perpendicular to the axis of the tested material, and the readings on the screen will change regularly. Select the minimum value among readings as the accurate thickness of the material.

The criterion for selecting the direction of the crosstalk spacer of probe and the axis of the tested material depends on the curvature of the material. For the pipe with larger diameter, the crosstalk spacer of probe should be perpendicular to the axis of the pipe;

for the pipe with smaller diameter, the crosstalk spacer of probe can be either parallel or vertical to the axis of material.The minimum reading is selected as the measured thickness.

5. Measurement of composite shape:

When measuring materials of composite shapes (such as elbow of pipe), the method described in "J. Technology of measurement - 4. Measurement of cylindrical surface" can be adopted,except that the measurement should be performed for two times to get two readings by placing the crosstalk spacer of probe vertical or parallel with the axis, the smaller of which is the thickness of the measured point.

6. Non-parallel surfaces:

In order to obtain a satisfactory ultrasonic response, the other surface of the material to be tested must be parallel or coaxial with the surface to be measured, otherwise it will cause measurement errors or no reading.

7. Effects of material's temperature:

The thickness of material and the transmission speed of ultrasonic wave are affected by temperature. For high measurement accuracy, separately measure samples of the same material under the same temperature condition, then calculate the measurement error caused by temperature, and correct error with parameterS.For steel, high temperatures will cause big error (measured values are smaller than actual data), and this way can also be used to correct errors.

8. Materials of attenuation:

For some materials with fibers, pores, and coarse particles, they cause great scattering and energy attenuation of ultrasonic waves, resulting in abnormal readings or even no readings (usually the abnormal reading is smaller than the actual thickness), in which case the material is not suitable to be tested with this thickness gauge.

9. Samples for reference:

A material of known thickness or sound speed helps calibrate the instrument.At least one sample for reference is required to calibrate the instrument. The ultrasonic thickness gauge is equipped with a steel sample with thickness of 4.0 mm. Please refer to calibration instruction in "G. Measurement interface menu operation - 4. Calibration".

K. Avoid measurement error

1. Ultra-thin material

With any ultrasonic thickness gauge, if the thickness of the tested material falls below the probe's lower limit, measurement errors will appear. If necessary, the minimum thickness limit can be measured by sample comparison.

When measuring ultra-thin materials, sometimes an error called "double refraction" occurs, in which the measured value is equal to twice the actual thickness. Another error is called "pulse envelope and loop jump", in which the measured value is bigger than the actual thickness. To avoid such errors, repeat checking measurement of critical thin material.

2. Rust spots and corrosion pits

Rust spots and corrosion pits on the other surface of the tested material will cause readings to change irregularly or no reading in extreme cases, and small rust spots are sometimes difficult to detect. When pits are found or suspected, be careful with the measurement of this area, and place the crosstalk spacer of probe at different angles for multiple tests.

3. Material identification error

If you have calibrated the instrument with one material and use it to test another material, an erroneous result will occur. You should be careful when selecting the correct sound speed. Or, if the sound speed in the actual test displays certain deviation from that of calibration, errors may also occur. Please make adjustment in use.

4. Probe abrasion

The surface of probe is made of acrylic resin. After the instrument is used for a long time, the roughness of probe surface will increase, resulting in a decrease of sensitivity. If the user can determine errors caused by this, the probe surface can be polished with a small amount of 500# sandpaper or whetstone to smooth surface and ensure parallelism. If the result is still unstable, you may need to replace the probe.

5. Laminated material, composite material

It is impossible to measure uncoupled laminate materials because ultrasonic waves cannot penetrate the uncoupled space. Since ultrasonic waves cannot transmit at a constant velocity in composite materials, instruments that measure thickness by ultrasonic reflection are not suitable for measuring laminated materials and composite materials.

6. Effects of oxide layer on metal surface

Some metals can produce a dense oxide layer on the surface, such as aluminum. This layer of oxide is tightly bonded to the substrate with no obvious interface. However,the transmission speed of ultrasonic waves in these two substances is different, thus resulting in errors. Different thickness of oxide layer causes different errors, to which the user shall pay attention. You can carve a piece of the same material with a micrometer or caliper as sample to calibrate the instrument.

7. Use and selection of coupling agent

Coupling agent is used to transfer high-frequency ultrasonic energy between the probe and the tested material. Inappropriate type or improper usage may cause errors or failed measurement with lable of coupling agent flashing. It should be used in an appropriate amount and applied evenly.

Coupling agent is usually applied to the surface of tested material. When the temperature is high, coupling agent is applied to the bottom of probe.

It is important to choose the right type of coupling agent. For materials with smooth surface, coupling agents of low viscosity (such as randomly mixed coupling agent, light machine oil,etc.) are suitable. For rough surface, vertical surface and top surface or aluminum, higher-viscosity coupling agents (such as glycerin creams, greases, etc.) can be used.

Coupling agents of various formulations are available in many places.

L. Sound velocities 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
Gold	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℃)	1480	Titanium	6070
Glycerinl	1920	Zirconium	4650
Soluble glass	2350	Nylon	2620

M. Attention

1. Probe protection:
   The surface of the probe is acryl resin, which is sensitive to grooves on rough surface and should be handled with care in use. When measuring rough surface, please reduce the slide of probe on the surface; the surface temperature of the measured object should not exceed 60℃ (high temperature probe for high temperature surface), otherwise the probe will fail to work; oil and dust on the surface will gradually age the cable in probe, and cause it to break. So clean the dirt on cable after use.
2. Cleaning product:
   Alcohol and diluents have a corrosive effect on product, especially the Display, so when cleaning product, gently wipe it with a little water.
3. Cleaning of calibration sample:
   When using random calibration sample to calibrate the instrument, apply coupling agent to prevent it from rusting. After finishing, please wipe coupling agent off test sample. Do not drip sweat on calibration sample when the temperature is high. If it is not in use for a long time, apply a little fat oil on the surface of random calibration sample (all kinds of anti-rust oil will also do). When using it again, please wipe anti-rust oil off calibration sample first and then start to perform.
4. Please keep the instrument away from flammable or explosive environment.
5. Please keep the instrument away from strong impact, high temperature and water immersion.
6. Please keep the instrument away from dangerous voltage in ase of accidents.
7. Please do not disassemble the instrument or try to change internal parts.

Specific Declarations:

Our company shall hold no any responisibility resulting from using output from this product as an direct or indirect evidence.

We reserves the right to modify product design and specification without notice.

Version: GT1201-EN-01