Ultrasonic Thickness Gauge
MT200

User's Manual

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1 Overview

The Mitech model MT200 is a digital ultrasonic thickness gauge. Based on the same operating principles as SONAR, the MT200 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

- Display：128×64 dot matrix LCD with EL backlight.
- Measuring Range：(0.75～300)mm (in Steel).
- Sound Velocity Range: 1000~9999 m/s.
- Resolution：0.1mm/0.01mm（selectable）.
- Accuracy： ±（0.5%Thickness+0.04）mm
- Units: Metric/English unit selectable.
- Four measurements readings per second for single point measurement, and ten per second for Scan Mode.
- Memory for 20 files (up to 99 values for each file) of stored values.
- Upper and lower limit can be pre-set. It will alarm automatically when the result value exceeding the limit.
- Power Supply： Two “AA” size, 1.5 volt alkaline batteries. 100 hours typical operating time (EL backlight off).
- Communication：RS232 serial port.
- Case：Extruded aluminum body suitable for use under poor working conditions.
- Outline dimensions：132mm X 76.2 mm.
- Weight：345g

1.2 Main Functions

- Capable of performing measurements on a wide range of material, including metals, plastic, ceramics, composites, epoxies, glass and other ultrasonic wave well-conductive materials.
- Four transducer models are available for special application, including for coarse grain material and high temperature applications.
- Probe-Zero function, Sound-Velocity-Calibration function
- Two-Point Calibration function.
- Two work modes: Single point mode and Scan mode.
- Coupling status indicator showing the coupling status.
- Battery information indicates the rest capacity of the battery.
- Auto sleep and auto power off function to conserve battery life.
- Optional software to process the memory data on the PC.
- Optional thermal mini-printer to print the measured data via RS232 port.

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	Quantity	Note
Standard Configuration	1	Main body	1	
	2	Transducer	1	Model: N05/90°
	3	Couplant	1	
	4	Instrument Case	1	
	5	Operating Manual	1	
	6	Screwdriver	1	
	7	Alkaline battery	2	AA size
Optional Configuration	1	Transducer: N02		See Table3-1
	2	Transducer: N07		
	3	Transducer: HT5		
	4	Mini thermal printer	1	
	5	Print cable	1	
	6	DataPro for Thickness Gauge	1	For use on the PC
	7	Communication Cable	1	

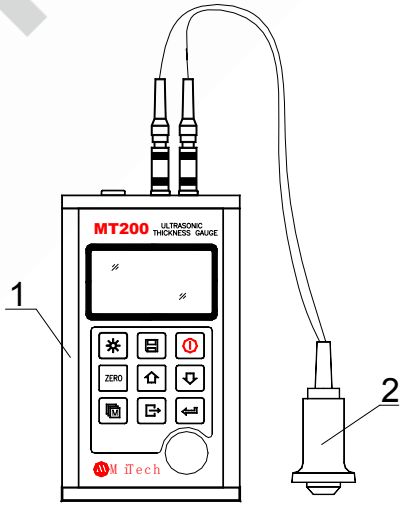
1.5 Operating Conditions

- Operating Temperature: －20℃～＋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

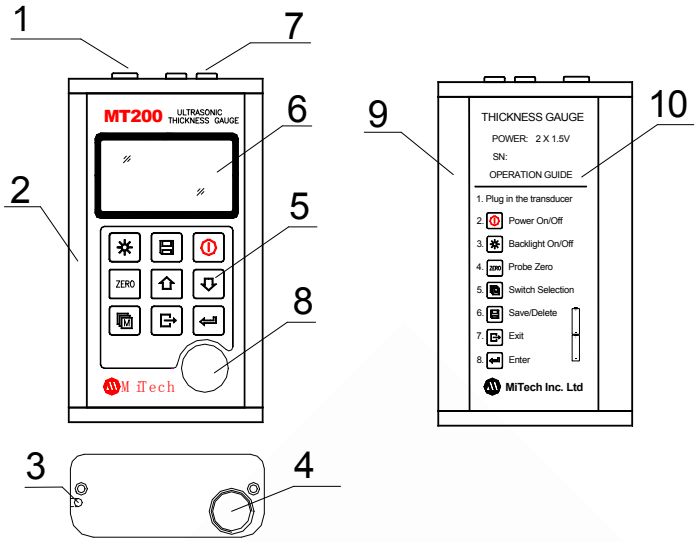
2.1 Instrument Appearance

① Main Body
② Transducer

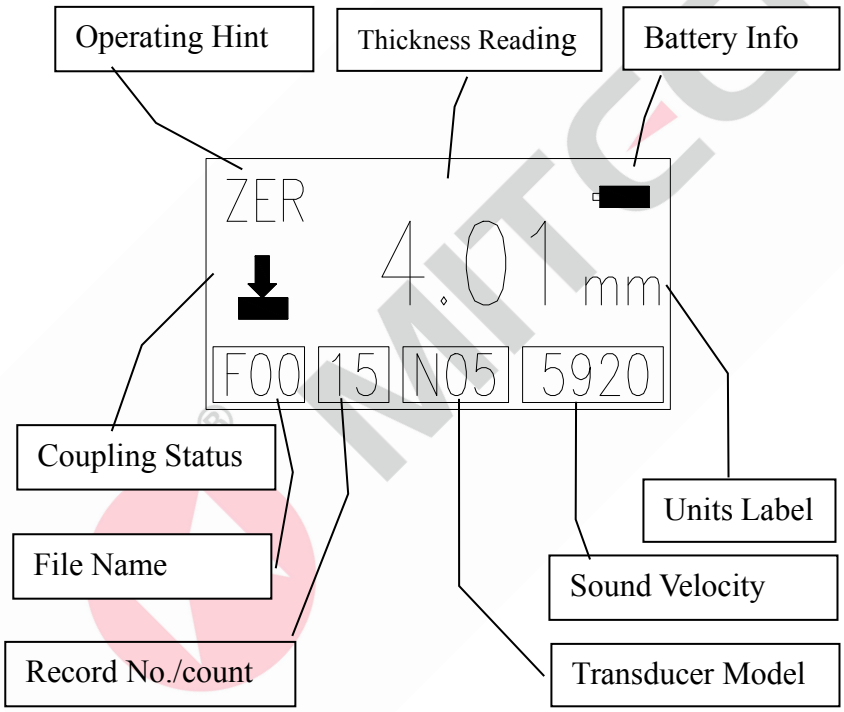


2.2 Parts of the Main Body

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 Measurement Screen



Battery Information: Display the information of the rest capacity 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.
Operating Hint: Show hints of current operation
FIL: File selection；
MEM：Memory data viewing；
PRB： Transducer set；
VEL： Change velocity;
CAL：Velocity calibration；
DPC：Dual Point Calibration state；
ZER：Probe zero state
SCA: Indicate that current thickness measurement mode is scan mode, and not single point mode.

File Name: show current file name.
Record No./Count: Indicate current record number while this item is highlighted, or total record counts while it is not highlighted.
Transducer Model: Current transducer model setting in the instrument
Sound Velocity: Current sound velocity setting

Thickness Reading： Display present single time measured value. ↑ means exceeding upper measuring limit. ↓ means lower than bottom measuring limit.
Units Label： 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**.

2.4 Keypad Definitions

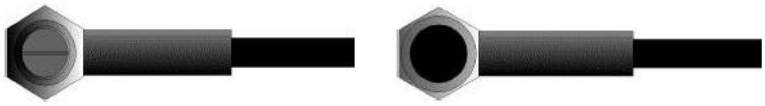
	Turn the instrument on and off		Exit from current selection
	Turn on/off the EL backlight		Enter
ZERO	Probe Zero operation		Plus or scroll up
M	Switch selection among items		Minus or scroll down
	Data Save or Data Delete		

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)	20mm	for thick, highly attenuating, or highly scattering materials
N05	5	10	1.2mm～230.0mm（In Steel）	Φ20mm×3.0mm	Normal Measurement
N05 /90°	5	10	1.2mm～230.0mm（In Steel）	Φ20mm×3.0mm	Normal Measurement
N07	7	6	0.75mm～80.0mm（In Steel）	Φ15mm×2.0mm	For thin pipe wall or small curvature pipe wall measurement
HT5	5	14	3～200mm （In Steel）	30mm	For high temperature (lower than 300℃) measurement.

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 pressing the 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 measurement screen.
It is turned off by pressing the key when it is on. The tool has a special memory that retains all of its settings even when the power is off.

4.2 Transducer Set

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

1. On the measurement screen, press the key multiple times to activate the 【Transducer model】 tab.
2. Use the key and the key to switch to the desired transducer model.
3. Press the key to exit.
4. You can also change the transducer model set by menu operation. Please refer to chapter 5 for the help of menu operation.

4.3 Probe Zero

The 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. Make sure the instrument is on and the Two-Point calibration function is OFF. The Probe-Zero function is disabled in Two-Point calibration mode.
2. 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.
3. Change the model of the transducer set in the instrument to the model currently using.
4. Apply a single droplet of ultrasonic couplant to the face of the metal probe-disc.
5. Press the transducer against the probe disc, making sure that the transducer sits flat against the surface.
6. While the transducer is firmly coupled to the probe disc, press on the keypad. The instrument will display “ZER” on the operating hint area while it is calculating its zero point.
7. After the “ZER” disappears, 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-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 [ORIGIN] while in probe zero state will stop current probe zero 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.

Notes:

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

Notes:

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.

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 Use the [⇧] key and the [⇩] key to adjust the displayed thickness up or down, until it matches the thickness of the sample piece.

⑥ Press the [↵] key. The gauge is now displaying the sound velocity value it has calculated based on the thickness value that was entered.

⑦ Press the [⇥] key to exit the calibration mode. The gauge is now ready to perform measurements.

4.4.2 Calibration to a known velocity

Notes:

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

① On the measurement screen, press the [M] key multiple times to tab to the sound velocity item.

② Press the [↵] key to switch among the preset commonly using velocities. Use the [⇧] key and the [⇩] key to adjust the sound velocity value up or down, until it matches the sound velocity of the material to be measured.

③ Press the [⇥] key to exit from the calibration mode. The gauge is now ready to perform measurements.

④ Another method to set the instrument with a known sound velocity is as following:

⑤ Highlight the 【Test Set】—>【Velocity Set】submenu item, press [↵] to enter the sound velocity set screen.

⑥ Press the [M] key multiple times to tab to the numeric digit to be changed; Use the [⇧]/[⇩] key to increase/decrease numeric values on the display until it matches the sound velocity of the material to be measured. An auto repeat function is built in, so that when the key is held down, numeric values will increment/decrement at an increasing rate.

⑦ Press the [↵] key to confirm the modifying; or press the [⇥] key to cancel the calibration.

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.
Notes：
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

Notes:
This procedure requires that the operator has two known thickness points on the test piece that are representative of the range to be measured.

1. On the 【Test Set】—>【2-Point Cal】submenu item, press ⏎ to toggle the Two Point mode to ON. Then exit from the menu to the measurement screen. The string “DPC” will appear on the operating hint area of the main measurement screen.
2. Press ⏎ to start the calibration procedure. The string “NO1” will appear on the operating hint area, indicating measuring the first point.
3. Apply couplant to the sample piece.
4. 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.
5. Having achieved a stable reading, remove the transducer. If the displayed thickness changes from the value shown while the transducer was coupled, repeat step 4.
6. Use the ⇧ key and the ⇩ key to adjust the displayed thickness up or down, until it matches the thickness of the sample piece.
7. Press the ⏎ key to confirm. The hint will changes to “NO2”, indicating measuring the second calibration point.
8. Repeat steps 3 through 7. The hint will change back to “DPC”.
9. 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 loses contact with the surface for more than two seconds, the gauge will display the smallest measurement it found. When the transducer is removed from the material being scanned, the gauge will display the smallest measurement it found.
On the 【Test Set】—>【Work Mode】menu item, press ↵ to toggle between single point mode and scan mode.

4.8 Resolution

The Limit Set feature of the gauge allows the user to set an audible and visual 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. On the 【Test Set】->【Tolerance Limit】 menu item，press the ↵ key to activate the limit set screen.
2. Use the key, the ⇧ key and the ⇩ key to change the bottom limit and the upper limit value to the desired values.
3. Press the ↵ key to confirm the change and return to the previous screen, or press the key to cancel the change.
4. If the limit setting exceeds the measurement range, the gauge will remind you to re-set. If the bottom limit is larger than the upper limit, the values will be exchanged automatically.

4.9 Resolution

The gauge has selectable display resolution, which is 0.1mm and 0.01mm.
On the 【Test Set】-> 【Resolution】 menu item, press the ↵ key to switch between “High” and “Low”.

4.10 Unit Scale

On the 【Test Set】-> 【Unit】 menu item，press the ↵ key to switch back and forth between Engilish and metric units.

4.11 Memory Management

4.11.1 Storing a reading

There are twenty files (F00-F19) that can be used to store the measurement values inside the gauge. At most 99 records can be stored to each file. The following procedures outline this process:

① Press the key to activate the 【File Name】item on the main measurement screen.
② Use the ⇧ key and the ⇩ key to select the desired file to save the data.
③ After a new measurement reading appears, press the key to save the measurement value to current file.

If the 【Auto Save】 function is enabled, the measurement value will be automatically saved to current file after a new measurement operation.

4.11.2 Viewing stored readings

Press the key multiple times until the 【Record No】area On the measurement screen is highlighted. Use the ⇧ key and the ⇩ key to change the record number. The gauge will automatically read the stored values according the record number from the memory and display them on the “Thickness Reading” area of the screen simultaneously. If you want to delete the displaying record data from the memory, just press the key.
The other way to view the stored record is by menu operations. On the 【Memory Manager】-> 【View Mem Data】 menu, press the ↵ key to activate the memory viewing screen.

F00 05 5% F01 00 0% F02 00 0% F03 00 0% F04 00 0% F05 00 0% F06 00 0% ↓F07 00 0%	At most eight files, including the file name, the record counts and the ratio used of the file can be showed on one screen. Use the ⇧/⇩ key to scroll up/down. Press ⇨ to exit browsing. Press ↵ to see details of that file.
F00 05 5% F01 00 0% F02 00 0% F03 00 0% F04 00 0% F05 00 0% F06 00 0% ↓F07 00 0%	Press ⇧ or ⇩ to move the cursor to the line which you want to see details. Press ↵ to see details of that file.
4.00 5.01 6.01 7.00 8.01	The left screen displays the total five record data in the file F00.

4.11.3 Clearing selected files

Enter the 【Memory Management】menu screen and highlight the 【Delete by File】 menu item. Then press the ↵ key. This function provides the user with the ability to delete the selected data files previously saved in memory.

4.11.4 Clearing all the files

Enter the 【Memory Management】menu screen and highlight the 【Delete All Data】menu item. Then press the ↵ key. This operation will delete all the measurement data stored in the memory after confirmation.

4.12 Data Printing

Before printing, please insert one connection plug of the print cable (Optional parts) into the socket on the up-left of the main body, and insert the other plug into the communication socket of the mini-printer.

4.12.1 Print Current File

Enter the【Print function】 menu screen and highlight the 【Print Current】 menu item, then press the ↵ key.
This operation will send all the data in current file to the mini printer via RS232 port and print them out.

4.12.2 Print Selected File

Enter the【Print function】menu screen and highlight the 【Print Memory】 menu item, then press the ↵ key. After specifying the start file name and the end file name, the gauge will send all the data in the files specified to print out.

4.12.3 Print All Memory

Enter the【Print function】 menu screen and highlight the【Print All Mem】 menu item，then press the

key.
This operation will send all the memory data to the mini printer and print them out.

4.13 System Set

From the main menu screen, press on the 【System Set】menu item and enter its submenu.

1. When【Auto Save】is set to <On>，could store the measured data automatically to current file after measurement
2. When 【Key Sound】 is set to 【On】, the buzzer would make a short hoot while press the key each time.
3. When【Warn Sound】 is set to 【On】, if the measured value exceeds the tolerance limit, the buzzer would make a long hoot.
4. LCD Brightness Set: Press on the 【System Set】->【LCD Brightness】 menu item to enter the LCD brightness set screen. On the screen, press to enhance the brightness, or press to weaken the brightness. Press to confirm the modifying, or press to cancel the modifying.

4.14 System information

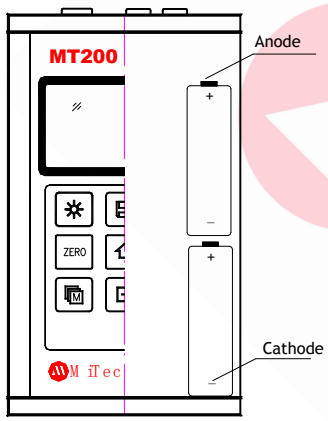
This System information function will display the information about the main body and the firmware. The version would change with the firmware.

4.15 EL Backlight

With the background light, it is convenient to work in the dark condition. Press key to switch on or switch off the background light at any moment as you need after power on. Since the EL light will consume much power, turn on it only when necessary.

4.16 Battery Information

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 fill. When the battery capacity runs out, the battery symbol will be shown as and will begin to flash. When this occurs, the batteries should be replaced.
Refer to the sketch below during battery replacing. Please pay much attention to the polarity of the battery.



Procedure:
1 Power Off the instrument
2 Take off the cover of the battery and take out the two batteries
3 Insert the new batteries into the instrument
4 Replug the battery cover
5 Power 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 half capacity.

4.17 Auto Power Off

The instrument features an auto power off function designed to conserve battery life. If the tool is idle for 5 minutes, it will turn itself off. While the voltage of the battery is too low this function will also work.

4.18 System Reset

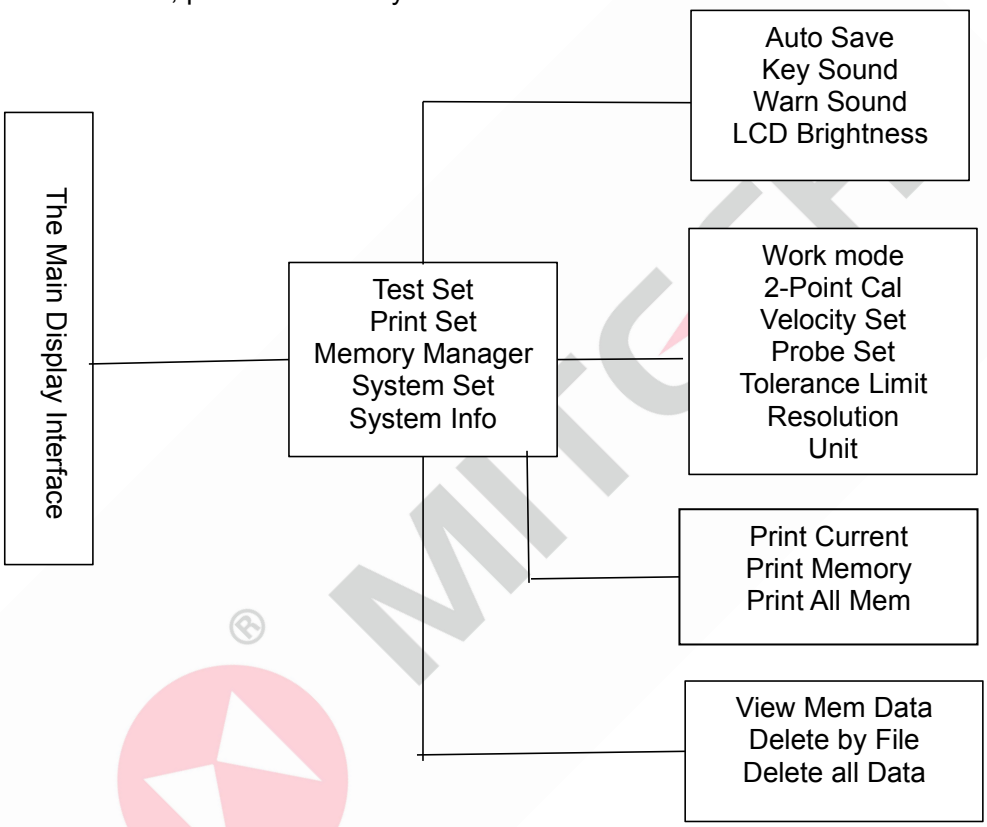
Press down the key while powering on the instrument will restore factory defaults. All the memory data will be cleared during system reset. The only time this might possibly helpful is if the parameter in the gauge was somehow corrupted.

4.19 Connecting to a Computer

The gauge is equipped with an RS232 serial port. Using the accessory cable, the gauge has the ability to connect to a computer, or external storage device. Measurement data stored in the memory of the gauge can be transferred to the computer through the RS232 port. Detailed information of the communication software and its usage refer to the software manual.

5 Menu Operation

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



5.1 Enter the Main Menu

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

5.2 Enter the Sub menu

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

5.3 Change the Parameter

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

5.4 Numeric Digit Input

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

5.5 Save and Exit

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

5.6 Cancel and Exit

Press the ⎋ 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/μs	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.

User Notes

Warranty:

The product is guaranteed for one year since purchased. Log www.mitech-ndt.com or follow our company official public platform to register for maintenance. Please fill the blanks as required, if the product is not registered for maintenance, it will follow the date of manufacturer.

When applying for maintenance, please visit our official website, www.mitech-ndt.com or official accounts, submit “online reporting to repair” sheet.

In accordance with the international relevant regulations, the following are not within the scope of free warranty,

- Damage caused by man-made or improper keeping;
- Self-dismantle or non-special repair shop dismantle;
- Do not follow the requirement of service registration or warranty expired;
- Consumable parts.

Service promise:

- MITECH users have lifelong maintenance service
- Free maintenance, inspection, software upgrade and etc.

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