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Instruction Manual Ultrasonic Material Thickness Gauge

SAUTER TU-US

Version 2.0
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PROFESSIONAL MEASURING

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V. 2.0 04/2020

Instruction Manual Ultrasonic Material Thickness Gauge

Congratulations on the purchase of an ultrasonic material thickness gauge from SAUTER. We hope you will enjoy your quality measuring device with its wide range of functions.
Please do not hesitate to contact us if you have any questions, wishes or suggestions.

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1. General overview

The model TU-US is a digital ultrasonic material thickness gauge. It is based on the same operating principles as SONAR. With the TU-US the material thickness of various materials can be measured with an accuracy of up to 0.01mm or 0.001 inch. It can be used for a variety of metallic and non-metallic materials.

1.1 Technical data

	TU 80-0.01US	TU 230-0.01US	TU 300-0.01US
Display	128x64 dot matrix LCD display with backlight		
Measuring range	0,75~80mm	1,2~200/230mm	3~200/300mm
Resolution	0,01mm	0.01 / 0.1mm	0.01 / 0.1mm
Measurement uncertainty	±0,5% + 0,04mm		
Sound velocity	1000-9999m/s		
Memory	20 groups (with 100 measured values each)		
Communication	RS-232		
Ambient temperature	-10°C - +60°C		
Max. humidity	≤90%		
Power supply	2x 1.5V AA alkaline batteries		
Dimensions	132x76x32mm		
Weight	approx. 345g		

1.2 General functions

- A wide range of materials can be measured, metal, plastics, ceramics, composites, glass and other ultrasonic conductive materials
- Four sonic probes are available for specific applications, including coarse grained material and high temperature applications.
- Zero adjustment function of the measuring probe
- Sound velocity calibration function
- Two-point calibration function
- two measuring functions: single measurement and scan mode
- coupling indicator
- Battery status display
- "Auto sleep" and "Auto power off" function to conserve battery power.
- Software available on request to transfer memory data via USB connection to a PC.

1.3 Measuring principle

The Ultrasonic Digital Material Thickness Gauge measures the thickness of a part or structure by accurately measuring the time taken for a short ultrasonic pulse to pass through the thickness of a material controlled by a probe, then reflected from the back or inner surface and returned to the probe.

This measured two-way transmission time is divided by 2 (representing the outward and return journey), and then multiplied by the sound velocity of the corresponding material. The result is expressed by the following formula:

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

H = Material thickness of the test object

v = sound velocity of the corresponding material

t = the measured transit time for the sound

1.4 Equipment

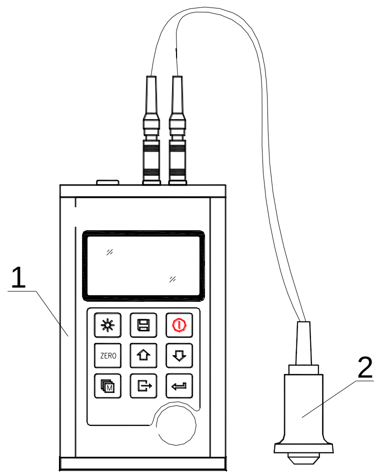
	No.	Designation	Quantity	Note
Scope of delivery	1	Main body	1	
	2	Measuring probe	1	ATU-US10 90°
	3	Coupling means	1	
	4	Transport case	1	
	5	Instruction manual	1	
	6	Screwdriver	1	
	7	Alkaline battery	2	size AA
Accessories sold separately	8	Measuring probe: ATU-US01		See table p.10
	9	Measuring probe: ATU-US02		
	10	Measuring probe: ATB-US02		
	13	Data Pro for material thickness gauge	1	for PC
	14	Communication cable	1	

2. Design features

2.1 External device view

1= housing

2= measuring probe



2.2 Parts of the main body

1 communication socket

2 aluminium housing

3 Belt mounting hole

4 Battery cover

5 Keypad

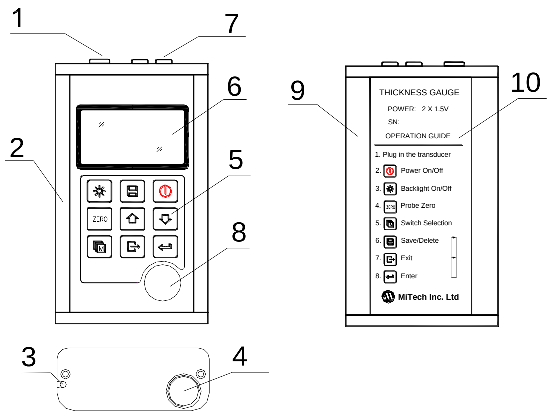
6 LCD display

7 Beech for US probe (no polarity)

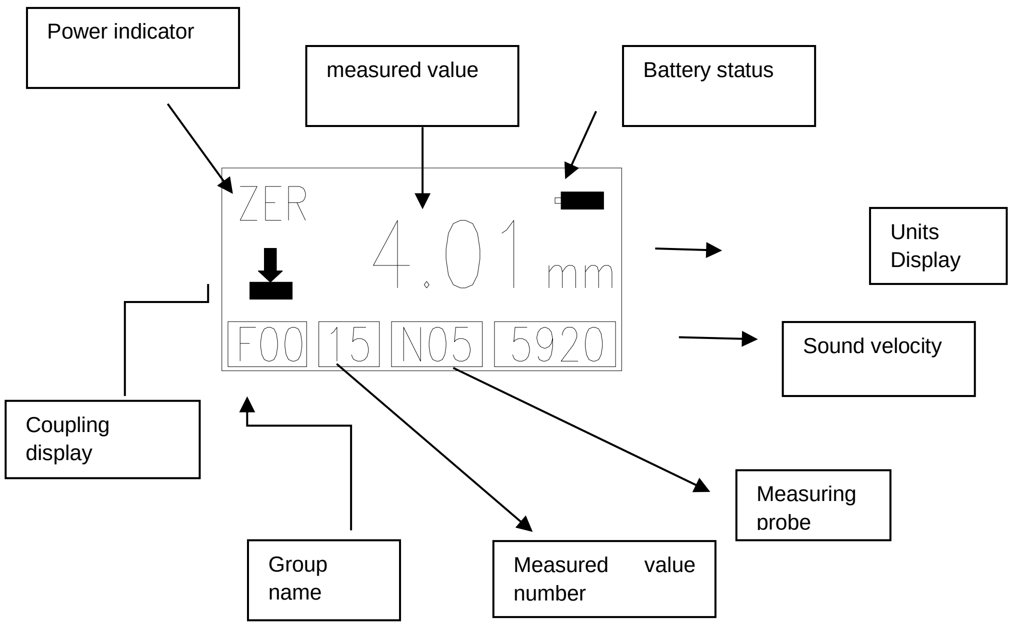
8 Zero plate for US probe

9. aluminium housing

10. explanation of the key symbols



2.3 Digital display



- **Battery indicator:** Status display battery

- **Pairing indicator:** shows the pairing status;
    - This symbol must appear during measurements. If this is not the case, it is not possible to measure.
- **Operating display**: shows whether the unit is switched on.
- **FIL:** Group number
- **PRB:** Probe active
- **VEL:** Sound velocity change
- **CAL:** Calibration of the speed of sound
- **DPC:** Two point calibration status
- **ZER:** Zero calibration of the measuring probe
- **SCA:** Shows status scan mode (On/Off)
- **Group name:** number of the current group
- **Measured value:** Number: shows the consecutive number.
- **Measuring probe models:** the selected measuring probe is displayed.
    - ATU-US01: N02
    - ATB-US06: N05
    - ATU-US02: N07
    - ATB-US02: HT5
- **Sound velocity:** shows the current sound velocity.
- **Measured value:** The display shows the measured value. ↑ means that the upper measurement limit has been reached. ↓ means that the lower measurement limit has been reached.
- **Unit display:** When the **mm** symbol lights up, the material thickness is measured in mm and the speed of sound in **m/s. When** the **inch** symbol appears, the material thickness is measured in inches and the speed of sound in **inches/s.**

3. Description of the control panel

	Turning the machine on and off		Exit the run- the selection
	Switching the background light on and off		Enter- Key
ZERO	US measurement probe Zero setting		scroll forward
	Switching between entries		roll back
	Save data or delete data		

4. Preparation for commissioning

4.1 Selection of the measuring probe

With this device you can measure a wide range of materials, from various metals to glass and plastic. For different types of materials, different probes, i.e. US-measuring heads, are required. The correct probe is crucial for reliable measurement success. The following sections explain the important properties of the probe and what should be considered when selecting a probe for a specific work object.
In general terms, this means that the best probe for a work object should send sufficient ultrasonic energy into the material to be measured so that a strong, stable echo arrives at the instrument. Certain factors influence the strength of the ultrasound as it is transmitted.

These can be read below:

- The initial signal strength: The stronger a signal is from the beginning, the stronger the returning echo will be. The initial signal strength is mainly a factor of the size of the ultrasonic emitter in the probe. A strong emitting surface will emit more energy into the material than a weak one. Consequently, a so-called "1/2 inch" US probe will emit a stronger signal than a "1/4 inch" US probe.
- Absorption and scattering: When ultrasound passes through any material, it is partially absorbed. In materials with a granular structure, the sound waves are scattered. Both of these influences reduce the strength of the sound waves and thus the ability of the device to detect or record the returning echo. Sound waves with a higher frequency are "swallowed" more than those with lower frequencies. So it might seem that it would be better to use a low frequency probe in any case, but these are less alignable (bundled) than those with high frequencies. Consequently, a high frequency probe would be the better choice to detect small depressions or impurities in the material.
- Geometry of the measuring probe: The physical limits of the measuring environment sometimes determine the suitability of the measuring probe for a certain test object. Some measuring probes are simply too large to be used in a fixed environment. If the available surface area for contact with the measuring probe is limited, a measuring probe with a small contact area is required. If you measure a curved surface, for example a drive cylinder wall, the contact surface of the probe must also be adapted to this.
- Temperature of the material: If measurements are made on unusually hot surfaces, high temperature probes are used. These are built in such a way that they can be used at high temperatures without suffering damage, for special materials and techniques. In addition, care must be taken when performing a "zero calibration" or "calibration with known material thickness" using a high temperature probe.

- The selection of the suitable measuring probe is often a compromise between different influences and properties. Sometimes it is necessary to try out several probes until the most suitable one is finally found for the respective test object.
- The measuring probe is the "end piece " of the measuring instrument. It transmits and receives ultrasonic waves, which the instrument uses to measure the thickness of the material to be examined. The probe is connected to the gauge by an adapter cable and two coaxial connectors. When the probe is in use, plugging in the connectors is easy: either the plug fits into the socket or into the device itself.
- The measuring probe must be inserted correctly to obtain accurate, reliable measurement results.

This is briefly described below, followed by instructions for use.

The upper figure shows the bottom view of a typical measuring probe. The two half circles are visible, visibly divided in the middle. One of the semicircles directs the ultrasound into the material to be measured and the other directs the echo back to the measuring probe. When the measuring probe is placed on the material to be measured, it is located directly under the centre of the spot whose thickness is to be measured.
The picture below shows the top view of a measuring probe. It is pressed onto the measuring probe from above with the thumb or forefinger to keep it exactly placed. Only moderate pressure is required, as the surface only needs to be positioned evenly on the material to be measured.

Model	Freq MHZ	Dia. mm	Measuring range	Lower limit	Description
ATU-US01	2	22	3.0mm～300.0mm(Stahl) 40mm (cast iron)	20	For thick, highly damping or highly scattering materials
ATU-US09	5	10	1.2mm～230.0mm (steel)	Φ20mm×3.0mm	Normal measurement
ATU-US10 /90°	5	10	1.2mm～230.0mm(Stahl)	Φ20mm×3.0mm	Normal measurement
ATU-US02	7	6	0.75mm～80.0mm (Stahl)	Φ15mm×2.0mm	For thin or slightly bent tube material
ATB-US02	5	14	3～200mm (steel)	30	High temperature measurement gen.(< 300°C)

4.2 Conditions and preparations for surfaces

For any kind of ultrasonic measurement, the condition and roughness of the surface to be measured is of utmost importance. Rough, uneven surfaces can
restrict the penetration of the ultrasonic waves through the material, resulting in unstable, incorrect measurement results
The surface to be measured should be clean and free of any substances, rust or verdigris. If this is the case, the measuring probe cannot be clean
can be placed on the surface. A wire brush or scraper is often helpful to clean the surface. In extreme cases, belt sanders or the like can be used. However, it is important to avoid gouging the surface, which prevents a clean placement of the probe.
Extremely rough surfaces like cast iron are very difficult to measure. These types of surfaces behave as if light were shining on frosted glass; the beam is scattered and sent in all directions.
In addition, rough surfaces contribute to considerable wear and tear of the probe, especially in situations where it is "scrubbed" over the surface.
They should therefore be checked at a certain distance, especially at the first signs of unevenness on the contact surface. If it is worn down more on one side than the other, the sound waves can no longer penetrate vertically through the material surface of the test object. In this case, small irregularities in the material are difficult to measure because the sound beam is no longer exactly below the measuring probe.

5. How it works

5.1 Switching on and off

The unit is switched on and off with the on/off key. When the unit is switched on for the very first time, the model type, manufacturer information and serial number are displayed before the measurement screen appears. The unit has a special memory in which all measurements are stored, even after the unit is switched off.

5.2 Probe selection

The measuring probe must be "preset" before the measurement. This serves as an additional aid and enables the user to choose between the individual models the correct measuring probe for the measurement requirements (frequency and diameter dependent).

1. On the control panel, press the key (bottom left) several times to select the measuring probe.
2. Press the key or the key to display the different models.
3. To exit, press the key. The probe setting can also be changed in the menu, see chapter 5.

5.3 Zero setting

The key is used to zero the measuring instrument. If this is not done correctly, all measurements taken may be incorrect.

When the unit is zeroed, the specified error value is measured and automatically corrected for all subsequent measurements.

The procedure is as follows:

1. The unit must be switched on and the two-point calibration must be inactive. The
   Zero setting is not possible with this one.
2. The measuring probe is plugged in and the connections of the plugs
   will be reviewed. The contact surface of the measuring probe must be clean.
3. The currently used measuring probe is displayed in the device
4. A drop of coupling agent is now applied to the metal zero plate.
5. The measuring probe is carefully pressed onto the zero plate.
6. While the measuring probe is now in direct contact with the zero plate through the gel on the zero plate, the .key is pressed. ZER" appears on the display while the instrument calculates the "zero point".
7. When the symbol "ZER" disappears, the probe is lifted from the zero plate.

Now the unit has detected the initial error factor and will use it to compare all subsequent measurements. When zeroing, the instrument will always use the sound velocity of the built-in zero plate, even if other values have been previously entered to make actual measurements.
Although the last zero setting is saved, it is recommended that it be carried out again each time the unit is switched on, even if a different probe is used. This will ensure that the unit is always set correctly. Pressing the ZERO key cancels the current zero setting.

5.4 Sound velocity

In order to be able to make exact measurements, this must be adjusted to the speed of sound of the corresponding material. Different materials have different sound velocities.
If this is not done, all measurements will be faulty by a certain percentage. **Single point calibration** is the most common way to optimise linearity over a long range. **Two-point calibration** allows higher accuracy at a shorter range by calculating the zero setting and the speed of sound.
Note: For **single-point and two-point calibrations,** ink or coating must be removed in advance. If this is not done, the calibration result will consist of a kind of "multi-material sound velocity" and will certainly not be the same as the actual material to be measured.

5.4.1 Calibration with known material thickness

Note: This procedure requires a sample of the material to be measured, the exact material thickness of which, e.g. on any
species was measured before.

1. The zero setting is made.
2. The sample material is provided with coupling gel.
3. The measuring probe is pressed onto the piece of material. A material thickness value can now be read on the display and the coupling symbol appears.
4. As soon as a stable reading value is reached, the measuring probe is lifted off again. If the thickness of the material just detected changes from the value that existed during the coupling, step 3) must be repeated.
5. The and ⇧ keys ⇩ can now be used to adjust the required material thickness (that of the material pattern).
6. The key is pressed and the calculated sound velocity value is displayed on the basis of the material thickness that was previously saved.
7. To exit the calibration mode, press the ⇨ key. From now on measurements can be taken.

5.4.2 Calibration at known sound velocity

Note: For this procedure, the sound velocity of the material to be measured must be known. A table of the most common materials can be found in Appendix A of this manual.

1. Press the key several times to move to the element "Speed of sound".
2. You can switch between the preset sound velocities with the key.
3. If necessary, the preset sound velocity can be overwritten with the keys and up and down until the desired value of the material to be measured is reached. This is necessary, for example, if, as already mentioned, there are differences in the material composition from (manufacturer to manufacturer) for one and the same material.
4. To exit the calibration mode, press the key. From now on measurements can be taken.

Another method of calibrating the instrument with a known speed of sound is as follows:

1. Go to the {Test Set} → {Velocity Set} submenu, press the key to enter the sound velocity menu.
2. Press the key several times until the changeable numeric digit is reached. Use the / keys to change the numerical value up or down until it corresponds to the speed of sound of the material to be tested.
3. An automatic repeat function is built into the machine so that if the key is held down, the numerical values add up at equal intervals or decrease in steps.
4. Press the key to confirm or the key to cancel the calibration.
5. In order to achieve the most accurate measurement results, it is generally recommended to calibrate the measuring device with a material sample of known material thickness.

The material composition itself (and thus the speed of sound) often varies from one manufacturer to another. Calibration with a material sample of known thickness ensures that the measuring instrument has been adjusted as accurately as possible to the material to be measured.

5.5 Measurements are made

The meter always stores the last measured value until a new value is added.

For the measuring probe to function properly, there must be no air bridges between its contact surface and the surface of the material to be measured. This is achieved with the ultrasonic gel, the "coupling agent". This liquid "couples" or transmits the ultrasonic waves from the measuring probe into the material and back again. Before the measurement, a little coupling agent should therefore be applied to the surface of the material to be measured. Afterwards the measuring probe is carefully pressed onto the material surface. The coupling symbol and a number appear on the display. When the device has been adjusted and the correct sound velocity has been determined, the number in the display shows the current material thickness, measured directly under the measuring probe.

If the coupling indicator does not appear or the number on the display is questionable, first check that there is sufficient coupling agent at the point under the measuring probe and that it has been placed flat on the material. Sometimes it is necessary to try a different measuring probe for the corresponding material (diameter or frequency).

While the measuring probe is in contact with the material to be measured, four measurements are taken per second. When it is lifted from the surface, the display shows the last measurement.

Note: Sometimes a thin film of the coupling agent is drawn between the probe and the material surface when the probe is lifted. In this case it is possible that a measurement is made through this film, which then turns out larger or smaller than it should. This is obvious because if one measurement is taken while the measuring probe is still in place and the other when it has just been lifted off. In addition, when materials with thick paint or coating are used, it is these rather than the intended material that is measured instead. Ultimately, the responsibility for the clean use of the measuring device in connection with the detection of these phenomena is withheld from the user.

5.6 Two-point calibration

This procedure assumes that the user has two known material thickness points of the test material and that these are representative for the measuring range.

1. On the {Test Set} → {2- Point Cal} submenu, press the key to enable two-point calibration. Then the menu is left to enter the instrument screen. "DPC" appears on the display.
2. Press the key to start calibration. The sequence "NO1" appears, indicating the first measurement point.
3. Coupling agent is applied to the material sample.
4. The US measuring probe is placed on it (on the first or second calibration point) and the correct position of the measuring probe on the material sample is checked. The display should now show a measured value and the coupling symbol should appear.
5. As soon as a stable measured value is reached, the measuring probe is lifted off. If the reading differs from the reading when the probe was still coupled, step 4 must be repeated.
6. The material thickness measurement is changed up and down with the / buttons until the material thickness of the material sample is found.
7. Press the key to confirm. The display jumps to "NO2" and the second calibration point can be measured.
8. Steps 3 to 7 are repeated. The display jumps back to "DPC".
9. Now the device is ready to take measurements in its measuring range.

5.7 The Scan Mode

While the instrument excels in single point measurements, it is sometimes desirable to examine a larger area to look for the thinnest point. This unit has a scan mode that allows you to do just that. In normal operation, four measurements are taken per second, which is very appropriate for single measurements. In scan mode this is ten measurements per second and the readings are shown on the display. While the measuring probe is in contact with the material to be measured, the device automatically displays the measured value. The measuring probe can be moved over the surface, because short interruptions of the signal are ignored. In case of interruptions lasting longer than two seconds, the last measured value found is displayed. If the measuring probe is lifted, the last measured value found is also displayed.

In {Test Set} → {Work Mode} Menu, press the key to switch between single point measurement mode and scan mode.

5.8 Set limit value

This allows the user to set an audible and visible parameter during the measurement. If a measurement exceeds the limit set by the user, a beep is sounded. This improves the speed and effectiveness of the measurements, as there is no need to constantly look at the display.

The following describes how to make this option:

1. In the {Test Set} → {Tolerance Limit} menu, press the key to activate the command.
2. Use the and keys to set the upper and lower limit value to the desired measured value.
3. The key is pressed again to confirm and enter the actual menu or the key is pressed to cancel the limit setting.
4. If the set limit exceeds the measuring range, the meter will remind you to reset the instrument. If the lower limit is greater than the upper limit, the values are automatically replaced.

5.9 Resolution

The unit has two selectable screen resolutions, 0.1mm and 0.01mm. These can be found in the menu under {Test Set}→ {Resolution}.
Use the key to select between "high" (high resolution) and "low" (low resolution).

5.10 Unit scale

In the menu {Test Set}→ {Unit} the key is used to select between mm (metric) and inch (English).

5.11 Storage management

5.11.1 Saving a measured value

The measured values can be stored in the unit in 100 groups (F00-F99) and 100 measured values can be stored in each group.
The procedure is as follows:

1. Press the key to display the {File name} menu.
2. Use the and keys to select the appropriate group.
3. When a new reading appears, press the memory key to save the measurement to the current file. With the {Auto Save} function, the measured value is automatically stored in the file as soon as a new measurement is added.

5.11.2 Edit measured values

Press the key repeatedly until the display shows {File name}. Use the and keys to change the group number.

	deletes the selected group
	deletes all groups
or	marks the selected group to save to it
	Leave dialogue

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

Press the key repeatedly until the display shows {Record count}. Use the and keys to change the group number.

	deletes the marked measured value
	deletes all measured values
or	leave dialogue

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

5.12 System settings

From the main menu, press the key in the submenu {System Set}.

1. When {Auto Save} is set to <On>, the data of the current file can be saved automatically after measurement.
2. If {Key Sound} is set to <On>, the buzzer will sound a short beep each time a key is pressed.
3. If {Warn Sound} is set to <On>, a long beep is heard each time the tolerance limit is exceeded.
4. LCD picture brightness adjustment: In the submenu {System Set} → {LCD Brightness}, press the key. Use the and arrows to increase or decrease the display brightness. The key is used to confirm or cancel the changes.
5. In the menu {Unit System} it is possible to switch between metric and imperial units
6. The internal system time can be set in the menu {Date/Time}.
7. In the menu {Language} the different languages can be set

5.13 System information

This function gives the main information about the main body of the machine and the firmware. The design changes when the firmware changes.

5.14 Backlit display

This allows it to be used in dark environments. The key is used to activate and deactivate the backlight once the meter has been switched on. Because the EL light consumes a lot of electricity, it should only be switched on when needed.

5.15 Auto Power Off

The Auto power off function can be set here. It can be selected between Off, 2 minutes, 5 minutes and 10 minutes.

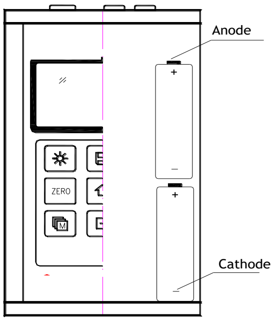
5.16 System Reset

If the key is pressed during machine start-up or if {System reset} is selected in the menu, all settings and the memory are cleared and reset to default settings.

5.17 Battery information

Two AA alkaline batteries are required as energy source. After several hours of use, the display shows the symbol. The larger the black portion in the symbol, the fuller the battery is. When the battery capacity is exhausted, the following symbol appears and starts flashing. The batteries should now be replaced.
The picture on the next page shows the position of the batteries in the device. When changing the batteries it is essential to pay attention to the polarity.
Procedure:

1. Switch off the machine.
2. The battery cover is removed from the unit and the two batteries are removed.
3. The batteries are inserted correctly.
4. The battery cover is replaced.
5. The unit is switched on again for checking.



If the unit is not used for a long period of time, the batteries should be removed.
It is recommended to replace the batteries already when the capacity is down to 10%.

5.18 Connection to PC

The unit is equipped with USB 2.0 as standard. With the optional available cable the connection to the PC is possible. The measurement data stored in the unit's memory can be transferred via this cable.
For detailed information on the communication software, please read the software manual.

6. Operation of the menu

Both, the pre-setting of parameters and the additional function, are realised by the menu operation. The key provides access to the main menu.

6.1 Access to the main menu

Press the key to access and exit the main menu.

6.2 Access to the submenu

Press the key to access the submenu.

6.3 Change the parameter

Press the key to change the value of the parameter on the display set to Parameter.

6.4 Numerical digital input

Press the key several times to move to the number to be changed; use the and keys to increase or decrease the numerical value on the display until you reach the desired numerical value.

6.5 Saving and exiting the menu

Press the key to confirm any changes and return to the previous page of the screen.

6.6 Deleting and exiting the menu

Press the key to delete any changes and return to the previous screen page.

7. Maintenance

If any unusual problems occur with your measuring instrument, please do not repair or disassemble it at your own risk.

8. Transport and storage

- The measuring instrument must not be exposed to vibrations, strong magnetic fields, decomposing media or dust and must not be subjected to rough handling. It should be kept at normal temperature.

9. Annex

9.1 Sound velocities

Material	Sound Velocity	
	In/us	m/s
Aluminum	0.250	6340-6400
Conventional. Steel	0.233	5920
Stainless steel	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
Sheet metal	0.117	2960
Epoxy resin	0.100	2540
Ice	0.157	3988
Nickel	0.222	5639
plexiglass	0.106	2692
Styrofoam	0.092	2337
Porcelain	0.230	5842
PVC	0.094	2388
Quartz glass	0.222	5639
Rubber	0.091	2311
Teflon	0.056	1422
Water	0.058	1473

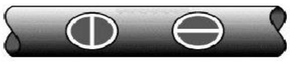
9.2 Remarks on application

9.2.1 Measuring tubes and hose material

If a piece of pipe is measured to determine the thickness of the pipe wall, the positioning of the measuring probe is important. If the diameter of the pipe is larger than

4 inches, the position of the probe on the pipe should be such that the incision on the contact surface is perpendicular to the long axis of the pipe.

For smaller pipe diameters, two measurements should be taken at the same point, one with the incision on the contact surface perpendicular to the long axis and the other parallel to it. The smaller of these two measurements is then taken as the exact measurement of this point.



Perpendicular Parallel

9.3 Measuring hot surfaces

The speed of sound through a particular material depends on its temperature. With rising...

the temperature, the speed of sound decreases.

For most applications with a surface temperature of less than 100°C no further precautions need to be taken. At temperatures above this, the change in the sound velocity of the material to be measured begins to have a noticeable effect on the ultrasonic measurement.

At such high temperatures, it is recommended to first calibrate with a material sample of known material thickness, which corresponds exactly or approximately to the temperature of the material to be measured. This enables the measuring instrument to calculate the exact sound velocity through the hot material.

For measurements on hot surfaces it may also be necessary to use a "high temperature probe". These are specially designed for use at high temperatures, especially since contact with the material surface should be maintained for a short time to ensure a stable measurement.

While the measuring probe is in direct contact with the hot surface, it heats up. Thermal expansion and other effects can have a negative effect on the measuring accuracy.

9.4 Measuring coated materials

Coated materials are special because their density (and therefore the speed of sound) can vary considerably from one piece to another.
Even through a single surface, noticeable differences in the speed of sound can be detected. The only way to obtain an accurate measurement result is to first perform a calibration on a material sample of known material thickness. Ideally, this should be from the same piece as the material to be measured, at least from the same production series. With the help of the "pre-calibration" the deviations are reduced to a minimum.
An additional important factor when measuring coated materials is that any trapped air gap causes premature reflection of the ultrasonic beam. This becomes noticeable in a sudden decrease of the material thickness. While on the one hand this prevents the exact measurement of the total material thickness, on the other hand the user is positively alerted to air gaps in the coating.

9.5 Material suitability

Ultrasonic material thickness measurements are based on the fact that a sound is sent through the material to be measured. Not all materials are suitable for this. Ultrasonic measurement can be applied practically to a wide range of materials including metals, plastics and glass. Difficult materials include some cast materials, concrete, wood, fibreglass and some rubber.

9.6 Coupling means

All ultrasonic applications require a medium to transmit the sound from the probe to the test material. Typically this is a very viscous medium.
Ultrasound cannot be efficiently transmitted through air.
A variety of coupling means are used. For most applications, propylene glycol is too suitable. Glycerine is suitable for difficult applications. However, glycerine causes corrosion of some metals by water absorption.
Other coupling agents for measurements at normal temperatures may contain water, various oils or greases, gels and silicone fluids. High temperature measurements require special high temperature coupling agents.
A characteristic of ultrasonic measurement is that the device uses the second rather than the first echo from the rear surface of the material to be measured when it is in standard pulse-echo mode. This results in a reading that is **twice** as large as it should be.
The responsibility for the appropriate use of the measuring instrument and the detection of these phenomena lies exclusively with the user himself.

Remark:
The CE Declaration of Conformity is available at the following link: https://www.kern-sohn.com/shop/de/DOWNLOADS/