



Ultrasonic material thickness gauge

TU-US



English version

Operating instructions Ultrasonic material thickness gauge

Version 3.0
2024-05
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TU_US-BA-e-2430

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SAUTER

SAUTER TU-US

Ultrasonic material thickness gauge

Operating instructions Ultrasonic material thickness gauge

Version 3.0 2024-05

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1 Technical data

| SAUTER model | 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. Air humidity | ≤90% | | |
| Power supply | 2x 1.5V AA alkaline batteries | | |
| Dimension | 132x76x32mm | | |
| Weight | Approx. 345g | | |

2 Declaration of Conformity

The current EC/EU Declaration of Conformity can be found online at
<https://www.kern-sohn.com/shop/de/DOWNLOADS/>

3 Overview of the device

3.1 Scope of delivery

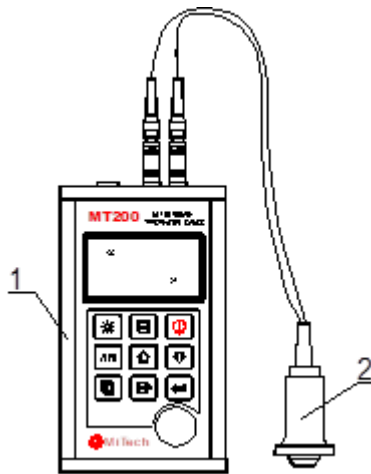
- Operating instructions
- Main body
- Measuring probe (ATU-US10 90°)
- Coupling agent
- Transport case
- Operating instructions
- Screwdriver
- 2x AA alkaline battery

3.2 Accessories available separately

- Measuring probe: ATU-US01
- Measuring probe: ATU-US02
- Measuring probe: ATB-US02
- Data Pro for material thickness gauge
- Communication cable

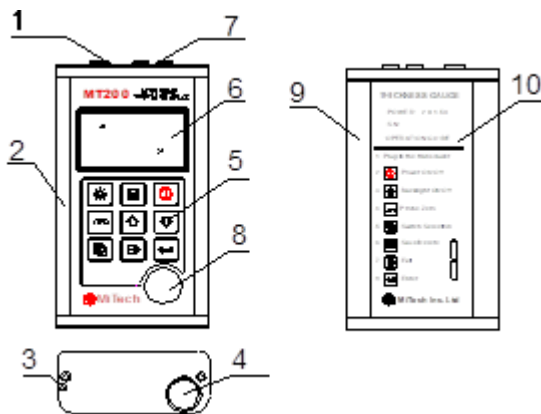
3.3 Components

3.3.1 External device view



| Description of the | Function |
|--------------------|-----------------|
| 1 | Housing |
| 2 | Measuring probe |

3.3.2 Parts of the main body



| | Description of the |
|----|---|
| 1 | Communication socket |
| 2 | Aluminium housing |
| 3 | Harness mounting hole |
| 4 | Battery cover |
| 5 | Keypad |
| 6 | LCD display |
| 7 | Socket for US measuring probe (no polarity) |
| 8 | Zero plate for US measuring probe |
| 9 | Aluminium housing |
| 10 | Explanation of the button symbols |

3.4 General functions

A wide range of materials can be measured, including metals, plastics, ceramics, composites, glass and other ultrasonically conductive materials. Four transducers are available for specialised applications, including coarse grained material and high temperature applications.

- Reset function of the measuring probe
- Sound velocity calibration function
- Two-point calibration function
- Two measurement functions: Single measurement and scan mode
- Coupling indicator
- Battery status display
- "Auto sleep" and "Auto power off" function to conserve battery power.
- software is available on request to transfer memory data to the PC via USB connection.

3.5 Measuring principle

The digital ultrasonic material thickness gauge measures the thickness of a part or structure by accurately measuring the time it takes for a short ultrasonic pulse, controlled by a probe, to penetrate through the thickness of a material, then reflect off the back or inner surface and be sent back to the probe.

This measured two-way transmission time is divided by 2 (representing the round trip) and then multiplied by the speed of sound of the corresponding material. The result is expressed with the following formula:

H = material thickness of the test object

v = speed of sound of the corresponding material

t = the measured transit time for the sound





4 Basic information (general)


4.1 General information on warning notices

Warnings are used in these operating instructions to warn you of possible personal injury or damage to property in certain situations.

| Signal word | Description of the |
|----------------|--|
| DANGER | Failure to observe the instructions will lead directly to serious injury, permanent impairment (e.g. loss of a limb) or death of the user or third parties |
| WARNING | Failure to observe the instructions may result in serious injury, permanent impairment (e.g. loss of a limb) or death of the user or third parties |
| CAUTION | Failure to observe the instructions may result in minor injuries or temporary damage to the user or third parties (e.g. minor cuts) |
| NOTE | Failure to observe the instructions may result in damage to property |

Symbols in warning notices:

| Symbol | Meaning |
|---|--|
| Warning signs | Warning signs warn you of hazards that may result in personal injury. The symbol indicates the type of hazard. |
|  | Indicates general hazards or a danger point |
|  | Warning of flammable substances |
|  | Warning of explosive substances |
|  | Warning of electrostatically sensitive assemblies |

| Symbol | Meaning |
|---|--|
| Command sign | Mandatory signs prescribe measures that you must take to avoid personal injury or damage to property. The symbol indicates the necessary actions or objects to prevent damage. |
|  | Indicates a prescribed action |

4.2 Intended use

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

After use, place the appliance and its accessories in the appliance box and store it properly. The device should be stored in a dry and cool environment.

If you have any questions, please contact SAUTER or visit our website www.sauter.eu.

4.3 Improper use

The measuring device is not to be used for medical purposes.

Do not use the device in potentially explosive atmospheres or for measurements in liquids or on live parts. This device is not waterproof and cannot be used in environments with high humidity or water mist. Avoid the ingress of liquids, powders or solid foreign bodies such as water and dust into the measuring opening and the housing.

Unauthorised structural changes, additions or conversions to the device are prohibited. Unauthorised modifications may impair the accuracy of the device or even cause irreversible damage to the device.

4.4 Guarantee

Warranty expires with

- Non-compliance with our specifications in the operating instructions
- Use outside the described applications
- Modifying or opening the device
- Mechanical damage and damage caused by media, liquids, natural wear and tear
- Improper set-up or electrical installation
- Improper assembly or electrical installation

5 Basic warnings and safety instructions

5.1 Observe the notes in the operating instructions




Read the operating instructions carefully before commissioning/using the appliance, even if you already have experience with SAUTER appliances. Always keep the instructions in the immediate vicinity of the appliance.

5.2 Staff training

The appliance may only be used by persons who have read and understood the operating instructions, in particular the chapter on safety.

5.3 Security

| ⚠ WARNING | |
|--|--|
|  | <p>Read all safety information and instructions. Failure to observe the safety information and instructions may result in electric shock, fire and/or serious injury.</p> <p>Keep all safety information and instructions for future reference.</p> <ul style="list-style-type: none">● Make sure that there are never people or objects under the load, as they could be injured or damaged!● The design of the measuring device must not be modified. This can lead to incorrect measurement results, safety-related defects and the destruction of the measuring device.● Do not operate the appliance in potentially explosive rooms or areas and do not install it there.● Do not operate the device in an aggressive atmosphere.● Do not immerse the appliance in water. Do not allow any liquids to penetrate the inside of the appliance.● The device may only be used in a dry environment and under no circumstances in rain or at a relative humidity above the operating conditions.● Protect the device from permanent direct sunlight.● Do not expose the appliance to strong vibrations.● Do not remove any safety signs, stickers or labels from the appliance. Keep all safety signs, stickers and labels in a legible condition● Do not open the device |

⚠ WARNING



Choking hazard!

Do not leave the packaging material lying around carelessly. It could become a dangerous toy for children.

- The appliance is not a toy and does not belong in the hands of children.
- This appliance can be dangerous if it is used improperly or not as intended by untrained persons! Observe the personnel qualifications!

⚠ WARNING



Improper use of rechargeable or non-rechargeable batteries can cause them to catch fire, explode, emit toxic vapours or release corrosive liquids. The following therefore applies to rechargeable and non-rechargeable batteries:

- Protect from fire and heat.
- Never expose to high pressure or microwaves.
- Do not bring into contact with liquids or chemicals.
- Never bring the electrical contacts of rechargeable batteries and batteries into contact with metal objects or short-circuit them.
- Never modify rechargeable batteries, batteries and chargers.
- Batteries must never be charged.
- Never use or charge a defective, damaged or deformed battery.

CAUTION

- Keep a sufficient distance from heat sources.
- Do not use the device in environments with high humidity or water mist.

! NOTE

- To avoid damaging the device, do not expose it to extreme temperatures, extreme humidity or moisture.
- Do not use harsh cleaning agents, abrasive cleaners or solvents to clean the appliance.

6 Transport and storage

6.1 Hint

If you store or transport the device improperly, the device may be damaged. Observe the information on transporting and storing the appliance.

6.2 Transport

When transporting the appliance, use the transport case included in the scope of delivery to protect the appliance from external influences.

6.3 Storage

Observe the following storage conditions when the appliance is not in use:

- dry and protected from frost and heat
- protected from dust ingress in the transport case
- the storage temperature corresponds to the technical data
- Do not expose to vibrations or strong magnetic fields

6.4 Packaging/return transport

Returns are only possible within the limits of the general terms and conditions. Keep all parts of the original packaging for any necessary return transport.

- Only the original packaging is to be used for return transport
- Disconnect all connected cables and loose/movable parts before dispatch
- Reattach any transport locks provided
- Secure all parts against slipping and damage

7 Unpacking and commissioning

7.1 Unpacking



In the event of a return, please observe the instructions in the chapter "Packaging/return transport"

On receipt of the appliance, you should first check that no damage has occurred in transit, that the outer packaging, the housing, other parts or even the appliance itself have not been damaged. If any damage is evident, please notify SAUTER GmbH immediately.

7.2 Commissioning

7.2.1 Selection of the measuring probe

This device can be used to measure a wide range of materials, from various metals to glass and plastic. Different measuring probes, i.e. US measuring heads, are therefore required for different types of material. The correct measuring probe is crucial for reliable measurement success. The following sections explain the important characteristics 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 transmit 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 found below:

- The initial signal strength: The stronger a signal is from the start, 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 capacity and scattering: When ultrasound flows through a material, it is partially absorbed. In materials with a granular structure, the sound waves scatter. Both of these influences reduce the strength of the sound waves and therefore the ability of the device to recognise or pick up the returning echo. Sound waves with higher frequencies are "swallowed" more than those with lower frequencies. However, a probe with a low frequency is less alignable (focussed) than one with high frequencies. Consequently, a high frequency probe would be the better choice for detecting small pits 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

particular test object. Some probes are too large to be used in a fixed environment. If the surface available for contact with the probe is limited, a probe with a small contact area is required. If you are measuring a curved surface, for example a drive cylinder wall, the contact surface of the measuring probe must also be adapted to this.

- Temperature of the material: If measurements are taken on exceptionally hot surfaces, high-temperature probes are used. These are designed so that they can be used for special materials and techniques at high temperatures without suffering damage. In addition, care must be taken during "zero calibration" or "calibration at known material thickness" with a high-temperature probe.
- The selection of a suitable measuring probe is often a compromise between different influences and properties. Sometimes it is necessary to try out several probes until you finally find the most suitable one for the test object in question.
- The measuring probe is the "end piece" of the measuring device. The probe transmits and receives ultrasonic waves, which the device uses to measure the thickness of the material being analysed. The measuring probe is connected to the measuring device by an adapter cable and two coaxial connections.
- The measuring probe must be used correctly in order to obtain accurate, reliable measurement results.



The top illustration shows the bottom view of a typical measuring probe. The two semicircles are visibly divided in the centre. One of the semicircles guides the ultrasound into the material to be measured and the other guides the echo back to the measuring probe. If the measuring probe is placed on the material to be measured, it is located directly under the centre of the area whose thickness is to be measured.

The picture below shows the top view of a measuring probe. The measuring probe is pressed from above with the thumb or index finger in order to position it precisely.

| Model | Freq MHZ | Diameter mm | Measuring range | Lower limit | Description |
|----------------------|-------------|----------------|--|-------------|---|
| ATU- US01 | 2 | 22 | 3.0mm~300.0mm (steel) 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 (steel) | Φ20mm×3.0mm | Normal measurement |
| ATU- US02 | 7 | 6 | 0.75mm~80.0mm (steel) | Φ15mm×2.0mm | For thin or slightly bent pipe material |
| ATB- US02 | 5 | 14 | 3~200mm (steel) | 30 | High temperature measurements (<300°C) |

7.2.2 Conditions and preparations for surfaces

With any type of ultrasonic measurement, the quality and roughness of the surface to be measured is of the 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.

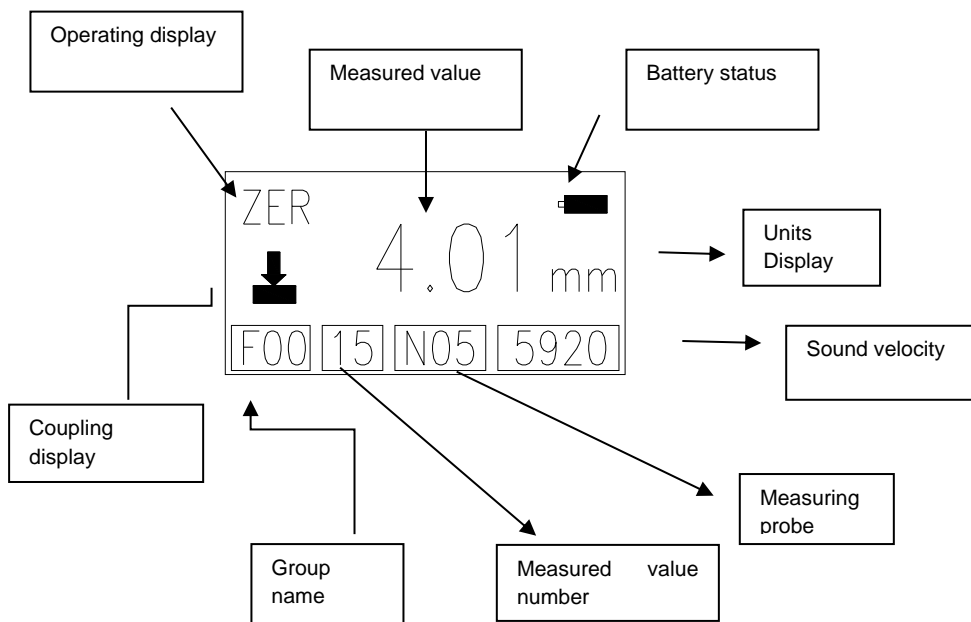
be placed on the surface. A wire brush or scraper is often helpful to clean the surface. In extreme cases, belt sanders or the like can be used. However, gouging of the surface must be avoided, which prevents clean placement of the measuring probe.

Extremely rough surfaces such as cast iron are very difficult to measure. These types of surfaces behave like when light shines on frosted glass, the beam is scattered and sent in all directions.

In addition, rough surfaces contribute to considerable wear of the measuring probe. They should therefore be checked at a certain distance, especially at the first signs of unevenness on the contact surface. If this is more worn 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 as the sound beam is no longer exactly under the probe.

8 Menu










8.1 Menu display




| Function | Description of the |
|-------------------|---|
| Battery indicator | Battery status display |
| Coupling display | Displays the pairing status; This symbol must appear during the measurement. If this is not the case, it is not possible to measure. |
| Operating display | Indicates whether the device is switched on |
| FIL | Group number |
| PRB | Measuring 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: displays the consecutive number |
| Measuring probes | The selected measuring probe is displayed. <ul style="list-style-type: none"> • ATU-US01: N02 • ATB-US06: N05 • ATU-US02: N07 • ATB-US02: HT5 |

| | |
|-----------------------|--|
| Speed of sound | Displays the current speed of sound |
| Measured value | The measured value appears on the display. ↑ Upper measurement limit has been reached ↓ Lower measurement limit was reached |
| Unit display | When the mm symbol lights up, the material thickness is measured in mm and the sound velocity in m/s . If the inch symbol appears, the material thickness is measured in inches and the sound velocity in inches/s . |


8.2 Description of the control panel

| | | | |
|--|------------------------------------|---|-----------------------------------|
|  | Switching the device on and off |  | Abandonment the current selection |
|  | Switching the backlight on and off |  | Enter button |
|  | US measuring probe Zero setting |  | roll forward |
|  | Switch between the entries |  | Roll back |
|  | Save data or Delete data | | |


8.3 Navigation in the menu

The presetting of the parameters and the additional function are realised via the menu operation. The main menu can be accessed using the  button.


8.3.1 Access to the main menu ü

Use the button  to access the main menu and to exit it again.




8.3.2 Access to the submenu ü

Use the button  to access the submenu.


8.3.3 The parameters change

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


8.3.4 Numerical digital input

Press the button  several times to access the number to be changed; use the buttons  and  to increase or decrease the numerical value on the display to the desired numerical value.

8.3.5 Saving and exiting the menu

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

8.3.6 Deleting and exiting the menu

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




9 Basic operation

9.1 Switching on and off


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

9.2 Selection of the measuring probe

The measuring probe must be "pre-set" before the measurement. This serves as an additional aid and enables the user to select the correct probe for the measurement requirements (depending on frequency and diameter) between the individual models.

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

9.3 Zero setting


Set the correct probe via the "Select probe" menu. Set the sound velocity to 5920 m/s². The  button is used to zero the measuring device. If this is not done correctly, all measurements taken may be incorrect. When the device detects the zero setting, the specified error value is measured and automatically corrected for all subsequent measurements.

The procedure is as follows:

1. The device must be switched on and the two-point calibration must be inactive. The Zero setting is not possible.
2. The measuring probe is plugged in and the plug connections are checked. The contact surface of the measuring probe must be clean.
3. The measuring probe currently in use is displayed in the device.
4. A drop of coupling agent is now added to the metal zero plate.
5. The measuring probe is carefully pressed onto the zero plate.
6. A progress bar starts to run from left to right. When it reaches the right, an acoustic signal sounds and the zero setting is complete.
7. Lift measuring probe, measuring device automatically switches to measuring mode

The device has now recognised the initial error factor and will compare all subsequent measurements with it. When zeroing, the device will always use the sound velocity of the built-in zero plate, even if other values were previously entered in order to take current measurements.

Although the last zero setting is saved, it is recommended that it is carried out again each time the device is switched on, as well as when a different measuring probe is

used. This ensures that the device is always set correctly. Pressing the  button cancels the current zero setting.

9.4 Speed of sound





In order to be able to take exact measurements, this must be set to the speed of sound of the corresponding material. Different materials have different speeds of sound.

If this is not done, all measurements will be incorrect by a certain percentage. **Single-point calibration** is the most common method of optimising linearity over a long range. **Two-point calibration** allows greater accuracy at shorter ranges by calculating the zero setting and the speed of sound.

Note: For **single-point and two-point calibrations**, colour or coating must be removed beforehand. If this is not done, the calibration result will consist of a type of "multi-material sound velocities" and will certainly not be that of the actual material to be measured.






9.4.1 Calibration with known material thickness

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







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 is now shown on the display and the coupling symbol appears.
4. As soon as a stable reading is reached, the measuring probe is lifted again. If the material thickness just determined then changes from the value that existed during coupling, step 3 must be repeated.
5. The required material thickness (that of the material pattern) can now be adjusted using the buttons ,  and .
6. Press the button  and the calculated sound velocity value appears based on the material thickness that was previously saved.
7. The device automatically switches to measuring mode

9.4.2 Calibration with known sound velocity

Note: For this procedure, the speed of sound of the material to be measured must be known. A table of the most common materials can be found in the appendix of these operating instructions.

1. Press the  button several times to access the "Speed of sound" element.
2. Use the button  to switch between the preset sound velocities.
3. If necessary, the preset sonic velocity can be overwritten up and down using the buttons  and  until the desired value of the material to be measured is reached. This is necessary, for example, if, as already mentioned, there are deviations in the material composition from (manufacturer to manufacturer) for one and the same material.
4. To exit calibration mode, press the  button. Measurements can now be taken.

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

1. Go to the {Test Set} → {Velocity Set} submenu and press the  button to access the sound velocity menu.
2. The  button is pressed several times until the changeable numerical digit is reached. Use the  /  buttons 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 device; if the button is held down, the numerical values add up or decrease in steps at the same interval.
4. Press the  button to confirm or the  button to cancel the calibration.
5. In order to achieve the most accurate measurement result possible, it is generally recommended to calibrate the measuring device with a material sample of known thickness.

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

9.5 Measurements

The measuring device always saves 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 probe into the material and back again. A little coupling agent should therefore be applied to the surface of the material to be measured before the measurement. The measuring probe is then carefully pressed onto the material surface. The coupling symbol and a number appear on the display. Once the device has been set and the correct sound velocity has been determined, the number on 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 whether there is sufficient coupling agent in the area under the measuring probe and whether it has been placed flat on the material. Sometimes it is necessary to try a different probe for the material in question (diameter or frequency).

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

Note: Sometimes a thin film of coupling agent is drawn between the measuring probe and the material surface when the measuring probe is lifted. This film can cause the measurement to be larger or smaller. In the case of materials with a thick colour or coating, this can be measured by mistake instead of the intended material. The user is responsible for the proper use of the measuring device in connection with recognising these phenomena.


9.6 Two-point calibration

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

1. Coupling agent is applied to the material sample.
2. The US measuring probe is placed on it and the correct position of the measuring probe on the material sample is checked. A measured value should now be shown on the display and the coupling symbol should appear.
3. As soon as a stable measured value is reached, the measuring probe is removed. If the reading differs from the reading when the measuring probe was still coupled, step 2 must be repeated.
4. The measurement of the material thickness is changed up and down using the buttons   and  until the value of the material pattern is set.
5. To set the 2nd value, press the  button. The device switches to measuring mode. The 2nd sample is now measured (the thickness should be different to the 2nd sample, otherwise an error message will be displayed)
6. As soon as a stable measured value is reached, the measuring probe is removed. If the reading differs from the reading when the measuring probe was still coupled, step 2 must be repeated.
7.  Press the button, the input screen appears, adjust the nominal thickness here.
8. The measurement of the material thickness is changed up and down using the buttons   and  until the value of the material pattern is set.
9. End the 2-point calibration with the  button or cancel with the  button.
10. The device is now ready to take measurements in its measuring range.

9.7 The scan mode







This device has a scan mode. In normal mode, four measurements are taken per second, which is very useful for individual measurements. In scan mode, ten measurements are taken per second and the reading results 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, as short interruptions to the signal are ignored. In the event 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 the {Test Set} → {Work Mode} menu, press the  button to switch between single-point measurement mode and scan mode.

9.8 Set limit value


This allows the user to set an audible and visible parameter during the measurement. If a measurement is beyond the limit value set by the user, a signal tone sounds. This improves the speed and effectiveness of the measurements as it is not necessary to constantly look at the display.

The following section describes how to create this option:


1. In the {Test Set} → {Tolerance Limit} menu, press the  button to activate the command.
2. Use the  button and the  and  buttons to set the upper and lower limit values for the desired measured value.
3.  Press the button again to confirm and go to the actual menu or press the  button to cancel the limit setting.
4. If the set limit exceeds the measuring range, the measuring device will remind you to reset it. If the lower limit is greater than the upper limit, the values are automatically exchanged.

9.9 Resolution

The device has two selectable screen resolutions: 0.1mm and 0.01mm. These can be found in the menu under {Test Set} → {Resolution}.

 The button can be used to select between "high" (high resolution) and "low" (low resolution).

9.10 Unit scale





In the {Test Set} → {Unit} menu, use the  button to select between mm (metric) and inches (English).

9.11 Storage management




9.11.1 Saving a measured value

The measured values can be stored in 100 groups (F00-F99) in the device and 100 measured values can be stored in each group.

The procedure is as follows:

1.  Press the button to call up the {File name} menu on the display.
2. The corresponding group can be selected using the buttons  and .
3. After a new reading appears, press the save button  to save the measurement in the current file. With the {Auto Save} function, the measured value is automatically saved in the file as soon as a new measurement is added.

9.11.2 Edit measured values

 Press the button several times until {File name} appears on the display. The group number can be changed using the  and buttons. 




 Deletes the selected group

 Deletes all groups


 or  marks the selected group to save in it

 Leave dialogue

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

 Press the button several times until {Record count} appears on the display. The group number can be changed using the  and buttons. 

 Deletes the selected 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 |
| | |
| | |

9.12 System setting


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

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

9.13 System information

This function provides the most important information about the main part of the device and the firmware. The version changes when the firmware changes.


9.14 Backlit display

This also allows you to work in dark surroundings. The backlight is activated and deactivated with the  button as soon as the measuring device is switched on. As the EL light consumes a lot of power, it should only be switched on when required.



9.15 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.

9.16 System reset

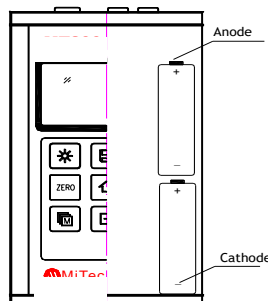
If the  button is pressed during device start-up or {System reset} is selected in the menu, all settings and the memory are deleted and reset to the default settings.

9.17 Battery information

Two AA alkaline batteries are required as a power source. After using the batteries for several hours, the symbol  appears on the display. The larger the black part of the symbol, the fuller the battery is. When the battery capacity is exhausted, the following symbol  appears and starts to flash. The batteries should now be replaced. The picture on the next page shows the position of the batteries in the appliance. It is essential to observe the polarity when changing the batteries.

Procedure:

1. Switch off the device.
2. Remove the battery cover from the device and take out the two batteries.
3. The batteries are inserted correctly.
4. The battery cover is replaced.
5. The appliance is switched on again for checking.



If the appliance is not to be used for a longer period of time, the batteries should be removed.

It is recommended to replace the batteries when the capacity is only 10%.

10 Battery operation / power supply

⚠ WARNING



Risk of fire and explosion due to incorrect charging or defective battery




Fire or explosion can lead to serious injuries

- ⇒ Be sure to observe the notes on rechargeable batteries and batteries in the Safety chapter.
- ⇒ Observe the national and international transport regulations for devices with a permanently installed lithium-ion battery.
- ⇒ Do not replace defective batteries yourself! Contact SAUTER or a specialist dealer directly.

This device is equipped with two AA alkaline batteries. Please use the original battery and do not replace any other batteries to avoid damage to the device or other failures.

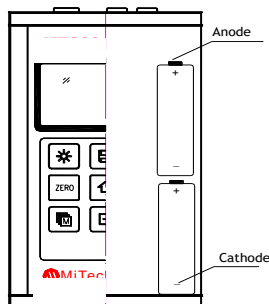
- Nominal voltage 1,5 V
- Capacity 3,000 mAh

When the battery capacity is exhausted, the following symbol  appears and starts to flash.

It is essential to observe the polarity when changing.

Procedure:

1. Switch off the device.
2. Remove the battery cover from the device and remove the two batteries.
3. Insert the batteries correctly.
4. Replace the battery cover.
5. Switch the appliance on again to check.



If the appliance is not to be used for a longer period of time, the batteries should be removed.

It is recommended to replace the batteries when the capacity is only 10%.

11 Interfaces

The device is equipped with a USB 2.0 interface as standard. It can be connected to a PC using the optional cable. The measurement data stored in the device memory can be transferred via this cable.

For detailed information on the communication software, please read the software manual.

12 Maintenance, servicing and disposal



Disconnect the appliance from the power supply before carrying out any maintenance, cleaning or repair work.

12.1 Cleaning

Clean the device with a damp, soft, lint-free cloth. Ensure that no moisture penetrates the housing. Do not use sprays, solvents, alcohol-based cleaners or abrasive cleaners, but only clear water to moisten the cloth.

12.2 Maintenance and repair

Do not make any changes to the appliance and do not install any spare parts. Contact the manufacturer for repair or device inspection.

12.3 Waste disposal



Old appliances and accessories should not be disposed of with household waste.

The operator must dispose of the packaging and appliance in accordance with the applicable national or regional legislation at the place of use.

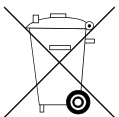
The device consists of various components and materials, such as

- Electronic components (circuit boards, electrical cables)
- Plastic (housing)
- Metal

Improper disposal of the appliance can have harmful effects on people and the environment.

Proper and environmentally friendly disposal can prevent harmful effects and recover raw materials.

Disposal of rechargeable batteries and batteries:



Rechargeable batteries and batteries do not belong in household waste.

The disposal of rechargeable batteries and batteries must be carried out by the operator in accordance with the applicable national or regional law of the place of use.

13 Battery law

Note in accordance with the Battery Act - BattG:

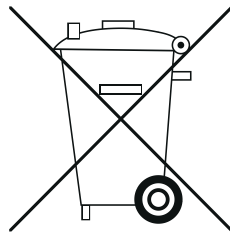
INFORMATION



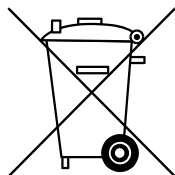
- The following information is valid for Germany.

In connection with the sale of batteries and rechargeable batteries, we are obliged as a dealer under the Battery Act to inform end users of the following:

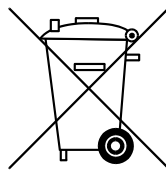
- End users are legally obliged to return used batteries and rechargeable batteries.
- After use, batteries and rechargeable batteries can be returned free of charge to municipal collection centres or retailers. The batteries/rechargeable batteries must have reached the end of their normal service life, otherwise precautions must be taken against short circuits.
- The return option is limited to batteries and rechargeable batteries of the type that we carry or have carried in our range and to the quantity that end users usually dispose of.
- A crossed-out wheelie bin means that you must not dispose of batteries or rechargeable batteries in household waste. Old batteries or rechargeable batteries may contain harmful substances that can damage people and the environment if not disposed of correctly.



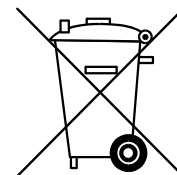
- Batteries containing harmful substances are labelled with a symbol consisting of a crossed-out dustbin and the chemical symbol (Cd = cadmium, Hg = mercury, or Pb = lead) of the heavy metal that is decisive for the classification as containing harmful substances.



Cd



Hg



Pb

14 Appendix

14.1 Sound velocities

| Material | Sound Velocity | |
|--------------------|----------------|-----------|
| | In/us | m/s |
| Aluminium | 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 |
| Epoxy resin | 0.100 | 2540 |
| Ice | 0.157 | 3988 |
| Nickel | 0.222 | 5639 |
| Perspex | 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 |

14.2 Comments on the application

14.2.1 Measuring pipes 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 greater than

4 inches, the position of the measuring 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 measured value of these two measurements is then taken as the exact measured value for this point.



Perpendicular Parallel

14.2.2 Measuring hot surfaces

The speed of sound through a particular material depends on its temperature. As the temperature increases, 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 speed of sound 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 perform a calibration with a material sample of known thickness that corresponds exactly or approximately to the temperature of the material to be measured. This allows the measuring device to calculate the exact speed of sound 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 as 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. Due to thermal expansion and other effects, this can have a detrimental effect on the measurement accuracy.

14.2.3 Measuring coated materials

Coated materials are special because their density (and therefore the speed of sound) can vary considerably from one piece to another.

Noticeable differences in the speed of sound can be detected even through a single surface. The only way to obtain an accurate measurement result is to carry out a calibration on a material sample of known thickness beforehand. Ideally, this should be made from the same piece as the material to be measured, or at least from the same production series. With the help of "pre-calibration", 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 is noticeable in a sudden decrease in material thickness. Whilst this prevents the accurate measurement of the overall material thickness, the user is positively alerted to air gaps in the coating.

14.2.4 Material suitability

Ultrasonic material thickness measurements are based on sending sound through the material to be measured. Not all materials are suitable. Ultrasonic measurement can be practically applied to a variety of materials including metals, plastics and glass. Difficult materials include some cast materials, concrete, wood, fibreglass and some types of rubber.

14.2.5 Coupling agent

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 transmitted efficiently through air.

A variety of coupling agents are used. Propylene glycol is suitable for most applications. Glycerine is suitable for difficult applications. However, glycerine causes corrosion in some metals due to water absorption.

Other coupling agents for measurements at normal temperatures can include water, various oils or greases, gels and silicone fluids. Measurements at high temperatures 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 user is solely responsible for the appropriate use of the measuring device and for recognising these phenomena.