

T610

EN

OPERATING MANUAL
MATERIAL MOISTURE
MEASURING DEVICE



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Notes regarding the operating manual

Symbols

**Danger!**

Warns of a hazard which can lead to personal injury.

**Caution!**

Warns of a hazard which can lead to damage to property.

The current version of the operating manual can be found at:
www.trotec.de

Legal notice

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The scope of delivery may vary from product images. This document was created with all due care. TROTEC® accepts no liability whatsoever for possible mistakes or omissions.

The only party responsible for determining measured results to be valid, drawing conclusions and deriving actions is the user! TROTEC® accepts no claims of warranty for the correctness of the determined measured values or measured results. Further, TROTEC® accepts no liability whatsoever for possible mistakes or damage which have been caused by utilising the determined measured results. © TROTEC®

Warranty

The warranty is for 12 months. Damages caused by incorrect use by untrained people or start-up by unauthorised people are excluded from the warranty.

The device complies with the fundamental health and safety requirements of the applicable EU regulations and was tested at the factory for perfect functionality multiple times. However, if faults in the functionality occur and cannot be remedied with the measures in the chapter Errors and faults, please get in touch with your dealer or distributor. When making a warranty claim, supply the device number (see the rear of the device). The invoice acts as warranty certificate. When manufacturer's instructions or legal regulations have not been followed, or after unauthorised changes to the device are made, the manufacturer is not responsible for the resulting damages. Changes to the device or unauthorised replacement of individual parts can drastically impact the electrical safety of this product and leads to the forfeit of the warranty. Liability does not extend to damages to people or property caused by the device being used other than as described in the instructions in this operating manual. Subject to changes to technical design and model changes as part of constant development and product improvement without prior notice.

No liability is accepted for damages resulting from improper use. In such cases, entitlements to a warranty are then also forfeited.

Information about the device

Description of the device

The material moisture measuring device T610 measures the moisture level of building material up to a depth of 30 cm by means of microwaves.

The measurement method belongs to the dielectric measurement methods.

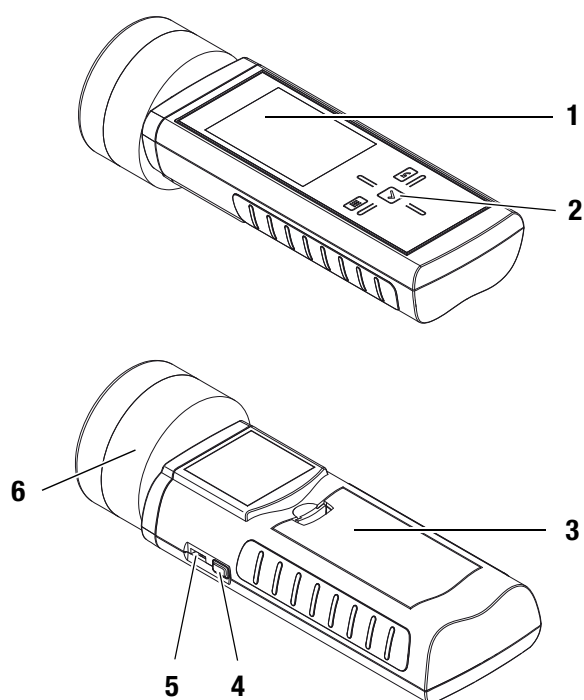
A minimum, maximum and average function is available for the direct analysis of the measured data. Besides, the currently measured value can be recorded via the hold function.

The device can be operated via a capacitive touchscreen control panel.

When not in use, an automatic switch-off saves the battery.

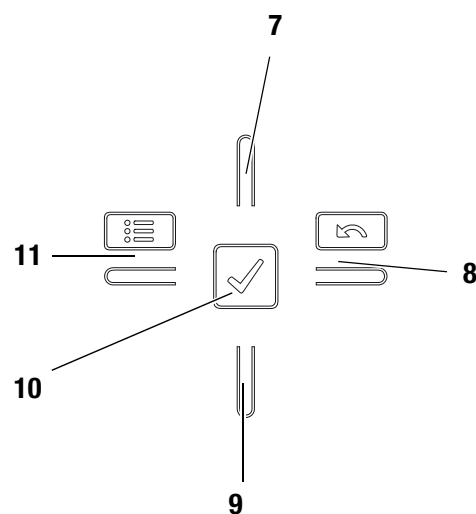
You can connect the device to a computer by using the USB cable included in the scope of delivery. Then you can extract and analyse your measured results with the optional MultiMeasure Studio software.

Device depiction



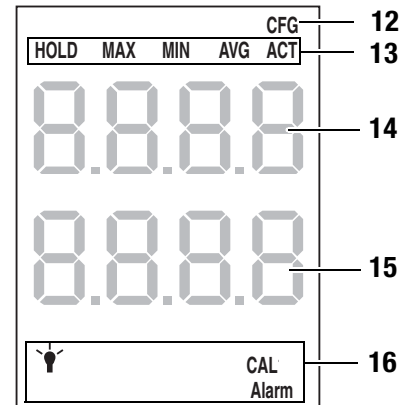
No.	Operating element
1	Display
2	Cross control
3	Battery compartment with battery cover
4	On/Off key
5	USB interface
6	Measuring head

Cross control



No.	Operating element
7	Up key
8	Right/back key
9	Down key
10	OK button
11	Left/menu key

Display



No.	Display element
12	Configuration mode display
13	Measuring mode
14	Measurement value display top
15	Measurement value display bottom
16	Configuration mode options

Technical data

Parameter	Value
Model	T610
Dimensions (L x W x H)	191 x 63 x 35 mm
Weight incl. batteries	approx. 420 g
Measuring range	0 to 200 digits
Operating range	
Operating temperature	0 °C to +50 °C
Relative humidity	< 90 % or < 20 g/m ³ (non-condensing)
Storage	
Relative humidity	< 95 % (non-condensing)
Ambient temperature	-20 °C to +60 °C
Energy	
Battery	4 x Alkaline LR6 AA, 1.5 V batteries comparable NiMH rechargeable batteries (>2500 mAh)
Current consumption, active	approx. 110 mA
Current consumption, passive	approx. 40 µA
Battery life	at least 24 h

Scope of delivery

The scope of delivery includes:

- 1 x Material moisture measuring device T610
- 4 x Alkaline LR6 AA, 1.5 V batteries
- 1 x USB cable
- 1 x Display protection film
- 1 x Getting started guide
- 1 x Factory test certificate

Safety

Carefully read the operating manual before using the device and keep it within reach!

- Do not use the device in atmospheres containing oil, sulphur, chlorine or salt.
- Never use the device for measurements at live parts.
- Ensure that all connection cables are protected from damages (e.g. from kinks or crushing).
- Protect the device from permanent direct sunlight.
- Observe the storage and operating conditions (see chapter Technical data).

Intended use

Only use the material moisture measuring device T610 for the moisture measurement of building materials.

Here, read and observe the technical data.

To use the device for its intended use, only connect and use accessories and spare parts which have been approved by TROTEC®.

Improper use

Do not use the device in potentially explosive atmospheres, or for measurements in liquids. TROTEC® accepts no liability for damages resulting from improper use. In such a case, entitlements to a warranty are forfeited. Any unauthorised modifications, alterations or structural changes to the device are forbidden.

Personnel qualifications

People who use this device must:

- have read and understood the operating manual, especially the Safety chapter.

For maintenance or repair work which requires the housing to be opened, contact TROTEC® customer service. Devices which have been opened unlawfully are void of any warranty and warranty claims.

Residual risks



Danger!

Do not leave the packaging lying around. Children may use it as a dangerous toy.



Danger!

The device is not a toy and does not belong in the hands of children.



Danger!

Dangers can occur at the device when it is used by untrained people in an unprofessional or improper way. Observe the personnel qualifications.



Caution!

To prevent damages to the device, do not expose it to extreme temperatures, extreme humidity or moisture.

Transport and storage

Transport

Use a suitable bag to transport the device safely.

Storage

When the device is not being used, observe the following storage conditions:

- dry,
- protected from dust and direct sunlight,
- with a plastic cover to protect it from invasive dust, if necessary.
- The storage temperature is the same as the range given in the chapter Technical data.
- When storing the device for a long time, remove the batteries.

Accessories

Optionally, the following accessories are available for transport and storage:

- TROTEC® Holster 3

For further information please contact your TROTEC® customer service.

Operation

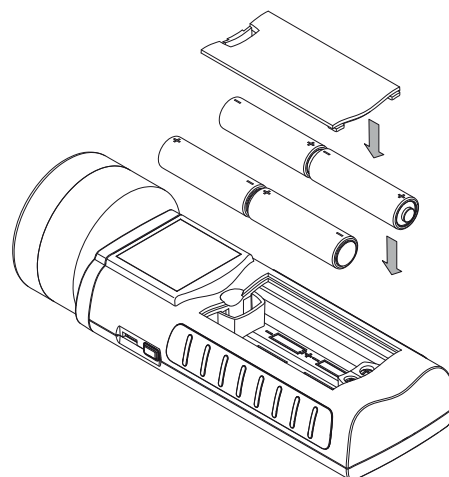
Inserting the batteries

- Insert the supplied batteries before first use.



Caution!

Make certain that the surface of the device is dry and the device is switched off.



1. Open the cover of the battery compartment (3).
2. Insert the batteries in the compartment as indicated in the figure.
3. Close the cover of the battery compartment (3).
 - The device can now be switched on.

Switch-on and measurements

Notes:

Note that moving from a cold area to a warm area can lead to condensation forming on the device's circuit board. This physical and unavoidable effect can falsify the measurement. In this case, the display shows either no measured values or they are incorrect. Wait a few minutes until the device has become adjusted to the changed conditions before carrying out a measurement.

Please observe the information regarding the measurement principle.

The cross control is very sensitive. Therefore, avoid dirt on the control panel, because it could be misinterpreted by the device as keystroke.

Before use make sure that the touchscreen control panel is dirt-free.

If required clean the touchscreen control panel according to chapter Cleaning the device on page 10.

1. Hold the device pointing into clear space.
 - The device should point away from the body and not at or near material surfaces. When failing to observe the above instructions, the following calibration will be corrupt.
2. Press the On/Off key (4) until a beep is emitted.
3. The device performs a short self-test.
 - The device name and firmware version is shown on the display.
 - The battery charge is indicated on the display.
 - The device carries out an automatic calibration. During calibration the display indicates the lettering *CAL*. These flashing characters are accompanied by brief acoustic signals.
 - An extended acoustic signal indicates that the calibration has been completed.
 - The device is ready for operation.
4. Select the desired measuring mode.
5. Place the measuring head (6) vertically on the surface of the material to be measured. Hold the measuring head still during the entire measuring process.
 - The measured value will be displayed.

Carrying out a comparative measurement

1. Look for a preferably dry spot at the component.
2. Perform a measurement as previously described.
 - The thus determined measured value will be the reference value for *dry*.
3. Look for a preferably damp or wet spot at the component, if any.
4. Perform a measurement as previously described.
 - With regard to the present conditions, the thus determined measured value will be the reference value for *damp/wet*.
5. Carry out further measurements at the component.

Higher measured values usually signify a higher moisture content in the near-surface area of the material to be measured.

Carrying out a grid measurement

Particularly for larger areas, it is always recommended to perform measurements in form of a preferably close-meshed grid, for it is only this way that changes in the moisture content of the material can relatively confidently be detected and occasional outliers minimized.

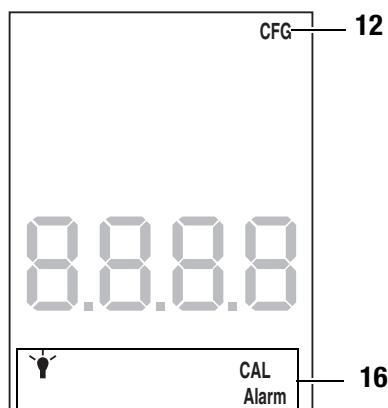
1. Look for a preferably dry spot at the component.
2. Carry out at least five individual measurements within a radius of approx. 20 cm.
3. Calculate the average value of the individual measurement results.
 - The average will be the reference value.
4. Carry out further grid measurements at the component.
 - Higher measured values most likely signify the moisture penetration of the measured material.

Key lock

1. Briefly press the On/Off key (4) during operation.
 - The device emits a short beep.
 - The following message appears on the display: LoC on.
 - Key lock is activated.
2. Press the On/Off key (4) again.
 - The device emits a short beep.
 - The following message appears on the display: LoC off.
 - Key lock is no longer activated.

Configuration mode

1. Press the Left/menu key (11) for approx. 2 seconds.
 - The device emits a short beep.
 - The CFG symbol (12) is displayed in the upper right corner.
 - The available options for configuration mode (15) are displayed.
2. Use the cross control (2) to select the desired option.
3. Confirm the selection by pressing the OK button (10).
 - The selected symbol will be illuminated.



Configuration mode	Description
ALARM	Setting the threshold value for the alarm
Lamp	Adjusting the display illumination
CAL	Setting the offset value

Setting the alarm

Here you can determine the limit value for the alarm function. Upon exceeding this value, the device emits an acoustic signal and the indication ALARM (16) flashes. The alarm function draws on the current digit measured value. The limit value can be determined within a range of 0.1 to 200.

1. Select ALARM (16) whilst in configuration mode.
2. Press the OK button (10) to confirm.
 - The upper measurement value display (14) flashes.
3. Press the Up (7) or Down (9) key to activate or deactivate the alarm.
 - On or Off will be indicated in the upper measurement value display (14).
4. Press the Right/back key (8).
 - Depending on the selection, the alarm is either activated or deactivated.
 - The lower measurement value display (15) flashes.
5. Press the keys Left/menu (11) or Right/back (8) to select a digit.
 - The selected digit flashes.
6. Press the Up (7) or Down (9) key to change the value of the selected digit.
7. Repeat the steps 5. and 6. until the value is set as desired.
8. Press the OK button (10) for approx. 2 seconds.
 - The alarm is set.
 - The device switches to measuring mode.
 - With activated alarm function the indication ALARM (16) continues to be displayed.

Adjusting the display illumination

The display illumination can be adjusted within a range of 20 to 100 %. Another available setting is AL.on (always on). AL.on features a brightness of 100% and deactivates the automatic switch-off function.

1. Select the lamp (16) whilst in configuration mode.
2. Press the OK button (10) to confirm.
3. Select the desired value by use of the Up (7) or Down (9) key.
4. Press the OK button (10) for approx. 2 seconds.
 - The set value will be adopted.
 - The device switches to measuring mode.

Setting the offset value

By use of CAL a single-point calibration can be carried out for the selected sensor indications. All sensors are already factory-calibrated and have a corresponding characteristic calibration curve. By stating a calibration value (offset) a global shift of the calibration curve, which has an effect on the entire measuring range, is performed for the single-point calibration! The offset value to be entered is that value by which the calibration curve will be shifted.

Example:

The displayed value is always 5 too high => change the offset value for this measurement channel to -5.

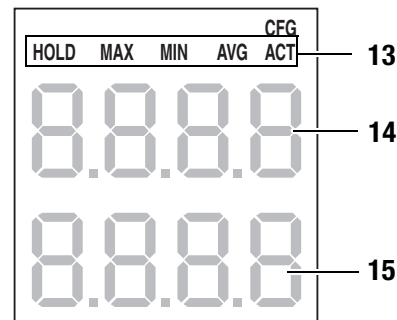
The offset value's default setting is 0.0.

Changing this value brings about an automatic reset of the measured values.

1. Select CAL (16) whilst in configuration mode.
2. Press the OK button (10).
3. Press the Up (7) or Down (9) key to activate or deactivate the offset.
 - On or Off will be indicated in the upper measurement value display (14).
4. Press the Right/back key (8).
 - Depending on the selection, the offset is either activated or deactivated.
 - The lower measurement value display (15) flashes.
5. Press the keys Left/menu (11) or Right/back (8) to select a digit.
 - The selected digit flashes.
6. Press the Up (7) or Down (9) key to change the value of the selected digit.
7. Repeat the steps 5. and 6. until the value is set as desired.
8. Press the OK button (10) for approx. 2 seconds.
 - The offset is set.
 - The device switches to measuring mode.
 - With set offset value the indication CAL (16) continues to be displayed.

Measuring mode

1. Press the keys Right/back (8) or Left/menu (11) until the desired measuring mode is displayed.
 - The selected measuring mode (13) will be indicated on the display (1).
 - The current measured value is displayed in the lower measurement value display (15).
 - The values of the measuring modes AVG, MIN, MAX and HOLD are displayed in the upper measurement value display (14).



The device comes with the following measuring modes:

Measuring mode	Description
ACT	Measured value in real time
AVG	Average value of measurements since switch-on
MIN	Minimum measured value
MAX	Maximum measured value
HOLD	Measured value will be held

Holding the measured value

1. Set the measuring mode to HOLD.
 - The current measured value will be held and displayed.
 - The device will hold this value until the measured values are set back or the device is switched off.

Resetting the measured values

1. Press the OK button (10) for approx. 2 seconds.
 - All previously stored measured values of the measuring modes AVG, MIN, MAX and HOLD will be set back.
 - All measured values are then determined anew based on the measurement proceeding in the background.

Measured value storage

Please note that measured values cannot be saved on the device itself. In order to save measured values, the device has to be connected to a PC via a USB cable using the MultiMeasure Studio software.

1. Briefly press the OK button (10).
 - The displayed measured value will be saved in the software.

Further information can be gathered from the help text of the MultiMeasure Studio software.

USB interface

The device can be connected to a PC via the USB interface (5). See chapter PC software on page 9.

Switch-off

1. Press and hold the On/Off key (4) for approx. 3 seconds until a beep is emitted.
 - The device will be switched off.

Measuring principle

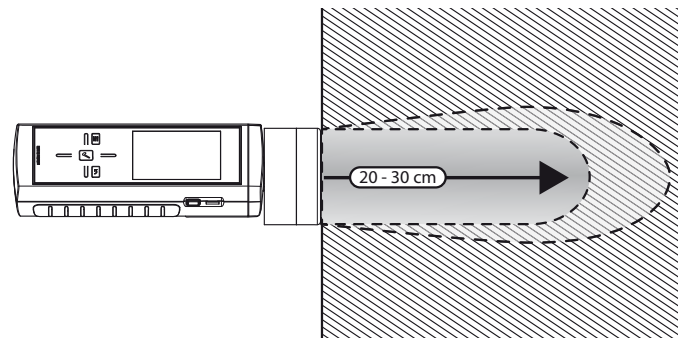
The measurement method applied here utilizing microwaves belongs to the dielectric moisture measurement methods.

- The measuring head generates an electromagnetic wave, which spreads throughout the material and is reflected.
- Not only the near-surface volume elements of the measured material contribute to the reflection of this wave, but also those located at a lower level. The weighting of the share in how the individual volume elements contribute drops with increasing depth. This means that underlying moisture zones have a proportionally lesser influence on the display value than near-surface moisture penetration.
- With increasing frequencies the influence of ohmic drops (ionic conductivities, e.g. salinization of the brickwork) declines distinctly. From roughly 1 GHz these drops are almost negligible as opposed to dielectric losses. The microwave method is thus almost independent of the salinity degree.

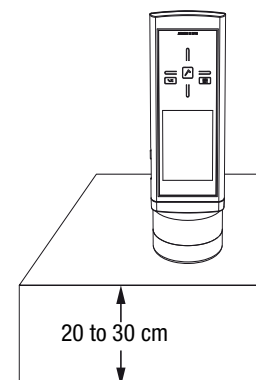
Dielectric moisture measurement methods are based on the dielectric properties of water.

- The water molecule aligns itself in a preferential direction within an externally applied field; it is polarizable. If an alternating electromagnetic field is applied, the molecules begin to rotate with the frequency of the field (orientational polarization). This effect is described macroscopically by the physical variable dielectric constant (DK).
- For water the dielectric effect is so pronounced, that the DK of water amounts to about 80. The DK of most solids, construction materials among them, is much smaller; it is in the range between 2 and 10, chiefly between 3 and 6. Hence measured is the difference between the DK of water and the DK of the building materials. Due to the great difference between these values, even small amounts of water can easily be detected.
- With increasing frequencies it is much harder for the water molecule to follow an externally applied alternating electromagnetic field owing to material-inherent bonding forces. In a way, there is friction within the material or in other words dielectric loss. These losses can be measured by means of specific microwave arrangements.

Notes regarding the measurement principle

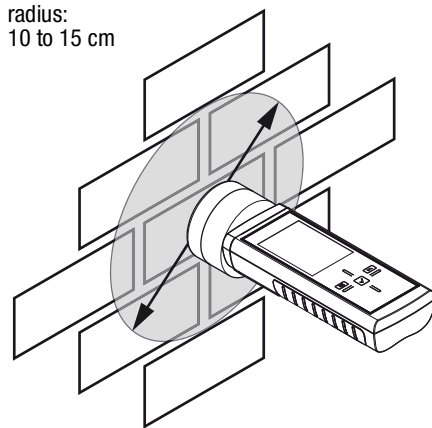


- The microwave sensor of the device at hand contains an antenna arrangement enabling non-destructive penetration depths of up to approx. 30 cm. It is suited to determine the moisture in the volume of the measured material.
- The measurement is effected according to a reflection principle, i.e. measured is the humidity-dependent share of the wave, which is reflected by the material to be measured.
- The maximum penetration depth is substantially reduced when the material to be measured or the component is soaked in the near-surface area.



- Depending on the material and moisture level the field advances 20 to 30 cm into the good to be measured. Therefore, the materials whose moisture is to be measured have to have at least this thickness.
- If the material to be measured is of lesser thickness, shares of the electromagnetic wave emitted by the sensor are reflected at the material's rear side, hence interfering with the moisture-dependent reflections at the measuring head antenna. Depending on the material and moisture level this effect can in part lead to substantial distortions of the measured value.

- In order to minimize measurement errors caused by varying material thicknesses or inhomogeneities, it is recommended to perform a preferably close-meshed grid measurement covering the entire area to be examined.



- The sensor's microwave field exhibits a distinct lateral expansion. A minimum distance to the side limits of the measured material must be observed, for otherwise the measured value might be falsified. In simplified terms the measuring volume can be seen as a cylinder with a radius of 10 to 15 cm. Therefore, the minimum distance for delimiting the material is stated as 10 cm.
- A moisture measurement with less distance to the side edge of the material can result in a distortion of the measured value.
- For a significant and exact measurement with the microwave sensor it must be ensured that the observed measuring volume is sufficiently dimensioned.
- The measured values are to be interpreted as relative values, for the microwave method only enables a differentiation between dry and wet building materials.
- The main area of use consists in comparative measurements at the same construction material or similar components. Depending on the display value, humid zones can be determined and narrowed down.
- Measuring according to the microwave method is further suited for the examination of water damage and for leak detection.
- If the test material contains metal (e.g. pipes, lines, reinforcements, plaster base), the measured value skyrockets. Thanks to the depth effect (penetration), the device is also suitable for localizing metal objects and detecting reinforcements.

- Owing to the correlation between the material's bulk density and the dielectric constant of building materials described above, there can be different display values with different material densities and multi-layered wall or floor constructions. Cluster measurements are recommended to avoid the misinterpretation of the measured values. For this, at least five individual depth measurements are carried out within a radius of 20 cm and from these individual results an average value is to be calculated. This value then constitutes the reference value for other cluster measuring spots.
- For a more precise analysis of homogenous materials (brickwork thicker than 30 cm) a cluster measurement is advisable. Generally, three measurements within a radius of 15 cm are a sufficient basis for evaluation.

PC software

Use the MultiMeasure Studio Standard PC software (free standard version) or MultiMeasure Studio Professional (paid professional version, dongle required) to carry out a detailed analysis and visualisation of your measured results. You can only use all configuration, visualisation and functional options of the device when using this PC software and a TROTEC® USB dongle (professional).

Installation requirements

Ensure that the following minimum requirements for installing the MultiMeasure Studio Standard or MultiMeasure Studio Professional PC software are fulfilled:

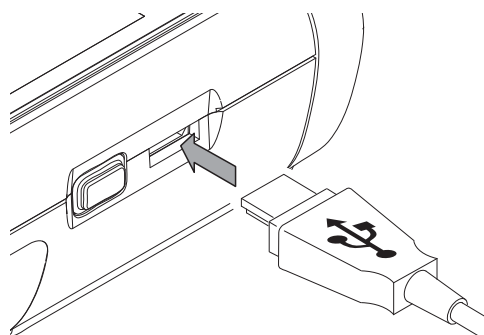
- Supported operating systems (32 or 64 bit version):
 - Windows XP from service pack 3
 - Windows Vista
 - Windows 7
 - Windows 8
- Software requirements:
 - Microsoft Excel (to display stored Excel files)
 - Microsoft .NET Framework 3.5 SP1 (is otherwise automatically installed during the software installation)
- Hardware requirements:
 - Processor speed: min. 1.0 GHz
 - USB connection
 - Internet connection
 - 512 MB RAM, minimum
 - 1 GB hard disk space, minimum
 - Optional: TROTEC® USB dongle (Professional) for using the professional version of the PC software

Installing the PC software

1. Download the current PC software from the Internet. To do so, visit the website www.trotec.de. First click on *Service*, followed by *Downloads* and then *Software*. Select the MultiMeasure Studio Standard software from the list. If you want to use the optionally available professional version of the PC software "MultiMeasure Studio Professional" (dongle), then get in touch with your TROTEC® customer service.
2. Double-click on the downloaded file to start the installation.
3. Follow the instructions of the installation wizard.

Starting the PC software

1. Connect the device to your PC via the USB connection cable provided in the scope of delivery.



Note:

Step 2 only needs to be performed, when using the Professional software functions.

If you only use the Standard software functions, please proceed to step 3.

2. In order to enable the Professional functions, connect the TROTEC® USB dongle to a free USB port on your PC.
 - The TROTEC® USB dongle (Professional) is automatically detected by the operating system.
 - If you only connect the TROTEC® USB dongle (Professional) to your PC after starting the PC software, click the *Parameters* menu item in the PC software. Afterwards, click the USB symbol (dongle check) to read the connected TROTEC® USB dongle (Professional).
3. Switch on the device (see chapter Switch-on and measurements on page 5).
4. Start the MultiMeasure Studio software.

Information regarding the use of the MultiMeasure Studio software is provided in the help text of the software.

Errors and faults

The accurate functionality of the device was tested during production a number of times. However, if functionality faults do occur, then check the device according to the following list.

The device does not switch on:

- Check the charging status of the batteries. Change the batteries when the message *Batt lo* is displayed upon switch-on.
- Check that the batteries are properly positioned. Check the polarity is correct.
- Never carry out an electrical check yourself; instead, contact your TROTEC® customer service.

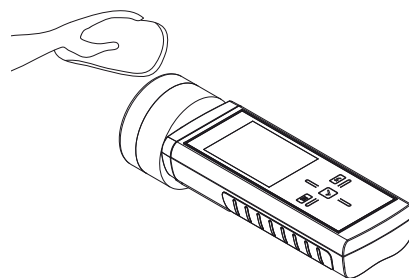
Maintenance



For maintenance or repair work which requires the housing to be opened, contact TROTEC® customer service. Devices which have been opened unlawfully are void of any warranty and warranty claims.

Cleaning the device

1. Use a soft, lint-free cloth for cleaning.
2. Dampen the cloth with clean water. Do not use sprays, solvents, alcohol-based or abrasive cleaners to dampen the cloth.
3. Clear dirt from the housing, the connections and the colour display.



Battery change

Change the batteries when the message *Batt lo* is displayed upon switch-on or the device can no longer be switched on. See Inserting the batteries on page 4.

Disposal



In the European Union, electronic equipment must not be treated as domestic waste, but must be disposed of professionally in accordance with Directive 2002/96/EC of the European Parliament and Council of 27th January 2003 concerning old electrical and electronic equipment. After the end of its use, please dispose of this device in a manner appropriate to the relevant legal requirements.

In the European Union, batteries must not be treated as domestic waste, but must be disposed of professionally in accordance with Directive 2006/66/EC of the European Parliament and Council of 6th September 2006 concerning batteries and accumulators. Please dispose of batteries in a manner appropriate to the relevant legal requirements.

Declaration of conformity

in accordance with the EC Low Voltage Directive 2006/95/EC and the EC Directive 2004/108/EC about electromagnetic compatibility.

Herewith, we declare that the T610 material moisture measuring device was developed, constructed and produced in compliance with the named EC directives.

The $\text{C} \in$ marking is found on the rear of the device.

Manufacturer:

Trotec GmbH & Co. KG

Grebbeener Straße 7

D-52525 Heinsberg

Phone: +49 2452 962-400

Fax: +49 2452 962-200

E-mail: info@trotec.de

Heinsberg, 31/03/2014

Managing Director: Detlef von der Lieck

TROTEC GmbH & Co. KG

Grebbeener Str. 7
52525 Heinsberg
Deutschland

📞 +49 2452 962-0

📠 +49 2452 962-200

info@trotec.com

www.trotec.com