

Handheld Device HD2

More Information:
www.imko.de



Thank you for purchasing this IMKO product

This manual is an original operating manual of the manufacturer.

The described instructions for use and commissioning are part of the products described and must be kept for future installation or use.

Important!

Please read these instructions carefully to accomplish optimum results with your moisture probe. Please contact your authorized dealer, distributor or service center for troubleshooting, questions or suggestions on your new moisture probe. You may contact IMKO directly, too after exploring your local contact.

We look forward to helping you!

For warranty claims, please contact your local dealer, distributor or service center. The warranty does not include any kind of willful damage to the device or its accessories or an operation outside of the product specification. Please refer to the information in this manual. If you have any questions, please contact IMKO service. Don't open the device and please do not try to repair the device yourself- the guarantee expires when the device is opened or modified.

In the course of product improvements, we reserve the right to make technical and visual changes to the device.

Handheld Device HD2:

The HD2 is a portable device which serves for the display of measurement values delivered by TRIME moisture measurement sensors and was designed for mobile field deployment.

Connectable to following Moisture Probes: PICO64/32, TRIME-IPH, SONO-M1/M2

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1 General Notices

Please read the operating instructions carefully.

Should you have any further questions, please contact our service department under the contact data at the end of this document. In no event should you attempt to open and repair the device yourself. Should you like to file any guarantee claims, please contact the distribution partner where you purchased the device.

Within the scope of product improvements, the device is subject to technical and optical changes.

1.1 Intended Use

This handheld device was designed to serve as a reading device for various IMKO probes. Only the listed probes may be connected to the device. The connection of a probe not intended for connection may lead to damage of the device and/or the connected probe.

1.2 The Chargeable Accumulator

Never change the integrated accumulator yourself.

The stated maximum operating periods refer to ideal conditions. The ambient temperature and the charging cycle can significantly reduce the performance time. In addition, the charging capacity is decreasing for technical reasons within the course of the utilization of the device or due to storage at very high or low temperatures.

1.3 Charging the HD2 Handheld device

Only use the respectively provided charger or a comparable power supply unit to charge the HD2 handheld device. Any deviation of the charging voltage can lead to damage of the device.

The device is heating up during the charging process.

Should the HD2 only function for a short period or not at all in spite of several attempts to charge it, the integrated accumulator is defective and must be exchanged. In this case, please contact our local distribution partner or us directly.

1.4 Temperatures and Ambient Conditions

The HD2 handheld device was designed for deployment under rough conditions.

The operation of the device under conditions beyond those depicted may lead to damage of the device.

2 Control Elements

Probe/Charger Connection

Display

„Measurement/Activate“

- Shutting ON/OFF → press 1s
- Perform Measurement → press shortly
- Selection of a Menu Item → press shortly
- Storing a setting → press shortly

„UP“

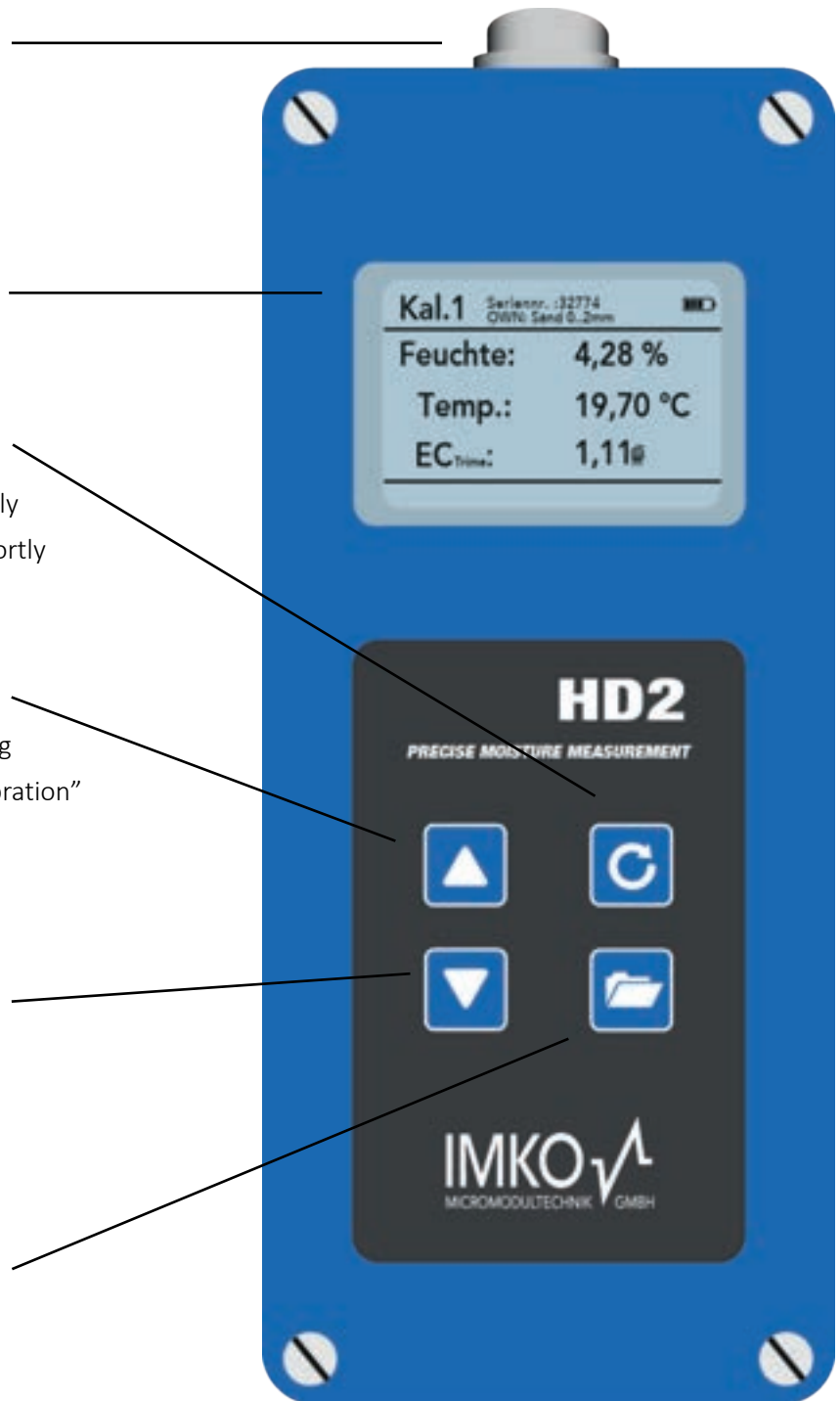
- Back to previous Menu Item or Setting
- Direct link to “CHOOSE-Material Calibration”
(Mode: Normal / Average)
- Direct link to “Density setting”
(Mode: water calculation)

„DOWN“

- Go to next Menu Item or Setting
- Deleting the Value Memory
(Mode – Average Value)

„Settings“

- Conclude Settings
- Choose Menu
- Leave Menu Item



3 Initial Commissioning

3.1 Safety Instructions

Attention:

Before initial commissioning, please read the General Notices in the first chapter of this operating instructions. Any not intended use may lead to damage of the device.

3.2 Checking the scope of delivery

- HD2 Handheld device
- Plug-in Power Supply Unit (12V/2A)
- Charging Adapter
- Protective Hood
- Manual

3.3 Charging the Accumulator

The integrated accumulator should be charged before putting the device into operation the first time. For this purpose, plug in the provided charging adapter into the 7-pole socket of the HD2. Subsequently, connect the plug-in power supply unit to the charging adapter. In the event that the device is already switched on, or if the accumulator is completely discharged, the charging process will commence immediately. If not, switch on the HD2 by pressing the button „Measurement“ for approximately

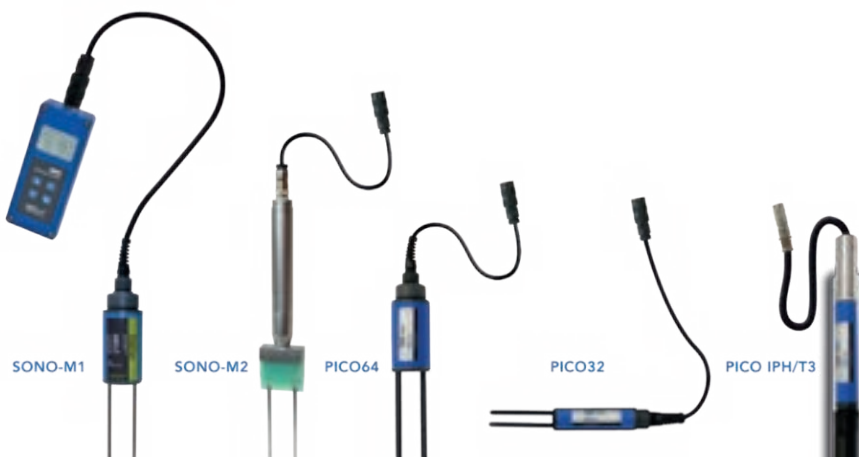
1 second. An active charging process is indicated in the display by an animated accumulator symbol. The integrated charging electronics charges the accumulator until it is completely charged. In case of complete discharge, this will approximately take 2 hours. As soon as the charging process is completed, all 4 „accumulator bars“ will be permanently presented in the display and the trickle charging will commence.

Attention:

Only charge the accumulator at room temperature (approximately between 10°C and 30°C)! At too low temperatures, it may happen that the accumulator is over-charged. Too high ambient temperatures may lead to damage of the HD2 due to the additional heat-up during the charging process.

3.4 Connecting a Sensor





The HD2 handheld device can be operated with the following IMKO-moisture probes:










Connect the moisture probe to the HD2 by plugging in the 7-pole plug into the socket at the HD2 and fastening the coupling nut.

4 Operation

Key/Button Designation

Key/Button	Designation
	Measurement <ul style="list-style-type: none"> Shutting ON/OFF → press 1second Perform Measurement → press shortly Selection of a Menu Item → press shortly Storing a setting → press shortly
	Settings <ul style="list-style-type: none"> Conclude Settings Choose Menu Leave Menu Item
	UP <ul style="list-style-type: none"> Back to previous Menu Item or Setting Direct link to “CHOOSE – Material Calibration” (Mode: Normal / Average) Direct link to “Density setting” (Mode: water calculation)
	DOWN <ul style="list-style-type: none"> Go to next Menu Item or Setting Deleting the Value Memory (Mode – Average Value)

Display Symbols

Symbol	Designation
	Residual Accumulator Capacity
	Active Measurement
	Settings are stored
	Intensity of the Background Illumination
	Remaining time until shut-down (illumination / APO)
	Press button „UP“
	Press button „DOWN“

Text Meaning

Text	Meaning
Cal.:	Number of the active calibration in the probe
Moist.:	Moisture Measurement Value Notice: Depending on the set calibration, the measurement value may refer to %vol, %grav, ε or tp
Temp.:	Temperature
EC-TRIME:	Electrical Conductivity based on the TDR signal
Serialno.:	Serial Number of the probe, respectively of the HD2
HW:	Hardware Version
FW:	Firmware Version

4.1 Switching ON the HD2 Handheld device

Switch ON the HD2 by pressing the button „Measurement“  for approximately 1 second.

During the starting-up process, the HD2 will attempt to communicate with the connected probe. This will take approximately 4 seconds. If no probe is connected, or the probe is not able to communicate for any reason, an error message will be generated on the display.

If the probe was successfully detected, the operation mode will appear on the display and the HD2 is ready for use.

NOTE:

Should no connection to the probe be possible after several attempts, check if the probe is connected properly. Should this not deliver a positive result, please contact our service department.

4.2 Switching OFF the HD2 Handheld device

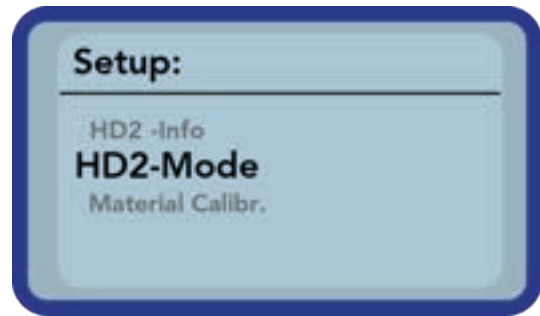
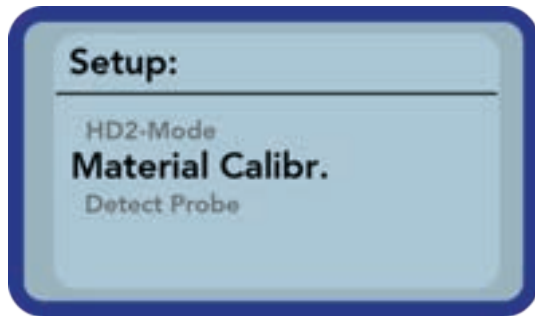
Switch OFF the HD2 by pressing the button „Measurement“  for approximately 1 second.





NOTE:

It is not possible to shut off the HD2 while it is in the „Settings“. Please, first leave the menu „Settings“ by pressing the button „Settings“  until the measurement display appears.

4.3 Settings

There are various options to modify and align the settings of the HD2 handheld device. You will reach the following menu configuration by pressing the button „Settings“ :



By actuating the buttons „Up“  and „Down“ , the entry intended for processing can be marked and subsequently be selected with the button “Measurement” . You can exit the current menu item and also the menu “Settings”, with the button “Settings” .

An Overview of the Setting Options

Settings	Designation
HD2-Mode	Switching the Operating Mode <ul style="list-style-type: none">• Normal“ → measurement of the variables Moisture, Temperature, and EC-TRIME• “Average Value“ → determination of the average value of up to 6 individual moisture measurement values• „Water Calculation“ → Calculates the content of water of the material in l/m³
Material calibration	<ul style="list-style-type: none">• Choosing or change the Material Calibration
Detect Probe	A new search for a connected probe (if an error has occurred during the activation of the device)
Language	Switching the System Language <ul style="list-style-type: none">• German• English
Auto-Power-Off	Setting of the automatic shut-down
Display Lighting	Setting of the Background Lighting <ul style="list-style-type: none">• Turn-Off-Time• Intensity
LCD-Contrast	Setting of the ideal contrast
Probe Info	Information regarding the probe
HD2-Info	Information regarding the HD2 handheld device

4.3.1 HD2-Mode

In this menu item, the operating mode of the HD2 handheld device can be changed.

With the selection „Normal“, an individual measurement of the three probe parameters Moisture, Temperature and the EC-TRIME is selected.





The parameter Moisture is, depending on the selected calibration, showing the moisture in volumetric or gravimetric percentage or showing the running period of the TDR pulse. When showing the running period of the TDR pulse, the unit is „ns“.

When selecting „Average Value“, depending on the selected calibration, only the moisture in %vol or %grav, respectively the running period in „ns“, is determined. The measured value is stored in a list of up to 6 measurement values. The arithmetic average is determined from the shown values.

NOTE:

Only a maximum of 6 values can be stored in the list. Older values are removed from the list and are not used for the calculation of the average value.

The selection „Water Calculation“ will switch on the mode determining the content of water in l/m³ of the measured material. To get the moisture of a bigger volume, it is recommended to probe at various places of the material. The single values will be calculated up in one average value.

By actuating the buttons „Up“  and „Down“ , the entry intended for processing can be marked and subsequently be selected with the button „Measurement“ . After the selection, the symbol  will appear in the upper right hand display corner which indicates that the selection is activated and has been stored.

The HD2 handheld device offers three operating modes:

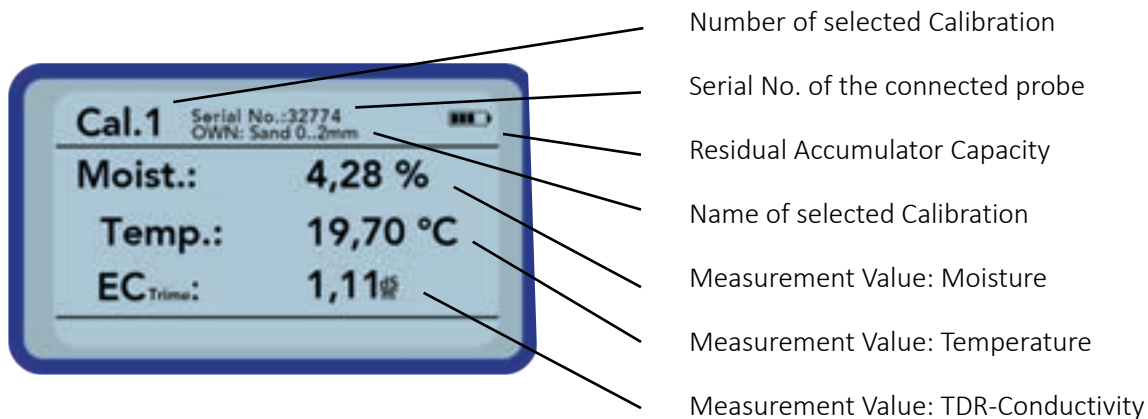
1. Normal → Individual Value Display – presents the measurement variables Moisture, Temperature and the EC-TRIME
2. Average Value → presents the average value of the moisture of up to 6 individual measurements
3. Water calculation → determines and presents the content of water in l/m³



NOTE:

During a measurement, no further actions are possible. It is necessary to wait until the measurement is concluded.

4.3.1.1 Operating Mode „Normal“

After switching on the HD2 handheld device, the following display will appear in the operating mode „Normal“ after the start screen:



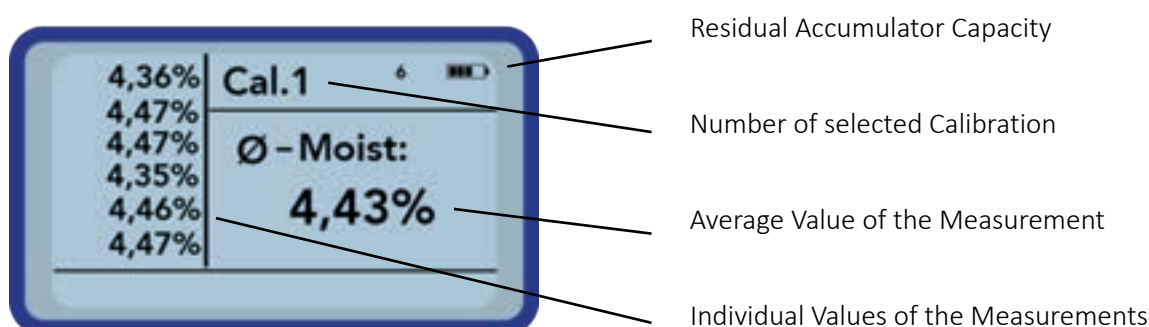
In order to initiate a measurement, shortly press the button “Measurement” . The measurement will commence and a turning -symbol will appear instead of the accumulator-symbol in the upper right hand corner. During this period, no other actions can be performed. The measurement requires approximately 4 to 5 seconds.



Once the measurement is concluded, the accumulator-symbol will reappear and the measured values will be generated on the display. The displayed results will remain until a new measurement is started.

4.3.1.2 Operating Mode „Average Value“

In this operating mode, only the moisture is measured and an average value of up to 6 individual values is calculated. Depending on the set calibration, either the volumetric or the gravimetric moisture is presented.

After switching on the HD2 handheld device, the following display will appear in the operating mode „Average value“ after the start screen:




In order to initiate a measurement, shortly press the button “Measurement” . The measurement will commence and a turning -symbol will appear instead of the accumulator-symbol in the upper right-hand corner. During this period, no other actions can be performed. The measurement requires approximately 4 to 5 seconds.

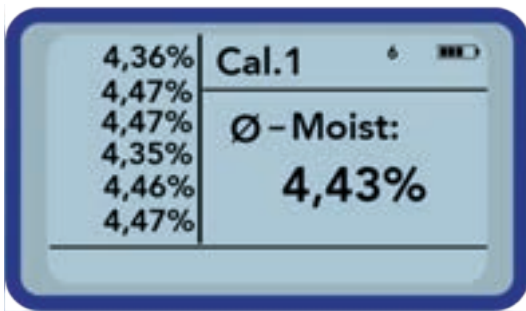
Once the measurement is concluded, the accumulator-symbol will reappear. On the left-hand side of the display, the individual values of the measurements will be presented. The currently measured value is presented at the top and old values will be shifted one position onwards. The arithmetic average value is displayed on the right-hand side. The average value is calculated out of the existing individual values up to a number of 6 values.

NOTE:

Only a maximum of 6 values can be stored in the list. Older values are removed from the list and are no longer taken for the determination of the average value

In order to delete the measurement series, actuate the button „Down“ .


TIPP!

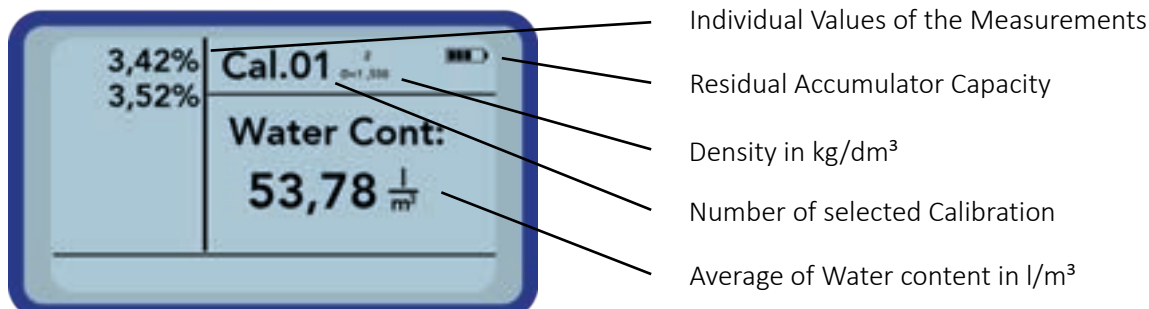



Within the operating mode „Average Value“, the HD2 will deliver a representative measurement result for the volume of the material..


4.3.1.3 Operating Mode „Water Calculation“

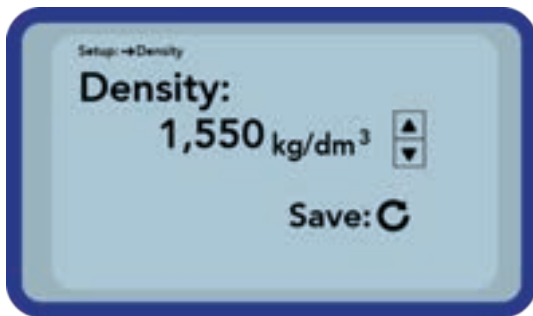
In this operating mode, only the variable Moisture is measured. There will be up to six single values stored and concluded to an average value. Out of this the water content per m³ is calculated. To get the correct water content it is necessary to set up the density of the measured material.

The measurement is initiated by actuating the button „Measurement“ . Repeating this will add another measurement value. The average water content will be calculated and displayed.



In order to delete the measurement series, actuate the button „Down“ .

To set up the density of your material, actuate the button „Up“ . Then you will get the following screen in the display:

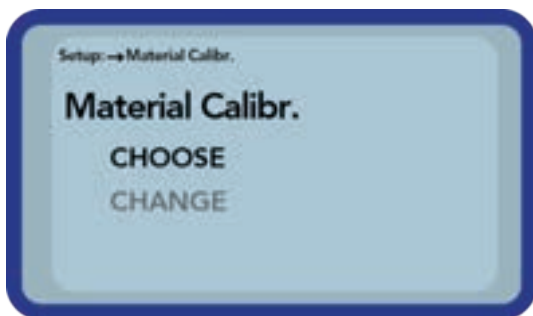


Adjust the density of your material by actuating the buttons „Up“ ▲ and „Down“ ▼. Confirm your setting by pressing the button „Measurement“ C. You will get back to the measurement screen. Leave the setting without changing the density by pressing the button „Settings“ F.

4.3.2 Material Calibration

Depending on the task of the deployment, various calibrations are deposited in the probe. These can be volumetric calibrations for grounds of various densities, gravimetric calibrations for the measurement of sand moisture contents, or also running period calibrations.

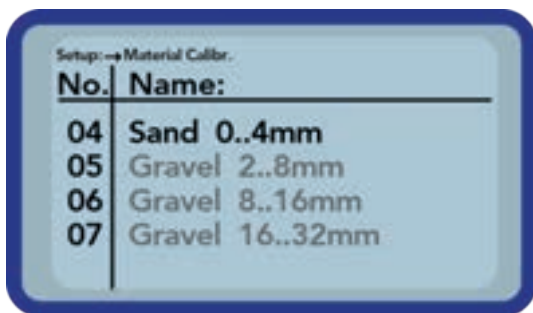
You can select the calibration required for your application within the menu item „Material Calibration“. This enables to cover a multitude of deployment options with merely one probe. Also it is possible to setup your own calibration, to enable the measurement of special materials.



After the selection of the menu item „Material Calibration“, you have to choose between „CHOOSE“, to save one out of fifteen calibration as default calibration, or „CHANGE“, to setup an individual new calibration in one of the fifteen calibration storages.

Menu item: „CHOOSE“:

The 15 calibration options are displayed by name. This requires a short moment of time. A display in a similar form as follows will be presented:



The list can be scrolled and the desired calibration be selected by actuating the buttons „Up“ ▲ and „Down“ ▼. The „!“ in front of a calibration indicates the currently active one. You can set the selected calibration to become the active one by actuating the button „Measurement“ C. After a short moment, the symbol 📄 will appear in the upper right hand display corner to indicate that the selection has been activated. In addition, the „!“ will be placed in front of the now active calibration.

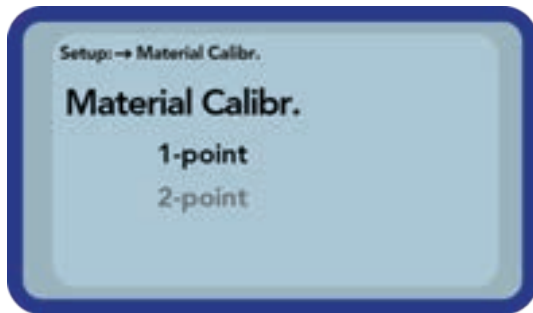
TIPP!

NOTE:

Get to this menu item directly out of the measurement screen, by actuating the button „Up“ ▲

Menu item: "CHANGE":

In this menu an own material calibration can be set, or an existing one can be changed according the individual requirement. Two options are available:



1 point calibration:

- Shifts an existing calibration curve to a choosen moisture point.
- The gradient isn't changed.
- Only one measurement is necessary.

2 point calibration

- Creates a linear calibration between two measured moisture points
- Two material samples with different moisture values are necessary

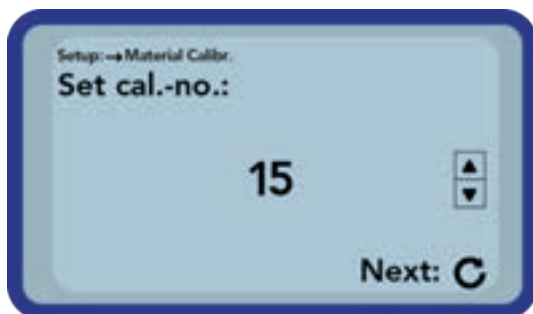
4.3.2.1 -1 Point Calibration



In this material calibration option an offset of the appointed calibration is done. As no change of the calibration curve gradient is proceeded, it is necessary to choose a calibration curve that fits to the material.


NOTE:

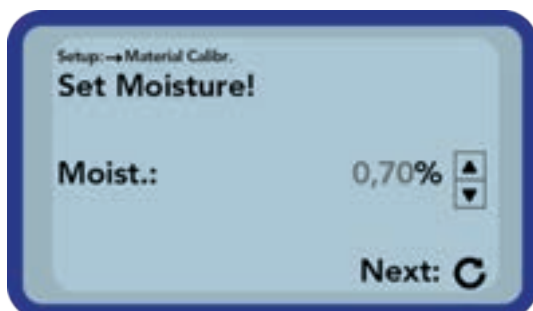
To perform a 1-point material calibration you need a sample of the material to be measured. The moisture of this material has to be exactly determined with another method before starting the calibration.




Procedure

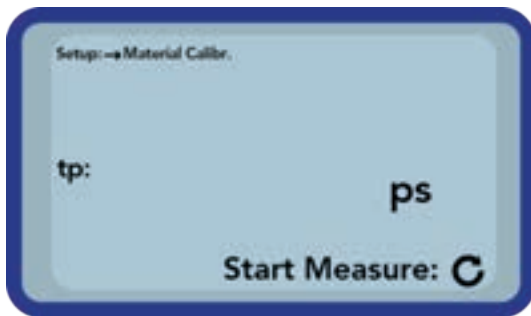



First you have to set the calibration curve to be changed (01 – 15) by pressing the buttons „Up“  and „Down“ .

Apply your setting by actuating the button „Measurement“ .



Next set the moisture of the material by pressing the buttons „Up“  and „Down“ . Apply your setting by actuating the button „Measurement“ .



To start the measurement of the material press the button „Measurement“ . To improve the accuracy, four measurements will be taken.

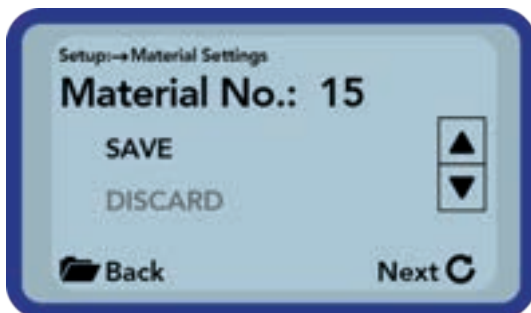
The individual values are averaged. The duration of a measurement takes around 20 seconds. After each measurement the signal runtime will be displayed for a short period.


NOTE:

Ensure that the probe rods are totally covered with the material during the time of the measurement and that the probe is not moved.

Attention:

If you choose “SAVE” at the end of calibration, the stored calibration in the probe electronics will be overwritten! The original calibrations can be restored by connecting the probe with a RS485 adapter (for example SM-USB) to a PC and to use the software PICO-Config.



Finally, you can store the calibration into the chosen calibration storage inside the probe. Choose „SAVE“ and confirm by pressing the button „Measurement“ .

If you choose “DISCARD” everything is left untouched.

To name of the changed calibration, is the original with the prefix „OWN:“.

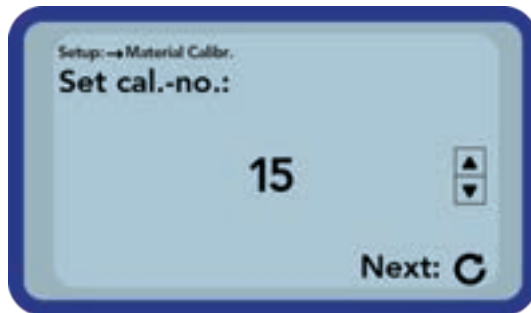
4.3.2.2 - 2 Point Calibration



During the 2-point material calibration, two material samples with different moisture values are measured. From these measurements, a linear equation ($f(x) = mx + b$) is calculated. This linear equation delivers very good measurement results especially in lower moisture values.


NOTE:

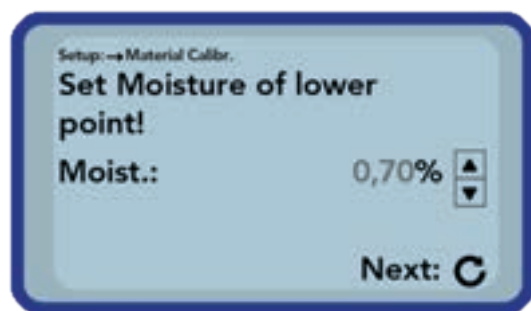
To perform a 2-point material calibration you need two material samples with different moisture values. You have to determine the moisture of these materials using another method before starting the calibration. The given sequence, first to measure the lower moisture point and second to measure the higher moisture point must be strictly followed.



Procedure




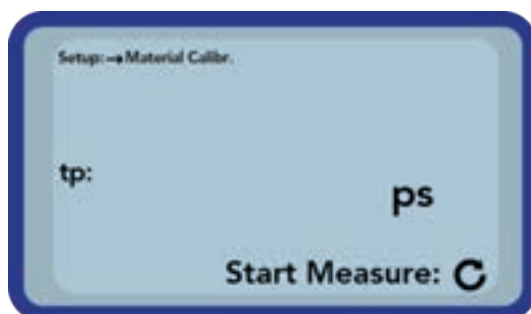
First you have to set the calibration curve to be changed (01 - 15) by pressing the buttons „Up“  and „Down“ .


Apply your setting by actuating the button „Measurement“ .



Next set the moisture of the lower moisture point by pressing the buttons „Up“  and „Down“ .

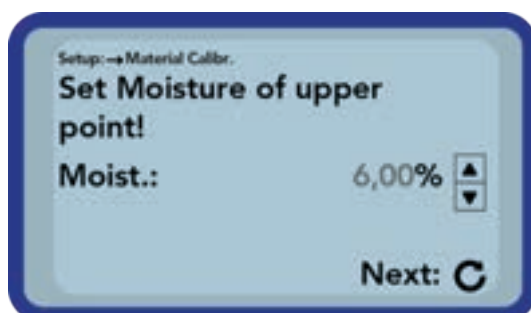
Apply your setting by actuating the button „Measurement“ .






To start the measurement of the material press the button „Measurement“ . To improve the accuracy, four measurements will be taken. The individual values are averaged. The duration of a measurement takes around 20 seconds. After each measurement the signal runtime will be displayed for a short period.

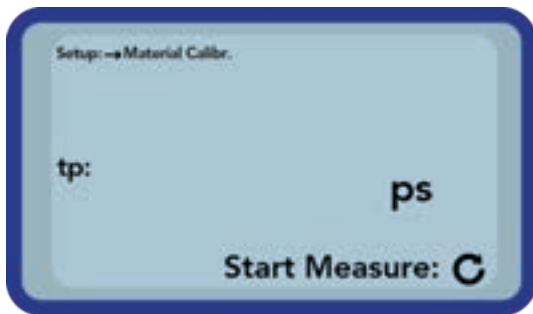
NOTE:


Ensure that the probe rods are totally covered with the material during the time of the measurement and that the probe is not moved.



Next set the moisture of the higher moisture point by pressing the buttons „Up“  and „Down“ .

Apply your setting by actuating the button „Measurement“ .



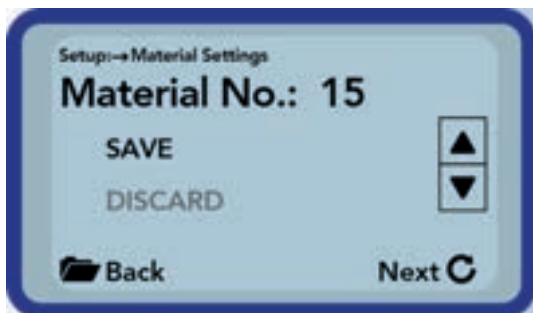
To start the measurement of the material press the button „Measurement“ . To improve the accuracy, four measurements will be taken. The individual values are averaged. The duration of a measurement takes around 20 seconds. After each measurement the signal runtime will be displayed for a short period.


NOTE:

Ensure that the probe rods are totally covered with the material during the time of the measurement and that the probe is not moved.

Attention:

If you choose “SAVE” at the end of calibration, the stored calibration in the probe electronics will be overwritten! The original calibrations can be restored by connecting the probe with a RS485 adapter (for example SM-USB) to a PC and to use the software PICO-Config.



Finally, you can store the calibration into the chosen calibration storage inside the probe. Choose „SAVE“ and confirm by pressing the button „Measurement“ .

If you choose “DISCARD” everything is left untouched.

To name of the changed calibration, is the original with the prefix „OWN:“.

TIPP:

Save your calibrations which are stored inside the probe to your PC. A RS485 adapter (such as SM-USB) and the software PICO-Config is required. With this method, individual calibrations can also be transferred to other probes.

4.3.3 Detecting Sensor/Probe





In the event that communication problems arise with the probe at the activation of the HD2 handheld device, or if no probe was connected, or it is intended to exchange the probe during operation, this menu item should be selected.

After selection of this menu item, the HD2 will again attempt to establish a connection to the connected probe. If this attempt is successful, the serial number of the probe will appear in the display. Should a connection not be possible, „No probe detected“ will be generated on the display.

NOTE:

Should no connection to the probe be possible in spite of several attempts, check if the probe is connected properly. Should this not deliver a positive result, please contact our service department.

4.3.4 Language

In this menu item, the language of the HD2 handheld device can be selected. English and German can be set. You can select the desired language by actuating the buttons „Up“  and „Down“  and activate the same via the button „Measurement“ . After activation of the language, the symbol  will appear in the upper right hand corner of the display.





4.3.5 Auto-Power-Off

In the menu item „Auto-Power-Off“, you can select an automatic shut-down offered in various time periods.

The following shut-off times can be selected:

- 1 Minute
- 2 Minutes
- 5 Minutes
- 10 Minutes
- 20 Minutes

The automatic shut-down function can be deactivated by choosing „-min“.

For this purpose, select the desired shut down time by actuating the buttons „Up“  and „Down“  and activate the same via the button „Measurement“ . After activation, the symbol  will appear in the upper right hand corner of the display.

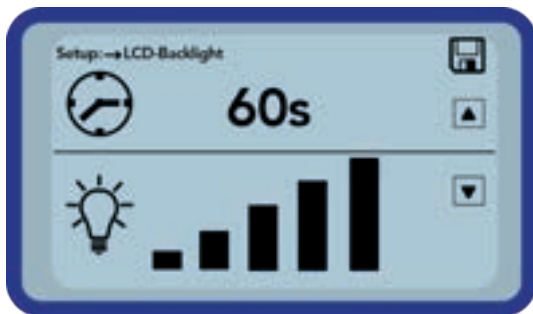
NOTE:





The HD2 will only automatically shut down if no further button is actuated. Any actuation of a button will start the shut down time again.

4.3.6 Display Illumination

If required, the background illumination of the display can be individually adjusted. Consequently, this enables the option to save power and to prolong the operational period.

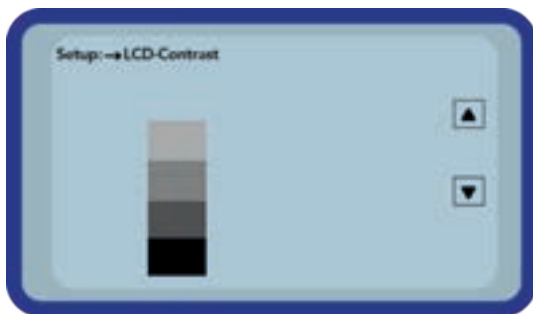
After the selection of the menu entry, the following screen will be presented on the display:







The selection of the background illumination, respectively the time until the automatic shut-down of it is selected via the button „Up“  by actuating it several times. Using the button „Down“ , is used to adjust the intensity of the illumination, respectively turn the same completely off. Activate and store your settings by actuating the button „Measurement“ . After activation, the symbol  will appear in the upper right-hand corner of the display

4.3.7 Display Contrast

At extreme temperatures, it may be necessary to adjust the contrast of the display in order to be able to clearly read the display. For this purpose, select the menu item „Display Contrast“.



Change the contrast by actuating the button „Up“ , respectively „Down“ . Set the contrast that you can realize the whole grayscale on the diagram. Activate and store your settings by actuating the button „Measurement“ . After activation, the symbol  will appear in the upper right hand corner of the display.

4.3.8 Probe Info

By selecting this menu item, the display presents information regarding the connected probe.

These are:

- Serial Number
- Probe Type
- Hardware Version (HW)
- Firmware Version (FW)

4.3.9 HD2-Info

By selecting this menu “item”, the display presents information regarding the HD2 handheld device.

These are:

- Serial Number
- Hardware Version (HW)
- Firmware Version (FW)
- Accumulator Capacity
- Accumulator Voltage

5 Technical Data HD2

Height	36mm		
Width	64mm		
Length	150mm		
Weight	(including accumulator) approx 437g		
Power Consumption	Power Down		approx 35µA
	Idle	- Background Illum. OFF	approx 26mA
		- Background Illum. Max	approx 56mA
	Probe turned ON		approx 100mA
	Measurement		approx 350mA
Measurement per Charge	20°C / Background Illum. Max Mode – Continuous Measurement		approx 5000
Connectable Sensors	SONO-M1, SONO-M2, PICO64, PICO32, PICO-IPH		
Storage Temperature	-30°C up to 80°C		
Operating Temperature	-20°C up to 70°C		
Charging Temperature	10°C up to 30°C		
Charging Voltage	Nom. 12V, Max. 15V, Min. 12V		
Charging Current	approx 1A		
Charging Time	At exhaustively discharged accumulator. 2h		
Accumulator	Ni-MH (4 x 1.2V) (AA), 2000mAh, >1000 Measurements		
Physical BUS	RS485		
Bus-Protocol	IMP-BUS-Protocol II		
IMP-Bus Port Settings	8 Data Bits, 2 Stop Bits, Odd Parity		

6 Measurment Volume/ Probe Dimensions

6.1 Introduction

The determination of the soil moisture content with the Time Domain Reflectometry (TDR) technology has in the mean time managed to well-establish itself on the market. In former times, the reliable measurement of the moisture was laborious and not always accurate. Since the development of the TRIME-TDR technology, there no longer any reason to rely on complicated and inaccurate technologies.

6.2 Measurement Volume of the SONO-M1 Probe

The penetration depth of the electrical and magnetic flux lines in theory reach indefinitely far into the measured material. However, the effective penetration depth of the SONO-M1 probes relevant for the measurement is approximately 2 cm in the vicinity of the probe rods.

The illustration demonstrates the effectively registered measurement volume (green waveform).



7 How to use the HD2 kit

7.1 Messungen direkt im Sand- und Kieshaufen

For measurements in sand and gravel pile, make sure that the probe rods are inserted in the material down to the gray probe bottom, so that the rods are in any case fully covered by the material.

To obtain a representative moisture value of the material, select the operating mode "Average Value" and take measurements at different locations.

NOTE:

After rain, the material is usually more wet in surface areas compared to the core volume. Of course this is vice versa after periods of drought. Then, the material dried up on the surface, but contains more water in the core volume. Therefore it is recommended to measure at different locations of the pile



7.2 Measurement of laboratory samples in the bucket

Following requirements are mandatory, to ensure the optimal accuracy of the system:

- The probe rods must be covered completely by the material



- The bucket must have a volume of 10 liters or more. Never use a metal bucket, the metal is disturbing the measurement field of the probe. Der Behälter sollte annähernd **zylindrisch** sein



- The bucket should be as far as possible cylindrical, to prevent compaction of the material



- The filling depth of the bucket must exceed the rod length by minimum 5cm



- The HD2 Kit is high precision measurement device. Carefully follow the above requirements to achieve repeatable, reliable and precise results from your measurements.

The HD2 Kit is high precision measurement device. Carefully follow the above requirements to achieve repeatable, reliable and precise results from your measurements.

1. Dump the sand sample into the bucket.



2. Compact the sand sample by lifting the bucket 5cm and letting it fall down vertically onto a solid base and repeat this procedure 5 times (if you still observe a compaction after 5-times, repeat this procedure until there is no more compaction to see!)

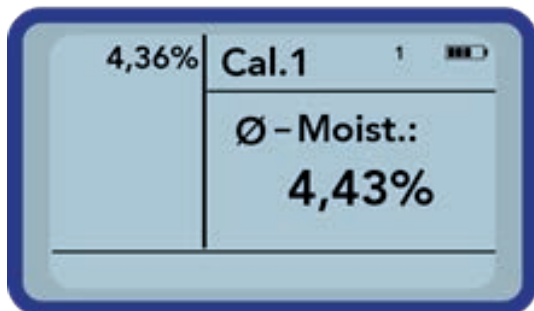


3. Sand: Insert the probe rods into the sand completely, until the gray probe body reaches the surface of the sand and press until you feel counter pressure of the sand (neither jiggle nor rotate the probe while inserting)

Gravel/ Grit: For gravel and grit also compact the material before inserting the probe, additionally jiggle the bucket while inserting the rods, as the sensor else is difficult to insert. Additionally this procedure helps to ensure, that the material is in good contact with the probe rods)

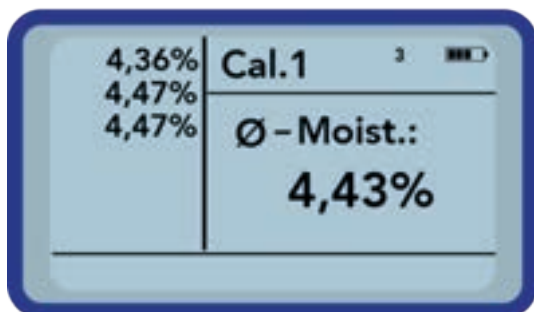


4. Follow the measurement instructions in Chapter 4.3.1.2 Operating Mode „Average Value“



5. After the measurement pull the probe out of the material and loosen up the material again by shaking the bucket.

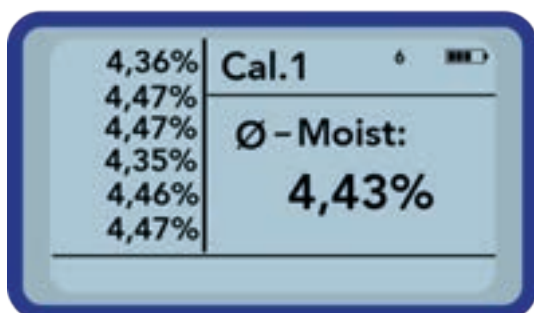
6. Follow the instructions point 2 to point 4 two more times to obtain in total three averaged measurement values.



7. Fill the material into another bucket, as then the bottom layers are on top and vice versa. This procedure is in particular important for material near the saturation point, as free water may build up at the bottom layers.



Follow the instructions point 2 to point 4 three times to obtain in total another three averaged measurement

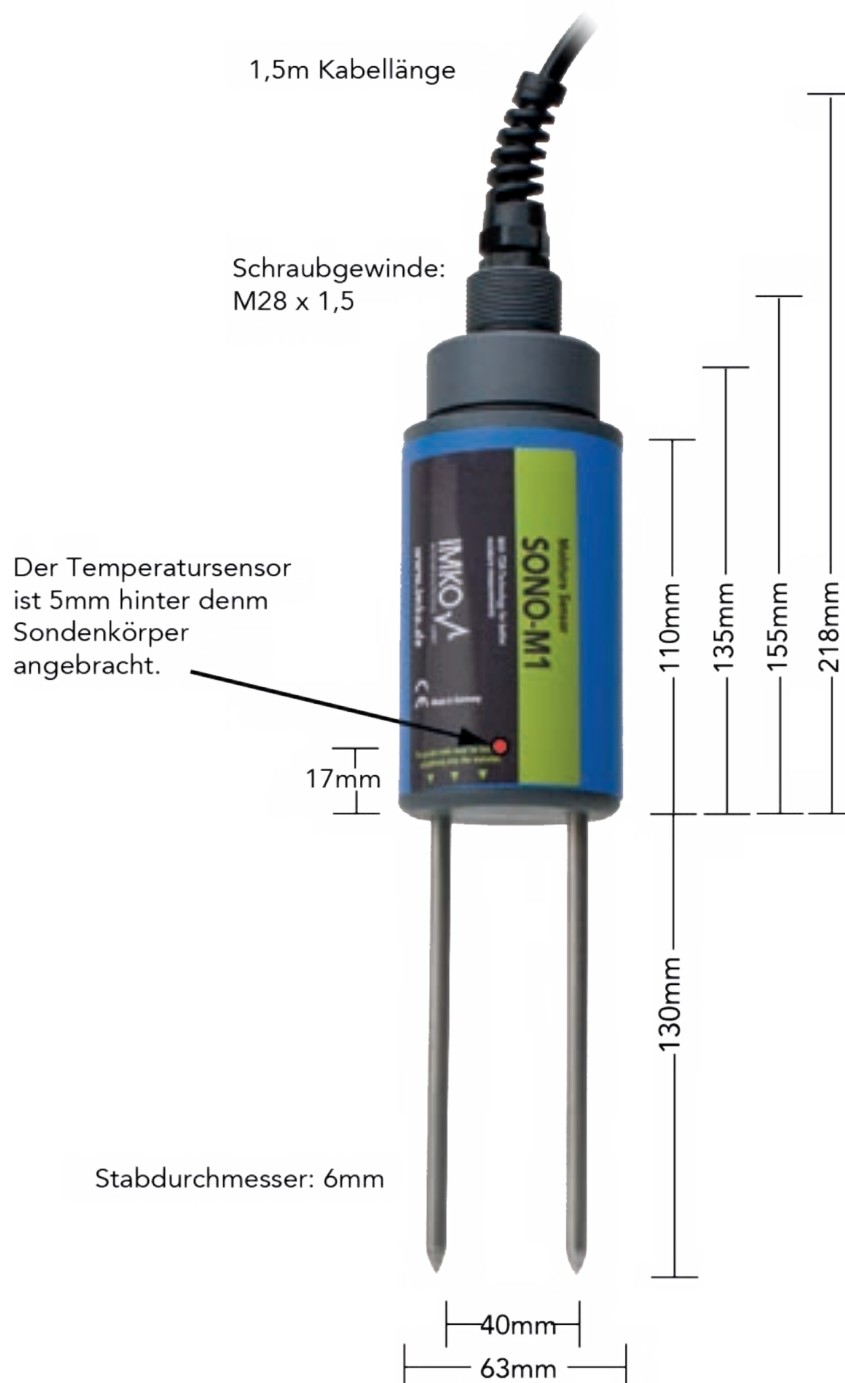


8. In total six averaged measurements are available now. The representative value for the probe is the average value out of these six measurements.

8 Technical Data SONO-M1 Probe

8.1 Probe dimension SONO-M1

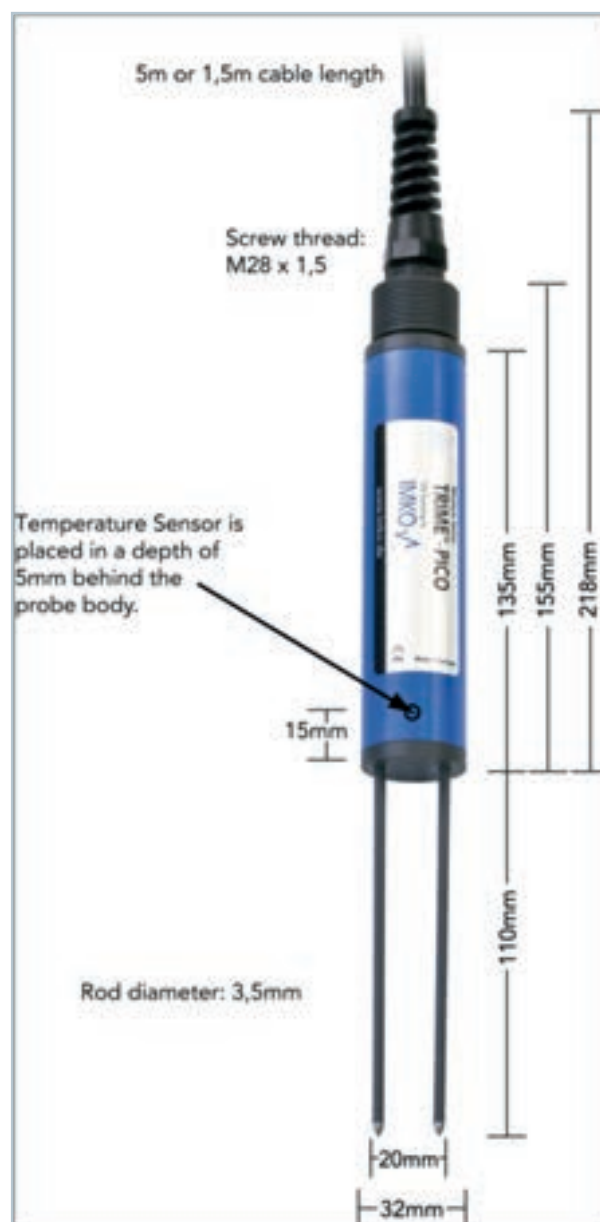
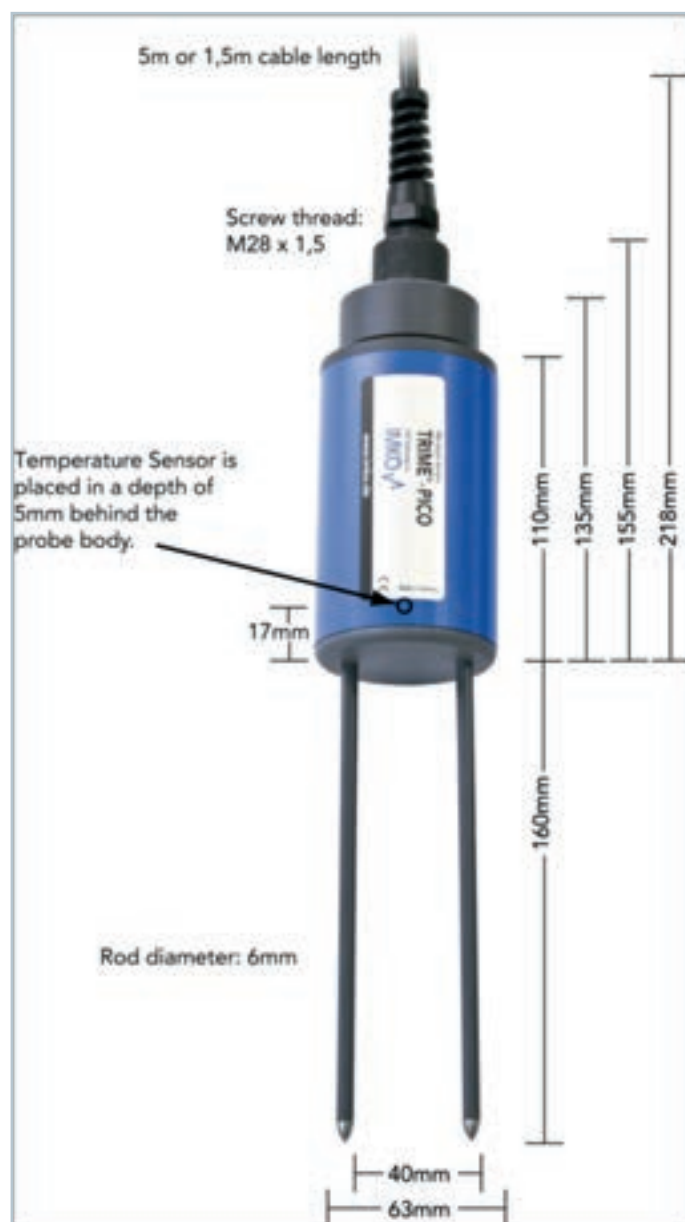
- For measurement of the moisture content in sand, and gravel
- State-of-the-art sensor with integrated TDR-electronics
- Measurement Value Range 0..40 vol.%
- Integrated Temperature Sensor
- Deployable up to more than 5dS/m Total Conductivity (Bulk-Soil-Conductivity).
- Measurement Volume \cong 1000ml
- Robust (IP68), proven, and suited for long-term usage



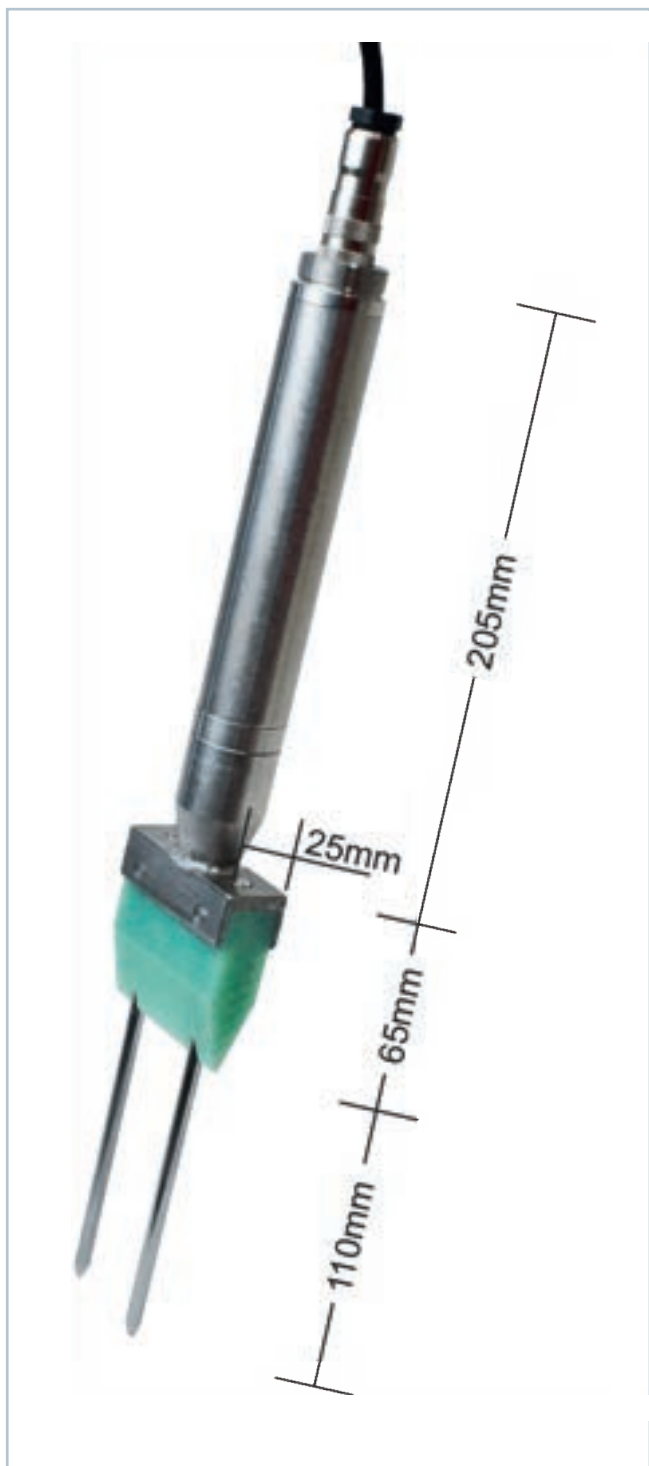
Technical Data

Power supply:	7V..24V-DC
Power consumption:	100mA @ 12V/DC during 2..3sec. of measuring
Moisture measuring range:	0..100% volumetric water content
Accuracy (in % volumetric water content):	±0.2%
conductivity range:	0..5dS/m
Repeating accuracy:	±0.3%
Temperature caused drift of lectronics (full range):	±0.3%
Material temperature measuring range:	-15°C...50°C
Material temperature measuring accuracy:	±0,5°C (permanent installed inside the probe)
Measurement volume:	1,0L \cong 130x100mm diameter
Operating Temperature:	-15°C...50°C
Calibration:	Calibration for sand and gravel is installed
	customizable material specific calibration storage of up to 15 user defined calibration curvescalibration of dielectric permittivity is possible
Probe body:	waterproof sealed PVC (IP68)
Size:	155 x Ø63mm
Rod lenght::	standard: 130mm
Rod diameter:	6mm
Interface	1,5m cable with 7-pin female connector





8.2 Probe Dimension PICO64 and PICO32



8.3 Probe Dimension SONO-M2



9 Exchange of the Probe Rods

 A blue probe body with a black cable is shown next to two black probe rods and two small black gaskets.	 A hand is shown pressing a black gasket into the bore hole of the blue probe body.
1) Prepare the gaskets, the probe body and the probe rods	2) Press the gaskets into the bore holes
 A hand is shown holding the blue probe body, pressing the black gasket to the end of the probe body.	 A hand is shown screwing a black probe rod into the blue probe body.
3) Drücken Sie die Dichtung bis zum Gewinde	4) Screw the rods into the probe body

10 Safety Notes

In this documentation, text points are highlighted, which require special attention.

DANGER:

The Warning Triangle with the exclamation mark warns you against personal injury or property damage.



Intended Use

Sensors and measuring systems of IMKO GmbH may only be used for the purpose described, taking into account the technical data. Misuse and use of the equipment other than for its intended purpose are not eligible. The function and operational safety of a sensor or measuring system can only be guaranteed if the general safety precautions, national regulations and the special safety instructions in this operating manual are observed during use.

The moisture sensors and measuring systems of IMKO GmbH are used to measure moisture according to the measuring purpose and measuring range defined and defined in the technical data. Only adherence to the instructions described in the manual is regarded as intended use. The manual describes the connection, use and maintenance of IMKO sensors and IMKO measuring systems. Read the manual before connecting and operating a sensor or measuring system. The manual is part of the product and must be kept close to the sensor or measuring system

Impairment of safety

The sensor or the measuring system has been designed and tested in accordance with EN 61010 safety regulations for electronic measuring instruments and has left the factory in a safe and safe condition. If the sensor or the measuring system can no longer be operated safely, it must be put out of operation and secured by means of marking before further commissioning. In case of doubt, the sensor or the measuring system must be sent to the manufacturer or his contractual partner for repair or maintenance.

Modifications

For safety reasons, it is not permitted to carry out any modifications or modifications to the sensor or the measuring system without the consent of the manufacturer. The opening of the sensor or hand-held meter, adjustment and repair work, as well as all maintenance work other than the work described in the manual may only be carried out by a specialist authorized by IMKO. The sensor or the measuring system must be disconnected from the power supply before installation or maintenance work. Do not open or repair the hand-held unit and the power supply!

Hazard Warnings

Danger due to improper operation. The sensor or the measuring system may only be operated by instructed personnel. The operating personnel must have read and understood the operating instructions.

Danger by electricity

The hand-held meter must not be immersed in water or other liquids. The sensor is insensitive to moisture contained in the typically measured products. Only connect the hand-held meter to a properly installed outlet with the supplied voltage supply cable, the voltage of which corresponds to the technical data.

Make sure that the power outlet is well accessible, so that you can unplug the power supply quickly if necessary. Use only the adapter that is suitable for your outlet.

Only operate the meter with the supplied original accessories. If you need additional accessories or replacement, please contact the manufacturer.

- Do not use the meter in following case:
- if the measuring instrument, sensor, plug-in power supply or accessories are damaged,
- the sensor or the measuring system does not operate as intended,
- the power cord or plug is damaged,
- the sensor or the measuring system has fallen down.

Unplug the power supply from the wall outlet in following case:

- if you do not use the sensor or the measuring system for an extended period of time,
- before cleaning, unpacking or changing the sensor or the measuring system,
- if you are working inside the sensor or measuring instrument, e.g. connect devices,
- if a fault occurs during operation,
- during thunderstorms.

Caution - Property damage

Ensure that there is a sufficient distance to strong heat sources such as heating plates, heating pipes. Disconnect the sensor or handheld device from other devices before relocating or transporting it. Disconnect the connectors on the device.

Do not use aggressive chemical cleaning agents, scouring agents, hard sponges or the like

11 Notes

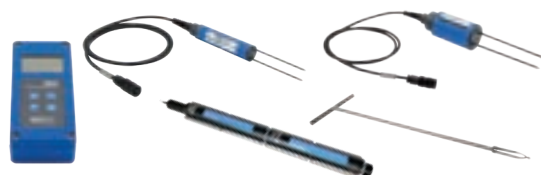
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