User Manual

Universal
Material moisture meter

FS_3 MM

Version 2.1

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2006

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User manual short version

1. Turn on the measuring device by pressing the "**0/1**" button for approx. 3 seconds. If a menu appears, press "**ESC**" until the measuring window appears.

2. The activated **sensor** is shown in the top right corner of the display. If you want to change the sensor, go to ESC (=Menu) → SENSOR. Make sure the sensor you select is connected correctly.

3. Define the appropriate **calibration curve** with the ▲ and ▼ button on the device. The type of calibration curve is shown in the top left corner of the display.

4. Place the FS_3 MM onto the material and use one hand to **press it down firmly** (4.0 kg pressure) so that the whole sensor plate touches the material.

5. Now you can **read the measuring value on the display**. The bar on the right of the display indicates the stability: The higher the bar, the more stable the measured value.

6. You can store the measuring value with the "**OK**" button. Storage was successful if the number before the „🖫" symbol increases. Now give this measuring row a name by pressing „**F1**". ***NOTE: The FS_3 stores the last stable value. Wait until the measuring value has been on the display for 3 seconds and then press OK.***

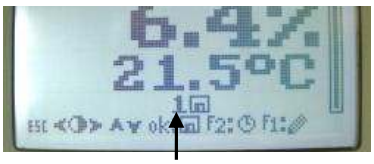




calibration curve **sensor**







number of logged values

To achieve accurate results, adjust the device temperature to the material temperature by placing it close to the material for approx. 15 minutes before measurement.

About AutoLog: With a programmed AutoLog time exceeding one minute the device automatically switches off to save battery power. If you want to abort the measurement, switch the power on and press F1 to stop the AutoLog function.

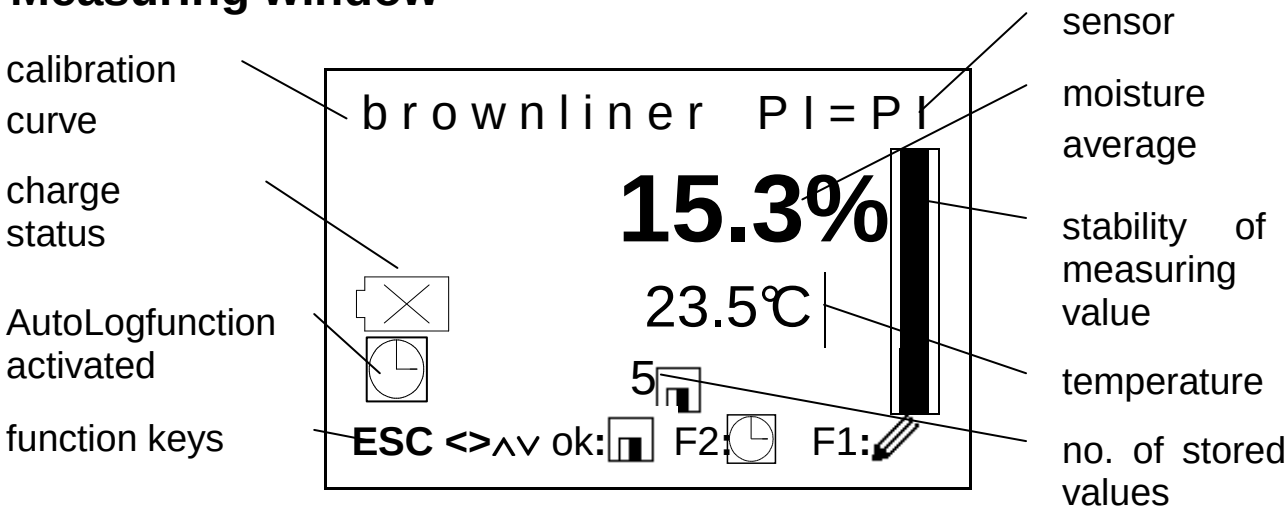
Types of calibration curves

Calibration curve		Definition
empty 1 to 14		15 calibration curves for customer calibration
paper_720		Example calibration curve
reference		For re-calibration of the FS_3 (see „Adjust")

Application

The FS_3 is a portable measuring instrument for quick moisture measurements on a number of different materials. First you need to create a calibration curve for each material. This is then used every time you measure the moisture of this material.

Measuring window



Description of the measuring window:

Calibration curve: The name of the activated calibration curve is shown to the top left of the measuring value.

Moisture: The material moisture is displayed in gray or black. Black means the measurement is valid. Gray means the measuring value is outside the measuring range.

Temperature: The temperature of the sensor is shown.

Stability of measuring value: This bar indicates the stability of the displayed value. The higher the bar, the more stable the measured value. If the „AutoLog function“ is activated, this bar is used to count down the time between measuring points. The amount of time elapsed is indicated by the height of the bar.

Stored values: Here you can see the number of stored measuring values for the measuring series.

Charge status of the battery: If this symbol appears in the measuring window the battery power is too low for accurate measurements. Exchange the batteries.

AutoLog function activated: Single measuring values are stored automatically at pre-programmed intervals. The „AutoLog function“ is activated by pressing F2. Stored values can be edited by pressing the F1 key.

Function keys: Here you can see immediately which keys are activated. The keys may have different functions in different menus.

NOTE: Keys can be operated with a short press and a long press (LT). For a long press (LT) the key has to be pressed for approx. 2 seconds.

Key functions for the measuring window:

0/1	→	back lighting for the display
0/1 (LT)	→	switching off the device
ESC	→	moves to main menu
◄	→	contrast brighter
►	→	contrast darker
OK	→	store measuring value
F1	→	edit measuring row (change name)
▲▼	→	change calibration curve

First start-up

Press **the "0/1" key for a few seconds**. The logo, software version, device name, serial number, and the battery status will be shown on the display. The moisture meter is **ready for operation when the measuring window appears**. If a menu appears, press "ESC" until the measuring window appears.



If the batteries are flat, exchange the batteries as follows:

Open the battery box of your device by simultaneously pressing the quick locks and removing the lid.



Pull out the battery holder and insert the three 1.5 Volt alkaline batteries. Insert the battery holder into the device. Make sure none of the connection wires get caught and close the battery box.

If measuring data have been stored: Give the data a name before leaving the measuring window or changing the calibration curve. To do this, press "**F1**" and proceed as follows:

Editing of the measuring row



Definition of measuring row and editing:

Measuring row: one or more stored values are combined in a measuring row.

Editing: You can give a measuring row a name or number directly on the FS_3 MM moisture meter.

The first three rows can be used to give names or numbers by pressing the following keys:

The ▲ key activates capitals (upper case letters). Every subsequent press will move up one letter. The ▲(LT) key (long press) scrolls quickly through the letters. When you reach the letter you want, confirm with **OK** or wait for a few seconds. Use the same principle and the ▼ or ▼(LT) (long press) to write in lower case letters.

For numbers, press the **F2** key; for special characters, press the **F1** key.

Use ► to move a character to the right. Use ◄ to move a character to the left or move to the line above.

Pressing **ESC** deletes all letters to the right of the cursor.

Press **OK to change to the next line**.

The measuring **row is stored by pressing OK in the third line**.

External sensors

The FS_3 MM is equipped with a pile sensor (**PILE**). You can also connect a roll sensor (**ROLL**) for measuring round objects.

NOTE: Each external sensor is adjusted to the FS_3 MM it is delivered with. Therefore, it can only be used with this device. If you want to connect a roll sensor, this has to be fitted and calibrated by ‚Messtechnik Schaller'.

Roll - RS_30 MM roll sensor



Remove the three countersunk screws on the base of the device. Keep the screws in a safe place (they are needed for measurement with the pile sensor). Now screw on the roll sensor with its three screws to the FS_3 MM basic device.

For the correct positioning of RS_30 MM make sure the marking “TOP” points towards the jacks. Finally, the roll sensor (**ROLL**) has to be activated in the menu item ESC (=menu) → SENSOR**.**

Most common reasons for incorrect readings

- ***Product temperature out of the application range***
  The temperature of the device and the temperature of the material should be approximately the same and be within the specified range.
- ***Incorrect calibration curve***
  Select the correct calibration curve before measuring.
- ***Too thin product / paper stack***
  The product (stack) must be at least 30 mm thick.
- ***Incorrect position of sensor on the material***
  You need a contact pressure of 4.0 kilograms when the sensor is placed on the material.
- ***Incorrect sensor / calibration curve combination***
  If the calibration curve is incorrect, this leads to incorrect measuring values.
- ***Electrically conductive materials under the sensor***
  All metal or conductive objects have to be removed from the measuring area (not within 15 cm of the device).
- ***Connected data link cable during measurement***
  The data link cable should not be connected during measurement.

Menu

The FS_3 has a menu structure, main menu and submenus similar to a mobile phone. In this device a protected level has been integrated. This means the user can measure and store data, but has no access to calibration data. To enter this level you need to enter a password for Super User rights (SU) .

The FS_3 MM has the following menu structure:

Measure

Sensor

DataLog

→ Manual Logs (all values stored with „OK“)
→ Auto Logs (all values stored with „F2“)
→ clear

Print

→ Last (last value stored with „OK“)
→ All (all values stored with „OK“)
→ clear

Send

→ Manual Logs (all values stored with „OK“)
→ Auto Logs (all values stored with „F2“)
→ clear

Options

→ Date Time
→ Log Time
→ Unlock
→ Adjust (SU)
→ Calibrate (SU)
→ Password (SU)
→ Reload (SU)

Status

Menu items and their use

NOTE: These explanations are easier to understand if you read them with your device in front of you.

Measure

The measuring window is displayed.

Sensor

Move the cursor to the sensor you want using the ▲ and ▼ keys. Confirm with **OK**. To quit the menu without changing the settings, press **ESC**.



NOTE: Ensure that the selected sensor is correctly connected.

DataLog

This gives you access to stored measuring rows.

Press **ESC** to change into the main menu.

There you must select the item **DataLog** with the ▼ key and confirm by pressing **OK**.

Now you have to select the type of view with ▼ and confirm with **OK**. See below for a list of views.

Use ▲ and ▼ to select the measured row and ◄ and ► to see the single values of the selected row.

Press **ESC** to return to the **DataLog** menu**.**

Manual Logs You can view all measuring rows stored with OK.

Auto Logs You can view all measuring rows stored with AutoLog function (F2).

clear This deletes the memory (irreversible!).



Print

This menu item prints the saved data via data link cable on the Custom S16 printer. The data link cable and printer are available from Messtechnik Schaller GmbH.



Remove the protective cap from the RS 232 plug on the top of your device and screw on the RS 232 data link cable. Connect the other end of this cable to the printer.

NOTE: Make sure the battery of your Custom S16 printer is fully charged.

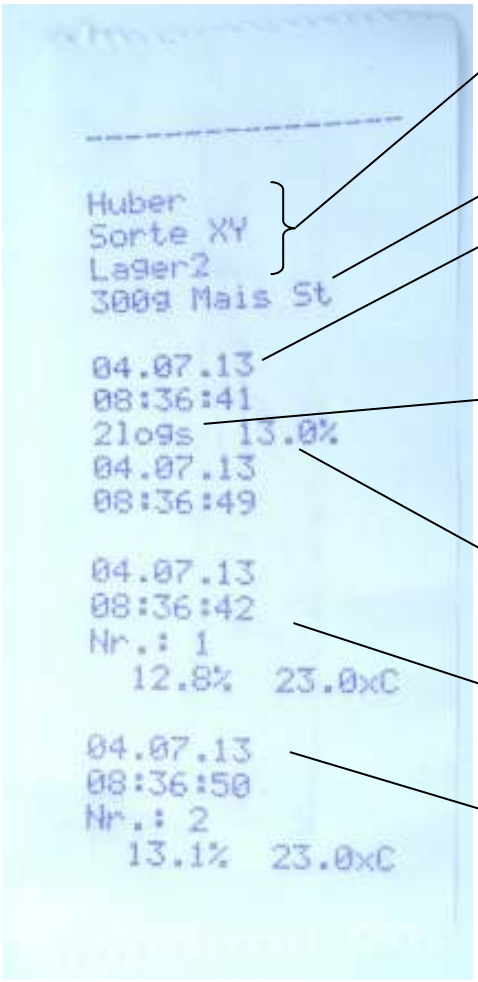
Press **ESC** to change into the main menu. Select **Print** with the ▼ key and confirm by pressing **OK**.

Now select the type of printing with ▼ and confirm with **OK**.

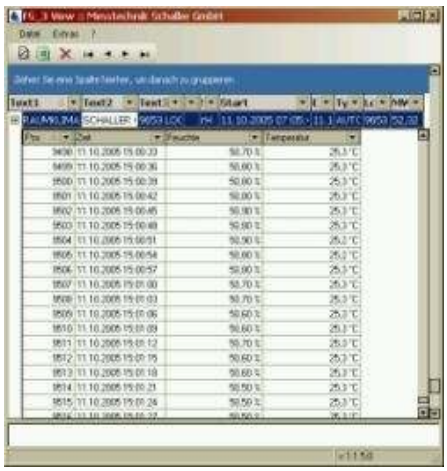
Last You can print the last measuring row stored with OK.

All You can print all measuring rows stored with OK.

clear The memory is deleted (irreversible!).



Send (to a computer)



This menu item is for transferring the stored data to a PC via the data link cable.

First of all you must install the software **FS_3 View** (from Messtechnik Schaller GmbH) on your computer. **Start this software on your computer** before sending data. For more information about this software, see the help file.

Set the correct computer interface in the software FS_3 View (e.g. COM1) !

Remove the protective cap from the RS 232 plug on the top of your device and screw on the RS 232 data link cable. Connect the other end of this cable to the serial interface of the computer.

Select **Send** and use the ▼ key to select the type of printing. Confirm by pressing **OK**.

The data are sent to the PC and automatically stored and shown in FS_3 View.

There are four types of printing available:

Manual Logs You can send all measuring rows stored with OK to the computer.

Auto All You can send all measuring rows stored with AutoLog function (F2) to the computer.

clear The memory is deleted (irreversible!).





Date Time



Here you can set the date and time in the displayed format using the **F2** key.

Enter the year and proceed further with the ► key to enter the month and day. To move from date to time, use the ► key.

The format for the date is **YY.MM.DD**.

Press **OK** to store the settings. To quit the menu without storing the changes, **press ESC (LT).**

Log Time



Here you can define the time **intervals for automatically storing values** (**AutoLog function)**. Select the time using the cursor and confirm by pressing **OK**. “fast” means that the device stores values one after another as quickly as possible.

Unlock



Many sensitive functions, such as carrying out new calibration curves, can only be done with “**Super User**” rights. Enter your password in the Unlock menu. Switching the device off and on again returns

It automatically to the user mode. The password on delivery is the 4-digit part of the serial number, given in the lower right corner of the display.

Adjust (SU rights)



This menu item is for re-calibration of the FS_3 moisture meter. Take care to follow the instructions exactly. It is possible to re-calibrate your FS_3 MM to approx. +/-1.0% moisture.

First check the measuring value on the PP2 test plate in its wooden case.

If the displayed value is outside the approved

deviation (see “Device checks conforming to ISO”), then ca

Place your device onto the test plate (with 4.0 kg pressure).

OK. A value appears in the “lc” field and the bar indicating measuring stability will move upwards. The stable value is now recorded. Your device is adjusted. Check the adjusted device again on the test plate in the wooden case (see Device checks conforming to ISO”).

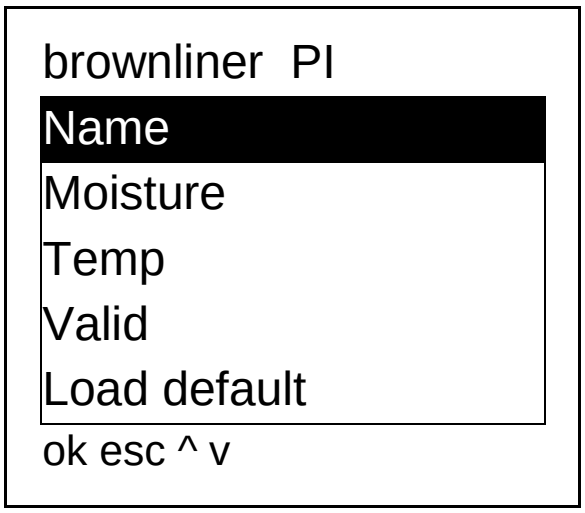
If an exclamation mark (!) appears on the display the calibration is outside the adjustable range. Contact Messtechnik Schaller GmbH.

Calibration (SU)

This menu contains the calibration curves. You can create a new calibration curve for a new material.

NOTE: Navigate as follows: Up or down with the ▲ or ▼ key, select one of the positions using ◄ and ►. Use F1 and F2 keys to move to the top or bottom of the list.

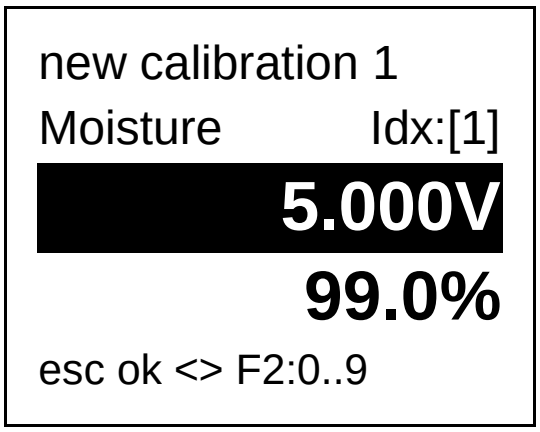
Select a curve which you do not use and confirm by pressing OK. The following menu appears:



Name Enter the material name with max. 10 characters, confirm with OK.

Moisture:

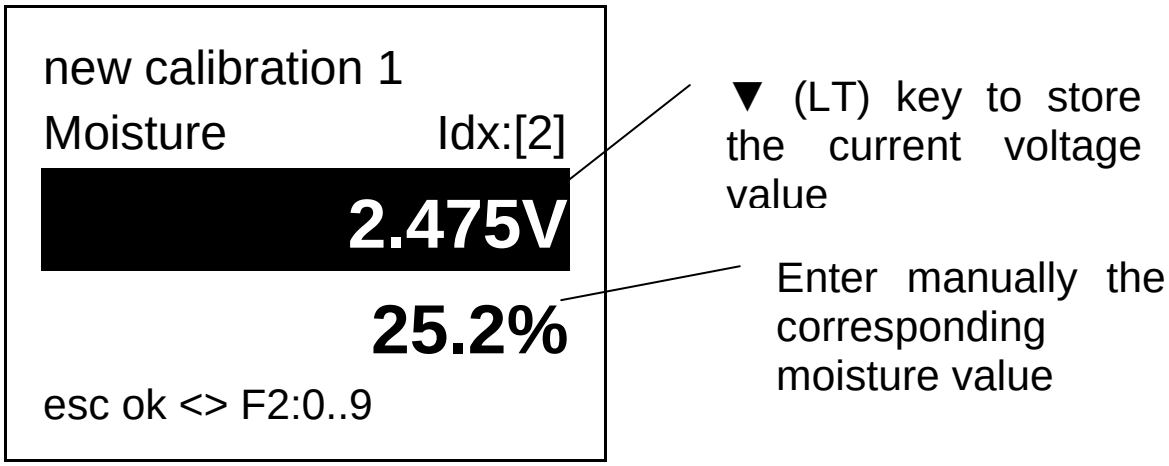
Here you calibrate your curves. For each curve 16 support points can be programmed. Two of these 16 support points must be defined as the low and high limit. This means you have 14 points in between for calibration purposes.



The Idx:[X] shows which of the 16 support points you are currently editing.

The first 2 values (voltage and moisture) are the upper limit and should not be changed.

Press OK to move from the voltage value to the moisture value. Press OK again to move to the next support point (Idx:[2]).



Press your moisture analyzer firmly onto the material and hold the ▼(LT) key. The current voltage value appears on the display. You can also enter the voltage value manually, e.g. if you have a calibration curve from Messtechnik Schaller GmbH. Enter the value and press OK. Now manually enter the corresponding moisture value of the material. For information on how to obtain this value, see “Determination of the material moisture”. Press and hold ESC(LT) to store the calibration curve and quit the “Moisture” submenu.

NOTE: Briefly press the ESC key to delete the characters to the right of the cursor.

NOTE: You have to record at least two points of the calibration curve. It makes sense to use a very dry and a very wet sample so that the complete measuring range is covered. The more support points your have in your calibration curve, the more accurate the measurement results will be. Messtechnik Schaller GmbH can provide a program which calculates the imaginary maximum value.

Temperature

The temperature compensation requires a factor (TK1). A factor is already stored in the device for the existing material types. Usually, you should keep this pre-programmed factor unless you want to determine your own temperature factor for your calibrated types.

To do this, proceed as follows:

To obtain a very accurate TK1, take multiple samples of your material with exactly the same moisture content and seal them in plastic bags. Now bring the samples to different temperatures, e.g. a sample at 23℃, one at 8 ℃ in the refrigerator and one in an oven at 40℃. Now measure the materials with the FS_3, first allowing the device to adjust to the material temperature.

Use following formula to calculate the correct factor for TK1:

$$TK1 = \frac{moisture\ at\ 23°C}{moisture\ at\ ??°C}$$

e.g.: If you measure a material moisture of 30% at 23℃ and 20% moisture at 8 ^C (the sample from the refrigerator), you calculate:

$$TK1 = \frac{30}{20} = 1.5$$ and the TK1 equals 1.5 at 8℃.

Valid

Valid means the valid range of the displayed moisture measurement. This is indicated by the color. Black means a valid value and gray means a moisture value which is out of the defined moisture range.

For example: The selected valid range is from 5% to 25% moisture. You enter the following values into your device:

Idx [1]	Idx [2]	Idx [3]	Idx [4]	Idx [5]	Idx [6]
50%	25.1%	25%	5%	4.9%	0%
0	0	1	1	0	0

Load default

This resets the calibration curve to initial factory settings.

Determination of the material moisture

See the chapter on customer calibration for information on creating new calibration curves. This section explains how you obtain the moisture value for the voltage value. Write down the voltage value and mark the sample, so you can assign the sample correctly to the voltage value. The principle is a comparison measurement based on the drying out method. Take the measured sample and weigh it. Dry it out in an oven and weigh it again. Use the following formula to determine the absolute moisture:

$$\%F = \frac{Mn - Mt}{Mn} \times 100$$

Mn: Mass of the container with average moisture content

Mt : Mass of the dried sample

%F: calculated absolute moisture

Repeat this procedure for all different moisture values.

NOTE: Do not use the dried material for any other measuring purposes.

Password (SU)

Here you can change your password for the Super User rights. The password is indicated on the display while in Super User mode. Therefore, do not leave the device unattended in the Super User mode.

Write down your password and keep it in a safe place. If you forget your password you cannot access the Super User mode. You can resend the device to Messtechnik Schaller GmbH where it can be reset for a fee.

Reload (SU)

In this menu you are asked if you want to reset all parameters to the factory settings.

Only use this function if absolutely necessary. First save your data with a data link cable (optionally available) and write down your customer calibration curves.

Status

In this menu the battery status and the currently available memory size of the device can be read out.

Measuring method

Although the drying method according to DIN 20287 is the only accepted calibration tool it is very time-consuming and only seldom applicable on-site. Also, the samples are destroyed and useless after determination of the moisture.

Messtechnik Schaller GmbH has created a new standard in moisture determination and documentation: the FS_3 generation for non-destructive measurement and results within seconds. However, it is not possible to develop one device for all applications.

The FS_3 has its limits. To eliminate user and application errors, we have listed the most common errors (see “Most common reasons for incorrect readings”).

Measuring principle

The measured material is penetrated by a weak electromagnetic field which is influenced by the moisture content.

Due to the polarity of the water molecules and the resulting high dielectric constant of the water (approx. 83), the capacity of the measuring field is changed according to the moisture of the sample.

Exemption from liability

Messtechnik Schaller GmbH accepts no liability for incorrect readings and any resulting damages.

As this measuring principle uses a quick procedure to determine the moisture content, it is dependent on application-specific and product-specific conditions. We therefore

recommend carrying out plausibility measurements using other methods to check the measuring results before consequential actions are taken.

Every device has a serial number and warranty seal. If this seal is broken, we can accept no claims for warranty.

If the device malfunctions, contact Messtechnik Schaller GmbH or your dealer (see last page).

Care instructions

To ensure a long life for your device, do not expose it to strong mechanical loads (e.g. dropping it) or heat.

Clean your device with a dry cloth. Water and cleaning agents can enter the device and damage it. Keep the device in a safe place when not in use.

We recommend regular device checks conforming to ISO, i.e. with the drying method or the check plate PP2 in the wooden case. Messtechnik Schaller GmbH also provides calibrations and calibration certificates for a fee.

Device checks conforming to ISO

The surface of the PP2 test plate must be free of scratches, dust, debris, grease, and moisture. Operating range:

Temperature: 20 ℃ to 26 ℃, 30% r.h. to 70% r.h.



Check procedure:

Switch on your device. Set the calibration curve "**reference**" and the sensor which you will check ("**Pile**" or "**Roll**"). Place the FS_3 in the middle of the PP2 and press it firmly with a **pressure of 4.0 kg** onto the plate.

Check the displayed values with those below in the table:

Date / Inspector:		**---**
SN of FS_3 MM (Pile):		**---**
SN of RS_30 (Roll):		**---**
Serial No. of PP2:		**---**
---	**Set points for „reference“**	**approved deviation**
FS_3 Pile against air:	**4.2**	**+/- 0.3%**
FS_3 Pile on PP2:		**+/- 0.3%**
FS_3 Roll against air:	**23.4**	**+/- 0.3%**
FS_3 Roll on PP2:		**+/- 0.3%**

Technical data

Resolution	**: 0.1% material moisture**
	: 0.5℃ temperature
Measuring range	**: dependent on the product**
Operating temperature	**: 0℃ to 40℃**
Storage temperature	**: -20℃ to 60℃**
Temperature compensation	**: can be entered in the FS_3**
Power supply	**: 3 pcs. AA Alkaline Mignon Batteries**
Power consumption	**: 60 mA, sufficient for approx. 900 operating minutes**
Display	**: 128 x 64 pixel matrix background lighting**
Data log memory	**: approx. 15,000 measuring values**
Dimensions	**: 175 x 92 x 35 mm**
Weight (without batteries)	**: approx. 300 grams**
Protection class	**: IP 64**
Supplied items	**: wooden case**
	: test plate PP2
	: 6 pcs. AA Alkaline Mignon batteries
Optional sensors	**: RS_30 MM Roll sensor**
	: Software package for recording measuring data
	: Portable printer





Technical Support

Schaller GmbH
Max-Schaller-Straße 99
A – 8181 St.Ruprecht an der Raab
Tel +43 (0)3178 28899
Fax +43 (0)3178 28899 901

E-Mail support@humimeter.com

Web http://support.humimeter.com

or

your local dealer

date / stamp