



Usermanual

Paper resp. Leather
Moisture Meter

P2

P4

LM5

Version 2.2_en
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2005

Quality information:

Congratulations on purchasing this product at Messtechnik Schaller GmbH (Ltd.).

We would like to inform you that your measuring device corresponds to the CE norms EN50081 and EN50082. The function of your instrument has been examined and calibrated before delivery.

Application

P2: Mainly for very strong paper, packing paper, cardboard

P4: Mainly for paper used for offset printing

LM5: mainly for leather

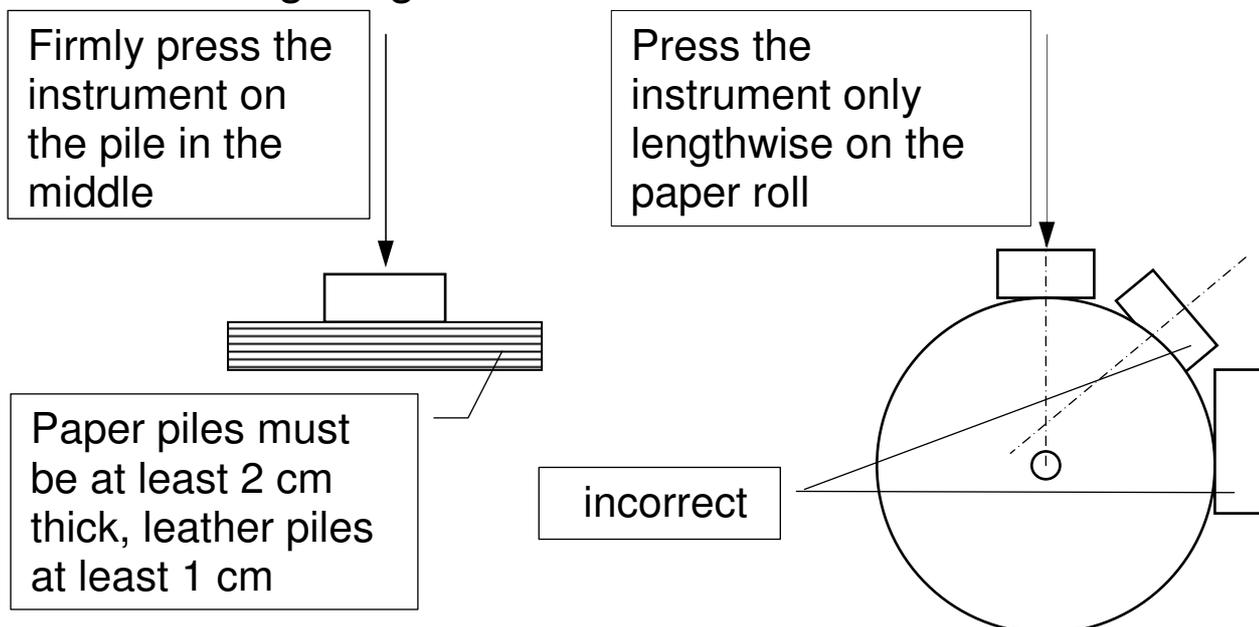
First setting into operation:

Your measuring device should be supplied with a battery by the manufacturer. If this is not the case, open the battery compartment and stick a 9 V block battery or a charged accumulator onto the connecting contacts. Then put the battery in the battery compartment. Make sure that the power cable does not get caught in the lid. Press the power switch (**ON**) at the front of the instrument and the display will go on. If this is not the case, check if the batteries are charged. If you hold your measuring instrument in the air you will see a certain value on the display depending on the switch position. Now you can compare this value to the rated values according to tables on pages 9 and 10. Furthermore it is advisable to check the measuring device at the proof plane which is the bottom of the wooden case.

Measuring procedure

Exact measuring results can best be achieved by adjusting the measuring instrument to the respective product temperature. So you should store the device near the object you wish to measure. A temperature difference of more than 5 °C results in a falsified measured value. Adjust the switch by shifting it to the correct position (refer to type of product). Turn on your measuring device and put it on the product with suitable pressure or move it with constant pressure lengthwise along the product roll to detect the wet streak.

Take care that you hold your measuring instrument with a moderate but sufficient pressure on the product because the compressed density influences the measuring result. Make sure that you always exert the same amount of pressure since the density of the material increases when it is pressed tighter or softer; so you could get different measuring results every time you measure the material. The absolute density can immediately be seen on the LC-Display. Please note that the bigger the supporting surface of the sensor, the more exact is the measurement (refer to sketch). The device turns off automatically after 90 seconds or when the measuring range has been exceeded.



How to choose type of product

Since there is no unified manufacturing process of the measuring products the adjustment of the switch can not be standardized. But there is always the possibility of having your device calibrated by Messtechnik Schaller GmbH (Ltd.). In this case we need a pile of your product (2 cm thick) size A4 in a plastic wrapping that is as tight as possible. You can classify your products by means of a comparison measurement applying methods appropriate for verification according to DIN20287. Take a 2 cm thick pile with an average quantity of moisture size A5, weigh some of the sheets and dry them in a drying stove. Store the rest of the paper in a plastic wrapping to preserve the moisture. The dried sheets of paper are weighed again. By using the following formula the absolute moisture is calculated.

Caution! The dried sheets of paper must not be used for measurement again.

M_n : mass of sheets with an average moisture.

M_t : mass of dried sheets

%F: calculated absolute moisture.

$$\%F = \frac{M_n - M_t}{M_n} \times 100$$

Now take the rest of the pile out of the plastic wrapping and measure it with your measuring device. Adjust the switch until the most exact value can be seen on the display and note down the position of the switch.

Verification and correction of switch position

Now weigh the rest of the material sample, store it in more humid or drier ambient conditions than where your calibration has been carried out. Do not forget to adapt the measuring device to the corresponding temperature. Then weigh your pile once more, calculate the moisture value by means of weight applying the formula of control value calculation, measure this moisture value and compare the result with the display

Control value calculation:

M_{ter} : Calculated dry mass of your control sample

M_{nk} : mass of the remaining material

$$M_{ter} = \frac{M_{nk} \times (100 - \%F)}{100}$$

M_{nneu} : new mass by drying or moistening

$\%F_{neu}$: New moisture value for comparison measurement

Now insert the switch position in the table.

*Please note: Messtechnik Schaller GmbH (Ltd.) provides special versions of **P2**, **P4** and **LM5** adapted to certain products. Refer to additional information on leather, page 11.*

Measuring method

Even if the kiln drying method is the only measuring procedure appropriate for verification according to DIN 20287 it is time consuming, in-situ application can very seldom be carried out; the method also has the disadvantage that the samples are destroyed. Schaller GmbH (Ltd.) has developed the P2, P4 and LM5 generation – a measuring method which provides exact measuring results within seconds. Yet it is not possible to develop a measuring device that is ideal under every single condition; even P2, P4 and LM5 have a certain limited range to provide optimum results. In order to minimize incorrect applications resulting from that fact we have provided you with a list.

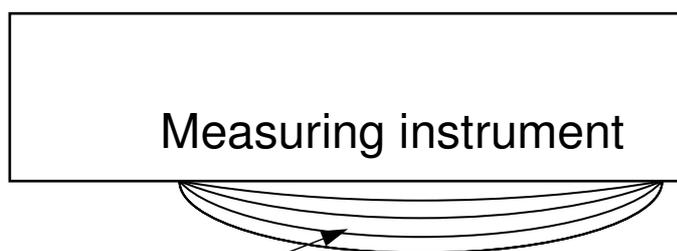
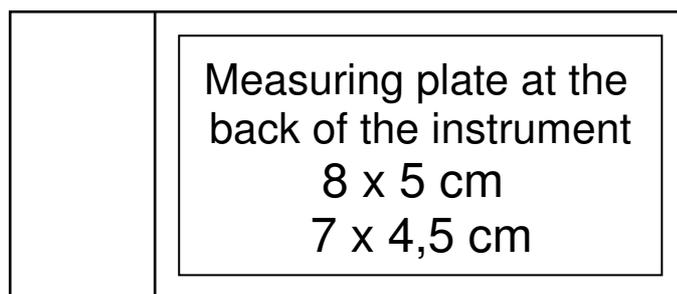
Important! Here are the most common reasons for measuring errors.

- *Product temperature beyond ambient conditions:*
The temperature of the measuring device and of the product should be nearly equal.
- *Wrong switch position*
- *Uneven pressing*
- *Wrong application on rolls*
Press your measuring device lengthwise to the longitudinal axis of the product roll, otherwise the bearing area of the sensor is too small.
- *Product pile not thick enough*
- *Electrically conductive material*
All metallic objects as well as electrically conductive packaging film or paper coloured with carbon black influence the measuring result in a negative way and must not be positioned within a range of 500 mm below the sensor area.

- *Exceeding of measuring range:*
This can occur depending on the type of product and the position of the selector switch. It is indicated on the display by blinking and means that the measuring accuracy is less precise.

Measuring principle

The material in the measuring field is penetrated by an electromagnetic field whose features change due to the material's quantity of moisture. Because of the characteristic polarity of the water molecule and the thus resulting high relative permittivity of water (about 83) the capacity of the measuring field changes together with the changing moisture of the measuring sample.



P2, P4 Measuring plate
8cm long x 5cm broad x 1,3cm depth
LM5 Measuring plate
7cm long x 4,5 cm broad x 0,5cm depth

Caution! When the material thickness is below a certain limit, the measuring result is falsified.

Exclusion of liability

The producer can not be made liable for any measuring errors and the damage that might result from it. This measuring principle is a quick measuring procedure which can be influenced by product and user-specific margin conditions. Therefore it is recommended to carry out a plausibility check of the measured values. In every measuring device there is a serial number and a seal of warranty. If this seal is broken no warranty claims will be accepted. In case of defect send back your measuring device to Messtechnik Schaller or your dealer. The device must be sufficiently packaged for protection reasons. (refer to technical support)

Care regulations

In order to guarantee that your measuring device is kept in good condition, please take care that it is not imposed to too much mechanical strain (it should not be dropped or exposed to excessive temperatures). Always use a dry cloth when cleaning your measuring device because it can be destroyed by incoming water or other cleaning agents.

Do not leave your device unattended – put it back into the delivered wooden case after the measuring procedure.

We recommend an ISO-approved examination of the device in regular intervals by applying the kiln method or by using the enclosed proof plane PP2 (base plate of the wooden case)!

If needed, Messtechnik Schaller GmbH (Ltd.) will also carry out a calibration at your expense. In this case a calibration certificate will be issued and delivered.

ISO-approved examination of the instrument

The surface of the proof plane PP2 must not be scratched and must be free of dust, dirt, fats and moisture.

Field of application: temperatures ranging from 10°C to 30°C, relative humidity 30-80%

Procedure of examination

Torn on the device, place it in the middle of the proof plane PP2 and press firmly onto it. Now check the values on the display against the set measuring values in the table and fill them in the provided table. We have defined the ideal temperature for your device – 20°C, but it can range between 17°C and 23°C. If an adjustment is not possible, a calculated correction of the temperature of the displayed value is necessary. The corrected value and the set value must be within the range of tolerance.

Set measuring values for PP2 should be at a temperature of 20°C.

Switch position	set measuring value		adjust tolerance	readjust tolerance
	P2	P4		
S1	6.4	4.3	0.6	0.9
S2	5.8	4	0.6	0.9
S3	5.1	3.7	0.5	0.8
S4	4.5	3.3	0.5	0.7
S5	3.8	3	0.4	0.6
S6	3.1	2.6	0.4	0.6

Value when held up in the air at switch position 1 is:
P2= 1.3% und **P4= 2.5%**

range of adjustment tolerance by the plant 0.6%

switch position	set measuring value	adjust tolerance	readjust tolerance
	LM5		
S1	11,9	0,9	1,5
S2	11	0,8	1,3
S3	10,1	0,8	1,1
S4	9,2	0,7	1,0
S5	8,2	0,6	0,9
S6	7,2	0,5	0,8

Value when held up in the air at switch position 1 is:
 LM5= 3,7%
 range of adjustment tolerance by the plant 0,8%

Example of temperature correction

This example has only been calculated for P2, but the temperature correction can be calculated for both P4 and LM5. Your measuring device is adjusted to a temperature of 28°C. The display of **P2** with switch position S1 on proof plane PP2 is **6.1%**.

Tcf: Temperature correction factor corresponds to 0.04% (S1) moisture of paper per 1 °C.

Tcv: Temperature compensated value

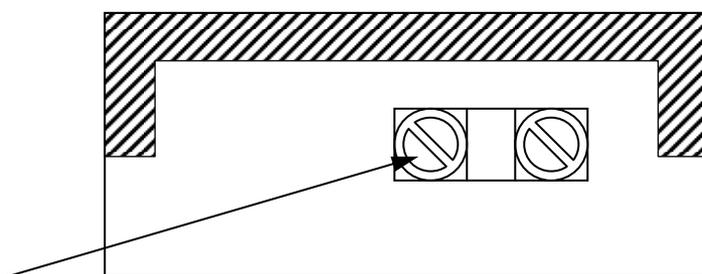
$$Tcv = \text{displayed value} + (\text{ambient temperature} - 20^\circ\text{C}) \times Tcf$$

P2: $Tcv = 6,1 + (28 - 20) \times 0,04$ results 6,4%

If your value is beyond the set range of adjustment tolerance a new adjustment by the factory is necessary. If there is a linear deviation from the set values, you can adjust the device to the zero point adjustment yourself. This is done as follows:

Zero point adjustment

Shift the selector switch to S1, put off the lid of the battery compartment, take out the battery (which must still be stuck to the connecting contacts). Then put off the serial number tag carefully. Now hold the device into the air with one hand and adjust the inner potentiometer as long as the following values appear on the display: **P2:1.3%, P4: 2.5%, LM5: 3.7%**. Again the temperature correction value must be taken into consideration. Put on the serial number tag again, insert the battery and close the lid.



inner Potentiometer

Additional information (for LM 5 only)

Switch positions 1 to 6 serve as an approach to the real quantity of moisture of the material. The density of the material has the biggest influence on the measuring result. For leather, the relevant range of density corresponds to 0.45 gram/cm³ for switch position 1 and 0.85 gram/cm³ for switch position 6. Various manufacturing procedures can result in a change of up to two switch positions. A higher moisture value is indicated on the display when measuring values lie below or above the set measuring range. These values can be used as reproducible comparative values and with the help of a conversion table you get values corresponding to absolute moisture values. When measuring leather it is especially important that the pressure against the material is the same pressure when determining the switch position.

P2 Examination table

Copy this table and fill in the displayed values – without temperature correction – and the ambient temperature. Enclose a copy of the data if the instrument should be adjusted again by the factory.

serial number measuring instrument: _____

serial number proof plate: _____

temperature : _____ °C date : _____

switch-position	set measuring value	displayed value P2	temperature-compensation value	drift in %	readjust tolerance
S1	6.4				0.6
S2	5.7				0.6
S3	5.1				0.5
S4	4.5				0.5
S5	3.8				0.4
S6	3.1				0.4

P4 Examination table

Copy this table and fill in the displayed values – without temperature correction – and the ambient temperature. Enclose a copy of the data if the instrument should be adjusted again by the factory.

serial number measuring instrument: _____

serial number proof plate: _____

temperature : _____ °C

date : _____

switch- position	set measuring value	displayed value P4	temperature- compensation value	drift in %	readjust tolerance
S1	4,3				0,6
S2	4				0,6
S3	3,7				0,5
S4	3,3				0,5
S5	3				0,4
S6	2,6				0,4

LM5 Examination table

Copy this table and fill in the displayed values – without temperature correction – and the ambient temperature. Enclose a copy of the data if the instrument should be adjusted again by the factory.

serial number measuring instrument: _____

serial number proof plate: _____

temperature : _____ °C

date : _____

switch- position	set measuring value	displayed value LM5	temperature- compensation value	drift in %	readjust tolerance
S1	11,9				1,5
S2	11				1,3
S3	10,1				1,1
S4	9,2				1
S5	8,2				0,9
S6	7,2				0,8

Technical data:

dissolution	0.1% moisture of material
depth of measurement	P2, P4:13mm LM5: 5mm
measuring range	P2: 3-10% moisture of paper P4: 3-8% moisture of paper LM5: 8-20% moisture of leather indication of % refers to wet weight P2, P4: switch position 4, LM5: switch position 2
working temperature	5 °C to 35 °C
temperature compensation	P2:0,04%/°C,P4:0,03%/°C LM5: 0,05%/C°
power supply	9V alkaline batteries or accumulator
drawing of current	5mA, sufficient for about 4000 measuring procedures, when BAT appears on the display, still about 200 measurements are possible
display	three-digit LC-Display
size	60 x 120 x 26 mm
weight without battery	about 140 grams
delivery	wooden case, proof plate, 9V alkaline compound battery, case protection made of rubber

Technical Support



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