TECHNICAL NOTES FOR USERS - NOTE #023
HOW TO CALIBRATE THICKER GRADES AND ROLLS IN FIELD

Keywords: paper moisture meter, biofuel moisture meter, infrared moisture meter, industrial installations, laboratory measurements

General

AK30/AK40 and AK50 moisture meters' penetration depth is 150 microns in most papers. Coating diminishes it and very heavy coating may lead to penetration depths of 50 microns or less. Penetration depth itself is not so important for measurement in general. This requires that the paper body is approximately climatized to have the same moisture level inside and on the surface. These facts don't affect much calibrations but should be taken into account in field and on-line measurements if original calibrations were performed for thin papers in the first place.

The meter will not show the same reading if the paper thickness is increased up to roll thickness, meaning infinity, when measured with the same calibration. There is a saturation limit which is typically about 120 g/m2. After that, adding more paper under the measured sample does not change the reading. In the following we explain shortly how to perform field calibrations with thin paper samples and by using an existing thin paper calibration without any other tools, like laboratory balances and ovens for determination of dry weight etc.

All you need is a few paper samples, a moisture meter and if it is of the on-line variety you will need the corresponding PC software or Profibus DP user interface to get the readings. A pencil and paper is recommended. You need to have at least some way of changing the paper moisture in at least one direction (up or down) to get new data points into calibration. The resulting calibration is likely valid within the three or two moisture points, if a limited calibration. Thus it is important to have paper samples with a moisture in the working range. This method works backwards too. One can calibrate a thin paper with a thick paper grade's calibration as long as the paper is of same grade. In fact, you can calibrate any BW paper for a new BW, be it higher or lower, no matter. Only coated and uncoated papers should not be mixed together and other special papers with some sort of surface treatment, like calendering.

Principle

The thinner the grade you have originally made the calibration with, the better BW gradation you may get if you wish to calibrate for several basis weights. E.g. if the BW is 30 g/m2 and you wish to obtain the calibrations for 60 g/m2, 90 g/m2 and 120 g/m2, you can do it by placing an increasing number of sheets under the meter. You do not have to know the moisture of the sample paper at this time but it would be helpful if you are able to vary its moisture by placing it to a warm and humid or dry place for a while (10 minutes) while performing these steps. Having even a simple climatic chamber would be most helpful. Figure 1. will depict the idea. Very thick boards and papers require longer times for climatization, even hours.

Calibrating for Thicker Grades

Place the meter into a stand if it is an on-line meter with a correct distance to the sample area and you can use the portable meter as is. The background under the sample should be black Aluminum or plastic to avoid any other effects. This should be according to the original calibration and according to the intended way of use. Wooden tables are not suitable at all. Follow the instructions below in order to reach a complete calibration. In the following we assume you are using the PC software (IRMA7Basic or Advanced programs). If the meter is using BURST mode, change it to OFF. The filtering should be set to SLOW or SPECIAL. Likely the paper is at some medium moisture (working at 50%RH ?). You should have some idea of the sample's moisture to place the points into a correct order in the calibration table.

1. Turn the meter on and select the accurate thin paper calibration. The scaling in SCALE mode is 100.0 and offset is zero. You can not change them in the latest meter revisions. Refer to the meter's manual to see how they are set back to default if you were able to change them in the first place.

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2. Select the accurate thin paper calibration.

3. Place the sample paper (one sheet only) under the meter

4. Make note of the moisture reading. = **mthin2**.

5. Select the calibration #68 SCALING 100X ONLY to get the signal

6. Place the number of extra sheets of sample paper under the meter to complete to the required BW. Press them tightly to avoid air spacing between layers.

7. Read the resulting moisture and divide it by 100.0. = **Sthick2**

8. Place the papers into a **dry** place for a while (10 minutes) making sure they are climatized similarly. Make sure air circulates between the sheets.

9. Select the accurate thin paper calibration.

10. Place the sample paper (one sheet only) under the meter

11. Make note of the moisture reading. = **mthin1**.

12. Select the calibration #68 SCALING 100X ONLY to get the signal

13. Place the number of extra sheets of sample paper under the meter to complete to the required BW. Press them tightly to avoid air spacing between layers. Don't waste time in this since the paper moisture is changing rapidly.

14. Read the resulting moisture and divide it by 100.0. = **Sthick1**

Now you have a set of points for lower and for about medium moisture. It would be good to have a third point at a higher moisture level.

15. Place the papers into a **humid** place for a while (10 minutes) making sure they are climatized similarly. Make sure air circulates between the sheets.

16. Select the accurate thin paper calibration.

17. Place the sample paper (one sheet only) under the meter

18. Make note of the moisture reading. = **mthin3**.

19. Select the calibration #68 SCALING 100X ONLY to get the signal

20. Place the number of extra sheets of sample paper under the meter to complete to the required BW. Press them tightly to avoid air spacing between layers. Don't waste time in this since the paper moisture is changing rapidly.

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21. Read the resulting moisture and divide it by 100.0. = **Sthick3**

Calibration

What do we have? We have the following data points in a table form:

measured signal	measured moisture %	approximate moisture level
Sthick1	Mthick1	lower
Sthick2	Mthick2	medium
Sthick3	Mthick3	higher

The moisture readings were from the original calibration and thin samples. The signal values came from the thick samples having the same moisture as the thin sample but getting the raw signal instead of a calibrated reading.

You can now select an unused calibration in the meter's library and go to Calibration page in the program and fill in the data points. You can also give a new name to this new table. Do not forget to set the calibration mode to MULTI instead of SCALE (being a scaling only). Set also the number of points used and make sure every data point is put to its correct place in the table. If the resulting curve looks funny, wrinkled or is not visible at all, it is possible that you have put them in an incorrect order. When happy with it, stop editing and upload the new table to meter and you can use it right away.

The portable meter is simpler in this respect since you can select a new table, fill in the points, check to MULTI mode and number of points in use and start using it. You can leave out either end (dry or humid) if not required to make a limited range calibration. Then you have the minimum set of data points (two moisture levels only). This should reflect to the number of points too.

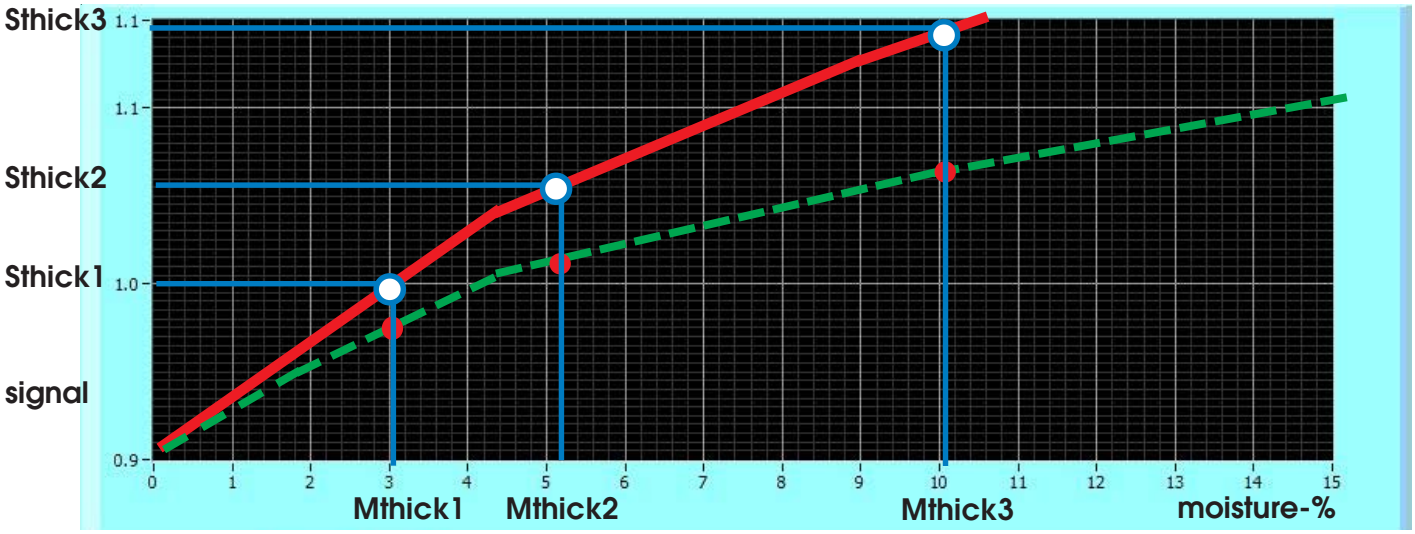

Figure 1. A sketch of the data points resulting from this task.

thin paper calibration
thick paper calibration

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The carefulness of how you do these steps will affect the final accuracy. If you have a climatic chamber available, you can increase the number of data points easily.

Note also that this method works in the other way too. If the original calibration was for a thick grade, you can repeat all the steps but interchange the names thin - thick in all sentences. The curves will be swapped in the Figure 1. too.

In fact, this method is very general. It does not matter what was the original calibration's BW. You can recalibrate a paper grade with a different BW but with similar properties. You read the actual moisture with a moisture meter using known moisture values of the known BW and read the raw (uncalibrated) signal values from the new different BW forming a table of required values. That is all that is required for a calibration entry.

You can fine tune this method further, if you accept some decrease in accuracy. By keeping papers of similar type in the same %RH, T conditions and by reading one of them with the meter with a known calibration, you might read the signal values of the new papers with the meter. This assumes that the papers will reach the same moisture percent in the same conditions. Note carefully, that this conclusion is valid only for papers of similar structure and grade (coating type, fiber contents, fillers etc). If the papers vary in some respect, they are likely not at the same moisture. In addition, one should recognize that the direction of recent %RH history will affect a lot. Paper and all fiber materials have hysteresis in %RH - % dependence meaning that the paper will not come to the same point in moisture if %RH is varied and then the original level is restored. This can be seen from our Tecnote #12. Dry papers wetting will follow a completely different curve than papers drying from a high moisture value. The difference in moisture is called the hysteresis which is rather constant throughout the %RH scale.

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