CALIBRATION OF CONTINUOUS MOISTURE DETECTORS

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Advances in technical knowledge has produced a large number of instruments and processes to help us maximize our returns from the sawmill. In addition, many tools are being developed that help to maximize our returns in the drying process. One such instrument is the Continuous Moisture Detector. These detectors are used today to mark the wet materials and can also be used for gathering information on the complete drying program. The manager who does not take advantage of these new advances is seriously handicapping himself. One major advantage of the continuous moisture detector is that it provides one of the highest returns on a small investment.

In order to realize the highest potential return, one must follow a proper calibration procedure. Let us discuss the calibration of continuous moisture detectors using resistance-type handmeters. It is very easy to check the calibration of a resistance-type handmeter since only one factor is involved--the factor of resistance. Simply place a standard resistor across the probe and one can readily see if his handmeter is in calibration. However, the calibration of a continuous moisture meter becomes a more involved process. Two factors that have to be considered are that this type of detector is generally affected by both the size and by the distance of the material away from the sensing area. Choosing the proper type of control and sensing unit can help decrease the effect of these factors.

Unlike detectors of the past, wood temperature, surface moisture and streaks of moisture in the material have little effect on many of our modern continuous sensors. Let us discuss three of the factors that should be considered.

A) Size - The main consideration for size is to choose the correct sensor. In order to correctly calibrate your continuous moisture detector, it must be designed to measure the moisture content of the size of material you are running.

B) Temperature - Some continuous moisture meters are greatly affected by temperature while others are less affected. For some manufacturers temperature is a very large factor in their sensing. However, it should be noted that some sensing methods are nearly independent of temperature. We have found that our Wagner meters are in the latter category.

C) Species, Density - A small amount of correction can usually be made by adjusting the Species Control at the console.

What are we actually doing when we're calibrating? First, we need to consider some background information involving the distribution of the moisture. Some graphs will assist us at this point. A resistance vs. oven test graph and a power-loss vs. oven test graph of two different handmeters will be used.

The first graph is a picture of the resistance handmeter vs. the oven test. This particular study was completed on samples of white fir. Several readings were taken for each sample and then the material was cut and the actual moisture content was determined by the oven test method. You will notice that each one of the marks along the left of the graph represents two percent intervals in moisture content, and that the line up through the average center of the samples is a representation of the handmeter dial. Looking at the graph you will note that most of the readings fall within two percent of the center line. And, of course, more of them fall within 1-1/2 percent. Notice that the closer you get to the center line, representing the dial, the greater the concentration of samples.

Several samples must be used to calibrate a continuous moisture meter. It is possible to pick up one sample that might be on one side of the line, or another sample that might be on the other side of the line. Therefore, if only one sample is used for calibration the meter could consistently read higher or lower than the actual moisture content.

We should take note that these graphs were done on Hemlock and of course some of the other species are more uniform in moisture which would result in less scatter content.

The major cause of error in the calibration of any type of moisture detector is the uneven distribution of moisture in the samples used.

Let us look at the power-loss vs. oven test graph. This study was completed on Hemlock, also, and it shows that most of the material is falling within two percent of the center line with a higher concentration within 1-1/2 percent of the average center line. You should note that if you were getting perfect accuracy, all of the samples would fall right on the center line.

To gain a better understanding, we need to look at distribution of moisture in a typical piece of wood. We cut out 1-inch sections in various places along a piece of lumber. For instance, at 4-feet from the even end we cut out an inch block and measured the moisture content. It read 10 percent. We then cut out a second block at the 8-foot point, and it measured 18 percent. We cut out another block at 12 feet from the end and it measured 27 percent.

In comparing the various cuts, we find that the drier the piece, the more even the distribution of moisture. But when we get up to 27 percent moisture content we probably have 60 to 80 percent in small areas in that piece of wood. The higher the average moisture content the more randomly the moisture appears to occur.

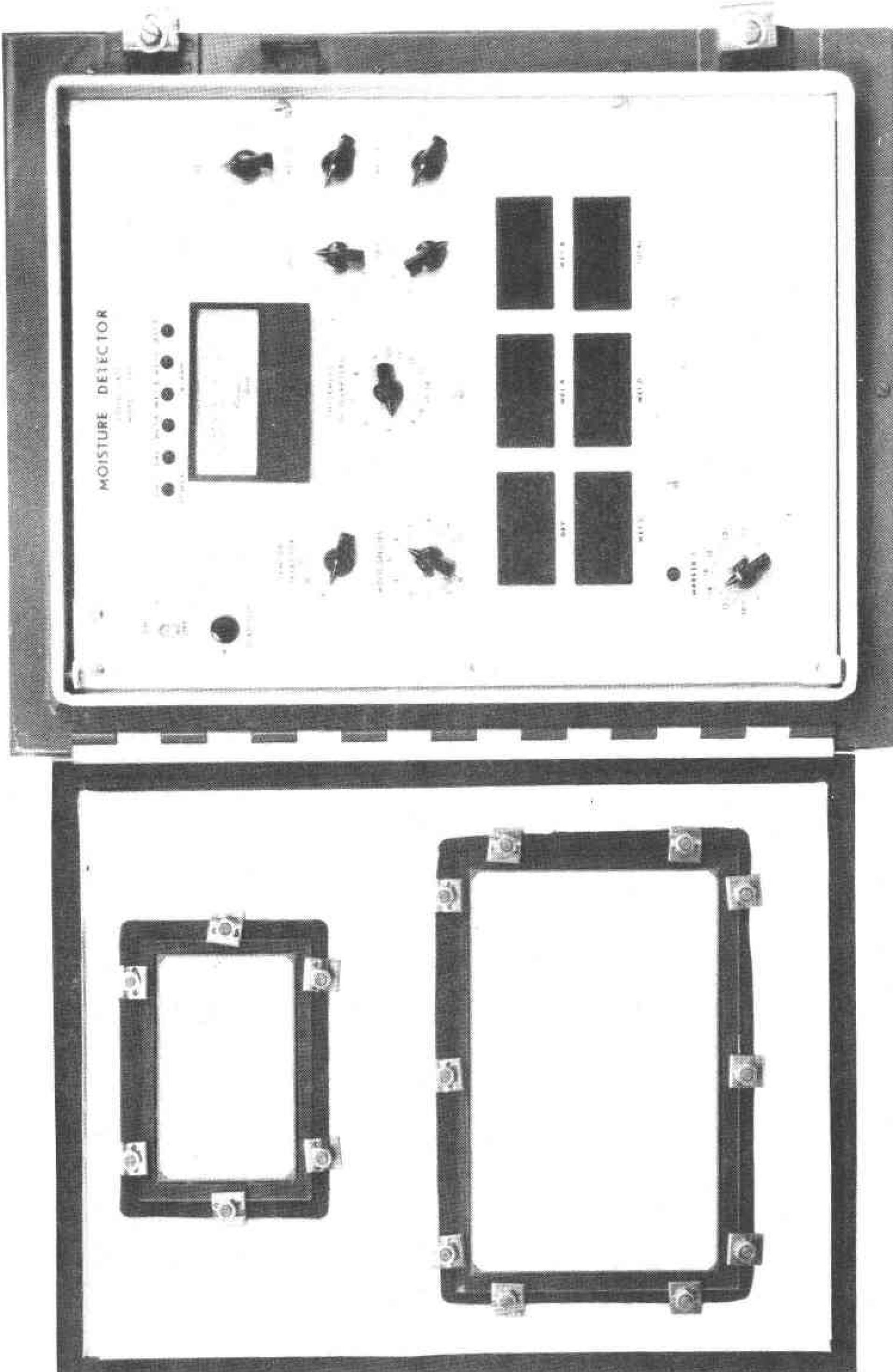
One advantage of the continuous moisture detector is that it is averaging in nature and tends to average out the spotty effects. This improves the accuracy of measurement.

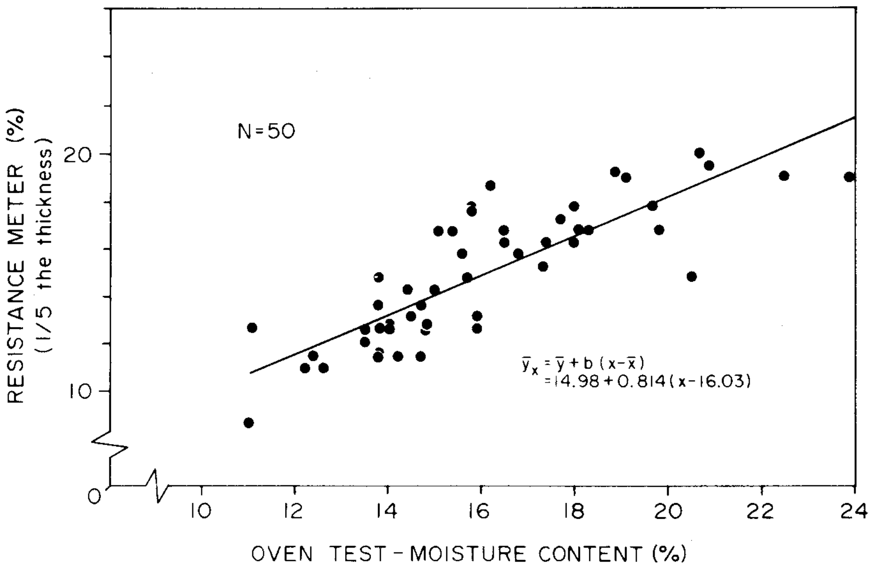
So we can see from the illustrations used why several samples need to be chosen in the calibration of continuous moisture detectors. The major factor of concern is the uneven distribution of moisture in the wood.

The most practical method of calibration of a continuous moisture detector is to use a resistance handmeter with long pin-type needles, such as a Delmhorst 26-E electrode. Then, pick samples with uniform moisture content, and drive the needles down into the wood to determine the average of each piece. After determining the average, place the sample over the sensor. Use several pieces in the high ranges of moisture, or near your marking percentage. Average the reading among these various samples so your dial reads correctly. Of course, the oven sample method is the most accurate and would take less samples to do the same job, but that method is very time consuming.

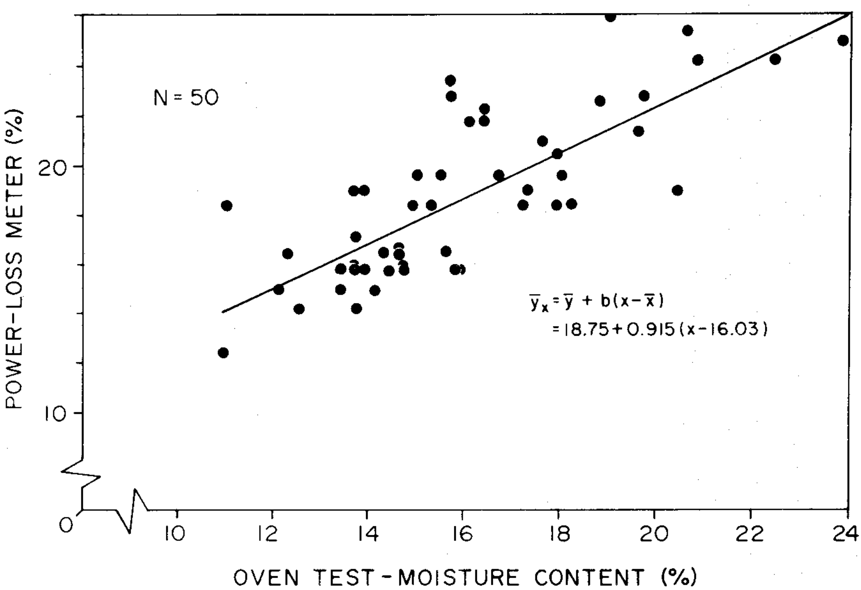
Now, what good is this going to do us? Suppose the moisture meter calibration drifts later while in use and we are not aware of it? To return to the original calibration we need some type of standard. Once we have calibrated our meter and have obtained the center line represented by our dial, we set the moisture meter standard on the sensor and write the calibrated setting on the standard. From then on we do not have to repeat the procedure of looking up samples and going through the process of calibration. Once we have gone through this process and written the readings on the standard we have our moisture meter calibration established. The standard calibration block merely allows us to have something to refer to.

A manager who installs a continuous moisture detector, and calibrates it properly, will soon realize a substantial return on his investment. A properly installed and operated moisture detector can pay for itself in savings in a few months' time.


MOISTURE DETECTOR



RESISTANCE METER (%)
(1/5 the thickness)
N=50
$\bar{y}_x = \bar{y} + b(x-\bar{x})$
$= 14.98 + 0.814(x-16.03)$
OVEN TEST-MOISTURE CONTENT (%)



POWER-LOSS METER (%)
N = 50
$\bar{y}_x = \bar{y} + b(x-\bar{x})$
$= 18.75 + 0.915(x-16.03)$
OVEN TEST-MOISTURE CONTENT (%)