

CALIBRATION PRINCIPLES

## CONTENT

1. PREPARATION	3
2. STATISTICAL DATA COLLECTION	4
3. STATISTICAL DATA PROCESSING	4
4. COEFFICIENT RECORDING	5
5. CALCULATION AND RECORDING OF THE THRESHOLD ATTENUATION VALUE	6

THE CALIBRATION OF THE MOISTURE METER SHOULD BE UNDERTAKEN AFTER ALL THE MAINTENANCE WORK DESCRIBED IN “ON-LINE MICROWAVE MOISTURE METER IDC 202. INSTALLATION DIRECTIONS”.

## 1. PREPARATION

**1.1.** Switch the meter on and allow at least 15 minutes to warm up.

**1.2.** Transfer the meter to “selection” mode by pressing “sel.” button (Figure 1).



Figure 1: LCD display in “Material selection” sub mode.

**1.3.** Select desired calibration by pressing buttons 1 to 9 set and confirm by pressing “enter”.

**1.4.** Press “cal.” button and enter password “16729”. The “calibration” menu is then displayed on LCD screen (Figure 2).



Figure 2: “Calibration” menu

**1.5.** Select second sub mode by pressing “2” and confirm by pressing “enter” (Figure 3). Set measuring time interval to 10 seconds.



Figure 3: LCD display when entering measuring time interval

**1.6.** Press “enter” button – the meter is transferred back to the “Calibration” menu.

**1.7.** Transfer the meter to “Measurement” mode by pressing “enter”. In this mode LCD indicates the number of calibration, the name of the material under test, average moisture and temperature during the last measurement interval (Figure 4)



Figure 4: LCD display in the “Measurement” mode.

**1.8.** Switching to the “Test” mode (Figure 5) from the “Measurement” mode is achieved by



**1.9.** Simultaneous pressing “enter” and “cal.” keys.

Figure 5: LCD display in the “Test” mode.

In this mode, an operator can observe the temperature (°C) of the material flowing through the measuring space, the signal amplitude in volts (V), the attenuation of the signal (dB) with respect to attenuation of a signal when there is no material and calculated according to these parameters moisture (%) of the material under test.

## 2. STATISTICAL DATA COLLECTION

### 2.1. SAMPLING PROCEDURE

1) Take not less than 5 samples of the material (30-50g) during the measurement time interval. The range of the measurement time is determined by indications on LCD of the CU. The place for taking samples is determined while assembling the device in accordance with "On-line microwave moisture meter IDC 202. Installation directions".

2) At the end of measurement time (according to indications on LCD) record values of signal attenuations  $N_i$  (dB) and temperature  $T_i$  (°C). Write the values in the format of Table 1.

3) Stir the tested material thoroughly and bring it to a laboratory for measuring moisture in laboratory conditions;

4) Split the sample into two parts, and analyze the moisture content of each ( $Z_{i_1}$  and  $Z_{i_2}$ ) by the standard method in the laboratory. Record obtained values  $Z_{i_1}$  and  $Z_{i_2}$ , then calculate the average  $W_i$  as:

$$W_i = 0,5 (Z_{i_1} + Z_{i_2}) \tag{1}$$

Table 1

No sample	Moisture according to laboratory method, % ( $W_i$ )	Attenuation $N_i$ , dB	Temperature $T_i$ , °C
1			
...	...	...	...
10			

2.2. Repeat measuring procedure at least 10 times in such a way that:

- The moisture of taken samples covers all the range of the device.
- The temperature of taken temperature should not differ by more than  $\pm 3^\circ\text{C}$ .

## 3. STATISTICAL DATA PROCESSING

The calibration coefficients A, B, C, D, are calculated using the MasterLab program, which is included with the delivery of the moisture meter.

3.1. Start the program from the floppy disk;

3.2. Input the data recorded in Table 1 into the computer MasterLab program, according to the following method:

- point at the "One-parametric device" button and click the left mouse button;
- enter the values  $W_i$ ,  $N_i$  and  $T_i$ , from the Table 1 to the corresponding columns in the MasterLab program (column "F" is not used)

3.3. Calculate the parameters of the function  $W = F(M)$  :

- open the "Graph" window by clicking the left mouse button;
- point at the "X2" button and click the left mouse button;
- point at the "Calculate" button and click the left mouse button.

3.4. Open the "Results" window, and record the values A , B , C , D and  $T_n$ .

Table 2

Constant	Material Under Test					
	Wheat	Sand	Silicate masses	Coal	Mold powder	Apatite
K1	0	0,025	0,025	0,015	0	0
K2	-0,125	0	0	0	0	0

## 4. COEFFICIENT RECORDING

An operator can record the following data into moisture meter memory:

- A, B, C, D,  $T_n$  (calculated by MasterLab);
- K1, K2 – temperature constants presented in Table 2.

**4.1.** Press “cancel” button – the moisture meter is switched to the “Measurement” mode (Figure 4).

**4.2.** Press “cal.” button and enter password “16729”. The “calibration” menu is then displayed on LCD screen (Figure 2).

**4.3.** Press “5” button and confirm by pressing “enter”. The LCD screen indicates that coefficient “A” is to be entered (the blinking cursor indicates the digit of the coefficient to be edited).

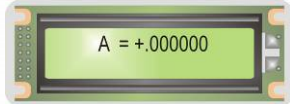


Figure 6: LCD display when entering calibration coefficients.

**4.4.** Enter the value (comma is entered by “sel” button) and confirm by “enter”. An operator is then offered to enter the next coefficient.

**4.5.** In a similar way enter other coefficients. When the coefficient  $T_n$  is entered and confirmed the meter is transferred to the “Calibration” menu (Figure 2).

### 4.6. ENTER CORRECTION COEFFICIENTS

- From the calibration screen (Figure 2) select option "4" and press the "enter" key.
- Enter the value for the first correction coefficient. The sign of the constant can be changed by pressing the “+/(N0)” key.



Figure 7: LCD display when entering correction coefficients.

- Confirm the entered value by pressing the "enter" key.
- Enter the value for the second correction coefficient. The sign of the constant can be changed by pressing the “+/(N0)” key.
- Confirm the entered value by pressing the "enter" key.
- The device automatically returns to the Calibration Menu, i.e. Message from Figure 2 is shown on the LCD display
- Press the "cancel" key to switch the device from “Calibration” mode to “Measurement” mode.

**NOTE:** The adjustment of the factory-set calibration formula (with which the device is delivered) is enabled only after agreement with the manufacturer.

## 5. CALCULATION AND RECORDING OF THE THRESHOLD ATTENUATION VALUE

5.1. From the Table 1 – select the minimum attenuation value  $N_{min}$ .

5.2. Calculate the threshold value:  $N_{th} = 0.8 \times N_{min}$ .

5.3. When the device is in the “Measurement” mode – press “+/- (N0)” button. An operator is then offered to enter a password (Figure 8).



Figure 1: LCD display in “Threshold” mode.

5.4. Enter the password “67294”. Enter the threshold value (the sign is changed by pressing “+/- (N0)” button) (Figure 9) and confirm by “enter”.



Figure 9: LCD display when entering threshold attenuation value.

The device is switched back to the “Measurement” mode.

## CALIBRATION OF THE MOISTURE METER IS FINISHED