

Wood Chip Moisture Tester MT-200



Operating Manual

Thank you for purchasing this product.
Please read the operating manual carefully and use this product properly.

Safety Precautions

If the safety precautions for the wood chip moisture tester are not observed, injuries or damage to property may result. The utmost care has been given to the safety of the product, however take care to read the precautions in this operating manual for proper handling.

■ Be sure to carefully follow all safety precautions.

Carefully read the operating manual.

■ Do not use the unit if it is not functioning properly.

Immediately contact our service representative if the unit malfunctions or does not operate properly.

Contents

1. Features	4
2. Specifications	6
3. Part names.....	7
4. Display	8
5. Description of Main Unit Keys (control panel)	9
6. Before Measuring	10
7. Directions.....	11
7-1. Measurement.....	11
7-2. Average display	14
7-3. Continuous measurement mode setting	15
7-4. Moisture Content Value Correction	16
7-5. Setting the Alarm.....	17
8. User Calibration Curve and Moisture Value Bias Adjustment Function	18
9. Warnings and Errors	22

1. Features

This unit is a wood chip moisture tester that applies electric resistance of an object to be measured. Only putting the bar sensor into wood chips displays their moisture content (%). This moisture tester needs only simple operation for quick measurement without selecting an operator or measurement environment.

- **Auto power off function**

If no measurement is made or key is operated for approximately 5 minutes, the power is automatically shut off and avoids wasting the batteries.

- **Upper limit setting function**

Setting any moisture value enables a buzzer to sound when a measured moisture value exceeds the set moisture value.

- **Able to compensate for moisture values**

A moisture value can be corrected in the range from -9.9 to +9.9%.

- **Up to 13 types of user original calibration curves registrable**

In order to support various types of wood chips, user-originated calibration curves can be registered under numbers from 03 to 15.

- **Calibration curve selectable from 2 types**

Regarding an electric resistance type moisture tester, an electric resistance value of an object to be measured is measured, and a moisture content is converted from the resistance value. This transformation formula is called a calibration curve. This unit has pre-registered calibration curves for cutting chips and crushing chips in accordance with a difference in shape and type of wood chips, and accordingly, only selecting a calibration curve number enables a user to simply conduct measurement.



Calibration curve No. 01:
Cutting chips



Calibration curve No. 02:
Crushing chips

<Display of moisture tester>

There are two types, "wet base" and "dry base", of moisture contents that indicate the hydrous state of a substance. A moisture content is generally calculated by a means called drying method.

What is the drying method?

The drying method is a method by which a moisture content is measured by comparing the weight of a sample before drying and the weight of the sample after drying at a certain temperature. The calculation of a moisture content with use of the drying method varies depending on what the percentage is calculated with respect to, and the formulas are shown as follows:

- **Wet base**

$$\text{Moisture content (\%)} = \frac{\text{Sample weight before drying (g)} - \text{Sample weight after drying (g)}}{\text{Sample weight before drying (g)}} \times 100$$

- **Dry base**

$$\text{Moisture content (\%)} = \frac{\text{Sample weight before drying (g)} - \text{Sample weight after drying (g)}}{\text{Sample weight after drying (g)}} \times 100$$

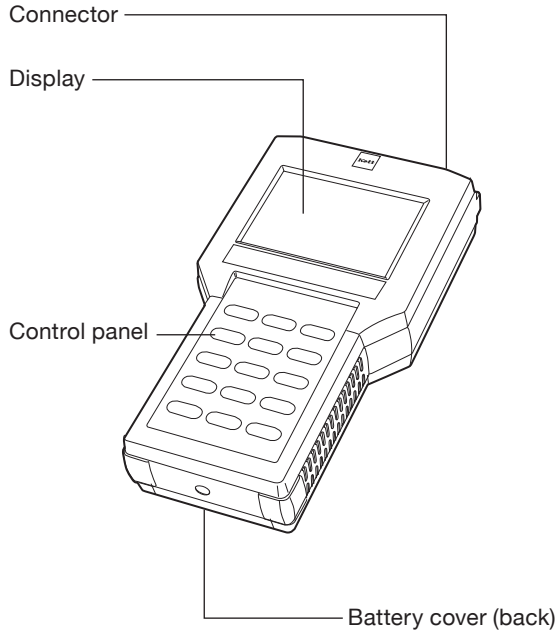
- * **In general, the wet base is used for grain such as rice and wheat, and the dry base is used for timber and minerals.**
- * **Be aware that all the moisture contents displayed on this unit are indicated on the wet base.**

2. Specifications

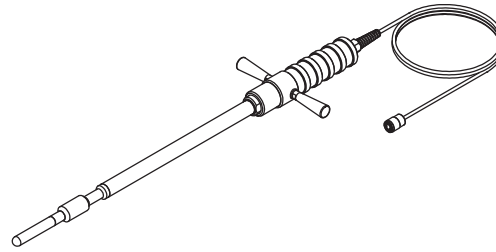
Measurement method	: Electrical resistance
Applications	: Cutting and crushing chips
Measurement range	: 15-55% (wet base)
Measurement precision	: <Cutting chips> Standard error: 5.0%, repeatability: 2.0% <Crushing chips> Standard error: 3.0%, repeatability: 2.0% Standard method: Constant weight method at 103°C (ISO 18134)
Display	: Digital (LCD, minimum displayed digit is 0.1%)
Operating Temperature	: Operating temperature: 0 to 40°C (no condensation)
Functions	: Upper limit alarm setting (15 to 55% and OFF), Moisture value bias adjustment (-9.0 to 9.9%), Auto power off (automatically turned off in approx. 5 minutes), Average value display, Continuous measurement mode, Calibration curve memory function (13 types)
Power supply	: 1.5 V batteries (AA alkaline) x6
Power consumption	: 0.54W
Dimensions	: 110 (W) x 210 (D) x 50 (H) mm
Mass	: 0.5kg
Accessories	: Bar sensor (PU-360), Shoulder strap, 1.5 V batteries (AA alkaline) x6, Operating manual

3. Part names

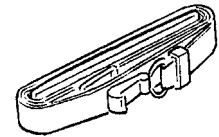
<Main unit>



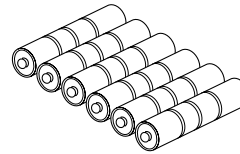
<Accessories>



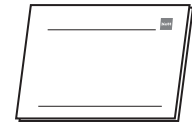
Bar sensor (PU-360)



Shoulder strap

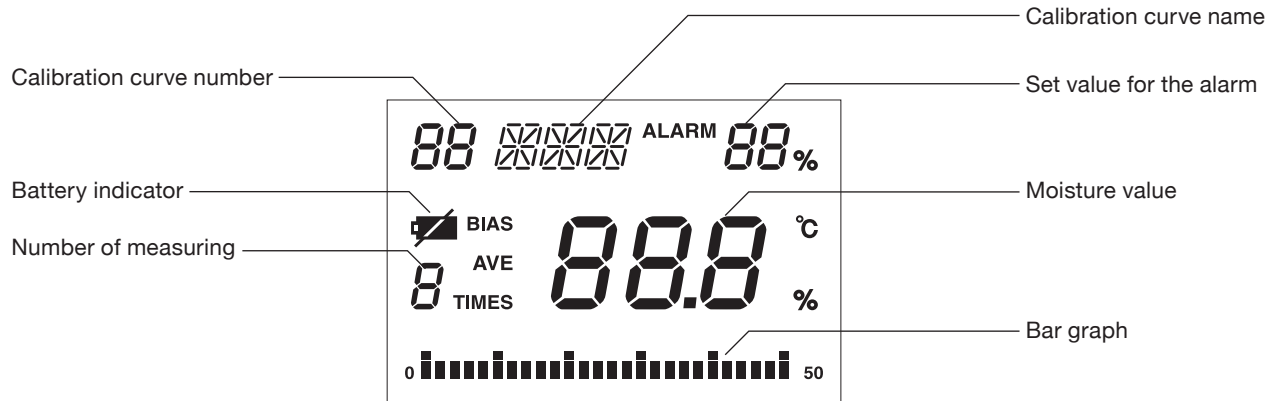


1.5 V batteries (AA alkaline) x6



Operating Manual

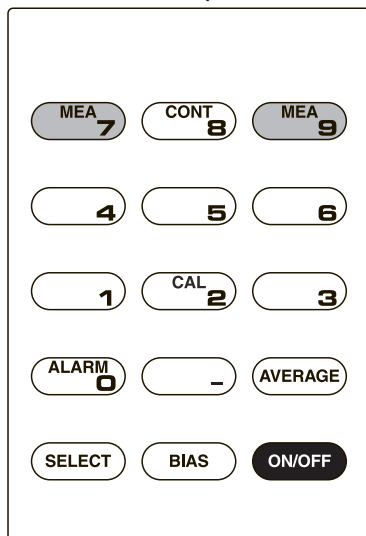
4. Display



5. Description of Main Unit Keys (control panel)

* The numerical keys from 0 to 9 are used for number input. Some keys combine numerical input and other functions.

<Control panel>



Key	Functions
ON/OFF	Turns the power "ON" and "OFF".
BIAS	Adjusts a moisture value bias.
SELECT	Selects a sample number.
AVERAGE	Averages measured values.
-	Enters a minus correction value.
ALARM 0	Activates an alarm.
CAL 2	Enters a calibration curve and a value.
MEA 7, MEA 9	Conducts measurement.
CONT 8	Changes the current mode to the continuous measurement mode.

6. Before Measuring

(1) The unit is powered by six 1.5 V batteries (AA, alkaline). Remove the rear battery cover, place the batteries into the compartment taking care to correctly orient the positive "+" and negative "-" terminals. Then attach the battery cover.

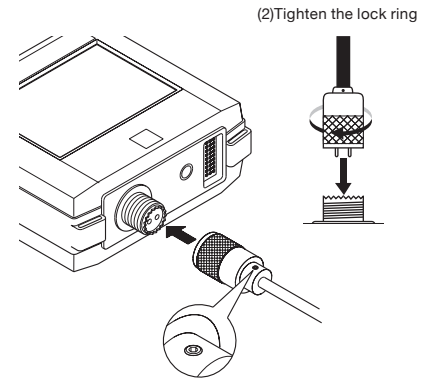
*  is displayed when the batteries become low. Replace all six with new batteries.

(2) Plug the connector of the bar sensor into the main unit securely, and tighten the lock ring to secure the connection.

* **At this moment, direct the silver indentation to the front side, or measured values may be affected.**

(3) Prepare a sample to be measured, and allow the sample to equilibrate to the same temperature as this unit.

* **Errors may occur when there is a large difference in the temperature between the sample and this unit. To make more accurate measurements, allow the temperature of a sample to equilibrate to that of this unit.**



(1) Direct the silver indentation to the front side and securely insert the connector

(2) Tighten the lock ring

7. Directions

7-1. Measurement


(1) Press the **ON/OFF** key to turn on the power. All elements of the LCD will be displayed for about 3 seconds. Subsequently, "calibration curve name," and "%" will be displayed.

* **At this time, if the display shows something other than the above, this unit may be in the abnormal state. Refer to "9. Warnings and Errors" on page 22.**



(2) Select the number of the calibration curve to be measured. This unit has two types of pre-registered calibration curves as shown below.

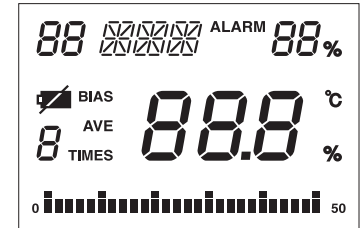
* **Different measurement results are obtained depending on wood chip shapes, and accordingly, a calibration curve needs to be selected at measurement.**

<Calibration curve No. 01: For measuring cutting chips>

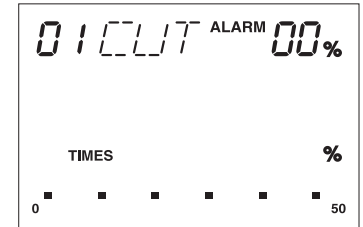
Successively press keys in the order of **SELECT** → **ALARM**  → **1**.

<Calibration curve No. 02: For measuring crushing chips>

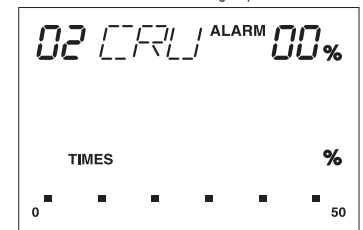
Successively press keys in the order of **SELECT** → **ALARM**  → **CAL**  **2**.



<Calibration curve No. 01: Cutting chip selection screen>





<Calibration curve No. 02: Crushing chip selection screen>

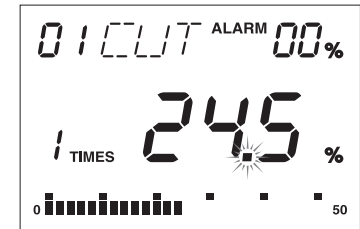


(3) Insert the bar sensor into wood chips.

- * **When the bar sensor is inserted, push the sensor firmly into wood chips to place more than half of the sensor in the chips. If insertion is not deep enough, contact between the bar sensor and wood chips is not sufficient and an accurate measurement result may not be obtained.**
- * **Do not stir, twist, or wrench wood chips with use of the bar sensor in a reckless manner. Failure to observe this may apply excessive load to the bar sensor and accordingly cause damage to it. In addition, the state of contact with a sample significantly changes, which may greatly affect a measurement result.**

(4) Press the  or  key. The decimal point will blink. After approximately 3 seconds a “beep” will sound and the “Measurement number”, “Moisture value”, and “Bar graph” will be displayed.

- * **The bar graph will display up to 50% in units of 2%.**
- * **When the moisture value is outside of the measuring range, "HI" will be displayed if the value is higher than the measuring range, and "LO" will be displayed if the value is lower than the measuring range.**



* The  symbol denotes a blinking display.

- (5) Remove the bar sensor from wood chips. At this time, the moisture value remains on the display. To continue to make further measurements, start the procedure from the step "(3) Insert the bar sensor into wood chips" on page 12.

When measurement is completed, press the **ON/OFF** key to turn off the power.

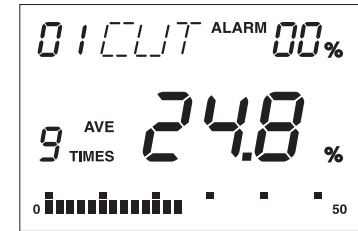
- * **The auto power off function turns off the power of this unit automatically if no measurement or operation is conducted for 5 minutes.**
- * **Clean the bar sensor unit with a dry cloth or the like after use. If the bar sensor is dirty, it may deteriorate.**





7-2. Average display

Pressing the **AVERAGE** key when the number of measurements is from 2 to 9 displays "measurement number" and "average value". At this time, "measurement number" and "average value" remain displayed, but if a measurement is continuously made, "measurement number" will be 1.


- * If the number of measurements exceeds 9, the measured value up to that point resets and measurement starts from measurement number 1.
- * Wood chips have individual differences depending on producing areas and tree species. Therefore, it is recommended to conduct measurement multiple times and use the average value function.

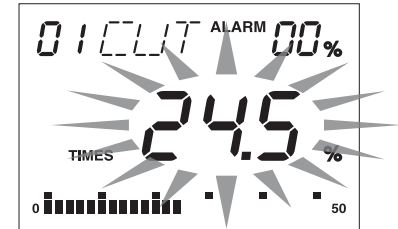


7-3. Continuous measurement mode setting


If the continuous measurement mode is selected, measurements can be made without pressing the  or  key for each measurement.


(1) Continuous measurement mode setting

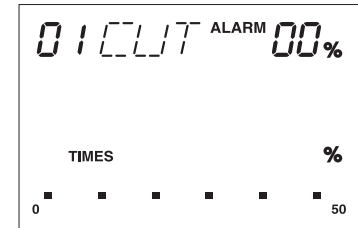
In the step "7-1. Measurement (4)" on page 12, pressing the  key causes the decimal point to blink and display the moisture value and bar graph. When the bar sensor is not inserted into wood chips or the moisture content is below the measurement range, "LO" will be displayed, and the numeric display will blink.



(2) Canceling the continuous measurement mode

Hold down the  key for 2 seconds or more until a "beep" sounds. The display will momentarily go blank. When you take your finger off the key, the unit will return to normal measurement mode.

- * Pressing the  key turns off the power and automatically cancels the continuous measurement mode.
- * Note that the battery life is shorter in the continuous measurement mode. The battery life is approximately 48 hours when measurements are continuously conducted (at 20°C).

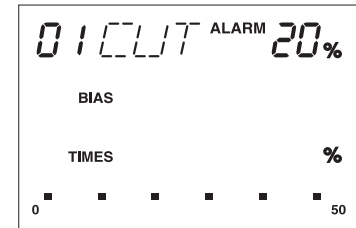


* The  symbol denotes a blinking display.

7-4. Moisture Content Value Correction

The moisture value scale of this unit is created by statistically processing the relationship between the drying method and electric resistance. However, depending on various conditions, there are cases where the standard measurement method and the moisture value do not agree. In such cases, a moisture value bias can be adjusted (-9.9 to 9.9%) by the following method.


- (1) Press the **BIAS** key.
The “BIAS” indicator will blink, and the previously entered bias value will be displayed. The initial value is 0.0%.
- (2) Enter a correction value. Enter a 2-digit number.
To enter “2.0%”, press the **CAL 2** and **ALARM 0** keys in succession.
To enter a negative value, press the key **-** prior to pressing the numerical keys.
- (3) Press the **MEA 7** or **MEA 9** key to make measurements.
 - * If a correction value has been entered, “BIAS” will be displayed.
 - * To cancel the correction value, enter “0.0%”.

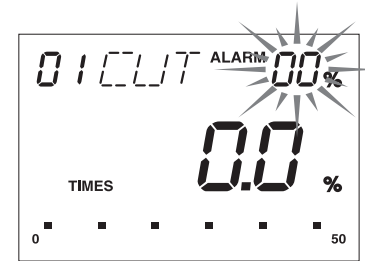




* The  symbol denotes a blinking display.

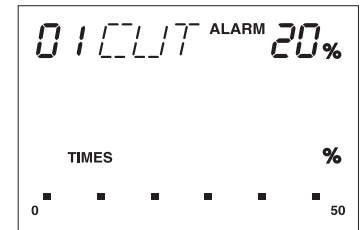
7-5. Setting the Alarm

When wood chips having moisture higher than the set moisture value are measured, a buzzer sounds to issue an alarm.

- (1) Press the  key.
The numbers to the right of “ALARM” will blink.



- (2) Enter the alarm value.
Enter a 2-digit number. To enter “20%”, press the  and  keys in succession.



- (3) The alarm setting value is displayed.
Press the  or  key to make measurements.

- * To cancel the alarm setting, enter “0.0%”.
- * The setting range is 15 to 55%.
- * If the continuous measurement mode is selected, the alarm setting cannot be used.

* The  symbol denotes a blinking display.

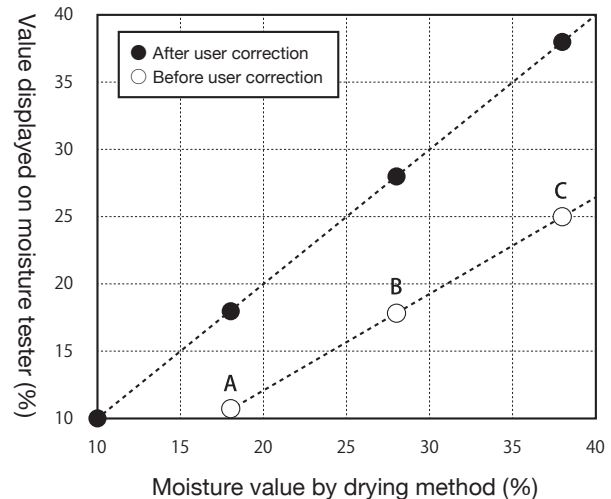
8. User Calibration Curve and Moisture Value Bias Adjustment Function

Calibration curves are created with plural samples in order for this unit to support measuring many different types of wood chips. However, wood chips have individual differences depending on producing areas and tree species. Therefore, our created calibration curves do not apply to some samples. In such a case, this function allows a user to create user original calibration curve for your sample and accordingly allows a user to conduct measurement with higher accuracy by adjusting moisture value bias.

The example of the graph at right shows that the measurement results using this unit are displayed lower than the measurement results by the drying method and the differences between them become larger as the moisture content of the sample to be measured is higher. In this case, even if a correction is conducted according to the procedure in "7-4. Moisture Content Value Correction" on page 16, the correction effect may be insufficient because a difference is present between the inclinations of the calibration curves. For such a case, a correction more suitable for user's sample can be conducted by user adjustment.

Meas. point	Moisture value by drying method (%)	Value displayed on moisture tester (%)
Point A	18	11
Point B	28	18
Point C	38	25

<Example of user calibration curve>

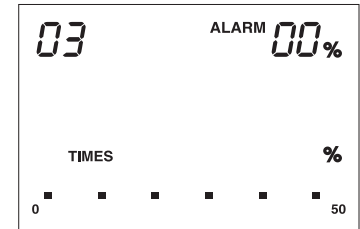


Regarding user's sample for user adjustment:

- (1) Measurement by using a base method such as drying method
- (2) Measurement by using this unit

A difference between the measurement value by the base method and the measurement value before correction is checked after conducting the measurements mentioned above, and the correction coefficients, A and B, are obtained from the results. Regarding how to obtain the correction coefficients, A and B, please prepare on your own, for example, use a regression formula.

- * **The user calibration curve function does not include the temperature correction function. Therefore, when the measurement of (2) mentioned above is conducted, conduct measurement by using 1.0 and 0.0 for the default correction coefficients A and B respectively of user calibration curves in the temperature environment to be used. When the correction coefficients are defaults, the calibration curve name is not displayed.**



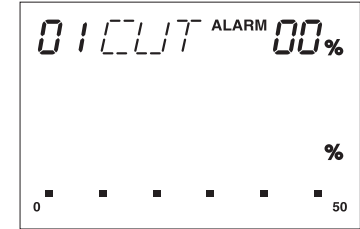
The user correction formula is shown as follows:

$$\text{Measurement Value after Correction (\%)} = \text{Correction Coefficient A} \times \text{Measurement Value before Correction (\%)} + \text{Correction Coefficient B}$$

- * **The correction coefficient A changes the inclination of the calibration curve, and the correction coefficient B is the bias value. If the correction coefficient is set to 1.0 or higher, a measurement value is apt to be displayed higher as the coefficient is set higher. Regarding the correction coefficient B, the procedure is the same as "7-4. Moisture Content Value Correction" on page 16.**
- * **In this case, the calibration curve originates from "Calibration curve No. 01: Cutting chips".**

Ex.) When 1.4 and 3.0 are entered into the correction coefficients A and B respectively of the user calibration curve No. 03

- (1) Press the **ON/OFF** key to turn on the power. All elements of the LCD will be displayed for about 3 seconds. After that, "CUT" and "%" are displayed.



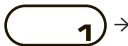

- (2) Press the **CAL 2** key, and the unit will be the calibration curve input mode.





- (3) Enter a user calibration curve number (03 to 15) to be registered. In this case, "03" is selected for user calibration curve registration.

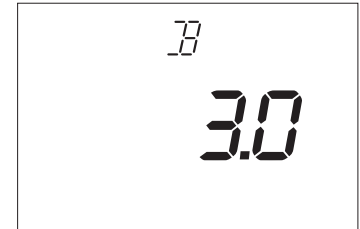
Successively press keys in the order of **ALARM 0** → **3** → **AVERAGE**.





- (4) Enter a number for the correction coefficient A (0.1 to 1.9). The default value is "1.0". In this case, "1.4" is entered for the correction coefficient A. Successively press keys in the order of  → .

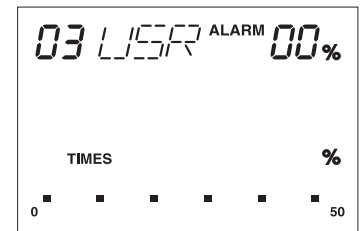


- (5) Enter a number for the correction coefficient B (-9.9 to 9.9). The default value is "0.0". In this case, "3.0" is entered for the correction coefficient B. Successively press keys in the order of  → .



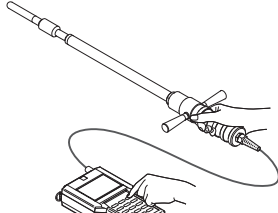
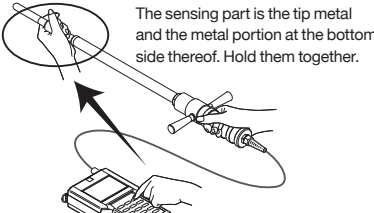
- (6) After the entry is completed, the unit is in the state where the registered calibration curve is selected. Pressing the  or  key enables measurement.

* **When user correction coefficient is viewed by a calibration curve number, conduct the steps (2) to (5), enter the calibration curve number to be viewed, and view the displayed coefficient.**



9. Warnings and Errors

The following warnings and errors are displayed when an abnormality is present in this unit or the measurement condition.

Display	Description
-5°C	This indication is displayed when the temperature of this unit decreases to -5°C or less. It is measurable.
50°C	This indication is displayed when the temperature of this unit increases to 50°C or more. It is measurable.
001	There is a problem with the temperature sensor. Servicing is required. The power is turned off after error display (in 4 seconds).
002	There is a problem with the electronic circuit used for moisture measurement. Servicing is required. The power is turned off after error display (in 4 seconds).
HI (always)	<p>If the measurement value is always displayed as "HI", an abnormality may occurs in this unit.</p> <p>Press the [ON/OFF] key to turn on the power. Direct the bar sensor in the air with the sensing part untouched, and press the [7] or [9] key. If "HI" is displayed even after the operation above, repair is needed.</p> 
Lo (always)	<p>If the measurement value is always displayed as "Lo", an abnormality may occurs in this unit.</p> <p>Press the [ON/OFF] key to turn on the power. Press the [7] or [9] key while holding the sensing part of the bar sensor. If "Lo" is displayed even after the operation above, repair is needed.</p>  <p>The sensing part is the tip metal and the metal portion at the bottom side thereof. Hold them together.</p>

The Kett logo consists of the word "Kett" in a white, sans-serif font, centered within a dark gray square.

KETT ELECTRIC LABORATORY

1-8-1 Minami-Magome Ota-Ku, Tokyo 143-8507 Japan
Tel. +81-3-3776-1121 Fax. +81-3-3772-3001
URL <http://www.kett.co.jp/> E-mail overseas@kett.co.jp

Caution

- It is strictly prohibited to transfer part or all of this manual without permission.
- The contents of this manual are subject to change without notice.
- The appearances, screens, etc. of the product and accessories displayed on this manual may differ from the actual ones, however, operations and functions are not affected.
- All efforts have been made to ensure the contents of this manual are accurate. However, if you notice any part to be unclear, incorrect, omitted, or the like in this manual, please contact us.
- Be aware that we are not liable for the effects resulting from operations according to this manual regardless of the items above.