
UNIVERSAL MOISTURE TESTER
HB-300



Operating Manual

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1. UNIVERSAL MOISTURE TESTER HB-300

Most conventional moisture testers utilizing the electrical measurement method are designed for one specific application as their product names suggest, such as Wood Moisture tester or Grain Moisture tester. This is because their calibrations are pre-set to measure a certain subject. They are handy because they are ready to be used immediately after purchase, but naturally you can't expect accuracy measuring other subjects. You have to have many different moisture testers to measure a range of subjects. For example, for processed food you may not have been able to find a suitable moisture tester and had to rely on the time consuming Dry Process Method to know the moisture content. The market was waiting for one handy electric moisture tester able to measure various kinds of samples in different conditions and shapes.

HB-300 can measure the moisture of many kinds of samples in various conditions and shapes such as solid, powder, grains, paste, sheet, etc. You can make the calibration for your samples relatively easily and register it to the tester. Many optional sensor probes are available for the HB-300 which further amplify the range of measurement subjects.

- **This tester allows a calibration of electric resistance to moisture content so that samples containing high moisture or materials that affect electric resistance, such as metal, powder or salt, may still be measured but inaccurately.**
- **You need to make and set the calibration for your measurement subject in order to display the moisture content % on the tester directly.**

2. FEATURES

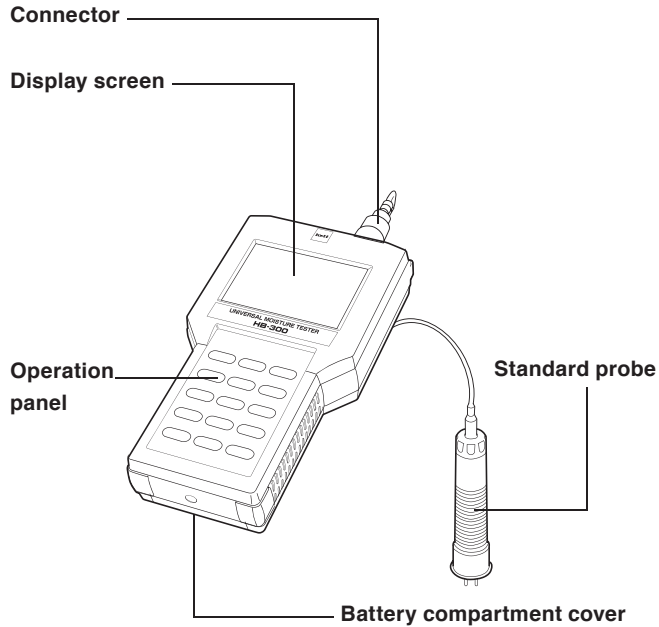
- By setting an unique calibration for each material, as required, the HB-300 can measure various kinds of materials.
- Easy operations to make calibrations.
- Up to 10 calibrations can be registered in the instrument
- Standard probe for constant pressure measurement is included. Many other optional probes are available.
- Upper limit alarm installed.
- Moisture content bias correction can be set.

3. SPECIFICATIONS

Measurement method	:	Electric resistance method
Measurement subjects	:	Solid, powder, grain, paste or sheet materials except samples containing electrolyte
Indicating range	:	1~99%
Measurement range	:	Electric resistance..... 10K Ω ~ 900M Ω Water content valueDepends on the sample
Measurement accuracy	:	Depends on the sample
Display	:	Digital (LCD)
Resolution	:	0.1%
Measurement temperature range	:	0~40°C
Function	:	Calibration curve memory (10 types), Display of average, Automatic power off (approx. in 5 minutes), Upper alarm setting (01~99% and off), Moisture value bias correction (-9.9 ~ 9.9%)
Power	:	1.5V battery (size AA alkaline) x 6
Dimension	:	110 mm (W) x 210mm (D) x 50 mm (H)
Weight	:	0.5Kg
Accessories	:	Standard probe, Shoulder strap, Carrying case, 1.5V AA battery x 6, Operating manual, Function mode list

4. NOMENCLATURE

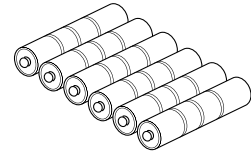
[Instrument body]



[Accessory]



Standard probe



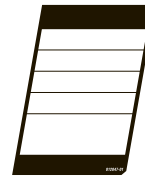
1.5V AA Battery x 6



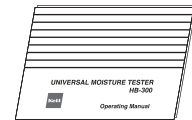
Shoulder strap



Carrying case

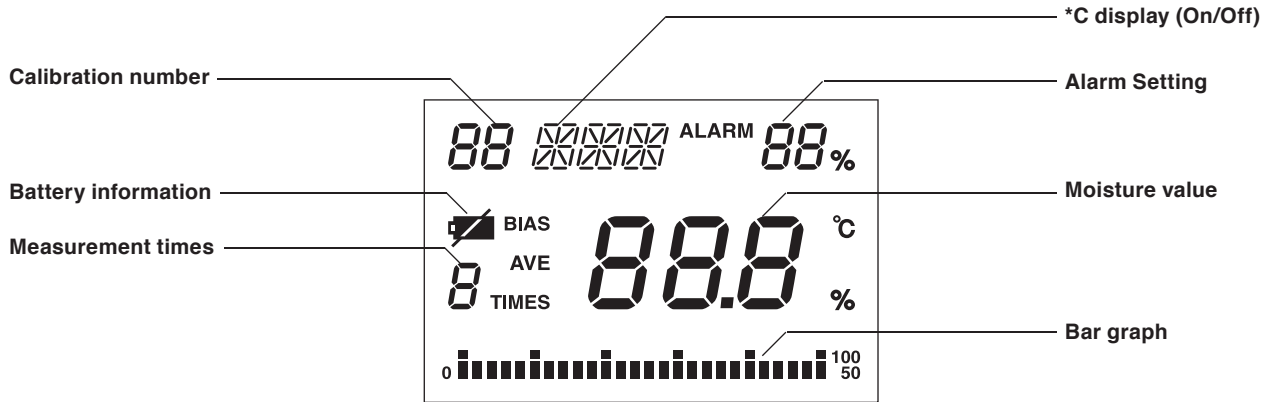


Function mode list



Operating manual

5. DISPLAY SCREEN

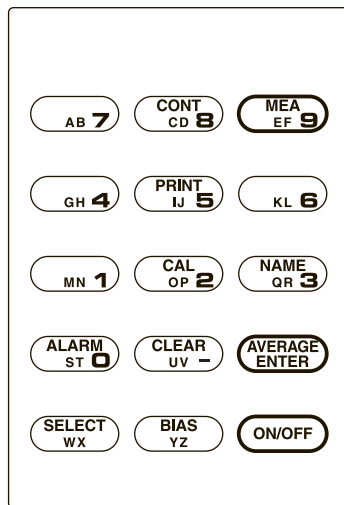


- C of "C display" stands for Calibration. (Refer to Page 23, procedure e.)

6. OPERATION PANEL KEYS

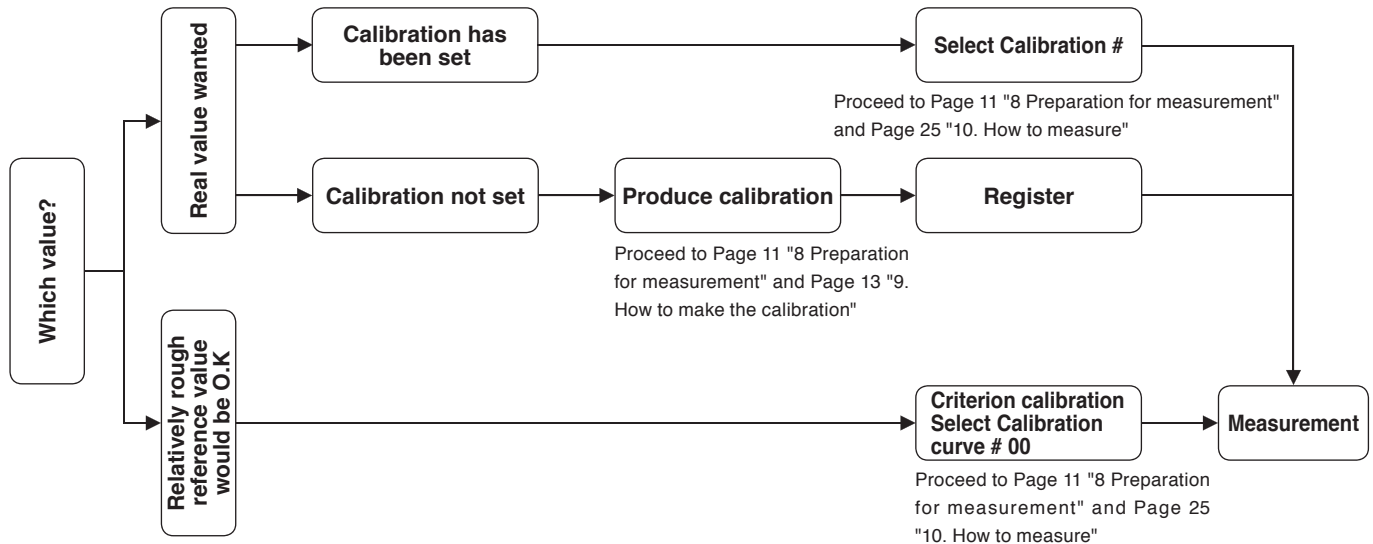
- 0~9 keys for entering numerical values. Some numeric keys have other functions as well.

[Operation panel]



Key	Function
ON/OFF	To turn the power on /off.
BIAS YZ	To apply bias correction.
SELECT WX	To select calibration #.
AVERAGE ENTER	To calculate average. To enter the numerical values on display.
CLEAR UV -	To clear miss types.
ALARM ST 0	To set the upper alarm.
CAL OP 2	To set the calibration.
MEA EF 9	To measure the sample.
CONT CD 8	To switch from/to continuous measurement mode and single measurement mode.

7. FLOW CHART FOR MEASUREMENT



8. PREPARATION FOR MEASUREMENT

- (1) Install the six AA batteries in the battery compartment on the back of the instrument:

Remove the battery compartment cover and install the batteries. Take care not to reverse the polarity (\oplus & \ominus) of the batteries. Replace the cover.

- **When the batteries are worn,  will blink on the display screen. Change all batteries at the same time.**

- (2) Set the probe either to "Constant" or to "Fix" according to the sample.

Turn the base of the probe clockwise till it clicks to set it to "Fix". Turn anti-clockwise to release it back to "Constant".

- **The probe is set at "Constant" at the time of shipment. At "Constant" the grip of the will slide so as to give a constant pressure on the sample.**

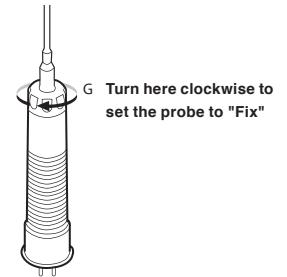


Fig.1

- (3) Firmly connect the probe connector to the instrument body and turn the lock ring.

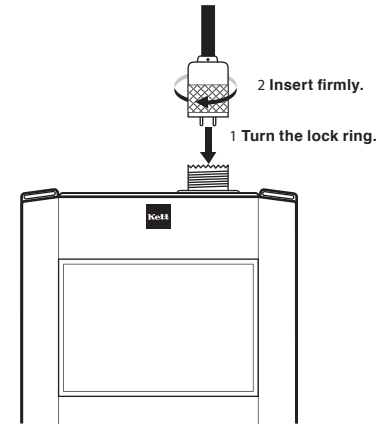


Fig.2

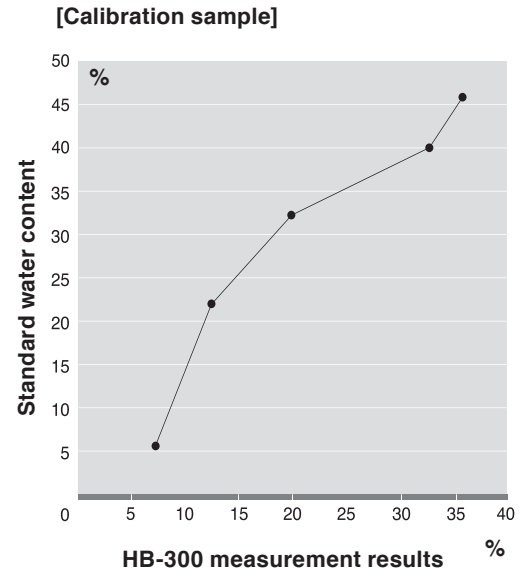
- (4) Prepare the sample to be measured, leave it to allow the sample temperature to even and equalize with the instrument's temperature.
- **If the sample temperature at this point is different from the samples you wish to measure later, it may result in an inaccurate measurement. While making the calibration curve, take care that the sample temperature is even and the same as at the measurement site where you will be measuring.**

9. HOW TO MAKE THE CALIBRATION

9-1. What is the calibration?

Generally, calibration of moisture testers measuring electric resistance show correlations between the actual moisture and the electric resistance of each sample. The actual moisture is to be measured by the drying process or other processes beforehand. The correlation can be displayed in a form of numerical expression, graph, list and etc. The criterion calibration set in HB-300 is a numeric expression of correlation of moisture and electric resistance. It was obtained by measuring electric resistance of a timber with a 4needle probe and its actual moisture measured by the drying process.

At the time of shipment this criterion calibration is set on all calibrations #00~10. You can register different calibrations of different samples on #01~10 respectively. However the criterion calibration on #00 can not be changed. To use HB-300 as a direct moisture reader, it is necessary to make and register a specific calibration for the sample by measuring the actual moisture, using the standard method or others, and to correlate it with the measurement results acquired with the criteria calibration of HB-300.



9-2. How to produce the calibration curve

- Use the same probe that will be used to measure the sample later. Do not change the setting of "Constant" or "Fix" if using the standard probe. Using different probes or different ways of measurement such as angle of the probe and depth may affect accuracy.
- While making a calibration, try to make the environment of measurement as equal as possible to the environment at the site where you will be using the instrument later. Especially difference of temperature will affect accuracy.
- It is necessary to make multiple calibrations and register them respectively if seasonal temperature changes of the sample are expected.

(Example)

Temp. at measurement	Temp. while producing calibration	Calibration # to register
15~20°C	17°C	01
20~25°C	22°C	02

(1) Prepare the sample

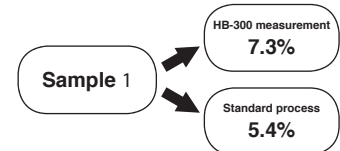
Prepare 2~5 samples with different moisture. Include both the upper and lower limits of moisture content that your samples to be measured might contain. For instance, if you want to measure 6~40% moisture, be sure to include under 6% and over 40% moisture samples in all the 2~5 samples.

(2) Measure the samples with the criterion calibration of HB-300 (in #00). Also measure the actual moisture value of the same samples with the standard method or the drying process using Infrared Moisture Determination Balance.

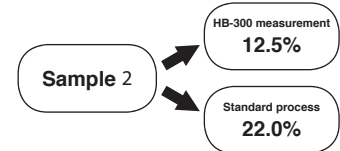
- For detailed description on how to measure, refer to "10-1 Measurement" on page 25.
- If the measurement results show much fluctuation, measure the samples by the continuous measurement mode (refer to "10-3 How to set Continuous Measurement Mode" on page 29) or calculate the average of the measurement results.

[Example: Measuring 5 samples]

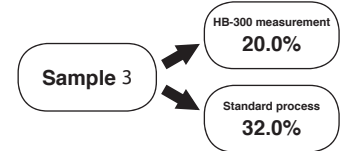
◆ Measurement 1



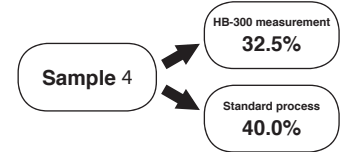
◆ Measurement 2



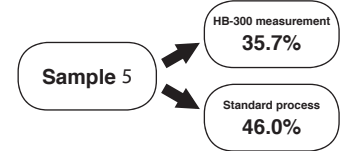
◆ Measurement 3



◆ Measurement 4



◆ Measurement 5



(3) Make a note of the measurement result acquired with the criteria calibration (#00) as shown in Table 1 on the right. Use a photocopy of the table format on the last page of this manual.

- Fill in the list starting from the smaller results first.


9-3. How to enter the calibration (measuring 5 samples)

(1) This description illustrates how to enter the results acquired from #00 into #02 for example.

- Enter with the numeric keys. Add "0" if you are entering a one-digit number.

[Example] Entering 9.9%

Press the key as  H  H 


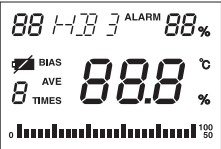

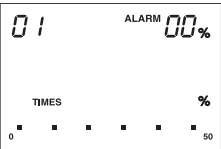

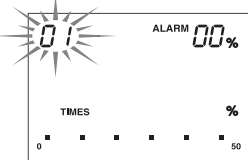



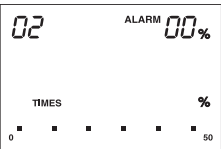


- To clear an error, complete filling all 3 digits---any number will do---and press  key to delete and re-enter.

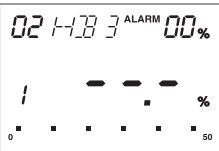

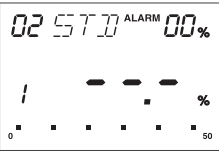
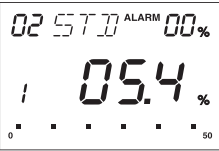
◆ Calibration #
◆ Sample name


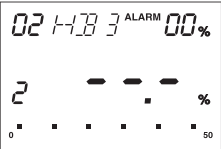




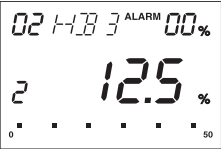




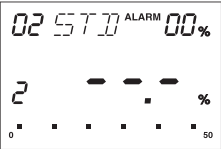








	HB-300 results (with #00 calibration)	Actual moisture content (Standard method)
Sample 1	7.3%	5.4%
Sample 2	12.5%	22.0%
Sample 3	20.0%	32.0%
Sample 4	32.5%	40.0%
Sample 5	35.7%	46.0%












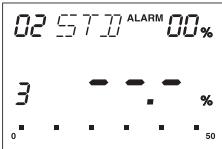








Table 1


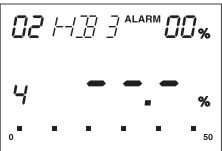









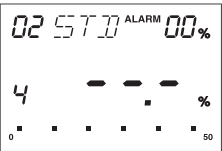




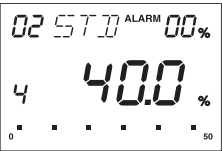



- When entering the calibration curve, start with the result *1 and follow the arrows shown here to fill the table.







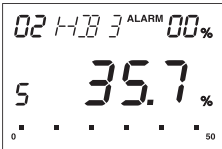




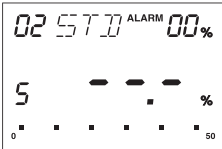








Step	Key	Display	Description
1			<p>Press the  key to turn the power on. The LCD will blink for about 3 seconds.</p>
2			<p>Displays [Calibration #], [TIMES] and [%]</p>
3	<p>[Select for calibration #]</p> 		<p>Press the  key to enter calibration # selection mode. The calibration # will blink. Enter "02" for instance.</p>
4	 		<p>Press the  key, the 1st digit will blink. Next, press the  key. The display will be "02". Now you have selected Calibration #2.</p>


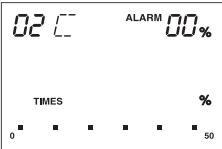

Step	Key	Display	Description
5	<p>[Entering the Calibration curve]</p> <p>CAL OP 2</p>		<p>Enter the results of Table 1 from Sample #1 with the HB-300 results first and the standard process next. Press the CAL OP 2 key to open Calibration entering mode.</p>
6	<p>ALARM ST 0</p> <p>AB 7</p> <p>NAME QR 3</p>		<p>Enter measurement results of sample #1. Press the ALARM ST 0, AB 7 and NAME QR 3 key to enter 07.3% for instance.</p>
7	<p>AVERAGE ENTER</p>		<p>Press the AVERAGE ENTER key, the display will change to [STD] from [HB3].</p> <ul style="list-style-type: none"> [HB3] stands for HB-300 measurement result and [STD] for standard method process result to enter.
8	<p>ALARM ST 0</p> <p>PRINT IJ 5</p> <p>GH 4</p>		<p>Press the ALARM ST 0, PRINT IJ 5 and GH 4 key to enter 05.4% for instance.</p>

Step	Key	Display	Description
9			Press the  key, the display will change to “2 TIMES” from “1 TIMES”. Enter sample #2 results.
0	  		Press the  ,  and  key for 12.5%.
!			Press the  key, the display will change to [STD] from [HB3].
@	  		Press the  ,  and  key for 22.0% to enter.

Step	Key	Display	Description
#			Press the  , the display will change to “3 TIMES” from “2 TIMES”. Enter sample #3 results.
\$	  		Press the  ,  and  key for 20.0% to enter.
%			Press the  key, the display will change to [STD] from [HB3].
^	  		Press the  ,  and  for 32.0% to enter.

Step	Key	Display	Description
&			Press the  key, the display will change to “4 TIMES” from “3 TIMES”. Enter sample #4 results.
*	  		Press the  ,  and  key for 32.5% to enter.
(		Press the  , the display will change to [STD] from [HB3].
)	  		Press the  ,  and  for 40.0% to enter.


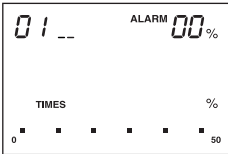


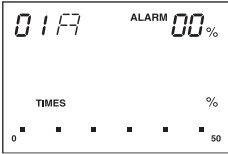


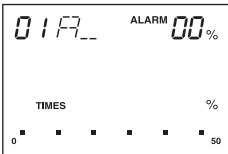


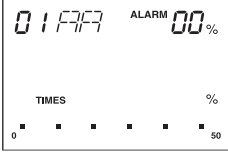


Step	Key	Display	Description
-			Press the  key, the display will change to “5 TIMES” from “4 TIMES”. Enter sample #5 results.
=	  		Press the  ,  and  for 35.7% to enter.
q			Press the  key, the display will change to [STD] from [HB3].
W	  		Press the  ,  and  key for 46.0% to enter.

Step	Key	Display	Description
e			<p>After Pressing the  key, the beep will notify that the calibration has been registered in #2 and the display will change to Measurement mode.</p> <ul style="list-style-type: none"> • “C” will appear on the right of the calibration # on the display after the registration is done properly.

- All 5 pairs of data (i.e. both HB-300 and the standard process measurement data) must be entered in "1 TIMES"~ "5 TIMES" to produce a calibration. If you are trying to make it with 2~4 samples, enter 99.9, the upper limit of the measurement for the rest of sample # ("TIMES").
For instance, if you have two samples, enter 99.9 as HB-300 and Standard process data in "3 TIMES"~"5 TIMES". Never leave the rest blank.
- If you enter different or new data in the calibration # from 01~10, the calibration will be over written and the last registered calibration will be changed. Making a record of the data that you have entered is recommended.

9-4. How to input sample or calibration name

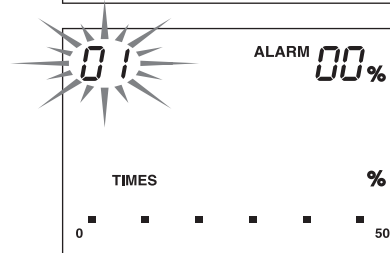
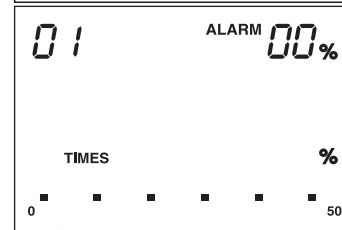
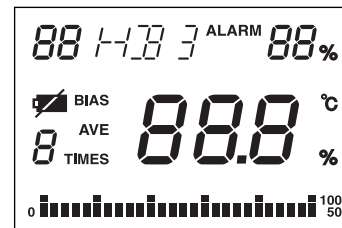
Example : When inpputing “ABC”


Step	Key	Display	Description
1			Press the  key, and " __ " will be displayed at right side of calibration number.
2			Press the  key, and "A" will be displayed at right side of calibration number.
3			Press the  key, and will change from "A" to "A _ "
4			Press the  key, and display will change from "A _ " to "AA". In case of inptut B,  key should be pressed twice.

10. HOW TO MEASURE



10-1. Measurement

- (1) Install the probe and press the **ON/OFF** key to turn the instrument power on. For 3 seconds the LCD will show all the letters and signs on it. After that "Calibration #", "TIMES" and "%" will be displayed.
- If the LCD wouldn't start up as described here, there might be an error occurring in the instrument. Refer to page 39 "12. Error display" .
- (2) Select the calibration # which you have registered as per page 13 "9. How to make the calibration"
Press the **SELECT wx** key, the calibration number will blink.
Enter two digit number (01~10).
- Prior to using HB-300, you need to register a specific calibration for your sample. Refer to page 13 "9. How to make the calibration, If you haven't completed the registration and just want to see relatively referential measurement readouts, select "00" .



❖  shows that either numbers or marks enclosed are blinking.


Example: Entering 02 to select

Press the  key, the first digit will blink. Next, press the  key. "02C" will be displayed.

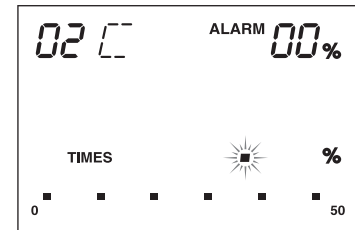
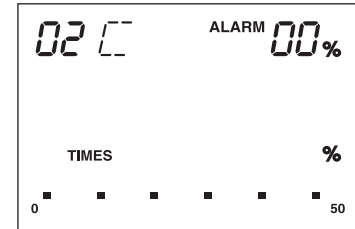
- If a registered calibration is selected, "C" will appear on the right of the calibration #.
- Once the calibration is registered, it will remain in the memory of the instrument after the power is turned off.


(3) Push the probe toward the sample.

- You must use the same probe used to measure the calibration data. Do not change the status of "Constant" or "Fix". Using different probes or different measurement procedures may affect the accuracy.

(4) Press the  key, the decimal point will blink. In about 3 seconds after a short beep, "Measurement Times", "Moisture %" and "Bar Graph" will be displayed.

- The bar graph increment is 2%, and capable of displaying 50% at maximum.
- If the measurement result is out of range, "HI" for exceeding and "LO" for lower than will be displayed.



❖  shows that either numbers or marks enclosed are blinking.

(5) Move the probe away from the sample. The last moisture % will remain displayed. To continue the measurement, push the probe toward the sample again as per page 26 (3).

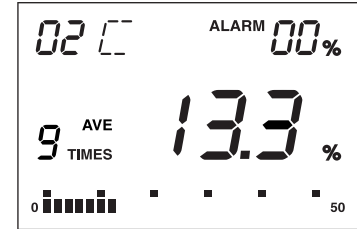
Turn the power off pressing the **ON/OFF** key after you have finished measurement.

- **This instrument will turn the power off automatically after being left unused for 5 minutes.**

10-2. Display of the average



After measurement has been done 2~9 times, you can display the average by pressing the **AVERAGE ENTER** key. The key will display "AVE" "Calculated average" and "Measurement times".

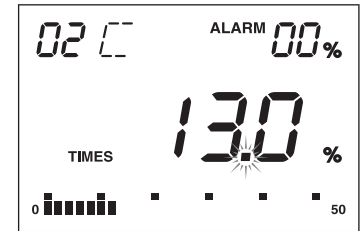
- After 9 times the "Measurement times" display will return to 1.
- In the continuous measurement mode, the average cannot be requested.




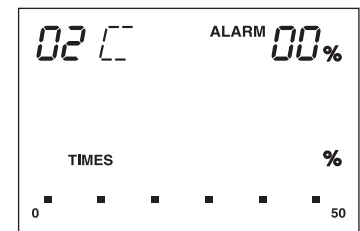
10-3. How to set Continuous Measurement mode


In this mode, you don't have to press the  key every time for measurement.

- (1) To set continuous measurement mode;
After the operation on P.26 "10-1 Measurement (4) Press the  key", Press the  key, the decimal point will blink and the bar graph will appear.
"LO" will be displayed if the probe is off the sample or the sample moisture is lower than the measurement range.



- (2) To release continuous measurement mode;
Press the  key for more than 2 seconds until a short beep is heard, the display will be off for a moment and return to the normal measurement mode when the pressed key is released.




❖  shows that either numbers or marks enclosed are blinking.

10-4. How to proceed for Bias Correction

The calibrations that you have set on the instrument are statistically calculated correlations of the sample's actual moisture and its electric resistance. However the measurement results may differ from the actual moisture, being affected by many aspects of the sample and the environment at the measurement site. In such cases, the calibration can accept a bias correction (-9.9~9.9% for each sample to measure) described as follows.




- (1) Select the calibration number.

Press the  key and enter the 2-digit number of the calibration.

- (2) Press the  key.

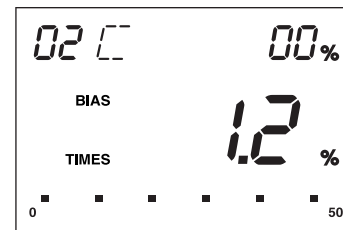
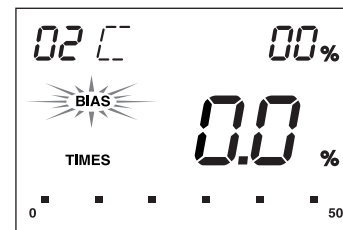
"BIAS" on the display will blink and display the corrected value which was last entered. 0.0% is the default value.


- (3) Enter the correction value.

Enter 2-digit value. Press the  and the  key for 1.2% for instance. If entering a minus correction press the  key before entering the numeric value.

- (4) Press the  key to start the corrected measurement.

- "BIAS" will be displayed during measurement.
- To release the correction, enter "0.0%".



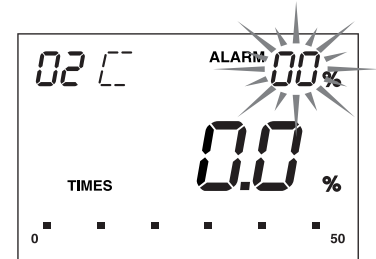
❖  shows that either numbers or marks enclosed are blinking.

10-5. How to set the alarm


The upper moisture limit alarm can be set at 1~99%. A series of short beeps let you know the sample is over the limit.


- (1) Press the  key.

The number to the right of "ALARM" will blink.

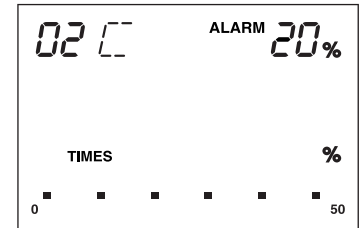


- (2) Enter the limit value.


Enter 2-digit number of the limit. e.g. Press the  and

 key to enter 20%.

- (3) Press the  key to start the measurement.



- To release the alarm setting, enter "0.0%".

❖  shows that either numbers or marks enclosed are blinking.

10-6. Setting for printer output

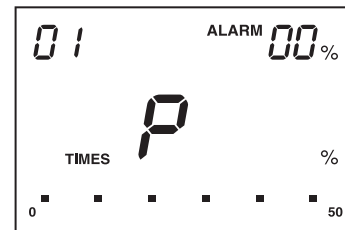
Calibration number, Measurement times, Moisture value and Average moisture value can be printed by using optional printer.

(1) Setting

Press the  key.

"P" will be displayed at the right side of "TIMES".

- **Doing the following measurement or the power supply is turned off.**

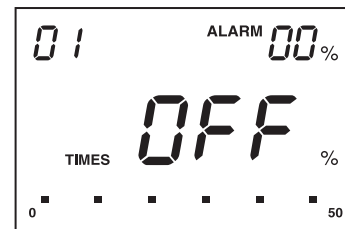


(2) Release of setting

Under measurement mode, press the  key and

"OFF" will be displayed at the right side of "TIMES".


- **(1) and (2) can be memorized even by the setting in case of which case even if it turns off power.**



10-7. Data Storage

Up to 250 measurement values are stored automatically. The contents of the data are “data number”, “year/month/day”, “time”, “calibration curve number”, and “moisture value”.

(1) Block function

For cases such as different measurement samples, pressing the  key between measurements is recognized as a separator signal, and a line feed is inserted when printing out.

(2) Management method of data

Refer to page 35 "Printer output of stored data" .
Refer to page 36 "Batch erasure of stored data" .

<Printout example>

HB-300 CALIBRATION No.02	
TIMES	(%)
1	33.4
2	30.9
3	29.3
4	28.1
5	27.2
6	26.5
7	25.9
8	23.1
9	21.9
TIMES	(%)
1	20.8
2	20.0
3	19.2
AVERAGE	20.0

11. FUNCTION MODE

Put the function mode list of accessories on the battery lid as needed, and please use it. Press the **ON/OFF** key to turn the power on. For 3 seconds the LCD will show all the letters and signs on it. After that "Calibration #", "TIMES" and "%" will be displayed.

11-1. Display of Input Moisture Values when Preparing a Calibration Curve

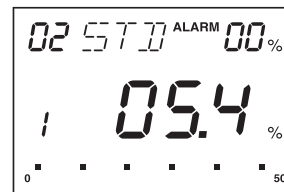
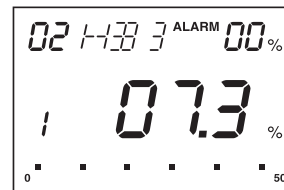
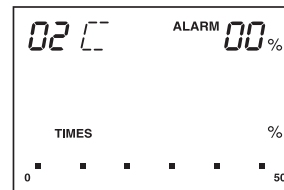
Press the **MN 1**, **GH 4** and **AVERAGE ENTER** key.

- **At this time, if there is an interval greater than 3 seconds between the pressing of each key, the curve number cannot be set.**

The HB-300 results for "Sample 1" is displayed.

Press the **AVERAGE ENTER** key, and the standard method results for "Sample 1" will be displayed.

Each time the **AVERAGE ENTER** key, and the results for "Samples 2 through 5" will be displayed.

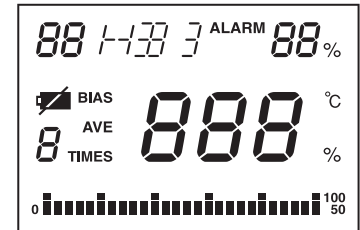


11-2. Erasing a Calibration Curve

The setting of a standard calibration returns to #00. Press the

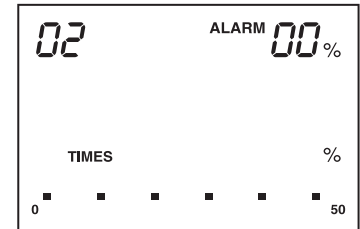
MN 1, **CLEAR UV -** and **AVERAGE ENTER** key.

The buzzer will sound, and all the LCD elements will be displayed for approximately 3 seconds. After that "Calibration #", "TIMES" and "%" will be displayed.



11-3. Printer output of stored data

Up to 250 stored data are printer output. After setting up the printer (VZ-330, option), connect the printer cable (VZC26, option). Press the **GH 4**, **MN 1** and **AVERAGE ENTER** key.



<Printout example>

(In the case of data, three)

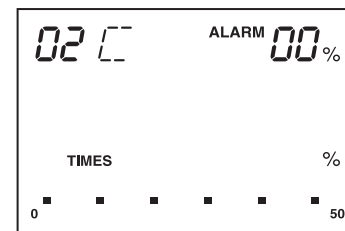
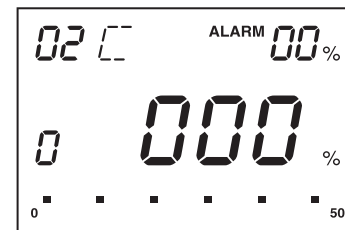
```
001 2005/05/27 10:34 #01 15.3%
002 2005/05/27 10:35 #01 15.4%
003 2005/05/27 10:34 #01 17.8%
```

The print changes line line when pushed while the block key is measuring it. (During the measurement of #002 and #003)

11-4. Batch erasure of stored data

Press the **GH 4**, **CLEAR UV -** and **AVERAGE ENTER** key.

A tone sounds and “0” will be displayed for the measurement number. Next, the display for moisture changes from 0 H 00 H 000. The original display will return after approximately 15 seconds.



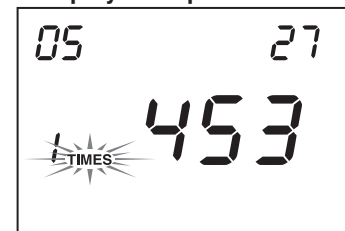
11-5. Date and Time Display

Press the **KL 6**, **MN 1** and **AVERAGE ENTER** key.


The date and time (24-hour system) are displayed. “TIMES” will blink.

An display example is shown as 27 May, 14:53.

<Display example>





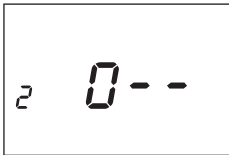





- If the clock is slow or the display is abnormal, the clock battery has been depleted. Servicing is required to use the clock function.



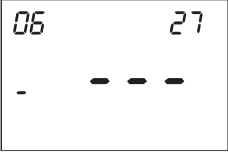
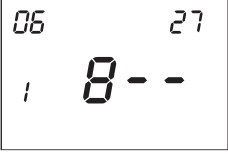

❖  shows that either numbers or marks enclosed are blinking.

(1) The following procedure sets the western calendar date and time.

<Example> 27 June 2005, 18:43

If you make a mistake when pressing an input number key, press the  key.

Step	Description	Display
1	Press the  key.	
2	Press the  and  key.	
3	Press the  key.	

Step	Description	Display
4	Press the ALARM ST 0 , KL 6 and AVERAGE ENTER key.	
5	Press the CAL OP 2 and AB 7 key.	
6	Press the AVERAGE ENTER key.	
7	Press the MN 1 , CONT CD 8 and AVERAGE ENTER key.	
8	Press the GH 4 , NAME QR 3 and AVERAGE ENTER key. "TIMES" will blink. The date and time are displayed. Press the ON/OFF key to turn off the power.	

11. ERROR DISPLAY

If an error has occurred in the instrument or in the measurement conditions, either of the following messages will appear for 4 seconds before turning the power off automatically.

(1) The temperature sensor has an error. Call for repair.



001

(2) The electric circuit for measuring the water content has an error. Call for repair.

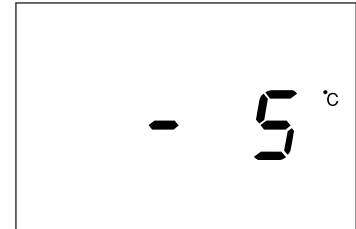


002



011

- (3) The instrument temperature is -5°C (23°F) or lower. Warm the instrument up to the usable ambient temperature range $0\sim 40^{\circ}\text{C}$ ($32\sim 104^{\circ}\text{F}$).



- (4) The instrument temperature is 50°C (122°F) or higher. Cool down the instrument to the usable ambient temperature range $0\sim 40^{\circ}\text{C}$ ($32\sim 104^{\circ}\text{F}$).



◆ Calibration #

◆ Sample Name

	HB-300 Measurement (Calibration #00)	Actual moisture by the Standard method
Sample 1		
Sample 2		
Sample 3		
Sample 4		
Sample 5		



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