Instant Moisture Meter for Grains, Seeds, Coffee and other small products

PM-650

Kett

Operating Manual

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

CONTENTS

1. Features

This instrument can measure the moisture content of many kinds of grain, seeds, and other products. Using a fixed sample volume allows the weight, temperature, and capacitance (dielectric) of the sample to be measured. After processing this information with the use of the embedded microprocessor, the “Moisture Value” is displayed. Refer to the “Product List” for measurable grain versions. Because the calibration curves of products on the “Product List” have been already stored, the measurement of a sample on the list can be instantly performed by simply pressing the product number.

[Note]

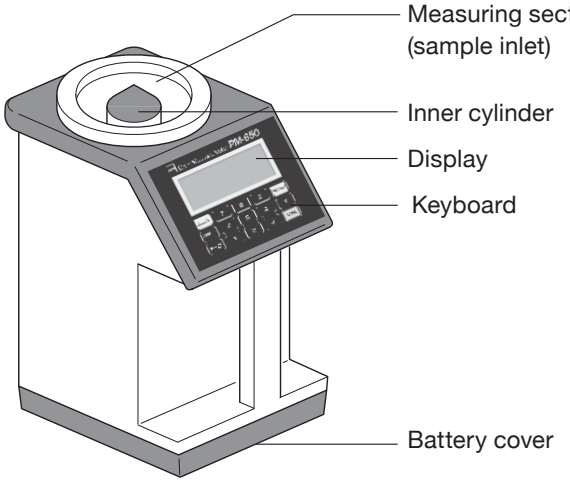
The entered product versions may be different even among the same PM-650 models. The display may be different between examples in the Operating Manual and the real ones on the actual tester, but the usage is the same.

2. Specifications

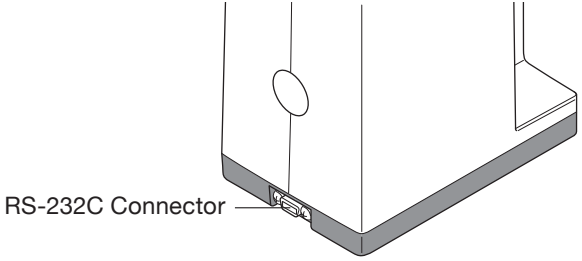
Measuring principle	:	Capacitance(Dielectric) (50MHz)	
Applications	:	Grain, seeds, small objects	
Measurement range	:	1 - 40% (sample dependent)	
Sample volume	:	240 mL	
Operating temperature range	:	0 - 40 °C	
Precision	:	<Moisture>	Standard error of 0.5% or less versus drying method (all samples with moisture content of less than 20%)
Correction function	:	<Mass>	By integrated weighing scale
		<Temperature>	By thermistor
Other functions	:	Average, auto power off, volume weight unit of g/L (sample weight/sample volume)	
Display	:	Digital (LCD)	
Power supply	:	Batteries (1.5 V Alkaline "AA" size, x4)	
Power consumption	:	240 mW	
Dimensions and weight	:	125 (W) x 205 (D) x 215 (H) mm, 1.3 kg	
Accessories	:	Funnel, Manual hopper, Brush, Batteries (1.5 V Alkaline "AA" size, x4), Product list, Operating manual	
Options	:	Printer (VZ-390), 200g standard weight	

3. Part Names

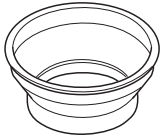
<Front>



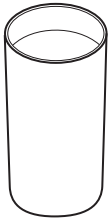
<Rear panel>



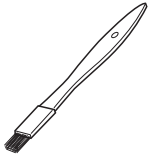
<Accessories>



Funnel

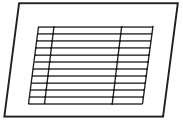


Manual hopper
(Sample cup)



Brush

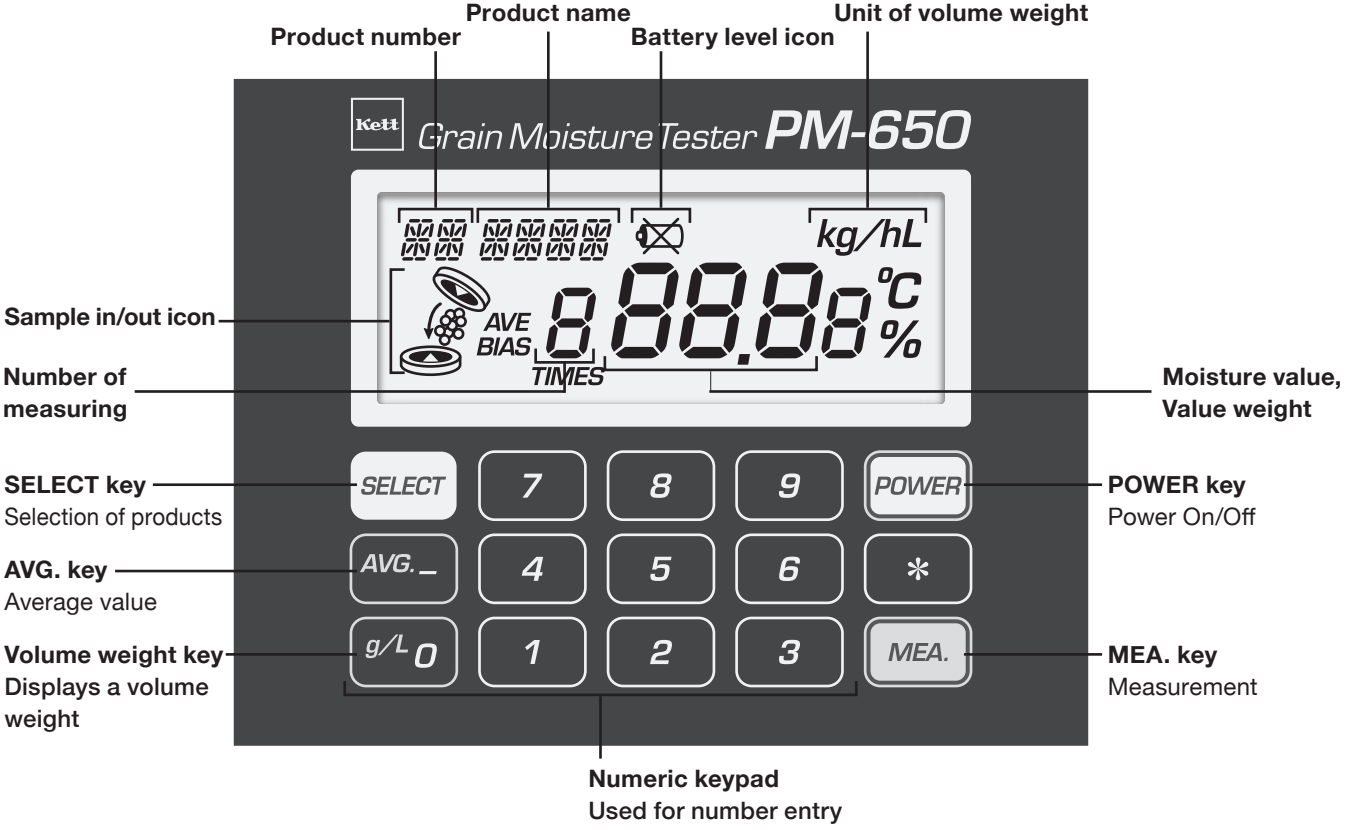
Batteries
(1.5V “R6” or “AA” size, x4)



Product list

Operating manual

4. Display / Keyboard

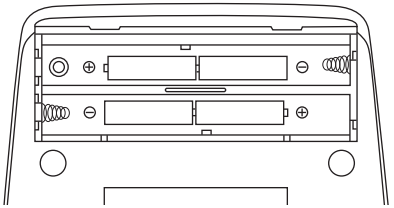


5. Preparation and Configuration

- **This instrument is equipped with an integrated weighing scale. For optimal results, this instrument should be placed on a horizontal surface and used in locations where the wind is not strong and the instrument isn't subject to vibration.**
- **Do not hit the instrument during operation and do not leave the instrument upside down.**
- **Although this instrument performs automatic temperature correction, for optimal measurement, leave this instrument at ambient temperature for 2 hours or more before use.**
- **The temperature sensor embedded in the main unit measures the ambient temperature around the measuring unit and automatically performs temperature correction. If the temperature difference between the main unit and a sample is ±10 °C or more, a measurement error may be generated and, therefore, the displayed measured value blinks (warning indication) (see "8. Error Display" on page** 23 and 24**).**

5-1. Battery Installation

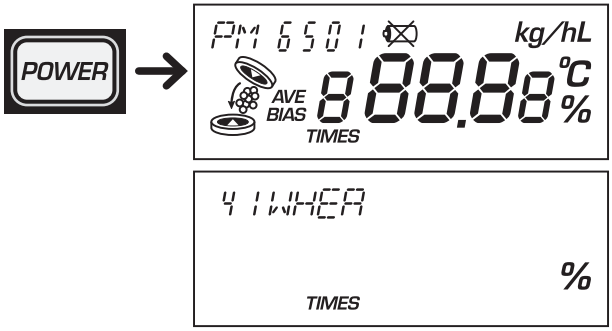
The unit is powered by four 1.5 V batteries (AA, alkaline). Remove the bottom battery cover, place the batteries into the compartment, ensuring to correctly orient the positive (+) and negative (–) terminals. Then replace the battery cover.



5-2. Product number viewing

(1) Press the POWER key.
(A buzzer sounds for 2 seconds, and all contents are displayed)

(2) The number of the product that was measured during the last test is displayed. In the case of the drawing (right) the product number is "41 WHEA".



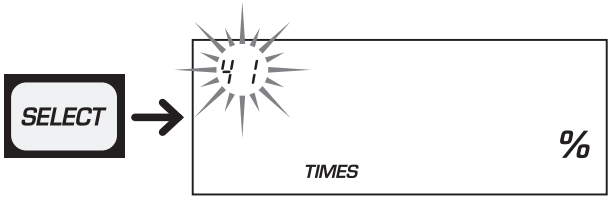
5-3. Product number selection

Select a product number to be measured from the "Product List".

[Note] The method of how to enter product numbers are different between "1 to 99" and "100 to 200 (A0 to K0)".

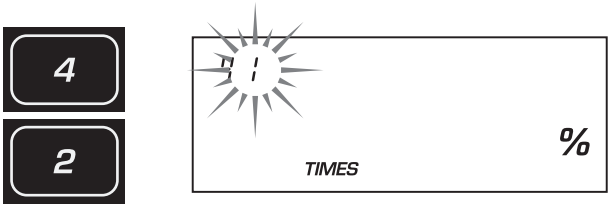
- Selection of product number "1 to 99" → procedure below
- Selection of product number "100 to 200 (A0 to K0)" →proceed to page 10

(1) Press the SELECT key, and the product number that was measured last time blinks (in this case, 41).



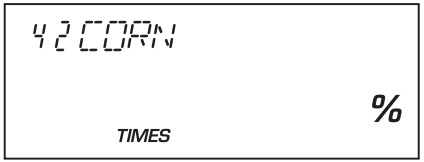
(2) For example, to now measure "42 CORN".

(3) Enter "42".
First, press the 4 key for the ten's place.
After "1" on the unit's place blinks, press the 2 key.



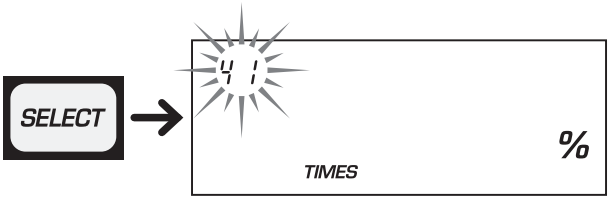
(4) Now, “42 CORN” is selected.

[Note] The product number is memorized while the instrument is off, and therefore, the last selected number is displayed when the instrument is turned on the next time.



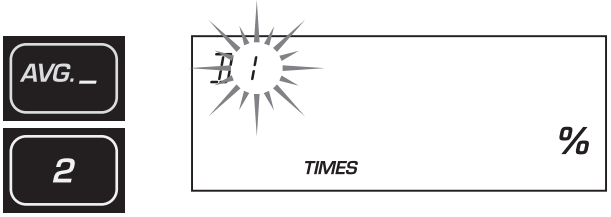
- **Select a product number "100 to 200 (A0 to K0) to be measured from the "Product List".**

(1) Press the SELECT key, and the product number that was measured last time blinks (in this case, 41).



(2) For example, to now measure "112 (B2) MUSK (muskmelon)".

(3) Entering "B2".
(B2 represents the product number of 112. Refer to the method below for how to enter a product number.)
Every time the AVG._ key is pressed, the display changes as "A → B → C → D → E → F". Press the AVG._ key twice to adjust the ten's place to "B". After "1" on the unit's place blinks, press the 2 key.

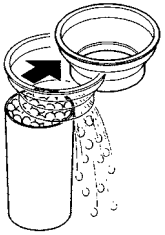


(4) Now, "112 (B2) MUSK (muskmelon)" is selected.
[Note] The product number is memorized while the instrument is off, and therefore, the last selected number is displayed when the instrument is turned on the next time.

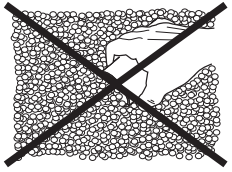
5-4. Sample extraction

(1) Mount the funnel on the manual hopper, and load a sample into the funnel to one-third of the funnel depth.

(2) Remove the funnel to eliminate surplus sample and to level off the sample.



[Note] Never extract a sample directly with the manual hopper.



5-5. Measurement

[Note] When a volume weight is measured, "Be sure to follow the procedure in section 7-1. page 19 to 21 (to check the accuracy of the weighing scale) before going further".

(1) Make sure that there is no residual sample in the measuring section, and press the MEA. key.

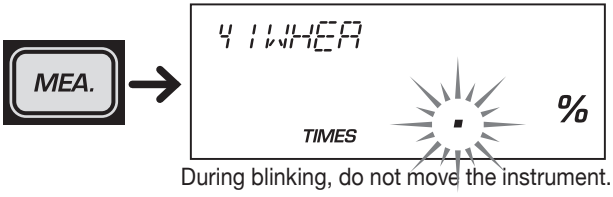
[Note] First, the decimal point blinks.
During the blinking, a zero adjustment (tare) of the weighing scale is performed. Therefore, never move the instrument. If the instrument vibrates even slightly, a zero adjustment cannot be performed, and the decimal point blinking may not stop.

(2) After the sample in icon starts to blink, load the sample from the manual hopper into the center of the measuring unit as shown in the drawing on the right.
Load the sample at a constant speed for the entire sample to be loaded within 5 to 6 seconds.

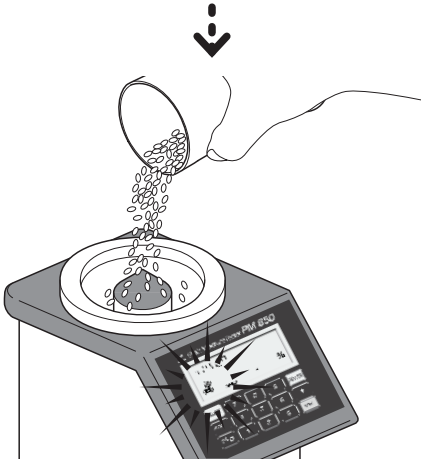
[Note] Especially for volume weight measurement, be sure to load the whole volume of the sample in the manual hopper into the measuring unit.

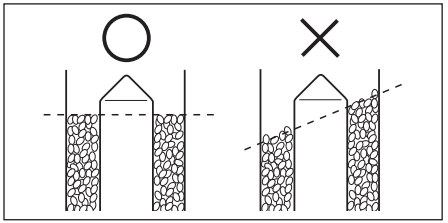
The sample should be level within the measuring section.

[Note] If the sample is not level in the measuring section, the moisture content may not be correctly measured.



During blinking, do not move the instrument.





(3) After the decimal point blinks for approx. 5 seconds, the measuring count and moisture content are displayed.

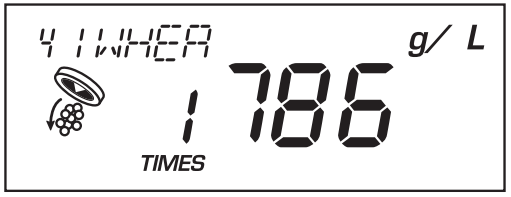
Display example : 41 WHEA 1TIMES 13.5%
(Product number : 41 WHEAT,
1st measurement, moisture content 13.5%)

The measuring count is displayed from 1 to 9.
The 10th measuring count is displayed as 1.

When the g/L O key is pressed after the moisture content is displayed, the volume weight is displayed with its unit. Once the g/L O key is pressed, the unit cannot return to the moisture content display.

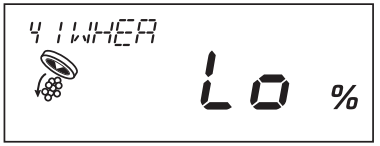
Display example : 41 WHEA 1TIMES 786g/L
(Product number : 41 WHEAT,
1st measurement, volume weight 786 g/L)

<Display example>

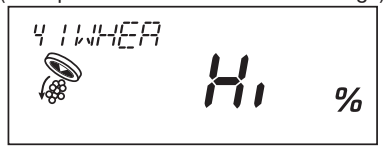


[Note 1] **For samples with high moisture content, the moisture content difference among individual grains is large. While the moisture content can be displayed, measurement precision is not as good as lower moisture content samples. The displayable range of the volume weight is slightly wider than the measurable range, and therefore, a displayed value may be beyond or below the measurable range on the specifications.**

(example of below measurement range)



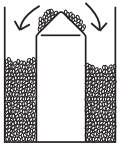
(example of above measurement range)

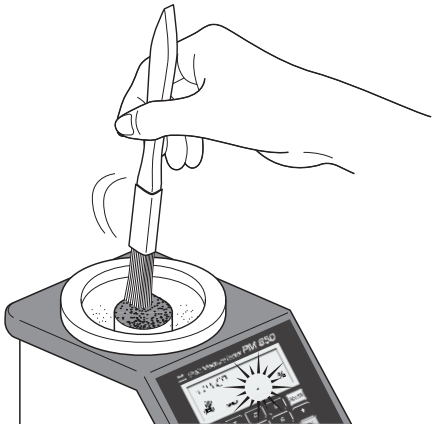


[Note 2] **When the moisture content is below the measurement range, "Lo" is displayed, and when the moisture content is above the range, "Hi" is displayed.**

[Note 3] **The**  **key is operable even when the moisture content is above beyond or below the measurable range, but the measurement is not counted.**

[Note 4] **Measurements of tapioca flour, wheat flour, corncob meal, feed barley meal, dried bean curd, buckwheat flour, tea, etc.**
(items to be measured vary with tester versions)
When the sample is loaded into the measuring unit, some sample may remain on the electrode at the center of the measuring unit. In such cases, use the attached brush to put the sample into the measuring unit within 5 seconds of the decimal point blinking. If a measurement is performed while the sample remains on the electrode, an error may occur.

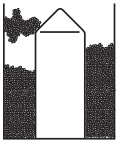


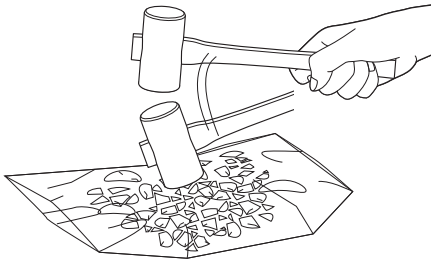


[Note 5] Measurement of pine pulp, cashew nuts, etc.

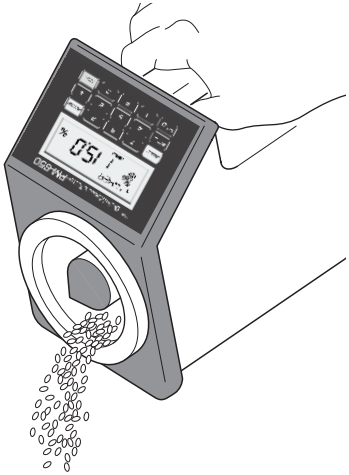
(Items to be measured vary with Instrument versions)

For samples that are likely to be caught by the electrode such as pine pulp, break the samples into fine pieces before measurement or eliminate pieces that are likely to be caught before measuring.





(4) After the sample out icon is displayed, discharge the sample to prepare for the next measurement.



[Note] The moisture content is displayed even after discharging the sample, but pressing the MEA. key clears the moisture content, blinks the decimal point, and starts the zero adjustment.

When samples with the same product number are continuously measured, repeat operations from "**5-4. Sample extraction**" on page 11.

When samples with different product numbers are measured, repeat operations from "**5-3. Product number selection**" on page 9.

6. Other functions

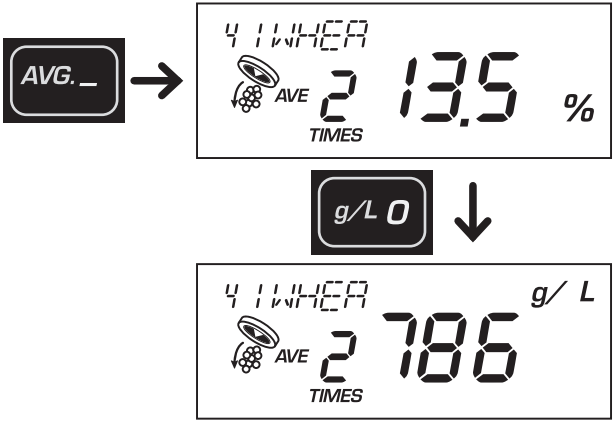
6-1. Displaying the average moisture value

When the measurement count is 2 to 9, the average value can be calculated (simple arithmetic mean).

Pressing the AVG. key displays the average value of measurements from 1st to the current (up to 9).

In the example at the right, “the average of 2 measurements is 13.5%”.

Pressing the g/L O key immediately after pressing the AVG. key displays the average of volume weights.In the example at right, "the average of 2 measurements is 786 g/L".



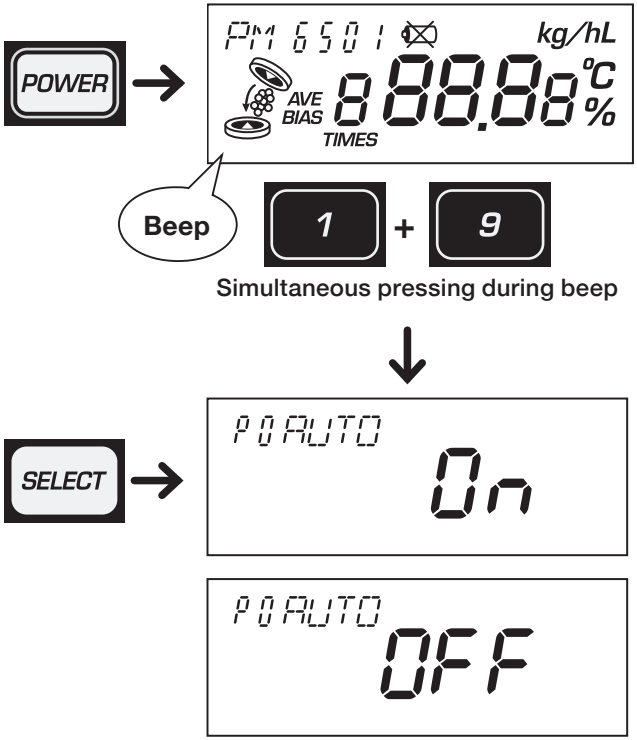
[Note] When the AVG. key is pressed once, the next measurement count starts from 1st.

6-2. Auto power off

If no measurement or operation is performed for 3 minutes with the power on, the power is automatically turned off to avoid battery drain.
Set the auto power off function to "OFF" when the data logger software (option) is using.

(1) Press the POWER key, and press both of 1 and 9 keys simultaneously while a buzzer sounds.

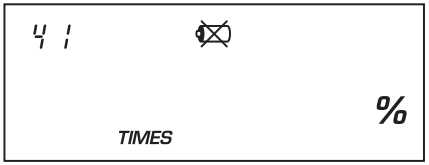
(2) Each time you press the SELECT key, auto power off function can switch "ON" or "OFF".



6-3. Battery level icon

When the battery is low, the battery level icon ( ) appears on the display.
When the icon appears, replace the battery with new ones reference "**5-1. Battery installation**" on page 8.

[Note] The moisture content may not be properly measured when the battery level icon displayed.



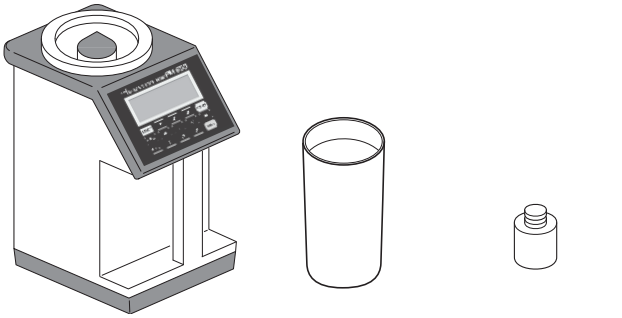
7. Options

A 200g standard weight (for checking the accuracy of weighing scale) and a printer (VZ-390) are optionally available. Follow the procedure below for usage.

7-1. 200g standard weight (for checking the accuracy of weighing scale)

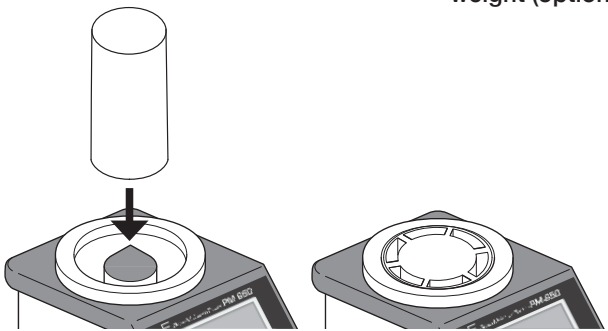
<Items to be prepared>

- Main unit (should be left at ambient temperature for 2 hours or more for thermal stabilization)
- Sample cup
- 200 g standard weight (option)
  (Class 3 or higher, diameter of bottom: 30 mm or less)

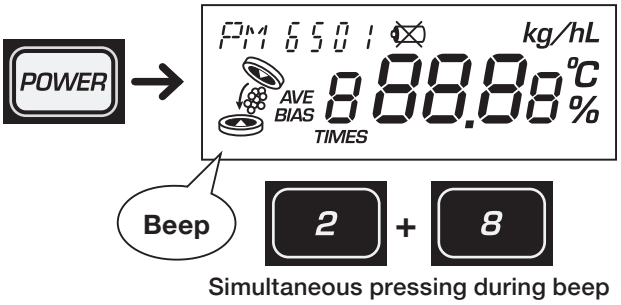


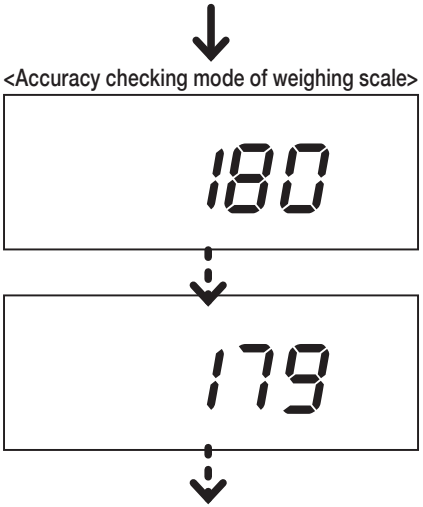
Main unit | Manual hopper | 200g standard weight (option)

(1) Before turning on the power, turn the sample cup upside down and put it into the measuring unit so that the cup covers the inner cylinder (refer to the drawing on the right.)



(2) Press the POWER key, and press the 2 and 8 keys simultaneously while a buzzer sounds.





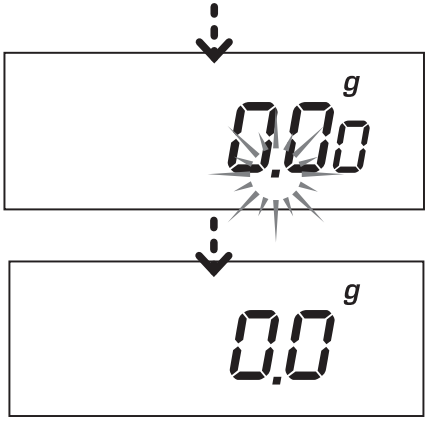
"180" is displayed, and the displayed number starts counting down ("179", "178", and so on in steps of 1 second).
The accuracy checking mode of the weighing scale is now activated.
During the count down, warm up is performed for 180 seconds.

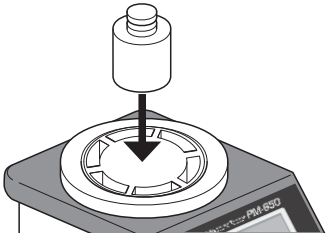
[Note] If a product number, product name, or other items instead of "180" is displayed, the accuracy checking mode of the weighing scale is not activated.

In such a case, press the POWER key to turn off the power once, and try the operations again from the step(2)above.

(3) After counting down, "0.00g" will be displayed for a few seconds, and then the decimal point starts blinking.

When the internal weighing scale displays "0.0g" as the zero point, put the 200g standard weight gently on the sample cup covered on the inner cylinder.





(4) The weight of the 200g standard weight is displayed.
The display example in the drawing on the right is 200.0g.
When the displayed value falls within the range from 199.0 through 201.0g, the result is normal. If the value is above or below the range, adjustment is required.

Normal from 199.0 to 201.0

(5) Press the POWER key to terminate.
This chapter, "7-1. 200g standard weight (for checking the accuracy of weighing scale)", is described for measuring volume weight, but is also useful for inspection operations using moisture content measurement. This procedure can be used as standard operating protocol before operation.

7-2. Printer (VZ-390)

Connecting the printer, VZ-390 (option), to the connector on the rear panel of the main unit with the cable supplied with the printer allows users to automatically print the measured results after measurement.

[Note] Refer to the operating manual for the printer for how to set up the printer.

RS-232C interface specifications	
Transmission format	Start-stop (asynchronous) transmission, transmission only
Signal format	Baud rate : 9600 bps Data bit length : 8 bits Parity : None Stop bits : 1 bit Code : ASCII

<Printing example>

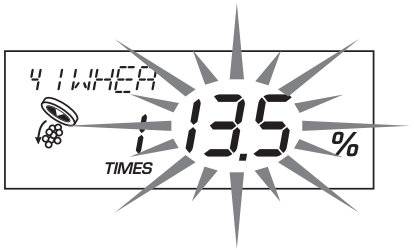
```
VERSION :  PM6501
   DATA VER. NO.  :  00006
PRODUCT  No.41
    WHEAT

TIMES      [%]        [g/L]

   1       13.6        765

   2       13.7        763

AVE.       13.7        764
```

8. Error Display

The following error are displayed when this instrument or usage conditions are not normal. In such cases, please contact us because repair may be necessary. This is also true should other error messages be displayed.

Error Display	Description	Remedy
001	Problem with the temperature measurement circuit.	Contact to our distributor.
002	Problem with the capacitance measurement circuit.	
003	Problem with the weight measurement circuit.	
011	The measurement of empty capacitance is too high.	
013	Main unit temperature is too high: over 60 °C.	Use the tester in the operating temperature of 0 to 40 °C.
014	Main unit temperature is too low: under -10 °C.	
015	Main unit board temperature is too high: over 60 °C.	
016	Main unit board temperature is too low: under -10 °C.	
017	Tare weighing is unstable for more than 20 seconds.	Use the tester in conditions that wind is not strong and no vibration is sensed.
018	Tare weight is too high.	Contact to our distributor.
019	Tare weight is too low.	
021	Sample weighing is unstable for more than 20 seconds.	Use the tester in conditions that wind is not strong and no vibration is sensed.
022	Sample pouring speed is too fast.	Load the sample in 5 to 6 seconds.
024	Sample temperature is too high: over 60 °C.	Try measurement after the samples are thermally homogenized in the measurement environment.
025	Sample temperature is too low: under -10 °C.	
028	The sample weight is lighter than the threshold.	Check the measurement condition.

Warning indication (measured value blinking)



- The main unit temperature is above (or below) the operating temperature range.
- The main unit board temperature is above (or below) the operating temperature range.
- The sample temperature is above (or below) the operating temperature range.
- The temperature difference between the sample and main unit board is 10°C or more.

9. Instructions for proper use

(1) This tester is a precision instrument equipped with an integrated weighing scale. To avoid instrument failure, do not hit the instrument or drop it.

(2) Do not directly touch the metal part of the measuring unit with your hand. Failure to observe this may generate static electricity which may lead to breakdown.

(3) The protrusion inside the measuring unit is the temperature sensor and, therefore, be careful not to break it.

(4) When the inner portion of the measuring unit becomes dirty, use a soft damp cloth to wipe inside.
Never wash this tester in water.

(5) When this tester is not used for a long period of time, remove the batteries.

(6) If a displayed measured value is not normal or is questionable, stop using this tester immediately and contact us.

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