Kett

Infrared Moisture Analyzer
FD-660

Operating Manual

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

CONTENTS

1. Safety Precautions

Improper use of the infrared moisture tester in violation of the following safety notes may result in death, injury or damage to property due to fire, smoke and other problems. Furthermore, the infrared moisture tester has high temperature components which can cause burns if proper safety guidelines are not followed.

■ **Please observe the safety precautions.**
Please read the precautions noted in the operating manual.

■ **Do not use if broken.**
If you suspect a problem or malfunction in the unit, discontinue use and immediately have the unit inspected by certified Kett service personnel.

■ **Warning symbol explanation.**
In order to prevent damage resulting from erroneously operating the equipment, the following symbols are indicated in the operating manual and on the product.
Please review the descriptions.

⚠ **Warning**	Failure to observe these items may lead to death or injury to the user.
⚠ **Caution**	Failure to observe these items may lead to injury to the user or damage to property.
⚠ **Note**	Items which the user should be aware of in order to safely use the unit.

⚠ Warning

- Do not measure materials that may cause a dangerous chemical change by the application of heat.
- Failure to observe this may result in an explosion or generation of poisonous gas.
- Do not place flammable materials near the infrared moisture tester.
- Some parts of the infrared moisture tester become extremely hot during operation and could lead to fire if flammable materials are placed nearby.
- This product should be used only with the applicable power supply voltage.
- Using this product with incorrect voltage may cause the product to be overheated, which may result in trouble or fire.
- Do not attempt to disassemble, modify or rebuild the infrared moisture tester.
- Doing so may result in an accident, electric shock, or other problems. If you believe the unit may be malfunctioning take it to an authorized Kett service center for service.
- Do not allow the unit to come in contact with water.
- The infrared moisture tester is not waterproof. Do not allow water or other liquids to get into the unit's enclosure as this may lead to electric shock or malfunction.

⚠ Caution

- Do not touch the heat-dispersing component of the heater cover or the sample dish with your bare hands. Doing so may result in burns. The infrared moisture tester is at a high temperature during and immediately after making measurements. When touching the unit, only use the specified control knobs and accessories.

Be sure to follow proper procedures during operation.

- When opening or closing the lid to the heater, always be sure to use the handle.
- Place the wind shield, sample dish tray, and sample dish appropriately (see "5. Assembly and Installation" on page 12).
- When removing a sample dish, do not allow your hands to come into contact with the heater or any of the metal parts around the heater, as doing so could result in burns.
- The sample dish and area around the sample dish will be very hot immediately after performing a measurement. Be sure to place the sample dish in an appropriate place to allow it to cool.

Never perform measurements using hazardous materials

- Heating materials which would present a risk of explosion or combustion, or materials which could give off noxious fumes when heated, is extremely dangerous and this instrument should never be used with any such materials. The same also applies to the use of any materials which might cause hazardous chemical reactions to take place when heated.
- When heating materials that would first dry along the surface, and then allow the internal pressure to rise excessively, there is a danger that heating such materials could cause them to rupture. Such materials should never be measured, as doing so could be dangerous.
- If any materials being measured ignites, immediately remove the power plug from its socket and take appropriate measures to extinguish the fire.
- Never place any easily flammable objects near the product.
- The components of the infrared moisture tester can become very hot when measurements are being taken or immediately after measurements have been taken. This heat could cause objects or materials to catch fire if they were to come into contact with the unit. No easily flammable objects or materials should be kept near the product.
- Never place any objects which might easily be damaged by heat near the unit, as doing so might result in deformation or damage to the objects in question.
- No objects should ever be placed upon the heater.
- If you see fire coming from the unit or notice smoke, an odd smell, or any other sign of abnormal functioning, remove the power plug from its socket, and take whatever other steps would be appropriate to deal with the problem.

Notes on using the control keys

- Never turn on the power to the unit while holding down any of the control keys.
- Never press any keys other than those directed or press two or more keys together at the same time unless directed to do so.
- When there is any danger that the unit might be damaged by lightning, remove the power plug from its socket.

Stopping operation

- The [**Start/Stop**] key can be pressed at any time during operation to halt operation. If you suspect for any reason that the product is not operating properly or that there is any sort of danger, immediately press the [**Start/Stop**] key to halt operation.

Setup and storage

- Avoid using or storing the unit in a location where it would be exposed to excessively high or low temperatures, high levels of humidity, direct sunlight, electromagnetic interference, corrosive gases, or large amounts of dust.
- Place the unit on a flat and stable surface where it will not be subjected to significant vibration during use.
- When moving the unit, never tilt it any more than necessary.
- Take care never to drop or bump the unit or otherwise allow it to be subjected to strong shocks or the application of excessive force.
- When removing the power cord or RS-232C interface cable, never pull on the cord or cable and instead, hold the plug or cable connector when removing.
- When the unit is not to be used over an extended period of time, remove the power plug from its socket.
- Use the supplied power cord and make sure to connect to the protective earth.

2. Measuring Principle and Features

■ Measuring principle

This unit determines the moisture and solid contents of samples by heating them using infrared illumination and measuring changes in mass due to evaporation. This is referred to as the loss on drying method and is the simplest method for determining moisture content and thus mandated by many public regulations related to measurement standards.

■ Features

● Auto Taring mechanism

The auto taring mechanism is incorporated in this instrument. This mechanism allows for measurement while performing a zero point calibration, and therefore, scale drift is eliminated even when a test is performed over a long period of time. This feature allows for reliable measurement.

● Organic carbon heater

An organic carbon heater is introduced for the heat source. This heater emits infrared rays more than 2 times stronger than a halogen heater in the wavelength range (2.5 to 3μm) in which moisture reacts with heat. This feature provides extremely efficient drying.

The service life is 7,000 hours* which is approximately 4 times the life of a comparable conventional infrared lamp. In addition, it is better for the environment as polluting halides and metals are not used.

**** Indicates actual measured time for the operation of infrared heater. This is not a guarantee of service life.***

● 2 types of measuring modes

This product provides 2 types of measuring modes, and therefore, can perform measurement under appropriate drying settings in accordance with the drying characteristics of the sample to be measured. (Automatic mode, Timed mode)

● Pre Heat mode

This product is equipped with a Pre Heat mode to eliminate a measurement error occurring immediately after turning on the power or when the temperature inside the measuring instrument is not stable.

● The ability to store measuring settings

Five (5) measuring settings storage numbers are provided. Storing various sample measuring settings on numbers allows users to perform measuring preparation smoothly.

● Data memory function

This unit is able to store up to 50 sets of measurement data in memory, thus making it possible to output large batches of data all at one time.

● PC connectivity

The connection of a PC and the use of the data logger, “FDL-02” (option) allows the drying state during measurement, final measurements, graphs, and the like to be displayed on the PC.

● Printer port

The connection of the printer (option) allows the drying state during measurement, final measurements, and the like to be printed out.

● Stainless-steel sample dish with 10 mm in diameter

● Scale calibration

■ Measurable objects

● Materials from which only water evaporates by heating

● Materials for which no dangerous chemical reactions or other changes occur as a result of heating

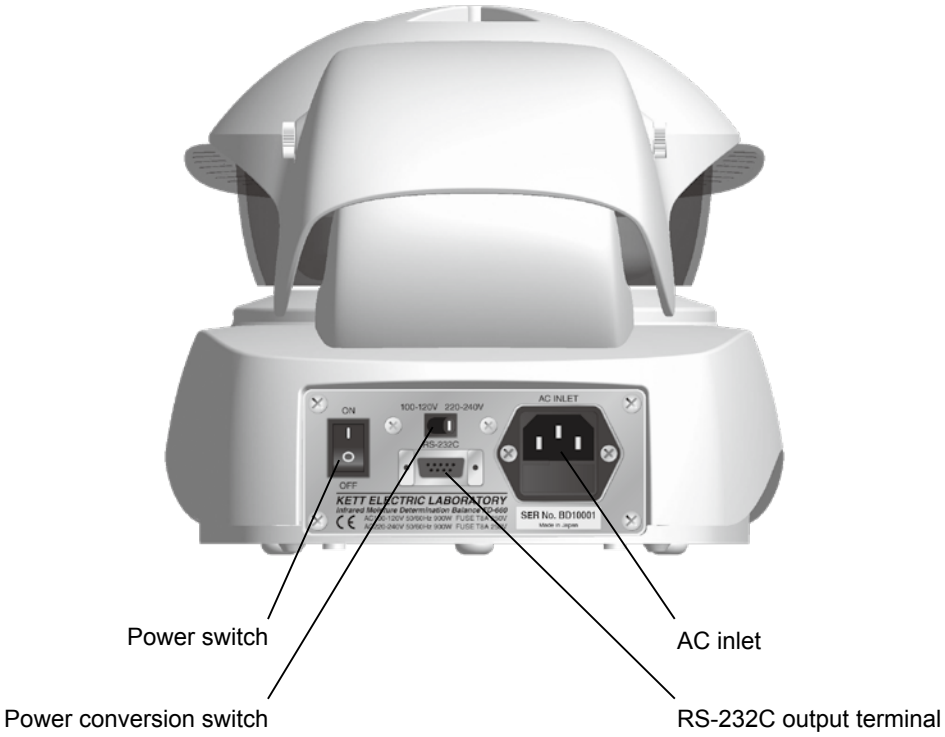
**** Measurements can be performed using virtually any material meeting these conditions.***

3. Specifications

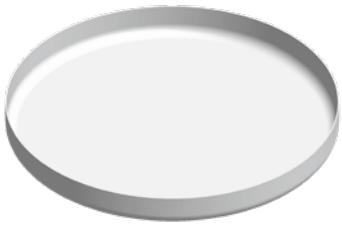
Measurement method	:	Detection of weight loss by heating & drying
Sample weight	:	1 - 80g optional weight sampling format
Minimum displayable units	:	Moisture content (solids): 0.1% or 0.01% (selectable), Weight: 0.005g (* The indication of 0.01% is not a guarantee of accuracy.)
Measurable quantities	:	Moisture content (wet base & dry base), weight, solid content
Measurement range	:	0 - 100% (wet base, solids) 0 - 500% (dry base)
Repeatability (Standard deviation)	:	Samples with a weight of 5 g or higher: 0.1% (When using standard samples and measuring settings as determined by Kett Electric Laboratory)
Measurement Mode	:	Automatic mode Timed mode (1 - 120 min.)
Temperature setting range	:	30 to 180ºC (in steps of 1ºC, temperature on dish)
Display	:	Backlit LCD display (96 x 40mm)
External output	:	RS-232C interface
Communications	:	Data output from "the data logger software FDL-02" (option)
Storage of measurement settings	:	5 types
Temperature/humidity operating range	:	5 - 40ºC, 85% RH or less (no condensation)
Heat source	:	Organic carbon heater (280 W x 2)
Temperature sensor	:	Thermistor
Power supply	:	AC 100V-120V (50/60Hz) : Power cord A (Flat blade attachment plug, Type A-1) AC 200V-240V (50/60Hz) : Power cord B (Round pin attachment plug, Type C-4)
Power consumption	:	Max. 900 W
Dimensions and weight	:	222 (W) x 360 (D) x 196 (H) mm, 3.2 kg
Sample dish	:	Stainless steel (110 mm in diameter, 11 mm in depth)
Accessories	:	2 sample dishes, sample dish handler, wind shield, sample dish tray, spoon, spare fuse (8A) ×2, package of aluminium foil sheets (10 per package), Power cord A or B (Power plug conversion adapter), operating manual
Options	:	Printer set (includes a VZ-380 printer, a printer interface cable (VZC69), a printer paper roll and an AC adapter), printer paper (10 rolls), package of aluminium foil sheets (500 sheets), RS-232C cable (VZC52), Data Logger software FDL-02, Sample crusher TQ-100, Deodorizing windshield case FW-100

4. Part Names

4-1 Names of Main Unit Parts



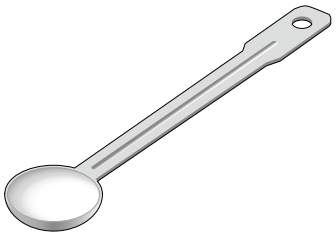
4-2 Accessories



Sample dish (2 pcs)
A-1

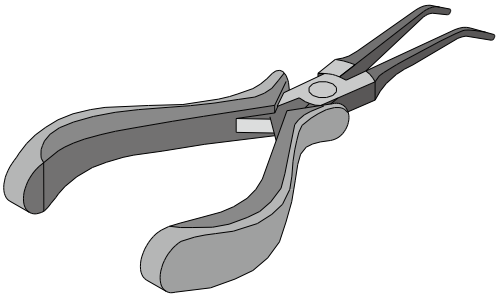
Wind shield
A-3

Sample dish stand
A-4

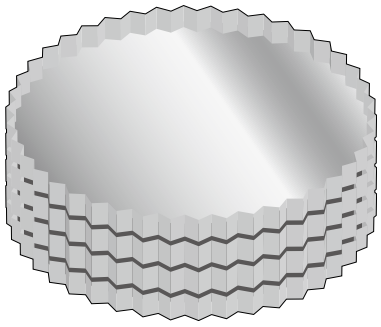


Spoon
A-5

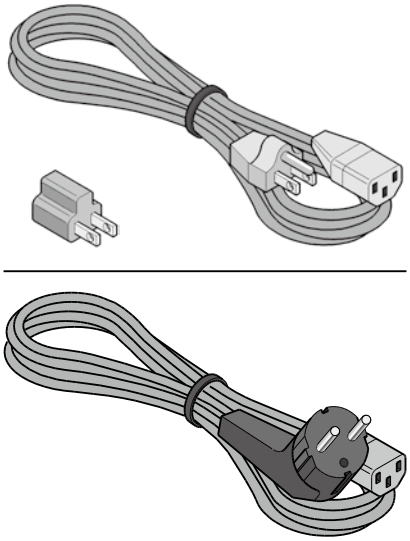
Spare fuse (8A)×2
A-7



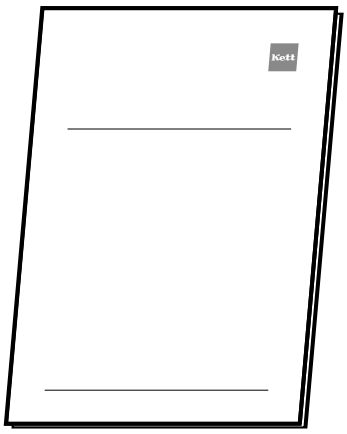
Sample dish handler
A-2



Aluminium sheets x10
A-6



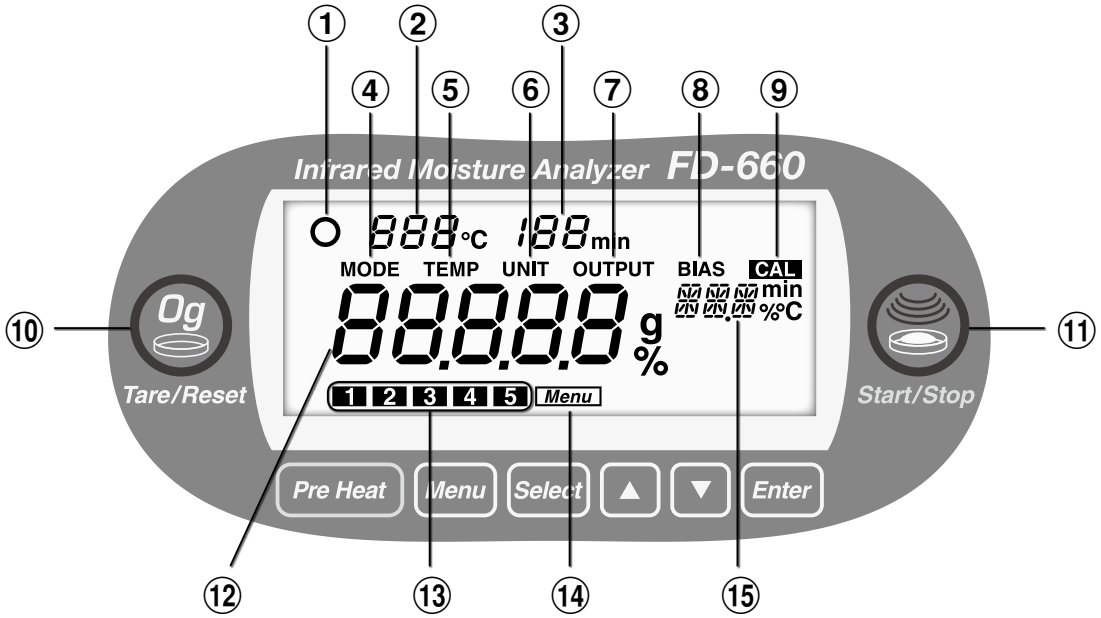
Power cord A with 3P-2P plug adapter A-8
or
Power cord B A-9



Operating Manual
A-10

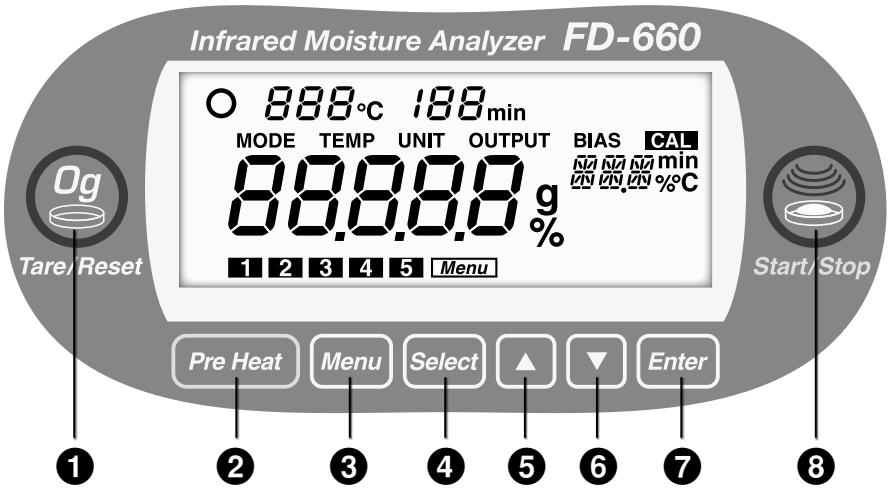
**** The aluminium sheets (A6) are 500 pieces per box when ordered additional.***

4-3 Display



Item No.	Name	Description
①	Stability indicator	Displayed when the internal scale becomes stable.
②	Temperature display	Used to display the temperature under the heater lid.
③	Measuring time display	Used to display the amount of elapsed time during measuring.
④	Mode setting display	Displayed when the measuring mode is selected.
⑤	Drying temperature setting display	Displayed when the drying temperature is specified.
⑥	Display for measurement standard and minimum display digit	Displayed when the measurement standard and minimum display digit are selected.
⑦	Measurement data output display	Displayed when a measurement data output format is selected.
⑧	Bias setting display	Displayed when the offset value of the moisture (or solid) is specified.
⑨	Calibration display	Displayed when the scale is calibrated.
⑩	Tare/Reset display	Lights up when taring (zero adjustment) can be performed. Blinks during taring (zero adjustment). Lights up when the screen can be returned to the weight display screen after measurement.
⑪	Start/Stop display	Lights up when the unit can start measuring. Blinks during measurement. Lights up when measurement can be forcibly terminated.
⑫	Moisture/Solid/Weight display	When measuring weight (i.e., when in idling mode), used to display the weight in grams. When performing measurements, used to display the moisture content and solids content as percentages. "oL" is displayed when the weight exceeds the measurable range at measuring a weight.
⑬	Measuring settings area number display	Used to display the number of the currently selected measuring settings area number.
⑭	Menu display	Displayed when a measuring setting number, a measuring mode, a measurement standard, an output format, or an offset value is specified.
⑮	Setting value display	Each item and its value are displayed when a measuring mode, a drying temperature, a measurement standard, measurement data output format, or an offset value is specified. The measuring mode is displayed during measurement. When an offset value is specified, the value is displayed after the measurement.

4-4 Control Panel Functions



Item No.	Name	Description
❶	Tare/Reset key	Used to perform zero adjustment (blinks during taring). Also used to perform a reset after an error has occurred. Also used to return to display of weight after completion of measurement.
❷	Pre Heat key	Used to warm up the whole system before measuring a sample. Also used to warm up the measuring instrument when it is cooled because of a long measuring interval (see page 18 for further information). [Temperature: 130ºC, time: 5 minutes] fixed Replace the sample dish after preheating.
❸	Menu key	Used at the start and end of specifying a measuring mode, a drying temperature, a measurement standard, measurement data output format, or an offset value.
❹	Select key	Used to select different settings or setting values.
❺	▲ (Up) key	Used to raise the setting value.
❻	▼ (Down) key	Used to lower the setting value.
❼	Enter key	Used to confirm currently selected settings.
❽	Start/Stop key	Used to start measuring or to abort a measuring operation. Used to forcibly terminate the measurement. Also used to turn off the alarm which sounds to indicate that a measuring operation has been completed.

5. Assembly and Installation

① Opening the package

Open the package and check to make sure all listed items are included. (see page 9)

② Installing the main unit

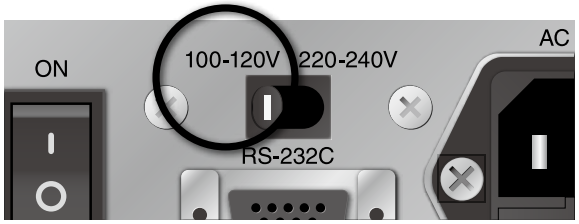
Place the unit on a flat and stable workbench that is insensitive to external vibration, wind, and the like.

③ Checking the power supply voltage

Check to see whether the power conversion switch on the rear panel of the main unit is set to the working voltage side.

**** It is set to the (100-120 volts) side in Japan and the US.***

If the switch is not set to the working voltage side, the error (Er701) is displayed when the power is turned on.



④ Attaching the wind shield

Open the heater lid.
Place the wind shield so that the ▽ mark on the shield points downward.
When the wind shield is appropriately placed, no backlash or rotation may be created.

**** Be careful not to apply excessive force on the center shaft when attaching the wind shield. Failure to observe this may damage the instrument.***

⑤ Placing the sample dish stand

Engage the sample dish stand (trivet) with the wind shield so that the △ mark on the stand is aligned with the ▽ mark on the shield. When the wind shield is appropriately placed, no backlash or rotation may be created.

**** Be careful not to apply excessive force on the center shaft when placing the sample dish stand. Failure to observe this may damage the instrument.***

⑥ Placing the sample dish

Gently place the sample dish on the sample dish stand.

* ***Put the sample dish on the proper place on the sample dish stand, and be careful not to put the dish on the edge of the stand.***

⑦ Close the heater lid

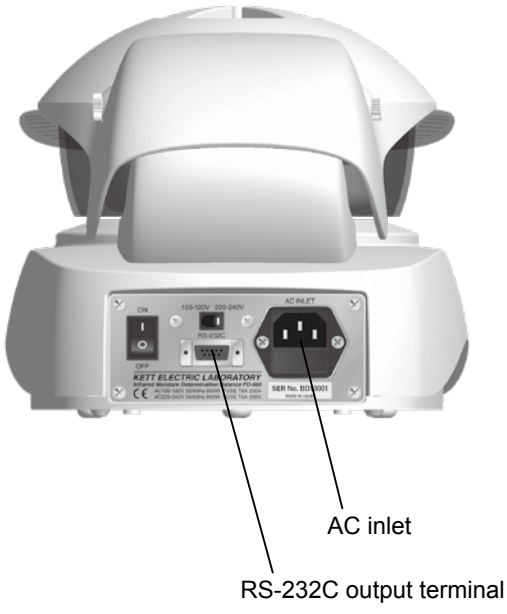
⑧ Connecting the power cord

Connect the power supply cord to the power supply input on the rear panel. After that, plug the power cord into a 100 VAC wall outlet.

⑨ Connecting the printer (option)

When a printer is used, use the printer-specific cable that is supplied with the printer. Connect the cable to the RS-232C output terminal.
Refer to "the VZ-380 Printer User's Manual" supplied with the printer for descriptions about the printer.

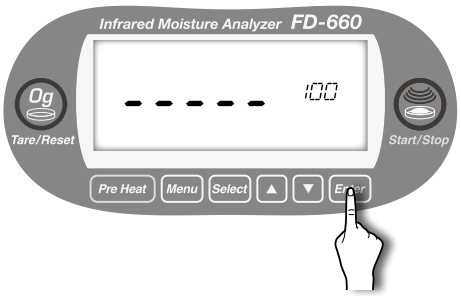
* ***Some parts must be oriented in a fixed direction for assembly. Note that placing parts in the wrong direction may result in errors in operation or in erroneous readings being obtained, and that you should take care that all parts are put into place in their proper positions.***



⑩ Turning on the power

Turn on the power switch located at the rear of the unit.
A beep sounds, and all contents are displayed. After that, the power supply voltage that has been automatically detected by the instrument is displayed with "CHE5", "CHE4", ... and "CHE0".
When the power is turned on for the first time after purchase or when the instrument is used with a power supply voltage other than the previous voltage, the power supply voltage is displayed with "-----".
After ensuring that the power supply voltage is correct by, press the [**Enter**] key.
The screen changes to the weight display screen with a beep.
If the power supply voltage that has been automatically detected by the instrument is wrong, or if the instrument cannot automatically detect the power supply voltage and “Er 701” is displayed (see page 42), follow the procedure below to perform manual setting.

When the power is turned on for the first time, ensure that the power supply voltage is correct and press the [**Enter**] key.



■ How to manually specify the power supply voltage

Turn on the power while holding the [**Menu**] key down.

A beep sounds, "All contents displayed" → "CHE5" → "-----" are displayed, and the power supply voltage is displayed.
When the power conversion switch is set to 100 - 120 V or 220 - 240 V, "100" or "220" is displayed respectively.

**** If "Er 701" is displayed, selection with the power conversion switch is wrong. Make a selection with the switch correctly (see ③ on page 12).***

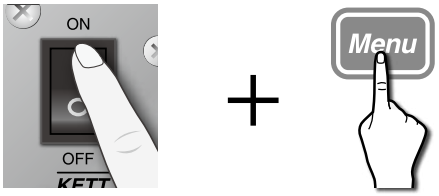
Make a selection of the power supply voltage in accordance with the power supply voltage to be used.
Press the [**Select**] key to select a power supply voltage.
Applicable voltage

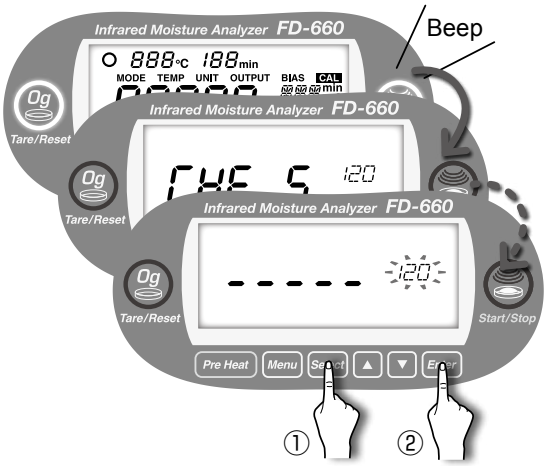
- 100 - 120 V: 100 V/110 V/120 V
- 200 - 240 V: 220 V/230 V/240 V

After selection, press the [**Enter**] key.

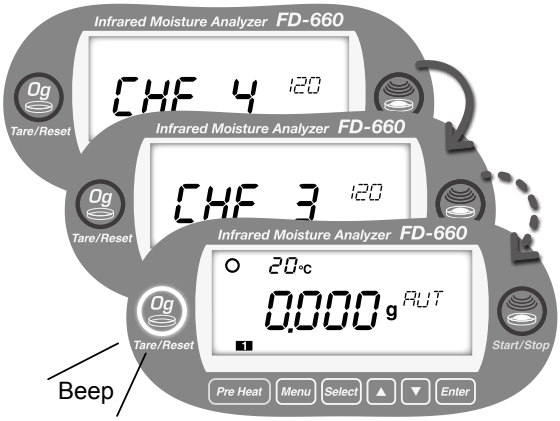
"CHE4", "CHE3", ..., and "CHE0" are displayed, and the screen changes to the weight display screen with a beep.
The measuring mode (see page 22) is displayed on the setting value display.

Turn on the power while holding the [**Menu**] key down.





After selection, press the [**Enter**] key.



6. Measurement Procedure

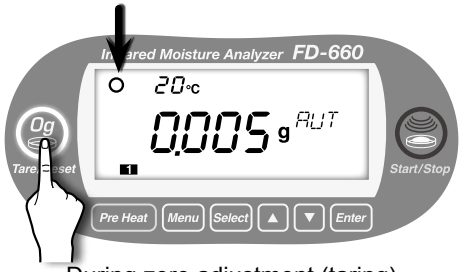
If a measurement is performed immediately after turning on the power, an error may be caused. It is recommended to leave the instrument for approx. 30 minutes after turning on the power or perform "Pre Heat" (see "■ Tips on how to ensure accurate measurements, ● First measurement" on page 18).
Before beginning a measurement, check to make sure that the sample dish is appropriately placed and there is no residue remaining in the sample dish. Proceed to the measurement procedure after ensuring that every part of the main unit is stable and that the heater lid is firmly closed in particular (see "5. Assembly and Installation" on page 12).

① Settings

When performing measurements for the first time, or when you wish to change current settings before measuring, then you should specify the measurement settings.
(see "7. Specifying Measuring Settings" on page 20)

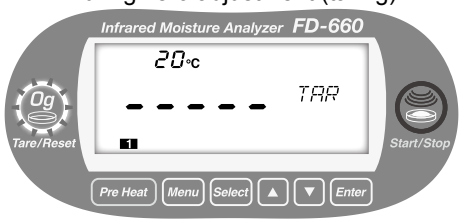
② Zero Point Adjustment

Check to make sure that the stability indicator (O) is being displayed, and then press the [**Tare/Reset**] key.



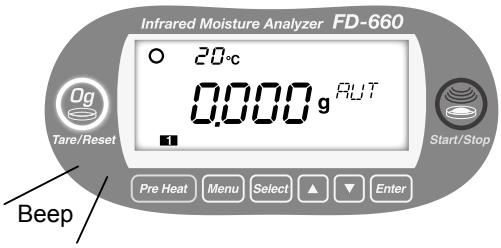
During zero adjustment (taring)

"-----" is displayed on the screen. The sample dish and wind shield move vertically and the zero adjustment is performed.



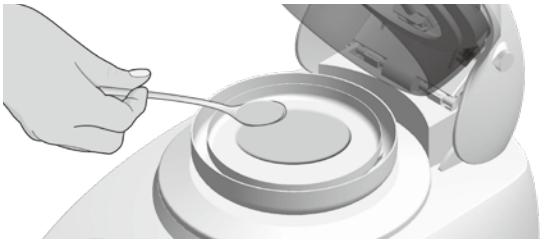
The procedure is completed after the [**Tare/Reset**] key lights with a beep and "0.000g" is displayed.

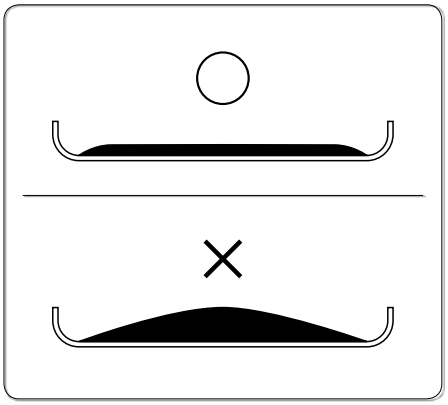
* ***Always confirm that the heater lid is closed when performing a tare. Also make sure that the tester is not exposed to drafts or wind, or subjected to any vibrations when a tare is being performed.***



③ Placing a sample on the sampling tray

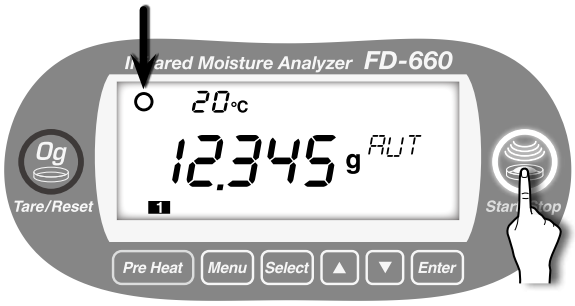
Open the lid to the heater and place the sample inside.
Be sure to place the sample as flat as possible into the tester so that heat is evenly applied to the sample during measurement.
(See "■ Tips on how to ensure accurate measurements" on page 18 for further information.)



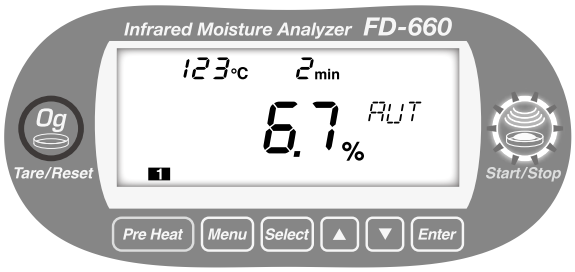


④ Starts measurement

Close the heater lid.
Check to make sure that the stability indicator (O) is being displayed, and then press the [**Start/Stop**] key.



* ***There may be times when the stability indicator (O) is not displayed because of external vibrations or drafts or wind. In such a case, measurement can be performed but the measurement result may not be accurate. You should always be sure to conduct measurements in a location as free as possible of vibrations, drafts, wind, or any other harmful influences.***
* ***Pressing the [Start/Stop] key while the heater lid is open will cause a safety alert buzzer to sound and measuring to be stopped.***



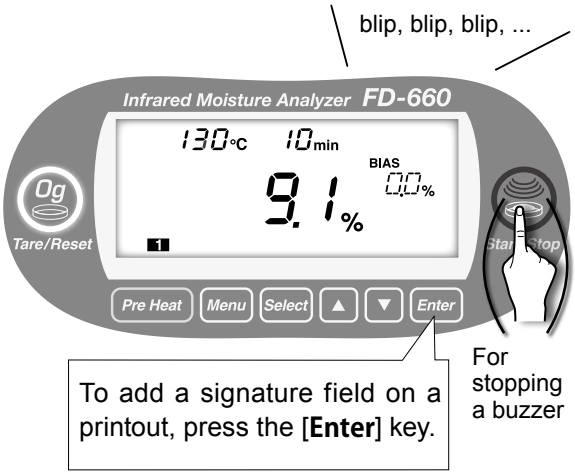
Heating & drying will begin.
The display switches from the weight (g) display to the moisture content (%) display and the measuring time is also displayed.
The measuring time shows the elapsed drying time (minute).
The zero adjustment is automatically performed once every minute (and once every 30 seconds when the measurement is about to finish) during moisture content measurement.

* ***Confirm that all the heaters light up by looking from the orange-colored window of the heater lid. The heater disconnection error message does not appear during a measurement, whereas it appears during preheating.***
* ***Replace the heater if it does not light up due to heater disconnection. (Refer to the page 41 "9-3. Heater Replacement")***
* ***Never open the heater lid during moisture content measurement. Doing so is not only hazardous but also could contribute to making it impossible to obtain accurate measurements. When the heater lid still needs to be opened to observe the sample during measurement or for other reasons, open it for less than 15 seconds (a warning buzzer sounds 10 seconds after opening the heater lid, the measurement stops in 15 seconds, and "ER306" is displayed).***
* ***To stop a measurement in progress, press the [Start/Stop] key.***

⑤ Completion of the test

After completion of the test, the measured results are displayed and the BIAS setting value (see page 34) is displayed on the setting value display. At the same time, the [**Tare/Reset**] key lights up and a buzzer sounds for 10 seconds.
To stop the buzzer, press the [**Start/Stop**] key.
The measured results continued to be displayed.

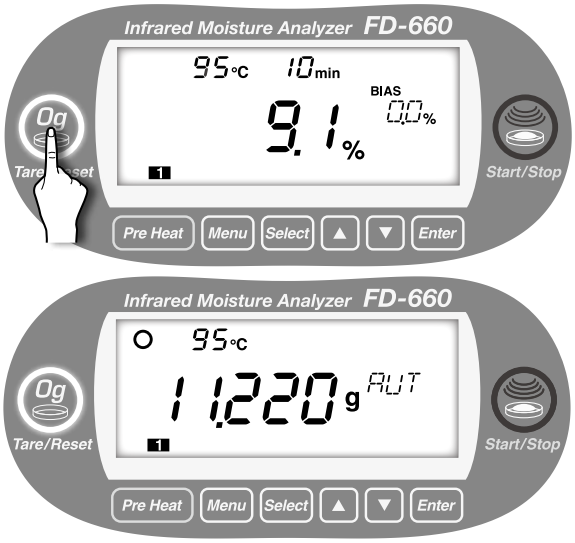
* ***If this product is connected to a printer (option), pressing the [Enter] key causes the signature field to be printed. (See "Sample Printer Output" on page 32 for further information.)***



⑥ Reset

Press the [**Tare/Reset**] key.
The display of the results of the measurement (i.e., moisture content) will disappear and be replaced by a display of the weight of the sample after drying.

**** Reset cannot be performed while a buzzer sounds.***



⑦ Disposing of samples after measurement

Open the heater lid, remove the sample dish with the sample dish handler, and dispose of measured sample.

**** Note that the sample and sample dish may be very hot and you should be careful in handling them at this time.***

⑧ Preparing for the Next Measurement

Leave the lid to the heater open to allow the tester to cool.
When performing sequential measurements, make sure that the entire unit has cooled before proceeding to the next measurement.
You should also keep a spare (cooled) sample dish available to use in the next measurement.
(See "■ Tips on how to ensure accurate measurements" on page 18 for further information.)

**** The guideline is for "the entire unit" is when 40°C or lower is displayed.***

When ready, return to step ② and begin the next measurement.

⑨ Turning off the power

When all the measurements have been completed, remove the power plug from the power outlet.
When not using the main unit, always remove the power plug from the power outlet.

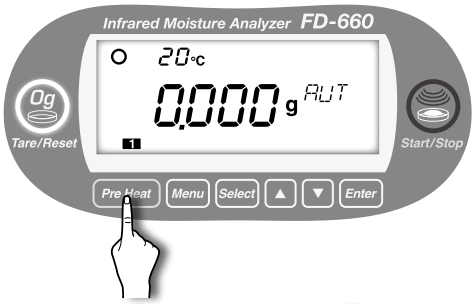
■ Tips on how to ensure accurate measurements

● First measurement

If a test is performed immediately after turning on the power, a measurement error may be caused.
It is recommended to turn on the power 30 minutes before use to optimize instrument stability.
In addition, we recommend using the Pre Heat function available with the instrument.

How to operate the Pre Heat function

1

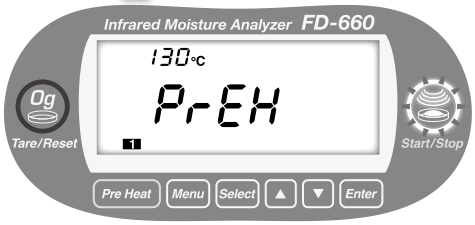


Place the sample dish, and close the heater lid.

**** No sample is necessary.***

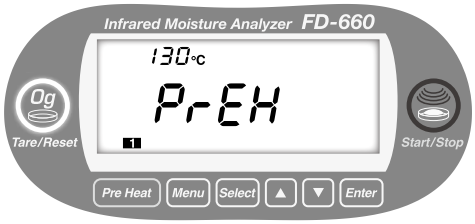
Press the [**Pre Heat**] key.

2



The [**Start/Stop**] key blinks, heating begins.
It is heated at 130ºC.

3

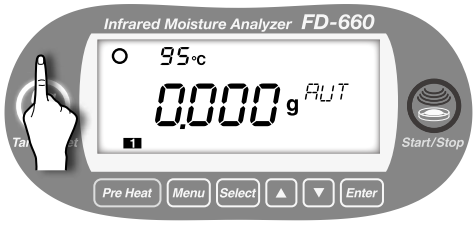


Pre heating will finish in 5 minutes.
The [**Tare/Reset**] key lights up.

**** When Er307 is displayed, confirm if***
-the ambient temperature is within the operating range(5-40ºC). (Page7)
-the power supply voltage is appropriate.(page14)

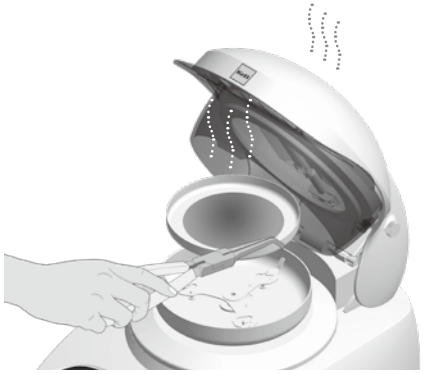
**** Replace the heater if it does not light up due to heater disconnection. (Refer to the page 41 "9-3. Heater Replacement")***

4



Press the [**Tare/Reset**] key.
"PrEH" will disappear and weight is displayed.

5



Open the heater lid, and remove the sample dish with the sample dish handler.

**** Note that the sample dish may be very hot and you should be careful in handling it at this time.***

Leave the heater lid open to allow the tester to cool.

6

Ensure that the entire unit has cooled, and place the spare (cool) sample dish.

**** The guideline for "the entire unit has cooled" is 40ºC or lower on the display.***

Use a cool sample dish.

● For multiple measurements in succession

Placing a sample onto a sample dish which is already warm may cause moisture from the sample to evaporate before the test is begun and cause errors to occur in measurement. Always be sure to use a cool sample dish when performing a second or subsequent measurements.
You should also take care to allow an even amount of time to elapse between measurements, as errors in measurement may occur if the temperature of the internal scale of the unit does not remain at a constant level.

**** Two sample dishes are supplied with this unit.***

● How to use sample dish and aluminium foil sheet

It is impossible to obtain accurate measurements if residue from the sample last measured remains on the sample dish. To avoid such problems, either wipe the sample dish clean of any dirt or soil (see “9. Maintenance” on page 40 for further instructions) or use disposable aluminium foil sheets to protect against residues, soil, or dirt.

**** Ten disposable aluminium foil sheets are supplied with the unit.***

● Measurement of powdered, particulate, and viscous samples

The easier it is to heat the surface of a sample material, the easier it is for projecting portions of the material or for material at the top of a mound of material to become burnt. If the material is placed in a mound on the dish or if the material is not flat and evenly laid out, this is likely to happen, thus making it impossible to obtain accurate measurements.
Note that while the precision of measurement improves the more flatly and evenly samples are placed and the higher the amount of sample material used, the quantity of sample material used is too great if the surface becomes burned before lower layers are fully dried.
Always be sure to lay out samples flatly and evenly as indicated in the diagram below.

● Measurement of liquid sample

Virtually all liquid materials will coagulate after being dried, and when working with such materials they should be placed on the provided sheets of aluminium foil. Note that these aluminium foil sheets are water-permeable, thus making it possible to obtain wide and even placement and making them effective for use in shortening measuring times and obtaining accurate measurements.
Depending on the sample in question, the use of sand to speed up drying (Silica sand or ocean sand with a mesh of 20 or so) may be even more effective.

● Measurement of large particulate sample

A long time may be required to thoroughly dry samples if the sample grains are large. In addition, the sample surface may be burned, thus making accurate measurement impossible. For this reason you should always crush samples to an appropriate size. The Sample Crusher TQ-100 (option) is excellent for this purpose.

● Removal of soil, sample gas, and others

Depending on the sample, oil and volatile substances may stick to the temperature sensor and on the inside of the heater base when the sample is being dried.
If the sample is in the form of a powder, under certain circumstances, the powder may accumulate on the upper side of the heater lid or in the space between the heater and lid. These types of powder substances can change the temperature around the sample and the air flow in the dryer section of the machine, resulting in an error in measured moisture.
A substantial error can easily arise if the upper side of the heater lid gets clogged with deposited material. Frequently clean the end of the sensor, the inside of the heater base, the upper side of the heater lid, and the space between the heater and lid. Remove any dirt or sample residue.

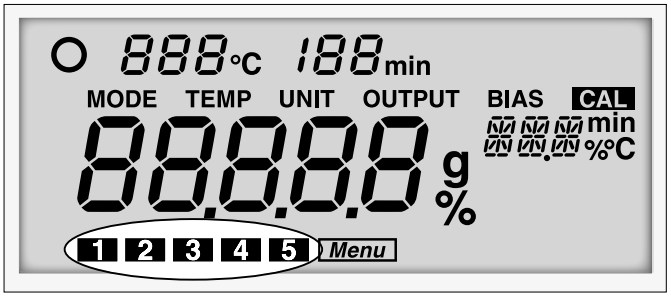
- Wipe off the dirt with a dry, soft cloth.
- If dirt remains, wipe with a damp cloth (not dripping) with a water/neutral detergent mix. Then, dry the instrument after rinsing the cloth in running water, wringing it well, and wiping off the detergent.

● Deodorizing windshield case

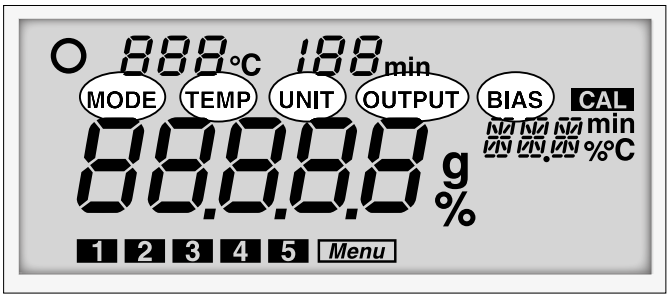
If the impact of exterior wind (from air-conditioners etc.) on the body is unavoidable, or if the sample generates a bad odor during moisture content measurement, or if the device is in an environment that will accumulate powder on its body from the sample, it is possible to lower reduce the impact of these problems by placing the device inside the deodorizing windshield case FW-100 (option).

7. Specifying Measuring Settings

When moisture content is measured, test settings such as drying temperature and measurement mode need to be specified in advance.
The specified measuring settings can be stored in the measuring setting storage areas.
There are 5 measuring setting storage areas as shown in the circle below **1** to **5**.

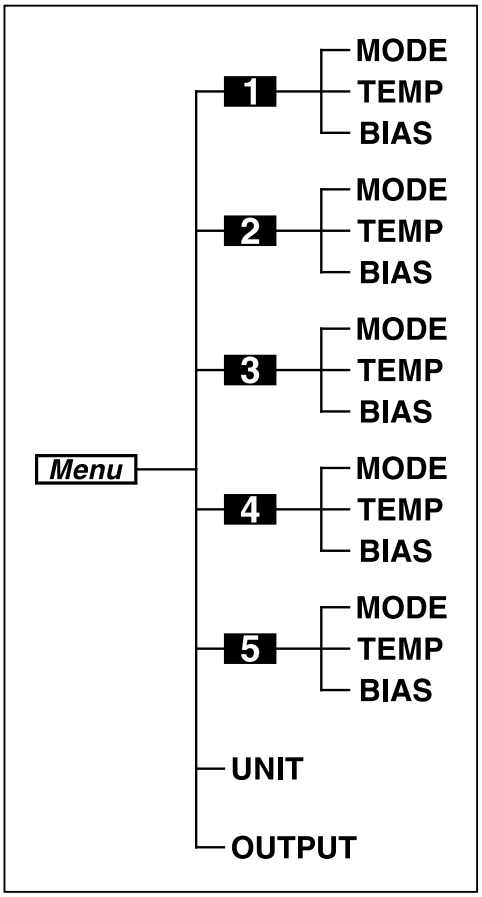


There are 5 menu items that need to be specified in the (see the circles below).



MODE : Measuring mode
TEMP : Drying temperature
UNIT : Measurement standard and Minimum display digit
OUTPUT : Output format
BIAS : Offset value

First, select a measuring setting storage area from **1** to **5**.
Next, specify MODE (measuring mode), TEMP (drying temperature), and BIAS (offset value).
UNIT (measurement standard and minimum display digit) and OUTPUT (output format) are common in all areas.



The stored settings can be always recalled, and therefore, storing settings for each sample type to be measured is useful.
Refer to the next chapter, "8. Menu Settings (pages 22 or later)" for details on how to set each menu item.
The following factory settings are stored in the **1** to **5** areas.

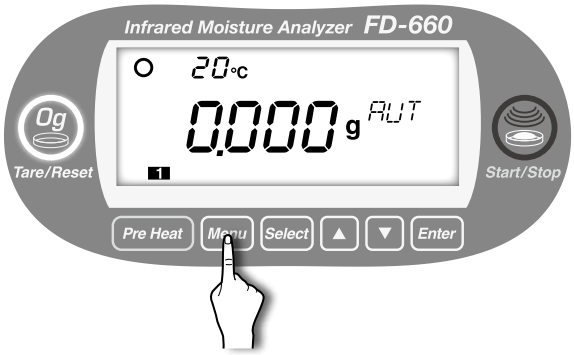
- MODE : Automatic mode (change in moisture content: 0.1%, monitoring time: 1 minute)
- TEMP : 120 ºC
- BIAS : 0.0 %

The following common menu items are stored.

- UNIT : Wet base
- OUTPUT : Printer Output

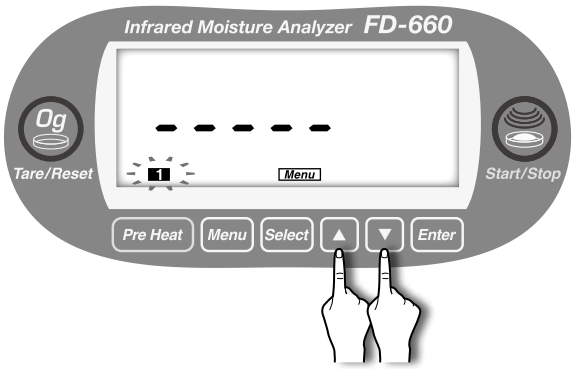
● Setting procedure

1



With the display showing the weight in grams, press the [**Menu**] key.

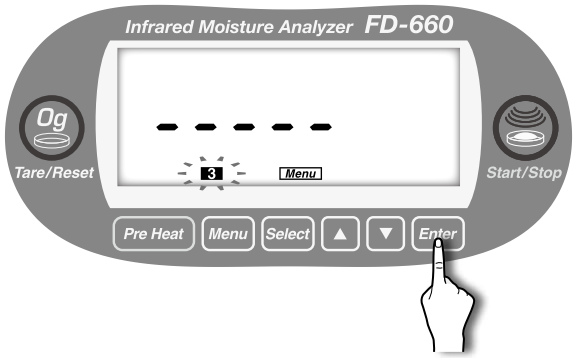
2



[Menu] lights up, and one of **1** to **5** blinks.

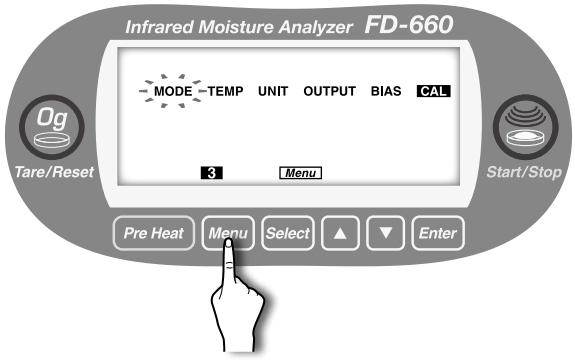
Select an area number to which the measuring settings are stored from **1** to **5** with use of the [▲] or [▼] key.

3



After the desired number blinks, press the [**Enter**] key.
“3” is selected in the example on the left.

4

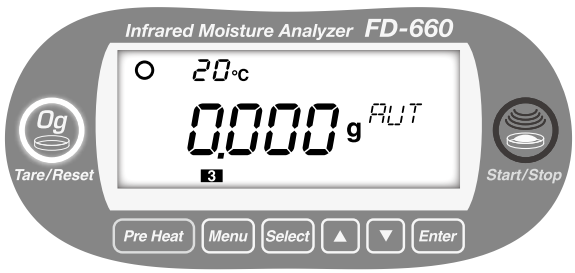


The "3" changes from blinking to lit.
Now, the measuring setting storage number is set to 3.

At the same time, "MODE" in the menu blinks, and the menu setting can now be performed (see "8. Menu Settings" on page 22).

Pressing the [**Menu**] key returns the screen to the weight display screen.

5



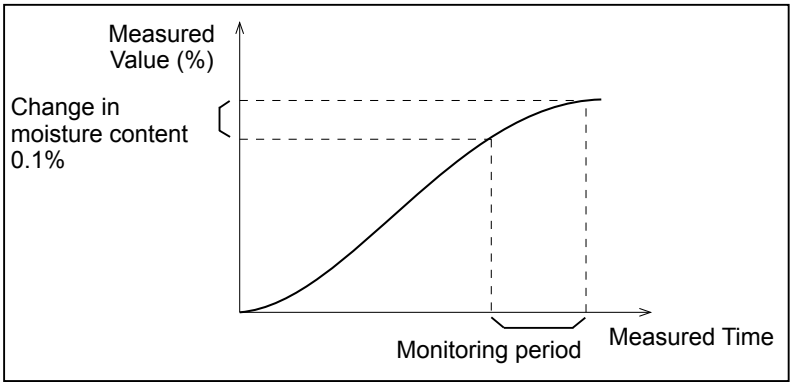
8. Menu Settings

8-1 Setting for MODE (measuring mode)

This unit is equipped with 2 measuring modes; one is “AUTO (automatic) mode”, and the other is “TIME (timed) mode”.
Use those modes depending on test requirements.

● Setting for AUTO (automatic) mode

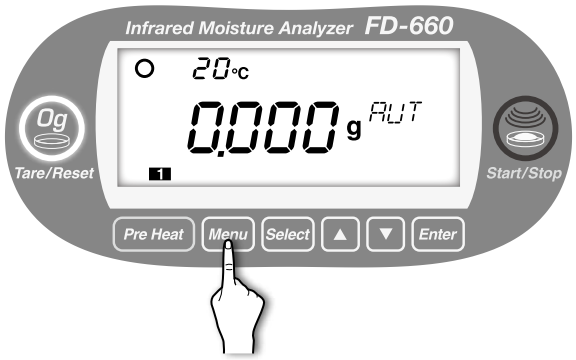
The test finishes when the amount of change in the moisture content changes by 0.1% or less within the specified monitoring time.
The monitoring time can be selected from 0.5, 1, 1.5, or 2 minutes.
Specifying a longer monitoring time causes measurement values to approach an equilibrium value, but more time is then required for the test.
Specifying a shorter monitoring time reduces the amount of time required for measurement, but the test is completed while there may still be a wide variation in measurements. Determine the automatic settings in accordance with your objectives and the type of sample to be measured.



* ***Because the moisture value and the amount of moisture change are calculated with inclusion of values less than the displayed decimal places, the unit may not stop even when the amount of moisture change reads 0.1% because of value rounding off.***

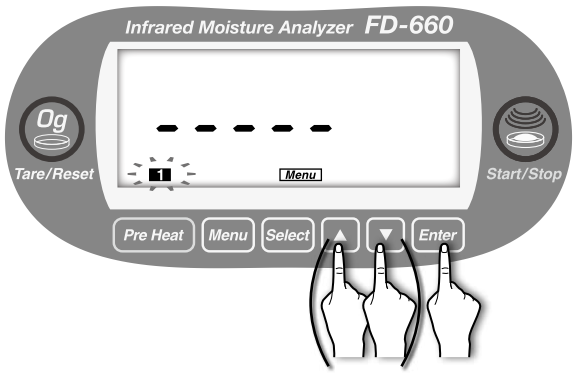
● Setting procedure

1



With the display showing the weight in grams, press the [**Menu**] key.

2

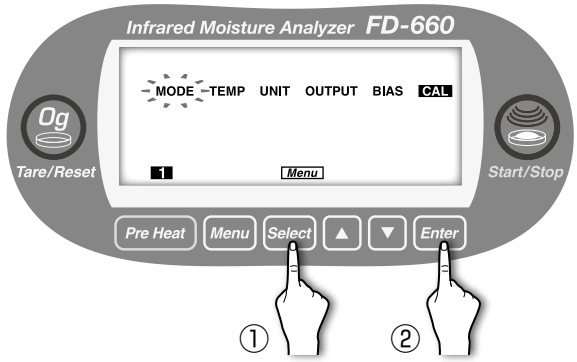


[Menu] lights up, and the number of the current measuring setting storage area blinks.

To change the number, use the [▲] or [▼] key (see "7. Specifying Measuring Settings" on page 20).

When the desired measuring settings area number starts flashing, press the [**Enter**] key.

3

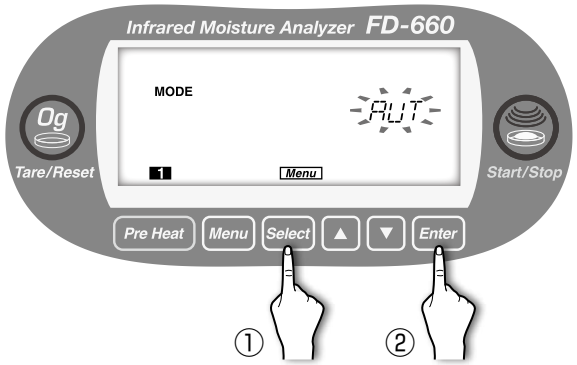


Move to the selection of menu item.

Every time the [**Select**] key is pressed, the menu items alternately blink in the order of “MODE” → “TEMP” → “UNIT” → “OUTPUT” → “BIAS” → “CAL” → “MODE” → ….

① Press the [**Select**] key.
② Press the [**Enter**] key after “MODE” blinks.

4



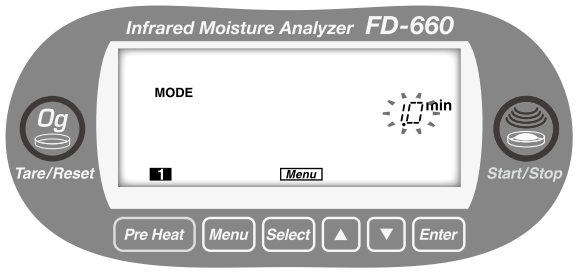
Move to the selection of a measuring mode.
The currently selected measuring mode blinks.

Every time the [**Select**] key is pressed, “AUTO (automatic mode)” and “TIME (timed mode)” alternately blink.

① Press the [**Select**] key.
② Press the [**Enter**] key after “AUT” blinks.

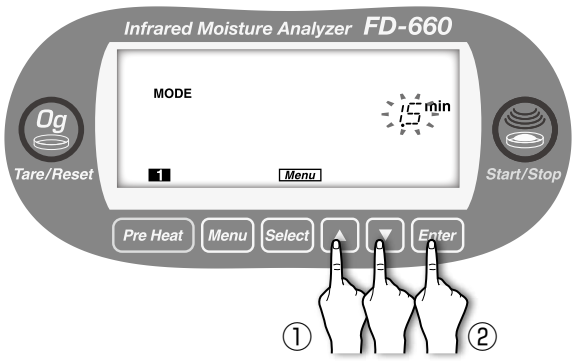
Automatic measuring mode is now selected.

5



Automatically, the monitoring time is displayed.
The currently selected monitoring time blinks.

6

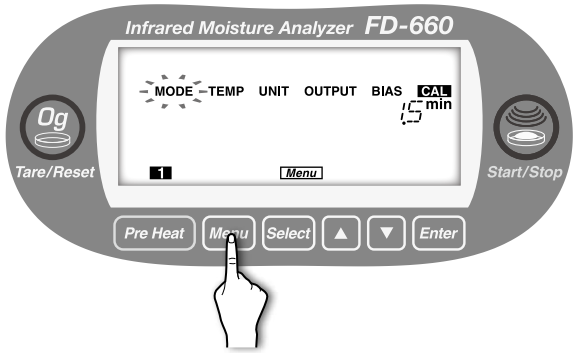


Every time the [▲] or [▼] key is pressed, "0.5 min" → “1 min”” → “1.5 min” → “2 min” → “0.5 min”... alternately blink.

① Press the [▲] or [▼] key to move to the monitoring time to be selected.
② Press the [**Enter**] key after your selecting monitoring time blinks (1.5 minutes is selected in the example on the left).

A monitoring time is now selected.

7

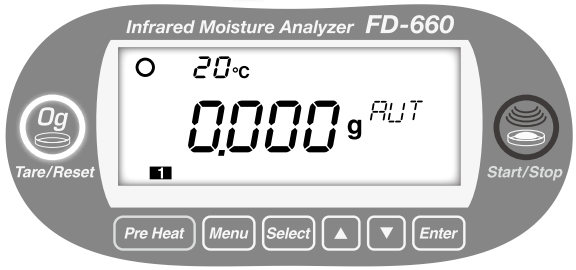


Since the measuring mode is specified, the "MODE" starts blinking.

To exit from the "MODE" menu setting, press the [**Menu**] key. The screen returns to the weight display screen.

To specify other menu items, press the [**Select**] key.

8

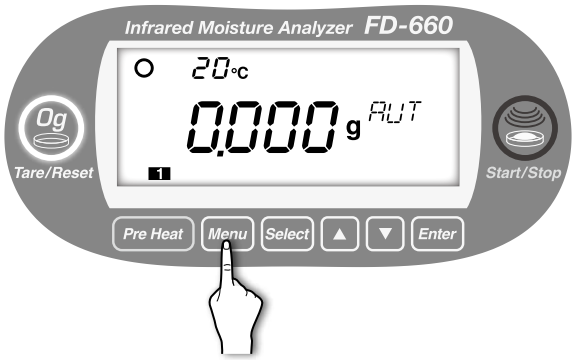


● Setting for TIME (timed) mode

In timed mode, the test time is specified before the test and the sample is dried to determine its moisture content.
When the specified measuring time is reached, the test is halted.
The measurement time can be specified from 1 to 120 minutes in steps of 1 minute.

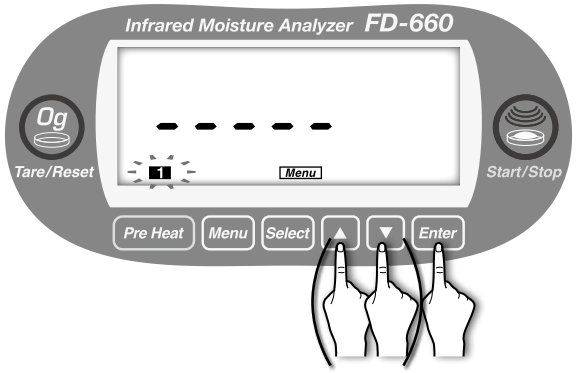
● Setting procedure

1



With the display showing the weight in grams, press the [**Menu**] key.

2

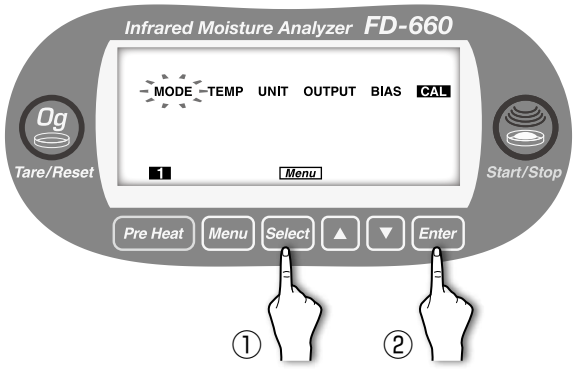


[Menu] lights up, and the number of the current measuring setting storage area blinks.

To change the number, use the [▲] or [▼] key (see "7. Specifying Measuring Settings" on page 20).

When the desired measuring settings area number starts flashing, press the [**Enter**] key.

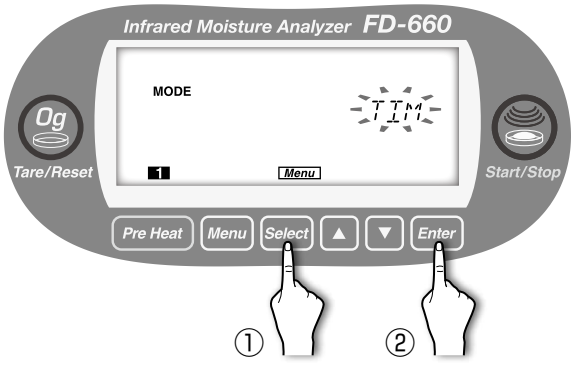
3



Move to the selection of menu item.
Every time the [**Select**] key is pressed, the menu items alternately blinks in the order of “MODE” → “TEMP” → “UNIT” → “OUTPUT” → “BIAS” → “CAL” → “MODE” → ….

① Press the [**Select**] key.
② Press the [**Enter**] key after “MODE” blinks.

4



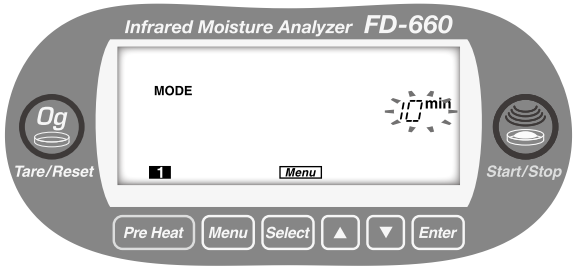
Move to the selection of a measuring mode.
The currently selected measuring mode blinks.

Every time the [**Select**] key is pressed, “AUTO (automatic mode)” and “TIME (timed mode)” alternately blink.

① Press the [**Select**] key.
② Press the [**Enter**] key after “TIME” blinks.

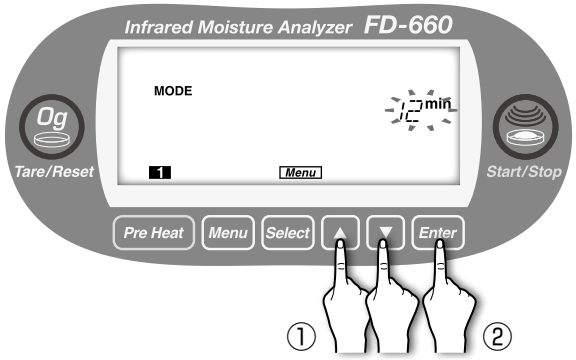
Timed measurement mode is now selected.

5



Automatically, the monitoring time is displayed.
The currently selected measuring time blinks.

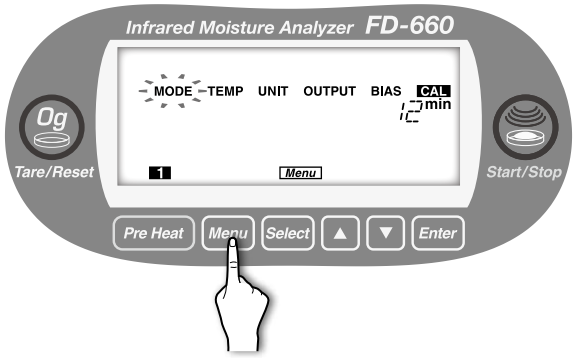
6



① Press the [▲] or [▼] key to specify the desired measuring time (12 minutes is specified in the example on the left). Configurable time range: “1 min” to “120 min”

② Press the [**Enter**] key.
The measuring time is now specified.

7

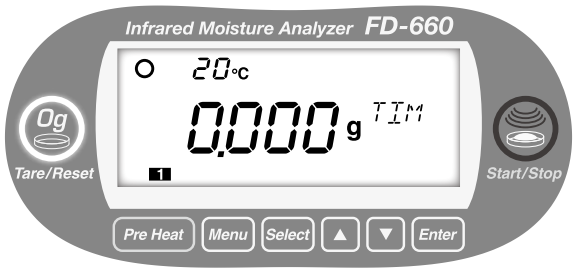


Since the measuring mode is now specified, the "MODE" starts blinking.

To exit from the "MODE" menu setting, press the [**Menu**] key. The screen returns to the weight display screen.

To specify other menu items, press the [**Select**] key.

8



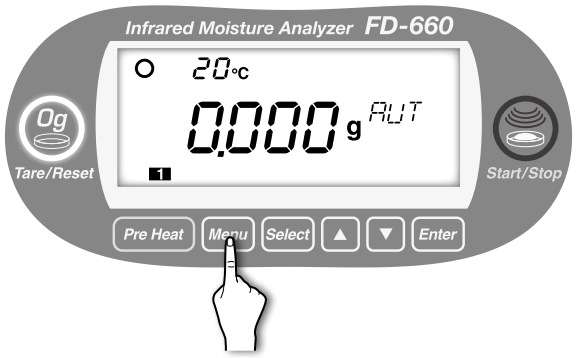
8-2. Setting for TEMP (drying temperature)

The following describes the optimal procedure to be followed to specify the drying temperature to be used in drying samples when conducting measurements.
The factory default drying temperature is set to 120°C. However, depending on the type of sample, its moisture content, or other settings, the proper drying temperature to use may vary. To find the proper drying temperatures to be used for different types of materials, conduct repeated measurements until you find the correct temperature to use for each type of material.
The temperature may be set to a temperature of anywhere from 30 to 180ºC in 1 degree increments.

* ***Note that the drying temperature does not refer to the temperature of the material being tested but is instead the temperature on the dish calculated from the temperature detected by the temperature sensor. The drying temperature may differ from the temperature of the material being dried depending on the material's color, moisture content, type, or shape.***
* ***Generally speaking, drying is performed more quickly when a higher drying temperature is specified, but if the temperature specified is too high it might result in the sample becoming scorched or burned, thus making it impossible to obtain accurate measurements.***
* ***Note that the meaning of the term 'drying temperature' as it is specified here differs from that of the drying temperature for our other models because of a structural design differences between the models.***
* ***If the ambient temperature is close to the drying temperature, the heater may not work.***

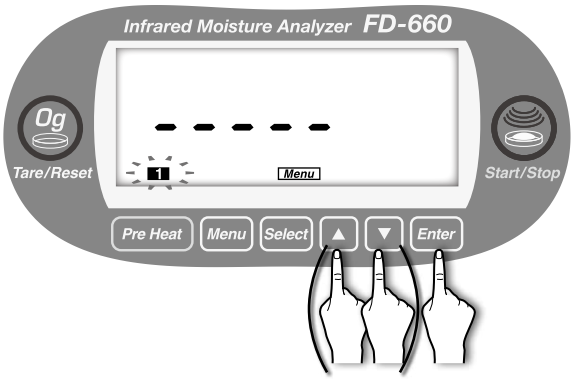
● Setting procedure

1



With the display showing the weight in grams, press the [**Menu**] key.

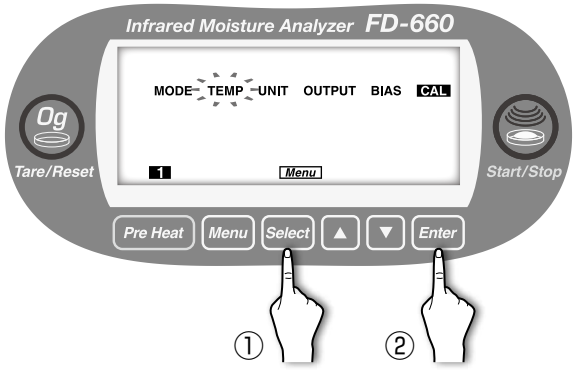
2



[Menu] lights up, and the number of the current measuring setting storage area blinks.

To change the number, use the [▲] or [▼] key (see "7. Specifying Measuring Settings" on page 20).
When the desired measurement settings area number starts flashing, press the [**Enter**] key.

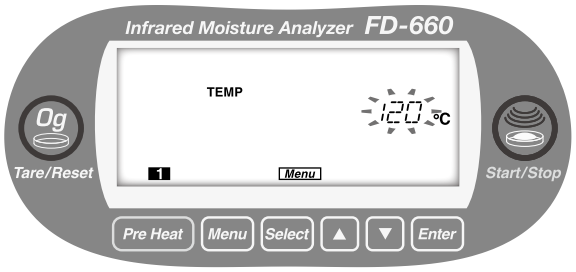
3



Move to the selection of menu item.

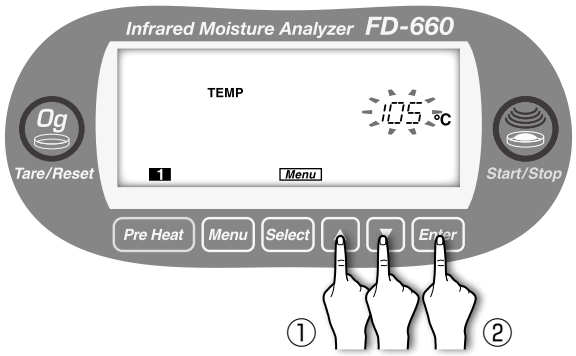
Every time the [**Select**] key is pressed, the menu items alternately blinks in the order of "MODE" → "TEMP" → "UNIT" → "OUTPUT" → "BIAS" → "CAL" → "MODE" → ….
① Press the [**Select**] key.
② Press the [**Enter**] key after "TEMP" blinks.

4



Move to the setting of the drying temperature.
The currently selected drying temperature blinks.

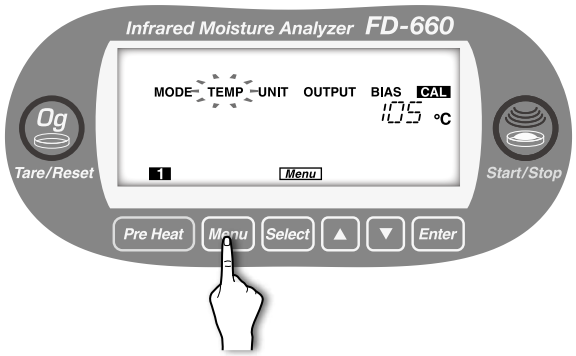
5



① Press the [▲] or [▼] key to specify the desired drying temperature (105ºC is specified in the example on the left).
② Press the [**Enter**] key.

Configurable temperature range: "30 ºC" to "180 ºC"

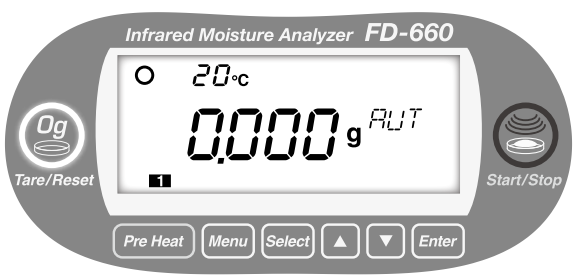
6



The blinking drying temperature changes from blinking to lit, and the drying temperature is specified.
"TEMP" starts to blink.
To exit from the "TEMP" menu setting, press the [**Menu**] key. The screen returns to the weight display screen.

To specify other menu items, press the [**Select**] key.

7



8-3 Selection of UNIT (measurement standard and minimum display digit)

● Selecting the measurement standard

This is used to select and specify the measurement standards to be used when performing measurements. There are 3 types of measurement standards; measuring by changes in wet content, measuring by changes in dry content, and measuring by changes in solid content, and therefore, the standard to be used should be selected in accordance with the type of material to be measured.

Type	Display during specification of setting	Formula	Description
Wet Base	WET	$\frac{W - D}{W}$ ×100 (%)	Percentage of evaporated moisture weight with respect to the weight before drying.
Dry Base	DRY	$\frac{W - D}{D}$ ×100 (%)	Percentage of evaporated moisture weight with respect to the weight after drying.
Solid	SOL	$\frac{D}{W}$ ×100 (%)	Percentage of residual weight after drying with respect to the weight before drying.

[Notation used in formula] W : Wet weight before measurement, D: Dry weight after measurement
(While a measurement is being performed, the weight at each point in time is used as the dry weight in calculating measurements.)

● Selecting the minimum display digit

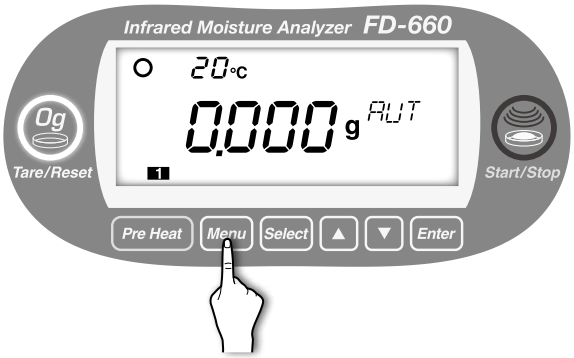
Select 0.1% or 0.01% for the minimum display digit, and configure it.

**** Note that the minimum display digit has no effect when performing comparative measurements.***

The UNIT setting is common for all measuring setting storage areas.

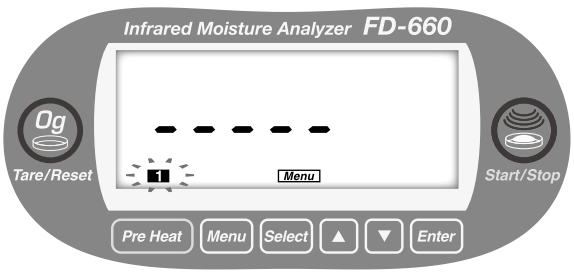
● Setting procedure

1



With the display showing the weight in grams, press the [**Menu**] key.

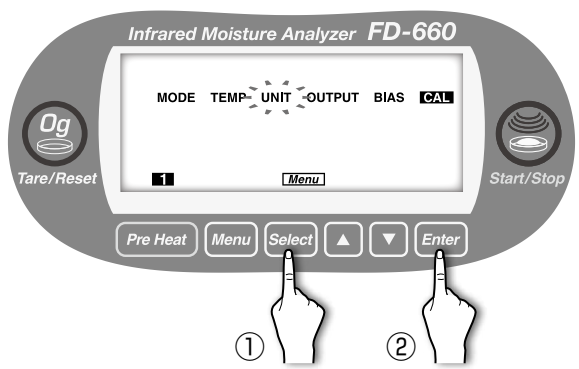
2



[Menu] lights up, and the number of the current measuring setting storage area blinks.

The UNIT setting is common to all measuring storage areas, and therefore, selection is not required.
Just press the [**Enter**] key.

3

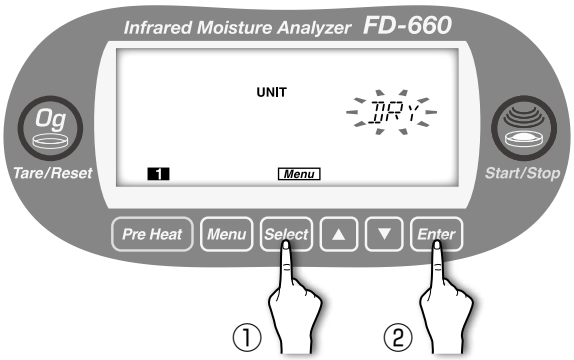


Move to the menu item selection.
Every time the [**Select**] key is pressed, the menu items alternately blinks in the order of “MODE” → “TEMP” → “UNIT” → “OUTPUT” → “BIAS” → “CAL” → “MODE” → …

① Press the [**Select**] key.
② Press the [**Enter**] key after “UNIT” blinks.

**** For UNIT, the measuring setting storage areas 1 to 5 are specified in common.***

4

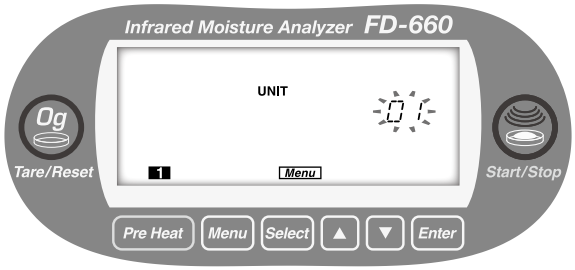


Every time the [**Select**] key is pressed, “WET” → “DRY” → “SOL” → “WET” → ... alternately blink.

① Press the [**Select**] key.
② Press the [**Enter**] key after the desired measurement standard blinks (“DRY” is selected in the example on the left).

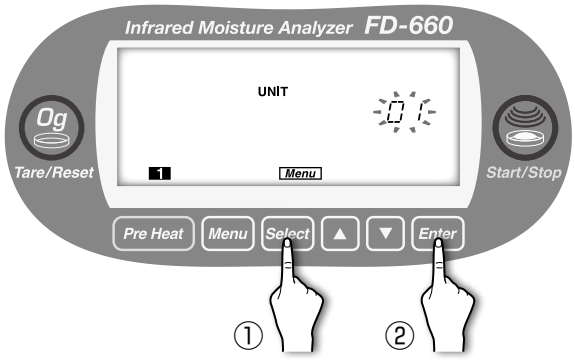
The measurement standard is now selected.

5



The minimum display digit is automatically lit.
The currently selected minimum display digit blinks.

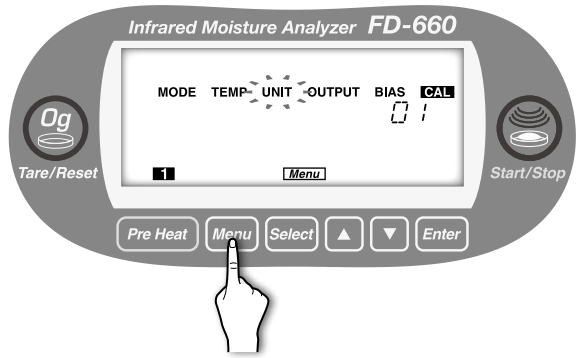
6



Every time the [**Select**] key is pressed, “01” and “001” alternately blink.

① Press the [**Select**] key.
② Press the [**Enter**] key after the desired minimum display digit blinks (“0.1%” is selected in the example on the left).

7

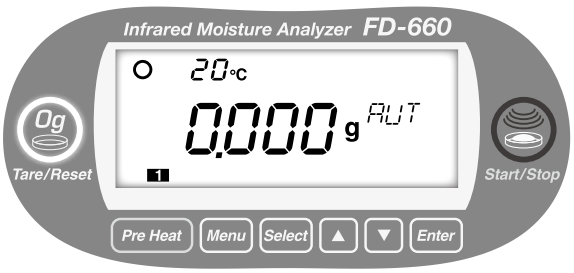


The measurement standard and minimum display digit are specified, and "UNIT" starts to blink.

To exit from the "UNIT" menu setting, press the [**Menu**] key. The screen returns to the weight display screen.

To specify other menu items, press the [**Select**] key.

8



8-4 Selection of OUTPUT (output format)

Connection to a PC or an optional printer allows for measurement data output.

● **PC (“PC” displayed on the screen of the main unit)**
The use of the data logger software, “FDL-02”, allows users to load data onto a PC.
Refer to the operating instructions of “FDL-02” for further information.

● **Printer (“PRT” displayed on the screen of the main unit)**
The following 6 kinds of output intervals are selectable.

Output interval	30 sec.	1 min.	2 min.	5 min.	10 min.	Final results only
Display during specification of setting	30S	1M	2M	5M	10M	FIN

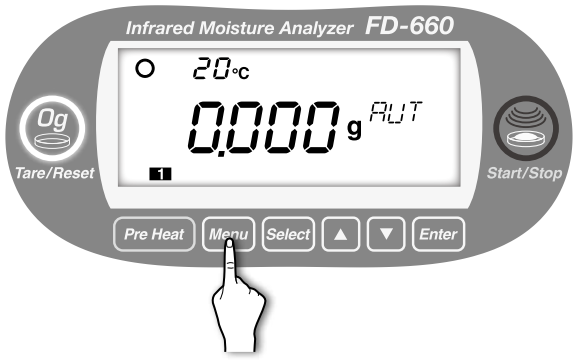
If it is set to [FIN], measurement settings and measurement conditions are output when the first measurement from carried out the following operations. Measurement conditions are not output after second or later measurements.

- ***Turned on the power again***
- ***Entered the Menu (see “8 Menu Settings" on p.22).***
- ***Printed the signature field (see “6 Measurement Procedure ⑤" on p.16).***

The setting contents of UNIT are common in all measuring setting storage areas.

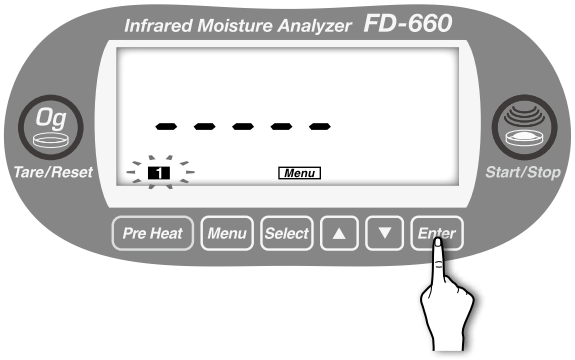
● Setting procedure

1



With the display showing the weight in grams, press the [**Menu**] key.

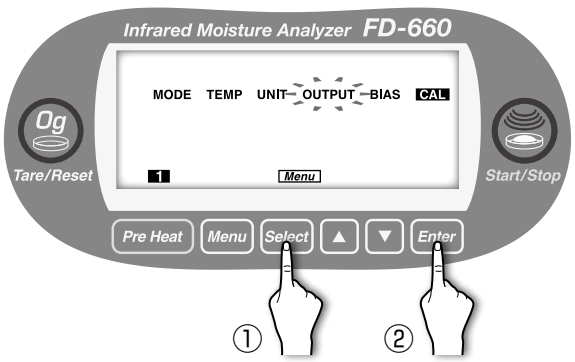
2



[Menu] lights up, and the number of the current measuring setting storage area blinks.

The OUTPUT setting is common to all measuring storage areas, and therefore, selection is not required.
Just press the [**Enter**] key.

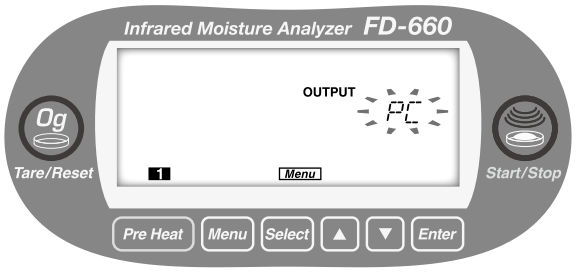
3



Move to the selection of menu item.
Every time the [**Select**] key is pressed, the menu items alternately blinks in the order of “MODE” → “TEMP” → “UNIT” → “OUTPUT” → “BIAS” → “CAL” → “MODE” → ….
① Press the [**Select**] key, and
② Press the [**Enter**] key after “UNIT” blinks.

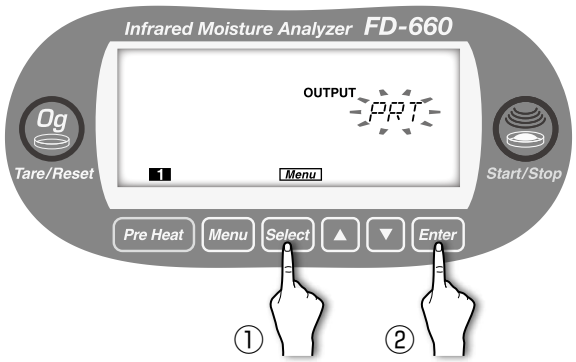
For OUTPUT, the measuring setting storage areas 1 to 5 are specified in common.

4



The currently selected output format blinks.
Every time the [**Select**] key is pressed, “PC” and “PRT” alternately blink.

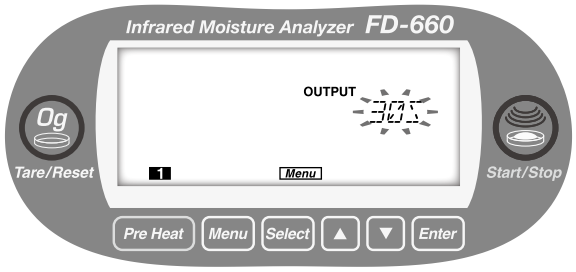
5



① Press the [**Select**] key.
② Press the [**Enter**] key after the desired output format blinks (“PRT” is selected in the example on the left).

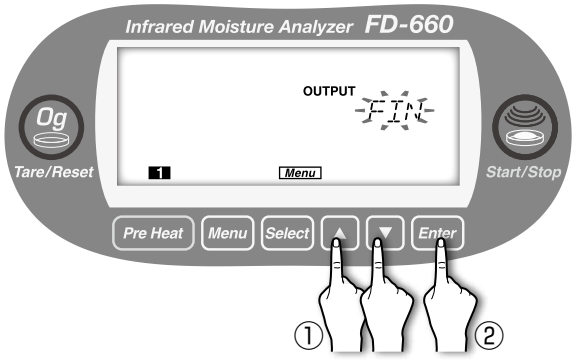
An output format is selected.
When the printer (PRT) is selected, move to the selection of output interval.

6



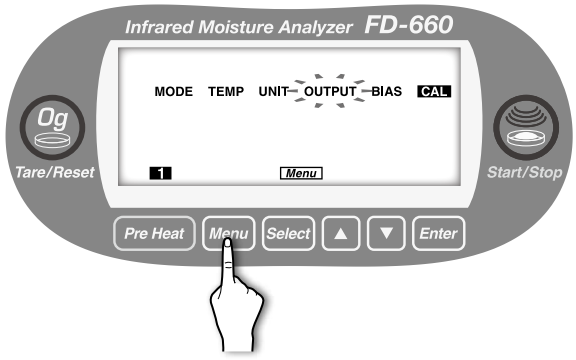
The currently selected output interval blinks.
Every time the [▲] or [▼] key is pressed, "30 S" → "1 M" → "2 M" → "5 M" → "10 M" → "FIN" → "30 S"... alternately blink.

7



① Press the [▲] or [▼] key.
② Press the [**Enter**] key after the desired output interval blinks (“FIN” is selected in the example on the left).

8

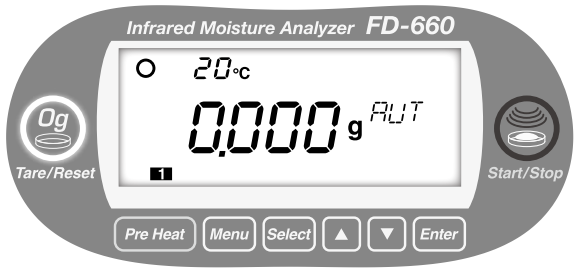


The output format is now specified, and "OUTPUT" starts to blink.

To exit from the "OUTPUT" menu setting, press the [**Menu**] key. The screen returns to the weight display screen.

To specify other menu items, press the [**Select**] key.

9



Output data includes intermediate or final measurements.

**** A dot-matrix printer can also be used. In that case, however, graphical output cannot be obtained. Please contact Kett if you require further information.***

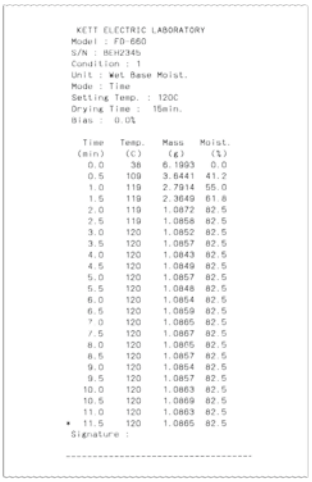
■ Outputting Past Measurement Data

Record are stored of up to 50 past measurements in sequence from the most recent to the oldest. This data can be output to a printer or computer.

1 Follow the directions given on page 30 “8-4 Selection of OUTPUT” to set the output format to either ‘TBL’ or ‘PC’.
2 From the weight display, press the **[Select]** key and hold the **[Select]** key down while pressing the **[Start/Stop]** key.
3 The data will then be output (in order) beginning from the most recently measured data. To stop printing while printing is still in progress, press the **[Start/Stop]** key.

■ Sample Printer Output

**** Note on the decimal precision of printed weight data***
Although the minimum weight which may be displayed by the FD-660 is 0.005 grams, weights (Mass) are printed to a precision of 4 decimal points because the values printed consist of averages from 7 measurements taken over each 30-second interval for each set of weight data output.



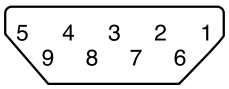
```
KETT ELECTRIC LABORATORY
Model : FD-660
S/N : BEH2345
Condition : 1
Unit : Wet Base Moist.
Mode : Time
Setting Temp. : 120C
Drying Time :  15min.
Bias :  0.0%

  Time   Temp.   Mass   Moist.
 (min)    (C)     (g)     (%)
   0.0      38   6.1993    0.0
   0.5     109   3.6441   41.2
   1.0     119   2.7914   55.0
   1.5     119   2.3649   61.8
   2.0     119   1.0872   82.5
   2.5     119   1.0858   82.5
   3.0     120   1.0852   82.5
   3.5     120   1.0857   82.5
   4.0     120   1.0843   82.5
   4.5     120   1.0849   82.5
   5.0     120   1.0857   82.5
   5.5     120   1.0848   82.5
   6.0     120   1.0854   82.5
   6.5     120   1.0859   82.5
   7.0     120   1.0865   82.5
   7.5     120   1.0867   82.5
   8.0     120   1.0865   82.5
   8.5     120   1.0857   82.5
   9.0     120   1.0854   82.5
   9.5     120   1.0857   82.5
  10.0     120   1.0863   82.5
  10.5     120   1.0869   82.5
  11.0     120   1.0863   82.5
* 11.5     120   1.0865   82.5
Signature :
```

■ Computer Interface

The RS-232C interface may be used to connect the FD-660 to a computer with an RS-232C interface and output measurement data to that computer.

● RS-232C Interface Specifications

Interface type	:	RS-232C
Communications method	:	Asynchronous communication
Baud rate	:	1200/2400/4800/9600 bps
Data bits	:	8 bits
Parity	:	None
Stop bits	:	1 bit
Connector	:	Female D-SUB9 pins
Pin layout	:	



Pin number	Direction	Description
1		Not used
2	Output	TXD
3	Input	RXD
4		Not used
5		GND
6		Not used
7		Not used
8		Not used
9		Not used
Frame		Shield

■ Setting Up and Transmitting Data

● Connecting the RS-232C cable

With the power to the FD-660 and the computer both turned off, connect the RS-232C cable. Insert the connector at the end of the RS-232C cable into the RS-232C port located at the rear of the FD-660 and then tighten the screws located at both sides of the cable connector. Follow the same procedure to insert the RS-232C cable into the RS-232C port of the computer.

● FD-660 settings

Turn on the power to the FD-660 and set the measurement data output destination to ‘PC’. (See “8-4 Selection of OUTPUT” on page 30)

● Starting up the computer

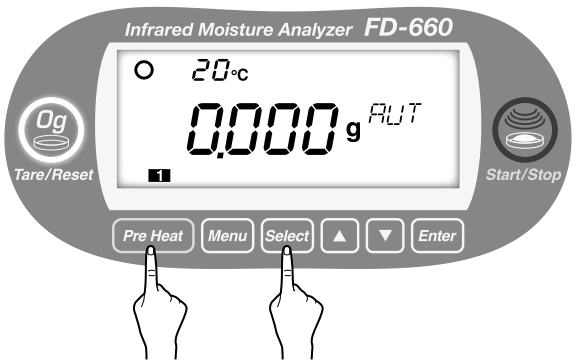
Turn on the power to the computer and, when Windows has started, start the Data Logger software FDL-02 or whatever software is to be used to read in data from the RS-232C interface.

**** For instructions on how to use your computer, operating system (Microsoft Windows), or software being used, see the user manuals provided with your computer, operating system, or software.***

**** The Microsoft Windows name and logo are the trademarks and registered trademarks of the Microsoft Corporation in the United States and other countries.***

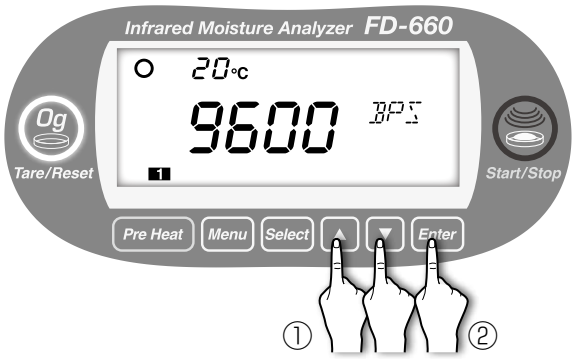
● Baud rate setting

1



Hold down the [**Pre Heat**] key and [**Select**] key simultaneously with the display showing the weight.
The setting value of the current baud rate is displayed.
Every time the [▲] or [▼] key is pressed, "2400" → "4800" → "9600" → "1200" → "2400" ... is alternately displayed.

2



① Press the [▲] or [▼] key to select a baud rate value to be set. (In the example at left, 9600 BPS is selected.)
② Press the [**Enter**] key.

■ Computer Output Format

Interface type: RS-232C
Numeric output format: JIS(ASCII)
Delimiter code: 0x09(tab)
Delimiter: 0x0D (CR)+0x0A(LF)

● Title output format at the time of measurement start (Underscore characters (i.e., '_') are used below to indicate blanks (i.e., '20' in hexadecimal)

1. "_KETT_ELECTRIC_LABORATORY" + delimiter
2. "_Model_:_FD-660" + delimiter
3. "_S/N_"+"XXXXXXX" (7-byte Serial No.) + delimiter
4. "_Setting_:_"+"X" (1-byte setting number) + delimiter
5. "_Unit_:_" + "Wet Base Moist." or "Dry Base Moist." or "Solid Content" + delimiter
6. Automatic format
   "_Mode_:_Auto" + delimiter
   "_Setting Temp._:_" + "XXX" (3-byte temperature setting) + "C" + delimiter
   "_Auto Stop Cond._:_"+"X.X" (3-byte automatic settings setting) + "min" + delimiter
7. Timed format
   "_Mode_:_Time" + delimiter
   "_Setting_Temp._:_" + "XXX" (3-byte temperature setting) + "C" + delimiter
   "_Drying_Time_:_" + "XXX" (3-byte drying time setting) + "min." + delimiter
8. "_Bias_:_"(+"-") + "X.X"+"%" + delimiter

● Measurement output format

tab + "Time (min.)" + tab + "Temp. (C)" + tab + "Mass (g)" + tab + "Moist (%)" + delimiter

● Intermediate measurement output format

The number of characters indicating the moisture content varies with display setting.
tab + "XXX.X" (5-byte measuring time) + tab + "XXX" (3-byte thermistor temperature) +
tab + "XX.XXXX" (7-byte sample weight) + tab + moisture content "XXX.XX" (6-byte moisture content) + delimiter
Or
tab + "XXX.X" (5-byte measuring time) + tab + "XXX" (3-byte thermistor temperature) +
tab + "XX.XXXX" (7-byte sample weight) + tab + moisture content "XXX.X" (5-byte moisture content) + delimiter

● Final measurement output format

The number of characters indicating the moisture content varies with display setting.
tab + "XXX.X" (5-byte measuring time) + tab + "XXX" (3-byte thermistor temperature) +
tab + "XX.XXXX" (7-byte sample weight) + tab + moisture content "XXX.XX" (6-byte moisture content) + delimiter
Or
tab + "XXX.X" (5-byte measuring time) + tab + "XXX" (3-byte thermistor temperature) +
tab + "XX.XXXX" (7-byte sample weight) + tab + moisture content "XXX.X" (5-byte moisture content) + delimiter

8-5. Setting for BIAS (offset value)

At times, it may be necessary for measurements to be corrected for bias.
The bias may be specified with a value between -9.9 and 9.9% in 0.1% increments. A bias should be specified in cases like those described below.

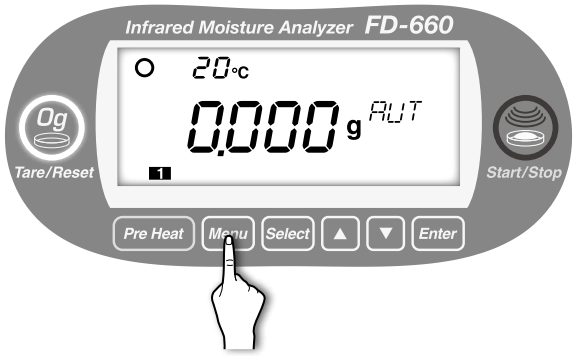
- There are numerous reasons why measured values with this unit do not completely agree with expected values measured with the official method (standard method). When this happens, adjusting the difference between measured value using this unit and measured value using the official method (standard method) with an offset value allows the measured value using this unit to be used as a value in accordance with the official method (standard method).

  **** In most cases, it is possible to change the measuring settings used to make the measurements obtained using this unit to match the expected values measured with the official method (standard method). But if such settings would cause the sample to be burned, would cause the time required for measurement to become too long, or otherwise result in problems, a bias (offset) should be specified instead.***

- When using more than one unit, there may be times when it is impossible to obtain identical measurements even when the same measuring settings are used, because of differences in the locations where the units are placed or because of differences in the surrounding environment. In such cases, the offset value of the unit that is to serve as the standard should be set to zero and the offset value of the other units set to account for any such differences.

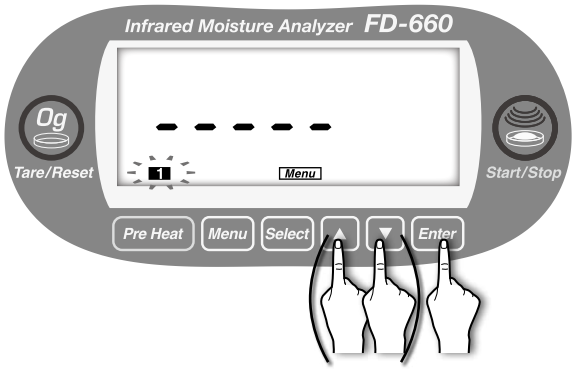
● Setting procedure

1



With the display showing the weight in grams, press the [**Menu**] key.

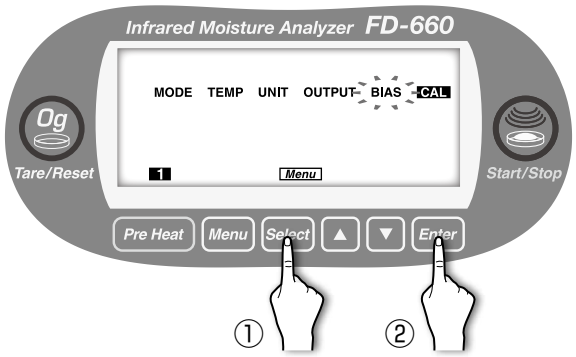
2



[Menu] lights up, and the number of the current measuring setting storage area blinks.

To change the number, use the [▲] or [▼] key (see "7. Specifying Measuring Settings" on page 20).
When the desired measuring settings area number starts flashing, press the [**Enter**] key.

3

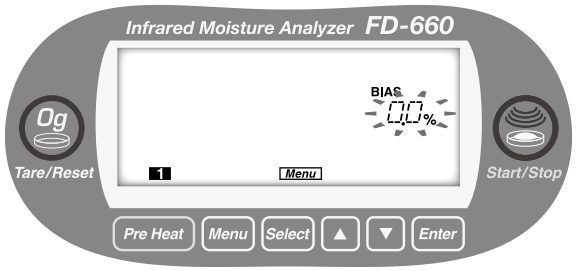


Move to menu item selection.

Every time the [**Select**] key is pressed, the menu items alternately blinks in the order of “MODE” → “TEMP” → “UNIT” → “OUTPUT” → “BIAS” → “CAL” → “MODE” → ….

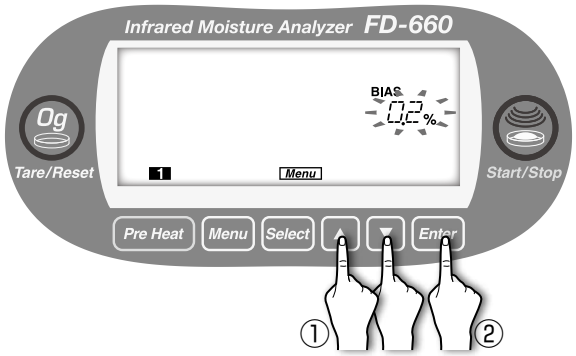
① Press the [**Select**] key.
② Press the [**Enter**] key after “BIAS” blinks.

4



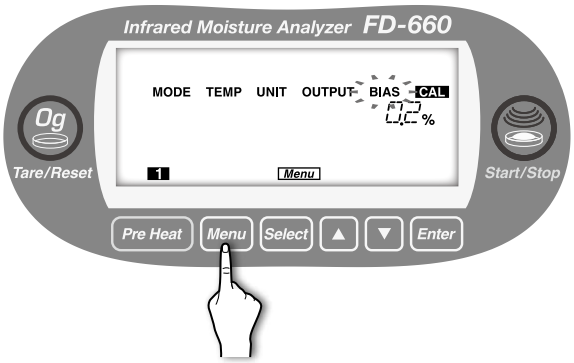
Move to the setting of the offset value.
The currently selected offset value blinks.

5



① Press the [▲] or [▼] key to specify the desired offset value (0.2% is specified in the example on the left).
② Press the [**Enter**] key.

6

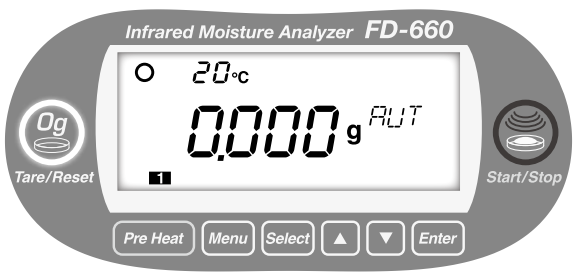


The blinking offset value changes from blinking to lit, and the offset value is specified.
"BIAS" starts blinking.

To exit from "BIAS" menu setting, press the [**Menu**] key. The screen returns to the weight display screen.

To specify other menu items, press the [**Select**] key.

7



8-6. CAL (scale calibration)

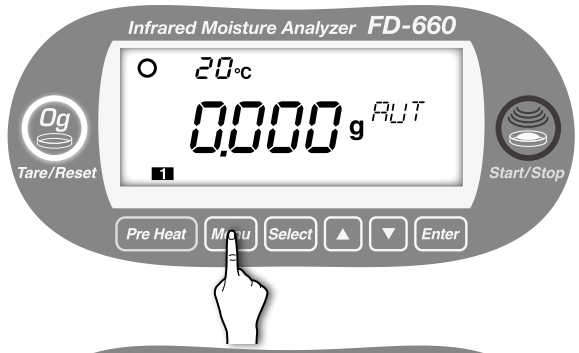
The scale calibration is performed with 0-point and 50-gram weight.
Separately prepare a weight of 50 g with one-thousandth (mg) indication described and less than 28 mm in height.

- ***The power to the unit should be turned on at least 30 minutes before calibration is performed in order to ensure accurate calibration.***
- ***This unit is significantly sensitive to ambient environment such as vibration, wind, and the like. Calibration should be performed after stabilizing the operating environment.***
- ***It is impossible to accurately calibrate the scale immediately after performing measurements or at any other time when the heater lid is hot. Allow the temperature of the heater lid to cool down to ambient temperature before performing calibration.***
- ***The weights used should consist of standard OIML weights or some other type of non-magnetic weights.***
- ***The heater lid must be closed during calibration to avoid wind effects. If you wish to abort a calibration already in progress, press the [Tare/Reset] key.***
- ***An 'Abort' message will be displayed and the screen will return to a weight display.***

CAL is performed for all measuring setting storage areas.

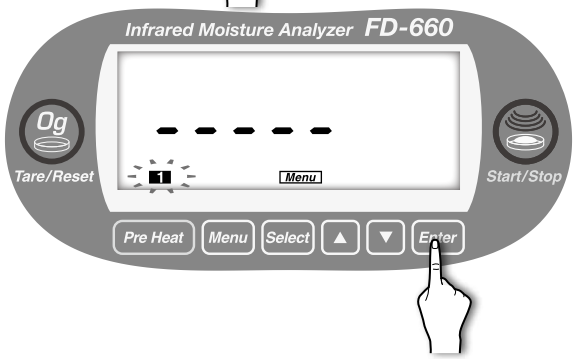
● Setting procedure

1



With the display showing the weight in grams, press the [**Menu**] key.

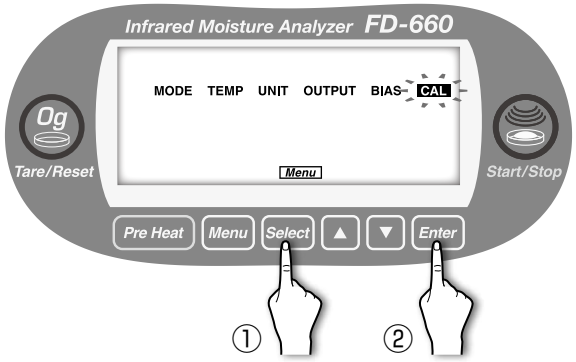
2



[Menu] lights up, and the number of the current measuring setting storage area blinks.

The CAL setting is common to all measuring storage areas, and therefore, selection is not required.
Just press the [**Enter**] key.

3

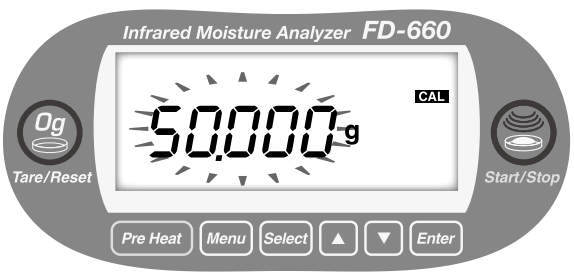


Move to the selection of menu item.

Every time the [**Select**] key is pressed, the menu items alternately blinks in the order of "MODE" → "TEMP" → "UNIT" → "OUTPUT" → "BIAS" → "CAL" → "MODE" → ….

① Press the [**Select**] key.
② Press the [**Enter**] key after "CAL" blinks.

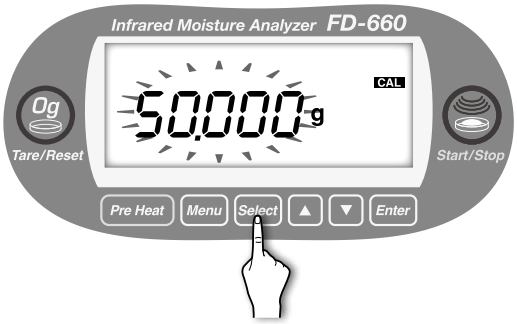
4



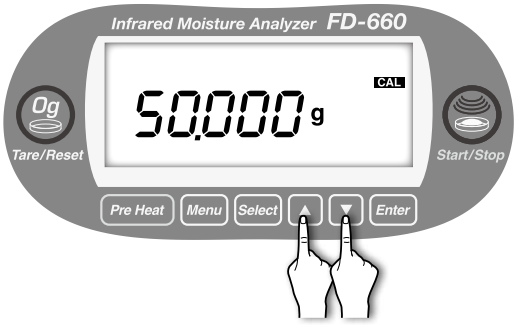
"CAL" turns to lit, and other items are turned off.
"50.000g" blinks.
Calibration with 50 grams is started.
When the weight to be used is 50.000 grams, proceed to the step **5 on page** 38.

When the weight to be used is not 50.000 grams, refer to the right page to perform the setting.

When the weight to be used is not 50.000 grams;

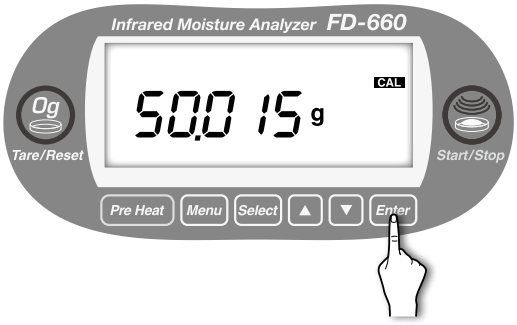


Press the [**Select**] key after “50.000g” blinks.



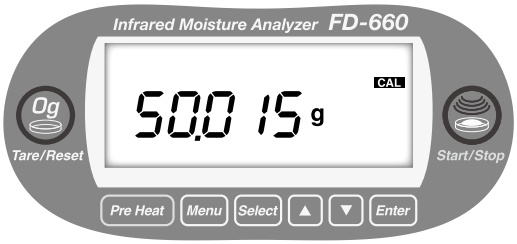
Blinking turns to lit.

Press the [▲] or [▼] key to specify the mass of the weight.



In the example on the left, 50.015 grams is specified.

Press the [**Enter**] key.



The specified mass of the weight is displayed.

Set up is complete.

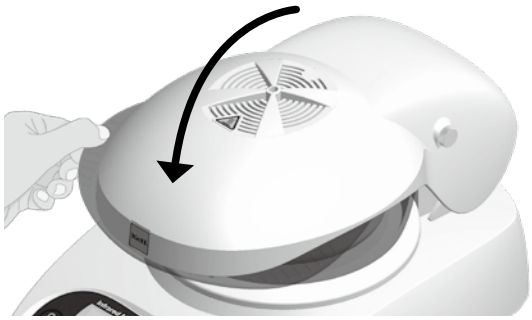
Proceed to the step **5** on the next page.

5

Open the heater lid, and place the weight on the sample dish.

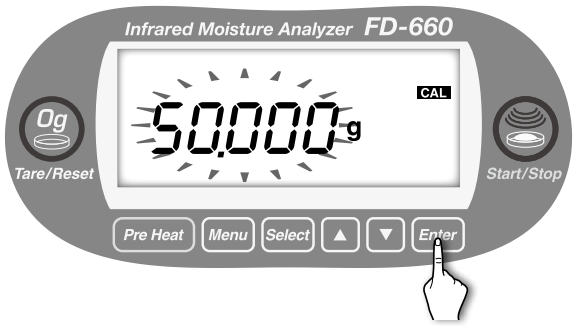
* ***When placing a weight on the sample dish, it should be placed so that the center of gravity of the weight is near the center of the dish.***

6

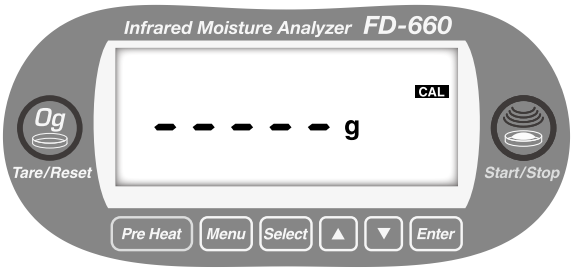


Close the heater lid, and press the [**Enter**] key.

* ***Be sure to close the heater lid.***

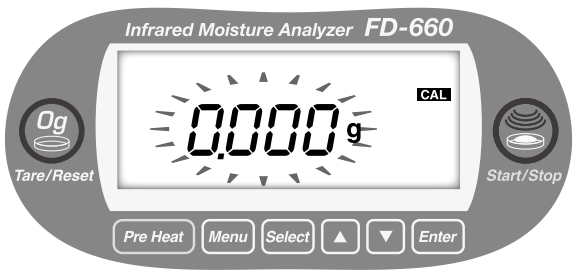


7



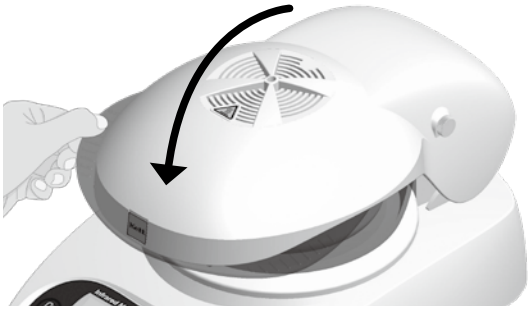
"-----g" is displayed.
Now, the 50-gram calibration is in progress.

8



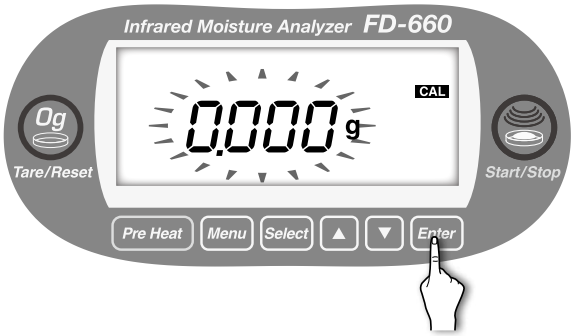
After a short interval, "0.000g" blinks.
Open the heater lid, and remove the weight from the sample dish.

9

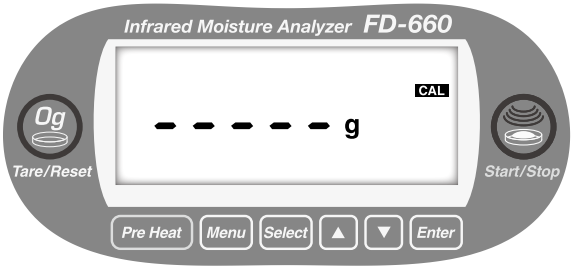


Close the heater lid, and press the [**Enter**] key.

**** Be sure to close the heater lid.***

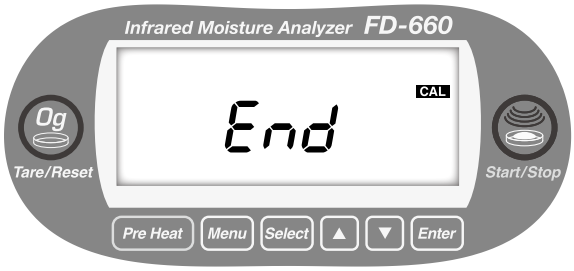


10



"-----g" is displayed.
Now, 0-point calibration is in progress.

11

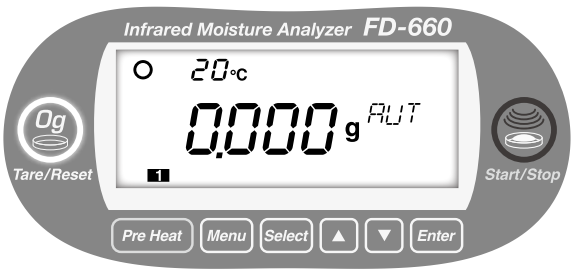


After a while, scale calibration is completed, "End" is displayed.

**** If this unit is connected to a printer, a calibration record is automatically printed out.***

```
        WEIGHT CALIBRATION

        KETT ELECTRIC LABORATORY
        Model : FD-660
        S/N : BEH2345

        REF=  50.000g
        BFR=  50.001g
        AFT=  50.000g
        Signature :

        ----------------------------------
```

12



The regular weight display screen automatically resumes.

9. Maintenance

9-1. How to Perform Maintenance

Maintenance should be performed after turning off the power, unplugging the power cord, and ensuring that the moisture tester is thoroughly cooled.

① How to disassemble
Remove the sample dish first, followed by sample dish stand, and the wind shield in order.

**** Hold the center part of the dish stand, and remove vertically.***
Do not apply excessive force to its shaft. Failure to observe this may damage the instrument.

② Installing parts and components
See “5. Assembly and Installation” on page 12.

③ Remove any traces of spillage or soiling from samples.

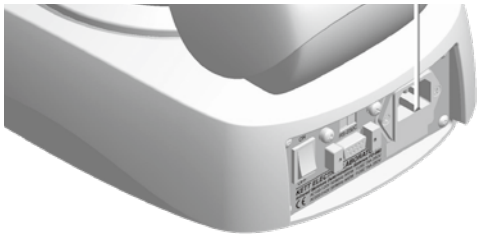
④ Maintenance of the main unit
- Wipe off the dirt with a dry, soft cloth.
- Avoid applying strong pressure when wiping, even if you find dirt or soiling difficult to remove.
- If dirt remains, wipe with a damp cloth (not dripping) containing water and a small amount of neutral detergent. Rinse the cloth in running water, wringing it well, and wiping off the detergent. Then dry the instrument
- Do not touch the glass part of the heater with your bare hand.

⑤ Maintenance of parts and accessories
- The spoon, sample dish, and wind shield can be washed in water with a sponge.
- Remove the sample dish and wind shield from the main unit when washing them.
- Wait until completely dry and then reattach them to the main unit before using the unit again.

**** When using detergents, be sure to follow the instructions provided with the detergent in question.***
**** Never use paint thinner, benzene, or any volatile cleaning agents, or any abrasive cleansers or polishes.***
**** Never use wire brushes or other hard cleaning tools.***

9-2. Fuse Replacement

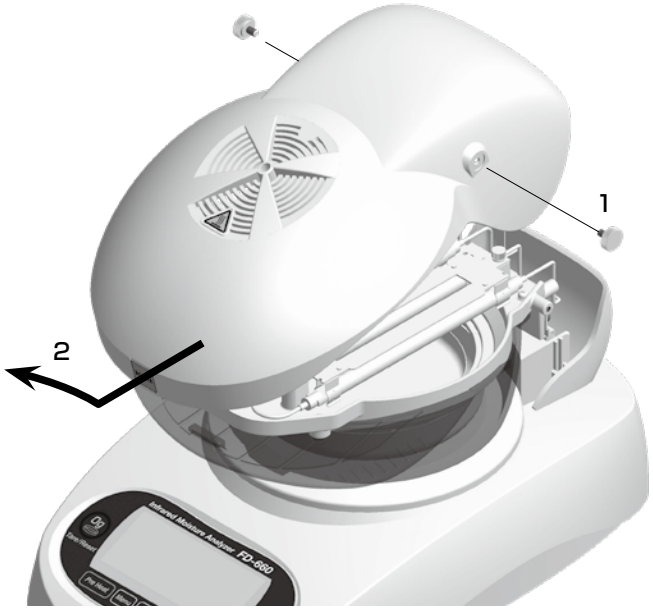
① Turn off the power, and unplug the power cord.
② Insert a flat-blade screwdriver from the top of the fuse holder on the rear panel of the main unit, and pull the fuse holder towards you.



③ Remove the fuses from the fuse holder and check to see if any are burned out.
④ If there are no burned-out fuses, return the fuse holder to its original position. If there is a burned-out fuse, replace it with one of the spare fuses or with a compatible (T8A 250V) fuse.
⑤ Put the fuse holder back to its original position in the main unit.

9-3. Heater Replacement

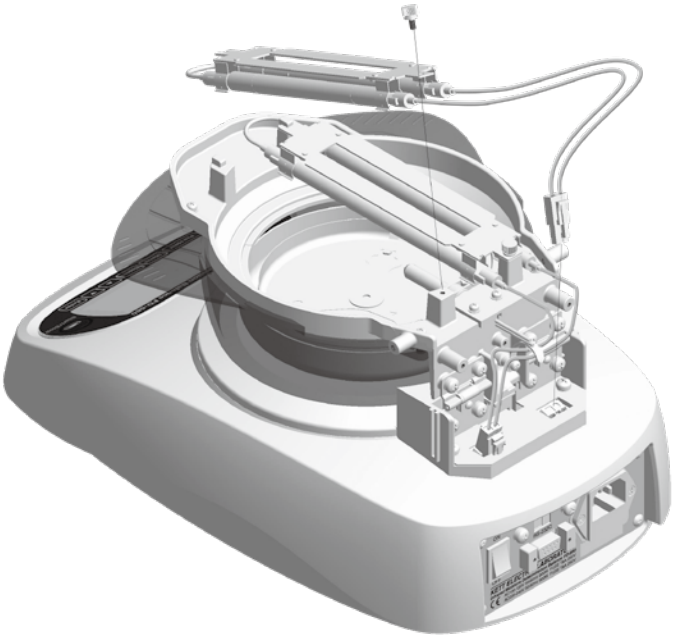
① Turn off the power, and unplug the power cord.
② Remove the heater lid.



1. Remove the screws on both sides of the heater lid after ensuring that the heater lid and heater are thoroughly cooled.

2. Lift the heater lid diagonally forward while moving it forward, and remove the lid.

③ Remove the heater.



1. Disconnect the coupling on the back side of the main unit. If it is hard to disconnect the coupling, open the rear cover slightly from side to side and try to disconnect it.
2. Raise the bracket holding the wire of the heater, and disengage the wire.
3. Remove the metal thumb nut that secures the heater holder base.
4. Disengage the hook while moving the heater holder base backward, and lift it.

④ Mount a new heater.
Firmly secure the wire and holder base as to cross the wire.

**** Plug the the connector on left side, if you are replacing the right heater.***
Plug the the connector on right side, if you are replacing the left heater.

**** Do not touch the glass part of the new heater with your bare hands.***
If an oil spot or soil is attached to the glass surface, the heater may deteriorate, and its life may be shortened.

⑤ Finally, attach the heater lid.

10. Error Display

If any of the following error messages are displayed, follow the procedures described below to check for the cause of the error and take appropriate actions to remove the error. If the error cannot be removed by following the procedures described below, then you should contact the vendor from which you purchased the unit.

Error display	Description	Action to be taken
Er102	A sample dish stand and a sample dish are not mounted.	Properly mount a sample dish stand and a sample dish. (See “5. Assembly and Installation” on page 12)
Er103	The sample weight is too light. (1 gram or less)	The minimum sample weight for this product is 1 gram. Try measuring again using a sample of at least 1 gram. Press the [**Tare/Reset**] key to cancel the error.
Er104	The sample weight is too heavy. (80 grams or more)	The maximum sample weight which can be used with this product is a weight of 120 grams. Try measuring again using a sample of 80 grams or less. Press the [**Tare/Reset**] key to cancel the error.
Er201	Invalid moisture content value (when the sample weight increases by 0.1 grams or more)	Set properly the sample dish, the dish stand, and the wind shield. Refer to page12 (5)"Placing the sample dish stand." This error is displayed when a sample is added during measurement. Press the [**Tare/Reset**] key to cancel the error.
Er202	Invalid moisture content value (when the sample weight in process is -1 gram or less)	Set properly the sample dish, the dish stand, and the wind shield. Refer to page12 (5)"Placing the sample dish stand." Press the [**Tare/Reset**] key to cancel the error.
Er306	Heater lid open	Press the [**Tare/Reset**] key to cancel the error. Refer to page16 "(4) Starts measurement."
Er307	Error during preheating	Operate in the temperature range of 5-40ºC. Confirm the power supply voltage setting (page 14, "specify the power supply voltage")
	Heater disconnection (This message appears only when preheating)	Replace the heater if it does not light up when heating. (page 41, "9-3. Heater Replacement")
Er401	Internal weight measuring unit communications error	Turn off the power and then turn the power back on again.
Er501	Invalid weight used during scale calibration	Use a calibration weight of the correct weight. Press the [**Tare/Reset**] key to cancel the error.
Er502	Instability encountered during scale calibration	Perform the calibration again with the unit placed on a flat, stable surface not subject to the effects of external vibration, drafts, or wind. Press the [**Tare/Reset**] key to cancel the error.
Er701	Power error	Turn the power to the unit off, check to make sure that the power conversion switch located on the back of the unit is set to the correct position. Then turn the power back on again. (page12, "5. Assembly and Installation")
	Power supply voltage automatic detection error	Specify the power supply voltage manually. (See "■ How to manually specify the power supply voltage" on page 14)
	Heater disconnection (Only when the input voltage is 220-240V)	Replace the heater if it does not light up when heating. (page 41, "9-3. Heater Replacement")

If any of the following errors are displayed, it indicates that a failure or breakdown of internal parts or components has occurred. Contact the vendor from which you purchased the unit.

Error display	Failure information
Er301	Temperature sensor short-circuit
Er302	Temperature sensor not connected
⚠ Er303	Heater overheated This error indicates the existence of an extremely hazardous condition. Turn off the power immediately. Please contact us urgently.
Er304	Temperature measurement error
Er305	Heater overheated
Er601 Er602 Er603	Auto-taring mechanism error
Er702	Power error
Er801	Memory error

Warning

- Reprinting of part or the whole of the contents of this document is strictly forbidden.
- The visual appearance, screen, etc. of the products and accessory items mentioned in this document may differ from those of the actual products and accessory items, although operation and function will not be affected.
- Although the contents of this document were drafted with great care, if you notice unclear points, errors, omissions, etc., please contact our company.
- Regardless of the above warnings, responsibility is not assumed concerning effects resulting from use of this document.

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