● Optional equipment

● Printer VZ-330

Example of VZ-330 output

```
KETT ELECTRIC LABORATORY
Model : FD-800
S/N : AG50000
ID : KETT0001
Code : A-05
Date/Time : 2007.10.07/16:46
Condition : 00
Unit : Wet Base Moist.
Temp. mode : T2
Mode : Auto
Setting Temp. : 190 C
Auto Stop Cond. : 0.05%
Bias : 0.00%
Wet-Mass :   7.4490

Time  Temp.  Moist.
(min)  (C)   (%)  0     4     8     12    16    20%
 0.0    25   0.00 |
 0.5    85   0.17 |
 1.0    165  1.54 |*
 1.5    189  3.27 | *|
 2.0    190  6.05 |  *
 2.5    192  8.05 |   |*
 3.0    190  10.04|   | *
 3.5    191  11.75|   |  *
 4.0    189  12.24|   |   *
 4.5    191  12.57|   |   |*
 5.0    190  12.77|   |   | *
 5.5    190  12.93|   |   |  *
 6.0    190  13.05|   |   |  *
 6.5    190  13.16|   |   |  *|
 7.0    191  13.25|   |   |   *
 7.5    190  13.34|   |   |   *|
 8.0    191  13.40|   |   |   *|
 8.5    190  13.44|   |   |   *|

Dry-Mass :   6.4475
```

● Radiation thermometer calibration kit GF-200 (with a digital thermometer, heating standard sample)

● Deodorizing/windproof case FW-100

The deodorizing/windproof case FW-100 can be installed within the FD-800 to reduce errors caused by the influence of external airpflow on the high precision balance. Further, since a deodorizing filter is provided on its upper portion, it is also possible to reduce odours created during heat drying.

● Available in many different fields.

● Can measure food related items such as cereals, starch, flour, instant noodles, brewed products, marine products, processed seafood, processed meat, spices, confectionaries, dairy products, dried foods, and vegetable oils. It can also measure industrial goods such as pharmaceuticals, mineral sands, corks, frits, cement, chemical fertilizers, paper, pulp, cotton, and textiles.

●Specifications	FD-800
Measurement format	Evaporation weight loss method (Heat drying and weight loss method)
Measurement object	Powder particle, liquid, paste, etc.
Sample weight	0.1 g~120 g using selective weight sampling method
Minimum displayable units	Switch between moisture 0.01 % / 0.1 %, mass 0.001 g
Measurement range	0 %~100 % (wet base, solids), 0 %~500 % (dry base)
Reproducibility (Standard deviation)*1	Sample mass 5 g and above 0.05 % (including water content) Sample mass 10 g and above 0.02 % (including water content)
Measurement modes	Automatic halting mode Timed halting mode (with measurement times of 1~240 minutes or continuous measurement mode, with a maximum measurement time of 12 hours) High-speed drying mode (used with either automatic or timed halting mode) Low-speed drying mode (used with either automatic or timed halting mode) Stepped drying mode (5 steps) Predictive (comparative) measuring mode
Temperature range	30 ˚C~180 ˚C in 1-degree increments when using a thermistor (T1) 30 ˚C~250 ˚C in 1-degree increments when using a radiation thermometer (T2) *2
Display	Backlight LCD display (137 mm x 43 mm)
External output	RS-232C interface
Communications	Data output with FD-800 Data logger software “FDL-01”
Storage of measurement conditions	100 of measurement conditions
Data memory	100 of data
Temperature/humidity operating range	5 ˚C~40 ˚C, maximum of 85 % RH
Heat source	Mid-infrared quartz heater (200 W x 2)
Temperature sensor	Thermistor (T1), Radiation thermometer (T2)
Power supply	AC100~120 V/220~240 V (50/60 Hz)
Power consumption	Maximum 900 W
Weight and external dimensions	Net:5.4 kg / Gross:9.5kg, 220 mm x 415 mm x 220 mm (W x D x H)
Sample dish	SUS sample dish (Diameter: 130 mm; Depth 13 mm)
Items included	2 sample dishes, 2 sample dish handlers, sample dish tray, wind shield, power cord, spoon & spatula set, 2 spare fuses (8 A), 2 packages of aluminum foil sheets (10 per package), glass fiber sheets (10 sheets), operating manual
Optional equipment	Printer (printer VZ-330, interface cable VZC-14, printer paper (10 rolls), aluminum foil sheets (500 sheets) GF-200 radiation thermometer calibration kit (with a digital thermometer, heating standard sample) *3 FD-800 Data Logger software FDL-01 (RS-232C interface cable, USB-RS232C conversion cable) Sample crusher TQ-100, deodorizing/windproof case FW-100 Glass fiber sheets (100 sheets)

Unibloc is a trade name of Shimadzu Corporation. MS Excel is a trademark of Microsoft Corporation.

*1.As per Kett’s in-house stipulated measurement conditions and standard samples.

*2.If the T1 temperature exceeds 180 ˚C during a measurement, the set temperature may not be achieved.

*3.For calibrating the radiation thermometer. For details, read the operating manual included with the “Radiation themometer calibration kit”.

Measurable material

● Material that will not cause dangerous chemical reactions when heated.

● Material that will dry due to evaporation of water or other substance that is to be measured.

⚠ Safety precautions

● For safe operation, ensure you read the Operating Manual before use.

● Do not attempt to measure material that will cause dangerous chemical reactions on heating. Further, the tester becomes very hot, so please take precautions against burns and/or fire.

KETT ELECTRIC LABORATORY

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ISO 9001

Management System Enhancement Department of the Japanese Standars Association (JSA) registers the Quality Management System of the avove organization, whith conform to JIS Q 9001,ISO 9001.

The Scope of the Registration.

Design,development and production management of Moisture Testers,NIR Composition Analyzers,Grain Inspectors and Coating Thickness Testers. Calibration and repair of Moisture Testers,NIR Composition Analyzers,Grain Inspectors and Coating Thickness Testers.

VEGETABLE OIL INK This brochure uses environmentally friendly “vegetable soy ink” and waste paper blend recycled paper”.

Requests

● For enquiries regarding this product, please contact us at the address above, or by e-mail.

● To improve the product, specifications and the external appearance may be changed without notice. In addition, please note that due to printing, the product’s color may appear different from the actual article.

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Kett

SCIENCE OF SENSING

FD-800

Infrared Moisture Determination Balance

KETT ELECTRIC LABORATORY

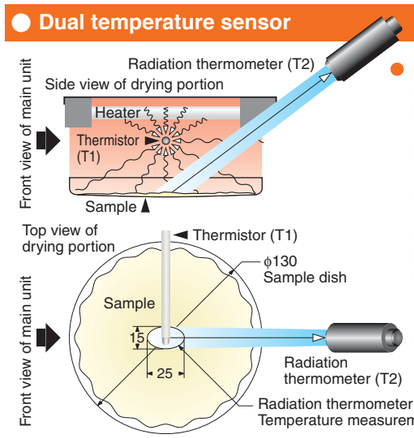
FD-800 Infrared Moisture Determination Balance

FD-800 is an instrument positioned at the top of Kett's infrared moisture determination balance series. It employs a revolutionary dual temperature sensor method to enable high precision moisture measurements. Conventional models measured the temperature within the drying chamber by using a thermistor, and controlled the heat drying temperature. Temperature measurement using thermistors is a procedure that is stable, and known to be reliable through years of experience. However, with a demand for an even more accurate moisture measurement, problems such as the temperature of the sample following the environmental temperature, and the fact that because of the shape of the sample it is difficult to maintain a constant distance between the test piece and the heater or thermistor, these inconsistencies have adversely affected the measuring accuracy. Thus, in addition to a thermistor, the tester is mounted with a radiation thermometer to measure the sample temperature without coming in contact with it. This complements to an extent the disadvantages of the thermistor, enables the user to optimise the heat drying settings to match the characteristics of the sample, and allows a reduction in measuring time and increase in measurement accuracy without burning or deforming the sample. This tester can handle highly advanced moisture control, and is positioned as a moisture sensor for quality control departments or testing divisions requiring a high level of moisture control.

Full spec model mounted with dual temperature sensor.

● **In addition to the thermistor (T1), the tester is mounted with a radiation thermometer (T2) that directly measures the temperature of the sample. The balance employs a highly advanced temperature measuring method that makes maximum use of the merits of both systems.**

Dual temperature sensor



● In addition to environmental temperature control using a conventional thermistor (T1), a radiation thermometer (T2) was employed to directly measure a new sample temperature, thus allowing high level temperature control that makes the maximum use of the merits of both types. (Patent pending).

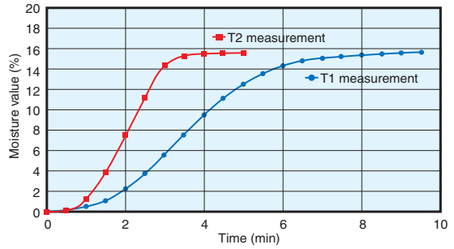
Measuring time shortened

Comparison of thermistor (T1) measurement and radiation thermometer (T2) measurement.
(Measurement example: Sodium Tartrate 2H20)

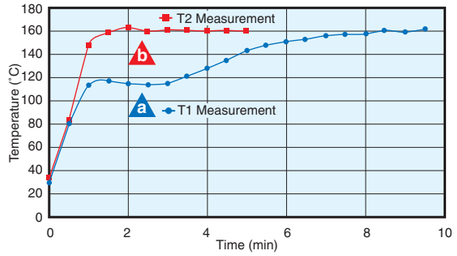
Measurement result : (T2) measurement was achieved in about half the time of the (T1) measurement

Temperature mode	Thermistor (T1) measurement	Radiation thermometer (T2) measurement
Moisture value	15.68 %	15.66 %
Measurement time	9.5 min.	5 min.

Drying curve: (T2) measurement was approximately half the time of the (T1) measurement



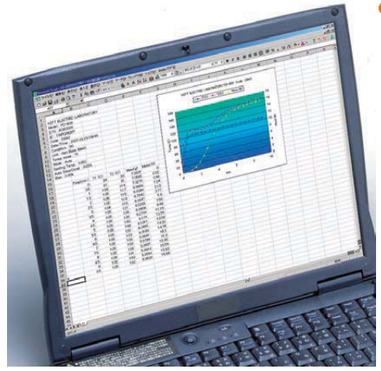
Sample surface temperature: Starting with a high temperature, (T2) measurement conducts heat drying efficiently



●Sample surface temperature T1 measurement data (a) shows the temperature of the sample surface when dried at T1=105 °C. ●Not all objects measured will necessarily show the same slope of the drying curve vs drying time as shown above.

●When heat drying samples, in the initial drying stage, the moisture is high, and increase in sample surface temperature is slow. With T1 measurement using a conventional thermistor (a), it was not possible to measure the temperature of the sample surface, and thus it was not possible to conduct this measurement. On the other hand, with T2 measurement (b) using the radiation thermometer, because the temperature of the sample surface is measured directly, it is possible to swiftly increase the sample surface temperature from initial drying to the target temperature, and shorten the drying time. During inititial drying, because the sample surface has a high moisture content, even if there is an addition of a large amount of thermal energy, it will not burn. In the second half of the drying stage, moisture is reduced and the sample becomes easier to burn. However, with T2 measurement, the surface temperature of the sample is under constant observation and control, and thus there is no risk of burning. As such, with T2 measurement, time can be shortened without the sample burning, and it is possible to obtain ideal heat drying.

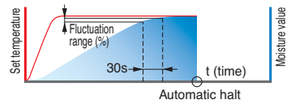
Optional data logger software FDL-01 (to be released soon)



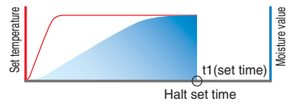
● By connecting the FD-800 to a PC in which the optional "Data logger software FDL-01 *3" and MS Excel are installed, it is possible to transfer and save the measurement data to the PC in real time. Also, it is possible to display the recorded measurement data graphically, so that the moisture and temperature condition changes can be visually confirmed. The graph can show the moisture, thermistor (T1) temperature, and radiation thermometer (T2) temperature. *2

Various moisture measurements are possible with the multiple drying mode

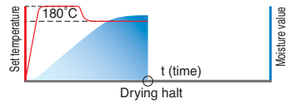
● **Automatic halting mode**
The sensor will automatically halt if the 30s interval moisture change (fluctuation range%) goes below the set value.



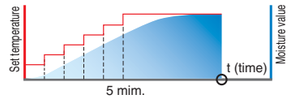
● **Timed halting mode**
Sensor will halt at the pre-set time (t1)



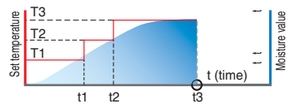
● **High-speed drying mode**
Shortens the measuring time by the high-speed drying during the initial drying stage, after which when the moisture is reduced, the set temperature is returned to normal.



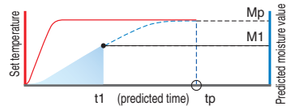
● **Low-speed drying mode**
Slowly dries samples in which surface membrane forms or samples that may break down at high temperatures.



● **Stepped drying mode**
Measures drying conditions in steps, and measures samples that contain a large amount of water, such as surface water or crystallized water.



● **Predictive (comparative) measuring mode**
Predicts future changes from the drying process and determines a measurement value (Mp). Measuring time is shortened.



Fluctuation range chart in which the user can see the drying status

● **Fluctuation range display**

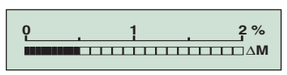


Fig. 1

● **Moisture fluctuation range ΔM and moisture value M**

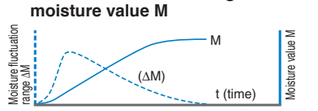
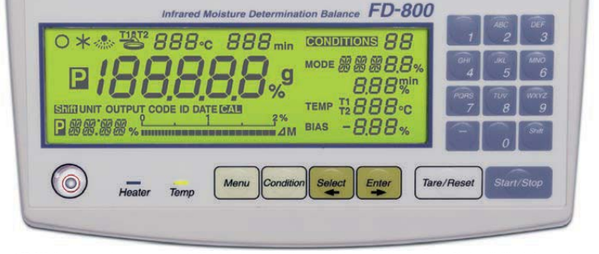


Fig. 2

● **Fluctuation range chart**
The heat drying with the Infrared Moisture Determination Balance changes like "M" in Fig 2, where a large amount of moisture is evaporated during the initial drying stage, and declines in the second half. "ΔM" expresses the fluctuation range of moisture. This "ΔM" is shown on the display as the fluctuation range. (Fig 1) By watching this change, the user can measure the drying process and the approximate the end of drying.



●FD-800 display area and operation switch. ●LCD is fully displayed for the purpose of photographing the display. Display will differ during actual use.

● **Advanced temperature control.**
In addition to temperature control using a conventional thermistor (T1), a radiation thermometer (T2) is newly employed to directly measure sample temperatures, allowing advanced temperature control that makes the maximum use of the merits of both types.

● **Measuring time shortened.**
By directly measuring the sample temperature, it is possible to efficiently heat the sample and greatly shorten the measuring time.

● **High precision measurement.**
Since the sample temperature can be measured, it is possible to set optimal drying conditions that match the characteristics of the sample, avoid burning or quality changes, and enable a more accurate moisture measurement.

● **The FD-800 employs a high precision aluminium integral-type mass sensor (Unibloc) *1.**
A highly reliable measuring unit that has superior response, temperature, and anti-shock characteristics.

● **The FD-800 employs a new type of auto tare mechanism.**
Since the measurement is performed automatically while taking the zero-point calibration of the balance, scale drift is compensated even over long measurement times, allowing high precision measurements.

● **A mid-infrared quartz heater was employed as a heat source.**
The quartz heater (max energy wavelength 2.6μm) is superior in drying efficiency for a wide range of samples, is not greatly affected by differences in sample colour, and has no overshoot caused by sample surface temperature, enabling ideal drying. What's more, this heating lamp also provides a long service life 5~10 times greater (20,000 to 30,000 hours) than older infrared or halogen lamps.

● **The FD-800 comes with six measuring modes to handle a range of measurement requirements.**
The FD-800 provides a wide selection of measuring modes (automatic halting mode, timed halting mode, high-speed drying mode, low-speed drying mode, stepped drying mode, and predictive (comparative) measuring mode) which makes it possible to perform measurements under the drying conditions most appropriate to the drying characteristics of the sample being measured.

● **The FD-800 enables the saving and registering of 100 measuring conditions (drying temperature, measurement mode).**
The FD-800 provides an area to save measurement conditions, and by saving the measurement conditions in this area, measurement preparations can be performed smoothly.

● **The FD-800 displays 30s interval moisture change volume (ΔM) numerically and on a scale.**
Moisture changes (ΔM) are shown on the display area. This is effective for measuring when drying is complete, and to determine the final measuring conditions.

● **Also available is the optional software "Data Logger software FDL-01".**
By connecting the FD-800 to a PC, it is possible to transfer measurement data into an MS Excel compatible worksheet.

● **May also be connected to the optional printer.**
By connecting the FD-800 to an optional printer (VZ-330), information such as the intermediate drying state and final measured values can be printed out in graphical form.

● **The radiation thermometer can be calibrated.**
Also available is the optional radiation thermometer calibration kit GF-200.

*1 Unibloc is a trade name of Shimadzu Corporation. *2 MS Excel is a trademark of Microsoft Corporation.

● **Can measure a variety of sample forms.**

Able to measure most materials if only the water content of the material evaporates through heating and the material does not cause dangerous chemical reactions.

● **Can measure a variety of materials.**