UniBloc Moisture Analyzer

MOC63u

Safety Precautions

Read instruction manual before using this instrument.

- Use this instrument for measurements in which water vaporizes from the sample under heating.
- The temperature of the heater installed in this instrument becomes higher than the set heating temperature for the sample.
- Any sample that is explosive, inflammable or may cause hazardous reaction under heating must not be measured with this instrument.

Optional accessories

- Printer EP-80
- Printer EP-90
- In-use protection cover for display (5 pieces)
- Aluminum sheet
- Fiberglass sheet
- Temperature calibration kit (*2)
- Sample pan (SUS)
- RS-232C cable
- USB connection cable
- Halogen heater for replacement (*3)

Standard accessories

- Sample pan
- Aluminum sheet
- Sample pan handler
- In use protection cover
- Fuse

Specifications

<table>
<thead>
<tr>
<th>Max</th>
<th>Min</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capacity</td>
<td>Minimum readability</td>
</tr>
<tr>
<td>Repeatability</td>
<td>*1</td>
</tr>
</tbody>
</table>

- Drying Heater
  - Power: 400W
  - Temperature range: 50-200°C (1°C increments)
  - Display: LCD with backlight

- Pan size: φ 95mm
- Dimensions (W×D×H): 202 × 336 × 157
- Weight: Approx 4.2kg
- Operational temperature and humidity range: 5 to 40°C, 85%RH or lower

Measurement modes

- Standard□□ (Easy start/Automatic end/Timed end)
- Rapid drying□ (Easy start/Automatic end/Timed end)
- Slow drying□ (Easy start/Automatic end/Timed end)
- Step drying
  - 1-240 minutes or continuous (max 12 hours)

- Interface: RS-232C (9-pin connector) I/O port, USB port

- Option
  - Sample pans (3 aluminum pans), pan supporter, windbreak, Heater insulation plate, aluminum pans (50 disposable pans), Sample pan handler, power cable, spare fuses (2), protective display cover, hexagonal wrench

- (*1) The repeatability (standard deviation) value is from a standard measurement (sample: sodium tartrate dihydrate). This value is not guaranteed for all samples, environments, and measurement conditions.

- (*2) Calibration is performed at one temperature (100 °C).
  Contact your Shimadzu representative if you would like to perform calibration at two or more temperatures, or to change the calibration temperature.

- (*3) The halogen heater can be removed and replaced by the user.

Company names, product/service names and logos used in this publication are trademarks and trade names of Shimadzu Corporation or its affiliates, whether or not they are used with trademark symbol “TM” or “®”.

Third-party trademarks and trade names may be used in this publication to refer to either the entities or their products/services. Shimadzu disclaims any proprietary interest in trademarks and trade names other than its own.

For Research Use Only. Not for use in diagnostic procedures.

The contents of this publication are provided to you “as is” without warranty of any kind, and are subject to change without notice. Shimadzu does not assume any responsibility or liability for any damage, whether direct or indirect, relating to the use of this publication.

© Shimadzu Corporation, 2015

www.shimadzu.com/an/
MOC63u

Trust the MOC63u for Both Speedy and Accurate Measurements

Moisture ratio measurements are indispensable for quality control and as checks of raw materials in a variety of industries including food products, chemistry, and pharmaceuticals. The MOC63u electronic moisture analyzer is capable of accurate, quick and easy moisture ratio measurements. Just place the sample in the sample pan and close the cover to start the measurement. This instrument can accommodate virtually any sample, and will contribute to enhanced user productivity.

Main Applications

Customers in the Food Product Industry
- Research and development of food products, drinks, and food additives
- Inspections of food products manufacturing processes and products
- Measurements of raw materials (such as rice, malt, tea leaves, and corn starch)

Customers in the Chemical Industry
- Research and development of samples, and inspection of products (solids, powders, pellets, films, and liquid samples)
- Moisture ratio measurements for plastics, rubbers, paints, pesticides, and functional materials

Customers in the Pharmaceuticals and Cosmetics Industries
- Pharmaceuticals research and development (pills, granules, capsules, and ointments)
- Cosmetics research and development (such as hair products, face lotions, and soap)
- Inspections of pharmaceutical and cosmetic manufacturing processes and products

Customers in Water Supply and Environmental Fields
- Moisture ratio measurements and inspections of sludge
- Moisture ratio measurements and inspections of soil
- Moisture ratio measurements and inspections of waste matter

Customers in the Automotive and Electrical Machinery Industries
- Moisture ratio measurements of plastic pellets and plastic parts
- Moisture ratio measurements of toner
- Moisture ratio measurements of foundry sand

Main Features

Simple Operation
Select the automatic starting mode, place the sample, and close the heater cover to start the measurements. The preparation for measurement is so simple that you do not even have to press the start key.

The Sample Pan Size Is a Spacious 95 mm Dia.
Generally, the wider, thinner, and more uniformly the sample is spread, the more precise the measurement. Uniform heating is provided by adopting a cleverly shaped reflector (patent pending).

A Wealth of PC Connection Functions
A USB connector is built in as standard for connecting to a PC. It can also be used in conjunction with the WindowsDirect function (patented).

- Equipped with the UniBloc aluminum block, to provide accurate moisture measurements.
- Equipped with a high output halogen heater capable of rapid heating.
- Wide observation window to allow checks of sample status during heating.
- 60 g capacity/0.001 g minimum display
- The temperature on the pan can be set between 50 °C and 200 °C.
- Can store 10 sets of measurement conditions and 100 data items.
- Cleaning and maintenance are easy.
- Liquid and paste samples can also be measured using fiberglass sheets.
- Energy saving design (32 % reduction in comparison to previous Shimadzu models)
Simple Operating Panel and Excellent Expandability

(1) A cross-shaped key layout has been adopted for excellent operability.
(2) A real time indicator has been adopted, which blinks to show the measurement status.
(3) An LCD with backlight has been adopted for excellent visibility.
(4) Graphics are provided to let you confirm the pan status in real time.

Accommodating a Range of Samples with a Variety of Measurement Modes

A Total of Five Modes Makes This Balance Compatible with a Variety of Sample Measurements

**Ending modes**
- Automatic ending mode
  Automatically ends measurement when moisture loss over the previous 30 seconds becomes smaller than specified percentage.
- Timed ending mode
  Automatically ends measurement when the specified amount of time has elapsed.

**Alternate drying modes**
- Rapid drying mode
  First dries with the highest temperature for the specified period, then shifts to the specified temperature shortening measurement time.
- Slow drying mode
  Gently heats samples that might solidify at the surface or samples that reduce under high temperature.
- Step drying mode
  Allows step-by-step changes in drying conditions. This feature is useful when measuring samples that contain a large amount of water.

This product conforms to Shimadzu’s Eco-labeled designation.
* Energy savings: 32% reduction as compared to the previous model
Sample Applications

Measurement of Milk

- Fiberglass sheets for liquid measurement were used to promote liquid evaporation.
- Two measurement conditions were used, timed ending and automatic ending modes. Essentially the same average values were obtained. With samples whose principal component has a relatively high evaporation temperature and also contains moisture, the same results will be obtained regardless of the mode used.

<table>
<thead>
<tr>
<th>Sample mass (g)</th>
<th>Moisture ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>1.081</td>
</tr>
<tr>
<td>2nd</td>
<td>1.025</td>
</tr>
<tr>
<td>3rd</td>
<td>1.031</td>
</tr>
<tr>
<td>Average</td>
<td></td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.047</td>
</tr>
<tr>
<td>CV (%)</td>
<td>0.05</td>
</tr>
</tbody>
</table>

The drying curve for milk in timed ending mode is shown below.

Photos of the milk before and after drying are shown below.

Measurement of Instant Coffee

- Commercially available powdered instant coffee was measured. A sample of approximately 1 g was placed in the pan, and the pan was shaken to spread the sample over the entire pan.
- Essentially no difference in the moisture ratio was evident in timed ending mode or automatic ending mode. When a high drying temperature is set to shorten the drying time, the radiant heat from the halogen lamp becomes significant, and sample surfaces are sometimes scorched. Accordingly, with colored samples and samples prone to degradation, it is better to set as low a drying temperature as possible.

<table>
<thead>
<tr>
<th>Sample mass (g)</th>
<th>Moisture ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>0.994</td>
</tr>
<tr>
<td>2nd</td>
<td>1.079</td>
</tr>
<tr>
<td>3rd</td>
<td>0.980</td>
</tr>
<tr>
<td>Average</td>
<td></td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.087</td>
</tr>
<tr>
<td>CV (%)</td>
<td>1.18</td>
</tr>
</tbody>
</table>

The drying curve for instant coffee in timed ending mode is shown below.

Photos of the instant coffee before and after drying are shown below.
Measurement of White Rice

- Polished *koshihikari* rice was used as the sample. The grains were measured as is, without pulverization.
- Almost no rice bran remained, so it was assumed that any lost weight would be due solely to moisture evaporation. There were few volatile components aside from moisture, so favorable repeatability was obtained.
- The entire sample turned yellow after drying. This was likely due to surface scorching.

![Drying curve for white rice in automatic ending mode](image1)

The drying curve for white rice in automatic ending mode is shown below.

![Photos of white rice before and after drying](image2)

Photos of the white rice before and after drying are shown below.

### Sample Measurement of Corn Starch

- Approx. 5 g of corn starch was added to the pan, and was spread over the entire surface using the tip of a spoon.
- No change in appearance was evident after drying.
- Favorable repeatability of 1 % max. was obtained.

![Drying curve for corn starch in automatic ending mode](image3)

The drying curve for corn starch in automatic ending mode is shown below.

![Photos of corn starch before and after drying](image4)

Photos of the corn starch before and after drying are shown below.
Measurement of Sludge Cake

- A sludge cake is created by drying sediments extracted from a sewage treatment plant. It is later incinerated. It is important to measure the moisture ratio, because the incineration energy will be excessive if there is too much moisture.
- A sludge cake is a moisture-containing solid, and may also contain fiber. This was placed on the pan, and pulverized to a diameter of about 10 mm or less. Because of the bad odor, taking the time to thoroughly pulverize it was impossible.
- The moisture ratio was 81%, with good repeatability. This is likely because the sample contains essentially no volatile components aside from water.

The drying curve for the sludge cake in automatic ending mode is shown below.

Photos of the sludge cake before and after drying are shown below.

Measurement of Plastic Pellets

- Plastic pellets consist almost entirely of polymeric materials, but there can be volatile components inside. The objective was to measure moisture adhering to the surface, so the drying temperature was set to 100 °C.
- Since the drying temperature was low, drying did not proceed easily. In timed ending mode, evaporation from the inside of the sample proceeded little by little, so an increase in the moisture ratio was evident over an extended period.
- In automatic ending mode, measurements will end if the change in the rate of decrease over 30 seconds falls below a set value. Accordingly, when samples with a low moisture ratio are analyzed at 0.05 % setting, the measurements will inadvertently end before the moisture is removed.

The drying curve for plastic pellets in timed ending mode is shown below.

Photos of the plastic pellets before and after drying are shown below.

<table>
<thead>
<tr>
<th>Measurement of Sludge Cake</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement conditions: 200 °C/AUTO 0.05 %</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Sample</th>
<th>Moisture ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>21:03</td>
<td>81.84</td>
</tr>
<tr>
<td>2nd</td>
<td>21:34</td>
<td>81.20</td>
</tr>
<tr>
<td>3rd</td>
<td>21:57</td>
<td>81.62</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>81.55</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.325</td>
<td></td>
</tr>
<tr>
<td>CV (%)</td>
<td>0.40</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement of Plastic Pellets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement conditions: 100 °C/TIME 25 min.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Sample mass (g)</th>
<th>Moisture ratio (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>10.080</td>
<td>0.12</td>
</tr>
<tr>
<td>2nd</td>
<td>10.016</td>
<td>0.13</td>
</tr>
<tr>
<td>3rd</td>
<td>10.290</td>
<td>0.13</td>
</tr>
<tr>
<td>Average</td>
<td></td>
<td>0.13</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.006</td>
<td></td>
</tr>
<tr>
<td>CV (%)</td>
<td>4.56</td>
<td></td>
</tr>
</tbody>
</table>
Moisture Ratio Measurements for Various Samples

The table below summarizes moisture ratio measurements for various samples using the moisture analyzer. For details, refer to the Shimadzu website.

<table>
<thead>
<tr>
<th>Sample</th>
<th>Sample Quantity</th>
<th>Measurement Mode</th>
<th>Set Temperature (˚C)</th>
<th>Measurement Time (min)</th>
<th>Moisture Ratio (%)</th>
<th>CV (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog food</td>
<td>1g</td>
<td>AUTO</td>
<td>160</td>
<td>5.48</td>
<td>6.45</td>
<td>3.17</td>
</tr>
<tr>
<td>Table salt</td>
<td>5g</td>
<td>TIME</td>
<td>200</td>
<td>10.00</td>
<td>0.08</td>
<td>6.93</td>
</tr>
<tr>
<td>Instant coffee</td>
<td>1g</td>
<td>TIME</td>
<td>120</td>
<td>10.00</td>
<td>7.43</td>
<td>1.18</td>
</tr>
<tr>
<td>Coffee beans (raw)</td>
<td>5g</td>
<td>AUTO</td>
<td>140</td>
<td>17.30</td>
<td>9.32</td>
<td>1.68</td>
</tr>
<tr>
<td>Coffee beans (roasted)</td>
<td>3g</td>
<td>AUTO</td>
<td>140</td>
<td>7.06</td>
<td>2.68</td>
<td>3.73</td>
</tr>
<tr>
<td>Green tea</td>
<td>5g</td>
<td>AUTO</td>
<td>120</td>
<td>9.05</td>
<td>3.76</td>
<td>0.41</td>
</tr>
<tr>
<td>Corn starch</td>
<td>5g</td>
<td>AUTO</td>
<td>180</td>
<td>9.25</td>
<td>12.17</td>
<td>0.73</td>
</tr>
<tr>
<td>Sugar (granulated sugar)</td>
<td>5g</td>
<td>AUTO</td>
<td>160</td>
<td>1.02</td>
<td>0.13</td>
<td>0.01</td>
</tr>
<tr>
<td>White rice</td>
<td>6g</td>
<td>AUTO</td>
<td>200</td>
<td>13.55</td>
<td>14.48</td>
<td>0.42</td>
</tr>
<tr>
<td>Mayonnaise</td>
<td>1g</td>
<td>TIME</td>
<td>160</td>
<td>10.00</td>
<td>20.61</td>
<td>0.46</td>
</tr>
<tr>
<td>Orange juice</td>
<td>1g</td>
<td>AUTO</td>
<td>140</td>
<td>10.09</td>
<td>88.89</td>
<td>0.09</td>
</tr>
<tr>
<td>Milk</td>
<td>1g</td>
<td>AUTO</td>
<td>140</td>
<td>7.30</td>
<td>87.36</td>
<td>0.04</td>
</tr>
<tr>
<td>Chocolate</td>
<td>3g</td>
<td>AUTO</td>
<td>140</td>
<td>6.18</td>
<td>2.36</td>
<td>1.49</td>
</tr>
<tr>
<td>Rolled oats</td>
<td>6g</td>
<td>AUTO</td>
<td>200</td>
<td>10.05</td>
<td>12.65</td>
<td>0.14</td>
</tr>
<tr>
<td>Tomato ketchup</td>
<td>2.5g</td>
<td>AUTO</td>
<td>140</td>
<td>19.47</td>
<td>69.40</td>
<td>0.16</td>
</tr>
<tr>
<td>Frozen sweets</td>
<td>2.5g</td>
<td>TIME</td>
<td>140</td>
<td>12.00</td>
<td>84.53</td>
<td>0.22</td>
</tr>
<tr>
<td>Dried mangoes</td>
<td>5g</td>
<td>AUTO</td>
<td>120</td>
<td>28.27</td>
<td>6.62</td>
<td>12.10</td>
</tr>
<tr>
<td>Palm oil</td>
<td>2.5g</td>
<td>TIME</td>
<td>120</td>
<td>5.00</td>
<td>0.41</td>
<td>3.70</td>
</tr>
<tr>
<td>Hand soap</td>
<td>1g</td>
<td>AUTO</td>
<td>200</td>
<td>21.36</td>
<td>88.89</td>
<td>0.39</td>
</tr>
<tr>
<td>Lipstick</td>
<td>1g</td>
<td>TIME</td>
<td>100</td>
<td>3.00</td>
<td>0.73</td>
<td>9.37</td>
</tr>
<tr>
<td>Plastic (PMMA pellet)</td>
<td>10g</td>
<td>TIME</td>
<td>100</td>
<td>25.00</td>
<td>0.13</td>
<td>4.56</td>
</tr>
<tr>
<td>Photocopy paper</td>
<td>1g</td>
<td>AUTO</td>
<td>200</td>
<td>1.50</td>
<td>7.84</td>
<td>0.71</td>
</tr>
<tr>
<td>Sodium tartrate dihydrate</td>
<td>5g</td>
<td>TIME</td>
<td>160</td>
<td>15.00</td>
<td>15.80</td>
<td>0.04</td>
</tr>
<tr>
<td>Detergent (powdered)</td>
<td>5g</td>
<td>AUTO</td>
<td>160</td>
<td>13.08</td>
<td>9.79</td>
<td>1.59</td>
</tr>
<tr>
<td>Solid soap</td>
<td>3g</td>
<td>TIME</td>
<td>200</td>
<td>16.00</td>
<td>9.09</td>
<td>1.66</td>
</tr>
<tr>
<td>Water-based paint</td>
<td>1g</td>
<td>AUTO</td>
<td>200</td>
<td>9.27</td>
<td>52.39</td>
<td>0.75</td>
</tr>
<tr>
<td>Sludge cake</td>
<td>2g</td>
<td>AUTO</td>
<td>200</td>
<td>21.31</td>
<td>81.55</td>
<td>0.40</td>
</tr>
<tr>
<td>Potting soil</td>
<td>5g</td>
<td>AUTO</td>
<td>120</td>
<td>15.30</td>
<td>33.40</td>
<td>2.16</td>
</tr>
<tr>
<td>Sawdust</td>
<td>4g</td>
<td>AUTO</td>
<td>160</td>
<td>8.27</td>
<td>34.38</td>
<td>0.91</td>
</tr>
</tbody>
</table>

Note 1: Measurement times, moisture ratios, and CV (%) values are aggregated from three data cycles.

Note 2: The CV (%) is the standard deviation divided by the average value, multiplied by 100 to represent it as a percent.
MOC63u Specifications

<table>
<thead>
<tr>
<th>Standard accessories</th>
<th>Optional accessories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Sample pan</td>
<td>1 Printer EP-80</td>
</tr>
<tr>
<td>2 Aluminum sheet</td>
<td>2 Printer EP-90</td>
</tr>
<tr>
<td>3 Sample pan handler</td>
<td>3 In-use protection cover for display (5 pieces)</td>
</tr>
<tr>
<td>4 In use protection cover</td>
<td>4 Aluminum sheet</td>
</tr>
<tr>
<td>5 Fuse</td>
<td>5 Fiberglass sheet</td>
</tr>
</tbody>
</table>

- *Standard accessories:
  - Sample pan
  - Aluminum sheet
  - Sample pan handler
  - In use protection cover
  - Fuse

- *Optional accessories:
  - Printer EP-80
  - Printer EP-90
  - In-use protection cover for display (5 pieces)
  - Aluminum sheet
  - Fiberglass sheet
  - Temperature calibration kit
  - Sample pan (SUS)
  - RS-232C cable
  - USB connection cable
  - Halogen heater for replacement

**Accessories list**

**Safety Precautions**

Read instruction manual before using this instrument.

- Use this instrument for measurements in which water vaporizes from the sample under heating.
- The temperature of the heater installed in this instrument becomes higher than the set heating temperature for the sample.
- Any sample that is explosive, inflammable or may cause hazardous reaction under heating must not be measured with this instrument.

**MOC63u Specifications**

- **Capacity**: Max 60 g, Min 0.02g
- **Minimum readability**: 0.001g, 0.01/0.1% (Selectable)
- **Repeatability**: 0.15% (2g), 0.05% (5g), 0.02% (10g)
- **Drying Heater**: Straight type halogen heater
- **Power**: 400W
- **Temperature range setting**: 50-200°C (1°C increments) (There is a time restriction when exceeding 180°C.)
- **Display**: LCD with backlight
- **Pan size**: 95mm
- **Dimensions (W×D×H) mm**: 202 × 336 × 157
- **Weight**: Approx 4.2kg
- **Operational temperature and humidity range**: 5 to 40°C, 85%RH or lower

**Measurement modes**

- Standard (Easy start/Automatic end/Timed end)
- Rapid drying (Easy start/Automatic end/Timed end)
- Slow drying (Easy start/Automatic end/Timed end)
- Step drying (Easy start/Automatic end/Timed end)

**Timer setting**

- 1-240 minutes or continuous (max 12 hours)

**Interface**

- RS-232C (9-pin connector) I/O port
- USB port

**Measurement conditions data memory**

- 10

**Data memory**

- 100

**Temperature calibration kit**

- Option

**Standard accessories**

- Sample pans (3 aluminum pans), pan supporter, windbreak, Heater insulation plate, aluminum pans (50 disposable pans), Sample pan handler, power cable, spare fuses (2), protective display cover, hexagonal wrench

(*) The repeatability (standard deviation) value is from a standard measurement (sample: sodium tartrate dihydrate). This value is not guaranteed for all samples, environments, and measurement conditions.

(*) Calibration is performed at one temperature (100 °C). Contact your Shimadzu representative if you would like to perform calibration at two or more temperatures, or to change the calibration temperature.

(*) The halogen heater can be removed and replaced by the user.