

Simplified Integrated Amount of
Solar Radiation Measuring System

OptoLeaf Measuring Instrument

D-Meter RYO-470M

Instruction Manual

(2018.10.05)

Before use, read this instruction manual carefully and understand the contents.

Save this manual for future reference.



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Taisei Fine Chemical Co., Ltd.

Function Product Division

<http://www.taisei-fc.co.jp>

Introduction

Thank you very much for purchasing our simplified integrated amount of solar radiation measuring system, OptoLeaf and the OptoLeaf measuring instrument. This system is an instrument to measure the amount of solar radiation based on the degree of color fading of a colored film. Before use of this system, please read this manual carefully and handle this system appropriately to make this system function properly.



Make sure to note the following points:

- The specifications of this instrument and the contents of this manual are subject to change without notice.
- Be aware that we will not bear any responsibility for any damage caused by the use of this instrument.
- Be aware that we will not bear any responsibility for the results produced by abuse, misuse, or improper use of this instrument.
- Our responsibility for the guarantee shall not exceed the cost of repairing this instrument or replacing any part in any case.
- We try to ensure the accuracy of the information in this manual; however, if any point is unclear or incorrect, please contact us.
- Reproduction or transcription of all or any part of this document without permission is prohibited.

Directions for use



Warning

Failure to observe the following may cause breakdown, smoking, ignition, injury, and more.

1. Do not disassemble or remodel the product.
2. Do not insert a foreign substance, such as an iron plate, plastic, or paper.
3. Do not expose this product to dust or moisture .
4. Do not throw the product into a fire.
5. Keep this product out of the reach of infants.



Caution

Failure to observe the following may cause performance deterioration, breakdown, damage, deformation, and discoloration.

1. Keep this product away from direct sunlight, high temperatures, and humid environments.
2. Use this product only within the temperature range of $20^{\circ}\text{C} \pm 15^{\circ}\text{C}$ (5°C to 35°C).
3. When “Low-Batt” is displayed on the screen, replace the existing batteries with new ones.
4. Do not apply excessive force to this product; for example, do not put an object on this product.
5. Do not expose this product to strong impacts; for example, do not drop this product from the top of a desk.
6. Do not put this product into a place where excessive force is applied such as a pants hip pocket.
7. Do not use thinner, benzene, alcohol, or the like to clean this product.



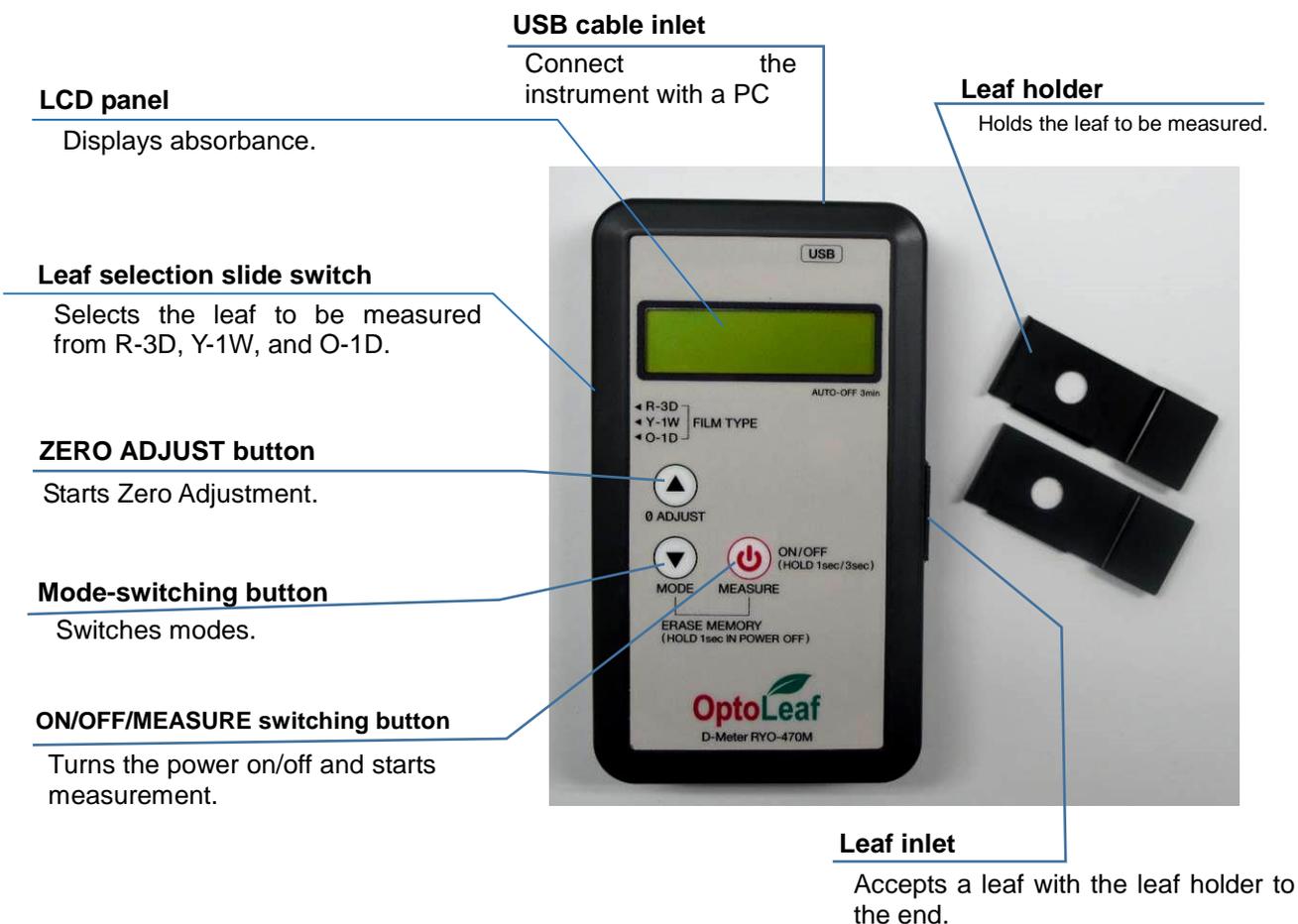
Be advised that we will not bear any responsibility for the results produced by abuse, misuse, or improper use of this product.

Packing contents (basic set)

| Simplified integrated amount of solar radiation measuring system | | |
|--|------------|--|
| OptoLeaf measuring instrument, D-Meter RYO-470M | ···1 pc. | OptoLeaf (R-3D·Y-1W·O-1D) ··· roll(s) * The rolls ordered with the main unit will be included. |
| Leaf holder | ···2 pcs. | * The explanation of how to use OptoLeaf and OptoLeaf |
| Transparence ref. leaf | ···2 pcs. | color fading curves are packed with OptoLeaf. |
| Instruction manual (this book) | ···1 copy | |
| Application Software Operation Manual | ··· 1 copy | |
| USB cable | ··· 1 pc. | |



Names and functions of the Components of the D-Meter RYO-470M



Battery box

Holds two AA batteries.
The lid can be opened by sliding.



For correct use

1. Operating temperature

D-Meter is a microcomputer-embedded precision instrument; **use this instrument under a normal temperature environment.**

Because the CPU of the microcomputer is heat sensitive, be careful not to raise the temperature of D-Meter.

Be aware also to keep this product out of direct sunlight. In addition, be careful not to use this product in extremely low temperatures.

***Normal temperature: 20°C ± 15°C (5°C to 35°C)** ... according to the definition of “normal temperature” by the Japanese Industrial Standard (JIS Z 8703)

2. Measurement range

The measurement range of D-Meter is 2.2 to 0.6.

OptoLeaf measurement shall be performed with absorbance of not less than 0.6 as a guideline.

Deviation from this range deteriorates the accuracy of measurement. Try to measure the OptoLeaf within the range wherever possible.

(An error with a spectrophotometer is usually within ± 0.05 , but when the range is exceeded, the error may be within ± 0.10 in some cases)

A value more than 2.3 for a high concentration and a value less than 0.5 for a low concentration are displayed as errors.

The measurement range of D-Meter is approximately equivalent to the range where an OptoLeaf color fade curve (calibration curve) is effective.

3. Measurement of OptoLeaf's initial value

Be sure to measure the initial values of all OptoLeaf pieces before use.

OptoLeaf is manufactured so that the initial value falls within 2.0 ± 0.2 , but a uniform concentration is considerably hard to make, and **even for the same OptoLeaf, the values may vary depending on the measuring points.** That is why, when plural OptoLeaf pieces are used to perform multipoint measurements at the same time, **be sure to measure the initial value for each OptoLeaf before use.**

OptoLeaf is used to measure the degree of color fading based on the initial value; therefore, even if the color of OptoLeaf fades slightly, OptoLeaf can be used by measuring a new initial value.

4. How to place OptoLeaf on leaf holder

Measure the same points of OptoLeaf before and after exposure.

Set an OptoLeaf on the leaf holder in the same direction as before exposure. As the D-Meter measures absorbance by means of the volume of light that passes through the leaf, which side of the OptoLeaf faces outward does not affect the result as long as the same part of the leaf is measured.

5. OptoLeaf color fade curve (calibration curve)

Be aware that measurement accuracy is reduced if exposure is insufficient or too great.

The provided color fade curves (calibration curves) are ones of OptoLeaf that have faded to some extent, and they can be represented by an approximate formula (on an attached sheet). However, the approximate formula does not apply to the stages of beginning and late fading—those stages are omitted from the curves on purpose. The tendency of the values for beginning or late fading is different from the tendency of the intermediate stage, and it can be said that another curve (or expression) may exist. The measurement range of D-Meter represents the intermediate stage of color fading (color fade curves).

How to use D-Meter, OptoLeaf measuring instrument

1. How to turn on the power

Hold down the ON/OFF button in the center of the panel for one second to turn on the power.

If the button is released within one second, the operation becomes invalid. In such a case, hold down the button again for one second.

When the power is turned on, the LCD shows the currently selected OptoLeaf type that is selected with the slide switch.

Keep on pressing the ON/OFF button.



Hold down the ON/OFF button **for one second.**

R-3D

Keep on pressing the button until the characters on the left are displayed. This is an example when "R-3D" is selected with the slide switch.

*Other indications are shown as follows:

Case of selecting "Y-1W" with the slide switch

Y-1W

Case of selecting "O-1D" with the slide switch

O-1D

2. How to turn off the power

There are two ways to turn off the power: manually and automatically.

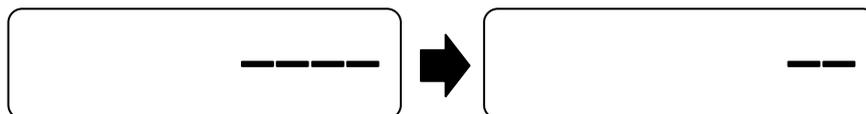
(1) Turning off the power manually

Hold down the ON/OFF button for three seconds.

A message on the display changes from "----" to "--". The message is cleared when the power is turned off.



Hold down the ON/OFF button **for three seconds**



If the button is released within three seconds, the MEASURE function is activated, and the measurement result is displayed.

(2) Turning off the power automatically

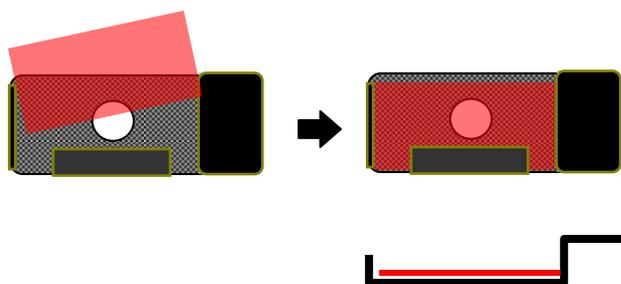
When three minutes have passed without any operation (without pressing any button), the power is automatically turned off, and the message is cleared.

3. How to set OptoLeaf to be measured

Set the OptoLeaf to be measured on the leaf holder and cut it into the appropriate size.

The size should be appropriate for setting it on the leaf holder and hiding the entire hole in the center of the holder with it.

Correct setting



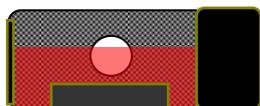
Set OptoLeaf horizontally when viewed from the side

 **Recommended size: 35 mm x 20 mm**

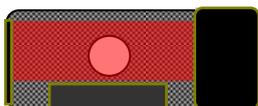
The dimensions of the OptoLeaf roll are 35 mm in width and 10 m in length, and cutting it into 20 mm in length is the right size.



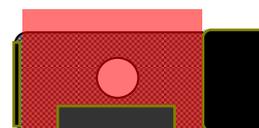
Wrong setting



(1) The opening of the hole leads to the wrong result



(2) Not nipping OptoLeaf may cause OptoLeaf to move



(3) Because of too large a size, it cannot enter the leaf inlet

(4) Warped OptoLeaf leads to the wrong result

Insert the leaf holder with the OptoLeaf side upward into the leaf inlet to load it into the D-Meter main unit. At this moment, insertion should be performed as far as it will go.

If the leaf holder is not successfully inserted, correct measurement cannot be obtained.



Insert the leaf holder all the way into the inlet.

4. Before measurement

• Measurement shall be performed as follows:

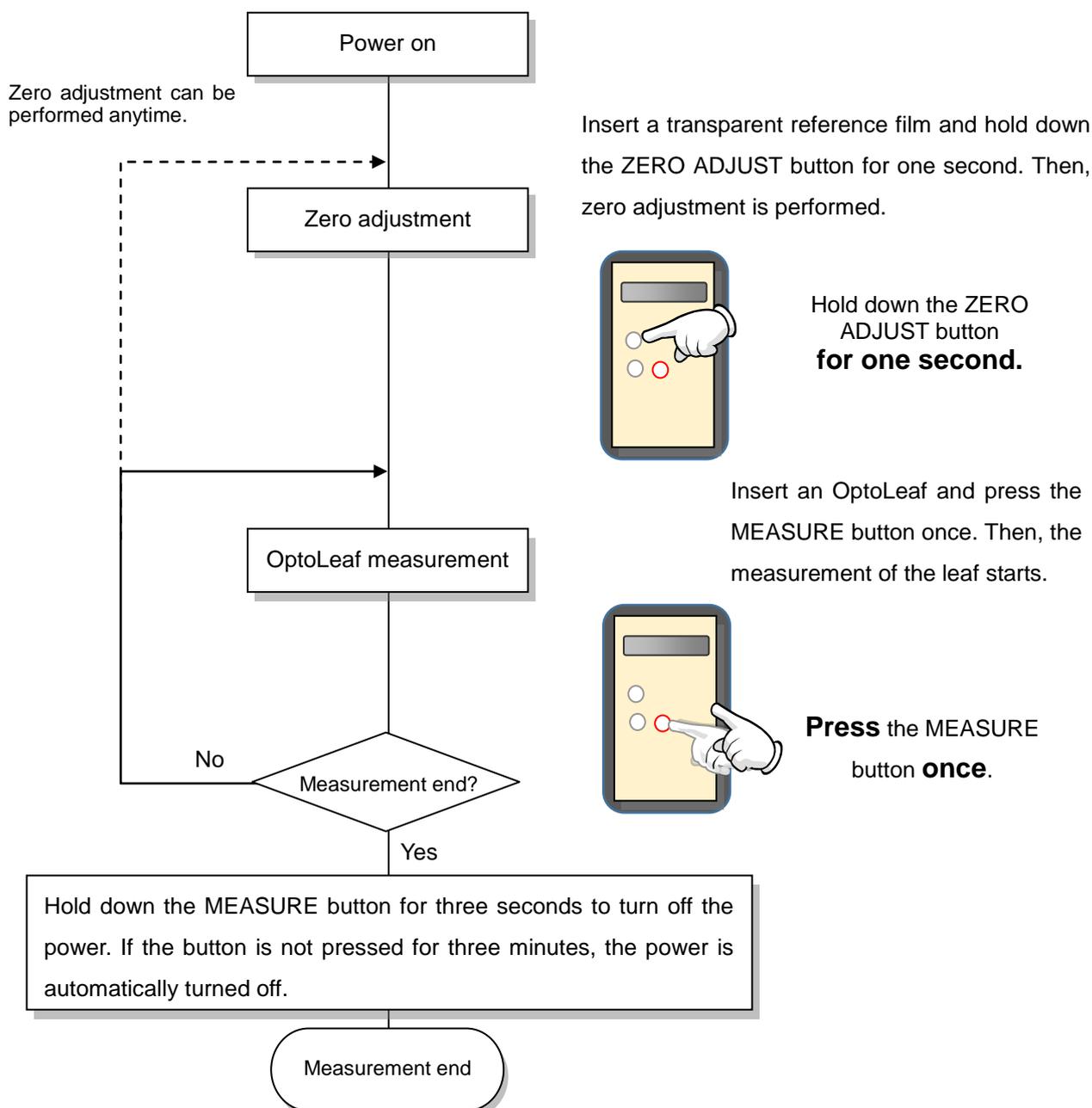
(1) Zero adjustment (for the purpose of obtaining correct measurement results)

- Insert a transparent reference film and perform the measurement.
- The results are saved even after the power is turned off. It is still recommended to perform zero adjustment once after turning on the power to grasp the instrument state.

(2) OptoLeaf measurement

- Insert OptoLeaf and perform the measurement.

• The OptoLeaf measurement flow is shown as follows:



5. Zero adjustment

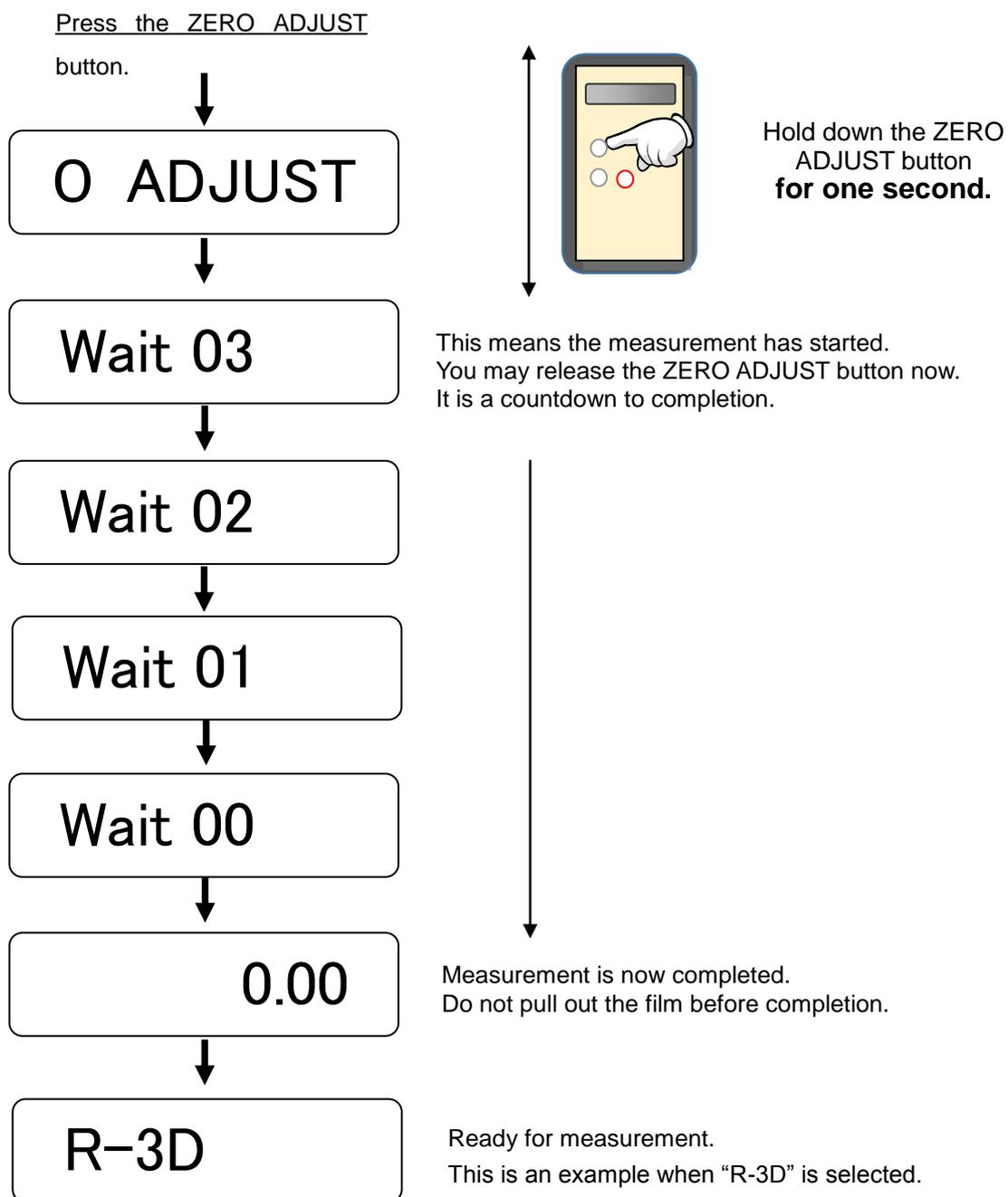
For the purpose of obtaining correct measurement results, zero adjustment shall be performed before OptoLeaf measurement.

Establish a reference value using the transparent reference film.

Place the transparent reference film on the leaf holder and insert it into the leaf inlet.

* Insertion shall be performed as far as it will go.

Next, hold down the ZERO ADJUST button for one second. Then, the message on the LCD panel changes as below.



Note: (1) If the ZERO ADJUST switch is released before "Wait 03" is displayed, zero adjustment is canceled. In such a case, the reference used the last time is active.

When zero adjustment is successfully completed, the reference value is saved in memory and remains even after the power is turned off.

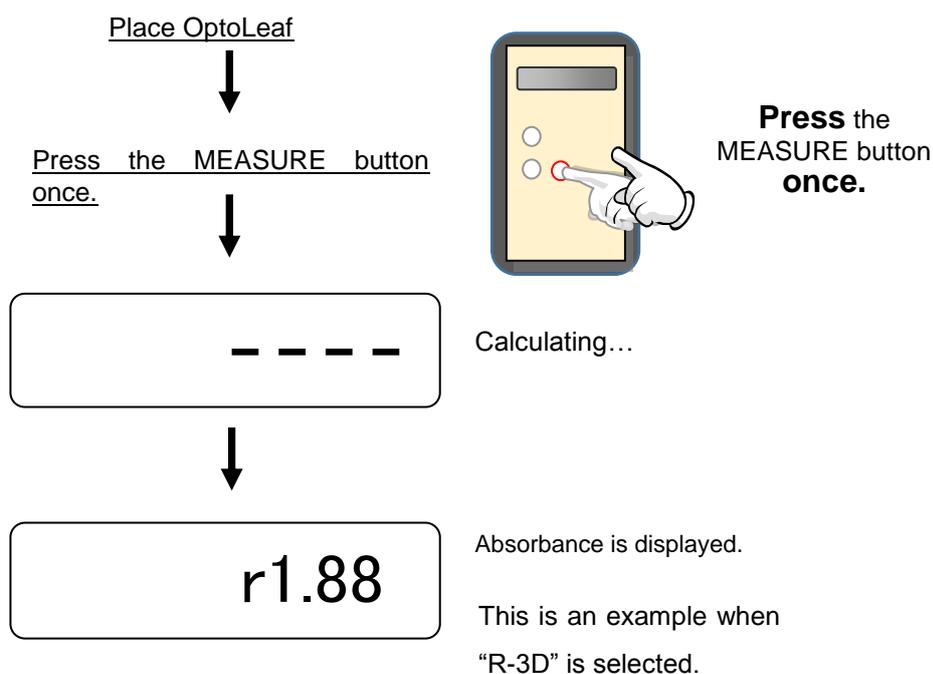
6. OptoLeaf measurement

Select an OptoLeaf type with use of the leaf selection slide switch depending on the OptoLeaf to be measured.



* If the selected type of the leaf selection slide switch does not match the actual type of OptoLeaf to be measured, correct measurement cannot be obtained.

Place the OptoLeaf you want onto the leaf holder, insert it into the leaf inlet of the main unit, and press the MEASURE button once, and the absorbance is displayed on the LCD panel.



- Note: (1) If the selected type of the leaf selection slide switch does not match the actual type of the OptoLeaf to be measured, correct measurement cannot be obtained.
- (2) Zero adjustment and OptoLeaf measurement can be always performed while the power is in the ON state.
- (3) If the color of the OptoLeaf is excessively faded (with the concentration close to the transparent reference film), a measurement error occurs.

7. MEMORY Mode

This is a function to store the measurement result in memory. It is saved even after D-Meter is powered off.

Data in memory can be transferred to a PC through dedicated D-Meter application software and saved there as a file.

Hold down the MODE button for one second when the power is ON. Then, the MEMORY mode becomes active.

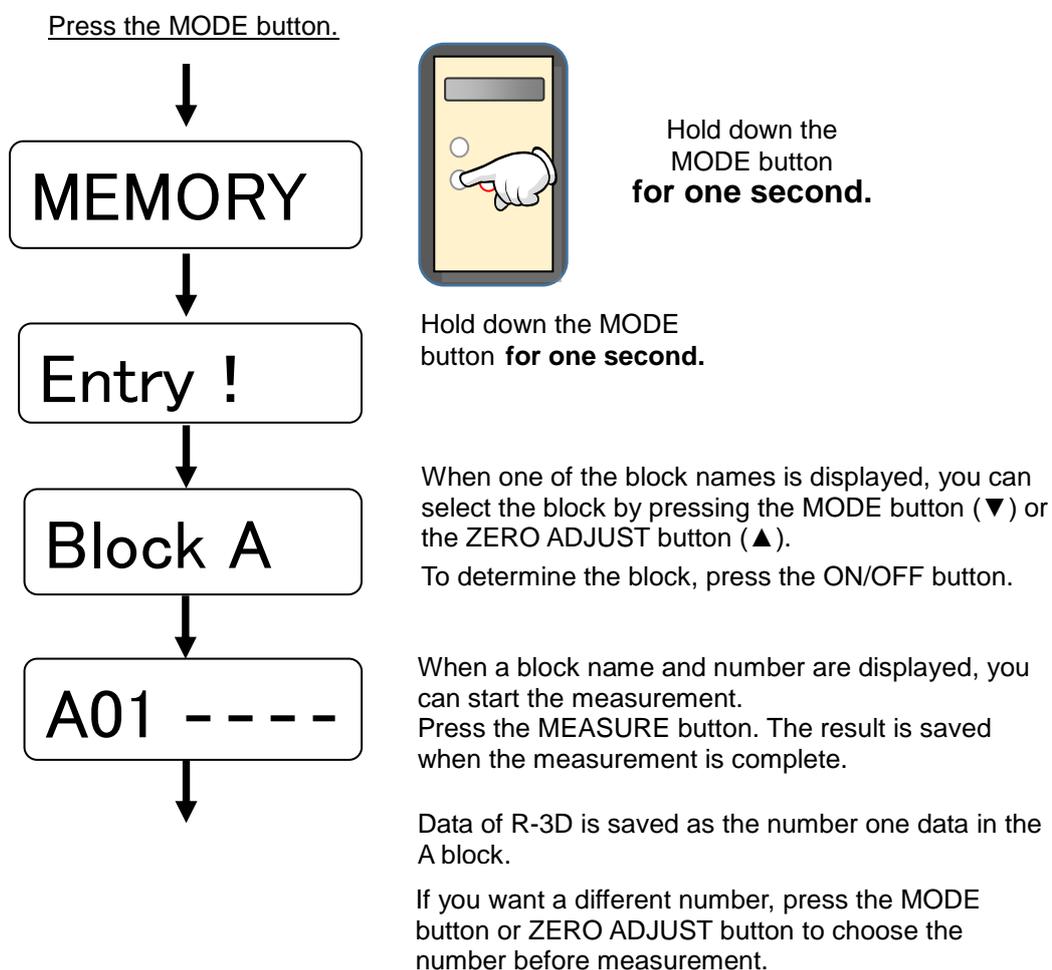
Memory is divided into 10 blocks from A to J.

In each block, 99 measurement data sets can be stored.

When the selected number already has data, it is overwritten.

To move from the MEMORY mode to the BASIC (normal measurement) mode, power off and then reboot the instrument.

To change the selection of a block used in memory, power off and then reboot the instrument.



Memory status displayed:

Either of the following messages is displayed.

A01r2.09

1. There is measurement data.
(When R-3D is selected).

A01- - - -

2. There is no measurement data.

A01r * * * *

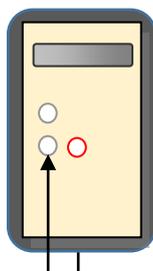
3. There is an error in the measurement data.
(When R-3D is selected).

8. Deletion of Memory Data

This is a function to delete all measurement data stored in the MEMORY mode.

Press the MEASURE and MODE buttons at the same time for one second, when the D-Meter is powered off.

Press the MEASURE and MODE buttons at the same time for one second.



When the D-Meter is powered off, press the MEASURE and MODE buttons at the same time for one second.

EraseAll

Press the MEASURE button to proceed to the next step.
Press the ZERO ADJUST or MODE button to cancel data deletion.

Sure?

Press the MEASURE button to execute the deletion of memory data.
Press the ZERO ADJUST or MODE button to cancel data deletion.

Deleting data...

Finished

Completion message is displayed.
The power is automatically turned off.

To confirm the deletion, turn on D-Meter and move to the MEMORY mode. If the following (meaning that there is no measurement data) is displayed, it means the data is deleted.

A01 ---

When the number one data in the A block is selected

9. Error message

An error message may be displayed on the LCD panel.

[Low-Batt]: Low voltage is detected. (Replace the batteries.)

[E: Under]: The measurement value is abnormal. The value is lower than the predetermined range.

(Check if the type of an actual leaf and the type selected with a slide switch are the same.)

There is a possibility of excessive light received because of excessive exposure.

(Execute the measurement again.)

[E: Over]: The measurement value is abnormal. The value is higher than the predetermined range.

(Check if the type of an actual leaf and the type selected with a slide switch are the same.)

[E: Photo]: Error in adjustment.

(Check if the transparent reference film was correctly inserted when adjustment was made.)

The wrong film may have been inserted instead of the transparent reference film.

Warranty

This warranty shall apply based on the warranty provisions described below; fill in the date of purchase, the addresses, and the telephone numbers below.

— Warranty Provisions —

- (1) In the event of product failure under normal operating conditions according to the instruction manual, we will repair or replace this instrument without charge based on this warranty; therefore, please do not hesitate to contact us below.
- (2) We shall bear no responsibility for any damage directly or indirectly caused by the failure of this instrument or the use of this instrument.
- (3) The following cases require a fee to repair even in the warranty period:
 - (1) Failure or damage caused by the customer's inappropriate handling, such as dropping this product and impact on this product during transportation or movement
 - (2) Failure or damage caused by the customer's misuse, improper modification, or repair
 - (3) Failure or damage caused by natural disaster, such as fire, salt damage, gaseous damage, earthquake, lightning strike, or storm and flood damage, and external factors such as abnormal voltage
- (4) This warranty is valid only in Japan.
- (5) This warranty is not reissued. Please keep this warranty in a safe place.

| | | |
|--------------------|----------------------------------|--|
| Product name/Model | | OptoLeaf Measuring Instrument, D-Meter RYO-470M |
| Product No. | | |
| Warranty period | | Date of purchase One year warranty from Y /M /D |
| Customer | Company name or your name | |
| | Address | 〒 |
| | Telephone No. | |
| Dealer | Shop Address Telephone No. | |

If a failure occurs during the period described above from the date of purchase, ask us for repair or replacement by presenting the product and this warranty. This warranty is our promise to repair or replace the instrument without charge based on the period and conditions specified in this document. This warranty shall not limit the legal rights of the customer. For repair, replacement, or others even after the warranty period expires, please do not hesitate to contact us.

For inquiries about unclear points or consultation, contact us as follows:

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|  大成ファインケミカル株式会社 Taisei Fine Chemical Co., Ltd. Function Product Division 3-5-1, Nishi-shinkoiwa, Katsushika-ku, Tokyo 124-8535 JAPAN TEL : 03-3691-7577 FAX : 03-3691-3035 http://www.taisei-fc.co.jp |
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