IHARA

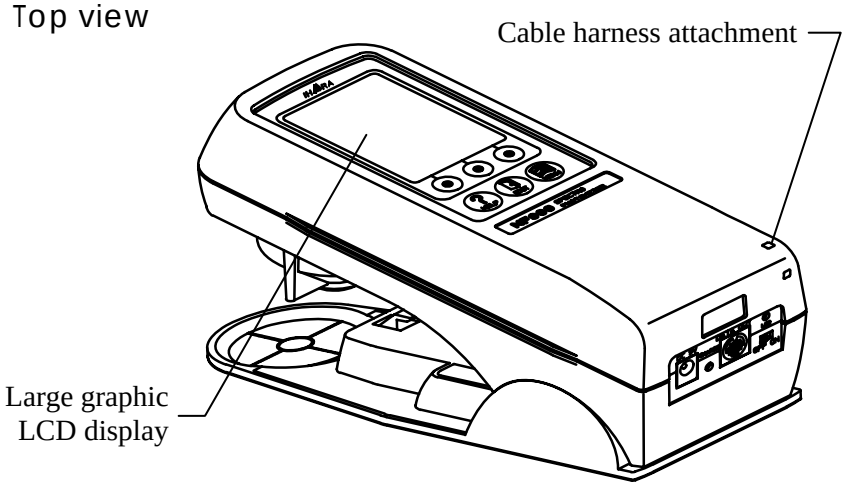
S900

Operation Manual

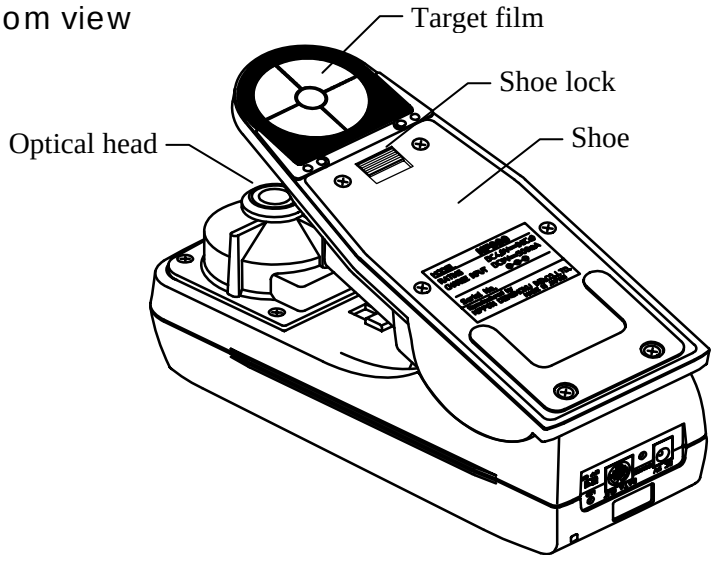
1.1. Product Items and Components

Spectrophotometer body

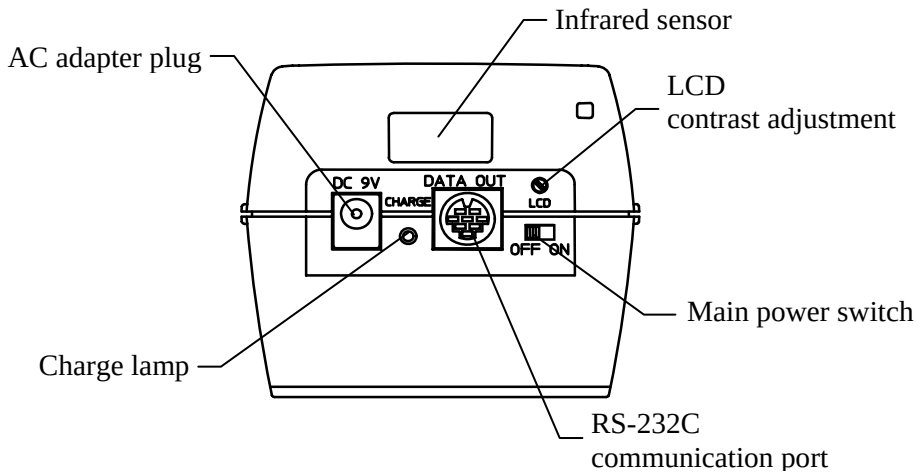
Top view



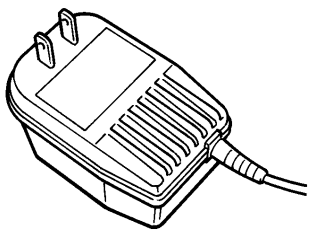
Bottom view



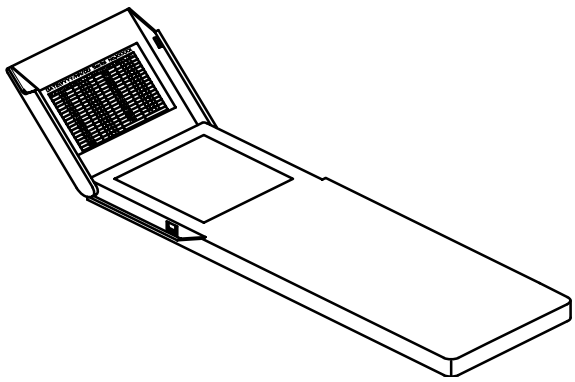
Rear view



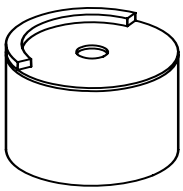
AC adapter



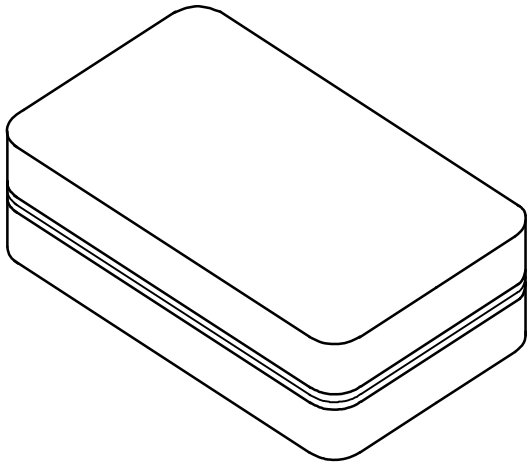
White calibration board



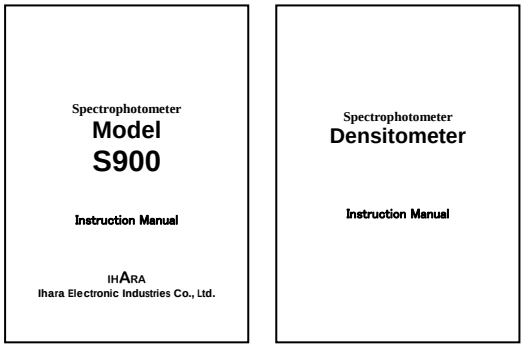
Zero cap



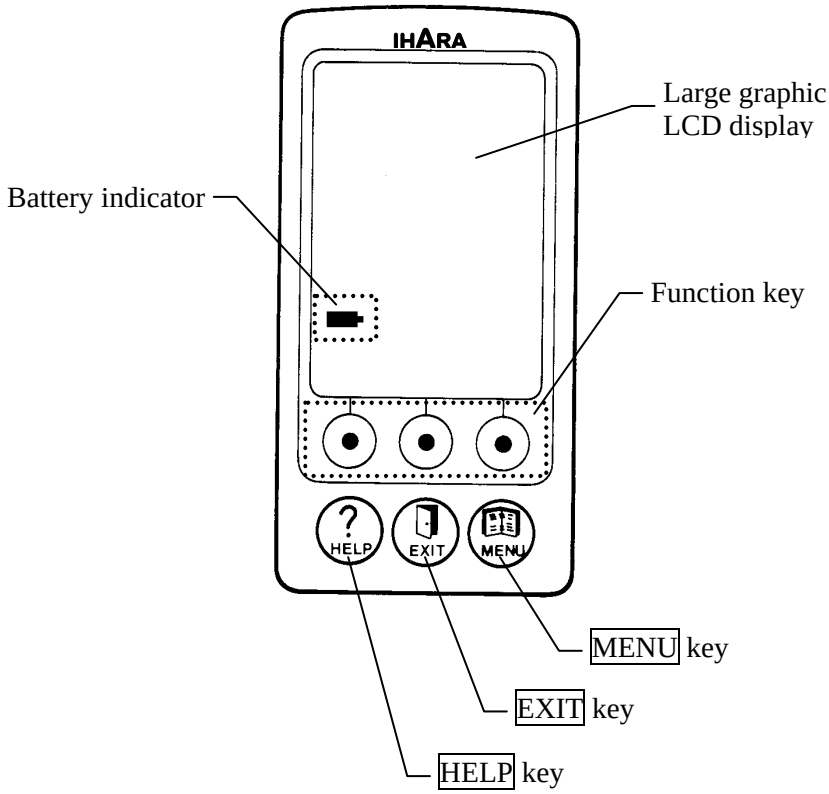
Soft case



Instruction manual



1.2. Operation Panel



2. PREPARATION BEFORE MEASUREMENT

2.1. Connecting the AC adapter

Securely plug the supplied AC adapter into the AC adapter connection jack on the rear of the equipment.

Do not connect the AC adapter to any power line other than the designated AC voltages.

Do not use any AC adapter other than the one supplied with the equipment.

Do not leave the AC adapter plugged into an outlet if the equipment is not in use for a long time.

2.2. Charging the Battery

The equipment has a NiCd battery built in. If the AC adapter is connected, charging is automatically started. Measurements can be made while charging. After charging is completed, measurements can be made even if the AC adapter is disconnected. If the AC adapter is kept connected even after completion of charging, charging is automatically started when the battery is used up. You can check the remaining battery capacity with the charge lamp and the battery indicator.

How to charge the battery

1. Insert the AC adapter into an AC 100V outlet and the AC adapter connection jack on the rear side of the equipment.
2. The charging lamp is lit orange during charging.

If the built-in battery is not charged at all, particularly just after purchase, the charge lamp may be lit for the first tens of seconds even with the AC adapter connected. This is not a failure. Leave it as it is, and charging will be started.

3. When charging is completed, the charge lamp changes from orange to green. Charging time is about 1.5 hours.

Measurements can be made during charging.
During charging, the main body may become heated, but this is not unusual.

If continuing use of the equipment with the battery charger connected, it is not always charging. Once the battery is fully charged, charging is temporarily ended. After that, as the battery charge decreases to a level that requires charging while using the Spectrophotometer, charging will be started again. You can check the state and level of charge by the charge lamp and battery indicator. If you start re-charging immediately, disconnect the AC adapter temporarily and insert it once again.

Proper charging of the battery

The NiCd battery life is around two years or about 500 charge/discharge cycles. However, improper charging will degrade the performance of the battery. This results in a decreasing capacity of the battery even with charging. Such a phenomenon is generally called a memory effect.

By following these points, the memory effect can be minimized.

・Use the battery until the charge is almost completely depleted.

It is not a good practice to begin charging the battery when it is in a charged state.

・Do not interrupt charging of the battery.

Do not pull out the battery charger until the charge lamp changes green. Measurements can still be made while charging.

If the memory effect occurs, the battery must be refreshed to recover the performance. For refreshing the battery, see page 96.

Battery indicator

The battery indicator is shown in the lower right area of the liquid crystal display. The battery indicator changes at seven stages depending on the remaining charge of the battery. If the remaining charge becomes 0 %, the battery must be charged.

100% 0%

The battery indicator below will be displayed during charging.

2.3. Power On-Off

Turning on the power supply

1. Slide the power switch at the rear side of the body to ON.
2. If any one of the keys is pressed, the power supply will be turned on.

HINT *Measurements can be made at the same time the power supply is turned on if measurement operation is made with the main power switch being not at ON.*

Turning off the power supply

If the equipment is left unused, the power supply will go off automatically (auto power-off). The auto power-off feature allows you to set up any of three stages and an invalid state. For details of the setup, see page 91.

If you carry or store the equipment for a long time, turn the main power switch to OFF.

2.4. Adjusting the Liquid Crystal Display Contrast.

If the liquid crystal display is hard to see, adjust the contrast.

1. Prepare a precision screwdriver.
2. Turn on the power supply.
3. Using the screwdriver, turn the LCD contrast adjustment at rear side of the equipment to an optimum position while checking the display.

3. BASIC OPERATION

3.1. Measuring Functions

Spectrophotometer
Colorimeter
Densitometer

3.2. Basic Functions of the Function Keys

● (FUNCTION) key:

The three function keys indicators have different functions assigned each one depending on the previous selection. The current function is shown on the liquid crystal display beside the key.

● Main functions assigned for the three function keys are:

- [↑] or [↓] keys: ···· Vertical scrolling of screen, vertical movement of selected item and increase and decrease of numerical value.
- [ENTER] key: ····· Decides selected item.
- [EDIT] key: ····· Changes numerical value.
- [PREV] key: ····· Closes current screen and returns to previous screen.
- [NEXT] key: ····· Closes current screen and goes to next screen.
- [ITEM] key: ····· Changes display item.
- [SETUP] key: ····· Set up for current mode of measurement.

(MENU) key:

Displays the function menu.

(EXIT) key:

Closes current screen and returns to the previous screen.
If an instruction message is shown, the key closes the instruction message on display.

(HELP) key:

Displays a specific help menu depending on each mode.

3.3. Basic Operating Procedures

Measuring procedures

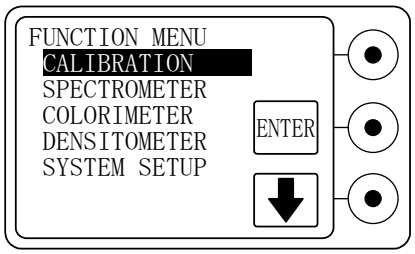
1. Put a measurement object on an even place.
2. Fit the target film window to the measurement object.
3. Press downs the head securely so that the position of the target film does not shift.
4. Do not release the head and continue to hold it while the display shows "MEASURING...".
5. You may release the head if the display shows "CALCULATING...".
6. Once measurement data is shown, the measurement is ended.

3.4. Operation of the Function Menu

All operations with this equipment are selected from the function menu. Select a measurement or setup item on the function menu, in order to use that function.

Operating the function menu

1. Press the MENU key. The function menu can be displayed from any state by pressing the MENU key.
2. Select a menu item to be executed with the ↑ or ↓ key and press the ENTER key.

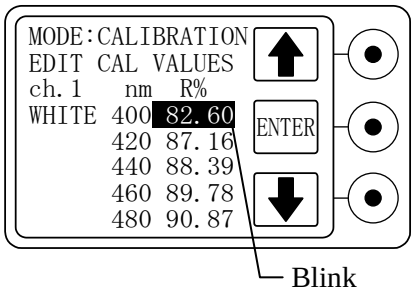


3.5. Entering a Numerical Value

All the entering methods for numerical values are the same.

Numerical value entering procedures

1. Select (reverse highlight) the numerical value portion with the ↑ or ↓ key. Note that the numerical value portion may be selected in advance.
2. Press the EDIT key. The numerical value will blink. Note that the numerical value may blink in advance.
3. The numerical value can be increased or decreased with the ↑ or ↓ key while it is blinking. The numerical value can be changed at high speed by holding down the key. Increase or decrease the numerical value to the one to be set.
4. Press the ENTER key after selecting numerical value to be set. The blinking display returns to the usual reverse highlight display.

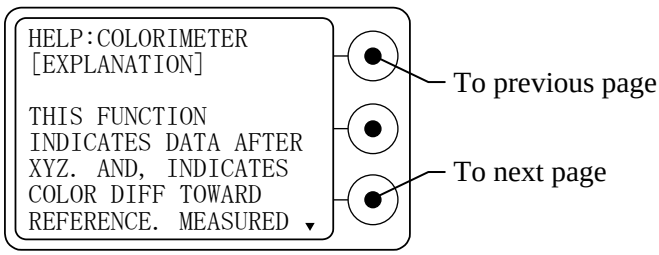


3.6. Help Operation

This Spectrophotometer has built-in help functions. If you do not know how to operate the equipment, press the HELP key at anytime. An explanation of the current mode will be displayed.

Help procedures

1. Press the HELP key. The help menu corresponding to the current mode will appear.
2. Select an item for further explanation, and press the ENTER key.
3. The help screen will appear.
4. If the screen has a mark "▲" or "▼" at the edge, this indicates that the help screen is of multiple pages. You can move to the next or previous pages with the up or down function key.



5. Return to the original help menu by pressing the EXIT key.
6. The help function can be ended and the display returned to the original screen by pressing the EXIT key while still in the help menu.

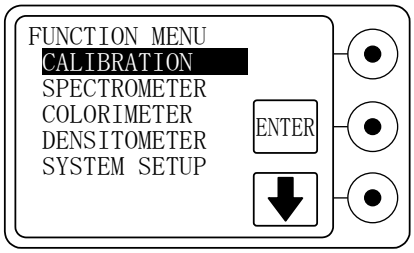
4. CALIBRATION

To ensure accurate measurements, calibration must be performed. Perform the calibration using the white calibration board supplied.

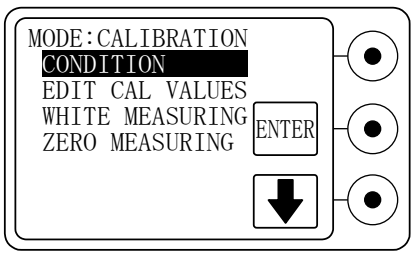
CHECK *The white calibration board should be stored carefully so that it is not be exposed to high heat, direct sun rays and chemicals, and should not be made dirty and scratched. Use of a dirty, scratched or damaged white calibration plate may result in incorrect measurements.*

4.1. Operation of the Calibration Menu

1. Press the MENU key to select "CALIBRATION" from the function menu, and press the ENTER key.



2. The calibration menu will appear. Select a desired operation or set item with the ↑ or ↓ key and press the ENTER key.



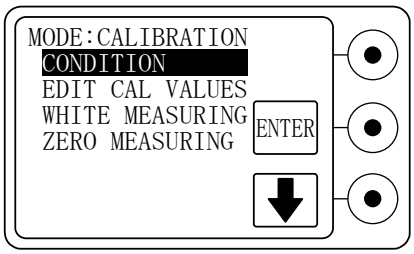
3. Set one item at a time.
4. After all the items are set up, press the EXIT key to return to the measurement screen.

4.2. Condition Setting

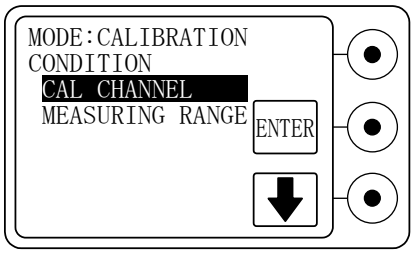
Conditions for calibration should be set up as follows.

HINT *If you carry out calibration in the same condition as before, you may not need to set up the conditions each time.*

1. Select "CONDITION" in the calibration menu and press the ENTER key.



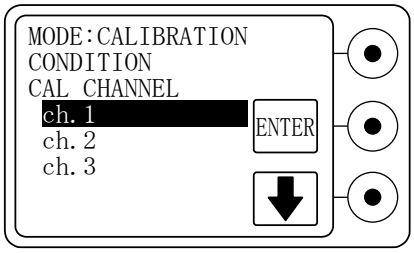
2. Select an item to be set with the ↑ or ↓ key and press the ENTER key.



●Operation of "CAL CHANNEL"

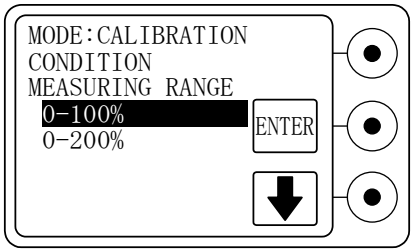
Up to three calibrations values can be stored. For each calibration, select the calibration value of a specific channel.

1. Select "CAL CHANNEL" in the condition setting menu and press the ENTER key.
2. Select a channel number to be used with the ↑ or ↓ key and press the ENTER key.



●Operation of "MEASURING RANGE"

1. Select "MEASURING RANGE" in the condition setting menu and press the ENTER key.
2. Select a range from among "0-100%" and "0-200%" with the ↑ or ↓ key and press the ENTER key.



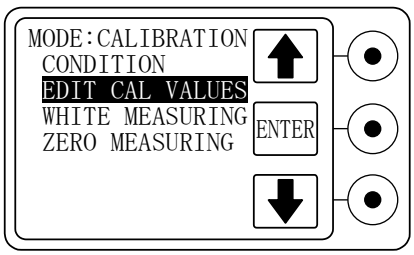
HINT *For normal calibration, the range of "0-100%" should be usually selected. If a message "A/D OVERFLOW! CARRY OUT CALIBRATION AGAIN." appears in the measurement, the spectral reflectance is far over 100 %. In that case, set the measuring range to "0-200%" and carry out calibration again.*

4.3. Setting the Calibration Value

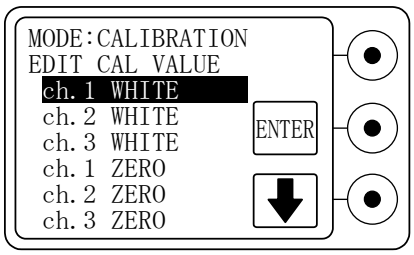
Enter a calibration value (reference spectral reflectance) of 400 to 700 nm of wavelength.

HINT *If the calibration value is not changed, you may not need to perform it each time.*

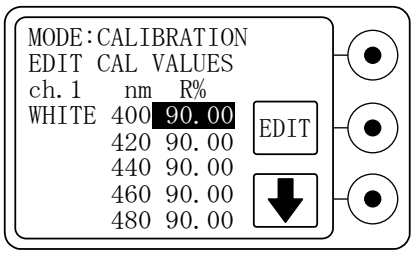
1. Select "EDIT CAL VALUES" in the calibration menu and press the ENTER key.



2. Select a combination of channel and white or zero to be entered with the ↑ or ↓ key.

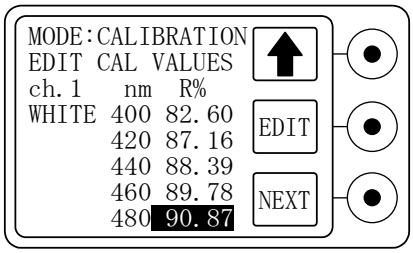


3. Enter a calibration value. Position the reverse highlight display to the desired value with the ↑ or ↓ key and press the EDIT key.



4. After the reverse highlight display begins blinking, change the value with the ↑ or ↓ key and press the ENTER key to select it. The reverse highlight display moves to the next wavelength.

5. By pressing the NEXT key at the lowest wavelength, you can move to the next page.



6. If pressing the NEXT key at 700 nm of wavelength, the calibration value of the specified channel and item is set and the screen will return to the calibration menu.

HINT *If using the supplied the zero cap for zero calibration, you should usually keep setting the zero calibration value at zero as white-zero calibration.*

HINT *By entering the value of a black calibration board as the zero calibration value, you can make white-black calibration.*

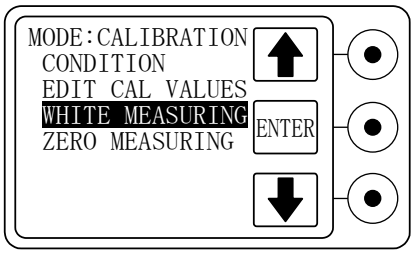
4.4. White Calibration

White calibration can be made by measuring the white calibration board.

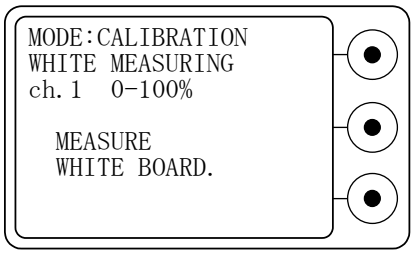
CHECK *The calibration conditions and white calibration value have to be set correctly before white calibration. For setting the calibration conditions, see page 18. For setting the calibration value, see page 20.*

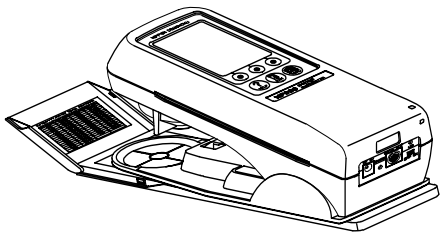
HINT *White calibration may be made before zero calibration, or zero calibration may be made before white calibration: they can be performed in either order.*

1. Select "WHITE MEASURING" from the calibration menu and press the ENTER key.

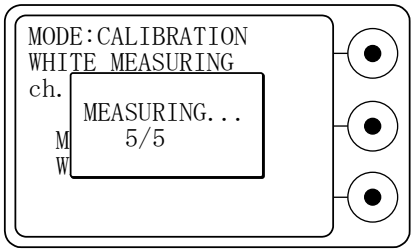


2. Measure at the center portion of the white calibration board.





3. Do not move the equipment until the measurement is completed. After the measurement has ended, the screen will return to the calibration menu.



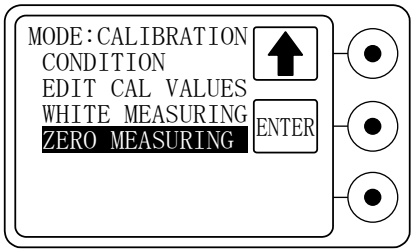
4.5. Zero Calibration

Zero calibration can be made as follows. Measurements should be carried out with use of the zero cap supplied.

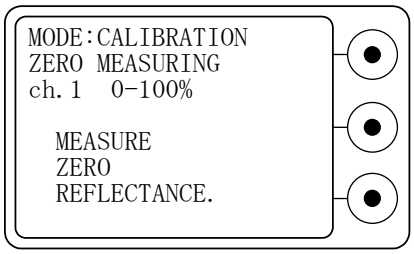
CHECK *You have to set the calibration conditions and zero calibration value correctly before zero calibration. For setting the calibration conditions, see page 18. For setting the calibration value, see page 20.*

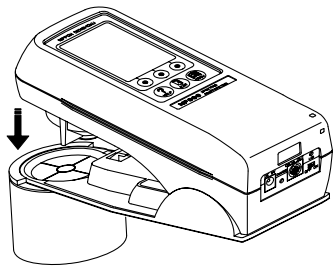
CHECK *Change the value with the ↑ or ↓ key and press the ENTER key to select it. The reverse highlight display moves to the next wavelength. White calibration may be made before zero calibration, or zero calibration may be made before white calibration: they can be performed in either order.*

1. Select "ZERO CALIBRATION" in the calibration menu and press the ENTER key.

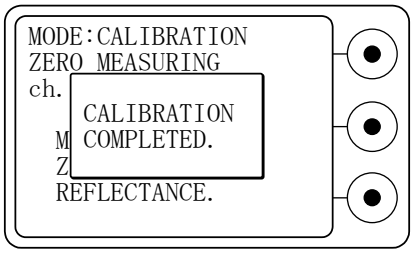


2. Fit the zero cap to the measuring head for measurement.





3. After the measurement ends, a message "CALIBRATION COMPLETED." will appear and the screen will return to the calibration menu.



5. SPECTROPHOTOMETER FUNCTIONS

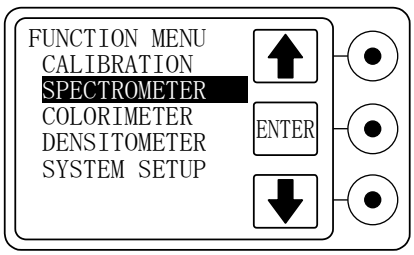
Spectral data of a target can be measured as follows. The measured data are stored in memory with sample numbers from 1 to 400 incremented automatically.

CHECK ***Sample numbers of the spectrophotometer function are in common with those of the colorimeter function. Note that storing with the same sample number in memory will overwrite the preceding data. The densitometer function will not store any data in memory.***

HINT *This Spectrophotometer is capable of looking up, printing and deleting the measured data stored in memory. For processing of the stored data, see the following subsections.*

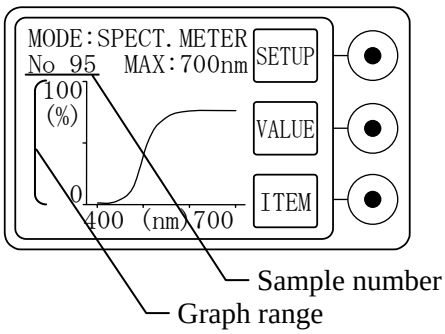
"Displaying stored data", page 35.
"Printing stored data", page 37.
"Deleting stored data", page 39.

Press the MENU key to select "SPECTROMETER" from the function menu and press the ENTER key.



A measuring screen of the spectrophotometer function will appear.

Ex.)Spectral reflectance graph



5.1. Measurement Items

The spectrophotometer displays the following formats.

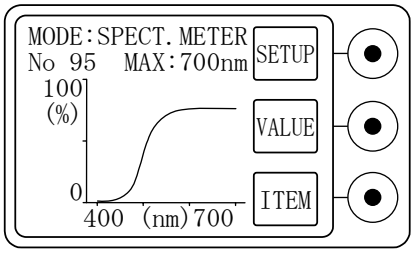
- Spectral reflectance graph.
- Spectral density graph.
- Spectral numerical value.

By pressing the ITEM key in the measurement mode, the display item will be changed one by one.

5.2. Spectral Reflectance Graph

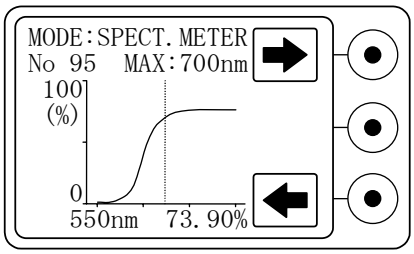
The Spectrophotometer can display a spectral reflectance graph from 400 to 700 nm of wavelength.

Select the spectral reflectance graph by pressing the ITEM key.



Looking up the reflectance

1. Press the VALUE key.
2. Select a wavelength to be looked up with the → or ← key. You can look up the reflectance of each wavelength.

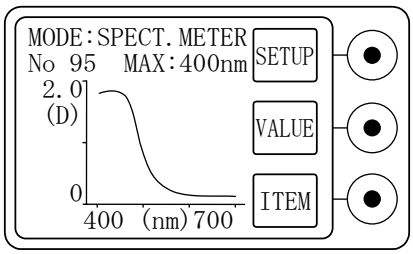


CHECK *To end the display of the reflectance graph, press the EXIT key.*

5.3. Spectral Density Graph

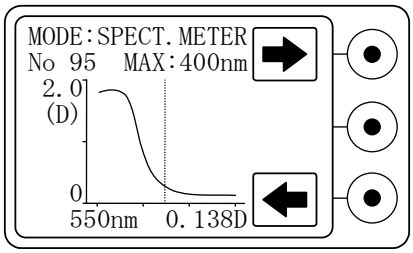
The Spectrophotometer can display a spectral density graph from 400 to 700 nm of wavelength.

Select the spectral density graph by pressing the ITEM key.



Looking up the density

1. Press the VALUE key.
2. Select a wavelength to be looked up with the → or ← key. You can look up the density of each wavelength.

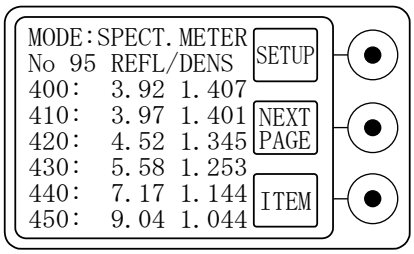


CHECK *To end the display of the density graph, press the EXIT key.*

5.4. Spectral Numerical Value

The Spectrophotometer can display spectral reflectance and spectral density values from 400 to 700 nm of wavelength.

Select the spectral numerical value by pressing the ITEM key.



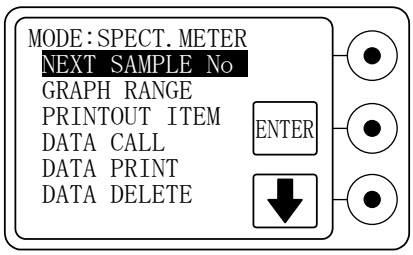
HINT *The range of wavelengths can be changed by pressing the NEXT PAGE key.*

5.5. Setting up the Spectrophotometer Functions

Details of the spectrophotometer functions can be set in the setup menu.
The details set in the setup mode are saved until they are changed again.

Common setup

1. Press the SETUP key. The setup menu for the spectrophotometer functions will appear.
2. Select an item to be set with the ↑ or ↓ key and press the ENTER key.

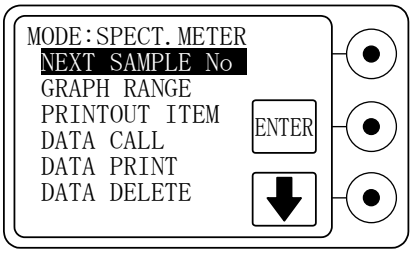


3. Set up for the item. Repeat setup for the other items.
4. After all the setups are completed, press the EXIT key. The screen will return to the measurement screen.

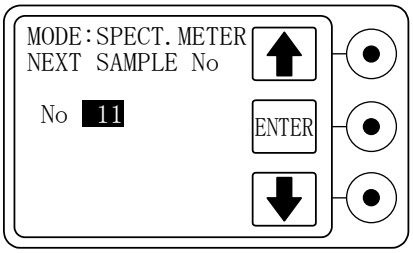
◆Setting the next samples

You can set up any of the samples from 1 to 400 to be measured next as follows.

1. Select "NEXT SAMPLE No" in the setup menu and press the ENTER key.



2. Enter the sample number to be measured next. Change the numerical value with the ↑ or ↓ key and press the ENTER key.



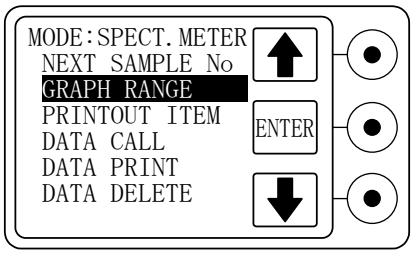
CHECK *The sample numbers for the spectrophotometer functions are in common with the colorimeter functions.*

◆Setting the graph range

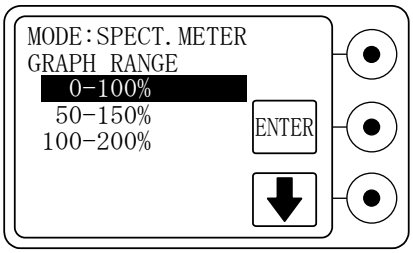
You can set up a graph display range for a measurement item.

CHECK *For the measurement item of "Spectral Numerical Value", the setup item is not shown and settings cannot be made.*

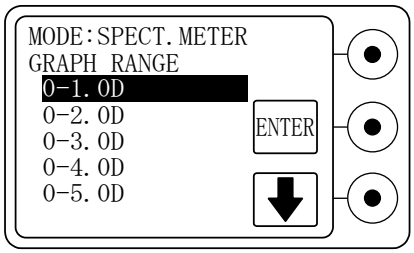
1. Select "GRAPH RANGE" in the setup menu and press the ENTER key.



2. Set a display range. Enter a type of range and press the ENTER key.



Spectral reflectance graph



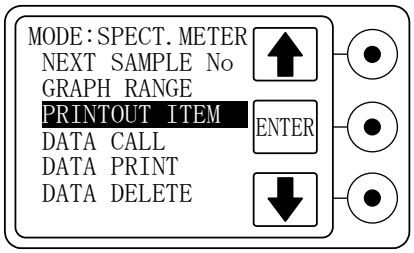
Spectral density graph

CHECK *The graph range is different depending on the display item into which the setup mode has been entered.*

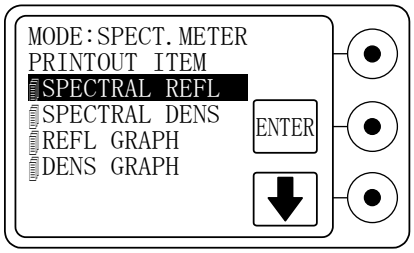
◆Setting the printout item

You can printout an item as follows.

1. Select "PRINTOUT ITEM" in the setup menu and press the ENTER key.



2. Set the printout item. Select a measurement item to be measured with the ↑ or ↓ key and press the ENTER key. A check mark will be placed next to the selected measurement item.



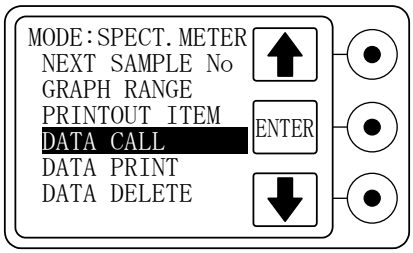
HINT *If a measurement item having a check mark is selected and the ENTER key pressed, the check mark will disappear.*

CHECK *The "Spectral Reflectance Graph" and "Spectral Density Graph" can only be printed on graphics printers.*

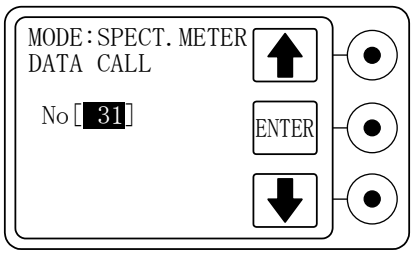
◆Displaying stored data

You can display any of the measured data numbered from 1 to 400 in memory.

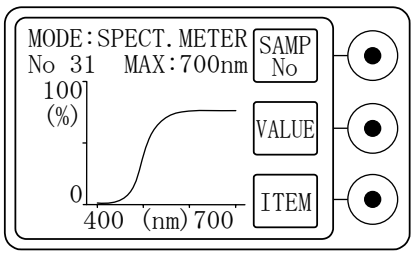
1. Select "DATA CALL" in the setup menu and press the ENTER key.



2. Enter the sample number of the measured data to be displayed. Change the value with the ↑ or ↓ key and press the ENTER key.



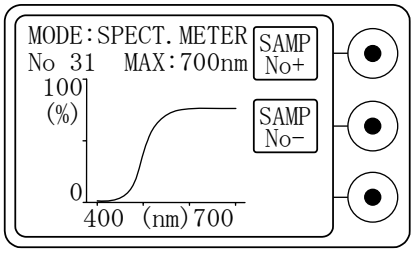
3. The measured data of the entered sample number will be displayed.



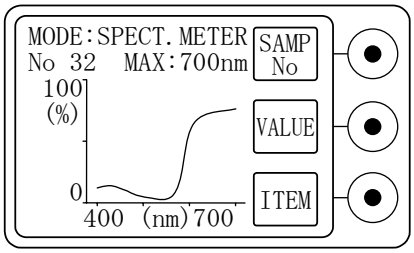
HINT *If stored data is called, the SAMP No key will be displayed as the top function key.*

To change the displayed sample number

1. Press the SAMP No key
2. Press the SAMP No+ key or SAMP No- key.



3. The display data will be replaced by the next or previous one accordingly.



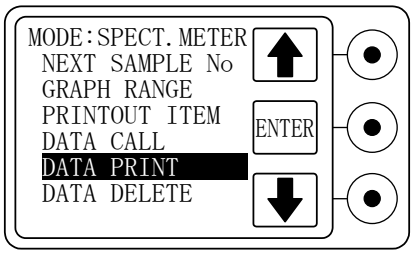
CHECK *To end calling the stored data, press the EXIT key.*

◆Printing stored data

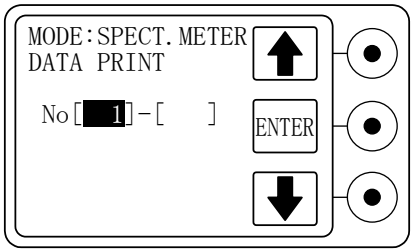
You can batch-print the measured data of a specified range (from 1 to 400) in memory.

CHECK *To print out the stored data, connect an output device and set printout items before printing. You should also set communication conditions in advance. For setting the printout items, see page 34. For setting the communication conditions, see page 92.*

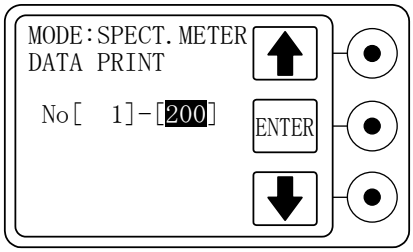
1. Select "DATA PRINT" in the setup menu and press the ENTER key.



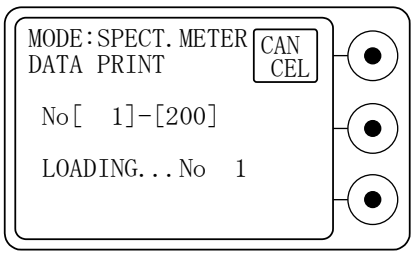
2. Enter the first sample number in the range to be printed out. The value can be changed with the ↑ or ↓ key and then pressing the ENTER key.



3. In turn, enter the last sample number in the range. The value can be changed with the ↑ or ↓ key and then pressing the ENTER key.



4. The screen will change to a printout screen. At the end of the printout, the screen will return to the setup menu.

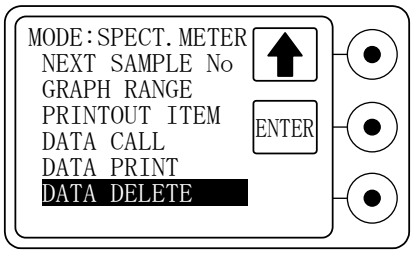


CHECK *To interrupt printout of the stored data, press the CANCEL key. Keep the CANCEL key pressed until the printout is interrupted.*

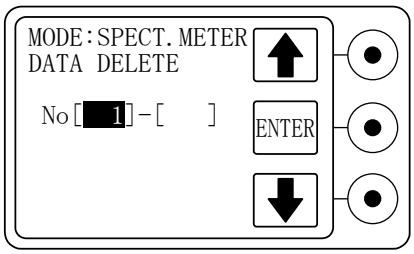
◆Deleting stored data

You can batch-delete the measured data of a specified range (from 1 to 400) in memory.

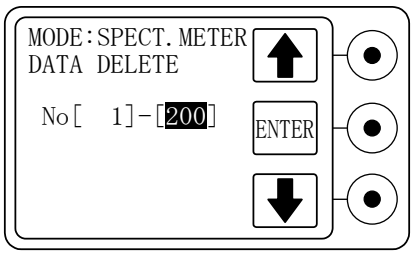
1. Select "DATA DELETE" in the setup menu and press the ENTER key.



2. Enter the first sample number in the range to be deleted. The value can be changed with the ↑ or ↓ key and then pressing the ENTER key.



3. In turn, enter the last sample number in the range. The value can be changed with the ↑ or ↓ key and then pressing the ENTER key.



4. A message "STORED DATA IS DELETED." will appear and the screen will return to the setup menu.

HINT

If all the data are deleted by setting the range to number from 1 to 400, the next sample number becomes "1" when returning to the measurement mode.

5.6. Output Format

If the Spectrophotometer is connected to a printer or personal computer via a serial communication connector, measured values can be output with the printout item set. The measured values can also be output with on infrared communication port.

For setting the printout items, see page 34.

For setting the communication conditions, see page 92.

Output examples:

```
No 59
 SPECTRAL REFL.
      nm     %
     400   3.47
     410   3.47
       .
       .
       .
     690  77.34
     700  77.95
 SPECTRAL DENS.
      nm  DENS.
     400  1.460
     410  1.460
       .
       .
       .
     690  0.112
     700  0.108
```

6. COLORIMETER FUNCTIONS

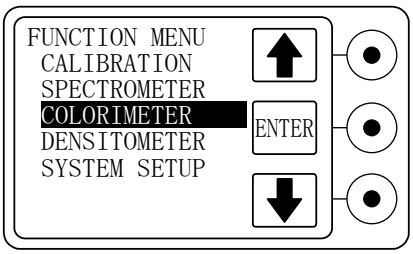
The Spectrophotometer can also measure color values and color differences.
The measured data are stored in memory with sample numbers from 1 to 400 incremented automatically.

CHECK ***Sample numbers of the colorimeter functions are in common with those of the spectrophotometer functions. Note that storing with the same sample number in memory will overwrite the preceding data. The densitometer functions will not store any data in memory.***

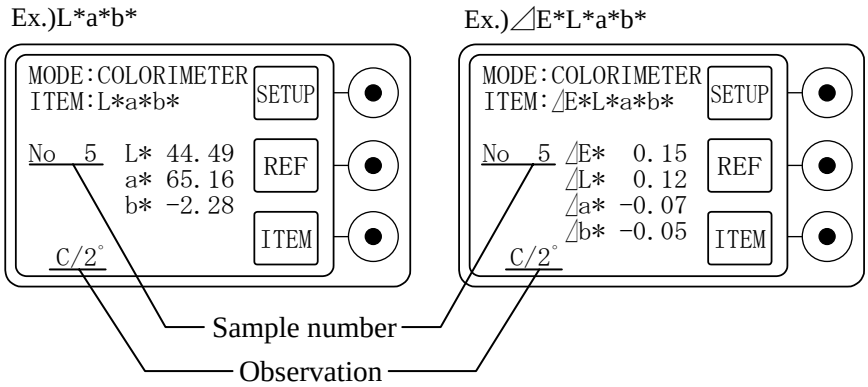
HINT *This Spectrophotometer is capable of looking up, printing and deleting the measured data stored in memory. For process of the stored data, see the following subsections.*

"Displaying stored data", page 81.
"Printing stored data", page 83.
"Deleting stored data", page 85.

Press the MENU key to select "COLORIMETER" from the function menu and press the ENTER key.



A measuring screen of the colorimeter functions will appear.



6.1. Measurement Items

Pressing the ITEM key in the measurement mode will change the display item one by one. Scrolling is made from a color measurement item to color difference, to metamerism, to pass-fail decision and sRGB in this order.

Only of the measurement items selected in "Measurement Display Item" in the "Setting up the Colorimeter Functions" subsection are displayed.

For setting the measurement display items, see page 65.

Measurement items		Note
Color measurement items	XYZ	
	Yxy	
	L*a*b*	
	L*C*H°	
	L*u*v*	
	Hunter Lab	
	Whiteness	W·Tw(CIE No.15.2/ISO 105-J02) W(ASTM E313) W(ISO 2470) Any of the items can be selected and its measured value displayed. Also see the "Setting the Whiteness" subsection, page 72.
	Yellowness index	YI(ASTM E 313) YI(ASTM D 1925/JIS K 7103) Any of the items can be selected and its measured value displayed. Also see the "Setting the Yellowness Index" subsection, page 73.

Measurement items		Note
	Reflection density (CMYK)	Status A Status T Status E Status I DIN wide band DIN narrow band Any of the items can be selected and its measured value displayed. Also see the "Setting the density response" subsection, page 74.

Measurement items		Note
Color difference measurement items	⊿XYZ	
	⊿Yxy	
	⊿E*L*a*b*	
	⊿E*L*C*H*	⊿E*L*C*H* ⊿Ecmc ⊿E*94 Any of the items can be selected and its measured value displayed. Also see the "Setting the ⊿LCH" subsection, page 69.
	⊿E*L*u*v*	
	Hunter ⊿ELab	
	⊿EFMC-2	
	⊿Whiteness	W・Tw（CIE No.15.2/ISO 105-J02） W（ASTM E313） W（ISO 2470） Any of the items can be selected and its measured value displayed. Also see the "Setting the Whiteness" subsection, page 72.
	⊿Yellowness index	YI（ASTM E 313） YI（ASTM D 1925/JIS K 7103） Any of the items can be selected and its measured value displayed. Also see the "Setting the Yellowness Index" subsection, page 73.
	⊿Reflection density（CMYK）	Status A Status T Status E Status I DIN wide band DIN narrow band Any of the items can be selected and its measured value displayed. Also see the "Setting the density response" subsection, page 74.
Metamerism		See the "Evaluating the Metamerism" subsection, page 59. See the "Setting the Metamerism" subsection, page 75.

Measurement items	Note
Pass–fail decision	See the "Pass-Fail Decision by Color Difference" subsection, page 60. See the "Setting the Pass-Fail Decision" subsection, page 79.
sRGB	

For the color difference measurement item, a reference color value has to be set before measurement.

For setting the reference color value, see page 47.

6.2. Setting the Reference Color Value

To make a color difference measurement, a reference color value has to be set before measurement.

CHECK *The color difference, metamerism and pass-fail decision in "Displaying stored data" and "Printing stored data" are calculated on the basis of currently set reference values before being displayed or printed out. Therefore, you must take care in processing the stored data after the reference data are changed.*
For "Displaying stored data", see page 81.
For "Printing stored data", see page 83.

To set the reference data, there are the following three methods.

(1) Setting the reference data using the data stored in the reference value memory.

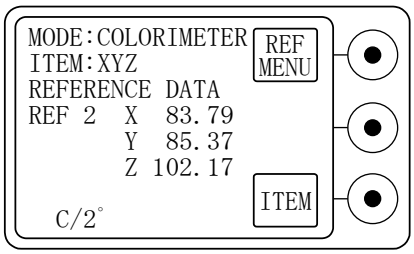
(2) Direct setting the reference values by measurement.

(3) Setting the reference values with use of the data in measurement data 1 to 400 stored in the measurement memory.

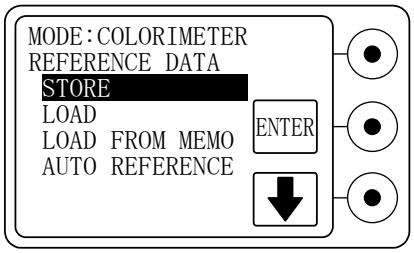
(1) Setting the reference data using data stored in the reference value memory.

You can measure the color difference of a target based on reference values data that is stored in the reference value memory and read it to set the reference values. The number of the reference data is 40.

1. Press the REF key in the measurement mode. The currently set reference values will appear.



2. Press the REF MENU key. The menu for setting the reference values will appear.



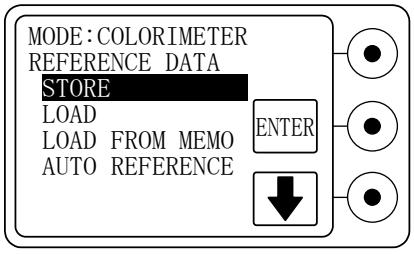
3. Store the reference data.
   Also see "Storing the reference data", page 48.
4. Load the reference data.
   Also see "Loading the reference data", page 52.
5. Make setting for automatic reference decision.
   Also see "Automatic reference decision", page 53.

●Storing the reference data

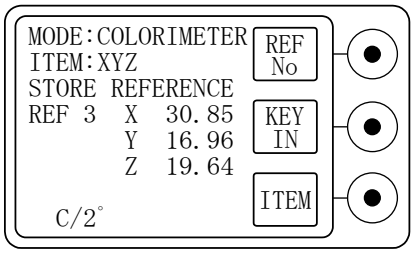
To store the reference data, there are the following two methods.

a. A target that is used as the reference should be measured and stored.
b. Spectral reflectances or XYZ tristimulus values should be directly entered and stored.

1. Select "STORE" in the reference values setting menu and press the ENTER key.



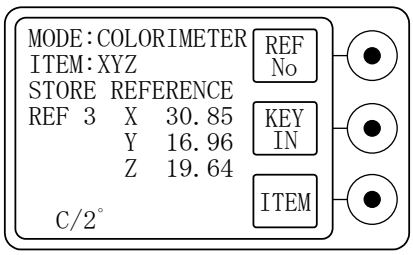
2. The store screen for the reference data will appear.



a. A target that is used as the reference should be measured and stored.

Measure the target that is used as the reference, and store the measured values in the reference value memory number shown.

1. Press REF No key to select the reference value memory number in which the reference values should be stored.

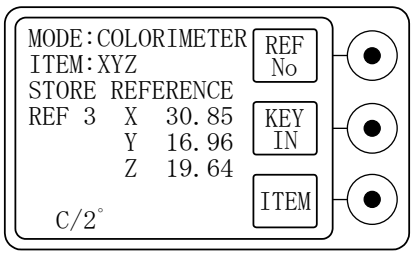


2. Measure the reference target.
3. After the measurement ends, the measured value is stored in the reference memory number shown.

b. Spectral reflectances or XYZ tristimulus values should be directly entered and stored.

Directly enter the reference spectral reflectances or XYZ tristimulus values, and store them in the reference value memory number.

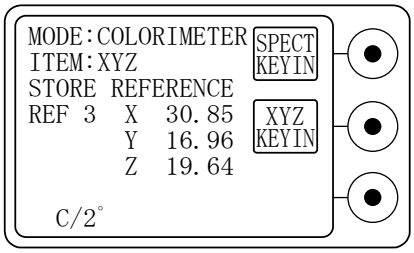
1. Press the REF No key to select the reference value memory number that should store the reference values.



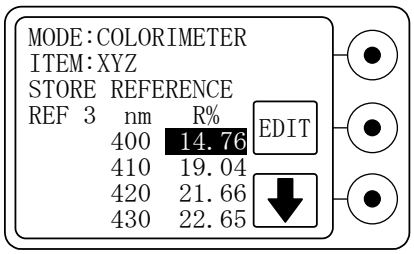
2. Press the KEYIN key.

To enter the spectral reflectance

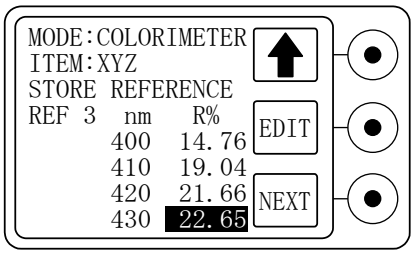
3. Press the SPECT KEYIN key.



4. Enter the spectral reflectance. Change the value that is reverse highlighted with the ↑ or ↓ key and press the EDIT key.



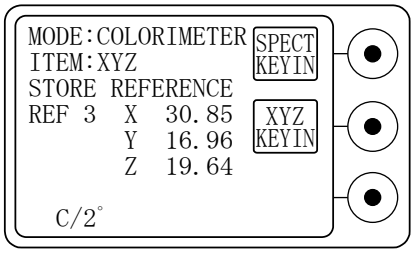
5. After the reverse highlight indicator begins to blink, change the value with the ↑ or ↓ key and press the ENTER key to select. The reverse highlight indicator will move to the next wavelength.
6. You can move to the next page by pressing the NEXT key at the bottom-most wavelength.



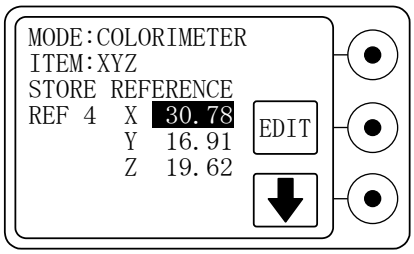
7. By pressing the NEXT key at 700 nm wavelength, the entered spectral reflectance is stored in the reference memory number shown.

To enter the XYZ tristimulus values

3. Press the XYZ KEYIN key.



4. Enter the XYZ tristimulus values. Change the value that is reverse highlighted with the ↑ or ↓ key and press the EDIT key.



5. After the reverse highlight indicator begins to blink, change the value with the ↑ or ↓ key and press the ENTER key to decide. The reverse highlight indicator will move to the next item.
6. By pressing the NEXT key at the bottom-most item, the entered XYZ tristimulus values are stored in the reference memory number shown.

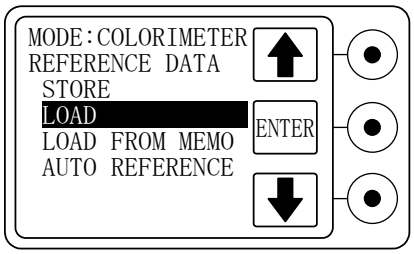
CHECK *To end storing of the reference data, press the EXIT key.*

CHECK *The entered XYZ tristimulus values have no identifications for observation conditions. Note, therefore, that the color difference is calculated unconditionally irrespective of the observation conditions set in the measurement mode.*

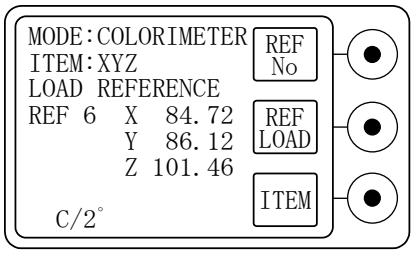
●Loading the reference data

The reference values can be set by loading the reference data from the reference value memory.

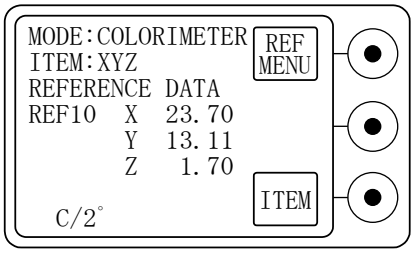
1. Select "LOAD" in the reference values setting menu and press the ENTER key.



2. The load screen for the reference data will appear.



3. Press the REF No key to select the reference memory number to be loaded.
4. Press the REF LOAD key. The message "REFERENCE DATA IS UPDATED." will appear. The data in the reference memory number shown is set as the reference values.



CHECK *If a reference memory number having no reference data is stored, the message "NO REFERENCE DATA." will appear and the screen returns to the previous one.*

●Automatic reference decision

During a measurement, you should set the automatic reference decision feature that can automatically retrieve the reference data closest to the color difference from data in the reference value memory before setting it as the reference value.

ON/OFF

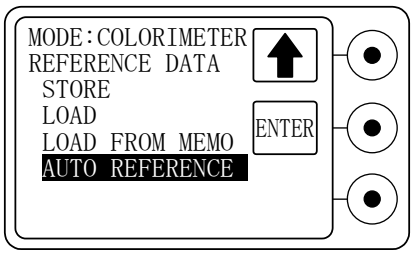
ON: Enables the automatic reference decision feature. Select desired plural reference value memory number to be made effective from among the 40 data in the reference value memory.

OFF: Disables the automatic reference decision feature.

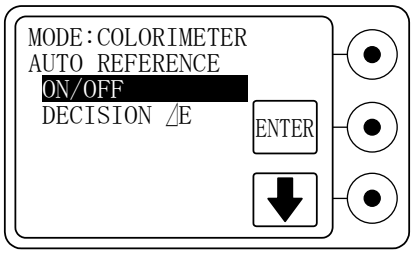
DECISION⊿E

This is used to set a color difference item for use in retrieving the nearest color difference.

1. Select "AUTO REFERENCE" in the reference values setting menu and press the ENTER key.

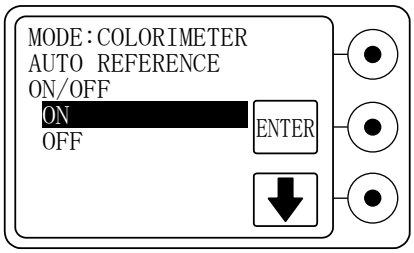


2. Select an item with the ↑ or ↓ key and press the ENTER key.

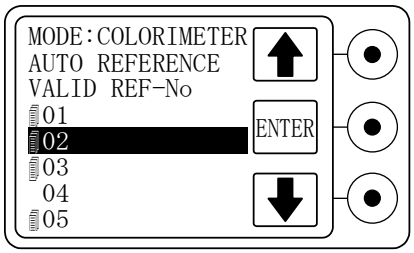


Setting "ON/OFF"

1. Select "ON/OFF" in the reference values setting menu and press the ENTER key.
2. Select "ON" or "OFF" with the ↑ or ↓ key and press the ENTER key.



3. If "ON" is selected at step 2 above, select the reference value memory number that is enabled for the automatic reference decision feature. Select the reference value memory number to be enabled with the ↑ or ↓ key and press the ENTER key. The number will have a check mark next to it.

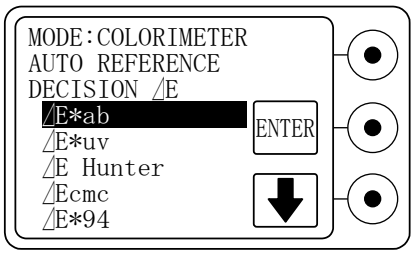


HINT *By selecting the memory number having a check mark next to it and pressing the ENTER key, the check mark goes off.*

CHECK *If you select no reference memory number, the currently set reference values are used as is.*

Setting "DECISION ⊿E"

1. Select "DECISION ⊿E" in the reference values setting menu and press the ENTER key.
2. Set a color difference item to be used for retrieving the reference data closest to the color difference. Select a type of color difference with the ↑ or ↓ key and press the ENTER key.

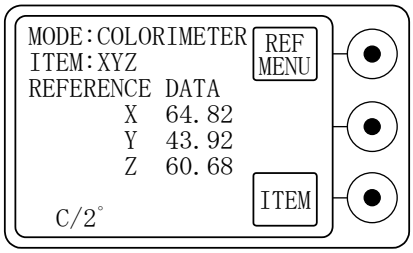


(2) Direct setting the reference values by measurement.

The reference target is measured and the measured data is set as the reference values.

CHECK *The measured data is not stored in the reference value memory.*

1. Press the REF key in the measurement mode. The currently set reference values will appear.



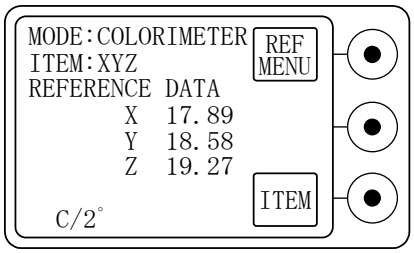
2. Measure the target used as the reference.
3. A message "REFERENCE DATA IS UPDATED." will appear. The reference values are set and control returns to the measurement mode.

(3) Setting the reference values with use of the data stored in measurement memory.

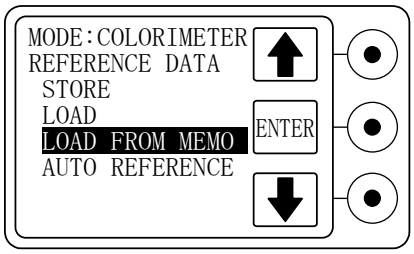
You can set the reference values by reading the measured data from 1 to 400 stored in the measurement memory.

CHECK *The measurement data is not stored in the reference value memory.*

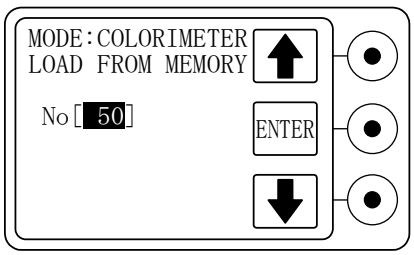
1. Press the REF key in the measurement mode. The currently set reference values will appear.



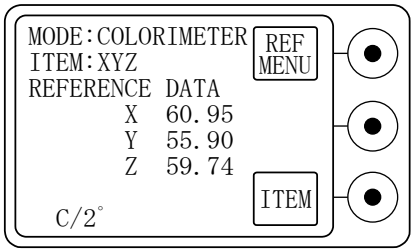
2. Press the REF MENU key, select "LOAD FROM MEMO" in the reference values setting menu and press the ENTER key.



3. Enter the sample number of the measurement data to be read as the reference value. Change the value with the ↑ or ↓ key and press the ENTER key.



4. The message "REFERENCE DATA IS UPDATED." will appear and the measured data of the specified sample number is set as the reference value.



6.3. Measurement When Using a Color Control Program

This Spectrophotometer can be used with color control programs used for color control and data analysis on a personal computer.

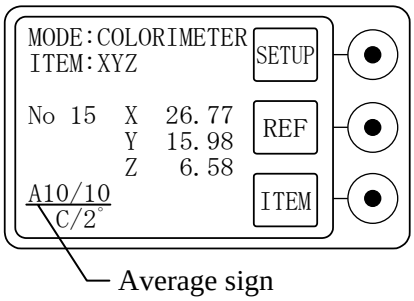
CHECK *You have to set "DATA FORMAT" for "SERIAL COMM" of "SYSTEM SETUP" to "PC". You also have to set communication conditions to the same ones as the color control program. For settings, see page 92.*

For a detailed description, see the instruction manual for the color control program.

6.4. Averaging Measurement

This Spectrophotometer can average measurement data up to 20 points for measuring an average of data at plural positions in a wide area or for measuring an average of plural samples. For details of the average measurement, see page 67.

Example of average measurement display



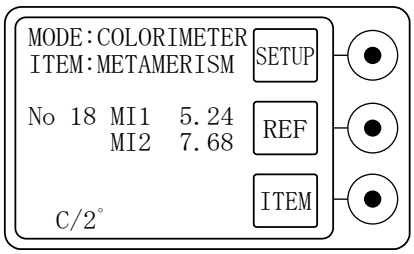
6.5. Evaluation of Metamerism

Metamerism is used to evaluate how much the color difference deviates if lighting is changed for two samples having the same or virtually the same color under an illuminating light.

For setting the metamerism, see page 75.

CHECK *The metamerism of the Spectrophotometer is an evaluation with the reference value. To evaluate metamerism, one of the two samples has to be set at the reference value. However, the reference value has to be set with spectral reflectance. Note that if the reference values are entered as XYZ tristimulus values by keys, they cannot be printed out.* *For setting the reference values, see page 47.*

Example of metamerism



6.6. Pass-Fail Decision by Color Difference

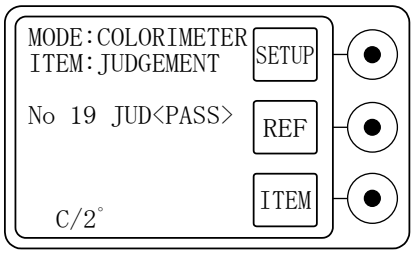
A pass-fail decision is made based whether or not the color difference of a measured target compared to the stored color difference value is within an allowable limit.

For setting the pass-fail decision, see page 79.

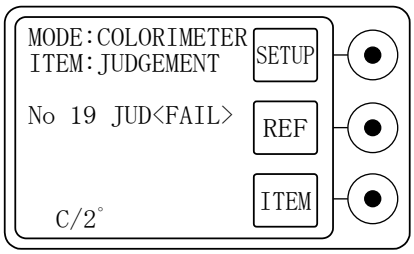
CHECK *You have to set the color difference value before the pass-fail decision.*
For setting the reference value, see page 47.

Example of pass–fail decision

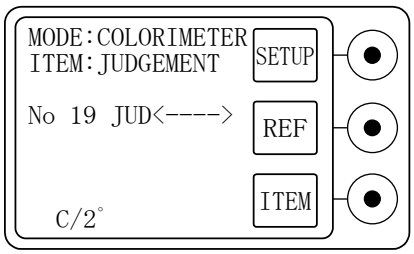
A result of the pass-fail decision is shown in parentheses 〈 〉.



Ex.)PASS



Ex.)FAIL



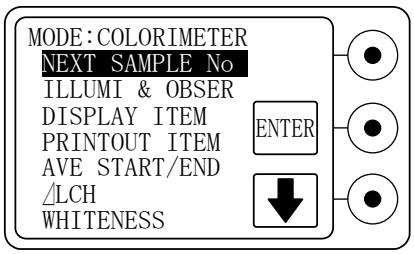
Ex.)Default

6.7. Setting up the Colorimeter Functions

Various color difference meter features can be set from the setup menu.
The settings are saved until they are changed again.

Common setup

1. Press the SETUP key. The setup menu for the colorimeter functions will appear.
2. Select an item to be set with the ↑ or ↓ key and press the ENTER key.

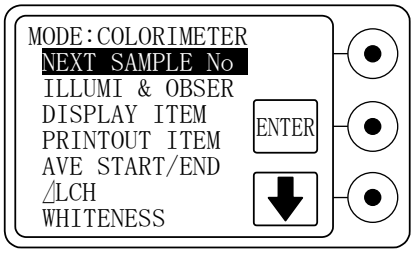


3. Set up for the item. Repeat setup for the other items.
4. After all the setups are completed, press the EXIT key. The screen will return to the measurement screen.

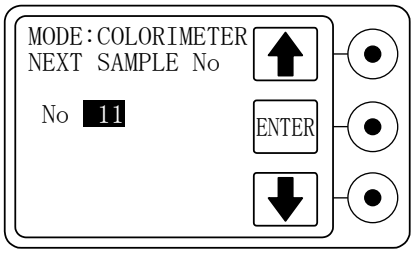
◆Setting the next samples

You can set up any of the samples from 1 to 400 to be measured next as follows.

1. Select "NEXT SAMPLE No" in the setup menu and press the ENTER key.



2. Enter the sample number to be measured next. Change the numerical value with the ↑ or ↓ key and press the ENTER key.



CHECK *The sample numbers for the colorimeter functions are in common with the spectrophotometer functions.*

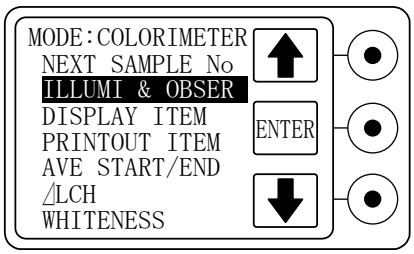
◆Setting the illuminant and observation

The illuminant and observation can be set as follows.

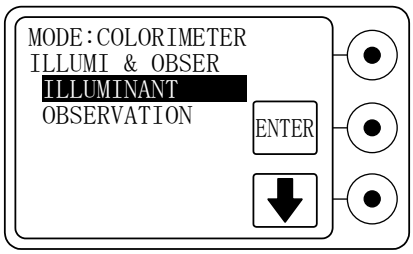
Illuminant : A, C, D65, D50, F2, F6, F7, F8, F10, F11 and F12

Observation : 2° and 10°

1. Select "ILLUMI & OBSER" in the setup menu and press the ENTER key.

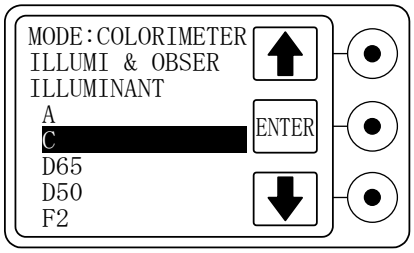


2. Select an item to be set with the ↑ or ↓ key and press the ENTER key.



●Setting the illuminant

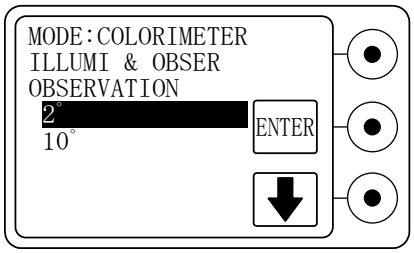
1. Select "ILLUMINANT" in the observation conditions menu and press the ENTER key.
2. Select a type of illuminant with the ↑ or ↓ key and press the ENTER key.



3. After a message "UPDATING..." appears, the screen returns to the observation conditions menu.

●Setting the Observation

1. Select "OBSERVATION" in the observation conditions menu and press the ENTER key.
2. Select a type of observation with the ↑ or ↓ key and press the ENTER key.

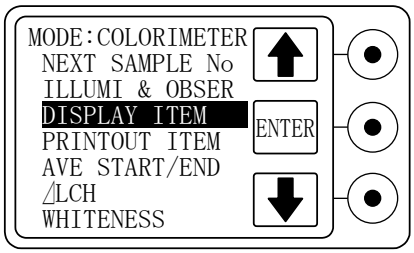


3. After a message "UPDATING..." appears and the current data is re-calculated in the set observation conditions, the screen returns to the observation conditions menu.

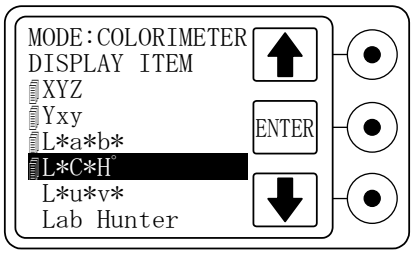
◆Setting the measurement display item

A measurement display item can be set as follows. The measurement display item set here is indicated the display item changed with the ITEM key in the measurement mode.

1. Select "DISPLAY ITEM" in the setup menu and press the ENTER key.



2. Select a measurement item to be displayed with the ↑ or ↓ key and press the ENTER key. The selected measurement item will have a check mark next to it.



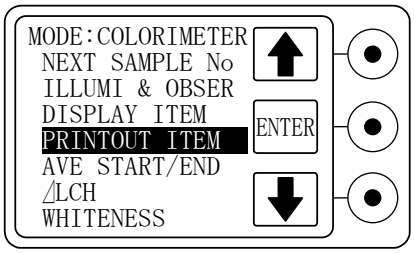
HINT *By selecting a check-marked measurement item and pressing the ENTER key, the setting will toggle and the check mark removed.*

CHECK *If no measurement items are selected, only XYZ are displayed.*

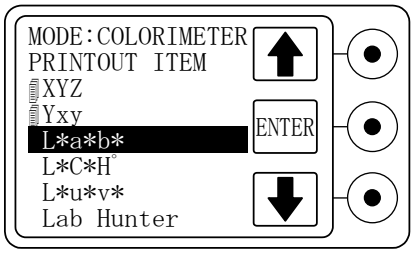
◆Setting the printout item

You can set the printout items as follows.

1. Select "PRINTOUT ITEM" in the setup menu and press the ENTER key.



2. Set the printout item. Select a measurement item to be printed with the ↑ or ↓ key and press the ENTER key. A check mark will be placed next to the selected measurement item.

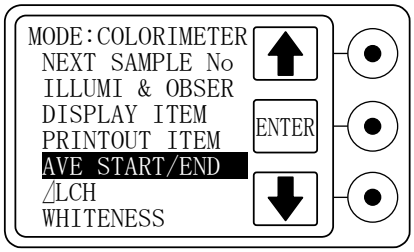


HINT *By selecting a check-marked measurement item and pressing the ENTER key, the setting will toggle and the check mark removed.*

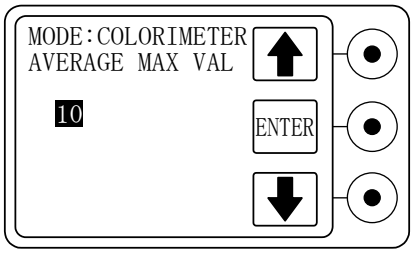
◆Setting the averaging start/end

This Spectrophotometer can average measurement data over up to 20 points in order to measure an average of data at plural positions in a wide area or to measure an average of plural samples.

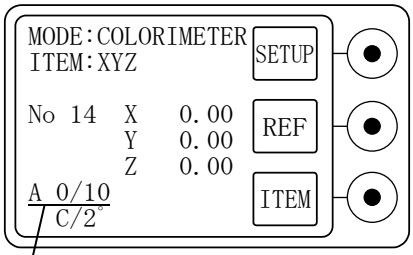
1. Select "AVE START/END" in the setup menu and press the ENTER key.

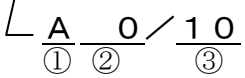


2. Set number of average times (2 to 20) by changing the number with the ↑ or ↓ key and press the ENTER key.



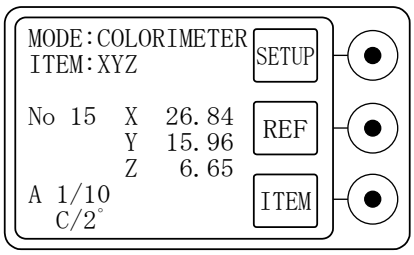
3. The screen will change to the average measurement screen.



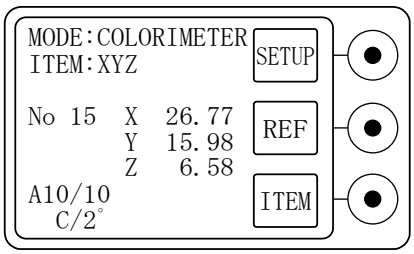


①Average sign
②Current measurement time
③Maximum number of average measurement times

4. Measure the targets to be averaged in order. The current measurement time will increase as each measurement is made. The data indicated is a measured value of the target.



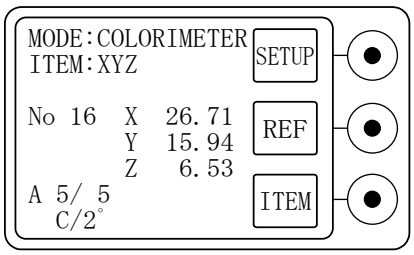
5. After the maximum number of average measurement times ends, a message "AVERAGING..." will appear. An average value will appear automatically and the average measurement ends. The average value is stored in the sample number memory indicated.



Calculating the average value in the course of measurement of the targets to be averaged

You can calculate an average value of the number of measurements at anytime during the course of step 4 above by pressing the SETUP key on the screen in which the average measurement is being made.

1. Press the SETUP key on the screen in which the average measurement is being made, select "AVE START/END" again and press the ENTER key.
2. The message "AVERAGING..." will appear and the screen will display an average value of the number of measurements up to this point.



◆Setting the ⊿LCH

You can set the type of ⊿LCH and lch value.

⊿LCH items include:

⊿E*L*C*H*
⊿Ecmc
⊿E*94

lch values include:

l: Adjustment value (1.00 ～ 2.00) associated with a correction coefficient multiplied by a brightness difference (⊿L*).

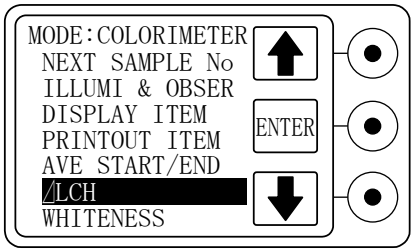
c: Adjustment value (1.00～2.00) associated with a chroma difference (⊿C*).

H: Adjustment value (1.00～2.00) associated with an ab color difference (⊿H)*

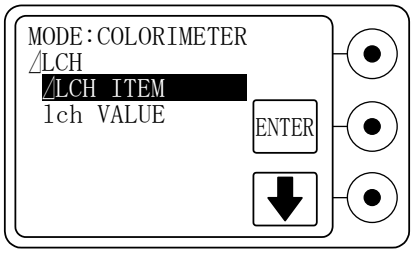
HINT *The ratio of l:c:h is usually set to 1:1:1. If a textile is measured, the ratio is set to 2:1:1.*

CHECK *The lch values are effective only if ⊿Ecmc or ⊿E*94 is selected in the "⊿LCH ITEM" . The h value is effective only for ⊿E*94.*

1. Select "⊿LCH" in the setup menu and press the ENTER key.

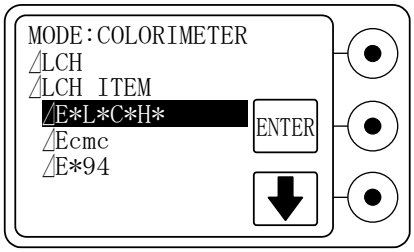


2. Select an item to be set with the ↑ or ↓ key and press the ENTER key.



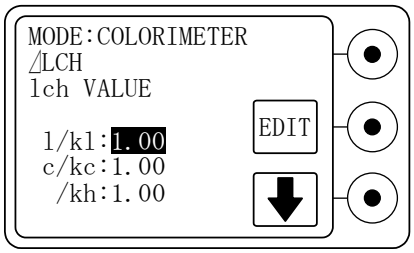
●Setting the "⊿LCH ITEM"

1. Select "⊿LCH ITEM" in the menu for ⊿LCH and press the ENTER key.
2. Select a type of ⊿LCH with the ↑ or ↓ key and press the ENTER key.

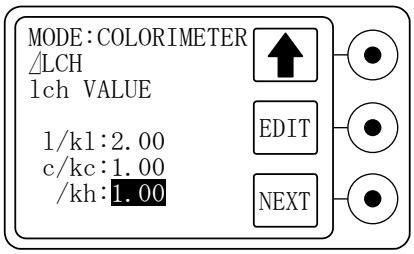


●Setting the "lch VALUE"

1. Select "lch VALUE" in the menu for ⊿LCH and press the ENTER key.
2. Enter lch values. Select the value to be changed using the ↑ or ↓ key and press the EDIT key.



3. After the reverse highlight indicator begins to blink, change the value with the ↑ or ↓ key and press the ENTER key to decide. The reverse highlight indicator will move to the next item.
4. Press the NEXT key at the bottom-most item. The screen will return to the menu for ⊿LCH.

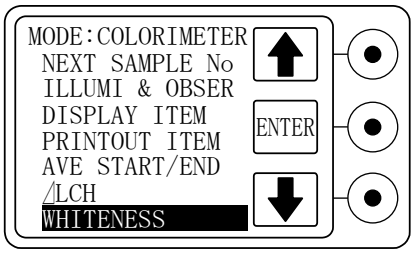


◆Setting the whiteness

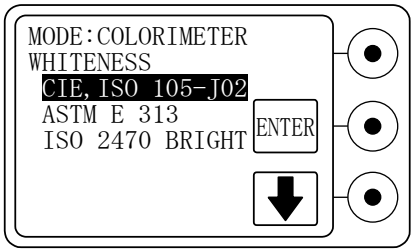
You can set the type of whiteness (W and ⊿W).

CIE No.15.2／ISO 105-J02
ASTM E 313
ISO 2470 brightness

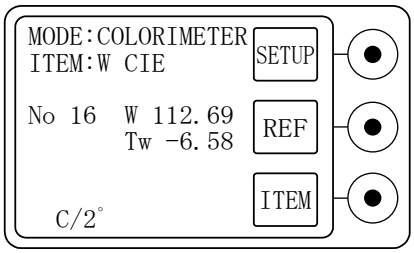
1. Select "WHITENESS" in the setup menu and press the ENTER key.



2. Select the type of whiteness with the ↑ or ↓ key and press the ENTER key.



CHECK *If returning to the measurement mode and setting the measurement display item to the whiteness index, the screen will indicate the type of whiteness selected.*



CHECK *To indicate ⊿W (ISO 2470 brightness), the reference values must be set with spectral data. If the reference values are entered with XYZ tristimulus values by key, ⊿W(ISO 2470 brightness) cannot be displayed. Also they cannot be printed out. For setting the reference values, see page 47.*

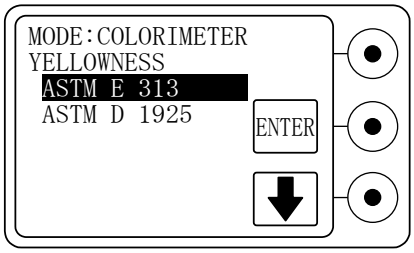
◆Setting the yellowness index

You can set the type of yellowness index (Y and ⊿YI).

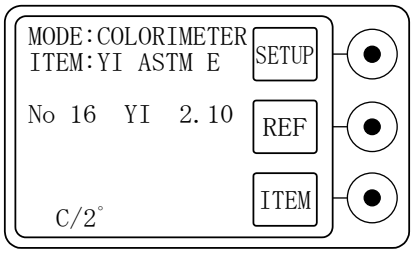
ASTM E 313
ASTM D 1925／JIS K 7103

1. Select "YELLOWNESS" in the setup menu and press the ENTER key.

2. Select the type of yellowness index with the ↑ or ↓ key and press the ENTER key.



CHECK *If returning to the measurement mode and setting the measurement display item to the yellowness index, the screen will indicate the type of yellowness index selected.*

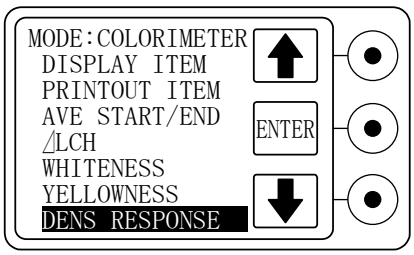


◆Setting the density response

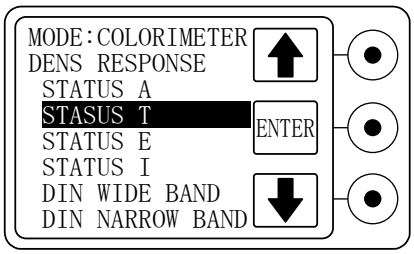
You can set the density response of the type of reflection density (CMYK).

Status A
Status T
Status E
Status I
DIN wide band
DIN narrow band

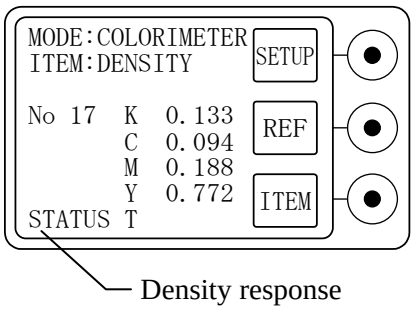
1. Select "DENS RESPONSE" in the setup menu and press the ENTER key.



2. Select a type of density response with the ↑ or ↓ key and press the ENTER key.



CHECK *If returning to the measurement mode and setting the measurement display item to the reflection density, the screen will indicate the type of density response selected.*



◆Setting the metamerism

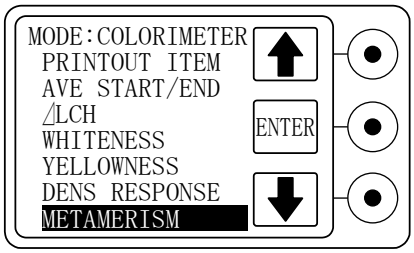
You can set the reference light, test lights, observer and color difference items for the metamerism evaluation.

CHECK

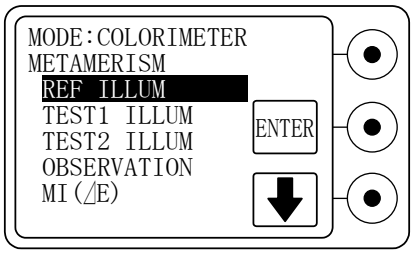
This Spectrophotometer can make the evaluation with two types of test light at the same time. The metamerism evaluation of the Spectrophotometer is made with the reference values. For the metamerism evaluation, one of two samples has to be set at the reference values. However, the reference values must be set with spectral reflectance. If the reference values are entered with XYZ tristimulus values by key, no metamerism can be displayed. Also they cannot be printed out.

For setting the reference values, see page 47.

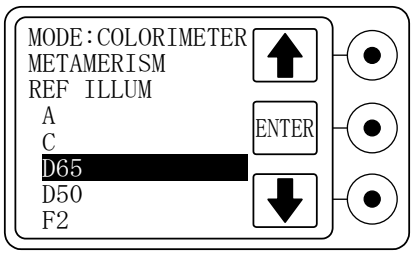
1. Select "METAMERISM" in the setup menu and press the ENTER key.



2. Select "REF ILLUM" with the ↑ or ↓ key and press the ENTER key.

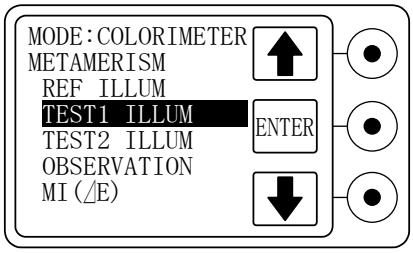


3. Set the type of reference light with the ↑ or ↓ key and press the ENTER key.

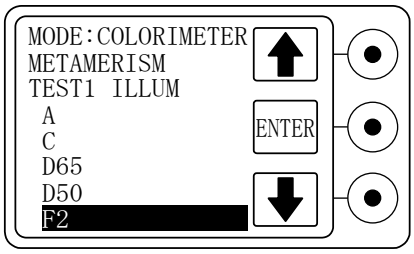


The reference light used should normally be the standard light D65.

4. Select "TEST1 ILLUM" with the ↑ or ↓ key and press the ENTER key.

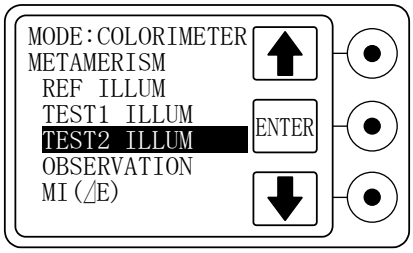


5. Set the type of test light 1 with the ↑ or ↓ key and press the ENTER key.



HINT *The test light should normally be standard light A and F6, F8 and F10. The CIE specifies that of the F illuminants for the test light, F2, F7 and F11 should have higher priority.*

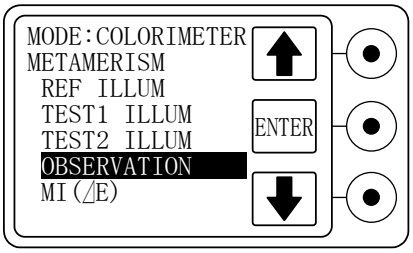
6. Select "TEST2 ILLUM" with the ↑ or ↓ key and press the ENTER key.



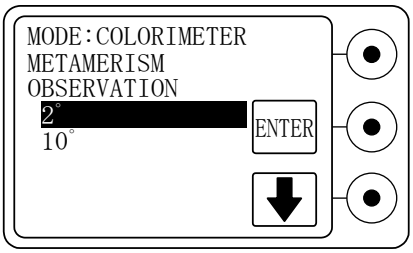
7. Set the type of test light 2 as with step 5 above.

HINT *If evaluations are made without two types of test lights, select "NONE".*

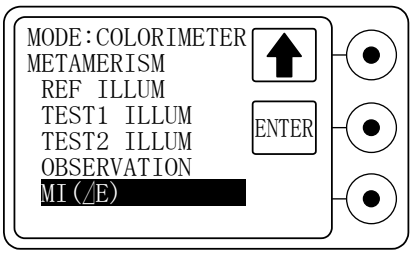
8. Select "OBSERVATION" with the ↑ or ↓ key and press the ENTER key.



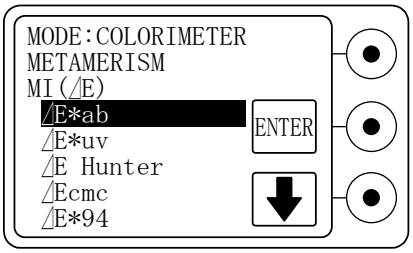
9. Set the type of observation with the ↑ or ↓ key and press the ENTER key.



10. Select "MI(⊿E)" with the ↑ or ↓ key and press the ENTER key.



11. Set the color difference item to be evaluated by selecting the type of color difference with the ↑ or ↓ key and press the ENTER key.

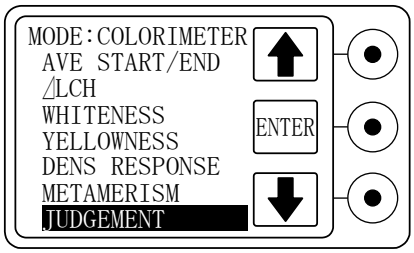


◆Setting the pass-fail decision

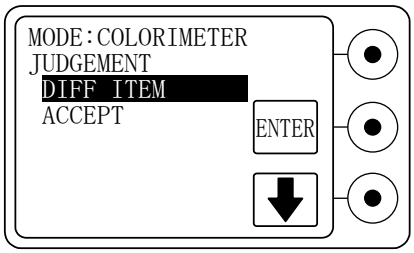
You can set a color difference item and allowable range for a pass-fail decision.

You have to set a color difference value before making the pass-fail decision. For setting reference value, see page 47.

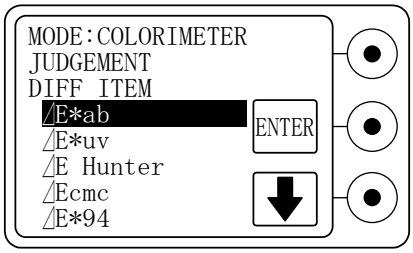
1. Select "JUDGEMENT" in the setup menu and press the ENTER key.



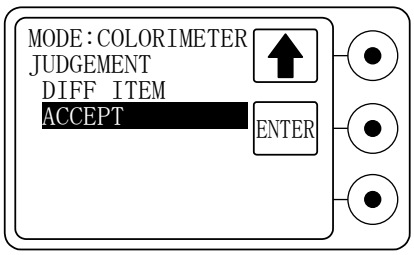
2. Select "DIFF ITEM" with the ↑ or ↓ key and press the ENTER key.



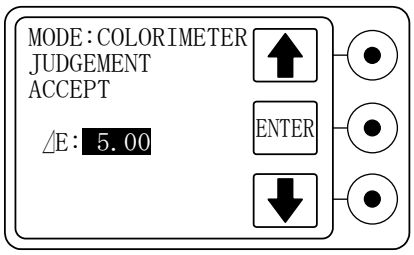
3. Set the color difference item to be evaluated by selecting the type of color difference with the ↑ or ↓ key and press the ENTER key.



4. Select "ACCEPT" with the ↑ or ↓ key and press the ENTER key.



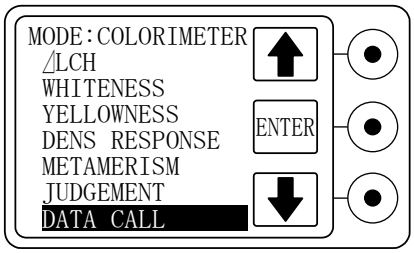
5. Set the allowable range of 0.01 to 99.99 of the color difference item to be evaluated as set in step 3 above, by changing the value with the ↑ or ↓ key and press the ENTER key.



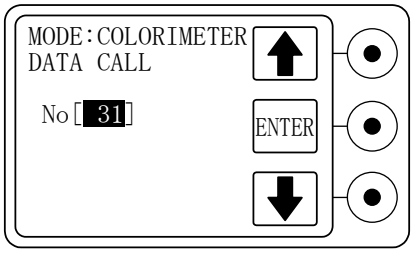
◆Displaying stored data

You can display any of the measured data numbered from 1 to 400 stored in memory.

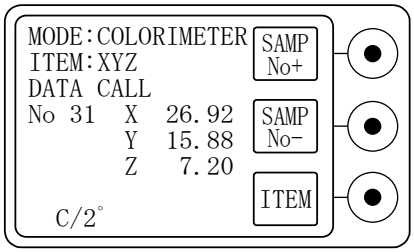
1. Select "DATA CALL" in the setup menu and press the ENTER key.



2. Enter the sample number of the measured data to be displayed, by changing the value with the ↑ or ↓ key and press the ENTER key.



3. A message "CALCULATING..." will appear, then the measured data of the entered sample number will be displayed.



HINT *If you display the stored data, the SAMP No+ key and the SAMP No– key will appear.*

To change the displayed sample number

1. Press the SAMP No+ or SAMP No- key
2. After the message "CALCULATING..." appears, the data screen will change to the specified sample number.

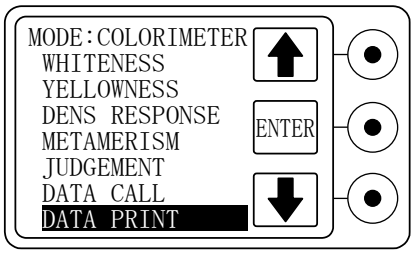
To end the stored data call, press the EXIT key.

◆Printing stored data

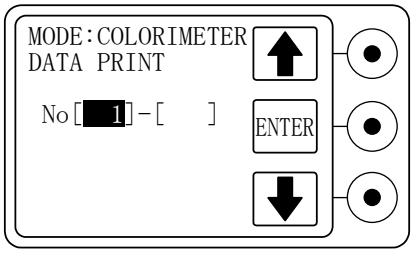
You can batch-print the measured data of a specified range (from 1 to 400) in memory.

CHECK *To print out the stored data, connect an output device and set printout items before printing. You should also set communication conditions in advance. For setting the printout items, see page 66. For setting the communication conditions, see page 92.*

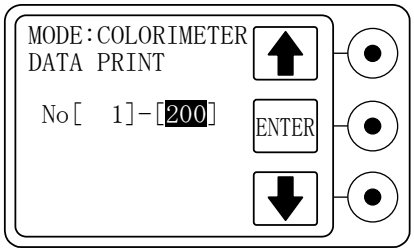
1. Select "DATA PRINT" in the setup menu and press the ENTER key.



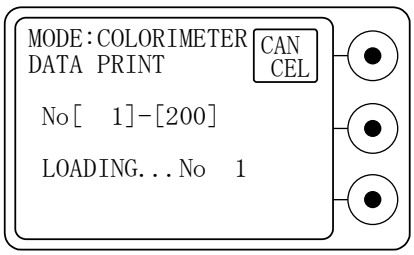
2. Enter the first sample number in the range to be printed out. The value can be changed with the ↑ or ↓ key and then pressing the ENTER key.



3. In turn, enter the last sample number in the range. The value can be changed with the ↑ or ↓ key and then pressing the ENTER key.



4. The screen will change to a printout screen. At the end of the printout, the screen will return to the setup menu.

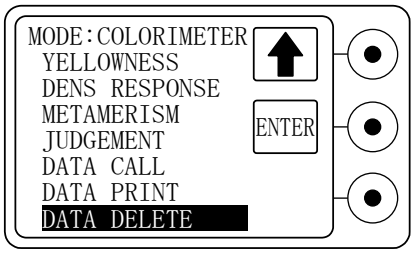


CHECK *To interrupt printout of the stored data, press the CANCEL key. Keep the CANCEL key pressed until the printout is interrupted.*

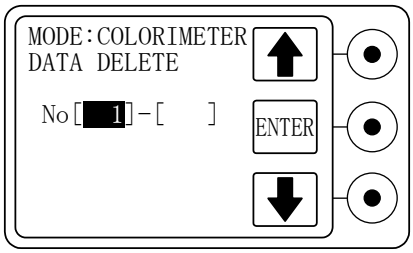
◆Deleting stored data

You can batch-delete the measured data of a specified range (from 1 to 400) in memory.

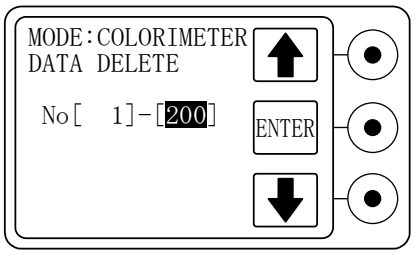
1. Select "DATA DELETE" in the setup menu and press the ENTER key.



2. Enter the first sample number in the range to be deleted. The value can be changed with the ↑ or ↓ key and then pressing the ENTER key.



3. In turn, enter the last sample number in the range. The value can be changed with the ↑ or ↓ key and then pressing the ENTER key.



4. A message "STORED DATA IS DELETED." will appear and the screen will return to the setup menu.

HINT

If all the data are deleted by setting the range to No 1 to 400, the next sample number becomes "1" when returning to the measurement mode.

6.8. Output Format

If the Spectrophotometer is connected to a printer or personal computer via a serial communication connector, measured values can be output with the printout item set. The measured values can also be output with an infrared communication port.

For setting the printout items, see page 66.

For setting the communication conditions, see page 92.

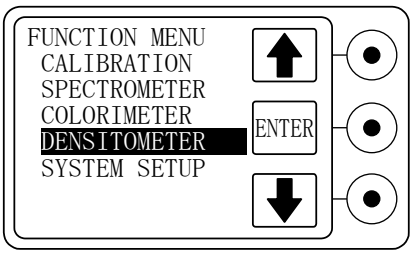
Output examples:

```
No 73      C/2°
        X  55.36
        Y  57.55
        Z   6.18
        x 0.4648
        y 0.4832
       dX   0.05
       dY  -0.02
       dZ  -0.01
       dx 0.0004
       dy-0.0003
     MI 1   0.06
     MI 2   0.01
    JUDGE <PASS>
```

7. DENSITOMETER FUNCTIONS

The Spectrophotometer can measure the density of a target.

Press the MENU key, select "DENSITOMETER" in the function menu and press the ENTER key.



CHECK *For instructions on using the densitometer functions, see the separate document: Instruction Manual for Densitometer Functions of Spectrophotometer.*

8. SYSTEM SETUP

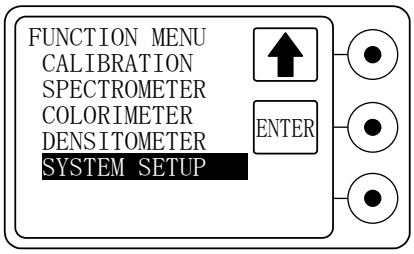
You can set up various all the items, such as the operating environment of the Spectrophotometer. Select "SYSTEM SETUP" in the function menu and proceed to the setup menu. The following items can be set in the setup menu.

- Power off timer
- Sound control
- Left/Right view
- Instructions
- Serial communication
- Security
- Battery refresh
- Version information

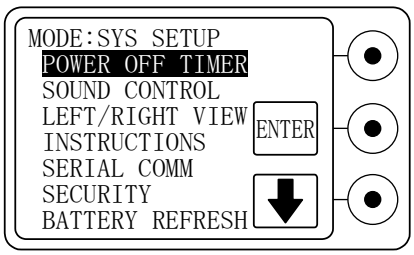
The details set in the setup mode are written in nonvolatile memory.
They are saved until the setting is changed again.

Common setup

1. Press the MENU key, select "SYSTEM SETUP" in the function menu and press the ENTER key.



2. The setup menu will appear. Select an item to be set with the ↑ or ↓ key and press the ENTER key. Proceed with setting.



3. Repeat setting for other items.
4. After all the setups are completed, press the EXIT key. The screen will return to the measurement screen.

8.1. Power Off Timer

Select one of "40 sec", "90 sec", "210 sec" or "DISABLE (no auto power off)" and press the ENTER key.

Note that the times shown are estimated, actual auto power off times may vary.

8.2. Sound Control

Select either of "ON" or "OFF" for sound control and press the ENTER key.

8.3. Left/Right View

Select either "Right-Hand Operation" or "Left-Hand Operation" for liquid crystal display and press the ENTER key. Display of the liquid crystal display will turn 180 degrees depending on the setting. However, the features of the function keys are always displayed at their sides.

8.4. Instructions

Select either "ON" or "OFF" for instruction message display and press the ENTER key.

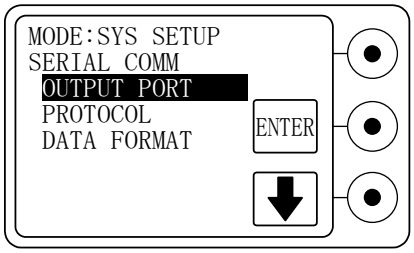
This setting is effective only for the densitometer features.

If you are familiar with the measuring procedures, you may turn the instruction message to "OFF". Operational performance will increase.

8.5. Serial Communications

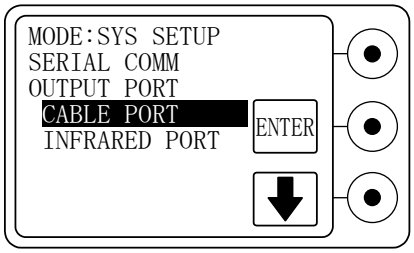
You can transfer measured data to a printer or personal computer.

The output port, protocol and data format should be set up as follows.



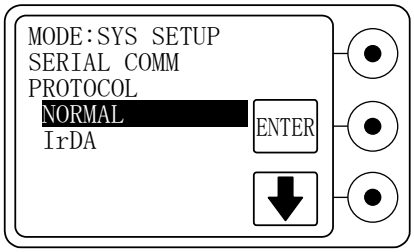
Setting the output port

To set up the output port, select either "CABLE PORT" or "INFRARED PORT" and press the ENTER key.



Setting the protocol

To set up the protocol, select either "NORMAL" or "IrDA" and press the ENTER key.



If "Normal" is selected

Communication conditions for serial communications should be set up to match the printer or personal computer to be connected.

Communication procedures:

Baud rate : 2,400 to 19,200 bps.
Data bit : 7 or 8 bits.
Stop bit : 1 or 2 bits.
Parity : NONE, ODD or EVEN.
Flow control : Fixed to hardware (CTS/RTS).

However, if the infrared communication is selected in "Setting the output port", serial communication is made without flow control.

Note that if these settings do not match the printer or personal computer connected, correct communication will not be established.

Setting the baud rate:

Select one of "19200 bps", "9600 bps", "4800 bps" or "2400 bps" and press the ENTER key.

Setting the data bit:

Select one of "8 bit" or "7 bit" and press the ENTER key.

Setting the stop bit:

Select one of "1 bit" or "2 bit" and press the ENTER key.

Setting the parity:

Select "NONE", "ODD" or "EVEN" and press the ENTER key.

This Spectrophotometer will automatically output the measurement results each time a measurement is made when the serial communication connector has the printer or personal computer connected. You must use one of the communication cables exclusively supplied as an option.

The connection cables available are:

(1)To connect to a 25 pin connector on the exclusive printer [PR-95] or a personal computer.

Communication cable D-Sub 25 pin (Part No.:H02388AS)

(2)To connect to a 9 pin connector for a personal computer.

Communication cable D-Sub 9 pin (Part No.:H02607AS) or communication cable D-Sub 25 pin and change connector
(Part No.:H02388AS and AT-925S)

If "IrDA" is selected

The measured data is output by infrared communications for use with IrDA.

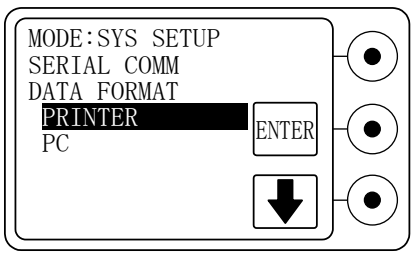
CHECK *The computer and other devices for reception of the measured data require infrared send and receive ports for use with IrDA.*

Setting the data format

Select data formats as either "PRINTER" or "PC" and press the ENTER key.

PRINTER: Outputs in the printer format for the [PR-95].

PC : Outputs in the format and communication procedures for a color control program.



8.6. Security

Ihara colorimeters have an optional security function to safeguard your investment. The densitometer will operate only with the correct user code. Please contact Ihara for more information.

If you have purchased this optional security feature, please follow the following steps to set up:

1. Enter the 5 digit number provided by Ihara to access the security feature.
2. Select and enter your own 4 digit security code.
3. Confirm your 4 digit security code by entering it again.
4. Select the number of measurement readings to be allowed before the security confirmation screen appears.
5. After the above-assigned number of measurements have been made, a technical support information screen will appear before the instrument shuts off. When you turn on the instrument again to take a measurement, the prompt to enter the security code appears.
6. You have two attempts to enter the correct security code.
7. If the security code is entered incorrectly, the instrument will turn off automatically.

8.7. Battery Refresh

The battery refreshing feature discharges the battery completely before recharging the battery. This is to dissolve the memory effect of the NiCd battery built in the equipment. For more on the memory effect of the NiCd battery, see page 8. Proceed as follows.

1. Select "BATTERY REFRESH" in the setup menu.
2. Connect an AC adapter between an AC 120V wall receptacle and the DC 9V connection jack on the rear side of the equipment.
3. Press the START key.
4. The charge lamp will change to green and discharging will start. The battery indicator will show the discharge time.
5. When the discharge ends completely, the charge lamp will change to orange and charging will start. While charging, the equipment is powered off.
6. When the charge lamp changes to green, refreshing the battery has been completed.

To cancel discharging, press the EXIT key.

The NiCd battery has a finite lifetime. Its capacity decreases severely after service of around two years or 500 charge and discharge cycles even in normal use. The battery refreshing feature will not extend this service life. If the battery capacity is consumed soon after refreshing the battery, the battery should be replaced.
For replacing the battery, see page 100.

8.8. Version Information

This screen shows information on the ROM version of the equipment and other options. The screen returns to the previous one by pressing the EXIT key.

9. ERROR AND WARNING MESSAGES

If any of the following messages appear during measurement, stop the measurement and check the equipment.

Message	Description
NEED CALIBRATION. YOU MUST CALIBRATE WHITE BOARD.	Needs white calibration. Make white calibration.
NEED CALIBRATION. YOU MUST CALIBRATE ZERO REFLECTANCE.	Needs zero calibration. Make zero calibration.
CALIBRATION ERROR! TRY AGAIN.	Calibration ended abnormally. Retry calibration.
A/D OVERFLOW! CARRY OUT CALIBRATION AGAIN.	A/D converter output overflow. Set calibration measurement range to "0-200%" and retry calibration.
LAMP IS OUT! MAKE CONTACT WITH THE DEALER TO REPLACE THE LAMP.	Lamp broken. If same message appears after another measurement, contact sales agent for lamp replacement.
TEMP. WARNING! NEED CALIBRATION AGAIN.	Alarm message informing of a temperature difference from the time of calibration to the current time. Measurement can be continued, but re-calibration is recommended for correct results.
PC COMM ERROR!	Message informing that communication with the PC is not normal. Make sure that the communication is correctly connected and the communication conditions are correctly set.

10. MAINTENANCE

10.1. Replacing the Battery

This Spectrophotometer has a NiCd battery built in. Its service life is around two years, but may be shortened if charged often. If the battery capacity cannot be recovered even when recharged or if the battery capacity is used up soon after recharging, the service life has been reached. Replace the NiCd battery.

Replacement part (option): NiCd battery, part No. H02523AS. When ordering the NiCd battery, inform the service representative of the serial number of the equipment.

How to replace the NiCd battery

1. Prepare a large Phillips screwdriver.
2. Remove the AC adapter. Turn off the main power switch on the rear side of the equipment.
3. Put the equipment upside down. Remove the six screws on the bottom. Take out the metal cover.
4. Pull out the connector at the end of the cable extended from the NiCd battery. Take out the NiCd battery.
5. Put a new NiCd battery in position. Securely insert the connector.
6. Correctly place the cable in the groove. Place the metal cover in the original position. Tighten the six screws.
7. Connect the AC adapter for charging.

If the charge lamp is not lit orange within one minute after the AC adapter is connected, check to insure proper connection of the battery connector.

Never disassemble the battery. Its strong alkali electrolyte may injure skin and clothes. Should the electrolyte, thoroughly wash the battery with water before handling leak.
Also, never place the battery into a fire. The battery may explode and is extremely dangerous.

The NiCd battery is a valuable recyclable resource. Please do not discard it, but bring it to a NiCd battery recycle shop for reuse.

10.2. Options and Replacement Parts

Options include:

Printer, Model [PR-95]
Communication cable D-Sub 9 pin (Part No. H02607AS)
Communication cable D-Sub 25 pin (Part No. H02388AS)
Conversion connector: 25 pin - 9 pin (Part No. AT-925S)

Replacement parts include:

Lamp unit (Part No. H02514PB)
NiCd battery (Part No. H02523AS)
White calibration board (Part No. H02567AS)

11. MAINTENANCE

11.1. Replacing the Battery

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Conversion connector: 25 pin - 9 pin (Part No. AT-925S)

Replacement parts include:

Lamp unit (Part No. H02514PB)
NiCd battery (Part No. H02523AS)
White calibration board (Part No. H02567AS)

12. TROUBLESHOOTING

The equipment cannot be powered on.

- Is the main power switch on the rear panel of the equipment ON?
- Is the AC adapter connected?
- Is the wall receptacle live?
- Is the liquid crystal display contrast adjusting control set correctly?
- Is the built-in battery connected securely?

Correct measured value is not indicated.

- Is calibration made correctly?
- Are setup items in measurement mode set correctly?
- Is the head held correctly during measurement?
- Is the whiteness calibration board scratched or dirty?
- Has the white calibration board been exposed to high temperature, direct sunshine or chemicals?
- Is a lamp turned on?
- Is the target film in proper condition?

Screen is hard to see.

- Is the liquid crystal display contrast adjusting control set correctly?
- Is the built-in battery used up?

Measured value cannot be transferred to printer or personal computer.

- Is exclusive communication cable used?
- Do communication procedures coincide with that of the other equipment?

See "Setting the Serial Communication", page 92.

Battery becomes low soon after charging.

- Is charging method correct?
- Has battery refreshment been made?
- Has battery service life ended?

  See "Proper charging of the battery", page 8.
- Is the auto power-off set properly?

13. SPECIFICATION

Classification/Model	Spectrophotometer, Model **S900**
Dimensions	212mm(L)×77mm(D)×84mm(H)
Weight	Approx. 770g
Measuring Geometry	0°/45°, Fiber Optic Pickup, Multi-Sensor Array (JIS Z 8722)
Light Source	Halogen Lamp (Approx.2856°K)
Detector	Photodiode
Spectral Range	400nm～700nm
Spectral Interval	Measuring: 20nm Output: 10nm
Measuring Area	ϕ 10(Standard), ϕ 3, ϕ 2
Illuminant Types	A, C, D_{65}, D_{50}, F2, F6, F7, F8, F10, F11, F12
Optical Observers	2°, 10°
Density Response	ISO Status T, E, A, I, DIN (Wide, Narrow)
Measurement Range	0 to 200%, Resolution: 0.01%
Measuring Time	Approx. 2 Seconds
Repeatability	⊿E*ab: 0.05(ϕ 10), 0.08(ϕ 3), 0.10(ϕ 2) On a White Board (20 Measurements)
Color Items	XYZ, Yxy, L*a*b*, L*C*H°, L*u*v*, Hunter Lab, W･Tw(CIE No15.2/ISO 105-J02), W(ASTM E 313), W(ISO 2470), YI(ASTM E 313), YI(ASTM D 1925/JIS K 7103), Density(CMYK), ⊿XYZ, ⊿Yxy, ⊿L*a*b*, ⊿L*C*H*, ⊿L*u*v*, Hunter ⊿Lab, ⊿W, ⊿YI, ⊿Density(CMYK), MI, Judgment, sRGB
Color Difference Formulas	⊿E*ab, ⊿Ecmc, ⊿E^*_{94}, ⊿E*uv, Hunter ⊿E, ⊿E_{FMC-2}
Averaging	Possible
Data Memory	Max. 400 Measurements (Spectral Reflectance)
Standard Data Memory	40 + 400 Data (Spectral Reflectance or XYZ Tristimulus Values)

Spectrophotometer	Spectral Reflection Graph Spectral Density Graph Spectral Reflection and Spectral Graph
Densitometer	CMYK Density, Density Difference, Dot Area, Dot Gain, Ink Trap, Print Contrast, Hue Error, Grayness, Cast, Brightness, Tone Curve Analysis, Auto Function, Plate Measurement
Dot Area Equation	Yule-Nielsen
Auto N Value	Possible
Temperature Range	5～40℃ (Temperature Sensor)
Display	128×64 Dot Graphic LCD
Display Area Size	62mm×44mm
Right or Left Handed View	Possible
LCD Contrast Adjustment	Possible
Operation Key	6 (Function Key 3)
Power Supply	NiCd (4.8V), 800mAh
AC Adapter	Output:DC 9V-500mA, Input:AC 120V
Recharge Time	Approx. 1.5 hours
Measurements Per Charge	Approx. 4,000 (Internal Testing)
Warm Up Time	None
Auto Power Off Time	Selectable
Data Interface	Serial Communication (RS-232C/IrDA)
Standard Accessories	Calibration Board, Zero Cap, AC Adapter, Operational Manual, Soft Case
Option	Printer [PR-95], Serial Interface Cable, Software, etc.

[APPENDIX]

COLOR AND COLOR DIFFERENCE FORMULAS

(Excerpted)

Colo nce	Standard	Formula	Description

o e	Standard	Formula	Description
	CIE 1931 CIE 1964 JIS Z 8701	$X = K\int_{400}^{700} S(\lambda)\bar{x}(\lambda)R(\lambda)$ $Y = K\int_{400}^{700} S(\lambda)\bar{y}(\lambda)R(\lambda)$ $Z = K\int_{400}^{700} S(\lambda)\bar{z}(\lambda)R(\lambda)$ $K = \frac{100}{\int_{400}^{700} S(\lambda)\bar{y}(\lambda)}$ where $S(\lambda)$: spectral distribution of a standard light used for color display $\bar{x}(\lambda)$, $\bar{y}(\lambda)$ and $\bar{z}(\lambda)$: color matching function in the XYZ colorimetric system or $X_{10}Y_{10}Z_{10}$ colorimetric system $R(\lambda)$: spectral solid angle reflectance	Tristimulus values in the three-c based on the color matching fun $\bar{y}(\lambda)$, $\bar{z}(\lambda)$ recommended by CIE And tristimulus values in the system based on the color matchi $\bar{x}_{10}(\lambda)$, $\bar{y}_{10}(\lambda)$, $\bar{z}_{10}(\lambda)$ recommen in 1964.
	CIE 1931 CIE 1964 JIS Z 8701	$x = \frac{X}{X+Y+Z}$ $y = \frac{Y}{X+Y+Z}$ where X, Y and Z :tristimulus values in the XYZ colorimetric system or $X_{10}Y_{10}Z_{10}$ colorimetric system	Chromaticity coordinates in colorimetric system or $X_{10}Y_{10}Z_{10}$ system.

Colo nce	Standard	Formula	Description
	CIE 1976 JIS Z 8729	..... $L^* = 116\left(\frac{Y}{Yn}\right)^{1/3} - 16$ ..... when $\frac{Y}{Yn} > 0.008856$ ..... $L^* = 903.29\frac{Y}{Yn}$ when $\frac{Y}{Yn} \le 0.008856$ ..... $a^* = 500\left[f\left(\frac{X}{Xn}\right) - f\left(\frac{Y}{Yn}\right)\right]$ $b^* = 200\left[f\left(\frac{Y}{Yn}\right) - f\left(\frac{Z}{Zn}\right)\right]$ Depending on the condition, the following formulas are used. when $\frac{X}{Xn} > 0.008856$ $f\left(\frac{X}{Xn}\right) = \left(\frac{X}{Xn}\right)^{1/3}$ when $\frac{X}{Xn} \le 0.008856$ $f\left(\frac{X}{Xn}\right) = 7.787\frac{X}{Xn} + \frac{16}{116}$ when $\frac{Y}{Yn} > 0.008856$ $f\left(\frac{Y}{Yn}\right) = \left(\frac{Y}{Yn}\right)^{1/3}$ when $\frac{Y}{Yn} \le 0.008856$ $f\left(\frac{Y}{Yn}\right) = 7.787\frac{Y}{Yn} + \frac{16}{116}$ when $\frac{Z}{Zn} > 0.008856$ $f\left(\frac{Z}{Zn}\right) = \left(\frac{Z}{Zn}\right)^{1/3}$ when $\frac{Z}{Zn} \le 0.008856$ $f\left(\frac{Z}{Zn}\right) = 7.787\frac{Z}{Zn} + \frac{16}{116}$ Where X, Y and Z :tristimulus values of the XYZ colorimetric system or $X_{10}Y_{10}Z_{10}$ colorimetric system	One of the perceptively almost spaces recommended by CIE in Brightness is indicated on verti chromaticity by rectangular abscissa axis a* and ordinate ax

o e	Standard	Formula	Description
	CIE 1976 JIS Z 8730	$\Delta E^*ab = \left[\left(\Delta L^*\right)^2 + \left(\Delta a^*\right)^2 \left(\Delta b^*\right)^2\right]^{1/2}$ Where ΔE^*ab : color difference by L*a*b* colorimetric system ΔL^*, Δa^* and Δb^* : it denotes the difference of brightness indexes L* and the difference of color coordinates a* and b* of two object colors in the L*a*b* colorimetric system	Color difference between two san L*a*b* colorimetric system.
	CIE 1976 JIS Z 8729	$C^* = \left(a^{*2} + b^{*2}\right)^{1/2}$ $H^\circ = \tan^{-1}\left(\frac{b^*}{a^*}\right)$ Where a^* and b^* : color coordinates of the L*a*b* colorimetric system	Brightness L* is same as L*a*b* colo Chroma is denoted by C* and Hue i H °.
	CIE 1976 JIS Z 8730	$\Delta H^* = \left[\left(\Delta E^*ab\right)^2 - \left(\Delta L^*\right)^2 - \left(\Delta C^*\right)^2\right]^{1/2}$ Where ΔE^*ab : color difference by L*a*b* colorimetric system ΔL^* : difference of brightness index L* of two object colors ΔC^* : difference of chroma C* of two object colors And it is permitted to calculate with not only the above method but the following formula. $\Delta H^* = 2\left(C_1^* C_2^*\right)^{1/2} \sin\left(\Delta hab/2\right)$ Where C_1^* and C_2^* : ab chroma C* of two object colors Δhab : difference of the ab hue of two object colors	They denote the hue element o difference ΔE*ab between two sa

Colo nce	Standard	Formula	Description
c	BS 6923	$\Delta Ecmc = \left[\left(\frac{\Delta L^*}{lS_L} \right)^2 + \left(\frac{\Delta C^*}{cS_C} \right)^2 + \left(\frac{\Delta H^*}{S_H} \right)^2 \right]^{1/2}$ Where $S_L = \frac{0.040975L^*}{1+0.01765L^*}$ when $L^*<16$..... $S_L = 0.511$ $S_C = \frac{0.0638C^*}{1+0.0131C^*} + 0.638$ $S_H = S_C\left(FT + 1 - F\right)$ l : adjustment value related to revised coefficient (S_L) of brightness difference (ΔL^*) c : adjustment value related to revised coefficient (S_C) of chroma difference (ΔC^*) $F = \left[\frac{(C^*)^4}{(C^*)^4 + 1900} \right]^{1/2}$ $T = 0.36 + \left\lvert 0.4\cos\left(H^\circ + 35\right) \right\rvert$ when $164^\circ \le H^\circ \le 345^\circ$ .... $T = 0.56 + \left\lvert 0.2\cos\left(H^\circ + 168\right) \right\rvert$	It is impossible that the scal colorimetric system will match sense of human beings in all colo case of evaluating small color could be that brightness, hue an match with eyesight. For CMC c this defect is improved and re with practical eyesight. Note: Usually used with l=1 and Note: l=2 and c=1 are often u industry.

o e	Standard	Formula	Description
	CIE No.116	$\Delta E^*_{94} = \left[\left(\frac{\Delta L^*}{k_L S_L}\right)^2 + \left(\frac{\Delta C^*}{k_C S_C}\right)^2 + \left(\frac{\Delta H^*}{k_H S_H}\right)^2\right]^{1/2}$ Where $S_L = \frac{0.040975 L^*}{1 + 0.01765 L^*}$ when $L^* < 16$ ..... $S_L = 0.511$ $S_C = \frac{0.0638 C^*}{1 + 0.0131 C^*} + 0.638$ $S_H = S_C (FT + 1 - F)$ k_L : adjustment value related to the revised coefficient of brightness difference (ΔL*) k_C : adjustment value related to the revised coefficient of chroma difference (ΔC*) k_H : adjustment value related to the revised coefficient of the element of hue (ΔH*)	Color difference newly recommen in 1994 to match the view sens beings the same as ΔEcmc. Note: Usually used with k_L=1, k_C=1 Note: k_L=2, k_C=1 and k_H=1 are of textile industry.
	CIE 1976 JIS Z 8729	$u^* = 13 L^* (u' - u'_n)$ $v^* = 13 L^* (v' - v'_n)$ where $u' = \frac{4X}{X + 15Y + 3Z}$ $v' = \frac{9Y}{X + 15Y + 3Z}$ $u'_n = \frac{4X_n}{X_n + 15Y_n + 3Z_n}$ $v'_n = \frac{9X_n}{X_n + 15Y_n + 3Z_n}$ u' and v' : UCS color coordinates u'_n and v'_n : UCS chromaticity coordinates by a standard light on a perfect reflecting diffuser X, Y and Z : tristimulus values of the XYZ color system or $X_{10}Y_{10}Z_{10}$ color system	One of the uniform color spaces s CIE in 1976. It is a color spac following three-dimensional coordinates used, and is called color space. The brightness index is denoted by color coordinates by u* and v*.
	CIE 1976 JIS Z 8730	$\Delta E^*uv = \left[(\Delta L^*)^2 + (\Delta u^*)^2 + (\Delta v^*)^2\right]^{1/2}$ where ΔE^*uv : color difference by the L*u*v* color system ΔL^*, Δu^* and Δv^* : difference of brightness indexes L* and difference of color coordinates u* and v* of two object colors in the L*u*v* color system	Denotes the color difference of two the L*u*v* color system.

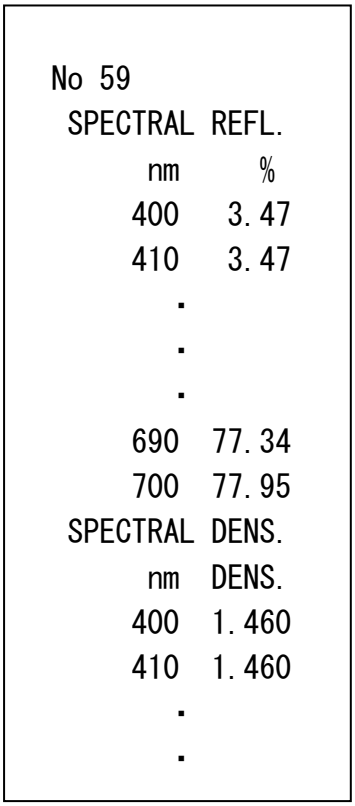
Colo nce	Standard	Formula	Description
Lab		$L = 10Y^{1/2}$ $a = 17.5(100X/Xn - Y)/Y^{1/2}$ $b = 7.0(Y - 100Z/Zn)/Y^{1/2}$ where L : brightness index in the Hunter Lab color system a and b : color coordinates in the Hunter Lab color system X, Y and Z : tristimulus values in the XYZ color system	A color system for represent color space proposed by R.S.Hu Brightness is indicated on a ver chromaticity by rectangular abscissa axis a and ordinate axis
⊿		$\Delta E = \left[(\Delta L)^2 + (\Delta a)^2 + (\Delta b)^2\right]^{1/2}$ where ΔE : color difference by the Hunter Lab color difference. ΔL, Δa and Δb : difference of brightness indexes L* and difference of color coordinates u* and v* of two object colors in the Hunter Lab color system.	Denotes the color difference of the Hunter Lab color system.
-2	ASTM D 2244	$\Delta E_{FMC\text{-}2} = \left[(\Delta L_{FMC\text{-}2})^2 + (\Delta C_{y-b})^2 + (\Delta C_{r-g})^2\right]^{1/2}$ where $\Delta L_{FMC\text{-}2} = 0.279K_2(P\Delta P + Q\Delta Q)/aD$ $\Delta C_{y-b} = K_1S(P\Delta P + Q\Delta Q)/bD^2 - K_1\Delta S/b$ $\Delta C_{r-g} = K_1(Q\Delta P - P\Delta Q)/aD$ $P = 0.724X + 0.382Y - 0.098Z$ $Q = -0.48X + 1.37Y + 0.1276Z$ $S = 0.686Z$ $a^2 = 17.3\times10^{-6}(P^2 + Q^2)/[1 + 2.73P^2Q^2/(P^4 + Q$ $b^2 = 3.098\times10^{-4}(S^2 + 0.2015Y^2)$ $D = (P^2 + Q^2)^{1/2}$ $K_1 = 0.55669 + 0.049434Y - 0.82575\times10^{-3}Y^2$ $+ 0.79172\times10^{-5}Y^3 - 0.30087\times10^{-7}Y^4$ $K_2 = 0.17548 + 0.027556Y - 0.57262\times10^{-3}Y^2$ $+ 0.63893\times10^{-5}Y^3 - 0.26731\times10^{-7}Y^4$	This is the color difference by Friele, MacAdam and determine a quantity of ellipse of MacAdam. The color difference ⊿ direction of the Red-Green difference ⊿Cy-b on the yellow-blue corresponds to in the CIE 1976 L*a*b* col Note: This instrument displays ⊿ and ⊿yb for ⊿Cy-b.

<table>
<tr><th>Standard</th><th>Formula</th><th>Description</th></tr>
<tr><td>CIE No.15.2
ISO 105-J02
JIS Z 8715</td><td>$$W = Y + 800(x_n - x) + 1700(y_n - y)$$
$$Tw = 1000(x_n - x) - 650(y_n - y)$$
In the X10Y10Z10 color system,
$$Tw = 900(x_n - x) - 650(y_n - y)$$
where
W : whiteness of a sample in the XYZ color system or the X10Y10Z10 color system
Tw : cast index of a sample in the XYZ color system or the X10Y10Z10 color system
Y : Y of tristimulus values of a sample in the XYZ color system or the X10Y10Z10 color system
x and y : color coordinates of a sample in the XYZ color system or the X10Y10Z10 color system
x_n and y_n :color coordinates of a perfect reflecting diffuser in the XYZ color system or the X10Y10Z10 color system</td><td rowspan="2">Evaluating whiteness.</td></tr>
<tr><td>ASTM E 313</td><td>$$W = 4B - 3G$$
where
B : blue reflectance (= 0.847Z) of a sample
G: same as Y of tristimulus values of a sample in the XYZ color system</td></tr>
<tr><td>ISO 2470
JIS P 8148</td><td>$$W = \frac{\sum_{\lambda=400}^{700} F(\lambda) \times R(\lambda)}{\sum_{\lambda=400}^{700} F(\lambda)}$$
where
$F(\lambda)$: relative spectral distribution function
$R(\lambda)$: characteristic spectral solid angle reflectance (reflectance of sample)
<table><tr><th>nm</th><th>$F(\lambda)$</th><th>nm</th><th>$F(\lambda)$</th><th>nm</th><th>$F(\lambda)$</th></tr><tr><td>400</td><td>1.0</td><td>450</td><td>82.5</td><td>500</td><td>5.6</td></tr><tr><td>410</td><td>6.7</td><td>460</td><td>100.0</td><td>510</td><td>0.3</td></tr><tr><td>420</td><td>18.2</td><td>470</td><td>88.7</td><td rowspan="3">520
⋮
700</td><td rowspan="3">0.0</td></tr><tr><td>430</td><td>34.5</td><td>480</td><td>53.1</td></tr><tr><td>440</td><td>57.6</td><td>490</td><td>20.3</td></tr></table></td><td>Note: This whiteness is knows a brightness.</td></tr>
</table>

Colo nce	Standard	Formula	Description
Y I	ASTM E 313	$$YI = 100\left(1 - \frac{B}{G}\right)$$ where *B*: blue reflectance (= 0.847Z) of a sample. *G*: same as Y of tristimulus values of a sample in the XYZ color system.	Evaluating yellowness index YI
Y I	ASTM D 1925 JIS K 7103	$$YI = \frac{100\left(1.28X - 1.06Z\right)}{Y}$$ where *X*, *Y* and *Z* : tristimulus values in the XYZ color system	
(de	ISO 5/3 JIS K 7653 DIN 16536	$$K = -log_{10}\left[\frac{\sum_{400}^{700}\left(S_K\,\lambda \times r\,\lambda\right)}{\sum_{400}^{700}\left(S_K\,\lambda \times r0\right)}\right]$$ $$C = -log_{10}\left[\frac{\sum_{400}^{700}\left(S_C\,\lambda \times r\,\lambda\right)}{\sum_{400}^{700}\left(S_C\,\lambda \times r0\right)}\right]$$ $$M = -log_{10}\left[\frac{\sum_{400}^{700}\left(S_M\,\lambda \times r\,\lambda\right)}{\sum_{400}^{700}\left(S_M\,\lambda \times r0\right)}\right]$$ $$Y = -log_{10}\left[\frac{\sum_{400}^{700}\left(S_Y\,\lambda \times r\,\lambda\right)}{\sum_{400}^{700}\left(S_Y\,\lambda \times r0\right)}\right]$$ where $S_K\,\lambda$:visual spectral product at a wavelength λ $S_C\,\lambda$:cyan spectral product at a wavelength λ $S_M\,\lambda$:magenta spectral product at a wavelength λ $S_Y\,\lambda$:yellow spectral product at a wavelength λ $r\,\lambda$: spectral solid angle reflectance at a wavelength λ (reflectance of sample). *r0*: spectral reflectance on (= 1) a perfect reflecting diffuser	Visual, cyan, magenta and yello of reflection density of a sample K, C, M and Y. The density different depending on spectral p and Y. In general, there are status status A, status I and DIN (wide band).

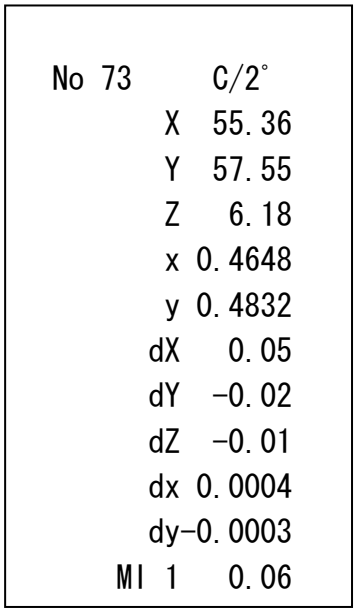
o e	Standard	Formula	Description
	JIS Z 8719	$MI = \left[(L2^* - L1^*)^2 + (a2^* - a1^*)^2 + (b2^* - b1^*)^2 \right]^{1/2}$ 1. Obtain tristimulus values Xr1, Yr1 and Zr1 and Xr2, Yr2 and Zr2 of two samples 1 and 2 to be compared for each observation as illuminated by a reference light r, with the sample 1 being reference. 2. Obtain tristimulus values Xt1, Yt1 and Zt1 and Xt2, Yt2 and Zt2 of samples 1 and 2 for each observation as illuminated by a test light t. 3. Correct tristimulus values Xt2, Yt2 and Zt2 of sample 2 illuminated by test light t so that the two samples should have same color as illuminated by the reference light r. The corrected values are X't2, Y't2 and Z't2. $X'_{t2} = X_{t2} \cdot \frac{X_{r1}}{X_{r2}}$ $X'_{t2} = X_{t2} \cdot \frac{X_{r1}}{X_{r2}}$ $Z'_{t2} = Z_{t2} \cdot \frac{Z_{r1}}{Z_{r2}}$ Corrected values : X't2, Y't2 and Z't2 4. Make conversion to L1*, a1* and b1* and L2*, a2* and b2* depending on definitions of Xt1, Yt1 and Zt1 and X't2, Y't2 and Z't2.	It is known that conditionally ma objects having different spectral can appear to be the same c illuminated by a specific light. Th deviation of the two objects having color as illuminated by the referenc the matching color as illuminated light is evaluated with a condition index. The conditional matching index M difference of two samples having color as illuminated by a refe compared to that illuminated by a t If the samples have no perfectl color as illuminated by the referen conditional matching index calculated after a correction has m the tristimulus values are made equ
		$R_{sRGB} = (3.2410X - 1.5374Y - 0.4986Z)/100$ $G_{sRGB} = (-0.9692X + 1.8760Y + 0.0416Z)/100$ $B_{sRGB} = (0.0556X - 0.2040Y + 1.0570Z)/100$ where X, Y and Z : tristimulus values in the XYZ color system	This is a RGB color space, whic "Default RGB Color Space", bas standard monitor. This is pr Hewlett-Packard and Microsoft. It only the observation system (standa but also the viewing environment in detail. I takes the illuminant w D65. In effect, the XnYnZn then becomes Rs

14. SPECTROPHOTOMETER FUNCTIONS



Output examples:

15. COLORIMETER FUNCTIONS



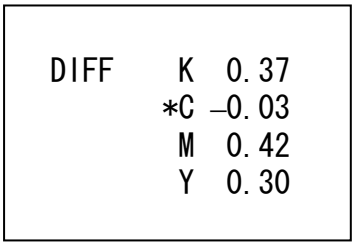
Output examples:

16. DENSITY MEASUREMENT

```
DENS   *K  1.47
        C  1.44
        Y  1.43
```

Output examples:

17. DENSITY DIFFERENCE MEASUREMENT

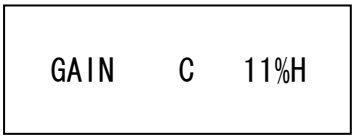


Output examples:

18. DOT AREA MEASUREMENT

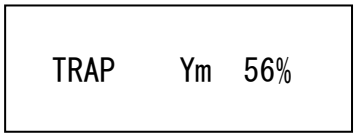
Output examples:

19. DOT GAIN MEASUREMENT



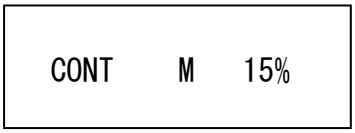
Output examples:

20. INK TRAP MEASUREMENT



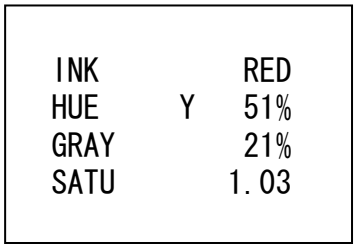
Output examples:

21. PRINT CONTRAST MEASUREMENT



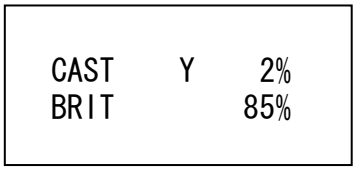
Output examples:

22. HUE ERROR / GRAYNESS MEASUREMENTS



Output examples:

23. CAST / BRIGHTNESS MEASUREMENT



Output examples:

24. TONE CURVE ANALYSIS MEASUREMENT

```
----------------
DOT ANALYSIS
----------------
CYLINDER: 1 C
N VALUE:  1.00
 REF  DENS  GAIN
----------------
100%  1.57    0%
 90%  1.13    4%
 80%  0.85    6%
 70%  0.68    8%
 60%  0.54    8%
 50%  0.42    7%
 40%  0.31    3%
 30%  0.23    1%
 20%  0.17    1%
 10%  0.13    2%
  0%  0.07    0%
----------------
CYLINDER: 2 M
N VALUE:  1.00
 REF  DENS  GAIN
----------------
100%  1.57    0%

          .
          .
          .

 10%  0.13    2%
  0%  0.07    0%
```

Output examples:

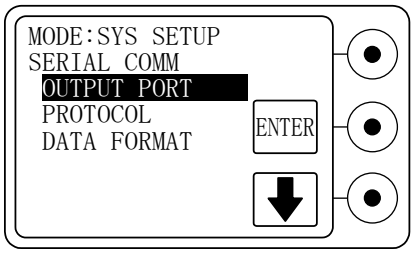
25. PLATE MEASUREMENT

Output examples:

26. Setting Serial Communications

You can transfer measured data to a printer or personal computer.

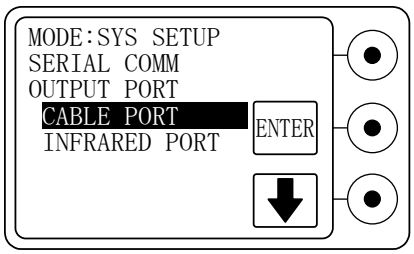
The output port, protocol and data format should be set up as follows.



CHECK *"DATA FORMAT" is only **S900** function.*

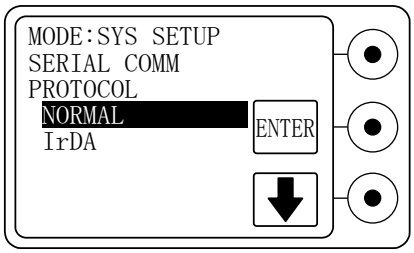
26.1. Setting the output port

To set up the output port, select either "CABLE PORT" or "INFRARED PORT" and press the ENTER key.



26.2. Setting the protocol

To set up the protocol, select either "NORMAL" or "IrDA" and press the ENTER key.



If "Normal" is selected

Communication conditions for serial communications should be set up to match the printer or personal computer to be connected.

Communication procedures:

Baud rate : 2,400 to 19,200 bps.
Data bit : 7 or 8 bits.
Stop bit : 1 or 2 bits.
Parity : NONE, ODD or EVEN.
Flow control : Fixed to hardware (CTS/RTS).

However, if the infrared communication is selected in "Setting the output port", serial communication is made without flow control.

CHECK *Note that if these settings do not match the printer or personal computer connected, correct communication will not be established.*

Setting the baud rate:

Select one of "19200 bps", "9600 bps", "4800 bps" or "2400 bps" and press the ENTER key.

Setting the data bit:

Select one of "8 bit" or "7 bit" and press the ENTER key.

Setting the stop bit:

Select one of "1 bit" or "2 bit" and press the ENTER key.

Setting the parity:

Select "NONE", "ODD" or "EVEN" and press the ENTER key.

This Spectrophotometer will automatically output the measurement results each time a measurement is made when the serial communication connector has the printer or personal computer connected. You must use one of the communication cables exclusively supplied as an option.

The connection cables available are:

(1)To connect to a 25 pin connector on the exclusive printer [PR-95] or a personal computer.

Communication cable D-Sub 25 pin (Part No.:H02388AS)

(2)To connect to a 9 pin connector for a personal computer.

Communication cable D-Sub 9 pin (Part No.:H02607AS) or communication cable D-Sub 25 pin and change connector
(Part No.:H02388AS and AT-925S)

If "IrDA" is selected

The measured data is output by infrared communications for use with IrDA.

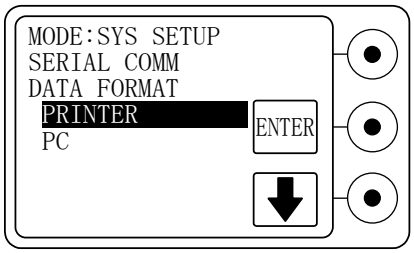
CHECK *The computer and other devices for reception of the measured data require infrared send and receive ports for use with IrDA.*

26.3. Setting the data format

Select data formats as either "PRINTER" or "PC" and press the ENTER key.

PRINTER: Outputs in the printer format for the [PR-95].

PC : Outputs in the format and communication procedures for a color control program.



*Only **S900** function.*