LM801S PORTABLE SPECTROMETER MANUAL

TABLE OF CONTENTS

1. Introduction

1.1 Product features

LeBio environ measurement series is a portable measuring instrument adopting innovative patented platform structure. It can measure different needs of data by changing the detectors according to different time, place and object. Such multi-purpose pattern makes it distinct from traditional measuring instruments. The power supply adopts rechargeable lithium battery and the instrument can also be connected to portable power source. Data is transmitted by Bluetooth so you can transfer the data to computer for analysis.

Innovative features:
- Can be used directly under the sun: It can measure the solar spectrum in four seasons throughout the year.
- Measure wavelength range is from 360 nm to 830 nm.
- Handheld platform mainframe: Provide multifunctional touch platform.
- Monitoring measurement detectors modularization: Adopt a kind of structure that separates mainframe and detectors and support multiple selection and replacement.
- Patented binding mechanism: the special patented structure can allow fine adjustment of the detector angle to aim at the object being measured.
- Lightweight and diverse measurement methods: handheld, place on table or use a tripod.
- Meet the demands of measurement environment: get more accurate data in a complex or dead angle environment.
- Provide integrated communication services to facilitate in agricultural, fishing, husbandry, planting, and breeding occasions such as LED lamp factories, plant factories, greenhouses, or fields.
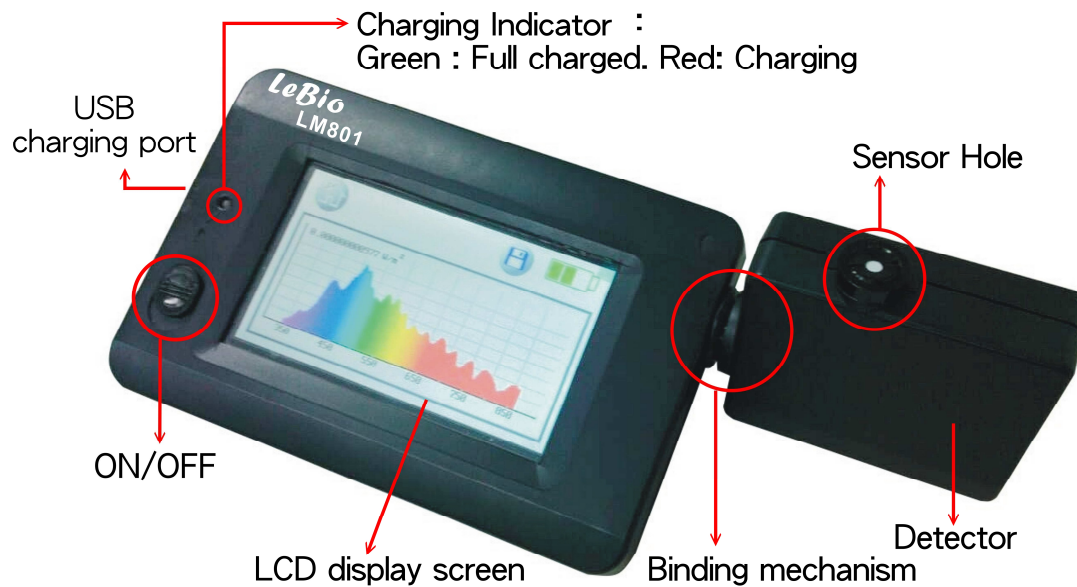
1.2 Packaging contents

1. Touch LCD display platform
2. Spectrometer
3. Temperature-humidity detector
4. CO2 detector
5. USB cable
6. Rechargeable lithium battery
7. Screwdriver
8. Charger / Adapter
9. Spare screw pack
10. Mounting bracket for tripod
11. Suitcase

1.3 Descriptions

(a) Product description

(b) Replace the detector Description:

Please turn off the spectrometer, when replacing the Temperature-humidity detector.

Instructions as following:

1. Turn off the spectrometer
2. Rotate the spectrometer' detector clockwise to make the sensor hole from the top to the side.
3. The binding mechanism of the latch should be aligned to the latch connector port.
4. Replace the spectrometer' detector out.
5. Replace with Temperature-humidity' detector, and keep the binding mechanism' latch aligned to the latch connector port.

6. Rotate Temperature-humidity detector counter-clockwise to make the sensor hole from the side to the top
7. Turn on the Spectrometer

1.4 Precautions

1. LM801S portable spectrometer is sophisticated equipment. Please be careful when you first open and take it out. Any collision or vibration may affect the precision of this machine, please handle with great care. If the product doesn't work, do not repair it by yourself. All repairs should be performed by qualified and authorized dealers.
2. Most LCD screen will have more than 99.9 % effective pixels; the probability of dead pixels will be less than 0.1% which will not affect the accuracy of the measurement. Please be assured to use.
3. When you change the detectors, please turn off the power, and turn on after replacement.
4. After replacing the rechargeable battery, please plug in the charger until the battery is fully charged and then start using it.
5. Do not remove the battery during charging. Plug in the power adapter to an electrical outlet (110V~240V) to start charging the battery.
6. Do not exposure the instrument long time under the sun or place beside the fire source, so as to avoid damage to it.
7. LM801S portable spectrometer is a very sophisticated equipment, humidity is easy to damage the instrument. Do not leave in wet or too high humidity place for a long time.
8. Spectrometer' detect holes by dripping water, gently drying in naturally room temperature, do not wipe with a cloth.
9. Contact with our repair service, please specify the for damage and situation of spectrometer.

Warnings:

1.Do not modify the battery yourself.
2. Please use lithium batteries with protection circuits. (Model# 18650)
3.Do not put the battery in fire or water.
4. During the battery charging process, if overheating, smoke or odor appears, please immediately unplug the charger from the outlet to avoid fire.
5. Do not connect any cables near a heat source, in order to avoid deformation or damage due to high temperature which might cause a fire or electric shock.
6. Do not use anything like cloth to wrap a charging instrument, to avoid deformation or even fire.
7. The product is accidentally dropped into water, or if water or metal ran into the product, please remove the battery immediately to avoid risks.
8. Do not scratch with sharp objects to detector' sensor hole, if may damage the cosine correctors.

9. Do not store the battery or spare battery in a high temperature environment, so as to avoid battery leakage or shorter battery life.
10. Do not use paint thinner, benzene, or other organic solvents to clean the instrument, they may damage the product's appearance and touch screen, and also may cause fire.

1.5 Annual calibration

This product is a high-precision measuring instruments, and there are many high-sensitivity internal components. Use with caution. To ensure the accuracy of measurement, calibration is recommended to be done once a year, please contact your dealer or our customer service department for calibration service units.

2. The boot screen instructions

2.1 boot screen

1. Detector has been inserted at boot, startup screen will show:

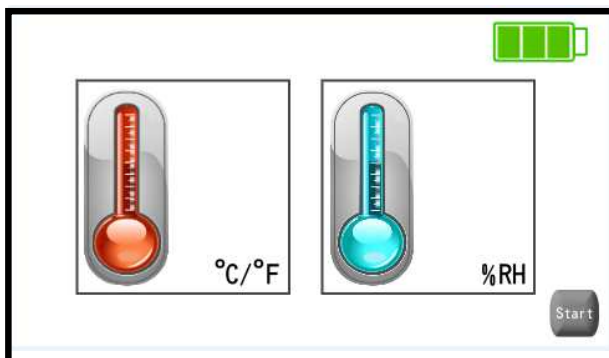2. Detector has not inserted at boot, startup screen will show:

Note: It may damage the spectrometer without turn off the power during the replacement of detector.

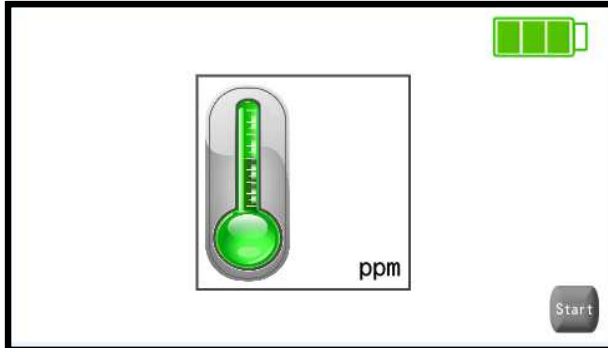3. According to the different detector inserted by user, you will see the matching page.
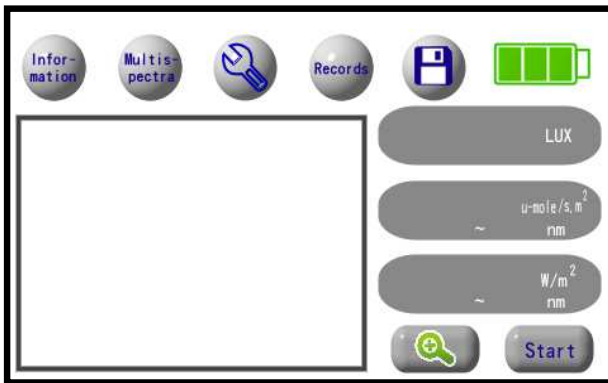4.
   (1) Temperature-humidity detector :

(2) CO2 detector :

(3) Spectrometer:

2.2 Display of Battery

 Battery is charged.

 Available 50% usage

 Available 25% usage

 Battery is low

 Battery is very low and it may shut down any time.

 Charging。（Red : Charging; Green: Full charged)

Charging instruction:

1.   Insert the end of the USB cable into the USB connector on the spectrometer.

2.   Insert the other end of the USB cable into the power adapter.

3. Plug in the power adapter to an electrical outlet (110V~240V) to start charging the battery.

Note:
- When the battery power is too low, please plug in the power adapter to an electrical outlet, not the USB cable connection with your computer.
- Please use spectrometer' USB cable and adapter set while charging the battery.

3. The functional specifications of temperature-humidity detector and CO2 detector

3.1 Temperature-humidity detector's main menu and functions
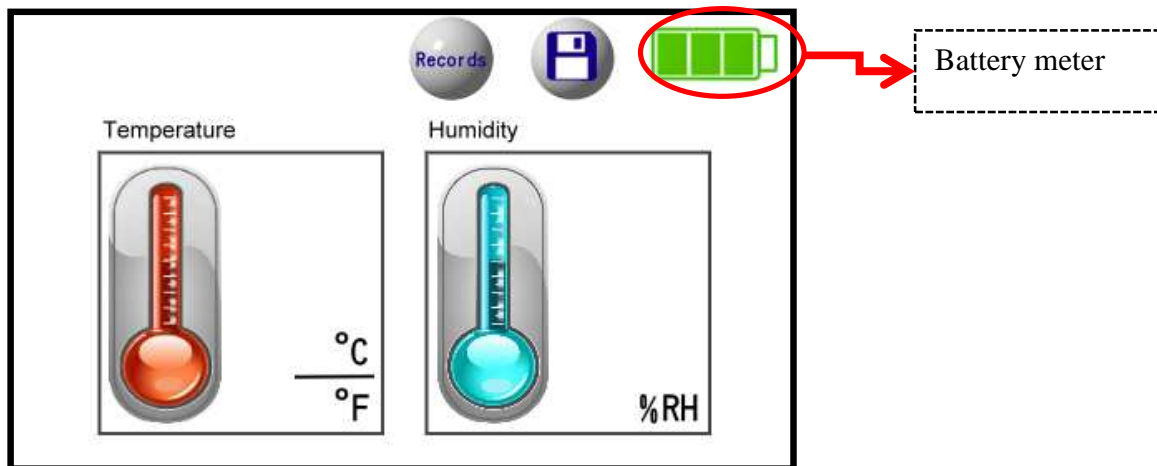
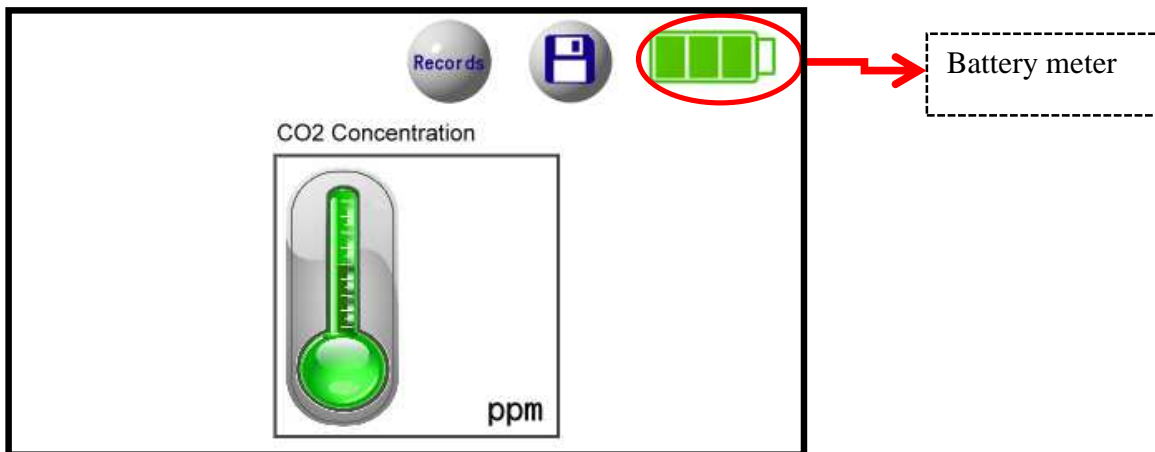Screen will display the real time temperature & humidity.

 History data (more related information of the measurements, see 4.6)

 Saving file: (more relevant information of the measurements, see 4.7)

Note:
1. It may damage the spectrometer without turn off the power during the replacement of detector
2. Language: in " Settings " for language

3.2 CO2 detector's main menu and functions.

Battery meter

Screen will display the real time CO2 concentration

 History data (more related information of the measurements, see 4.6)
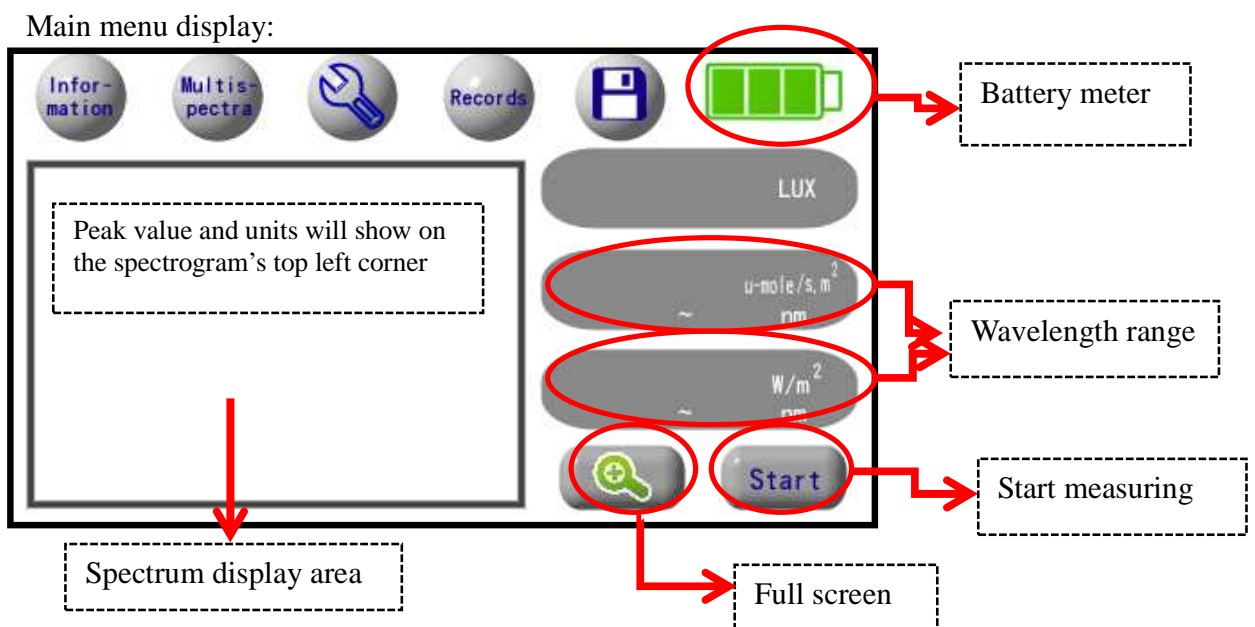
 Saving file: (more relevant information of the measurements, see 4.7)

Note:
1. It may damage the spectrometer without turn off the power during the replacement of detector
2. Language: in " Setting" for the language

4 The functional specifications of spectrometer

4.1 Spectrometer's main menu and functions

Main menu display:

When you press the "Start", it will begin measuring the spectrum, and show the spectrogram in the left box on screen, and the values on the right side, by showing units of Lux, u-mole / s·m2 and W / m2. If it is set in "continuous mode", press Start to measure then Start button will become "Stop". (More about single and continuous measurements please see "4.5 Settings")

Without a set wavelength, the initial set value will be visible wavelength range from 400 nm to 700 nm (that is PPFD, Photosynthetic Photon Flux Density).

Full screen: display an enlarged spectrogram, please see 4.2.

Information: display relevant information, please see 4.3.

 Multi-frequency record: multi-stage wavelength range of the spectrum measurement, see 4.4.

 Settings: set relevant parameter.

 History data cof the measurements, see 4.6)

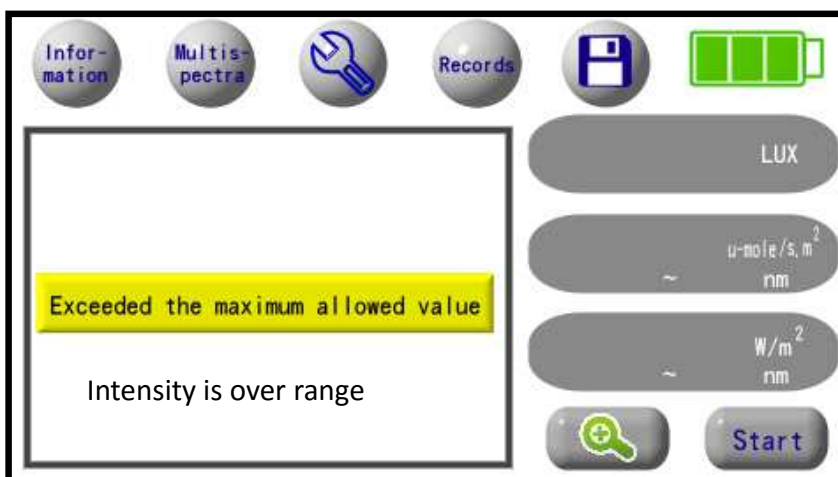 Saving file: (more relevant information of the measurements, see 4.7)

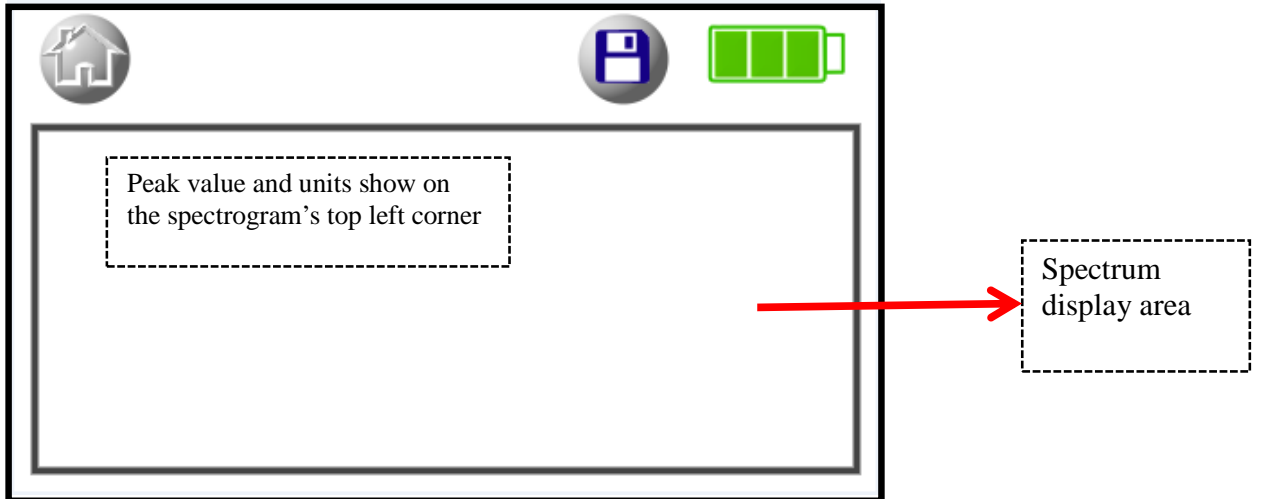 Battery is very low and it may shut down any time.

 Charging。（Red : Charging; Green: Full charged)

PS: When charging, use 110 V ~ 240 V power supply. If you use the USB cable to connect desktop or notebook, it will result in longer charging time because of the smaller charging current.

When the intensity of the light is over the instrument's measuring range, you will see the following screen. Data will show as "0" .
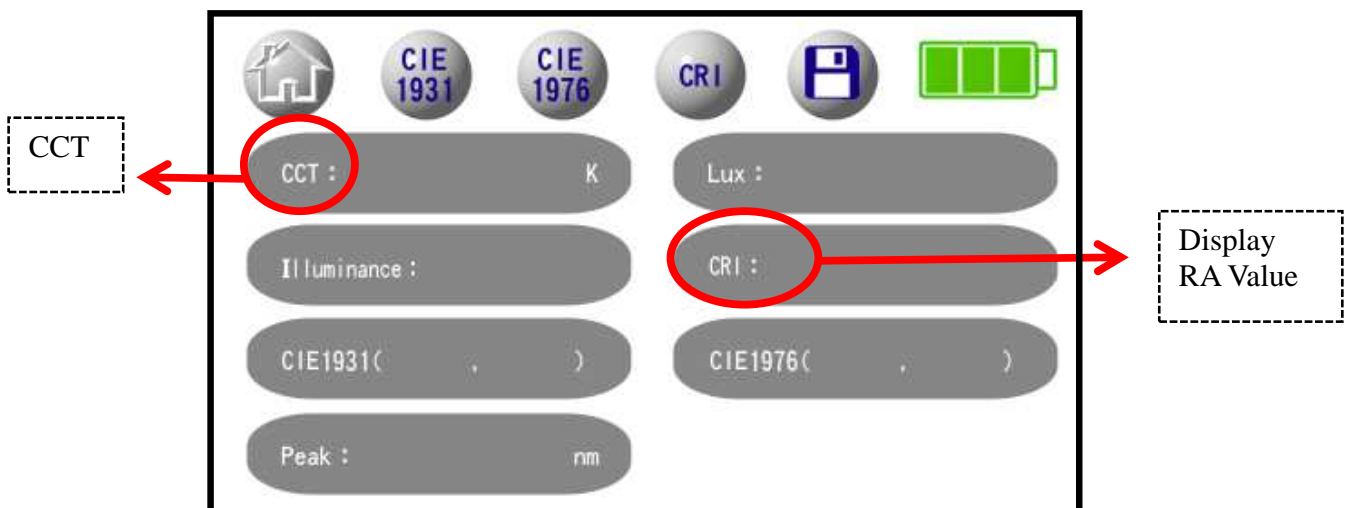
4.2 Full screen display:

Peak value and units show on the spectrogram's top left corner

Spectrum display area

Return to main menu.

Save current spectrum data, see 4.7.

4.3 Information

CCT

Display RA Value

CCT :   K

Lux :

Illuminance :

CRI :

CIE1931(,   )

CIE1976(,   )

Peak :   nm

Return to main menu.

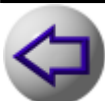Save relevant information and data, please see 4.7.
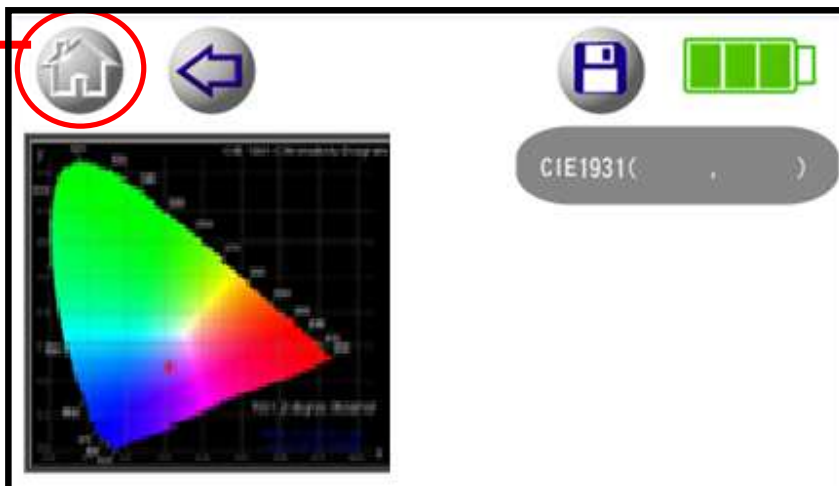
Note:
- Color temperature: that is CCT (Common Computer Test).
- Illumination: in Lux units.
- Irradiance: in W/m^2 units.
- Color-rendering index: Average of CRI from R1 to R8
- Peak wavelength: the highest point in the entire wavelength spectrum. That is λ_P.

4.3.1 CIE1931 (x,y) chromaticity coordinates

CIE1931 information, once clicked, you will see CIE1931 chromaticity coordinates in the following screen.
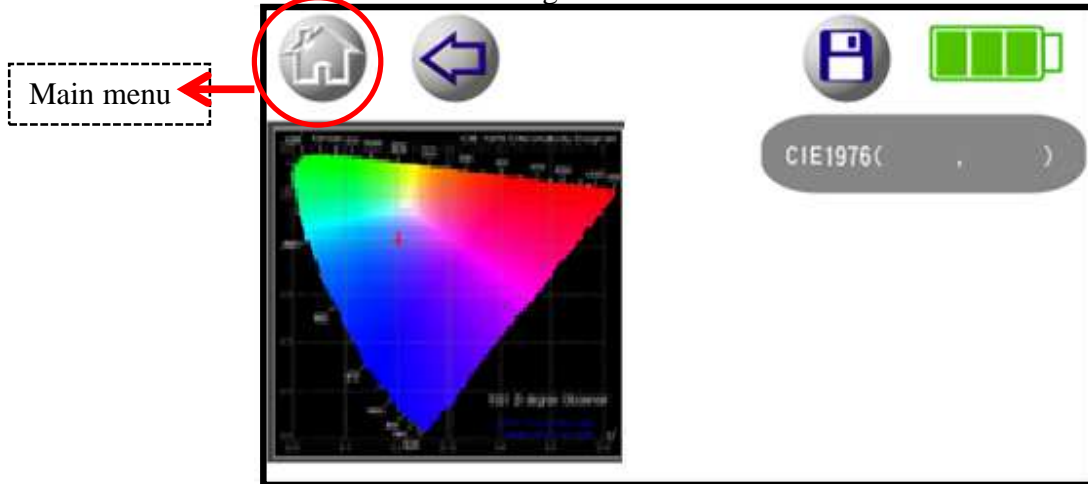

Back to previous page of "Information".

Save CIE1931 chromaticity coordinates information (more related

information see 4.7.)

4.3.2 CIE1976 (u,v) chromaticity coordinates

 CIE1976 information, once clicked, you will see CIE1976 chromaticity coordinates in the following screen.
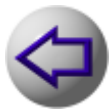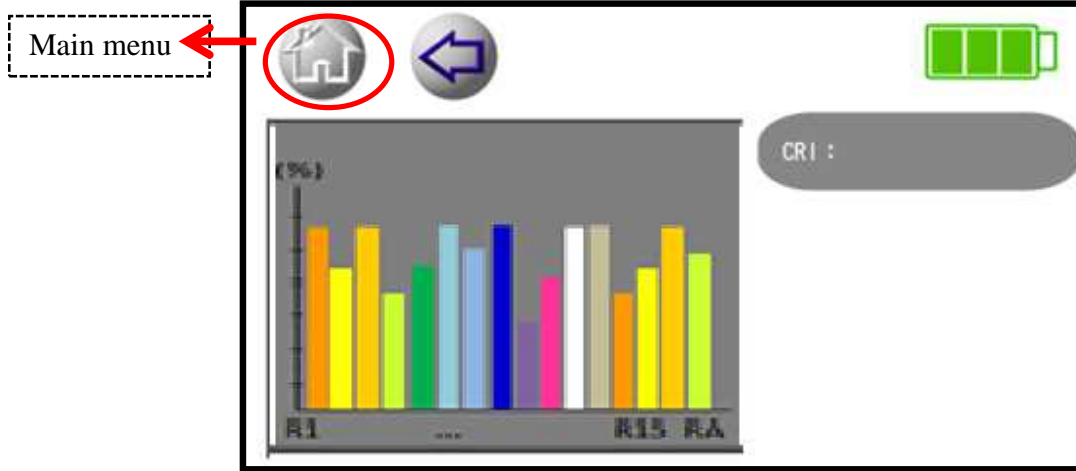

 Back to previous page of "Information".

 Save CIE1976 chromaticity coordinates information (more related information see 4.7.)

4.3.3 CRI color rendering index

 CRI color rendering index, once clicked, you will see the data such as color rendering index R1 ~ R15 and Ra (R1 to R8's average), the value of CRI in Information page is Ra, after clicking, shows the following screen.

Main menu

  Back to previous page of "Information".

4.4 Multi-frequency record

Display the strength unit you set

u-mole

Peak value shows on the spectrogram's top left corner

Whole spectrum display area

Set wavelength range (in the Settings page), click to see the curve in that wavelength range

Page of the record

Multi-frequency record is a feature of the LM801S's spectrometer, which the wavelength range can be set at different time periods (up to ten) and measuring the accumulated integrated intensity value of that wavelength range at a certain time (2 minutes to 60 minutes). Besides from showing the spectrogram of that wavelength range, it can instantly show the intensity curves of the wavelength range of variation within the set

time period, allowing users to understand the spectral changes in the wavelength range. In addition, multi-frequency record mode can be combined with the "single measurement" or "continuous measurement" in the Settings page. If you didn't set the wavelength range, the value of the initial wavelength range is from 400nm to 700nm. When you enable the "continuous mode" in the Settings page, press "Starts", "Start" will become "Stop", if you do not press "Stop" button, save function will be invalid.

Return to main menu. When you enable the "continuous mode" on the main page of the "Settings" option, if do not press "Stop" button, save function and settings function will be invalid.

Save relevant spectrum information and data, if you set the integration time less than 5 minutes, it will take a measurement points every 15 second; **if more than 5 minutes, take 20 measurement points. After setting 10-wavelength range, it will store up to 200 data**, see 4.7.

When there is no record time and is on single measurement, press the button to start continuous measurements. When a record time is already set, and then start measuring, it will become the next screen, so that users can terminate measurement at any time. If you didn't set the wavelength range, the value of the initial wavelength range is from 400nm to 700nm.

When a record time and continuous measurement are set, you can press this button to terminate measurement.

When a record time is set, you can press this button to do continuous measurements, and you can see the countdown.
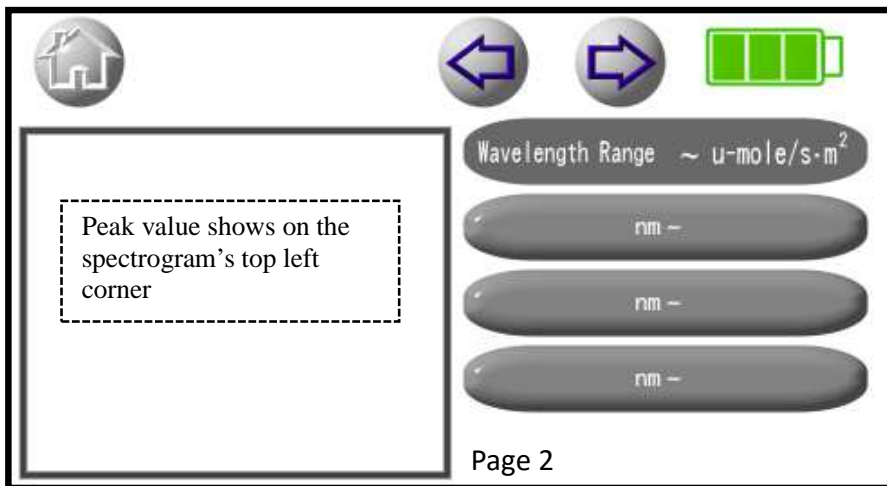
4.4.1 Record time

Setting continuous record time, after clicking, shows the following screen. Initial setting is range from 2 minutes to 60 minutes. When press "OFF", it will be single measurement mode, and can't set the time. When press "time input space" or "ON", it will go back to continuous measurement mode.

Time input space

Digital keyboard input
"C": Clean
"En": Enter

Single or continuous measurement
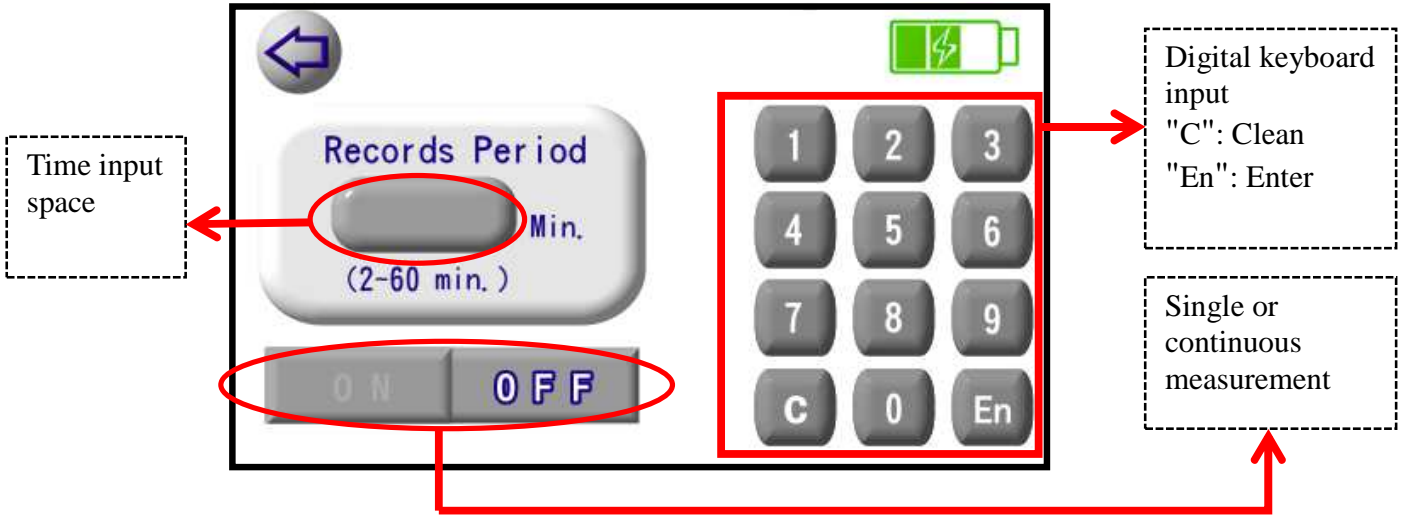
 Back to previous page of "Multi-frequency record" page.

4.4.2 Next page: wavelength range setting information

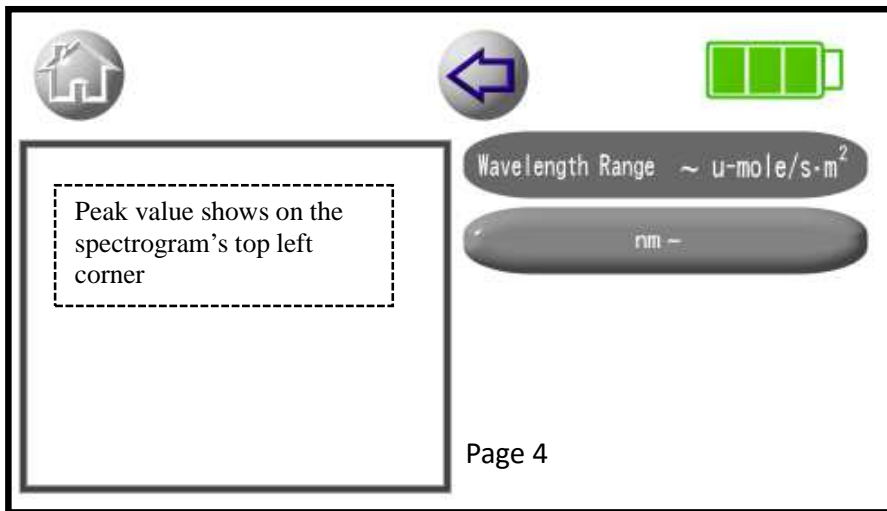 view the 4th to 6th wavelength range .

Peak value shows on the spectrogram's top left corner

Wavelength Range ~ u-mole/s·m^2

nm ~

nm ~

nm ~

Page 2

 Return to main menu

 Back to pervious multi-frequency record

 from the 4th to 6th wavelength range to next 7th to 9th page.

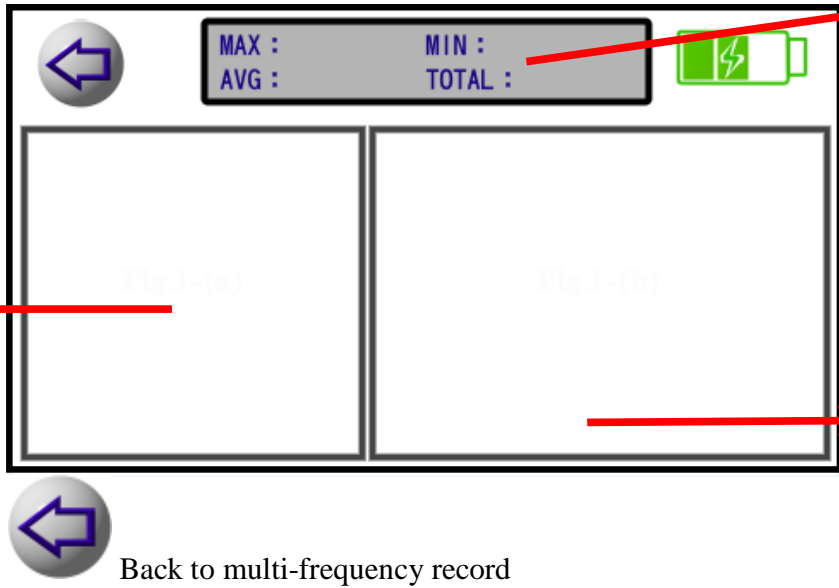Wavelength Range ~ u-mole/s·m^2

nm ~

Peak value shows on the spectrogram's top left corner

Page 4

 Return to main menu.

 Back to the fourth to seventh wavelength range

4.4.3 Specific wavelength range curves
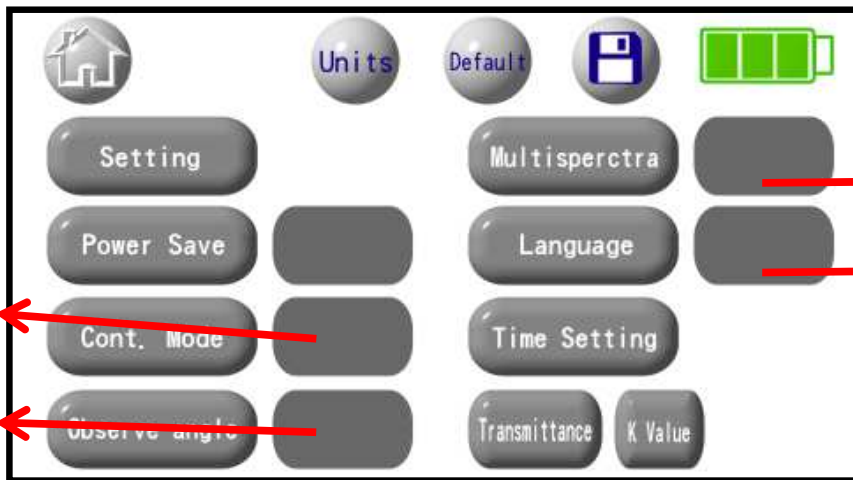
 360 ~ 400 nm _ 400   After clicking, shows the curve of that wavelength range, as follows.

In the continuous measurement mode, display setting time range, the maximum and minimum intensity value, average spectral intensity and total integral value

Spectrogram of the wavelength range

| MAX : | MIN : |
| AVG : | TOTAL : |

In continuous measurement mode, depending on the setting time, instantly shows the changing curve of intensity to time.

Back to multi-frequency record

4.4Settings

Units   Default

Setting   Multisperctra

Power Save   Language

Cont. Mode   Time Setting

Observe angle   Transmittance   K Value

Shows the wavelength range settings

Shows if continuous mode is on

Shows the language settings

Shows observation angle information

Back to main menu.

Delete

Factory default

Default information:

List	Default setting
Spectrometer setting	Record time : Auto
	Wavelength range: none (PPFD from 400nm~700nm
Power saver	Save mode , Auto shut off N/A
Continuous measurement mode	off
Observation angle	2°
Multi-frequency Record	Range : none
Language	Tradition Chinese
Time setting	2015/01/01/12/00/00
Transmittance rate:	Range : None
K Value	1
Wavelength unit	u-mole/s·m^2

4.5.1

Units

Set intensity units, you can use u-mole/s·m^2 or W/m^2, after clicking, shows the following screen. The initial setting is u-mole/s·m^2.
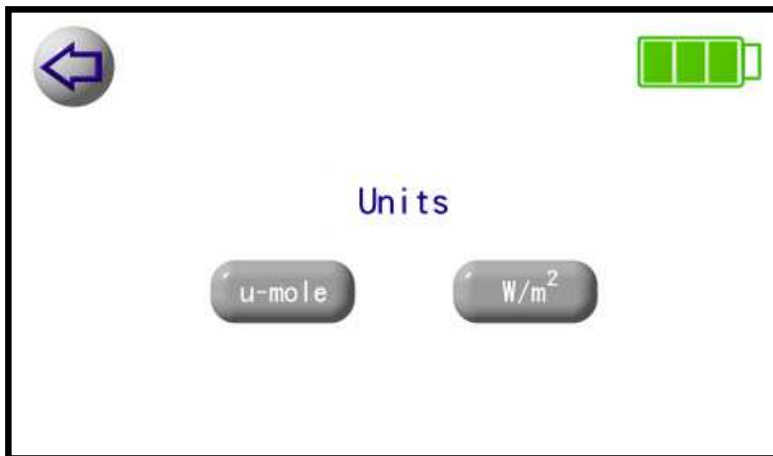
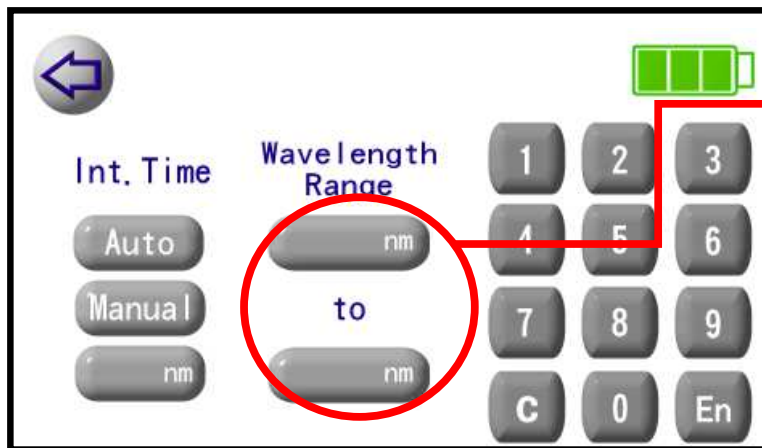Note: Six significant digits after the decimal point

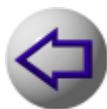Back to previous page of "Information"

4.5.2

Setting Set integration time and wavelength range of the spectrum. The integration time has "Automatic" and "manual" mode, when set to "Manual", you need to enter the integral Time (will affects the spectrogram). After clicking, shows the following screen.

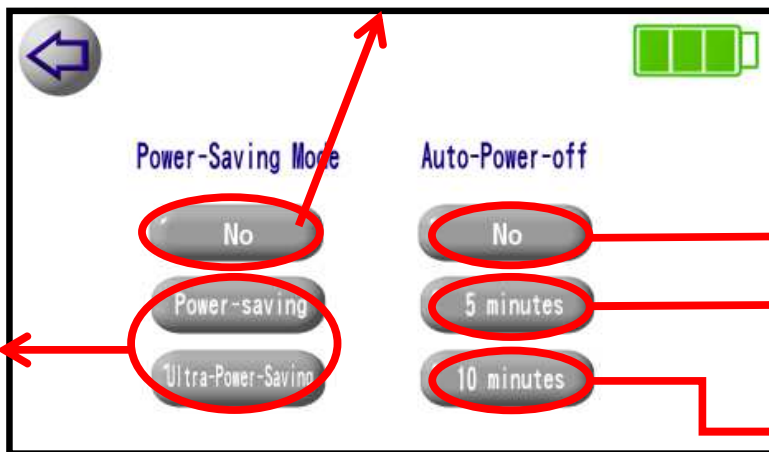Can set effective wavelength range from 360nm to 830 nm

Back to Settings

4.5.3

Power Save

Screen never darken

When automatic shutdown time is set to None, you can set power saving mode or extreme power saving mode, the system can be awakened by touch panel (6 seconds)

Never shutdown

Shutdown after 5 minutes of inactivity, press Power to restart

Shutdown after 10 minutes of inactivity, press Power to restart

After setting the power saving mode, the display screen will darken after three minutes, touch screen to wake the system. Setting extreme power saving mode, it will darken after three and half minutes and turn off the power or spectrometer, touch the screen to wake

up the system, but need to wait about six seconds before measuring. Initial setting is "power saving" mode and "none" automatic shutdown.

 Back to previous page of "Information"

4.5.4

 After clicking, shows on the right if the continuous mode is on or off. Continuous mode means spectrometer is continuing measure and display spectrogram in certain time period (integral time) after press "Start". At this time, "Start" will turn to "Stop" so user can stop measuring anytime.

 Shows the continuous mode is on. In this mode, you can't set options of settings or save until you press "Stop".

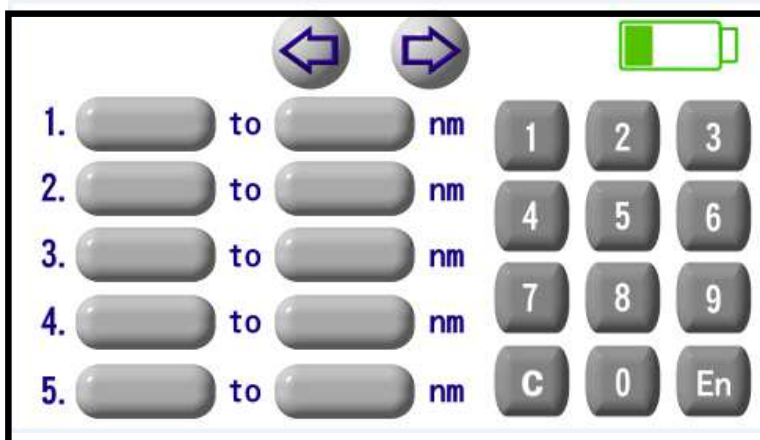 Shows the continuous mode is off and it's on single measurement mode.

4.5.5

 Choose observation angle between 2° and 10°.

4.5.6

 0Set the observed wavelength range in Multi-frequency record. You can set into ten ranges at most.

The initial value is no setting wavelength range, but during the measurement the initial is
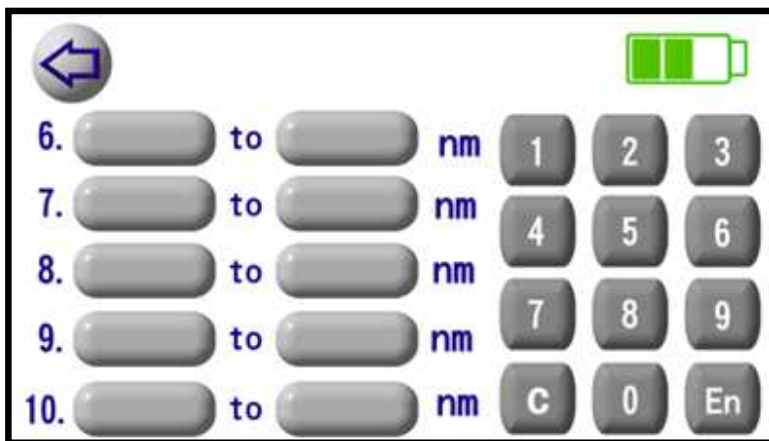
400nm to 700nm (PPFD).

Click the box to set or change the wavelength range, when the box is blank will be treated as no wavelength range is set.

 Back to previous page of "Information"

 Set the sixth to tenth wavelength range, after clicking, shows the following screen.

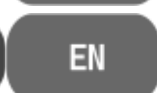 Back to previous page of "Set the first to fifth wavelength range" page.

4.5.7

 After clicking,shows current language on the right. You can choose from Traditional Chinese, Simplified Chinese, and English.

 Use Traditional Chinese
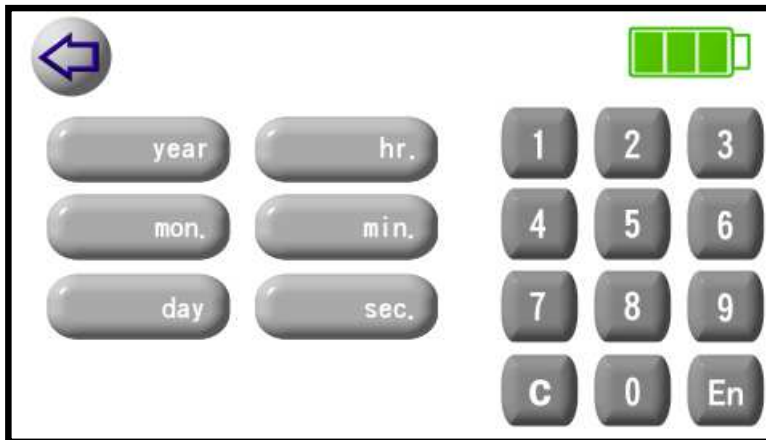
 Use Simplified Chinese

 Use English

4.5.8

 Set the system time. Moreover, the saved file name is initial set by

system time, for example, 201411122808.sps. After clicking, shows the following screen.
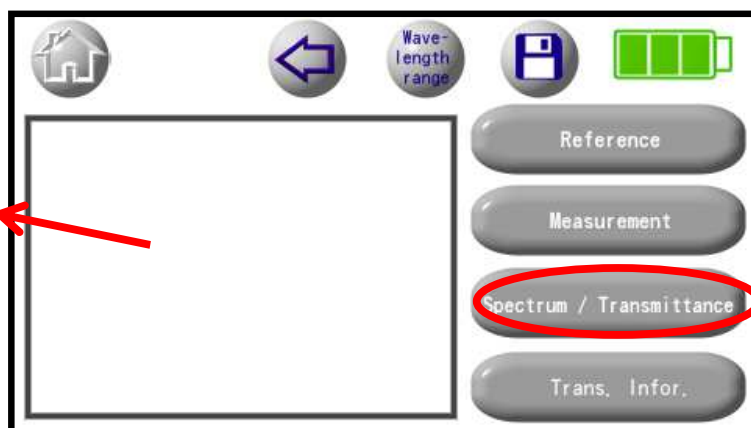

 Back to previous page of "Settings" page.

4.5.9

 Measured spectral transmittance under two different circumstances: For example, measure spectrum under the sun (first measurement), and then measure the spectrum under greenhouse shade screen (second measurement), transmittance will be calculated by using the second as numerator and the first as denominator, to let you see the greenhouse shade screen's transmittance and the spectrograms and percentage curves of both measurements. When you didn't set observed wavelength range, the initial setting will be the visible wavelength range (400 nm to 700 nm), and the wavelength range can be set up to ten ranges. After clicking, shows the following screen. There's no continuous measurement mode function for this.

Display area of both spectrum curves

Display both spectral transmittance percentage curves

 Return to main menu.
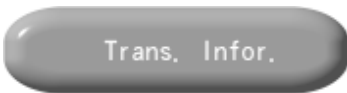
 Back to previous page of "Settings" page.

 Save the spectral transmittance information and data (spectrogram, curves and transmittance)(file name ends with, such as 201411122808t.sps), see4.7.

 Reference of measurement source (Transmittance 'denominator)

 Under the same spectrum with different Measurement object, Transmittance will be calculated by using the second as numerator and the first measurement source reference as denominator. Under the Different spectrum, should re-do the first measurement as a reference Transmittance.

 Display transmittance information, after clicking, shows the following screen.
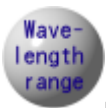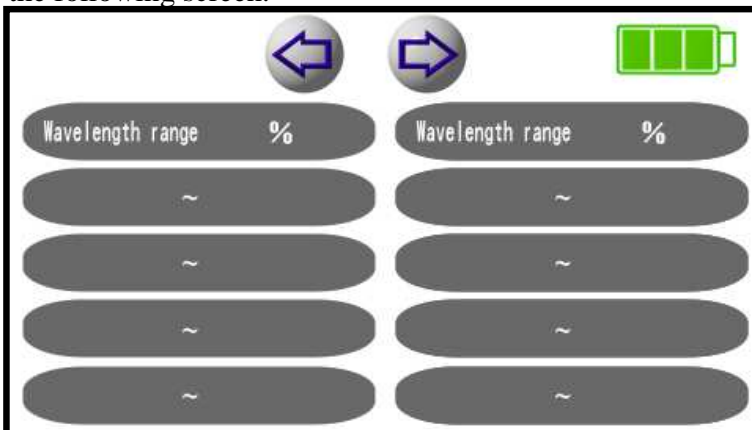
 Set the observed transmittance wavelength range, after clicking, shows the following screen.
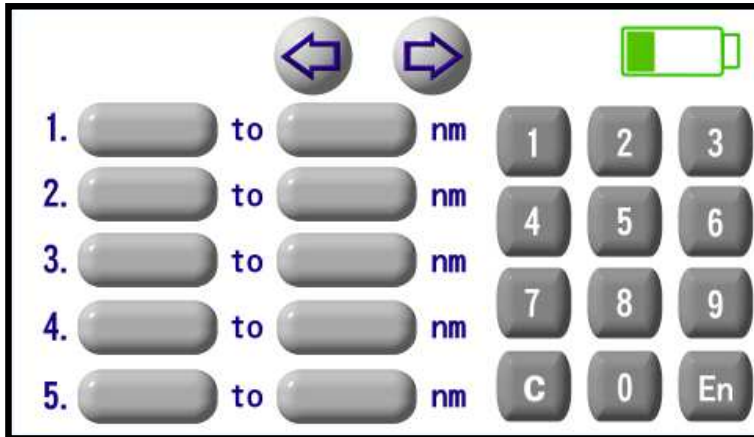
Back to previous page of "Transmittance" page.

Set the sixth to tenth wavelength range, after clicking, shows the following screen.
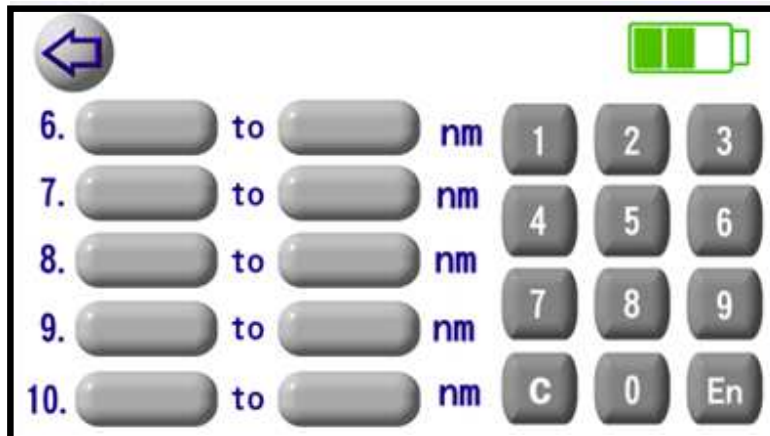
4.5.10

When the spectrometer is under calibration, the results will different when using different standards. K values can let user set adjusted value based on needs. Initial setting is 1.

Input K value
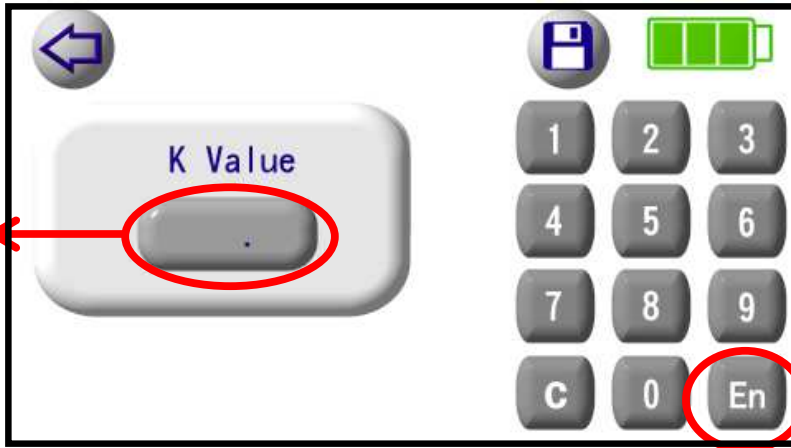
After input the K value must press En

 Back to previous page of "Settings" page.

4.6 History data

 All saved data, after clicking, shows the following screen
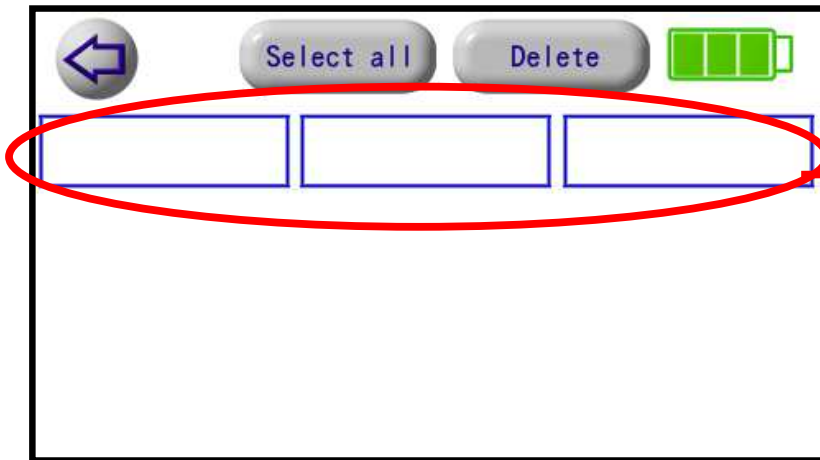
Saved data, click on file to see the spectrogram, can store up to 1200 pieces of data

 Back to main menu.

 To next "Saving file" page.

PS: The number of archives stored in the calculation of "multi-frequency

record" mode, if more than 5 minutes, take 20 measurement points. After setting 10-wavelength range, it will store up to 200 data

4.6.1 Delete

The file shows before the delete.
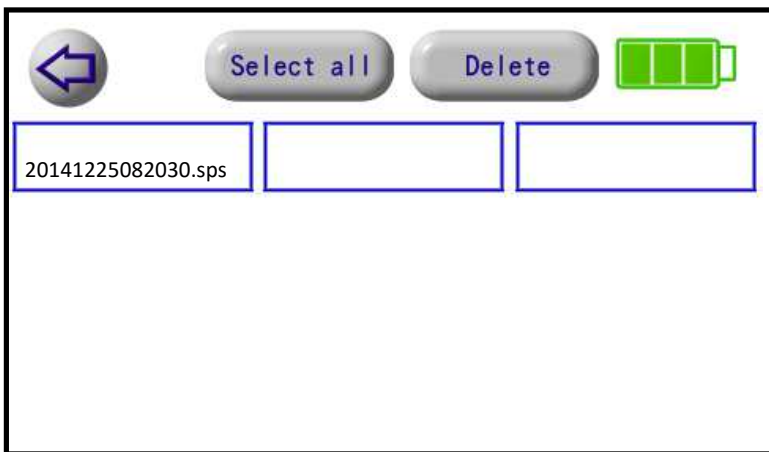
 Cancel "Delete" ，Back to previous page of " History" page.

 Choose all to delete

 Choose the file wish to delete

4.6.2 Bluetooth (transfer data to computer)
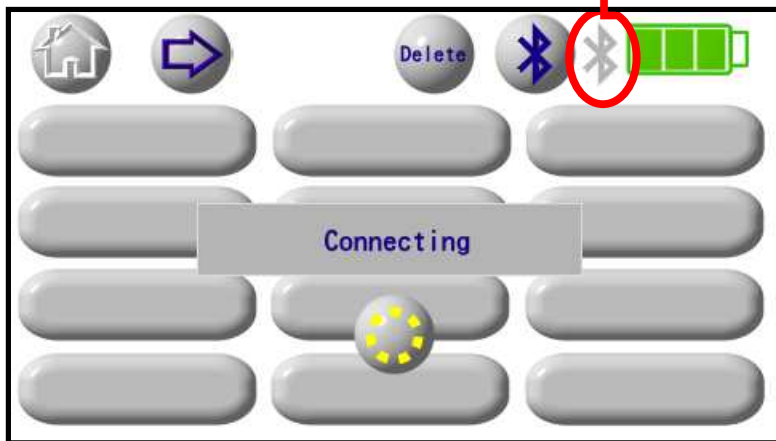
Bluetooth will change to blue when it connected.

Before Matching, all icons are invalid. The default matching code is 3333.

 (grey)disconnected (blue)connected。
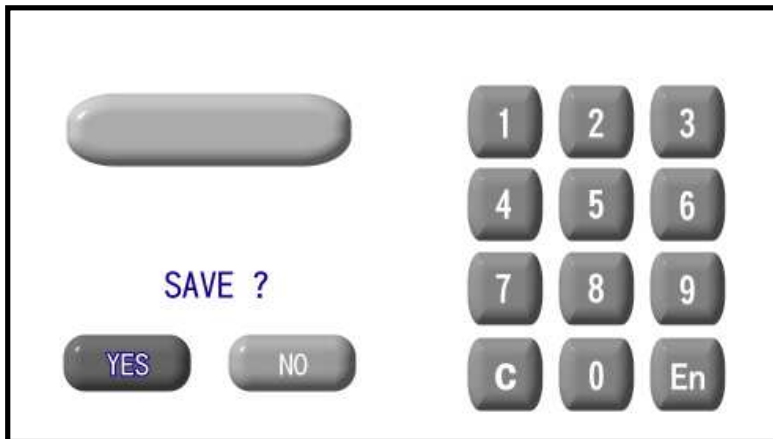
During the data transmission press will disconnected。

4.7 Saving file
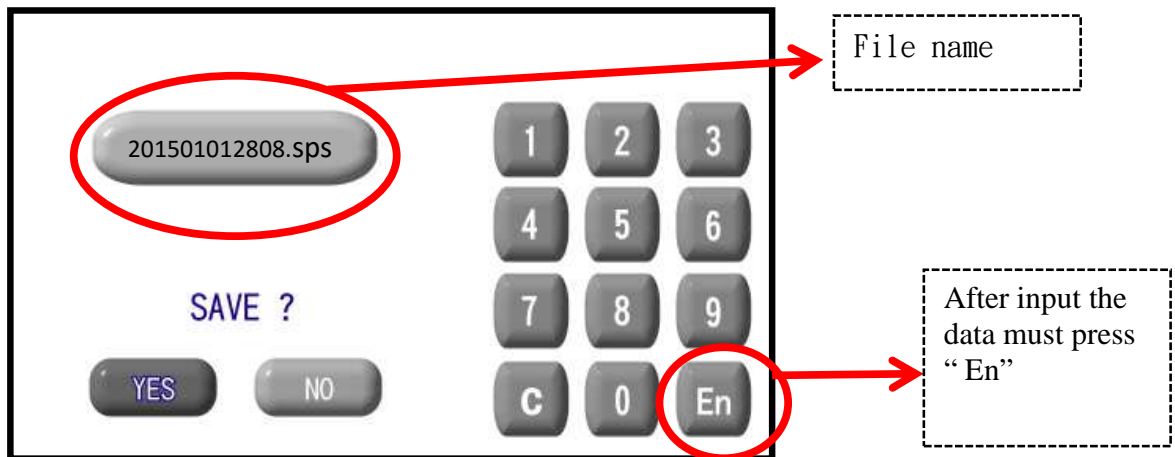
All measurement' default file name will set with Date & Time. See below as reference:

- Spectrometer file : 201411122808.sps。
- Transmittance file: 201411122808t.sps (file name with t)
- Multi-frequency record file: 201411122808.lmr
- Co2 file : 201411122808.co2
- temperature-humidity file: 201411122808.htv

Change the default file name press "C" to clear the file name, and input more than 3 digits and save.

5. Specifications

Display Platform:

Display mode	4.3 inch LCD (480x270) single-point touch panel
Data output interface	Bluetooth
Data output format	Can be converted to JPG by bundled software
Data storage capacity	2000
Analysis software	Use computer to analysis files transferred by Bluetooth
Dimensions	L160 x W106 x H25 mm
Weight	
Ambient temperature	-10°C ~ 50°C
Storage temperature	-30°C ~ 70°C
Storage humidity	0 ~ 90%RH
Battery life	Varied by settings (full-featured using for 5 hours)
Power supply	3000 mAh / rechargeable lithium battery
Language selection	Traditional Chinese / Simplified Chinese / English

Spectrometer:

Sensor	SONY ILX563A CCD
Spectral wavelength width	5.5 ~ 10nm
Detection head window Cosine response	2M Hz
Measuring ranges	Below picture as reference
Measuring ranges	Max. 200000 Lux
Spectral wavelength range	340nm ~ 850nm
Integral time	1ms ~ set by the user
Measurement functions	single / continuous
Operating modes	1. manual / Auto 2. Ten wavelength range can be set (overlap), and measured at the same time
Measurement modes	1. Standard mode 2. Transmittance mode 3. Multi-frequency record mode 4. continuous mode 5. History record review K value setting
Measurement capability	1. Color temperature: that is CCT (Common Computer Test). 2. Illumination: in Lux units. 3. Irradiance 4. u-mole 5. w /m^2 6. Color-rendering index: Average of CRI 7. Spectrogram 8. Transmittance

	9. CIE chromaticity coordinates (CIE1931， CIE1976)
	10. Wavelength length
	11. Wavelength strength
	12. Wavelength range is from 360 nm to 830 nm
	13. PPFD (400nm ~ 700nm)
	14. Blue wavelength zone(400nm~500nm)
	15. Green wavelength zone (500nm~600nm)
	16. Red wavelength zone(600nm~700nm)
	17. Red wavelength strength (700nm~780nm)
	18. Ten wavelength range can be set (overlap), and measured
Display resolution	16 bit
Calibration to Zero	Yes
Illumination precision	± 2% (standard 60000 Lux)
Color coordinates Repeatability Correlated Color Temperature	± 2% (standard 60000 Lux)
Color rendering index	± 1.5% (standard 60000 Lux)
Color accuracy	± 0.002 (standard 60000 Lux)
Dimensions	L76 x W69 x H25 mm
Weight	105 g
Operating temperature	–10°C ~ +50 $^{\circ}$C
Storage temperature	–30°C ~ +70 $^{\circ}$C

Temperature-humidity detector

Temperature range	-30°C ~ 115°C(support Fahrenheit and Celsius display)
Humidity range	0 ~ 100%RH
Temperature accuracy (25°C)	± 0.3^{o}C
Humidity accuracy (25°C)	± 4.5%RH
Temperature response time (15°C ~ 45°C)	10 seconds
Humidity response time (35%RH ~ 75%RH)	10 seconds
Dimensions	L76 x W69 x H25 mm
Weight	60 g

CO2 detector

Operating temperature range	0°C ~ 50°C
Operating humidity range	0 ~ 90%RH (Non-condensing)
Maximum measuring amount	5000 ppm
Accuracy	± 30 ppm ± 5%
Response time (90%)	60 seconds
Sampling time	3 seconds
Dimensions	L76 x W69 x H25 mm
Weight	80 g

6. Warranty terms

6.1 The principles of warranty

LeBio International Science and Technology ensures the LM801S products are within the warranty period, if material or functional defects and faults appear, Bao Qing International Technology will serve customers by repair or exchange with same level products.

1. Exchange:
If customers encounter products functional defects and faults within seven days after purchase or found missing parts after the arrival of the goods, first get confirmed by the dealer and get back to the manufacturer immediately, then leave customers'contact information so the customer service staff can confirm and set up an exchange number for customers, then the manufacturer can provide the seven days exchange services. Customers who get the exchange number must return the products to the manufacturer within 30 days. International customers please allow flexibility in the logistics which may leads to time increase during products' return.

Please note: Returned products must be in intact original factory packaging, except the missing parts after arrival situation, the returned products can not have any missing parts or outside scratches, in this case, manufacturer has the right to retain the right of final decision.

2. Repair service:
If seven days exchange period expired, dysfunction or defects belongs with the general RMA process. When there are products need to be returned to the manufacturer for repair, please mail, fax or telephone customer service staff to apply for a repair number, then send the number along with the products to the manufacturer for repair services.

After the manufacturer receives the products, the internal engineering staff will go through a basic test, and confirm the products' problem, products functional problems within warranty period can be repaired by general maintenance service process. But if the engineer decides it's not a functional problem, it will be treated as artificial damage which is not applicable to this regulation.

Please Note: In order to avoid damage in transit, we strongly recommend using international express logistic and careful protection. Product supplies and related accessories such as batteries, tripod, USB cable etc, are all excluded from repair services.

6.2 After warranty services
After one year warranty period expired, when LM801S series of products encounter functional damage or faults, customers can still rely on the service above, return the products to LeBio International Science and Technology for maintenance service, but LeBio will charge repair fees depending on the damage.

6.3 Limited Warranty

The warranty terms does not apply to damages caused by unnatural or external factors, such as the following conditions occur:
1. Due to natural disasters, improper operation and other non-product failures.
2. The product has been repaired or disassembled by unauthorized technical staff.
3. Warranty label is modified, damaged or lost.
4. Product serial number didn't match, damaged, or vague.

6.4 Disclaimer

Bao Qing International Science and Technology are not responsible for damages during delivery of LM801S series repair process. We recommend that you remove and keep safe the storage device before repair, and properly packaged and shipped the products.

Within the maximum extent permitted by applicable law, any loss of profit, expected cost, data, or any other indirect, incidental or consequential loss or damage, will not be LeBio International Science and Technology's liability.

6.5 Applicable object

LeBio International Science and Technology Warranty Terms only available for customers who buy products through formal and legitimate distribution channel.

6.6 Miscellaneous

Because the raw materials and accessories are not all manufacturing by LeBio International Science and Technology, in case of discontinued, raw materials and accessories will be replaced by the same level of alternatives and the products under warranty will be completely repaired.