Make Measurement more Easy

User Manual

WF32

Precision Colorimeter

iWAVE

Shenzhen Wave Optoelectronics Technology Co., Ltd.

Content

Safety Instructions

In order for safe and proper use of the instrument, please read carefully and follow the instructions of the manual.

 Use only original power adapter and original battery to avoid fault or damage of the instrument.

 Upon long time no use, cut off external power and remove the battery to avoid damage to the instrument resulting from battery fluid overflow.

 Do not use the instrument under the conditions with flammable and explosive gases, dusts or smokes to avoid accident.

 Do not use the instrument under the conditions of strong magnetic field, rattling, dust and smoke to avoid unexpected data and performance failure.

 The product is a precision instrument, do not disassemble it without permission, or it may be damaged and unrepairable.

Notes

1. Storage

● Upon long time no use, put the instrument into a packing box;

● Store the instrument in a cool and dry environment with a temperature at -10°C~50°C and relative humidity under 85%;

2. Use

● When using the instrument, the ambient temperature should be 0°C~40°C, relative humidity at 85%, without condensation;

● Do not use the instrument under the conditions of strong magnetic field, rattling, dust and smoke to avoid unexpected data and performance failure.

● Prevent foreign objects as liquid, powder or solid etc. from entering into the instrument to avoid unexpected measurement data.

Overview

The Colorimeter is a professional colorimeter designed and produced subject to the relevant standards of International Commission on Illumination (CIE) and national stands. Being with brand new imported key components, the instrument is well designed and features in precision, stability, easy handling, easy to learn and cost-effective.

The instrument applies to the color quality control, color difference control, color difference analysis, sampling testing and online testing for industries as textile, printing and dyeing, garments, shoes, leather, chemical, plastic, pigment, paint, ink, printing, metal, photography and toys etc., as well as to the auxiliary color matching during the processes as injection, inking, painting and spraying coating etc.

I. Structure

1.1 Appearance

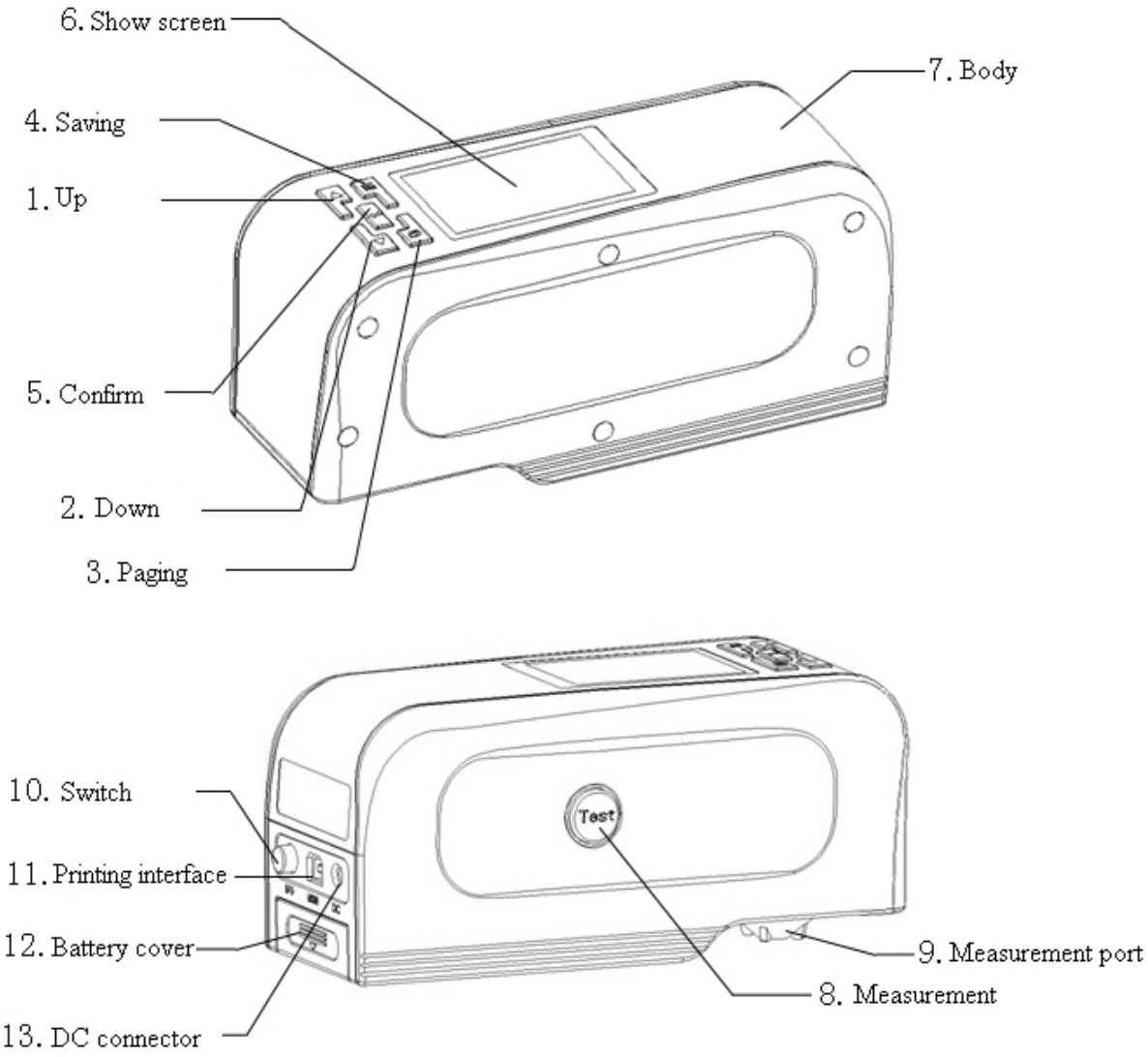


Figure 1. Instrument Appearance

1.2 Keys

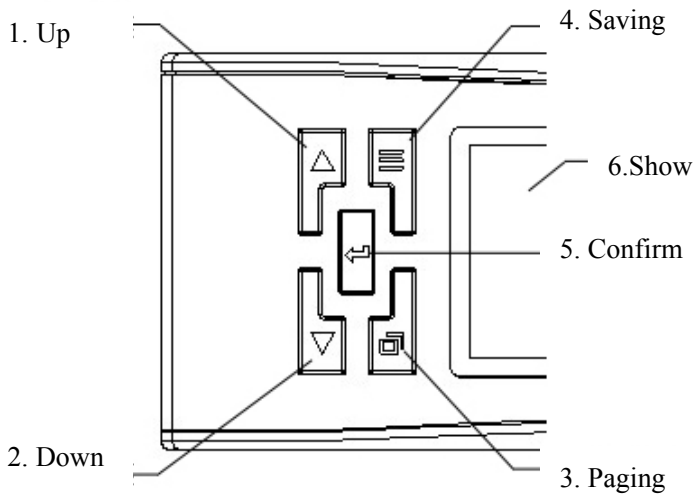


Figure 2. Bird's View

Up	-	move the position of the cursor in the screen; adjust the value of the activated items .
Down	-	move the position of the cursor in the screen; adjust the value of the activated items.
Paging	-	Switching between tabs.
Saving	-	Save settings.
Confirm	-	Confirm or activate selected items in the screen (a blue background of the item will be changed to a green background after activation); fast switching between "standard measurement" and "sample measurement".
Show screen	-	show measurement result etc.

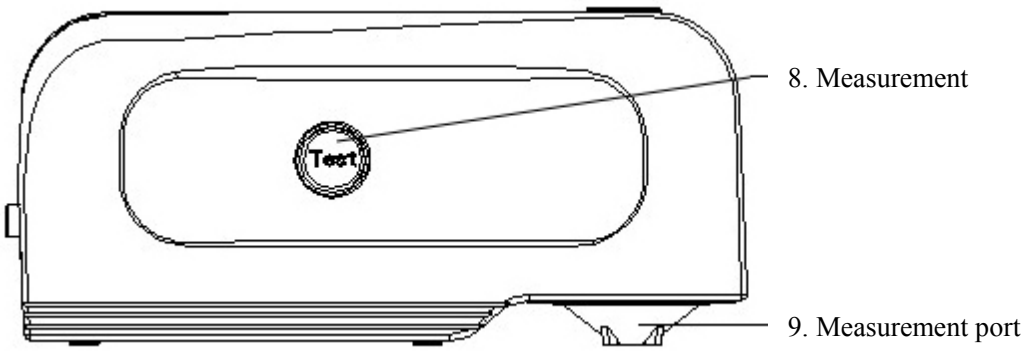


Figure 3. Back View

Measurement - Measuring

Measurement port - Optical channel for measuring.

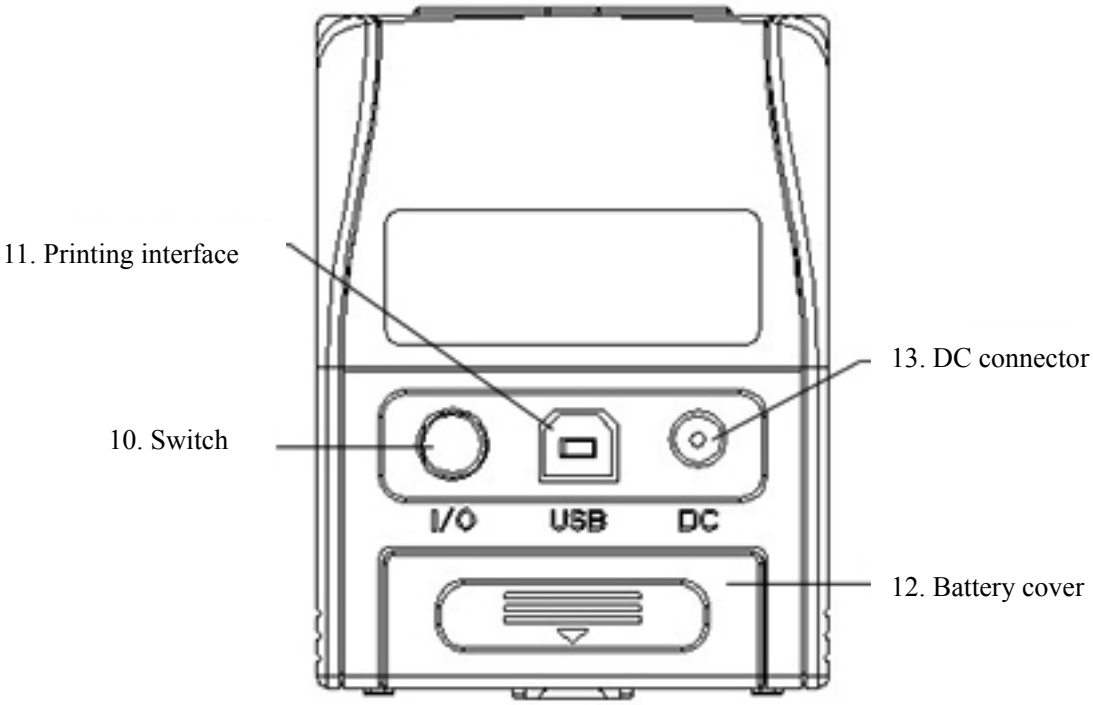


Figure 4. Right View

Switch - In (I) or Out (O) of the instrument.

Printing interface - connect to the printer to print the measuring data.

Battery cover - cover for the special lithium battery compartment DC connector - dedicated power adapter connector.

1.3 Power

The Colorimeter is powered by dedicated power adapter or special lithium batteries, the use of other facilities for power supply may damage the Colorimeter.

Ensure that the Switch is on Out (O) before connecting to the power adapter or mounting the battery.

1.3.1 Battery

1. First check and confirm if the Switch is on Out (O), then following the arrow direction as shown on Figure 5, take out the battery cover by pressing down.

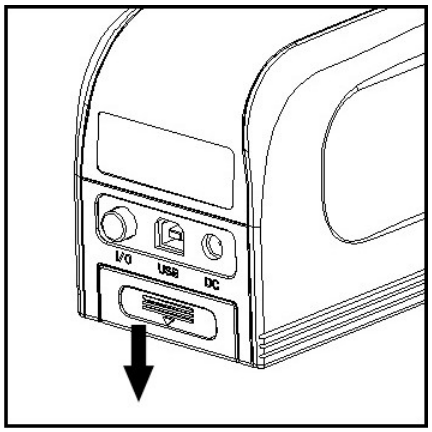


Figure 5. Remove the battery cover

2. Mount the battery into the compartment as shown in Figure 6, pay attention to the front and back of the battery.

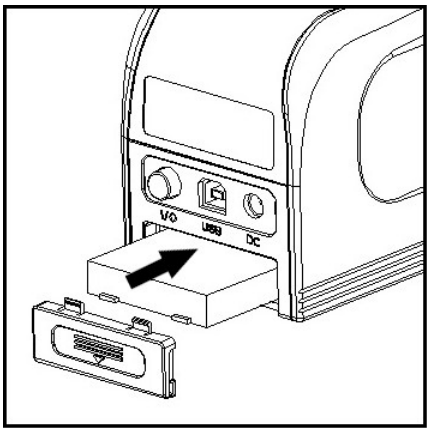


Figure 6. Mounting the battery

3. Follow the directions on Figure 7, press up to mount the battery into the compartment.

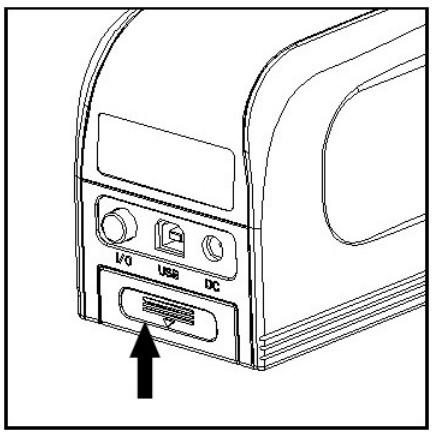


Figure 7. Mounting the battery cover

1.3.2 Power Adapter

1. First check and confirm if the Switch is on Out (O),
2. Plug the input cable of the power adapter as shown on Figure 8 into the DC connector.

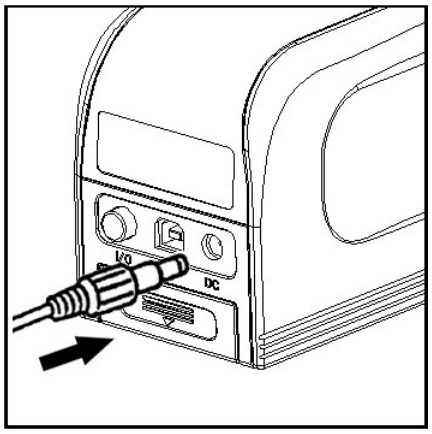


Figure 8. Power Adapter connection

II. Screen Description

2.1 Display layout

The screen of colorimeter is divided into four parts: the “Menu” on the left, the “Screen Column” on the top, the “Window” in the middle and the “Message Column” at the bottom, as shown in Figure 9.

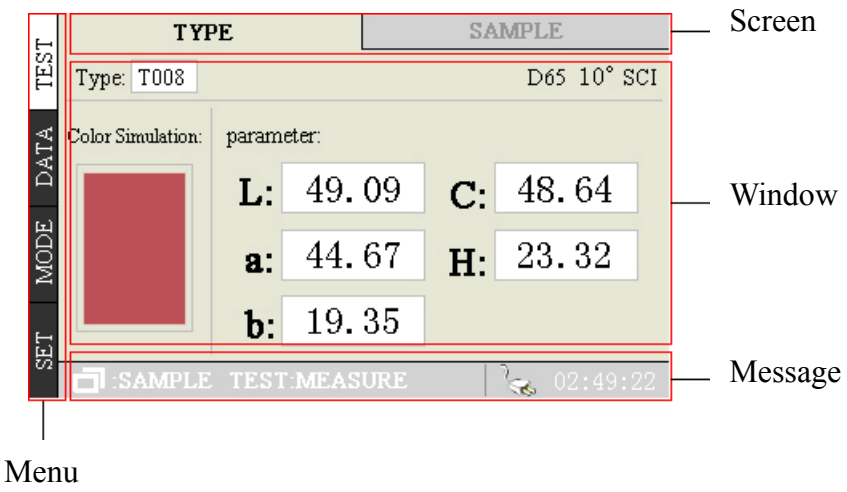


Figure 9 Display layout

2.2 Detailed interpretation of the screen

2.2.1 “Measurement” menu

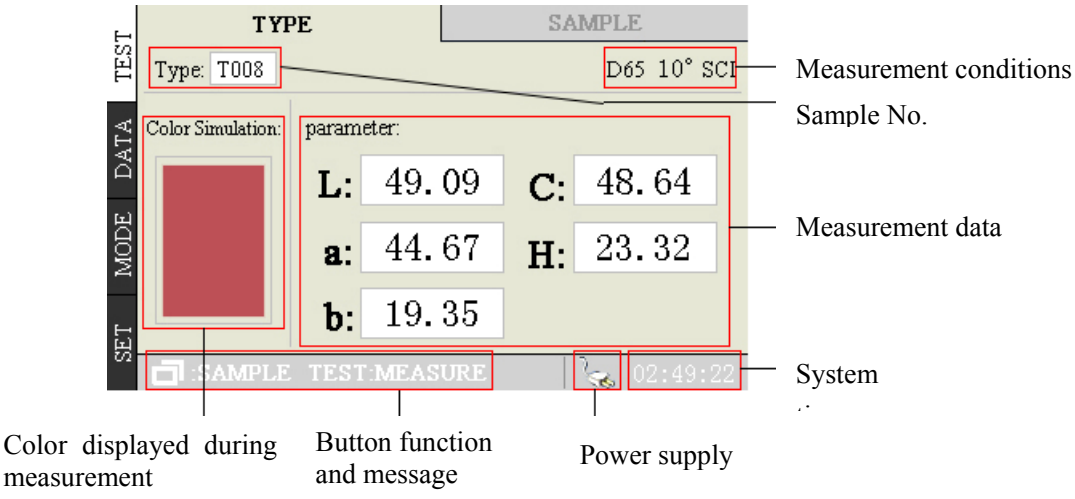


Figure 10 Detailed interpretation of “Sample Measurement”

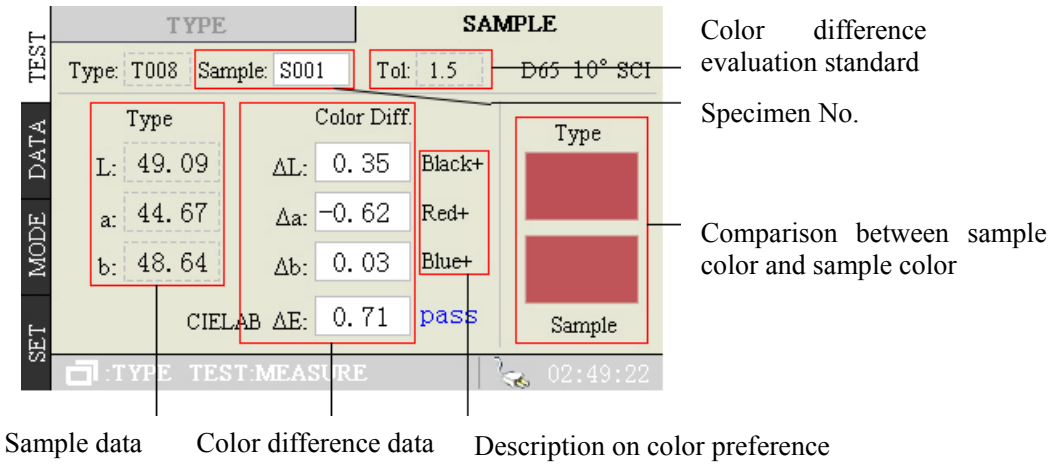


Figure 11 Detailed interpretation of "Specimen Measurement" screen

2.2.2 "Record" menu

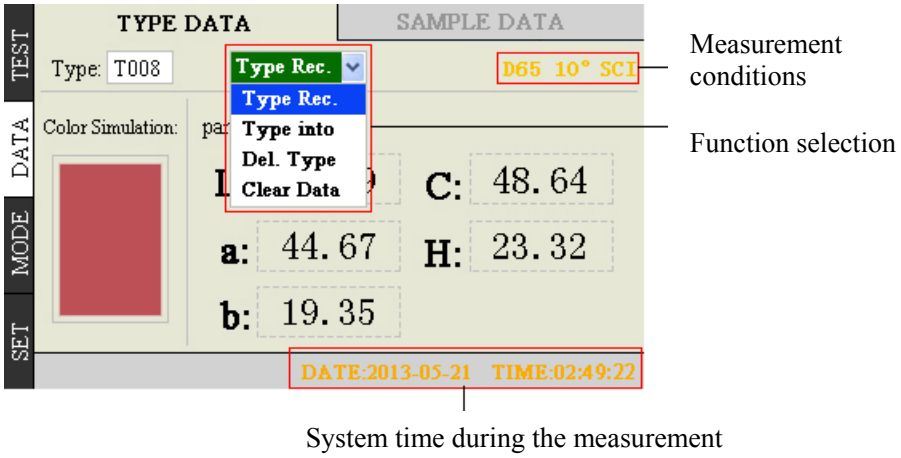


Figure 12 Detailed interpretation of "Sample Record" screen

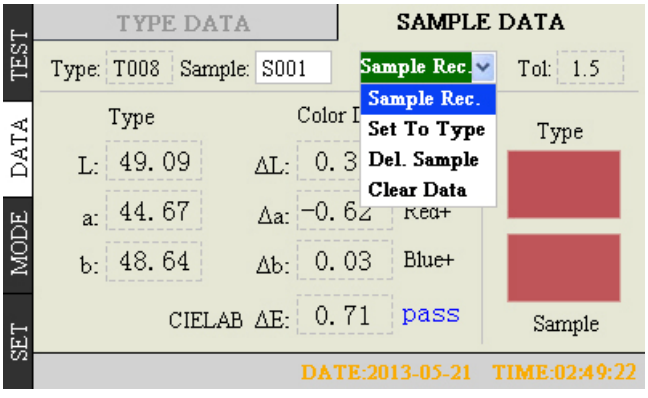
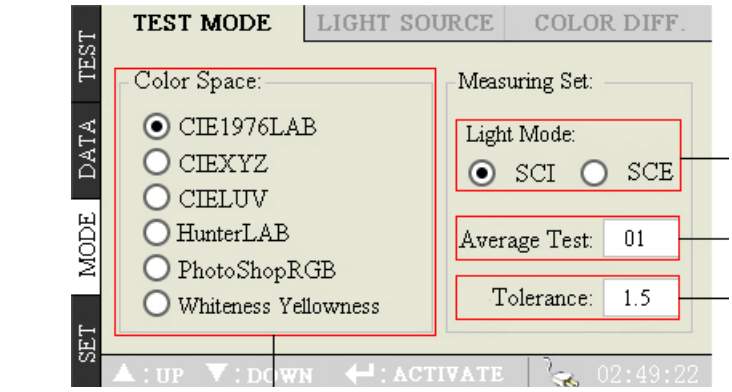


Figure 13 Detailed interpretation of "Specimen Record" screen

2.2.3 “Mode” menu



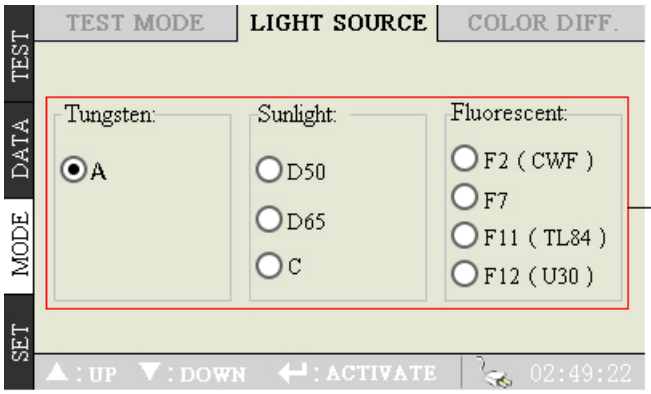
SCI/SCE setting

Setting of single measurement or mean of several repeated measurements

Setting color difference evaluation standard

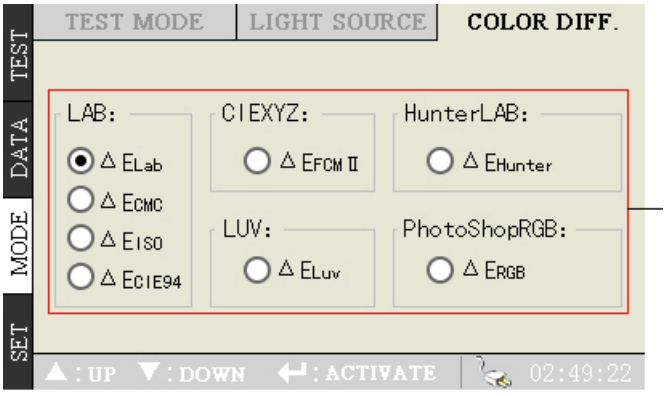
Select the corresponding color space required for color description

Figure 14 Detailed interpretation of “Measurement Mode” screen



Select the required standard light source for measurement

Figure 15 Detailed interpretation of “Light Source Selection” screen



Select the required color difference formula

Figure 16 Detailed interpretation of “Color Difference Formula” screen

2.2.4 “Setting” menu

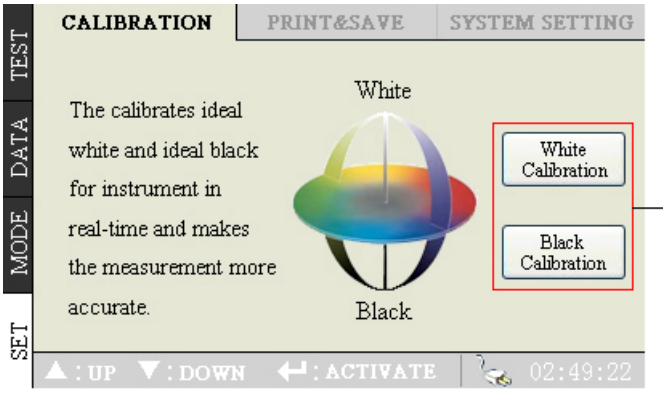


Figure 17 Detailed Interpretation of “Black and White Calibration” screen

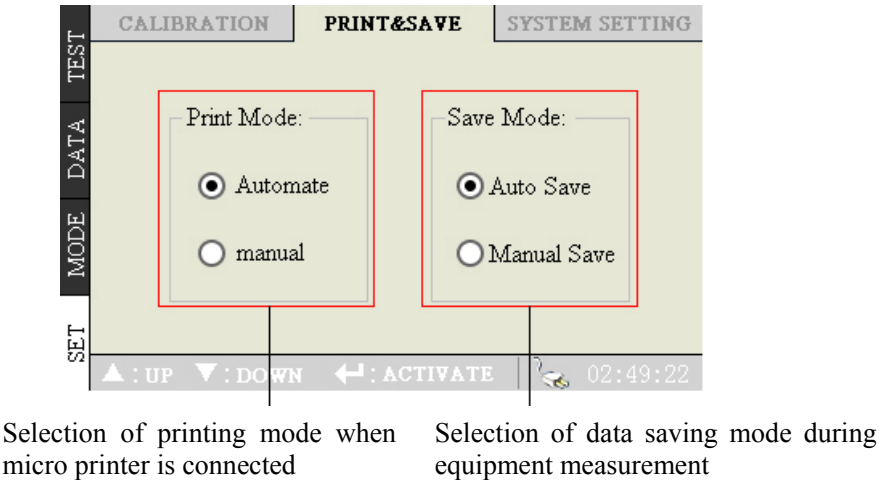


Figure 18 Detailed interpretation of “Printing and Saving” screen

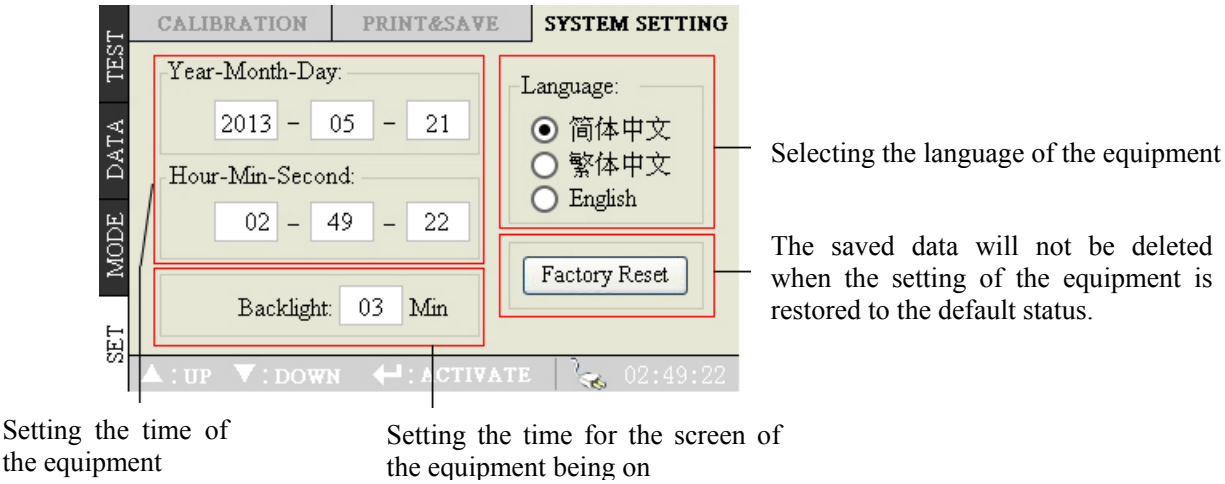


Figure 19 Detailed interpretation of “System Setting” screen

III. Operating Instructions

3.1 Startup

It is required to check whether the colorimeter is connected to external power supply or provided with battery prior to startup, so as to verify that the equipment is provided with power supply. Then, start up the equipment and the screen of the equipment will display the startup LOGO.

After the startup screen, the equipment will enter the self-test procedure to ensure the normal operation of the equipment.

3.2 Color difference measurement

The color difference measurement by the equipment is completed through two steps, namely: “Sample Measurement” and “Specimen Measurement”.

1. The standard color parameter of standard samples is obtained through sample measurement;

2. The parameter of the samples to be tested is obtained through specimen measurement and meanwhile the color difference data between specimens and samples is obtained through calculation.

The menu can be shifted to “Measurement” when the “Menu” button  is pressed. Under the menu of “Measurement”, there are two screens for sample measurement and specimen measurement, namely: “Sample Measurement” and “Specimen Measurement”. Shift between the two screens can be realized by pressing the “Screen Shift Button”  .

3.2.1 Measurement: Sample measurement

As is shown in Figure 20, the sample measurement can be conducted in “Measurement: Sample Measurement” screen to obtain the color parameter of standard samples. The color parameter measured will be displayed on the measurement screen.

The upper right part of the screen displays the current test conditions, such as light source, observer and light-emitting method.

The left part of the screen displays the current simulation color measured.

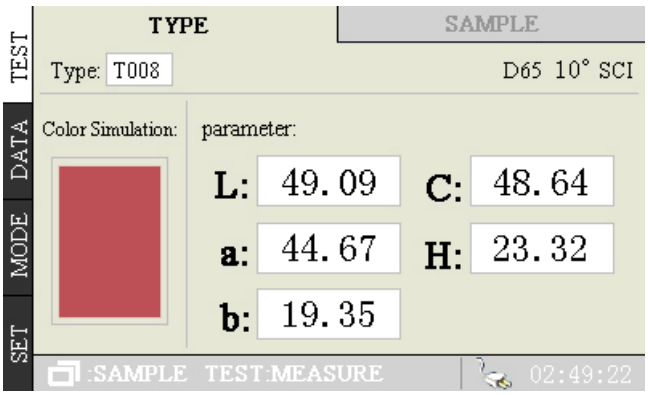


Figure 20 Measurement: Sample measurement

3.2.2 Measurement: Sample measurement

To measure the color difference between the specimen and the sample after sample measurement, it is advised to press the "Screen Shift Button" to shift the screen to "Measurement: Specimen Measurement" screen. As is shown in Figure 21, the color difference measured will be displayed in measurement screen.

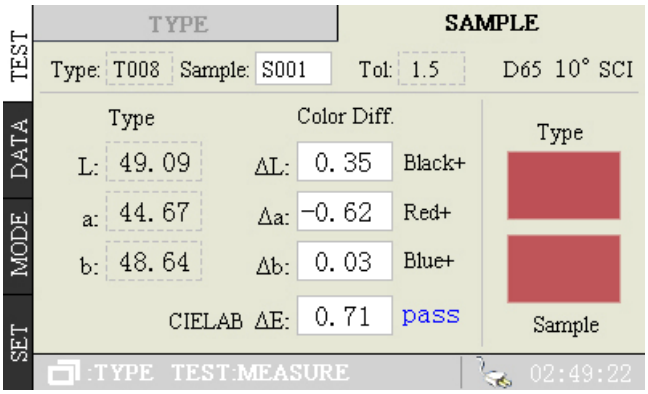


Figure 21 Measurement: Specimen measurement

Meanwhile, the right part of the screen displays the simulation colors of the sample and the specimen for visualized color difference analysis.

3.3 Record

The menu can be shifted to "Record" by pressing the "Menu" button . There are two screens under the menu of "Record" for viewing the recorded sample data and specimen data, namely: "Sample Record" and "Specimen Record". Shift between the two screens can be realized by pressing the "Screen Shift Button" .

3.3.1 Record: Sample record

The menu can be shifted to “Record” by pressing the “Menu” button . As is shown in Figure 22, through the screen, the records on saving of samples can be viewed and the options of the dropdown menu can be selected according to needs through “OK button” , “UP button” and “DOWN button” .

The dropdown menu can perform the following functions:

Sample record: Shift the screen to “Sample Record” screen;

Yellowness index record: Shift the screen to the screen of yellowness index and whiteness index;

Sample retrieval: Retrieve the current sample record to the “Measurement: Sample Record” screen and measure the specimens of this sample;

Sample deletion: delete the current samples and specimens;

Sample clearance: Delete all the samples and specimens without influencing the data concerning yellowness index and whiteness index;

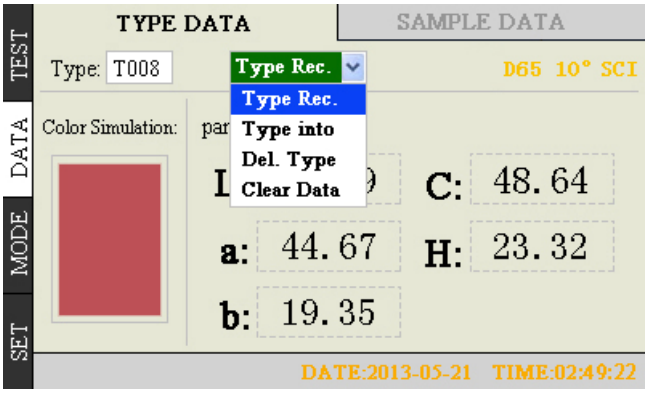


Figure 22 Record: Sample Record

3.3.2 Record: Specimen Record

After having selected the sample to be viewed, press the “Screen Shift Button” and the screen will shift to “Sample Record” screen and the screen will be shifted to sample record screen for this sample. As is shown in figure 23, select the sample record through “OK button” , “UP button” and “DOWN button” afterwards and you can view the color difference record of different specimens.

The dropdown menu performs the following functions:

Specimen record: Shift the screen to “Specimen Record” screen;

Yellowness index record: shift the screen to the screen for viewing yellowness index and whiteness index;

Sample retrieval: retrieve the current specimen record to the “Measurement: Sample Record” screen as samples and measure the specimens of this sample;

Specimen deletion: when this function is selected, the colorimeter will pop up the message box with two options “Delete all the specimens of current sample” and “Delete the specimens of all samples” for the user to choose from;

Record clearance: Delete all the samples and specimens without influencing the data concerning yellowness index and whiteness index;

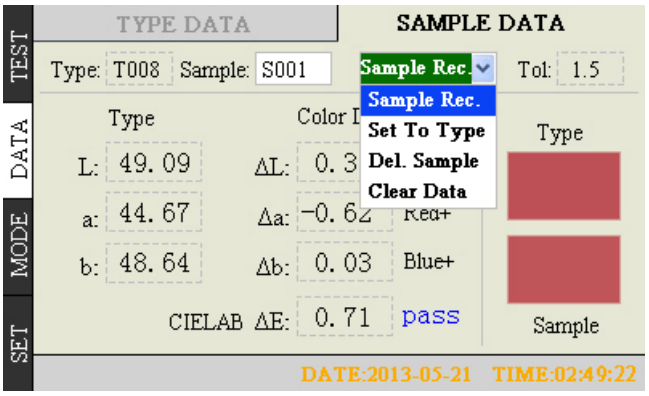


Figure 23 Record: Specimen record

3.4 Mode

The menu can be shifted to “Mode” by pressing the “Menu” button. There are three screens under the menu of “Mode” for measurement setting. The three screens are namely “Measurement Mode”, “Light Source Selection” and “Color Difference Formula”. Shift between the three screens can be realized by pressing the “Screen Shift Button” .

3.4.1 Mode: Measurement mode

When the screen is shifted to “Measurement Mode” screen as is shown in Figure 24, the color space during equipment measurement (CIE1976LAB, CIEXYZ, CIELUV, HunterLAB, sRGB, yellowness index and whiteness index), light-emitting method, setting of average measurement times and setting of tolerance of the equipment can be selected under the “Measurement Mode”.

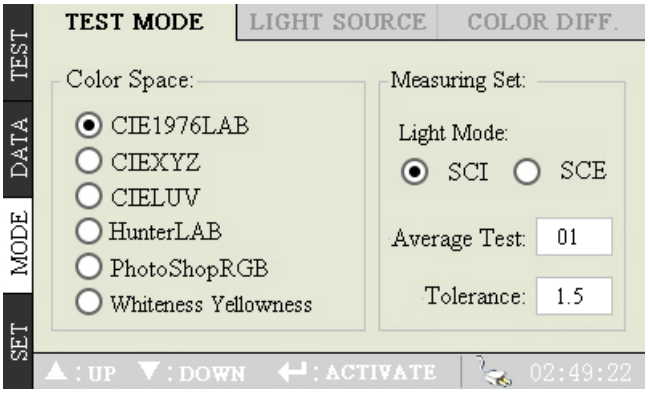


Figure 24 Mode: Measurement mode

Color space

CIE1976LAB: This color space is the universal uniform color space recommended by the International Commission of Illumination (CIE) for the world. CIE1976LAB uniform color space is obtained through the non-linear transform of CIEXYZ color space. The advantage of the color space is that the psychological effect of object color is better reflected when the color difference is greater than the recognition threshold (just noticed) and less than the color difference between two adjacent levels in the Munsell Color System. Since the CIE1976LAB color space is introduced, it is widely applied in the industry. Especially in the color quality control of products in such industries as dyes manufacturing, coating, textile printing, oil ink and plastic coloring, etc., it holds important position;

CIEXYZ: The color space is a kind of device-independent color space. The space model attempts to describe the color sensation of a person with normal color visual sense towards precisely defined color stimulation under precisely defined observation environment through the mathematical method. The values X, Y and Z are the so-called tristimulus values;

CIELUV: The International Commission of Illumination proposed a new chromaticity diagram by contracting the green area and expanding the blue area on the basis of the CIE1931 chromaticity diagram in 1960. After several modifications, it finally becomes the CIE1976LUV. It overcomes the defects of the 1931CIE-RGB color system and becomes the comparatively sophisticated color system. CIELUV is mainly applied to cases when the color difference is minor. This color space is often used in processing light source color and additive color mixing in such industries as color TV industry, etc.;

HunterLAB: Hunter proposed this color space and the corresponding color difference formula in 1948 and applied it in ceramics, plastics and textiles for several times. At present, 75% of food companies all across the world use this color space and color difference formula to test foods;

sRGB: sRGB color space is a kind of light mode based on color light. It is applied use in our daily life, for example: TV, computer display, scanner, etc. Images requires scanning in printing. Thus, scanner firstly takes the RGB color light message of the script image during the scanning. sRGB is a kind of additive color mixing mode. It describes a color through the values of R, G and B. The definable color of computer is the 16.7 million kinds of color combined based on the components R, G and B (ranging from 0~255). 0 represents no stimulation, 255 represents the maximum stimulation. In the case when all of R, G and B is 255, it will be white color. In the case when all of R, G and B is 0, it will be black color. This color space can be used to predict the color when the object color is entered into the display.

Yellowness index and whiteness index: The colorimeter can be used to measure yellowness index, Ganz whiteness index and ISO lightness.

Light-emitting method

Light-emitting method SCI refers to that the mirror reflected light in object reflected light is included during the measurement.

Light-emitting method SCE refers to that the mirror reflected light in object reflected light is not included during the measurement

Average measurement

The user can use the function of average measurement when he/she needs to measure several points and take the mean of them.

Tolerance setting

Intended for setting the standard for evaluating whether the color difference measured is qualified

3.4.2 Mode: Light source selection

When the screen is shifted to “Light Source Selection” screen as is shown in Figure 25, the light source (A, C, D50, D65, F2, F7, F11 and F12) for the measurement by the equipment can be selected from “Light Source Selection” to satisfy with the different measurement requirements.

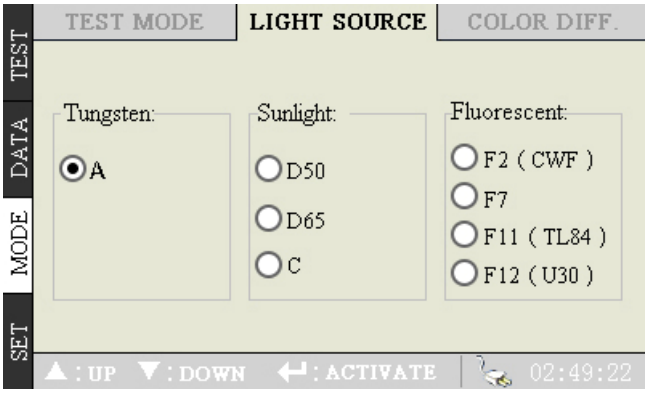


Figure 25 Mode: Light Source selection

Light source	Color temperature	Standard illumination	Environment	Application
A	2854K	Tungsten filament lamp	The light perpendicular to the light during sunrise or sunset and the indoor tungsten filament lamp.	Common indoor lamps, it can be used for discoloration detection.
C	6700K	6700K quartz halogen lamp	Daylight	Fluorescent lamp commonly used before 1964
D50	5000K	5000K quartz halogen lamp	A kind of warm daylight reflected on printed materials and photos	It is applied to the printing industry for observing the transparency of printed materials and the color
D65	6500K	6500K quartz halogen lamp	Average sunshine	As the most widely applied light source, it is not provided with precise D65 artificial light source at present. It is also be assessed as fluorescent light and light degree.
F2	4200K	Cool white fluorescent lamp (CWF)	Common lamps in offices and factories	Intended for the inspection of ordinary objects.
F7	6500K	Board-band fluorescent lamp (D65)	Blue light and cold sun light	Widely used in offices and factories.
F11	4000K	Narrow-band fluorescent lamp, for example: TL84 and TLD84	A kind of cool white light characterized by low energy consumption and excellent color rending property	Standard light source designated by European clothing industry
F12	3000K	Fluorescent lamp, for example: Westinghouse and Philips (TL84/U30)	A kind of warm white light characterized by low energy consumption and excellent color rendering property.	It is the standard light source designated by Seais Corporation of USA.

3.4.3 Mode: Color difference formula

When the screen is shifted to “Color Difference Formula” screen as is shown in Figure 26, the color difference formula (ΔE_{Lab}, ΔE_{CMC}, ΔE_{ISO}, ΔE_{CIE94}, ΔE_{FCMII}, ΔE_{LUV}, ΔE_{Hunter} and ΔE_{sRGB}) for the calculation of color difference for the measurement by the equipment can be selected in “Color Difference Formula” screen, so as to satisfy with the different measurement requirements.

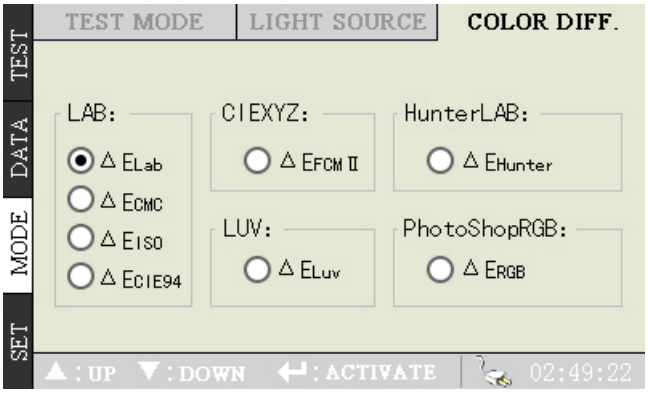


Figure 26 Mode: Color difference formula

Color difference formula

ΔE_{Lab}: In the past, the different color different formulas brought about great inconvenience to the actual application in the industry, for the transform between the data based on different color difference formulas is difficult or impossible and there is no mutual comparison between the results calculated in accordance with different color difference formulas. To change the chaotic situation and standardize the color difference evaluation standard, the International Commission of Illumination (CIE) formally recommended the CIE1976LAB uniform color space and the corresponding color difference formula, which standardized the application of color difference formulas;

ΔE_{CMC}: CMC color difference formula is obtained after the modification of CIE1976LAB color difference formula. It greatly improves the even degree of the color difference and makes the uniform application of color difference tolerance for all the color areas in actual industrial application become possible. The evaluation of color difference approaches that by naked eyes. Therefore, at present, the CMC color quality evaluation standard is already widely applied to industry.

ΔE_{ISO}: ISO color difference formula is the formula adopted for equipment-based evaluation of color fastness of dyed textiles by based on ISO standard. ISO color difference formula is the color difference calculation formula adopted for evaluating color fastness of dyed textiles by equipment in the national standards of China. It is the color difference formula established after the weighed processing of lightness

difference, saturation difference and hue difference based on CIE1976LAB color difference formula;

ΔECIE94: In 1991, R S Berns and his partners published new research findings. The color difference formula adopted therein became the tentative suggestion of the commission of new technology. Finally, the International Commission of Illumination (CIE) published a CIE technical report in 1995, announcing color difference model with the full name being "CIE 1994(ΔL* ΔC*ab ΔH*ab)".

ΔEFCM11.: It can be directly used in color difference evaluation without requiring the transform between other color systems. It is widely applied to such industries as textile printing, etc.;

ΔELUV: It is mainly used in the conditions when the color difference is slight. This color difference formula is usually used when processing light source color and additive color mixing in such industries as color TV industry, etc.;

ΔEHunter: Hunter proposed the color space and the corresponding color difference formula in 1948. It is often used in ceramics, plastics and textiles, etc. At present, 75% of food companies all across the world use this space and color difference formula to test the foods;

ΔEsRGB: It is used to predict the color difference after object color is entered into the display.

3.5 Setting

The menu can be shifted to "Setting" by pressing the "Menu" button. There are three screens under the menu of "Setting" for measurement setting. The three screens are namely "Black and White Calibration", "Print Selection" and "System Setting". Shift between the three screens can be realized by pressing the "Screen Shift button".

3.5.1 Setting: Black and white calibration

The equipment is provided with startup automatic black and white board calibration and manual black and white board calibration and the user can choose the calibration method by themselves.

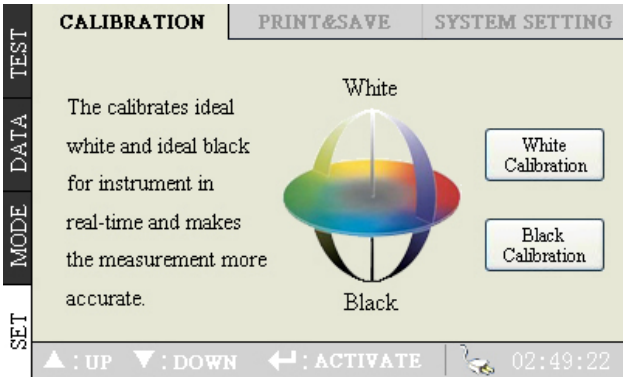


Figure 27 Setting: Black and white calibration

3.5.2 Setting: Printing and saving

As is shown in Figure 28, the printing method and the method for saving the measurement data can be set on the “Printing and Saving” screen;

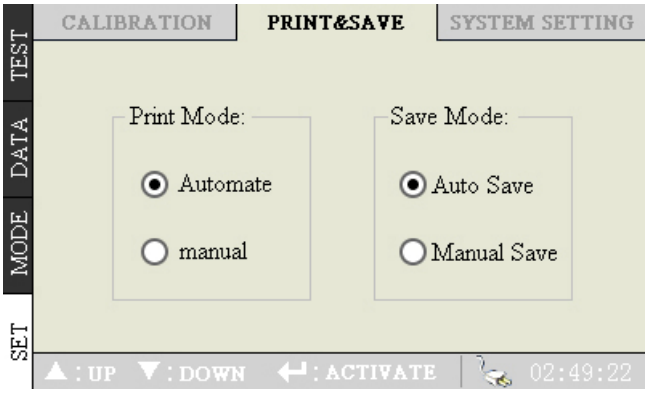


Figure 28 Setting: Printing and saving

Printing

Automatic printing: when this option is selected and the colorimeter is connected to micro printer, the micro printer will print the measurement data out automatically each time the colorimeter performs the measurement;

Manual printing: When this option is selected and the colorimeter is connected to micro printer, the micro printer will print the measurement data out by manually pressing the button  each time the colorimeter performs the measurement;

Saving

Automatic saving: When this option is selected, the data of each measurement by the colorimeter will be saved automatically;

Manual saving: When this option is selected, the measurement data will be saved when the button  is manually pressed after each measurement by the colorimeter;

3.5.3 Setting: System setting

As is shown in Figure 29, the system time, screen backlight time and system language can be set and selected in the “System Setting” screen;

The “Restore to default setting” available on this screen is intended for restore all the settings of the equipment to default status without deleting the data already saved in the equipment.

Figure 29 Setting: System setting

Ⅳ. Product standard

Model	WF32
Display Mode	CIELAB CIELCH CIEXYZ CIELUV HunterLAB sRGB
Whiteness Yellowness	Ganz Bbighteness ISO Brightness YI Yellowness
Color Difference	△E*ab △ECMC △EISO △ECIE94 △EFCMII △ELUV △EHunter △EsRGB
Illumination condition	CIE Recommendation: 8/d
Light Source	LED Blue Excitation
Sensor	Photodiode Array
Measurement caliber	Φ16mm or Φ8mm or Φ4mm
Measurement condition	Observer: CIE 10* Standard Observer Light Source: A C D50 D65 F2 F7 F8 F10 F11 F12 Light Mode: SCI/SCE
Measurement range	L: 0 to 100
Repetition	△E<0.03 (take the deviation average after 30 times measuring the whiteboard
Table difference	△E<0.2
Measurement interval	0.5 second
Data storage capacity	1. 100Storage Type 100, Type every 200 sample data. 2. Storage of the samples of 20000.
Language	English / simplified Chinese / traditional Chinese
Battery	Lithium battery is full of electricity can be measured more than 5000 times
Lifetime bulb	5 years more than 1.6 million measurements
Display	TFT true color 2.8 inch @(16:9)
Connector	Type B - USB RS-232 Baud rate 115200bps
Working temperature	0°C~40°C (32°F~104°F)
Storage temperature	-20°C~50°C (-4°F~122°F)
Humidity	Relative humidity less than 85%, without condensation
Weight	700g
Measurement	199x68x90 mm
Package measurement	400x240x340 mm
Standard accessories	Standard white plate, Standard hohlraum, 3000mAH Lithium battery, USB data line, Compact Disc(Color analysis system software), Power Adapter, User Manual, guarantee card
Optional accessories	Micro Printer, Powder Test Chassis,Multifunctional test accessories

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