



NH310/NH300/NR200
HIGH-QUALITY PORTABLE COLORIMETER

OPERATION MANUAL



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Product Description

This user manual is for model NH310, NH300 and NR200 colorimeter, but all the following descriptions are according to model NH310. You will find NH300 and NR200 technical parameters in Product Specifications.

NH310 colorimeter is researched and developed in accordance with CIE (International Commission on Illumination) and CNS (China National Standards). NH310 colorimeter is a high precise colorimeter with simple user interface and stable performance. It can be powered by both Li-ion battery and external DC power supply.

NH310 colorimeter adopts innovative patent technology -- automatic white and black calibration at startup which greatly simplifies the measuring steps.

NH310 colorimeter adopts innovative patent technology -- camera locating and illumination locating which brings out more precise and quicker locating.

NH310 colorimeter has been through numerous experiments and tests. It adopts complex advanced algorithms which make measurement performance more stable, more accurate and more compatible.

Cautions

- This colorimeter is a precise measuring instrument. Please avoid dramatic changes of external environment when measuring. These changes, including the flicker of surrounding light, the rapid change of temperature, will affect the measuring accuracy.
- Keep the instrument balanceable; make sure the measuring aperture cling to the test sample, and no shaking or shifting when measuring. Please prevent the colorimeter from fierce collision or crash.
- This instrument is not waterproof. Do not use it in high humidity environment or in water.
- Keep the colorimeter clean. Avoid dust, powder or solid particles entering the measuring aperture and the instrument.
- Replace the white calibration cover and put the colorimeter into instrument cabinet when not in use.
- Please take out the battery to prevent the colorimeter from damage if you don't use it for a long time.

- Please keep the colorimeter in a cool dry place.
- Any unauthorized changes to the colorimeter are not permitted, or it will affect the measuring accuracy, even cause irreversible damage.

I. Button Description

The following is a brief introduction of the buttons. We will give more detailed information about its function separately in next chapters.



Figure 1 Button Function

Button Function Introduction

1. Testing
2. Menu
3. Up/Camera/Print
4. Down/Save
5. Enter
6. Back

II. Interface Description

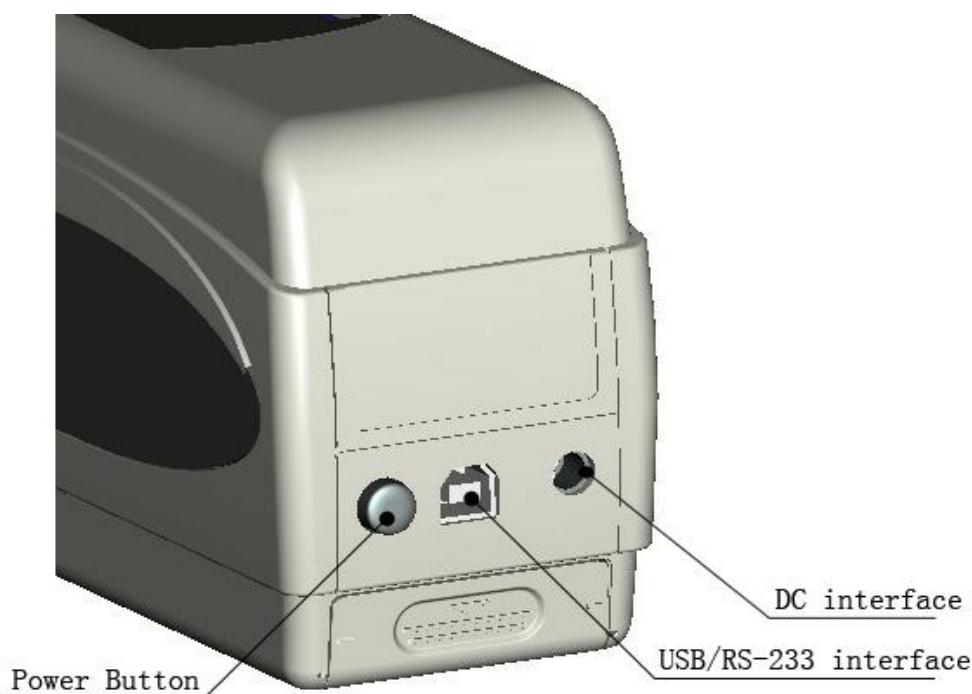


Figure 2 Interface Description

Interface Description

1. Power Switch: Press the button to turn on the colorimeter. Press the button again. The button will pop up. Then the colorimeter is turned off.
2. DC Interface: Connect with AC adapter. It is used to connect to external power source. The specification of external power source is 5V=2A.
3. USB Interface / RS-232 Interface: This interface is a common interface. The instrument automatically judges the connection status. USB interface is used to transfer data to PC. Its baud rate is 115200bps. RS-232 interface is used to connect to the printer; its baud rate is 19200bps.

Note: When connecting to external power source, please press

the power switch to start the instrument.

III. Battery Description and Installation

Please use original Li-ion battery. Do not use other batteries, or it will cause irreversible damage.

Please take out the battery to prevent the colorimeter from the damage of battery leakage if you don't use it for a long time.

When using external power source or connecting USB interface to PC, if you press the power switch, it will charge the Li-ion battery. If you don't want to charge the battery, please take out the battery.

When charging the battery, dynamic battery icon will display on the top right corner of "Standard Measurement" and "Sample Measurement" interfaces. In figure 3, the charging icon displays in "Standard Measurement" interface; if no charging, the dynamic icon will not appear.

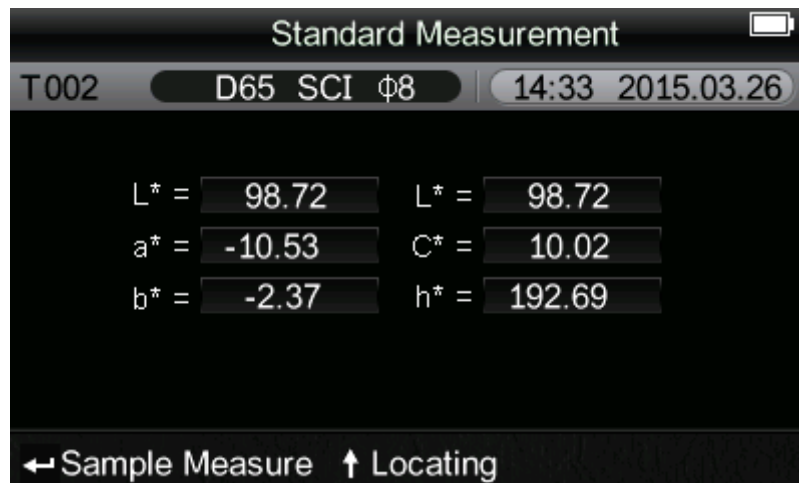


Figure 3 Charging Icon

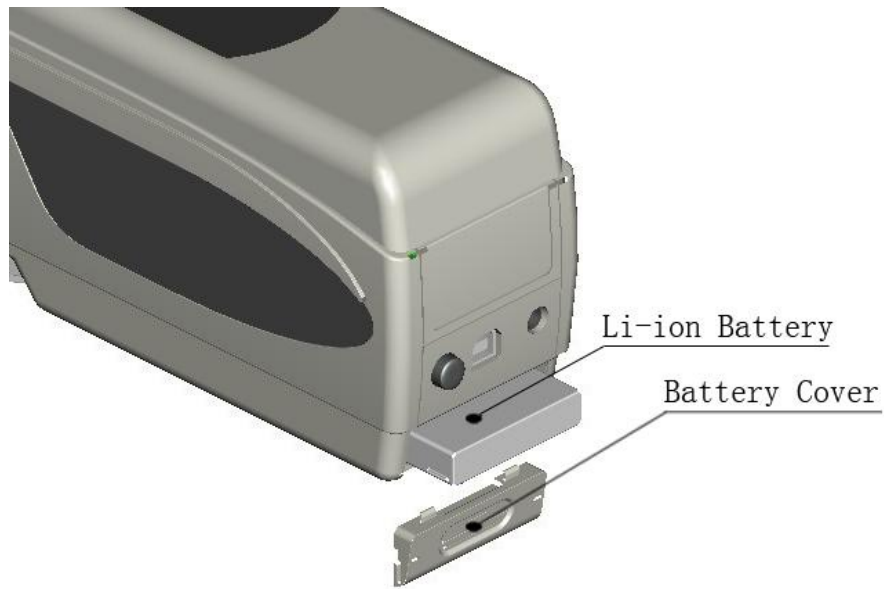


Figure 4 Battery Installation

Installing Battery

When installing battery, be sure the power switch is popped out (The power source of colorimeter is cut off). Then remove the battery cover.

Insert the Li-ion battery into battery compartment and push it gently in right direction.

Put the battery cover on Li-ion battery, and then push it up.

Battery Specification: Li-ion 3.7V==0.5A.

IV. NH310 Colorimeter Operating Instruction

(I) Turning On

1. Preparations Before Power On

- a) Check whether there is battery powered or external power supply.
- b) Make sure the white calibration cover is connected to the instrument and well installed. If it is loose or the white calibration cover isn't will installed, you must put the cover on and be sure it is connected to the instrument tightly.

2. Turning On

Press the power switch on the back side of the instrument, the LCD screen will display 3nh logo. After a few seconds, it will enter Standard Measurement interface automatically, and the default display is $L^*a^*b^*C^*H$.

3. White Calibration and Black Calibration

- a) Auto White Calibration and Black Calibration (Recommend)

NH310 colorimeter adopts humanity design and it is the most convenient colorimeter at present. It will perform white calibration and black calibration automatically during the startup. When the display enters measurement interface, the instrument has completed white calibration and black calibration automatically. Then you can take out the white calibration cover to perform measurement.

If the white calibration cover is loose or not installed, NH310 colorimeter will enter an interface "White Calibration Fail", as shown in Figure 5. It will display two options "Restart White Calibration" and "Skip White Calibration".



Figure 5 White Calibration Fail

Select option 1, you should replace the white calibration cover. After confirmation, the instrument will re-start white calibration automatically.

Select option 2, the instrument will skip white calibration and enter operating interface directly. At the moment, the instrument will adopt the last white and black calibration data. We do not recommend you to choose this option, because it may make the measured data not accurate enough .

b) Manual White Calibration and Black Calibration

After turning on NH310 colorimeter, press “Menu” to enter the main menu, as shown in Figure 6. Select “Calibrate” to enter White and Black Calibration interface, as shown in Figure 7.

Be sure the white calibration cover is well installed. Selecting “White Calibration” and press “Enter” button, the instrument will prompt you to place the white calibration plate. Then press “Enter” or “Testing” key to start white calibration.

Be sure the white calibration cover is removed. Select “Black Calibration” and press “Enter”. The instrument will prompt you to direct the measuring aperture to the air. Press “Enter” again or press “Testing” key to start black calibration.

Note: When starting black calibration, direct the measuring port to the air. Be sure the black calibration is performing in a dark, no bright light source environment. Keep the measuring port more than 3m away from any reflective items (hands, desks, walls etc.).

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By then, manual white calibration and black calibration are completed.



Figure 6 Main Menu

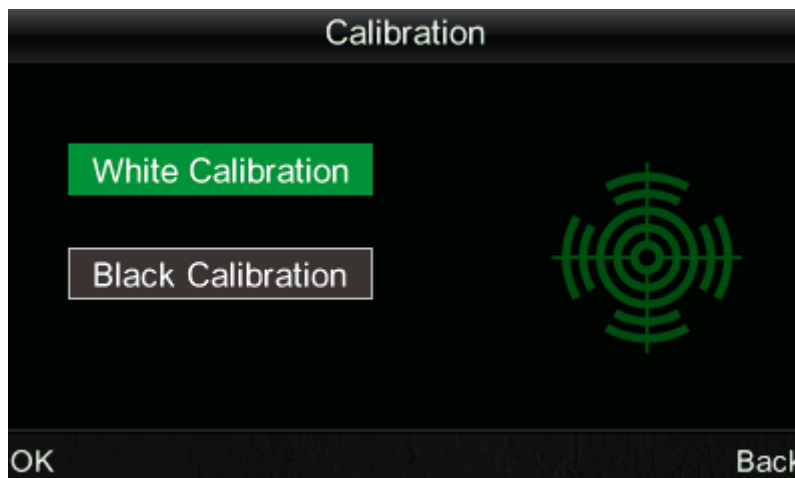


Figure 7 Manual Calibration

Suggestion: Manual white calibration and black calibration are only needed under the condition that the instrument has been used for a long time and the measured data are not accurate.

4. Changing Measuring Aperture

Note: After changing the measuring aperture, you have to enter the “Settings –Aperture Setting” to select the corresponding aperture. Or it may lead to the inaccurate measured data.

NH310 colorimeter can be configured with three measuring apertures: $\Phi 8\text{mm}$ measuring aperture, $\Phi 4\text{mm}$ measuring aperture and extended $\Phi 8\text{mm}$ measuring aperture (optional). The users can change it for different needs.

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a) Removing Measuring Aperture

As shown in Figure 8 and Figure 9, turn the measuring aperture counter clockwise 20 degrees, and then remove the aperture downward.



Figure 8 Counter Clockwise 20 Degrees



Figure 9 Remove the Aperture Downward

b) Installing Measuring Aperture

As shown in Figure 10 and Figure 11, align the measuring aperture with mounting hole, and then turn it clockwise about 20 degrees.



Figure 10 Align the Measuring Aperture With Mounting Hole



Figure 11 Turn the Measuring Aperture Clockwise About 20 Degrees

c) Installing Extended Measuring Aperture

As shown in figure 12 and figure 13, align the extended measuring aperture with mounting hole, and then turn it clockwise about 20 degrees. After the rotation, the arrow on the measuring aperture should be aligned with the red dot on the colorimeter, as shown in figure 12.



Figure 12 Align the Extend Measuring Aperture With Mounting Hole



Figure 13 Turn the Extended Measuring Aperture Clockwise About 20 Degrees

(II) Measurement

1. Locating and Measuring Method

There are two locating methods:

a) Camera Locating

Enter “Standard Measurement” or “Sample Measurement” interface, align NH310 measuring port with the test sample and cling to it. If you need precise locating, please press the “Up/Camera/Print” button, then, camera locating is starting. At the same time, the screen will display the matching status of the measuring aperture and the test sample. You can locate it accurately through moving the measuring port according to the display.

After aligning the measuring aperture, press the “Testing” key, the instrument will exit camera interface and finish sample testing in approx. 1 sec. After completing the measurement, the interface will display color parameters of the measured sample.

b) Facula Locating

Enter “Standard Measurement” or “Sample Measurement” interface, press the “Testing” key and hold it. The facula will appear at the moment. You can observe the matching status between the facula and the measured sample. At the same time, hold the measuring aperture close to the measured sample and adjust it. Then the alignment is achieved.

After the locating, release “Testing” button. The instrument will finish sample testing in approx. 1 sec and display color parameters of the measured sample.

2. Standard Measurement

There are two conditions about standard measurement. One is performing standard measurement after power on; another is after completing sample measurement or other operations, press “Back” button continuously to enter standard measurement.

a) Standard Measurement after Power On

After power on, the colorimeter will display “Standard Measurement”, as shown in Figure 14. Then, align measuring aperture to the standard, press “Testing” key, the screen will display color parameters of this standard. Press “Enter” button, the instrument will enter “Sample Measurement” interface.

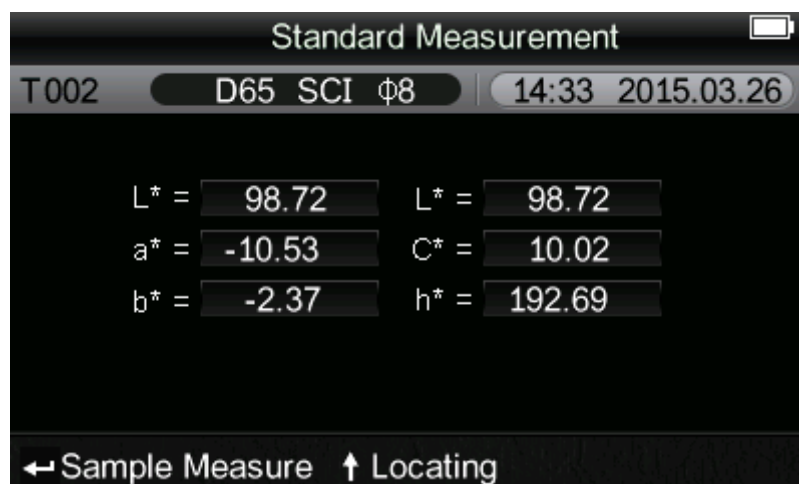


Figure 14 Standard Measurement Interface

b) Standard Measurement after Completing Sample

Measurement or Other Operations

After completing sample measurement or other operations, the instrument may display an interface. At this moment, press “Back” button repeatedly until the interface back to “Standard Measurement” interface, as shown in Figure 14. Then, perform standard measurement according to step a).

3. Sample Measurement

After completing standard measurement, press “Enter” button, the instrument will enter “Sample Measurement” interface automatically, as shown in Figure 15. Align the measuring aperture to the test sample to perform sample measurement.

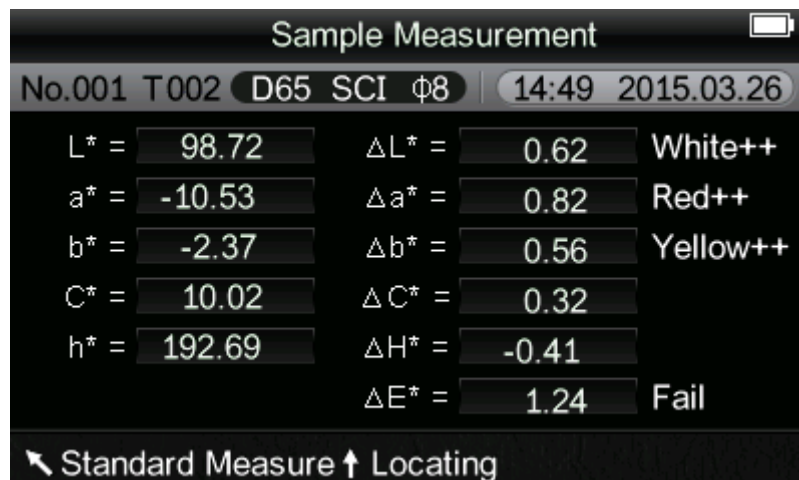


Figure 15 Sample Measurement Interface

Note: During the measurement (Approx. 1 sec), all buttons are ineffective.

(III) Save Data

There are two methods to save data.

1. Auto Save

Press “MENU” button to enter the main menu, as shown in Figure 6. Select “Settings” to enter an interface shown in Figure 16. Select “Auto Save” to enter status setting interface, as shown in Figure 17. Select

“On” and press “Enter” button to save the setting. After completing this setting, the measurement data will be saved automatically.



Figure 16 Settings Interface

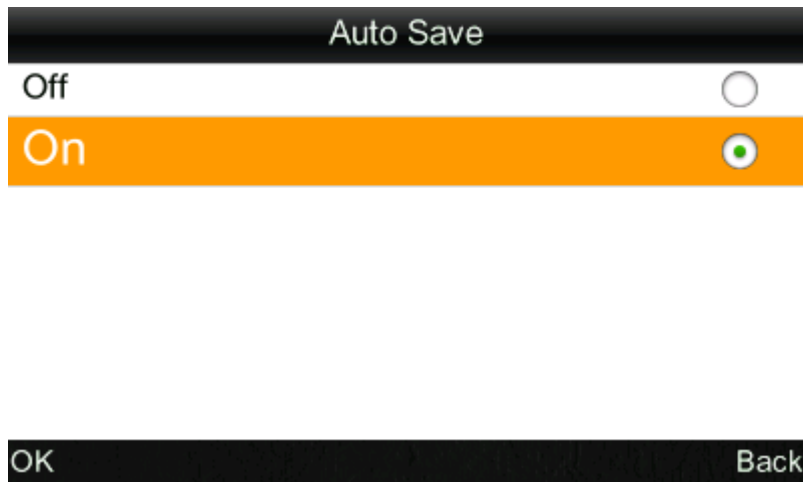


Figure 17 Auto Save

2. Manual Save

In Figure 17, select “Off”, then the data will not be saved automatically. If you want to save data when measuring, please press “Down/Save” button after each measurement.

(IV) Connect NH310 Colorimeter to the PC

Press “MENU” button to enter the main menu, as shown in Figure 6. Then, select “Comm” to enter an interface shown in Figure 18. Follow the instruction information mentioned in the interface to connect NH310 colorimeter to the PC with USB cable. When the communication is successful, the instrument will enter “Communicating...” interface, as

shown in Figure 19.



Figure 18 USB Communication



Figure 19 "Communicating" Interface

(V) Print

Only when the colorimeter is in "Standard Measurement", "Sample Measurement" or "Record" interfaces, you can print data through the printer.

Connect colorimeter to the printer. When the colorimeter is in one of the above interfaces, press and hold (about 5 second) "Up/Camera/Print" button to start the printer.

V. System Function Description

Except “Standard Measurement” and “Sample Measurement” interfaces, you should enter other function interfaces through the main menu. Main menu is shown in Figure 20.



Figure 20 Main Menu Interface

1. Record and Standard Entering

a) Record

Select “Record” in main menu to enter “Standard Record”, as shown in Figure 21. The figure shows the standard parameters. You can check different standard data through “Up” and “Down”. In figure 21, “T002” is a standard number. After selecting a standard, you can press “Enter” to check sample parameters and color difference parameters, as shown in Figure 22. You can check different data through “Up” and “Down”. No.001 in Figure 22 is the serial number of sample measurement.

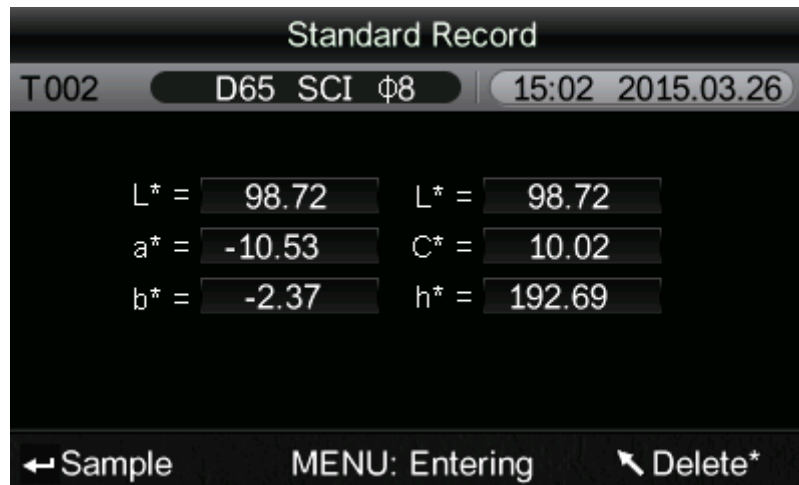


Figure 21 Standard Record

Note: “↶ Delete * ” means press Back key “↶” and hold it for 3 seconds, then the record will be deleted.

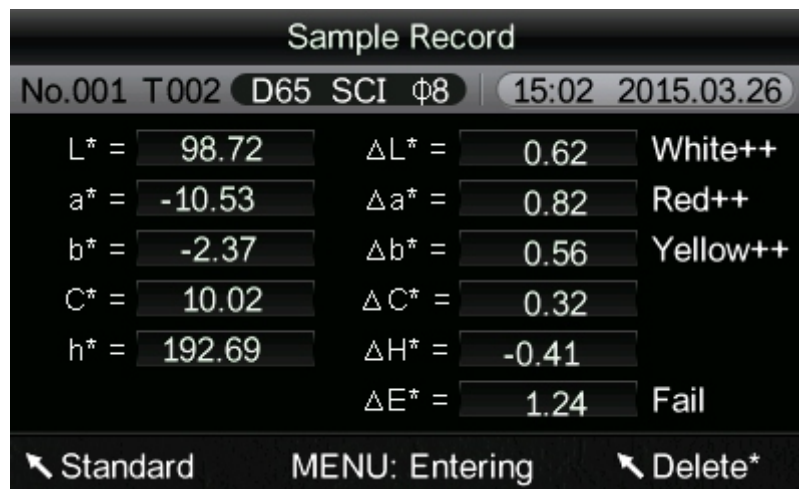


Figure 22 Sample Parameters under the T002 Standard

b) Standard Entering

In some cases, it's needed to measure color difference under a saved standard. Then, you can select “Record” in main menu to enter standard sample records interface. You can search the needed standard data through “Up” and “Down”. After finding it, press “Menu” button, and then the standard record is entered to the measurement interface, press “Enter”, you can perform sample measurement under this standard.

c) Sample Record Entered to a Standard

In some cases, it's needed to use a stored sample as a standard. Then, you can select “Record” to enter sample records interface, as shown in

Figure 22. You can search the needed sample data through “Up” and “Down”. After finding it, press “Menu” button, and then the sample record is entered to the measurement interface as a standard, press “Enter”, you can perform the color measurement under this standard.

2. Tolerance Setting

Select “Tolerance” in main menu to enter tolerance setting interface, as shown in Figure 23. You can add or subtract the number in which the cursor is positioned through “Up” and “Down” button. After setting the number to the needed one, press “Enter” button, the cursor will jump to the last number. When the cursor is in the last number, press “Enter” button to save the settings and return to the main menu.

If you don’t want to set or modify the tolerance, you can press “Back” button to return to the main menu.

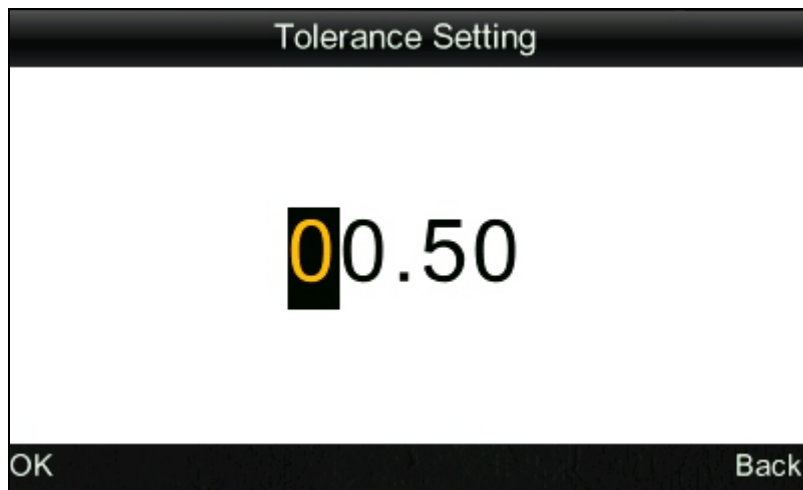


Figure 23 Tolerance Setting

3. Delete Records

Select “Delete” in main menu to enter the interface shown in Figure 25. There are two options: “Delete All Samples” and “Delete All Records”.

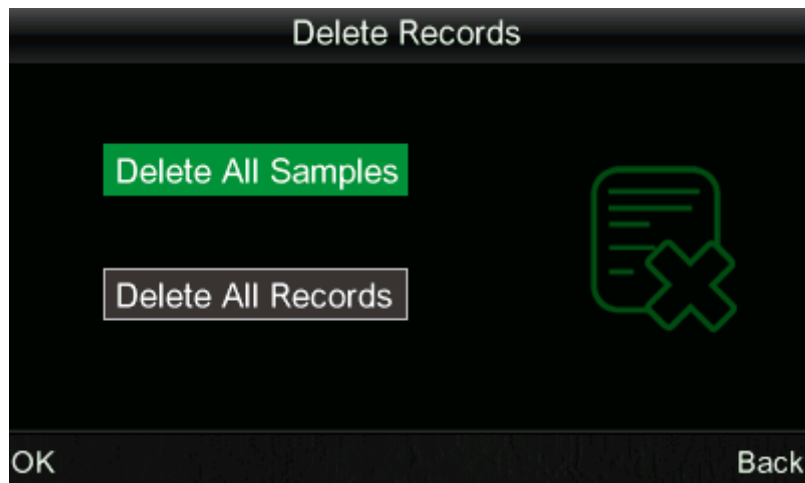


Figure 24 Delete Records

a) Delete All Samples

When select “Delete All Samples”, it will delete all samples in the instrument and save the standard records. Then, the instrument will display a warning interface, as shown in Figure 26. Press “Enter”, all sample data will be deleted, but the standard records are still retained.

b) Delete All Records

When select “All Records Delete”, all records in the instrument will be deleted, including all standard records and all sample records. Then, the instrument will display a warning interface, as shown in Figure 27. Press “Enter” button, all records in the instrument will be deleted.



Figure 25 “Delete All Samples” Warning Interface



Figure 26 “Delete All Records” Warning Interface

4. Time Setting

Select “Time” to enter time setting interface, as shown in Figure 27. You can make settings by pressing the button “Up” and “Down”, then press “Enter” to enter corresponding setting interface, as shown in Figure 28, Figure 29, Figure 30 and Figure 31. In Figure 28 and Figure 29, you can set display format of time and date by pressing “Up” and “Down”. Press “Enter” to save the settings and return to the previous menu.

If you don’t want to set or modify time and date, you can press “Back” button to return to the main menu.

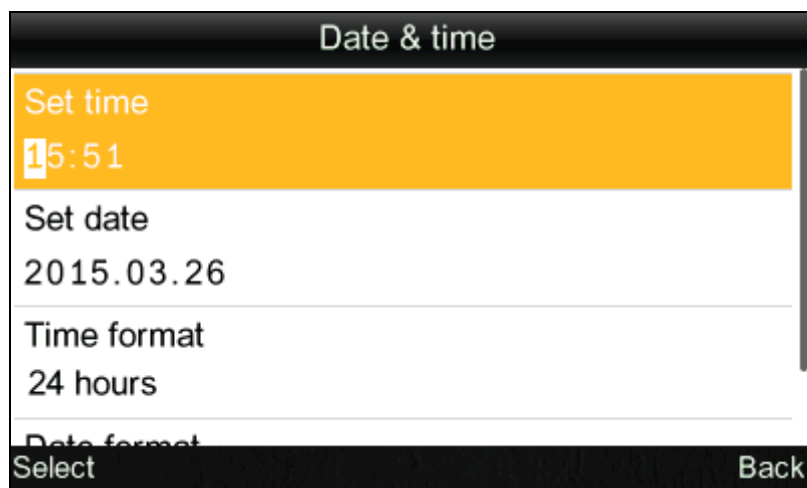


Figure 27 Time Setting Interface

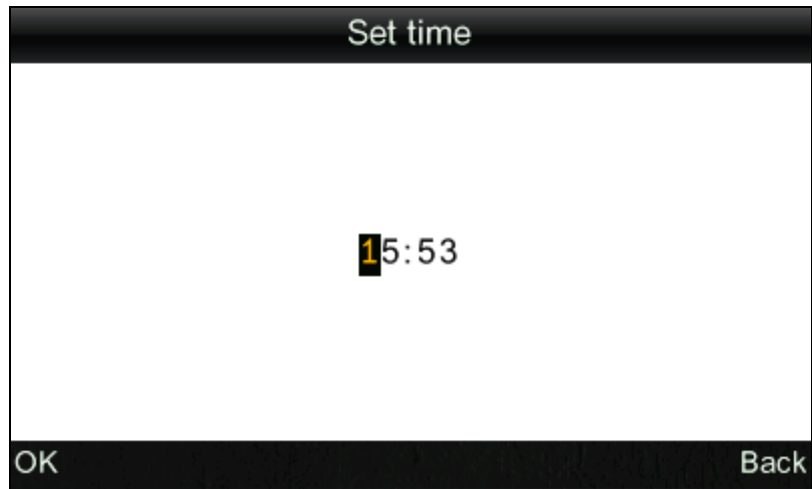


Figure 28 Set Time

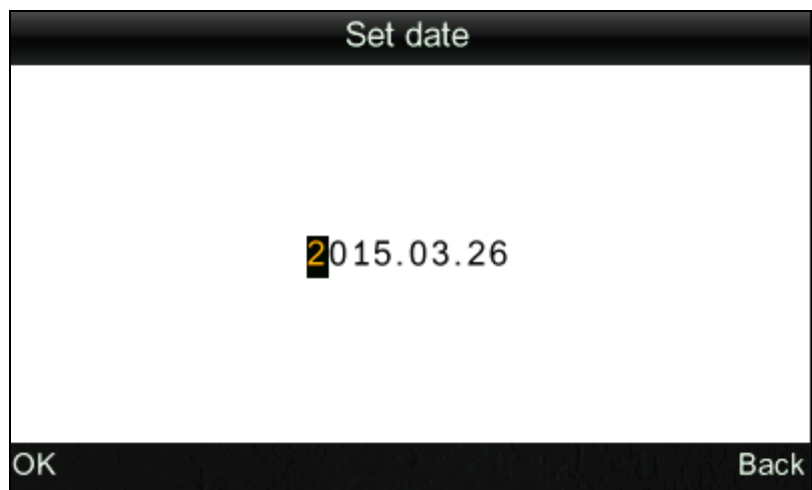


Figure 29 Set Date

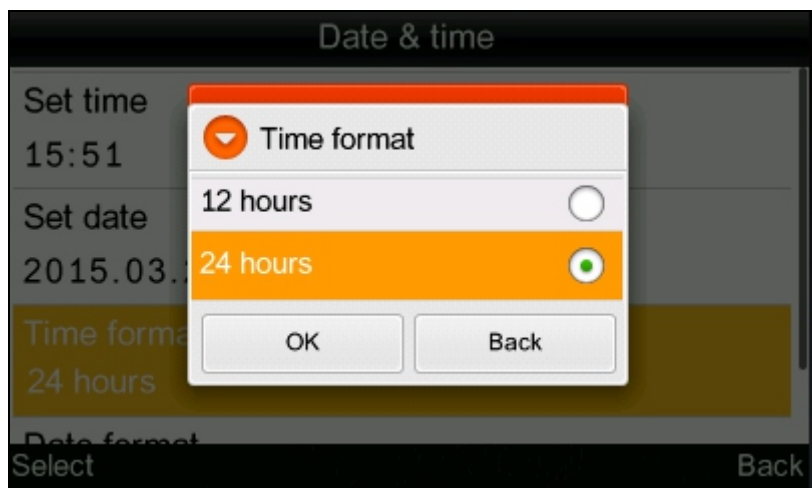


Figure 30 Time Format Setting

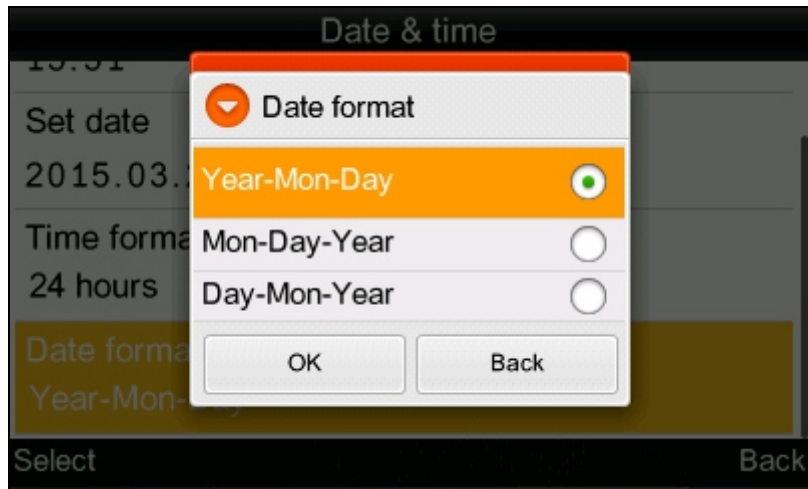


Figure 31 Date Format Setting

5. Display Mode

Select “Display” in the main menu to enter an interface, as shown in Figure 32. You can select different color spaces according to your need. This selection will change the display in “Standard Measurement” and “Sample Measurement” interfaces. You can make settings by pressing “Up” and “Down” button. Then press “Enter” to save the settings and return to the main menu.



Figure 32 Display Mode Interface

In NH310 colorimeter, the display mode will default to “CIE L*a*b*C*H*”. Other options are “CIE L*a*b*”, “CIE XYZ”, “CIE RGB”, “CIE L*u*v*”, “L*a*b* Whiteness & Yellowness”, “Color Fastness” and “Staining Fastness”. Measurement interfaces of each option is corresponding to the interfaces shown in Figure 33, Figure 34, Figure 35, Figure 36, Figure 38, Figure 39, Figure 40, Figure 41. When select “Color

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Fastness” and “Staining Fastness”, the measurement interface will first enter the “Standard Measurement” interface shown in Figure 39 and Figure 40. After completing standard measurement, it will enter the interface shown in Figure 41 and Figure 42.

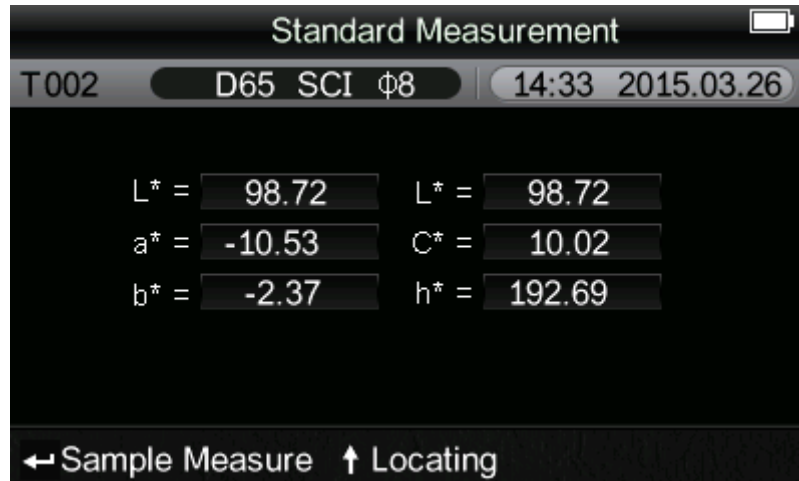


Figure 33 CIE L*a*b*C*H* Measurement Interface

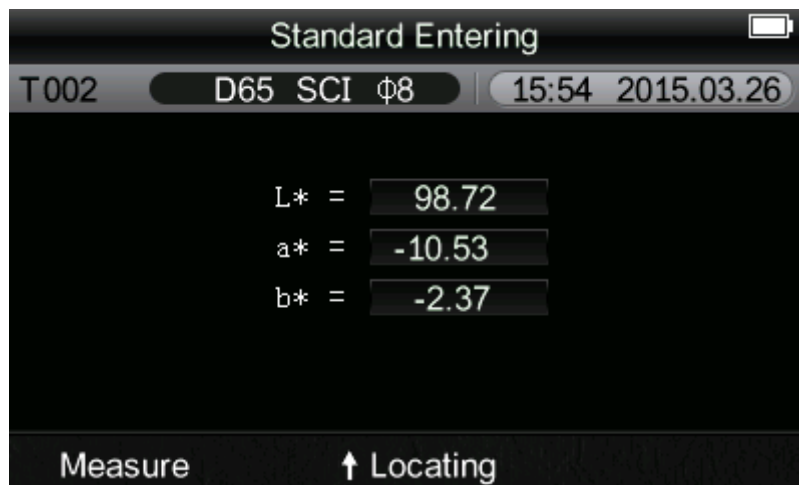


Figure 34 CIE L*a*b* Measurement Interface

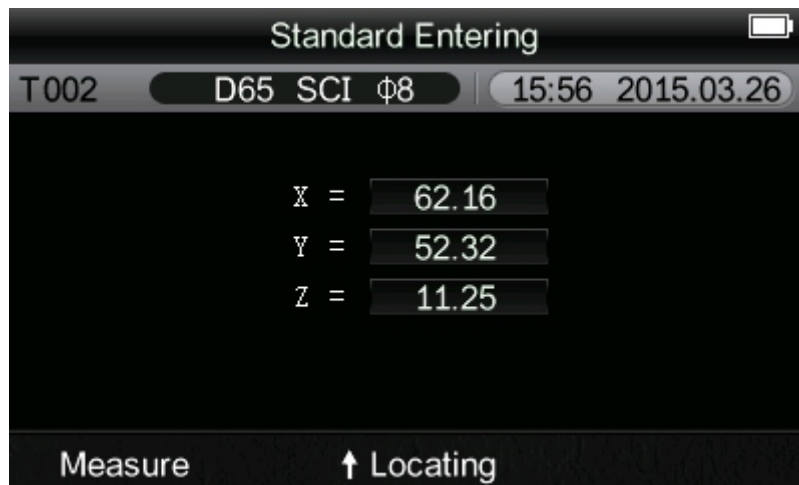


Figure 35 CIE XYZ Measurement Interface

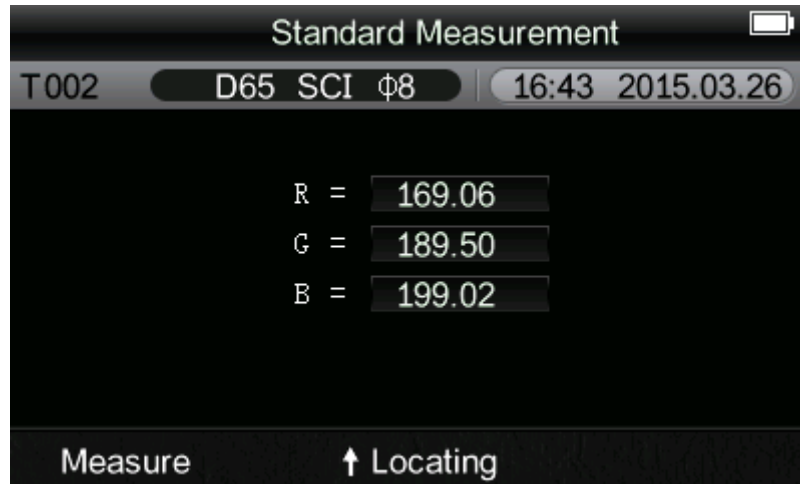


Figure 36 CIE RGB Measurement Interface

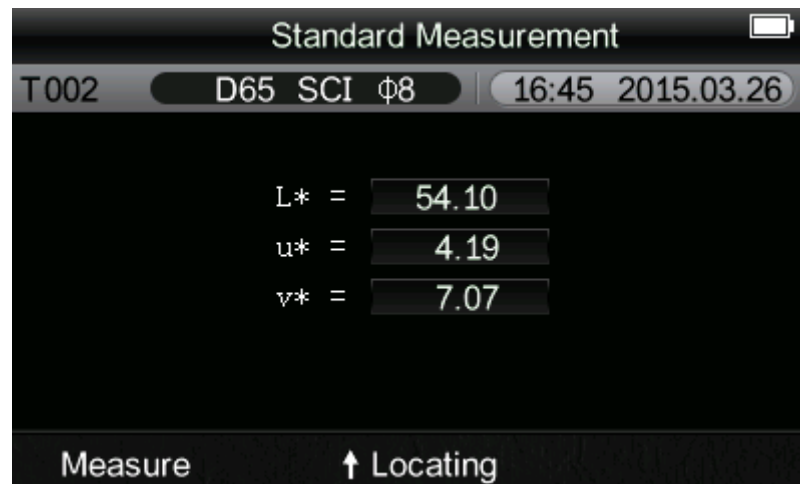


Figure 37 CIE L*u*v* Measurement Interface

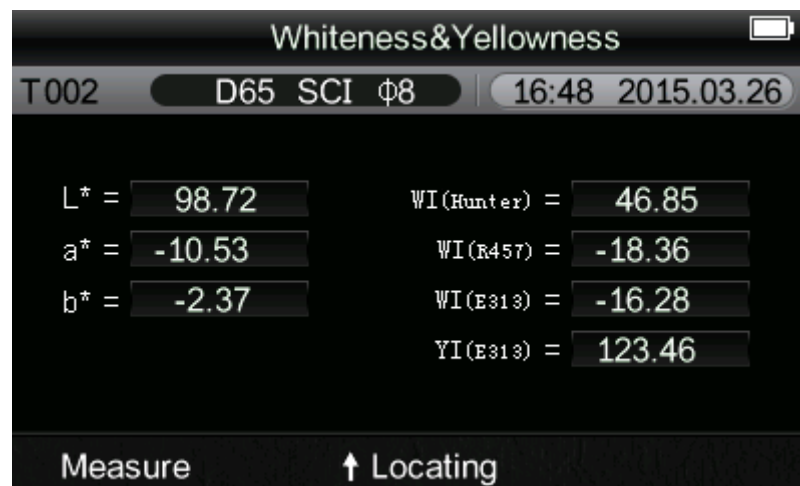


Figure 38 L*a*b* Whiteness & Yellowness Measurement Interface

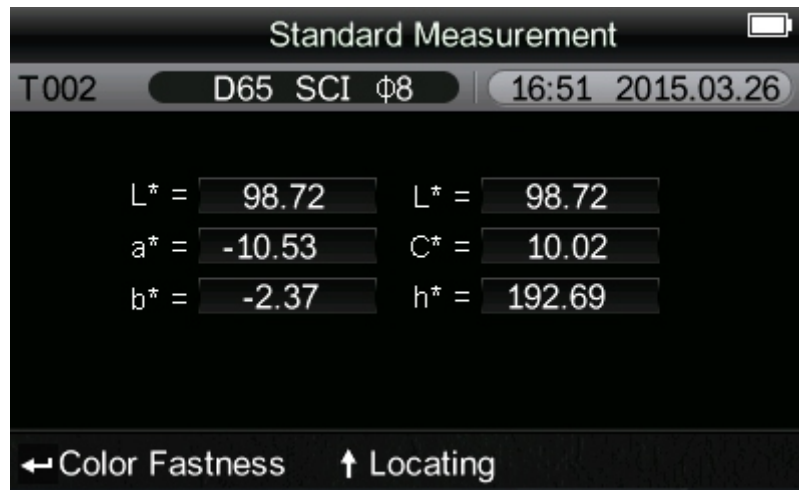


Figure 39 Color Fastness —Standard Measurement Interface

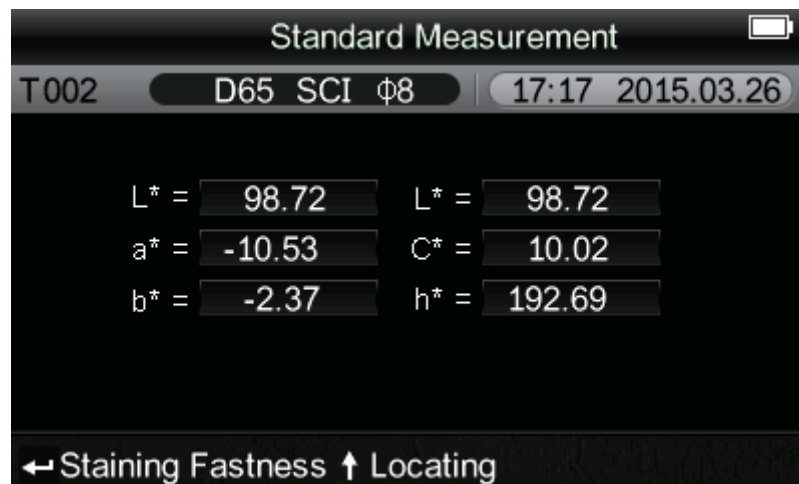


Figure 40 Staining Fastness —Standard Measurement Interface

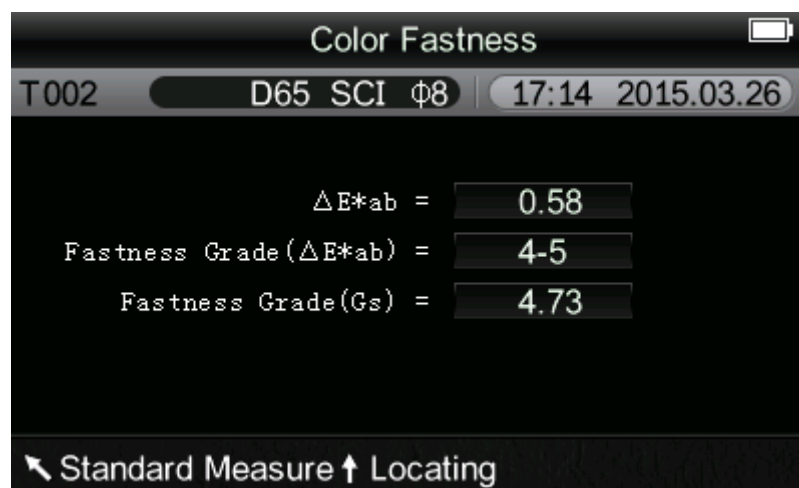


Figure 41 Color Fastness Measurement Interface



Figure 42 Staining Fastness Measurement Interface

6. Language Selection

Select "Language" in the main menu to enter an interface shown in Figure 43. You can select the language according to your need by pressing "Up" and "Down" buttons. Press "Enter" to save the settings and return to the main menu.

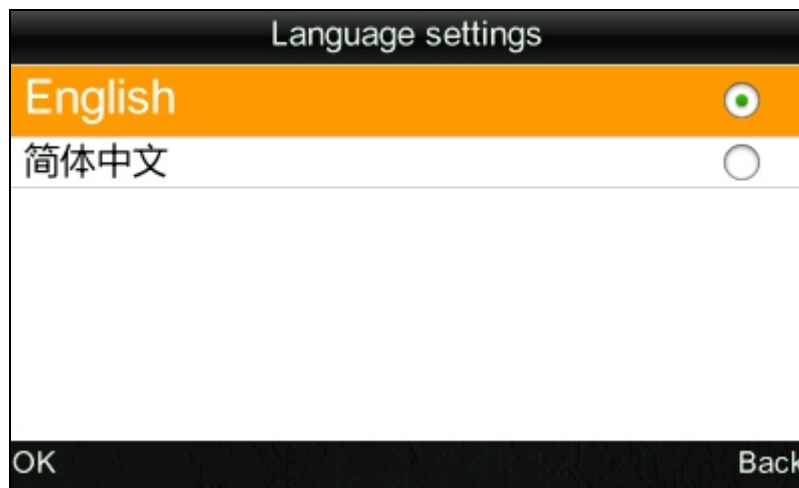


Figure 43 Language Selection Interface

7. Light Source Selection

Select "Light" in the main menu to enter an interface shown in Figure 44. You can select the light source according to your need by pressing "Up" and "Down" buttons. Press "Enter" to save the settings and return to the main menu.

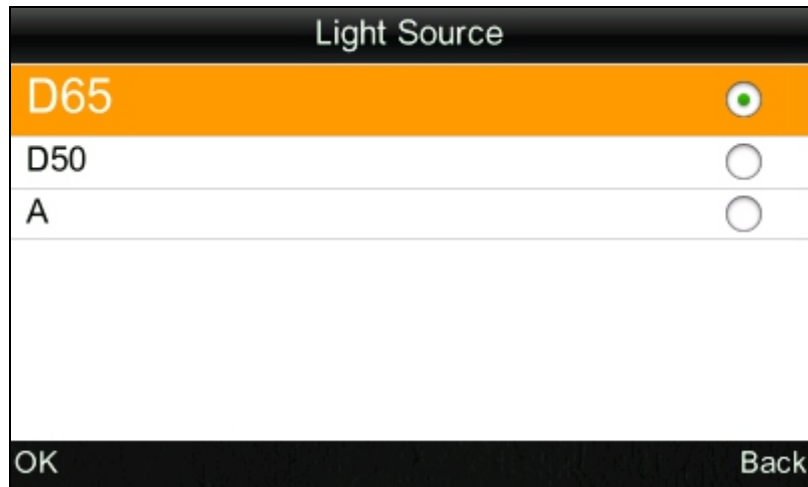


Figure 44 Light Source Selection Interface

8. SCI/SCE

Select “SCI/SCE” in the main menu to enter an interface shown in Figure 45. You can select SCI (including specular reflection) or SCE (excluding specular reflection) according to measurement need by pressing “Up” and “Down” buttons. Press “Enter” to save the settings and return to the main menu.

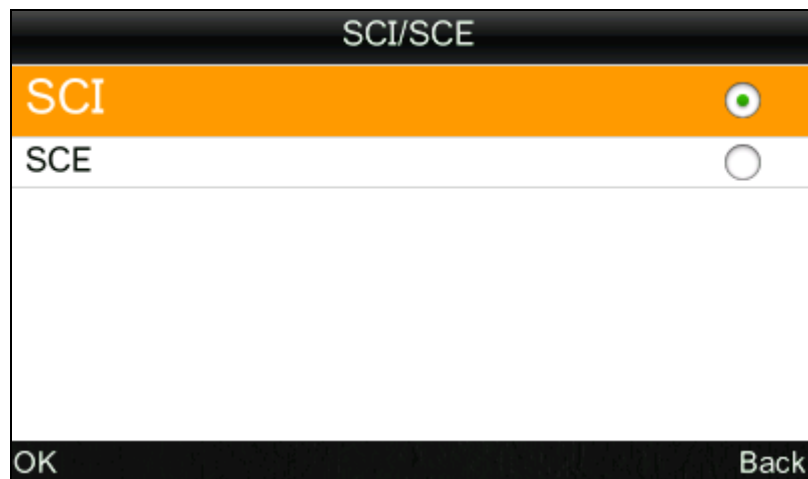


Figure 45 SCI/SCE Setting Interface

9. Average Measurement

Select “Average” in the main menu to enter an interface shown in Figure 46. You can set the number of average measurements according to your need. You can add or subtract the times by pressing “Up” and “Down” buttons. Press “Enter” to save the settings and return to the main menu. When the number is set to “01”, the instrument will

only make single measurement, and will not perform average measurement. The instrument is defaulted to one time measurement.

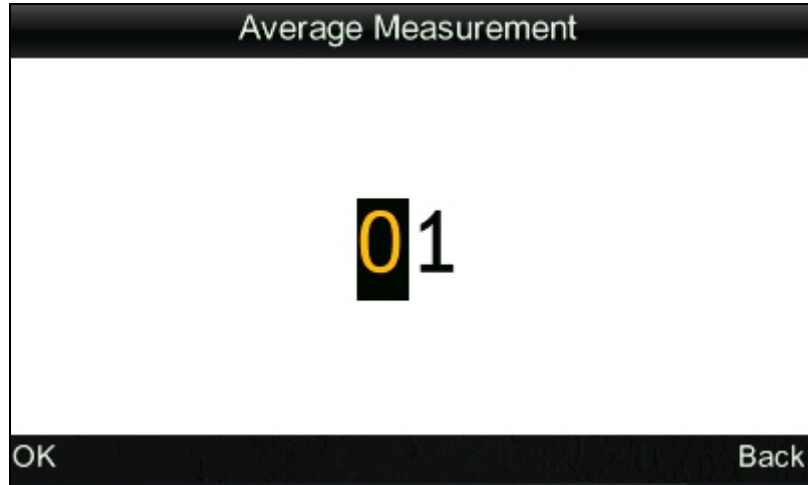


Figure 46 Average Measurement Setting Interface

10. Function Setting

Select “Settings” in the main menu to enter an interface shown in Figure 47. You can select the object according to your need by pressing “Up” and “Down” buttons. Press “Enter” to enter the corresponding setting interface. After completing these settings, press “Enter” button to save the settings and return to the previous menu.



Figure 47 Function Settings Interface

- a) Select “Settings” - “Color Offset” to enter an interface shown in Figure 48. You can set whether to display the color offset or not through this interface. Select “Open”, the corresponding color offset will display on the right of the measurement interface, as shown in Figure 49.



Figure 48 Color Offset Setting Interface

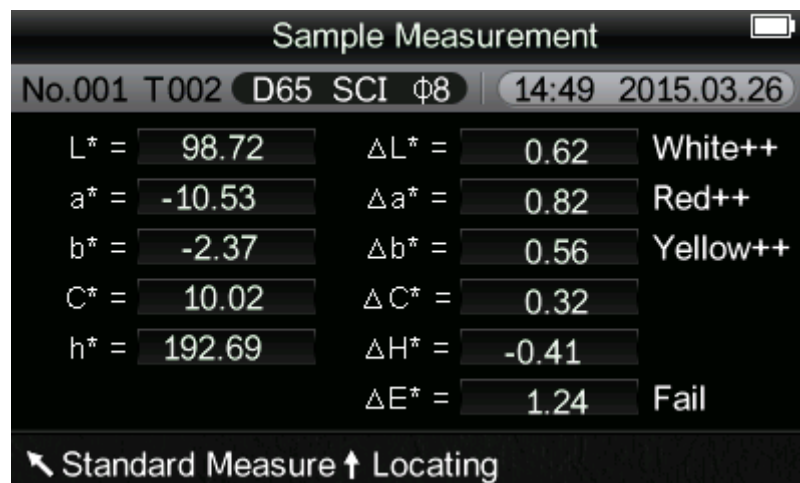


Figure 49 Color Offset Display

- Notes:
1. “White++” means the color of the measured sample is a little white
 2. “White+” means the color of the measured sample slant white.
 3. The same as other displays of color offset.

- b) Select “Settings” - “Auto Save” to enter an interface shown in Figure 50. This interface enables you to set measured data automatically or not. Select “Open”, each sample data and standard data will be saved automatically. Select “OFF”, data will not be saved automatically.

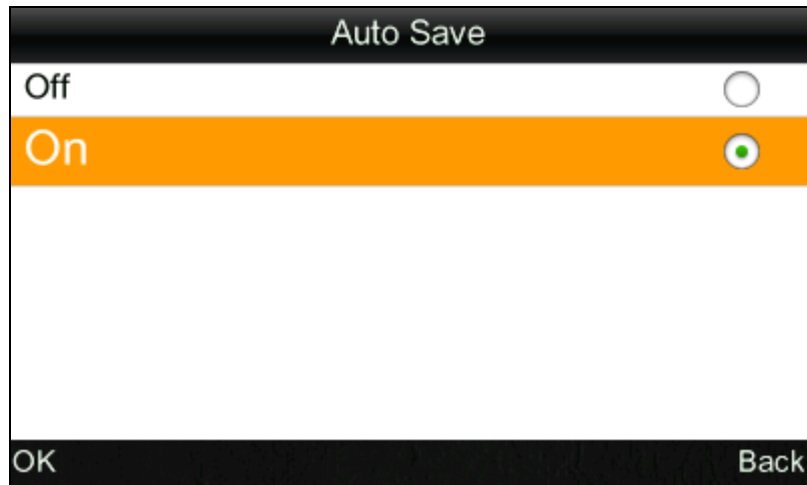


Figure 50 Auto Save Interface

- c) Select “Settings” - “Aperture Setting” to enter an interface shown in Figure 51. This interface is used for selecting measuring aperture. After changing the aperture, be sure to select the corresponding aperture in “ Aperture Setting ”, or it will cause the inaccuracy of the measured data. After changing the aperture, you need to re-perform white and black calibration, or it will also cause the inaccuracy of the measured data.

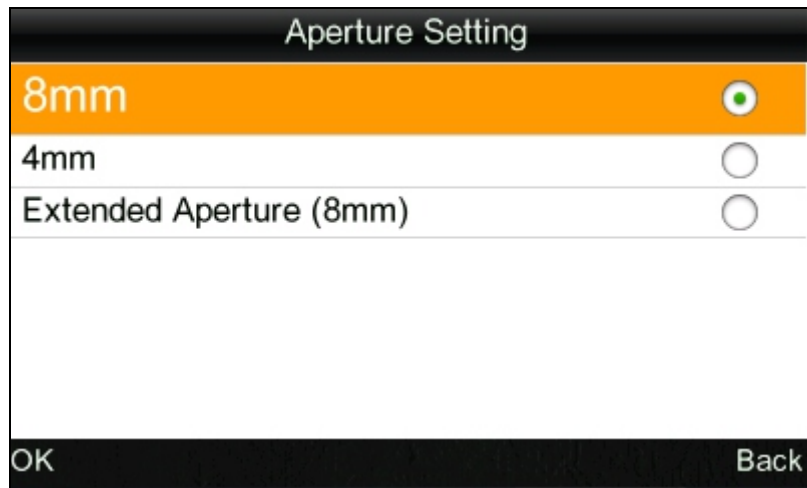


Figure 51 Aperture Setting

- d) Select “Settings” - “Color Diff Formula” to enter an interface shown in Figure 52. You can select the needed color difference formula through this interface. After selecting and saving this formula, the instrument will calculate the color difference according to the selected formula when measuring.



Figure 52 Color Diff Formula

- e) Select "Settings" - "Backlight Time" to enter an interface shown in Figure 53. When the instrument is in idle state, you can set the backlight time to save electricity consumption.

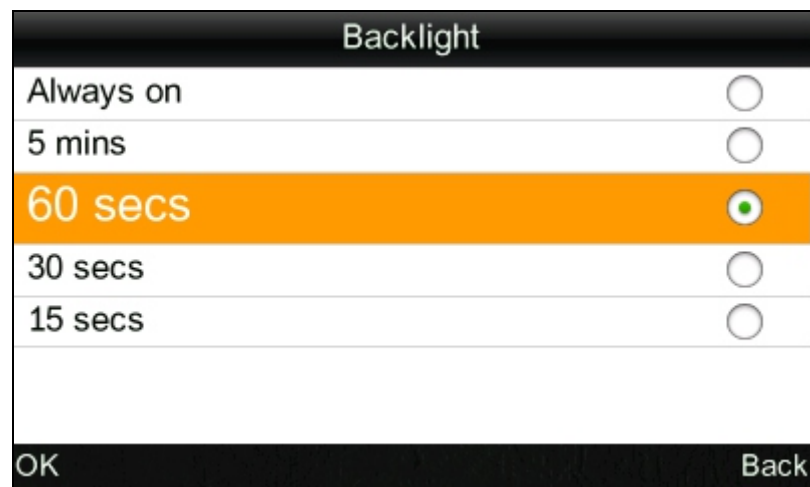


Figure 53 Backlight Time Setting Interface

- f) Select "Settings" - "Brightness Setting" to enter an interface shown in Figure 54. This interface is used to set the backlight brightness to help users to use this instrument in different environments.

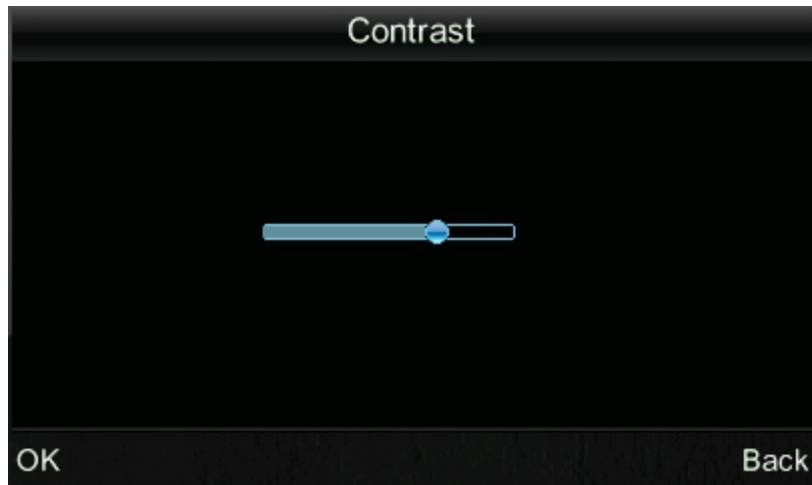


Figure 54 Brightness Setting Interface

- g) Select "Settings" - "Restore Factory Set" to enter an interface shown in Figure 55. Press "Enter" button. The instrument will restore to factory default setting and clear all records.



Figure 55 Restore Factory Set

VI. Product Parameters

1. Product Features

- This instrument adopts both accurate camera locating and illumination locating and fully considers users' need and adopts user-friendly design. It has original camera locating and illumination locating. You can select it according to your need.
- The colorimeter adopts auto white and black calibration. The calibration will be done during startup. This function can ensure the precision of this instrument, and it eliminates complex manual white and black calibration which greatly improves the convenient use of the colorimeter. You only need to turn on the colorimeter before performing measurements.
- The standard deviation of this colorimeter is $\Delta E^*_{ab} < 0.06$ (Average of 30 measurements of standard white calibration plate.).
- The colorimeter is configured $\Phi 8\text{mm}$ measuring aperture, $\Phi 4\text{mm}$ measuring aperture and extended aperture ($\Phi 8\text{mm}$) (optional), which can meet different requirements.
- The colorimeter adopts international standard illuminate D65, D50 and A. Users can select the light source according to their needs.
- This colorimeter has various color spaces. The users can select it according to their needs. And the instrument can display Whiteness, Yellowness and Color Fastness which is used widely.

2. Product Specifications

Model NH310

Model	NH310
Display Mode	CIE L*a*b; CIE XYZ; CIE RGB; CIEL*u*v; CIE*C*H; Whiteness & Yellowness; Color Fastness
Color Difference Formula	ΔE^*ab ; ΔL^*ab ; ΔE^*C^*H ; $\Delta ECIE94$; ΔE Hunter
Illuminating/viewing geometry	8/d (8° illumination angle/diffuse viewing)
Light Source	LED blue light excitation
Detector	Silicon photoelectric diode
Measuring Aperture	Φ8mm; Φ4mm; Φ8mm extended aperture (optional)
Measuring Conditions	Observer: CIE 10° Standard Observer Illuminant: CIE Standard Illuminant D65; D50; A
Measuring Range	L: 0 to 100
Repeatability	Standard deviation within ΔE^*ab 0.06 (Measurement Conditions: Average of 30 measurements of standard white plate)
Storage	100 pcs standard samples; 20000 pcs test samples
Minimum Interval Between Measurement	Approx. 1 sec
Battery Life	More than 3000 measurements
Lamp Life	more than 1.6 million times in 5 years
Display	TFT True-color; 2.8 inch@(16:9)
Interface	Model B: USB RS-232: Baud rate 19200bps
Operating Temperature	-10°C to 40°C (14°F to 104°F)

High-Quality Portable Colorimeter

Range	
Storage Temperature	-20°C to 50°C (-4°F to 122°F)
Humidity Range	less than 85% relative humidity, no condensation
Weight	500g
Dimensions	205 x 70 x 100 mm
Size of the Packing	435 x 205 x 345mm
Standard Accessories	Horizontal charger; Li-ion Battery; Operation Manual; Software CD; USB Cable; White Calibration Cover; Φ 8mm Measuring Aperture; Φ 4mm Measuring Aperture
Optional Accessories	Extended Aperture(Φ 8mm); Mini-printer; AC Adapter, Universal Test Components, Powder Test Box

Model NH300

Model	NH300
Display Mode	CIE L*a*b*c*h; CIE L*a*b; CIE XYZ
Color Difference Formula	ΔE^*ab ;
Illuminating/viewing geometry	8/d (8illumination angle/diffuse viewing)
Light Source	LED blue light excitation
Detector	Silicon photoelectric diode
Measuring Aperture	Φ 8mm;
Measuring Conditions	Observer: CIE 10°Standard Observer Illuminant: CIE Standard Illuminant D65
Measuring Range	L: 0 to 100
Repeatability	Standard deviation within ΔE^*ab 0.07 (Measurement Conditions: Average of 30 measurements of standard white plate)

High-Quality Portable Colorimeter

Storage	100 pcs standard samples; 20000 pcs test samples
Minimum Interval Between Measurement	Approx. 1 sec
Battery Life	More than 3000 measurements
Lamp Life	more than 1.6 million times in 5 years
Display	TFT True-color; 2.8 inch@(16:9)
Interface	Model B: USB RS-232: Baud rate 19200bps
Operating Temperature Range	-10°C to 40°C (14°F to 104°F)
Storage Temperature	-20°C to 50°C (-4°F to 122°F)
Humidity Range	less than 85% relative humidity, no condensation
Weight	500g
Dimensions	205 x 70 x 100 mm
Size of the Packing	435 x 205 x 345mm
Standard Accessories	Horizontal charger; Li-ion Battery; Operation Manual; Software CD; USB Cable; White Calibration Cover; Φ 8mm Measuring Aperture;
Optional Accessories	Mini-printer; AC Adapter, Universal Test Components, Powder Test Box

Model NR200

Model	NR200
Display Mode	CIE L*a*b*c*h; CIE L*a*b; CIE XYZ
Color Difference Formula	ΔE^*ab ;
Illuminating/viewing geometry	8/d (8° illumination angle/diffuse viewing)

High-Quality Portable Colorimeter

Light Source	LED blue light excitation
Detector	Silicon photoelectric diode
Measuring Aperture	Φ8mm;
Measuring Conditions	Observer: CIE 10°Standard Observer Illuminant: CIE Standard Illuminant D65
Measuring Range	L: 0 to 100
Repeatability	Standard deviation within ΔE^*_{ab} 0.08 (Measurement Conditions: Average of 30 measurements of standard white plate)
Storage	100 pcs standard samples; 20000 pcs test samples
Minimum Interval Between Measurement	Approx. 1 sec
Battery Life	More than 3000 measurements
Lamp Life	more than 1.6 million times in 5 years
Display	TFT True-color; 2.8 inch@(16:9)
Interface	Model B: USB RS-232: Baud rate 19200bps
Operating Temperature Range	-10°C to 40°C (14°F to 104°F)
Storage Temperature	-20°C to 50°C (-4°F to 122°F)
Humidity Range	less than 85% relative humidity, no condensation
Weight	500g
Dimensions	205 x 70 x 100 mm
Size of the Packing	435 x 205 x 345mm
Standard Accessories	Horizontal charger; Li-ion Battery; Operation Manual; Software CD; USB Cable; White Calibration Cover; Φ8mm Measuring Aperture;
Optional Accessories	Mini-printer; AC Adapter, Universal Test Components, Powder Test Box

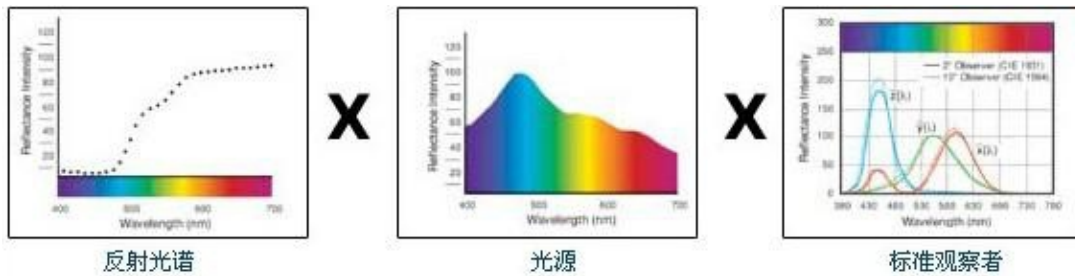
***Note: The specifications are subject to change without notice.**

Appendix

1. The Color of Objects

There are three major elements to perceive color: light, object and observer. Any change of these three elements will influence the observer's color perception. When the light source and the observer don't change, then the object will determine the observer's color perception.

Objects can affect the final color perception because the reflectance spectra (transmittance spectra) of the object have modulated the light source spectrum. Different objects have different reflectance spectra (transmittance spectra). The light source spectrum modulates the reflectance spectra (transmittance spectra) of different objects to obtain different results. The observer is the same, so it shows different colors. The theory is shown in the figure below.



$$= \begin{matrix} L=70.95 \\ a=69.72 \\ b=40.35 \end{matrix}$$

2. Human Eyes to Distinguish Colors

The color difference unit, NBS, is derived from the unit of color difference formula which is established by Judd-Hunter. In 1939, the American Bureau of Standards adopts this color difference formula and calculates the color difference according to it. When the absolute value is 1, it is called "The NBS Color Difference Unit".

Since then, people would consciously adjust the later color difference formulas to be similar with the NBS units. The formulas such as Hunter Lab, CIE LAB and CIE LUV are generally similar to NBS (not exactly the same), therefore, do not mistake the color difference units calculated by other color difference formulas are all NBS.










In national standards GB7705-87 (lithograph), GB7706-87 (letterpress), GB7707-87 (gravure) which promulgated by the National Bureau of Standards, the color printings rating in the same batch and same color according to color difference are defined as follows: General Product $\Delta E^*_{ab} \leq 5.00 \sim 6.00$, Fine Product $\Delta E^*_{ab} \leq 4.00 \sim 5.00$. Meanwhile, this quality standard is considered as a qualification for state enterprises promotion.

Table: The Perception Degree between NBS Unit and Color Difference

NBS Unit Color Difference	Perception Degree of Color Difference
0. 0~0.50	The Tiny Color Difference: Travel
0.5~1.51	The Smaller Color Difference: slight
1.5~3	The Small Color Difference: Noticeable
3~6	The Big Color Difference: appreciable
Above 6	The Bigger Color Difference: much

Safety Precautions

To ensure correct and safe use of colorimeter, please read the following terms carefully and comply with them. If there are any need or unclear, please refer to this description.

Battery	<ul style="list-style-type: none"> Please use 3NH original Li-ion battery. Do not use other batteries. Or it will damage the instrument or cause other failures. Do not disassemble, extrude and heat the battery. Do not put the battery into a fire. Doing so may cause battery explosion or a fire. After fully charged, when not use the instrument, please switch off external power source to avoid electric shock and instrument damage. Please take out the battery to prevent the instrument from battery leakage or other damages if you don't use it for a long time.
External Power Source	<ul style="list-style-type: none"> Always use the AC adapter supplied as a standard accessory if you need to connect an external power source. If the AC adapter other than those specified by 3NH, this may result in damage to the unit, fire or electric shock. Please switch off external power source if you don't use the instrument for a long time. Or it may damage the instrument or cause a fire.
Instrument	<ul style="list-style-type: none"> Do not use the instrument in places where flammable or explosive gases (gasoline etc.) are present. Doing so may cause explosion or a fire. Do not disassemble the instrument. Take special care not to allow liquid or metal objects to enter the instrument. Or it may cause short circuit, electric shock, even a fire. If the instrument has burning smell or other peculiar smell, turn the power off immediately, disconnect the AC adapter from the AC outlet (or remove the batteries if they are used), and contact the nearest 3NH authorized service center.