

Spectrodensitometer

User Manual

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Instruction

This Spectrodensitometer with 45/0 geometric optical structure is dependently developed by 3nh company, who has complete intellectual property rights. It is fully compliant with ISO 5-4 and supports the testing conditions of MO, M1, M2 and M3 specified in ISO 13655 standard. The instrument can accurately achieve the ISO Status T, E, A, I density measurement, easy to achieve a variety of printing parameters (such as: dot, overprint values, color error, etc.) measurement, and it also has many functions like built-in a variety of color space, color difference formula and color index, to meet kinds of customers' requirement. The spectrodensitometer has the character of stability, measurement density, chroma data precision and powerful function. Equipped with a variety of measuring calibers (2mm, 4mm, 8mm), the instrument is widely used in the ink printing industry, paper making industry, coating industry, scientific research institutions, quality inspection institutions and laboratory fields.

Features:

- 1) 45/0 geometrical optics structure, comply with CIE No.15 standard. Support MO, M1, M2 and M3 test conditions specified in ISO 13655, and accurately measure printing parameters such as printing density and overprint values.
- 2) Perfect combination of beautiful appearance and the human body mechanics structural design;
- 3) Use long life and low power consumption combined LED light source;
- 4) Three apertures optional (Φ 2/4/8/20mm), suitable for more samples measurement;
- 5) Measuring sample reflection spectrum, CMYK density, Lab, Yxy, s-RGB, color difference and other chromaticity data, used for accurate color transfer;
- 6) High electronic hardware configuration, 3.5-inch TFT true color screen, capacitive touch screen, concave grating, 256 pixel dual array CMOS detector, etc;
- 7) USB/Bluetooth2.1 dual communication mode, widely useful;
- 8) Super stain-resistant and stable standard white calibration plate;
- 9) Large capacity storage space, over 20,000 measurement data;
- 10) Two standard observer angles (2 degree/10 degree), a variety of illuminant, a variety of color indexes, conforms with a variety of standard colorimetric data, meet a variety of customers' requirement for color density measurement;
- 11) Especially suitable for printing plant process control, quality control;
- 12) PC software has a powerful function extension.

Measurement Conditions Selection:

Click "setting → measuring conditions" to choose measurement conditions and also can be set while doing calibration (refer to 4.2 chapter calibration).

- M0: Reflectance measured with A Illuminant, previously called: No-Filter, UV-included
- M1: Reflectance measured with D50 Illuminant, previously called: Daylight or D65-Filter
- M2: Reflectance measured with A Illuminant excluding UV component, previously called: UV Cutoff Filter, UV excluded

- M3: Reflectance measured with cross-polarized A Illuminant excluding UV component, previously called: Polarized-Filter

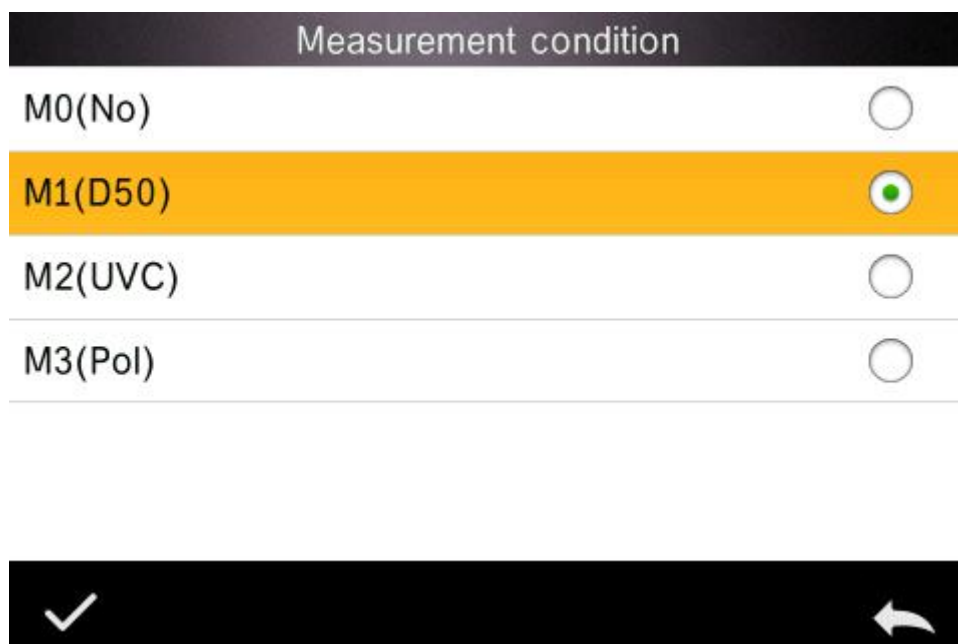


Figure1 Measurement Condition

1 Power On & Off

Turn the power switch to "1", the instrument is powered up, and the indicator light is always green. Turn the power switch to "0", the instrument is off and the indicator is off.

If the instrument is not power on after switched to "1", the battery may need to be charged. When the instrument is on for a long time without any operation, the instrument will automatically enter the standby state. At this time, press the measurement button to wake up the instrument into the working state (refer to chapter Setting -> screen backlight time section). When the instrument is started, jump from the LOGO interface to the main menu or the black and white calibration interface (beyond the validity period of the correction) to complete the diagnosis.

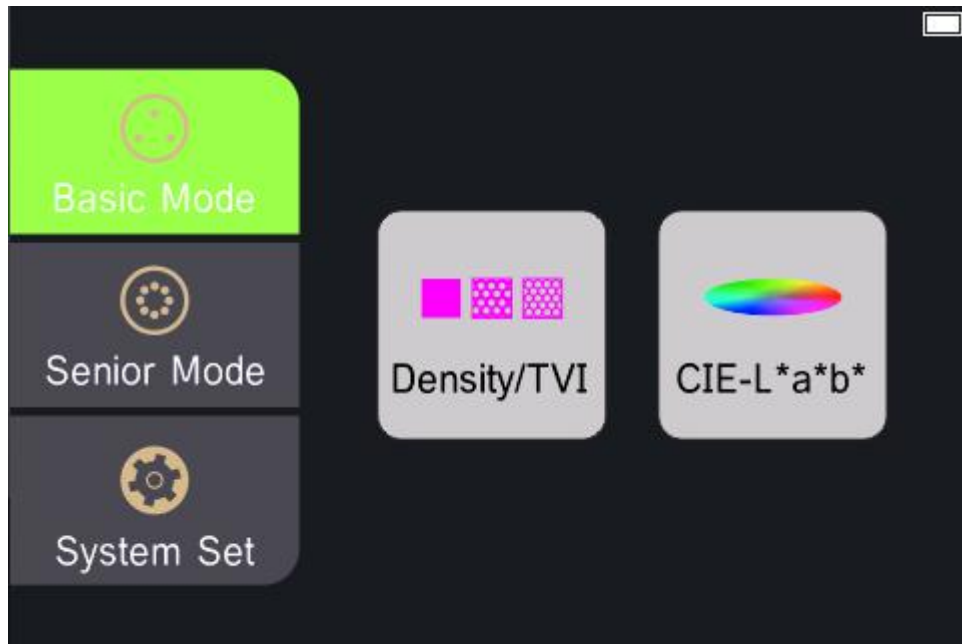


Figure 2 Main Menu

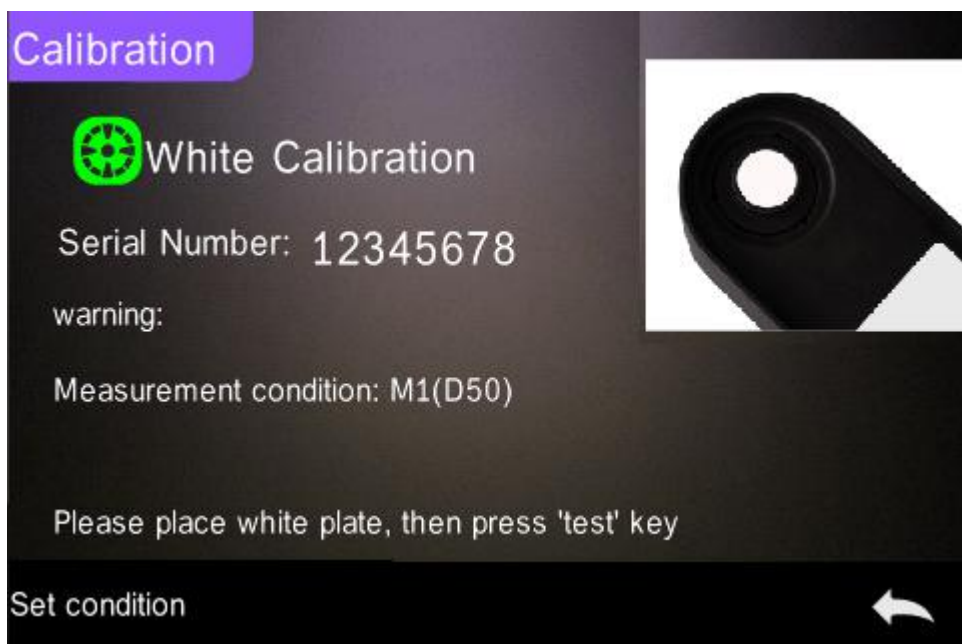


Figure 3 White and Black Calibration


Note: If the instrument is not in use for a long time, please cut off the power of the instrument.

2 Connecting to PC

2.1 USB Connection

USB steps to use the spectrodensitometer:

1. If the PC software has not been installed, please install it immediately,
2. Insert the square end of the USB cable into the instrument,

3. Plug the other end of the USB cable into the available interface on the PC,
4. If the connection is successful, the status bar of the instrument will display USB icon  and it is able to manage the instrument by PC software. Otherwise, you need to find the problem.


Note: for Windows, it should install the software driver before connecting the instrument to the computer.

2.2 Bluetooth Connection

Some of the bluetooth devices communicate wirelessly with computers.

Many Windows PCs have built in Bluetooth capability. If this is the case with your computer you may use the built in hardware. If not, you will need to purchase a Bluetooth device that plugs into your USB port before continuing.

Steps to use bluetooth for Spectrodensitometer:

1. Turn on the "System Settings → bluetooth" function;
2. Turn on bluetooth function on the PC and search for the device, for example:3nh-ble-device-01;
3. Fill in the matching code to connect;
4. If the connection is successful, the status bar of the instrument will display the bluetooth connection icon "  " and it is able to manage the instrument by PC software; Otherwise, you need to find the problem.

3 Instrument Operation

This chapter covers basic usage, icon definition, and measurement techniques for touch screens.

3.1 User Interface

This instrument contains a graphical touch screen display, and all functions can be directly accessed through the screen.

Enter basic mode

The basic mode has two quick menu screens, density /TVI and CIE L*a*b*.

Tap the icon to open the appropriate tool on the on-screen menu.

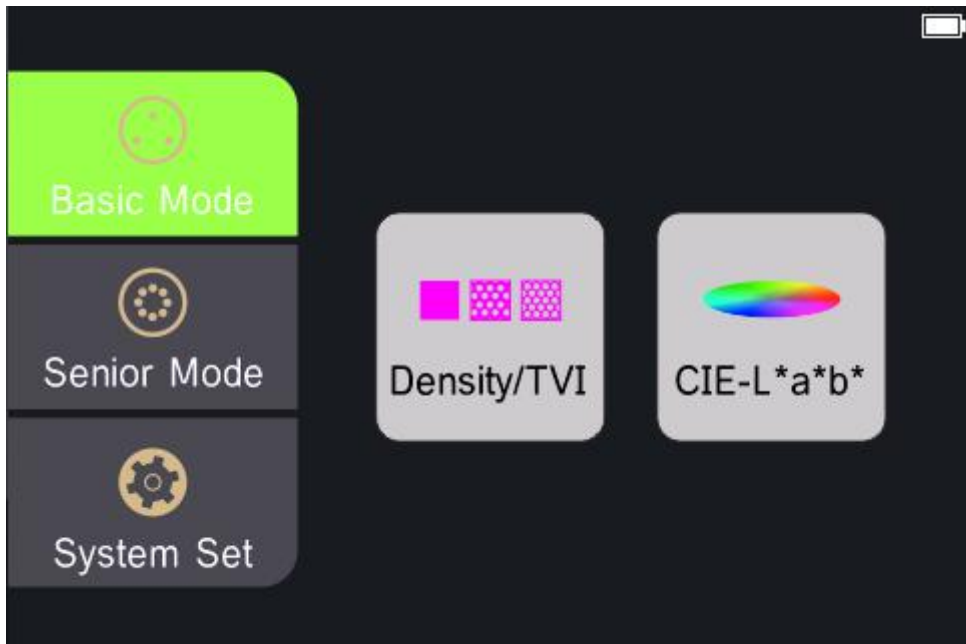


Figure 4 Basic Mode

Tap the "density /TVI" icon to enter the interface of density /TVI. Tap the "main menu" in the lower right corner of the icon to jump back to the interface of the main menu. Tap the "Settings" in the lower left corner and the screen jumps to the corresponding settings interface.

Note: the density /TVI interface settings include: measurement conditions, density states, density reference white, density accuracy, tone values, and tone value increase. The CIE L*a*b* interface is set up differently, including measurement conditions, light source and observer angle.

Enter advanced mode

Advanced mode has two quick menu screens, densitometer and basic comparison.

Tap the icon to open the appropriate tool on the menu.

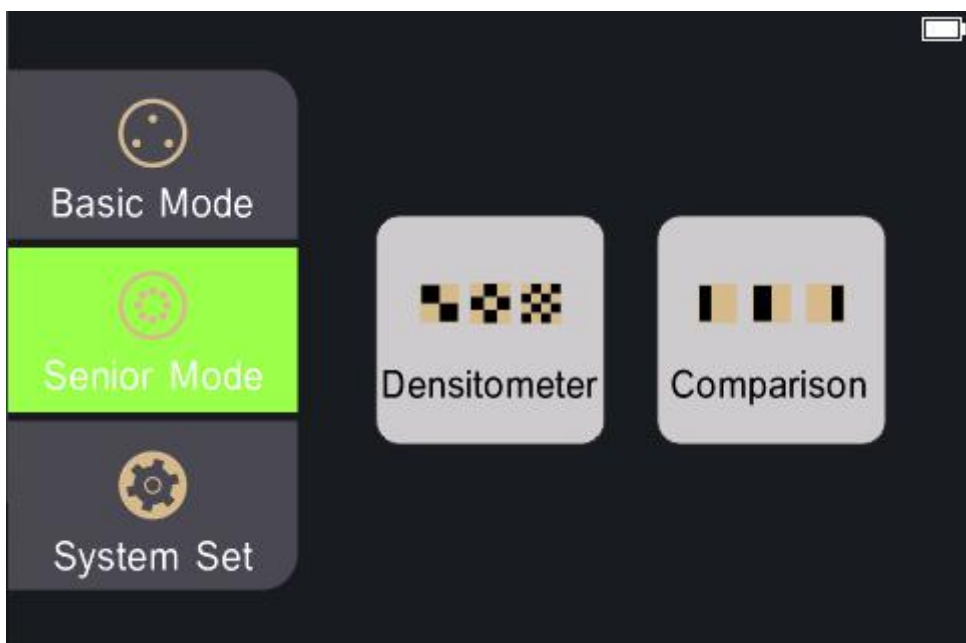


Figure 5 Advanced Mode

Enter System Settings

System Settings have two quick menu screens, Settings and Calibration.
Tap the icon to open the appropriate tool on the menu.

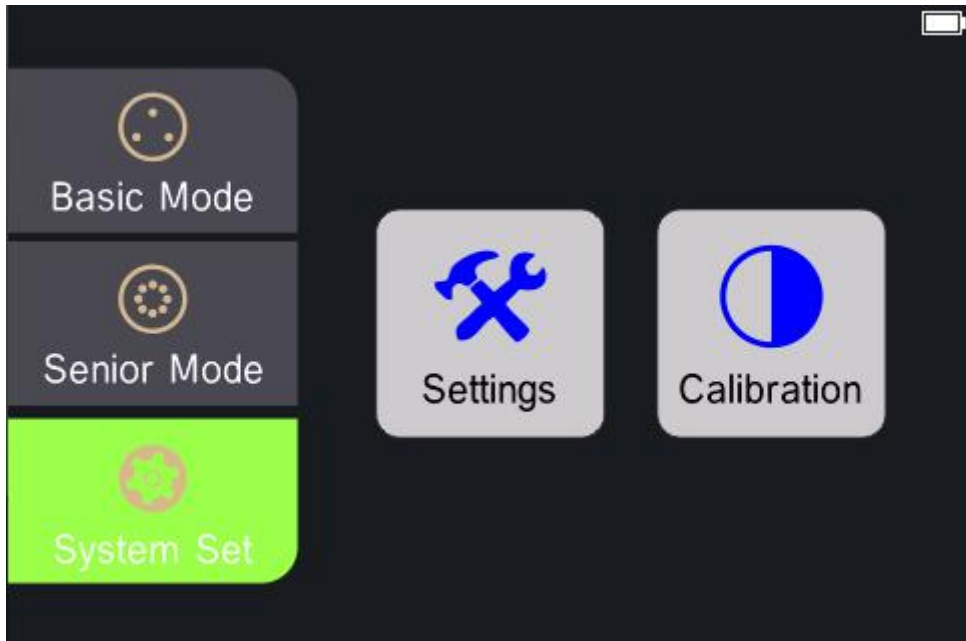


Figure 6 System Setting

3.2 Density /TVI Measurement

The Density / TVI Tool allows you to perform solid density and tint measurements without standards, by using the automatic patch recognition for CMYK.

The instrument will auto-detect the type of process color (C, M, Y, K) patch as each measurement is taken.

All measurement results are absolute only.

Click "Setting" in the density /TVI interface and select the required options as shown in the figure 7 below before the density /TVI measurement. .

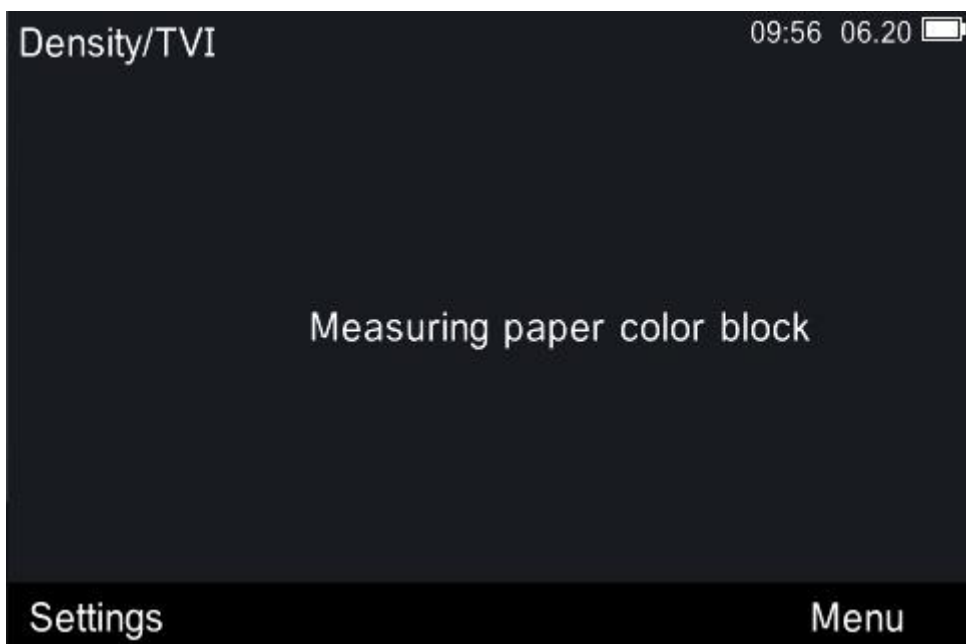


Figure 7 Density/TVI Interface

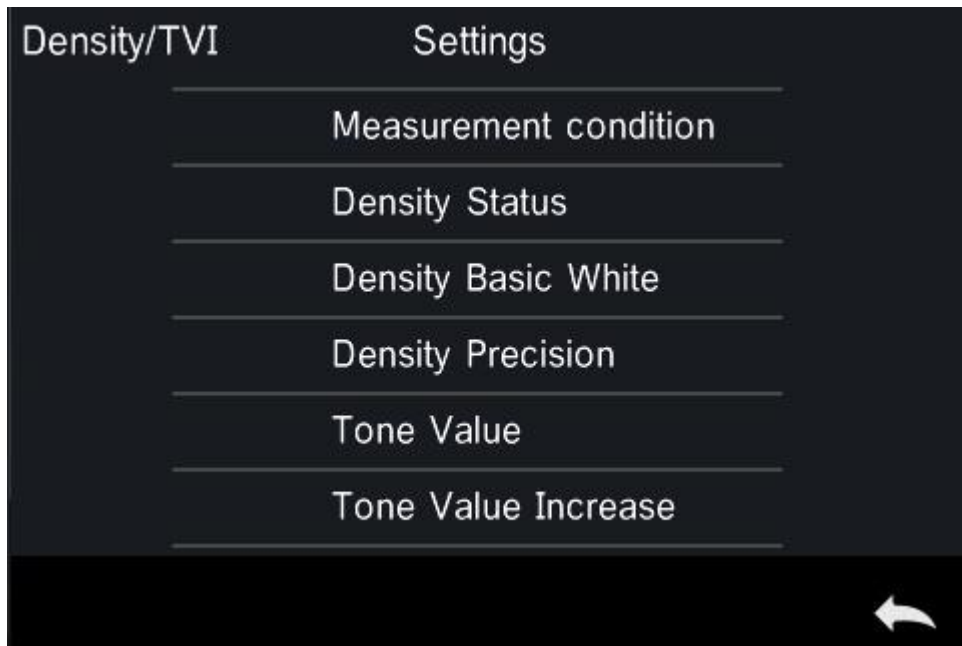


Figure 8 Density/TVI Interface Setting

Measurement Conditions

It is to select tone and density functions. The choices are M0, M1, M2, and M3.

Density State (density/TVI only)

Used to select the status for all densitometric functions. Options are: Status A, E, I, T, and G.

Density White Base (Density / TVI Tool only)

Used to set a paper or absolute requirement. If you select Paper, as white base, all subsequent measurements will refer exclusively to the printed ink layer, while the paper color effect will not be included. If you select Absolute, besides the printed ink layer, the measurement will also include the paper effect.

Density Precision (Density / TVI Tool only)

Used to select the density value display precision. Options are: Normal (x.xx) and High (x.xxx).

Tone Value (density/TVI only)

Used to set the formula for dot calculation to Murray-Davies, Yule-Nielsen, or SCTV (ISO 20654). Spot Color Tone Value (SCTV) provides tone values of colors that correlate well with visual appearance. If a tone ramp is printed with visually equidistant steps the corresponding SCTV values should have approximately equidistant percentages from 0 to 100%.

For the Murray-Davies formula, the degree of light optical absorption is predefined. For Yule Nielsen formula, this can be adapted for different conditions.

NOTE: The Yule-Nielsen formula should only be used in special cases, i.e. to determine the physical area coverage.

Tone Value Increased (density/TVI only)

Used to set up to three tint patch percentages for tint measurements. Typically, these values are 25%, 50% and 75%.

Density/TVI Measurement Steps:

1. Select the basic mode in the main menu interface, and tap the "density/TVI" icon to enter the density/TVI measurement interface.
2. According to the prompt, press the measuring key lightly to complete the measurement of paper.
3. According to the prompt, press the measuring key lightly to complete the measurement of the solid ink.
4. Measure the corresponding tints or another solid
5. View measurement data. Tap on the different ink areas at the top of the screen to view the other ink values.

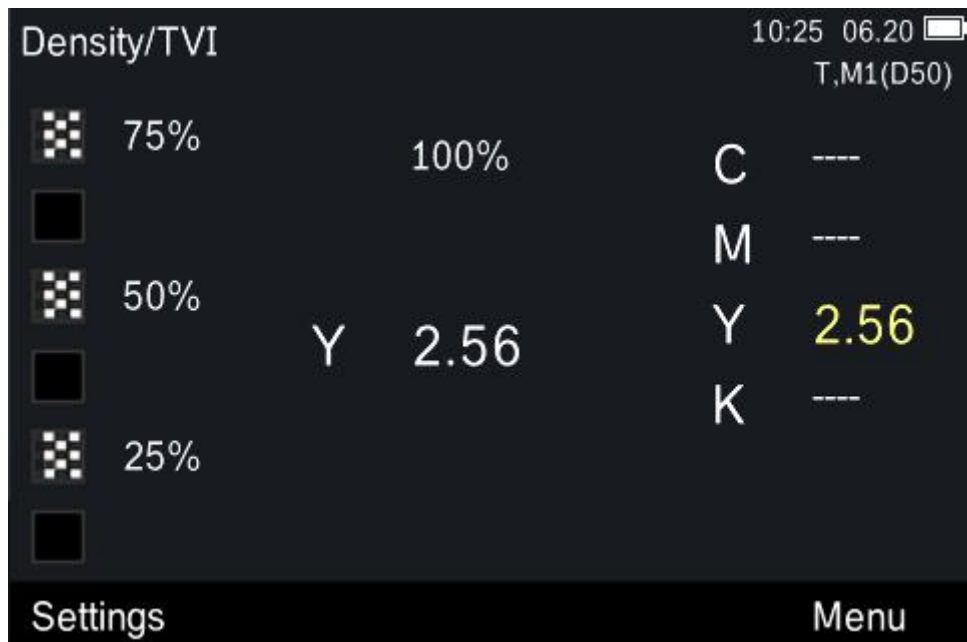


Figure 9 Density/TVI Interface 2

3.3 L*a*b* Measurement

Turn on the instrument and choose "Basic Mode" in the main menu interface, tap the "CIE L*a*b*" icon to enter the L*a*b* measurement interface.

L*a*b* Measuring Steps

1. Tap "Settings" and set measurement conditions (measurement conditions/light source/observe angle) according to the requirements.
2. Press the measuring key lightly to complete the measurement.

3.4 Advanced Measurement

3.4.1 Measurement

Choose advanced mode in the main menu and tap "Densitometer" to enter the densitometer measurement interface.

Density

This function is the measure of the ink thickness. For the process colors Cyan, Yellow, Magenta, or Black the desired Density Status (A, E, I, T, G) needs to be configured.

For four-color ink, its density value has been specified in C, M, Y and K values, while for spot-color ink, the density value will be the spectral density value of the determined wavelength.

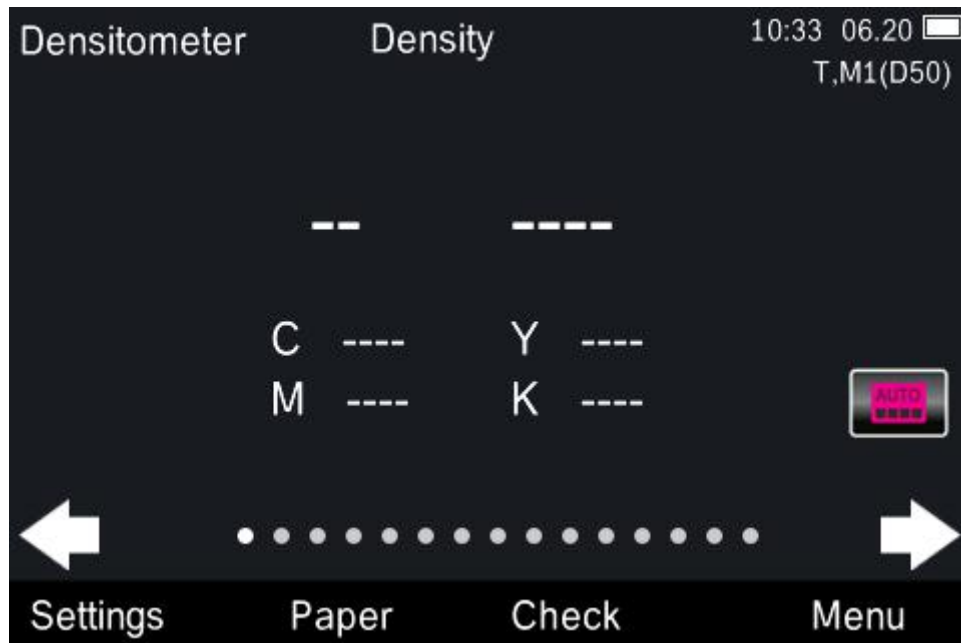


Figure 10 Density


Click the icon  on the right side of the screen to enter the interface of setting Color Density.



Figure 11 Set Density Color

Auto color picks the dominant color response and also displays the last measurements for the other colors (C, M, Y, and K).

Spot color picks the dominant spectral density wavelength. You can manually select the color response as well (C, M, Y, or K). In Job tools, the color response shown depends on the particular patch measured.

Density measurement steps:

- 1.Set measuring conditions,
- 2.Measure paper according to requirements,
- 3.Select density or all density,
- 4.Set density color,
- 5.Measure the sample,
- 6.View data.

All Densities

This function displays the density values for the measured sample for all filters (Cyan, Magenta, Yellow and Black).

3.4.2 View

This function is only available in advanced mode. The advanced menu screen can be switched by tapping left or right icons. The highlighted dots in the center color at the bottom of the screen represent your current screen, while the other dots represent the menu screen that can be switched.

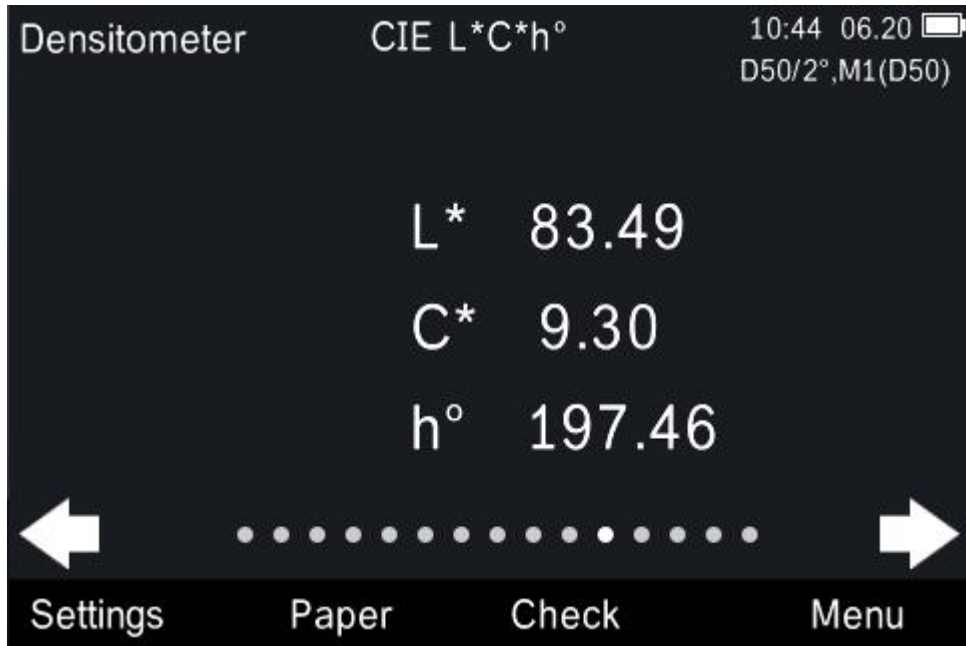


Figure 12 The function of View

“View” function also allows you to quickly view the desired screen by scrolling options. Click “View” on the densitometer interface as shown in figure 12 to enter the scrolling options interface and slide the scroll bar up and down to quickly select other options. For example: to quickly view the value of overprint, tap “View” and select “Overprint” under the scroll option. After confirmation, it will jump to the overprint value interface, as shown in Figure 13.

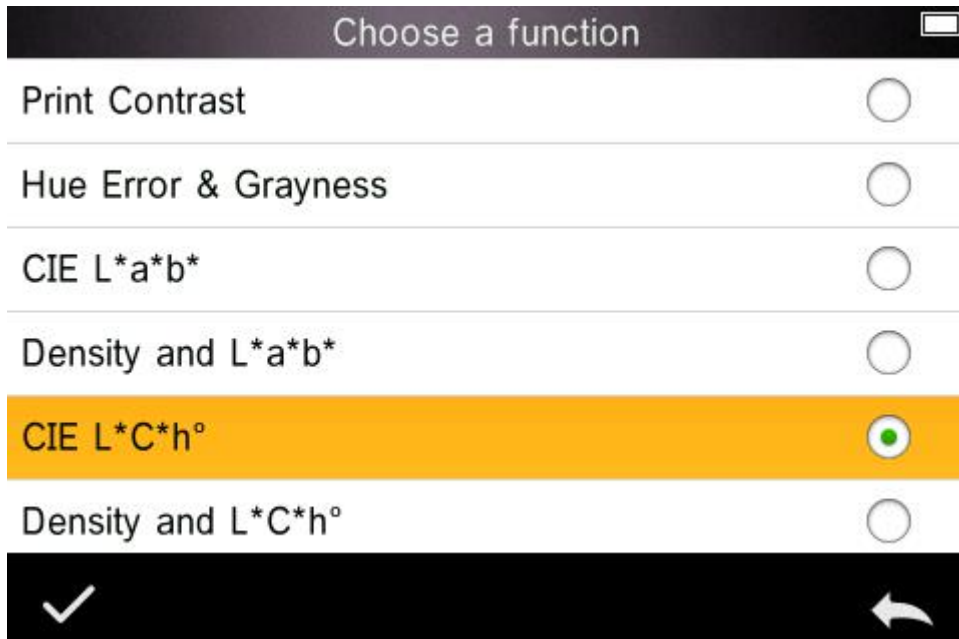


Figure 13 Scroll Option

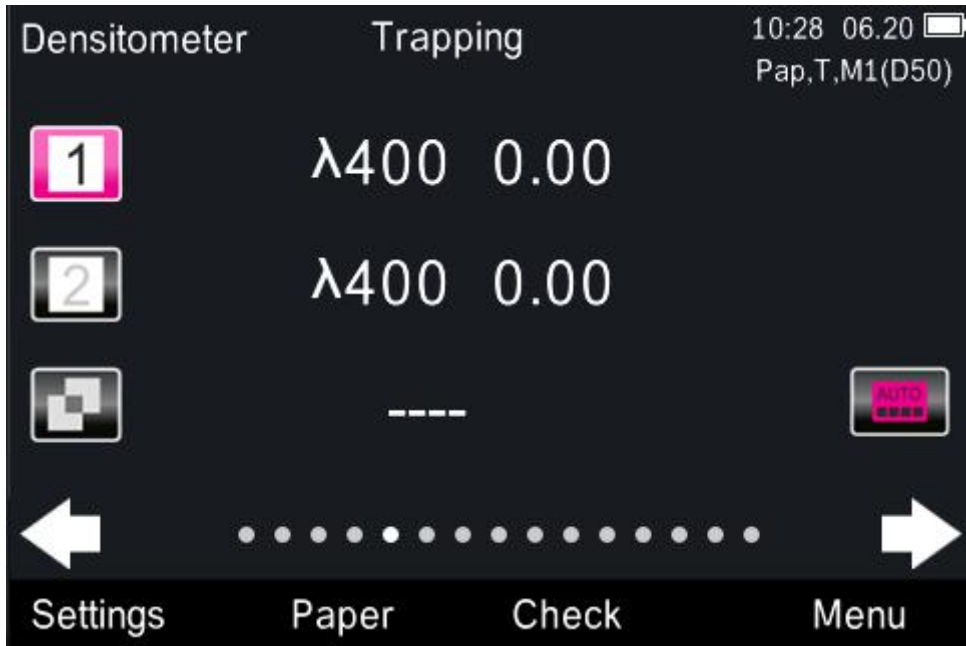


Figure 14 Scroll options "Overprint"

3.5 Basic comparison

Basic comparison is a quick way to compare standard and samples without storing data. To make a basic comparison, the first step is to set a standard against which each subsequent measurement is compared. If necessary, the standard sample can be remeasured.

Basic comparison procedure steps:

1. Tap the "Basic Comparison" icon on the screen in advanced mode to enter the basic comparison interface.

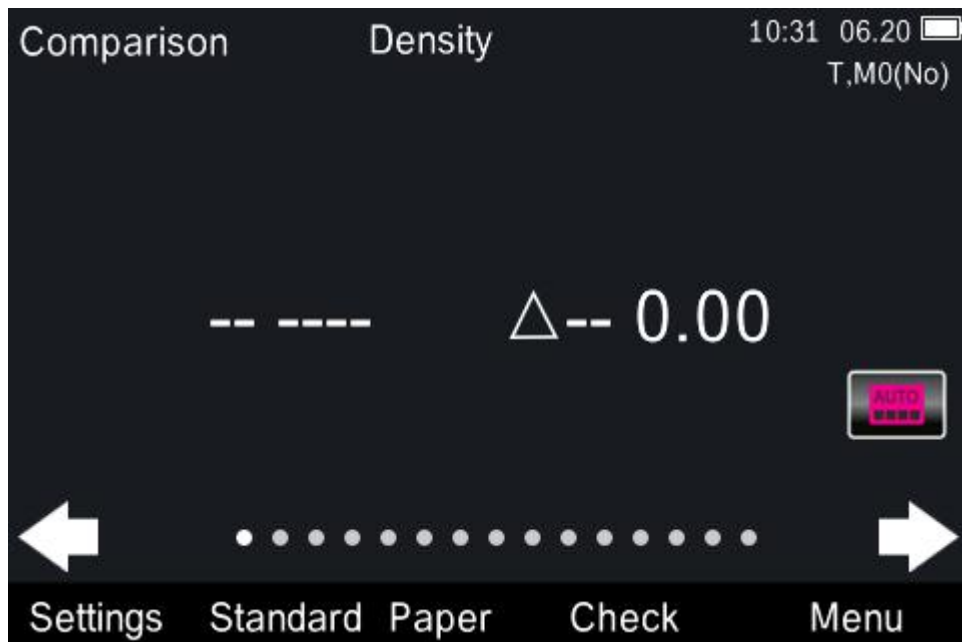


Figure 15 Basic Comparison

2. Click "Standard" to enter the measurement standard interface.

3. Standard measurement or standard selection.

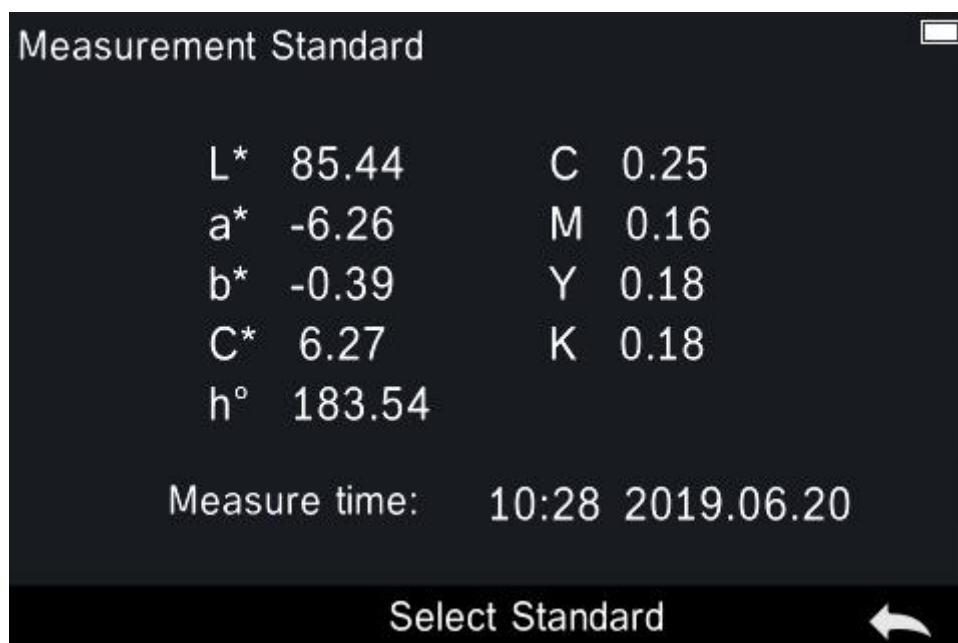


Figure 16 Standard Measurement

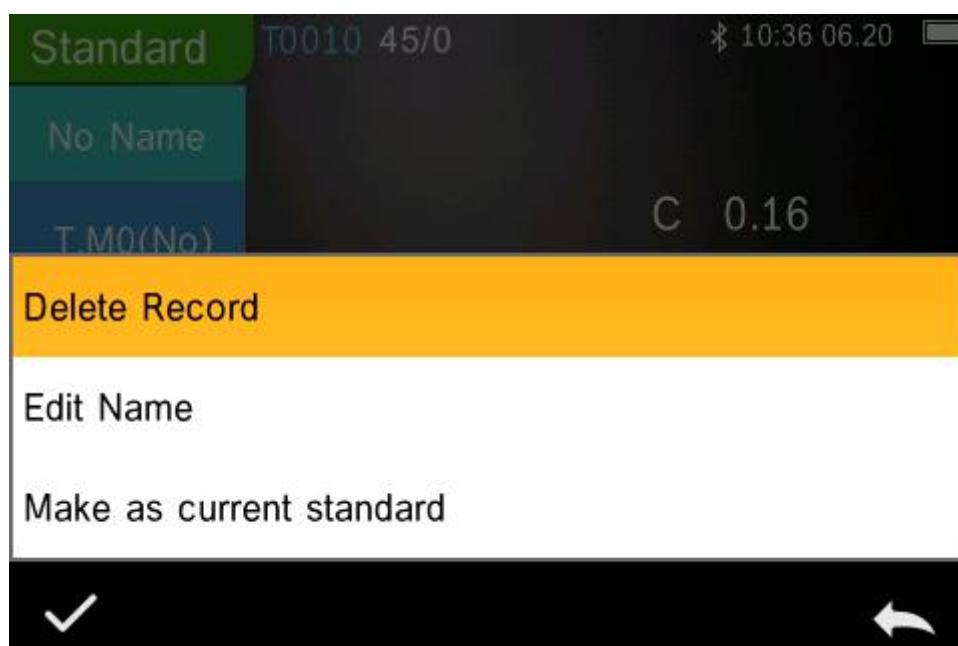



Figure 17 Select standard records

If you need to choose standard, switch to the standard record interface, and the selected standard record can be deleted, edited, input and other operations.

4. When the standard is confirmed, click the return icon  to the basic comparison interface.
5. If necessary, tap the "paper" and measure the paper.
6. Tap "View" and select the options used for comparison.
7. Measure sample.
8. View the measurement comparison results.
9. Continue to compare other sample measurements or choose other color options or standards for comparison.

4 System Setting

4.1 Setting

The system setting includes Language Setting, Measure Aperture, Bluetooth, Buzzer, Calibration Validity, Time Setting, Backlight Time, Operation Habit, Restore Factory Setting and About the Instrument as shown in Figure 18 and Figure 19.

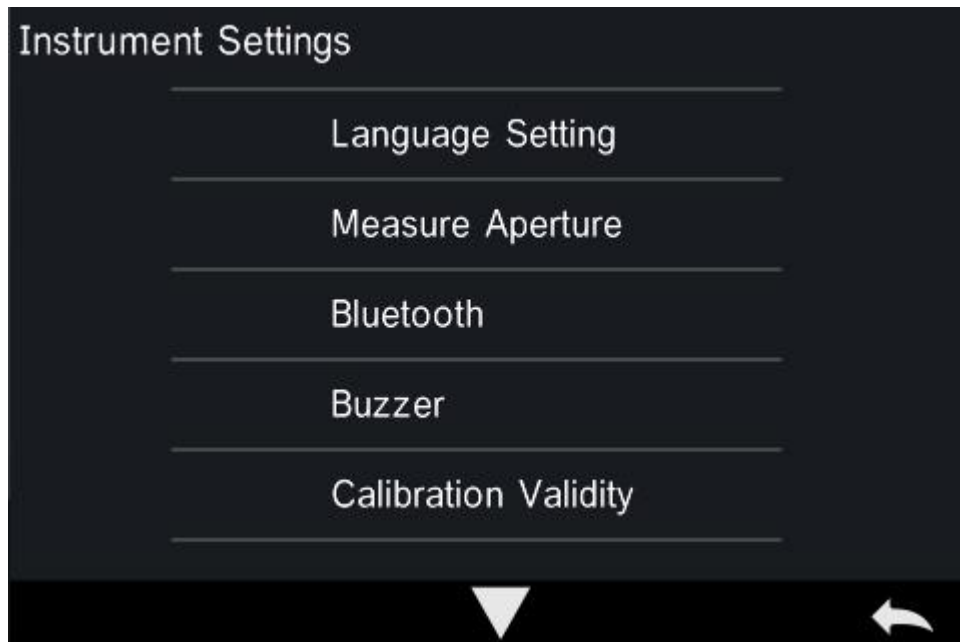


Figure 18 System Settings 1

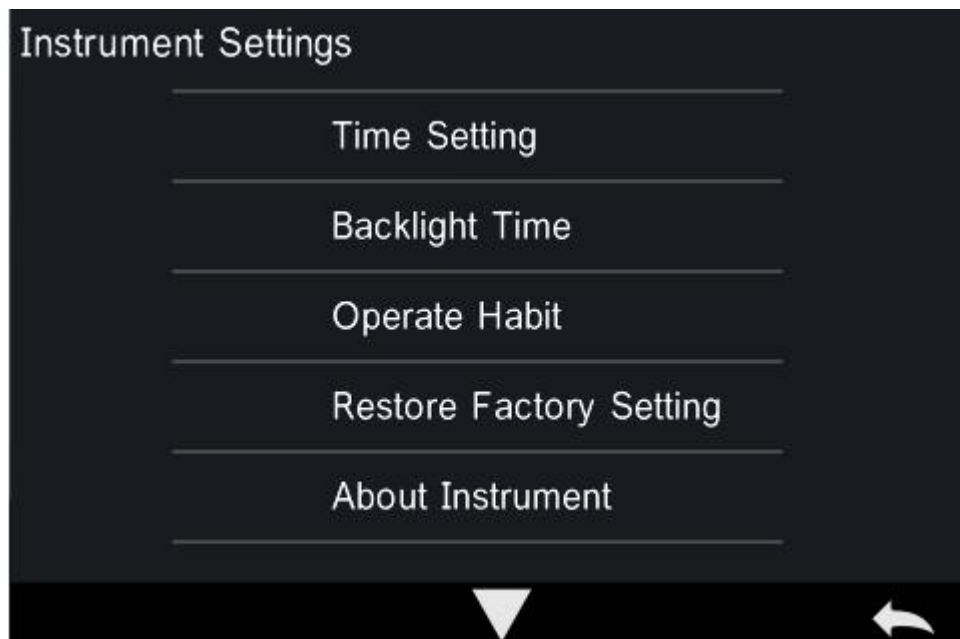


Figure 19 System Settings 2

4.2 Calibration

The instrument is equipped with a calibration box, and it will be prompted when calibration is required before measurement.

Re-calibration is required as following:

1. The instrument is used for the first time.
2. Over the calibration validity.
3. Measurement conditions have been changed.
4. The calibration environment is very different from the test environment.
5. Abnormal measurement data.

Note: Dirt and dust will seriously affect the calibration of the instrument and it should be kept clean. It is recommended to do regular cleaning .

Calibration steps :

1. Click the System Setting-> Calibration as shown in Figure 20. Select "Calibration" to enter white and black calibration interface as shown in Figure 21.

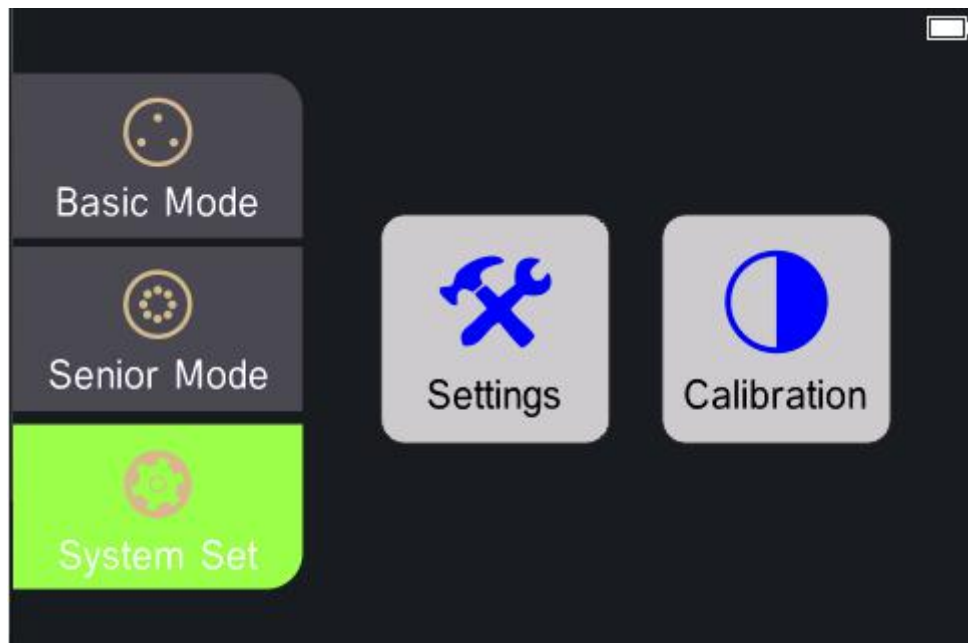


Figure 20 System Setting

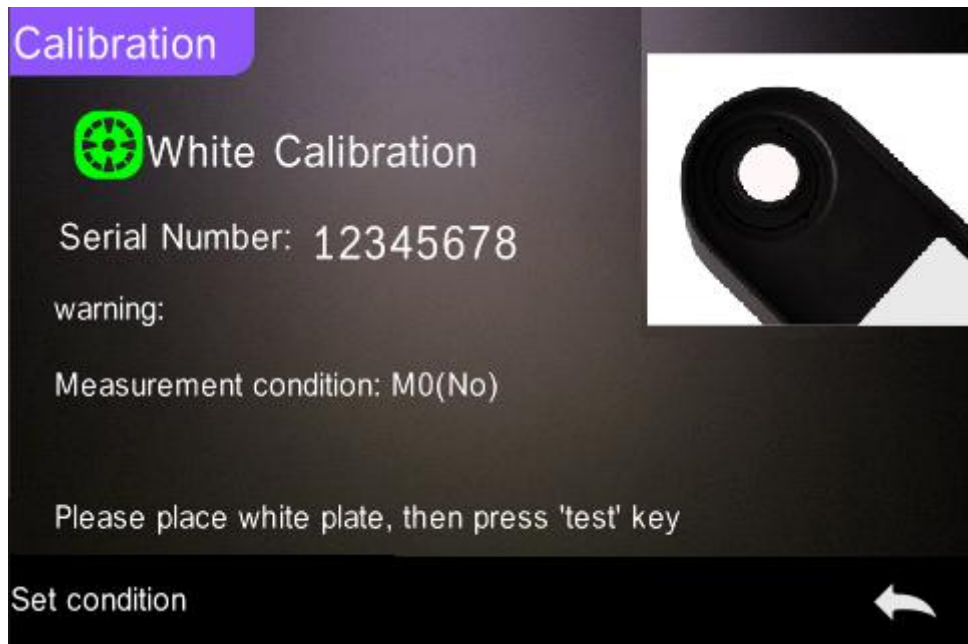


Figure 21 Calibration

Note: Select "Calibration" to enter white and black calibration interface ,it will show if the calibration is valid or not, and the remaining time if it is valid as shown in Figure 22.

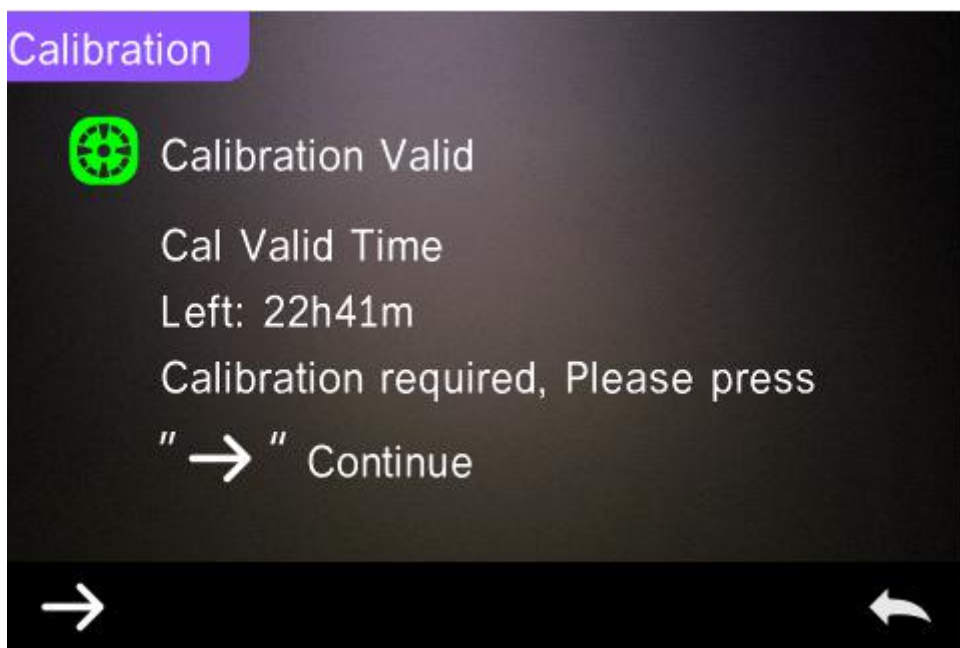


Figure 22 White and Black Calibration Valid

2. Tap the "Setting Measurement Conditions" in the lower left corner to set the required measurement conditions.

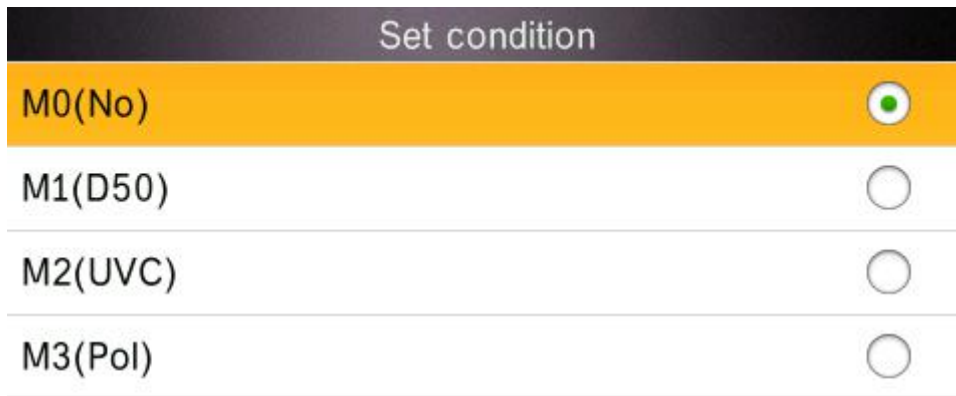


Figure 23 Set Measurement Conditions

3. According to the prompts, place the corresponding white board, and tap the measurement button lightly, and it prompts to complete the white calibration.

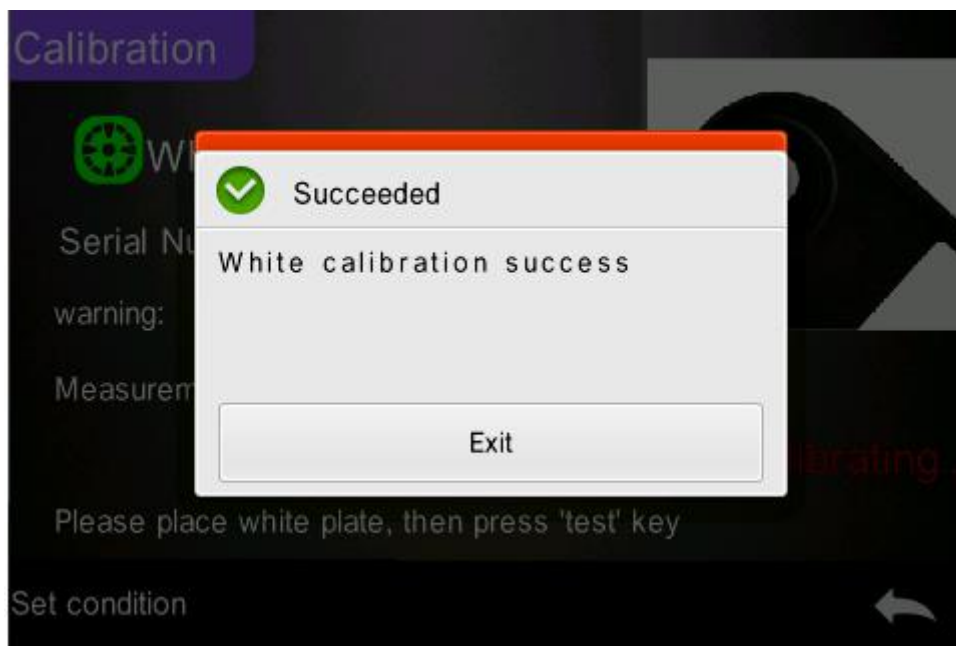


Figure 24 White board calibration successfully

4. According to the prompts, place the corresponding black board, tap the measurement button lightly, and it prompts to complete the black calibration.

5. Technical Specifications

Grating Spectrophotometer Densitometer		
Model	Standard	Advanced
Measurement Geometry	45/0(45 ring-shaped illumination, 0 degree viewing angle);	45/0(45 ring-shaped illumination, 0 degree viewing angle);
Features	standard ISO 5-4, CIE No.15 Common spectrophotometer densitometer, apply in ink printing, in Film Processing, Textile Printing and Dyeing, Plastic Electronics and Other Industries for Color Measurement and Quality Control;especially suitable for the measurement and quality control of optical density and dot enlargement in ink printing;able to customize single aperture Φ 2mm, Φ 4mm, Φ 8mm.	standard ISO 5-4, CIE No.15 High precision spectrophotometer densitometer, apply in ink printing, in Film Processing, Textile Printing and Dyeing, Plastic Electronics and Other Industries for accurate Color Measurement and Quality Control;especially suitable for the accurate measurement and quality control of optical density and dot enlargement in ink printing;able to customize single aperture Φ 2mm, Φ 4mm, Φ 8mm.
Light Source	Combined LED Light, UV Light	Combined LED Light, UV Light
Spectral separation device	Concave Grating	Concave Grating
Detector	256 Image Element Double Array CMOS Image Sensor	256 Image Element Double Array CMOS Image Sensor
Wavelength Range	400~700nm	400~700nm
Wavelength Pitch	10nm	10nm
Half Bandwidth	10nm	10nm
Measurement Conditions	Compliance with ISO 13655 measurement conditions; M0 (CIE Light Source A) M1 (CIE Light Source D50) M2 (Excluding UV light source) M3 (M2+Polarized light filter)	Compliance with ISO 13655 measurement conditions; M0 (CIE Light Source A) M1 (CIE Light Source D50) M2 (Excluding UV light source) M3 (M2+Polarized light filter)
Density Standards	ISO Status T,E,A,I	ISO Status T,E,A,I
Density index	Density value, density difference, dot area, dot enlargement, overprint, printing characteristics, printing contrast, tone error and gray level	Density value, density difference, dot area, dot enlargement, overprint, printing characteristics, printing contrast, tone error and gray scale, density scanning

Measurement aperture	Customized one aperture: Φ2mm,Φ4mm,Φ8mm optional	Customized one aperture: Φ2mm,Φ4mm,Φ8mm optional
Color Spaces	CIE LAB,XYZ,Yxy,LCh	CIE LAB,XYZ,Yxy,LCh,CIE LUV,HunterLAB
Color Difference Formula	$\Delta E^*ab, \Delta E^*94, \Delta E^*00$	$\Delta E^*ab, \Delta E^*94, \Delta E^*00, \Delta E^*uv, \Delta E^*cmc(2:1), \Delta E^*cmc(1:1), \Delta E(Hunter)$
Other Colorimetric Index	/	WI(ASTM E313, CIE/ISO,AATCC,Hunter), YI(ASTM D1925, ASTM 313), MI (Metamerism Index),Opacity, 2°/10°
Observer Angle	2°/10°	2°/10°
Illuminants	A,C,D50,D55,D65,D75,F2,F7,F11,F12	A,C,D50,D55,D65,D75,F2(CWF),F7(DLP),F11(TL84),F12(TL83/U30),F1,F3,F4,F5,F6,F8,F9,F10(TPL5)
Measurement Time	About 1.5s	About 1.5s
	Density: Within 0.01 D	Density: Within 0.01 D
Repeatability	Chromaticity value:within ΔE^*ab 0.04 (When a white calibration plate is measured 30 times at 5 second intervals after white calibration)Except M3	Chromaticity value:within ΔE^*ab 0.03 (When a white calibration plate is measured 30 times at 5 second intervals after white calibration) Except M3
Inter-instrument Error	Within ΔE^*ab 0.2 (Average for 12 BCRA Series II color tiles)Except M3	Within ΔE^*ab 0.18 (Average for 12 BCRA Series II color tiles)Except M3
Measurement mode	Single Measurement, Average Measurement(2-99)	Single Measurement, Average Measurement(2-99)
Size(L*W*H)	184*77*105mm	184*77*105mm
Weight	About 600g	About 600g
Power source	Li-ion battery. 5000 measurements within 8 hours	Li-ion battery. 5000 measurements within 8 hours
Illuminant Life Span	5 years, more than 3 million times measurements	5 years, more than 3 million times measurements
Display	3.5-inch TFT color LCD, Capacitive Touch Screen	3.5-inch TFT color LCD, Capacitive Touch Screen
Interface	USB	USB, Bluetooth 4.0
Data memory	10000 pcs	20000 pcs
Language	Simplified Chinese, English, Traditional Chinese	Simplified Chinese, English, Traditional Chinese

Working Environment	Temperature: 0~40°C; Humidity: 0~85% (No Condensation);altitude: less than 2000 m	Temperature: 0~40°C; Humidity: 0~85% (No Condensation);altitude: less than 2000 m
Storage Environment	Temperature: -20~50°C; Humidity: 0~85% (No Condensation)	Temperature: -20~50°C; Humidity: 0~85% (No Condensation)
Standard Accessory	Power Adapter, USB Cable, Built-in li-ion battery, User Manual, software(download from the website),White and Black Calibration Board, Protective Cover,Polarization filter box,Locating Plate	Power Adapter, USB Cable, Built-in li-ion battery, User Manual, software(download from the website),White and Black Calibration Board, Protective Cover,Polarization filter box,Locating Plate
Optional Accessory	Micro Printer	Micro Printer
Notes:	The specifications are subject to change without notice.	

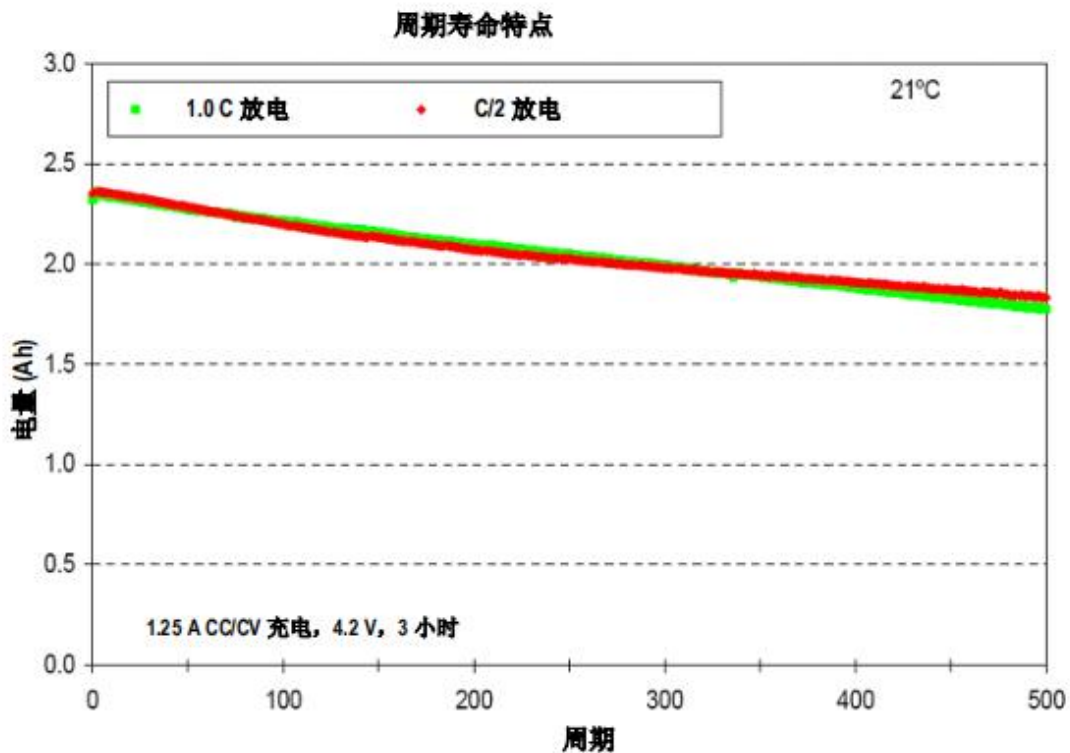
Appendix 1

Battery charging matters needing attention

The battery pack of the new instrument has a low to moderate charge, which should be charged for at least three hours before use. If you don't use a battery pack for a long time, you will eventually lose some of the charge of the battery pack. Please charge the battery frequently. If not in use, please store the battery in a cool place to maintain the battery performance.

Battery life expectancy

After 400 charge cycles, lithium-ion batteries typically lose 80% of their charge (see chart). A charging cycle can be defined as several partial charging to make the total amount of electricity reach 100%. Partial charge and discharge cycle helps to extend battery life, please try to avoid the mode of full charge and discharge cycle. After about 400 charge cycles, the amount of measurement available through a full charge will be reduced. At this point, consider replacing the battery.



Waste battery treatment

Please give the battery pack to the designated recycle bin.