BioLAB

OPERATING MANUAL

DOUBLE BEAM UV VISIBLE SPECTROPHOTOMETER

BSDBU-204-C

CE ISO9001 CERTIFIED

www.biolabscientific.com

INDEX

1. Introduction

1.1 Measurement Principle

The measurement principle of spectrophotometer is based on the Lambert-Beer law. When the beam of collimated monochromatic light passes through a certain uniform colored solution, the absorbance of the solution is directly proportional to the concentration of the solution and the optical path. And it supplies basis for the quantitative analysis. The Lambert-Beer law is described as following formula:
A=kbC
A - Absorbance of the analyte k - The absorption coefficient
b - The path length in cm
c - The analyte concentration

1.2 Performance and features

The performance and features of UV/Vis Spectrophotometer are as following:
■ Low stray light and high resolution optical system enables accurate measurement with good stability and reproducibility.
■ Novel technologies organically combine light, machine, electricity and microcomputer, together with scientific design, enables the instrument stability approaching or reaching a high level.
■ 10 inches colorful capacitive touch screen, guarantees the touch point more precise, and enables much high sensitivity and excellent stability.
■ High resolution with 1024 x 600, with fast running speed and large capacity.
■ Interactive human machine interface enables the operation interface much friendly, and the operation is convenient.
■ Powerful function of system settings, measurement functions such as photometric measurement, quantitative analysis, kinetic analysis, wavelength scan, multi- wavelength measurement, and DNA/protein measurement are available without on- line operation.
■ Available for cell position control with the accessory of automatic cells holder.
■ It provides unlimited storage. Data reading and writing are quite conveniently. USB storage is also available.
■ Connecting to designated model of inkjet printer is available and with direct output of A4 paper report, enables the print report to be much neat and clear.

1.3 Application

The UV/Vis spectrophotometer is a common analytical instrument in chemistry laboratory, and it is widely used in pharmaceutical, medicine and health, chemical, energy, machinery, metallurgy, environmental protection, geology, food, biology, materials, agriculture, forestry, fisheries and many other industries. It's also applied in the fields of higher education, metrology, teaching and scientific research, and quality control, raw material and product inspection during production process.
Double beam UV/Vis spectrophotometers equipped with touch screen, thanks to their stable performance, accurate measurement and powerful functions, they have strong advantages in various fields of scientific research and quality control.

1.4 Technical Specifications

Model	BSDBU-204-C
Wavelength Range	190nm -1100nm
Bandwidth	0.5/1.0/2.0/4.0nm
Wavelength Accuracy	±0.3nm
Wavelength Repeatability	≤0.1nm
Photometric Range	0 - 200%T, -0.3A - 3A, 0 - 9999C
Photometric Accuracy	±0.3%T
Stray Light	≤0.05%T
Dimensions	610mm x 410mm x 230mm

Table 1

1.5 Packing List

No.	Item	Unit	Qty	Note
1	UV/Vis Spectrophotometer	set	1	
2	Power Cord	pc	1	
3	Quartz Cell	kit	1	2 pcs/kit
4	Glass Cell	kit	1	4 pcs/kit
5	Dust Cover	pc	1	
6	User's Manual	pc	1	
7	Quality Certificate	pc	1	
8	Packing List	pc	1	

Table 2

1.6 Symbols and Notices

 : HIGH VOLTAGE.

Caution the danger of high voltage, and be careful of the risk of electric shock.

 : HOT SURFACE

Caution the hot surface, and avoid the risk of burn.


: ULTRAVIOLET RADIATION

Caution the emission of UV radiation.


: NOTICE.

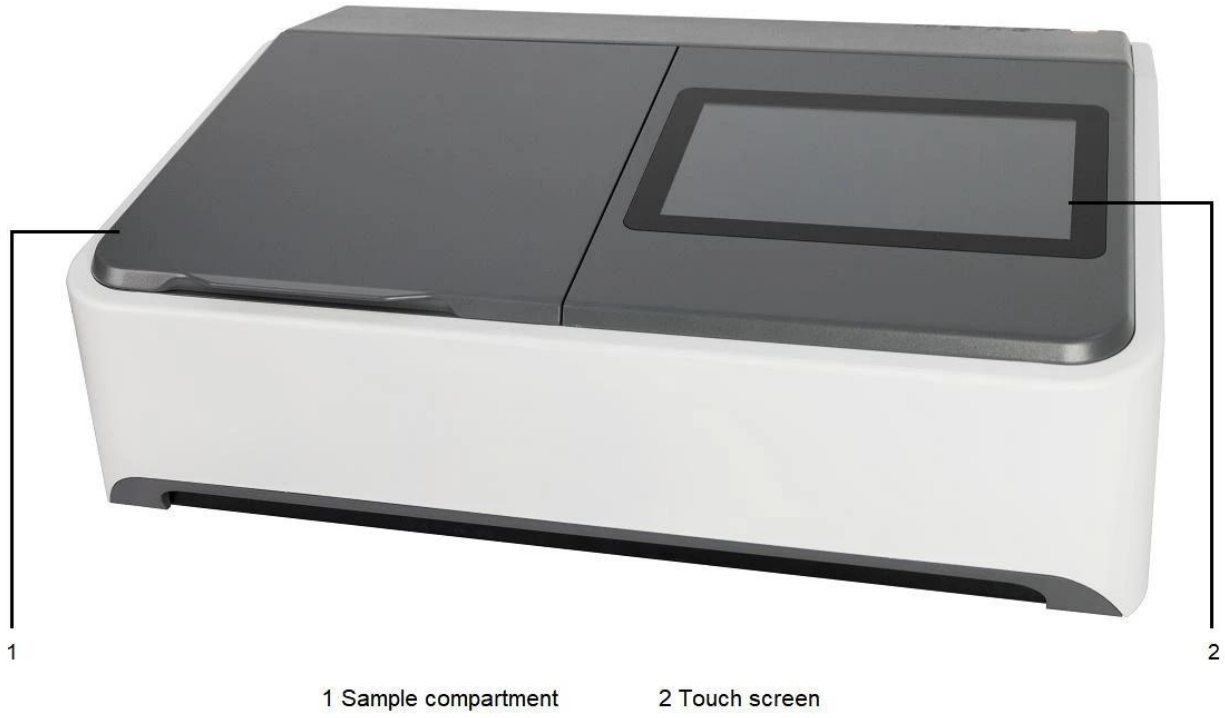
Pay attentions to the notice.


: SPECIAL EXPLANATION.

Pay additional attention to the special explanation.

1.7 Product Design

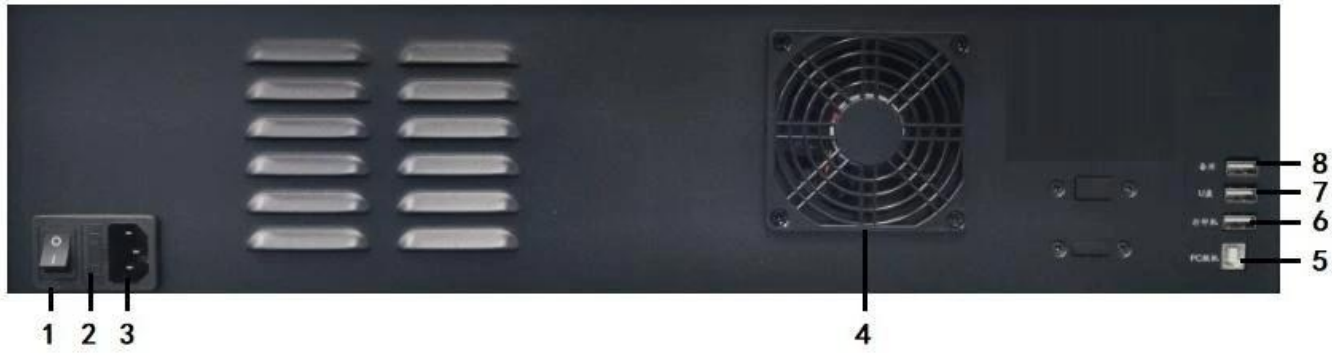
The profile of UV/Vis Spectrophotometer



1 Sample compartment 2 Touch screen

Figure 1

The back side of UV/Vis Spectrophotometer



1. Power switch 2. Fuse holder 3. Power socket 4. Ventilator
5. PC connecting port 6. Printer port 7. USB port 8. Reserved port

Figure 2

The compartment configuration of UV/Vis Spectrophotometer

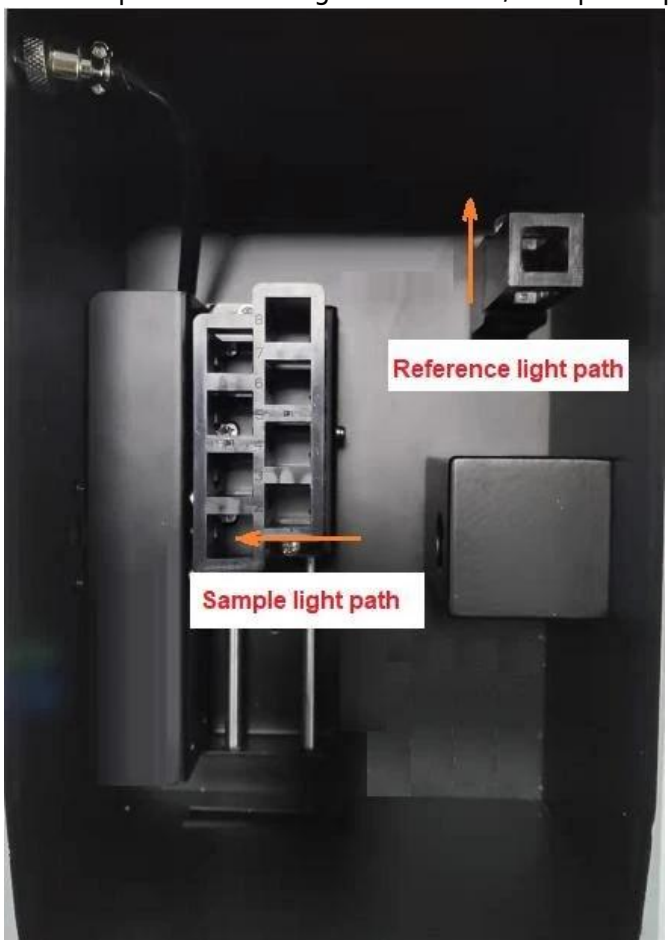


Figure 3

Above figures are only for reference! Please refer to the actual configuration.

2. Installation

2.1 Unpacking

Please check the outer packing and make sure it is intact before unpacking. Then, check the instrument and accessories according to packing list and ensure they are completely well. If any questions, or anything lost or damaged, please contact us in time.

2.2 Requirements

A laboratory should be prepared, and following requirements should be met:
1) The instrument should be placed in a dry room, and the room temperature should be in the range of 5 °C- 35 °C. The relative humidity should be no more than 85%.
2) Power supply requirement: The rated voltage should be 220V ± 22V AC (110V ± 11V AC is also optional), the frequency should be 50Hz (60Hz is also optional). Well- grounded is also required. An electronic AC regulator or AC regulator with the power more than 1000W is suggested to enhance the anti-interference performance of the instrument.
3) Other requirements: Be far away from strong or continuous vibration. Neither setting up the instrument near electromagnetic field, nor exposing the instrument to direct sunlight or the radiation of heaters. It should be free of dust, as well as corrosive vapors. The instrument should be placed on a stable workbench. And for well cooling and ventilation, a clearance of at least 15 cm to the wall is suggested.

2.3 Installation

Install the instrument as following steps:
Step 1: Place the instrument onto a stable bench after unpacking.
Step 2: Connect the power cord to the instrument. If a printer is equipped, connect the power cord of the printer and connect the instrument to the printer with the communication cable.

3. Instrument Operation

Before switching on the device, make sure all connections working well. The power supply should be well-grounded and meet related requirements, neither sample in the sample compartment nor any other blocks in the light path.

 Figures shown in this chapter are for reference only.

3.1 Power On & Self-diagnosis

1. Power On & Self-diagnosis
Switch on the device, it will proceed self-diagnosis. System will automatically diagnose the file, automatic sample holder, filter, tungsten lamp, deuterium lamp, lamp conversion, detector, Bluetooth, wavelength positioning, dark current, system parameters, and so on.

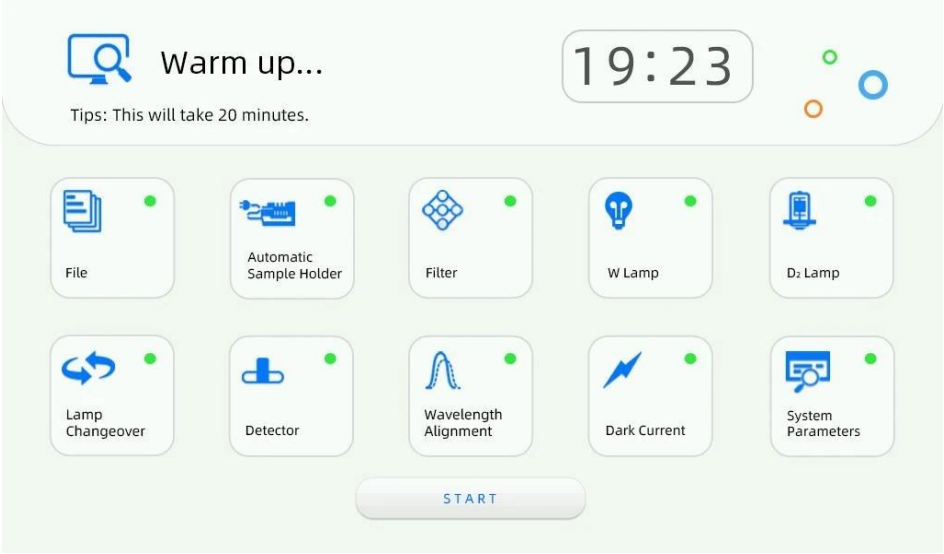


Figure 4

There is a status indicator lamp beside each self-diagnosis item, and it will turn green when the item passes in the self-diagnosis process. If any item is fail, the system will automatically give buzzing alarm, and the status indicator lamp will turn red at the same time. However, it will continue the self-diagnosis process.

Please don't open the lid of the sample compartment during the self-diagnosis process. Please contact us in time if any self-diagnosis item fails. Or refer to Chapter 5 for troubleshooting.

2. Warming up

Warming up starts after self-diagnosis finished, it takes around 20 min. The system will give buzzing alarm when warming up completed and enter the main operation interface automatically. Users also can click 

to skip warming up.

3. Ready for operation

After warming up, device is ready for operation.

Functions such as photometric measurement, quantitative analysis, kinetic analysis, wavelength scan, multi-wavelength measurement, DNA/protein measurement and system settings are available, choose and click the icon accordingly to enter the related mode.

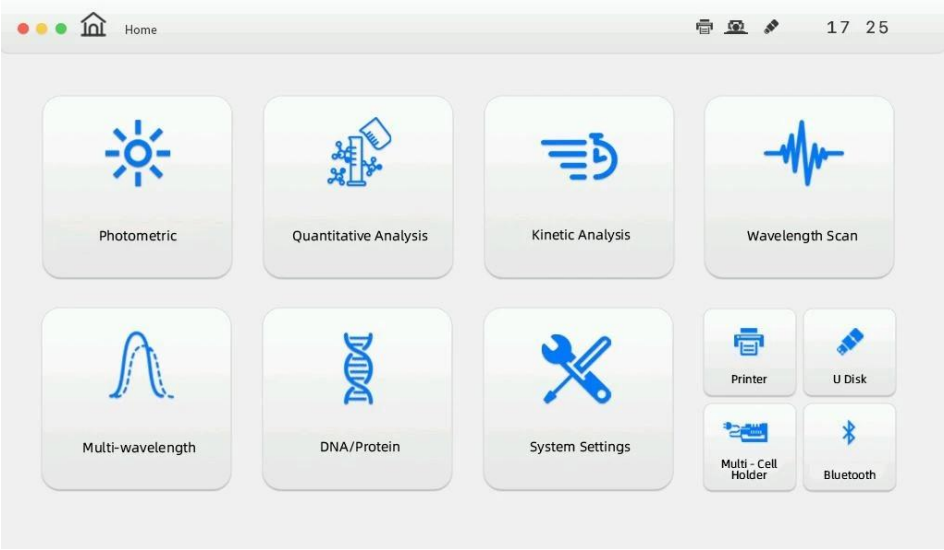


Figure 5

4. Description of touch keys
The common touch keys are shown on the bottom panel after entering each operation interface, followings are the descriptions.

BLANK : For blank calibration, adjust to 0.000 Abs or 100.0 %T.

SAVE : Save the data.

OPEN : Open the data.

: Exit the current interface, and return to the main interface.

CLEAR : Delete all records displayed in the current measurement interface.

PRINT : Print the data.

SETTING : For measurement parameters setting.

MEASURE : Measure and record the data.

DELETE : Delete the selected measurement data.

: Page up for data browsing or back to previous page.

: Page down for data browsing or go to next page.

3.2 Multi- cell Holder Management

It's only available for the instrument with the accessory of certain automatic cell holder.

With the accessory of certain automatic cell holder, automatic measurement can be performed with functions of photometric measurement, quantitative analysis, multi- wavelength measurement, and DNA/protein measurement. Click the icon 

on the bottom right corner of the main interface to enter the multi-cell holder management interface. User can choose manual or automatic operation mode with the multi-cell holder. If automatic mode is chosen, just select relevant cell positions and click

to return to the main interface, it will perform the measurement automatically after entering the specified measurement interface. If manual mode is chosen, after entering the specified measurement interface, click 

and click the corresponding position, the multi-cell holder will move to the right sample position and perform the measurement. User can measure other samples respectively by moving to certain sample position.

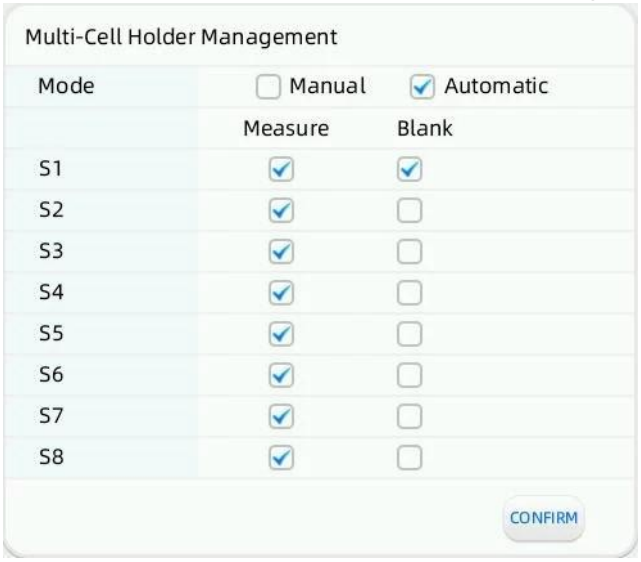


Figure 6

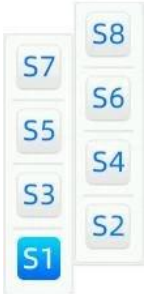


Figure 7

3.3 Photometric Measurement

Absorbance, transmittance, and energy measurements under certain wavelength are available with photometric measurement. The measurement result also can be printed out.

Click the icon 

in the main interface to enter the photometric measurement interface.

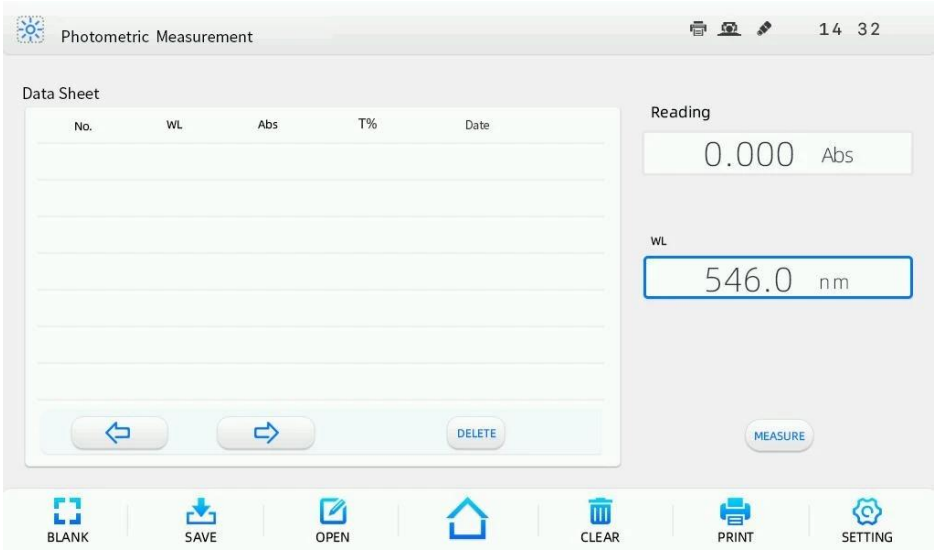


Figure 8

If user want to change the test mode of current displaying shown in reading column, just click 

to enter the setting interface, select the test mode among Abs, T%, and E , then click

to make sure the setting. Viewing the energy under certain wavelength with different gain is also available.

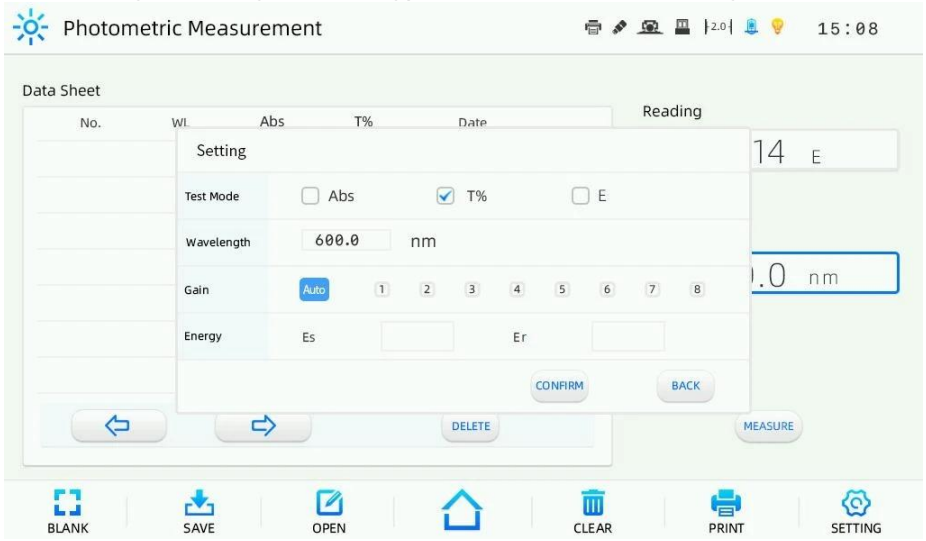


Figure 9

3.3.1 Photometric measurement

Following are the operation steps for photometric measurement. Step 1 Enter the photometric measurement interface.

Click the icon 

in the main interface to enter the photometric measurement interface.

Step 2 Set the measurement wavelength.
In the photometric measurement interface, click in the current wavelength display bar, a digital input window will pop up. Click

after inputting the wavelength value, a prompt "Moving wavelength ..." will be shown, and the instrument will move wavelength to the designated spot. User can click 

to exit the digital input window if wavelength setting is unnecessary.

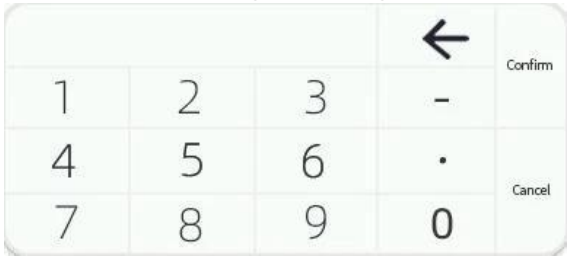


Figure 10

 The valid wavelength range is between 190 nm and 1100 nm. If the input value is out of range, it is invalid, user needs to input again.

 User can click to clear the input when an error is found, then input the target value again. The touch key also works in the process of digital setting in subsequent operations.

Step 3 Sample measurement.
Put the blank solution or reference solution separately into the reference light path and sample light path, and click 

. The instrument will be adjusted to 0.000 Abs/100.0 %T under certain wavelength. Then, replace the blank solution or reference solution with the sample solution only in the sample light path, click 

and record the measurement result.

3.3.2 Data processing
User can do data processing such as data saving, opening, printing and deleting after completing photometric measurements.

Data saving: User can save the data to the instrument memory by clicking 

. When a USB storage device is connected, user can select to save the data to the USB storage device. Input the file name in the file save window , and click

, the file will be saved with the suffix of ".bas".

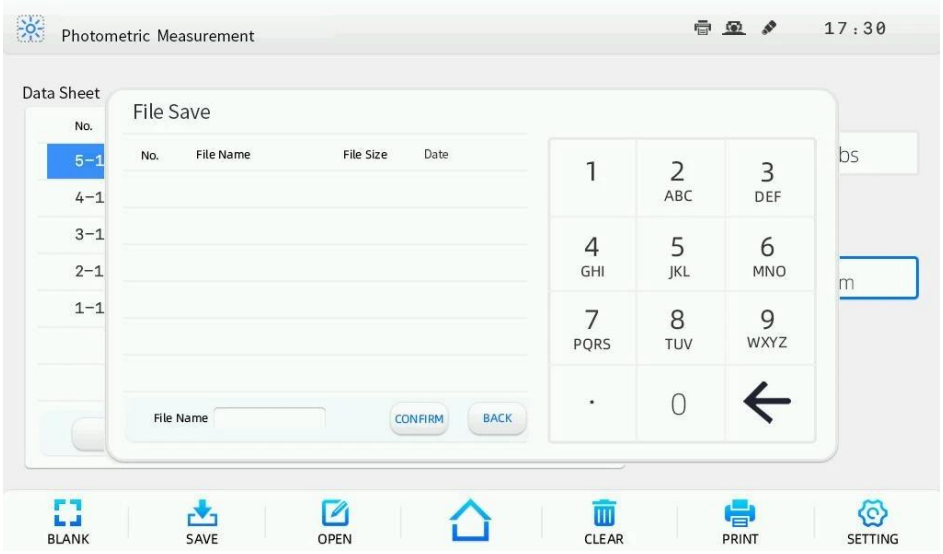


Figure 11

The valid length of the file name is no more than eight characters.

For data that already saved in the instrument memory, if user want to save it to the USB storage device later, please insert the USB storage device first. After opening the data in the instrument memory, long press SAVE and keep it for more than 3s before releasing, the file save prompts will pop up, select to save to the USB storage device, and then input the file name and confirm it, the data saving will be completed.

Data opening: Click OPEN to enter the data opening interface. User can select the file to be opened, and click CONFIRM to open the data.

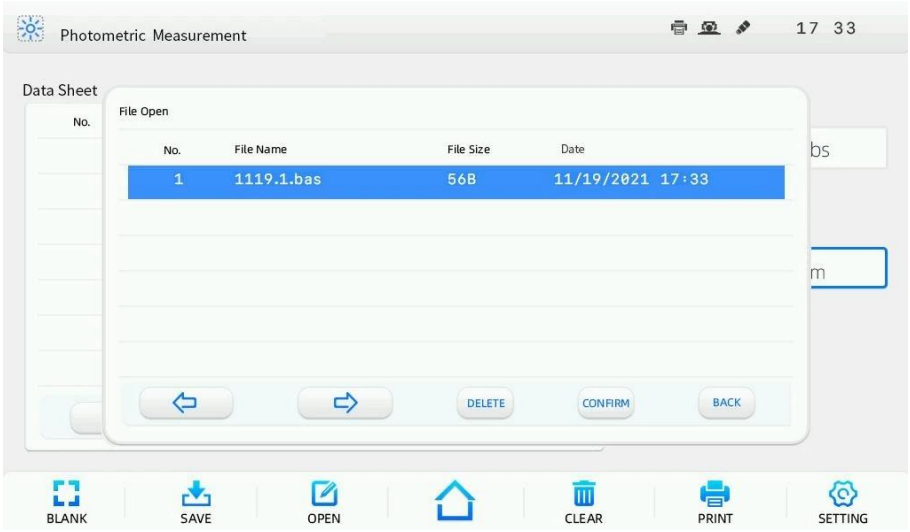


Figure 12

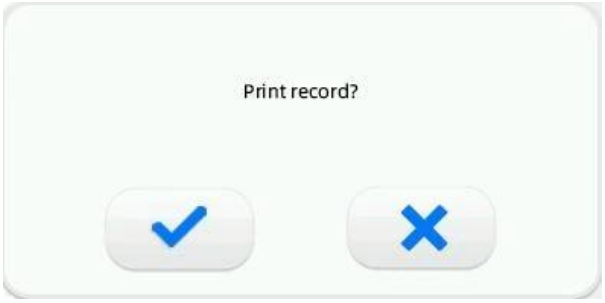


Figure 13

Data printing: User can print the data by clicking PRINT if a printer is connected. A dialog box will pop up , click to print the data.

Data deleting: If a few data need to be deleted, user can select the row of the data and click DELETE at the bottom of the data sheet, a dialog box will pop up , click to make sure the deleting. User also can click CLEAR on the lower pane of the

operation interface to clear all the data displayed in the data sheet. A dialog box will pop up , click to make sure the deleting.

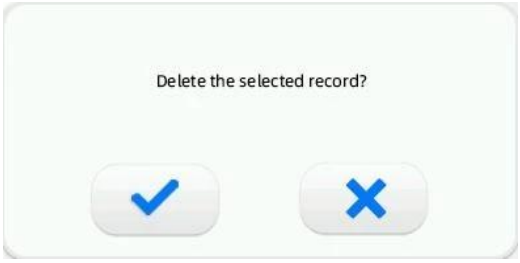


Figure 14

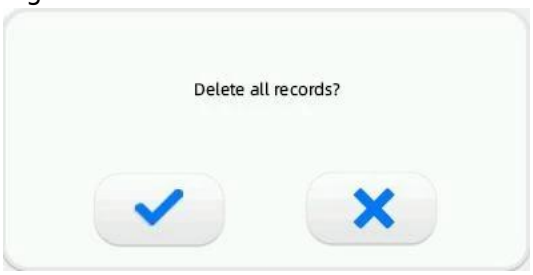


Figure 15

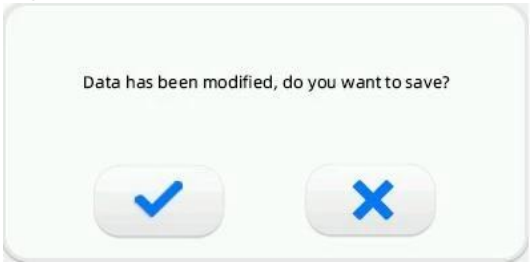


Figure 13

The delete operation only works for current display. The already saved data won't lost. Before exit the current interface or returning to the main interface, a dialog box will pop up (Fig. 3-13). If the data after delete operation need to be saved, user can click to save the updated data.

3.4 Quantitative Analysis

User can do sample measurement based on the method of standard curve in the quantitative analysis interface. User also can utilize coefficient method to do sample measurement.

Click the icon 

in the main interface to enter the quantitative analysis interface.

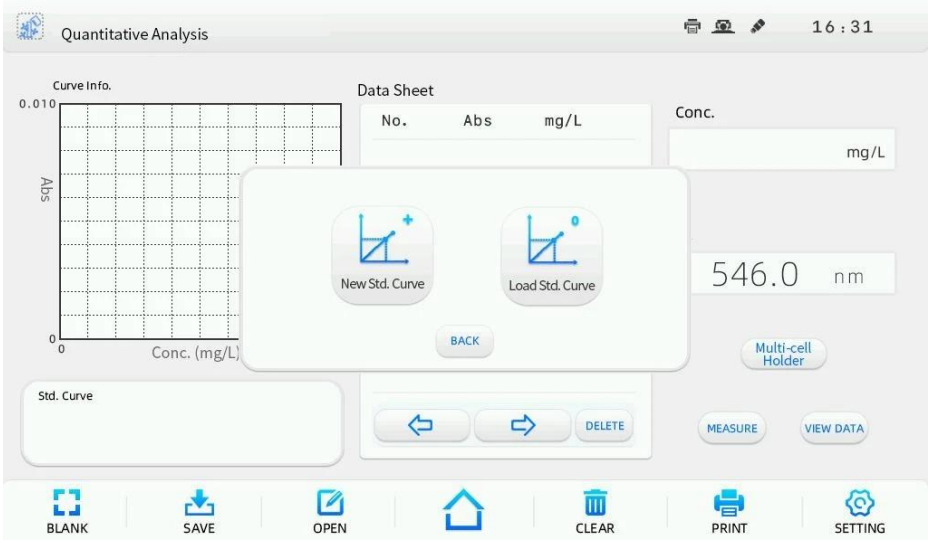


Figure 17

3.4.1 Standard curve measurement

The method of standard curve means to establish a calibration curve first, then measure the sample based on the calibration curve. The standard curve is also known as the standard calibration curve. Measure the absorbance of the sample and obtain the concentration that calculated according to the standard curve.


Different absorbance linearity range will cause different measurement error. The best absorbance linearity range is between 0.2 and 0.8.

1. Enter the interface of the standard curve method

In the main quantitative analysis interface, click 

to enter the interface of the standard curve method.

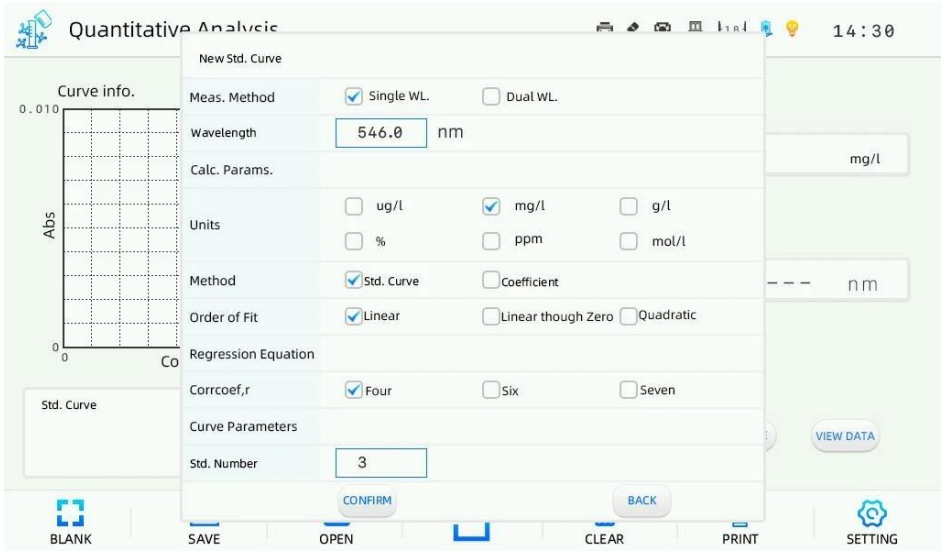


Figure 18

2. Create standard curve

In the interface of the standard curve method, select the measurement method, set the wavelength, select the method "Std. Curve" and certain fitting method, set the std. number, and click CONFIRM to enter the standard curve measurement interface.

Following are detail operation steps for standard curve measurement: Step 1 Measurement method selection and wavelength setting.

There are two measurement method for chosen, single wavelength and dual wavelength. Click in the wavelength column in the interface of the standard curve method, and a digital input window will pop up . Click Confirm after inputting the wavelength value. If the measurement method "Dual WL" is chosen, user should input the calculation parameters after wavelength setting. Select the unit, there are six kinds of commonly used concentration unit for chosen, μg/L, mg/L, g/L, %, ppm and mol/L. Select the effective displaying of correlation coefficient. Click in std. number column, input the number value and confirm it. Then click CONFIRM to enter the standard curve measurement interface , a prompt "Moving wavelength ..." will be shown, and the instrument will move wavelength to the designated spot.

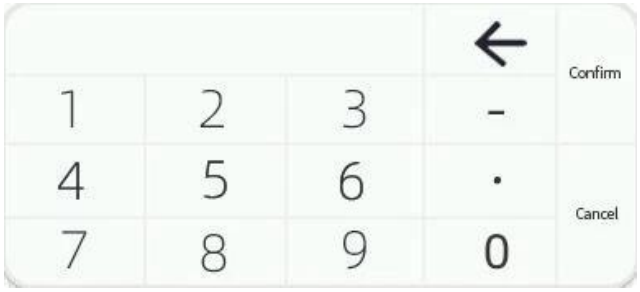


Figure 19

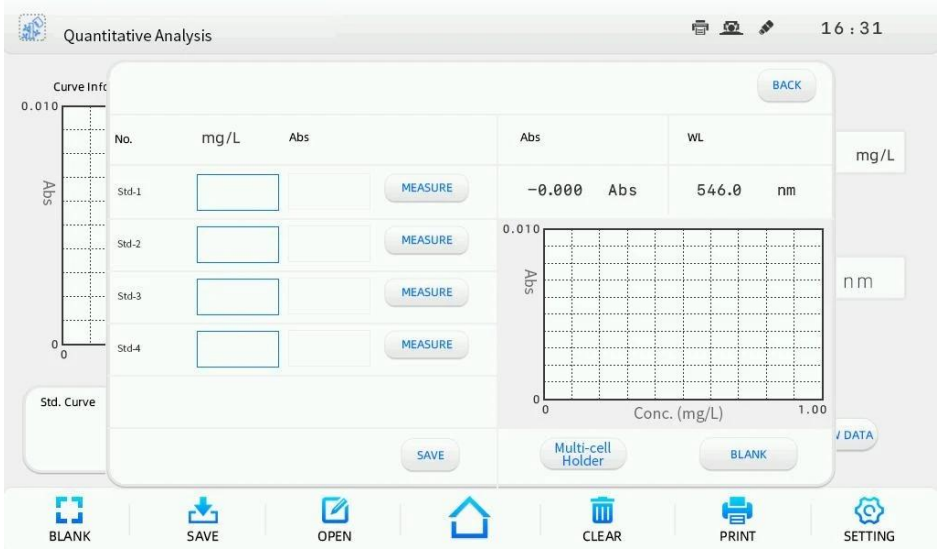


Figure 20

Step 2 Standard samples measurement and standard curve establishing.

Click in the concentration column of std-1, input the concentration value and confirm it. Input other standard concentration value one by one. Put the reference solution of standard samples separately into the reference light path and sample light path, and click BLANK to adjust 0.000 Abs. Then, replace the reference solution with the first standard sample solution only in the sample light path, click MEASURE to record the Abs. value. Measure other standard sample solutions accordingly.

At last, the standard curve is obtained . Up to ten standard points can be measured.

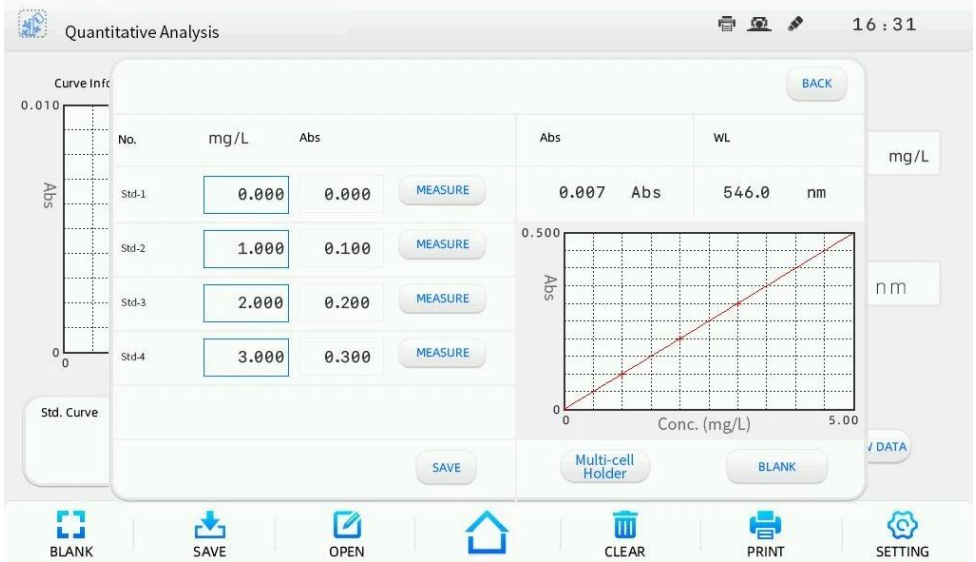


Figure 21

Step 3 Sample measurement.

Click SAVE in the obtained standard curve interface to enter the sample measurement interface. The curve information including the standard curve, curve equation and the correlation coefficient are shown on the left pane. Put the blank solution separately into the reference light path and sample light path, and click BLANK to adjust 0.000 Abs. Then, replace the blank solution with the sample solution only in the

sample light path, click MEASURE , the measurement result will be recorded.

Figure 22

In the sample measurement interface, user can click VIEW DATA to retrieve the data record of standard samples.

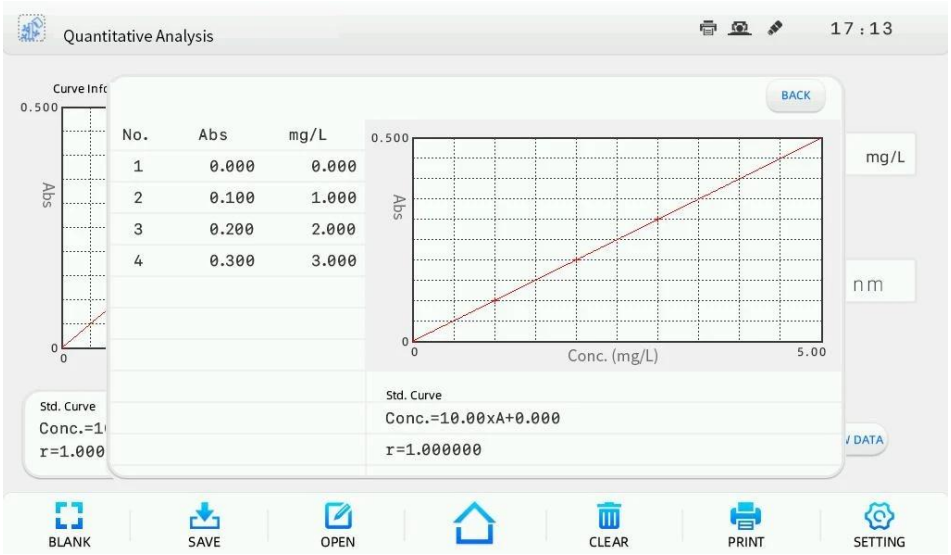


Figure 23

3. Data processing

User can do data processing such as data saving, opening, printing and deleting after completing standard curve measurement.

Data saving: User can save the data to the instrument memory by clicking SAVE . When a USB storage device is connected, user can select to save the data to the USB storage device. Input the file name in the file save window , and click CONFIRM , the file will be saved with the suffix of ".qua".

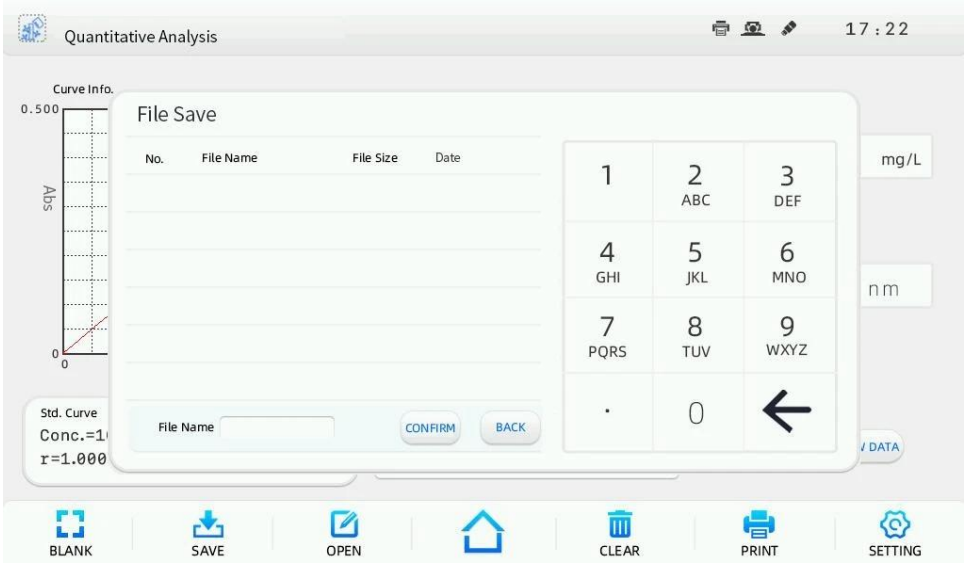


Figure 24

The valid length of the file name is no more than eight characters.

For data that already saved in the instrument memory, if user want to save it to the USB storage device later, please insert the USB storage device first. After opening the data in the instrument memory, long press SAVE and keep it for more than 3s before releasing, the file save prompts will pop up, select to save to the USB storage device, and then input the file name and confirm it, the data saving will be completed.

Data opening: Click OPEN to enter the data opening interface. User can select the file to be opened, and click CONFIRM to open the data.

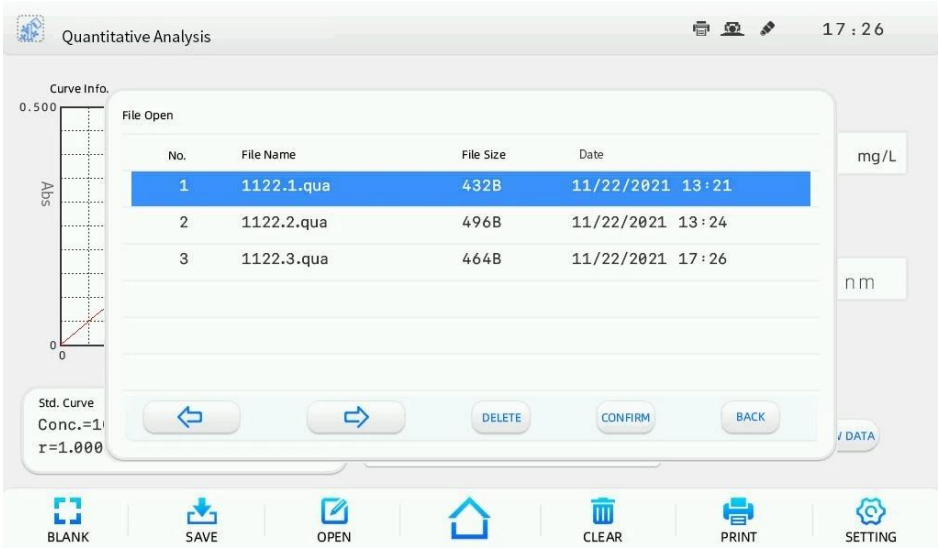


Figure 25

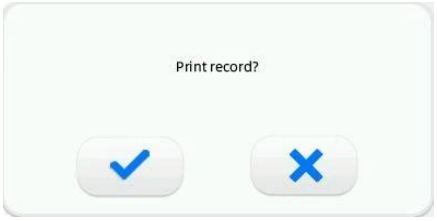


Figure 26

Data printing: User can print the data by clicking PRINT if a printer is connected. A dialog box will pop up , click to print the data.

Data deleting: If a few data need to be deleted, user can select the row of the data and click DELETE at the bottom of the data sheet, a dialog box will pop up , click to make sure the deleting. User also can click CLEAR on the lower pane of the operation interface to clear all the data displayed in the data sheet. A dialog box will pop up , click to make sure the deleting.

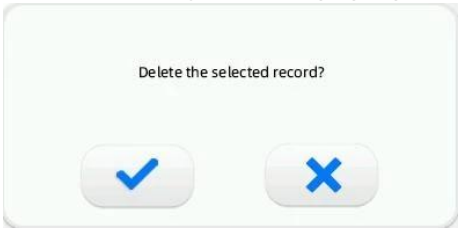


Figure 27

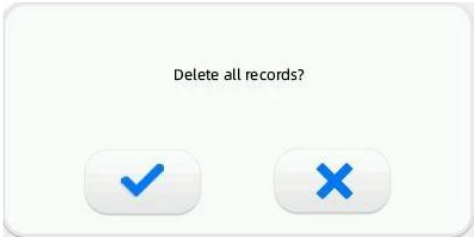


Figure 28

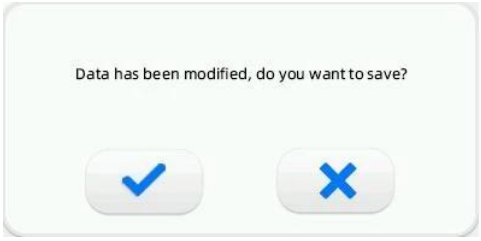


Figure 29

The delete operation only works for current display. The already saved data won't lost. Before exit the current interface or returning to the main interface, a dialog box will pop up (Fig. 3-26). If the data after delete operation need to be saved, user can click to save the updated data.

4. Load standard curve

User can load the saved standard curve. In the main quantitative analysis interface, click to Load Std. Curve

enter the standard curve loading interface

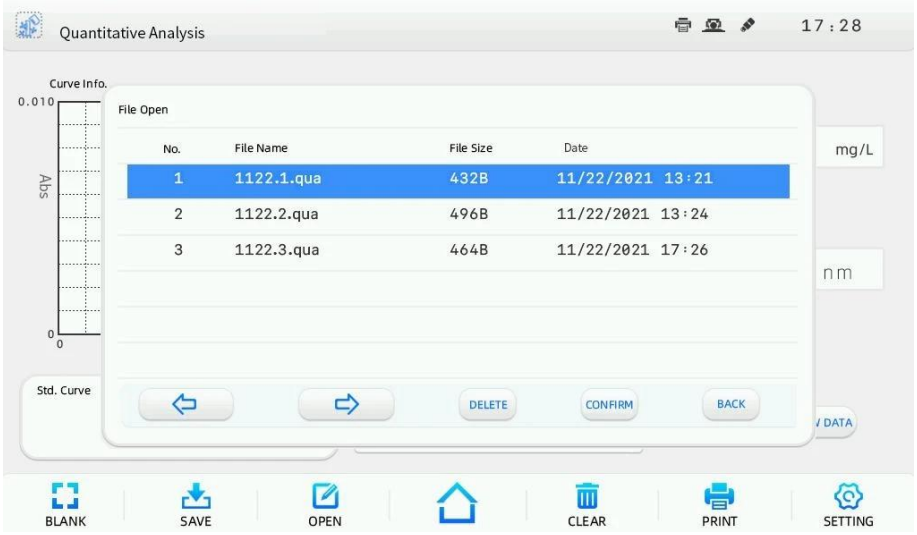


Figure 30

User can browse the pages by clicking  and  , and select the file of the standard curve need to be loaded. Then, click  to enter the sample measurement interface.

 The file are saved in ascending order, and the latest saved file is saved at the bottom. The instrument memory is unlimited, user can save files freely.

3.4.2 Coefficient method application

The coefficient method is a simple application of standard curve method. User can input the coefficients of the standard curve, and do the sample measurement further. The calculation formula is based on the fitting method. For linear fit, the calculation formula is C=K1xA+K0.

Following are detail operation steps for coefficient method:

Step 1 Enter the coefficient method interface.

In the main quantitative analysis interface, click  to enter the interface of the standard curve method, select "Coefficient" as the method

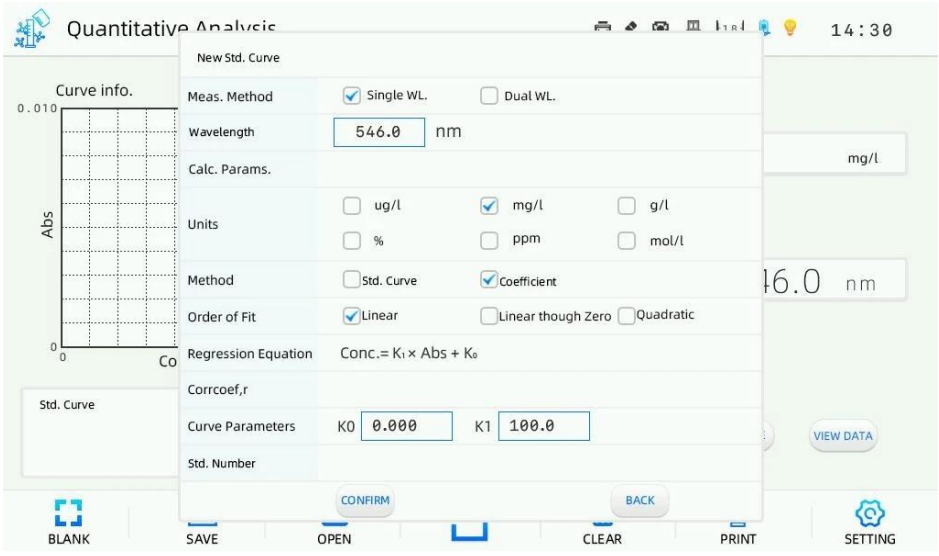


Figure 31

Step 2 Measurement method selection and wavelength setting.

There are two measurement method for chosen, single wavelength and dual wavelength. Click in the

wavelength column, and a digital input window will pop up. Click

after inputting the wavelength value. If the measurement
method "Dual WL" is chosen, user should input the calculation parameters after wavelength setting. Then, select the unit. There are six kinds of commonly used concentration unit for chosen, μg/L, mg/L, g/L, %, ppm and mol/L.

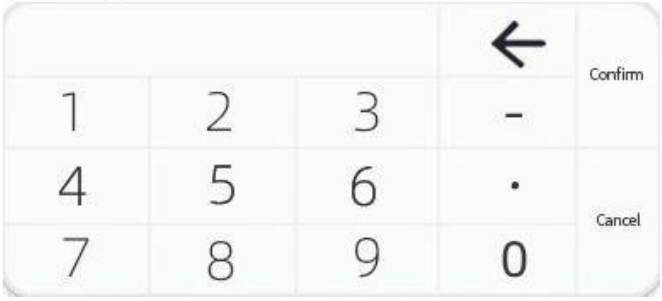


Figure 32

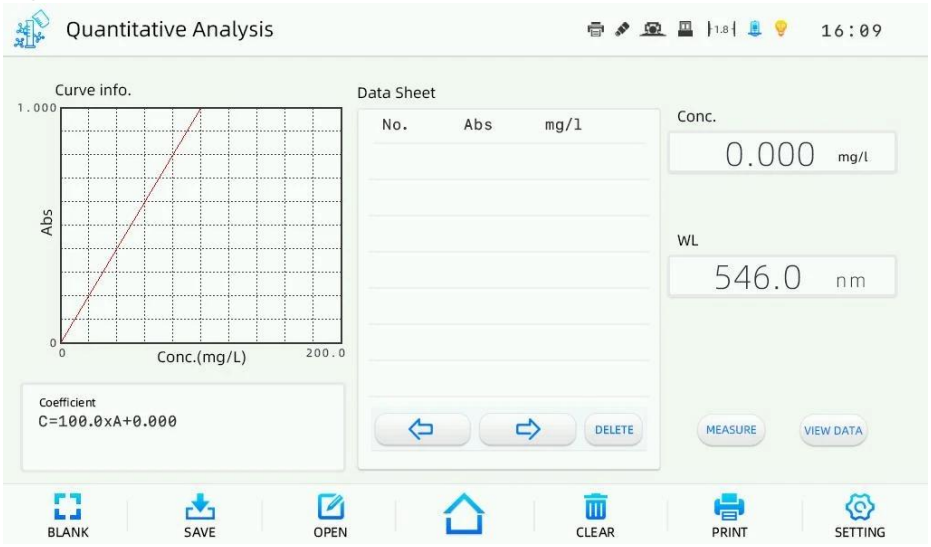


Figure 33

Step 3 Coefficients setting.

For linear fit as an example, select the fitting method "Linear Fit". Click the blank column of K1, input the value in the pop-up digital input window and make sure the setting, input the value of K0 like the same.

Then, click

to enter the sample measurement interface (Fig. 3-30). A prompt "Moving wavelength …" will be shown, and the instrument will move wavelength to the designated spot.

Step 4 Sample measurement.

Put the blank solution separately into the reference light path and sample light

path, and click 

to adjust 0.000 Abs. Then, replace the blank solution with the sample solution only in the sample light path, click , the measurement result will be recorded.

User can do data processing such as data saving, printing and deleting after completing sample measurement. It is omitted here.

3.5 Kinetic Analysis

A curve of absorbance or transmittance or energy at a specific wavelength in a certain time range is available with kinetic analysis, and the variation tendency of a sample can be analyzed.

Click the icon 

in the main interface to enter the kinetic analysis interface

Figure 34

3.5.1 Kinetic analysis

Following are the operation steps for kinetic analysis:

Step 1 Enter the kinetic analysis interface.

Click the icon 

in the main interface to enter the kinetic analysis interface.

Step 2 Set the kinetics scan parameters.

Click 

to enter the kinetics scan setting interface . User can select the test mode, set the measurement wavelength and time, time interval, the ordinate range. Click in the wavelength column, input the wavelength value in the digital input window, click

to make sure the setting. Then, separately set the ordinate range and time like the same. Click 

to return to the kinetic analysis interface after completing all the settings.

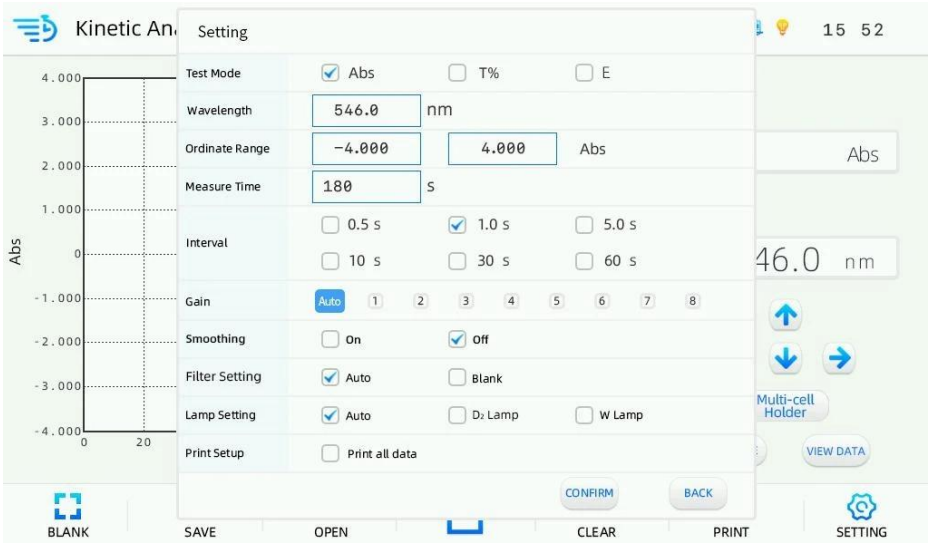


Figure 35

The time interval can be selected among 0.5 s,1.0 s, 5.0 s, 10 s, 30 s, and 60 s.

Step 3 Kinetics scan.

Put the blank solution separately into the reference light path and sample light path, and click BLANK . The instrument will be adjusted to 0.000 Abs/100.0 %T under certain wavelength. Then, replace the blank solution with the sample solution only

in the sample light path, click MEASURE to begin the kinetics scan. The scan curve will be shown instantly in the graph display area during the kinetics scan process.

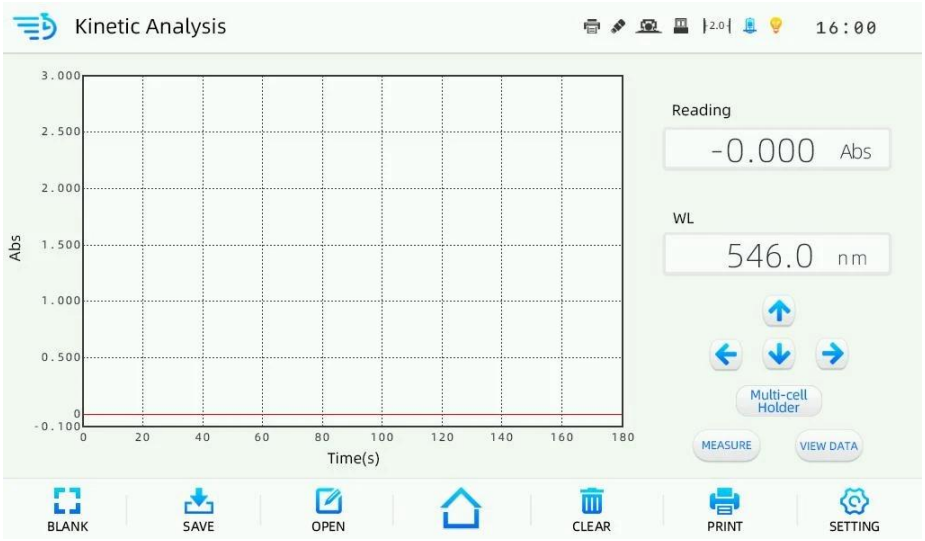


Figure 36

3.5.2 Data processing

Data retrieval with the graph is available after completing the kinetics scan. User can click to enter the data sheet displaying interface after completing kinetics scan, and do data processing such as data browsing, retrieval,saving, deleting, and printing.

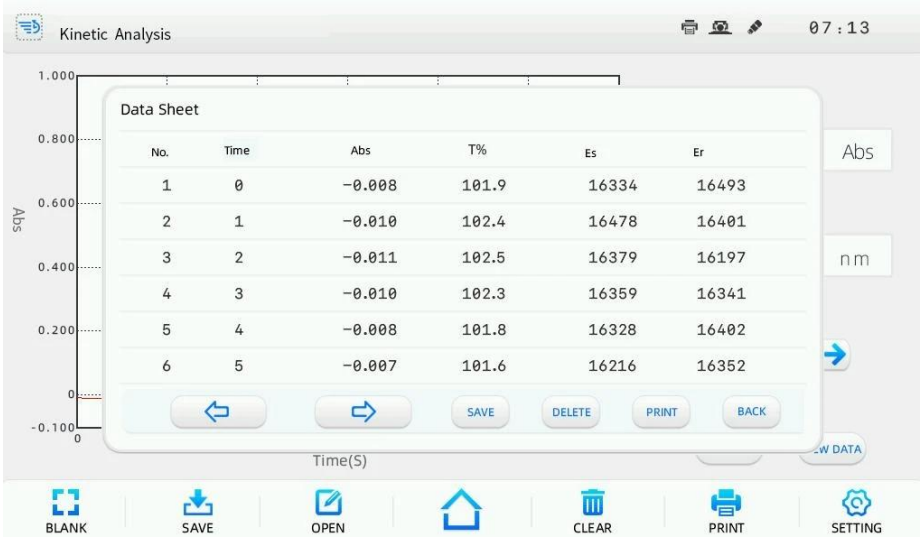


Figure 37

Data browsing: In the data sheet displaying interface, user can browse the data pages by clicking  and  .

Data retrieval: After completing the kinetics scan, user can click  or  to move the cursor to the most left or the most right of the scanning curve in the graph display area. User also can search the data by clicking  or  to move the cursor to left or right point by point. If quickly searching the data at a certain point is demanded, user can click the corresponding position in the graph display area first, so that the cursor initially locks the search area, and then perform accurately searching by clicking  or  .

Data saving: User can save the data to the instrument memory by clicking  . When a USB storage device is connected, user can select to save the data to the USB storage device. Input the file name in the file save window, and click  , the file will be saved with the suffix of ".kin".

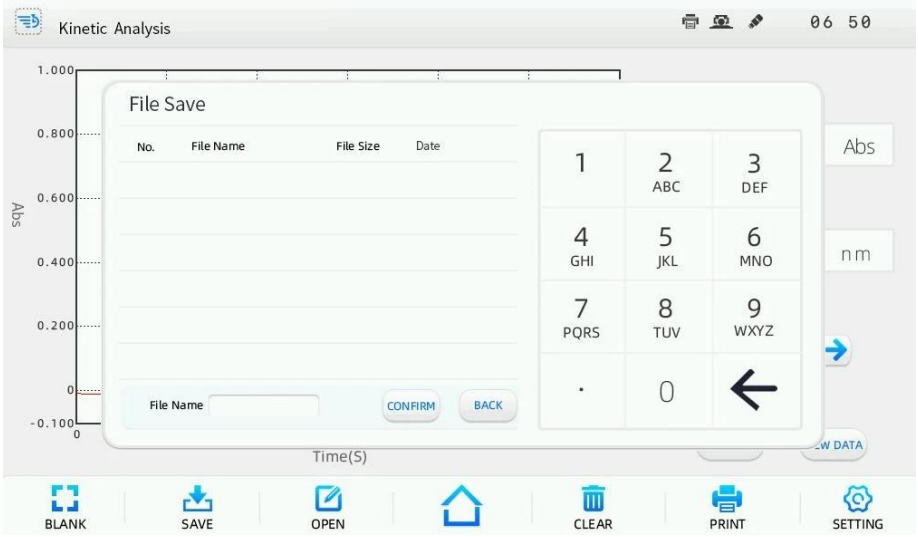


Figure 38

 The valid length of the file name is no more than eight characters.

For data that already saved in the instrument memory, if user want to save it to the USB storage device

later, please insert the USB storage device first. After opening the data in the instrument memory, long press SAVE and keep it for more than 3s before releasing, the file save prompts will pop up, select to save to the USB storage device, and then input the file name and confirm it, the data saving will be completed.

Data opening: Click OPEN to enter the data opening interface . User can select the file to be opened, and click CONFIRM to open the data.

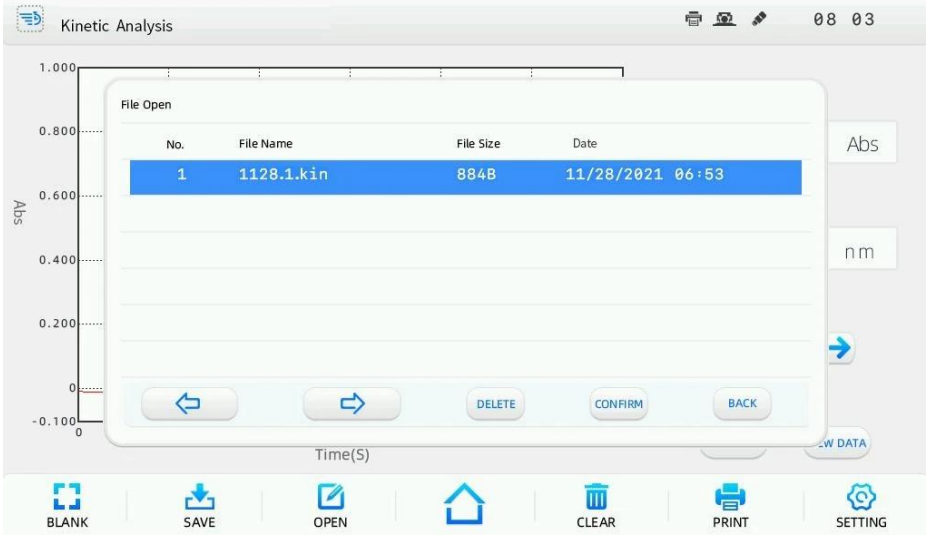


Figure 39

Data printing: User can print the data by clicking PRINT if a printer is connected. A dialog box will pop up , click to print the data.

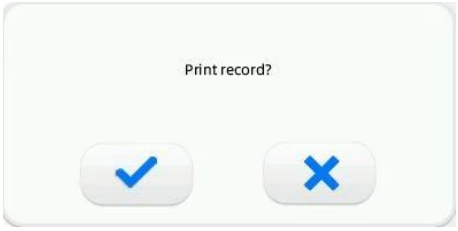


Figure 40

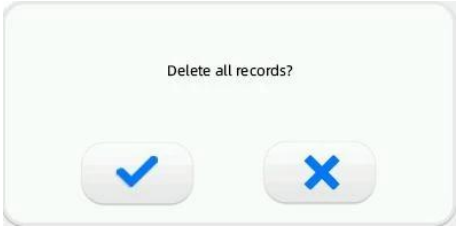


Figure 41

Data deleting: If the data displayed in the data sheet need to be deleted, user can click DELETE at the bottom of the data sheet, a dialog box will pop up, click to make sure the deleting. User also can click CLEAR on the lower pane of the operation interface to perform the data deleting.

It's not available for deleting a part of the kinetic scan data. Once performing the data deleting, all the data displayed will be deleted.

3.6 Wavelength Scan

A curve of absorbance or transmittance or energy in a certain wavelength range is available with wavelength scan. User can do qualitative analysis such as to determine components of a simple sample by this function.

Click the icon 

in the main interface to enter the wavelength scan interface

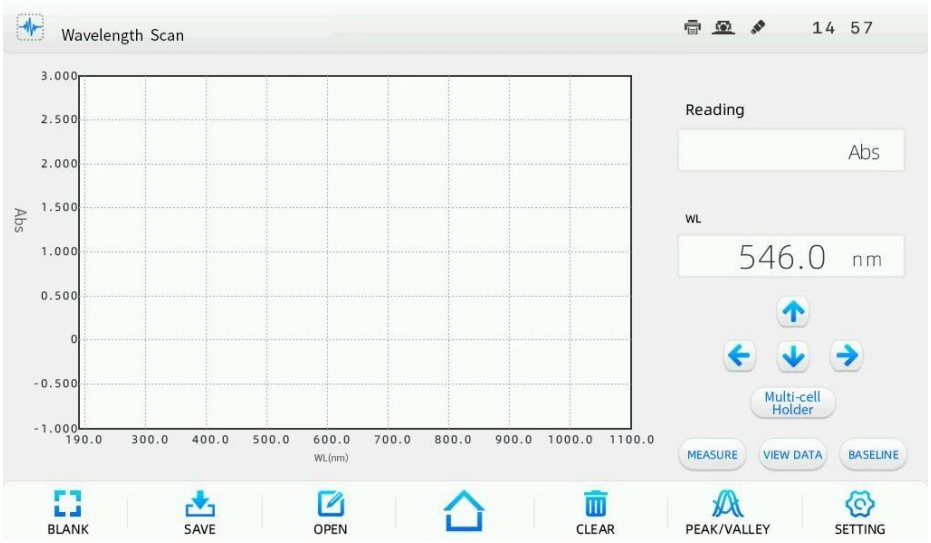


Figure 42

3.6.1 Wavelength scan

Following are the operation steps for wavelength scan:

Step 1 Enter the wavelength scan interface.

Click the icon 

in the main interface to enter the wavelength scan interface.

Step 2 Set the wavelength scan parameters.

Click 

to enter the wavelength scan setting interface. User can select the test mode, set the measurement wavelength range and the ordinate range, select the wavelength interval and scanning speed. Click

in the wavelength column, successively input the value of wavelength range in the digital input window, click 

to make sure the setting. Set the ordinate range like the same. The wavelength interval can be selected among 0.1 nm, 0.2 nm, 0.5 nm, 1.0 nm, 2.0 nm, and 5.0 nm. There are three kinds of scanning speed for selection, fast, medium, and slow. Just select the right wavelength interval and scanning speed. Then, click to return to the wavelength scan interface after completing all the settings.

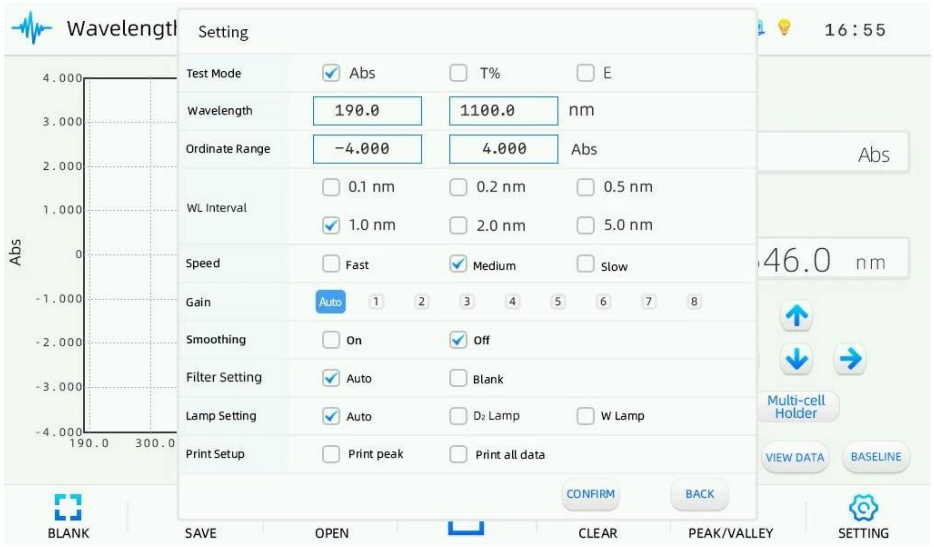


Figure 43

Step 3 System baseline calibration.

System baseline calibration should be done before performing the wavelength scan. Click BASELINE to enter the system baseline calibration interface. Click START to perform system baseline calibration. Click BACK to return to the wavelength scan interface after completing the calibration.

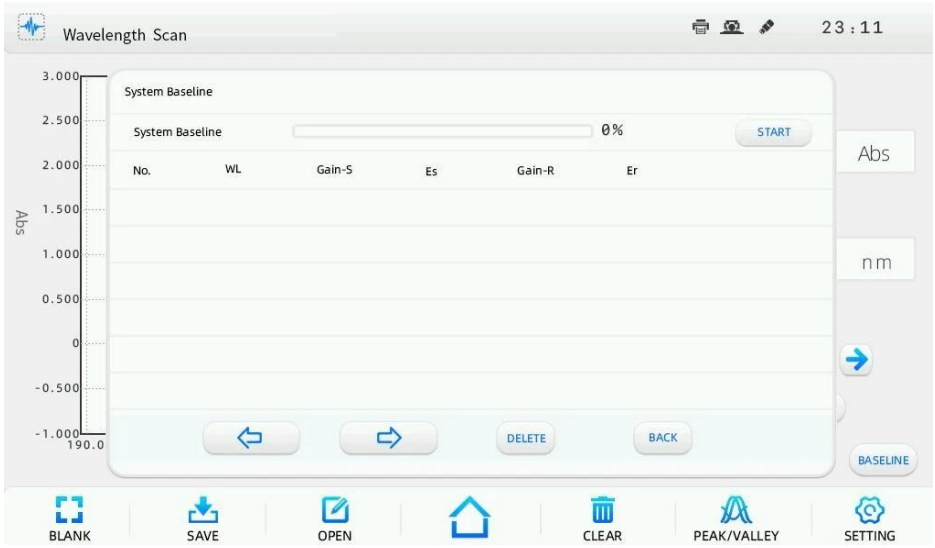


Figure 44

Step 4 Wavelength scan.

Put the blank solution separately into the reference light path and sample light path, and click BLANK to perform blank calibration. A prompt "Blank Correction..." will be shown at the same time. The instrument will be adjusted to 0.000
Abs/100.0 %T under each wavelength. Then, replace the blank solution with the sample solution only in the sample light path, click MEASURE to begin the wavelength scan. The scan curve will be shown instantly in the graph display area during the wavelength scan process .

Figure 45

The scanning sequence is from the maximum wavelength to the minimum wavelength. The system will automatically give buzzing alarm after completing the baseline calibration and sample scan, and the instrument will return to the maximum wavelength at the same time.

3.6.2 Data processing

Data retrieval with the graph is available after completing the wavelength scan. User can click VIEW DATA to enter the data sheet displaying interface after completing wavelength scan, and do data processing such as data browsing, retrieval,saving, deleting, printing, and peak or valley searching.

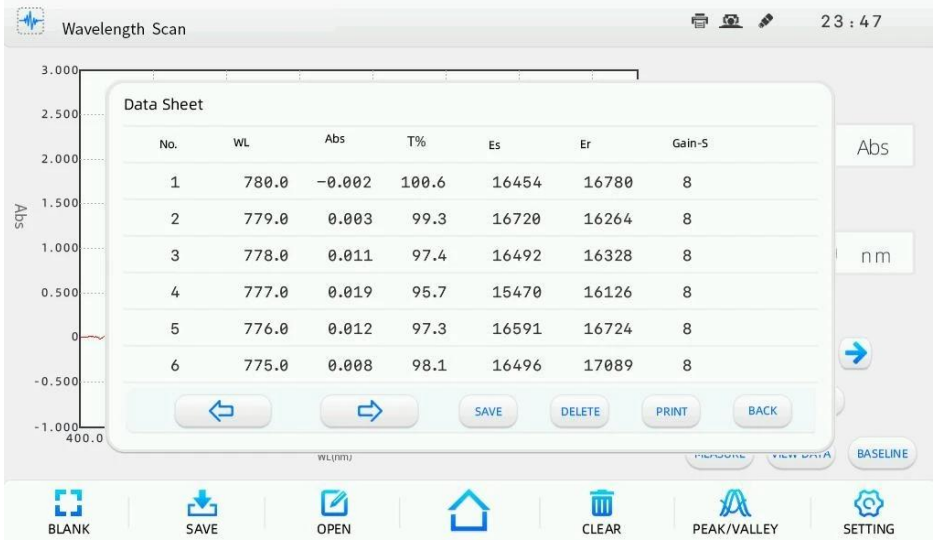


Figure 46

Data browsing: In the data sheet displaying interface, user can browse the data pages by clicking and .

Data retrieval: After completing the wavelength scan, user can click and to search the peaks or valleys. User also can click and to search the data point by point. If quickly searching the data at a certain point is demanded, user can click the corresponding position in the graph display area first, so that the cursor initially locks the search area, and then perform accurately searching by clicking or .

Data saving: User can save the data to the instrument memory by clicking SAVE . When a USB storage device is connected, user can select to save the data to the USB storage device. Input the file name in the file save window, and click CONFIRM , the file will be saved with the suffix of ".wls".

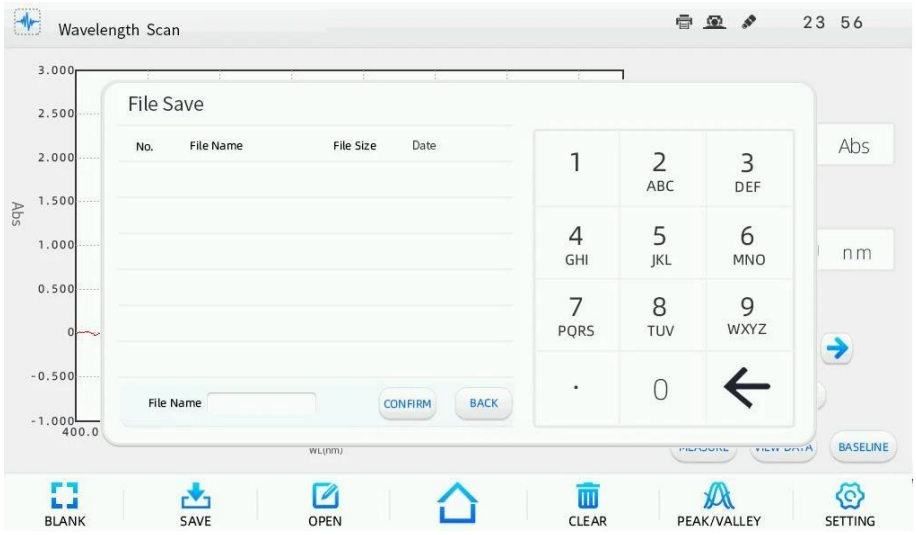


Figure 47

The valid length of the file name is no more than eight characters.

For data that already saved in the instrument memory, if user want to save it to the USB storage device later, please insert the USB storage device first. After opening the data in the instrument memory, long press SAVE and keep it for more than 3s before releasing, the file save prompts will pop up, select to save to the USB storage device, and then input the file name and confirm it, the data saving will be completed.

Data opening: Click OPEN to enter the data opening interface . User can select the file to be opened, and click CONFIRM to open the data.

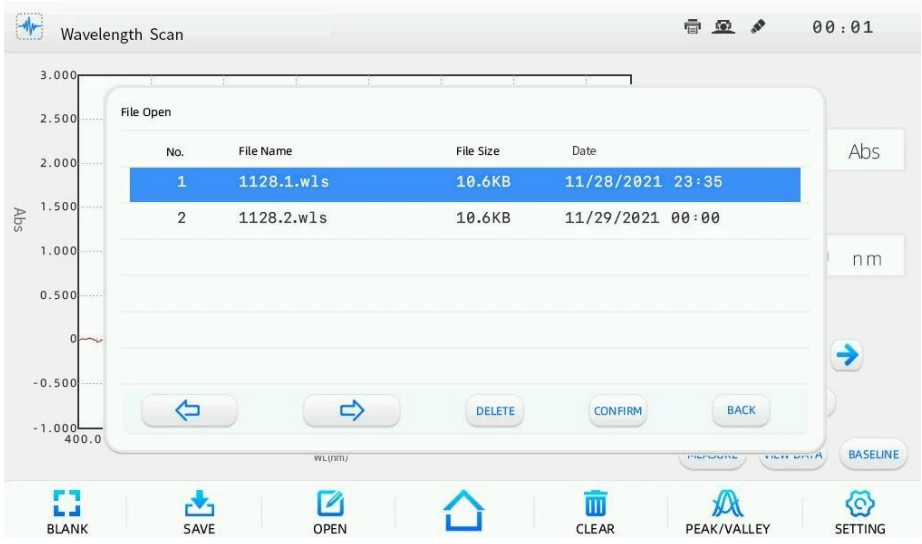


Figure 48

Peak/Valley searching: User can perform peak or valley searching after completing wavelength scan

.Click PEAK/VALLEY to enter the operation interface of peak/valley searching . Select the searching mode (peak or valley), set the appropriate threshold value and click CALCULATION , the searching result will be shown in the list.

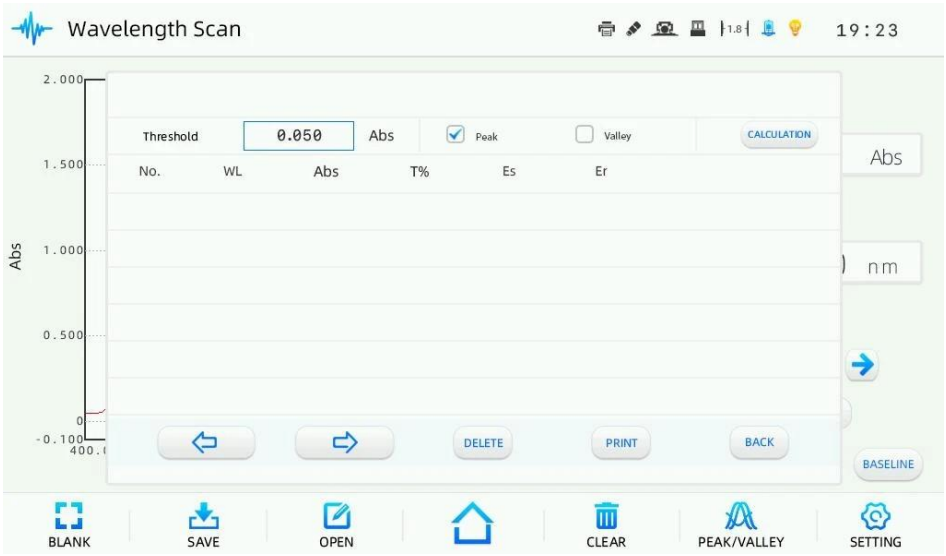


Figure 49

Data printing: User can print the data by clicking PRINT if a printer is connected. A dialog box will pop up, click ✓ to print the data.

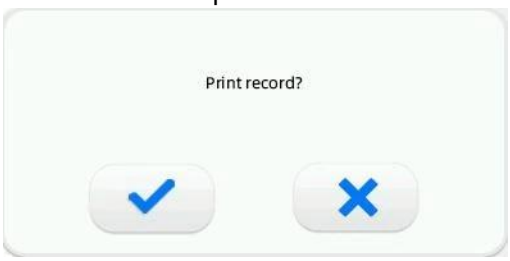


Figure 50

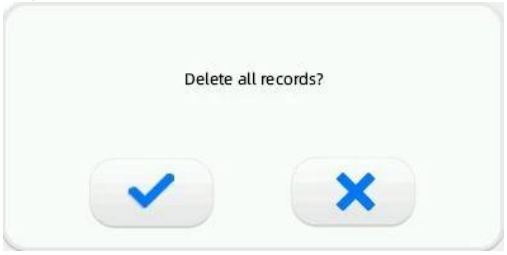


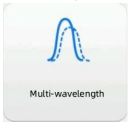
Figure 51

Data deleting: If the data displayed in the data sheet need to be deleted, user can click DELETE at the bottom of the data sheet, a dialog box will pop up, click ✓ to make sure the deleting. User also can click CLEAR on the lower pane of the operation interface to perform the data deleting.

It's not available for deleting a part of the wavelength scan data. Once performing the data deleting, all the data displayed will be deleted.

3.7 Multi-wavelength Measurement

User can quickly obtain absorbance or transmittance values of the sample under several wavelengths with multi-wavelength measurement.

Click the icon 

in the main interface to enter the multi-wavelength measurement interface.

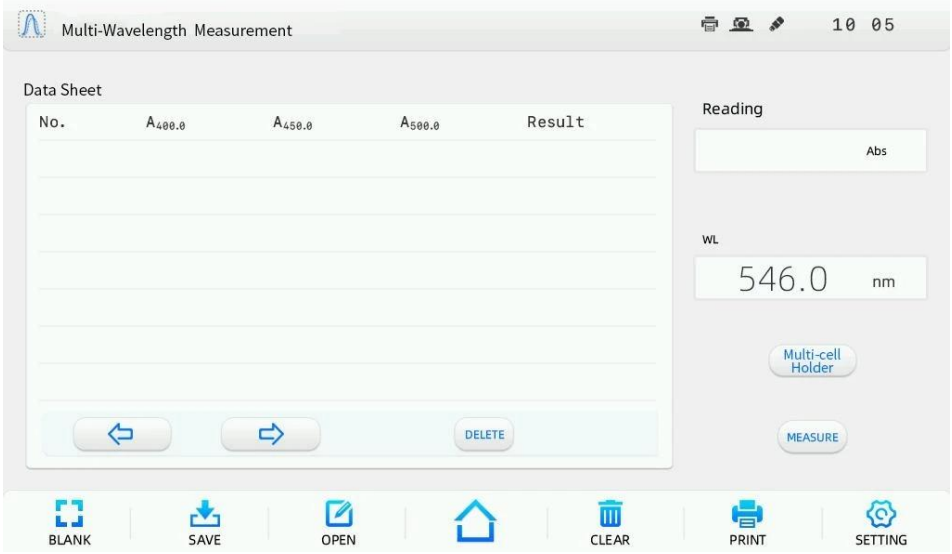
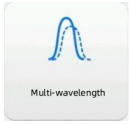


Figure 52

3.7.1 Multi-wavelength measurement

Following are the operation steps for multi-wavelength measurement: Step 1 Enter the multi-wavelength measurement interface.

Click the icon 

in the main interface to enter the multi-wavelength measurement interface.

Step 2 Set the measurement parameters.

In the multi-wavelength measurement interface, click 

to enter the parameters setting interface. Select the test mode first. There are two test mode for chosen, absorbance and transmittance. Up to eight wavelengths can be set.

Select the right wavelength number, and click in the first wavelength column, a

digital input window will pop up. Click 

after inputting the wavelength value. Click in the calculation parameter column, user can edit the calculation

parameter. Input other wavelengths and calculation parameters successively. Then, click 

to return to the multi-wavelength measurement interface after completing all the settings.

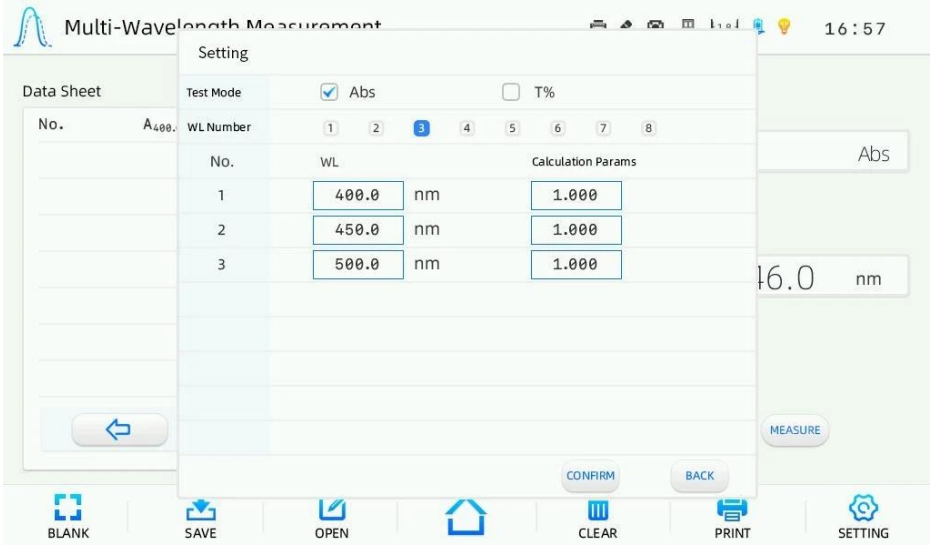


Figure 53

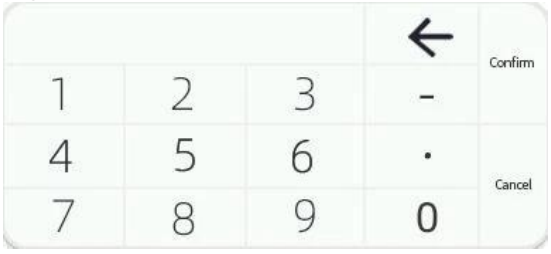


Figure 54

Step 3 Sample measurement.

Put the blank solution or reference solution separately into the reference light path and sample light path, and click BLANK . The instrument will be adjusted to 0.000 Abs/100.0 %T under certain wavelengths. Then, replace the blank solution or reference solution with the sample solution only in the sample light path, click MEASURE and record the measurement result.

3.7.2 Data processing

User can do data processing such as data saving, opening, printing and deleting after completing multi-wavelength measurements.

Data saving: User can save the data to the instrument memory by clicking SAVE . When a USB storage device is connected, user can select to save the data to the USB storage device. Input the file name in the file save window, and click CONFIRM , the file will be saved with the suffix of ".mul".

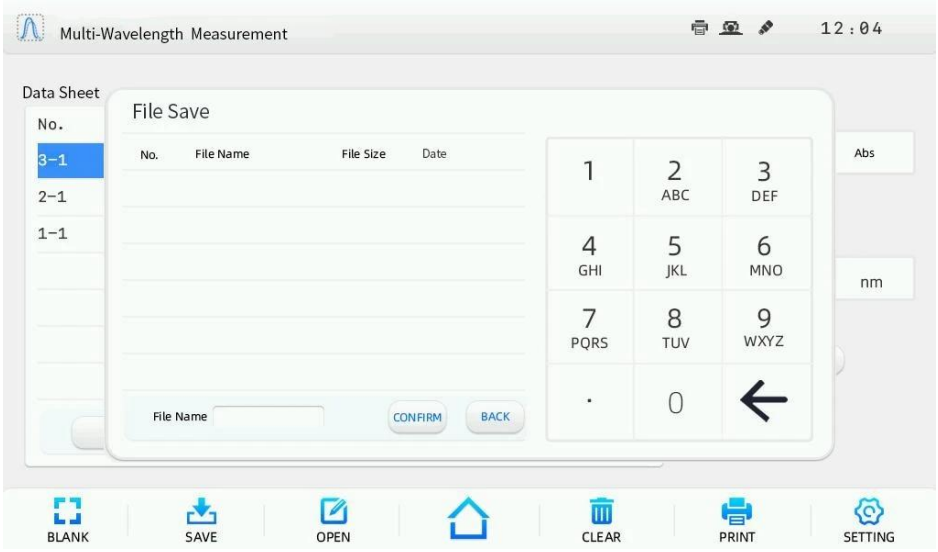


Figure 55

The valid length of the file name is no more than eight characters.

For data that already saved in the instrument memory, if user want to save it to the USB storage device later, please insert the USB storage device first. After opening the data in the instrument memory, long press SAVE and keep it for more than 3s before releasing, the file save prompts will pop up, select to save to the USB storage device, and then input the file name and confirm it, the data saving will be completed.

Data opening: Click OPEN to enter the data opening interface. User can select the file to be opened, and click CONFIRM to open the data.

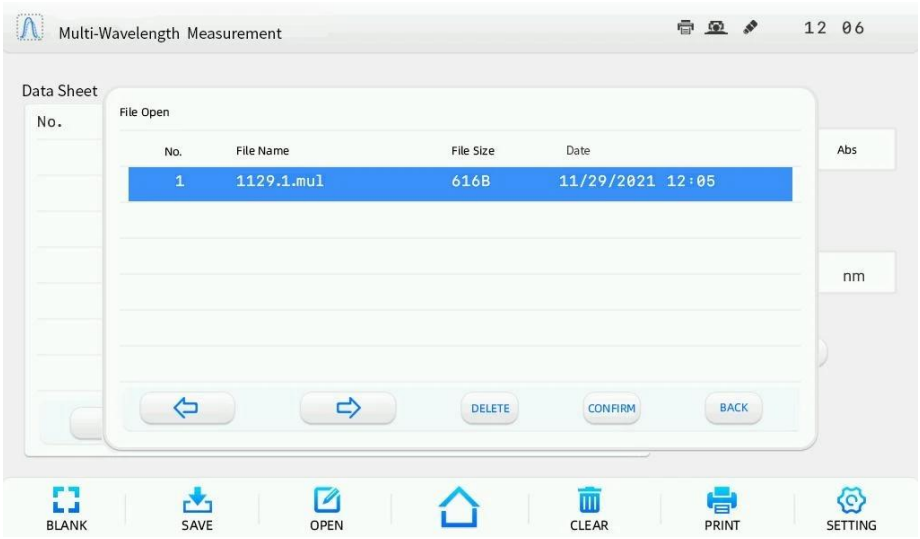


Figure 56

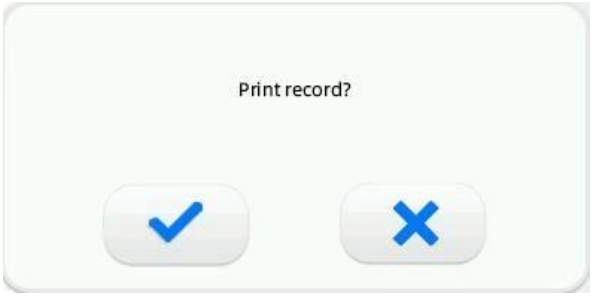


Figure 57

Data printing: User can print the data by clicking PRINT if a printer is connected. A dialog box will pop up , click to print the data.

Data deleting: If a few data need to be deleted, user can select the row of the data and click DELETE at the bottom of the data sheet, a dialog box will pop up, click to make sure the deleting. User also can click CLEAR on the lower pane of the operation interface to clear all the data displayed in the data sheet. A dialog box will pop up , click " " to make sure the deleting.

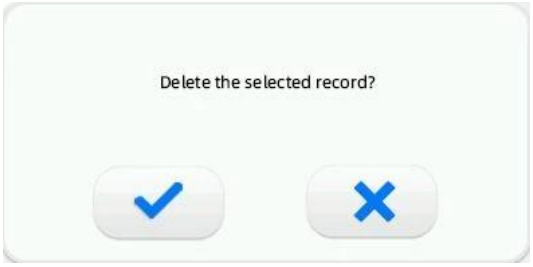


Figure 58

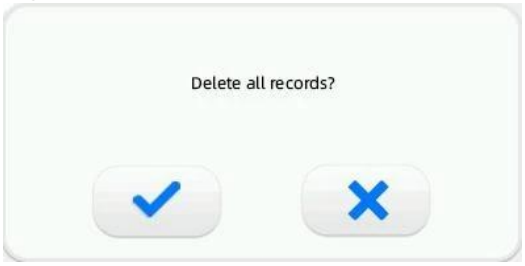


Figure 59

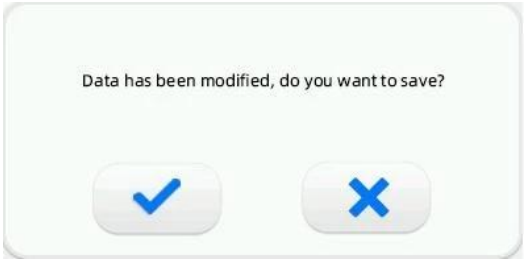


Figure 60

The delete operation only works for current display. The already saved data won't lost. Before exit the current interface or returning to the main interface, a dialog box will pop up. If the data after delete operation need to be saved, user can click to save the updated data.

3.8 DNA/Protein Measurement

With the DNA/Protein measurement function, quantitative analysis and purity detection of DNA and protein according to the UV absorption characteristics are available.

Click the icon 

in the main interface to enter the DNA/Protein measurement interface.

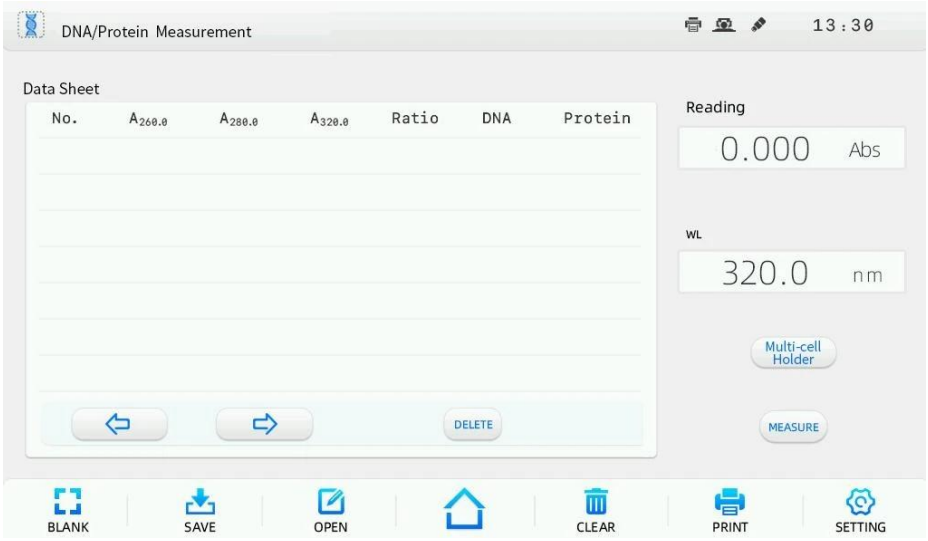


Figure 61

3.8.1 DNA/Protein measurement

Following are the operation steps for DNA/Protein measurement:

Step 1 Enter the DNA/Protein measurement interface.

Click the icon 

in the main interface to enter the DNA/Protein measurement interface.

Step 2 Select the test mode.

In the DNA/Protein measurement interface, click 

to enter the measurement setting interface . There are two test modes for selection, method 1 with the calculation formula of CDNA=(A260 - A320) 62.9 - (A280 - A320) 36, CProtein=(A280 - A320) 1552 - (A260 - A320) 757.3, and method 2 with the calculation formula of CDNA=(A260 - A320) 49.1 - (A230 - A320) 3.48, CProtein=(A230 - A320) 183 - (A260 - A320) 75.8. Select the right test mode, and click 

to return to the DNA/Protein measurement interface.

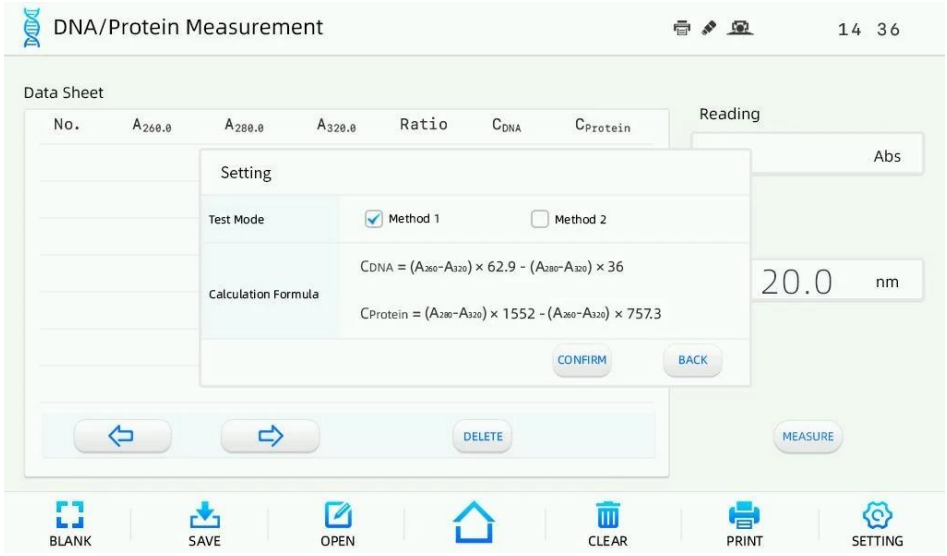


Figure 62

Step 3 Sample measurement.

Put the blank solution or reference solution separately into the reference light path and sample light path, and click BLANK . The instrument will be adjusted to 0.000 Abs/100.0 %T under certain wavelengths. Then, replace the blank solution or reference solution with the sample solution only in the sample light path, click MEASURE and record the measurement result.

3.8.2 Data processing

User can do data processing such as data saving, opening, printing and deleting after completing DNA/Protein measurements.

Data saving: User can save the data to the instrument memory by clicking SAVE . When a USB storage device is connected, user can select to save the data to the USB storage device. Input the file name in the file save window, and click CONFIRM , the file will be saved with the suffix of ".dna".

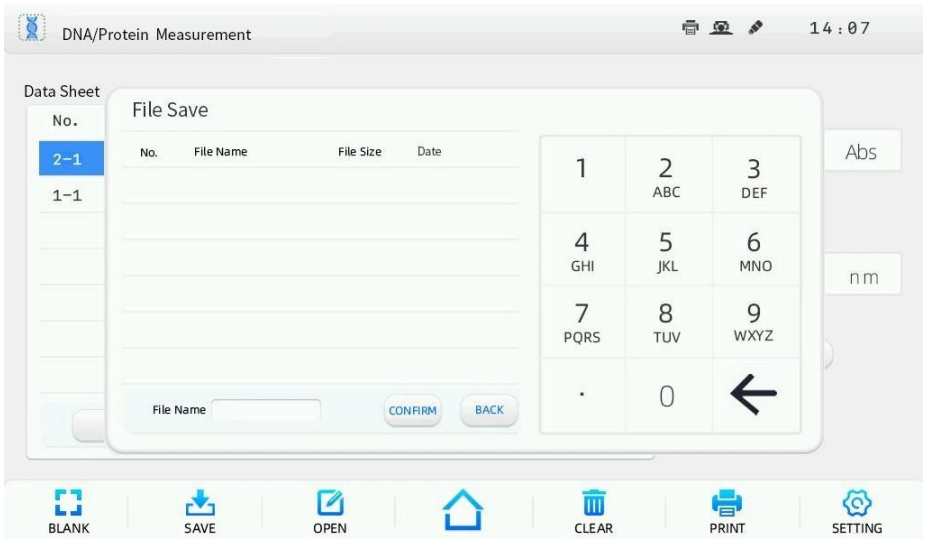


Figure 63

The valid length of the file name is no more than eight characters.

For data that already saved in the instrument memory, if user want to save it to the USB storage device later, please insert the USB storage device first. After opening the data in the instrument memory, long press SAVE and keep it for more than 3s before releasing, the file save prompts will pop up, select to save to the USB storage device, and then input the file name and confirm it, the data saving will be completed.

Data opening: Click OPEN to enter the data opening interface. User can select the file to be opened, and click CONFIRM to open the data.

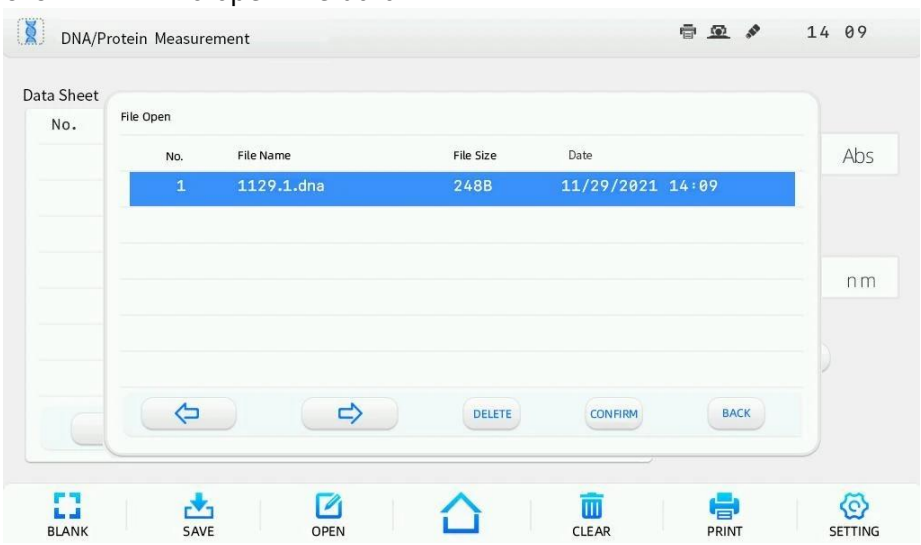


Figure 64

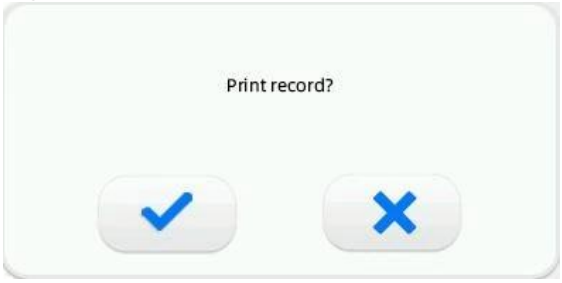


Figure 65

Data printing: User can print the data by clicking PRINT if a printer is connected. A dialog box will pop up, click ✓ to print the data.

Data deleting: If a few data need to be deleted, user can select the row of the data and click DELETE at the bottom of the data sheet, a dialog box will pop up, click ✓ to make sure the deleting. User also can click CLEAR on the lower pane of the operation interface to clear all the data displayed in the data sheet. A dialog box will pop up, click ✓ to make sure the deleting.

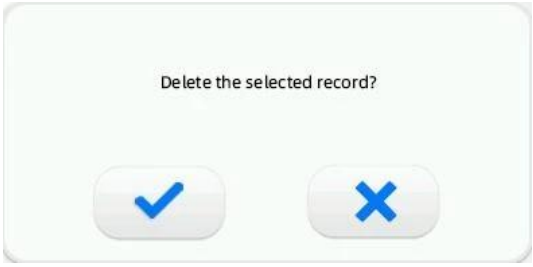


Figure 66

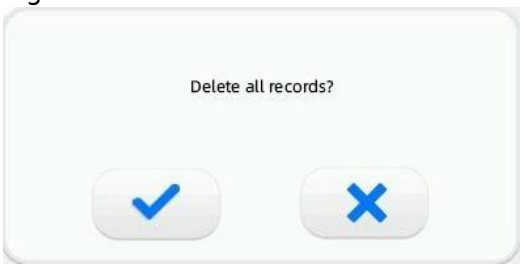


Figure 67

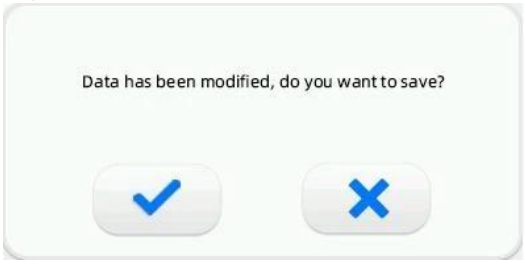


Figure 68

The delete operation only works for current display. The already saved data won't lost. Before exit the current interface or returning to the main interface, a dialog box will pop up. If the data after delete operation need to be saved, user can click to save the updated data.

3.9 System Settings

Operations such as dark current calibration, wavelength calibration, bandwidth setting, time settings, lamps management, general settings, and the relevant operation with file system and system information are available in the system settings interface.

Click the icon 

in the main interface to enter the system settings interface

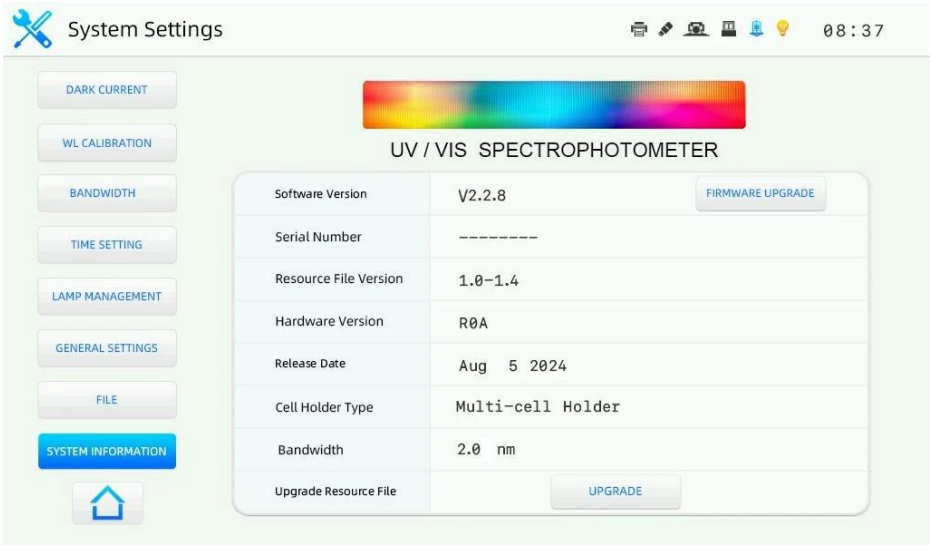


Figure 69

3.9.1 Dark current calibration

The dark current may changes when the instrument runs for a long time, or the wavelength is set again, or any other influences. For measurement accuracy, the dark current calibration is necessary before measurement.

Click DARK CURRENT in the system settings interface to enter the dark current calibration interface.

Click START , the system will start the calibration and a prompt "Correcting dark current..." will be shown. The dark current data displayed will be refreshed after completing the calibration. Click  to return to the main interface.

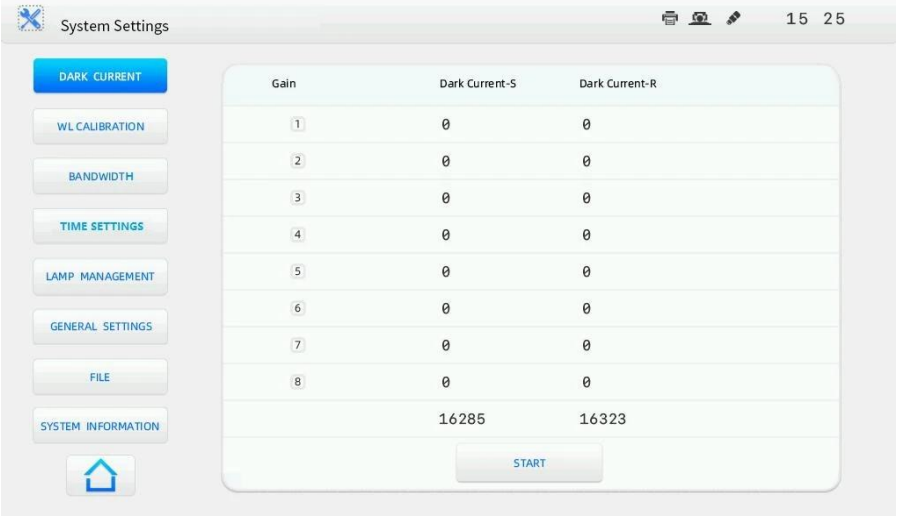


Figure 70

3.9.2 Wavelength calibration

The wavelength calibration is necessary when user doubts that there is a deviation of the wavelength.

Click WL CALIBRATION in the system settings interface to enter the wavelength calibration interface .

Click START , the system will start the calibration of characteristic wavelength 656.1nm with the deuterium lamp in the instrument, and a prompt "Correcting

wavelength..." will be shown. The calibration process may cost more than one minute. Click  to return to the main interface after completing the calibration.

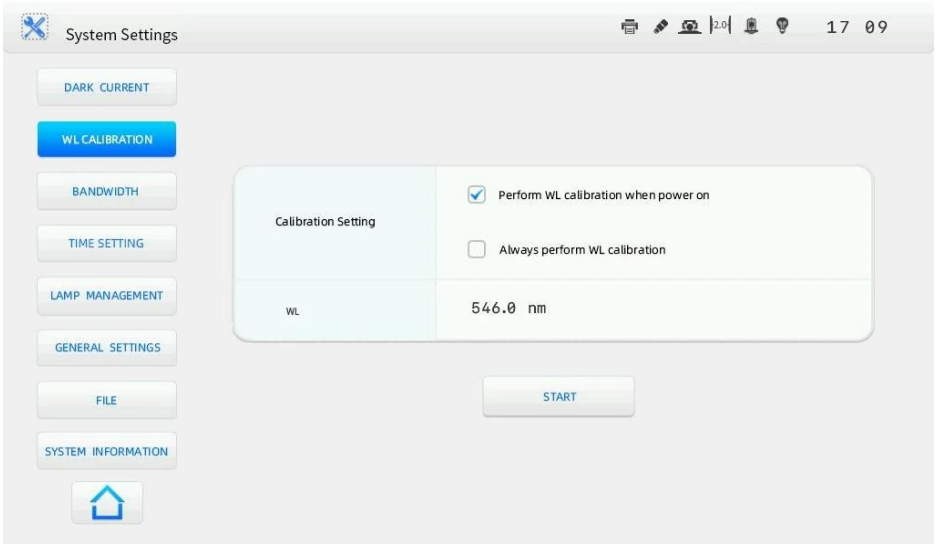


Figure 71

3.9.3 Bandwidth setting

User can set the bandwidth. Click

in the system settings interface to enter the bandwidth setting interface . The bandwidth of UV/Vis Spectrophotometer is fixed with 1.8nm or 1.0nm which depends on user requirements.

UV/Vis Spectrophotometer is adjustable, and there are five kinds of bandwidth for selection, 0.5 nm, 1.0 nm, 2.0 nm, 4.0 nm, and 5.0 nm.

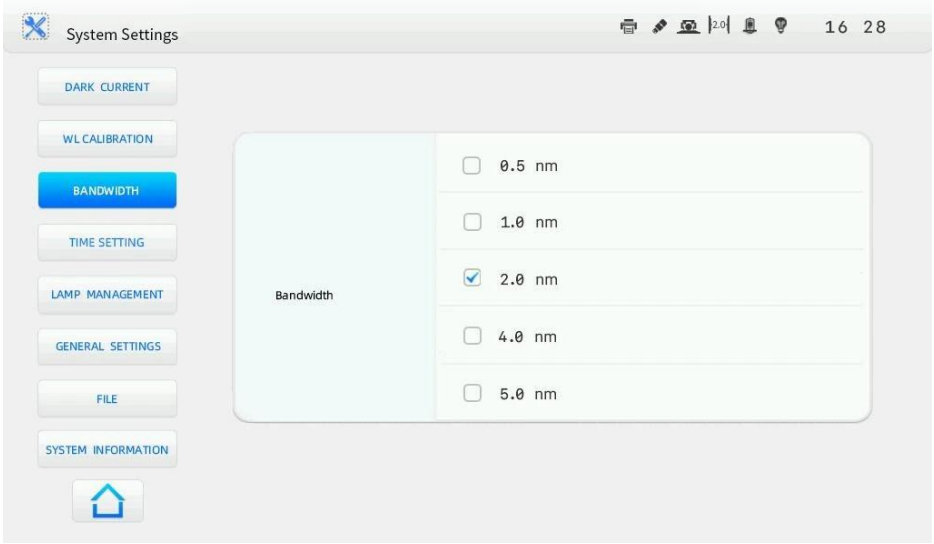


Figure 72

3.9.4 Time settings

User can set the system displaying time. Click 

in the system settings interface to enter the time setting interface.

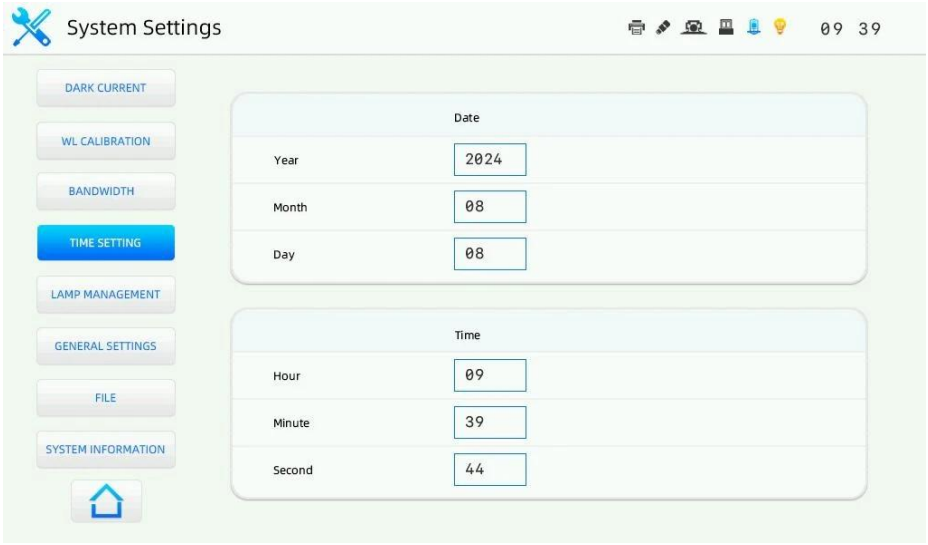


Figure 73

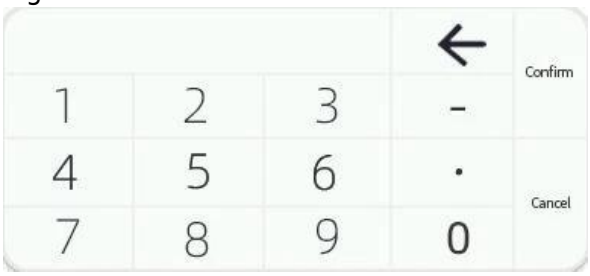


Figure 74

Click in the year column, a digital input window will pop up. Click after

inputting the year value.

Successively set other time parameters. Click  to return to the main interface after completing all the settings.

3.9.5 Lamps management

Click

in the system settings interface to enter the lamps management interface.

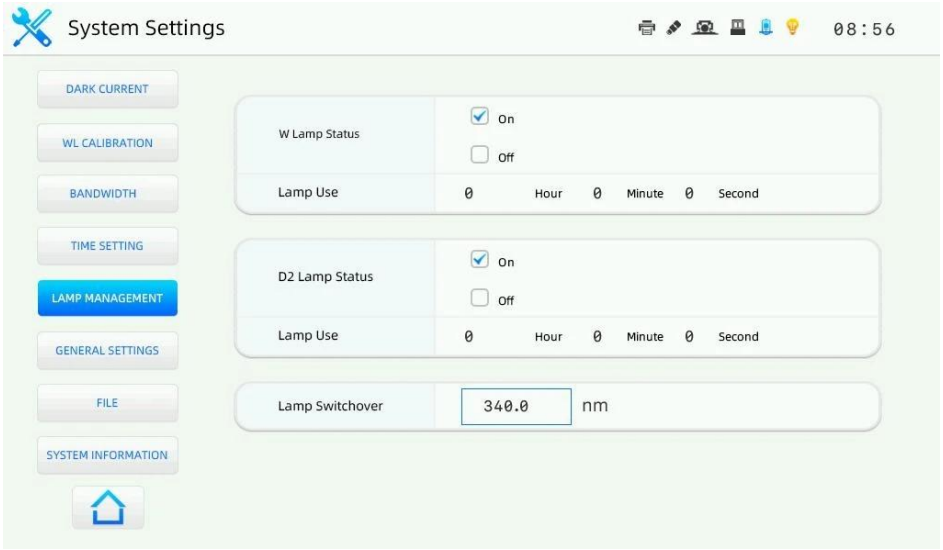


Figure 75

User can switch on or off the lamp as necessary. The service time of the lamp is recorded. User also can

set the lamp switchover wavelength. Click in the lamp switchover column, input the switchover wavelength value in the pop-up digital input window and click Confirm to confirm the setting.

User maybe only use the UV range or visible range to measure, to prolong the service life of the lamp, switching off the idle lamp after the instrument completing self-diagnosis is suggested.

The default lamp conversion wavelength is 340nm, and the valid setting range is between 300nm and 400nm. For measurement accuracy, please don't measure just under the switchover wavelength. Please set the switchover wavelength properly before measurement.

3.9.6 General settings

Click GENERAL SETTINGS in the system settings interface to enter the general setting interface . User can data precision, buzzer on or off, printer type, time format, and date format. The screen brightness also can be set. User can click CONFIRM to restore the factory defaults as necessary, and a dialog box will pop up (Fig. 3-74), click ✓ to make sure the restoring. And a prompt "Restore factory settings? " will be shown.

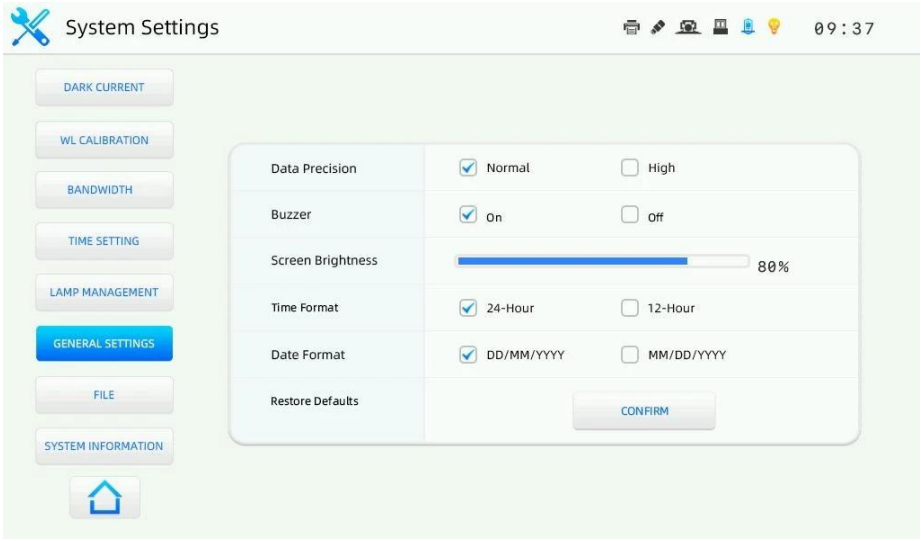


Figure 76

Figure 77

All the saved data including the test record, parameters setting and standard curves will be cleared by factory defaults restoring. So, please be careful to perform this operation.

3.9.7 File system

Click FILE in the system settings interface to enter the file system operation interface . User

can click FORMAT to perform file format as necessary, and a dialog box will pop up , click ✓ to make sure the format, and a prompt "Format file system?" will be shown. Otherwise, click ✕ to exit the file formatting.

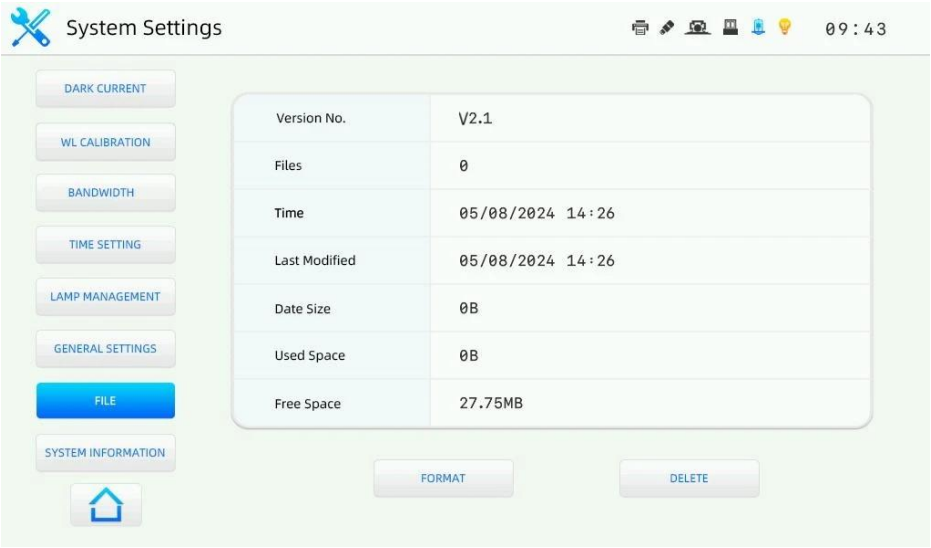


Figure 78

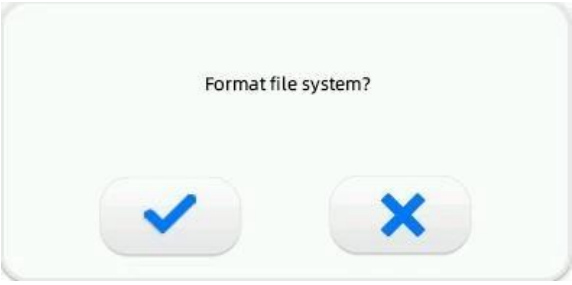


Figure 79

Once the file formatting is performed, all the data saved will be cleared. So, please be careful to perform this operation.

User also can delete the file. Click DELETE to enter the file opening interface, select the file and click DELETE at the bottom of the file list, a dialog box will pop up, click ✓ to make sure the file deleting. Otherwise, click ✕ and BACK to exit the deleting.

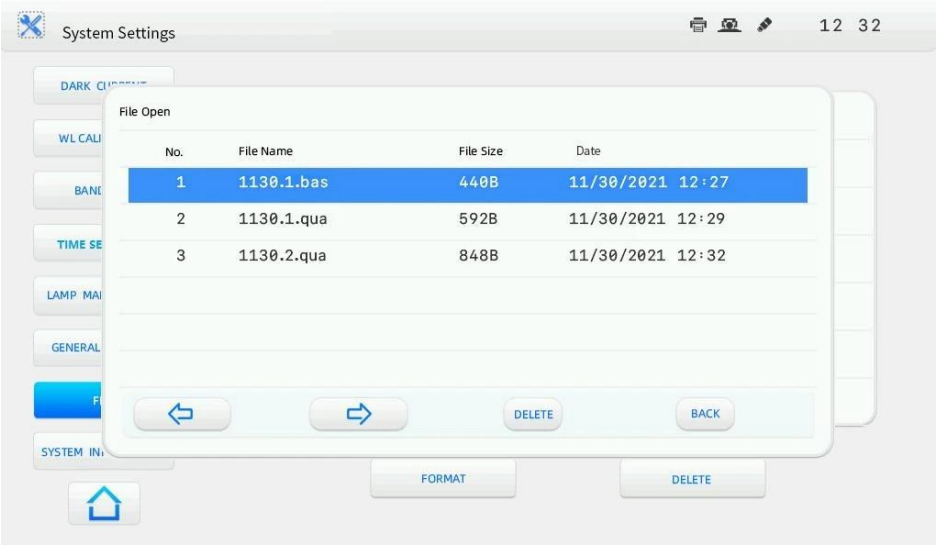


Figure 80

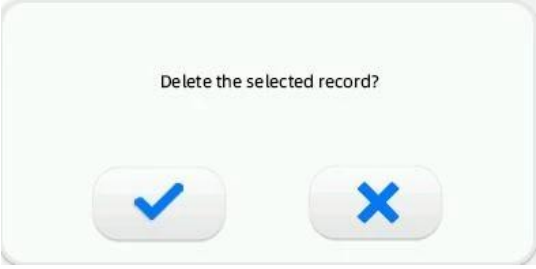


Figure 81

3.9.8 System information

Click SYSTEM INFORMATION in the system settings interface to enter the system information displaying interface. The system information such as software version, resource file version, hardware version, release date, cell-holder type, and bandwidth can be viewed

in this interface. User also can click UPGRADE to upgrade the resource file as necessary.

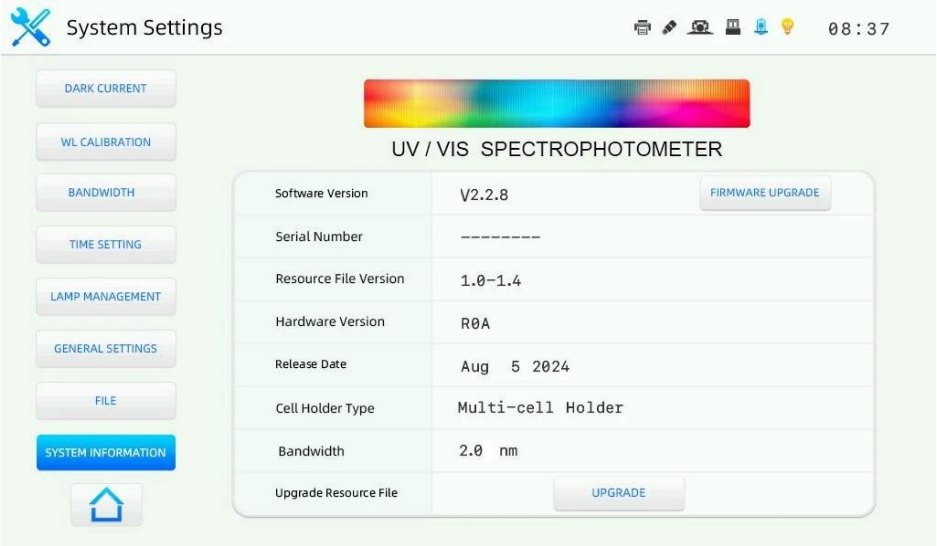


Figure 82

The version information may change with the system updating. Please just refer to the actual information with your instrument.

4. Maintenance

4.1 Maintenance

UV/Vis Spectrophotometer is a precise optical instrument. It was assembled and debugged carefully before delivery. However, appropriate maintenance will not only guarantee its reliability and stability, but also prolong its service life. Correct use is the best maintenance. In addition to previously mentioned installation requirements, following tips also should be noticed in daily use.
(1) Before switching on the power, make sure that neither sample in the sample compartment nor any other block in the light path, and the cell holder position is all right, to avoid error during the self-diagnosis.
(2) Please carefully load the solution into the cuvette, and the height is better no more than 2/3 of the cuvette. Try to avoid the bubble generation, for the bubble on the inner surface of the cuvette or in the solution will affect the measurement result. Please wipe off the solution that residue on the outer surface of the cuvette in time. To measure volatile samples, using with cuvette cover is suggested. Try to avoid contamination to the cell holder, otherwise, wipe off the residue solution on the cell holder promptly.
(3) Don't touch both the two optical surfaces of the cuvette with finger, for the finger will absorb the light and furtherly affect the measurement accuracy. Please handle the cuvette gently, for it is frangible. Clean the cuvette properly. Improper cleaning or without enough clean also will affect the measurement accuracy, even cause unstable result.
(4) Whether placing or removing the sample, please close the lid of the sample compartment in time during the measurement. Please remove the sample from the sample compartment promptly after completing the measurement, check that there is no residue in the sample compartment and keep it dry. Any solution sample or residue left in the sample compartment may cause damage to parts of the instrument such as filter turning moldy, some components be corroded. Please open and close the lid gently.
(5) To prolong the service life of the lamp, switching off the idle lamp during the measurement is suggested. Please switch off the instrument and disconnect the plug in time, to prevent possible damage from thunderstorms.
(6) Be careful in the transport. Don't place heavy object onto the instrument, to prevent the light path shift which will furtherly affect the instrument stability and measurement accuracy.
(7) Don't disassemble the cover and the inner parts of the instrument without authorization, especially for the optical parts. Don't loosen the tightening screws and nuts at will. All optical surfaces including the light sources can't be touched by hand or any other objects. Otherwise, it may affect the normal operation even cause damage.
(8) Keep the instrument surface and the working environment clean. For the surface of the cover deals with painting process, please don't clean the cover with organic solutions such as alcohol, gasoline and ether. If the instrument is not in use, user can cover the instrument with clean cloth or dust cover to avoid dust accumulation.
(9) A long time not in use should be avoided, and regular boot is suggested to guarantee the normal operation. In the high temperature and humidity area, user should pay more attention to keep away from moisture.

 The instrument self-diagnosis is performed for normal diagnosis each time when switching on the

power. However, the system error may accumulate after transport, moving, and a period of time's use. When the measurement data differs greatly from the experienced value, or any above situation occurs, the dark current calibration and wavelength calibration are suggested to be done.

4.2 Fuse Replacement

Danger! Be sure to switch off the power and unplug the socket before replacement! Following are the steps of replacing the fuse.
Step 1: Power off and unplug the power cord from the instrument.
Step 2: Take out the fuse holder by a 3*75 flat screwdriver with blade, remove the broken fuse from the working position and replace it with the spare fuse

Figure 83

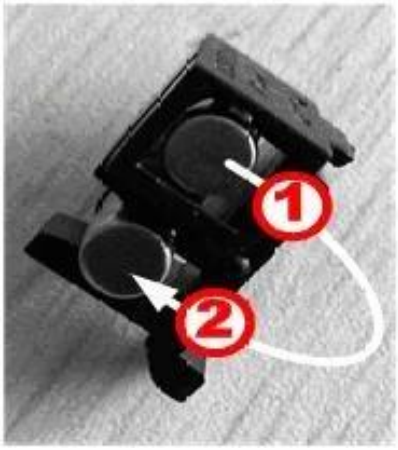


Figure 84
Step 3: Fit the fuse holder back to the position.

4.3 Lamps Replacement

Danger! Be sure to switch off the power and unplug the socket before replacement!
Caution to high temperature! Wait 20 minutes before open the lamp chamber after power off to avoid scald!
4.3.1 Deuterium lamp replacement
Following are the steps of replacing deuterium lamp.
Step 1: Power off and unplug the power cord from the instrument.
Step 2: Remove the four screws on the sides of the spectrophotometer.
Step 3: Remove the cover of the instrument very carefully and place it backside the instrument.
Step 4: Unscrew the four screws on the bottom sides of the lamp chamber cover, then remove the lamp

chamber cover.
Step 5: Disconnect the three leads of the deuterium lamp (Fig. 4-3) from the circuit board, unscrew the two fixing screws (as shown in Fig. 4-4) and remove the deuterium from the base of lamp chamber. Then fix the new lamp onto the right position and connect its three leads to the circuit board.

The deuterium lamp is pre-aligned, there's no need to re-adjust the position. However, the facula should focus on the center of the slit (Fig. 4-5).

Do not handle the lamp with bare fingers. Use clean tissue or cloth when handling lamp.

Figure 85

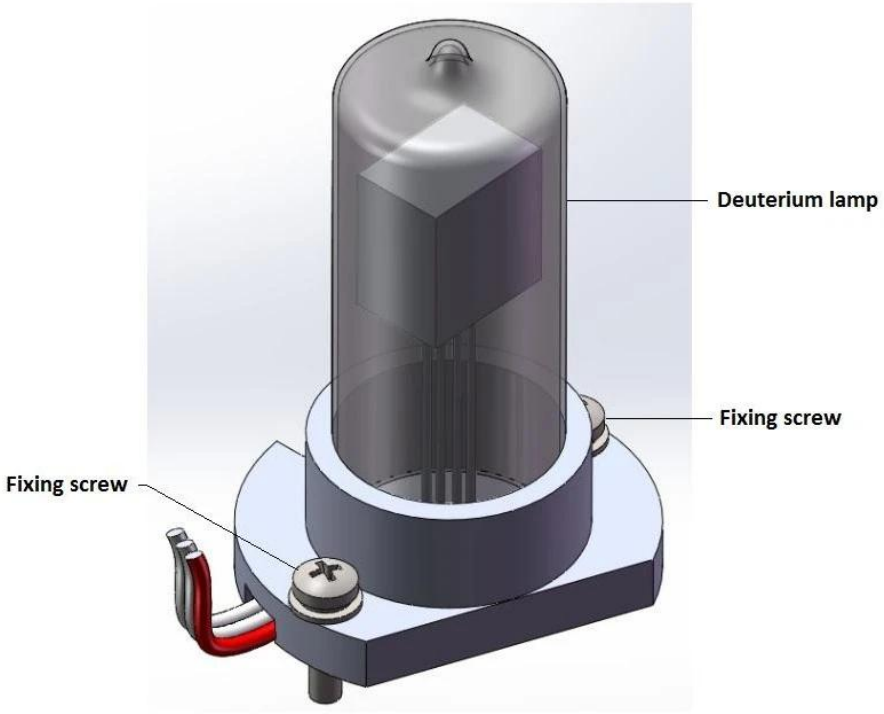


Figure 86

Step 6: Switch on the power, it's just ok when the deuterium lamp lighting up well.
Step 7: Power off. Reinstall the lamp chamber cover and tighten the screws. Then reinstall the instrument cover. Be sure to prevent any wires from being pinched in the process.
Step 8: Reinstall the four screws on the sides of the spectrophotometer.

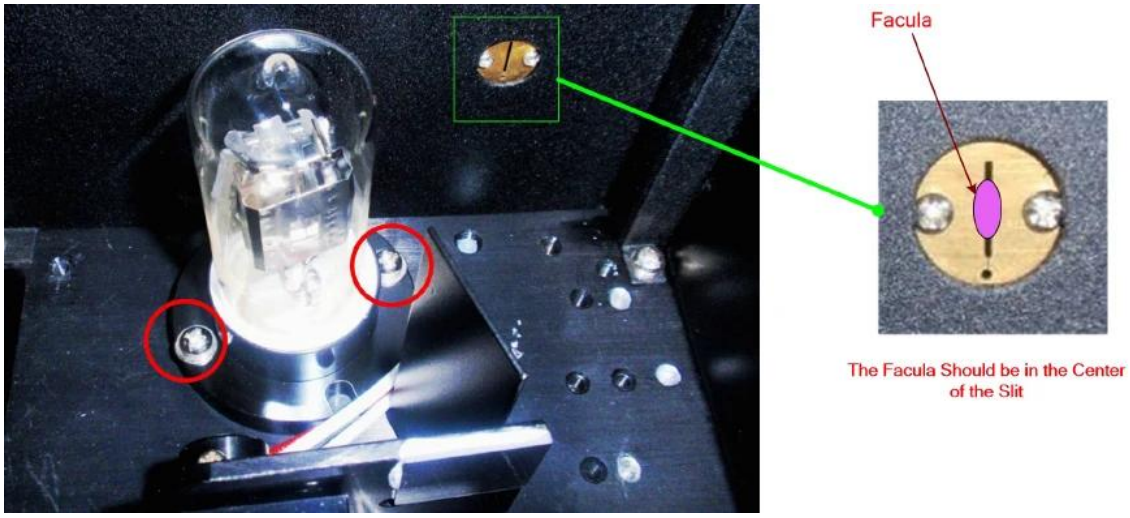


Figure 87

4.3.2 Tungsten halogen lamp replacement

Following are the steps of replacing tungsten halogen lamp.

Step 1: Power off and unplug the power cord from the instrument.

Step 2: Remove the four screws on the sides of the spectrophotometer.

Step 3: Remove the cover of the instrument very carefully and place it backside the instrument.

Step 4: Unscrew the four screws on the bottom sides of the lamp chamber cover, then remove the lamp chamber cover.

Step 5: Unplug and remove the tungsten halogen lamp from the lamp holder.

Insert the new lamp by pushing it in as far as it will go.

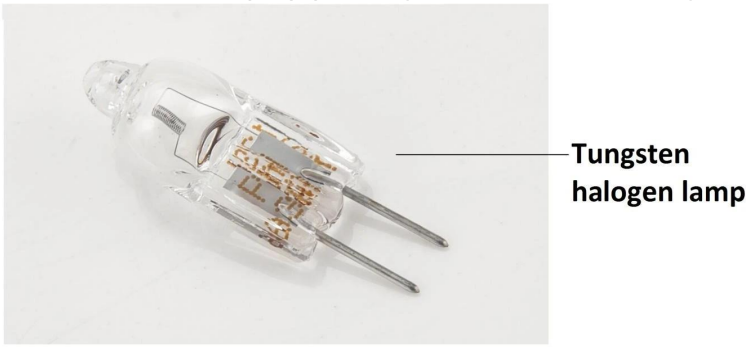


Figure 88

Do not handle the lamp with bare fingers. Use clean tissue or cloth when handling lamp. There's no difference in polarity of the two legs of tungsten halogen lamp.

Step 6: Adjust the lamp location and focus the light spot. For detail adjustment, please refer to Service Manual.

Step 7: Reinstall the lamp chamber cover and tighten the screws. Then reinstall the instrument cover. Be sure to prevent any wires from being pinched in the process.

Step 8: Reinstall the four screws on the sides of the spectrophotometer.

5. Troubleshooting

UV/Vis Spectrophotometer is strictly debugged and inspected before delivery. Commonly, it won't appear problems in normal storage, transport and use. However, wrong operation or extreme states, and problems caused by long-term use still can't be avoided, such as the damage of electrical and optical units caused by bad storage and working environment, the damage of vulnerable units or the loosen of the fixing parts caused by improper transport, the lamp exceeds its lifetime, the wastage of electrical units, other troubles caused by wrong operation, and so on.
Please carefully refer to the related instructions before operating the instrument. Troubles and troubleshooting are introduced in following table

No.	Trouble		Cause	Troubleshooting
1	No response when switching on the power.		1) Power disconnection.	- Check the power supply and power cord, make sure that the power supply is OK and the power cord is connected well.
			2) The fuse is burned.	- Change the fuse.
			3) The switching power supply is damaged.	- Contact the distributor or the factory technical engineer for maintenance.
2	No display or unclear display, however the fan of the power supply unit is running when switching on the power.		1) The control chip or component is damaged.	- Contact the distributor or the factory technical engineer for maintenance.
			2) Bad connection of the display, or the display is damaged.	- Contact the distributor or the factory technical engineer for maintenance or change the display.
3	Self-diagnosis Failure	Lamp conversion fault.	1) Control motor fault.	- Contact the distributor or the factory technical engineer for maintenance.
		Filter fault.	1) Control motor does not work.	- Contact the distributor or the factory technical engineer for maintenance.
			2) The optocoupler positioning is abnormal.	- Contact the distributor or the factory technical engineer for maintenance.

No.	Trouble	Cause	Troubleshooting

3	Self-diagnosis Failure	Detector fault.	1) Amplifier circuit fault.	- Contact the distributor or the factory technical engineer for maintenance.
			2) Filter position error.	- Contact the distributor or the factory technical engineer for maintenance.
			3) Bad connection of signal wire between the amplifier and the microcomputer board.	- Contact the distributor or the factory technical engineer for maintenance.
		Wavelength calibration fault.	1) Some sample in the sample compartment, or the lid of the sample compartment is opened.	- Check the sample compartment, make sure that no sample is in the light path. Don't open the lid of the sample compartment during self-diagnosis.
			2) Wrong position of the cell holder causes block to the light path.	- Make sure that the cell holder is in right position.
			3) Deuterium lamp is not lighted.	- Contact the distributor or the factory technical engineer for maintenance.
			4) The optical parts turn moldy and cause low energy.	- Contact the distributor or the factory technical engineer for maintenance.
			5) Wavelength motor fault.	- Contact the distributor or the factory technical engineer for maintenance.
			6) Filter motor fault.	- Contact the distributor or the factory technical engineer for maintenance.
		Dark current error	1) The lid of the sample compartment is opened during self- diagnosis.	- Don't open the lid of the sample compartment during self- diagnosis.
			2) Amplifier board fault.	- Contact the distributor or the factory technical engineer for maintenance.
4	The reading is not stable when adjusting 100% T or 0.000 Abs.		1) Wrong position of the cell holder causes block to the light path.	- Make sure that the cell holder is in right position.
			2) The warming up time is not enough.	- Warming up with enough time, no less than 20 min.
			3) The tungsten lamp is exhausted or with bad connection.	- Replace the tungsten lamp with a new one.

No.	Trouble	Cause	Troubleshooting

4	The reading is not stable when adjusting 100% T or 0.000 Abs.	4) Deuterium lamp is exhausted.	- Replace the deuterium lamp with a new one.
		5) Wavelength error.	- Do dark current calibration and wavelength calibration, then, try again.
		6) Light path, or the amplifier and its power supply fault.	- Contact the distributor or the factory technical engineer for maintenance.
5	The sample reading is not stable.	1) Abnormal self- diagnosis.	- Make sure that the instrument can pass through the self- diagnosis successfully.
		2) The warming up time is not enough.	- Warming up with enough time, no less than 20 min.
		3) Unstable voltage.	- Contact the distributor or the factory technical engineer for maintenance.
		4) Ambient interference, such as unstable power supply, corrosive gas interference.	- Configure with a steady power supply, keep the instrument from corrosive gas.
		5) Unstable sample.	- For the sample is unstable, measure it as soon as possible. If there is some bubble in the solution, eliminate the bubble or reload the solution. Measure with a cuvette cover for volatile sample.
		6) The cuvette is contaminated and it's too dirty.	- Make sure that the cuvette is clean before measurement.
		7) The blank value is much higher, or the sample concentration is too high and the absorbance reading is out of the stable range.	- The absorbance value of the blank solution or reference solution is better below 0.1. Dilute the sample solution properly, and the absorbance value is better between 0.2 and 0.8.
		8) The tungsten lamp or deuterium lamp is exhausted, and the energy is too weak.	- Change the light source.

No.	Trouble	Cause	Troubleshooting
6	The sample reading is not accurate.	1) Dark current drift.	- Calibrate the dark current, and measure the sample again after blank recalibrating.
		2) Cuvette matching error	- Make sure that the cuvettes matching well.
7	The touch screen has no response.	System halted.	- Restart the instrument.
8	The printer doesn't work, or printing error.	1) Loosen connection between the instrument and the printer.	- Make sure the connection between the instrument and the printer is well.
		2) The printer model doesn't match.	- Choose the factory specified printer type.

Table 3

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