LABDEX

Double Beam UV-Vis Spectrophotometer LX212DS

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Index

1. Safety Measures

- Read the entire user manual carefully before you unpack, set up or operate the device. Wrong operations could lead to serious injury to the operator or damage to the device.
- To make sure that the protection provided by this instrument is not impaired, do not use or install this instrument in any manner other than that specified in these operating instructions.
- The source lamps are operated at high temperatures. To avoid the risk of electrocution, make sure the instrument is disconnected from the power source before changing the lamps.

1.1 Caution

- Health hazards caused by ozone.
- Hazardous levels of ozone can be generated when the UV lamp is not cooled.
- Burn hazard, allow the lamp(s) to cool down for at least 30 minutes before they are serviced/replaced.

1.2 Warning

- Health hazards caused by UV light.
- UV-Light can cause eye and skin damage. Protect eyes and skin from direct exposure to UV light.
- Do not look directly at an energized lamp without UV safety glasses.

1.3 Dangerous

- Potential danger with contact with chemical/biological substances.
- Working with chemical samples, standards and reagents can be dangerous.
- Make yourself familiar with the necessary safety procedures and the correct handling of the chemicals before use and read and follow all relevant safety data sheets.

Normal operation of this device may require the use of chemicals or samples that are biologically unsafe.

- Observe all cautionary information printed on the original solution containers and safety data sheets before their use.
- Dispose of all consumed solutions under local and national regulations and laws.
- Select the type of protective equipment suitable to the concentration and quantity of the dangerous material being used.

2. Introduction

Double Beam UV-Vis Spectrophotometer LX212DS is a double beam spectrophotometer with 190 to 1100 nm wavelength range, Deuterium Lamp (UV light) and Tungsten lamp (visible light) as a light source. Equipped with TFT color screen and windows graphic interface. Advanced ARM system and long optical system assures precision measurements and good stability of the instrument.

3. Features

- 7 inch TFT color screen
- 190 to 1100 nm Wide Wavelength range
- Came with massive 1GB memory storage for test data and working curves
- Performs photometric, quantitative, kinetic, spectrum scan, multi-wavelength measurements, etc
- USB port and SD card for data transfer to PC and other devices for further analysis, processing and storage
- Available with optional Auto 8 Cell holder

4. Specifications

Model No.	LX212DS
Optical system	Double beam, Grating 1200 lines/mm
Wavelength range	190 ~ 1100 nm
Spectral bandwidth	0.5 nm, 1 nm, 2 nm, 4 nm, 5 nm
Wavelength accuracy	±0.1nm@656.1nm, ±0.3nm@all
Wavelength repeatability	≤ 0.1 nm
Photometric accuracy	0.2%T(0~100%T), ±0.002A(0-0.5A), ±0.004A(0.5-1A)
Photometric repeatability	≤0.15%T (0-100%T), 0.001A(0-0.5A), 0.002A(0.5-1A)
Photometric range	0-200%T, -0.3~3A, 0-9999C (0-9999F)
Stray light	<=0.03%T@220nm, 360nm
Stability	±0.0003A/h @500 nm
Baseline flatness	±0.001A
Photometric mode	T , A , C , E
Noise	0.0005A@500nm
Scanning speed	Hi, Med, Low (Max. 3000nm/min)
Wavelength setting	Automatic
Display	7" TFT Colored capacitive LCD screen
Light source	Imported deuterium & Tungsten lamp
Detector	Imported silicon photodiode
Cuvette holder	10mm single hole cell holder
Data output	USB drive, USB host, RS232
Power	AC 220 / 50 Hz or AC 110 / 60 Hz
Dimension	590 x 475 x 250 mm
Packaging dimension	880 x 690 x 520 mm
Gross weight	45 kg

5. Applications

Utilized for biochemistry, biotechnology, microbial science, chemistry, pharmacy, water testing, ecological and food science industries for Quality & Research analysis.

6. Instrument Introduction

With low stray light and the high-resolution structure of a double-beam optical monochromator, the instrument has good stability, reproducibility and accuracy of readings. Not only the instrument has automatically set 0% T and 100% T and other control functions as well as the concentration of computing and data processing functions of a variety of methods, but also to prevent user errors with special features, no worries when using. Scientific design, the use of new technologies, the optical, mechanical, electrical and computer technology combined with organic, both to improve product performance and convenience for users to use. The large graphic LCD screen can display the data and maps. The extensive machine software can complete quantitative analysis, qualitative analysis, kinetics, DNA/Protein and other tests. Coupled with powerful storage and printing capabilities, the computer can complete all testing, analysis and data output with no connection to the PC. Optional equipment is also available on the Windows platform running UV Professional user application software, the instrument has greater functionality. Overall structure consists of three parts: an optical system, a power system and a micro-computer system.

6.1 Top view structure

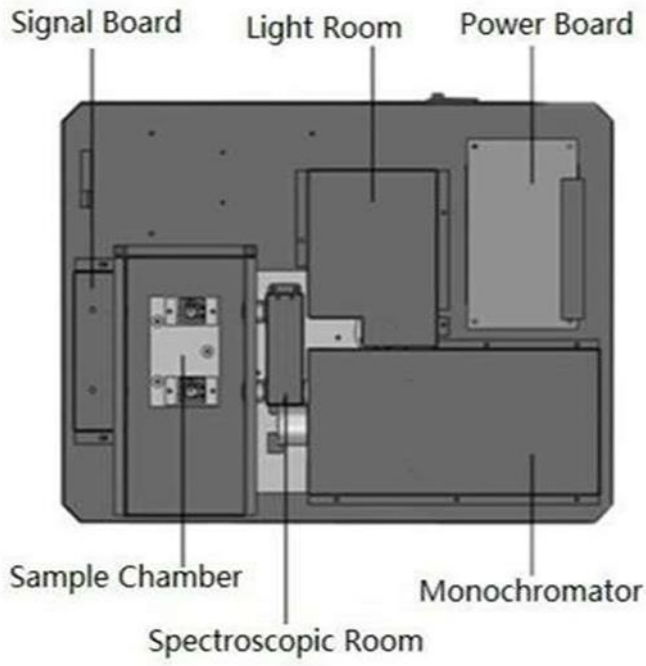

Figure-1

6.2 Bottom view structure

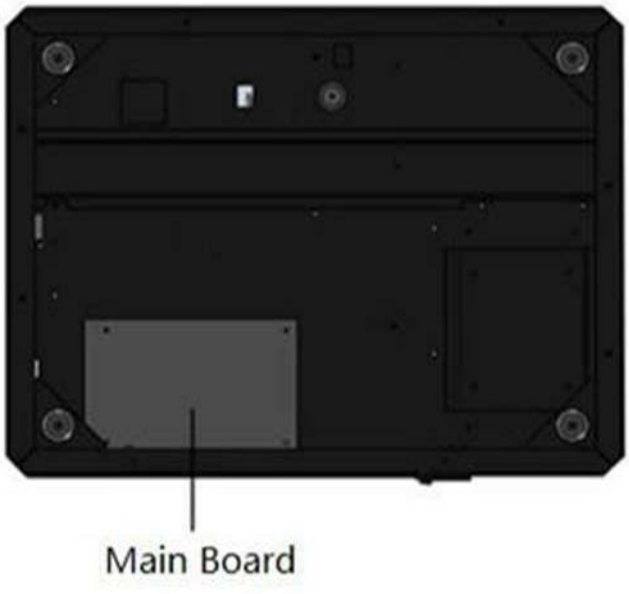

Figure-2

6.3 Light path diagram

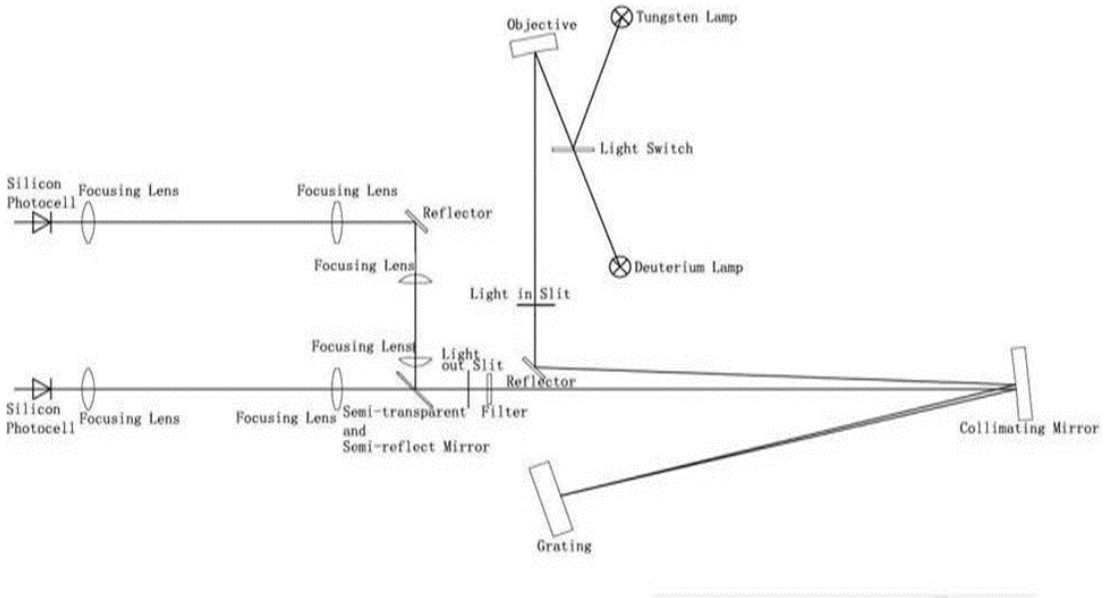

Figure-3

6.4 Important part of the instrument

1) **Power Board:** The 110-220V/50Hz-60Hz power conversion and regulation outside access to the necessary equipment: 11.5V (tungsten lamp power), +12 V (fan power, electrical power), +5 V (computer system power), + /-15V (signal board power supply), deuterium lamp filament preheating, and lit power deuterium lamp is lit up and the power breakdown.
2) **Lightroom:** There are tungsten halogen lamps and deuterium lamp source devices to automatically switch.
3) **Tungsten halogen:** Visible spectral region. Applicable wavelength range 340-1100nm. Because it uses the principle of the halogen cycle, it has a greater intensity of light emission and longer life. The halogen cycle requires a higher temperature. Thus, lamps commonly use quartz glass or high-temperature glass. Tungsten halogen lamps emit energy in the visible region around the operating voltage is proportional to the fourth power, therefore, to make light stable, the model has a stability of less than 0.2% of the power supply, the other imported Philips halogen socket tungsten halogen lamp replacement to ensure stable and easy to use and long life.
4) **Deuterium lamp:** Suitable wavelength range of 190-340nm. When deuterium lamp operation, maximum energy sources in the vicinity of 230nm, 486.0nm and 656.1nm and have two characteristic lines, can be used for instrument calibration wavelength accuracy in the visible region. Stability of the steady flow of less than 0.02% of the models.
5) **Monochromator:** Contains spectral components - grating, into the slit, the slit, mirror, focusing lens, and the wavelength filter drive system, the monochromatic light emitted from the composite light can be decomposed into monochromatic any wavelength of monochromatic light from optical separation means.
6) **Raster:** The dispersion of the original, the model uses 1200 / mm holographic grating to ensure high resolution and low stray light.
7) **Filter:** Due to the grating spectrum spectral overlap exists between the problem class times, so the use of filters to eliminate the spectral overlap problem.
8) **Action slits:** The slits in the monochromator are large, and the resolution of the instrument is not only related to the dispersion of the grating and the size of the image (i.e., the slit width). The slit is too large, colour band deteriorates, is not conducive to the qualitative analysis, quantitative analysis also affect the linear range of the calibration curve, the slit is too small, the flux decreased, reducing the signal-to-noise ratio affects the measurement accuracy, the slits there is two general representation of the width, the actual width of the slit of a knife-edge between the two expressed (in mm), the other to represent the bandwidth of spectral bands (in nm).
9) **Spectroscopic Room:** Contains a half-mirror, focusing lens and reflector to achieve a beam monochromator out into two beams of light in different directions.
10) **Sample Chamber:** Fixed 2-position cuvette holder, one is for reference solution, and the other is for sample solution. The 8-position cell changer is optional.
11) **Signal Board:** Transfer to the motherboard processed signal detection light amplification.

12) **Mainboard:** Instrument micro control unit, control instruments light source switch, the motor rotates, the signal processor display, etc

6.5 Performance Indicators Definitions

1) **Optical system:** Usually refers to the formal structure of the optical system, at present, domestic and international institutions often use it as a photometer industry type and CT auto collimation two structures.
2) **Wavelength range:** Means for wavelength photometer can difference between maximum and minimum values of the test.
3) **Wavelength accuracy:** This means the actual wavelength difference between the real wavelength and the setting wavelength. Each wavelength photometer is in a lot of points to check wavelength accuracy; spectrophotometer wavelength accuracy is an important technical indicator, and its qualitative, quantitative and structural analysis of the impact is enormous. Way to check wavelength accuracy of many spectral lines as a standard filter praseodymium, neodymium, holmium oxide filter, holmium oxide wavelength standard solution, deuterium lamp or low-pressure mercury lamp emission and interference filters and so on.
4) **Wavelength repeatability:** Wavelength Repeatability is the ability of the instrument to return to the original wavelength. It reflects the wavelength drive mechanism and the stability of the whole instrument.
5) **Spectral bandwidth (sensitivity, resolution):** Refers to a peak spectral bands when the slit on the detector detected through a monochromator energy half-width, expressed in nm wavelength, from another perspective to understand this concept will more user-friendly: First, the monochromator exit slit represents not just the physical size or geometry, it also represents the optical sense, this is the spectral bandwidth, we know that the light from the failure of a single monochromator wavelength, but at a narrow wavelength spectral band are arranged in the order, the number of spectral wavelength band comprises, represented by the spectral bandwidth. Spectral bandwidth is a direct response to the quality level of monochromatic light from the monochromator out. The index with the instrument resolution and sensitivity are similar but different, they react with photometer performance quality from different sides. Resolution refers to the size of the instrument to distinguish two adjacent wavelengths' ability Sensitivity is measured at low concentrations do, when the concentration changes by one unit to the detector signal caused by the change amount, it is subject to a calibration curve (standard curve as the horizontal axis, the absorbance on the vertical axis) and a precision instrument itself restrictions. Two measurement precision of the method is the same, the greater the sensitivity calibration curve slope, while the slope is equal, the higher the sensitivity, the better precision. It is noted that to obtain accurate test results, the natural bandwidth of the spectral bandwidth of the instrument (Spectral Bandwidth referred to as SBW) and the analysis of samples (Natural Bandwidth referred to as NBW) ratio should be less than 0.1, more than 99.5% can be obtained so that the measurement accuracy.

6) **Stray light:** The wavelength of stray light is irradiated onto the non-selection signal generated by the detector. It is an important source of photometric analysis of errors, stray light limits the accuracy of the General Assembly high-concentration solution analysis. Stray light represented by T%.
7) **Photometric range:** Refers to meet the photometric test range in various technical indicators, represented by A or T.
8) **Photometric accuracy:** The true average value refers to the degree of compliance with a plurality of measurements; a photometric accuracy check usually uses repeated measurements of the neutral density filter carefully filmed to a standard photometric detection. A neutral density filter for light in a wavelength range having almost the same transmittance (or absorbance) of the filter, and the use of its wavelength-insensitive characteristic bandwidth changes, to check the accuracy of the optical instrument and repeatability.
9) **Photometric Repeatability:** Refers several times under the same conditions as measured in parallel, each parallel line with the degree of determination between the results.
10) **Noise:** The sum of the instrument detects the unwanted signals, which is the purpose of the relative signal. Generally, the spectrophotometer has two sources of noise, one from the light source, the second is derived from the internal electronic noise inherent in the instrument, such as the power supply, amplifier, AD conversion and the like. To reduce noise, and improve signal-to-noise ratio, there must be a good electrical design. Noise measurement repeatability tests under low concentrations also affect test accuracy. Noise by averaging several measurements after partial elimination.
11) **Drift:** Refers to the degree of deviation from the instrument over time the starting value. It depends on the stability, light stability of the electrical device and the like. Single-beam instruments, the warm-up time has a great influence on the length of the drift.
12) **Baseline flatness:** Refers to the distribution of the full wavelength range of the instrument noise.

7. Installation

1) After unpacking, carefully check the packing list inside to see if the object is complete and intact.
2) Determine whether the work environment meets the foregoing requirements, the ambient temperature of 10 ~ 35 ℃, relative humidity less than 85%, and operating voltage 110-220V/50-60HZ.
3) The instrument is placed on a horizontal platform, the instrument should avoid direct sunlight and be away from electromagnetic launchers and high-power electrical devices, the use of the environment can't have dust, corrosive gases and vibration.
4) Around the instrument there is no obstacle to the flow of air.
5) Ensure that the power cord is connected to a properly grounded electrical outlet.
6) Check the sample chamber, ensure that there is not any solution, or foreign matter and the process of self-test to ensure that the sample compartment lid is closed, you can't half-open (this is very important otherwise affect the instrument self-test results and normal use!).
7) Turn on the instrument. Then the instrument does a self-test. After that, the instrument can be operated normally. In case there is an error alarm halfway, please refer to the chapter on instrument troubleshooting.

Note:

Use only a grounded socket for the connection of this device to the power supply. If you are not sure if the sockets are grounded, have this checked by a qualified electrician. The power plug serves in addition to the power supply to isolate the device quickly from the power source where necessary. During the disconnection from the power source, it must be made sure that the correct power plug is pulled (for example by labeling the sockets). This is recommended for long-term storage and can prevent potential dangers in the event of a fault. Therefore, make sure that the socket to which the device is connected is easy to always reach each user.

Using conditions:

1) Equipment should be installed away from the hot or humid environment.
2) The instrument should be used in 16-35 ℃, 45-80% humidity conditions.
3) Please try to stay away from issuing magnetic, electric, and high-frequency waves of electrical devices, and do not install the instrument in the air chlorine, hydrochloric acid gas, hydrogen sulfide gas, such as sulfurous acid gas, corrosive gas Excessive places.
4) Place the instrument table should be smooth, without vibrations; nearby fans of the instrument should be left with enough space to exhaust smoothly.
5) Instrument is best to use a single power outlet, power should ensure good grounding. Doing so may result in equipment not working properly. If the local voltage is unstable, the instrument is equipped with a power supply.
6) The instrument should be away from direct sunlight. Avoid dusty environments.

8. Software Installation

Instrument self-test

After you switch on the instrument, it will go through a self-checking process.

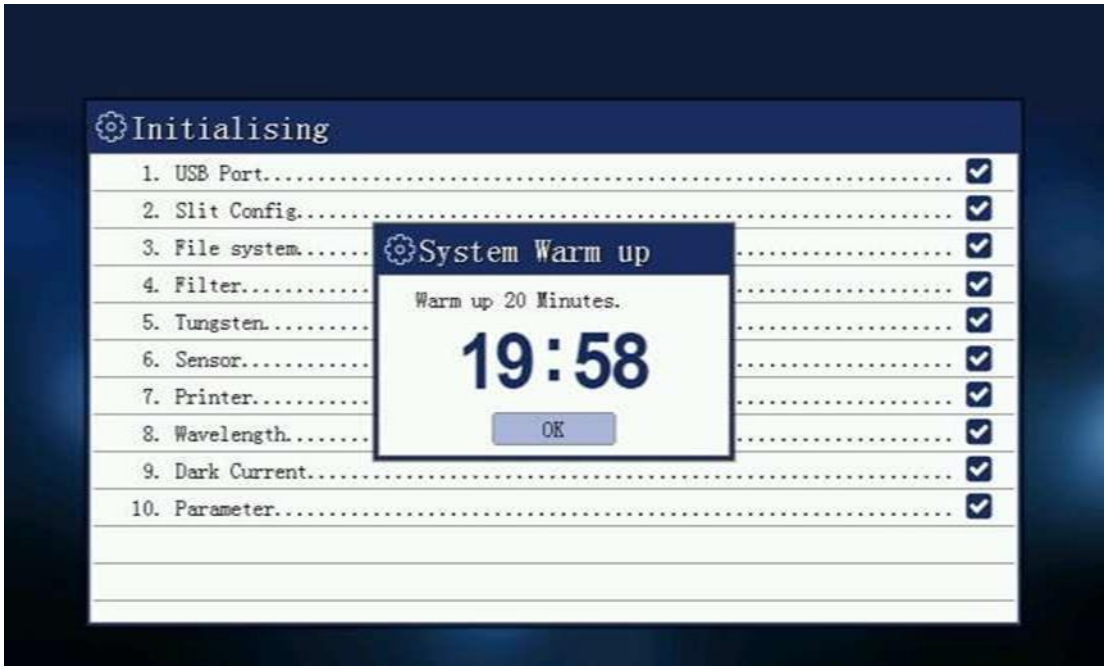

Figure-4

1) **Communication port inspection**
   Check whether the communication port of the instrument is working properly or not. The result is displayed correctly √ and an error is ×, the buzzer alarm.
2) **File system check**
   Check the instrument's built-in flash file system is correct. If the result is displayed correctly √, an error will reformat the file system.
3) **Filter positioning**
   Check the instrument's filter motor and locator are working correctly. The result is displayed correctly as √, an error as ×, the buzzer alarm.
4) **Light positioning**
   Check the instrument light switch motor and its locator is working correctly. The result is displayed correctly √, an error is displayed result is ×, the buzzer alarm.
5) **Printer check**
   Check the printer interface device is working properly. The result is displayed correctly √, an error is displayed result is ×, the buzzer alarm.

6) **Tungsten lamp examination**
   Open the instrument tungsten light source and check the operating parameters of the tungsten lights are working properly. If the parameter is not working properly, then re-set the operating parameters of a tungsten lamp. Change detections are always displayed correctly, the result is always √.
7) **Deuterium lamp examination**
   Open the deuterium light source instrument operating parameters to check the deuteriumlamp is working correctly. If the parameter is not working properly, then re-set the operating parameters of the deuterium lamp. Change detections are always displayedcorrectly, the result is always √.
8) **Signal detector check**
   Check signal detector instrument is working correctly. The result is displayed correctly √, an error is displayed result is ×, the buzzer alarm.
9) **Wavelength Calibration**
   The wavelength parameter checking instrument is working properly. Correct, then the pop-up boxes, please confirm whether the user input wavelength calibration if no user inputwithin five seconds, then skip this. If the argument is the wrong wavelength, then start looking for a deuterium lamp to automatically correct the characteristic peak wavelength. The wavelength calibration result is displayed √, the correction is not passed, then the result is ×, the buzzer alarm.
10) **Dark current correction**
    Read instrument dark current of energy, checking eligibility. If the dark current is in theproper range, which means that the dark current is correct, then displays the results √. If the dark current exceeds the maximum setting, the user is prompted dark current error. The results are displayed as ×, the buzzer alarm.
11) **System parameters check**
    The instrument system baseline reading is correct. If correct, then the pop-up box that asks the user whether to re-enter the correction system baseline, baseline correction system default does not automatically skip the 3 seconds. If an error does not exist or the baseline, the baseline correction system directly. Showing results √, the correction is not passed, then the result is ×, buzzer alarm. After self-test and re-calibration of dark current, into the main programs.

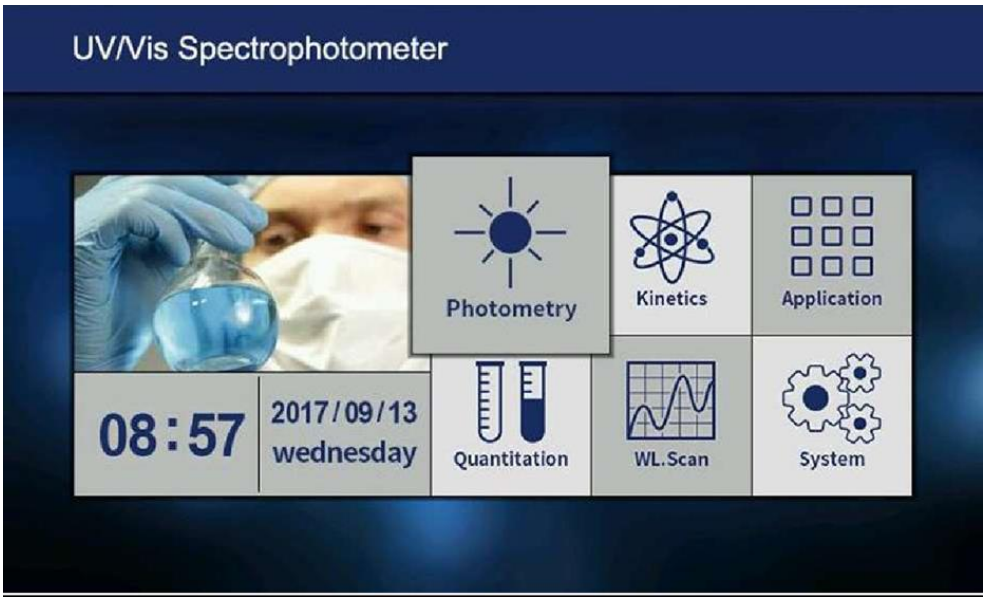

Figure-5

Note: After power on the instrument, the instrument will automatically self-test and initialization until after initialization is complete, the instrument will warm up for 20 minutes, 20 minutes warm-up time or press **[ESC]** to skip preheating case, the instrument being prompted preparatory work environment, which is the instrument re- calibration dark current, set the working parameters, etc., and then enter the main menu.

9. Working Principle

The nature of absorption: The spectrophotometric analysis method is the use of substances to choose a different wavelength of light absorption characteristics established. Typically using a prism or grating to obtain monochromatic light that passes through the continuous monochromatic solution, the solution was measured and the absorption of each wavelength, the absorption spectrum curve obtained.

Absorption spectrum selective absorption of light from the material, which is the material of macroscopic phenomena, and the nature of the molecular absorption is the result of internal movement and light interaction. When molecules absorb certain wavelengths of spectral energy or by some wavelengths of the spectrum are absorbed to form the absorption spectra. The smaller the energy absorption, the wavelength of light corresponding to the absorption peak at a longer wavelength. When the infrared absorbent is formed in the infrared absorption spectrum, if the energy absorption is larger, the shorter the wavelength corresponds to the absorption peak at a shorter wavelength, when generating the ultraviolet absorption spectra of absorption in the ultraviolet region.

Absorption Law - Lambert-Beer law: When a parallel beam passes through the homogeneous solution, the absorbance of monochromatic light is proportional to the product of the solution concentration and thickness.
Its digital expression: **A = KCL = LogI0/I = -LogT.**
Premise absorption laws established numeric expression:

1) The incident light is monochromatic.
2) The absorption process without interaction of each substance, the absorbance of each substance has additivity.
3) The role of light and matter is limited to the absorption process, with no fluorescent and photochemical scattering phenomena.
4) An absorbent system is a continuous uniform distribution.

9.1 Impact spectrophotometry factors

1) Non-absorption errors caused by radiation and matter
2) Fluorescence and photochemical reactions, in general, errors fluorescence spectrophotometry produced negligible fluorescence efficiency is very small in most cases the color system, and the fluorescence emission is isotropic, only a small portion along the transmitted light direction into the detector, the measurement of absorbance is low, resulting in a negative deviation. Depends on the instrument to measure the impact of the absorption of fluorescence largely on the optical absorption cell and detector design.

3) Reflection and scattering, absorption law applies only to homogeneous medium absorption system, turbid solution so that the measured increase in absorbance due to scattering, resulting in deviation from Beer's law.

9.2 Non-Ideal instrument error cause

1) Beer's law deviation polychromatic contrast, most of the photometer can only get close to monochromatic light with a narrow lumen there is still a polychromatic nature, which can lead to deviations from Beer's law.
2) Deviation depends on the two monochromatic molar absorptivity difference ο ε, | ο ε | is very small, can be approximated that monochromatic, at low concentrations, the curve remains linear, but larger concentrations, with concentration increases, AC curve bend more serious, there is Beer's law applies only to dilute solutions.
3) Stray light, stray light entering the detector means unnecessary components to be tested at other wavelengths outside the range of the wavelength spectral bandwidth. The main dispersive element from a prism or grating spectrometer, a mirror, a lens surface scattering, dust and other inner walls of monochromator components and diffuse reflection and other scars, the stray light can cause serious measurement error. The instrument is the smallest wavelength of energy, usually at a maximum stray light (such as a deuterium lamp 220nm, a tungsten lamp 340nm).
4) Slit width, the slit width of the spectrum affects not only the purity but also affects the absorbance. When quantitative analysis is to obtain sufficient measuring signal, the slit should be larger, in the qualitative analysis the use of a smaller slit when the entrance slit and the exit slit width equal to the width of the slit caused the minimum error.
5) Wavelength scale ruler of error, the wavelength of the gauge that wavelength accuracy of the instrument, such as a large error or correction, the spectral measurements produce errors that affect the accuracy of absorbance measurements (in the absorption spectrum of the peak of the more significant)
6) Impact of non-parallel incident, one of the prerequisites ear than the law is the use of a parallel incident beam to ensure that all beams through the same thickness of the absorbing medium, when a large deviation from parallelism when the incident beam, obviously leads to deviations from Beer's law. If the instrument is in moderate-intensity beam deviation from parallelism, absorbance measurement error is generally caused by less than 0.5%.
7) Photometric scale error, the photometric accuracy of the scale that is transmittance, which directly affects the accuracy of the magnitude of the error photometric measurements.

10. Operations

10.1 Flow chart of the instrument operation

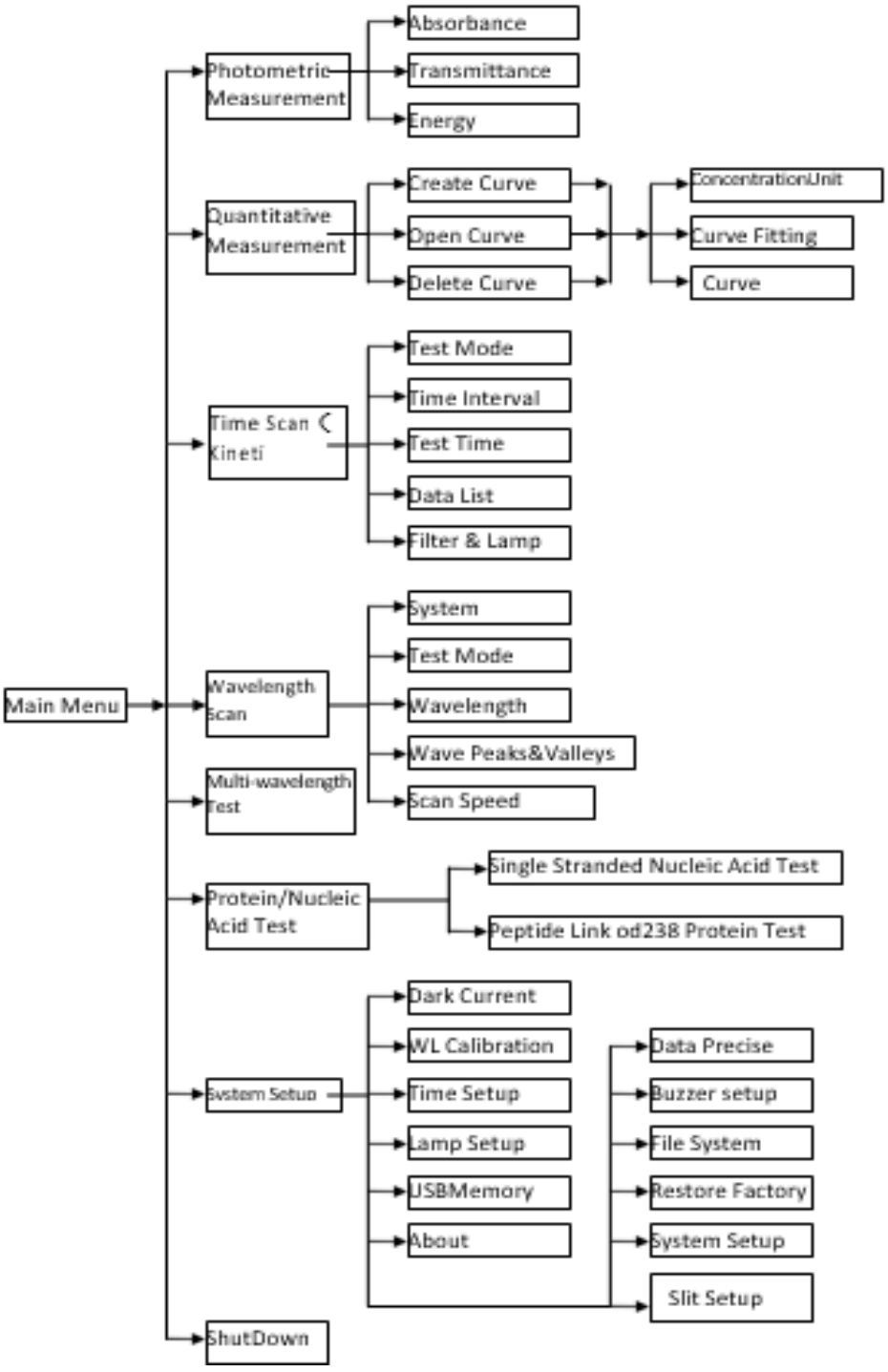

Figure-6

10.2 Panel schematic diagram

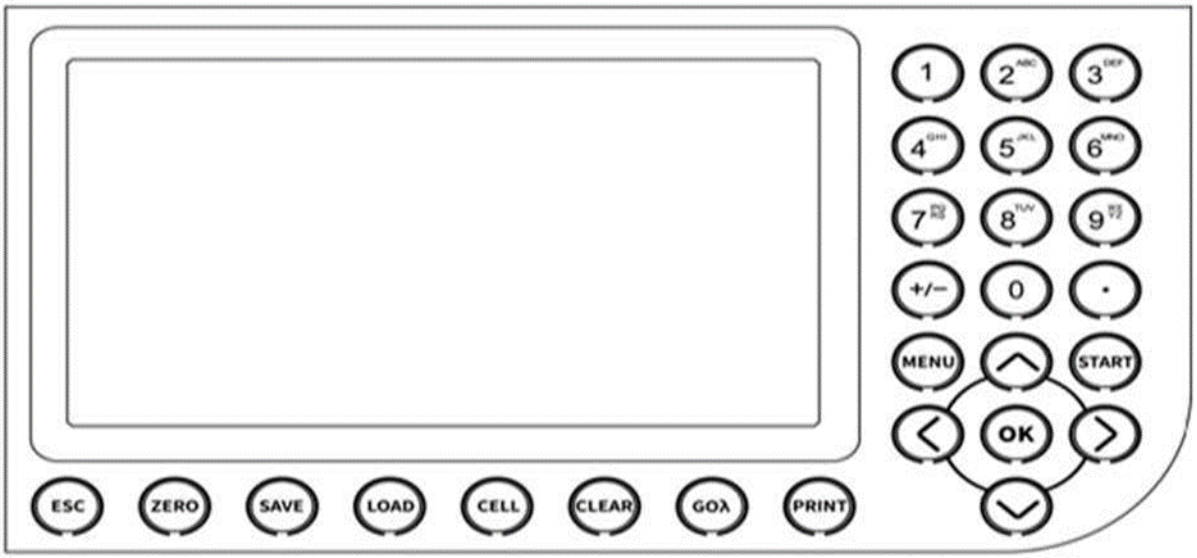

Figure-7

Button function description:

Button name	Button functional description
【MENU】	Menu key under each function
【PRINT】	Print output button
【SAVE】	File storage button
【LOAD】	File open button
【ESC】	Back, cancel button, test stop button
【CLEAR】	Clear key to delete the input data, delete files
【GOλ】	Set the wavelength
【ZERO】	Adjust 100%T and 0Abs, build user baseline key
【OK】	Confirmation button, function, menu selection button
【START】	Test beginning button
【0】-【9】	Number button
【.】	The decimal point
【+/-】	Plus or minus sign
【↑】,【↓】	Up and down key
【←】,【→】	Left and Right key
【CELL】	Automatic sample holder button

10.3 Basic Operations

How to adjust the blank?

In any test interface, put the cuvette containing the reference solution into the cuvette slot, and pull it into the light path, press【Zero】key to adjust the blank.

How to set the wavelength?

In any measurement interface press【Goλ】key to set the current working wavelength Store files in txt or cvs format (use Excel format for simple spreadsheet files).

11. Software Operations

11.1 Photometric Measurement

1) **Function description**
   Photometric measurements measure the absorbance of the sample at a single wavelength, transmittance or energy value.
2) **Set measuring mode**
   Press the set button, enter the measurement mode settings menu, select the desired test mode, and press **[ENTER]** to confirm. If you choose the energy model, an energy window appears and prompts you to select the amplifier gain.

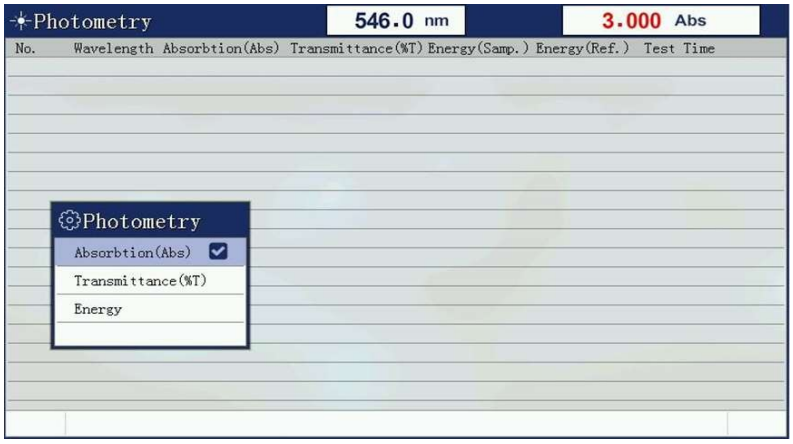

Figure-8

3) **Set wavelength**
   Set the current working wavelength range 190nm-1100nm, press the up and down button to open the wavelength setting window, press [0] - [9] to enter the desired wavelength, press **[CLEAR]** to clear the input, press **[ENTER]** to confirm. Input errors or exceeds the set range buzzer alarm.

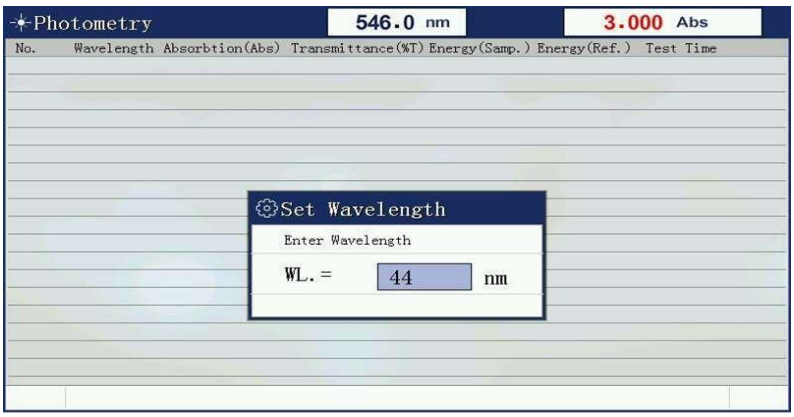

Figure-9

4) **Correction 100%T/0 Abs**
In two samples simultaneously into the two slots reference solution, and then press the [ZERO] key, the instrument will be a blank correction in the current wavelength. Display calibration is completed 100.0% T or 0.000Abs.

5) **Measurement data**
Calibrated with reference solution 100% T/0Abs, remove the rear slot reference sample solution into the sample solution, and then press the **[START]** button, then perform a test, the sample data are immediately added to the list.

Figure-10

6) **Delete data**
Delete files Press the **[CLEAR]** button, delete files prompt box will pop up, this operation will delete all the test data currently under test. Select **[Yes]**, the file will be deleted allthe data and select **[No]** will return the test window.

7) **Save the file**
Press the Save button to save the current list of test data to a file. If this is the first timeyou save a file, the dialog box will pop up asking to save the file name input.

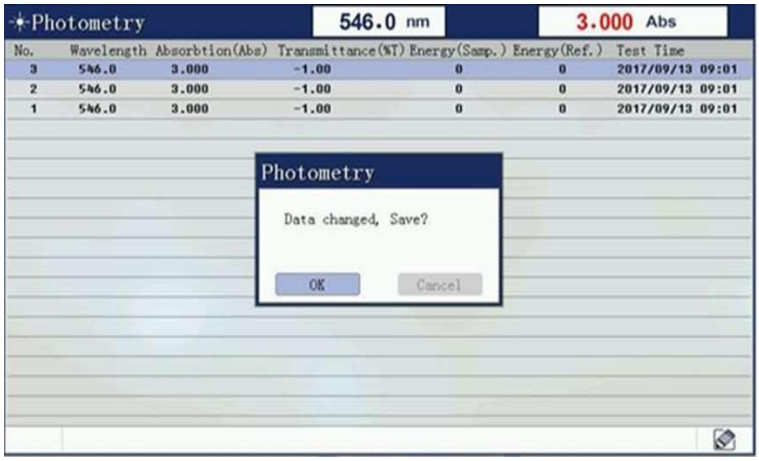

Figure-11

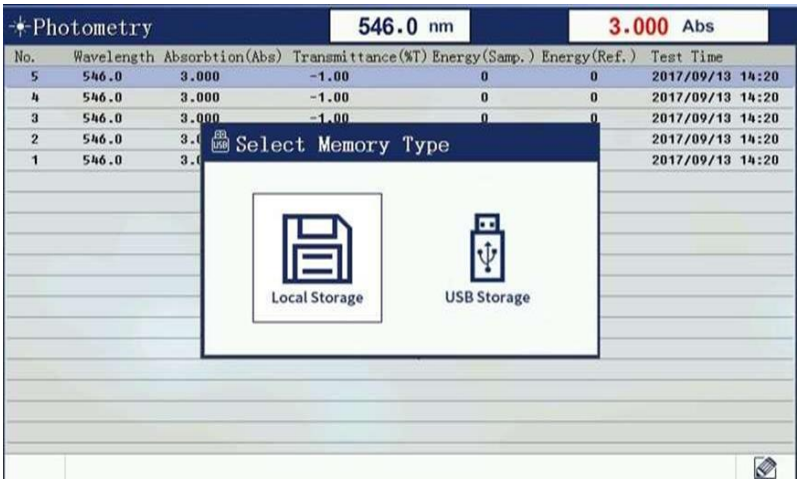

Figure-12

8) **Open the file**

In photometric measurement interface will be displayed by the Load button to open thewindow, open the window has all the photometric data file list. Select the appropriate data file and press **[ENTER],** the file will be read into all the test data, and then automatically enter the measurement mode.

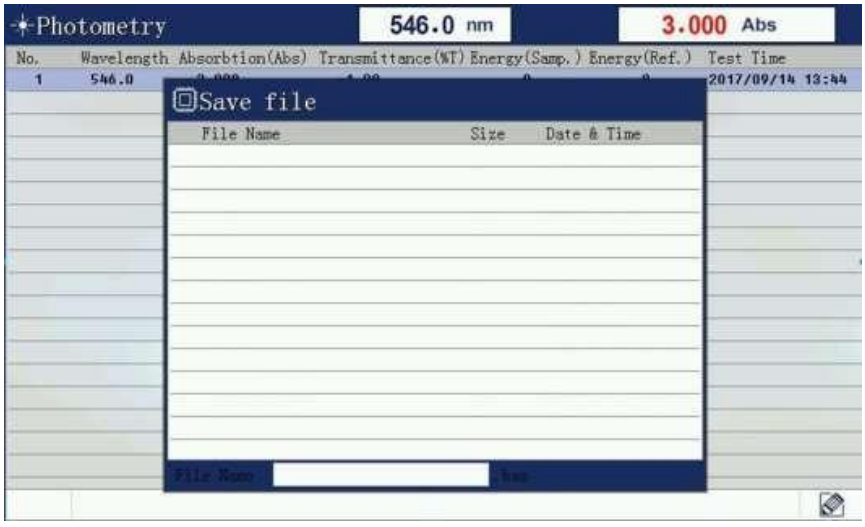

Figure-13

11.2 Quantitative measurement

Select **[quantitative measurement]** with up and down, left and right keys, then press Enter. There are two options: build standard curve and open standard curve.

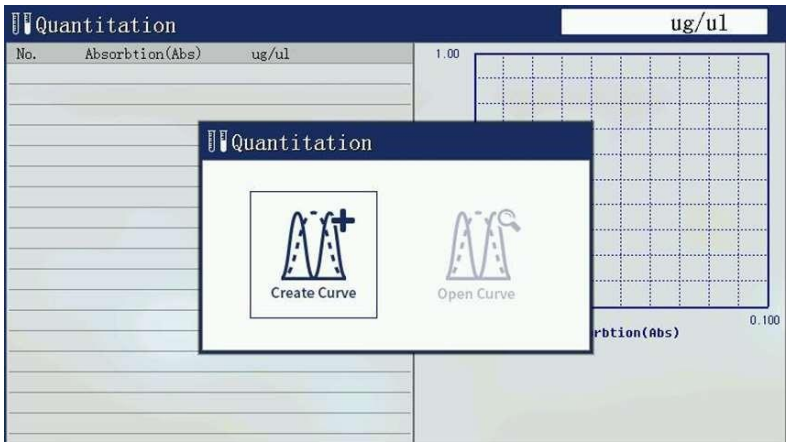

Figure-14

11.2.1 Build standard curve

Several configured standard samples are used, input the concentration of the sample standard, and collect the absorbance of the standard sample. The relationship between concentration and absorbance is calculated as curve parameters, and this parameter is used to measure the concentration of the sample.

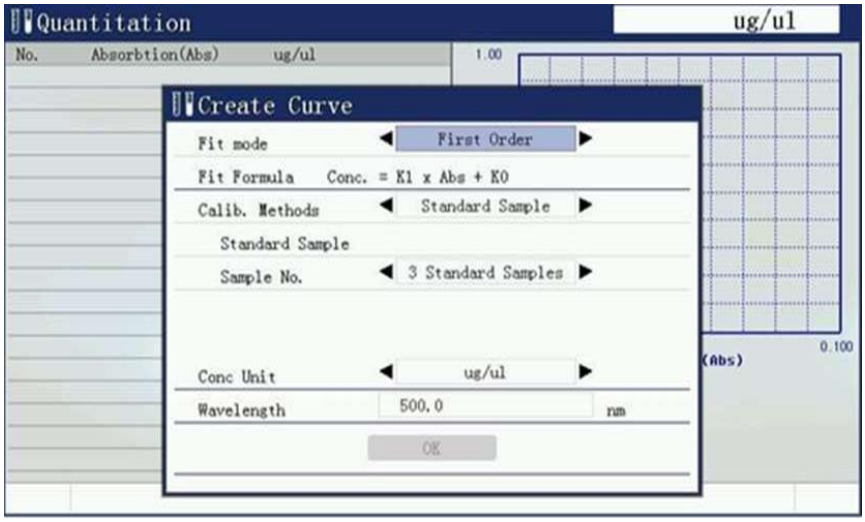

Figure-15

1) **Curve fitting mode:** There are first-order fitting, first-order fitting through zero, and second-order fitting.
2) **Curve building method:** There are standard sample methods and coefficient methods. The stand sample method is to prepare the sample first, build the curve, and then test the sample. The coefficient method is to enter the known coefficient and build a standard curve, then test the sample.
3) **The number of samples:** At least 2 samples. More sample numbers, more accurate testing data.
4) **Concentration units:** Enter the concentration value of each standard sample, because the parameters of the curve have established limits, please select the appropriate concentration units.
5) Wavelength value is required.

11.2.2 Standard sample measuring

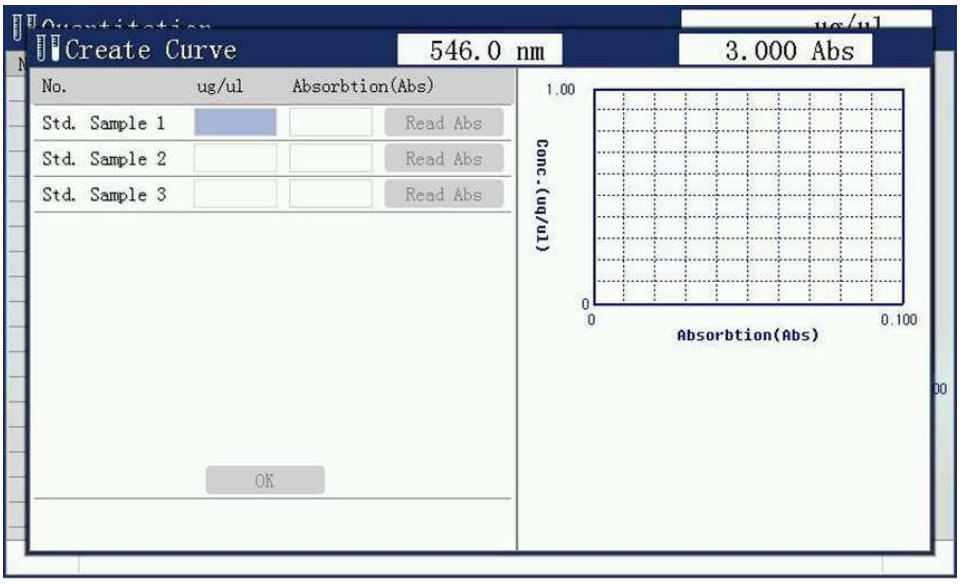

Figure-16

Put various standard samples into a cuvette holder orderly, and enter the concentration value of each sample, then press the **[enter]** key, and read the absorbance of the sample. The input is completed, and the data of the standard sample is calculated automatically according to the parameters of the curve, displayed on the screen. If the parameter is wrong, then the buzzer alarm exits to establish the curve function.

11.2.3 Sample test

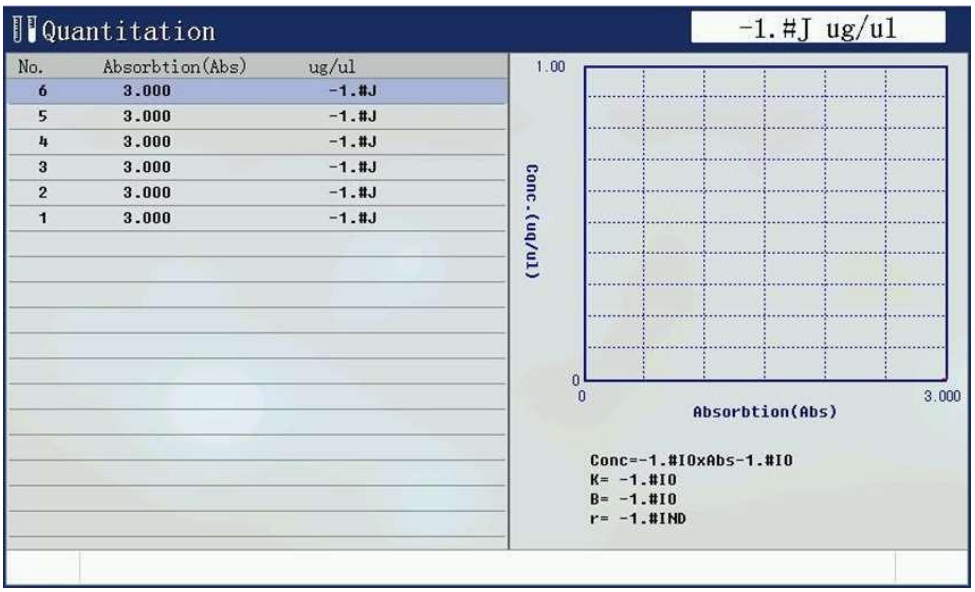

Figure-17

Put the sample into the cuvette holder and press the **[start]** key, to get the concentration value of the current sample.

11.2.4 Open standard curve

By opening the previously established curves for measurements. Select the appropriate quantitative test file and press the **[Enter]** key to open a standard curve file.

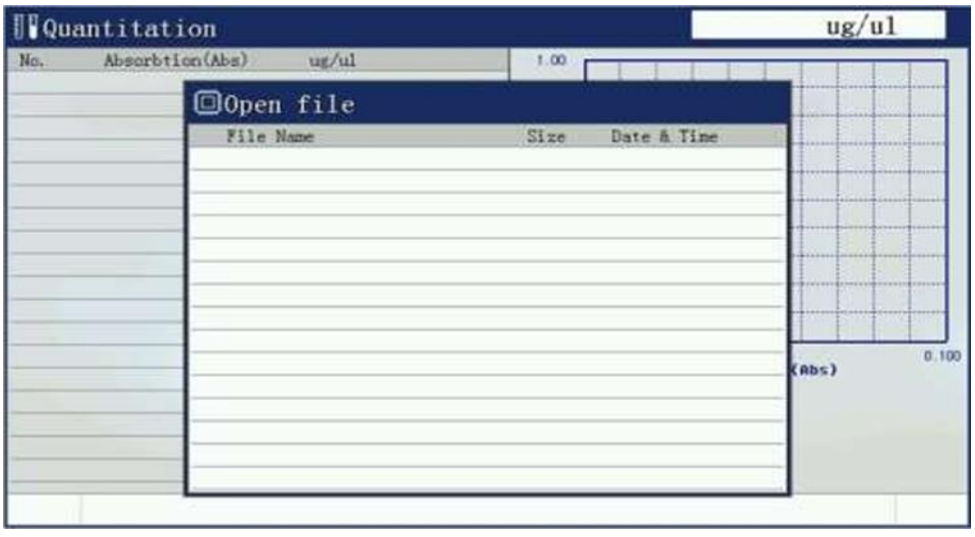

Figure-18

11.3 Time Scan (Kinetic)

11.3.1 Function description

The scan time (kinetic) function is a fixed time interval to the trend in absorbance or transmittance of the test current and is displayed on the map. Select the time scanning (kinetic) menu option and press **[ENTER].**

11.3.2 Time scanning parameters set

Set the time to scan the scanning parameters: Time interval, test time, and measurement mode, the display displays the upper and lower limits.

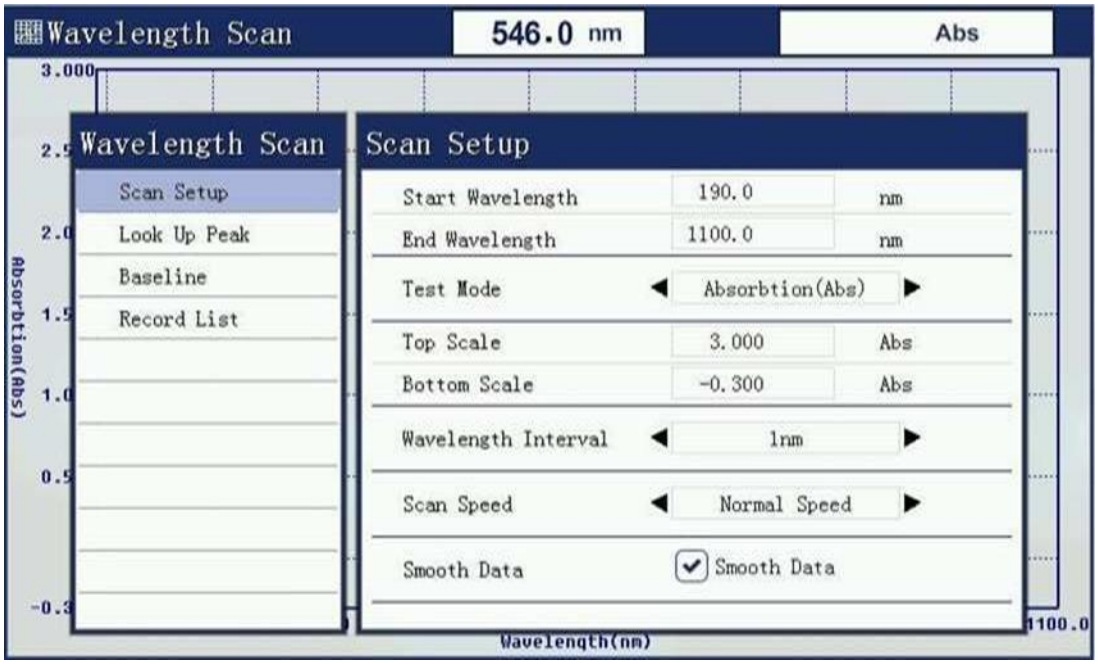

Figure-19

1) **Set test time:** Test time is the total time of the entire test.
2) **Set measurement mode:** The measurement mode is absorbance, transmission or energy. Choose a different measurement mode, you need to reset the display to display the upper and lower limits.
3) **Set the upper and lower limit:** The different measurement modes and upper and lower displays are not the same.
4) **Set the time interval:** Scan scanning interval setting time, 0.5 seconds minimum, 1 minute maximum.
5) **Select to make data smoothing:** The function of data smoothing is to reduce the irregular fluctuation caused by the external environment during the test.

11.3.3 Data test

Press **[START]** to start measuring. The current real-time map will be on the screen.

Figure-20

11.3.4 Data list

Press the **[Menu]** key to check the scanning data after the scanning finish.

Figure-21

11.3.5 Slope calculation

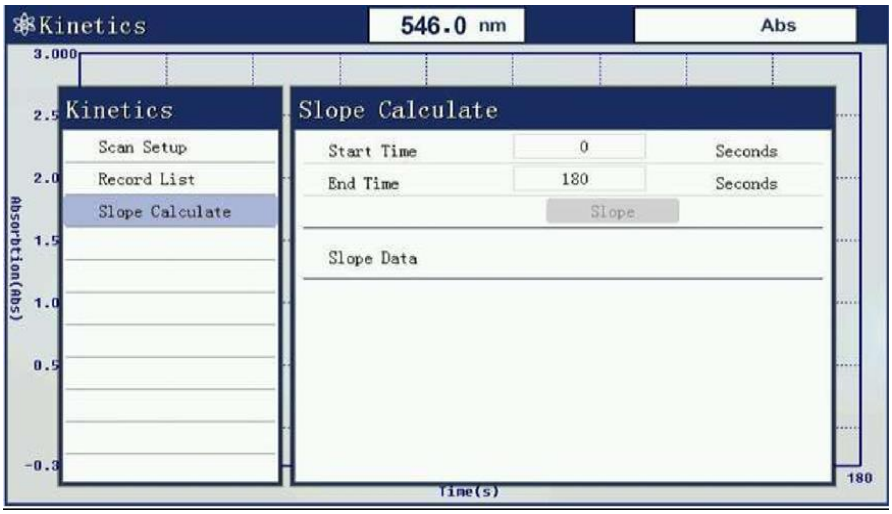

Figure-22

11.4 Wavelength scanning

11.4.1 Function description

In the set wavelength range, in a certain wavelength interval to record the absorbanceof the sample and the energy transmittance value, the results are plotted in the map,which can be seen in the sample absorbance, transmittance, and the energy value trends at different wavelengths.

11.4.2 Set scanning wavelengths

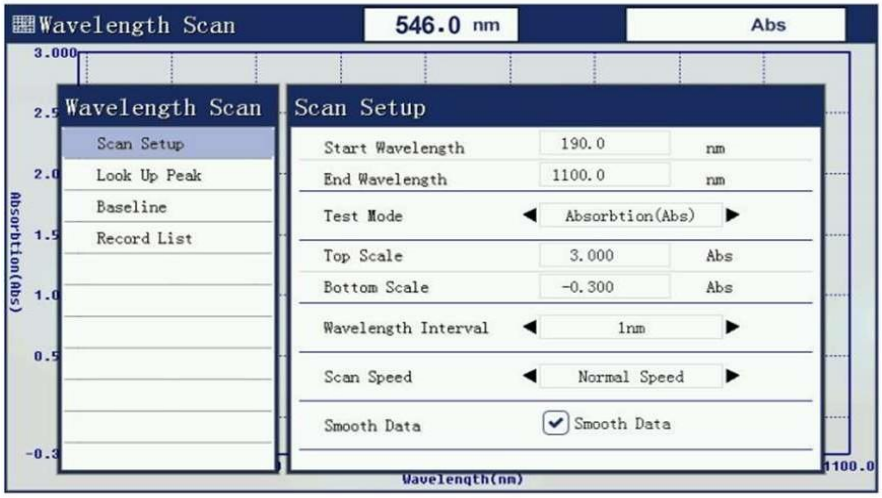

Figure-23

1) **Set start wavelength and end wavelength**
   The start wavelength and end wavelength mean the wavelength range used for scanning.
2) **Set the measurement mode**
   The measurement mode is absorbance, transmission or energy. Choose a different measurement mode, you need to reset the display to display the upper and lower limits.
3) **Set the upper and lower limit**
   The different measurement modes: upper and lower display is not the same.
4) **Set wavelength scan interval**
   Scan scanning wavelength interval from 0.1nm to 5.0nm.
5) **Set scanning speed**
   The scanning speed determines the quantity of data collected on a single-point wavelength. The faster the speed, the less the collecting quantity.
6) **Select to make data smoothing**
   The function of data smoothing is to reduce the irregular fluctuation caused by the external environment during testing.
   Note: You must set the scan settings before calibration parameters blank because the scan settings modify the parameters, the baseline will lead to an invalid user, and the user needs to re-establish a baseline.

11.4.3 System baseline

Before the beginning of the measurement wavelength scan, you must create a system baseline. If you have previously established a system baseline, you can skip it. A long time without updating the system, re-create the system baseline.

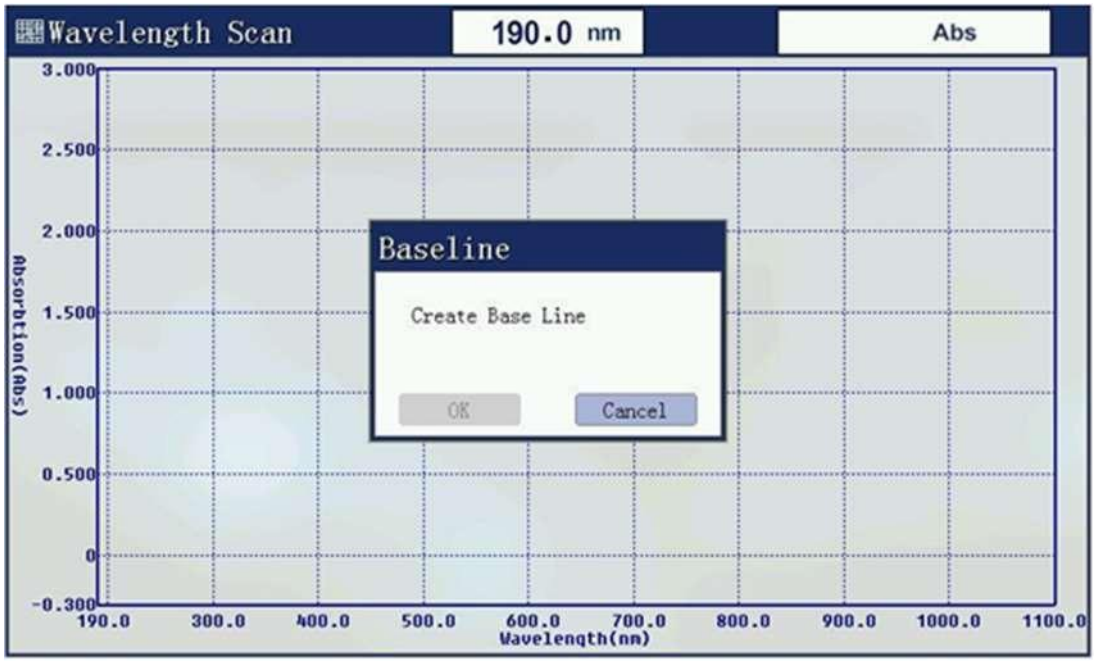

Figure-24

Press the **[Menu]** key to view the baseline data after building the system baseline.

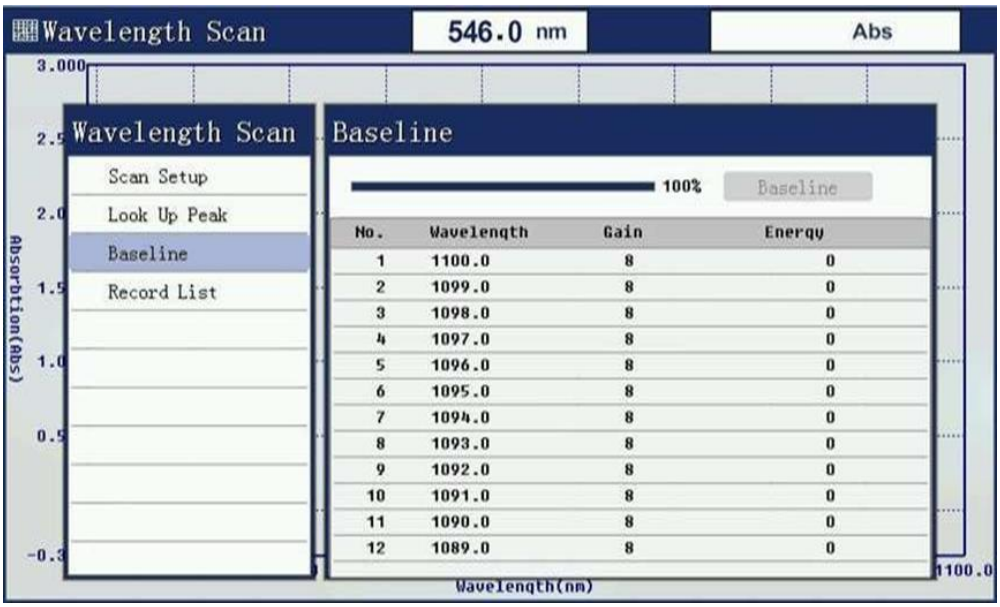

Figure-25

11.4.4 Create a user baseline (corrected blank)

Before starting the measurement, the user must establish a baseline, that is, correction of the reference sample 100% T and 0Abs.

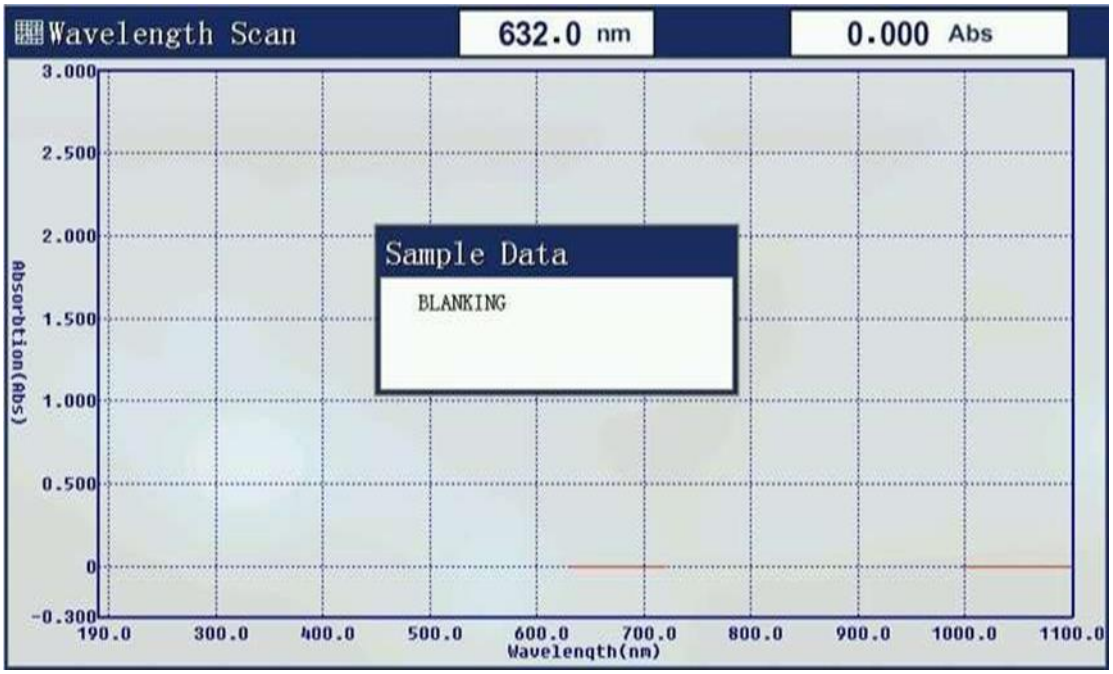

Figure-26

11.4.5 Begin testing

The tested samples were placed in the light path, press **[START]** to start the test.

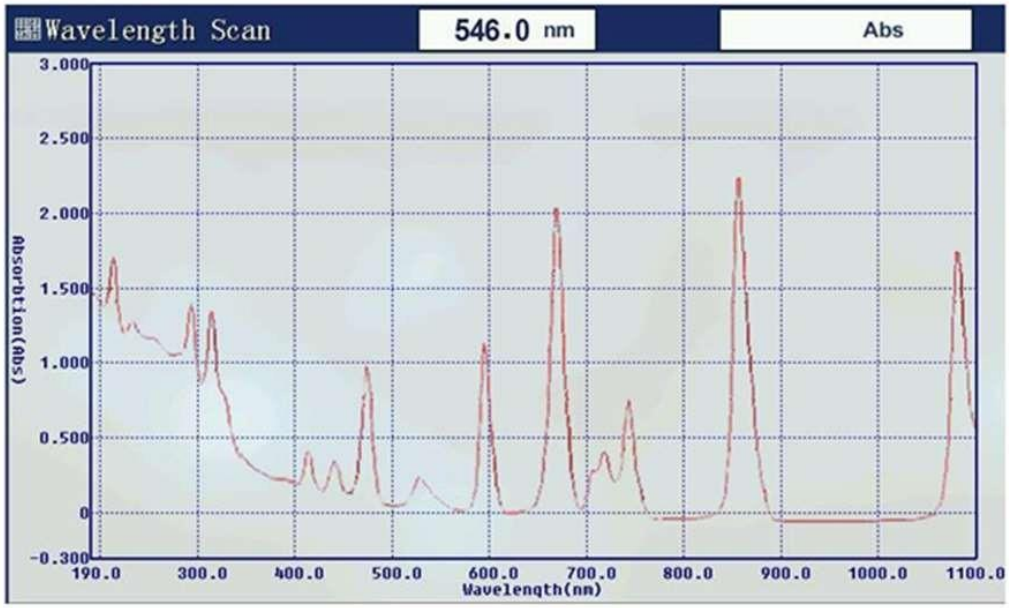

Figure-27

11.4.6 Peaks and valleys

After the test is finished, you can choose to find peaks and valleys peaks and valleys value of test results.

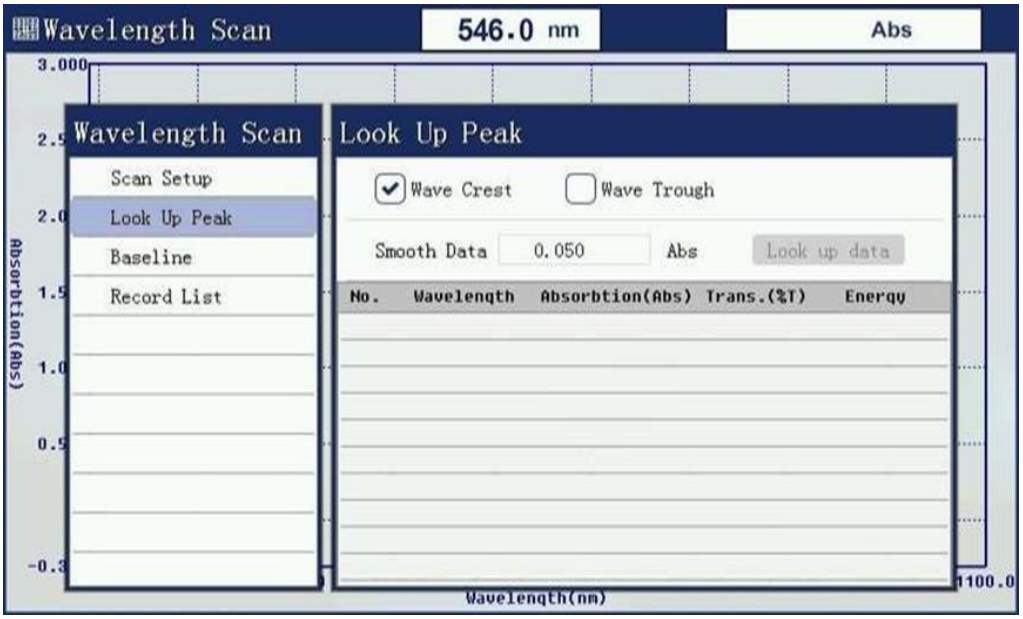

Figure-28

11.4.7 Data list

Press the **[Menu]** key to see the list of test data.

Figure-29

11.5 Multi-wavelength test

11.5.1 Function description

Multi-wavelength for the user is needed to test a sample while measuring the transmittance or absorbance at a wavelength setting of several functions, the user interface can be placed in this first sample obtained values for several wavelengths simultaneously, thus simplifying user operation processes.

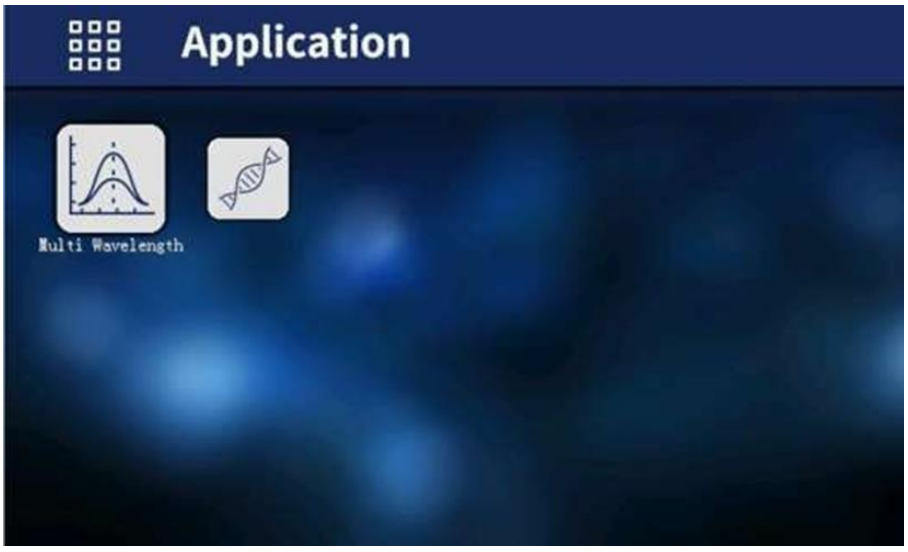

Figure-30

11.5.2 Set parameter

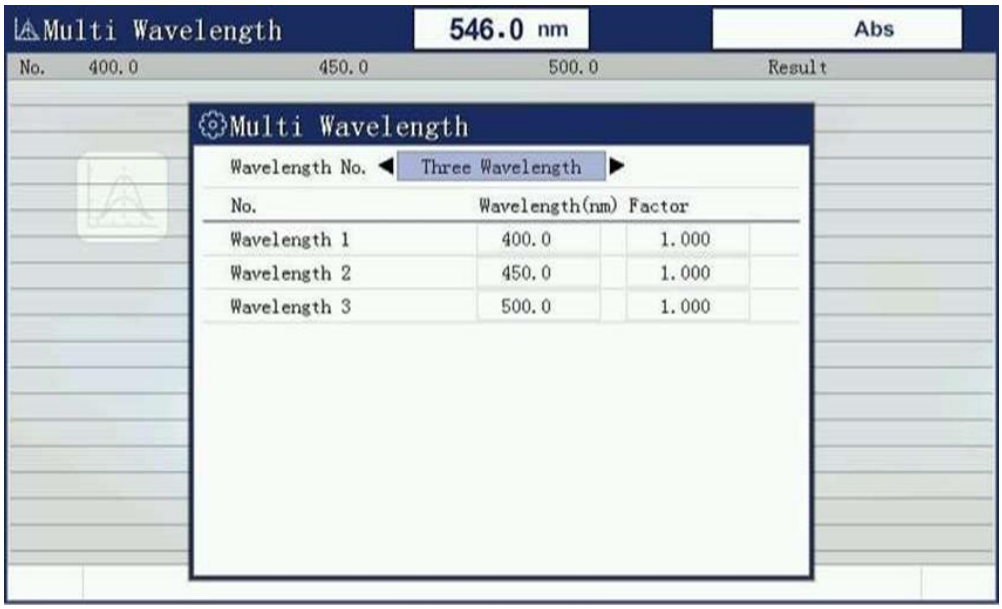

Figure-31

1) **Set the number of wavelength measurement**
   When you select a multi-wavelength test capability will be prompted to enter the number of the instrument wavelength.
2) **Set test wavelength**
   After setting the number of wavelengths measuring wavelength will enter the setup interface, this interface inputs wavelength values of all measured using the number keys, lost a good point **[ENTER]** after confirming then lose the next one, until all shall be measured wavelengths losers.
3) **Correction 100%T/0Abs**
   After these parameters are set, place two reference solutions for both colorimetric tanks, and then press the **[ZERO]** key, the instrument will go to the pre-school set a good few wavelengths were blank, went after the end of the prior setting the minimum wavelength, and displays 100.0% T or 0.000Abs.
4) **Data test**
   Remove the rear slot of the reference sample solution (the front does not move), place in the sample solution is measured, and then press the **[START]** button will measure a set of data, if a second sample is to be measured, replace the solution after press **[START],** once on.

Figure-32

11.6 Protein/DNA measurement

11.6.1 Function description

Protein / nucleic acid comprises two tests: Measurement of protein and single-stranded nucleic acid testing. The curve and parameter are installed inside the instrument for the two tests and users can make tests without building the standard curve again.

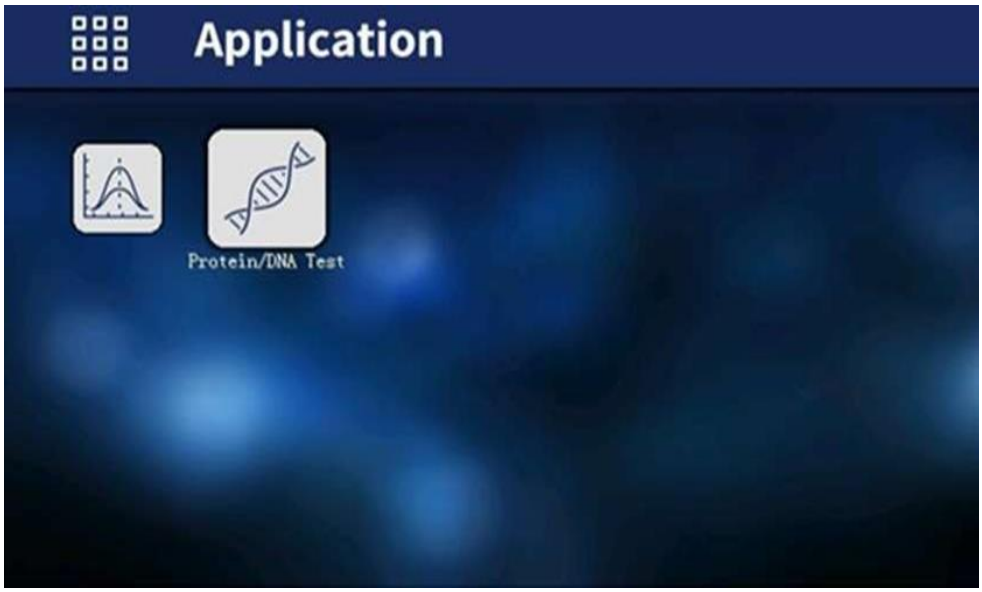

Figure-33

11.6.2 Parameter selection

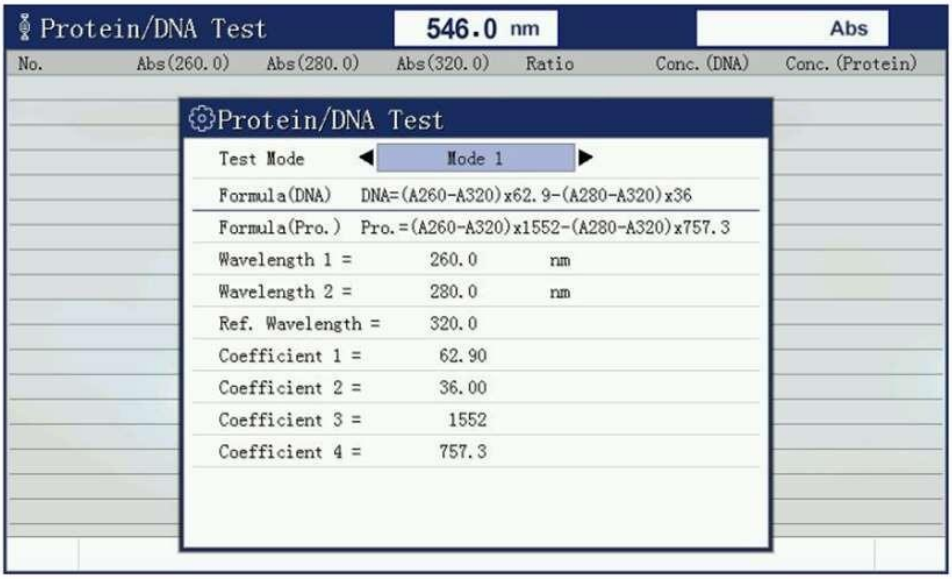

Figure-34

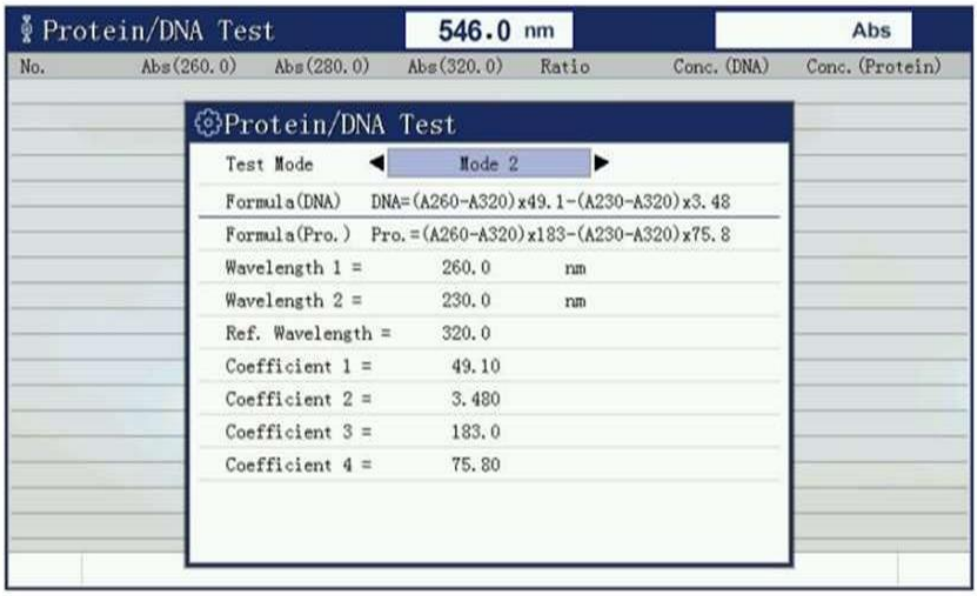

Figure-35

11.6.3 Set zero

Put reference solution into light path after selecting mode and press the **[Zero]** key to set zero.

11.6.4 Test

Put the sample solution into the light path and press the **[Start]** key to measure.

Figure-36

11.7 System setup

Press the icon **[System]**, you will enter the system setup window.

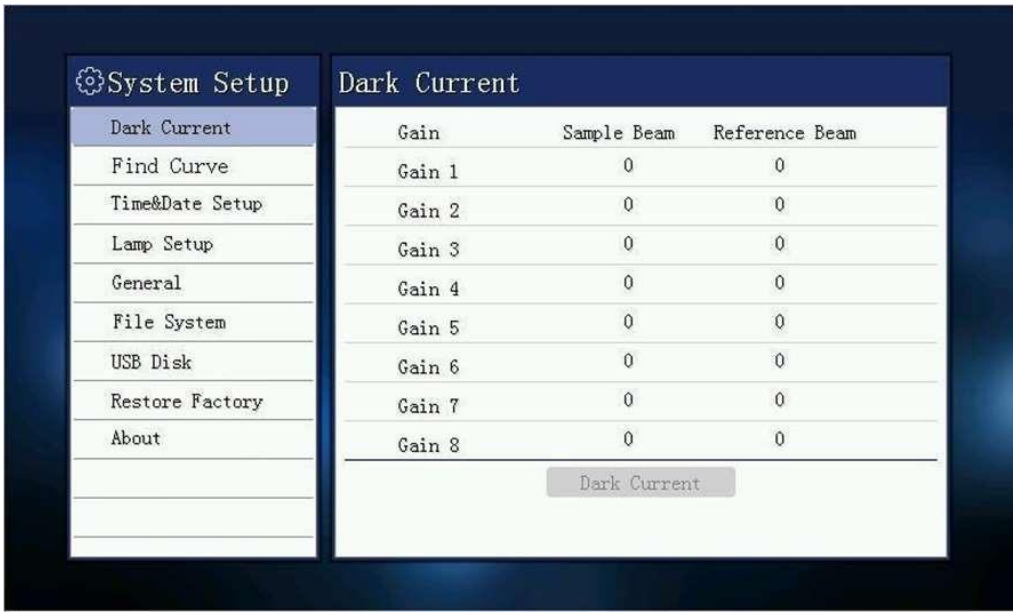

Figure-37

11.7.1 Dark current measurements

Long-time operation of the instrument probably leads to the drift of dark current. this function can correct the full range of dark current. Make sure to cover the sample chamber lid when testing dark current.

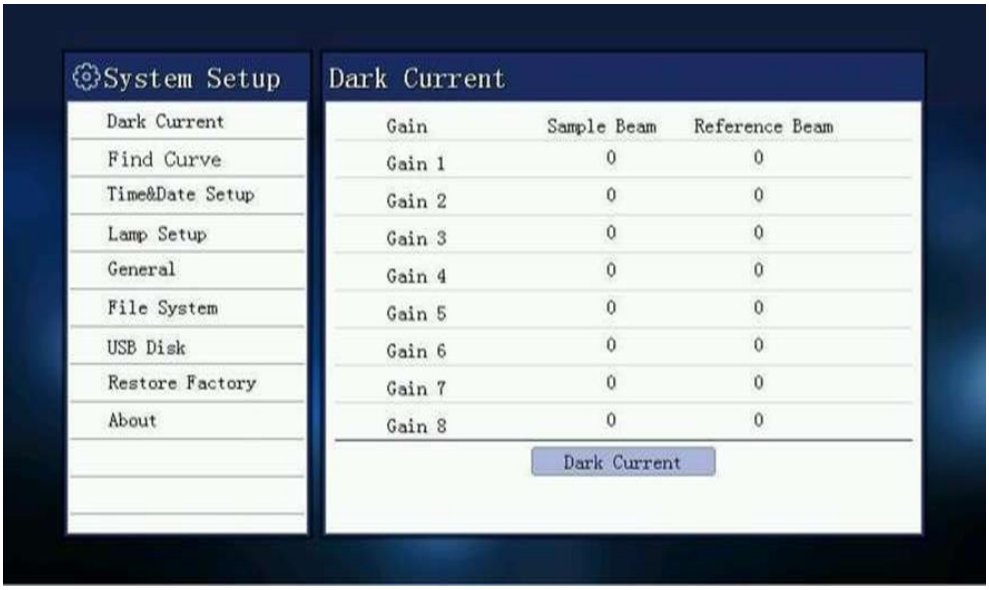

Figure-38

11.7.2 Looking for deuterium lamp curve

This function is to locate the 656.1nm wavelength characteristic curve by looking at the deuterium lamp, and wavelength calibration. If the seek fails the deuterium lamp characteristic curve, the wavelength is an invalid instrument, and the instrument will not work.

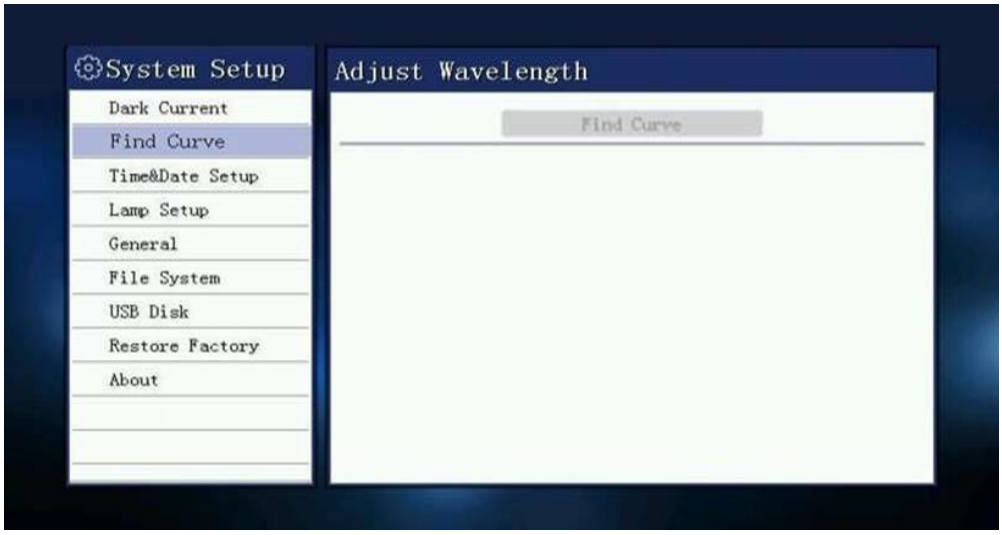

Figure-39

11.7.3 Time and date settings

Set the time and date of the instrument, set the year, month, day, hour, minute, and second.By the arrow keys select the year, month, day, hour, minute, and second, through the numeric keys currently selected content. Press Enter to confirm your entry, and press Esc to abandon input.

Note: Time and date will not power down after the instrument is switched off.

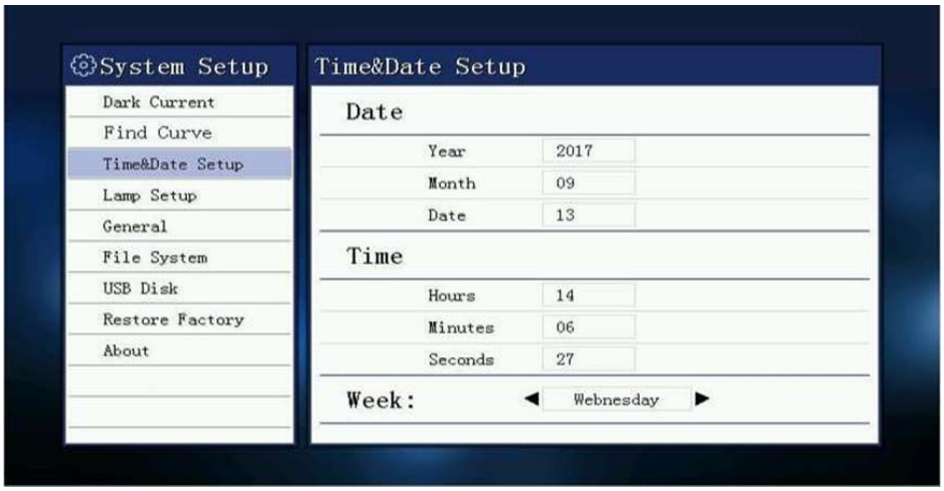

Figure-40

11.7.4 Light source management

Deuterium lamps and tungsten light source light switches control the display of each light source life. Up and down keys to select the source, press Enter to confirm the selection, the arrow keys to select the state of the light source, and press Enter toconfirm the selection.

Note: Open deuterium lamps need preheating after 15 seconds before they can open.

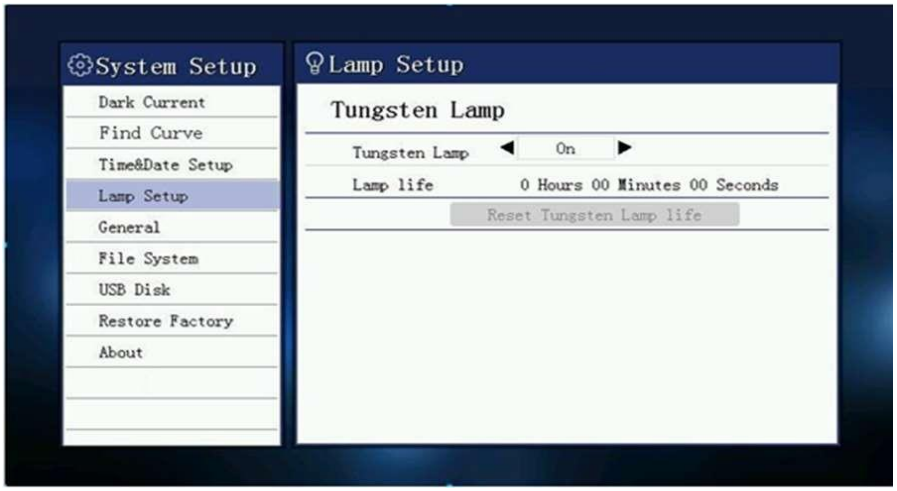

Figure-41

11.7.5 General

You can see the language option, data precise, beep setup, screen brightness and font setup.

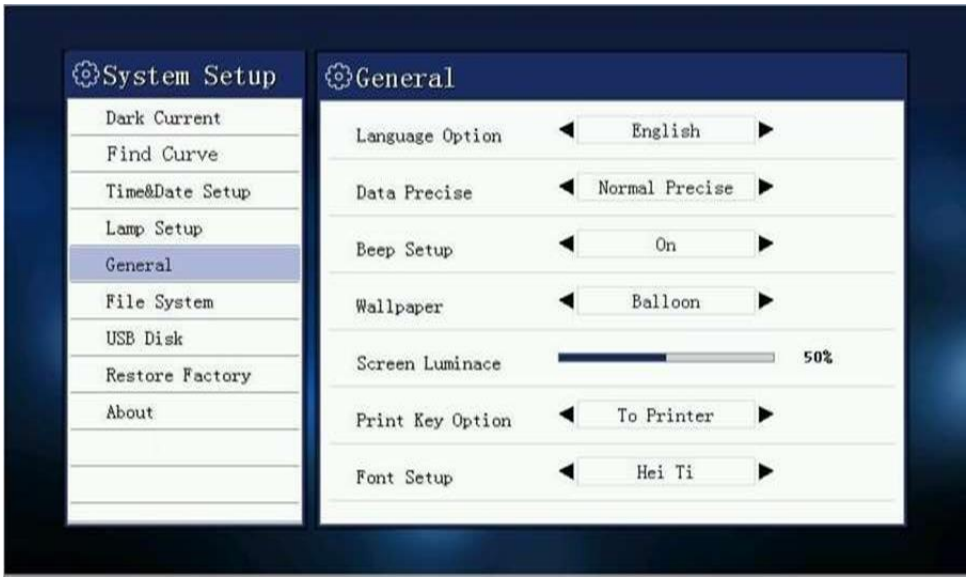

Figure-42

11.7.6 File system

Here you can see file status in local storage, you can format the disk and delete all files here.

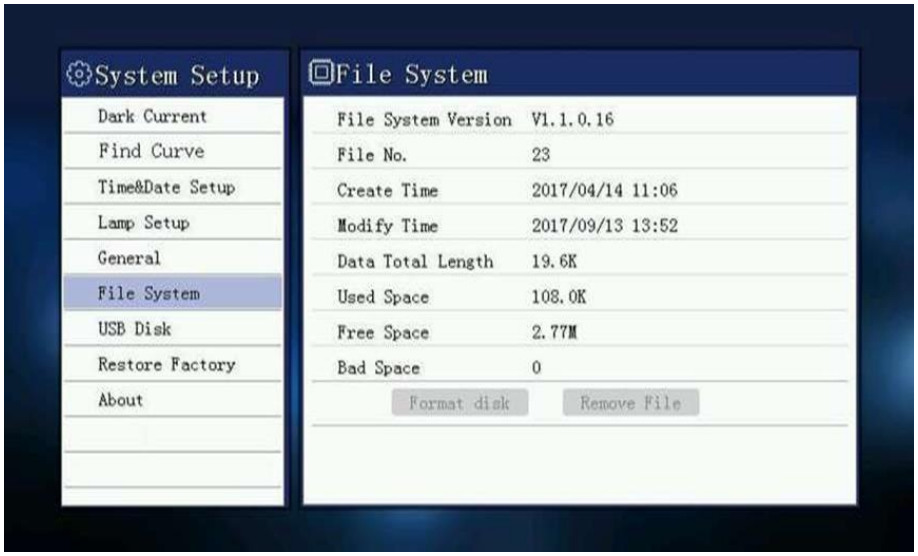

Figure-43

11.7.7 USB storage device

It shows the status of the external USB flash drive.

Figure-44

11.7.8 Restore factory settings

This operation will restore all system configuration information, this operation does not affect the system baseline and data files.

Figure-45

11.7.9 System information

You can view software version and hardware version information.

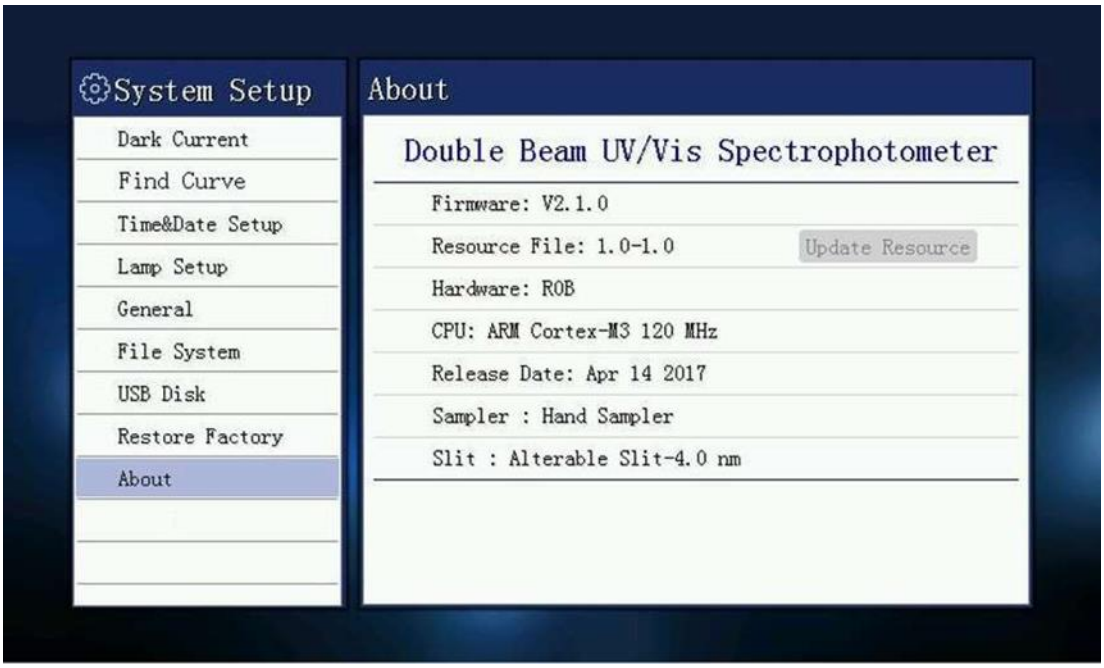

Figure-46

12. Maintenance

Caution:
Potential Chemical, Biological Eye and Skin Hazards.
Only qualified personnel should conduct the tasks described in this section of the manual.

Notice:
Remove all cells remaining in the instrument. Dispose of the cells or their contents in an authorized manner.
Correct use is the best safeguard for equipment maintenance, with emphasis on the use of the environment and mobile devices, in addition to the requirements previously proposed for use, we must also pay attention to the following issues.

12.1 Cleaning requirements

Danger!
1) Chemical exposure hazard.
2) Gas from a chlorine compound and UV light reaction can cause death.
3) Do not use chlorine compounds for cleaning.

Caution:
1) Potential Pinch, Eye, Burn and Chemical Hazards.
2) Before cleaning, always disconnect the instrument from the power source.

Notice!
Never use solvents like turpentine, or acetone or like clean the instrument, including the display and accessories.

12.1.1 Spectrophotometer

1) Only clean the housing, the cell compartments and all accessories with a soft, dampcloth. A mild soap solution can also be used.
2) Do not get excess water in the cell compartments.
3) Insert no brush and no sharp objects in the cell compartment, to avoid damage to mechanical components.
4) Dry the cleaned parts carefully with a soft cotton cloth.

12.1.2 Display

1) Do not scratch the display. Never touch the display with ball pens, pencils or similar pointed objects.
2) Clean the display with a soft, lint- and oil-free cotton cloth. Diluted window cleaner liquid can also be used.

12.1.3 Cuvettes/cells

CAUTION: Potential Chemical/ Biological Exposure Hazards.
Users correct laboratory practices if a risk of chemical exposure exists.

1) After use, clean the glass cells with cleaning agents.
2) Afterwards, rinse the cuvettes/sample cells several times with tap water and then thoroughly with deionized water.

Note: Glass cuvettes/sample cells that have been used for organic solvents (such as chloroform, benzene, toluene, etc.) must be rinsed with acetone before being treated with cleaning agents. In addition, another rinse with acetone is necessary as a final treatment step before the cuvettes/sample cells are dried.

12.2 Routine precautions

1) Use the dust cover to prevent dust accumulation when the instrument is not working for a long time.
2) Be careful not to spill solution into the sample chamber, to prevent corrosion, for some volatile samples, we recommend using the cuvette lid to prevent the impact of volatile gases to light, thus affecting the accuracy of the test equipment.
3) Check every part of the instrument to make sure they are not lost to prevent optical path deviations and ensure the instrument is working properly.
4) Moving instruments should be handled with care, and no heavy items can be placed on the top of the instrument, to avoid affecting the optical path shift stability and accuracy.
5) Wavelength calibration is recommended once a week to improve the accuracy of the measured data, not necessary to do it every time.
6) The instrument can't be left unused for a long time, which will shorten its life, and running 1-2 times a week is recommended, half an hour each time.

13. Troubleshooting

Refer to the following table for common troubles.

13.1 Power failure

Failures	Causes	Solutions
Boot no reaction	No electrical outlet	Check the external power supply
	The power cord is not plugged in	Re-seated host power
	The socket switches inlifuse burned	Replace the spare fuse embedded.
	The instrument socketswitch is broken	
	Internal power supplyboard or transformer burned	
Display error	Internal wiring is a loose display	Open the housing and re-seat the wire under the guidance of your professional personnel
	Internal +5 V power supply is not normalor lost cable	Open the housing and re-seat the cable under the guidance of your personnel professional.
	Internal proceduresby the unexpectedcollapse of the high-frequency voltage shock	Reprogram it under the guidance of your professional personnel.
	The motherboard is not working properly	

13.2 Self-test failures

Failures	Causes	Solutions
Filter positioning error	Loose electrical line filter	Open your housing service personnel under the guidance of re-seated
	Optocoupler line filter lose	Open your housing service personnel under the guidance of re-seated
	+12 V power supply board is not normal or loose cable	Open your housing service personnel under the guidance of re-seated
	Filter optocoupler bad	
	The motor driver chip on the motherboard bad	
Position error	The switch motor cable loose	Open housing service personnel underthe guidance of re-seated
Sources	Switch micro switch wire loose	Open your housing service personnel under the guidance of re-seated

	Switch bad micro switch	Open your housing service personnel under the guidance of re-seated
	+12 V power supply board is not normal or lost cable	
	The motor driver chip on the motherboard bad	
Error signal detector	Motherboard connector cable loose signal board	Open your housing service personnel under the guidance of re-seated
	The power board + / -15 power cable is loose or not properly	Open your housing service personnel under the guidance of re-seated.
	Bad signal board	
	Bad motherboard	

13.3 Other failures

Failures	Causes	Solutions
Wavelength self-checking is normal. Energy is low or unstable in the tungsten lamp wavelength region	Tungsten lights over 2000hours or bad	Refer to 15.1 Replace tungsten lamp
	Using too long causes the internal optics moldy	
	Experimental cuvette with a glass	Use quartz cuvette
Wavelength calibration test normal. Low-energy deuterium lamps or unstable areas	Both sides of the samplechamber are too dirty lens	Lens cleaning paper Moistened with alcohol to wipe dry
	Deuterium lamp is lit for more than 2000 hours or bad	Deuterium lamp replacement
	Using too long causes theinternal optics moldy	

14. Accessories

Standard Accessories

S. No	Accessory Name
1	Glass cuvette 10 mm/1 set of 4
2	Quartz cuvette 10 mm/1 set of 2
3	Power cable
4	PC software

Optional Accessories

S. No	Accessory Name
1	Glass cuvettes 5 to 100 mm
2	Quartz cuvettes 5 to 100 mm
3	Manual 4-cell holder (10 to 100 mm)
4	Auto 8-cell holder
5	Tungsten lamp
6	Deuterium lamp
7	21 CFR part 11 compliant software

15. Replacement

15.1 Tungsten lamp replacement

1) Turn off the instrument and unplug the power cord and disconnect the equipment on both sides of the four screws fastening the shell and the shell gently removing the left vertical against the instrument. (**Note:** The connecting wire between the housing and the base plate, so after the fastening of the housing screws are not removed too much force is to pull the housing to prevent the pull-beam break)
2) Remove the lamp compartment cover with three fixing screws and gently remove the lamp compartment cover. (**Note:** If the instrument has been open for some time the lamp compartment cover will be very hot, please be careful burns)
3) Find the objects shown in the following figure, loose fastening sheet metal screws, pull out a tungsten lamp, and the new tungsten lamp according to the original position seated, and put on a solid metal piece tighten the screws (to ensure tungsten light positive)

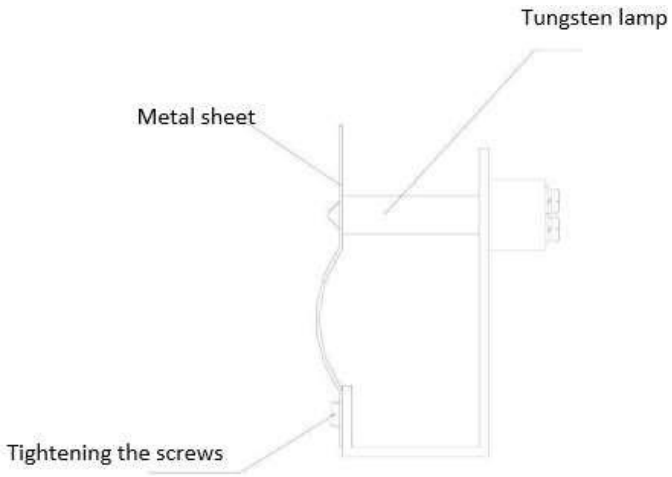

Figure-47

4) Turn on the instrument, make a tungsten lamp light, and convert the light source switching mirror to a horizontal position manually.
5) Loosen the screws seat switch motors, and seat motors to move the focus to switch into the slit in the smallest and tungsten lights centered.
6) Replace the lamp compartment cover (be careful not to press the right side of the line) and the instrument housing (do not press the display line) and tighten the corresponding screws.
7) Re-POST, after the completion of the self-test mode in the wavelength photometric measurements were walked at 340nm, 370nm, 1000nm, and 1100nm let automatic zero. If it does not display the low energy lamp replacement is completed.

15.2 Deuterium lamp replacement

1) Turn off the instrument and unplug the power cord and disconnect the equipment on both sides of the four screws fastening the shell and the shell gently removing the left vertical against the instrument. (**Note:** The connecting wire between the housing and the base plate, so after the fastening of the housing screws are not removed too much force is to pull the housing to prevent the pull-beam break).
2) Remove the lamp compartment cover with three fixing screws and gently remove the lamp compartment cover. (**Note:** If the instrument has been open for some time the lamp compartment cover will be very hot, please be careful burns!!!)
3) Find the objects shown in the figure, as shown in Figure unscrew the screws and disconnect the plug on the power supply board to remove the deuterium lamp socket, then put the new deuterium lamp installed under the original position (note deuterium lamp light mouth will toward the objective) and plug it in the power supply board.

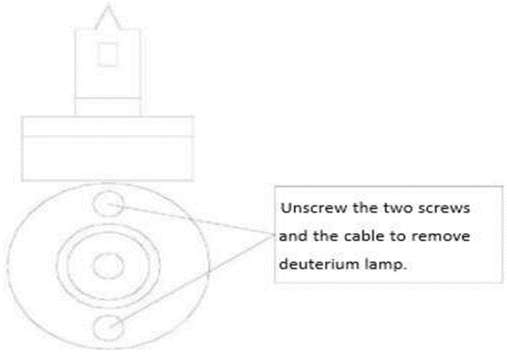

Figure-48

4) Turn on the instrument, make a deuterium lamp light, and convert the light source switching mirror to a vertical position manually.
5) Loosen the screws fixed lens holder and fine-tune the focus lens holder into the slot on the smallest and deuterium light centered.
6) Convert the light source switching mirror to a horizontal position manually.
7) Loosen the screws seat switch motors, and seat motors to move the focus to switch into the slit in the smallest and tungsten lights centered.
8) Replace the lamp compartment cover (be careful not to press the right side of the line) and the instrument housing (do not press the display line), then tighten the corresponding screws.
9) Re-POST, after the completion of the self-test mode in the wavelength photometric measurements were walked at 200nm, 330nm, 340nm, 370nm, 1000nm, and 1100nm let automatic zero. If you no longer display low energy lamp replacement is completed.