LABDEX

USER MANUAL

Single beam UV-Visible Spectrophotometer

LX511SS

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1. Safety Measures

- Read the entire user manual carefully before you unpack, set up or operate the device. Incorrect operations could lead to serious injury to the operator or damage to the device.
- To ensure 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, ensure the instrument is disconnected from the power source before changing the lamps.

Caution
• Health hazard 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.
Warning
• Health hazard 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.
Dangerous
• Potential danger when in contact with chemical/biological substances. • Handle chemicals safely by knowing the procedures and reading safety data sheets.

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

- Dispose of all consumed solutions in accordance with the local and national regulations and laws.
- Select the type of protective equipment suitable for the concentration and quantity of the dangerous material being used.

Precautions:

- Use the dust cover to prevent dust accumulation when the instrument is not working for a long time.
- Don't spill in the chamber. Use the cuvette lid for volatile samples to ensure accuracy.
- Check every part of the instrument to make sure they are not loose to prevent the optical path deviations and ensure the instrument is working properly.
- Handle the instrument carefully; avoid heavy items on top for stability and accuracy.
- Wavelength calibration is recommended once a week to improve the accuracy of the measured data; it is not necessary to do it every time.
- 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.

2. Introduction

Single beam UV-Visible Spectrophotometer LX511SS is a single 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.	LX511SS
Optical system	Single beam, grating 1200 lines/ mm
Wavelength range	190 to 1100 nm
Bandwidth	1 nm
Wavelength accuracy	±0.1nm@656.1nm, ±0.3nm@all
Wavelength repeatability	≤0.1 nm
Wavelength setting	Automatic
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 mode	T, A, C, E
Photometric range	0-200%T, -0.3~3A, 0-9999C (0-9999F)
Stability	±0.0005A/h@500nm
Stray light	≤0.03%T@220, 360nm
Baseline flatness	±0.001A
Scanning speed	Hi, Med, Low (Max. 3000nm/min)
Display	7
Lamps	Imported deuterium and Tungsten lamp
Detector	Imported silicon photodiode
Cuvette holder	10mm manual 4-cell holder
Output	USB drive, USB host, RS232
Power	AC 220V/50Hz or AC 110V/60Hz
Dimension	590 × 475 × 250 mm
Net Weight	20 Kg
Packaging dimension	810 x 660 x 390 mm
Gross Weight	27 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

6.1 Structure Introduction

The overall structure consists of three parts: Optical system, power system and micro-computer system.

6.1.1 Top view of structure

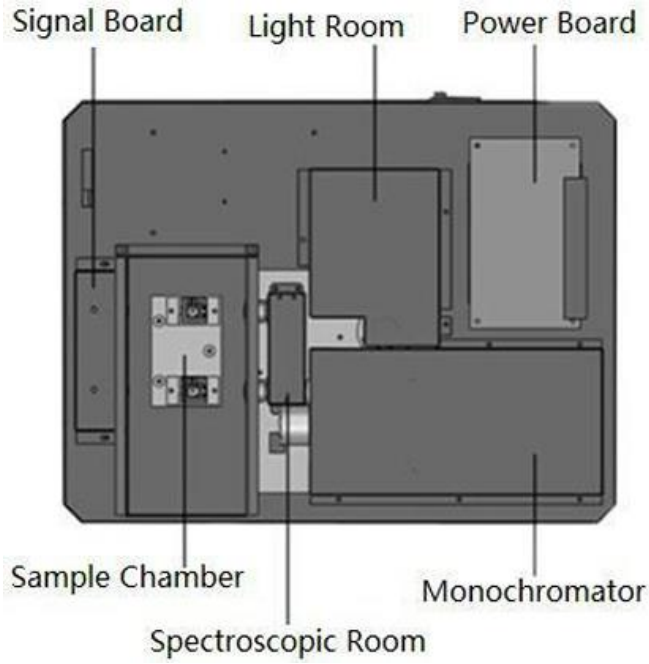

Figure-1

6.1.2 Bottom view of structure

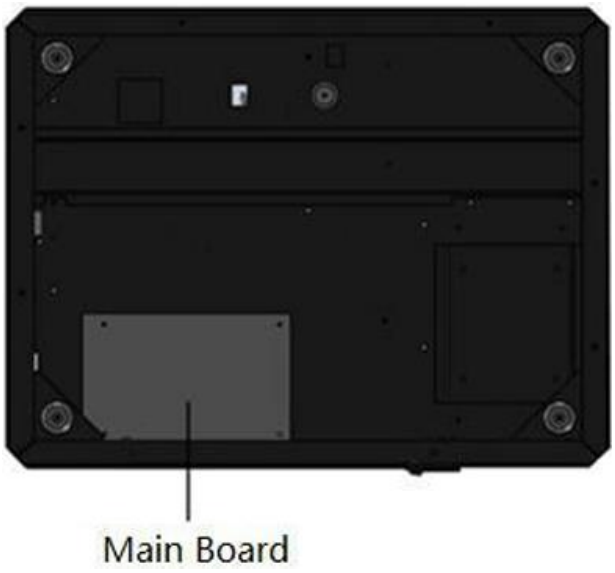

Figure-2

6.1.3 Light path diagram

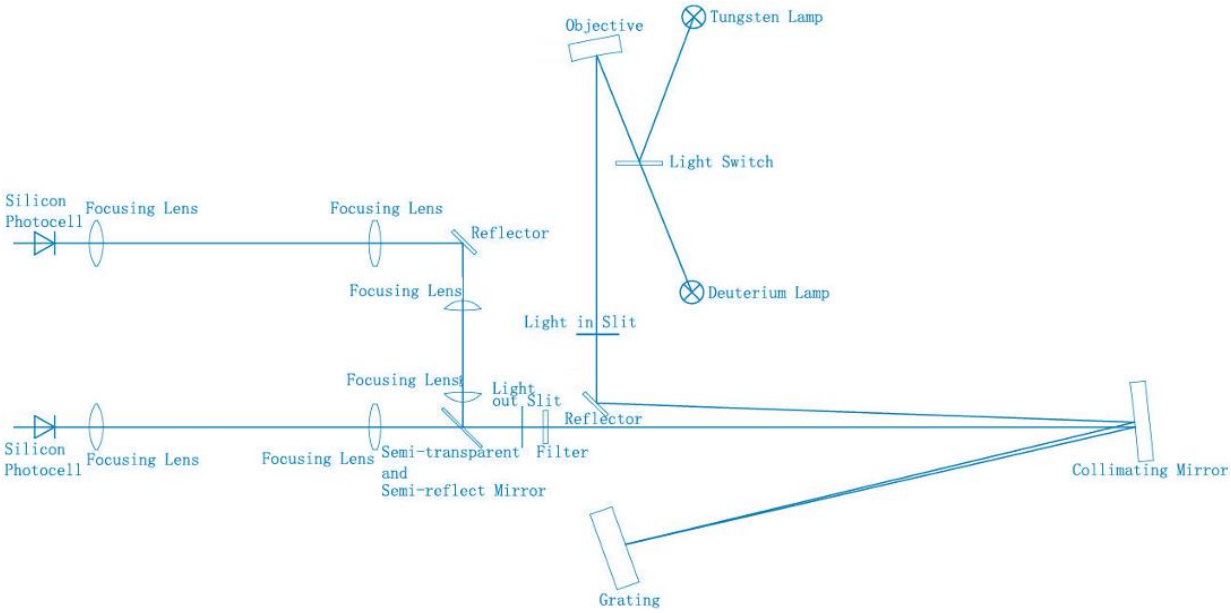

Figure-3

6.1.4 Important parts 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) **Light room:** There are tungsten halogen lamps and deuterium lamp sources 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. As 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, where the operating voltage is proportional to the fourth power; therefore, to make the light stable, the model has a stability of less than 0.2% of the power supply, and the other imported Philips halogen socket tungsten halogen lamp replacement to ensure stable, easy to use and long life.
4) **Deuterium lamp:** suitable wavelength range of 190-340nm. When a deuterium lamp is operated, maximum energy sources in the vicinity of 230nm, 486.0nm and 656.1nm and has two characteristic lines, which can be used for instrument calibration and wavelength accuracy in the visible region.
5) **Monochromator:** Contains spectral components- grating, into the slit, the slit, mirror, focusing lens, and the wavelength filter drive system, the monochromatic light is emitted from the composite light can be decomposed into monochromatic any wavelength of monochromatic light from the optical separation.

6) **Raster:** The dispersion of the original, the model uses a 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 spectral overlap.
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, color band is deteriorated, is not conducive to the qualitative analysis, quantitative analysis also affect the linear range of the calibration curve, the slit is too small, flux decreased, reducing the signal to noise ratio, affect the measurement accuracy, the slits there are 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 the reference solution, and the other is for the sample solution. An 8-position cell changer is optional.
11) **Signal Board:** Transfer to the motherboard, processed signal detection, and light amplification.
12) **Main board:** Instrument micro control unit, control instruments, light source switch, the motor rotates, the signal processor display, etc.

6.2 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:** It means that a wavelength photometer can differentiate between the maximum and minimum values of the test.
3) **Wavelength accuracy:** Wavelength accuracy is the difference between actual and set wavelengths, vital for photometers and spectrophotometers. It affects analysis outcomes significantly. Accuracy can be checked using standard filters like holmium oxide and emissions from deuterium or mercury lamps.
4) **Wavelength repeatability:** Wavelength Repeatability is the ability of the instrument to return 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.

The indices with the instrument resolution and sensitivity are similar, but different; they reflect 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, when the concentration changes by one unit, the change in 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. The two measurement precisions of the method are the same; the greater the sensitivity calibration curve slope, the closer the slope is to being equal, the higher the sensitivity, the better the precision. It is noted that, to obtain accurate test results, the ratio of 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) 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, and stray light limits the accuracy of the General Assembly high-concentration solution analysis. Stray light represented by T%.
7) **Photometric range:** Refers to 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; the photometric accuracy check is usually through the use of 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 to several measurements 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 are the purpose of the relative signal. Generally, the spectrophotometer has two sources of noise, one from the light source, and the second is derived from the internal electronic noise inherent in the instrument, such as: power supply, amplifier, AD conversion and the like. To reduce noise and improve the signal-to-noise ratio, there must be a good electrical design. Noise measurement repeatability test under low concentrations, but it also affects test accuracy. Noise by averaging several measurements after partial elimination.
11) **Drift:** Refers to the degree of deviation from the instrument's starting value. It depends on the stability, light stability of the electrical device and the like. For a single-beam instrument, 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

7.1 Using Conditions

Equipment should be installed in a cool, dry environment (16-35℃, 45-80% humidity) and kept away from magnetic, electric, or high-frequency interference. Avoid corrosive gases and vibrations; ensure a smooth surface and adequate space for the fan. Use a single power outlet with good grounding, and if voltage is unstable, use a power supply. Protect the instrument from direct sunlight and dust.

7.2 Instrument Installation

1) After unpacking, carefully check the packing list inside if the object is complete and intact.
2) Determine whether the work environment meets the foregoing requirements, the ambient temperature is 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 environment can't have dust, corrosive gases and vibration.
4) Around the instrument, no obstacles to the flow of air.
5) The company supplied a power cord and ensured there was a well-grounded power outlet line.
6) Check the sample chamber, ensure that there is no solution and foreign matter and perform the process of self-test to ensure that the sample compartment lid is closed; you can't half-open (this is very important, otherwise it will affect the instrument self-test results and normal use!).
7) Turn on the instrument. Then the instrument makes 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, ensure that the socket to which the device is connected is easy to reach for each user.

8. Working Principle

8.1 Nature of absorption

The spectrophotometric analysis method is the use of substances to choose a different wavelength of light absorption characteristics. 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 was obtained, and the absorption spectrum curve was 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 certain wavelengths of the spectrum, they 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 corresponding to the absorption peak at a shorter wavelength, when generating the ultraviolet absorption spectra of absorption in the ultraviolet region.

8.2 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 a 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) The absorbent system is a continuous, uniform distribution.

8.3 Impact spectrophotometry factors

1) Non-absorption errors caused by radiation and matter.
2) Fluorescence and photochemical reactions, in general, errors in fluorescence spectrophotometry produce negligible fluorescence efficiency, which is very small in most cases. The color system and the fluorescence emission are isotropic, resulting in 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 measures the impact on the absorption of fluorescence great extent on the optical absorption cell and detector design.
3) Reflection and scattering, the absorption law applies only to a homogeneous medium absorption system, a turbid solution, so that the measured increase in absorbance due to scattering results in deviation from Beer's law.
4) Non-ideal instrument error caused.

5) Beer's law deviation polychromatic contrast, the majority of the photometers can only get close to monochromatic light with a narrow lumen; in fact, there is still a polychromatic nature, which can lead to deviations from Beer's law.
   Deviation depends on the two monochromatic molar absorptivity difference △ ε, | △ ε | is very small, and it can be approximated that monochromatically, at low concentrations, the curve remains linear, but at larger concentrations, with concentration increases, the AC curve bends more seriously, and Beer's law applies only to dilute solutions.
6) **Stray light:** Stray light entering the detector means unnecessary components are being 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, at 220nm, tungsten lamp at 340nm)
7) **Slit width:** The slit width of the spectrum affects not only the purity, but also the absorbance. When quantitative analysis is used to obtain a sufficient measuring signal, the slit should be larger. In qualitative analysis of the use of a smaller slit when the entrance slit and the exit slit widths are equal to the width of the slit, a minimum error was caused.
8) Wavelength scale ruler of error, the wavelength of the gauge determines the 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).
9) Impact of non-parallel incident, one of the prerequisites earlier 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 there is 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, the absorbance measurement error is generally less than 0.5%.
10) Photometric scale error, photometric accuracy of the scale, which directly affects the accuracy of the magnitude of the error in photometric measurements.

9. Operations

9.1 Main Functions

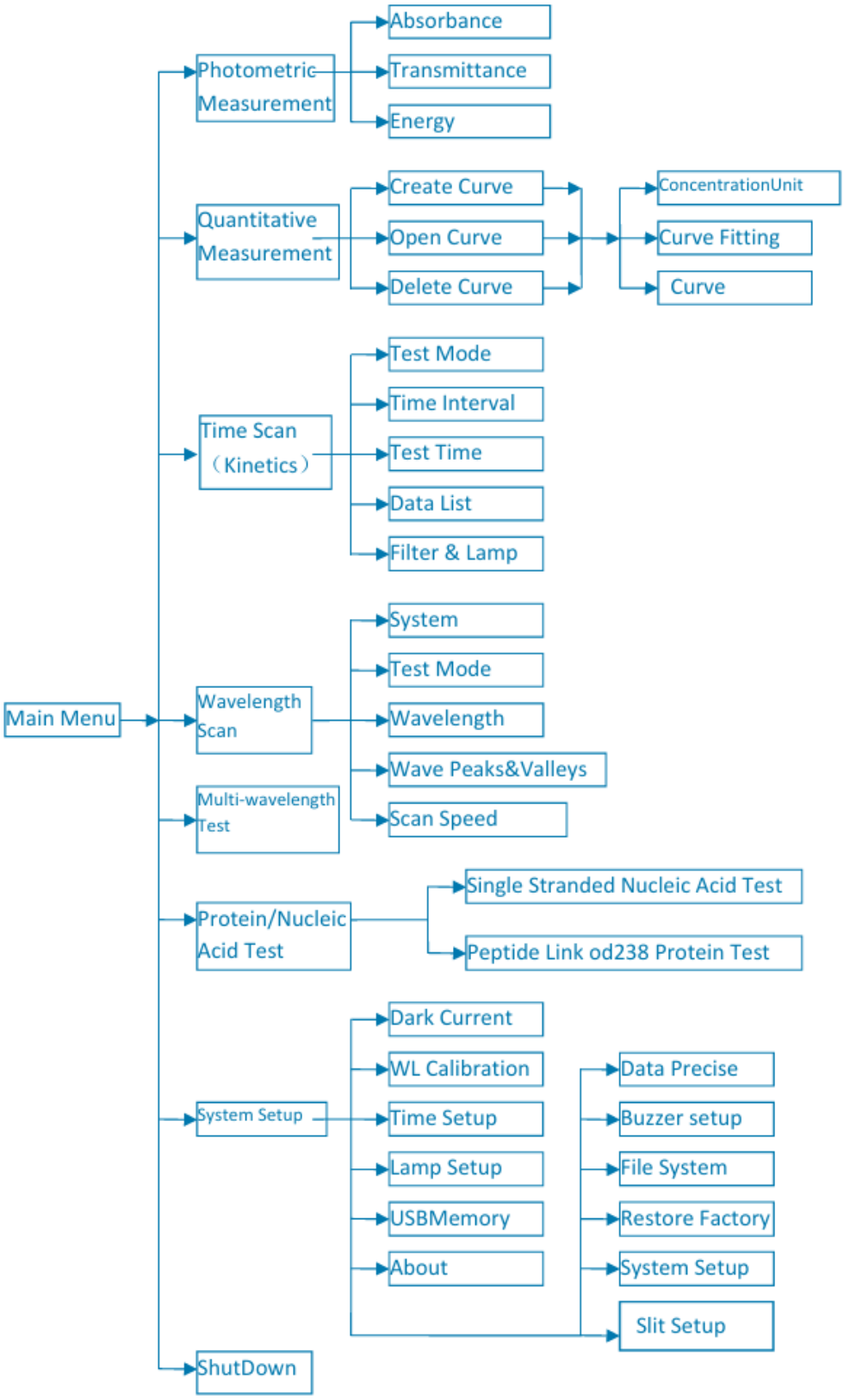

Figure-2

9.2 Key definitions and basic definitions

9.2.1 Panel schematic diagram

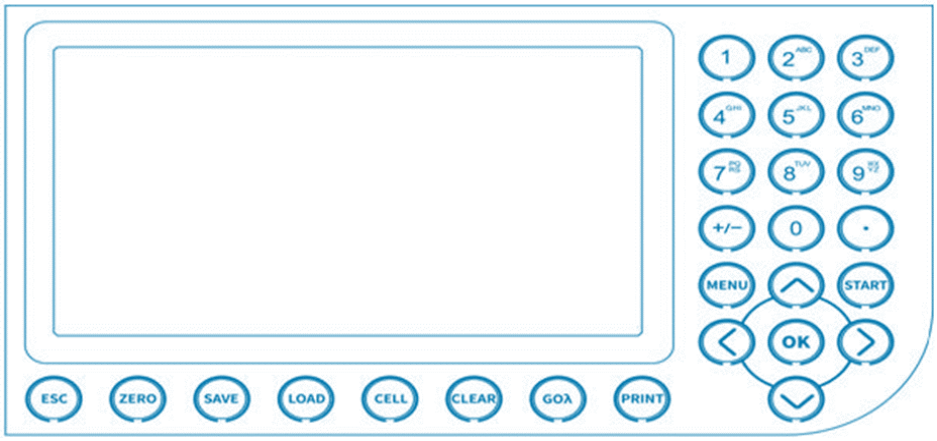

Figure-3

9.2.2 Button function descriptions

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 the key to delete the input data, and 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 keys
[CELL]	Automatic sample holder button

9.2.3 Basic Operations

1) **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 the **[ZERO]** key to adjust the blank.

2) **Set the wavelength**
In any measurement interface, press the **[GOλ]** key to set the current working wavelength.
3) Store files in txt or cvs format (use Excel format for a simple spreadsheet file).

9.3 Programs

9.3.1 Instrument Self-test

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

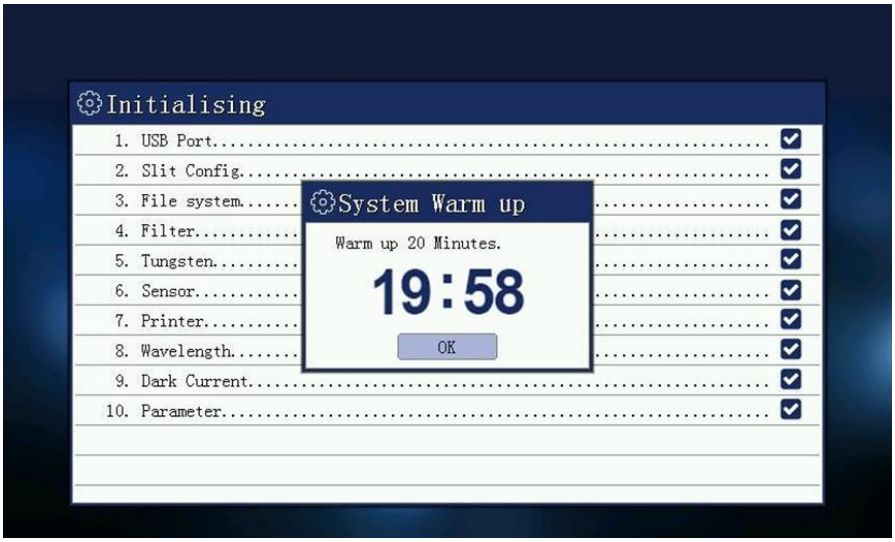

Figure-4

1) **Communication port inspection**
Check if the communication port of the instrument is working properly or not. The result is displayed correctly as √ and an error as ×, the buzzer alarm.
2) **File system check**
Check the instrument's built-in flash file system is correct. The result is displayed correctly √; an error will reformat the file system.
3) **Filter positioning**
Check the instrument's filter motor and its locator to ensure they 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 to ensure they are working correctly. The result is displayed correctly √, an error is displayed, the result is ×, and the buzzer alarm.
5) **Printer check**
Check that the printer interface device is working properly. The result is displayed correctly √, an error is displayed, the result is ×, and the buzzer alarm.
6) **Tungsten lamp examination**
Open the instrument tungsten light source, and check that the operating parameters of the tungsten lights are working properly. If the parameter is not working properly, then reset the operating parameters of a tungsten lamp. Change detections are always displayed correctly, and the result is always √.

7) **Deuterium lamp examination**
Open the deuterium light source instrument operating parameters to check that the deuterium lamp is working correctly. If the parameter is not working properly, then reset the operating parameters of the deuterium lamp. Change detections are always displayed correctly, and the result is always √.

8) **Signal detector check**
Check that the signal detector instrument is working correctly. The result is displayed correctly √, an error is displayed, the result is ×, and 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 there is no user input within five seconds, then skip this. If the argument is a wrong wavelength, then start looking for a deuterium lamp to automatically correct the characteristic peak wavelength. Wavelength calibration result is displayed by √, the correction is not passed, then the result is ×, the buzzer alarm.

10) **Dark current correction**
Read the instrument dark current of energy, checking eligibility. If the dark current is in the proper range, which means that the dark current is correct, then it displays the results √. If the dark current exceeds the maximum setting, the user is prompted with a dark current error. The results are displayed as ×, the buzzer alarm.

11) **System parameters check**
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 is not correct, the baseline correction system will act directly. Showing results √, the correction is not passed, then the result is ×, buzzer alarm.
After the self-test and re-calibration of the dark current, into the main programs.

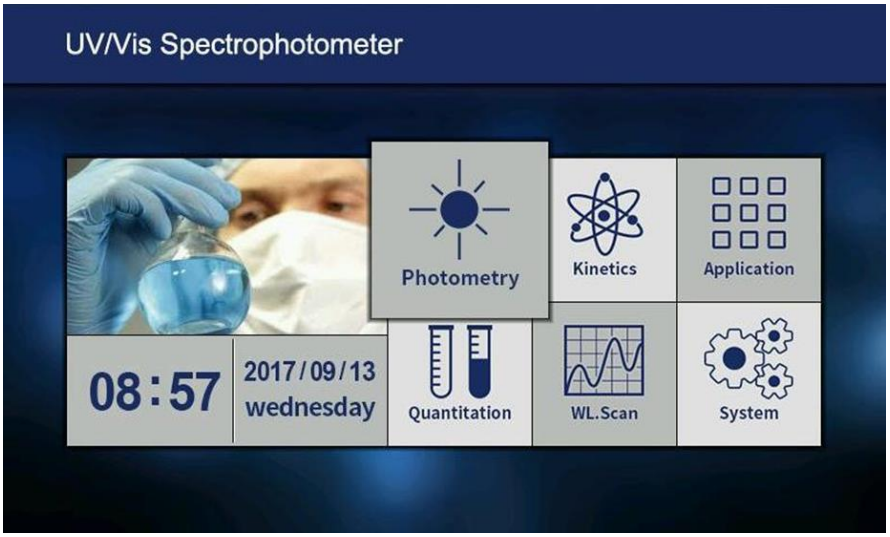

Figure-5

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.

9.3.2 Photometric Measurement

9.3.2.1 Function description

Photometric measurements measure the absorbance of the sample at a single wavelength, transmittance or energy value.

9.3.2.2 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, the energy window appears and prompts you to select the amplifier gain.

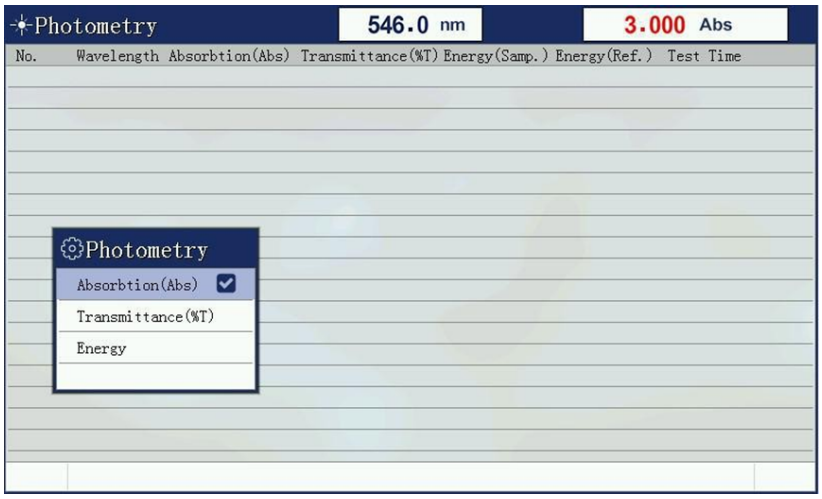

Figure-6

9.3.2.3 Set wavelength

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

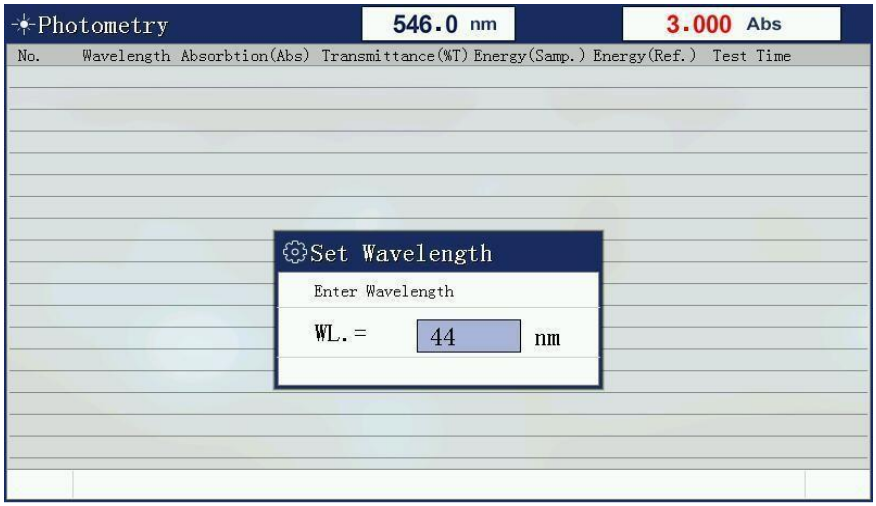

Figure-7

9.3.2.4 Correction 100%T/0Abs

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

9.3.2.5 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-8

9.3.2.6 Delete data

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

9.3.2.7 Save the file

Press the **Save** button to save the current list of test data to a file. If this is the first time you save a file, the dialog box will pop up asking for the file name.

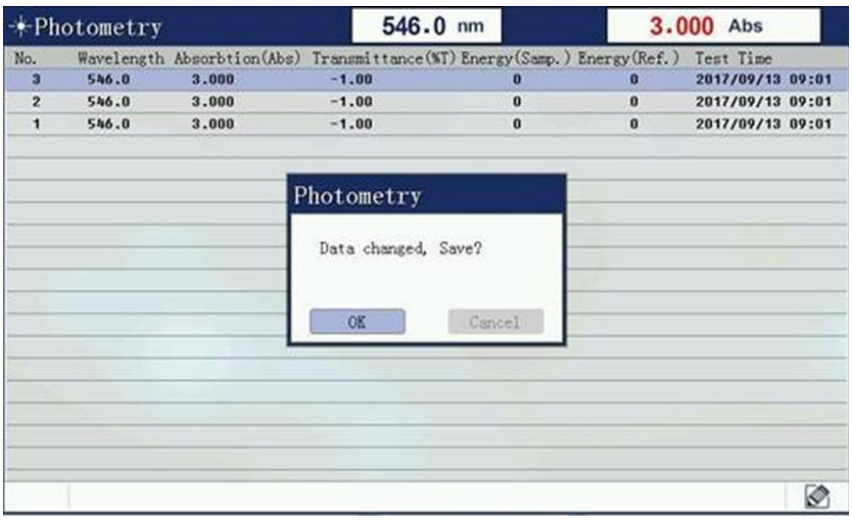

Figure-9

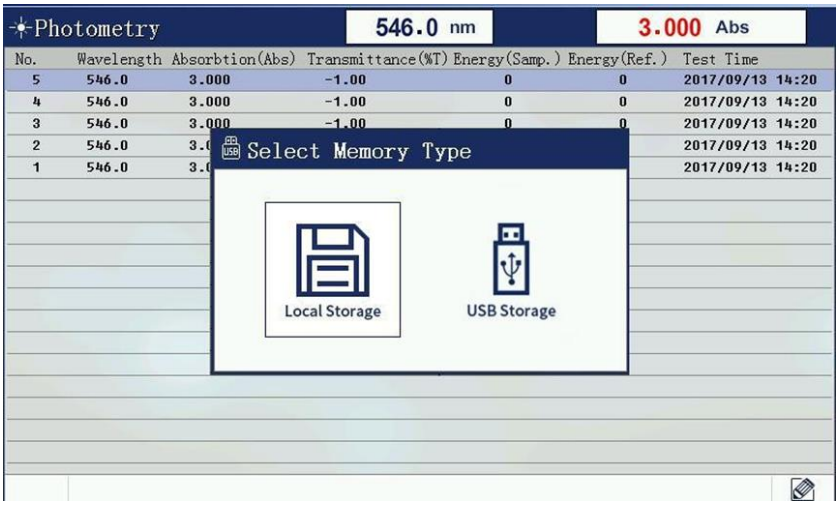

Figure-10

9.3.2.8 Open the file

In the photometric measurement interface, the Load button will display the interface to open the window, which has a list of all the photometric data files. 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.

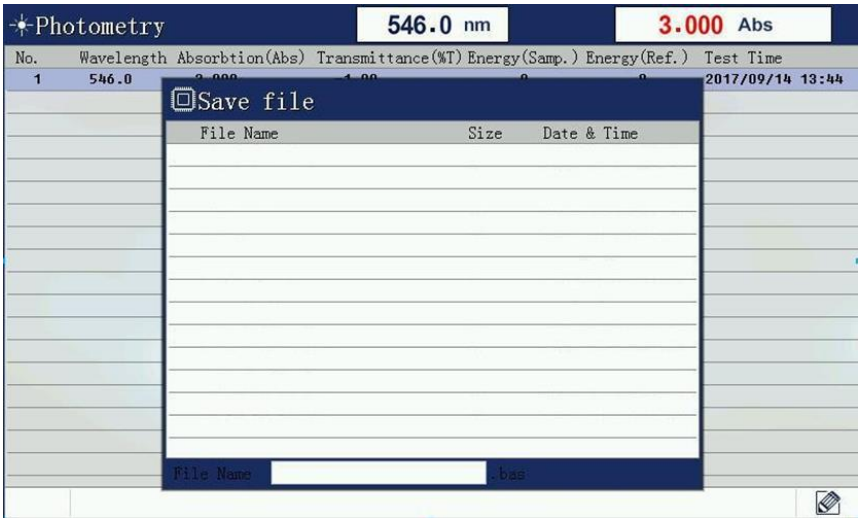

Figure-11

9.3.3 Quantitative measurement

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

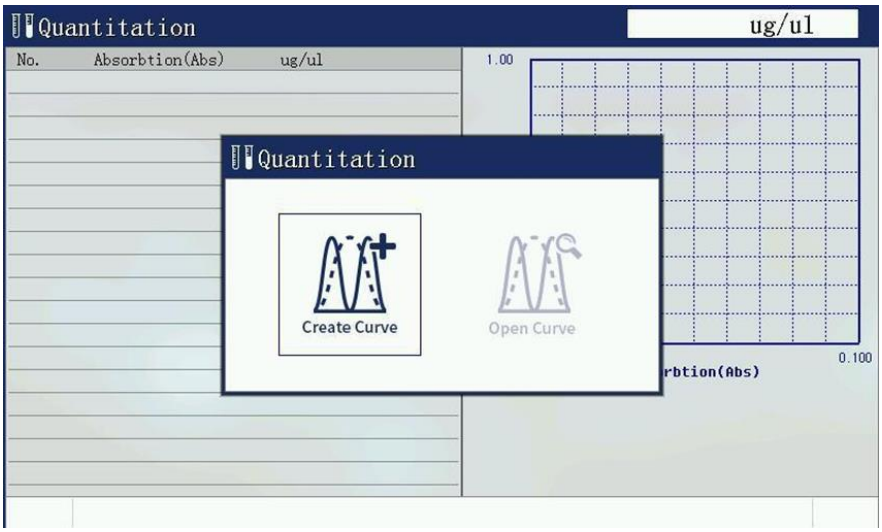

Figure-12

9.3.3.1 Build standard curve

Use several configured standard samples, input the concentration of the sample standard, and collect the absorbance of the standard sample. The relationship between concentration and absorbance is calculated using curve parameters, and these parameters are used to measure the concentration of the sample.

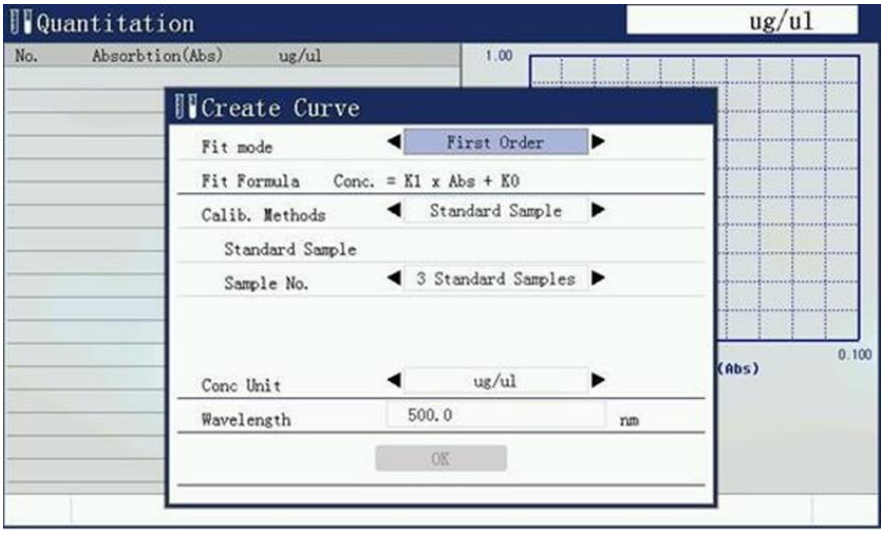

Figure-13

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 the coefficient method. The stand sample method is to prepare a sample first, build 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.

9.3.3.2 Standard sample measuring

Put various standard samples into the 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 sounds, and the exit is established to establish the curve function.

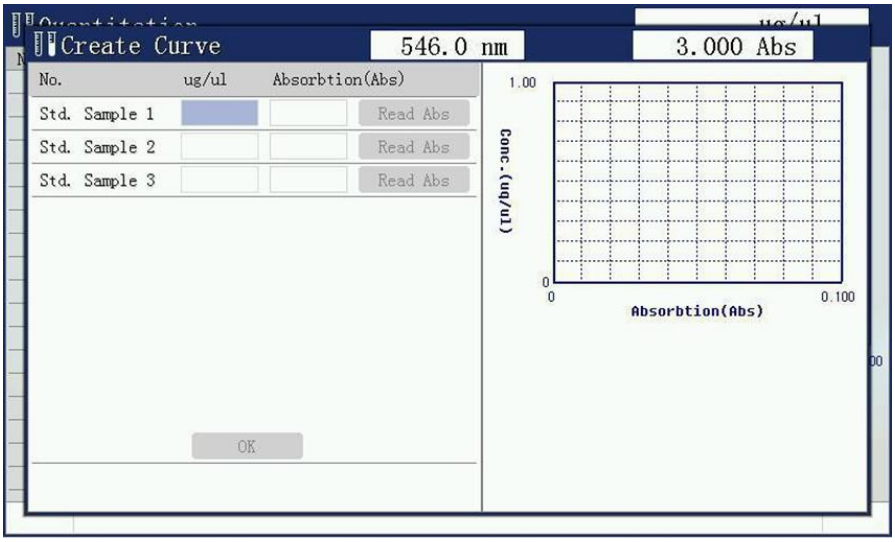

Figure-14

9.3.3.3 Sample test

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

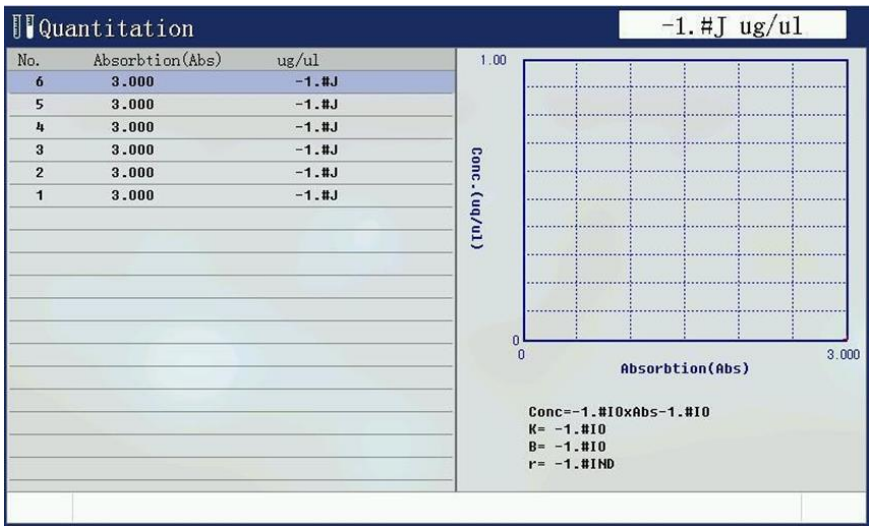

Figure-15

9.3.3.4 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.

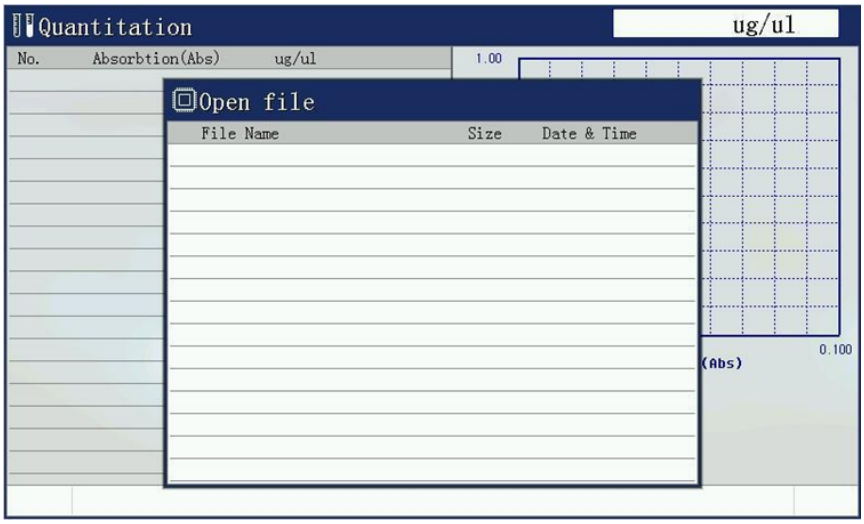

Figure-16

9.3.4 Time Scan (Kinetic)

9.3.4.1 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, press **[ENTER]**.

9.3.4.2 Time scanning parameters set

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

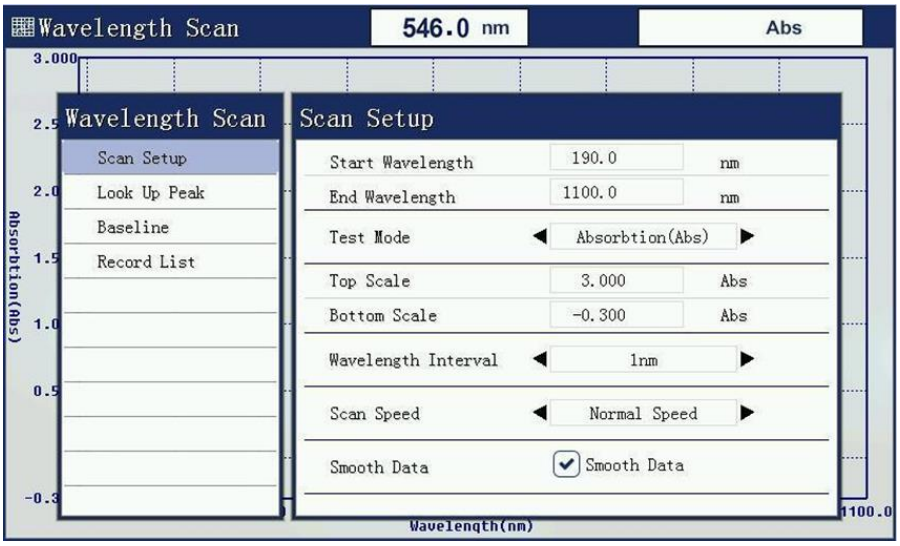

Figure-17

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 upper and lower limits**
The different measurement modes, 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 for data smoothing is to reduce the irregular fluctuation caused by the external environment during the test.

9.3.4.3 Data test

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

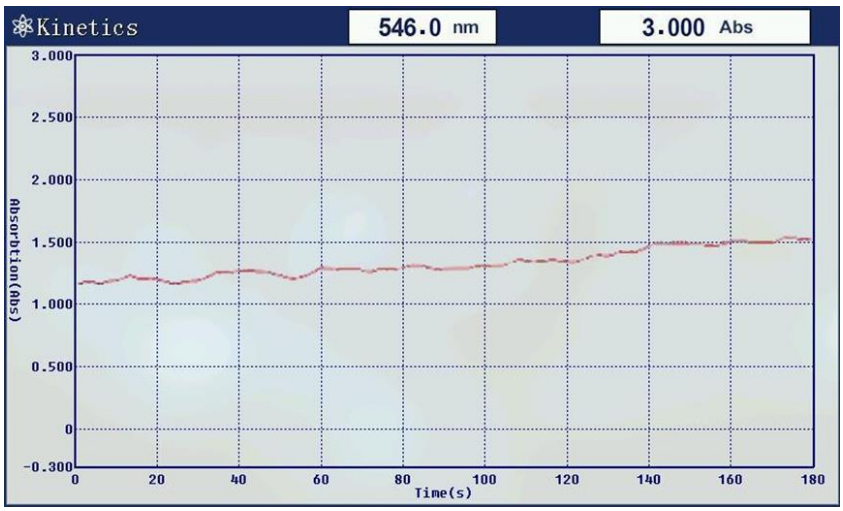

Figure-18

9.3.4.4 Data list

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

Figure-19

9.3.4.5 Slope calculation

After scanning, press the **[Menu]** key to set the starting time and end time for slope calculation.

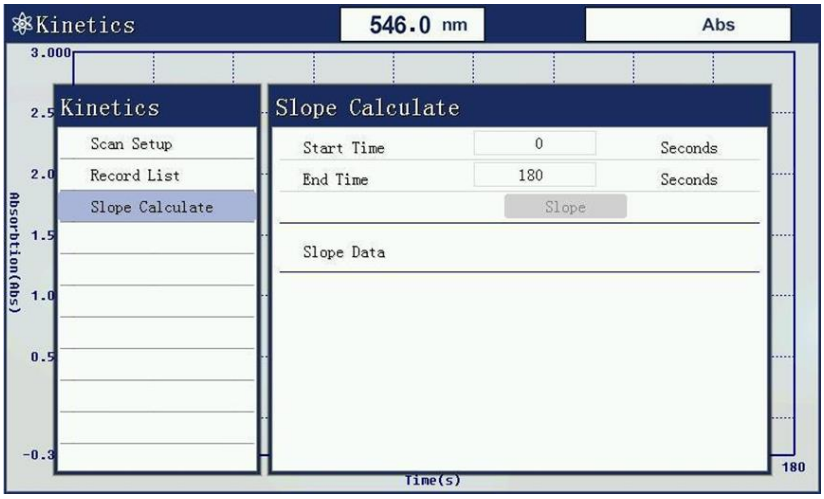

Figure-20

9.3.5 Wavelength scanning

9.3.5.1 Function description

In the set wavelength range, in a certain wavelength interval, to record the absorbance of 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.

9.3.5.2 Set scanning parameters

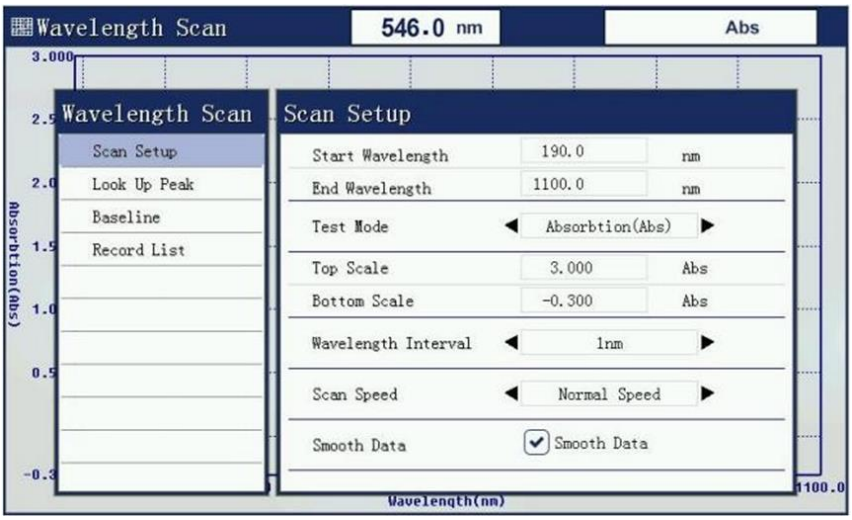

Figure-21

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 upper and lower limits**
   The different measurement modes: Upper and lower displays are 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 at a single point wavelength. The faster the speed, the less the collecting quantity.
6) **Select to make data smoothing**
7) The function for 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 modifying the scan settings to modify the parameters, the baseline will lead to an invalid user, and the user needs to re-establish a baseline.

9.3.5.3 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. A long time without updating the system, re-create the system baseline.

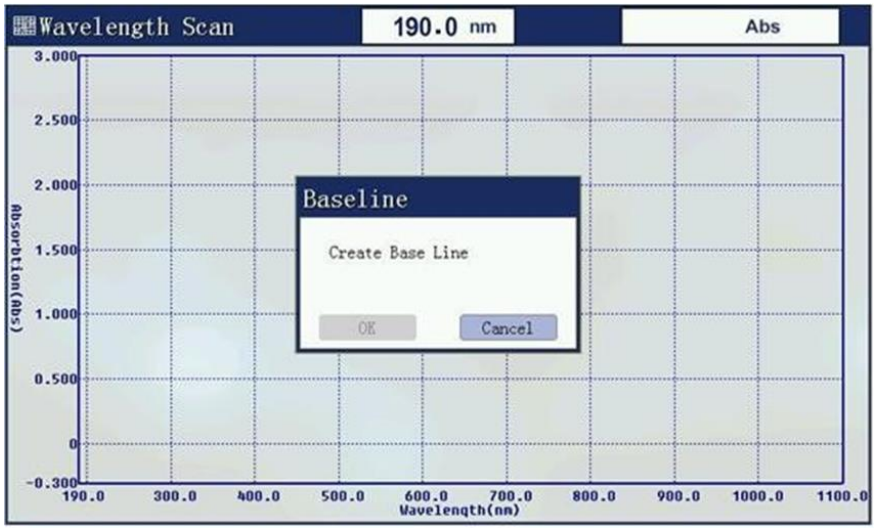

Figure-22

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

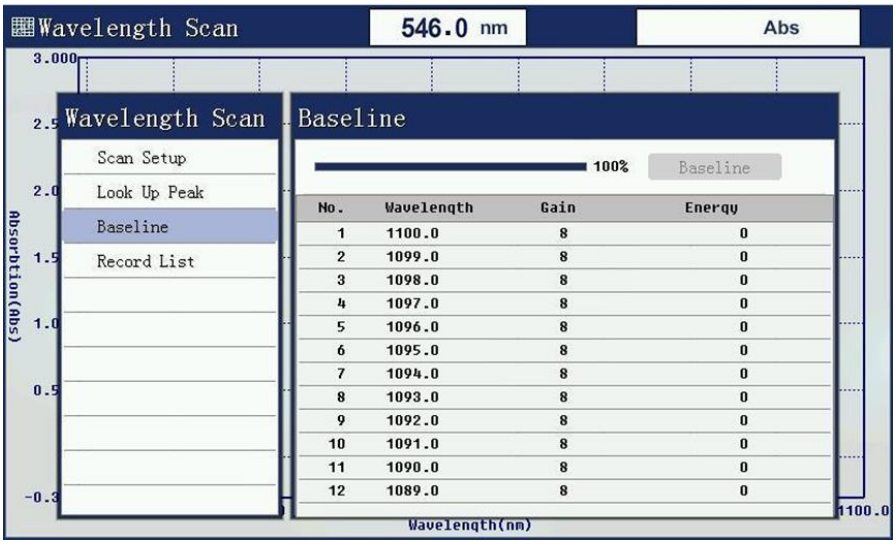

Figure-23

9.3.5.4 Create a user baseline (corrected blank)

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

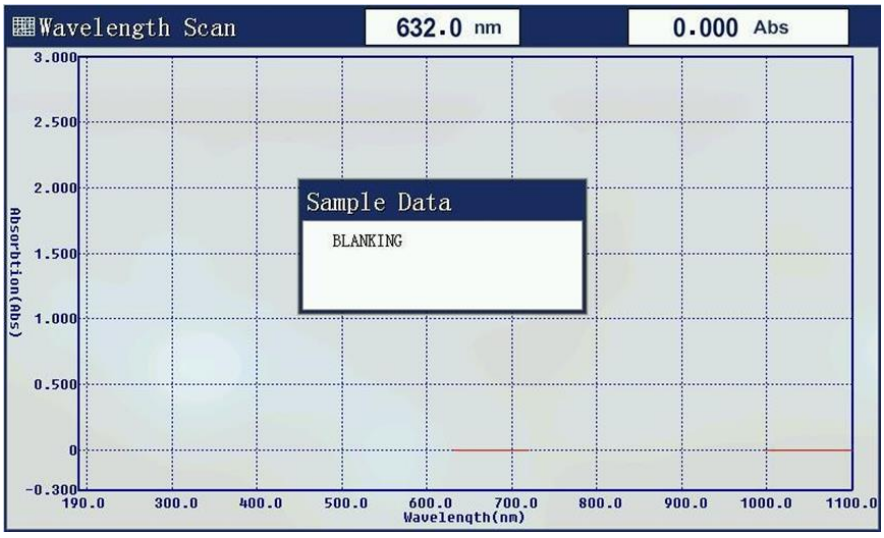

Figure-24

9.3.5.5 Begin testing

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

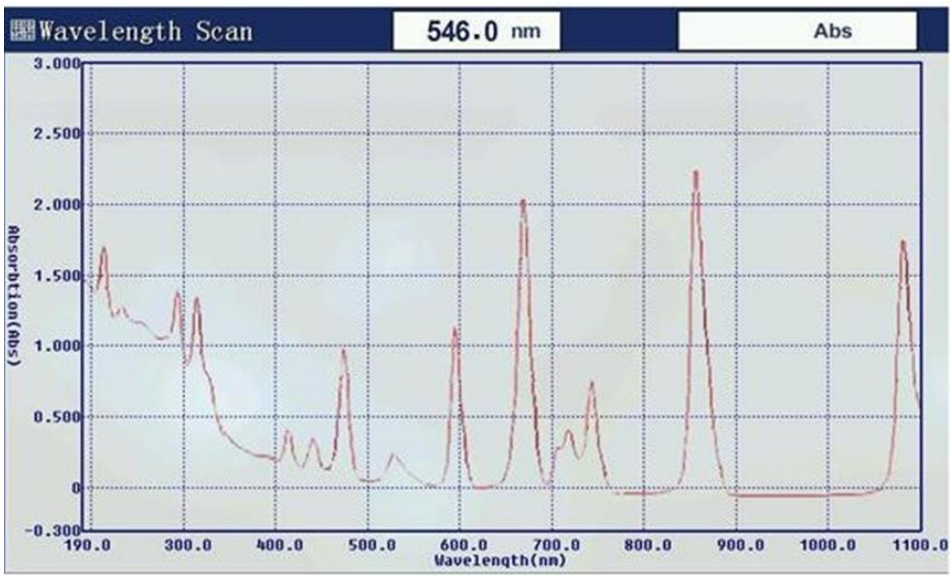

Figure-25

9.3.5.6 Peaks and valleys

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

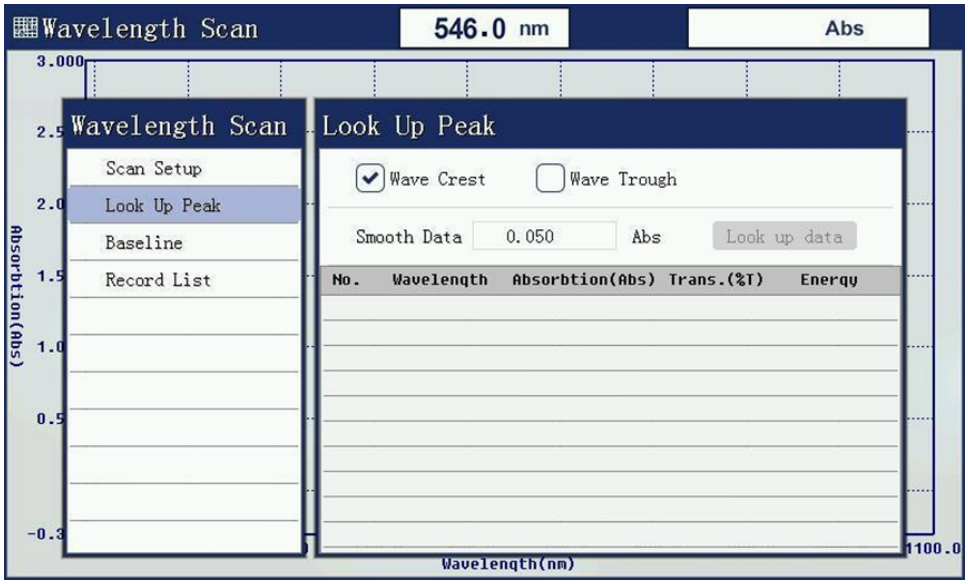

Figure-26

9.3.5.7 Data list

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

Figure-27

9.3.6 Multi-wavelength test

9.3.6.1 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, obtaining values for several wavelengths simultaneously, thus simplifying user operation processes.

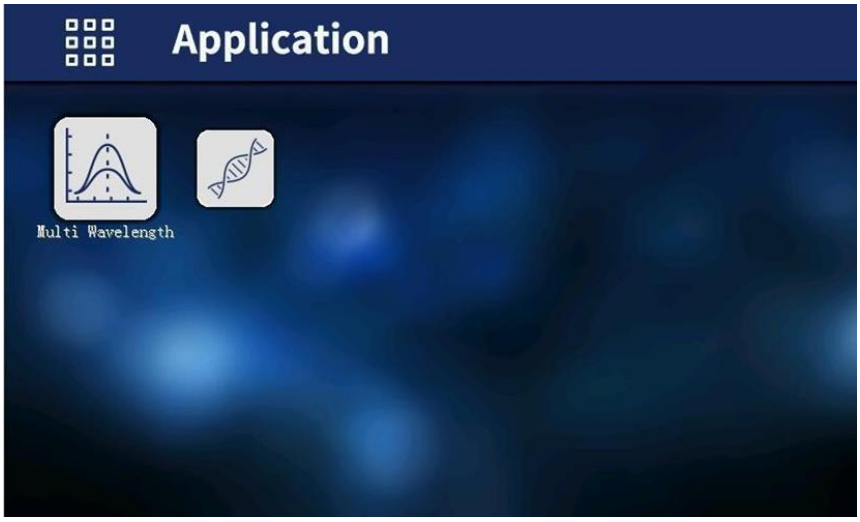

Figure-28

9.3.6.2 Set parameter

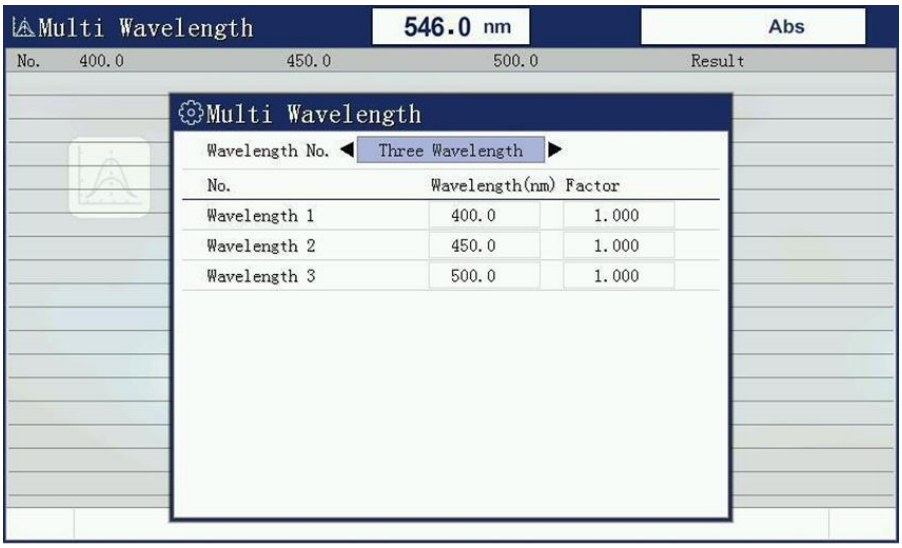

Figure-29

1) **Set the number of wavelength measurements**
   When you select a multi-wavelength test, a capability will prompt you 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, press **[ENTER]** after confirming, then lose the next one until all measured wavelengths are lost.

9.3.6.3 Correction 100%T/0Abs

After these parameters are set, place two reference solutions for both colorimetric anti-tank, and then press the **[ZERO]** key. The instrument will go to pre-school, set a good few wavelengths to blank, and then go after the end of the prior setting, the minimum wavelength, and displays 100.0% T or 0.000Abs.

9.3.6.4 Data test

Remove the rear slot of the reference sample solution (the front does not move) and place the sample solution to be measured. Pressing the **[START]** button will measure a set of data. If a second sample is to be measured, replace the solution after pressing **[START]** once.

Figure-30

9.3.7 Protein/DNA measurement

9.3.7.1 Function description

Protein / nucleic acid comprising 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 a standard curve again.

Figure-31

9.3.7.2 Parameter selection

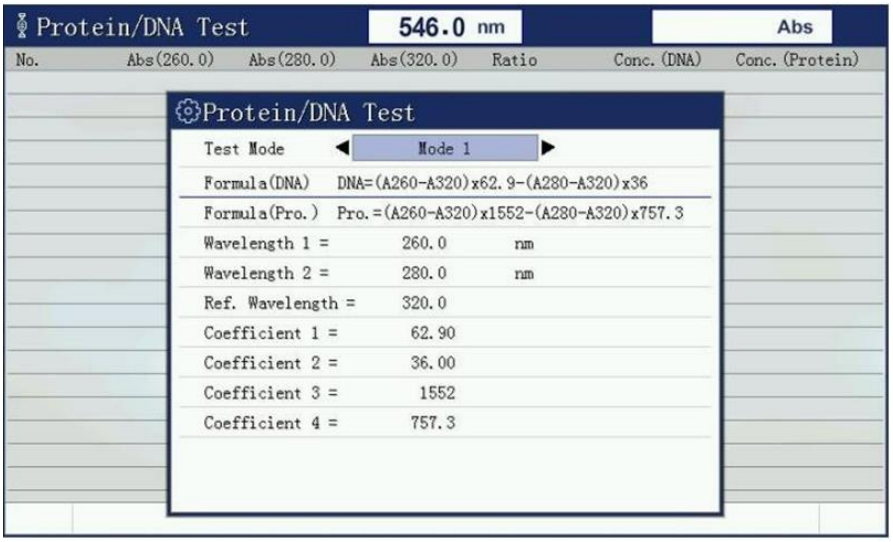

Figure-32

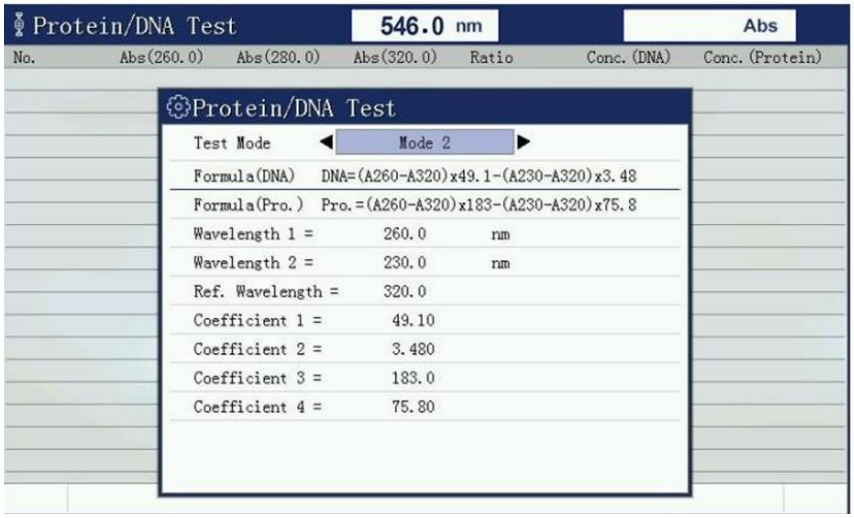

Figure-33

9.3.7.3 Set zero

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

9.3.7.4 Test

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

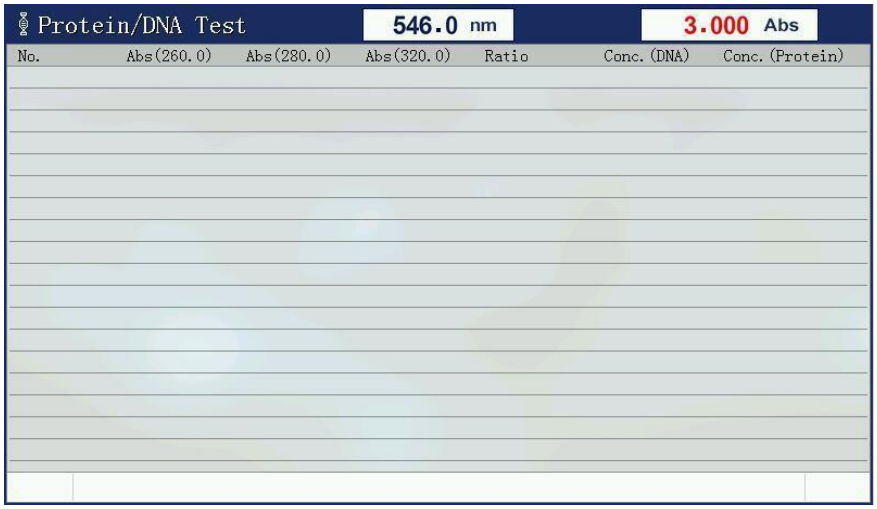

Figure-34

9.3.8 System Setup

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

Figure-35

9.3.8.1 Dark current measurements

Long-time operation of the instrument probably leads to a drift of dark current. This function can make corrections for the full range of dark current. Please ensure to cover the sample chamber lid when testing dark current.

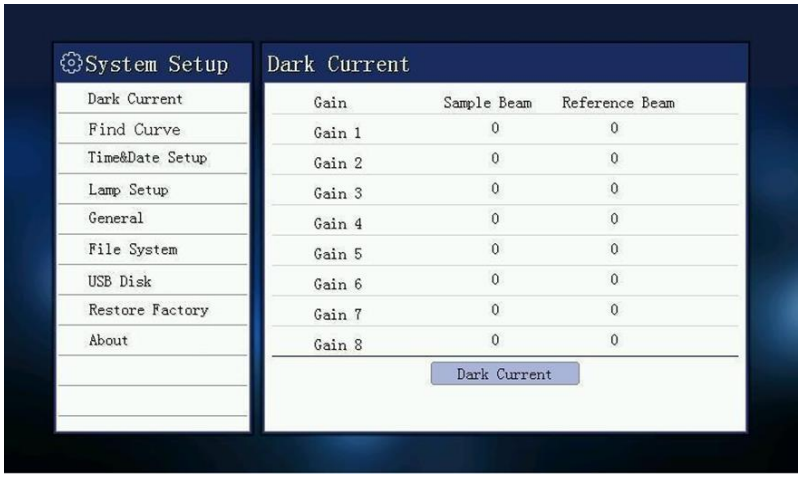

Figure-36

9.3.8.2 Looking for the deuterium lamp curve

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

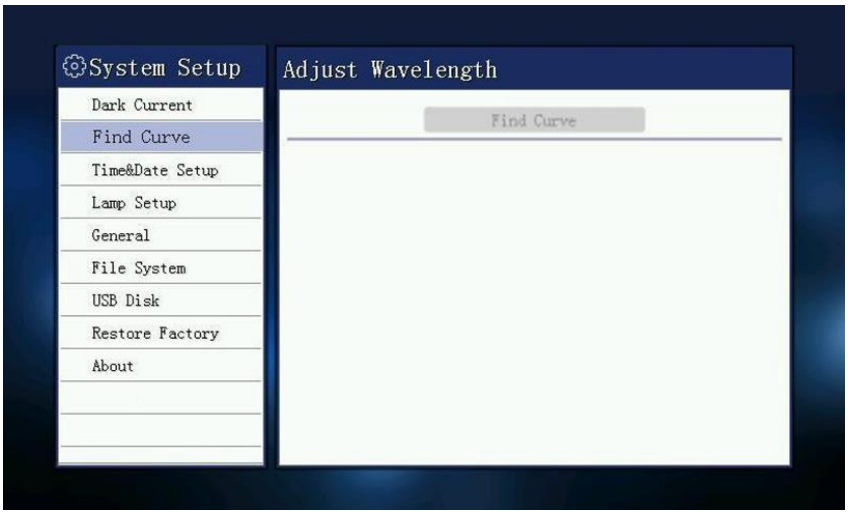

Figure-37

9.3.8.3 Time and date settings

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

Note: Time and date will not be powered down or lost after the instrument is switched off.

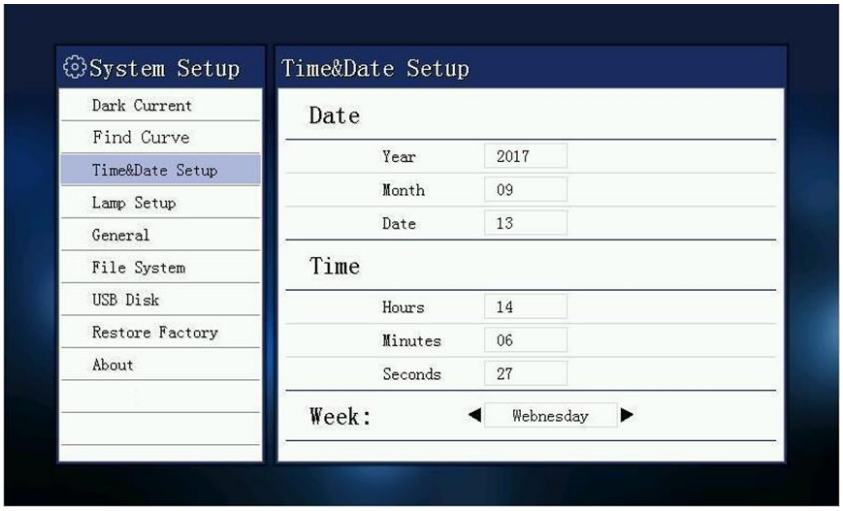

Figure-38

9.3.8.4 Light source management

Deuterium lamps and tungsten light source light switches to control the display of each light source's life. Use the 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 to confirm the selection.

Note: The open deuterium lamp needs preheating after 15 seconds, before it can open.

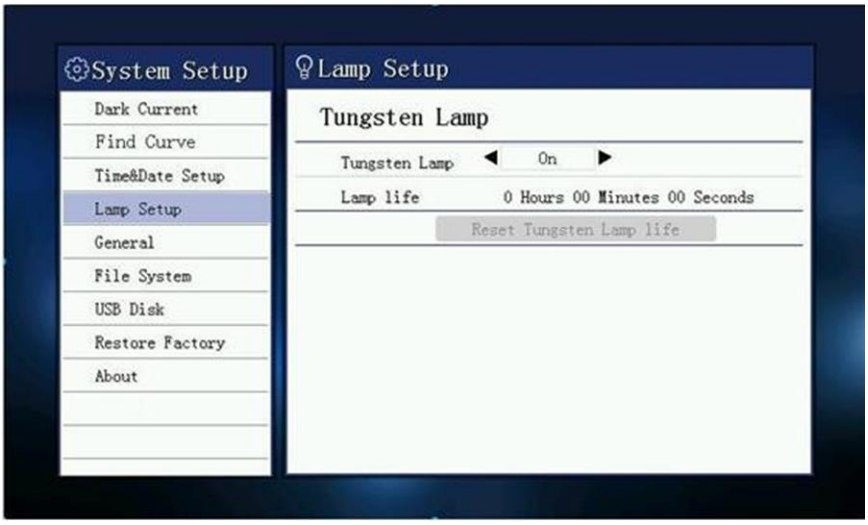

Figure-39

9.3.8.5 General

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

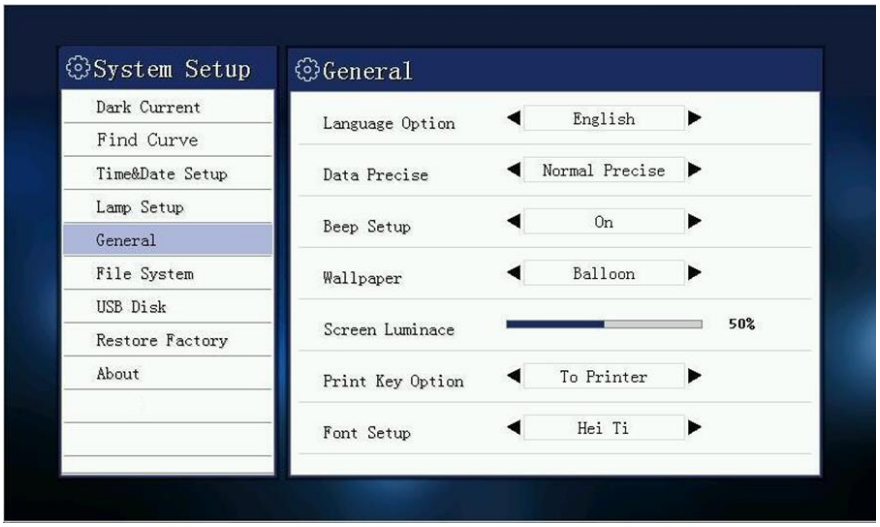

Figure-40

9.3.8.6 File system

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

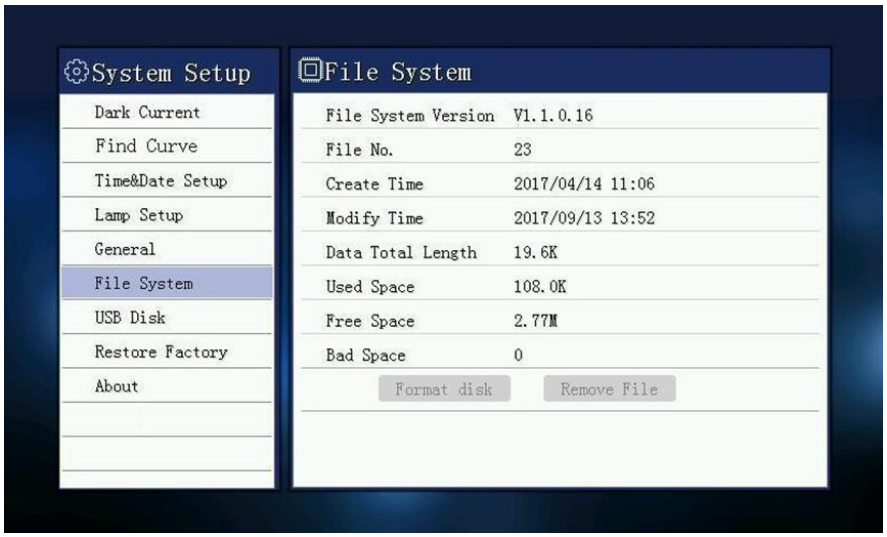

Figure-41

9.3.8.7 USB storage device

It shows the status of the external USB flash drive.

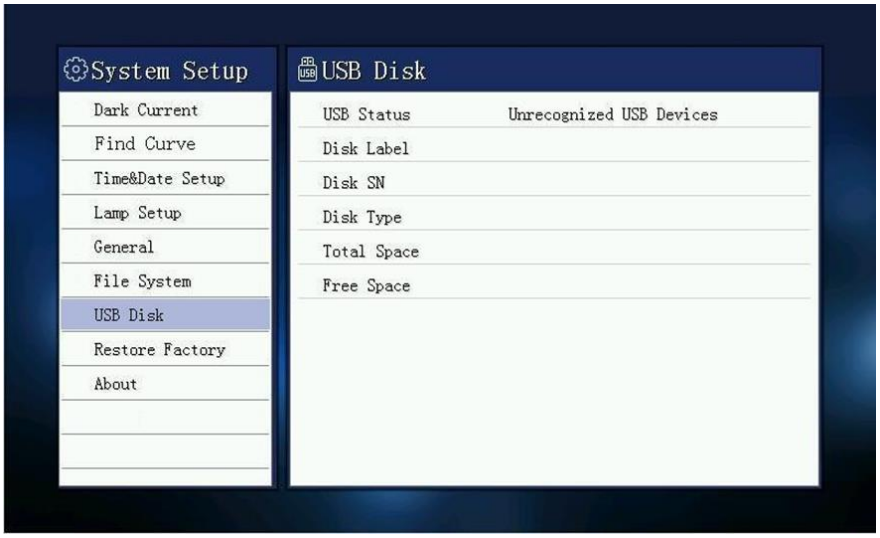

Figure-42

9.3.8.8 Restore factory settings

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

Figurre-43

9.3.8.9 System information

You can view software version and hardware version information.

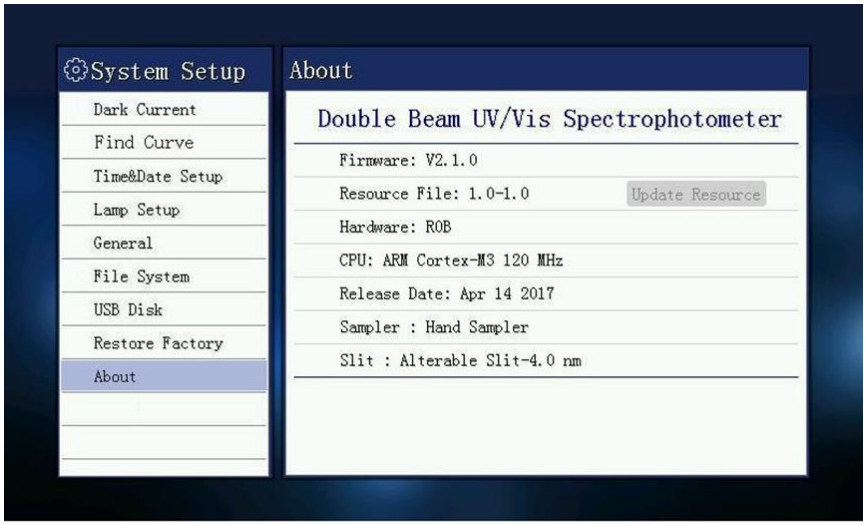

Figure-44

10. Maintenance

Caution
• Potential chemical, biological eye and skin hazards. • Only qualified personnel should conduct the tasks.

10.1 Cleaning requirements

Danger
• Chemical exposure hazard. • Gas from a chlorine compound and UV light reaction can cause death. • Do not use chlorine compounds for cleaning.
Caution
• Potential pinch, eye, burn and chemical hazards. • Before cleaning, always disconnect the instrument from the power source.
Notice
Never use solvents like turpentine, acetone, or similar to clean the instrument, including the display and accessories.

10.1.1 Spectrophotometer

1) Only clean the housing, the cell compartments and all accessories with a soft, damp cloth. 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.

10.1.2 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.

10.1.3 Cuvettes/Cells

Caution:

- Potential Chemical/ Biological Exposure Hazards.
- User 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.

11. Troubleshooting

11.1 Power failure

Failure	Cause	Solution
Boot no reaction	No electrical outlet	Check and ensure the external power supply is available
	Power cord not plugged in	Properly connect and secure the power cord
	The inline fuse in the socket switch is blown	Replace with a suitable fuse
	The instrument socket switch is faulty	Inspect and repair or replace the switch
	The internal power board or transformer is damaged	Inspect internal components and repair as required
Display error	Internal wiring is loose	Open the housing and securely reconnect the wiring
	Internal +5V power supply unstable or loose	Open the housing and properly reconnect the cable
	Processor error due to voltage fluctuation	Reprogram and reset the system
	Motherboard malfunction	Inspect and repair the motherboard

11.2 Self-test failures

Failure	Cause	Solution
Filter positioning error	Loose electrical line filter	Open the housing and securely re-seat the filter
	The optocoupler line filter is loose	Open the housing and securely re-seat the filter
	+12V power supply unstable or loose cable	Open the housing and properly reconnect the cable
	Filter the optocoupler for faults	Inspect and replace the component
	The motor driver chip is faulty	Inspect and replace the motor driver chip
Positioning error sources	The switch motor cable is loose	Open the housing and securely reconnect the cable
	The micro switch wiring is loose	Open the housing and securely reconnect the wiring
	The micro switch is faulty	Inspect and replace the micro switch

	+12V power supply unstable or loose cable	Inspect and properly reconnect the power supply cable
	The motor driver chip is faulty	Inspect and replace the motor driver chip
Error signal detector	The motherboard connector cable is loose	Open the housing and securely reconnect the cable
	Power board (+7 / -5 power cable) is loose/faulty	Open the housing and properly reconnect the cable
	Signal board faulty	Inspect and replace the signal board
	Motherboard faulty	Inspect and repair or replace the motherboard

11.3 Wavelength and Calibration Troubleshooting

Failure	Cause	Solution
Wavelength self-check normal, but energy is low or unstable (tungsten region)	The tungsten lamp has been used for more than 2000 hours and is faulty	Replace the tungsten lamp
	Prolonged use causes internal optics contamination	Clean internal optical components
	The experimental cuvette is made of glass	Use a quartz cuvette
Wavelength calibration is normal, but there is low energy in the deuterium lamp or unstable output	Optical surfaces in the sample chamber are dirty	Clean with lens paper and alcohol, then dry properly
	The deuterium lamp has been used for more than 2000 hours, or is faulty	Replace the deuterium lamp
	Prolonged use causes internal optics contamination	Clean internal optical components

12. Accessories

Standard Accessories

S. No	Accessory Name
1	Glass cuvette 10 mm
2	Quartz cuvette 10 mm
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 complaint software

13. Replacement

13.1 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. Then, gently remove 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, is not removed; too much force should not be used to pull the housing to prevent the pull-beam break.
2) Remove the lamp compartment cover, 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 not to burn.
3) Find the objects shown in the following figure, loosen fastening sheet metal screws, pull out a tungsten lamp, and seat the new tungsten lamp according to the original position, and put on a solid metal piece, tighten the screws (to ensure the tungsten light is positive).

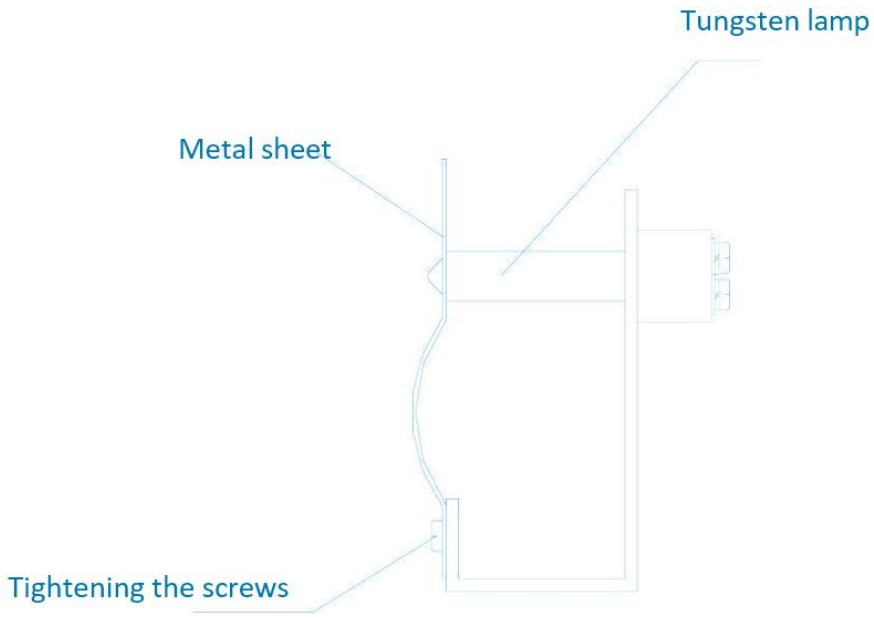

Figure-45

4) Turn on the instrument, turn on the tungsten lamp light, and manually convert the light source switching mirror to horizontal position.
5) Loosen the screws of the seat switch motors, seat motors to move the focus to switch into the slit in the smallest and tungsten lights centred.
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) After the completion of the self-test mode, the wavelength photometric measurements were walked at 340nm, 370nm, 1000nm, and 1100nm, and set to automatic zero. If it does not display, the low-energy lamp replacement is completed.

13.2 Deuterium lamp replacement

1) Turn off the instrument, unplug the power cord, and disconnect the equipment on both sides of the four screws fastening the shell. Then, gently remove 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, do not apply too much force to pull the housing to prevent the pull-beam from breaking.
2) Remove the lamp compartment cover, 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 not to burn!
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 in accordance with the original position (note that the deuterium lamp light mouth will be toward the objective), and plug it into the power supply board.

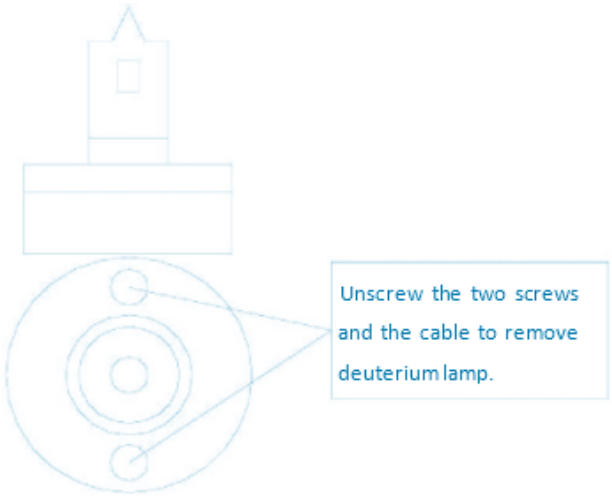

Figure-46

4) Turn on the instrument, turn on the deuterium lamp light, and convert the light source switching mirror to vertical position manually.
5) Loosen the screws of the fixed lens holder, fine-tune the focus lens holder into the slot on the smallest and deuterium light centered.
6) Convert the light source switching mirror to horizontal position manually.
7) Loosen the screws of the seat switch motors, 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) After the completion of the self-test mode in the wavelength photometric measurements, the wavelengths were walked 200nm, 330nm, 340nm, 370nm, 1000nm, 1100nm, and set to automatic zero. If you no longer display low energy, lamp replacement is completed.