



# **C-7100 Series Spectrophotometer Operating Manual and Maintenance Guide**



**PEAK INSTRUMENTS INC.**  
Version 1701

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# I. Spectrophotometer Overview

## 1. Basic operating principle

1) The nature of absorption: 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 is 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 corresponding to the absorption peak at a shorter wavelength, when generating the ultraviolet absorption spectra of absorption in the ultraviolet region.

2) Absorption Law - Lambert Beer law: when a parallel beam through the homogeneous solution, the absorbance of monochromatic light is proportional to the product of the solution concentration and thickness.

Its digital expression:  $A = KCL = \log I/I_0 = -\log T$

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, no fluorescent and photochemical scattering phenomena ④ absorbent system is a continuous uniform distribution

3) Impact spectrophotometry reasons:

A. Non-absorption errors caused by radiation and matter

B. 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 on the absorption of fluorescence great extent on the optical absorption cell and detector design.

C. 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

D. Non-ideal instrument error caused

E. Beer's law deviation polychromatic contrast, the majority of the photometer can only get close to monochromatic light with a narrow lumen, in fact, there is still a polychromatic nature, can lead to deviations from Beer's law. Deviation

depends on the two monochromatic molar absorptivity difference  $\Delta \epsilon$ ,  $|\Delta \epsilon|$  is very small, can be approximated that monochromatic, at low concentrations, curve remains linear, but larger concentrations, with concentration increases, AC curve bend more serious, there is Beer's law applies only to dilute solutions

F. Stray light, stray light entering the detector means is 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 deuterium lamp 220nm, tungsten lamp 340nm)

G. Slit width, the slit width of the spectrum affects not only the purity, but also affect the absorbance. When quantitative analysis in order to obtain sufficient measuring signal, the slit should be larger, in the qualitative analysis of the use of a smaller slit when the entrance slit and the exit slit width equal to the width of the slit caused minimum error

H. 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 )

I. 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 lead 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%

J. Photometric scale error, photometric accuracy of the scale that is transmittance, which directly affects the accuracy of the magnitude of the error photometric measurements.

## 2. Performance Indicators Definitions

- 1) Optical system: usually refers to the formal structure of the optical system, at present, domestic and international institutions often used 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 means the actual wavelength difference between the real wavelength and the setting wavelength. Each wavelength photometer to be in a lot of points to check wavelength accuracy; spectrophotometer wavelength accuracy is an important technical indicators, it 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 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 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 equal, the higher the sensitivity, the better precision. It is noted that, in order to obtain accurate test results, the natural bandwidth of the spectral bandwidth of the instrument (Spectral Bandwidth referred SBW) and the analysis of samples (Natural Bandwidth referred NBW) ratio should be less than 0.1, more than 99.5% can be obtained so that the measurement accuracy.

- 6) Stray light: 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 limit 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 measured; photometric accuracy check is usually through the use of repeated measurements of the neutral density filter carefully film 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: power supply, amplifier, AD conversion and the like. To reduce noise, improve signal to noise ratio, there must be a good electrical design. Noise measurement repeatability test under low concentrations, but 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 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.

### 3. Application

Subjects available for physics, chemistry, medicine, biology, pharmacology, geology and other scientific research, is widely used in chemical, pharmaceutical, biological and chemical, metallurgy, light industry, materials, environmental protection, medicine and other industries and laboratory analysis of the industry's most one important quality control instruments, is essential for routine laboratory instruments.

### 4. Using conditions

Equipment should be installed away from the hot or humid environment. The instrument should be used in 16-35 °C, 45-80% humidity conditions. Please try to stay away from issuing magnetic, electric, high-frequency waves of electrical devices, do not install the instrument in the air chlorine, hydrochloric acid gas, hydrogen sulfide gas, such as sulfurous acid gas, corrosive gas Excessive places. Place the instrument table should be smooth, without

vibrations; nearby fan of the instrument should be left enough space to exhaust smoothly. 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 instability, give the instrument is equipped with power supply. The instrument should avoid direct sunlight. Avoid dusty environments.

## II. Product features and installation

### 1. Features

With low stray light and a high resolution structure of double-beam optical monochromator , the instrument has a 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.

Large screen graphic LCD display 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 with PC.

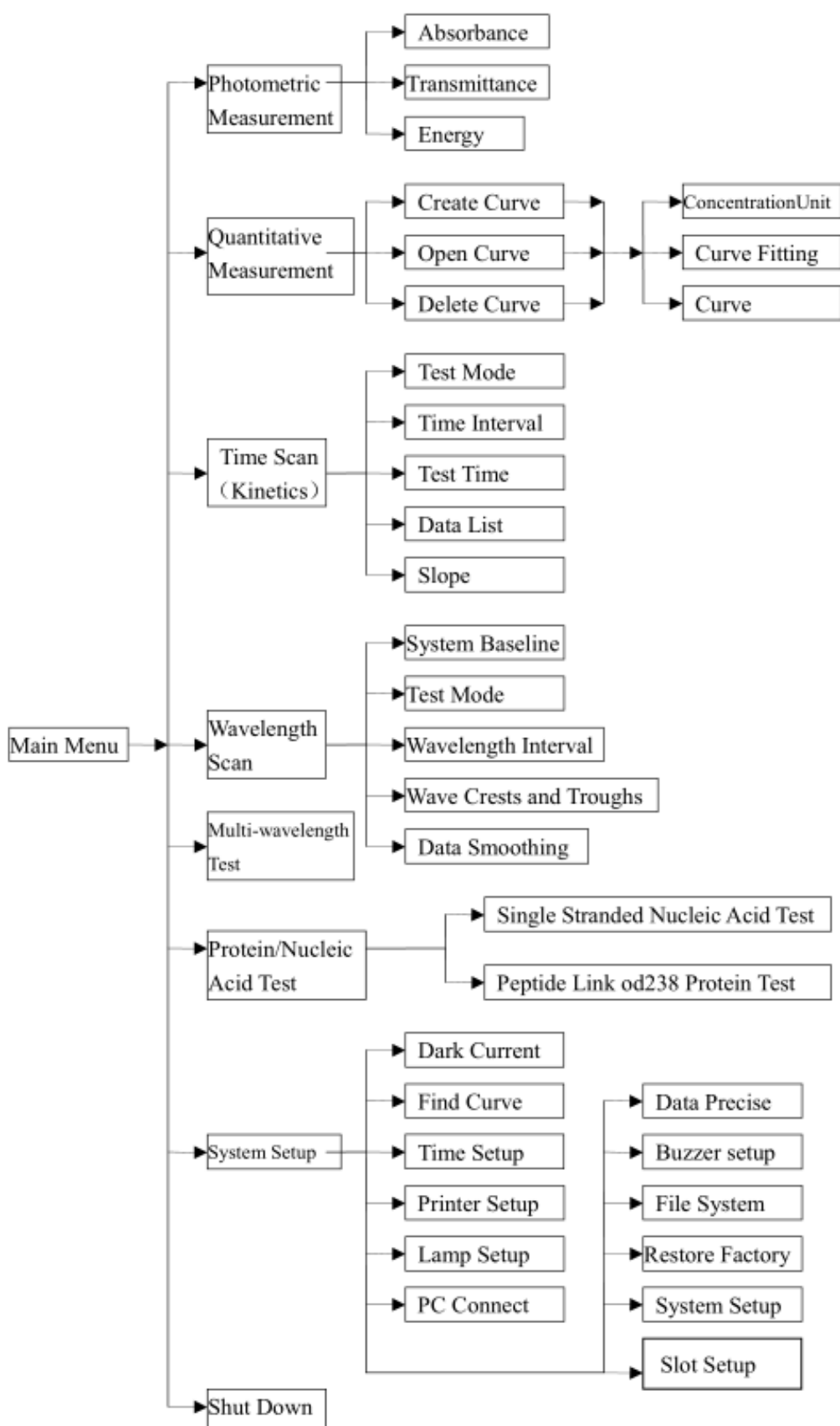
Optional equipment is also available on the Windows platform running UV Professional user application software, the instrument has greater functionality.



## 2. Performance Indicator

Model	C-7100	C-7100S	C-7100A
Display	7 inch TFT		
Keyboard Control	Silicone Buttons		
Optical System	Single Beam		
	Holographic grating, 1200 lines/mm		
Slit Width	2nm	1 nm	0.5,1,2,4 nm
Wavelength Range	190 - 1100nm		
Wavelength Accuracy	$\pm 0.3\text{nm}$		
Wavelength Repeatability	$\leq 0.1\text{nm}$		
Photometric Accuracy	0.2%T(0-100%T), $\pm 0.002\text{A}$ (0-0.5A), $\pm 0.004\text{A}$ (0.5-1A)		
Photometric Repeatability	$\leq 0.15\%T$ (0-100%T), 0.001A(0-0.5A), 0.002A(0.5-1A)		
Stray Light	$\leq 0.03\%T@220\text{nm}, 360\text{nm}$		
Stability	$\pm 0.001\text{A/h}@500\text{nm}$		
Photometric Range	0-200%T, -0.3-3.0A, 0-9999C(0-9999F)		
Baseline Flatness	$\pm 0.0015\text{A}$ (200-1000nm)		
Noise	0.0003A@500nm		
Working Mode	T,A,C,E		
Wavelength Setting	Automatic		
Scanning Speed	High, Medium and Low		
Detector	Solid Silicon Photodiode		
Light Source	Tungsten Halogen/Deuterium Lamp		
Data Output	RS232, USB(A), USB(A)		
Processor	Cortex_M3, 120Mhz		
Power Requirements	AC 220V/50Hz		
Shipping Dimensions and Weight	770*630*340mm, 27kg		

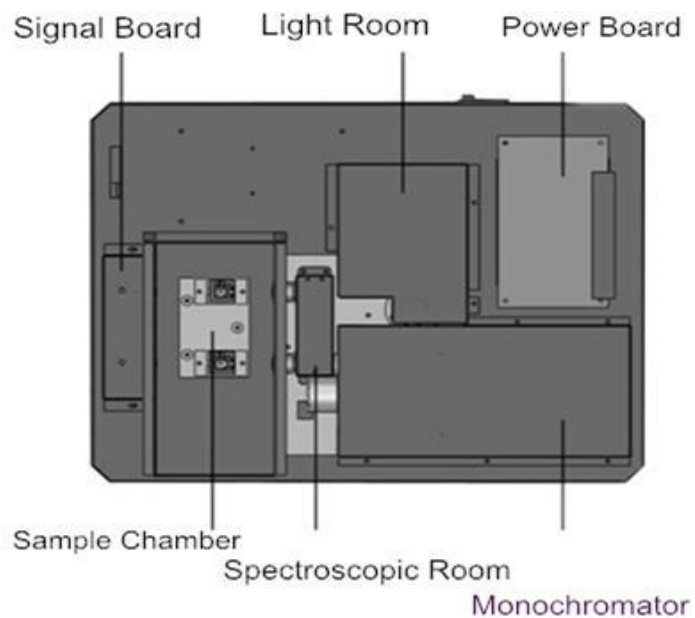
### 3. Main Functions



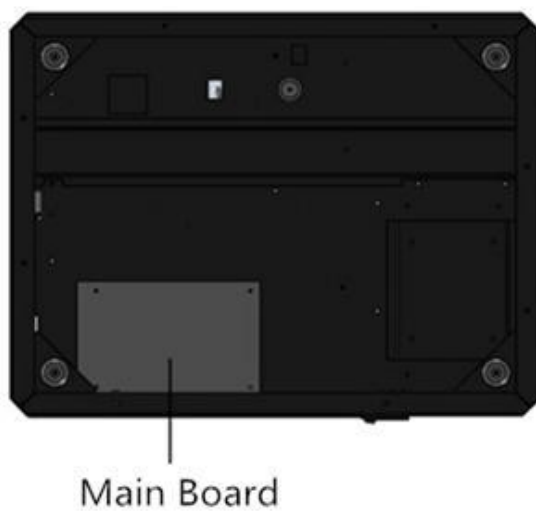
## 4. Structure introduction

Overall structure consists of three parts: optical system, power system and micro-computer system.

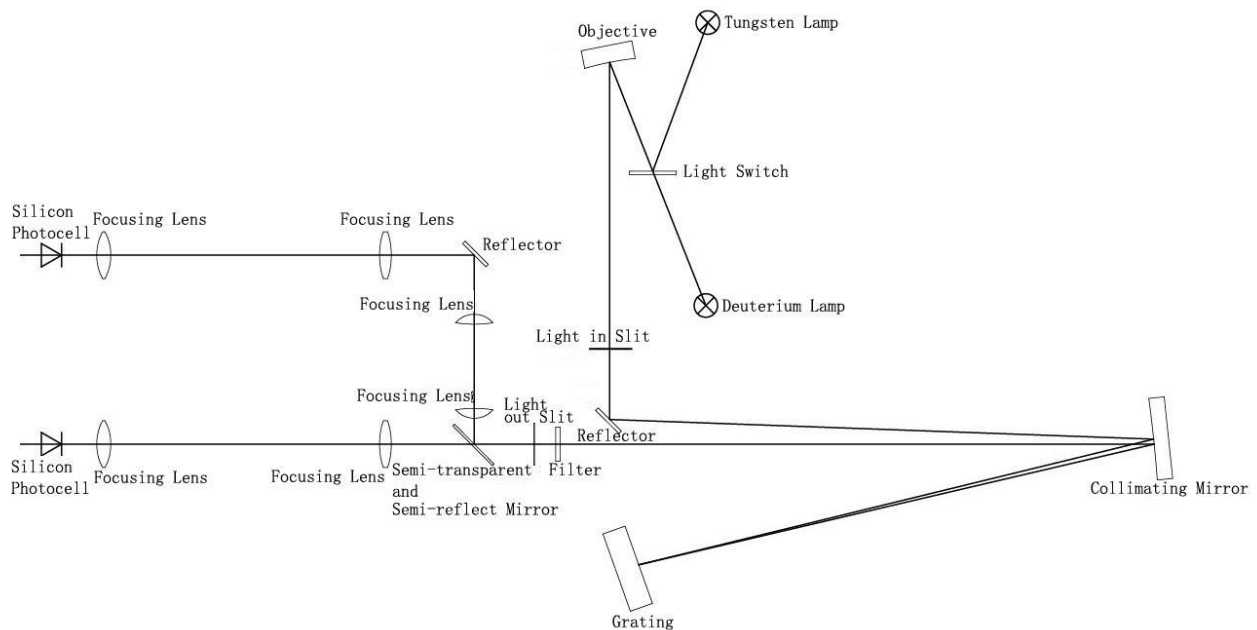
### 1) Top view:



### 2) Bottom view:



### 3) Light path diagram



### 4) Important part of the instrument

A. Power Board: The 220V50Hz/110V60Hz 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.

B. Light room: there are tungsten halogen lamp and deuterium lamp source device to automatically switch. Halogen tungsten: tungsten halogen light source visible. Applicable wavelength range 340-1900nm. Because it uses the principle of halogen cycle, it has a greater intensity of light emission and longer life. As the halogen cycle requires a higher temperature. Thus lamps commonly used 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.

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 has 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, to ensure stable deuterium lamps, imported from Japan, Hitachi another seat belt deuterium lamp replacement lamps to ensure the convenience and use of the stability and long life.

C. 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 means

Raster: the dispersion of the original, the model uses 1200 / mm holographic grating ensure high resolution and low stray light.

Filter: Due to the grating spectrum spectral overlap exists between the problem class times, so the use of filters to eliminate spectral overlap problem.

Action slits, the slits in the monochromator is 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).

D. Spectroscopic Room: contains a half-mirror, focusing lens and reflector to achieve a beam monochromator out into two beams of light in different directions

E. Sample Chamber: fixed 4-cell holder. 8-cell changer is optional.

F. Signal Board: Transfer to the motherboard processed signal detection light amplification

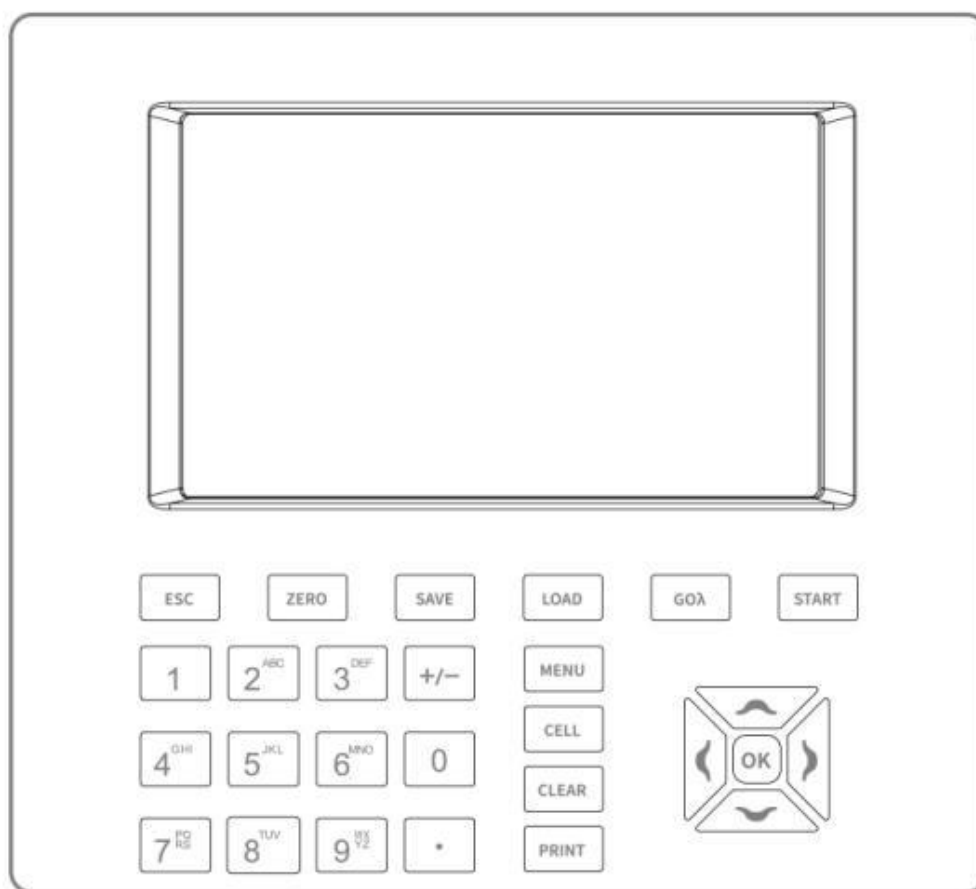
G. Main board: instrument micro control unit, control instruments light source switch, the motor rotates, the signal processor display, etc.

## 5. Instrument installation

- 1) After unpacking, carefully check the packing list inside the object is complete and intact;
- 2) Determine whether the work environment to meet the foregoing requirements, the ambient temperature 10 ~ 35 °C, relative humidity less than 85%, operating voltage (220 3 22) V / (50 3 1) H3
- 3) The instrument is placed on a horizontal platform, the instrument should avoid direct sunlight and away from electromagnetic launchers and high-power electrical devices, the use of the environment can not have dust, corrosive gases and vibration;
- 4) Around the instrument can not be any obstacle to the flow of air around the instrument;
- 5) The company supplied with a power cord and make sure there are well-grounded power outlet line;
- 6) Check the sample chamber, ensure that there is not any solution, and foreign matter and the process of self-test to ensure that the sample compartment lid is closed, you can not half-open (this is very important, Otherwise affect the instrument self-test results and normal use!!!).
- 7) Turn on the instrument. Then the instrument make self-test. after self-test, the instrument can be operated normally. in case there is an error alarm halfway, please refer to the chapter of instrument troubleshooting.

### III. Key definitions and basic operation

#### 1. Button panel schematic diagram



#### 2. 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】	Enter the 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

### 3. Basic operation

#### 1) How to adjust the blank

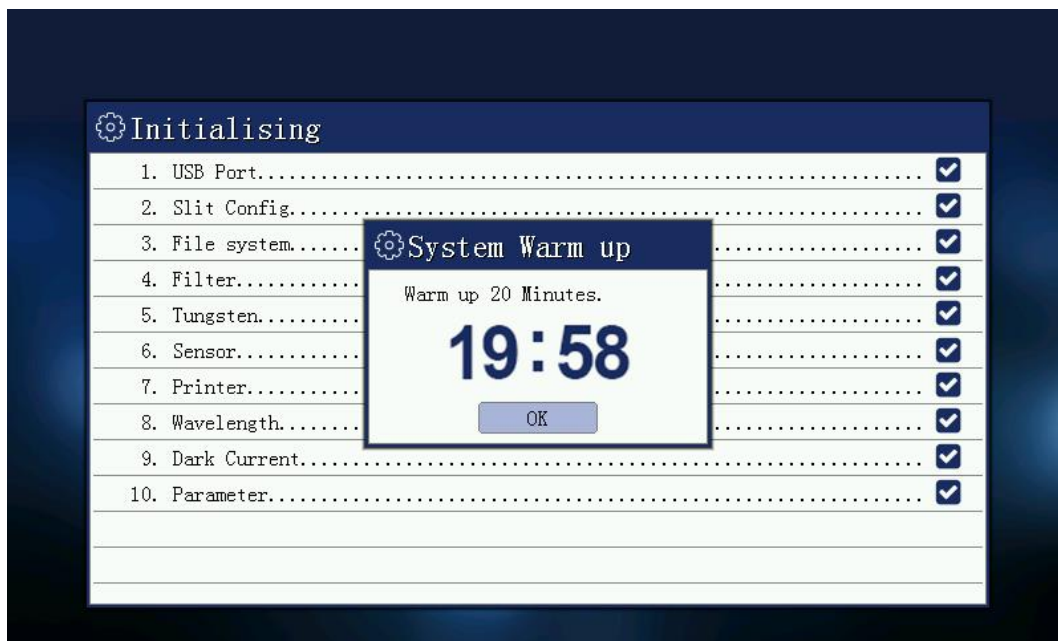
In any test interface, put the cuvette containing the reference solution into cuvette slot, and pull it into light path., press **【Zero】** key to adjust the blank.

#### 2) How to set the wavelength

In any measurement interface press **【Goλ】** key to set the current working wavelength

#### 3) Store files in txt or cvs format ( to use Excel format for simple spreadsheet file)

## IV. Instrument self-test



### 1.Communication port inspection

Check the communication port of the instrument is working properly. The result is displayed correct as  $\checkmark$  and an error as  $\times$ , the buzzer alarm.

### 2.File system check

Check the instrument's built-in Flash file system is correct. The result is displayed correctly  $\checkmark$ , an error will reformat the file system.

### 3.Filter positioning

Check the instrument's filter motor and its locator is working correctly. The result is displayed correct as  $\checkmark$ , an error as  $\times$ , the buzzer alarm.

### 4.Light positioning

Check the instrument light switch motor and its locator is working correctly. The result is displayed correctly  $\checkmark$ , an error is displayed result is  $\times$ , 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, check the operating parameters of 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 deuterium light source instrument operating parameters to check the deuterium lamp is working correctly. If the parameter is not working properly, then re-set the operating parameters of the deuterium lamp. Change detections are always displayed correctly, 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

Wavelength parameter checking instrument is working properly. Correct, then the pop-up boxes, please confirm whether the user input wavelength calibration if no user input within five seconds, then skip this. If the argument is 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 instrument dark current of energy, checking eligibility. If the dark current in the proper range, which means that the dark current is correct, then displays the results of √. 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

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 ×, the buzzer alarm.

Self-test end, after re-calibration dark current, into the main instrument display.





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.

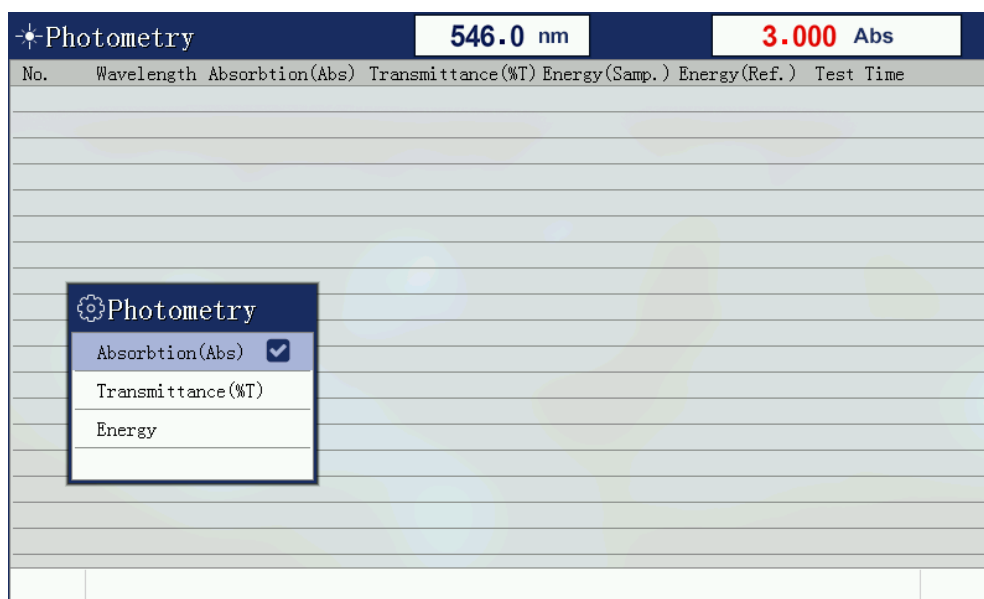
## V. Photometric measurement

## 1. Function description

Photometric measurements are measuring 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, press [ENTER] to confirm. If you choose the energy model, energy window appears and prompts to select the amplifier gain.



### 3.Set wavelength

Set the current working wavelength range 190nm-1100nm, press the up and down button to open 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.



#### 4. Correction 100%T/0Abs

In two samples simultaneously into the two slots reference solution, and then press the [ZERO] key, the instrument will be 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/OAbs, 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.

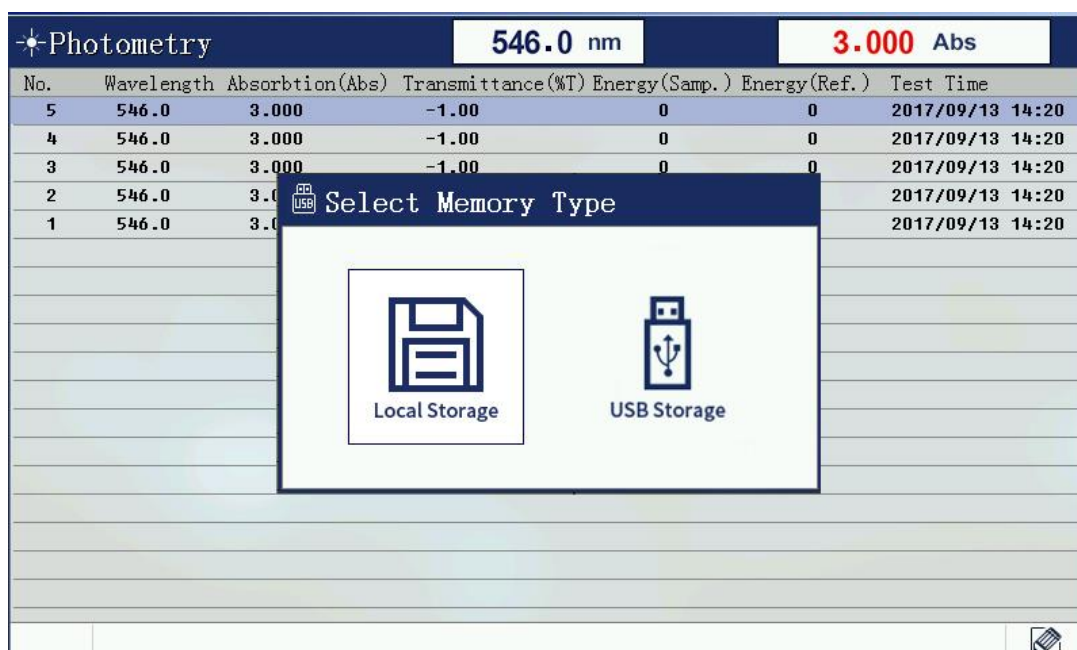
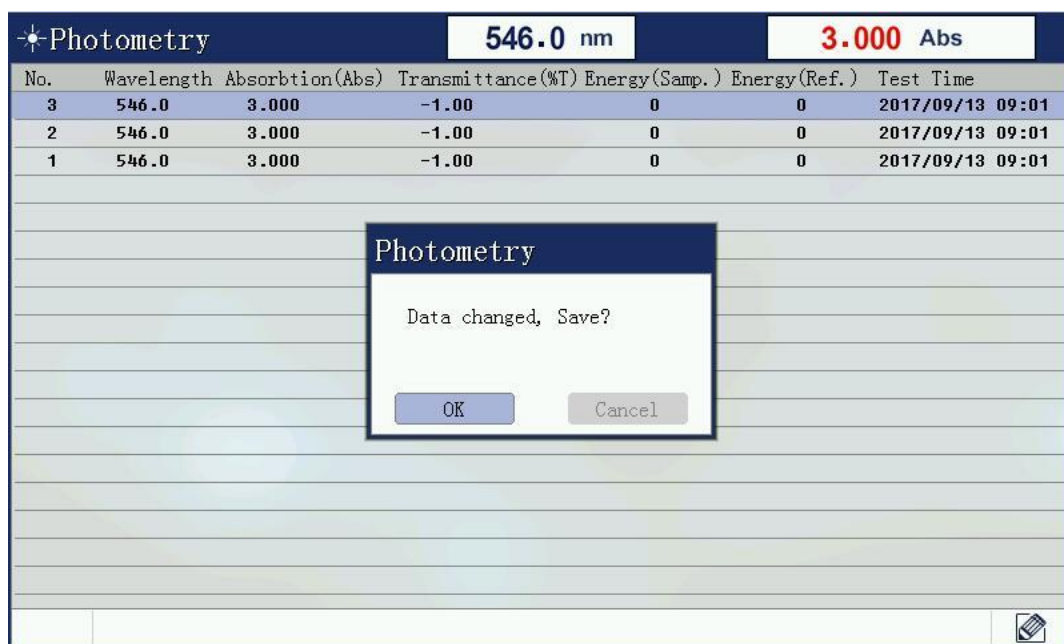
[illegible]

## 6. Delete data

Delete files Press [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 all the data, 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 time you save a file, the dialog box will pop up asking to save the file name input.



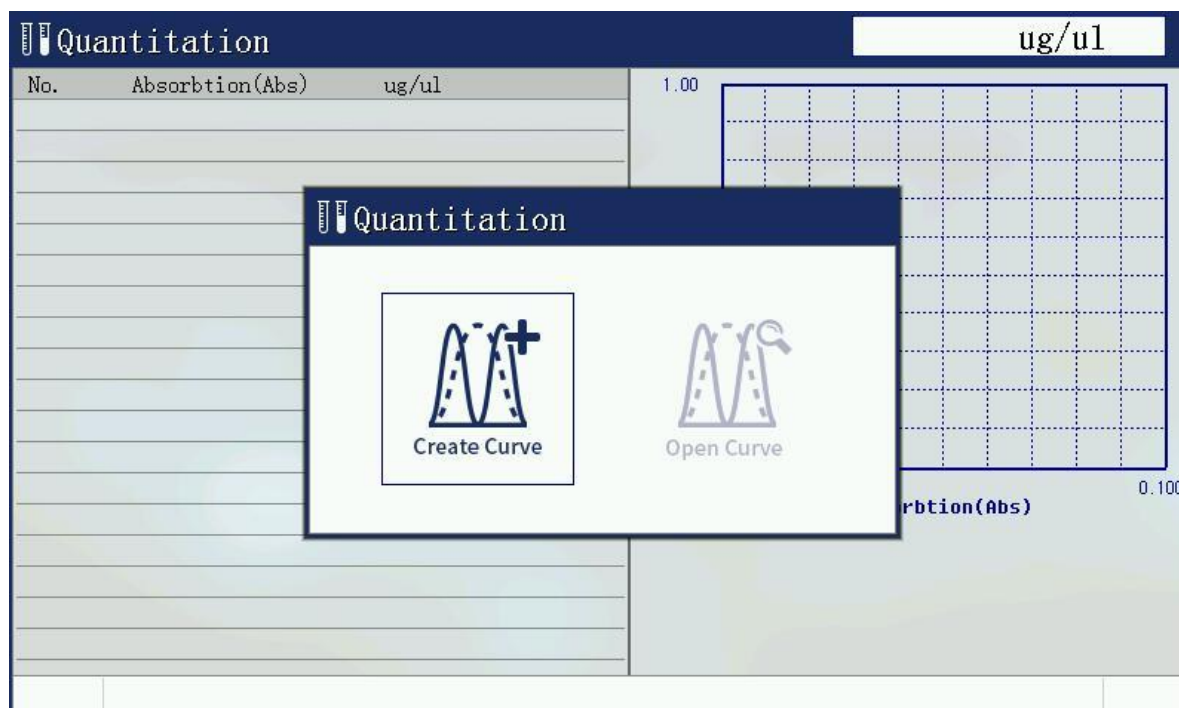
## 8. Open the file

In photometric measurement interface will be displayed by the Load button to open the window, 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 enters the measurement mode.



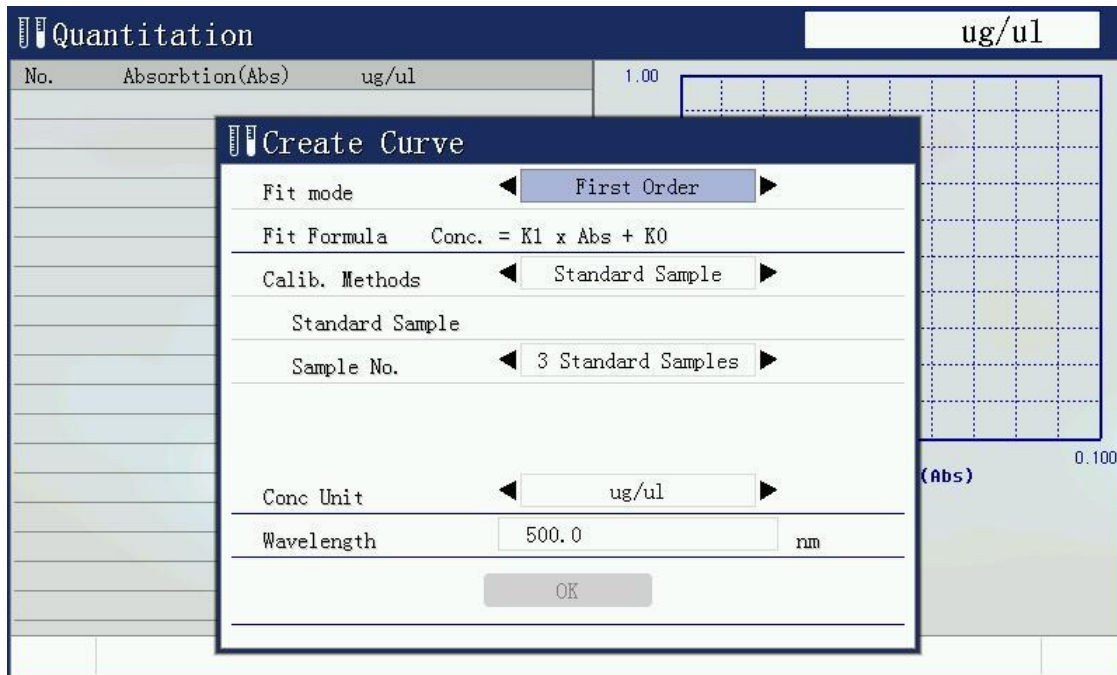
## VI. Quantitative measurement

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



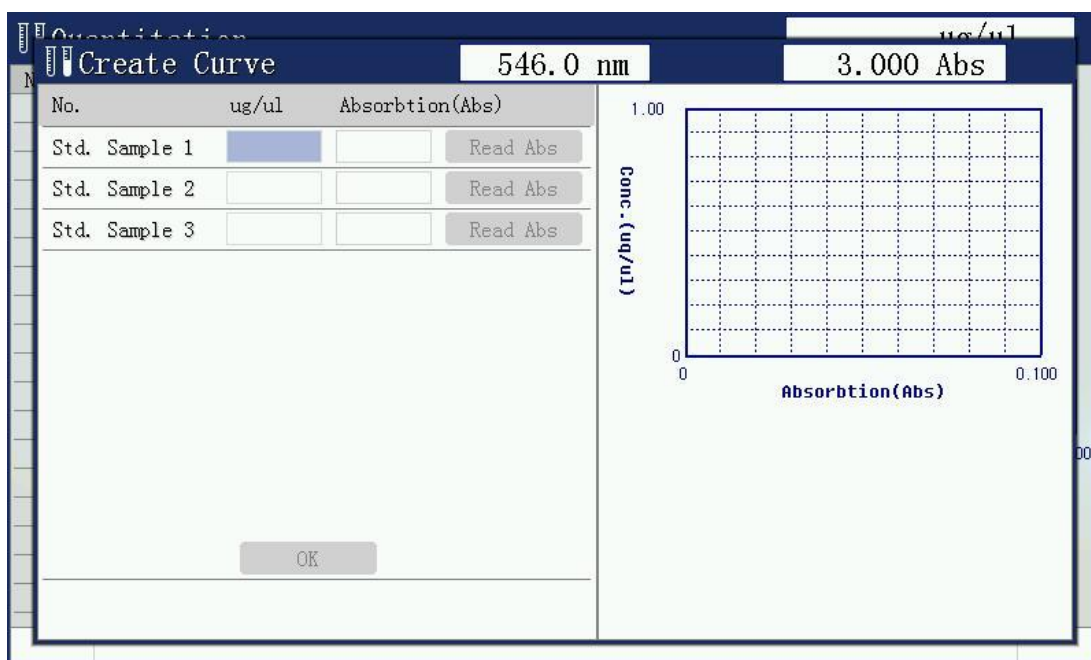
## 1. Build standard curve

To use several configured standard samples, input the concentration of sample standard, collect the absorbance of standard sample, through the relationship between concentration and absorbance is calculated curve parameters, use this parameter to measure the concentration of the sample.



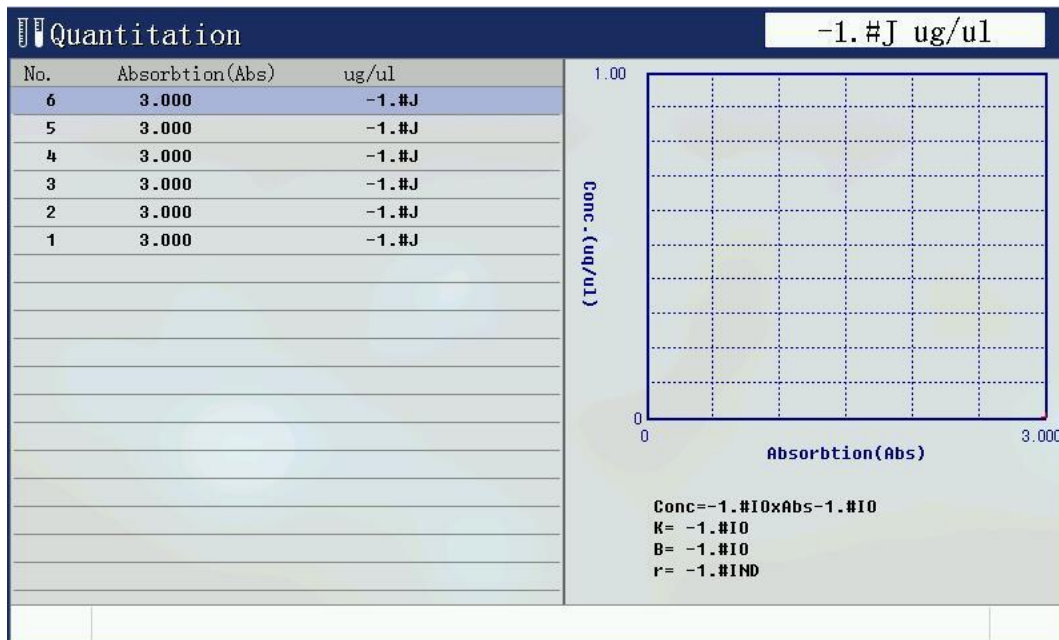
- 1) Curve fitting mode: there are first order fitting, first order fitting through zero, and second order fitting.
- 2) Curve building method: there are standard sample method and coefficient method. Stand sample method is to prepare sample first, build curve, and then test sample. Coefficient method is to enter the known coefficient and build standard curve, then to test 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 has established limits, please select the appropriate concentration units.
- 5) wavelength value is required.

## 2. Standard sample measuring



Put various standard samples into cuvette holder orderly, and enter the concentration value of each sample, then press [enter] key, read the absorbance of the sample. The input is completed, 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, exit to establish the curve function.

### 3. Sample test



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

### 4. Open standard curve

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





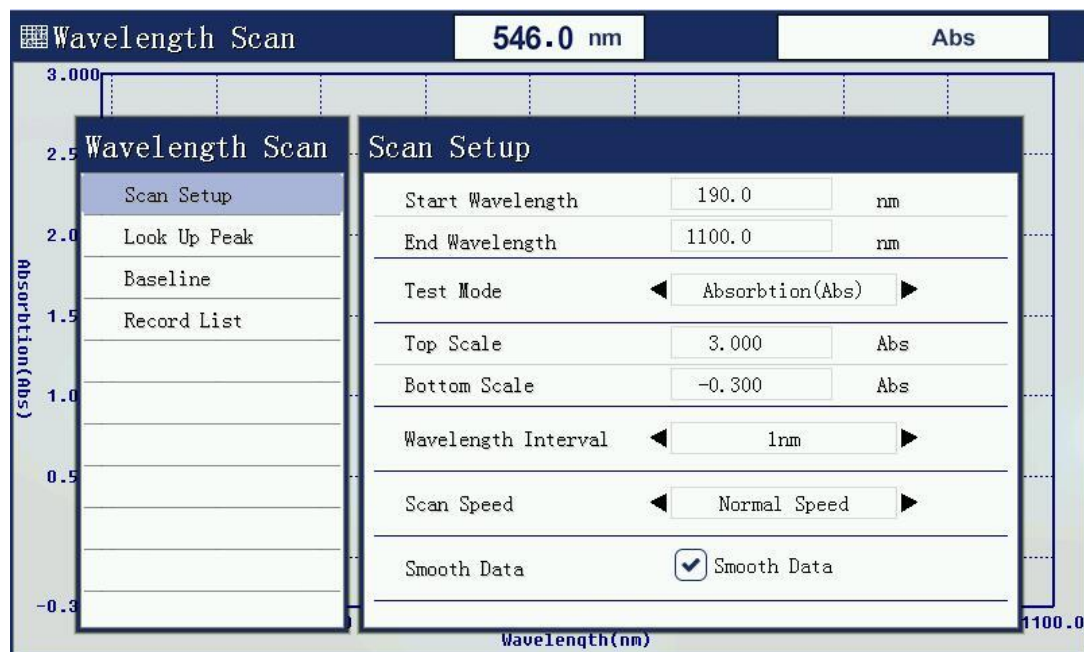
## VII. Time scan (Kinetic)

### 1. Function description

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

### 2. Time scanning parameters set

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



#### 1) Set test time

Test time is the total time of the entire test.

#### 2) Set the measurement mode

The measurement mode is absorbance, transmission or energy. Choose different measurement mode, you need to re-set the display to display the upper and lower limits.

#### 3) Set upper and lower limit

The different measurement modes, upper and lower display is not the same.

#### 4) Set the time interval

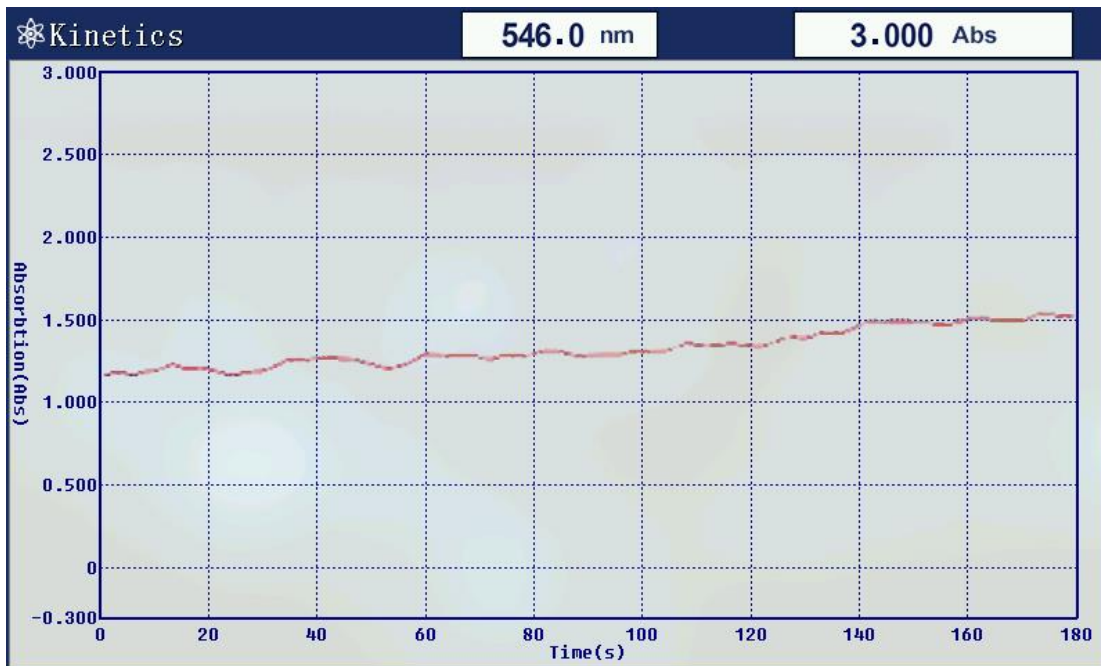
Scan scanning interval setting time, 0.5 seconds minimum, 1 minute maximum.

#### 5) Select to make data smoothing

The function for data smoothing is to reduce the irregular fluctuation caused by external environment during test.

### 3. Data test

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



#### 4. Data list

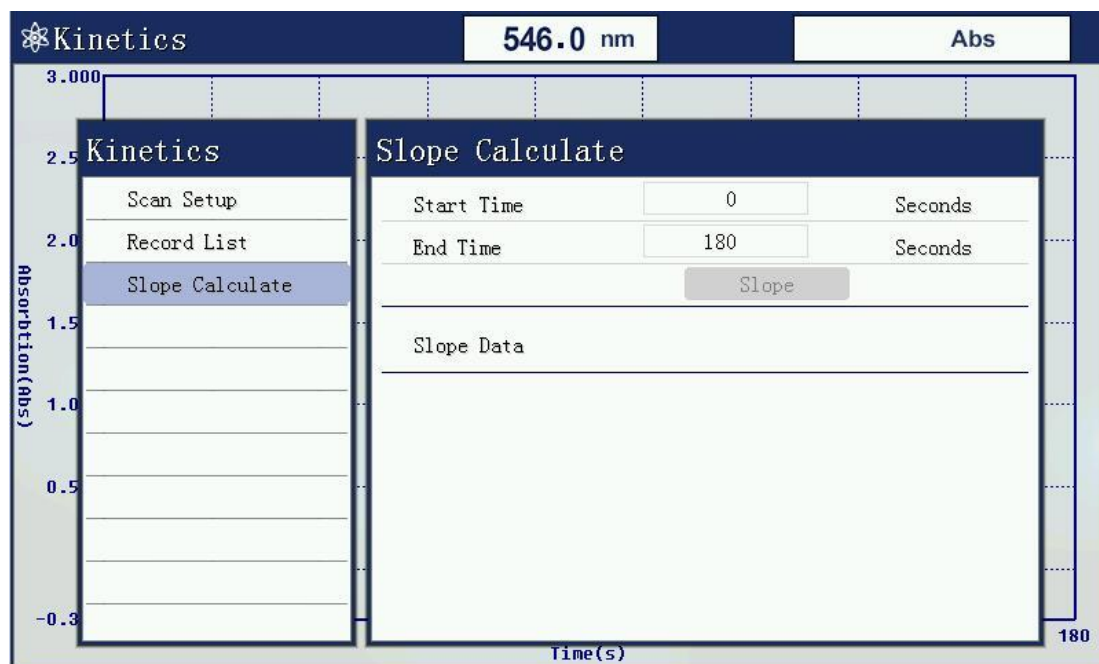
Press [Menu] key to check the scanning data after scanning finish.





## 5. Slope calculation

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

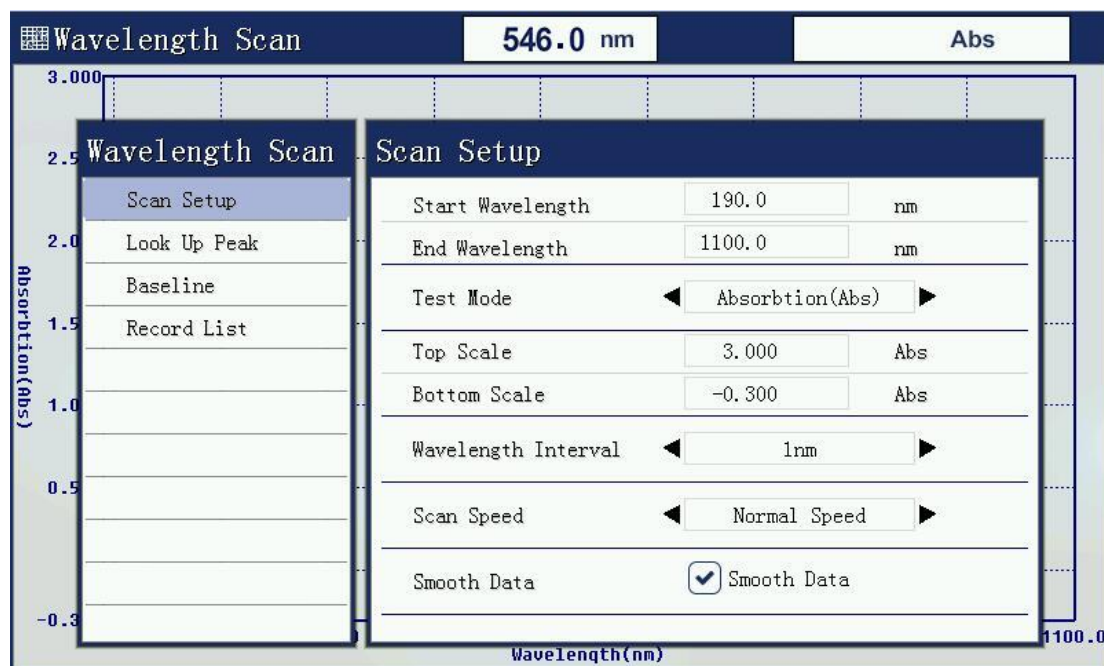


## VIII. Wavelength scanning

### 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.

### 2. Set scanning parameters



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 different measurement mode, you need to re-set the display to display the upper and lower limits.

3) Set upper and lower limit

The different measurement modes: upper and lower display is not the same.

4) Set the time interval

Scan scanning interval setting time, 0.5 seconds minimum, 1 minute maximum.

5) Set scanning speed

The scanning speed depends on the quantity of data collecting on single point wavelength. the faster the speed, the less the collecting quantity.

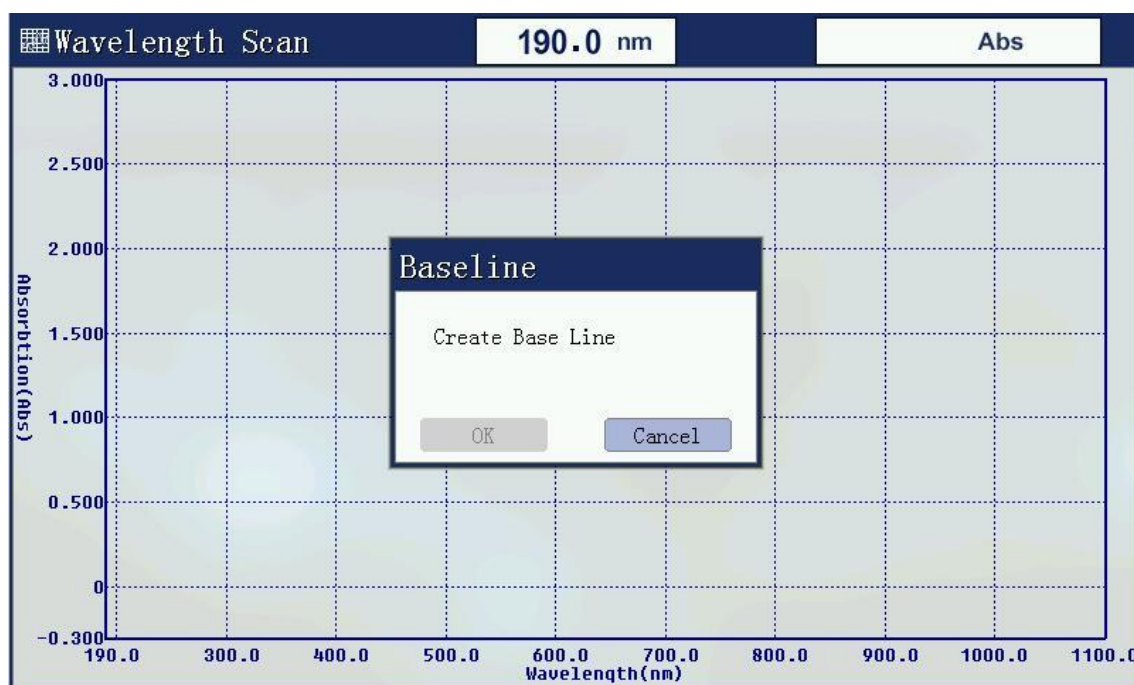
6) select to make data smoothing

The function for data smoothing is to reduce the irregular fluctuation caused by external environment during testing.

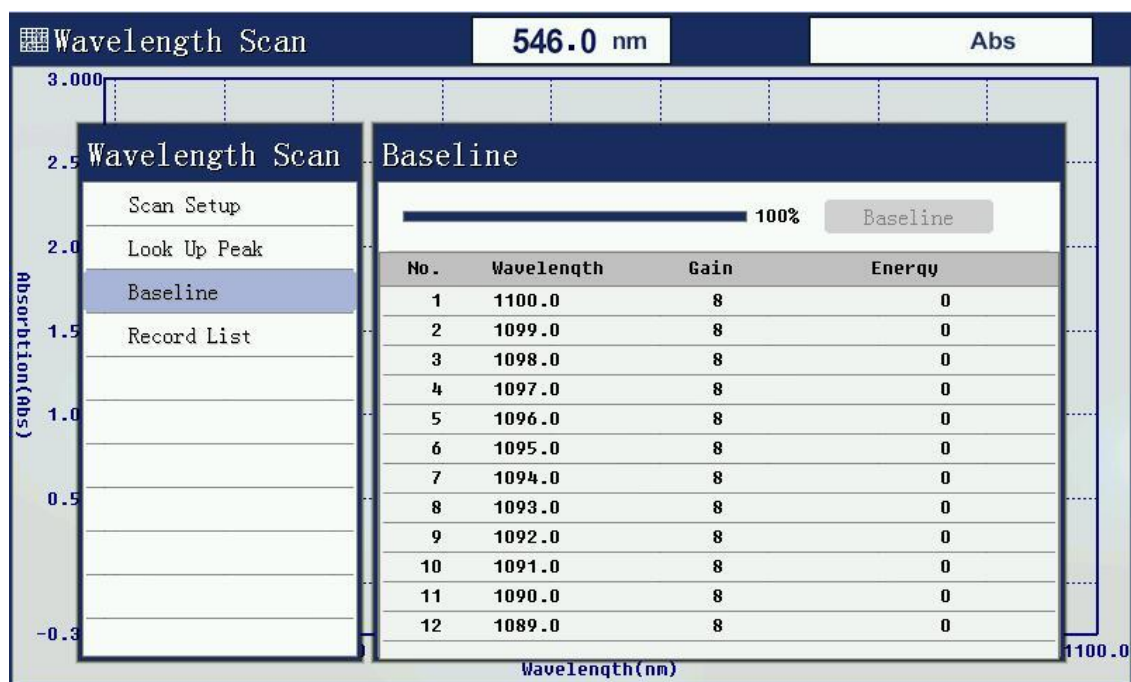
Note: You must set the scan settings before calibration parameters blank, because the scan settings to modify the parameters, the baseline will lead to an invalid user, the user needs to re-establish a baseline.

### 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.

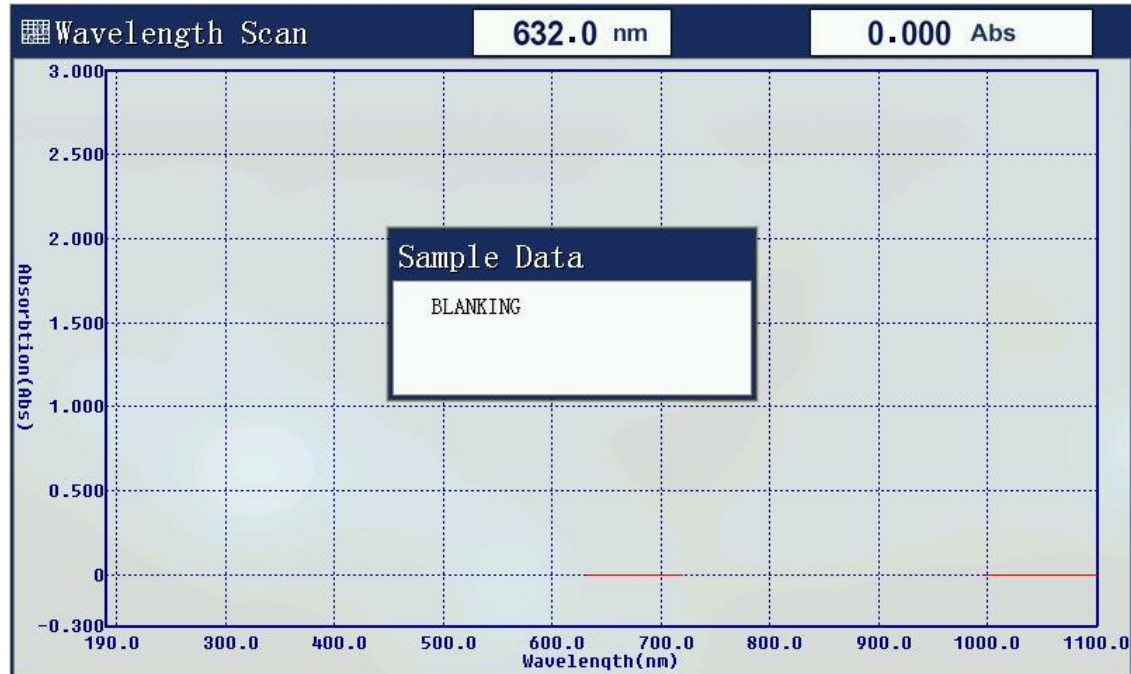


Press [Menu] key to view the baseline data after building system baseline.



#### 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.





## 7. Data list

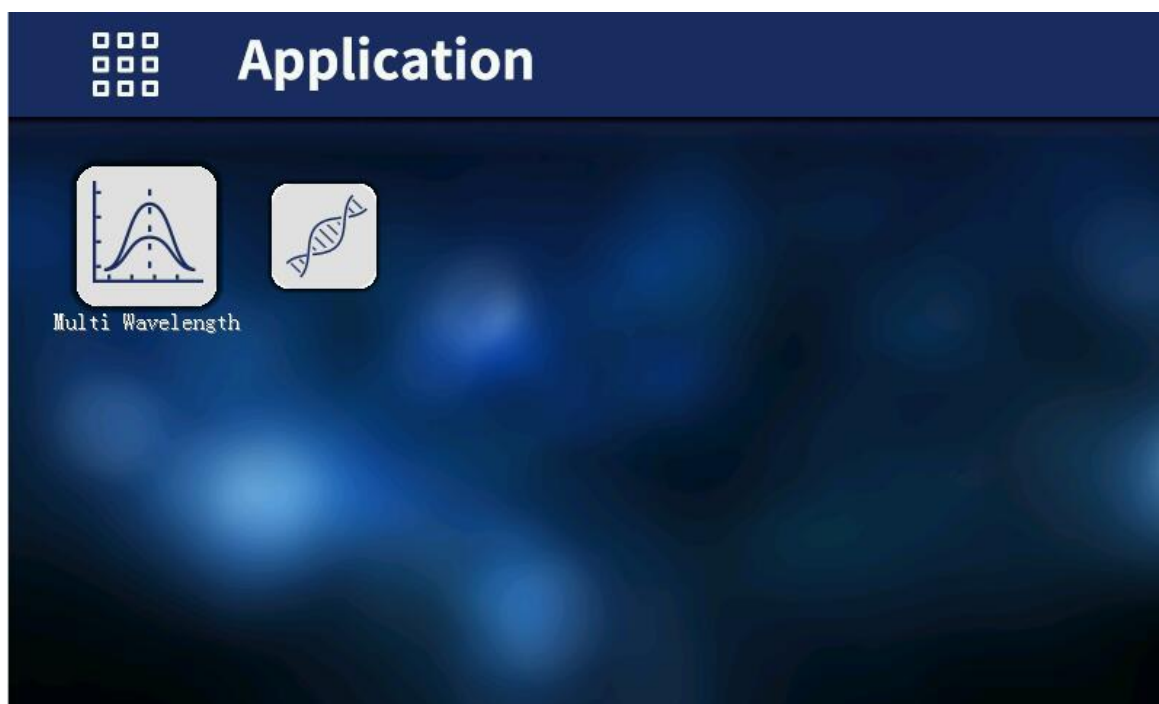
Press [Menu] key to see the list of test data.



## IX. Multi-wavelength test

### 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.





## 2. Set parameter

No.	Wavelength(nm)	Factor
Wavelength 1	400.0	1.000
Wavelength 2	450.0	1.000
Wavelength 3	500.0	1.000

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 input 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 solution for both colorimetric anti-tank, and then press the [ZERO] key, the instrument will go to 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

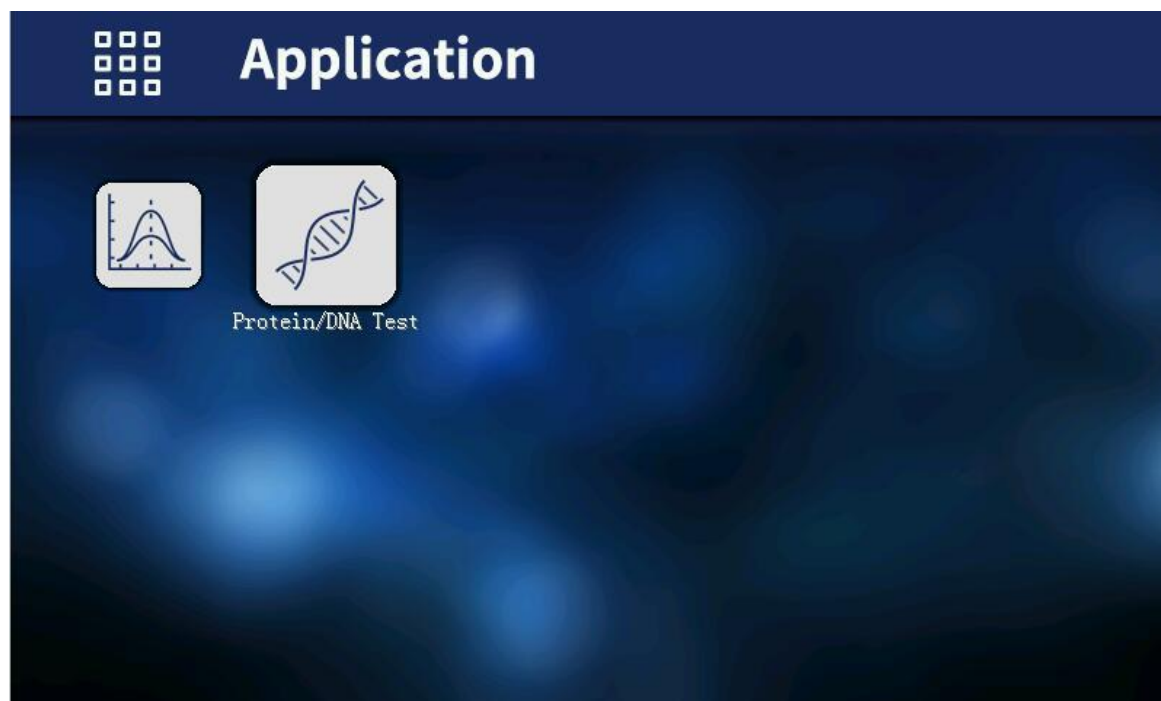
Remove the rear slot of the reference sample solution (the front does not move), and placed in the sample solution is measured, and then press the [START] button will measure a set of data, if a second sample to be measured, replace the solution after press [START], once on.



## X. Protein/nucleic acid measurement

### 1. Function description

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



## 2. Parameter selection

Protein/DNA Test		546.0 nm	Abs			
No.	Abs(260.0)	Abs(280.0)	Abs(320.0)	Ratio	Conc. (DNA)	Conc. (Protein)
<div> <div>Protein/DNA Test</div> <div> Test Mode ◀ Mode 1 ▶ </div> <div> Formula(DNA) DNA=(A260-A320)×62.9-(A280-A320)×36 </div> <div> Formula(Pro.) Pro.=(A260-A320)×1552-(A280-A320)×757.3 </div> <div> Wavelength 1 = 260.0 nm </div> <div> Wavelength 2 = 280.0 nm </div> <div> Ref. Wavelength = 320.0 </div> <div> Coefficient 1 = 62.90 </div> <div> Coefficient 2 = 36.00 </div> <div> Coefficient 3 = 1552 </div> <div> Coefficient 4 = 757.3 </div> </div>						

Protein/DNA Test		546.0 nm	Abs			
No.	Abs(260.0)	Abs(280.0)	Abs(320.0)	Ratio	Conc. (DNA)	Conc. (Protein)
<div> <div>Protein/DNA Test</div> <div> Test Mode ◀ Mode 2 ▶ </div> <div> Formula(DNA) DNA=(A260-A320)×49.1-(A230-A320)×3.48 </div> <div> Formula(Pro.) Pro.=(A260-A320)×183-(A230-A320)×75.8 </div> <div> Wavelength 1 = 260.0 nm </div> <div> Wavelength 2 = 230.0 nm </div> <div> Ref. Wavelength = 320.0 </div> <div> Coefficient 1 = 49.10 </div> <div> Coefficient 2 = 3.480 </div> <div> Coefficient 3 = 183.0 </div> <div> Coefficient 4 = 75.80 </div> </div>						





## 1. Dark current measurements

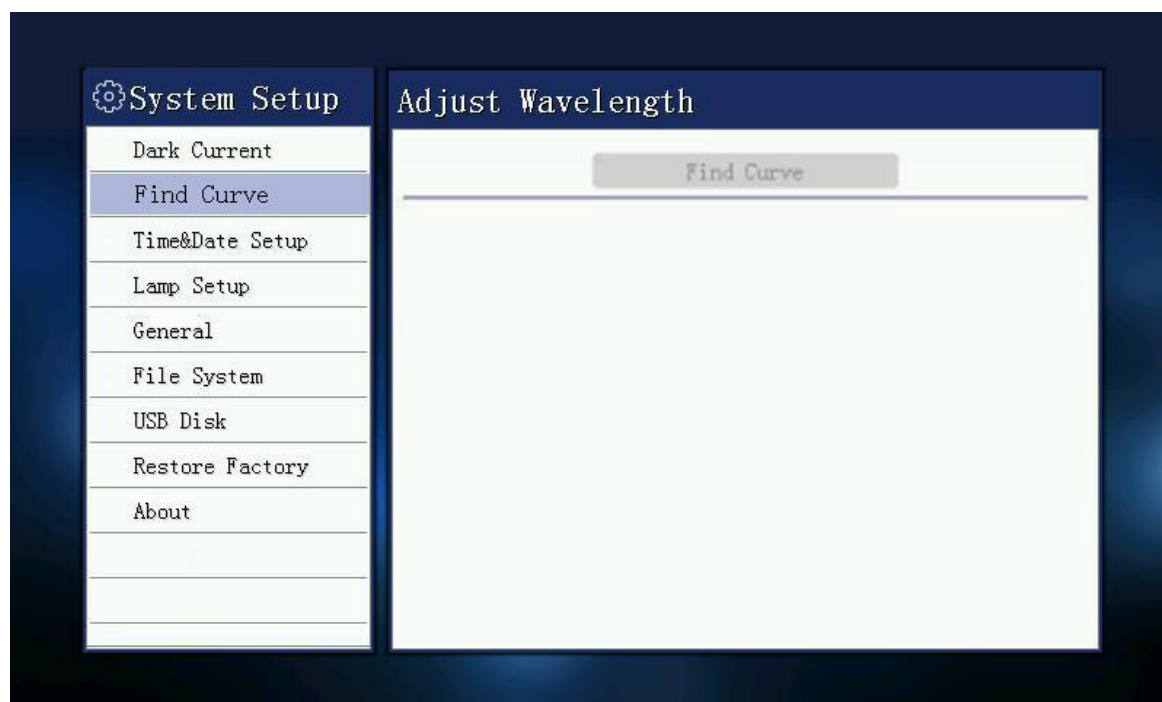
Long time operation of instrument probably lead to drift of dark current. this function can make correction for full range of dark current. Please make sure to cover the sample chamber lid when test dark current.



## 2. Looking for deuterium lamp curve

This function is to locate 656.1nm wavelength characteristic curve by looking deuterium lamp, wavelength calibration.

If the seek fails deuterium lamp characteristic curve, the wavelength is invalid instrument, the instrument will not work.



### 3. Time and date settings

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

Note: The time and date after the instrument is switched off, will not power down lost.

System Setup	
Dark Current	
Find Curve	
Time&Date Setup	
Lamp Setup	
General	
File System	
USB Disk	
Restore Factory	
About	

Time&Date Setup	
Date	
Year	2017
Month	09
Date	13
Time	
Hours	14
Minutes	06
Seconds	27
Week:	◀ Wednesday ▶

### 4. Light source management

Of deuterium lamps and tungsten light source light switches to control the display of each light source life.

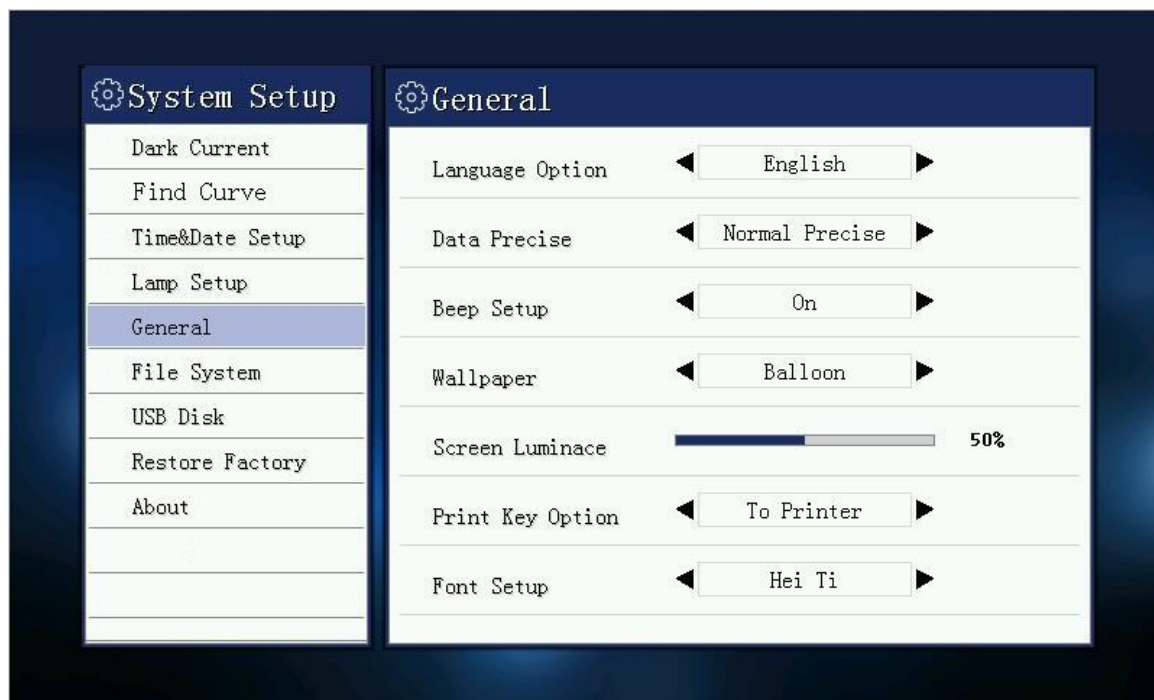
Up and down keys to select the source, press Enter to confirm the selection, the arrow keys to select the state of the light source, and press Enter to confirm the selection,

Note: Open deuterium lamp need preheating after 15 seconds, before they can open

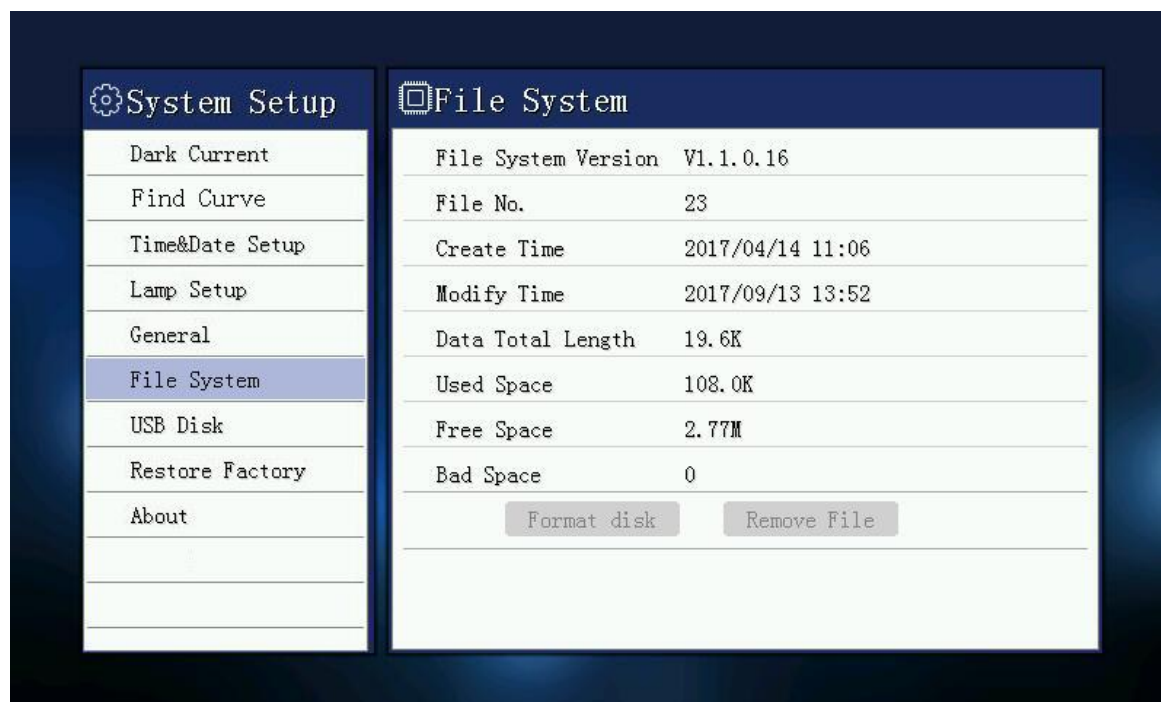
System Setup	
Dark Current	
Find Curve	
Time&Date Setup	
Lamp Setup	
General	
File System	
USB Disk	
Restore Factory	
About	

Lamp Setup	
Tungsten Lamp	
Tungsten Lamp	◀ On ▶
Lamp life	0 Hours 00 Minutes 00 Seconds
Reset Tungsten Lamp life	

## 5. General



## 6. File system



## 7. USB storage device



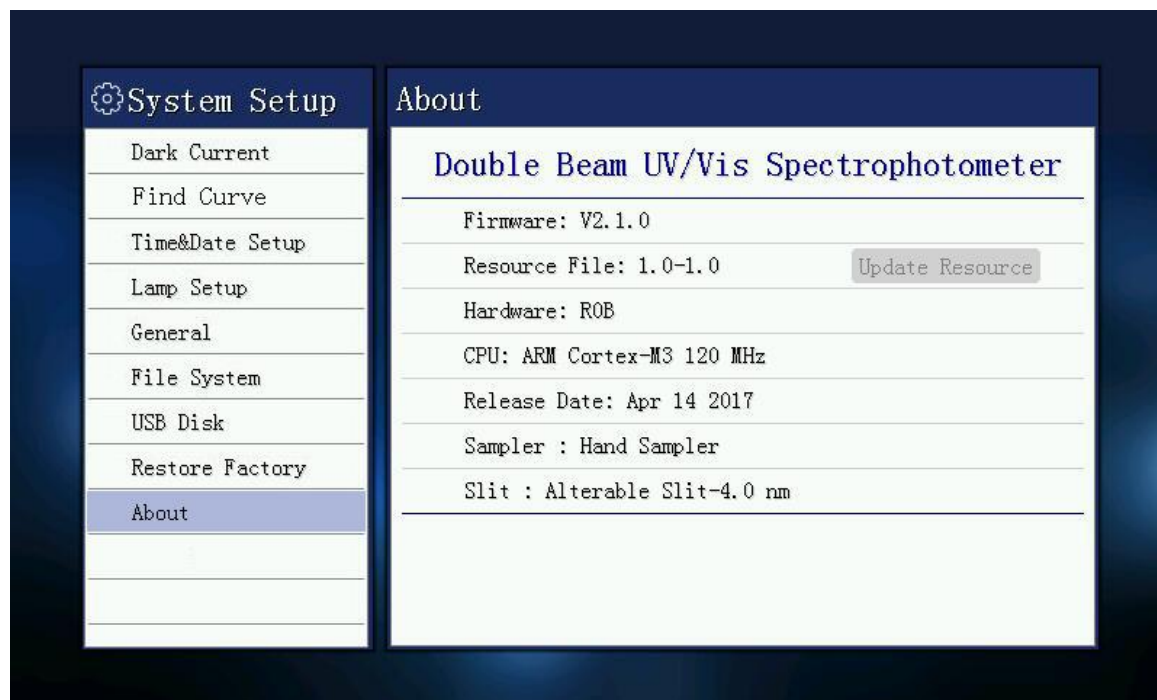
## 8. Restore factory settings

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



## 9. System information

You can view software version and hardware version information.



## XII. Instrument Care and Maintenance

### 1. Routine precautions

Any instrument is concerned, the 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:

- 1) Use the environment clean, the host instrument when not in use can be used to cover up the cloth cover to prevent dust accumulation, the thermostat should be placed in long-term storage of dry indoor better,
- 2) The sample is placed over the pool should pay attention to the color being careful not to let the solution spilled into the sample chamber, to prevent corrosion, for some volatile sample, we recommend using the cuvette lid to prevent the impact of volatile gases to light, thus affecting the accuracy of the test equipment,
- 3) Any optical instrument road section screws and nuts, are not going to loose, to prevent the optical path deviations affect the instrument is working properly,
- 4) The instrument must not mirror all the hard and soft hands or objects to touch, once leaving traces, will produce stray light and reduce the effective energy punish and even cause damage to man-made instruments,
- 5) Instrument handling should be handled with care, can not be placed on the instrument shell weight, so as to avoid affecting the optical path shift stability and accuracy,
- 6) The instrument can not work in bright light to ensure the accuracy of measurements,
- 7) Instrument power do not always do wavelength calibration, but can not always do, wavelength calibration is recommended once a week in order to improve the accuracy of the measured data,
- 8) The instrument can not be left unused for a long time, so instead of reducing life, if not for some time, it is recommended boot 1-2 times a week, each about half an hour.



## 2. Instrument Care and Maintenance

- 1) Check the sample chamber lens: regular checks on both sides of the sample chamber is about bias in quartz lens position, look at whether fingerprints and other stains, if stains serious impact on the accuracy of the measured value will be found after the stain, after a clean cloth moistened with alcohol to wipe in one direction **can** decontamination is recommended to check once a month,
- 2) Wavelength accuracy check: Buy a calibrated holmium oxide solution in the instrument wavelength scanning interface scanning range corresponding absorption spectra, measured by the detection of reconciliation between the peak value of the calibration standard, the error is between wavelength accuracy of the instrument error, it is recommended to check once a year,
- 3) Wavelength Accuracy cursory examination: After the completion of the self-test instrument interface into any of the tests, set the wavelength to 546nm, and then open the sample chamber, take a small piece of white paper on the left side of the lens at any of the sample chamber, watching the display in the white color of the light sheet of paper, if the wavelength of light green indicates substantially correct, and when the result of the test is larger away from their past experiences can be checked at any time.

## XIII. Instrument Troubleshooting

When the instrument is faulty, the instrument can determine the initial failure is part of the nature of the general failure of the instrument's internal and external points, life failures and occasional failures of the points, and the user can handle and can not handle the points, to distinguish the above conditions are favorable for the use and maintenance of equipment, because it can provide the right information to effectively and timely maintenance personnel, will be beneficial to promptly resolve the problem, during the warranty period no sales staff telephone guidance, please do not attempt to open the housing for servicing equipment found The first time questions please contact the company service personnel!

### 1. Power failure

Failures	Causes	Solutions
Boot no reaction	No electrical outlet	Check the external power supply
	Power cord not plugged in	Re-seated host power
	Socket switch inline fuse burned	Replace the spare fuse embedded or purchase the same size fuse 3A
	Instrument socket switch is broken	Please contact the manufacturer or your local dealer
	Internal power supply board or transformer burned	Please contact the manufacturer or your local dealer
Instrumentation display is not normal	Internal wiring is loose display	Opening the housing service personnel under the guidance of re-seated
	Internal +5 V power supply is not normal or loose cable	Opening the housing service personnel under the guidance of re-seated
	Internal procedures by the unexpected collapse of the high-frequency voltage shock	Service personnel under the guidance of re-programming process
	The motherboard is not working properly	Please contact the manufacturer or your local dealer

## 2. Self-test failure

Failures	Causes	Solutions
Filter positioning error	Loose electrical line filter	Opening the housing service personnel under the guidance of re-seated
	Optocoupler line filter loose	Opening the housing service personnel under the guidance of re-seated
	+12 V power supply board is not normal or loose cable	Opening the housing service personnel under the guidance of re-seated
	Filter optocoupler bad	Please contact the manufacturer or your local dealer
	Motor driver chip on the motherboard bad TD62083	Please contact the manufacturer or your local dealer
Positioning error sources	Switching motor cable loose	Opening the housing service personnel under the guidance of re-seated
	Switch micro switch wire loose	Opening the housing service personnel under the guidance of re-seated
	Switching bad micro switch	Opening the housing service personnel under the guidance of re-seated
	+12 V power supply board is not normal or loose cable	Please contact the manufacturer or your local dealer
	Motor driver chip on the motherboard bad TD62083	Please contact the manufacturer or your local dealer
Error signal detector	Motherboard connector cable loose signal board	Opening the housing service personnel under the guidance of re-seated
	Power board + / -15 power cable is loose or not properly	Opening the housing service personnel under the guidance of re-seated
	Bad signal board	Please contact the manufacturer or your local dealer
	Bad motherboard	Please contact the manufacturer or your local dealer

## 3. Other failure

Failures	Causes	Solutions
Normal self tungsten lamp wavelength region of low energy or unstable	Tungsten lights over 2000 hours or bad	Refer to Chapter XV to replace tungsten lamp
	Use too long causes the internal optics moldy	Please contact the manufacturer or your local dealer
Wavelength calibration test normal low energy deuterium lamp or unstable areas	Experimental cuvette with a glass	Use quartz cuvette
	Both sides of the sample chamber is too dirty lens	Lens cleaning paper moistened with alcohol to wipe dry
	Deuterium lamp is lit more than 2000 hours or bad	Refer to Chapter XV deuterium lamp replacement
	Use too long causes the internal optics moldy	Please contact the manufacturer or your local dealer



## XIV. Light source replacement

Note: To make the instrument work, choose to replace original parts! ! !

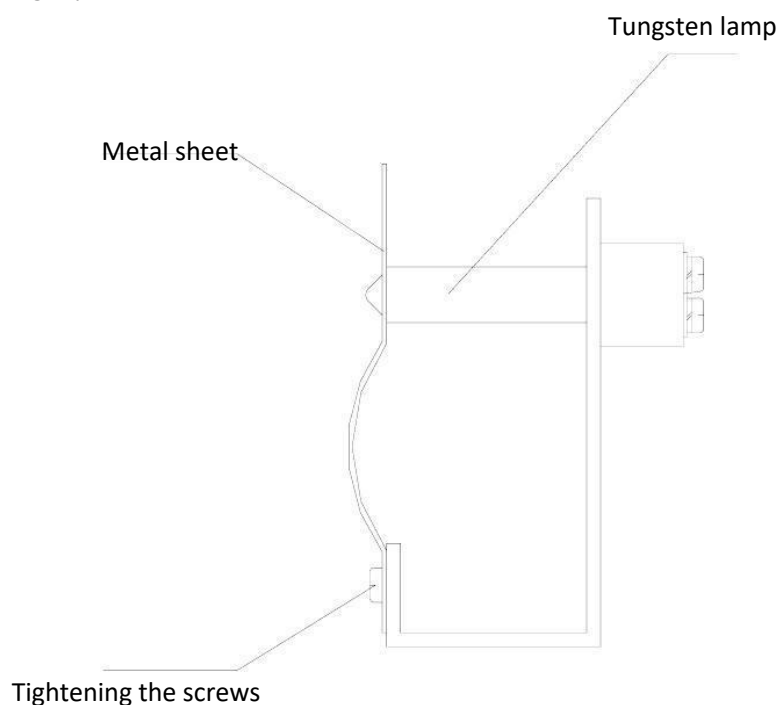
Device names mentioned in this chapter and its location, please refer to Chapter 2 Section 4 describes where to find the structure.

### 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 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 are not removed too much force 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 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)



4) Turn on the instrument, make tungsten lamp light, and convert the light source switching mirror to horizontal position manually.

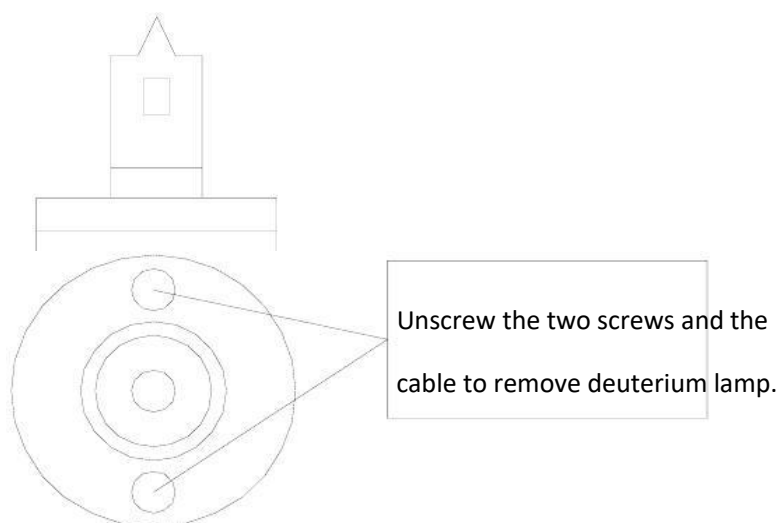
5) Loosen the screws seat switch motors, seat motors to move the focus to switch into the slit in the smallest and tungsten lights centered,

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 340nm, 370nm, 1000nm, 1100nm let automatic zero. If it does not display the low energy lamp replacement is completed, if there is low energy, repeat the above steps, if not enough, please contact the company sales staff.

## 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 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 are not removed too much force 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 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 in accordance with the original position (note deuterium lamp light mouth will toward objective), and plug it in the power supply board.



- 4) Turn on the instrument, make deuterium lamp light, and convert the light source switching mirror to vertical position manually.
- 5) Loosen the screws 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 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), and tighten the corresponding screws,
- 9) Re-POST, after the completion of the self-test mode in the wavelength photometric measurements were walked 200nm, 330nm, 340nm, 370nm, 1000nm, 1100nm let automatic zero. If you no longer displays low energy lamp replacement is completed, if there is low energy, repeat the above steps, if not enough, please contact the company sales staff.