

Single Beam UV/Visible Spectrophotometer

LMUS-B102

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1. Safety Measures

1.1 Safety Notes

- Read the entire user manual carefully before you unpack, set up, or operate the device. Wrong operations could lead to serious operator injury 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 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 with contact with chemical/biological substances.
- Working with chemical samples, standards, and reagents can be dangerous.
- Make yourself familiar with the necessary safety procedures and the correct handling of the chemicals before use and read and follow all relevant safety data sheets.

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

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

1.2 Precautions

- Use the dust cover to prevent dust accumulation when the instrument is not working for a long time.
- Be careful not to spill solution into the sample chamber, to prevent corrosion, for some volatile samples, we recommend using the cuvette lid to prevent the impact of volatile gases to light, thus affecting the accuracy of the test equipment.
- Check every part of the instrument to ensure they are not loose to prevent optical path deviations and affect the instrument's working properly.

Single Beam UV/Visible Spectrophotometer LMUS-B102

- Moving instruments should be handled with care, and no heavy items can be placed on the top of the instrument, to avoid affecting the optical path shift stability and accuracy.
- Wavelength calibration is recommended once a week to improve the accuracy of the measured data, 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 LMUS-B102 has wavelength range of 190 to 1100 nm. It features spectral bandwidth of 0.5, 1, 2, 4, and 5 nm with large digital display. Equipped with an advanced optical system that ensures reliable performance. Integrated with an automatic wavelength setting which simplifies operation. Our Spectrophotometer is ideal for chemical analysis and research laboratories.

3. Features

- 10.1-inch color touchscreen
- Windows graphic interface
- Photometric measurement
- Kinetics function
- USB data transfer

4. Specifications

Model No.	LMUS-B102
Wavelength	190 nm to 1100 nm
Spectral Bandwidth	0.5 / 1 / 2 / 4 / 5 nm
Optical System	Single Beam, Grating 1200 lines/mm
Wavelength Accuracy	± 0.1nm
Wavelength Repeatability	Less than or equal to 0.1nm
Photometric Range	0 to 200%T, -0.3 to 3A, 0 to 9999C
Photometric Accuracy	0.2%T(0 to 100%T), ±0.002A(0 to 0.5A), ±0.004A(0.5 to 1A)
Photometric Repeatability	Less than or equal to 0.15%T (0 to 100%T), 0.001A(0 to 0.5A), 0.002A(0.5 to 1A)
Light Source	Deuterium & Tungsten lamp
Detector	Silicon Photodiode
Cuvette Holder	10mm manual 4-cell holder
Stray Light	Less than or equal to 0.03%T (220nm, 360nm)
Stability	± 0.0005A/h@500nm
Baseline Flatness	± 0.001A
Noise	0.0005A@500nm
Data Output Port	USB drive, USB host, RS232
Power Supply	AC 110 to 220V/50 to 60Hz
Dimension	810×660×390 mm
Weight	27 Kg

5. Applications

Single Beam UV/Visible Spectrophotometer LMUS-B102 is employed for chemical analysis, quality control, and research. It is widely applied in pharmaceuticals, environmental studies, and food testing.

6. Instrument Introduction

6.1 Structure introduction

The structure consists of three parts: an optical system, a power system, and a micro-computer system.

6.1.1 Top view of structure

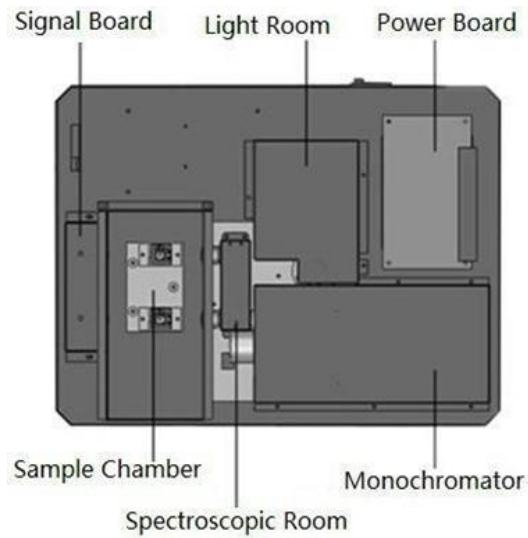


Figure-1

6.1.2 Bottom view of structure

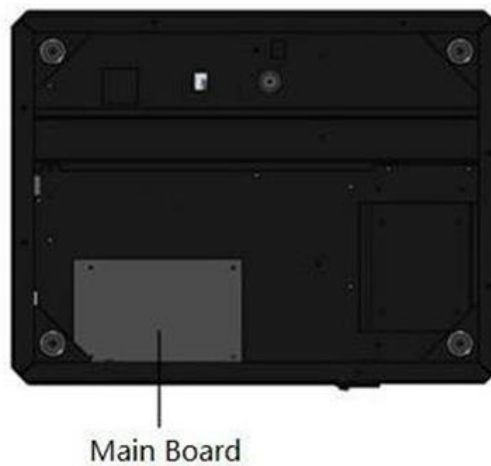


Figure-2

6.1.3 Light path diagram

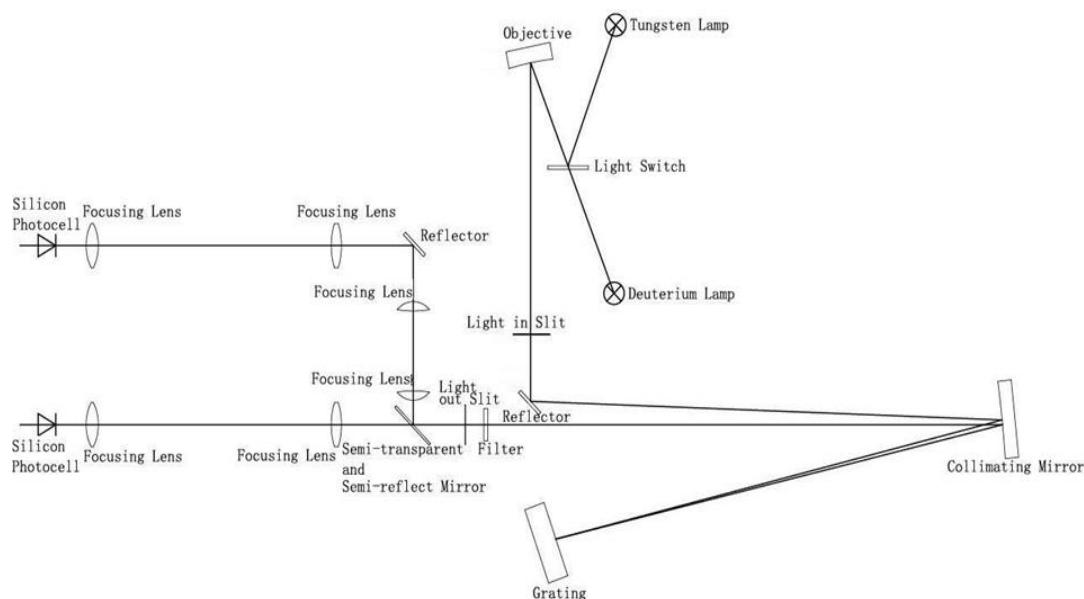


Figure-3

6.2 Important part of the instrument

6.2.1 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.

6.2.2 Lightroom

There are tungsten halogen lamps and deuterium lamp source devices to automatically switch.

Tungsten halogen: Visible spectral region. Applicable wavelength range 340-1100nm. Because it uses the principle of the halogen cycle, it has a greater intensity of light emission and longer life. The halogen cycle requires a higher temperature. Thus, lamps commonly use quartz glass or high-temperature glass. Tungsten halogen lamps emit energy in the visible region around the operating voltage is proportional to the fourth power, therefore, to make light stable, the model has a stability of less than 0.2% of the power supply, the other imported Philips halogen socket tungsten halogen lamp replacement to ensure stable and easy to use and long life.

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.

6.2.3 Monochromator

Contains spectral components- grating, into the slit, the slit, mirror, focusing lens, and the wavelength filter drive system, the monochromatic light emitted from the composite light can be decomposed into monochromatic any wavelength of monochromatic light from the optical separation.

Raster: The dispersion of the original, the model uses 1200/mm holographic grating to 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 slit 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, the color band deteriorates, is not conducive to the qualitative analysis, quantitative analysis also affect the linear range of the calibration curve, the slit is too small, the flux decreased, reducing the signal-to-noise ratio affects the measurement accuracy, the slits there 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).

6.2.4 Spectroscopic room

Contains a half-mirror, focusing lens, and reflector to achieve a beam monochromator out into two beams of light in different directions.

6.2.5 Sample chamber

Fixed 2-position cuvette holder, one is for reference solution, and the other is for sample solution. The 8-position cell changer is optional.

6.2.6 Signal board

Transfer to the motherboard processed signal detection light amplification.

6.2.7 Mainboard

Instrument micro control unit, control instruments light source switch, the motor rotates, the signal processor display, etc.

6.3 Performance Indicators Definitions

6.3.1 Optical system

Usually refers to the formal structure of the optical system, at present, domestic and international institutions are often used as a photometer industry type and CT auto collimation two structures.

6.3.2 Wavelength range

This means that the wavelength photometers can differentiate between the maximum and minimum values of the test.

6.3.3 Wavelength accuracy

This means the actual wavelength difference between the real wavelength and the setting wavelength. Each wavelength photometer is in a lot of points to check wavelength accuracy; spectrophotometer wavelength accuracy is an important technical indicator, and its qualitative, quantitative, and structural analysis of the impact is enormous. Way to check wavelength accuracy of many spectral lines as a standard filter praseodymium, neodymium, holmium oxide filter, holmium oxide wavelength standard solution, deuterium lamp or low-pressure mercury lamp emission and interference filters, and so on.

6.3.4 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.

6.3.5 Spectral bandwidth (sensitivity, resolution)

Refers to a peak spectral band 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 be 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 is equal, the higher the sensitivity, the better precision. It is noted that to obtain accurate test results, the natural bandwidth of the spectral bandwidth of the instrument (Spectral Bandwidth referred to as SBW) and the analysis of samples (Natural Bandwidth referred to as NBW) ratio should be less than 0.1, more than 99.5% can be obtained so that the measurement accuracy.

6.3.6 Stray light

The wavelength of stray light is irradiated onto the non-selection signal generated by the detector. It is an important source of photometric analysis of errors, stray light limits the accuracy of the General Assembly high-concentration solution analysis. Stray light represented by T%.

6.3.7 Photometric range

Refers to meet the photometric test range in various technical indicators, represented by A or T.

6.3.8 Photometric accuracy

The true average value refers to the degree of compliance with a plurality of measurements; a photometric accuracy check is usually by 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.

6.3.9 Photometric repeatability

Refers several times under the same conditions as measured in parallel, each parallel line with the degree of determination between the results.

6.3.10 Noise

The sum of the instrument detects the unwanted signals, which is the purpose of the relative signal. Generally, the spectrophotometer has two sources of noise, one from the light source, the second is derived from the internal electronic noise inherent in the instrument, such as the power supply, amplifier, AD conversion, and the like. To reduce noise, and improve signal-to-noise ratio, there must be a good electrical design. Noise measurement repeatability tests under low concentrations, but also affect test accuracy. Noise by averaging several measurements after partial elimination.

6.3.11 Drift

Refers to the degree of deviation from the instrument over time the starting value. It depends on the stability, light stability of the electrical device and the like. Single-beam instruments, the warm-up time has a great influence on the length of the drift.

6.3.12 Baseline flatness

Refers to the distribution of the full wavelength range of the instrument noise.

7. Installation

7.1 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 of 10 - 35°C, relative humidity of less than 85%, and operating voltage of 220V/50Hz.
- 3) The instrument is placed on a horizontal platform, the instrument should avoid direct sunlight and be away from electromagnetic launchers and high-power electrical devices, the use of the environment cannot have dust, corrosive gases, and vibration.
- 4) Around the instrument no obstacle to the flow of air around the instrument.
- 5) Ensure the power cord is a well-grounded power outlet line.
- 6) Check the sample chamber, ensure that there is not any solution or foreign matter, and the process of self-test to ensure that the sample compartment lid is closed, you cannot half-open (this is very important otherwise 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 always reach each user.

7.2 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. Try to stay away from issuing magnetic, electric, and high-frequency waves of electrical devices, and do not install the instrument in the air chlorine, hydrochloric acid gas, hydrogen sulfide gas, such as sulfurous acid gas, corrosive gas Excessive places. Place the instrument table should be smooth, without vibrations; nearby fans of the instrument should be left with 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 is unstable, the instrument is equipped with a power supply. The instrument should avoid direct sunlight. Avoid dusty environments.

8. Software Installation

Instrument Startup:

Connect the power cable to a power socket, then switch on the instrument via the power switch on the back, self-checking will start and remind you whether to create the system baseline or not.

Note: Wait approximately 20 seconds before switching on again so as not to damage the electronics and mechanics of the instrument.

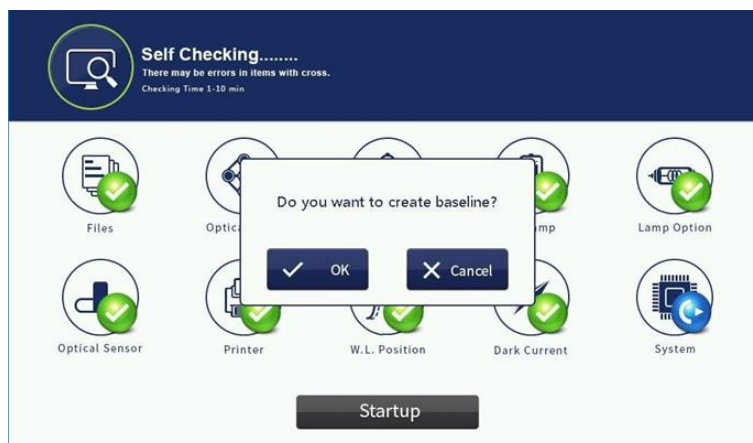


Figure-4

If the user needs to, press the “OK” button, and start the following process. The user can stop it by pressing “Cancel” button.



Figure-5

After you create the system baseline or cancel it, the machine will start preheating automatically and last twenty minutes. We suggest the user finish the preheat process, otherwise it may influence the instrument’s accuracy and stability.



Figure-6

[Files]	Check the instrument's built-in Flash file system if they are damaged or not. If there is an error, please format the file system.
[Optical Filter]	To check whether the instrument's filter motor and its locator are working correctly or not.
[T-H Lamp]	Tungsten Halogen Lamp. Open the instrument tungsten light source, and 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.
[D2 Lamp]	Deuterium Lamp. Open the 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.
[Lamp Option]	Check whether the instrument light switch motor and its locator are working correctly or not.
[Optical Sensor]	Check if the signal detector is working correctly.
[Printer]	Check the printer interface device is working properly.
[WL Position]	Check if the wavelength calibration function is working normally or not.
[Dark Current]	Read 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 displays the results \checkmark . If the dark current exceeds the maximum setting, the user is prompted dark current error. The results are displayed as \times .
[System]	Check if instrument system parameters are correct or not.

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If the user wants to skip this step, then press '**Startup**' to enter the main interface. After the preheating process, it will also enter the main menu automatically.



Figure-7

9. Working Principle

9.1 The nature of absorption

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

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

9.2 Absorption Law- Lamber 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:

$A = KCL = \text{Log} I_0/I = -\text{Log} T$. 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, with no fluorescent and photochemical scattering phenomena.
- 4) The absorbent system is a continuous uniform distribution.

9.3 Impact spectrophotometry reasons

- 1) Non-absorption errors caused by radiation and matter.
- 2) Fluorescence and photochemical reactions, in general, errors fluorescence spectrophotometry produced negligible fluorescence efficiency is very small in most cases the color system, and the fluorescence emission is isotropic, only a small portion along the transmitted light direction into the detector, the measurement of absorbance is low, resulting in a negative deviation. Depends on the instrument to measure the impact of the absorption of fluorescence great extent on the optical absorption cell and detector design.
- 3) Reflection and scattering, absorption law applies only to a homogeneous medium absorption system, a turbid solution so that the measured increase in absorbance due to scattering, resulting in deviation from Beer's law.

- 4) Non-ideal instrument error caused.
- 5) Beer's law deviation polychromatic contrast, most of the photometers can only get close to monochromatic light with a narrow lumen there is still a polychromatic nature, which can lead to deviations from Beer's law. Deviation depends on the two monochromatic molar absorptivity differences $\Delta \epsilon$, $|\Delta \epsilon|$ is very small, can be approximated that monochromatic, at low concentrations, the curve remains linear, but at larger concentrations, with concentration increases, the AC curve bends more serious, there is Beer's law applies only to dilute solutions.
- 6) Stray light, stray light entering the detector means unnecessary components to be tested at other wavelengths outside the range of the wavelength spectral bandwidth. The main dispersive element from a prism or grating spectrometer, a mirror, a lens surface scattering, dust and other inner walls of monochromator components, and diffuse reflection and other scars, the stray light can cause serious measurement errors. The instrument is the smallest wavelength of energy, usually at a maximum stray light (such as a deuterium lamp 220nm, a tungsten lamp 340nm).
- 7) Slit width, the slit width of the spectrum affects not only the purity but also affect the absorbance. When the quantitative analysis is to obtain sufficient measuring signal, the slit should be larger, in the qualitative analysis the use of a smaller slit when the entrance slit and the exit slit width equal to the width of the slit caused the minimum error.
- 8) 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).
- 9) Impact of non-parallel incident, one of the prerequisites of the law is the use of a parallel incident beam to ensure that all beams through the same thickness of the absorbing medium, when a large deviation from parallelism when the incident beam, obviously leads to deviations from Beer's law. If the instrument is in moderate-intensity beam deviation from parallelism, absorbance measurement error is generally caused by less than 0.5%.
- 10) Photometric scale error, photometric accuracy of the scale that is transmittance, which directly affects the accuracy of the magnitude of the error photometric measurements.

10. Operations

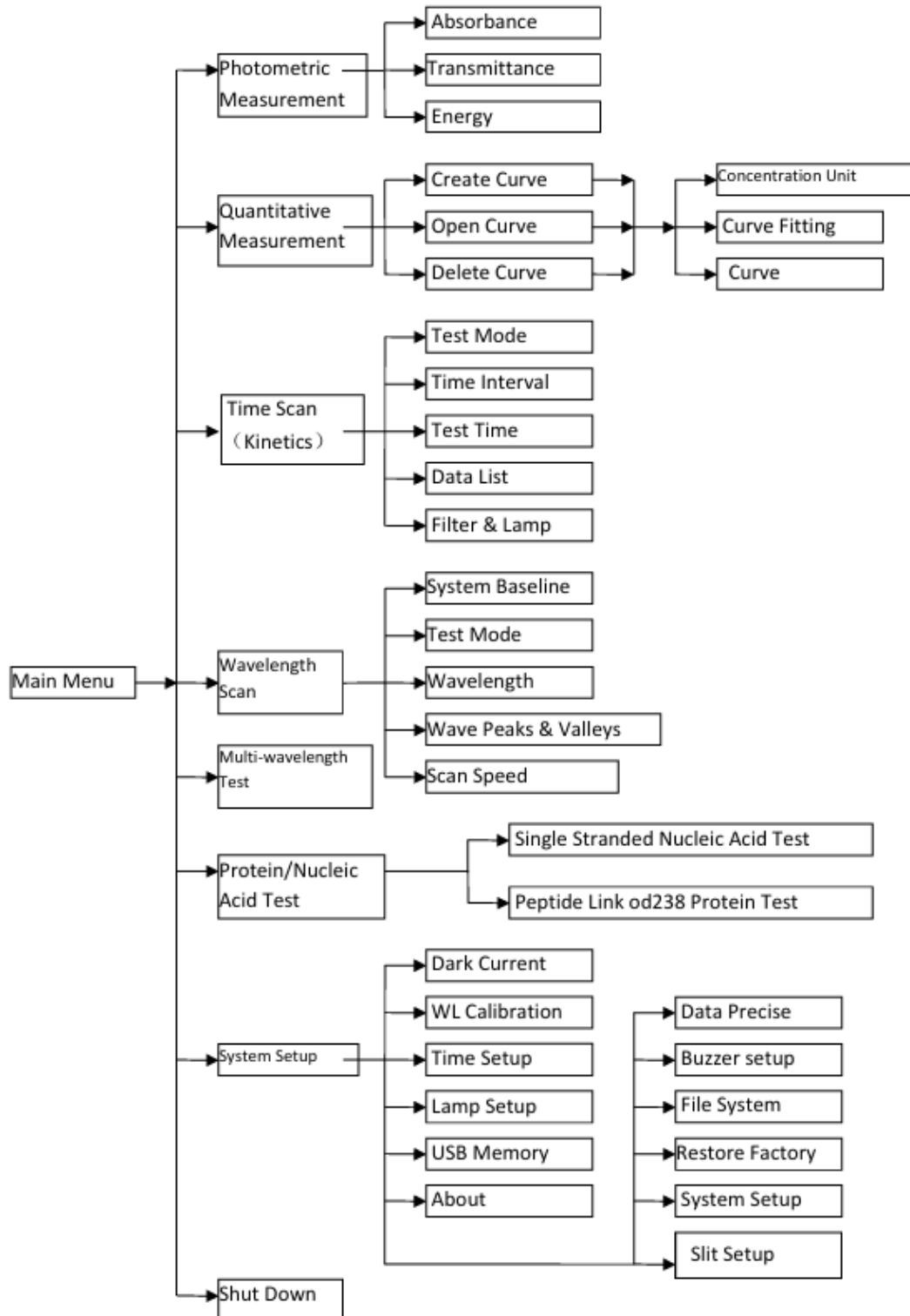


Figure-8 Main functions

11. Software Operations

11.1 System Setup

Press the above icon to enter the system setup to check and set up system parameters. The default interface is as follows.



Figure-9

11.1.1 About

It shows the basic information about this instrument, like software version, resource file version, hardware, program release date cell holder, etc. Usually, you don't need to update the resource file unless subject to our notice.

11.1.2 Dark Current

The long-time operation probably leads to the drift of dark current, this function is to correct a full range of dark current. Ensure to cover the sample chamber lid when test dark current.



Figure-10

11.1.3 WL Calibration

The user can choose how to calibrate wavelength.

Automatic: The instrument will check if the current wavelength is correct automatically, if not correct, WL calibration will start automatically. If the current wavelength is valid, it will reminder operators to calibrate the wavelength or not.



Figure-11

11.1.4 Slit Management

This function is only working for the models with adjustable slits.



Figure-12

11.1.5 Time&Date

The user can set up the date and time.



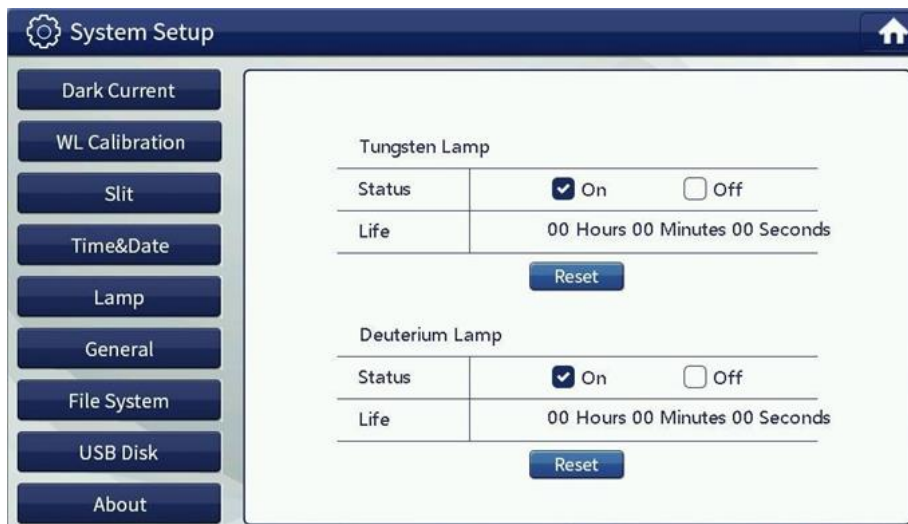
Date	
Year	2018
Month	01
Day	30

Time	
Hour	14
Minute	06
Second	32

Figure-13

11.1.6 Lamp Setup

The user can check and change the status and working time for tungsten and deuterium lamps. The user can highlight on or off to choose its status.



Tungsten Lamp	
Status	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Life	00 Hours 00 Minutes 00 Seconds
<input type="button" value="Reset"/>	

Deuterium Lamp	
Status	<input checked="" type="checkbox"/> On <input type="checkbox"/> Off
Life	00 Hours 00 Minutes 00 Seconds
<input type="button" value="Reset"/>	

Figure-14

11.1.7 General

The user can choose the precise level, beep status, screen brightness, time, and date format. Press **“Restore”** to restore defaults.



Figure-15

11.1.8 File System

The user can see the file number on the local disk, create time, and modify the time of the resource file and the last file saved on the local disk. Data size, used space, and total storage space are shown too. If the user presses format, all the data in the local disk will be deleted. Press **“Delete”** to remove the saved file(s).

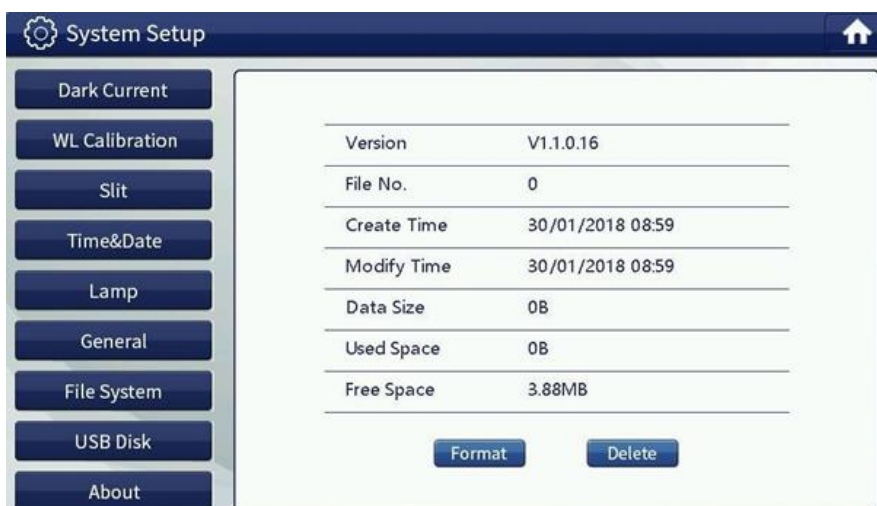


Figure-16

11.1.9 USB Disk

The user can insert the USB pen drive to store test data and files on your flash memory, it will display your USB status here.



Figure-17







11.2 Photometry

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



Figure-18

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 Zero	<p>Correction 100%T/0Abs In two samples simultaneously into the two slots reference solution, and then press the [Zero], the instrument will blank correction in the current wavelength. Display calibration is completed 100.0% T or 0.000Abs.</p>
 Save	Save the test file and data
 File	<p>Open saved file After you do some test, first press save button, then open files. Otherwise the system will remind you Data Modified, Save Record. You can press OK to save test records or cancel it to continue open other files.</p>
 Delete	<p>Delete the latest test records. This function cannot be used to delete saved files.</p>
 Print	<p>Print the test results The user can choose the file you want to print, then press this icon to print directly. All the other print function is the same as this one, so we will not introduce other print function correspondingly.</p>
 Set	Set the operating modes (Abs, %T, or Energy) and Gain value.

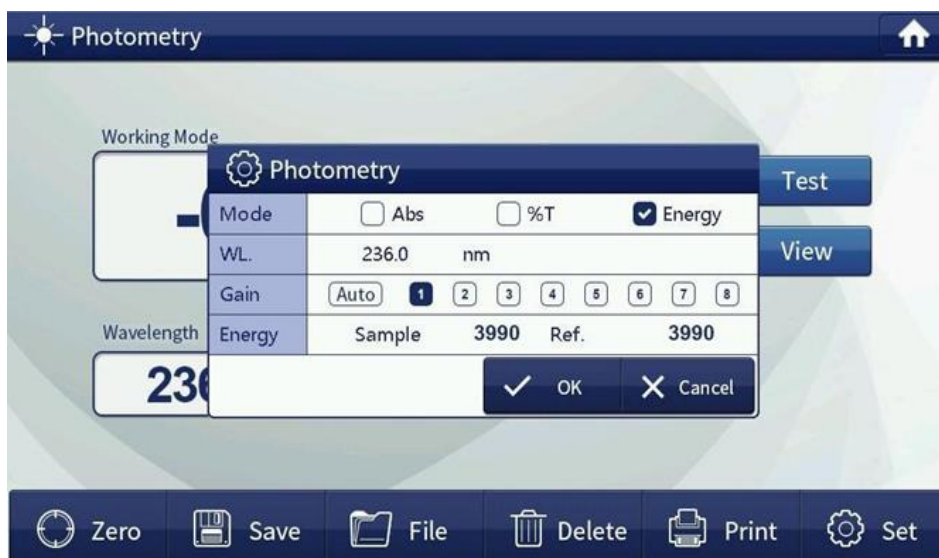


Figure-19



 Test	After you blank and set up other parameters, press this button to do the test.
 View	<p>To view the test records. After you press this button, you will enter this window. Here you can save the results too and delete each test record.</p>



Figure-20

	Return key: Press this icon to return to the previous window.
	Home Key: Press this icon to return to the main menu.

11.3 Wavelength Scan

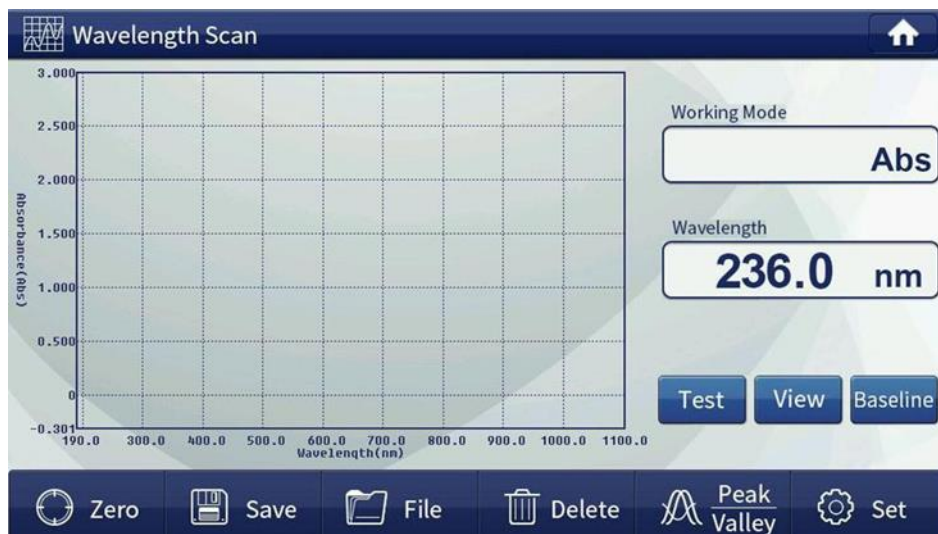


Figure-21

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

	Set	Set up the relevant parameters for the wavelength scan.
--	------------	---

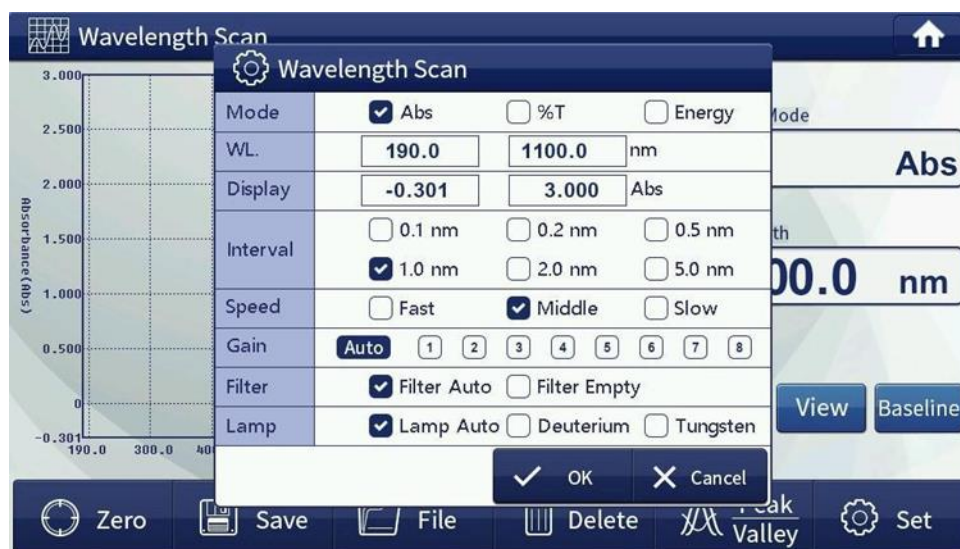


Figure-22

1) **Set measurement mode (Mode)**

The measurement mode is absorbance, transmission, or energy. Choose a different measurement mode, the user needs to re-set the display range to show its maximum and minimum limits.

2) **Set wavelength scan range(WL)**

3) **Display:** To show limits of values in different measurement modes, and the limit is different under different modes.


4) **Set wavelength scan interval from 0.1nm to 5.0nm.**

5) **Set scanning speed**





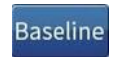
The scanning speed determines the quantity of data collected on a single-point wavelength. The faster the speed, the less the collecting quantity.

6) **Filter auto:** The filter will be switched automatically according to different wavelengths. Filter empty means the filter is not working no matter what the wavelength is.

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

	<p>Correction 100%T/0Abs In two samples simultaneously into the two slots reference solution, and then press the [Zero], the instrument will blank correction in the current wavelength range. Display calibration is completed 100.0% T or 0.000Abs. Press the screen out of the area of “blanking” window to stop zero calibration.</p>
	<p>Save the test file and data</p>

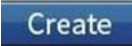



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 File	<p>Open saved file After you do some test, first press save button, then open files. Otherwise, the system will remind you Data Modified, and Save Record. You can press OK to save test records or Cancel it to continue open other files.</p>
 Delete	<p>Delete the latest test records. This function cannot be used to delete saved files.</p>
 Test	<p>After you blank and set up other parameters, press this button to do the test. If the user wants to stop the test process, press the screen anywhere.</p>
 View	<p>To view the test records After you press this button, you will enter detailed Data List. Here you can save the results too, and delete test records, if the user deletes, you will remove all the test records.</p>
 Baseline	<p>Before the wavelength scan, the user must create a system baseline. If you have previously established a system baseline, the user can skip this step. A long time without updating the system, re-create the system baseline.</p>

After the user press the Baseline button, the program will enter the following window:



Figure-23

If you want to stop creating a baseline, press again, the press  return key .  To set up the threshold value and check the curve's peak and valley values. After you input the threshold value, press , all the relevant records will come out.

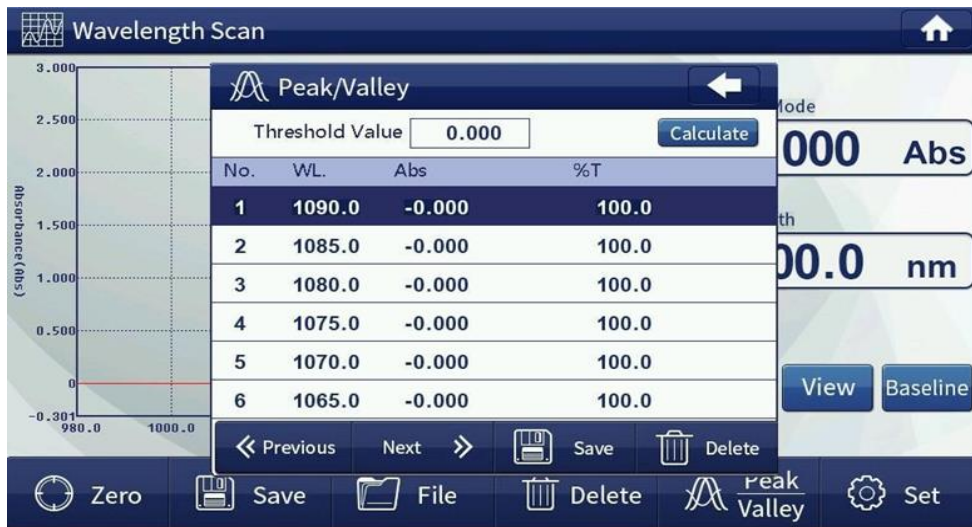


Figure-24

	Go to the previous page of the data list.
	Go to the next page of the data list.
	Return key. Press this icon to return to the previous window.
	Home Key. Press this icon to return to the main menu.

11.4 Quantitation



Press icon to enter the quantitative measurement program. There are two options: create a standard curve or open a saved standard curve.



Figure-25

If the user wants to return to the main menu window, press the cross icon

11.4.1 Build standard curve

To use several configured standard samples, input the concentration of the sample standard, collect the absorbance of the standard sample, and then calculate curve parameters through the relationship between concentration and absorbance which will be used to measure the concentration of the test sample.

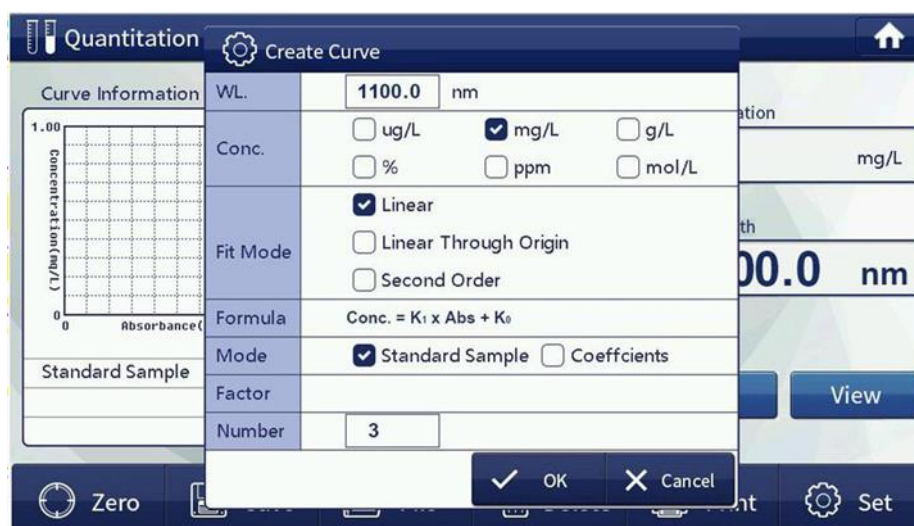


Figure-26

The user can input wavelength, highlight concentration units and fit modes (linear, linear through origin and polynomial 2nd order), and test mode (standard samples or coefficients). When the user uses coefficients mode, it will show the relevant factors in the factor column. If the user highlights the standard sample mode, you need to input the number of standard samples (at least two).

- 1) Wavelength value is required, the user needs to input it by yourself.
- 2) **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.
- 3) **Curve fitting mode:** There are linear fitting, linear through the origin, and second-order fitting.
- 4) **Curve building method:** There are standard sample methods and coefficient methods. The stand sample method is to prepare the sample first, build a curve, and then test the sample. The coefficient method is to enter the known coefficients and build a standard curve, then to test sample.
- 5) **Number of samples:** At least 2 samples. The more samples, the more accurate of testing data.

Continue the next step after setting all relevant parameters, let's take the configurations in the above picture as an example, press the **OK** button to enter the following interface:

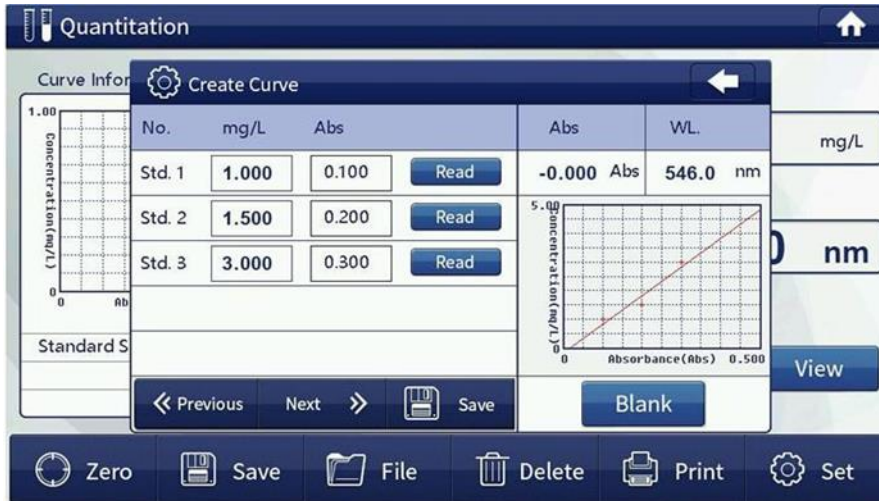


Figure-27


Press **Save** in the small window to continue, and if necessary, calibrate absorbance by pressing the Blank button.



Figure-28

After that, you can do the test, view test results, save and open files, delete test records, and print and set the concentration units.

11.4.2 Build Standard Curve

You can open the files saved on local or USB memory by press .

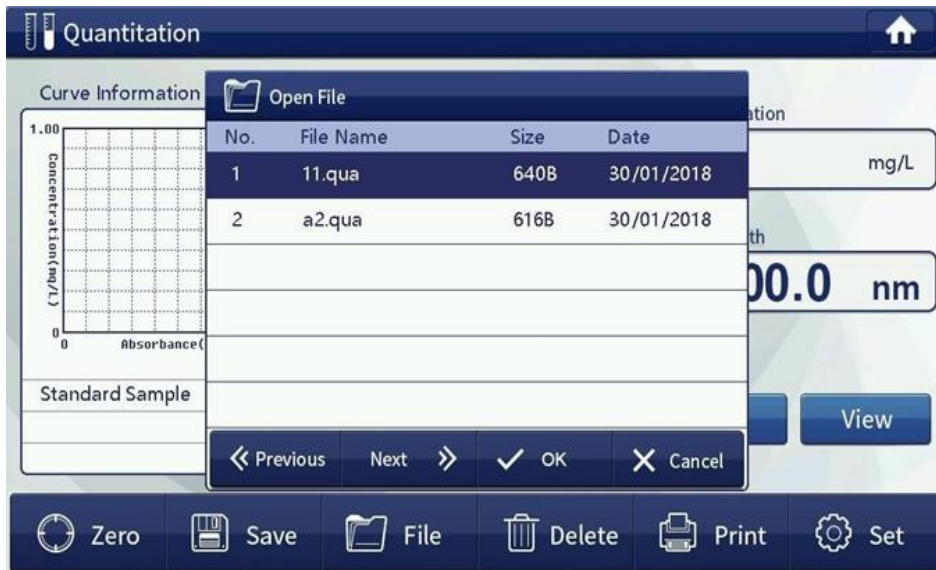




Figure-29

11.5 Multi-Wavelength





In the Multi-Wavelength program, absorbance values can be measured at up to eight wavelengths.



Figure-30

 Zero	Correction 0.000Abs
 Save	Save the test file and data

Single Beam UV/Visible Spectrophotometer LMUS-B102

 File	Open saved file
 Delete	Delete all the latest test records This function cannot be used to delete saved files.
 Print	Print the test results, you can choose the file you want to print, then press this icon to print test records directly.
 Set	Set up the number of wavelengths, at most eight.

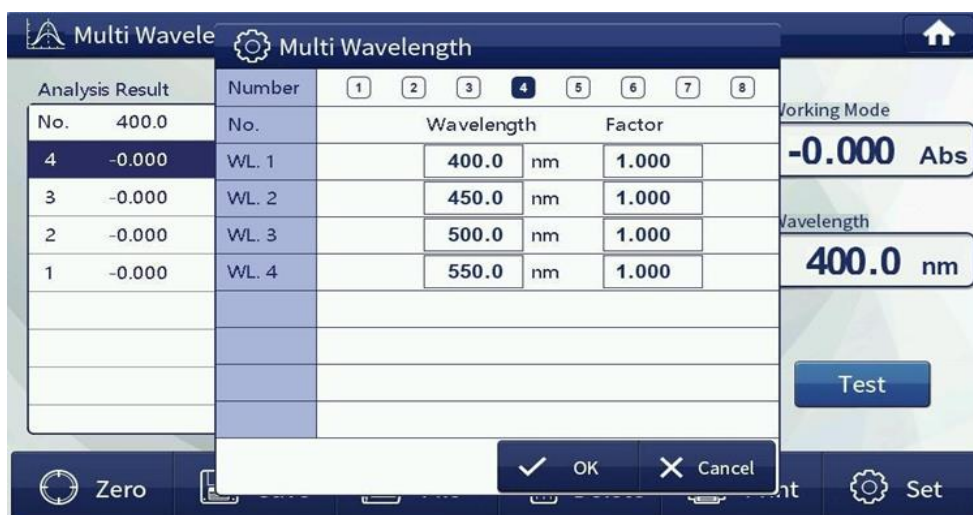


Figure-31

11.6 Kinetics (Time Scanning)

The Kinetics function is to test the absorbance or transmittance of the test sample within a fixed duration and at a certain time interval and display the trend or values on the curve.

Press the icon  to enter the kinetics program:



Figure-32

 **Set up relevant parameters.** The user needs to do the setup before the test.

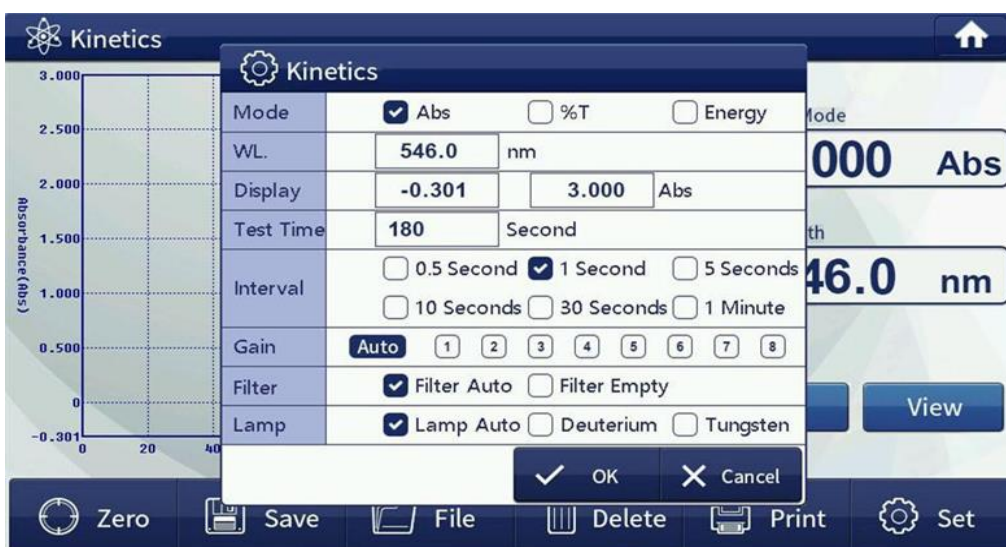


Figure-33

1) Set operating mode (Mode)

The measurement mode is absorbance, transmission, or energy. Choose a different measurement mode, the user needs to re-set the display range to show its maximum and minimum limits.

2) Set wavelength (WL)

3) Display: To show limits of values in different measurement modes, and the limit is different under different modes.




4) Test time: Input the total test time.

5) Set scan time interval from 0.5 seconds to 1.0 minute.

6) Filter auto: The filter will be switched automatically according to different wavelengths. Filter empty means the filter is not working no matter what the wavelength is.

7) Gain: The user can choose different gain values when under energy mode, or you can highlight the gain auto option, and this is strongly recommended.

The user can highlight the lamp auto, and choose a deuterium lamp or tungsten lamp. Lamp auto is recommended in most cases.

	<p>Correction 100%T/0Abs Operators need to do zero calibrations before the test. Press this button and the instrument will blank correction at the current wavelength. Display calibration is completed 100.0% T or 0.000Abs.</p>
	<p>Save the test file and data.</p>
	<p>Open the saved file.</p>




	Delete the latest test records. This function cannot be used to delete saved files.
	After the user sets up other parameters and does blanking, press this button to do the test. If the user wants to stop the test process, press the screen anywhere, and the save file window will come out to remind the user whether to save this test data or not.
	To view the test records. After the user press this button, you will see the detailed Data List. Here you can delete test records, if you delete them, you will remove all the test records.



Figure-34

11.7 Protein/DNA Test

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

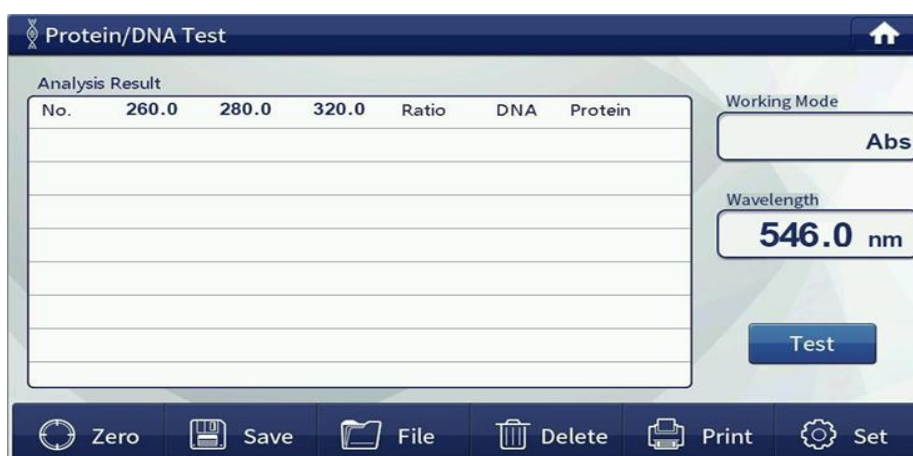








Figure-35

Single Beam UV/Visible Spectrophotometer LMUS-B102

 Zero	Correction 0.000Abs
 Save	Save the test file and data.
 File	Open the saved file.
 Delete	Delete all the latest test records. This function cannot be used to delete saved files.
 Print	Print the test results, the user can choose the file you wants to print, then press this icon to print test records directly.
 Set	There are two modes with different formulas.

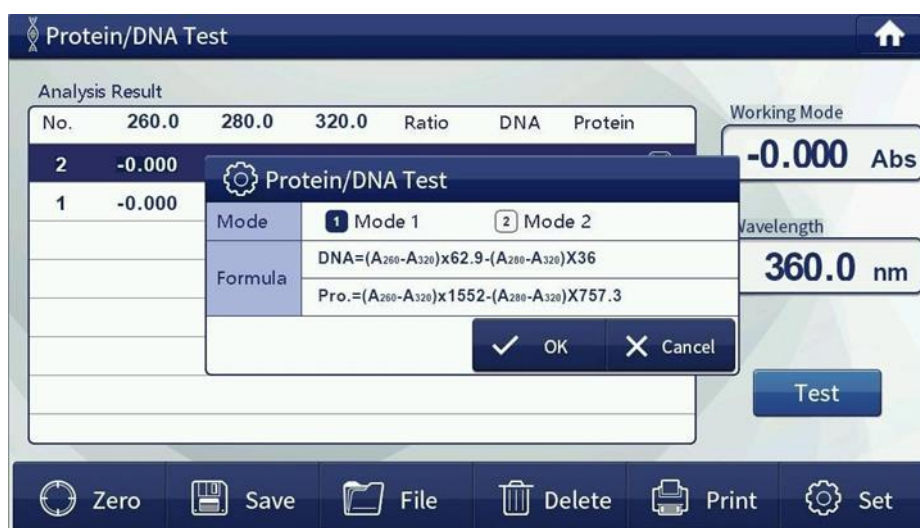


Figure-36

12. Maintenance

Caution:

- Potential chemical, biological eye, and skin hazards.
- Only qualified personnel should conduct the tasks described in this section of the manual.

Notice:

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

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, or acetone or like clean the instrument, including the display and accessories.

12.1 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.

12.2 Display

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

12.3 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.

13. Troubleshooting

Refer to the following table for common troubles if you are not sure about the problems.

13.1 Self-test failure

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

13.2 Power failure

Failures	Causes	Solutions
Boot no reaction	No electrical outlet	Check the external power supply
	The power cord is not plugged in	Re-seated host power
	The socket switch inline fuse burned	Replaced the fuse
	The instrument socket switch is broken	
	Internal power supply board or transformer burned	
Display error	Internal wiring is a loose display	Open the housing and re-seat the wire under the guidance of service personnel
	Internal +5V power supply is not normal or loose cable	Open the housing and re-seat the cable under the guidance of service personnel
	Internal procedures by the unexpected collapse of the high-frequency voltage shock	Reprogram it under the guidance of service personnel
	The motherboard is not working properly	

13.3 Other failure

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

14. Accessories

Standard Accessories

Accessory	Quantity	Unit
10mm glass cuvette	4	Piece
10mm quartz cuvette	2	Piece
Power cord	1	Piece
PC software	1	Each

Optional Accessories

Model No.	Accessory	Unit
LMUS-B102-G1	5 mm Glass Cuvettes	Box
LMUS-B102-G2	10 mm Glass Cuvettes	Box
LMUS-B102-G3	20 mm Glass Cuvettes	Box
LMUS-B102-G4	30 mm Glass Cuvettes	Box
LMUS-B102-G5	50 mm Glass Cuvettes	Box
LMUS-B102-G6	100 mm Glass Cuvettes	Box
LMUS-B102-Q1	5 mm Quart Cuvettes	Box
LMUS-B102-Q2	10 mm Quart Cuvettes	Box
LMUS-B102-Q3	20 mm Quart Cuvettes	Box
LMUS-B102-Q4	30 mm Quart Cuvettes	Box
LMUS-B102-Q5	50 mm Quart Cuvettes	Box
LMUS-B102-Q6	100 mm Quart Cuvettes	Box
LMUS-B102-W1	Quartz Micro- Cuvettes with Black Walls (0.35/0.7/1.0/1.4/1.7ml)	Box
LMUS-B102-W2	Quartz Micro- Cuvettes with Black Walls (50/100/200ul)	Box
LMUS-B102-M1	5 mm Manual 4-cell Holder	Each
LMUS-B102-M2	50 mm Manual 4-cell Holder	Each
LMUS-B102-M3	100 mm Manual 4-cell Holder	Each
LMUS-B102-H1	10 mm Single hole cell Holder	Each
LMUS-B102-H2	50 mm Single hole long-path cell Holder	Each
LMUS-B102-H3	100 mm Single hole long-path cell Holder	Each
LMUS-B102-A1	Auto 8-cell Holder	Each
LMUS-B102-F1	Film Holder	Each
LMUS-B102-R1	Tube rack	Each
LMUS-B102-Y1	Adjustable XY micro cell holder	Each
LMUS-B102-P1	Peltier/Siper System	Each
LMUS-B102-I1	Integrating Sphere	Each

Single Beam UV/Visible Spectrophotometer LMUS-B102

LMUS-B102-L1	Tungsten Lamp (for 1000)	Each
LMUS-B102-L2	Tungsten Lamp (for 1200/1600/1700/1800/1900/N/K/X/T)	Each
LMUS-B102-D1	Deuterium Lamp (for 1000/1200)	Each
LMUS-B102-D2	Deuterium Lamp (for 1600/1700/1800/1900/N/K/X/T)	Each
LMUS-B102-X1	Xenon Lamp	Each
LMUS-B102-T1	Thermal Printer	Each
LMUS-B102-B1	Built-in Thermal Printer	Each
LMUS-B102-S1	PC software (for 1000/1200)	Each
LMUS-B102-S2	PC Software (for 1600/1700/1800/1900/N/K/X/T)	Each
LMUS-B102-C1	21 CFR software	Each

15. Replacement

15.1 Tungsten lamp replacement

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

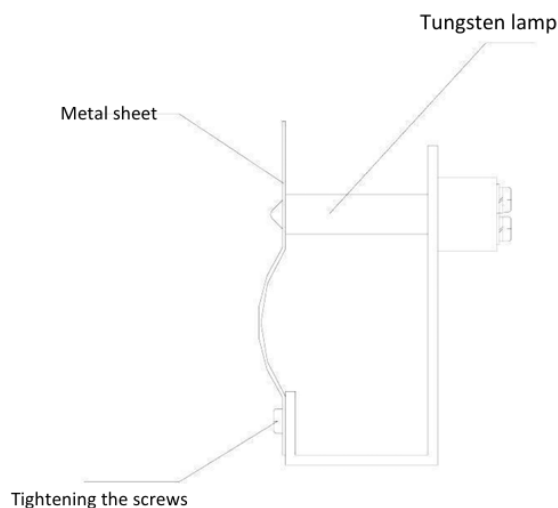


Figure-37

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

15.2 Deuterium lamp replacement

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

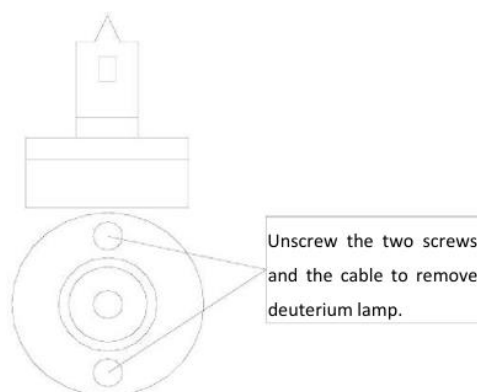


Figure-38

- 4) Turn on the instrument, make the deuterium lamp light, and convert the light source switching mirror to the vertical position manually.
- 5) Loosen the screws fixed lens holder, and fine-tune the focus lens holder into the slot on the smallest and deuterium light centered.
- 6) Convert the light source switching mirror to a horizontal position manually.
- 7) Loosen the screws seat switch motors, and seat motors to move the focus to switch into the slit in the smallest and tungsten lights centered.
- 8) Replace the lamp compartment cover (be careful not to press the right side of the line) and the instrument housing (do not press the display line), 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 the user no longer displays low energy lamp replacement is completed, if there is low energy, repeat the above steps.



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