

# INSTRUCTION MANUAL

UV2500

UV-Vis Spectrophotometer



**UV2500—UV-Vis Spectrophotometer**

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Vision: 01

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## **PREFACE**

Thank you very much for your purchase of UV2500 double beam UV-Vis spectrophotometer.

The UV2500 is intended for the purpose of photometric analysis, do not use it for any other purpose.

The UV2500 is designed for use by persons having a basic knowledge of chemical analysis. Remember that improper use of this instrument, chemicals or samples would result not only in wrong analytical data but in consequences adverse to safety.

Before using this instrument, be sure to read through this instruction manual to enable correct use.

Keep this manual handy for easy reference when necessary.

Information contained in this manual is subject to change without notice for product improvement.

## **ABOUT THIS MANUAL**

UV2500 double beam UV-Vis spectrophotometer: Host-operable; It is also controlled by computer with the optional UV Analyst software.

Before using this instrument, be sure to read through this instruction manual. Especially, the operation method of this instrument and "Safety Precautions" should be read carefully. Because these contents relate to the safety of human and this instrument.

## **Precautions on Electromagnetic Wave Interference**

### **(1) Possible Electromagnetic Wave Interference Caused by This Instrument**

When this instrument is used in a residential area or an adjacent area thereto, it may cause interference.

When this instrument is used in a residential area or an adjacent area thereto, it may cause interference to radio and television reception.

To prevent this, use the specified system connection cables in strict accordance with the instruction manual. The instrument is designed to minimize possible electromagnetic wave interference caused by it if the specified cables are connected properly. However, there is no guarantee that electromagnetic wave interference will not be caused by the instrument. If the instrument does cause interference to radio or television reception, which can be determined by turning off and on the instrument, the user is encouraged to try to correct the interference by one or more of the following measures:

- Increase separation between the instrument and radio/TV receiver.
- Connect the instrument to an outlet on a circuit different from that to which the radio/TV receiver is connected.

### **(2) Possible Electromagnetic Wave Interference Affecting This Instrument**

If this instrument is used near an intense electromagnetic source, interference noise may be given to the instrument to incur an adverse effect on its performance or functionality.

To prevent this, use the specified system connection cables in strict accordance with the instruction manual. The instrument is designed to minimize possible electromagnetic wave interference affecting it if the specified cables are connected properly.

However, there is no guarantee that electromagnetic wave interference will not occur in this instrument. If the instrument does incur electromagnetic wave interference, which can be determined by turning on and off possible sources of electromagnetic wave interference nearby, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient the instrument.
- Increase separation between the instrument and possible sources of electromagnetic wave interference.
- Increase separation between the power cable of the instrument and possible sources of electromagnetic wave interference.

- Connect the instrument to an outlet on a circuit different from that to which possible sources of electromagnetic wave interference are connected.
- Confirm that any other device connected with the instrument is not affected by electromagnetic wave interference.

## **Warranty on Product**

The UV2500 double beam UV-Vis Spectrophotometer is warranted to operate according to the specifications given in the instruction manual, provided it is used in accordance with the instructions described in the manual.

### **(1) Scope of Warranty**

(a) Any parts which prove to be defective in design or workmanship during the warranty period will be repaired without charge.

(b) A substitute part may be used for repair, or replacement with an equivalent product may be made instead of repair.

(c) Such system components as a personal computer and printer to be updated frequently for improvement may not be available in original versions at the time of replacement.

### **(2) Warranty Period**

One year from the date of initial installation.

Consumables such as WI and D2 lamps are excluded from warranty.

### **(3) Exclusions on Warranty**

Note that this warranty is void in the following cases, even if they occur within the warranty period.

(a) Failure due to operation at a place not meeting the installation requirements specified by us.

(b) Failure due to power supply voltage/frequency other than specified by us or due to abnormality in power supply.

(c) Corrosion or deterioration of the tubing due to impurities contained in reagent, gas, air or cooling water supplied by the user.

(d) Corrosion of the electric circuits or deterioration of the optical elements due to

highly corrosive atmospheric gas.

(e) Failure due to use of hardware, software or spare parts other than supplied by us.

(f) Failure due to improper handling or maintenance by the user.

(g) Failure due to maintenance or repair by a service agent not approved or authorized by us.

(h) After disposal of this instrument, or after its resale without our approval.

(i) Failure due to relocation or transport after initial installation.

(j) Failure due to disassembly, modification or relocation not approved by us.

(k) Consumables, and failure of parts that have reached the end of specified useful life.

(l) Failure of parts excluded from the warranty in the instruction manual or other documents.

(m) Failure due to acts of God, including fire, earthquake, storm, lightning, social disturbance, riot, crime, insurrection, war (declared or undeclared), radioactive pollution, contamination with harmful substances, etc.

(n) Failure of the hardware, or damage to the system software, application software, data or hard disk due to computer virus infection.

(o) Failure of the personal computer connected with the instrument, or damage to the system software, application software, data or hard disk due to power interruption or momentary power voltage drop caused by lightning or the like.

(p) Failure of the personal computer connected with the instrument, or damage to the system software, application software, data or hard disk due to disconnection of main power to the personal computer without taking the specified normal shutdown procedure.

#### **(4) Limitations on Warranty**

(a) Any express warranties other than the explicit conditions indicated in (1) are excluded from this warranty.

(b) Any other implied warranties of merchantability and fitness for a particular purpose are not included in this warranty. No liability is assumed for direct or indirect damages arising out of explicit or implied warranties.

(c) Oral or written information or advice given by our dealers, distributors, agents or employees without our express permission shall not create a warranty or in any way increase the scope of this warranty.

### **Technical Service on Installation/Relocation and After sale**

Installation of this instrument shall be carried out by or under supervision of qualified service personnel of Techcomp Corporation or its authorized service agent. Before installation of the instrument, the user shall make preparations for satisfying the installation requirements in accordance with the instruction manual.

If relocation of the instrument becomes necessary after initial installation (delivery), please notify your local sales representative or nearest service office of Techcomp.

### **Technical Training**

For using the instrument safely and correctly, technical training speeches are held at Techcomp's or user's site. Contact Techcomp or distributor for attending procedures.

Technical training speeches are payable, it will charge fee.

### **About Discard**

Because of lithium battery using in the instrument, please distinguish it from common waste and avoid causing environmental pollution. Meanwhile, the relevant laws and regulations may be changed in future, or new laws and regulations may be issued. Therefore, at the time of discarding the instrument, please be sure to confirm it in accordance with relevant laws and regulations, or consult our relevant departments.



## **Other Precautions**

### **(1) Use and Storage of Samples and Reagents**

- (a) The user is responsible for proper use, maintenance and treatment when using the instrument for daily analysis. Moreover, all the samples and reagents used shall be in accordance with the prescribed operation procedures.
- (b) Reagents, standard solutions and accuracy-control samples shall be used, stored and discarded as instructed by the respective suppliers.

### **(2) About this Instruction Manual**

- (a) Information contained in this instruction manual furnished with the instrument is subjected to change without notice for product improvement.
- (b) The copyright of this manual belongs to the technical department of Techcomp.
- (c) No part of this manual may be reproduced or transmitted in any form or by any means without our express written permission.



# In Order To Operate Safely

## Safety Precautions

Before using UV2500 UV-Vis spectrophotometer, please read the following safety instructions carefully and understand them fully.



### General Precautions on Safety

- Following all the operation procedures provided in this instruction manual.
- Installation and maintenance activities of this instrument are limited to the service personnel trained and qualified by Techcomp.
- Be sure to observe the warnings indicated on the product and in the instruction manual. Failure to do so could result in personal injury or damage to the instrument.
- Among safety precautions, there will be (Danger), (Warning), (Attention), and other prominent prompt words, attention signs and phrases as the followings.



**Danger:** Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.  
(There is no such sign in this instrument.)



**Warning:** Indicates a potentially hazardous situation which, if not avoided, can result in death or serious injury.



**Attention:** This sign reminds users the potential danger causing slight injuries or major damages of the instrument.



: This attention sign usually comes with phrases; it often records the notices of operating the instrument safely and accurately; it has fairly clear purposes.

In addition, there are also “Notices” warning words shown as followings that are indirectly related to human safety.

- △ Notice: It refers to those signs that are indirectly related to human safety, and only used to prevent and avoid instrument from damages.
- ◇ Note: It is a supplementary sign with the purpose of accurately operating the instrument and testing samples.



## **In Order To Operate Safely**

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### **General Precautions on Safety (Continued)**

- Because of danger, please make sure not to modify or alter the product, make sure not to use unspecified parts, and make sure not to operate the equipment by removing/defeating the safety device(s).
  
- Installation, maintenance and relocation of this instrument shall be carried out by or under supervisions of qualified service personnel of Techcomp or its authorized service agent.
  
- Please do not perform any other operations that are not included in the manual. If any problem occurs with the equipment, please contact the agent from whom you purchased it or the service department of Techcomp.
  
- When using chemicals, please make sure to ventilate the room well. If there is not enough ventilation, it may be hazardous to your health.
  
- Although we have carefully considered the instructions written on the products and manuals, it is possible for an unexpected event to occur. When operating the equipment, aside from following the instructions, be very cautious.



# In Order To Operate Safely

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This instruction manual contains the following important safety notices:



## **Danger**

No such signs in this instrument.



## **Warning**

### **Electric shock accident caused by high voltage (500V)**

- D2 lamp works with up to 500V working power supply, which may cause electric shock accidents. Before replacing D2 lamp, make sure that the instrument's power switch is off and the instrument's power cord has been unplugged.

### **Electric shock accident caused by power voltage (100, 500V)**

- UV2500 runs with a power supply voltage of 100V~240V, which may cause electric shock accidents. Make sure that the power switch of UV2500 is off before connecting its power cord.



## **Attention**

### **Burn caused by high temperature**

- D2 and WI lamps may cause burns due to the high temperature when they are lit. When replacing the lamps, please turn off the power switch of UV2500, unplug the power cord of UV2500, and then wait for the lamp to cool down fully to avoid burns.

### **Fatigue due to prolonged work**

- Viewing the display screen and operating the instrument or dealing with data at the meantime can cause eye and physical fatigue if you continue to work in the same posture for extended periods. When operating or dealing with data for a prolonged period, for your health, make sure to take a break for 10 to 15 minutes every hour in order to rest your eyes and body.

### **Indoor ventilation**

- If using UV detection system in a small room for a long time, it may cause the concentration of indoor nitrogen to increase and the concentration of indoor oxygen to decrease, or produce a small amount of ozone, which will affect human health. In this case, please install exhaust fans or open the windows frequently to keep the room well ventilated.



## **In Order To Operate Safely**

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### **Safety Precautions On UV2500 UV-Vis Spectrophotometer**

#### **About working power**

- (a) The voltage for UV2500 UV-Vis spectrophotometer must be AC100V or AC220V (50Hz or 60Hz), and the power is over 1KVA. If the power supply is fluctuated or there is interference on the power supply line, which will not only affect the normal operation of the instrument, but also may cause accidents.
- (b) When connecting and installing the power cord, the grounding wire must be installed at the same time, and make sure that the ground wire is well grounded. If UV2500 grounding is not good, not only reduce the ability of resisting external interference, and also the host will also produce floating voltage, which may cause the risk of electric shock.
- (c) Inside UV2500, a high voltage circuit is used. In order to avoid the risk of electric shock, please do not open the lid except the one allowed to be opened during operation (the cover of the sample chamber).

#### **About fire**

Avoid smoking and using a fire in the vicinity of the instrument.

#### **About warning signs on the instrument**

There are warning signs related to high voltage and high temperature attached on the UV2500 UV-Vis spectrophotometer host. Pay more attention to them during operating the instrument to avoid causing safety accidents.

#### **About backing up computer data**

If the computer is disturbed or the mis-operation occurs, the data may be lost. Recommend to save the data from the computer hard disk to a CD or floppy disk every once in a while.

To avoid the unusual operation, be sure to set space of more than 100MB in computer hard disk as work area for the related application software.

#### **About computer viruses**

If programs or data has suddenly been destroyed, if an unexpected operation takes place or if an abnormal display appears on the screen, your computer may have been infiltrated by a computer virus. The computer viruses are rogue programs

and software that secretly invade a computer and operate it willfully while destroying memorized data.

Computer viruses can be infected by using programs and software containing viruses, as well as programs, software and electronic documents containing viruses when surfing the internet or communicating with others.

Therefore, please be sure to confirm the programs, software and electronic documents that need to be used. Do not use the programs and software from unknown sources to avoid computer virus infection.

In some cases, antivirus software can be used to remove the virus, but some viruses may not be eliminated by antivirus software. In this case, it may be necessary to reinstall the operation system or repair the computer hardware. Please prepare the antivirus software and deal with the computer virus by yourself.



## **In Order To Operate Safely**

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### **About turning off computer power**

If turning off the computer together with the instrument which is still running, it may do a damage to the computer, or operation system, application software and data may be destroyed, or the data can't be saved.

Before turning off the computer, please exit the application software of the instrument, and then shut down the computer according to the correct steps in the operation system.

### **About sudden power failure of computer**

Sudden power failure or momentary voltage drop due to the power grid voltage fault, power outages and lightning, which may do a damage to the computer or operation system, application software and data.

To avoid such problems, it is recommended to use a device to prevent sudden power failure of AC power source.



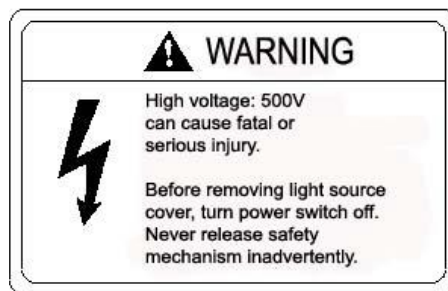
# In Order To Operate Safely

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## Warning Labels

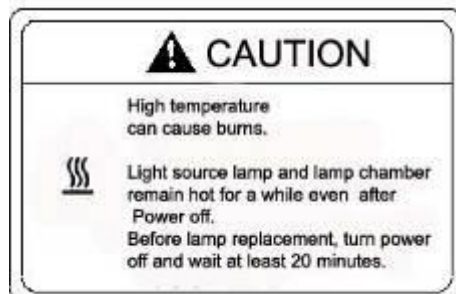
The warning labels shown below are attached to UV2500 UV-Vis spectrophotometer, please pay attention to them.

### (1) Dangerous voltage (500V、220V)



The warning label above is attached to the cover of the lamp source compartment and power supply socket.

### (2) Attention to high temperature



The warning label above is attached to the cover of the lamp source compartment.

# Chapter 1 Installation

## 1.1 Unpacking

UV2500 double beam UV-visible spectrophotometer is a precision instrument, as shown in Figure 1-1. Therefore, do not put the packing cases horizontally or upside down, or carry, move or stack them carelessly.

After opening the packing case, put UV2500 onto work table with great care. Avoid serious shock to packing case when unpacking it. Moreover, the weight of UV2500 UV-visible spectrophotometer is about 30kg. Care should be taken when moving it.



Figure 1-1 UV2500 double beam UV-visible spectrophotometer

**Note:** To avoid shock during transportation, sponge has been used for fixing viewfinder in UV2500. Before powering on the spectrophotometer, first open cover of light source chamber and take out the sponge. Otherwise, it may have influence on spectrophotometer initialization check and normal use.

## 1.2 Installation Conditions

Before installing UV2500, please confirm the following installation conditions.

### 1.2.1 Work Power Supply

The requirements for UV2500 work power supply are as follows.



- 1) Voltage: AC100V, 115V, 220V,230V or 240V, fluctuation within  $\pm 10\%$  is allowed.
- 2) Frequency: 50Hz or 60Hz, fluctuation within  $\pm 4\%$  is allowed.
- 3) Power: more than 200VA is required. If other devices share the same power supply, it needs more than 500VA.
- 4) Grounding wire: Grounding is good and grounding wire should be installed in accordance with relevant regulations.

### **1.2.2 Installation Site**

The requirements of UV2500 for work table are as follows:

- 1) Work table for UV2500 should be horizontal and reliable, withstanding weight of more than 35kg, with a width of more than 550mm, a depth of more than 750mm.
- 2) If other auxiliary devices will be put on the work table as well, the area required should be more.
- 3) Leave space of more than 200mm at both sides of the spectrophotometer. Avoid spectrophotometer touching to the wall directly.
- 4) The height of UV2500 is about 230mm. For easy operation, select suitable height of work table.

## **1.3 Installation Environment**

Work environment of spectrophotometer will have great influence on spectrophotometer performance and life time. Before installing UV2500, confirm the following environment conditions of installation site.

### **1.3.1 Environment Temperature**

Allowed environment temperature range: 5~35°C. However, it is suggested to install air conditioner and set room temperature at about 20~25°C for instrument under stable work status.

### **1.3.2 Environment Humidity**

Allowed environment humidity range: 45%~85%. It is suggested to install dehumidifying device and control the humidity in room within 30%~70% for instrument under stable work status.

### **1.3.3 Storage Temperature**

Allowed temperature range for storage: -20~60°C。

### **1.3.4 Indoor Environment**

- 1) Free from acid gas or alkaline gas and other gases which may corrode metals significantly.
- 2) Free from gases which may dissolve paint such as from organic solvents (especially benzene gas, etc).

### **1.3.5 Samples and Reagents**

1) Sample solvent and Corrosive material of samples, reagents and acid-base solutions should not to be put near spectrophotometer. When using them, be careful to avoid drop or spill onto the cover or inside sample chamber.

2) If organic solvent has been dropped or spilled onto the cover or inside sample chamber, please cleans it by soft cloth or paper at once.

3) If acid or alkali solution has been spilled inside sample chamber, please take apart the chamber to wash and clean.

### **1.3.6 Other Precautions**

1) The place where the spectrophotometer is to be installed shall have sufficient space for the user to operate it conveniently.

2) Avoid direct sunlight or installation by a window if at all possible, otherwise optical performance might deteriorate or the spectrophotometer surface might become discolored.

3) Vibrations or shocks strong enough to be felt by the human body must not be transmitted to the instrument, otherwise the fine adjustment mechanism might malfunction.

4) Avoid installation near heat generating apparatuses such as a gas burner, electric heater or oven in order to prevent the spectrophotometer cover being heated beyond 70°C. Open flame is not allowed in the place where the spectrophotometer is installed.

5) Avoid installation near instruments which generate a strong electric field.  
(such as high capacity transformer, large machinery and microwave oven etc.)

6) Avoid a dusty environment, otherwise optical performance might deteriorate.

7) The power voltage must be stable and free from a rapid fluctuation, otherwise the spectrophotometer noise might increase.

8) Do not frequently turn on and off electric instruments (stirrer, vibrator, etc) which are connected to the same power line as the UV2500.

Note: The optical system is very precise. In addition, the control unit incorporates high-density electronic circuit components. Therefore, the above cautions should be strictly observed.

## Chapter 2 Function

### 2.1 Work Principle

UV2500 double beam UV-visible Spectrophotometer is used for spectral analysis of sample by spectrophotometry in UV-visible region. The theoretical basis of spectrophotometry is Lambert-Beer's law:

$$A=KLC$$

In the formula, A (Or in terms of Abs) is the absorbance of the measured substance to monochromatic light. K is the absorption coefficient of the measured substance; L is the thickness of measured substance; C is the concentration of measured substance. From the above formula, it can be concluded that A is proportional to C.

In actual test, the monochromatic light passes through the sample to photoelectric conversion device such as photocell, and the photoelectric conversion devices convert the light energy signal into photocurrent, as shown in Figure 2-1. Therefore, the absorbance value A can be expressed by the strength of photocurrent. It is assumed that the photocurrent that has not passed through the sample to be tested is  $I_0$ , and photocurrent through sample to be tested is  $I_t$ . So the ratio of the two is transmittance  $\tau$  (Or in terms of T%):

$$\tau=I_t/I_0 \times 100\%$$

It is found from Lambert-Beer's law that the negative logarithm of transmittance is proportional to the concentration of measured substance:

$$A = -\lg \tau = -\lg (I_t/I_0) = KLC$$

K value is related to the wavelength of incident monochromatic light and the characteristics of the measured substance. That is to say, different substances have different absorbance values under different monochromatic light wavelength. This feature is the theoretical basis for the qualitative and quantitative analysis of substances by spectrophotometry.

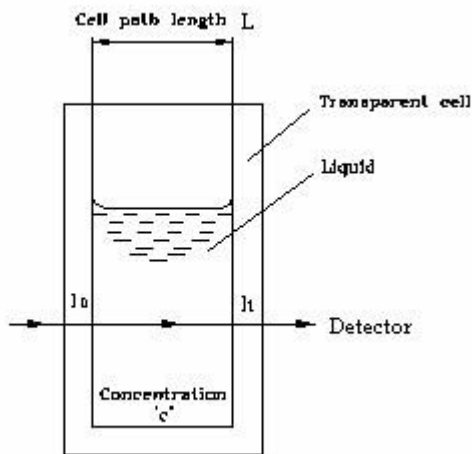


Figure 2-1 Sketch diagram of spectrophotometry work principle

## 2.2 Optical Path System

The double beam optical path system of UV2500 is shown in Figure 2-2.

The Polychromatic light from light source lamp (WI, D2) is reflected through the light source mirror (Light Source Mirror in Figure 2-2), and then enters the optical splitting system through the slit of entering light, and is dispersed into monochromatic light by concave Grating (Grating in Figure 2-2) in the optical splitting system.

The monochromatic light from the optical splitting system enters the beam splitting system after passing through the slit of exiting light and the color filter system. In beam splitting system, the monochromatic light is divided into measuring beam and reference beam by semi-transparent mirror (M4, Half Mirror in Figure 2-2) after collimating through the collimator Mirror (M3, Troidal Mirror in Figure 2-2).

The monochromatic light from the beam splitting system enters the beam splitting system after passing through the exit slit and the color filter system. In beam splitting system, monochromatic light is divided into measuring beam and reference beam by semi-transparent mirror (M4, Half Mirror in Figure 2-2) after collimating through the collimating Mirror (M3, Troidal Mirror).

After being reflected by the reflecting Mirror (M6, Mirror in Figure 2-2), the measuring beam passes through the sample cell (Cell in Figure 2-2) and Lens (M6, Lens in Figure 2-2) in the sample chamber, and then enters into the photoelectric converter (Detector in Figure 2-2) composed of photocell and other parts, and is converted into electrical signals.

After being reflected by the reflecting Mirror (M5, Mirror in Figure 2-2), the reference beam passed through the reference cell (Cell in Figure 2-2) and Lens (M7, Lens in Figure 2-2) in the sample chamber, and also enters into the photoelectric converter (Detector in Figure 2-2) composed of photocell and other parts, and is converted into electrical signals.

The light from the same light source pass through the reference sample and the measured sample respectively, and then reach the receiving system through the slit at the same time, after the comparison of the circuit, the required measurement data are obtained. The signal of the reference beam is used for background deduction. By using this method, the measuring speed and stability

of the instrument are greatly improved. And many measurement methods that cannot be done by single beam spectrophotometer can be accomplished.

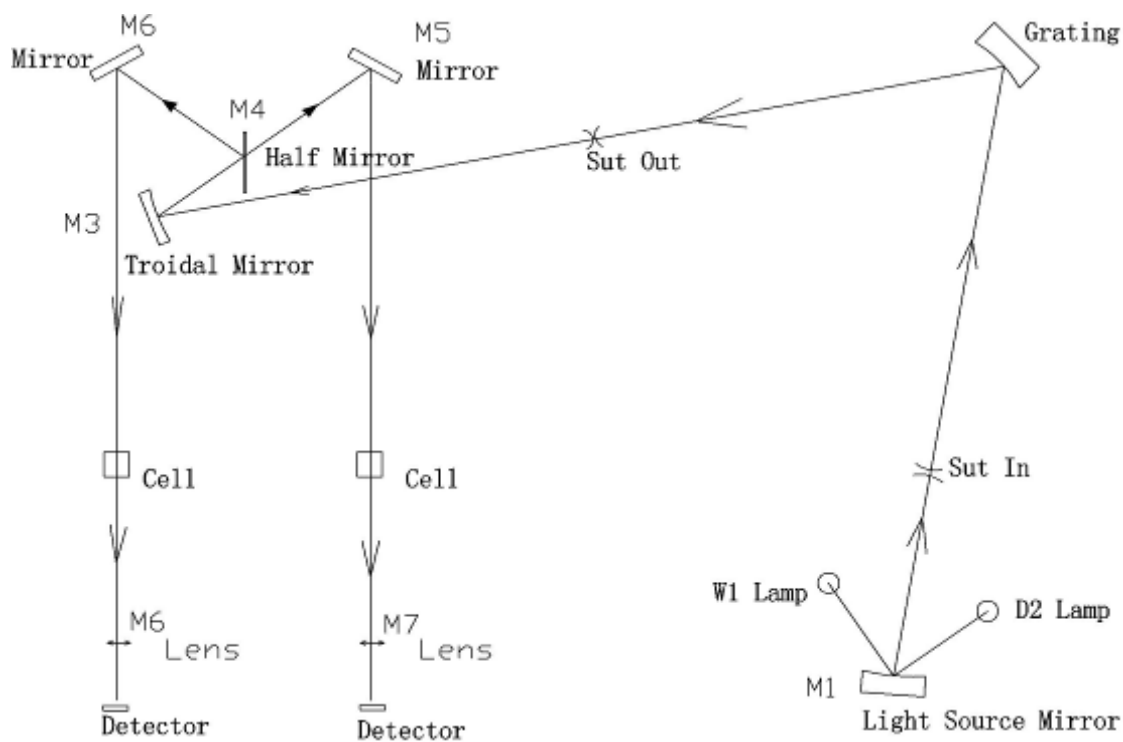


Figure 2-2 Sketch diagram of the optical path system of UV2500

## 2.3 Circuit System

UV2500 circuit system can be seen in Figure 2-3.

The system can be controlled by instrument operation panel or by external PC via data communication line (control software is optional).

Light signal is converted into electricity signal by photoelectric converter (Detector in Figure 2-3), then will be amplified by pre-amplifier (AMP in Figure 2-3). Then it will be processed by microcomputer control section (Main Control Board in Figure 2-3) and finally in the form of absorbance value and other forms are displayed on the operation screen.

The microcomputer control section (Main Control Board in figure 2-3), deuterium Lamp (D2 Lamp in figure 2-3) and tungsten Lamp (W1 Lamp in figure 2-3) is controlled or provided by the power board of the lamp (Lamp Power Board in figure 2-3).

The results can be displayed on the instrument operation panel or printed on a printer.

USB B is the communication interface that can be connected with external PC, ACC is the control signal interface of the optional accessories of UV2500, and RS232 is the Printer interface. DC24V is the power supply interface of the optional accessories, and it also contains the SD card slot.

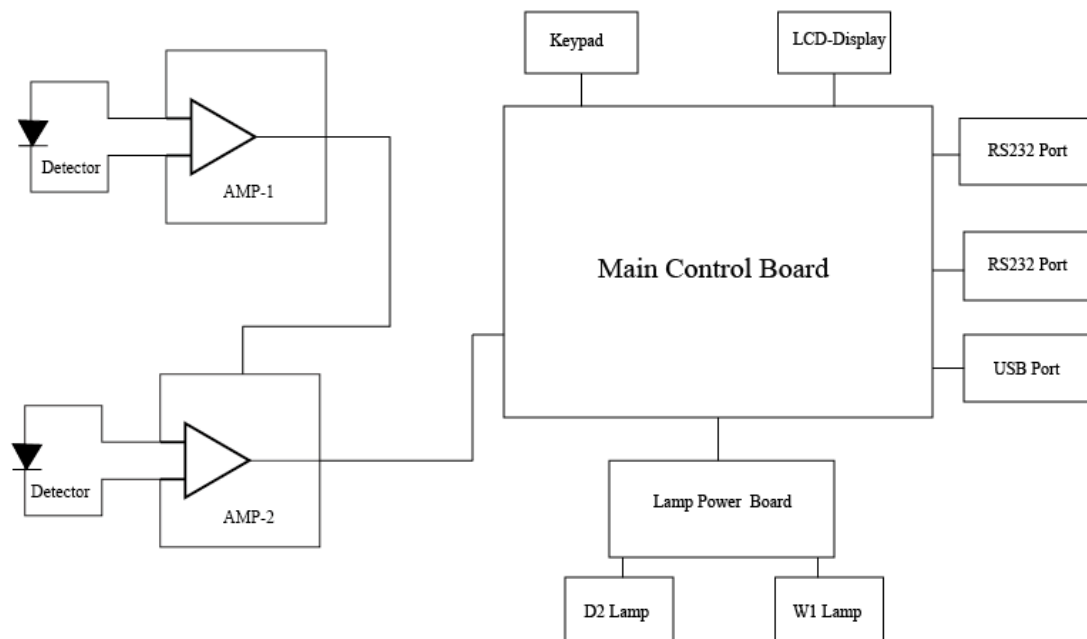


Figure 2-3 Sketch diagram of UV2500 circuit system

## 2.4 Function Mode

Function mode of UV2500 can be seen in Figure 2-4.

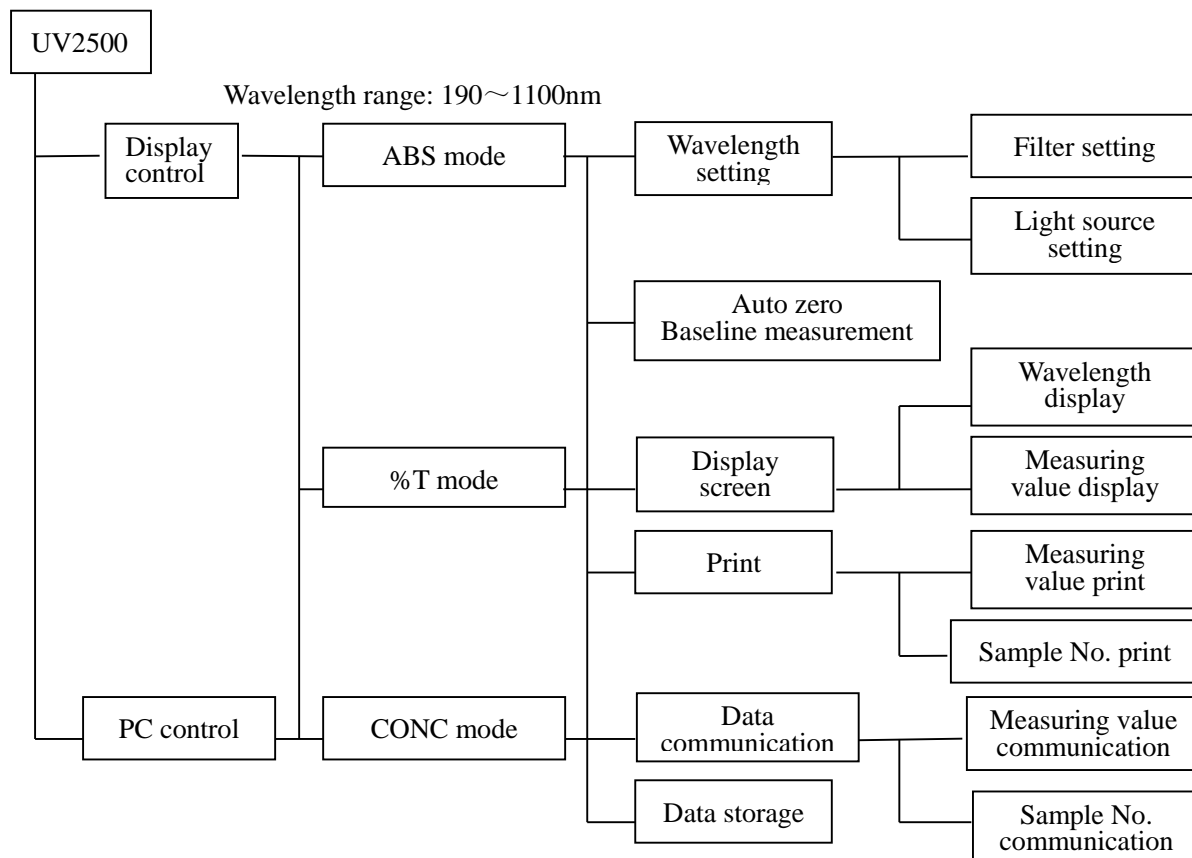


Figure 2-4 Sketch diagram of UV2500 function mode

## 2.5 Sample Chamber

Sample chamber of UV2500 can be seen in Figure 2-5. (Standard cuvette holder configuration)

UV2500 can configure options such as standard cuvette holder, micro cuvette holder, glass sheet test holder, long path rectangle cuvette holder, film cuvette holder, auto sampler, cylinder holder, flow cell holder, thermostatic 6-port positioner, thermostatic cuvette holder, thermostatic auto sampler etc. All these options are installed inside sample chamber and can be replaced easily. As for installation and use of options, refer to option instruction manual.



Figure 2-5 UV2500 double beam UV-visible spectrophotometer sample chamber

## 2.6 Specifications

Specifications of UV2500 can be seen as follows:

Wavelength range	190~1100nm
Wavelength setting	0.1nm increment
Wavelength accuracy	≤±0.3nm
Wavelength repeatability	≤0.2nm
Test mode	Abs, %T, Conc
Photometric range	Abs: -2.000~3.000 %T: 0~300%T Conc: 0.000~9999
Transmittance accuracy	±0.3%T (NIST930 standard filter) ±0.5%T (Potassium dichromate) Equivalently ±0.002Abs (0~0.5Abs) ±0.004Abs (0.5~1Abs) ±0.008Abs (1~2Abs)
Transmittance repeatability	0.1%T (NIST930 standard filter) ±0.2%T (Potassium dichromate) Equivalently 0.001Abs (0~0.5Abs) 0.002Abs (0.5~1Abs) 0.004Abs (1~2Abs)
Baseline flatness	±0.002Abs (200~1090nm)
Noise	≤0.07%T (at 500nm)
Baseline stability	≤0.0003Abs/h (at 500nm, 2 hours after power on)
Spectrum bandwidth	≤(1.5nm±0.3nm)
Stray light	≤0.05 %T (at 220nm NaI, at 340nm NaNO <sub>2</sub> )
Wavelength scan speed	10 nm/min, 100 nm/min, 200 nm/min, 400 nm/min, 800nm/min, 1200 nm/min, 2400 nm/min, 3600nm/min (excluding switch time of filter and light source lamp)
Wavelength slew speed	6000 nm/min
Light source	W1 lamp, D2 lamp
Switch point of light source	Auto (325nm~370nm can be set)
Detector	Silicon photocell
Display mode	Capacitive display
Printer	Thermal serial dot matrix printer: WH-M02
Meteringmode	Double beam
Dimension of sample chamber	145 (W) ×380 (D) ×165 (H) mm
Dimension	520 (W) ×630 (D) ×230 (H) mm
Weight	About 30kg
Power supply	100, 115, 220, 230, 240V (50/60Hz)
Power consumed	200VA (100V~240V, 50/60Hz)



## Chapter 3 Operation

### 3.1 Operation

#### 3.1.1 Operational Method

The user interface of the UV2500 is convenient and easy-to-use. Screen prompts help you to select the variables that are required for method set-up and data acquisition.

The UV2500 can be operated by software UV Analyst. So please find its operational procedure in the manual of UV Analyst.(the software is optional part for the UV2500)

#### 3.1.2 Introduction of Operation Interface

The Figure 3-1 below shows the screen touch interface of the UV2500, which designed by operation function to showing.

Function: wavelength scan\time scan \photometry\quantitative\DNA/RNA\OD600\protein testing\GLP/GMP.

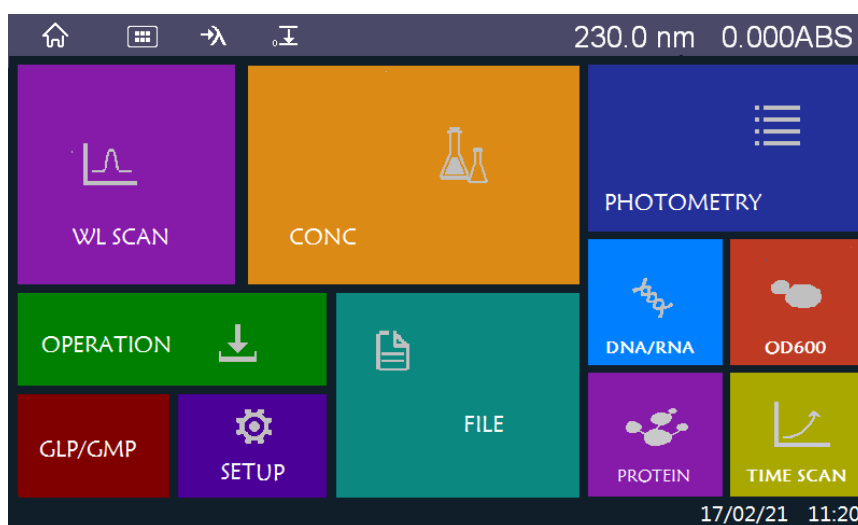


Figure 3-1 Schematic diagram of operation interface of UV2500

### 3.2 Preliminary Operation

#### 3.2.1 Initialization

Upon turning on the power switch, the instrument performs a self-diagnosis and automatic wavelength calibration. Lamp\Filter\656.1nm will be checked, the result will display (OK or NG). The initialization progress will last for about 1minute, then turn to the main interface.

### 3.3 Main Menu

The main menu as below (Figure 3-2):

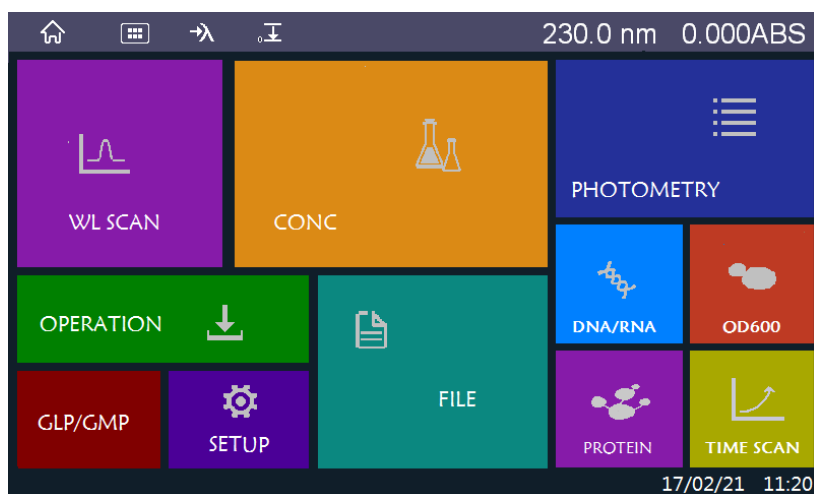



Figure 3-2 Main menu of UV2500

There are four icons for quick action at the upper left corner (main interface\quick measure\wavelength setting\going to zero);

The wavelength and the absorbance at the real-time display in the upper right corner; the time and the date is showing in the lower right corner.

### 3.4 Photometry

Click the icon “” to get photometric value in a real quick action, which only adapt for one setting wavelength, as shown in Figure 3-3.

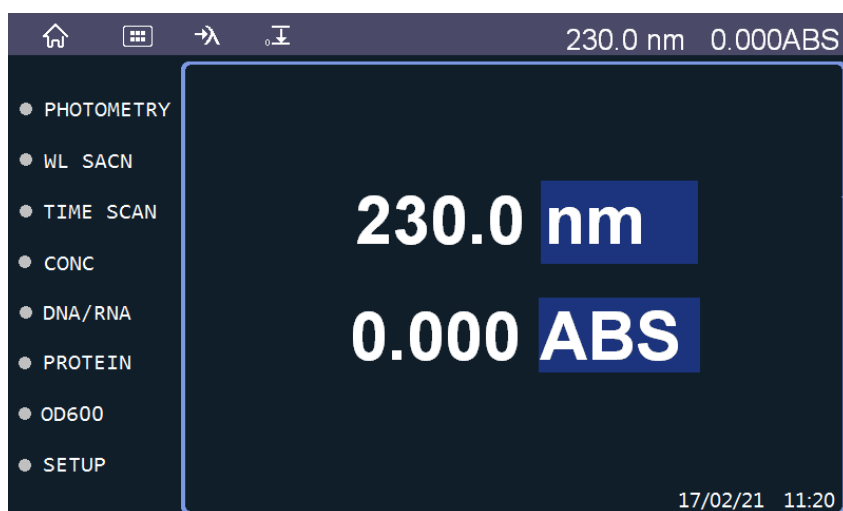


Figure 3-3 Rapid measurement interface

Click the “Photometry” in the main interface to enter photometry mode (could for one

wavelength or multi wavelength), as shown in Figure 3-4.

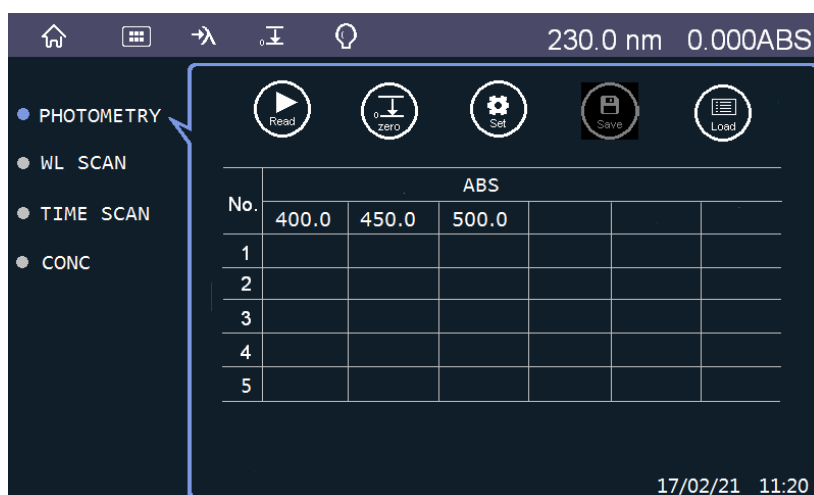


Figure 3-4 Measurement interface of fixed wavelength

### 3.4.1 Photometry in “ABS” or “%T” Mode

1) Click “Setting” in the photometry testing interface to get into parameter setting, as shown in Figure 3-5.

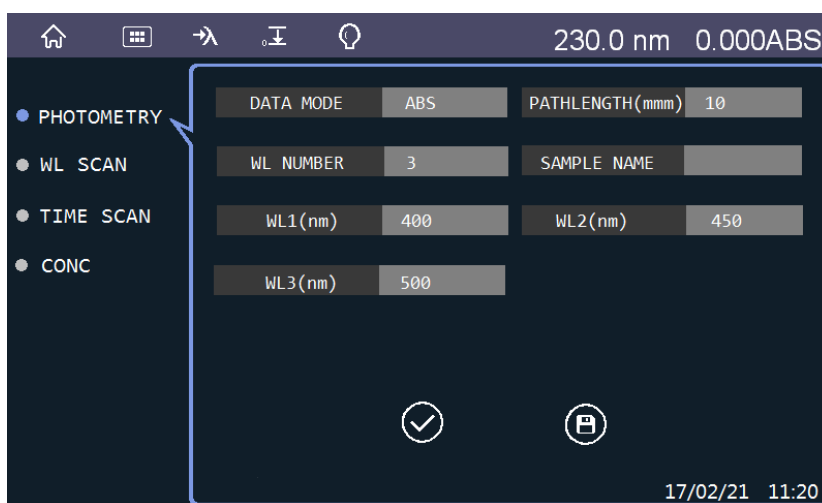




Figure 3-5 Setting interface of fixed wavelength measurement

- DATA MODE: “ABS” (Absorbance measurement)\“%T” (percent transmittance measurement)
- WL NUMBER: 1 to 6;
- WL1~3 (nm): Wavelength range 190~1100nm, increased by 0.1nm;
- PATHLENGTH (mm): 10nm is the suggestion value. Measurement by a cell other than 10 mm rectangular cell, the photometric value can be converted into one measured with a 10 mm rectangular cell;
- SAMPLE NAME: Not more than 8 characters, only for English alphabet and the number;

2) Click “” to confirm the parameter; click “” to save the parameter in the

memory.

- 3) Click “Zero” to realize autozero (zero adjusting), result adjust to 0.000Abs in ABS mode, result adjust to 100%T in %T mode;
- 4) Click “Read” icon to start the testing;
- 5) The testing result will appear in the interface after several seconds.
- 6) The “End” icon is available for executing during the operation as the testing be liked to finish;
- 7) The result of the testing could save or print after it finishing.

The “Load icon is for loading testing method at the beginning, which saved in the unit or SD card.

### 3.4.2 Photometry in “Ratio” Mode

Ratio of 2 wavelengths can be performed. Example of application includes purity determination of DNA and/or RNA by using the difference and ratio of the absorbance at two user-selected wavelengths. Background can be corrected at a specific wavelength if the wavelength number is set at 3.

The photometric values A1 (WL1) and A2 (WL2) at two specified wavelength is calculated based for the following formula.

$$\text{Diff} = A2 - A1 \quad \text{Ratio} = \frac{A2}{A1}$$

The photometric values A1(WL1), A2 (WL2) and A3 (WL3) at three specified wavelengths are calculated base on the following formula.

$$\text{Diff} = K0 * (K2 * (A2 - A3) - K1 * (A1 - A3))$$
$$\text{Ratio} = K0 * \frac{K2 * (A2 - A3)}{K1 * (A1 - A3)}$$

Click “Setting” in the photometry testing interface to get into parameter setting.

- DATA MODE: “Ratio”;
- WL NUMBER: 2 or 3;
- WL1~2: Wavelength range 190~1100nm, increased by 0.1nm;
- PATHLENGTH (mm): 10mm is the suggestion value. Measurement by a cell other than 10 mm rectangular cell, the photometric value can be converted into one measured with a 10 mm rectangular cell;
- SAMPLE NAME: Not more than 8 characters, only for English alphabet and the number;
- K0\K1\K2: The coefficient of the formula, the default value is 1;

Click “” to confirm the parameter; click “” to save the parameter in the memory.

The other operation is the same with 3.3.1.

## 3.5 Wavelength Scan

Wavelength scan is a method to record the value (Absorbance/transmittance) of the sample in a wavelength range.

### 3.5.1 Wavelength Scan Interface

Click “WL Scan” to go to Wavelength scan mode, as shown in Figure 3-6.

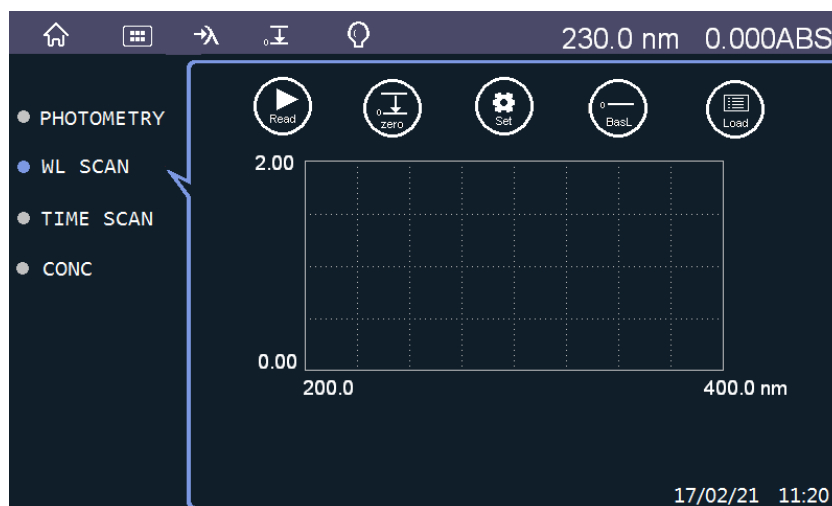


Figure 3-6 Interface of wavelength scan

“Set”: Parameter setting;

“Read”: To start the wavelength scanning;

“Zero”: Execute the auto-zero. Adjust to 0.000Abs in ABS mode, result adjust to 100%T in %T mode;

“Baseline”: Measuring the baseline;

“Load”: Loading the method saved before.

“Save”: Saving the testing result;

“Print”: Send order to printer to print the result directly.

### 3.5.2 Parameter Setting and Measuring

1) Click “Setting” icon to set the parameter, as shown in Figure 3-7.

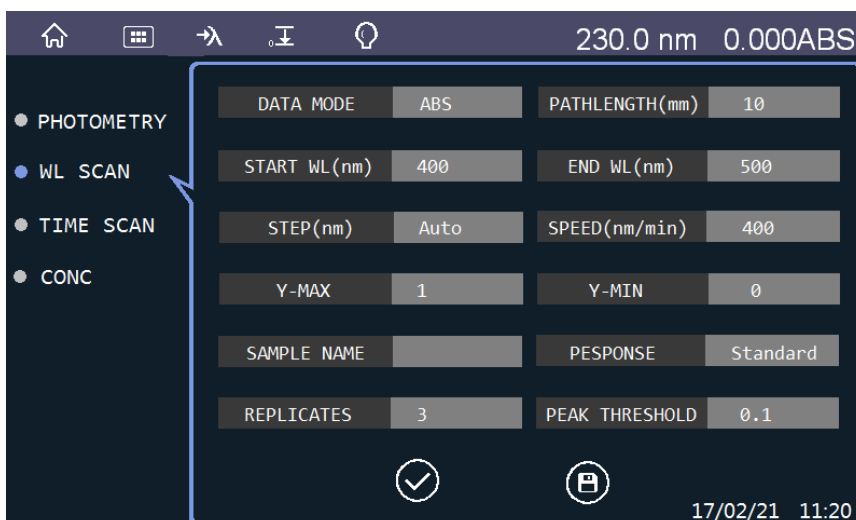


Figure 3-7 Setting interface of wavelength scan parameter

- DATA MODE: %T (percent transmittance measurement)\ABS (absorbance measurement)\E (S) (Energy on the sample path)\E (R) (Energy on the reference path)

**Attention:** the light source could switch from W1 to D2 while wavelength scanning even though the data mode is E(S)\E(R).

- PATHLENGTH (mm): 10mm is the suggestion value. Measurement by a cell other than 10 mm rectangular cell, the photometric value can be converted into one measured with a 10 mm rectangular cell;
- START WL (nm)  
Start Wavelength for wavelength scanning operation. Enter a long wavelength value of the measurement wavelength range.  
This parameter is specifiable within a range of 190 to 1100 nm in increments of 0.1 nm.
- END WL (nm)  
End Wavelength for wavelength scanning operation. Enter a short wavelength value of the measurement wavelength range.  
This parameter is specifiable within a range of 190 to 1100 nm in increments of 0.1 nm.

Note: 1. The minimum scan width is 10 nm.

2. The data read interval varies depending on the wavelength range.

3. The data reading wavelength interval varies depending on the specified wavelength range.

- Y-MAX  
Upper limit on Y-axis.  
The specifiable range for Y-axis upper limit in each Data Mode is as follows:  
ABS: Within a range of -3.000 to 3.000 in increments of 0.001.  
%T: Within a range of 0 to 300.0 in increments of 0.1.
- Y-MIN  
Lower limit on Y-axis.

The specifiable range for Y-axis lower limit in each Data Mode is as follows:

ABS: Within a range of -3.000 to 3.000 in increments of 0.001.


%T: Within a range of 0 to 300.0 in increments of 0.1.

- **SPEED (nm/min)**  
Wavelength scanning speed (10\100\200\400\800\1200\ 2400\3600nm/min)
- **STEP (nm)**  
Wavelength scan sampling interval (Unit: nm) as following List.

Scan range Velocity (nm/min)	(1-100) nm	(100.1-200) nm	(200.1-500) nm	(500.1-910) nm
	3600	5	5	5
2400	5	5	5	5
1200	2	2	2	2
800	1	1	1	1
400	0.5	0.5	0.5	1
200	0.2	0.2	0.5	1
100	0.1	0.2	0.5	1
10	0.1	0.2	0.5	1

- **SAMPLE NAME:** Not more than 8 characters, only for English alphabet and the number;
- **RESPONSE:** There are three response speeds to select: Fast, Medium and Slow. “Medium” is for the ordinary measurement. The “slowly” is suggested as desired to reduce variation. If high-resolution is required, please select “Fast” response.
- **REPLICATES:** Repeat times of the wavelength scanning at the set parameter (1~5).
- **PEAK THRESHOLD:** Threshold function is used to determine the level of signal changes required to be identified as peak or valley. The range of threshold is 0.1 ~ 100.0 %T (E) or 0.001 ~ 1.000 ABS.

### 3.5.3 Sample Measuring

- 1) Click “

28




Figure 3-8 Data processing interface of wavelength scan

- 5) The “End” icon is available for executing during the operation as the testing be liked to finish;
- 6) The result of the testing could save or print after it finishing.

### 3.5.4 Secondary Processing



The measured spectrum is stored in internal memory. Several kinds of computational processing can be performed for the stored spectrum. The following explains these secondary-processing operations.

#### 1) Trace

The Trace processing function allows the user to read out values of the on-screen spectrum by moving the red cursor (click the icon “” to active the cursor). The right arrow and the left arrow used to control the red cursor.

#### 2) Zoom

Click “” icon, allowing the spectrum in the right location for analyst.

Click “” and “”, allowing rescale the measured spectrum in different graph axial scales.

3) P-V: Detecting the spectral peaks and valleys, offering the test value;

4) Deriv: Obtaining a derivative spectral graph, displaying 1st through 4th order derivate spectrum.

5) Smooth: Employing a data-smoothing algorithm to smooth the noise. Execute 1st through 9th order smooth spectrum as needed. Selection of this function causes the spectral graph screen to change.

6) Calcula: Making a calculation of the measured spectrum with K by arithmetic (plus\minus\divide\multiply)

7) Area: This function is used to carry out area calculation. Specify the wavelength range for area calculation, and this function will perform integration.

When the spectral wavelength Start wavelength and End wavelength are specified, the



area function calculates the following area values.

8) Reset: Loading the originality spectrum.

## 3.6 Time Scan

Time scan is a method to detect and record the value (Absorbance\transmittance) of the sample at a known wavelength in a time range.

### 3.6.1 Time Scan Interface

Click “TIME SCAN” to enter time scan mode, as shown in Figure 3-9.

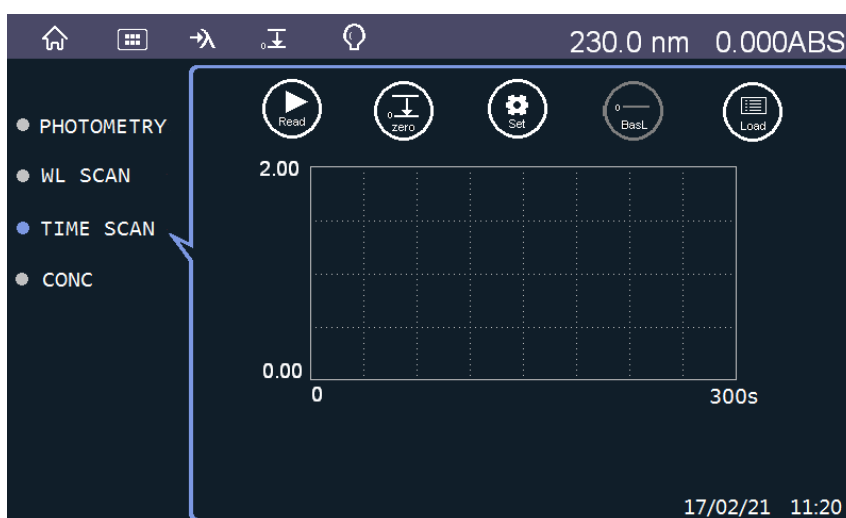


Figure 3-9 Interface of time scan

“Set”: Parameter setting;

“Read”: To start the time scanning;

“Zero”: Execute the auto-zero. Adjust to 0.000Abs in ABS mode, result adjust to 100%T in %T mode;

“Baseline”: Measuring the baseline;

“Load”: Loading the method saved before.

“Save”: Saving the testing result;

“Print”: Send order to printer to print the result directly.

### 3.6.2 Parameter Setting and Measuring

Click “Setting” icon to set the parameter, as shown in Figure 3-10.

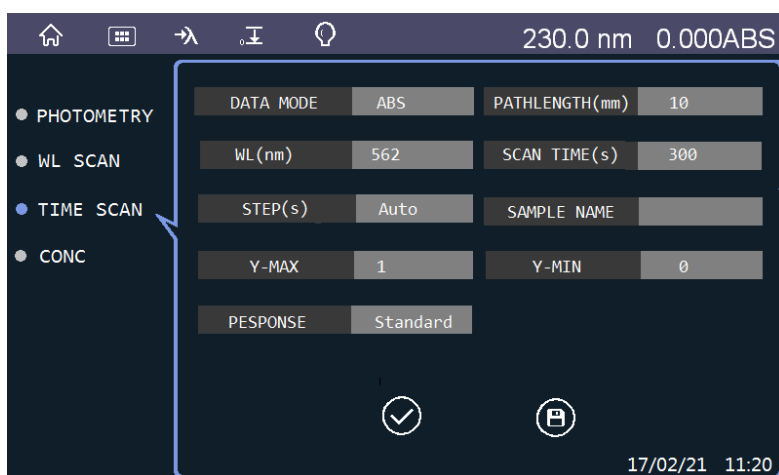


Figure 3-10 Setting interface of time scan parameter

- DATA MODE: %T (percent transmittance measurement)\ABS (absorbance measurement)\E (S) (Energy on the sample path)\E (R) (Energy on the reference path)

**Attention:** the light source could switch from W1 to D2 while wavelength scanning even though the data mode is E(S)\E(R).

- PATHLENGTH(mm): 10mm is the suggestion value. Measurement by a cell other than 10 mm rectangular cell, the photometric value can be converted into one measured with a 10 mm rectangular cell;
- WL(nm): The certain wavelength for time scanning. Range: 190~1100nm, by increment 0.1nm.
- SCAN TIME(S): Specify a scanning time which corresponds to the upper limit value on the abscissa axis of spectral graph. Range of 60 to 99999 seconds in increments of one second.
- STEP(S): Signal response interval which depend on the specified scan time (auto\0.1\0.2\0.5\1\2\5\10\100)

Scan Time (sec)	Reading Interval (sec)
Scan time < 100	0.1
100 ≤ Scan time < 200	0.2
200 ≤ Scan time < 500	0.5
500 ≤ Scan time < 1000	1.0
1000 ≤ Scan time < 2000	2.0
1000 ≤ Scan time < 5000	5.0
5000 ≤ Scan time < 9999	10.0
Scan time ≥ 10000	100.0

- SAMPLE NAME: n\Not more than 8 characters, only for English alphabet and the number;
- Y-Max and Y-Min: The specifiable range for Y-axis upper and lower limit in each Data Mode. Range:-1000~1000;
- RESPONSE: There are three response speeds to select: Fast, Medium and Slow. “Medium” is for the ordinary measurement. The “slowly” is suggested as desired to reduce variation. If

high-resolution is required, please select “Fast” response.

### 3.6.3 Sample Measuring

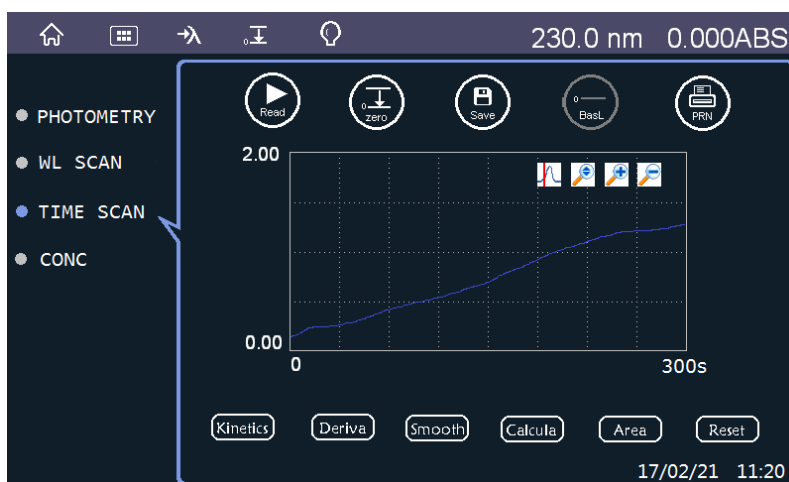


- 1) Click “

Figure 3-11 Data processing interface of time scan

### 3.6.4 Secondary Processing

The measured spectrum is stored in internal memory. Several kinds of computational processing can be performed for the stored spectrum. The following explains these secondary-processing operations.

- 1) Trace

The Trace processing function allows the user to read out values of the on-screen spectrum by moving the red cursor (click the icon “

- 2) Zoom

Click “

Click “

- 3) Kinetics: Making the Kinetic calculation with input the start time, end time and the

factor K.

4) Deriva: Obtaining a derivative spectral graph, displaying 1st through 4th order derivative spectrum.

5) Smooth: Employing a data-smoothing algorithm to smooth the noise. Execute 1st through 9th order smooth spectrum as needed. Selection of this function causes the spectral graph screen to change.

6) Calcula: Making a calculation of the measured spectrum with K by arithmetic (plus\minus\divide\multiply)

7) Area: This function is used to carry out area calculation. Specify the wavelength range for area calculation, and this function will perform integration.

When the spectral wavelength Start wavelength and End wavelength are specified, the area function calculates the following area values.

8) Reset: Loading the originality spectrum.

## 3.7 Concentration

### 3.7.1 Concentration Measuring

Measuring the absorbance value of the sample at a certain wavelength, depending on the known standard curve to get the concentration of the unknown sample.

Click “CONC” in the main interface to go to concentration testing mode, as shown in Figure 3-12.

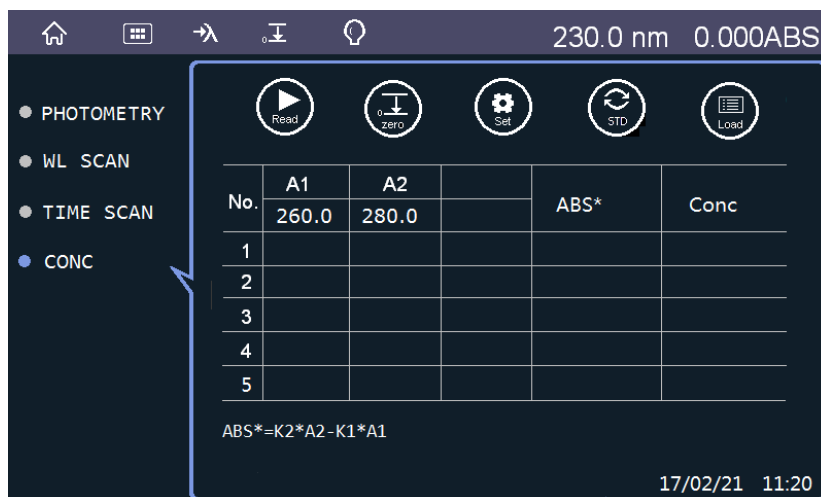


Figure 3-12 Measurement interface of single wavelength

“Set”: Parameter setting;

“Read”: To read the absorbance value at the certain wavelength, showing in the display screen;

“Zero”: Execute the auto-zero. Adjust to 0.000Abs in ABS mode, result adjust to 100%T in %T mode;

“Load”: Loading the method saved before;

“Save”: Saving the testing result;

“Print”: Send order to printer to print the result directly.

### 3.7.2 Parameter Setting and Measuring

1) Click “Setting” icon to set the parameter, as shown in Figure 3-13.

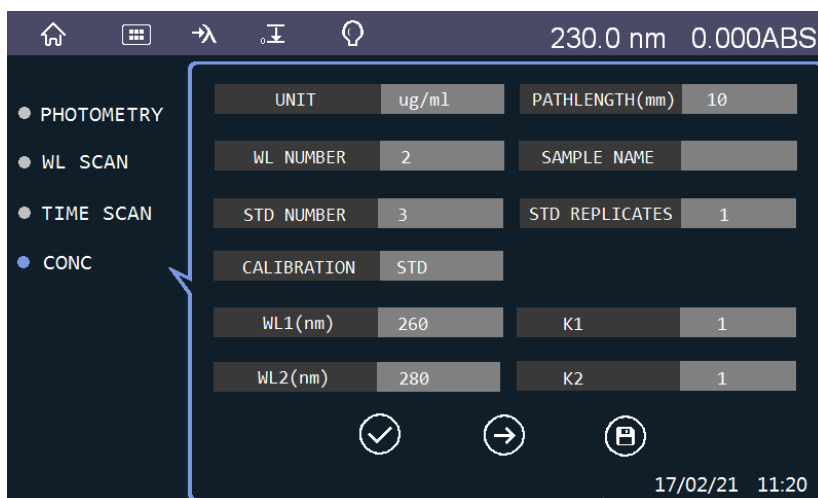



Figure 3-13 Setting interface of measuring concentration at single wavelength

- UNIT: The unit of the standard sample and the unknown sample ( $\mu\text{g/mL}$ ,  $\mu\text{g}/\mu\text{L}$ ,  $\text{ng}/\mu\text{L}$ ,  $\text{mg/mL}$ ,  $\text{pmol}/\mu\text{L}$ ,  $\text{mmol}/\mu\text{L}$ ,  $\mu\text{mol/L}$ ,  $\text{mg/L}$ ,  $\text{mg/dL}$ ,  $\mu\text{g/L}$ ,  $\text{g/L}$ ,  $\text{u/L}$ ,  $\text{ppm}$ ,  $\text{ppb}$ ,  $\%$ ,  $\text{conc}$ )
- PATHLENGTH (mm): 10mm is the suggestion value. Measurement by a cell other than 10mm rectangular cell, the photometric value can be converted into one measured with a 10 mm rectangular cell;
- WL NUMBER: The number of the wavelength used to make the testing.(1~3);
- SAPLE NAME: Not more than 8 characters, only for English alphabet and the number;
- STD NUMBER: The number of standard sample while “STD” selected as the calibration (1~9).
- STD REPLICATES: The repeat times of the standard sample measuring to make sure the result (1~5);
- CALIBRATION: The method to calculate the concentration of the unknown sample (K-factor (need to input the k factor of the formula )or STD)
- WL1~3: The specified wavelength;
- K1~3: The correction factor for the absorbance value.

Click the “” to go to the second page of the parameter setting, as shown in Figure 3-14.

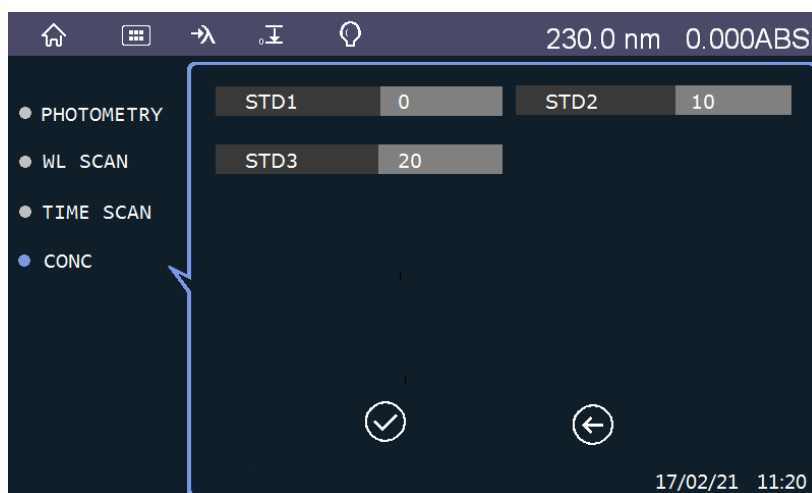



Figure 3-14 Further setting interface of measuring concentration at single wavelength

STD1~3: the concentration of the standards while the “STD” selected as the calibration.

K0/K1: the factor to build the formula, while the “K-factor” selected as the calibration.

### 3.7.3 Sample Measuring

- 1) Type “

## 3.8 Operation

There are several submenus come under the “Operation”: system\operation\time setup \GLP/GMP\Lamp.

Click the submenu in the left side, the setting or the detail information will show in the right side, as shown in Figure 3-15.

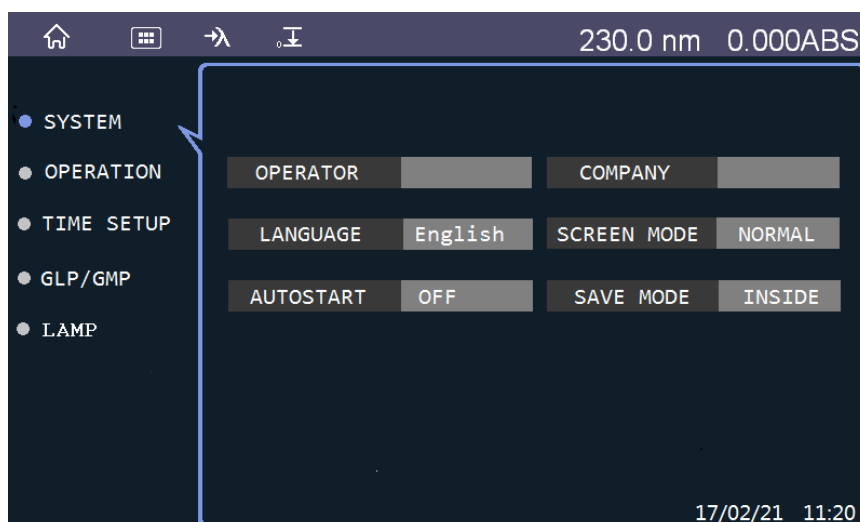


Figure 3-15 Setting interface of system

○ SYSTEM

OPERATOR: Not more than 8 characters, only for English alphabet and the number;

COMPANY: Not more than 8 characters, only for English alphabet and the number;

LANGUAGE: “English” or “Chinese”

SCREEN MODE: “Normal” or “DNA master” ( main interface design difference)

AUTOSTART: Directly turn to the presupposed testing item or “OFF”(the main interface is the default one)

SAVE MODE: “inside” (the unit inside memory) or “SD card” ( the error message will display if the SD card not inside);

○ OPERATION

WAVELENGTH CALIBRATION: Calibration with D2 lamp characteristic peak at the 656.1nm;

DARK CURRENT: Please preheat the instrument for about 30min before execute the “dark current” ( the 0%T calibration);

FACTORY RESET: Reset all the parameter setting;

○ TIME SETUP

Set the time\date\display format about the unit, as shown in Figure 3-16.

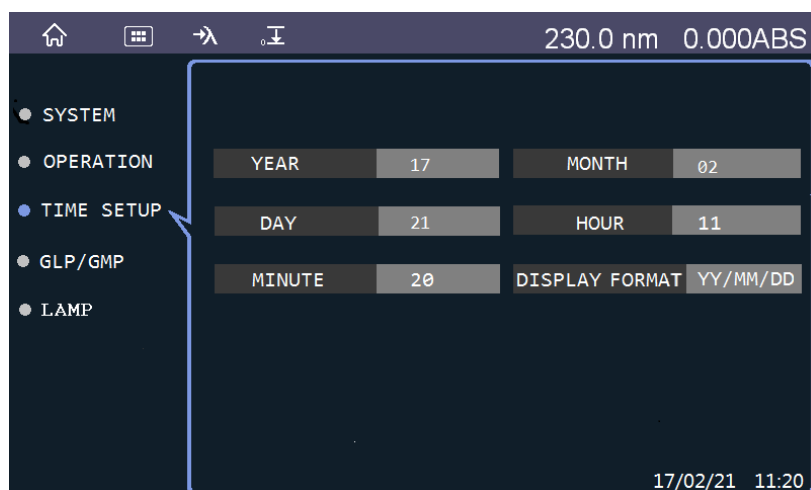


Figure 3-16 Setting interface of time

○ GLP/GMP

The GLP/GMP is the program of the unit self-diagnostic. The testing parameters and judging criteria had been saved in the program, the program will execute automatic-ally as the certain item selected, the result will output after the program completed.

Please make sure there is no sample in the sample chamber and the two light source is lighting.

Check item	Process	Specification
WL Accuracy	Wavelength Scan, Range: 660~650nm, speed: 100nm/min	+/-0.3nm
WL Reproducibility	Wavelength Scan, Range: (660~650nm), 3 times, speed: 100nm/min	+/-0.3nm
Bandpass	Wavelength Scan, Range: 660~650nm, speed:100nm/min	1.5±0.3nm
Noise Level	Time Scan, WL:500.0nm, 5min	≤0.001ABS
Baseline Stability	Time Scan, WL:500.0nm, 3600s	≤0.001ABS
Baseline Flatness	Wavelength Scan, Range:950.0-200.0, Speed:400nm/min,	≤±0.004ABS
Hardware	RAM\ROM	---

- WL Accuracy

Wavelength scanning from 660.0nm to 650.0nm, the unit will record the maximum value of the corresponding peak. If the peak value is within the range of 656.1±0.3nm, the WL Accuracy item will display <OK>.

- WL Reproducibility

Perform wavelength scan from 660.0 to 650.0nm as in the WL Accuracy test in the first stage. The maximum value of wavelength will be located, then the motor moves from 650.0 to 190.0nm, and then from 190.0 to 660.0nm.

In second stage, the scan from 660.0~650.0nm again; find another wavelength position at the same time.

In the third stage, the wavelength scan moves from 650.0~1100.0nm, from 1100.0 ~660.0nm and perform a wavelength scan the third time and mark the third wavelength peak position.

From the three values recorded in the 3 stages, get the maximum wavelength value and the minimum wavelength value, taking the mean of the two values i.e. (max-min)/2. If the result is within 0.3nm, the WL Reproducibility item will display <OK>.

- Bandpass

Perform a wavelength scan from 660.0 to 650.0nm as in WL Accuracy test. From the measured data, identified the maximum value and the minimum value and taking the mean of the absorbance value i.e.  $A/2 = (Max-Min)/2$ , as shown in Figure 3-17. At  $A/2$  Abs value, two wavelength values that are close to  $A/2$  can be identified. The difference between these two wavelengths is the value of bandpass. If the bandpass value is within 1.5nm±0.3nm, the bandpass item will display <OK>.



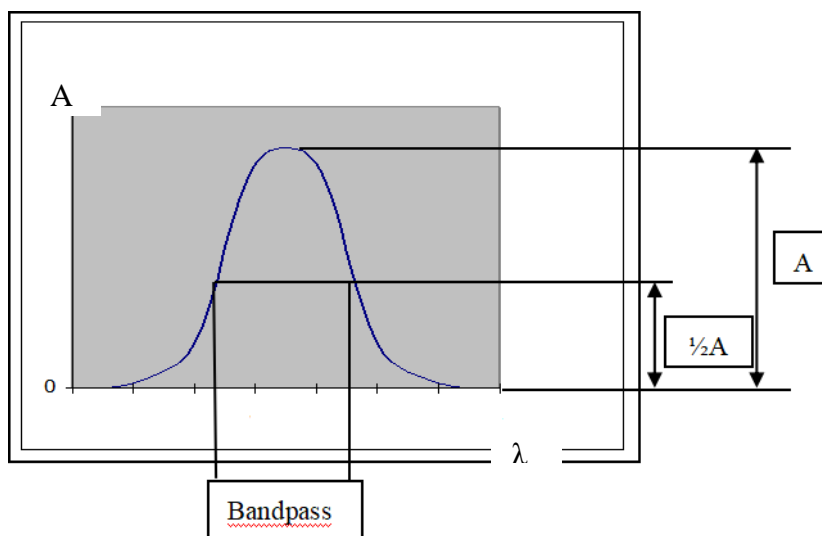


Figure 3-17 Schematic diagram of bandpass

- Noise Level

After the time scan of 300S at 500.0nm, identify the maximum value and the minimum value of the measured data. The noise level value is the difference between the maximum value and the minimum value (peak to peak). If the noise level value is within the range of 0.001ABS, the item will display <OK>.

- Baseline Stability

After the time scans of 3600S at 500.0nm, the peak-to-peak value of the wavelength scan is defined as baseline stability value. If this value is within the range of 0.001ABS, this item will display <OK>.

- Baseline Flatness

Perform a wavelength scan from 950.0nm to 200.0nm twice. The first time the measured data is recorded as the baseline, and the second group of data is defined as absorbance. The maximum value and the minimum value will be identified in this scan. The result (Max-Min)/2 is defined as baseline flatness. If the value is within the range of ( $\pm 0.004$ ABS), the baseline flatness item will display as <OK>.

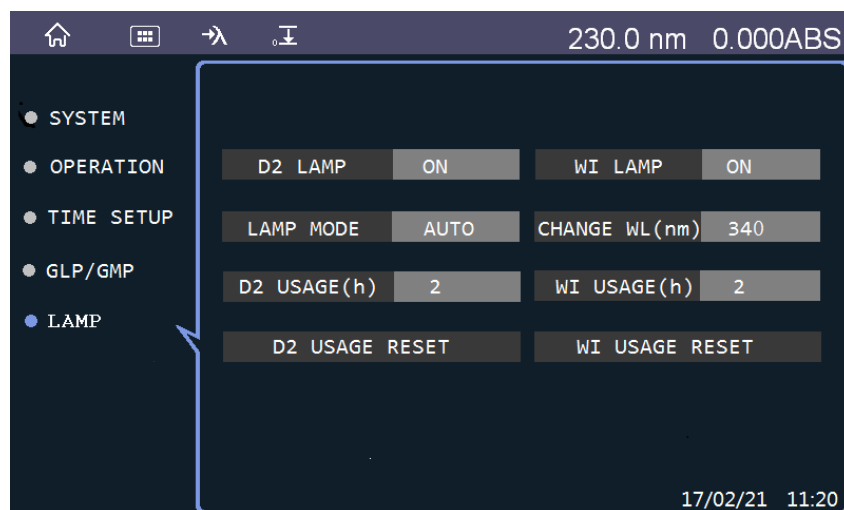


Figure 3-18 Setting interface of lamp

## ○ LAMP

Figure 3-18 shows the detail information of the two light source (the D2 lamp and the WI lamp): the status of the D2 lamp and the WI lamp; lamp mode; change WL; D2 usage (h); WI usage (h); D2 usage reset; WI usage reset.

## 3.9 File

Store file: Spectrophotometer memory and SD card, as shown in Figure 3-19.

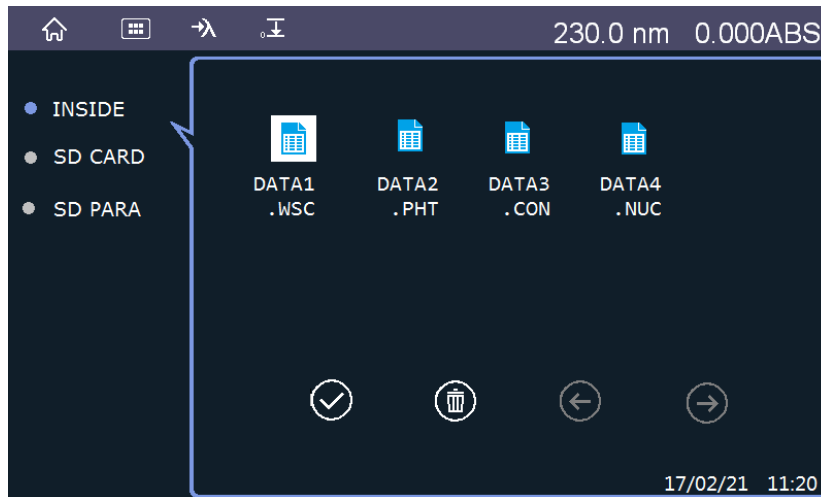


Figure 3-19 Interface of the spectrophotometer memory

1. INSIDE  
Save files in inside memory, up to 10 files can be saved
2. SD CARD  
Save files in SD card (SD card is standard accessory).

The file type of the data file:

- PHO Data file of fixed wavelength direct read
- WSC Data file of wavelength scan
- TSC Data file of time scan
- CON Data file of concentration regression at a fixed wavelength and direct read
- NUC Data file of test related to DNA/RNA
- PTN Data file of test related to protein

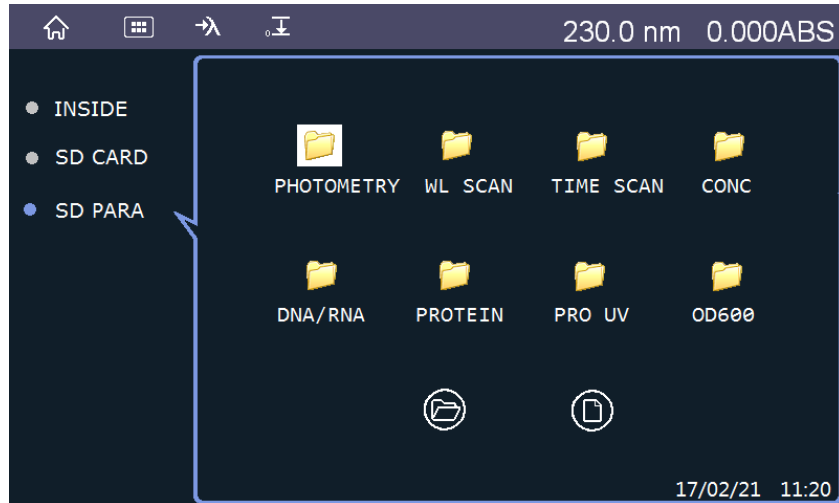


Figure 3-20 Saving interface of SD card parameter

### 3. SD PARA

Create different folders according to different measurement items, which are used to save the measurement method parameters of the samples. We can open, preview and create folders according to the icons at the bottom, as shown in Figure 3-20.

File type of method file:

- PRP Method file of fixed wavelength direct read
- PRW Method file of wavelength scan
- PRT Method file of time scan
- PRC Method file of concentration regression at a fixed wavelength

### 3.10 OD600

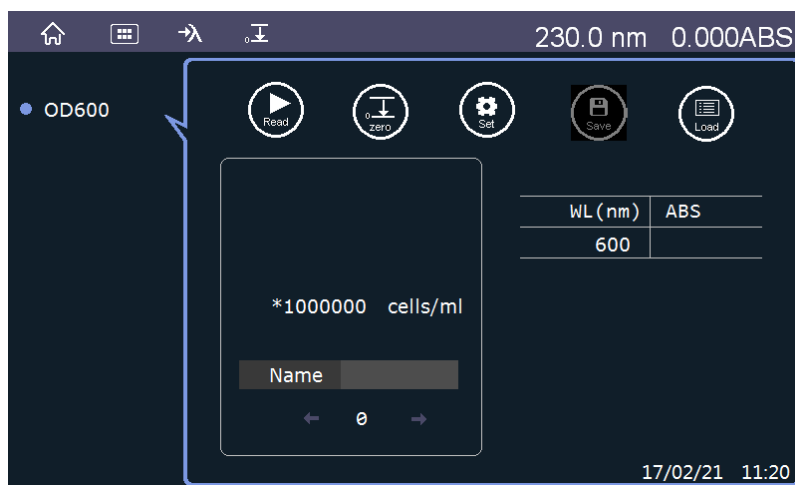


Figure 3-21 Measurement interface of OD600

This interface is used to measure the absorbance of a solution at a wavelength of 600nm, as shown in Figure 3-21.

It is mainly used to measure the concentration of bacterial nutrient solution. The absorbance of bacteria is used to measure the concentration of bacterial nutrient solution, so as to estimate the growth situation of bacteria or cell density of bacteria. For example, if the OD600 value is between 0.6 and 0.8, it indicates that bacteria are in the logarithmic growth stage of vigorous growth.

“Name”: Input sample name;

“0”: Indicates the current sample number; The left and right arrows can review the finished measurement results;

“Read”: Start measuring;

“Zero”: Zero absorbance at 600nm;

“Set”: Parameter setting;

“Save”: Measured data saving;

“Load”: Existing measurement results and measurement methods file loading;

Click “Set” to enter the setting interface, as shown in Figure 3-22:

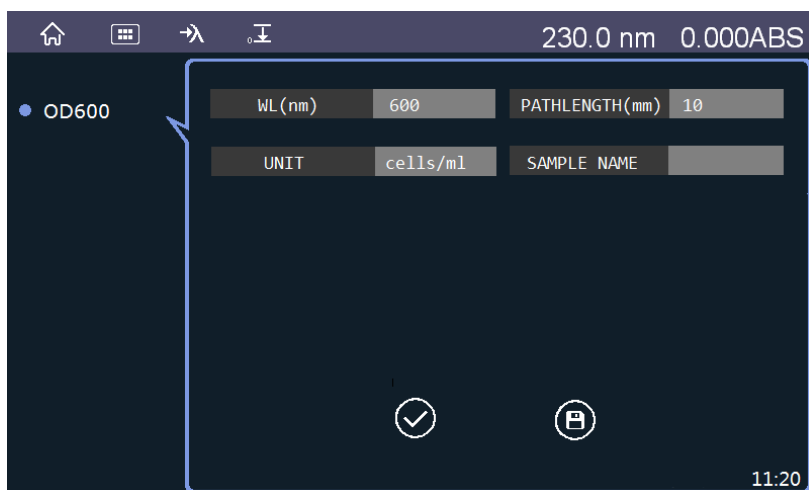


Figure 3-22 Setting interface of OD600 parameter

The optical path length, concentration unit of cell and sample name can be set in this interface.

- **PATHLENGTH (mm):** 0.1, 0.125, 0.2, 0.5, 1, 2, 5, 10 eight options are available;  
In general, set the optical path length of cuvette as 10mm.  
If the optical path length of cuvette is set as other numerical values, the measured data will be automatically converted according to the cuvette with an optical path length of 10mm. For example: if the optical path length of cuvette is set as 5mm, the final measured data displayed by the instrument is 2 times of the actual measured data, and so on.
- **UNIT:** OD、 Cells/mL
- **SAMPLE NAME:** It is used to set the sample name, up to 8 characters can be input. Only English and numbers, common symbols can be displayed.

### 3.11 DNA/RNA

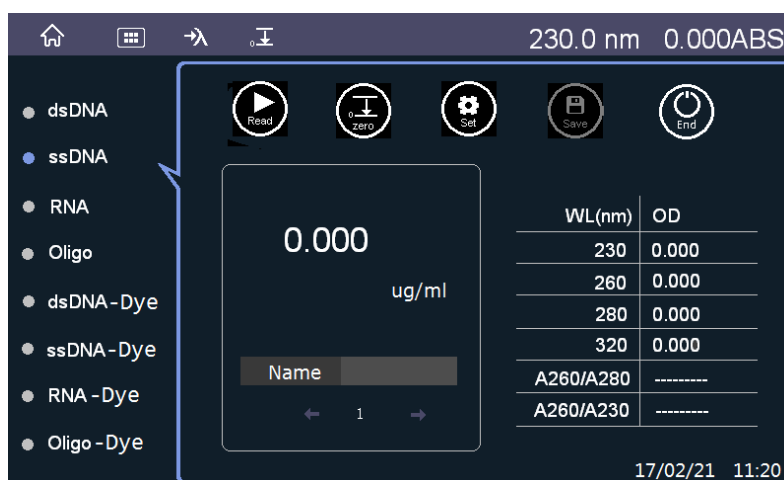


Figure 3-23 Measurement interface of DNA/RNA

Click the icon of DNA/RNA in the main interface to enter the measurement interface of nucleic acid, as shown in Figure 3-23.

Select the corresponding measurement items according to the measurement requirements, the available test items are as follows:

- dsDNA: Double-stranded deoxyribonucleic acid
- ssDNA: Single-stranded deoxyribonucleic acid
- RNA: Ribonucleic acid
- Oligo: Oligosacchride
- dsDNA-Dye: Dyeing double-stranded deoxyribonucleic acid
- ssDNA-Dye: Dyeing single-stranded deoxyribonucleic acid
- RNA-Dye: Dyeing ribonucleic acid
- Oligo-Dye: Dyeing oligosacchride

“Name”: showing the input sample name;

“← 0 →”: Indicates the current sample number; The left and right arrows can review the finished measurement results;

“Read”: Start measuring;

“Zero”: Zero absorbance of the cuvette or the reference sample is carried out before the measurement (Automatically zero absorbance at 230nm/260nm/280nm/ 320nm in sequence);

“Set”: Parameter setting;

“Save”: Measured data saving;

“Load”: Existing measurement results and measurement methods file loading;

“End”: End of the measurement file.

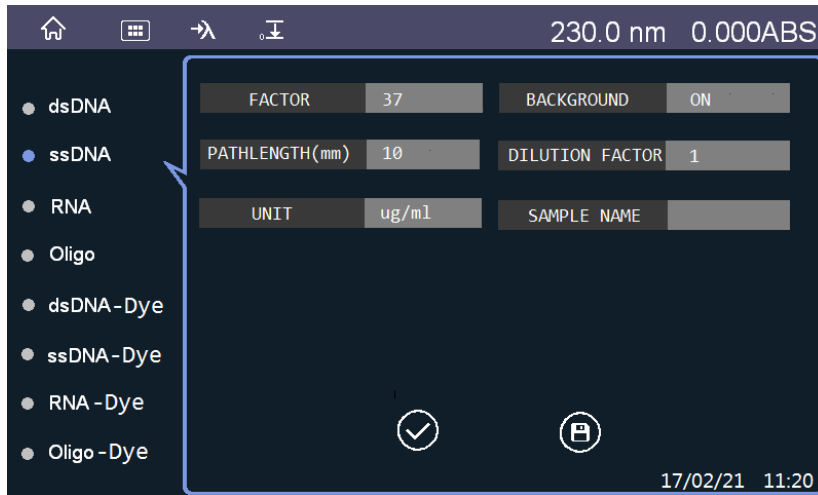


Figure 3-24 Setting interface of DNA/RNA parameter

Click “Set” to enter the setting interface of DNA/RNA parameter, as shown in Figure 3-24.

- Factor: The default value is 50, users can also input by themselves;
- BACKGROUND: Background calibration is performed with the absorbance value at 320nm;
- PATHLENGTH (mm): 0.1, 0.125, 0.2, 0.5, 1, 2, 5, 10 eight options are available;
- DILUTION FACTOR: 1-9999;
- UNIT:  $\mu\text{g}/\text{mL}$ ,  $\mu\text{g}/\text{uL}$ ,  $\text{ng}/\text{uL}$ ,  $\text{mg}/\text{mL}$ ;
- SAMPLE NAME: It is used to set the sample name, up to 8 characters can be input. Only English and numbers, common symbols can be displayed.

After parameter setting, use icon to confirm or save as a method file.

Analyze DNA/RNA after dyeing, the analysis interface is shown in Figure 3-25.

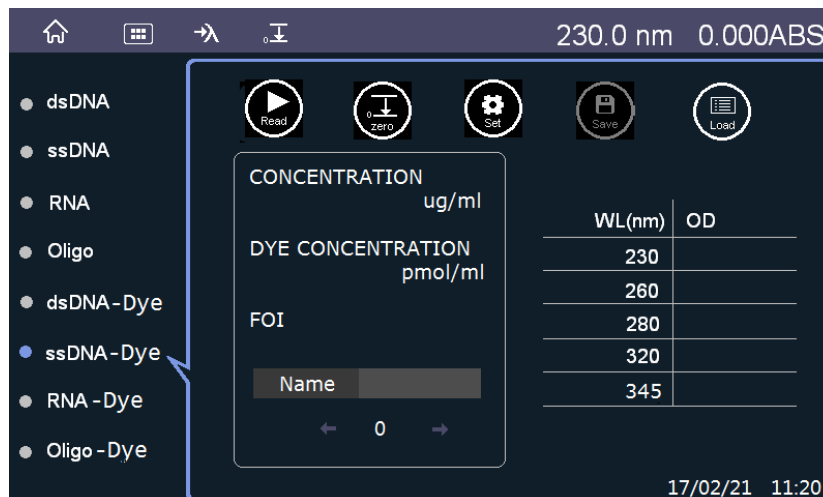


Figure 3-25 Measurement interface of ssDNA-Dye

Click "Set" to enter the setting interface, as shown in Figure 3-26:

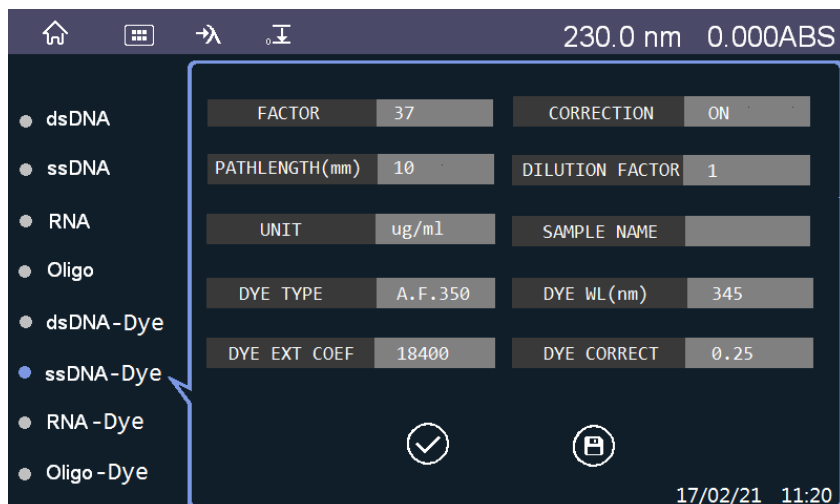


Figure 3-26 Setting interface of ssDNA-Dye parameter

- Factor: The default value is 50, users can also input by themselves;
- Correction: Background calibration is performed with the absorbance value at 320nm if the selection is “ON”;
- PATHLENGTH (mm): 0.1, 0.125, 0.2, 0.5, 1, 2, 5, 10 eight options are available;
- DILUTION FACTOR: 1~9999;
- UNIT:  $\mu\text{g}/\text{mL}$ ,  $\mu\text{g}/\text{uL}$ ,  $\text{ng}/\text{uL}$ ,  $\text{mg}/\text{mL}$ ;
- SAMPLE NAME
- DYE TYPE: A.F. 350, A.F. 488, A.F. 532, A.F. 546, A.F. 555, A.F. 568, A.F. 594, A.F. 647, A.F. 666, A.F. 680, Cy3, Cy3.5, Cy5, Cy5.5, Oyster-500, Oyster-550, Oyster-556, Oyster-645, Oyster-650, Oyster-656, Texas Red, Custom. The Custom represents a user-defined dye. After confirming the dye type, “DYE WL”, “DYE EXT COEF”, “DYE CORRECT” are default values; When the dye is custom, the default value can be customized as needed. Please refer to appendix for detailed dye types and parameters.
- DYE WL (nm): Customize the maximum absorption wavelength of dye;
- DYE EXT COEF: Customize the extinction coefficient of dye;
- DYE CORRECT: Customize the calibration coefficient of dye at 260nm.



### 3.12 Protein

Click the icon of “PROTEIN” in the main interface to enter the measurement interface of protein sample, as shown in Figure 3-27.

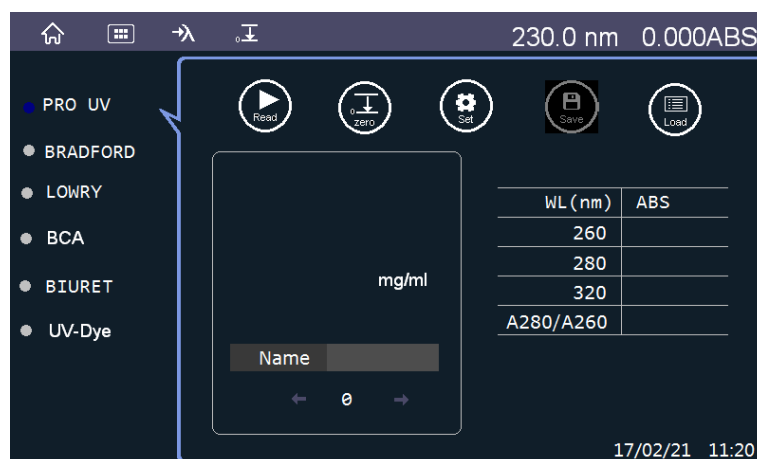


Figure 3-27 Measurement interface of Protein

According to the measurement requirements, the corresponding measurement methods are selected. Different measurement methods, concentration calculation methods and measurement wavelength are also different, the details are as follows:

Measurement methods	Wavelength (nm)
PRO UV	260/280/320
BRADFORD	595
LOWRY	750
BCA	562
BIURET	546
UV-Dye	260/280/320/346

This instruction manual introduces “PRO UV” and “BRADFORD” as examples  
Click “PRO UV” to enter the measurement interface of “PRO UV”.

“Zero”: Zero absorbance (Automatically zero absorbance for 260nm/280nm/ 320nm in sequence)

“Name”: Input sample name;

“← 0 →”: Indicates the current sample number; The left and right arrows can review the finished measurement results;

- “Read”: Start measuring;
- “Zero”: Zero absorbance of the cuvette or the reference sample is carried out before the measurement (Automatically zero absorbance at 230nm/260nm/280nm/ 320nm in sequence);
- “Set”: Parameter setting;
- “Save”: Measured data saving;
- “Load”: Existing measurement results and measurement methods file loading;
- “End”: End of the measurement file.

Click “Set” to enter the setting interface of the parameter, as shown in Figure 3-28:



Figure 3-28 Setting interface of PRO UV parameter

- A280 FACTOR: Shows the default factors of different protein according to the protein type (For example, when BSA is selected, the factor of A280 is 1.45);
- A260 FACTOR: Input the absorbance factor of 260nm according to the protein type;
- PATHLENGTH (mm): 0.1, 0.125, 0.2, 0.5, 1, 2, 5, 10 eight options are available;  
In general, set the optical path length of the cuvette as 10mm.  
If the optical path length of cuvette is set as other numerical values, the measured data will be automatically converted according to the cuvette with a optical path length of 10mm. For example: if the optical path length of cuvette is set as 5mm, the final measured data displayed by the instrument is 2 times of the actual measured data, and so on.
- BACKGROUND: The background deduction is performed with the absorbance value at 320nm.
- PROTEIN: BSA, SerumAl (M), SerumAl (H), LgG (M), Lysozym (C), MolarExtC, ExtCoeff, Exit.
- DILUTION FACTOR: 0.01~9999.99.
- UNIT:  $\mu\text{g}/\text{mL}$ 、 $\mu\text{g}/\mu\text{L}$ 、 $\text{ng}/\mu\text{L}$ 、 $\text{mg}/\text{mL}$ ;
- SAMPLE NAME

Click “Bradford” to enter the measurement interface of “Bradford”, as shown in Figure 3-29.

The protein content is detected by coomassie brilliant blue (CBB) is one kind of the dyeing binding methods. Coomassie brilliant blue is red in the free state and has a maximum absorbance

at 488nm; When it binds to the protein and turns cyan, the protein-pigment binder has a maximum absorbance at 595nm. Its absorbance value is proportional to the protein content, so it can be used for quantitative analysis of protein. The binding of protein and CBB reach equilibrium within about 2 minutes and the reaction will be finished very quickly, and the binding remains stable within 1h at room temperature.

This method can be used for the determination of the protein content in the degree of microgram, and the concentration range of protein is 0~1000 µg/mL, which is a common method for rapid determination of trace protein.

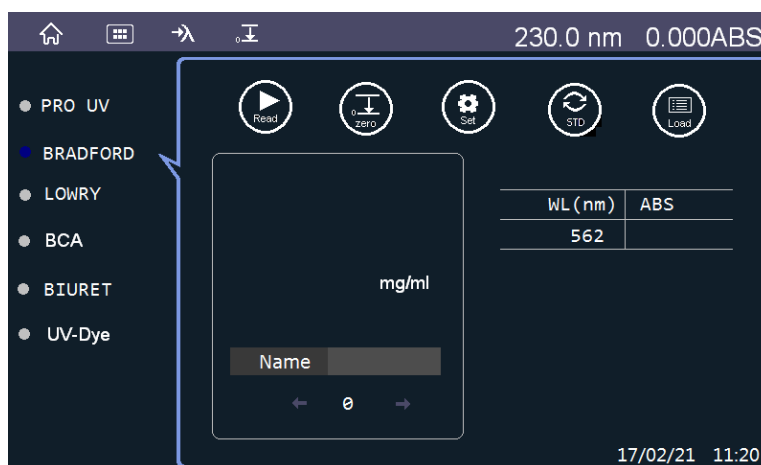


Figure 3-29 Measurement interface of BRADFORD

“Name”: Input sample name;

“0”: Indicates the current sample number; The left and right arrows can review the finished measurement results;

“Read”: Start measuring;

“Zero”: Zero absorbance (Zero absorbance at 562nm);

“Set”: Parameter setting;

“STD” and “SAMP”: Switch measurement interface between standard sample and unknown sample;

“Save”: Measured data saving;

“Del”: Delete the selected data;

“Load”: Existing measurement results and measurement methods file loading;

“End”: End of the measurement file.

Click “Set” to enter the setting interface of parameter, as shown in Figure 3-30:

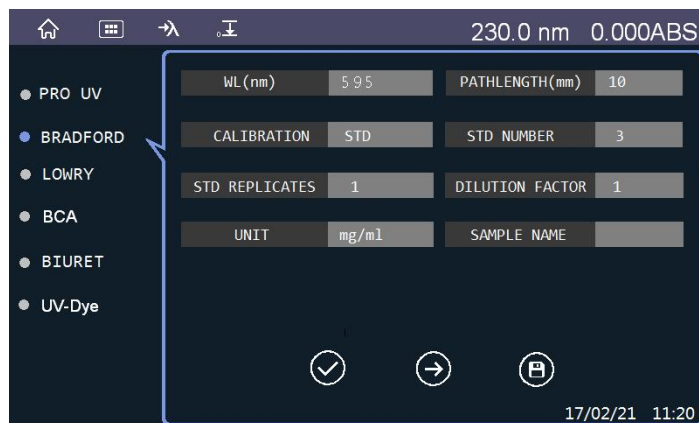


Figure 3-30 Setting interface of BRADFORD parameter

- WL (nm): 595nm is the default value, and all the data will be measured at this wavelength;
- PATHLENGTH (mm): 0.1, 0.125, 0.2, 0.5, 1, 2, 5 and 10mm are available;
- CALIBRATION: STD and K-factor are optional. STD is the measurement method of the standard solution, and K-factor is the input method of K factor;
- STD NUMBER: After selecting the calibration method for measuring standard solution, input the number of standard sample to be measured (range 1-9);
- STD REPLICATES: Repetition times of measurement for standard samples (range 1-5);
- DILUTION FACTOR: Dilution factor of sample, input range: 0.01~9999.99;
- UNIT:  $\mu\text{g}/\text{mL}$ ,  $\mu\text{g}/\mu\text{L}$ ,  $\text{ng}/\mu\text{L}$ ,  $\text{mg}/\text{mL}$ ,  $\text{pmol}/\mu\text{L}$ ,  $\text{mmol}/\mu\text{L}$ ,  $\mu\text{mol}/\text{L}$ ,  $\text{mg}/\text{L}$ ,  $\text{mg}/\text{dL}$ ,  $\mu\text{g}/\text{L}$ ,  $\text{g}/\text{L}$ ,  $\text{U}/\text{L}$ , ppm, ppb, %, conc;
- SAMPLE NAME

According to different calibration methods, different input items appear in the second interface of “Set”. “K-factor” prompts to input the values of K0 and K1; “STD” prompts to input the concentration of standard sample, as shown in Figure 3-31:

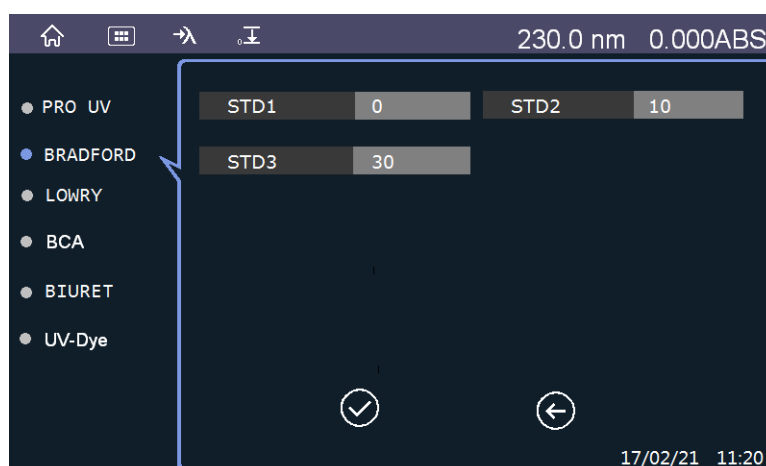


Figure 3-31 Setting interface of Bradford parameter

After setting parameters, click the icon of “√” at the bottom of the interface to save parameters. After parameters are saved, the measurement state is entered.

After “Zero” according to the requirement, the standard sample is measured. After the

measurement is finished, the corresponding first-order equation and correlation coefficient R will appear on the left side of the measurement interface, as shown in Figure 3-32;

Switch to the measurement interface of the unknown sample by click “Samp” to measure the unknown sample.



Figure 3-32 Measurement results interface of Bradford

## Appendix

### 1) Solvent choice

The following factors should be fully considered when selecting the solvents to dilute the sample to be tested:

- Solvent is weak absorption in the range of measured wavelength (the absorbance is small).
- Solvent will not react with the solute (measured sample).
- Solvent is less volatile.

The following table shows the commonly used organic solvents and their wavelength ranges for reference.

Reagents	Wavelength range
Cyclohexane	>200 nm
Ethyl alcohol	>220 nm
Methyl alcohol	>220 nm
Ethyl ether	>220 nm
Dioxane	>220 nm
Hexane	>220 nm
Chloroform	>250 nm
Isopropyl alcohol	>250 nm
Acetic acid	>250 nm
Ethyl acetate	>270 nm
Carbon tetrachloride	>275 nm
Benzene	>280 nm
Methyl ethyl ketone	>335 nm
Acetone	>340 nm
Carbon disulfide	>380 nm

### 2) About special samples

Please note that the various formulas of Lambert/Beal's law may not hold when measuring the following special sample.

- Measured samples that will emit fluorescence.
- Measured samples are very muddy.

In addition, when measuring solid samples such as glass plates, the monochromatic light will have a certain energy loss ( $r$ ) due to the possible reflection on the solid surface. In this case, the formula:

$$I_t/I_0 = t - r$$

Where  $r$  is related to the properties of the measured substance.

### 3) About quantitative calculation

The quantitative calculation mode of UV2500 contains the first order calibration curve type.

Using the least square method to get a regression line from 9 data at most, the calculation formula:

$$A1 = \frac{\sum y_i x_i - \frac{1}{n} \sum y_i \cdot \sum x_i}{\sum y_i^2 - \frac{1}{n} (\sum y_i)^2}, \quad A0 = \frac{\sum x_i}{n} - K1 \cdot \frac{\sum y_i}{n}$$

In the formula:

X = Concentration of each standard sample (input value)

Y = Absorbance of each standard sample (measured value)

n = Standard sample

#### 4) Remeasurement of standard sample

After the calibration curve is finished, if you are not satisfied with it, you can reconfigure the standard samples, and measure the standard samples again to calibrate the calibration curve, as shown in Figure 1.

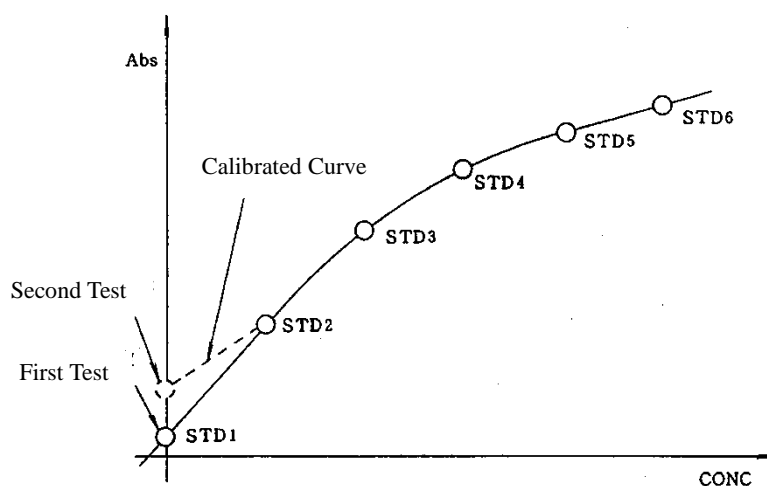


Figure 1 Calibration curve of remeasured standard sample

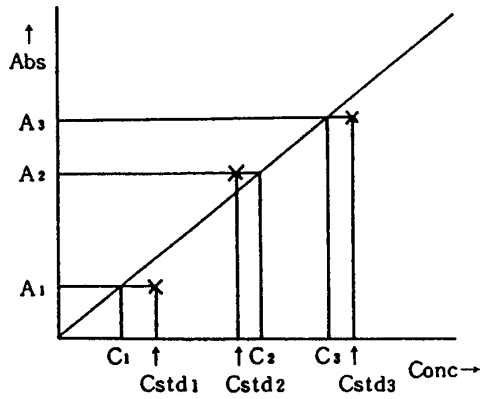
#### 5) Kinetic calculation function

The kinetic calculation function is mainly used for the analysis of reaction rate, which is widely used in clinical trials and biochemical industry by hospitals, pharmaceutical companies and other units.

#### 6) Correlation coefficient of calibration curve

##### (1) Calculation method of correlation coefficient

Correlation coefficient is calculated as follows:



In the above figure:

An: Absorbance of standard sample or its average value

Cn: Concentration of calibration curve corresponding to An

Cstdn: Concentration of standard sample

N: Number of standard sample

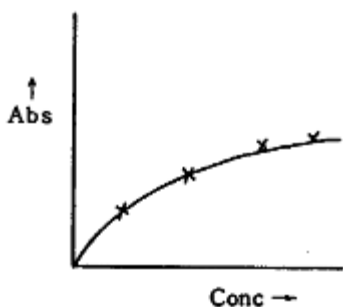
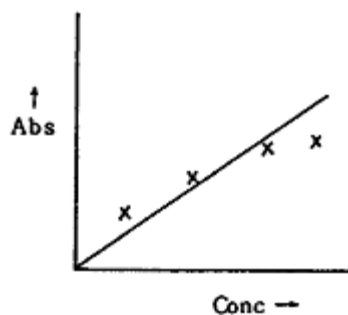
$$\text{Correlation coefficient: } R = \sqrt{\frac{\sum (C_n - \bar{C})^2 - \sum (C_n - C_{stdn})^2}{\sum (C_n - \bar{C})^2}}, \quad R_2 = (R)^2$$

## (2) Application method of correlation coefficient

The correlation coefficient R can show whether the calibration curve made from the standard samples is suitable. The correlation coefficient is closer to 1, the measured value is more suitable to the calibration curve. On the contrary, if the correlation coefficient R is significantly different from 1, it is necessary to remeasure the standard samples or to reselect the type of the calibration curve.

The following is an introduction to the correlation coefficient R when selecting different types of calibration curve:





In the above figure, × is the measurement point of the standard sample.

At the top of the figure is the calibration curve type of selecting the first order, and the correlation coefficient  $R < 1$ .

At the bottom of the figure is the calibration curve type of selecting the second order, and the correlation coefficient  $R < 1$ .

In the example as shown in the above figure, it is obvious that it is more appropriate to select the second order. Through the digital processing of the calibration curve, the previous discrimination work by visual inspection, experience and other methods has become easier.

#### 7) Dye types and corresponding parameters of DNA/RNA

Table 1

DYE TYPE	DYE WL (nm)	DYE EXT COEF	DYE CORRECT
Alexa Fluor 350	345	18400	0.25
Alexa Fluor 488	492	62000	0.30
Alexa Fluor 532	525	82300	0.24
Alexa Fluor 546	555	104000	0.21
Alexa Fluor 555	555	150000	0.04
Alexa Fluor 568	576	93000	0.45
Alexa Fluor 594	588	80400	0.43
Alexa Fluor 647	650	239000	0.00
Alexa Fluor 660	660	107000	0.00
Alexa Fluor 680	680	164000	0.00
Cy3	550	150000	0.08
Cy3.5	581	150000	0.08
Cy5	649	250000	0.05
Cy5.5	675	250000	0.05

Oyster-500	503	78000	0.29
Oyster-550	553	150000	0.05
Oyster-556	560	155000	0.03
Oyster-645	649	220000	0.05
Oyster-650	653	200000	0.04
Oyster-656	660	200000	0.04
Texas Red	593	85000	0.23

## Chapter 4 Maintenance

### 4.1 Daily Maintenance

UV2500 UV-Vis Spectrophotometer has high precision. The purpose of maintenance is to make spectrophotometer work under good status.

#### 4.1.1 Cleaning Sample Chamber

Sample chamber is easy to be contaminated. If sample is spilled inside the chamber, make sure to wash the chamber. The wash procedures are as follows. Reassemble the sample chamber after it is dry. (As shown in Figure 4-1 to Figure 4-4).

- (1) Open cover of sample compartment.
- (2) Unscrew the screw of cuvette holder(one screw).
- (3) Hold front board of sample compartment, and take out cuvette holder  
(Note: there is a located pin).
- (4) Clean and dry cuvette holder and inner of sample chamber.
- (5) Install cuvette holder back to sample chamber and tighten the screw.

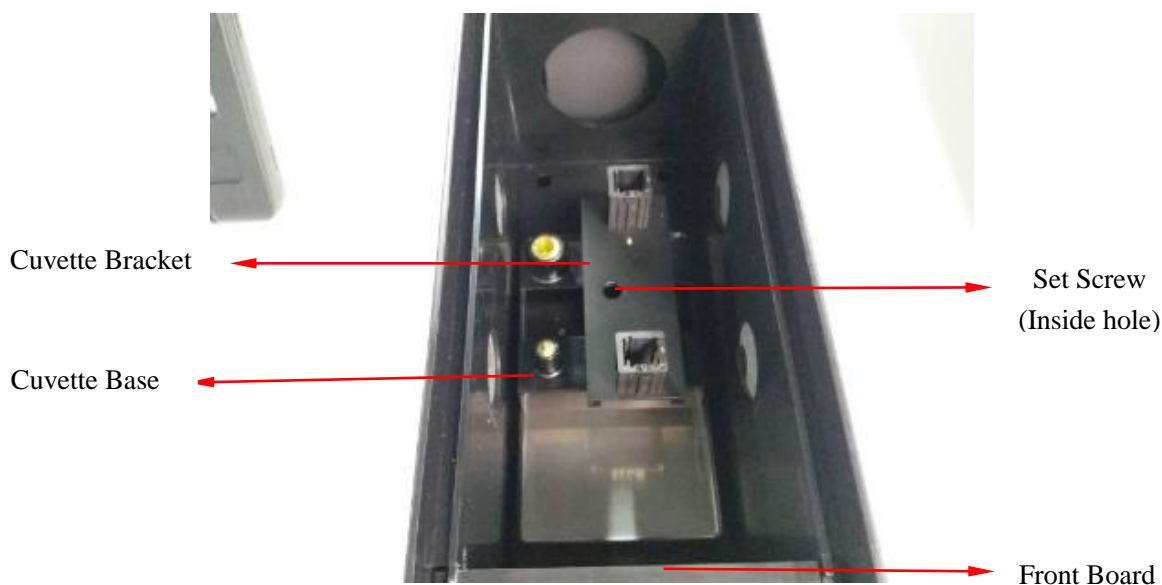


Figure 4-1 Open cover of sample chamber



Figure 4-2 Screw/Unscrew the screw of cuvette holder



Figure 4-3 Remove/mount cuvette holder



Figure 4-4 Sample chamber after removing cuvette holder

#### 4.1.2 Cleaning Spectrophotometer Chamber

Please do not put chemical reagent, sample on UV2500 (Figure 4-5). Otherwise, optical system performance may be influenced. In case chemical reagent, sample has been spilled on the cover, be sure to clean the cover by soft cloth, water and scour and dry the cover.

Please take special care not to spill chemicals or samples on the display screen.



Figure 4-5 UV2500 UV-Vis Spectrophotometer

#### 4.1.3 Cleaning and Storing of Cuvette

After sample test is finished, clean the cuvette by distilled water carefully. And clean inner of cuvette using soft cloth or the plectet.

When storing it, we should put cuvette into a seal container and put dryer inside it as well. Meanwhile, we should put the container in a clean place.

If there is dirt on transmittance face of cuvette, can use mixed solution of alcohol and ether

1:1 and soft cloth to clean the transmittance face of cuvette.

△Note

(1) The cuvette of UV2500 is standard part.

(2) There are two kinds of cuvettes: quartz cuvette can be used in whole wavelength, and glass cuvette can only be used in visible region with wavelength more than 340nm. They have the same appearance, so pay attention to this when purchase the cuvette.

The cuvette and cuvette holder as shown in Figure 4-6.

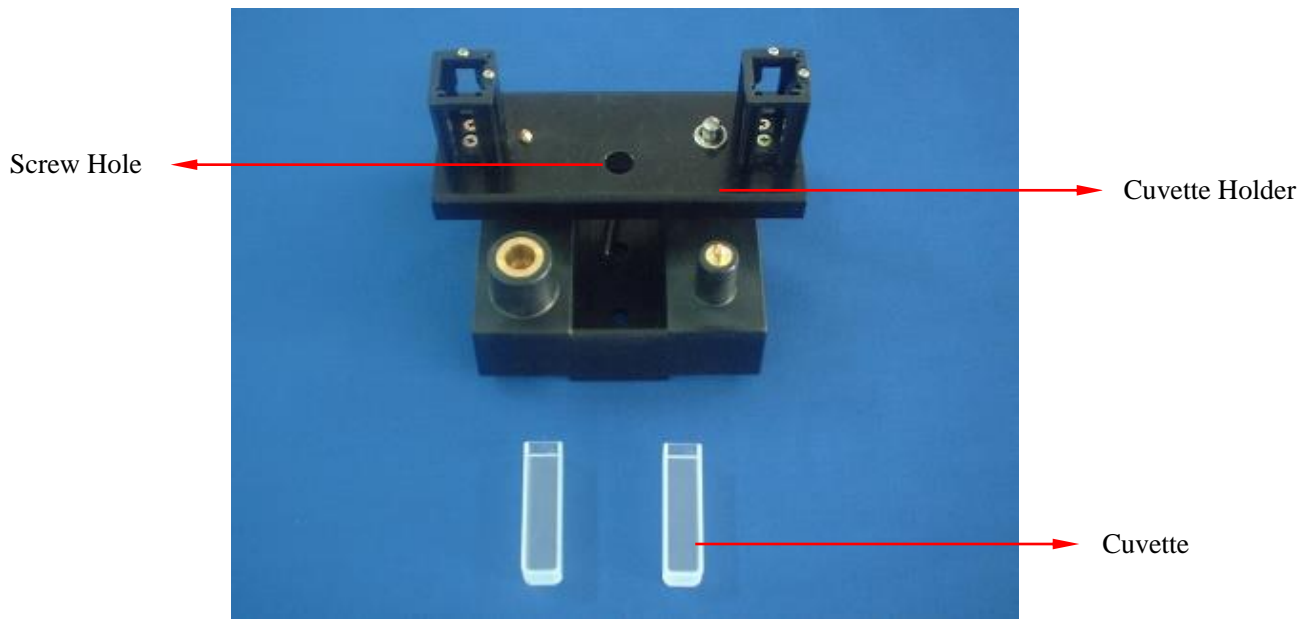


Figure 4-6 Cuvette and cuvette holder

#### 4.1.4 Infusing lubricant

Exclusive lubricant has been infused on each movable part of spectrophotometer in factory. If movable part is found abnormal after the spectrophotometer has been used for a long time, please contact our service department.

#### 4.1.5 Cleaning Quartz Plate of Protective Window and Lens of Sample Chamber

If quartz plate of protective window and lens of sample chamber has been contaminated (on either side of sample chamber), clean them according to the following procedures after washing your hands.

(1) First confirm spectrophotometer has been turned off. And power cord of instrument has been pulled out.

(2) Open cover of sample chamber and take out cuvette holder.

(3) Clean quartz plate of protective window and lens using mixed solution of alcohol and ether 1:1 and soft cloth. And then dry them.

(4) Install cuvette holder back to the previous position.

△Note

(1) When cleaning lens, only need to clean the face towards sample chamber, for the other face is sealed and need not to be cleaned.

- (2) Try not to remove lens or lens assembly to avoid optical path deviation.
- (3) When cleaning quartz plate of protective window, only need to clean the face towards sample chamber, for the other face is sealed and need not to be cleaned.
- (4) Quartz plate of protective window or lens must be removed for clean, shown as Figure 4-7.
- (5) During clean and removal process, do not leave fingerprint on quartz plate of protective window or lens.

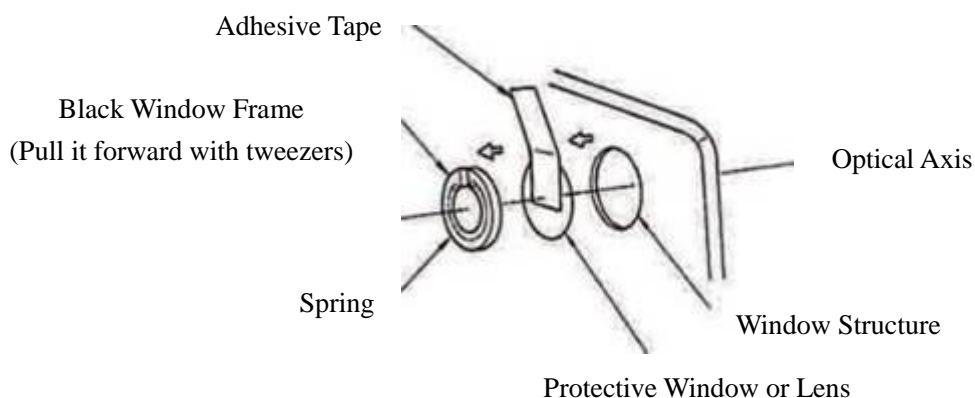


Figure 4-7 Schematic diagram of removing/mounting quartz plate of protective window or lens of sample chamber

## 4.2 Performance Confirmation

After powering on the spectrophotometer, wait for 30 minutes for stability. Then performance confirmation can be done. This spectrophotometer has the automatic test function of GLP/GMP. For details, please refer to the introduction of <GLP/GMP> (system performance confirmation) in section 3.8.

The items and contents of automatic test function are shown in the following table:

Items	Contents
(1) Wavelength Accuracy	Test peak value of D2 lamp feature spectrum and get the error comparing with 656.1nm. Specification: $\leq \pm 0.3\text{nm}$
(2) Spectral Bandwidth	The spectral bandwidth value can be calculated by applying the test results of wavelength accuracy. Specification: $1.5 \pm 0.3\text{nm}$
(3) Wavelength Repeatability	For repeatability test of wavelength standard value Specification: $\leq 0.3\text{nm}$
(4) Noise level	Measuring the maximum value and minimum value of the data, and then calculate the square root of the difference of them. Specification: $\leq 0.001\text{Abs (500nm)}$

(5) Baseline Stability	Check stability using time scan (3600S). Specification: $\leq 0.0004\text{Abs/h}$ (500nm) (◇Note: 2 hours after powering on)
(6) Baseline Flatness	Check baseline flatness using wavelength scan (200nm~1090nm, 400nm/min) Specification: $\leq \pm 0.001\text{Abs}$
(7) Hardware	ROM and RAM Wavelength drive mechanism Light lamp Service time of lamp

△Note

- 1) Auto test basic performance and work status of main parts of spectrophotometer, must wait for 30 minutes after powering on the spectrophotometer.
- 2) As for baseline stability test, it must be done 120 minutes after powering on the spectrophotometer. And test time is about 60 minutes. Usually, it need not to test this item.
- 3) If spectrophotometer performance has been tested too often by auto test of GLP/GMP, it may have bad effect on spectrophotometer lifetime. It is suggested to select some items for test according to necessity.

### 4.3 Troubleshooting

This chapter mainly introduces the analysis of fault cause and treatment methods of the fault when the spectrophotometer is abnormal.



### 4.3.1 Failure Cause and Countermeasure

If the spectrophotometer is abnormal, correct it referring to the following table.

Symptom	Cause	Countermeasure
Turn on the spectrophotometer, but no action. (Spectrophotometer is unable to be operated)	(1) Power cord, fuse are abnormal. (2) Work power supply Abnormal.	(1) Replace power cord and fuse. (2) Replace work power Supply.
After powering on, light source is not on, "Lamp NG" is displayed on display screen.	(1) Relevant light source lamp is broken. (2) Light source light has been set under OFF status.	(1) Replace relevant light source lamp. (2) Confirm setting of light source lamp again.
Data fluctuation is large.	(1) There is something blocking optical path in sample compartment. (2) Lamp performance decreases. (3) Lamp or reflector contaminated (4) Misoperation during zero calibration.	(1) Take out material blocking optical path. (2) Replace light source lamp. (3) Replace, clean lamp/ reflector. (4) Adjusting zero correctly.
"656.1nm NG" displayed on display screen during auto test.	Wavelength value is not correct.	(1) Perform wavelength calibration. (2) Contact to our Service Department.
Display abnormally; Display screen can not be input.	(1) Display screen fault; (2) Micro control board fault.	(1) Replace display screen; (2) Replace micro control board.

### 4.3.2 Replacement of fuses

There are fuses (3.15A) which prevent the spectrophotometer circuit from being damaged by strong electric shock installed in spectrophotometer input power supply, and power supply board, circuit board inside spectrophotometer.

If fuse is found to have been blown out, first check and find the cause. Then replace the fuse.

## 4.4 Replacement of Consumable Parts

WI lamp, D2 lamp and fuse are consumable parts. When WI lamp and D2 lamp exceed their lifetime, light energy may decrease or lamp may not be ON. So WI lamp and D2 lamp need to be replaced. If user has no WI lamp or D2 lamp for spare, contact our Service Department for purchase.

WI lamp (P/N: 0007162) lifetime: 1000 hours

D2 lamp (P/N: 0001472) lifetime: 1000 hours



Accidents may occur due to electric shock by power supply voltage. Before opening the cover of light source chamber, first turn off the spectrophotometer and pull out power cord to avoid accident.

### 4.4.1 Light Source Replacement

The procedures are as follows (Figure 4-8~Figure 4-12):

- (1) Turn off the power supply (switch to OFF position), then wait until light source lamp cools sufficiently.
- (2) Unscrew the screw of light source chamber cover. Remove cover of light source chamber.
- (3) Replace WI lamp:
  - (a) Remove the fixed metal shrapnel from the top of the WI lamp;
  - (b) Pull out the old WI lamp gently, and take out old WI lamp from lamp base;
  - (c) Put the new WI lamp inside lamp base and push to the bottom.
  - (d) Pay attention that spiral of WI lamp filament should face to light-entrance slot (at right side).
- (4) Replace D2 lamp:
  - (a) Pull out plug of D2 lamp lead;
  - (b) Hold metal part of base of old D2 lamp; rotate anticlockwise to take out old D2 lamp;
  - (c) Hold metal part of base of new D2 lamp, and rotate clockwise to fix the new D2 lamp;
  - (d) Plug the pin of D2 lamp lead.
- (5) Install cover of lamp source chamber.

**NOTE**

- (1) When power supply switch is ON, replacing lamp is forbidden.
- (2) After turning off the power supply, wait until lamp cools sufficiently.  
And then replace the lamp.
- (3) When installing new lamp, use clean gloves, cloth and paper to hold lamp to avoid any fingerprint being left on lamp.
- (4) After lamp has been replaced, when confirming the lamp ON, please close the cover of lamp source chamber to avoid eye injury caused by lamp.

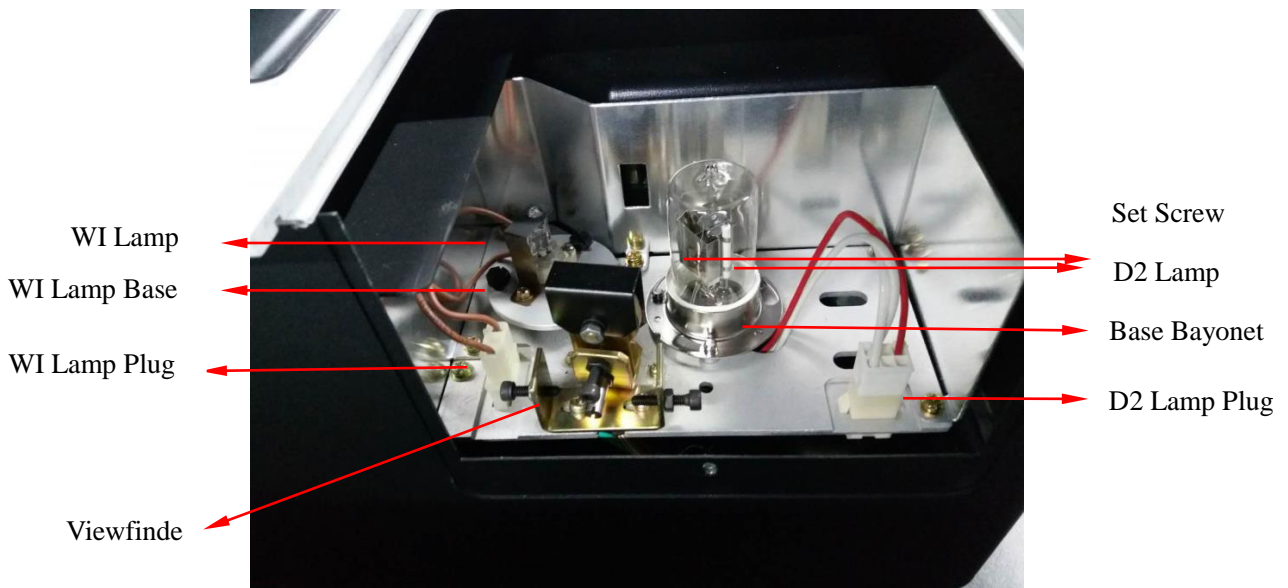


Figure 4-8 Structure of light source chamber

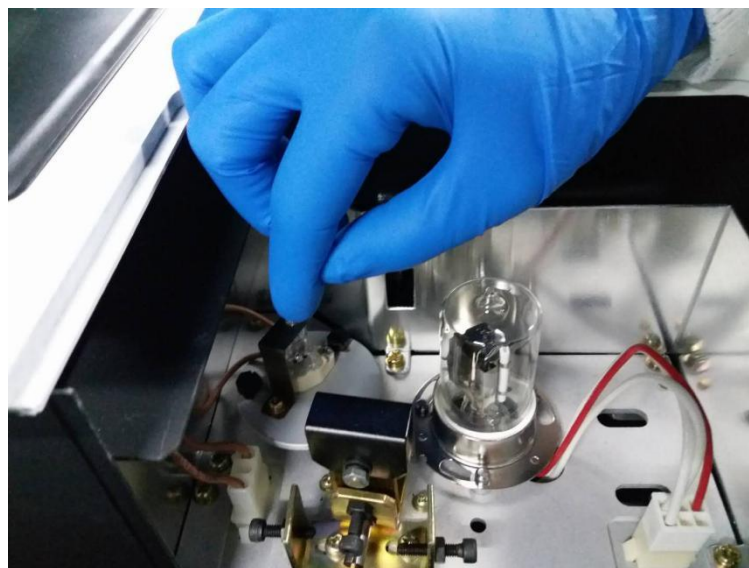


Figure 4-9 Remove WI lamp

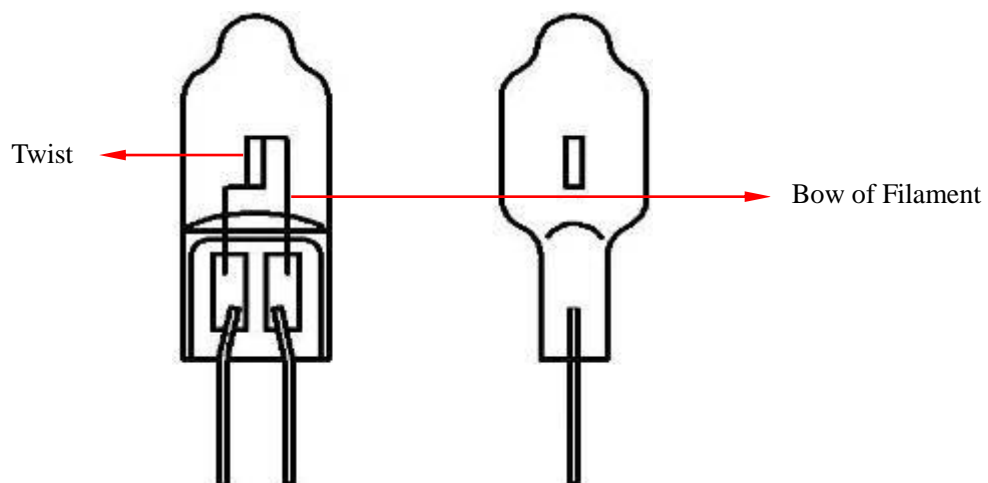


Figure 4-10 Schematic diagram of WI lamp filament

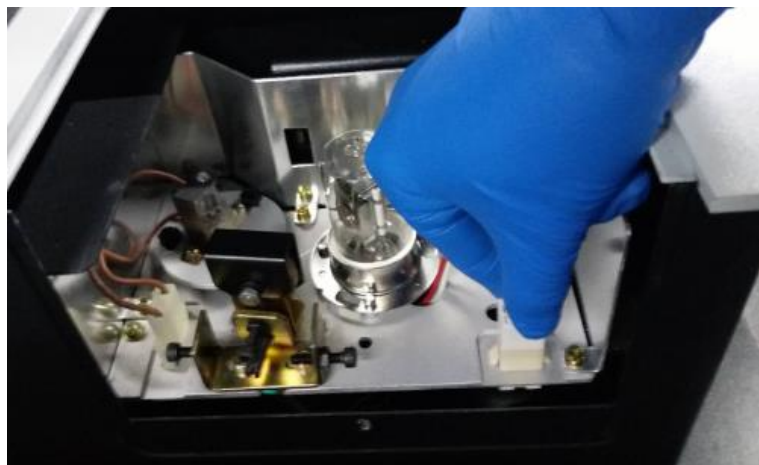


Figure 4-11 Pull out/install plug of D2 lamp lead

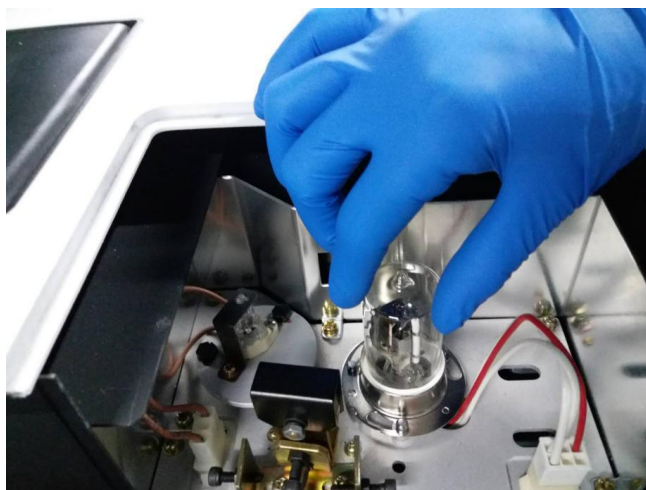


Figure 4-12 Remove/install D2 lamp

#### 4.4.2 Clear of Light Source Lamp Use Time

After replacing the lamp, clear the use time of old lamp. The specific clear procedures can refer to relevant section.

#### 4.4.3 Adjustment of Light Source Lamp



#### WARNING

Usually, after replacing lamp, there is no need to do any adjustment. If light source adjustment is required, warnings are as follows:

- (1) When lamp is ON, WI lamp and D2 lamp have high voltage. So touching lamp and its lead is forbidden to avoid electric shock.
- (2) When lamp is ON, WI lamp and D2 lamp have high temperature. So touching surface of the lamp is forbidden to avoid scald.
- (3) When D2 lamp is ON, it will emit strong ultraviolet radiation. So avoid seeing the lamp directly.

The adjustment of WI lamp position are as follows, as shown in Figure in Figure 4-13 and Figure 4-14:

- (1) Turn off D2 lamp.
- (2) Set wavelength above 400nm.

Aim the viewfinder of light source at WI lamp side to make WI lamp aim at light-entrance slit. And confirm relative position of WI lamp facula and light-entrance slit is OK.

If relative position of WI lamp facula and light-entrance slit has deviation, adjust Screw C of WI lamp and Screw A of viewfinder.

If WI lamp facula has horizontal deviation, adjust screw A of viewfinder.

If WI lamp has vertical deviation, adjust Screw C of WI lamp (three in all).

After adjustment, tighten Screw A.

- (3) Set wavelength as 580nm.

Open the door of sample chamber under wavelength 580nm. Insert a white paper in front of photocell, aiming at the shape of WI lamp facula (yellow at 580nm). If facula is dark or the shape is abnormal, adjust Screw C of WI lamp and Screw A of viewfinder to make the shape of WI lamp facula rectangle.

◇ Note: As for turning on and turning off the lamp, setting of wavelength, please refer to relevant section.

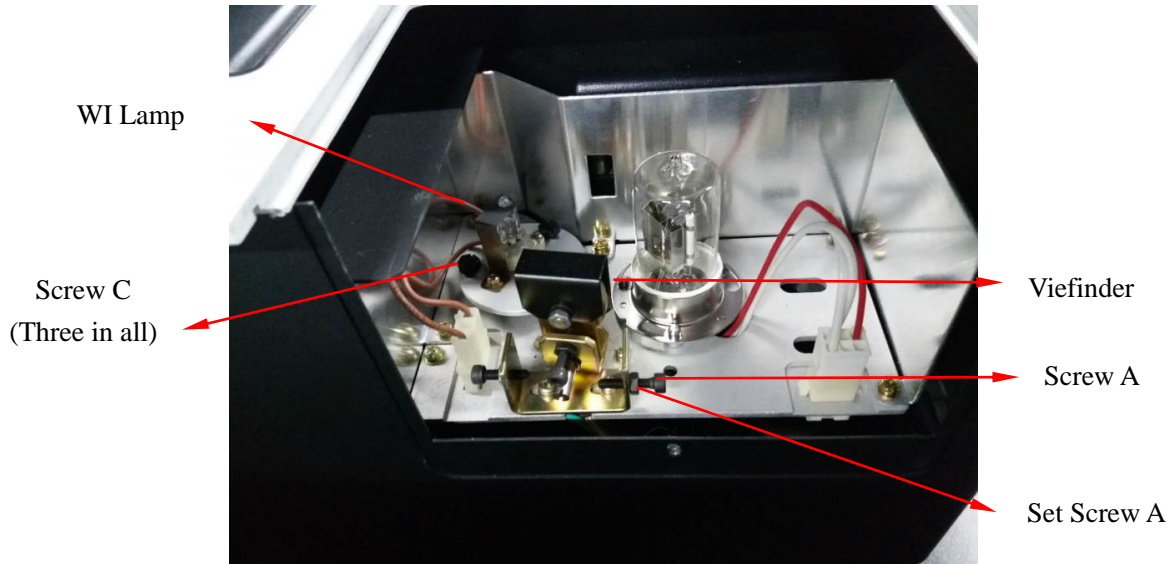


Figure 4-13 Replace and adjust WI lamp

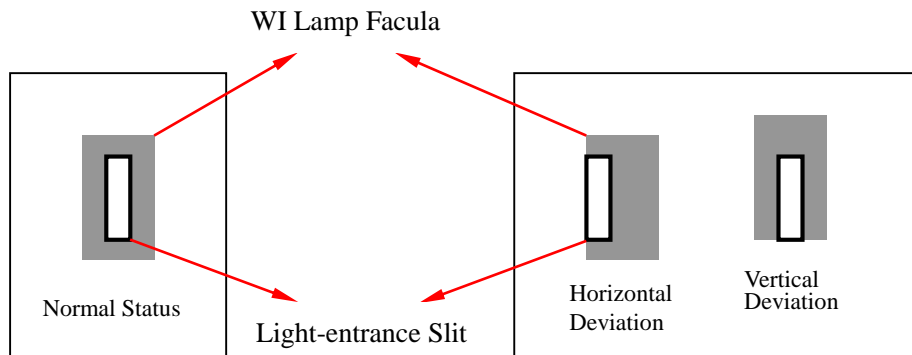


Figure 4-14 Relative position of WI lamp facula and light-entrance slit

A) The adjustment of D2 lamp position are as follows, as shown in Figure 4-15 and Figure 4-16:

- (1) Turn off WI lamp.
- (2) Set wavelength below 300nm.

Aim the viewfinder of light source at D2 lamp side to make D2 lamp aim at light-entrance slit. And confirm relative position of WI lamp facula and light-entrance slot is OK.

If relative position of D2 lamp facula and light-entrance slit has deviation, adjust Screw B of viewfinder.

If D2 lamp facula has horizontal deviation, adjust screw B of viewfinder.

After adjustment, tighten set screw B.

◇ Note: D2 lamp is UV light source lamp, D2 lamp facula can be observed at light-entrance slit of lamp source chamber, which is polychromatic light. But after polychromatic light of D2 lamp has been changed into homogeneous light by monochromator, we cannot see facula by eyes. So we cannot adjust D2 lamp position by observing the shape of D2 lamp facula inside sample chamber.

◇ Note: As for turning on and turning off the lamp, wavelength settings, transmittance/absorbance mode setting, refer to relevant section.

◇ Note: When adjusting position of WI lamp and D2 lamp, if instrument is OK by Step (2), there is no need to perform Step (3) and Step (4).

◇ Note: If position of D2 lamp and WI lamp has serious deviation, light source viewfinder may need to be adjusted. However, the method is very complex, please contact to relevant Service Department for help.

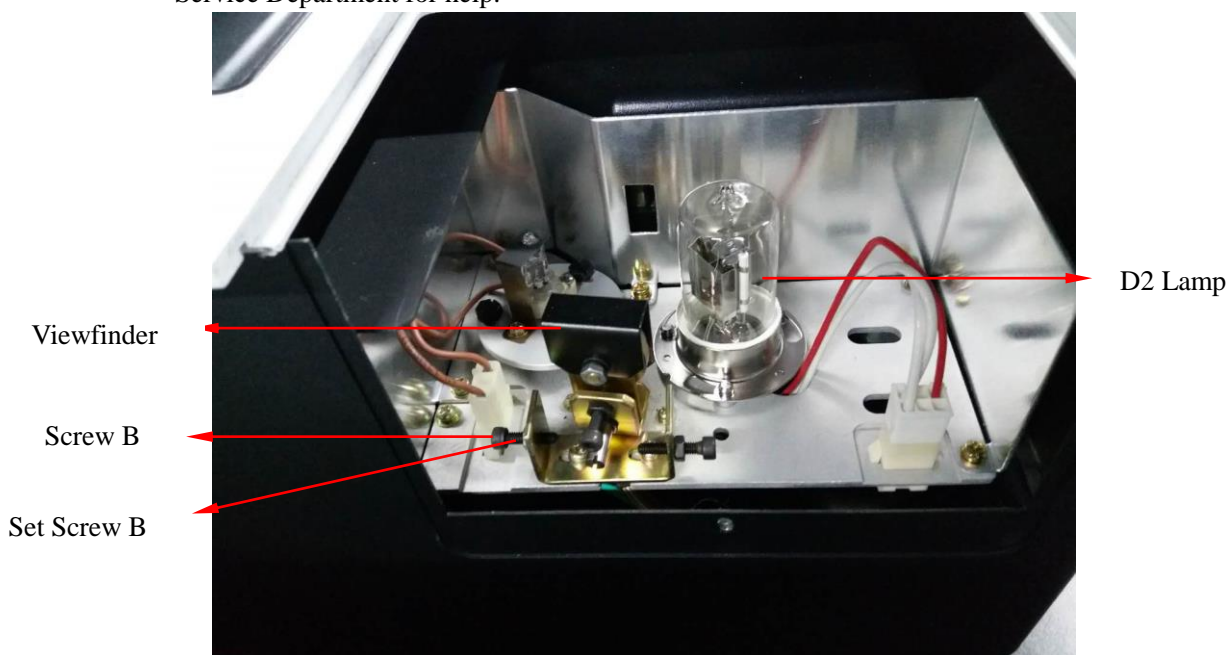


Figure 4-15 Replace and adjust D2 lamp

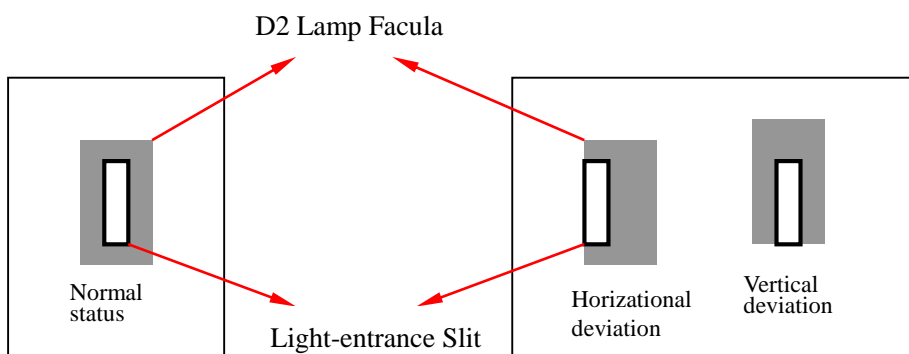


Figure 4-16 Relative position of D2 lamp facula and light-entrance slit

## 4.5 Assembly and Disassembly of Spectrophotometer Main Parts

If failures occur, parts may need to be replaced. This section mainly introduce the assembly and disassembly methods of spectrophotometer main parts.



### WARNING

Those who has not been trained are forbidden to assemble and disassemble the instrument, otherwise instrument may be damaged or human may be injured.



### WARNING

Pay attention to the electric shock caused by power supply voltage. Before open the cover or assemble and disassemble the circuit of spectrophotometer, please first turn off the power supply and pull out the power cord.

### 4.5.1 Open Spectrophotometer Cover

- (1) Open cover of sample chamber, and unscrew the set screw of cuvette holder. Take out the cuvette holder.
- (2) Unscrew the set screw of sample chamber holder.
- (3) Unscrew the set screw on the side of spectrophotometer.
- (4) Take out spectrophotometer cover. (Do not exert too much force to avoid breaking connection wire.)
- (5) Install the spectrophotometer cover. (Do not press the connection wire by cover during installation.)

### △Note

When taking out or installing the cover of spectrophotometer, pay attention to avoid the sponge fallen down or rolled up.

### 4.5.2 Assembly and Disassembly Procedures of Power Switch

- (1) Remove spectrophotometer cover.
- (2) Pull out each connection wire plug of power switch.
- (3) Unscrew the set screws of power switch and take out power switch.
- (4) Install the power switch (pay attention to plug the connection wire plugs correctly).



### **4.5.3 Assembly and Disassembly Procedures of Control Board and Lamp Power Supply**

- (1) Remove spectrophotometer cover.
- (2) Pull out each connection wire of control board and lamp power supply.
- (3) Unscrew the set screws of control board and lamp power supply and take out control board and lamp power supply.
- (4) Unscrew the set screw of spectrophotometer host control board or lamp power supply board, take out them from the installation holder.
- (5) When installing control board or lamp power supply board, pay attention to plug the connection wire plugs correctly.

△Note

When replacing the circuit board, do not bend the board forcibly.

### **4.5.4 Assembly and Disassembly Procedures of Pre-amplifier**

- (1) Remove spectrophotometer cover.
- (2) Unscrew the set screws on the cover of pre-amplifier, and remove the cover of pre-amplifier.
- (3) Pull out each connection wire plug of pre-amplifier.
- (4) Unscrew the set screws of pre-amplifier. And take out pre-amplifier.
- (5) Install pre-amplifier (pay attention to plug the connection wire plugs correctly).

△Note

- (1) When assembling and disassembling reference photoelectric converter and pre-amplifier, avoid the photocell shined by high light to prevent photocell from fatigue.
- (2) The installation position of the lens in front of the photocell (sample chamber lens) is also related to the light energy. In general, please try not to move the lens mount.

## 4.6 Storing of Spectrophotometer

### 4.6.1 After Test

- (1) Turn off spectrophotometer, and pull out the plug of power cord.
- (2) Cover the instrument with dustproof cover.

△Note

If there are corrosive, volatile organic solvent or venomous sample in the sample chamber, be sure to take them out.

### 4.6.2 Long Time Maintenance

- (1) Please do not place the spectrophotometer in the place with high temperature (more than 70°C), low temperature (less than -20°C), high humidity (more than 80%), or vibrant source.
- (2) Make sure to cover the dustproof cover on the spectrophotometer.
- (3) Spectrophotometer cannot be touched with corrosive and venomous gases.
- (4) When spectrophotometer is being transported to storage place, fix the viewfinder by sponge.
- (5) Do not keep the spectrophotometer in electromagnetism field place.
- (6) Do not keep the spectrophotometer in dusty place.
- (7) Avoid direct sunlight to the instrument.

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