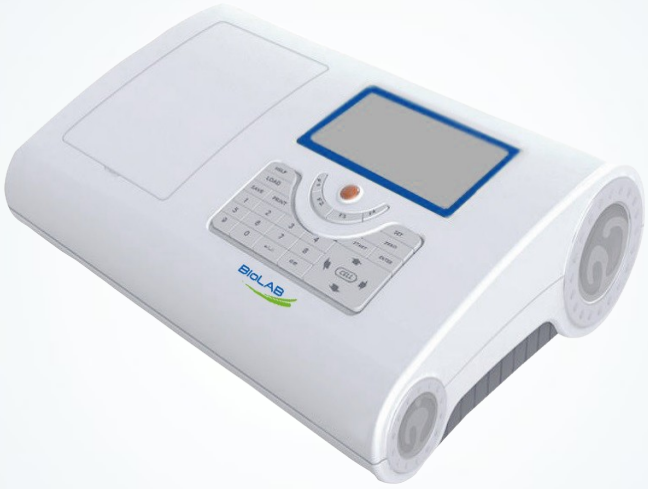
Operation Manual



BSDBU-202

Double Beam UV Visible Spectrophotometer

Thank you for Choosing Biolab products. Please read the “Operating Instructions” and “Warranty” before operating this unit to assure proper operation.

Index

Safety

The safety statements in this manual comply with the requirements of the HEALTH AND SAFETY AT WORK ACT, 1974.

Read following instructions before installing and using the instrument and its accessories. The apparatus should be operated by appropriate laboratory technicians.

■ General

The apparatus described in this manual is designed to be used by properly trained personnel in a suitable equipped laboratory. For the correct and safe use of this apparatus it is essential that laboratory personnel follow generally accepted safe procedures in addition to the safety precautions called for in this manual.

The covers on this instrument may be removed for servicing. However, the inside of the power supply unit is a hazardous area and its cover should not be removed under any circumstances. There are no serviceable components inside this power supply unit. Please avoid touching the high voltage power supply at all times.

Some of the chemicals used in spectrophotometer are corrosive and/or inflammable and samples may be radioactive, toxic, or potentially infective. Care should be taken to follow the normal laboratory procedures for handling chemicals and samples.

■ Electrical

Before switching on the apparatus, make sure it is set to the voltage of the local power supply. The power cord shall be inserted in a socket provided with a protective earth contact. The protective action must not be negated by the use of an extension cord without a protective conductor.

■ Warning

Any interruption of the protective conductor inside or outside the apparatus or disconnection of the protective earth terminal is likely to make the apparatus dangerous. Intentional interruption is prohibited.

Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation.

NEVER touch or handle the power supply on due to the high voltage!

The protection is likely to be impaired if, for example, the apparatus

- Shows visible damage
- Fails to perform the intended measurements
- Has been subjected to prolonged storage under unfavorable conditions
- Has been subjected to severe transport stresses

■ Radio Interference

For compliance with the EMC standards referred to in the EC Declaration of Conformity, it is necessary that only shielded cables supplied by us are used when connecting the instrument to computers and accessories.

01 Introduction

1.1 Measurement Principle

The measurement principle of spectrophotometer is based on the Lambert-Beer law. When the beam of collimated monochromatic light passes through a certain uniform colored solution, the absorbance of the solution is directly proportional to the concentration of the solution and the optical path. And it supplies basis for the quantitative analysis. The Lambert-Beer law is described as following formula:

A=k◈b◈C

A — Absorbance of the analyte

k — The absorption coefficient

b — The path length in cm

c — The analyte concentration

1.2 Performance and features

The performance and features of BSDBU-202 series UV/Vis Spectrophotometer are as following:

• Low stray light and high resolution optical system enables accurate measurement with good stability and reproducibility.

• Novel technologies organically combine light, machine, electricity and microcomputer, together with scientific design, enables the instrument stability approaching or reaching a high level.

• 6-inch colorful LED display enables clear and reliable display, and accurate readings.

• Interactive human machine interface enables the operation interface much friendly, and the operation is convenient.

• Powerful function of system settings, measurement functions such as photometric measurement, quantitative measurement, wavelength scan, kinetic analysis, DNA/Protein measurement and Multi-wavelength measurement are available without on-line operation.

• Available for cell position control with the accessory of automatic cells holder.

• Data processing such as data retrieval and graph zooming are available.

• Data saving and reading is much flexible, and the data saved on the instrument memory can be exported to PC as necessary.

1.3 Application

The UV/Vis spectrophotometer is a common analytical instrument in chemistry laboratory, and it is widely used in pharmaceutical, medicine & health, chemical, energy, machinery, metallurgy, environmental protection, geology, food, biology, materials, agriculture, forestry, fisheries and other industries. It's also applied in the fields of higher education, metrology, teaching and scientific research, and has advantages in quality control, raw material and product inspection in production.

BSDBU-202 series are double beam UV/Vis spectrophotometers. Thanks to their stable performance, accurate measurement and powerful functions, they have strong advantages in various fields of scientific research and quality control.

1.4 Technical Specifications
BSDBU-202 series UV/Vis spectrophotometer has three models, BSDBU-202, BSDBU-202A and BSDBU-202S. The detail specifications are as following:

Model	BSDBU-202	BSDBU-202-A	BSDBU-202-B
Wavelength Range	190 nm -1100 nm		
Bandwidth	1.8 nm	1 nm	0.5/1/2/4 nm, adjustable
Wavelength Accuracy	±0.3 nm		
Wavelength Repeatability	≤0.1 nm		
Photometric Range	0 - 200 %T, -0.3 A - 3 A, 0 - 9999 C		
Photometric Accuracy	±0.2 %T		
Stray Light	≤0.03 %T@220nm,360nm		
Dimensions	625 mm × 430 mm × 210 mm		

1.5 Packing List

No.	Item	Unit	Qty	Note
1	BSDBU-202 series UV/Vis Spectrophotometer	set	1	
2	Power Cord	pc	1	
3	Quartz Cell	kit	1	2 pcs/kit
4	Glass Cell	kit	1	4 pcs/kit
5	Dust Cover	pc	1	
6	Software Kit	kit	1	
7	User's Manual	pc	1	
8	Software Manual	pc	1	
9	Quality Certificate	pc	1	
10	Packing List	pc	1	

1.6 Symbols and Notices

 : HIGH VOLTAGE.

Caution the danger of high voltage, and be careful of the risk of electric shock.

 : HOT SURFACE

Caution the hot surface, and avoid the risk of burn.

 : ULTRAVIOLET RADIATION

Caution the emission of UV radiation.

 : NOTICE.

Pay attention to the notice.

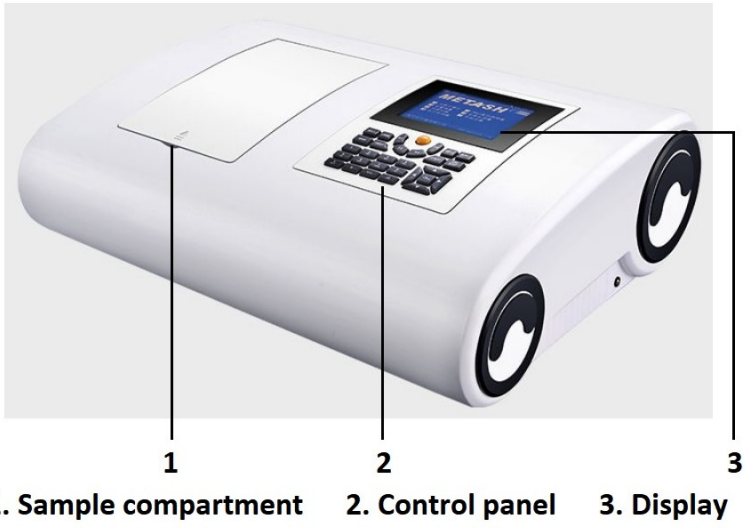
 : SPECIAL EXPLANATION.

Pay additional attention to the special explanation.

1.7 Product Design

1. Configuration

The profile of BSDBU-202 series UV/Vis Spectrophotometer is shown in Fig. 1-1



1. Sample compartment 2. Control panel 3. Display

The back side of BSDBU-202 series UV/Vis Spectrophotometer is shown in Fig. 1-2:

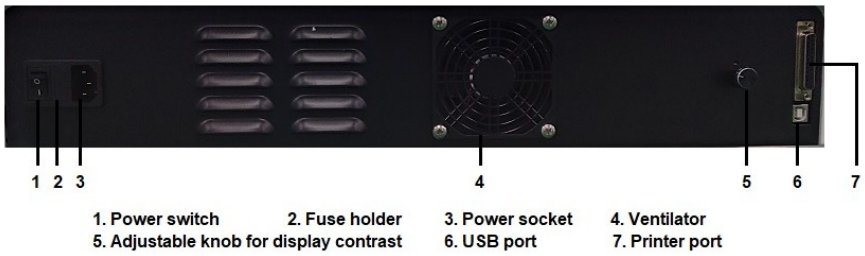
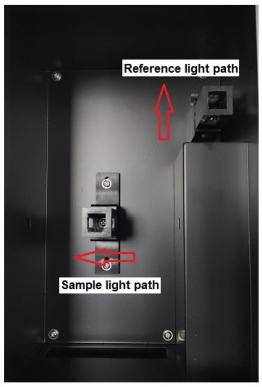


Fig. 1-2

The compartment configuration of BSDBU-202 series UV/Vis Spectrophotometer is shown in Fig. 1-3:



The schematic diagram of the instrument's internal structure is shown in Fig. 1-4:

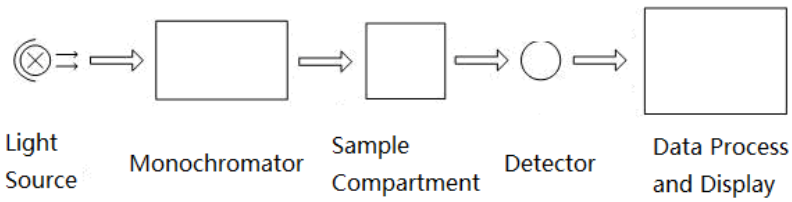


Fig 1.4

2. Control Panel and Keys

The control panel of BSDBU-202 series UV/Vis Spectrophotometer is shown in Fig. 1-5.

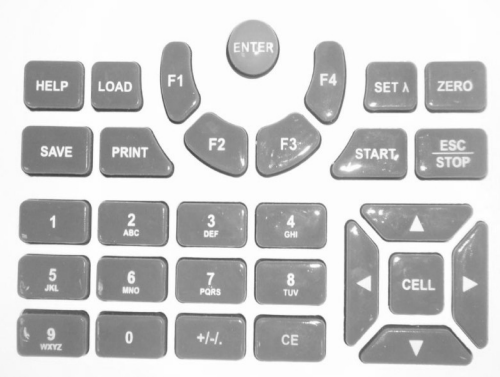


Fig 1-5

The keys include number & character keys, function keys and shortcut keys. Following are the description of the keys.

1) Number & character keys

User can input the value such as wavelength, concentration, and date. It's also used for file name edit.

2) Function keys

: Load the saved data.

: Save the measurement data.

: Print the measurement data or the current screen display.

: Set the measurement wavelength.

: Calibrate the blank, to adjust to 0.000 Abs or 100.0 %T, or to run baseline calibration.

: Start the measurement.

: Esc key, to exit the current interface, and return to the previous interface.

It's also for Stop key, to stop the measurement during the wavelength scanning or kinetic scanning.

: Confirm the setting or the operation.

: Reserved for extended function, it's not available currently.

: For cell position control. It's only available for the instrument with the accessory of automatic cells holder.

: Clear the input or clear the current display.


:

Up, down, left and right keys are used for selection. Up and down keys are also used for ordinate setting, and for wavelength scanning data retrieval with peak or valley. And also for caps lock when inputting the letter. Left and right keys are also used for abscissa setting, and for wavelength or kinetic scanning data retrieval point by point.

3) Shortcut keys

:

The shortcut key operation is based on the information on the screen.

02 Installation

Please carefully read the instruction in this chapter before unpacking and installation BSDBU-202 series UV/Vis Spectrophotometer.

2.1 Unpacking

Please check the outer packing and make sure that it is intact before unpacking BSDBU-202 series UV/Vis Spectrophotometer. Then, check the instrument and its accessories according to the packing list and make sure they are completely well. If you have any questions, or

anything lost or damaged, please contact us in time.

2.2 Requirements

A laboratory should be prepared, and following requirements should be met:

1) The instrument should be placed in a dry room, and the room temperature should be in the range of 5 ℃~ 35 ℃. The relative humidity should be no more than 85%.

2) Power supply requirement: The rated voltage should be 220 V ± 22 V AC (110 V ± 11 V AC is also optional), and the frequency should be 50 Hz (60 Hz is also optional). Well grounding is also required. An electronic AC regulator or AC regulator with the power more than 1000 W is suggested to enhance the anti-interference performance of the instrument.

3) Other requirements: Be far away from strong or continuous vibration. Neither setting up the instrument near electromagnetic field, nor exposing the instrument to direct sunlight or the radiation of heaters. It should be free of dust, as well as corrosive vapors. The instrument should be placed on a stable workbench. And for well cooling and ventilation, a clearance of at least 15 mm to the wall is suggested.

2.3 Installation

Install the instrument as following steps:

Step 1: Place the instrument onto a stable bench after unpacking.

Step 2: Connect the power cord to the instrument. If a printer is equipped, connect the power cord of the printer and connect the instrument to the printer with the communication cable.

03 Instrument Operation

Before switching on the power, make sure that all connections work well, the power supply is with well grounding and met the requirement, neither sample in the sample compartment nor any other block in the light path.

3.1 Power On & System Initialization

1. Power On & System Initialization

Switch on the power after connecting the instrument to the power supply, and enter the system initialization interface (Fig. 3-1). The system will check the memory, initialize the communication port and printer, start the kernel, initialize the AD converter, and perform positioning items including filter, automatic cells holder (if installed) and D2/W lamps. Later, it starts the warm up process.

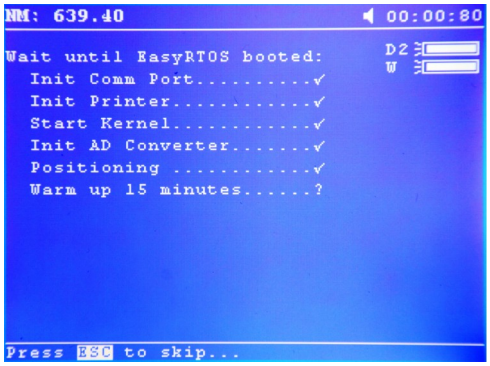


Fig. 3-1

☞ Please don't open the lid of the sample compartment during the system initialization.

2. Warm up

It will cost 15 minutes for warm up process. User can press ESC STOP to skip the process. If the beeper is on, the instrument will beep three times when the warm up process is completed.

3. Ready for operation

Whether the warm up process is skipped or not, a prompt "System calibration? No" will be given. Press ▼ or ▲ to select "Yes" and press ENTER, the system will continue the calibration process and then enter the main interface (Fig. 3-2).

User also can skip the system calibration by pressing ENTER or ESC STOP directly to enter the main interface.

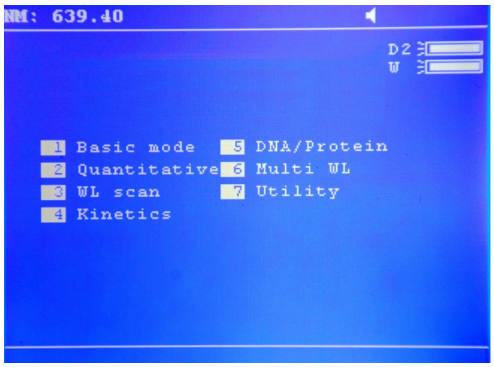


Fig. 3-2

For BSDBU-202S, its bandwidth is adjustable, and there will additionally show "F1 Slit Width: 2.0nm" in the main interface. User can press F1 to set the bandwidth, when it shows "Set Slit: 2.0nm", press ▼ or ▲ (or ◀ or ▶) to select certain bandwidth, and press ENTER to make sure the setting.

The system calibration process includes "get dark current", "search 656.1nm", "check energy" and "baseline calibration". If the data in memory has been lost, the instrument will automatically perform system calibration. And for measurement accuracy, the system calibration is usually suggested.

It's ready for operation. Functions such as photometric measurement (Basic mode), quantitative measurement, wavelength scan, kinetic analysis, DNA/Protein measurement, Multi-wavelength measurement, and system settings (Utility) are available with the instrument operation. Just press the corresponding number key to enter the operation interface.

3.2 Photometric Measurement

Absorbance, transmittance, and concentration measurements under certain wavelength are available with photometric measurement. The measurement result also can be print out.

When the system shows the main interface, press 1 on the key panel to enter the photometric measurement interface (Fig. 3-3).

Fig. 3-3

There are four function shortcuts at the bottom of the screen: Unit, Mode, F Factor, and Standard.

Unit: Press F1 to enter the setup, it shows “Please select unit: ”. press ▼ or ▲ (or ◀ or ▶) to select the unit, such as mg/L, g/L, ppb, ppm, %, other, IU, mM/L, M/L, μg/mL and mg/mL. If “other” is selected, there further shows “Please input self defined unit: ”, user can edit the unit.

Mode: Press F2 to select the mode, it shows “please select mode:”. press ▼ or ▲ to select the mode, and there are three modes for selection: Abs, T% and Conc.

F Factor: Press F3, it shows “Please input Factor: ”. User can input the value between 0.000 and 9999.

Standard: Press F4, it shows “Please input Conc. of standard: ”. User can input the value between 0.000 and 9999.

3.2.1 Photometric measurement

Following are the operation steps for photometric measurement:

Step 1: Enter the photometric measurement interface.

When the system shows the main interface (Fig. 3-2), press 1 to enter the photometric measurement interface (Fig. 3-3).

Step 2: Set the measurement wavelength.

Press SET λ, it shows “Please input wl:” (Fig. 3-4), input the value and press ENTER to confirm the setting, the instrument will move wavelength to the designated spot, and adjust blank automatically.

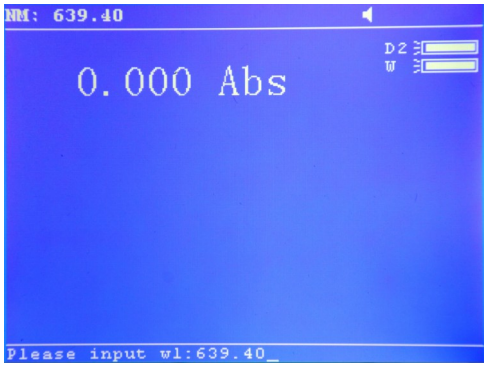


Fig. 3-4

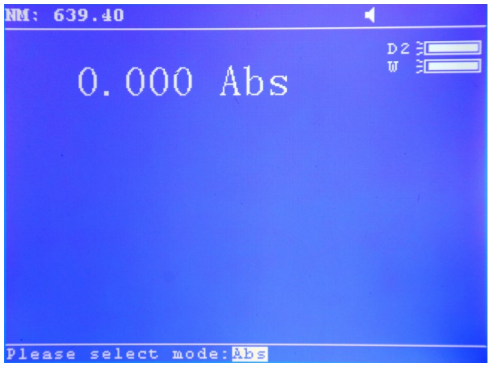


Fig. 3-5

The valid wavelength range of BSDBU-202 series is between 190 nm and 1100 nm. If the input value is out of the range, it is invalid, and user needs input again.

User can press CE to clear the input when an error is found, then input the target value again. It also works in the process of digital setting in subsequent operations.

Step 3: Mode selection & Sample measurement.

Press F2 to select the mode (Fig. 3-5), and begin to measure sample, use liquid sample as an example.

a. Under the mode of T%, or Abs, put the blank solution or reference solution separately into the reference light path and sample light path, press ZERO to calibrate blank. Then replace the blank solution or reference solution with the sample solution only in the sample light path, read out the value directly.

b. Under the mode of Conc., press F1 to select the unit. Then put the blank solution or reference solution separately into the reference light path and sample light path, press ZERO to calibrate blank. For the sample that has known F-factor, replace the blank solution or reference solution with the sample solution only in the sample light path, and input F-factor. The system will measure the Absorbance, and user can read the concentration directly. For the sample that F-factor hasn’t known, replace the blank solution or reference solution with the standard solution only in the sample light path,

and input the standard concentration. The system will measure the absorbance, and calculate F-factor as well. (F = Conc. / Abs). Next, replace the standard solution with the sample solution, read the concentration directly (Fig. 3-6).

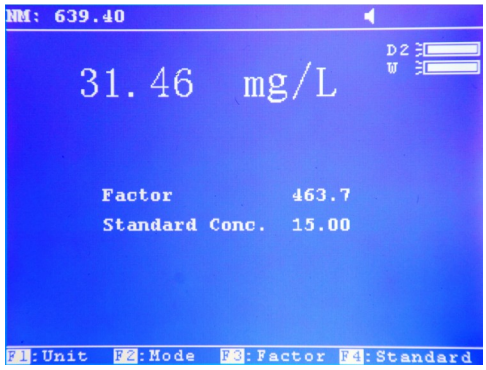


Fig. 3-6

Photometric measurement is usually for simple measurement, the result can be directly read out, and the data saving is unavailable.

3.3 Quantitative Measurement

In UV/Vis spectrophotometry, the method of standard curve is usually used for quantitative measurement. It means to establish a calibration curve first, then measure the sample based on the calibration curve. The standard curve is also known as the standard calibration curve. Measure the absorbance of a group of standard solutions in ascending order of concentration, each concentration with a relevant absorbance. Utilize the absorbance as ordinate and the concentration as abscissa, draw coordinate points according to the measurement and establish a straight line that through the points as much as possible. So that obtains the standard calibration curve. The linear fit equation of the standard curve is usually described as following formula:

$$A=K\times C+B$$

Here, A is for absorbance, K is for the slope, C is for the concentration, and B is for the intercept.

Measure the absorbance of the sample and obtain the concentration that calculated according to the standard curve.

Different absorbance linearity range will cause different measurement error. The best absorbance linearity range is between 0.2 and 0.8.

Although the standard curve is shown with the absorbance as ordinate and the concentration as abscissa, the linear fit equation of the instrument is shown as C=K0+K1×A. However, it won't affect the sample measurement and the final result display.

BSDBU-202 series UV/Vis Spectrophotometer has two operation states with the quantitative measurement function, Quantitative test and Standard calibration curve. User can do sample measurement based on the standard calibration curve. User also can utilize sample measurement referring with the experienced calculation formula.

When the system shows the main interface, press 2 ABC on the key panel to enter the quantitative measurement interface (Fig. 3-7).

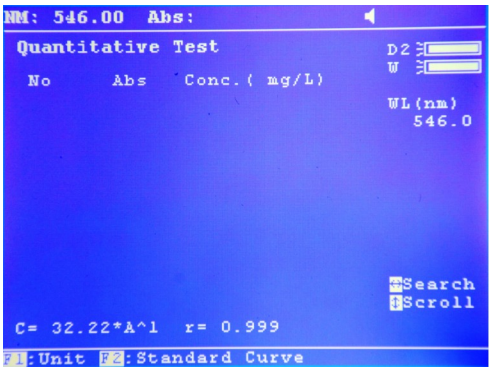


Fig. 3-7

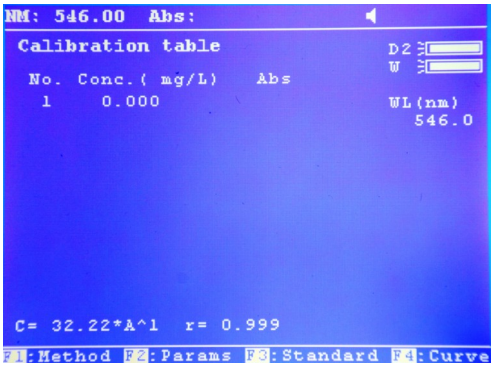


Fig. 3-8

There are two function shortcuts at the bottom of the screen: Unit, Standard Curve.

Unit: Press F1 to enter the setup, it shows "Please select unit: ". press ▼ or ▼ (or ◄ or ►) to select the unit, such as mg/L, g/L, ppb, ppm, %, other, IU, mM/L, M/L, μg/mL and mg/mL. If "other" is selected, there further shows "Please input self defined unit: ", user can edit the unit.

Standard curve: Press F2 to enter the standard curve operation interface (Fig. 3-8), continue the next setup.

Method: Press F1 to enter the setup, press ▼ or ▼ to select the fitting method. There are four methods for selection: Linear fit through zero, Cubic fit,

Square fit, Linear fit. (Each fit equation was: C=K1*A^1, C=K0+K1*A^1+K2*A^2+K3*A^3, C=K0+K1*A^1+K2*A^2, C=K0+K1*A^1)

Params: Press 

to set the parameters of calculation formula. When the method Linear fit through zero is selected, it shows “Input K1 =”, input the value and press 

, then shows “Input r =”. When the method Cubic fit is selected, step by step input the factors: K0, K1, K2, K3. When the method Square fit is selected, step by step input the factors: K0, K1, K2. When the method Linear fit is selected, there shows “Input K0 =”, input the value and press 

, then shows “Input K1 =”, input the value and press 

, further shows “Input r =”.

Standard: Press 

to enter the standard setting, it shows “Edit the number… ”, press 

, it shows “Input standard Conc.”, make sure the input, then input the next value accordingly. Press 

to end the setting. Then begin the testing.

Curve: After completing the testing press 

to view the standard curve.

3.3.1 Standard curve measurement

Following are detail operation steps for standard curve measurement:
Step1: Enter the quantitative measurement interface.

When the system shows the main interface (Fig. 3-2), Press 

to enter the quantitative measurement interface (Fig. 3-7).
Step 2: Set the measurement wavelength.

Press 

, it shows “Correction method:”. press 
or 
, and there are three methods for selection: Single WL, 3 Points, Isoabsorbance. For example, Single WL is selected, press 

and it shows “Please input wl 1:”, input the value, then press 

to confirm the setting.
Step 3: Standard blank calibration.

Put the blank solution of standard separately into the reference light path and sample light path, press ZERO to calibrate blank.

Step 4: Standard curve setup.

Press F1 to enter the unit setup, press ▼ or ▲ to select the unit and press ENTER to confirm the setting. Then press F2 to enter the standard curve operation interface (Fig. 3-8). Press F1 to enter the method setup, press ▼ or ▲ to select “Linear fit” (for example) and press ENTER. Then press F3 to enter the standard setting interface (3-9), it shows “Edit the number… ”, the cursor points to the setting position, press ENTER, it shows “Input standard Conc: ”, input the concentration value and press ENTER to make sure the input, then input the next value accordingly. Press ESC STOP after completing all the standards setting.

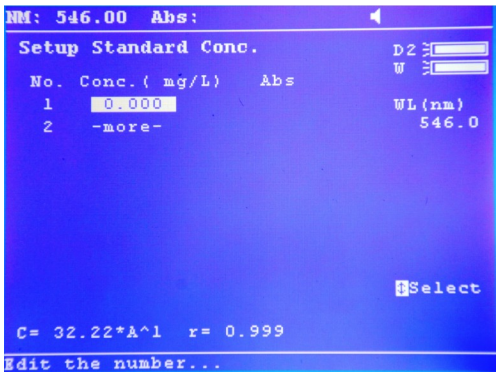


Fig. 3-9

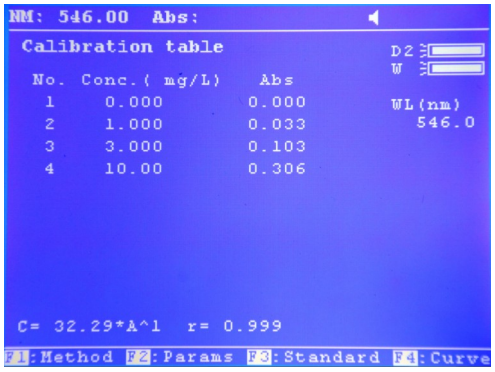


Fig. 3-10

Step 5: Standard curve measurement.

When press ESC STOP to end the standard setting, it shows “Place Standard #1”, replace the blank solution with the first standard solution only in the sample light path, and press ENTER or START, accordingly to measure other standards and record the data (Fig. 3-10).

If some data need to be reacquired, user can press F3, and press ▼ or ▲, let the cursor point to the data to be reacquired, press START to record the new data.

After completing all the standards measurement, it will show the corresponding equation. User also can select other fitting method, and the system will change the parameters accordingly. Press F4 to view the curve.

Step 6: Sample measurement.

After completing the standard curve measurement, press ESC STOP to return to the quantitative measurement interface. Put the blank solution of sample separately into the reference light path and sample light path, press ZERO to calibrate blank. Then, replace the blank solution with sample solution only in the sample light path, press START, the measurement data will be given (Fig. 3-11). More than one hundred testing data can be shown on the table list.

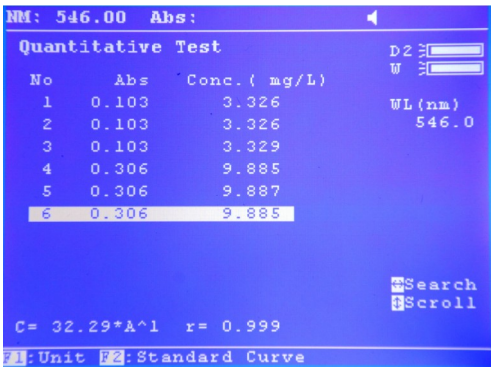


Fig. 3-11

Fig. 3-12

3.3.2 Measurement based on experienced calculation formula

Following are brief operation steps for quantitative measurement based on experienced calculation formula.

Step1: Enter the quantitative measurement interface (Fig. 3-7).

Step 2: Set the measurement wavelength.

Step 3: Put the blank solution separately into the reference light path and sample light path, press ZERO to calibrate blank.

Step 4: Parameters of calculation formula setting.

Press F1 to set the unit and press F2 to enter the standard curve operation

interface. Press F1 to set the fitting method (“Linear fit through zero” for example) and press F2 to enter the parameters setting interface (Fig. 3-12), set each parameter according to the prompts.

Step 5: Sample measurement.

Press ESC STOP after completing all parameters setting, return to the quantitative measurement interface. Replace the blank solution with sample solution only in the sample light path, press START to record the measurement data.

3.3.3 Data processing

User can do data processing such as data saving, loading and retrieval after completing quantitative measurement.

In the standard curve operation interface, press SAVE to save standard measurement data and the standard curve, it shows “Please input File Name:”, input the file name and press ENTER, the file will be saved, use “.fit” as suffix. User can press F4 to view the curve.

In the quantitative measurement interface, press SAVE to save sample measurement data, the file will be saved, use “.qua” as suffix. User can press ▲ or ▼ (or ◀ or ▶) to browse the sample data one by one. While pressing ▲ or ▼, it shows “Search sample:”, input the testing serial number, and press ENTER to view the designated sample data.

In the standard curve operation interface or the quantitative measurement interface, press LOAD, it will show “Open file:”, press ▲ or ▼ (or ◀ or ▶) to select certain file with the right suffix, and the saved data can be load.

User should enter the right interface to load the file with the right suffix. Otherwise, the file can’t be opened, and the system will give the prompts “File Type Error”.

3.4 Wavelength Scan

A curve of absorbance or transmittance in certain wavelength range is available with wavelength scan. User can do qualitative analysis such as to determine components of a simple sample by this function.

When the system shows the main interface, press 3 DEF on the key panel to enter the wavelength scan interface (Fig. 3-13).

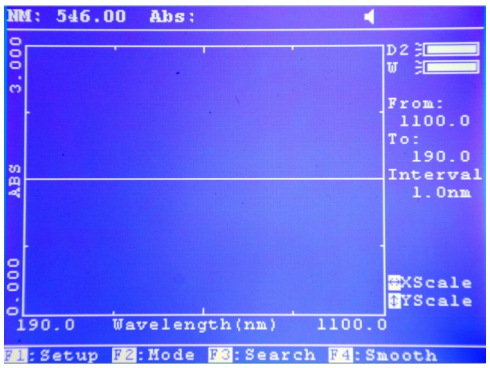


Fig. 3-13

There are four function shortcuts at the bottom of the screen: Setup, Mode, Search, and Smooth.

Setup: Press F1 to enter the setup, it shows “Scan from:” (the maximum of the wavelength), make sure the input, and shows “Scan to:” (the minimum of the wavelength), then press ▼ or ▲ (or ◀ or ▶) to select Scan step and Scan speed.

Mode: Press F2 to select the mode, shows “Please select mode:”, press ▼ or ▲ to select the mode, and there are two modes for selection, Abs, and T %.

Search: After completing the wavelength scan, press F3 to enter the data retrieval interface, it shows the function shortcuts: **Threshold**. Press F1 to set, it shows “Please input peak height:”, make sure the input, then press ▼ or ▲ to search the peak (Only available for Abs mode). In

the data retrieval interface, user can press or to retrieve the scanning data point by point.

Smooth: User can press to perform spectrum smoothing after completing the wavelength scanning.

3.5.2 Data processing

User can do data processing such as data saving, loading, kinetic analysis and data retrieval after completing kinetic measurement.

1. Data saving

In the kinetic measurement interface, press to save the kinetic measurement data, it shows “Please input File Name:”, input the file name and press , the file will be saved, use “.kin” as suffix.

2. Data loading

In the kinetic measurement interface, press , it will show “Open file:”, press or (or or) to select certain file with the right suffix, and the saved data can be load.

3. Kinetic analysis

In the kinetic measurement interface, user can press to perform data processing (kinetic analysis) after completing the kinetic measurement. Successively input Begin Time, End Time, and Factor. The system will give the kinetic analysis result based on the setting time range. The value I.U. will be calculated with the calculation formula I.U.=Factor×ΔA/min, and be displayed on the right of the screen (Fig. 3-15). The average straight line between the Begin Time and End Time will be calculated. The gradient of this line gives the rate of change of ΔA/min.

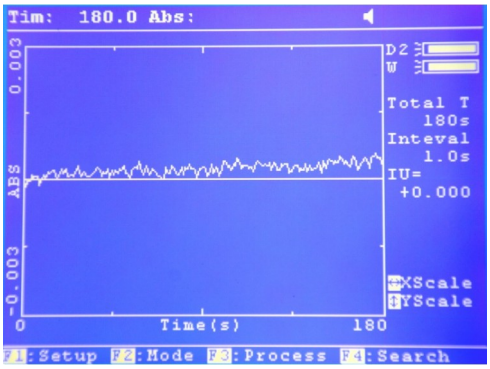


Fig. 3-15

3.8.2 Printer setting

In the system settings interface, press 2 ABC to enter the printer setting interface (Fig. 3-21).

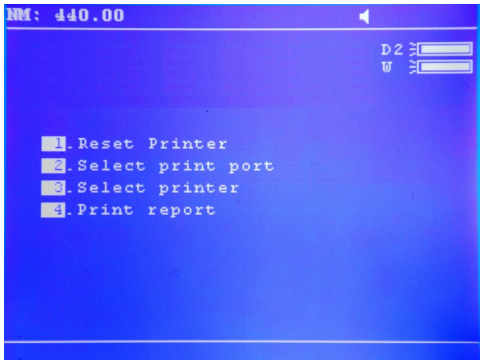


Fig. 3-21

There are four setting items: Reset printer, Select print port, Select printer, and Print report.

1. Reset printer

Press 1 to reset the printer to initial setting.

2. Select print port

Press 2 ABC, it shows “Select the print port:”. There are two print port for selection, LPT (parallel port, for printer only), and Comm (serial port, for multifunction interface). Press ▲ or ▼ to select appropriate print port, press ENTER to confirm the setting.

3. Select printer

Press 3, it shows “Printer:”. There are eight printer types for selection, SPRT SP _T, SPRT SP _POS76II, HP PCL (black mode), HP PCL (1 color cartridge), Epson ESC/P, Epson ESC/P2 or above, Epson Stylus C4x, and Epson Stylus C6x. Press ▲ or ▼ to select appropriate printer type and press ENTER to confirm the setting.

4. Print report

User can select to print the report or print the displayed content on the current screen. Press 4 to switch the print mode between “print report” and “print screen”. A small icon "" will appear on the upper right of the screen when print screen is selected. And it will disappear when print report is selected.

3.8.3 Lamps management

User can switch on or off the lamp and set the lamp conversion wavelength by lamps management. In the system settings interface, press 3 to enter the lamps management interface (Fig. 3-22).

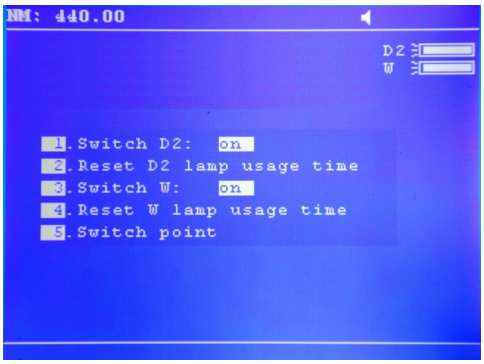


Fig. 3-22

There are five setting items: Switch D2: on/off, Reset D2 lamp usage time, Switch W: on/off, Reset W lamp usage time and Switch point.

1. Switch D2: on/off

Press 1 to switch the deuterium lamp status between on and off.

2. Reset D2 lamp usage time

The system will record the usage time of deuterium lamp automatically. User can reset the usage time to zero as necessary. Press 2, it shows such as “5 hrs used. Are you sure? No”. Press ▼ or ▲ to select Yes or No, and press ENTER to

confirm the setting. User also can press ESC STOP to exit the interface without any operation.

3. Switch W: on/off

Press 3 DEF to switch the tungsten lamp status between on and off.

4. Reset W lamp usage time

The system will record the usage time of tungsten lamp automatically. User can reset the usage time to zero as necessary. Press 4 GHI there shows such as “5 hrs used. Are you sure? No”. Press ▲ or ▼ to select Yes or No, and press ENTER to confirm the setting. User also can press ESC STOP to exit the interface without any operation.

5. Switch point

It’s used for lamp conversion wavelength setting. The valid setting range is between 300nm and 360nm, and the default lamp conversion wavelength is 339nm. Press 5 JKL, there shows “Input the D2/W switch point:”, input the conversion wavelength value as demand and press ENTER to confirm the setting.

☞ For measurement accuracy, please don’t measure just under the coeversion wavelength. Please set the conversion wavelength properly before measurement.

3.8.4 Time setting

User can set the system displaying time. In the system settings interface, press 4 GHI to enter the time setting interface (Fig. 3-23).

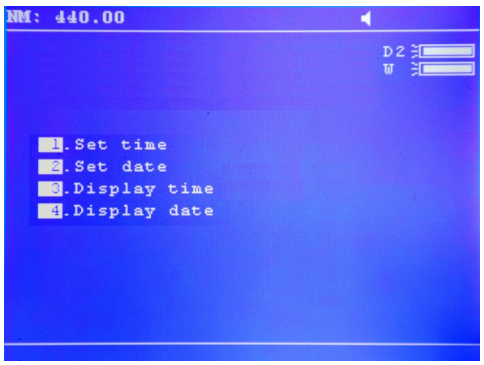


Fig. 3-23

There are four setting items: Set time, Set date, Display time, and Display date.

1. Set time

Press 1, it shows “Please input the time:”. The input format “**.**.**” means hour, minute and second respectively. Input the time values and press ENTER to confirm the setting. The time will be displayed on the upper right corner of the screen with the display format “** : ** : **”.

2. Set date

Press 2 ABC, it shows “Please input the date:”. The input format “**.**.**” means year, month and day respectively. Input the date values and press ENTER to confirm the setting.

3. Display time

User can press 3 DEF to display time, and it will be displayed on the top right corner of the screen.

4. Display date

User can press 4 GHI to display date, it will be displayed on the top right corner of the screen with the format “** - **- **”.

Display time or display date, user can only choose one. If display time is performed, the date won’t display.

3.8.5 Dark current calibration

The dark current may changes when the instrument runs for a long time, or the wavelength is set again, or any other influences. For measurement accuracy, the dark current calibration is necessary before measurement.

In the system settings interface, press 5 JKL to perform dark current calibration.

3.8.6 Photometric accuracy verification

Photometric accuracy verification is performed with the certified sample (with known absorbance or transmittance) to test the photometric validity of the instrument.

In the system settings interface, press 6 to enter the photometric accuracy verification interface (Fig. 3-24).

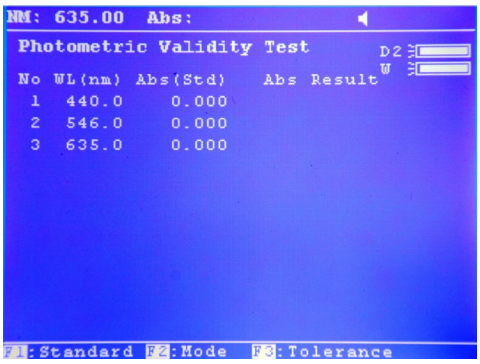


Fig. 3-24

There are three function shortcuts at the bottom of the screen: Standard, Mode, and Tolerance.

Standard: Press F1 to enter the standard setting, it shows “Edit the number... ”, press ENTER, it shows “Input the standard:”, input the standard absorbance or transmittance value and confirm the setting.

Mode: Press F2 to select the test method, it shows “Please select mode:”, press ▲ or ▼ to select the mode, and there are two modes for selection, Abs, and T%.

Tolerance: Press F3 to enter the setup, it shows “Input tolerance:”, input the tolerance value and confirm the setting.

Following are the operation steps for photometric accuracy verification:

Step1: Enter the photometric accuracy verification interface.

In the system settings interface (Fig. 3-20), press 6 to enter the photometric accuracy verification interface (Fig. 3-24).

Step 2: Set the test wavelength.

Press SET λ, it shows “Edit the number... ”, press ENTER, it shows “Please input wl:”, input the value and press ENTER to confirm the setting. Several wavelength points

can be set, accordingly input the next value. Otherwise, press ESC STOP to end the setting.

Step 3: Select the test mode.

Press F2 to enter the mode setup. Press ▲ or ▼ to select Abs or T% as the test mode, press ENTER to confirm the setting.

Step 4: Standard setting.

Press F1 to enter the setting, it shows “Edit the number… ”, press ENTER, it shows “Input standard:”, input the certified value of the standard and press ENTER to confirm the setting. If several wavelength points are set, it shows “Edit the number… ”, press ENTER, it shows “Input standard:”, accordingly input the next value. After completing all the settings, it

shows “Edit the number… ”, press ESC STOP to return to the photometric accuracy verification interface.

Step 5: Tolerance setting.

Press F3 to enter the setup, it shows “Input tolerance:”, input the tolerance value and confirm the setting.

Step 6: Photometric accuracy verification.

Put the reference solution separately into the reference light path and sample light path, press ZERO to calibrate blank. Then replace the reference solution with the certified sample solution only in the sample light path, press START to begin the test. The system will determine the test result (pass or fail) according to the tolerance. At last, all the test date will be recorded (Fig. 3-25).

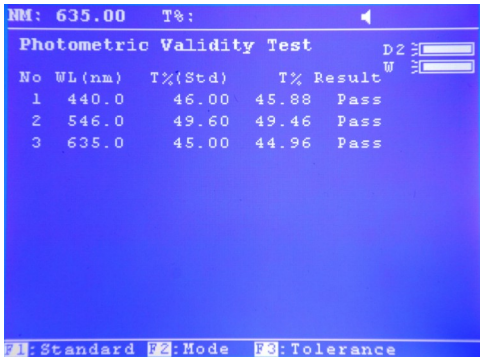


Fig. 3-25

User can do data saving and loading after completing the photometric accuracy verification. In the photometric accuracy verification interface, press SAVE to save test data, and the file will be saved using ".phv" as suffix.

In the photometric accuracy verification interface, press LOAD to perform data loading, just select certain file with the right suffix to be loaded.

3.8.7 Wavelength verification

Wavelength verification is performed with the certified wavelength reference material to test the wavelength validity of the instrument.

In the system settings interface, press 7 PGRS to enter the wavelength verification interface (Fig. 3-26).

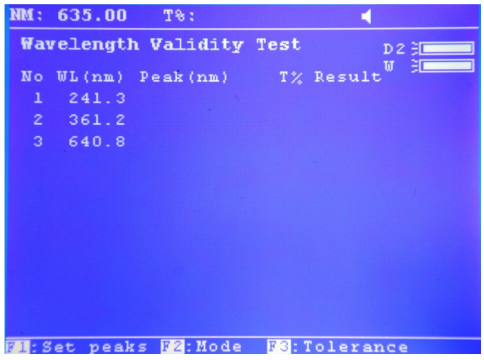


Fig. 3-26

There are three function shortcuts at the bottom of the screen: Set peaks, Mode, and Tolerance.

Set peaks: Press F1 to enter the setup, it shows "Edit the number… ", press ENTER,

it shows “Please input wl:”, make sure the input, then input the next value accordingly. Press ESC STOP to end the setting.

Mode: Press F2 to select the test method, it shows “Please select mode:”, press ▲ or ▼ to select the mode, and there are two modes for selection, Abs, and T%.

Tolerance: Press F3 to enter the setup, it shows “Input tolerance:”, input the tolerance value and confirm the setting.

Following are the operation steps for wavelength verification:

Step1: Enter the wavelength verification interface.

In the system settings interface (Fig. 3-20), press 7 PGRS to enter the wavelength verification interface (Fig. 3-26).

Step 2: Select the test mode.

Press F2 to enter the mode setup. Press ▲ or ▼ to select Abs or T% as the test mode, press ENTER to confirm the setting.

Step 3: Set the reference wavelengths (Set peaks).

Press F1 to enter the setting, it shows “Edit the number… ”, press ENTER, it shows “Please input wl:”, input the value and press ENTER to confirm the setting. The cursor moves to the second row automatically and it shows “Edit the number… ”, press ENTER, it shows “Please input wl:”, input the second wavelength value and press ENTER to conform the setting. Several wavelengths can be set. Accordingly input the next value, otherwise, press ESC STOP to end the setting, and return to the wavelength verification interface.

Step 4: Tolerance setting.

Press F3 to enter the setup, it shows “Input tolerance:”, input the tolerance value and confirm the setting.

Step 5: Wavelength verification.

Press ZERO to calibrate blank without anything in the light path. Then put the wavelength reference material into the sample light path, press START to begin the test. The system will determine the test result (pass or fail) according to the tolerance. At last, all the test date will be recorded (Fig. 3-27).

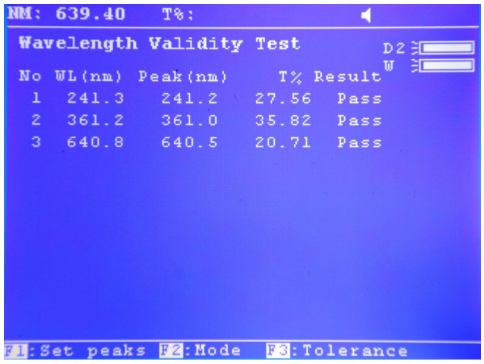


Fig. 3-27

3.8.10 System baseline calibration

System baseline calibration is performed in the whole wavelength range of the instrument. In the system settings interface, press 0 to perform the system baseline calibration. If the beeper is on, the instrument will beep three times after completing the system baseline calibration. And the wavelength will move to the default position 546.0nm.

3.8.11 File system format

In the system settings interface, press F1, it shows “Delete entire files, are you sure? No”. Press ▲ or ▼ to select Yes or No, and press ENTER to confirm the setting. User also can press ESC STOP to exit the interface without any operation.

☞ Once the file system format is performed, all the files will be cleared. To avoid data lost, please perform the operation carefully.

3.8.12 Restore factory default

In the system settings interface, user can press F2 to perform restore factory default.

If the operation is performed, the parameter settings will be restored to factory default. However, the saved data won't be cleared.

User can do data saving and loading after completing the wavelength verification.

In the wavelength verification interface, press SAVE to save test data, and the file will be saved using ".wlv" as suffix.

In the wavelength verification interface, press LOAD to perform data loading, just select certain file with the right suffix to be loaded.

3.8.8 Connect to PC

In the system settings interface, press 8 TUV to perform PC connection.

"Connecting to computer... " will be shown on the screen (Fig. 3-28).

Fig. 3-28

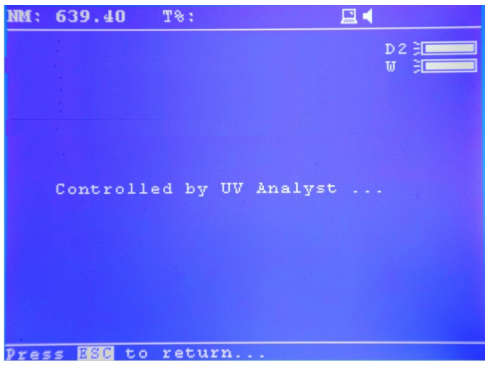


Fig. 3-29

For PC connection, only when PC sends "online" commands in the software interface can it be effectively executed.

"Controlled by UV Analyst..."will be shown on the screen after successfully connecting to PC (Fig. 3-29). User can press ESC STOP to exit PC connecting.

3.8.9 Beeper on/off

In the system settings interface, press 9 to switch the beeper status between on and off.

If the beeper is on, a small icon "" will appear on the upper right of the screen. Otherwise, the small icon will disappear. However, the beeper is on as default setting with each booting.

4. Data retrieval

In the kinetic measurement interface, user can press F4 to perform data retrieval. press ◄ or ► to retrieve the kinetic measurement data point by point. Press ESC STOP to exit the data retrieval.

3.6 DNA/Protein Measurement

Quantitative analysis and purity testing are available by DNA/protein measurement based on the characteristic absorption under ultraviolet radiation.

When the system shows the main interface, press 5 on the key panel to enter the DNA/Protein measurement interface (Fig. 3-16).

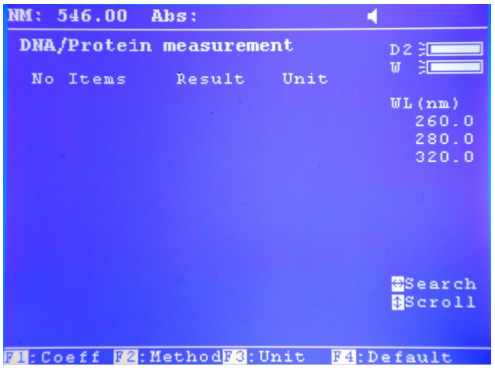


Fig. 3-16

There are four function shortcuts at the bottom of the screen: Coeff, Method, Unit, and Default.

Coeff: Press F1 to enter the coefficients setup, it shows "Input f1=62.90". User can use the default value, or input the setting value, and gradually input the factors f2, f3 and f4 according to the prompts.

Method: Press  to select the test method, it shows “Measurement: Absorbance difference 1”, press  or  to select the test method, and there are two methods for selection, Absorbance difference 1(with the testing wavelengths 260nm and 280nm), and Absorbance difference 2 (with the testing wavelengths 260nm and 230nm). Then shows “With reference: Yes”, press  or  to select Yes or No. If selecting Yes, the measurement will be taken together with the two testing wavelengths and the reference wavelength 320nm.

Unit: Press  to enter the setup, it shows “Please select unit: ”. Press  or  (or  or ) to select the unit, such as mg/L, g/L, ppb, ppm, %, other, IU, mM/L, M/L, ⌣g/mL and mg/mL. If “other” is selected, there further shows “Please input self defined unit:”, user can edit the unit.

Default: Press  to restore the default coefficients values. For the measurement method "Absorbance difference 1", the default coefficients are: f1 =62.90, f2 =36.00, f3 =1552, f4 =757.3, and for the measurement method "Absorbance difference 2", the default coefficients are: f1 =49.10, f2 =3.480, f3 =183.0, and f4 =75.80.

3.6.1 DNA/Protein measurement

Following are the operation steps for DNA/Protein measurement:

Step1: Enter the DNA/Protein measurement interface.

When the system shows the main interface (Fig. 3-2), press  to enter the DNA/Protein measurement interface (Fig. 3-16).

Step 2: Test method selection

Press  to select the test method, it shows “Measurement: Absorbance difference 1”, press  or  to select the test method, and there are two methods for selection, Absorbance difference 1 (with the testing wavelengths 260nm and 280nm), and Absorbance difference 2 (with the testing wavelengths

260nm and 230nm). Then shows “With reference: Yes”, press ▼ or ▲ to select Yes or No. If selecting Yes, the measurement will be taken together with the two testing wavelengths and the reference wavelength 320nm.

Step 3: Coefficients & Unit setting.

Press F1 to enter the coefficients setup, it shows “Input f1=62.90”. User can use the default value, or input own experienced value, and gradually input the factors f2, f3 and f4 according to the prompts.

Then, press F3 to enter the unit setup, it shows “Please select unit: ”. Press ▼ or ▲ to select the unit, or input the self-defined unit, press ENTER to confirm the setting.

Step 4: DNA/Protein measurement.

Put the reference solution separately into the reference light path and sample light path, press ZERO to calibrate blank. Then replace the reference solution with the sample solution only in the sample light path, press START to begin DNA/Protein measurement. The absorbance values and DNA/Protein concentration results will be recorded (Fig. 3-17).

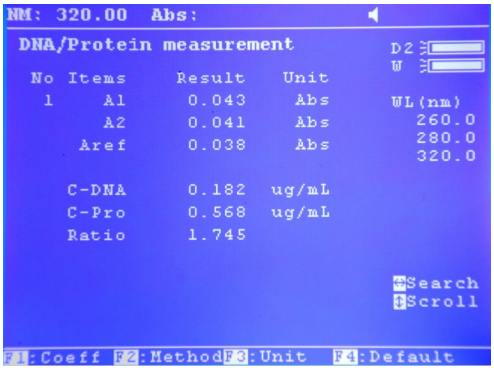


Fig. 3-17

3.6.2 Data processing

User can do data processing such as data saving, loading, and retrieval after completing DNA/Protein measurement.

1. Data saving

In the DNA/Protein measurement interface, press SAVE to save the DNA/Protein measurement data, it shows “Please input File Name:”, input the file name and press ENTER, the file will be saved, use “.dna” as suffix.

2. Data loading

In the DNA/Protein measurement interface, press LOAD, it will show “Open file:”, press ▼ or ▼ (or ◄ or ◄) to select certain file with the right suffix, and the saved data can be load.

3. Data retrieval

In the DNA/Protein measurement interface, the current display only shows one sample record. For more sample records, user can press ▼ or ▲ to browse the sample data one by one. While pressing ◄ or ◄, there shows “Search sample:”, input the testing serial number, and press ENTER to view the designated sample data.

3.7 Multi-wavelength Measurement

Absorbance or transmittance under several wavelengths by one time measurement is available with multi-wavelength measurement.

When the system shows the main interface, press 6 on the key panel to enter the multi-wavelength measurement interface (Fig. 3-18).

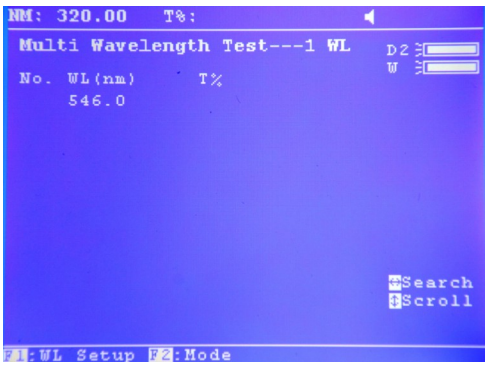


Fig. 3-18

There are two function shortcuts at the bottom of the screen: WL Setup, Mode.

WL Setup: Press  to enter the setup, it shows “Edit the number… ”, press  it shows “Please input wl: ”, make sure the input, then input the next value accordingly. Press  to end the setting.

Mode: Press  to select the mode, it shows “please select mode:”. Press  or  to select the mode, and there are two modes for selection: Abs, T%.

3.7.1 Multi-wavelength measurement

Following are the operation steps for multi-wavelength measurement:

Step1: Enter the multi-wavelength measurement interface.

When the system shows the main interface (Fig. 3-2), press  to enter the multi-wavelength measurement interface (Fig. 3-18).

Step 2: Multi-Wavelength parameters setting

Press  to enter the setup, it shows “Edit the number… ”, press  , it shows “Please input wl: ”, make sure the input, then input the next value accordingly.

Press  to end the setting.

Up to 10 wavelengths point can be set, and the wavelength parameters will be remembered. If user want to reduce wavelength points for next measurement, after entering the wavelength setting, press  first to delete the last wavelength parameters one by one when the system prompting " Edit the number…", then reset the wavelength parameters.

Step 3: Mode selection.

Press  to select the mode, it shows “please select mode:”. Press  or  to select Abs or T% as the measurement mode, press  to confirm the setting.

Step 4: Multi- wavelength measurement.

Put the reference solution separately into the reference light path and sample light path, press  to calibrate blank. Then replace the reference solution with the sample solution only in the sample light path, press  to begin multi-

wavelength measurement. The measurement data will be recorded (Fig. 3-19).

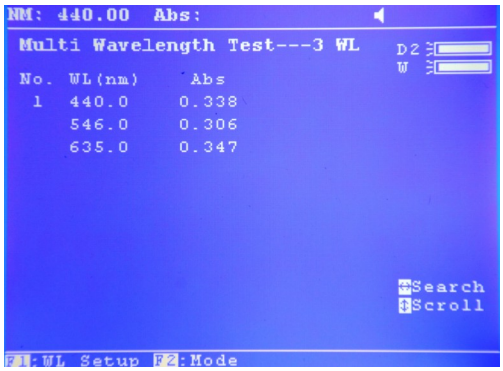


Fig. 3-19

For multi-wavelength measurement, the instrument performs wavelength movement following the setting sequence. If the beeper is on, the instrument will beep three times after completing blank calibration or sample measurement. And it will return to the first wavelength position.

3.7.2 Data processing

User can do data processing such as data saving, loading, and retrieval after completing multi-wavelength measurement.

1. Data saving

In the multi-wavelength measurement interface, press SAVE to save the multi-wavelength measurement data, it shows “Please input File Name:”, input the file name and press ENTER, the file will be saved, use “.mul” as suffix.

2. Data loading

In the multi-wavelength measurement interface, press LOAD, it will show “Open file:”, press ▼ or ▼ (or ◀ or ◀) to select certain file with the right suffix, and the saved data can be load.

3. Data retrieval

In the multi-wavelength measurement interface, the current display only shows one sample record. For more sample records, user can press ▼ or ▼ to browse the sample data one by one. While pressing ◀ or ◀, it shows “Search sample:”, input the testing serial number, and press ENTER to view the designated

sample data.

3.8 System Settings

In the system settings interface, user can carry out wavelength calibration, dark current calibration, photometric accuracy verification, wavelength verification and system baseline calibration. Other operations such as printer setting, lamps management, time setting, beeper setting, file system format, restore factory default, and PC connection are also available.

When the system shows the main interface, press 

on the key panel to enter system settings interface (Fig. 3-20).

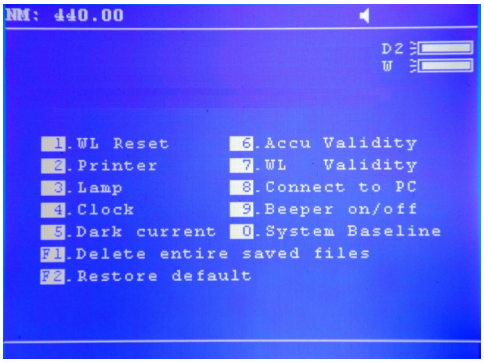


Fig. 3-20

There are twelve operation items shown in the system settings interface: WL Reset, Printer , Lamp, Clock, Dark current, Accu Validity, WL Validity, Connect to PC, Beeper on/off, System Baseline, Delete entire saved files, and Restore default. User can press the corresponding number key or shortcut key to enter the relevant operation interface or directly perform certain operation. In the system settings interface, user can press 

to return to the main interface.

3.8.1 Wavelength calibration

The wavelength calibration is necessary when user doubts that there is a deviation of the wavelength. In the system settings interface, press 

to directly perform wavelength calibration. The system will start the calibration of characteristic wavelength 656.1nm with the deuterium lamp in the instrument. The instrument will beep three times after completing the wavelength calibration. The data will be processed at the same time, and the wavelength will move to the

current set position.

3.4.1 Wavelength scan

Following are the operation steps for wavelength scan:

Step1: Enter the wavelength scan interface.

When the system shows the main interface (Fig. 3-2), press 3 DEF to enter the wavelength scan interface (Fig. 3-13).

Step 2: Select the scanning mode.

Press F2 to enter the mode setup. Press ▲ or ▼ to select Abs or T% as the scanning mode, press ENTER to confirm the setting.

Step 3: Set the scanning parameters.

Press F1 to enter the setting, input the wavelength scanning range respectively with Scan from and Scan to, press ENTER to confirm the setting. Successively press ▲ or ▼ to select the scanning step and scanning speed, press ENTER to confirm the setting and return to the wavelength scan interface. Then, press ▲ or ▼ to set the ordinate, it shows “Min Y: ”, next shows “Max Y: ”. Input the displaying range and press ENTER to confirm the setting.

Scan step can be selected between 0.1nm, 0.2nm, 0.5nm, 1.0nm, 2.0nm and 5.0nm at most. Due to the memory limitation of the system (each scanning curve with 1001 data at most), it provides a reasonable scan step for selection according to the actual wavelength scanning range. And there are three scanning speeds for selection, HI, MEDIUM, and LOW.

Step 4: Sample scanning.

Put the reference solution separately into the reference light path and sample light path, press ZERO to calibrate baseline. Then replace the reference solution

with the sample solution only in the sample light path, press START to begin sample scanning, and the spectrum will be shown at the same time.

The scanning sequence is from the maximum wavelength to the minimum wavelength. If the beeper is on, the instrument will beep three times after completing the baseline calibration and sample scan, and it will return to the maximum wavelength at the same time.3.4.2 Data processing

User can do data processing such as data saving, loading, retrieval and spectrum smoothing after completing wavelength scan.

1. Data saving

In the wavelength scan interface, press SAVE to save the scanning data, it shows "Please input File Name:", input the file name and press ENTER, the file will be saved, use ".wav" as suffix.

2. Data loading

In the wavelength scan interface, press LOAD, it will show "Open file:", press ▼ or ◄ (or ► or ◄) to select certain file with the right suffix, and the saved data can be load.

3. Data retrieval

In the wavelength scan interface, user can press F3 to enter the data retrieval interface. Press F1, it shows "Please input peak height:", input the value and press ENTER, then press ▼ or ◄ to search the peak. User also can press ► or ◄ to retrieve the scanning data point by point. Press ESC STOP to exit the data retrieval.

The peak height retrieval is only available with absorbance mode and the spectrum should contain obvious characteristic peaks.

4. Spectrum smoothing

In the wavelength scan interface, user can press F4 to perform spectrum smoothing, and it will directly show a smoothed spectrum. If pressing F4 several times, it will perform spectrum smoothing several times.

3.5 Kinetic Analysis

A curve of absorbance or transmittance at a specific wavelength in certain time range is available with kinetic analysis, and the variation tendency of a sample can be analyzed.

When the system shows the main interface, press 4 on the key panel to enter the kinetic measurement interface (Fig. 3-14).

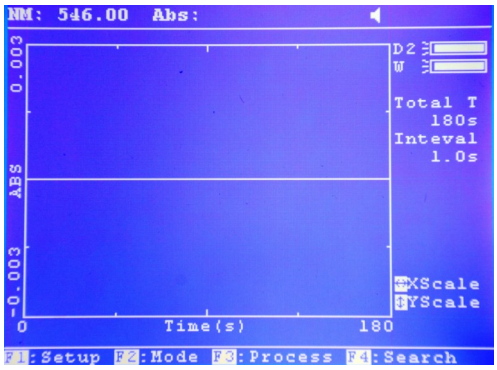


Fig. 3-14

There are four function shortcuts at the bottom of the screen: Setup, Mode, Process, and Search.

Setup: Press F1 to enter the setup, it shows “Total Time:”, make sure the input, and shows “Delay Time:”, make sure the input, then shows “Time interval:”, press ▼ or ▲ (or ◄ or ►) to select the time interval.

Mode: Press F2 to select the mode, shows “Please select mode:”, press ▼ or ▲ to select the mode, and there are two modes for selection, Abs, and T %.

Process: User can press F3 to perform data processing after completing the kinetic measurement, it shows “Begin Time:”, make sure the input, and shows “End Time:”, make sure the input, then shows “Factor:”, make sure the input and the value I.U. will be calculated (the calculation formula is I.U.=Factor×ΔA/min) and displayed on the right of the screen.

Search: After completing the kinetic measurement, press F4 to perform data

retrieval. User can press or to retrieve the kinetic measurement data point by point.

3.5.1 Kinetic measurement

Following are the operation steps for kinetic measurement:

Step1: Enter the kinetic measurement interface.

When the system shows the main interface (Fig. 3-2), press to enter the kinetic measurement interface (Fig. 3-14).

Step 2: Select the kinetic measurement mode.

Press to enter the mode setup. Press or (or or) to select Abs or T% as the measurement mode, press to confirm the setting.

Step 3: Set the measurement wavelength.

Press , it shows “Please input wl:”, input the value and press to confirm the setting, the instrument will move wavelength to the designated spot.

Step 4: Set the kinetic measurement parameters.

Press to enter the setting, input Total Time and Delay Time, then press or to select the time interval, press to confirm the setting and return to the kinetic analysis interface. Then, press or to set the ordinate, it shows “Min Y: ”, next shows “Max Y: ”. Input the displaying range and press to confirm the setting.

The maximum of Total Time is 30000s. The Time interval can be selected between 0.5s, 1.0s, 2.0s, 5.0s, 10s, 30s and 1min. Due to the memory limitation of the system (each kinetic measurement with 4000 data at most), it provides a reasonable time interval for selection according to the total time.

Step 5: Kinetic measurement.

Put the reference solution separately into the reference light path and sample light path, press to calibrate blank. Then replace the reference solution with the sample solution only in the sample light path, press to begin kinetic measurement, and the kinetic curve will be shown at the same time.

If the beeper is on, the instrument will beep three times after completing the kinetic measurement, and it will return to the maximum wavelength at the same time.

04 Maintenance

4.1 Maintenance

BSDBU-202 series UV/Vis Spectrophotometer is a precise optical instrument. It was assembled and debugged carefully before delivery. However, appropriate maintenance will not only guarantee its reliability and stability, but also prolong its service life. Correct use is the best maintenance. In addition to previously mentioned installation requirements, following tips also should be noticed in daily use.

(1) Before switching on the power, make sure that neither sample in the sample compartment nor any other block in the light path, and the cell holder position is all right, to avoid error during the self-checking.

(2) Please carefully load the solution into the cuvette, and the height is better no more than 2/3 of the cuvette. Try to avoid the bubble generation, for the bubble on the inner surface of the cuvette or in the solution will affect the measurement result. Please wipe off the solution that residue on the outer surface of the cuvette in time. To measure volatile samples, using with cuvette cover is suggested. Try to avoid contamination to the cell holder, otherwise, wipe off the residue solution on the cell holder promptly.

(3) Don’t touch both the two optical surfaces of the cuvette with your fingers, for the fingerprint will absorb the light and furtherly affect the measurement accuracy. Please handle the cuvette gently, for it is frangible. Clean the cuvette properly. Improper cleaning or without enough clean also will affect the measurement accuracy, even cause unstable result.

(4) Whether placing or removing the sample, please close the lid of the sample compartment in time during the measurement. Please remove the sample from

the sample compartment promptly after completing the measurement, check that there is no residue in the sample compartment and keep it dry. Any solution sample or residue left in the sample compartment may cause damage to parts of the instrument such as filter turning moldy, some components be corroded. Please open and close the lid gently. (5) To prolong the service life of the lamp, switching off the idle lamp during the measurement is suggested. Please switch off the instrument and disconnect the plug in time, to prevent possible damage from thunderstorms.

(6) Be careful in the transport. Don't place heavy object onto the instrument, to prevent the light path shift which will furtherly affect the instrument stability and measurement accuracy.

(7) Don't disassemble the cover and the inner parts of the instrument without authorization, especially for the optical parts. Don't loosen the tightening screws and nuts at will. All optical surfaces including the light sources can't be touched by hand or any other objects. Otherwise, it may affect the normal operation even cause damage.

(8) Keep the instrument surface and the working environment clean. For the surface of the cover deals with painting process, please don't clean the cover with organic solutions such as alcohol, gasoline and ether. If the instrument is not in use, user can cover the instrument with clean cloth or dust cover to avoid dust accumulation.

(9) A long time not in use should be avoided, and regular boot is suggested to guarantee the normal operation. In the high temperature and humidity area, user should pay more attention to keep away from moisture.

The system error may accumulate after transport, moving, and using for a period of time. When the measurement data differs greatly from the experienced value, or any above situation occurs, the dark current calibration and wavelength calibration are suggested to be done.

4.2 Fuse Replacement

Danger! Be sure to switch off the power and unplug the socket before replacement!

Following are the steps of replacing the fuse.

Step 1: Power off and unplug the power cord from the instrument.

Step 2: Take out the fuse holder by a 3*75 flat screwdriver with blade, remove the broken fuse from the working position and replace it with the spare fuse (Fig. 4-1, Fig. 4-2).

Fig. 4-1

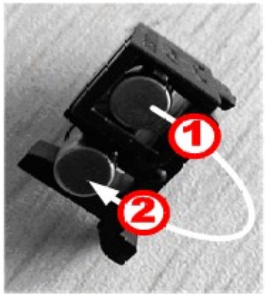


Fig. 4-2

Step 3: Fit the fuse holder back to the position.

4.3 Lamps Replacement

Danger! Be sure to switch off the power and unplug the socket before replacement!

Caution to high temperature ! Wait 20 minutes before open the lamp chamber after power off to avoid scald!

4.3.1 Deuterium lamp replacement

Following are the steps of replacing deuterium lamp.

Step 1: Power off and unplug the power cord from the instrument.

Step 2: Remove the four screws on the sides of the spectrophotometer.

Step 3: Remove the cover of the instrument very carefully and place it backside the instrument.

Step 4: Unscrew the four screws on the bottom sides of the lamp chamber cover, and remove the lamp chamber cover.

Fig. 4-3

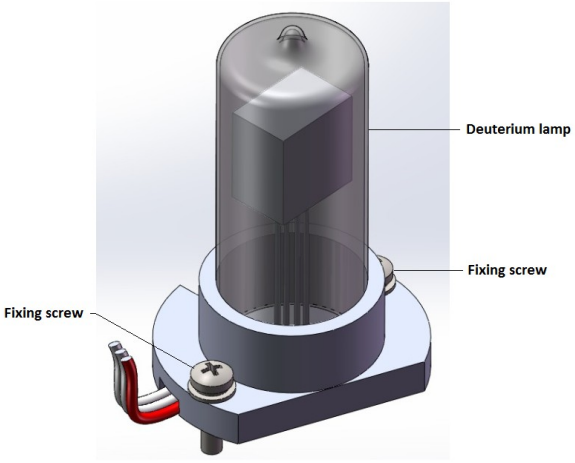


Fig. 4-4

Step 5: Disconnect the three leads of the deuterium lamp (Fig. 4-3) from the circuit board, unscrew the two fixing screws (as shown in Fig. 4-4) and remove the deuterium from the base of lamp chamber (Fig. 4-5). Then fix the new lamp onto the right position and connect its three leads to the circuit board.

The deuterium lamp is pre-aligned, there's no need to re-adjust the position. However, the facula should focus on the center of the slit (Fig. 4-6).

Do not handle the lamp with bare fingers. Use clean tissue or cloth when handling lamp.

Step 6: Switch on the power, it's just ok when the deuterium lamp lighting up well.

Step 7: Power off. Reinstall the lamp chamber cover and tighten the screws. Then reinstall the instrument cover. Be sure to prevent any wires from being pinched in the process.

Step 8: Reinstall the four screws on the sides of the spectrophotometer.

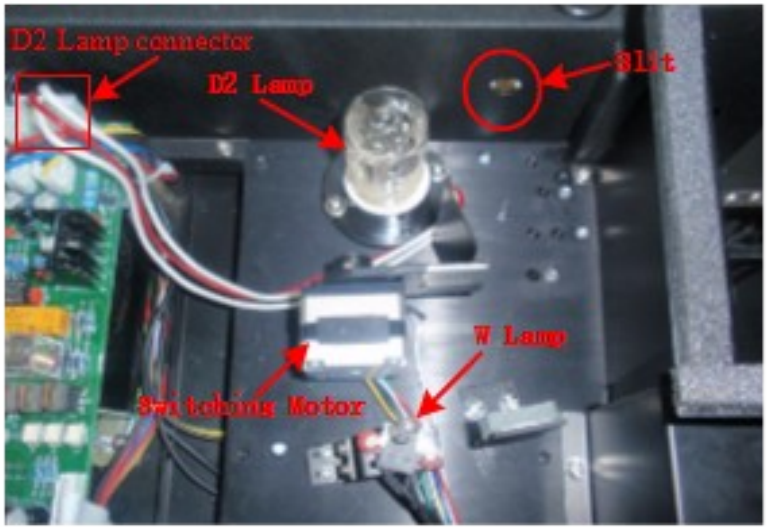


Fig. 4-5

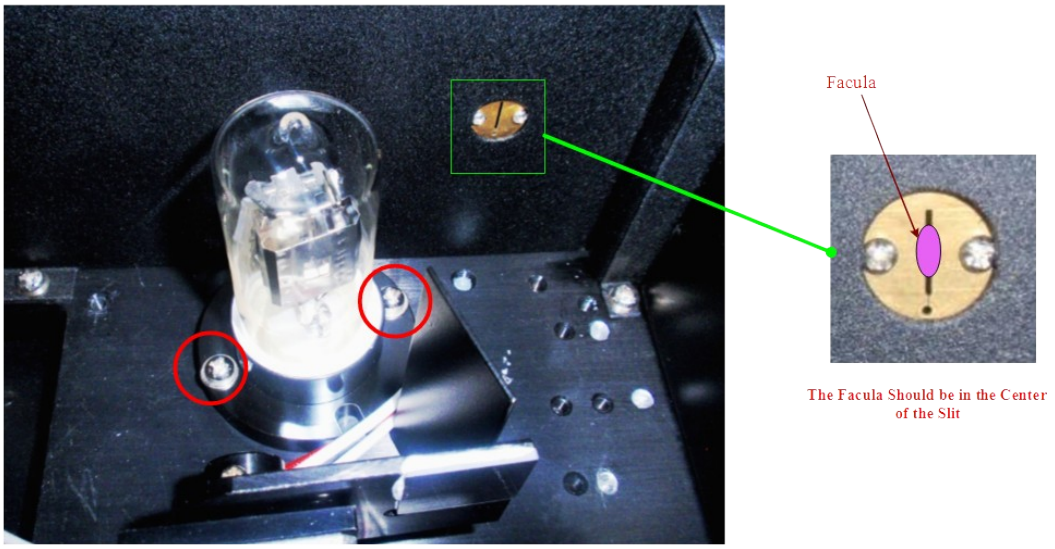


Fig. 4-6

4.3.2 Tungsten halogen lamp replacement

Following are the steps of replacing tungsten halogen lamp.

Step 1: Power off and unplug the power cord from the instrument.

Step 2: Remove the four screws on the sides of the spectrophotometer.

Step 3: Remove the cover of the instrument very carefully and place it backside the instrument.

Step 4: Unscrew the four screws on the bottom sides of the lamp chamber cover, and remove the lamp chamber cover.

Step 5: Unplug and remove the tungsten halogen lamp (Fig. 4-7) from ceramic base (the white connector). Insert the new lamp by pushing it in as far as it will go (4-8).

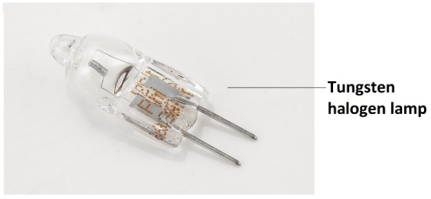


Fig. 4-7

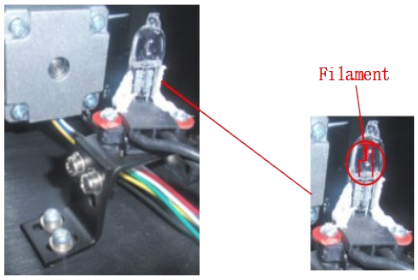


Fig. 4-8

Do not handle the lamp with bare fingers. Use clean tissue or cloth when handling lamp. There's no difference in polarity of the two legs of tungsten

halogen lamp.

Step 6: Switch on the power, observe the entrance facula, it should be focused on the center of the slit. If the facula is deviated to left or right, then loosen the No.2 screws (as shown in Fig.4-9) and move the lamp seat to left or right until it focus on the center of the slit. Then fix the screws. If the facula is deviated to up or down, then loosen the No.1 screws (as shown in Fig.4-9) and move the lamp seat up or down until the facula focus on the center of the slit. Then fix the No. 1 screws again.

Step 7: Power off. Reinstall the lamp chamber cover and tighten the screws. Then reinstall the instrument cover. Be sure to prevent any wires from being pinched in the process.

Step 8: Reinstall the four screws on the sides of the spectrophotometer.

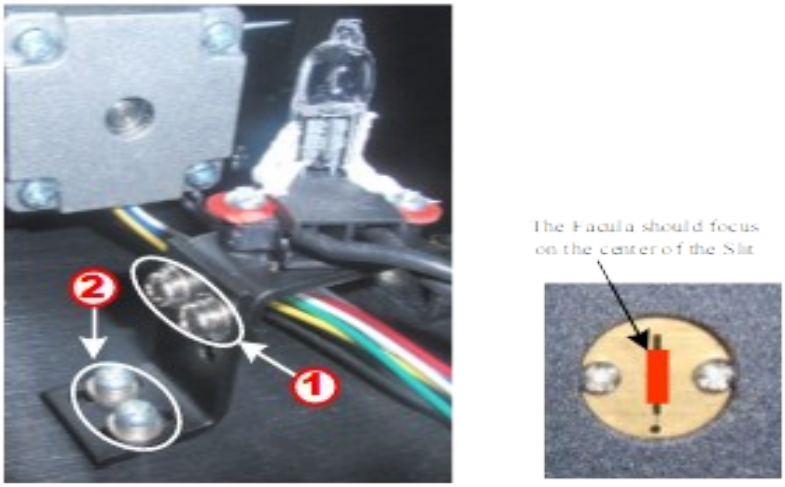


Fig. 4-9

05 Troubleshooting

Each BSDBU-202 series UV/Vis Spectrophotometer is strictly debugged and inspected before delivery. Commonly, it won't appear problems in normal storage, transport and use. However, wrong operation or extreme states, and problems caused by long-term use still can't be avoided, such as the damage of electrical and optical units caused by bad storage and working environment, the damage of vulnerable units or the loosen of the fixing parts caused by improper transport, the lamp exceeds its lifetime, the wastage of electrical units, other troubles caused by wrong operation, and so on.

Please carefully refer to the related instructions before operating the instrument. Troubles and troubleshooting are introduced in following table.

No.	Trouble		Cause	Troubleshooting
1	No response when switching on the power.		1) Power disconnection.	- Check the power supply and power cord, make sure that the power supply is OK and the power cord is connected well.
			2) The fuse is burned.	- Change the fuse.
			3) The switching power supply is damaged.	- Contact the distributor or the factory technical engineer for maintenance.
2	No display or unclear display, however the fan of the power supply unit is running when switching on the power.		1) The control chip or component is damaged.	- Contact the distributor or the factory technical engineer for maintenance.
			2) Bad connection of the display, or the display is damaged.	- Contact the distributor or the factory technical engineer for maintenance or change the display.
			3) The display contrast is not properly adjusted.	- Adjust the controlling knob to appropriate display contrast.
3	System initialization Failure	Low battery voltage	1) Low battery voltage.	- Contact the distributor or the factory technical engineer to replace the battery.

		A/D converter fault.	1) Amplifier circuit fault.	- Contact the distributor or the factory technical engineer for maintenance.
		System positionin g fault	1) Filter position error.	- Contact the distributor or the factory technical engineer for maintenance.
			2) Lamp switching position error.	- Contact the distributor or the factory technical engineer for maintenance.
			3) Slit position error.	- Contact the distributor or the factory technical engineer for maintenance.

No.	Trouble	Cause	Troubleshooting
4	Connecting to PC Failure	1) USB cable is not connected.	- Make sure the USB cable is connected well.
		2) Communication port is occupied.	- Make sure no other software is occupying the communication port
		3) Several workstations run at the same time and cause the computer crashed.	- Log off or reboot the computer and ensure that only the instrument workstation is running
		4) USB key is not inserted	- Make sure the USB key has already inserted
		5) Software mismatched.	- Install and run the right software
		6) Communication port of the computer is damaged.	- Try again on another computer.
5	The reading is not stable when adjusting 100% T or 0.000 Abs.	1) Wrong position of the cell holder causes block to the light path.	- Make sure that the cell holder is in right position.
		2) The pre-warming time is not enough.	- Pre-warming with enough time, no less than 15 min.
		3) The tungsten lamp is exhausted or with bad connection.	- Replace the tungsten lamp with a new one.
		4) Deuterium lamp is exhausted.	- Replace the deuterium lamp with a new one.
		5) Wavelength error.	- Do dark current calibration and wavelength calibration, then, try again.

		6) Light path, or the amplifier and its power supply fault.	- Contact the distributor or the factory technical engineer for maintenance.
6	The sample reading is not stable.	1) The pre-warming time is not enough.	- Pre-warming with enough time, no less than 15 min.
		2) Unstable voltage.	- Contact the distributor or the factory technical engineer for maintenance.
		3) Ambient interference, such as unstable power supply, corrosive gas interference.	- Configure with a steady power supply, keep the instrument from corrosive gas.
		4) Unstable sample.	- For the sample is unstable, measure it as soon as possible. If there is some bubble in the solution, eliminate the bubble or reload the solution. Measure with a cuvette cover for volatile sample.
		5) The cuvette is contaminated and it's too dirty.	- Make sure that the cuvette is clean before measurement.

No.	Trouble	Cause	Troubleshooting
6	The sample reading is not stable.	6) The blank value is much higher, or the sample concentration is too high and the absorbance reading is out of the stable range.	- The absorbance value of the blank solution or reference solution is better below 0.1. Dilute the sample solution properly, and the absorbance value is better between 0.2 and 0.8.
		7) The tungsten lamp or deuterium lamp is exhausted, and the energy is too weak.	- Change the light source.
7	The sample reading is not accurate.	1) Dark current drift.	- Calibrate the dark current, then measure the sample again after blank recalibrating.
		2) Cuvette matching error	- Make sure that the cuvettes matching well.
8	The printer doesn't work, or printing	1) Loosen connection between the	- Make sure the connection between the instrument and

	error.	instrument and the printer.	the printer is well.
		2) The printer model doesn't match.	- Choose the factory specified printer type.

Appendix A

DNA/Protein Test Algorithm

Test Name	Method	Wavelength (s)	Calculations	Parameters	Displayed Units
DNA MEASUREMENT					
DNA/Protein Concentration and DNA purity	Absorbance difference 1 (260,280)	$A_1=A_{260nm}$ $A_2=A_{280nm}$ $A_{ref}=A_{320nm}$ (optional)	DNA concentration: $(A_1-A_{ref})f_1-(A_2-A_{ref})f_2$ Protein concentration $(A_2-A_{ref})f_3-(A_1-A_{ref})f_4$	$f_1=62.9$ $f_2=36.0$ $f_3=1552$ $f_4=757.3$	DNA: µg/ml Protein:µg/ml
	Absorbance difference 2 (260,230)	$A_1=A_{260nm}$ $A_2=A_{230nm}$ $A_{ref}=A_{320nm}$ (optional)	DNA concentration: $(A_1-A_{ref})f_1-(A_2-A_{ref})f_2$ Protein concentration $(A_2-A_{ref})f_3-(A_1-A_{ref})f_4$	$f_1=49.1$ $f_2=3.48$ $f_3=183$ $f_4=75.8$	
	Absorbance ratio	$A_1=A_{260nm}$ $A_2=A_{280nm}$ or A_{230nm} $A_{ref}=A_{320nm}$ (optional)	$\text{Ratio}=\frac{A1-Aref}{A2-Aref}$	None	No units(ratio)

Appendix B

A number of correction techniques can be used to eliminate or reduce interference errors. In general, if the source of the error is known and is consistent from sample to sample, the error can be eliminated. On the other hand, if the source is unknown and varies from sample to sample, the error can be reduced but not eliminated. Correction techniques can always require data from at least two wavelengths. The more sophisticated correction techniques require multi-wavelength or spectral data.

A.1 Isoabsorbance

When a known interfering component with a known spectrum is present, the error introduced by this component at the analytical wavelength for the target analyte can be eliminated by selecting a reference wavelength at which the interfering compound exhibits the same absorbance as it does at the analytical wavelength. The absorbance at this reference wavelength is subtracted from the absorbance at the analytical wavelength, as shown in Figure A1.The residual absorbance is the true absorbance of the analyte.

This technique is less reliable when the spectra of the analyte and of the interferent are highly similar. Moreover, it can correct for only one interference

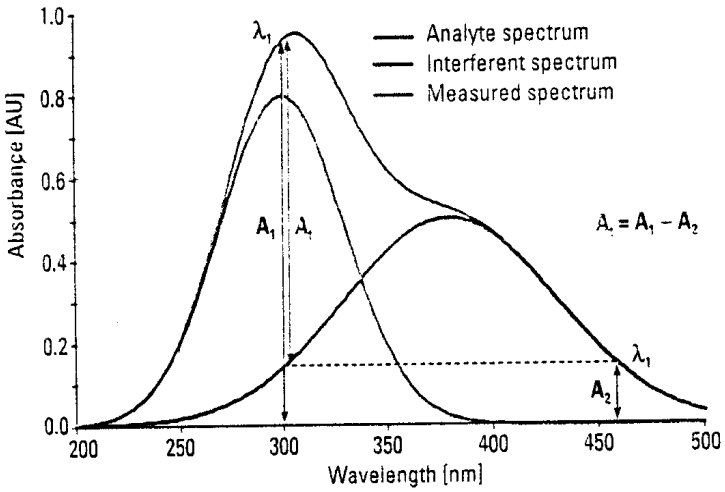


Fig A1 Isoabsorbance correction

A.2 Three-point correction

The three-point, or Morton-Stubbs correction uses two reference wavelengths, usually those on either side of the analytical wavelength.

The background interfering absorbance at the analytical wavelength is then estimated using linear interpolation (see Figure A2).This method represents an improvement over the single-wavelength reference technique because it corrects for any background absorbance that exhibits a linear relationship to the

wavelength. In many cases, if the wavelength range is narrow, it will be a reasonable correction for non-linear background absorbances such as that resulting from scattering of from a complex matrix.

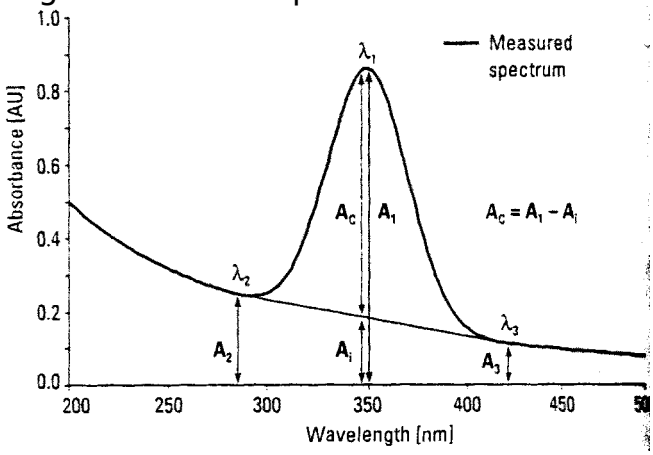


Fig A2

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