Single Beam UV-Visible Spectrophotometer FM-UVS-A101

Index

1. Introduction

Single Beam UV-Visible Spectrophotometer FM-UVS-A101 operates with wavelength range of 200 nm to 1000 nm and spectral bandwidth 4 nm. Equipped with large LCD display and a USB interface which allowsit to plug directly to computer for output results. It uses silicon photodiode detector, deuterium and tungsten lamp as light source which provides best wavelength coverage across working range of spectrophotometer. This single beam spectrophotometer has highly stable optics with 1200 lines/mm grating. System save test results up to 200 group data and 100 standard curves.

2. Features

- ✓ LCD screen (128 × 64 dots)
- ✓ Wavelength range 200 nm to 1000 nm
- ✓ 1200 lines / mm grating optical system
- ✓ Spectral bandwidth 4 nm
- ✓ Wavelength repeatability 1 nm
- ✓ Automatic 0 % transmittance
- ✓ 100 % transmittance calibration
- ✓ Large sample compartment accommodate 5 to 100 mm path length cuvettes
- ✓ High accuracy with digital wavelength display
- ✓ Data restores after sudden power cut
- ✓ Auto setting of wavelength
- ✓ System save test results 200 group data and 100 standard curves

3. Specifications

Model No.	FM-UVS-A101
Wavelength range	200 nm to 1000 nm
Spectral bandwidth	4 nm
Optical system	Single beam, grating 1200 lines/mm
Wavelength accuracy	± 2 nm
Wavelength repeatability	1 nm
Photometric range	T: 0 to 200% , A: (-0.3) to 3, C: 0 to 9999
Photometric accuracy	T: ≤ ±0.5%, A: ±0.003 % @ 1 A
Light source	Tungsten lamp and deuterium lamp
Stray light	0.3 % T
Stability	±0.002 A/h @ 500 nm
Display	LCD (128 × 64 dots)
Standard cell holder	4 position 10 mm cell changer
Sample compartment	Standard 10 mm path length cuvette
Detector	Silicon photodiode
Output	USB port and parallel port (printer)
Power requirement	AC 110 / 220 V, 50 / 60 Hz
Dimensions (W × D × H)	470 × 370 × 180 mm
Weight	14 g

4. Applications

Used in biochemistry, biotechnology, microbiology, chemistry, pharmacy, water testing, environmental andfood science industries for detection of impurities, functional groups, and quality analysis and research.
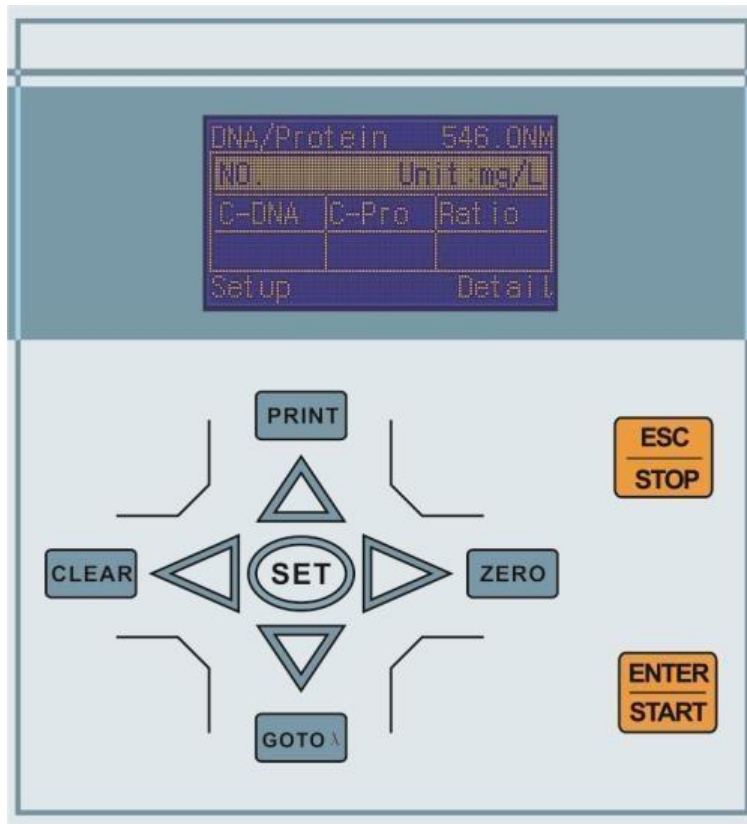
5. Instrument Introduction

Figure-1

5.1 Control Panel

Structure

The spectrophotometer consists of five parts:
1. Halogen or deuterium lamps to supply the light.
2. A monochromator is used to isolate the wavelength of interest and eliminate unwanted second-order radiation.
3. A sample compartment to accommodate the sample solution.
4. Detector to receive the transmitted light and convert it to an electrical signal.
5. A digital display to indicate absorbance or transmittance.
6. The block diagram below illustrates the relationship between these parts.

Light
Source

Monochromator

Sample
Compartment

Detector

Process and
Display
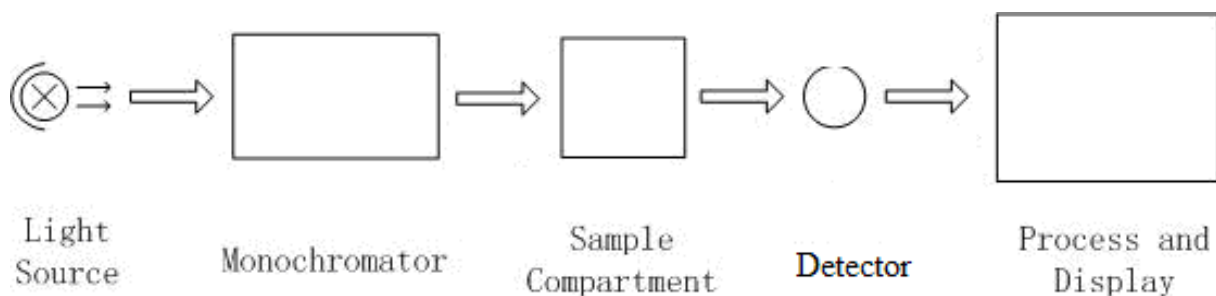
Block diagram for the Spectrophotometer

7. In your spectrophotometer, light from the lamp is focused on the entrance slit of the monochromator where thecollimating mirror directs the beam onto the grating.
8. The grating disperses the light beam to produce the spectrum, a portion of which is focused on the exit slit of the monochromator by a collimating mirror.
9. From here the beam is passed to a sample compartment through one of the filters, which helps to eliminate unwantedsecond-order radiation from the diffraction grating.
10. Upon leaving the sample compartment, the beam is passedto the silicon photodiode detector, which causes the detector to produce an electrical signal displayed on thedigital display.

6. Installation

6.1 Environment Required
    To ensure the best performance, the following conditions are required:
- The best working temperature range is 16-30℃ and the humidity is 45-80%.
- Keep it as far as possible away from the strong magnetic or electrical fields or any electrical device that may generate high-frequency fields.
- Set the unit up in an area that is free of dust, corrosive gases, and strong vibrations.
- Remove any obstructions or materials that could hinder the flow of air under and around the instrument.
- The power requirement is 220±22V@50±1Hz or 110±11V@60±1 Hz。
- Use the appropriate power cord and plug it into a grounded outlet. If the local voltage is not stable enough, a manostate is required.
- Be away from direct sunlight

6.2 Voltage Confirmation
- Be sure to set the instrument's Voltage Switch at your local power supply, or severe damage may occur!
- The Voltage Switch is on the bottom of the instrument. (The default value is 220V, you can see the value on the Voltage Switch)

6.3 Installation

Step 1: Check the packing list
- Unpack the contents and check the materials with the Packing List.
- If any damage or loss is found.

Step 2: Position
Place the instrument on the stable table carefully.

Step 3: Install printer (Optional)
- Make sure the printer is powered off; link the printer's data cable to the instrument's
- parallel port.

Step 4: Link the power cord
Make sure the instrument's power switch is in the Off condition, link the power cord to the instrument and insert another end in the socket provided with a protective earth contact.
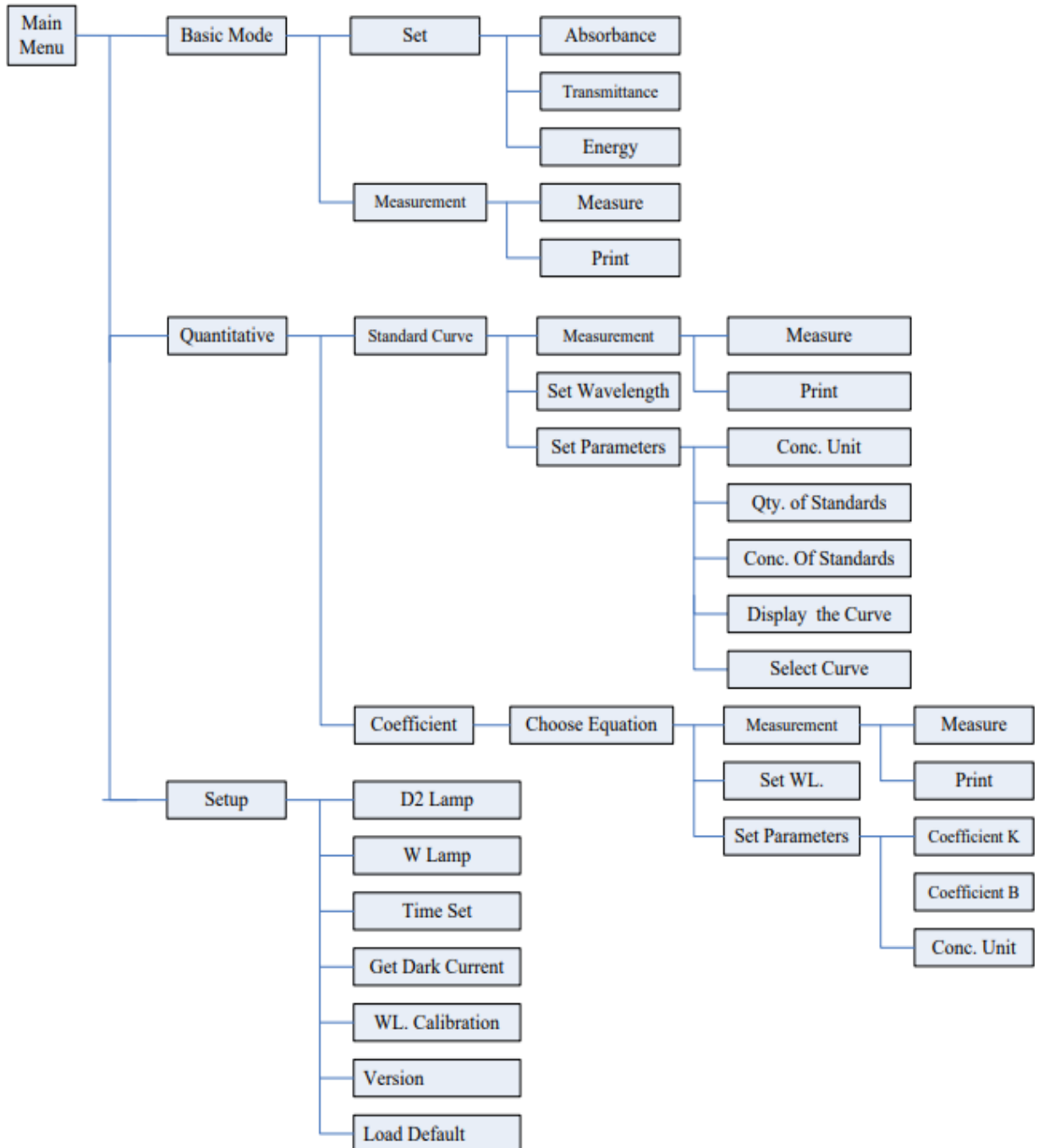
Step 5: Switch on the power
- Check again, and make sure that all the links are right. Switch on the power.
- The instrument can be used to measure after self-test and pre-warm.

7. Operations

7.1 Operation Introduction

1) Software Tree

2) Firmware Functions

The firmware consists of 3 functions: Basic Mode, Quantitative, and System Functions.

1. Basic Mode

Measure the Absorbance, Transmittance, or Energy in a fixed wavelength point. The test result can be stored in the RAM.

2. Quantitative

- **Standard Curve Method**：Set up a standard curve by standard samples; use a new curve to measure the unknown sample's concentration. The curves and the test results can be stored in the RAM.

- **Coefficient Method:** Input the values of the curve equation's coefficient, and then measure theunknown sample's concentration.

3. System Functions (setup)

Light source management; Get Dark Current; Calibrate Wavelength and Set time, etc.

7.2 Basic Operations

1) Choose Photometric Mode

Press the Arrow key to choose and to confirm.

2) Set Wavelength

In the measurement Interface, press to set wavelength, use the arrow

Keyboard to input the value, press it automatically set parameters to confirm and set 100% T/0Abs.

3) Set Parameters

Press to go into the parameter setting interface, and press the arrow

Key to choose the corresponding menu and use the arrow key to input the

 parameter, press to confirm, and press to return.

4) Set the position of the auto-cell holder. (The Auto Cell Holder is optional)

In the measurement Interface, press first, then press the Arrow key of 1-8,

and then the corresponding cell will be positioned at the light path.

5) Delete the Input Value

Press to delete the last character of the input.

6) Delete the test result and stored data

In the measurement Interface, press to delete the test result and stored data.

7) Calibrate 100%T/0Abs
Put the reference in the light path, press ⬚⬚ to calibrate 100%T/0Abs

8) Measure the samples
Put the samples in the light path and press ⬚⬚ to measure.

9) Print the test result
In the Measurement Interface, press ⬚⬚ to print the result.

7.3 Preparation before test

1) Switch on the instrument and begin the system self-test (Diagnostic Program)
- Make sure to remove all the blocks in the light path.
- Close the compartment lid and switch on the power.
- Then the system will begin self-testing.

Note: During the diagnostic program don't open the lid of the compartment.

2) Pre-warm
When the diagnostic program is finished, it goes into pre-warm condition, and 20 minutes is required before measuring.

3) Check the Cuvettes
- The cuvette should be clear and there's no solution remaining on the transparent surface.
- If thewavelength is below 340nm, a **Silicon Cuvette** is a must.

7.4 Measure

1) Basic Mode

Step 1-Go into the Basic Mode interface
In the main menu, use the arrow key to choose "**Basic Mode**", and press to go into the corresponding setting interface.

Basic Mode
○ Basic Mode
○ Quantitative
○ Setup   08:08
                 08/26

ENTER

ESC

Basic Mode
0.000 Abs
500.0 nm
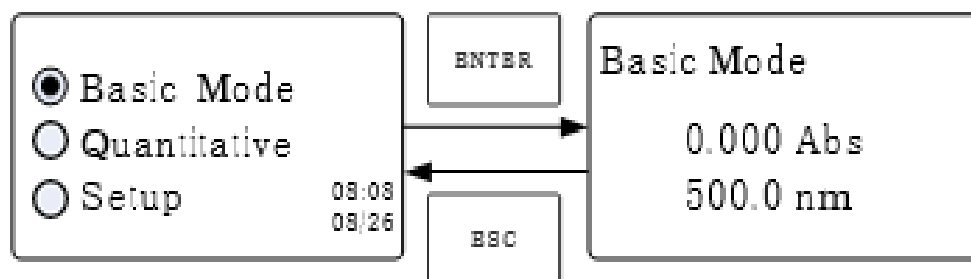
Figure-2

Step 2-Set Wavelength

Press to set Wavelength, input the wavelength value by the Arrow Keypad, then press to confirm.
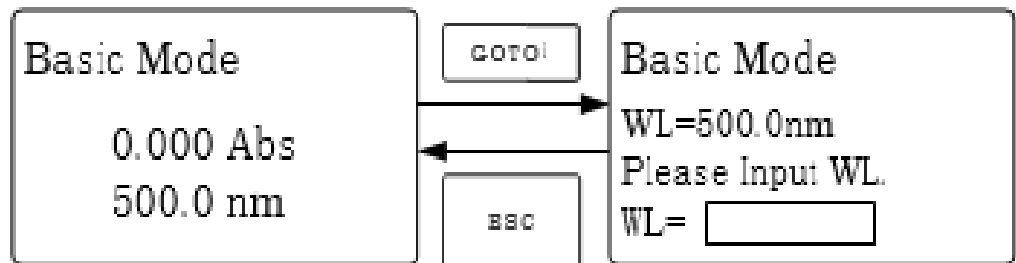
Figure-3

Step 3-Set Photometric Mode

Press the to go into parameter setting interface，press Array Key to select "Abs"、"%T" or "**Energy**" mode，press to confirm press to return.
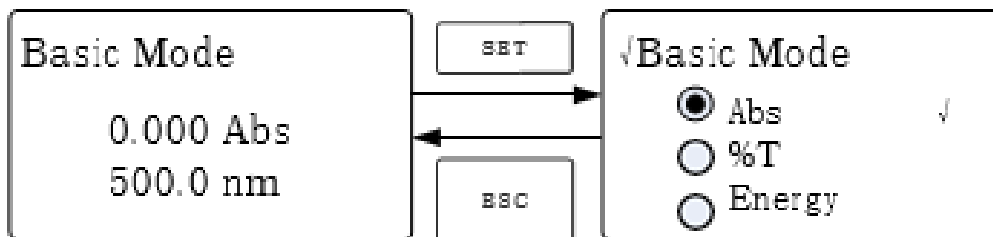
Figure-4

Step 4-Go into the Continuous Measurement Interface
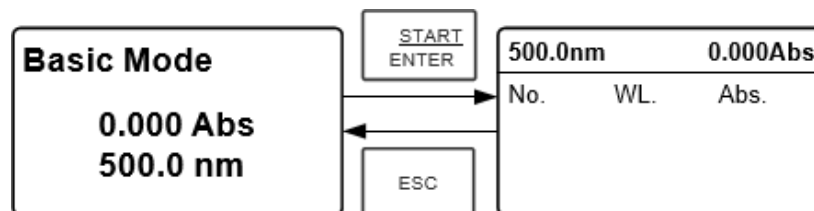
Press to go into the continuous measurement interface.

Figure-5

Step 5-Calibrate 100%T/0Abs

Put the Reference Solution in the light path and press to calibrate 100%T/0Abs.

Step 6-Measure Sample

- Put the unknown concentration sample in the light path, press [START/STOP] to measure, and the result is displayed in the datasheet.
- At the same time, the test result will be stored in the RAM automatically.
- Repeat this step to finish all the sample measurements.

Step 7-Print the data

Press [PRINT] to print the test result.

Step 8-Delete the data

Press [ENTER] to delete the test data.

7.5 Quantitative

Step 1: Go into the Quantitative Interface

In the main menu, press Arrow Key to choose "**Quantitative**"; Press to enter the Quantitative method selecting Interface.
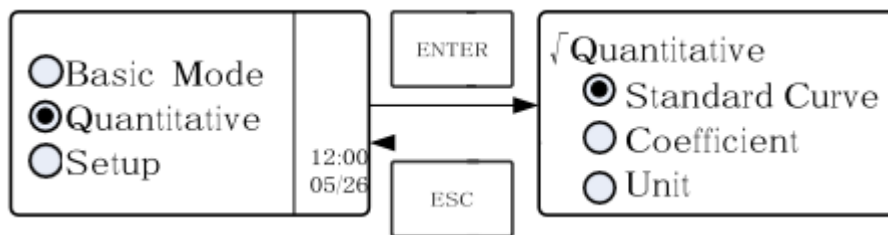
Figure-6

Step 2: Choose Unit

Move the cursor to "Unit" and press to go into the concentration unit choosing interface. Use the Arrow Key to move the cursor on the unit you want, and press to confirm
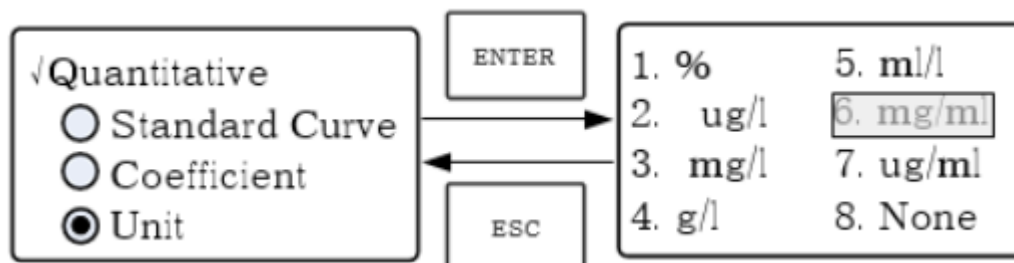
Figure-7

Step 3: Choose Methods

There are two methods to be selected: Standard Curve and Coefficient.

1) Standard Curve:

Go into the "Standard Curve" Interface

In the "Quantitative" menu, press Arrow Key to choose "Standard Curve";

Press [ENTER] to go into the sub-menu. Here you can create a new curve, or users can load a saved curve. If users want to delete a saved curve, just choose "**Delete Curve**".
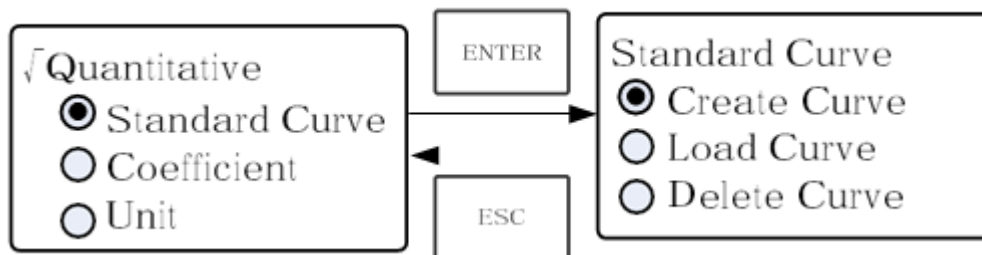

Figure-7

2) Set Wavelength:

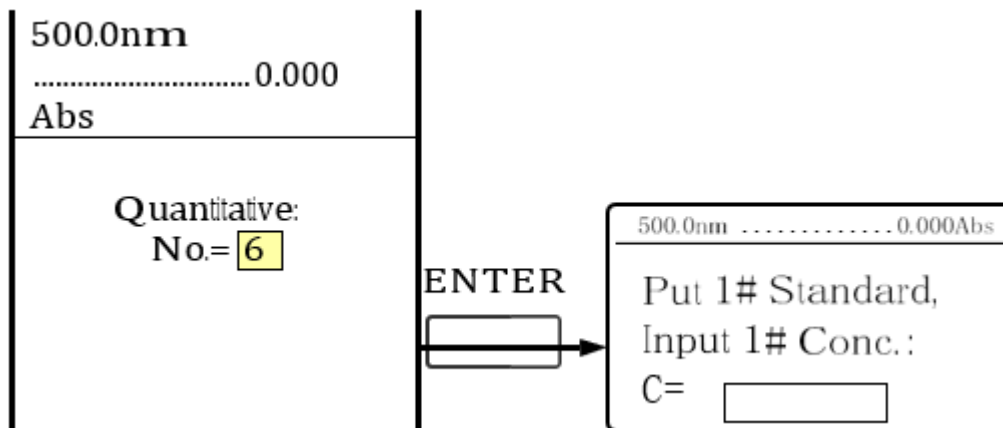Move the cursor to "**Create Curve**", then press [ENTER] to go into the sample quantity setting interface.
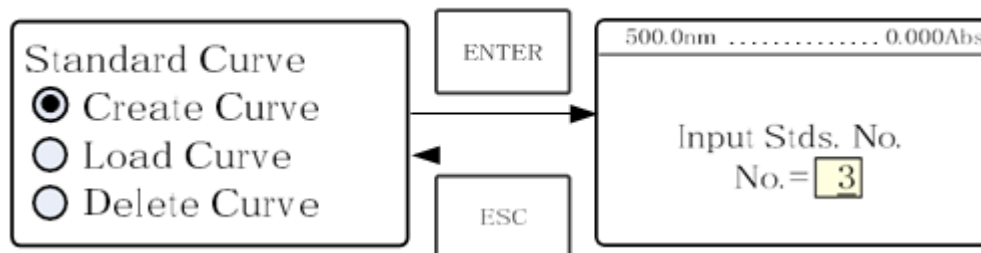
Figure-8

Press [⊟⊟] to go into the wavelength setting interface and input the WL. value by the arrow keypad and press to [⊟⊟] confirm.

500.0nm 0.000Abs

Input Stds No:
No. = 3

GOTO!

Quantitative
WL=500.0nm
Please Input WL.
WL=
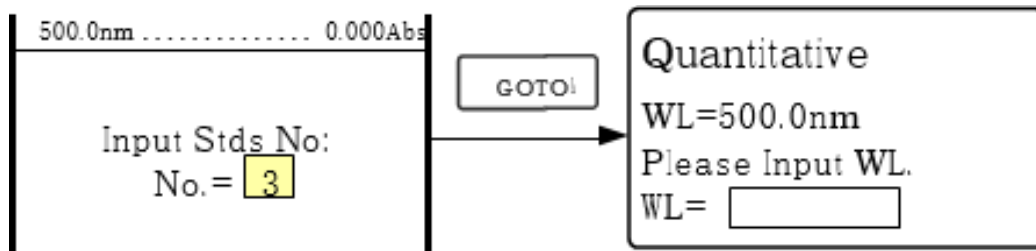
Figure-9

Use the Arrow Key to input the quantity of the standard samples, then press to confirm. The system will go into the following interface.
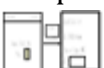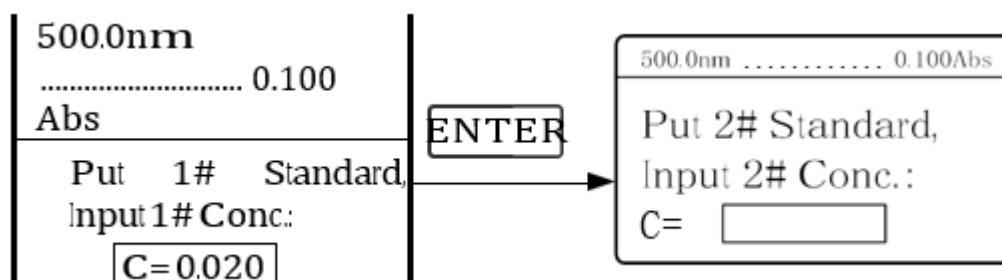
500.0nm
..............................0.000
Abs

Quantitative:
No.= 6

ENTER

500.0nm 0.000Abs

Put 1# Standard,
Input 1# Conc.:
C=

Figure-10

3) **Calibrate 100%T/0Abs**
Put the Reference Solution in the light path then press to calibrate 100%T/0Abs

4) **Input Standard Samples Concentration**
Pull the 1# Standard Sample into the light path and input the value of its concentration by the Arrow keypad,then press to confirm. The system will go into the next interface.

500.0nm
.... 0.100
Abs

Put 1# Standard,
Input 1# Conc.:
C= 0.020

ENTER

500.0nm 0.100Abs

Put 2# Standard,
Input 2# Conc.:
C=

Figure-11

Pull the 2# Standard Sample into the light path and input its concentration, then press to confirm. Repeat the above step till the last sample's concentration is finished, press to confirm. Then the StandardCurve and its equation will display on the screen automatically. At the same time, the curve equation will be saved in the RAM automatically.
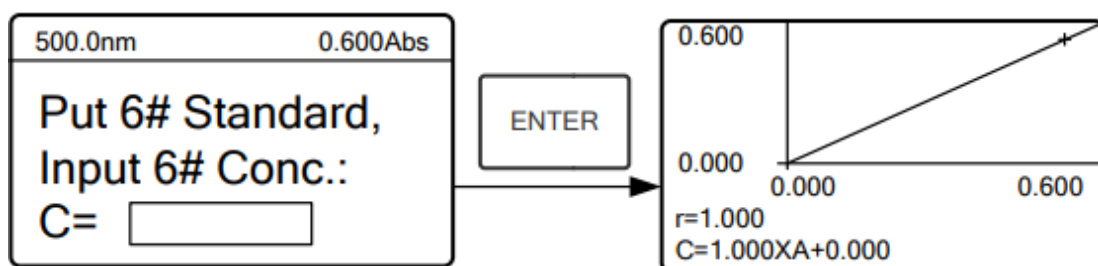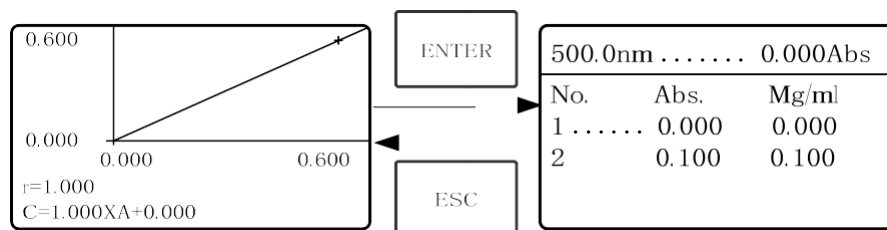

Figure-12

Note: If there's some mistake during the operation, the system will beep 3 times and return the initial interfaceautomatically. Of course, the curve cannot be displayed on the screen.

5) Measure Samples

Pull the Reference solution in the light path and press to go into the continuous measurement interface.

Figure-13

Pull the unknown sample in the light path, then press to measure. The results will be displayed on thescreen one by one. At the same time, the data will be saved in the RAM automatically. A total of 200 groups of datacan be saved.

6) Load Curve

All the curve equations will be saved in the RAM automatically. If users want to reload the saved curve,just follow the following steps:

Move the cursor to "**Load Curve**" and press to confirm. Then the system will go into the curveequation record interface.
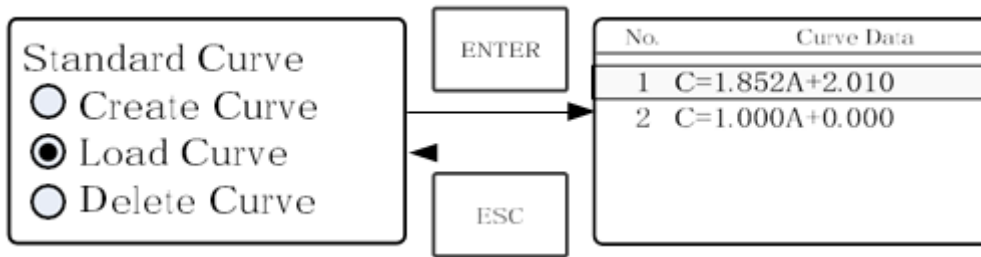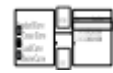
Figure-14

Move the cursor on the equation that you need and press to confirm. Then the corresponding curve will be displayed on the screen.
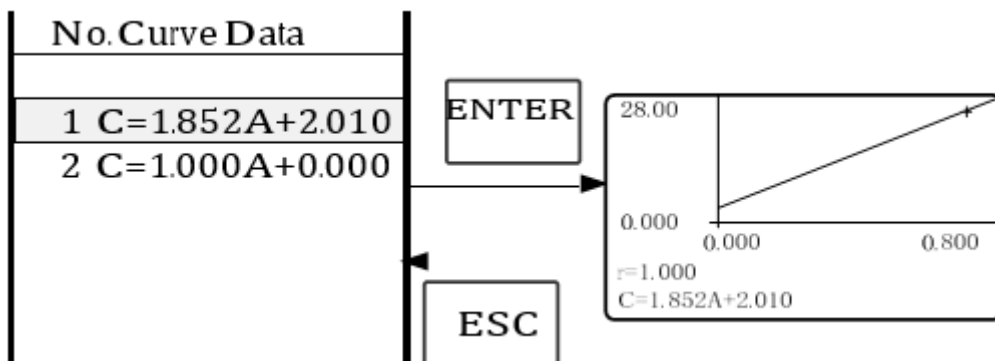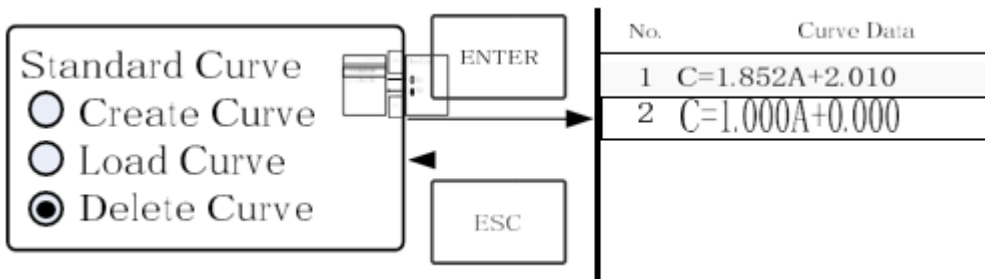

Figure-15

Press [icon] to go into the sample continuous measure interface and measure samples.

Note: When you reload the curves, the wavelength will be set at the point where you create the standard curve automatically.

7) Delete Curve

Move the cursor to "**Delete Curve**" and press to [icon] confirm. Then the system goes into the curve equation choosing interface.

Figure-16

Move the cursor on the curve equation that you don't need again and press it, then the system will ask toconfirm again.
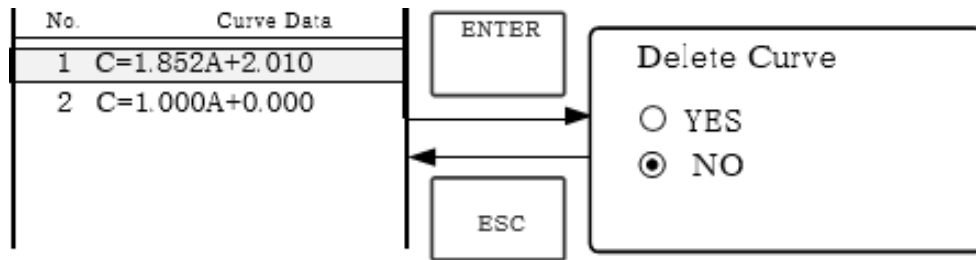

Figure-17

Move the cursor to "**Yes**" and press to confirm, then the curve equation will be deleted. If users don't want to delete it, just choose "**NO**" or press to return.

7.6 Coefficient Method：

Go into the "Coefficient" Method.

Press the Arrow Key to choose "**Coefficient**", and press to go into pre-test interface, then press ⊞ interface.
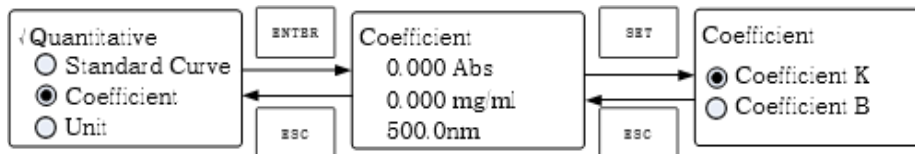

Figure-18

1) Parameter Setting

Use the Arrow Key to move the cursor on "**Coefficient K**" and press ⊞ to go into the K setting interface. Input K and press ⊞ to confirm, the system will return to the former interface automatically.
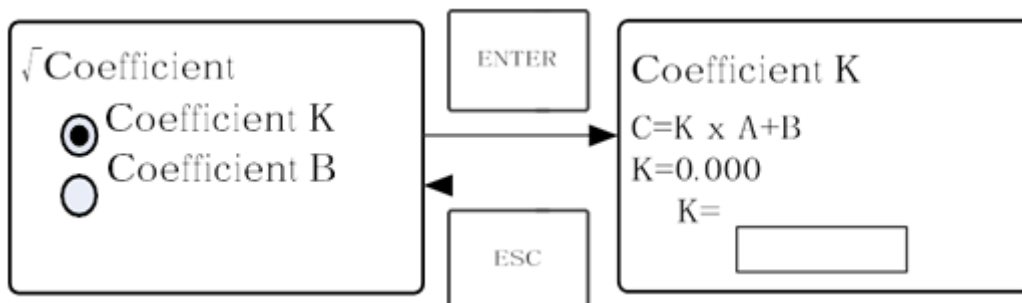

Figure-19

Input the value of Bin the wavelength setting interface and press ⊞ to go back to the pre-test interface.

2) Set wavelength

Press ⊞ to go into the wavelength setting interface, input the wavelength value by the Arrow ⊞ keypad, and press to confirm
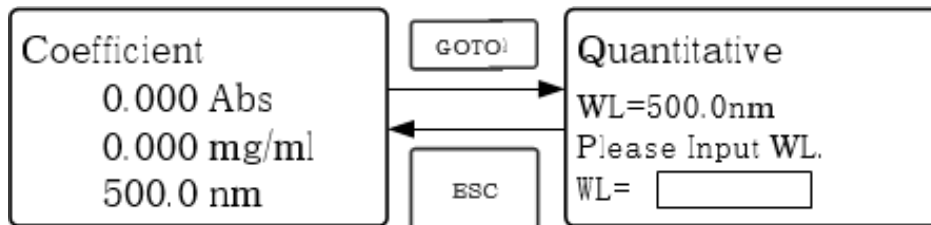
Coefficient
0.000 Abs
0.000 mg/ml
500.0 nm

GOTO⌁   ESC

Quantitative
WL=500.0nm
Please Input WL.
WL=

Figure-20

3) Calibrate 100%T/0Abs

Press ⊞ to go into the continuous measurement interface. Pull the Reference Solution in the light path，then press to ⊞ calibrate 100%T/0Abs.
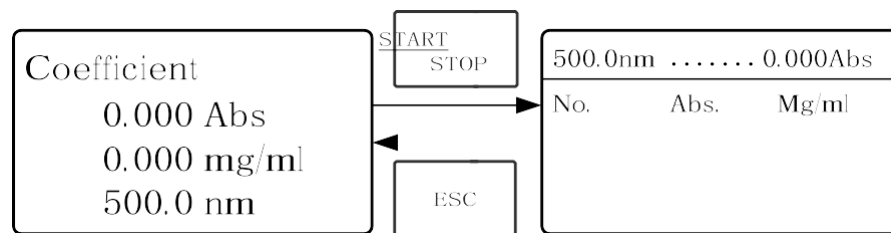
Coefficient
0.000 Abs
0.000 mg/ml
500.0 nm

START STOP   ESC

500.0nm 0.000Abs
No.   Abs.   Mg/ml

Figure-21

4) Measurement

Place the samples to be measured in the light path, press to ⊞ measure，and then the result will be displayed on the screen. Repeat this step to measure other samples. All the test results will be listed on the screen and stored in the RAM automatically. They can be reloaded even after a sudden power cut.

Step 4: Print the test result

In the continuous measurement interface, press ⊞ to print the test result.

Step 5: Delete the test data

In the continuous measurement interface, press ⊞ to delete the test result. delete the test result.

5) SETUP

In the main menu, press Arrow Key to choose **"Setup"** and press [ ] to go into the utility setting interface.
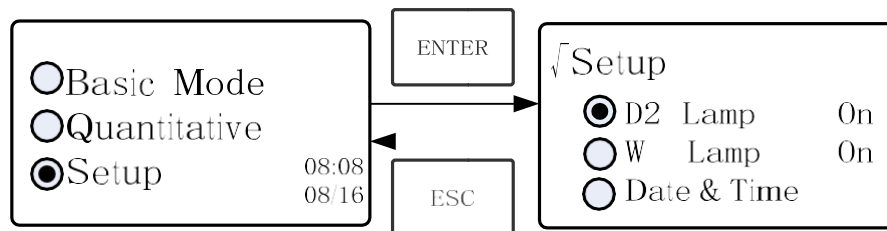

Figure-22

6) Power on/off D2 lamp

When the wavelength point needed is in the range of 340-1100nm, the D2 lamp can be switched off to prolong its lifetime.

Use the Arrow key to choose **"D2 Lamp"** and press [ ] it to go into the D2 lamp setting interface.

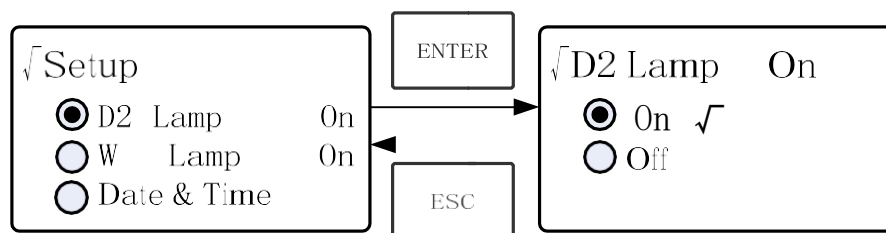Press the Arrow key to choose "**On**" or "**Off**" and press to confirm. Press to return.

Figure-23

7) Power on/off W lamp

When the wavelength point needed is in the range of 190-339nm, the W lamp can be switchedoff to prolong its lifetime

Use the key of Arrow Key to choose "**W Lamp**" and press to [ ] go into the W lamp setting interface. Use the key of Arrow Key to choose "On" or "Off" and press to confirm to return.
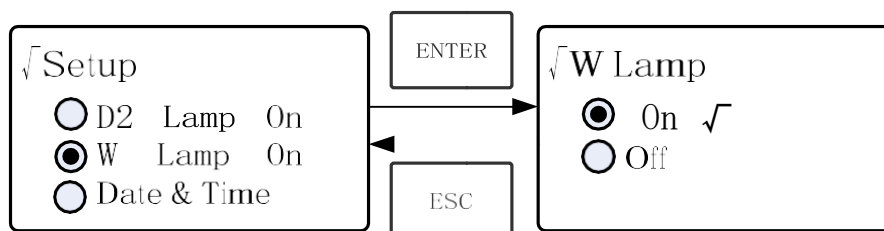

Figure-24

18

8) Set Date & Time

Press the Arrow Key to choose "**Date & Time**" and press to go into the settings interface. Use the Arrow Keyto choose the setting item and input the value by Arrow keypad. （Hour：0-23，Minute：0-59，Second：0-5，Year：0000-9999， Month：1-12， Day: 1-31, Week: 1-7）， press to return.
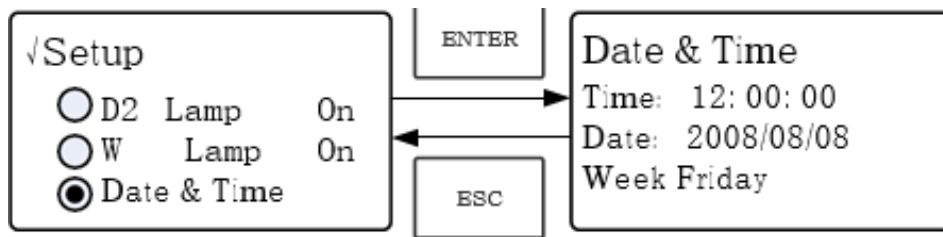
Figure-25

9) Calibrate Dark Current
When the working condition changes, A dark current calibration is required before any measurement.
Use the Arrow key to choose "**Dark Current**" and press to confirm. Note: Remove the cuvettes from the light path before this action, don't open the lid of the compartment during calibration and press to return when it finishes.
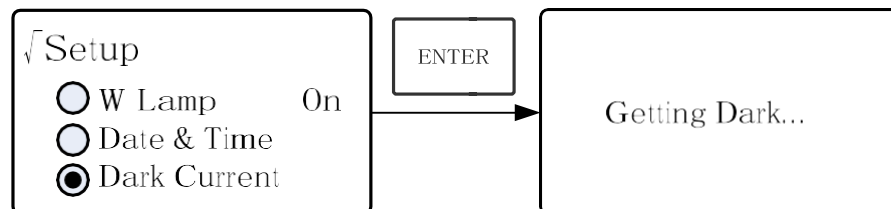
Figure-26

10) Wavelength Calibration

After some time, the energy of the lights would drop off and there will be some but slight influence on the test result. In this case, users can reset the wavelength to compensate. We suggest the users reset the wavelength every one or two months.
Remove all the blocks in the light path and close the lid of the compartment,
Press the Arrow Key to choose "**Calibrate WL**" and press to begin the calibration. The lid of the compartment should not be opened during the calibration. It returns automatically after calibration.
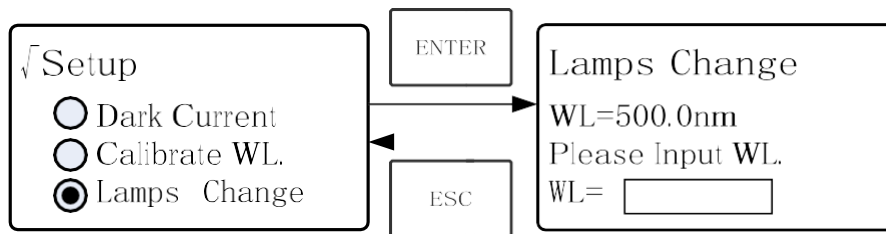
Figure-27

11) **Lamps Change (Input the lamps changing wavelength point)**
The instrument permits the users to set the lamp's changing wavelength point. In the range of300-400nm, users can choose the lamp freely.
Press t h e Arrow Key to choose "Lamp Change" and press it to go into the corresponding setting interface. Input the value of lamps hanging wavelength point by the Arrow keypad（300—400nm），then press to confirm and return.
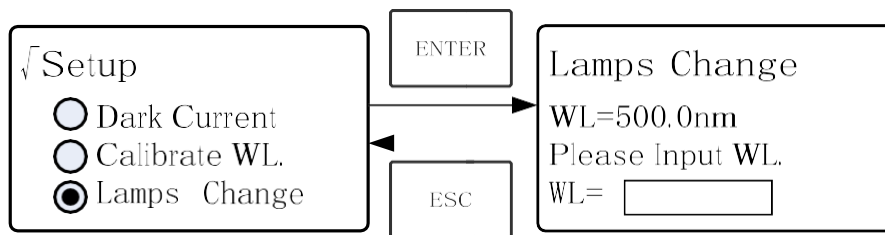

Figure-28

12) **Load Default**
Press Arrow Key to choose "**Load Default**" and press to confirm. press Arrow Key to choose "**Yes**" and press toconfirm. Then the system will recover the default setting when leaving the factory. Choose "**No**" with pressed to cancel the operation and return.

Figure-29

13)   Version

Press the Arrow Key to choose "**Version**" and press to confirm. User will see the version of the software and hardware. Press to return.

Figure-30

Note: For the reason of the update, the version you see on the screen may be different from the above one.

8. Maintenance

Daily Maintain
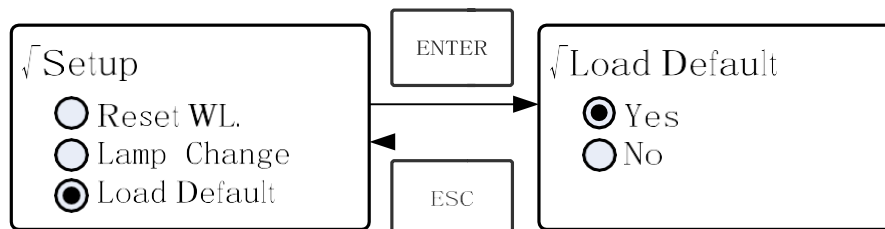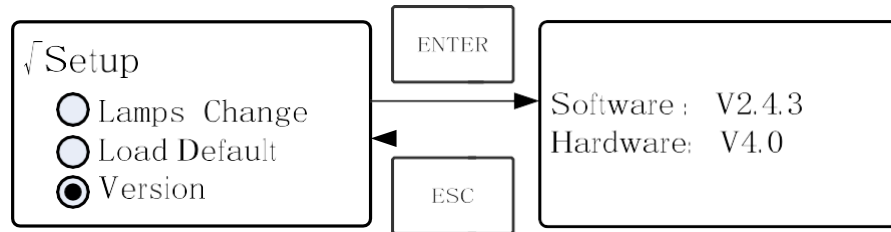
1) **Check the compartment**

   After measurement, the cuvettes with sample solutions should be taken out of the compartment in time. Or the volatilization of the solution would make the mirror go moldy. Users must pay more attention to the corrosive sample and liquid easy to volatilize. Any solution that remains in the compartment should be wiped off immediately.

2) **Surface Clean**

   The cover of the instrument is with paint, use a wet towel to wipe off thedrip on the surface immediately. Organic solution is forbidden to be used to clean the cover. Please wipe off the dirt on the cover timely.

3) **Clean the cuvettes**

   After every test or after a solution change, the cuvettes should be cleaned carefully, or the remains on the surface would cause measuring error.

9. Troubleshooting

Possible Cause	Solution
No power supply	Switch on the power supply
Bad contact in the power supply	Improve the contact
Bad contact with the data cable	Improve the contact
No Stable Reading	
Glass cuvettes used in UV Range	Use Silicon Cuvettes.
No stable Sample	Improve the sample
A much higher sample concentration	Dilute the sample
Low voltage or unstable power supply	Improve the power condition
Lights defect	Replace a new lamp
Light used up	Replace a new lamp
Worse Repeatability	
Unstable sample	Improve the sample
Cuvettes polluted	Clean the cuvettes
Incorrect reading	
Dark Current Error	Re-get the dark current
Worse matching of the cuvettes	Improve the matching of the cuvettes

10. Replacement

Spare part replacement

Replace the Fuse

⚠	**Danger! Be sure to switch off the power and unplug the socketbefore replacement!**

Step 1: Tools preparation

Prepare a 3×75 Flat Blade screwdriver

Step2：Switch Off the power supply

Switch off the power supply and unplug the socket.

Step 3: Take out the Fuse Seat

Take out the fuse seat by the screwdriver.

Figure-31

Step 4: Replace a new fuse

Pick out the spare fuse and replace it to the working position. No enough pre-warmIncrease the pre-warm time.

Figure-32

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