

DW-L3 L5 L6 Series Spectrophotometer
User Manual



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1 Principle, Applications and Features

1.1 Principle

The light absorption of a substance is selective. As a substance is excited by the radiation of light, the light absorption effect will occur in the substance. Each substance has its own special absorption spectrum. When a homogeneous light passes through a solution, the light energy will be lessened, because some of the energy is absorbed by the solution. The loss of energy is in proportion to the concentration of substance.

The series of instruments can perform chemical quantitative analysis on sample substance according to the principle of colorimetry. Within the range of concentration, all parameters are in compliance with the Beer's law:

$$A = \lg \frac{I_0}{I} = KCL \quad T = \frac{I}{I_0}$$

A: Absorbance

C: Concentration of the
substance for measurement

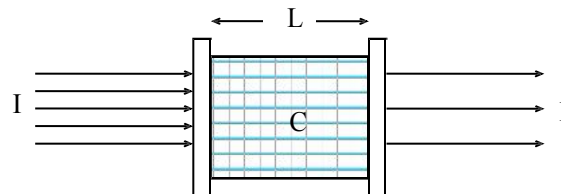
T: Transmittance

L: Length of sample in optical
path

I: Intensity of
transmitting light

K: Absorption coefficient of
sample

I_0 : Intensity of the
incident ray



1.2 Applications

The series of instruments can do quantitative and qualitative analysis for sample substance within the UV and visible spectral range. They are suited to wide applications in pharmaceutical manufacturing, health, clinic test, biochemistry, petrochemical industry, environmental protection, food safety and quality control. Besides, they can be

used for the educational purpose, such as demonstration in class or serve as the common analysis instruments at physical or chemical laboratories in institutes or universities.

1.3 Features

- Large color touch screen
- Highly intelligent operating module and user-friendly interface
- Automatic 100%T and OA
- Simple replacement of light source
- Concentration factor setup and direct reading of concentration
- USB port and UVWin8 PC communication software

2 Specifications and Functions

2.1 Technical Parameters

Model	L6S/L6	L5S/L5	L3S/L3
Optical system	Proportional dual beam, 1,200 lines/mm, holographic grating		
Max. wavelength deviation	±0.3nm	±0.5nm	
Receiving component	Silicon photocell		
Wavelength reproducibility	≤0.2nm		
Transmittance range	0.0% ~ 200.0%		
Absorbance range	-0.301 A ~ 4.000A		
Min. spectrum bandwidth	1.8 nm		

	L6S/L6	L5S/L5	L3S/L3
Stray light	$\leq 0.03\%$ (at 220nm and 360nm)		$\leq 0.03\%$ (at 360nm)
Wavelength range	190nm ~ 1100nm		325nm ~ 1100nm
Light source	Tungsten lamp 12V20W, Deuterium lamp DD2.5		Tungsten lamp 12V20W
Max. transmittance deviation	$\pm 0.3\%$		
Transmittance reproducibility	$\leq 0.15\%$		
Drift	$\leq 0.0009A/0.5h$ (at 500nm after working for 2hrs)(only for L6S L5S L3S)		
Baseline flatness	$\pm 0.002A$ (200 nm~1090nm)(only for L6S L5S L3S)		
Noise	100% line noise $\leq 0.15\%$; 0% line noise $\leq 0.1\%$		

2.2 Specifications

Screen	8 inch
Weight	30kg
Power supply	AC220V±22V, 50Hz±1Hz
Dimensions	700mm×580mm×490mm

2.3 Main functions

Automatic control

- Power on self-test of working status and automatic wavelength calibration;
- Automatic wavelength positioning;
- Automatic filters switching;
- Display and printing of spectrum and data;
- Error message indication;
- Drawing and printing of spectrum graph and data;
- Automatic searching of optimal energy point of light source.

Analyzing, testing, and information processing

- Photometric measurement;
- Spectrum scanning;
- Quantitative analysis;
- Multi-wavelength determination;
- Chemical kinetics measurement;
- Zoom in/out of spectrum graph, saving and recalling of curve;
- Calibration, search and printing of peak value.

3 Installation

3.1 Installation Environment

Place the instrument on a firm and leveled bench. Keep the working environment tidy and clean, free from serious dust.

Together with the instrument working properly, the environment must meet the following requirements:

- Room temperature between 5°C - 35°C, and relative humidity not higher than 85%
- Power supply AC 220V± 22V, 50 Hz±1 Hz, with good earthing (and not share a same socket with other equipment)
- Free of direct sunlight, vibration, strong air flows and erosion by corrosive substances
- Away from strong magnetic fields, electric fields, and electrical devices generating high frequency waves

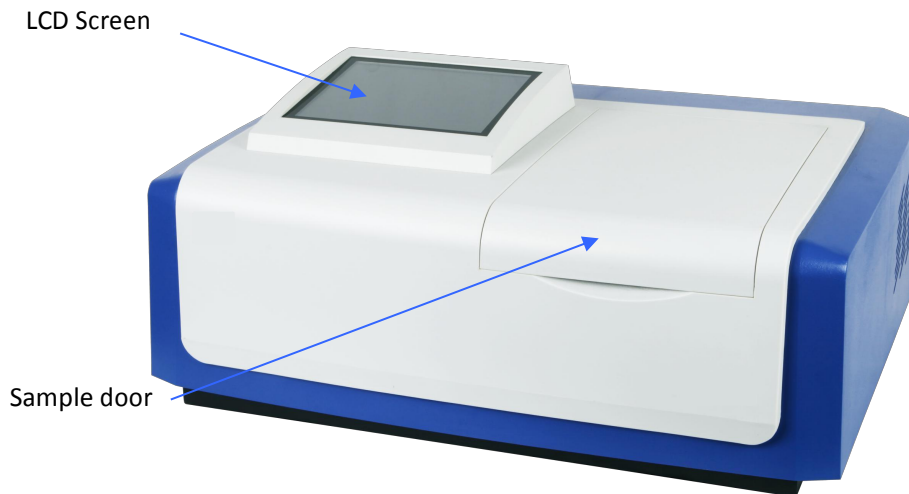
Note: Use AC stabilized voltage power supply of 500W or above in case of any noticeable voltage fluctuation.

3.2 Unpacking and Inspection

Tear off sealing tapes (keep the outer package for later use), and check the main device and accessories according to the packing list. If there is any missing part, please contact local distributor or our company directly.

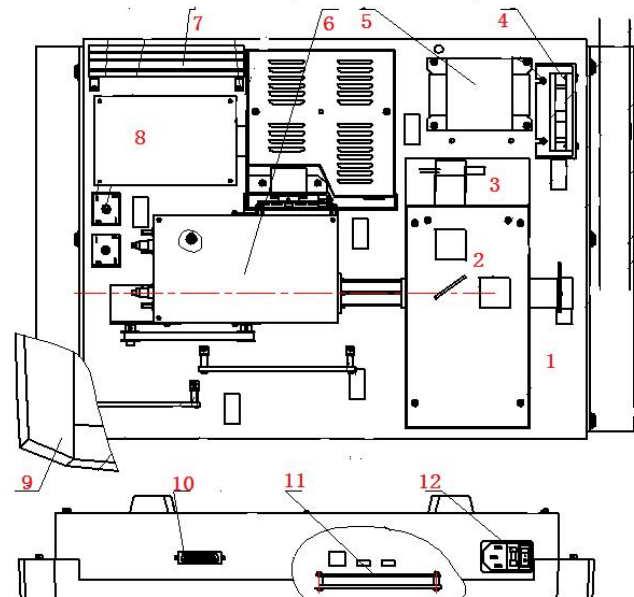
4 Exterior View and System Illustrations

4.1 Exterior View



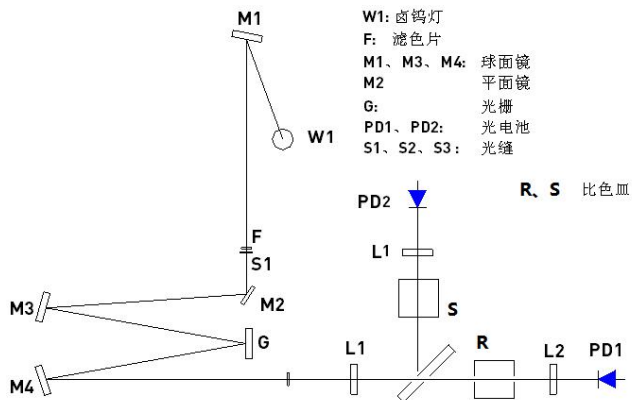
4.2 Interior Structure

- | | |
|------------------|----------------------|
| 1. Backplane | 2. Holder |
| 3. Case | 4. Fan |
| 5. Transformer | 6. Monochromator |
| 7. Radiator | 8. Circuit board |
| 9. Plastic shell | 10. Printer port |
| 11. USB port | 12. Power receptacle |



4.3 System Illustration

4.3.1 Optical System



W1: tungsten lamp

F: filters

M1, M3, M4: spherical mirrors

M2: mirrors

G: grating

PD1, PD2: photocells

S1, S2, S3: slits

RS, S: cell holders

The optical system consists of tungsten lamp (W1), deuterium lamp (D2) and spherical mirror (M1), which reflects the light energy emitted from the tungsten lamp (visible light source) and deuterium lamp (UV light source) and projects it on the incident slit (S1) of the monochromator.

The computer-controlled stepping motor drives mirror M1 to rotate so as to switch the source lamp. The monochrome system consists of incident slit S1 and exiting slit S2, reflector M2 and M3, and grating G, and has M4, M5, M6, M7 and M8 Spectroscopic systems.

In the sample chamber, both sample and reference solution can be placed. Lens L1 and L2 will gather the spots on the cell holder and photocells.

The optical system adopts asymmetric aberration correction C-T arrangement and wavelength change through the sine mechanism to obtain high quality spectral lines. At the exiting slit can get monochromatic spectrum with different wavelengths, which is also known as monochromatic beam.

4.3.2 Circuit system

Circuit system consists of power adaptor, different analog voltage stabilizing circuits, the three-way motor drive circuit, preamplifier, and computer-controlled system power.

Power transformer provides all AC power that the equipment needs.

The voltage stabilizing circuit includes 12V/20W tungsten lamp with constant voltage source, $\pm 15V$ voltage stabilizing working power, +12V DC fan power supply, 12V DC power supply for stepper motor, 5V power supply of large current with stable voltage for computer work, and constant current for deuterium lamp.

This local front-end system has a three-way circuit including photoelectric current amplification, program-controlled gain amplifier and (V/ F) conversion.

Photoelectric detection device adopts high quality silicon battery, which has long service life, shows good endurance and is not easily moistened.

4.3.3 Computer system

The computer system is equipped with high performance ARM processor, which is stable and reliable. It communicates with external computer system via USB interface, equipped with print port. The display is large color LCD touch screen.

5 Basic Operations

5.1 Testing Preparation

5.1.1 Power on and self-test

When the instrument is switched on, the display will show that the system will be preheating for 30 minutes. Press Yes to confirm and the system starts initializing. Without press, the system will enter initialization after preheating for 30 minutes.

Caution: Don't open the door of sample chamber during initialization!

After initialization, the system enters the main menu. Press the icon on the screen to enter the testing functions. In the sub-menu, press the [Menu] on the upper right corner to return the main menu.

5.1.2 Wavelength correction

Through system settings, wavelength correction can be performed, see details in Section 6.6 and 7.4.

5.1.3 Place reference and test samples

Select suitable cuvettes for testing, place reference and test samples on the designated cell holders.

Attention! After self-test is completed, if the user wants to use one lamp only, he can control the deuterium lamp and tungsten lamp through the fifth item [System Settings] from the main menu. In this way, the service life of light source lamp can be prolonged.

6 Application Operations

In this manual, the “[]” means function key, for example, [Display Settings].
The “<>” means tab, for example, <K-coefficient>.

6.1 Photometric Measurement

6.1.1 Monitor Testing

Press [Photometric] from the main function menu on the right hand of the screen to get into the function settings.

◆ **Wavelength:**

Click the input box on the right of Wavelength, a numeric keypad will pop up, key in the value and then press [ENTER]. If the input value is not appropriate for the instrument parameter, the display will show "error" to indicate wrong input. Then input a correct value. When the parameters are set ok, the instrument will automatically make the wavelength to the value as you set.

◆ Analysis Data:

It shows real-time information from testing, and press T%/Abs switch key to view different value. Press the data in the box , a zoom-in window will display to facilitate data view.

[Display Settings] Configure the display of testing results with three or four digits after decimal point.

[T% / Abs] T (transmittance) and Abs (absorbance) switch key.

Otherkeys

[Auto Zero] key to get the baseline resume zero.

Press [Print] key to print the testing results.

6.1.2 Test example

First, set the test wavelength. When all parameters are set ok, use matched cuvettes containing reference and testing samples separately. Open the sample chamber and place the cuvettes on to the cell holder R and S1, and then press **[AUTO ZERO]** button. The screen shows: zero...

The instrument automatically adjusts 0% (dark current) and 100% (full scale). The indication on the screen will disappear when auto zero is finished. Press the right arrow key to move cell holder to S1 position. Now, you will get the information of the analyst of interest. When each analyst of interest is finished with testing, press **[Print]** key to print the testing results.

6.2 Spectrum Measurement

Select [Spectrum] from the main function menu to enter the function settings. Under the <Monitor Test> window, the curve can be directly read out.

The white directory key [←] and [→] on the bottom of the window can display a line vertical to X axis, which is used for fine reading of curve parameters.

Rectangular buttons are for function configurations:

[Parameter Settings] key is to set the parameters.

[Scale Settings] key is to modify scale of curve.

[Peak/Valley Display] key is to view the current valley of the curve.

Square buttons are to perform different operations:

[Baseline Correction] key is to adjust the baseline.

[Test] key is to start testing.

[Access] key is to save the testing curves or call the stored testing curves.

[Print] key is to print the current testing results.

6.2.1 Parameter Settings

- **Measurement Modes:**

There are three options: T (transmittance), ABS (Absorbance), and E (Energy).

If [E] (energy) is selected, press [E] continuously to adjust the rate of preamplifier from 1 to 4.

- **Record Range:**

The recording range is different for different measurement mode. According to your requirement, you can use the box after RecordRange to edit and input. The left box is for the lower limit and the right for upper limit.

Where,	T	Range (-1.00%T - 200.0%T)
	Abs	Range (-0.301A - 4.0000A)
	E	Range (0.000E - 300.0E)

- **Scan Range:**

Click the input box after ScanRange, and a numeric keypad will pop up. With it, input the starting wavelength (in left box) and the ending wavelength (in right box).

- **Scan Speed:**

Three types of speed: Fast, Medium, and Slow.

- **Sampling Interval:**

Five interval options: 0.1nm, 0.5nm, 1nm, 2nm, and 5nm.

- **Scan Times:**

Select according to different requirements. Click the input box after ScanTimes and input 1 to 3.

- **Light Source Options:**

Two light source options: deuterium lamp and tungsten lamp.

6.2.2 Scale Setting

From the pop-up dialogue window, the starting and end point of X and Y axis can be set. Press **[Confirm]** to complete setting.

6.2.3 Peak/Valley Display

Press **[Peak/Valley Display]** to pop up a dialogue box which shows the value of peak and valley.

Select 1 to 5 from the sensitivity option to adjust the sensitivity of peak/valley.

As an appropriate sensitivity is selected, the page will display the peak/valley values of the testing curve under the current sensitivity. Use the previous/next page function to view more data. If the peak/valley data is too much, please lower the sensitivity.

[↑] and **[↓]** keys are to go to the previous or next page.

6.2.4 File List

Press **[Access]** to pop up a dialogue box where you can save testing curve or call stored curve.

[Access]

First, select the location where the file is to be saved, press **[Access]**, and a numeric keypad will pop up. Key in a name for the file, press **[ENTER]**, and the current curve information will be saved. The file name must contain less than 8 characters. If a selected serial number already has a file, the new saved file will overwrite it.

[Read]

Select the location of the file and press **[Read]**. The screen will switch to MonitorTest, and at the same time, the stored curved will be read and shown on the display.

[Download]

The testing data will be downloaded to U drive.

[Delete]

Select the location where the file is saved, press **[delete]**, and the selected file will be deleted.

[Rename]

Select the location where the file is saved, press **[Rename]**, and a numeric keypad will pop up. Key in a new file name, press **[Enter]** to confirm, and the file will have a new name.

6.2.5 Example

When all parameters are set ok, use matched cuvettes containing reference and testing samples separately. Press **[Baseline Correction]** button to perform baseline correction.

The screen shows: running baseline correction... Press **[Stop Correction]** key to stop.

When the baseline correction is finished, open the sample chamber and place both samples on the reference and standard holders. Close the chamber door and press **[Test]** key and the instrument starts performing scanning. Now, the screen will switch to **[Display Curve]** page. Press **[Start]** key to execute test and the testing results will show on the screen. Touch the curve on the screen, the curve cursor can be coarsely tuned and show real-time information.

6.3 Quantitative Measurement

Select **[Quantitative]** from the main menu on the right area of the screen to enter the function module.

There are three tabs on the screen: < K-coefficient>, <Single-point Calibration>, and <Multi-point Calibration>.

6.3.1 K-coefficient

K-coefficient is an easy application of working curve method. With the absorbance which is measured by the system, it will calculate the concentration of a sample with the designated equation. The testing result will be directly shown on the main page.

Introduction of function keys:

[Clear Data] key is to clear the testing data.

[Auto Zero] key is to adjust zero before test.

[Test] key is to start testing.

[Access] key is to save the current testing curve or call the stored curves.

[Print] key is to print the testing data of the current test.

[↑] and **[↓]** keys are to go to the previous or next page.

[Parameter Settings]

Press [Parameter Settings] and a dialogue box will show. It's used to set the parameters of K-coefficient.

- **Wavelength:**

Click the input box on the right of Wavelength, a numeric keypad will pop up, key in the value for measurement wavelength. The instrument will automatically make the wavelength to the value as you set.

- **Unit:**

To set the unit of test: 8 options in total.

- **Equation Parameters:**

To set the parameters of equation: K and B value.

Press [Apply] to complete the configuration, and click [Cancel] to exit the configuration dialogue window.

Example:

Under the Parameter Settings, you can configure the parameters and enter K and B value. Place the blank sample in the optical path of the sample cell. With [Auto Zero] key, you can perform zero calibration of the absorbance at the current working wavelength. Then remove the blank sample. When the zero calibration of absorbance is finished, you can press [Test] key to start testing the concentration of the unknown sample.

6.3.2 Single-point Calibration

Single-point calibration method is to measure the absorbance of a standard sample first, and with a coordinate zero, create a working curve. According to this working curve, the concentration of a sample can be determined. The testing result will be directly shown on the main page.

Introduction of function keys:

[Clear Data] key is to clear the testing data.

[Auto Zero] key is to adjust zero before test.

[Test] key is to start testing.

[Access] key is to save the current testing curve or call the stored curves.

[Print] key is to print the testing data of the current test.

[↑] and [↓] keys are to go to the previous or next page.

[Parameter Settings]

Press [Parameter Settings] and a dialogue box will show. It's used to set the parameters of Single-point Calibration.

Wavelength:

Click the input box on the right of Wavelength, a numeric keypad will pop up, key in the value for measurement wavelength. The instrument will automatically make the wavelength to the value as you set.

Unit:

Set the unit of test: 8 options in total.

Concentration Value:

Enter the value directly in the box Conc=, and click [Calibrate] to complete the configuration.

Example:

Under the Parameter Settings, you can configure the parameters and enter the concentration value [**Conc**]. Place the blank sample in the optical path of the sample cell. With [Auto Zero] key, you can perform zero calibration of the absorbance at the current working wavelength. Then remove the blank sample. When the zero calibration of absorbance is finished, you can press [Test] key to start testing the concentration of the unknown sample.

6.3.3 Multi-point Calibration

Multi-point calibration method is to measure the absorbance of a standard sample first, and create a working curve. Then, according to the working curve, the concentration of a sample can be determined. The testing result will be directly shown on the main page.

Introduction of function keys:

[Clear Data] key is to clear the testing data.

[Auto Zero] key is to adjust zero before test.

[Test] key is to start testing.

[Access] key is to save the current testing curve or call the stored curves.

[Print] key is to print the testing data of the current test.

[↑] and **[↓]** keys are to go to the previous or next page.

[Parameter Settings]

Press **[Parameter Settings]** and a dialogue box will show. It's used to set the parameters of Single-point Calibration.

- **Wavelength:**

Click the input box on the right of Wavelength, a numeric keypad will pop up, key in the value for measurement wavelength. The instrument will automatically make the wavelength to the value as you set.

- **Unit:**

Set the unit of test: 8 options in total.

- **Standard Sample Parameters:**

Press **[Calibrate]** to jump to CalibrationSetting dialogue box. The following are introductions to the function keys.

[Auto Zero] key is to adjust zero before test.

[Test] key is to start testing.

[Access] key is to save the current testing curve or call the stored curves.

[Print] key is to print the testing data of the current test.

[Clear Data] key is to clear the testing data.

[Complete Calibration] key is to confirm the completion of current calibration.

[Display Curve] key is to display curve after calibration.

On the Display Curve page, there are following functions.

[Save/Call] key is to save the current testing curve or call the stored curves.

[Print] key is to print the testing data of the current test.

[Complete Calibration] key is to confirm the completion of current calibration.

[Display Data] key is to return to the configuration page and start the calibration again.

Example:

- 1) Under Parameter Settings, all parameters are set. Enter [**Calibrate**] and pop up CalibrationSettings.
- 2) Press [**Auto Zero**] to calibrate the curve.
- 3) Put standard and reference sample on to the corresponding holder and input the known concentration.
- 4) Press [**Calibrate**] to test the Abs of standard sample.
- 5) Repeat step 3 and 4. And ten standard samples at most can be tested.
- 6) When the calibration is completed, press [**Complete Calibration**] to confirm.
- 7) Press [**Display Curve**] to view the sample curve which is calibrated. Press [**Access**] to store or read the calibrated curve. Press [**Print**] to print the data.
- 8) After the calibration is finished, press [**Close**] to close the current dialogue box and return the [**Parameter Settings**] window.
- 9) Press [**Apply**] on the [**Parameter Settings**] window to complete the configuration.
- 10) When the calibrated curve equation is set, first, click [**AUTO ZERO**] key to perform zero calibration of absorbance at the current wavelength. Then, put the unknown and reference sample on the corresponding holder. When the calibration is finished, press [**Test**] to start testing the unknown sample.

6.3.4 File List

Press **[Access]** to pop up the File List dialogue box. Under this operation, the current curve can be saved or the saved curve can be called to display.

[Access]

[Access] First, select the location where the file is to be saved, press **[Access]**, and a numeric keypad will pop up. Enter a name for the file, press **[ENTER]** to confirm, and the current curve information will be saved. The file name must contain less than 8 characters. If a selected serial number already has a file, the new file will overwrite it.

[Read]

First, select the location where the file is saved, press **[Read]**, the page will jump to MonitorTest, and the curve information which has been read will display.

[Download]

Download the data to U drive.

[Delete]

First, select the location where the file is saved, press **[Delete]**, and the selected file will be deleted.

[Rename]

First, select the location where the file is saved, press **[Rename]**, and a numeric keypad will pop up. Key in a new file name, press **[ENTER]** to confirm, and the file will have a new name.

6.4 Kinetics Measurement

6.4.1 Test Monitor

Press **[Kinetics]** from the main function menu to enter the function settings. Under the tab <Test Monitor>, the curve can be directly read out.

Rectangular buttons are function keys:

[Parameters] key is to modify parameters.

[Scale Settings] key is to modify the scale of grid.

Square buttons are operation keys:

[Auto Zero] key is to adjust zero before test.

[Access] key is to save the current testing curve or call the stored curves.

[Print] key is to print the testing data of the current test.

[Parameter Settings]

Press **[Parameter Settings]** to pop up a dialogue box for configuring the parameters for single-point calibration.

- **Mode:**

Two modes: **【T】** transmittance (T%), and **【Abs】** Absorbance (ABS).

- **Wavelength**

Click the input box after Wavelength and enter testing wavelength.

- **Time:**

The max value shall not be greater than 180min or 3600s.

- **Time Unit:**

Two unit options: **【min】** for minute and **【s】** for second.

- **Record Range:**

The recording range is different for different measurement modes. According to your requirement, it can be entered and edited.

You can use the box after RecordRange to edit and input. The left box is for the lower limit and the right for upper limit.

Where, T% range: (-1.0000T% - 200.0%T), ABS range: (-0.301A - 4.0000A).

6.4.2 Scale Setting

From the pop-up dialogue window, the starting and end point of X and Y axis can be set. Press confirm to complete setting.

6.4.3 File List

Press **[Access]** to pop up the File List dialogue box. Under this operation, the current curve can be saved or the saved curve can be called to display.

[Access]

[Access] First, select the location where the file is to be saved, press **[Access]**, and a numeric keypad will pop up. Enter a name for the file, press **[ENTER]** to confirm, and the current curve information will be saved. The file name must contain less than 8 characters. If a selected serial number already has a file, the new file will overwrite it.

[Read]

First, select the location where the file is saved, press **[Read]**, the page will jump to MonitorTest, and the curve information which has been read will display.

[Download]

Download the data to U drive.

[Delete]

First, select the location where the file is saved, press **[Delete]**, and the selected file will be deleted.

[Rename]

First, select the location where the file is saved, press **[Rename]**, and a numeric keypad will pop up. Key in a new file name, press **[ENTER]** to confirm, and the file will have a new name.

6.4.4 Example

When all parameters are set ok, use matched cuvettes containing reference and testing samples separately. Press **[Auto Zero]** button to start zero calibration.

The screen shows: running baseline correction... Press **[Stop Correction]** key to stop.

When the baseline correction is finished, open the sample chamber and place both samples on the reference and standard holders. Close the chamber door and press **[Test]** key and the instrument starts performing scanning. Now, the screen will switch to **[Display Curve]** page. Press **[Start]** key to execute test and the testing results will show on the screen. Touch the curve on the screen, the curve cursor can be coarsely tuned and show real-time information.

6.5 Multi-wavelength Measurement

Press **[Multi-wavelength]** from the main function menu to get into the function settings.

6.5.1 Test Monitor

Rectangular buttons are function keys:

[T% / Abs] key is to switch between transmittance (T%), and Absorbance (ABS).

[Clear Data key] is to clear the testing data.

Square buttons are operation keys:

[Auto Zero] key is to adjust zero before test.

[Test] key is to start testing.

[Print] key is to print the testing data of the current test.

6.5.2 Example

Press the red circled areas on the right hand of **[Wavelength]** (nm) to set wavelength and the number of sample cuvettes. Then, enter wavelength values from small to large. Next, get reference (blank) sample (which must be put onto the reference cell holder R) and testing sample in the matched quartz cuvettes, and place them separately on to the cell holder S. Press **[AUTO ZERO]** for the cell holder R. Then press **[Test/Stop]** key to start testing. After a while, the display will show the results.

When the testing is finished, press **[Print]** key to print out the testing data.

6.6 System Settings

6.6.1 L5 System Settings

Press the **[System Settings]** from the main menu, to enter this function module. The default tab is <basic parameters>.

Press <Time Setting> tab to set the time. Press the box after the time unit and enter.

- **Power On/OFF (Tungsten Lamp):**

To turn on the tungsten lamp, press [ON] and to turn it off to press [OFF].

- **Wavelength Correction:**

The wavelength can be corrected by user here (correction value: measured value - standard value, the correction range is ± 0.5 nm). Press the box to enter the wavelength which the user wants to set.

- **Source Lamp Switch Wavelength:**

When the deuterium lamp reaches a set wavelength value, it will switch to another lamp. Enter the limit wavelength value from the box .

Otherfunctionkeys:

[Dark Current Calibration]: Calibrate the drift dark current.

[Language]: Select the system language.

[Initialization]: Press key and the system will be initialized. Use with caution!

6.6.2 System Settings

Press the [System Settings] from the main menu, to enter this function module. The default tab is <basic parameters>.

Press <Time Setting> tab to set the time. Press the box after the time unit and enter.

- **Power On/OFF (Tungsten Lamp):**

Turn on the tungsten lamp, press [ON] and to turn it off to press [OFF].

- **Power On/OFF (Deuterium Lamp):**

Turn on the deuterium lamp, press [ON] and to turn it off to press [OFF].

- **Wavelength Correction:**

The wavelength can be corrected by user here (correction value: measured -standard value, the correction range is ± 0.5 nm). Press the box to enter the desired wavelength.

- **Source Lamp Switch Wavelength:**

When the deuterium lamp reaches a set wavelength value, it will switch to another lamp. Enter the limit wavelength value from the box .

- **Band width:** Indicate the width of current slit.

Other functions keys:

[Dark Current Calibration]: Calibrate the drift dark current.

[Language]: Select the system language.

[Initialization]: Press key and the system will be initialized. Use with caution!

[Band Width Setting]: Set the width of slit on the pop-up window. There are five options: 0.5nm, 1nm, 2nm, 4nm and 5nm.

7 Maintenance and Troubleshooting

7.1 Routine Maintenance

1. To ensure the stability of the instrument, it is recommended to use AC stabilized voltage power supply of 500W or above in case of noticeable voltage fluctuation. When the instrument is not in use, switch it off, and shut down the main power supply.
2. In order to maintain clean environment, cover the instrument with a piece of cloth when the main device is not in use to avoid dust. It's better to keep the room dry and at constant temperature when storing the instrument for long time without operation.
3. Use a soft cloth wetted with warm water to clean the instrument case. Do not use ethanol, ether, acetone or other organic solution. Cover the instrument with a dust cover after use. Don't touch any mirrors in the equipment with hands or any soft/hard objects. Once a trace is left, it will increase stray light and reduce effective energy, which might lead to breakdown of the equipment.
4. Clean the sample chamber and cuvette after use each time, to prevent the parts of instrument from rotting, which is caused by the samples. Use petroleum ether to clean cuvette after use each time, use lens tissue to clean the

cuvette, and place them in cuvette boxes for future use.

5. If the instrument is not in use for a long period of time, it will reduce the service life. It's better to turn it on once or twice a week, and get the power on for about half an hour each time, if it is not in use.
6. On the regular basis, check the wavelength of the instrument according to metrology rules, to ensure the instrument is available to operate with good precision. Remember move the device gently and don't place any heavy stuff on the shell of the device.
7. Don't remove any screws and nuts in the optical path, except those outside of the light source chamber. Otherwise, it might affect the proper work of the instrument. If you have any question regarding the optical path, please feel free to contact after-sale service of the manufacturer.

7.2 Light Source Replacement

Reminder: When replacing the tungsten halogen lamp or deuterium lamp, the instrument shall be disconnected to the power supply and the lamp is cool down enough. Please be mindful of the color of the cable. Don't look at the lamp directly for a long time to prevent eyes from getting hurt.

Tungstenhalogenlamp

1. Turn off the instrument and disconnect the power cord from power supply;
2. Slacken the fixing screws from both sides of the case;
3. Remove the protective guard plate from the lamp chamber;
4. Wear clean gloves to pull off the old lamp, and fit the new lamp;

Deuterium lamp (for UV only)

1. Turn off the instrument and disconnect the power cord from power supply;
2. Slacken the fixing screws from both sides of the case;
3. Remove the protective guard plate from the lamp chamber;
4. Wear clean gloves to pull off the old lamp, and mount the new lamp;

5. Switch on the instrument; select wavelength of 500nm to check if the image of filament focuses on the Incident slit. If no, loosen the fixing screws of the light source component; slightly adjust the light source component to get the filament image focus on the Incident slit; at the same time, observe the data on the display, and make sure all data are at the maximum value, prior to fix the screws tightly.
 6. Shut the instrument case.
5. Switch on the instrument; select wavelength of 240nm to check if the image of filament focuses on the Incident slit. If no, loosen the fixing screws of the light source component; slightly adjust the light source component to get the filament image focus on the Incident slit; at the same time, observe the data on the display, and make sure all data are at the max. value, prior to fix the screws tightly.
 6. Shut the instrument case.

7.3 Troubleshooting

The failures of the instrument can be divided into categories, one is normal wear and tear of parts or components, and the other is the malfunction of instrument. As the equipment is high precision device, if it doesn't work, the user shall instantly contact the after-sale service department of the manufacturer and provides description of malfunctions, so can the engineer determine whether the user can fix it with his instruction. If the user cannot solve the problem, the manufacturer will arrange engineer to provide on-site support. Below are some examples of common failures only for reference:

7.3.1 The device can perform zero or full scale adjustment.

Failure	Cause(s)	Troubleshooting
[AUTO ZERO] key doesn't adjust 100%T or 0.0000A.	<ul style="list-style-type: none">a. There is an object which obstructs light in the sample chamber.b. The preamplifier is broken.c. The motor for filters doesn't work properly.d. The mirror is not in the correct position as the source lamp changes.e. The mirror in the light chamber is aging.f. The source lamp is broken.	<ul style="list-style-type: none">a. Remove the object which obstructs light.b. Fix the preamplifier.c. Replace the filter motor.d. Replace the motor controlling the mirror.e. Replace with a new mirror.f. Replace with a new lamp.

7.3.2 The device doesn't work.

Failure	Cause(s)	Troubleshooting
The display is dark when power on.	<ul style="list-style-type: none">a. No 220V voltage supply from the power.b. The power cord is not properly connected.c. The fuse of power supply is broken.d. The switch of power is broken.e. The cable of display is not well connected.f. The power PCB is broken.g. The CPU PCB is broken.h. The display is broken.	<ul style="list-style-type: none">a. Check whether the power supply is 220V.b. Get the power cord properly connected.c. Replace with a new 2A fuse.d. Replace with a new switch.e. Get the cable well connected.f. Repair or replaceg. Repair or replaceh. Repair or replace

7.3.3 The power on self-test fails.

Failure	Cause(s)	Troubleshooting
The computer system fails in self-test.	a. The internal electronic component is broken.	a. Contact after-sales department.
The initialization of sample cell position fails.	a. The photoelectric switch is broken. b. The motor for sample position doesn't work. 1) The motor for sample position is broken. 2) The circuit board which drives the motor is broken.	a. Replace the photoelectric switch. 1) Replace with a new motor. 2) Repair CPU circuit board.
The initialization of filters fails.	a. The photoelectric switch is broken. b. The motor for filters doesn't work. 1) The motor for filters is broken. 2) The circuit board which drives the motor is broken.	a. Replace with a new photoelectric switch. 1) Replace with a new motor. 2) Repair CPU circuit board.

<p>The energy of tungsten lamp fails.</p>	<ul style="list-style-type: none"> a. The tungsten lamp doesn't work properly. <ul style="list-style-type: none"> 1) The tungsten lamp is broken. 2) The circuit board for tungsten lamp is broken. b. The tungsten lamp is aging. c. The circuit board of preamplifier is broken. d. The circuit board of CPU is broken. e. There is an object which obstructs light in the sample chamber. 	<ul style="list-style-type: none"> a. Troubleshoot accordingly: <ul style="list-style-type: none"> 1) Replace with a new lamp. 2) Repair the power supply circuit board. b. Replace the broken lamp. c. Repair the preamplifier. d. Repair the circuit board of CPU. e. Remove the object which obstructs light.
<p>The positioning of wavelength fails.</p>	<ul style="list-style-type: none"> a. The light from tungsten lamp doesn't project into slit. b. The tungsten lamp is aging. 	<ul style="list-style-type: none"> a. Adjust the position of source lamp. b. Replace the lamp.

7.3.4 The halogen lamp doesn't work properly.

Failure	Cause(s)	Troubleshooting
The halogen lamp doesn't shine. (With 11.5V DC)	a. The halogen lamp is not properly connected with the lamp holder. b. The halogen lamp is broken.	a. Get it well connected. b. Replace with a new lamp.
The halogen lamp doesn't shine. (Without 11.5V DC)	The circuit system of halogen lamp is broken.	Fix the circuit system.
The halogen lamp shines.	a. The halogen lamp has been used for a very long time. (The glass gets dark.) b. The light from halogen lamp doesn't project into slit. c. There is an object which obstructs light in the sample chamber.	a. Replace with a new lamp. b. The motor which switches the source lamp fails to work properly. c. Remove the object which obstructs light.

7.3.5 The graph and data cannot be printed.

Failure	Cause(s)	Troubleshooting
The display is right.	<ul style="list-style-type: none">a. The printer is not turned on.b. The cable between main device and printer is not well connected.c. There is something wrong with the output system of main device.d. There is something wrong with the printer.	<ul style="list-style-type: none">a. Turn on the printer.b. Get the cable well connected with both ends.c. Fix it.d. Fix the printer.
The printer doesn't work properly.	The printer is broken down.	Replace printer

7.3.6 The deviation of sample reading is huge

Failure	Cause(s)	Troubleshooting
The reading deviates from the standard reading.	<ul style="list-style-type: none">a. There is big error in sample agent.b. The cuvettes are not well matched.c. The cuvette is stained.d. The device is not stable.e. Due to the time or temperature, the sample solution might fluctuate.	<ul style="list-style-type: none">a. Inspect the process of sample preparation and the gauge used.b. Calibrate the matched cuvettes, or replace with new ones.c. Clean the cuvette.d. Fix the device.e. Strictly follow sample testing procedures.

7.3.7 The reading is not stable.

Failure	Cause(s)	Troubleshooting
Numbers flash to an increase or decreasing direction unstably.	<ul style="list-style-type: none">a. The preheating time is not enough. (Generally 30mins)b. The instrument is affected by environment. The device is moistened.	<ul style="list-style-type: none">a. Increase the preheating time, and reduce the humidity of room.b. Increase preheating time.
Numbers fluctuate unstably.	<ul style="list-style-type: none">a. The earthing of the device is not good.b. The device is moistened.c. The source lamp is aging.d. The room temperature is too high.e. 220V power supply is not stable.f. The optical path has some bias.g. The preamplifier is broken.	<ul style="list-style-type: none">a. Make sure the earthing is good.b. Improve working environment.c. Replace with a new lamp.d. Improve the working environment.e. Use an AC regulated power.f. Readjust the optical path.g. Fix or replace with a new lamp.

7.4 Wavelength Correction

From the main menu, select [Spectrum] function and setup as following: measurementMode, **[ABS]**, scan range (350nm~650nm), record range (0.0000A~1.2000A), scan speed (middle), samplinginterval (0.1nm), and scan time (1). On the completion of setup, press **[Baseline Correction]**. Put the standard holmium solution in the optical path, and press **[Start]** to scan. When scanning is finished, press **[Peak/Valley Display]** tab. Read the wavelength of corresponding peak. The difference between it and the wavelength of standard holmium solution shall be within ± 0.5 nm. If the difference is bigger than ± 0.5 nm, correct the wavelength in the **[System Settings]**, which can be accessed from the menu.

Inspection Frequency: once to twice a year or after source light lamp is replaced.

8 Warranty

The manufacturer will repair the instrument for free, if it fails to work due to defective workmanship within 12 months following the purchase date, provided that the damage is not caused by intentional act (wearable parts, lamp and cuvette are not covered by this warranty).