

DW-N Series Spectrophotometer
User Manual



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1 Principle, Applications and Features

1.1 Principle

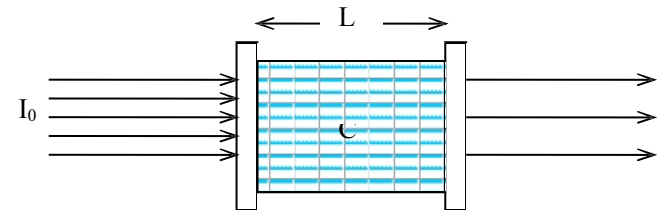
The light absorption of a substance is selective. As a substance is excited by the radiation of light, the light absorption effect will occur in the substance. Each substance has their own special absorption spectrum. When a homogeneous light passes through a solution, the light energy will be lessened, 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:

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

Where,

- A: Absorbance
- T: Transmittance
- I: Intensity of transmitting light
- I_0 : Intensity of the incident ray
- K: Absorption coefficient of sample
- C: Concentration of the substance for measurement
- L: Length of sample in optical path





1.2 Applications

The series of instruments can do quantitative and qualitative analysis for sample substance within the UV (N4/N4S only) 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

- 7 inch LCD touch-screen display
- Highly intelligent operating module and user-friendly interface
- Automatic 100%T and 0A
- Simple replacement of light source
- Concentration factor setup and direct reading of concentration
- USB port and UVWin8 PC communication software (optional) .

2 Specifications and Functions

2.1 Specifications

2.1.1 Optical system

- Single beam (with monitor optical path), 1,200 lines/mm holographic grating

2.1.3 Receiving component

- Silicon photocell

2.1.5 Wavelength range

- N2, N2S : 325nm ~ 1000nm

2.1.6 Light source

- Tungsten lamp: 12V20W

2.1.2 Max. wavelength deviation

- $\pm 1\text{nm}$

2.1.4 Wavelength reproducibility

- $\leq 0.5\text{nm}$

- N4, N4S : 190nm ~ 1100nm

- Deuterium lamp: DD2.5 (only for N4, N4S)



2.1.7 Baseline flatness

● N2S : $\pm 0.003A$ (335 nm ~ 990nm)

● N4S : $\pm 0.003A$ (210 nm ~ 990nm)

2.1.8 Drift

● N2S : $\leq 0.002A/0.5h$
(at 500nm , after working for 2 hrs)

● N4S : $\leq 0.002A/0.5h$
(at 250nm and 500nm , after working for 2 hrs)

2.1.9 Min. spectrum bandwidth

● N2, N2S : 4 nm

● N4, N4S : 2 nm

2.1.10 Noise

● 100% (T) $\leq 0.2\%$ (T);

● 0% (T) $\leq 0.1\%$ (T)

2.1.11 Stray light

● N2, N2S : $\leq 0.1\%$ (at 360nm)

● N4, N4S : $\leq 0.1\%$ (at 220nm and 360nm)



2.1.12 Absorbance range

- -0.301 A ~ 4.000A

2.1.13 Max. transmittance deviation

- $\pm 0.5\%$

2.1.14 Transmittance reproducibility

- $\leq 0.2\%$

2.1.15 Transmittance range

- 0.0% ~ 200.0%

2.1.16 Dimensions

- 480mm×370mm×200mm

2.1.17 Net Weight

- N2, N2S : 14kg
- N4, N4S : 16kg

2.1.18 Power supply

- AC220V $\pm 22V$, 50Hz ($\pm 1Hz$), (110V optional)



2.2 Main functions

2.2.1 Automatic control

- Power on self-checking of working status and automatic wavelength calibration;
- Automatic wavelength positioning;
- Automatic filters switching;
- Display test data and spectrum(N2S,N4S only);
- Error message indication;
- Printing spectrum and data (printer optional)

2.2.2 Analyzing, testing, and information processing

- Photometric measurement;
- Spectrum scanning; (only fo N2S and N4S)
- Quantitative analysis;
- Multi-wavelength determination;
- Chemical kinetic analysis;
- 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. To get 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 220 V± 22 V, 50 Hz±1 Hz, (110V optional) 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

3.2.1 Inspection

Please check the integrity of outer package before unpacking. Contact the transport agency when the package is found intact or damaged.

3.2.2 Checking

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.

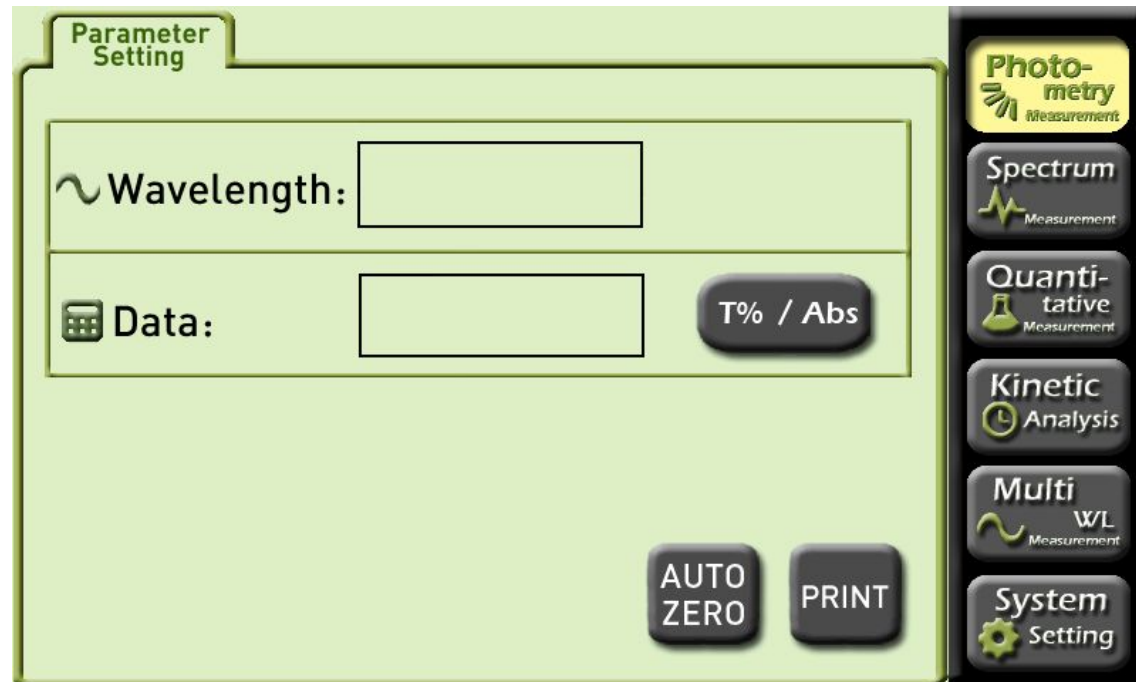
4 Exterior View and System Illustration


4.1 Exterior View



4.2 Touch Screen

The work partition of touch screen of N series is as shown below:
select different test units by clicking the button in the right of the figure.





4.3 System Illustration

4.3.1 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, $\pm 15\text{V}$ 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.

4.3.2 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 7 inch color LCD touch-screen.

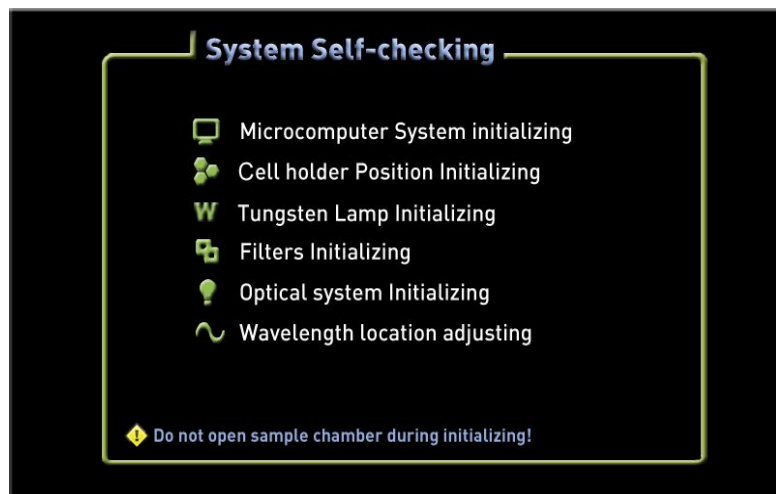
5 Basic Operations

5.1 Testing Preparation

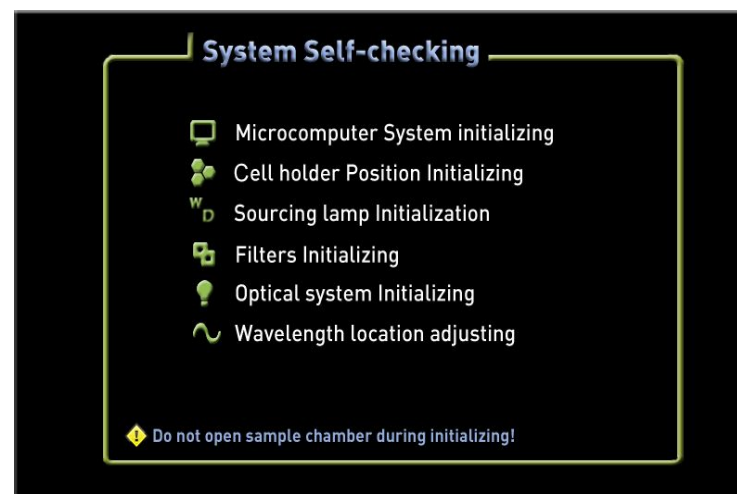
5.1.1 System Self-checking

When the instrument is switched on, the display will show welcome. Then, it performs self-checking (see figure blow), and the system starts initializing.

Caution: Don't open sample chamber during initializing!



N2 and N2S Power On Self-checking



N4 and N4S Power On Self-checking



5.1.2 Wavelength Modification

Through system settings, Wavelength Modification 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 cell holder with reference sample on holder R, and testing samples on holder S1 to S7.

Attention!

After self-checking is passed, if you want to use one lamp only, you can select the deuterium lamp or tungsten lamp through the fifth item 【System Setting】 from the main menu. In this way, the service life of light source lamp can be prolonged.

5.2 Keypad

The N series of instruments have two kinds of pop-up keypad, namely, numeric and alphabet keypad.



Numeric Keypad

Numeric keypad: **【CE】** to clear data; **【Cancel】** to cancel the input; **【Enter】** to confirm the data input.



Alphabet Keypad

Alphabet keypad: **【CE】** to clear data; **【Cancel】** to cancel the input; **【Enter】** to confirm the data input; **【←】** as backspace to delete last character or space.

6 Application Operations

6.1 Photometric Measurement

6.1.1 Parameter Setting

Press [Photometry] on the right hand of the screen to get into the function settings. The first screen is Parameter Setting page.

● **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.

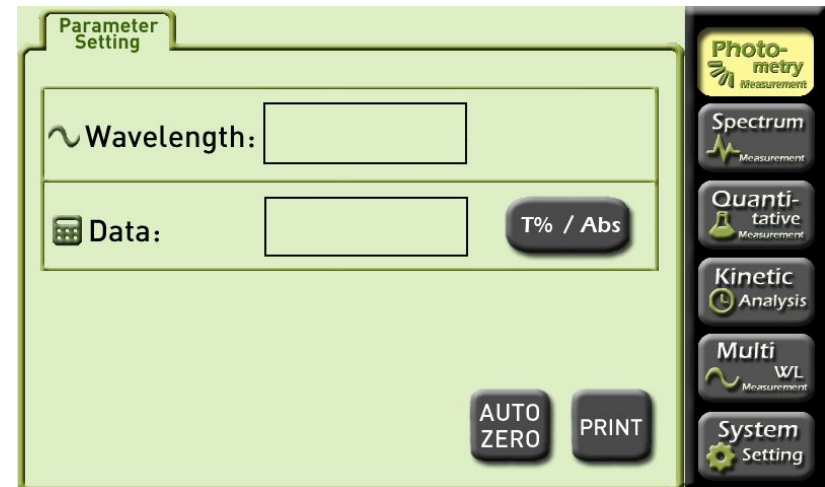
When the parameters are set ok, the instrument will automatically make the wavelength to the value as you set.

● **Data:**

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

Other keys on the Parameter Setting page:

- ◆ **【T%/Abs】** $\tau(T)$ (transmittance) and Abs (absorbance) switch key
- ◆ **【AUTOZERO】** Auto zero of baseline.
- ◆ **【PRINT】** Print the result of test.





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 analyte of interest.

When each analyte of interest is finished testing, press **【PRINT】** key to print the testing results.

6.2 Spectrum Measurement

(This function Only for N2S & N4S)

6.2.1 Parameter Setting

Press [Spectrum] on the right hand of the screen to get into the function settings. The first screen is Parameter Setting. All function tabs o [Spectrum] can be found on the upper left of the display, and they can switch back and forth.

- **Measurement Mode :**

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.

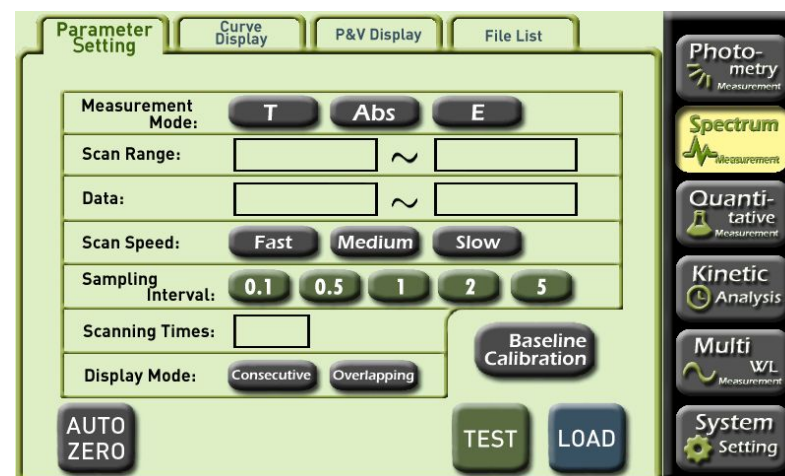
- **Scan Range:**

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

- **Data:**

The recording range is different for different measurement mode. According to your requirement, you can use the box after Data 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 Speed:**

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

- **Sampling Interval:**

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

- **Scanning Times:**

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

- **Display Mode:**

Two modes: continuous and overlapping.

Consecutive: only one spectral line shows on the screen.

Overlapping: the number of spectral lines are consistent with scanning times .

If the number of scanning times is greater than 2, press **【TEST/STOP】** key to perform the second scan after one scan is finished.

Other keys on the Parameter Setting:

- ◆ **【Baseline Calibration】** Perform baseline calibration to make sure the testing results are more accurate.
- ◆ **【AUTO ZERO】** This key is to execute auto zero.
- ◆ **【TEST】** Press the key is to start scanning when all parameters are set. The display will jump to Curve Display. (See details in Section 6.2.2)
- ◆ **【LOAD】** Recall the saved curve files from the memory. Press this key and the display will jump to File List. (See details in Section 6.2.4)

6.2.2 Curve Display

When all parameters are set, 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 **【Baseline Calibration】** .

The screen shows: correcting baseline... To stop baseline calibration, press **【STOP】** . When the baseline calibration is finished, press **【→】** to move to cell holder S1, and press **【TEST】** to start scanning. The screen will jump to Display Curve (see the right picture).

Press **【START】** to begin testing. The testing result curve will show on the screen. Touch the curve, a cursor will appear, which can be used for coarse adjustment to view real-time testing information.

Introduction of function keys on Curve Display:

◆ **【Scale Select】**

Press **【Scale Select】** to edit scale bar. The screen will automatically highlight the field to be edited. The user is free to choose the starting and ending region to be edited. With finishing editing, press **【ENTER】** , and the display will be refreshed with new coordinate. This function is mainly for zoom-in or zoom-out of a certain area of graph.

◆ **【START】 / 【STOP】**

Press **【START】** key to test. After a while, when a curve appears, **【STOP】** key then can work.

◆ **【←】 and 【→】**

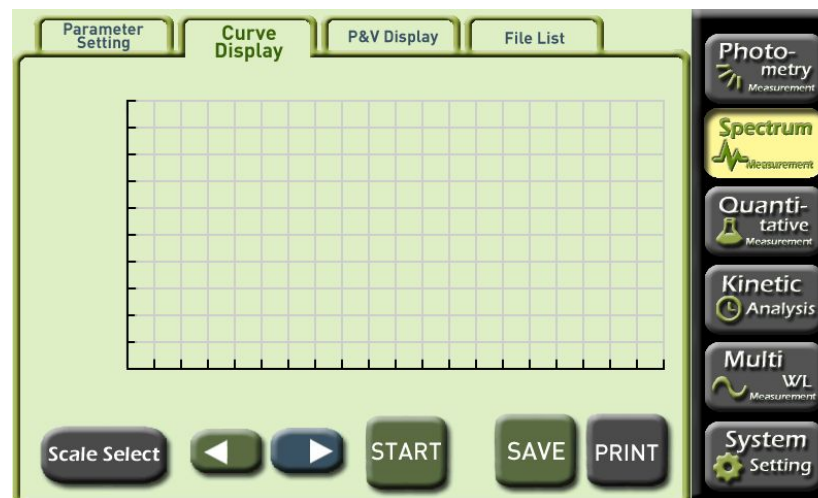
Move the cursor to show real-time curve information.

◆ **【SAVE】**

Save the current test curve to File List and the display will jump to File List. (See details of File List in Section 6.2.4)

◆ **【PRINT】**

Print the curve, scanned image, peak and valley values of the current test which is just finished.



6.2.3 Peak & Valley Display

When finishing testing a curve, press the P&K Display tab, the screen will turn to the corresponding interface (see the picture below).

On the Peak & Valley Display page, please select the sensitivity of peak & valley from the box first.

There are three options, low, medium and high. Press the box to switch the options.

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.

Function introductions of keys of Peak Display:

◆ **【HOME】**

Back to the first page.

◆ **【PRE】【NEXT】**

Use the keys to go to the previous or next page.

◆ **【END】**

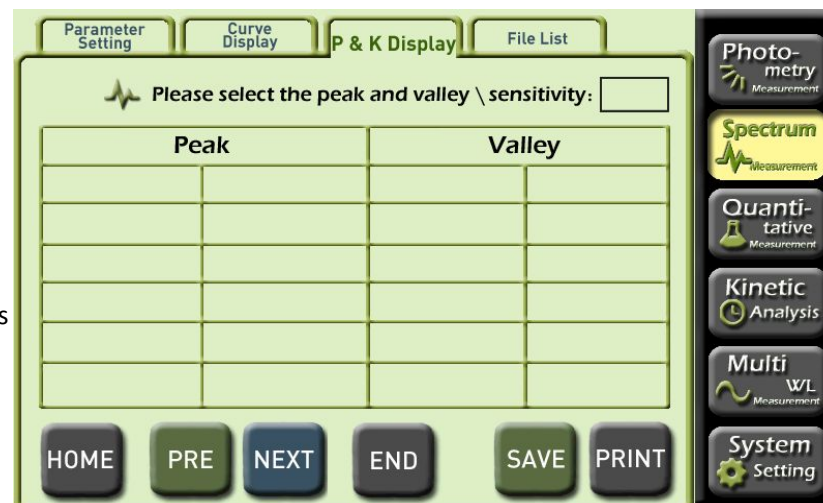
Proceed to the last page.

◆ **【SAVE】**

Save the current test curve to File List and the display will jump to File List. (See details of File List in Section 6.2.4)

◆ **【PRINT】**

Print the curve, scanned image, peak and valley values of the current finished test.



6.2.4 File List

Press **【LOAD】** on the Parameter Setting page, or press **【SAVE】** on P&K Display page, the screen will jump to File List page.

A maximum of 10 curves can be stored in the instrument (only for spectrum measurement function), which doesn't share the same file list with other functions.

Select the location of a file first, then execute the operations (save, read, rename or delete).

The introduction of function keys on File List page:

◆ **【SAVE】**

First, select the location where the file is to be saved, press **【SAVE】**, 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.

◆ **【LOAD】**

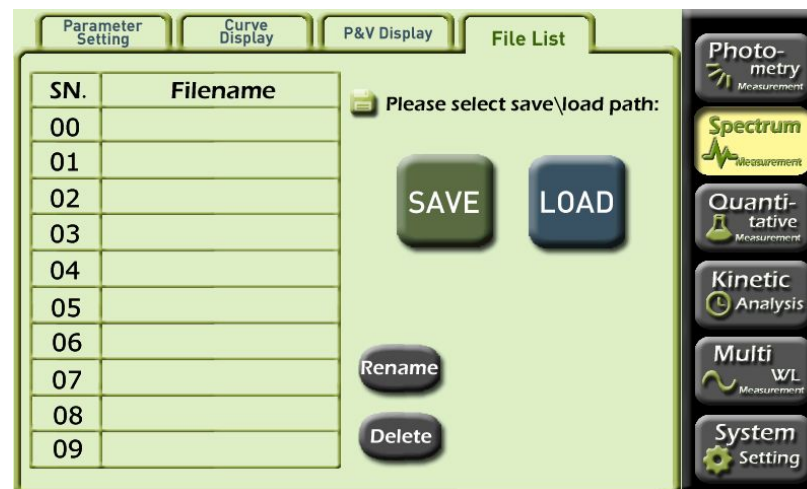
First, select the location where the file is saved, press **【LOAD】**, the page will jump to Curve Display, and the curve information which has been read will show on the screen (For Curve Display function, see details in Section 6.2.2.)

◆ **【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.

◆ **【Delete】**

First, select the location where the file is saved, press **【delete】**, and the selected file will be deleted.



6.3 Quantitative Measurement

6.3.1 Parameter Setting

Select [Quantitative] from the main menu on the right area of the screen to enter the function module. This function module can create a concentration curve with different measurement methods. The first screen is Parameter Setting page. All function tabs of [Quantitative] measurement can be found on the upper left of the screen, and they are switchable (except the File List).

- **Measurement Wavelength:**

Click the input box on the right of Measurement 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.

- **Measurement Unit:**

There are eight options for the measurement unit.

- **Measurement Method:**

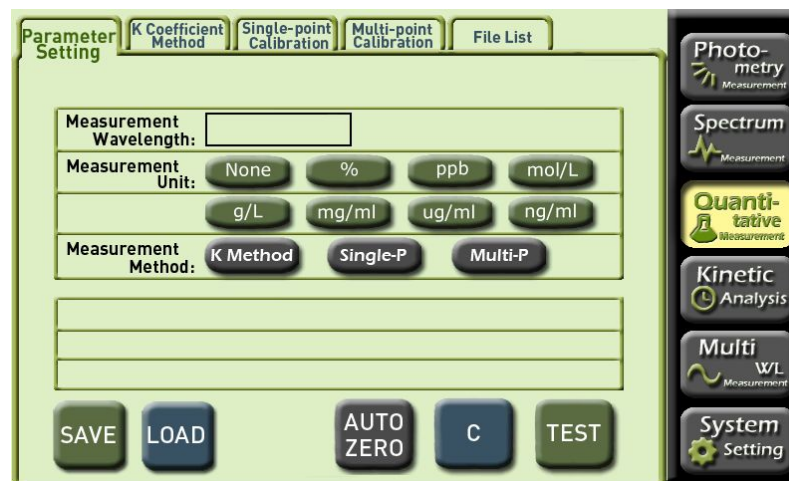
Three options for measurement mode: K Method (K coefficient), Single-P (single-point calibration), and Multi-P (multi-point calibration).

With selecting a method, the system will be ready to apply the mode for testing. The corresponding parameters will display in the lower left column. (See details in Section 6.3.2 6.3.3, and 6.3.4)

- **Modify Parameters**

The purple circled area is to modify parameters. Under the selected method, you can modify the setup here:

(e.g., K-coefficient: K and B value; Single-point calibration: concentration value
Multi-point calibration: the calibration point, up to nine points can be modified)



The introduction of other keys on the Parameter Setting page:

◆ **【SAVE】**

Only under K-coefficient and Single-point calibration, there is such a function. It'll save the current calibration concentration information to File List and the display will jump to File List. (See details of File List in Section 6.3.5)

◆ **【LOAD】**

Call the saved curve files from File List. Press this key and the screen will jump to File List page. (See details in Section 6.3.5)

◆ **【AUTO ZERO】**

Press this key to adjust zero automatically.

◆ **【C】**

Press this key to calibrate the analyte of interest in the current cell holder. It only works for Single-point calibration and Multi-point calibration.

◆ **【TEST】**

Press the key is to start test when all parameters are set. The screen will jump to the related page (depending on specific testing method which has been selected).

6.3.2 K-coefficient Method

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.

On the parameter setting page, select **【K-coefficient Method】** from the options in Measurement Method. Enter slope K and intercept B values for the standard curve in the red circled area (see the figure in Section 6.3.1). Press **【TEST】** to jump to K-coefficient Method page (see the picture below). If you want to reset parameters, click the tab Parameter Setting on the upper left of the screen.

When K and B values are set ready, place a blank sample onto the cell holder in the current optical path. Press **【AUTO ZERO】** to adjust the absorbance of current working wavelength to zero. After zero calibration, press **【TEST】** to test the concentration of unknown sample.

Introduction of function keys on the K-coefficient Method page:

◆ **【AUTO ZERO】**

Press this key to adjust zero automatically.

◆ **【TEST】**

Test the concentration of sample in the current cell holder.

◆ **【PRINT】**

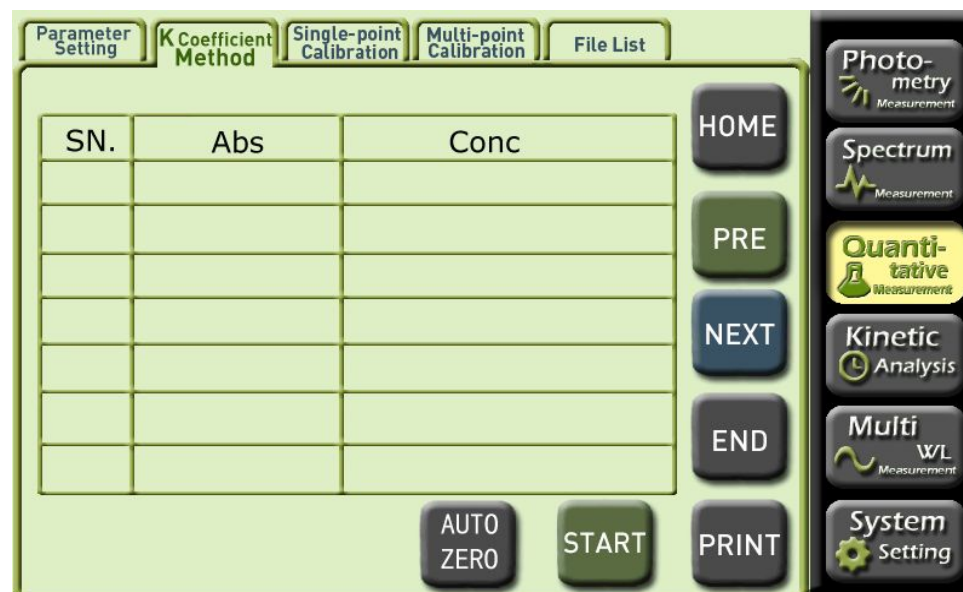
Print the concentration information of the test which is just finished.

◆ **【HOME】 【END】**

Go back to the first page or forward the last page

◆ **【PRE】 【NEXT】**

Use the keys to go to the previous or next page.



6.3.3 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.

On the parameter setting page, select **【Single-point calibration】** from the options in Measurement Method. Enter the concentration value of a standard curve in the red circled area (see the figure in Section 6.3.1) . Press **【C】** to jump to Single-point Calibration page (see the figure below). If you want to reset parameters, click the tab Parameter Setting on the upper left of the screen.

When the concentration value is set ready, place a blank sample on to the cell holder in the current optical path. Use **【AUTO ZERO】** to adjust the absorbance of current working wavelength to zero. After zero calibration, press **【TEST】** to measure the concentration of unknown sample.

Introduction of function keys on the Single-point Calibration page:

◆ **【AUTO ZERO】**

Press this key to adjust zero automatically.

◆ **【TEST】**

Test the concentration of sample in the current cell holder.

◆ **【PRINT】**

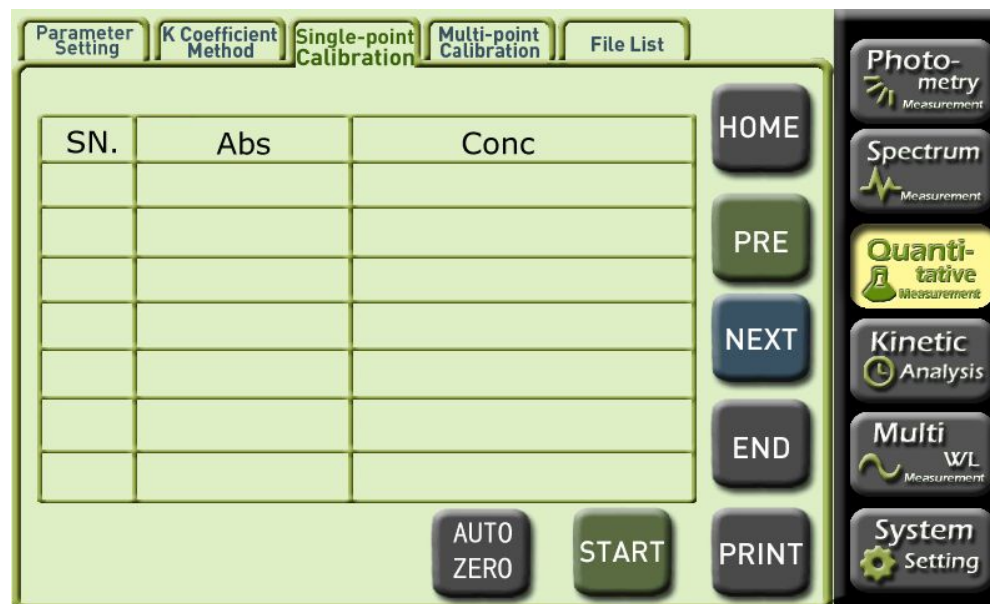
Print the concentration information of the test which is just finished.

◆ **【HOME】 【END】**

Go back to the first page or forward the last page

◆ **【PRE】 【NEXT】**

Use the keys to go to the previous or next page.



6.3.4 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.

On the parameter setting page, select **【Multi-point calibration】** from the options in Measurement Method.

Enter the number of calibration points (a maximum of nine points) of a standard curve in the red circled area (see the figure in Section 6.3.1) . Press **【C】** to jump to Multi-point Calibration page (see the figure below). If you want to reset parameters, click the tab Parameter Setting from the above of the screen.

Introduction of function keys on the Multi-point Calibration page:

◆ **【Set Conc.】**

Enter the concentration of the current standard solution.

◆ **【TEST】**

Test the value of solution in the current cell holder.

◆ **【NEXT】**

Move next calibration point. The input cursor will move the next line.

◆ **【AUTO ZERO】**

Press this key to adjust zero automatically.

◆ **【PRINT】**

Print the concentration information of the test which is just finished.

◆ **【PRE】 【NEXT】**

Use the keys to go to the previous or next page.

◆ **【BACK】**

Return to the Parameter Setting page of Quantitative Measurement.

Example:



- 1) Enter the number of calibration points (at least 3 points, and at most 9 points) of a standard curve in the red circled area. Press **【C】** to jump to Multi-point Calibration page.
- 2) Press **【Set Conc.】** to calibrate the known concentration of current sample cell. Press **【TEST】** to generate concentration index, and press **【NEXT】** to continue calibration.
- 3) On the completion of setting all Calibration Points, when pressing **【NEXT】**, the original **【Set Conc.】** button will change to **【Display Data】**. Press this key, the display will turn to what it show in the right picture.

Introduction of function keys on the Parameter Setting-Curve of Multi-point Calibration interface:

◆ **【BACK】**

Return to the Parameter Setting page of Quantitative Measurement. (The original settings will be lost.)

◆ **【Display Data】**

Return to the Parameter Setting for Multi-point Calibration. (The original settings will no be lost.)

◆ **【Test】**

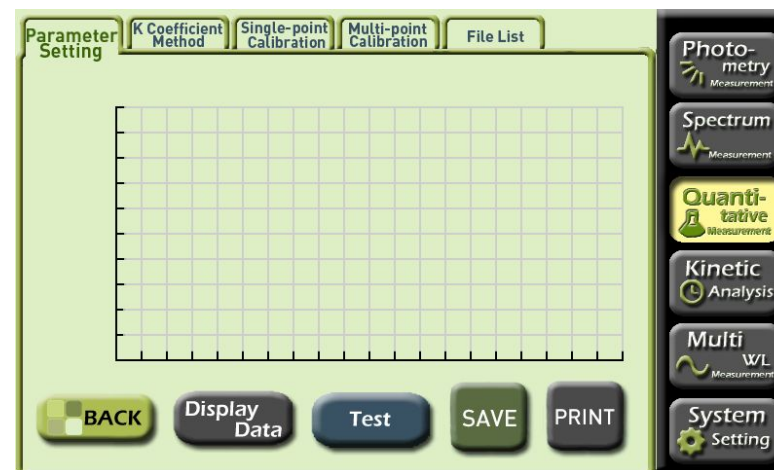
After the calibration of curve, the system starts testing. The display will jump to Multi-point Calibration page.

◆ **【SAVE】**

Save the current coordinate curve which has been calibrated and the equation files

◆ **【PRINT】**

Print the current coordinate curve which has been calibrated.



- 4) If finishing setting all calibration points to construct equation system, press **【Test】** to enter Multi-point Calibration testing interface.
- 5) When the calibration curve equation is set up, place a blank sample onto the cell holder in the current optical path. Use **【AUTO ZERO】** to adjust the absorbance of current working wavelength to zero and then remove the blank sample. After zero calibration, press **【TEST】** to measure the concentration of unknown sample.

Introduction of function keys on the Multi-point Calibration interface:

◆ **【AUTO ZERO】**

Press this key to adjust zero automatically.

◆ **【START】**

Start testing the concentration of solution in current sample cell.

◆ **【PRINT】**

Print the concentration information of the test which is just finished.

◆ **【HOME】**

Go back to the first page.

◆ **【PRE】 【NEXT】**

Use the keys to go to the previous or next page.

◆ **【END】**

Go to the last page.



6.3.5 File List

Press **【SAVE】** and **【LOAD】** on the Parameter Setting page, or press **【SAVE】** on the Multi-point Calibration - Parameter Setting - Curve interface, the display will jump to File List page.

A maximum of 10 curves can be stored in the instrument (only for quantitative measurement function), which doesn't share the same the file list with other functions. Select the location of a file first, then can perform save, read, rename or delete operations.

The introduction of function keys on File List page:

◆ **【SAVE】**

First, select the location where the file is to be saved, press **【SAVE】**, 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.

◆ **【LOAD】**

First, select the location where the file is saved, press **【LOAD】**, the page will jump to Curve Display, and the curve information which has been read will display. (For Curve Display function, see details in Section 6.2.2.)

◆ **【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.

◆ **【Delete】**

First, select the location where the file is saved, press **【delete】**, and the selected file will be deleted.

◆ **【BACK】**

Return to the Parameter Setting page of Quantitative Measurement.



6.4 Kinetic Analysis

6.4.1 Parameter Setting

Press [Kinetic Analysis] from the main function menu on the right of the screen to enter the function settings. The first screen is Parameter Setting page. All function tabs of [Kinetic Analysis] can be found on the upper left of the screen, and they can switch back and forth.

- **Measurement Mode:** Two options: 【T】 transmittance (T%), and 【Abs】 Absorbance (ABS).
- **Measurement Wavelength:** Click the input box after Measurement Wavelength and enter testing wavelength.
- **Measurement Time:** The max value shall not be greater than 180min or 3600s
- **Time Unit:** Two unit options: 【Min】 for minute and 【Sec.】 for second.

- **Data:**

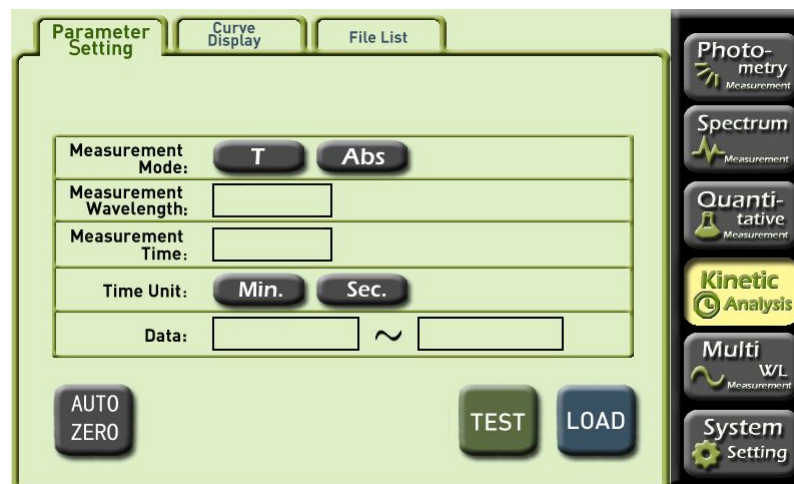
The data range is different for different measurement modes. According to your requirement, it can be entered and edited.

You can use the box after Data 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).

Introduction of other function keys on the Parameter Setting page:

- ◆ 【AUTOZERO】 Adjust zero baseline.
- ◆ 【TEST】 On the completion of setting parameters, start kinetic analysis.
- ◆ 【LOAD】 Recall equation curve file from the File List, and the interface will jump to File List. (See details in Section 6.4.3)



6.4.2 Curve Display

When parameter settings are completed, use matched quartz cells for reference and testing samples. Open the sample chamber and place the cells onto the cell holder R and S1, and then press **【AUTO ZERO】** button.

The screen shows: zero...

The instrument is automatically adjusting 0%T(dark current) and 100% T(full scale). When the indication on the screen disappear, press right arrow to move the cell holder to S1, and press [Start/Stop] key to start testing.

Introduction of function keys on the Curve Display page:

◆ **【Scale Select】**

Press **【Scale Select】** to enter the function area of editing scale bar. The screen will automatically highlight the field to be edited. The user is free to select from the scale bar the starting and ending region which is to be edited. When finishing with editing, press **【ENTER】**, and the screen will be refreshed with new coordinate. This function is used for zoom-in or zoom-out of a desired area of graph.

◆ **【START】 / 【STOP】**

Press **【START】** key to test, and please wait for a moment. When a curve appears **【STOP】** key will work.

◆ **【←】 and 【→】**

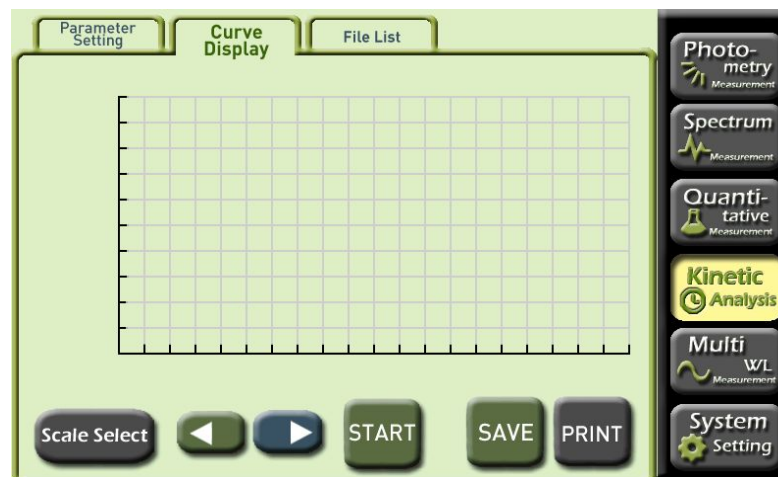
Move the cursor to show real-time curve information.

◆ **【SAVE】**

Save the current test curve to File List and the display will jump to File List. (See details of File List in Section 6.4.6)

◆ **【PRINT】**

Print the current graph which is finished testing.



6.4.3 File List

Press **【LOAD】** on the Parameter Setting page, or press **【SAVE】** on Curve Display page, the screen will jump to File List page.

A maximum of 10 curves can be stored in the instrument (only for kinetic analysis function), which doesn't share the same the file list with other functions.

Select the location of a file first, then perform operations (save, read, rename or delete).

The introduction of function keys on File List page:

◆ **【SAVE】**

First, select the location where the file is to be saved, press **【SAVE】**, and a numeric keypad will pop up. Key in a name for the file, press **【ENTER】** to confirm, and the current curve information will be saved. The file name must be less than 8 characters. If a selected serial number already has a file, the new saves file will replace the old one.

◆ **【LOAD】**

First, select the location where the file is saved, press **【LOAD】**, the page will jump to Curve Display, and the curve information which has been read will show on the screen. (For Curve Display function, see details in Section 6.4.2.)

◆ **【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.

◆ **【Delete】**

First, select the location where the file is saved, press **【delete】**, and the selected file will be deleted.



6.5 Multi-wavelength Measurement

6.5.1 Parameter Setting

Press [Multi WL] from the main function menu on the right of the screen to get into the function settings. The first screen is Parameter Setting page. All function tabs from Page 1 to 4 can be found on the upper left place of the screen, and they can switch back and force.

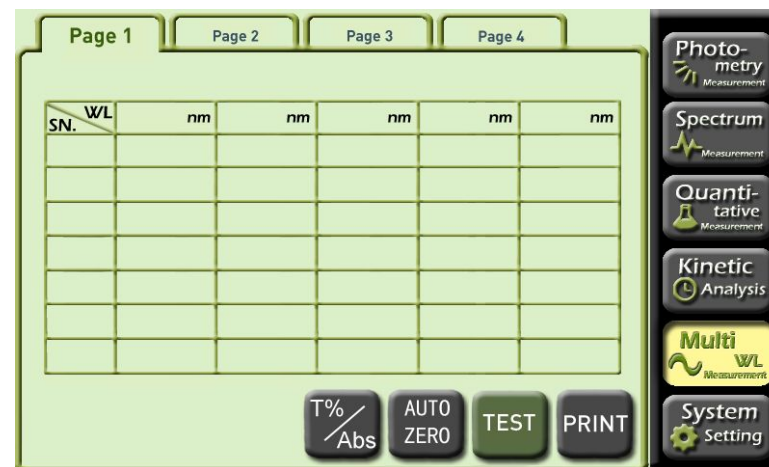
Introductions of other function keys on the Parameter Setting page:

- ◆ 【T% / Abs】 Two measurement modes can be switched: transmittance (T%), and Absorbance (ABS).
- ◆ 【AUTOZERO】 Adjust zero baseline.
- ◆ 【TEST】 On the completion of setting parameters, start multi-wavelength testing.
- ◆ 【PRINT】 Print the testing results.

Example:

Press the red circled areas on the right hand of 【WL.(nm)】 (wavelength) 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 R, S1, S2 and S3. In this example, R is air, S1 is 10% neutral density filter, S2 is 20% neutral density filter and S3 is 30% neutral density filter. 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 Setting

6.6.1 System setting of N2 and N2S series

Press the [System Setting] from the main menu, to enter this function module. The display shows like this:

- **Tungsten Lamp Working Status:**

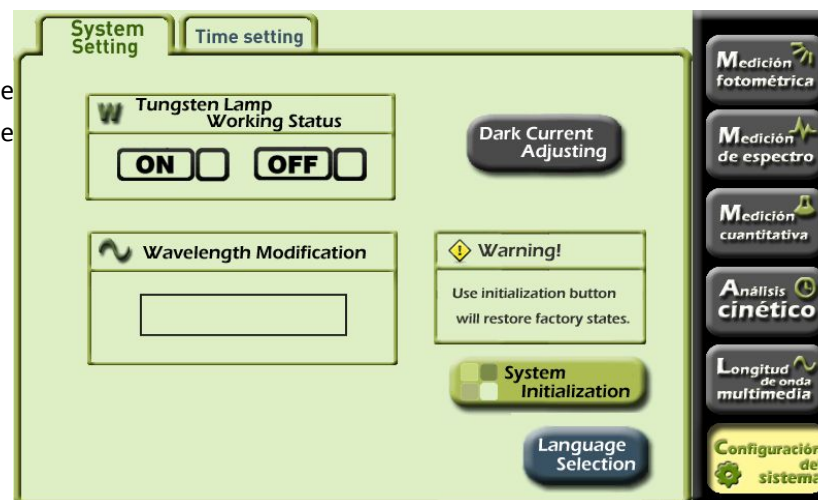
To turn on the tungsten lamp, press **【ON】** and to turn it off to press **【OFF】** .

- **Wavelength Modification:**

The wavelength can be corrected by user here (correction value is the measured value minus the standard value, the correction range is ± 0.5 nm). Enter the wavelength which the user want to set from the box .

- **Language selection**

This option provides instrument language as Chinese, English and Spanish.



Introduction of other keys on the System Settings:

- ◆ **【Dark Current Adjusting】** Calibrate the drift dark current.
- ◆ **【System Initialization】** Press the key and the system will be initialized. Use with caution!

6.6.2 System setting of N4 and N4S series

Press the [System Settings] from the main menu, to enter this function module. The display shows like this:

- **Tungsten Lamp Working Status:**

To turn on the tungsten lamp, press 【ON】 and to turn it off to press 【OFF】 .

- **Deuterium Lamp Working Status:**

To turn on the deuterium lamp, press 【ON】 and to turn it off to press 【OFF】 .

- **Wavelength Modification:**

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 wavelength which the user want to set.

- **Wavelength of Sourcing lamp Select:**

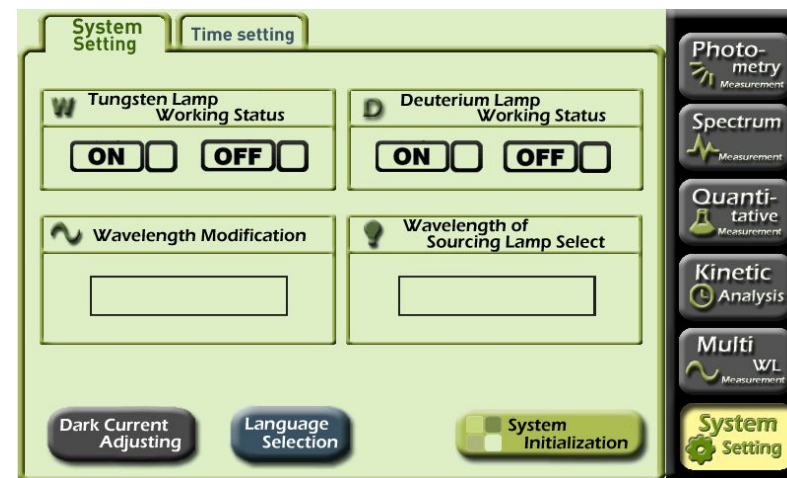
When the deuterium lamp reaches a set wavelength value, it will switch to another lamp. Enter the limit wavelength value from the box .

- **Language selection**

This option provides instrument language as Chinese, English and Spanish.

Introduction of other keys on the System Settings:

- ◆ 【Dark Current Adjusting】 : Calibrate the drift dark current.
- ◆ 【System Initialization】 : Press key and the system will be initialized. Use with caution!



6.6.2 Time Setting

Press the [Time Settings] from the main menu, to enter this function module. The display shows like this:

- Date :**

The user can be in the corresponding year, month and day input box to set the date data, with the keyboard in the interface below.

- Time :**

The user can be in the corresponding hours, minutes and seconds, input box to set the date data, with the keyboard in the interface below.

The screenshot shows the 'Time setting' interface. It features two tabs at the top: 'Parameter Setting' and 'Time setting'. The 'Time setting' tab is selected. Below the tabs, there are two main sections: 'Date' and 'Time'. The 'Date' section has three input boxes labeled 'Year:', 'Month:', and 'day:'. The 'Time' section has three input boxes separated by colons, representing hours, minutes, and seconds. At the bottom of the main area is a numeric keypad with buttons for digits 0-9, a 'Cancel' button, and an 'Enter' button. To the right of the main interface is a vertical sidebar with several menu options, each with an icon: 'Medición fotométrica', 'Medición de espectro', 'Medición cuantitativa', 'Análisis cinético', 'Longitud de onda multimedia', and 'Configuración del sistema'.

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

The series of instruments use 12V/20W inserted tungsten halogen lamp and DD2.5 deuterium lamp (for N4 and N4S). Please follow the replacement procedures below:

Tungsten halogen lamp

- a. Turn off the instrument and disconnect the power cord from power supply;
- b. Slacken the fixing screws from both sides of the case;
- c. Remove the protective guard plate from the lamp chamber;
- d. Wear clean gloves to pull off the old lamp, and fit the new lamp;
- e. 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 max. value, prior to fix the screws tightly.
- f. Shut the instrument case.

Deuterium lamp (for N4 and N4S)

- a. Turn off the instrument and disconnect the power cord from power supply;
- b. Slacken the fixing screws from both sides of the case;
- c. Remove the protective guard plate from the lamp chamber;
- d. Wear clean gloves to pull off the old lamp, and mount the new lamp;
- e. 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.
- f. Shut the instrument case.

Note: Replace the tungsten halogen or deuterium lamp only after the instrument is disconnected from power supply and the lamp is cool. Pay attention to the color of wires when replacing the deuterium lamp. Do not look at the lamp with naked eyes for long time.

7.3 Q/A

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 can not 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 doesn't work.

Failure	Cause	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

7.3.2 The power on self-checking test fails.

Failure	Cause	Troubleshooting
The computer system fails in self-checking.	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. b. Troubleshoot accordingly: 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. b. Troubleshoot accordingly: a. Replace with a new motor. b. Repair CPU circuit board.
The energy of tungsten lamp fails.	a. The tungsten lamp doesn't work properly. 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.	a. Troubleshoot accordingly: 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.
The positioning of wavelength fails.	a. The light from tungsten lamp doesn't project into slit. b. The tungsten lamp is aging.	a. Adjust the position of source lamp. b. Replace the lamp.

7.3.3 The halogen lamp doesn't work properly.

Failure	Cause	Troubleshooting
The halogen lamp doesn't shine. (With about 11.5V DC)	<ul style="list-style-type: none"> a. The halogen lamp is not properly connected with the lamp holder. b. The halogen lamp is broken. 	<ul style="list-style-type: none"> a. Get it well connected. b. Replace with a new lamp.
The halogen lamp doesn't shine. (Without about 11.5V DC)	The circuit system of halogen lamp is broken.	Fix the circuit system.
The halogen lamp shines.	<ul style="list-style-type: none"> 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. 	<ul style="list-style-type: none"> 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.

7.3.4 The graph and data cannot be printed.

Failure	Cause	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

7.3.5 Reading is not stable.

Failure	Cause	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 the working environment. c. Replace with a new source lamp. d. Improve the working environment. e. Use an AC regulated power. f. Readjust the optical path. g. Fix or replace with a new one.

7.3.6 The deviation of sample reading is huge

Failure	Cause	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 device can perform zero or full scale adjustment.

Failure	Cause	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.

7.4 Wavelength Modification

From the main menu, select [Spectrum] function and setup as following: measurement Mode, 【ABS】 , scan range (350nm~650nm), Data (0.0000A~1.2000A), scan speed (middle), sampling interval (0.1nm), and scan time (1). On the completion of setup, press 【baseline calibration】. 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 cell are not covered by this warranty).