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1 Overview

1.1 Features

UV2800 is a double beam UV/Vis scanning spectrophotometer with a big LED screen. The instrument uses intelligence modular design. It has friendly user interface, automatic operation system, powerful functions, advanced optical and circuit system and mechanical structure, and provide excellent technical specifications and long-time stable operating performance. So it can fit requirements by various users in different fields for any level's analysis applications.

UV2800 spectrophotometer operates with man-machine interaction in English. It's easy to be operated and mastered. To achieve a function is only by selecting and confirming the relevant items in the menu shown on the big LED screen. To replace light source lamps of the instrument is also very simple, only rotating some screws is needed. And the light source will be on the optimal position without tedious adjustment step.

UV2800 spectrophotometer can be widely used in organic, inorganic, petroleum, pharmacy, environment, biochemistry, clinic, food and feedstuffs etc. fields. It's essential equipment for quality control (QC) and quality assurance (QA).

1.2 Technical Specifications

1.2.1 Technical Parameters

Wavelength range:	190 - 1100 nm
Wavelength accuracy:	± 0.3 nm
Wavelength repeatability :	≤ 0.2 nm
Transmittance range:	0 - 200% T
Absorbance range:	-0.301 - 4.000 A
Transmittance accuracy:	$\pm 0.3\%$ T
Transmittance repeatability:	$\leq 0.1\%$ T
Drift:	≤ 0.0005 A/h @500 nm (After power on the instrument 2 hours)
Baseline straightness:	± 0.001 A
Stray light:	$\leq 0.05\%$ T
Noise:	$\leq 0.1\%$ T @ 100%; $\leq 0.05\%$ T @ 0%
Scan speed:	3 modes: fast, median and slow
Spectral Bandwidth:	1.8 nm

1.2.2 Operation Conditions

Environment Temperature:	5 - 35°C
Environment humidity:	$\leq 85\%$
Working voltage:	110 ~220 V 50 ~60 Hz
Power consumption:	200W
Main accessories:	Printer
Working place:	Should avoid strong electro-magnetic interference and vibration around the work place

1.2.3 Size

Dimension	540 mm(L)×430 mm(W)×220 mm(H)
Weight	18 kg

1.3 Main functions

The functions of the instrument can be divided into two groups: automatic control functions and analytical operation and data processing functions.

1.3.1 Automatic control

- 1) Self-check and wavelength auto-calibrate when power on;
- 2) Auto-set wavelength position;
- 3) Auto-switch filter;
- 4) Auto-switch light source;
- 5) Auto-optimize light source switching point;
- 6) Display and print spectrograms and data;
- 7) Display error messages.

1.3.2 Analytical operation and data processing

- 1) Photometric measurement
- 2) Spectrometric scanning
- 3) Quantitative analysis
- 4) Multi-wavelength measurement(This function can only work with six-cuvettes stand)
- 5) Chemical kinetics measurement
- 6) Spectrogram zoom, save and load
- 7) Peaks' values determination, searching and printing

1.4 Instrument's structure

1.4.1 Internal layout

As Shown in figure 1.

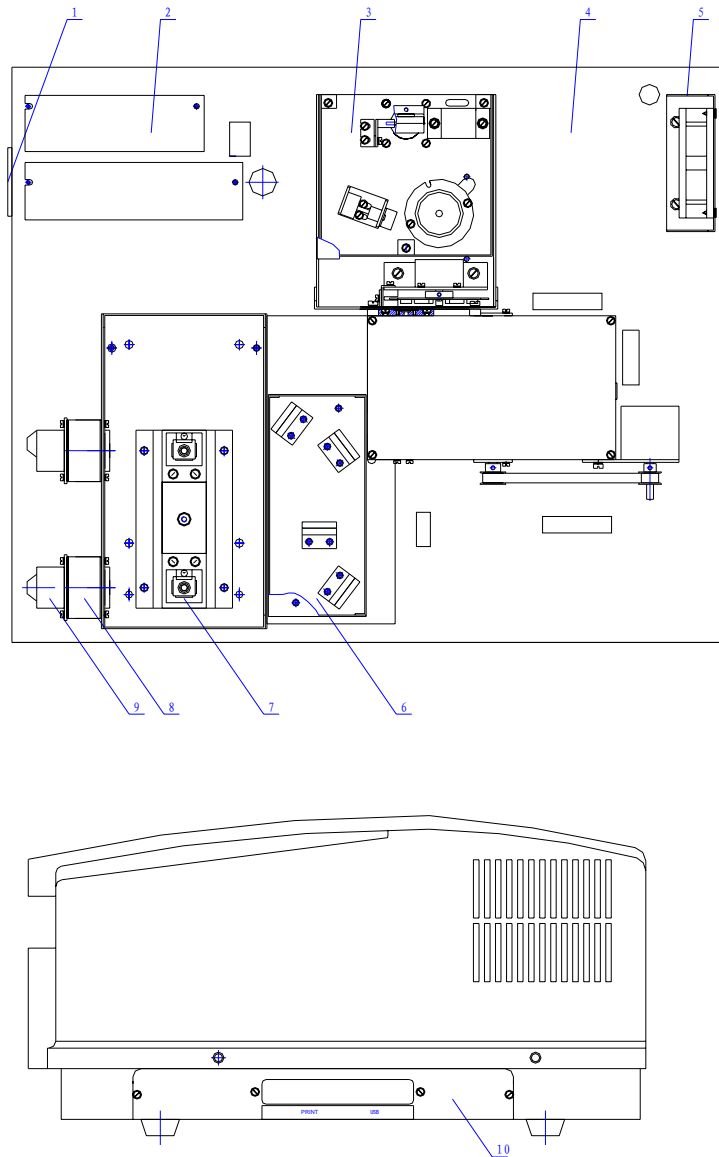
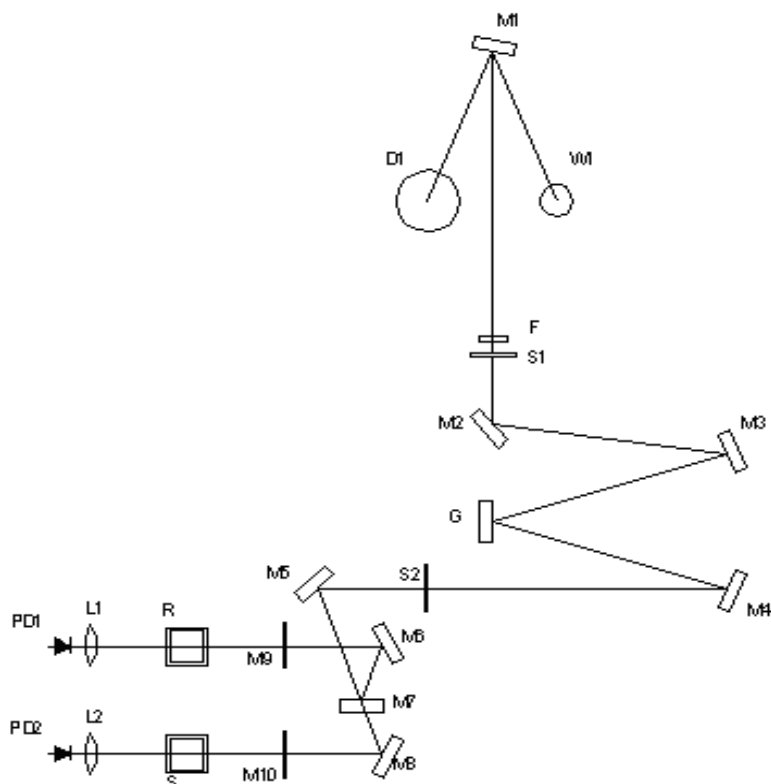


Figure 1

- | | | |
|---------------------------------------|-----------------|----------------------------------|
| 1. Power switch | 2. Power supply | 3. Monochromator and light house |
| 4. Basement | 5. Fan | 6. Light splitter |
| 7. Sample house | 8. Lenses | 9. Pre-amplifier |
| 10. CPU circuit, USB and Printer port | | |

1.4.2 Optical system

UV2800 optical system is shown in Figure 2



W1: Halogen tungsten lamp

D2: Deuterium lamp

F: Filter

M1, M3, M4, M5, M6, M8: Spherical mirrors

M2, M7, M9, M10: Plane mirrors

G: Grating

S1, S2: Optical slits

L1, L2: Lenses

R, S: Sample and reference cuvettes stand

PD1, PD2: Photoelectric cells

Figure 2

The light source of the instrument is composed by a tungsten lamp (W1), a deuterium lamp (D2) and a spherical mirror (M1). It can focus the light from W1 or D2 onto the incidence slit of the monochromator. Switching lamp is achieved by a stepmotor to rotate M1 under program controlling.

The monochromatic system of the instrument is composed by an incidence slit (S1), an exit slit (S2), a plane reflection mirror (M2), collimation mirrors (M3, M4), a grating (G) and filters (F). A wavelength stepmotor and a filters stepmotor are used to rotate the G and F under program controlling. The M5 to M7 as split system are used to split the single light beam into double beams.

Cuvettes will be put on the stand (R and S position) in the sample house. And lenses L1 and L2 focus the light on photoelectric cells. Reference sample should put on R position, and standard or sample should put on S position.

The optical system structure is using an asymmetry aberration correction C-T arrangement, which can give out high quality homogeneous light.

1.4.3 Electric circuit system

The circuit system is composed by power supply, regulated voltage circuit, stepmotor drive circuits, pre-amplifier circuit and microcontroller circuit.

The regulated voltage circuit can give out 12 V 20 W for tungsten lamp, 300 mA current for deuterium lamp, ± 15 V working voltage, 12 V for fan and stepmotors and 5 V for microcontroller.

The pre-amplifier circuit includes photocurrent amplifier, programming gain amplifier and V/F transformer.

The photodetector is high quality silicon photocell, which is long life, anti-fatigue and anti-damp.

1.4.4 Microcontroller system

The MCS-51 microcontroller is used for program control in UV2800. A USB interface is used for communication between instrument and PC computer. A standard parallel port is provided for printer. A big LED screen is used to provide clear display. And the instrument also provide 256K ROM and power-off protected 128K RAM.

1.5 The basic principle

Although the instrument of UV/Vis keeps in growing, the basic work principle is still based on Lambert-Beer's law, as following:

$$A = KLC$$

Where: A is the absorbance of the sample at a special wavelength;

K is a coefficient, named absorbance coefficient.

L is the thickness of the sample. Normally it is the cuvette's size.

C is the concentration of the sample.

It can be found that the absorbance of the sample under homogeneous light is directly proportional to the concentration of the sample.

When a homogeneous light goes through the sample and arrives the detector, the photoelectric cell transfers this light into photocurrent. The strength of the photocurrent determines the absorbance's value. If I_0 represents the photocurrent that comes from the light through the reference sample, I represents the light that goes through the sample and the ratio between them is represented by τ named transmittance, or T % named light transmittance, we can get the following equation:

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

The Lambert-Beer's law points out that the negative logarithm value of the transmittance is the absorbance, and it is directly proportional to the concentration of the sample, as equation:

$$A = -\lg \tau = \lg (I_0/I) = KCL$$

At the same time, different substances at different wavelengths will have different absorbance. This character of substances becomes the basic principle for compounds' quantitative and qualitative analysis by spectrophotometry method.

2 Installing the instrument

2.1 Checking the accessories

Besides UV2800 UV/Vis machine, the essential accessories are also shipped inside the packing. And depend on customer's choice when order, optional accessories will also be shipped together. Please check that you get the complete set using packing list and accessories list after unpacking. If there are any damage or lost, please contact with us immediately.

2.1.1 Standard packing list

- | | |
|-----------------------------|-----------------------|
| 1) Machine | 1 |
| 2) Power cord | 1 |
| 3) Quartz cuvettes | 2 pairs (accessories) |
| 4) 5A fuse | 2 (duplicate parts) |
| 5) User Manual | 1 |
| 6) Certification of quality | 1 |
| 7) Packing list | 1 |

NOTE:

The accessories list inside the packing box is the actual accessories in the packing.

2.2 Installation Requestments

In order to keep the instrument operating in good condition for long time, please check the working place for the instrument carefully before you begin to install it.

The place you have chosen should meet the following requirements:

- 1) Avoid high temperature and high humidity place

Do not install the instrument at high temperature and high humidity place. The instrument should work at 5 - 35°C and humidity $\leq 85\%$.

- 2) Avoid strong electro-magnetic interference

The instrument should be as far as possible away devices that can give out magnetic field, electronic field or high-frequency wave.

- 3) Avoid corrosive gases

Do not install the instrument at the place that have corrosive gases, such as chlorine, hydrochloric acid, hydrogen sulfide, sulfurous acid, beyond the standard.

- 4) Place on a stable workbench

The workbench for the instrument should be flat, stable and avoid vibration. There should have enough space beside the fan to achieve good ventilation.

5) Avoid using the same power outlet with other instruments

The instrument should use a power outlet alone. Do not plug it with any other electronic devices. The power outlet should have protection ground line.

6) Avoid the instrument directly exposure under sun light.

7) Avoid installing the instrument at overmuch dust place

2.3 Work power voltage

WARNING:

Unsuitable power voltage can damage the instrument!

UV2800 UV/Vis can work under AC 110~220 V 50~60 Hz. This range can cover most of countries' electric standard in the world wide. But please check the power voltage inside the range before plugging in the instrument to avoid the damage.

The metal parts of the instrument can be electrified if there is no ground line. And it also affect the signal's stability if there is no good ground. So please check the ground line before power on the instrument. The ground line should fit the relative electrician standards.

WARNING

The neutral line and ground must not connect inside power outlet!

2.4 The instrument installing

It's very simple to install the UV2800 instrument. Only four steps are needed as following describe.

First step: Unpacking the instrument and place it on a stable workbench.

Second step: Connect power cord and plug it into power outlet.

Third step: Power on the machine. The instrument goes into system initialization process. The screen display:

Initialization		
LSI System	.....	OK
Sample Room	.....	OK
Filter zero	.....	OK
Switch zero	.....	OK
WaveLen zero	.....	OK
Wi Energy	.....	OK
D2 Energy	.....	OK
Locate Wave	.....

Fourth step: Main menu display on the screen after initialization. Now the instrument is ready for using. The screen display:

12 : 30 : 10	500.0nm	0.0000A
<Main Menu>		
1. Photometer		
2. Spectrum		
3. Quantitative		
4. Kinetics		
5. Data processing		
6. Multi-wavelength		
7. Utilities		
<hr/>		
Select item:		

WARNING:

Do not open the door of the sample house during the initialization process!

3 Operating instrument

3.1 Keypad description

UV2800 UV/Vis instrument use a special cord to connect keypad and the microcontroller. All functions will be setup through keypad inputting and the statuses or menu will be displayed on the screen.

The layout of the keypad is shown in figure 4.

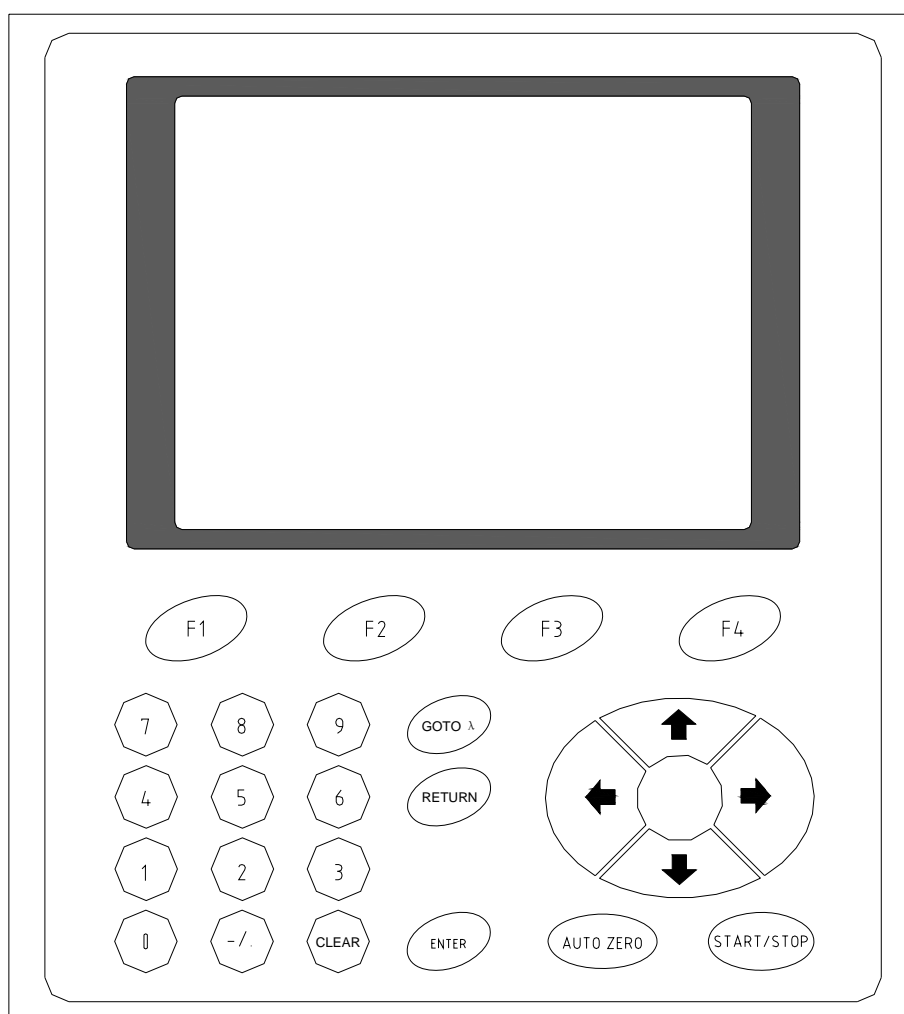


Figure 4

There are 25 keys on the keypad, include 11 number keys, 4 arrow keys and 10 function keys. Each key's function are described in this section.

F1 to F4

Functions of these keys will be different under the different menu. They correspond

with functions in four blocks displayed at the bottom of the screen. The detail will describe in each function's descriptions.

0 – 9, -/.

0-9 are number keys and -/. is point and sign key. They are used for input number parameters, such as wavelength value, limit values for A, T or E and concentration values etc.

[↑], [↓], [←] [→]

These four arrow keys can move the cursor to up, down, left or right direction. Press once, the cursor on the screen move one position. Then the items can be selected.

[ENTER]

This is the confirming key. After input new value or select a menu item, this key must be pressed to confirm.

[CE]

This is the clear key. After input a new value and before confirm it, this value can be cleared by pressing this key.

[GOTO λ]

Under single wavelength measurement, this key is used for setting a new wavelength value.

[AUTO ZERO]

This key is the auto zero adjustment key. After press this key, the instrument will set τ (T) =100% or A=0.000.

[START/STOP]

This key is running or stop key. After set all parameters, the instrument will begin measurement when press this key. After the measurement finished, it can be run again if press this key again. When this key is pressed in measurement process, the measurement will be stopped and the instrument will go into parameter setting status.

[RETURN]

This key is used for return to the upper-level menu.

3.2 System initializing and self-checking

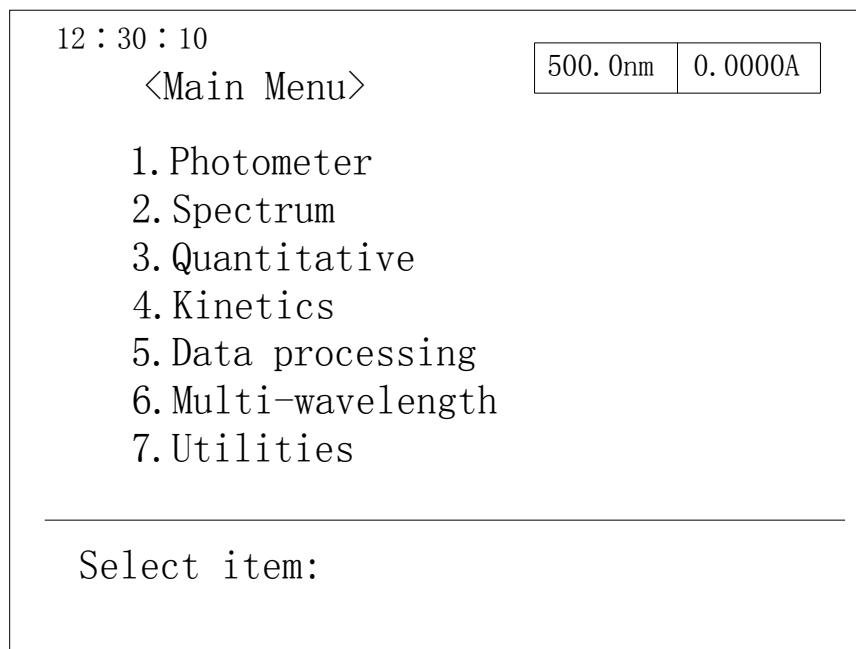
When power on the instrument, it will go into system initializing and self-checking status first. The screen display:

```
Initialization

LSI System      ..... OK
Sample Room     ..... OK
Filter zero     ..... OK
Switch zero     ..... OK
WaveLen zero    ..... OK
Wi Energy       ..... OK
D2 Energy       ..... OK
Locate Wave     .....
```

All items must be display OK in this process. If any error happed in this step, a “Failure” will display in that item’s line and the instrument will be stopped.

After the instrument passed self-checking process, main menu will display on the screen. The instrument needs warm-up 30 minutes before any measurement process. The main menu displayed on the screen is shown below:



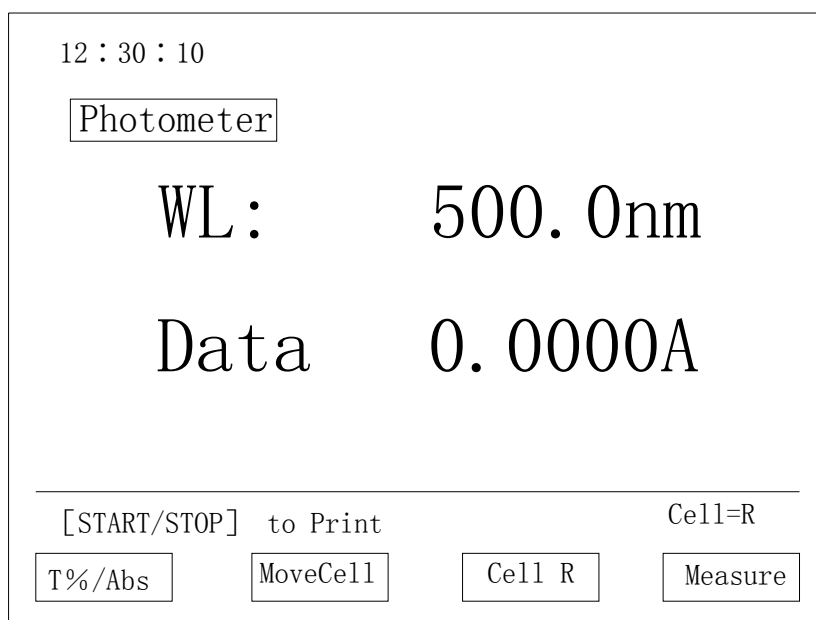
Using \uparrow or \downarrow keys to select one function, the selected item will be displayed in the inverse color. Using [ENTER] key to confirm and go into the down-level menu.

NOTE:

If only one lamp wants to be used for measurement, the other lamp can be turned off to prolong the lamp's life. After self-checking, select item 7 [System set] function, deuterium and tungsten lamp can be set as on or off.

3.3 Photometric measurement

Select [Spectrophotometer] in the main menu and press [ENTER] to go into this function. The screen display:



Four functions displayed at the bottom of the screen can be selected by F1-F4 keys.

F1: Switch key

Switch between light transmittance T% and absorbance Abs.

F2: Cuvettes stand moving key

The cuvette stand moves one position when press this key once. The order is S1, S2, S3, S4, S5, S6 (This function can only work with six-cuvettes stand).

F3: Cuvettes stand return key

The S position on the cuvettes stand will move into the light path (This function can only work with six-cuvettes stand).

F4: Sample measurement key

Measure the Sample. The detail will be described in 3.3.1

[GOTO λ] key can set the wavelength: Input the wavelength that the user wanted by number keys and press [ENTER] to confirm.

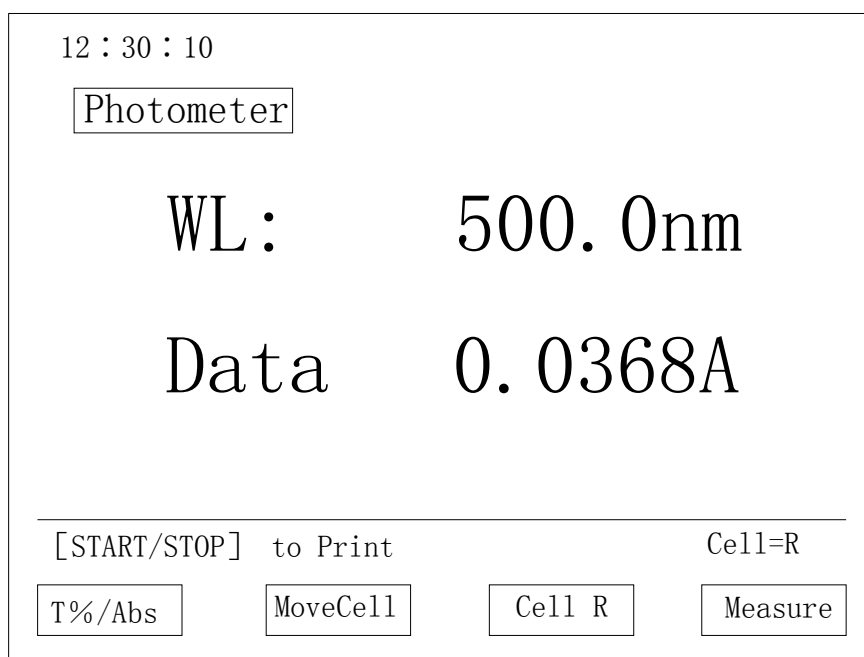
The screen will display: Set wavelength...

The wavelength will auto move to the setting position.

After set all parameters, pour the reference sample into the pair of silicon cuvettes and put them at R and S position on the stand. Close the sample house door and press [AUTO ZERO].

“Blanking...” will display on the screen.

After auto zero correction was finished, replace the reference sample inside S position’s cuvette with the sample solution. Then the measurement result will display on the screen after close the sample house door.



After finished each measurement, pressing [START/STOP] can print out the result of this measurement.

3.3.1 Sample measurement

Press F4, the screen display:

12 : 30 : 10		Photometer		K=1.0000	600.0nm	0.0120A
SN.	Cell	WaveLen	Abs	K*Abs		
001	R	500.0	0.0370	0.0370		
002	R	500.0	0.0370	0.0370		
003	R	550.0	0.0325	0.0325		
004	R	550.0	0.0326	0.0326		
005	R	600.0	0.0120	0.0120		
[START/STOP] to Start			Cell=R			
Browse		MoveCell		Cell R		Factor

Press [START/STOP] once after put in one sample for measurement. Functions display on the screen means:

F1: Display data key

Display measurement data. The detail descript in 3.3.1.1

F2: Cuvettes stand moving key

The cuvette stand moves one position when press this key once. The order is S1, S2, S3, S4, S5, S6 (This function can only work with six-cuvettes stand).

F3: Cuvettes stand return key

The S position on the cuvettes stand will move into the light path (This function can only work with six-cuvettes stand).

F4: K factor setting key

Set K value.

SN: Sample's order number

Cell: The cuvette stand position that is measurement now.

WaveLen: The work wavelength

The [GOTO λ] and [AUTO ZERO] keys can be used to change wavelength and adjust zero under this menu.

3.3.1.1 Data display

Press F1, the screen display:

12 : 30 : 10		K=1.0000		600.0nm	0.0120A
Photometer					
SN.	Cell	WaveLen	Abs	K*Abs	
001	R	500.0	0.0370	0.0370	
002	R	500.0	0.0370	0.0370	
003	R	550.0	0.0325	0.0325	
004	R	550.0	0.0326	0.0326	
005	R	600.0	0.0120	0.0120	
Clear		▲	▼	Return	

F1: Clear key

F2: Previous page key

F3: Next page key

F4: Return key

NOTE:

- 1) The lamp used for measurement should select in item 7[Utilities] in the main menu.
- 2) Using [RETURN] key go back to the main menu.

3.4 Spectrometric measurement

3.4.1 Spectrum menu

Select [Spectrum] item in the main menu, press [ENTER] to go into this function.
The screen display:

12 : 30 : 10			
Parameter	230.0nm | 0.0120A		
1. Measure mode :T%	<input type="text" value="ABS"/> E		
2. Scan range :230.0nm ~ 660.0nm			
3. Record range :0.0000A ~ 1.2000A			
4. Scan speed :F	<input type="text" value="M"/> S		
5. Scan Inter. : <input type="text" value="0.1"/>	0.5 | 1 | 2 | 5		
6. Repeat num : 1			
7. Draw mode : <input type="text" value="Seq."/>	Over		
<hr/>			
[START/STOP] to scan	Cell=R		
<input type="text" value="Baseline"/>	<input type="text" value="MoveCell"/>	<input type="text" value="Cell R"/>	<input type="text" value="LoadFile"/>

3.4.1.1 Operations

1) Using number keys select the line which wants to set a new value. Then input a new value. If value is invalid, "error" will display on the screen. And a correct value is waiting for inputting. Using [RETURN] key returns to the upper level menu.

2) After input new value, press [ENTER] key to confirm.

3.4.1.2 Menu items description

1. Measure Mode: Measurement modes

There are 3 modes that can be select: T%- light transmittance, ABS – absorbance and E - energy.

If E is selected, two new lines will display on the screen:

Energy gain: 1-8

Lamp: Deuterium, tungsten, auto

2. Scan range

Input beginning and stop wavelengths. The left number in the line is beginning wavelength, the right is stop wavelength. The scan range should be inside 190 – 1100 nm.

230 – 660 nm is selected in the figure.

If the inputting value is invalid, “error” will display on the screen. And a correct value is waiting for inputting.

3. Record Rang

The default valid values for record range are different with different measurement mode. User can modify them. The left number in this line is the low limit, the right is the upper limit.

In the figure, the range set to 0.000 – 1.2000 A

4. Scan speed

Three speed rates can be selected: fast (F), median (M) and slow (S).

Median is selected in the figure.

5. Scan Inter.

Set wavelength interval for scanning. Five intervals can be selected: 0.1, 0.5, 1, 2, and 5 nm.

0.1 nm is selected in the figure.

6. Repeat num

Set repeat times for scanning. Valid value is 1 – 20.

If more than 1 times is set, the interval time between each scanning need to be set.

7. Draw mode

Seq (sequence) or Over (overlay) can be selected.

Sequ mode: only one curve will be display on the screen.

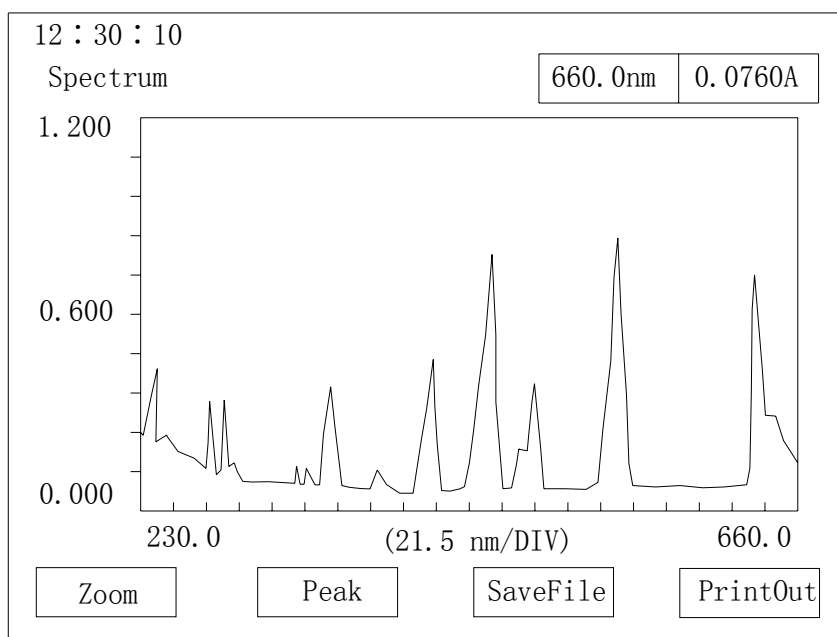
Over mode: all scanning curves will display on the screen. The number of curves is the same as scanning times.

Seq is selected in the figure.

3.4.2 Spectrum Scanning

After finished setting all parameters, press [RETURN] to return to spectrum measurement menu. Pour the reference sample (blank) into the pair of silicon cuvettes and put cuvettes at R and S position on the stand. Close the sample house door and press F1 for baseline correction. Press [START/STOP] to stop if wanted.

Replace the reference sample in S position's cuvette with the sample solution after baseline correction finished. Closing the sample house door and press [START/STOP] to begin scanning. The screen display:



Four functions which can be selected by F1-F4 keys will display at the bottom of the screen.

F1: Zoom:

Modify the scale of display. Press F1, the value which can be changed will display in inverse color. Input new value, then press [ENTER] to confirm. The next value that can be changed will be display in inverse color. After finished setting all parameter, press [START/STOP] to redraw the screen with the new ruler scale. This function is used to zoom in or out the curve in the interesting range.

F2: Peak:

When press F2, the screen will display all peaks' and valleys' values.

The screen display:

Peak		Valley	
WL.	Abs	WL.	Abs
249.0	0.2110A	246.0	0.1733A
277.0	0.3198A	256.5	0.1443A
286.5	0.3684A	268.0	0.1100A
332.5	0.1641A	281.5	0.0930A
360.0	0.3973A	290.0	0.1243A
385.0	0.1221A	327.0	0.0527A
416.5	0.4143A	337.5	0.0521A
485.5	0.8243A	351.0	0.0540A
537.5	0.9343A	462.0	0.0545A
640.5	0.7143A	469.5	0.1196A

If all values can not display in one page, use Pre (F2) or Next (F3) to scroll the screen. Use PrintOut (F4) to print out the data.

F3: Save File:

Save spectrogram curve. Maximum 8 curves can be saved.

The screen display:

Input Chars
<>:select

ABCDEFGHIJKLMN OPQRSTUVWXYZ 0123456789-+*

Chars:

Using arrow keys ← or → to select in 10 numbers and 26 letters to give a name to the file. Press [ENTER] key to confirm. The file name should less than 8 characters.

Then press F4 [Save] to save the file or F3 [Exit] without save.

The screen display after pressing F4:

Curve files (Spectrum)	
File-1	AA
File-2	
File-3	
File-4	
File-5	
File-6	
File-7	
File-8	

The saved file NO. (1-8)

Input an order number after “The saved file No. (1-8)” and press [ENTER] to confirm and finish saving.

If the order number was already used, old file will be erased and new file will be created.

F4: PrintOut

Print out the spectrogram curve, peaks' values and valleys' values depend on which one is displayed on the screen.

3.4.3 Loading file

In spectrum menu, F4 key is used for loading curve from file. Press F4, the screen display:

Curve files (Spectrum)	
File-1	AA
File-2	
File-3	
File-4	
File-5	
File-6	
File-7	
File-8	

The loaded file NO. (1-8)

Inputs file order number at “The loaded file No. (1-8)” position and press [ENTER] to confirm. The screen will display the curve that saved in the file. This curve can also be zoom, detect peaks and valleys and print out.

If no curve exists in the input file, the screen will display to ask for new order number. Input new one at that time.

NOTE:

Baseline correction in scanning range must be done for spectrum after power on. After that, the correction does not need for each scanning if keep the same scanning range. But it should do again when change the scanning range.

3.5 Quantitative measurement

3.5.1 Quantitative measurement menu

Select this item on the main menu, press [ENTER] to go into the function. This function supports to create concentration curve under different measurement mode. The screen display:

12 : 30 : 10		
Quantitative	525.0nm	0.0000A
1. WL: 525.0nm 0.0nm		
2. Method: <input type="text" value="K,B"/> Point Points		
K=10.00		
B=2.00		
3. Unit: mg/ml		
<hr/>		
		Cell=R
<input type="text" value="LoadFile"/>	<input type="text" value="MoveCell"/>	<input type="text" value="Cell R"/>
		<input type="text" value="Start"/>

3.5.1.1 Operations

- 1) Use number keys to select the line that want to be set. Input new value when cursor stops on the item.
- 2) After input new value, press [ENTER] to confirm.

3.5.1.2 Menu items description

1) WL:

Set the work wavelengths. User can set 2 wavelengths according to requestment. Normally only set the first wavelength and leave the second one as zero (one wavelength method). After pressing [ENTER] to confirm, the instrument will set the wavelength to the input value.

“Set wavelength...” display on the screen. When wavelength setup finished, the screen display the menu again.

2) Method:

There are 3 methods can be selected: K,B (factor method), Point (one-point calibration) and Points (multi-point calibration).

Select one then press [ENTER] to confirm. The relative parameter setting screen will be display. The detail will descript in 3.5.2, 3.5.3 and 3.5.4.

3) Unit:

Set the unit used for measurement. 8 units can be selected.

3.5.2 K factor method

K factor method is a simple application of work curve. First it measured absorbance value of the sample. Then the sample's concentration can be calculated by an equation using this Abs value. The equation's parameters should be setting by user and input by keypad.

Select [K,B] in Method line, then press [ENTER] to confirm. The screen will display:

12 : 30 : 10			
Quantitative	525.0nm 0.0000A		
1. WL: 525.0nm 0.0nm			
2. Method: [K,B] Point Points			
K=10.00			
B=2.00			
3. Unit: mg/ml			
Cell=R			
LoadFile	MoveCell	Cell R	Start

Input k and b values to setup work curve for k factor method. Press [ENTER] to confirm.

After set all parameters, pour the reference sample into a pair of silicon cuvettes and put cuvettes at R and S position on the stand. Close the sample house door and press [AUTO ZERO] to adjust the zero point. Then replace the reference sample inside S position's cuvette with the sample solution. Close the sample house door and press F4 into unknown sample measurement menu. The detail process can refer 3.5.2.1.

3.5.2.1 Measuring the concentration of unknown sample

After input the work curve, press F4 to prepare the measurement of the concentration of the unknown sample. The screen display:

12 : 30 : 10

Measure data		525.0nm	0.6487A
SN.	Cell	Abs	Conc (ug/ml)
001	R	0.0000	0.0000
002			

Press [START] to Measure Cell=R

Replace the reference sample inside S position's cuvette with the sample solution. Close the sample house door and press [START/STOP] to measure the concentration of unknown sample. After measure the absorbance of the unknown sample, the result will display on the screen.

There are three functions display at the bottom of the screen.

F1: Browse: Display data. Descript in 3.5.2.1.1

F2: MoveCell: The cuvette stand moves one position when press this key once. The home position is S and the moving order is S1, S2, S3, S4, S5, S6 (This function can only work with six-cuvettes stand).

F3: Cell R: The cuvette stand will move back to the S position (This function can only work with six-cuvettes stand).

3.5.2.1.1 Display data

Press F1, the screen display:

12 : 30 : 10

Measure data

525.0nm

0.0326A

SN.	Cell	Abs	Conc (ug/ml)
001	R	0.0000	0.0000
002	S1	0.0370	0.0370
003	S2	0.0325	0.0325
004	S4	0.0326	0.0326

Cell=R

SaveFile



ReadFile

If data more than one page, F2 (Previous Page) and F3 (Next page) can scroll the screen display. F1 save data to the file. F4 will reload the sample file.

3.5.3 Single-point calibration method

Single-point calibration method only measure one standard sample's absorbance. Then a work curve is created by this value and the zero point. The unknown sample's concentration will be calculated by the work curve.

Pour the reference sample into a pair of silicon cuvettes and put cuvettes at R and S position on the stand. Close the sample house door and press [AUTO ZERO] to adjust the zero point.

Select [Point] in method line and press [ENTER] to confirm. The screen display:

12 : 30 : 10			
Quantitative	525.0nm 0.0000A		
1. WL: 525.0nm 0.0nm			
2. Method: K, B	Point Points		
C=10.00			
A=			
3. Unit: mg/ml			
Cell=R			
LoadFile	MoveCell	Cell R	Start

Input the concentration of the standard sample and press [ENTER] to confirm. Replace the reference sample inside S position's cuvette with the standard sample solution. Close the sample house door and press [START/STOP] to measure the absorbance of the standard sample. Replace the standard sample with unknown sample and press [START/STOP] key to measure unknown sample's concentration. The detail processes refer 3.5.2.1.

3.5.4 Multi-point calibration method

Multi-point calibration method will measure a serial of standard samples' absorbances. Then a work curve is created by these values. The unknown sample's concentration will be calculated by the work curve.

Select [Points] in Method line and press [ENTER] to confirm. The screen display:

12 : 30 : 10		
Quantitative	525.0nm	0.0000A
1. WL: 525.0nm	0.0nm	
2. Method: K, B	Point	Points
	Std. Num.	=3
	Order	=1
	0 intercept:	NO
3. Unit: mg/ml		
		Cell=R
Between 2 and 8		

Input standards number (Std. Num), order of the work curve (Order) and curve if go through the original point (0 intercept) based on the screen request. Press F4 to measure standards to build the work curve. The details refer to 3.5.4.2.

Press F1 to load the work curve which saved before. The details refer to 3.5.4.1.

3.5.4.1 Load the equation

Press F1, the screen display:

Formula files

File-1	AA
File-2	
File-3	
File-4	
File-5	
File-6	
File-7	
File-8	

The loaded file NO. (1-8)

Input the file order number, the screen will return to quantitative measurement menu and the work curve is already loaded. Pour the reference sample into a pair of silicon cuvettes and put cuvettes at R and S position on the stand. Close the sample house door and press [AUTO ZERO] to adjust the zero point. Then replace the reference sample inside S position's cuvette with the unknown sample solution. Press F4 for unknown sample's concentration measurement. The detail processes refer 3.5.2.1.

3.5.4.2 Standards measurement

Before press F4 pour the reference sample into a pair of silicon cuvettes and put cuvettes at R and S position on the stand. Close the sample house door and press [AUTO ZERO] to adjust the zero point. Then press F4. The screen display

12 : 30 : 10
Standard

525.0nm	0.0120A
---------	---------

No.	Cell	Conc (ug/ml)	ABS
1			
2			
3			

Please input conc Cell=R

NextSmpl

Three functions display at the bottom of the screen.

F1: Input next standard.

Select the positions of each standard (This function can only work with six-cuvettes stand, otherwise only S can be used). Then input the standards concentrations relative the positions (in the order from low to high). Put each standard in the inputting order (from low to high) at the S position. Press [START/STOP] to measure. Repeat these processes till finished all standard samples' measurements.

The screen display:

12 : 30 : 10
Standard

525.0nm	0.0120A
---------	---------

No.	Cell	Conc (ug/ml)	ABS
1	R	0.0000	0.0000
2	S1	40.000	0.6387
3	S2	100.00	1.5850

BuildCuv SaveFile Measure Set Std.

The first column is the order number of standard samples. Second column is the sample stand's position. Third column is concentrations of standard samples. And

fourth column is absorbances of the standard samples.

Four functions display at the bottom of the screen.

F1: BuildCuv. Display the equation's curve. The detail refers 3.5.4.2.1

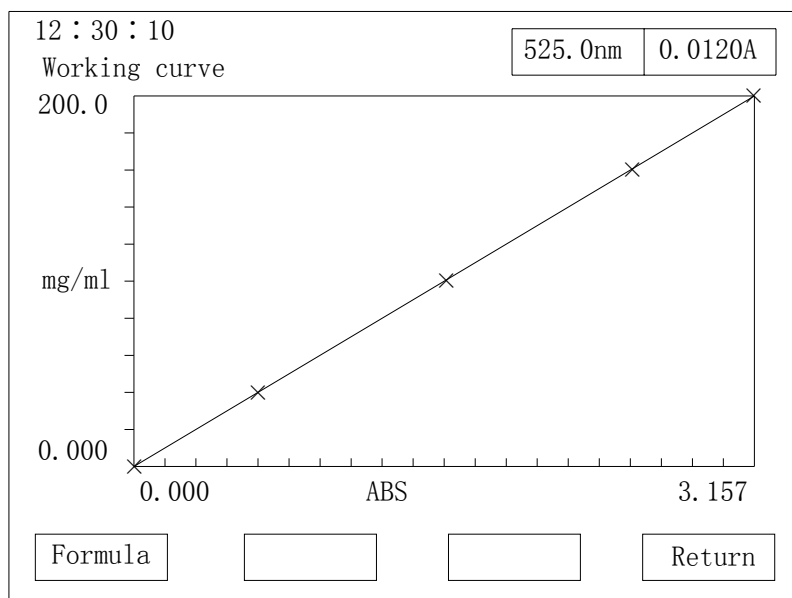
F2: SaveFile. Save the work curve and data.

F3: Measure. The detail refers 3.5.2.1.

F4: Set Std. Modify standards concentration if the inputting is wrong.

3.5.4.2.1 Build curve key [F1]

Press F1 to display the equation curve as shown in the figure:



Two functions display at the bottom of the screen.

F1: Formula. Display the curve's equation.

F4: Return. Return to the upper menu.

3.6 Kinetics measurement

3.6.1 Menu

Select Kinetics in the main menu, then press [ENTER] to go into this function. The screen display:

12 : 30 : 10	
Parameter	500.0nm 0.0000A
1. Measure mode : ABS	<input type="checkbox"/> T% <input type="checkbox"/> E
2. Time range : 0.0s ~ 120.0s	
3. Record range : -0.001A ~ 0.001A	
4. Wavelength : 500nm	
5. Scan Inter : 0.2	<input type="checkbox"/> 0.5 <input type="checkbox"/> 1.0 <input type="checkbox"/> 2.0 <input type="checkbox"/> 5.0
6. Repeat num : 1	
7. Draw mode : <input type="checkbox"/> Seq. <input type="checkbox"/> Over	

[START/STOP] to scan	Cell=R
<input type="text"/>	<input type="text"/> MoveCell <input type="text"/> Cell R <input type="text"/> LoadFile

3.6.1.1 Operation

1) Using number keys select the line which wants to set a new value. Using [RETURN] key returns to the upper level menu.

2) After input new value, press [ENTER] key to confirm.

3.6.1.2 Description of items in the menu

1. Measure mode: Three modes can be selected: T%- light transmittance, Abs – absorbance and E-energy.

2. Time range: Valid values are no more than 6000 seconds.

3. Record range

4. Wavelength: work wavelength. Valid values are in the range of 190-1100 nm.

5. Scan Inter: time interval between two times measurements. Five number can be selected: 0.2, 0.5, 1, 2 and 5 second.

6. Repeat num: Can be 1-20. If more than 1, time interval between each times need to be input.

7. Draw mode: Sequence or overlay.

If select E measure mode, 2 new lines will display

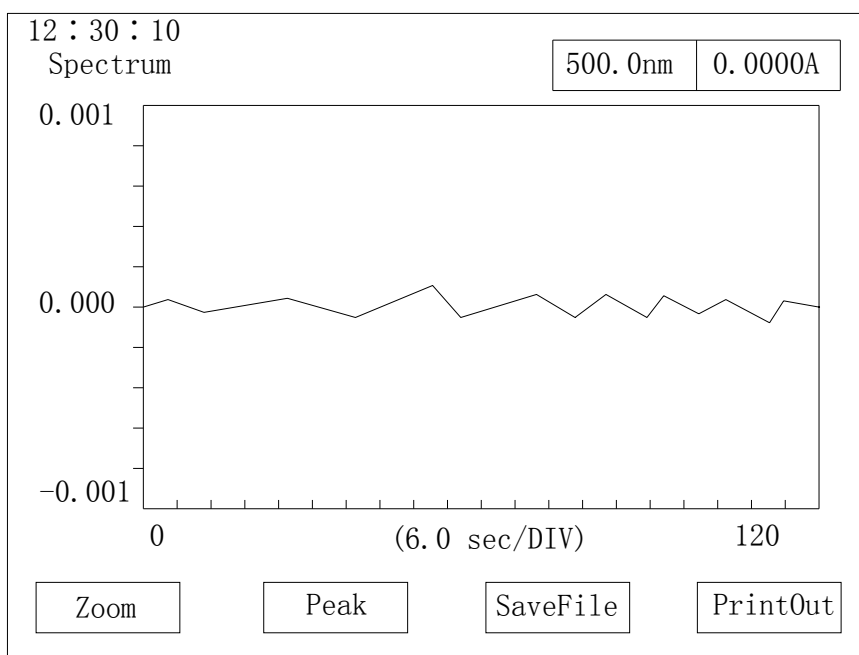
8. Energy gain: 1-8

9. Lamp: Deuterium, tungsten, auto

After set all parameters, pour the reference sample into a pair of silicon cuvettes and put cuvettes at R and S position on the stand. Close the sample house door and press [AUTO ZERO].

“Blanking...” will display on the screen.

Replace the reference sample inside S position’s cuvette with the sample solution after zero correction finished. Close the sample house door, press [START/STOP] key to begin measurement. The screen display:



NOTE:

- 1) The lamp used for measurement should be selected in item 7[Utilities] in main menu.
- 2) Using [RETURN] go back to the main menu.

NOTE:

The spectrogram’s saving, loading and printing are same as the description in 3.4.

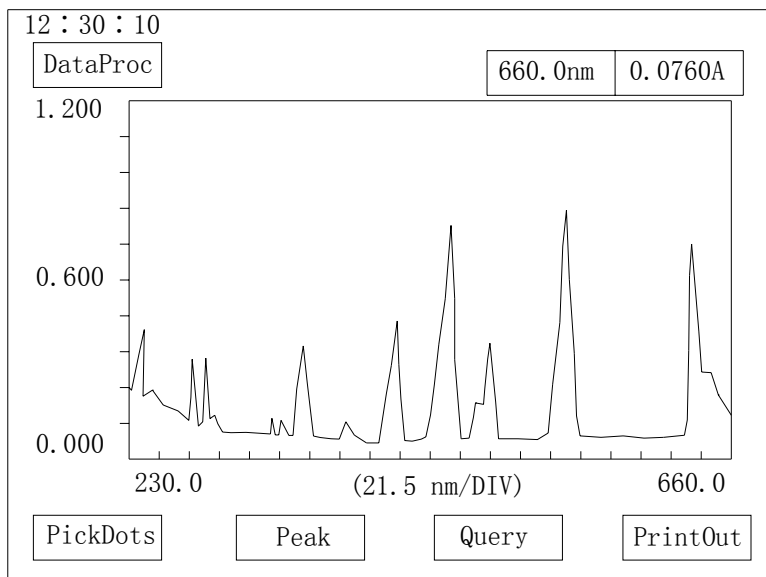
3.7 Data processing

Select the item in the main menu, then press [ENTER] to go into this function. The screen display:

Curve files(Spectrum)	
File-1	AA
File-2	
File-3	
File-4	
File-5	
File-6	
File-7	
File-8	

The loaded file NO. (1-8)

Input the order number of the file and press [ENTER] to confirm, the screen will redraw and display the loading curve.



Four functions display at the bottom of the screen.

F1: PickDots: Multi-points display. The detail refers 3.7.1

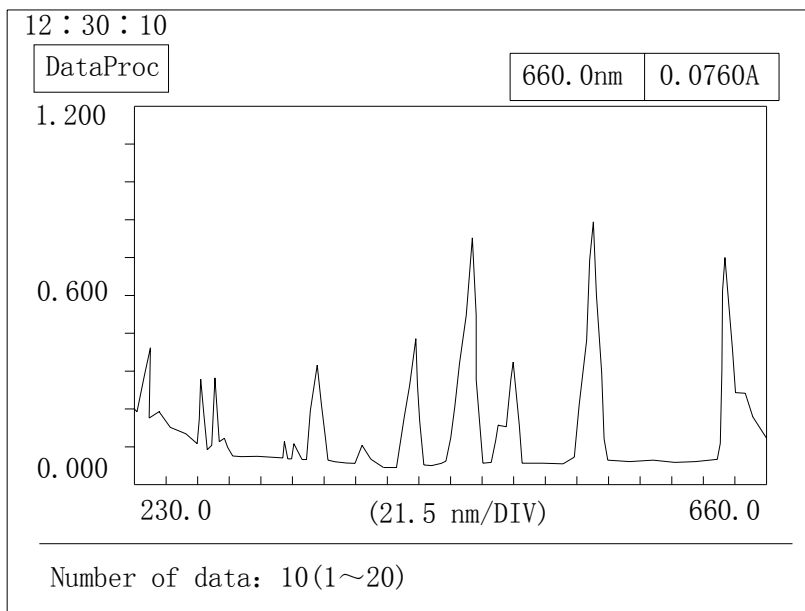
F2: Peak: Detect peaks and valleys and display them.

F3: Query: Display data in a range. The detail refers 3.7.2

F4: PrintOut. Print out the data or graph displayed on the screen.

3.7.1 Multi-points display

F1 is used to display data at the user input wavelength position. The screen display:



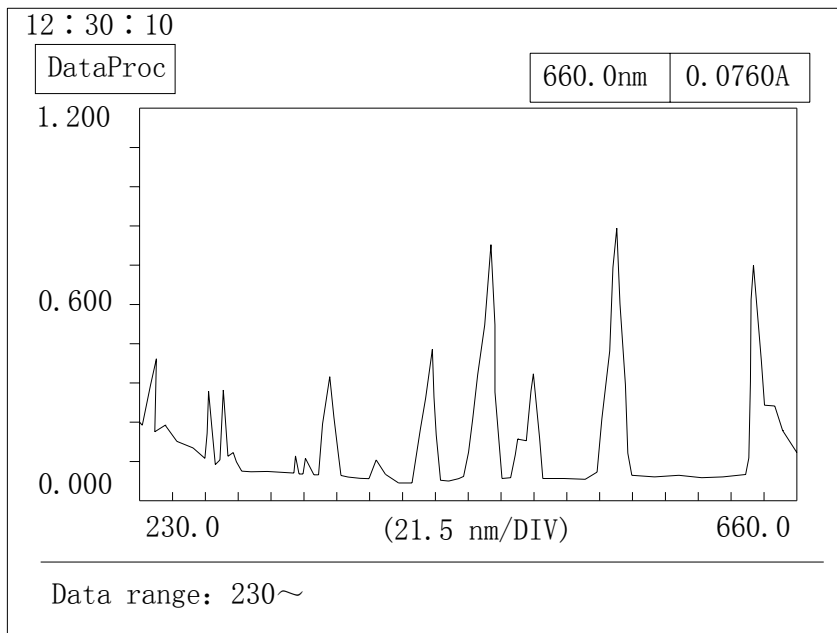
Input how many points want to be displayed and then input wavelength (WL) and press [ENTER], the relative data value will display. The screen display:

SN	WL	DATA	SN	WL	DATA
01	235.0	0.2242			
02	240.0	0.3481			
03	250.0	0.2238			
04	400.0	0.0437			
05	500.0	0.0318			

Exit PrintOut

3.7.2 Query data

Query data is used to display all data in an input wavelength range.
Press F3, the screen display:



Input wavelength range and interval, then press [ENTER]. The screen display:

Query		
SN.	WaveLen	Abs
0001	235.5	0.2242
0002	240.0	0.3481
0003	245.0	0.2238
0004	250.0	0.0437
0005	255.0	0.0318

If data is more than one page, press F2 or F3 to scroll the screen.
Press F4 to print out the result.

3.8 Multi-wavelength measurement

3.8.1 Measurement menu

Select the item in the main menu and press [ENTER] to go into the function. The screen show:

12 : 30 : 10				
Wavelengths		635.0nm 11.17%		
WL. num :3				
Room num :1				
SN	WaveLen	Cell-S1		
1				
2				
3				
[START/STOP] to Start				
T%/Abs		SetParam	PrintOut	

3.8.1.1 Operation

- 1) Using arrow keys select the item which wants to set a new value. Then input a new value.
- 2) After input a new value, press [ENTER] to confirm.

3.8.1.2 Description of menu items

F1: Switch functions between light transmittance T and absorbance Abs.

F3: Set parameters. The detail refers 3.8.1.3

F4: Print out.

3.8.1.3 Set parameters

Press F3, set the number of wavelengths and input wavelengths' values from short to long in sequence. Put reference sample or blank sample at R and S position on the cuvettes stand and press [AUTO ZERO] to adjust zero. Then put samples want to be measured at S position. Press [START/STOP] to begin measurement. When finished, the result will display on the screen as shown in the figure:

12 : 30 : 10

Wavelengths	635.0nm	11.17%
-------------	---------	--------

WL. num :3
Room num :1

SN	WaveLen	Cell-S1		
1	440.0	11.27		
2	546.0	11.82		
3	635.0	11.17		

[START/STOP] to Start

T%/Abs		SetParam	PrintOut
--------	--	----------	----------

Pressing F4 can print out results after measurement finished.

NOTE:

- 1) The lamp used for measurement should be selected in item 7[Utilities] in main menu.
- 2) Using [RETURN] go back to the main menu.

3.9 System setting (Utilities)

3.9.1 System setting menu

Select the item “Utilities” and press [ENTER] key to go into this function. The screen display:

12 : 30 : 10	500.0nm	0.0000A
Utilities		
1. Beep : ON		
2. Lamp WL: 340nm		
3. Time: 10 \ 04 \ 15	13:22:10	
4. Timer: Time	5. Adjust WL	
6. Decimal: 3	7. Reset	
8. WI: ON	9. D2: ON	
Select:		

3.9.1.1 Operation

- 1) Using number keys select the line which wants to set a new value.
- 2) After input new value, press [ENTER] key to confirm.

3.9.1.2 Description of items

1. Beep: Set beep on or off
2. Lamp WL: Set the switch lamp's wavelength. Default wavelength is 340 nm. The valid values are 294 - 364 nm.
3. Time: Set the date and time.
4. Timer: set to display time or date
5. Adjust WL: let user adjust wavelength accuracy by inputting a bias value. The bias value is the difference between the measure value and standard. The bias value is in the range of -2 nm to 2 nm.
6. Decimal: set digit after the decimal point. 3 or 4 can be selected.
7. Reset: reset parameters to the default.
8. W lamp stat: On or Off
9. D2 lamp stat: On or Off

Press [ENTER] after setting all new values. It will take some seconds for opening lamps before returning to the main menu.

4 Maintenance and troublesome

4.1 Maintenance

The key points for the maintaining UV2800 are operation in correct way and keep the environment fitting the requirements described in 2.2. And also:

- 1) Keep the environment clean. Cover the instrument when do not use.
- 2) Keep the environment dry and temperature stable.
- 3) Do not splash solution into sample house. If measure the volatile sample, use cuvette cover.
- 4) Do not touch any mirror or glass part's surface. It not only decrease the accuracy of the instrument, but also can even destroy the instrument.
- 5) When move the instrument, should move carefully and gently. Avoid fierce vibration. And do not put any heavy things upon the instrument cover.
- 6) When do not use the instrument for a long time, should power on the instrument about half hour 1 or 2 times each week.
- 7) Do not splash any solution onto the instrument cover.

4.1.1 Checking the inaccuracy of wavelength

4.1.1.1 Checking Method

The 656.1 nm of deuterium lamp is used to do the checking work.

- 1) Select [Spectrum] item in the main menu.
- 2) Set measurement mode as E mode, factor 1, scanning range 653 – 659 nm, record range 0.0000 – 50.000 E, median speed, interval 0.1 nm and scanning times 1.
- 3) Press [START/STOP] to scan.
- 4) When scanning finished, press F2 to get the peak value. It should be 656.1 ± 0.3 nm. Beyond this range, should set Adjust WL value in Utilities menu as description in 3.9.

4.1.1.2 Frequency for checking

Should be checked 1 to 2 times each year.

4.2 Troublesome

When instrument have problem in the work, please check the troublesome list here. The troublesome list lists almost all errors can be happened and how to solve it. If the problem does not solve after following how to do or user can not handle it by self, please contact our technical support immediately.

4.2.1 Instrument do not work

Phenomena	Possible reason	How to do
The screen do not light after power on	a. No 110 -220 V power b. Power cord loosen c. Fuse broken d. Power switch broken e. Screen cable loosen f. Screen broken g. Circuit work wrong	a. Check the power outlet b. Re-plug the power cord. c. Replace 2.5 A fuse d. Replace power switch e – f. Contact technical support

4.2.2 Error when initialization

Phenomena	Possible reason	How to do
System check error	a. ROM broken b. RAM broken	Contact technical support
Sample initial position error	a. photoelectric switch broken b. Step-motor work wrong	Contact technical support
Filter initial position error	a. photoelectric switch broken b. Step-motor work wrong	Contact technical support
Lamp initial error	a. photoelectric switch broken b. Step-motor work wrong	Contact technical support
Tungsten lamp energy error	a. Tungsten lamp ageing b. Something in sample house block the light path c. Circuit work wrong	a. Replace a new lamp b. Remove all other things inside the sample house c. Contact technical support
Deuterium lamp energy error	a. Deuterium lamp ageing b. Something in sample	a. Replace a new lamp b. Remove all other things

	house block the light path c. Circuit work wrong	inside the sample house c. Contact technical support
Wavelength location error	a. Deuterium lamp ageing b. Step-motor work wrong	a. Replace a new lamp b. Contact technical support

4.2.3 Deuterium lamp work wrong

Phenomena	Possible reason	How to do
Lamp do not light, but can hear the sound of relay working	a. Lamp loosen b. Lamp broken c. Lamp power circuit work wrong	a. Re-plug the lamp b. Replace a new one c. Contact technical support
Lamp do not light and can not hear any sound	Lamp power circuit work wrong	Contact technical support
Lamp light, but the instrument do not work	a. Something inside sample house block the light path b. Lamp ageing c. Light do not focus to the slit	a. Remove block things b. Replace a new lamp c. Contact technical support

4.2.4 Tungsten lamp work wrong

Phenomena	Possible reason	How to do
Lamp do not light, but have about 11.5 V DC	a. Lamp loosen b. Lamp broken	a. Re-plug the lamp b. Change a new one
Lamp do not light and no 11.5 V DC can be found	Lamp power circuit work wrong	Contact technical support
Lamp light, but the instrument do not work	a. Something inside sample house block the light path b. Lamp ageing c. Light do not focus to the slit	a. Remove block things b. Replace a new lamp c. Contact technical support

4.2.5 Energy low

If low deuterium lamp's energy is happened at the very first time powering on the instrument after unpacking, please keep the sample house door opening about 1 to 2 days. Then power on again.

Phenomena	Possible reason	How to do
Lamps can light, but report energy low	a. Something inside sample house block the light path b. Filters do not at the correct position c. Step-motor work wrong	a. Remove block things b. Power off the instrument. After about 10 second, power on again. c. Contact technical support
Lamp do not light	Refer list 4.2.3 and 4.2.4	Refer list 4.2.3 and 4.2.4
Energy low only at UV range	Wrong cuvettes used	Should use quartz cuvettes
Lamp light, but can not find light spot	Light do not focus on the slit. Step-motor work wrong	Contact technical support

4.2.6 Can not print out

Phenomena	Possible reason	How to do
Screen display normal	a. Printer do not power on b. Printer cable loosen c. Printer work wrong d. Print out system work wrong	a. Power on the printer b. Re-plug the cable c. Replace a printer d. Contact technical support

4.2.7 Readout unstable on the screen

Phenomena	Possible reason	How to do
Readout drift to one direction	a. Warm-up time is not enough b. Damp inside the instrument	a. Warm-up more than 30 min. b. Work at dry surroundings and increase the warm-up time.
Readout jump	a. Instrument do not ground b. Damp inside the instrument c. Lamp ageing d. Temperature of the surroundings too high e. Power source drift f. Light path or circuit	a. Connect the instrument to the ground line b. Work at dry place c. Replace a new lamp d. Decrease the temperature e. Use stabilized power source f. Contact technical support

	work wrong	
--	------------	--

4.2.8 Readouts do not accuracy

Phenomena	Possible reason	How to do
Readout far from the standard	a. Standards are polluted b. Cuvettes pair do not fit each other c. Cuvettes are polluted d. Instrument do not stable	a. Check the standard samples b. Adjust or replace cuvettes c. Clean the cuvettes d. Contact technical support

4.2.9 Can not adjust zero or full scale

Phenomena	Possible reason	How to do
[AUTO ZERO] can not adjust 100 % T or 0.0000 A	a. Something inside sample house block the light path b. Filters do not at the correct position c. Lamp ageing d. Step-motor work wrong	a. Remove block things b. Power off the instrument. After about 10 second, power on again. c. Replace a new lamp d. Contact technical support

5 Replacing Lamp

5.1 Replacing process

When lamp arrive its life or damaged, replace it as following steps,

- 1) Power off the instrument and unplug the cord from power outlet.
- 2) Remove screws on the both sides of the instrument.
- 3) Remove the shell and place it at the left side of the instrument. If necessary, unplug the cable connected between the screen and the motherboard.
- 4) Loosen screws of the light source cover and remove it.
- 5) Replace the corresponding lamp.
 - a) Replacement of tungsten lamp

Take off the damaged tungsten lamps (Please wear cotton gloves to keep safe) and replace a new one (12V 20W) as shown in figure 5.

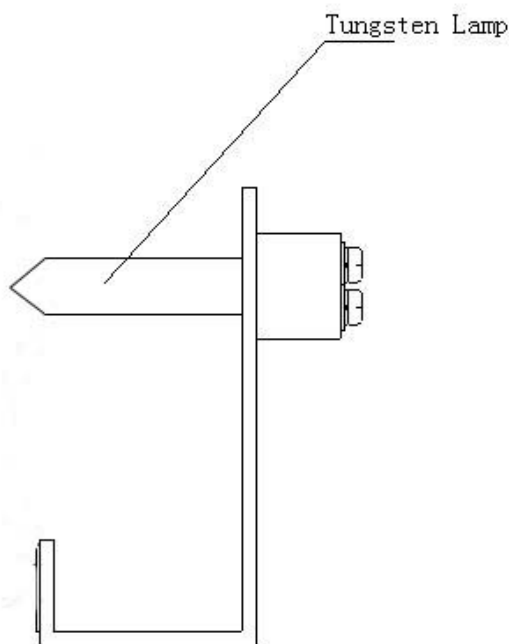


Figure 5

b) Replacements of the deuterium lamp

First loosen the three screws on the connectors and remove three down-lead wires of deuterium lamp. Remember the sequence of the down-lead wires. Then loosen the two fix-screws of the deuterium lamp and remove the damaged lamp, as shown in figure 6. Put on new deuterium lamp with cotton gloves. Tighten fix-screws to fix the deuterium lamp on the position and connect the three down-lead wires to the connectors in original sequence. Take care of that three down-lead wires do not touch

with the metal shell.

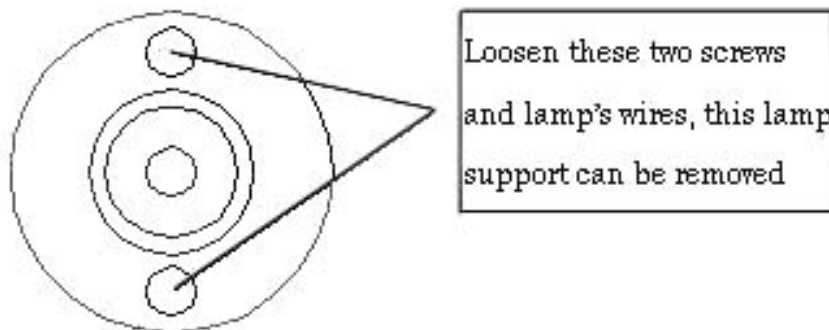
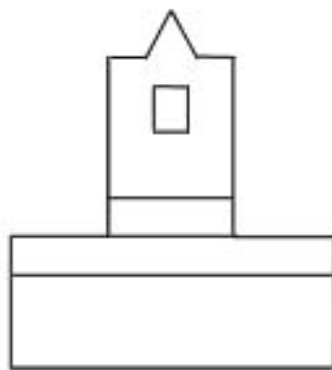


Figure 6

WARNING:

The sequence of three down-lead wires must be same as the original.

5.2 Supplement of replacement

- 1) Do not touch the window of the lamp with bare hands. If touched, must clean all fingerprints with ethanol and dry it before light the lamp. Otherwise, the window will be polluted and can not be removed forever.
- 2) Do not loosen any other screws except requirement.