FISON

Double Beam UV-Visible Spectrophotometer

FM-UVS-C102

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1. Safety Measures

Note: The apparatus described in this manual is designed to be used by properly trained personnel in a suitably equipped laboratory. For the correct and safe use of this apparatus, laboratory personnel must follow generally accepted safe procedures in addition to the safety precautions called for in this manual.

1) The covers on this instrument may be removed for servicing. However, the inside of the power supply unit is a hazardous area, and its cover should not be removed under any circumstances.
2) There are no serviceable components inside this power supply unit. For this instrument, avoid always touching the high-voltage power supply.
3) Some of the chemicals used in spectrophotometry are corrosive and/or inflammable and samples may be radioactive, toxic, or potentially infective. Care should be taken to follow the normal laboratory procedures for handling chemicals and samples.

Electrical

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

Warning

- Any interruption of the protective conductor inside or outside the apparatus or disconnection of the protective earth terminal is likely to make the apparatus dangerous. Intentional interruption is prohibited.
- Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation.

Note: NEVER touch or handle the power supply on this instrument due to the high voltage.

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

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

2. Introduction

Double Beam UV-Visible Spectrophotometer FM-UVS-C102 offers 190 nm to 1100 nm wavelength range and 0.5.1,2 and 4 nm spectral bandwidth. Equipped with 5 inch LCD display and a USB interface allows it to plug directly to the computer for output results. The deuterium and tungsten lamp acts as light source to provide best wavelength coverage across working range of spectrophotometer. This double beam spectrophotometer has highly stable optics with 1200 lines/mm grating and adjustable wavelength scanning with 3000 nm / min maximum speed. It uses two silicon photodiode detectors to measure the test sample and reference sample simultaneously.

3. Features

- ✓ 5 inch LCD display
- ✓ Wavelength range 190 nm to 1100 nm
- ✓ Spectral bandwidth 0.5,1, 2 and 4 nm
- ✓ 1200 lines / mm grating optical system
- ✓ Wavelength repeatability 0.2 nm
- ✓ Built in UV-Vis Analyst software eliminates need of additional software
- ✓ Solvent resistance tactile keypad with alphanumeric entry for file names and units
- ✓ Pre-aligned deuterium lamp for easy replacement
- ✓ Real time clock for date and time stamping of results

4. Specifications

Model No.	FM-UVS-C102
Wavelength range	190 nm to 1100 nm
Spectral bandwidth	0.5, 1, 2 and 4 nm
Optical system	Double beam, grating 1200 lines / mm
Wavelength accuracy	± 0.3 nm
Wavelength repeatability	0.2 nm
Scanning mode	High, Medium and Low (Adjustable)
Maximum scanning speed	3000 nm / min
Photometric range	T: 0 to 200% , A: (-0.3) to 3
Photometric accuracy	T: ≤ ±0.5%, A: ±0.005 % @ 1 A
Light source	Tungsten and deuterium lamp (pre-aligned)
Stray light	≤ 0.05 % T @ 220, 340 nm
Stability	±0.002 A/h @ 500 nm
Display	5 inches LCD (320 × 240 dots)
Baselines flatness	± 0.001 A
Standard cell holder	Standard 10 mm single cell holder (2 pcs)
Sample compartment	Standard 10 mm path length cuvette
Detector	Silicone photodiode
Output	USB port and parallel port (printer)
Power requirement	AC 110 / 220 V, 50 / 60 Hz
Dimensions (W × D × H)	600 × 450 × 200 mm
Weight	22 kg

5. Applications

Used for clinical, pharmaceutical, bio-chemical lab, and also for routine applications such as quantitative analysis, kinetics, wavelength scanning, multi-wavelength and DNA/Protein analysis.

6. Instrument Introduction

This instrument is ideal for measurements in the visible and ultraviolet wavelength region of the electromagnetic spectrum.

Fig.1

The spectrophotometer consists of five parts:

1. Halogen or deuterium lamps to supply the light.
2. A Monochromator to isolate the wavelength of interest and eliminate the unwanted second-order radiation.
3. A sample compartment to accommodate the sample solution detectors to receive the transmitted light and convert it to an electrical signal.
4. A digital display to indicate absorbance or transmittance.

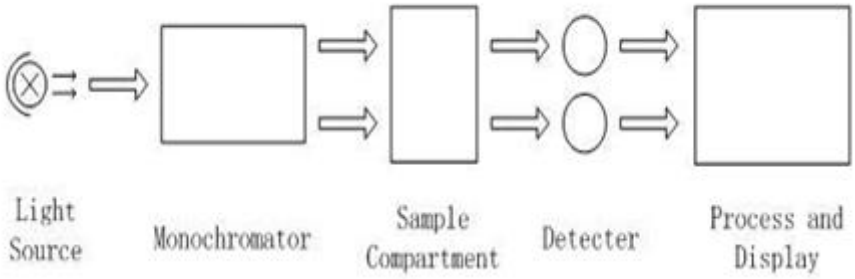


Fig.2

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

7. Installation

1) Carefully unpack the contents and check the materials against the following packing list to ensure that you have received everything in good condition.
2) After carefully unpacking the contents, check the materials with the packing list to ensure that you have received everything in good condition.
3) Place the instrument in a suitable location away from direct sunlight. To have the best performance from your instrument, keep it as far as possible from any strong magnetic or electrical fields or any electrical device that may generate high-frequency fields. Set the unit up in an area that is free of dust, corrosive gases, and strong vibrations.
4) Remove any obstructions or materials that could hinder the flow of air under and around the instrument.
5) Use the appropriate power cord and plug it into a grounded outlet.
6) Turn on your spectrophotometer. Allow it to warm up for 15 minutes before taking any readings. We suggest you then do the Calibrate System with the Search 656.1nm to set the wavelength to the deuterium lamp emission line.

Note:

This symbol means Caution, Risk of Danger.

8. Operations

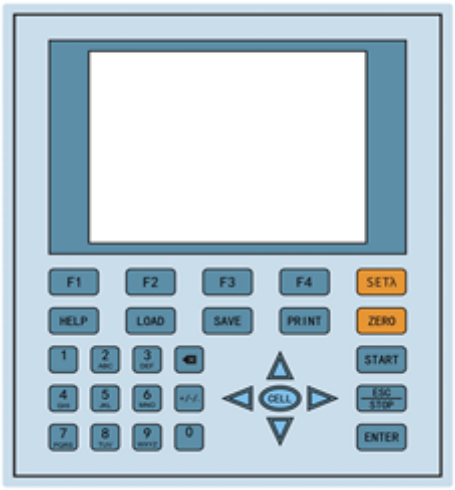


Fig.3

Prepare the spectrophotometer

Fig 3 is the control panel. Users can perform all operations by pressing the keys, and the LCD displays all the results and operation information.

8.1 Description of Keys

[LOAD] Load data or curve saved before.
[SAVE] Save data or curve
[SET λ] Set wavelength
[ZERO] Blank or scan the user baseline
[PRINT] Print test results or screen
[START] Start testing or scanning sample
[ESC/STOP] Exit to the previous screen or cancel the operation
[ENTER] Confirm the inputted data or selected item; Go into the next setup or screen
[F1]-[F4] Function based on the information on the screen
[0]-[9] Input number or letter, consequently, press a numeric key to select the character.
[+/-/.] Input +, - or dot.
[CE] Clear all characters when you are inputting or clear curve displays on the screen.
[<] , [>] Change "x" scale; Search point after scan; [<] clear a character
[^], [^] Change "y" scale; Search peak after scan; Scroll items for selecting Change capital/small letter last typed in; Browse the items for selection.
[CELL] Set cell position (Only available when Auto Changer is used).
[HELP] Reserved key for future Function Extending, not available now.

8.2 Turn on Spectrophotometer

Turn on the spectrophotometer by pressing the Power Switch **(IO) (**see Fig1). The instrument starts to initiate, and the steps are as follows:

1) The instrument will check memory first (Fig 4), kindly wait or press any keyto skip this step, after positioning the filter, auto-cell changer(if installed), andD2/W lamps, the screen display as Fig 4A. 15 minutes pass or press **【ESC】,**the screen display as Fig 5, Select "No" to skip to the main menu(Fig 7) and select "Yes"(recommended) to calibrate system (Fig 6). The calibrating process includes "get dark current", "searching 656.1nm" and "check energy".After finishing the calibration system, go to the main menu (Fig 7).
2) If the data in memory has been lost, the instrument will directly calibrate thesystem without any choice for you.
3) If no auto-cell changer is installed "cell #1" will disappear in Fig7

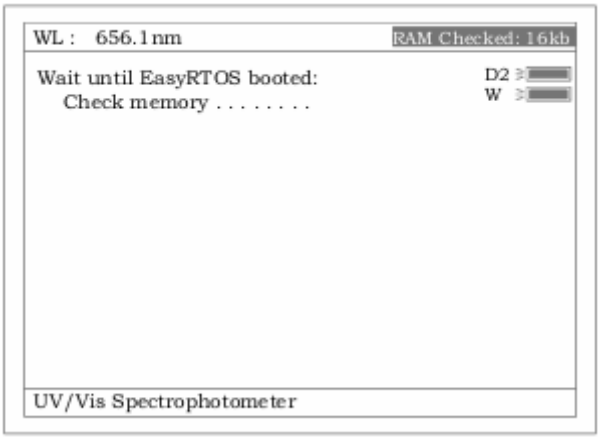


Fig.4

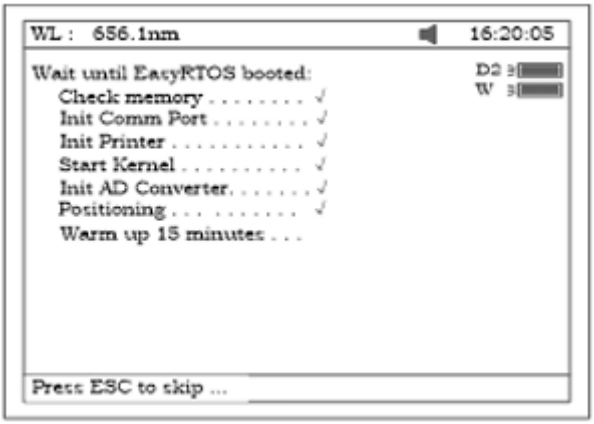


Fig.4A

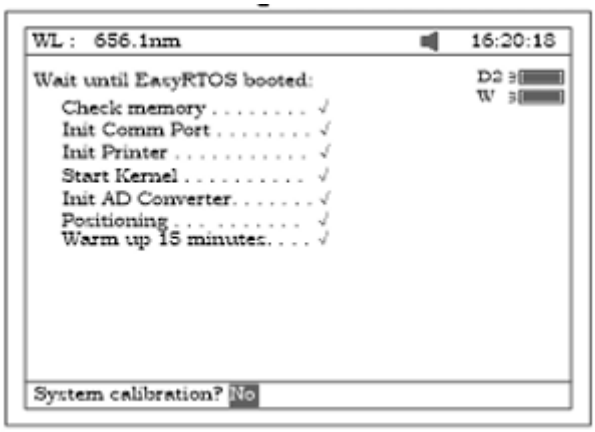


Fig.5

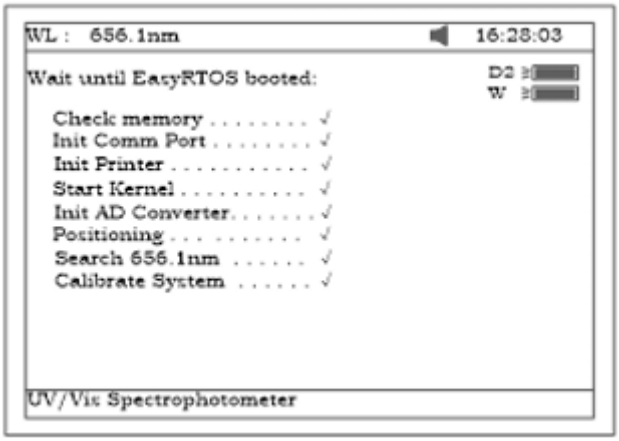


Fig.6

Fig.7

8.3 Basic operation

Blank

There is a system baseline stored in the memory of the instrument. Usually, the user may not rebuild the system baseline before the test. Only by putting the sample into the sample light path and the reference into the Reference Light Path,the result can be obtained. As the system baseline always gets a little change after the instrument is powered on, the user must rebuild the system baseline. There are a couple of ways to rebuild the system baseline. Select "Yes" inFig 5 or Press【**0**】In Fig 73 or Press【**F4**】In Fig41,

Regarding Blanking, important points are listed below:

1) Take measures in Basic Mode

a. Put the reference cuvette with reference solution into the Reference Light Path and the sample cuvette with reference solution into the sample Light Path. Press the Key ZERO for blanking.

Note:

1. If the reference solution is too thick, "Energy Low…" will appear following the "Blanking…" on the screen (Fig 8). If "Energy too Low…" appearsfollowing the "Blanking…", the test will be paused and "Warning…" will appear on the screen. (Fig 9).
2. If no automatic changer is installed "cell #1" and "Max E" will disappear in Fig8.

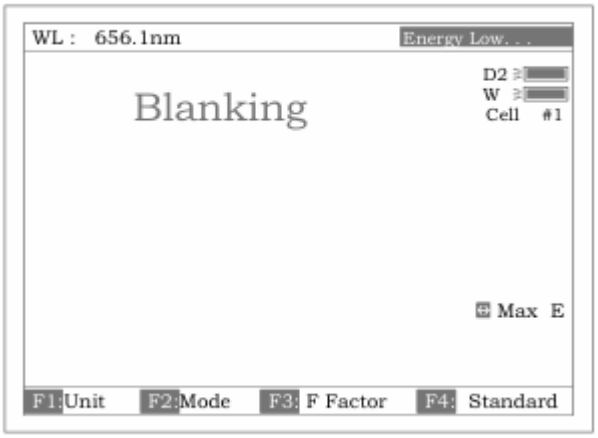


Fig.8

3. Do not open the sample compartment lid during blanking.
4. The dark current won't be taken after power is on if you bypass the calibrating system. It is recommended to take the dark current after warming up.

Fig.9

b. Take out the sample cuvette and replace the reference solution with the sample solution after flushing the cuvette completely. Put the sample cuvette into the Sample Light Path, then the result will display on the screen automatically. However, the 【 START 】 must be pressed in other measurements such as DNA/Protein, Muli WL Quantitative, etc.

2) Take measures in the WL Scan

a. After all scan parameters are entered, put the reference cuvette with reference solution into the Reference Light Path and the sample cuvette with sample solution into the sample light path, Press 【START】 to scan.

b. (Recommended) After all scan parameters are entered, put the reference cuvette with reference solution into the Reference Light Path and the sample cuvette with reference solution into the Sample Light Path, Press 【ZERO】 to obtain the user baseline. Then take out the sample cuvette and replace the reference solution with the sample solution after flushing the cuvette completely. Put the sample cuvette into the Sample Light Path. Press 【START】 to scan.

Set wavelength (Example: set wavelength in “Basic mode”)

- Press **[**SET **λ]** (Fig 10).

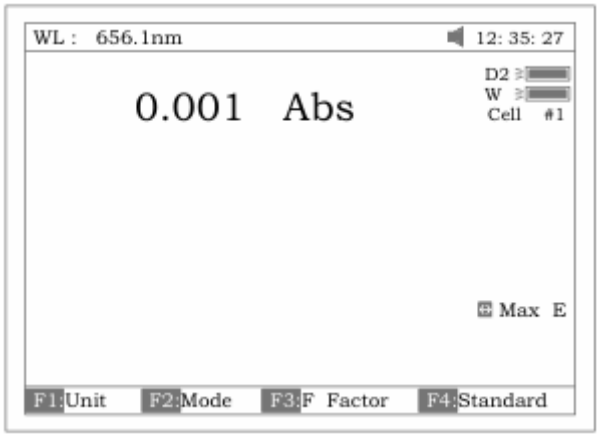


Fig.10

- Use a numeric keypad to input wavelength (Fig 11).

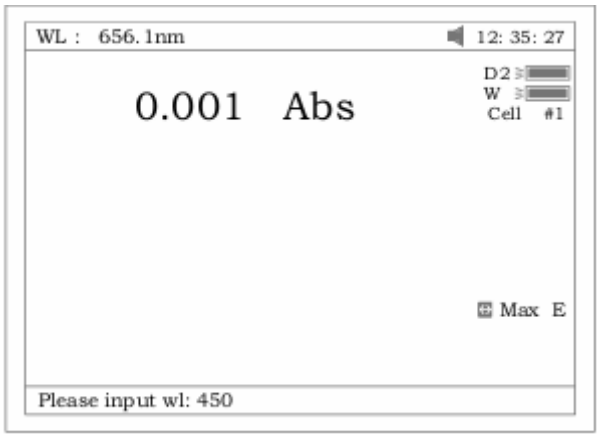


Fig.11

- Press 【**ENTER**】to change the wavelength from 656.1nm to 450.0nm, and then blank; After blanking, the screen displays as Fig 12.

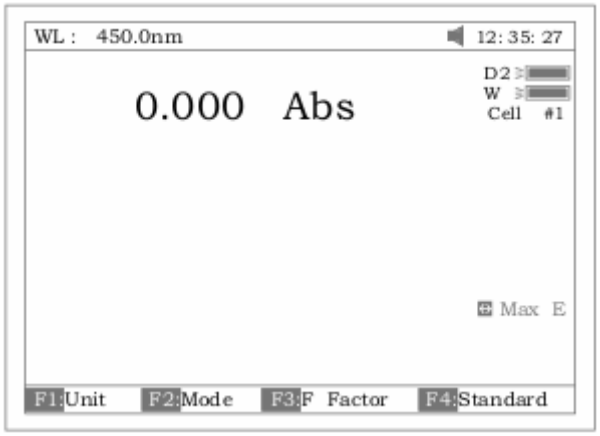


Fig.12

- **Load or delete data or curve** (Take the "WL scan" test for example)

  Press 【**3**】 in Fig.7 to go into the "WL scan". After【**LOAD**】 is pressed, the first file (ABC.wav) in memory will appear on the bottom line of the screen. Shown in Fig 13. Press 【∧】or【∧】to browse the files storedin memory. Then if:

1. The key **[ENTER]** be pressed and the file selected will be loaded and displayed on the screen.

   Note:

   - The file selected must match the "WL scan" test's type. If not the "file type error…" will appear on the Right of the top line.
   - Different tests have different file types. Refer to Table 1 on **Page 12**.

2. The key 【**CE**】be pressed and the file selected will be deleted by selecting" Yes".

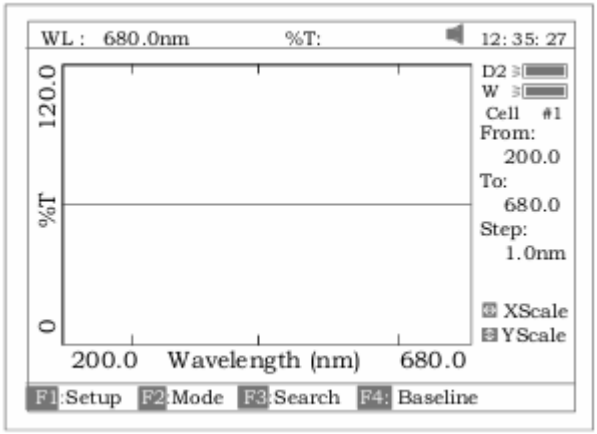


Fig.13

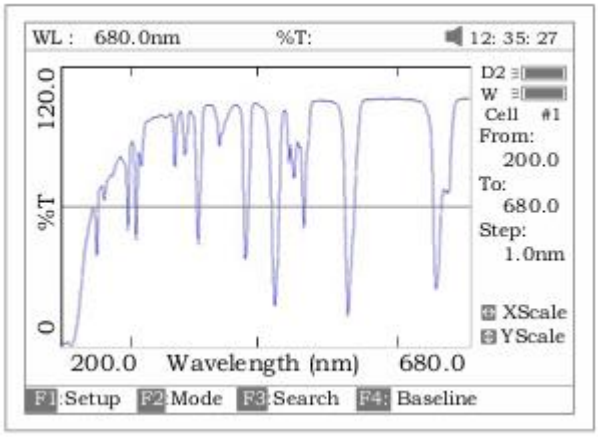


Fig.14

Table 1

Test	File Type
Quantitative Curve	***.fit
Quantitative Test Result	***.qua
WL Scan	***.wav
Kinetics	***.kin
DNA/Protein	***.dna
Multi WL	***.mul
WL Validity	***. wlv
Accu. Validity	***.phv

Save data or curve (Example: Save curve in "WL" scan)

- Press the key [SAVE] in Fig 14 to save the curve.
- Name the curve by pressing the numeric keypad (Fig 15) and press the key **[ENTER]** to confirm.

Note:

1. Pressing the numeric key continually to scroll characters and pressing【 ∧ 】, 【 ∧ 】 to alter capital letter to minuscule. Table 2 shows all characters built in.
2. If the name already exists in memory, the warning "duplicated name, are you sure？ " will appear. "Yes" for overwrite and "No" for Exit.
3. The length of the filename is less than 4.

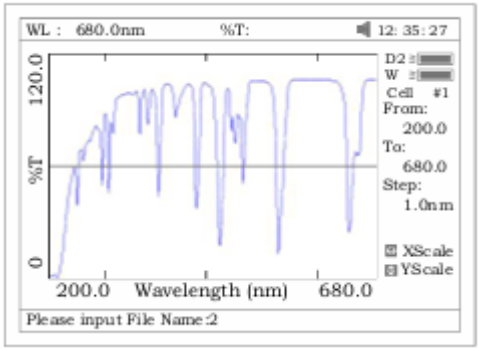


Fig.15

key	representing	key	representing	key	representing
0	0,+,-,*,/	1	1,#,?,:,I	2	2,A,B,C,=
3	3,D,E,F,%	4	4,G,H,I,{	5	5,J,K,L,}
6	6,M,N,O,~	7	7,P,Q,R,S,	8	8,T,U,V,"
9	9,W,X,Y,Z	+/-/.	-,.,		

Print test report (For example: Print the report in "Basic mode",Fig16)

Press the key【PRINT】to print the report (curve or data you have loaded or tested, Fig 17).

Fig.16

```
                    Basic Mode Test Report

Wavelength:    546.0nm
Result:          0.221 Abs
Date and Time: 25-06-2003 13:55:53
```

Fig.17

Before measurement

- Make a blank reference solution by filling a clean cuvette (or test tube) half full with distilled or de-ionized water or other specified solvent. Wipe the cuvette with tissue to remove the fingerprints and droplets of liquid.

Analyze Sample

For different user requirements, we provide different test methods.

Basic Mode

Push the blank cuvette into the Reference Light Path and Main Light Path. In

the main menu (Fig7), press【**1**】to enter the "Basic mode" test. After automaticallyblanking, it will display as Fig 18 (automatic changer installed) or Fig 19 (automatic changer uninstalled) and wait for the operator.【**ESC/STOP**】to exit.

Note: If no automatic changer is installed "cell #1" and "Max E" will disappear in

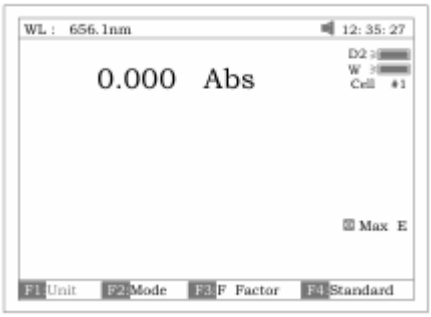


Fig.18

Fig.19

Test: There are three modes (T%, Abs, conc/factor) for you to select by pressing【F2】to make a choice.

Fig.20

1. **Abs mode**

   Push the blank cuvette into the Reference Light Path and Main Light Path. Press 【**F2**】 to select Abs mode, Press 【**ZERO**】for Blanking, and then Push the sample into Main Light Path to take a reading (Fig 20)

2. **T% mode**

   The operation is the same as Abs test mode but pressing 【**F2**】 to select T% mode.

3. **Conc/Factor mode**

   Press 【F1】 to select a concentration unit (Fig 21). If no unit is suitable for your test, kindly select the item "Other", press【ENTER】 and input a new unit by pressing the numeric keypad (Fig 22).

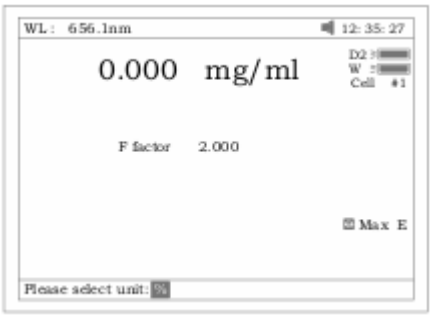


Fig.21

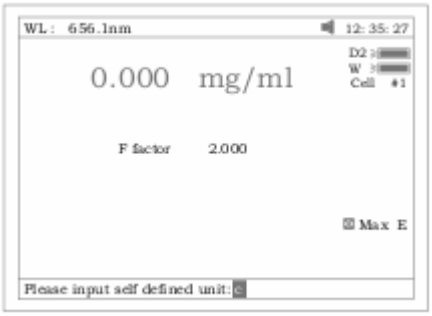


Fig.22

4. Push the blank cuvette into the Reference Light Path and Main Light Path and press 【**ZERO**】for Blanking. There are now two choices for you to take:
   4.1 Press【**F3**】to input known F value, Fig 23. Then push the sample into the MainLight Path to take a reading of the concentration.
   4.2 Push a sample of known concentration into the Main Light Path.

Press【**F4**】to input the known Conc value, Fig 24. Then push the sample into the Main Light Path to take a reading of concentration.

Note:

1. You can select wavelength at any time by pressing【**SETλ**】. After your selection, the instrument always blanks automatically.
2. If F value is more than 9999, the clue of "out of range" will display on screen.

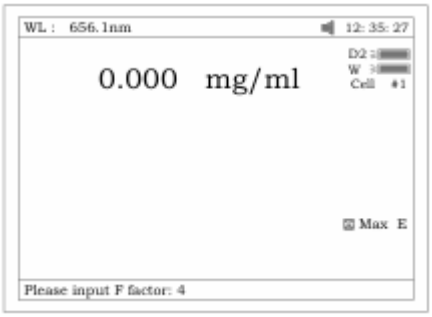


Fig.23

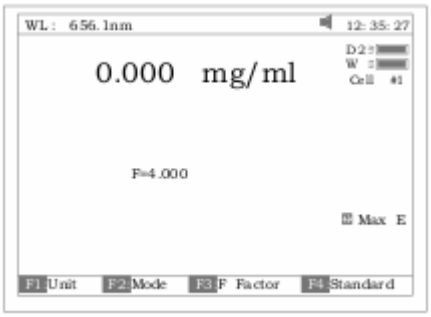


Fig.24

Print Test Report

Press 【**PRINT**】to print test results (Fig 25).

```
                    Basic Mode Test Report

Wavelength:    546.0nm
Result:          0.221 Abs
Date and Time: 25-06-2003 13:55:53
```

Fig.25

<u>Quantitative</u>

Press【**2**】in Main Menu for the "Quantitative" Test (Fig 26). Press【**ESC/STOP**】to exit.

Note: If no automatic changer is installed "cell #1" will disappear in Fig26.

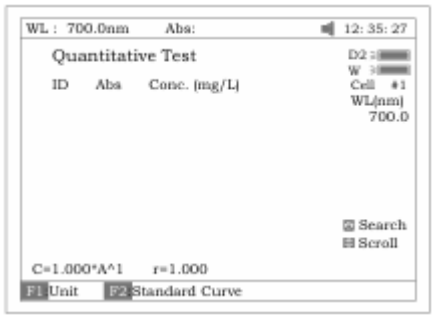


Fig.26

How to operate

1. Press 【F1】to select the unit of concentration (Fig 27).

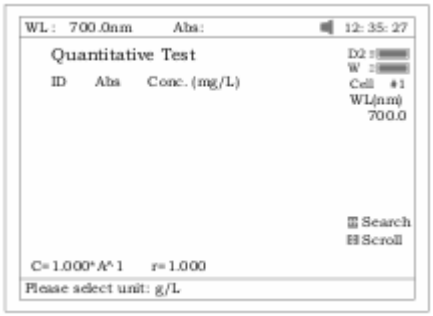


Fig.27

2. Press 【 SETλ 】 to select correction methods and enter the wavelength. There are three correction methods (single, Isoabsorbance and 3-point, Fig 28)

   Note: Kindly refer to Appendix B for the correction method.

Fig.28

3. Press 【**F2**】in Fig 26 for more items to select. See Fig 29.

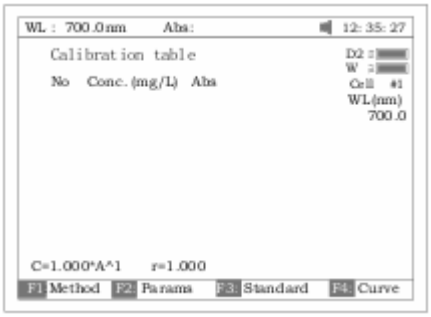


Fig.29

3.1 Press 【F1】in Fig 29 to select the fitting method. There are 4 methods for you to choose from: Linear fit, linear fit through zero, square fit and cubic fit.

3.2 Press 【**F2**】in Fig 29 to enter directly a known standard curve. Fig29A.

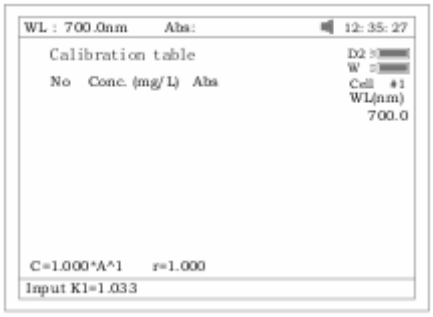


Fig.29A

The constants to be entered depend on which fitting method is selected. Thetable below lists their relation:

Fitting Method	**Fitting Equation**	**constants**
linear fit through zero	C=K1×A	K1, r*
Linear fit	C=K0+K1×A	K0,K1,r*
square fit	$C=K0+K1\times A+K2\times A^2$	K0,K1,K2
cubic fit	$C=K0+K1\times A+K2\times A^2+K3\times A^3$	K0,K1,K2,K3

* r: regression coefficients, default=1

3.3. Press 【**F3**】in Fig 29 to establish a standard curve by measuring a group of standard samples. See Fig 30.

3.3.1 Enter standard concentrations of samples by pressing the Numeric keypad followed by **ENTER.** Press 【▯】or【▯】to modify the inputted data (Fig31).
Press【**ESC/STOP**】to finish inputting and to exit (Fig 32).

Fig.30

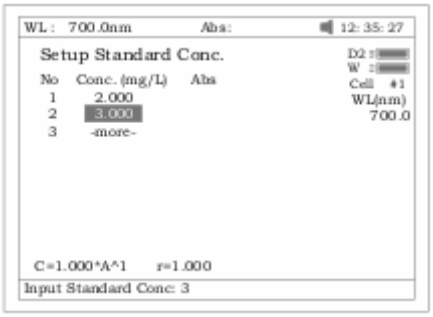


Fig.31

3.3.2 Push the blank cuvette into the Reference Light Path and Main Light Path, press【0Abs/%100T】and the instrument will step to the wavelength and blank. See Fig 32.

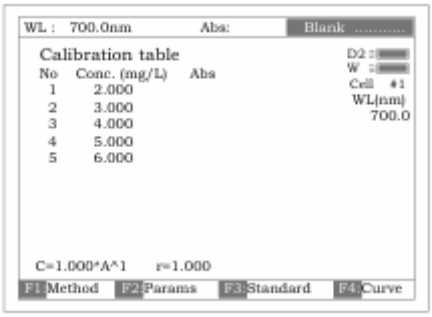


Fig.32

3.3.3 Pull the first sample cuvette of known concentration into the light path, Press the key【**START**】to get values of the standard curve one by one (Fig 33).

3.3.4 Press【**F4**】to draw the curve. You can get a different curve by pressing 【**F1**】to select a different fitting method. (See Fig 34-Fig37.) For linearfits, "r" represents the fitting coefficient of linear regression. r=1 is the best fitting. Usually "r" is very close to 1.

Note: If there are few standard samples, it is not suitable for selecting square fitting, especially cubic fitting, otherwise invalid fitting results will be obtained.

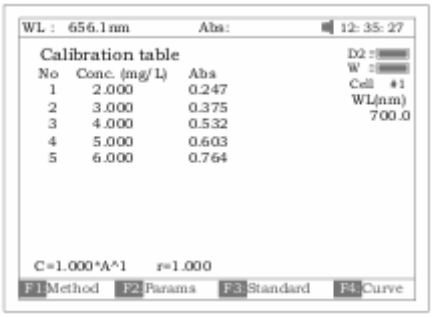


Fig.33

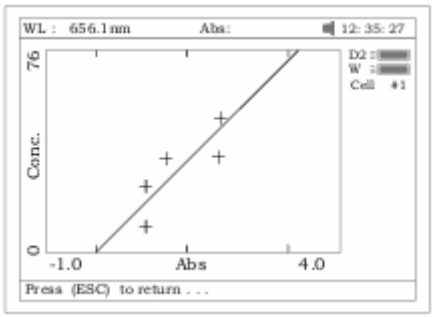


Fig.34 Linear through zero fit

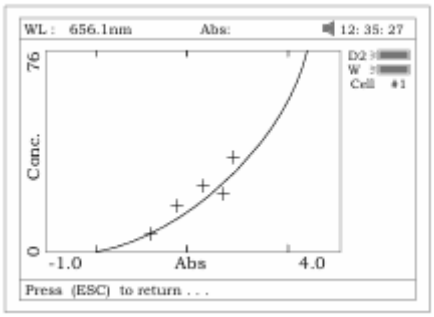


Fig 35 Square fit

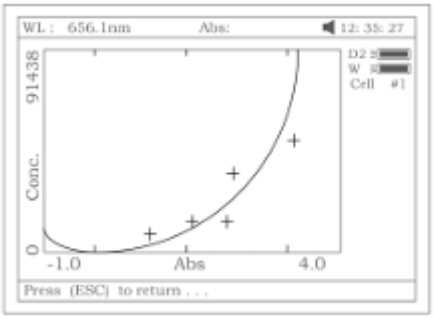


Fig 36 cubic fit

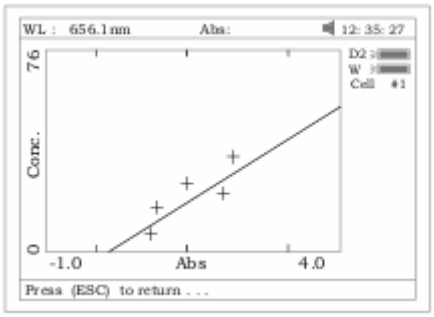


Fig 37 Linear fit

3.3.5 Press【**SAVE**】to save calibration if required.

3.3.6 Press【**ESC/STOP**】to exit

4 Quantitative Test

Before the test, the standard curve must be obtained. There are three ways for you to obtain it (a, b or c).

a. Standard curve built up and saved in the instrument.
In Fig 33 press【Load 】and then press【▯】or【▯】to select the filewith type ***.fit. At last press【ENTER】TO confirm.

b. Known standard curve, which is not saved in the instrument.
See 3.2. For Fig 29 enter a known standard curve directly.

c. Use the standard samples for the test. First, the standard curve must beestablished using the method shown in 3.3.

Note: All sample results must be taken in screen Fig26.

4.1 Push the blank cuvette into the Reference Light Path and Main Light Path andpress 【**ZERO**】for blanking.

4.2 Pull the sample cuvette into the Main Light Path and press the key **START】**,the results will be displayed on the screen (Fig 38).

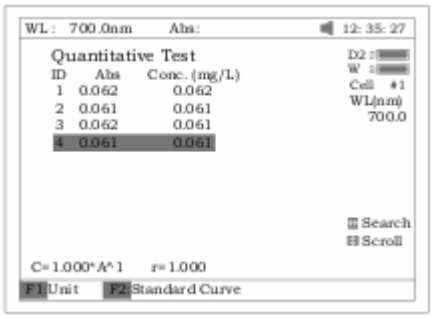


Fig.38

4.3 If there is more than one sample, repeat step 4.2 for the next sample.

4.4 Press **(SAVE)** to save the results and fitting parameters.

Print Test Report

Press the key【**PRINT**】to print the test report (Fig 39).

```
                        Quantitative Test Report

File Name:
Date and Time: 25-06-2003 13:54:32

No    546.0nm Abs(eff)   C(mg/L)
 1    0.212     0.212      3.315
 2    0.212     0.212      3.321
 3    0.000     0.212      3.315

Fitting Params:C= 15.64*A^1    r= 0.105
```

Fig 40

WL Scan

Press【**3**】in main menu for the "WL Scan" test (Fig 41). 【**ESC/STOP**】to exit.

To load a previous curve, press【**LOAD**】and select a previously stored curve(.wav).

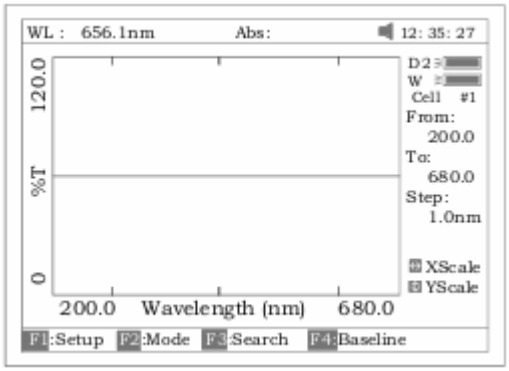


Fig.41

Scan sample

1. Press 【**F1**】to setup, input the start wavelength, and end wavelength by pressing the numeric keypad (Fig 42). Note: This instrument scans from high to low wavelength. Browse and select the items of scan step and scanspeed by pressing 【∧】or【∧】.

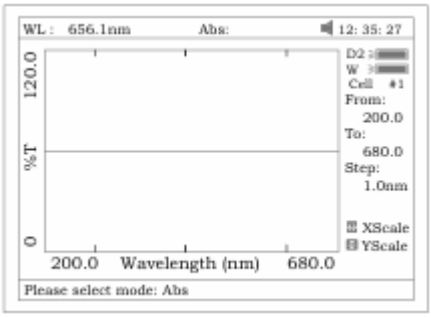


Fig.42

Note:
"Scan step" allows the selection of 0.1nm, 0.2nm,0.5nm,1nm,2nm and 5nm.
"Scan speed" allows the selection of "HI", "MEDIUM" and "LOW".

For the survey scan, we suggest 5nm, HI. For a detailed scan, we suggest 0.5nm, HI

2. Press **[F2]** to select the test mode, "Abs", "%T" or "E" (Fig 43).

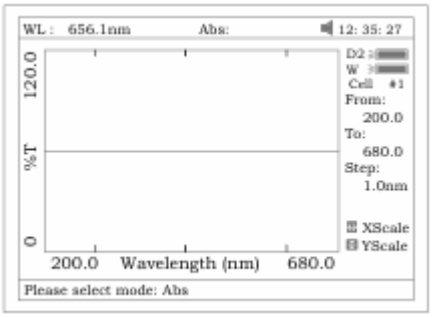


Fig.43

3. Put the blank cuvette into the Reference Light Path and Main Light Path, press 【**ZERO**】to scan the baseline (Fig 44). Press the key 【**ESC/STOP**】to stop scanning:

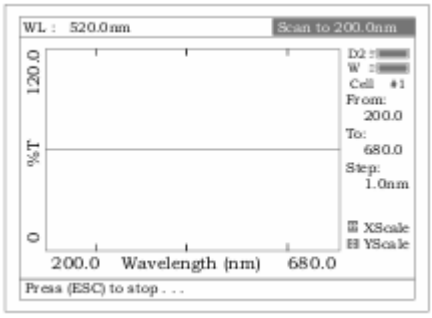


Fig.44

4. Put the sample cuvette into Main Light Path, press 【**START**】to scan the sample(Fig 45) 【**ESC/STOP**】to stop scanning. When scan has finished the beeper beeps 3 times (Fig 46).

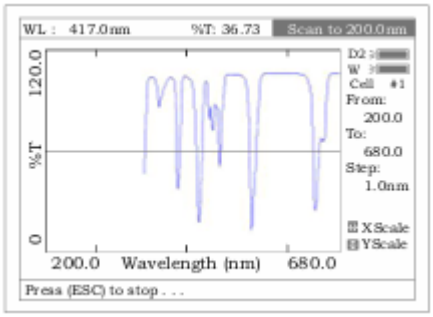


Fig.45

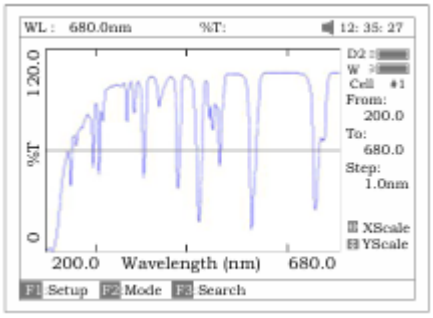


Fig.46

5. If you want to change the scale, press 【<】 or 【>】 to change the “x” scale(Fig 47) and input the upper limit and lower limit by pressing the numeric keypad . To change the “y” scale press 【□】or【□】.

   After these inputs, the instrument will redraw the curve (Fig 48).

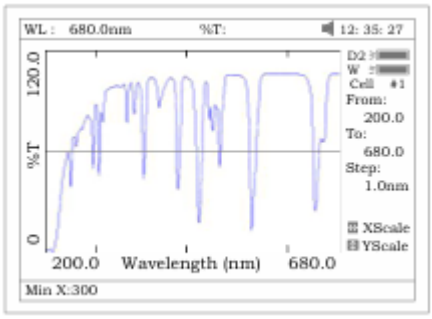


Fig.47

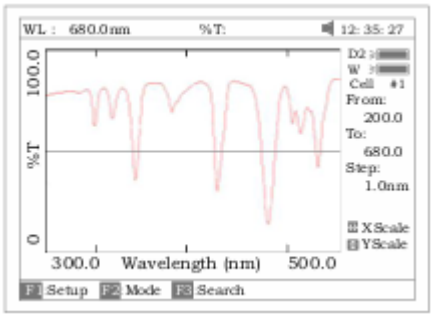


Fig.48

6. Press 【**F3**】to search the Abs/%T value of the scan. There are two ways for you to search (Fig 49).

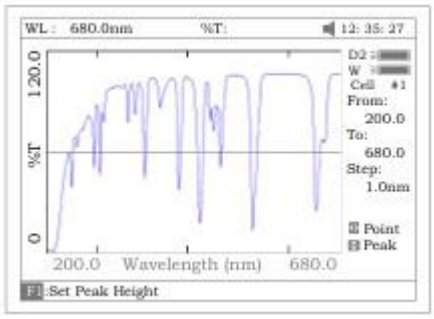


Fig.49

1) **Peak to peak**, press 【**F1**】to set "peak height" and input value by pressingthe numeric keypad (Fig 50). Press 【▯】to search the peak from left to rightand press【▯】to search from right to left. The value of every peak found willbe displayed on the screen one at a time (Fig 51).

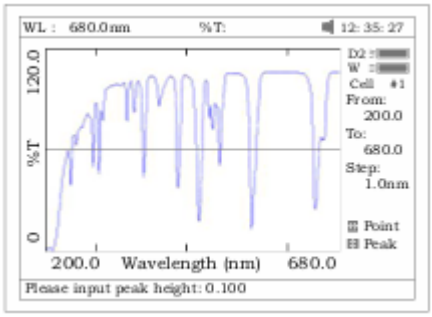


Fig.50

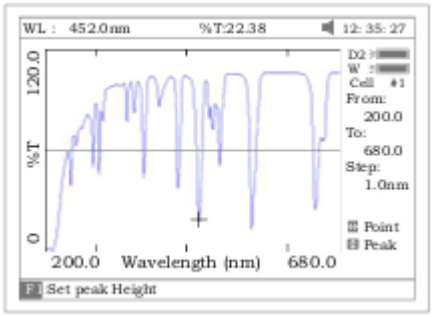


Fig.51

2) **Point to point,** Press 【>】 to search the point from left to right and press 【<】 to search from right to left. The search step interval is the same as the scanstep. The value of every point searched will be displayed on the screen.

Save Curve

Press 【**SAVE**】 to save the curve. Note: Load/Save requires the first scan display page (Fig. 48). Press **ESC** if in Search to return to the required page.

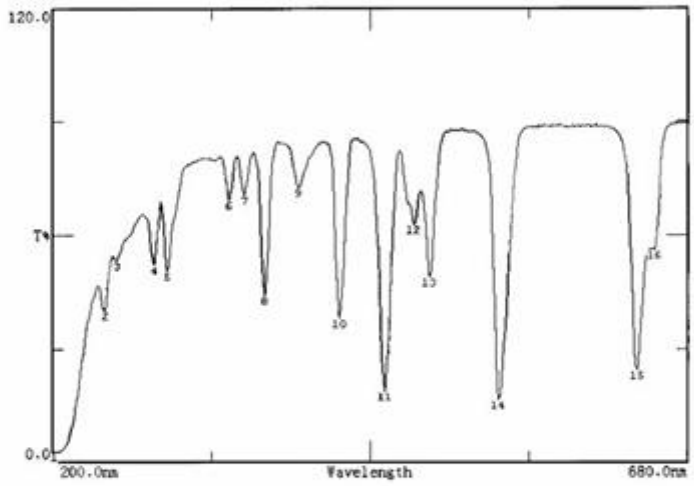
Print Test Report

Press 【**PRINT**】 to print the curve you have loaded or scanned (Fig 52).

Note: The report always is printed in Fig 46.

Wavelength Scan Test Report

File Name:
Date and Time: 25-06-2003 13:47:54
Scan From: 680.0nm
Scan To: 200.0nm
Scan Step: 1.0nm
Peak Height: 0.030Abs



Peak list:

No.	Wavelength(nm)	Abs	T%
1	202.0	1.585	2.60
2	240.0	0.397	40.08
3	249.0	0.274	53.18
4	277.0	0.285	51.93
5	287.0	0.298	50.30
6	333.0	0.161	68.98
7	345.0	0.154	70.19
8	360.0	0.357	43.95
9	386.0	0.141	72.26
10	417.0	0.422	37.83
11	451.0	0.731	18.58
12	473.0	0.205	62.38
13	485.0	0.313	48.61
14	537.0	0.790	16.22
15	641.0	0.621	23.95
16	654.0	0.252	55.93

Fig.52

Kinetics

Press【**4**】in main menu for "Kinetics" (Fig 53). 【**ESC/STOP**】to exit.

To load a previous kinetics result, press【**LOAD**】 and select a previously stored result (.kin).

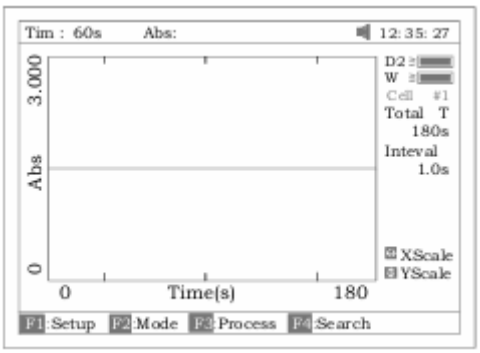


Fig.53

Test

1. Press 【**F1**】 to set "Total Time", " Delay Time"," Time interval" and input the value by pressing the numeric keypad (Fig 54).

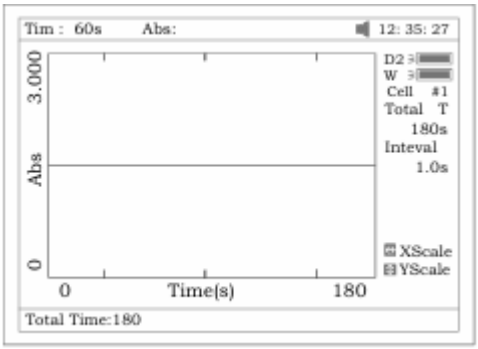


Fig.54

2. Select the test mode ("Abs" or "%T") by pressing【**F2**】(Fig 55).

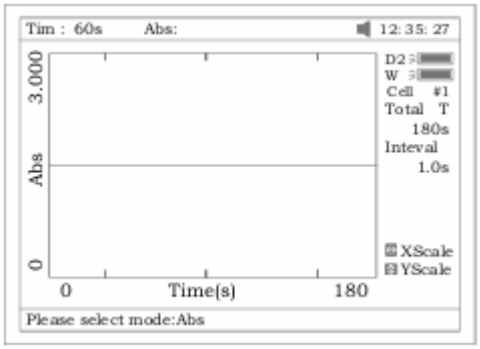


Fig.55

3. Set wavelength by pressing【**SETλ**】. Pull the blank cuvette into theReference Light Path and Main Light Path and press 【**ZERO**】for blanking.

4. Pull the sample cuvette into the Main Light Path and press【**START**】to scan the sample. After the delay time, the beeper beeps 3 times and time -scan starts.At the end of the time scan, the beeper also beeps 3 times (Fig 56):

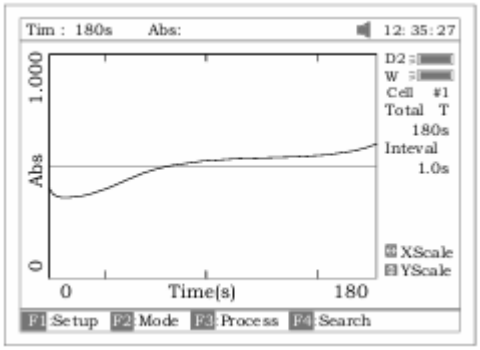


Fig 56

5. Press 【**F3**】to process the data, and enter "Begin Time"," End Time" and" Factor" (Fig 57) and the value in I.U. will be calculated and displayed (Fig 58). The average straight line between the Begin Time and End Time will be calculated. The gradient of this line gives the rate of change of ΔA/min.

   Note: I.U.=Factor×ΔA/min

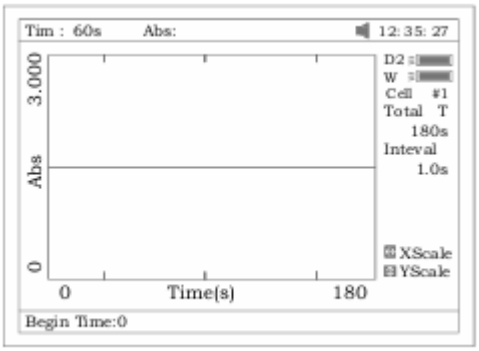


Fig.57

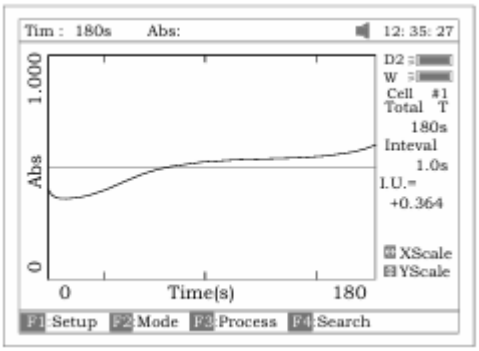


Fig.58

6. If you want to change the scale, kindly refer to step 5 of "WL scan".

7. Press【F4】to search the Abs/%T value in relation to the time axis. Search point to point by pressing the key【＜】or【＞】. Kindly refer to step 6 of "WL scan".

Save Curve

Press the key 【**SAVE**】 to save curve. Note: Load/Save requires the first kinetics display page Fig. 56. Press **ESC** if in Search to return to the required page.

Print Test Report

Press the key 【**PRINT**】to print the curve you have loaded or scanned (Fig 59).

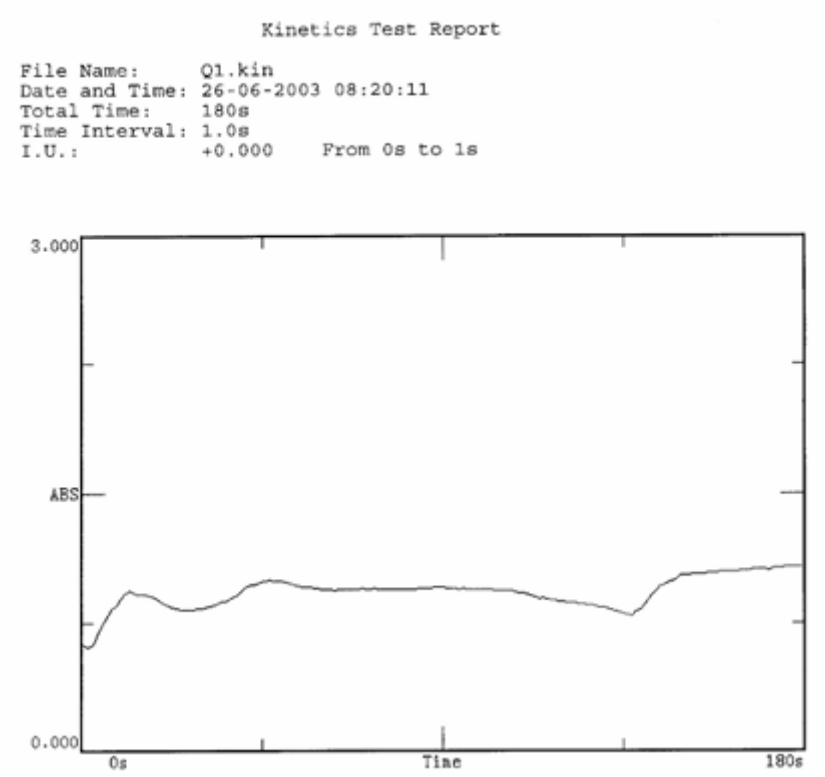


Fig.59

DNA/Protein

Press【**5**】in main menu for "DNA/Protein" (Fig 60). 【**ESC/STOP**】to exit. **Note:** The algorithm of the test refers to Appendix A kindly.

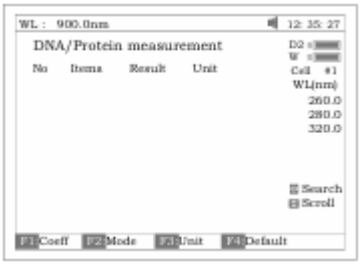


Fig.60

To load previous DNA results, press **(LOAD)** and select a previously stored result(.dna)

Test

1. To use a simpler or different algorithm, you can enter your values for f1- f4. Press【**F1**】to set f1-f4. Input the value by pressing the numeric keypad (Fig 61).

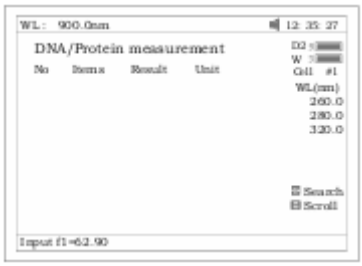


Fig.61

2. Press【**F2**】to select test mode. "Absorbance difference 1" is for testing at thewavelength 260nm,280nm and 320nm (optional) and the "Absorbance difference 2" is for testing at the wavelength 260nm,280nm and 320nm (optional, Fig 62). Then select with/without reference. If selected with reference (no), the A ref. will be "0" (Fig 63).

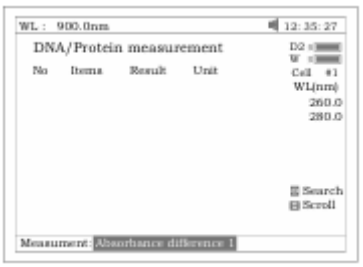


Fig.62

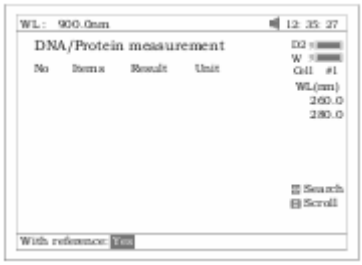


Fig.63

3. Press 【**F3**】to select the unit of concentration (Fig 64).

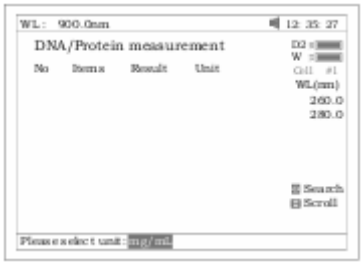


Fig.64

4. Push the blank cuvette into the Reference Light Path and Main Light Path , thenpress 【**ZERO**】for blanking .

5. Pull the sample cuvette into Main Light Path, press 【**START**】to test thesample. The test result will be displayed on the screen (Fig 65).

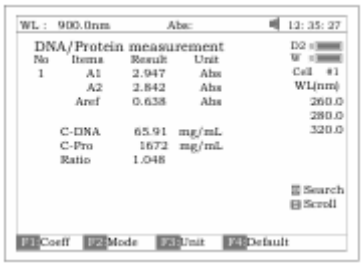


Fig.65

6. If there is more than one sample, repeat step 5 for the next sample.

7. Press the key 【<)or【>】for searching. Input the sample number (Fig 66), the result will be displayed on the screen. Press the key 【∧】or【∧】to browse the test results one by one.

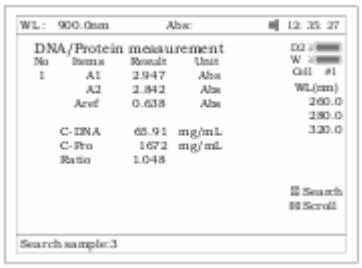


Fig.66

Recall the default:
Press the key【**F4**】to recall the default of the f1-f4.
Save Data:
Press the key 【**SAVE**】 to save data.
Print Test Report:
Press the key【**PRINT**】to print the test result (Fig 67).

DNA / Protein Test Report

File Name:
Date and Time: 26-06-2003 09:16:33

No	260.0nm	280.0nm	320.0nm	C-DNA	C-Pro	Ratio
1	0.226	0.212	0.102	3.825	76.60	1.127
2	0.226	0.213	0.102	3.803	79.32	1.113

Unit:ug/mL

Fig.67

Multi-Wavelength

Press **【6】** in main menu for "Multi WL" (Fig 68). **【ESC/STOP】** to exit.

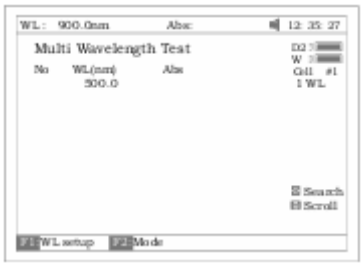


Fig.68

To load previous multi-wavelength results, press **(LOAD)** and select previously stored results (.mul).

- **Test**

1. Press **【F1 】** to set up a group of wavelengths for testing by pressing the numeric keypad followed by **【ENTER】**. **(^)** or **(ˇ)** to modify the inputted data Fig. 69. Press **【ESC/STOP】** to finish setup and exit. Note: It is recommended to enter the highest wavelength first.

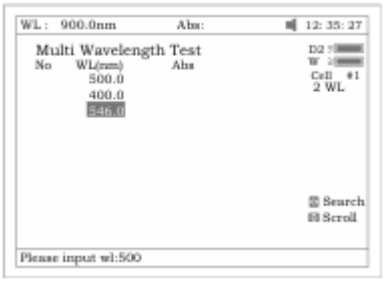


Fig.69

2. Press **【F2】** to select mode (Fig 70).

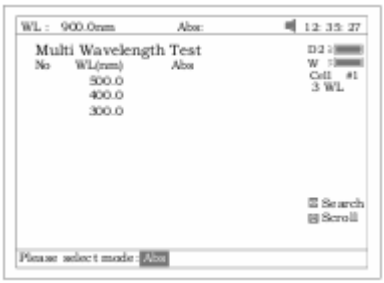


Fig.70

3. Push the blank cuvette into the Reference Light Path and Main Light Path, thenpress 【**ZERO**】for Blanking .

4. Pull the sample cuvette into Main Light Path, press【**START**】to test. The testresults will be displayed on the screen (Fig 71).

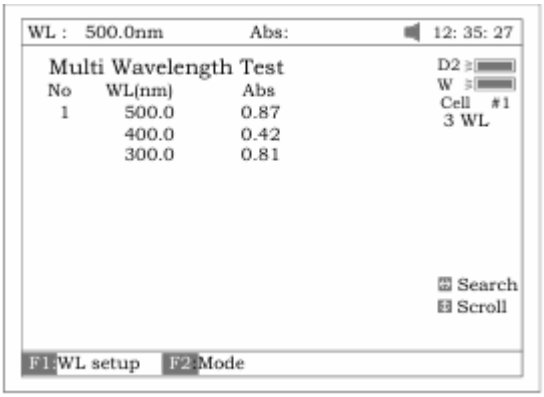


Fig.71

5. If there is more than one sample, repeat step 4 for the next sample. **Note:** When the test has finished, the wavelength will go to the first WL.

6. Press 【＜)or【＞】for searching. Input the sample number, the result will bedisplayed on the screen. Press 【□】or【□】to browse the test results oneby one.

- **Save Data**
  Press 【**SAVE**】 to save data.

- **Print Test Report**
  Press【**PRINT**】to print the test results (Fig 72).

```
                    Multi-Wavelength Test Report

File Name:      M1.mul
Date and Time: 26-06-2003 09:25:16

No   300.0nm   400.0nm   500.0nm
 1   0.107     0.074     0.054
 2   0.106     0.073     0.055
 3   0.106     0.072     0.054

Unit:Abs
```

Fig.72

Setting and Calibration

Utility

Press【7】in Main menu for "Utility" (Fig 73). 【ESC/STOP】to exit.

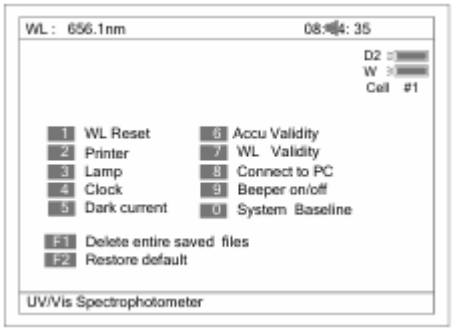


Fig.73

- **WL Reset**

Press【1】to reset wavelength (Fig74).

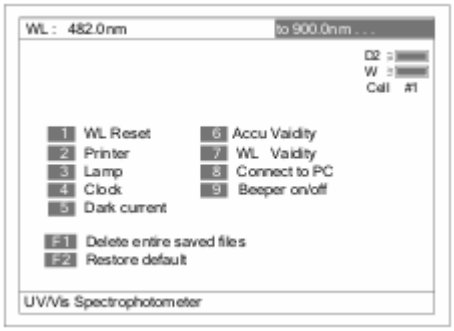


Fig.74

- **Printer**

Press【2】to set the printer (Fig 75). 【ESC/STOP】to exit.

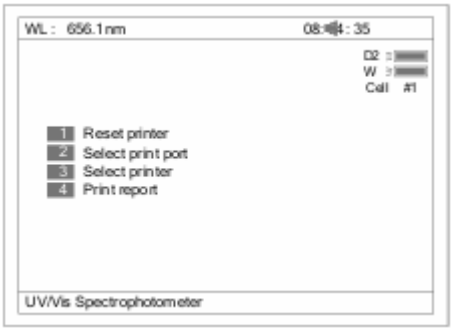


Fig.75

1. Press【1】**in Fig 75** to Reset the Printer.

2. Press【2】**in Fig 75** to select the print port (LPT or Comm., Fig 76).

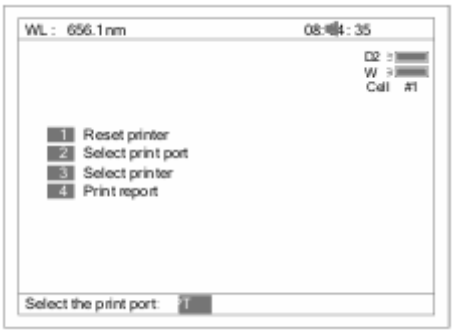


Fig.76

3. Press【3】**in Fig 75** to select printer (HP PCL (1 colour cartridge), PCL (black mode), Epson ESC/P or Epson/P2 or above, Fig77).

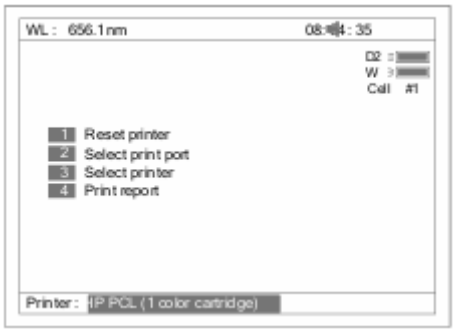


Fig.77

4. Press【4】**in Fig 75** to select print mode. If you select "Print screen" mode, a little icon will be displayed on the top line of the screen (Fig 78), if you select "Print report" mode, the little icon will disappear.

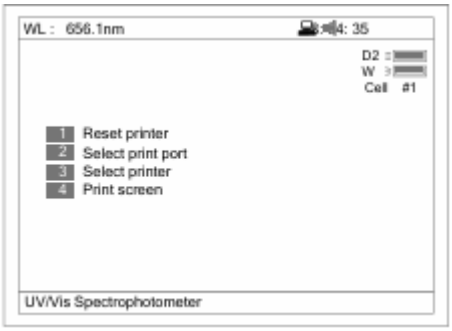


Fig.78

- **Lamp**
  Press【**3**】to set the lamp (Fig 79). 【**ESC/STOP**】to exit.

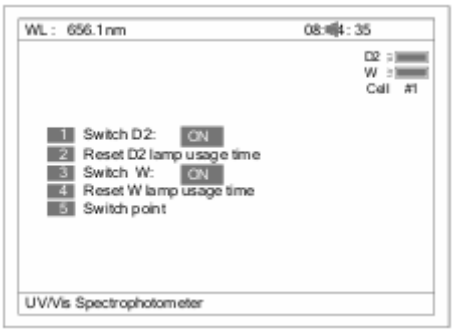


Fig.79

2. Press【**1**】**in Fig 79** to switch on/off D2. Fig 80.

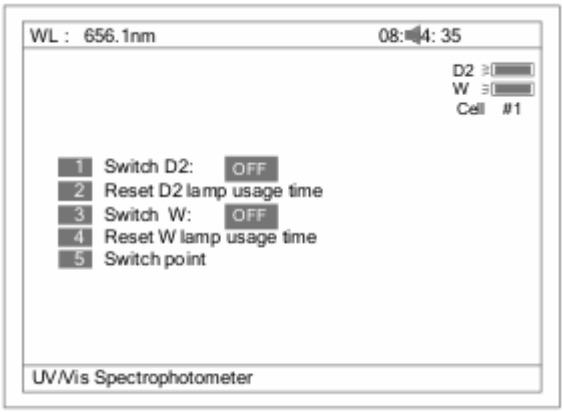


Fig.80

3. Press【**2**】**in Fig 79** to reset usage time of D2(Fig 81). Press 【▯】or【▯】to select "Yes" or "No", and then press 【**ENTER**】.

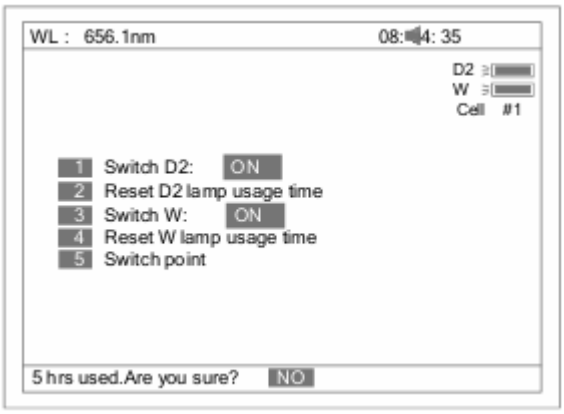


Fig.81

4. Press【3】**in Fig 79** to switch on/off W. The indication is also on the top rightcorner of the screen (Fig 82).

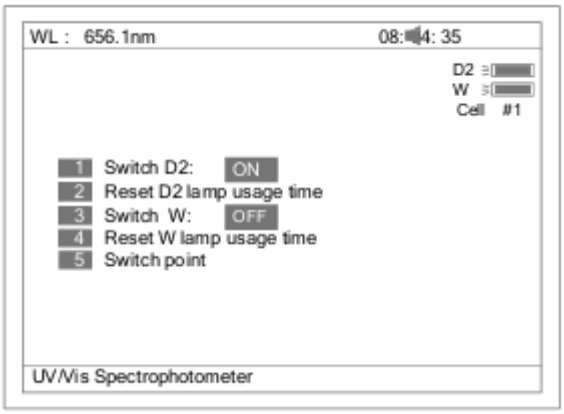


Fig.82

4. Press 【4】**in Fig 79** to reset the usage of W (Fig 83). Press 【▯】or【▯】to select "Yes" or "No", and then press 【**ENTER**】.

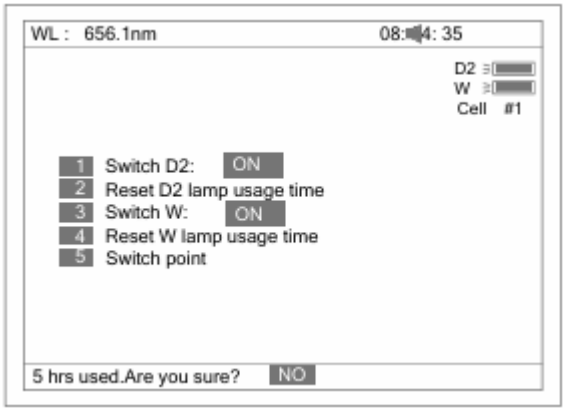


Fig.83

5. Press【**5**】**in Fig 79** to set the switch usage point of D2 and W lamp (Fig 84).

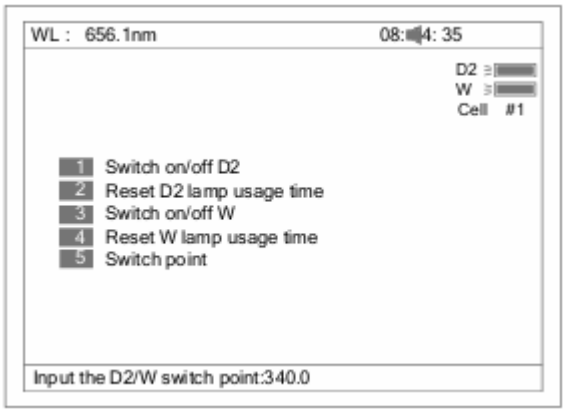


Fig.84

- **Clock**
  Press 【**4** 】**In Fig73** to set the display mode and modify the clock (Fig 85). 【**ESC/STOP**】 to exit.

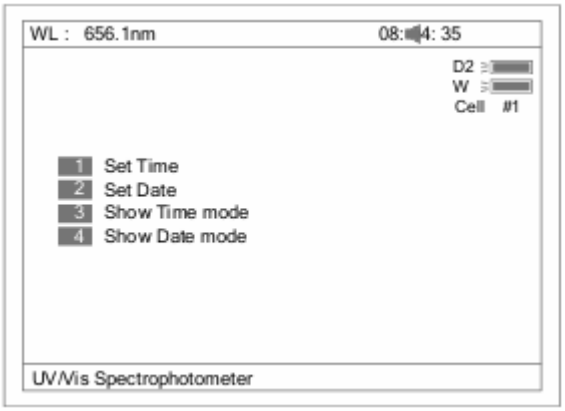


Fig.85

1. Press【**1**】**in Fig 85** to modify time by pressing the numeric keypad (Fig 86).

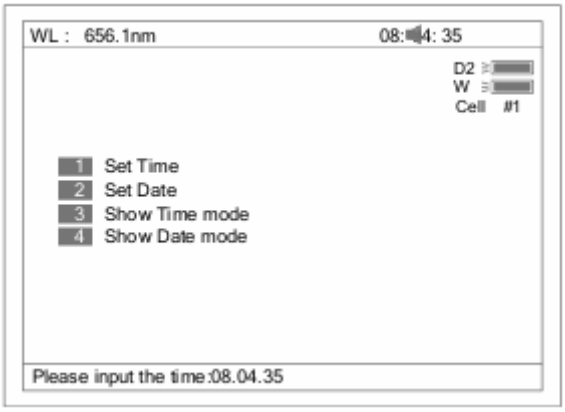


Fig.86

2. Press【2】in Fig 85 to modify the date by pressing the numeric keypad.
3. Press【3】in Fig 85 to set the date display on the top right corner of the screen.
4. Press【4】in Fig 85 to set the time display on the top right corner of thescreen (Fig 87).

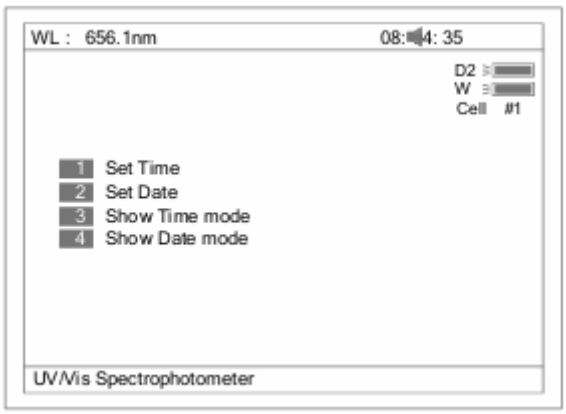


Fig.87

- **Dark Current**

Press 【5】In Fig73 to get a dark current (Fig 88).

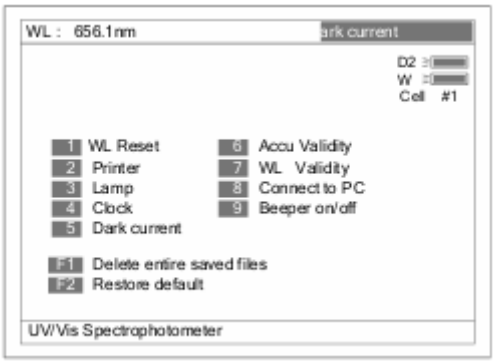


Fig.88

- **Accu Validity**

Press 【4】In Fig73 to do Accu Validity (Fig 89). 【ESC/STOP】to exit.

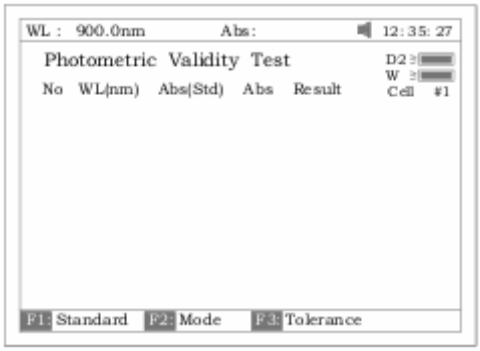


Fig.89

1. Press 【**SETλ**】to set the wavelength. Press 【**ENTER**】to edit and inputwavelength by pressing the numeric keypad (Fig 90). 【**ESC/STOP**】to finishinputting and exit.

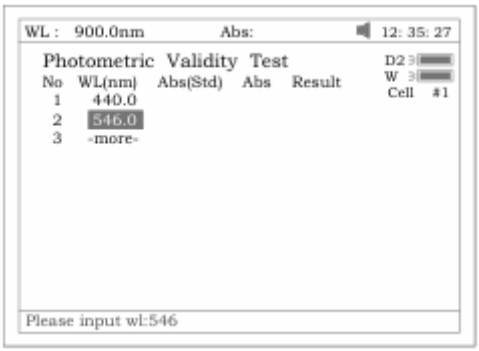


Fig.90

2. Press【**F1**】to set the standard value, Press 【**ENTER**】to edit and input by pressing the numeric keypad (Fig 91). 【**ESC/STOP**】to finish inputting and exit.

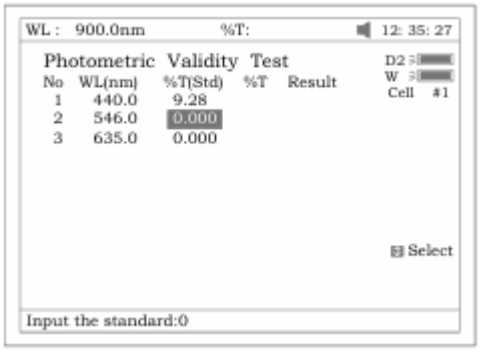


Fig.91

3. Press 【**F2**】to select test mode (Abs or %T, Fig 92).

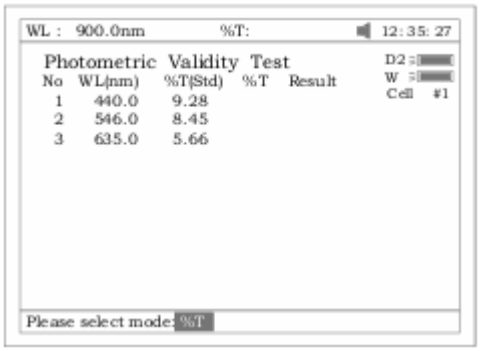


Fig.92

4. Press 【F3】 to set tolerance (Fig 93). Input the value by pressing the numeric keypad.

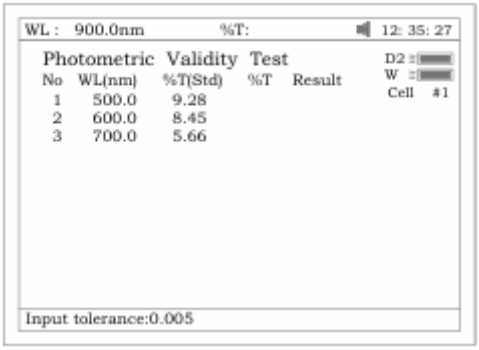


Fig.93

5. Press【**ZERO**】for Blanking.

6. Put the sample (calibrated neutral density filter) into the Main Light Path. Press 【START】 to check. The results will be displayed on the screen (Fig 94). If the discrepancy between the results and the calibrated standards is not more than the tolerance, “pass” will be displayed after the test result. Otherwise, “fail” will be displayed.

7. The result can be saved, loaded and printed by pressing【**SAVE**】, 【**LOAD**】 and 【**PRINT**】.

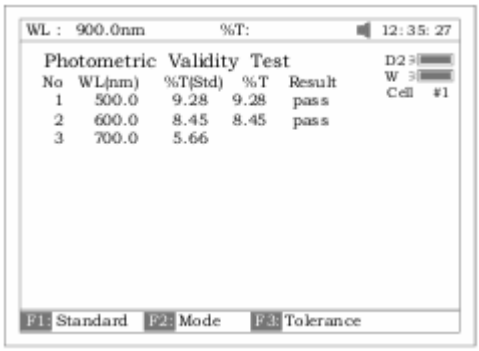


Fig.94

- **WL Validity**

1. Press【**7**】**in Fig 73** to WL validity (Fig 95). 【**ESC/STOP**】to exit.

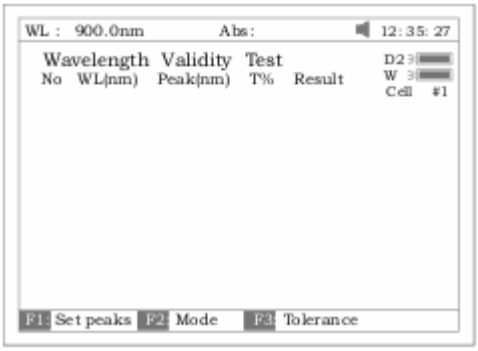


Fig.95

2. Press 【**F1**】to set the standard peak. Press 【**ENTER**】to edit and input wavelength by pressing the numeric keypad (Fig96). 【**ESC/STOP**】tofinish inputting and exit.

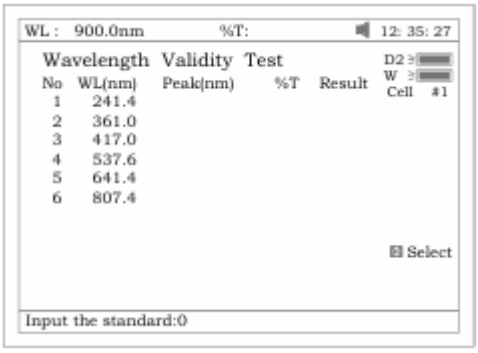


Fig.96

3. Press 【**F2**】to select test mode (Abs or %T, Fig 97).

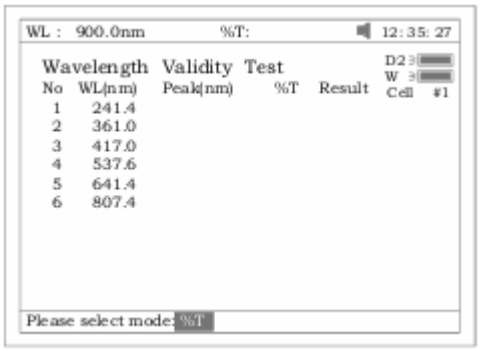


Fig.97

4. Press 【**F3**】to set tolerance (Fig 98). Input the value by pressing the numeric keypad.

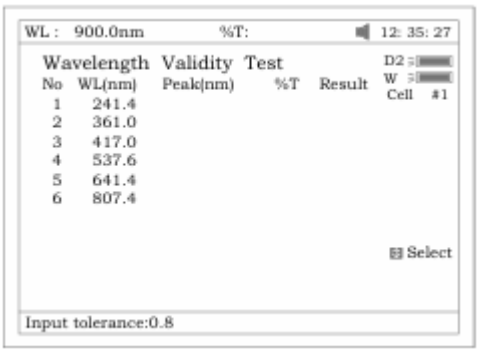


Fig.98

5. Press 【ZERO】for blanking.
6. Put the sample (calibrated holmium liquid) into the Main Light Path. Press 【**START**】to check. The results will be displayed on the screen (Fig 99). If the discrepancy between the results and the calibrated values is not more than the tolerance, "pass" will be displayed after the test results. Otherwise, "fail" will be displayed.

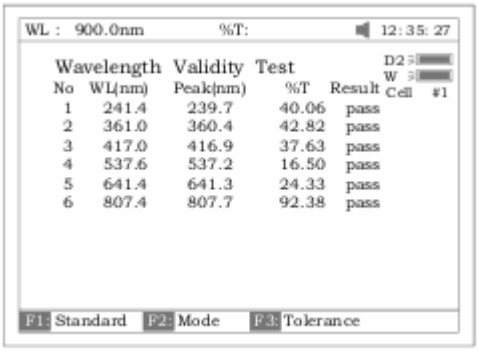


Fig.99

7. The result can be saved, loaded and printed by pressing【SAVE】,【LOAD】and【PRINT】.

- **Connect to PC**

Press【8】in Fig 73 to connect to the PC (Fig 100). If the instrument is controlled by a PC, the screen displays Fig 100A. Press **【ESC/STOP】** to exit.

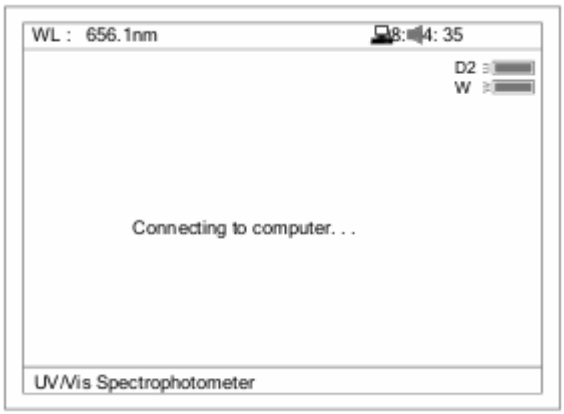


Fig.100

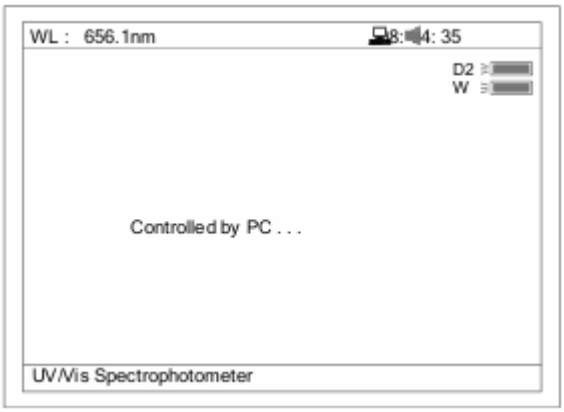


Fig.100A

- **Beeper on/off**
  Press【9】in Fig 73 to turn on/off the beeper
- **Delete entire saved files**
  Press **【F1】in Fig 73** to delete entire saved files. After deleting the files, double-confirm need to do.
- **Restore default**
  Press **【F2】in Fig 73** to restore the default parameters.

9. Maintenance

To keep the instrument work in good condition, constant maintenance is needed.

Daily Maintenance

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

2. **Surface Clean**
   The cover of the instrument is painted. Kindly use a wet towel to wipe. off the drips on the surface immediately. Organic solutions are forbidden. to be used to clean the cover. Kindly wipe off the dirt on the cover timely.

3. **Clean the cuvettes**
   After every test or after a solution change, the cuvettes should be cleanedcarefully, or the remains on the surface would cause measuring errors.

10. Troubleshooting

Possible Cause	Solutions
1. **No response after power on** • Bad contact in power supply • Fuse melt	• Improve the contact • Replace a new fuse
2. No stable Readings • Not enough pre-warm • Glass cuvettes used in UV Ranges • Unstable Sample • Much higher sample concentration • Low voltage or unstable power supply • Lights defect • Light used up	• Increase the pre-warm time • Use Silicon Cuvettes in UV Range • Improve the sample • Dilute the sample • Improve the power condition • Replace a new lamp • Replace a new lamp
3. Worse Repeatability • Unstable sample • Cuvettes polluted	• Improve the sample • Clean the cuvettes

11. Replacement

Spare parts replacement

1. Replace the Fuse

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

Step 1: Tools preparation

Prepare a 3×75mm Flat Blade Screwdriver

Step 2：Switch Off the power supply

Switch off the power supply and unplug the socket.

Step 3: Take out the Fuse Seat

Take out the Fuse Seat with the Screwdriver. (Fig 101)

Fig.101

Step 4: Replace a new Fuse

Pick out the Spare Fuse and replace it with the working position.

Step 5: Reset the Fuse Seat

Replace the Fuse Seat in the power socket

Step 6: Switch on the power

Plug the socket and switch on the power.

2. Replace lamps

High temperature！ Wait 20 minutes before opening the lampchamber after powering off to avoid scald!

Step 1 Tools preparation

Prepare a 6×150mm Cross Blade screwdriver and a pair of gloves.

Step 2 Switch Off the power supply

Switch off the power supply and unplug the socket.

Step 3 Remove the cover

Unscrew the screws indicated in Fig.102 (Two sides with screws), then remove the cover to one side.

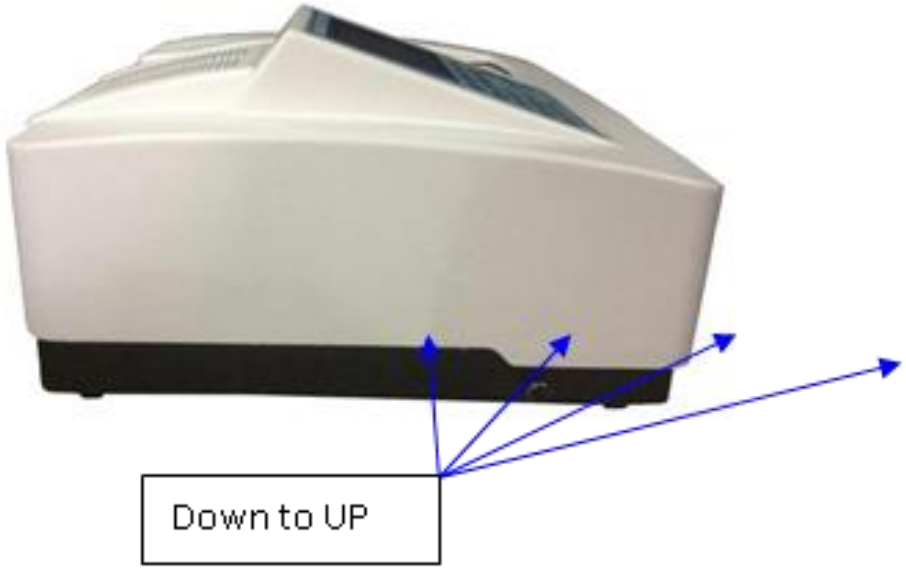


Fig.102

Step 4: Remove the cover of the Lamp Chamber

Unscrew the screws of the Lamp Chamber indicated in Fig.103 and remove its cover. (Fig 103).

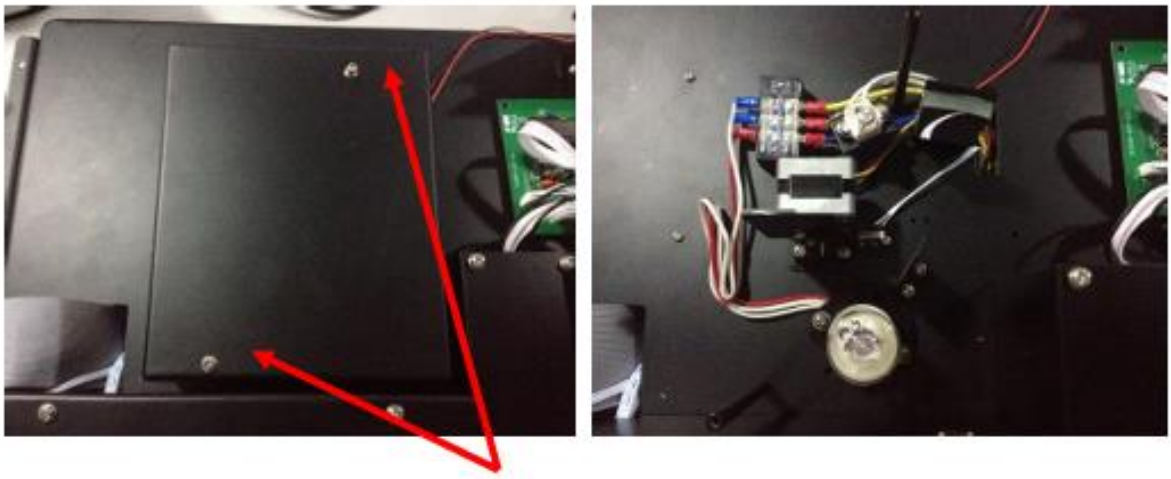


Fig.103

Step 5: Replace Lamps

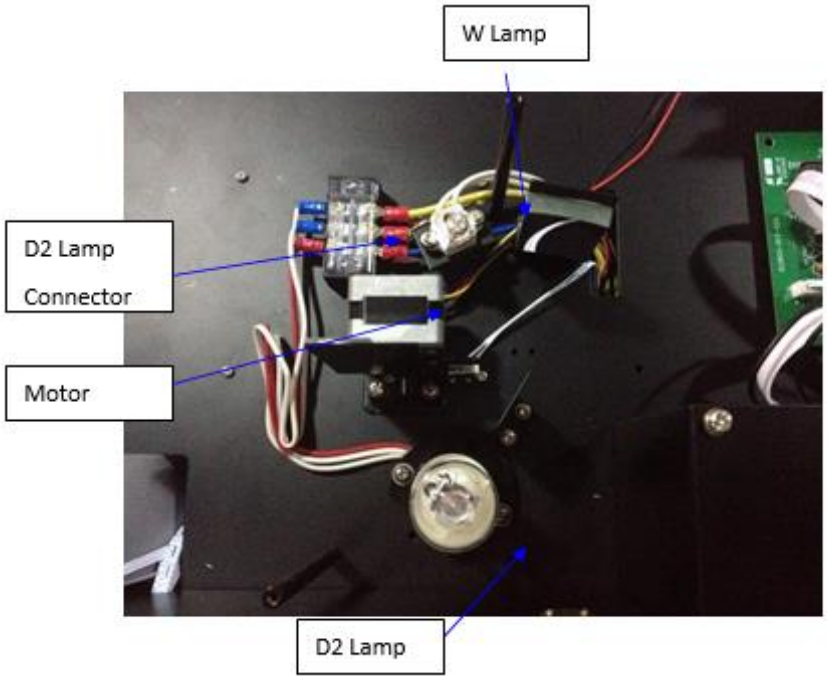


Fig.104

1) Replace D2 Lamp

Unscrew the 2 screws on the D2 Flange (Indicated in the Red Circles in Fig 105), unplug the power connector（Indicated in the Red Square in Fig.104） in the Power Board and remove the D2 lamp. Draw on the Cotton Glove and replace it with a new lamp. Fix the 2 screws and plug in the connector again.

The D2 Lamp is pre-aligned, so there's no need to re-adjust the position of it. The Facula should focus on the center of the Slit.

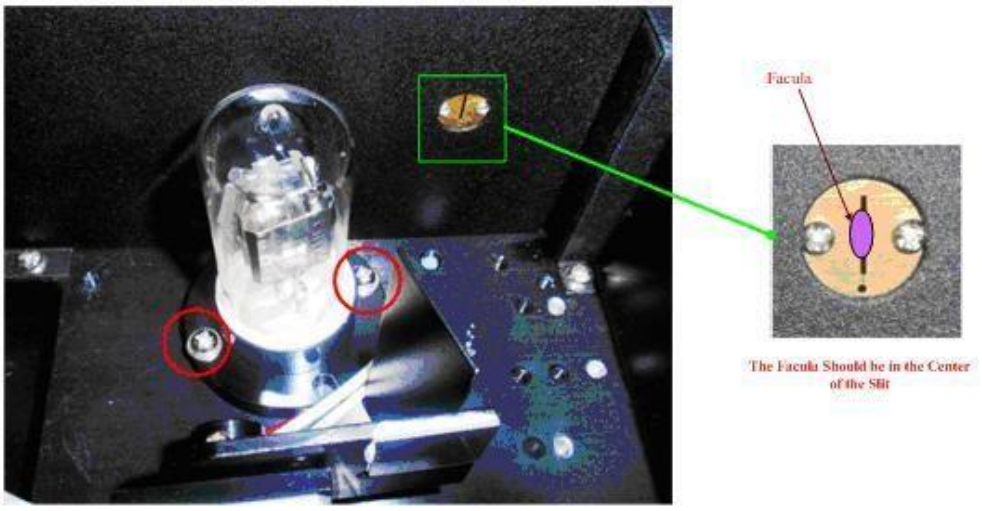


Fig.105

2) Replace the W lamp

Remember the direction of the filament before pulling out the Wlamp. Be sure that the new lamp's filament is in the same direction as before.

Pull out the defective W lamp and draw on the Cotton Glove. Insert the newW lamp as deep as possible on the Lamp Seat. Be sure to keep the Filament in the same direction as the old one faces (Fig.106).

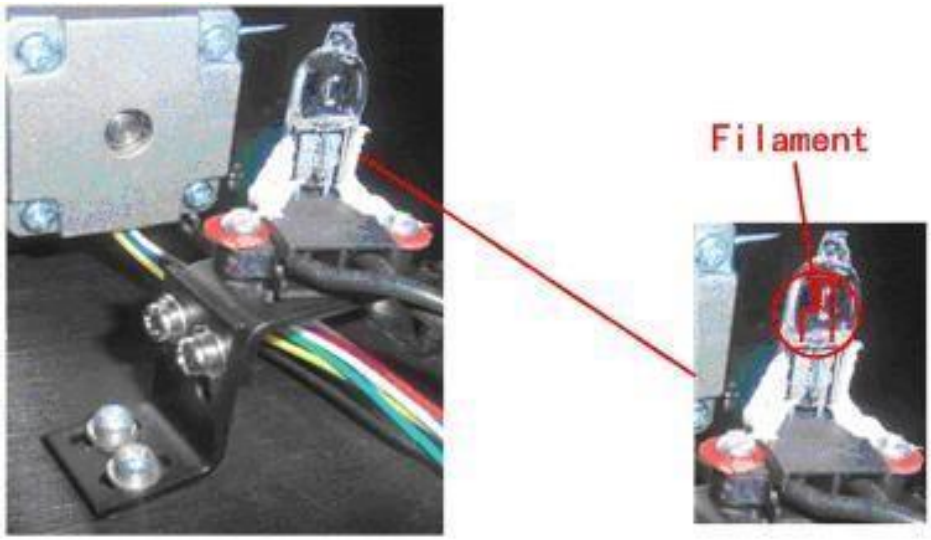


Fig.106

Switch on the power, observe the Entrance Facula, and it should focus on the center of the Slit. (Fig.107)

If the Facula deviates to the Left or Right, then loosen the No.2 screws in Fig.107and move the lamp seat to the Left or Right until it focuses on the center of the slot. Then fix the screws.

If the facula deviates Up and Down, then loosen the No.1 screws in Fig.107 and move the lamp seat Up and Down until the facula focuses onthe center of the slit. Then fix the No. 1 screws again.

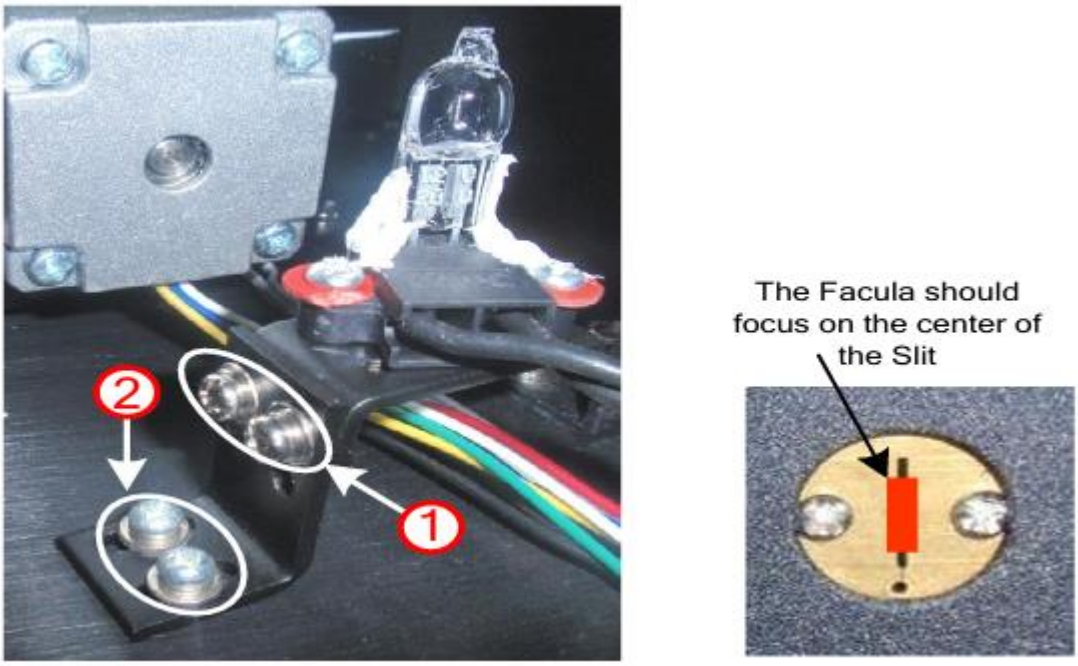


Fig.107

Step 8 Finish

Reset the cover of the Lamps chamber and fix the screws. Reset thecover of the instrument and fix the screws. Then the course finished.

12. Accessories

Description	Quantity
Spectrophotometer	1
Mains Lead	1
Glass Cuvettes	1 Set of 4
Quartz Cuvettes	1 Set of 2
Operation Manual	1
Software Manual	1
Software Kit (Disc 1+ USB Lead 1+Dongle 1)	1
Fuse	2

13. Appendix

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

A.1 Isoabsorbance

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

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

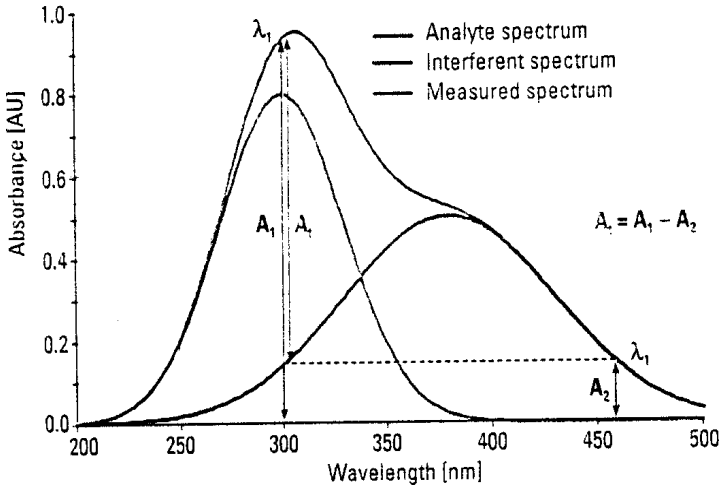


Fig A1 Is absorbance correction

A.2 Three-point correction

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

The background interfering absorbance at the analytical wavelength is then estimated using linear interpolation (see Figure A2). This method represents an improvement overthe single-wavelength reference technique because it corrects for any background absorbance that exhibits a linear relationship to the wavelength. In many cases, if the wavelength range is narrow, it will be a

reasonable correction for non-linear background absorbances such as that resulting from the scattering of a complex matrix.

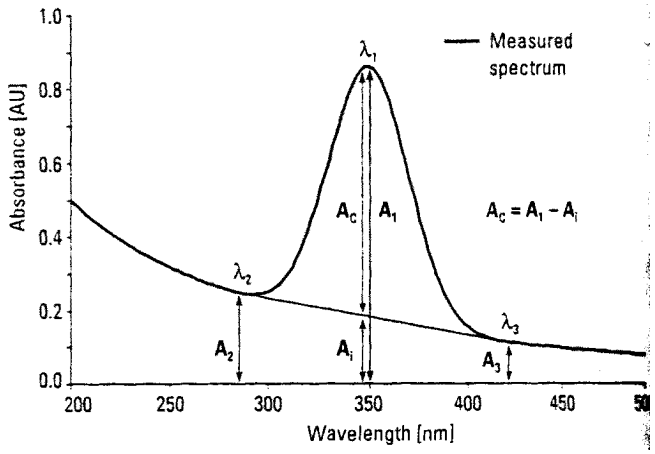


Fig A2