SQ-2800 Single Beam Scanning UV/Visible Spectrophotometer User's Guide

Contents

Safety:

The safety statements in this manual comply with the requirements of the HEALTH AND SAFETY AT WORK ACT, 1974.

Read the following before installing and using the instrument and its accessories. The UNICO SQ-2800 should be operated by appropriate laboratory technicians.

General:

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 it is essential that laboratory personnel follow generally accepted safe procedures in addition to the safety precautions called for in this manual.

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. There are no serviceable components inside this power supply unit. For UNICO SQ-2800, avoid touching the high voltage power supply at all times.

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:

Before switching on the apparatus, make sure it is set to the voltage of the local power supply (see Installation).

The power cord shall be inserted in a socket provided with a protective earth contact. The protective action must not be negated by the use of 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.

NEVER touch or handle the power supply on UNICO SQ-2800 due to the high voltage.
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 unfavorable conditions

- Has been subjected to severe transport stresses

Performance:

To ensure that the instrument is working within its specification, especially when making measurements of an important nature, carry out performance checks with particular reference to wavelength and absorbance accuracy. Performance checks are detailed in this manual.

Radio Interference:

For compliance with the EMC standards referred to in the EC Declaration of Conformity, it is necessary that only shielded cables supplied by us are used when connecting the instrument to computers and accessories.

Introduction:

The UNICO SQ-2800 model spectrophotometer (Fig 1) is a single beam, general purpose instrument designed to meet the needs of the Conventional Laboratory, The UNICO SQ-2800 model spectrophotometer is ideal for various applications, such as: Chemistry, Biochemistry, Biotechnology, Petrochemistry, Environmental Protection, Food and Beverage Labs, Water and Waste Water Labs and other fields of quality control and research.

The UNICO SQ-2800 model spectrophotometer incorporates a 320×240 dot matrix LCD display for photometric results, easy operation and wavelength range of 190nm to 1100nm. This instrument is ideal for measurements in the visible and ultraviolet wavelength region of the electromagnetic spectrum.
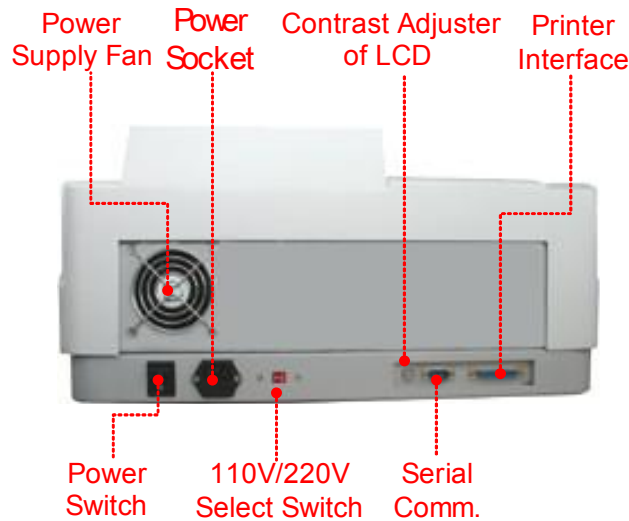

Sample Compartment Lid LCD Display

Rod   Keypad
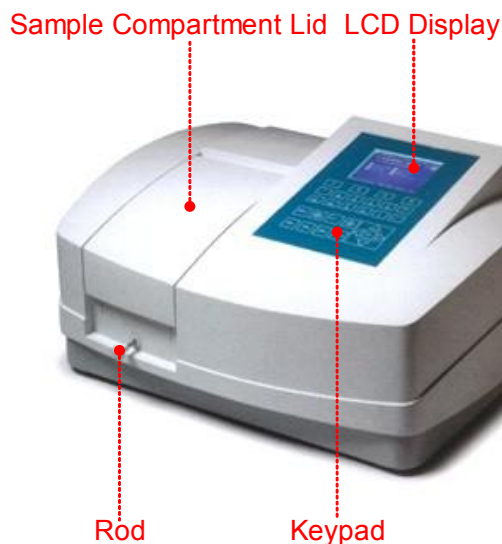
Fig 1

Working Principle:

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;

4) A detector to receive the transmitted light and convert it to an electrical signal;

5) A digital display to indicate absorbance or transmittance. The block diagram (Fig 2) below illustrates the relationship between these parts.
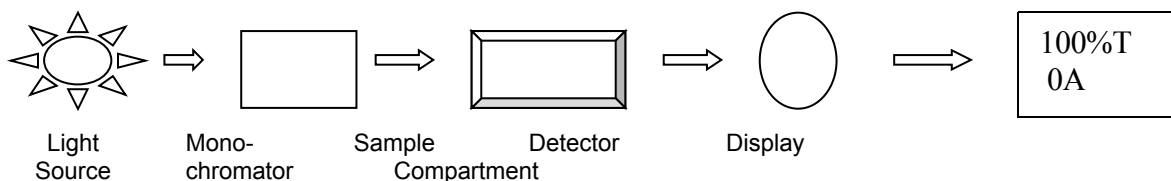
Block diagram for the Spectrophotometer

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.

Unpacking Instructions:

Carefully unpack the contents and check the materials against the following packing list to ensure that you have received everything in good condition.

Packing List

Description	Quantity
Spectrophotometer...	1
Mains Lead..	1
Cuvettes...	Set of 4, glass
Cuvettes...	Set of 2, quartz
Dust Cover..	1
Manual..	1

Specifications:

• *Wavelength Range:*	*190~1100nm*
• *Spectral Bandpass:*	*4 nm*
• *Wavelength Accuracy:*	*±0.8nm*
• *Wavelength Repeatability:*	*±0.5nm*
• *Stray Radiant Energy:*	*<0.15%@220nm&340nm*
• *Photometric Range:*	*0-200%T, -0.3~3.0A*
• *Noise:*	*<0.001A @ 500nm 0A*
• *Drift:*	*<0.002A/h @ 500nm*
• *Power Requirements:*	*AC 110V/60Hz or 220V/50Hz*
• *Dimensions:*	*550W × 420L × 270H mm*
• *Light Source:*	*Tungsten Halogen/Deuterium*
• *Weight:*	*18 kg / 44 lbs*

Installation:

1. After carefully unpacking the contents, check the materials with the packing list to ensure that you have received everything in good condition.

2. Place the instrument in a suitable location away from direct sunlight. In order 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.

3. Remove any obstructions or materials that could hinder the flow of air under and around the instrument.

4. Use the appropriate power cord and plug into a grounded outlet.

5. Turn on your UNICO SQ-2800 model 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. Refer to this Manual (see Appendix B – Lamp Replacement)

Operation:

Prepare the spectrophotometer

Fig 3 is the control panel. User can perform all operations by pressing the keys and all the results and operation information are displayed on the LCD.
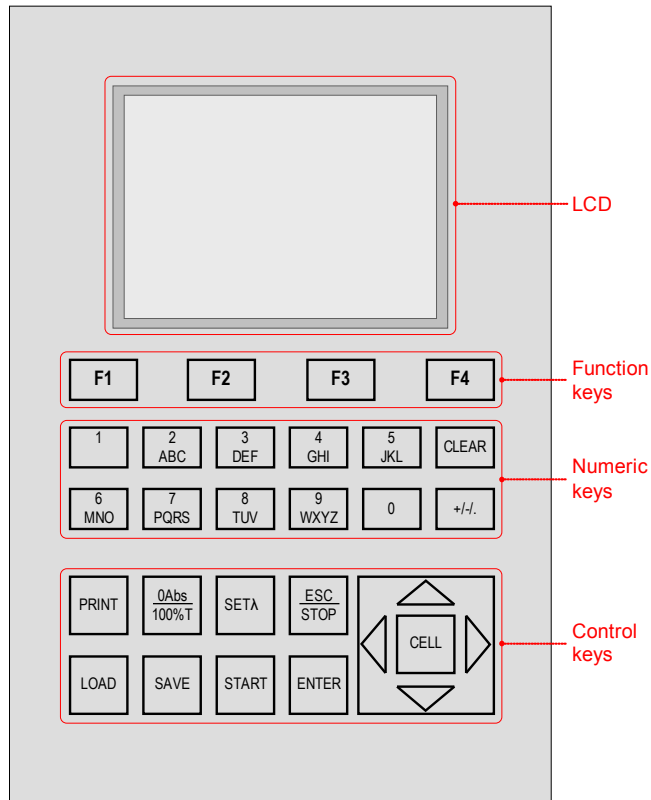

Fig 3

Description of keys

[**LOAD**]	Load data or curve saved before;
[**SAVE**]	Save data or curve;
[**SET λ**]	Set wavelength;
[**0Abs/100%T**]	Blank or scan the base line;
[**PRINT**]	Print test results or screen
[**START**]	Start testing or scanning sample;
[**ESC/STOP**]	Exit to previous screen or cancel the operation;
[**ENTER**]	Confirm the inputted data or selected item; Go into next setup or screen;
[**F1**] - [**F4**]	Function based on the information on the screen;
[**0**] - [**9**]	Input number or letter; consecutively press a numeric key to select a character;
[**+/-/.**]	Input +, - or dot;
[**CLEAR**]	Clear all characters when you are inputting or clear curve displays on the screen;
[**<**] , [**>**]	Change "X" scale; Search point after scan; [**<**] clear a character;
[**Λ**] , [**V**]	Change "Y" scale; Search peak after scan; Scroll items for selecting;

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	Change capital/small letter last typed in; Browse the items for selection;
[CELL]	Set cell position.

Turn on spectrophotometer

Turn on spectrophotometer by pressing the Power Switch (IO) (see Fig 1). The instrument starts to initiate and the steps are as below:

    1. The instrument will check memory first (Fig 4), please wait or press any key to skip this step, after positioning filter, auto-cell changer(if installed) and D2/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 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 finish the calibration system, go to main menu too (Fig 7).

    2. If the data in memory has been lost, the instrument will directly calibrate system without any choice for you.

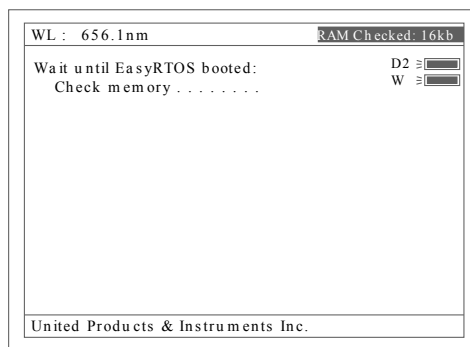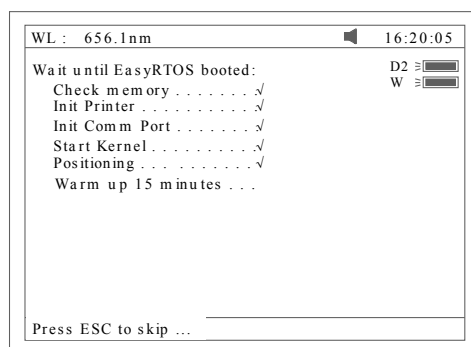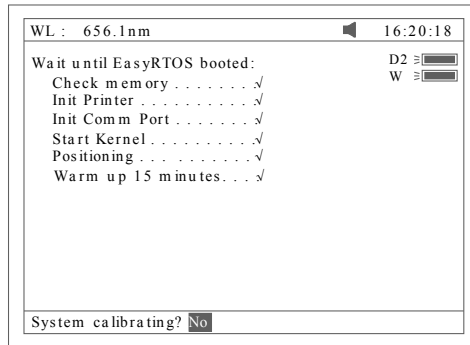   3. If no auto-cell changer installed "cell #1" will disappear in Fig 7

```
WL :  656.1nm                    RAM Checked: 16kb

Wait until EasyRTOS booted:                    D2 ≡▐███▌
   Check memory . . . . . . . .                W  ≡▐███▌








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```
Fig 4

```
WL :  656.1nm                     🔇      16:20:05

Wait until EasyRTOS booted:                    D2 ≡▐███▌
   Check memory . . . . . . . . √            W  ≡▐███▌
   Init Printer . . . . . . . . . . √
   Init Comm Port . . . . . . . √
   Start Kernel . . . . . . . . . √
   Positioning . . . . . . . . . . √
   Warm up 15 minutes . . .




Press ESC to skip ...
```
Fig 4A

```
WL :  656.1nm                           16:20:18

Wait until EasyRTOS booted:                    D2 ≋▭
    Check memory . . . . . . √              W ≋▭
    Init Printer . . . . . . . . . √
    Init Comm Port . . . . . . . √
    Start Kernel . . . . . . . . . √
    Positioning . . . . . . . . . √
    Warm up 15 minutes. . . . √




System calibrating? No
```

Fig 5


```
WL :  656.1nm                           16:28:03

Wait until EasyRTOS booted:                    D2 ≋▭
    Check memory . . . . . . √              W ≋▭
    Init Printer . . . . . . . . . √
    Init Comm Port . . . . . . . √
    Start Kernel . . . . . . . . . √
    Positioning . . . . . . . . . √
    Init AD Converter . . . . . √
    Search 656.1nm . . . . . . √
    Check Energy . . . . . . √



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```

Fig 6


```
WL :  656.1nm                          16:31: 35
                                               D2 ≋▭
      UNICO SPECTROPHOTOMETER          W ≋▭
        SPECTRO-QUEST               Cell  #1

      1  Basic mode      5  DNA/ Protein
      2  Quantitative    6  Multi WL
      3  WL scan         7  Utility
      4  Kinetics        8  Defined test



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```
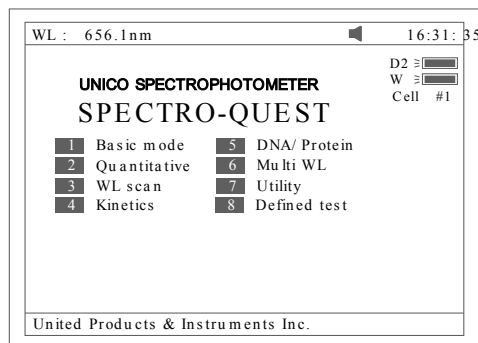
Fig 7

Basic operation

Blank

> ◇ Push the blank cuvette into the lightpath.

> ◇ Press the key [**0Abs/100%T**] 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…" appears following the "Blanking…", the test will be paused and "Warning…"will appear on the screen.(Fig 9).*

2. If no automatic changer installed "cell #1" and "Max E" will disappear in Fig 8.

WL : 656.1nm   Energy Low. . .
D2
W
Cell #1

Blanking

⊡ Max E
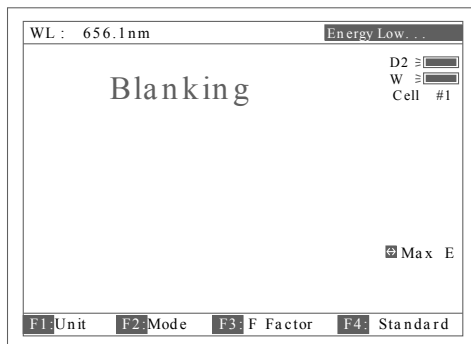
F1:Unit F2:Mode F3:F Factor F4: Standard

Fig 8

NOTE:
1. Blanking is automatic after a wavelength change
   DO NOT OPEN SAMPLE COMPARTMENT LID DURING BLANKING.

2. The dark current don't be taken after power on, if you bypass the calibrating system. It is recommended to take the dark current after warm up. See page 38.
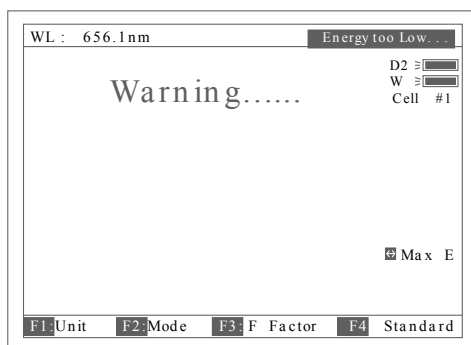

WL : 656.1nm   Energy too Low. . .
D2
W
Cell #1

Warning......

⊡ Max E

F1:Unit F2:Mode F3:F Factor F4 Standard

Fig 9

Set wavelength (Example: set wavelength in "Basic mode")

➢ Press [SET λ] (Fig 10).

WL : 656.1nm   12:35:27
D2
W
Cell #1

0.001 Abs

⊡ Max E

F1:Unit F2:Mode F3:F Factor F4:Standard
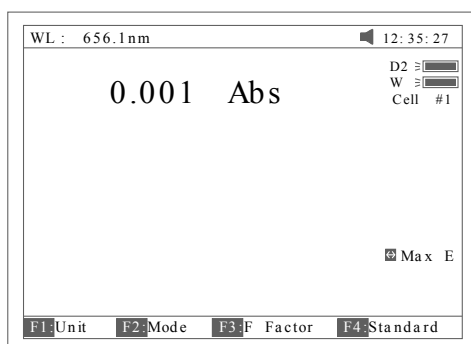
Fig 10

➢ Use numeric keypad to input wavelength (Fig 11).
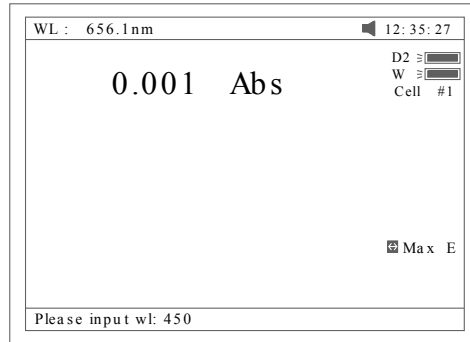
```
WL :   656.1nm                          ◀ 12:35:27
                                        D2 ≅ ▭
                   0.001    Abs         W  ≅ ▭
                                        Cell   #1



                                        ⊡ Max  E


Please input wl: 450
```
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.
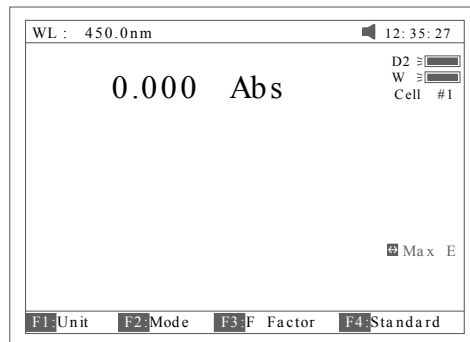
```
WL :   450.0nm                          ◀ 12:35:27
                                        D2 ≅ ▭
                   0.000    Abs         W  ≅ ▭
                                        Cell   #1



                                        ⊡ Max  E

F1:Unit    F2:Mode    F3:F  Factor   F4:Standard
```
Fig 12

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

➢ Press [**3**] in Fig 7 go into "WL scan". After [**LOAD**] being pressed, the first file (ABC.wav) in memory will appear on the bottom line of screen .Showed as Fig 13. Press [∧] or [∨] to browse the files stored in memory. Then if :

1. The key [**ENTER**] be pressed, the file selected will be loaded and displays on the screen. Fig 14.

   Note
   1) *The file selected must match "WL scan" test's type. if not , the "file type error…" will appear on the right of top line.*
   2) *Different test has different file type. Refer to table 1 on page 12.*

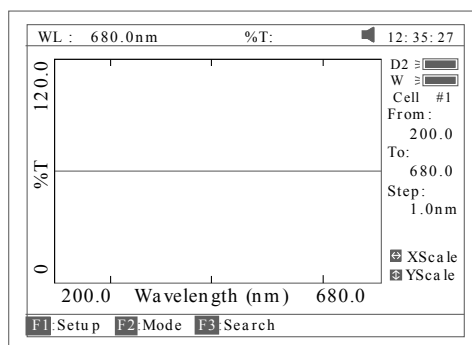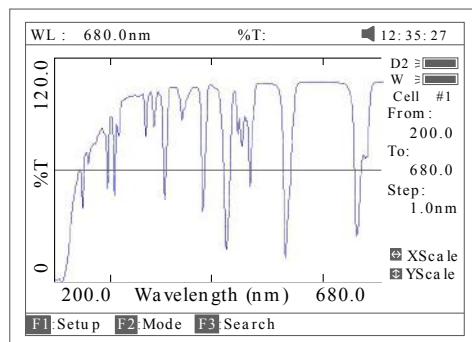2. The key [**CLEAR**] be pressed the file selected will be deleted by selecting "Yes".

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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 curve.

◇ Name the curve by pressing the numeric keypad (Fig 15), press the key [**ENTER**] to confirm.

Note
1) *Pressing numeric key continually to scroll characters and pressing [∧], [∨] to alter capital letter to miniscule. 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 filename is less than 4.*
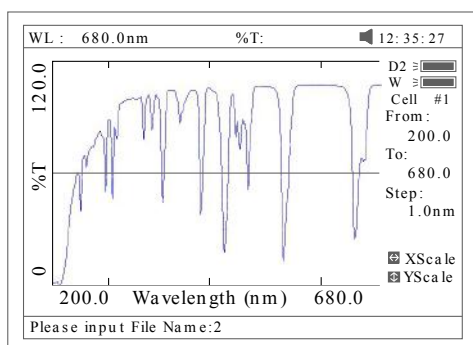
Fig 15

Table 2

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", Fig 16)

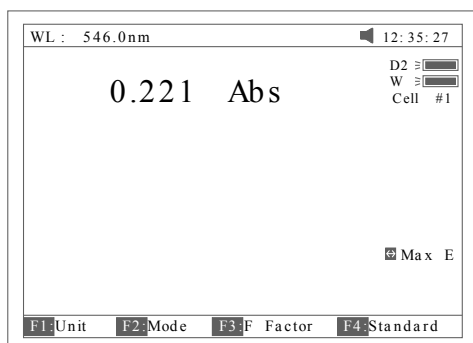Press the key [**PRINT**] to print the report (curve or data you have loaded or tested, Fig 17).

Fig 16

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.
- Fit the blank cuvette into the 4-cell linear changer and place the cuvette in the slot nearest you. For the SQ-2800, push the changer so that the cuvette is in the light path (Push the rod in). Close the lid.

Analyze Sample

For different user requirements, we have provided different test methods.

1   Basic Mode

Push the blank cuvette into the light path. In main menu (Fig 7), press [**1**] to enter "Basic mode" test. After automatically blanking, it will display as Fig 18 (automatic changer installed) or Fig 19 (automatic changer uninstalled) and wait for the operator. [**ESC/STOP**] to exit.

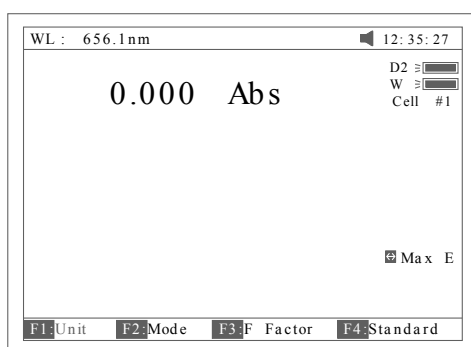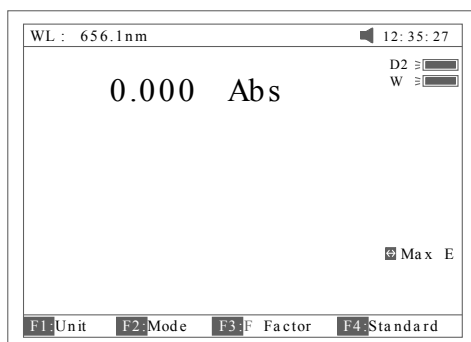*Note: If no automatic changer installed "cell #1" and "Max E" will disappear in Fig 18*

```
WL :  656.1nm                          12:35:27
                                   D2 ≥▭
                                   W  ≥▭
          0.000    Abs             Cell  #1




                                   ⊕ Max  E


 F1:Unit    F2:Mode    F3:F  Factor   F4:Standard
```
Fig 18

```
WL :  656.1nm                          12:35:27
                                   D2 ≥▭
                                   W  ≥▭
          0.000    Abs




                                   ⊕ Max  E


 F1:Unit    F2:Mode    F3:F  Factor   F4:Standard
```
Fig 19

● Test
There are three modes (T%, Abs, Conc/factor) for you to select by pressing [**F2**] to make choice.

1. Abs mode
Push the blank cuvette into the light path. Press [**F2**] to select Abs mode, Press [**0Abs/100%T**] for Blanking, and then push the sample into lightpath to take reading (Fig 20)
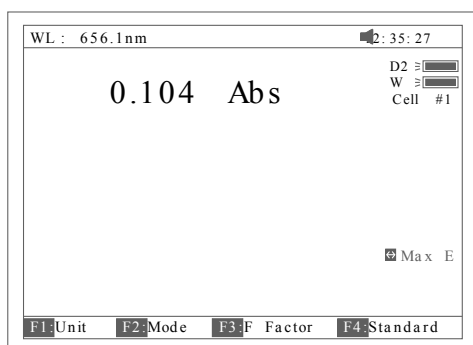
Fig 20

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, please select the item "Other", press enter and input a new unit by pressing the numeric keypad (Fig 22).
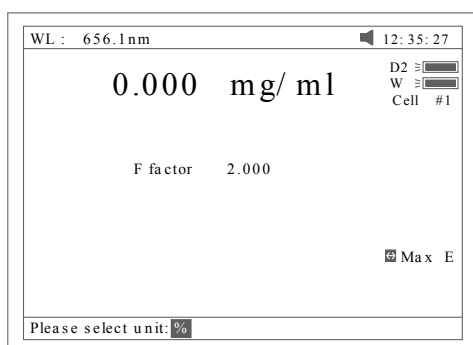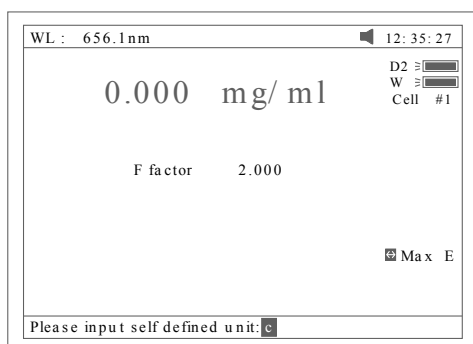

Fig 21

Fig 22

Push the blank cuvette into the light path and press [**0Abs/100%T**] for Blanking. There are now two choices:

1) Press [**F3**] to input known F value, Fig 23. Then push the sample into lightpath to take reading of concentration. Push sample of known concentration into the lightpath
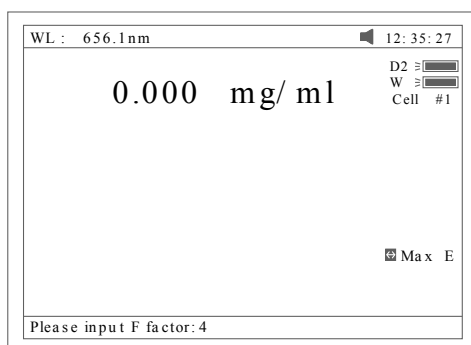
15

```
WL :  656.1nm              ◀  12:35:27

                                    D2 ⊒▭▬
          0.000   mg/ml            W  ⊒▭▬
                                    Cell  #1




                                    ⊡ Max  E

Please input F factor: 4
```

Fig 23

2) Press [**F4**] to input known Conc value, Fig 24. Then push the sample
    into lightpath to take reading of concentration.


```
WL :   656.1nm             ◀  12:35:27

                                    D2 ⊒▭▬
          0.000   mg/ml            W  ⊒▭▬
                                    Cell  #1



          F=4.000

                                    ⊡ Max  E

F1:Unit    F2:Mode    F3:F Factor   F4:Standard
```
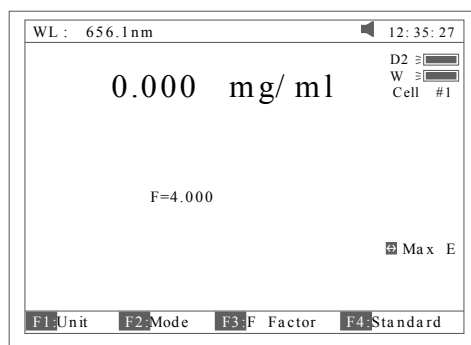

Fig 24

Note:
1) *You can select wavelength at any time by pressing [SET λ]. After your
    selection, instrument always blanks automatically.*
2) *If F value is more than 9999, the "out of range" will display on screen.*

● 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

2   Quantitative

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

Note: .If no automatic changer installed "cell #1" will disappear in Fig 26.
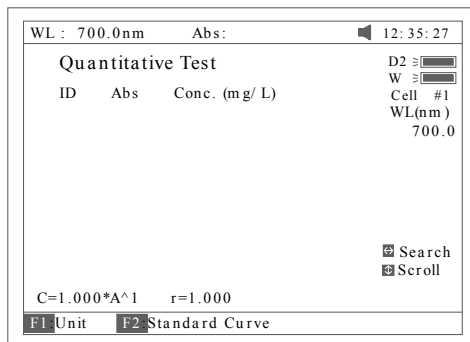
16

Fig 26

● How to operation

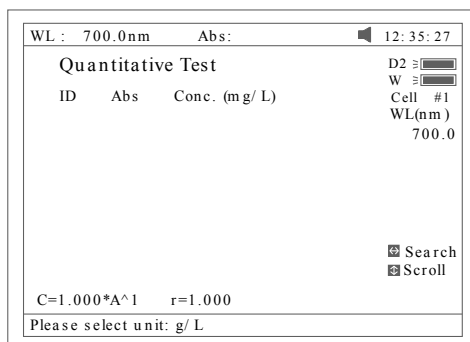➢ Press [**F1**] to select unit of concentration (Fig 27).

Fig 27

➢ Press [SET λ] to select correction methods and enter the wavelength. There are three correction methods (single, Isoabsorbance and 3 point, Fig 28).

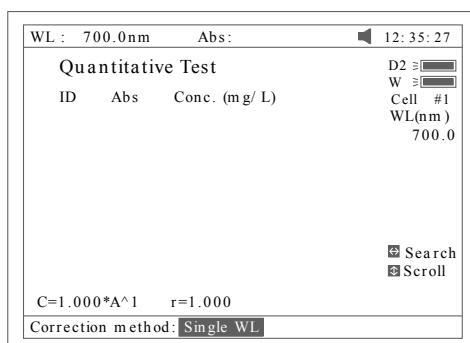*Note: Please refer to the Appendix C for the correction method.*

Fig 28

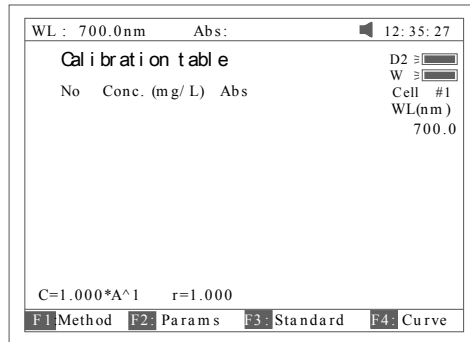➢ Press [**F2**] in Fig 26 for more items to select .See Fig 29.

Fig 29

➤ Press [**F1**] in Fig 29 to select fitting method. There are 4 methods for you to choose: Linear fit, linear fit through zero, square fit and cubic fit.

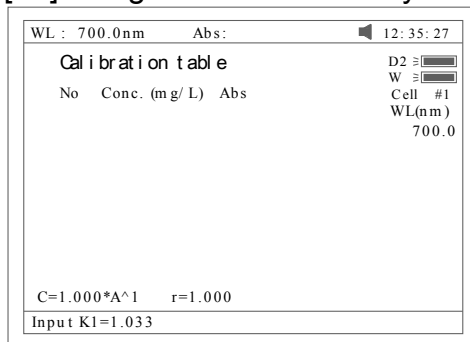➤ Press [**F2**] in Fig 29 to enter directly a known standard curve. Fig 29A.

Fig 29A

The constants to be entered are depending on which fitting method selected. The table below lists the relation:

Fitting Method	Fitting Equation	constants
Linear fit through zero	$C=K_1 \times A$	K1, r*
Linear fit	$C=K_0+K_1 \times A$	K0,K1,r*
Square fit	$C=K_0+K_1 \times A+K_2 \times A^2$	K0,K1,K2
Cubic fit	$C=K_0+K_1 \times A+K_2 \times A^2+K_3 \times A^3$	K0,K1,K2,K3

*r: regression co-efficient, default=1

➤ Press [**F3**] in Fig 29 to establish a standard curve by measuring a group of standard samples. See Fig 30.
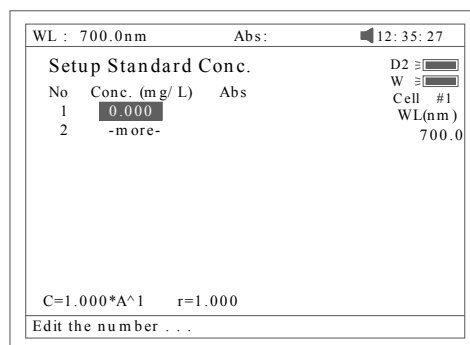

Fig 30

18

➢ Enter standard concentrations of samples by pressing the Numeric keypad followed by [**ENTER**]. Press [∧] or [∨] to modify the inputted data Fig31.

```
┌──────────────────────────────────────────┐
│ WL :  700.0nm          Abs:      ◀ 12:35:27│
│   Setup Standard Conc.           D2 ≡▭    │
│   No   Conc. (mg/ L)    Abs      W  ≡▭    │
│   1      2.000                   Cell  #1  │
│   2      3.000                   WL(nm)    │
│   3     -more-                      700.0  │
│                                            │
│                                            │
│                                            │
│   C=1.000*A^1    r=1.000                   │
│ Input Standard Conc: 3                     │
└──────────────────────────────────────────┘
```
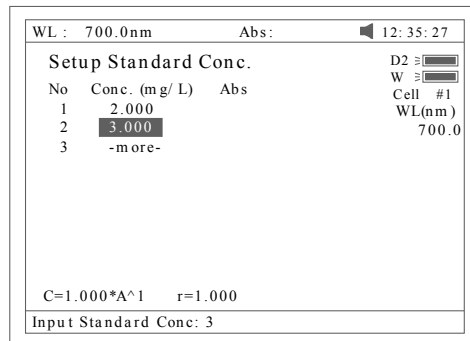Fig 31

➢ Press [**ESC/STOP**] to finish inputting and to exit Fig 32.

➢ Push the blank cuvette into the light path, press [**0Abs/%100T**], the instrument will step to the wavelength and blank. See Fig 32.

```
┌──────────────────────────────────────────┐
│ WL :  700.0nm          Abs:     Blank .....│
│   Calibration table              D2 ≡▭    │
│   No   Conc. (mg/ L)    Abs      W  ≡▭    │
│   1      2.000                   Cell  #1  │
│   2      3.000                   WL(nm)    │
│   3      4.000                      700.0  │
│   4      5.000                             │
│   5      6.000                             │
│                                            │
│   C=1.000*A^1    r=1.000                   │
│ F1:Method  F2:Params  F3:Standard  F4:Curve│
└──────────────────────────────────────────┘
```
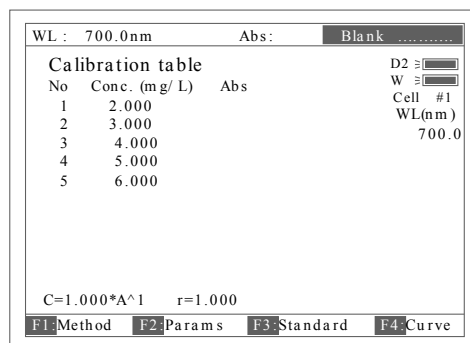Fig 32

➢ Pull the first sample cuvette of known concentration into the light path, Press the key [**START**] to get values of standard curve one by one (Fig 33).
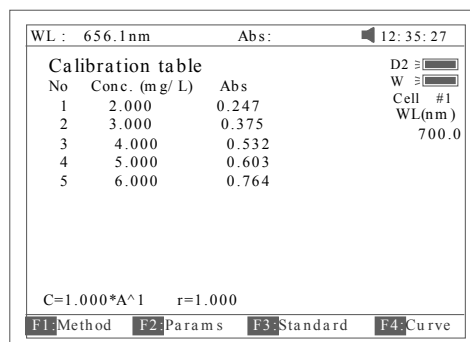
```
┌──────────────────────────────────────────┐
│ WL :  656.1nm          Abs:      ◀ 12:35:27│
│   Calibration table              D2 ≡▭    │
│   No   Conc. (mg/ L)    Abs      W  ≡▭    │
│   1      2.000     0.247         Cell  #1  │
│   2      3.000     0.375         WL(nm)    │
│   3      4.000     0.532            700.0  │
│   4      5.000     0.603                   │
│   5      6.000     0.764                   │
│                                            │
│   C=1.000*A^1    r=1.000                   │
│ F1:Method  F2:Params  F3:Standard  F4:Curve│
└──────────────────────────────────────────┘
```
Fig 33

*Note: If auto-cell changer is installed, the vary samples are measured by pressing [**CELL**] following numbers (1-8) and pressing [**ENTER**] to confirm.*

➢ Press [**F4**] to draw the curve. You can get a different curve by pressing [**F1**] to select a different fitting method. See Fig 34 -Fig 37.

For linear fits, "r" represent fitting coefficient of linear regression. r=1 is 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 result will be obtained.
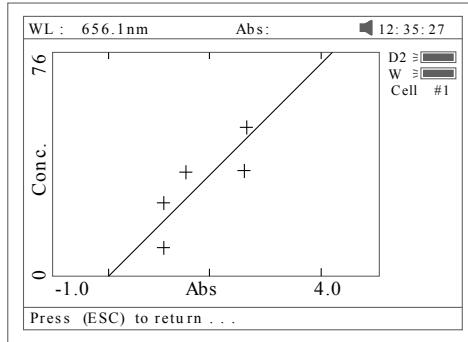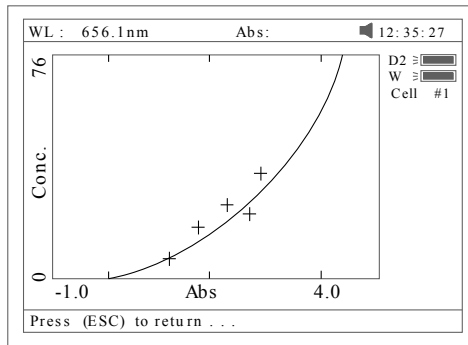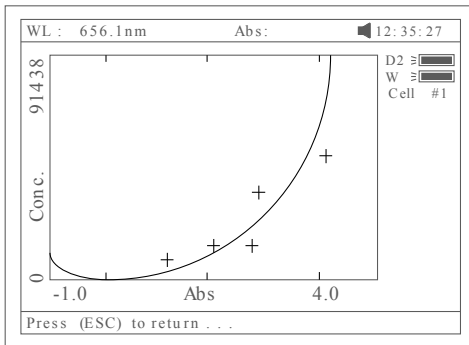

Fig 34 linear through zero fit

Fig 35 square fit

Fig 36 cubic fit
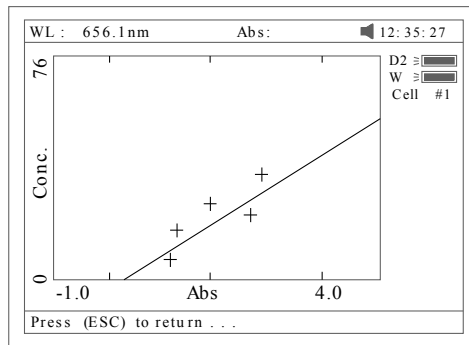
Fig 37 linear fit

➢ Press [**SAVE**] to save calibration if required
➢ Press [**ESC/STOP**] to exit

● Quantitative Test

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Before test, the standard curve must be obtained. There are three ways for you to obtained 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 file with type ***.fit. At last press [ENTER] to confirm.
b) Known standard curve, which is not saved in the instrument. See page 17 for Fig 29 enter a known standard curve directly.
c) Use the standard samples for the test. First the standard curve must be established using the method shown in page 17.

Note: All sample results must be taken in screen Fig 26.

➢ Push the blank cuvette into the light path and press [**0Abs/100%T**] for blanking.
➢ Pull the sample cuvette into the light path, press the key [**START**], the results will be displayed on the screen (Fig 38). If there is more than one sample, repeat for the next sample.
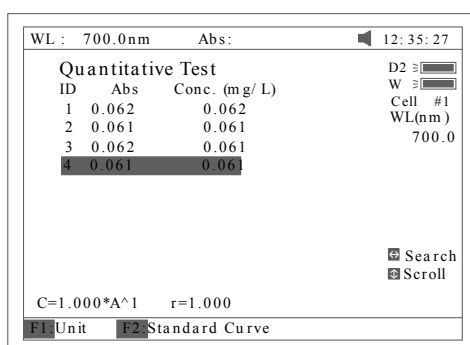
```
WL :   700.0nm        Abs :              ◀ 12: 35: 27
      Quantitative Test                     D2 ⊒▬
      ID     Abs    Conc. (m g/ L)          W  ⊒▬
       1   0.062        0.062               Cell  #1
       2   0.061        0.061               WL(nm )
       3   0.062        0.061                  700.0
       4   0.061        0.061

                                           ⊡ Search
                                           ⊡ Scroll
      C=1.000*A^1      r=1.000
   F1: Unit    F2: Standard Curve
```
Fig 38

➢ 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 39

3   Wavelength Scan

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

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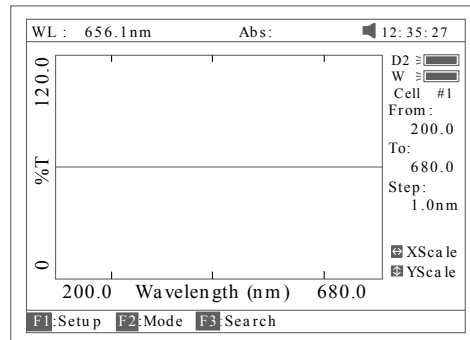

Fig 41

● Scan sample

1. Press [**F1**] to setup, input the start wavelength, and end wavelength by pressing the numeric keypad (Fig 42).

Note: The SQ-2800 scans from high to low wavelength. Browse and select the items of scan step and scan speed by pressing [∧] or [∨].
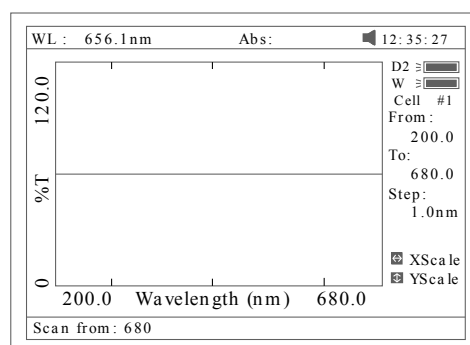

Fig 42

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

2. Press [**F2**] to select the test mode, "Abs", "%T" or "E"' (Fig 43).


```
WL :   656.1nm          Abs:           🔊 12:35:27
                                              D2 ≋▭
  120.0                                       W  ≋▭
                                              Cell  #1
                                              From :
                                                 200.0
  %T                                          To:
                                                 680.0
                                              Step:
                                                 1.0nm

   0                                          ⊕ XScale
                                              ⊞ YScale
      200.0    Wavelength (nm)     680.0
  Please select mode: Abs
```
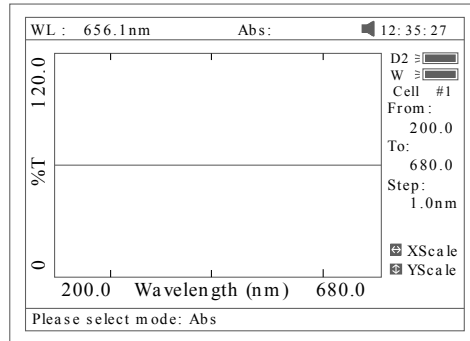
Fig 43

3. Push the blank cuvette into the light path, press [**0Abs/100%T**] to scan the base line (Fig 44). Press the key [**ESC/STOP**] to stop scanning;


```
WL :   520.0nm              Scan to 200.0nm
                                              D2 ≋▭
  120.0                                       W  ≋▭
                                              Cell   #1
                                              From :
                                                 200.0
  %T                                          To:
                                                 680.0
                                              Step:
                                                 1.0nm

   0                                          ⊕ XScale
                                              ⊞ YScale
      200.0    Wavelength (nm)     680.0
  Press (ESC) to stop . . .
```
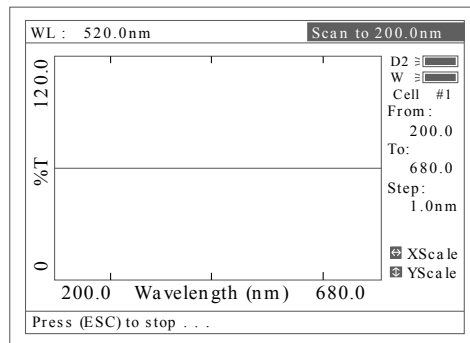
Fig 44

4. Pull the sample cuvette into the 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).


```
WL :  417.0nm   %T: 36.73 Scan to 200.0nm      WL :  680.0nm     %T:        🔊 12:35:27
                                D2 ≋▭                                          D2 ≋▭
 120.0                          W ≋▭           120.0                           W ≋▭
                                Cell  #1                                       Cell   #1
                                From :                                         From :
                                  200.0                                          200.0
 %T                             To:            %T                              To:
                                  680.0                                           680.0
                                Step:                                          Step:
                                  1.0nm                                           1.0nm

  0                             ⊕ XScale         0                             ⊕ XScale
                                ⊞ YScale                                       ⊞ YScale
    200.0  Wavelength (nm)  680.0                 200.0   Wavelength (nm)  680.0
 Press (ESC) to stop . . .                     F1:Setup  F2:Mode  F3:Search
```
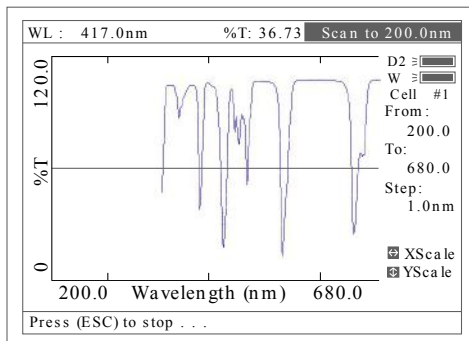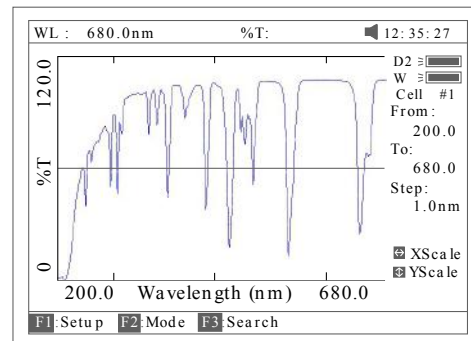
Fig 45   Fig 46

5. If you want to change the scale, press [<] or [>] to change "x" scale (Fig 47), input upper limit and lower limit by pressing the numeric keypad. To change "y"scale press [∧] or [∨]. After these inputs the instrument will redraw the curve (Fig 48).
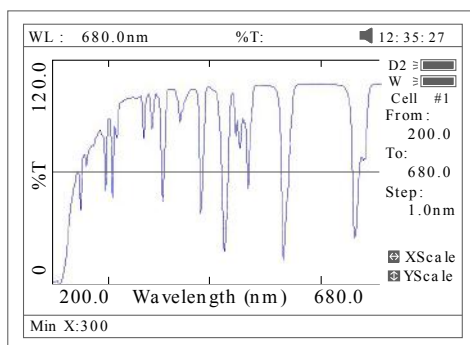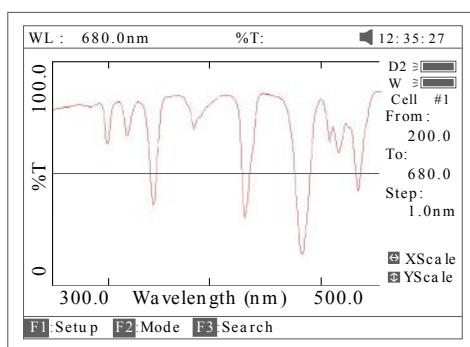

Fig47

Fig 48

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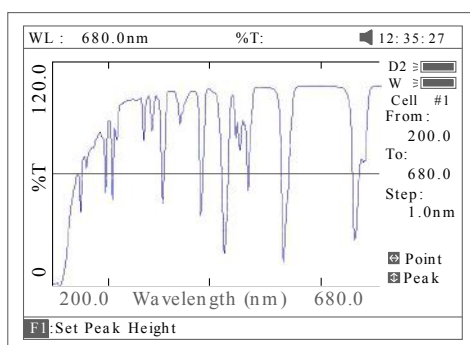

Fig 49

a) *Peak to peak, press [**F1**] to set "peak height" and input value by pressing the numeric keypad (Fig 50). Press [∨] to search the peak from left to right and press [∧] to search from right to left. The value of every peak found will be displayed on the screen*

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one at a time (Fig 51)*.*

```
WL :   680.0nm          %T:          🔊 12:35:27
                                            D2 ≋▬▬
  120.0                                      W  ≋▬▬
                                            Cell  #1
                                            From :
                                              200.0
  %T                                        To:
                                              680.0
                                            Step:
                                              1.0nm
  0                                         ⊕ Point
                                            ⊠ Peak
      200.0   Wavelength (nm)   680.0
Please input peak height: 0.100
```

Fig 50

```
WL :   452.0nm          %T:22.38     🔊 12:35:27
                                            D2 ≋▬▬
  120.0                                      W  ≋▬▬
                                            Cell  #1
                                            From :
                                              200.0
  %T                                        To:
                                              680.0
                                            Step:
                          +                   1.0nm
  0                                         ⊕ Point
                                            ⊠ Peak
      200.0   Wavelength (nm)   680.0
F1 :Set peak Height
```
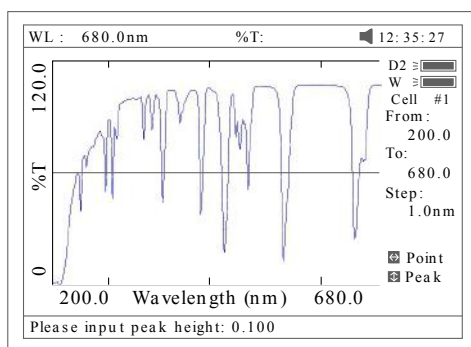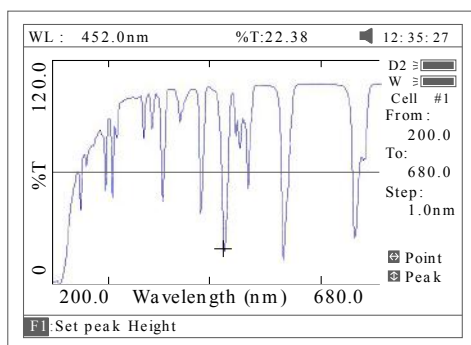
Fig 51

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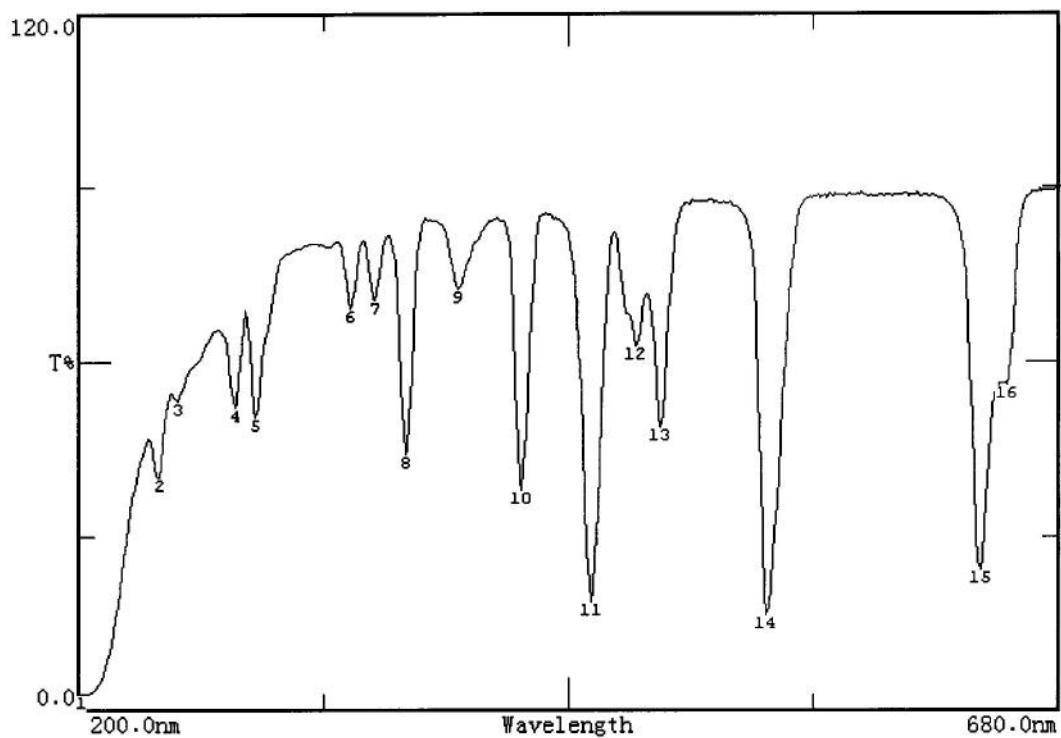
Peak list:
No.	Wavelength(nm)	Abs	T%
1	202.0	1.585	2.60
2	240.0	0.397	40.08
3	249.0	0.274	53.18
4	277.0	0.285	51.93
5	287.0	0.298	50.30
6	333.0	0.161	68.98
7	345.0	0.154	70.19
8	360.0	0.357	43.95
9	386.0	0.141	72.26
10	417.0	0.422	37.83
11	451.0	0.731	18.58
12	473.0	0.205	62.38
13	485.0	0.313	48.61
14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

Fig 52

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4   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)
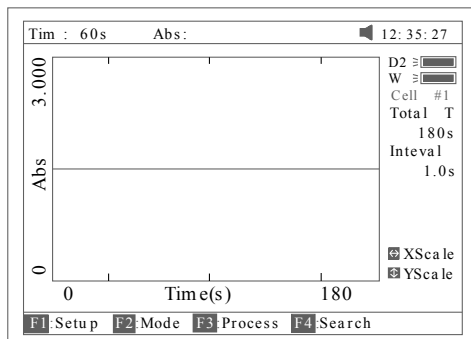
Fig 53

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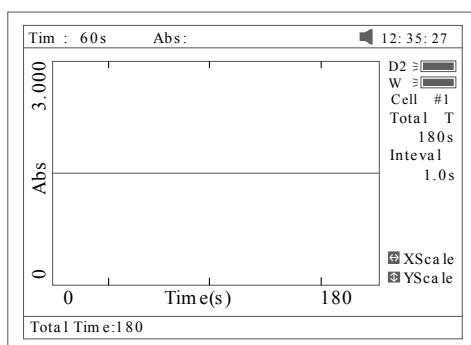
Fig 54

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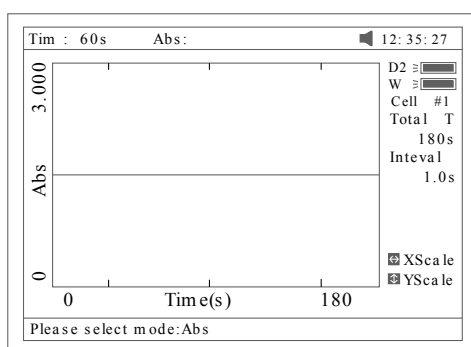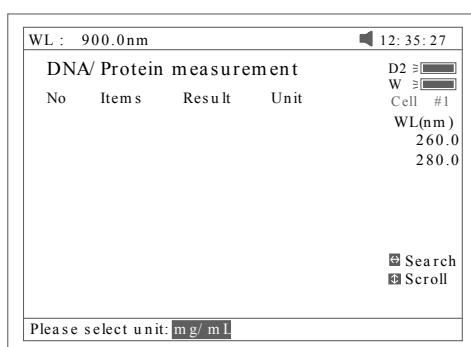

Fig 55

  3. Set wavelength by pressing [SET λ]. Pull the blank cuvette into the light path, press [**0Abs/100%T**] for blanking

  4. Pull the sample cuvette into the light path, 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);
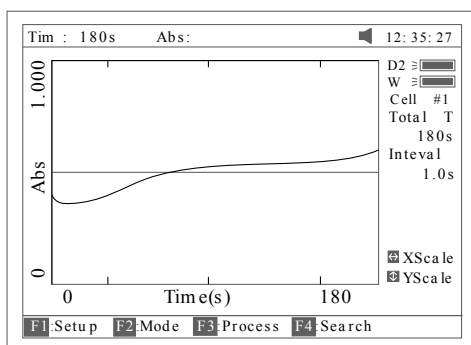
Fig 56

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 X ΔA/min
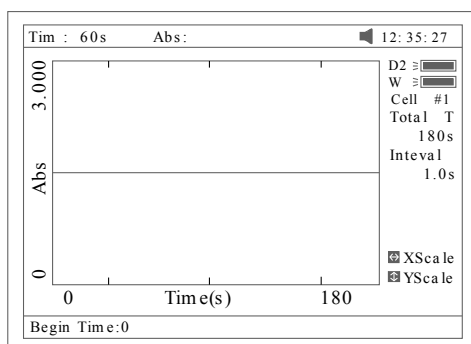
Fig 57
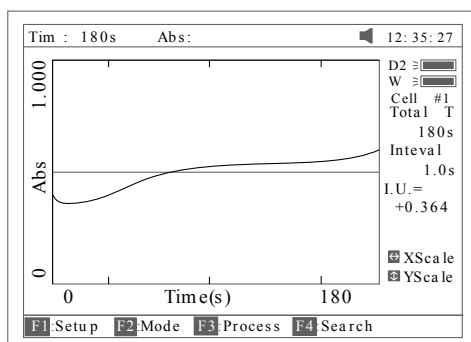
Fig 58

6. If you want to change the scale, please 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 [**>**]. Please 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).

```
              Kinetics Test Report

File Name:      Q1.kin
Date and Time: 26-06-2003 08:20:11
Total Time:    180s
Time Interval: 1.0s
I.U.:          +0.000     From 0s to 1s
```
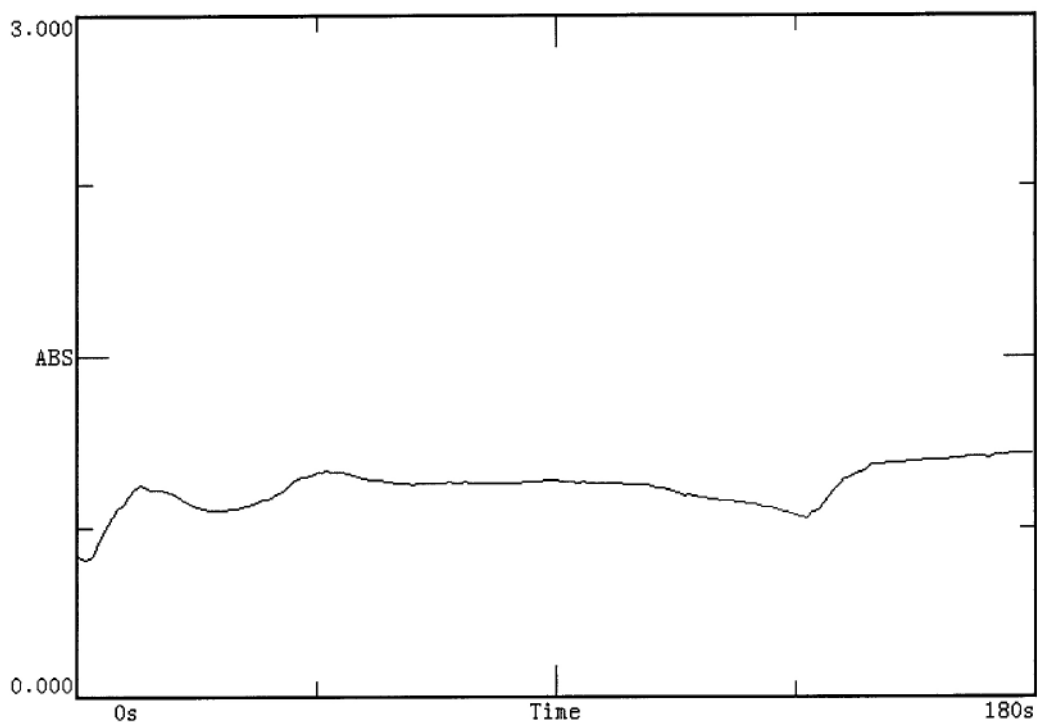

Fig 59

5   DNA/Protein

Press [**5**] in main menu for "DNA/Protein" (Fig 60). [**ESC/STOP**] to exit.

Note: The algorithm of the test refer to Appendix A please.
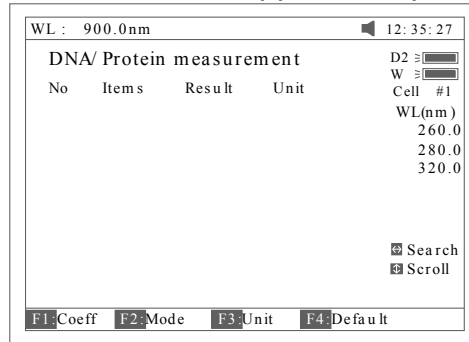
Fig 60

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 own values for f1-f4. Press [**F1**] to set f1-f4. Input the value by pressing the numeric keypad (Fig 61).
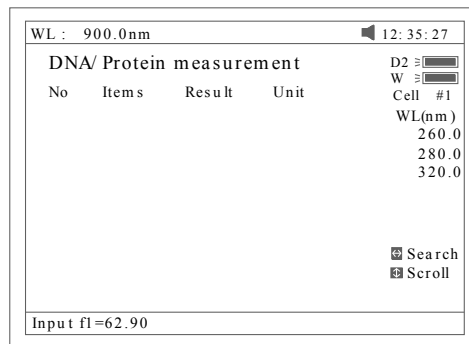
Fig 61

    2. Press [**F2**] to select test mode. "Absorbance difference 1" is for testing at the wavelength 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

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```
WL :   900.0nm                    🔊 12:35:27
   DNA/ Protein measurement          D2 ▤▬▬
                                     W  ▤▬▬
   No    Items    Result    Unit     Cell   #1
                                     WL(nm )
                                         260.0
                                         280.0




                                     ⏎ Search
                                     ⏎ Scroll

   With reference: Yes
```
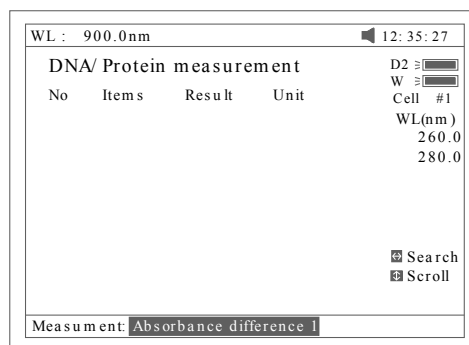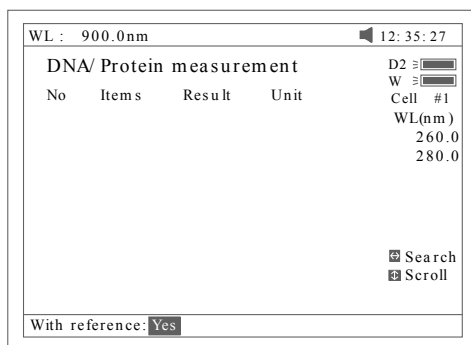
Fig 63

3.   Press [**F3**] to select the unit of concentration (Fig 64).

```
WL :   900.0nm                    🔊 12:35:27
   DNA/ Protein measurement          D2 ▤▬▬
                                     W  ▤▬▬
   No    Items    Result    Unit     Cell   #1
                                     WL(nm )
                                         260.0
                                         280.0




                                     ⏎ Search
                                     ⏎ Scroll

   Please select unit: mg/ ml
```
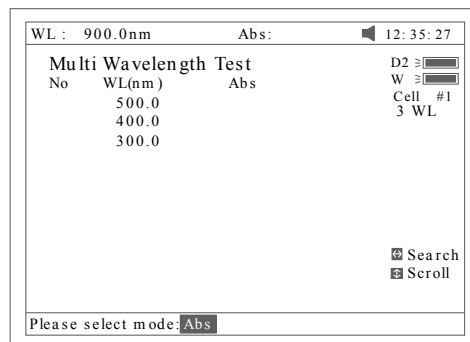
Fig 64

4.   Push the blank cuvette into the light path, then press [**0Abs/100%T**] for blanking.

5.   Pull the sample cuvette into the light path, press [**START**] to test the sample. The test result will be displayed on the screen (Fig 65).
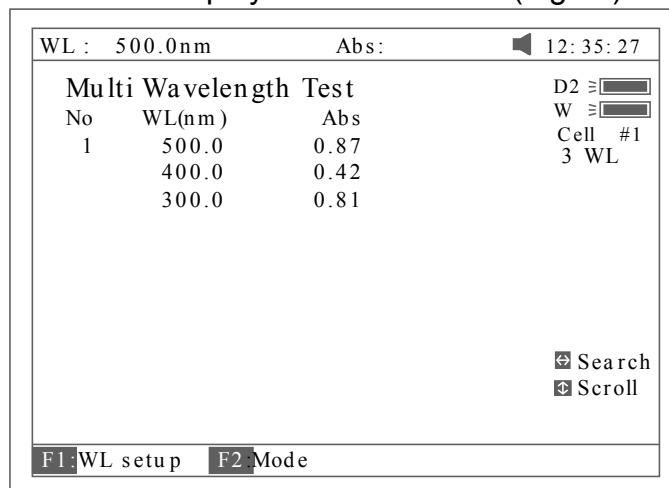
```
WL :   900.0nm          Abs:       🔊 12:35:27
   DNA/ Protein measurement          D2 ▤▬▬
   No    Items    Result    Unit     W  ▤▬▬
   1      A1      2.947     Abs      Cell   #1
          A2      2.842     Abs      WL(nm )
          Aref    0.638     Abs          260.0
                                         280.0
          C-DNA   65.91    mg/ mL        320.0
          C-Pro    1672    mg/ mL
          Ratio    1.048

                                     ⏎ Search
                                     ⏎ Scroll

  F1:Coeff   F2:Mode   F3:Unit   F4:Default
```
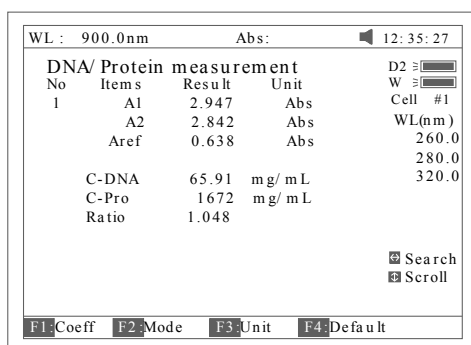
Fig 65

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

6   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 setup a group of wavelengths for testing by pressing the numeric keypad followed by **[ENTER]**. [∧] or [∨] 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.


```
WL :   900.0nm          Abs:        ◀ 12:35:27
      Multi Wavelength Test            D2 ⊒▬▬
      No    WL(nm)        Abs          W  ⊒▬▬
            500.0                      Cell  #1
            400.0                       2 WL
           546.0


                                       ⊡ Search
                                       ⊡ Scroll

Please input wl:500
```
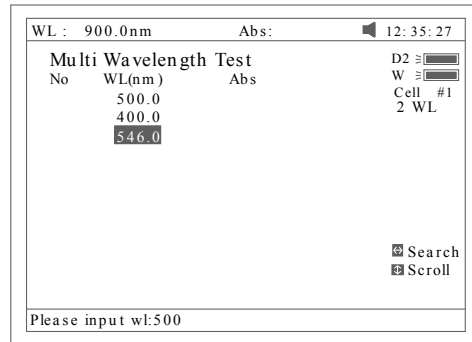
Fig 69

    2. Press [**F2**] to select mode: T%, Abs (Fig 70).


```
WL :   900.0nm          Abs:        ◀ 12:35:27
      Multi Wavelength Test            D2 ⊒▬▬
      No    WL(nm)        Abs          W  ⊒▬▬
            500.0                      Cell  #1
            400.0                       3 WL
            300.0


                                       ⊡ Search
                                       ⊡ Scroll

Please select mode:Abs
```

Fig 70

    3. Push the blank cuvette into the light path, then press [**0Abs/100%T**] for Blanking.

    4. Pull the sample cuvette into the light path, press [**START**] to test. The test results will be displayed on the screen (Fig 71).


```
WL :   500.0nm          Abs:        ◀ 12:35:27
      Multi Wavelength Test            D2 ⊒▬▬
      No    WL(nm)        Abs          W  ⊒▬▬
      1     500.0         0.87         Cell  #1
            400.0         0.42          3 WL
            300.0         0.81


                                       ⊡ Search
                                       ⊡ Scroll

 F1:WL setup    F2:Mode
```

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 be displayed on the screen. Press [ʌ] or [v] to browse the test results one by 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

7 Utility
Press **[7]** in Main menu for "Utility" (Fig 73). [**ESC/STOP**] to exit.
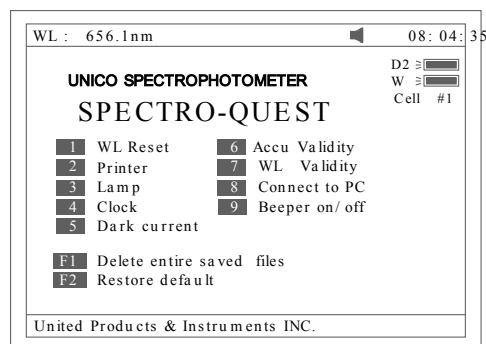
Fig 73

● WL Reset

Press **[1]** to reset wavelength (Fig 74).
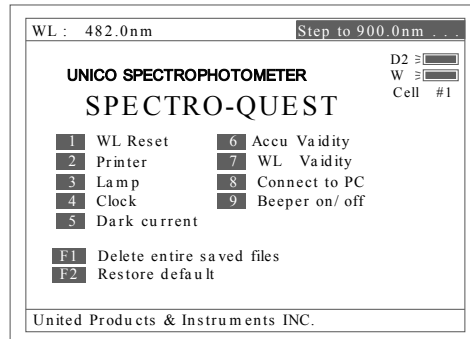
Fig 74

● Printer

Press **[2]** to set printer (Fig 75). [**ESC/STOP**] to exit.
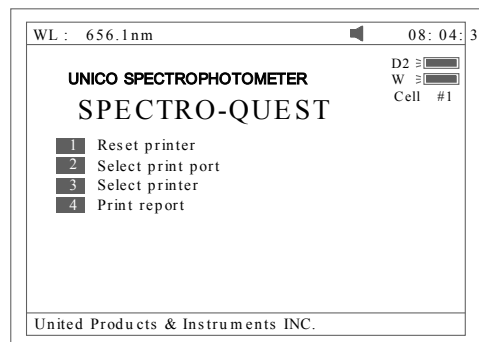
Fig 75

1. Press **[1] in Fig 75** to Reset Printer.

2. Press **[2] in Fig 75** to select print port (LPT or Comm., Fig 76).
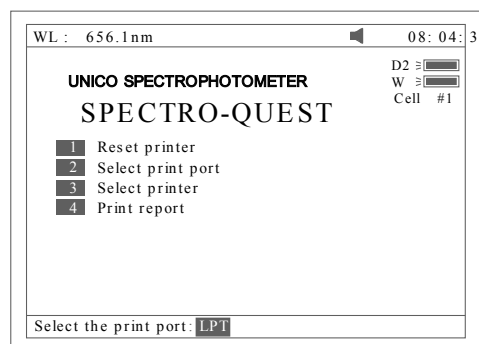
Fig 76

3. Press **[3] in Fig 75** to select printer (HP PCL (1 color cartridge), PCL

(black mode), Epson ESC/P or Epson/P2 or above, Fig 77).
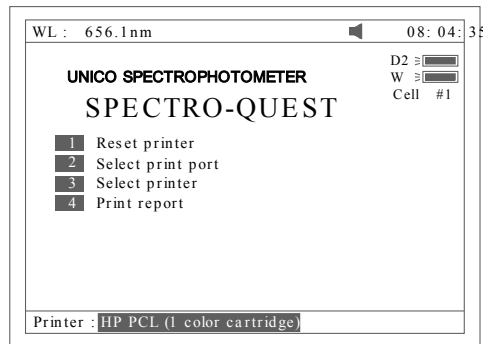
Fig 77

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.
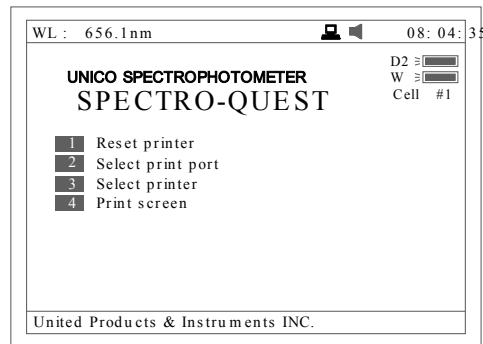
Fig 78

● Lamp
Press **[3]** to set lamp (Fig 79). [**ESC/STOP**] to exit.
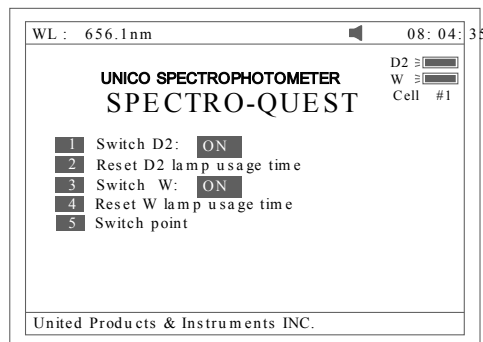
Fig 79

1. Press **[1] in Fig 79** to switch on/off D2. Fig 80.
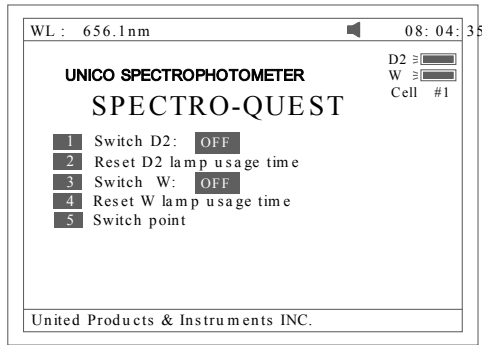
Fig 80

2. Press **[2] in Fig 79** to reset usage time of D2 (Fig 81). Press [Λ**]** or **[**v**]** to select "Yes" or "No", and then press [**ENTER]**.
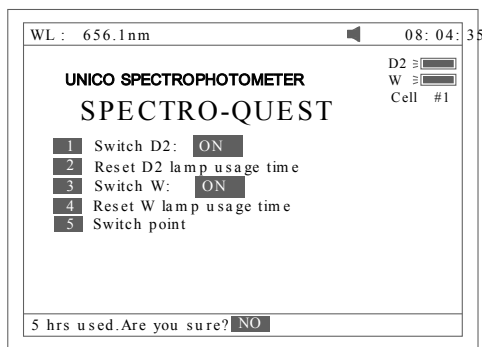
Fig 81

3. Press **[3] in Fig 79** to switch on/off W. The indication is also on the top right corner of the screen (Fig 82).
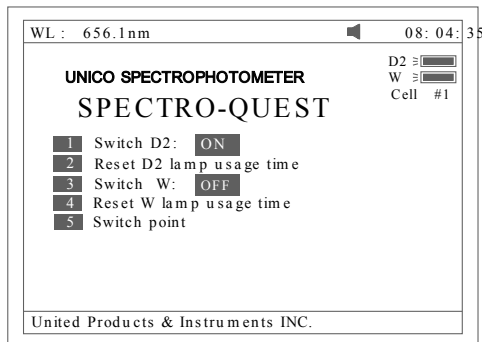
Fig 82

4. Press **[4] in Fig 79** to reset usage of W (Fig 83). Press **[**Λ**]** or **[**v**]** to select "Yes" or "No", and then press [**ENTER]**.
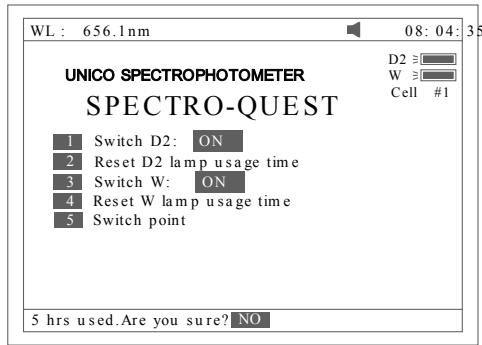
Fig 83

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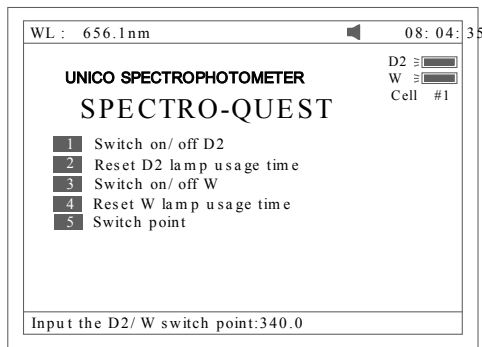
Fig 84

● Clock

Press [**4] In Fig 73** to set the display mode and modify the clock (Fig 85). [**ESC/STOP**] to exit.
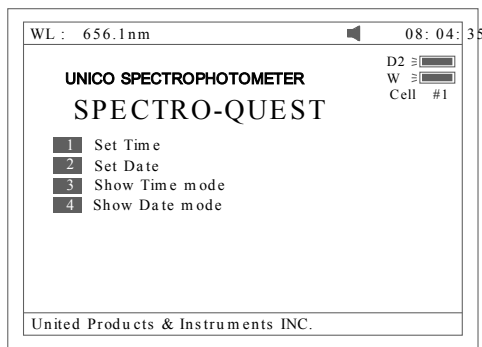
Fig 85

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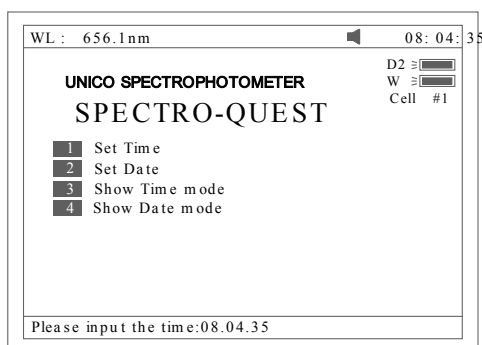
Fig 86

2. Press **[2] in Fig 85** to modify 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 the screen (Fig 87).
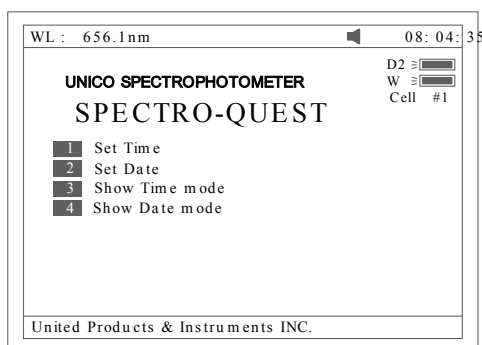
Fig 87

Note: Make sure press DOT ([+/-/.] button) between numbers. For example, January 20, 2005, should input like: 20.01.05

● Dark Current
Press [**5] In Fig 73** to get dark current (Fig 88).
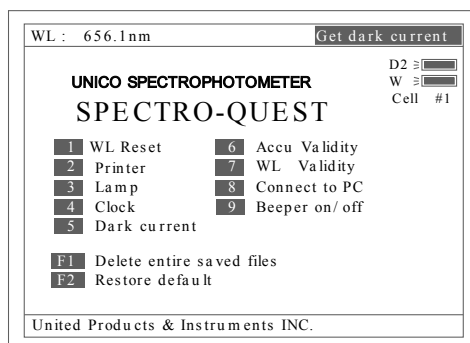
Fig 88

● Accu Validity
Press [**6**] **In Fig 73 to do** Accu validity (Fig 89). [**ESC/STOP**] to exit.
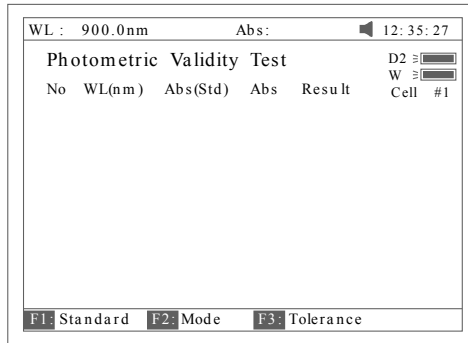
Fig 89

1. Press [**SET λ**] to set the wavelength. Press [**ENTER**] to edit and input wavelength by pressing the numeric keypad (Fig 90). [**ESC/STOP**] to finish inputting and exit.
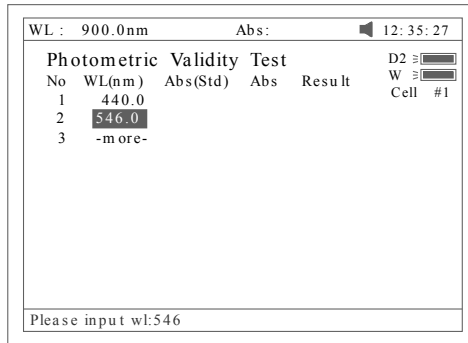
Fig 90

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.
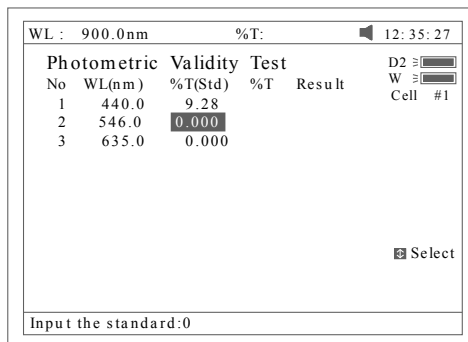
Fig 91

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 [**0Abs/100%T**] for Blanking.

6. Put the sample (calibrated neutral density filter) into the 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

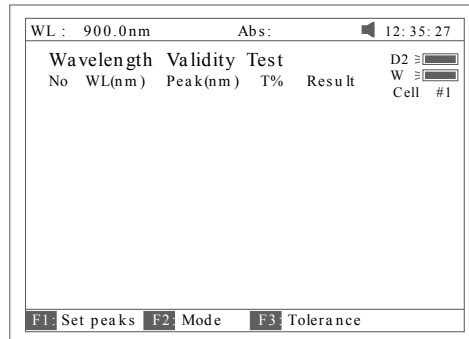Press **[7] in Fig 73** to WL validity (Fig 95). **[ESC/STOP]** to exit.

Fig 95

1. Press [**F1**] to set the standard peak. Press [**ENTER**] to edit and input wavelength by pressing the numeric keypad (Fig 96). **[ESC/STOP]** to finish inputting and exit.
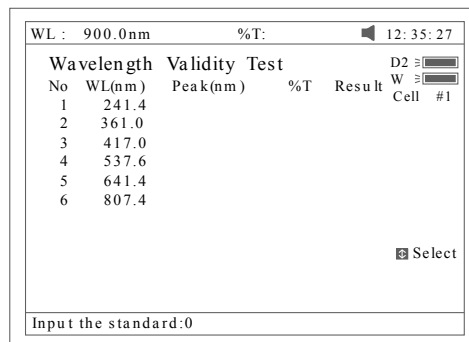

Fig 96

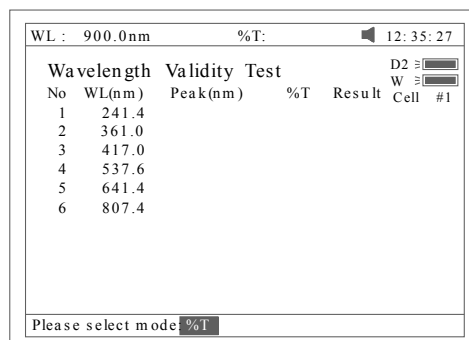2. Press [**F2**] to select test mode (Abs or %T, Fig 97).

Fig 97

3. Press [**F3**] to set tolerance (Fig 98). Input the value by pressing the numeric keypad.


```
WL :   900.0nm          %T:            🔊  12:35:27
   Wavelength  Validity  Test                    D2 ≡▭
   No   WL(nm)    Peak(nm)      %T   Result  W  ≡▭
    1     241.4                               Cell   #1
    2     361.0
    3     417.0
    4     537.6
    5     641.4
    6     807.4



                                            ⊞ Select


 Input tolerance:0.8
```
Fig 98

4. Press [**0Abs/100%T**] for blanking.

5. Put the sample (calibrated holmium liquid) into the 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.


```
WL :   900.0nm          %T:            🔊  12:35:27
   Wavelength  Validity  Test                    D2 ≡▭
   No   WL(nm)    Peak(nm)      %T   Result  W ≡▭
    1     241.4     239.7      40.06   pass   Cell   #1
    2     361.0     360.4      42.82   pass
    3     417.0     416.9      37.63   pass
    4     537.6     537.2      16.50   pass
    5     641.4     641.3      24.33   pass
    6     807.4     807.7      92.38   pass




 F1: Standard   F2: Mode    F3: Tolerance
```
Fig 99

6. 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 PC (Fig 100), if the instrument is on-line with the PC. The screen displays as Fig 100A. Press [**ESC/STOP**] to exit.
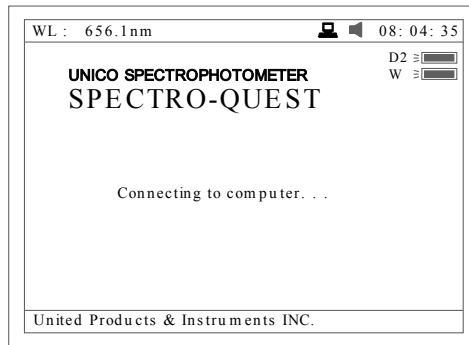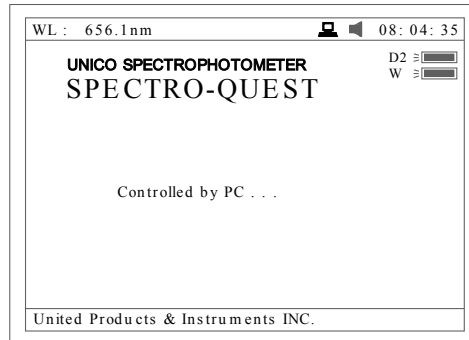
Fig 100

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 the delete the files, double confirm need to do.

- Restore default
  Press **[F2] in Fig 73** to restore the default parameters.

8   Defined Test (auto-cell changer required)

Press [8] in main menu for "defined test" (Fig 101). [**ESC/STOP**] to exit.
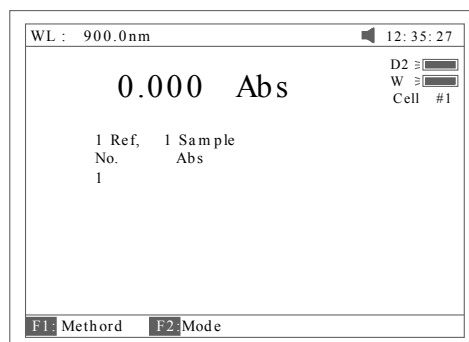

Fig 101

1. Press **[F1]** to setup method (Fig 102). There are 8 items (1 ref. 1 sample, 1 ref. 2 samples, 1 ref. 3 samples, 1 ref. 4 samples, 1 ref. 5 samples, 1 ref. 6 samples, 1 ref. 7 samples, N refs. N samples) for selecting. We take " 1 ref. 4 samples" for example, Fig 102
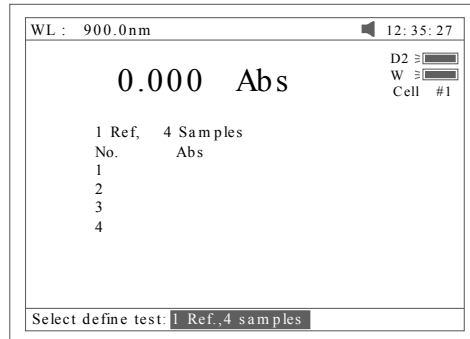

Fig 102

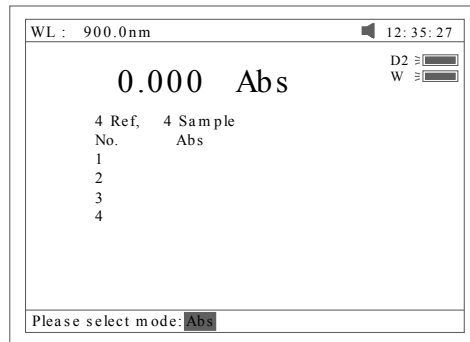2. Press **[F2]** to select test mode (Abs or %T, Fig 103).

Fig 103

3. Put the reference into cell NO.1 and 4 samples into cell NO.2-NO.5.Set wavelength.

4. Press **[START]** .Automatically the reference is taken in cell NO.1,the 4 samples are taken in cell NO.2-NO.5. The results are displayed as Fig 104.
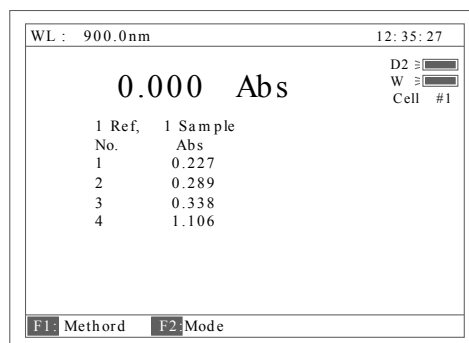

Fig 104

5. Select "N refs. N samples", Take "8 refs. 8 samples" for example.

6. After setup wavelength and mode (%T or Abs),put 8 references into CELL NO.1-NO.8.

7. Press **[START],** the screen display as Fig 105, the "Place 1ˢᵗ group…" appear on the right of top line**,** Press [**0Abs/100%T**], the 8 references are taken automatically and the screen change to Fig 106.

```
WL :  900.0nm                    Place 1st group . .
                                           D2 ▷ ▭
              0.000    Abs                  W  ▷ ▭
                                           Cell  #1

       1 Ref,   1 Sample
       No.        Abs
       1
       2
       3
       4
       5
       6
       7
       8
   F1: Methord    F2:Mode
```

Fig 105

```
WL :  900.0nm                    Place 2nd group .
                                           D2 ▷ ▭
              0.000    Abs                  W  ▷ ▭
                                           Cell  #1

       1 Ref,   1 Sample
       No.        Abs
       1
       2
       3
       4
       5
       6
       7
       8
   F1: Methord    F2:Mode
```
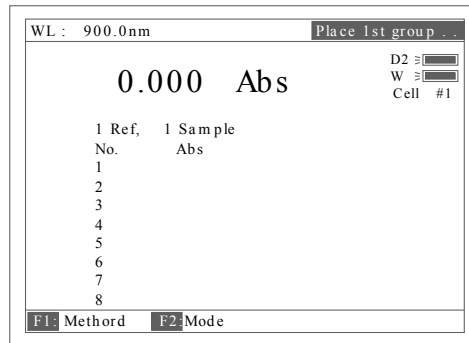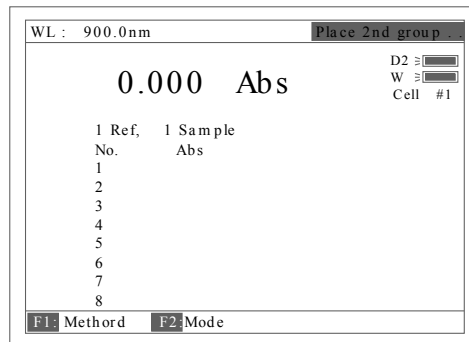
Fig 106

8. Remove 8 references and put 8 samples into CELL NO.1-NO.8, Press the [**START],** the results are taken **automatically** . Fig 107.
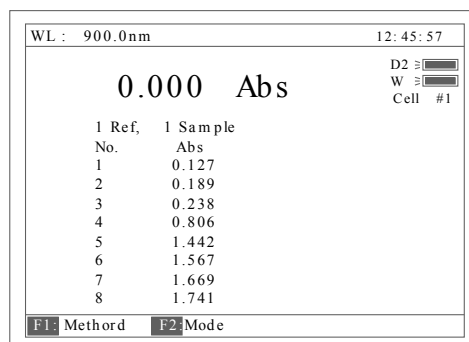
```
WL :  900.0nm                         12:45:57
                                           D2 ▷ ▭
              0.000    Abs                  W  ▷ ▭
                                           Cell  #1
       1 Ref,   1 Sample
       No.        Abs
       1         0.127
       2         0.189
       3         0.238
       4         0.806
       5         1.442
       6         1.567
       7         1.669
       8         1.741
   F1: Methord    F2:Mode
```

Fig 107

Appendix A

DNA/Protein Test Algorithm

Test Name	Method	Wavelength	Calculations	Parameters	Displayed Units
DNA MEASUREMENT					
DNA/Protein Concentration and DNA purity	Absorbance difference (260,280)	$A_1=A_{260nm}$ $A_2=A_{280nm}$ $A_{ref}=A_{320nm}$ (optional)	DNA concentration: $(A_1-A_{ref})f_1-(A_2-A_{ref})f_2$ Protein concentration $(A_2-A_{ref})f_3-(A_1-A_{ref})f_4$	$f_1=62.9$ $f_2=36.0$ $f_3=1552$ $f_4=757.3$	DNA: µg/ml Protein: µg/ml
	Absorbance difference (260,230)	$A_1=A_{260nm}$ $A_2=A_{230nm}$ $A_{ref}=A_{320nm}$ (optional)	DNA concentration: $(A_1-A_{ref})f_1-(A_2-A_{ref})f_2$ Protein concentration $(A_2-A_{ref})f_3-(A_1-A_{ref})f_4$	$f_1=49.1$ $f_2=3.48$ $f_3=183$ $f_4=75.8$	
	Absorbance ratio	$A_1=A_{260nm}$ $A_2=A_{280nm\ or}$ A_{230nm} $A_{ref}=A_{320nm}$ (optional)	$Ratio=\dfrac{A_1-A_{ref}}{A_2-A_{ref}}$	None	No units (ratio)

Appendix B

Lamp Replacement

A. TO REPLACE DEUTERIUM LAMP

1. Turn off and unplug the instrument (VERY IMPORTANT: HIGH VOLTAGE).

2. Remove the cuvette holder rod by unscrewing the rod counterclockwise.

3. Remove the all screws around the sides of the spectrophotometer. See Fig A1

Fig A1

4. Very carefully remove the cover of the instrument and place in right side of the instrument. Fig A2

Fig A2

HINT: If it is necessary to remove the cover from the right side of the instrument, carefully remove 3 connectors (CZ6, CZ4 and J3) on PCB marked SST8.417.100. Be sure to reconnect after replacing the lamp!
*Fig A3*

CZ6   CZ4
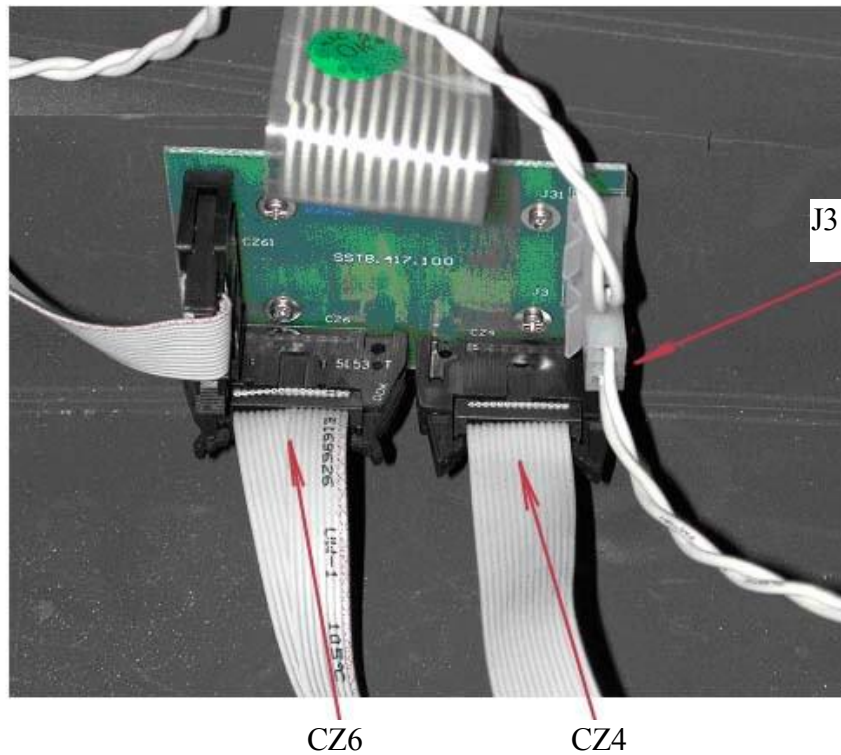
Fig A3

5. Remove the grey metal protection cover. Using screwdrivers remove the two top screws and the two bottom screws, and then place the protective cover to the side. See Fig A4

Fig A4

6. Disconnecting the connector J7 on the PCB marked SST8.411.128. Unscrew the screw that holds the lamp bracket to the instrument base. Pull the entire lamp and lamp holder assembly out. See Fig A5
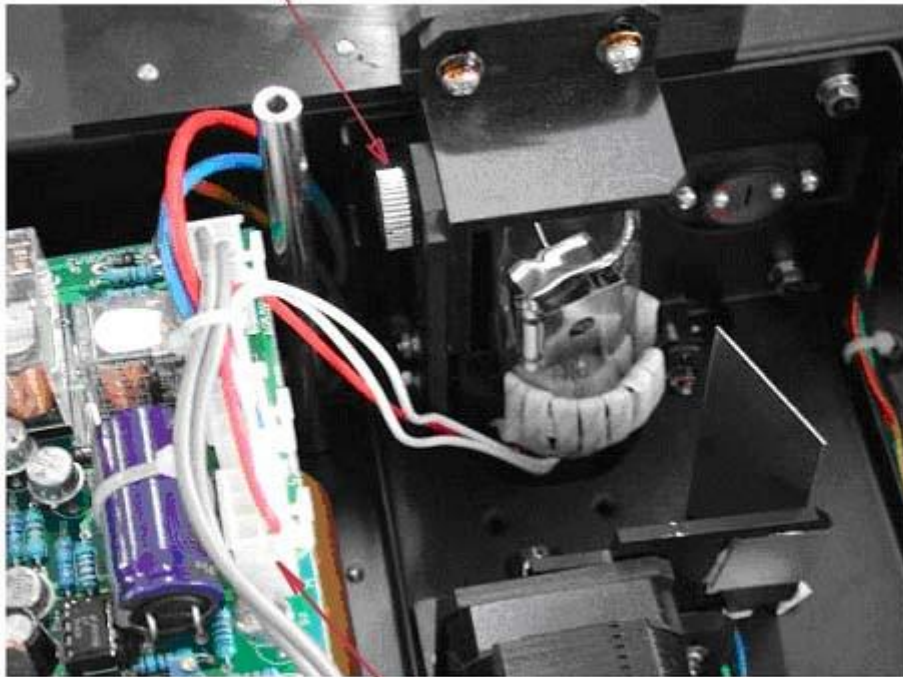
J7

Fig A5

7. Replace the pre-aligned lamp with a lamp (Fig A6) provided by UNICO or an authorized UNICO Service Provider. This comes pre-assembled with lamp socket.
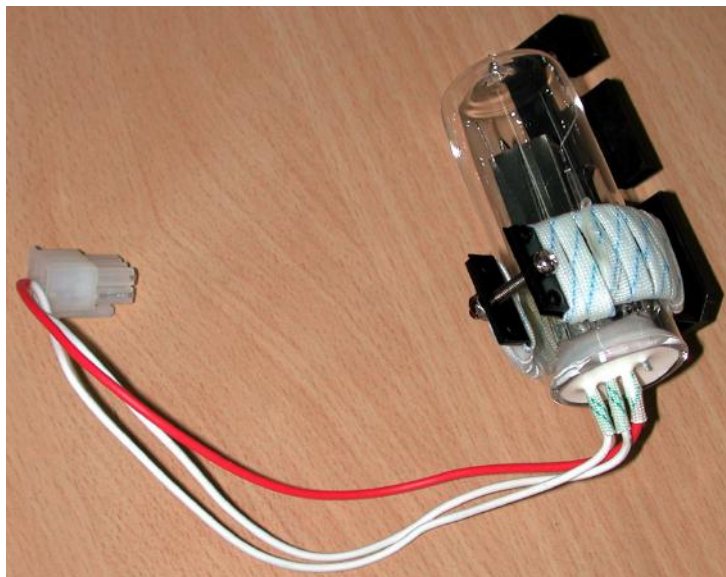

Fig A6

CAUTION: THE LAMP MAY BE HOT! TAKE PRECAUTIONS TO PREVENT POSSIBLE BURNS.

8. Reconnect the connector J7 to the PCB marked SST8.411.128.

9. Re-fit the grey metal protection cover, Fig A4. Temporarily re-fit the main cover and fix with two screws, one each side.

Switch on and remove the grommet from the middle of the rear panel. You can now look through the hole and view the image of the lamp on the slit. Check the lamp alignment Fig A7. If the image is not covering the slit, the lamp alignment needs adjustment. This requires running the SQ-2802 without the covers, with high voltages accessible, and so should only be performed by a suitably qualified engineer.

If adjustment is required, remove the cover and grey protection cover, put on UV protection glasses and turn on the instrument. Adjust to make the image central on the slit, Fig A7.

Install the grey metal protection cover and cover of instrument.
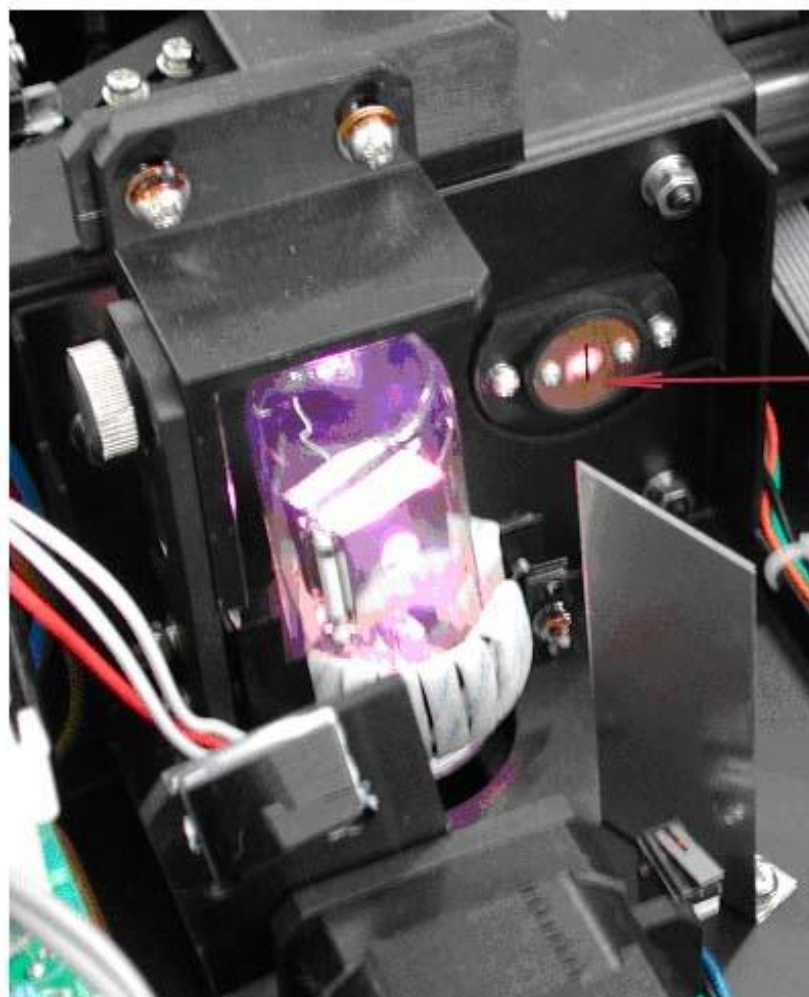

Focus on the slit

Fig A7

CAUTION: Wear UV protection glasses when replacing deuterium lamp.

10. Re-fit all the screws around the sides of the spectrophotometer, Fig A1.

11. Re-set the lamp usage time. Select "Utility", lamp, and re-set D2 usage time.

B. TO REPLACE TUNGSTEN-HALOGEN LAMP

1. The step 1-step 5 are the same as the REPLACING DEUTERIUM.

2. Remove the lamp from the ceramic base.

3. Insert the new lamp (Fig A8), pushing it in as far as it will go.

4. Re-fit the grey metal protection cover, Fig A4. Temporarily re-fit the main cover and fix with two screws, one each side.

    Switch on and remove the grommet from the middle of the rear panel. You can now look through the hole and view the image of the lamp on the slit. Check the lamp alignment Fig A9. If the image is not covering the slit, the lamp alignment needs adjustment. This requires running the SQ-2802 without the covers, with high voltages accessible, and so should only be performed by a suitably qualified engineer.

    If adjustment is required, remove the cover and grey protection cover and turn on the instrument. Adjust to make the image central on the slit, Fig A9. Install the grey metal protection cover and instrument cover.

Fig A8
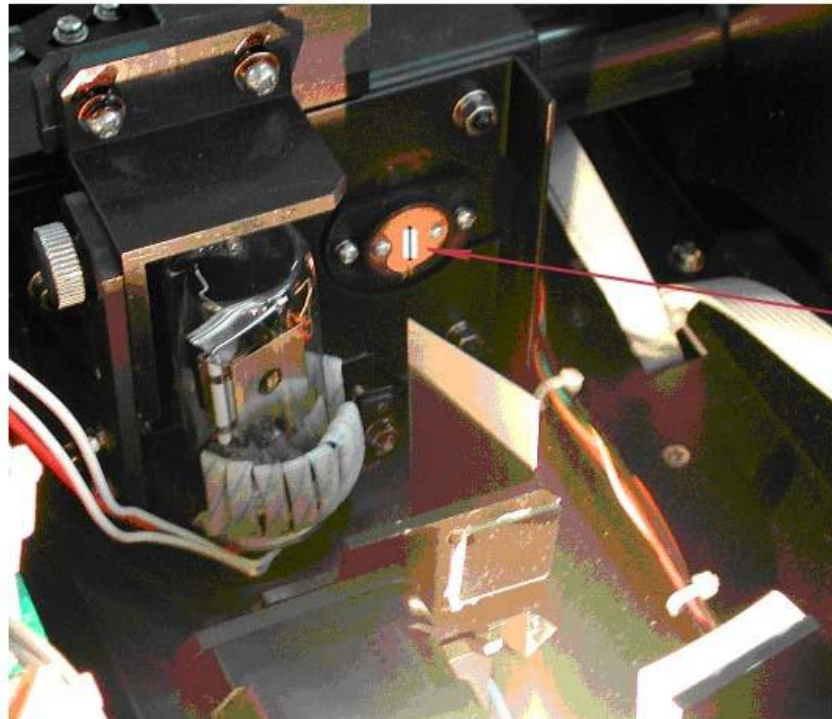
Focus on the slit

Fig A9

CAUTION: DO NOT HANDLE THE LAMP WITH BARE FINGERS. USE TISSUE OR CLOTH WHEN HANDLING LAMP.

The oil from your fingers can cause the lamp to burn out prematurely.

5. Re-fit all the screws around the sides of the spectrophotometer, Fig A1

6. Install the gray metal protection cover and cover of instrument.

7. Re-set the tungsten lamp usage time. Select Utility, lamp and re-set W lamp usage time.

Appendix C

A number of 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 can always 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 analyze 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 analyze.

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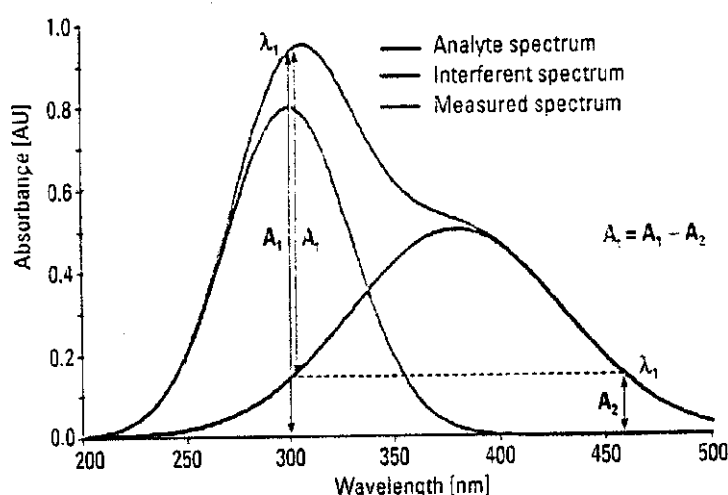

Fig A1 Isoabsorbance correction

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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 over the 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 absorbance such as that resulting from scattering of from a complex matrix.
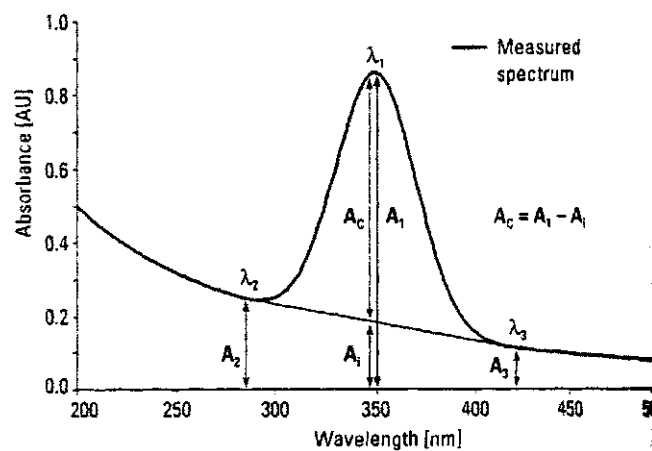

Fig A2