

**Instruction Manual
Lightwave S2000
UV/Vis Diode Array Spectrophotometer**

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Declaration of Conformity

This is to certify that the WPA Lightwave S2000: 80-3000-72

manufactured by Biochrom Ltd. conform to the requirements of the following Directives:- 73/23/EEC & 89/336/EEC

Standards to which conformity is declared

EN 61 010-1: 2001

Safety requirements for electrical equipment for measurement, control and laboratory use.

EN 61326: 1998

Electrical equipment for measurement, control and laboratory use – EMC requirements

Signed:

Dated: 14th January 2003

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1 Introduction

The Lightwave represents a breakthrough in UV/Vis Spectroscopy. For the first time, the benefits of Diode Array technology have been incorporated into a low cost Spectrophotometer.

The Lightwave offers: -

- Instantaneous scanning
- No moving parts
- Open sample compartment
- Space saving shape

We believe that the Lightwave will give many years of trouble free operation. We do however recommend that you read this manual prior to use.

We welcome any comments you may have regarding either the product or this manual. Please contact: -

Sales Co-ordinator

Tel: +44 (0)1223 423723

Fax: +44 (0)1223 420164

E-mail: enquires@biochrom.co.uk

2 Conditions of Service

The Lightwave is intended for use under cover at a temperature of between 5 and 40°C.

If dangerous or aggressive chemicals are used, care should be taken to avoid spillage. Normal precautions should be taken against contact with all samples used, some of which may be harmful.

The following parts are user replaceable: -

	Cat No
Tungsten Lamp	S2000T
Tungsten & Deuterium Lamp Assembly	S2000L
As for S2000L but accepting old unit in part exchange	S2000LX
Fan	FA074
Cuvette Holder	CS003

For other problems please contact our sales office or local authorised dealer in your region.

Health & Safety Notice

Instruments will only be accepted for repair or re-calibration when accompanied by a signed letter or certificate from the sender to the effect that there is no hazard to health due to biological, chemical or radioactive contamination. A copy of this certificate can be found on the base of the unit or at the end of this manual.

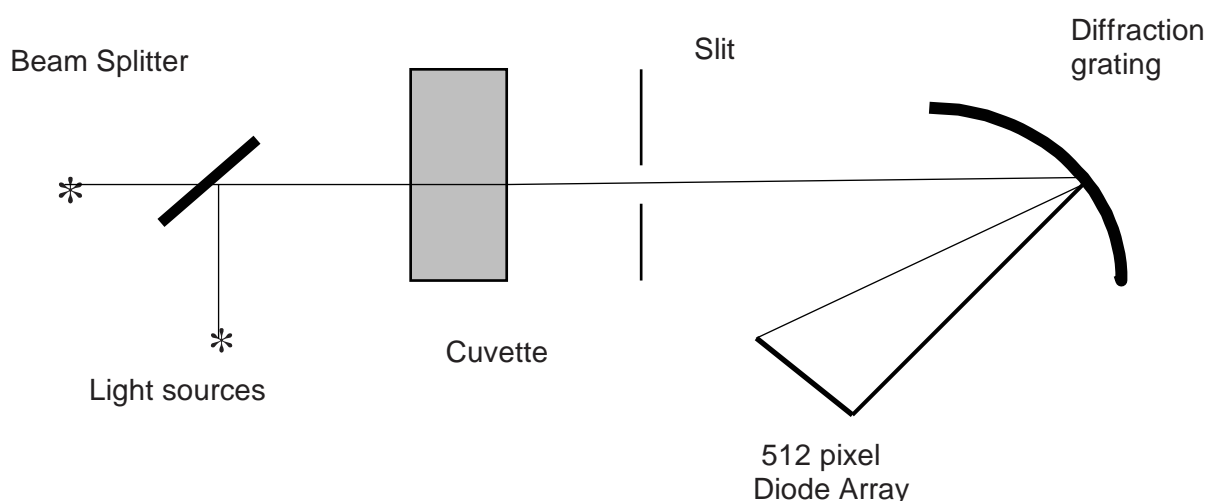
3 Principle of Operation

The optical layout comprises a concave grating and 512 pixel diode array. On making a measurement both lamps (Deuterium and Tungsten) flash consecutively. A self-regulating circuit ensures flash to flash repeatability.

The data for each wavelength is recorded and stored in memory. Stray light is minimised by positioning the diffraction grating after the cuvette compartment, thereby eliminating the need for a light cover.

The use of a diode array detector allows simultaneous measurement across all wavelengths (scanning), and involves no moving optical parts, thereby minimising maintenance costs.

A simplified optical layout is presented below: -



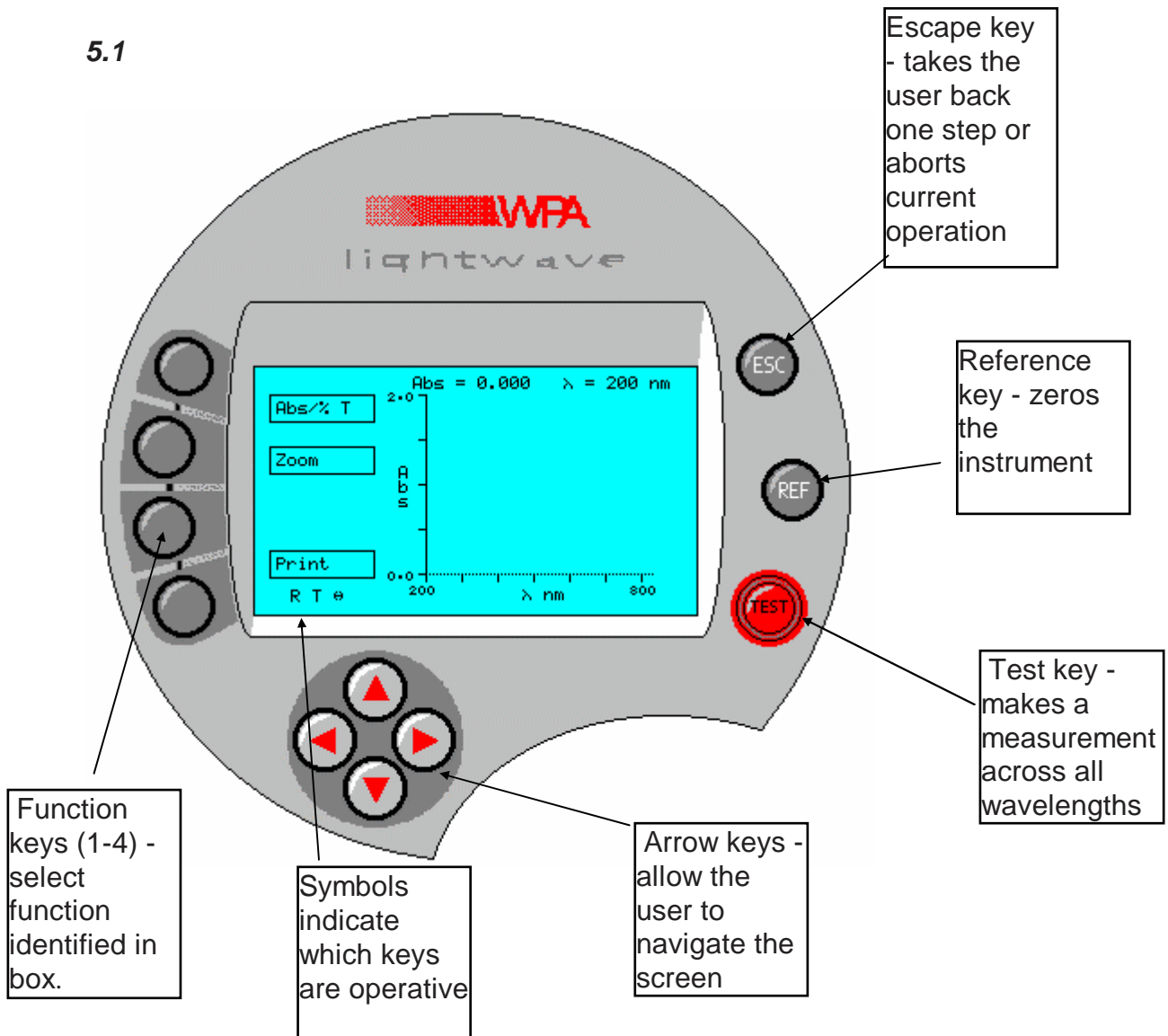
The added advantage of the above optical arrangement is that Stray light is minimised, thereby eliminating the need for a cover over the cuvette chamber.

4 Specifications

Specification	S2000 Lightwave
Optical arrangement	Single beam, diode array (512 pixel) using Rowland Circle optics with flat field corrected concave grating.
Wavelength range	200 –825nm
Spectral bandpass	5nm
Resolution/Bandwidth	5nm
Stray Light	<0.1% at 220nm NaI and 340nm NaNO ₂
Wavelength Accuracy	±1.5nm
Wavelength reproducibility	Better than ±0.6nm
Photometric modes	Abs, %T, Conc ⁿ , ΔAbs/min, ΔAbs*factor/min
Photometric range	-0.3 - 1.999A 0 - 199.9%T
Photometric Reproducibility	±0.002Abs (0 to 0.5Abs) ±0.007Abs (0.5-1.0Abs)
Photometric Accuracy	±0.003Abs (0 to 0.5Abs) ±0.01Abs (0.5-1.0Abs)
Slew rate	Full spectrum measured simultaneously, measurement time <5 sec
Zero stability	±0.003Abs/hour after 20min warm up
Noise	±0.001Abs at 0A 500nm
Modes of operation	Scanning Ratio (A260/A280 user adjustable) Multi Wavelength Absorbance % Transmission Concentration (linear or curved calibration) Kinetics Programmable - up to 99 methods stored in battery backed memory
Display	240 x 128 pixel dot matrix LCD
Output	RS232 to WPA printer for text and graphics RS232 ASCII for PC data logging
Light sources	Pulsed Deuterium and Tungsten halogen lamps giving life in excess of 15000 hours
Sample compartment	40mm pathlength. Accepts 10mm and 40mm cuvettes, 15mm beam height. Accepts standard, semi-micro, micro and ultra micro cuvettes down to 50/70 μl.
Dimensions (l x w x d)	Approx. 380 x 140 x 275 mm
Weight	4.5kg
Electrical Requirements	90-250V 50/60Hz Max 100VA

5 Controls

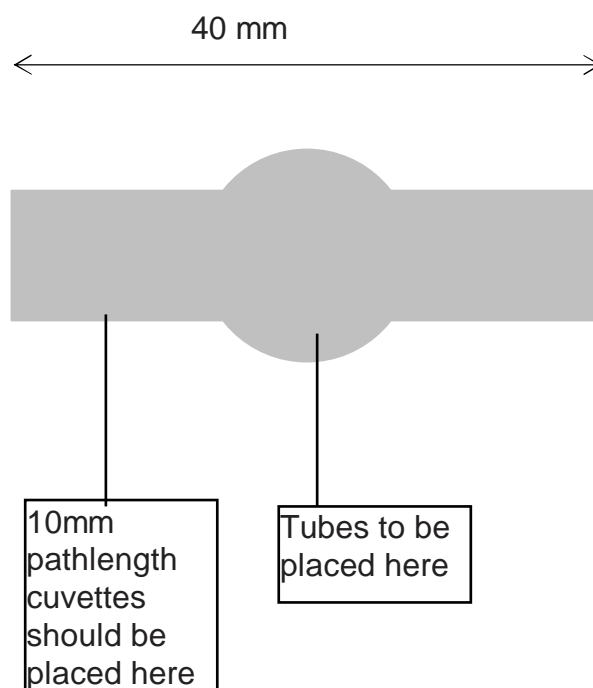
5.1



Note: The arrow keys and REF and TEST buttons are only operational in certain modes. When operational, symbols (R for Ref, T for Test, + arrows) will appear in the bottom left hand corner of the display. Similarly the Function keys on the left-hand side of the display are only operational when a box appears.

6 Cuvette Chamber

Samples may be placed in a cuvette or 16 mm diameter tube. The cuvette holder has been designed to accommodate a variety of cuvette sizes in an accurate and repeatable manner.



Note: It is important to align the square cuvettes to the far left-hand side of the chamber. The alignment of the cuvette is important to ensure reproducible readings.

Results obtained using round cuvettes will be more variable due to unavoidable irregularities in the glass.

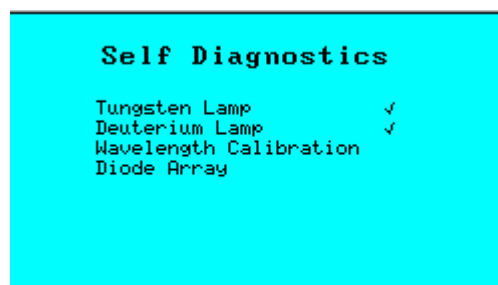
7 Installation & Start-up

Unpack the Lightwave and ensure that you have received the following in good condition: -

S2000 Lightwave Spectrophotometer
Mains Lead
Starter pack of 10 disposable UV cuvettes
Instruction manual
Warranty Card

Place the unit on a level surface, insert the IEC cable in the rear socket and then connect to the electricity supply (90-250V 50/60Hz).

Switch the instrument on using the switch at the rear. The Lightwave logo should appear followed by a self-diagnostic screen as below:



Check that all tests are passed or contact our sales office/authorised dealer.

Warm Up Time

To allow the optical and electronic components to stabilise it is recommended to allow a minimum of 10 minutes for the unit to warm up. For minimum drift, leave the instrument for 45 minutes to 1 hour.

It is best practice to always take a reference measurement prior to making a TEST, however the Lightwave will remember the last reference until the unit is switched off or re-referenced.

Lamp Failure

Failure of the lamps indicates either that there was a cuvette in the compartment when the instrument was switched on (simply remove the cuvette and switch ON again) or that the lamp has failed or the output is too low for good performance.

Failure of one lamp will not affect the other lamp - so if the Deuterium lamp fails you can still make good visible measurements (380 to 825 nm).

See Section 12 on Servicing & Maintenance

Failure in Wavelength Calibration

The wavelength calibration is performed by observing the key spectral data from the Deuterium lamp and ensuring that the peak remains in the correct position. A failure in wavelength calibration infers some movement of the fixed optical system or exposure to extreme temperatures.

Try leaving the unit on for a few minutes and then re-start.

If the failure re-occurs please consult your local dealer/service agent or our service department.

Note: The unit will continue to operate despite being out of wavelength calibration.

Failure of Diode Array

On start up the unit checks that all pixels (512) are operating. A failure of any pixel will give the above error.

The unit can still be used as operation at other wavelengths will not be affected. The faulty pixel will show itself as a line on the wavelength scan.

If the failure occurs please consult your local dealer/service agent or our service department.

8 Measurement of Cell Density

Cell Density measurements are Turbidimetric in nature and as such are highly dependent on the optical design of the instrument used. Ideally calibration curves should be used for each species of bacteria studied, and the same type of spectrophotometer used for any series of experiments on a given strain.

Cross correlation between instruments can be made, but will require a conversion factor to bring any one type of instrument in accord with another.

The Lightwave has a specific cell density function which has been developed to give readings in accordance with the average readings from a group of different spectrophotometers. If used in single Absorbance mode (rather than the cell density function in 10.4.1) readings will be considerably higher due to the novel optical arrangement in the Lightwave. The cell density function compensates for this.

We recommend that all Cell Density measurements are performed in the Cell Density Screen. This automatically sets the wavelength to 600nm.

See section 10.4.1.

9 General Operations

9.1 Referencing

When R is displayed in the bottom left hand corner of the display, it is possible to Reference the instrument by pressing REF.

The reference *across all wavelengths* will be held in the memory until the unit is switched off, or re-referenced. However, for best results reference the unit before each measurement is taken.

The reference material will normally be a low absorbing material, often the solvent, which is mostly water.

**If the reference Absorbance is too high the instrument will display ----
If this appears, first check the type of cuvette being used (Quartz for UV measurements). If this is satisfactory consider an alternative reference material.**

9.2 Measurement at Low Levels (<0.050A)

Due to the narrow beam size needed for use with small volume cuvettes, the Lightwave is sensitive to variations in cuvettes and to scratches or dirt on the inside or outside of the cuvette.

We therefore recommend using the same cuvette as the reference and to measure the sample.

10 Software Operation

10.1 Repeat Last Operation

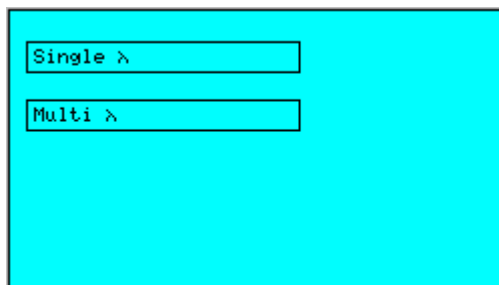
This button returns the user to the last screen displayed when the instrument was switched off.

This provides a short cut to the last test performed.

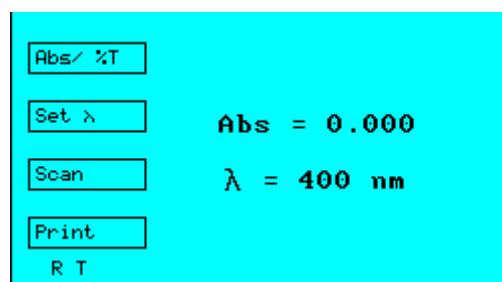
10.2 Make a measurement

10.3 Single/Multi λ

This function key takes the user to a further menu screen allowing the option of single or multi wavelength measurements.



10.3.1 Single measurement



This mode should be used when readout in Absorbance or %Transmission is required for a single wavelength.

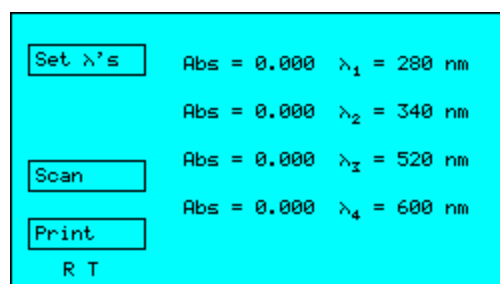
You can toggle between Abs and %T by pressing function key 1.



To avoid accidental changes to the wavelength setting the arrow keys only become functional when “Set λ ” is pressed. Use the $\uparrow\downarrow$ keys to change wavelength then press “Accept λ ” to accept.

For very low level Absorbances, variation between cuvettes can be significant. It is worthwhile to use matched cuvettes, or read both cuvettes with the reference solution before commencing a series of tests.

10.3.2 Multi Wavelength



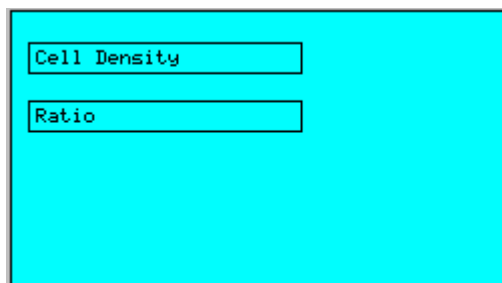
The wavelength settings can be changed in a similar manner to the single measurement mode and are memorised until re-set.

Pressing function key 1 highlights the first wavelength setting, others can be accessed by pressing the $\uparrow\downarrow$ arrows. Pressing function key 1 again allows the value to be changed (using the $\uparrow\downarrow$ arrows). Pressing once more confirms the choice and moves to the next wavelength.

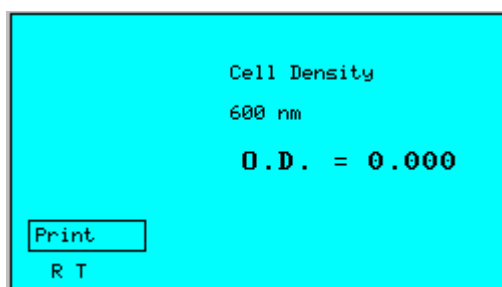
Once the user is satisfied with the settings press function key 4 “All OK”. Reference and Test are then active so you can make a measurement.

10.4 Cell Density/Ratio

This function key takes the user to a further screen allowing the option of cell density or ratio measurements.



10.4.1 Cell Density Measurement

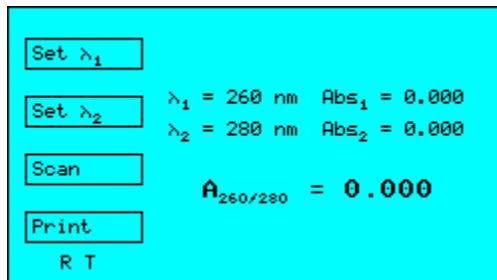


This function provides an auto-correction for use with cell cultures to compensate for the high turbidity of such samples.

Pressing REF will set the optical density (OD) to 0.000 on a blank sample. The cell density measurements can then be made by pressing TEST. The results are displayed in Optical Density Absorbance.

The attenuation of the primary light beam is measured and any stray or scattered light is rejected unlike other spectrophotometers with different optical set ups. To compensate for this, the absorbance at two wavelengths is measured simultaneously and an algorithm is applied providing better comparison between instruments.

10.4.2 Ratio Measurement



Ratio measurement is used most commonly to measure the purity of DNA preparations. A value of between 1.7 and 2.0 generally indicates purity.

The wavelength settings can be changed in a similar manner to the single measurement mode and are memorised until re-set.

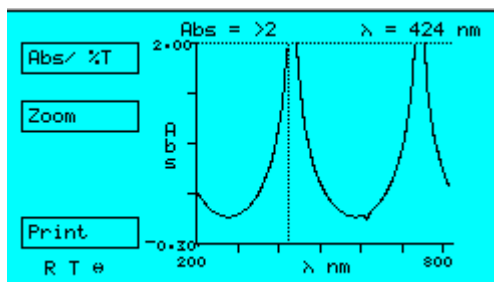
Once set, pressing REF or TEST will display the values in Absorbance on the screen and calculate the Ratio.



Users may find it useful to look at the spectrum around 260/280nm to give further indications of purity. Just press SCAN to have a look.

10.5 Scanning

The 512-pixel diode array captures readings from the complete wavelength range each time a measurement is made.



The scan displaying this information can be viewed on the graphics display.

Two cursors can be moved across the screen (using ←→) to identify the wavelength and reading at a particular point in the spectrum.

Note: The spectrum is averaged. For exact Absorbances refer to Zoom Screen or Single Measurement.

“Zoom” Function

To magnify a portion of the spectrum press function button 2. A box will appear (at the inter-section of the cursors); this can be re-positioned using the arrow keys. Once the position is OK press the “Zoom In” button.

The spectrum is automatically re-sized to fill the screen. The cursors can be used once again to identify the reading at a particular wavelength.


Note: Due to the translation of pixel values onto the display screen, the position of the cursor does not always correspond exactly to the maximum or minimum Absorbance. To determine the maxima or minima with greatest precision please note the values given at the top of the display.

10.6 Select a Method (to “run a method” see later in manual)

Up to 99 methods can be user programmed. These enable readout in concentration units, using linear or non-linear calibration curves. The facility for kinetic operation is also included.

To select a method, move the cursor to the desired number using the Page up or Page down functions, and the arrow keys. Alternatively select a new method to bring up the next free location.

Once selected the following screen will be displayed:



Run	Method 00
Program	Name XXXXXXXXXXXX
Delete	λ 550 nm
Print	Cal Curve
	Display Concentration
	Units g/l
	Factor -----
	Kinetics No

10.7 To Program a New Method (or re-program an existing method)

Select "Program" using function key 2.
The following screen is displayed.



Programming a method is simple.

To change each selection you need to do the following:-

- Position the cursor over the relevant line
- Press CHANGE
- Use arrow keys to amend the entry
- Press ACCEPT to confirm

The table below is a summary of the information that can be programmed into each method.

Name	This can be an alpha-numeric name of up to 13 characters - including spaces
λ	Wavelength setting.
Cal	Calibration. Can be a curve or a (straight) line.
Display	Absorbance, %Transmission or Concentration
Units	A choice of units that are available, or none
Factor	This is only relevant for the straight line calibration ---- will be displayed if the "curve" option is selected under Cal
Kinetics	Yes/No option This provides the option of measurement at pre-set time intervals (single wavelength only) for Rate of Reaction studies and enzyme assays. If Yes selected, a number of further options will appear - see under "setting kinetics"

To assign a name (of up to 13 letters) position the cursor on the **Name** using the $\uparrow\downarrow$ keys and then press function key 4 to "Change".

Using the arrow keys assign the name (the $\leftarrow\rightarrow$ arrows move between digits and the $\uparrow\downarrow$ arrows select letters or numbers) and then press key 4 once again to confirm.

Note: Not all the letters need to be used, however to save a method a name must be entered or otherwise the new values will revert to default values.

Position the cursor against the next option and repeat the procedure to select the desired option.

Changing Wavelength

Use up/down arrows to change the wavelength.

Note: The wavelength changes slowly at first and then more quickly dependent upon how long the arrow is pressed.

Calibration

Line Curve

To highlight Curve, press \rightarrow , then ACCEPT

This will take you to a new screen - see *non-linear calibration section*.

The default option is LINE.

Where the Absorbance of the sample does not change in a linear fashion with concentration, select CURVE.

If a linear calibration is chosen the factor should be entered against the appropriate heading.

The default factor is 1.0000

Display

There is a choice of display.

The Delta A/min function is only available if Kinetics is selected (this measures the change in Absorbance per minute, as calculated by least square analysis).

If Concentration is selected, another screen displays two options

- Abs * F
- $\Delta A/\text{min} * F$

The Abs*F is the most commonly used concentration relationship. Once again only select $\Delta A/\text{min} * F$ if using kinetics.

Selecting $\Delta A/\text{min}$ or $\Delta A/\text{min} * F$ when kinetics is not chosen will not be accepted, reverting the user back to a previous screen.

Units

If reading out in concentration you may select from a choice of units. These will appear on the final result screen when the Method is run.

A choice of units can be made for concentration measurements.

If the chosen display is “Absorbance or % T “ the choice of units will be ignored.

Factor

The Factor is only relevant to LINE calibrations and represents the multiplication factor to convert Absorbance into Concentration (as per the Beer-Lambert Law).

Concentration = Factor x Absorbance (or OD)

Position the cursor onto the Factor line and press key 4 to change.

The cursor will appear under the first unit e.g. Factor 1.0000

Use the $\uparrow\downarrow$ keys to select the correct value between 0 and 9, or move the cursor to another position using the $\leftarrow\rightarrow$ keys.

Once the correct value has been programmed change the decimal point using the function key 3.

Pressing “Accept” confirms the choice.

Non-linear calibration

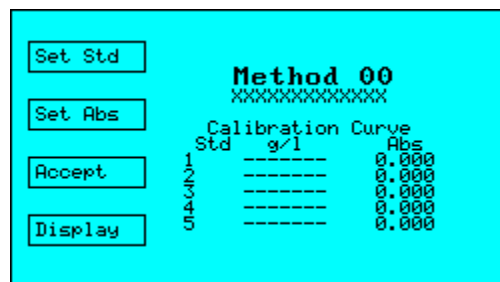
The software contains a curve-fitting program. This accepts up to 5 points and attempts to fit a polynomial of order equal to the number of points less one.

E.g. for 5 points, the software will attempt to fit a 4th order polynomial.
It is necessary to enter at least two points (3 points to give a curve), with the lower point defining the minimum value, and the upper point defining the maximum value.

The polynomial fits the curve to the points exactly, and since the program will not allow maxima or minima (to prevent one reading having two possible values), some combination of points will give rise to an error message "Invalid Curve ".

If this appears adjust the points slightly and re-try. It is sometimes worthwhile plotting the points out and trying to identify points that are difficult to fit on a smooth curve. It is these points which are most likely to be causing the problem.

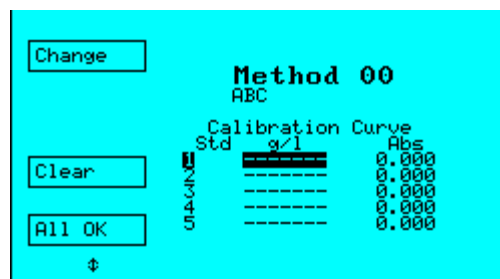
If "curve" is selected under the Cal option, the screen will change as follows:-



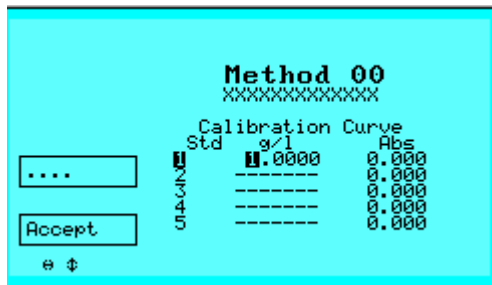
Set Std

This allows the concentration values to be selected. Up to five values may be entered.

The following screen will be displayed



- Highlight the standard to be entered (or amended)
- Press function key 1 to change



- Use the UP/DOWN arrows to change the values of each digit, and LEFT/RIGHT arrows to move between digits.

- Press



To change the position of the decimal point

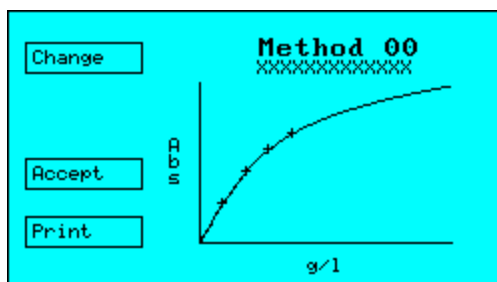
- When finished, press ACCEPT
- Once all the values are set, press ALL OK

The cursor will move to the first Absorbance measurement.

This can be set numerically following the same procedure as above. Alternatively you may place the standard in the cuvette chamber and press TEST to write the value into the memory location.

If you make a mistake, just re-test the sample.

Once all the readings have been entered against the Standard, press ACCEPT to confirm, or Display if you wish to view the curve before proceeding.



Kinetics

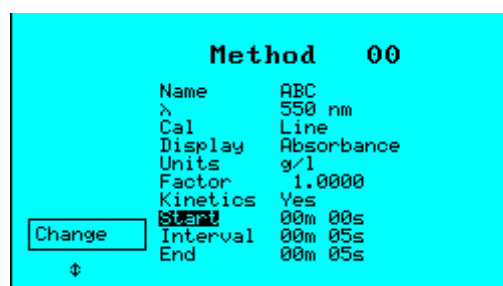
The kinetics facility allows the user to run a series of measurements at programmed intervals.

To program a method to include multiple measurements select:-

Kinetics **Yes** No

using the ←→ keys to highlight the Yes option.

The following screen will be displayed:-



Start Time

This is the delay before the first measurement is made.

Interval

This is the interval between measurements. There is a minimum interval of 10 seconds.

End Time

This increases in increments of the interval time.

The software can calculate automatically the change in Absorbance per minute ($\Delta A/\text{min}$) using a least squares correction.

The correlation coefficient is displayed (1.000 is a perfect fit, 0.000 is no fit), along with $\Delta A/\text{min}$ and the concentration ($\Delta A/\text{min}$. Factor).

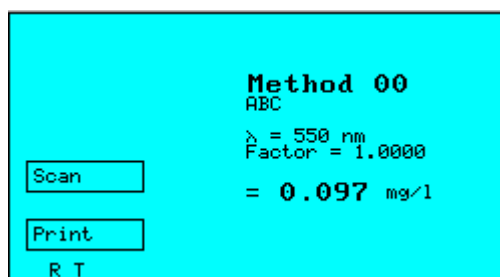
To program the time place the cursor over the desired selection and press key 4 to change.

Use the arrow keys to move between digits and to increase or decrease the value. The interval time is restricted to values above 10 seconds. The maximum period is 59m 59s after completion of the START time.

Note: If running a long kinetics method, it is advisable to leave the unit on for at least 30 minutes to allow the lamps to fully stabilise, otherwise a slight long term drift will be apparent.

10.8 Run a Method

The following screen should be displayed:



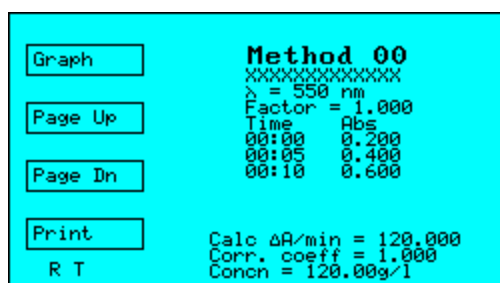
Pressing REF will zero the instrument and clear the screen.
Pressing TEST will take a measurement (or if kinetics have been selected, start the run).

Kinetics Run

During the kinetics run the screen will initially show the Start Time less time elapsed.

Once this reached zero, the first measurement will be taken, followed by more measurements at each selected interval until the End time is reached.

Each measurement is displayed on the screen in turn. Once all the readings have been taken the calculated $\Delta A/\text{min}$, correlation coefficient and concentration will be displayed.



The $\Delta A/\text{min}$ is calculated using a Least Squares Fit. You can view the graph by pressing function key 1, or scroll through the readings using the page up or page down keys.

To repeat the test, re-press TEST.

To abort a run, press ESC.

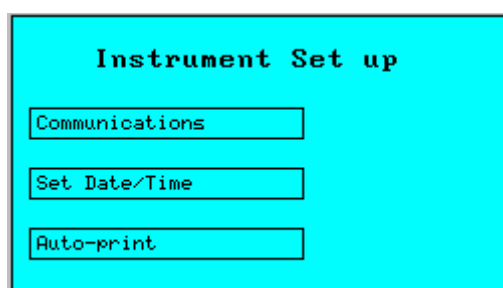
Values may be printed to a printer or to a PC.
A maximum of 20 readings can be accommodated in the memory.

10.9 Using Bi-directional communications

1. Connect the Lightwave to a PC using "Hyperterminal" (see Section 11.1.2).
2. Establish communication between the Lightwave and the PC by pressing Control and the letter H together (*Control H*). The PC should respond with 'HELLO' on the PC screen.
3. To make a reference reading press *Control R*. A series of R's will run across the bottom of the Lightwave screen and the PC will respond with 'REF DONE'.
4. To read a sample press *Control T*. The Lightwave will respond with a row of T's running across the bottom of the Lightwave screen. The data obtained will be transmitted to the PC in comma delimited ASCII [Wavelength, Value (Abs)]. A message of 'TEST DONE' will be received when all the data has been transmitted.

NOTE: Inputting any other characters will give the prompt 'COMMAND NOT RECOGNISED'.

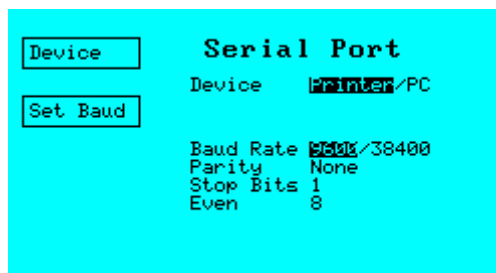
11 Instrument Set-up



11.1 Communications

The Lightwave has a bi-directional RS232 port that can be used to connect up to a PC or 40-column printer.

The communication settings are the same for PC and Printer, but have a different format. They are accessed from the “Set up instrument” then “Communications” buttons from the entry menu.



Clicking on the “Device” function key will toggle between Printer and PC.

RS232 settings are as follows. The Baud rate is user adjustable by clicking on function key 2 “Set Baud” to toggle between the two available values :

Setting	Printer/PC
Baud Rate	9600 or 38400
Parity	None
Stop Bits	1
Data Bits	8

If connecting to a PC at 38400 Baud the length of the cable should be no longer than 3m.

11.1.1 Printing

The unit is designed to print to a 40 column serial printer. It is only possible to print to the WPA S2000P printer using 9600 Baud.

Printer Specifications

Type	Serial RS232
Protocol: Text	EPSON ESC/POS format
Protocol:Graphics	Sends graphics command 1B(hex),01(hex); then 40 bytes of data, the lower 6 bits of each containing the graphics dots comprising that line. Repeated for each graphics line of dots.
Width	40 column
Handshaking	RTS/CTS
or	Wire in DTR line to the CTS feed from Lightwave

The WPA S2000P printer from WPA meets all the above specifications.

To avoid any possible damage, ensure that both printer and spectrophotometer are switched off prior to connection. There are 2 different print formats dependent upon which mode of operation has been selected.

In the majority of cases the user will be asked to confirm the **Sample Number**, or revise. This will then appear on the printout.

Printing Format

Format 1

On connection the following header will appear: -

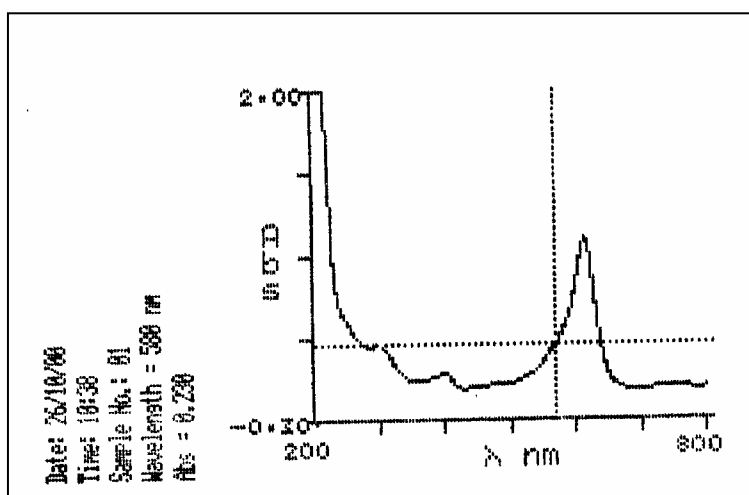
WPA
S2000 Spectrophotometer
Software Version 2.4

Date	Time	No	Value	Units	nm
26/10/00	10:41	01	10.4	% T	629
26/10/00	10:41	01	0.984	A	629

This format is used for basic Absorbance or %Transmission measurements.

Format 2

The unit will essentially download the screen display onto the printer e.g.



11.1.2 Connection to PC

The Lightwave is configured to be used with commonly available software for RS232 communications such as "terminal" (Windows 3.11™) or "Hyperterminal" (Windows 95/98™). These are usually located under Program Manager "Accessories" with your PC. After you have the data displayed on your VDU you can easily save the information and import it to other applications to store or analyse.

Note that the Windows 3.11 'Terminal' facility is very dependant on the speed of the base machine. A slow 386 or 486 machine may miss data. In such cases, it is advisable to use a DOS based package such as 'Odyssey' to collect data.

Before disconnecting or connecting the instrument turn the PC and Lightwave off to avoid damage to any part.

11.2 Setting Up the Lightwave to a PC Link

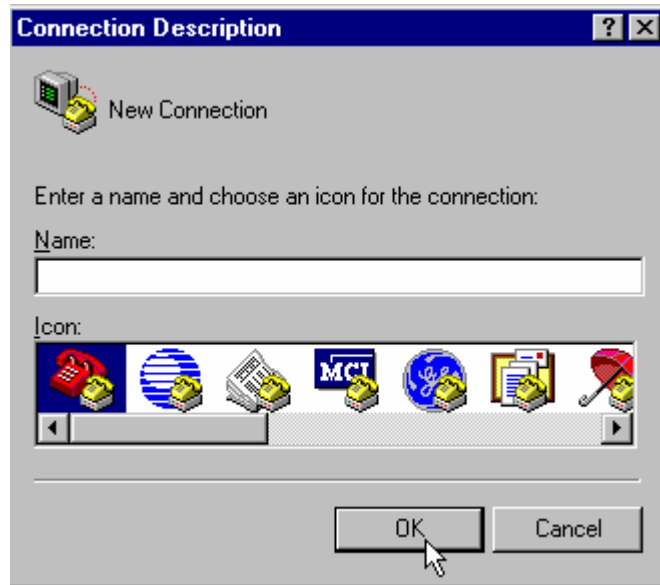
First connect the Lightwave and the PC using a suitable cable, such as WPA part number S2000PC. Connections to the most common PC COM ports are shown in the Table below, together with the necessary connectors.

FROM:	TO:	
Lightwave 9 way D type Female	COMM1 9 way D type Female	COMM2 25 way D type Female
Pin 2	Pin 3	Pin 2
Pin 3	Pin 2	Pin 3
Pin 7	Pin 8	Pin 5
Pin 8	Pin 7	Pin 4
Pin 5 (screen)	Pin 5 (screen)	Pin 7 (screen)

Windows 95 or 98 (or NT users)

Open HyperTerminal program under Program Manager "Accessories".

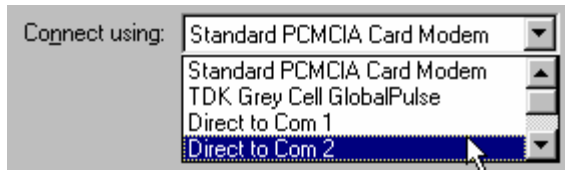
Double Click on icon "Hypertrm"



You will be asked for a suitable name - e.g Lightwave and an icon. Once this is set up you can click on this icon and the settings will be loaded correctly.

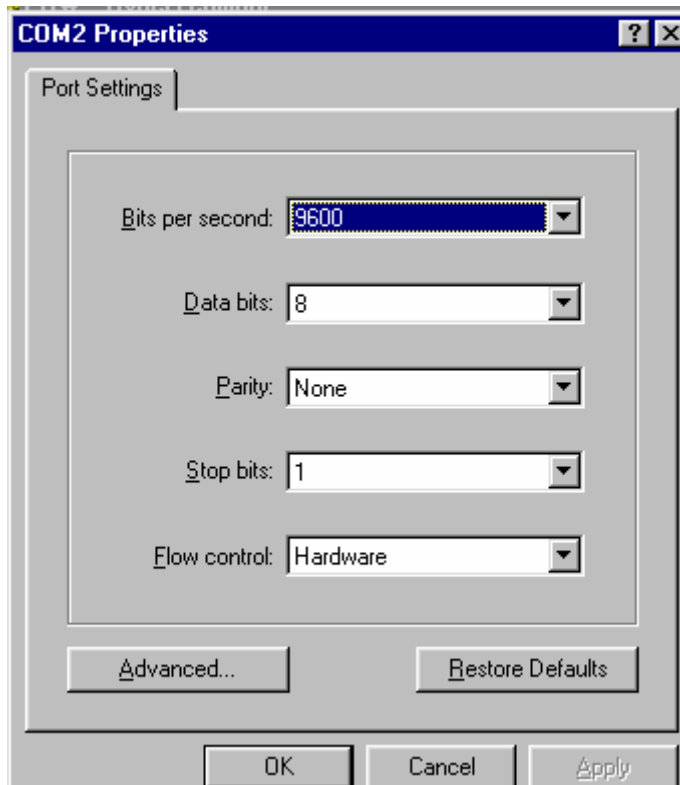
You will then be asked to configure the phone number. Ignore the first options and move the "Connect using" option.





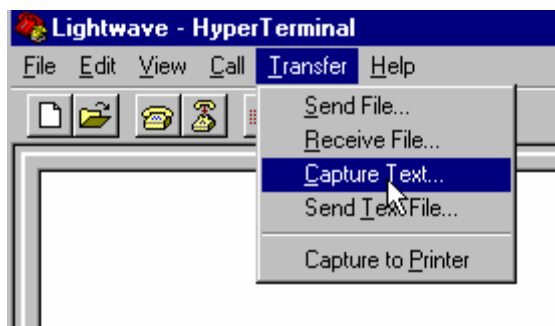
Select the correct COM port (which will be used to receive the Lightwave data) under “Connect Using” and then OK.

Now set up the COM port: -



Set the settings as above then press OK.

To capture data, select Transfer - Capture Text.



You will be asked for a file name - e.g. Lightwave.txt. Then Press START.

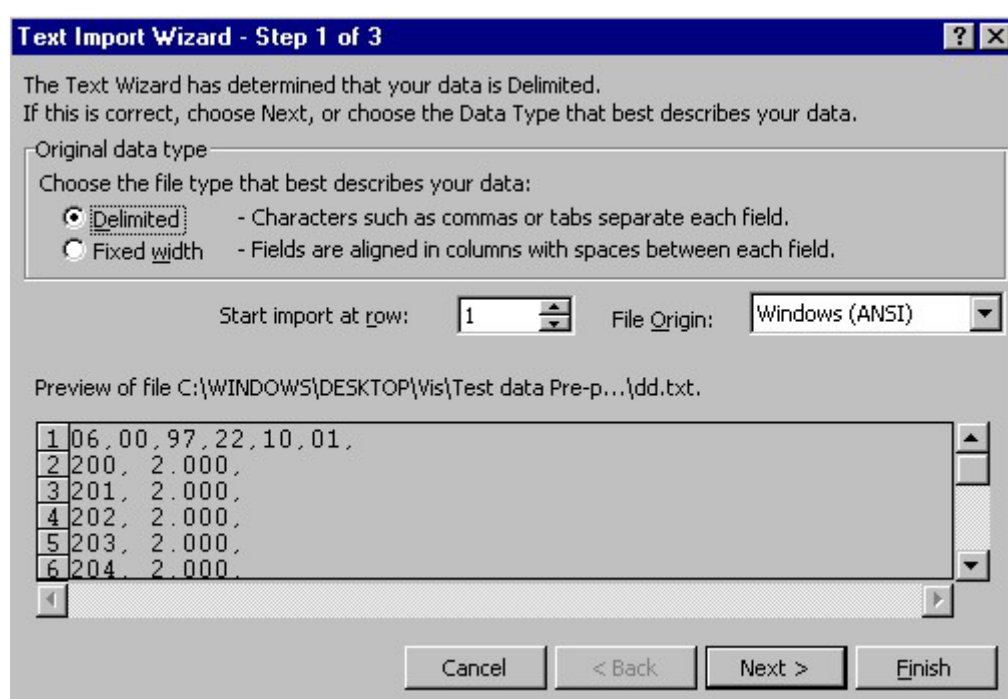
Pressing PRINT on the S2000 will send data to the PC (ensure that PC is selected under Communication).

To End data transfer Select Transfer - Capture Text- Stop.

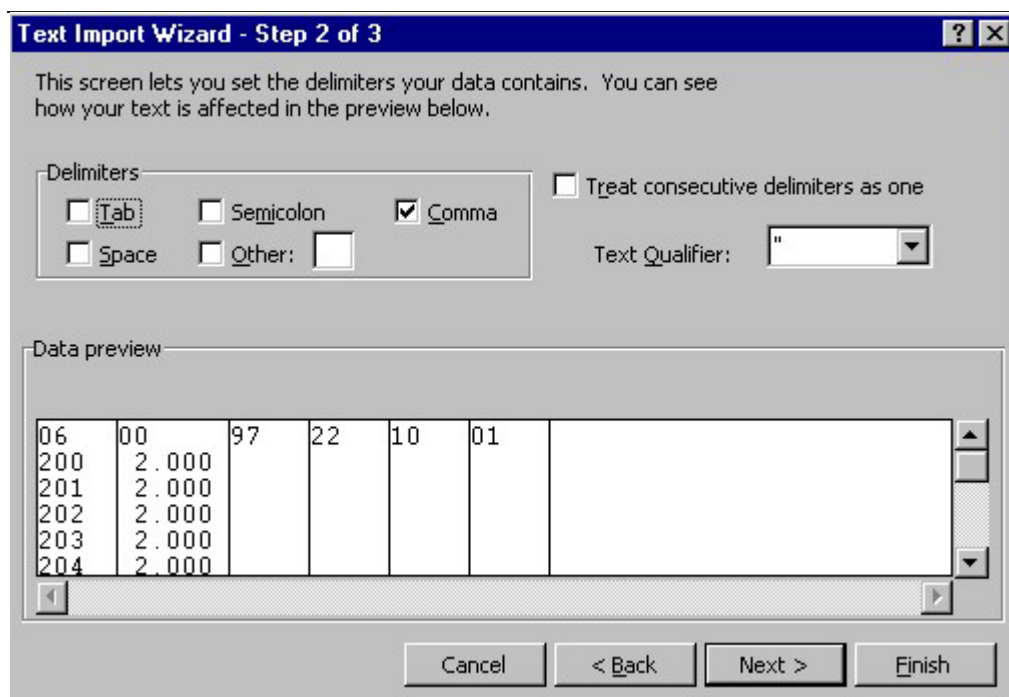
The file can then be imported into EXCEL™ directly using the Import Wizard within MS Excel™. The import wizard will detect the format automatically.

Importing Into Excel (or similar spreadsheet program)

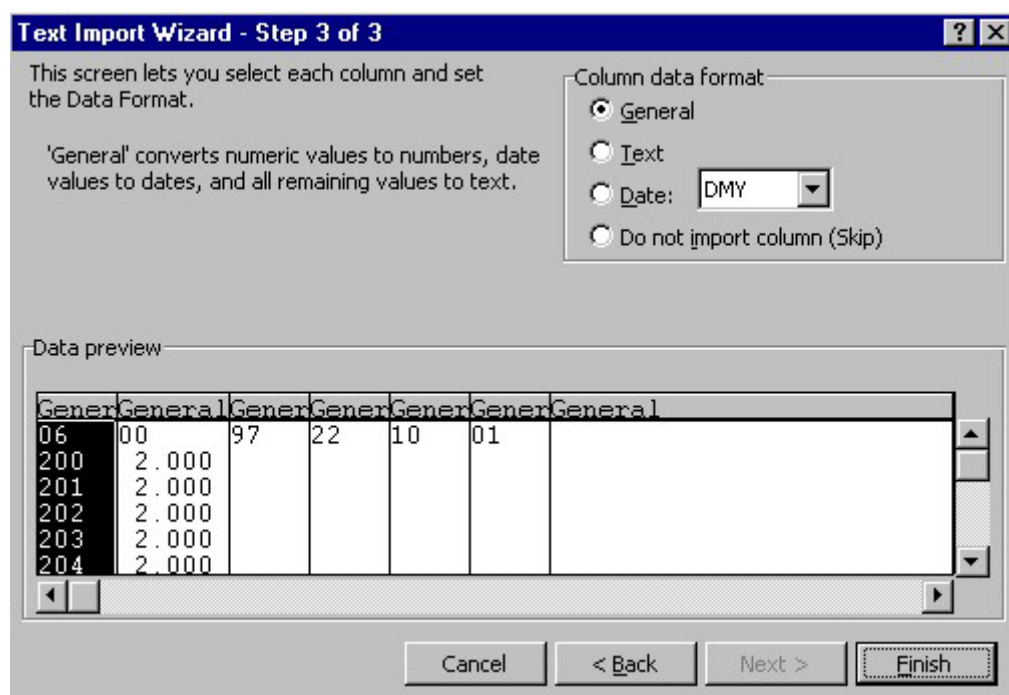
Open Excel™ and open the data file (*.txt); the following screen will be displayed:-



Choose Delimited (if not already chosen) and press NEXT.



Select comma, then NEXT

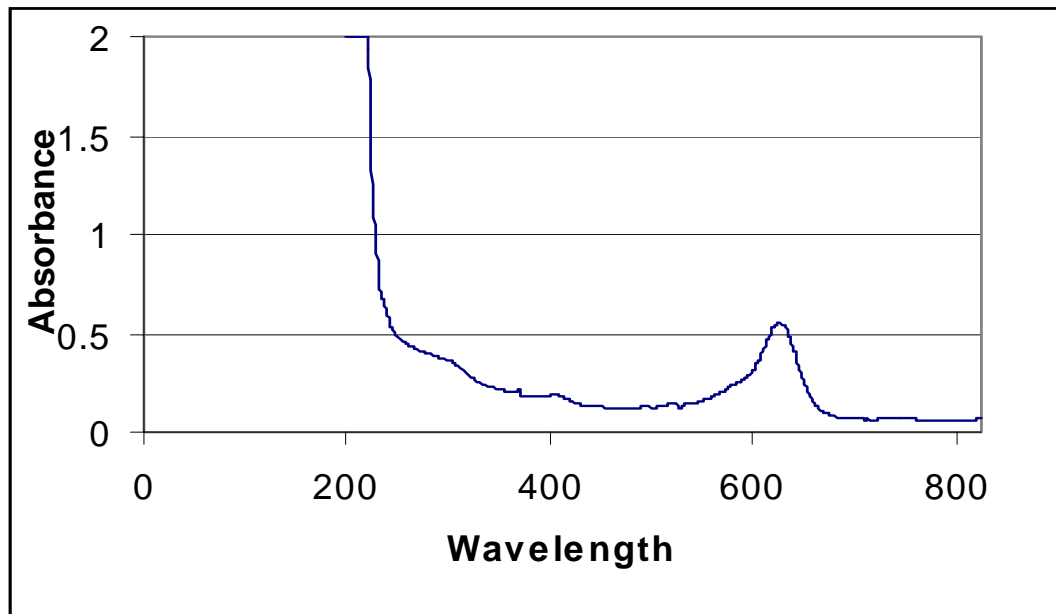


Select General, then FINISH. The data will then appear as indicated in the excel spreadsheet. To create a graph of the data (if scan data) use the graph facility in Excel. You will need to re-arrange the columns (wavelength first, Absorbance (or %T) second).



WPA has set up an Excel™ file (sample.xls) to import the data and display Spectra. This can be obtained from our sales office and e-mailed to you or put onto a disc. Alternatively the data can be imported into you own Excel file.

A typical printout would look like that below:-



The PC format is designed to be compatible with most Windows™ spreadsheet software including LOTUS 123™ and MS EXCEL™.

Windows 3.11™

Open the Terminal emulator and under the “Settings” menu, run down to “Communications” and set the following parameters.

COM1/COM2	:	Depending on which port you are using. (Usually the mouse is in COM1 and COM2 is available)
BAUD RATE	:	9600
PARITY	:	None
STOP BITS	:	1
DATA BITS	:	8
FLOW CONTROL	:	“Hardware” with the parity check and carrier Detect boxes inactive.

Once you have set these values click OK. You can save these settings using the file menu.

Whenever you use the programme again you can open the saved file to retrieve the settings.

Data output format is as follows:

ASCII strings, comma de-limited.

Format 1

Dd,mm,yy, hh,min, sample number or ref, value, units, wavelength

Format 2 Spectral data

Dd,mm,yy, hh,min, sample number or ref, carriage return, value1, wavelength 1, carriage return, value 2, , wavelength 2, carriage return, value 512, wavelength 512, carriage return, checksum

¹Format 3

Dd,mm,yy, hh,min, method no, name, sample number or ref, elapsed time in mm/ss, value, *repeat for other values*, delta A/min, correlation coefficient, display, units

Format 4

dd,mm,yy, hh,mm, sample no or ref, value, units, wavelength, value, units, wavelength, value, units, wavelength, value, units, wavelength

Format 5

dd,mm,yy, hh,mm, method no, name, Std,value,Abs, Std,value,Abs, Std,value,Abs, etc

Format 6

dd,mm,yy, hh,mm, method no, name, sample no or ref, value, units, wavelength, Factor or curve

¹ "Windows" and "Windows 95/98" are acknowledged to be trademarks of Microsoft Group

11.3 Set Time/Date

The time and date are available in the following formats: -

Euro Format

Time hh:mm (24 hour clock)

Date dd/mm/yy

OR

US Format

Time hh:mm (24 hour clock)

Date mm/dd/yy

Click on “Format” to toggle between the two formats. These are retained even if the unit is switched off. The embedded processor is year 2000 compliant.

To set the Time/Date enter the “Set up Instrument” screen and select “Set Time/Date”.

Use the ↑↓ to change the setting or use the ←→ arrows to move between time and date settings.

Press “Accept” to confirm

11.4 Auto-Print

This function key takes the user to a second screen where the Auto-print function can be toggled ON and OFF.

When the Auto-print is ON, the instrument automatically increments the Sample Number and outputs the data in the set mode (PC or Printer) each time TEST is pressed (but not REF). The Sample Number screen is not displayed.

When Auto-print is OFF, printing is via the Print button.

NOTE: the Print button remains active even when Auto-print is ON in case duplicates are required.

12 Servicing and Maintenance

The Lightwave has been designed to be extremely robust and require minimal servicing.

The unit performs a series of self-diagnostic checks each time it is switched on to check the:

- **Lamp performance**
- **Wavelength calibration**
- **Diode Array**

The only user serviceable parts are the lamps, fan and cuvette chamber.

12.1 Replacing the Lamps

The Lightwave uses novel technology that will ensure that the lamp replacement is a very infrequent event (the lamps should last many thousands of hours).

The innovative method of operation requires a particular type of lamp. The lamp alignment is also crucial to the correct operation and we cannot guarantee performance to the published specification if lamps other than those from WPA are used.

The part numbers for replacement lamps are as follows: -

Tungsten Lamp	S2000T
Tungsten & Deuterium Lamp Assembly	S2000L
As for S2000L but accepting only unit in part exchange	S2000LX

The lamps come complete with comprehensive fitting instructions.

CARE: The lamps may be hot, and fingermarks may burn to the surface rendering the bulb useless.

12.2 Routine Maintenance

Very little attention will be required, we nonetheless recommend the following: -

- 1 Keep the instrument clean. Immediately wipe off any spilt liquids. Clean with a slightly damp cloth. Non-abrasive water based soap or detergent may be used.
- 3 Remove the cuvettes from the instrument when not in use.
- 4 At regular intervals check the mains cable for wear and tear and replace if damaged.
- 5 Store in a cool place away from corrosive chemicals or fumes.

The cuvette compartment has a drain hole to ensure that any spillage within the cuvette compartment will not damage the instrument. The grey cuvette holder can be pulled out to clear any spillage and to access the cuvette compartment. Check that the cuvette tray has not accumulated any liquid or deposits from the storage of wet cuvettes.

Particular care should however be taken to avoid spillage when handling aggressive or organic liquids as these can damage the plastic mouldings.

12.3 Decontamination

If the S2000 is sprayed to decontaminate it, please ensure that the optics are protected by temporarily sealing the optic opening in the cuvette chamber with tape.

12.4 Calibration

WPA can provide a service and calibration for your instrument including the provision of a certificate traceable to international standards.

Please contact our sales office for further details.

13 CE Marking

European Directives for Low Voltage and Electro Magnetic Compatibility

ALL WPA INSTRUMENTS COMPLY WITH EUROPEAN DIRECTIVES FOR EMC AND LOW VOLTAGE SAFETY AND ARE ACCORDINGLY CE MARKED

It should be noted that external equipment connected to inputs or outputs could increase the susceptibility of measurements to interference if placed in the maximum electric fields prescribed by the Standard. Although the situation can be alleviated by the use of screened connections, WPA instruments should not be used under such extreme conditions, which would themselves constitute a danger to the operators.

The unit has been tested using a 2m RS232 cable connected; however a longer lead may affect the level of EMC emission.

14 Guarantee

The Lightwave is guaranteed against faulty workmanship and components for two years. In the unlikely event of service requirements (other than Lamp replacement) during, or after, the guarantee period, do not open the instrument to attempt repairs.

Please return the instrument either to WPA or to your local distributor. Whenever an instrument is returned, please ensure that a label indicating your name, address, telephone and extension number is securely attached to the instrument.

15 Health & Safety Certificate and Declaration of Decontamination Status

Before an instrument can be accepted for repair, service or return to stock this form must be completed and returned to WPA showing that no hazard to health exists to WPA due to Physical, Chemical, Biological or Radioactive contamination of the unit. Where the unit has been used in potentially hazardous environments evidence of decontamination conducted should be given. **WPA reserve the right to destroy the said instrumentation (at the cost of the user) after a period of 3 months has expired between the instrument being received and the satisfactory completion of this certificate.**

Instrument Model Number
Instrument Serial Number

Circle A if applicable, otherwise circle and complete all parts of section B

A This equipment (including any accessories) has not been in contact with blood or other body fluids, respired gases or pathological samples. It represents no hazard to health due to Physical, Chemical, Biological or Radioactive contamination of the unit.

B 1. This equipment been exposed internally or externally to hazardous materials as indicated below:-

- Yes No Body fluids, respired gases, pathological samples
- Yes No Other biohazards
- Yes No Chemicals or substances hazardous to health
- Yes No Radioactive hazards
- Yes No Other hazards

Please attached further details.

2. Has this equipment been cleaned and decontaminated. Yes No

How was this contamination removed?.....
.....

I declare that I have taken all reasonable steps to ensure the accuracy of the above information.

Signed..... Name (print)

Company/Establishment.....Position.....

Date