



Libra S6 User Manual

English

Deutsch

Français

Español

Italiano



Biochrom Ltd
Certificate No. 890333

Declaration of Conformity

This is to certify that the Libra S6 and S6H Visible Spectrophotometers
Part number 80-5000-10 and 80-5000-11

Serial number 88000 onwards

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: 26th Oct 2004

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Unpacking, Positioning and Installation

- Inspect the instrument for any signs of damage caused in transit. If any damage is discovered, inform your supplier immediately. Check the position of the metal lamp bracket inside the lamp access area.
- Ensure your proposed installation site conforms to the environmental conditions for safe operation:
 - Indoor use only
 - Temperature 5°C to 35°C. Note that if you use the instrument in a room subject to extremes of temperature change during the day, it may be necessary to recalibrate (by switching off and then on again) once thermal equilibrium has been established (2-3 hours).
 - Maximum relative humidity of 80 % up to 31°C decreasing linearly to 50 % at 40°C
- The instrument must be placed on a hard, flat bench or table that can take its weight (<2 kg) such that air is allowed to circulate freely around the instrument.
- This equipment must be connected to the power supply with the power cord supplied. It can be used on 90 - 240V supplies.
- Switch on the instrument via the display after it has been plugged in. The instrument performs a series of self-diagnostic checks for lamp performance, wavelength calibration and diode array pixels; press F2 to proceed.

If the instrument has just been unpacked or has been stored in a cold environment, it should be allowed to come to thermal equilibrium for 2-3 hours in the laboratory before switching on to prevent calibration failure as a result of internal condensation.

- The cell holder supplied with the instrument accepts standard 10mm pathlength glass or plastic cells (adapters are available to convert it to accept 10, 12 and 16mm diameter test tubes). It can be removed for cleaning if spillages occur by undoing the screws that hold it or it can be flushed through with water in situ.
- If the instrument has a heated cell holder option and it is on, allow 10 minutes for it to come to thermal equilibrium. This cell holder cannot be removed.

If this equipment is used in a manner not specified or in environmental conditions not appropriate for safe operation, the protection provided by the equipment may be impaired and instrument warranty withdrawn.

Essential Safety Notes

There are a number of warning labels and symbols on your instrument. These are there to inform you where potential danger exists or particular caution is required. Before commencing installation, please take time to familiarise yourself with these symbols and their meaning.



Caution (refer to accompanying documents).
Background colour yellow, symbol and outline black.

OPERATION

Introduction

Your spectrophotometer is a simple-to-use, microprocessor controlled instrument. It is a diode array product (1024 pixels), has no moving parts and scans very quickly.

After switch on, calibration and pressing F2 to proceed the home page is shown offering the choice of

- Repeat last operation
- Make a measurement
- Set up instrument

“Repeat last operation” returns the user to the last screen displayed when the instrument was switched off, and provides a short cut to the last test that was performed.

Within “Make a measurement” your spectrophotometer has facilities for:

- measurement of absorbance, % transmission, ratio and concentration values
- cell culture optical density measurements at 600nm
- entry of a multi point standard curve in memory
- output of wavelength scan to display
- output of kinetics assay to display
- application of a factor to an absorbance change over a specified time interval for an enzymatic determination (reaction rate)
- storage of up to 99 user defined methods

Within “Set up instrument” your spectrophotometer can be set up to

- select the display language option (English, French, German, Spanish, Italian)
- link via a serial lead to either a serial printer for hardcopy output or to a PC for download of results to spreadsheet
- link via a converter lead to chart recorder
- set the date for print outs

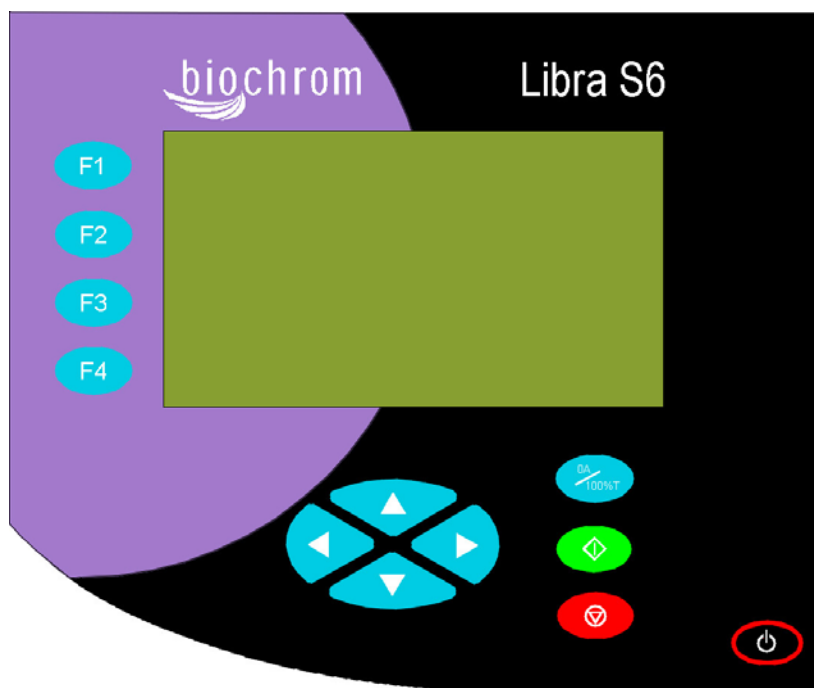
The instrument is supplied with Grafico PC utility - on the accompanying CD - and a serial lead. These provide the user with the means to capture, print and store data from the instrument to a PC. Specifically it

- produces a printable graphical plot of the scan, in Abs
- logs date, time and serial number with any output from the instrument
- produces a results log in order to store, tabulate and subsequently print output from the instrument
- enables export of the output from the instrument to Excel as a text file

A tutorial on UV/Visible spectrophotometry is included as part of the Grafico software.

Using the Instrument

The back-lit liquid crystal display is very easy to navigate around using the function / select and arrow keys on the hard wearing, spill proof membrane keypad.





Keypad	
F1, F2, F3, F4	The function select / entry soft keys on the keypad are situated next to the corresponding option on the display, and are used to select an appropriate mode
◀ ▶ ▲ ▼	When a parameter within a mode needs selecting or changing (as indicated by on the display), the four arrow keys (◀ ▶ ▲ ▼) are used in conjunction with the function keys to make that selection or change. Use F4 to implement change, followed by ▶ ▶ to choose between options indicated, and ▲ ▼ to enter alphanumeric characters (for example in the selection of a wavelength or entry of a method title). Then use F4 to accept the change made.
⏏	to escape or stop making measurements
0A/100%T	to set reference to 0.000AU or 100%T on a reference solution at the current wavelength in the mode selected, or to do a reference scan if in scan mode
⬆	to start making measurements
Display	The following symbols will appear in bottom right hand corner and mean the following:
◊	Use ▶ ▶ ▲ ▼ to select option
R T	Ready to set reference or run sample



Note that the light beam shines from LEFT to RIGHT through the cell chamber; ensure the cell is inserted in the correct alignment. The optical height is 15mm, and the minimum volume that can be used is approx. 700µl in a semi-micro cell.

Absorbance and % Transmission

This makes simple absorbance measurements on samples, measuring the amount of light that has passed through a sample relative to a blank (this can be air). The procedure is as follows:



Option on display or action	Press	Comment
Make a measurement	F2	
Single / Multi λ / Ratio	F1	
Single λ	F1	
Abs / % T	F1	Alternates between the two
Set λ	F2, then $\blacktriangle \blacktriangledown$	Select wavelength
Accept λ	F2	
Insert reference RT on display	0A/100%T	Used for subsequent samples until changed
Insert sample		Value is displayed
Repeat as necessary		
To exit		

To make up to 4 absorbance measurements on the same sample:

Option on display or action	Press	Comment
Make a measurement	F2	
Single / Multi λ / Ratio	F1	
Multi λ	F2	
Set λ 's	F1, then $\blacktriangle \blacktriangledown$	Select first wavelength
Select λ	F1, then $\blacktriangle \blacktriangledown$	Select second wavelength
Repeat as necessary		
All OK	F4	
Insert reference RT on display	0A/100%T	Used for subsequent samples until changed
Insert sample		Absorbance values are displayed
Repeat as necessary		
To exit		



Absorbance Ratio

This makes simple absorbance ratio measurements on samples, measuring the amount of light that has passed through a sample relative to a blank (this can be air) at two wavelengths. The procedure is as follows:

Option on display or action	Press	Comment
Make a measurement	F2	
Single / Multi λ / Ratio	F1	
Ratio	F3	
Remove this row		
Set λ 1	F2, then \blacktriangle \blacktriangledown	Select wavelength
Accept λ	F2	
Set λ 1	F2, then \blacktriangle \blacktriangledown	Select wavelength
Accept λ	F2	
Insert reference RT on display	0A/100%T	Used for subsequent samples until changed
Insert sample		Ratio is displayed
Repeat as necessary		
To exit		



Cell Density

This function should be used to make an OD600nm reading on a cell culture rather than a direct absorbance reading as it compensates for turbidity using an auto-correction; the absorbance at two wavelengths is measured simultaneously and an algorithm applied to compensate for scattered light. This enables better comparison with results obtained from other instruments. The procedure is as follows:

Option on display or action	Press	Comment
Make a measurement	F2	
Cell Density / Proteins	F2	
Insert reference RT on display	0A/100%T	Used for subsequent samples until changed
Insert sample		Value is displayed; an auto-correction factor is applied to the Absorbance value.
Repeat as necessary		
To exit		



Scan

An absorption spectrum can be obtained from your instrument, enabling simple identification of peak height and position. The procedure is as follows:

Option on display or action	Press	Comment
Make a measurement	F2	
Scan	F4	
Abs / % T	F1	Alternates between the two
Insert reference RT on display	0A/100%T	Used for subsequent samples until changed
Insert sample		Scan is displayed
Repeat as necessary		
<i>To identify peaks:</i>		
Move cross hairs	◀ ▶	Abs and λ values appear at top
<i>To zoom in on a region of interest:</i>		
Zoom	F2, then ◀ ▶ ▲ ▼	Move box that appears on display to area of interest
Zoom in	F1	Examine detail
Zoom out	F1	Return to original data
To exit		

Factor Concentration

Factor concentration mode is used when a conversion factor is known, and is required to convert the absorbance measurement for a sample at a specific wavelength into a concentration, by a simple multiplication of absorbance x factor. The procedure to define a new method is as follows:

Option on display or action	Press	Comment
Make a measurement	F2	
Select a method	F3	
	▲ ▼	Select method number
New	F1	Name is highlighted
Change Name	F4, then ▲ ▼	Enter first character of name
	▶, then ▲ ▼	Enter second character of name
	▶, then ▲ ▼	Repeat as necessary
Accept	F4	λ is highlighted
Change Wavelength	F4, then ▲ ▼	
Accept	F4	Units is highlighted
Select Units	F4, then ▲ ▼	
Accept	F4	Cal is highlighted
Select Calibration option	F4, then ◀ ▶	Select Factor
Enter Factor	F4 then ▲ ▼	
....	F3	Moves decimal point
Positive or negative?	F2	Alternates between the two
Accept	F4	
Kinetics		Leave as no
All OK	F1	Accept method protocol
Run method	F1	
Insert reference RT on display	0A/100%T	Used for subsequent samples until changed
Insert sample		Concentration is displayed
Repeat as necessary		
To delete	F3, then F1	
To exit		

Note: It is not necessary to enter the name, and this can be omitted for a quick measurement.




Standard Curve

The construction of a multi-point calibration curve from standards of known concentration in order to quantify unknown samples is a fundamental use of a spectrophotometer; this instrument has the advantage of being able to store this curve as a method, using up to 5 standards.

To include a zero concentration standard, include this in the number of standards to be entered and enter 0.00 for concentration; use a blank when required to enter standard

The procedure to define a new method is as follows:

Option on display or action	Press	Comment
Make a measurement	F2	
Select a method	F3	
	▲ ▼	Select method number
New	F1	Name is highlighted
Change Name	F4, then ▲ ▼	Enter first character of name
	▶, then ▲ ▼	Enter second character of name
	▶, then ▲ ▼	Repeat as necessary
Accept	F4	λ is highlighted
Change Wavelength	F4, then ▲ ▼	
Accept	F4	Units is highlighted
Select Units	F4, then ▲ ▼	
Accept	F4, ▼	Cal is highlighted
Select Calibration option	F4, then ◀ ▶	Select Std
Accept	F4	Goes to Calibration Curve page
Set Std	F1	1 is highlighted (maximum is 5)
Change	F1, then ▲ ▼	Enter concentration of standard 1
....	F3	Moves decimal point
Accept	F4	2 is highlighted
Change	F1, then ▲ ▼	Enter concentration of standard 2
....	F3	Moves decimal point
		Repeat as necessary
Incorrect entry?	F3, then F1, ▲ ▼, F4	Clears entry prior to re-entry
Standards are all OK	F4	Accept Concentrations
Insert reference RT on display	0A/100%T	Used for subsequent samples until changed
Insert Standard 1	⬆	Absorbance for Std 1 is measured Std 2 is highlighted
Insert Standard 2	⬆	Absorbance for Std 2 is measured Std 3 is highlighted
		Repeat as necessary
Incorrect entry?	F3, then F1,	Clears entry prior to re-entry

	▲ ▼, F4	
All OK	F4	Accept Standards
Change Curve Fit algorithm	F3, then ▼, F4	Select linear least squares or polynomial curve
View Graph	F4	
Accept graph	F3	Can now run samples
To run samples		
All OK	F1	
Run	F1	
Insert reference RT on display	0A/100%T	Used for subsequent samples until changed
Insert sample		Concentration is displayed
Repeat as necessary		
To delete	F3, then F1	
To exit		
To delete	F2, then F1	
To exit		

Kinetics




Kinetics studies, where the change in absorbance needs to be followed as a function of time at a fixed wavelength, can be readily performed.

Reagent test kits are routinely used for the enzymatic determination of compounds in food, beverage and clinical laboratories by measuring NAD / NADH conversion at 340 nm. The change in absorbance over a specified time period can be used to provide useful information when an appropriate factor, defined in the reagent kit protocol, is applied. Reaction rate and enzyme activity can be calculated if the factor used takes account of the absorbance difference per unit time, as opposed to the absorbance difference *per se*.

For this reason, the change in absorbance per minute (**$\Delta A/\text{min}$**), concentration (**$\Delta A/\text{min} \times \text{factor}$**) and **correlation coefficient** (calculated from a best fit of the data points) are displayed. They may not be relevant for simple kinetics experiments.

The procedure to define a new method is as follows:


Option on display or action	Press	Comment
Make a measurement	F2	
Select a method	F3	
	▲ ▼	Select method number
New	F1	Name is highlighted
Change Name	F4, then ▲ ▼	Enter first character of name
	►, then ▲ ▼	Enter second character of name
	►, then ▲ ▼	Repeat as necessary
Accept	F4	Wavelength is highlighted
Change Wavelength	F4, then ▲ ▼	
Accept	F4	Units is highlighted
Enter Units	F4, then ▲ ▼	
Accept	F4	Cal is highlighted
Select Calibration option	F4, then ◀ ▶	Select Factor
Enter Factor	F4 then ▲ ▼	If required; this is used to convert $\Delta A/\text{min}$ to Concentration
....	F3	Moves decimal point
Positive or negative?	F2	Alternates between the two
Accept	F4	
Kinetics	F4, then ◀ ▶	Select Yes or Fixed time *
Accept	F4	Start is highlighted
Enter Start Time	F4, then ◀ ▶ ▲ ▼	Usually 00m 00s, unless there is a lag time
Accept	F4	Interval is highlighted
Enter time interval between each measurement	F4, then ◀ ▶ ▲ ▼	Minimum interval is 10 seconds

Accept	F4	End is highlighted
Enter end time	F4, then ◀ ▶ ▲ ▼	Maximum time is 59m 59s after completion of start time Maximum number of readings is 20, so maximum end time is 20 x the time interval
Accept	F4	
Run method	F1	
Insert reference RT on display	0A/100%T	Used for subsequent samples until changed
Insert sample		Abs values displayed for each time interval At end of run, calculated $\Delta A/\text{min}$, correlation coefficient and concentration are displayed
<i>To view data</i>		
Use Page Up and Page Dn	F2 or F3	
<i>To view graph</i>	F1	
		Return to values
Repeat as necessary		
To exit		





* The Fixed time option is for a single time measurement after a specified time, and therefore no options for start time, time interval and graphics are available.

- If the instrument is connected to a chart recorder the output is linearly fitted between data points as the software automatically interpolates these for the benefit of presentation.
- If you have a factory fitted electrical heated cell holder version of the instrument, go to Set-up to switch this facility on (37°C). Allow 10 minutes for the instrument to come to thermal equilibrium.

To recall a saved method

Option on display or action	Press	Comment
Make a measurement	F2	
Select a method	F3	
	▲ ▼	Select method number
Accept	F4	Selected method is recalled
Run method	F1	
Insert reference RT on display	0A/100%T	Used for subsequent samples until changed
Insert sample		

SET UP

Option on display or action	Press	Comment
Set up instrument	F3	
Set Language	F1	
Select display language	▲ ▼	English, French, German, Spanish, Italian
Accept	F1	
To exit		
Comms/Software Update	F2, F1	Select Communications
Select serial printer or PC	F1	Alternates between them, with default settings for each option: Printer 1 is S1000P Printer 2 is Martell / Seiko DPU-414 PC is for download to spreadsheet
Set Baud of 9600 or 38400	F2	Alternates between the two
Auto-print	F3	Select on for automatic increment of sample number and print out after measurement
Accept	F4	
To exit		
Set Date / Time	F3	
Select format	F1	European or North American
Enter values	◀ ▶ ▲ ▼	Enter as appropriate
Accept	F4	
To exit		
Heater control*	F4	May not be available*
Heated cell	◀ ▶	Select on for thermostating at 37°C
Accept	F4	
To exit		

*Heated cell holder factory fitted version only. This option cannot be fitted retrospectively to an instrument.

ACCESSORIES

PC serial cable (spare)	80-3001-00
S1000P serial printer (includes serial printer cable)	80-3002-53
Chart recorder interface cable	80-3003-55
Test tube adapters (10, 12, 16mm)	80-2117-47

ERROR MESSAGES

After switch on, the instrument undergoes self-diagnostic tests for the tungsten lamp, wavelength calibration and diode array as part of its calibration procedure (✓ for OK, X for fail). The results of this test are displayed and can be printed out or output to PC for filing and GLP (Good Laboratory Practice) purpose. The messages for tungsten lamp and / wavelength calibration are self explanatory, involving checking that the cell compartment is clear or replacement of the tungsten lamp. In the unlikely event of a diode array fail message contact your local supplier.

OUTPUT OF RESULTS

Use with serial printer

The instrument is designed to print to a 40 column serial printer at 9600 Baud. Output is automatic when a measurement is made. Note that all results can be output to PC using the serial lead and Grafico software supplied on the user manuals CD.

Use with chart recorder

Kinetics results can be output to a chart recorder using the appropriate cable (80-3003-55). Voltage setting is 1V per 1 Absorbance unit ($\pm 10\%$) with an offset of 1V = 0.000 Abs on the chart recorder; corresponding %T values are 1V per 100%T ($\pm 10\%$) with 0V = 0%T.

To make the chart cable yourself, you require a female 9 way D type at one end with two (1 red, 1 black) 4mm banana plugs at the other (depending on the chart recorder) and 2 metres of coaxial cable or screened twin core, with the shield connecting the black plug and pin 5 and the core connecting the red plug and pin 1.

USE WITH PC AND THE GRAFICO PC UTILITY SOFTWARE

Your instrument is supplied with a serial lead and Grafico software (on the user manuals CD) that enables it to be connected to a PC so that results can be captured, stored, printed and transferred into other applications easily. In particular, a complete wavelength scan can be visualised on the PC and copied/pasted into a word document or powerpoint presentation. An informative tutorial on aspects of UV/Visible Spectrophotometry is available as part of the software.

Installation

The software takes up approximately 0.5Mb of hard disk space when installed. Proceed as follows to install the software:

1. Place CD into the CD drive of the PC
2. Use Windows explorer to locate the **setup.exe** file Grafico folder within the appropriately named instrument folder on the user manuals CD
3. Double click on this so that the software installs, filling out the information as requested.
4. The software can be started directly by Start > Programs > Grafico.

Introduction

- When Grafico is selected, you are prompted to enter the file details (note that the title entered here is used as the title of the wavelength scan graph). After pressing OK, the instrument (it should be already switched on and connected to the PC with the serial lead) is recognised by the software.
- There are two parts to the Grafico software, data-logging and scan.
- The default mode is data-logging; this receives instrument output from absorbance, %T, concentration and rate measurements (including time and date stamp).
 - Results can be copied from Grafico and pasted directly into Excel for ease of data transfer. Alternatively results can be saved and opened up using Excel.
- If scan mode is selected (View > Scan mode), the full 330-800nm wavelength scan output from the instrument is shown (just press the run key as usual). Multiple peaks can be identified using a trace routine and labelled if required (by dragging the icon at the left side of the displayed graph and releasing at the appropriate point).
 - Graphs can be copied and pasted into Word, Excel or powerpoint
 - Graphs can be saved in a format that can be opened directly by Excel

Menu Descriptions

File

New	Clears any existing data and starts a new report. Prompts for file details (user name, organisation, title, descriptive text)
Save / Save As	Saves the data file in the file format selected. The file details are included with this data
Setup	Displays a tabbed dialogue box so that automatic post process options for saving of graph, printing of graph and the graph scaling parameters can be defined. The default data directory can be defined and is used for all save operations.
Print	Prints the entire file, including a header if defined in File>New
Print Setup	Runs the Common Print Dialog function to set up the printer
Exit	Closes the application

Edit

Copy	Copies the data to clipboard for pasting into another application; in data-logging and scan modes this is text and graphic, respectively
Clear	Clears the data from the data set
Select All	Selects data and header together

View

Scan mode	Switches between scan and data logging modes. Successive scans overwrite existing scans on the display and can be saved if the autosave function is on
File details	Shows the file details entered at the start (or after File > New) and allows modification of these details, if required
Autoscale	Automatically sets the scale of the absorbance axis to optimise presentation (2.5, 2.0, 1.5, 1.0, 0.5, 0.2 or 0.1A)
Set scale	Sets the scale to user preference (Full, Auto, Define)
Display grid	Toggles on/off the grid on the graph (for presentation purposes)
Toolbar	View menu bar as icons
Status bar	View status bar at bottom of display

Help

Tutorial	View tutorial on UV/Visible spectrophotometry
Help topics	View help topics
About	View version number etc

Practical Aspects

Data logging mode

- When exporting rate mode results you can add the time in 10 second intervals to the spreadsheet manually (note that first data point is after 10 seconds, not zero seconds) and then graph the absorbance / time data (see scan mode – export to excel for more details).

Scan mode

- Files can be saved as *.txt, *.csv (opens directly in Excel when double clicked) or *.wmf (picture) formats
- Label a peak by dragging and releasing the icon at the left side of the graph. The absorbance/wavelength details are shown in the title bar. Dragging it again moves the label; moving it the left hand side takes the label away. Multiple peaks can be added.
- Use display grid off for clearer presentation.
- Data can be output in absorbance only

Scan mode – export to Excel and graphing

- If saving as a *.txt file, save the results to folder of choice.
 - Use Excel to open this file; with files of type set to “all files”
 - Note that saving as a *.csv file and double clicking on it will open Excel directly
- Highlight the wavelength and absorbance values and click the graph icon
- Select chart type “XY Scatter” and the curved lines (no data points) option
- Label the axes etc as required
- Double click on the x-axis, select Scale and minimum to 330 and maximum to 800
- Set colour scheme to suit your preferences

MAINTENANCE

After Sales Support

Support agreements that help you to fulfil the demands of regulatory guidelines concerning GLP/GMP are available.

- Calibration, certification using filters traceable to international standards
- Certificated engineers and calibrated test equipment
- Approved to ISO 9001 standard

Choice of agreement apart from break down coverage can include

- Preventative maintenance
- Certification

When using calibration standard filters, insert such that the flat surface is facing away from the spring end of the cell holder

Observe all necessary precautions if dealing with hazardous samples or solvents.

Lamp Replacement

A replacement lamp is available from your supplier using the following part numbers:

Tungsten Lamp, S1000L 80-2115-33

(use only this tungsten lamp as it is supplied with the connection wires; others will not operate correctly in this spectrophotometer)

- The design of the lamp area is such that users are able to change their own lamps. No lamp alignment is necessary as the lamp is pre-aligned.
- The lamp becomes hot in use. Ensure it is cool before changing it.
- Do not touch the optical surfaces of the lamp with your fingers (use tissue); if touched, the area should be cleaned with iso-propanol.
- Instructions for lamp change are provided with the lamp and overleaf.

To change the lamp, proceed as follows:

1. Switch off the instrument, remove the sample from the cell holder and disconnect the power supply cord
2. Remove the protective layers at the lamp access and plug in points on the underneath of the instrument
3. Remove the lamp wires from the groove by gently unclipping it
4. Remove the lamp by twisting the lamp assembly anti-clockwise
5. Remove the lamp connection end by gently pulling with your fingers
6. Replace with new lamp using the reverse of these actions

Cleaning and general care of the instrument

External cleaning

Switch off the instrument and disconnect the power cord.

Use a soft damp cloth.

Clean all external surfaces.

A mild liquid detergent may be used to remove stubborn marks.

Changing cell holder or removal for cleaning

- Undo the screws that are visible on the top of the cell holder using a small flat headed screwdriver and lift the holder out by holding onto the projection; this may require pushing to the right as you do so in order to prevent fouling against the left side of the instrument cover.
- Insert the test tube holder and secure in place using the same screws.
- Note that as well removal for cleaning, spillages in the cell holder can be flushed through using water from a squeeze bottle in order to prevent crystallisation / fermentation of residues.

Changing the brightness of the display

To change display brightness, proceed as follows:

1. Ensure the instrument is on and that there is no sample in the cell holder
2. Remove the protective layer at the lamp plug in point (underneath and at the rear of instrument)
3. Place the instrument on its back, insert a small flat headed screwdriver into the potentiometer slot and turn it right or left until a suitable level of brightness is obtained.

SPECIFICATION AND WARRANTY

<i>Wavelength range</i>	330 - 800 nm
<i>Monochromator</i>	Flat grating
<i>Wavelength calibration</i>	Automatic upon switch on
<i>Spectral bandwidth</i>	7 nm
<i>Wavelength accuracy</i>	$\pm 2\text{nm}$
<i>Wavelength reproducibility</i>	$\pm 1\text{nm}$
<i>Light sources</i>	Pulsed Tungsten halogen
<i>Detector</i>	Diode array
<i>Photometric range</i>	- 0.300 to 2.500A, 0.3 to 199%T
<i>Photometric linearity</i>	$\pm 2.0\%$ or $\pm 0.010\text{A}$ to 1.000A at 546nm, whichever is the greater
<i>Photometric reproducibility</i>	$< 0.002\text{ A}$ at 0A and 500nm
<i>Stray Light</i>	$< 1\%T$ 340nm according to ANSI/ASTM E387-72
<i>Stability</i>	$\pm 0.005\text{A/h}$ at 0A and 546nm after warm-up
<i>Noise</i>	$\pm 0.002\text{A}$ near 0A and $\pm 0.020\text{A}$ near 2A at 600nm
<i>Analogue output</i>	1V per 1 Abs ($\pm 10\%$), 1V = 0A offset 1V per 100%T ($\pm 10\%$), 0V = 0%T offset
<i>Digital output</i>	9 pin serial
<i>Dimensions</i>	180 x 270 x 390 mm
<i>Weight</i>	1.75 kg
<i>Power input</i>	90-265 V, 50/60 Hz, 15 VA
<i>Safety standard</i>	EN61010-1
<i>EMC emissions</i>	EN 61326-2.3 Generic emissions
<i>EMC immunity</i>	EN 61000-4-6 Generic immunity part 1
<i>Mains harmonics</i>	EN 61000-3-2
<i>Susceptibility standard</i>	IEC 801
<i>Quality System</i>	Designed and manufactured in accordance with an ISO 9001 approved quality system
<i>British Design Registration No.</i>	2097049

Specifications are measured after the instrument has warmed up at a constant ambient temperature and are typical of a production unit. As part of our policy of continuous development, we reserve the right to alter specifications without notice.

Warranty

Your supplier guarantees that the product supplied has been thoroughly tested to ensure that it meets its published specification. The warranty included in the conditions of supply is valid for 12 months only if the product has been used according to the instructions supplied. They can accept no liability for loss or damage, however caused, arising from the faulty or incorrect use of this product.

This product has been designed and manufactured by Biochrom Ltd, 22 Cambridge Science Park, Milton Road, Cambridge CB4 0FJ, UK.