



Biochrom Ltd
Certificate No. 890333

Declaration of Conformity

This is to certify that the Ultraspec 100 *pro* Visible Spectrophotometer
Part number 80-2114-60
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: 1993 Safety requirements for electrical equipment for measurement, control and laboratory use.
- EN 61326-2.3: 1998 Electromagnetic compatibility - Generic emission standard part 1. Electrical equipment for measurement, control and laboratory use.
- EN 61000-4-6: 1992 Electromagnetic compatibility - Generic immunity standard part 1. Residential, commercial and light industry.

Signed:

Dated: 16th October 2002

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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
 - 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.
- Ensure that the cooling fan inlets and outlets are not obstructed; position at least 2 inches from the wall.
- This equipment must be connected to the power supply with the power cord supplied and **MUST BE EARTHED (GROUNDED)**. 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 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not appropriate for safe operation, the protection provided by the equipment may be impaired and instrument warranty withdrawn.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:

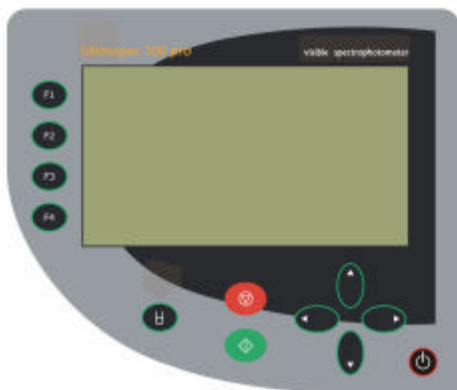
- measurement of absorbance, % transmission and concentration values
- cell culture optical density measurements at 600nm
- entry of a multi point standard curve in memory
- output of wavelength scan to display
- output of kinetics assay to display
- application of a factor to an absorbance change over a specified time interval for an enzymatic determination (reaction rate)
- storage of up to 50 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
- set the date for print outs

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 highlighted text 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
⊞	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 right to left across the cell chamber; ensure the cell is inserted in the correct alignment.

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	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		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	F1	
Multiple 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		Used for subsequent samples until changed
Insert sample		Absorbance values are 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	F2	
Insert reference RT on display		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		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



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	l 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		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	I 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		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, ▲▼, F4	Clears entry prior to re-entry
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		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 (**DA/min**), concentration (**DA/min x 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 DA/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 number of readings is 20, so maximum end time is 20 x the time interval Maximum time is 59m 59s after completion of start time
Accept	F4	
Run method	F1	
Insert reference RT on display	⏏	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 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		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 the two, with default settings for each option
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	⊗	

ACCESSORIES

Venturi action funnel flow cell

80-2115-39

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, and screen displays, where appropriate, are downloaded; ensure output to printer is on in Set-up > Communications. Output is automatic when **print** is pressed, a printer is connected and switched on and Auto-print has been specified in Set-up > Auto-print.

Use with PC

Results can be downloaded directly to Excel when the PC has the Spreadsheet Interface Software installed (80-2110-73) and the two are linked with the serial cable (80-2105-97); detailed instructions are supplied with the software. Thus absorbance / wavelength data comprising a scan, for example, can be picked up as columns of numbers and converted to a more conventional graph using the spreadsheet; results can then be formatted or manipulated as appropriate prior to inclusion in reports or archiving / saving to hard disk.

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 number:

Tungsten Lamp 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
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.

SPECIFICATION AND WARRANTY

<i>Wavelength range</i>	330 - 830 nm
<i>Monochromator</i>	Flat grating
<i>Wavelength calibration</i>	Automatic upon switch on
<i>Spectral bandwidth</i>	8 nm
<i>Wavelength accuracy</i>	± 2 nm
<i>Wavelength reproducibility</i>	± 1 nm
<i>Light sources</i>	Pulsed Tungsten halogen
<i>Detector</i>	Diode array
<i>Photometric range</i>	- 0.300 to 2.000A
<i>Photometric linearity</i>	± 2.0 % or ± 0.010 A to 1.000A at 546nm, whichever is the greater
<i>Photometric reproducibility</i>	< 0.002 A at 0A and 500nm
<i>Stray Light</i>	$< 1\%$ T 340nm according to ANSI/ASTM E387-72
<i>Stability</i>	± 0.005 A/h at 0A and 546nm after warm-up
<i>Noise</i>	± 0.002 A near 0A and ± 0.020 A near 2A at 600nm
<i>Analogue output</i>	No
<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.

