WPA CO 7500 Colorimeter
User Manual

WPA

biochrom

Biochrom Ltd
Certificate No. 890333

Declaration of Conformity

This is to certify that the WPA CO 7500 Colorimeter
Part number 80-3000-43 (mains only)
80-3000-44 (mains / battery)

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: 24th March 2003

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CONTENTS

Unpacking, Positioning and Installation

- 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

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not appropriate for safe operation, the protection provided by the equipment may be impaired and instrument warranty withdrawn.

- The instrument is powered by mains electricity using the supplied power-adapter. Using the instrument with the mains adapter will automatically recharge the internal rechargeable battery (mains/battery version only).
  - The battery will last approx. 1 month when fully charged with normal use.
  - A full battery recharge will take approx. 12 hours (overnight).

OPERATION

Introduction

Your colorimeter is a small, robust, easy to use instrument that has been designed with both the student user and "field" user in mind. It is ideal for teaching the principles of science and analysis in sixth form colleges and technical schools, as well as being rugged enough for measurements in, for example, remote location health clinics where simple diagnostic tests need to be made.

The instrument measures in absorbance and % transmission mode as well as in simple kinetics, enabling changes in absorbance over time and reaction rates to be determined. It can be used in the 400 – 700 nm wavelength range as it has an integral, colour coded rotating wheel containing filters at 440, 470, 490, 520, 550, 580, 590 and 680nm. These are made from coloured gelatin and are encased in glass, enabling the instrument to be used in "tropical" conditions. A filter is selected by moving the wheel until the required wavelength is displayed in the window above the cell compartment.

The instrument produces stable white light that is directed through the reference and sample solutions in turn to a detector after being filtered to a single colour. This colour is normally chosen to be complimentary (that which is most absorbed) to the test solution. The amount of energy passing through the reference is deemed equivalent to 100% transmission and is compared with that through the absorbing sample, measured as T% (normally $0< T< 100$).

Successful measurement of concentration is dependent on arranging the chemistry and conditions to get the best agreement with the Beer/Lambert Law. To make full use of the instrument's excellent performance, it is recommended to arrange the chemistry and dilutions to give Absorbance readings in the range 0.2 - 1.2A. Below 0.2A the relative concentration accuracy is reduced, whilst Absorbance readings above 1.2A imply concentrations of high molar strength that do not obey Beer/Lambert's Law so well. In addition small photometric errors become increasingly important and the effect of stray light will increase.

If it is not possible to stay within these bounds it may be desirable to make calibration curves for known concentrations and their measured Absorbances. As colorimeter measurements are comparative it is essential that only the solutions themselves change. This product contains a fully stabilised light source and electronics with a fixed light path.

The instrument can be linked via a serial lead to either a serial printer for hardcopy output or to a PC for download of results to spreadsheet. It has an analogue output, and can also be connected to a chart recorder to output absorbance time data when in kinetics mode.

Using the Instrument

Keypad	
on/off	**On / off button**
R	**to set reference** to 0.000 OD at 600nm on a reference
T	to **make** a measurement
	to measure kinetics
Abs/%T	To select between absorbance or %Transmission
	Wavelength indicator
Display	There is a battery indicator

Note that the light beam shines from front to back through the cell chamber; ensure the cell is inserted in the correct alignment.

The following table indicates the absolute minimum volume necessary for the correct function of the unit. The use of disposable plastic cuvettes is recommended.

Cuvette/Tube	**Min Volume (ml)**	**Part number**	**Minimum Depth (approx) from base of cuvette to meniscus (mm)**
Macro Cuvette (max fill volume 4.5ml)	1.0ml	80-3000-60	14mm
Semi-micro (max fill volume 1.4ml)	0.5ml	80-3000-76	13mm
10mm diameter tube	0.9ml	-	16mm
12mm diameter tube	1.1ml	-	15mm
16mm diameter tube	2.2ml	-	15mm

Making an absorbance or %T measurement

1. Switch the instrument on by pressing the ON/OFF button.
2. Select the required wavelength by turning the thumbwheel at the side of the instrument. The wavelength selected is displayed in the window above the cuvette compartment. Note: Two of the locations are empty.
3. Select Abs or %T mode
4. Place a reference into the cuvette compartment and press and release the R (reference) button. The display will show 0.00 Abs or 100%T.
5. Remove the reference sample and replace with the sample solution in a cuvette or tube.
6. Press and release the T (test) button. The result is displayed in absorbance or %Transmission units

Multiple samples can be compared with the same reference by placing different samples in the cuvette chamber and making measurements for each one. It is recommended to re-reference with the reference solution every 10 to 15 minutes to avoid any slow instrument drift. If in doubt, always re-reference.

Note: At high Absorbances the time taken to take a measurement will be longer (up to 10 seconds) as the light levels are proportionally lower.

Making a kinetics measurement

1. The kinetics mode provides a continuous readout of changes in absorbance of a sample.
2. Press and release the (kinetics) button.
3. Select Abs or %T mode
4. Place a reference into the cuvette compartment and press and release the R (reference) button. The display will show 0.00 Abs or 100%T.
5. Remove the reference sample and replace with the sample solution in a cuvette or tube.
6. Press and release the T (test) button. The lamp will remain on, the lamp indicator will flash on the display, readings will be taken every 1-2 seconds and the display will then show the changes in optical density (Abs or %T) over time. The results are also output via both the RS232 and the analogue outputs.
7. To stop the readings repress the kinetics or T test button and the instrument will revert to the flash mode of operation.

TROUBLE SHOOTING NOTES

ERROR INDICATION	SOLUTION
A flashing Absorbance reading of 2.00 A is obtained.	This indicates an Absorbance of more than 1.99 and which is therefore out of range. The sample needs to be diluted.
A negative reading is obtained.	In normal measurements the test sample has a positive Absorbance compared to that of the Reference. Occasionally it can happen that the chemistry has been arranged for a coloured Reference and a less absorbing test solution, i.e. one of negative Absorbance. The instrument will respond correctly to negative absorbances down to –0.30 A. Negative readings will also be obtained if the Reference and Test cuvettes are mixed up.
A flashing Absorbance reading of –0.30 Abs is obtained.	This indicates an Absorbance of less than –0.30 Abs and is therefore out of range. The sample needs to be diluted.
Unexpected results are obtained	Any bubbles in solution will produce considerable error. Check bulb is flashing
rEF is displayed when T is pressed	The baseline has not been set. Replace the sample with a blank or reference sample and press R. The samples can then be tested.
No reading is obtained when using the instrument is being operated by battery.	Check that there is sufficient battery power available. The battery power available is indicted by the battery symbol at the bottom right hand corner of the display. Three bars in the battery indicates that it is fully charged. If only one or no bars are present the battery needs to be recharged. Connect the instrument to the electric power supply using the adaptor/recharge unit. The battery will be recharged in 12 hours.
An abnormally high absorbance reading is obtained at one wavelength	Visually check the sample to ensure that there has been no errors in the chemistry performed. Check the condition of the filter. Deterioration of the filter could cause higher absorbance readings.

IMPORTANT WARNING

- This colorimeter has been designed for non toxic water based solutions. If stronger solutions or dangerous or aggressive chemicals have to be used then they must be treated with great care and be contained in properly stoppered glass cuvettes.
- Never cover the end of a cuvette by the thumb or finger to shake the contents.
- Never pipette by mouth.

ACCESSORIES, CONSUMABLES AND SPARES

S2000P serial printer (includes serial cable)	80-3000-94
Spreadsheet interface software	80-2112-23
Serial interface cable	80-3001-00
Pack of 100 disposable cells, 1ml minimum volume	80-3000-60
Pack of 100 disposable cells, 0.5ml minimum volume	80-3000-76
Adapter set for 10 and 12mm tubes	80-3000-57
Spare filter set	80-3000-58
Spare lamp	80-3000-59

OUTPUT OF RESULTS

Use with serial printer

The instrument is designed to print to a serial printer at 9600 Baud with the S2000P serial printer and cable. Output is automatic when R / T is pressed and the printer is connected and switched on.

Use with PC

Results can be downloaded directly to Excel when the PC has the Spreadsheet Interface Software installed (80-2112-23) and the two are linked with the serial cable (80-3001-00); detailed instructions are supplied with the software. Baud rate is 9600 and the separator should be set to space.

Use with chart recorder

The instrument can be connected to an analogue chart recorder using the 2 x 4 mm banana plug sockets. The output is 0-2V for 0-2A and 0-1.99V for 0-199%T. A standard chart recorder cable should be sourced locally.

MAINTENANCE

General maintenance

The instrument has no serviceable parts.
The instrument requires little maintenance. The following are considered good practice:

1. Always disconnect from the mains supply when not in use.
2. Keep the instrument clean and dry immediately wipe off any spilt liquids. Clean with a slightly damp cloth; a 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 power adaptor and cable for wear and tear and replace if damaged.
5. Store in a cool place away from corrosive chemicals or fumes.

Changing a filter

Ultimately the filters may need replacement depending on the environment. High humidity will cause the filters to fail more rapidly. If a filter does have to be replaced, replace the whole set (part number 80-3000-58):

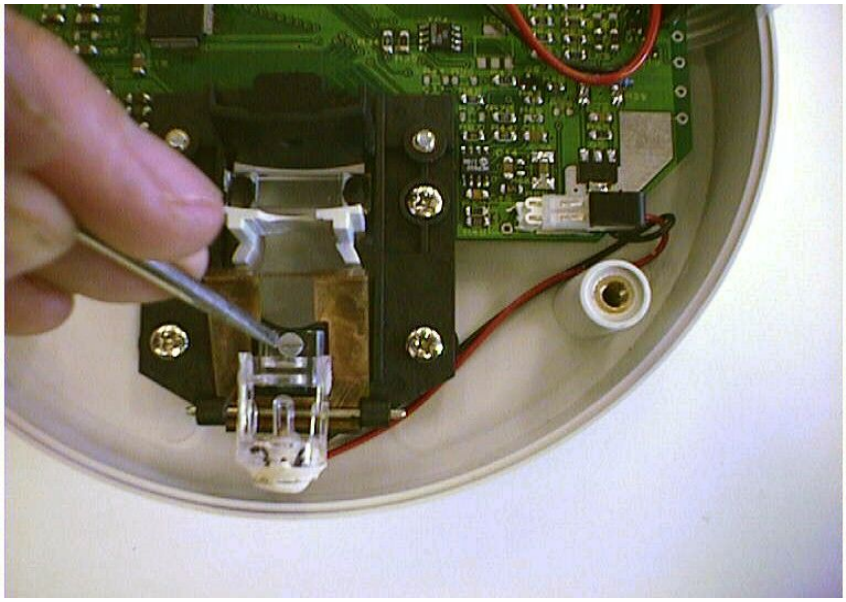
1. Disconnect from power supply.
2. Place the instrument upside down on a soft surface and unscrew the large grey screw at the centre of the filter wheel. The filter wheel can then be removed.
3. Remove the filter to be replaced by pushing the locating clip back on the underside of the filter wheel whilst pulling on the filter (a large flat head screwdriver may help).
4. Insert a new filter ensuring that it clicks firmly into place.

5. Replace the filter wheel and tighten the screw finger tight.

Replacing the light bulb

1. Disconnect from power supply
2. Place the instrument upside down on a soft surface and remove the 4 screws in the base using a No 1 Pozidrive cross head screwdriver.

3. Remove the lamp assembly fixing screw with a small flat screwdriver and unplug.
4. Insert the new lamp assembly (part number 80-3000-59) and tighten the fixing



screw.

5. Replace the base of the instrument and tighten the 4 base plate screws.

SPECIFICATION AND WARRANTY

Wavelength range	440 – 680nm
Standard gelatin filters	440, 470, 490, 520, 550, 580, 590 and 680nm
Bandwidth	40nm
Range	Absorbance –0.3A to 1.99A % Transmission – 0 – 199% T
Accuracy	<±0.05A at 1A using Neutral Density Filters
Repeatability	±0.02A at 1A using cuvettes
Operational modes	Absorbance, Transmission, Kinetics
Cuvette holder	Fixed with drain hole. Accepts 10mm pathlength semi micro and macro cuvettes or 16mm round tubes. Can accept 10-12mm tubes with optional adapters
Output	0 – 2V for 0 – 2Abs or 0 – 1.99V for 0 –199%T (via 2 x 4mm sockets, ~ 100mV offset in the output voltage) RS232
Power requirements	External power adaptor (110 to 220V, 50/60Hz, 20VA) or internal rechargeable NiMH battery (mains/battery version only)
Approximate dimensions	180 x 150 x 60mm
Weight	0.6kg

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. The product does not fulfil the specific requirements of the IVD.

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.