WEALTEC

SpectroArt 200 Spectrophotometer

Installation and Operation Manual

Version 1.0

Item# 03070

This instrument is intended for laboratory use only

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A. Important Notice

Before setting up and operating the instruments of SpectroArt 200 spectrophotometer, please carefully read these instructions to get familiarized with the installation and operation process. Instructions should be read by experienced individuals before operating the instruments.

Any improper usage of the instruments may cause damage. Please refer to the safety notice included with this equipment.

The instruments shall not be modified or altered in any way. Any modification or alteration will void the warranty, void the regulatory certifications and create potential safety hazard. Wealtec is not responsible for any injury or damage caused by using the instruments for any non-intended purpose or injury as a result of modification of the instruments by any person who is not authorized by Wealtec Corp.

A-1. Warranty

SpectroArt 200 spectrophotometer is warranted to be free from defects in materials or workmanship for a period of one year from the original invoice date, under normal usage. Any defects occurring during warranty period, Wealtec Corp. will repair or replace defective products or parts without charge unless the defects arise from conditions outlined below. The defects described below are specially excluded from Wealtec warranty policy.

1. Improper operation of the instrument.
2. Repair or modification by any person who is not authorized by Wealtec Corp.
3. Damage caused by any (in)-direct accident, neglect or misuse.
4. Use fittings or spare parts supplied by anyone other than Wealtec Corp.
5. Damage caused by disaster.
6. Damage caused by any improper solvents or samples

A-2. Technical and Service Contact

Most of the operation details are described in this instruction manual to assist and guide operator for an appropriate solution. For any other technical/ service questions, please contact your local representative or contact Wealtec international technical/ service specialist by E-mail: support@wealtec.com.

A-3. <u>Safety Notice</u>

A-3-1. Certification

The SpectroArt 200 spectrophotometer is designed to meet the international electrical safety standards EN61010-1 and EMC regulations. This product meets CE requirements and if operated according to the guidance of the instruction manual, is certified safe. It is possible that emissions from this product may interfere with some sensitive appliances when placed nearby or in the same circuit as those applications. The user should be aware of this potential and take appropriate measures to avoid interference. Any modification or alteration will void the warranty, void the regulatory certifications and create potential safety hazards.

A-3-2. Safety Information

Before operating the unit, please note the following precautions:

- ➢ Do not use near flammable materials.
- ➢ Always inspect the SpectroArt 200 spectrophotometer for damaged components before use.
- ➢ Always connect the system to the correct AC power source
- ➢ Always connect the correct instrument (Computer only) via the serial port connector.
- ➢ Do not pour liquid into the sample chamber. Thorough clean-up is needed after each spill (Section E. Care and Maintenance).
- ➢ Do not place object on the SpectroArt 200 spectrophotometer.
- ➢ The SpectroArt 200 spectrophotometer has no customer-serviceable components, do not open the unit.

B. Introduction

Spectroscopy is a technique that measures the interaction of molecules in a sample with electromagnetic radiation. The energy of the light produced by the spectrometer of the spectrophotometer is used to excite molecules in the sample. For every molecule excited, one photon of the emitted light is absorbed, hence the transmitted light looses some of its energy. The absorbance of a solute depends linearly on its concentration and is strongly dependant upon the wavelength of light. This is why spectrophotometry is performed using monochromatic light, in which all photons have the same wavelength. A spectrum is obtained when the absorption of light is measured as a function of its wavelength. The light source of SpectroArt 200 is a xenon flash light. In contrast to traditional light sources such as deuterium or tungsten-halogen that emit either UV-light or visible light receptively, xenon flash lights emit light of both UV-and visible light wavelengths.

The concentration of a solute can be calculated by measuring either the light that is absorbed by the sample or the light that is transmitted through the sample. The absorbance (A) is related to the intensity of light before (I_0) [Incident light] and after (I) [Transmitted light] passage through the solute;

$$A = -\log_{10}\left(\frac{I}{I_o}\right)$$

According to Lambert-Beer's law, the absorbance depends linearly on the concentration of the solute, where c is the molar concentration, l is the optical path length in cm and ε is the molar absorption coefficient in L mol^{-1}cm^{-1};

$$A = \varepsilon c l$$

% Transmittance can be calculated as;

$$\%T = 100\left(\frac{I}{I_o}\right) = 10^{-\varepsilon c l} * 100$$

The shows the relationship between Transmittance and Concentration and Absorbance and Concentration.
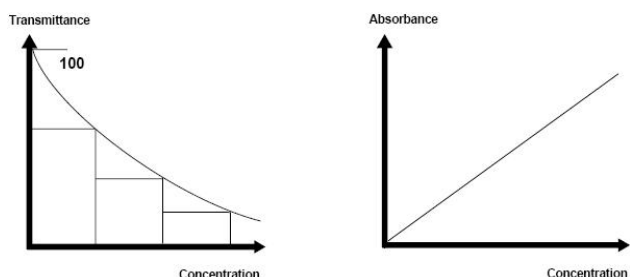
B-1. <u>Specifications</u>

|	
Light source	Xenon flash light
Detector	Photodiode array
Display	Touch screen TFT LCD 5.7"
Wavelength range (nm)	200 – 800
Wavelength accuracy (nm)	± 0.5 from 240 – 640
Absorption/Photometric accuracy (nm)	± 0.001@1AU
Absorption/Photometric repeatability (nm)	± 0.005@1AU
Stray light (nm)	0.1%@220
Photometric noise	0.001@0AU, 550
Spectral bandwidth (nm)	< 3
Absorbance range (AU)	0 – 3.0
Data collection speed (msec)	60
Path length (mm)	10
Beam length [Z-axis] (mm)	8.5
Pre-set wavelength	9 Max.
Sample test repetition	10 Max.
System optimization	On start up
LCD sleep mode	Yes
Standard curve storage	10 Max.
Analytic data storage	99 Max.
Kinetic analysis reading interval range (sec)	2 – 999
Communication port	RS232
Number of cuvette	1
Applicable cuvette types	Standard/Semi-micro/Micro-volume
Printer	Built-in
Dimension [LxWxH] (cm)	39 x 29 x 12
Weight (kg)	5
Input	90 – 264 Vac, 47 – 63 Hz
Operating temperature (˚C)	0 – 40 Humidity : 10% to 90% R.H. Non-condensing

B-2. __Product Description__

B-2-1. SpectroArt 200 Spectrophotometer Hardware Overview

Touch screen TFT LCD
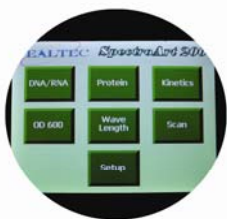
Light path axis

Fan guard

Integrated thermal printer

Sample compartment lid
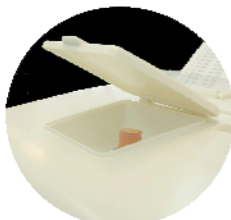
Cuvette chamber

Serial output port (RS-232)

Printer paper shaft

Thermal printer paper

Power switch

Prog./Diagnostic switch

Prog. mode

Diagnostic mode

Power input module

Printer paper compartment lid

Display

Touch screen high resolution TFT display.

Sample compartment lid

Lift the sample compartment lid to insert cuvette into the cuvette chamber.

Integrated thermal printer

Built-in alphanumeric/graphic printer. Press print button to record results immediately.

Printer paper compartment lid

Open the printer paper compartment lid to install new roll of printer paper.

Fan guard

Exhaust air leaves cabinet through this opening.

Universal power input module

Appropriate power cord is connected to the power input module.

Power switch

Instrument main power switch.

Serial output port

RS-232 connection to a computer.

Cuvette chamber

Insert cuvette into the cuvette chamber. Insure that the cuvette is placed in the proper orientation with respect to the light path (Light path axis = Horizontal – x-axis).

C. Installation of SpectroArt 200 Spectrophotometer

C-1. Package List

Item	Quantity
SpectroArt 200 spectrophotometer	1
Thermal paper roll	1
Power cable	1
Instruction and operation manual	1

C-2. <u>Environment requirement</u>

To insure correct operation and stable performance over an extended period of time, install the SpectroArt 200 in a location which meets the following conditions:

- Recommended room temperature.
- Not exposed to direct sun light.
- Not subject to direct or continuous vibration.
- Not subject to intense magnetic or electromagnetic fields.
- Relative humidity between 10 – 90 %.
- Area free from corrosive gases or other corrosive substances.
- Area with very little dust or other airbone particles.
- Allow a 15 cm minimum space around the instrument for proper air flow.

C-3. <u>SpectroArt 200 Spectrophotometer Setup</u>

SpectroArt 200 allows you to perform the following in the setup menu

- Calibration
- Adjusting UV parameters
- Restoring touch pad settings
- Printer testing
- Beep volume adjustments
- Time and Date settings
- Display settings (brightness and contrast adjustments)
- Set default settings

To enter the setup menu, touch the "**Setup**"-button in the main menu

C-3-1. Calibration and Wavelength Linearity Test

A calibration kit is required and can be bought from Wealtec for calibration and wavelength linearity test. Make sure all the standard samples are wiped off thoroughly with lint free tissues prior to measurements

- Touch the "**Calibration**"-button. Make sure no sample is in the cuvette holder and then touch "**OK**".
- Insert the calibration standard into the cuvette holder and then touch "**OK**".

- Touch "**OK**" to print calibration data.
- Make sure at least six peaks and readings are generated, otherwise, remove sample, clean and reinsert to repeat calibration procedure.
- Exit the setup menu by touching the "**Exit**"-button.
- Touch the "**Scan**"-button in the main menu.
- Remove the calibration standard and touch the "**Blank**"-button in the scan menu. Make sure no sample is in the cuvette holder, then touch "**OK**".
- Insert the calibration standard once more into the cuvette holder, and then touch "**Sample**". Touch "**OK**".
- Print out the graph generated with peaks specified by touching the "**Print**"-button.
- Check the peaks generated. The detected peak values should always be within ± 3 nm from the reference peaks
  640 nm, 536 nm, 485 nm, 452 nm, 416 nm, 361 nm, 278 nm & 240 nm
- Touch the "**Exit**"-button to leave the scan menu.
- To perform a *wavelength linearity test*, touch the "**Protein**"-button in the main menu.
- Touch the "**Setup**"-button to enter the protein setup menu.
- Touch the "**Method**" button five times for customised assay. Then touch the "**Change W. length**"-button and key in 280 nm using the number pad.
- Touch the "**Blank Rep.**"-button and enter the number 5 using the number pad. Then touch "**Enter**".
- Touch the "**STD Rep.**"-button and enter the number 5 using the number pad. Then touch "**Enter**".
- Touch the "**Unknown Rep.**"-button and enter the number 5 using the number pad. Then touch "**Enter**".
- Touch the "**Exit**"-button to leave the protein setup menu and enter the protein menu.
- Touch the "**Blank**"-button. Ensure no cuvette is in the sample compartment, and then touch "**OK**".
- Touch the "**STD**" button and enter the unit µg/ml. Press "**OK**".
- Insert the blank sample of the standard curve reference and touch "**OK**".
- Repeat the procedure 4 times.
- When the display shows "*STD CONC. 1/5*", insert the first sample, that is 20 µg/ml. Enter 20, using the number pad. Touch "**Enter**" and then "**OK**".
- Repeat the procedure 4 times until the sample has been read 5 times all together.

- When the display shows "*STD CON. 2/5*", remove the 20 µg/ml sample, and insert the 40 µg/ml sample into the cuvette holder. Enter 40, using the number pad. Touch "**Enter**" and then "**OK**".

- Repeat the procedure 4 times until the sample has been read 5 times all together.

- When the display shows "*STD CONC. 3/5*", Remove the 40 µg/ml sample, and insert the 60 µg/ml sample into the cuvette holder. Enter 60, using the number pad. Touch "**Enter**" and then "**OK**".

- Repeat the procedure 4 times until the sample has been read 5 times all together.

- When the display shows "*STD CONC. 4/5*", Remove the 60 µg/ml sample, and insert the 80 µg/ml sample into the cuvette holder. Enter 80, using the number pad. Touch "**Enter**" and then "**OK**".

- Repeat the procedure 4 times until the sample has been read 5 times all together.

- When the display shows "*STD CONC.   5/5*", Remove the 80 µg/ml sample, and insert the 100 µg/ml sample into the cuvette holder. Enter 100, using the number pad. Touch "**Enter**" and then "**OK**".

- Repeat the procedure 4 times until the sample has been read 5 times all together.

- The results from the standard curve are displayed in the protein menu with R^2-value and linear equation. The R^2-value should be >0.98.

- Touch the "**Unknown**"-button, and enter the number 1, using the number pad. Touch "**Enter**".

- Insert the 60 µg/ml reference sample in the cuvette holder and touch "**OK**". Repeat 4 times.

- To print the results, touch "**Print**". The concentration stated on the printed copy should be 60 ± 2 µg/ml.

- Touch the "**Exit**" button to end calibration and linearity test and then touch the "**Setup**"-button in the main menu to return to the system setup menu.

C-3-2. UV-Parameters

In UV-parameters you can change the number of times the xenon flash lamp flashes for a single detector reading. In order to get the best dynamic range for a reading, the number of flashes may need to be increased (default setting is 1). Increase number of flashes until the maximum digital count without noise (for a given measurement), is reached. With SpectroArt 200 it is also possible to adjust the number of times in average, that the detector reads a single measurement.

Generally, the more times a signal is read, the better signal to noise ratio can be obtained. However, a high average number means a longer measurement time.

- Touch the "**UV Param**"-button in the system setup menu.
- Enter a new flash number (1-8), using the number pad. To delete a number, touch the "**Back**"-button. Press "**Enter**".
- Enter a new average number (1-50), using the number pad. To delete a number, touch the "**Back**"-button.
- Press "**Enter**" to return to the system setup menu.

C-3-3. Touch Pad Settings

In TP-setup, it is possible to restore the touch pad settings if they have been altered. To perform TP-setup, a password is required.

- Touch "**TP Setup**" in the system setup menu.
- Enter the password using the number pad. To delete a number, touch the "**Back**"-button.
- Touch "**Enter**" and follow the instructions given:
  1. *Touch the lower left marker.*
  2. *Touch the upper right marker.*
  3. *Touch the marker labelled 1.*
  4. *Touch the marker labelled 2.*
  5. *Touch the marker labelled 3.*
  6. *Touch the marker labelled 4.*
- The new calibration data is automatically saved.

C-3-4. Printer Test

Touch the "**Printer Test**"-button in the system setup menu. SpectroArt 200 automatically prints out a sinus curve.

C-3-5. Set Default

When touching the "**Set Default**"-button in the system setup menu, SpectroArt 200 applies the default settings

C-3-6. Beep Settings

- Touch the "**Beep Setting**"-button in the system setup menu.

- To increase the beep-volume, touch the "**+**"-button next to "Sound Volume" repeatedly, until the desired volume is reached.
- To decrease the beep-volume, touch the "**-**"-button next to the "**+**"-button repeatedly, until the desired volume is reached.
- Press "**Exit**" to leave the beep-setting window and return to the system setup menu.

C-3-7. Time/Date Settings

- Touch the "**Date/Time**"-button in the system setup menu.
- Enter the year (4 digits) using the number pad. To delete a number, touch the "**Back**"-button. Touch "**Enter**".
- Enter the month (1-12) using the number pad. To delete a number, touch the "**Back**"-button. Touch "**Enter**".
- Enter the day (1-31) using the number pad. To delete a number, touch the "**Back**"-button. Touch "**Enter**".
- Enter the hour (1-23) using the number pad. To delete a number, touch the "**Back**"-button. Touch "**Enter**".
- Enter the minute (0-59) using the number pad. To delete a number, touch the "**Back**"-button. Touch "**Enter**".
- The updated time and date settings are displayed swiftly. Every time you print your results, the updated time and date settings will be included in the print-out.
- Press "**Exit**" to leave the Time/date setting window and return to the system setup menu.

C-3-8. Display Settings

- Touch the "**Display**"-button in the system setup menu.
- To increase the brightness of the LCD-display, touch the "**+**"-button next to "Brightness" repeatedly, until the desired brightness is reached.
- To decrease the brightness of the LCD-display, touch the "**-**"-button next to the "**+**"-button repeatedly, until the desired brightness is reached.
- To increase the contrast of the LCD-display, touch the "**+**"-button next to "Contrast", repeatedly, until the desired brightness is reached.
- To decrease the contrast of the LCD-display, touch the "**-**"-button next to the "**+**"-button repeatedly, until the desired contrast is reached.
- Press "**Exit**" to leave the display setting window and return to the system setup menu.

D. Quick Guide to Assays

D-1. <u>DNA/RNA</u>

This function enables measurements of double-stranded DNA, single stranded DNA and RNA. With the help of a conversion factor, that is, the concentration of nucleic acid at 1.00 absorbance units at 260 nm, and the dilution factor, the concentration of DNA or RNA in your sample can be determined. The conversion factor differs according to the type of nucleic acid that is measured. The default conversion factors used by SpectroArt 200 are 50.0 µg/ml, 37µg/ml or 40 µg/ml for double-stranded DNA, single-stranded DNA and RNA respectively. Hence, the concentration of DNA or RNA is calculated as follows;

Conc = A260 nm* conversion factor * dilution factor

Or, if 320 nm correction is enabled;

Conc = (A260 nm – A320 nm) * conversion factor * dilution factor

SpectroArt 200 measures the purity of DNA or RNA in a sample by dividing the DNA or RNA absorbance values by the absorbance of protein at 280. If 320 nm correction is enabled, the readings from this wavelength are subtracted from both DNA/RNA absorbance-values and protein absorbance-values. With SpectroArt 200 you can also measure other forms of nucleic acids at your customised wavelength with your customised conversion factor.

To measure DNA or RNA, enter the setup menu to choose dsDNA, ssDNA or RNA under "sample target". Choose whether to enable 320 nm-correction or not. Exit setup and read the blank. When you touch "**Sample**", you are asked to enter the dilution factor using the number pad. Press "**Enter**" and read the sample.

D-2. <u>Protein</u>

SpectroArt 200 has four different programmed assays for protein concentration measurements. Three of these (Bradford 595 nm, Lowry 750 nm and BCA 562 nm) are common colorimetric assays that measure changes in absorption at a fixed wavelength in the visible light region. Protein can also be measured with SpectroArt 200 within the UV-light range at 280 nm. This assay can be used when measuring protein in an environment such as a crude cell extract where nucleic acids are present. It is also possible to choose a custom wavelength anywhere in the wavelength range for other assays. To choose one of the programmed assays, enter the protein setup menu. The default setting is Bradford 595 nm. Touch the "**method**"-button in the setup

menu until your preferred assay shows. If you want to measure at other wavelength, touch the "**method**"-button until "Custom" shows. Touch the button and key in your preferred wavelength using the number pad. Next, choose the number of points in your standard curve by touching the "**STD Curve**"-button and entering a number (2-10), using the number pad. In the same way, choose number of blank repetitions (1-10), Standard curve point repetitions (1-10) and the number of times you want to run your unknown samples (1-10). Exit the protein setup menu and run your blank sample which is the media you have diluted your samples in. After blanking the spectrophotometer, touch the "**STD**"-button and enter the unit. Insert your zero-sample and touch "**OK**". When you have measured the absorbance of all of your samples in the standard curve, a graph with linear equation and R^2-value will show on the display. To measure your unknown samples, touch the "**Unknown**"-button and enter the dilution factor. When you have measured the sample, the ABS and calculated concentration will show on the display.

D-3. <u>Kinetics</u>

With the kinetics function you can follow an enzymatic reaction over time, for example the build-up of a product from a substrate. You specify the total time to measure and then at what intervals to measure within this period. Enter the setup menu to specify at what wavelength to measure, e.g. the absorbance of the build-up product. You also specify the total time you want to measure and the interval time, that is, how often the spectrophotometer reads the sample.

D-4. <u>OD600</u>

The OD600 function as applicable for monitoring. e.g. bacterial growth. Enter the OD600 setup-menu and insert the correct conversion factor for the bacteria to be measured, using the number pad. Run a blank sample and then touch the "**Sample**"-button. Insert the dilution factor using the number pad and then measure the OD600-value of your bacteria. SpectroArt 200 calculates the correct concentration of cells per ml by multiplying the OD600 value by the conversion factor and the dilution factor.

D-5. <u>Wavelength</u>

When you want to collect absorbance data quick and easy you can choose the wavelength function. This function allows you to measure the absorbance of up to 9 different wavelengths

simultaneously. Add or remove wavelengths using the number pad in the setup menu. Then scan a blank and your sample in the wavelength window.

D-6. <u>Scan</u>

With the scanning function you can analyse an unknown sample within 200 and 800 nm for either absorbance or transmittance. Enter the wavelength setup menu and choose whether to measure absorbance or transmittance by touching the "**Mode**"-button. Key in the maximum and minimum X-value, that is, the wavelength range you wish to scan. Then touch the "**Y-value**"-button to determine the maximum and minimum absorbance values. SpectroArt 200 will generate and display a spectrum with peaks found.

D-7. <u>Functions</u>

D-7-1. DNA/RNA

- Touch the "**DNA/RNA**"-button in the main menu to launch the DNA/RNA-menu.
- Enter the DNA/RNA-setup menu by touching the "**Setup**"-button.
- The default setting is dsDNA which has a conversion factor of 50.000 µg/ml. Touch the "**Sample Target**"-button once or twice to measure ssDNA or RNA respectively. The conversion factor changes automatically.
- For customised settings, touch the "**Sample Target**"-button until the nucleic acid window displays "custom". To change conversion factor, touch the "**Set Value**"-button and then key in a new value using the number pad. To delete a number, touch the "**Back**"-button. When the desired value is displayed, touch the "**Enter**"-button to return to the DNA/RNA-setup menu.
- To enable 320 nm background correction, touch the "**320 nm correction**"-button.
- Touch "**Exit**" to return to the DNA/RNA menu.
- Before you measure your sample you must blank the spectrophotometer. Touch the "**Blank**"-button and insert your blank sample into the cuvette holder. To read the blank, touch "**OK**".
- Remove the blank sample and insert the nucleic acid containing sample.

- Touch the "**Sample**"-button and key in dilution factor using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**". If you want the dilution factor to be applied to all samples, touch "**OK**", otherwise, touch "**Cancel**".

- To read you nucleic acid containing sample, touch "**OK**".

- The results are presented as follows:

  Sample ID: XX

  ABS@260 nm = XX

  ABS@280 nm = XX

  Ratio 260/280 nm = XX

  Concentration = XX µg/ml

  ABS@320 nm = XX

- To analyse more samples, touch the "**Sample**"-button and key in the new dilution factor is needed. Insert new sample into the cuvette holder and then touch "**OK**". The ID-number shown will increase by one. To scroll between readings, touch either the "**Prev**." or "**Next**"-buttons.

- Print results by touching "**Print**".

D-7-2. Protein

- Touch the "**Protein**"-button in the main menu to launch the protein-menu.

- Enter the protein setup menu by touching the "**Setup**"-button.

- The default setting is Bradford at 595 nm. To change assay, touch the "**Method**"-button once for Lowry at 750 nm, twice for BCA at 562 nm, three times for UV-protein at 280 nm or four times for UV 320 nm.

- For a customised assay, touch the "**Method**"-"button five times. Then touch the "**Change W. length**"-button and key in your desired wavelength (within 200-800 nm) using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the protein setup menu.

- To change the number of points in your standard curve, touch the "**STD Curve**"-button and key in the new number (2-10) using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the protein setup menu.

- To change the number of times the zero-sample is read, touch the "**Blank Rep.**"-button and key in the number (1-10) using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the protein setup menu.

- To change the number of times each point in your standard curve is measured, touch the "**STD Rep.**"-button and key in number (1-10) using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the protein setup menu.

- To change the number of times your unknown samples are read, touch the "**Unknown Rep.**"-button and key in new number (1-10) using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the protein setup menu.

- When your desired settings are shown in the protein setup menu, touch the "**Exit**"-button to return to the protein menu.

- Insert a blank sample (the media your protein in diluted in) and then touch "**OK**".

- Remove the blank sample and insert your zero protein-sample.

- Touch the "**STD**"-button and enter unit by touching the "**mg/ml**", "**µg/m**l" or "**µg/µl**"-button. Then touch "**OK**"

- To read the zero-sample, touch "**OK**" (If you choose to read the zero-sample more than once, repeat procedure until the STD Conc. Window is displayed).

- Enter the first protein concentration of your standard curve (the lowest concentration) using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**".

- Remove the zero-sample and insert the sample containing the lowest protein concentration of your standard curve.

- To read the first concentration in the standard curve, touch "**OK**" (If you choose you read the sample more than once, repeat the procedure for the designated number of times).

- Repeat the procedure with the second lowest, third lowest concentration etc. of your standard curve and measure for designated number of times.

- When the standard curve measurements are finished, the curve will be displayed in the protein menu together with the linear equation and R^2-value.

- To print the standard curve results, touch "**Print**". All absorbance values for each standard curve points are printed out as well as linear equation and R^2-value.

- Remove the last standard curve point sample and insert your unknown sample into the cuvette holder.

- Enter the dilution factor using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**",

- To read the unknown sample, touch "**OK**" (If you choose to read the unknown sample more than once, repeat procedure the designated number of times)

- The results are presented as follows

Sample ID: XX

CONC = XX mg/ml or μg/ml or μg/μl

- To analyse another unknown sample, touch the "**Sample**" button, insert the second unknown sample into the cuvette holder and then touch "**OK**". The ID-number will increase by one. To scroll between your unknown samples, touch either the "**Prev.**" or the "**Next**"-button.

- Print unknown sample-results and standard curve equation/R^2-value by touching the "**Print**"-button.

Save/Load: To save a standard curve result for later use, touch "**S/L**". Touch "**Save**" and key in the name of the curve from the number keypad. To change the numbers of the number pad into letters press the number-buttons repeatedly until desired letter is displayed in the field above the number pad [(1), (2,A,B,C), (3,D,E,F), (4,G,H,I), (5,J,K,L), (6,M,N,O), (7,P,Q,R,S), (8,T,U,V), (9,W,X,Y,Z), (.), (0), (-)]. Then press "**Enter**". Absorbance values for each standard curve point as well as linear equation of the curve will be saved.

When loading a standard curve, ensure that the appropriate settings (Bradford at 595 nm, Lowry at 750 nm, BCA at 562 nm, UV-protein at 280 nm, UV 320 nm or customised assay are set before loading the standard curve and measuring the unknown sample. To load a standard curve, touch "**S/L**". Touch "Load" and key in the name for the curve and please be advised some buttons needed to be pressed more than once for the desired characters to be displayed. To delete a standard curve touch "**S/L**". Touch "Delete" and key in the name for the curve.

D-7-3. Kinetics

- Touch the "**Kinetics**"-button in the main menu to launch the kinetics menu
- Touch the "**Setup**"-button to enter the kinetics setup menu.
- Touch the "**Wavelength**"-button and key in the wavelength you wish to measure at (200-800 nm) using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the kinetics setup menu.
- Touch the "**Total Time**"-button and key in the total length of the measurement in seconds (maximum 764 seconds) using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the kinetics setup menu.

- Touch the "**Sampling Interval**"-button to change the interval in which new measurements are made (minimum 3 seconds) using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the kinetics setup menu.
- When all settings you have chosen are displayed in the kinetics setup menu, touch "**Exit**" to return to the kinetics menu.
- Touch the "**Blank**"-button.
- Insert a blank sample into the cuvette holder and touch "**OK**".
- Remove the blank sample and insert the kinetics sample into the cuvette holder.
- To start the measurement, touch the "**Start**"-button and then touch "**OK**". While the spectrophotometer is measuring, the "Running Kinetics"-window is displayed. Changes in total time as well as the chosen sampling interval are shown.
- When the total time has elapsed, the kinetics menu displays a graph with the X-axis showing time and the Y-axis showing ABS.
- To get a printed copy of the absorbance values at each interval, touch "**Print**".

D-7-4. OD600

- Touch the "**OD600**"-button in the main menu to launch the OD600 menu.
- Touch the "**Setup**"-button to enter the OD600 setup menu.
- Touch the "**Convert Factor**"-button and key in the conversion factor suitable for the bacteria you are about to measure, using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the OD600 setup menu.
- When the correct conversion factor is shown in the OD600 setup menu, touch "**Exit**" to enter the OD600 menu.
- Touch the "**Blank**"-button.
- Insert a blank sample (e.g. the broth the bacteria is grown in) and touch "**OK**".
- Remove the blank and insert your bacterial cell sample into the cuvette holder.
- Touch the "**Sample**"-button and key in the dilution factor using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**".
- To read the sample, touch "**OK**".
- The results are displayed as follows:
  Sample ID: XX
  Conc = XXE+XX cells/ml
  C.F = XXE + XX, D.F. = XX

- To read more samples, exchange samples in the cuvette holder, touch the "**Sample**"-button and repeat the measuring procedure.
- The sample ID will increase by one. To scroll between the samples, touch either the "**Prev**." or the "**Next**"-button.
- To get a printed copy of the OD600 results (A_{600} value and concentration), touch the "**Print**"-button.

D-7-5. Wavelength

- Touch the "**Wavelength**"-button in the main menu to launch the wavelength menu.
- Touch the "**Setup**"-button to enter the wavelength setup menu
- The default setting is #1 260.00 and #2 280.00. To add a wavelength (maximum 9), touch the "**ADD**"-button and key in the wavelength you want to add (200 -800 nm) using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the wavelength setup menu.
- To remove a wavelength, touch the "**Remove**"-button and key in the number of the wavelength you wish to remove (200-800 nm). To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the wavelength setup menu.
- When the wavelength/s you wish to measure at are displayed in the wavelength setup menu, touch "**Exit**".
- Touch the "**Blank**"-button.
- Insert a blank sample into the cuvette holder and then touch "**OK**".
- Remove the blank sample and insert the sample you wish to analyse, then touch the "**Sample**"-button. To measure, touch "**OK**".
- The results are displayed as follows:
  Sample ID: XX
  ABS@XXX nm = XX
- To read another sample, insert new sample into the cuvette holder, touch "**Sample**" and repeat the measuring procedure.
  The sample ID-number will increase by one. To scroll between the samples, touch either "**Prev.**" or "**Next**".
- To get a printed copy of your measurements, touch the "**Print**"-button.

D-7-6. Scan

- Touch the "**Scan**"-button in the main menu to launch the scan menu.
- Touch the "**Setup**"-button to enter the scan setup menu
- To change reading mode from absorbance to transmittance, touch the "**Mode**"-button.
- To select the lower and upper wavelengths to scan within, touch the "**X Range**"-button.
- First key in the lower wavelength using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to enter the upper wavelength using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the scan setup menu.
- Next, decide within what absorbance values to scan by touching the "**Y Range**"-button. Enter the minimum absorbance value using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to key in the maximum absorbance value using the number pad. To delete number, touch the "**Back**"-button. Touch "**Enter**" to return to the scan setup menu.
- When the settings you have decided are displayed in the scan setup menu, touch "**Exit**".
- Touch the "**Blank**"-button.
- Insert a blank sample into the cuvette holder and then touch "**OK**".
- Remove the blank sample and then insert the sample to be measured.
- Touch the "**Sample**"-button and then touch "**OK**".
- The result is presented as a graph in the scan menu with wavelength on the X-axis and absorbance on the Y-axis.
- To get a printed copy of the graph with peaks found specified (wavelength and absorbance), touch "**Print**".

E. Care and Maintenance

⊃ **Cleaning Up a Fluid Spill.**

- Turn the instrument off and unplug the power cord.
- Use syringe to clean the cuvette chamber.
- Use cotton swab to dry the cuvette chamber.
- Dampen cloth with water. Use it to clean the instrument from the outside, including the display.

⊃ **Cleaning Quartz Cuvettes**

- Wash cuvettes using a dilute alkaline solution such as 0.1 M NaOH and a dilute acid such as 0.1 M HCl. Rinse cuvettes several times with distilled water. Always use clean cuvettes before taking absorbance measurements. Rigorous cleaning may be after using difficult samples. In such cases follow the manufacturer's instruction and use a suitable detergent to clean the cuvettes.

⊃ **Changing Thermal Printer Paper**

- Open the printer paper compartment lid.

- Remove the Teflon core shaft from old paper roll and insert into center hole in new paper roll.

- Lift up the side printer latch.

- Un-roll enough paper (Feed paper from bottom of roll as shown. Do not fold or crease leading edge of paper) to allow for enough space to feed leading edge of the paper into slot opening in paper storage area as shown in the picture below.

- Wind any excess paper back on roll and drop new paper roll with shaft into grooves in paper storage area as shown. Let go and lock the side printer latch.
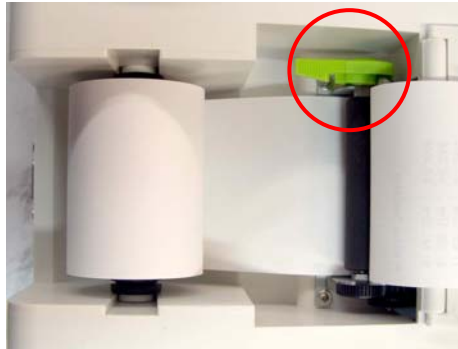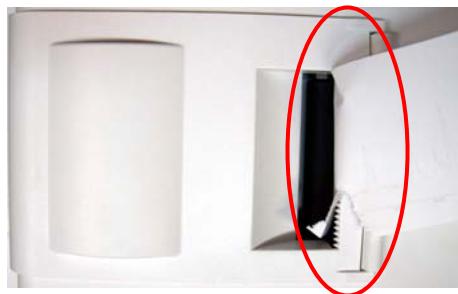
■ Close the printer paper compartment lid.

● **Tearing Paper**

■ When tearing paper off print outs, always tear paper forward against serrated edge of printer outlet as shown.

F. Order Information

SpectroArt 200 Spectrophotometer System

Item #	Description
1210000	SpectroArt 200 spectrophotometer system, 90 – 264 Vac, 47 – 67 Hz, includes power cable/1set, warranty card, thermal paper/1 roll and an instruction manual.

Optional Accessories

Item #	Description
1211001	Standard cuvette 3.5 ml, 10 mm lightpath, quartz, black wall 2pcs.
1211002	Semi-micro cuvette 1.4 ml, 10 mm lightpath, quartz black wall 2pcs.
1211003	Micro cuvette 700 µl 10 mm lightpath, quartz black wall 2pcs.
1211004	Micro cuvette 100 µl, 10 mm lightpath, quartz black wall 2pcs.
1211005	Hellma TrayCell*-Fiber-Optic Ultra-Micro Cell 5µ (68.5 mm), black wall 1 pcs.
1211006	Disposable cuvette 3.5 ml, 100 pcs.
1211007	Didymium filter/standard calibration filter 1pcs
1211008	Thermal printer paper 5 rolls.

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