

# UNICO®

## 1200 SERIES SPECTROPHOTOMETER



## USER'S MANUAL

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## **General Information**

The spectrophotometer described in this manual is designed to be used by properly trained personnel in a suitable equipped laboratory. For the correct and safe use of this spectrophotometer it is essential that laboratory personnel follow generally accepted safe procedures in addition to the safety precautions called for in this manual.

The inside of the power supply unit is a hazardous area and its cover should not be removed under any circumstances. **ANY Servicing** must be done by an authorized person.

Some of the chemicals you use in the spectrophotometer may be corrosive, flammable, radioactive, toxic, and/or potentially infective. Care should be taken to follow the normal laboratory procedures for handling chemicals and samples. Please carefully read the **Safety, Electrical, Warning, Performance** and **Radio Interference** instructions below.

### **Safety**

This spectrophotometer has been designed and tested in accordance with EN 61326-1: 1997 Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use standard (EMC Requirements). The spectrophotometer has been tested and supplied in a safe condition.

The safety statements in this manual comply with the requirements of the HEALTH AND SAFETY AT WORK ACT, 1974.

Read the following before installing and using the instrument and its accessories.

### **Electrical**

Before switching on the spectrophotometer, make sure it is set to the voltage of the local power supply (see **Installation** section).

The main plug shall be inserted in a socket provided with a protective earth grounded contact. The protective action must not be negated by the use of an extension cord without a protective conductor.

### **Warning**

Any interruption of the protective conductor inside or outside the spectrophotometer or disconnection of the protective earth terminal is likely to make the spectrophotometer dangerous. Intentional interruption is prohibited. Whenever it is likely that the protection has been impaired, the spectrophotometer shall be made inoperative and be secured against any unintended operation.

The protection is likely to be impaired if, for example, the spectrophotometer

- Shows visible damage
- Fails to perform the intended measurements
- Has been subjected to prolonged storage under unfavorable conditions
- Has been subjected to severe transport stresses

## Performance

Carry out performance checks with particular reference to wavelength and absorbance accuracy to ensure that the spectrophotometer is working within its specification, especially when making measurements of an important nature. Performance checks are detailed in this manual.

## Radio Interference

For compliance with the EMC standards referred to in the EC Declaration of Conformity, it is necessary that only shielded cables supplied by **UNICO**<sup>®</sup> are used when connecting the instrument to computers and accessories.

## Introduction

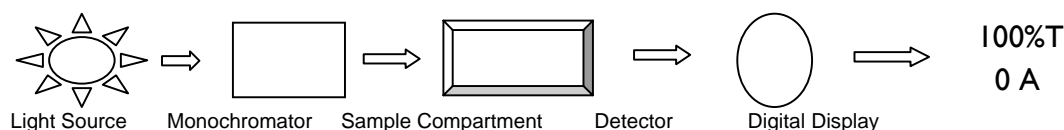
The newly redesigned **UNICO**<sup>®</sup> **1200/1201** Spectrophotometers are single beam, general purpose instruments designed to meet the needs of the conventional laboratory. **UNICO**<sup>®</sup> **1200/1201** is ideal for various applications, such as: Clinical Chemistry, Biochemistry, Petrochemistry, Environmental Protection, Food and Beverage Labs, Water and Waste Water Labs, and other fields of quality control.

Featuring a digital display of photometric result, easy operation, and wavelength range of **325 nm~1000 nm**, **UNICO**<sup>®</sup> **1200/1201** are ideal for measurements in the visible wavelength region of the electromagnetic spectrum.

## Working Principle

The spectrophotometer consists of five parts:

- 1) **Light Source** (Halogen Lamp) to supply the light;
- 2) **A Monochromator** to isolate the wavelength of interest and eliminate the unwanted second order radiation;
- 3) **A Sample Compartment** to accommodate the sample solution;
- 4) **A Detector** to receive and convert the transmitted light to an electrical signal;
- 5) **A Digital Display** to show absorbance or transmittance. Figure-1 illustrates the relationship between these parts.



**Figure-1** Block Diagram for the Spectrophotometer

In the spectrophotometer, light from the Halogen Lamp is focused on the entrance slit of the Monochromator where the collimating mirror directs the beam onto the grating. The grating disperses the light beam to produce the spectrum, a portion of which is focused on the exit slit of the Monochromator by a collimating mirror. From here the beam is passed to a Sample Compartment through one of the filters, which helps to eliminate unwanted second order radiation from the diffraction grating. Upon leaving the Sample Compartment, the beam is passed to the silicon photodiode Detector and causes the Detector to produce an electrical signal that is shown on the Digital Display window.

## Specifications

Table-1 lists the specification for both **1200** and **1201**.

Table-1 Specifications

	<b>Model 1200</b>	<b>Model 1201</b>
Wavelength Range	325~1000 nm	
Spectral Bandpass	5 nm	
Wavelength Accuracy	± 2 nm	
Wavelength Repeatability	± 1 nm	
Stray Radiant Energy	< 0.5%T at 340 and 400 nm	
Photometric Range	0~125%T 0~2.0 Abs 0~1999C (0~1999 Factor)	
Photometric Accuracy	± 1.0%T	
Power Requirements	115/230 V ±10%, 60/50 Hz switchable	
Sample Holder	Single Test Tube/Cuvette	4-position Cuvette Holder
Dimensions	415W x 320D x 175H (mm) (16-1/2 x13 x 6-3/4 inches)	
Net Weight	6.5 kg (15 lbs)	

## Unpacking Instructions

Carefully unpack the contents and check the materials against the following packing list to ensure that you have received everything in good condition.

### **Packing List**

Refer to Table-2 for the **Packing List**.

Table-2 Packing List

<b>Description</b>	<b>Quantity</b>	
	<b>Model 1200</b>	<b>Model 1201</b>
<b>Spectrophotometer</b>	1	1
<b>Dust Cover</b>	1	1
<b>10 mm Optical Square Cuvette</b>	2	2
<b>Test Tubes (1/2 inch)</b>	Box of 12	-
<b>V-type Tube Holder (8 to 25 mm)</b>	1 (installed)	-
<b>10 mm Single Cuvette Holder</b>	1	-
<b>Black Block</b>	1	1
<b>4-position Cuvette Holder</b>	-	1 (installed)
<b>Power Cord</b>	1	1
<b>User Manual</b>	1	1

## Installation

1. Place the instrument in a suitable location away from direct sunlight. In order to have the best performance from your instrument, keep it as far as possible from any strong magnetic or electrical fields or any electrical device that may generate high-frequency fields. Set the unit up in an area that is free of dust, corrosive gases and strong vibrations.
2. Remove any obstructions or materials that could hinder the flow of air under and around the instrument.
3. Select either **230V** or **125V** on the Voltage Selector Switch on the bottom of the **1200/1201** shown in Figure-2, to match your local main voltage supply.
4. Turn on your **UNICO® 1200/1201** and allow it to warm up for 15 minutes before taking any readings.

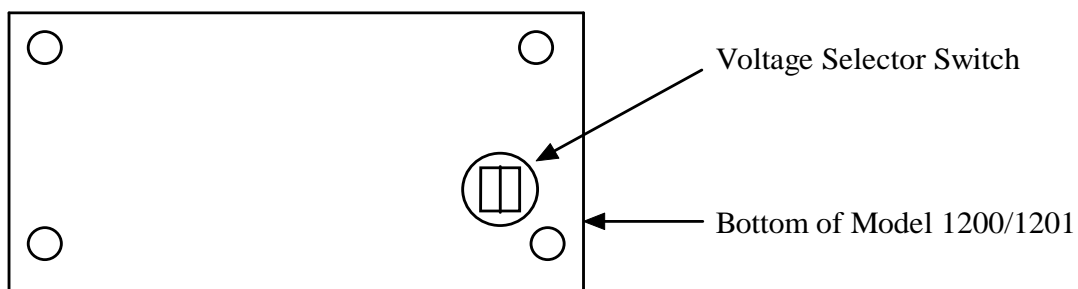


Figure-2 Bottom of **UNICO® 1200/1201**

## 1200 and 1201 Spectrophotometer Operation Panel

**Mode Indicator:** Show the current measurement mode (**T**--%Transmittance, **A**--Absorbance, **C**--Concentration, and **F**--Factor) (refer to Figure-3).

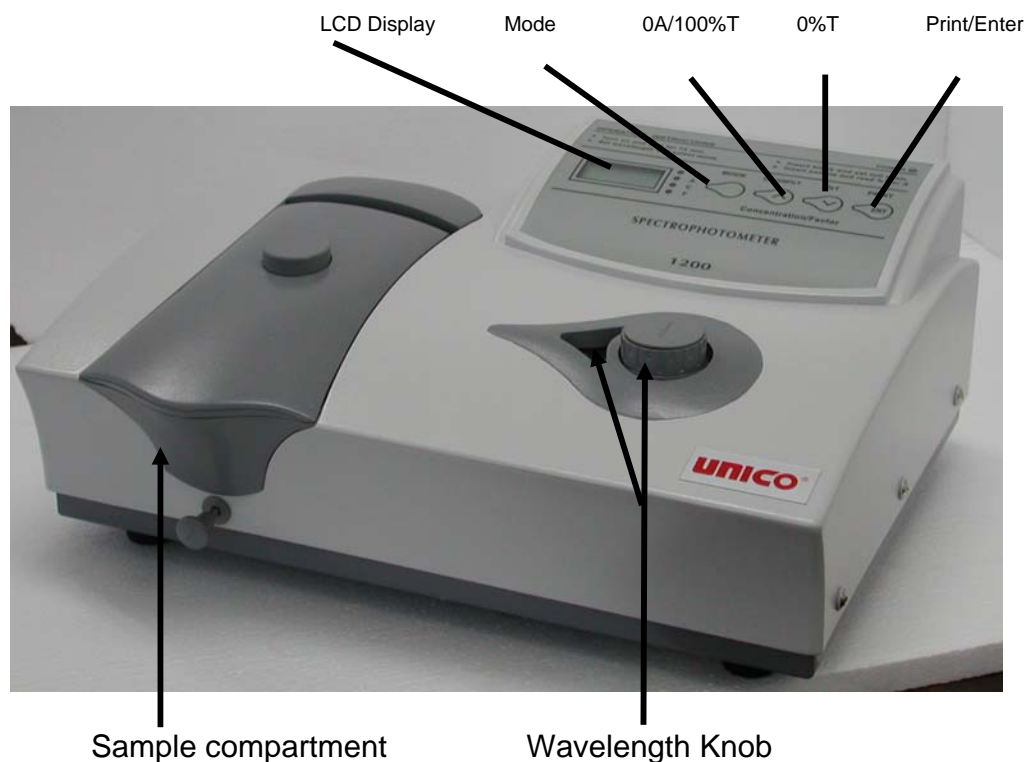


Figure-3 UNICO® 1200 Spectrophotometer

**MODE** Button: *There are four modes.*

- **T** mode is transmittance mode;
- **A** mode is absorbance mode;
- **C** mode is to measure unknown sample concentration through a standard solution;
- **F** mode is to measure unknown value with a previously determined factor.

**Λ** (0A/100%T) Button: *Adjust Digital Display reading to 100%T or 0.000A when blank reference solution is in the Sample Compartment.*

**v** (0%T) Button: *When in **T** mode, put **S-1200-111** into the Cuvette Holder to block the optical light beam. Press **v** button to adjust the Digital Display reading to 00.0%T.*

**ENT** (PRINT) Button: *When pressed:*

*At **A** and **T** modes, send the displayed results to printer;  
At **C** mode, set the concentration value (refer to **Concentration Mode** in **Basic Operation** section);*

At **F** mode, set the factor number and change to **C** mode (refer to **Factor Mode** in **Basic Operation** section);

If you want to print the test results at **C** mode, push the **MODE** button to the position when the LED light is off, then push the **ENT** button;

If connected with a PC using **UNICO**<sup>®</sup> Windows-based Application Software, the communication with the PC will be set up (refer to the **UNICO**<sup>®</sup> **1200 Series Spectrophotometer Software User's Manual Version SS-1.22** for details).

**Sample Compartment:** Accept 10 mm test tube or 10 mm square cuvette (with different cuvette holders). The compartment can accept up to 50 mm pathlength cuvettes with optional holders.

**WAVELENGTH** (Wavelength Control) Knob: Select desired wavelength in nanometers (nm).

**Wavelength Readout Window:** Display desired wavelength.

### Changing Cuvette Holders

There are five different **Cuvette Holders (Sample Holders)** (refer to Figure-4 from left to right):

- **S-1200-101:** Test Tube V-type Cuvette Holder with base for 8~25 mm Diameter Test Tubes
- **S-1200-102:** Single Square Cuvette Holder with base for 10 mm Cuvettes
- **S-1200-103:** 4-position Cuvette Holder for 10 mm Square Cuvette
- **S-1200-104:** Longpath 4-position Cuvette Holder for up to 50 mm rectangular Cuvettes
- **S-1200-105:** Water-jacketed Cuvette Holder with base and panel for temperature controlled application

**S-1200-101**, **S-1200-102**, and **S-1200-105** all consist of two parts: the upper holder and the identical universal base (**S-1200-106:** Universal base for V-type holder, Single Cuvette Holder and water-jacketed Holder). Follow the steps below to replace a **4-position Cuvette Holder** (Figure-5) with a **V-type Tube Holder (Test Tube Holder)**. The only tool needed is a standard **Philips** head screwdriver.

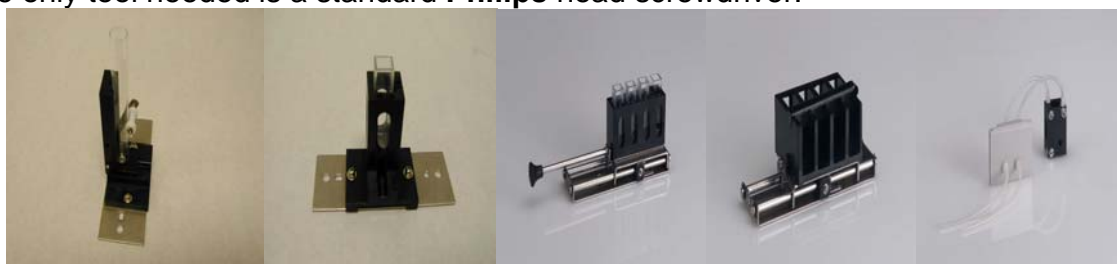


Figure-4 **Sample Holders** for Model 1200/1201





Figure-5 **4-position Cuvette Holder with Base**

- Step 1 **Remove 4-position Cuvette Holder Rod.** Unscrew the **4-position Cuvette Holder Rod** by turning the knob counterclockwise until it was removed from the **Holder**. Gently slide the guide rod out of the Sample Compartment.
- Step 2 **Locate the Front Screw of the Holder Base.** Open the cover of the Sample Compartment, remove any cuvettes or any breakable items, push in the **Cuvette Holder Rod** (black knob) all the way back (the first position is into the light beam), and locate the **Front Screw** of the **4-position Cuvette Holder** shown in Figure-6.
- Step 3 **Remove Front Screw of the Holder Base.** Look over the Sample Compartment, remove the **Front Screw**.
- Step 4 **Remove Back Screw of the Holder Base.** Place your hand **ON TOP** of the **4-position Cuvette Holder** and gently slide towards the front. The back screw is then exposed and can be removed.
- Step 5 **Take out 4-position Cuvette Holder and insert V-type Tube Holder.** Simply take out the **4-position Cuvette Holder** from the **V-type Tube Holder** and insert the **V-type Tube Holder** into it.
- Step 6 **Install V-type Tube Holder.** Locate the **Front and Back Screws** of the **V-type Tube Holder Base** and fasten them.

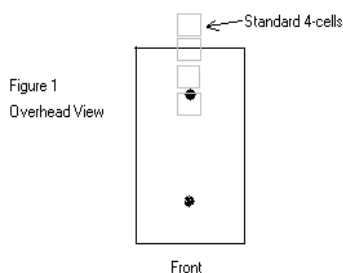


Figure-6 **Changing Cuvette Holders**

## Basic Operation

Simple **OPERATION INSTRUCTIONS** are printed on the front panel of your **UNICO® 1200/1201**. Three Basic Operations: **Sample Preparation and Analysis**, **Concentration Mode-C**, and **Factor Mode** are shown in this section.

### **Sample Preparation and Analysis**

#### **A. Spectrophotometer Warm-up and 0%T Check**

1. Turn on the spectrophotometer by turning on the Power Switch (**IO**). Allow 15 minutes for the instrument to warm up.
2. Even though the **0%T** is pre-set at **UNICO®**; it may shift due to unexpected factors like temperature change. To check **0%T**, simply insert the **Black Block** (item number: **S-1200-111**, used to check the **0%T**) into the Cuvette Holder and close the lid. Select **T** mode, the display should be 00.0%T. If not, press the **0%T** button to set **0%T**.

**NOTE:** *If you lose the **Black Block**, you may use any opaque object to block the light beam to the detector to carry out **0%T Check**.*

3. Select either the **T** (Transmittance Mode) or **A** (Absorbance Mode) by pressing the **MODE** button until the red light for **T** or **A** is on.

#### **B. Sample Preparation**

4. Select the desired wavelength by turning the **WAVELENGTH** control knob.
5. Make a blank reference solution by filling a clean square cuvette (or test tube) half full with distilled/de-ionized water or other specified solvent. Wipe the cuvette with tissue to remove the fingerprints or droplets of liquid.
6. Insert the blank cuvette into Sample Compartment and close the cover.
7. Set 0.000A or 100%T with the **0A/100%T** ( $\wedge$ ) button.

**NOTE:** *This step fulfills the instruction on the front of the spectrophotometer (Set Full Scale).*

8. Remove the blank square cuvette or test tube. Set it aside in case that you may need to adjust the 0A/100%T using  $\wedge$  button later (i.e. change the wavelength).

#### **C. Sample Analysis**

9. Rinse a second square cuvette with a small amount of the sample solution to be tested. Fill the square cuvette half full and wipe it.
10. Put the sample cuvette in the Sample Compartment. Close the cover.
11. Read the **T** or **A** from the Digital Display window. Remove the sample cuvette or test tube.
12. If you are to test the same sample at other wavelengths, repeat **step 4 to 10** for each wavelength.
13. For each new sample you analyze, repeat **step 3 to 11**.

## Concentration Mode

**C** is used for determining the concentration of unknown samples.

**NOTE:** *This method should only be used when the relationship between Absorbance and Concentration is known to be linear. The concentration of the Standard solution used to calibrate the instrument should be higher than the most concentrated sample.*

1. Select the desired wavelength by turning the wavelength control knob.
2. Using the **MODE** button, select **A** mode.
3. Insert the cuvette containing the blank solution.
4. Set 0.000A with the  $\wedge$  button.
5. Using the **MODE** button, select **C** mode.
6. Insert a cuvette containing a standard solution of known concentration in the Sample Compartment and set the Digital Display window to be the value of the standard by using the  $\wedge$  and  $\vee$  buttons.
7. Press the **ENT** button.

**NOTE:** *If the reading changes, the factor required is too high (i.e. >1999) to be displayed. In this case, divide the concentration by 10; re-select the **C** mode by successive presses on the **MODE** button, cycling through the **F**, **T**, and **A** modes, and follow **step 2** above to set the concentration of the standard to the reduced value.*

8. With the standard concentration set, determine the concentration values of samples with unknown concentration by inserting the sample cuvette into the Sample Compartment and reading the value direct from the Digital Display.
9. To read the value of the multiplier used to convert Abs to Concentration, after measuring all the samples, change the mode to **F** and read the multiplier from the display. Keep a record of this value for future use.

**Operational Note:** *if the **MODE** is changed to read **F** or **A** and the Concentration **C** reading is "frozen", re-start at **step 1**.*

## Factor Mode

This is a special mode for measuring concentration values of unknown samples using a previously determined factor to convert absorbance readings to concentration.

1. After setting the wavelength, and setting zero Abs on the blank solution, using the **MODE** button, select **F** mode.
2. Insert a cuvette containing a sample.
3. Using the  $\wedge$  and  $\vee$  buttons, set the Digital Display window to the desired value of the multiplier.
4. Press the **ENT** button. The spectrophotometer switches to the **C** mode.

**Operational Note:** *If the Concentration of the sample is too high to be displayed, the instrument will not switch to **C** mode when the **ENT** button is pressed. Dilute the sample and multiply the concentration reading by the dilution factor to obtain the original sample concentration. If dilution is impossible or causes other problems, you may divide the*

factor value by “10” or “100” and follow **step 1 to 4** to enter the “new” factor value. You need to calculate the sample concentration by multiplying readout with the multiple “10” or “100”.

5. Read the concentration value of the sample direct from the display.
6. Insert a cuvette containing the next sample and read the result. Repeat until all samples have been measured.

**Operational Note:** if the **MODE** is changed to read **A** or **T** and the Concentration **C** reading is “frozen”, re-start at **step 1**.

## **Output and Data Processing**

### **Printer**

Model **1200/1201** Model has a RS232C Interface connector that can be connected to any RS232 printers (**UNICO**<sup>®</sup> provides RS232 printer, item number: **S-1100-206**, as an optional accessory). It requires a 9-pin, null modem connection cable. The RS232 Printer Setting should be as follows:

- **Baud Rate:** 9600 bps
- **Parity:** None
- **Data Bits:** 8
- **Stop Bit:** 1

### **UNICO<sup>®</sup> Application Software**

The **UNICO<sup>®</sup> Application Software--VIS1200** is Windows-based software designed to operate with **UNICO<sup>®</sup> Spectrophotometer Model 1200/1201**. **1200/1201** uses its RS232C Interface connector to connect with a PC. The software runs on a PC with 95/98/Me/NT/2000/XP operating system installed. The Software offers two additional analytical methods: **Standard Curve** and **Absorbance vs. Time Kinetics**. It performs the following methods for analysis:

- **Absorbance/%Transmittance/Concentration:** measure the Absorbance, %Transmittance, Concentration/Standard, or Concentration/Factor at a single wavelength within the range of **325~1000 nm**
- **Standard Curve:** create a calibration curve (choice of 4 curve fits) with up to 8 standard solutions at a single wavelength to determine concentrations of unknown samples
- **Absorbance vs. Time Kinetics:** measure a sample’s absorbance change over a selected period of time, store the test results in data table, display the results graphically, and calculate the reaction rate within a given time interval

Refer to the **UNICO<sup>®</sup> 1200 Series Spectrophotometer Software User’s Manual Version SS-1.22** for detail.

## **Maintenance**

### **Lamp Replacement**

1. Turn off and unplug the instrument.
2. Remove the lamp access door at the back of the instrument by removing the four set screws.
3. Unplug the lamp from the white connector. Insert the new lamp; pushing it in as far as it will go. Replacement lamp: Item Number: **S-1200-505** (6V 10W G4 type)

**CAUTION:** DO NOT HANDLE THE LAMP WITH BARE FINGERS. USE TISSUE OR CLOTH WHEN HANDLING LAMP.

4. Turn on the instrument. Set the wavelength at 340 nm, insert a test tube or an empty cuvette with cuvette holder, and blank the instrument. If the energy is low, adjust the lamp by “pulling” or “pushing” it so that the light beam is focused on the entrance slit of the monochromator. Since the lamp socket is pre-aligned, there will be minimum, if any, adjustment required.
5. Re-install the lamp access door.

### **Wavelength Calibration Check**

Normally the **UNICO® 1200** Series spectrophotometer retains its wavelength calibration indefinitely. However if the instrument receives a severe shock or is abused, use the following methods to check wavelength calibration. Please note that this test requires the **UNICO®** Didymium filter, item number **S-2100-116**, or the Holmium Oxide filter, item number **S-2100-115**.

In the filter method, the didymium filter has two distinct absorbance peaks at 529 nm and 807 nm. The Holmium filter has a distinct peak at 361 nm. When the instrument is calibrated properly you will find minimum Transmittance (maximum Absorbance) at the range  $\pm 2$  nm from these peaks. Note that the specific Transmittance values are not important as you are only looking for the wavelength where the minimum Transmittance (maximum Absorbance) occurs.

**Note:** *If you calibration filter has a certified peak/valley curve attached, please use the peaks on the curve to verify the instrument.*

### **Holmium Oxide Filter Method**

1. Turn instrument on and allow it to warm up for 15 minutes.
2. Select the **A** mode.
3. Set the wavelength to 350 nm.
4. Make sure the Cuvette Adapter is empty and place it in the Sample Compartment. Close the lid.
5. Set zero Absorbance by pressing the  button. Wait a few seconds when the display flashes. The reading should be 0.000A. If not, repeat **step 5**.

6. Remove the Cuvette Adapter and insert the Holmium filter into it. Place it in the Sample Compartment again and close the lid.
7. Record the Absorbance reading on the Digital Display window.
8. Advance the wavelength setting by 1 nm and repeat **step 4 to 7**.
9. Repeat **step 8** until the wavelength setting reaches 370 nm.
10. Look for the maximum absorbance reading obtained, and this should be found within 359~363 nm. The wavelength accuracy of the **1200** is  $\pm 2$  nm.

### ***Didymium Filter Method***

1. Set the Wavelength to 800 nm.
2. Make sure the cuvette adapter is empty and place it in the Sample Compartment. Close the lid.
3. Set zero Abs by pressing the  $\square$  button. Wait a few seconds when the display flashes. The reading should then be 0.000A. If not, repeat **step 3**.
4. Remove the cuvette adapter and insert the Didymium filter into it. Place it in the Sample Compartment again and close the lid.
5. Record the Absorbance reading on the Digital Display window.
6. Advance the wavelength setting by 1nm and repeat **step 2 to 5**.
7. Repeat **step 6** until the wavelength setting reaches 815 nm.
8. Look for the maximum absorbance reading obtained, and this should be found within 805~809 nm. The wavelength accuracy of the **1200** is  $\pm 2$  nm.
9. If a "middle" wavelength check is desired, set the wavelength to 522 nm (optional)
10. Make sure the Cuvette Adapter is empty and place it in the Sample Compartment. Close the lid.
11. Set zero Abs by pressing the  $\wedge$  button. Wait a few seconds when the display flashes. The reading should be 0.000A. If not repeat **step 11**.
12. Remove the Cuvette Adapter and insert the Didymium filter into it. Place it in the Sample Compartment and close the lid.
13. Record the absorbance reading on the Digital Display window.
14. Advance the wavelength setting by 1 nm and repeat **step 10 to 13**.
15. Repeat **step 14** until the wavelength setting reaches 536 nm. Again, look for the maximum absorbance reading. It should be within 527~531 nm.

### **Absorbance Accuracy Check**

Specification:  $\pm 1\%$  at 1A

The absorbance accuracy should be checked against a set of neutral density filters accurately calibrated to the NIST standards. Contact your **UNICO**<sup>®</sup> representative for more information (**800-588-9776 or 732-274-1155**).

An alternative method using potassium dichromate is described below. Due to the many factors that might affect the results (i.e. temperature, bandpass, weighing and diluting errors), this method is less accurate and should only be used as a guide.

Reference: Johnson E A

Potassium Dichromate as an absorbance standard

PSG Bulletin 1967, No. 17, page 505

1. Make up N/100 sulfuric acid as the solvent and use part of it to make a solution containing 120 + 0.5 mg/l of potassium dichromate.
2. Wash out a square cuvette with solvent, and fill with solvent.
3. Put the cuvette in the Cuvette Adapter, then into the Sample Compartment and close the lid.
4. Set the wavelength to 350 nm.
5. Set the **MODE** button to **A**.
6. Set the reading to 0.000A using the  $\square$  button.
7. Empty the cuvette. Wash out with dichromate solution, and fill with dichromate solution.
8. Put the cuvette in the Cuvette Adapter, then into the Sample Compartment and close the lid.
9. Read the absorbance of the standard from the Digital Display window. The value should be  $1.288 \pm 0.04$  A. Refer to the notes above when interpreting the result.

### Stray Light Check

Specification: Less than 0.5%T at 340 nm by ASTM E 387

A good indication as to whether the stray light level is within specification may be obtained as follows:

1. Set the wavelength to 340 nm.
2. Set the **MODE** button to **T**.
3. With the square Cuvette Adapter in the Sample Compartment, but no cuvette, close the lid and press the  $\square$  button to set the display to 100.0%.
4. Remove the Cuvette Adapter from the Sample Compartment and close the lid. Make a note of the reading that should be at or near 0.00.
5. Prepare a solution containing 50 g/l of sodium nitrite ( $\text{NaNO}_2$ ) in distilled water and fill a square cuvette with this solution.
6. Insert the cuvette into the Cuvette Adapter, place it in the Sample Compartment, and close the lid. The display should read < 0.5%T. If the reading obtained in **step 4** is greater than 0.00, it should be subtracted from the displayed reading to give the correct reading for the stray light value.

## 1200 and 1201 Parts List

Table-3 1200 and 1201 Parts List

Item Number	Description
S-1200	<b>UNICO®</b> Model <b>1200</b> Spectrophotometer 5 nm Bandpass
	Wavelength range: 325~1000 nm. Voltage preset at 110V
	Complete with 10 mm single Square Cuvette Holder, V-type Holder for 5~10 mm round tube, a pair of Glass Cuvettes, 12 pcs. of 10 mm Test Tubes
	RS-232C Port, Dust Cover, User Manual
S-1200-E	Same as Model <b>1200</b> but preset at 220 V
S-1201	<b>UNICO®</b> Model <b>1201</b> Spectrophotometer 5 nm Bandpass
	Wavelength range: 325~1000 nm. Voltage preset at 110V
	Complete with 4-position Cuvette Holder for 10 mm Square Cuvettes, a pair of Glass Cuvettes
	RS-232C Port, Dust Cover, User Manual
S-1201-E	Same as Model <b>1201</b> but preset at 220 V
<b>Software</b>	
S-1200-401	<b>UNICO®</b> Application Software for PC's, Window's 95®/98® or above Required. Programs include Standard Curve, Abs./%T/Conc., and Abs.vs.Time. Includes <b>S-2100-226</b> cable
<b>Accessories</b>	
S-1200-101	Test Tube V-type Cuvette Holder with base for 8~25 mm diameter Test Tubes
S-1200-102	Single Square Cuvette Holder with base for 10 mm Cuvettes
S-1200-103	4-position Cuvette Holder for 10 mm Square Cuvette
S-1200-104	Longpath 4-position Cuvette Holder for up to 50 mm rectangular Cuvettes
S-1200P-105	Water-jacketed Cuvette Holder with base and panel for temperature controlled application
S-1200-106	Universal base for V-type holder, Single Cuvette Holder and water-jacketed Holder
S-1200-111	Black Block to set 0%T
S-2100-115	Holmium Oxide Filter 10 mm x 10 mm x 45 mm
S-2100-116	Didymium Filter 10 mm x 10 mm x 45 mm
<b>Output Devices</b>	
S-1100-206	Printer (requires <b>S-1100-207</b> cable)
S-1100-207	Printer Cable (male 25 pin to female/female, Null Modem)
S-2100-226	RS-232C cable (9-pin to 9 pin, female/Female, Null Modem)
<b>Glassware</b>	
S-90-301	Test Tube Cuvettes, 10 mm diameter, 12 pcs.
S-90-302P-100	Disposable Cuvette, Polystyrene, 10 mm pathlength, 100 pcs.
S-90-302P-500	Disposable Cuvette, Polystyrene, 10 mm pathlength, 500 pcs.
S-90-304G	Square Cuvettes, Optical Glass, Set of 2
S-90-305P	Disposable semi-micro Cuvette, Polystyrene, 10 mm pathlength, 500 pcs.
<b>Misc. and Replacement Items</b>	
S-1100-101	Experiment manual includes safety in the lab, instructor guide
S-1100-505	Tungsten-Halogen Lamps, Package of 2 (6V 10W G4 type)
S-1100-508	Printer Paper, Package of 3
S-1200-511	User Manual
S-1200-512	Dust Cover
S-1200-513	Fuse, 3A, quantity 1 (size 5 x 20)
S-1200-520	Service Manual



## Troubleshooting

Table-4 Troubleshooting

<b>PROBLEM</b>	<b>Possible Cause</b>	<b>Solution</b>
<b>Instrument Inoperative (Power indicator has no light)</b>	Power cord not connected to outlet	<i>Plug instrument in</i>
	Dead Power outlet Wrong voltage setting	<i>Change to a different outlet</i>
	Internal fuse blown or defective electronic component	<i>Call an authorized service engineer</i>
<b>Instrument can not set 100%T (0.000A)</b>	No Cuvette Adapter in the Sample Compartment	<i>Cuvette Adapter must be in Sample Compartment to open sample holder shutter</i>
	Light beam blocked: <ul style="list-style-type: none"> <li>• Holder misaligned</li> <li>• Shutter</li> </ul>	<i>Check sample holder</i>
	Lamp is old or defective	<i>Replace lamp</i>
	Lamp is off alignment	<i>Refer to Lamp Replacement instructions in this manual</i>
	Defective electronic component	<i>Call an authorized service engineer</i>
<b>%T can not be set to 00.0%T</b>	Sample holder	<i>Remove Cuvette Adapter or test tube</i>
	Sample holder shutter	<i>May be stuck open Close shutter</i>
	Defective electronic component	<i>Call an authorized service engineer</i>
<b>Incorrect Transmittance to Absorbance correlation</b>	Bubbles or particles in solution	<i>Check sample preparation and analytical procedure</i>
	Defective electronic component	<i>Call an authorized service engineer</i>
<b>Digital Display does not change regardless of sample concentration</b>	Concentration reading "frozen"	<i>Change MODE from C to F, T or A and back to C Restart measurement procedure</i>
	Wrong wavelength setting	<i>Check sample procedure and wavelength setting</i>
	Insufficient sample volume	<i>Fill cuvette with more samples</i>
	Stray sample preparation vapors	<i>Prepare the sample away from the instrument. Use proper ventilation</i>
	Bubbles or particles in solution	<i>Check sample preparation and analytical procedure</i>
	Defective electronic component or loose wiring	<i>Call an authorized service engineer</i>

Table-4 Troubleshooting  
(continued)

<b>Instrument drift and noise</b>	No sufficient warm up time Significant temperature change Lamp not adjusted properly	<i>Check lamp has been properly installed or has moved during transit Refer to Lamp Replacement instructions in this manual</i>
	Lamp old or defective	<i>Replace with a new lamp</i>
	Sample Holder Misaligned	<i>Refer to Lamp Replacement instructions in this manual</i>
	Unstable power supply Defective or dirty detector or defective electronic component	<i>Call an authorized service engineer</i>
<b>Incorrect readings obtained</b>	Insufficient sample volume	<i>Fill cuvette with more samples</i>
	Wrong wavelength setting Failed to blank (0A/100%T) Failed to set 0%T	<i>Check analytical procedure and wavelength setting Check wavelength accuracy according to procedure in this manual</i>
	Stray sample preparation vapors	<i>Prepare sample away from instrument. Use proper ventilation</i>
	Bubbles or particles in solution	<i>Check sample preparation and analytical procedure</i>
	Instrument out of electronic calibration	<i>Call an authorized service engineer</i>

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