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ScholAR™ Chemistry

Model 1208

SPECTROPHOTOMETER

User Manual

Version 1.0

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New York 14586,USA

Http://www.scholarchemistry.com

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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 **Scholar Chemistry** are used when connecting the instrument to computers and accessories.

Introduction

The newly redesigned **Scholar Chemistry 1208** Spectrophotometers are single beam, general purpose instruments designed to meet the needs of the conventional laboratory. **Scholar Chemistry 1208** 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**, **Scholar Chemistry 1208** 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.

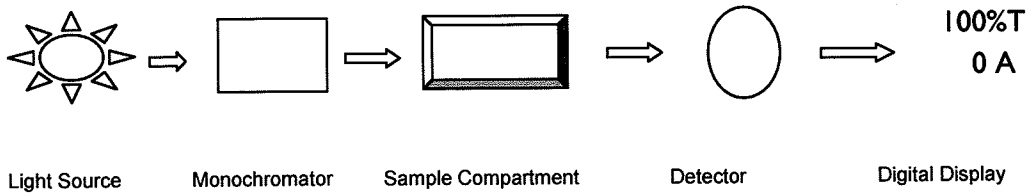


Figure-1 Block Diagram for the Spectrophotometer

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 **1208**.

Table-1 Specifications

	Model 1208
Wavelength Range	325~1000 nm
Spectral Bandpass	8 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 -9999~9999C (-9999~9999 Factor)
Photometric Accuracy	± 1.0%T
Power Requirements	80-240 V ac, 50-60 Hz
Sample Holder	Single Test Tube/Cuvette or 4-poisiton Cuvette Holder
Dimensions	420W x 340D x 180H (mm)
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

Description	Quantity
	Model 1200
Spectrophotometer	1
Dust Cover	1
10 mm Optical Square Cuvette	2
Test Tubes (1 / 2 inch)	Box of 12
Tube & Cuvette (2 in 1)Holder	1 (installed)
Power Cord	1
User Manual	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. Turn on your **Scholar Chemistry** and allow it to warm up for 15 minutes before taking any readings.

1208 Spectrophotometer Operation Panel

Mode Indicator: *Show the current measurement mode (**T**--%Transmittance, **A**--Absorbance, **C**--Concentration, and **F**--Factor)* (refer to Figure-2).

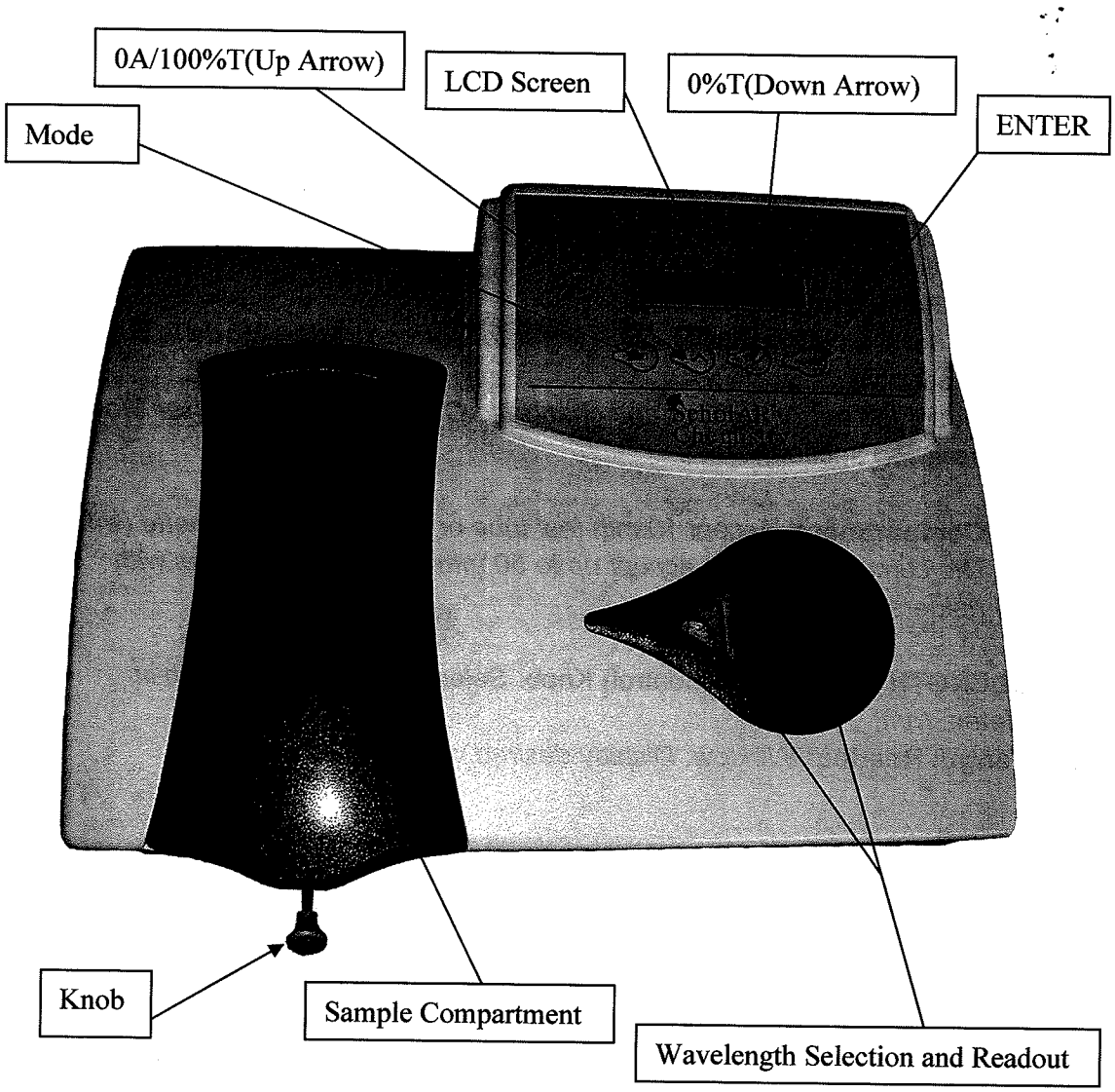


Figure-2 **Scholar Chemistry 1208** Spectrophotometer

MODE Button: *There are three modes.*

- ***T /A** mode is transmittance and 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.*

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

▼ (0%T) Button: At ***T*** *mode and with 0%T block in the cell holder, Press 0%T▼ button to set 00.0%T as shown in Figure 3.*

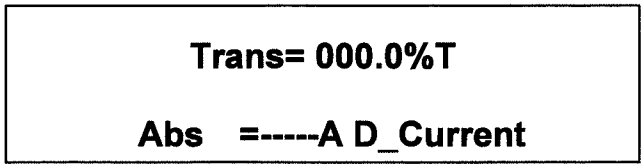


Figure 3

ENTER Button: *When pressed:*
*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);*

Sample Compartment: *Accept 10 mm test tube or 10 mm square cuvette (with one holder). 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.*

Basic Operation

Simple **OPERATION INSTRUCTIONS** are printed on the front panel of your **Scholar Chemistry 1208**. Three Basic Operations: **%T/Abs mode**, **Concentration Mode**, and **Factor Mode** are shown in this section.

Power on 1208 and Warm Up

Turn on the spectrophotometer by turning on the Power Switch (**IO**), the screen first displays the model number and version as Fig.4 and then shows "warming up..." as Fig.5. You can wait for 15 minutes or press **ENTER** to skip warm up. Then 1208 automatically goes to Main Screen (%T/Abs mode) (Fig.6).

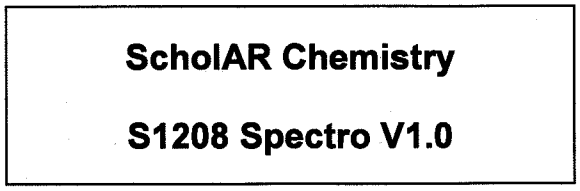


Fig.4

Fig.5 Warm up 15 minutes

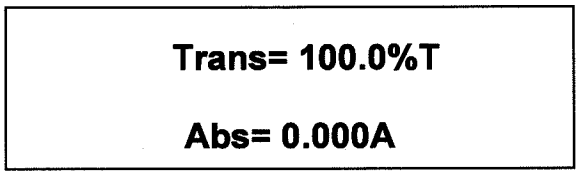


Fig.6 Main Screen (%T/Abs mode)

Sample Preparation and Analysis (%T/Abs mode)

A. 0%T Check.

Even through the **0%T** is pre-set; it may shift due to unexpected factors like temperature change. *At **T** mode, Press* **v** *button, follow the screen instruction (Figure 7. 1208 will collect the dark current (Figure 8), and then adjust the Digital Display reading to 00.0%T displayed as Figure 3.*

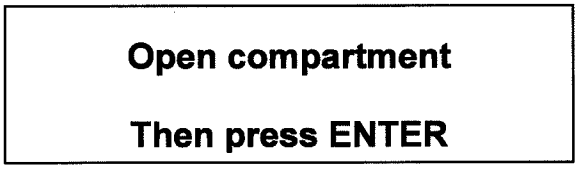


Figure 7

Figure 8

Note: There is a shutter installed in compartment of 1208.When you open the compartment,the shutter will block the optical light beam.

B. Blank with Reference (Set 100%T/0Abs)

1. Select the desired wavelength by turning the **WAVELENGTH** control knob.
2. 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.
3. Insert the blank cuvette into Sample Compartment and close the cover.
4. Set 0.000A or 100%T with the **0A/100%T** (∧) button. (Figure 9 & 10)

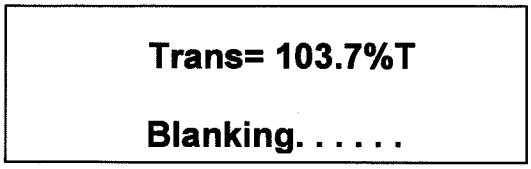


Figure 9 Blanking

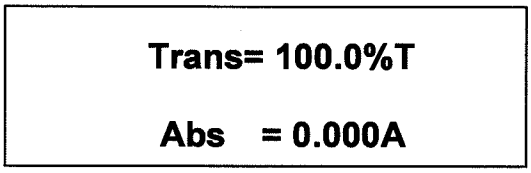


Figure 10 Blanked

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

5. Remove the blank square cuvette or test tube.

C. Sample Analysis

6. 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.
7. Put the sample cuvette in the Sample Compartment. Close the cover.
8. Read the **T** or **A** from the Digital Display window. (Figure 11). Remove the sample cuvette or test tube.

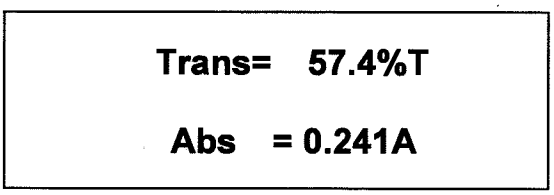


Figure 11 Measure Sample

If you are to test the same sample at other wavelengths or analyze new sample, repeat **step 1 to 8**

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. In **T%/Abs mode**,select the desired wavelength by turning the wavelength control knob.
2. Insert the cuvette or tube containing the blank solution.
3. Set 0.000A with the ▲ button.
4. Remove the blank cuvette or tube,
5. Insert a cuvette containing a standard solution of known concentration in the Sample Compartment.
6. Press **MODE.** The screen shows as Figure 12. Flash cursor is at "**!**". Press **Up Arrow ▲** or **Down Arrow ▼** to move the flash cursor to go left or right.

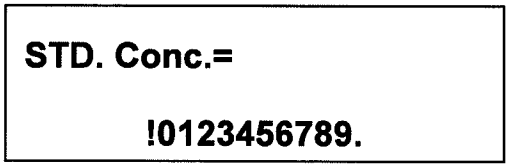


Figure 12 Ready for Concentration Value Entry

6.1 Move the cursor to a desired number and press ENTER to confirm. To delete the number just enered, press MODE button.

6.2 Repeat this until the whole value of the standard is entered(Figure 13).

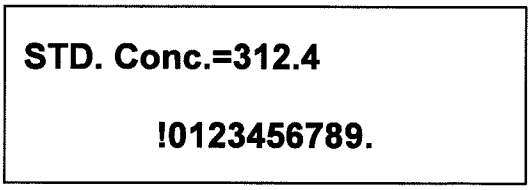


Figure 13 Enter Concentration Value of Standard

6.3 Move the cursor to "!" and press **ENTER** to finish and confirm the input. The standard then is measured automatically and the result is displayed (Figure 14). If concentration unit (ppm) is not the correct value unit, press **Down Arrow ▼** at this time to change the concentration unit.

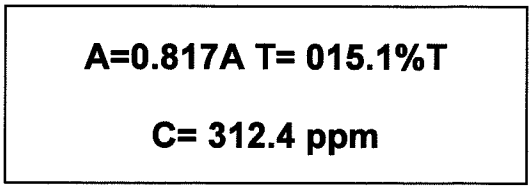


Figure 14 Measure Standard

Note: If no (concentration value) number is inputted and ENTER button is pressed (Figure 12), the previous standard concentration and unit will be used and displayed.

7. Insert a cuvette containing a solution of unknown concentration in the Sample Compartment, take readings.
8. If multiple samples are being measured and it takes a long time, you may want to reset 0.000Abs. Insert the cuvette or tube containing the blank solution. Set 0.000A with the ▲ button.

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. In **T%/Abs mode**, select the desired wavelength by turning the wavelength control knob.
2. Press **MODE, STD Conc** screen will be displayed (Figure 12). Press **ENTER** to skip Concentration **Mode**. Press **MODE** again, factor input screen shows as Figure 15. Flash cursor is at first digit "!".

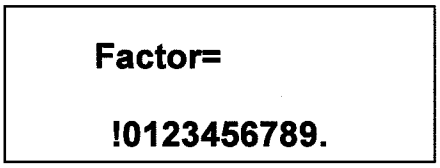


Figure 15 Ready for Factor Input

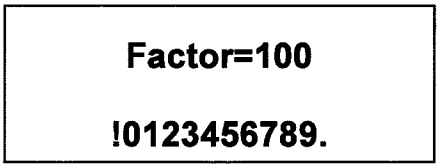


Figure 16 Enter Factor Value

3. Use the same method to input factor (refers to 6.1 to 6.3 above). Figure 17 shows the result.

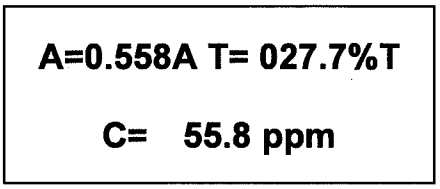


Figure 17

Note: If no (factor) numbers is inputted and ENTER button is pressed (Figure 15), the previous factor and unit will be displayed and used for measurement.

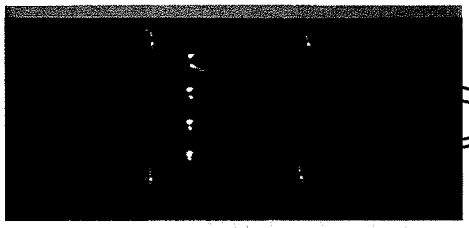
4. Insert a cuvette containing a solution of unknown concentration in the Sample Compartment ,take readings

Note: To reset blank (0.000A), Insert the cuvette or tube containing the blank solution, set 0.000A with the▲ button.

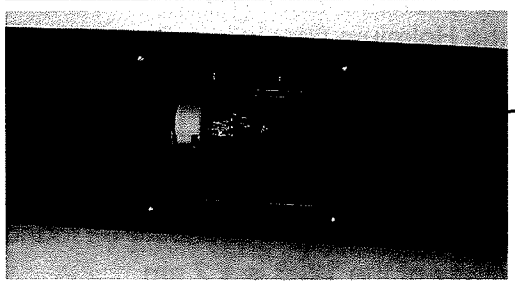
Maintenance

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,shown as Figure 18 and 19
3. Unplug the lamp from the white connector. Insert the new lamp; push it in as far as it will go. Replacement lamp: Item Number: **S-1200-505** (6V 10W G4 type)



4 Screws
Figure 18



Lamp
Figure 19

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 **Scholar Chemistry 1208** 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 **Scholar Chemistry** 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 ± 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 **T/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 **1208** is ± 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 ▲ 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 **1208** is ± 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 ▲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: ± 1% at 1A

The absorbance accuracy should be checked against a set of neutral density filters accurately calibrated to the NIST standards. Contact your **ScholAR Chemistry** representative for more information.

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.

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/A**.
3. With the square Cuvette Adapter in the Sample Compartment, but no cuvette, close the lid and press the ▲ 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 mg/l of sodium nitrite ($NaNO_2$) 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.

Troubleshooting

Table-4 Troubleshooting

PROBLEM	Possible Cause	Solution
Instrument Inoperative (Power indicator has no light)	Power cord not connected to outlet	*Plug instrument in*
	Dead Power outlet,	*Change to a different outlet*
	Internal fuse blown or defective electronic component	*Call an authorized service engineer*
Instrument can not set 100%T (0.000A)	Light beam blocked: • Holder misaligned ·Shutter	*Check sample holder*
	Lamp is old or defective	*Replace lamp*
	Lamp is off alignment	*Refer to Lamp Replacement instructions in this manual*
	Defective electronic component	*Call an authorized service engineer*
Incorrect Transmittance to Absorbance correlation	Bubbles or particles in solution	*Check sample preparation and analytical procedure*
	Defective electronic component	*Call an authorized service engineer*
Digital Display does not change regardless of sample concentration	Wrong wavelength setting	*Check sample procedure and wavelength setting*
	Insufficient sample volume	*Fill cuvette with more samples*
	Stray sample preparation vapors	*Prepare the sample away from the instrument. Use proper ventilation*
	Bubbles or particles in solution	*Check sample preparation and analytical procedure*
	Defective electronic component or loose wiring	*Call an authorized service engineer*
Instrument drift and noise	No sufficient warm up time Significant temperature change Lamp not adjusted properly	*Check lamp has been properly installed or has moved during transit* *Refer to Lamp Replacement instructions in this manual*
	Lamp old or defective	*Replace with a new lamp*
	Sample Holder Misaligned	*Refer to Lamp Replacement instructions in this manual*

	Unstable power supply Defective or dirty detector or defective electronic component	*Call an authorized service engineer*
Incorrect readings obtained	Insufficient sample volume	*Fill cuvette with more samples*
	Wrong wavelength setting Failed to blank (0A/100%T) Failed to set 0%T	*Check analytical procedure and wavelength setting Check wavelength accuracy according to procedure in this manual*
	Stray sample preparation vapors	*Prepare sample away from instrument. Use proper ventilation*
	Bubbles or particles in solution	*Check sample preparation and analytical procedure*
	Instrument out of electronic calibration	*Call an authorized service engineer*