Kalstein®

Visible Spectrophotometer
YR01844
Instruction Manual

Thank you very much for purchasing our Visible Spectrophotometer

YR01844.

Please read the “Operating Instructions” and “Warranty” before operating this unit to assure proper operation. After reading these documents, be sure to store them securely together with the “Warranty” at a hand place for future reference.

 Warning: Before operating the unit, be sure to read carefully and fully understand important warnings in the operating instructions.

■ Safety

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

Read following instructions before installing and using the instrument and its accessories. The apparatus should be operated by appropriate laboratory technicians.

■ General

The apparatus 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 apparatus it is essential that laboratory personnel follow generally accepted safe procedures in addition to the safety precautions called for in this manual.

The covers on this instrument may be removed for servicing. However, the inside of the power supply unit is a hazardous area and its cover should not be removed under any circumstances. There are no serviceable components inside this power supply unit. Please avoid touching the high voltage power supply at all times.

Some of the chemicals used in spectrophotometer are corrosive and/or inflammable and samples may be radioactive, toxic, or potentially infective. Care should be taken to follow the normal laboratory procedures for handling chemicals and samples.

■ Electrical

The power cord shall be inserted in a socket provided with a protective earth 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 apparatus or disconnection of the protective earth terminal is likely to make the apparatus dangerous. Intentional interruption is prohibited.

Whenever it is likely that the protection has been impaired, the apparatus shall be made inoperative and be secured against any unintended operation.

NEVER touch or handle the power supply on due to the high voltage!

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

- 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

Contents

Chapter 1 Introduction

1.1 Measurement Principle

The measurement principle of spectrophotometer is based on the Lambert-Beer law. When the beam of collimated monochromatic light passes through a certain uniform colored solution, the absorbance of the solution is directly proportional to the concentration of the solution and the optical path. And it supplies basis for the quantitative analysis. The Lambert-Beer law is described as following formula:

$$A=k\times b\times C$$

A — Absorbance of the analyte

k — The absorption coefficient

b — The path length in cm

c — The analyte concentration

1.2 Application

The spectrophotometer is a common analytical instrument in chemistry laboratory, and it is widely used in pharmaceutical, medicine & health, chemical, energy, machinery, metallurgy, environmental protection, geology, food, biology, materials, agriculture, forestry, fisheries and other industries. It's also applied in the fields of higher education, metrology, teaching and scientific research, and has advantages in quality control, raw material and product inspection in production.

1.3 Technical Specifications

The technical specifications of YR01844 Visible Spectrophotometer are shown in following table (Table 1-1).

Table 1-1

Model	YR01844
Wavelength Range	325 nm -1000 nm
Bandwidth	4 nm
Optical System	Single Beam, Grating 1200 lines/mm
Wavelength Accuracy	±2 nm
Wavelength Repeatability	≤0.5 nm
Photometric Range	0 - 200%T, -0.3 A - 3.0 A, 0 - 9999 C
Photometric Accuracy	±0.5 %T
Stray Light	≤0.2 %T@ 360 nm
Data Output Port	USB
Display	128*64 Dots LCD
Light Source	Tungsten Lamp
Detector	Silicon Photodiode
Power Requirement	AC 85 V - 250 V
Dimensions	420 mm × 280 mm × 180 mm
Net Weight	8 kg

1.4 Packing List

Following table (Table 1-2) is the packing list of YR01844 Visible Spectrophotometer.

Table 1-2

No.	Item	Unit	Qty	Note
1	YR01844 Visible Spectrophotometer	set	1	
2	Power Cord	pc	1	
3	10mm Glass Cell	kit	1	4 pcs/kit
4	Dust Cover	pc	1	
5	Black Block	pc	1	
6	User's Manual	pc	1	
7	Quality Certificate	pc	1	
8	Packing List	pc	1	

NOTE: If there is any change in this package, an Accessory & Spare Parts List attached should be referred to as final.

1.5 Product Design

1. Configuration

The profile of YR01844 Visible Spectrophotometer is shown in Fig. 1-1.

Fig. 1-1

The back side of YR01844 Visible Spectrophotometer is shown in Fig. 1-2:

Fig. 1-2

The schematic diagram of the instrument's internal structure is shown in Fig. 1-3:

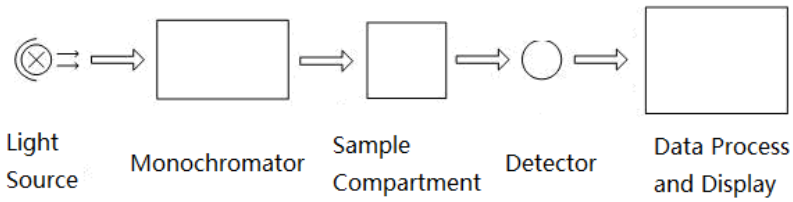

Fig. 1-3

2. Control Panel and Keys

The control panel of YR01844 Visible spectrophotometer is shown in Fig. 1-4.

Fig. 1-4

There are four keys on the control panel. Following are the description of the keys.

MODE: Used for measurement mode selection. There are four measurement modes for selection, T (for Transmittance), A (for Absorbance), C (for Concentration) and F (for Factor).

: Up key, to set the concentration or factor value, the value will increase one by one with each press, and holding the key will speed up the increase. It's also used for dark current calibration, adjust to 0.0 %T, and it's effective only in T mode together with the black block in the light path.

: Down key, to set the concentration or factor value, the value will decrease one by one with each press, and holding the key will speed up the decrease. It's also used for blanking, adjust to 0.000 Abs or 100.0 %T.

ENTER: Enter key, to confirm the concentration (C) or factor (F) setting. It's also used as Print key when connecting to a printer.

Chapter 2 Installation

Please carefully read the instruction in this chapter before unpacking and installation YR01844 Visible Spectrophotometer.

2.1 Unpacking

Please check the outer packing and make sure that it is intact before unpacking YR01844 Visible Spectrophotometer. Then, check the instrument and its accessories according to the packing list and make sure they are completely well. If you have any questions, or anything lost or damaged, please contact us in time.

2.2 Requirements

A laboratory should be prepared, and following requirements should be met:

1) The instrument should be placed in a dry room, and the room temperature should be in the range of 10 ℃~ 35 ℃. The relative humidity should be no more than 85%.
2) Power supply requirement: The rated voltage should be 85 V -250 V AC. Well grounding is also required. An electronic AC regulator or AC regulator with the power more than 1000 W is suggested to enhance the anti-interference performance of the instrument.
3) Other requirements: The instrument should be placed on a stable workbench. Be far away from strong or continuous vibration. Neither setting up the instrument near electromagnetic field, nor exposing the instrument to direct sunlight or the radiation of heaters. It should be free of dust, as well as corrosive vapors.

2.3 Installation

Install the instrument as following steps:

Step 1: Place the instrument onto a stable bench after unpacking.

Step 2: Connect the power cord to the instrument. If a printer is equipped, connect the power cord of the printer and connect the instrument to the printer with the communication cable.

Chapter 3 Instrument Operation

Before switching on the power, make sure that all connections work well, the power supply is with well grounding and met the requirement.

NOTE: The lid of sample compartment should be closed during the operation procedure.

3.1 Power On

Switch on the power after connecting the instrument to the power supply. Wait about 20 minutes for pre-warming before operation.

3.2 Transmittance Measurement

Following are the operation steps for transmittance measurement:

Step 1: Set the measurement wavelength.

Turn the wavelength control knob and let the mark line points to desired wavelength.

Step 2: Select T mode.

Press the key 

until the indicator lights up under T Mode.

Step 3: Set 0.0%T & 100.0%T.

Put the black block into the light path, and press the key  to calibrate the dark current until it shows 0.0%T.

Then, remove the black block from the light path, and press the key  to calibrate blank of the instrument itself until it shows 100.0%T.

Step 4: Sample measurement.

Put the blank solution or reference solution into the light path, and press the key  to adjust 100.0 %T. Then, replace the blank solution or reference solution with the sample solution, and user can directly read out the transmittance measurement result.

3.3 Absorbance Measurement

Following are the operation steps for Absorbance measurement:

Step 1: Set the measurement wavelength.

Turn the wavelength control knob and let the mark line points to desired wavelength.

Step 2: Select T mode, Set 0.0%T & 100.0%T.

Press the key MODE until the indicator lights up under T Mode.

Put the black block into the light path, and press the key ▲ to calibrate the dark current until it shows 0.0%T.

Then, remove the black block from the light path, and press the key ▼ to calibrate blank of the instrument itself until it shows 100.0%T.

Step 3: Select A mode.

Press the key MODE until the indicator lights up under A Mode.

Step 4: Sample measurement.

Put the blank solution or reference solution into the light path, and press the key ▼ to adjust 0.000Abs. Then, replace the blank solution or reference solution with the sample solution, and user can directly read out the absorbance measurement result.

3.4 Concentration Measurement

The concentration measurement with the instrument is based on the calculation formula C=F×A. There are two modes for concentration measurement, C mode and F mode.

With C mode, user can obtain the concentration of sample to be analyzed referring with a standard sample solution.

With F mode, user obtains the sample concentration with the known value of F.

Following are the operation steps for concentration measurement.

Step 1: Set the measurement wavelength.

Turn the wavelength control knob and let the mark line points to desired wavelength.

Step 2: Select T mode, Set 0.0%T & 100.0%T.

Press the key MODE until the indicator lights up under T Mode.

Put the black block into the light path, and press the key ▲ to calibrate the dark current until it shows 0.0%T.

Then, remove the black block from the light path, and press the key ▼ to calibrate blank of the instrument itself until it shows 100.0%T.

Step 3: Select A mode, Adjust 0.000Abs.

Press the key MODE until the indicator lights up under A Mode. Put blank solution into the light path, and press the key ▼ to adjust 0.000Abs.

Step 4: Sample measurement.

a) Measurement with C mode.

First, select C mode, and set the standard concentration value.

Press the key MODE until the indicator lights up under C Mode. Replace the blank solution with standard solution into the light path, and set the concentration value by pressing the two keys ▲ and ▼, then press the key ENTER to make sure the setting. The F value is automatically calculated and shown. Press the key ENTER, it will switch to C mode again.

Then, measure the sample.

Replace the standard solution with sample solution, with its absorbance and the F value obtained from the standard solution, the concentration measurement result can be directly read out.

b) Measurement with F mode.

Select F mode, set F value and measure the sample.

Press the key MODE until the indicator lights up under F Mode. Replace the blank solution with sample solution. Set the F value by pressing the two keys ▲ and ▼, then press the key ENTER to make sure the setting. It will switch to C mode and the sample concentration measurement result is shown directly.

NOTE:

The C value and F value only can be set with integer. However, the reading result is relative. For example, the concentration of standard sample is 0.1, user can input 1, if the sample concentration shows 2, then the actual concentration is 0.2.

The valid F value is between 1 and 9999.

To avoid abnormal concentration display, please don't press the key MODE to switch the display mode after completing the value setting of C or F. If wrong operation is done, please operate again step by step as described above.

Chapter 4 Maintenance

4.1 Maintenance

YR01844 Visible Spectrophotometer is a precise optical instrument. It was assembled and debugged carefully before delivery. However, appropriate maintenance will not only guarantee its reliability and stability, but also prolong its service life. Correct use is the best maintenance. In addition to previously mentioned installation requirements, following tips also should be noticed in daily use.

(1) To ensure the steady operation of the instrument, it is recommended to use an AC voltage stabilized power source.

(2) Please carefully load the solution into the cuvette, and the height is better no more than 2/3 of the cuvette. Try to avoid the bubble generation, for the bubble on the inner surface of the cuvette or in the solution will affect the measurement result. Please wipe off the solution that residue on the outer surface of the cuvette in time. To measure volatile samples, using with cuvette cover is suggested. Try to avoid contamination to the cell holder, otherwise, wipe off the residue solution on the cell holder promptly.

(3) Don't touch both the two optical surfaces of the cuvette with your fingers. For the fingerprint will absorb the light and furtherly affect the measurement accuracy. Please handle the cuvette gently, for it is frangible. Clean the cuvette properly. Improper cleaning or without enough clean also will affect the measurement accuracy, even cause unstable result.

(4) Whether placing or removing the sample, please close the lid of the sample compartment in time during the measurement. Please remove the sample from the sample compartment promptly after completing the measurement, check that there is no residue in the sample compartment and keep it dry. Any solution sample or residue left in the sample compartment may cause damage to parts of the instrument such as filter turning moldy, some component be corroded. Please open and close the lid gently.

(5) Please switch off the instrument and disconnect the plug in time, to prevent possible damage from thunderstorms.

(6) Be careful in the transport. Don't place heavy object onto the instrument, to prevent the light path shift which will furtherly affect the instrument stability and measurement accuracy.

(7) After months of operation or after it is moved, the instrument should be checked for its wavelength accuracy.

(8) Don't disassemble the cover and the inner parts of the instrument without authorization, especially for the optical parts. Don't loosen the tightening screws and nuts at will. All optical surfaces including the light source can't be touched by hand or any other objects. Otherwise, it may affect the normal operation even cause damage.

(9) Keep the instrument surface and the working environment clean. For the surface of the cover deals with painting process, please don't clean the cover with organic solutions such as alcohol, gasoline and ether. If the instrument is not in use, user can cover the instrument with clean cloth or dust cover to avoid dust accumulation.

(10) A long time not in use should be avoided, and regular boot is suggested to guarantee the normal operation. In the high temperature and humidity area, user should pay more attention to keep away from moisture.

Note: When the measurement data differs greatly from the experienced value, the dark current calibration is suggested to be done.

4.2 Replacement of Tungsten Lamp

After a long time of use, the instrument needs calibrating or repairing, as its performance may have changed.

Following are the steps of replacing tungsten lamp.

Step 1: Power off and unplug the power cord from the instrument.

Step 2: Remove the four screws on the sides of the spectrophotometer.

Step 3: Remove the pull rod for cell position selection by unscrewing the rod counterclockwise.

Step 4: Remove the wavelength control knob (Fig.4-1).

1) Use a Flat Head Screw Driver to pick the cover out from the knob.
2) Use a Spanner or Sleeve to loosen the screw in the knob, then remove the knob.

Fig. 4-1

Step 5: Remove the cover of the instrument very carefully and place it backside the instrument.

NOTE: CAUTION NOT TO PULL THE PANEL WIRING LOOSE!

Step 6: Unplug and remove the lamp from ceramic base (the white connector). Insert the new lamp by pushing it in as far as it will go.

CAUTION: a) Do not handle the lamp with bare fingers. Use clean tissue or cloth when handling lamp.
b) There's no difference in polarity of the two legs of tungsten lamp.

Step 7: Set the wavelength at 500nm, switch on the power, move the lamp up and down and from side to side, until its focus falls exactly on the entrance slit. Observe the reading in T mode without adjusting the key  (0ABS/100%T). Readjust the lamp to make the reading at its maximum. If it can't focus on the center of the entrance slit, you have to adjust the four screws shown in Fig. 4-2. The screws 3 and 4 are for height adjustment of the light spot while the screws 1 and 2 for the horizontal adjustment.

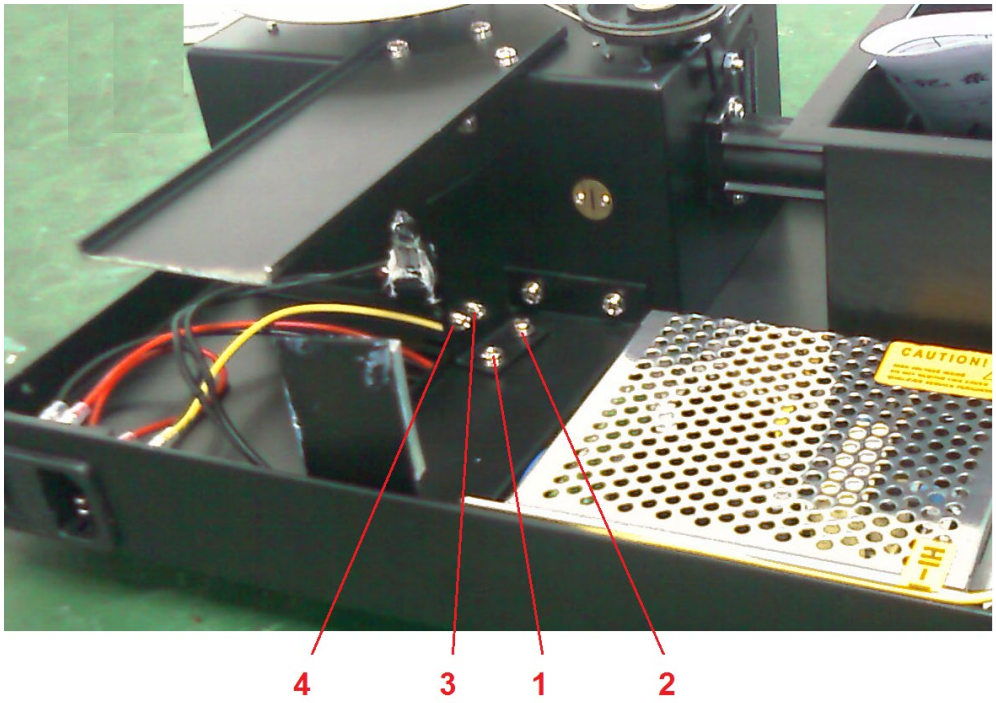

Fig. 4-2

Step 8: Power off, tighten the four screws. Reinstall the instrument cover. Be sure to prevent any wires from being pinched in the process.

Step 9: Reinstall the four screws on the sides of the spectrophotometer. Reposition the pull rod for cell position selection and the wavelength control knob.

4.3 Wavelength Calibration

The wavelength accuracy is checked by a point-to-point method against the two characteristic absorption peaks of a didymium filter at about 529nm and 808nm.

In case the point-to–point measurement shows larger wavelength different from the peak wavelength of the didymium filter (the tolerance error is ±2nm), remove the wavelength control knob, loosen the three positioning screws on the wavelength dial (Fig. 4-3), adjust the dial pointer to the wavelength of characteristic absorption peak, and tighten the screws.

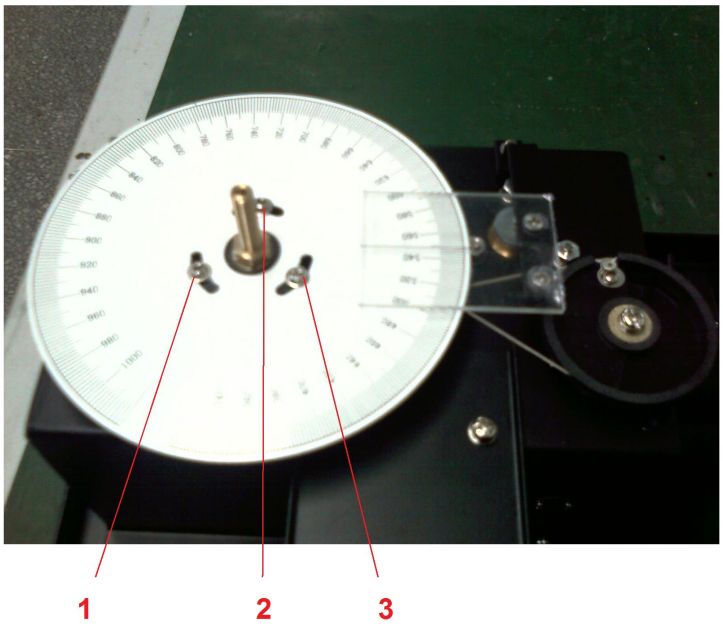

Fig. 4-3

Chapter 5 Troubleshooting

Each YR01844 Visible Spectrophotometer is strictly debugged and inspected before delivery. Commonly, it won't appear problems in normal storage, transport and use. However, wrong operation or extreme states, and problems caused by long-term use still can't be avoided, such as the damage of electrical and optical units caused by bad storage and working environment, the damage of vulnerable units or the loosen of the fixing parts caused by improper transport, the lamp exceeds its lifetime, the wastage of electrical units, other troubles caused by wrong operation, and so on.

Please carefully refer to the related instructions before operating the instrument. Troubles and troubleshooting are introduced in following table (Table 5-1).

Table 5-1

No.	Trouble	Cause	Troubleshooting
1	No response when switching on the power.	1) Power disconnection.	- Check the power supply and power cord, make sure that the power supply is OK and the power cord is connected well.
		2) The fuse is burned.	- Change the fuse.
		3) The switching power supply is damaged.	- Contact the distributor or the factory technical engineer for maintenance.
2	The reading is not stable when adjusting 100% T or 0.000 Abs.	1) Wrong position of the cell holder causes block to the light path.	- Make sure that the cell holder is in right position.
		2) Black block in the light path.	- Remove the black block.
		3) The pre-warming time is not enough.	- Pre-warming with enough time, no less than 20 min.
		4) The tungsten lamp is exhausted or with bad connection.	- Replace the tungsten lamp with a new one.
		5) Light path, or the amplifier and its power supply fault.	- Contact the distributor or the factory technical engineer for maintenance.

Table 5-1 (Continued)

No.	Trouble	Cause	Troubleshooting
3	The sample reading is not stable.	1) The pre-warming time is not enough.	- Pre-warming with enough time, no less than 20 min.
		2) Unstable voltage.	- Contact the distributor or the factory technical engineer for maintenance.
		3) Ambient interference, such as unstable power supply, corrosive gas interference.	- Configure with a voltage stabilizer, keep the instrument from corrosive gas.
		4) Unstable sample.	- For the sample is unstable, measure it as soon as possible. If there is some bubble in the solution, eliminate the bubble or reload the solution. Measure with a cuvette cover for volatile sample.
		5) The cuvette is contaminated and it's too dirty.	- Make sure that the cuvette is clean before measurement.
		6) The blank value is much higher, or the sample concentration is too high and the absorbance reading is out of the stable range.	- The absorbance value of the blank solution or reference solution is better below 0.1. Dilute the sample solution properly, and the absorbance value is better between 0.2 and 0.8.
		7) The tungsten lamp is exhausted, and the energy is too weak.	- Change the tungsten lamp.
4	The sample reading is not accurate.	1) Dark current drift.	- Calibrate the dark current and measure the sample again after blank recalibrating.
		2) Cuvette matching error	- Make sure that the cuvettes matching well.
5	The printer doesn't work, or printing error.	1) Loosen connection between the instrument and the printer.	- Make sure the connection between the instrument and the printer is well.
		2) The printer model doesn't match.	- Choose the factory specified printer type.