ATO

USER MANUAL
FOR
MODEL 721G/722G
VISIBLE SPECTROPHOTOMETER

Table of Contents

1. MAIN USAGES 3

2. WORKING ENVIRONMENT 3

3. MAIN TECHNICAL DATA AND SPECIFICATIONS 4

4. WORKING PRINCIPLE 5

5. OPTICAL PRINCIPLE 6

6. INSTALLATION, OPERATION AND MAINTENANCE 7

6.1 INSTALLATION 7
6.2 OPERATION 7
6.3 MAINTENANCE 8

7. CALIBRATION AND TROUBLESHOOTING 9

7.1 REPLACEMENT OF TUNGSTEN HALOGEN LAMP 9
7.2 WAVELENGTH ACCURACY CALIBRATION 9
7.3 TROUBLESHOOTING 10

8. INSTRUMENT PACKAGE 11

9. PRESERVATION AND WARRANTY FOR REPAIR 11

APPENDIX

LIST OF ACCESSORIES AND SPARE PARTS 12

PACKING LIST 12

1. Main Usages

721G/722G visible spectrophotometer enables quantitative and qualitative analysis of samples within the visible spectrum. It can be widely used in pharmaceutical manufacturing, health, clinical tests, biochemistry, petrochemical industry, environmental protection and quality control fields. It is one of the common instruments in physical and chemical labs.

2. Working Environment

1) The instrument should be installed in dry room, with temperature between 5°C - 35°C and relative humidity of not higher than 85%.
2) Place the instrument on a firm and leveled bench, and avoid strong or continuous vibration.
3) Keep moderate indoor lighting, and avoid direct sunlight on the instrument.
4) Keep air from fans way from the instrument, to present the instrument from being affected.
5) Keep the instrument far from strong magnetic field, electric field, and electrical devices generating high frequency wave.
6) The power supply to the instrument should be of AC220V±22V 50Hz±1Hz, and have good earthing. It is recommended to use AC voltage stabilizer for the instrument to better combat interference. User an electronic AC voltage stabilizer or AC constant voltage stabilizer of above 500 W.
7) Avoid using the instrument in places with hydrogen sulfide, sulfurous acid, fluorine or other corrosive gases.

3. Main Technical Data and Specifications

1) Type: Type III
2) Optical system: Single beam, diffraction grating
3) Wavelength range: MODEL 721G 340nm～1000nm; MODEL722G 325nm~1000nm.
4) Light source: Tungsten halogen lamp 12V/20W
5) Receiving component: photocell
6) The largest allowable error of the wavelength(nm): ±2.
7) Wavelength reproducibility (nm): ≤1.
8) Spectrum bandwidth (nm): 5±1.0.
9) Stray light (T): ≤0.5%(at 360 nm).
10) Range of transmittance measurement(T): 0.0%～100.0%.
11) Range of absorbance measurement(A): 0.000～1.999.
12) Direct-read Range: 0000～1999.
13) The largest allowable error of the transmittance (T): ±0.5%.
14) Transmittance repeatability (T): ≤0.2%.
15) Noise (T): 100% Noise≤0.3%, 0% Noise≤0.2%.
16) Stability (T): bright current≤0.5%T/3min,
    dark current≤0.2%/3min.
17) Power supply: AC220V±22V, 50Hz±1Hz.
18) Dimensions: 450mm×390mm×210mm.
19) Net weight: 12kg.

4. Working Principle

Substances in solutions under radiation of light absorb light, and this kind of absorption is selective. Different substances have their own absorption spectrums. Therefore, when homogeneous light passes through a solution, its energy will be reduced due to absorption. The degree of energy reduction is in proportion to the concentration, that is, in compliance with the Beer law.

$$T = I / I_0$$
$$\log I_0 / I = KCL$$
$$A = KCL$$

Where:

T: Transmittance

I_o: Intensity of the incident ray

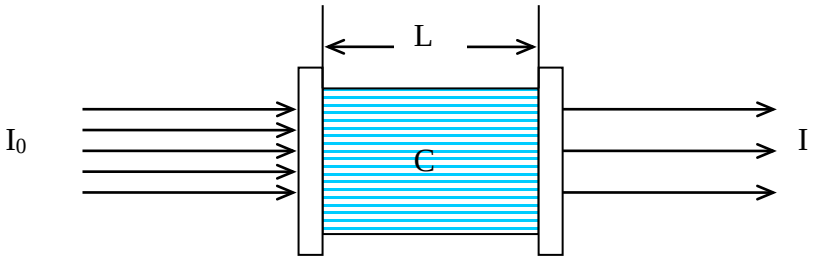
I: Intensity of transmitting light

A: Absorbance

K: Absorption coefficient

L: Length of the light track in the solution

C: Concentration of solution

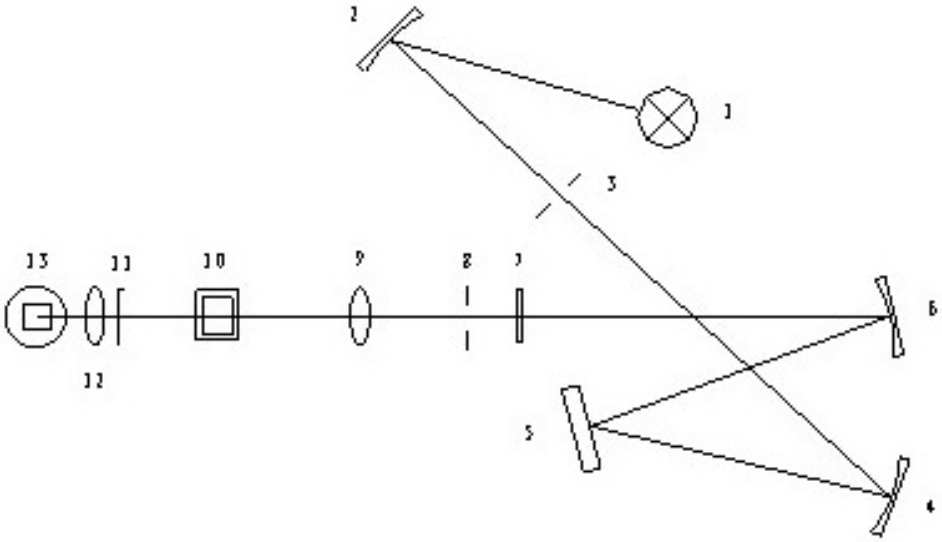


The above Formula shows that if the incident ray, the absorption coefficient and the optical path remain constant, the intensity of the transmitted light varies with the concentration of the solution. The Model 721G/722G spectrophotometer works just as the principle stated.

5. Optical Principle

721G/722G visible spectrophotometer uses a grating CT dispersion system and single beam light path. See Figure for the layout.

The continuous spectrum of light from the tungsten halogen lamp projects on the spherical convergent lens. After being converged, the ray of light goes through the light filter toward the entrance slit of monochromator. The slit locates in the focal plane of the spherical convergent lens and the collimation mirror in the monochromator. The multiplex light entering the monochromator become a parallel beam projects on the dispersion component, grating, after being reflected by plane reflector and being collimated by the collimation mirror. The multiplex light entering the grating is turned into orderly and sequential monochromatic spectrum by diffraction effect. Again, the monochromatic spectrum comes back to the collimation mirror. As the exit slit is also located on the focal plane of the collimation mirror, the monochromatic spectrum dispersed from the grating formats an image at the exit slit through the collimation mirror (here convergence principle works). The exit slit selects monochromatic light with specified bandwidth to go through the convergent lens and to come to the to-be-tested sample center of sample chamber. After the sample is absorbed, the light that has transmitted through will project on the photocell.



1. Tungsten halogen lamp
2. Reflector
3. Entrance slit
4. Collimation lens I
5. Grating
6. Collimation lens II
7. Filter
8. Exit slit
9. Convergent Lens
10. Sample holder
11. light valve
12. Convergent Lens
13. Photocell

Figure: Optical Principle of 721/722G Visible Spectrophotometer

6. Installation, Operation and Maintenance

6.1 Installation

1. Inspect the instrument for safety before installation and operation, and make sure the voltage of power supply is correct and the equipment is well grounded. Only after the safety check, can the instrument be turned on and operated.
2. The equipment has to be calibrated before using, since long distance transportation and moving may influence its accuracy.

6.2 Operation

Turn on the instrument and allow it to warm up for 20 minutes before use.

There are 4 keys on the keyboard of this instrument:

1. MODE
2. PRINT
3. ▽/0%
4. △/AO 100%

6.2.1 "MODE": Press the key to switch between A, T, C and F values.

A: Absorbance

T: Transmittance (Trans)

C: Concentration (Conc.)

F: Slop factor (Factor)

F values are entered by pressing keys (as described below).

6.2.2 "PRINT": This key has 2 functions.

a) Data transmission between the RS232 serial port and the computer (one-way data transmission from the instrument to the computer).

b) When the instrument is in the F status, the key is for confirmation of the current F value, and automatically calculates the current C value (C=F*A).

6.2.3 ▽/0%: This key has 2 functions.

a) Zero: This function is only effective when the status is T. Open the sample chamber cover; the display will indicate 00.0 after this key is pressed.

b) Down: This function is only effective when the status is F. Press the key to reduce F value

by one at a time. Press the key and hold down, and the value reduction will be accelerated. If the F value is 0, press the key and the value will become 1999. Press the key again to decrease the F value by one at a time.

6.2.4 △/AO 100%: This key has 2 functions.

a) Only works in status A or T, close the sample chamber cover. The display will indicate 0.000 and 100.0.

b) Up: This function is only effective in the F status. Press the key to increase the F value by one at a time. Press the key and hold down, and increase will be accelerated. If the F value is 1999, the value will become 0 after the key is pressed. Press the key again to increase the F value by one at a time.

Example: Set slope to 1500

Method 1

1) Press “MODE” to switch to the F status.
2) If the current F value is 1000, press "△/AO 100% " to change the F value to 1500.
3) Press “PRINT” to indicate the current F value as 1500. Then the instrument automatically returns to the C status. If the measured A value is 0.234, the displayed C value will be 0351.

Method 2

1) Press “MODE” to switch to the F status.
2) If the current F value is 1000, press "△/AO 100% " to change the F value to 1500. Press “MODE” again to switch the instrument to the C status. If the measured A value is 0.234, the displayed C value will be 0351.

6.3 Maintenance

1. To ensure that the equipment works stably, we suggest that users use AC voltage stabilizer.
2. When the equipment stops working, users need to turn off the switch then the power.
3. In case of dust and contamination, cover the equipment with a dust-proof shield. Meanwhile, desiccants should be put in the shield to keep the reflector away from moisture, mildew and contamination, which have negative effects to the equipment.
4. After working for a few months or being moved, wavelength accuracy is to be checked to ensure the normal working and accuracy of the equipment.

7. Calibration and Troubleshooting

After the equipment is used for a long time, its performance index will deviate from the normal condition; so it's necessary to do calibration or repairing, sometimes. Here is the brief introduction for your reference.

7.1 Replacement of tungsten halogen lamp

The light source lamp is a wearable part. The lamp may be displaced after replacement or due to movement of the instrument. To ensure that the instrument maintains adequate sensitivity, it is particularly important to correctly position the lamp. Wear gloves when replacing the lamp, to prevent the lighting energy from being impaired by stains left on the lamp shell.

721G/722G spectrophotometer uses a 12V/20W plug-in tungsten halogen lamp as the light source. Disconnect the power supply before replacement. Take out the failed tungsten halogen lamp and replace it with a new one. Set the wavelength of the instrument to be 500 nm. Turn on the instrument, move the lamp up, down, left and right until the image is on the entrance slit. In the T status, do not adjust with △/AO 100%；(close the sample chamber cover) observe the reading; adjust the lamp until the reading become the highest.

7.2 Wavelength Accuracy Calibration

721G/722G spectrophotometer uses praseodymium-neodymium filter of 529nm and 808nm characteristic absorption peak (need to be calibrated) to calibrate and test wavelength in a point-by-point manner.

The optical splitting system uses a grating as the dispersion component. Because its dispersion is linear, the wavelength gradations are linear too.

If the wavelengths obtained with the above point-by-point method are not consistent with the characteristic absorption wavelengths of praseodymium-holmium glass and the differences are larger than the specified error range, to remove the wavelength hand-wheel. Loose the three fixing screws on the wavelength scale, place the indicator to the value of the absorbed wavelength, and fasten the screws tightly (errors should be less than ±2nm).

CAUTION
Clean the colorimetric plate after using in case of the contamination from samples

7.3 Troubleshooting

Failure	Causes	Solution
1. The instrument does not work after turning the power on.	1. The power supply is not connected 2. The fuse of power supply is broken 3. The power switch has poor contact	1. Check the power supply. 2. Replace the fuse wire. 3. Replace the power switch.
2. Unstable display	1. Inadequate time of warning up 2. Excessive vibration in the environments, excessive air flows near the light source, or intensive external illumination 3. Poor contact of power supply 4. Poor earthing of instrument	1. Wait for 30 minutes after power-on. 2. Improve working environments. 3. Check the voltage of power supply. 4. Improve earthing of instrument.
3. 0% cannot be set	1.The light valve is jammed 2. The amplifier is broken.	1. Repair light valve 2. Repair the magnifier.
4. 100% cannot be set	1. Tungsten halogen lamp was not lit 2. Unaligned light path 3. The magnifier is broken.	1. Check the power supply to the lamp 2. Adjust the light path 3. Repair the magnifier.
5. Excessive errors of concentration	1. The display board is broken	1. Repair or replace the display board.

8. Instrument Package

1) Instrument	1 pc
2) Power cord	1 pc
3) Fuse (1.5A)	2 pcs
4) Instrument User Manual	1 pc
5) Accessory box	1 pc: colorimetric plate 1 set (4 pcs)
6) Packing list	1 pc
7) Quality certificate	1 pc

Note: if there is any change in the accessories, the actual package list should be taken as valid and binding.

9. Preservation and Warranty for Repair

1) Preserve the instrument in the original package indoors with ambient temperatures between 5°C - 35°C and relative humidity of not higher than 85%. The air should contain no hazardous substances which may cause corrosion.
2) The manufacturer undertakes to repair the instrument for free if the instrument fails to work within 12 months due to defective workmanship after the purchase date, provided that the instrument has been delivered, preserved and operated under normal conditions (excluding wearing parts and consumables, such as colorimetric plate).

Note: Serial printer is optional for this equipment.

MODEL 721G/722G

VISIBLE SPECTROPHOTOMETER

List of Accessories and Spare Parts

SN	Abr./Model	Name/Specification	Qty	Unit	Remarks
1		Product User Manual	1	pc	
2		Quality certificate	1	Pc	
3		Guarantee Card	1	Pc	
4		Power Cord		Pc	
5		Fuse（2A）	2	Pc	
6		1cm glass colorimetric plates	4	Pc	
7		List of Accessories and Spare Parts	1	Pc	
8		Packing List	1	pc	

Packing List

Main Device: 1 pc

Accessories: 1 set