E-1000 Series Spectrophotometer

User Manual and Maintenance Guide

PEAK INSTRUMENTS INC.

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Section 1 Introduction

1.1 Basic working principle

1.1.1 The nature of absorption

Spectrophotometer is the method set up by the use of substances to choose different wavelengths of light absorption properties. Generally utilize a prism or grating to get monochromatic light, so that monochromatic light passes through the solution continuously, and absorption of the solution was measured at each wavelength to obtain the absorption spectrum curve.

Absorption spectrum results from absorption of light from the substance, which is the material macroscopic phenomena, and the nature of the absorption is molecular internal movement and the results of light mutual interaction. When the molecules absorb certain energy or wavelength spectrum, among the transmission spectrum, some wavelengths are absorbed to form the absorption spectrum. The smaller the energy absorption is, the corresponding wavelength of light, the absorption peak is at a longer wavelength. When in the infrared region, infrared absorption spectrum formed, if greater the energy absorption is, the shorter the wavelength of the corresponding absorption peak is at a shorter wavelength. When the absorption is in the UV region, ultraviolet absorption spectrum produced.

1.1.2 Absorption law

Lambert-Beer's law: When a bunch of parallel monochromatic light passes through a uniform solution, the solution absorbance is in direct proportion to the product of concentration and thickness.
Its mathematical formula: $A = KCL = LogI_0 / I = -LogT$

The premise of absorption Law mathematical formula: ① the incident light is monochromatic, ② in the absorption process no interaction of each substance, the absorbance of each substance has additive property, ③the role of light and matter is limited to the absorption process, no fluorescent and photochemical scattering phenomenon, ④ the absorbent is a uniform distribution and continuous system.

1.1.3 Influence factors

1.1.3.1 Errors caused by non-absorption of radiation and material.

1.1.3.2 The effect of fluorescence and photochemical reactions, in general, spectrophotometer measurement error generated by fluorescence can be ignored. The fluorescence efficiency of the color system is very small in most cases, and the fluorescence emission is isotropic, only a small portion along direction of the transmitted light goes into the detector so that the absorbance was low, resulting in a negative deviation. Fluorescence absorption effects on measurements greatly depend on the instrument's absorption cell and detector optical design,

1.1.3.3 Reflection and scattering, absorption law applies only to the absorption system with uniform medium, the turbid solution increases the measured absorbance because of scattering, leading to deviations from Beer's Law.

1.1.3.4 Errors caused by non-ideality of the instrument.

1.1.3.5 Polychromatic light deviates from Beer's law, most of the photometer can only get close to monochromatic light with a narrow lumen, in fact, there is still a polychromatic nature can lead to deviations from Beer's law. Two monochromatic deviation depends on the molar absorptivity difference $\Delta \varepsilon$, when $|\Delta \varepsilon|$ is very small, can be approximately considered as monochromatic light, at low concentrations, curve remains linear; but at greater concentrations, with concentration increases, A-C curve bend more seriously, so

the Beer's law applies only to dilute solution.

1.1.3.6 Stray light, stray light is wavelength component which is not required, but enters the detector and is outside the tested spectral bandwidth range. It comes mainly from the spectrometer dispersion element prism or a grating, mirrors, scattering of lens surface, monochrome dust of inner wall and reflection and diffuse of other elements scars, etc. Stray light can cause serious measurement errors. When the instrument energy is at the minimum wavelength, stray light is usually at its maximum (e.g. deuterium lamp 220nm, tungsten lamp 340nm).

1.1.3.7 Slit width, slit width not only affects the purity of the spectrum, but also the absorbance values. In quantitative analysis, in order to obtain sufficient measurement signal, should use a larger slit, in the qualitative analysis a small slit is used, when the exit slit width is equal to the width of the entrance slit, error caused by slit width is minimal.

1.1.3.8 Wavelength gauge error, wavelength gauge is the wavelength accuracy of the instrument, if the error is considerably large or no error correction, the spectral measurement will cause errors that affect the accuracy of absorbance measurements (in the peak of absorption spectrum is more significant).

1.1.3.9 The impact of non-parallel incident light, one of the prerequisites in Beer's law is the use of a parallel incident beam, to ensure that all the beam passing through the same thickness of the absorbing medium, when incident beam has large deviation from parallel light, obviously lead to deviations from Beer law. If deviation of parallel beam is in the instrument moderate, absorbance measurement error is generally within 0.5%.

1.1.3.10 Luminosity scale error, the accuracy of transmittance, the error size directly affects the accuracy of photometric measurements.

1.2 Applications

Discipline for physics, chemistry, medicine, biology, pharmacology, geology and other scientific research, is one of the most important quality control instruments which is widely used in chemical, pharmaceutical, biological and chemical, metallurgy, light industry, materials, environmental protection, medical tests and analysis of industry and other industries, is an essential equipment in routine laboratory.

1.3 Use conditions

The instrument should be installed away from the hot and humid environment; the instrument should be used at 16-35 ℃, 45-80% of humidity. Please try to stay away from the device which emits magnetic field, electrical field and the high-frequency wave. Do not install the instrument in the place where air chlorine, hydrochloric acid gas, hydrogen sulfide gas, sulfurous acid gas and other corrosive gases are seriously overweight. The instrument table should be smooth, without vibrations; the instrument should spare enough space close to the fan to exhaust smoothly. Instrument would better use an independent power outlet; power should be ensured good grounding. Otherwise may cause the instrument does not work properly. If the local voltage is instable, instrument should be equipped with stable power supply. The instrument should avoid direct sunlight and avoid dusty environment.

Section 2 Product Features and Installation

2.1 Features

The new UV-Vis spectrophotometer adopts improved CT monochromator, it has a wider spectral range and excellent quality. Due to the strong role of the instrument concealed microprocessor system, coupled with excellent optical, electrical systems, and

reasonable mechanical structure, and the use of large-screen LCD, it will provide very effective and intuitive means for the analytical testing of every laboratory .

The menu on large-screen LCD selects and recognizes each corresponding steps that the function you need to complete.

As an excellent practical UV/visible spectrophotometer, which has a quick and easy method of analysis can be widely applied in organic, inorganic, petroleum, pharmaceutical, environment, biochemistry, medicine, food and other economic sectors. It is one of the indispensable methods in routine quality control (QC) and quality analysis (QA).

2.2 Technical data

Model	E-1000V	E-1000UV
Display	70*40mm blue backlit LCD	
Wavelength Range	320 - 1020nm	190 - 1020nm
Slit Width	4nm	4nm
Wavelength Accuracy	±2nm	
Wavelength Repeatability	≤1nm	≤1nm
Photometric Accuracy	0.5%T	
Photometric Repeatability	0.2%T	
Stray light	≤0.15%T@ 360nm	
Stability	0.002A@ 500nm	
Output Port	RS232	
Light Source	Tungsten Halogen Lamp	Tungsten Halogen/ Deuterium Lamp
Power Requirements	220V/50HZ, 110V/60HZ	

2.3 Installation

2.3.1 After unpacking, carefully check the packing list whether the things inside are complete and intact;

2.3.2 Ensure the working environment meets the above requirements, environmental temperature is 10 ~ 35 ℃, relative humidity is less than 85%, operating voltage (220 ± 22) V / (50 ± 1) HZ,

2.3.3 Place the instrument on a level platform, the instrument should avoid direct sunlight, be away from electromagnetic emitting devices and high-power electrical devices, there can not be dust, corrosive gas and vibration;

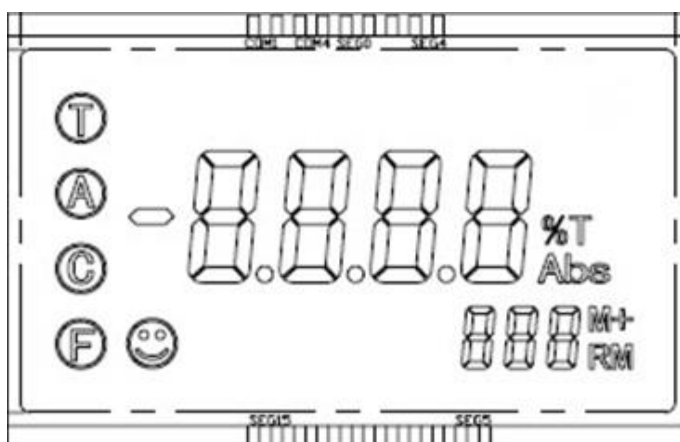
2.3.4 There must not be any obstacles to the flow of air around the instrument;

2.3.5 Use the company supplied power cord and make sure electrical outlets have intact ground wire;

2.3.6 Turn on the instrument power supply. It can be used normally after 30 minutes warm-up time.

Section 3 Display Description and Button Definition

3.1 Display screen diagram



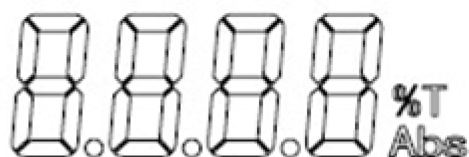
3.2 Display content description

Ⓣ Transmittance

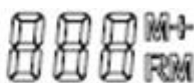
Ⓐ Absorbance

Ⓒ Concentration

Ⓕ Factor

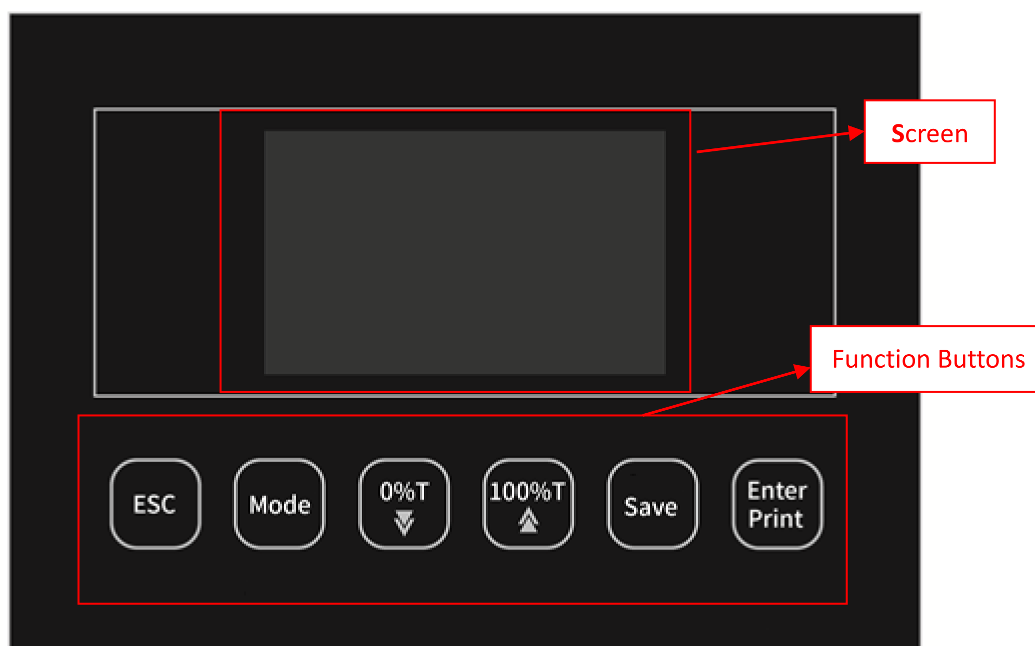


Test data display



Storage status display

3.3 Panel diagram



3.4 Button Functions

<Esc>: exit

<Mode>: the key used to select the Transmittance, Absorbance,

Concentration and Factor mode.

<0%T>: the key has two functions:
a. To set zero. It is effective only in T mode. Insert black block into cell holder, then close the sample compartment cover. If it does not show 0.0, Press the key, and it will show 0.0.
b. As the descending key. When in F and C mode, press the key and the F (C) value will decrease by 1. Holding the key will speed up the decrease. When the value reaches your target value, press enter key immediately.

<100%T>: the key has two functions:
a. When in T (A) mode, press the key and it will read 100.0 (0.000), it means to set 100%T under T mode, and set 0.000A under A mode.
b. To be used as the ascending key. It is effective in F and C mode. Press the key and the F (C) value will increase by 1. Holding the key will speed up the increase. When the value reaches your target value, press enter key immediately.

<Enter/Print>: the key has two functions:
a. Enter function. It is effective in F and C mode. Press the key after setting F (C) value.
b. Print function. Press the key to print the current value under T and A mode. Press the key to print C and F value under C mode.

<Save>: the key used to store /read

Section 4 Programs

Note: Please use black block to set zero one more time when turning on instrument or changing wavelength. Then set 100%T/0.000Abs. Setting zero are totally different from setting 0.000A. Setting zero is used to calibrate the dark current and select suitable magnification, while setting 0.000A is only for reference solution. Actually it is to deduct the absorbance value of preparation solution (reference solution), so as to test the correct absorbance of

the substance to be tested, which dissolved in preparation solution.

4.1 Transmittance

4.1.1. Turn the instrument on. Allow the instrument to warm up for 30 minutes.

4.1.2. Put the reference solution and the solution to be tested into cuvettes separately.

4.1.3. Open the sample compartment cover and Insert the black block into the slot of cuvette, at the same time, put the cuvettes containing reference solution and the solution to be tested into the other slots of cuvette. Suggest Inserting black block into the first slot of cuvette, reference solution into the second slot and sample solution for the other 2 slots. Then close the sample compartment cover.

4.1.4. Rotate the wavelength knob to set wavelength.

4.1.5. Press Mode key to T mode, pull the black block into light path. Press 0%T key until display reads 0.0. Please note to set zero one more time if wavelength make a change.

4.1.6. Pull reference solution into light path, press 100%T key until display reads 100.0, then pull the solution to be tested into light path, you can get the transmittance value for the solution to be tested.

4.2. Absorbance

4.2.1. Turn the instrument on. Allow the instrument to warm up for 30 minutes.

4.2.2. Put the reference solution and the solution to be tested into cuvettes separately.

4.2.3. Open the sample compartment cover and Insert the black block into the slot of cuvette, at the same time, put the cuvettes containing reference solution and the solution to be tested into the other slots of cuvette. Suggest Inserting black block into the first slot of cuvette, reference solution into the second slot and sample solution for the other 2 slots. Then

close the sample compartment cover.

4.2.4 Rotate the wavelength knob to set wavelength.

4.2.5 Press Mode key to T mode, pull the black block into light path. Press 0%T key until display reads 0.0. Please note to set zero one more time if wavelength make a change.

4.2.6 Press Mode key to A mode, pull reference solution into light path, press 0Abs key until display reads 0.000, then pull the solution to be tested into light path, you can get the absorbance value for the solution to be tested.

4.3 Quantitation

4.3.1 Measure concentration with standard samples.

4.3.1.1 Press Mode key to ‘A’ mode.

4.3.1.2 Rotate the wavelength knob to set wavelength. Please note to set zero one more time if wavelength changes.

4.3.1.3 Put reference solution, standard solution and the solution to be tested into cuvettes separately.

4.3.1.4 Open the sample compartment cover and Insert reference solution, standard solution and the solution to be tested into the slots of cuvette separately. Suggest Inserting reference solution into the first slot of cuvette. Then close the sample compartment cover.

4.3.1.5 Pull reference solution into light path, press 0Abs key until display reads 0.000.
Press Mode key to C mode.

4.3.1.6 pull standard solution into light path, press 0%T and 100%T key to increase or decrease to reach the concentration value of the known standard sample. Then press Enter key. The mode go to F mode automatically, display reads F value. Then press Enter again, the mode go to C mode accordingly.

4.3.1.7 Pull the sample to be tested into light path, display reads the concentration value of samples to be tested.

4.3.2 Measure concentration with factor(coefficient).

4.3.2.1 Press Mode key to 'A' mode.

4.3.2.2 Rotate the wavelength knob to set wavelength. Please note to set zero one more time if wavelength make a change.

4.3.2.3 Put reference solution and the solution to be tested into cuvettes separately.

4.3.2.4 Open the sample compartment cover and Insert reference solution and the solution to be tested into the slots of cuvette separately. Suggest Inserting reference solution into the first slot of cuvette. Then close the sample compartment cover.

4.3.2.5 Pull reference solution into light path, press 0Abs key until display reads 0.000. Press Mode key to F mode.

4.3.2.6 Press 0%T and 100%T key to increase or decrease to reach the factor value of the known standard sample, then press Enter key. The mode go to C mode automatically.

4.3.2.7 Pull the sample to be tested into light path, display reads the concentration value of samples to be tested.

Note: it is required to input integer number for C and F value. If the value is fractional, please convert fractional number into integer, and convert it back after test finish.

4.4 Store and read data

Press Save key to store the displayed value after user get a test data (A/T/C/F). At the moment, M+ is lighted and shows the storage position number on the left.

RAM is lighted after holding 'Save' key. It shows the total storage data quantity on the left. Press 0%T and 100%T key to select the position you want to read. Display reads after press Enter key.
Press ESC key and return to the normal test interface.

4.5 Delete data

Hold ESC key 3 seconds or more after turn on the instrument to cancel all saved data.

4.6 Print data

Connect to thermo printer with serial port. Press Enter key to print value under T/ A mode.

Connect to thermo printer with serial port. Press Enter key to print value under the mode of storing and reading.

Note: printer is optional.