WZZ—3 AUTOMATIC POLARIMETER

OPERATING INSTRUCTION

Please read through these operating instruction before using

CONTENTS

I. APPLICATION AND FEATURE

The polarimeter is an instrument used for determining the Optical Rotation of substances. In this way, the concentration, content, purity, etc of certain substances can be found out. The WZZ—3 automatic polarimeter utilizes a photoelectric detection automatic balance principle, measuring results displayed by LCD. Type WZZ—3 automatic polarimeter not only preserves the advantages of Type WZZ—1, WZZ—2 polarimeters(stable, small size, high sensitivity, human error-free, easy reading), but also adds four models, can measure optical rotation、specific rotation、concentration and sugar degree, easy operation. Therefore, the WZZ—3 automatic polarimeter can widely be used in various fields of the organic chemical industry.

Agriculture: use in contents analyses of agricultural antibiotic, hormone, microbial agro-pharmaceuticals and agricultural products.

Medication: use in analyses of antibiotic, vitamin and glucose, and in pharmacological research of Chinese medicinal herbs.

Food: use in analyses of sugar, monosodium glutamate and soy sauce; in inspection of their final products and determination of sugar content in food.

Petroleum: use in analyses of mineral oil and in control of oil ferment process.

Essence: use in analyses of essential oil.

Health: use in analyses of diabetics' urine.

II. SPECIFICATIONS

Measuring range: ±45°

Accuracy: ±(0.01° + measuring value×0.05%)

Repeatability: ≤0.003° ($S_{n-1}=\sqrt{\frac{\sum_{i=1}^{n}\left(x_i-\bar{x}\right)^2}{n-1}}$ n≥6)

Display: LCD (lattice)

Minimum value in reading: 0.001°

Stability(5min): 0.005°

Monochromatic light source: sodium lamp (589.44nm)

Sample tube: 200mm, 100mm

Power supply: 220V±22V, 50Hz±1Hz

Outer size: 600mm×320mm×200mm

Weight (net): 28kg

RS232 interface: band rate 9600, 1 bit stop, 8 bits data

III. CONSTRUCTION AND PRINCIPLE

The polarimeter utilizes a 20W sodium lamp, a small aperture stop and a lens to make up a collimated point light source as shown in figure 1. The parallel light passes through polarizer and becomes a polarized light whose vibration direction is denoted by line OO in figure 2a. When the polarized light is passing through the Faraday modulation coil, its vibration direction will generate a β angle swing (50Hz), as shown in figure 2b. Then the polarized light passes through the analyzer and is projected onto the photomultiplier, an ac signal will be produced.

The optical zero point of the polarimeter is obtained when the polarization plane of the polarizer is perpendicular to that of the analyzer (i.e. OO$\perp$PP), and at the time $\alpha = 0$ (see figure 3). A photo-signal of 100Hz will be obtained at the optical zero point, due to the β angle swing which is generated by the Faraday coil, as shown in curve C. But in the case where samples α_1° and α_2° exist, two 50Hz signals with inverse phases are obtained, as shown in curve B' and D'. Therefore, this will enable the servomotor with an operating frequency of 50Hz to be driven. The polarizer will be turned through α angle ($\alpha = \alpha_1$, or $\alpha = \alpha_2$) by means of a worm-worm wheel. Now, the polarimeter has returned back to the optical zero point. At the frequency of 100Hz the servomotor keeps stationary and the optical rotation of the sample is indicated.

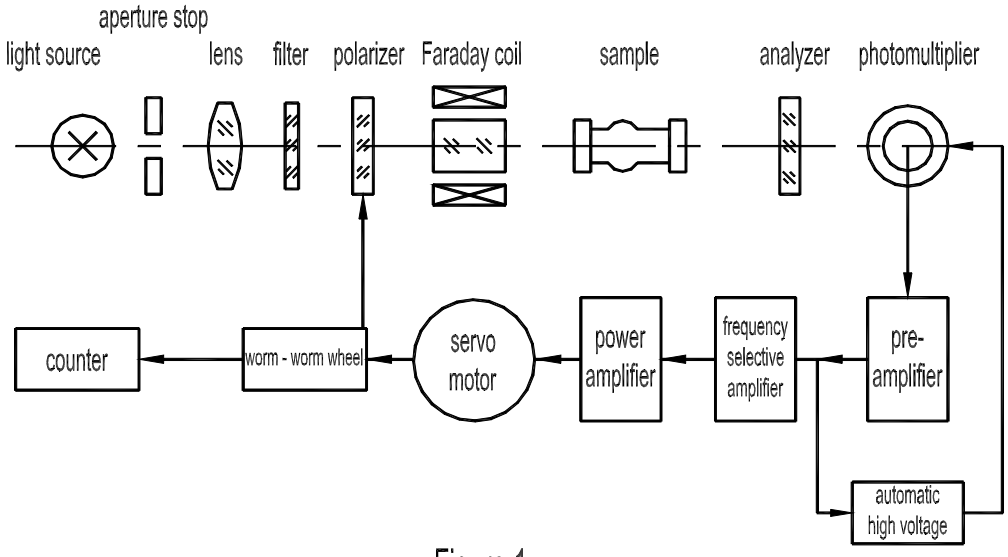
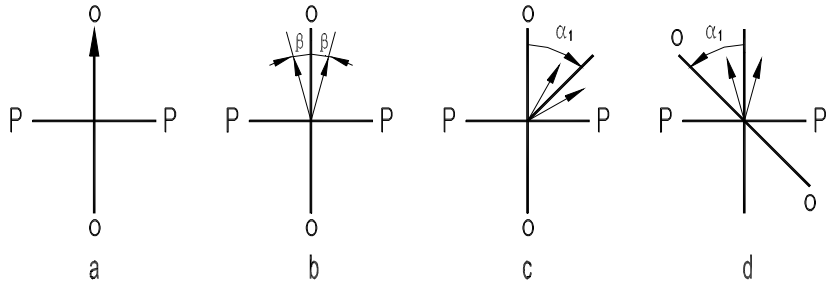


Figure 1



a) polarized light generated by polarizer, polarization plane is OO.

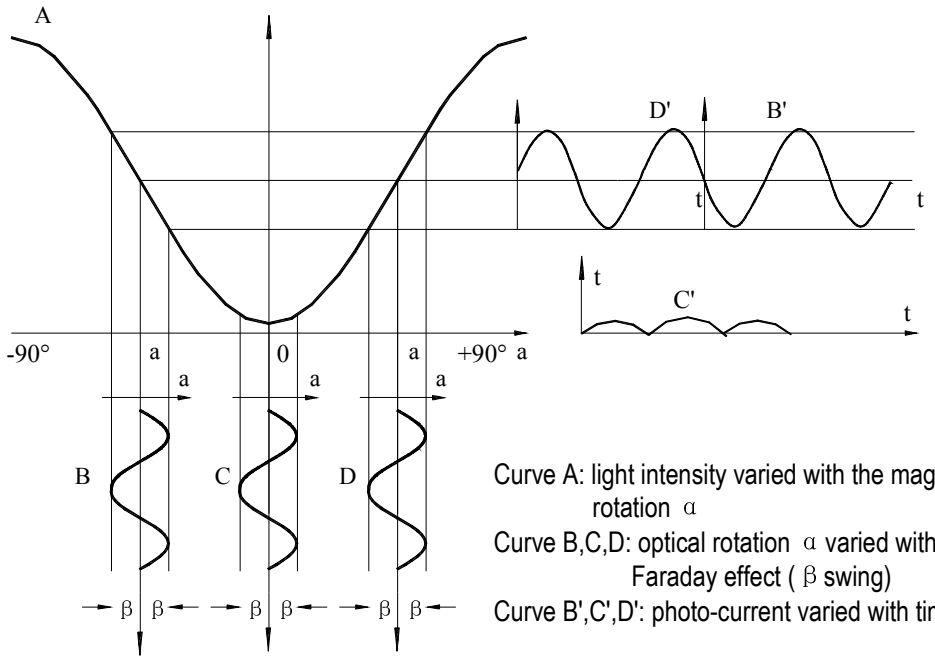
b) polarized light after passing through the Faraday coil, the light vibration direction a swing of β angle.

c) polarized light after passing through sample, vibration direction turning through α_1°

d) polarizer turing to the opposite direction through α_1° to compensate sample optical rotation and to reach the balanced condition.

OO: polarization plane of polarizer PP: polarization plane of analyzer

Figure 2

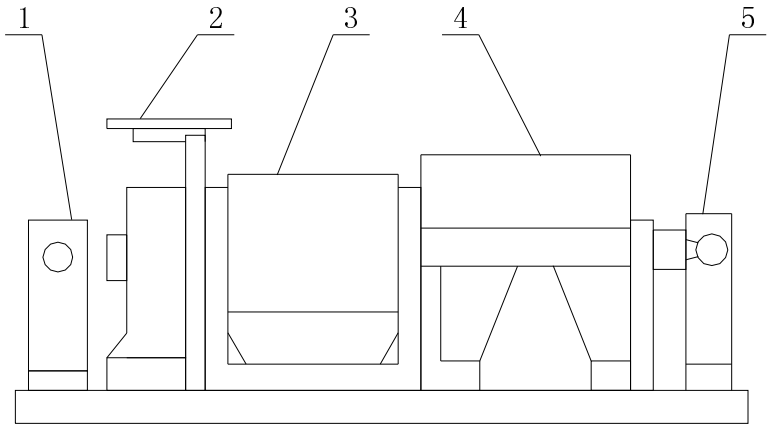


Curve A: light intensity varied with the magnitude of optical rotation α

Curve B,C,D: optical rotation α varied with time t due to Faraday effect (β swing)

Curve B',C',D': photo-current varied with time t—photo-signal

Figure 3



1. light source 2. counter 3. Faraday coil
4. sample chamber 5. photomultiplier

Figure 4

IV. OPERATION

1. The polarimeter should be placed in a dry place with good ventilation and kept from corrosion. The instrument should be handled with care and vibration is not allowed.
2. Insert the power plug of the instrument into the 220V power source. (It is required to use an AC electronic voltage regulation (1kVA).) And connect the grounding terminal to the earth reliably.
3. Turn on the power supply switch, the sodium lamp should light up. The instrument should be prewarmed for 5 minutes.
4. Turn on the light source switch (when the DC switch has been pulled up, if the lamp goes out, the DC switch should be pulled up and down repeatedly for one or two times, so as to make the sodium lamp light up under DC condition).
5. After the sodium lamp has been lit, please press "↵" button, LCD operates. (MODE — model, C — concentration, L — tube length, n — time of measurement; Default: MODE: 1, L: 2.0, C: 0, n: 1)
6. Display model shift
   a. Display model classification
   MODE1—optical rotation; MODE2—specific rotation;
   MODE3—concentration; MODE4—sugar degree
   b. If you need not shift display model, press "measure" button, display "0.000".

c. If you need shift, modify the value. Input “MODE, L, C, n”, should press “↵” button every time. When input “n”, press “↵” button, display “0.000”, this means you can measure. When input “C”, if find input error, can press “→”, cursor can be moved, then modify.
d. When measuring, need shift model, please press “→”.
e. When measuring, appear black or disorder screen, please press “↵”.

7. Display form

a. Measure optical rotation—MODE: 1 (see figure 5)
Need input “n”

α—value of optical rotation, α_{AV}—average value

b. Measure specific rotation—MODE: 2 (see figure 6)
Need input “L(dm), C, n”

$[\alpha]$—value of specific rotation, $[\alpha_{AV}]$—average value

c. Measure concentration—MODE: 3 (see figure 7)

Need input “L, $[\alpha]$, n”

C—value of concentration, C_{AV}—average value

(If $[\alpha]$ is negative, you need not input “-”, it can display “-” automatically, “-” means left-ratation sample)

d. Measure sugar degree—MODE: 4 (see figure 8)
Need input “n”

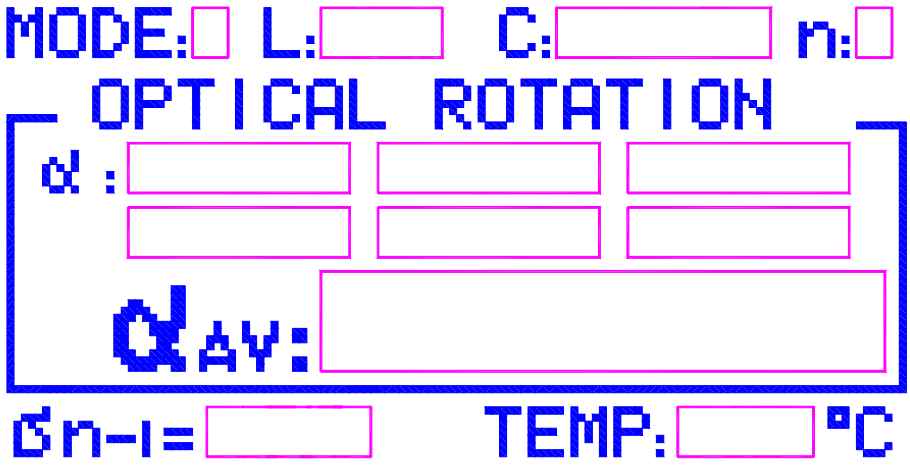


Figure 5

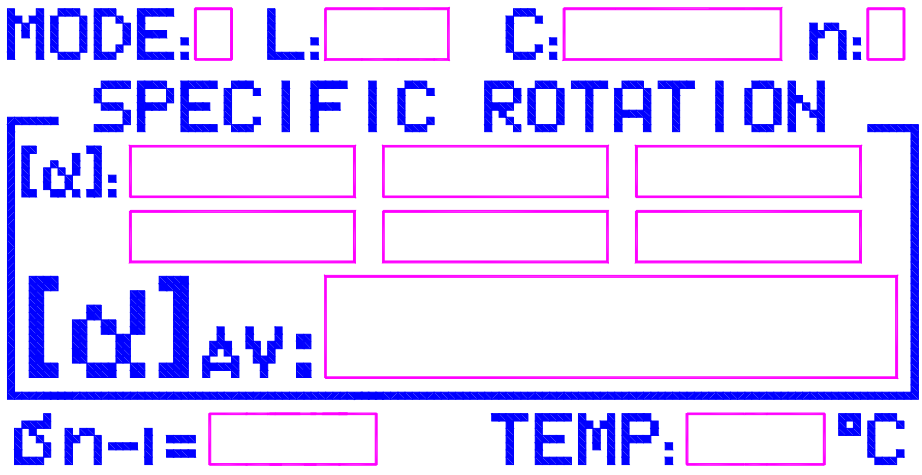


Figure 6

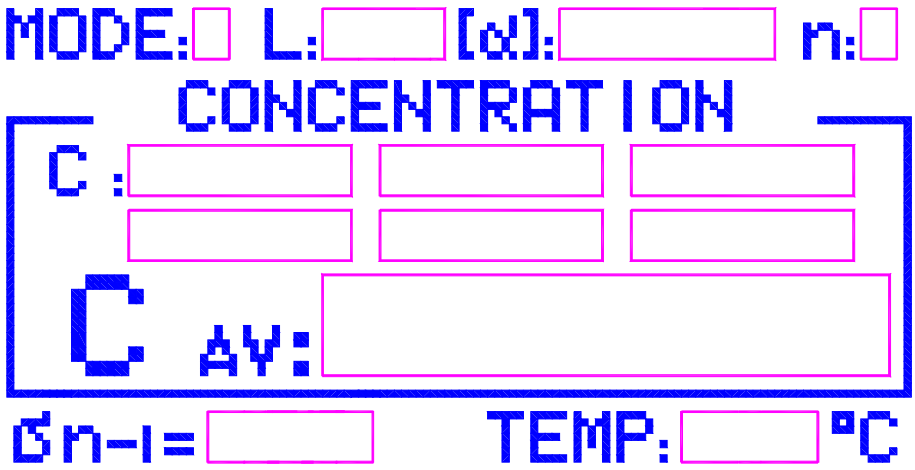


Figure 7

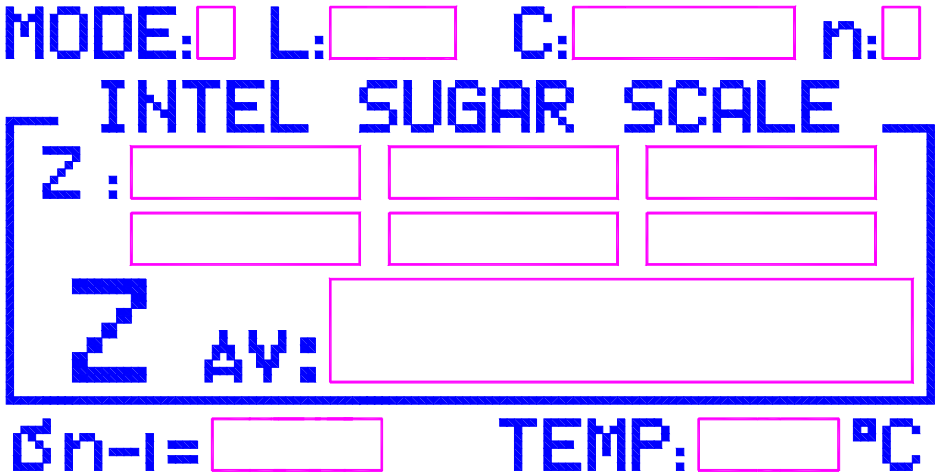


Figure 8

Z—value of sugar degree, $[Z]_{AV}$—average value

S_{n-1}—standard error of n=6, reflect discreteness of sample preparation and instrument measuring result. Low discreteness, high credence of measuring result.

8. Put the test tube containing distilled water or other blank solvent into the sample chamber, and close the cover. Press the "clear" button, display "0". (If there are air bubbles in the test tube, the first thing should be done is to make the air bubbles float on the protruded tube-neck. The atomized water drops on the both ends of test tube should be wiped dry. The screw-nut of the test tube should not be screwed down too tightly, so as to avoid stress, otherwise, the readings may be affected. When placing the test tube, care should be taken for the marked position and direction.)
9. Take out the test tube, then, inject the sample to be measured into the test tube. According to the same position and direction, put the test tube into the sample chamber, then, close the cover. Now the instrument will indicate the optical rotation of the sample.
10. The instrument will do repetition measurement for n times automatically, and display the value (when n=6, S_{n-1} is effective). If n=1, press "repetition-measurement" button to reset. If n>1, press "repetition-measurement" button, the instrument will measure repeatedly for n times.
11. If the polarized angle of the sample exceeds the measuring range, the instrument will be oscillating at $\pm 45^\circ$, at this time, the test tube should be taken out, then the instrument will reset to zero automatically. After diluting the sample, measure again.
12. Turn off the light source switch, power supply switch step by step when the measuring process is over.
13. Please press "zero" button before measurement every time.

You can use RS232 cable to connect the instrument with computer. But first you should install the supplied software.

Remark:

1. Calculate the specific rotatory power according to the formula following:

$$[\alpha] = 100\alpha / LC$$

Where, α is the measured optical rotation;
C is the concentration of solution (g/ml);
L is the length of test tube (dm).

2. Calculate the purity of the sample according to the formula following:
Purity=Measured specific rotation / Theoretical specific rotation
3. Measurement of the international saccharic concentration
According to the international standard of saccharic concentration, it is specified to use 26grams of pure sugar to make up 100ml of solution, to use a

200mm test tube, and to use the sodium light to perform the measurement at 20℃. Its optical rotation is +34.626, and its saccharic concentration is 100° Z.

V. COMMON BREAKDOWN AND HANDING

Breakdown Appearance	Analyses for Reason	Handling method
After turning on the power source (AC), the sodium lamp doesn't light up.	The sodium lamp or the fuse is broken..	Change
After turning on the power source (DC), the sodium lamp doesn't light up.	The speed of turning on light source switch is too slow. The sodium lamp is break. The power board is break.	Turn on quickly. Change Send to our repair department.
The instrument can't balance automatically.	The light can't go through the sample chamber. The lamp is not lit up completely. The high voltage or servo system has problem.	Clear sundries. Waiting. Send to our repair department.
The sound is too loud.	Mechanical friction	Open the back door, moving parts oiling.
Repeatability is bad and value is deviating.	The lamp is aging. The optical system has dust.	Change Send to our repair department.