Refractometer

WYA-2S

User Manual

Hangzhou ZHIYI Technology Co., Ltd
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1. User instruction

1.1 Applications and Features

This instrument can widely be used in petroleum, chemical, pharmaceutical, sugar refining and food industries, as well as in related colleges, universities and scientific research institutions for measuring the refractive index nD of transparent, subtransparent liquid or solid substance. This instrument can also be used to measure the Brix (BX) of the sugar solution, and correct the affect of temperature on the Brix automatically. In addition, this instrument can display the temperature of the sample.

1.2 Main Technical Parameters

Model	WYA-2S
Measuring range nD	1.3000~1.7000
Dissolved solids Brix	0~100%
Refractive index nD	±0.0002
Temperature range	0~50°C
Power supply	AC 110V/220V±10%, 50/60HZ
External size(W*D*H)	210*110*310mm
Package size(W*D*H)	370*240*470mm
Gross Weight	12kg

1.3 CONSTRUCTION AND PRINCIPLE

i. Principle block diagram

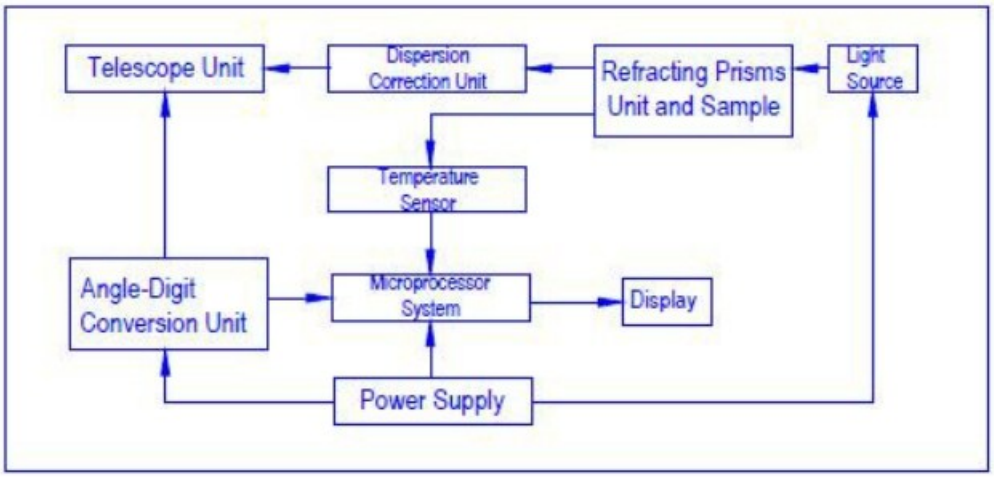


Figure 1

ii. Principle

The operational principle of the ABBE refractometer for measuring the refractive index of the transparent or subtransparent substance is based on the measurement of the critical angle. The observation system composed of the visual telescope unit and dispersion correction unit can be used to aim at the dividing line between the bright area and the dark area, that is to aim at the critical angle. The angle-digit conversion unit can be used to convert the angular magnitude into digital magnitude, which will be sent into the microprocessor system for being data-processed. Then, the refractive

index of Brix of the sample being measured will be displayed digitally.

iii. Construction of the instrument



Figure 2

1. Eyepiece
2. Dispersion correction hand-wheel
3. Display window
4. Power switch (POWER)
5. Reading display button (READ)
6. Brix (through temperature correction) display button (BX-TC)
7. Refractive index display button (nD)
8. Brix (not through temperature correction)
9. Adjustable hand-wheel
10. Light-gathering illuminating unit
11. Refracting prisms unit
12. Temperature display button (TEMP)
13. RS232 interface

2.Operation

2.1 Operation procedure

a. When the power switch “POWER” (4, see fig.2) is pressed, the illuminating lamp in the light-gathering illuminating unit (10) lights up; and at the same time, the display window (3) displays “00000” a few seconds later.

b. Open the refracting prisms unit (11), and remove the mirror-cleaning paper, which is put in between the two prisms when the instrument is idle to prevent the hard particles possibly remaining on the prisms from damaging the working surfaces of the prisms. Only single-layer mirror-cleaning paper is needed.

c. Check the surfaces of the upper and lower prisms, and carefully clean their surfaces with water or alcohol. After a sample is measured, the surfaces of the two prisms should also be cleaned carefully, because a little of the original sample remaining on the prisms will affect the measuring accuracy of the next sample.

d. Put the sample to be measured on the working surface of the lower refracting prism.

If the sample to be measured is a kind of liquid, a clean dropper may be used to suck in one or two drops liquid sample and then put drops onto the working surface of the refracting prism. After that, the cup of the upper light-intake prism should be put on. If the sample to be measured is a kind of solid substance, the solid sample must have a smooth polished surface that should be wiped clean before performing the measurement. Put one or two drops of a transparent liquid (such as naphthalene bromide), the refractive index of which is higher than of the solid sample, onto the working surface of the refracting prism, then put polished surface on the working surface of the refracting prism and let them have a good contact (see fig. 3). When measuring the solid sample, there is no need to put on the cup of the light-intake prism.

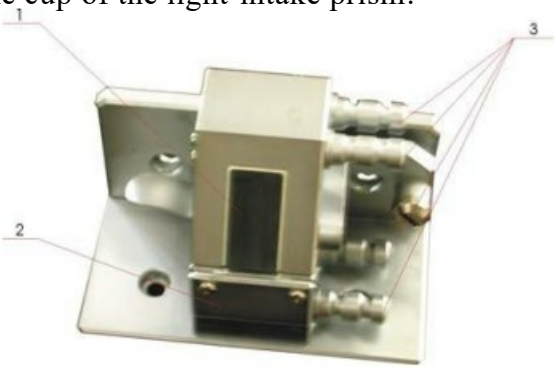


Figure 3

1. Light-intake prism
2. Refracting prism
3. Thermostat (a mechanism used for flow of the constant temperature water)

e. Rotate the rotating arm and collecting lens cone of the light-gathering illuminating unit so as to make the light-intake surface of the upper light-intake prism (when measuring the liquid sample) or the light-intake surface in front of the solid sample (when measuring the solid sample) be illuminated evenly.

f. Observe the field of view by means of the eyepiece (1), and at the same time, rotate the adjustable hand-wheel (9), so as to make the bright area dark area dividing line fall in the cross-line view field. If you see the field of view is dark through the eyepiece, you may rotate the adjustable hand-wheel counter clockwise. If you see the field of view is bright, you may rotate the adjustable hand-wheel clockwise. The bright area is at the top of the view field. Under the condition of the bright view field, you may rotate the eyepiece to adjust the visibility for seeing the cross-line clearly.

g. Rotate the dispersion correction hand-wheel (2) in the notch under the eyepiece sleeve, and at the same time, regulate the position of the light-gathering lens, so as to get a good contrast between

the bright area and dark area in the view field, and to make the bright area-dark area dividing line have the minimum dispersion.

h. Rotate the adjustable hand-wheel, so as to make the bright area-dark area dividing line be correctly aligned with the cross-point of the cross line (see fig.4).



Figure 4

i. When the reading display button "READ" (5) is pressed, "00000" in the display window disappears, and "-" is displayed; and a few seconds later, "-" disappears, and the refractive index of the sample being measured will be displayed in the display window. If you want to know the Brix value of the sample being measured, you may press the Brix (not through temperature correction) display button "BX" (8) or press the Brix (through temperature correction, ICUMSA) display button "BX-TC" (6). The three buttons "nD" (7), "BX-TC", and "BX" are used to select the measuring modes. After a measuring mode is selected, when the button "READ" is pressed, the display window will display the data in accordance with the pre-selected measuring mode. Sometimes, when the button "READ" is pressed, "-" is displayed, and a few seconds later, "-" disappears, and the display window becomes completely dark without any other displayed contents. It means that there is something wrong with the instrument, the instrument can not operate normally now, and it needs to be inspected or repaired. When the selected measuring mode is "BX-TC" or "BX", if the rotation of the adjustable hand-wheel is out of the Brix measuring range (0-95%), when the button "READ" is pressed, "·" will be displayed in the display windows.

j. If you want to measure the temperature of the sample, you may press the temperature display button "TEMP" (12), and the display window will display the temperature value of the sample being measured. The measurement of the sample's temperature can always be performed except when the display window displays "-" after the button "READ" is pressed, the pressing of the button "TEMP" is ineffective. When the temperature is displayed, if you press the button "nD", or button "BX-TC", or button "BX", the original refractive index or Brix will be displayed in the display window. In order to distinguish the displayed values between temperature and Brix, there will be a sign of "" added before the temperature value, a sign of "" added before the value of BX-TC, and a sign of "" added before the value of BX.

k. After the measurement of the sample is completed, the refracting prisms unit must be carefully cleaned with alcohol or water (when the sample is sugar solution).

l. There is a mechanism used for flow of the constant temperature water in the refracting prisms unit of the instrument. If you want to measure the refractive index of the sample at a specified temperature, an external thermostat can be connected to this instrument. Thus, you can perform the measurement of the sample, after the temperature is regulated to the value you required.

m. First, send out a random character, then wait to receive (Parameter: baud-rate 2400, date-bits 8, stop-bit 1, byte length 18)

Remark:

- ◆ it is possible to appear the phenomena that the instrument reset automatically or stop working (seldom seen). It results from external strong static or electric network fluctuation. You could cut off power supply and turn on the instrument again.
- ◆ You should connect the water temperature correctly if measuring the refractive index of the sample at a specified temperature. The water temperature could bear definite pressure (no more than 0.5MP). Incorrect connection or not clamping could result in the danger of

electricity.

2.2 Calibration of the instrument

The instrument should be calibrated periodically, or when the measuring data is under suspicion, the instrument may also be calibrated. When making the calibration, distilled water or glass standard block should be used. If there is an error between the measuring data and the standard one, you may use a screw driver, let it go into the small hole of the dispersion correction hand-wheel (2), and rotate the inside screw carefully, so as to make the cross lin on the division plate move up and down (see fig.5). Then perform the measurement again until the measuring data meets the requirement.

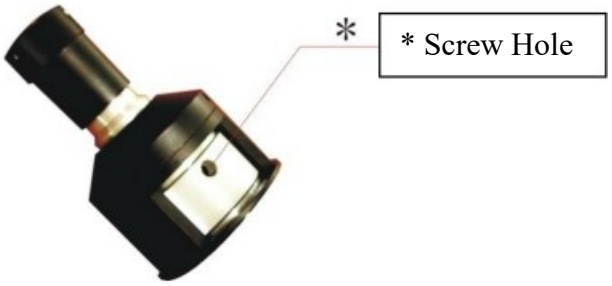


Figure 5

When the sample is the standard block, the measuring data should conform to the specified data on the standard block. If the sample is distilled water, the measuring data should coincide with the data listed in the following table.

Temperature (°C)	Refractive index (nD)	Temperature (°C)	Refractive index (nD)
18	1.3331	25	1.3325
19	1.3330	26	1.3323
20	1.3329	27	1.3322
21	1.3328	28	1.3321
22	1.3328	29	1.3320
23	1.3327	30	1.3319
24	1.3326		

3.Maintenance

i. The instrument should be positioned in a dry and well ventilated place where the temperature is rather suitable, so as to prevent the optical components of the instrument from becoming damp and going moldy.

ii. When moving the instrument, you should hold its bottom in the palm, not use rocker arm of the light-gathering illuminating unit (10) in order to avoid breaking the instrument.

iii. Before and after using the instrument, or when changing the sample, the working surface of the refracting prisms system must be cleaned and wiped.

iv. No solid impurity is permitted to exist in the sample to be measured. When measuring the solid sample, the working surface of the refracting prisms should be prevented from being roughed and scratched. This instrument is strictly forbidden to measure relatively strong corrosive samples.

v. The instrument should avoid violent vibration and shock so as to prevent the optical components from being broken or loosened, for keeping the accuracy of the instrument.
vi. If the lamp bulb in the light-gathering illuminating system is out of order, first you should cut off power supply, remove the collecting lens cone axially, screw the faulty bulb off anti-clockwise, change the new one and screw down clockwise. After loading the collecting lens cone, turn on the instrument. Observing the facula projected on surface of refracting prisms, if it located in center, it is ok. If it deviates, regulate the position of the lamp bulb (join socket) right and left (by loosening the side fixed screw), so that the light can be gathered on the light-intake surface of the refracting prisms and no obvious inclination will occur.
vii. Since the collecting lens of the instrument is made of plastics, in order to prevent its surface from being damaged by the corrosive sample, when you use the instrument, you should cover the collecting lens with a transparent plastic hood.
viii. When the instrument is not used, it should be covered with a plastic cover hood or put into a box.
ix. The user is not allowed to disassemble and assemble the instrument arbitrarily. If the instrument is out of order, or the accuracy requirement can not be reached, it should be repaired without delay.

4.Appendix

4.1 Appendix one: how to protect and use naphthalene bromide correctly

- ! Naphthalene bromide is the strongly corrosion liquid. When using the instrument every time, you should carefully clean the surfaces that are put some drops of Naphthalene bromide with alcohol.
- ! The skin touched the naphthalene bromide will not result in adverse reaction. But you should wash your hands after using.
- ! Eating forbidden. In case of splashing in eyes or mouth, please clean with water immediately.

Specification:
1-Bromonaphthalene
This reagent is a colorless oily liquid with a higher odor than naphthalene. Sensitive to light, miscible with ethanol, ether and chloroform, slightly soluble in water.
Note :The reagent should be stored in the dark
$C_{10}H_7Br$
Relative molecular mass: 207.07
CAS code:90-11-9
Bromide(Br) %---<=0.005
Density(20℃)/(g/mL)---1.482~1.492
Refractive index(n20D)---1.657~1.659
PH(H^+)/(mmol/100g)---<=0.06
H_2O,%--- <=0.05

4.2 Appendix two

In case of an interruption in the mains longer than the specified (10ms) time, the power supply unit of the equipment is switched off. The switch-on may be carried out by the operator.
In case of a disturbance like EFT (Electrical Fast Transients) occurring on AC power lines, the indication of the data will be incorrect or reset. The operator should push the “Ready” button to recover the normal operation.
In case of a ESD (Electromagnetic Discharge) occurring on the equipment, especially on the front panel, the equipment will be reset. The operator should push the “Ready” button to recover the normal operation.

Hangzhou ZHIYI Technology Co., Ltd
Address:No.51 of Xiba Road,Wuchang Street, Yuhang District, 311100 ,Hangzhou, Zhejiang Province, China
Phone:+86 13336040868
Email:sales@iqctest.com