

DIGITAL ABBE REFRACTOMETER

Model CAR - 02

Operating Manual



CONTECH[®]
Instruments Ltd.
AN ISO 9001-2008 COMPANY

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1. Applications of the Instrument

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 n_D of transparent or subtransparent liquid, or solid substance. This instrument can also be used to measure the Brix (BX) of the sugar solution, and to correct the effect of temperature on the Brix automatically. In addition, this instrument can display the temperature of the sample.

2. Main Specifications

(1) Measuring Range

Refractive index n_D	:	1.3000 - 1.7000
Brix BX - TC	:	0 - 95 %
Brix BX	:	0 - 95 %

(2) Measuring Accuracy

Refractive index n_D	:	± 0.0002
Brix BX - TC	:	± 0.1 %
Brix BX	:	± 0.1 %

(3) Temperature

Temperature displaying range	:	0 - 50 °C
Correcting range of BX versus temperature	:	15 - 45 °C

(4) Overall Dimensions of the Instrument

330mm × 180mm × 380mm

(5) Weight of the Instrument

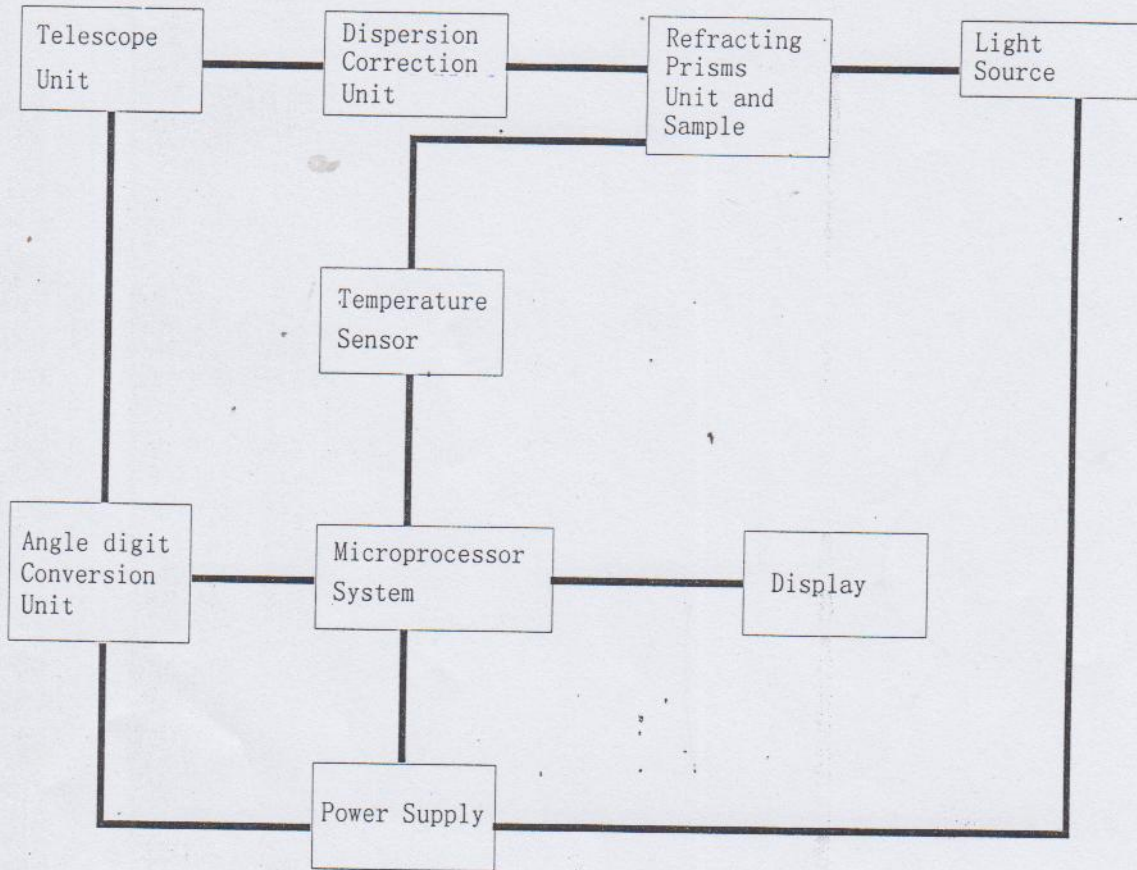
10 Kg

(6) Power Supply

220 V \pm 22 V (frequency: 50 Hz)

3. Principel of Operation

(1) Principle Block – diagram

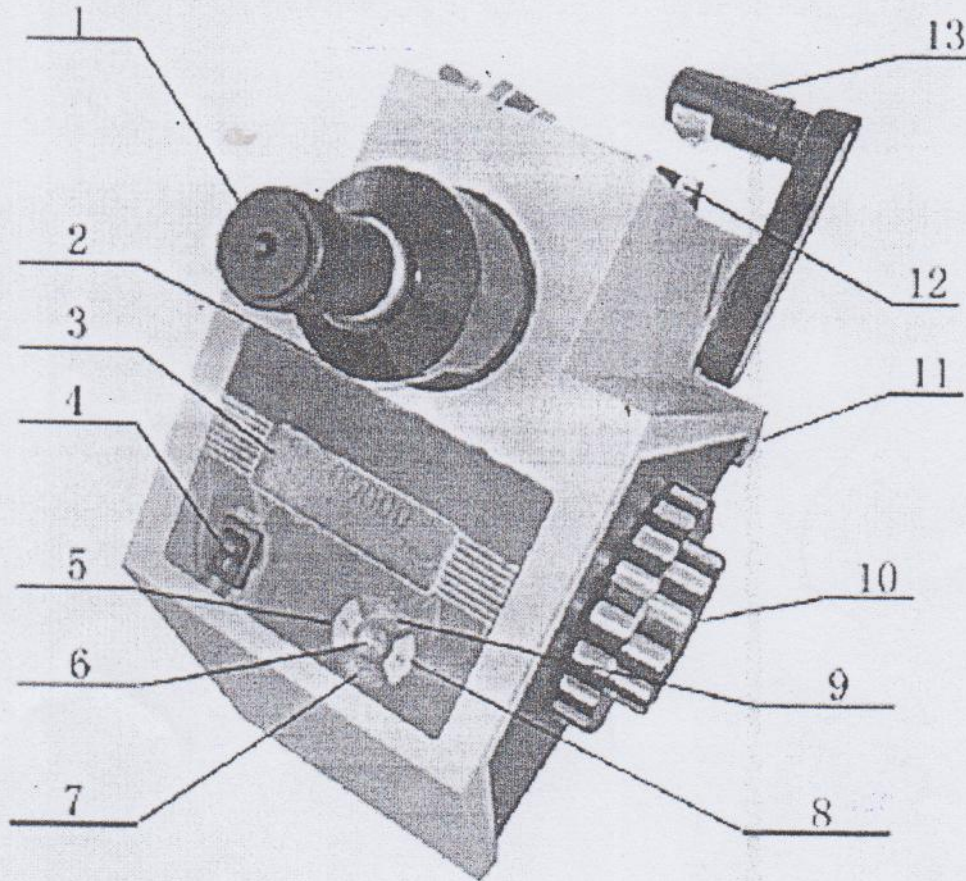


(2) Principle

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.

4. Construction of the Instrument

The following schematic diagram shows the construction of the instrument:



1. Eyepiece
2. Dispersion Correction Hand – wheel
3. Display Window
4. Power Switch(“POWER”)
5. Refractive Index Display Button(“ n_D ”)
6. Reading Display Button(“READ”)
7. Brix (through temperature correction) Display Button (“BX – TC”)
8. Brix (not through temperature correction)
9. Temperature Display Button(“TEMP”)
10. Adjustable Hand – wheel
11. Rs232 connect

12.Refracting Prisms Unit

13.Light – gathering Illuminating Unit

5. Operationg Procedure and How to Use the Instrument

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

(2) Oper 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.

(3) 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 litte of the original sample remaining on the prisms will affct the measuring accuracy of the next sample.

(4) 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 which 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 that of the solid sample, onto the working surface of the solid sample onto the working surface of the refracting prism and let them hacc a good contact. (See Fig.1).

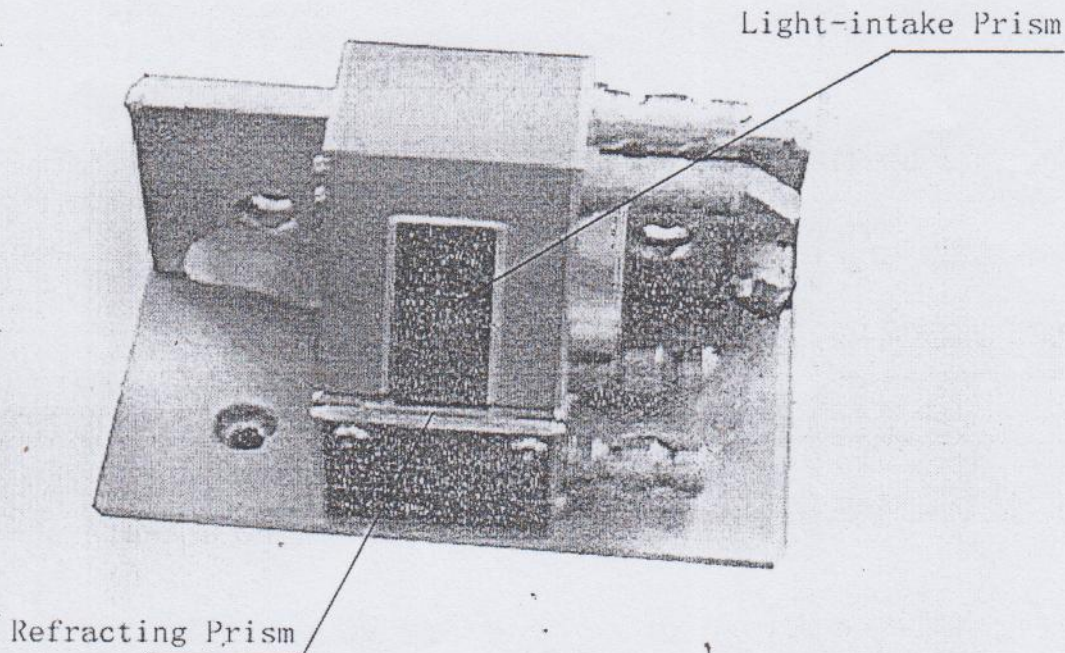


Fig.1

When measuring the solid sample, there is no need to put on the cup of the light-intake prism.

(5) 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.

(6) 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.

(7) Rotate the dispersion correction hand-wheel (2) in the notch under the eyepiece sleeve, and at 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.

(8) 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.2).



Fig.2

(9) 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”)(B) or press the Brix (through temperature correction) (ICUMSA) display button (“BX-TC”) (6). The three buttons “ n_D ”(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.

(10) 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 “n_D”, 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.

(11) 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).

(12) 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.

(13) First, send out a random character, then wait to receive.

(Parameter: Baud-rate 2400, Data-bits 8, Stop-bit 1, Byte length 18)

6. 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 an inner-hexagon spanner, let it go into the small hold of the dispersion correction hand-wheel(2), and rotate the inside screw carefully, so as to make the cross line on the division plate move up and down. (See Fig. 3). Then perform the measurement again until the measuring data meets the requirement.

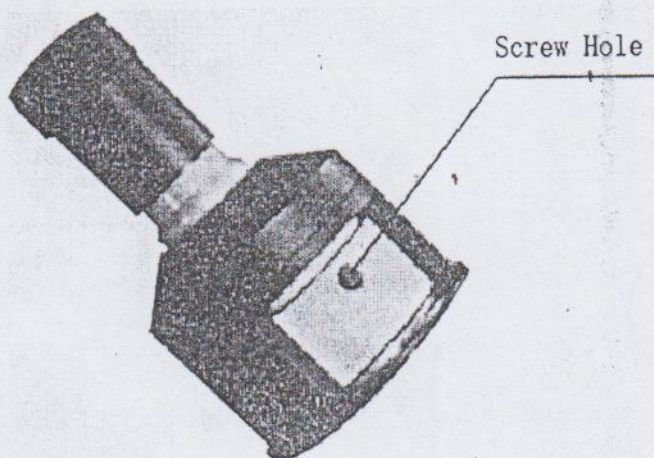


Fig.3

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 (n_D)	Temperature (°C)	Refractive Index (n_D)
18	1.33316	25	1.33250
19	1.33308	26	1.33239
20	1.33299	27	1.33228
21	1.33289	28	1.33217
22	1.33280	29	1.33205
23	1.33270	30	1.33193
24	1.33260		

7. Maintenance

- (1) The instrument should be positioned in a dry 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.
- (2) Before and after using the instrument, or when changing the sample, the working surface of the refracting prisms system must be cleaned and wiped.
- (3) 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.
- (4) 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.
- (5) If the lamp bulb in the light-gathering illuminating system is out of order, the collecting lens cone can be removed axially, so as to replace the faulty bulb with a new one. Then, regulate the position of the lamp bulb 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.
- (6) Since the collecting lens of the instrument is made of plastics, in order to prevent its surface from being damaged by corrosive sample, when you use the instrument, you should cover the collecting lens with a transparent plastic hood.
- (7) When the instrument is not used, it should be covered with a plastic cover hood, or put into a box.
- (8) 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, the instrument should be repaired without delay.



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