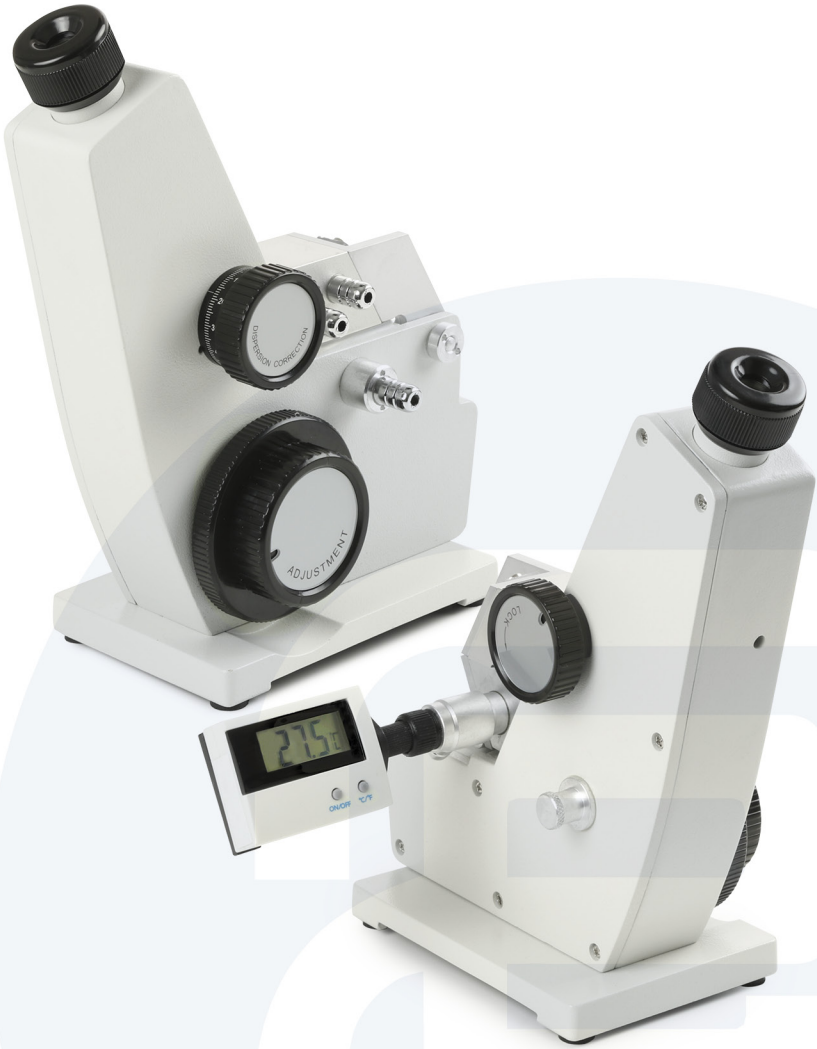
98.490

Abbe refractometer



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user manual

v.330401

Contents

1.0 Introduction

With your purchase of the Abbe refractometer you have chosen for a quality product. The Abbe refractometer is developed for use in laboratories and in the food industry.
The maintenance requirement is limited when using the refractometer in a decent manner.
This manual describes the construction of the refractometer, how to use the refractometer and maintenance of the refractometer

The contents of this manual are subject to change without notice. The appearance of the actual product can differ from the models described in this manual

2.0 General safety instructions

Install the product indoors on a stable, vibration free and level surface in order to prevent the relatively heavy instrument to fall thereby harming the operator

2.1 Handle with care

This product is a precise optical instrument. Delicate handling us required. Avoid sudden shocks and impacts that can affect the precision of the instrument. Product should be used in a proper environment

3.0 Construction of the refractometer

The names of the several parts are listed below and are indicated in the picture:

- **A.** Adjustable eyepiece
- **B.** Main body
- **C.** Dispersion correction knob
- **D.** Water connection (in-out)
- **E.** Water connection (out)
- **F.** Adjustment knob
- **G.** Stand foot
- **H.** Water connection (in)
- **I.** Digital thermometer
- **J.** Scale illumination window
- **K.** Reflection mirror
- **L.** Primary prism
- **M.** Light window
- **N.** Secondary prism
- **O.** Cover light window
- **P.** Prism lock

3.1 Functions of the refractometer

The instrument consists of a main body (B), stand foot (G) and a measuring part consisting of a primary- (L) and a secundary prism (N). When moving the instrument always pick it up by its main body

4.0 Preparing the refractometer for use

- Remove the instrument from the alluminium case and place it on a flat surface
- Screw the thermometer gently in its inlet on the main body, which is situated at the side of the primary prism (L).

5.0 Working with the refractometer

For optimum use please follow the below procedures

5.1 Calibrating the refractometer

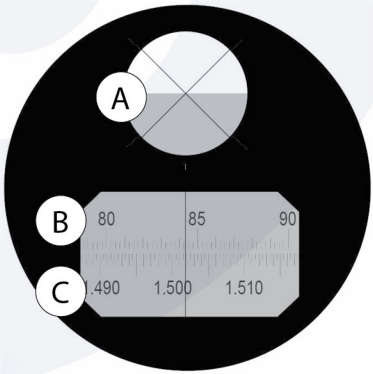
Before measuring the instrument should be calibrated with the supplied test piece and immersion fluid, this should be done as descripted below:

- Put some drops of the immersion fluid onto the surface of the primary prism (L)
- Gently put the test piece into the fluid, with the polished side pointing downwards
- Look trhough the eyepiece and turn it until the image is in focused
- Now turn the adjustment knob (F) until the cross exactly seperates the light and dark image in the field of view (A in ill. 1)
- The scale should now read exactly the same value as mentioned on the test piece. If this is not the case, adjust the scale by turning the set screw (B) with the supplied screw driver

A. Scale with cross

B. Brix scale (sugar percentage)

C. nD scale (refractive index)



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5.2 Measuring liquid samples with the refractometer

1. Put some drops of the sample fluid onto the primary prism (L), en close the secundary prism (N) by means of the knob (P). Make sure the sample is homogeneous and without air bubbles
2. Open the light cap (O) and close the reflection mirror (K)
3. look through the eyepiece (A) and focus the cross line
4. Turn the scale illumination window (J) until the brightest image is reached
5. Now move the cross with adjustment knob (F) until it is exactly at the border line of the dark and light image (A in ill. 1)
6. Color shifting in the image can be corrected to “black/white” by means of the dispersion knob (C).
7. Now a last correction to get the cross exactly on the border line can be made with adjustment knob (F)
8. The refractive index value (nD) can now be read on the bottom part of the scale (C in ill. 1)

5.3 Measuring the sugar percentage in a liquid

1. Put some drops of the sample fluid onto the primary prism (L), en close the secundary prism (N) by means of the knob (O). Make sure the sample is homogeneous and without air bubbles
2. Open the light cap (O) and close the reflection mirror (K)
3. Look through the eyepiece (A) and focus the cross line
4. Turn the scale illumination window (J) until the brightest image is reached
5. Now move the cross with adjustment knob (F) until it is exactly at the border line of the dark and light image (A in ill. 1)

6. Color shifting in the image can be corrected to "black/white" by means of the dispersion knob (C)
7. Now a last correction to get the cross exactly on the border line can be made with knob (F)
8. The sugar percentage (BRIX) can now be read on the upper part of the scale (B in ill. 1)

5.4 Measuring clear-transparent solid materials (e.g. glass)

Note!
Make sure one of the sides of the sample is perfectly smooth

1. Put some drops of the supplied immersion fluid onto the primary prism (L)
2. Carefully place the specimen with its smooth side into the fluid.
3. Open the light cap (O) and close the reflection mirror (K).
4. Look through the eyepiece (A) and focus the cross line
5. Turn the scale illumination window (J) until the brightest image is reached
6. Now move the cross with adjustment knob (F) until it is exactly at the border line of the dark and light image (A in ill. 1)
7. Color shifting in the image can be corrected to "black/white" by means of the dispersion knob (C)
8. Now a last correction to get the cross exactly on the border line can be made with knob (F).
9. The refractive index can now be read on the bottom part of the scale (C in ill. 1)

5.5 Measuring non-clear-transparent solid materials (e.g. satinized glass)

Note!
Make sure one of the sides of the sample is perfectly smooth

1. Put some drops of the supplied immersion fluid onto the primary prism (L)
2. Carefully place the specimen with its smooth side into the fluid
3. Open the reflection mirror (K)
4. Look through the eyepiece (A) and focus the cross line
5. Turn the scale illumination window (J) until the brightest image is reached
6. Now move the cross with adjustment knob (F) until it is exactly at the border line of the dark and light image (A in ill. 1)
7. Color shifting in the image can be corrected to "black/white" by means of the dispersion knob (C)
8. Now a last correction to get the cross exactly on the border line can be made with knob (F)
9. The refractive index can now be read on the bottom part of the scale (C in ill. 1)

5.6 Establishing the dispersion value DFC

1. Put some drops of the sample fluid onto the primary prism (L), en close the secundary prism (N) by means of the knob (P). Make sure the sample is homogeneous and without air bubbles
2. Open the light cap (O) and close the reflection mirror (K)
3. Look through the eyepiece (A) and focus the cross line
4. Turn the scale illumination window (J) until the brightest image is reached
5. Now move the cross with adjustment knob (F) until it is exactly at the border line of the dark and light image (A in ill. 1)
6. Correct the dispersion with the knob (C) and write down the value "Z" (on the side of the dispersion correction knob C). If "Z" is higher than 30, write "Z" as a negative number
7. Now a last correction to get the cross exactly on the border line can be made with knob (F)
8. The refractive index can now be read on the bottom part of the scale (C in ill. 1)
9. Copy the values of "A", "B" and "σ" from the table on page 7 of this manual with the use of the values "Z" en nD, written down on point 6
10. Use the values for the below formula:

$$D_{FC} = A + \sigma B$$

5.6.1 Calculation example 1, measured values with 2 decimals behind the comma:

Measured at 22°C:
nD liquid: 1.3300
Dispersion correction **Z**: 40.0

Found values A and B in the nD column in table 5.7:
A = 0.02484
B = 0.03304

Found value σ in the Z column in table 5.7:
σ = -0.500 (negative value, for Z is higher than 30)

$D_{FC} = A + \sigma B$
$D_{FC} = 0.02484 + (0.03304 \times -0.500)$
$D_{FC} = 0.00832$

5.6.2 Calculation example 2, measured values with more as 2 decimals behind the comma:

Measured at 20°C:
ND distilled wate : 1.3330*
Dispersion correction **Z**: 41.62*

**In the table the measured values nD 1.3330 and "Z" value 41.62 are not included, therefore calculate "A", "B" and "σ" as follows:*

- Take the nD value 1.33 (or the corresponding "Z" value) from the table
- Read the correct value (in this case – 5 x 10-6 per 0.001) and add it to the value of "A" given for 1.33

1.3330 -1.33 = 0.003
so the correcting value is: 3 x – 5 x 10-6 = 0.000015

The given value "A" for 1.33 is 0.02484, so the corrected "A" value for nD 1.3330 is:
0.02484 + 0.000015 = 0.024825

Repeat the these steps also for the "B" and "σ" values

Results:
A = 0.024825
B = 0.032983
σ = -0.5716 (negative value for Z is higher as 30)

$D_{FC} = A + \sigma B$
$D_{FC} = 0.024825 + (0.032983 \times -0.5716)$
$D_{FC} = 0.005972$

5.7 Table dispersion values

ND	A	0.001 decimal correction for A: x(10 $^{-6}$)	B	0.001 decimal correction for B: x(10 $^{-9}$)	Z	σ	0.1 decimal correction for σ: x (10 $^{-4}$)	Z
1.30000	0.02499	-5	0.03349	-13	0	0.000		60
1.31000	0.02494	-5	0.03336	-16	1	0.999	1	59
1.32000	0.02489	-5	0.03320	-16	2	0.995	4	58
1.33000	0.02484	-5	0.03304	-10	3	0.988	7	57
1.34000	0.02479	-5	0.03285	-20	4	0.978	10	56
1.35000	0.02474	-4	0.03265	-21	5	0.966	12	55
1.36000	0.02470	-4	0.03244	-22	6	0.951	15	54
1.37000	0.02466	-5	0.03221	-34	7	0.934	17	53
1.38000	0.02461	-4	0.03197	-27	8	0.914	20	52
1.39000	0.02457	-3	0.03170	-27	9	0.891	23	51
1.40000	0.02454	-4	0.03143	-30	10	0.866	52	50
1.41000	0.02450	-3	0.03113	-31	11	0.839	27	49
1.42000	0.02447	-4	0.03082	-32	12	0.809	30	48
1.43000	0.02443	-3	0.03050	-35	13	0.777	32	47
1.44000	0.02440	-2	0.03615	-36	14	0.743	34	46
1.45000	0.02438	-2	0.02979	-38	15	0.707	36	45
1.46000	0.02435	-2	0.02941	-39	16	0.669	38	44
1.47000	0.02433	-3	0.02902	-42	17	0.629	40	43
1.48000	0.02430	-2	0.02860	-43	18	0.588	41	42
1.49000	0.02428	-1	0.02817	-46	19	0.545	43	41
1.50000	0.02427	-2	0.02771	-47	20	0.500	45	40
1.51000	0.02425	-1	0.02724	-49	21	0.454	46	39
1.52000	0.02424	-1	0.02675	-52	22	0.407	47	38
1.53000	0.02423	0	0.02623	-54	23	0.358	49	37
1.54000	0.02423	0	0.02569	-56	24	0.309	49	36
1.55000	0.02423	0	0.02513	-59	25	0.259	50	35
1.56000	0.02423	0	0.02454	-61	26	0.208	51	34
1.57000	0.02424	+1	0.02393	-64	27	0.156	52	33
1.58000	0.02425	+1	0.02329	-64	28	0.104	52	32
1.59000	0.02426	+1	0.02262	-67	29	0.052	52	31
1.60000	0.02428	+2	0.02192	-70	30	0.000	52	30
1.61000	0.02430	+2	0.02119	-73				
1.62000	0.02433	+3	0.02042	-77				
1.63000	0.02437	+4	0.01962	-80				
1.64000	0.02442	+5	0.18877	-85				
1.65000	0.02447	+5	0.01788	-89				
1.66000	0.02453	+6	0.01694	-94				
1.67000	0.02461	+8	0.01594	-100				
1.68000	0.02470	+9	0.01487	-107				
1.69000	0.02480	+10	0.01373	-114				
1.70000	0.02493	+13	0.01250	-123				

5.8 The use of circulating water

For use in so-called "on-line" situations it can be important to keep the temperature of the sample fluid on a constant level. The refractometer can be linked to a water circulator to keep the prisms of the refractometer on a constant temperature

Therefore the connection points of the circulation system should be connected to eachother by means of flexible rubber hoses (not supplied). Proceed as follows:

- The water supply should be connected to connection point "H"
- Connection point "E" should be connected to one of the connection points "D"
- The last connection point should be used for the discharge

5.9 Refractive indices and average dispersion values of distilled water

As an example dispersion values and nD values corrected at temperatures of 10 - 40°C are given

Temp. in °C	Refractive index in nD	Dispersion value D_{FC}	Temp. in °C	Refractive index in nD	Dispersion value D_{FC}
10	1.33369	0.00600	33	1.33157	0.00593
11	1.33364	0.00600	34	1.33144	0.00593
12	1.33358	0.00599	35	1.33131	0.00592
13	1.33352	0.00599	36	1.33117	0.00592
14	1.33346	0.00599	37	1.33104	0.00591
15	1.33339	0.00599	38	1.33090	0.00591
16	1.33331	0.00598	39	1.33075	0.00591
17	1.33324	0.00598	40	1.33061	0.00590
18	1.33316	0.00598			
19	1.33307	0.00597			
20	1.33299	0.00597			
21	1.33290	0.00597			
22	1.33280	0.00597			
23	1.33271	0.00596			
24	1.33261	0.00596			
25	1.33250	0.00596			
26	1.33240	0.00596			
27	1.33229	0.00595			
28	1.33217	0.00595			
29	1.33206	0.00594			
30	1.33194	0.00594			
31	1.33182	0.00594			
32	1.33170	0.00593			

6.0 Maintenance and cleaning

- Always place the dustcover over the refractometer after use
- Clean both prism surfaces with a tissue

6.1 Cleaning the optics

If eyepiece or prism surfaces are poluted, they can be cleaned with a lenspaper with a little alcohol

Note!

Never use a drop of alcohol directly on the lenses, since it can damage the coating

Note!

Cleaning cloths containing plastic fibres can damage the coating of the lenses!

6.2 Maintenance of the stand

Dust can be removed with a brush. In case the stand is really dirty the surface can be cleaned with a non-aggressive cleaning product

7.0 Refractometer accessories

See our website for the current accessories
www.euromex.com

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