Fisher
Bioblock Scientific
Parc d'innovation - BP 50111 - F67403 illkirch cedex

France
tél 03 88 67 14 14
fax 03 88 67 11 68
email infos@bioblock.fr
www.bioblock.com

Belgique / België
tél 056 260 260
fax 056 260 270
email belgium@bioblock.com
www.bioblock.be

España
tfno 91 515 92 34
fax 91 515 92 35
email ventas@bioblock.com
www.es.fishersci.com

Instruction manual

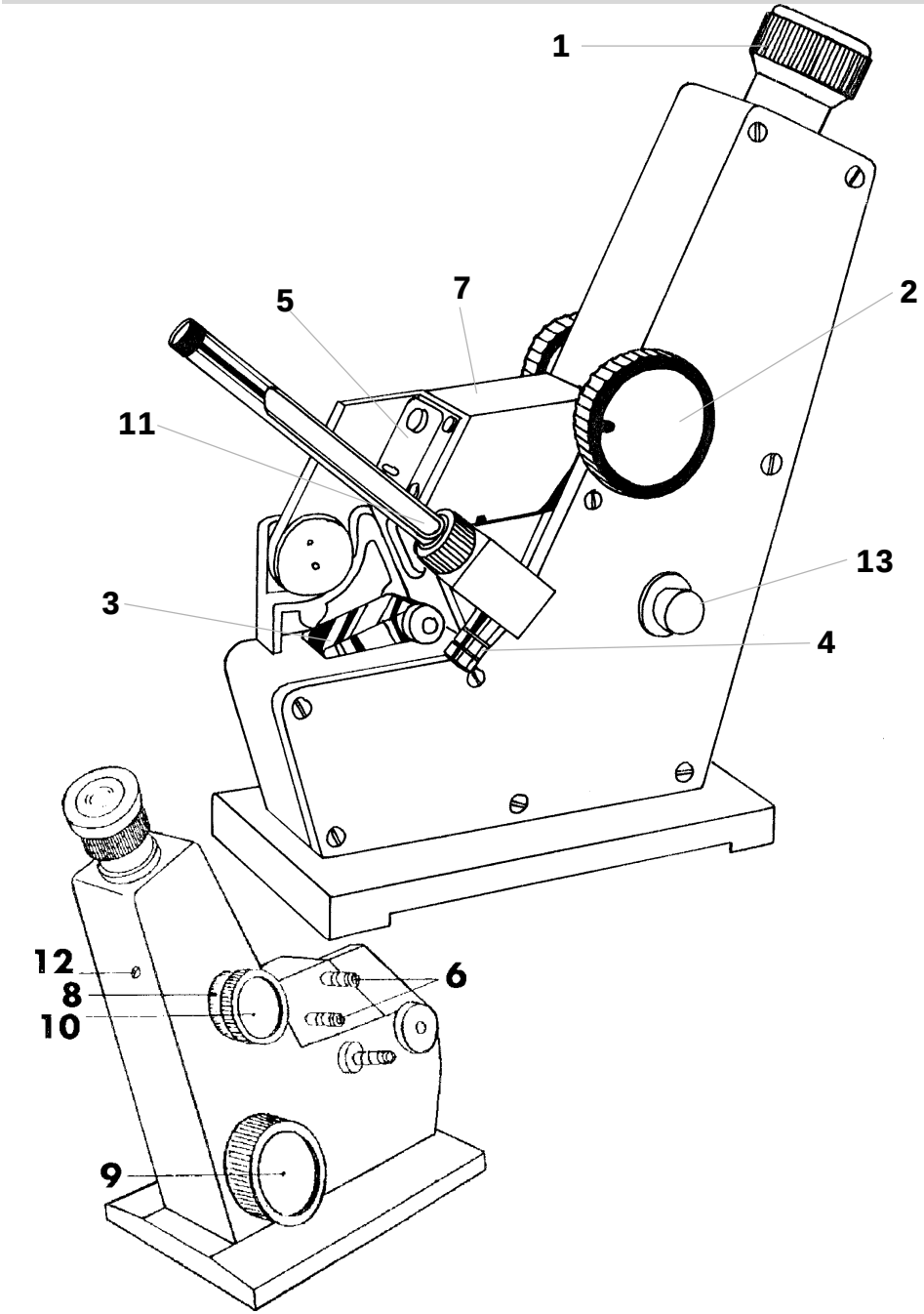
Medline
Unit 33 Monument Business Park
Warpsgrove Lane, Chalgrove
Oxfordshire OX44 7RW, U.K.
tel: +44 1865 400321 - fax: +44 1865 400736
sales@medlineuk.com
www.medineuk.com

Index

Specifications

Model :	**CONVEX**
Refractive index :	1.300 - 1.700 nD
Scale unit :	0,0005
Sugar solution :	0 - 95%
Scale unit :	0,5%
Max. inaccuracy :	0,2% between 0-50% 0,1% between 50-95%
Temperature range :	0 - 50 °C
Weight :	3 kg

Fig. 1



Parts of the refractometer

1	Eyepiece (magnification 30x)
2	Prism open/shut handle
3	Reflecting mirror
4	Inlet nozzle to measure water temp.
5	Light entry prism cover
6	Inlet nozzles for thermostatic bath
7	Upper prism in housing
8	Prism control CF value
9	Measurement knob
10	Colour compensation knob
11	Thermometer entry
12	Calibration screw
13	Scale light entry prism

Unpacking and assembling

- Take the instrument out of the metal case.
- Remove the protective papers from eyepiece and prims.
- Your instrument is ready for use.
- Thermometer, standard glass gauge, and bromonaphthalene are stored separately in a wooden shelf at the top of the wooden case.
- In order to guarantee the measuring accuracy of the instrument it should be put in a room with a temp. of 20 °C tol. ± 3 °C.

Calibration check

- Open the light entry prism cover (5).
- Close the reflecting mirror (3).
- Turn the colour compensation knob (10), erasing the colour of the boundery line.
- Stop the knob at that position where the red and the blue disappear completely.
- As the red appears immediately above the boundery line and the blue immediately below, the area midway between the two will be the position of complete colour compensation.
- When the boundery line is aligned with the intersection of the cross lines, the scale matches the refractive index (depending on the calibration method).

Calibration check

a) Method of distilled water :

- Open the upper prism.

- Put 2-3 drops of distilled water onto the main prism surface, close the upper prism and look through the eyepiece.
  If the thermometer scale is at 20 ℃, the brix scale will be O (or 1.3330 refractive index).

- If there is any difference, follow next steps :
  * while looking through the eyepiece, turn the measurement knob (9) slowly, bringing the brix scale to O (or 1.3330 refr. index)
  * take the enclosed screwdriver and turn the calibration screw (12) to align the boundery line with the intersection of the crossed lines.

b) Method using standard glass gauge :

- Open the upper prism.

- Apply an extremely small amount of bromonaphthalene on the polished surface of the standard glass gauge (the opposite side on which the refractive index is engraved). 1 drop of 2mm diam. is an appropriate amount.

- Press the polished surface of the standard glass gauge onto the lower prism. The bromonaphthalene should spread into a thin film completely filling the space between the standard glass gauge and the lower prism.

- Illuminate the frontside of the standard glass gauge so that the light makes a 90° angle of incidence before touching the lower prism.

- While looking through the eyepiece, turn the measurement knob (9) bringing the nD scale to the value indicated on the test piece.

- Use the enclosed screwdriver, turn the calibration screw and align the boundary line with the intersection of the crossed line.

Measurement of liquids

- Open the upper prism and put 2-3 drops of specimen onto the center of the surface of the lower prism.
  Gently close the upper prism and lock it by handle (2). At this time, the specimen will form a thin film between the upper and lower prism .

- Check if the reflecting mirror (3) is closed, open the light entry prism cover (5).

- Focus the cross line by means of the eyepiece.

- Turn the measurement knob to obtain the bright/dark borderline position.

- Turn the colour compensation knob (10) to obtain a clear and well defined boundery line.

- Turn the measurement knob again, aligning the boundary line with the intersection of the crossed lines.

- The value on the scale gives refractive index or brix of the liquid sample.

Measuring of semi-transparent liquids

- Open the upper prism and put 2-3 drops of semi-transparent liquid on the surface of the lower prism;

- Because the liquid sample is coloured, a lot of transmitted light is absorbed. Therefore the light entering in the refractive prism may be too weak and the bright and dark borderline may not be clear. Thus it should be illuminated by reflecting light.

- Close the light entry prism cover (5) and open the reflecting mirror (3). You can also get the image of the bright and dark borderline, but the bright and dark part will be reversed due to a mirror in the optical path.

- For next steps see “transparent liquids”.

Measurement of solids

- While measuring solids, a contact liquid must be used to fix the sample onto the lower prism. It's absolutely necessary that the refractive index of the contact liquid is higher than that of the sample.

- The operation method is the same as mentioned under "calibration check method using standard glass gauge".

Measurement of sugar content

The measuring procedure for sugar content in liquid state is the same as measuring transparent liquid. The percentage of the sugar content is directly visible on the scale (brix value).

Temperature correction for Abbe refractometer

If you measure a sample at a temp. lower or higher than 20 °C, a correctionfactor must be added on the results. This to compensate the difference due to the calibration value of the prism which is 20 °C. The correction is 0,0000078 per degree centigrade is constant over the total scale range.

Example :

The refractometer reading is 1.4636 at a prism box temp. of 55 °C.
The correction to be applied is
(T-20) x 0,0000078 = 35 x 0,0000078 = 0,00027

Result :

Scale reading	1, 4636
Correction for 55 °C	0, 00027
Correct refractive index at 55 °C	1, 46387

Temperature correction table

Instead of calculating the temperature correction, following table can be used.

Temp. °C	Correction
0	- 0,00016
10	- 0,00008
20	none
30	+ 0,00008
40	+ 0,00016
50	+ 0,00023
60	+ 0,00031
70	+ 0,00039
80	+ 0,00047
90	+ 0,00054
100	+ 0,00062

- The colour compensation knob (10) provided with a dispersion drum, can be used to obtain an approx. dispersion value of the sample.
- The dispersion value is obtained with next formula :
  NF - NL = A + Ba.
- When the refractive index is mesured, the colours on the boundery line should be completely eliminated.
- Read the dispersion scale from the prism control CF value (8) which is divided 60-0-60.
- Repeat the measurement several times from the left and right scales by turning the colour compensation knob (10).
- Obtain the main value “Z” from the values of the left and the right scales. Then obtain the value of a from the dispersion table according the value “Z”.
- The value will take a negative sign if “Z” is > 30 and a positive sign if “Z” is < 30.
- A and B values are obtained from the table “read value of the refractive index.

Determination of dispersion value

Example: the main dispersion of distilled water :
nD = 1.3330 at 20 °C

- Reading obtained by rotating :

	left	right
1st reading	43,7	43,8
2nd "	43,7	43,7
3rd "	43,8	43,6
4th "	43,6	43,7
5th "	43,8	43,6
Average	43,72	43,7

The total average = "Z" = 43,71

- From the dispersion table we find :

When nD = 1.3330
A = 0.02479
B = 0.02856

When Z = 43,71
= -0.6574

- Result :
NF - NL = A + Ba
= 0.02479 - 0.02856 x 0.6574
= 0.00601

Read value of the refractive index

nD	A		B	
1.30000	0.02496		0.02901	
1.31000	0.02480	-6	0.02889	-12
1.32000	0.02485	-5	0.02876	-13
1.33000	0.02480	-5	0.02861	-15
1.34000	0.02476	-4	0.02845	-16
1.35000	0.02471	-5	0.02828	-17
1.36000	0.02466	-5	0.02810	-18
1.37000	0.02462	-4	0.02790	-20
1.38000	0.02458	-4	0.02768	-22
1.39000	0.02454	-4	0.02746	-22
1.40000	0.02450	-4	0.02722	-24
1.41000	0.02446	-4	0.02696	-26
1.42000	0.02443	-3	0.02670	-26
1.43000	0.02440	-3	0.02641	-29
1.44000	0.02437	-3	0.02612	-29
1.45000	0.02434	-3	0.02580	-32
1.46000	0.02431	-3	0.02547	-33
1.47000	0.02429	-2	0.02513	-34
1.48000	0.02427	-2	0.02477	-36
1.49000	0.02425	-2	0.02440	-37
1.50000	0.02423	-2	0.02400	-40
1.51000	0.02422	-1	0.02359	-41
1.52000	0.02421	-1	0.02316	-43
1.53000	0.02420	-1	0.02272	-44
1.54000	0.02419	0	0.02225	-47
1.55000	0.02419	0	0.02176	-49
1.56000	0.02419	0	0.02126	-50
1.57000	0.02420	+1	0.02073	-53
1.58000	0.02421	+1	0.02017	-56
1.59000	0.02422	+1	0.01959	-58
1.60000	0.02424	+2	0.01899	-60
1.61000	0.02427	+3	0.01835	-64
1.62000	0.02430	+3	0.01769	-66
1.63000	0.02434	+4	0.01699	-70
1.64000	0.02438	+4	0.01626	-73
1.65000	0.02443	+5	0.01549	-77
1.66000	0.02450	+7	0.01467	-82
1.67000	0.02457	+7	0.01381	-86
1.68000	0.02466	+9	0.01288	-93
1.69000	0.02476	+10	0.01189	-99
1.70000	0.02489	+13	0.01083	-106

Dispersion table according "Z"

When the scale on the colour compensation knob shows a value between 0.00 and 30.0, the value for a is found as follows :
60.0 - (prism control CF value a) = "Z".
Based on this "Z" value, the value for a can be found on the chart.
However this value will be positive.

z	a	z	a	z	a	z	a	z	a	z	a
30.0	0.000	35.0	-0.259	40.0	-0.500	45.0	-0.707	50.0	-0.866	55.0	-0.966
30.1	0.005	35.1	-0.264	40.1	-0.505	45.1	-0.711	50.1	-0.869	55.1	-0.967
30.2	0.010	35.2	-0.269	40.2	-0.509	45.2	-0.714	50.2	-0.871	55.2	-0.969
30.3	0.016	35.3	-0.274	40.3	-0.514	45.3	-0.718	50.3	-0.874	55.3	-0.970
30.4	0.021	35.4	-0.279	40.4	-0.518	45.4	-0.722	50.4	-0.876	55.4	-0.971
30.5	-0.026	35.5	-0.284	40.5	-0.522	45.5	-0.725	50.5	-0.879	55.5	-0.972
30.6	-0.031	35.6	-0.289	40.6	-0.527	45.6	-0.729	50.6	-0.881	55.6	-0.974
30.7	-0.037	35.7	-0.294	40.7	-0.531	45.7	-0.733	50.7	-0.884	55.7	-0.975
30.8	-0.042	35.8	-0.299	40.8	-0.536	45.8	-0.736	50.8	-0.886	55.8	-0.976
30.9	-0.047	35.9	-0.304	40.9	-0.540	45.9	-0.740	50.9	-0.889	55.9	-0.977
31.0	-0.052	36.0	-0.309	41.0	-0.545	46.0	-0.743	51.0	-0.891	56.0	-0.978
31.1	0.058	36.1	-0.314	41.1	-0.549	46.1	-0.747	51.1	-0.893	56.1	-0.979
31.2	0.063	36.2	-0.319	41.2	-0.553	46.2	-0.750	51.2	-0.896	56.2	-0.980
31.3	0.068	36.3	-0.324	41.3	-0.558	46.3	-0.754	51.3	-0.898	56.3	-0.981
31.4	0.073	36.4	-0.329	41.4	-0.562	46.4	-0.757	51.4	-0.900	56.4	-0.982
31.5	-0.078	36.5	-0.334	41.5	-0.566	46.5	-0.760	51.5	-0.903	56.5	-0.983
31.6	-0.084	36.6	-0.339	41.6	-0.571	46.6	-0.764	51.6	-0.905	56.6	-0.984
31.7	-0.089	36.7	-0.344	41.7	-0.575	46.7	-0.767	51.7	-0.907	56.7	-0.985
31.8	-0.094	36.8	-0.349	41.8	-0.579	46.8	-0.771	51.8	-0.909	56.8	-0.986
31.9	-0.099	36.9	-0.353	41.9	-0.584	46.9	-0.774	51.9	-0.911	56.9	-0.987
32.0	-0.105	37.0	-0.358	42.0	-0.588	47.0	-0.777	52.0	-0.914	57.0	-0.988
32.1	0.110	37.1	-0.363	42.1	-0.592	47.1	-0.780	52.1	-0.916	57.1	-0.989
32.2	0.115	37.2	-0.368	42.2	-0.596	47.2	-0.784	52.2	-0.918	57.2	-0.989
32.3	0.120	37.3	-0.373	42.3	-0.600	47.3	-0.787	52.3	-0.920	57.3	-0.990
32.4	0.125	37.4	-0.378	42.4	-0.605	47.4	-0.790	52.4	-0.922	57.4	-0.991
32.5	-0.131	37.5	-0.383	42.5	-0.609	47.5	-0.793	52.5	-0.924	57.5	-0.991
32.6	-0.136	37.6	-0.388	42.6	-0.613	47.6	-0.797	52.6	-0.926	57.6	-0.992
32.7	-0.141	37.7	-0.392	42.7	-0.617	47.7	-0.800	52.7	-0.928	57.7	-0.993
32.8	-0.146	37.8	-0.397	42.8	-0.621	47.8	-0.803	52.8	-0.930	57.8	-0.993
32.9	-0.151	37.9	-0.402	42.9	-0.625	47.9	-0.806	52.9	-0.932	57.9	-0.994
33.0	-0.156	38.0	-0.407	43.0	-0.629	48.0	-0.809	53.0	-0.934	58.0	-0.995
33.1	0.162	38.1	-0.412	43.1	-0.633	48.1	-0.812	53.1	-0.935	58.1	-0.995
33.2	0.167	38.2	-0.416	43.2	-0.637	48.2	-0.815	53.2	-0.937	58.2	-0.996
33.3	0.172	38.3	-0.421	43.3	-0.641	48.3	-0.818	53.3	-0.939	58.3	-0.996
33.4	0.177	38.4	-0.426	43.4	-0.645	48.4	-0.821	53.4	-0.941	58.4	-0.996
33.5	-0.182	38.5	-0.431	43.5	-0.649	48.5	-0.824	53.5	-0.943	58.5	-0.997
33.6	-0.187	38.6	-0.435	43.6	-0.653	48.6	-0.827	53.6	-0.944	58.6	-0.997
33.7	-0.193	38.7	-0.440	43.7	-0.657	48.7	-0.830	53.7	-0.946	58.7	-0.998
33.8	-0.198	38.8	-0.445	43.8	-0.661	48.8	-0.833	53.8	-0.948	58.8	-0.948
33.9	-0.203	38.9	-0.449	43.9	-0.665	48.9	-0.836	53.9	-0.949	58.9	-0.998
34.0	-0.208	39.0	-0.454	44.0	-0.669	49.0	-0.839	54.0	-0.951	59.0	-0.999
34.1	0.213	39.1	-0.459	44.1	-0.673	49.1	-0.842	54.1	-0.953	59.1	-0.999
34.2	0.218	39.2	-0.463	44.2	-0.677	49.2	-0.844	54.2	-0.954	59.2	-0.999
34.3	0.223	39.3	-0.468	44.3	-0.681	49.3	-0.847	54.3	-0.956	59.3	-0.999
34.4	0.228	39.4	-0.473	44.4	-0.685	49.4	-0.850	54.4	-0.957	59.4	-1.000
34.5	-0.233	39.5	-0.477	44.5	-0.688	49.5	-0.853	54.5	-0.959	59.5	-1.000
34.6	-0.239	39.6	-0.482	44.6	-0.692	49.6	-0.855	54.6	-0.960	59.6	-1.000
34.7	-0.244	39.7	-0.486	44.7	-0.696	49.7	-0.858	54.7	-0.962	59.7	-1.000
34.8	-0.249	39.8	-0.491	44.8	-0.700	49.8	-0.861	54.8	-0.963	59.8	-1.000
34.9	-0.254	39.9	-0.495	44.9	-0.703	49.9	-0.863	54.9	-0.965	59.9	-1.000
										60.0	-1.000

Maintenance

- When not in use the instrument should be put in a dry and well ventilated room.

- If the surface of the optical parts is dirty, it should be cleaned with a cotton rag. If the optical surfaces are oily, they should be cleaned with xylene or ether.

- After measuring a corrosive liquid, clean immediately the optical workpiece, metallic workpiece and paint to avoid corrosion.

Trouble shooting

SYMPTOM	CAUSES	REMEDIES
Troubled definition	Dioptric correction not calibrated	Calibrate dioptric correction by turning correction ring (1)