KERN OPTICS

GB

Operating manual
Digital refractometer

Manual_ORF-U_V1

KERN ORF 45BM, 92BM, 85BM, 92HM, 3SM, 2WM, 1PM, 2UM, 5UM, 6US, 1RS

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1. Introduction

This refractometer is an easy-to-use measuring instrument.
Please read the operating instructions before use to achieve an optimal measurement result.
The refractometer is designed for fast and precise determination of concentrations in liquids. Automatic temperature compensation is also included. The measuring instrument will work reliably for many years if handled correctly. These instructions apply to all digital refractometers listed under point 3.

2 Specifications

1.	Temperature range	0 °C–40 °C (32 F–104 F)
2.	Temperature measuring accuracy	+/- 0.5 °C (1 F)
3.	Automatic temperature compensation	5 °C – 40 °C
4.	Minimum volume of sample	Approx. 3 drops
5.	Measurement period	≤ 3 seconds
6.	Power supply	2 x AAA batteries
7.	Battery life	≥ 3,750 measurements
8.	Dimensions	145 x 67 x 38 mm
9.	Weight	185 g
10.	Language	English
11.	Auto-Off function	after 90 seconds
12.	IP protection class	IP 65

2.1 Models

Model KERN	Scales	Measuring range	Accuracy	Division	Calibration solution
ORF 45BM	Brix Refractive index	0 – 45 % 1.3330 – 1.4098 nD	±0.2% ±0.0003 nD	0.1 % 0.0001 nD	0% (distilled water)
ORF 92BM	Brix Refractive index	58 – 92% 1.4370 – 1.5233 nD	±0.2% ±0.0003 nD	0.1 % 0.0001 nD	60% solution
ORF 85BM	Brix Refractive index	0 – 85 % 1.3330 – 1.5100 nD	±0.2% ±0.0003 nD	0.1 % 0.0001 nD	0% (distilled water)
ORF 92HM	Brix Baume Water content Refractive index	58 – 92% 38 – 43 °Be 13 – 25 % 1.4370 – 1.5233 nD	±0.2% ±0.1 °Be ±0.1 % ±0.0003 nD	0.1 % 0.1 °Be 0.1 % 0.0001 nD	60% solution
ORF 3SM	Brix Salt (NaCl) Refractive index	0 – 35 % 0 – 28 % 1.3330 – 1.3900 nD	±0.2% ±0.2% ±0.0003 nD	0.1 % 0.1 % 0.0001 nD	0% (distilled water)
ORF 2WM	Mass SW Volume SW Oechsle KMW (Babo)	0 – 35 % 0 – 28 % 30 – 150 °Oe 0 – 25 °KMW	±0.2% ±0.1 % ±1 °Oe ±0.1 °KMW	0.1 % 0.1 % 1 °Oe 0.1 °KMW	0% (distilled water)
ORF 1PM	Brix Urine (spec. weight)	0 – 10 g/dl 1.3330 – 1.3990 nD	±0.1 g/dl ±0.001 sgU ±0.00003 nD	0.1 g/dl 0.001 sgU 0.001 nD	0% (distilled water)
ORF 2UM	Refractive index FG BF CW	1.330 – 1.500 nD -50 – 0 °C 1.00 – 1.150 kg/l -40 – 0 °C	±0.0003 nD ±0.5 °C ±0.01 kg/l ±0.5 °C	0.0001 nD 0.1 °C 0.01 kg/l 0.1 °C	0% (distilled water)
ORF 5UM	EG PG Urea CW	-50 – 0 °C -50 – 0 °C 0 – 40 % -40 – 0 °C	±0.5 °C ±0.5 °C ±0.2% ±0.5 °C	0.1 °C 0.1 °C 0.1 % 0.1 °C	0% (distilled water)
ORF 6US	Urea Refractive index	0 – 40 % 1.3330 – 1.4098 nD	±0.2% ±0.0003 nD	0.1 % 0.0001 nD	0% (distilled water)
ORF 1RS	Refractive index	1.3330 – 1.5400 nD	±0.0003 nD	0.0001 nD	0% (distilled water)

3. Description

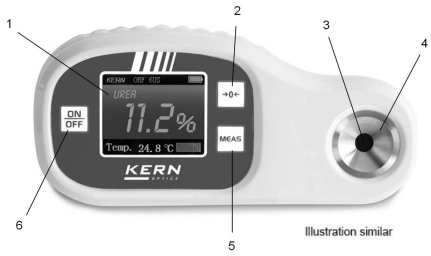

Illustration similar

1. LCD
2. Calibrate + Toggle between °C and °F
3. Prism
4. Prism window
5. Measure
6. On / Off

Battery compartment cover at the rear

4. General information

4.1 Intended use

The refractometer is a measuring instrument for determining the refractive index of transparent substances in liquid or in some cases also in the solid state. It is used to observe the behaviour of light as it passes from a prism with known properties to the substance being tested.
Use of the refractometer for other purposes is contrary to its intended use and may be hazardous. The manufacturer shall not be liable for any damages caused by improper use.

4.2 Warranty

The warranty shall be void in the event of:

- Failure to observe the instructions in the operating manual
- Use for purposes other than those described
- Modifications or opening the device housing
- Mechanical damage and/or damage resulting from media, liquids, natural wear and tear

5. Basic safety information

5.1 Follow the instructions in the operating manual

- Carefully read through the operating manual even if you have prior experience with KERN refractometers.
- Every language version includes a non-authoritative translation. The original German document is the definitive version.

5.2 Warning

- Do not let acids come into contact with skin or eyes. If acid comes into contact with skin, flush with copious amounts of water. Shower if larger areas of skin are affected.
- If acid comes into contact with eyes, keep the eyelid open and flush the eye with running lukewarm water from the outer corner to the inner corner. Flush eyes for at least 15 minutes. Then consult a doctor or ophthalmologist immediately.
- Thoroughly clean the refractometer after each use.
- The refractometer must not be exposed to extreme temperatures, high mechanical stresses, strong direct sunlight or high humidity.
- This refractometer is not a toy. Keep out of reach of children.
- Make sure that you will not be hit by anything else while you are using the refractometer, as this could cause serious eye injuries

6. Supplied items

After unpacking and before using the device for the first time, check that all listed parts have been supplied. Replace damaged or faulty parts immediately and do not put them into operation.

- Refractometer
- Screwdriver + batteries
- Storage box
- Cleaning cloth
- Pipette
- Calibration liquid

7. Automatic temperature compensation

The refractive coefficient is temperature-dependent. Materials expand when they are heated (their density decreases) and contract when they cool (their density increases). The speed of light through a liquid increases with the temperature and the refractive coefficient therefore decreases.
In solid substances this thermal effect has only a minor impact. In liquid substances, however, the change in density is considerable. Automatic

temperature compensation ensures accurate measurement results for water-based solutions in relation to the temperature of the sample.

The refractometer is temperature-compensated for water-based, sugary solutions. Temperature differences in a range of 5 °C–40 °C (41 °F–104 °F) can be compensated. However, the temperature of the sample has only a minor influence on the accuracy of the measurement. The volume of the sample compared to the mass of the refractometer is so small that in moat cases the sample is almost immediately at the temperature of the refractometer and assumes the ambient temperature, and is therefore in equilibrium with the temperature range of the measuring instrument. The temperature coefficient of the majority of water-based solutions is generally very close to the coefficient of the cane sugar/water solution. However, the temperature coefficient of oils, hydrocarbons and other, non-water-based solutions is generally greater. In order to achieve as accurate a result as possible, non-water based samples should be measured at an ambient temperature as close to 20 °C (68 °F) as possible.

8. Calibration/zero point calibration

The models of the ORF series have been calibrated at the factory. In general, this condition does not change even over a long period of usage, when carfully handled. Therefore it is not necessarily needed to carry out any additional calibration before use.
The calibration function should only be considered when the original condition of the measuring prism or other optical components changes due to wear and tear causing measuring inaccuracies while using the refractometer.
For the majority of models all you need for calibration/zero point calibration is distilled and deionised water. Ideally, the ambient and calibration liquid temperature should be exactly 20.0 °C (68.0 °F) during calibration.
Calibration liquid with 60% Brix is required for a variety of models.
You should be aware of the adjustment condition when using a measuring instrument.

1. Inspect the prism to ensure that the surface is clean and dry.
2. Apply a few drops of the calibration liquid onto the prism window.
3. Press the „→ 0 ←“ button; the measuring instrument begins the zero point calibration process.
4. The measuring instrument is performing the calibration process when "Scan zero" and a loading bar appear in the display.
5. When the calibration process is complete "Scan Result" and "Pass" is shown in the display in case the calibration was successful. When it was not successful the display shows "Fail". The calibration result will be saved and will be the new zero point even after the device is powered off and on again.

9. Measuring*

1. Inspect the prism window [4] to ensure it is clean and dry.
2. Apply a few drops of the liquid being examined onto the prism window.
3. Press the ‚Meas‘ button; the instrument begins to measure and the results is shown in the display for 90 seconds.
4. Press the “Meas” button to re-check the previous measurements.

10. Battery change

When the batteries are fully charged the “  „ symbol appears at the top right of the display in green colour.
If the batteries are too weak or almost drained the „  “symbol appears at the top right in red colour. The batteries should then be replaced. Open the battery cover on the rear and replace the batteries. Always replace both batteries!

11. Switching the temperature

The measuring instrument works in Celsius or Fahrenheit. For changing over just press the „→ 0 ←“ button for 2 seconds.

12. Switching the measuring scale (not applicable for: ORF 1RS)

1. Hold "Meas" for 2 seconds, the scale will change to the next measurement type.
2. Repeat Step 1 until desired the scale is shown on the screen.

13. Troubleshooting

If you suspect that the measuring instrument is not working correctly or displays incorrect results, perform a zero point calibration. Then perform a measurement using water to check the zero point. If this does not lead to any improvement, please perform a factory reset by pressing "On/Off" and "Meas" simultaneously and confirming with „→ 0 ←“.
If the measured data still appear untrustworthy, please replace the batteries and perform the above calibration once again.
If the measuring instrument jams or no longer reacts, separate the measuring instrument from the power supply by removing the batteries and replacing them.
If no data appears in the display when it is switched on, examine the position and polarity of the batteries. If the instrument still does not work, please examine the battery charge status and/or replace the batteries. If the batteries are good and the measuring instrument still does not display, please call your dealer‘s technical customer service.

13.1 Error messages

Calibration was not successful.
Make sure you are using the correct calibration solution and there is sufficient amount and perform the calibration again while having an environmental temperature that matches 20.0 °C (68.0 °F) as accurate as possible.

Measurement outside of measuring range at top of scale.

Measurement outside of measuring range at bottom of scale.

Temperature too high for measuring instrument.

Temperature too low for measuring instrument.

No liquid on the prism or not sufficient amount.

14. Cleaning and maintenance

Clean the refractometer using a soft, lint-free cloth moistened with water, or if necessary alcohol. Do not use any aggressive or abrasive cleaning agents.

Never touch the measuring prism [2] with hard tools made from plastic, wood, rubber, metal, glass etc. Hard objects can quickly damage the relatively soft prism glass, re-sulting in measurement errors.

The refractometer is maintenance-free.

Cleaning should be carried out immediately before and after each use of the refractometer to maximise its life and optimise measurement results.

15. Storage

Store the refractometer in a dry, non-corrosive environment, preferably between 10 °C and 30 °C.

16. Service

After reading this operating manual, if you have any questions about setting up or using the refractometer, or if any unexpected problem occurs, please contact your dealer. The device housing may only be opened by trained service technicians authorised by KERN.

17. Disposal

The packaging consists of environmentally friendly materials which can be disposed of via local recycling facilities.
The device and storage box should be disposed of by the operator in accordance with applicable national or regional regulations at the place of use.

18. Additional information

The product may differ slightly from the illustrations.
The exposing the refractometer to direct sunlight!
Never bring the refractometer into contact with solvents.

19. Brix to refractive index (nD) conversion table

Data from „ICUMSA“ International Commission for Uniform Methods of Sugar Analysis, at 20 °C and 589 nm wavelength.

BRIX %	RI nD	BRIX %	RI nD	BRIX %	RI nD
0	1,3330	30	1,3812	60	1,4419
1	1,3344	31	1,3830	61	1,4442
2	1,3359	32	1,3848	62	1,4465
3	1,3373	33	1,3866	63	1,4488
4	1,3388	34	1,3885	64	1,4511
5	1,3403	35	1,3903	65	1,4535
6	1,3418	36	1,3922	66	1,4558
7	1,3433	37	1,3941	67	1,4582
8	1,3448	38	1,3960	68	1,4606
9	1,3463	39	1,3979	69	1,4630
10	1,3478	40	1,3999	70	1,4655
11	1,3494	41	1,4018	71	1,4679
12	1,3509	42	1,4038	72	1,4704
13	1,3525	43	1,4058	73	1,4729
14	1,3541	44	1,4078	74	1,4754
15	1,3557	45	1,4098	75	1,4779
16	1,3573	46	1,4118	76	1,4804
17	1,3589	47	1,4139	77	1,4830
18	1,3605	48	1,4159	78	1,4855
19	1,3622	49	1,4180	79	1,4881
20	1,3638	50	1,4201	80	1,4907
21	1,3655	51	1,4222	81	1,4933
22	1,3672	52	1,4243	82	1,4960
23	1,3689	53	1,4265	83	1,4986
24	1,3706	54	1,4286	84	1,5013
25	1,3723	55	1,4308	85	1,5040
26	1,3741	56	1,4330		
27	1,3758	57	1,4352		
28	1,3776	58	1,4374		
29	1,3794	59	1,4397		

* Further information on Measuring

It is important to take care of the lighting conditions in the user environment when calibrating the device and subsequent measuring a sample.
The measuring prism of the refractometer does not have any coverage and therefore a measurement in addition to the light of the internal light source is also influenced by ambient light.
To bright lighting (eg., by a lamp directly above the device) may trigger an error message already during the calibration. Ordinary (diffuse) light is not a problem.

The lighting conditions (or the location of the device) may not be changed after the calibration or between different measurements, otherwise the refractometer performs each of the processes on a different basis and the results would not be comparable.

We recommend that both for the calibrations and for measurements, after the sample was placed on the measuring prism, to create an improvised opaque cover over the prism (incl. sample).