

Operating manual

Digital refractometer

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

Version 1.0
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GB





KERN ORD

Version 1.0 01/2015

Operating instructions Digital refractometer

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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.

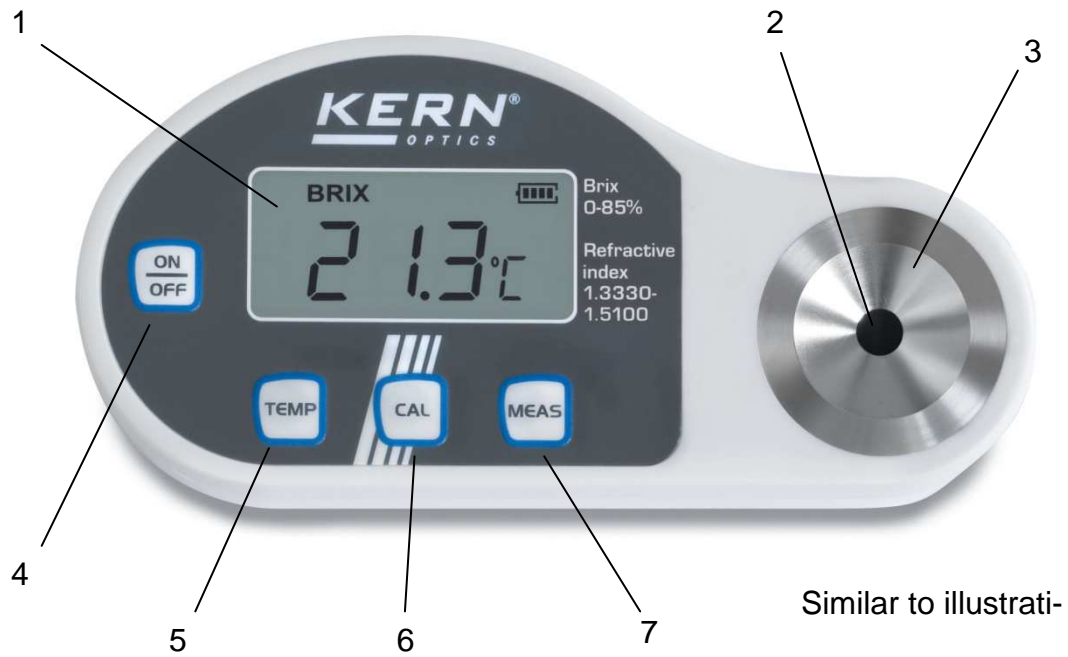
2 Specifications

1.	Temperature range	0 °C–40 °C (32 F–104 F)
2.	Temperature measuring accuracy	+/- 0.5 °C (1 F)
3.	Automatic temperature compensation	10 °C–30 °C
4.	Minimum volume of sample	Approx. 3 drops
5.	Measurement period	≤ 3 seconds
6.	Power supply	2 x AAA batteries
7.	Battery life	≥ 10,000 measurements
8.	Dimensions	135 x 65 x 40 mm
9.	Weight	180 g
10.	Language	Englisch

2.1 Models

Model	Scales	Measuring range	Accuracy	Division	Calibration solution
KERN					
ORD 45BM	Brix Refractive index	0 – 45 % 1.3330 – 1.4098 nD	± 0.2% ± 0.0003 nD	0.1 % 0.0001 nD	0% (distilled water)
ORD 92BM	Brix Refractive index	58 – 92% 1.4370 – 1.5233 nD	± 0.2% ± 0.0003 nD	0.1 % 0.0001 nD	60% solution
ORD 85BM	Brix Refractive index	0 – 85 % 1.3330 – 1.5100 nD	± 0.2% ± 0.0003 nD	0.1 % 0.0001 nD	0% (distilled water)
ORD 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
ORD 1SM	Salt (NaCl) Refractive index	0 – 28 % 1.3330-1.3900 nD	± 0.2% ± 0.0003 nD	0.1 % 0.0001 nD	0% (distilled water)
ORD 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)
ORD 2WM	Mass SW Vol. AP Oechsle KMW (Babo)	0 – 35 % 0 – 22 % 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)
ORD 1PM	Serum protein Urine (spec. weight) Refractive index	0 – 12 g/dl 1.000 – 1.050 sgU 1.3330 – 1.3990 nD	± 0.1 g/dl ± 0.001 sgU ± 0.0003 nD	0.1 g/dl 0.001 sgU 0.001 nD	0% (distilled water)
ORD 2UM	EG PG BF CW	-50 – 0 °C -50 – 0 °C 1.00 – 1.50 kg/l -40 – 0 °C	± 0.5 °C ± 0.5 °C ± 0.01 kg/l ± 0.5 °C	0.1 °C 0.1 °C 0.01 kg/l 0.1 °C	0% (distilled water)
ORD 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)
ORD 6US	Urea	0 – 40 %	± 0.2%	0.1 %	0% (distilled water)
ORD 1RS	Refractive index	1.3330 – 1.5400 nD	± 0.0003 nD	0.0001 nD	0% (distilled water)

3 Description



1. LCD
2. Prism
3. Prism window
4. On/Off
5. Temperature display and switchover (°C/°F)
6. Calibrate
7. Measure



Battery compartment and 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
- ⇒ Storage box
- ⇒ Pipette
- ⇒ Adjustment tool
- ⇒ Cleaning cloth
- ⇒ 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 10 °C–30 °C (50 °F–86 °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 most 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 refractometer's zero position must be inspected prior to initial use and periodically thereafter. A zero point calibration should be performed at least once daily and prior to any measurement where the highest possible accuracy is required, or when moving to a different environment with a different ambient temperature. For the majority of models all you need for calibration/zero point calibration is distilled and de-ionised water. Ideally, the ambient and calibration liquid temperature should be between 10 °C and 30 °C (50 °F–86 °F) during calibration.

Calibration liquid with 60% sugar 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 CAL button [6] for five seconds; the measuring instrument begins the zero point calibration process.



4. The measuring instrument is performing the calibration process when 'CAL3', 'CAL2', 'CAL1', 'CAL0' appear in the display.
5. When the calibration process is complete this is shown in the display



6. Calibration liquids vary, depending on the measuring range of the instrument.

9 Measuring

1. Inspect the prism window [3] 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.



4. You may press the 'Meas' button again and then release it; a second measurement is then performed. Remember to clean and dry the prism after measuring.

10 Battery replacement

When the batteries are fully charged the '🔋' symbol appears at the top left of the display.

If the batteries are too weak or almost drained the '🔋' symbol appears at the top right. 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 with either degrees Celsius or degrees Fahrenheit. To switch, simply press the 'Temp' button [5].



12 Switching the measuring scale

The measuring instrument is multifunctional. A variety of measuring scales can be used.

1. Ensure that the refractometer is in temperature

mode:



2. Simultaneously press the 'Cal' [6] and the 'Meas' [7] buttons. The measuring instrument will change the measuring scale:



3. When the required measuring scale appears release the buttons again. Adjustment is complete

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 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



Adjustment outside of measuring range (zero point).



Battery discharged.



Temperature too low for measuring instrument (0 °C)



Temperature too high for measuring instrument (40 °C)



Temperature too low for measuring instrument (32 °F)



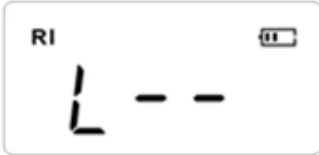
Temperature too high for measuring instrument (104 °F)



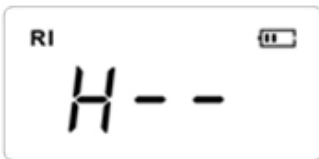
Measurement outside of measuring range at bottom of scale.



Measurement outside of measuring range
at top of scale.



Measurement outside of measuring range
at bottom of scale.



Measurement outside of measuring range
at top of scale.



Calibration liquid outside of measuring range

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 immerse the device in water or hold it under running water. Never handle the device with wet or damp hands.

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, resulting 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

BRIX	Refractive	BRIX	Refractive	BRIX	Refractive
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index		index		index	
%	nD	%	nD	%	nD
0	1.33299	30	1.38115	60	1.44193
1	1.33442	31	1.38296	61	1.44420
2	1.33586	32	1.38478	62	1.44650
3	1.33732	33	1.38661	63	1.44881
4	1.33879	34	1.38846	64	1.45113
5	1.34026	35	1.39032	65	1.45348
6	1.34175	36	1.39220	66	1.45584
7	1.34325	37	1.39409	67	1.45822
8	1.34476	38	1.39600	68	1.46061
9	1.34629	39	1.39792	69	1.46303
10	1.34782	40	1.39986	70	1.46546
11	1.34937	41	1.40181	71	1.46792
12	1.35093	42	1.40378	72	1.47037
13	1.35250	43	1.40576	73	1.47285
14	1.35408	44	1.40776	74	1.47535
15	1.35568	45	1.40978	75	1.47787
16	1.35729	46	1.41181	76	1.48040
17	1.35891	47	1.41385	77	1.48295
18	1.36054	48	1.41592	78	1.48552
19	1.36218	49	1.41799	79	1.4881
20	1.36384	50	1.42009	80	1.49071
21	1.36551	51	1.42220	81	1.49333
22	1.36720	52	1.42432	82	1.49597
23	1.36889	53	1.42647	83	1.49862
24	1.37060	54	1.42862	84	1.50129
25	1.37233	55	1.43080	85	1.50398
26	1.37406	56	1.43299		
27	1.37582	57	1.43520		
28	1.37758	58	1.43743		
29	1.37936	59	1.43967		

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