

# Operating manual

## Analogue refractometer

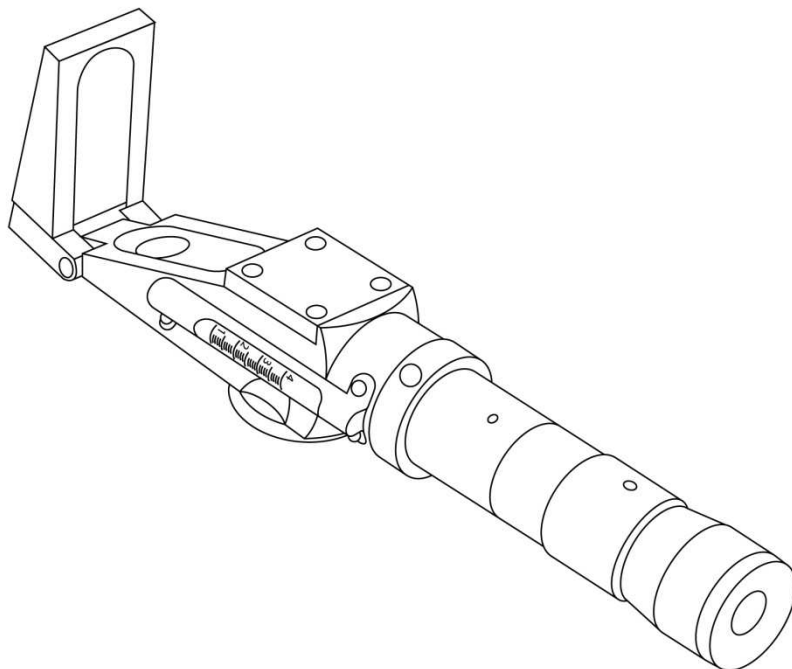
**KERN**      **ORA 90 BE**      **Analogue Expert**

**3x Brix scale**

**KERN**      **ORA 1 RE**      **Analogue Expert**

**3x nD scale**

Version 1.0  
01/2015  
GB





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# KERN ORA

Version 1.0 01/2015

## Operating instructions

### Analogue refractometer

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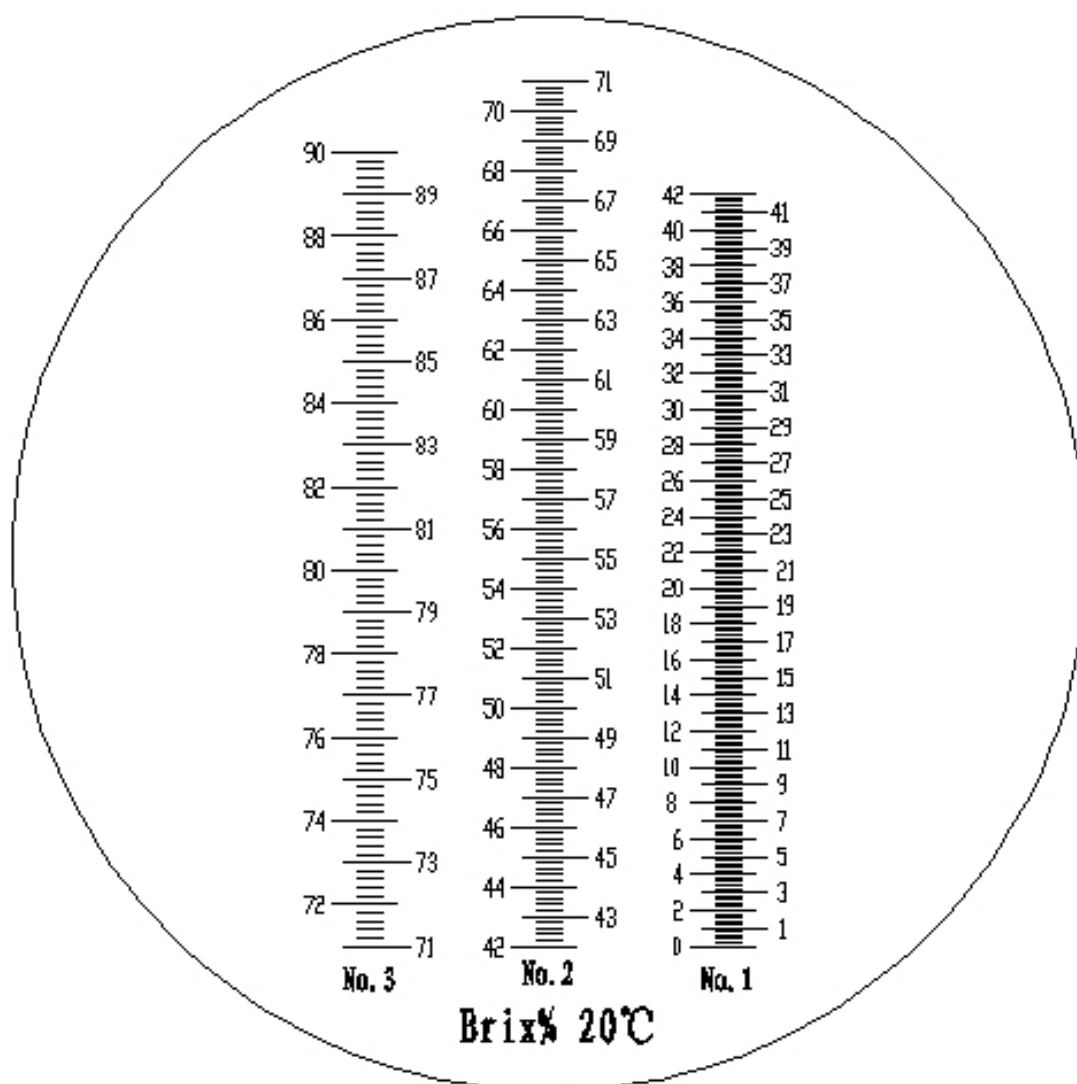
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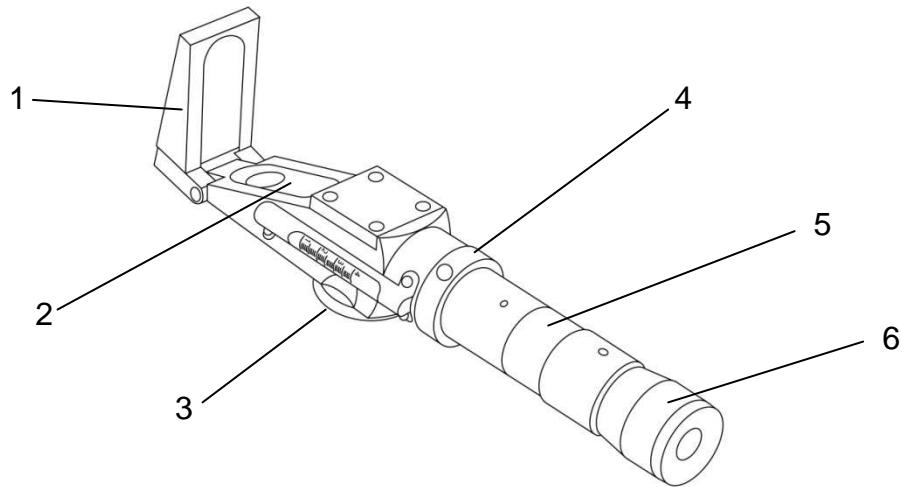
# 1 Technical data

Models KERN	Measuring range and Scales	Scale gradua- tions Accuracy	Dimensions Product	Net weight
<b>ORA 90BE</b>	Brix: 0-42% Brix: 42-71% Brix: 71-90%	0.2 % Brix 0.2 % Brix 0.2 % Brix	200x40x40mm	0.600kg
<b>ORA 1RE</b>	nD: 1.333- 1.5200	0.005 nD	200x40x40mm	0.600kg

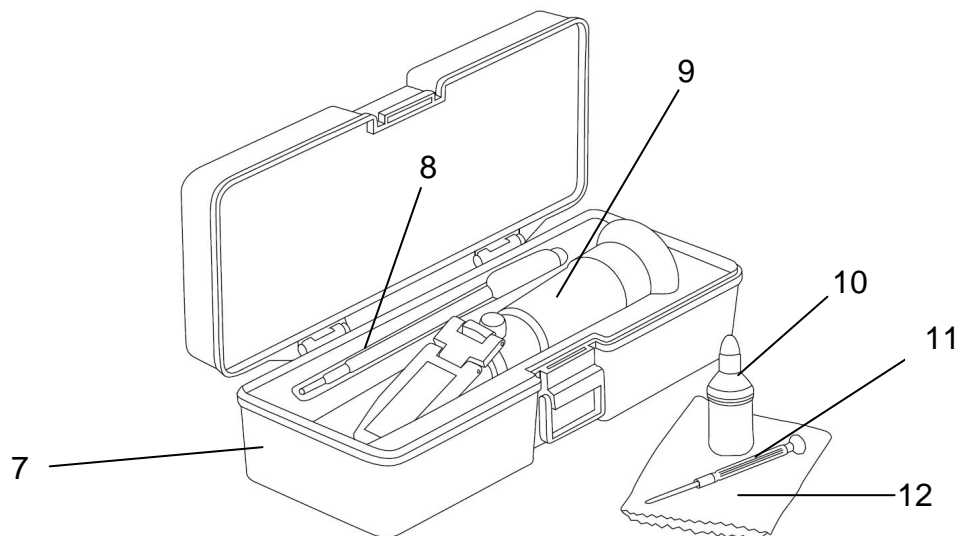
Example scale on the ORA 90 BE



## 2 Description



1. Prism cover
2. Prism surface
3. Adjusting wheel measuring range
4. Dispersion adjusting ring
5. Optical tubes
6. Eyepiece with diopter adjustment ring



7. Storage box
8. Pipette
9. Refractometer
10. Distilled water / calibration liquid
11. Tools
12. Cleaning cloth

## 3 General information

### 3.1 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.

### 3.2 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

## 4 Basic safety information

### 4.1 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.

### 4.2 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
- ⇒ The rubber eyeshade may cause irritation when in prolonged contact with the skin. If this happens, consult your doctor.
- ⇒ Do not touch the lenses with your fingers.

## 5 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
- ⇒ Tools
- ⇒ Cleaning cloth

## 6 Before the first use

Remove the protective film (if present) from the prism surface [2] and move the measuring range adjusting wheel [3] to position 1.

## 7 Use/measurement

The refractometer can be used to quickly and accurately determine the refractive index of transparent substances, liquid or solid ones. Please make sure your hands are dry before handling the measuring device.

The measuring instrument has three measuring ranges. Please use the measuring range adjusting wheel on the underside of the casing to switch measuring ranges.

The light falling on the prism can be changed using a rotating flap on the underside of the prism.

In addition, the refractometer is provided with an adjusting ring [4], which can reduce chromating, primarily with low liquid concentrations.

The light/dark transition is clearly visible.

## Important!



The ambient/room temperature and the sample temperature influence the refractometer measuring result.

The scales are designed for an ambient temperature of +20 °C!

If the measurements are carried out at a temperature other than +20 °C, the results must be correspondingly corrected.

A correction table can be found in the annex, Point 13.

### 7.1 Additional advice

It is important that the samples being measured are representative samples. Measurements should be carried out quickly on samples that evaporate easily. The samples should be at the same temperature as the measuring instrument in order to achieve an accurate result.



## 7.2 Measuring procedure

- ⇒ Make sure your hands are dry before handling the refractometer.
- ⇒ Open the prism cover [1] and use the supplied pipette [8] to apply a few drops of the sample liquid [8] onto the prism surface [2], then close the prism cover [1]. Spread the liquid evenly by pressing down on the prism cover [1].
- ⇒ Hold the device horizontally and wait about 30 seconds (for optimal temperature equalisation between the sample and device).
- ⇒ View the measurement scale through the eyepiece [6]. Point the prism surface [2] of the refractometer at a bright light source while doing this.
- ⇒ The light falling on the prism can be changed using a rotating flap on the underside of the prism.
- ⇒ Rotate the adjustment ring [6] on the eyepiece [6] to adjust the focus.
- ⇒ The boundary line will move on the measurement scale depending on the concentration. This bright/dark boundary line shows the result directly on the scale.
- ⇒ The measuring instrument has three measuring ranges. Please use the measuring range adjusting wheel on the underside of the casing to switch measuring ranges.
- ⇒ The light/dark boundary can be brought into sharp focus using the dispersion adjusting ring [6]. This is useful for low liquid concentrations.
- ⇒ If the temperature deviates from +20 °C, correct the measured result using the corresponding value from the temperature correction table [13].
- ⇒ Carefully clean the supplied pipette [8] and the refractometer after carrying out the measurement.

### Important!



After every measurement, use a lint-free, absorbent cloth to remove the fluids from the prism surface [2] and prism cover [1]. Then carefully clean the prism and prism cover using a cloth moistened with water or if necessary alcohol, and dry both parts using a soft, dry and lint-free cloth. Avoid rubbing the prism [2].

## 8 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.

## 9 Storage

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

## 10 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.

## 11 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.

## 12 Additional information

The product may differ slightly from the illustrations. We reserve the right to make changes to reflect technical advancements, decorations not included.

Avoid exposing the refractometer to direct sunlight!

Never bring the refractometer into contact with solvents.

### 13 Brix to refractive index (nD) conversion table

BRIX %	Refractive index nD	BRIX %	Refractive index nD	BRIX %	Refractive index 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.



## 14 Annex

**Table 1: International Temperature Correction Table for °Brix (% sugar gradient)**

**Correct the result by the following values (refractometer must be correctly calibrated at 20 °C)**

		% Brix reading																	
		0.0	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0	65.0	70.0	75.0	80.0	85.0
<b>Temperature °C</b>	<b>10.0</b>	-0.53	-0.56	-0.59	-0.62	-0.65	-0.67	-0.69	-0.71	-0.72	-0.73	-0.74	-0.75	-0.75	-0.75	-0.75	-0.75	-0.74	-0.73
	<b>11.0</b>	-0.49	-0.52	-0.54	-0.57	-0.59	-0.61	-0.63	-0.64	-0.65	-0.66	-0.67	-0.68	-0.68	-0.68	-0.68	-0.67	-0.67	-0.66
	<b>12.0</b>	-0.44	-0.47	-0.49	-0.51	-0.53	-0.55	-0.56	-0.57	-0.58	-0.59	-0.60	-0.60	-0.61	-0.61	-0.60	-0.60	-0.60	-0.59
	<b>13.0</b>	-0.40	-0.41	-0.43	-0.45	-0.47	-0.48	-0.50	-0.51	-0.52	-0.52	-0.53	-0.53	-0.53	-0.53	-0.53	-0.53	-0.52	-0.52
	<b>14.0</b>	-0.34	-0.36	-0.38	-0.39	-0.40	-0.42	-0.43	-0.44	-0.44	-0.45	-0.45	-0.46	-0.46	-0.46	-0.46	-0.45	-0.45	-0.44
	<b>15.0</b>	-0.29	-0.31	-0.32	-0.33	-0.34	-0.35	-0.36	-0.37	-0.37	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.38	-0.37	-0.37
	<b>16.0</b>	-0.24	-0.25	-0.26	-0.27	-0.28	-0.28	-0.29	-0.30	-0.30	-0.30	-0.31	-0.31	-0.31	-0.31	-0.31	-0.31	-0.30	-0.30
	<b>17.0</b>	-0.18	-0.19	-0.20	-0.20	-0.21	-0.21	-0.22	-0.22	-0.23	-0.23	-0.23	-0.23	-0.23	-0.23	-0.23	-0.23	-0.23	-0.22
	<b>18.0</b>	-0.12	-0.13	-0.13	-0.14	-0.14	-0.14	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15	-0.15
	<b>19.0</b>	-0.06	-0.06	-0.07	-0.07	-0.07	-0.07	-0.07	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.08	-0.07
	<b>20.0</b>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	<b>21.0</b>	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.07
	<b>22.0</b>	0.13	0.14	0.14	0.14	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.16	0.16	0.16	0.15	0.15	0.15	0.15
	<b>23.0</b>	0.20	0.21	0.21	0.22	0.22	0.23	0.23	0.23	0.23	0.24	0.24	0.24	0.24	0.23	0.23	0.23	0.23	0.22
	<b>24.0</b>	0.27	0.28	0.29	0.29	0.30	0.30	0.31	0.31	0.31	0.32	0.32	0.32	0.32	0.31	0.31	0.31	0.30	0.30
	<b>25.0</b>	0.34	0.35	0.36	0.37	0.38	0.38	0.39	0.39	0.40	0.40	0.40	0.40	0.40	0.39	0.39	0.39	0.38	0.37
	<b>26.0</b>	0.42	0.43	0.44	0.45	0.46	0.46	0.47	0.47	0.48	0.48	0.48	0.48	0.48	0.47	0.47	0.46	0.46	0.46
	<b>27.0</b>	0.50	0.51	0.52	0.53	0.54	0.55	0.55	0.56	0.56	0.56	0.56	0.56	0.56	0.55	0.55	0.54	0.53	0.52
	<b>28.0</b>	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.64	0.64	0.65	0.65	0.64	0.64	0.64	0.63	0.62	0.61	0.60
	<b>29.0</b>	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.73	0.73	0.73	0.73	0.72	0.72	0.71	0.70	0.69	0.68
<b>30.0</b>	0.74	0.75	0.77	0.78	0.79	0.80	0.81	0.81	0.81	0.82	0.81	0.81	0.81	0.80	0.79	0.78	0.77	0.75	