

Operating manual Analogue refractometer

KERN ORA 1 SA Seawater salinity
ORA 3 SA NaCl% Brix%



KERN & Sohn GmbH

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Version 1.3

CONTENTS

1	Technical data.....	1
2	Description.....	2
3	General information.....	3
3.1	Intended use.....	3
3.2	Warranty.....	3
4	Basic safety information.....	4
4.1	Follow the instructions in the operating manual.....	4
4.2	Warning.....	4-5
5	Supplied items.....	5
6	Before the first use.....	6
7	Use/measurement.....	6
7.1	Zero point calibration.....	7-8
7.2	Additional advice.....	9
7.3	Measuring procedure.....	9-10
8	Cleaning and maintenance.....	11
9	Storage.....	11
10	Service.....	12
11	Disposal.....	12
12	Additional information.....	12
13	Brix to refractive index (nD) conversion table.....	13
14	Annex.....	14

1. Technical data

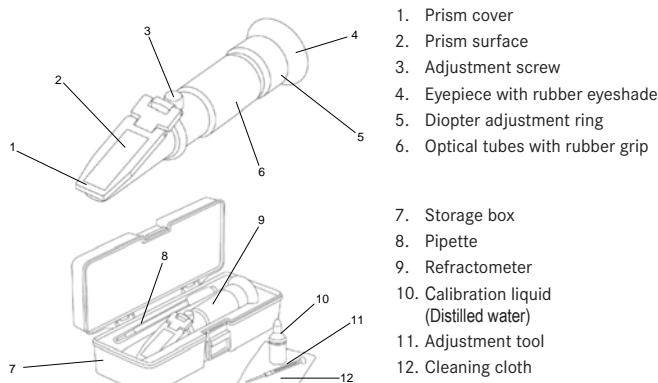
Modell KERN	Measuring range and Scales	Scale graduations Accuracy	Dimensions Product	Net weight
ORA 1 SA	0-100% salinity 1,000-1,070 sg	1‰ salinity 0,001sg	198x40x40mm	0,155kg
ORA 3 SA	0-28% Salz (NaCl) 0-32% Brix	0,2% (NaCl) 0,2% Brix	178x40x40mm	0,145kg

Example scale on
ORA 2 SA



1

2. Description



2

3. General information

3.1 Intended use

The refractometer is a measuring instrument for determining the refractive index of transparent substances in the liquid or 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

3

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.

4

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
- ▶ Adjustment tool
- ▶ Cleaning cloth
- ▶ Calibration liquid (Distilled water)

5

6. Before the first use

Remove the protective film (if present) from the prism surface [2] and check that the rubber eye-cup [4] is fitted correctly.

7. Use/measurement

The refractometer can be used to quickly and accurately determine the refractive index of transparent substances, liquid or solid ones. To ensure correct measurement, the measuring device should be adjusted before measurements are carried out. Please make sure your hands are dry before handling the measuring device.

6

7.1 Zero point calibration

- Hold up the refractometer against a sufficiently bright light source and look through the eyepiece [5], holding the rubber eyeshade [4] closely against your eye/glasses.
- Rotate the eyepiece [5] to adjust it for your eyesight, until you can see the scale sharply.
- Open the prism cover [1].
- Thoroughly clean the prism [2] and the underside of the prism cover [1] using a soft cloth or soft paper (with alcohol if necessary) and wipe dry.
- Now apply a few drops of the calibration liquid [10] onto the prism surface [2].
- Close the prism cover [1]. The amount of fluid should be sufficient to moisten most of the prism surface. There should not be any air bubbles between the measuring prism [2] and prism cover [1].
- Wait about 30 seconds to allow the temperatures of the fluid and prism to equalise.
- Look through the eyepiece [4] while pointing the refractometer's prism surface [2] at a bright light source.
- Through the eyepiece [4], you will see a bright and a blue field. The boundary line between them shows the measured value on the scale which is also visible through the eyepiece [4].

7

Important!

The ambient/room temperature and the sample temperature influence the refractometer measuring result. The scales of the refractometer models, which have "SB" in its name, 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 14. Refractometer models, which have "SA" in its name, are equipped with an automatic temperature compensation (ATC). Between +10°C and +30°C measurement differences due to temperature changes are automatically compensated.



8

7.2 Additional advice

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

7.3 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]. Close the prism cover [1]. Spread the liquid evenly by pressing down on the prism cover [1] and eliminate any air bubbles present.
- 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 [4]. Point the prism surface [2] of the refractometer at a bright light source while doing this.
- Rotate the adjustment ring [5] on the eyepiece [4] 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 on the scale.
- The ORA 2SA and ORA 3SA instruments have a marking on the scale for the liquid saturation point.
- If the temperature deviates from +20 °C and a refractometer without ATC is used, 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.

9

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].



10

8. Cleaning and maintenance

Clean the refractometer using a soft, lint-free cloth moistened with either 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.

11

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. Avoid exposing the refractometer to direct sunlight. Never bring the refractometer into contact with solvents.

13. 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.

12

Refractive index nD	Refractive index nBrix	BRIX	%	Refractive index nD	Refractive index nBrix	BRIX	%
0.0	1.3229	30	1.3815	60	1.44193	61	1.44420
1	1.33442	31	1.38236	61	1.45584	62	1.44650
2	1.33586	32	1.38478	62	1.44881	63	1.46061
3	1.33732	33	1.38651	63	1.45113	64	1.46303
4	1.33879	34	1.38846	64	1.45348	65	1.46538
5	1.34026	35	1.39032	65	1.45584	66	1.46792
6	1.34171	36	1.39220	66	1.45822	67	1.47037
7	1.34315	37	1.39409	67	1.46061	68	1.47285
8	1.34456	38	1.39600	68	1.46303	69	1.47535
9	1.34629	39	1.39792	69	1.46538	70	1.47787
10	1.34762	40	1.39986	70	1.46792	71	1.48040
11	1.34937	41	1.40181	71	1.47037	72	1.48295
12	1.35093	42	1.40378	72	1.47285	73	1.48552
13	1.35250	43	1.40576	73	1.47535	74	1.48811
14	1.35408	44	1.40775	74	1.47787	75	1.49071
15	1.35558	45	1.40978	75	1.48040	76	1.49333
16	1.35729	46	1.41181	76	1.48295	77	1.49597
17	1.35891	47	1.41385	77	1.48552	78	1.49862
18	1.36054	48	1.41582	78	1.48811	79	1.50129
19	1.36218	49	1.41799	79	1.49071	80	1.50386
20	1.36384	50	1.42099	80	1.49333	81	1.50598
21	1.36551	51	1.42220	81	1.49597	82	1.50750
22	1.36720	52	1.42432	82	1.49862	83	1.50917
23	1.36889	53	1.42647	83	1.50129	84	1.51076
24	1.37060	54	1.42860	84	1.50386	85	1.51235
25	1.37233	55	1.43080	85	1.50598	86	1.51397
26	1.37406	56	1.43299	86	1.50750	87	1.51557
27	1.37572	57	1.43517	87	1.50917	88	1.51717
28	1.37738	58	1.43733	88	1.51076	89	1.51876
29	1.37906	59	1.43967	89	1.51235	90	1.51936

13

14. Annex

Table 1: International Temperature Correction Table for °Brix (% sugar gradient)
Correct the result by the following values (refractometer must be correctly adjusted at 20 °C).

Temperature °C	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
10.0	-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	-0.75	-0.73
11.0	-0.42	-0.45	-0.48	-0.51	-0.54	-0.57	-0.60	-0.63	-0.66	-0.69	-0.72	-0.75	-0.78	-0.80	-0.82	-0.84	-0.86	-0.86
12.0	-0.31	-0.34	-0.37	-0.40	-0.43	-0.46	-0.49	-0.52	-0.55	-0.58	-0.61	-0.64	-0.67	-0.70	-0.73	-0.76	-0.78	-0.78
13.0	-0.21	-0.24	-0.27	-0.30	-0.33	-0.36	-0.39	-0.42	-0.45	-0.48	-0.51	-0.54	-0.57	-0.60	-0.63	-0.66	-0.69	-0.69
14.0	-0.11	-0.13	-0.15	-0.17	-0.19	-0.21	-0.23	-0.25	-0.27	-0.29	-0.31	-0.33	-0.35	-0.38	-0.40	-0.42	-0.44	-0.44
15.0	-0.01	-0.03	-0.05	-0.07	-0.09	-0.11	-0.13	-0.15	-0.17	-0.19	-0.21	-0.23	-0.25	-0.27	-0.29	-0.31	-0.33	-0.33
16.0	0.09	0.12	0.15	0.17	0.19	0.22	0.24	0.26	0.28	0.30	0.32	0.34	0.36	0.38	0.40	0.42	0.44	0.44
17.0	0.21	0.24	0.27	0.30	0.33	0.36	0.39	0.42	0.45	0.48	0.51	0.54	0.57	0.60	0.63	0.66	0.69	0.69
18.0	0.33	0.36	0.39	0.42	0.45	0.48	0.51	0.54	0.57	0.60	0.63	0.66	0.69	0.72	0.75	0.78	0.81	0.81
19.0	0.45	0.48	0.51	0.54	0.57	0.60	0.63	0.66	0.69	0.72	0.75	0.78	0.81	0.84	0.87	0.90	0.93	0.93
20.0	0.57	0.60	0.63	0.66	0.69	0.72	0.75	0.78	0.81	0.84	0.87	0.90	0.93	0.96	0.99	0.99	0.99	0.99
21.0	0.69	0.72	0.75	0.78	0.81	0.84	0.87	0.90	0.93	0.96	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
22.0	0.81	0.84	0.87	0.90	0.93	0.96	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
23.0	0.93	0.96	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
24.0	0.27	0.28	0.29	0.30	0.31	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41	0.42	0.42
25.0	0.34	0.35	0.36	0.37	0.38	0.39	0.39	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
26.0	0.42	0.43	0.44	0.45	0.46	0.47	0.47	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48	0.48
27.0	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67
28.0	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.74
29.0	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.82
30.0	0.74	0.75	0.77	0.78	0.80	0.81	0.81	0.82	0.83	0.84	0.85	0.86	0.87	0.88	0.89	0.89	0.89	0.89

14