



## REFRACTOMETERS

# 11 – 13

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## Refractive index measurement for laboratories and the industry

### Features

- The KERN ORA refractometers are universal, maintenance-free analogue handheld refractometers
- The handy and robust design allows the easy, efficient and sustainable use in everyday life
- Manually calculated conversions and errors of the user are avoided by multiple selectable scales
- These scales are especially developed, exactly calculated and checked. They are also characterized by their thin and clear lines
- The optical system and the prism cover are made of special material which allows a low-tolerance measuring
- All ORA models are equipped with an eyepiece for easy and smooth setting for many different diopter strengths

- The models marked with "ATC" have an automatic temperature compensation which enables accurate measurement at different ambient temperatures (10 °C/30 °C)
- The following accessory-parts are included:
  - Storage box
  - Calibration liquid
  - Calibration block (if required)
  - Pipette
  - Screwdriver
  - Cleaning tissue
- Further accessories are optionally available

### Technical data

- Die-cast housing of copper-aluminium alloy, chrome coated
- Measurement temperature without ATC: 20 °C
- Measurement temperature range with ATC: 10 °C/30 °C
- Dimensions of the box: 205×75×55 mm (depending on the model)
- Product length: approx. 130 – 200 mm (depending on the model)
- Net weight approx. 135 – 600 g (depending on the model)

**Note:** Also available with calibration certificate, see page 106



## Scope of application: Sugar

The following models are particularly suitable for the measurement of the “BRIX” value. They are used to determine the sugar content in food, especially in fruit, vegetables, juice and soft drinks. In the same ideal way these refractometers serve for monitoring processes in the industry (coolant monitoring, oils, water-based mixtures).

The main scope of applications is:

- Industry: Monitoring of lubricants for process and quality control
- Food industry: Beverages, fruits and sweets
- Agriculture: Determination of the degree of ripeness of fruits for quality control in harvesting, determination of colostrum milk quality
- Restaurants and large-scale catering establishment



Model	Scales	Measuring range	Division	ATC
<b>KERN</b>				
<b>ORA 10BB*</b>	Brix	0 – 10 %	0,1 %	
<b>ORA 10BA</b>	Brix	0 – 10 %	0,1 %	✓
<b>ORA 20BB*</b>	Brix	0 – 20 %	0,1 %	
<b>ORA 20BA</b>	Brix	0 – 20 %	0,1 %	✓
<b>ORA 32BA</b>	Brix	0 – 32 %	0,2 %	✓
<b>ORA 62BB*</b>	Brix	28 – 62 %	0,2 %	
<b>ORA 62BA</b>	Brix	28 – 62 %	0,2 %	✓
<b>ORA 82BB</b>	Brix	45 – 82 %	0,5 %	
<b>ORA 80BB</b>	Brix	0 – 80 %	0,5 %	

! \* ONLY WHILE STOCKS LAST

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## Scope of application: Honey

The following models are particularly suitable for the measurement of the “BRIX” value, as well as the water content in honey and “degrees Baumé” to determine the relative density of liquids.

The main scope of applications is:

- Beekeeping
- Honey production



Model	Scales	Measuring range	Division	ATC
<b>KERN</b>				
<b>ORA 3HB*</b>	Brix Baumé Water content	58 – 92 % 38 – 43 °Bé 12 – 27 %	0,5 % 0,5 °Bé 1 %	
<b>ORA 3HA</b>	Brix Baumé Water content	58 – 92 % 38 – 43 °Bé 12 – 27 %	0,5 % 0,5 °Bé 1 %	✓
<b>ORA 6HB</b>	Water content according to AOAC standard	12 – 30 %	0,1 %	
<b>ORA 6HA</b>	Water content according to AOAC standard	12 – 30 %	0,1 %	✓

ORA 6HB + 6HA: no calibration certificate possible

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## Scope of application: Salt

The following models are particularly suitable for the measurement and concentration control of the mass fraction of sodium chloride in water as well as of the content of NaCl (salt) in water. This is often used in the preparation and the cooking of sauces, bases for pastries, the production of brines (e.g. for white cheese) and the preparation of seafood and marinades for meat.



The main scope of applications is:

- Food industry
- Restaurants and large-scale catering establishment
- Aquaristic: Fishkeepers/Fishfarmers in sea and sweetwater

Model	Scales	Measuring range	Division	ATC
<b>KERN</b>				
<b>ORA 1SB*</b>	Salt content (NaCl) % specific gravity	0 – 100 ‰ 1,000 – 1,070 sg	1 ‰ 0,001 sg	
<b>ORA 1SA</b>	Salt content (NaCl) % specific gravity	0 – 100 ‰ 1,000 – 1,070 sg	1 ‰ 0,001 sg	✓
<b>ORA 3SB*</b>	Salt content (NaCl) % Brix	0 – 28 % 0 – 32 %	0,2 % 0,2 %	
<b>ORA 3SA</b>	Salt content (NaCl) % Brix	0 – 28 % 0 – 32 %	0,2 % 0,2 %	✓

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## Scope of application: Wine

The following models are particularly suitable for the measurement of the content of sugar in fruits. It indicates the expected °Alcohol of the fruit. The degree of ripeness of fruit (fruit-sugar) can also be determined, such as e.g. grapes.



The main scope of applications is:

- Agriculture: Wine-growing and fruit-growing
- Wine-production
- Must and alcohol production

°Oe = Degree Oechsle, °KMW = Klosterneuburger Must balance

Model	Scales	Measuring range	Division	ATC
<b>KERN</b>				
<b>ORA 1WB*</b>	Oechsle KMW (Babo) Brix	0 – 140 °Oe 0 – 25 °KMW 0 – 32 %	1 °Oe 0,25 °KMW 0,2 %	
<b>ORA 1WA</b>	Oechsle KMW (Babo) Brix	0 – 140 °Oe 0 – 25 °KMW 0 – 32 %	1 °Oe 0,25 °KMW 0,2 %	✓
<b>ORA 3WB*</b>	Oechsle Brix	30 – 140 °Oe 0 – 32 %	1 °Oe 0,2 %	
<b>ORA 3WA</b>	Oechsle Brix	30 – 140 °Oe 0 – 32 %	1 °Oe 0,2 %	✓

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## Scope of application: Beer/alcohol

The following models are particularly suitable for determining the sugar content of the original wort of beer in its unfermented state. The value can be read straightaway, without having to be converted, using the SG Wort and Degrees Plato scales. In addition, the percent by volume and percent by mass scales can be used to determine the alcohol content of clear spirits.

The main scope of applications is:

- Beer brewers
- Alcohol production



Model	Scales	Measuring range	Division	ATC
<b>KERN</b>				
<b>ORA 3AB*</b>	Brix Original gravity (specific weight)	0 – 32 % 1,000 – 1,130	0,2 % 0,001	
<b>ORA 3AA</b>	Brix Original gravity (specific weight)	0 – 32 % 1,000 – 1,130	0,2 % 0,001	✓
<b>ORA 4AB*</b>	Plato	0 – 18° P	0,1° P	
<b>ORA 4AA</b>	Plato	0 – 18° P	0,1° P	✓
<b>ORA 1AB</b>	Percentage by volume	0 – 50 % (v/v)	1 % (v/v)	
	Percentage by volume	50 – 80 % (v/v)	2,5 % (v/v)	
<b>ORA 2AB</b>	Percentage by mass	0 – 50 % (w/w)	1 % (w/w)	
	Percentage by mass	50 – 80 % (w/w)	2,5 % (w/w)	

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## Scope of application: Urine

The following models are particularly suitable for the measurement of the specific gravity (sg) in urine, the quantity of serum (serumproteine) in urine (doping control among athletes), and the refractive index.

The main scope of applications is:

- Hospitals
- Doctor's surgeries/Physicians
- Medical training institutions
- Nursing homes
- Sports medicine (doping test)
- Veterinary



Model	Scales	Measuring range	Division	ATC
<b>KERN</b>				
<b>ORA 2PB*</b>	Serum protein	0 – 12 g/100 ml	0,2 g/100 ml	
	Urine (spec. gravity)	1,000 – 1,050	0,002	
	Refractive index	1,3330 – 1,3600 nD	0,0005 nD	
<b>ORA 2PA</b>	Serum protein	0 – 12 g/100 ml	0,2 g/100 ml	✓
	Urine (spec. gravity)	1,000 – 1,050	0,002	
	Refractive index	1,3330 – 1,3600 nD	0,0005 nD	
<b>ORA 5PB</b>	Serum protein	2 – 14 g/100 ml	0,1 g/100 ml	
	Urine (s. g. dog)	1,000 – 1,060	0,001	
	Urine (s. g. cat)	1,000 – 1,060	0,001	

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Scope of application: Industry/Automotive

The following models are particularly suitable for the measurement and determination of AdBlue®, glycol concentration ethylene (EG) and propylene (PG), battery fluid (BF), urea, the freezing point of windscreen wash water (CW). Furthermore these models are suitable for the measurement of thermal exchange systems.

The main scope of applications is:

- Automotive industry: Car-workshops and producers, in accordance with the VW standards G11/G12 and G13
- Chemical industry
- Solar industry: Antifreeze monitoring



Model	Scales	Measuring range	Division	ATC
KERN				
ORA 4FB*	Ethylene glycol (G11/ 12)	-50 – 0 °C	1 °C	
	Propylene glycol (G13)	-50 – 0 °C	1 °C	
	Windshield washer fluid	-40 – 0 °C	5 °C	
	Battery fluid	1,10 – 1,40 kg/l	0,01 kg/l	
ORA 4FA	Ethylene glycol (G11/ 12)	-50 – 0 °C	1 °C	✓
	Propylene glycol (G13)	-50 – 0 °C	1 °C	
	Windshield washer fluid	-40 – 0 °C	5 °C	
	Battery fluid	1,10 – 1,40 kg/l	0,01 kg/l	
ORA 1UB*	Urea	0 – 40 %	0,2 %	✓
ORA 1UA	Urea	0 – 40 %	0,2 %	
ORA 4UB*	Urea	30 – 35 %	0,2 %	
	Ethylene glycol (G11/ 12)	-50 – 0 °C	1 °C	
	Propylene glycol (G13)	-50 – 0 °C	1 °C	
	Windshield washer fluid	-40 – 0 °C	5 °C	
ORA 4UA	Battery fluid	1,10 – 1,40 kg/l	0,01 kg/l	✓
	Urea	30 – 35 %	0,2 %	
	Ethylene glycol (G11/ 12)	-50 – 0 °C	1 °C	
	Propylene glycol (G13)	-50 – 0 °C	1 °C	
ORA 4UA	Windshield washer fluid	-40 – 0 °C	5 °C	
	Battery fluid	1,10 – 1,40 kg/l	0,01 kg/l	

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## Scope of application: Expert applications

The following models have a special large measuring range for the refractive index and large divided scales for the measurement and clear reading of Brix values.

The main scope of applications is:

- Universal application, especially when extra large measuring ranges are required

Model	Scales	Measuring range	Division	ATC
<b>KERN</b>				
<b>ORA 80BE</b>	Brix	0 – 50 % 50 – 80 %	0,5 % 0,5 %	
<b>ORA 90BE</b>	Brix	0 – 42 % 42 – 71 % 71 – 90 %	0,2 % 0,2 % 0,2 %	
<b>ORA 1RE*</b>	Refractive index	1,333 – 1,405 nD 1,405 – 1,468 nD 1,468 – 1,517 nD	0,005 nD 0,005 nD 0,005 nD	
<b>ORA 4RR*</b>	Refractive index	1,440 – 1,520 nD	0,001 nD	

\*no calibration certificate possible



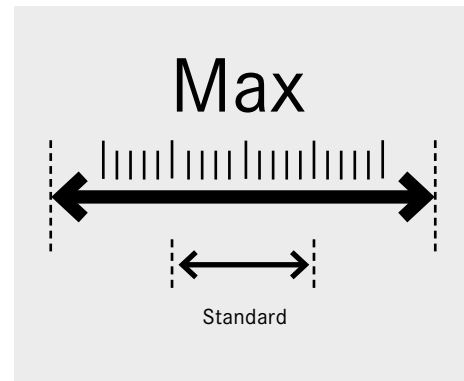
ORA 4RR



ORA 90 BE/ORA 1RE



ORA 80BE



## Scope of application: Gemmology/Jewellery

This model has a special refracting-index range for jewellery. For this refractometer there is a nice leather bag in the scope of delivery included.

The main scope of applications is:

- Jewellers
- Training/Education
- Jewellery industry

Model	Scales	Measuring range	Division
<b>KERN</b>			
<b>ORA 1GG*</b>	Refractive index	1,30 – 1,81 nD	0,01 nD

\*no calibration certificate possible



ORA 1GG

## Accessory parts: Analogue refractometer – ORA



Prism coverplate with LED ORA-A1101



Calibration liquid/Contact liquid



Leather bag ORA-A2103



Calibration block

Model	Description
<b>KERN</b>	
<b>ORA-A1101</b>	Prism coverplate with integrated LED illumination
<b>ORA-A2103</b>	Leather bag for analog refractometers
<b>ORA-A2107</b>	Leather bag for Gem refractometers (Spare part)
<b>ORA-A1010</b>	Calibration liquid – distilled water – Set of 5 Volume: 5× approx. 3 ml
<b>ORA-A1002</b>	Contact liquid – Clove oil (for Calibration value 19,6%) Volume: approx. 2 ml
<b>ORA-A1003</b>	Calibration liquid – saturated salt solution Volume: approx. 2 ml
<b>ORA-A1004</b>	Contact liquid – Clove oil (for Calibration value 78,8%) Volume: approx. 2 ml
<b>ORA-A1005</b>	Calibration block for models ORA 82BB, ORA 3HA, ORA 3HB, ORA 6HA, ORA 6HB, ORA 4RR
<b>ORA-A1007</b>	Contact liquid – Diiodomethane “Standard” (Refractive index: 1,74 nD) Volume: approx. 2 ml
<b>ORA-A3001</b>	Contact liquid – Diiodomethane “Pro” (Refractive index: 1,79 nD) Volume: approx. 2 ml
<b>ORA-A1008</b>	Calibration block for model ORA 1GG
<b>ORA-A2001</b>	Prism coverplate (spare part)

### Relationship overview – refractometer calibration (analogue)

Model refractometer	Calibration value	Calibration liquid	Article number liquid	Calibration block	Article number calibration block
ORA 10BA; ORA 10BB; ORA 18BB; ORA 1WA; ORA 1WB; ORA 20BA; ORA 20BB; ORA 32BA; ORA 32BB; ORA 3SA; ORA 3SB; ORA 3WA; ORA 3WB; ORA 7WA; ORA 80BB; ORA 80BE; ORA 3AB; ORA 3AA	0 % Brix	distilled water	ORA-A1010	–	–
ORA 4AA; ORA 4AB	0 ° Plato	distilled water		–	
ORA 1UA; ORA 1UB	0 % Urea	distilled water		–	
ORA 4FA; ORA 4FB; ORA 4UA; ORA 4UB	0 °C EG/PG/CW	distilled water		–	
ORA 1SA; ORA 1SB	0 ‰ Salinity	distilled water	ORA-A1010	–	–
ORA 2SA; ORA 2SB	0 % Salt (NaCl)	distilled water		–	
ORA 2AB	0 % Vol (weight)	distilled water		–	
ORA 2PA; ORA 2PB; ORA 5PB	1,000 sg Urine	distilled water		–	
ORA 62BA; ORA 62BB	29,6 % Brix	saturated salt solution	ORA-A1003	–	–
ORA 3HA; ORA 3HB; ORA 82BB	78,8 % Brix	Clove oil CAS 8000-34-8	ORA-A1004	yes	ORA-A1005
ORA 4RR	1,4875 nD	Clove oil CAS 8000-34-8	ORA-A1004	yes	ORA-A1005
ORA 6HA; ORA 6HB	19,6 % Water content	Clove oil CAS 8000-34-8	ORA-A1002	yes	ORA-A1005
ORA 1GG	1,515 nD	Diiodomethane CAS 90-11-9	ORA-A1007	yes	ORA-A1008



## KERN Pictograms

 <b>360° rotatable microscope head</b>	 <b>Fluorescence illumination for compound microscopes</b> With 100 W mercury lamp and filter	 <b>Integrated scale</b> In the eyepiece	 <b>Battery operation</b> Ready for battery operation. The battery type is specified for each device.
 <b>Monocular Microscope</b> For the inspection with one eye	 <b>Fluorescence illumination for compound microscopes</b> With 3 W LED illumination and filter	 <b>SD card</b> For data storage	 <b>Rechargeable battery pack</b> Rechargeable set
 <b>Binocular Microscope</b> For the inspection with both eyes	 <b>Phase contrast unit</b> For a higher contrast	 <b>USB 2.0 interface</b> For data transmission	 <b>Plug-in power supply</b> 230V/50Hz in standard version for EU. On request GB, AUS or USA version.
 <b>Trinocular Microscope</b> For the inspection with both eyes and the additional option for the connection of a camera	 <b>Darkfield condenser/unit</b> For a higher contrast due to indirect illumination	 <b>USB 3.0 interface</b> For data transmission	 <b>Integrated power supply unit</b> Integrated in microscope. 230V/50Hz standard EU. More standards e.g. GB, AUS or USA on request.
 <b>Abbe Condenser</b> With high numerical aperture for the concentration and the focusing of light	 <b>Polarising unit</b> To polarise the light	 <b>WIFI data interface:</b> For transmitting of the picture to a mobile display device	 <b>Package shipment</b> The time required to manufacture the product internally is shown in days in the pictogram.
 <b>Halogen illumination</b> For pictures bright and rich in contrast	 <b>Infinity system</b> Infinity corrected optical system	 <b>HDMI digital camera</b> For direct transmitting of the picture to a display device	 <b>Pallet shipment</b> The time required to manufacture the product internally is shown in days in the pictogram.
 <b>LED illumination</b> Cold, energy-saving and especially long-life illumination	 <b>Zoom magnification</b> For stereomicroscopes	 <b>PC software</b> To transfer the measurements from the device to a PC.	
 <b>Incident illumination</b> For non-transparent objects	 <b>Auto-focus</b> For automatic control of the focus level	 <b>Automatic temperature compensation</b> For measurements between 10 °C and 30 °C	
 <b>Transmitting illumination</b> For transparent objects	 <b>Parallel optical system</b> For stereomicroscopes, enables fatigue-proof working	 <b>Protection against dust and water splashes IPxx:</b> The type of protection is shown in the pictogram of. DIN EN 60529:2000-09, IEC 60529:1989+A1:1999 +A2:2013	
 <b>Fluorescence illumination</b> For stereomicroscopes			

## Abbreviations

<b>C-Mount</b>	Adapter for the connection of a camera to a trinocular microscope	<b>SLR camera</b>	Single-Lens Reflex camera
<b>FPS</b>	Frames per second	<b>SWF</b>	Super Wide Field (Field number at least Ø 23 mm for 10× eyepiece)
<b>H(S)WF</b>	High (Super) Wide Field (Eyepiece with high eye point for wearers of glasses)	<b>W.D.</b>	Working Distance
<b>LWD</b>	Long Working Distance	<b>WF</b>	Wide Field (Field number up to Ø 22 mm for 10× eyepiece)
<b>N.A.</b>	Numerical Aperture		