

Refractometers

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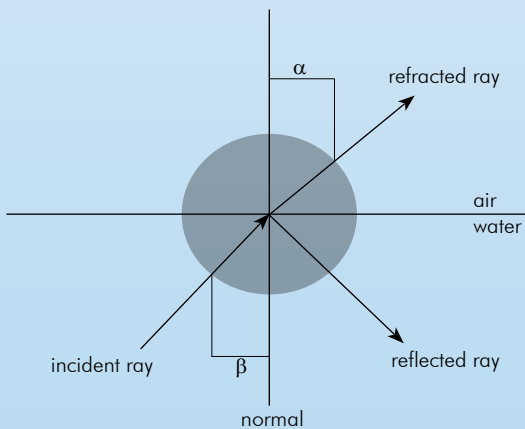


What is REFRACTOMETRY?

You've lost the key to your locker in the swimming pool. You spot it lying on the bottom of the shallow part of the pool, reach in to take it – and your hand misses. The refraction of light at the boundary of two different materials can be explained as easily as that. If the swimming pool was filled with salt water, the image of the key would have been shifted even more.

Light moves at different speeds in materials of different densities. In a vacuum, it reaches 299 792 458 m/s, however in water "only" 225 000 000 m/s. If a ray of light with a defined wavelength strikes a boundary between one medium to another at a fixed angle, the angle of the ray will change according to the refractive indices of the media. Snell's law describes this phenomenon:

$$n_1 \cdot \sin \delta_1 = n_2 \cdot \delta_2, \text{ where } \delta_1 \text{ is angle } \alpha \text{ and } \delta_2 \text{ angle } \beta$$



Under constant conditions with known material properties, the formula can be manipulated to calculate the refractive index of an unknown second medium. The angle of incidence and angle of refraction can be measured, the refractive index of one of the materials (the prism of the refractometer) is known, and so, after adjusting the formula, the refractive index of the unknown material is a matter of simple mathematics.

Measurement of the refractive index depends on the temperature and wavelength of the light. Determination of the refractive index can provide information on the purity of a substance, but not its exact composition.

The refractive index of water at 20 °C is 1.33 nD.

Ice has a refractive index of 1.31 nD.

Adding sugar to pure water changes the refractive index, depending on the amount added. Adding salt changes the refractive index as well, but in relation to the concentration.

This means that if pure water at 20 °C does not have a refractive index of 1.33, it has been "polluted" with some

other material. As a rule, determining the refractive index of a substance is a quick and reliable check of its purity.

Sun flower oil diluted with cheaper oil can be detected just as easily as the sugar content of marmalade during the production process.

Another example: cyclohexane at 20 °C has the same refractive index as a 52.9 % sugar solution. This shows that no statements on the composition or possible admixture of a substance can be made without knowing exactly what it is.

Temperature is one of the greatest factors which can influence the refractive index. Each substance reacts differently and specifically to temperature.

40 Brix Sugar Solution

"0.00015 per °C"

Temperature	Refractive Index
20.0 °C	1.39986 nD
20.1 °C	1.39985 nD
21.0 °C	1.39971 nD

Paraffine Oil

"0.00036 per °C"

Temperature	Refractive Index
20.0 °C	1.48001 nD
20.1 °C	1.47997 nD
21.0 °C	1.47965 nD

A temperature corrected scale in a refractometer must always be specific to a substance, and can never be considered to be universal.

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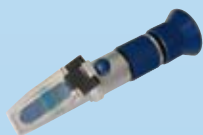
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DR6000 Series | Digital Refractometers

Digital laboratory refractometers from A. Krüss Optronic are setting new benchmarks on many counts. An intuitive touchscreen presents a clear overview of all data and functions and the integrated SQL database stores all data and allows external access via a network or standalone PC.

The refractive index can be a parameter in quantitative or qualitative analysis and quality assurance. Degrees of polymerisation can also often be monitored frequently, quickly and cost-efficiently without turbidity or the colour of the sample affecting measurement precision. There is no longer any elaborate preparation of samples necessary. The sample is simply placed on the measuring prism and the measurement process is started. The flat stainless steel plate is easy to clean and is highly resistant to aggressive substances.

As the refractive index depends on the temperature of the sample, the refractometer should be tempered. The DR6000 series is thus available with integrated electronic temperature control by means of a Peltier element. This type of temperature control is faster and more reliable than previous water bath thermostats which can be connected to the digital refractometer without Peltier temperature control. It is thus possible to carry on using an existing thermostat. For continuous measurements or series of measurements with many samples and high volumes of samples, devices with flow measurement cells are available. A sample can thus displace the previous one, nonetheless achieving an accurate measurement result without cleaning the measuring prism after every measurement. If a printer is connected to the RS-232 interface, the measurement result can be printed out either directly after the measurement or later. All stored measurement data can also be filtered according to different criteria and exported to a USB stick in .XLS (Excel) or .CSV format.

Fields of application:

Determination of mixing ratios, quality and quantity inspection in the following industries:

- Pulp and paper industries
- Beverage industry
- Food industry
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- Textiles industry
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- Chemical industry
- Petrochemical industry
- Metalworking industry
- Wastewater management



DR6000 with interfaces for external Thermostats

The integrated SQL database stores up to 99 user-defined measurement methods and the last 999 measurement results with all relevant data, such as date, time and user. An optional user management system with three authorisation levels safeguards the settings against any inadvertent changes. The DR6000 series thus complies with all GLP requirements and is ideally suited for use in FDA-regulated areas. Refractometers can be connected to a PC via an Ethernet interface or integrated in an existing network. If there is access to the Internet, remote maintenance and fault diagnostics are also possible. DR6000 refractometers are sturdy, low-maintenance and also extremely quiet - a quality which is often underestimated when it comes to constant use in a laboratory.



Specifications

Standard

	Range 1.3200 – 1.5800 nD 0-95 %Brix	Range 1.3200 – 1.7000 nD 0-95 %Brix	Accuracy 0.0001 nD 0.1 %Brix	Resolution 0.0001 nD 0.1 %Brix	Built-in Peltier Thermostat	Flow- through cell
DR6000 *	X		X	X		
DR6000-F *	X		X	X		X
DR6000-T	X		X	X	X	
DR6000-FT	X		X	X	X	X
DR6100 *		X	X	X		
DR6100-F *		X	X	X		X
DR6100-T		X	X	X	X	
DR6100-FT		X	X	X	X	X

High accuracy

	Range 1.32000 – 1.58000 nD 0-95 %Brix	Range 1.32000 – 1.70000 nD 0-95 %Brix	Accuracy 0.00002 nD 0.02 %Brix	Resolution 0.00002 nD 0.01 %Brix	Built-in Peltier Thermostat	Flow- through cell
DR6200 *	X		X	X		
DR6200-F *	X		X	X		X
DR6200-T	X		X	X	X	
DR6200-FT	X		X	X	X	X
DR6300 *		X	X	X		
DR6300-F *		X	X	X		X
DR6300-T		X	X	X	X	
DR6300-FT		X	X	X	X	X

* All models without internal temperature control can be connected with our external Peltier thermostat PT31 (see page 17)

Common Specifications	
Measurement modes	Single, Interval
Scales	Preset standard scales: Refractive Index [nD], %Brix (saccharose, inverted sugar, glucose, fructose). Temperature corrected [nD], temperature corrected [%Brix]. User defined scales can be initialized.
Calibration	manufacturer's 4-point-calibration, user defined 1-point-calibration with any substance possible
Measurement time	~4 s
Prism	Sapphire
Illumination	LED 590 nm (est. life: >100.000 hours)
Housing	Cast aluminium, powder-coated
Analysis basin	Stainless steel
Display	LCD 5.7" 320x240 Pixel, TFT
Operation	Touchscreen
Interface	RS-232, USB, Ethernet
Protection class	IP65 for analysis basin
Working voltage	90 – 260 V~, 50/60 Hz, 60 W

Common Specifications	
Temperature measurement	5 – 90 °C
Temperature resolution	0.1 °C
Temperature measurement accuracy	± 0.05 °C
Temperature compensation	ICUMSA User defined 3-Point
Temperature sensor	PT100 Sensor
Sample temperature	10 – 80 °C
Ambient temperature	15 – 35 °C

Only T-Models	
Temp. control range	10 – 80 °C (optional)
Temp. accuracy	± 0.1 °C
Temp. stability	0.05 °C

KRÜSS LabGuide

The program KRÜSS-LabGuide makes it easy for the laboratory technician to carry out measuring processes and find related documentations and values. It replaces the current manual records in the form of electronic journals. All requirements in handling electronic records and electronic signatures (ER/ES) are met by the KRÜSS-LabGuide according to 21 CFR Part 11. The development of the KRÜSS-LabGuide represents a collaborative effort between A. KRÜSS Optronic GmbH and iCD.GmbH on the basis of Laboratory Information/Management-Systems (LIMS) LABS/Q.

KRÜSS-LabGuide software has been developed for the new generation of digital polarimeters, refractometers and densimeters. It is our aim to fulfill the particular requirements for documentation and data security serving the pharmaceutical industry. Aside from a multi-lingual user guide, the system also includes a standardized interface for data exchange with other systems. A certified interface for SAP-QM is available as optional equipment.



Measuring Device Management

The supported laboratory devices are connected with each other via ethernet interface. The units will be automatically registered with KRÜSS-LabGuide and are available to the User for measuring- and test purposes.

Management of Measuring Methods

On the basis of prepared measuring methods for polarimeters and refractometers the User may set up and manage his own measuring methods with product-specific marginal values.

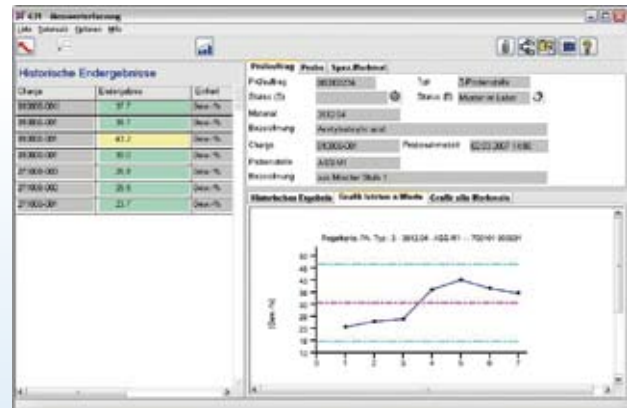
User Management

The program includes a user management feature. Each user is assigned to a group through which he will be assigned access rights. Selection of the language version may be made during the registration process. All actions are recorded in an audit trail according to the requirements specified in 21 CFR Part 11.



Evaluation and Reporting

Aside from the statistical print-outs of the recorded test data, the User has available to him various pre-established reports to print out results and test data. Individual reports may be obtained via external reporting tools with the use of a standardized data bank interface.



Scalability

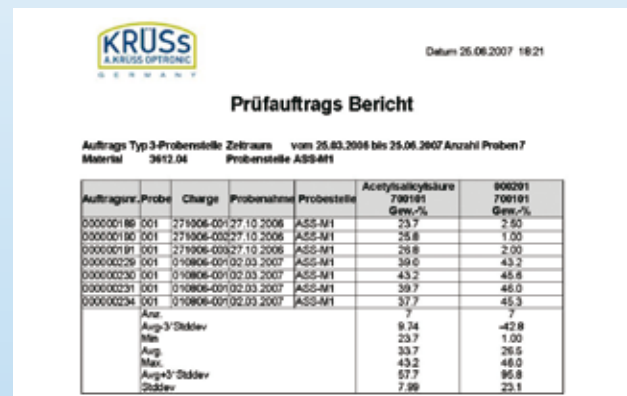
LabGuide is a data bank based program. It may be used at an individual work station together with a test device, as well as in a network as an intranet application with several test devices and a central data bank.

Interfaces

Aside from the standardized XML-Interface used to exchange measuring data between LabGuide and other systems, the system offers data exchange with SAP-QM over a certified interface, as an optional feature.

Expandability

LabGuide may be expanded through a variety of modules, beginning with the connection to other units such as analysis scales, via the management of test devices all the way to a complete, high performance Laboratory Information/Management System (LIMS).



AR2008 | Digital Abbe Refractometer



Fields of application:

Determination of mixing ratios, quality and quantity inspection in the following industries:

- Pulp and paper industries
- Beverage industry
- Food industry
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- Petrochemical industry
- Metalworking industry
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The digital Abbe refractometer AR2008 has an electronic data processing system. The refractive index or Brix value is shown on an LCD display together with the temperature.

A serial interface allows measured values with date and time to be transferred directly to the PC or printer.

An automatic temperature compensation feature is optionally selectable.

The AR2008 has a thermostat connection for prisms and a built-in light source (589 nm) for the measuring prism.

The AR2008 is extremely sturdy and is ideally suited for use in a harsh environment.

It is supplied with a glass calibration plate, contact fluid and a screw-driver as well as a dust hood.



Specifications

Measurement range	Refractive index	1.3000 – 1.7200 nD
	Sugar scale	0-95 %Brix
	Temperature	0 – 99 °C
Accuracy	Refractive index	0.0002 nD
	Sugar scale	± 0.1 %Brix
Resolution	Refractive index	0.0001 nD
	Sugar scale	0.1 %Brix
	Temperature	0.1 °C
Autom. Temperature compensation	0 – 90 °C	
Interfaces	serial RS-232 9600 Baud serial RS-422 9600 Baud	
Power supply	110/230 V~, 50/60 Hz, 40 W	

AR4 and AR4D | Abbe Refractometers

The Abbe refractometer was developed in 1869 by Ernst Abbe and is used to determine the refractive index otherwise known as the index of refraction. It is based on the principle of total reflection which occurs at the boundary between the prism and the sample. The refractive index of the prism determines the upper limit of the measurement range, as it always has to be greater than that of the sample.

To determine the refractive index of solids, a contact liquid with an average refractive index is required. Abbe refractometers are characterised by their easy handling and minimal sample quantities.

Samples in the form of solids or pastes can be measured just as easily as liquids. Furthermore, colouration or clouding scarcely affect the measurement result.

Besides the refractive index, the solid content can be determined in %Brix.

The refractive index of a sample depends on the wavelength of the light used in measurement. That is why we supply our AR4 and AR4D with LED illumination for the measuring prism. This has the standard wavelength of 589 nm and has a very long service life (>100,000 h). Refractometers also have scale illumination.

The refractive index also depends on temperature.

As the temperature increases, the refractive index drops.

That is why our Abbe refractometers have thermostat connections on both the illumination prism as well as the measurement prism. A digital thermometer is included in the scope of supply.

Our Abbe refractometers can easily be checked and calibrated with the calibration plates provided and comply with all requirements of ASTM D1218.



AR4

AR4D

Specifications

Measurement range	1.3000 – 1.7000 nD 0-95 %Brix	
Accuracy	± 0.0002 nD ± 0.1 %Brix	
Scale division	0.0005 nD 0.25 %Brix	
Thermometer	Digital thermometer: -40–120 °C	
Illumination	Scale illumination, LED-illumination (590 nm) for prism	
Display	AR4D	Readings via scale window and ocular
	AR4	Readings via ocular
Power supply	110 V or 220 V, switchable	
Dimensions	AR4D	230 x 110 x 270 mm
	AR4	140 X 100 X 235 mm
Weight	AR4D	5.5 kg
	AR4	4.4 kg
Special features	Adjustable scale, prisms can be temperature-controlled, thermostat connections for prisms	

Fields of application:

Determination of mixing ratios, quality and quantity inspection in the following industries:

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- Beverage industry
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- Textiles industry
- Pharmaceutical industry
- Chemical industry
- Petrochemical industry
- Metalworking industry
- Wastewater management

PR21 | Process Refractometer



The process refractometer was developed for direct installation in pipelines and boilers, and is ideal for process monitoring, control and separation of products in the chemical, beverage, food, pulp and paper as well as sugar industries.

As no bypass is necessary, it is much simpler to install the process refractometer in a pipeline or tank.

Standard connections enable the process refractometer to be assembled quickly and easily.

Depending on diameter, a T-piece is inserted into the pipeline or an adapter welded on, as with the tank.

Fields of application:

Determination of mixing ratios, quality and quantity inspection in the following industries:

- Pulp and paper industries
- Beverage industry
- Food industry
- Sugar and sweetener industry
- Textiles industry
- Pharmaceutical industry
- Chemical industry
- Petrochemical industry
- Metalworking industry
- Wastewater management

Common Specifications

Measurement mode	Refractive index [nD], Sugar content [%Brix], User defined [%]
Measurement time	3–60 s
Temperature sensor	PT100
Temp. measurement	-10–200 °C
Temp. resolution	0.1 °C
Temp. measurement accuracy	0.2 °C
Temperature compensation	ICUMSA, arbitrary
Process temperature	-5–160 °C
Ambient temperature	0–60 °C
Prism	Sapphire
Illumination	LED 590 nm
Housing	Edelstahl
Interfaces	Analog 0/4-20 mA, Ethernet, PROFIBUS (optional)
Protection class	IP65
Explosion protection	optional
Power supply	24 V

Model overview

Model / Article-No.	Measurement accuracy	Resolution	Product Temperature	Ambient temperature
PR21S	0.0002 nD	0.0001 nD	< 60 °C	< 40 °C
PR21S-T	0.2 %Brix	0.1 %Brix	< 160 °C	< 60 °C
PR21H	0.00002 nD	0.00001 nD	< 60 °C	< 40 °C
PR21H-T	0.02 %Brix	0.01 %Brix	< 160 °C	< 60 °C

PRB21 | Bypass Process Refractometer

The bypass process refractometer PRB21 fills the gap between the DR6000 series of digital laboratory refractometers and the process refractometer PR21. The sample is directed through a bypass to the measurement chamber which is made of stainless steel, while the actual prism is made of sapphire and is thus particularly scratch-resistant. The PRB21 is usually connected to a PLC and is used for continuous process monitoring. The measurement interval is adjustable (>3 s) and the measurement result is not affected by either the colour or the turbidity of the sample. The PRB21 has various interfaces and can also be supplied with PROFIBUS on request. A display is also available for visual monitoring. The internal temperature sensor allows automatic temperature compensation and the measured temperature to be sent to the PLC.



Specifications		
Measurement range		1.3300 nD–1.5600 nD 0–95 %Brix
Accuracy	PRB-H	0.00002 nD; 0.02 %Brix
	PRB-S	0.0002 nD; 0.2 %Brix
Resolution	PRB-H	0.00001 nD; 0.01 %Brix
	PRB-S	0.0001 nD; 0.1 %Brix
Measurement units		Refractive Index [nD] Saccarose [%Brix] Invert Sugar [%Brix] Glucose [%Brix] Fructose [%Brix]
Measurement time		3–60 s
Temperature measurement		-10 – 99.9 °C
Temperature resolution		0.1 °C
Temperature accuracy		0.2 °C
Temperature compensation		ICUMSA
Temperature sensor		PT100
Prism		Sapphire
Illumination		LED 590 nm
Housing		Cast steel
Interfaces		RS-232, analog 0/4–20 mA
Protection class		IP65
Working voltage		24 V
Display		LCD 120x32 Pixel
Operation		Touchscreen
Output		1 Relay

Fields of application:

Determination of mixing ratios, quality and quantity inspection in the following industries:

- Pulp and paper industries
- Beverage industry
- Food industry
- Sugar and sweetener industry
- Textiles industry
- Pharmaceutical industry
- Chemical industry
- Petrochemical industry
- Metalworking industry
- Wastewater management

Features:

- Excellent value for money
- Wide measurement range from 1.3300–1.5600 nD / 0–95 %Brix
- Just 3 seconds measurement time
- Password-protected
- Prism in the sample chamber is easy to clean
- Stainless steel sample chamber is suitable for food samples
- User-friendly interfaces for direct connection to a PLC
- Minimal sample quantities required
- Very easy to install, no special requirements

DR301-95, DR201-95 and DR101-60 Digital Hand-held Refractometers

DR301-95

The digital handheld refractometer DR301-95 has more functions than a simple handheld refractometer and at the same time is more cost-effective than a desktop unit. Besides the refractive index, sugar and salt scales, up to two other user-defined scales can be programmed. To do this, the handheld refractometer can be connected to a PC via a serial interface. The software supplied with it allows results to be managed and printed out. While the instrument can be operated as a mobile unit with a 9 V block battery, the optionally available power supply unit turns the DR301-95 into a small laboratory refractometer. The sample plate is made of stainless steel and is so flat that it can be cleaned quickly and easily. The instrument is calibrated simply with distilled water and has an optional temperature compensation feature. For incoming goods control applications, an upper and lower tolerance alarm can be entered.



DR301-95



DR201-95

DR201-95 und DR201-95OE

The DR201-95 is a compact digital handheld refractometer which eliminates any user-related reading errors of manual handheld refractometers. Specially developed for fast and easy quality control and process control, it has a wide measuring range for a refractive index scale and a sugar scale. One DR201-95 can thus often replace several existing instruments. For wine-growing, a special model is available with an Oechsle scale instead of a sugar scale. Both instruments are low-maintenance and are calibrated simply with distilled water. The 1.5 V battery lasts for over 1000 measurements.

DR101-60

As an entry-level model in digital refractometry, the DR101-60 covers many areas of application where the wide measurement range of the DR201-95 is not required. It offers excellent value for money, in terms of both procurement and operation. Calibration is also with distilled water. The waterproof case allows the DR101-60 to be rinsed under running water. This digital handheld refractometer also has an automatic temperature compensation feature, of course.



DR101-60

Fields of application (DR301-95 | DR201-95 | DR101-60):

Determination of mixing ratios, quality and quantity inspection in the following industries:

- Pulp and paper industries
- Beverage industry
- Food industry
- Sugar and sweetener industry
- Textiles industry
- Pharmaceutical industry
- Chemical industry
- Petrochemical industry
- Metalworking industry
- Wastewater management

Model Overview				
Model / Article-No.	DR301-95	DR201-95	DR201-95-OE	DR101-60
Measurement range	1.3330–1.5318 nD 0–95 %Brix	1.3330–1.5318 nD 0–95 %Brix	0–250 °Oechsle 0–95 %Brix	1.3330–1.4419 nD 0–60 %Brix
Accuracy	0.00015 nD 0.1 %Brix	0.0003 nD 0.2 %Brix	1 °Oechsle 0.2 %Brix	0.0005 nD 0.25 %Brix
Resolution	0.0001nD 0.1 %Brix	0.0001nD 0.1 %Brix	1 °Oechsle 0.1 %Brix	0.0001nD 0.1 %Brix
Temperature measurement	5–40 °C 41–104 °F	0–40 °C	0–40 °C	0–40 °C
Temperature accuracy	0.5 °C	0.5 °C	0.5 °C	0.5 °C
Temperature compensation	5–40 °C	10–40 °C	10–40 °C	10–40 °C
Prism	Optical glass			
Housing	Plastic			
Dimensions	180 x 100 x 60 mm	130 x 80 x 40 mm		110 x 62 x 32 mm
Weight	500 g	200 g		160 g
Power supply	9 V battery (adaptor available separately)	1.5 V battery		1.5 V battery

HR-Serie | Manual Hand-held Refractometers

Manual handheld refractometers are for fast everyday use. They are particularly easy to use and very sturdy. Various scales and additional functions ensure that there is exactly the right handheld refractometer for many application areas. This makes for reliability when reading, as the measured value does not first have to be converted.

Some models have an automatic temperature compensation feature, which increases measurement precision for measurements which are performed at 10–40 °C instead of 20 °C. For calibration, distilled water is required, or else a small calibration plate is provided.

Fields of application:

Determination of mixing ratios, quality and quantity inspection in the following industries:

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- Textiles industry
- Pharmaceutical industry
- Chemical industry
- Petrochemical industry
- Metalworking industry
- Wastewater management



Abb. 1



Abb. 2



Abb. 4

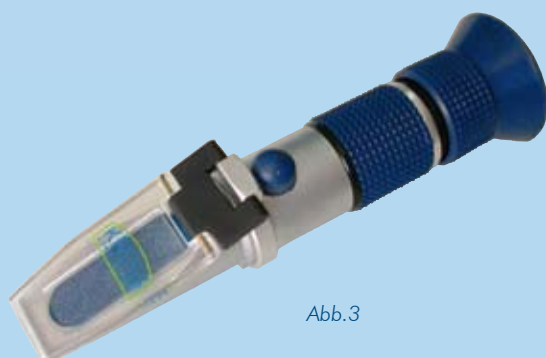


Abb. 3

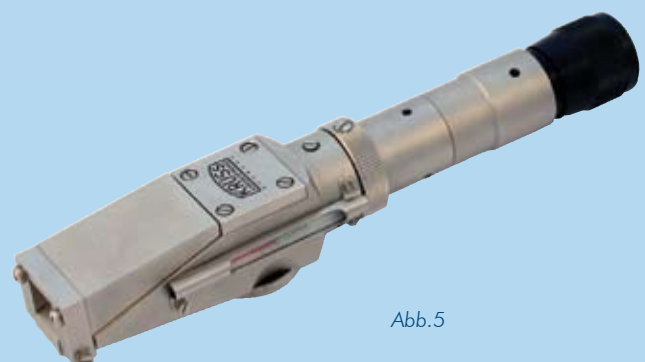


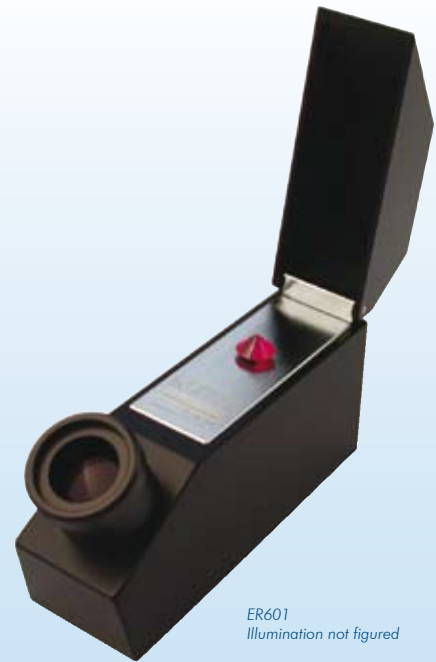
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Manual Hand-held Refractometers

Model	Fig. No.	Measurement range	Accuracy	Scale division	Temperature compensation	Thermometer	Field of application
HR10	Fig. 1	0-10 %Brix	0.1 %Brix	0.1 %Brix	-	-	For sugar concentration in fruit juices, soft drinks, vegetables, foods and cooling lubricants
HR18-01	Fig. 1	0-18 %Brix	0.1 %Brix	0.1 %Brix	-	-	For sugar concentration in fruit juices, soft drinks, vegetables, foods and cooling lubricants
HRKL32	Fig. 2	0-32 %Brix 0-140 °Oechsle 0-27° KMW BaBo	0.2 %Brix 1 °Oechsle 0.2° KMW BaBo	0.2 %Brix 1 °Oechsle 0.2° KMW BaBo	-	-	For the measurement of Brix and alcohol content in must by either oechsle and Klosterneuburg scale
HRN20	Fig. 2	0-20 %Brix	0.2 %Brix	0.2 %Brix	-	-	For sugar concentration in fruit juices, soft drinks, vegetables, foods and cooling lubricants
HRN32	Fig. 2	0-32 %Brix	0.2 %Brix	0.2 %Brix	-	-	For sugar concentration in fruit juices, soft drinks, vegetables, foods and cooling lubricants
HRT32	Fig. 3	0-32 %Brix	0.2 %Brix	0.2 %Brix	automatically	-	For sugar concentration in fruit juices, soft drinks, vegetables, foods and cooling lubricants
HRN62	Fig. 3	28-62 %Brix	0.2 %Brix	0.2 %Brix	-	-	For analysing chemical and technical liquids, such as oils, fats, coolants, lubricants
HRT62	Fig. 3	28-62 %Brix	0.2 %Brix	0.2 %Brix	automatically	-	For analysing chemical and technical liquids, such as oils, fats, coolants, lubricants
HRN82	Fig. 3	45-82 %Brix	0.2 %Brix	0.2 %Brix	-	-	For analysing chemical and technical liquids, such as oils, fats, coolants, lubricants
HR92	Fig. 3	58-90 %Brix 38-43 °Baume 12-27 %Water	1 %Brix 0.5 °Baume 1 % Wasser	1 %Brix 0.5 °Baume 1 % Water	-	-	For examination of highly concentrated sugars, determination of water content in honey and analysing fats, lubricants and cooking oil
HRH30	Fig. 2	12-30 % water content in honey	0.1 %Wasser	0.1 %Water	-	-	For examination of highly concentrated sugars, determination of water content in honey and analysing fats, lubricants and cooking oil
HR900	Fig. 5	0-90 %Brix	0.2 %Brix	0.2 %Brix	-	6-36 °C	Universal hand refractometer with stage switch for all ranges. Adjustable prisms for sharp contours, direct and indirect light guidance for measurement of clear and opaque substances. With thermometer
HR901	Fig. 5	1.333-1.517 nD	0.0005 nD	0.0005 nD	-	6-36 °C	Universal hand refractometer with stage switch for all ranges. Adjustable prisms for sharp contours, direct and indirect light guidance for measurement of clear and opaque substances. With thermometer
HR27-100	Fig. 2	1.000-1.070 d ₂₀ ²⁰ 0-100 %Salinity	0.001 d ₂₀ ²⁰ 1 ‰Salinity	0.001 d ₂₀ ²⁰ 1 ‰Salinity	-	-	For salinity analysis
HRS16	Fig. 1	1.333-1.373 nD 0-160 %Salinity	0.001 nD 2 ‰Salinity	0.001 nD 2 ‰Salinity	-	-	For salinity analysis
HR146	Fig. 2	1.3330-1.3834 nD 0-28 %Salinity	0.001 nD 0.1 ‰Salinity	0.001 nD 0.1 ‰Salinity	-	-	For salinity analysis
HRM18	Fig. 2	0-12 g/dl 1.333-1.360 nD 1.000-1.050 UG	0.2 g/dl 0.0005 nD 0.002 UG	0.2 g/dl 0.0005 nD 0.002 UG	-	-	For the measurement of serum protein and specific urine weight
HRMT18	Fig. 2	0-12 g/dl 1.333-1.360 nD 1.000-1.050 UG	0.2 g/dl; 0.0005 nD; 0.002 UG	0.2 g/dl; 0.0005 nD; 0.002 UG	automatically	-	For the measurement of serum protein and specific urine weight
HRO32	Fig. 2	0-32 %Brix 30-130 °Oe 4.4-19 %Alkohol	0.2 %Brix 1 °Oe 0.1 %Alkohol	0.2 %Brix 1 °Oe 0.1 %Alkohol	-	-	For the measurement of Oechsle, Brix and alcohol content in must
HROT32	Fig. 3	0-32 %Brix 30-130 °Oe 4.4-19 % Alkohol	0.2 %Brix 1 °Oe 0.1 % Alkohol	0.2 %Brix 1 °Oe 0.1 % Alkohol	automatically	-	For the measurement of Oechsle, Brix and alcohol content in must
HRKFZ1	Fig. 3	Frostschutz: 50-0 °C Batteriesäure: 1.10-1.30 g/cm ³	Ethylen-Propylen: 5° Batteriesäure: 0.01	Ethylen-Propylen: 5° Batteriesäure: 0.01	-	-	Anti freeze and battery fluid tester
HR25-800	Fig. 4	0-80 %Brix	0.5 %Brix	0.5 %Brix	-	-	Universal hand refractometer with stage switch for all ranges. Adjustable prisms for sharp contours, direct and indirect light guidance for measurement of clear and opaque substances

ER60-Serie | Gem Refractometers

Gemstone refractometers are used for the classification and quality control of gemstones. The gemstone to be examined is simply placed on the prism with a drop of contact fluid. The refractive index of the gemstone is read through the ocular of the refractometer. The refractive index is an important parameter in classifying a mineral or gemstone. Each mineral has its typical refractive index, due to its chemical composition and crystalline structure. Our gemstone refractometers are characterised by their particularly sharp image and good readability. With the sodium filter that only lets through light with a wavelength of 589 nm, the refractometer can be used as a mobile unit with an ordinary light source or with sufficient ambient lighting. LED illumination is also available with a wavelength of 589 nm.



ER601
Illumination not figured



ER604
Illumination not figured

Model overview				
	Standard Gem Refractometer		Professional Gem Refractometer	
Model / Artikel-No.	ER604	ER604-LED	ER601-NA	ER601-LED
Measurement range	1.33–1.81 nD	1.33–1.81 nD	1.33–1.83 nD	1.33–1.83 nD
Resolution	0.01 nD	0.01 nD	0.01 nD	0.01 nD
Monochromator	Na-Filter 589 nm	Na-Filter 589 nm	Na-Filter 589 nm	–
Illumination	–	LED 589 nm	–	LED 589 nm
Power supply Illumination	–	100–240 V	–	100–240 V
Prism	Optical glass			
Housing	Cast aluminium			

Refractometer accessories

PT31 | Peltier thermostat



This electronic water-bath thermostat with Peltier element is a versatile, high-performance instrument. In one application, for example, it can be used to set the correct refractometer temperature. It is extremely robust, compact and easy to operate. Because it is so small it does not take up valuable space in the laboratory.

Specifications PT31	
Resolution	0.1 °C
Heating power	30 W
Cooling power	15 W
Pump pressure	2000 Pa
Pump performance	20 l/h
Temperature	8–40 °C (continuously adjustable)
Temperature accuracy	±0.2 °C
Power supply	115-230 V
Dimensions	140 x 80 x 210 mm
Weight	1.5 kg

CBM910 | Printer



24 character normal paper printer for Digital Refractometers from the DR6000 series and the Digital Abbe Refractometer (AR2008), as well as for our Digital Polarimeters (P8000 series) and Density Meters (DS7000 series).

AR15 | Flow-through cell with funnel



Flow-through cell with funnel
upgrade for AR4 and AR2008.

AR16 | Flow-through cell



Flow-through cell
upgrade for continuous measurement with
AR4 and AR2008.

Refractometer calibration solutions



- **RI34** calibration solution 1.3400 nD (5 %Brix)
- **RI39** calibration solution 1.3900 nD (35 %Brix)
- **RI43** calibration solution 1.4300 nD (55 %Brix)
- **RI48** calibration solution 1.4800 nD (76 %Brix)
- **RI65** calibration solution 1.6500 nD

All bottles contain 30cc and are supplied with a
certificate.

History of A. KRÜSS Optronic

200 years – a long time for a company’s history. The family enterprise of A. Krüss has invested this time to keep up with the breathtaking developments in science, technology, optics and precision engineering.

An amazing number of high-precision optical and other quite different products have been shipped world-wide from the Hamburg laboratories. Although some have long since been forgotten, more recent products, are known throughout the world.

But let us return to the origins, to 1796 and the Hamburg workshop of Edmund Gabory, „Mechanicus Opticus“.

Gabory was trained in London by none other than Jesse Ramsden, the world famous optician, at a time when precision engineering was flourishing. On finishing his training in 1790, Edmund set up a workshop of his own in London Holborn. In 1796 he moved with his family to Hamburg, the international portcity and trading centre. This is where the talented optical engineer established his career and saw his business prosper. In 1813 Gabory died. The company was taken over by his widow Mary and their son Edmund Nicolas. In 1823 Gabory’s daughter Mary Ann married Andres Krüss.

The combination of scientific skill with Hanseatic business acumen, tradition and perspective proved to be a successful formula. Together with his wife and her brother, Andres Krüss led the company to further success, adding nautical instruments and charts to their product range. Brisk trade with the neighbouring Scandinavian and other foreign countries developed. In 1844 Andres Krüss established a company of his own named Optical Institute A. Krüss. Four years later he fell victim to one of the cholera epidemics. After his death, the company was first run by his widow who then handed it over to her sons Edmund and William in 1851.

In 1859 Edmund set up the company’s own lens-grinding facility. In addition to camera lenses, they later manufac-tured projectors for dissolving views. In order to demonstrate the quality of his photographic lenses he opened his own photographic studio. He was awarded first prize for his lenses at the World Exhibition in London in 1862. In 1865 Krüss patented his famous Magic Lantern, forerunner of the cinema projector.

Still in existence at this time, the original company of Edmund Gabory was merged with Optical Institute A. Krüss in 1886. After completing his training with distinction at Steinhilf and his university studies in Munich, Edmund’s son Hugo returned to take over the management of the company in 1888. In a period of many new inventions and scientific developments, Dr. Hugo Krüss established himself as a pioneer in theoretical and applied photometry. His Manual of Electromechanical Photometry became a standard work. In his capacity as chairman of the German Society for Precision Engineering and Optics, Dr. Krüss was appointed by the German government as an expert for customs and excise in 1892; while in office, he convinced the government to establish a tariff heading specifically for „scientific instruments“. In 1917 the Hamburg Senate awarded Dr. Krüss a professorship in recognition of his achievements in the scientific world and his engagement in public affairs.

In 1904 Hugo’s son, Dr. Paul Krüss joined the family company at the age of only 24. The so-called „master craftsman with a doctorate“ managed the company from 1920 during the troubled times of crisis and World War as well as during the later restructuring of the German economy. Using his international connections in the world of science, he developed a range of scientific instruments including laboratory equipment for schools.

Andres Krüss, Paul’s son, was an engineer and became a partner in 1946 in the 6th generation. Due to his hard work during the „German Economic Miracle“, Andres secured new customers and new markets. Dr. Paul Krüss died in 1976 at the age of 96. No one else had ever run the company so long.

Today the company is run in the 7th generation by Martina Krüss-Leibrock, who took over A. KRÜSS Optronic in 1980. Martina is the daughter of Andres who died in 1992. In 2005 Martinas daughter Karin Leibrock joined the management of the company in the 8th generation. And today the company A. Krüss remains famous for high-precision, state-of-the-art measuring instruments. Thus the traditional craftsman’s art of precision engineering has been perfectly combined with innovative electronic technology.



Trichina-Microscope 1862



Laboratory-Microscope 1885



Astronomic spectroscope, made 1900
in front of a portrait of Prof. Hugo Krüss



General management today:
Martina Krüss-Leibrock and Karin Leibrock

A.KRÜSS Optronic GmbH
Alsterdorfer Straße 276–278
22297 Hamburg | Germany
Telefon +49-(0)40-51 43 17-0
Fax +49-(0)40-51 43 17-60
eMail info@kruess.com
Web www.kruess.com