MEASURING QUALITY. SINCE 1796

KRÜSS
A.KRÜSS OPTRONIC
GERMANY

REFRACTOMETERS

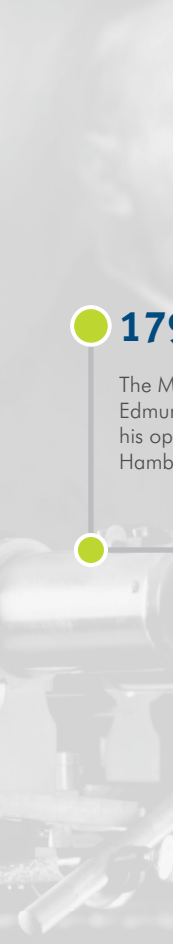
PROFESSIONAL SOLUTIONS FOR ALL APPLICATIONS

www.kruess.com

CUTTING-EDGE TECHNOLOGY, MADE IN GERMANY

A.KRÜSS Optronic is a leading manufacturer of high-precision measuring devices and analytical instruments. The family enterprise founded in 1796 offers an extensive range of products and customised solutions for quality assurance in the pharmaceutical, chemical, petrochemical, food and beverage industry as well as for research and science. Whether it is a refractometer, polarimeter, density meter, gas analyser, flame photometer, melting point meter or microscope – our instruments meet the highest requirements in terms of speed, accuracy and reliability. Thanks to our strong R&D capacities, we are a driving force in the technology market setting the standards for functional scope and user-friendliness. A dense network of sales partners and certified service partners allows us to provide individual consultation as well as optimised service and support for our customers around the globe.

OVER 200 YEARS OF PIONEERING SPIRIT AND SUCCESS



1796

The Mechanicus Opticus Edmund Gabory sets up his optical workshop in Hamburg

1823

The daughter of the late Gabory, Mary Ann, marries Andres Krüss, who continues the company together with his brother-in-law, Edmund Nicolas. He responds to the increasing demand for nautical instruments by selling sea charts

1844

Andres Krüss establishes his own company Optisches Institut von A. Krüss and in 1848 incorporates Gabory into the company

1862

Andres' son, Edmund Johann Krüss, who took over the company in 1851, is awarded the first prize for his photographic lenses at the world exhibition in London

1865

Krüss has his improvement of the Laterna Magica patented

1888

The heydays of the company boasting many innovations and inventions begin after Edmund Johann Krüss' son, Hugo, took over the management. Dr. Hugo Krüss' handbook of electrotechnical photometry lays the groundwork for this subject

1920

The son of Dr. Hugo Krüss, Paul, takes over the company and leads it successfully through World War II and the time of reconstruction. He not only makes important contributions to the spectral analysis and photometry, but he also invents and produces the corresponding devices, among other things, for school lessons

1946

Ing. Andres Krüss becomes joint partner of the company in the sixth Krüss generation. Hard work and the economic miracle bring new markets and customers

1975

A.KRÜSS Optronic offers a digital tensiometer for the automatic measurement of the boundary and surface tension of liquids

CONTENT

1980

Andres Krüss'daughter, Martina Krüss-Leibrock, is the seventh generation to take over the A.KRÜSS Optronic GmbH.
She makes important advances in the internationalisation of the company

2000

A.KRÜSS Optronic launches a refractometer featuring a fully automatic data acquisition

2003

A.KRÜSS Optronic is the first company in this sector to offer measuring devices and analytical instruments with a touch-screen display

A.KRÜSS Optronic develops the P8000 series that are still the fastest polarimeters in the world

2005

The daughter of Martina Krüss-Leibrock, Karin Leibrock, joins the management

A.KRÜSS Optronic is awarded with the "Top 100" seal of approval for especially innovative mid-sized companies

2008

A.KRÜSS Optronic is the first manufacturer in Germany to offer density meters

2011

A.KRÜSS Optronic puts a flame photometer on the market – worldwide one of a kind to this day – allowing for a simultaneous high-precision measurement of up to five elements

2013

Thomas Schmauck joins the management and is now together with Karin Leibrock in charge of the operative business of A.KRÜSS Optronic

2014

With a new user interface, the digital devices from A.KRÜSS Optronic set the standard for user-friendliness

In addition to the existing ISO 9001certification, A.KRÜSS Optronic now also boasts an ISO 14000 certified environmental management system

2015

With the gas analysers of the MAT1000 series, A.KRÜSS Optronic offers solutions for controlling modified atmosphere packaging

THE WORLD OF REFRACTOMETRY

Whether it is the pharmaceutical, chemical, food or beverage industry, the producers of aromas, scents and essential oils, the petrochemical, metalworking or the automobile industry – refractometers play an important role in all of these industries to provide quality assurance. They determine the refractive index of liquid or solid substances from which you can deduce their identity and quality as well as their concentration in binary or quasi-binary mixtures. It also allows you read the progress of reactions and material conversions.

Refractometers are used in a number of applications - from the determination of the purity and concentration of ingredients of medications to the measurement of the sugar content in food and beverages to the analysis of petroleum oil. They are also the method of choice for the quality control of operating fluids for machines and motors or AdBlue, the synthetic urea solution for the treatment of diesel engine exhaust gases.

The refractometer technology takes advantage of the fact that light refracts at the boundary between media of different optical densities. In air, for example, it spreads with a speed of about 300,000 km/s; in water, which is optically denser than air, with approx, 225,000 km/s. It does not only slow down but also changes its direction similar to a sled going downhill at an angle hitting a piece of grass. One skid gets to the grass first and will be slowed down earlier than the other one resulting in a change of direction. However, the light is not completely refracted but also partially reflected depending on the angle of incidence. If you increase the angle of incidence, you will get to a state where the entire light is reflected. This angle is called the limiting angle of total reflection. It is measured by modern digital refractometers which is then used to calculate the refractive index. This allows for a characterisation of the sample as every substance has it characteristic refractive index. In case of binary or quasi-binary mixtures whose one component is known, it is possible to also determine the second one mathematically.

In order to achieve reliable and reproducible measurement results, refractometers must work with light of a constant wavelength – 589 nm as a standard – and maintain an exact temperature of the sample as the wavelength and temperature influence the refractive index of substances. The users also expect that the devices can be integrated easily into any production process, that they allow for an automatic work and that they are easy to handle.

INFOBOX

ALL SAMPLES CAN BE MEASURED

From bright to dark, from basic to acidic, from a low to a high viscosity – our refractometers can measure almost any sample. A high-quality optical system, an intelligent analysis logarithm and a powerful LED allows you to measure extremely challenging samples such as non-homogeneous samples such as fruit juices with pulp, opaque samples such as heavy oils or emulsions such as cosmetics. Aggressive acids and bases can be easily measured using a chemical-resistant stainless steel measuring tray and a sapphire prism. Even foils and solids can be measured by using a high-refractive contact liquid.

SCALES

There is a relationship between many physical measured variables. If these dependent relationships are known, you will only have to measure one variable from which all the others can be calculated. If the refractive index is known, it is often also possible to derive the concentration, density or viscosity which is automatically displayed on the refractometer. The most common used scale among the 100 different scales is the BRIX scale. It is used to determine the sugar concentration in aqueous solutions and often already pre-installed in digital refractometers. In case standard scales are no longer sufficient, the formula editor will help you to create completely customised mathematical conversion formulas.

FOCUS ON QUALITY

WITH REFRACTOMETERS FROM A.KRÜSS

DIGITAL REFRACTOMETERS – DR6000-T MODELS

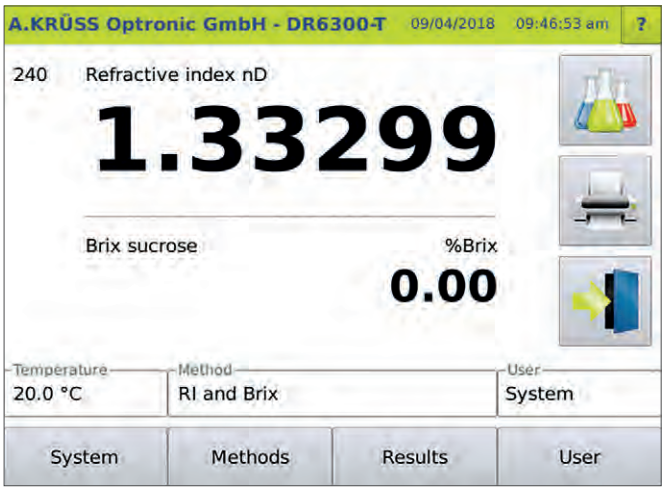
MEASURING ALL LIQUIDS AND PASTES

We developed the digital refractometers of the DR6000 model series in close cooperation with well-known partners from industry and research. They deliver highly accurate and reproducible measurement results, offer the option to work semi and fully automatically and are easily integrated into existing processes in the laboratory. There are four different models available for different requirements on accuracy, resolution and measurement range whereby you can access the same operation and functionality. The refractometers are very robust due to the aluminium cast housing and are suitable for nearly any sample thanks to the chemical-resistant measurement prism made of sapphire and a measuring tray made of stainless steel. Even turbid or highly viscous samples can be analysed without any difficulty.

The samples are simply supplied with a pipette, syringe or spatula. Low viscous to slightly viscous samples can also be supplied via a peristaltic pump or an autosampler and therefore be measured fully automatically. A high-performance LED with a 100,000 h service life and a narrow frequency spectrum will therefore provide highly accurate measurement results with a small sample volume of only 0.3 ml. All measurement data as well as system and method settings are automatically recorded and saved in a tamper-proof way. When the audit trail function is activated, all configuration changes made by each individual user are saved as well.

As a standard, the refractometer models DR6000-T and DR6000-TF are equipped with a Peltier element that controls the temperature of the sample up to 80 °C. Once the measurement has started, it will take only a few seconds until the display shows the measurement values on the selected scales. The user has the choice between two measurement methods - a measurement with a manual measurement time input and with an optimized measurement time thanks to automated stability recognition. These methods can be carried out as single, continuous and interval measurements. This covers the entire range of applications. Our refractometers are also very quiet - an invaluable advantage when used continuously in the laboratory.

The refractometers of the DR6000 series feature a self-explanatory, user-friendly interface, which makes it easy even for non-skilled personnel to easily operate the device. The user interface is found on all of our measurement instruments so that the user will always be able to work in the same straightforward way and so that integrated solutions with several different devices can be readily realised. A state-of-the-art TFT display ensures a clear, bright representation of all the information and the integrated touch- screen completes the user-friendly experience.



User interface of the **DR6000** *series*

INFOBOX

INFLUENCING FACTOR TEMPERATURE

If the temperature of a sample varies by 1 °C, this will then become already apparent with the fourth decimal place of the measured value. A precise temperature control is therefore extremely important in order to ensure a high accuracy and reproducibility of the measurement results. This is realised either through a built-in Peltier element or through external thermostats. This allows for standard-compliant measurements at various temperatures, for example, at 20 °C according to Ph. Eur or at 25 °C according to USP. A quick temperature control should be ensured; this will save a lot of time in case many temperature changes take place.

PELTIER TEMPERATURE CONTROL

The built-in Peltier element makes it possible to control the temperature of samples within a range of 10–80 °C in order to be decoupled from external temperature influences. The selected temperature has a very high accuracy of up to 0.01 °C ensuring the comparability and reproducibility of the measurement results. An extremely homogeneous temperature control also rules out any measurement deviations due to temperature gradients. In addition, our temperature control offers short heating and cooling times; temperature changes between 20 °C and 70 °C are achieved in less four minutes.

DR6300-T *with integrated Peltier temperature control*

PELTIER TEMP. CONTROL

TEMP. COMPENSATION

	DR6000-T	DR6100-T	DR6200-T	DR6300-T
TEMPERATURE CONTROL	With integrated Peltier temperature control			
TEMP. CONTROL RANGE	10–80 °C			
ACCURACY OF TEMP. CONTROL	±0.1 °C			
TEMPERATURE COMPENSATION	Can be activated (ICUMSA or freely definable)			
SCALES	Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix], User-defined			
MEASUREMENT RANGE	nD 1.3200–1.5800 0–95 %Brix	nD 1.3200–1.7000 0–95 %Brix	nD 1.32000–1.58000 0–95 %Brix	nD 1.32000–1.70000 0–95 %Brix
MEASUREMENT ACCURACY	nD ±0.0001 ±0.1 %Brix		nD ±0.00002 ±0.02 %Brix	
RESOLUTION	nD 0.0001 0.1 %Brix		nD 0.00001 0.01 %Brix	
MEASUREMENT PERIOD	approx. 4 s			
MEASUREMENT PRISM	Sapphire			
LIGHT SOURCE	LED			

DIGITAL REFRACTOMETERS – DR6000 MODELS

MEASURING SUGARY SAMPLES

The DR6000 models are especially suited for highly accurate measurements of products from the sugar industry. All their features are identical with our DR6000-T models but do not feature an internal Peltier temperature control. Instead of temperature control, the temperature compensation according to ICUMSA can be used. With the help of this already implemented conversion function, the concentration level [% Brix] at the measuring temperature is converted (compensated) to the value at a standard temperature of 20 °C.

If needed, our DR6000 models can also be temperature-controlled using an external thermostat. The built-in thermostat connections allow you connect, for example, our PT31 or PT80 in next to no time; both are circulating thermostats with built-in Peltier technology. A temperature sensor integrated into the refractometer displays the current sample temperature which can be regulated via the connected thermostat. In this way it is possible to measure nearly all liquids and pastes also with the DR6000 models when the temperature influence on the measurement value is not known and the temperature compensation can not be used.

The measuring tray of the refractometers consists of a smooth stainless steel surface and allows for a simple and thorough cleaning in order to rule out measurement inaccuracies due to a sample carry-over. When working manually, the measuring tray is cleaned with a cleaning agent recommended for the respective sample and a soft cloth; in case of semi and fully automatic work through rinsing or displacement.
A special sample cover prevents the sample from evaporating and from an unintended exposure to light during the measurement and supports an even temperature distribution in the sample. An integrated measured data storage saves up to 99 user-defined measurement methods as well as the last 999 measurement results. The refractometers of the DR6000 series feature USB, RS-232-and Ethernet interfaces. This allows you to also connect devices such as a PC, printer, barcode scanner, keyboard and mouse. A user management with several authorisation levels protects the settings against accidental changes.

The DR6000 series meets all the requirements of the GMP/GLP incl. international standards and guidelines such as 21 CFR Part 11 (Audit Trail), OIML, ASTM, ICUMSA. Our refractometers are perfectly suited for the use in FDA regulated areas.

Manual sample supply with **DR6000** *series*

INFOBOX

CALIBRATION AND ADJUSTMENT

The refractometer should be inspected on a regular basis to ensure that it delivers reliable measurement results. An easier method is the testing of the water value. The refractive index (nD) of distilled water at 20 °C (589 nm) is exactly 1.33299. If this value is not met, you can use the tare function to carry out a one-point adjustment; the device adjustment is compared with the currently measured value. Certified, traceable standards, which we also use for every commissioning, IQ/OQ/PQ or annual maintenance work, are recommended for a subsequent calibration in order to validate the specified measurement accuracies of our devices.

TEMPERATURE COMPENSATION

A temperature control of the measurement sample is not required when sugary beverages and confectionary products are measured. A conversion table published by the ICUMSA, which shows the influence of temperature on the refractive index of sucrose, glucose , fructose and invert sugar solutions, makes this possible. Since the influence of the temperature on the measured value is known, it is possible to take measurements at any ambient temperature and to automatically convert them to the desired reference temperature – often 20 °C. Temperature differences will also be automatically compensated.

DR6200 *temperature controlled with an external thermostat*

Sugar SAMPLES

TEMP. COMPENSATION

THERMOSTAT TEMP. CONTROL

	DR6000	DR6100	DR6200	DR6300
TEMPERATURE CONTROL	Without a sample temperature control, you can connect a thermostat for the temperature control			
TEMP. CONTROL RANGE				
ACCURACY OF TEMP. CONTROL				
TEMPERATURE COMPENSATION	Can be activated (ICUMSA or freely definable)			
SCALES	Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix], User-defined			
MEASUREMENT RANGE	nD 1.3200–1.5800 0–95 %Brix	nD 1.3200–1.7000 0–95 %Brix	nD 1.32000–1.58000 0–95 %Brix	nD 1.32000–1.70000 0–95 %Brix
MEASUREMENT ACCURACY	nD ±0.0001 ±0.1 %Brix		nD ±0.00002 ±0.02 %Brix	
RESOLUTION	nD 0.0001 0.1 %Brix		nD 0.00001 0.01 %Brix	
MEASUREMENT PERIOD	approx. 4 s			
MEASUREMENT PRISM	Sapphire			
LIGHT SOURCE	LED			

A STRONG PERFORMANCE PACKAGE

UNLIMITED NUMBER OF METHODS

- Measurement modes: single, continuous or interval measurement
- Method parameters such as scales, temperature, temperature compensation, sample supply, limit values, comments
- Alarm option for monitoring the limit values of standards and samples
- Pre-defined scales such as %Brix sucrose, %Brix invert sugar, %Brix glucose, %Brix fructose
- More than 100 additional scales available on request
- Any number of freely definable scales with conversions based on tables or formulas such as m%, Vol.-%, g/cm³, °Oe, dry substance, salinity and %BRIX

COMPLETE DATA RECORDING AND BACKUP

- Records all measured data as well as system or method selections in a tamper-proof measured data storage
- Audit trail for logging configuration changes
- Data reports with own logo

INTUITIVE OPERATION

- State-of-the-art touch-screen display
- Uniform operation of all A.KRÜSS laboratory devices
- Displays measured value in two measurement units
- Freely assignable speed buttons for the most important functions
- Easy to understand, menu-guided adjustment
- A choice of six languages (de, en, es, fr, it, pt)

FLEXIBLE DATA EXPORT

- Print-out on serial ASCII printer (real paper)
- Print-out on network printer in PDF or PS format
- Print-out as PDF on USB flash drive or to network share
- Export in HTML or CSV format on USB flash drive or to network share
- Can be connected to a keyboard, mouse, barcode scanner or external PC in order to use the KrüssLab
- Easy integration into existing networks (DHCP-Client) or a LIMS

TEMPERATURE CONTROL AS REQUIRED

- With internal Peltier temperature control
- With external thermostat temperature control
- Temperature compensation

COMPLIANCE WITH GLOBAL STANDARDS AND NORMS

- GMP/GLP
- 21 CFR Part 11
- Pharmacopoeia (USP, BP, JP, Ph. Eur.)
- FDA, ISO, HACCP, OIML, ASTM, ICUMSA, NIST

FAST, RELIABLE MEASUREMENT

- Measurement of even turbid or highly viscous samples
- Measurement with manual measurement time input or optimized measurement time thanks to automatic stability recognition
- Multiple measurements with averaging
- Statistical analysis

EASY FILLING AND CLEANING

- Small sample volume approx. 0.3 ml
- Manual, semi-automatic or fully automatic sample supply
- Chemical-resistant materials such as measurement prism made of sapphire, measuring tray made of stainless steel
- Freely configurable cleaning processes (for devices with flow through functions)
- Semi-automatic or fully automatic drying (optional)

INTELLIGENT USER ADMINISTRATION

- Can be activated or deactivated as required
- Different authorisation levels
- Setup of user profiles
- Customized settings for different users or work groups

AUTOMATION OPTIONS – DR6000-TF MODELS

SAMPLE SUPPLY OPTIONS

MANUAL

When working manually with the DR6000 and DR6000-T models, the low-viscous to highly viscous samples are added into the measuring tray with a pipette, syringe or spatula. The measuring tray is then closed with a sample cover. The cleaning is effortless: Apply cleaning agent to the measuring tray and wipe it off using a soft cloth until all sample residues have been dissolved and removed.

SEMI-AUTOMATIC

The semi-automatic operation requires the DR6000-TF models with flow-through function, flow-through measuring cell, drying unit DS7060 and a peristaltic pump DS7070, which draws the sample or the cleaning agent into the measuring cell. Thanks to the 3/2-way valve of the drying unit, you do not need to interchange the tubes when switching from the sample supply or the cleaning to the drying.

FULLY AUTOMATIC

The DR6000-TF models with through-flow function, flow-through measuring cell, drying unit DS7060, peristaltic pump DS7070 and autosampler AS80 or AS90 allow for a fully automated operation.
The samples are taken from the vials of the autosampler and drawn into the measuring cell by the pump. If needed, the system can be automatically rinsed and dried after each measurement.

Semi-automatic sample supply with **DR6200-TF**, *drying unit* **DS7060** *and peristaltic pump* **DS7070**

SEMI-AUTOMATIC

SEMI-AUTOMATIC SOLUTIONS

In case of low-viscous to slightly viscous samples, a high sample throughput or harmful samples, we recommend a semi-automatic sample supply via a peristaltic pump. This improves the reproducibility of the measurement results and saves costs as the peristaltic pump draws only the needed sample volume into the measuring cell.

The drying unit DS7060 integrated into the refractometer allows for a fully automatic drying: It is connected to the peristaltic pump and features a valve that makes it unnecessary to interchange the tubing between filling operations, the cleaning and the drying operations. This unit is characterised by its high chemical resistance (FFKM and PVDF) and is versatile.

Peristaltic pump DS7070

- Inexpensive and durable peristaltic pump, especially when used with laboratory instruments from A.KRÜSS
- The rotational speed of the peristaltic pump can be adjusted on the refractometer, for low-viscous to slightly viscous samples
- Pump tube made of durable TPE
- Steady sample transportation thanks to the 8 roller head
- Direct connection with drying unit DS7060 with 3/2-way valve so that a fully automatic drying is possible without having to interchange the tubes
- Can be coupled with autosampler AS80 and AS90 for the fully automatic sample supply
- High-quality and robust metal housing
- Easy change of tubes within seconds

DATA MANAGEMENT WITH KRÜSSLAB

Our KrüssLab software allows you to conveniently control all of your A.KRÜSS devices on a PC. The KrüssLab can be easily installed via Windows Explorer. Your devices are connected to your local network via Ethernet or directly to your computer and identified via its IP address. The user-friendly interface that you already know from your A.KRÜSS devices will then appear on the PC monitor.

The KrüssLab allows you the following:

- Central user management; the user rights can be transferred to the individual devices
- Remote control of any number of devices
- Measured data can be saved in a database
- Access to measured data even if the measurement devices are switched off
- The selection of measured data with different filters
- The print-out of measured data to any printer

Fully automatic sample supply with **DR6200-TF**, *peristaltic pump* **DS7070** *and autosampler* **AS90**

FULLY AUTOMATIC

FULLY AUTOMATIC SOLUTIONS

In working environments with a high sample throughput, fully automatic executions of the entire process - from the sample supply to the cleaning and drying - are useful if they are flexible, powerful and robust.
Our AS80 and AS90 autosamplers are the suitable products to meet these high requirements. Together with the peristaltic pump DS7070, they allow for an unsupervised measurement of up to 89 samples.

You can set any number of individual measurement methods, cleaning processes and sampler templates on the user interface of the refractometer. The AS80 and AS90 models require very little space, are easy and fast to install and very durable. They come with a sample plate and a set of polypropylene or glass vials.

Autosampler AS80 and AS90

- Also suitable for aggressive and low-viscous samples
- Two options are available for each autosampler:
  AS80-T18: 18 x 50 ml (42 mm x 43 mm) or
  AS80-T36: 36 x 35 ml (28 mm x 65 mm);
  AS90-T53: 53 x 16 ml (22 mm x 55 mm) or
  AS90-T89: 89 x 6 ml (16 mm x 55 mm)
- Sets of polypropylene vials or glass vials are available
- Sample supply via peristaltic pump DS7070
- Integrated rinse port
- Optional model with a penetrable membrane
- Suitable for measuring stations with more than one analysis device (requires LIMS software)
- Control via the serial interface (RS-232) of the refractometer

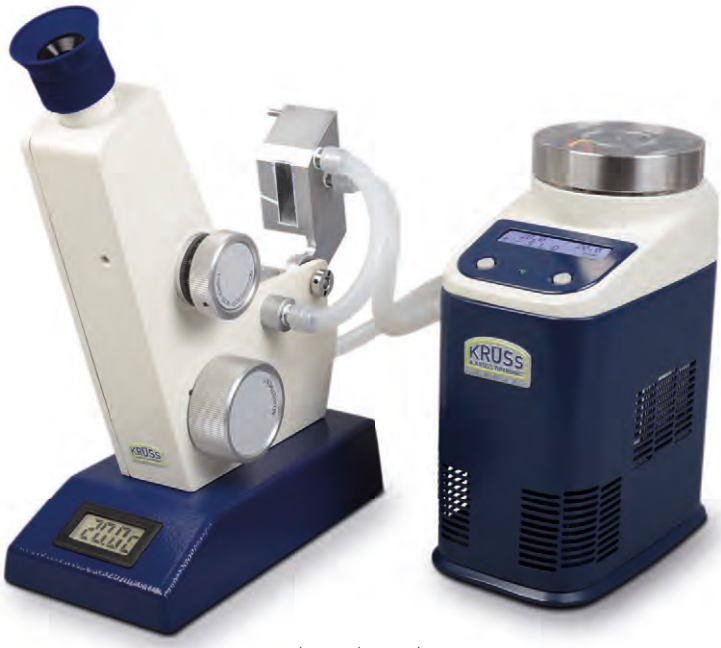
ABBE REFRACTOMETERS – AR4 AND AR2008

MEASUREMENTS OF LIQUIDS, PASTES, FOILS AND SOLIDS

The Abbe refractometer was developed around 1869 by Ernst Abbe and was one of the first laboratory instrument for determining the refractive index of liquids. Its measuring principle is based on the total reflection. Thanks to the favourable purchase prices, the easy operation and reliability, it still has a firm presence in the laboratory. With the AR4 and AR2008, A.KRÜSS has two classic Abbe refractometers in its product line. They measure the refractive index nD, the dry substance content in % and the dispersion value nF-nC of liquid, viscous as well as solid samples. As a standard, contact liquid for the optical coupling is included in the delivery for the determination of solids. The scope of delivery also includes a calibration body for the calibration and adjustment, a mains adaptor and a dust cover. For the temperature control, the devices are equipped on both sides on the upper and lower prisma holder with thermostat connections that allow for the temperature control with an external thermostat.

ANALOGUE ABBE REFRACTOMETER

The AR4 determines the refractive index between nD 1.3000–1.7200 and the sugar content in the range of 0–95 % Brix. The scales can be adjusted manually using the drive knob. The measured value is then read via an eyepiece. The refractometer can be connected to a thermostat, e. g. our circulating thermostat PT31 with Peltier element in order to maintain the temperature at 20 °C or 25 °C. The temperature will be measured with the integrated digital thermometer and shown on the LCD display.



AR4 *with circulating thermostat* **PT31**

THERMOSTAT TEMP. CONTROL

	AR4
SCALES	Refractive index (nD), concentration of sucrose [%Brix]
MEASUREMENT RANGE	nD 1,3000–1,7200 0–95 %Brix
MEASUREMENT ACCURACY	nD ± 0,0002 ± 0,1 %Brix
SCALE MARKING (RESOLUTION)	nD 0,0005 0,25 %Brix
READING ACCURACY	nD 0,0005 0,25 %Brix
TEMP. MEASUREMENT RANGE	0–99 °C

	PT31
ACCURACY OF TEMP. CONTROL	±0.2 °C
TEMP. CONTROL RESOLUTION	0.1 °C
TEMP. CONTROL RANGE	8–35 °C
HEATING CAPACITY	30 W
COOLING CAPACITY AT 20 °C	20 W
PUMP PRESSURE	2000 Pa
PUMP CAPACITY	20 l/h
FILLING VOLUME	100 ml

DIGITAL ABBE REFRACTOMETER

The AR2008 measures the refractive index or the sugar content within a range of nD 1.3000–1.7200 and 0–95 % Brix. The output of the measurement results is performed digitally. The refractive index of the Brix value is shown on the LED display together with the temperature. A serial interface allows you to directly send the measured values together with the date and time of day to a PC or printed out. The refractometer can be coupled with a thermostat, e.g. our circulating thermostat PT80. In this combination, the device measures the refractive index within the temperature range of 0–70 °C. An automatic temperature compensation for the Brix scale can be optionally connected.

PT80 – robust, compact, powerful

The PT80 is a high-quality circulating thermostat with Peltier technology that covers with a temperature range between 5 and 80 °C all basic temperature control applications in the lab. The desired temperature can be adjusted and read on a user-friendly touch screen display. The thermostat can be coupled to a PC via the RS-232 interface. We developed the PT80 specifically for the sample preparation and temperature control of our high-quality laboratory instruments such as the polarimeter, digital refractometer or Abbe refractometer.

AR2008 *with circulating thermostat* **PT80**

TEMP. COMPENSATION

THERMOSTAT TEMP. CONTROL

	AR2008
SCALES	Refractive index (nD), concentration of sucrose [%Brix]
MEASUREMENT RANGE	nD 1.3000–1.7200 0–95 %Brix
MEASUREMENT ACCURACY	nD ±0.0002 ±0.1 %Brix
RESOLUTION	nD 0.0001 0.1 %Brix
TEMP. MEASUREMENT RANGE	0–99 °C

	PT80
ACCURACY OF TEMP. CONTROL	±0.1 °C
TEMP. CONTROL RESOLUTION	0.1 °C
TEMP. CONTROL RANGE	5–80 °C
HEATING CAPACITY	120 W
COOLING CAPACITY AT 20 °C	40 W
PUMP PRESSURE	11000 Pa
PUMP CAPACITY	60 l/h
FILLING VOLUME	250 ml

HANDHELD REFRACTOMETERS – DR101-60, DR201-95, DR301-95 AND HR SERIES

DIGITAL HANDHELD REFRACTOMETERS

The mobile measurement with a digital handheld refractometer saves time as random checks or the regulation of mixing ratios can be carried out directly on the site. The measurement results are determined at the touch of a button and shown on the display. Unlike in the case of the analogue handheld refractometers, the digital determination of reproducible measurement results does not depend on the user's interpretation.

The devices measure the refractive index and the sugar content with automatic temperature compensation. The sample tray made of stainless steel and the measurement prism made of optical glass is formed in such a way for the devices that they can be easily and quickly filled and cleaned. For consistent measurement results we recommend a daily calibration with distilled water. For the adjustment we offer various certified and traceable calibration standards.

DR201-95

DR301-95

DR101-60

TEMP. COMPENSATION

	DR101-60	DR201-95	DR301-95
SCALES	Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix]		Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix], salinity [‰], User-defined
MEASUREMENT RANGE	nD 1.3330–1.4419 0–60 %Brix	nD 1.3330–1.5318 0–95 %Brix	nD 1.3330–1.5318 0–95 %Brix
MEASUREMENT ACCURACY	nD ±0.0005 ±0.35 %Brix	nD ±0.0003 ±0.2 %Brix	nD ±0.00015 ±0.1 %Brix
RESOLUTION	nD 0.0001 0.1 %Brix	nD 0.0001 0.1 %Brix	nD 0.0001 0.1 %Brix
TEMP. MEASUREMENT RANGE	10–40 °C		
TEMPERATURE ACCURACY	±0,5 °C		
TEMPERATURE COMPENSATION	10–40 °C		

DR101-60
As an entry-level model for the digital refractometry, the DR101-60 covers the measurement ranges between nD 1.3330–1.4419 and 0–60 % Brix. Thanks to the automatic temperature compensation for the Brix scale, you can achieve reproducible measurement results even under changing environmental conditions. As a water-tight device, the DR101-60 meets the IP65 standard and can be cleaned under running water.

DR201-95
The compact handheld refractometer DR201-95 offers an extended measurement range of the refractive index and the sugar content of nD 1.3330–1.5318 and 0–95 % Brix. The automatic temperature compensation for the Brix scale helps the user with the measurements of beverages and sugary confectionary products. The device is splash-proof and meets the IP64 standard.

DR301-95
As a mobile handheld device or digital tabletop unit, the DR301-95 can measure the refractive index or the sugar content within a measurement range of nD 1.3330–1.5318 or 0–95 %Brix. In addition, the device measures the salinity and allows for the use of two additional freely definable scales. The automatic temperature compensation for the Brix scale can be optionally connected.
A USB interface allows you to send measured data to a PC or a printer at any time. An alarm option can be set up for monitoring the limit values in production processes. The provided mains adaptor turns the DR301-95 into a small lab refractometer; for a mobile use it is operated with a 9 V monobloc battery.

HANDHELD REFRACTOMETERS

Hand refractometers are barely bigger than a torch and can be used anywhere in mobile applications. They are especially easy to use, very robust and require no batteries. The devices differ mainly in the selectable scales, e.g. for the determination of the salinity, water content in honey, serum protein content, Oechsle, Brix and potential alcohol content as well as ethylene- and propylene glycol content. No manual conversion is required thanks to the scales and application errors are ruled out.

The majority of our handheld refractometers are equipped with an automatic temperature compensation. The measured values are therefore already corrected to 20 °C when taking a reading. For a consistent measurement accuracy, we recommend to calibrate the devices daily with distilled water; you can use the provided calibration bodies and contact fluids for the adjustment.

You will find the range of our HR series together with the technical specifications on page 30.

HR serie

TEMP. COMPENSATION

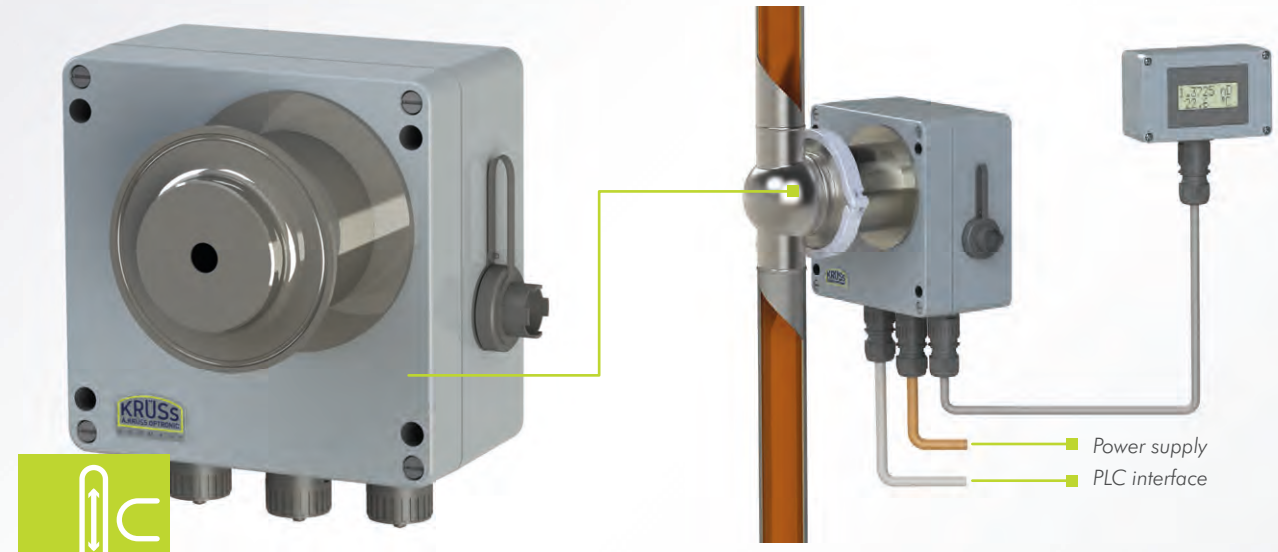
PROCESS REFRACTOMETERS – PR SERIES AND PRB21S

INLINE REAL-TIME MEASUREMENT

The inline process refractometers PR21S and PR21S-T are installed in pipelines of production facilities in order to control and regulate the concentration, mixing and fermentation processes. Thanks to the standardised connections, the measurement devices can be easily installed in pipelines. The measuring chamber is made of stainless steel, the measurement prism consists of scratch-resistant and especially chemical-resistant sapphire and is designed to prevent solids from sticking. The water cooling makes the PR21S-T suitable for process temperatures of up to 120 °C; the PR21S can measure samples with a temperature of up to 60 °C. The inline process refractometers determine the refractive index and the sugar content directly in the line within a range of nD 1.3200–1.5200 and 0–95 %Brix. The measured value can optionally be read off on an external display on the site or in the process control station. A MPC interface (memory-programmable control) is available for the automated process control.

Equipment features of our PR21 series

- Measurement intervals from 3 to 60 seconds selectable
- Automatic temperature compensation (%Brix and freely definable for customer-specific products)
- Integrated sensor for temperature monitoring
- User-defined scales
- Stainless steel measurement chamber that meets all the requirements of the food and pharmaceutical industry, CIP/SIP capable
- Sample prisms, made of scratch-proof and chemical-resistant sapphire
- Cleaning via process cleaning processes
- PR21S-T model can be coupled with water cooling and is suitable for process temperatures up to 120 °C
- Easy connection with process control system or MPC via analogue output (0/4-20 mA)
- A display for the visual monitoring is also available



PR21S *Single view and inline installed in pipeline*

	PR21S	PR21S-T
SCALES	Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix], User-defined	
MEASUREMENT RANGE	nD 1.3200–1.5200 0–95%Brix	
MEASUREMENT ACCURACY	nD ±0.0002 ±0.2 %Brix	
RESOLUTION	nD 0.0001 0.1 %Brix	
PROCESS TEMPERATURE	≤ 60 °C	≤ 120 °C via water cooling

ATLINE REAL-TIME MEASUREMENT

The Atline process refractometer PRB21S are installed in tanks or boilers using tube connections for the continuous monitoring and control of the concentration of liquids. The sample flows via the bypass into the measurement chamber made of stainless steel. The measurement prism consists of scratch-resistant sapphire and is resistant against solvents and acids. The PRB21S determines the refractive index and sugar content in the range between nD 1.3200–1.5600 and 0–95 %Brix up to a process temperature of 60 °C. The exact temperature of the sample is determined via the temperature sensor directly in the process flow. The PRB21S can be operated as a single device with an external display for reading the measured values or it can be integrated into an existing process control system. The measurement device is equipped with two analogue interfaces and can be delivered with a PROFIBUS interface upon request.

Equipment features of PRB21S

- Measurement intervals from 3 to 60 seconds selectable
- Automatic temperature compensation (%Brix and freely definable for customer-specific products)
- Integrated sensor for temperature monitoring
- Brix scale (sucrose, glucose, fructose and invert sugar)
- Stainless steel measurement chamber that meets all the requirements of the food and pharmaceutical industry, CIP/SIP capable
- Sample prism, made of scratch-proof and chemical-resistant sapphire
- Cleaning manually or via internal process cleaning
- Suitable for process temperatures up to 60 °C
- Two analogue outputs (RS-232, 0/4-20 mA); a PROFIBUS interface is optionally available
- A display for the visual monitoring is also available

PRB21S *in single view and atline built into the tank*

PRB21S

Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix], User-defined
nD 1.3200–1.5600 0–95 %Brix
nD ±0.0002 ±0.2 %Brix
nD 0.0001 0.1 %Brix
≤ 60 °C

PROCESS INTEGRATION

- Housing made of aluminum cast for the hygienic installation of the process refractometers in pipelines, boilers and tanks
- Easy installation using welding flanges and clamps of various diameters
- Special installation via bypass in pipelines

REFRACTOMETER APPLICATIONS

PHARMACEUTICAL INDUSTRY

Typical applications:	Analysed substances:	Special requirements:	Standards:	Recommended devices:
▪ Characterisation tests in research and development ▪ Identity test, purity control and concentration determination of raw materials, semi-finished products and end products	Pharmaceuticals, infusion solutions, dialysis preparations, blood sera etc.	Precision, compliance with standards	Pharmacopoeia (USP, BP, JP, Ph. Eur.), GLP, FDA, NIST	DR6100-T DR6300-T

CHEMICAL INDUSTRY

Typical applications:	Analysed substances:	Special requirements:	Standards:	Recommended devices:
▪ Characterisation tests in research and development ▪ Identity test, purity control and concentration determination of raw materials, semi-finished products and end products ▪ Tracking of chemical processes during production	Organic solvents, aliphatic or aromatic hydrocarbons, alcohols, salt solutions, acids, bases, stains, industrial oils, paints and varnishes, resins, glue components, tensides, extinguishing agents, polymer products, silicones, raw plastic materials etc.	Exact temperature control within a wide temperature range, wide measurement range, variety of scales, variability of measurement methods, option of interval measurements	AOAC, OIML, ASTM, DIN, CID	DR6100-T DR6300-T DR201-95 DR301-95 PR SERIES PRB21S

PETROCHEMICAL, AUTOMOTIVE AND AVIATION INDUSTRY, METAL PROCESSING AND BUILDING TECHNOLOGY

Typical applications:	Analysed substances:	Special requirements:	Standards:	Recommended devices:
▪ Identity test and concentration determination ▪ Outgoing goods inspection ▪ Stability test	Lubricating oils, fuels, gear oils, wax, lubricants, cooling lubricants, de-icing agents and anti-freeze agents, battery acid, AdBlue, tensides, cleaners, windshield wiper concentrate etc.	Easy handling, availability of the Brix scale, temperature compensation option	AOAC, OIML, ASTM, DIN, CID	DR6000-T DR6200-T DR301-95 HR SERIES PR SERIES PRB21S

FOOD INDUSTRY

Typical applications:	Analysed substances:	Special requirements:	Standards:	Recommended devices:
▪ Quality and purity control of raw materials and end products ▪ Determination of the sugar concentration	Sugar, jams, honey, syrup, seasoning sauces, mustard and mayonnaise, convenience products, dairy products, baby food, egg products, oils, starch hydrolysis products etc.	Fast measurement and easy handling, easy cleaning, routine analysis with high sample throughput	AOAC, OIML, ASTM, GLP, ICUMSA	DR6000-T DR6200-T AR4 AR2008 HR SERIES PR SERIES PRB21S

SUGAR INDUSTRY

Typical applications:	Analysed substances:	Special requirements:	Standards:	Recommended devices:
▪ Determination of the sugar concentration in semi-finished products and end products ▪ Determination of the solids content in solutions ▪ Determination of the purity in combination with a polarimeter	Sugar cane, beet pulp, molasses, refined sugar, syrup, invert sugar etc.	Availability of the international sugar scale, maintenance-free	ICUMSA, GLP	DR6000 DR6200-T PR SERIES PRB21S

MANUFACTURERS OF AROMAS, FRAGRANCES AND ESSENTIAL OILS

Typical applications:	Analysed substances:	Special requirements:	Standards:	Recommended devices:
▪ Quality control of raw materials and auxiliary materials ▪ Monitoring of the production of semi-finished products and end products	Essential oils (such as orange, lemon, lavender and peppermint oil), glyceric acid, Aromas and perfumes for the food, cosmetic and tobacco industry etc.	Low sample volumes with a high aggressiveness, high accuracy	Pharmacopoeia (USP, BP, JP, Ph. Eur.), AOAC, OIML, GLP	DR6100-T DR6300-T DR6100-TF DR6300-TF

BEVERAGE INDUSTRY

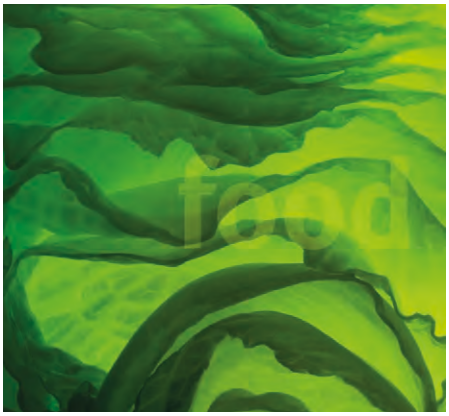
Typical applications:	Analysed substances:	Special requirements:	Standards:	Recommended devices:
▪ Routine analysis with high sample throughput ▪ Quality and purity control of raw materials and end products ▪ Determination of the sugar concentration in juices and alcohol-free beverages ▪ Determination of the alcohol or extract content in beer, spices, wine or spirits ▪ Quality control of dairy products ▪ Sewage water check	Fruit and vegetable juices, dietary beverages, beer, spices, wine, spirits, distillates, liquors, sugar concentrates, dairy products, aromas and colouring etc.	Fast measurement and easy handling, easy cleaning.	AOAC, OIML, ICUMSA, IAMFES, GLP	DR6200-T DR6200-TF PR SERIES PRB21S

HOSPITALS AND PHARMACIES

Typical applications:	Analysed substances:	Special requirements:	Standards:	Recommended devices:
▪ Incoming and outgoing goods inspection ▪ Checking medicines for pharmacopeias ▪ Analysis of body secretions	Medicines, infusion solutions, blood sera, dialysis preparations, urine etc.	Easy handling, availability of the Brix scale, temperature compensation option	Pharmacopoeia (USP, BP, JP, Ph. Eur.), GLP	AR4 DR301-95 DR6100-T DR6300-T

TESTING LABORATORIES, INSTITUTES, TEACHING FACILITIES

Typical applications:	Analysed substances:	Special requirements:	Standards:	Recommended devices:
▪ Testing of foodstuff and pharmaceutical products ▪ Testing of the compliance with national and international standards ▪ Training	Food and beverage samples, samples from research and development, acids, bases, solvents	High variability of the measurement techniques, simple convenient data management	Pharmacopoeia (USP, BP, JP, Ph. Eur.), AOAC, OIML, ASTM, ISO, DIN, GLP	AR4 AR2008 DR6100-T DR6300-T



For our product range, we offer extensive services: From application and product consultation to familiarise you with our products to the installation and annual maintenance and calibration/ adjustment with certified calibration standards to a IQ/OQ/PQ/DQ documentation for strongly regulated industries. In order to cover the service requirements of our customers, we have the support of certified service partners. Several times a year and within the scope of an intensive service training, A.KRÜSS Optronic certifies sales partner from around the world. Our dense network of sales partners and certified service partners ensures an individual consultation, optimized service and a prompt support for our customers around the globe.

CERTIFIED SERVICE

APPLICATION CONSULTATION AND PRODUCT DEMONSTRATION	■ We are happy to assist you with application questions by phone, on site or in our training center in Hamburg	■ For you, we demonstrate our products on site so that measuring methods and measuring instruments meet your specific requirements
INSTALLATION	■ We will consider your work environment and work processes during the installation so that our devices can achieve the best measurement results ■ Our qualified personnel will ensure that your internal and external quality standards are complied with	■ We issue test reports and quality assurance documents and train your employees on our devices
IQ/OQ/PQ/DQ	■ With the Design Qualification (DQ) we support you in the selection of the right device for your application ■ Through an Installation Qualification (IQ) we make sure that all ordered components have been delivered and installed according to regulations and are functional in the usage environment	■ The Operation Qualification (OQ) will ensure the correct functioning of the individual components of your device ■ With the help of Performance Qualification (PQ) we evaluate the reliability of your equipment during routine use
CALIBRATIONS AND ADJUSTMENTS	■ We recommend having our devices calibrated and adjusted once a year by our qualified personnel or one of our certified service partners in order to ensure the measurement accuracy	■ We issue GMP/GLP compliant calibration protocols and calibration certificates ■ We calibrate and adjust all measuring instruments with certified calibration standards
REPAIR AND MAINTENANCE	■ Repair service in case of performance problems or functional problems ■ Repairs/maintenance on location or in our service center incl. maintenance protocol	■ Calibration using recognised and traceable standard, if applicable, adjustment
WARRANTY EXTENSIONS	■ Guarantee extension from 12 to 36 months as a part of agreed maintenance services.	
SERVICE AND MAINTENANCE CONTRACT	■ Annual inspection and maintenance of your devices incl. all functional and safety tests, cleaning of the most important components, calibration with certified traceable calibration standards and, if applicable, adjustments and detailed documentation	■ Reduced response times and problem solving times ■ New Firmware updates upon request ■ Provision of rental equipment to bridge the time required for maintenance, calibrations, adjustments and repairs

We are here for you over the entire service life of your devices with an extensive range of services and maintenance services.

TECHNICAL DATA – DIGITAL REFRACTOMETERS

	DR6000	DR6100	DR6200	DR6300	DR6000-T
SCALES	Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix], User-defined				
MEASUREMENT RANGE	nD 1.3200–1.5800 0–95 %Brix	nD 1.3200–1.7000 0–95 %Brix	nD 1.32000–1.58000 0–95 %Brix	nD 1.32000–1.70000 0–95 %Brix	nD 1.3200–1.5800 0–95 %Brix
MEASUREMENT ACCURACY	nD ±0.0001 ±0.1 %Brix		nD ±0.00002 ±0.02 %Brix		nD ±0.0001 ±0.1 %Brix
RESOLUTION	nD 0.0001 0.1 %Brix		nD 0.00001 0.01 %Brix		nD 0.0001 0.1 %Brix
MEASUREMENT PERIOD	approx. 4 s				
MEASUREMENT PRISM	Sapphire				
LIGHT SOURCE	LED				
WAVELENGTH	589 nm				
TEMPERATURE CONTROL	Without a sample temperature control, you can connect a thermostat for the temperature control				
TEMP. CONTROL RANGE					
ACCURACY OF TEMP. CONTROL					
TEMPERATURE COMPENSATION	Can be activated (ICUMSA or freely definable)				
TEMPERATURE MEASUREMENT	With integrated temperature sensor Pt100				
TEMPERATURE MEASUREMENT RANGE	10–80 °C				
TEMP. MEASUREMENT ACCURACY	±0.1 °C				
TEMP. MEASUREMENT RESOLUTION	0.1 °C				
METHODS	A practically unlimited number of methods can be set				
ADJUSTMENT	Automatic (menu-guided)				
CONTROL	5.7"-TFT touch-screen, 640 x 480 Pixel				
HOUSING	Aluminum cast, powder-coated				
INTERFACES	USB, RS-232, Ethernet				
OPERATING VOLTAGE	90–240 V, 47–63 Hz				
POWER CONSUMPTION (MEASUREMENT OPERATION)	25 W				
POWER CONSUMPTION (MAX.)	75 W				
DIMENSIONS (W X H X D)	215 mm x 150 mm x 345 mm				
WEIGHT	5 kg				

DR6100-T	DR6200-T	DR6300-T
Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix], User-defined		
nD 1.3200–1.7000 0–95 %Brix	nD 1.32000–1.58000 0–95 %Brix	nD 1.32000–1.70000 0–95 %Brix
nD ±0.0001 ±0.1 %Brix	nD ±0.00002 ±0.02 %Brix	
nD 0.0001 0.1 %Brix	nD 0.00001 0.01 %Brix	
approx. 4 s		
Sapphire		
LED		
589 nm		
With integrated Peltier temperature control		
10–80 °C		
±0.1 °C		
Can be activated (ICUMSA or freely definable)		
With integrated temperature sensor Pt100		
10–80 °C		
±0.1 °C		
0.1 °C		
A practically unlimited number of methods can be set		
Automatic (menu-guided)		
5.7”-TFT touch-screen, 640 x 480 Pixel		
Aluminum cast, powder-coated		
USB, RS-232, Ethernet		
90–240 V, 47–63 Hz		
40 W		
75 W		
215 mm x 150 mm x 345 mm		
5 kg		

DR6000-TF	DR6100-TF	DR6200-TF	DR6300-TF
Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix], User-defined			
nD 1.3200–1.5800 0–95 %Brix	nD 1.3200–1.7000 0–95 %Brix	nD 1.32000–1.58000 0–95 %Brix	nD 1.32000–1.70000 0–95 %Brix
nD ±0.0001 ±0.1 %Brix		nD ±0.00002 ±0.02 %Brix	
nD 0.0001 0.1 %Brix		nD 0.00001 0.01 %Brix	
approx. 4 s			
Sapphire			
LED			
589 nm			
With integrated Peltier temperature control			
10–80 °C			
±0.1 °C			
Can be activated (ICUMSA or freely definable)			
With integrated temperature sensor Pt100			
10–80 °C			
±0.1 °C			
0.1 °C			
A practically unlimited number of methods can be set			
Automatic (menu-guided)			
5.7”-TFT touch-screen, 640 x 480 Pixel			
Aluminum cast, powder-coated			
USB, RS-232, Ethernet			
90–240 V, 47–63 Hz			
45 W			
75 W			
215 mm x 150 mm x 345 mm			
5.3 kg			

TECHNICAL DATA – ABBE REFRACTOMETERS

	AR2008	AR4
SCALES	Refractive index (nD) concentration of sucrose [%Brix]	
MEASUREMENT RANGE	nD 1.3000–1.7200 0–95 %Brix	
MEASUREMENT ACCURACY	nD ±0.0002 ±0.1 %Brix	
RESOLUTION	nD 0.0001 0.1 %Brix	nD 0.0005 0.25 %Brix
MEASUREMENT PRISM	Optical glass	
LIGHT SOURCE	LED	
WAVELENGTH	589 nm	
TEMPERATURE COMPENSATION	0–90 °C	
TEMPERATURE MEASUREMENT	Digital thermometer	
TEMPERATURE MEASUREMENT RANGE	0–99 °C	0–99 °C
TEMP. MEASUREMENT ACCURACY	±0.3 °C	±0.5 °C
TEMP. MEASUREMENT RESOLUTION	0.1 °C	
METHODS		Adjustable scale
CONTROL	Digital evaluation	Reading via eyepiece
HOUSING	Aluminum cast, powder-coated	
INTERFACES	RS-232, RS-422	
OPERATING VOLTAGE	115/230 V, reversible	7.5 V
POWER CONSUMPTION (MAX.)	40 W	15 W
DIMENSIONS (W X H X D)	120 mm x 290 mm x 250 mm	100 mm x 270 mm x 190 mm
WEIGHT	5 kg	2.5 kg
SPECIAL FEATURES	Thermostat connections available	

TECHNICAL DATA – DIGITAL HANDHELD REFRACTOMETERS

	DR101-60	DR201-95	DR301-95
SCALES	Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix]		Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix], salinity [‰], User-defined
MEASUREMENT RANGE	nD 1.3330–1.4419 0–60 %Brix	nD 1.3330–1.5318 0–95 % Brix	
MEASUREMENT ACCURACY	nD ±0.0005 ±0.35 %Brix	nD ±0.0003 ±0.2 %Brix	nD ±0.00015 ±0.1 %Brix
RESOLUTION	nD 0.0001 0.1 %Brix		
MEASUREMENT PERIOD	approx. 1 s		
MEASUREMENT PRISM	Optical glass		
LIGHT SOURCE	LED		
WAVELENGTH	589 nm		
TEMPERATURE COMPENSATION	10–40 °C		
TEMPERATURE MEASUREMENT	With integrated temperature sensor Pt100		
TEMPERATURE MEASUREMENT RANGE	10–40 °C		
TEMP. MEASUREMENT ACCURACY	±0.5 °C		
TEMP. MEASUREMENT RESOLUTION	0.1 °C		
HOUSING	Synthetic material, coated		
INTERFACES			Only USB
IP CODE	IP65	IP64	IP50
OPERATING VOLTAGE	1.5 V battery		9 V battery (mains adaptor incl.)
DIMENSIONS (W X H X D)	110 mm x 62 mm x 32 mm	130 mm x 80 mm x 40 mm	180 mm x 100 mm x 60 mm
WEIGHT	160 g	200 g	500 g

TECHNICAL DATA – PROCESS REFRACTOMETERS

	PR21S	PR21S-T	PRB21S
SCALES	Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix], User-defined		
MEASUREMENT RANGE	nD 1.3200–1.5200 0–95 %Brix		nD 1.3200–1.5600 0–95 %Brix
MEASUREMENT ACCURACY	nD ±0.0002 ±0.2 %Brix		
RESOLUTION	nD 0.0001 0.1 %Brix		
MOUNTING	Inline		Atline
MEASUREMENT PERIOD	3–60 s		
MEASUREMENT PRISM	Sapphire		
LIGHT SOURCE	LED		
WAVELENGTH	589 nm		
TEMPERATURE COMPENSATION	ICUMSA or freely definable		
TEMPERATURE MEASUREMENT	With integrated temperature sensor Pt100		
TEMPERATURE MEASUREMENT RANGE	10–120 °C		10–120 °C
TEMP. MEASUREMENT ACCURACY	±0.2 °C		
TEMP. MEASUREMENT RESOLUTION	0.1 °C		
PROCESS TEMPERATURES	10–60 °C	10–120 °C	10–60 °C
AMBIENT TEMPERATURE	0–60 °C		0–40 °C
HOUSING	Stainless steel, aluminum cast, powder-coated		
INTERFACES	Analogue 0/4-20 mA, RS-232, optional PROFIBUS		
IP CODE	IP65		
OPERATING VOLTAGE	24 V (18–30 V)		
POWER CONSUMPTION (MEASUREMENT OPERATION)	5 W without display, 6 W with display		
DIMENSIONS (W X H X D)	180 mm x 190 mm x 180 mm		
WEIGHT	3.5 kg		3 kg
SPECIAL FEATURES		Water cooling	

OVERVIEW OF REFRACTOMETERS, ACCESSORIES AND CONSUMABLES

ORDER NUMBER	DIGITAL REFRACTOMETERS
DR6000	Without a sample temperature control, measurement range nD 1.3200–1.5800, measurement accuracy nD ±0.0001
DR6100	Without a sample temperature control, measurement range nD 1.3200–1.7000, measurement accuracy nD ±0.0001
DR6200	Without a sample temperature control, measurement range nD 1.32000–1.58000, measurement accuracy nD ±0.00002
DR6300	Without a sample temperature control, measurement range nD 1.32000–1.70000, measurement accuracy nD ±0.00002
DR6000-T	With Peltier temperature control, measurement range nD 1.3200–1.5800, measurement accuracy nD ±0.0001
DR6100-T	With Peltier temperature control, measurement range nD 1.3200–1.7000, measurement accuracy nD ±0.0001
DR6200-T	With Peltier temperature control, measurement range nD 1.32000–1.58000, measurement accuracy nD ±0.00002
DR6300-T	With Peltier temperature control, measurement range nD 1.32000–1.70000, measurement accuracy nD ±0.00002
DR6000-TF	With Peltier temperature control, flow-through measuring cell and drying unit DS7060, measurement range nD 1.3200–1.5800, measurement accuracy nD ±0.0001
DR6100-TF	With Peltier temperature control, flow-through measuring cell and drying unit DS7060, measurement range nD 1.3200–1.7000, measurement accuracy nD ±0.0001
DR6200-TF	With Peltier temperature control, flow-through measuring cell and drying unit DS7060, measurement range nD 1.32000–1.58000, measurement accuracy nD ±0.00002
DR6300-TF	With Peltier temperature control, flow-through measuring cell and drying unit DS7060, measurement range nD 1.32000–1.70000, measurement accuracy nD ±0.00002

ORDER NUMBER	ACCESSORIES/CONSUMABLES DIGITAL REFRACTOMETERS
AS80	Autosampler for 18 or 36 samples, including: sample plate 18 x 50 ml (42 mm x 43 mm) or 36 x 35 ml (28 mm x 65 mm), set of vials made of polypropylene (50 ml) or glass (35 ml); other vials on request PTFE connection tube
AS80-T18	Sample plate 18 x 50 ml (42 mm x 43 mm)
AS80-T36	Sample plate 36 x 35 ml (28 mm x 65mm)
AS80-V18	Sample containers for AS80-T18, volume: 50 ml
AS80-V36	Sample containers for AS80-T36, volume: 30 ml
AS90	Autosampler for 53 or 89 samples, including: sample plate 53 x 16 ml (22 mm x 55 mm) or 89 x 6 ml (16 mm x 55 mm), set of polypropylene vials (16 ml or 6 ml); other vials on request, PTFE connection tube
AS90-T53	Sample plate 53 x 16 ml (22 mm x 55 mm)
AS90-T89	Sample plate 89 x 6 ml (16 mm x 55 mm)
AS90-V53	Sample containers for AS90-T53, volume: 16 ml
AS90-V89	Sample containers for AS90-T89, volume: 8 ml
BC876	Barcode scanner
DR6001	Small Tygon tube set for the manual filling, consisting of: Air tube (320 mm), waste tube (320 mm), 2 adaptors Olive/UNFa, 1 adaptor Luer/UNFa and 1 Luer tube connection
DR6002	Large Tygon tube set for the automatic filling, consisting of: suction tube (320 mm); drain tube (320 mm); connection tube (320 mm); waste tube (320 mm), and 6 adaptors Olive/UNFa
DR6003	Small PTFE tube set for the manual filling, consisting of: drain tube (400 mm), waste tube (280 mm), 1 adaptor Luer/UNFa and 3 PEEK hollow screws, flanged and fitted
DR6004	Large PTFE tube set for the automatic filling, consisting of suction tube (320 mm), drain tube (400 mm); connection tube (340 mm), waste tube (280 mm) and 6 PEEK hollow screw, flanged and fitted
DS7009	Luer syringe, 2 ml, 10 pieces
DS7010	Luer syringe, 10 ml, 10 pieces
DS7019	PE waste container with lid, 600 ml
DS7021	Adaptor Olive/UNFa for Tygon tube to UNF connection
DS7023	Adaptor Luer/UNFa for syringe to UNF connection
DS7060	Drying unit with 3/2-way valve
DS7070	Peristaltic pump
DS7071	DS7071 tube set for peristaltic pump DS7070, consisting of: TPE pump tube (105 mm), 5 pieces; PTFE tube connection UNF, 2 pieces
KB876DE	Mini keyboard with German layout
KB876EN	Mini keyboard with English layout
KB876F	Protective cover for mini keyboard KB876DE/KB876EN
PC761	Foil cover for DR6000 series dimensions (H x W x D): 250 mm x 220 mm x 13 mm, thickness: 0.19 mm, transparent

OVERVIEW OF REFRACTOMETERS, ACCESSORIES AND CONSUMABLES

ORDER NUMBER	ABBE REFRACTOMETERS
AR4	Analogue Abbe refractometer, measurement range nD 1.3000–1.7200, measurement accuracy nD ±0.0002
AR2008	Digital Abbe refractometer, measurement range nD 1.3000–1.7200, measurement accuracy nD ±0.0002

ORDER NUMBER	ACCESSORIES/CONSUMABLES ABBE REFRACTOMETERS
AR11	Measurement prism for AR4 and AR2008
AR12	Illumination prism for AR4 and AR2008
AR15	Funnel flow-through cell for AR4 and AR2008
AR16	Flow-through cell for AR4 and AR2008
AR17	Thermosensor for AR2008
AR18	Digital thermometer for AR4
AR41	Temperature sensor for AR4
ARK01	Illumination cable for AR2008, incl. LED
ARFT	Filter for thermostat

ORDER NUMBER	DIGITAL HANDHELD REFRACTOMETERS
DR101-60	Digital handheld refractometer, measurement range nD 1.3330–1.4419, measurement accuracy nD ±0.0005
DR201-95	Digital handheld refractometer, measurement range nD 1.3330–1.5318, measurement accuracy nD ±0.0003
DR301-95	Digital handheld refractometer, measurement range nD 1.3330–1.5318, measurement accuracy nD ±0.00015

ORDER NUMBER	ACCESSORIES/CONSUMABLES DIGITAL HANDHELD REFRACTOMETERS
DR301-300	Mains adaptor for DR301-95

ORDER NUMBER	HANDHELD REFRACTOMETERS
HRB10-T	Handheld refractometer, determination of Brix, measurement range 0–10 %Brix, measurement accuracy ±0.1 %Brix
HRB18-T	Handheld refractometer, determination of Brix, measurement range 0–18 %Brix, measurement accuracy ±0.1 %Brix
HRB32-T	Handheld refractometer, determination of Brix, measurement range 0–32 %Brix, measurement accuracy ±0.2 %Brix
HRB62-T	Handheld refractometer, determination of Brix, measurement range 28–62 %Brix, measurement accuracy ±0.2 %Brix
HRB82-T	Handheld refractometer, determination of Brix, measurement range 45–82 %Brix, measurement accuracy ±0.2 %Brix
HRB92-T	Handheld refractometer, determination of Brix, determination of Baumé, determination of water content in honey, measurement range 58–92 %Brix, 38–43 °Bé, 12–27 % water content in honey, measurement accuracy 0.5 %Brix, ±0.5 °Bé, ±0.5 % water content in honey
HRB90	Handheld refractometer, determination of Brix, measurement range 0–90 %Brix, measurement accuracy ±0.2 %Brix (with thermometer 6–36 °C)
HRH30-T	Handheld refractometer, determination of water content in honey, measurement range 12–30 % water content in honey, measurement accuracy ±0.1 % water content in honey
HRND	Handheld refractometer, determination of refractive index, measurement range 1.3330–1.5170, measurement accuracy ±0.0005 (with thermometer 6–36 °C)
HRS10-T	Handheld refractometer, determination of salinity (NaCl), specific gravity (D 20/20), measurement range 0–10 %, 1.000–1.070, measurement accuracy ±0.1 %, ±0.001
HRS28-T	Handheld refractometer, determination of salinity (NaCl), measurement range 0–28 %, measurement accuracy ±0.2 %
HRM18-T	Handheld refractometer, determination of refractive index, serum protein and specific gravity of urine, measurement range 1.3330–1.3600, 0–12 g/dl, 1.000–1.050 UG, measurement accuracy ±0.0005, ±0.2 g/dl, ±0.002 UG
HRO32-T	Handheld refractometer, determination of Oechsle, determination of Brix and potential alcohol content, measurement range 0–32 %Brix, 30–130 °Oe, 4.4–19 % alcohol, measurement accuracy ±0.2 %Brix, ±1 °Oe, ±0.1 % alcohol
HRKFZ-T	Handheld refractometer, battery fluid and radiator antifreeze tester for ethylene and propylene glycol content, measurement range antifreeze: -50–0 °C, battery acid: 1.10–1.30 g/cm³, measurement accuracy antifreeze: ±5 °C, battery acid: ±0.01 g/cm³

ORDER NUMBER	ACCESSORIES/CONSUMABLES HANDHELD REFRACTOMETERS
HRK01	Cover flap for HR series

ORDER NUMBER	PROCESS REFRACTOMETERS
PR21S	Inline process refractometer, measurement range nD 1.3200–1.5600, measurement accuracy nD ±0.0002
PR21S-T	Inline process refractometer, measurement range nD 1.3200–1.5600, measurement accuracy nD ±0.0002
PRB21S	Inline process refractometer, measurement range nD 1.3200–1.5600, measurement accuracy nD ±0.0002

ORDER NUMBER	ACCESSORIES/CONSUMABLES PROCESS REFRACTOMETERS
PR2023	Connection DN40/DIN32676-DN80 for PR21 series
PR2025	Welded stud DIN32676-DN80 for PR21 series
PR2026	Set of blind covers DIN32676-DN80 for PR21 series
PR2028	Display for PR21 series and PRB21S
PR2029	PROFIBUS interface for PR21 series

ORDER NUMBER	CALIBRATION STANDARDS
CI	Cinnamon oil , nD 1.5902 at 25°C
RI34	Calibration solution with certificate, nD 1.3400 ±0.0002 at 25°C, temperature coefficient -0.000338 / + °C, 5 %Brix
RI39	Calibration solution with certificate, nD 1.3900 ±0.0002 at 25°C, temperature coefficient -0.000344 / + °C, 35 %Brix
RI43	Calibration solution with certificate, nD 1.4300 ±0.0002 at 25°C, temperature coefficient -0.000400 / + °C, 55 %Brix
RI48	Calibration solution with certificate, nD 1.4800 ±0.0002 at 25°C, temperature coefficient -0.000395 / + °C, 76 %Brix
RI65	Calibration solution with certificate, nD 1.6500 ±0.0002 at 25°C, temperature coefficient -0.000395 / + °C
RK01	Calibration standards for AR series, nD 1.5166

MATERIAL OF OUR PRODUCTS IN CONTACT WITH SAMPLES

We offer suitable solutions for any type of sample. Refer to the table to see of which materials the parts in contact with the samples are made of. We will gladly assist you in the selection of the products.

COMPONENT	PART	MATERIAL
Refractometers DR6000 series, PR21 series and PRB21S	Measurement prism	Sapphire
	Measuring tray	Stainless steel (1.4305)
Handheld refractometers	Measurement prism	Flint glass (SF4)
AR4, AR2008, digital handheld refractometers	Measurement prism	Flint glass (SF4)
AR4, AR2008	Optical block	Coated aluminium
Digital handheld refractometers	Measuring tray	Full chromed surface
Drying unit DS7060	3/2-way valve	FFKM, PVDF
Autosampler AS80, AS90	Vials	PP/glass
	Connecting tube	PTFE
Tube sets DR6001, DR6002	Tubes	Tygon
	Adaptor: Olive/UNFa	ETFE
	Adaptor: Luer/UNFa	PTFE
Tube sets DR6003, DR6004	All parts in contact with samples	PTFE
Luer syringes DS7009, DS7010	–	PE/PP
Waste container DS7019	–	PE
Splash guard DS7020	–	PTFE
Tube sets DS7071	Pump tube	TPE
	Tube connections UNF/OLIVE	PTFE

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A.KRÜSS Optronic GmbH
Alsterdorfer Strasse 276–278
22297 Hamburg | Germany

Phone +49 40 514317-0
Fax +49 40 514317-60

E-mail info@kruess.com
Web www.kruess.com

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