

REFRACTOMETERS

PROFESSIONAL SOLUTIONS FOR ALL APPLICATIONS





CUTTING-EDGE TECHNOLOGY, MADE IN GERMANY

A.KRÜSS Optronik 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

1844

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

1865

Krüss has his improvement of the Laterna Magica patented

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

1975

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

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

1823

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

1862

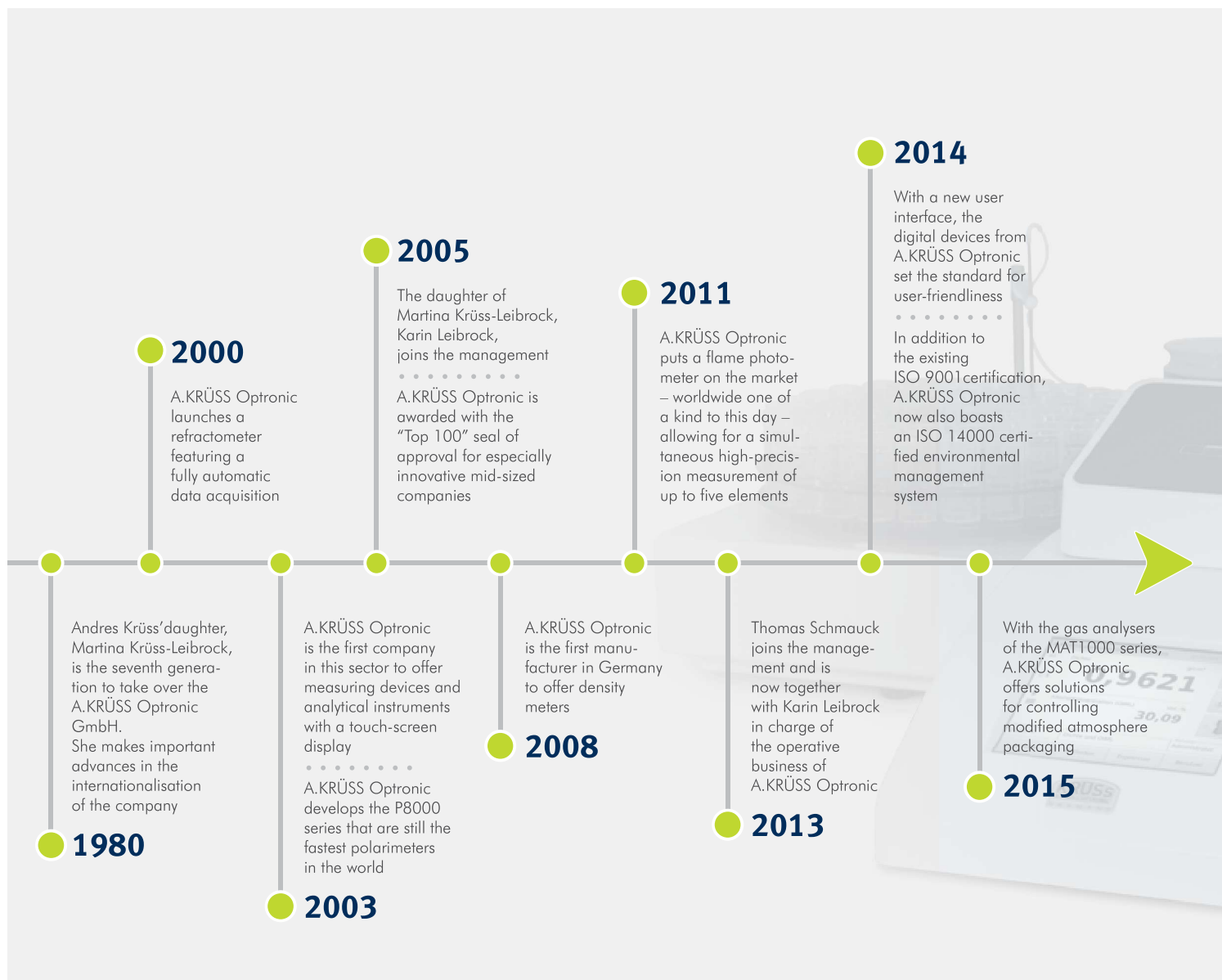
The heydays of the company boasting many innovations and inventions begin after Edmund Johann Krüss' son, Hugo, took over the management. Dr. Hugo Krüss' handbook of electro-technical photometry lays the groundwork for this subject

1888

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

1946

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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 its 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 than four minutes.

DR6300-T with integrated Peltier temperature control

All
SAMPLES



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

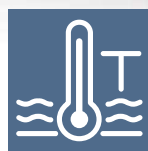
A temperature control of the measurement sample is not required when sugary beverages and confectionary products are measured. A conversion table published by the ICUMSA, which shows the influence of temperature on the refractive index of sucrose, glucose, fructose and invert sugar solutions, makes this 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

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
MEASUREMENT ACCURACY	nD ± 0.0001 ± 0.1 %Brix	
RESOLUTION	nD 0.0001 0.1 %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
- 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



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

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

ADVANCED TECHNOLOGY FOR DIGITAL REFRACTOMETERS 2022

New touch screen technology with 7.0 inch display

- Operation is via capacitive touchscreens with fast computing unit
- The glass surface can be operated with gloves and cleaned with solvents
- The 18-bit colour depth delivers 262,000 colours and produces clear images
- Glare effects in sunlight are reduced to a minimum

Higher data security with better authorisation concepts

- From now on with specific setting of network access restrictions
- Enhanced authentication methods with Secure Login
- The combination of user name & password protects saved data from unauthorised access
- Audit trail to record configuration changes
- Possibility of data reports with own logo

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 30 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

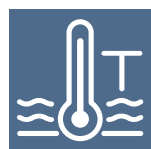
The Abbe refractometer was developed around 1869 by Ernst Abbe and was one of the first laboratory instrument for determining the refractive index of liquids. Its measuring principle is based on the total reflection. Thanks to the favourable purchase prices, the easy operation and reliability, it still 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 n_D and sugar content %Brix, from 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 n_D 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.



THERMOSTAT TEMP. CONTROL



AR4 with circulating thermostat PT31

AR4

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

PT31

ACCURACY OF TEMP. CONTROL	$\pm 0.2^\circ\text{C}$
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 or 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 5–80 °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 $\pm 0.35\%$ Brix	nD ± 0.0003 $\pm 0.2\%$ Brix	nD ± 0.00015 $\pm 0.1\%$ 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	$\pm 0,5^{\circ}\text{C}$		
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. The device measures the salinity, and additionally it is possible using two additional predefined scales (freely defined). Via the menu control of the device, for each scale, the automatic temperature compensation, due to sucrose, can be switched on.

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.



TEMP. COMPENSATION

PROCESS REFRACTOMETERS – PR SERIES

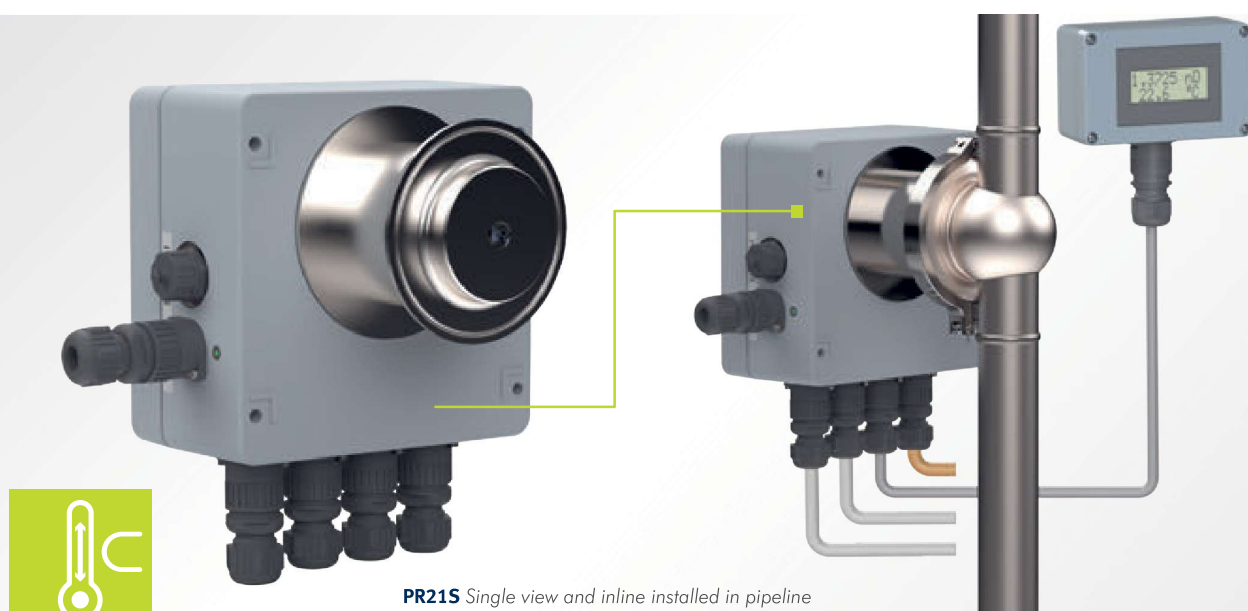
INLINE REAL-TIME MEASUREMENT

The inline process refractometers PR21S is installed in pipelines of production facilities in order to control and regulate the concentration, mixing and fermentation processes. Thanks to the standardised connections, the measuring devices can be easily mounted 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 device 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 0–90 %Brix. The measured value can optionally be read on site via an externally connectable display or in the process control centre. A serial and a two-part potential-free current interface (0/4–20 mA) is available for data transmission. The status of the process refractometer can be monitored by means of a status LED and a switching output.

Equipment features of our PR2

- 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 capable
- Sample prisms, made of scratch-proof and chemical-resistant sapphire
- Cleaning via individual customer process cleaning procedures
- Suitable for process temperatures up to 60 °C and relative pressures up to 9 bar
- Easy connection to process control system or PLC via serial or two-part potential-free current interface (0/4–20 mA)
- IP code: IP65
- A display for the visual monitoring is also available



PR21S Single view and inline installed in pipeline



TEMP. COMPENSATION

PR21S

SCALES	Refractive index (nD) concentration of sucrose [%Brix], User-defined
MEASUREMENT RANGE	nD 1.3200–1.5200* (configured individually) 0–90%Brix
MEASUREMENT ACCURACY	nD ± 0.0002 ± 0.2 %Brix
RESOLUTION	nD 0.0001 0.1 %Brix
PROCESS TEMPERATURE	10 °C – 60 °C

* The measurement range of your device will be configured individually based on the specifications made in the PDF requirement profile provided by us. A binding order only comes into effect once you have returned the fully completed form to us.

BYPASS REAL-TIME MEASUREMENT

The PRB21S bypass process refractometer is integrated into the process by means of hose connections. The sample is passed through the measurement chamber as a partial flow of the main process (bypass), either by pumping or hydrostatic pressure, and is measured continuously. This ensures continuous monitoring and control over the concentration of liquids. The measurement chamber is made of stainless steel. The measurement prism is made of scratch-resistant sapphire and it is resistant to solvents and acids. The PRB21S determines the refractive index and sugar content in the range between n_D 1.3200–1.5600 and 0–95 %Brix up to a process temperature of 60 °C. 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 a serial and a two-part potential-free current loop. The status of the process refractometer can be monitored by means of a status LED and a switch output.

Equipment features of PRB21S

- 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 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 and relative pressures up to 2 bar
- Easy connection to process control system or PLC via serial or two-part potential-free current interface (0/4-20 mA)
- IP code: IP65
- A display for the visual monitoring is also available



PRB21S bypass mounted in a pipeline and in single view



TEMP. COMPENSATION

PRB21S

Refractive index (n_D), concentration of sucrose [%Brix], User-defined
n_D 1.3200–1.5600 0–95 %Brix
$n_D \pm 0.0002$ ± 0.2 %Brix
n_D 0.0001 0.1 %Brix
10 – 60 °C

PROCESS INTEGRATION

- Cast aluminium housing for hygienic installation of the process refractometers in pipelines, boilers and tanks.
- Easy installation of the PR21S by means of a weld-on socket (flange) and flange clamp
- Installation of the PRB21S in the bypass via hoses

REFRACTOMETER APPLICATIONS

PHARMACEUTICAL INDUSTRY				
Typical applications: ■ Characterisation tests in research and development ■ Identity test, purity control and concentration determination of raw materials, semi-finished products and end products	Analysed substances: Pharmaceuticals, infusion solutions, dialysis preparations, blood sera etc.	Special requirements: Precision, compliance with standards	Standards: Pharmacopoeia (USP, BP, JP, Ph. Eur.), GLP, FDA, NIST	Recommended devices: DR6100-T DR6300-T
CHEMICAL INDUSTRY				
Typical applications: ■ 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	Analysed substances: 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.	Special requirements: Exact temperature control within a wide temperature range, wide measurement range, variety of scales, variability of measurement methods, option of interval measurements	Standards: AOAC, OIML, ASTM, DIN, CID	Recommended devices: DR6100-T DR6300-T DR201-95 DR301-95 PR SERIES
PETROCHEMICAL, AUTOMOTIVE AND AVIATION INDUSTRY, METAL PROCESSING AND BUILDING TECHNOLOGY				
Typical applications: ■ Identity test and concentration determination ■ Outgoing goods inspection ■ Stability test	Analysed substances: 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.	Special requirements: Easy handling, availability of the Brix scale, temperature compensation option	Standards: AOAC, OIML, ASTM, DIN, CID	Recommended devices: DR6000-T DR6200-T DR301-95 HR SERIES PR SERIES
FOOD INDUSTRY				
Typical applications: ■ Quality and purity control of raw materials and end products ■ Determination of the sugar concentration	Analysed substances: Sugar, jams, honey, syrup, seasoning sauces, mustard and mayonnaise, convenience products, dairy products, baby food, egg products, oils, starch hydrolysis products etc.	Special requirements: Fast measurement and easy handling, easy cleaning, routine analysis with high sample throughput	Standards: AOAC, OIML, ASTM, GLP, ICUMSA	Recommended devices: DR6000-T DR6200-T AR4 AR2008 HR SERIES PR SERIES
SUGAR INDUSTRY				
Typical applications: ■ 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	Analysed substances: Sugar cane, beet pulp, molasses, refined sugar, syrup, invert sugar etc.	Special requirements: Availability of the international sugar scale, maintenance-free	Standards: ICUMSA, GLP	Recommended devices: DR6000 DR6200-T PR SERIES
MANUFACTURERS OF AROMAS, FRAGRANCES AND ESSENTIAL OILS				
Typical applications: ■ Quality control of raw materials and auxiliary materials ■ Monitoring of the production of semi-finished products and end products	Analysed substances: Essential oils (such as orange, lemon, lavender and pepper-mint oil), glyceric acid, Aromas and perfumes for the food, cosmetic and tobacco industry etc.	Special requirements: Low sample volumes with a high aggressiveness, high accuracy	Standards: Pharmacopoeia (USP, BP, JP, Ph. Eur.), AOAC, OIML, GLP	Recommended devices: DR6100-T DR6300-T DR6100-TF DR6300-TF

BEVERAGE INDUSTRY

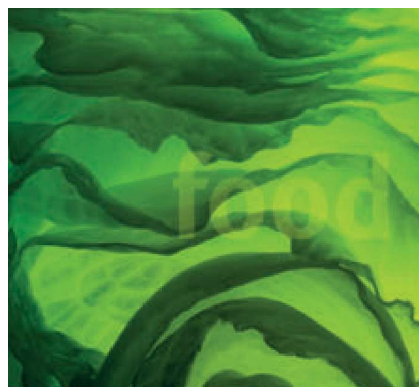
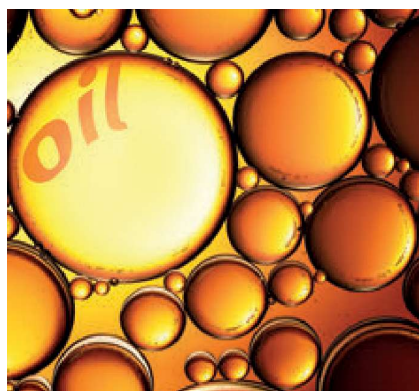
Typical applications: ■ Routine analysis with high sample throughput ■ Quality and purity control of raw materials and end products ■ Determination of the sugar concentration in juices and alcohol-free beverages ■ Determination of the alcohol or extract content in beer, spices, wine or spirits ■ Quality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

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

Typical applications: ■ Testing of foodstuff and pharmaceutical products ■ Testing of the compliance with national and international standards ■ Training	Analysed substances: Food and beverage samples, samples from research and development, acids, bases, solvents	Special requirements: High variability of the measurement techniques, simple convenient data management	Standards: Pharmacopoeia (USP, BP, JP, Ph. Eur.), AOAC, OIML, ASTM, ISO, DIN, GLP	Recommended devices: AR4 AR2008 DR6100-T DR6300-T
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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	DR6000-T	DR6100-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 1.3200–1.5800 0–95 %Brix	nD 1.3200–1.7000 0–95 %Brix
MEASUREMENT ACCURACY	nD ±0.0001 ±0.1 %Brix		nD ±0.0001 ±0.1 %Brix	nD ±0.0001 ±0.1 %Brix
RESOLUTION	nD 0.0001 0.1 %Brix		nD 0.0001 0.1 %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 tempe- rature control		With integrated Peltier temperature control	
10–80 °C				
±0.1 °C				
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	7.0" - capacitive touch-screen, 800 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		40 W	
POWER CONSUMPTION (MAX.)	75 W			
DIMENSIONS (W X H X D)	215 mm x 150 mm x 345 mm			
WEIGHT	5 kg			

DR6200-T**DR6300-T**

Refractive index (nD) concentration of sucrose, glucose, fructose and invert sugar [%Brix], User-defined	
nD 1.32000–1.58000 0–95 %Brix	nD 1,32000–1,70000 0–95 %Brix
nD ± 0.00002 ± 0.02 %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)	
7.0" - capacitive touch-screen, 800 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)			
7.0" - capacitive touch-screen, 800 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) concentra- tion 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 $\pm 0.35\%$ Brix	nD ± 0.0003 $\pm 0.2\%$ Brix	nD ± 0.00015 $\pm 0.1\%$ 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		
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	PRB21S
SCALES	Refractive index (nD) concentration of sucrose [%Brix], User-defined	
MEASUREMENT RANGE	nD 1.3200–1.5200* 0–90 %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	Bypass
MEASUREMENT PERIOD	ca. 10 seconds	
PERMITTED PRESSURE LOAD	< 9 bar (relative)	< 2 bar (relative)
MEASUREMENT PRISM	Sapphire	
WAVELENGTH	589 nm	
TEMPERATURE COMPENSATION	ICUMSA or freely definable	
TEMPERATURE MEASUREMENT	With integrated temperature sensor Pt100	
TEMPERATURE MEASUREMENT RANGE	-200–120 °C	
TEMP. MEASUREMENT ACCURACY	± 0.2 °C	
TEMP. MEASUREMENT RESOLUTION	0.1 °C	
PROCESS TEMPERATURES	10–60 °C	
AMBIENT TEMPERATURE	0–40 °C	
AMBIENT HUMIDITY	10 - 90 % (non-condensing)	
HOUSING	Stainless steel, aluminum cast, powder-coated	
INTERFACES	RS232; RS232 for display, 2x analog 0(4)-20 mA; relay input, 2x relay output	
IP CODE	IP65	
OPERATING VOLTAGE	24 V _{DC} (Min: +18 V _{DC} ; Max: +30 V _{DC})	
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

* The measurement range of your device will be configured individually based on the specifications made in the PDF requirement profile provided by us. A binding order only comes into effect once you have returned the fully completed form to us.

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 30 ml (28 mm x 65 mm), set of vials made of polypropylene (50 ml) or glass (30 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 30 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: 6 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
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 $\pm 0.1\%$ Brix
HRB18-T	Handheld refractometer, determination of Brix, measurement range 0–18%Brix, measurement accuracy $\pm 0.1\%$ Brix
HRB32-T	Handheld refractometer, determination of Brix, measurement range 0–32%Brix, measurement accuracy $\pm 0.2\%$ Brix
HRB62-T	Handheld refractometer, determination of Brix, measurement range 28–62%Brix, measurement accuracy $\pm 0.2\%$ Brix
HRB82-T	Handheld refractometer, determination of Brix, measurement range 45–82%Brix, measurement accuracy $\pm 0.2\%$ 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, $\pm 0.5^\circ\text{Bé}$, $\pm 0.5\%$ water content in honey
HRB90	Handheld refractometer, determination of Brix, measurement range 0–90%Brix, measurement accuracy $\pm 0.2\%$ 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 $\pm 0.1\%$ 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 $\pm 0.1\%$, ± 0.001
HRS28-T	Handheld refractometer, determination of salinity (NaCl), measurement range 0–28%, measurement accuracy $\pm 0.2\%$
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 , $\pm 0.2\text{ g/dl}$, $\pm 0.002\text{ UG}$
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 $\pm 0.2\%$ Brix, $\pm 1^\circ\text{Oe}$, $\pm 0.1\%$ 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/cm ³ , measurement accuracy antifreeze: $\pm 5^\circ\text{C}$, battery acid: $\pm 0.01\text{ g/cm}^3$
HRKFZG-T	Handheld refractometer, battery fluid G11/12 & G13, windshield wiper water (ethanol & isopropanol), Measurement range battery acid: 1.10–1.40 g/cm ³ , G11/12 & G13: -50–0 °C, windscreen wiper water: -40–0 °C Measurement accuracy battery acid: $\pm 0.01\text{ g/cm}^3$, G11/12 & G13: $\pm 1^\circ\text{C}$, windscreen wiper water: $\pm 5^\circ\text{C}$

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

ORDER NUMBER	PROCESS REFRACTOMETERS
PR21S	Inline process refractometer, measurement range nD 1.3200–1.5200, 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 DIN32676-DN80 for PR21S
PR2025	Welded stud DIN32676-DN80 for PR21S
PR2026	Set of blind covers DIN32676-DN80 for PR21S
PR2028	Display 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 $-0.000338 / + ^\circ\text{C}$, 5 %Brix
RI39	Calibration solution with certificate, nD 1.3900 ± 0.0002 at 25°C, temperature coefficient $-0.000344 / + ^\circ\text{C}$, 35 %Brix
RI43	Calibration solution with certificate, nD 1.4300 ± 0.0002 at 25°C, temperature coefficient $-0.000400 / + ^\circ\text{C}$, 55 %Brix
RI48	Calibration solution with certificate, nD 1.4800 ± 0.0002 at 25°C, temperature coefficient $-0.000395 / + ^\circ\text{C}$, 76 %Brix
RI65	Calibration solution with certificate, nD 1.6500 ± 0.0002 at 25°C, temperature coefficient $-0.000395 / + ^\circ\text{C}$
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	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



A.KRÜSS Optronik 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

