KRÜSS
A.KRÜSS OPTRONIC
G E R M A N Y

Polarimeters

- P8000
- P8000-PT
- P8000-DT
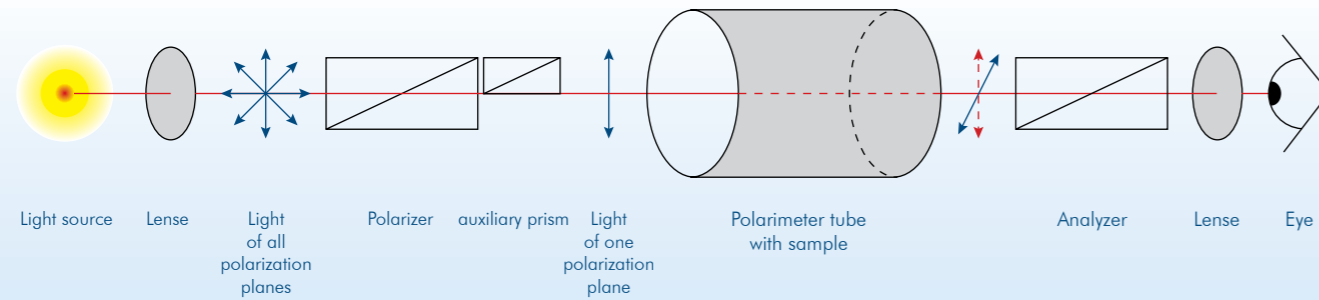- PS8000
- P3000
- P1000
- Accesories

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What is POLARIMETRY?

Light source Lense Light of all polarization planes Polarizer auxiliary prism Light of one polarization plane Polarimeter tube with sample Analyzer Lense Eye

If we regard light as an electromagnetic wave propagating through space, it is possible to illustrate the phenomenon of "polarized light".
The oscillation and the direction of propagation of the wave define a very specific plane. If you would look towards the beam you would see this wave as a line which is inclined at a certain angle in space.
Regular light includes waves that are inclined in any direction of the space while polarized light is inclined only at a defined angle.
This polarization can only be achieved by a very close meshed grating – a polarization filter. This one filters out all waves from the regular light that do not have the same inclination as the filter's grating. Is the light now directed to a second grating which is exactly 90° to the first grating, no light will fall on the detector or the human eye located behind it. If you place an optically active substance between the two filters, light will again pass through the second filter.
Optically active substances change the inclination of the lightwave. Depending on the design of the device, the second filter is rotated (manually or automatically) until no light will fall on the detector. This technical setup explains the terms "optical rotation", "rotation angle" as well as the terms "clockwise" and "anticlockwise". The two later terms describe the behavior of the wave mentioned above during the passage through an optically active substance. Depending on the molecular structure of the substance, the direction of the inclination of the wave is towards the right or towards the left.
In order to be able to measure this change, the second filter has to be rotated anticlockwise or clockwise.
Typical substances are sugar, lactic acid, tartaric acid but also many other biologically active substances.

Optically active are chiral substances whose molecules can take up different spatial arrangements that can not be aligned with by a rotation. Hence, this is a form of configuration isomerism. The different molecules of the substance are called enantiomers.

The following two enantiomers of lactic acid are an example of such a molecule:

S- (+) lactic acid   R- (-) lactic acid
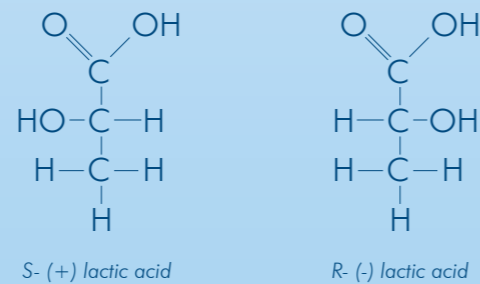
The chiral center of the lactic acid is the middle carbon atom. Since the two enantiomers have different rotation angles, the polarimetry will provide information about the molecular structure.
In addition to the properties of the substance, the following factors also have an influence on the strength of the optical activity: the temperature, the wavelength of the light, the concentration of the substance and possibly also the solvent.
The following applies as well: The longer the path of the light through an optically active substance, the larger the angle of rotation.

A.KRÜSS Optronic Polarimeters

Precision Instruments „made in Germany"

For over 200 years A.KRÜSS Optronic has been famous worldwide for innovative optic-electronic measuring instruments of the highest precision.
As the oldest company in this field, our target is to develop instruments which set new standards.
With our products we aim to simplify testing and inspection tasks in laboratories or production facilities.
For this reason all instruments are user-friendly and can be operated intuitively.

P8000-Serie | Automatic High-Speed Polarimeters

The fastest polarimeters in the world!

The digital polarimeters of the P8000 series feature an innovative measuring principle to measure optically active liquids.

Our patented measuring technology works much faster than in conventional polarimeters, as it reduces measuring time to just one second, regardless of the rotation angle of the sample.

In addition, it permits continuous measurement, for example for kinetic investigations or in HPLC use.

All adjustments on the device are made via an easy to use touchscreen. An easy to understand help display can be called up at any time.

With minimum effort, the user can carry out a simple menu-driven calibration using test quartz.

The T-models of the P8000 series are equipped with thermostat interfaces and the delivery includes an external PT31 thermostat.

The connection of a temperature-controlled gauge head permits extremely accurate measurement.

The devices are intended for use in FDA-regulated sectors due to their GLP compliance, integrated user management and full network support, for simple connection to the laboratory environment and an LIMS.

All internal data (measurement values, parameters and methods) are organised in an SQL database.
This can be accessed externally using SQL queries through a fixed interface (e.g. LIMS).
With KrüssLab software, the device can be controlled by PC remote mode, using the same intuitive layout as the touchscreen on the polarimeter.
The PC stores measurement results as a local copy in the database, so your data is retained after the polarimeter is switched off.
Various data filters allow you to send data in Excel or HTML to your printer or export it in PDF format.

Range of applications

Pharmaceutical industry
- Monitoring chemical processes
- Purity control and determination of concentrations
- Characterisation of new synthetic substances
- The analysis of pharmaceuticals complies with Pharmacopoeia, DAB and other national and international standards.

Chemical industry
- Purity control and determination of concentrations
- Analysis of optically-active components (qualitative and quantitative)
- Determination of changes in the configuration
- Monitoring chemical processes

Sugar industry
- Quality control of original and end product
- Determination of fructose and glucose
- Sugar concentrations in refined beet and cane sugar, molasses and beet pulp

Food industry
- Determination of concentration
- Purity control
- Quality control

Special features

- Extreme time savings – about 1 sec. measurement duration
- Bright touchscreen display with intuitive operation
- Extreme precision and resolution across the entire measurement range (regardless of rotation angle)
- High resolution LED with 100,000 hour service life
- Interval or continuous measurement possible
- 100 different methods and user tables (individual tables) can be set
- Calibratable temperature sensor
- High light intensity: Measurement and continuous sample readings possible to an optical density of 3.0
- Tough powder-coated metal housing
- Very quiet operation
- Data display of all important settings and measurements
- User management functionality (password-protected) can be activated
- Integral SQL database for data storage
- USB interface for data export and firmware updates and for connecting keyboard or barcode scanner
- RS-232 interface for serial printer
- Ethernet interface for direct connection to a PC (with possibility of remote maintenance via internet)
- PDF-export
- Direct printing possible on a PostScript-enabled network printer
- Full cGMP/GLP capability: password protection, data backup, automatic printout or data output in CSV-format
- Meets the relevant international standards such as Pharmacopoeia, OIML, ASTM
- NIST-compliant calibration certificate
- IQ/OQ/PQ-commissioning possible
- Extremely low maintenance and long life
- 3 year warranty with registration

Main measuring display

This is where the measurement is carried out and the results as well as the important parameters are displayed.

- Reading [°, °Z, g/ml]: Optical rotation, international sugar scale, concentration
- Tube temperature
- Sample number
- Tube length
- Wavelength
- Thermostat temperature
- Status information

Parameter selection

This menu is used to adjust the measuring parameters.

- Sample designation
- Comment
- Tube length
- Wavelength
- Measuring unit [°, °Z, g/ml]
- Specific rotation
- Temperature compensation

Individual user administration and help key

- Your settings are protected by an individual password.
- All screens have a help key which calls up explanations of the symbols shown on the screen.
- There is also extensive online help with every unit.
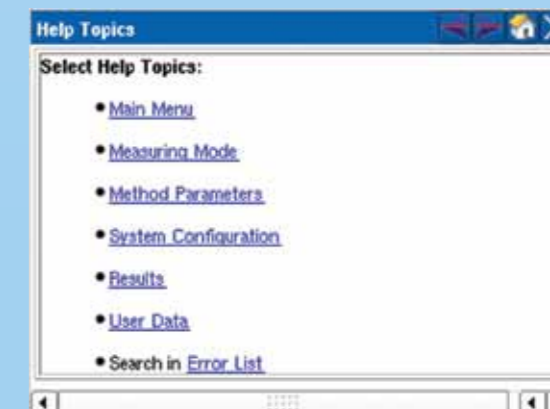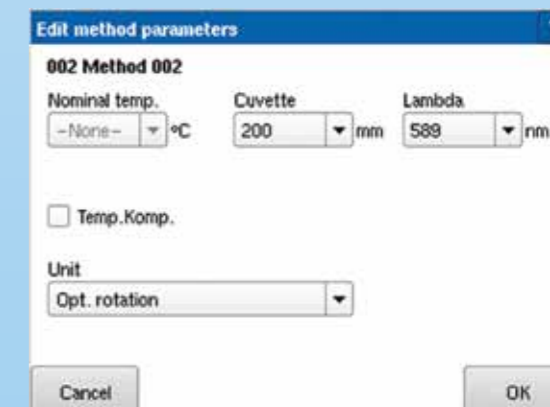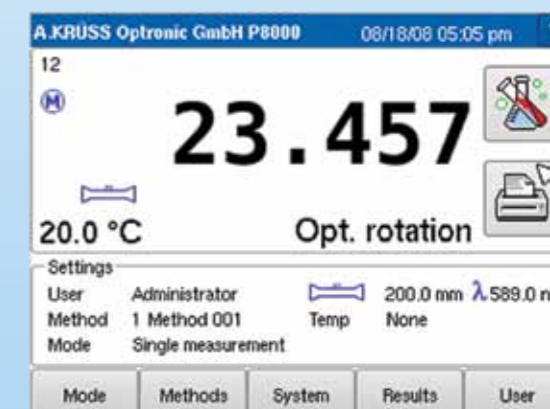
Specifications

	P8000	P8000-T	P8100	P8100-T
Measuring method	Optical rotation, int. sugar scale, concentration, spec. rotation, user-defined	Optical rotation, int. sugar scale, concentration, spec. rotation, user-defined	Optical rotation, int. sugar scale, concentration, spec. rotation, user-defined	Optical rotation, int. sugar scale, concentration, spec. rotation, user-defined
Measuring range	±90° ±259 °Z 0–99.9 g/ml	±90° ±259 °Z 0–99.9 g/ml	±90° ±259 °Z 0–99.9 g/ml	±90° ±259 °Z 0–99.9 g/ml
Measuring units	Angle [°, °Z] conc. [g/100 ml] user defined	Angle [°, °Z] conc. [g/100 ml] user defined	Angle [°, °Z] conc. [g/100 ml] user defined	Angle [°, °Z] conc. [g/100 ml] user defined
Resolution	0.001° 0.01 °Z 0.1 g/ml	0.001° 0.01 °Z 0.1 g/ml	0.001° 0.01 °Z 0.1 g/ml	0.001° 0.01 °Z 0.1 g/ml
Accuracy	±0.003° ±0.01 °Z ±0.5 g/100 ml	±0.003° ±0.01 °Z ±0.5 g/100 ml	±0.002° ±0.01 °Z ±0.5 g/100 ml	±0.002° ±0.01 °Z ±0.5 g/100 ml
Reproducibility	0.002°	0.002°	0.002°	0.002°
Measuring time ±90°	1 s	1 s	1 s	1 s
Light source	1 LED with filter	1 LED with filter	1 LED with filter	1 LED with filter
Wavelength	589 nm others optional	589 nm others optional	589 nm others optional	589 nm others optional
Wavelength selection	One fixed wavelength	One fixed wavelength	One fixed wavelength	One fixed wavelength
Connection for temperature sensor	Special tube with PT100 temperature sensor required	Special tube with PT100 temperature sensor required	Special tube with PT100 temperature sensor required	Special tube with PT100 temperature sensor required
Temperature measurement	0–99.9 °C	0–99.9 °C	0–99.9 °C	0–99.9 °C
Temperature resolution	0.1 °C	0.1 °C	0.1 °C	0.1 °C
Temperature accuracy	±0.2 °C	±0.2 °C	±0.2 °C	±0.2 °C
Temperature reading point	Tube	Tube	Tube	Tube
Temperature control	–	PT31 Peltier thermostat (water) with fast closure system	–	PT31 Peltier thermostat (water) with fast closure system
Range of temperature control	–	15–40.0 °C	–	15–40.0 °C
Accuracy of temperature control	–	±0.2 °C	–	±0.2 °C
Max. length of tube	220 mm	220 mm	220 mm	220 mm
Sensitivity	min 0.1 % (OD3)	min 0.1 % (OD3)	min 0.1 % (OD3)	min 0.1 % (OD3)
Calibration	Automatic (menu-driven)	Automatic (menu-driven)	Automatic (menu-driven)	Automatic (menu-driven)
Display	LCD TFT 5.7 " 640x480 pixel color display (VGA)	LCD TFT 5.7 " 640x480 pixel color display (VGA)	LCD TFT 5.7 " 640x480 pixel color display (VGA)	LCD TFT 5.7 " 640x480 pixel color display (VGA)
Operation	Touchscreen	Touchscreen	Touchscreen	Touchscreen
Measured data storage	999 measurements	999 measurements	999 measurements	999 measurements
Interfaces	RS-232 (printer) USB (data export, firmware updates) Ethernet (LIMS, remote monitoring)	RS-232 (printer) USB (data export, firmware updates) Ethernet (LIMS, remote monitoring)	RS-232 (printer) USB (data export, firmware updates) Ethernet (LIMS, remote monitoring)	RS-232 (printer) USB (data export, firmware updates) Ethernet (LIMS, remote monitoring)
Operating voltage	90–250 V 50/60 Hz	90–250 V 50/60 Hz	90–250 V 50/60 Hz	90–250 V 50/60 Hz
Dimensions in cm	64.5 x 20.0 x 36.0	64.5 x 20.0 x 36.0	64.5 x 20.0 x 36.0	64.5 x 20.0 x 36.0
Weight	28 kg	28 kg	28 kg	28 kg

P8000-PT | Automatic polarimeters with Peltier temperature control

Direct temp. control of the sample tube

Based on the reliable P8000 series, A. KRÜSS Optronic has developed a polarimeter with electronic temperature control using a special tube.
Peltier elements and a glass tube with unbreakable metal sleeve are just some of its special features. The good insulation and positioning of the Peltier elements gives verifiable homogeneous sample temperature, making it possible to omit the water bath thermostat otherwise required for precise measurements. The advantages are obvious:
There is no thermostat to be readjusted and maintained. The set-point temperature is entered directly on the touch-screen of the polarimeter and the device can automatically detect whether the tube has been connected. Of course, it is possible to use standard tubes without temperature control if the accuracy of a temperature-controlled sample is not required. In case the sample has been warmed up before, the time to bring it up to the right temperature can be considerably reduced thus utilizing the short measuring time of the P8000-Series – approx. one second . The P8000 series is the fastest polarimeter in the world!

Special features

As for the P8000, plus temperature-controlled Peltier sample tube.

Applications

As for the P8000

Specifications

	P8000-PT	P8100-PT
Measuring method	Optical rotation, int. sugar scale, concentration, spec. rotation, user-defined	Optical rotation, int. sugar scale, concentration, spec. rotation, user-defined
Measuring range	±90° ±259 °Z 0–99.9 g/ml	±90° ±259 °Z 0–99.9 g/ml
Measuring units	Angle [°, °Z], conc. [g/100 ml], user defined	Angle [°, °Z], conc. [g/100 ml], user defined
Resolution	0.001° 0.01 °Z 0.1 g/ml	0.001° 0.01 °Z 0.1 g/ml
Accuracy	±0.003° ±0.01 °Z ±0.5 g/100 ml	±0.002° ±0.01 °Z ±0.5 g/100 ml
Reproducibility	0.002°	0.002°
Measuring time ±90°	1 s	1 s
Light source	1 LED with filter	1 LED with filter
Wavelength	589 nm, others optional	589 nm, others optional
Wavelength selection	One fixed wavelength	One fixed wavelength
Max. length of tube	220 mm	220 mm
Sensitivity	min 0.1 % (OD3)	min 0.1 % (OD3)
Calibration	Automatic (menu-driven)	Automatic (menu-driven)

	P8000-PT	P8100-PT
Display	LCD TFT 5.7 " 640x480 pixel color display (VGA)	LCD TFT 5.7 " 640x480 pixel color display (VGA)
Operation	Touchscreen	Touchscreen
Measured data storage	999 measurements	999 measurements
Interfaces	RS-232 (printer) USB (data export, firmware updates) Ethernet (LIMS, remote monitoring)	RS-232 (printer) USB (data export, firmware updates) Ethernet (LIMS, remote monitoring)
Operating voltage	90–250 V 50/60 Hz	90–250 V 50/60 Hz
Dimensions in cm	64.5 x 20.0 x 36.0	64.5 x 20.0 x 36.0
Weight	28 kg	28 kg
Peltier temperature control	Special tube PRG-100-EPT required	Special tube PRG-100-EPT required
Temperature measurement	0–99.9 °C	0–99.9 °C
Temperature resolution	0.1 °C	0.1 °C
Temperature accuracy	±0.2 °C	±0.2 °C
Temperature reading point	Tube	Tube
Range of temperature control	15–40.0 °C	15–40.0 °C
Accuracy of temperature control	±0.2 °C	±0.2 °C

P8000-DT Series | Autom. Polarimeters with Rinsing and Drying Module

Semiautomatic sampling

The P8000-DT features a temperature-controlled micro-cuvette that can be used in flow-through operation. This is particularly useful for aggressive or expensive samples and substances, as are often used in the pharmaceutical and flavouring industries.
The built-in rinsing and drying unit permits semi-automatic sampling, and subsequent cleaning using a hose pump and the integrated drying unit.
This eliminates the need to remove the sample tube and clean it outside the polarimeter, for major savings of valuable sample substances as well as time.
Cleaning is also possible through displacement by the new sample.

Special features

As for the P8000-T, plus
• Rinsing and drying module for aggressive substances and small sample volumes
• Parts that come into contact with samples are chemical-resistant (PTFE, PFA, viton, glass)
• Adjustable measurement and cleaning parameters
• Also available with autosampler

Applications

As for the P8000-T
Main application areas: Flavourings industry and ingredient analysis of high-value substances.

Specifications

	P8000-DT	P8100-DT
Measuring method	Optical rotation, int. sugar scale, concentration, spec. rotation, user-defined	Optical rotation, int. sugar scale, concentration, spec. rotation, user-defined
Measuring range	±90° ±259 °Z 0–99.9 g/ml	±90° ±259 °Z 0–99.9 g/ml
Measuring units	Angle [°, °Z] conc. [g/100 ml] user defined	Angle [°, °Z] conc. [g/100 ml] user defined
Resolution	0.001° 0.01 °Z 0.1 g/ml	0.001° 0.01 °Z 0.1 g/ml
Accuracy	±0.003° ±0.01 °Z ±0.5 g/100 ml	±0.002° ±0.01 °Z ±0.5 g/100 ml
Reproducibility	0.002°	0.002°
Measuring time ±90°	1 s	1 s
Light source	1 LED with filter	1 LED with filter
Wavelength	589 nm others optional	589 nm others optional
Wavelength selection	1 fixed wavelength	1 fixed wavelength
Connection for temperature sensor	Special tube with PT100 temperature sensor required	Special tube with PT100 temperature sensor required
Temperature measurement	0–99.9 °C	0–99.9 °C
Temperature resolution	0.1 °C	0.1 °C
Temperature accuracy	±0.2 °C	±0.2 °C

	P8000-DT	P8100-DT
Temperature reading point	Tube	Tube
Temperature control	PT31 Peltier thermostat (water) with fast closure system	PT31 Peltier thermostat (water) with fast closure system
Range of temp. control	15–40.0 °C	15–40.0 °C
Accuracy of temperature control	±0.2 °C	±0.2 °C
Max. length of tube	220 mm	220 mm
Sensitivity	min 0.1 % (OD3)	min 0.1 % (OD3)
Calibration	Automatic (menu-driven)	Automatic (menu-driven)
Display	LCD TFT 5.7 " 640x480 pixel color display (VGA)	LCD TFT 5.7 " 640x480 pixel color display (VGA)
Operation	Touchscreen	Touchscreen
Measured data storage	999 Measurements	999 Measurements
Interfaces	RS-232 (printer) USB (data export, firmware updates) Ethernet (LIMS, remote monitoring)	RS-232 (printer) USB (data export, firmware updates) Ethernet (LIMS, remote monitoring)
Operating voltage	90–250 V 50/60 Hz	90–250 V 50/60 Hz
Sample-feeding	Hose pump	Hose pump
Cleansing	Rinsing and drying module	Rinsing and drying module
Dimensions in cm	64.5 x 20.0 x 36.0	64.5 x 20.0 x 36.0
Weight	28 kg	28 kg

PS8000 Series | Automatic Sugar Polarimeters

Fast, precise sugar values

This low-cost alternative to the P8000 was developed especially for the sugar industry.
The PS8000 is a precise and very fast polarimeter, with the same operating and measurement functions as the P8000.
The high light intensity permits measurement and continuous sample readings up to an optical density of 3.0 (dark samples).
The measuring values are displayed in the international sugar scale.
Display for different initial weights is possible:
In addition to the standard unit of 26 g/100 ml, initial weights of 13 g/100 ml and 6.5 g/100 ml can also be selected.

Applications

As for the P8000
Main application area: Sugar industry

Special features

As for the P8000

Specifications

	PS8000	PS8000-T
Measuring method	Int. sugar scale	Int. sugar scale
Measuring range	±259 °Z	±259 °Z
Measuring units	Angle (°Z)	Angle (°Z)
Resolution	0.01 °Z	0.01 °Z
Accuracy	±0.01 °Z	±0.01 °Z
Reproducibility	0.02 °Z	0.02 °Z
Measuring time ±90°	1 s	1 s
Light source	1 LED with filter	1 LED with filter
Wavelength	589 nm others optional	589 nm others optional
Wavelength selection	1 fixed wavelength	1 fixed wavelength
Connection for temperature sensor	Special tube with PT100 temperature sensor required	Special tube with PT100 temperature sensor required
Temperature measurement	0–99.9 °C	0–99.9 °C
Temperature resolution	0.1 °C	0.1 °C
Temperature accuracy	±0.2 °C	±0.2 °C
Temperature reading point	Tube	Tube

	PS8000	PS8000-T
Temperature control	–	PT31 Peltier thermostat (water) with fast closure system
Range of temp. control	–	15–40.0 °C
Accuracy of temperature control	–	±0.2 °C
Max. length of tube	220 mm	220 mm
Sensitivity	min 0.1 % (OD3)	min 0.1 % (OD3)
Calibration	Automatic (menu-driven)	Automatic (menu-driven)
Display	LCD TFT 5.7 " 640x480 pixel color display (VGA)	LCD TFT 5.7 " 640x480 pixel color display (VGA)
Operation	Touchscreen	Touchscreen
Measured data storage	999 Measurements	999 Measurements
Interfaces	RS-232 (printer) USB (data export, firmware updates) Ethernet (LIMS, remote monitoring)	RS-232 (printer) USB (data export, firmware updates) Ethernet (LIMS, remote monitoring)
Operating voltage	90–250 V 50/60 Hz	90–250 V 50/60 Hz
Dimensions in cm	64.5 x 20.0 x 36.0	64.5 x 20.0 x 36.0
Weight	28 kg	28 kg

P3000 Series | Automatic Polarimeters

For fast standard measurements

The P3000 economical polarimeter is a simplified version of the P8000 and uses the same patented fast measurement technique. It measures samples in just 1 second, regardless of the rotation angle, saving much time over measurement with conventional polarimeters.
The P3000 is operated fully automatically with an intuitive touchscreen. Measured values can be displayed as optical rotation angles or in the ICUMSA international sugar scale, and can be printed out with the printer interface.
The P3000 offers unbeatable value for money for all applications where measurement accuracy to 2 decimal points is sufficient.

Specifications

Measuring method	Optical rotation, int. sugar scale
Measuring range	±90° ±259 °Z
Measuring units	Angle [°, °Z]
Resolution	0.01° 0.01 °Z
Accuracy	±0.01° ±0.01 °Z
Reproducibility	0.01°
Measuring time ±90°	1 s
Light source	1 LED with filter
Wavelength	589 nm
Wavelength selection	1 fixed wavelength
Temperature measurement	0–99.9 °C
Temperature resolution	0.1 °C
Temperature accuracy	±0.2 °C
Temperature reading point	Tube
Max. length of tube	220 mm
Sensitivity	min 0.1 % (OD3)
Calibration	Automatic (menu-driven)
Display	LCD 3.5" color display
Operation	Touchscreen
Interfaces	RS-232
Operating voltage	100–250 V, 50/60 Hz
Dimensions in cm	64.5 x 20.0 x 36.0
Weight	28 kg

Range of applications

Pharmaceutical industry
- Hospitals and pharmacies
- Monitoring chemical processes
- Purity control and determination of concentrations
- The analysis of pharmaceuticals complies with Pharmacopoeia, DAB and other national and international standards.

Chemical industry
- Purity control and determination of concentrations
- Analysis of optically active components (qualitative and quantitative)
- Determination of changes in the configuration
- Monitoring chemical processes

Sugar industry
- Quality control of original and end product
- Determination of fructose and glucose

Food industry
- Determination of concentration
- Purity control
- Quality control

P1000-LED | Manual Lab Polarimeter

Classic traditional instrument

The P1000-LED polarimeter is a simple and robust device for basic applications in the lab and for training. It operates according to the half-shade principle and the reading takes place via an eye-piece and two noniuses. The P1000-LED features a high-quality metal stand and a sample chamber for tubes of up to 220 mm length. The LED diodes last about 500 times longer than conventional sodium lamps, making this a highly economical alternative. It is equipped with a swivel-mounted cover, polarizer and analyzer and the delivery includes accessories.

New: *Energy-saving, long-life LED illumination*

Specifications

Measuring range	2 semi-circles (0-180º)
Glass tubes	100 and 200 mm
Scale division	1°
Reading precision	0.05° (with nonius)
Light source	LED
Dimensions in cm	14.0 x 33.0 x 50.0
Weight	4.3 kg

Scope of delivery

- Polarimeter tubes 100 and 200 mm with bubble trap

Accessories

- Replacement sodium lamp for older models
- Glass cover plate

Polarimeter Accessories

Polarimeter tubes made of glass

PRG-100-ETT and PRG-200-ETT:
Glass and metal polarimeter tubes
Temperature-controlled glass/metal tubes with funnel
and temperature sensor.
The PRG-100/200-ETT is a highly robust, multi-purpose
polarimeter tube. The glass interior makes it acid-proof,
which is very important in the pharmaceutical industry.
The outside metal housing makes it unbreakable.
Verifiable homogeneous sample temperature along the
entire length is afforded by the outward-facing inlets.
The PT-100 temperature sensor is positioned directly in
the sample, and can be Teflon-coated on request.
The tube can be opened at both ends for cleaning.
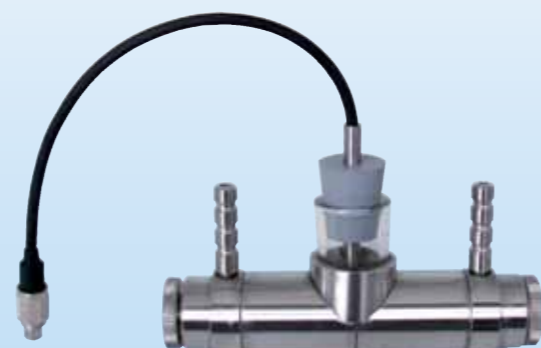
Article No	Length in mm	Volume in ml (approx.)
PRG-100-ETT	100	6.00
PRG-200-ETT	200	12.00

The temperature sensor is also available with acid-resistant Teflon coating!

Micro glass tube for small sample volumes
without temperature control

Article No	Length in mm	Volume in ml (approx.)
PRG-50-M	50	0.55
PRG-100-M	100	1.10

Glass tube with bubble trap for single measurements
without temperature control

Article No	Length in mm	Volume in ml (approx.)
PRG-100	100	8.00
PRG-200	200	15.00

Glass tube with funnel
without temperature control

Article No	Length in mm	Volume in ml (approx.)
PRG-50-E	50	3.00
PRG-100-E	100	6.00
PRG-200-E	200	12.00

Custom-made product: If this selection of polarimeter tubes and quartz plates does not meet your requirements, please do not hesitate to contact us!

PRG-100-EPT:
Electronic Peltier temperature control for the P8000-PT
Glass tube with integrated Peltier temperature control
The PRG-100-EPT is a multi-purpose polarimeter tube with
autonomous temperature control.
The built-in Peltier elements provide automatic temperature
control without a water connection.
This enables simple and highly precise temperature moni-
toring between 10 °C and 40 °C.
The glass interior makes it acid-proof, which is very important
in the pharmaceutical industry.
The outside metal housing makes it unbreakable.
Verifiable homogeneous sample temperature along the entire
length is afforded by the good insulation and positioning of
the Peltier elements.
The PRG-100-EPT is designed especially for the P8000-PT
polarimeter, and works only with that model.

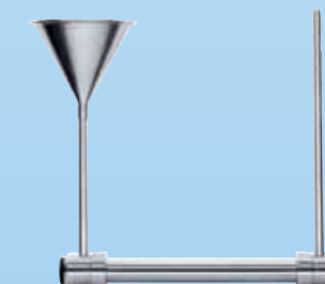| Article No	Length in mm	Volume in ml (approx.)
PRG-100-EPT	100	8.00

Polarimeter tubes made of stainless steel

Stainless steel micro flow-through tube with hose
connectors without temperature control

Article No	Length in mm	Volume in ml (approx.)
PRM-10-SDM	10	1.50

Stainless steel flow-through tube with funnel and overflow
pipe without temperature control

Article No	Length in mm	Volume in ml (approx.)
PRM-100-D	100	12.00
PRM-200-D	200	17.00

Stainless steel flow-through tube with funnel, overflow
pipe and temperature control

Article No	Length in mm	Volume in ml (approx.)
PRM-100-DT	100	12.00
PRM-200-DT	200	17.00

Stainless steel flow-through tube with hose connectors
without temperature control

Article No	Length in mm	Volume in ml (approx.)
PRM-50-SD	50	10.00
PRM-100-SD	100	12.00
PRM-200-SD	200	17.00

Stainless steel flow-through tube with hose connectors and temperature control

Article No	Length in mm	Volume in ml (approx.)
PRM-100-SDT	100	12.00
PRM-200-SDT	200	17.00

Stainless steel flow-through tube with hose connectors, temperature sensor and temperature control

Article No	Length in mm	Volume in ml (approx.)
PRM-100-SDTT	100	12.00
PRM-200-SDTT	200	17.00

Quartz Control Plates

Economy quartz control plates with manufacturer´s certification traceable to official PTB certificate	
PQE+17	+17° (+/- 1°), +50 °Z (+/- 1 °Z)
PQE+34	+34° (+/- 1°), +99 °Z (+/- 1 °Z)
PQE -17	−17° (+/- 1°), −50 °Z (+/- 1 °Z)
PQE -34	−34° (+/- 1°), −99 °Z (+/- 1 °Z)

Premium quartz control plates with manufacturer´s certification traceable to official PTB certificate (individual PTB certificate available upon request)	
PQP+8	+8° (+/- 1°), +25 °Z (+/- 1 °Z)
PQP+17	+17° (+/- 1°), +50 °Z (+/- 1 °Z)
PQP+26	+26° (+/- 1°), +75 °Z (+/- 1 °Z)
PQP+33	+33° (+/- 1°), +95 °Z (+/- 1 °Z)
PQP+34	+34° (+/- 1°), +99 °Z (+/- 1 °Z)
PQP-10	−10° (+/- 1°), −30 °Z (+/- 1 °Z)

Sodium Lamps

P1000-300
Replacement sodium lamp for older models

Glass Cover Plate

P1000-150
Glass cover plate for polarimeter tube, package of 2 pieces

KrüssLab Software

The custom LIMS for your KRÜSS instruments.
For convenient remote control of refractometer, polarimeter and densimeter.
• Simple installation with Windows Explorer
• Device management, remote control and measurement administration
• Uses the same intuitive layout as the touchscreen on your Krüss instrument, for direct PC control
• The PC stores measurement results as a local copy in the database
• Central control of an unlimited number of KRÜSS instruments
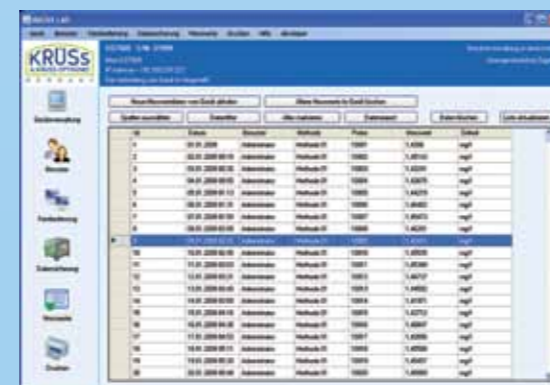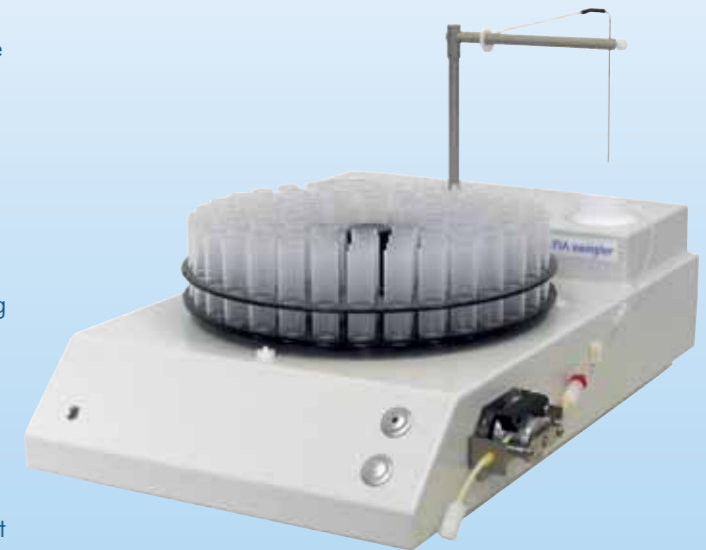
Printer

CBM910
24 characters regular paper printer for:
• Digital refractometers from the DR6000 series
• Digital Abbe refractometer AR2008
• Digital polarimeters from the P8000 series
• Density meters DS7000 series

Automated sample injector - Autosampler

AS80
The refractometer, fitted with a flow-through cuvette, and the density meter can be completed by means of an automated sample injector system.
This consists of a rotor sampler, a peristaltic pump and a constriction-tube valve as toggle switch. The sampler uses a plate with 89 positions for sample tubes in polystyrene with dimensions Ø 16 x 100 mm. These can accept sample volumes of 8 ml. Peristaltic pump and valve are integrated into the sampler and are controlled via this by the measuring device. The heads of the two assemblies are situated on the right-hand side of the unit.
The sample is transported into the measurement system by means of the peristaltic pump. If the measured value is stable and is recorded, the valve toggles from Sample to Standby and the system is rinsed. This minimises spreading and measurement errors. To take the following measurement the rotor is moved to the next sampling position and the valve set back to sample mode.

Peltier Thermostat

PT31
The electronic water bath thermostat with Peltier element is a versatile and powerful device used to control the temperature of refractormeters, polarimeters etc.
It is extremely robust, compact and easy to operate.
With its small footprint it takes little space in the lab.

Resolution	0.1 °C
Heating output	30 W
Cooling efficiency	15 W
Power supply	115–230 V
Pump pressure	2000 Pa
Pump capacity	20 l/h
Temperature	8–40 °C (continuously adjustable)
Temperature accuracy	±0.2 °C
Bath volume	about 100 ml
Dimensions in cm	8.0 x 21.0 x 14.0
Weight	1.5 kg

Water bath cleaner

PT35
• Prevents mould and algae growth
• Protects pipes

Further Products available from A.KRÜSS Optronic GmbH

· Refractometers

· Density Meters

· Microscopes

· Melting Point Meters

· Peltier Thermostat

· Cold Light Sources

· Spectroscopes

· Spectral Measuring Instruments

· UV Lamps

· Software

· Gemmological Instruments

KRÜSS
A.KRÜSS OPTRONIC
G E R M A N Y

Refractometers

· DR6000 Series
· DR6000 Series / Accessories
· AR2008
· AR4
· PR21
· PRB21
· DR301-95
· DR201-95
· DR101-60
· HR Series
· ER60 Series
· Refractometer Accessories

innovation since 1796

2 + 1 year
WARRANTY EXTENSION
Please register
on our website
**www.kruess.com**

1.37113

www.kruess.com

What is Refractometry?

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

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

$n_1 \cdot \sin \delta_1 = n_2 \cdot \sin \delta_2$,
where δ_1 is angle α and δ_2 is angle β
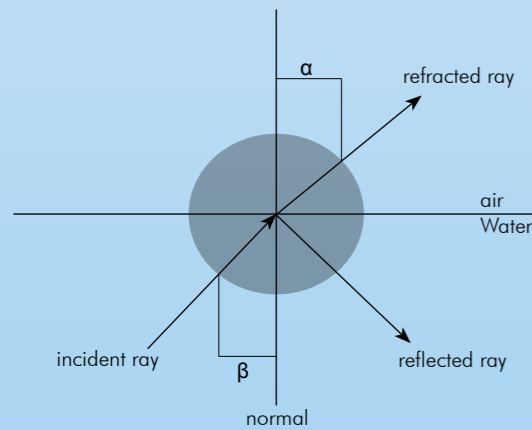
Under constant conditions with known material properties, the formula can be manipulated to calculate the refractive index of an unknown second medium. The angle of incidence and angle of refraction can be measured, the refractive index of one of the materials (the prism of the refractometer) is known, and so, after adjusting the formula, the refractive index of the unknown material is a matter of simple mathematics.
Measurement of the refractive index depends on the temperature and wavelength of the light. Determination of the refractive index can provide information on the purity of a substance, but not its exact composition.

The refractive index of water at 20 °C is 1.33 nD. Ice has a refractive index of 1.31 nD.
Adding sugar to pure water changes the refractive index, depending on the amount added. Adding salt changes the refractive index as well, but in relation to the concentration.
This means that if pure water at 20 °C does not have a refractive index of 1.33, it has been "polluted" with some other material. As a rule, determining the refractive index of a substance is a quick and reliable check of its purity.

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

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

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

40 % Brix Sugar Solution $\Delta nD = 0.00015/°C$

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

Paraffine Oil $\Delta nD = 0.00036/°C$

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

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

A.KRÜSS Optronic Refractometers

Precision Instruments „made in Germany"

For over 200 years A.KRÜSS Optronic has been famous worldwide for innovative optic-electronic measuring instruments of the highest precision.
As the oldest company in this field, our target is to develop instruments which set new standards.
With our products we aim to simplify testing and inspection tasks in laboratories or production facilities.
For this reason all instruments are user-friendly and can be operated intuitively.

DR6000 Series | Digital Refractometers

Versatile and powerful!

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

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

The flat stainless steel plate is easy to clean and is highly resistant to aggressive substances.
As the refractive index depends on the temperature of the sample, the refractometer should be tempered. The DR6000 series is thus available with integrated electronic temperature control by means of a Peltier element.
This type of temperature control is faster and more reliable than water bath thermostats.
For continuous measurements or series of measurements with many samples and high volumes of samples, devices with flow measurement cells are available. A sample can thus displace the previous one, nonetheless achieving an accurate measurement result without cleaning the measuring prism after every measurement.

The DR6000 series of refractometers are robust, low-maintenance and also very quiet - an often underestimated quality for equipment used continuously in a laboratory.

An integrated SQL database stores up to 99 user-defined measurement methods and the last 999 measurement values with all associated data. You can select the stored results by means of various filters and export data in

XLS- or CSV-format on a USB flash drive, print directly or convert to a PDF document for printing from a PC.
By connecting a printer to the RS-232 interface, results can be printed out as soon as they are measured.

The refractometer can be connected to a PC or linked to a network via an Ethernet interface. If there is access to the Internet, remote maintenance and fault diagnosis are also possible.

Optional user management functionality with three authorisation levels protects the settings from being changed unintentionally. The DR6000 series thus meets all GLP requirements and is best suited for use in FDA-regulated situations.

Special KrüssLab software also enables the instrument to be controlled from a PC. This exactly replicates the intuitive touchscreen of your Krüss unit, allowing you to "operate" it directly from the PC. Measured values are copied from the device into the KrüssLab database. You then have permanent access to more than the last 999 results. This data can be accessed even when the Krüss unit is switched off.
The refractometers in this series meets the guidelines of ASTM D1218 and D1747.

Special features

- Bright touchscreen display with intuitive operation in 6 languages
- Very efficient integrated Peltier temperature regulation with high precision (T-Models)
- Fast and easy cleaning of the probe
- High resolution LED with 100.000 hour service life
- Very quiet operation
- Compact powder-coated metal housing
- 99 different methods and customer tables (individual tables can be set)
- Data display of all important settings and measurements
- User management functionality (password-protected) can be activated
- Integral SQL database for data storage
- USB interface for data export and firmware updates and for connecting keyboard or barcode scanner
- RS-232 interface for serial printer
- Ethernet interface for direct connection to a PC (with possibility of remote maintenance via internet)
- PDF-export
- Direct printing possible on a PostScript-enabled network printer
- Full cGMP/GLP capability: password protection, data backup, automatic printout or data output in CSV-format
- Meets the relevant international standards such as Pharmacopoeia, OIML, ASTM
- NIST-compliant calibration certificate
- IQ/OQ/PQ-commissioning possible
- Extremely low maintenance and long life
- 3 year warranty with registration

Fields of application

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

- Beverages
- Food
- Sugar / sweeteners
- Chemicals
- Flavours
- Petrochemicals
- Cosmetics / hygiene
- Metalworking
- Pharmaceuticals
- Water / effluent
- Education / research
- Purity control
- Quality control

Main measuring display

This is where the measurement is carried out and the results as well as the important parameters are displayed.

- Measured value: refractive index, %Brix, user-defined unit
- Target and actual temperature
- User
- Method
- Temperature compensation
- Status information
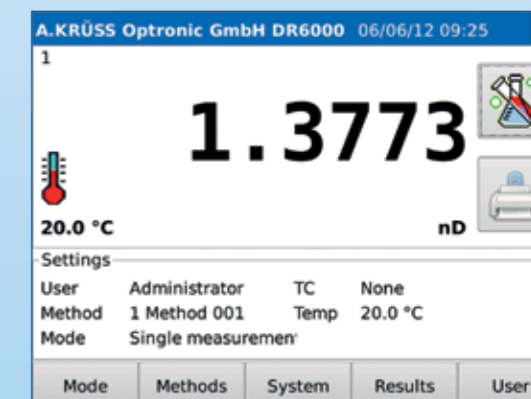
Mode and method menu

In the mode menu any user can adjust settings.

- Single or interval measurements
- Mark measurements as QC measurements
- Define sample numbers

Where the user administration function has been activated, only administrators can make changes in the method menu.

- Name of method
- Unit
- Target temperature
- Temperature compensation (ICUMSA or user-defined)
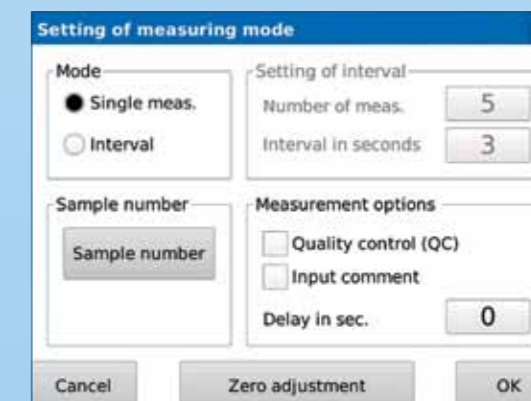
Results menu

The last 999 measurements are stored in the results menu along with all associated settings and parameters. Columns can be displayed or hidden and the results filtered, printed or exported.

- Date and time
- Method
- User
- Sample number
- Target and actual temperature
- Measured value
- Unit
- etc.

Specifications

Model / Article-No.	Range 1.3200 – 1.5800 nD 0-95 %Brix	Range 1.3200 – 1.7000 nD 0-95 %Brix	Resolution 0.0001 nD 0.1 %Brix	Resolution 0.00001 nD 0.01 %Brix	Accuracy 0.0001 nD 0.1 %Brix	Accuracy 0.00002 nD 0.02 %Brix
DR6000	•		•		•	
DR6100		•	•		•	
DR6200	•			•		•
DR6300		•		•		•

Common Specifications

Measurement modes	Single, Interval
Scales	Preset standard scales: Refractive Index [nD], %Brix saccharose, inverted sugar, glucose, fructose, Temperature compensated [nD], Temperature compensated [%Brix]. User defined scales can be initialised.
Calibration	Automatic (menu-driven), manufacturer´s calibration with up to 30 sampling points, user defined 1-point-calibration
Measurement time	~4 s
Prism	Sapphire
Illumination	LED 590 nm (est. life: >100.000 hours)
Housing	Cast aluminium, powder-coated
Analysis basin	Stainless steel,
Display	LCD TFT 5.7 ", 640x480 pixel color display (VGA)
Operation	Touchscreen
Measured data storage	999 measurements

Interface	RS-232 (printer) USB (data export, firmware updates) Ethernet (LIMS, remote monitoring)
Working voltage	90–250 V 50/60 HzW
Protection class	IP65 for analysis basin
Temperature measurement	5–90 °C
Temperature resolution	0.1 °C
Temperature measurement accuracy	±0.05 °C
Temperature compensation	ICUMSA, User defined 3-Point
Temperature sensor	PT100 Sensor
Sample temperature	10–80 °C
Ambient temperature	15–35 °C
Temperature control (except T-Models)	Thermostat connections
Dimensions in cm	21.5 x 15 x 34.5
Weight	5 kg

All models are also available in the following versions:

T Model: with built-in electronic Peltier thermostat

Model / Article-No.	Temperature control range	Temperature accuracy	Temperature stability
DR6000-T DR6100-T DR6200-T DR6300-T	10–80 °C (optional)	±0.1 °C	0.05 °C

F-Model: with flow cell

The flow cell is a variation of the DR6000 series and is indicated by the suffix "F" (e.g. -F, -TF). It consists of a measuring cell cover fixed with robust stainless steel brackets over the prism, with two tubes for inflow and outflow. All parts that come into contact with the sample (tubes and measuring cell cover) are made of PTFE (Teflon). Combined with the sapphire prism equipped with a Peltier thermostat, precise and stable temperature control is assured. The UNF-thread hose coupling is made of PEEK.

The flow cell allows the unit to run in automated mode using a peristaltic pump or autosampler. It can also be filled by means of injection if required. Thanks to its special geometry (forced venting), no air bubbles can become trapped.

As a result of the small size of the micro-measuring cell, this version is particularly suitable for applications in which it is important for samples to be in small volumes (e.g. in the flavourings industry).
The measuring cell can be removed easily and the sample thus placed directly on to the prism.

TF-Model: with integrated electronic Peltier thermostat AND flowcell

TF models are a combination of T- and F-models
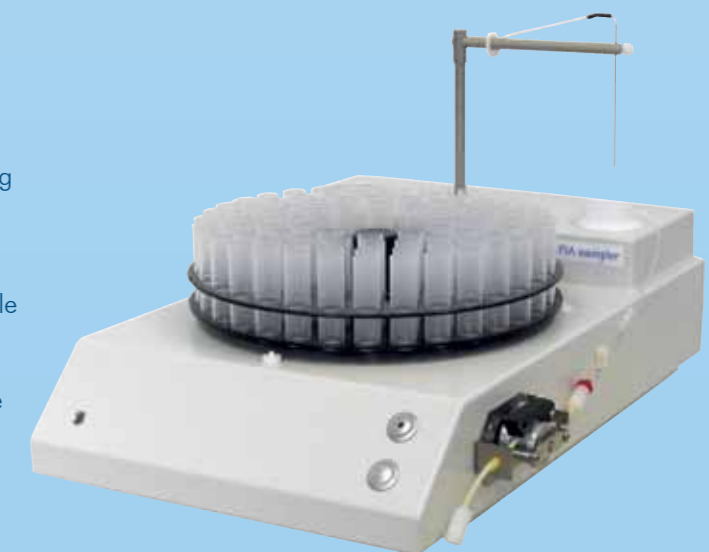
DR6000 Series | Accessories

Automated sample injector - Autosampler

AS80
The refractometer, fitted with a flow-through cuvette, and the density meter can be completed by means of an automated sample injector system.
This consists of a rotor sampler, a peristaltic pump and a constriction-tube valve as toggle switch. The sampler uses a plate with 89 positions for sample tubes in polystyrene with dimensions Ø 16 x 100 mm. These can accept sample volumes of 8 ml. Peristaltic pump and valve are integrated into the sampler and are controlled via this by the measuring device. The heads of the two assemblies are situated on the right-hand side of the unit.
The sample is transported into the measurement system by means of the peristaltic pump. If the measured value is stable and is recorded, the valve toggles from Sample to Standby and the system is rinsed. This minimises spreading and measurement errors. To take the following measurement the rotor is moved to the next sampling position and the valve set back to sample mode.

AR | Abbe Refractometers

The modern classic!

The Abbe refractometer was developed in 1869 by Ernst Abbe and is used to determine the refractive index otherwise known as the index of refraction.
It is based on the principle of total reflection which occurs at the boundary between the prism and the sample. The refractive index of the prism determines the upper limit of the measurement range, as it always has to be greater than that of the sample.
With the AR Series, Krüss has two models of the Abbe refractometer in its range. These are easy to use and require only a small sample volume. These devices allow samples in the form of solids or pastes to be measured just as easily as liquids. Furthermore, colouration or clouding scarcely affect the measurement result. Besides the refractive index, the solid content can be determined in %Brix. To determine the refractive index of solids, a contact liquid with an average refractive index is required.
The refractive index of a sample is dependent on the wavelength of the light used for the measurement and on the temperature. As the temperature increases, the refractive index drops. That is why our Abbe refractometers have thermostat connections on both the illumination prism as well as the measurement prism.

Fields of application

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

• Beverages
• Food
• Sugar / sweeteners
• Chemicals
• Flavours
• Petrochemicals
• Cosmetics / hygiene
• Metalworking
• Pharmaceuticals
• Water / effluent
• Education / research

AR2008

AR4

AR2008 | Digital Abbe Refractometer

The digital Abbe refractometer AR2008 has an electronic data processing system. The refractive index or Brix value is shown on an LCD display together with the temperature.
A serial interface allows measured values with date and time to be transferred directly to the PC or printer.
An automatic temperature compensation feature is optionally selectable.
The AR2008 has a thermostat connection for prisms and a built-in light source (589 nm) for the measuring prism. The AR2008 is extremely sturdy and is ideally suited for use in a harsh environment.
It is supplied with a glass calibration plate, contact fluid and a screwdriver as well as a dust hood.

Specifications

Measurement range	1.3000–1.7200 nD 0–95 %Brix
Accuracy	±0.0002 nD ±0.1 %Brix
Resolution	0.0001nD 0.1 %Brix
Temperature Range	0–99 °C
Temperature resolution	0.1 °C
Autom. Temperature compensation	0–90 °C
Interfaces	serial RS-232 9600 Baud serial RS-422 9600 Baud
Power supply	110/230 V, 50/60 Hz, 40 W
Dimensions in cm	12.0 x 29.0 x 25.0
Weight	5 kg

AR4 | Analogue Abbe Refractometer

The AR4 offers readings via ocular. It has an adjustable scale, temperature controlled prisms, and thermostat connections for prisms.
The refractive index of a sample depends on the wavelength of the light used in measurement.
That is why we supply our AR4 with LED illumination for the measuring prism. This has the standard wavelength of 589 nm and has a very long service life (>100.000 h). Refractometers also have scale illumination.
Since the refractive index is also temperature-dependent, our Abbe refractometers feature thermostat points on both the lighting and the measurement prisms.
A digital thermometer is supplied. Other wavelengths are available on request.
Our Abbe refractometers can easily be checked and calibrated with the calibration plates provided and comply with all requirements of ASTM D1218.

Specifications

Measurement range	1.3000–1.7000 nD 0-95 %Brix
Accuracy	±0.0002 nD ±0.1 %Brix
Scale division	0.0005 nD 0.25 %Brix
Thermometer	Digital thermometer: -40–120 °C
Illumination	Scale illumination, LED-illumination (590 nm) for prism
Display	Readings via ocular
Power supply	110/220 V, switchable
Dimensions in cm	10.0 x 27.0 x 19.0
Weight	2.5 kg
Special features	Adjustable scale, prisms can be temperature-controlled, thermostat connections for prisms

PR | Process Refractometer

Complete quality control!

Process refractometers are built directly into pipework and boilers or operated in the bypass. They are ideal for process monitoring, control and product separation in a variety of industries (chemicals, beverages, food and sugar).

Why use Refractometers in pipelines?

The monitoring of refractive index is a popular method of inline quality control in many process industries, including pulp and paper, food and beverage, chemical and pharmaceutical, and wastewater. It provides real-time data for quality control and Good Manufacturing Practice (GMP), and can be used to monitor qualities such as concentration of a solution, density of a fluid, or % Brix. An inline process refractometer is installed directly into pipework or a boiler, with standard connections for easy assembly. The alternative bypass process refractometer analyses a stream of fluid drawn off the main process run.

Fields of application

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

- Beverages
- Food
- Sugar/sweeteners
- Chemicals
- Flavours
- Petrochemicals
- Cosmetics / hygiene
- Metalworking
- Pharmaceuticals
- Water / effluent
- Education / research

Special Features

- Excellent value for money
- Wide measurement range from 1.3300 –1.5600 nD; 0–95 %Brix
- Adjustable measurement interval (min. 3 s)
- Password-protected
- Prism in the sample chamber is easy to clean
- User-friendly interfaces for direct connection to a PLC
- Very easy to install, no special requirements

PR21 Series | Process Refractometer

As no bypass is necessary, it is much simpler to install the process refractometer in a pipeline or tank. Standard connections enable the process refractometer to be assembled quickly and easily. Depending on diameter, a T-piece is inserted into the pipeline or an adapter welded on, as with the tank.
Three interfaces are available for this unit:
Analogue 0/4-20 mA, Ethernet, or PROFIBUS.

PR21

Model overview

	Measurement accuracy	Resolution	Product temperature	Ambient temperature
PR21S	±0.0002 nD	0.0001 nD	< 60 °C	< 40 °C
PR21S-T	±0.2 %Brix	0.1 %Brix	< 160 °C	< 60 °C
PR21H	±0.00002 nD	0.00001 nD	< 60 °C	< 40 °C
PR21H-T	±0.02 %Brix	0.01 %Brix	< 160 °C	< 60 °C

Specifictions

Measurement mode	Refractive index [nD], Sugar content [%Brix], User defined [%]
Measurement interval	3–60 s
Temp. sensor	PT100
Temp. measurement	-10–200 °C
Temp. resolution	0.1 °C
Temp. measurement accuracy	± 0.2 °C
Temp. compensation	ICUMSA, arbitrary
Process temperature	-5–160 °C
Ambient temperature	0–60 °C

Prism	Sapphire
Illumination	LED 590 nm (est. life: >100.000 h)
Housing	Stainless steel, Cast aluminium, powder-coated
Interfaces	Analogue 0/4-20 mA, Ethernet, PROFIBUS (optional)
Protection class	IP65
Working voltage	24 V
Dimensions in cm	18.0 x 19.0 x 18.0
Weight	3.5 kg

PRB21 | Bypass Process Refractometer

The bypass process refractometer PRB21 fills the gap between the DR6000 series of digital laboratory refractometers and the process refractometer PR21.
The sample is fed into the measurement chamber through a stainless steel bypass. The prism is made of particularly scratch-resistant sapphire.
The PRB21 is generally connected to a PLC and provides continuous process control. Small sample volumes suffice for this. The measurement interval is adjustable (>3 s) and the measurement result is not affected by either the colour or the turbidity of the sample.

The PRB21 has various interfaces and can also be supplied with PROFIBUS on request. A display is also available for visual monitoring. Automatic temperature compensation can be obtained by means of the internal temperature sensor and the measured temperature fed to the PLC.

PRB21

Specifictions

Measurement range	1.3200 nD–1.5600 nD 0–95 %Brix	
Accuracy	PR-H:	±0.00002 nD; ± 0.02 %Brix
	PR-S:	±0.0002 nD; ± 0.2 %Brix
Resolution	PRB-H:	0.00001 nD; 0.01 %Brix
	PRB-S:	0.0001 nD; 0.1 %Brix
Measurement units	Refractive Index [nD] Saccharose [%Brix] Invert Sugar [%Brix] Glucose [%Brix] Fructose [%Brix]	
Measurement interval	3–60 s	
Temperature sensor	PT100	
Temperature measurement	-10–99.9 °C	

Temperature resolution	0.1 °C
Temperature accuracy	±0.2 °C
Temperature compensation	ICUMSA, arbitrary
Ambient temperature	0–40 °C
Prism	Sapphire
Illumination	LED 590 nm (est. life: >100.000 h)
Housing	Cast aluminium, powdercoated
Interfaces	RS-232, analogue 0/4–20 mA
Protection class	IP65
Working voltage	24 V
Display (optional)	LCD 120 x 32 Pixel
Dimensions in cm	18.0 x 10.0 x 18.0
Weight	3 kg

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

For mobile use - with a large measurement range!

Quick, precise measurement results simplify incoming goods inspection, optimise quality assurance and reduce work processes. The devices can easily be carried on inspection rounds, as they are lightweight and fit into any lab coat pocket.

Fields of application

Determination of mixing ratios, quality and quantity inspection in the following industries:
- Beverages
- Food
- Sugar / sweeteners
- Chemicals
- Flavours
- Petrochemicals
- Cosmetics / hygiene
- Metalworking
- Pharmaceuticals
- Water / effluent
- Education / research

Special features

- Large measuring range
- High precision
- Calibrated with water
- Display of measurement results in various units
- Automatic temperature compensation
- Robust casing
- Little weight

DR301-95

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

DR301-95

DR201-95 and DR201-95OE

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

DR201-95

DR101-60 und DR101-60-OE

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

DR101-60

	DR301-95	DR201-95	DR201-95-OE	DR101-60	DR101-60-OE
Measurement range	1.3330−1.5318 nD 0−95 %Brix	1.3330−1.5318 nD 0−95 %Brix	0−250 °Oechsle 0−95 %Brix	1.3330−1.4419 nD 0−60 %Brix	0-150 °Oechsle 0 − 60 %Brix
Accuracy	±0.00015 nD ±0.1 %Brix	±0.0003 nD ±0.2 %Brix	±1 °Oechsle ±0.2 %Brix	±0.0005 nD ±0.25 %Brix	±1 °Oechsle ±0.2 %Brix
Resolution	0.0001nD 0.1 %Brix	0.0001nD 0.1 %Brix	1 °Oechsle 0.1 %Brix	0.0001nD 0.1 %Brix	1 °Oechsle 0.1 %Brix
Temperature measurement	5−40 °C 41−104 °F	0−40 °C	0−40 °C	0−40 °C	0−40 °C
Temperature accuracy	±0.5 °C	±0.5 °C	±0.5 °C	±0.5 °C	±0.5 °C
Temperature compensation	5−40 °C	10−40 °C	10−40 °C	10−40 °C	10−40 °C
Prism	optical glass				
Housing	Plastic				
Dimensions in cm	18.0 x 10.0 x 6.0	13.0 x 8.0 x 4.0		11.0 x 6.2 x 3.2	11.0 x 6.2 x 3.2
Weight	500 g	200 g		160 g	160 g
Power supply	9 V Battery, (Adaptor available separately)	1.5 V Battery		1.5 V Battery	1.5 V Battery

HR Series | Manual Hand-held Refractometers

Quick on-site measurements!

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

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

Fields of application

Determination of mixing ratios, quality and quantity inspection in the following industries:
• Beverages
• Food
• Sugar / sweeteners
• Chemicals
• Flavours
• Petrochemicals
• Cosmetics / hygiene
• Metalworking
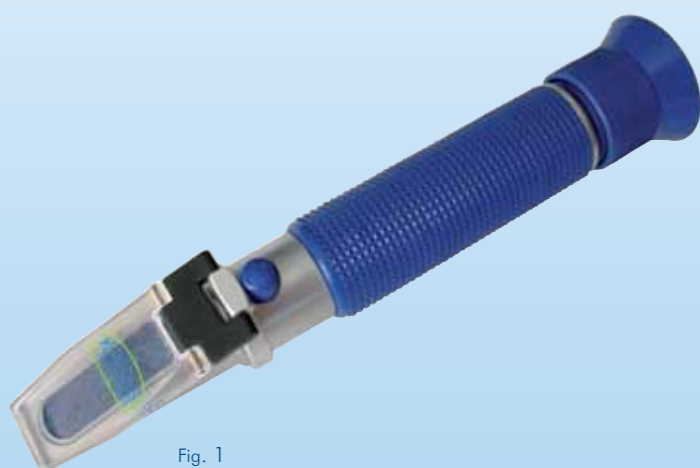• Pharmaceuticals
• Water / effluent
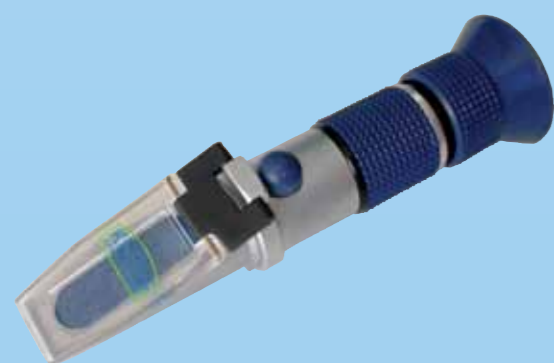• Education / research

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Model	Fig. Nr.	Measurement range	Accuracy	scale division	Temperature compensation	Thermo-meter	Field of application
HR10	Fig. 1	0–10 %Brix	0.1 %Brix	0.1 %Brix	-	-	For sugar concentration in fruit juces, soft drinks, vegetables, foods and cooling lubricants
HR18-01	Fig. 1	0–18 %Brix	0.1 %Brix	0.1 %Brix	-	-	For sugar concentration in fruit juces, soft drinks, vegetables, foods and cooling lubricants
HRKL32	Fig. 2	0–32 %Brix 0–140 °Oechsle 0–27° KMW BaBo	0.2 %Brix 1 °Oechsle 0.2° KMW BaBo	0.2 %Brix 1 °Oechsle 0.2° KMW BaBo	-	-	For the measurement of Brix and alcohol content in must by either oechsle and Klosterneuburg scale
HRN20	Fig. 2	0–20 %Brix	0.2 %Brix	0.2 %Brix	-	-	For sugar concentration in fruit juces, soft drinks, vegetables, foods and cooling lubricants
HRN32	Fig. 2	0–32 %Brix	0.2 %Brix	0.2 %Brix	-	-	For sugar concentration in fruit juces, soft drinks, vegetables, foods and cooling lubricants
HRT32	Fig. 3	0–32 %Brix	0.2 %Brix	0.2 %Brix	automatically	-	For sugar concentration in fruit juces, soft drinks, vegetables, foods and cooling lubricants
HRN62	Fig. 3	28–62 %Brix	0.2 %Brix	0.2 %Brix	-	-	For analysing chemical and technical liquids, such as oils, fats, coolants, lubricants
HRT62	Fig. 3	28–62 %Brix	0.2 %Brix	0.2 %Brix	automatically	-	For analysing chemical and technical liquids, such as oils, fats, coolants, lubricants
HRN82	Fig. 3	45–82 %Brix	0.2 %Brix	0.2 %Brix	-	-	For analysing chemical and technical liquids, such as oils, fats, coolants, lubricants
HR92	Fig. 3	58–92 %Brix 38–43 °Baume 12–27 % Water	1 %Brix 0.5 °Baume 1 % Water	1 %Brix 0.5 °Baume 1 % Water	-	-	For examination of highly concentrated sugars, de termination of water content in honey and analysing fats, lubricants and cooking oil
HRH30	Fig. 2	12–30 % Water content in honey	0.1 % Water content in honey	0.1 % Water content in honey	-	-	For examination of highly concentrated sugars, de termination of water content in honey and analysing fats, lubricants and cooking oil
HR900	Fig. 5	0–90 %Brix	0.2 %Brix	0.2 %Brix	-	6–36 °C	Universal hand refractometer with stage switch for all ranges. Adjustable prisms for sharp contours, direct and indirect light guidance for measurement of clear and opaque substances. With thermometer
HR901	Fig. 5	1.333–1.517 nD	0.0005 nD	0.0005 nD	-	6–36 °C	Universal hand refractometer with stage switch for all ranges. Adjustable prisms for sharp contours, direct and indirect light guidance for measurement of clear and opaque substances. With thermometer
HR27-100	Fig. 2	$1.000–1.070\ d^{20}_{20}$ 0–100 ‰ Salinity	$0.001\ d^{20}_{20}$ 1 ‰ Salinity	$0.001\ d^{20}_{20}$ 1 ‰ Salinity	-	-	For salinity analysis
HRS16	Fig. 1	1,333–1,373 nD 0–160 ‰ Salinity	0.001 nD 2 ‰ Salinity	0.001 nD 2 ‰ Salinity	-	-	For salinity analysis
HR146	Fig. 2	1,3330–1,3834 nD 0-28 % Salinity	0.001 nD 0.2 % Salinity	0.001 nD 0.1 % Salinity	-	-	For salinity analysis
HRM18	Fig. 2	0–12 g/dl 1.333–1.360 nD 1.000–1.050 UG	0.2 g/dl 0.0005 nD 0.002 UG	0.2 g/dl 0.0005 nD 0.002 UG	-	-	For the measurement of serum protein and specific urine weight
HRMT18	Fig. 2	0–12 g/dl 1.333–1.360 nD 1.000–1.050 UG	0.2 g/dl 0.0005 nD 0.002 UG	0.2 g/dl 0.0005 nD 0.002 UG	automatically	-	For the measurement of serum protein and specific urine weight
HRO32	Fig. 2	0–32 %Brix 30–130 °Oe 4.4–19 % Alcohol	0.2 %Brix 1 °Oe 0.1 % Alcohol	0.2 %Brix 1 °Oe 0.1 % Alcohol	-	-	For the measurement of Oechsle, Brix and alcohol content in must
HROT32	Fig. 3	0–32 %Brix 30–130 °Oe 4.4–19 % Alcohol	0,2 %Brix 1 °Oe 0.1 % Alcohol	0.2 %Brix 1 °Oe 0.1 % Alcohol	automatically	-	For the measurement of Oechsle, Brix and alcohol content in must
HRKFZ1	Fig. 3	Anti freeze: 50–0 °C Battery acid: 1.10–1.30 g/cm³	Ethylen-Propylen: 5 °C Battery acid: 0.01 g/cm³	Ethylen-Propylen: 5 °C Battery acid: 0.01 g/cm³	-	-	Anti freeze and battery fluid tester
HR25-800	Fig. 4	0–80 %Brix	0.5 %Brix	0.5 %Brix	-	-	Universal hand refractometer with stage switch for all ranges. Adjustable prisms for sharp contours, direct and indirect light guidance for measurement of clear and opaque substances

Real or not?!

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

ER601
Illumination not figured

ER604
Illumination not figured

Model overview

	Standard Gem Refractometer		Professional Gem Refractometer	
	ER604	ER604-LED	ER601-NA	ER601-LED
Measurement range	1.33–1.81 nD	1.33–1.81 nD	1.33–1.83 nD	1.33–1.83 nD
Resolution	0.01 nD	0.01 nD	0.01 nD	0.01 nD
Monochromator	Na-Filter 589 nm	Na-Filter 589 nm	Na-Filter 589 nm	–
Illumination	–	LED 589 nm	–	LED 589 nm
Power supply Illumination	–	100–240 V	–	100–240 V
Prism	Optical glass			
Housing	Cast aluminium			

Peltier thermostat

PT31
This electronic water-bath thermostat with Peltier element is a versatile, high-performance instrument. In one application, for example, it can be used to set the correct refractometer temperature. It is extremly robust, compact and easy to operate. Because it is so small it does not take up valuable space in the laboratory.

Resolution	0.1 °C
Heating power	30 W
Cooling power	15 W
Power supply	115–230 V
Pump pressure	2000 Pa
Pump performance	20 l/h
Temperature	8–40 °C (continuously adjustable)
Temperature accuracy	±0.2 °C
Bath volume	ca. 100 ml
Dimensions in cm	8.0 x 21.0 x 14.0
Weight	1.5 kg

Printer

CBM910
24 characters plain paper dot matrix printer for:

• Digital Refractometers from the DR6000 series
• Digital Abbe-Refractometer AR2008
• Digital Polarimeter from the P8000 Series
• Density Meters from the DS7000 Series

Optical archiving unit

AR42
This camera enables results to be archived with ease. The optical unit also detects the limit of wavelengths that are not visible to the human eye (infrared).

• High quality glass lens
• 30 images per second
• Snapshot function (1.3 MP)
• Detects the limit of invisible wavelengths (infrared)
• Includes inserter / adapter for eyepiece

Connector	USB
Image frequency	30 images/s
Photo resolution	1366 x 768 Pixel
Video resolution	640 x 480 Pixel

Flow-through cell with funnel

AR15
Flow-through cell with funnel
upgrade for AR4 and AR2008.

Flow-through cell

AR16
Flow-through cell upgrade for continuous measurement
with AR4 and AR2008.

Refractometer calibration solutions

- **RI34** calibration solution 1.3400 nD (5 %Brix)
- **RI39** calibration solution 1.3900 nD (35 %Brix)
- **RI43** calibration solution 1.4300 nD (55 %Brix)
- **RI48** calibration solution 1.4800 nD (76 %Brix)
- **RI65** calibration solution 1.6500 nD
  All bottles contain 30 cc and are supplied with a
  certificate.

Further Products available from A.KRÜSS Optronic GmbH

· Polarimeters

· Density Meters

· Microscopes

· Melting Point Meters

· Peltier Thermostat

· Cold Light Sources

· Spectroscopes

· Spectral Measuring Instruments

· UV Lamps

· Software

· Gemmological Instruments