

MEASURING QUALITY. SINCE 1796



## POLARIMETERS

FAST AND RELIABLE ANALYSIS OF OPTICALLY ACTIVE SUBSTANCES



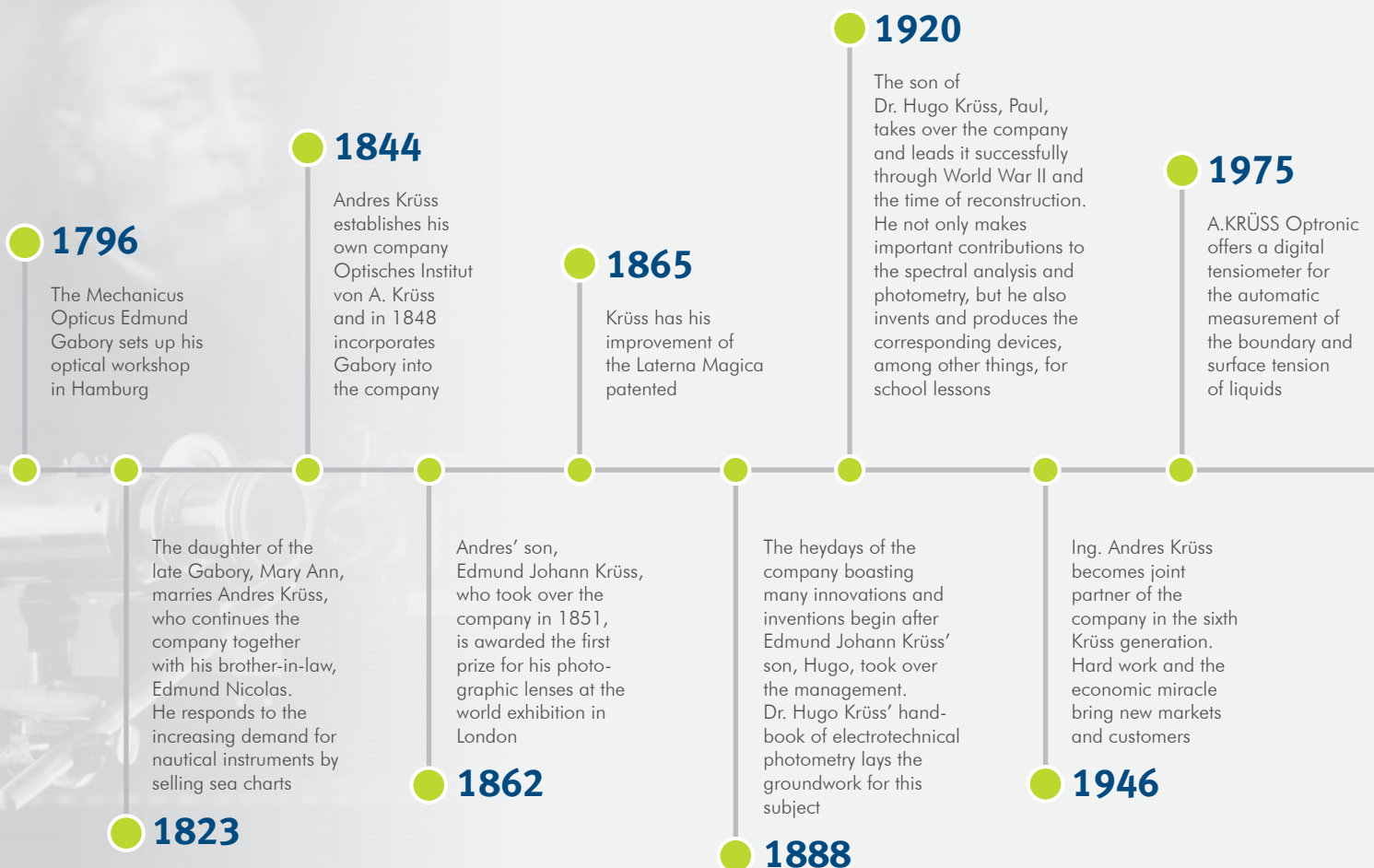
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# A.KRÜSS OPTRONIC – CUTTING-EDGE TECHNOLOGY, MADE IN GERMANY

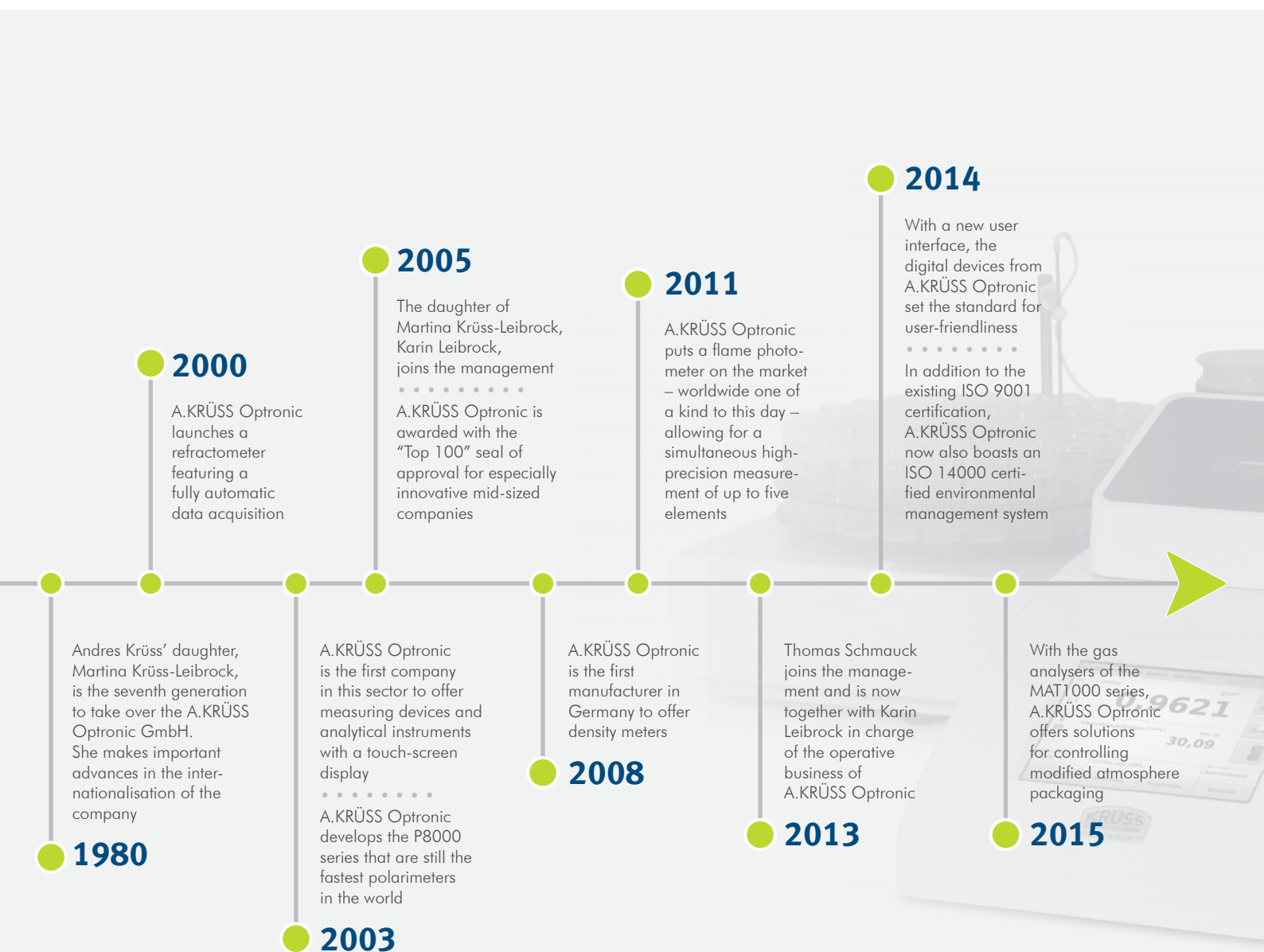
A.KRÜSS Optronic is a leading manufacturer of high-precision optoelectronic measuring devices and analytical instruments. The family enterprise founded in 1796 offers an extensive range of products and customised solutions for quality assurance in the pharmaceutical, chemical, petrochemical, food and beverage industry as well as for research and science. We also offer a wide variety of products for professional gemology. 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



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## SUCCESS FACTOR POLARIMETRY

One of the most important quality control methods used in the pharmaceutical, chemical, cosmetics, food and beverage industry is polarimetry – optically active substances are analysed by determining their angle of rotation. The angle of rotation allows you to ascertain the identity and quality of substances as well as their concentration in mixtures. It can also indicate the progress of reactions and conversions. Polarimeters are used in a wide range of applications – from the determination of the purity and concentration of ingredients in pharmaceuticals to the maturity testing of agricultural products to the measurement of the sugar content in beverages and candies.

Their sophisticated optical technology makes the chirality of molecules measurable and thus distinctions possible when other measured variables such as density or refractive index won't allow it. A filter polarises light emitted by a light source, i.e. it filters out all the waves that are not inclined

at a defined angle. The light is directed towards a second polariser, the analyser, which is rotated by 90° from the first one. No light will therefore fall on the detector located behind it. However, if you place an optically active substance between the polarisers, which changes the inclination of the light waves to the right or to the left depending on its molecular structure, light will again fall on the detector. The analyser is now rotated until it is back in the "dark position". As each optically active substance has its characteristic angle of rotation, it is then possible to characterise the sample.

In order to achieve a high measurement accuracy, the sample temperature must be accurately controlled since the optical activity of substances depends on the temperature. In addition, polarimeters must meet the increasing requirements on process efficiency and not only perform reliable and fast measurements but must also be easy to handle and allow for an automatic operation.

**Optical rotation** °  
**°Z International sugar scale**  
**Concentration** g/100 ml  
**Specific rotation**

### OUR POLARIMETER MODEL SERIES

#### P8000

Our devices of the P8000 series are the fastest polarimeters in the world – thanks to our patented measurement procedure, which reduces the measurement time to approx. 1 s regardless of the sample's angle of rotation. They achieve a high measurement accuracy of up to  $\pm 0.002^\circ$ , offer the option of a water bath or Peltier temperature control as well as an automatic operation and feature all the functions that are important in FDA-regulated sectors. Their self-explanatory, well-arranged user interface ensures a convenient user experience.

#### P3000

The polarimeter P3000 is a simplified version of the devices of the P8000 series. It applies the same measurement procedure and is therefore just as fast but built for standard applications in terms of measurement accuracy and functional range. The P3000 is our solution for all sectors where measurement results with two decimals and the possibility of a print-out on a serial ASCII printer are sufficient – and it boasts an excellent price-performance ratio.

#### P1000-LED

Our polarimeter P1000-LED – an analogue classic of optoelectronics – is suitable for basic applications in the lab and training. It operates according to the half-shade principle, and the measurement results are read through an eyepiece and two noniuses. Thanks to the integrated high-performance LED, whose service life is 2000 times longer than that of conventional sodium discharge lamps, the P1000-LED requires only little maintenance and is very cost-effective.



**FOCUS ON QUALITY**

WITH POLARIMETERS FROM A.KRÜSS

## POLARIMETERS WITHOUT TEMPERATURE CONTROL – P8000 AND P8100

If the maximum functional range is desired but a temperature control of the sample for high-precision measurements not required, our polarimeter models P8000 and P8100 will be the right choice. They only differ in their measurement accuracy when measuring the optical rotation, all other features are identical. The devices are very robust and yet precise and suitable for nearly all samples as the parts that come in contact with the sample are chemical-resistant.

The P8000 and P8100 are especially recommended in case of a high sample throughput in the sugar industry. Instead of a temperature control, the temperature can be compensated according to ICUMSA. That allows you to take measurements at any temperature; the results will then be converted to the desired temperature. In addition, the international sugar scale has been predefined on our devices, and the initial weight is taken into account for the conversion into the specific rotation.

For any type of sample, we offer the suitable measurement tube in glass or stainless steel. The tube is filled manually via a funnel or the opened screw connection on the side. Once the tube has been inserted into the measurement

chamber and the measurement has been started, the display will show the measured values on the selected scales within seconds. In addition to the international sugar scale, the optical rotation, specific rotation and concentration have been predefined, too, and the user can use any number of self-defined scales. He also has the choice between two measurement procedures, the measurement with a manual measurement time input and an optimised measurement time thanks to the automatic stability recognition, as well as between the individual, continuous and interval measurement modes. For cleaning purposes, the tube is removed, unscrewed at the sides and rinsed with the appropriate medium.

The P8000 and P8100 feature a self-explanatory, well-arranged user interface that is also easy to use by non-expert personnel. It is found on all of our measurement instruments so that the user will always be able to work in the same straightforward way. A state-of-the-art TFT display ensures a clear, bright representation of all the information, and the integrated touch-screen tops off the convenient user experience. The menu-driven adjustment of our devices using our quartz control plates (see page 20) is also completed in next to no time.

### YOUR ADVANTAGES

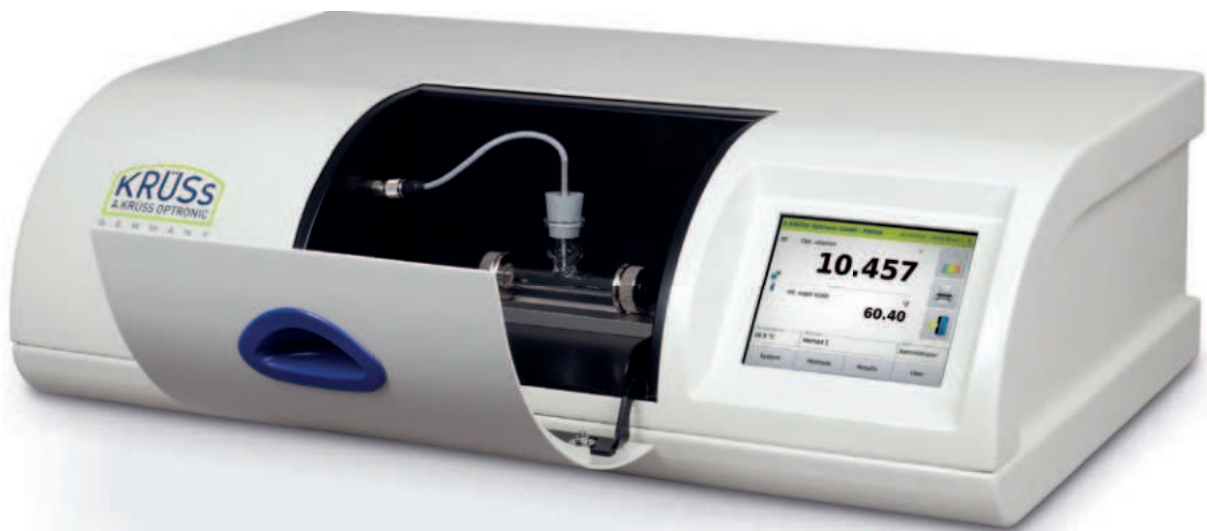
- Intuitive operation via touch-screen display
- Optional user administration with two authorisations
- Easy, menu-driven adjustment
- Freely assignable shortcut keys
- Any number of freely configurable methods
- Predefined scales (opt. rotation, spec. rotation, int. sugar scale, concentration)
- Any number of freely definable scales with conversions based on tables or formulas
- Suitable tubes for any type of sample
- Measurement up to an optical density of 3.0
- Temperature measurement directly inside the sample
- Reliable temperature compensation
- Very short measurement time of approx. 1 s
- Manual measurement time input or optimised measurement time thanks to automatic stability recognition
- Highest accuracy over the entire measurement range
- Compact, robust powder-coated steel housing
- High-performance LED with a service life of 100,000 h
- Interfaces for the convenient transfer of measured values
- Extensive connections for peripheral equipment
- Compliance with GMP/GLP, 21 CFR Part 11, Ph. Eur., OIML, ICUMSA etc.
- IQ/OQ/PQ by A.KRÜSS Optronic or one of our certified service partners
- Service, maintenance, calibration and adjustment on site

### RECOMMENDED MEASUREMENT TUBES

- PRG-50-/-100-/-200-E with temperature probe PRT-E/PRT-T (tubes included in the scope of delivery)
- PRM-100-/-200-D

Complete measurement tube catalogue, see page 26.





P8000 with measurement tube PRG-100-E and temperature probe PRT-E

**P8000**

**P8100**

	P8000	P8100
SCALES	Optical rotation [°] Int. sugar scale [°Z] Concentration [g/100 ml] Spec. rotation User-defined	
MEASUREMENT RANGES	±90° ±259 °Z 0–99.9 g/100 ml	
ACCURACY	±0.003° ±0.01 °Z ±0.5 g/100 ml	±0.002° ±0.01 °Z ±0.5 g/100 ml
RESOLUTION	0.001° 0.01 °Z 0.1 g/100 ml	
MEASUREMENT PERIOD ±90°	Approx. 1 s	
LIGHT SOURCE	1 LED with filter	
WAVELENGTH	589 nm	
TEMPERATURE MEASUREMENT	With temperature sensor PT100, integrated into temperature probe PRT-E or PRT-T	
TEMPERATURE MEASUREMENT RANGE	0–99.9 °C	
TEMPERATURE MEASUREMENT RESOLUTION	0.1 °C	
TEMPERATURE MEASUREMENT ACCURACY	±0.2 °C	
TEMPERATURE CONTROL	Can be retrofitted (requires water bath thermostat PT31, sample chamber bushing P8020 and temperature-controlled measurement tube PRG-100-ET)	
TEMPERATURE CONTROL RANGE		
TEMPERATURE CONTROL ACCURACY		

## POLARIMETERS WITH WATER BATH TEMPERATURE CONTROL – P8000-T AND P8100-T

The polarimeter models P8000-T and P8100-T have the same functional scope as the P8000 and P8100 but will also allow for a water bath temperature control in the range between 8 and 40 °C when combined with temperature-controlled measurement tubes such as our PRG-100-ET. That makes them suitable for high-precision measurements as they are, for example, required in the pharmaceutical industry. Especially if a multitude of different temperature-controlled measurement tubes are to be used, the P8000-T and P8100-T are the right choice. We offer a very large selection of this type of tubes. Micro-cuvettes required in case of small sample volumes are available in different shapes, capacities and optical lengths – all can be temperature-controlled.

Our PT31, an electronic water bath thermostat with Peltier element, ensures that the sample has the correct temperature. The thermostat connections integrated in the P8000-T and P8100-T allow you to connect it in next to no time, and the measurement tubes can also be quickly inserted and changed thanks to the quick coupling system. The PT31 can heat as well as cool, and this despite its very small size compared to conventional lab thermostats, which allows it to be easily placed on any working surface. It is operated

directly via the user interface of the polarimeter or its own operating element. The target temperature can be saved so that it is already set when the device is switched on.

The temperature control is homogeneous; there will be no temperature gradient in the sample. The temperature sensor PT100 integrated into the temperature probe determines when the set temperature is reached. The temperature is measured directly inside the sample, which is why we offer the temperature probe also in the PTFE-coated PRT-T version in addition to the stainless steel version PRT-E. By preheating the sample, it is possible to significantly shorten the temperature adjustment time and to take advantage of the very short measurement period of our devices.

The user can himself perform the regular calibration and adjustment of the temperature sensor required for an accurate temperature control using a certified thermometer. By request, they can be performed by A.KRÜSS Optronic or one of our certified service partners within the scope of an on-site maintenance.

The P8000-T and P8100-T can also be used with our standard tubes without temperature control if the required precision is ensured through temperature compensation.

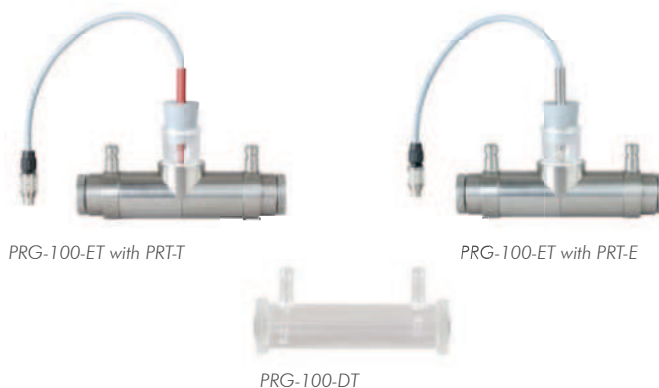
### YOUR ADVANTAGES

- Intuitive operation via touch-screen display
- Optional user administration with two authorisations
- Easy, menu-driven adjustment
- Freely assignable shortcut keys
- Any number of freely configurable methods
- Predefined scales (opt. rotation, spec. rotation, int. sugar scale, concentration)
- Any number of freely definable scales with conversions based on tables or formulas
- Measurement up to an optical density of 3.0
- Temperature measurement directly inside the sample
- Accurate, homogeneous water bath temperature control
- Large selection of temperature-controlled tubes
- Quick coupling system for an easy tube change
- Very short measurement time of approx. 1 s
- Manual measurement time input or optimised measurement time thanks to automatic stability recognition
- Highest accuracy over the entire measurement range
- Compact, robust powder-coated steel housing
- High-performance LED with a service life of 100,000 h
- Interfaces for the convenient transfer of measured values
- Extensive connections for peripheral equipment
- Compliance with GMP/GLP, 21 CFR Part 11, Ph. Eur., OIML, ICUMSA etc.
- IQ/OQ/PQ by A.KRÜSS Optronic or one of our certified service partners
- Service, maintenance, calibration and adjustment on site

### RECOMMENDED MEASUREMENT TUBES

- PRG-50-/-100-/-200-E with temperature probe PRT-E/PRT-T (tubes included in the scope of delivery)
- PRG-100-/-200-ET with temperature probe PRT-E/PRT-T
- PRG-100-DT
- PRM-100-/-200-DTT
- PRM-25-/-50-/-100-/-200-SDTM

Complete measurement tube catalogue, see page 26.



We also offer the devices – then called P8000-TF and P8100-TF – with flow-through function, integrated drying unit DS7060 and peristaltic pump DS7070 for semi- or fully automatic measurements – see page 12 f. For the appropriate flow-through measurement tubes, see page 26.



P8000-T with measurement tube PRG-100-ET, temperature probe PRT-T and water bath thermostat PT31

**P8000-T**

**P8100-T**

	P8000-T		P8100-T	
SCALES	Optical rotation [°] Int. sugar scale [°Z] Concentration [g/100 ml] Spec. rotation User-defined			
MEASUREMENT RANGES	±90° ±259 °Z 0–99.9 g/100 ml			
ACCURACY	±0.003° ±0.01 °Z ±0.5 g/100 ml		±0.002° ±0.01 °Z ±0.5 g/100 ml	
RESOLUTION	0.001° 0.01 °Z 0.1 g/100 ml			
MEASUREMENT PERIOD ±90°	Approx. 1 s			
LIGHT SOURCE	1 LED with filter			
WAVELENGTH	589 nm			
TEMPERATURE MEASUREMENT	With temperature sensor PT100, integrated into temperature probe PRT-E or PRT-T			
TEMPERATURE MEASUREMENT RANGE	0–99.9 °C			
TEMPERATURE MEASUREMENT RESOLUTION	0.1 °C			
TEMPERATURE MEASUREMENT ACCURACY	±0.2 °C			
TEMPERATURE CONTROL	With water bath thermostat PT31 (requires temperature-controlled measurement tube such as PRG-100-ET)			
TEMPERATURE CONTROL RANGE	8–40 °C			
TEMPERATURE CONTROL ACCURACY	±0.2 °C			

## POLARIMETERS WITH PELTIER TEMPERATURE CONTROL – P8000-P AND P8100-P

High-precision measurements through temperature control without an additional device – this is what our polarimeter models P8000-P and P8100-P offer, which otherwise have the same functional scope and the same characteristics as the other devices of the P8000 series. They are recommended if the temperature of the sample is to be controlled extremely accurately within a very short period of time and with a short control cycle and independent of the outside temperature.

This also requires the measurement tube PRG-100-EPT consisting of a chemical-resistant glass body with an unbreakable stainless steel jacket which is fitted with three Peltier elements allowing for a direct temperature control. The target temperature is entered on the user interface of the polarimeter; the device will automatically detect whether the tube is connected. Thanks to the ideal positioning and insulation of the Peltier elements, a homogenous temperature is provided ensuring the required temperature equilibrium in the sample. The temperature sensor PT100 integrated into the tube determines when the target temperature is reached.

The advantages of a direct temperature control of the tube are obvious: The measurement operation is more efficient, no water bath thermostat PT31 needs to be readjusted and

maintained while it saves space and material since there is no thermostat and no external tubing. Shortening the temperature adjustment time by preheating the sample is possible but hardly necessary as the P8000-P and P8100-P in combination with the measurement tube PRG-100-EPT are capable of controlling the temperature of any sample very fast even when the temperature differences are high. The temperature change common in the pharmaceutical industry between 20 °C for Ph. Eur. and 25 °C for USP, for example, takes only 2–3 min for the tube and sample. In the interval measurement mode, the fast, accurate temperature control allows you to monitor reactions and conversions or to carry out HPLC applications in an optimal way.

The user can himself perform the regular calibration and adjustment of the temperature sensor required for an accurate temperature control; all he needs is a certified thermometer. By request, they can be performed by A.KRÜSS Optronic or one of our certified service partners within the scope of an on-site maintenance.

The P8000-P and P8100-P can also be used with our standard tubes without temperature control if the required precision is ensured through temperature compensation. In this case, the temperature probe PRT-E/PRT-T will be connected via the adaptor plug PRT-P.

### YOUR ADVANTAGES

- Intuitive operation via touch-screen display
- Optional user administration with two authorisations
- Easy, menu-driven adjustment
- Freely assignable shortcut keys
- Any number of freely configurable methods
- Predefined scales (opt. rotation, spec. rotation, int. sugar scale, concentration)
- Any number of freely definable scales with conversions based on tables or formulas
- Measurement up to an optical density of 3.0
- Temperature measurement at the tube
- Accurate, homogenous, fast Peltier temperature control
- Chemical-resistant, unbreakable measurement tube
- Very short measurement time of approx. 1 s
- Manual measurement time input or optimised measurement time thanks to automatic stability recognition
- Highest accuracy over the entire measurement range
- Compact, robust powder-coated steel housing
- High-performance LED with a service life of 100,000 h
- Interfaces for the convenient transfer of measured values
- Extensive connections for peripheral equipment
- Compliance with GMP/GLP, 21 CFR Part 11, Ph. Eur., OIML, ICUMSA etc.
- IQ/OQ/PQ by A.KRÜSS Optronic or one of our certified service partners
- Service, maintenance, calibration and adjustment on site

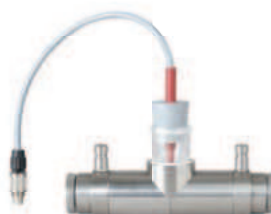
### RECOMMENDED MEASUREMENT TUBES

- PRG-100-EPT
- PRG-50-/-100-/-200-E with temperature probe PRT-E/PRT-T and adaptor plug PRT-P (tubes included in the scope of delivery)
- PRG-100-/-200-ET with temperature probe PRT-E/PRT-T
- PRM-100-/-200-DTT

Complete measurement tube catalogue, see page 26.



PRG-100-EPT



PRG-100-ET with PRT-T



PRG-100-ET with PRT-E



P8000-P with measurement tube PRG-100-EPT

**P8000-P**

**P8100-P**

	P8000-P	P8100-P
SCALES	Optical rotation [°] Int. sugar scale [°Z] Concentration [g/100 ml] Spec. rotation User-defined	
MEASUREMENT RANGES	±90° ±259 °Z 0–99.9 g/100 ml	
ACCURACY	±0.003° ±0.01 °Z ±0.5 g/100 ml	±0.002° ±0.01 °Z ±0.5 g/100 ml
RESOLUTION	0.001° 0.01 °Z 0.1 g/100 ml	
MEASUREMENT PERIOD ±90°	Ca. 1 s	
LIGHT SOURCE	1 LED with filter	
WAVELENGTH	589 nm	
TEMPERATURE MEASUREMENT	With temperature sensor PT100, integrated into measurement tube PRG-100-EPT	
TEMPERATURE MEASUREMENT RANGE	0–99.9 °C	
TEMPERATURE MEASUREMENT RESOLUTION	0.1 °C	
TEMPERATURE MEASUREMENT ACCURACY	±0.2 °C	
TEMPERATURE CONTROL	With measurement tube PRG-100-EPT with 3 integrated Peltier elements	
TEMPERATURE CONTROL RANGE	15–40 °C	
TEMPERATURE CONTROL ACCURACY	±0.2 °C	

# MAXIMUM EFFICIENCY THROUGH AUTOMATION

## SAMPLE SUPPLY OPTIONS

### MANUAL

We offer a large selection of measurement tubes for manual operation. While filling the sample into the tube via a funnel or the opened screw connection on the side, you check whether the filling is free of bubbles. For cleaning purposes, the tube is removed, unscrewed at the sides and rinsed with the appropriate medium until all sample residues have been dissolved and eliminated.

### SEMI-AUTOMATIC

Semi-automatic operation requires a P8000-TF/P8100-TF with flow-through function and drying unit DS7060, a flow-through measurement tube and the peristaltic pump DS7070, which sucks the sample or the cleaning medium into the tube. Thanks to the drying unit's 3/2-way valve, you do not need to reconnect any tubes when switching from sample supply or cleaning to drying.

### FULLY AUTOMATIC

The P8000-TF/P8100-TF with flow-through function and drying unit DS7060, a flow-through measurement tube, the peristaltic pump DS7070 and the autosampler AS80 or AS90 allow for a fully automatic operation. The samples on the rotary plate of the autosampler are taken with the suction needle and sucked into the tube by the pump. If desired, the system can be automatically rinsed and dried after each measurement.



Semi-automatic sample supply with P8000-TF and peristaltic pump DS7070

## SEMI-AUTOMATIC SOLUTIONS

In case of low-viscous to slightly viscous samples, it is possible to perform a semi-automatic sample supply and cleaning of the measurement tube using the peristaltic pump DS7070. This means higher efficiency and more safety if aggressive or harmful substances are analysed. It also improves the reproducibility of the measurement results and saves costs as the peristaltic pump sucks only the required sample volume into the measurement tube.

The drying unit DS7060 integrated into the polarimeter allows for a fully automatic drying: It is directly connected to the peristaltic pump, and via its 3/2-way valve, the flow of the sample or cleaning medium and the drying air is regulated. The DS7060 also has a high resistance to chemicals as the parts that come into contact with the sample are made of FFKM and PVDF.

This configuration is especially helpful if

1. the sample throughput is high and/or
2. only a small sample volume is available, for example in case of
  - products from the natural substance synthesis
  - expensive pharmacological agents
  - aromas
  - fragrances
  - perfumes
  - essential oils

The measurement tube can remain in the beam path of the polarimeter during the cleaning. Note: This configuration requires flow-through micro-cuvettes.

## DATA MANAGEMENT WITH KRÜSSLAB

Our KrüssLab software allows you to conveniently control all of your KRÜSS devices, polarimeters as well as refractometers or density meters, on a PC. The software can easily be installed via Windows Explorer. Your measurement device is connected to your local network via Ethernet or directly to your computer and identified via its IP address. The user-friendly interface that you are familiar with from your KRÜSS devices is mirrored on the PC monitor. The KrüssLab software allows you the following:

- a central user management. The user right settings can be transferred to the individual devices
- the remote control of any number of devices
- saving any number of measurements in a database. There is no storage limitation to the last 999 measurements as is the case with our devices. The database can be stored in your company network so that it is included in your data backup
- access to measured data even if the measurement device is switched off
- the selection of measured data with different filters
- the print-out of measured data on any printer
- the backup of device settings



Fully automatic sample supply with P8000-TF, peristaltic pump DS7070 and autosampler AS90

## FULLY AUTOMATIC SOLUTIONS

Working environments involving a high sample throughput require flexible, powerful and robust solutions for a fully automatic execution of the entire process from the sample supply to the cleaning and drying. Our AS80 and AS90 autosamplers meet these high requirements. Together with the peristaltic pump DS7070, they allow for an unsupervised measurement of up to 89 samples.

You can create any number of individual measurement methods and cleaning procedures as well as sampler templates on the polarimeter's user interface. The AS80 and AS90 require very little space, are easy and fast to install and very durable. For both autosamplers, the scope of delivery includes one of two sample plates of different sizes with a corresponding set of polypropylene or glass vials.

### Autosamplers AS80 and AS90

- Also suitable for aggressive and slightly viscous samples
- Can each be fitted with two types of sample plates:  
AS80-T18: 18x 50 ml (42 mm x 43 mm) or  
AS80-T36: 36x 35 ml (28 mm x 65 mm)  
AS90-T53: 53x 16 ml (22 mm x 55 mm) or  
AS90-T89: 89x 6 ml (16 mm x 55 mm)
- Set of polypropylene or glass vials included
- Sample supply via peristaltic pump DS7070
- Integrated rinse port
- Optional design for use with vials with a penetrable membrane
- Suitable for measuring stations using more than one analysis device (requires LIMS software)
- Control via the polarimeter's serial interface (RS-232)

## A STRONG PERFORMANCE PACKAGE

### FLEXIBLE DATA EXPORT

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

### COMPLETE DOCUMENTATION OF MEASURED VALUES

- Complete recording of all measured data as well as system and method settings in a tamper-proof data storage
- Documentation of all measured values of the last 999 measurements with consecutive numbering

### INTELLIGENT USER ADMINISTRATION

- Can be activated or deactivated depending on the requirements
- Two authorisation levels
- Optional setup of user profiles
- Customised settings for different users or work groups

### UNLIMITED NUMBER OF METHODS

- Create any number of methods and analyse each sample using the desired parameters
- Method parameters: scales, temperature, temperature compensation, sample supply, wavelength, tube length, limit values, comment and many more
- Measurement modes: single, continuous or interval measurement
- Predefined scales for optical rotation, specific rotation, sugar content and concentration
- Any number of freely definable scales with conversions based on tables or formulas



## POLARIMETER SOLUTIONS FOR ANY NEED

- P8000/P8100 without temperature control
- P8000-T/P8100-T with water bath temperature control
- P8000-P/P8100-P with Peltier temperature control
- P8000-TF/P8100-TF with water bath temperature control and flow-through function

## COMPLIANCE WITH GLOBAL STANDARDS

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

## INTUITIVE OPERATION

- State-of-the-art touch-screen display
- Secondary scale for displaying a second measured value
- Freely assignable shortcut keys for the most important functions
- Easy, menu-driven adjustment
- A selection of six languages (de, en, es, fr, it, pt)

## FAST, RELIABLE MEASUREMENT

- Measurement up to an optical density of 3.0
- Very short measurement time of approx. 1 s – the fastest polarimeters in the world!
- Measurement with manual measurement time input or optimised measurement time thanks to automatic stability recognition
- Reliable temperature compensation
- Highest accuracy over the entire measurement range

## EASY FILLING AND CLEANING

- Suitable tubes for any type of sample
- Manual, semi-automatic or fully automatic sample supply
- Chemical-resistant materials
- Freely configurable cleaning procedures
- Semi-automatic or fully automatic drying



## THE ECONOMICAL SOLUTION FOR STANDARD MEASUREMENTS – P3000

The polarimeter P3000 is based on the technology of the P8000 series but built for standard applications for which a measurement accuracy of  $\pm 0.01^\circ$  is sufficient and a temperature control can be omitted. The device is, for example, used for quality control in the food industry. It performs its tasks in the record measurement time of approx. 1 s that you are familiar with from our digital polarimeters.

Also in terms of robustness and resistance to chemicals, the P3000 matches the devices of the P8000 series, the user has access to the same variety of measurement tubes, and the process from the sample supply to the cleaning is identical to the process with the P8000 and P8100.

The measured values are optionally displayed as an optical angle of rotation or on the international sugar scale of the ICUMSA. If desired, they can be printed on a serial ASCII printer. Thanks to the reliable temperature compensation, it is possible to take measurements at any temperature; the results will then be converted to the value for 20 °C.

The P3000 is operated via touch-screen and very easy to operate thanks to the reduced functional scope. The user interface is available in two languages – English and German. The P3000 therefore boasts a very solid performance at an attractive price.



P3000 with measurement tube PRG-100-E and temperature probe PRT-E

### RECOMMENDED MEASUREMENT TUBES

- PRG-50-/-100-/-200-E with temperature probe PRT-E/PRT-T (tubes included in the scope of delivery)
- PRM-100-/-200-D

Complete measurement tube catalogue, see page 26.



PRG-100-E

PRG-200-E



PRM-100-D

### P3000

SCALES	Optical rotation [°] Int. sugar scale [°Z]
MEASUREMENT RANGES	$\pm 90^\circ$ $\pm 259^\circ\text{Z}$
ACCURACY	$\pm 0.01^\circ$ $\pm 0.01^\circ\text{Z}$
RESOLUTION	0.01° 0.01°Z
MEASUREMENT PERIOD $\pm 90^\circ$	Approx. 1 s
LIGHT SOURCE	1 LED with filter
WAVELENGTH	589 nm
TEMPERATURE MEASUREMENT	With temperature sensor PT100, integrated into temperature probe PRT-E or PRT-T
TEMPERATURE MEASUREMENT RANGE	0–99.9 °C
TEMPERATURE MEASUREMENT RESOLUTION	0.1 °C
TEMPERATURE MEASUREMENT ACCURACY	$\pm 0.2^\circ\text{C}$
TEMPERATURE CONTROL	Can be retrofitted (requires water bath thermostat PT31, sample chamber bushing P8020 and temperature-controlled measurement tube PRG-100-ET)
TEMPERATURE CONTROL RANGE	
TEMPERATURE CONTROL ACCURACY	

## IDEAL FOR BASIC LAB APPLICATIONS AND TRAINING – P1000-LED

Our polarimeter P1000-LED is used by numerous companies and institutes for basic lab applications and training, for example the experiment on saccharose inversion. It measures the optical rotation according to the half-shade principle, and the measurement results are read through an eyepiece and two noniuses.

The P1000-LED features a sample chamber for tubes with a length of up to 220 mm, a polariser and an analyser. A high-performance LED is used as the light source whose service life is up to 2000 times longer than that of conventional sodium discharge lamps – the device therefore

requires only little maintenance and is very cost-effective. A high-quality metal stand and a pivoted cover make the equipment complete.

The scope of delivery for the P1000-LED includes a 100 mm and a 200 mm measurement tube with a debubbler for the proper filling.

This simple, analogue device can also be validated. The sample chamber is adapted to receive our quartz control plates for the calibration and adjustment.



P1000-LED

### RECOMMENDED MEASUREMENT TUBES

- PRG-100-/-200  
(tubes included in the scope of delivery)
- PRG-50-/-100-M

Complete measurement tube catalogue, see page 26.



PRG-100

PRG-200

### P1000-LED

SCALE	Optical rotation [°]
MEASUREMENT RANGE	2 graduated circles (0–180°)
SCALE DIVISION	1°
READING ACCURACY	0.05° (with nonius)
LIGHT SOURCE	1 LED with filter
WAVELENGTH	589 nm

## TEMPERATURE-CONTROLLED GLASS TUBES

### FOR WATER BATH TEMPERATURE CONTROL

The PRG-100-/-200-ET is an especially robust, externally temperature-controlled and versatile measurement tube. Its glass body makes it chemical-resistant, which is, for example, very important in the pharmaceutical and chemical industry where samples are often analysed in 10% hydrochloric acid. The tube is also unbreakable thanks to its stainless steel jacket. The inlets for the temperature-control medium located at the side allow for an accurate, homogeneous temperature control across the entire tube length and thus the required temperature equilibrium in the sample. The temperature probe inserted into the filling funnel of the tube determines when the target temperature is reached. Since it is inserted directly into the sample, it is available in two versions: in stainless steel (PRT-E) and in PTFE-coated stainless steel (PRT-T).

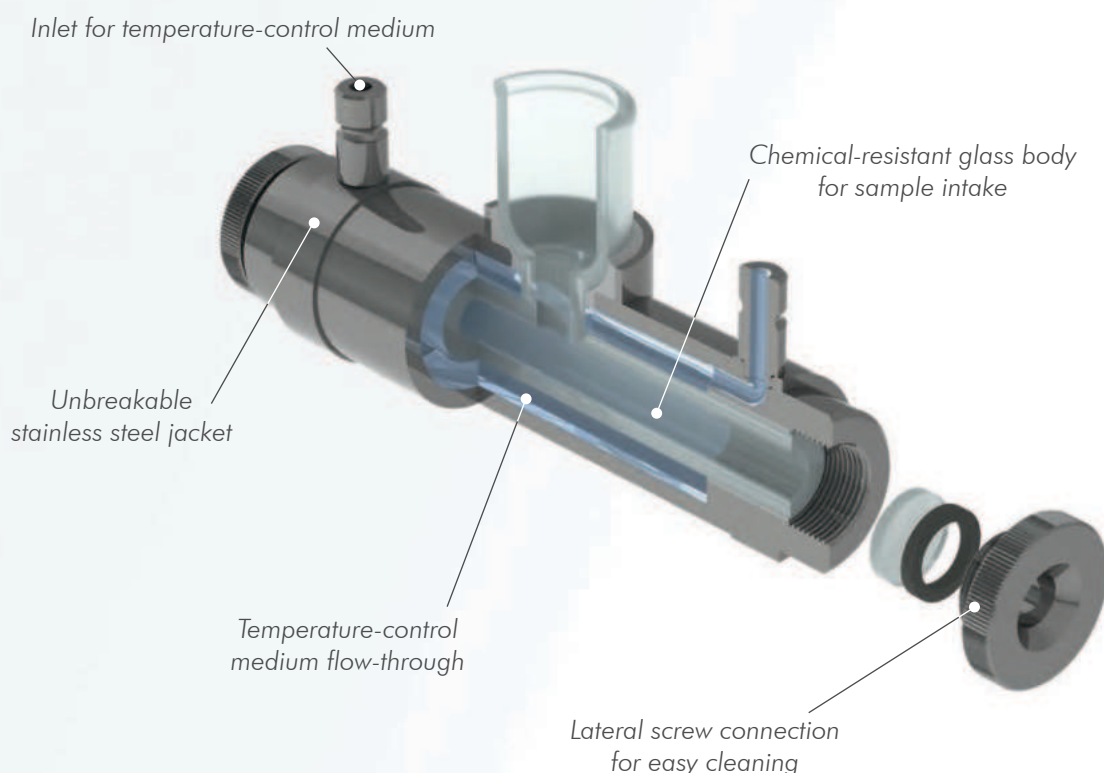
### YOUR ADVANTAGES

- Suitable for all samples, even aggressive chemicals, thanks to glass body
- Easy to fill and degas via the wide filling funnel
- For standards-compliant work available in the lengths 100 mm and 200 mm
- Precise temperature measurement directly inside the sample with temperature probe PRT-E/PRT-T
- Nearly any temperature range, depending on the connected water bath
- Easy to clean by opening the lateral screw connection; cover glasses are also easy to change
- Flexibility thanks to a wide selection of additional temperature-controlled glass tubes for the whole range of applications

### GLASS TUBE WITH STAINLESS STEEL JACKET AND FILLING FUNNEL, TEMPERATURE-CONTROLLED

ORDER NO.	LENGTH IN MM	VOLUME IN ML
PRG-100-ET	100	< 4
PRG-200-ET	200	< 8

### DESIGN OF MEASUREMENT TUBE PRG-100-/-200-ET



## FOR PELTIER TEMPERATURE CONTROL

With the PRG-100-EPT, we have developed a directly temperature-controlled measurement tube for our polarimeters P8000-P and P8100-P which allows high-precision measurements without the use of an additional external device. Three Peltier elements ensure an accurate, fast temperature control in the range between 15 and 40 °C. Thanks to their ideal positioning and insulation, the temperature control is homogeneous over the entire tube length, and there will be no temperature gradient. The temperature sensor PT100 integrated into the tube determines when the target temperature is reached. Just like the PRG-100-/-200-ET, the PRG-100-EPT features a chemical-resistant glass body and an unbreakable stainless steel jacket. That makes it also suitable for aggressive samples and very durable as well.

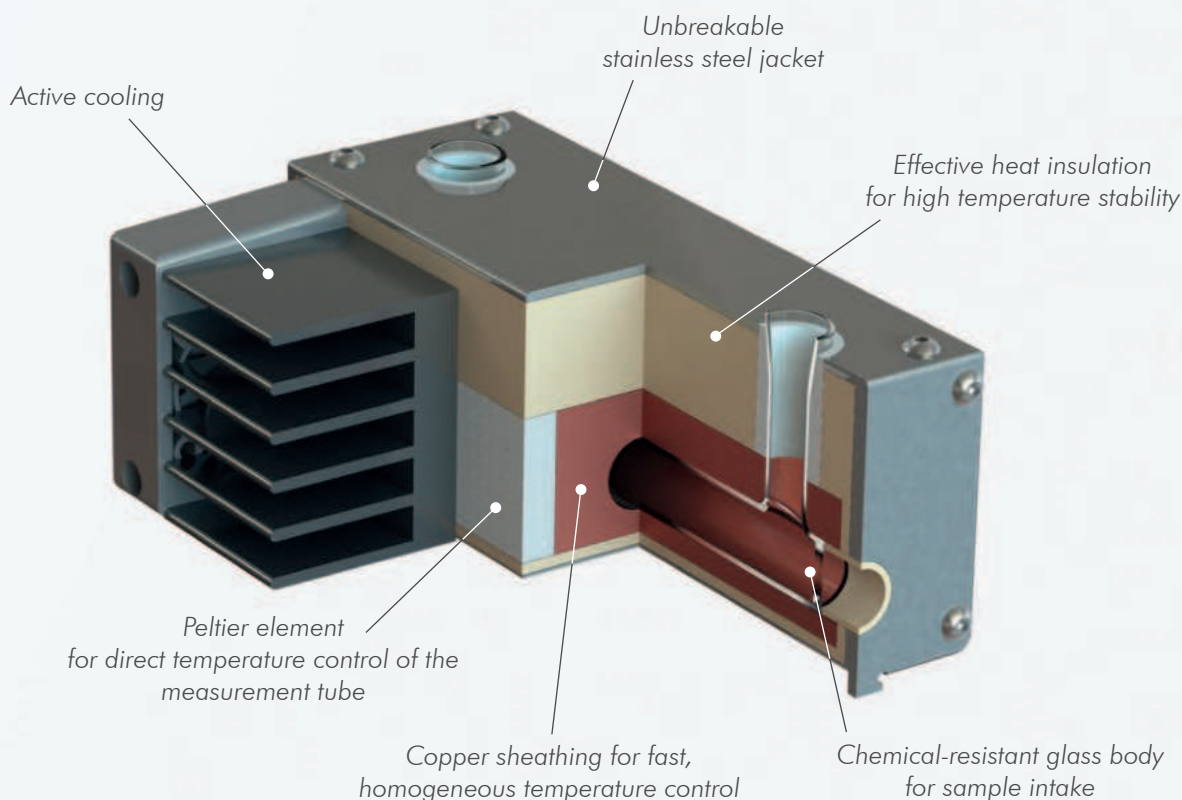
## YOUR ADVANTAGES

- Suitable for all samples, even aggressive chemicals, thanks to glass body
- Easy to fill and degas via the dual opening
- The polarimeter automatically detects the measurement tube thanks to the data memory integrated into the tube in which all relevant control parameters as well as the serial number are stored
- Precise temperature measurement close to the sample with integrated temperature sensor
- Accurate, homogeneous and very fast temperature control
- Recommended in case of frequent temperature changes (for example from 20 °C for Ph. Eur. to 25 °C for USP)

## GLASS TUBE WITH STAINLESS STEEL JACKET AND INTEGRATED PELTIER TEMPERATURE CONTROL

ORDER NO.	LENGTH IN MM	VOLUME IN ML
PRG-100-EPT	100	8

## DESIGN OF MEASUREMENT TUBE PRG-100-EPT



## QUARTZ CONTROL PLATES – FOR A STEADILY HIGH MEASUREMENT ACCURACY

Like all measurement devices, polarimeters should be calibrated and adjusted on a regular basis. Sugar solutions are widely used as a standard for this purpose. Their disadvantage: They always have to be freshly produced for measurements. User errors during the initial weighing are difficult to prevent, and the high temperature dependency of the respective solutions also needs to be taken into account. Optically active quartz is better suited for the calibration and adjustment of polarimeters, which is cut from mono-crystals and installed in stainless steel casings.

We offer you a selection of PTB-certified, OIML-, ICUMSA- and pharmacopoeia-compliant premium quartz control plates. For applications that do not require a PTB certification and where a PTB-traceable factory certificate is sufficient, we can provide the corresponding more inexpensive versions. The following applies to both of our quartz control plate versions: They are highly accurate and last for an indefinite period of time compared to calibration fluids used with other measurement devices. However, they should also be calibrated on a regular basis.



P3000 with premium quartz control plate

### PREMIUM QUARTZ CONTROL PLATES WITH PTB CERTIFICATE

	PQP+17	PQP+34	PQP-17	PQP-34
TYPE	Polarimeter Quartz Professional (PQP)			
ACCURACY	±0.001°			
ANGLE OF ROTATION	+17° (±1°), +50 °Z (±1 °Z)	+34° (±1°), +99 °Z (±1 °Z)	-17° (±1°), -50 °Z (±1 °Z)	-34° (±1°), -99 °Z (±1 °Z)
WAVELENGTH	589 nm			
TEMPERATURE	20 °C			
HOUSING	Stainless steel			
SUITABLE FOR	P8000 series and P3000			

### SIMPLE QUARTZ CONTROL PLATES WITH FACTORY CERTIFICATE, TRACEABLE TO PTB CERTIFICATE

	PQE+17	PQE+34	PQE-17	PQE-34
TYPE	Polarimeter Quartz Economy (PQE)			
ACCURACY	±0.005°			
ANGLE OF ROTATION	+17° (±1°), +50 °Z (±1 °Z)	+34° (±1°), +99 °Z (±1 °Z)	-17° (±1°), -50 °Z (±1 °Z)	-34° (±1°), -99 °Z (±1 °Z)
WAVELENGTH	589 nm			
TEMPERATURE	20 °C			
HOUSING	Stainless steel			
SUITABLE FOR	P3000, limited suitability for P8000			



### YOUR BENEFITS AS AN A.KRÜSS CUSTOMER

- IQ/OQ/PQ by A.KRÜSS Optronic or certified service partners
- Service, maintenance, calibration and adjustment on site
- Calibration and adjustment with certified quartz control plates
- Training and application consulting on site
- Spare parts and accessories directly from the manufacturer
- Customer-specific customisation of devices
- Efficient support thanks to a fast confirmability of the customer's situation based on extensive reports

### CALIBRATION AND ADJUSTMENT OF OUR POLARIMETERS

We recommend to have our polarimeters calibrated and adjusted once a year exclusively by A.KRÜSS Optronic or by one of our certified service partners. Our calibration protocols and certificates are GMP-/GLP-compliant and thus constitute one component of GMP-/GLP-compliant work. For the calibration and adjustment of our polarimeters, we use certified, PTB-traceable quartz control plates (PTB = Physikalisch-Technische Bundesanstalt, The National Metrology Institute of Germany). A calibration and an adjustment are usually completed within a very short period of time so that any interference with the operational processes of our customers is minimised.

### MAINTENANCE OF OUR POLARIMETERS

Our maintenance contracts include the following services:

- response time of no more than 48 hrs and phone support during office hours, for example technical support in case of faults
- maintenance of the devices named in the maintenance contract including functional check and safety inspection, cleaning of all components important for the proper function as well as calibration with certified quartz control plates and, if necessary, adjustment
- provision of the required certified quartz control plates as well as measuring instruments, control and special tools
- firmware updates if they are required for the functionality of the devices
- Should repairs be required within the scope of maintenance work, we will charge for the required spare parts separately. We will grant a one year warranty on replacement and spare parts
- provision of rental equipment to bridge the time required for maintenance, calibrations, adjustments and repairs. Maintenance customers will have preferential rights on rental equipment
- preparation of GMP-/GLP-compliant maintenance and calibration protocols
- warranty extension from 24 to 36 months when registered on our website [www.kruess.com](http://www.kruess.com) within three months after purchase

# APPLICATIONS FOR OUR POLARIMETERS ACCORDING TO INDUSTRIES

## PHARMACEUTICAL INDUSTRY

### Typical applications:

- determination of the concentration of sugar as an ingredient of pharmaceutical agents
- purity control and content determination
- determination of the stereochemical composition and mutarotation
- characterisation of new synthetic substances

### Analysed substances:

sugar, amino acids and proteins, blood sera, vitamins, steroids, antibiotics, hormones, painkillers, amphetamines etc.

### Special requirements:

precision, compliance with standards

### Standards:

pharmacopoeias (USP, BP, JP, Ph. Eur.), GLP

### Recommended polarimeters:

P8000-T, P8000-P

## CHEMICAL INDUSTRY

### Typical applications:

- purity control and concentration determination
- monitoring of chemical processes during the production of optically active substances
- characterisation tests in research laboratories
- reaction kinetic analyses

### Analysed substances:

biopolymers, synthetic polymers, glycerinaldehydes, various hydrocarbons etc.

### Special requirements:

accurate temperature control at different temperatures, variability of the measurement methods, option of interval measurements

### Standards:

AOAC, OIML, ASTM, GLP

### Recommended polarimeters:

P8000-T, P8000-P

## FOOD AND BEVERAGE INDUSTRY

### Typical applications:

- characterisation, quality and purity control of raw materials and end products
- determination of the sugar concentration in beverages and candies
- routine analysis with high sample throughput

### Analysed substances:

sugar, lactic acid, starch (polysaccharide) in food and feed, aromas, lactose in milk, glucose in wine, sugar composition in honey etc.

### Special requirements:

fast measurement with easy handling, robust, acid-resistant measurement tubes

### Standards:

AOAC, OIML, ASTM, GLP

### Recommended polarimeters:

P8000-T, P8000-TF

## SUGAR INDUSTRY

### Typical applications:

- determination of the sugar concentration in raw materials, preliminary, intermediate and end products
- monitoring of chemical processes, e.g. during the manufacture of invert sugar
- purity control

### Analysed substances:

sugar cane, beet pulp, molasses, refined sugar, syrup, invert sugar etc.

### Special requirements:

availability of the international sugar scale, no need for maintenance

### Standards:

ICUMSA, GLP

### Recommended polarimeters:

P8000, P3000

## MANUFACTURERS OF AROMAS, FRAGRANCES AND ESSENTIAL OILS

### Typical applications:

- quality control of raw materials and additives
- monitoring of the production of intermediate and end products

### Analysed substances:

essential oils such as orange, lavender, lime and peppermint oil, glyceric acid, aromas and perfumes for the food and cosmetics industry etc.

### Special requirements:

high resistance to chemicals, availability of micro-cuvettes

### Standards:

Ph. Eur., AOAC, OIML, GLP

### Recommended polarimeter:

P8000-TF

## HOSPITALS AND PHARMACIES

### Typical applications:

- incoming/outgoing goods inspection
- control of pharmaceutical products according to pharmacopoeias

### Analysed substances:

pharmaceutical agents as well as raw materials and additives

### Special requirements:

robustness, easy handling, low price

### Standards:

pharmacopoeias (USP, BP, JP, Ph. Eur.), GLP

### Recommended polarimeters:

P1000-LED, P3000

## TRAINING IN THE INDUSTRY OR AT UNIVERSITIES

### Use for practical exercises and experiments:

- kinetics of the cane sugar inversion
- mutarotation of glucose
- determination of the concentration of polysaccharides through amylolysis

### Special requirements:

easy handling, low price

### Standard:

GLP

### Recommended polarimeters:

P1000-LED, P3000

### P8000 SERIES

- Measurement of optical rotation
- Easy operation thanks to self-explanatory, well-arranged user interface and touch-screen display
- User administration that can be activated or deactivated depending on the requirements, with optional password protection and different user rights
- Easy, menu-driven adjustment
- Any number of measurement methods for monitoring the measurement process according to method, batch, product and/or production line incl. limit value monitoring
- Measurement modes: single, continuous or interval measurement
- Measurement with manual measurement time input or optimised measurement time thanks to automatic stability recognition
- Predefined scales for optical rotation, specific rotation, sugar content and concentration
- Any number of freely definable scales with conversions based on tables or formulas
- Suitable tubes for any type of sample
- Measurement up to an optical density of 3.0
- Manual, semi- or fully automatic sample supply
- Temperature measurement with calibratable and adjustable temperature sensor
- Reliable temperature compensation
- Optionally with efficient water bath or Peltier temperature control
- Very short measurement time of approx. 1 s
- Compact, robust powder-coated steel housing
- Chemical-resistant materials
- High-performance LED with a service life of 100,000 h
- Optional drying unit
- Tamper-proof data storage (saves the last 999 measurements)
- Customised layout of the result reports
- Interfaces for the convenient transfer of measured values (USB, Ethernet, RS-232)
- Compliance with GMP/GLP, 21 CFR Part 11, pharmacopoeias (USP, BP, JP, Ph. Eur.), FDA, ISO, HACCP, OIML, ASTM, ICUMSA, NIST

### P3000

- Measurement of optical rotation
- Easy to use thanks to touch-screen display
- Easy, menu-driven adjustment
- Measured values are displayed as an optical angle of rotation or on the international sugar scale
- Suitable tubes for any type of sample
- Measurement up to an optical density of 3.0
- Temperature measurement with calibratable and adjustable temperature sensor
- Reliable temperature compensation
- Very short measurement time of approx. 1 s
- Compact, robust powder-coated steel housing
- Chemical-resistant materials
- Interface for printing measured values (RS-232)
- Compliance with GMP/GLP, pharmacopoeias (USP, BP, JP, Ph. Eur.), FDA, ISO, HACCP, OIML, ASTM, ICUMSA, NIST

### P1000-LED

- Measurement of optical rotation according to the half-shade principle
- Manual adjustment on the scale
- Measurement results are read through an eyepiece and two noniuses
- Tube chamber for tubes with a length of up to 220 mm
- High-performance LED with a service life of 100,000 h
- Robust cast aluminium housing
- Includes two measurement tubes with a debubbler
- Low-maintenance, cost-effective solution

## TECHNICAL DATA

	P8000	P8100	P8000-T/-TF	P8100-T/-TF
SCALES	Optical rotation [°] Int. sugar scale [°Z] Concentration [g/100 ml] Spec. rotation User-defined		Optical rotation [°] Int. sugar scale [°Z] Concentration [g/100 ml] Spec. rotation User-defined	
MEASUREMENT RANGES	±90° ±259 °Z 0–99.9 g/100 ml		±90° ±259 °Z 0–99.9 g/100 ml	
ACCURACY	±0.003° ±0.01 °Z ±0.5 g/100 ml	±0.002° ±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
RESOLUTION	0.001° 0.01 °Z 0.1 g/100 ml		0.001° 0.01 °Z 0.1 g/100 ml	
MEASUREMENT PERIOD ±90°	Approx. 1 s		Approx. 1 s	
LIGHT SOURCE	1 LED with filter		1 LED with filter	
WAVELENGTH	589 nm		589 nm	
SAMPLE PERMEABILITY	> 0.1 % (OD3)		> 0.1 % (OD3)	
MAX. TUBE LENGTH	220 mm		220 mm	
TEMPERATURE MEASUREMENT	With temperature sensor PT100, integrated into temperature probe PRT-E or PRT-T		With temperature sensor PT100, integrated into temperature probe PRT-E or PRT-T	
TEMPERATURE MEASUREMENT RANGE	0–99.9 °C		0–99.9 °C	
TEMPERATURE MEASUREMENT RESOLUTION	0.1 °C		0.1 °C	
TEMPERATURE MEASUREMENT ACCURACY	±0.2 °C		±0.2 °C	
TEMPERATURE CONTROL	Can be retrofitted (requires water bath thermostat PT31, sample chamber bushing P8020 and temperature-controlled measurement tube PRG-100- ET)		With water bath thermostat PT31 (requires temperature-controlled measurement tube such as PRG-100-ET)	
TEMPERATURE CONTROL RANGE			8–40 °C	
TEMPERATURE CONTROL ACCURACY			±0.2 °C	
METHODS	A practically unlimited number of methods can be set			
ADJUSTMENT	Automatic (menu-driven)			
HOUSING	Steel, powder-coated			
CONTROL	5,7" touch-screen, 640 x 480 pixels			
INTERFACES	1x USB, 1x RS-232, 1x Ethernet			
OPERATING VOLTAGE	110–250 V, 50/60 Hz			
POWER CONSUMPTION (MEASUREMENT OPERATION)	35 W		35 W	
POWER CONSUMPTION (MAX.)	50 W		50 W	
DIMENSIONS (W X H X D)	645 mm x 200 mm x 360 mm			
WEIGHT	28 kg			

P8000-P		P8100-P	P3000		P1000-LED
Optical rotation [°] Int. sugar scale [°Z] Concentration [g/100 ml] Spec. rotation User-defined			Optical rotation [°] Int. sugar scale [°Z]	SCALE	Optical rotation [°]
±90° ±259 °Z 0–99.9 g/100 ml			±90° ±259 °Z	MEASUREMENT RANGE	2 graduated circles (0–180°)
±0.003° ±0.01 °Z ±0.5 g/100 ml	±0.002° ±0.01 °Z ±0.5 g/100 ml	±0.01° ±0.01 °Z		SCALE DIVISION	1°
0.001° 0.01 °Z 0.1 g/100 ml		0.01° 0.01 °Z		READING ACCURACY	0.05° (with nonius)
Approx. 1 s			Approx. 1 s	LIGHT SOURCE	1 LED with filter
1 LED with filter			1 LED with filter	WAVELENGTH	589 nm
589 nm			589 nm	MAX. TUBE LENGTH	220 mm
> 0.1 % (OD3)			> 0.1 % (OD3)	ADJUSTMENT	Manual adjustment on the scale
220 mm			220 mm	HOUSING	Cast aluminium
With temperature sensor PT100, integrated into measurement tube PRG-100-EPT			With temperature sensor PT100, integrated into temperature probe PRT-E or PRT-T	OPERATING VOLTAGE	110–250 V, 50/60 Hz
0–99.9 °C			0–99.9 °C	POWER CONSUMPTION (MEASUREMENT OPERATION)	15 W
0.1 °C			0.1 °C	POWER CONSUMPTION (MAX.)	15 W
±0.2 °C			±0.2 °C	DIMENSIONS (W X H X D)	140 mm x 330 mm x 500 mm
With measurement tube PRG-100-EPT with 3 integrated Peltier elements			Can be retrofitted (requires water bath thermostat PT31, sample chamber bushing P8020 and temperature-controlled measurement tube PRG-100-ET)	WEIGHT	4.3 kg
15–40 °C					
±0.2 °C					
			N/a		
			Automatic (menu-driven)		
			Steel, powder-coated		
			3,5" touch-screen, 320 x 240 pixels		
			1x RS-232		
			110–250 V, 50/60 Hz		
65 W			30 W		
85 W			40 W		
			645 mm x 200 mm x 360 mm		
			28 kg		

## OVERVIEW OF POLARIMETERS, ACCESSORIES AND CONSUMABLES

ORDER NUMBER	POLARIMETERS
P8000	Digital polarimeter without temperature control and with a measurement accuracy of up to $\pm 0.003^\circ$
P8100	Digital polarimeter without temperature control and with a measurement accuracy of up to $\pm 0.002^\circ$
P8000-T	Digital polarimeter with water bath temperature control and a measurement accuracy of up to $\pm 0.003^\circ$
P8100-T	Digital polarimeter with water bath temperature control and a measurement accuracy of up to $\pm 0.002^\circ$
P8000-TF	Digital polarimeter with water bath temperature control, flow-through function and a measurement accuracy of up to $\pm 0.003^\circ$
P8100-TF	Digital polarimeter with water bath temperature control, flow-through function and a measurement accuracy of up to $\pm 0.002^\circ$
P8000-P	Digital polarimeter with Peltier temperature control and a measurement accuracy of up to $\pm 0.003^\circ$
P8100-P	Digital polarimeter with Peltier temperature control and a measurement accuracy of up to $\pm 0.002^\circ$
P3000	Digital polarimeter without temperature control and with a measurement accuracy of up to $\pm 0.01^\circ$
P1000-LED	Analogue polarimeter with a reading accuracy of up to $0.05^\circ$

ORDER NUMBER	GLASS MEASUREMENT TUBES
PRG-100	Glass tube, 100 mm, 8 ml
PRG-200	Glass tube, 200 mm, 15 ml
PRG-50-E	Glass tube with filling funnel, 50 mm, 3 ml
PRG-100-E	Glass tube with filling funnel, 100 mm, 6 ml
PRG-200-E	Glass tube with filling funnel, 200 mm, 12 ml
PRG-100-ET	Glass tube with stainless steel jacket and filling funnel, temperature-controlled, 100 mm, < 4 ml
PRG-200-ET	Glass tube with stainless steel jacket and filling funnel, temperature-controlled, 200 mm, < 8 ml
PRG-100-EPT	Glass tube with stainless steel jacket, inlet and outlet as well as integrated Peltier temperature control and temperature measurement, 100 mm, 8 ml
PRG-50-M	Micro glass tube, 50 mm, 0.55 ml
PRG-100-M	Micro glass tube, 100 mm, 1.1 ml
PRG-50-MT	Micro glass tube, temperature-controlled, 50 mm, 0.4 ml
PRG-100-D	Flow-through glass tube, 100 mm, 8.7 ml
PRG-100-DT	Flow-through micro glass tube, temperature-controlled, 100 mm, 0.7 ml

ORDER NUMBER	STAINLESS STEEL MEASUREMENT TUBES
PRM-200-ET	Stainless steel tube with filling funnel, temperature-controlled, 200 mm, 17 ml
PRM-100-D	Stainless steel flow-through tube with filling funnel and overflow pipe, 100 mm, 12 ml
PRM-200-D	Stainless steel flow-through tube with filling funnel and overflow pipe, 200 mm, 17 ml
PRM-100-DT	Stainless steel flow-through tube with filling funnel and overflow pipe, temperature-controlled, 100 mm, 12 ml
PRM-200-DT	Stainless steel flow-through tube with filling funnel and overflow pipe, temperature-controlled, 200 mm, 17 ml
PRM-100-DTT	Stainless steel flow-through tube with filling funnel and overflow pipe, temperature-controlled, with temperature probe, 100 mm, 12 ml
PRM-200-DTT	Stainless steel flow-through tube with filling funnel and overflow pipe, temperature-controlled, with temperature probe, 200 mm, 17 ml
PRM-50-SD	Stainless steel flow-through tube with hose connections, 50 mm, 10 ml
PRM-100-SD	Stainless steel flow-through tube with hose connections, 100 mm, 12 ml
PRM-200-SD	Stainless steel flow-through tube with hose connections, 200 mm, 17 ml
PRM-10-SDM	Stainless steel flow-through micro tube with hose connections, 10 mm, 1.5 ml
PRM-50-SDM	Stainless steel flow-through micro tube with hose connections, 50 mm, 1 ml
PRM-100-SDM	Stainless steel flow-through micro tube with hose connections, 100 mm, 0.5 ml
PRM-100-SDT	Stainless steel flow-through tube with hose connections, temperature-controlled, 100 mm, 12 ml
PRM-200-SDT	Stainless steel flow-through tube with hose connections, temperature-controlled, 200 mm, 17 ml
PRM-25-SDTM	Stainless steel flow-through micro tube with hose connections, temperature-controlled, 25 mm, 0.5 ml
PRM-50-SDTM	Stainless steel flow-through micro tube with hose connections, temperature-controlled, 50 mm, 1 ml
PRM-100-SDTM	Stainless steel flow-through micro tube with Luer connections, temperature-controlled, 100 mm, 0.5 ml
PRM-200-SDTM	Stainless steel flow-through micro tube with Luer connections, temperature-controlled, 200 mm, 2.5 ml
PRM-100-SDTT	Stainless steel flow-through tube with hose connections, temperature-controlled, with temperature probe, 100 mm, 12 ml
PRM-200-SDTT	Stainless steel flow-through tube with hose connections, temperature-controlled, with temperature probe, 200 mm, 17 ml

E with filling funnel  
 ET with filling funnel, temperature-controlled  
 EPT with integrated Peltier temperature control and temperature measurement  
 M micro tube  
 MT micro tube, temperature-controlled  
 D flow-through tube with filling funnel

DT flow-through tube with filling funnel, temperature-controlled  
 DTT flow-through tube with filling funnel, temperature-controlled and with temperature probe  
 SD flow-through tube with hose connections  
 SDM flow-through micro tube with hose connections  
 SDT flow-through tube with hose connections, temperature-controlled  
 SDTM flow-through micro tube with hose connections, temperature-controlled  
 SDTT flow-through tube with hose connections, temperature-controlled and with temperature probe

ORDER NUMBER	QUARTZ CONTROL PLATES
PQE+17	Factory-certified economy quartz control plate for P3000 (to a limited extent P8000 series); accuracy: $\pm 0.005^\circ$ , angle of rotation: $+17^\circ (\pm 1^\circ)$ , $+50^\circ \text{Z} (\pm 1^\circ \text{Z})$ at $20^\circ \text{C}$
PQE+34	Factory-certified economy quartz control plate for P3000 (to a limited extent P8000 series); accuracy: $\pm 0.005^\circ$ , angle of rotation: $+34^\circ (\pm 1^\circ)$ , $+99^\circ \text{Z} (\pm 1^\circ \text{Z})$ at $20^\circ \text{C}$
PQE-17	Factory-certified economy quartz control plate for P3000 (to a limited extent P8000 series); accuracy: $\pm 0.005^\circ$ , angle of rotation: $-17^\circ (\pm 1^\circ)$ , $-50^\circ \text{Z} (\pm 1^\circ \text{Z})$ at $20^\circ \text{C}$
PQE-34	Factory-certified economy quartz control plate for P3000 (to a limited extent P8000 series); accuracy: $\pm 0.005^\circ$ , angle of rotation: $-34^\circ (\pm 1^\circ)$ , $-99^\circ \text{Z} (\pm 1^\circ \text{Z})$ at $20^\circ \text{C}$
PQP+17	PTB-certified premium quartz control plate for P8000 series and P3000; accuracy: $\pm 0.001^\circ$ , angle of rotation: $+17^\circ (\pm 1^\circ)$ , $+50^\circ \text{Z} (\pm 1^\circ \text{Z})$ at $20^\circ \text{C}$
PQP+34	PTB-certified premium quartz control plate for P8000 series and P3000; accuracy: $\pm 0.001^\circ$ , angle of rotation: $+34^\circ (\pm 1^\circ)$ , $+99^\circ \text{Z} (\pm 1^\circ \text{Z})$ at $20^\circ \text{C}$
PQP-17	PTB-certified premium quartz control plate for P8000 series and P3000; accuracy: $\pm 0.001^\circ$ , angle of rotation: $-17^\circ (\pm 1^\circ)$ , $-50^\circ \text{Z} (\pm 1^\circ \text{Z})$ at $20^\circ \text{C}$
PQP-34	PTB-certified premium quartz control plate for P8000 series and P3000; accuracy: $\pm 0.001^\circ$ , angle of rotation: $-34^\circ (\pm 1^\circ)$ , $-99^\circ \text{Z} (\pm 1^\circ \text{Z})$ at $20^\circ \text{C}$

ORDER NUMBER	ACCESSORIES AND CONSUMABLES
PT31	Water bath thermostat; adjustment range: $8\text{--}40^\circ \text{C}$ ; interface: RS-232; power supply: $100\text{--}240 \text{ V}$ , $50/60 \text{ Hz}$ , $60 \text{ W}$ ; dimensions (w x h x d): $90 \text{ mm} \times 210 \text{ mm} \times 140 \text{ mm}$
PT31-DECKEL	Cover for water bath thermostat PT31
PT31-NETZTEIL	Mains adaptor for water bath thermostat PT31 with EU connector
P8001	Set for the connection of water bath thermostat PT31 to polarimeter P8000-T/-TF, consisting of: 2 silicone tubes (300 mm); 2 tube connections, straight
P8002	Set for the connection of measurement tubes (old version), consisting of: 2 silicone tubes (250 mm); 2 tube connections, straight
P8003	Set for the connection of measurement tubes (new version), consisting of: 2 silicone tubes (100 mm); 2 tube connections, angled
PRT-E	Temperature probe made of stainless steel with sensor PT100
PRT-T	Temperature probe made of stainless steel, PTFE-coated, with sensor PT100
PRT-P	Adaptor plug for the connection of temperature probe PRT-E/PRT-T to polarimeter P8000-P/P8100-P
DS7009	Luer syringe, 2 ml, 10 pieces
DS7010	Luer syringe, 10 ml, 10 pieces
DS7019	PE waste container with lid, 600 ml
DS7060	Drying unit with 3/2-way valve
DS7070	Peristaltic pump
DS7071	Tube set for peristaltic pump DS7070, consisting of: TPE pump tube (105 mm), 5 pieces; PTFE tube connection UNF, 2 pieces
DS7072	Tube set for peristaltic pump DS7070, consisting of: TPE pump tube (105 mm), 5 pieces; PTFE tube connection (olive), 2 pieces
AS80	Autosampler for 18 or 36 samples, including: sample plate $18 \times 50 \text{ ml}$ ( $42 \text{ mm} \times 43 \text{ mm}$ ) or $36 \times 35 \text{ ml}$ ( $28 \text{ mm} \times 65 \text{ mm}$ ) set polypropylene vials (50 ml) or glass vials (35 ml); other vials on request PTFE connecting tube
AS90	Autosampler for 53 or 89 samples, including: sample plate $53 \times 16 \text{ ml}$ ( $22 \text{ mm} \times 55 \text{ mm}$ ) or $89 \times 6 \text{ ml}$ ( $16 \text{ mm} \times 55 \text{ mm}$ ) set polypropylene vials (16 or 6 ml); other vials on request PTFE connecting tube
AS80-T18	Sample plate $18 \times 50 \text{ ml}$ ( $42 \text{ mm} \times 43 \text{ mm}$ )
AS80-T36	Sample plate $36 \times 35 \text{ ml}$ ( $28 \text{ mm} \times 65 \text{ mm}$ )
AS90-T53	Sample plate $53 \times 16 \text{ ml}$ ( $22 \text{ mm} \times 55 \text{ mm}$ )
AS90-T89	Sample plate $89 \times 6 \text{ ml}$ ( $16 \text{ mm} \times 55 \text{ mm}$ )
BC876	Barcode scanner
KB876DE	Mini keyboard with German layout
KB876EN	Mini keyboard with English layout
KB876F	Protective cover for mini keyboard KB876DE/KB876EN

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