

Polarimeters

- P8000 Series
- PS8000 Series
- P8000-PT Series
- P3000 Series
- P1000-LED
- Polarimeter Accessories



What is polarimetry?

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".

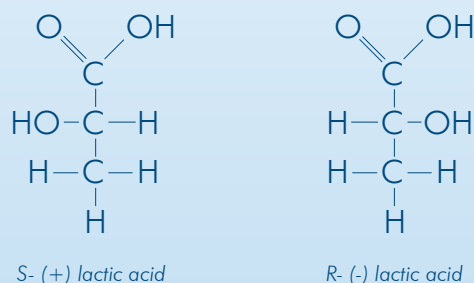
The two later terms describe the behavior of the wave mentioned above during the passage through an optically active substance. Depending on the molecular structure of the substance, the direction of the inclination of the wave is towards the right or towards the left.

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.

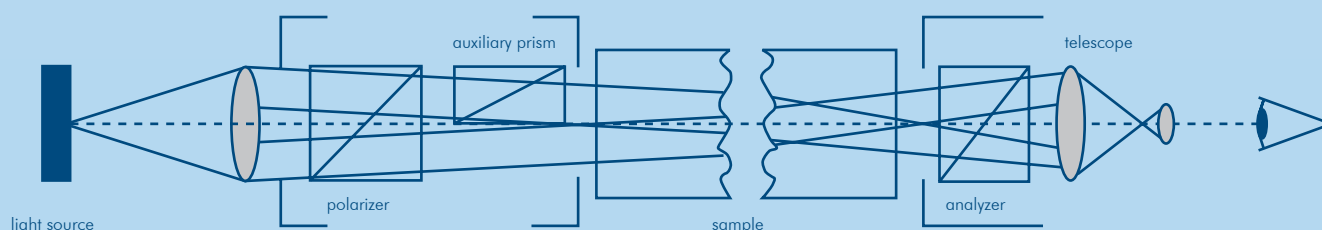
The following two enantiomers of lactic acid are an example of such a molecule:



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



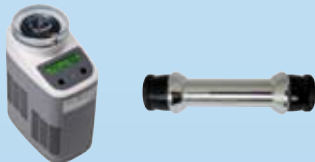
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P8000 Series | Automatic Polarimeters

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

This patented development reduces the measuring time to one second irrespective of the rotation angle of the sample, which, compared to conventional polarimeters, saves a lot of time.

All adjustments on the device are made via an easy to use touchscreen.

In addition, an easy to understand help display can be called up at any time.

With only very little 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. This allows the connection of temperature-controlled gauge heads to achieve high-precision measuring results.

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. 21 CFR Part 11 software is also available for the device. 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).

A self-explanatory touch screen with clear menu navigation and data output and USB/RS-232 interfaces fulfil all demands.



The features at a glance

- Automatic, digital polarimeter with a high accuracy and resolution
- Reliable, robust and easy to operate
- Reduces the measuring time to 1 second irrespective of the angle of the sample
- Menu-driven touchscreen operation
- Sample parameters can be customized
- Ideal for individual, continuous analyses
- RS-232, USB and Ethernet interfaces for PC and printer
- Simple output of all important measuring data including date and time
- Low noise level

Range of applications

Pharmaceutical industry

- Monitoring chemical processes
- Purity control and determination of concentrations
- Examination of substances listed in the German Pharmacopoeia

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

A.KRÜSS Optronic GmbH P8000 18.08.08 12:14 ?

5

(M)

23.457

20.0 °C Opt. Rotation °

Einstellungen

| | | | | |
|----------|---------------|--------|----------|--------------------|
| Benutzer | Administrator | System | 200.0 mm | λ 589.0 nm |
| Methode | 1 Method 001 | Temp | Keine | |
| Modus | Einzelmessung | | | |

Modus Methoden System Ergebnisse Benutzer

Methoden ?

| Nr. | Name |
|-----|------------|
| 002 | Method 002 |

Ändern

Kommentar

Ändern

Parameter

Solltemp = Keine
Einheit = Opt. Rotation °

Abbrechen Löschen Neu Bearbeiten Ok

Benutzer Einstellungen – Schulz ?

Login ID: C

Passwort: *****

Recht: User

Gültig bis: 12.04.2007 00:00

Abbrechen Ok

Main measuring display

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

- Reading [$^{\circ}$, $^{\circ}Z$, g/ml], optical rotation, 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 [$^{\circ}$, $^{\circ}Z$, g/ml]
- Specific rotation

Help monitor

The symbols used in the main measuring display are explained on the help monitor.

| | 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/100ml | ±0.003° ±0.01 °Z ±0.5 g/100ml | ±0.002° ±0.01 °Z ±0.5 g/100ml | ±0.002° ±0.01 °Z ±0.5 g/100ml |
| 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 589 nm | 1 LED with filter 589 nm | 1 LED with filter 589 nm | 1 LED with filter 589 nm |
| 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 temperature sensor PT100 required | Special tube with temperature sensor PT100 required | Special tube with temperature sensor PT100 required | Special tube with temperature sensor PT100 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 |
| Thermostat | – | Peltier thermostat with water | – | Peltier thermostat with water |
| 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 5.7 " 320x240 pixel color display | LCD 5.7 " 320x240 pixel color display | LCD 5.7 " 320x240 pixel color display | LCD 5.7 " 320x240 pixel color display |
| Operation | Touchscreen | Touchscreen | Touchscreen | Touchscreen |
| Measured data storage | 999 measurements | 999 measurements | 999 measurements | 999 measurements |
| Interfaces | RS-232 USB Ethernet | RS-232 USB Ethernet | RS-232 USB Ethernet | RS-232 USB Ethernet |
| Operating voltage | 100 V...250 V~ 50/60 Hz | 100 V...250 V~ 50/60 Hz | 100 V...250 V~ 50/60 Hz | 100 V...250 V~ 50/60 Hz |

PS8000 Series | Automatic Sugar Polarimeters

The PS8000 is a precise and fast polarimeter especially designed for the application in the sugar industry. The operation and the measuring functions are same as those for the P8000. The measuring values are displayed in the international sugar scale. The rotation angle is shown as additional information. The display of the international sugar scale is possible for different initial weights: except for the standard unit of 26 g, initial weights of 13 g and 6.5 g can also be selected.



Technical data | PS8000 and PS8000-T

| | PS8000 | PS8000-T |
|--|---|---|
| Measuring method | International sugar scale | International sugar scale |
| Measuring range | ±250 °Z | ±250 °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 | One fixed wavelength | One fixed wavelength |
| Connection for temperature sensor | Special tube with temperature sensor PT100 requires | Special tube with temperature sensor PT100 requires |
| 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 |

| | PS8000 | PS8000-T |
|--|---|---|
| Temperature reading point | Tube | Tube |
| Thermostat | – | Peltier Thermostat with water |
| Range of temperature 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 5.7" 320x240 Pixel color display | LCD 5.7" 320x240 Pixel color display |
| Operation | Touchscreen | Touchscreen |
| Measured data storage | 999 measurements | 999 measurements |
| Interfaces | RS-232 USB Ethernet | RS-232 USB Ethernet |
| Operating voltage | 100...250 V 50/60 Hz | 100...250 V 50/60 Hz |

P8000-PT Series | Autom. Polarimeter with Peltier Temperature control

Based on the reliable P8000 series, A. Krüss Optronic has developed a polarimeter with electronic temperature control.

This makes it possible to omit the water bath thermostat that is otherwise required for performing 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-Serie – approx. one second. The P8000 series is the fastest polarimeter in the world!



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

| | |
|------------------------------|---------------------------------------|
| Sensitivity | min 0.1 % (OD3) |
| Calibration | Automatic (menu-driven) |
| Display | LCD 5.7" 320x240 Pixel, color display |
| Operation | Touchscreen |
| Measured data storage | 999 measurements |
| Interfaces | RS-232 USB Ethernet |
| Operating voltage | 100 V...250 V~, 50/60 Hz |

| | |
|--|-----------------------------------|
| Peltier Temperature control | Special tube PRM-100-PT necessary |
| Temperature measurement | 0...99.9 °C |
| Temperature resolution | 0.1 °C |
| Temperature accuracy | ±0.2 °C |
| Temperature reading point | Tube |
| Range of temperature control | 15...40.0 °C |
| Accuracy of temperature control | ±0.2 °C |

P3000 Series | Automatic Polarimeters

The P3000 is a very easy to operate polarimeter for the fully automatic measurement of the optical rotation. The measurement value is automatically shown directly after the sample has been inserted and output in angular degrees. The delivery of the polarimeter includes accessories and PC software for the operation and storage.



Range of applications

Pharmaceutical industry

- Monitoring chemical processes
- Purity control and determination of concentrations
- Examination of substances listed in the German Pharmacopoeia

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

Technical data

| | P3001RS | P3002RS |
|---|-----------------------------------|-----------------|
| Measuring range | $\pm 45^\circ$ | $\pm 45^\circ$ |
| Resolution | 0.005° | 0.001° |
| Accuracy | $< 0.01^\circ$ | $< 0.004^\circ$ |
| Measurement duration | 1°/s | 1°/s |
| Minimum light transfer of sample | 10 % | 1 % |
| Light source | Sodium lamp (589 nm) | |
| Power supply | 230 or 110 V, AC, 50/60 Hz, 100 W | |

Scope of delivery

- Polarimeter tubes 100 and 200 mm
- Spare sodium lamp 589 nm
- Small glass cover plates for polarimeter tubes

P1000-LED | Manual Lab Polarimeter

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.

It is equipped with a swivel-mounted cover, polarizer and analyzer and the delivery includes accessories.



Technical data

| | |
|-------------------|-------------------------|
| Measuring range | 2 semi-circles (0-180°) |
| Glass tubes | 100 and 200 mm |
| Scale division | 1° |
| Reading precision | 0.05° (with nonius) |
| Light source | LED |

Scope of delivery

- Polarimeter tubes 100 and 200 mm

New LED light: *saves current and lasts longer*

Polarimeter Accessories

Polarimeter tubes made of glass

Micro glass tube for small sample volumes.
No temperature control

| Article No | Length in mm | Volume in ccm |
|------------|--------------|---------------|
| PRG-50-M | 50 | 0.55 |
| PRG-100-M | 100 | 11.00 |



Glass tube with bubble trap for single measurements.
No temperature control

| Article No | Length in mm | Volume in ccm |
|------------|--------------|---------------|
| PRG-100 | 100 | 8.00 |
| PRG-200 | 200 | 15.00 |



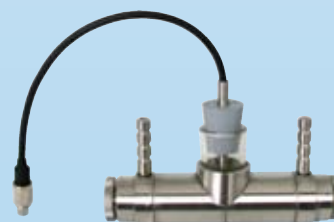
Glass tube with funnel.
No temperature control

| Article No | Length in mm | Volume in ccm |
|------------|--------------|---------------|
| PRG-50-E | 50 | 3.00 |
| PRG-100-E | 100 | 6.00 |
| PRG-200-E | 200 | 12.00 |



Glass tube with funnel and temperature sensor.
With temperature control

| Article No | Length in mm | Volume in ccm |
|-------------|--------------|---------------|
| PRG-100-ETT | 100 | 6.00 |
| PRG-200-ETT | 200 | 12.00 |



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

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

Polarimeter tubes made of stainless steel

Stainless steel micro flow-through tube with hose connectors.
No temperature control

| Article-No | Length in mm | Volume in ccm |
|------------|--------------|---------------|
| PRM-10-SDM | 10 | 1.50 |



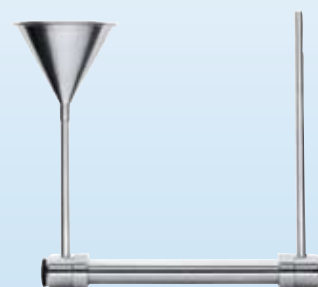
Stainless steel polarimeter tube with funnel.
With temperature control

| Article No | Length in mm | Volume in ccm |
|------------|--------------|---------------|
| PRM-100-ET | 100 | 12.00 |
| PRM-200-ET | 200 | 17.00 |



Stainless steel flow-through tube with funnel and overflow pipe.
No temperature control

| Article No | Length in mm | Volume in ccm |
|------------|--------------|---------------|
| PRM-100-D | 100 | 12.00 |
| PRM-200-D | 200 | 17.00 |



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

| Article No | Length in mm | Volume in ccm |
|------------|--------------|---------------|
| PRM-100-DT | 100 | 12.00 |
| PRM-200-DT | 200 | 17.00 |



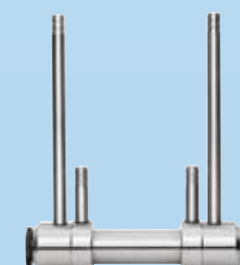
Stainless steel flow-through tube with hose connectors.
No temperature control

| Article No | Length in mm | Volume in ccm |
|------------|--------------|---------------|
| PRM-50-SD | 50 | 10.00 |
| PRM-100-SD | 100 | 12.00 |
| PRM-200-SD | 200 | 17.00 |



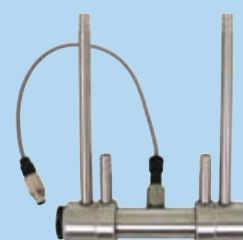
Stainless steel flow-through tube with hose connectors.
With temperature control

| Article No | Length in mm | Volume in ccm |
|-------------|--------------|---------------|
| PRM-10-SDT | 100 | 12.00 |
| PRM-200-SDT | 200 | 17.00 |



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

| Article No | Length in mm | Volume in ccm |
|--------------|--------------|---------------|
| PRM-100-SDTT | 100 | 12.00 |
| PRM-200-SDTT | 200 | 17.00 |



Quartz Control Plates



| Economy quartz control plates with manufacturer's 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) |

CBM910 | printer



24 characters regular paper printer for digital refractometer from the DR6000 series and the digital Abbe refractometer AR2008 as well as for our digital polarimeters from the P8000 series.

Sodium Lamps

P1000-300
Spare sodium lamp

Glass Cover Plate

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

PT31 | Peltier Thermostat



The electronic water bath thermostat with Peltier element is a versatile and powerful device used to control the temperature of refractometers, polarimeters etc.

It is extremely robust, compact and easy to operate. Saves space in the lab due to its small size.

| Specifications PT31 | |
|----------------------|---------------------------------|
| Resolution | 0.1 °C |
| Heating output | 30 W |
| Cooling efficiency | 15 W |
| Power supply | 115-230 ~ |
| Pump pressure | 2000 Pa |
| Pump capacity | 20 l/h |
| Temperature | 8-40 °C (continuously variable) |
| Temperature accuracy | ±0.2 °C |
| Dimensions | L/B/H 140 x 80 x 210 mm |
| Weight | 1.5 kg |

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