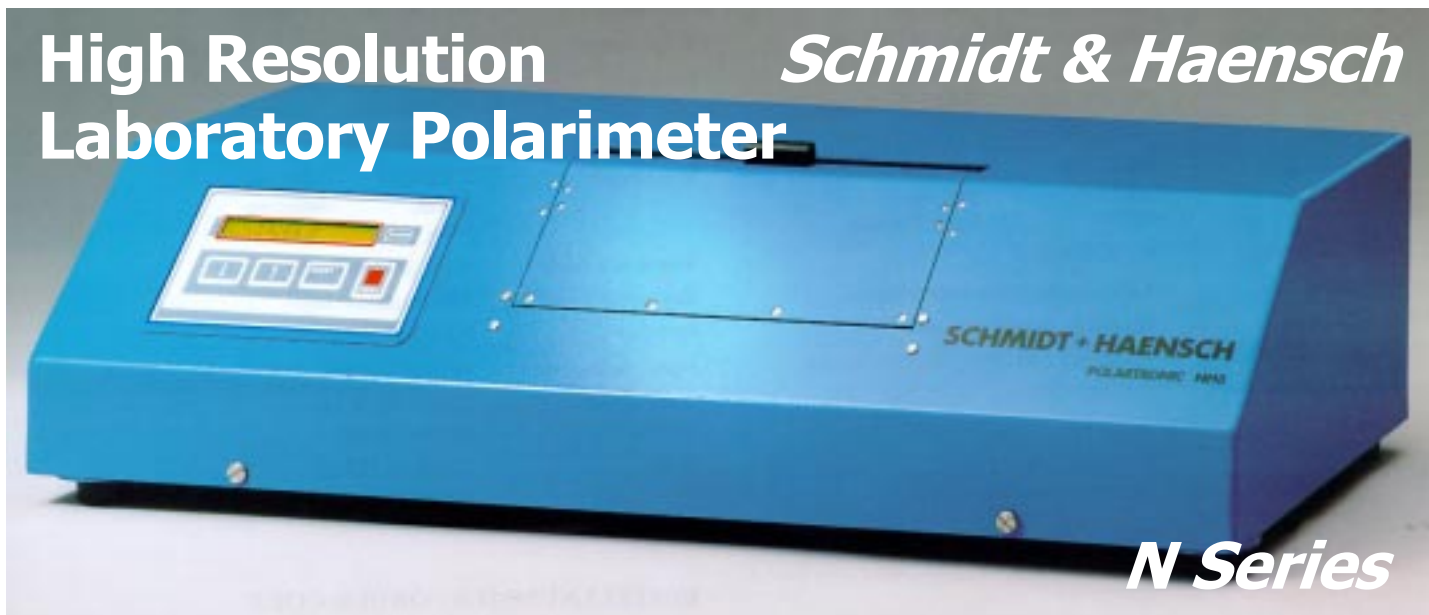


High Resolution Laboratory Polarimeter

Schmidt & Haensch



Digital Polarimeter

The N series full circle automatic polarimeters are ideal for routine laboratory operations and quality control. The high quality optical design is similar to our higher resolution instruments but the electronics and display have been simplified to produce a reliable easy to use polarimeter with outstanding price/performance value. Like the higher resolution units, the N series use a rotating analyzer linked to an optical encoder to determine the optical rotation of the sample. The resolution is constant at 0.01 degrees throughout the +/- 85 degree range and the response time is much faster than similar instruments.



Quality optics, precision engineering

The N Series polarimeters are designed and manufactured to exacting engineering specifications by Schmidt and Haensch.

Schmidt and Haensch has been in polarimetry for more than a century and is the originator of most of the important innovations in the field. You can still see 19th century S+H instruments on display in museums and private collections (most recently at the Pittcon 50 year celebration)

This tradition of quality and innovation is evident in today's modern digital designs. The N series instruments are constructed around a steel optical bench chassis. The overall construction is very robust and includes a steel outer case. The optical components are the best available. The result is stability, accuracy, speed and repeatability in a range of polarimeters built for service and durability.

Value Features of the N Series

- High performance - 0.01 degree resolution across the range - at an economical price.
- Patented direct linking of optical encoder gives high accuracy, repeatability and speed of measurement.
- Continuous automatic measurement of optical rotation, no need to zero between measurements.
- Bright LCD display - single line 16 characters.
- Displays Levorotory samples .
- RS232 data port standard.
- Program and display up to 4 custom scales.
- Membrane keyboard, Simple 4 keys operations.
- Sugar versions comply with ICUMSA.
- NIR version for sugar industry.
- Operates with any polarimeter tube.
- Wide range of special tubes including microtubes, flow through and temperature controlled tubes.

Ordering Information

Model	Description	Part No
NH8	Full circle polarimeter +/- 85 degrees 589 nm	T06070
NHZ	Full circle polarimeter sugar degrees +/- 230 degs Z 589 nm	T06090
NNIR	Near infra red full circle polarimeter sugar degrees +/- 230 degs Z 882 nm	T06100

Introduction to Polarimetry

Polarimeters utilize so-called **polarized light**. The human eye cannot recognize whether light is polarized or not, and so the concept of polarimetry is not intuitively obvious. You can however easily observe the effects of polarization using two **polarizing filters**.

Polarizers look like simple grey colored filters. If you hold them one over the other against a light source you can vary the amount of light that passes through the filter combination by rotating one of the filters. At one special position no light will pass through the combination of filters. If one of the filters is turned by 90° the light once again passes through the combination.

There is only one **plane of polarization**, which can pass through a polarizing filter. If the planes of the two filters are perpendicular to each other, the light from the first one cannot pass the second one.

You can experience polarized light with a pair of Polaroid sunglasses. Reflected light from water (glare) is polarized - if you look at the reflection from a lake with your polaroid sunglasses and turn your head to the side you will see the effect of the polarizing lens blocking the sun's glare.

Some materials like quartz or sucrose solutions naturally rotate the plane of polarization. They are called **optically active**. What polarimeters do is detect this change in the plane of polarization, induced by optically active samples, in order to quantify their optical activity.

In a simple polarimeter two polarizing filters are positioned so that no light passes through the combination. If an optical active sample is brought between these filters, light will pass again. By turning one of the filters to relocate the dark position the amount of rotation introduced by the sample can be measured.

In practice this simple design is not sensitive enough to find the darkest position with the desired accuracy. Our automatic polarimeters use **Faraday modulators** to achieve the high sensitivity and accuracy needed for quantitative analysis.

Faraday modulators make use of an effect whereby some materials become optically active in a magnetic field. If a rod of such a material is brought into a coil, which is connected, to an alternating current, the rod will have an alternating optical activity. Such a modulator, positioned between two polarizing filters, will thus induce a periodically changing intensity of the light passing through it. Small changes in this synchronous signal can be detected with great accuracy and so the final position of the polarizing filter and hence the optical rotation can be found very precisely.

Specifications

Model	NH8	NHZ (Sugar)	NNIR (Sugar)
Range	+ / - 85 degrees	+/- 230 degs Z	+/- 230 degs Z
Display	1 line by 16 characters backlit LCD display		
Resolution / accuracy	+/- 0.01 deg	+/- 0.05 degree Z	
Response time	5 degrees/second		
Light Source	Tungsten - halogen lamp		
Wavelength	589 nm	882 nm	
Measuring tubes	Up to 200 mm in length		
Power	110/220 V 50/60 Hz		
Dimensions / weight	735 x 315 x 208 mm / 20 kg		
Data port	RS232		

Principle of Operation

For a diluted sample of optically active material, which is brought into a polarimeter in a polarimeter tube, the measured angle of rotation depends upon:

- The type of sample,
- Sample concentration,
- The length of the tube
- The temperature of the sample
- The wavelength of the polarimeter lamp.

The relationship between these variables is given by a formula named after the 19th century French physicist **Jean B. Biot**.

BIOT's law states:

$$c = \alpha / [\alpha] \cdot 10000 / l$$

c : concentration (in g / 100 cm³ solution)

α : rotation (in angular degree)

[α] : specific rotation

l : length of the tube (in mm)

The **specific rotation** depends on the temperature and the wavelength of the light. For some samples this value also depends on the concentration. (Note that the concentration is given in grams per 100 cm³ and not as grams per 100 g.)

Let's have a look at an example. The specific rotation of aqueous solutions of sucrose at 20.0 °C and a wavelength of **589.44 nm** (the centre of the two yellow lines of the sodium lamp) is given by ICUMSA (the International Commission for Uniform Methods of Sugar Analysis) as $[a] = 66.588 \pm 0.002$. So, if 26.000 g of sucrose are dissolved in pure water to 100 cm³, the rotation in a tube of 200 mm will be $\alpha = 34.626^\circ \pm 0.001^\circ$ as you can verify by filling in the data to BIOT's formula above.

This solution is called the **Normal Sucrose Solution** and its rotation 100.00 °Z (sugar degrees). The **International Sugar Scale (ISS)** is linearly divided, i.e. a rotation of 17.313° equals to a reading of 50.00 °Z. The sugar versions (NHZ and NNIR) of the N series polarimeters include this sugar scale. Other concentration scales can also be displayed.

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