

High Resolution Quartz Wedge Saccharimeter

Schmidt & Haensch



Saccharomat

Quartz Wedge Saccharimeter

The Saccharomat use the quartz wedge principle which directly compares the rotation of the sugar sample to that of the quartz. . Unlike a circle type polarimeter a wedge type is not sensitive to small changes in the wavelength .This makes the instrument very accurate and eliminates the need for checking and re-calibration with a quartz plate. The Saccharomat is available with standard visible illumination (589 nm) or with near IR (882nm) or a combination of the two.

Digital electronics with built in software



Saccharomat is an advanced microprocessor controlled instrument with a multi line LCD display. It shows the analysis of

the current sample, the sample ID, tube type, date and the temperature (with temperature sensing tube). The layout of the display can be customized by the user. All the information is also available via the RS232 interface for connection to a PC.

Quality optics, precision engineering

The Saccharomats 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

Advanced Features of the Saccharomat

- Fully compliant with ICUMSA
- Quartz wedge design means there is no calibration drift over time as the filter ages
- Continuous measurement operation.
- Fast balancing - short measuring time
- 8 line 30 character display backlit LCD display
- Independent display of concentration, sample ID, tube size, temperature and date.
- Personalize the display layout to suit your needs
- Simultaneous POL and BRUX with DUR refractometer.
- RS232 data port standard.
- Hygienic easy clean membrane keyboard
- Operates with any polarimeter tube.
- Wide range of special tubes including microtubes, flow through and temperature controlled tubes.

modern digital designs. The Saccharomat 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.

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 circle 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. (The light beam is modulated by a Faraday modulator to increase sensitivity - see these notes on the Circle Polarimeter data sheets)

In a quartz wedge polarimeter a quartz wedge is used in place of the rotating analyzer. The wedge is moved across the beam until the rotation induced by the sample is cancelled out. Quartz and sucrose solutions have almost identical optical rotation characteristics (that is why quartz plates are used as standards for Saccharimeters). In the quartz wedge saccharimeter variations in the filter wavelength affect both the sucrose solution and the quartz wedge analyzer in the same way and so have no effect on the measurement. The accuracy of the Saccharomat is not influenced by filter drift and so offers unparalleled long term calibration stability

Specifications

Model	SMAT_MHZ	SMAT_NIR	SMAT_NNIRW2
Part Number	T07030	T07040	T07050
Range	- 35 to 105 degrees Z (optionally -20 Z to +120 Z)		
Display	8 line backlit LCD display		
Resolution / accuracy	+/- 0.01 deg Z in accordance with ICUMSA		
Response time	5 seconds for each measurement		
Light Source	Halogen lamp		
Wavelength	589 nm	882 nm	882 nm + 589 nm
Measuring tubes	Up to 200 mm in length		
Power	110/220 V 50/60 Hz		
Dimensions / weight	733 x 425 x 195 mm / 25 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.

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