

Product Introduction

Compact Automatic Polarimeter SEPA-500 コンパクト自動旋光計 SEPA-500

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Introduction

Polarimeters are indispensable products for measuring the concentration or purity of sugars, amino acids, vitamins, alkaloids, hormones, and other optically active substances used in fields such as pharmaceuticals, sugar manufacturing, and the food industry.

HORIBA offered its first polarimeter the SEPA-200, in 1992. Since its introduction, with feedback from customers and together with HORIBA's ongoing product development, HORIBA has now released its 3rd generation polarimeter the SEPA-500. Using the latest technologies and research, the SEPA-500 was developed to perform highly accurate, quick, and easy measurements.

Measurement Principle

Optical rotation of the plane of linearly polarized light occurs in response to the concentration and the

characteristics of light passing through optically active materials. Sugars and amino acids are generally optically active, and the concentration and optical activity can be measured from optical rotation. Optical rotation can be used as a parameter to measure product quality and therefore polarimeters can be used for quality control or process control in industrial production of pharmaceuticals and foods.

SEPA-500 configuration is shown in Figure 2.

The measurement begins with a fixed wavelength light source that is linearly polarized so only polarized light enters the cell with liquid sample. The polarization plane rotates in response to the optical activity, concentration, and light path of the cell. After the light has passed through the sample cell, it enters a Faraday rotator for modulation and then to a second polarizer, known as the "Analyzer," which detects the angle of rotation. Finally, the light enters a photo diode that converts the intensity to

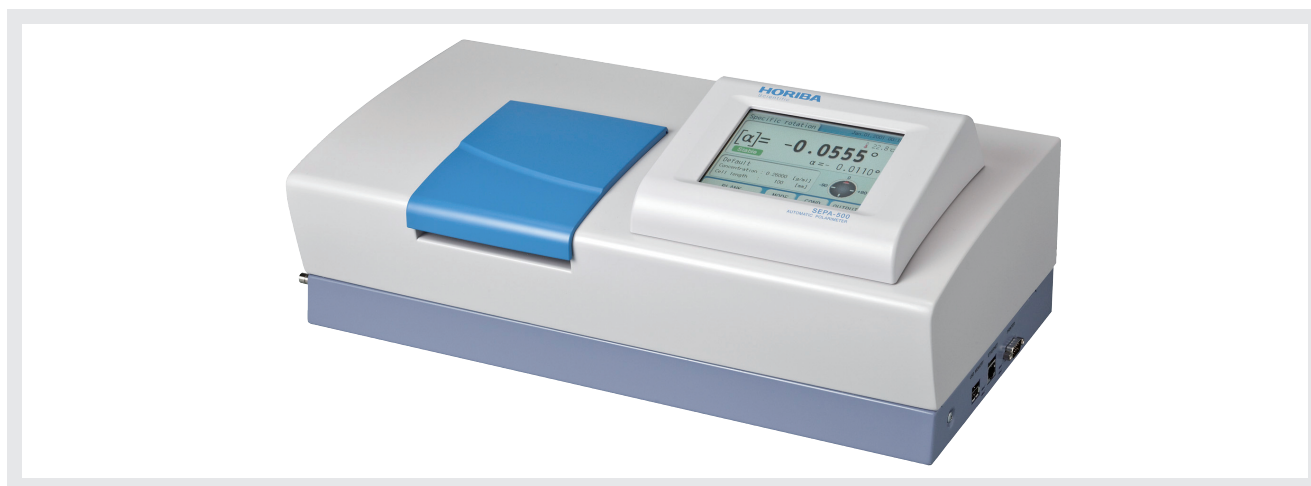


Figure 1 SEPA-500

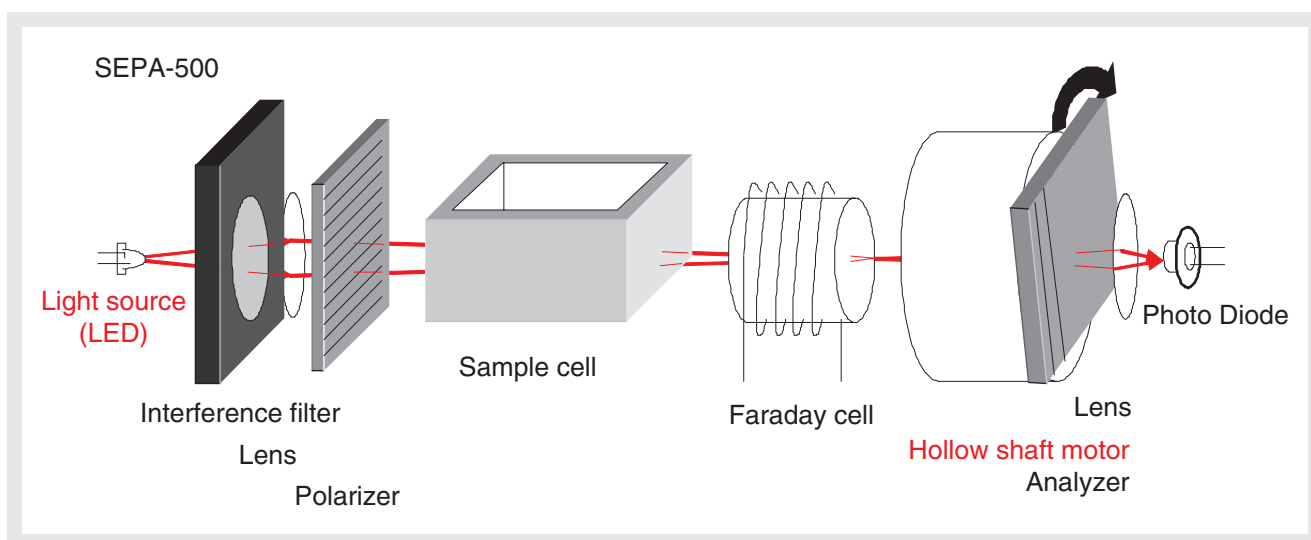


Figure 2 SEPA-500 configuration

an electrical signal.

The rotating Analyzer automatically controls the angle to minimize the detected intensity at all times. That is, the polarization plane angle of the analyzer is controlled to be orthogonal to the light, which is rotated while passing through sample. The optical rotation obtained is the difference between the rotation angle of a sample filled cell and that of the empty cell.

The Faraday rotator is made of a transparent material surrounded by a Faraday coil. The polarization plane of the light traveling inside is rotated when a magnetic field is applied, using a current in the coil. This is called the Faraday effect. Using this Faraday effect, the direction of rotation of the polarization plane is detected. The resolution of the measurement angle is improved by vibrating the polarization plane to optically null the measurement.

High Speed and High Resolution Measurement

Precision and speed of measurement depends on the control mechanism of the rotating Analyzer.

In the previous SEPA-300 model, HORIBA had achieved a resolution of 5/10000 degrees using a stepping motor and a worm gear in the rotating Analyzer.

The SEPA-500 uses a new hollow shaft motor. The hollow shaft motor has no shaft or any moving parts in its rotation axis so the beam can pass through the Analyzer which is set on the rotation axis. This method removes angle measurement errors, due to mechanical components such as the coupling and the worm gear, used in earlier models.

Additionally, using digital electronics, the control algorithm was optimized for smooth and stable positioning of the rotating Analyzer, while keeping a low backlash. With these improvements, a maximum rotation

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Compact Automatic Polarimeter SEPA-500

Specifications

Light source	LED
Polarizer	Polarizing film
Measurement wavelength	589 nm (equivalent to sodium D-line)
Sensor	Photodiode
Maximum cell length	100 mm
Range of measurement angles	±90
Measurement accuracy	±0.002 (at less than 1); ±0.2% (at 1 or more)
Measurement repeatability	±0.002
Minimum display angle	0.0001
Maximum response speed	60 /sec.
Measurement method	Symmetrical angle oscillation optical null method
Temperature measurement points	Cell holder / inside cell
Range of measurement temperatures	0-99.9 C
Display	Color LCD; 5.7
Input method	Touch screen
Measurement items	Angle of rotation, specific rotation, sugar content (international standard), concentration, sugar purity
Data processing	Continuous automatic measurement, statistical (mean, SD) processing
Data storage	External printer (optional), external USB memory (*1)
External connection	Ethernet
External dimensions	Body: 490 (W)×250 (D)×200 (H) mm
	External printer: 106 (W)×181 (D)×107 (H) mm
	Maximum water flow: 12 L/min.
	Maximum head pressure: 50 kPa
Thermostatic water circulation connection	Hose: External diameter: 11 mm; internal diameter: 7 mm
Weight	13 kg

*1: Some units will not operate with FAT16 system memory products.

*2: The product displays used in this catalog are composites. Actual displays may differ.

Figure 3 SEPA-500 specifications

speed of 60 degrees/second and an angle resolution of 1/10000 degrees, were achieved, it is achieving the highest performance worldwide. This performance is twelve times higher than the previous model's rotation speed and has five times more angle resolution. This high speed and high resolution measurement is not only useful for samples with large optical rotation, but also for the continuous monitoring of samples using a flow cell.

Maintenance Free of Light Source

The SEPA-500 has the LED as the light source. As the wavelength width of the LED is larger than that of Na

lamp, an interference filter is used to control the central wavelength to 589 nm and FWHM (full spectral width at half maximum) to 2.5 nm. The LED has a longer lifetime of over 20000 hours compared to the Na lamp used in earlier models. This light source is also practically maintenance free as it will last for more than 10 years in general use.

Compact and Light Weight

In addition to the advances in performance, the SEPA-500 also has a smaller footprint and a compact size. This was possible due to the advances in the optical system, such as using an LED light source instead of a Na lamp, and using a hollow shaft motor rather than the traditional worm gear mechanism. Additionally, the SEPA-500 has a very simple optical system in which the motor frame is sandwiched between optical components. This not only reduces the size and weight but also improves the axis stability of the optical system.

When compared to the SEPA-300, with external dimensions of W565 D445 H270 and a weight 35 kg, the SEPA-500 has a space saving design with external dimensions of W490 D250 H200 and a weight 13 kg. This is approximately half the weight and volume of the previous model.

Devised Operativeness

The user interface was also improved by using a touch screen color LCD display.

The user can switch the display mode to angle of rotation, specific rotation, sugar content (international standard), concentration or sugar purity, using the touch screen. From the condition setup screen, the measurement conditions can be stored on a removable disk. Measured data can be displayed on screen, printed on an optional impact printer, and also saved to a USB thumb drive for use with a PC.

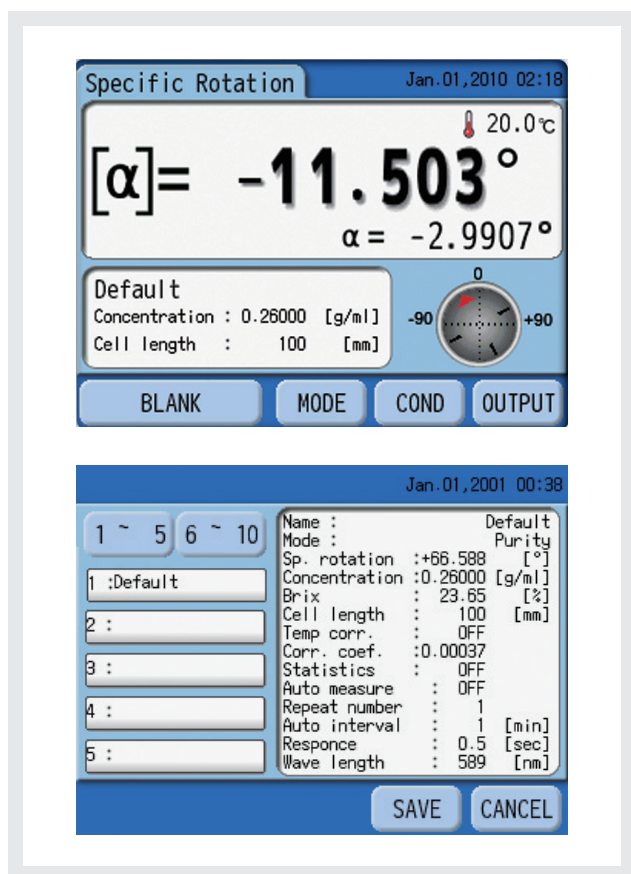


Figure 4 Measurement results screen and condition setting and input screen

Temperature Control Cell Unit with Peltier Effect

Temperature control is important for the optical rotation measurements as unstable temperatures will generate erroneous data.

In the earlier models, the solution was to use circulating water from connected thermostat bath. In SEPA-500, a Peltier type temperature control cell unit can be installed to cool the sample chamber (Figure 5). This permits the

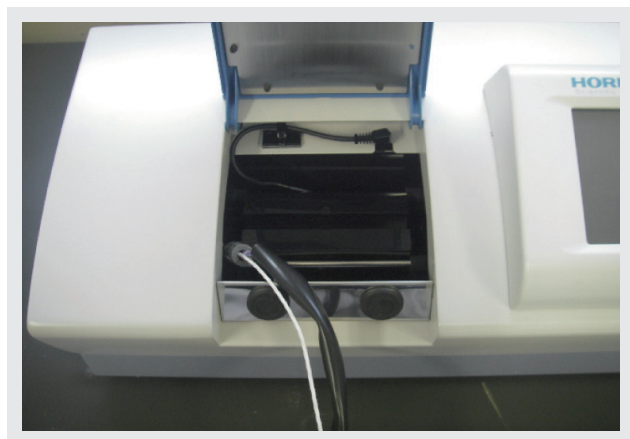


Figure 5 Peltier type temperature control cell unit in the sample chamber

Optical rotation measurement to be made without the need for a thermostat bath, reducing bench space requirements and the possibilities of a water leak.

Summary

The SEPA-500 has achieved high speed / high resolution measurements by using a hollow shaft motor and incorporating an LED to eliminate light source maintenance. A touch panel display was adopted to enhance the user interface. The (optional) Peltier type temperature control cell unit maintains a constant temperature while eliminating water leaks.

The SEPA-500 has been developed as compact and light weight analyzer and we hope that customers will enjoy the enhanced user interface and the simplicity of operation.