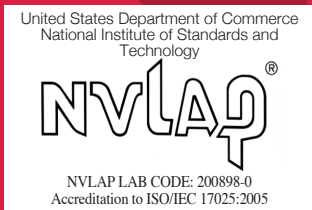


For research, analysis and control

The Autopol[®] IV Automatic Polarimeter

Including
Autopol Model Selection Guide



**The brand of polarimeter used
in more labs than any other.***

**RUDOLPH
RESEARCH
ANALYTICAL**

TECHNICAL BULLETIN 909

*Emmes Surveys

Polarimetry

Polarimetry

A sensitive nondestructive technique for measuring the optical activity exhibited by inorganic and organic compounds. A compound is considered to be optically active if linearly polarized light is rotated when passing through it. The amount of optical rotation is determined by the molecular structure and concentration of chiral molecules in the substance. Each optically active substance has its own specific rotation as defined in Biot's law:

$$[\alpha]_{\lambda}^T = \frac{\alpha_{\lambda}^T}{c \cdot l}$$

$[\alpha]$ = specific rotation

l = optical pathlength in dm

λ = wavelength

T = temperature

α = optical rotation

c = concentration in g/100ml

The polarimetric method is a simple and accurate means for determination and investigation of structure in macro, semi-micro and micro analysis of expensive and non-duplicable samples. Polarimetry is employed in quality control, process control and research in the pharmaceutical, chemical, essential oil, flavor and food industries. It is so well established that the United States Pharmacopoeia and the Food & Drug Administration include polarimetric specifications for numerous substances.

Research Applications

Research applications for polarimetry are found in industry, research institutes and universities as a means of:

- Isolating and identifying unknowns crystallized from various solvents, or separated by high performance liquid chromatography.
- Evaluating and characterizing optically active compounds by measuring their specific rotation and comparing this value with the theoretical values found in literature.
- Investigating kinetic reactions by measuring optical rotation as a function of time.
- Monitoring changes in concentration of an optically active component in a reaction mixture, as in enzymatic cleavage.



PHARMACEUTICALS



ESSENTIAL OILS



SUGAR & CONFECTIONERY PRODUCTS



ORGANIC CHEMISTRY

In each of these applications, the AUTOPOL offers up to six discrete wavelength selections to observe the effect of wavelength upon an optically active substance.

Quality and Process Control Applications,

both in the laboratory or on-line in the factory, are found throughout the pharmaceutical, essential oil, flavor, food and chemical industries. A few examples are listed below.

Pharmaceutical Industry

Determines product purity by measuring specific rotation and optical rotation of:

- Amino acids
- Amino sugars
- Analgesics
- Antibiotics
- Cocaine
- Codeine
- Dextrose
- Diuretics
- Serums
- Steroids
- Tranquilizers
- Vitamins

Flavor, Fragrance and Essential Oil Industry

Utilizes polarimetry for incoming raw materials inspection of:

- Camphors
- Citric acid
- Glyceric acid
- Gums
- Lavender oil
- Lemon oil
- Orange oil
- Spearmint oil

Food Industry

Ensures product quality by measuring the concentration and purity of the following compounds in sugar based foods, cereals and syrups:

- Carbohydrates
- Fructose
- Glucose
- Lactose
- Levulose
- Maltose
- Raffinose
- Sucrose
- Various starches
- Xylose
- Natural monosaccharides

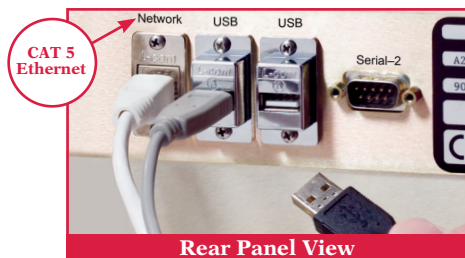
Chemical Industry

Analyzes optical rotation as a means of identifying and characterizing:

- Biopolymers
- Natural polymers
- Synthetic polymers

AUTOPOL® IV

Unmatched features and flexibility utilizing



Rear Panel View

Embedded Windows 7

No virus, no malware and direct Ethernet connection to LIMS or Server without a PC.

Connect to almost any USB printer



USB

Measurement Modes

The Autopol IV can read directly in one of four measurement modes: Optical Rotation, Specific Rotation, Concentration or Specific Rotation Plus. Specific Rotation Plus allows a correction to be applied to a result for loss on drying. Each measurement mode can be activated via touchscreen selection. Sample cells can be specified at any length (e.g., 50mm, 100mm, 200mm), or entered as a precise dimension (e.g., 199.98mm). Concentration is entered as a percentage. (See Figure 3)

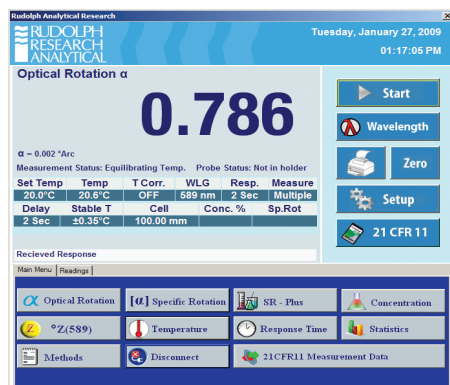


Figure 3

Temperature Control of Samples

is allowed through rubber gasketing in the Autopol door which permits tubing to be connected from an external temperature controlled Water Bath to the jacket of a jacketed polarimeter sample tube. (See Figure 4)

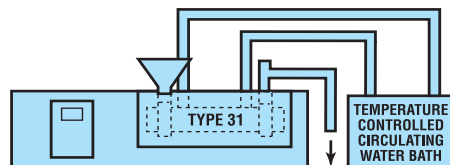


Figure 4

Cells 10mm to 200mm Long

Instruments of some manufacturers accept only special sample cells, with maximum lengths of 100mm. Autopols accept standard sample cells up to 200mm long. A 200mm sample cell offers twice the sensitivity as the same solution in a 100mm cell. This is especially useful for solutions having small rotations. Also some pharmacopeia monographs require a 200mm (2dm) cell like the USP monograph for Methotrexate. Rudolph Research sample cells are made to NIST standards; and the complete range of sizes and types are listed in Technical Bulletin 913. NIST certificates are available for cell length validation.



Figure 5

Multiple Wavelengths

The Autopol IV comes in single, dual and six wavelength models. Wavelength selection is completely automatic and is accomplished via menu selection. There are no lamps or filters to manually remove or insert. The following wavelengths are available: 365nm, 405nm, 436nm, 546nm, 589nm, and 633nm. Optional wavelengths are available; contact the factory for more information.

White-light Source Permits Spectral Versatility

The Tungsten-Halogen lamp employed in the Autopol is a compact, reliable, low-cost, high-intensity light source that allows any desired wavelength in the visible spectrum to be selected by means of a narrow band multilayer interference filter. (See Figure 6) The Autopol standard 10nm bandwidth is specified to permit high energy throughput and sensitivity for sample transmittances of only 0.01% (O.D. = 4), while minimizing the effects of sample ORD and color.

This lamp is keyed for easy alignment



Estimated Life = 2,000 hours
Estimated Cost = \$100 USD each

Figure 6

Temperature Display

The Autopol IV comes standard with a temperature probe which can be inserted into the Polarimeter cell as shown below or into the cell probe port. (See Figure 7)



Figure 7

Choosing a Polarimeter

That's right for your application and budget

Autopol I



The Autopol I is our entry-level polarimeter model designed for:

- University Education
- Starch Analysis
- Lactose in Milk
- Flavors
- Chemicals
- Natural Product Research
- Invert Sugar
- Vitamins
- Fragrance

Standard Features: 0.01° Arc Accuracy, 589nm fixed wavelength, built in thermoprobe for temperature measurement, Windows Embedded 7 for direct connection to the network server and flexible USB printing.

Optional Features:

- TempTrol™ heating and cooling: 15°C – 40°C ±.2°C
- AP Accuracy Option: 0.004° Arc Optical Rotation
- AP Resolution Option: 0.01, 0.001°Arc Selectable

Autopol II



The Autopol II offers the same standard and optional features as the Autopol I, but allows greater wavelength flexibility.

Standard Wavelengths: 589nm and 546nm

Optional Wavelengths: 365nm, 405nm, 436nm, 578nm, 633nm

A total of 2-4 extra wavelengths may be ordered at time of purchase or added later when needed.

Optional Features:

- TempTrol™ heating and cooling: 15°C – 40°C ±.2°C
- AP Accuracy Option: 0.004° Arc Optical Rotation
- AP Resolution Option: 0.01, 0.001°Arc Selectable

Autopol III



The Autopol III is Rudolph's entry level pharmaceutical solution:

Accuracy: 0.002°C, 0.2% above 1°
Standard Wavelengths: 589nm and 546nm

Complete Accessory Package with IQOQO documentation, 2 user selectable cells and 1 NIST traceable calibration standard with NIST Certificate

Optional Features:

- 100mm or 200mm TempTrol™ heating and cooling: 15°C – 40°C ±.2°C
- Optional Wavelengths: 365nm, 405nm, 436nm, 578nm, 633nm, (up to 4 wavelengths may be selected or added later.
- AP Accuracy Option: ±0.002° up to 10° Arc, ±0.004° 10° - 89°Arc
- AP Resolution Option: 0.01, 0.001, 0.0001°, Arc Selectable

Below is an example of why Polarimeters with accuracy of ±0.01 are not suitable for pharmaceutical applications. Please review the USP monograph for the material Ofloxacin. Ofloxacin must have a specific rotation between +1° and -1° at a concentration of 10mg per ml.

Biot's Law:

$$[\alpha]_{\lambda}^T = \frac{\alpha_{\lambda}}{c \cdot l}$$

$[\alpha]$ = specific rotation, l = optical pathlength in dm; λ = wavelength, T = temperature, α = optical rotation, c = concentration in g/100ml

The Autopol I has an accuracy of ±0.02° optical rotation. Below is how its relative accuracy affects a hypothetical Ofloxacin sample:

$$[\alpha]_{\lambda}^T \text{ (Specific Rotation)} \stackrel{\pm 0.01}{=} \frac{(1)(0.01)}{0.1} \leftarrow 10\text{mg/ml}$$

(Optical pathlength in dm) ↑ .01g/ml
1g/100ml = 1% = 0.01

Specific Rotation error = ±1.0

You cannot successfully inspect a pharmaceutical (such as Ofloxacin) having a Specific Rotation between +1 and -1 and a 1% concentration, which is quite common for most pharmaceuticals, with an instrument that has an accuracy of ±1.0 in Specific Rotation.

The Autopol IV has an accuracy of 0.002 for Optical Rotations of 1°Arc for a total unknown of +/-0.002 under the same conditions:

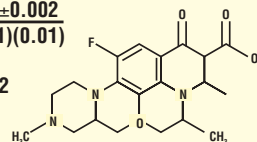
$$\text{Specific Rotation error} = \frac{\pm 0.002}{(1)(0.01)}$$

Autopol IV SR error = ±0.2

USP Ofloxacin

Specific rotation <781S>: between +1° and -1°

Test solution: 10mg per mL, in chloroform



Autopol IV



This model is available in one, two and six wavelength versions and has a more expensive optical system than the Autopol III. It is the system of choice for research universities, pharmaceutical and fine chemical research departments. This instrument is also excellent for studying racemics and kinetics. Temperature control may be accomplished through a circulating Water Bath or with **Rudolph's optional Patented TempTrol™ System, which electronically heats and cools the sample to a specified temperature without the use of water circulation.**

IQOQPQ documentation is included with the instrument.

Autopol V PLUS



The APV PLUS has all the features of the APV and adds resistance to acid erosion with its Silco Steel trough and Hastelloy cell. Furthermore this instrument comes standard with a 3 rotation quartz standard, Windows 7 operating system with Windows based navigation, 3 USB ports to allow quick & easy connection to a mouse, keyboard, printer, bar code scanner or memory stick, ethernet port for network cable connection. **The Autopol V Plus comes standard with Rudolph's Patented TempTrol™ System, which electronically heats and cools the sample to a specified temperature without the use of water circulation.**

The AutoPol V Plus is available with 325nm to measure USP Dextromethorphan Hydrobromide.

IQOQPQ documentation is included with the instrument.

Autopol V



This is a top of the line six wavelength polarimeter specifically designed with the input of the world's largest pharmaceutical companies. This unit comes standard with 21CFR11 software and **Rudolph's Patented TempTrol™ System, which electronically heats and cools the sample to a specified temperature without the use of water circulation.** IQOQ documentation is included with the instrument. This unit includes all wavelengths necessary to measure 99% of all monographs found in the USP, EP, JP and BP. Please see Technical Bulletin 914 for more details on the Autopol V. IQOQPQ documentation is included with the instrument.

Autopol VI



The APVI was developed for the most demanding advanced research laboratories and features 0.0003 accuracy for low rotation samples of +/- 1° Arc in addition to all of the features of the APV PLUS including **Rudolph's Patented TempTrol™ System, which electronically heats and cools the sample to a specified temperature without the use of water circulation.**

The AutoPol VI Plus is available with 325nm to measure USP Dextromethorphan Hydrobromide.

IQOQPQ documentation is included with the instrument.

Specifications

| Markets | Education | Food | Pharmaceutical QC |
|-----------------------------------|--|--|---|
| SPECIFICATIONS | Autopol I | Autopol II | Autopol III |
| Measuring Mode | Optical Rotation, Specific Rotation, Specific Rotation Plus Concentration, User Defined Scale, Sugar Degrees, °Z (ISS) | Optical Rotation, Specific Rotation, Specific Rotation Plus Concentration, User Defined Scale, Sugar Degrees, °Z (ISS) | Optical Rotation, Specific Rotation, Specific Rotation Plus Concentration, User Defined Scale, Sugar Degrees, °Z (ISS) |
| Measuring Scale | Degrees Arc Optical Rotation | Degrees Arc Optical Rotation | Degrees Arc Optical Rotation |
| Resolution | 0.01° Arc Optical Rotation, 0.01% Concentration, 0.01 Specific Rotation | 0.01° Arc Optical Rotation, 0.01% Concentration, 0.01 Specific Rotation | 0.001° Arc Optical Rotation, 0.001% Concentration, 0.001 Specific Rotation |
| Accuracy | 0.01° Arc Optical Rotation, 0.03°Z (ISS) Sugar Degrees | 0.01° Arc Optical Rotation, 0.03°Z (ISS) Sugar Degrees | 0.002° Arc up to 1°, 0.2% above 1°, 0.01° Z (ISS) |
| AP Accuracy Option | Resolution: 0.001° Arc Optical Rotation Reproducibility: 0.002° Arc Optical Rotation, Accuracy: ±0.004° Arc Optical Rotation | Resolution: 0.001° Arc Optical Rotation Reproducibility: 0.002° Arc Optical Rotation, Accuracy: ±0.004° Arc Optical Rotation | Accuracy: ±0.002° up to 10°, ±0.004° 10° - 89° Arc Optical Rotation |
| AP Resolution Option | AP Selectable Resolution: 0.01, 0.001° Arc | AP Selectable Resolution: 0.01, 0.001° Arc | AP Selectable Resolution: 0.01, 0.001, 0.0001° Arc |
| Reproducibility | 0.01° Arc Optical Rotation | 0.01° Arc Optical Rotation | 0.002° Arc Optical Rotation |
| Measuring Range | ± 89.9° Arc Optical Rotation, ± 999.99° Arc Specific Rotation, 0-99.9% Concentration | ± 89.9° Arc Optical Rotation, ± 999.99° Arc Specific Rotation, 0-99.9% Concentration | ± 89.9° Arc Optical Rotation, ± 999.99° Arc Specific Rotation, 0-99.9% Concentration |
| Prism | Glan Thompson Calcite | Glan Thompson Calcite | Glan Thompson Calcite |
| Optical Wavelengths | 589nm | 589nm, 546nm standard Optional wavelengths: 365nm, 405nm, 436nm, 578nm | 589nm, 546nm standard Optional wavelengths: 365nm, 405nm, 436nm, 578nm |
| Wavelength Selection | Fixed | Touchscreen Selectable: 2 standard, 4 optional | Touchscreen Selectable: 2 standard, 4 optional |
| 21 CFR Part 11 Compliant Software | Yes with optional external PC software | Yes with optional PC software | Yes with optional PC software |
| Temperature Control | By external water bath (standard) TempTrol™ Automatic Electric Heating and Cooling 15°- 40°C ±0.2°C (optional) | By external water bath (standard) TempTrol™ Automatic Electric Heating and Cooling 15°- 40°C ±0.2°C (optional) | By external water bath (standard) TempTrol™ Automatic Electric Heating and Cooling 15°- 40°C ±0.2°C (optional) |
| Temp. Probe Range | 10°C - 100°C | 10°C - 100°C | 10°C - 100°C |
| Temp. Probe Accuracy | ±0.1°C | ±0.1°C | ±0.1°C |
| Measurement Time | 5 measurements in less than 25 seconds (avg.) | 5 measurements in less than 25 seconds (avg.) | 5 measurements in less than 25 seconds (avg.) |
| Light Source | Tungsten-Halogen 6V, 20W, avg. 2,000 hour life | Tungsten-Halogen 6V, 20W, avg. 2,000 hour life | Tungsten-Halogen 6V, 20W, avg. 2,000 hour life |
| Sample Chamber | Accepts sample tubes up to 200 mm | Accepts sample tubes up to 200 mm | Accepts sample tubes up to 200 mm |
| Data Storage | 8 GB Non-removable Compact Flash | 8 GB Non-removable Compact Flash | 8 GB Non-removable Compact Flash |
| Communication Interface | 3 – USB Ports, 2 – RS232 Ports, Ethernet Port for Network Connection | 3 – USB Ports, 2 – RS232 Ports, Ethernet Port for Network Connection | 3 – USB Ports, 2 – RS232 Ports, Ethernet Port for Network Connection |
| Calibration | Automatic calibration via touchscreen | Automatic calibration via touchscreen | Automatic calibration via touchscreen |
| Display | 8" color, 800 x 600 pixel resolution with 400 nits of brightness | 8" color, 800 x 600 pixel resolution with 400 nits of brightness | 8" color, 800 x 600 pixel resolution with 400 nits of brightness |
| User Interface | Touchscreen | Touchscreen | Touchscreen |
| Automatic Sensitivity Control | Measures samples with transmittance as low as 0.01% (up to O.D. 4.0) | Measures samples with transmittance as low as 0.01% (up to O.D. 4.0) | Measures samples with transmittance as low as 0.01% (up to O.D. 4.0) |
| Input Power | 100 - 240V, 50/60 Hz | 100 - 240V, 50/60 Hz | 100 - 240 V, 50/60 Hz |
| Operating Dimensions | 24.3" W x 12.7" H x 17.5" D 617 mm W x 323 mm H x 445 mm D | 24.3" W x 12.7" H x 17.5" D 617 mm W x 323 mm H x 445 mm D | 24.3" W x 12.7" H x 17.5" D 617 mm W x 323 mm H x 445 mm D |
| Operating Weight | 42 lbs. (19.05 kg) | 42 lbs. (19.05 kg) | 42 lbs. (19.05 kg) |

| Research | Big Pharma | Big Pharma | Advanced Research |
|--|--|--|---|
| Autopol IV | Autopol V | Autopol V Plus | Autopol VI |
| Optical Rotation, Specific Rotation, Specific Rotation Plus Concentration, User Defined Scale, Sugar Degrees, °Z (ISS) | Optical Rotation, Specific Rotation, Specific Rotation Plus Concentration, User Defined Scale, Sugar Degrees, °Z (ISS) | Optical Rotation, Specific Rotation, Specific Rotation Plus Concentration, User Defined Scale, Sugar Degrees, °Z (ISS) | Optical Rotation, Specific Rotation, Specific Rotation Plus Concentration, User Defined Scale, Sugar Degrees, °Z (ISS) |
| Degrees Arc Optical Rotation | Degrees Arc Optical Rotation | Degrees Arc, % Concentration | Degrees Arc, % Concentration |
| 0.001° Arc Optical Rotation, 0.001% Concentration, 0.001 Specific Rotation | 0.001° Arc Optical Rotation, 0.001% Concentration, 0.001 Specific Rotation | 0.001° Arc Optical Rotation, 0.001% Concentration, 0.001° Specific Rotation | 0.0001° Arc Optical Rotation, 0.0001% Concentration, 0.0001° Specific Rotation |
| 0.002° up to 1°, 0.2% up to 5°, 0.01° above 5° | 0.002° up to 1°, 0.2% up to 5°, 0.01° above 5° | 0.002° up to 1°, 0.2% up to 5°, 0.01° above 5° | 0.0003° Arc Optical Rotation |
| Autopol IV Single Accuracy: ±0.002° Arc Optical Rotation Autopol IV Dual Accuracy: ±0.002° Arc Optical Rotation Autopol IV Six Wavelength Accuracy (546nm and 589nm): ±0.002° Arc Optical Rotation | Accuracy (546nm and 589nm): ±0.002° Arc Optical Rotation Accuracy for other wavelengths is the same as the standard model | Autopol V Plus Single Accuracy: ±0.002° Arc Autopol V Plus Six Wavelength Accuracy (546nm and 589nm): ±0.002° Arc Accuracy for other wavelengths is the same as the standard model | Not applicable |
| AP Selectable Resolution: 0.01, 0.001, 0.0001° Arc | AP Selectable Resolution: 0.01, 0.001, 0.0001° Arc | AP Selectable Resolution: 0.01, 0.001, 0.0001° Arc | Not applicable |
| 0.002° Arc Optical Rotation | 0.002° Arc Optical Rotation | 0.002° Arc | 0.0002° Arc Optical Rotation |
| ±89.9° Arc Optical Rotation, ±999.99° Arc Specific Rotation, 0-99.9% Concentration | ±89.9° Arc Optical Rotation, ±999.99° Arc Specific Rotation, 0-99.9% Concentration | ±89.9° Arc Optical Rotation, ±999.99° Arc Specific Rotation, 0-99.9% Concentration | ±89.9° Arc Optical Rotation, ±999.99° Arc Specific Rotation, 0-99.9% Concentration |
| Glan Thompson Calcite | Glan Thompson Calcite | Glan Thompson calcite quartz | Glan Thompson calcite quartz |
| 365nm, 405nm, 436nm, 546nm, 589nm, 633nm (other wavelengths available: 578nm) | 365nm, 405nm, 436nm, 546nm, 589nm, 633nm (other wavelengths available: 578 nm) | 365nm, 405nm, 436nm, 546nm, 589nm, 633nm (other wavelengths available: 325 nm) | 365nm, 405nm, 436nm, 546nm, 589nm, 633nm (other wavelengths available: 325 nm) |
| Touchscreen Selectable: 1, 2 and 6 | Touchscreen Selectable: 6 standard | Touchscreen Selectable: 6 standard | Touchscreen Selectable: 6 standard |
| Yes with optional PC software | Built-in | Built-in | Built-in |
| By external water bath (standard) TempTrol™ Automatic Electric Heating and Cooling 15°- 40°C ±0.2°C (optional) | TempTrol™ Automatic Electronic Heating & Cooling 15°-40°C (standard) ±0.2°C (standard) | TempTrol™ Automatic Electronic Heating & Cooling 15°-40°C (standard) ±0.2°C (standard) | TempTrol™ Automatic Electronic Heating & Cooling 15°- 40°C (standard) ±0.2°C (standard) |
| 10°C - 100°C | 10°C - 100°C | 10°C - 100°C | 10°C - 100°C |
| ±0.1°C | ±0.1°C | ±0.1°C | ±0.1°C |
| 4°/sec. slewing rate & 5 sec. nominal settling time | 4°/sec. slewing rate & 5 sec. nominal settling time | 4°/sec. slew rate and 5 sec. nominal settling time | 4°/sec. slew rate and 5 sec. nominal settling time |
| Tungsten-Halogen 6V, 20W, avg. 2,000 hour life | Tungsten-Halogen 6V, 20W, avg. 2,000 hour life | Tungsten-halogen 6V, 20W, avg. 2,000 hour life | Tungsten-halogen 6V, 20W, avg. 2,000 hour life |
| Accepts sample tubes up to 200 mm | Accepts sample tubes up to 200 mm | Accepts sample tubes up to 200mm | Accepts sample tubes up to 200mm |
| 8 GB Non-removable Compact Flash | 8 GB Non-removable Compact Flash | 8 GB Non-removable Compact Flash | 8 GB Non-removable Compact Flash |
| 3 – USB Ports, 2 – RS232 Ports, Ethernet Port for Network Connection | 3 – USB Ports, 2 – RS232 Ports, Ethernet Port for Network Connection | 3 – USB Ports, 2 – RS232 Ports, Ethernet Port for Network Connection | Three USB ports, two RS232 serial ports, one Ethernet port for printer |
| Automatic calibration via touchscreen | Automatic calibration via touchscreen | Automatic calibration by push-button | Automatic calibration via touch screen |
| 8" color, 800 x 600 pixel resolution with 400 nits of brightness | 8" color, 800 x 600 pixel resolution with 400 nits of brightness | Adjustable 10.4 inch diagonal, 800-600 pixels, color, Flat Panel Monitor with Resistant Touch Screen Interface, 200 nits brightness | Adjustable 10.4 inch diagonal, 800-600 pixels, color, Flat Panel Monitor with Resistant Touch Screen Interface, 200 nits brightness |
| Touchscreen | Touchscreen | Touchscreen | Touchscreen |
| Measures samples with transmittance as low as 0.01% (up to O.D. 4.0) | Measures samples with transmittance as low as 0.01% (up to O.D. 4.0) | Measures samples with transmittance as low as 0.01% (up to O.D. 4.0) | Measures samples with transmittance as low as 0.01% (up to O.D. 4.0) |
| 100 - 240 V, 50/60 Hz | 100 - 240 V, 50/60 Hz | 85 - 260 V, 48-62 Hz | 100 - 240V, 50/60 Hz |
| 30" W x 17" H x 11" D 762 mm W x 431.8 mm H x 279.4 mm D | 30" W x 17" H x 11" D 762 mm W x 431.8 mm H x 279.4 mm D | 32" W x 11.5" H x 18" D 813 mm W x 292 mm H x 457 mm D | 35" W x 10.5" H x 17" D 890 mm W x 267 mm H x 432 mm D |
| 85 lbs. (39 kg) | 85 lbs. (39 kg) | 90 lbs. (41 kg) | 85 lbs. (39 kg) |

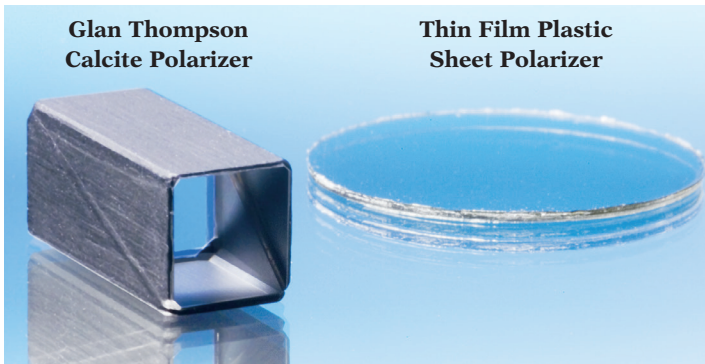
Full cGMP/GLP Compliance

Quality

No matter which model Autopol you choose, Rudolph uses the same high quality optics. While other manufacturers use Polaroid Plastic Dichroic Sheet Polarizers, Rudolph does not. Instead, Rudolph uses the same high quality Glan Thompson Calcite Polarizers in all its models.

Why are high quality polarizing prisms important? Because prisms are two of the most critical optical components in the polarimeter. Polaroid polarizers are made of a polymeric plastic where the molecules are stretched and oriented in a specific direction so as to linearly polarize light. These types of plastic sheet polarizers are very inexpensive (\$50.00 USD) and are vulnerable to heat, warp over time, deteriorate from moisture, and also have greater light absorption than Calcite Polarizers. In many cases, the plastic polarizers must be replaced in 3 – 5 years. Glan Thompson Calcite Polarizers are comprised of a carbon crystalline structure similar to diamond and have excellent light transmission characteristics. The quality of these prisms is so good, Rudolph guarantees its prisms over the life of the polarimeter (See Figure 9)

Figure 9



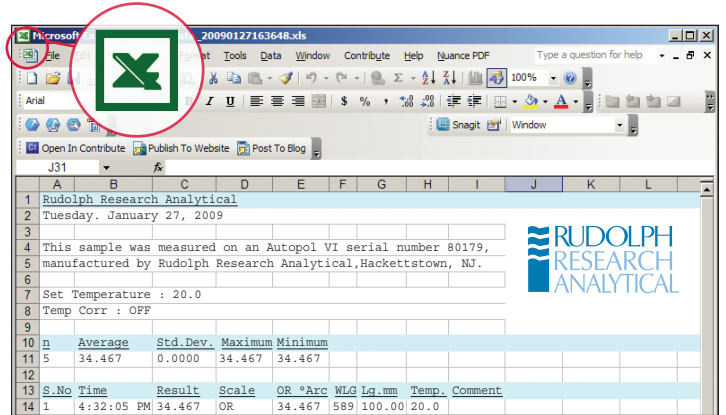
Validation and Calibration

Rudolph Research Analytical knows that you must be able to validate your instrument's operating performance regularly. Therefore, the Autopol® V, V Plus and VI come standard with the accessories, validation tools and automatic calibration functions necessary to ensure that the temperature control, temperature measurement and optical measurement processes are working accurately and reproducibly. All functions are accessed simply and conveniently through the Autopol® liquid sealed touchscreen.

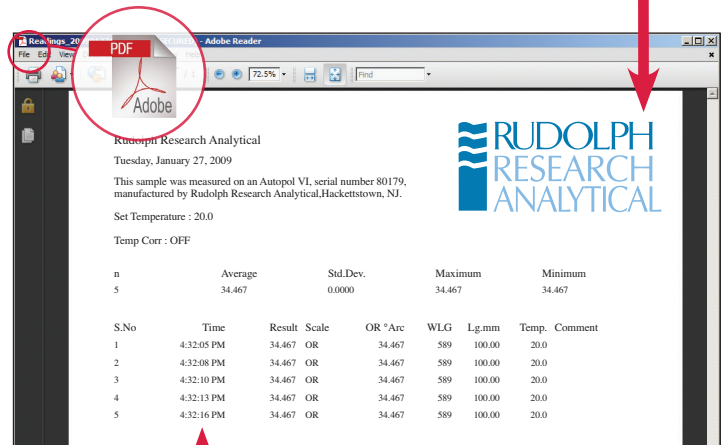


cGMP/GLP Printing

Measurement reports can be saved as an Excel or PDF file and edited quickly and easily. You can import logos and print your company's customized "C of A" directly.



Print your customized Certificate of Analysis including your company logo directly from the Autopol VI® touch screen



Capable of making multiple measurements on a single sample and reporting complete statistical data and all measurement results

Just listen to our customers

"We have the AUTOPOL V from Rudolph Research Analytical (RRA)... I have used numerous polarimeters and this is by far the best. We have had it for 1-1/2 years and have had zero problems, the original lamp is still in the instrument. I recommend it over other instruments. RRA installed, trained and performed the IQOQ... It is one piece of equipment that you never worry about."

Alan Davis – Rockwell Medical Technologies