RUDOLPH RESEARCH ANALYTICAL

TECHNICAL BULLETIN 950

Automation Selection Guide

Application and Features

Rudolph Research Analytical serving its customers with Integrity, Quality, and Innovation for over 50 years.

See website for how above accreditations and warranty certifications apply

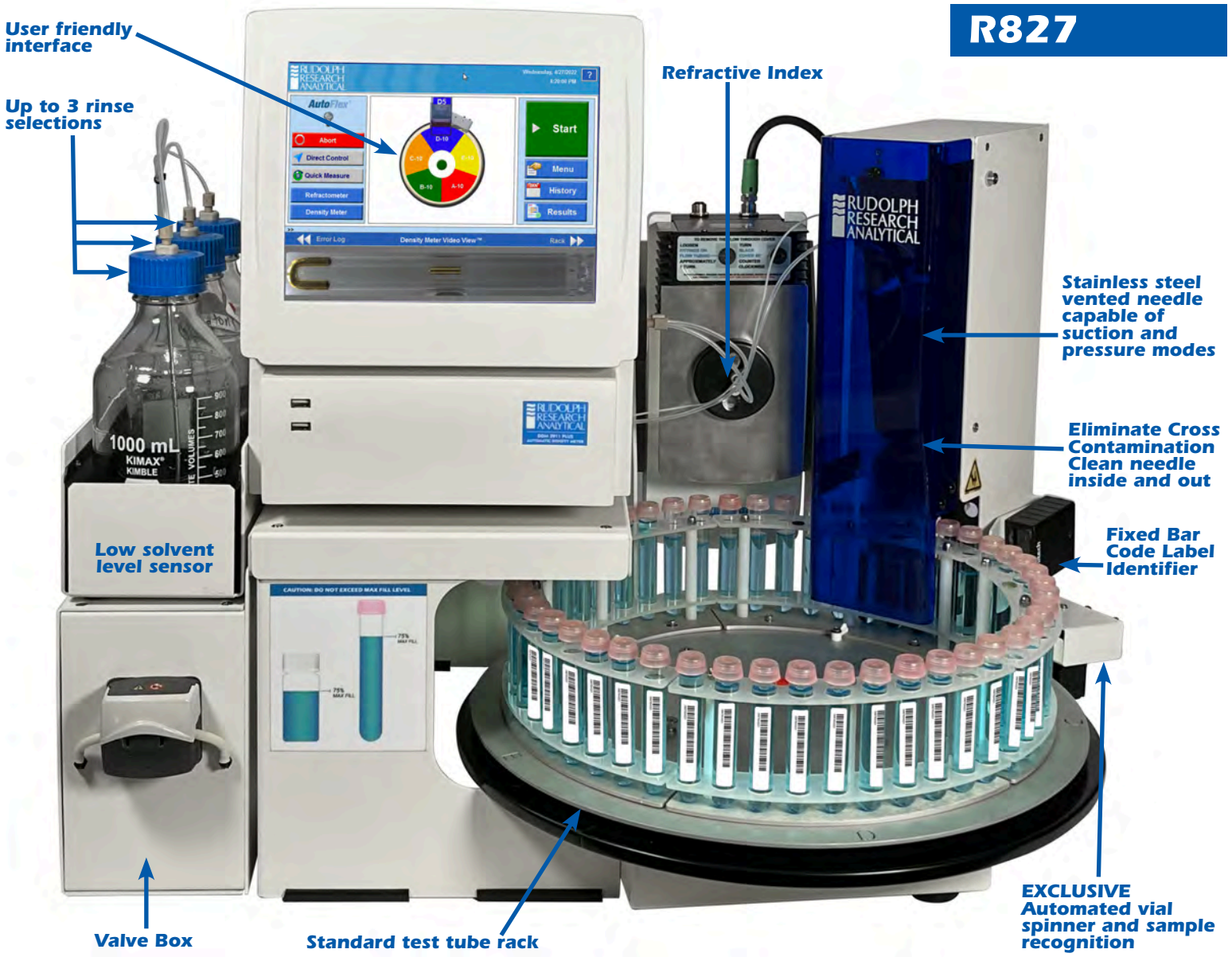
CALIBRATION
NVLAP LAB CODE: 200898-0
Accreditation to ISO/IEC 9001
www.rudolphresearch.com/resources/quality

Flexible Automated Carousel Solutions

Automate your Density, Specific Gravity, Optical Rotation, Specific Rotation, Refractive Index, Brix, Urea, Color (Reflectance and Transmittance), pH measurements and more.

- **Self-validated system** - new software makes it easy to run daily system validations which can be done as often as you'd like without any interruption to your routine.
- **Custom sample racks allow use of your vial** - Saves time, money and no decanting. Simply use the same vial you're accustomed to: 4 Dram, 1 oz., 1/2 oz. , 16x100mm, 13x100mm, 13x7mm, 5mL, and more.
- **Heated Racks** - For your heated applications we have 2 configurations available: 40/10 (40 heated and 10 non-heated) and 20/30 (20 heated and 30 non-heated). Petroleum Customers know that it is necessary to have non-heated availability for some control samples and the AutoFlex® R837 is the only auto sampler available at the time of publication that can comply with both heated and unheated applications.
- **Urgent sample** – Allows the user to run an interrupt sample without having to restart the active run.
- **Flexible Method Selection** – One of our goals at Rudolph Research Analytical is to keep things simple for the user. Each sample may require different sample load mode and/or parameters, measurement parameters, measurement criteria, temperature, cleaning parameters with solvent type, amount of solvent and drying time.
- **Unattended Operation** – The R827 and R837 has the intelligence to alert the operator to a low solvent condition or high waste jar condition.
- **Unmatched Features** – Push the start button and watch the vial spin to read your barcode (QR, PDF417, or 2D labels) for the sample ID. Low and highly viscous samples load flawlessly. The R837 measures Density, SG, OR, SR, RI, Brix, CIE L*a*b*, Gardner, ABS, %T, Cobalt, pH, then transfers the results automatically to LIMS, SAP or any proprietary data management system. The R837 can reclaim the sample if enabled, then thoroughly clean and dry with zero cross contamination.

Rudolph sets the standard in high throughput labs



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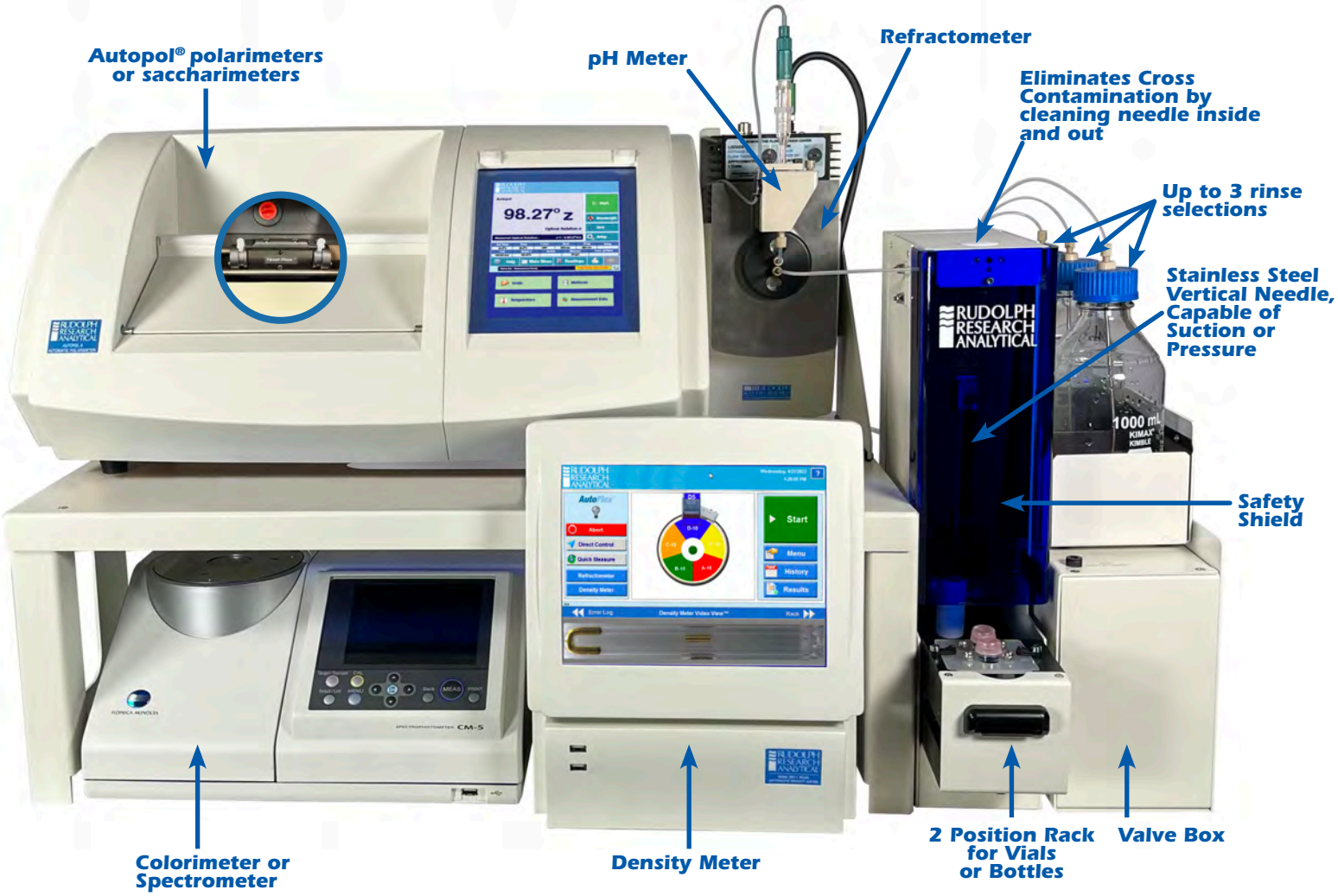
Flexible Automated Drawer Solution

Mixing highly viscous samples with regular samples is seamless. Users may assign pressure, suction, rinsing and heating to the sample drawer or the carousel system.



R837

Automation Flexibility with 2 sample capacity

The Two Sample Drawer Model, with fully automated sample loading, is perfect for labs who want the benefits of automatic sample loading, cleaning and drying but don't have a large number of samples to measure.

- 3 sample movement techniques: suction, pressure, or both
- 3 rinses to thoroughly clean the system.
- Automated cleaning allows lab staff to efficiently focus on higher valve activation.
- Samples can be heated automatically.
- Automatically load a blank and a sample in one routine.
- Instruments are always ready to use, walk away and the system cleans itself.
- Make 1 to 6 measurements per sample.
- By using the next sample as a rinse it reduces cycle time.
- Very compact footprint with fully automated functionality as shown.

Data Collection Solutions

Automated Data Collection

Automated sampling manages electronic data recording, sample IDs, and reduces operator errors. Test tubes and bottles can be automatically identified by the system with a built in bar code and label reader.

- Use any format of bar codes: PDF 417, 2D Matrix, UPC, or any bar code your lab chooses.
- The bar code is recorded as the Sample ID, measurements are taken, and data is available for export to a USB, Network Server, LIMS or any data storage system.
- Labeling sample vials is also simplified as each bar code can be placed at any rotation on the sample vial or bottle because the sample vials are spun as they pass the bar code reader.

QR CODE

PDF 417

2D MATRIX

UPC

- **Import List of Sample IDs** – Sample IDs can be saved and exported to AutoFlex®, which can automatically populate the sample sequence without the need of sample labels.
- **Low sample volume consumption** – The AutoFlex® R837 uses less than 12ml of sample for a 5 instrument combinations of measurement: SG, RI, OR, LAB and pH (Density Meter, Refractometer, Polarimeter, Colorimeter, pH meter).
- **Fast Throughput** – 1.5 to 8 minutes per cycle (load, measure & clean).

Reporting

SYNERGY®

CERTIFICATE OF ANALYSIS

This sample was measured on Autosampler,Needle Box Serial Number : 1047 and Valve Box Serial Number : 00000

Density Meter Serial Number : DDM4085

Refractometer Serial Number : 1780

Polarimeter Serial Number : 35262

pH-Meter Serial Number : 1780001024219

Colorimeter Serial Number : 104034

Printed Date and Time : Wednesday,09/02/2020 12:48:44 PM

	Autosampler						Density Meter		
	N	DateTime	Pos	Sample ID	Lot ID	AS Methoc	Density	Specific Gravity	Temp
1	1	09/02/2020 11:41:58 AM	A1	Scope		Synergy	1.000696g/cm^3	1.003664	25.000

		Refractometer				Polarimeter	
	Density Meter Methoc	Refract Inc	Brix	Sample Temp	Refractometer Methoc	OR	Sample Temp
1	Emerald	1.35048	11.71	19.99 C	Automated 20C	0.00	24.4 C

	Polarimeter	pH-Meter			Colorimeter			
	Polarimeter Methoc	pH value	Temperature	pH-Meter Methoc	L*	a*	b*	Gardner
1	TEST	6.561	25.0	TEST	96.471	-19.408	2.808	0.200

Operator Name : _____

Reviewer Name : _____

Page 1

Flexible Automation Solution

Automate your Density, Specific Gravity, Refractive Index, Color, and pH measurements.

- Push the Start button and measure Density, Specific Gravity, Refractive Index, Optical Rotation, Specific Rotation, Color, and pH. All results are exported automatically to your LIMS with a sample ID number.
- Flexible Sample Vials: Test Tubes, Boston Rounds, 1 OZ, ½ OZ, virtually any size bottle.
- Flexible rack configurations: Heated and unheated on the same carousel.
- Flexible Method Selection: Suction Mode, Pressure Mode, Combination Mode (for unmatched power) 3 variable rinse selections and endless drying time options.

Smart Sample Loading Technology

- SMART TECHNOLOGY™ automatically adjusts pump speed ranging from thin to high viscosity samples up to 36,000 mPa-s (cP).
- A heated rack option allows heavy crudes be pumped through the system.
- Standard Methods: Define measurement configuration, sample load configuration (Vacuum or Gas Displacement) solvent choices, and drying time.
- No loss of accuracy or reproducibility over manually loaded samples.
- No house air required.

Flexible Automation Solutions

The AutoFlex® Series of Automation is engineered to work better and built to last

The Rudolph R837 Automatic Sampling System is rugged and specifically designed to stand up in harsh laboratory and industrial applications.

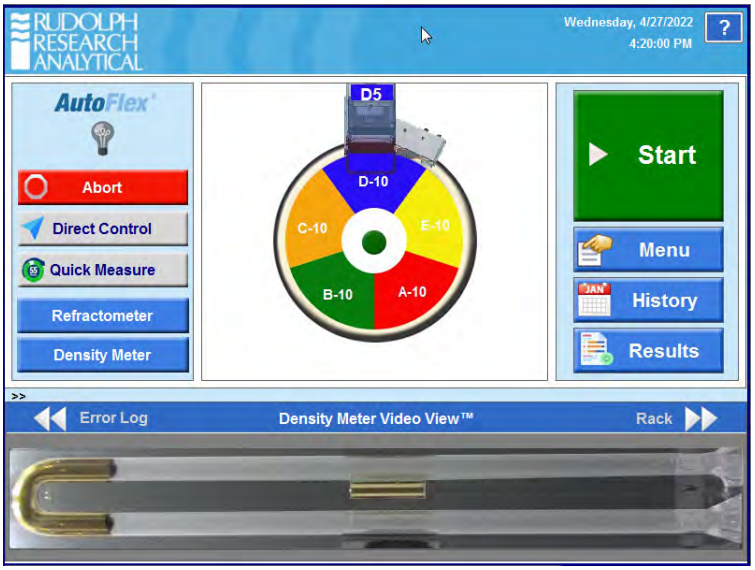
- Superior material construction: Stainless Steel Needle, PTFE, Teflon, and PEEK liquid flow path materials.
- Robust needle with a sufficient torque to pierce any septum.
- Never miss piercing a sample vial with precision-engineered probe arm and sample racks which virtually eliminate misalignment errors.
- Safety guard protects hands and automated needle detects no-sample condition.
- Modular design reduces combined footprint.
- Interlocking drawer for safety and compliance.

Application Flexibility

The AutoFlex® R837 can be configured with various instruments and measurement methods to automate a wide range of sample viscosities. It is perfect for high throughput laboratories looking to increase productivity. The AutoFlex® is excellent when used in combination with Rudolph Research laboratory instruments in the Petroleum, Chemical, Flavor, Fragrance, Pharmaceutical, and Toxicology industries.

Flexibility Unmatched with Windows Embedded

The user interface allows the operator to interrupt a measurement routine with an urgent sample. If you need to quickly find and measure a sample in the rack, the auto-find feature will search and measure it for you.



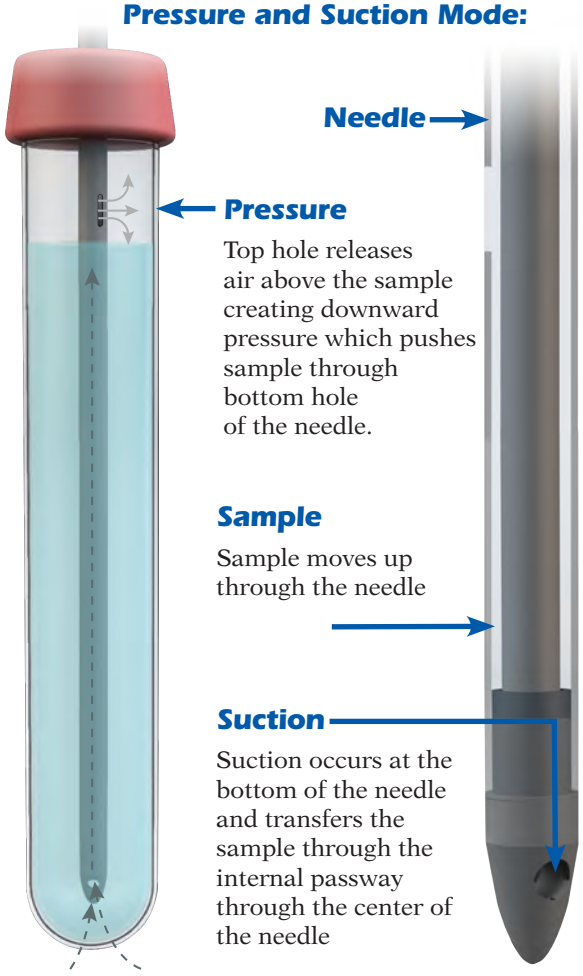
Cross Contamination Elimination

Eliminate sample cross contamination with complete needle cleaning - a Rudolph exclusive feature

- Self-cleaning needle eliminates cross contamination by washing both inside and outside areas of the needle between each sample. Most commercially available automation systems only flush the inside of the sample needle but neglect cleaning the outside of the needle thereby carrying over small amounts of the prior sample into new samples.
- The AutoFlex® Soaker rinses the entire system with your choice of 3 solvents between each sample.
- Low solvent level sensing: the 3 solvent bottles have a non-contact low level sensor which will prompt the user with a low solvent level message.

- Sample return feature: allows 95% of the original sample to be returned to the sample vial.
- Solvent selection flexibility: by using highly solvent resistant materials for all sample pathways, a wide variety of solvents may be used including: water, acetone, isopropanol, toluene, hexane, and heptane.

Rudolph's exclusive Pressure and Suction Mode:



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=Heated Rack or Drawer to Match Your Testing Throughput=

Pre-Heat your samples from 30°C to 90°C with heated sample positions.

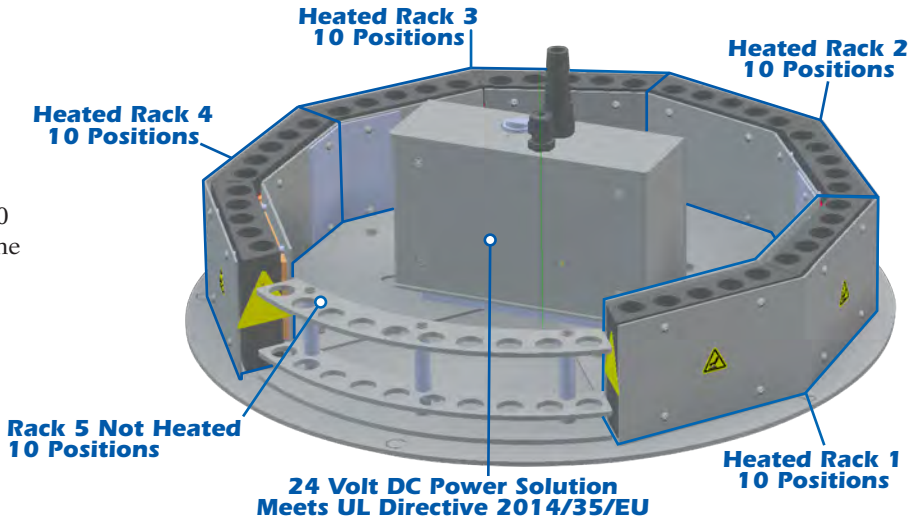
2 Heated Carousel Configurations

- 20 Heated and 30 non-heated sample positions, for a total of 50 positions.
- 40 Heated and 10 non-heated sample positions, providing independent temperature control for 20 samples that can be set at one temperature and the other 20 at a different temperature and 10 non-heated, for a total of 50 positions.

Heated Tubing

- Keeps the sample in a liquid state to load and unload the sample without clogging. The temperature is controlled by the measurement method making it transparent, operator friendly, reliable, and safe. Heating is activated only when it is it is required in the method.

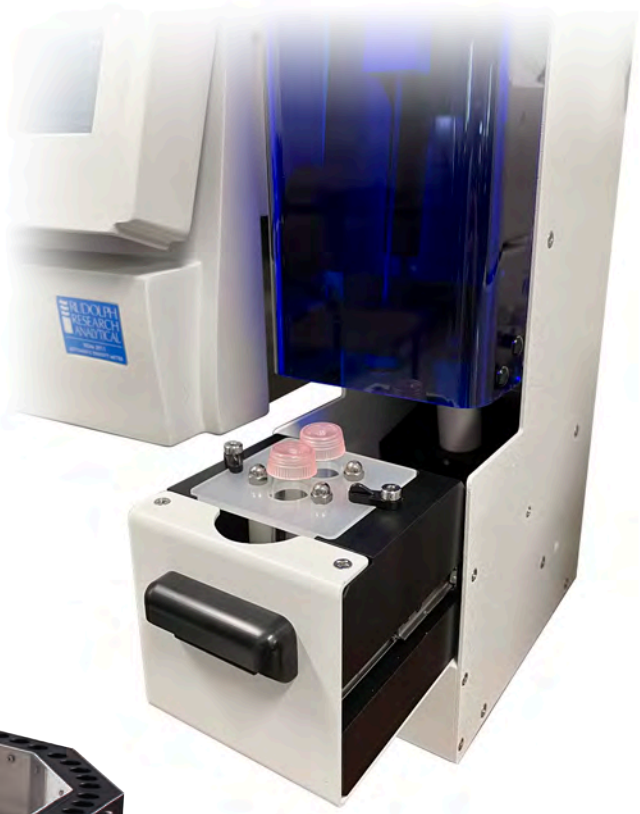
One Carousel for Heated and Non-Heated Samples



Complies with ASTM D4052 and D5002

Shown below is the AutoFlex® with a 4 heated racks and 1 non-heated rack system and 2 method solution setup.

Two Sample Drawer



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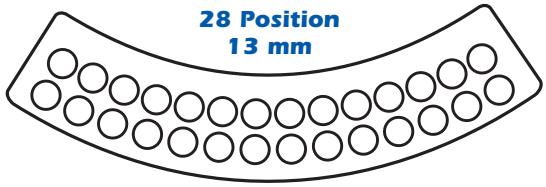
Flexible Rack Configurations For Your Application

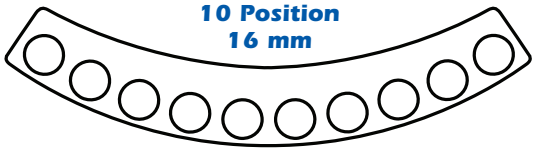
Rudolph Research can provide a sample rack or two position drawer configured to the bottles or vials used in your laboratory so there is no decanting.

A sample of the many custom rack configurations available only from Rudolph. Mix or match up to 5 heated or unheated racks on one Carousel

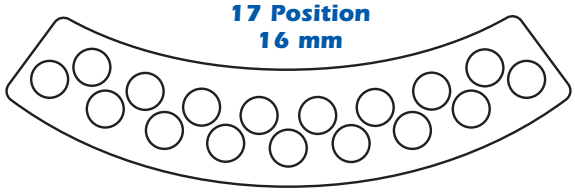
Small diameter 28 Positions per rack with up to 5 racks. 13mm Test Tube (Dual Rows) Up to 140 samples per carousel.



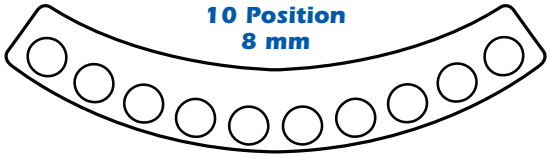
Standard Test Tube Rack, 10 Positions per rack, 16mm Test Tube (Single Row) Up to 50 samples per carousel.



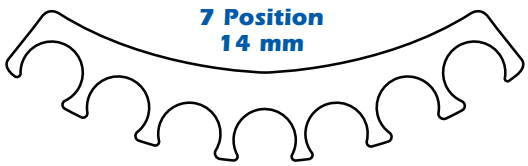
Standard Test Tube Rack, 17 Positions per rack, 16mm Test Tube (Duel Row) Up to 85 samples per carousel.



Short Test Tube Rack, 10 Positions per rack, 8mm Test Tube (Single Row) Up to 50 samples per carousel.



Boston Round bottle with caps Rack, 6 or 7 Positions per rack, (1/2 oz or 1 oz)(14 mm or 28mm) 30-35 samples per carousel.



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Pharmaceutical

Description

Rudolph Polarimeters are the industry standard for Pharmaceutical companies measuring Specific Rotation. Many Pharmaceutical Laboratories also use Rudolph Density Meters and Refractometers. Adding Automation offers several benefits. Consistent sample loading procedures adds to accuracy, repeatability and greatly reduces operator error and digitizes all measurement results with permanent storage. Many Pharmaceutical Lab Managers want instruments always cleaned and ready for measurements at all times and do not want Lab Technicians rinsing and drying measurement cells by hand. Using a two sample drawer automation system with a Polarimeter allows the user to measure their Blank and sample in one operation. The method would then consist of loading the blank, cleaning, and then measuring the sample under test. The instrument will end with a cleaning and drying the measurement cell so the instrument is always left ready to use.

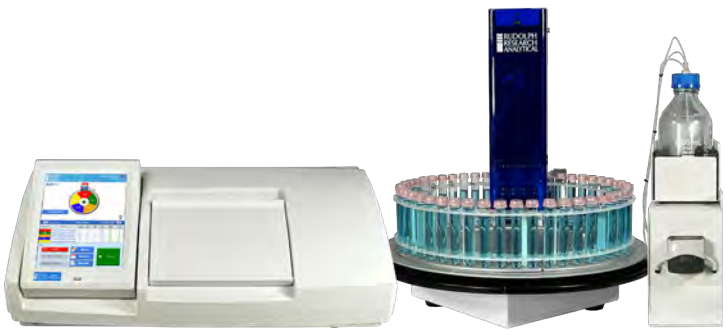
Typical Rudolph Users

Laboratories making multiple measurements may choose to use a Rudolph Carousel Automation System to handle many samples, in multiple instruments and then clean the entire system. Custom sample racks can range from 50-100 sample positions. You many even choose to use your own, existing vessels. All of this can be done within prevailing Pharmaceutical Regulations.

gsk Pfizer TEVA BAYER Johnson & Johnson

Many Choices From Rudolph

Rudolph Polarimeter, R837 Carousel



Autopol V and R827 Sample Drawer

Alcohol Beverage Testing

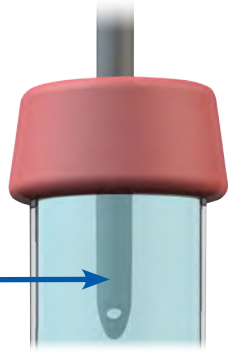
Description

When testing beverages containing alcohol the primary reason for measurement is to determine the %ABV or Proof of the final product. The Rudolph TTB approved DDM 2911 PLUS is the measurement instrument, and it can produce measurements per sample in 2-3 minutes. A high-throughput alcohol lab has many samples per day, automatically cleaning and drying in between samples improves reproducibility and accuracy.

Many distilleries also blend flavorings into spirits and alcohol/water mixtures to create a flavorful finished cocktail and beverages. The instrument used to measure these products is the Rudolph **AlcoTest-RI®** which can also be loaded and cleaned using an Auto-Sampler.

Reasons to Choose Rudolph

- Rudolph can maximize throughput by utilizing a higher speed Auto-Sampler that rinses one sample out with the next sample. The Rudolph R817 Auto Sampler utilizes a rapid Peri-Pump to quickly load a sample and then load the next sample without having to clean and dry the instruments in between.
- Very Fast Cycle Times
- Custom Racks and sample containers are used to provide maximum sample capacity and hold containers large enough to supply adequate sample volume.
- A Bar Code Reader with Vial Spinning option is available.
- Highly evaporative alcohol samples may be kept in capped sample vials or bottles until time of measurement by Rudolph's cap piercing needle.



Typical Rudolph Users

- High Throughput Distilleries making dozens to hundreds of measurements per day.
- Distilleries who do not wish to clean the instrument between samples.

San Luis Spirits of Texas uses an Rudolph AutoFlex® Automation system and a Rudolph DDM Density Meter to measure a high volume of Beverages for %ABV V/V each day.

Jim Beam utilizes various Rudolph Alcohol Proof Testing instruments and Rudolph AutoFlex® Automation to keep up with very high quantities of samples.

Alcohol Beverage Testing Solutions

R817 Carousel with Alcotest-RI®

R837 Carousel with Density and Refractometer

Flavor and Fragrances

Description

The Flavor and Fragrance industries have unique needs. Many wish to make multiple tests of their sample such as Density, Optical Rotation, RI or Brix, pH, and Color, all with one sample loading. Since samples may be scarce or very valuable, using the minimum amount of sample is of great importance. Samples may be viscous or require several solvents to fully clean the instrumentation. Rudolph's most capable automation system can handle all these requirements. The R837, using both suction and pressure at the same time makes pumping high viscosity samples of up to 37,999 mPa -s possible through instruments still using less than 12mL of sample.

Reasons to Choose a Rudolph Automation Solution

- Measure Density, SG, RI, Brix, OR, pH, and LAB with 12ml of sample
- Custom racks use custom choice of vial or bottle thereby eliminating decanting
- Use up to 3 solvents
- Cap piercing Needle allows you to keep your samples sealed
- 3 Sample Load Modes: Gas Displacement, Vacuum, and Hybrid allows flexible pumping solutions.

Typical Rudolph AutoFlex® Customers

- Flavor and Fragrance customers who are testing incoming materials for QC and commercial purposes
- Customers who need multi parameter measurement capability with minimal sample volume.
- Labs who prefer removable racks that hold custom bottles.

Firmenich uses Rudolph AutoFlex® Automation to make multiple measurements from one small sample of 4-6ml. Measure RI/ BRIX, OR, SG, and Color with a minimal amount of sample volume.

PetNet – Use the Rudolph sample reclaiming feature with the AutoFlex® Automation system to reuse up to 95% of a sample for further testing.

Two measurement sampling solutions for automation with low sample volume

R837 Carousel with Density, Refractometer, Polarimeter, Colorimeter and pH Meter

R827 Carousel with Density and Refractometer

Sugar Testing

Description

Sugar Beet and Cane Mills often need to make multiple analysis from a single sample while reducing bench chemist involvement. Automating sample loading and instrument cleaning increases throughput, increases repeatability and allows for multiple tests in a single sample.

Reasons to Choose Rudolph

- Using a Rudolph AutoFlex® R817 Automation solution in the sugar laboratory minimizes sample handling and measures: Brix, Purity, Density, SG, and pH in 2 minutes and with just 8ml of sample.
- Rudolph automation systems clean automatically with up to 3 choices of solvent

Typical Rudolph AutoFlex® Customers

MINN-DAK FARMERS COOPERATIVE

Minn-Dak Farmers Cooperative and Amalgamated Sugar use a Rudolph AutoFlex® with a 5 instrument package to handle their high sample throughput and multi parameter testing.

TATE + LYLE

Tate and Lyle use Rudolph Automation and Refractometer, Polarimeter, Density Meter and a Colorimeter to perform QC measurements for High Fructose Corn Syrup

Streamline your sugar testing needs

Saccharimeter, Density Meter, Refractometer, Automation Carousel, pH Meter, and Colorimeter

Biological Fluid Analysis

Description

Labs testing biological fluids such as urine, work with very limited sample volume. Automated testing is limited to a 2ml sample volume. Urine labs must test 100's of samples per day therefore automating sample loading, cleaning while still using 2ml of sample is a must.

Reasons to Choose Rudolph

- Fast measurement and loading speed enable a laboratory to process large numbers of samples on one instrument.
- Automated sample loading and instrument cleaning allows laboratories to process many sample per day on one instrument.
- Smaller required sample size preserves sample for other tests and allows for more samples in each rack.

Typical Rudolph AutoFlex® Customers

- Labcorp and The Australian Anti-Doping Authority use a Rudolph J457 Refractometer and R837 AutoFlex® automation system.
- Quest Diagnostics – Quest uses Rudolph Automation with a Refractometer and pH Meter for Toxicology Analysis.
- Australian Government Sports Integrity – Uses Rudolph Automation Refractometer and pH Meter to do high volumes of samples for Toxicology Screening

Quest Diagnostics™

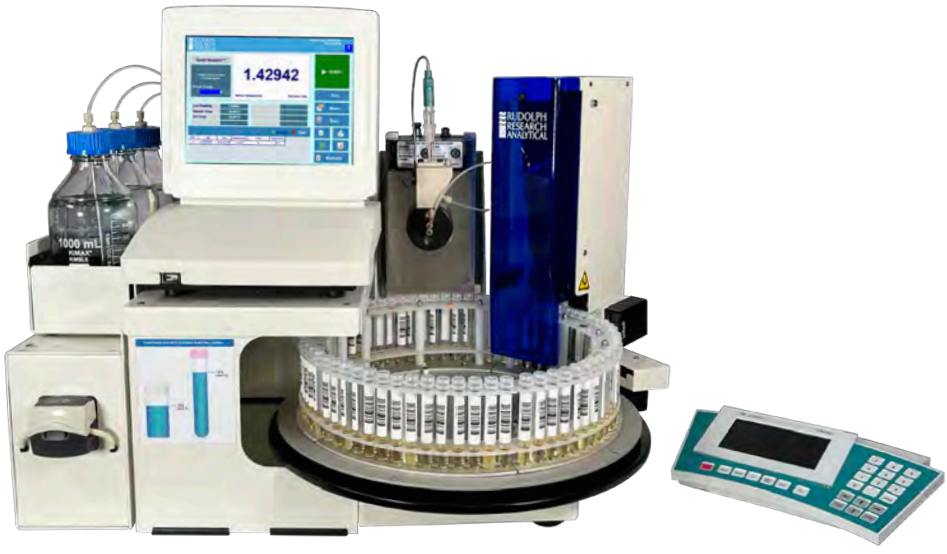
LabCorp Laboratory Corporation of America

Australian Government Sport Integrity Australia

SPORT INTEGRITY AUSTRALIA

Urine Testing From Rudolph

Rudolph Refractometer, pH Meter and R827 Carousel



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Food and Beverage Quality Control

Description

Food and Beverage companies use Rudolph for Quality Control testing. Rudolph's automated testing solutions offer multiple instruments to perform multi-parameter tests, such as SG, Density, RI/BRIX, Optical Rotation, Color, pH. Rudolph offers exclusive and superior sample handling including: bar code reading, sample agitation, sample pumping and suction, and up to 3 rinsing agents.

Reasons to Choose Rudolph

Sample agitation prior to measurement

Typical Rudolph AutoFlex® Customers

Pepsi uses Rudolph AutoFlex® Automation with a Rudolph DDM Density Meter and J-Series Refractometer to measure incoming ingredients and finished products. The ability to mix the sample and work with a large number of samples makes Rudolph AutoFlex® the right solution for Pepsi.

Bayer Foods – Measures incoming ingredients for quality and purity using Rudolph AutoFlex®, Automation, DDM Density Meter and a J-Series Refractometer. Key features for Bayer are high throughput, multiple rinses, and high accuracy instruments.

Coca-Cola Quality Control and Formulation Laboratories utilize Rudolph to test for RI/BRIX, Optical Rotation, Color, and Specific Gravity. Using the Rudolph AutoFlex® Automation the lab has both high throughput capability and complete flexibility in sample container selection, rinse selections, and choice of analytical instruments.

pepsi

BAYER

Coca-Cola

Many Choices From Rudolph

Rudolph Polarimeter, Density Meter, Refractometer, Colorimeter and Automation Carousel

Rudolph Density Meter, Refractometer and R827 Carousel

Petroleum

Description

Petroleum companies have a wide variety of samples to test in many different viscosities. Often samples are so viscous that they must be heated. Thick, sticky samples are also difficult to clean thus multiple rinses with 2-3 solvents may be necessary. Rudolph addresses these sampling needs in 3 ways. Rudolph offers advance sample pumping and suction to help deliver difficult samples. Additionally, Rudolph can supply temperature-controlled racks, tubing and sample chambers so samples are reduced to a manageable viscosity in order to flow smoothly through the AutoFlex® Automation system. Finally, Rudolph offers up to 3 rinsing solvents to clean pathways and instruments.

Reasons to Choose Rudolph

- Rudolph offers heated sample racks and tubing for 2, 20, or 40 samples in addition to non-temperature-controlled sample racks. On carousel models Rudolph heated and un-heated racks can be mixed giving you the flexibility to run both heated and non-heated samples.
- With up to 3 rinse solvents, you can be sure your instrument and pathways are left clean and ready for more samples (From jet fuels, lubricants, or heavy crudes).

Typical AutoFlex Petroleum Customer

Petroleum Refiners testing a large variety of petroleum products with a wide variety of viscosities. One AutoFlex® Solution can test many different products and leave the Density Meter properly cleaned after use. Heated sample racks can be customized for specialized industrial containers used to heat highly viscous samples. A Rudolph self-contained, fully temperature-controlled system with multiple rinses allows maximum measurement flexibility, without additional apparatus such as outside air or water baths.

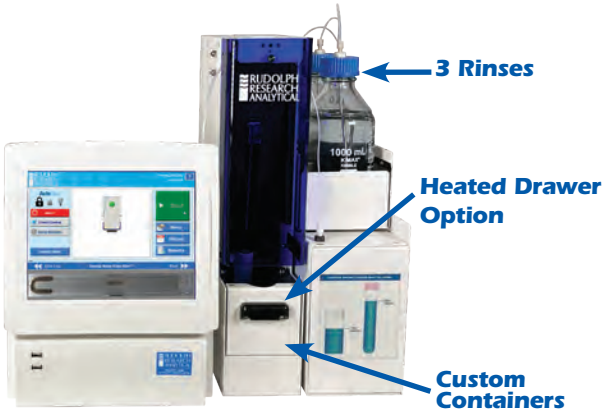
TotalEnergies

Total Energies uses Rudolph AutoFlex® Automation solution with 40-position temperature a non-temperature controlled 10 position rack. The heated and non-heated rack solution combined with and a Rudolph Density Meter with heated tubing and interface measures any petroleum product that comes through their lab. This includes high viscous crude oils up to light fuels.

Shell – The Shell Technology centers perform testing all over the world covering a wide variety of petroleum products. Thus Shell required measurement over a wide temperature range combined with a need for high accuracy and high throughput. Rudolph AutoFlex® and DDM Density meter with variable pumping solutions and flexibility rinsing options was the clear solution.

Three Choices From Rudolph

Rudolph Density Meter and R837 Sample Drawer



Rudolph Density Meter and R837 Carousel

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Features and Specifications

Standard Features:

- 3 rinses available
- Inside and Outside Needle Wash
- Low Solvent Level Detection
- Suction Mode
- Pressure Gas Displacement Mode
- Flexible Method Selection
- LIMS Compatible
- 5 Test Tube Racks Handling 50 Samples
- Rack Specific Method Selection
- SAP Compatible
- Variable Drying and Rinse Times

Optional Features:

- Racks (customized to your bottles)
- Heated Racks
- Built in Bar Code / Label Reader with Vial Spinner
- Handheld Bar Code / Label Reader
- Automated Empty Vial Recognition
- Extra Racks
- Sample Return Feature: Allows 95% of sample to be returned to sample vial
- Custom Programming

Specifications:

Sample Viscosity:
Samples up to 36,000 mPa-s (cP)

Sample Volume Requirements:
3.5ml typical, optional to 1.5ml or 1.5mL to 10mL config. dependent

Rack Sample Capacity:
50 - 16 x 100mm test tubes. 70 - 13 x 100 mm, or optionally dozens of sample vial configurations and capacities.

Cleaning Cycle:
1:45 minutes nominal – time varies by application

Full Measurement and Cleaning Cycle:
2:30 minutes nominal - time varies by application

Software Interface:
Compatible with Rudolph Research instruments running Windows Embedded OS

Power Requirements:
100-240 volts - 50-60 Hz – 10 amps

Operating Dimensions: **L:** 24” **W:** 24” **H:** 20.5”
L: 61 cm **W:** 61 cm **H:** 52cm

Weight: 42 lbs. / 19 kg

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Features	R817D & R817C	R827D & R827C	R837D & R837C
	Sample Movement Methods		
Pumping Method	SmartSample™ Peristaltic Pump	SmartSample™ Peristaltic Pump	SmartSample™ Loading Technology comes standard with 3 choices
Suction Mode	Yes – All Models		
Pressure Gas Displacement Mode	No	No	Yes
Hybrid Sample Loading	No	No	Yes
Air Drying	No	Internal Air Pump	
Sample Agitation	No	Yes	Yes
	Sample Capacities & Custom Sample Vessels		
Carousel Capacity	Carousel Models – Up to 140 samples		
Drawer Capacity	2	2	2
Custom Racks	Carousel Models – Use your vessel		
	Rinsing and Cleaning Features		
Needle Cleaning	Self-Cleaning Needle Soaker	Full Needle Washing and Drying	
Rinses available	Rinse with next sample	Up to 3	Up to 3
Variable Drying and Rinsing Times	Variable Rinsing with sample only.	Complete flexibility in Drying and Rinsing times and Routines	
Low Sample Volume Consumption	No	Yes	Yes
Low Solvent Alert	N/A	Yes	
Typical Measurement Time	1-4 Minutes	3-7 Minutes	3-7 Minutes
Min Sample Volume	10mL	2mL	2mL
	Data Reading and Sample Handling Features		
Bar Code Reader	Optional on all Carousel Models – Handheld Bar Code for drawer models		
Vial Spinner	Optional on all Carousel Models – Handheld Bar Code for drawer models		
LIMS / SAP / Network Capable	All Models		
Safety Shield	All Models		
AutoFind™	AutoFind™ is available on all carousel models		
Multiple Analysis	Up to 6 analysis		

Rudolph stands behind each instrument purchase with a 20 year support guarantee. Rudolph is still repairing instruments it manufactured in the 1970's.