RUDOLPH RESEARCH ANALYTICAL

TECHNICAL BULLETIN 947

Refractometer Selection, Application and Feature Guide



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

Rudolph subjects itself to a variety of industry accreditations and outside examination. Visit our website to learn how these apply to your purchase.

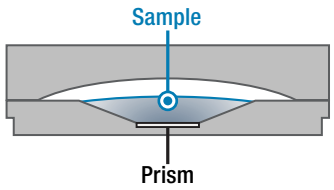
Exclusive TempTrol™
Dual Temperature Control System

The J457 has the widest temperature range

The J457optics with the remote display has the best air circulation of any model in the Rudolph range allowing the widest temperature setting and the fastest stabilization times.

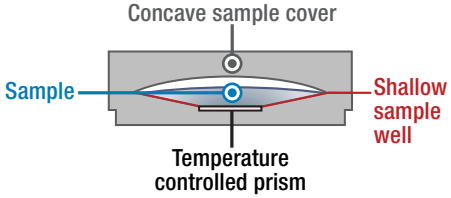
Great for applications where the measurement temperature is near ambient. Temperature control is provided only from below the sample.

ENVIRONMENTAL PROTECTION COVER (EP)



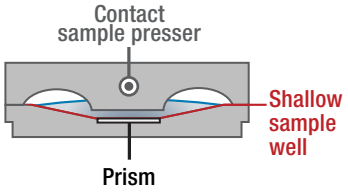
For most samples 10° from ambient select J Series standard temperature controlled sample cover (CC option)

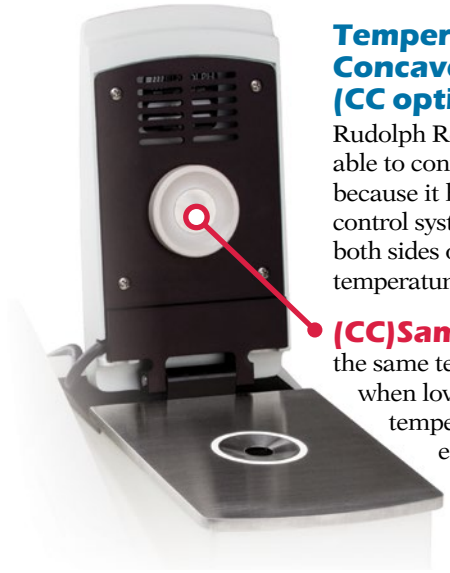
TEMPERATURE CONTROLLED SAMPLE COVER (CC)



For semi-solid and highly evaporative samples more than 10° from ambient select a model with a contact presser (CP option)

CONTACT PRESSER OPTION (CP)





Temperature Controlled Concave Sample Cover (CC option is standard)

Rudolph Research Analytical's J457 is able to control temperature to 100°C because it has a unique dual temperature control system where heat is applied to both sides of the sample. (Optionally, higher temperatures are available.)

(CC)Sample Cover is controlled to the same temperature as the prism and, when lowered, is designed to provide a temperature controlled micro environment that provides unrivaled temperature stability, fast measurement time and minimal evaporation.

Optional Contact Presser (CP Option)

The J457 is available with an optional Temperature Controlled Sample Presser (CP option) that touches the sample. Compared with the standard temperature controlled cover, the optional **(CP) Contact Presser** reduces the empty volume of the measurement area thereby decreasing evaporation and at the same time helping to evenly spread semi solid materials over the measurement prism. This feature offers improved performance on many samples such as PET and Glycerine.

Contact Lens Presser

Specialized pressers for applications



Rudolph offers the widest range and most accurate optical system.

Wide range from 1.26 RI to 1.72 RI is available

- Extreme low range makes the instrument able to measure fluorocarbons like sevoflurane (1.27RI)
- Extreme high range makes the instrument able to measure aromatic flavor materials like cinnamic aldehyde (1.619 RI) and chemicals like methylene iodide (1.718 RI).

High accuracy +/- 0.00002

The J457 has accuracy equal to the short range food refractometers making it able to be used for high accuracy Brix measurement.

Easy clean prism

All Rudolph Refractometers have the flat, easy clean prism as standard.

Ultra Hard Sapphire Prism



Some manufacturers use glass or YAG (Yttrium-Aluminum-Garnet) prisms. These prisms are softer than sapphire and have slower temperature transfer coefficients.

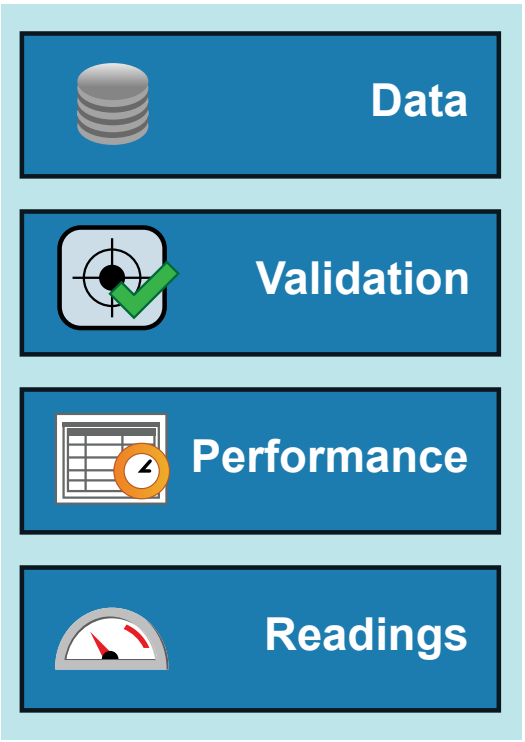
Don't worry you can clean the Rudolph prism with regular paper towels, no special cleaning paper is required.

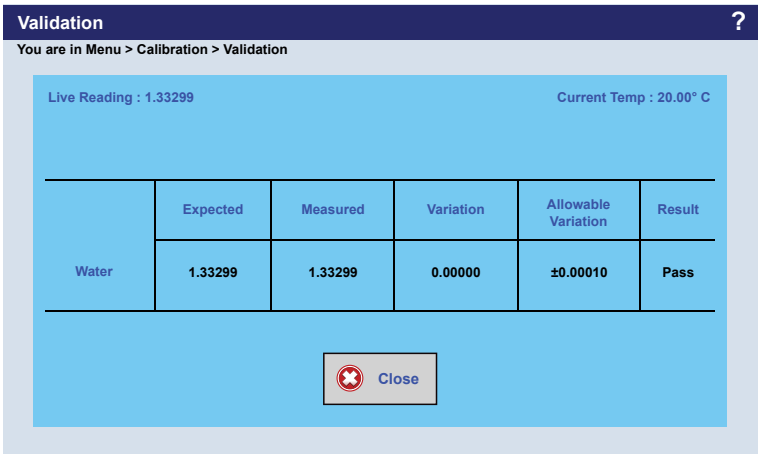
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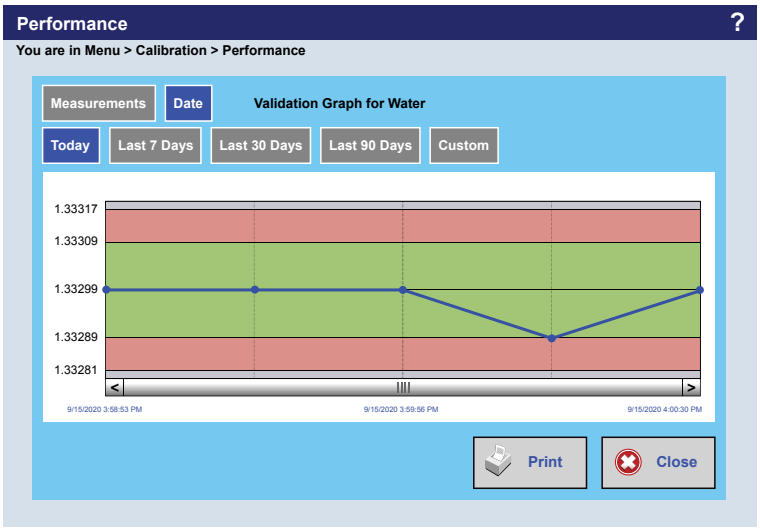
Validation

Set a standard, measure it over time. The J457 has the ability to set up prompted validations and provide a graph of that validation over time.

The range can be programmed by the laboratory allowing a lab to set limits as defined by USP<831> or ISO or any other standard.







Sample Handling Options

Flexible Sample Handling Options for Your Application

Rudolph Research offers many options to deliver samples to the refractometer including, AutoFlex™ R837 Auto Sampler, Peristaltic Pump, Vertical KVP for samples with suspended solids, and the DP Cover. These options offer the ability to use the refractometer horizontally or vertically, with samples introduced manually, with a syringe, or pumped for higher throughput labs.

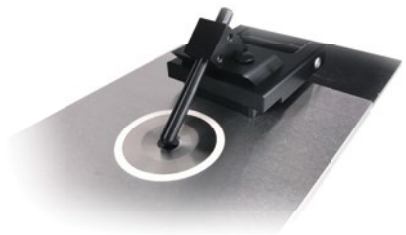
For most liquids and semi solids the drop sample prism is the easiest. Drop it on and wipe it off. Some users may prefer to push the sample through either because it's extremely evaporative and needs to be kept in a closed system or, more commonly, because the refractometer is attached to a sample handling system such as the Rudolph R837. Also available is a solids measuring attachment for plastics.



Vertical Loading Position



Solid and Thin Film Measuring



ULV (Ultra Low Volume)

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Chemical Concentration Measurement

Description

Many chemicals are sold and shipped as solutions. Both suppliers and end users want to know the exact concentration of the solution. That concentration determines the value of the material and, from a users point of view, how much is added to the process mixture. Refractometers are an extremely quick way to validate starting material purity, measure concentrations, and validate mixture end points. Our rugged instruments can be located in a load out area or beside a production line, not just in a lab.

Reasons to Choose Rudolph

- Chemical measurement needs temperature control, not correction, and all Rudolph refractometers from the J57 above have this.
- Confidence in the products you ship to your customers with validated instruments with validated standards and measurement processes.
- Many solvents have Refractive Indices(RI) outside of the range that a food refractometer can measure; a specialty chemical model is needed.

Typical Rudolph Users

- Most countries now require that urea solutions be a part of diesel exhaust emission systems. This fluid goes by different names such as Adblue, DEF and ARLA. Manufacturers like YARA and distributors like BRENNTAG use Rudolph.
- Manufacturers of polymers like Nylon need to monitor raw material solutions. Dupont / Kordsa are just one of many Rudolph users.
- Urea Formaldehyde and Phenol Formaldehyde resins are critically important to the wood industry. Manufacturers like Hexion and Dynea use Rudolph as part of process control.

BRENNTAG DUPONT HEXION

Three Choices From Rudolph

J57WR-EP

Very simple to operate, minimal bench space and a good choice when there is just one dedicated application.



J357CC

Very wide range so it can measure materials dissolved in fluorocarbon solvents. Flat, easy to clean prism, with on-board concentration programming.



J457CB

All the advantages of the J357 but operating from a seperate computer allowing easy data transfer to SAP, Excel and similar.



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Food Quality Control

Description

Measurement of Brix is central to food manufacturing. Consistant Brix measure is key to product consistency. Food product profit margins are tight, so careful monitoring of the quality of incoming raw material and also strict monitoring of how much of that raw material is used in the process are the main drivers of factory profit.
Brix Range 0-100; RI Range 1.33-1.53; 1.29-1.72

Reasons to Choose Rudolph

- Accuracy in the second decimal place in Brix means the ability to stay closer to specification.
- Temperature control allows the instrument to be calibrated with traceable references to meet ISO and similar standards.
- Flat, easy clean prism means better results even when used by non-laboratory trained operators.

Typical Rudolph Users

- Cargill and ADM uses Rudolph Refractometers in ingredient manufacturing plants globally.
- Mars Wrigley use Rudolph instruments to check the quality of incoming flavor materials.
- Nestle uses Rudolph to check the quality of tomato products for prepared meals.

Cargill™

MARS WRIGLEY confectionery

Nestle®

Three Choices From Rudolph

J57HA-EP

Very simple to operate, minimal bench space and a good choice when there is just one dedicated application.



J357CC

Wide temperature range and dual temperature control make it the ideal instrument when measuring hot samples directly from a kettle or cooking vessel.



J457CC-WC

A split design instrument keeps the computer display portion clear of the wet working area.



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Pharmaceutical

Description

Pharmaceutical measurement demands meeting the required standard, for example USP<831>, EP2.2.6 and similar. There is no "good enough" in pharma, additives and formulations must meet USP requirements. Documentation is also key, simply generating a number is not enough. The laboratory has to be able to prove calibration and, when it is operating under 21 CFR 11; document who did the measurement and create an audit trail showing every interaction with the instrument. Additionally, the operating software and data security has to be proven to work by an IQOQPQ before acceptance.

From a measurement system point of view it is also important that the instrument has the broad range to measure pharmaceuticals. This includes materials like sevoflurane (RI of 1.26) and cinnamon oil (RI of 1.61). A food or even a general chemical refractometer usually does not have sufficient range to cover this.

Reasons to Choose Rudolph

- Proven 21 CFR 11 system with electronic signature and full audit trail documentation
- Detailed IQOQPQ using traceable standards across the whole range of the instrument.
- Wide enough range to measure everything in the USP / EP / BP / IP / CP / JP.

Typical Rudolph Users

- Reference laboratories like the USP need to be able to measure EVERY material in the Pharmacopeia and find the wide range of the J257 essential.
- GSK, Merck, Pfizer all use the J series for checking incoming raw materials.
- Biogen uses the J series for in process concentration measurement.

Three Choices From Rudolph

J257 EP

Sufficient range to measure all pharmaceutical products, sufficient accuracy to meet all Pharmacopeia needs, integrated 21 CFR 11.



J357CC

Similar to the J257 but providing extra accuracy allowing some headroom above the pharma requirements.



J457CB

Rudolph optics with your choice of networked PC. Utilizing Rudolph 21 CFR 11 software making the system easier to monitor and back up by remote located IT departments



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Petroleum

Description

The petroleum industry is standardized through ASTM methods, and the key is having a refractometer that meets the specifications of ASTM.. For Refractive Index(RI) measurements this mostly means ASTM D1218 and D1747. Compliance with D1218 is for measurement at temperatures between 20°C and 30°C and is mostly used for light hydrocarbons. D1747 is for measurements up to 100°C and is often used for crude oils and other process streams. ASTM is very strict with temperature as these types of samples generally have a very much larger dn/dt value than the water / sugar samples used in food.

Reasons to Choose Rudolph

- Reflectance style measurement system allows the instrument to measure samples much darker than a traditional Abbe style refractometer can.
- Temperature control allows the instrument to be calibrated with traceable references to meet ISO and similar standards.
- Flat, easy clean, prism means better results even when used by non-laboratory trained operators.
- Compliance with D1218 is for measurement at temperatures between 20°C and 30°C for light hydrocarbons, and D1747 is for measurements up to 100°C for crude oils.

Typical Rudolph Users

- ExxonMobil uses the J457 at 67° C to check a process stream.
- SGS uses Rudolph refractometers for custody transfer checking.
- Sinopec uses the J357 for research and development.

ExxonMobil

SGS

SINOPEC
PREMIUM LUBRICANTS

Three Choices From Rudolph

J57WP-EP

Very simple to operate, minimal bench space and a good choice when the only requirement is to meet D1218.



J357CC

Wide temperature range and dual temperature control make it the ideal stand alone laboratory instrument for both D1218 and D1747



J457CC-FC

A split design instrument keeps the computer display portion clear of the hot working area. The optics may also be located under a fume hood to protect operators from noxious samples.





Flavor and Fragrances

Description

Flavor and fragrance materials are traded worldwide. Essential oils are distilled from plants in some of the most remote corners of the globe. Innovation laboratories make analogues of traditional flavors or even whole new materials. The two most common specifications in certificates of analysis are Specific Gravity(SG) (density) and Refractive Index(RI).

Reasons to Choose Rudolph

- Wide range of 1.26 RI to 1.70 RI allows measurement of all currently approved compounds.
- Built in temperature control provides more accurate results than relying on temperature correction models.
- Flat, easy clean prism means better results even when used by non-laboratory trained operators.

Typical Rudolph Users

- Firmenich uses automated systems in many countries, for in bound raw materials testing and final product release.
- Coca Cola uses automated systems for measuring raw material in beverage bases.
- Takasago measures Refractive Index(RI) combined with Optical Rotation(OR), Color and Specific Gravity(SG).

Coca-Cola TAKASAGO Firmenich

Three Choices From Rudolph

J257EP

Very simple to operate, minimal bench space and a good choice when only Refractive Index(RI) is needed.



DDM 2911-VL / J457 OM-DP

Minimum sample volume combined solution that gives Specific Gravity(SG) and Refractive Index (RI).



R837, DDM 2911, J457OM-DP, Autopol I

Automated solution for measurement of Refractive Index(RI), Specific Gravity(SG), Optical Rotation(OR), Color, and pH.



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Biological Fluid Analysis

Description

Samples are sometimes very difficult to obtain, and the refractometer test is a "non-destructive" test on a very small volume of sample. . The sample might come from a small animal and the volume is minimal. Samples from humans are subject to regulations and right of refusal, and retaining the sample is important. The number of samples tested is often very high, and the refractometer is a rapid test. There is a lot of variability between biological entities and, in the case of humans, testing often matters by individual, it's not enough to just test one or two and use that for the group. Large samples can be divided up into smaller volumes for repeat testing.

Reasons to Choose Rudolph

- Fast measure speed enables a laboratory to process a large number of samples on one instrument.
- Ultra low volume models available to measure with small amounts of sample.
- Automated systems for easy measurement of large sample sets.

Typical Rudolph Users

- Labcorp, Quest and Clinical Reference Labs all use J57 refractometers for workplace drug testing.
- Mt. Sinai Hospital uses a J457ULV for medical research.
- The Australian Sports Anti-Doping Authority uses a J457/R837 for monitoring the presence of performance enhancing drugs in both local and international sports.

LabCorp
Laboratory Corporation of America

Australian Government
Australian Sports Anti-Doping Authority

Mount Sinai

Three Choices From Rudolph

J57HA-EP

The standard reference instrument for urine Specific Gravity(SG) measurement for workplace drug testing.



J457ULV

Ultra low volume design (as low as 10µl) for research applications.



J457FC OMDP and R837

Automated system for high volume testing.



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Description

The sugar processing industry uses refractometers across the entire production process. Whether the source is sucrose from sugar cane or sugar beets, or corn based sweeteners our refractometers monitor Brix and Refractometer Dissolved Solids (RDS) in all aspects of our customers processing. Accurate Brix and RDS measurement is a key to process control, and end product purity all which help sweeten the bottom line.

Reasons to Choose Rudolph

- Very easy to operate for rotating seasonal staff.
- Temperature control allows the instrument to be calibrated with traceable references to meet ISO and ICUMSA.
- Flat, easy clean prism means better results even when used with a variety of sugar sample types.

Typical Rudolph Users

- American Sugar Refining uses many J57 refractometers in both process and finished product laboratories around the world.
- Western Sugar uses many J57 instruments in factory labs.
- Dangote Sugar uses J457 refractometers in factories in Africa.

ASR GROUP

The Western Sugar Cooperative
(Grower Owned)

DANGOTE SUGAR

Three Choices From Rudolph

J57HA-EP

Very simple to operate, minimal bench space, temperature controlled.



J457KVP

Pour-In design allows for high through put of similar samples with regular prism cleaning.



Autopol 880 & J157

Combined solution for sugar purity measurements.



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Combined Systems

Description

A refractometer is a very useful analysis tool. It's very fast, tolerant of difficult matrices and can provide a lot of useful information with a very low investment in both capital and training. It is still only one number though and so is limited when a sample is not a binary solution. Combining a refractometer and a density meter or another instrument adds value not otherwise achieved with a single measurement metric. Combining adds new constituents not otherwise obtained by a single system and also saves time and streamlines reporting.

Reasons to Choose Rudolph

- A variety of sample loading options enabling the systems to be used with a wide variety of sample types.
- Built in calculations for many common samples.
- Easy to export both results to one certificate of analysis.

Typical Rudolph Users

- Bell Flavors uses a combined density / refractometer system with autosampler for QC testing.
- Constellation Brands uses an Alcotest for measurement on ready-to-drink spirit mixes without distillation.
- CF Industries uses Rudolph systems for UAN solutions.

Bell

Constellation Brands

CF Industries

Three Choices From Rudolph

DDM 2910-AF+J457OM-DP

Ideal for measuring Specific Gravity(SG) and Refractive Index(RI) in the flavor/fragrance industry.



R837, DDM 2911, J457OM-DP, Autopol I

Automated solution for measurement of Refractive Index(RI), Specific Gravity(SG), Optical Rotation(OR), Color, and pH.



DDM 2911 J457 UAN system

A complete system for measuring N, AN, and Urea in fertilizer.



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The J Series Refractometer



The J Series Refractometer has been used in many industries for over two decades. It was the first refractometer from a company with a 50 year history of manufacturing optical instruments. It was one of the first refractometers developed with integrated temperature control, and the current dual temperature control system still leads the technology in this area.

The instrument range has been continually expanded with new application specific accessories and models released on a regular basis. The current version of the instrument has market leading computer control and networking. Combined with the proven optical features, Rudolph Research Refractometers are the default instrument for corporations both large and small, as well as many of the world's standards labs and reference bodies.

Why Rudolph...

Rudolph began in the 1940s by suppling Polarimeters to laboratories and has grown to be a market leader in high accuracy, benchtop Polarimeters, Refractometers and Density Meters.

While many companies offer similar ideals, here is how Rudolph has adhered to our three guiding principles: **Quality, Integrity, and Innovation**.

Integrity:

Integrity is not just an ideal; it is a deep commitment to providing customers what they need, when they need it, wherever they need it. Integrity is real humans answering your phone call, working through your application problem, advising you as to what instrument will best serve your needs, or servicing your instrument quickly and properly.

Quality:

Rudolph's focus on quality is a mindset of actions not just a word. Rudolph products are engineered to stand up to the harshest application requirements and tested right in the field. Rudolph backs its claim of quality with a strong warranty and, unlike any other company in the industry, Rudolph also extends a written commitment to service your instrument for a full 20 years.

Innovation:

At Rudolph innovation means first listening to problems and then solving them. We do not innovate just for the sake of innovating; we innovate to solve our customer's problems.

By listening to customers, Rudolph has developed exclusive features that address real issues.

With over 8,000 installations worldwide, Rudolph is a preferred provider of high-quality instruments that work well for their application and are backed by real assurances and, most importantly, responsive people.



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