

*For High Accuracy Applications*

# The DDM Series of Automatic Density Meters

United States of America  
National Institute of Standards and Technology



NVLAP LAB CODE: 200898-0  
Accreditation to ISO/IEC 17025:2005



# The Simplicity of Touch Screen Measurement

## Oscillating U-Tube with Viscosity Correction and Reference Oscillator

Rudolph DDM Density meters utilize an oscillating U-tube with full range viscosity correction and reference oscillator that allows for long term calibration stability and measurement at all temperatures with a single calibration.  
(Patent # 7,735,353)

## Full Feature VideoView™ with Automatic Scanning of Entire U-Tube

Rudolph's exclusive VideoView is protected under Patent #7,437,909 and provides superior high resolution visual bubble detection within your sample with live on-screen video viewing. Images can be saved with the sample results and may be viewed and or printed as desired.

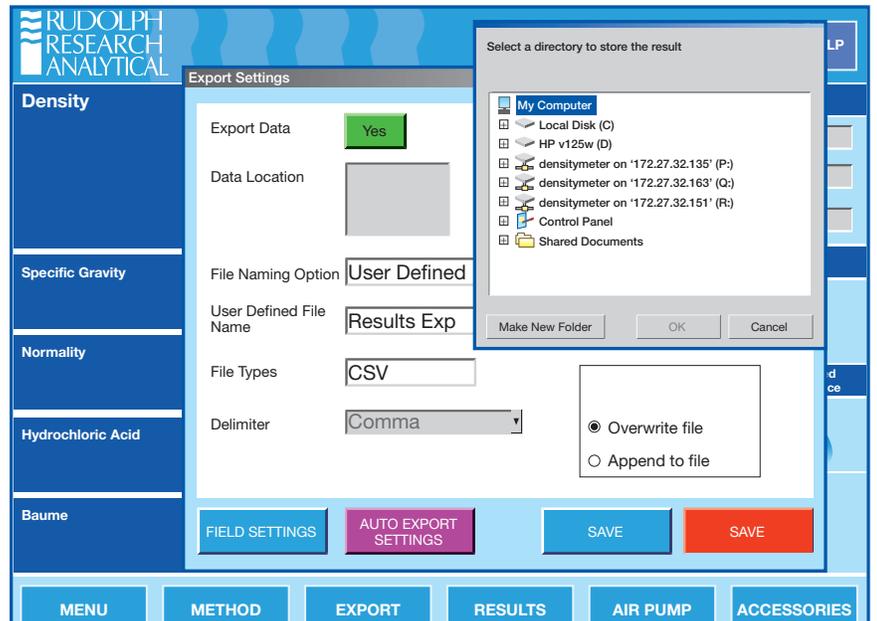
A full view of the entire U-tube is possible at 2X magnification. Further, the U-Tube can be scanned at 6X or 10X magnification so the user can see that the U-Tube is bubble free. The 10X magnification is also extremely helpful in detecting the cleanliness of the glass U-tube. The clarity, magnification and resolution are the very best available.

- Three magnified video assisted views of the entire cell are available, in 2X, 6X and a 10X magnifications
- Images may be saved with results for subsequent review
- Automatic Bubble detection is available which will flag the sample(s) with suspected bubbles



## Computer Windows Embedded Based Flexibility

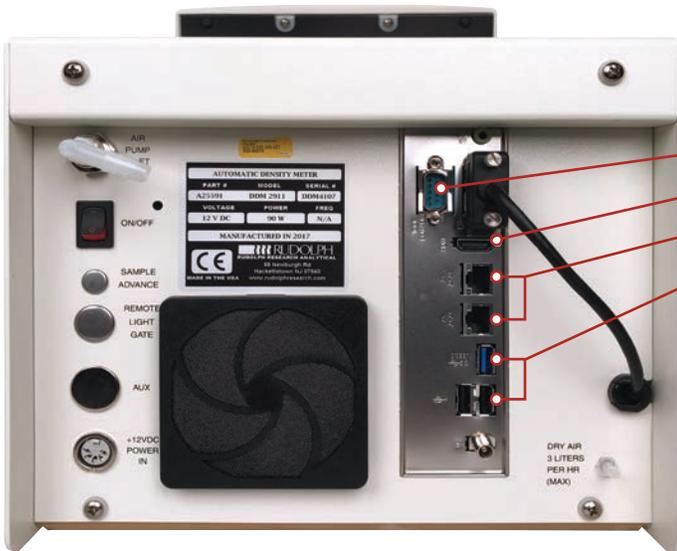
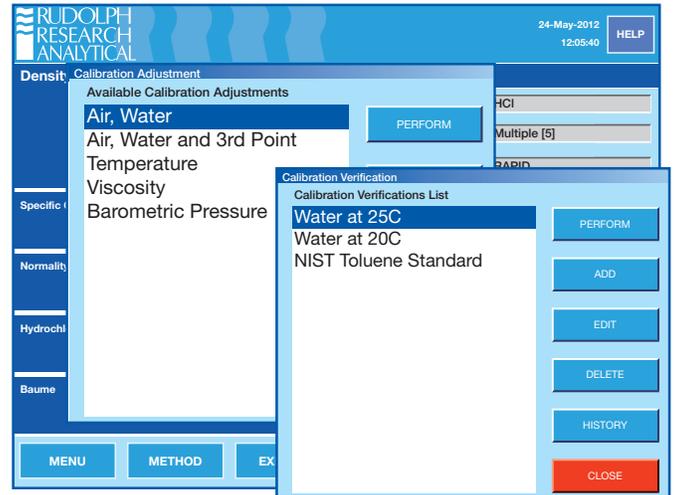
- 32 gigabytes of internal memory allows almost unlimited capacity for saving measurement data. All Rudolph DDM Series Density meters are network ready and data may also be saved directly to your server or to any desired directories
- Internet access is possible directly from all Rudolph DDM Density Meter touch screens. The disk protection feature protects the operating system against malware infections in networked environments
- Windows based navigation architecture is so intuitive that most operators will never read the manual, but should you wish to reference the manual, it is stored right on the Rudolph DDM's internal memory
- Copy methods, transfer concentration tables, download data, etc., via the USB ports on the front and back of the unit
- Five USB ports allow for quick and easy connection to a mouse, keyboard, printer, bar code scanner, or memory stick. Embedded Windows prevents any and all viruses and malware



# Measurement with the Flexibility of Windows®

## cGMP/GLP Calibration

- Calibrate the Rudolph DDM Density Meter with 2 or 3 NIST Traceable Standards – calibrating with merely air and water appears inconsistent with cGMP/GLP compliance regulations
- Can print out complete method configuration, communication settings, as well as calibration verification and calibration adjustment data/history
- Measured values can be shown continuously as temperature stability is being reached or, at the discretion of the user, measured values will only be displayed once the measurement is complete
- Unlimited number of customizable calibration adjustments and calibration verifications possible
- Complete History of Calibration Adjustments and Verifications are available to View, Print, and/or Export
- Set calendar reminders as to when Calibration Verifications are due



## Versatile Communication Capability

The Rudolph DDM Density Meter's standard communication package includes:

- 1 RS232 port
- HDMI
- CAT 5 Ethernet Port for Network Cable Connection
- 5 USB ports -2 Front Located and 3 Rear Located

Allowing the capability to:

- Export measurement results with saved video view images to a thumb drive, store it locally on the C:\ drive, or easily send data to any external PC, LIMS, SAP, etc.
- Print measurement results to any local or networked printer. Most all printers are supported by Windows 7® but if required the driver may be added
- Save measurement data direct to your Network/Server

1-40, Goryo Ohara, Nishikyoku-ku,  
Kyoto 615-8245, Japan  
Tel: +81-75-382-1411

Date: Jan 1, 2017

This sample was measured on DDM 2911 PLUS serial number 20212, manufactured by Rudolph Research Analytical, Hackettstown, NJ, USA.

Lot ID 2019  
Temperature: 20.0 Deg C

No	Sample ID	Density	Sp. Gravity	Normality	HCL % wt	° Baume	Time
1	8421	1.09803	1.1000	6.0092	19.95	12.94	14:20:50 PM
1	8421	1.09803	1.1000	6.0092	19.95	12.94	14:21:40 PM
1	8421	1.09803	1.1000	6.0092	19.95	12.94	14:22:30 PM
1	8421	1.09803	1.1000	6.0092	19.95	12.94	14:23:20 PM
1	8421	1.09803	1.1000	6.0092	19.95	12.94	14:24:10 PM

Counts : 5  
Average : 1.0980  
SD : 0.0000  
Maximum : 1.0980  
Minimum : 1.0980

Operator : \_\_\_\_\_

**sanyo**  
CHEMICAL INDUSTRIES

## cGMP/GLP Printing

Sample measurement reports are edited quickly and easily. Just import your logo to the Rudolph DDM Density Meter and send your company's customized certificate of analysis to your server or local printer.

**Print your customized Certificate of Analysis including your company logo directly from the DDM Density Meter touch screen**

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

# Versatility, Traceability, C

## For Highly Regulated Labs, Full 21 CFR Part 11 Instrument Level Compliance

The United States Food and Drug Administration 21 CFR Part 11 regulation establishes the FDA's requirements for electronic records and electronic signatures (ERES) to be trustworthy, reliable, and essentially equivalent to paper records and handwritten signatures. The Rudolph DDM Density Meter user interface software's 21 CFR11 features fully support the requirements of 21CFR Part 11.

The Rudolph DDM Density Meter's 21 CFR Part 11 software module is easily enabled through the user friendly touch screen. This module gives you full compliance with:

- Electronic signature
- Access levels
- Internal write protected storage
- Unique passwords
- Write protected documents sent directly to server
- Audit Trail
- PDF Meta Data
- Unique and Settable User rights and privileges

**Files may be Password Protected.**

**Export Format**

You are in Setup > OP > Communication Settings > File Export Options > Export Format

All files exported to PDF can be password protected so that the file cannot be edited.

Do not Save Data

Export Option  Export All Results To File

File Format **Excel** **Pdf**

Excel Data Delimiter Tab (txt)

Password Option  Enable Password

Password \*\*\*\*

Retype Password \*\*\*\*

**As Audit Trails are produced they are saved internally which can be viewed, exported or printed.**

**Audit Trail**

You are in 21CFR11 > Audit Trail

User Name	Group	Tab Name	Description
Labadmin	ADMIN_GROUP	Measurement	Reviewed by Lab Admin. Results file "C:\Autop\Data\21CFR11Readings_da
JOperator	OPERATOR_GR...	Measurement	Measurement completed and waiting to be reviewed.
JOperator	OPERATOR_GR...	Measurement	Measurement started by Joe Operator
		Login	"Labadmin" login failed due to invalid user/password
Labadmin	ADMIN_GROUP	Password Settings	Login Attempts is changed from 0 to 3
Labadmin	ADMIN_GROUP	Password Settings	Expiration is changed from 0 to 30
Labadmin	ADMIN_GROUP	Add User	JOperator account was added
Labadmin	ADMIN_GROUP	Add User	JDoe account was added
Labadmin	ADMIN_GROUP	Add / Edit Groups	Group Senior Operator is added
Labadmin	ADMIN_GROUP	Set 21CFR11	Enable Operator is changed from turned OFF to turned ON
Labadmin	ADMIN_GROUP	Set 21CFR11	Enable Reviewer is changed from turned OFF to turned ON
Labadmin	ADMIN_GROUP	Set 21CFR11	Enable 21CFR11 is changed from turned OFF to turned ON

**User Access Levels are set by the administrator.**

**Add / Edit User**

You are in 21CFR11 > 21CFR11 Admin Options > Edit User

User Name

Full Name

Password

Retype Password

Group

Account Locked

User must change password at next login

**User Rights**

**Add / Edit Groups**

You are in Menu > 21CFR Part 11 > 21CFR11 Admin Options > Add / Edit Groups > Edit

Group Name

Description

Operator - Make Measurements

Reviewer - Review Measurements

**Menu Access**

- MENU
  - CALIBRATION
    - CALIBRATION VERIFICATION
    - CALIBRATION ADJUSTMENT
    - BACKUP / RESTORE CALIBRATION
  - METHOD MANAGEMENT
    - ADD METHOD
    - EDIT METHOD
    - HIDE METHOD
    - RENAME METHOD
    - DELETE METHOD

# Compliance and Flexibility



## NIST Traceable Calibration Standards

Rudolph knows how important it is to calibrate with Traceable Standards and therefore, we include either a NIST or other National Physical Laboratory (NPL) standard in the accessories provided with your density meter.

The Rudolph DDM Density Meter includes all the accessories for immediate use:

- Traceable Standard
- Quick Start Guide
- IQOQPQ Documentation
- Rinse/Sample Waste Container
- Filling Nozzles
- Connecting Fittings & Tubing
- Luer Syringes
- User Manual
- Tools

## Flexible Method Management

Factory installed measurement methods allow for immediate selection of the correct method to match the most common applications.

For unique measurement applications, easily create a sample method using an unlimited number of Concentration Tables, Formulas, and Polynomials to match the measurement methods used in your laboratory.

Method Management		
NAME	TYPE	
AOAC Ethanol	Factory	ADD
Brix	Factory	COPY
Crude Oil	Factory	HIDE
Density	Factory	RENAME
Density Continuous	Factory	VIEW
Density through Temperature	Factory	RESULTS
Density VC	Factory	METHOD CONFIGURATION
Factory QC Testing	Factory	CLOSE
Fuel Oil	Factory	
Lubricants	Factory	
OIML Ethanol	Factory	

## Customized Methods:

- Concentration D2O – Heavy Water
- Proofing of Ethanol Sample
- Density of Gases
- Testing of aspartame and other artificial sweeteners
- Monomer Solutions
- Hydrogen Peroxide
- Determination of Partial Specific Volume
- ppm, Normality, Molarity
- % Toluene in Heptane
- Mole Fraction of Methanol
- Purity of sample testing
- Density of Gasses and Aerosols
- Potassium Permanganate
- Ultracentrifugation applications
- SG of Urine
- Sodium Hydroxide

# Choose the sample handling

## Syringe Injection

Samples can be easily loaded in the DDM series Density Meter by directly injecting your sample into the inlet port of the DDM. You can watch the sample progress through the U-Tube and monitor for bubbles. Need a closer look? View at 2X, 6X or 10X magnification. When your measurement is complete simply flush the U-Tube with your choice of solvent and use the convenient air tube to dry the U-Tube.

### Who Should Use this System?

Laboratories who make only a few measurements per day. Users who wish to use very small amounts of sample – Only 1ml of sample is required.



## Peristaltic Pump

Combining a Peristaltic Pump with a Rudolph Density meter makes sample loading and cleaning faster and more convenient. A Peristaltic Pump draws the sample into the Density Meter and could also load a Refractometer. The user drops a tube into the sample and starts the Peri Pump from the DDM display. The Peristaltic Pump draws the sample through one or two instruments and then measures. The measured sample is displaced to waste by the following sample.

### Who Should Use this System?

Laboratories working with low viscosity samples such as beverages.

Users who don't mind utilizing 50 ml of sample for a measurement. A large amount of sample is needed to ensure all of the previous sample is displaced with the new sample.



# solution for your application

## Rudolph DDM with AutoFill™

AutoFill™ was developed by listening to customers who wanted an easier method of sample loading that they could decant right from their existing containers. Samples are easily poured right into the AutoFill™ sample well without having to come in contact with the sample; simply pour it in. From there the lid is closed and the sample is advanced to the U-Tube with the push of a button on the DDM touch screen. To clean, open the lid and pour in the solvent of your choice. Close the sample well lid again, press a button and the solvent is flushed through the U-Tube and air drying is automatically started.

### Who Should Use this System?

Users who want to make many measurements each day and want an easy to load Density Meter with an equally easy cleaning routine. Laboratories who do not want to come in contact with caustic acids, or bases.



**AutoFill™ allows you to easily pour directly into the sample well.**

# Sample handling options for

## Rudolph DDM with the Rudolph Easy Clean System (ECS)

The Rudolph ECS sampling system is an excellent choice if you need to significantly automate your sample loading and cleaning. Using Rudolph's ECS Auto Sampler is simple; the user brings the sample to the Density Meter in any container that has an opening and a sample volume of 3-4ml. A test tube or beaker is commonly used in a lab and a can or bottle is more common in industrial environments. The operator presses the fill button, waits a few seconds while the sample is drawn from the sample vessel, and the Density Meter U-Tube is filled with sample.

From that point the operation is completely automatic. The sample is measured and the data is recorded. Depending on how the system is configured the data may also be printed, saved to an Excel file, stored in the instrument, or transferred to a LIMS system.

Once measurement is complete, the sample is blown to a waste storage vessel using the built in air pump. The measuring cell is flushed with a solvent of the user's choice, flushed again with a second solvent such as acetone or alcohol that is fast drying and then blown with air to completely dry the system.

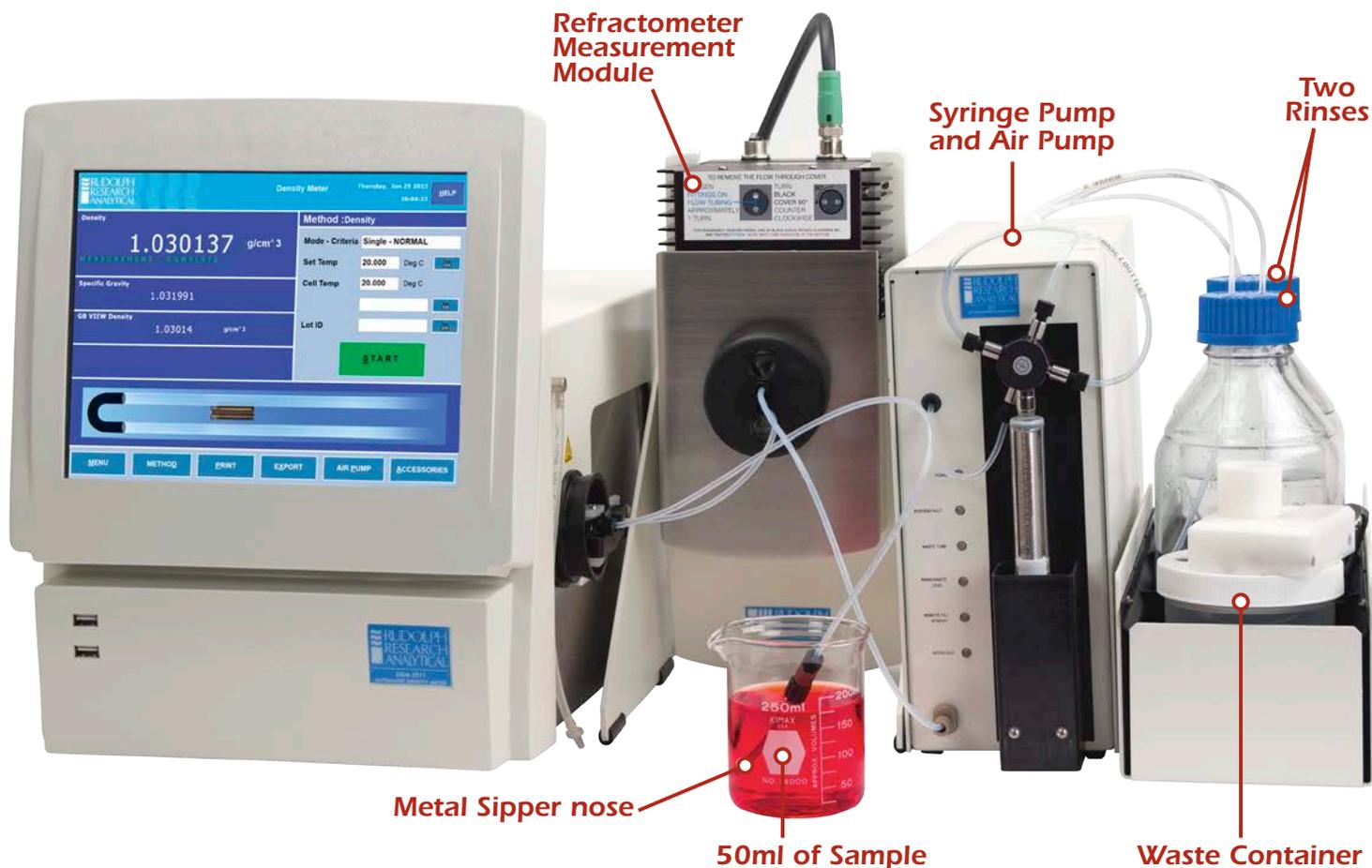
The dry and rinse times are user programmable. Utilizing a Windows™ interface the operator is able to select and adjust both rinse and air drying times for each unique sample.

### Who Should Use this System?

Laboratories looking for a faster and semi-automatic sample loading and cleaning solution.

Laboratories that want to decant from their own vessels and sampling containers.

Laboratories working with acids, bases, and caustic samples.



# high throughput laboratories

## Automate your Laboratory with a Rudolph AutoFlex R837 Automation System

The DDM Series of density meters can be combined with various Rudolph Automation Systems and Sample Handling Accessories. Available are Peristaltic Pumping, Heated Sampler, the ECS (Easy Clean System), and the Rudolph R837 AutoFlex Sampler.

The Rudolph Research R837 AutoFlex is perfect for high throughput laboratories looking to increase productivity.

### The R837 AutoFlex Sampler Facilitates:

- Customizable bottle size, Test Tube size, Boston Rounds: 1oz, ½ oz, virtually any size
- Customizable Rack configurations: heated and unheated on the same carousel
- Automated sample introduction
- Flexible Method Selection: Suction mode, Pressure mode, Rinse and Dry Duration
- Programmable cleaning and drying
- Automatic solvent and waste level detection
- System Configuration minimal sample volume: 1.5 mL
- A heated interface is available
- Fast throughput, 2-5 min complete cycle time
- Automation saves operator time and increases your lab's efficiency
- An urgent-sample interruption can be made at any time

Operation is completely automatic. The sample is measured and the data recorded. Depending on how the system is configured the data may also be printed, saved as an Excel file or transferred to a LIMS system



## Multiple measurements from one sample, with full automation and automatic cleaning and drying.

### Description

Combine instruments with Automation to Measure: Refractive index, BRIX, Density, Specific Gravity, Optical Rotation, Color, Alcohol % vol/vol, Proof and more all from a single sample.

### AutoFlex gives you the most flexibility in sample vial selection, sample handling and instrument combinations.

Ideal for high throughput Flavor, Fragrance, Alcohol, Chemical, Petroleum, Food Labs who run many samples each day and want automatic cleaning of the system.



# AlcoTest-RI-J209

## AlcoTest-RI-J209 Alcohol Production Test Solution

By Measuring Specific Gravity and Refractive Index the alcohol % by vol/vol can be determined for many products. This is a fast, single sample load solution for the Alcopops, Wine and Beer industries. The process of pre-distilling samples to remove the alcohol and adding back distilled water to replace any solids is eliminated. Simply load a sample into the system, the system measures the sample and using the AlcoTest software calculates the alcohol %.

### AlcoTest-RI-J209 is ideal for

- High volume producers of Alcopops products with high solids and or high sugar based flavorings
- Producers of wine who wish to quickly measure Alcohol % by vol/vol
- Producers of beer and other malt beverages
- Distilled Products with Obscuration

### For alcohol % by vol/vol the following accuracies apply

better  $\pm 0.01$  % v/v with DDM 2911 PLUS

– TTB Compliant for high proof spirits

better  $\pm 0.04$  % v/v with DDM 2911

better  $\pm 0.07$  % v/v with DDM 2910

**For obscured products, accuracies will vary by product. Ask for a demonstration or sample study.**



# Densitometry

The Rudolph DDM series of density meters, with high precision Peltier temperature control of sample, has the features to meet the needs of today's industrial applications.



## BEVERAGES, SPIRITS, WINE

- The US TTB requires 0.02% Ethanol accuracy for testing of % Ethanol in wine, beer, and spirits
- The DDM2911 Plus offers 0.01% accuracy for Ethanol testing
- Direct and accurate means of °Brix determination, °Plato, °Balling, Proof, % Solids



## FOOD, FLAVOR, FRAGRANCE

- Measure Density, Specific Gravity
- Checking of raw materials and product release
- Check batch consistency and ensure proper blending ratios
- Add refractive index, color and optical rotation with a R837 Automation solution



## PHARMACEUTICAL

- Capable of 2,3,4 or more multiple measurements with standard deviation, mean, min and max reading for true cGLP/GMP compliance
- Complete IQ/OQ/PQ documentation.
- 21CFR 11 Compliance; Electronic Signature and Secure Data Storage
- Compliant with USP <841>ISO 17025, JP, BP and EP



## PETROLEUM, CHEMICAL

- Measure API, Density and Specific Gravity values in accordance with ASTM D1250, ASTM D4052, ASTM D4806, ASTM D5002, ASTM D5931, ISO 12185 and DIN 51757
- Measure in units of kg/m<sup>3</sup>, g/cm<sup>3</sup>, g/mL, pounds/gallon, specific gravity, Baumé and more

# Alcohol Proof Testing



## DDM 2911 PLUS Density Meter is Rudolph Research's TTB Approved Instrument for Alcohol Proof Testing.

The capability you need to easily test your spirits production and comply with TTB Requirements:

The DDM 2911 PLUS has built-in precision Electronic Temperature Control ensuring accurate and reproducible results. A Windows embedded OS allows the operator to save calibration and measurement data right to Excel™.

- With 0.00001 g/cm<sup>3</sup> accuracy the DDM 2911 PLUS is an excellent choice for the Alcohol Beverage industry to measure alcohol concentration to determine alcohol Proof
- Easy to Use. Easy to Validate
- Windows Embedded OS
- Precision built-in electronic Temperature Control
- Easily combined with Rudolph's R837 Automation System
- 3 Year Domestic Warranty – 20 Year Service Guarantee

**0.01% Alcohol Determination adding Precision to the Art of Craft Distilling**

# Specifications

	DDM 2909	DDM 2910	DDM 2911	DDM 2911 PLUS
<b>Accuracy</b>	Density: 0.0002 g/cm <sup>3</sup> Temperature: 0.05 °C	Density: 0.0001 g/cm <sup>3</sup> Temperature: 0.05 °C	Density: 0.00005 g/cm <sup>3</sup> Temperature: 0.03 °C	Density: 0.00001 g/cm <sup>3</sup> Temperature: 0.01 °C
<b>Repeatability</b>	Density: 0.0001 g/cm <sup>3</sup> Temperature: 0.02 °C	Density: 0.0001 g/cm <sup>3</sup> Temperature: 0.02 °C	Density: 0.00002 g/cm <sup>3</sup> Temperature: 0.01 °C	Density: 0.000005 g/cm <sup>3</sup> Temperature Selectable: 0.001 °C
<b>Resolution</b>	Density: 0.0001 g/cm <sup>3</sup> Temperature: 0.01 °C	Density: 0.0001 g/cm <sup>3</sup> Temperature: 0.01 °C	Density: 0.00001 g/cm <sup>3</sup> Temperature: 0.01 °C	Density: 0.000001 g/cm <sup>3</sup> Temperature Selectable to: 0.001°C
<b>Density Range</b>	0 to 3 g/cm <sup>3</sup>			
<b>Temperature Range</b>	0 °C to 95°C (controlled via Peltier)			
<b>Pressure</b>	0 to 10 bars			
<b>Video Scanning &amp; Magnification</b>	Three magnified video assisted views of the entire cell are available, in 2x, 6x and a 10x magnifications with video scanning. Images maybe saved with results for subsequent review.			
<b>Automatic Bubble Detection</b>	Automatically warns operator of bubbles			
<b>Measurement Modes</b>	Continuous, Single, Multiple			
<b>Measurement Technique</b>	Mechanical Oscillating U-Tube Method			
<b>Minimum Sample Volume</b>	Less than 1mL			
<b>Wetted Materials</b>	Borosilicate glass, Teflon PTFE ECTFE			
<b>Operating System</b>	Windows Embedded; write protected software safe from malware and viruses			
<b>Measurement Time:</b>	30 - 60 seconds after thermal equilibration			
<b>Display</b>	10.4 inch diagonal TFT type LCD with wide viewing angle, anti-glare flat panel touch screen, 300 nits brightness, 800 x 600 pixels, chemical, scratch and spill resistant monitor, the industry's largest and most flexible interface			
<b>Communication Interface</b>	Touch Screen User Interface, 5 – USB Ports, 2 – RS232 Ports, Ethernet Port for Network Connection, Keyboard Bar Code Scanner, Mouse, Network Capabilities			
<b>Remote Support</b>	Troubleshooting, Diagnostics, Software Updates available via the Internet			
<b>Internal Memory</b>	32 GB Non-removable Compact Flash			
<b>Operating Dimensions</b>	18.36" (L) x 11.80" (W) x 13.90" (H) 46.61 cm (L) x 29.97 cm (W) x 35.30 cm (H)			
<b>Shipping Dimensions and Weight</b>	24.5" (L) x 17.5" (W) x 22" (H) 62cm (L) x 44cm (W) x 56cm (H)			
<b>Shipping Weight</b>	50 lbs. (23kg)			
<b>Power Supply</b>	85 to 260 VAC; 48 to 62 Hz			
<b>Power Consumption</b>	140 Watts at peak			
<b>Origin of Manufacture and Design</b>	USA			