

VROC[®] initium one plus



The Workhorse for Viscosity
Fingerprinting
Automatic Viscometer/Rheometer



RheoSense

Simply Precise[®]

VROC[®] initium one plus is the leading automatic viscometer that measures true viscosity with the highest accuracy and repeatability. Its superior resolution is revolutionizing characterization of Newtonian and non-Newtonian samples



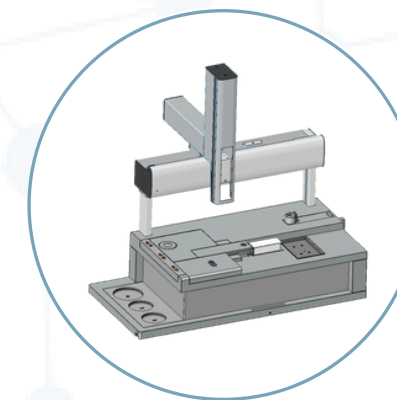
Absolute Viscosity



Sample Recovery & Retrieval



Viscosity Fingerprinting



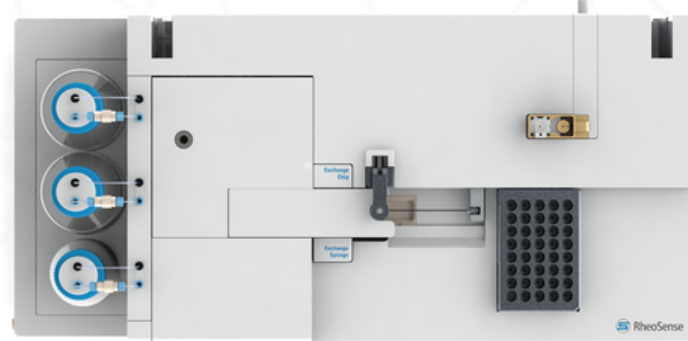
Fully Automated



Self Cleaning

Listed on US Pharmacopeia 914
www.rheosense.com/technology

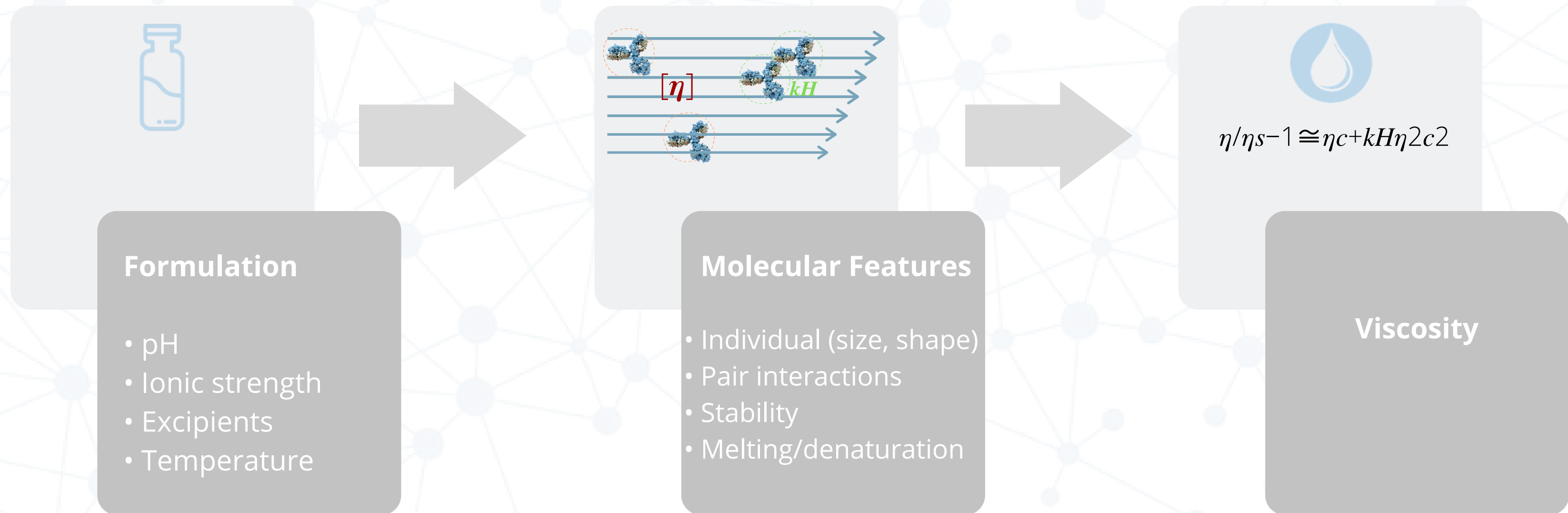
Viscometer/Rheometer



- Sample volume as low as 26 μL
- Viscosity Ranges: 0.3 – 1,000 mPa-s (with autosampler)
- 0.3 - 3,000 mPa-s (with manual syringe)
- Shear Rate Range 40 – 140,000 1/s
- Temperature Range 4 - 70°C
- Repeatability: 0.5% of reading
- Accuracy: 2% of reading
- Up to 4 samples per hour
- Standard 96 Well Plate or 40 Vial Rack
- Sample storage temperature control from 4- 40 ° C

*Acceptable solvent bottle sizes: 250 mL, 500 mL and 1 Liter.

Intelligent Formulation - Work Smart, Not Hard



Understand how formulation impacts molecular scale behavior by measuring viscosity.

VROC[®] initium one plus Applications

 Engine Oils

 Standard Oils

 NIST Traceable Mineral Oils

 ASTM Standards

 Inkjet Inks

 Conductive/ Graphene Inks

 Electrolyte Solutions

 Skincare (serums)

 Fragrances

 Cannabis Oils

 Volatile Chemicals

 Food & Beverage

 Intrinsic Viscosity

 Automation

 Formulation

 Protein Screening

 Antibody Therapeutics

 Drug Delivery

 RNA Therapeutics

 Hydrodynamic Radius

 Whole Blood/Blood Plasma & Serum

 Enzymatic Reaction Kinetics

 Molecular Weight & Size

 Solubility

 Protein Stability

 Cell Culture

 Ophthalmic Solutions

 Viscosity-Injectability

Specifications

Power: AC 110 ~ 220 V
50/60 Hz, 150 Watts

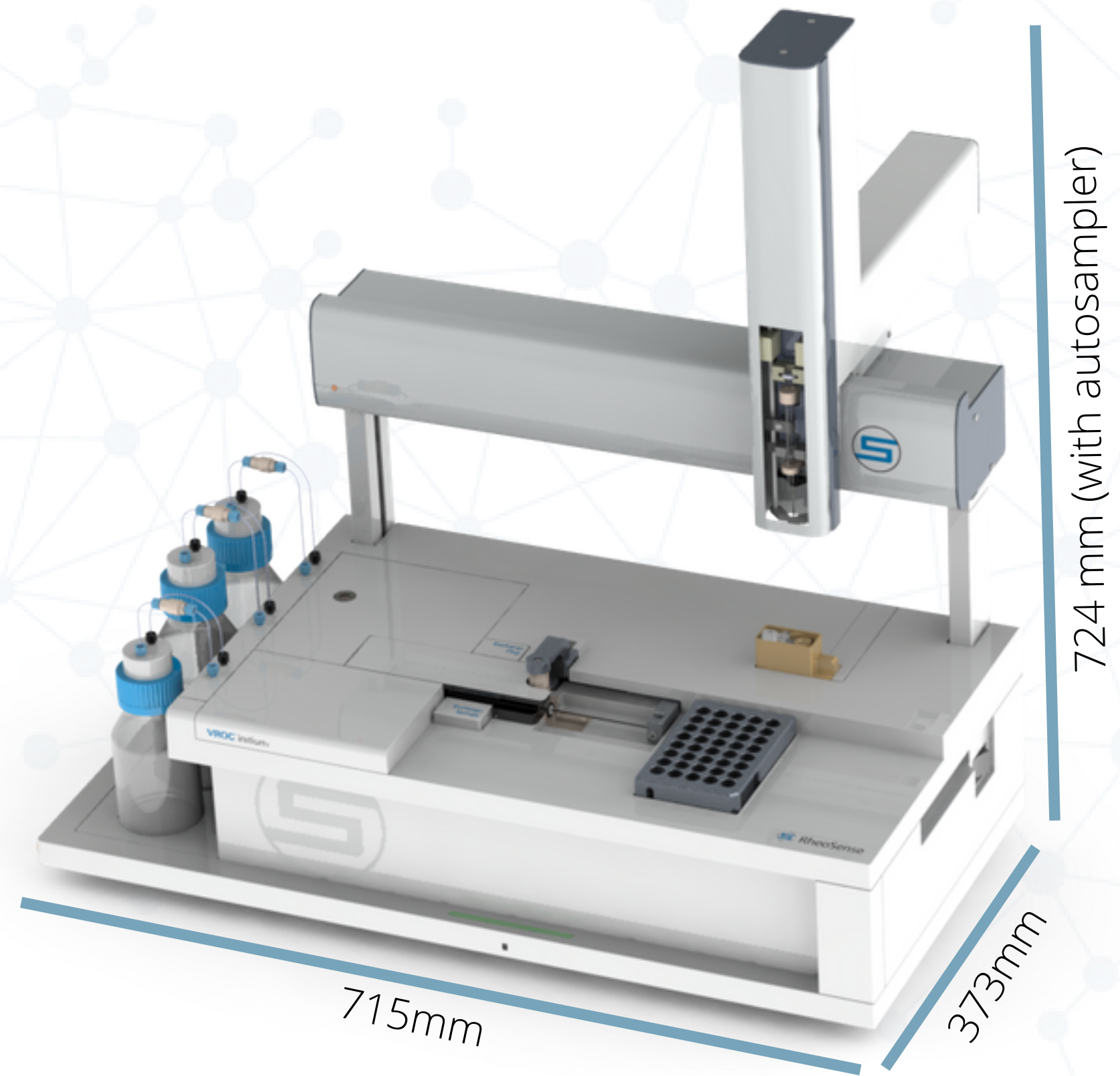
Width: 715 mm

Length: 373mm

Height: 193 mm (without autosampler)
724 mm (with autosampler)

Weight: 14 kg (without autosampler)
22 kg (with autosampler)

CE and UL Certified



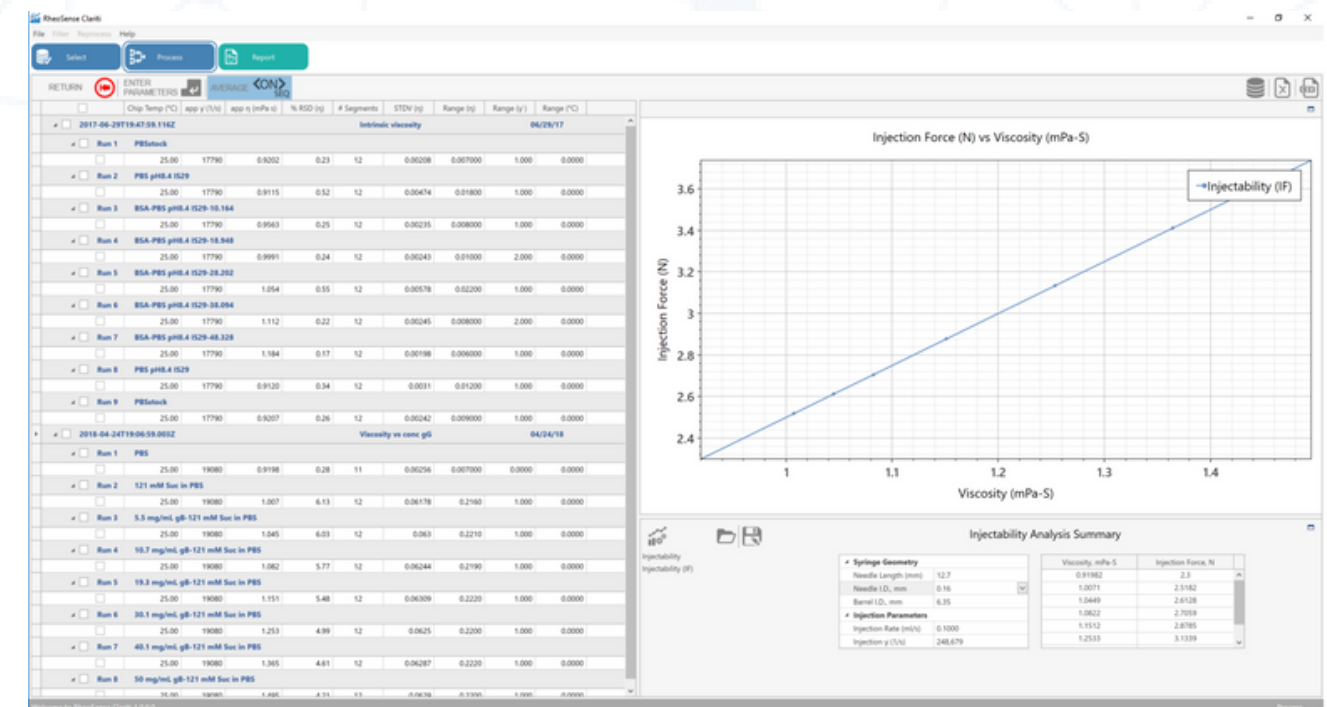
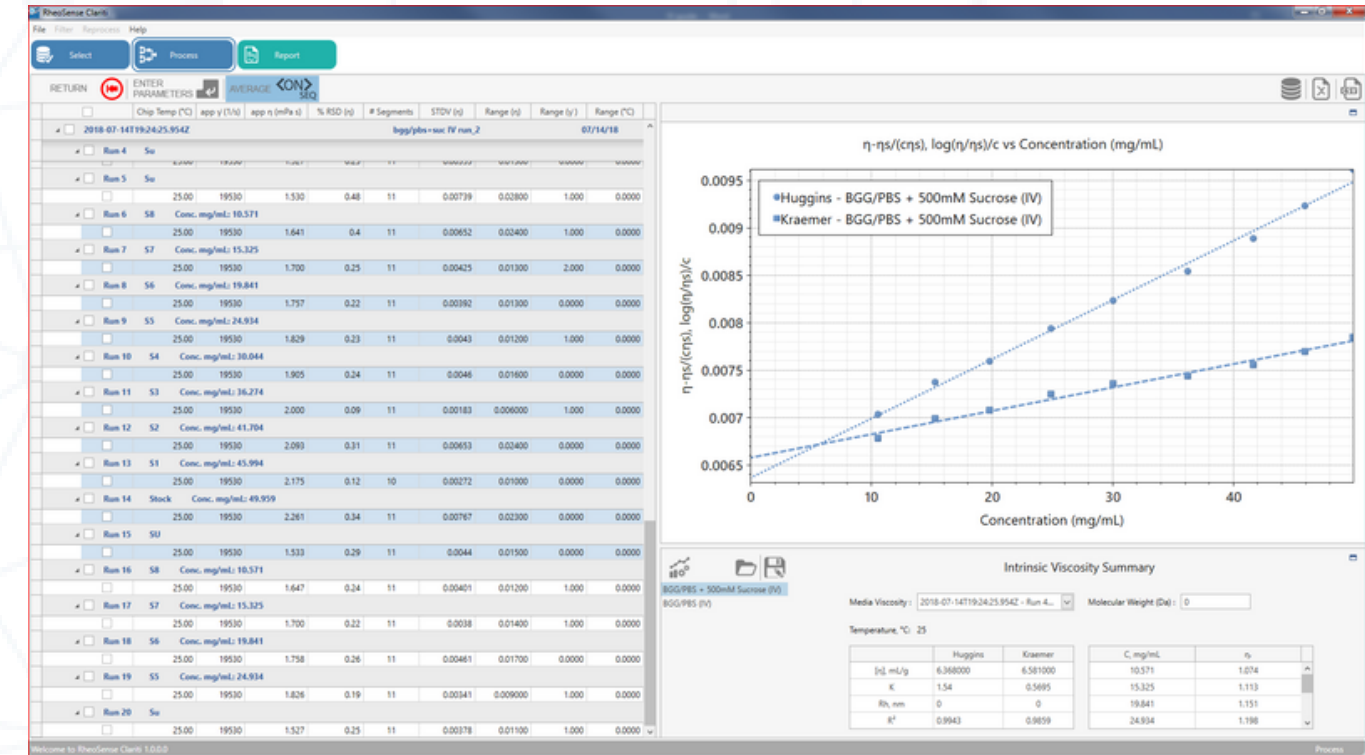
Clariti - Simplifying Your Data Analysis



RheoSense Clariti enables complete user versatility.

Clariti's advanced capabilities are leading the way in:

- Data Processing, Analysis to Report Generation
- Predictive Injectability Analysis
- Intrinsic Viscosity
- Hydrodynamic Radius and Pair Interactions
- Custom Report Generation
- So much more!





RheoSense

Simply Precise™



m-VROC™

Choice of Leading Companies!
The Ideal Viscometric
Characterization Platform

m-VROC™ is RheoSense's premium automated viscometer, capable of the most demanding applications, and is ideal as your wide-dynamic range R&D viscometer.

- Smallest Sample Volume – 20 µL
- Automated Temperature & Shear Rate Sweeps
- Fast Measurement Time
- Precise Temperature Control
- Wide Dynamic Viscosity Range: 0.2 ~ 100,000 mPas
- Shear Rate Range: 0.5 ~ 1,400,000 s⁻¹
- No Evaporation – No Air-Liquid Interface
- Characterization of Newtonian & Non-Newtonian
- Accuracy up to 2% of Reading
- Repeatable Measurement up to 0.05% of Reading

m-VROC™ is the leading small sample viscometer in fundamental applications and is used routinely by leading companies at multiple locations world-wide. It is the ultimate viscometric solution for small sample testing: as little as 50 µL and high shear rate viscosity measurement, up to 1,400,000 s⁻¹.

Specifications

Min Sample Volume	20 µl
Shear Rate Range, s ⁻¹	0.5 ~ 1,400,000
Viscosity Range, mPa-s (cP)	0.2 ~ 100,000
Temperature Range	4 ~ 70 °C
Accuracy	2% of Reading
Repeatability	0.5% of Full Scale
Temperature Sensor	Built-In
Software	Included
Non-Newtonians?	Yes
Temperature Sweep	Yes
Shear Rate Sweep	Yes



RheoSense

| Contact: 925.866.3801 or info@RheoSense.com

RheoSense is a global high-tech company based in Silicon Valley. Our innovative *m*-VROC™ & *micro*VISC™ instruments feature patented Viscometer/Rheometer-on-a-Chip (VROC®) technology. Utilizing state-of-the-art MEMS and microfluidics breakthroughs that redefine the viscometry industry, our instruments offer the smallest sample volume per measurement coupled with exceptional ease-of-use and accuracy. We are the leader in biotechnology, pharmaceutical, and the emerging protein therapeutics industries. RheoSense instruments have been rigorously tested, approved, and adopted worldwide by Fortune Global 500 companies and leading research universities.

e-VROC

Extensional Viscosity Measurement

When you need to understand extensional and shear viscosities in your complex industrial process, e-VROC is the ideal solution for precise, reliable measurement.



e-VROC™ provides extensional viscosity data by monitoring the sample flow through a microfluidic contraction within the measuring cell. The system measures the pressure upstream and downstream of a contraction using the MEMS pressure sensors, and it registers changes in the flow. The fluid undergoes an almost constant extension through the contraction/expansion, enabling the calculation of the extensional viscosity.

The advantage of this approach is that shear-rate dependent viscosity and extensional viscosity can be provided at a specific temperature within the same measurement.

e-VROC™ is ideal for polymer applications, or for fluids with certain extensional viscosity properties similar to those that are used as additives to prevent mists from forming in volatile fluids like jet fuel or for turbulent drag reduction in oil pipelines and sewer systems.

Technical Specifications

Minimum Sample	500 μ L
Viscosity Range	10.0-2,000mPas
Shear Rate Range	0.1-1000 s^{-1}
Temperature Range	4-70°C
Temperature Stability	\sim +/-0.07°C
Extensional Viscosity	Yes
Accuracy	\sim +/- 2% reading
Repeatability	\sim +/- 0.5% reading
Shear Sweeps	Yes
Temperature Sweeps	Yes
Typical Test Time	<1 min

Other Applications Include:

- Fiber extrusion spinnerets
- Paint rolling
- Blow molding
- Ink jet printer nozzles
- Sheet or film drawing
- Flow through a porous media

RheoSense, Inc.

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 **RheoSense**
Simply Precise™

RheoSense e-VROC™ Technology

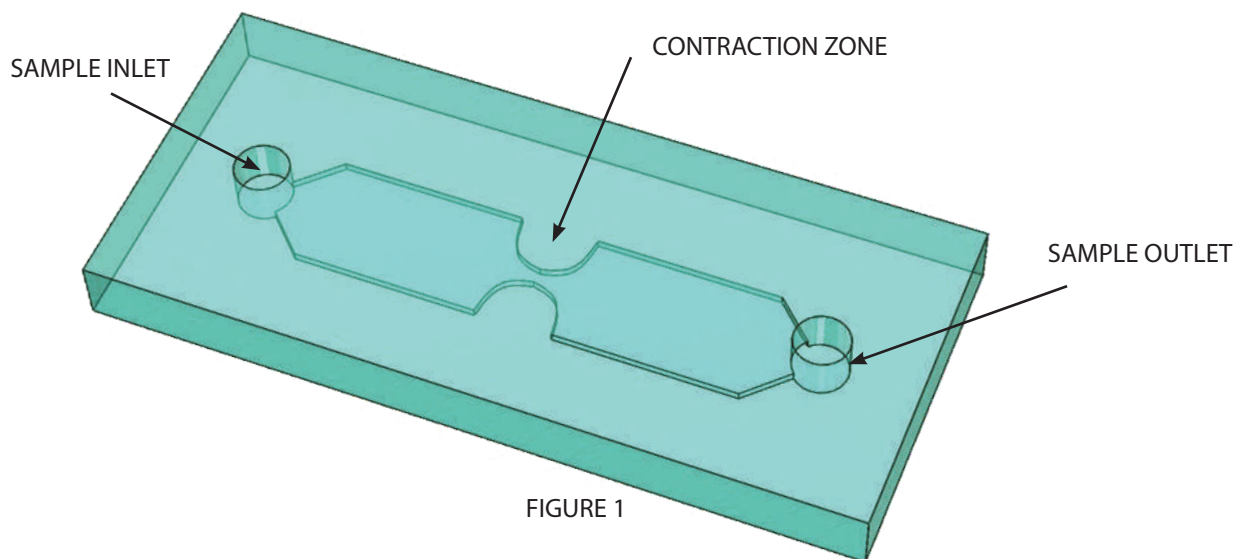


FIGURE 1

Technology

The breakthrough *e-VROC™* (Viscometer/Rheometer-On-a-Chip) technology offers powerful advantages over conventional viscometers and rheometers.

The *e-VROC™* solution:

- Requires as little as 500µL of sample
- Offers a remarkably wide dynamic viscosity range
- Achieves exceptionally high and low shear rates
- Automated testing for rapid results
- Prevents film forming, evaporation, and contamination
- Measures both Newtonian and non-Newtonian fluids easily
- Has a very small footprint
- Delivers extraordinary precision and accuracy

With *e-VROC™*, RheoSense took the standard principles of rheometry and created a dynamic micro-sample viscometer by adding microfluidics while reducing the size of the device with MEMS (micro-electrical mechanical systems) manufacturing. The result was a new technology that allows the measurement of extensional viscosity at high extensional rates, compared to other methods.

Scientific Principle

The *e-VROC™* chip is engineered with a microfluidic channel of uniform width and depth. It has hyperbolic contraction/expansion zone in the middle of the channel and four monolithically integrated MEMS pressure sensors (two in the upstream and two in the downstream of the contraction/expansion zone). A liquid entering the channel first experiences shear flow in the straight channel and then experiences a uniform extension in the contraction zone as illustrated by the elongational shape change of the square in figure 1.

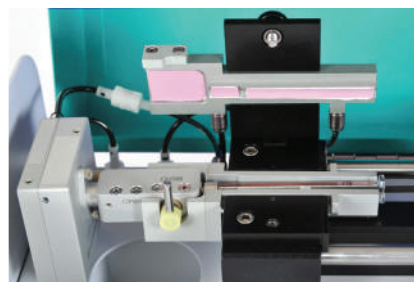
Compared to other methods of extensional viscosity measurement, *e-VROC™* allows the measurement of extensional viscosity at high extensional rates. The system measures the pressure upstream and downstream of a contraction using the MEMS pressure sensors, and it registers changes in the flow. The fluid undergoes an almost constant extension through the contraction/expansion, enabling the calculation of the extensional viscosity.

Step 1



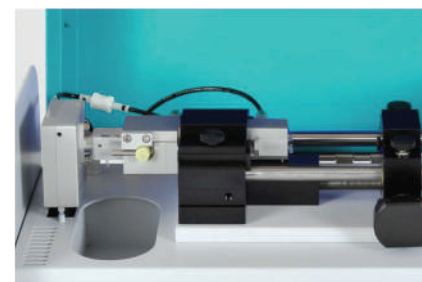
Load the syringe with sample.

Step 2



Thread the syringe into the measuring cell and close the thermal jacket

Step 3



Press start and begin the measurement

hts-VROC

High Temperature, High Shear Viscosity Measurement

When you need to measure high temperature and high shear viscosities in your complex industrial process, hts-VROC is the ideal solution for precise, reliable measurement.

hts-VROC™ provides extensional viscosity data by monitoring the sample flow through a microfluidic channel. The system measures the change in pressure using the MEMS pressure sensors, and it registers changes in the flow.

The advantage of this approach is that shear-rate and temperature dependent viscosity can be accurately measured.

hts-VROC™ is ideal for polymer applications, or for fluids with certain extensional viscosity properties similar to those that are used as additives to prevent mists from forming in volatile fluids like jet fuel or for turbulent drag reduction in oil pipelines and sewer systems.

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Technical Specifications

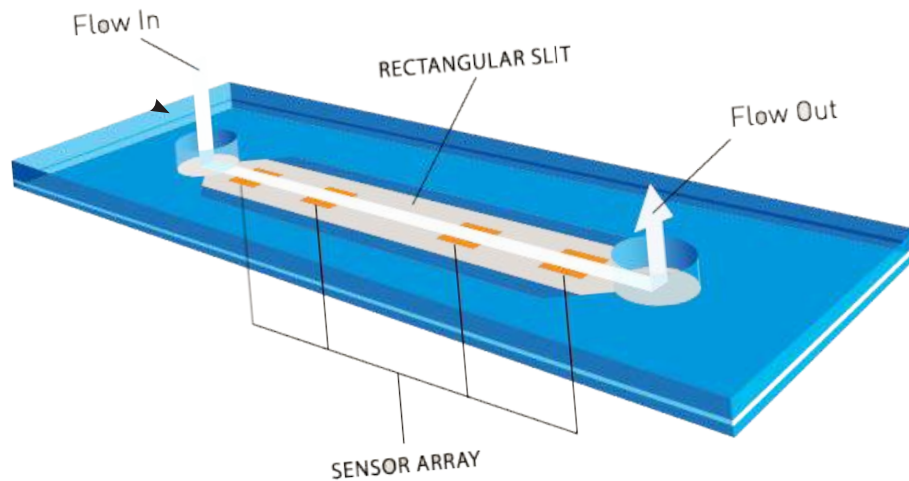
Minimum Sample	500 μ L
Viscosity Range	1.0-2,000mPas
Shear Rate Range	0.1-1000 s^{-1}
Temperature Range	4-70°C
Temperature Stability	\sim +/-0.07°C
Extensional Viscosity	Yes
Accuracy	\sim +/- 2% reading
Repeatability	\sim +/- 0.5% reading
Shear Sweeps	Yes
Temperature Sweeps	Yes
Typical Test Time	<1min

Other Applications Include:

- Fiber extrusion spinnerets
- Paint rolling
- Blow molding
- Ink jet printer nozzles
- Sheet or film drawing
- Flow through a porous media

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Simply Precise™

RheoSense VROC™ Technology



Technology

The breakthrough VROC™ (Viscometer/Rheometer-On-a-Chip) technology offers powerful advantages over conventional viscometers and rheometers.

VROC™ solution:

- Requires as little as 50µL of sample
- Offers a remarkably wide dynamic viscosity range
- Achieves exceptionally high and low shear rates
- Automated testing for rapid results
- Prevents film forming, evaporation, and contamination
- Measures both Newtonian and non-Newtonian fluids easily
- Has a very small footprint
- Delivers extraordinary precision and accuracy

RheoSense took the standard principles of rheometry and created a dynamic micro-sample viscometer by adding microfluidics while reducing the size of the device with MEMS (micro-electrical mechanical systems) manufacturing. The result was a new technology that allows the measurement of extensional viscosity at high extensional rates, compared to other methods.

Scientific Principle

The VROC™ chip is engineered with a microfluidic channel of uniform width and depth

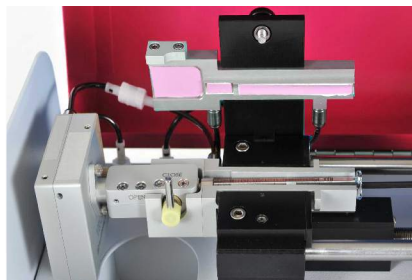
Compared to other methods of viscosity measurements, VROC™ solutions allow accurate and quick results.

Step 1



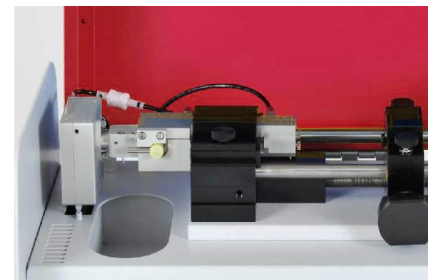
Load the syringe with sample.

Step 2



Thread the syringe into the measuring cell and close the thermal jacket

Step 3



Press start and begin the measurement

*micro*VISC™

Choice of Industry Leaders!



RheoSense

Simply Precise™

microVISC™ is ideal for your routine and frequent viscosity measurements

- Small Sample Volume – 100 μ L
- Battery-Operated
- Fastest Measurement Time – Less than a Minute
- No Evaporation – No Air-Liquid Interface
- Portable – Weighs only 1 kg
- Easy Operation
- Precise Temperature Control
- Accuracy up to 2% of Reading

microVISC™ is the fastest viscometer for your routine viscosity measurement. The instrument is intuitively designed and users can start operating within a minute. *microVISC™* employs RheoSense's patented Viscometer/Rheometer-on-a-Chip (VROC®) technology and offers accurate and repeatable viscometry measurements, using sample size as small as 100 μ L. Battery-operated and portable, *microVISC* can be deployed at any laboratory location or in the field. *microVISC™* has been adopted by leading companies worldwide as their choice for quick, easy, and rapid viscometry measurements. High precision and accuracy save time and resources.

Specifications

Min Sample Volume	100 μ L
Shear Rate Range, s^{-1}	1.7 ~ 5,800
Viscosity Range, mPa-s (cP)	0.2 ~ 20,000
Temperature Range	18 ~ 50 °C
Portable	Yes
Accuracy	2% of Reading
Repeatability	0.5% of Full Scale
Temperature Sensor	Built-In
Software	Optional
Non-Newtonians?	Yes
Temperature Accuracy	0.15

Applications

microVISC™ is an integral part of R&D, manufacturing, and quality control:

- Biopharma & Protein Therapeutics
- Cosmeceuticals
- Inks: Conductive & Ceramic
- Coating
- Fracking
- Oils & Lubricants
- Rechargeable Battery
- Beverages
- Stamping Oil Recovery
- Hydrogels
- Ointments
- Suspensions

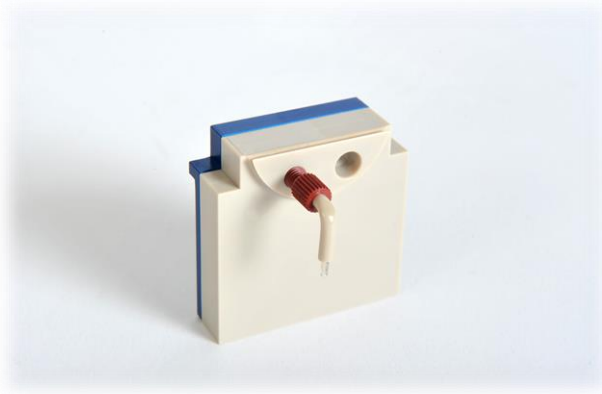


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A05	<i>microVISC Chip, 0-100 cP</i> 50 μm flow channel
A10	<i>microVISC Chip, 4-600 cP</i> 100 μm flow channel
A20	<i>microVISC Chip, 10-2,000 cP</i> 200 μm flow channel
A30	<i>microVISC Chip, 30-8,000 cP</i> 300 μm flow channel
B10	<i>microVISC Chip, 60-5,000 cP</i> 100 μm flow channel
B20	<i>microVISC Chip, 70-10,000 cP</i> 200 μm flow channel
B30	<i>microVISC Chip, 100-20,000 cP</i> 300 μm flow channel
C10	<i>microVISC Chip, 400-22,000 cP</i> 100 μm flow channel
C20	<i>microVISC Chip, 500-40,000 cP</i> 200 μm flow channel
C30	<i>microVISC Chip, 2,000-80,000 cP</i> 300 μm flow channel



microVISC-m

Portable Viscosity Measurement for Oil Analysis in the Lab or Field

Rapid, accurate, & reliable viscometer for determining oil health and extending lubricant changeover cycles

It's widely recognized in the industry that viscosity analysis is the fastest, easiest, and most cost effective way to assess the overall health of lubricating oil.

Early detection of problems in the lube oil is essential for machinery, bearings, generators, or any rotating equipment. Lube oil can be affected in many ways – oxidation can occur, it can become contaminated from fuel, water, or refrigerant leakage, or it can mix with exhaust from the pistons introducing soot. Additives in the oil also breakdown over time. When lubricating oil quality declines, costly equipment failures will occur.

It is also important to consider the costs associated with prematurely changing a lubricant that is still good. It is common practice to change lubricating oils in a pump, shaft, or any rotating machinery, at a set interval, whether they need it or not. Significant operating costs can be saved by quickly and easily verifying the oil's quality, allowing operators to extend the useful service life of a lube that is still within the manufacturer's specifications.

microVISC-m™ from RheoSense measures the viscosity of an oil and uses ASTM methods to report the kinematic and absolute viscosity of the sample at the desired reference temperature(s), typically 40°, 50°, or 100° C, allowing for easy determination of oil health. The rectangular-slit method employed in the measurement is incredibly fast and easy to use with little to no training. Data generated with the microVISC-m is also stored with date and time stamps for traceability.

microVISC-m™ is a handheld, battery-operated analyzer that is ideal for lab or remote field measurements. The

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Technical Specifications

Minimum Sample	100 μL
Viscosity Range	1-3500 cSt
Operating Range	18° - 40° C
Output Range	20° - 100° C
Humidity Range	0~90 %, non-condensing
Accuracy	~+/- 2% reading
Repeatability	~+/- 0.5% reading
Typical Test Time	<1min
Standards	Correlates to ASTM D445

re-chargeable battery can perform up to 100 measurements in between charges, giving the unit true portability. Up to eight different types of oil can be pre-programmed into microVISC-m at a time, which allows operators to recall setups at the push of a button. Disposable pipettes reduce the risk of sample contamination, and an automated cleaning capability means no clean up between samples.

Applications

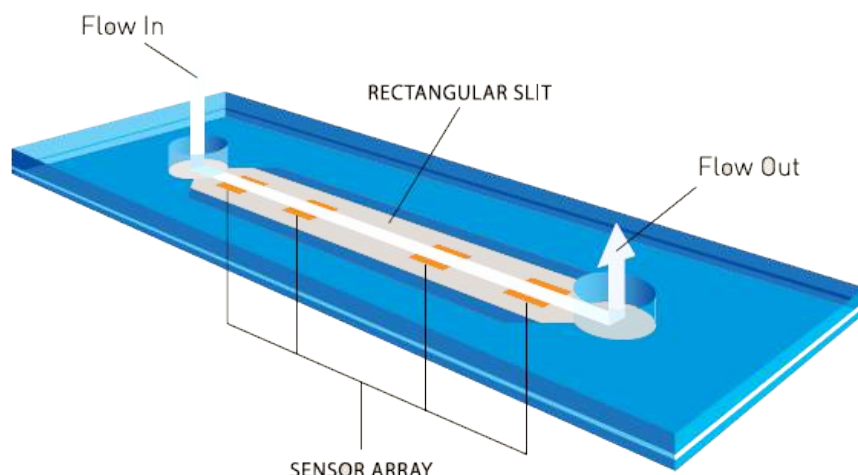
- Remote mining machinery and equipment
- Naval vessels with aviation and marine lubricants
- Compressors, bearings, and rotating equipment on ships
- Fleet maintenance services for trucks, tanks, buses, and other vehicles
- Transformer oils for power companies
- Small- and medium-sized diesel engines
- Offshore wind turbines where visits are expensive and infrequent
- Preventative maintenance in stationary factories and installations



RheoSense

Simply Precise™

RheoSense *micro*VISC-m™ Technology



Technology

The breakthrough *micro*VISC-m™ (Viscometer/Rheometer-On-a-Chip) technology offers powerful advantages over conventional viscometers and rheometers.

The *micro*VISC-m™ solution:

- Requires as little as 100µL of sample
- Offers a remarkably wide dynamic viscosity range
- Achieves exceptionally high and low shear rates
- Automated testing for rapid results
- Prevents film forming, evaporation, and contamination
- Measures both Newtonian and non-Newtonian fluids easily
- Has a very small footprint
- Delivers extraordinary precision and accuracy

With *micro*VISC-m™, RheoSense took the standard principles of rheometry and created a dynamic micro-sample viscometer by adding microfluidics while reducing the size of the device with MEMS (micro-electrical mechanical systems) manufacturing.

This new technology, housed within a rugged, portable case and powered with a rechargeable, long-life battery, is ideal for remote field measurements where space may be limited and conditions may be difficult.

It's designed to use disposable pipettes, which reduce the risk of sample contamination, and it is highly user friendly. Users can operate it within one minute with almost no training.

Scientific Principle

The measurement method, also known as the rectangular slit method, provides highly accurate dynamic viscosity data and kinematic viscosity in order to compare with industry standards like ASTM, ISO, SAE, etc. This is accomplished using the innovative *micro*VISC-m™ firmware which utilizes ASTM D341 temperature compensation principles to provide viscosity data at reference temperatures that are different from the actual measurement temperature. This gives the user the ability to compare a sample viscosity at 40° C, 50° C and 100° C in a single measurement.

Step 1

Load the sample into the disposable pipette.



Step 2

Mount the pipette.



Step 3

Push run.

