Single instrument for both density and viscosity measurement to extremely high accuracy
- Measure reservoir fluid density and viscosity at 30,000 psi and 400 °F
- Less than 0.7 cc fluid sample required for measurement
- No hardware or software changes to measure density and viscosity across complete range
- All Titanium Grade 5 wetted parts, built in high-accuracy fluid temperature measurement

Specifications

Fluid Measurements
- Viscosity Range: 0.2 to 300 cP
- Viscosity Accuracy: 0.1 cP below 10 cP, 5% of reading (standard), higher accuracy available
- Density Range: 0 to 15 g/cc
- Density Accuracy: 0.001 g/cc, higher accuracy available
- Reproducibility: Better than 0.1% of reading
- Temperature: Ph1000 (class AA), Calibrated to NIST traceable viscosity and density standards.

Operational Environment
- Process Fluid Temperature: -40 up to 200 °C
- Ambient Temperature: -40 up to 200 °C
- Pressure Range: up to 30,000 psi

Mechanical
- Material (Wetted parts): Titanium Grade 5
- Dimensions: 44 x 55 x 75.3 mm
- Process Connection: 1/4" HP (9/16-18 UNF)
- Ingress Protection: IP69
- Electrical Connection: Fixed cable

Electronics & Communication

Display (SME-TRD)
- Operational temp.: max. 55 °C
- Power supply: 24 V DC, IP65/66
- Software: Data acquisition and service control panel
- Multi-line LCD (max. 55°c)

Analog output: 4-20 mA (3 channel)
- Digital output: Modbus RTU (RS-485), Ethernet, USB
- Wireless output: Bluetooth LE 4.0

Protected by US and International patents granted and pending
rheonics • Switzerland • USA • www.rheonics.com • info@rheonics.com +41 52 511 32 00 +1 713 364 5427
Operating principle

The rheonics DVM measures viscosity and density by means of a torsional tuning fork resonator with flattened tine ends, which is immersed in the fluid under test. The more viscous the fluid, the higher the mechanical damping of the resonator, and the denser the fluid, the lower its resonant frequency. From the damping and resonant frequency, the density and viscosity may be calculated by means of rheonics’ proprietary algorithms. Thanks to rheonics’ coupled torsional resonator design (US patent number 9518906), the transducer is perfectly balanced, while maintaining excellent mechanical isolation from the sensor’s mounting.

Damping and resonant frequency are measured by the rheonics sensing and evaluation electronics (US patent number 8291750). Based on rheonics’ proven gated phase-locked loop technology, the electronics unit offers stable and repeatable, high-accuracy readings over the full range of specified temperatures and fluid properties.

Application

PVT and coreflood studies
- Highly accurate and reliable density measurement at pressure to 30,000 psi and temperature to 400 °F
- Complete DVM sensor unit rated for up to 200 °C temperature for installation in PVT oven or bath
- Fully automated inline high pressure and high temperature density meter and viscometer
- Live oil viscosity (dynamic and kinematic) and density measurement in combination with high pressure sample cylinders and high pressure pump
- Improve crude oil separation and recovery from wells by understanding behavior of reservoir fluid through multistage separators under operation pressure and temperatures of each stage
- Stable and repeatable measurements of fluid property of foamed systems under extreme conditions
- Gas viscosity at HPHT for flow modeling in poros media

Real-time scale deposition evaluation
- Evaluate the performance of scale and wax inhibitors at high pressure and high temperature

Oil fields fluids
- Viscosity measurement of completion fluids at high pressure and high temperature
- Inline real-time on location accurate measurement of fracturing fluid viscosity and density
- Long term HPHT viscosity monitoring of drilling mud to assess heat stress and thermal stability
- Continuous measurement - eliminate manual sampling

Other applications:
- Jet fuel, aerosols, adhesives, automotive fluids, coatings, colloids, dispersions
- High pressure diesel injector development
- Lubricant viscosity profile under operational high pressure and high temperature conditions
- Gas mixture specific gravity measurement under HPHT conditions
- Simulation of deepwater conditions. Pipeline and umbilical restart tests
- Stability tests of emulsions for non-newtonian and newtonian fluids
- Small form factor for direct installation in flow lines
**Mechanical & Electrical**

**Electronics (select between)**

- **SME-TRD**
  - Transmitter housing (IP66)
  - Onsite and remote installation of electronics head
  - Available with and without rugged display for field use

- **SME-TR**
  - 35mm DIN rail mount
  - Extra-small form factor for easy installation
  - Ethernet connection
  - External adapters for WiFi

**Mechanical**

- Titanium Grade 5
- Complete unit including cable and connector on DVM rated for up to 200 °C insertion in fluid bath

**Process connection**

- 1/4” HP (9/16-18 UNF) (standard)
- Custom connections and adapter

**Dimensions**

- **SME-DRM**
  - 35mm DIN rail mount
  - Extra-small form factor for easy installation
  - Ethernet connection
  - External adapters for WiFi

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**Customer equipment panel box**

- **Sensor Cable**
  - Up to 30 m
  - Up to 200°C

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**HPHT FLUID IN**

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**HPHT FLUID OUT**

---

**OVEN**

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**Power Communication**

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**HPHT ULTRA HIGH ACCURACY SIMULTANEOUS DENSITY AND VISCOSITY MEASUREMENT**

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**DVM-DS-1706**
DVM
HPHT ULTRA HIGH ACCURACY SIMULTANEOUS DENSITY AND VISCOSITY MEASUREMENT

Electronics installation

Dimensions

Industrial high-contrast LCD
Bluetooth LE 4.0
Status LED
DVM

HPHT ULTRA HIGH ACCURACY SIMULTANEOUS DENSITY AND VISCOITY MEASUREMENT

DVP dimensions

Software

rheonics Application

PC Data Acquisition & Analysis

Connect using:
- 📱 Bluetooth
- 🌐 Cloud
- 🔔 Real-time data
- 🔍 Process view
- 🔴 Alerts
- ⚙️ Configure
- 📱 Android
- 📱 iOS

Connect over:
- 🌐 USB
- 🌐 Ethernet
- 📱 Bluetooth
- 🌐 Cloud
- 🛠 Configure sensor
- 📅 Check calibration
- 🔧 Firmware upgrade
DVM
HPHT ULTRA HIGH ACCURACY SIMULTANEOUS DENSITY AND VISCOSITY MEASUREMENT

Ordering

Ordering code example

<table>
<thead>
<tr>
<th>DVM</th>
<th>V1</th>
<th>STD</th>
<th>D1</th>
<th>DCAL1</th>
<th>E1</th>
<th>C1/C2</th>
<th>T1</th>
<th>P1</th>
<th>X1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Viscosity range</td>
<td>V. Calibration</td>
<td>Density range</td>
<td>D. Calibration</td>
<td>Electronics</td>
<td>Communication</td>
<td>Temperature</td>
<td>Pressure</td>
<td>Process Connection</td>
</tr>
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</tr>
</tbody>
</table>

Order code

V1 0.2 - 300 cP Standard calibrated range
V2 custom Customer specified calibration range (0.02 to 500 cP)

Viscosity Calibration (select all)

STD Standard calibration
CUS Customer specific calibrations - specify viscosity range, accuracy required and operational conditions

Density range (select all)

D1 0 - 1.5 g/cc Standard range
D2 custom Customer specified range (max. 3 g/cc)

Density Calibration (select all)

DCAL1 0.001 g/cc Standard calibration accuracy
DCAL2 0.0001 g/cc or better Customer specific calibrations - specify density range, accuracy required and operational conditions

Electronics (select one)

E1 SME-TRD Transmitter housing with display
E2 SME-TR Transmitter housing with solid cover
E3 SME-DRM 35mm DIN rail mount housing

Communication (select all)

C1 4-20 mA 3 channels of 4-20 mA analog signal
C2 Modbus RTU (RS-485) Modbus RTU over RS-485
C3 USB USB 2.0 compliant service and data acquisition port
C4 Ethernet Ethernet TCP/IP with RJ45 connector
C5 Bluetooth LE 4.0 Bluetooth module for short range communication, only available with display module

Temperature (select one)

T1 125 °C Sensor rated for operation in process fluids up to 125 °C (250 °F)
T2 150 °C Sensor rated for operation in process fluids up to 150 °C (300 °F)
T3 175 °C Sensor rated for operation in process fluids up to 175 °C (350 °F)
T4 200 °C Sensor rated for operation in process fluids up to 200 °C (400 °F)

Pressure (select one)

P1 Sensor rated for process fluids pressure up to 700 bar (10,000 psi)
P2 Sensor rated for process fluids pressure up to 1000 bar (15,000 psi)
P3 Sensor rated for process fluids pressure up to 1400 bar (20,000 psi)
P4 Sensor rated for process fluids pressure up to 2100 bar (30,000 psi)

Process Connection (select one)

X1 1/4” HP (9/16-18 UNF) Standard
X2 custom Custom fluid connection

Accessories

- Torque wrench 20 N.m adjustable Torque wrench to tighten the sensing element with correct torque (20 N.m)
- Cable gland 1/2” NPT 1/2” NPT Standard and Ex cable glands
- Transmitter mounting bracket Mounting bracket for SME-TR and SME-TRD transmitter housings

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