**Specifications**

**Fluid Measurements**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Viscosity Range</td>
<td>0.2 to 300 cP (lower than 0.2 available)</td>
</tr>
<tr>
<td>Viscosity Accuracy</td>
<td>0.1 cP below 10 cP, 5% of reading (standard)</td>
</tr>
<tr>
<td>Density Range</td>
<td>0 - 15 g/cc</td>
</tr>
<tr>
<td>Density Accuracy</td>
<td>0.001 g/cc (higher accuracy available)</td>
</tr>
<tr>
<td>Reproducibility</td>
<td>Better than 1% of reading</td>
</tr>
<tr>
<td>Temperature</td>
<td>Ph1000 (class AA)</td>
</tr>
<tr>
<td>Calibration</td>
<td>Calibrated to NIST traceable viscosity and density standards</td>
</tr>
</tbody>
</table>

**Operational Environment**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Process Fluid Temperature</td>
<td>-40 up to 200 °C</td>
</tr>
<tr>
<td>Ambient Temperature</td>
<td>-40 up to 200 °C</td>
</tr>
<tr>
<td>Pressure Range</td>
<td>up to 30,000 psi</td>
</tr>
</tbody>
</table>

**Mechanical**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material (Wetted parts)</td>
<td>Titanium Grade 5</td>
</tr>
<tr>
<td>Dimensions</td>
<td>44 x 55 x 75.3 mm</td>
</tr>
<tr>
<td>Process Connection</td>
<td>1/4&quot; HP (9/16-18 UNF)</td>
</tr>
<tr>
<td>Ingress Protection</td>
<td>IP69</td>
</tr>
<tr>
<td>Electrical Connection</td>
<td>Fixed cable</td>
</tr>
</tbody>
</table>

**Electronics & Communication**

<table>
<thead>
<tr>
<th>Description</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog output</td>
<td>4–20 mA (3 channel) (Viscosity, Density, Temp)</td>
</tr>
<tr>
<td>Digital output</td>
<td>Modbus RTU (RS-485)</td>
</tr>
<tr>
<td></td>
<td>Ethernet</td>
</tr>
<tr>
<td></td>
<td>USB</td>
</tr>
<tr>
<td>Wireless output</td>
<td>Bluetooth LE 4.0</td>
</tr>
</tbody>
</table>

**Display**

- SME-TRD (max. 55 °C)

**Multi-line LCD**

- Operational temp. max. 55 °C
- Power supply 24 V DC
- IP65/66
- Software: Data acquisition and service control panel
- iOS and Android app

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*Protected by US and International patents granted and pending*
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 porous 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
DVM
HPHT ULTRA HIGH ACCURACY SIMULTANEOUS DENSITY AND VISCOSITY MEASUREMENT

Mechanical & Electrical

Electronics (select between)

- SME-TRD
- SME-TR

- Explosion-proof IP66 enclosures
- Onsite and remote installation of electronics head
- Available with and without rugged display for field use

- SME-DRM

- 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

Customer equipment panel box

Power Communication

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

HPHT Fluid In

HPHT Fluid Out

Oven

Sensor Cable
- Up to 30m
- Up to 200 °C
Electronics installation

Display connector
USB
Ethernet

Power 24V DC
Modbus RTU (RS-485)
Viscosity(ch1)
Density(ch2)
Temperature(ch3)
GND

Sensor cable

Industrial high-contrast LCD
Bluetooth LE 4.0
Status LED

Dimensions

SME-TR

SME-TRD

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

DVP dimensions

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
# Ordering

## Ordering code example

<table>
<thead>
<tr>
<th>V1</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>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>
</tr>
<tr>
<td>V1</td>
<td>0.2 - 300 cP</td>
<td>STD</td>
<td>Standard calibrated range</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V2</td>
<td>custom</td>
<td>DCal1</td>
<td>Customer specified calibration range (0.02 to 500 cP)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Viscosity range (select all)

- V1: 0.2 - 300 cP
- V2: custom

## 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
- D2: custom

## Density Calibration (select all)

- DCal1: 0.001 g/cc
- DCal2: 0.001 g/cc or better

## Electronics (select one)

- E1: SME-TRD
- E2: SME-TR
- E3: SME-DRM

## Communication (select all)

- C1: 4-20 mA
- C2: Modbus RTU (RS-485)
- C3: USB
- C4: Ethernet
- C5: Bluetooth LE 4.0

## Temperature (select one)

- T1: 125 °C
- T2: 150 °C
- T3: 175 °C
- T4: 200 °C

## Pressure (select one)

- P1: 700 bar (10,000 psi)
- P2: 1000 bar (15,000 psi)
- P3: 1400 bar (20,000 psi)
- P4: 2100 bar (30,000 psi)

## Process Connection (select one)

- X1: 1/4” HP (9/16-18 UNF)
- X2: custom

## Density range (select all)

- D1: 0 - 1.5 g/cc
- D2: custom

## Density Calibration (select all)

- DCal1: Standard calibration accuracy
- DCal2: Customer specific calibrations - specify density range, accuracy required and operational conditions

## Electronics (select one)

- E1: SME-TRD
- E2: SME-TR
- E3: SME-DRM

## Communication (select all)

- C1: 4-20 mA
- C2: Modbus RTU (RS-485)
- C3: USB
- C4: Ethernet
- C5: Bluetooth LE 4.0

## Temperature (select one)

- T1: 125 °C
- T2: 150 °C
- T3: 175 °C
- T4: 200 °C

## Pressure (select one)

- P1: 700 bar (10,000 psi)
- P2: 1000 bar (15,000 psi)
- P3: 1400 bar (20,000 psi)
- P4: 2100 bar (30,000 psi)

## Process Connection (select one)

- X1: 1/4” HP (9/16-18 UNF)
- X2: custom

## Accessories

- Torque wrench: 20 N.m adjustable
- Cable gland: 1/2” NPT Standard and explosion-proof cable glands
- Transmitter mounting bracket: Mounting bracket for SME-TR and SME-TRD transmitter housings

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## Contact Information

**rheonics GmbH**

Technoparkstr. 2

8406 Winterthur

Switzerland

+41 52 511 32 00

**rheonics Inc.**

3 Sugar Creek Center Blvd, Ste 100

Sugar Land, TX 77478

United States of America

+1 713 364 5427

[www.rheonics.com](http://www.rheonics.com)

[info@rheonics.com](mailto:info@rheonics.com)

†subject to change without notice