

DVM

HPHT Density and Viscosity Sensor

- 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 to 100 cP
Viscosity Accuracy	5% of reading 0.1 cP below 1 cP
Density Range	0 – 1.5 g/cc
Density Accuracy	0.001 g/cc gas calibration available
Reproducibility	Better than 1% of reading
Temperature	Pt1000 (class AA)
Calibrated to NIST traceable viscosity and density standards.	

Operational Environment

Process Fluid Temperature	-40 up to 200 °C (-40 °F up to 400 °F)
Ambient Temperature	
Pressure Range	up to 30,000 psi (≈ 2,100 bar)

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	IP69K
Electrical Connection	Fixed cable



Electronics & Communication

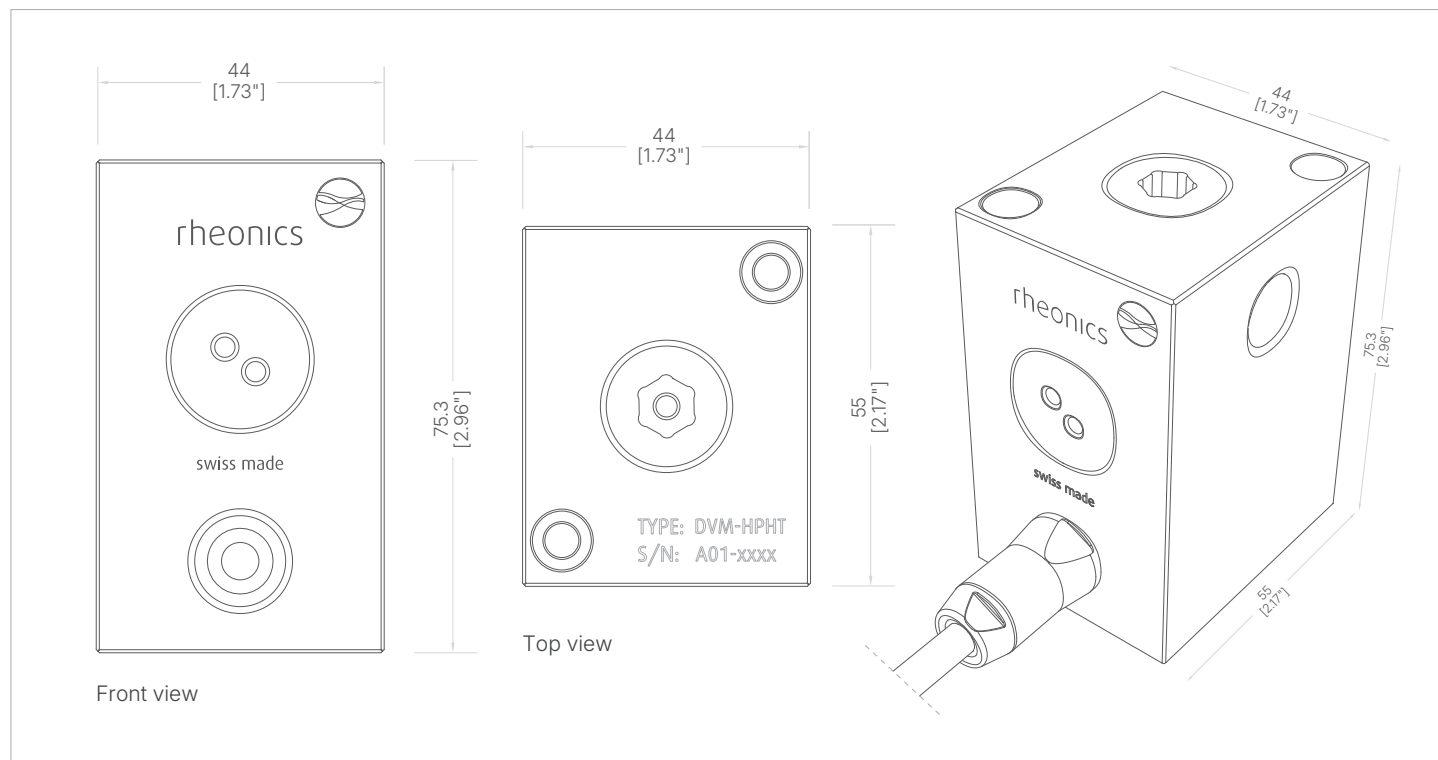
Analog output	4-20 mA (3 channel) {Viscosity, Density, Temp.}	Display	Multi-line LCD (SME-TRD)	Multi-line LCD (max. 55°C)
Digital output	Modbus RTU (RS-485) Ethernet USB	Operational temp.		max. 20° to 65° C
Wireless output	Bluetooth LE 4.0	Power supply	SME-TR(D) SME-DRM and SME-BOX	24 V DC IP66 IP20
		Software	Data acquisition and service control panel	iOS and Android app

DVM

HPHT Density and Viscosity Sensor



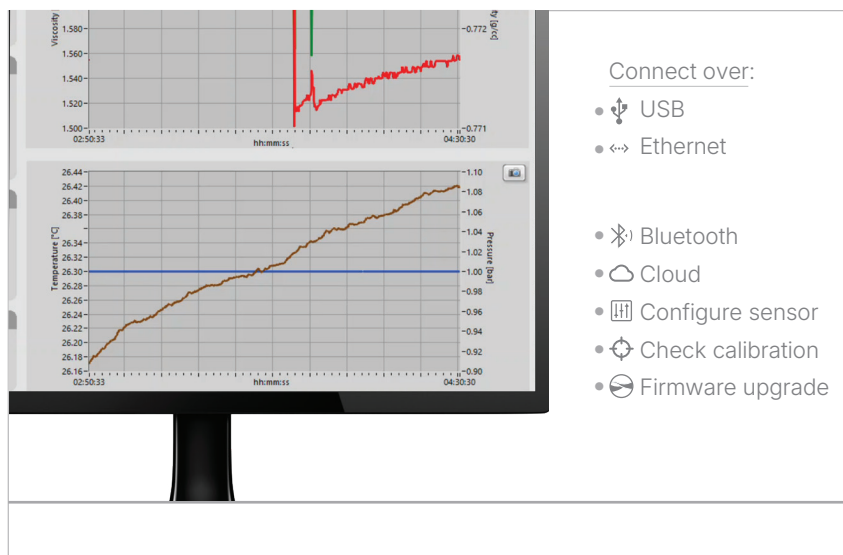
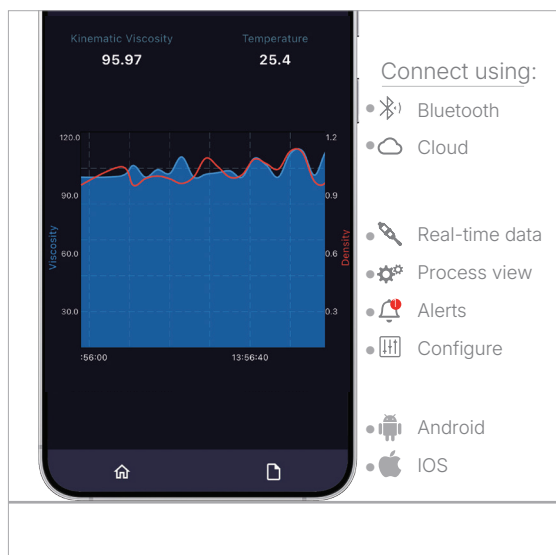
DVM dimensions



Software

Rheonics Application

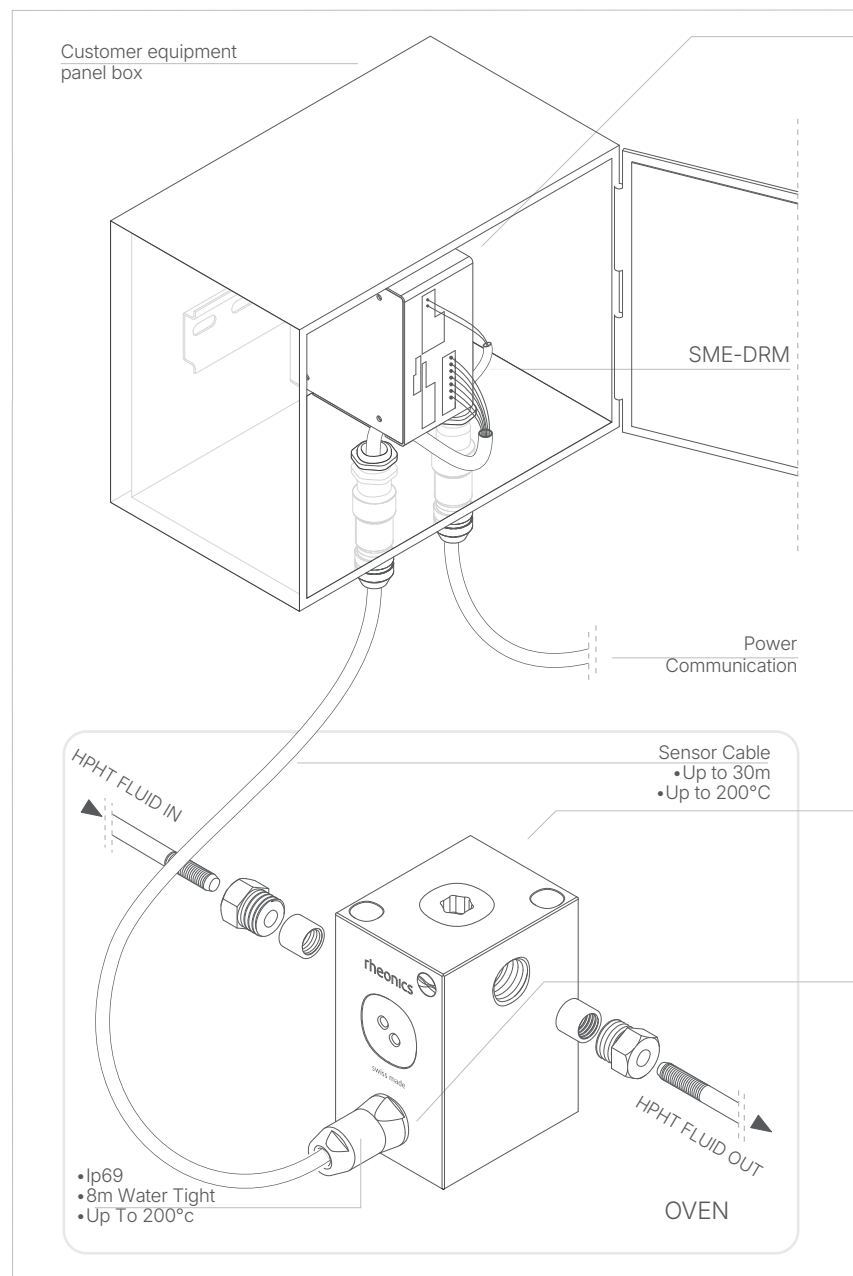
PC Data Acquisition & Analysis



DVM

HPHT Density and Viscosity Sensor

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

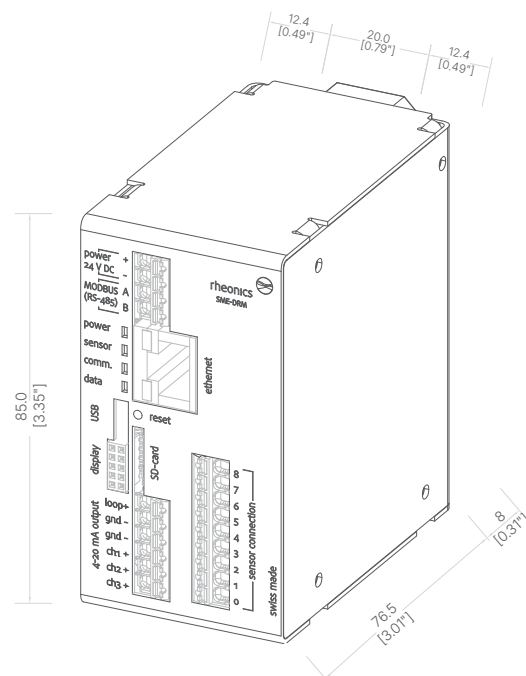
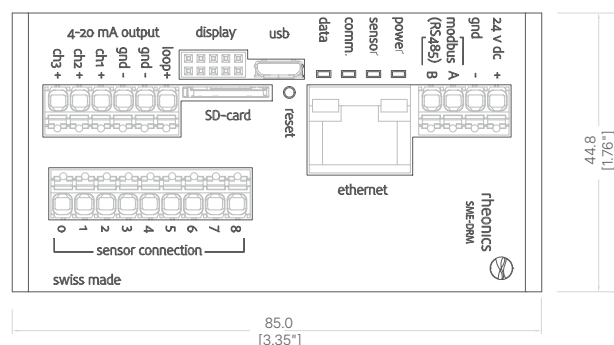
Mechanical

- 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

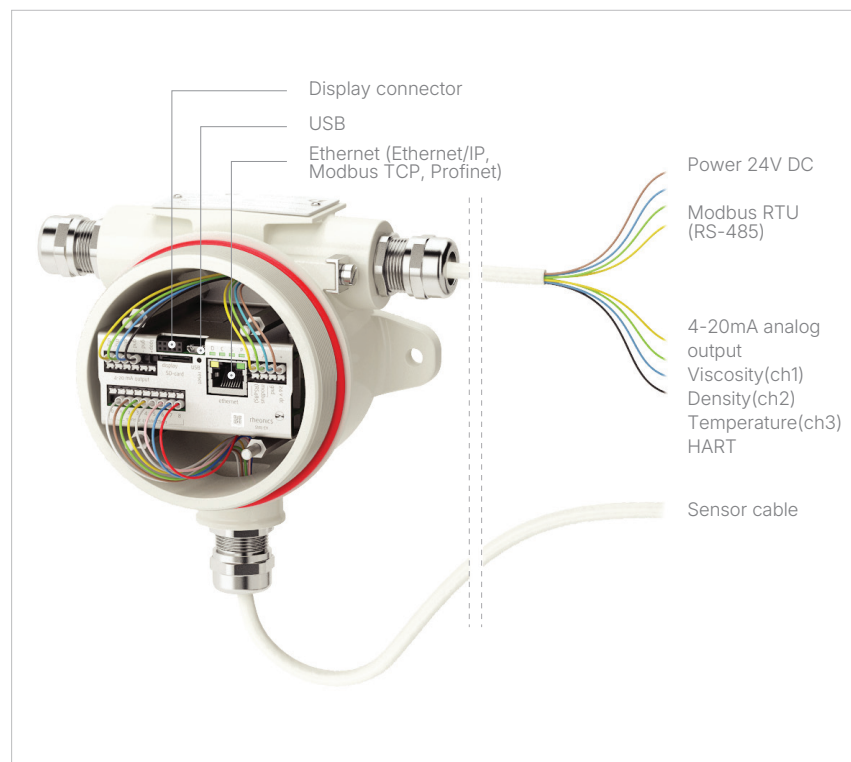


DVM

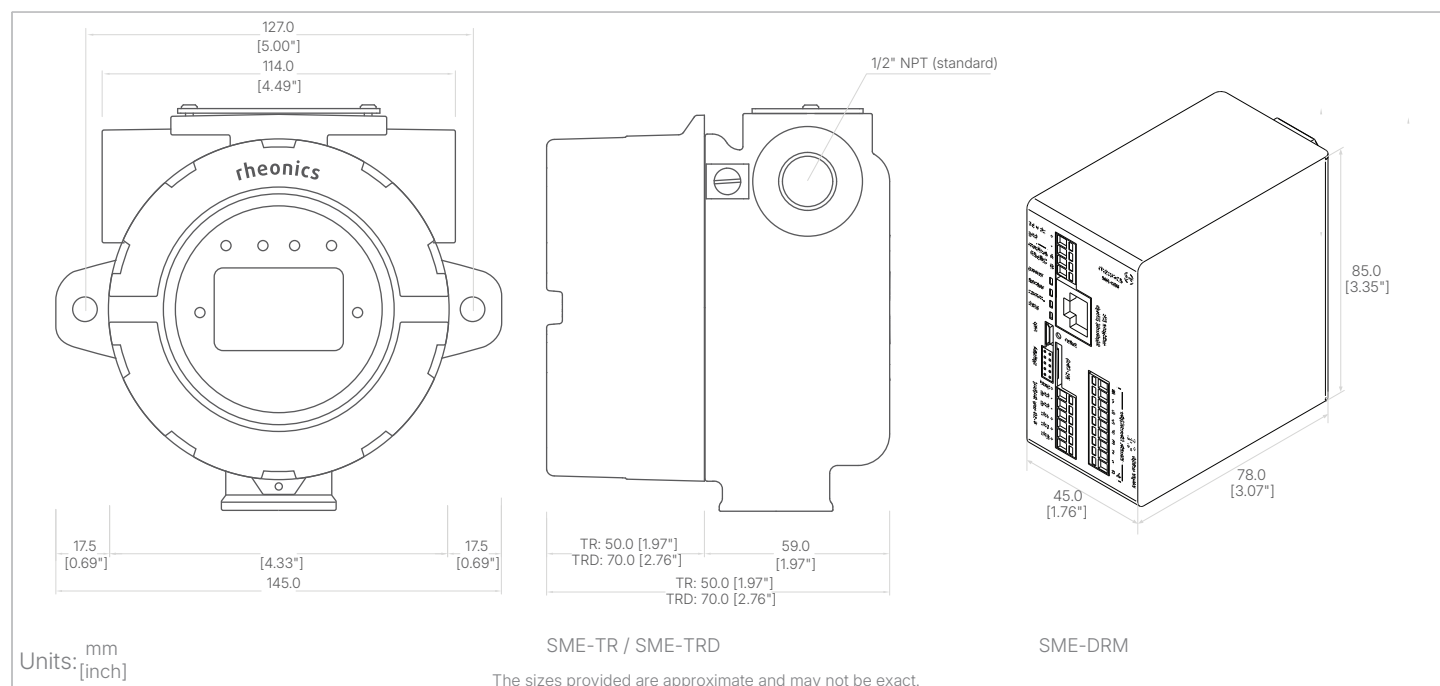
HPHT Density and Viscosity Sensor



Electronics installation



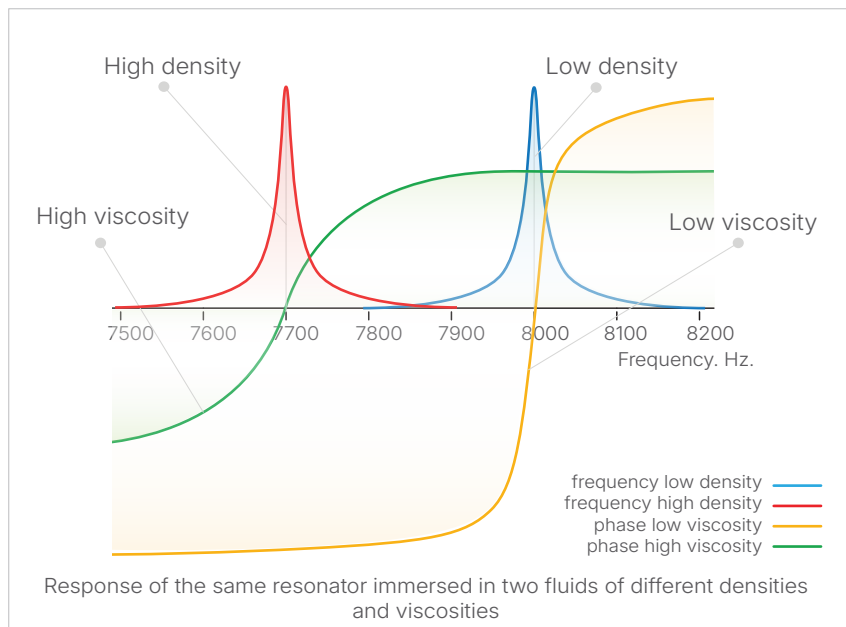
Dimensions



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

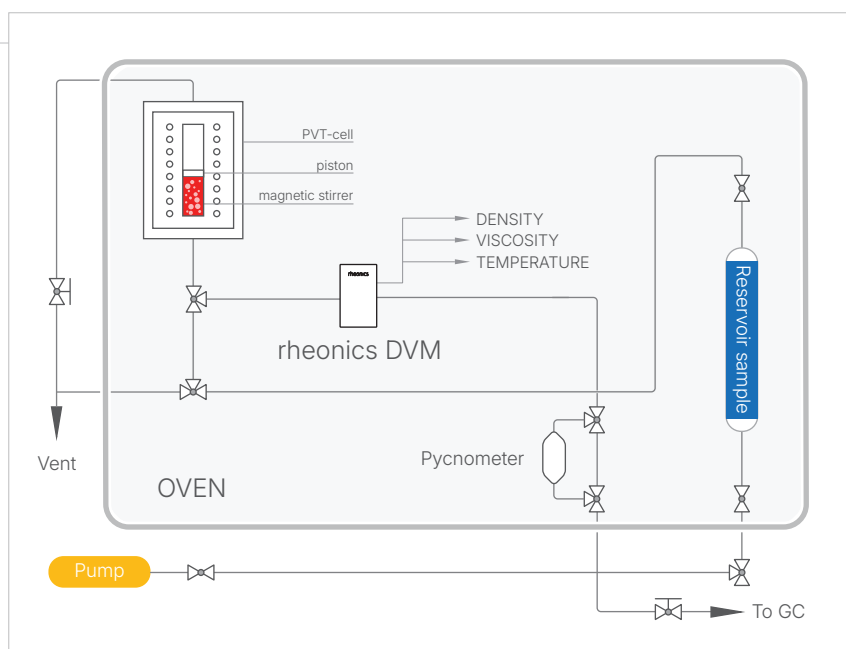
- Highly accurate and reliable density measurement at pressure to 30,000 psi ($\approx 2,100$ bar) and temperature to 400 °F (200 °C)
- Complete DVM sensor unit rated for up to 200 °C temperature for installation in PVT oven or bath
- Fully automated inline high pressure and high temperature density 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 Sensor Configuration: Probe + Electronics + Cable***DVM probe configuration code**

DVM-[MA]-[DEN RAN]-[DEN CAL]-[VIS RAN]-[VIS CAL]-[T]-[P]-[X]

Order code	Name
Material [MA]	
TG5	Titanium Grade 5
Density Range [DEN RAN] (select one)	
D1	0 to 1.5 g/cc
Density Calibration [DEN CAL] (select one)	
DCAL1	Standard density accuracy: $\pm 0.001\text{g/cc}$ (1kg/m ³ 0.0083lb/gal)
DCALG	Gas calibration
Viscosity Range [VIS RAN] (select one)	
V1	0-30 mPa.s
V2	0-100 mPa.s
Viscosity Calibration [VIS CAL] (select one)	
VCAL1	Standard: $\pm 5\%$ of reading or $\pm 0.1\text{mPa.s}$, whichever is greater

Temperature [T] (select one) Optional

ULT	Ultra-low temperature (up to -200°C)
LT7	-70°C (-94°F)
LT4	-40°C (-40°F)
-20°C (-40°F) to max value by code	
T1	125 °C (250 °F)
T2	150 °C (300 °F)
T3	175 °C (350 °F)
Pressure rating [P] (select one) From vacuum to max value by code	
P6	750 bar (10000 psi)
P7	1000 bar (15000 psi)
P8	1500 bar (20000 psi)
P9	2100 bar (30,000 psi)
Process Connection (select one)	
X1	Threaded connection
Variants [X] (select one)	
-X1-14N	¼" HP (9/16-18 UNF)

Electronics Configuration**SME Electronics Configuration Code**

SME-[EVAR]-[EMAT]-[COM]-[ADD]

Order code	Name
Electronics [EVAR] (select one)	
E1	SME-TRD (Transmitter housing with display)
E2	SME-TR (Transmitter housing with solid cover)
E3	SME-DRM (DIN-rail mount housing)
E4	SME-BOX (Desktop version with 10.4" touchscreen)
Material [EMAT]	
-	Aluminum housing (only for E1 and E2)
SS	316L stainless steel housing (only for E1 and E2)
Communication [COM] (multiple selection)	
C1	4-20 mA
C2	Modbus RTU (RS-485)
C3	USB
C4	RJ45
C5	Bluetooth LE 4.0
C6	Modbus TCP
C7	Ethernet/IP
C8	HART
C9	Profinet
C10	WirelessHart
C11	CAN
C12	IO-LINK

Cable Configuration**Cable configuration code**

CAB-[CVAR]-[LXX]

Order code	Name
Cable Type [CVAR]	
STD	Standard cable
90	Cable with 90° connector
EX	EX-rated cable (explosion-proof)
HT	High-temperature cable
IP69K	Cable with IP69K protection rating
Cable Length [LXX]	
Lxx	Length: 5, 10, 30 meters (15, 30, 90 ft) or custom, limited for certain cable types

*Additional cable is optional as DVM has an integrated cable by design

www.rheonics.com
info@rheonics.com
 rheonics

