LEMIS®
process

40 SERIES

MDM-40 - Denisty Meter
MDM-41 - Viscosity Meter
MDM-42 - Denisty & Viscosity

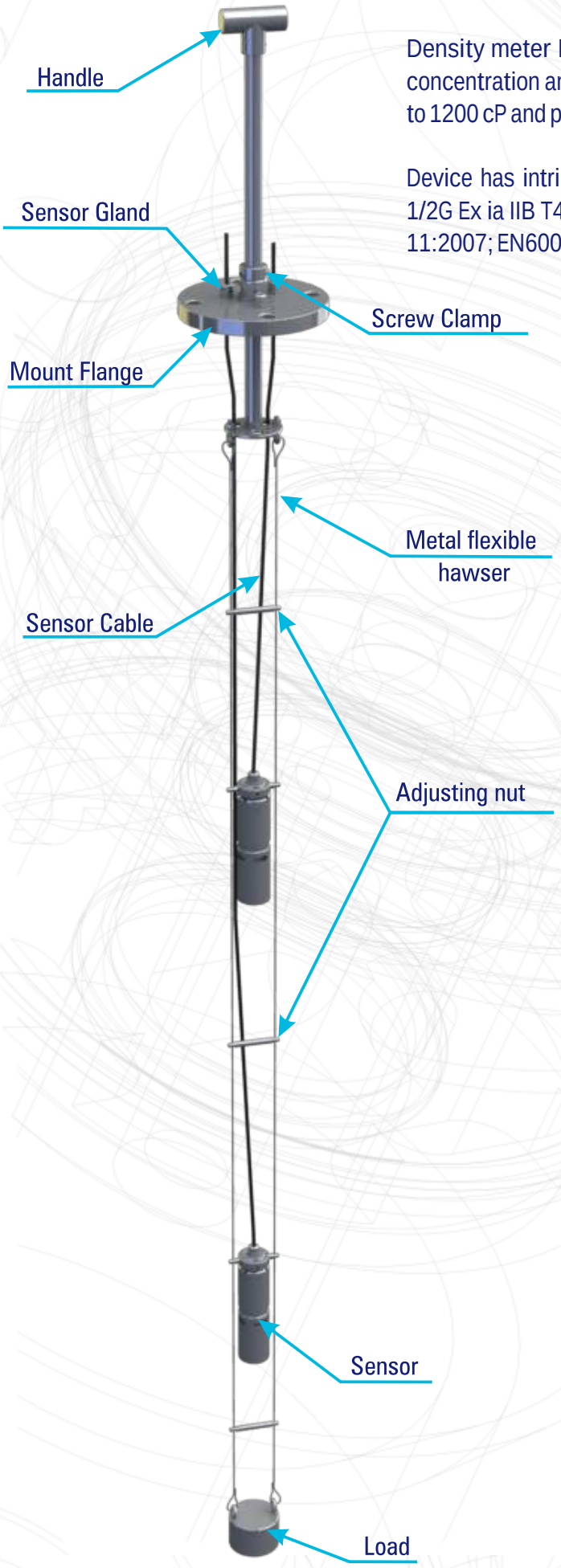
MULTI-POINT DENSITY METER

UP TO 16 SENSORS IN ONE DEVICE

MDM-40

IN PROCESS TO EXCELLENCE

MDM-40 OVERVIEW



Density meter MDM-40 is designed for continuous process measurements of density, concentration and temperature. Device measures liquids with max dynamic viscosity up to 1200 cP and process temperature range -40...+85°C (-40...+185°F).

Device has intrinsically safe circuit ia level with implosion protection marking ATEX II 1/2G Ex ia IIB T4 ; IECEx Ex ia IIB T4 Ga /Gb compliant to EN 60079-0:2006; EN 60079-11:2007; EN60079-26:2004 standards and can operate in hazardous areas.

Simple sensor adjustment

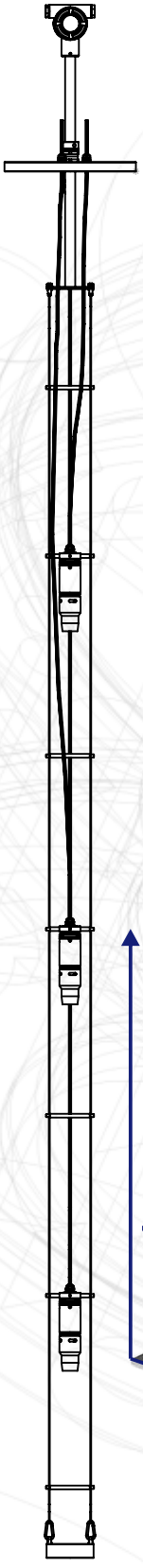
To adjust sensor in required length:

- Loosen sensor gland
- Loosen adjusting nuts
- Adjust sensors in required length and tighten adjusting nuts
- Tighten sensor gland

References:

1. VOPAK TERMINAL, UK (2008)
2. PETROCHINA, CHINA (2014)
3. HPCL, INDIA (2016)

Principle of Operation



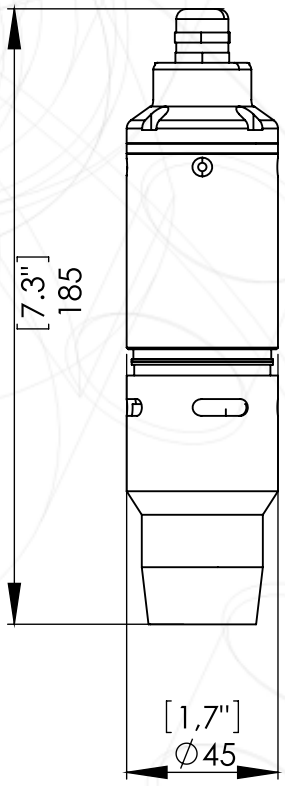
Density and Viscosity

For Density and Viscosity measurements a vibrating sensor is used. The sensor consists of a compact cylindrical tube that is vibrated in a hoop mode which delivers a balanced drive.
This unique quality of the sensor allows for it to be installed not only with a rigid mounting, but also suspended on cables or using tape measures.

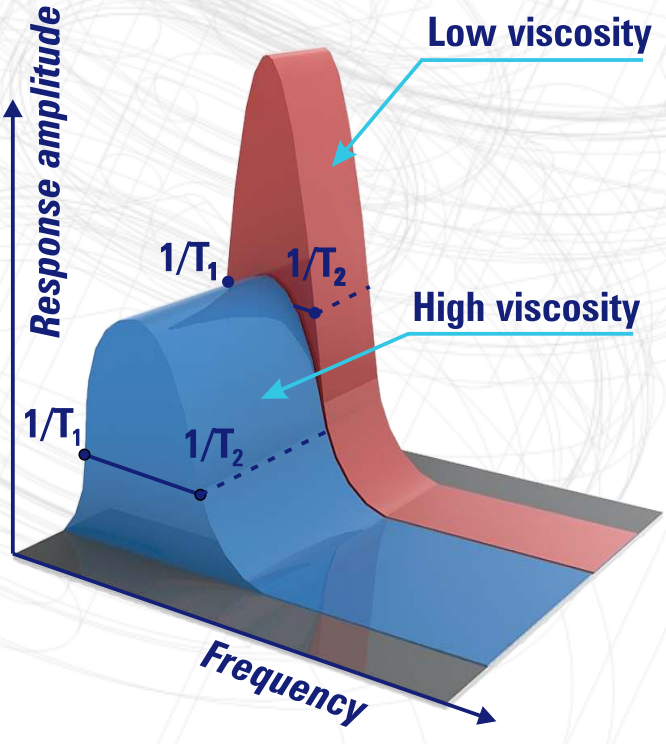
Density is determined using the well established resonant frequency principle. By alternately driving the sensor into vibration at the upper and lower half power (3dB) frequencies the bandwidth can be determined, which is also a function of the dynamic viscosity of the fluid.

Thus a single sensor will report the density, dynamic viscosity and temperature (form an integral RTD sensor) and thus kinematic viscosity can also be determined.

By using calculations based on the ASTM D341equations, the kinematic viscosity can be calculated at a reference temperature. Base density can be calculated based on the methods defined in the Manual of Petroleum Measurement Standards.



Sensor dimensions



$f = 1 / T$
f - frequency
T - oscillation period

$\rho = A + B \cdot T_R^2$
ρ - density
A, B - calibration coefficients
T_R - resonator oscillation period

$\mu = \eta / \rho$
μ - kinematic viscosity
η - dynamic viscosity
ρ - density

$\Delta T = T_2 - T_1$
1/ΔT - bandwidth
T_1 - oscillation period at a point A
T_2 - oscillation period at a point B

$\eta = C + D(\Delta T/T_R)^2 + E(\Delta T/T_R)^4$
η - dynamic viscosity
C, D, E - calibration coefficients
1/ΔT - bandwidth
T_R - resonator oscillation period

Advantages

- Density/concentration measurement in up to 16 points
- Temperature measurement in up to 16 points
- Measurment in tanks up to 35 meters
- Continuous measurements
- High accuracy
- Simple installation
- Suitable for very viscous liquids
- Wide range of applications
- Safe operation, low maintenance
- Easy cleaning
- Rigorous factory testing
- Automatic viscosity/temperature compensation

Specifications

Measuring range:	
Density	0… 3 g/cm³ (0… 3000 kg/m³)
Density Standard calibration	0.6… 1.2 g/cm³ (600… 1200 kg/m³)
Temperature	-40… +60°C (-40... +140°F)
Accuracy:	
Density	±0.0003 or ±0.0005 g/cm³ (±0.3 or ±0.5 kg/m³)
Temperature	±0.1°C (±0.2°F) or ±0.2°C (±0.4°F)
Repeatability:	
Density	±0.0001 g/cm³ (±0.1 kg/m³)
Temperature	±0.1°C (±0.2°F)
Resolution:	
Density	0.0001 g/cm³ (0.1 kg/m³)
Temperature	0.01°C (0.02°F)
Supported measuring units	Real Density: g/cm³, kg/m³, lb/gal, lb/ft³; API; SG Referred Density: at 15°C, 20°C, 60°F; API60; SG60 Tables ASTM D 1250 Temperature in °C or °F Alcohol tables
Temperature compensation	Automatic
Viscosity compensation	Automatic
Process Connections	Large selection of flanges available
Ambient temperature	-40… +60°C (-40... +140°F)
Weather rating	IP68 for sensor and IP 65 for other parts
Materials:	
Sensor	Stainless steel SS 316 L; NiSpan C; Hastelloy C22;Teflon
Other Wetted Parts	Stainless steel SS316 L or Hastelloy C22
Power supply	6-12 VDC 30 mA (60 mA pick) for 1 Sensor
Output:	
Sensor	Line density and temperature digital signals
Analog	Up to 3x isolated 4-20 mA, HART, configurable
Digital	Standard: RS485, Modbus; user choice of signals and protocols
Factory calibration	Calibration certificates supplied as standard
CE mark	Compliant EN 61326 ; EN 5011 ; EN 50082-2
Hazardous environment Approvals	
ATEX	II 1/2G Ex ia IIB T4 Ga/Gb
IEC	Ex ia IIB T4 Ga/Gb

For more information please visit www.lemis-process.com

QUALITY SYSTEM CERTIFICATION DNV·GL ISO 9001

USA
LEMIS USA, Inc.
15556 Summit Park Dr. Suite 601
Montgomery
TX 77356, USA
Ph.: +1 281 465 8441
E-mail: info@lemis-usa.com

EUROPE
LEMIS PROCESS SIA
Marupe district, Marupe,
Robeznieku street 12, LV-2167,
Latvia
Ph: +371 6738 3223
E-mail: info@lemis-process.com