Viscomaster™ series viscosity transmitters
for marine and power HFO applications

- On-line real-time Kinematic viscosity
- Marine approved
- Minimum maintenance
- High accuracy
- Simple to use
Introduction
The measurement and control of heavy fuel oil (HFO) viscosity is a known requirement within the marine and diesel engine industries. Capillary type viscometers have historically been used for this function, despite their inherent need for regular cleaning and maintenance. With the increasing pressure on operators to reduce costs, lower maintenance viscometers are required to control their systems.

Viscomaster series viscosity transmitters
The two instruments in the Viscomaster transmitter series, the Viscomaster and the Viscomaster Dynamic, have been designed to support the current developments in engine technology and the need for fuel quality data tracking throughout the engine service life. They have similarly excellent performance on viscosity measurement, whilst the Viscomaster has added functionality to accommodate the more demanding applications, that require line density measurement and Ignition Index calculations.

Viscomaster Dynamic
Designed as a direct alternative to conventional fuel viscometers, the Viscomaster Dynamic is calibrated over the range of 5 to 50cP and gives direct viscosity and temperature outputs. It can be programmed with a fuel density reading (typically from suppliers data or a laboratory sample) to enable it to output a calculated kinematic viscosity. This removes the need to inaccurately fix a fuel density value as other viscometer manufacturers require.

Viscomaster
Calibrated over the range 0.5 to 100cP with a full density calibration, the Viscomaster measures the HFO density and viscosity simultaneously in real time with unprecedented accuracy and speed of response. Its twin, fully configurable analog outputs allow the transmission of any two HFO specific parameters such as kinematic viscosity, density, base density and temperature amongst others. Customers can now log real time data on a range of fuel quality factors such as referred viscosity and Ignition Index, which are invaluable aids in maintaining engine performance.

Description
The 7829 Viscomaster and the new 7829 Viscomaster Dynamic transmitters are a major innovation in the measurement of all types of fuel oil that supply engines, turbines and marine burners. Since its introduction in 1993, the Solartron fork viscometer design has been adapted to serve different applications within the Oil industry. Solartron Mobrey has worked closely with customers to enhance this instrument and develop a product that is designed for HFO measurement and control. Tested for more than 16,000 service hours in power generation and with numerous installations worldwide, this technology can easily cope with a range of fuels from HFO to IF30 for turbines. Correctly installed, the Viscomaster requires little or no maintenance and is naturally tolerant of the harsh engine environments.

As a solution to this need, the existing Solartron fork viscometer - with its inherently rugged, maintenance free design - was specifically introduced into the Marine market. With no need for re-calibration and no moving parts this accurate viscometer is rapidly becoming an industry standard in HFO viscosity control.
**Product description**

**Viscomaster**
- 2 x 4-20mA analog outputs:
  - Both outputs fully configurable to any calculated measurement including density, dynamic/kinematic viscosity, temperature, CCAI etc.
- On-line density measurement
- Dynamic and Kinematic viscosity
- MODBUS output of all parameters including density, base density, (API 2540) viscosity, base viscosity (ASTM D341) and ignition index (CCAI, CII)
- No moving parts, minimum maintenance
- 1.5” Cone seat fitting, leaktight metal to metal seal
- 316L Stainless steel wetted parts
- Factory calibrated
- PTFE coated tines for asphaltene rich fuels

**Viscomaster Dynamic**
- 2 x 4-20mA analog outputs:
  - 1 Configurable dynamic/kinematic viscosity
  - 1 Fixed as temperature
- Fixed density input, temperature corrected
- Dynamic and Kinematic viscosity
- MODBUS output of all parameters including calculated density at operating temperature and calculated Kinematic viscosity at operating temperature.
- No moving parts, minimum maintenance
- 1.5” Cone seat fitting, leaktight metal to metal seal
- 316L Stainless steel wetted parts
- Factory calibrated
- PTFE coated tines for asphaltene rich fuels

**Principle of Operation**
The sensor is a simple tuning fork maintained in vibration electronically. The density is a function of the resonant frequency, the viscosity is a function of the bandwidth.

7829 digitally measures the frequency at a point A (the lower -3db point) and then at point B (the upper -3db point) - see diagram. From these two measurements the 7829 can calculate the bandwidth (B-A), resonant frequency ((A+B)/2) and hence the quality factor (resonant frequency/bandwidth), to give digitally determined values of the density and viscosity for the fluid.

$$Q = \frac{\text{Resonant frequency}}{\text{bandwidth}}$$

$$Q \propto \frac{1}{\sqrt{\text{Viscosity}}}$$

**Configuration**
ADView is a software package provided by Mobrey Measurement to enable you to:
- Configure our density and viscosity transmitters
- View and save data from them
- Check that they are functioning correctly

ADView is installed on a PC and interacts with the 7829 Viscomaster Series transmitters through one of the PC’s standard serial (RS-232) ports.

Download from: www.mobrey.com/downloads
## Features and benefits

<table>
<thead>
<tr>
<th>Features</th>
<th>Customer benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stable and accurate in-line measurement</td>
<td>Optimum combustion efficiency</td>
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<td></td>
<td>Optimal fuel consumption</td>
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<td></td>
<td>Reduced maintenance required</td>
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<td>Prevention of engine damage</td>
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<td>True Kinematic viscosity measurement</td>
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<tr>
<td>Simultaneous on-line Viscosity and Density outputs</td>
<td>Engine performance parameters</td>
</tr>
<tr>
<td>(Viscomaster gives continuous on-line density measurement)</td>
<td>(CII &amp; CCAI)</td>
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<td></td>
<td>True fuel oil characterisation (no assumed density values)</td>
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<tr>
<td>Designed for marine environments</td>
<td>Unaffected by vibration</td>
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<tr>
<td></td>
<td>Dirt / Asphaltene resistant</td>
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<tr>
<td>Rugged design, no moving parts</td>
<td>Robust tine design -</td>
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<td></td>
<td>No thin sensor sections</td>
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<td></td>
<td>Virtually no maintenance</td>
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<td></td>
<td>Low cost of ownership</td>
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<tr>
<td>Simple Installation</td>
<td>Compact design</td>
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<tr>
<td></td>
<td>Standard &amp; customer specific installations available</td>
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<tr>
<td>Vibrating fork principle</td>
<td>Proven design</td>
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<tr>
<td></td>
<td>&gt; 10 years experience in Viscosity measurement</td>
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<td></td>
<td>Reliable, stable &amp; accurate</td>
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<tr>
<td>Internal PT100</td>
<td>No need for external temperature sensor.</td>
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<tr>
<td>Two head mounted integral 4-20mA outputs</td>
<td>No need for external 4-20mA interface box</td>
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<td></td>
<td>Simple wiring</td>
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<tr>
<td>Stable calibration</td>
<td>No need for re-calibration</td>
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<td></td>
<td>No local service requirements</td>
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<td>Worldwide marine approvals</td>
<td>No operator training needed</td>
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<td></td>
<td>Certified safety &amp; performance by recognised marine authorities</td>
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<tr>
<td>Retrofit kits available</td>
<td>Easy replacement of existing viscometer technologies. No need to change pipework/system design</td>
</tr>
</tbody>
</table>

## Viscomaster Series marine approvals

<table>
<thead>
<tr>
<th>Marine approval</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lloyds London</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>Germanische Lloyd</td>
<td>Germany</td>
</tr>
<tr>
<td>Det Norske Veritas</td>
<td>Norway</td>
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<tr>
<td>Bureau Veritas</td>
<td>France</td>
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<tr>
<td>RINA</td>
<td>Italy</td>
</tr>
<tr>
<td>American Bureau of Shipping</td>
<td>USA</td>
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<tr>
<td>Nippon Kaiji Kyokai</td>
<td>Japan</td>
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<tr>
<td>Russian Maritime Register of Shipping</td>
<td>Russia</td>
</tr>
<tr>
<td>Korean Register of Shipping</td>
<td>Korea</td>
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<tr>
<td>China Classification of Ships (pending)</td>
<td>China</td>
</tr>
</tbody>
</table>
Fuel heater control

Most marine & land-based engine/burner applications use a fuel booster module to pre-condition the HFO prior to injection. These modules usually consist of a number of supply pumps fed by either HFO or MDO, a flow meter, in-line filters to remove impurities and a holding/mixing tank. Following this supply section, the fuel is usually sent to booster pumps that increase the flow rate up to a maximum of 20m³/hr and then through a series of heat exchangers (liquid or electric) to change the product viscosity for efficient combustion. Viscosity measurement can be performed in both in-line and pipe-elbow installations (as shown above) and are direct replacements for existing viscometer units (Contact Solartron Mobrey for further details).

Proven applications

<table>
<thead>
<tr>
<th>Company</th>
<th>Instrument</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPPE, Setubal oil fired power station</td>
<td>7829 Visconic series</td>
<td>Heavy fuel oil to burners, heater control</td>
</tr>
<tr>
<td>Power stations in Puerto Rico, Portugal and UK</td>
<td>7829 Viscomaster digital viscometer</td>
<td>Venezuelan Bunker C to burners</td>
</tr>
<tr>
<td>Various German diesel engine manufacturers</td>
<td>7829 Viscomaster digital viscometer</td>
<td>Power generation - heavy fuel oil to engines, heater control</td>
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<tr>
<td>Wilton Power Station</td>
<td>7829 Visconic series</td>
<td>Heavy fuel oil to burners, heater control</td>
</tr>
<tr>
<td>Fuel Booster Module manufacturers in Germany, Finland, Denmark and Belgium</td>
<td>7829 Viscomaster and 7829 Viscomaster Dynamic</td>
<td>Heavy fuel oil to engines</td>
</tr>
</tbody>
</table>
# Ordering Information: Viscomaster Series

## 7829 Viscomaster and Viscomaster Dynamic digital viscometer

### Code | Materials of Construction
---|---
F | 316L Stainless steel, PTFE laminated tines
E | Advanced: 4-20mA output ATEX II 2G EEx d IIC T4
F | Advanced: 4-20mA output CSA Class 1 Div 1 Groups C&D

### Code | Amplifier System
---|---
E | Advanced: 4-20mA output ATEX II 2G EEx d IIC T4
F | Advanced: 4-20mA output CSA Class 1 Div 1 Groups C&D

### Code | Amplifier Housing
---|---
A | Alloy (cast)

### Code | Process Connections
---|---
N | 1.5” Cone seat compression fitting

### Code | Stem Length (Nominal Length)
---|---
A | 0 mm: no stem extension and with standard spigot

### Code | Default Configuration 4-20mA Output #1*
---|---
H | 0-25cSt
J | 0-50cSt
E | 0-100cSt Viscomaster only
Z | Special: Use this letter for any special configuration

### Code | Calibration Type
---|---
R | 5-50cP Viscomaster Dynamic only
B | 0.5-100cP Viscomaster only

### Code | Calibration Boundary
---|---
A | Free stream
B | 2” schedule 40 boundary
C | 3” schedule 40 boundary
H | 2½” schedule 40 boundary
J | DN80 boundary
Z | Special: Use this letter for any special configuration

### Code | Reserved
---|---
B | Default

### Code | Traceability
---|---
A | None
X | Certificates of material traceability

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* Analog output #2 default setting: Temperature
**Specification**

**Sensor:**
- **Type:** Vibrating fork sensor piezodrive with digital density and viscosity measurement
- **Materials:** 316L Stainless steel
- **Tine finish:** PTFE laminated
- **Temperature sensor:** PT100 IEC 60751 Class B, DIN 43760 Class B (integral)

*PTFE is applied only to the tines for its anti-stick properties not for corrosion protection.*

**Process connections:** 1.5" Cone seat

**Performance:**
- **Viscosity calibrated ranges:** 0.5 to 100cP (Viscomaster) 5 to 50cP (Dynamic)
- **Viscosity accuracy:** ±1%span (±0.2cP in 0 to 10cP range)
- **Viscosity repeatability:** ±0.5% of reading
- **Temperature range:**
  - Process: -50°C to +200°C (-60°F to +392°F)
  - Ambient: -40°C to +85°C (-40°F to +185°F)
- **Pressure range:** As defined by process connection
- **ViscoMaster only:** Density calibrated range 0.6 to 1.25 g/cc (38 to 78 lb/ft³)
- **Density accuracy:** ±0.001 g/cc (±0.0624 lb/ft³)
- **Density repeatability:** ±0.0001 g/cc (±0.0062 lb/ft³)

**Flow-through chamber**

**Electronics**
- **Power supply:** 20 to 28V dc
- **Analog outputs:** 2 x 4-20mA, isolated (self powered by default)
- **Power supply:** 15-28V dc
- **Accuracy:** ±0.1% reading, ±0.05%FSD @20°C
- **Repeatability:** ±0.05%FSD over range -40°C to +85°C
- **Comms:** RS485 Interface: 9600 baud MODBUS RTU (Modicon)
- **Electrical connection:** Screw terminal, cable entry to suit ½" NPT gland (20mm adaptor available)

**Approvals**
- **Enclosure:** IP66
- **ATEX:** II 2G EEx d IIC T4
- **CSA:** Class 1 Div. 1 Group C
- **EMC:** EN61326-1997 (Industrial)

**Flow-through chamber dimensions:**
- Diameter: 461 (18.15”)
- Height: 708 (27.87”)
- Diameter: 316 (12.44”)
- Height: 115 (4.53”)

**Lloyd’s approval valid to 70bar / 1030psi maximum.**
Retrofit of existing viscometer technologies

Mobrey Measurement now offers adapters to retrofit existing viscometer technologies with the Viscomaster series transmitters.

Contact Mobrey Measurement for further details.