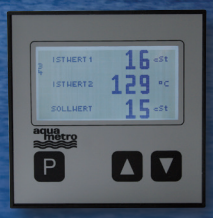
aqua metro

everything that counts

Viscomaster™

Viscosity- and Density-Solutions for fuel oil applications



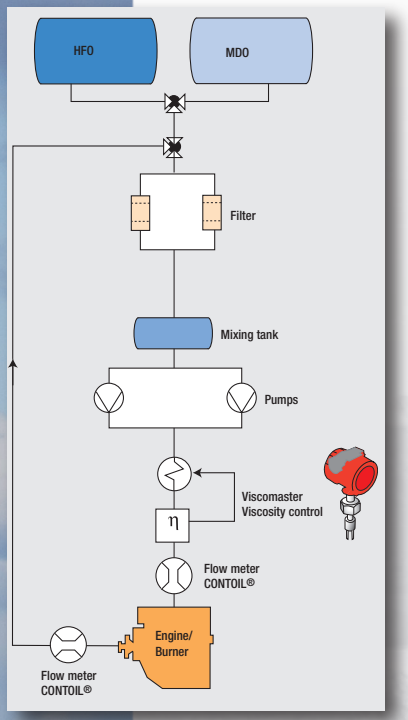
Higher efficiency with better and innovative HFO solutions:
Certified HFO system from one supplier

- On-line real-time kinematic viscosity
- Marine approved
- Minimum maintenance
- High accuracy
- Simple to use

www.aquametro.com

VD 7-400 e 01.2016

Industry introduction



Introduction

The measurement and control of fuel oil 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.
As a solution to this need, the existing 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 viscosity control.

Description

The Viscomaster and the new 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 fork viscometer design has been adapted to serve different applications within the oil industry. We have worked closely with customers to enhance this instrument and develop a product that is designed for 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 maintainance and is naturally tolerant of the harsh engine environments.

Viscomaster™ series viscosity transmitters

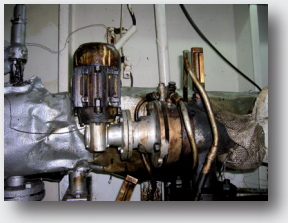
The main instruments in the Viscomaster transmitter series, the Viscomaster and the Viscomaster Dynamic, have been designed to support the current developments in engine technology and the need for fuel quality data tracking throughout the engine service life. They have similarly excellent performance 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

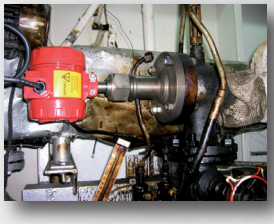
Designed as a direct alternative to conventional fuel viscometers, the Viscomaster Dynamic is calibrated over the range of 0.5 to 50 cP and gives direct viscosity and temperature outputs. It can be programmed with a fuel density reading (typically from suppliers data or a laboratory sample) to enable 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 100 cP with a full density calibration, the Viscomaster measures the FO 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 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



Before - Capillary viscometer



After - VISCOMASTER retrofit

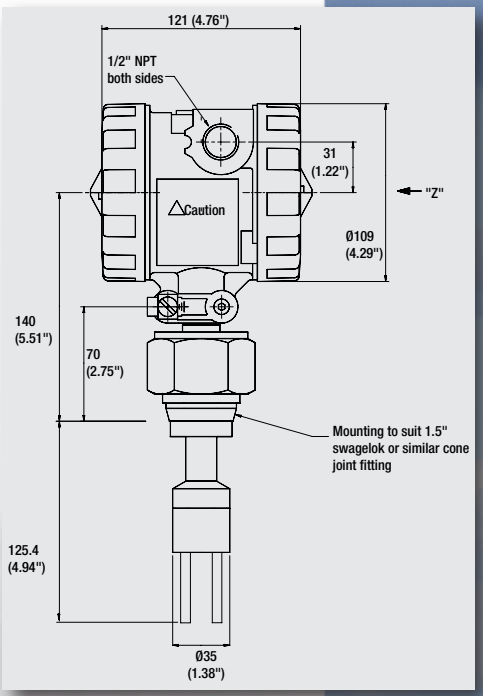
Product description

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
- DLC coated tines for asphaltene rich fuels

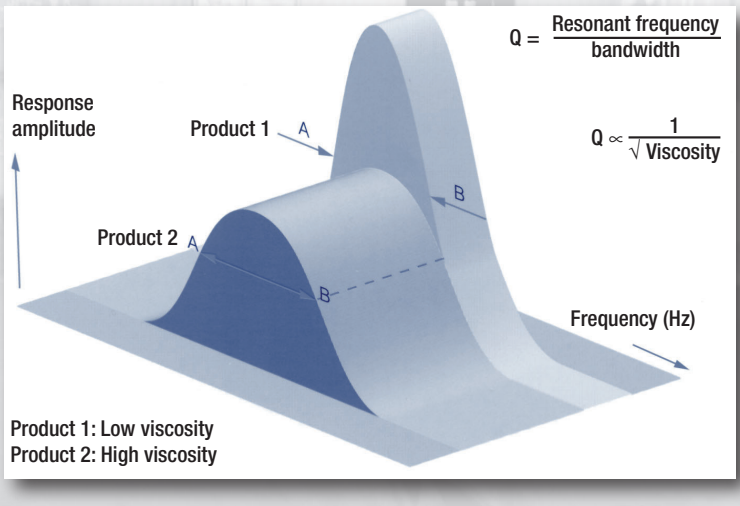
Viscomaster™

- 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
- DLC 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.
Viscomaster 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 Viscomaster 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.



Configuration

ProLink III:

- Configure our density and viscosity transmitters
- View and save data from them
- Check that they are functioning correctly

ProLink III is installed on a PC and interacts with the Viscomaster Series transmitters through one of the PC’s standard USB ports.

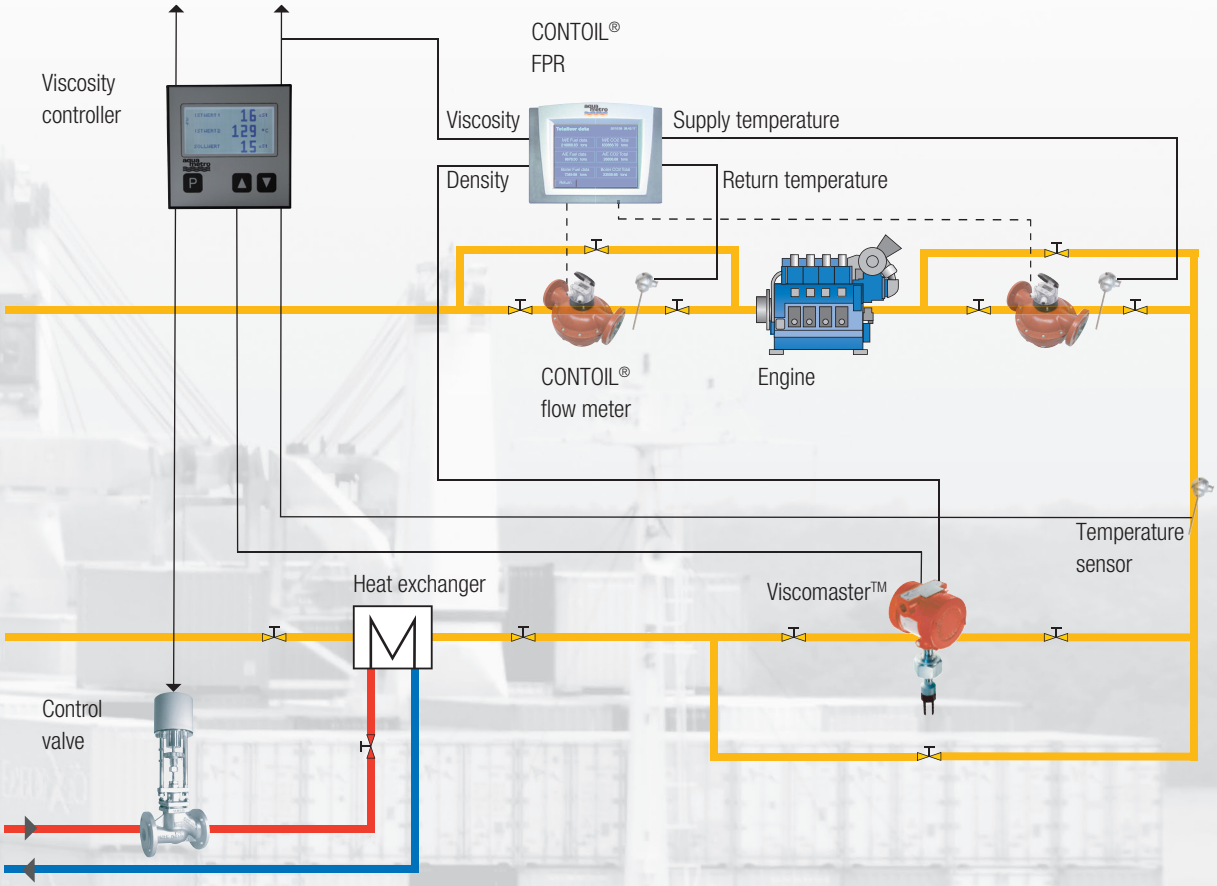
Features, benefits and approvals

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

Viscomaster™ Series marine approvals

Marine approval	Country
Lloyds London	United Kingdom
Germanischer Lloyd	Germany
Det Norske Veritas	Norway
Bureau Veritas	France
RINA	Italy
American Bureau of Shipping	USA
Nippon Kaiji Kyokai	Japan
Russian Maritime Register of Shipping	Russia
Korean Register of Shipping	Korea
China Classification of Ships	China

Certified HFO system



Most marine & land-based engine/burner applications use a fuel booster module or own conditioning setup to pre-condition the fuel 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 and then through a series of heat exchangers to change the fuel viscosity for optimum combustion.

Proven applications

Company	Instrument	Application
Various shipyard in Korea	Viscomaster Dynamic	Heavy fuel oil to M/E, G/E
Various German diesel engine manufacturers	Viscomaster digital viscometer	Power generation - heavy fuel oil to engines, heater control
Fuel Booster Module manufacturers in Germany, Finland, Denmark, Korea and Belgium	Viscomaster and Viscomaster Dynamic	Heavy fuel oil to M/E, G/E

Specification

Sensor

Type	Vibrating fork sensor piezo drive with digital density and viscosity measurement
Materials	316L Stainless steel
Tine finish	DLC (Diamond-Like Carbon) coated
Temperature sensor	PT100 BS1904 Class DIN 43760 Class B (integral)
Process connections	1.5“ Cone seat

Performance

Viscosity calibrated ranges	0.5 to 100 cP (Viscomaster) 0.5 to 50 cP (Dynamic)
Viscosity accuracy	±1 % span (±0.2 cP in 0 to 10 cP range)
Viscosity repeatability	±0.5 % of reading
Temperature range	
- Process	-50 to +200 °C (-60 to +392 °F)
- Ambient	-40 to +65 °C (-40 to +149 °F)
Pressure range**	As defined by process connection
ViscoMaster Density	
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 repeatablity	±0.0001 g/cc (±0.0062 lb/ft3)

** Lloyd’s approval valid to 70 bar / 1030 psi maximum.

Electronics

Power supply	20 to 28 V dc
Analog outputs	2 x 4-20 mA, isolated (self powered by default) Power supply: 15-28 V dc Accuracy: ±0.1 % reading, ±0.05 % FSD @20 °C Repeatability: ±0.05 % FSD over range -40 to +85 °C
Comms	RS485 Interface: 9600 baud MODBUS RTU (Modicon)
Electrical connection	Screw terminal, cable entry to suit 1/2“ NPT gland (20 mm adaptor available)

Approvals

Enclosure	IP66 / IP 67
ATEX	II 2G EEx d IIC T6 Ga / Gb
EMC	EN61326-1997 (Industrial)

Ordering information

Viscosity sensor types

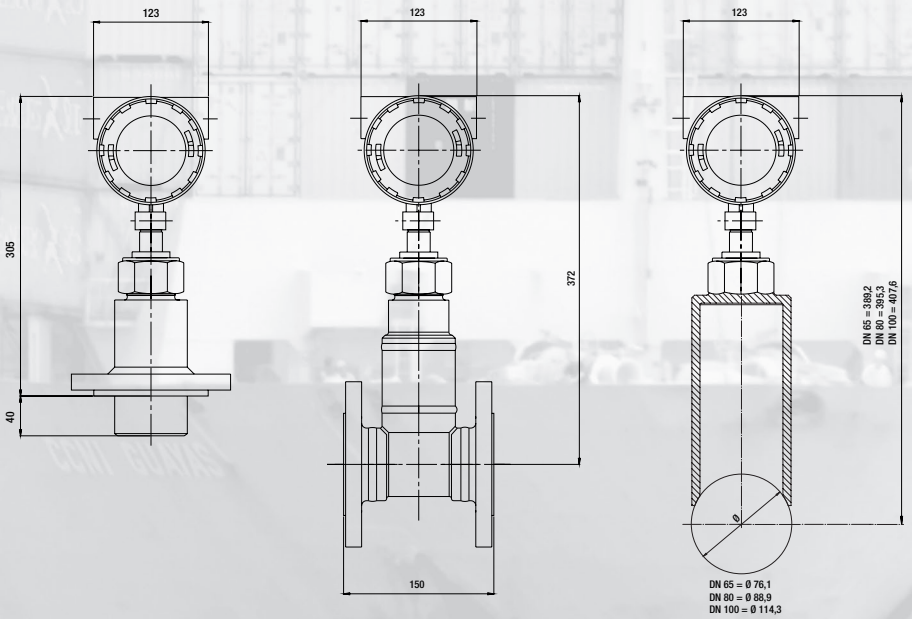
Type	Art. No.
Viscomaster for in-line or capillary adapter, density & viscosity	95430
Viscomaster Dynamic for in-line or capillary adapter, no density	95431
Viscomaster Density for in-line or capillary adapter, no viscosity	95432

Viscosity adapter types

Type	Art. No.
Viscomaster In-line adapter DN 50, PN 10/16/40	94651
Viscomaster In-line adapter JIS 50, 10 K	94652
Viscomaster In-line adapter JIS 50, 16 K	94653
Viscomaster Capillary adapter (VAF Viscotherm)	80721
Viscomaster Capillary adapter (Nakakita)	80722
Viscomaster Weld-on-Pipe adapter DN 65	94613
Viscomaster Weld-on-Pipe adapter DN 80	94614
Viscomaster Weld-on-Pipe adapter DN 100	94615

Retrofit of existing viscometer technologies

Aquametro AG now offers adapters to retrofit existing viscometer technologies with the Viscomaster series transmitters.



Viscomaster™
Capillary adapter
(retrofit for VAF Viscotherm or Nakakita)

Viscomaster™
In-line adapter
(retrofit for VAF Viscosense)

Viscomaster™
Weld-on-Pipe adapter
(for DN >50mm or new buildings)

Please contact Aquametro AG for further details.

Ordering information

Steam control valves

Type	Art. No.	Type	Art. No.
Steam valve JIS 15 A, 10 K, 230 VAC	93882	Steam valve DN 15, PN 16, 230 VAC	93819
Steam valve JIS 20 A, 10 K, 230 VAC	93870	Steam valve DN 20, PN 16, 230 VAC	93829
Steam valve JIS 25 A, 10 K, 230 VAC	93872	Steam valve DN 25, PN 16, 230 VAC	93871
Steam valve JIS 32 A, 10 K, 230 VAC	93874	Steam valve DN 32, PN 16, 230 VAC	93873
Steam valve JIS 40 A, 10 K, 230 VAC	93876	Steam valve DN 40, PN 16, 230 VAC	93875
Steam valve JIS 50 A, 10 K, 230 VAC	93878	Steam valve DN 50, PN 16, 230 VAC	93877
Steam valve JIS 65 A, 16 K, 230 VAC	94612	Steam valve DN 65, PN 16, 230 VAC	94635
Steam valve JIS 80 A, 16 K, 230 VAC	94637	Steam valve DN 80, PN 16, 230 VAC	94636
Steam valve JIS 100 A, 16 K, 230 VAC	94639	Steam valve DN 100, PN 16, 230 VAC	94638

Note: also thermal oil control valves available on request.

Viscosity controller

Type	Art. No.
VC 220-LCD Visco Controller, 110 - 230 VAC, 2 Input (Visco Control + Display / Temp. Display) 2 Output Relay additional for alarm (4 Relay output in total), 48…62 Hz; 0 Output Analogue (4…20 mA)	94656
VC 211-LCD Viscosity Controller, 110 - 230 VAC, 2 Input (Visco Control + Display / Temp. Display) 1 Output Relay additional for alarm (3 Relay output in total), 48...62 Hz; 1 Output Analogue (4…20 mA)	94791
VC 221-LCD Visco Controller, 110 - 230 VAC, 2 Input (Visco Control + Display / Temp. Display) 2 Output Relay additional for alarm (4 Relay output in total), 48...62 Hz; 1 Output Analogue (4…20 mA)	94793
VC 320-LCD Visco Controller, 110 - 230 VAC, 2 Input (switchable Visco Control + Display / Temp. Control + Display) 2 Output Relay additional for alarm (4 Relay output in total), 48...62 Hz;	94794
VC 322-LCD Viscosity Controller, 110 - 230 VAC, 2 Input (switchable Visco Control + Display / Temp. Control + Display) 2 Output Relay additional for alarm (4 Relay output in total), 48...62 Hz; 2 Output Analogue (4…20 mA)	94727

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