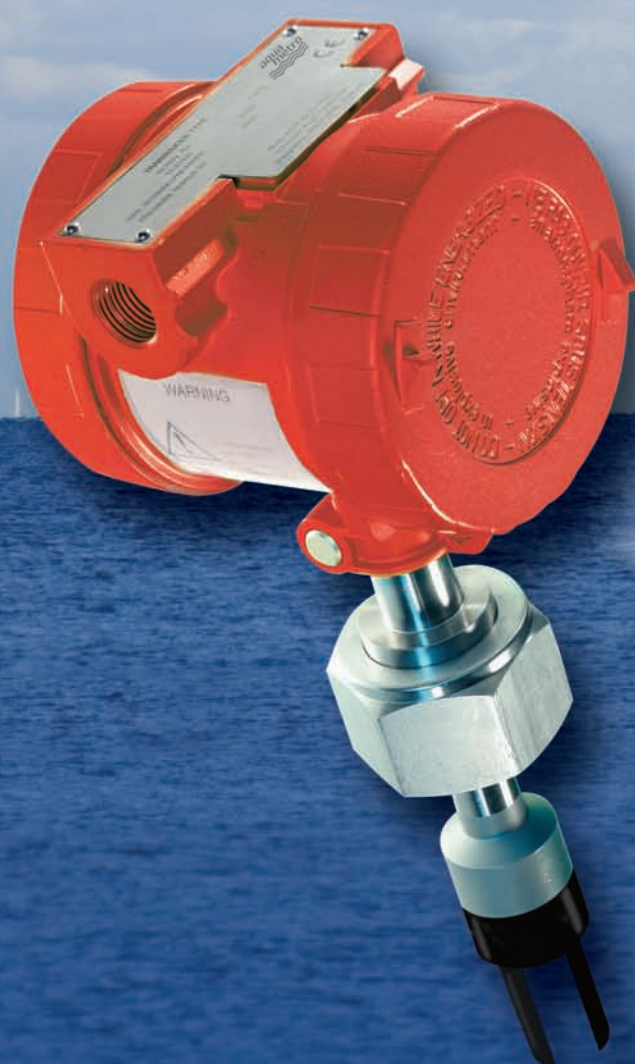


Viscomaster™

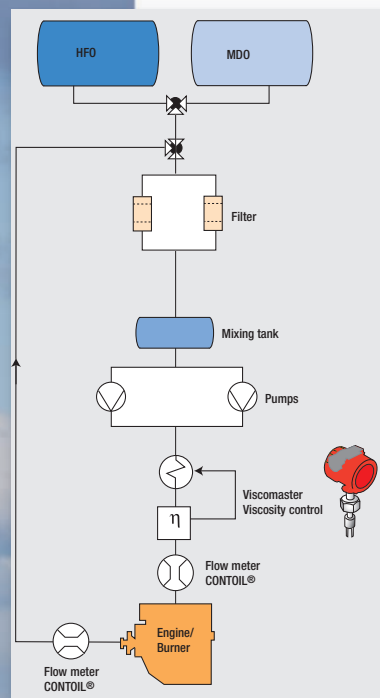
Viscosity- and Density-Solutions for fuel oil applications



**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

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 maintenance and is naturally tolerant of the harsh engine environments.

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 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
- PTFE coated tines for asphaltene rich fuels

Viscomaster™

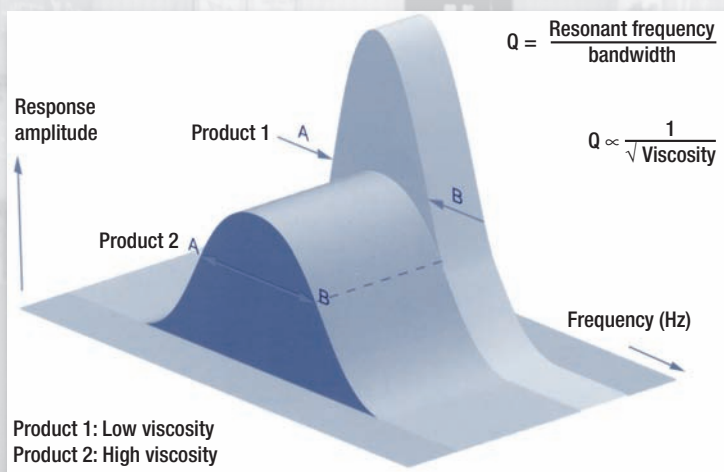
- 2 x 4-20mA analog outputs:

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
- 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.

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.



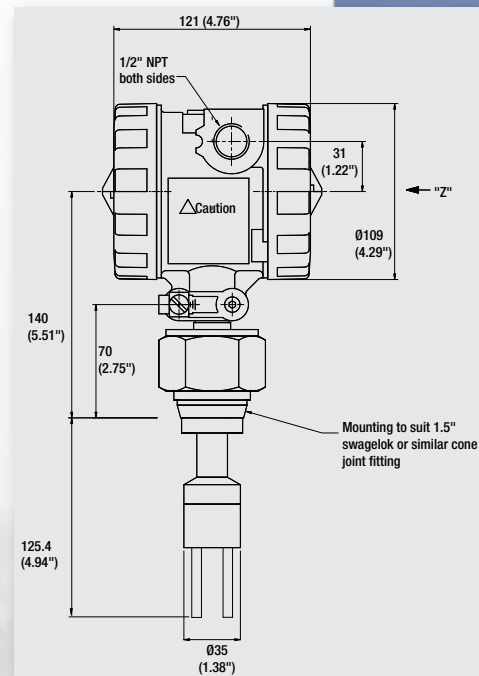
Configuration

ADView is a software package 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 Viscomaster Series transmitters through one of the PC's standard serial (RS-232) ports.

Download from: www.aquametro.com/english/software_e.html



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 Density 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)

Designed for marine environments

- Fuel savings with engine performance parameters (CII & CCAI)
- True fuel oil characterisation (no assumed density values)

Rugged design, no moving parts

- Unaffected by vibration
- Dirt / Asphaltene resistant

Simple Installation

- Robust fine design
- No thin sensor sections
- Virtually no maintenance
- Low cost of ownership
- Compact design
- Standard & customer specific installations available

Vibrating fork principle

- Proven design
- >10 years experience in Viscosity measurement
- Reliable, stable & accurate

Internal PT100

Two head mounted integral 4-20mA outputs

- No need for external temperature sensor
- 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

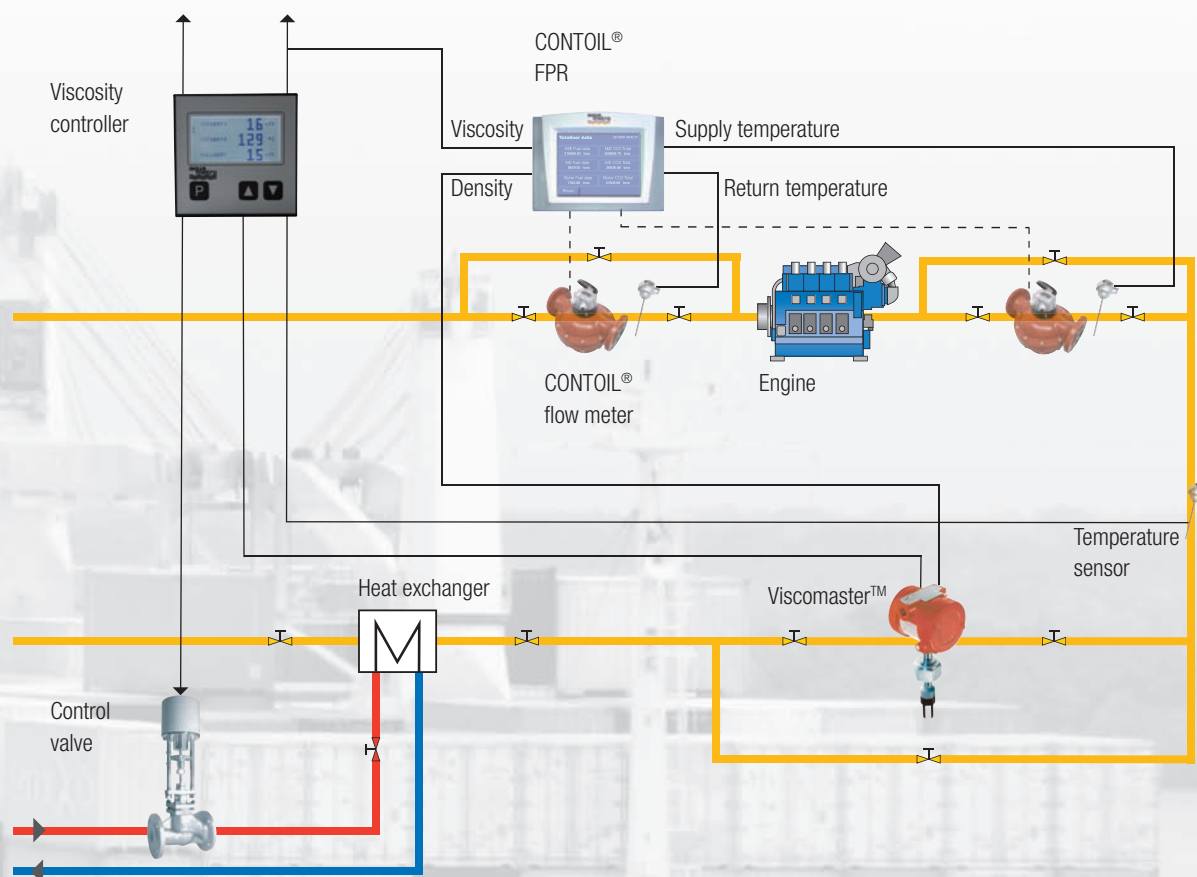
Korea

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 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 - heavyfuel 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 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)
Process connections	1.5" Cone seat

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

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 +85 °C (-40 to +185 °F)
Pressure range**	As defined by process connection
ViscoMaster Density	
Density calibrated range	0.6 to 1.25 g/cc (38 to 78 lb/ft ³)
Density accuracy	± 0.001 g/cc (± 0.0624 lb/ft ³)
Density repeatability	± 0.0001 g/cc (± 0.0062 lb/ft ³)

** 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
ATEX	II 2G EEx d IIC T4
EMC	EN61326-1997 (Industrial)

Ordering information

Viscosity sensor types

Type

Viscomaster for in-line or capillary adapter
 Viscomaster Dynamic for in-line or capillary adapter, no density
 Viscomaster Density for in-line or capillary adapter, no viscosity

Art. No.

93645
 93647
 94359

Viscosity adapter types

Type

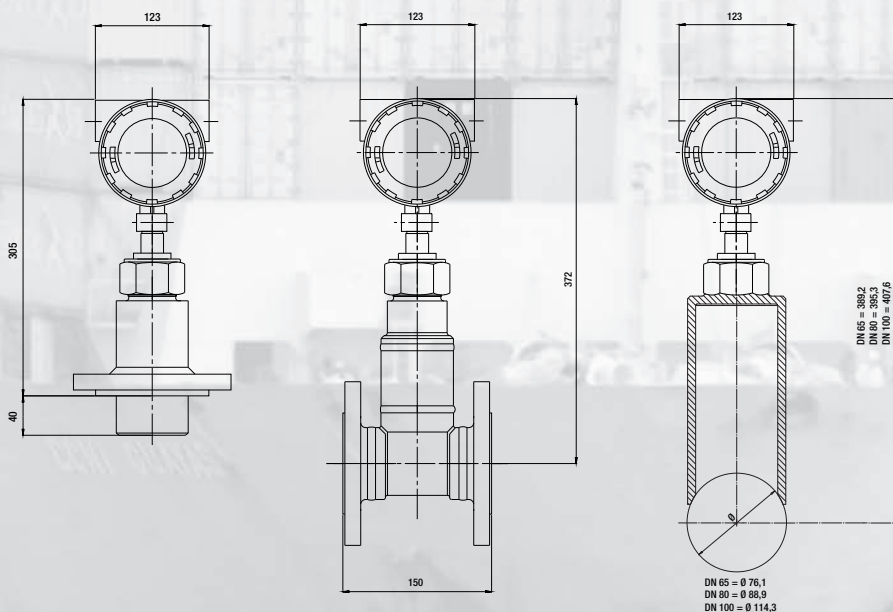
Viscomaster In-line adapter DN 50, PN 10/16/40
 Viscomaster In-line adapter JIS 50, 10 K
 Viscomaster In-line adapter JIS 50, 16 K
 Viscomaster Capillary adapter (VAF Viscotherm)
 Viscomaster Capillary adapter Nakakita)
 Viscomaster Weld-on-Pipe adapter DN 65
 Viscomaster Weld-on-Pipe adapter DN 80
 Viscomaster Weld-on-Pipe adapter DN 100

Art. No.

94651
 94652
 94653
 94654
 94655
 94613
 94614
 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 Viscosense)

**Viscomaster™
 In-line adapter**
 (retrofit for VAF Viscotherm or Nakakita)

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

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

Viscosity controller

Type	Art. No.
VC 220-LCD Visco Controller, 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, 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, 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 222-LCD Visco Controller, 230 VAC, 2 Input (Visco Control + Display / Temp. Display) 2 Output Relay additional for alarm (4 Relay output in total), 48...62 Hz; 2 Output Analogue (4...20 mA)	94792
VC 322-LCD Viscosity Controller, 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
Power supply 115 VAC 48...62 Hz or 24 VAC 48...62 Hz or 24 VAC/DC	on request
Temperatur sensor PT100	80393
Temperatur pipe collar	81551

Viscosity special price Package

Type	Art. No.
Aquametro Viscomaster Package	
- Viscomaster for in-line or capillary adapter	93645
- Viscosity Controller VC211	93882
- Viscosity Adapter (free choice)	
Aquametro Viscomaster Dynamic Package	
- Viscomaster Dynamic for in-line or capillary adapter	93647
- Viscosity Controller VC211	93882
- Viscosity Adapter (free choice)	
Aquametro Viscomaster Controller Package Option	
- Viscosity Controller additional 1 relay and 1 analogue output	

SALES PARTNER:

HEAD OFFICE:

AQUAMETRO AG, Ringstrasse 75, CH-4106 Therwil / Switzerland
Phone +41 61 725 11 22, Fax +41 61 725 15 95, info@aquametro.com, www.aquametro.com

Aquametro (China) Pte Ltd, Tower A, Room 2209, No.188, Zhang Yang Road Tomson Centre, Post code: 200122, Shanghai / China

Phone +86 215 012 6401, Fax +86 215 012 6402, sales.china@aquametro.com.sg, www.aquametro.com

AQUAMETRO Korea Ltd, #905, Centum IS Tower, 1209, Jaesong-Dong, Haeundae-Gu, Busan, 612-050 / Korea

Phone +82 51 905 5566, Fax +82 51 905 5569, aquametro@korea.com, www.aquametro.co.kr

AQUAMETRO (S.E.A.) Pte Ltd, No. 21 Bukit Batok Crescent #11-84, The WCEGA Tower, Singapore 658065

Phone +65 6899 1980, Fax +65 6899 2972, customersupport@aquametro.com.sg, www.aquametro.com

