process measurement solutions

solartron mobrey

Viscomaster™ series viscosity transmitters

IP7000

for marine and power HFO applications

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

Viscomaster : Industry introduction

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.

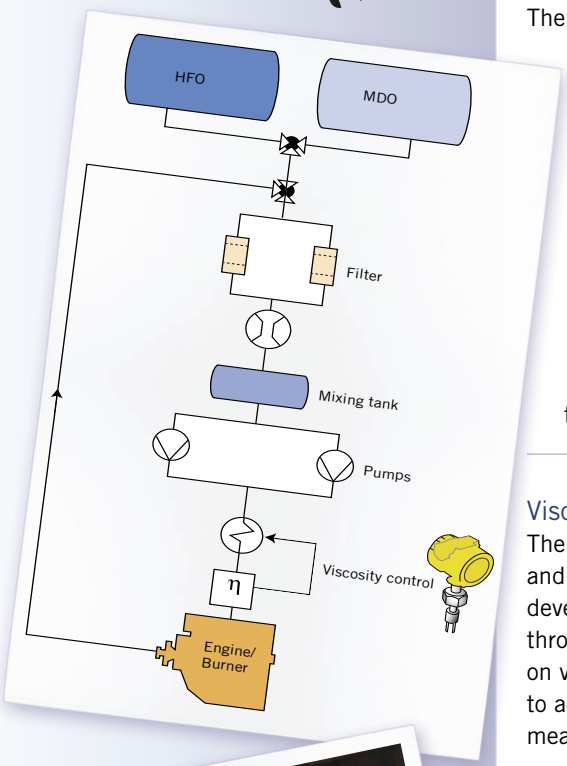
As a solution to this need, the existing Solartron Mobrey fork viscometer - with its inherently rugged, maintenance free design - was specifically introduced into the Marine market. With no need for re-calibration and no moving parts this accurate viscometer is rapidly becoming an industry standard in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

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.

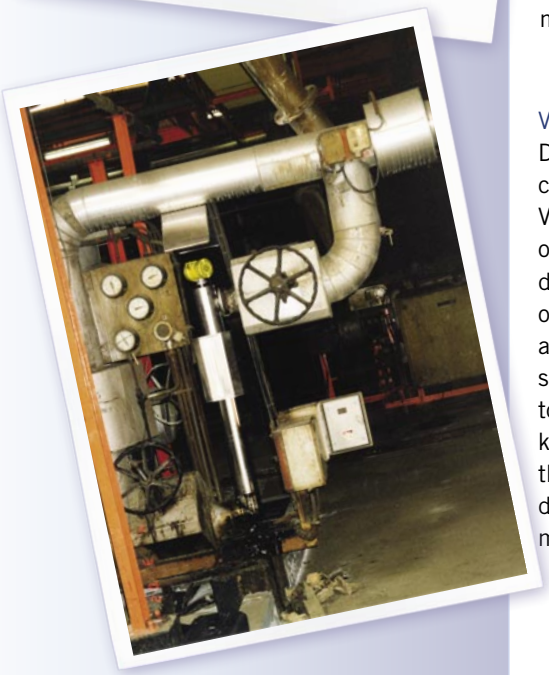
Since its introduction in 1993, the Solartron fork viscometer design has been adapted to serve different applications within the Oil industry. Solartron Mobrey has worked closely with customers to enhance this instrument and develop a product that is designed for HFO measurement and control. Tested for 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 maintainance 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 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.

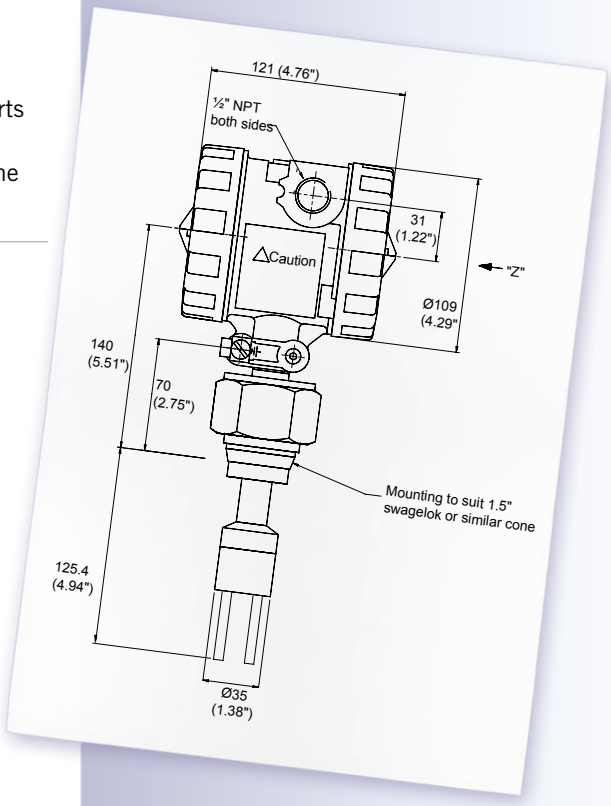
Product description

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

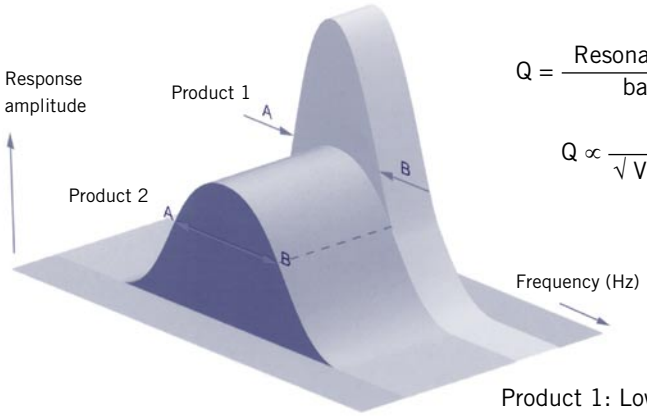
- 2 x 4-20mA analog outputs:
  Both outputs fully configurable to any calculated measurement including density, dynamic/kinematic viscosity, temperature, CCAI etc.
- On-line density measurement
- Dynamic and Kinematic viscosity
- MODBUS output of all parameters including density, base density, (API 2540) 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.

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.



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

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

Product 1: Low viscosity
Product 2: High viscosity

Configuration

ADView is a software package provided by Solartron Mobrey 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.solartronmobrey.com/downloads

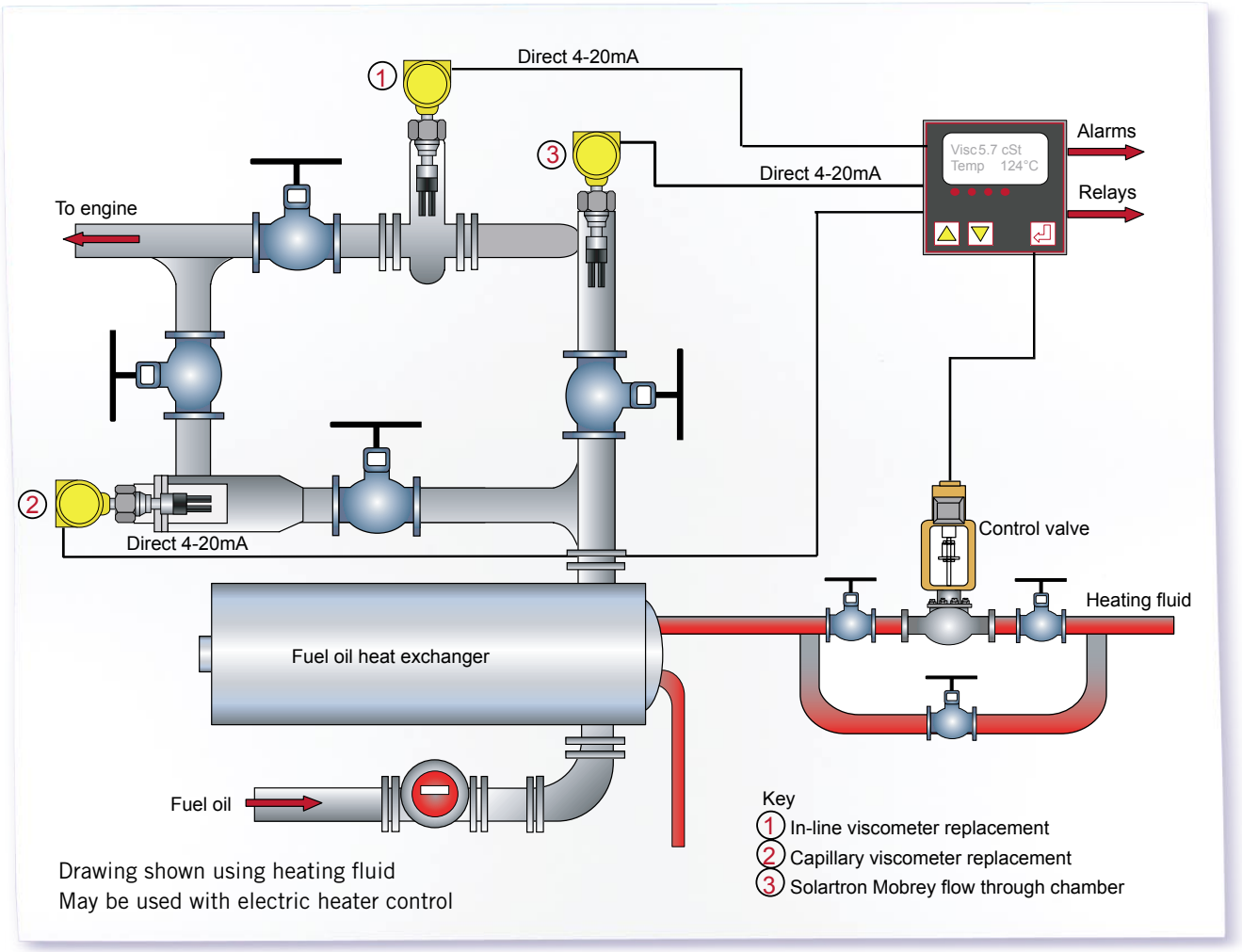
Features and benefits

Features	Customer benefits
Stable and accurate in-line measurement	Optimum combustion efficiency Optimal fuel consumption Reduced maintenance required Prevention of engine damage True Kinematic viscosity measurement
Simultaneous on-line Viscosity and Density outputs (Viscomaster gives continuous on-line density measurement)	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 4-20mA 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
Germanische Lloyd	Germany
Det Norske Veritas	Norway
Bureau Vertias	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 (pending)	China

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 20m^3/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

Company	Instrument	Application
CPPE, Setubal oil fired power station	7829 Visconic series	Heavy fuel oil to burners, heater control
Power stations in Puerto Rico, Portugal and UK	7829 Viscomaster digital viscometer	Venezuelan Bunker C to burners
Various German diesel engine manufacturers	7829 Viscomaster digital viscometer	Power generation - heavy fuel oil to engines, heater control
Wilton Power Station	7829 Visconic series	Heavy fuel oil to burners, heater control
Fuel Booster Module manufacturers in Germany, Finland, Denmark and Belgium	7829 Viscomaster and 7829 Viscomaster Dynamic	Heavy fuel oil to engines

Ordering information: Viscomaster Series

7829 Viscomaster and Viscomaster Dynamic digital viscometer

7829		
Code	Materials of construction	
F	316L Stainless steel, PTFE laminated tines	
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	

7829	F	E	A	N	A	H	R	A	B	A	Viscomaster Dynamic typical ordering info.

7829	F	E	A	N	A	H	B	A	B	A	Viscomaster typical ordering info.

* 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/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 70bar / 1030psi maximum.

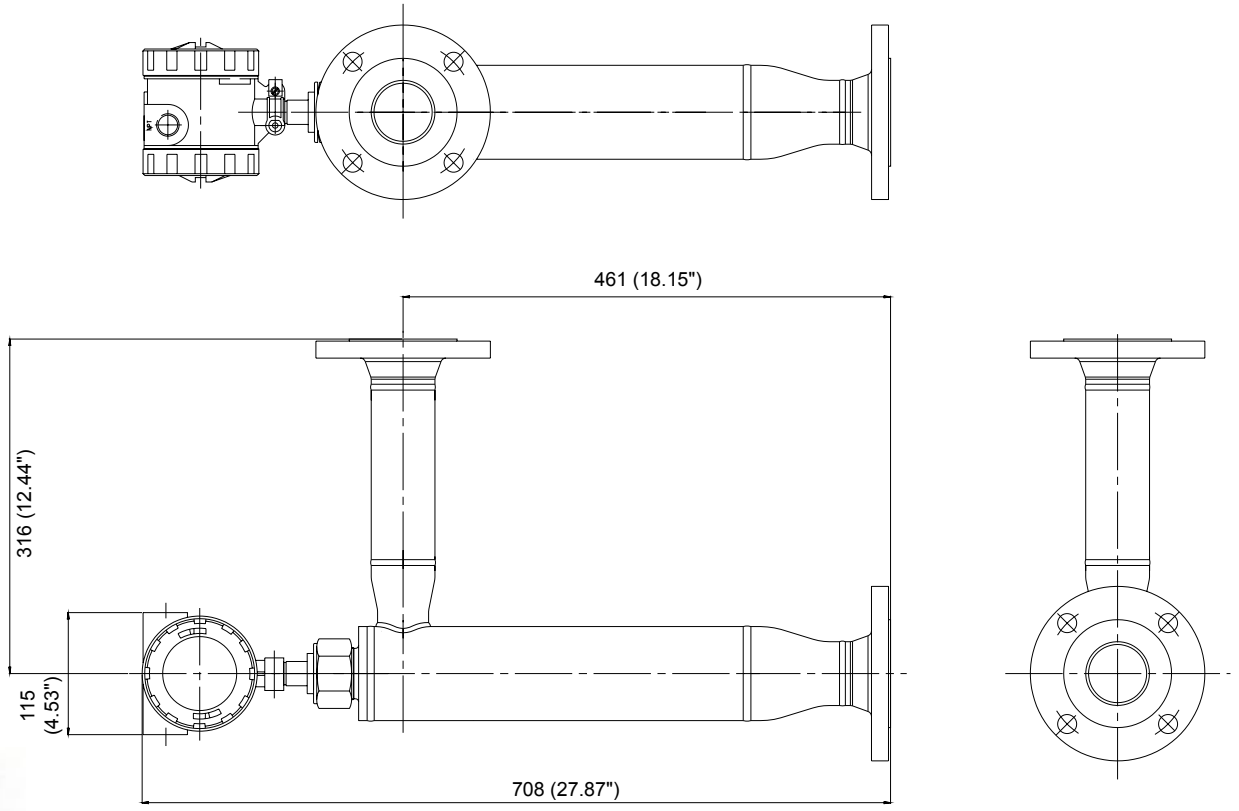
Electronics

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

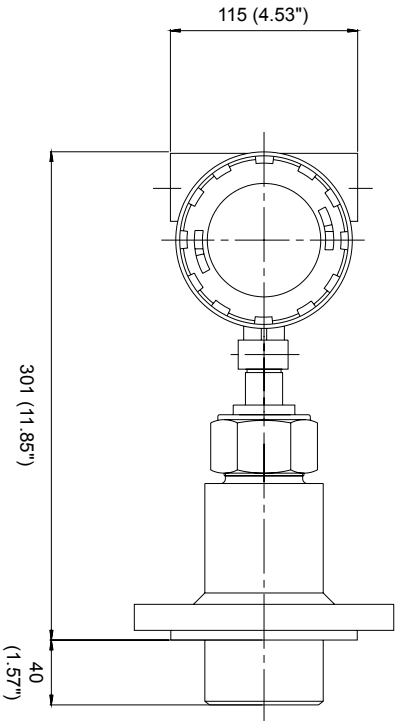
Enclosure	IP66
ATEX	II 2G EEx d IIC T4
CSA	Class 1 Div. 1 Group C
EMC	EN61326-1997 (Industrial)

Flow-through chamber

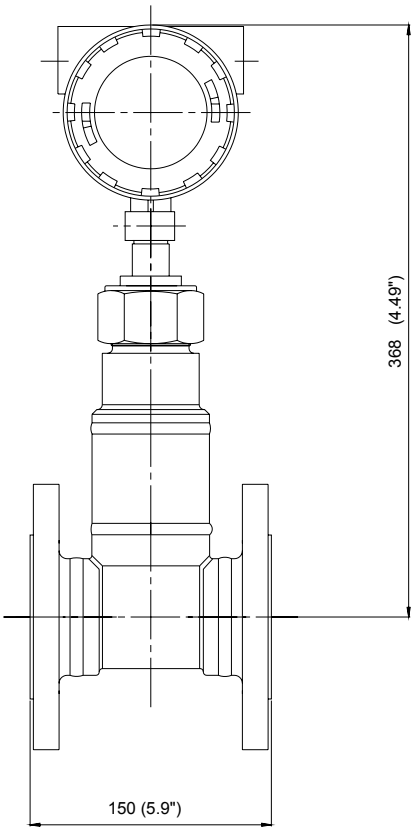


Retrofit of existing viscometer technologies

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



Capillary viscometer adapter



In-line viscometer adapter

Contact Solartron Mobrey for further details.

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