

PD Meters

BARTON®

Flotrac®/Floco® Meters, Samplers & Pulse Transmitters



Flotrac® Meters



Like positive displacement meters, the Flotrac Meter is designed for mechanically measuring volumes of low-viscosity liquids flowing at high pressure. The Flotrac Meter employs the unique “constrained vortex” principle to provide an accurate measurement over a 10:1 range.

Process liquid enters the metering chamber through the 1-in. (25-mm) inlet connection. As the liquid makes a 360-degree loop, it is separated equally into two streams. The special configuration of the metering chamber forces these streams into a series of vortices, causing the rotor assembly to rotate in direct proportion to the flow rate. The two liquid streams are then combined at the meter outlet port.

Specifications

Operating Pressure	2500 psig (172 bar) SWP with standard bolting 1500 psig (103 bar) SWP with L7M NACE bolting
Operating Temperature	+32°F (0°C) to +200°F (+95°C)
Viscosity	10 centistokes, max.
Pipe Connections	1-in. (25-mm) female, inline Flanged connections optional
Register	8 digits
Weight	22 lb (10 kg)
Dimensions	Length: 8.75 in. (220 mm) Width: 5.75 in. (145 mm) Height: 6.0 in. (150 mm)

Features

All construction materials used in the Flotrac Meter are resistant to corrosion and abrasion, and only one moving part in the meter—the rotor—comes in contact with the process fluid. The rotor assembly, comprised of bearings and an integral magnet, can be quickly removed or replaced without removing the meter from the line. The register assembly is magnetically coupled to the rotor assembly, eliminating friction and leakage from packing glands.

Flotrac Models 306 and 380 share several interchangeable parts, enabling the user to easily convert a “standard flow” 306 meter to a “low flow” 380 meter and visa versa.

Similar to a PD meter, the Flotrac meter does not require the installation of straight-run pipe upstream or downstream of the meter.

Construction

The Flotrac Meter body is constructed of SA-216 WCB epoxy-coated cast steel with an SA-105 forged steel cover. The impeller and housing inserts are made of glass-filled Rytan®, which is practically impervious to dissolved salts and alkalis, water, most acids, and low-viscosity hydrocarbon liquids. Other wetted parts include 300 series stainless steel and a Buna-N body seal O-ring. The assembly is suitable for “sour” non-NACE service when the non-wetted body bolts are supplied as optional grade L7M and the body O-ring is supplied in Viton®. The rotor bearings and journals are made of special materials that provide exceptional service life with water or non-lubricating liquids. The register assembly features a sealed weatherproof aluminum case. The meter is compliant with ASME B31.1 & B31.3 requirements.

	Model 306	Model 380
Accuracy and Capacity	±1.0% of reading, 9 to 90 USGPM	±2.0% of reading, 1.5 to 15 USGPM (water) ±2.0% of reading, 4 to 15 USGPM (10 centistokes)
Pressure Drop	50 PSID (345 Kpad) in water at maximum flow	50 PSID (345 Kpad) in water at maximum flow
Register Resolution		
US Barrels	1/100	1/1000
Liters	1	1/10
Cubic Meters	1/1000	1/10,000

Floco® Series-F Meters Models F500/F2500

The Floco Series F Meter is a positive displacement meter with a unique rotor design that provides sustained accuracy even under adverse conditions. It accurately measures viscous, waxy, corrosive and abrasive liquids to within $\pm 1\%$ maximum accuracy.

The Series F Meter measures liquid by separating it into equal portions and counting them. Liquid enters the meter through the inlet port, where the bridge deflects the liquid downward to strike the rotor blades and turn the rotor. The liquid then passes through the outlet port, which is aligned with the inlet port. The unique rotor design allows solid particles and sediment to pass through the meter without causing damage or malfunction. Bridge seals prevent the liquid from passing to the outlet port without being measured.

Floco meters are unique in that the more viscous the process fluid, the better the meter performance. High viscosities allow the meter to measure low flow rates with improved accuracy.

Series F Meters are available in various models with pressure ratings up to 2000 psi (138 bar), an operating temperature range of -20°F (-29°C) to $+400^{\circ}\text{F}$ ($+205^{\circ}\text{C}$), and a flow rate capacity of 6 to 90 USGPM based on 20° API gravity oil.

Standard connections include 1-in. female and 2-in. or 3-in. male NPT threads. Raised face and ring joint flanges can also be supplied. Standard units for registering totals are US gallons, 42-gallon barrels, liters, or cubic meters.

Series F Meters are available with Buna-N, Viton®, or Teflon® components for compliance with process demands, and a long life between maintenance cycles.

Application

A wide variety of liquids can be metered with the Series F meter, including heavy oil (25,000 centistokes max), asphalt emulsion, brine, bunker C oil, crude oil, kerosene, liquid fertilizers, paraffin, refined oils, and water.

The Series F Meter does not require the installation of straight-run pipe upstream or downstream of the meter. The meter can be installed in any position and the register can be rotated in two planes for optimal visibility.

Safe Working Pressure

Model	Number of Bolts per Sideplate	Bolt Diameter	Bolt Grade	Safe Working Pressure	
				(psi)	(Mpa)
F-500	4	3/8 in.	Standard (A574 or SAE Grade 8)	750	5.2
F-500	4	3/8 in.	NACE (A320 L7M & A193 B7M)	425	2.9
F-2500	8	3/8 in.	Standard (A574 or SAE Grade 8)	1500	10.3
F-2500	8	3/8 in.	NACE (A320 L7M & A193 B7M)	850	5.9
F-2500	8	7/16 in.	Standard (A574)	2000	13.8
F-2500	8	7/16 in.	NACE (A564)	1500	10.3

Construction

The Series F Meter consists of four basic parts: body, rotor, sideplates, and register (with gear case assembly and magnetic coupling seal). Almost all spare parts are interchangeable among Series F models.

Body and Sideplates

The meter body is A216 WCB cast steel with a maximum hardness of HRC22.

The sideplates are A105 forged steel. The number and type of sideplate bolts determines the safe working pressure of the meter, as shown in the table below. All meters are compliant with ASME B31.1 & B31.3 requirements. When equipped with NACE bolts, Series F meters are compliant with NACE MR0175 / ISO 15156: 2003 revision. All meters supplied with flanged end connections utilize slip-on flanges as standard. Optional weldneck flanges for B31.1 compliance are available. All flanged connections are welded per ASME Section IX procedures.

Liner and Wearplates

Body parts subject to mechanical wear or fluid abrasion are designed for economical field replacement. The body liner and side wearplates are constructed of polished 316 stainless steel to assure a low-friction seal with the rotor blades. Wearplates are reversible for extended life.

Bridge and Bridge Seals

The bridge is available in either Delrin® or 316 stainless steel. Delrin® is a plastic material that can withstand chemical attack and temperatures to 180°F (82°C). Alternatively, 316 stainless steel is extremely resistant to abrasive and high-temperature fluids.



Bearings

Bearing selection should be based on the following guidelines:

- Aluminum Bronze – General bearing, durable in most applications including crude oil
- Meehanite – Recommended for use with abrasive process fluid, which is often apparent by indications of severe wear on the rotor shaft
- Carbon Graphite – Recommended for use where “yellow” metals are not acceptable or where the process fluid has very low lubricity
- Glass-Filled Teflon® – Recommended for use where other materials fail due to chemical attack

Rotor

The rotor, which is the measuring element of the flowmeter, is constructed of 316 stainless steel and has chrome-plated shaft ends for bearing surfaces. The standard rotor hub is made of non-clad 316 stainless steel for superior corrosion resistance. The rotor hub may be ordered clad with a Viton® or Buna-N elastomer for improved flow at very low flow rates. The spring-loaded blades are made of a stainless steel substrate with a Buna-N, Viton®, or Teflon® covering.

Bridge Seals

Bridge seals are constructed of Viton® or Buna-N.

Registers

The register and gear case assembly, featuring a 316 stainless steel proven magnetic coupling design, is sealed from contact with the metered liquid for accurate registration and long life.

All registers display flow totals in seven digits with the resolution indicated in the table below. A standard sweep hand provides 10 times greater resolution than that shown. Reset registers have two displays: one reset and one small-digit non-reset. The displays feature 1/4-in. digits for good visibility.

Available Registers

Units	Resolution
US Gallons (1-in. and 2-in.)	1 gal
US Gallons (3-in. only)	10 gal
Barrels (42 US gal)	0.1 bbl
Liters	10 liters
Cubic Meters	0.01 m ³

Maintenance

Floco meters can be serviced without being removed from the line, and without special tools or training. Removal of the meter sideplate provides easy access to all internal parts. Using the assembly drawing and parts list shipped with each meter, a user can readily identify all parts and assembly procedures.

Specifications

Trim Configurations

Internals	Standard	High Temperature	NACE
Maximum Temperature	180°F (80°C)	300°F (150°C) 410°F (210°C) optional	180°F (80°C)
Bearing	Aluminum Bronze	Aluminum Bronze	Carbon Graphite
Rotor	Welded SS/Buna-N	Welded SS/Teflon®	Welded SS/Viton®
Bridge	Delrin®	Stainless Steel	Delrin®
Seals	Buna-N	Viton®	Viton®
Bolting	Standard	Standard	L7M

Flow Rates

Meter Size	Flow Capacity (USGPM)*	Ideal Flow Rates (USGPM)**	Pressure Drop at Maximum Flow (PSID)*
1-in. Female/ 2-in. Male	6 min 60 max	10 min 35 max	12
3-in. Male	9 min 90 max	15 min 60 max	5

* Based on pale hydraulic oil 0.89 S.G. at 60°F, 110 SSU at 100°F with ±1.0% accuracy. Minimum capacity improves with higher viscosities.

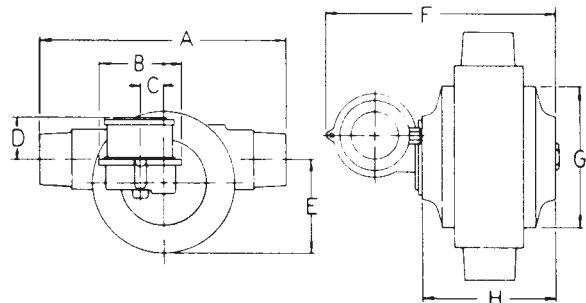
** These flow rates are determined to provide the best accuracy and durability.

Dimensions

Series F Meter with Threaded or Victaulic Ends (in.)*

Meter Size	A	B	C	D	E	F	G	H
1- & 2-in.	10-1/2	3-1/2	1	1-7/8	4	10-1/2	6	5-3/4
3-in.	12	3-1/2	1	1-7/8	4	13-1/2	6	8-3/4

* Victaulic ends are available only on 2-in. meters.



Series F Meter with Flanged Ends (in.) Face to Face, Raised Face or Ring Joint Meters

Meter Size*	150 or 300 ANSI	600 ANSI	900 ANSI
2-in.	11	12	13-1/2
3-in.	12	13	13-1/2

* Flanged ends are not commonly available on 1-in. meters.

Floco® Samplers

The Floco Sampler is an accessory to the Floco Model F-500 Meter that provides an efficient method of obtaining composite “proportion-to-flow” sampling. The sampler indicates the flowing product quality, and is often used to determine the oil and water ratio (water cut) in a crude oil production facility. Accurate sampling is achieved by drawing fixed-size samples that are proportional to the net flow volume. Individual sample size and the sampling interval can be adjusted. The system is mechanically driven to ensure low installation cost and high reliability.

To help assure accuracy, the sampler draws each sample from the middle of the flow stream. All samples are safely stored in a composite receptacle with a weight-actuated shut-off. The sampler assembly can be mounted to any Floco F-500 Meter in a horizontal (standard) or vertical (optional) pipeline. Vertical installations must be specified as flow-up or flow-down. Direction of flow (up or down) must be specified for vertical installations. When the orientation is properly specified, the sampler will shut off automatically when the receptacle is full.

The sample bottle is vented to the atmosphere. To avoid exposing personnel to toxic vapors, never use the sampler in applications requiring NACE MR0175.

Operating parameters are:

- Pressure: 10 to 500 PSIG
- Maximum Temperature: 200°F (93°C) for Buna-N, 400°F (205°C) for Viton®
- Weight: 5 lb (2.3 Kg) with an empty receptacle

The Floco Sampler is available in two models: MMS-1 and FRA. The respective models employ unique internal sample valve and full bottle shut-off mechanisms.



Floco® MMS-1 Sampler

The Floco MMS-1 Sampler is designed such that rotations of the Floco rotor drive a reduction gear train and, in turn, a cam. The cam converts rotary motion to linear motion to activate a spool valve that functions as a 3-way valve. This valve directs flow from the process to an accumulator or from the accumulator to the receptacle bottle. The weight-activated full bottle shut-off is integral to the receptacle design, which allows for the installation of a manual shut-off valve, if desired.

Specifications

Materials of Construction	Housing:	ASTM A216 WCB cast carbon steel
	Internals:	316 stainless steel
	Elastomers:	Buna-N (standard) Viton® (optional).
Gear Ratios	80:1 (standard) 20:1 and 40:1 (optional)	
Receptacle	1/2 gallon polyethylene	
Dimensions	21 in. x 7 in. (53.4 cm x 17.8 cm) with the receptacle in place; extends 16 in. (38 cm) below centerline of flowmeter connections	
Sample Volume	Adjustable from 0.25 cc to 4.5 cc per sample	

Sample Size Per Barrel (cc)*

Gear Ratio:	1-in. and 2-in. Meters		3-in. Meter	
	Min.	Max.	Min.	Max.
80:1	1.3	24.7	0.6	12.3
40:1	2.7	49.5	1.3	24.7
20:1	5.5	99.0	2.7	49.5

* Volumes are approximate.

Floco® FRA Sampler



The Floco FRA Sampler is designed such that rotations of the Floco rotor drive a reduction gear train and, in turn, a disc valve. As the various ports in the discs align, flow is diverted from the process to an accumulator or from the accumulator to the receptacle bottle. The weight-activated full bottle shut-off trips a spring-loaded slide gate valve to stop the flow from the accumulator to the receptacle bottle.

Specifications

Materials of Construction	Housing:	ASTM A48 Cast Grey Iron
	Internals:	Hardened 440 stainless steel and Meehanite (standard) 440 stainless steel with a high-performance treatment for abrasive service (optional) 316 stainless steel for corrosion-resistant applications (optional)
	Elastomers:	Buna-N (standard) Viton® (optional).
	Gear Ratios	80:1 (standard) 20:1 and 40:1 (optional)
Receptacle	1/2 gallon (2 liters) polyethylene with transport lid and level scale 8.38 in. x 4.9 in. (21.3 cm x 12.5 cm)	
Dimensions	13.5 in. x 5.5 in. (35 cm x 14 cm) with the receptacle in place; extends 13.5 in. (35 cm) below centerline of flowmeter connections	
Sample Volume	Adjustable from 0.6 cc to 5.7 cc per sample	

Sample Size Per Barrel (cc)*

	Maximum Barrel Size Per Barrel (42 Gallons)	Number of Samples Per Barrel (42 Gallons)
80:1 Gear Ratio		
1-in. or 2-in. Meter	32 cc	5.5
3-in. Meter	16 cc	2.75
40:1 Gear Ratio		
1-in. or 2-in. Meter	63 cc	11.0
3-in. Meter	32 cc	5.5
20:1 Gear Ratio		
1-in. or 2-in. Meter	127 cc	22.0
3-in. Meter	63 cc	11.0

Floco® Pulse Transmitter

The Floco Pulse Transmitter (FPT) adds a frequency output to a Floco Series F Meter. It is ideally suited for retrofitting in-situ meters to provide the necessary electronic output associated with an automation or SCADA project. The transmitter typically consists of a gear-like target mounted within the magnetic field of a standard turbine flowmeter pick-up coil. As the teeth of the gear pass under the pick-up coil, an electronic pulse is generated in that the same way the movement of the rotor blades of a turbine meter generates a pulse. The FPT can generate up to 126 pulses per US gallon for any 1-in. or 2-in. Floco meter.

The FPT can be installed easily and quickly without removing the meter from service. The transmitter mounts directly to the meter body and can be used with or without a mechanical register. NuFlo MC series totalizers or frequency-2-4-20 mA converters are available to meet desired output signal requirements. For applications requiring a high amplitude 2-24 volt square wave signal, NuFlo offers an economical powered coil as an alternate. Electrical certifications are different for this alternate style.

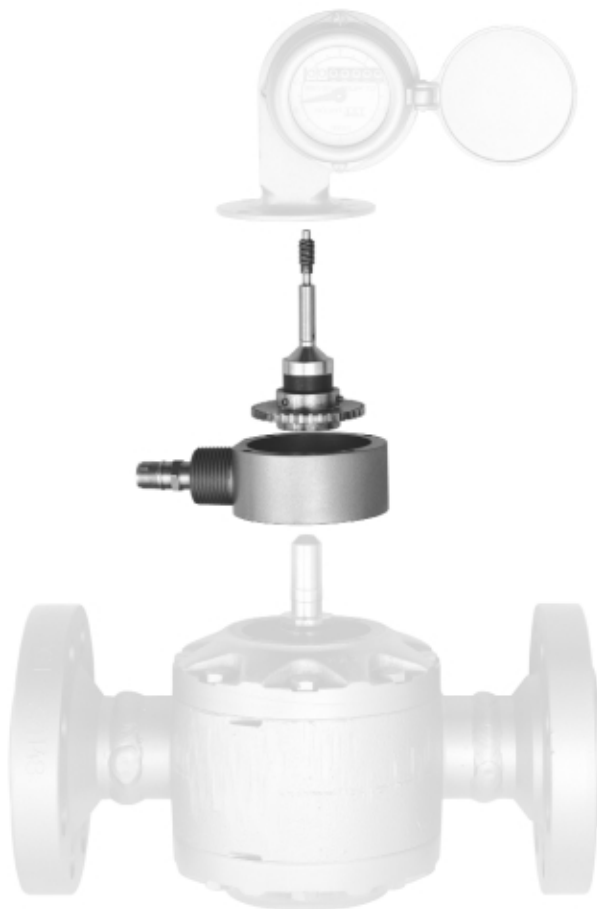
While the standard FPT is suitable for +250°F (+121°C), optional temperature ratings up to +450°F (+232°C) are available. Explosion-proof models feature a 1/2-in. FNPT electrical connection, while the intrinsically safe model has an optional 1-in. MNPT hub.

Approval Classification Options

- CSA, Explosion-Proof, Class I, Groups B, C, D; Class II, Groups E, F, G; Class III; Enclosure 4 (US and Canadian electrical code)
- CSA, Intrinsically Safe, Class I, Groups A, B, C, D; Class II, Groups E, F, G; Class III; Enclosure 4 (with approved barrier)
- CSA, Intrinsically Safe, Class I, Groups A, B, C, D; Class II, Groups E, F, G; Class III; Enclosure 4 (without barriers when connected to a NuFlo Scanner Flow Computer, or a NuFlo MC-II Flow Analyzer)
- CSA, General Purpose

Floco® Pulse Transmitter Output Specifications

Meter Type	K-Factor (Pulses / US Gallon)	Frequency Out (Hertz)		Output Amplitude (Volts, Peak to Peak)			
		Min.	Max.	Flame-Proof		IS or General Purpose	
				Min.	Max.	Min.	Max.
Floco 1- and 2-in.	126.0	12.0	126.0	0.4	2.0	3.0	9.0
Floco 3-in.	63.0	9.5	95.0	0.4	1.9	2.9	8.8



Floco® Model 308 Pulse Transmitter

The Floco Model 308 Pulse Transmitter is a cost-efficient, high-resolution device that indicates discrete increments of flow passing through a Floco meter. The remote signal can be interpreted to determine both flow rate and accumulated flow.

Optional pulse rates from 1 to 1,000 pulses per barrel or 1 to 100 pulses per gallon may be used to operate electric counters, batching counters, or combined with preset electrical counters to control pumps, motors, valves, or solenoid-actuated equipment.

A specially designed gear train provides the gear ratios used to obtain the desired pulse frequency through a glass-encapsulated dry reed switch actuated by the magnetic field of a gear-driven magnet. Although the Model 308 transmitter is not explosion-proof, the reed switch is hermetically sealed for use in hazardous locations as allowed by local electrical code.

The wafer-type cast aluminum case of the Model 308 mounts on a Floco Meter just beneath the register. The pulse transmitter is easily retrofit to existing meters in the field without recalibrating the meter. The Model 308 Pulse Transmitter incorporates an integral weatherproof junction box with a three-position terminal strip that is easily replaced in the field.

Standard Pulse Resolution for 10:1 Ratio

Register Type	Pulses Per Unit Volume
Gallons	10
Barrels	100
Liters	10
Cubic Meters	1000

If a higher pulse resolution is required, consult NuFlo Measurement Systems. Resolution as high as 10 times the standard pulse resolution is available.

General Specifications

Dimensions	Length: 4.5 in. Width: 3.75 in. Height: 2.0 in.
Weight	1.5 lb
Temperature Rating	-25°F (-32°C) to +160°F (+71°C)
Conduit Connection	1/2-in. NPT
Contact Rating	12 volt-ampere AC 10 watts DC resistive 1/2 amp or 250 volts max.
Contact Resistance	10 to 60 milliohms plus 40 milliohms lead resistance

MEASUREMENT SYSTEMS

Formerly: NuFlo Measurement Systems • Barton Instrument Systems • Caldon, Inc.

NORTH
AMERICA

1.800.654.3760

ms-us@c-a-m.com

ASIA
PACIFIC

603.2287.1039

ms-asiapacific@c-a-m.com

EUROPE, MIDDLE EAST
& AFRICA

44.1243.826741

ms-uk@c-a-m.com

USA: Houston, TX • Corpus Christi, TX • Kilgore, TX • Odessa, TX • Dallas, TX • Tulsa, OK
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HOUSTON HEAD OFFICE: 281.582.9500 • www.c-a-m.com/flo