

FORCEmeter™



LIQUID • GAS • STEAM

INSTALL IT & FORGET IT

The ForceMeter™ offers the same rugged design for which the Niagara Meters brand is known. The ForceMeter is ideal for applications including water, compressed air, gases, super-heated steam and saturated steam.

FEATURES & BENEFITS

Quick Response Time

- Displays the flow rate from zero to full range of flow in less than a second or a dampening value can be used to slow the response time

Rugged Design

- No frictional moving parts to wear out
- Withstands thermal shock
- All welded flow sensor construction
- Hermetically sealed
- Extreme temperature ranges: -320° to 500° F
- Not damaged by over range

Easy to Maintain

- Calibration verification without a flow stand
- No maintenance needed
- Ability to change flow ranges by changing targets

Flexible

- Warning and fault history stored
- Option for bidirectional
- 2 line, 4 button display
- HART™ compliant communication
- 4-20mA output
- 2-wire, loop powered or 3-wire version available

Approvals

- CE, FM

Approved for Hazardous Locations



ForceMeter Display

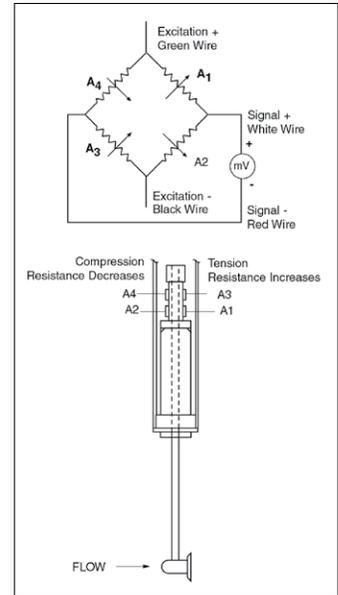
FORCEmeter™ Principle of Operation

HOW A FORCEMETER WORKS:

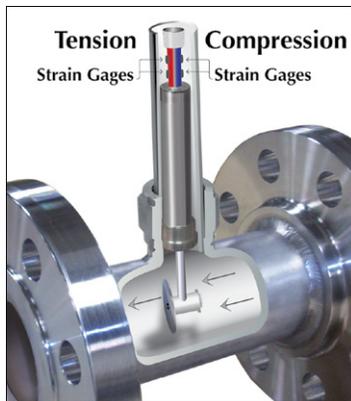
The ForceMeter is a liquid, steam or gas flow meter. The force of the fluid is sensed on the target in the flow stream using a hermetically sealed strain gage bridge circuit. The transmitter converts the force to a 4-20 mA output that is proportional to the flow rate.

How the Bridge Circuit Works

- Force from the fluid flow is transferred from the target to the sensing tube
- Four interconnected, 5000 Ohm strain gages are attached to the sensing tube in a bridge circuit
- At zero flow, the bridge circuit is balanced producing zero output
- Force from the flow produces strain on the sensing tube
- The bridge circuit senses the force (strain) producing an output



Bridge Circuit Diagram



Basic Principle of Operation

$$\text{Force} = C_d A \rho \frac{V^2}{2g}$$

C_d = Drag Coefficient

A = Target Area

ρ = Fluid Density

$\frac{V^2}{2g}$ = Velocity Head

TRANSMITTER OPTIONS

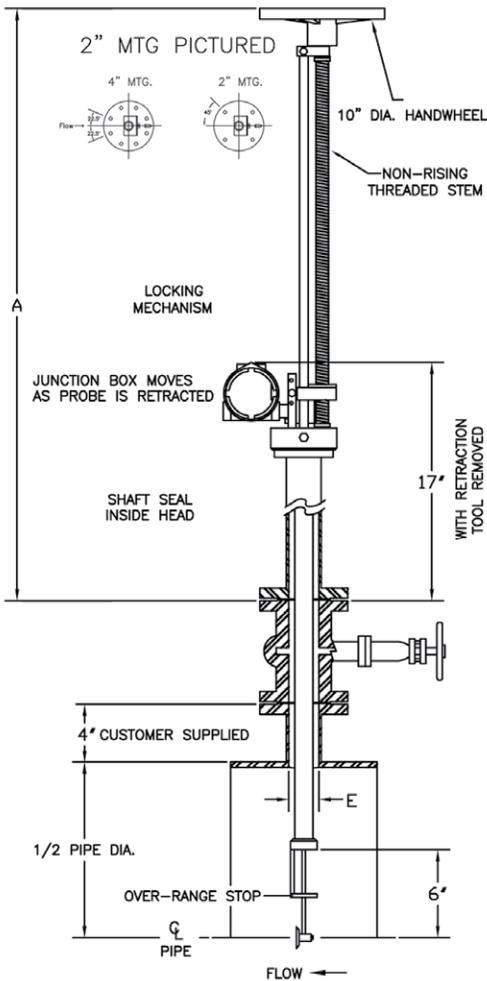
2-Wire: A 2-wire loop powered meter with a 4-20mA output and HART communication. It has a turndown ratio of 15:1, and is used where 2-wire loop powered is required.

3-Wire: The 3-wire has a power, signal (4-20mA and HART communication), and ground connection. With more power available, the meter produces a higher signal-to-noise ratio, minimizing electrical interference. This increases the turndown ratio to 20:1, allowing lower flow rates to be measured.

ONE METER, MANY SOLUTIONS

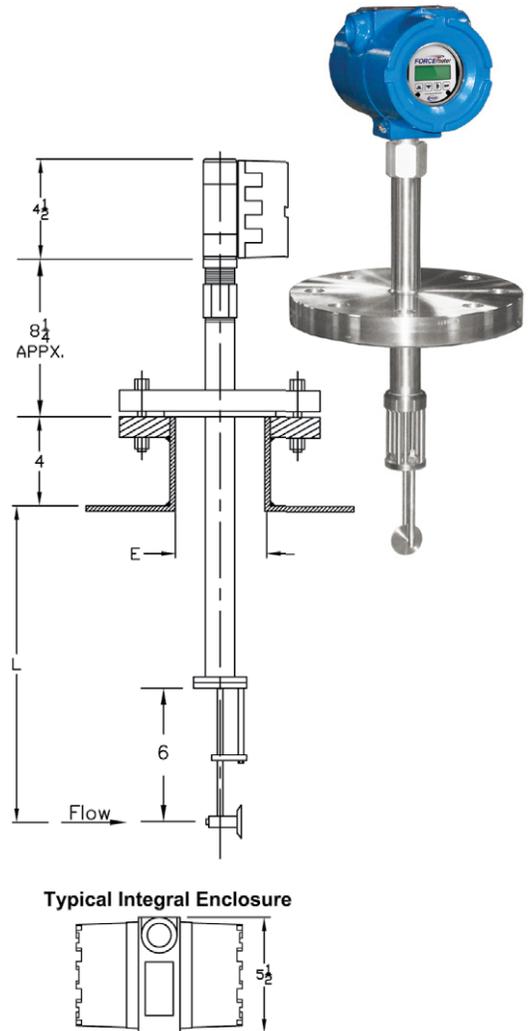
The ForceMeter insertion meter is used in applications with 4" line sizes and larger. A fixed or retractable insertion installation is very useful and economical. The retractable insertion allows for a hot tap installation for processes where the line cannot be interrupted.

Retractable Insertion



Dimensions A (Retractable)		
LINE SIZE	RETRACTION TOOL	DIM. A
4", 5", 6"	RT4-18	46 7/16
8", 10", 12"	RT4-18	46 7/16
14", 16", 18"	RT4-18	46 7/16
20", 22", 24"	RT20-36	55 7/16
26", 28", 30"	RT20-36	55 7/16
32", 34", 36"	RT20-36	55 7/16

Fixed Insertion



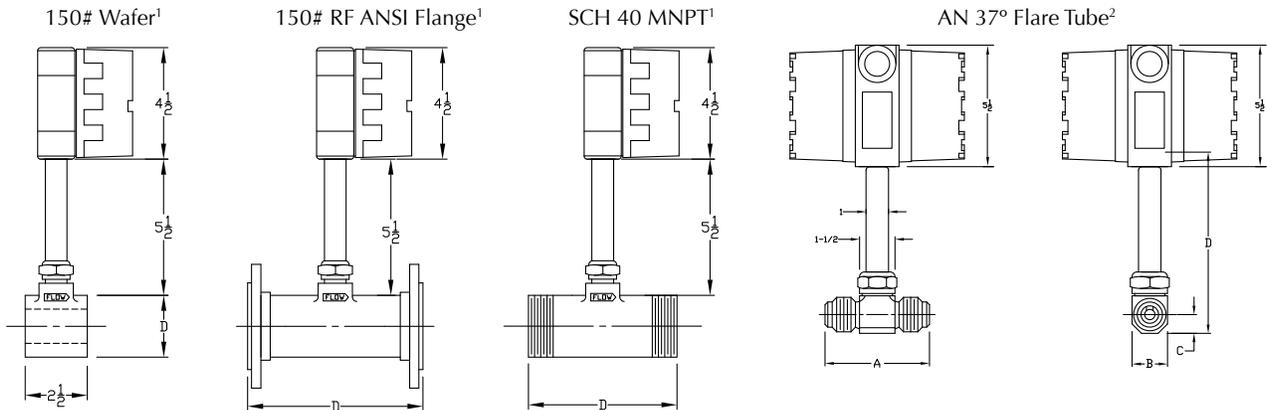
1. Hot tap available.
2. Shown with customer supplied valves and pipe.

IDEAL FOR LIQUIDS, GASES OR STEAM

The ForceMeter inline flow meter is used in applications with line sizes of 0.5" to 6.0". The meter is supplied with the housing in all typical mounting configurations, such as wafer, MNPT, AN 37° Flare Tube, and flanged.

Standard Mounting Options:

Wafer, Flanged, MNPT, AN 37° Flare Tube



SIZE	D DIMENSION				
	Wafer	150# RF		MNPT	
		Dim.	Product Wt. (lbs.)	Dim.	Product Wt. (lbs.)
1/2"	1-3/4"	5"	8	4"	6
3/4"	2-1/8"	5"	9	4"	6
1"	2-1/2"	5"	9	5"	6
1-1/4"	2-7/8"	6"	11	6"	7
1-1/2"	3-1/4"	6"	12	6"	7
2"	4"	8"	18	8"	7
3"	5-1/4"	9"	28	9"	9
4"	6-3/4"	10-1/2"	40	-	-
6"	8-5/8"	12-1/2"	60	-	-

SIZE	DIMENSIONS				Product Wt. (lbs.)
	A	B	C	D	
1/2"	3.600"	1-3/8"	11/16"	7-5/8"	2.250
3/4"	3.600"	1-3/8"	11/16"	7-5/8"	2.250
1"	3.666"	1-3/8"	11/16"	7-5/8"	2.250
1-1/4"	3.666"	1-11/16"	7/8"	7-5/8"	2.500
1-1/2"	3.760"	1-15/16"	1"	8-1/8"	3.000
2"	4.260"	2-9/16"	1-5/16"	8-5/8"	4.500

1. Drawings shown as remote displays.
2. Drawing shown as integral display.

ADAPTABLE AND FLEXIBLE TO YOUR ENVIRONMENT

Approvals

- Designed to meet military standards for shock and vibration
- FM hazardous locations
- CE

Variety of Materials

- Carbon steel
- 304 Stainless steel
- 316/316L Stainless steel
- Alloy C276
- Inconel
- Brass target only - oxygen applications



All-Welded Construction Available

Remote Transmitter

- High temperature applications
- Location, display not visible

Operating Temperatures

- -65° to 425° F (-54° to 218° C) standard
- -65° to 500° F (-54° to 260° C) extended temp
- -320° to 250° F (-195° to 121° C) cryogenic



Remote Transmitter Enclosure

FUNCTIONAL	
Fluid Types	Liquids (Reynolds numbers greater than 2000), gases and steam
Bridge Resistance	5000 ohms \pm 30 ohms
Operating Pressure	Up to 5000 PSI maximum working pressure Mounting Type / Connections: according to the appropriate ANSI specifications
Operating Temperature	-65° to 425° F (-54° to 218° C) standard -65° to 500° F (-54° to 260° C) extended temp -320° to 250° F (-195° to 121° C) cryogenic
Transmitter Ambient Temperature	-4° to 158° F (-20° to 70° C)
PERFORMANCE	
Accuracy	\pm 1.0% of rate
Repeatability	\pm 0.15% of rate
Turn Down	15:1 for 2 wire version; 20:1 for 3 wire version
Response Time	0.3 seconds
Damping	User adjustable 0 to 99 samples
Flow Direction	Unidirectional or bidirectional
Communications	HART® communication signal (superimposed on a 4-20 mA DC signal)
PHYSICAL	
Housing / Flanges	316L stainless steel (standard), others available
Rating	NEMA 4X
Mounting Positions	Horizontal, vertical or on an angle
Typical Straight Pipe Requirements	10 x pipe diameter of straight uninterrupted pipe upstream 5 x pipe diameter of straight uninterrupted pipe downstream
Process Connections	MNPT (0.5" to 3.0") ANSI Raised Face Flange (Class 150# standard, 0.5" to 6.0") Wafer (0.5" to 6.0") AN 37 Degree Flare Tube (0.5" to 2.0") Fixed Insertion Probes, 2" or 4" ANSI Raised Face Flange (Class 150# standard) Retractable Insertion Probes, 2" or 4" ANSI Raised Face Flange (Class 150# standard)
Transmitter Housing	Integral: Polyester powder coated aluminum, dual cavity Remote: Compression-molded fiberglass Remote Hazardous: Polyester powder coated aluminum, dual cavity
Power	18 to 36 VDC
Line Sizes	Inline 0.5" to 6.0", Insertion 4.0" to 60"
Electrical Connections	0.75" NPT
Remote Enclosure Rating	NEMA 4X
Remote Enclosure Dimensions	7 x 8.5 x 4.5 inches (17.8 x 21.5 x 11.4 cm) (with tabs)
Maximum Remote Distance	200 ft (61 m)
ACCESSORIES	
	Rate / Total Indicator, Batch Controller, Mass Flow Computer (gases or steam)

Approvals

- CE Electromagnetic Compatibility Directive (EMC)
- FM
XP Class I, Div 1, Groups B, C, D
DIP Class II & III, Div 1, Groups E, F, G



150 Venture Boulevard · Spartanburg, SC 29306
800-778-9251
864-574-3327
sales@niagarameters.com
www.niagarameters.com

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