FORCEmeter™

LIQUID • GAS • STEAM

FORCEmeter™ Features/Benefits

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.

BENEFITS

Quick Response Time

- Displays the flow rate from 0 to full range of flow in less than a second or a damping 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
- Loop-powered

Approvals

- CE, FM

ForceMeter™ Display

Approved for Hazardous Locations

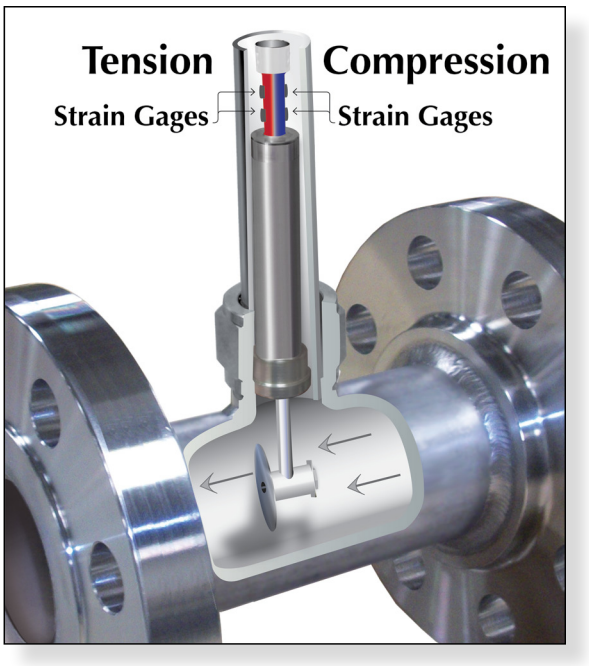
FORCEmeter™ Principle of Operation

HOW A FORCEMETER™ WORKS:

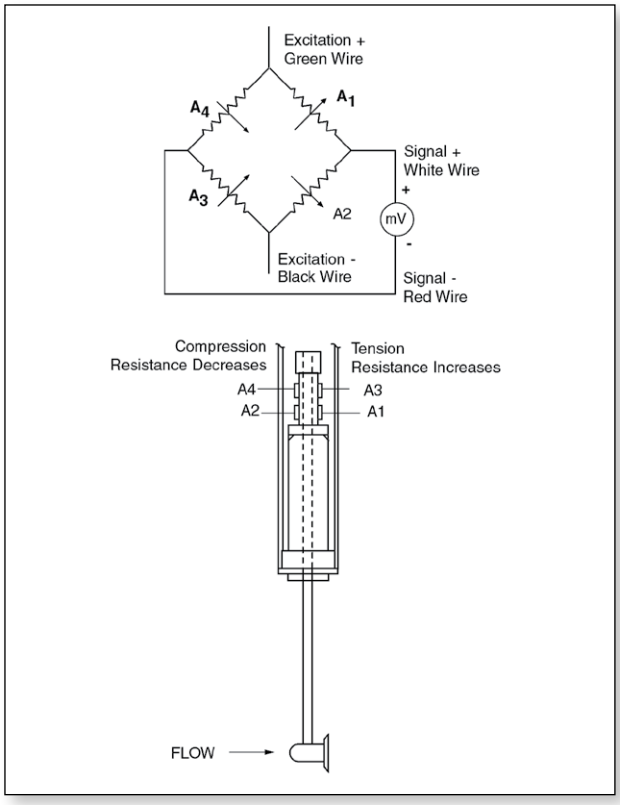
The ForceMeter™ is a liquid, steam or gas flow meter. The force of the fluid is sensed on the target in the flow stream using a hermetically sealed strain gage bridge circuit. The transmitter converts the force to a 4-20mA output that is proportional to the flow rate.

How the Bridge Circuit Works

- Forces from the fluid flow are transferred from the target to the sensing tube
- Four interconnected strain gages are attached to the sensing tube in a bridge circuit
- At zero flow, the bridge circuit is balanced and produces zero output
- Flow produces strain on the sensing tube
- The bridge circuit senses the force which produces an output



Bridge Circuit Diagram



Basic Principle of Operation:

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

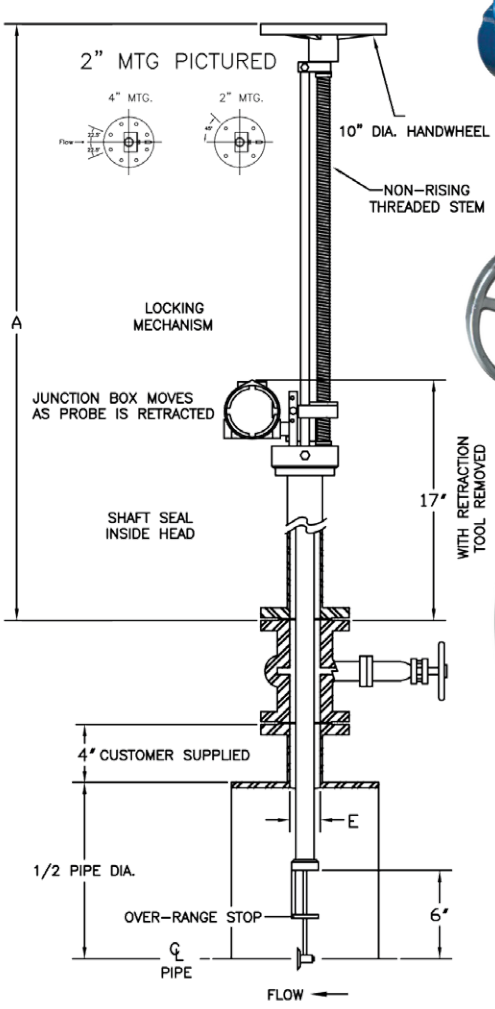
C_d = Drag Coefficient
A = Target Area
ρ = Fluid Density

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

ONE METER, MANY SOLUTIONS

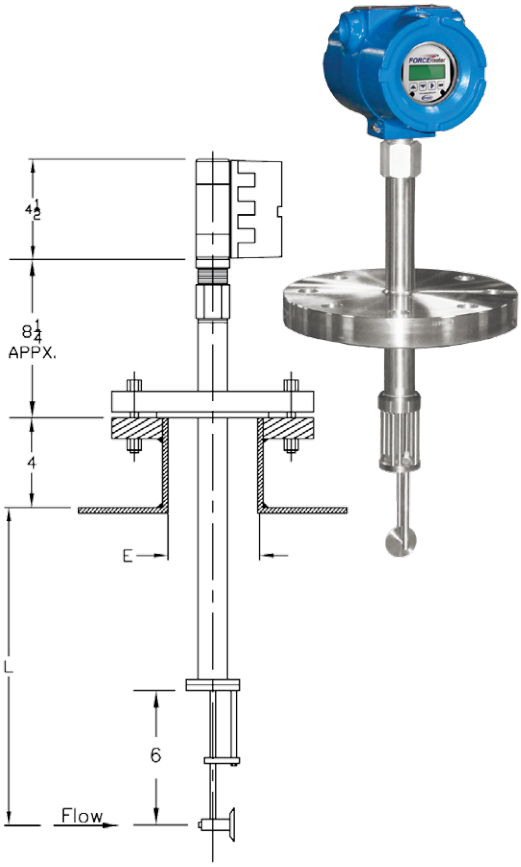
The ForceMeter™ insertion meter is used in applications with 4″ line sizes and larger. A fixed or retractable insertion installation is very useful and economical. The retractable insertion allows for a hot tap installation for processes where the line cannot be interrupted.

Retractable Insertion

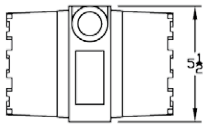


Hot Tap Available

Fixed Insertion



Typical Integral Enclosure



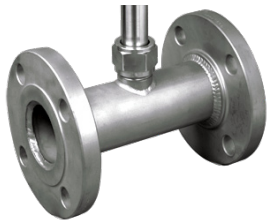
Dimensions A (Retractable)		
LINE SIZE	RETRACTION TOOL	DIM. A
4″, 5″, 6″	RT4–18	46 7/16
8″, 10″, 12″	RT4–18	46 7/16
14″, 16″, 18″	RT4–18	46 7/16
20″, 22″, 24″	RT20–36	55 7/16
26″, 28″, 30″	RT20–36	55 7/16
32″, 34″, 36″	RT20–36	55 7/16

IDEAL FOR LIQUIDS, GASES OR STEAM

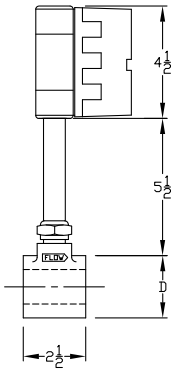
The ForceMeter™ inline flow meter is used in applications with line sizes of 0.5″ to 6.0″. The meter is supplied with the housing in all typical mounting configurations, such as wafer, MNPT, AN 37° Flare Tube, and flanged.

Standard Mounting Options:

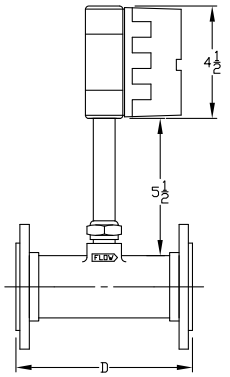
Wafer, Flanged, MNPT, AN 37° Flare Tube

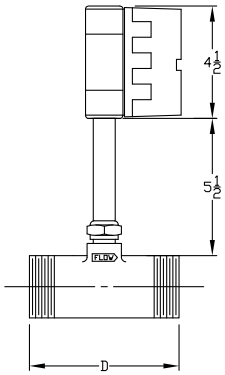

150# Wafer



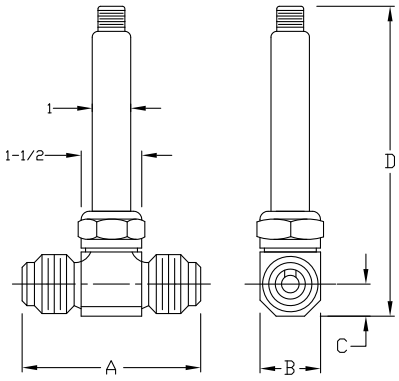
150# RF ANSI Flange



SCH 40 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				
	A	B	C	D	Product Wt. (lbs.)
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

NFP - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____

Model Type
V = Standard
D = Custom

Approvals
B = Hazardous Approval
I = Intrinsically Safe Approval
Z = None

Flow Direction
1 = Unidirectional
2 = Bidirectional

Transmitter Mounting
V = Integral
R = Remote
B = Hazardous Remote

Transmitter Type
1 = ForceMeter™
3 = ForceMeter™ w/ blind cover

Body Material
Y = SST 316L

Flange Rating
01 = 150# RF ANSI
02 = 300# RF ANSI

Mounting Connection
H = 4.0″ flange retractable probe
M = 2.0″ flange fixed probe
P = 4.0″ flange fixed probe
U = 2.0″ flange retractable probe

Line Size: 4.0″ to 60″

ForceMeter™ Insertion

NFI - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____ - _____

Model Type
V = Standard
D = Custom

Approvals
B = Hazardous Approval
I = Intrinsically Safe Approval
Z = None

Flow Direction
1 = Unidirectional
2 = Bidirectional

Transmitter Mounting
V = Integral
R = Remote
B = Hazardous Remote

Transmitter Type
1 = ForceMeter™
3 = ForceMeter™ w/ blind cover

Body Material
C = Carbon Steel
X = SST 304
Y = SST 316L

Flange Rating
00 = NA (mounting connection J)
01 = 150# RF ANSI (mounting connection F)
02 = 300# RF ANSI (mounting connection F)

Mounting Connection
F = Flanged
J = MNPT

Line Size: 0.5″ to 6.0″

ForceMeter™ Inline

FORCEmeter™ Options

ADAPTABLE AND FLEXIBLE TO YOUR ENVIRONMENT

Approvals

- Military shock and vibration
- FM hazardous locations, intrinsically safe
- CE

Variety of Materials

- Carbon steel
- 304 stainless steel
- 316L stainless steel
- Hastelloy
- Inconel
- Brass target only - oxygen applications

All-Welded Construction Available

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

FORCEmeter™ Technical Data

FUNCTIONAL SPECIFICATIONS	
Fluid Types	Liquids (Reynolds numbers greater than 2000), gases and steam
Bridge Resistance	5000 ohms ± 30 ohms
Operating Pressure	Sensing Element: 1000, 5000, or 10,000 PSI 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 Temperature	-4° to 158° F (-20° to 70° C)
PERFORMANCE SPECIFICATIONS	
Accuracy	± 1.0% of rate
Repeatability	± 0.15% of rate
Turn Down	15:1
Response Time	0.33 mS
Damping	User adjustable 0 to 99 samples
Flow Direction	Unidirectional or bidirectional
Approvals	CE Electromagnetic Compatibility Directive (EMC) 2004/108/EC FM (Canada & US) XP Class I, Div 1, Groups B, C, D DIP Class II & III, Div 1, Groups E, F, G Intrinsically Safe
PHYSICAL SPECIFICATIONS	
Housing / Flanges	316L stainless steel (standard), others available
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	18-36 VDC
Line Sizes	Inline 0.5” to 6.0”, Insertion 4.0” to 60”
Electrical Connections	0.75” NPT
ACCESSORIES	
	Rate / Total Indicator, Batch Controller, Mass Flow Computer (gases or steam)

NIAGARA® meters

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FM201106 Rev. B