

# Omniflo®

## Turbine Flowmeters

### Description

Flow Technology's Omniflo® turbine flowmeter is a tangential flow transducer capable of measuring very low flow rates in either liquid or gas with excellent speed of response and repeatability.

A high-resolution, volumetric flow sensing instrument, the Omniflo® offers repeatability which is better than  $\pm 0.1\%$  in liquids and  $\pm 0.2\%$  in gases. The flowmeter's unique, tangential rotor design allows it to operate effectively in low flow environments where standard axial turbine meters cannot be used. Flow rates as low as 0.001 GPM (3.78 mLPM) in liquids and 0.0015 ACFM (2.5 LPH) in gases can be measured. When paired with linearizing electronics, it is capable of overall accuracy of  $\pm 0.25\%$  in liquids and  $\pm 0.60\%$  in gas.

The Omniflo's® stainless steel construction makes it capable of withstanding pressures up to 400 BAR (5,800 psi). Optional configurations are available for higher operating pressures, dependent on end fittings.

### Applications

The Omniflo's® low flow sensing capability makes it an effective instrument for such low flow applications as fuel flow metering, mixing and blending of costly chemical additives, measuring of pharmaceutical products, purging of gases used in food packaging, liquid metering in automotive and aerospace applications, and numerous leak rate detection applications.

With its precision pivot sapphire bearing configuration, it can accurately measure flow rates significantly lower than other available techniques. Ball bearing and sleeve (journal) bearing configurations are used for more rugged or less demanding flow rate applications.

### Operation

Based on its superior sensitivity to very low flows, the Omniflo® depends on a precision orifice, located within the flowmeter sensing element (capsule), which directs fluid past the underside of the tangential rotor. Since the rotor is freely suspended and of low mass, it responds almost instantaneously to changes in the process flow rate.



### Omniflo®

Turbine Flowmeters

### Features

- Operates in low flow ranges where standard axial turbine flowmeters cannot be used
- Accuracy of  $\pm 0.25\%$  in liquids and  $\pm 0.60\%$  in gas when paired with linearizing electronics
- Repeatability better than  $\pm 0.1\%$  of reading in liquids and  $\pm 0.2\%$  of reading in gas
- Measures flow rates as low as 0.001 GPM (3.78 mLPM) in liquids, and 0.0015 ACFM (2.5 LPH) in gas
- Standard configuration withstands pressures up to 400 BAR (5,800 psi), higher operating pressures are available, dependent on end fittings
- Compact size, 3" face-to-face with NPT or MS end connections

# Specifications

## Applicable to Both Liquid and Gas Flowmeters

### Materials Of Construction

Standard	316 SST Housing 17-4 PH Rotor Teflon O-Ring 15-7 Retaining Ring
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Other materials of construction optional (see model number chart).

<b>Operating Temp. Range</b>	Defined by bearing and pickoff selection (see below)
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<b>Bearing Type</b>	Temperature Limits:
Sapphire jewel pivot bearing, with tungsten carbide shaft	-60° F to 300° F (-50° C to 149° C)
<b>Note:</b> Standard maximum operating temperature of the jewel bearing is 300° F. Maximum operating temperatures up to 600° F are available as a special.	

Ceramic journal bearing	-100° F to 800° F (-75° C to 425° C)
Tungsten carbide journal	-60° F to 1200° F (-50° C to 650° C)
Ball bearing 440 C stainless steel (not recommended for water service)	-450° F to 300° F (-270° C to 150° C)

<b>Pickoff Type</b>	Temperature Limits:
Magnetic	-430° F to 350° F (-260° C to 177° C)
High Temp. Magnetic	-430° F to 750° F (-260° C to 400° C)
Modulated Carrier (RF)	-300° F to 350° F (-185° C to 177° C)
High Temp. (RF)	-300° F to 750° F (-185° C to 400° C)

Water Cooled Mag & RF	Up to 1,100° F (593° C)
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### Pickoff Mating Electrical Connections

MS Connector	
2-pin, standard pickoff	15-89515-101
3-pin, amplified pickoff	15-89515-102
4-pin, pickoff with RTD	15-93825-01
Threaded Connection with Leads	
Junction Box with Terminal	73-31836-105

<b>Operating Pressure Range</b>	Defined by end connection selected. Pressures up to 400 BAR (5,800 psi) are standard. Consult factory for higher pressures.
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<b>Filtration Recommendations</b>	100 micron or better Jewel/Journal Bearing 10 micron or better Ball Bearing
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## Operation (cont'd)

The Omniflo's® modular design permits removal of the flowmeter's sensing element (capsule) for maintenance. This feature also facilitates replacement of the capsule for the purpose of obtaining a different flow range.

A Modulated Carrier (RF) or a Magnetic pickoff senses the rotation of the rotor and provides an electrical frequency output proportional to the process flow rate. The use of the RF pickoff optimizes the ability of the meter to measure minute flows since it does not produce any magnetic drag to the rotor motion, unlike magnetic pickoffs.

The Omniflo's® frequency output can be processed by complementary electronics, ranging from basic amplifiers, indicators and totalizers, to linearizers and more complex flow computers which compensate for all measurable process parameters for ultimate volumetric or mass flow measurement accuracy.

## Liquid Service

Performance specifications are based on tests with water at normal conditions (viscosity of 1.0 centistoke) with Pivot Bearing.

<b>Calibration Accuracy</b>	≤±0.05% of reading or better (accuracy of primary flow calibration standard directly traceable to NIST)
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<b>Repeatability</b>	≤±0.1% of reading
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<b>Linearity</b>	±0.1% with linearizing electronics
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<b>Pressure Drop</b>	Less than 700 mBAR (10 psid) at maximum flow rate
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<b>Viscosity</b>	Max. viscosity recommended 50 CST
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**Note:** Universal viscosity calibrations may limit flow range (consult factory). Multiple viscosity calibrations available.

## Gas Service

Performance specifications are based on air at normal conditions 14.7 psia and 68° F (1 BAR and 20° C) with Pivot Bearing.

<b>Calibration Accuracy</b>	≤±0.3% of reading (accuracy of primary flow calibration standard directly traceable to NIST)
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<b>Repeatability</b>	≤±0.2% of reading
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<b>Linearity</b>	±0.1% with linearizing electronics
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<b>Pressure Drop</b>	Less than 20 mBAR (8 INWC) at maximum flow rate
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**Note:** Universal Reynolds Number calibrations may limit flow range (consult factory). Multiple Reynolds Number calibrations available.

# FTO Sizing

NORMAL 10:1 FLOW RANGE										EXTENDED FLOW RANGE										
LIQUID	FLOW RANGE - LIQUID - JEWEL BEARING (Bearing Code C)																			
	RF						MAG				RF				MAG					
	MIN		MAX		MIN		MAX		MIN		MAX		MIN		MAX		MIN		MAX	
	mLPM		GPM		mLPM		GPM		mLPM		GPM		mLPM		GPM		mLPM		GPM	
	FTO-1		7.57 75.7		.002 .02		N/A		N/A		3.78 303		.001 .08		N/A		N/A		N/A	
	FTO-2		30.3 303		.008 .08		N/A		N/A		11.35 605		.003 .16		N/A		N/A		N/A	
	FTO-3		94.6 946		.025 .25		151.4 1514		.04 .40		37.8 1514		.01 .40		N/A		N/A		N/A	
	FTO-4		302.8 3028		.08 .80		378.5 3785		.10 1.0		75.7 4920		.02 1.3		378.5 4920		.10 1.3		1.3	
	FTO-5		567.7 5677		.15 1.5		567.7 5677		.15 1.5		189.2 7570		.05 2.0		567.7 7570		.15 2.0		2.0	
	FLOW RANGE - LIQUID - BALL BEARING (Bearing Code A)																			
FTO-1		7.57 75.7		.002 .02		N/A		N/A		7.57 303		.002 .08		N/A		N/A		N/A		
FTO-2		30.3 303		.008 .08		N/A		N/A		18.9 605		.005 .16		N/A		N/A		N/A		
FTO-3		94.6 946		.025 .25		151.4 1514		.04 .40		75.7 1514		.02 .40		N/A		N/A		N/A		
FTO-4		302.8 3028		.08 .80		378.5 3785		.10 1.0		189.2 4920		.05 1.3		378.5 4920		.10 1.3		1.3		
FTO-5		567.7 5677		.15 1.5		567.7 5677		.15 1.5		378.5 7570		.10 2.0		567.7 7570		.15 2.0		2.0		
FLOW RANGE - LIQUID - JOURNAL BEARING (Bearing Codes D, E & G)																				
FTO-3		151.4 1514		.04 .40		189.2 1514		.05 .40		113.5 1514		.03 .40		N/A		N/A		N/A		
FTO-4		492.0 4920		.13 1.3		567.7 4920		.15 1.3		378.5 4920		.10 1.3		N/A		N/A		N/A		
FTO-5		567.7 5677		.15 1.5		757.0 7570		.20 2.0		567.7 7570		.15 2.0		N/A		N/A		N/A		
GAS	FLOW RANGE - GAS - JEWEL BEARING (Bearing Code C)																			
	RF						RF													
	MIN		MAX		MIN		MAX		MIN		MAX		MIN		MAX		MIN		MAX	
	ALPH		ACFM		ALPH		ACFM		ALPH		ACFM		ALPH		ACFM		ALPH		ACFM	
	FTO-1		2.55 25.5		.0015 .015		N/A		N/A		N/A		N/A		N/A		N/A		N/A	
	FTO-2		4.25 42.5		.0025 .025		3.40 50.9		.002 .03		5.95 101.9		.0035 .06		.008 .20		.015 .30		.30	
	FTO-3		8.49 84.9		.005 .05		13.59 339.8		.008 .20		25.49 509.7		.015 .30		.015 .30		.015 .30		.30	
	FTO-4		20.39 203.9		.012 .12		13.59 339.8		.008 .20		25.49 509.7		.015 .30		.015 .30		.015 .30		.30	
	FTO-5		33.98 339.8		.02 .20		25.49 509.7		.015 .30		25.49 509.7		.015 .30		.015 .30		.015 .30		.30	
	PULSES PER UNIT OF VOLUME AND FREQUENCY																			
Abbreviations for Units of Measurement																				
mLPM = Milliliters per Minute																				
GPM = Gallons per Minute																				
ALPH = Actual Liters per Hour																				
ACFM = Actual Cubic Feet per Minute																				
P/L = Pulses per Liter																				
P/G = Pulses per Gallon																				
P/Ft³ = Pulses per Cubic Foot																				
LIQUID & GAS	Liquid meters Based on normal range						Gas meters Based on normal range													
	Nominal K-factor		Max. Freq. Approx.		Nominal K-factor		Max. Freq. Approx.		Nominal K-factor		Max. Freq. Approx.									
	P/mL P/G		Hz		P/L P/Ft³		Hz		P/mL P/G		Hz									
	FTO-1		211 800K		270		170K 4800K		1200		170K 4800K		1200							
	FTO-2		119 450K		600		85K 2400K		1000		85K 2400K		1000							
	FTO-3		48 180K		750		36K 1030K		860		36K 1030K		860							

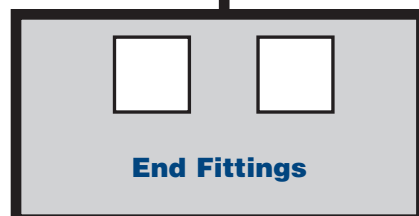
Blue = Metric (SI) Units  
Metric units in mLPM (liquid) & ALPH (gas)

Black = English (US) Units  
English units in GPM (liquid) & ACFM (gas)

## Abbreviations for Units of Measure:

mLPM = Milliliters per Minute  
GPM = Gallons per Minute  
ALPH = Actual Liters per Hour  
ACFM = Actual Cubic Feet per Minute  
P/L = Pulses per Liter  
P/G = Pulses per Gallon  
P/Ft³ = Pulses per Cubic Foot  
P/mL = Pulses per Milliliter

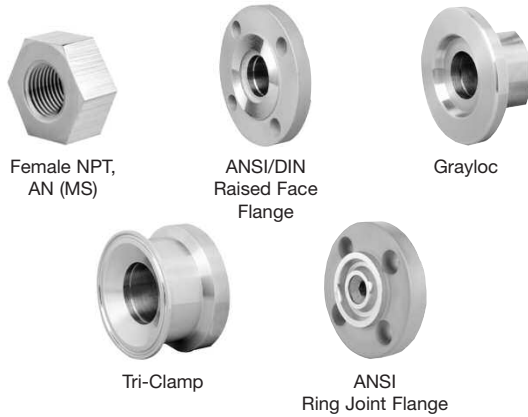
- Notes:**
- 1) Some combinations may be less than 10:1.
  - 2) Meters using magnetic pickoffs may have single digit mv amplitude readings at the low flow rate.



# Model Numbering System

## Calibration

### End Fittings



AI = AN (MS) internal straight threads 1/2" nominal size
NI = NPT internal threads 1/2" nominal size
BI = British Standard tapered pipe thread pn BS21:1973
C1 = 150# Raised Face Flange, 1/2"
C2 = 300# Raised Face Flange, 1/2"
C3 = 600# Raised Face Flange, 1/2"
C4 = 900# Raised Face Flange, 1/2"
J2 = 300# Ring Joint Flange, 1/2"
J3 = 600# Ring Joint Flange, 1/2"
J4 = 900# Ring Joint Flange, 1/2"
G2 = 1GR7 Grayloc, 8179 PSIG
G3 = 1GR11 Grayloc, 4334 PSIG
T1 = 3/4" Clamp Size
T2 = 1.5" Clamp Size
D1 = DN20, PN10-40
D3 = DN25, PN64-160
D5 = DN25, PN250
D7 = DN25, PN400
D9 = DN40, PN10-40
Other end fittings available upon request.

CODE	DESCRIPTION	CODE
<b>Note:</b> A=Air, W=Water, S=Solvent, B=Oil Blend (Viscosity must be provided with oil blend calibrations "B")		FA FW FS FB
NA	10-point, normal 10:1 range, in air	GA GW GS GB
NW	10-point, normal 10:1 range, in water	
NS	10-point, normal 10:1 range, in solvent	
NB	10-point, normal 10:1 range, in oil blend	
XA	10-point, extended range, in air	U2  U3
XW	10-point, extended range, in water	
XS	10-point, extended range, in solvent	
XB	10-point, extended range, in oil blend	
TA	20-point, normal 10:1 range, in air	SPECIF FOR RE
TW	20-point, normal 10:1 range, in water	
TS	20-point, normal 10:1 range, in solvent	
TB	20-point, normal 10:1 range, in oil blend	
YA	20-point, extended range, in air	R1 R2 R3
YW	20-point, extended range, in water	
YS	20-point, extended range, in solvent	
YB	20-point, extended range, in oil blend	
		E1 E2 E3

\* The third digit of the calibration designator is normally not used and occupied by a dash (-).

When required, the following codes are used:

- U — To signify required units of measure other than GPM or ACFM
- R — To signify special calibration flow range other than normal 10:1 or extended range
- B — To signify both changes in units and special flow range

Calibration

- = Standard    R = Range  
U = Units        B = Both

L = Liquid    G = Gas

Material

Bearing

# Materials of Construction

DESCRIPTION
15-point, extended range, in air
15-point, extended range, in water
15-point, extended range, in solvent
15-point, extended range, in oil blend
30-point, extended range, in air
30-point, extended range, in water
30-point, extended range, in solvent
30-point, extended range, in oil blend
Universal Viscosity Curve, 2 Viscosities (specify minimum viscosity & maximum viscosity). 10 points each viscosity
Universal Viscosity Curve, 3 Viscosities (specify minimum viscosity & maximum viscosity). 10 points each viscosity
TEMP. & PRESSURE, MIN./MAX., REYNOLDS NO. CALIBRATIONS
10 points, 1 pressure, Reynolds No. Cal.
10 points, 2 pressure, Reynolds No. Cal.
10 points, 3 pressure, Reynolds No. Cal.
20 points, 1 pressure, Reynolds No. Cal.
20 points, 2 pressure, Reynolds No. Cal.
20 points, 3 pressure, Reynolds No. Cal.

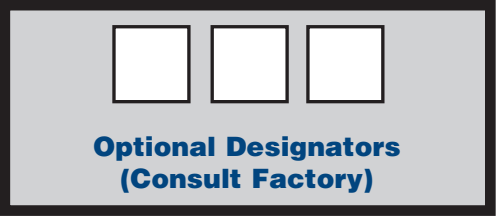
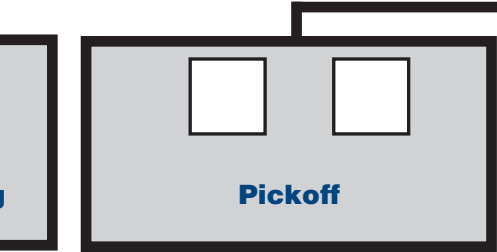
CODE	BEARING TYPE				
	A	C	D	E	G
H	X	X	X	X	X
U		X	X		X
Available configurations of bearing types and materials of construction.					
MATERIALS					
H = STANDARD, 316 Housing, 17-4 PH rotor, Teflon O-ring					
U = HIGH TEMPERATURE, 316 Housing, 17-4 PH rotor, Metal O-ring					

## Bearings

Bearing selection will affect flow range. Refer to sizing specification table for correct flow ranges.	
C	= SAPPHIRE PIVOT (Sapphire pivot, Carbide shaft)
A	= BALL BEARING (440 C balls, 316 shaft)
D	= CARBIDE JOURNAL (Carbide sleeve and shaft) liquid only
E	= GRAPHITE JOURNAL (Graphite sleeve, 316 shaft) liquid only
G	= CERAMIC JOURNAL (Ceramic sleeve and shaft) liquid only

## Pickoffs

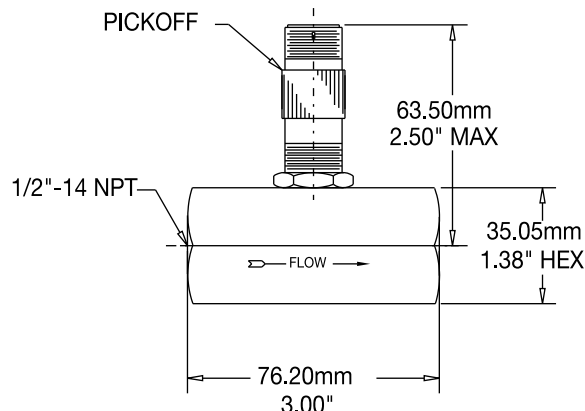
-1	= Modulated Carrier, MS connector
-2	= Magnetic, MS connector
-3	= Magnetic, flying leads/threaded connection
-5	= Modulated Carrier, flying leads/threaded connection
-6	= Magnetic, MS connector, 400° C (750° F) max.
-7	= Magnetic, flying leads/threaded connection, 400° C (750° F) max.
-L	= Modulated Carrier, MS connector, 400° C (750° F) max.
-M	= Modulated Carrier, flying leads/threaded connection 400° C (750° F) max.
-8	= Modulated Carrier, MS connector, 11/16" thread, 330 µH coil
-9	= Modulated Carrier, MS connector, 5/8" – 18 thread, 330 µH coil
-Y	= Modulated Carrier, CSA X-Proof
-Z	= Magnetic, CSA X-Proof
T1	= Modulated Carrier w/RTD, MS connector
T2	= Magnetic w/RTD, MS connector
T3	= Magnetic w/RTD, flying leads/threaded connection
T5	= Modulated Carrier w/RTD, flying leads/threaded connection
-X	= Modulated Carrier, I.S. approved, MS connector
SS	= Modulated Carrier, I.S. approved, flying leads/smooth body
XX	= Modulated Carrier, I.S. approved, flying leads/threaded body
-U	= Magnetic, I.S. approved, MS connector
PP	= Magnetic, I.S. approved, flying leads/smooth body
TT	= Magnetic, I.S. approved, flying leads/threaded body
Notes: 1. Maximum temperature rating of pickoffs is 177° C (350° F) unless otherwise noted.	
2. See Amplifier Link literature for amplified pickoff codes.	



Please note:  
Highlighted areas indicate standard base price configuration.

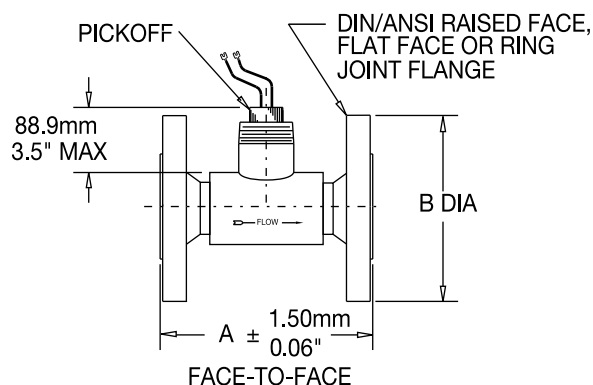
# Dimensions

## AN, NPT & BSP Connections



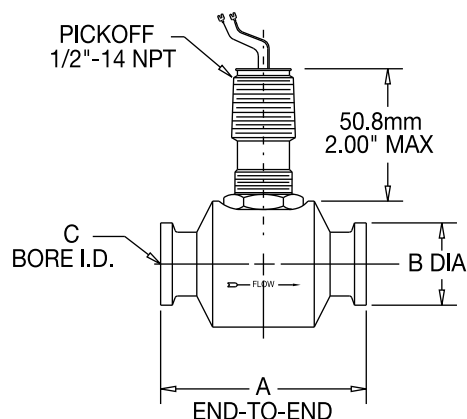
FTO Series flowmeter with internal thread end connectors (AN, NPT & BSP). Pickoff has 2-pin MS connector.

## Flanged Connections



FTO Series flowmeter with flanged end connections. Pickoff is X-proof with flying leads and a 1" NPT spud for electronic enclosure mounting.

## Tri-Clamp Connections



FTO Series flowmeter with Tri-Clamp end fittings. Pickoff is shown with NPT threads and flying leads for mounting electronic enclosures.

TRI-CLAMP END FITTING	"A" DIM.	"B" DIA.	"C" I.D.
T2	82.55mm 3.25"	50.29mm 1.98"	17.27mm .68"
T1	76.20mm 3.00"	24.89mm .98"	17.27mm .68"

ANSI FLANGE SIZE	"A" DIM.	"B" DIA.
1/2" – 150LB	102mm 4.00"	89mm 3.50"
1/2" – 300LB	108mm 4.25"	95mm 3.75"
1/2" – 600LB	118mm 4.63"	95mm 3.75"
1/2" – 900LB	133mm 5.25"	121mm 4.75"
1/2" – 1500LB	133mm 5.25"	121mm 4.75"
1/2" – 2500LB	149mm 5.88"	133mm 5.25"

DIN FLANGE SIZE	"A" DIM.	"B" DIA.
DN20, PN10-PN40	101.6mm 4.00"	105mm 4.13"
DN25, PN64-PN160	117.6mm 4.63"	140mm 5.51"
DN25, PN250	117.6mm 4.63"	150mm 5.90"
DN25, PN400	133.3mm 5.25"	180mm 7.086"
DN40, PN10-PN40	101.6mm 4.00"	150mm 5.905"

Note: DIN flange dimensions per specifications, DIN 2501-1 and DIN EN1092-1.

Blue = Metric (SI) Units

Black = English (US) Units

Specifications are for reference only and are subject to change without notice.

Note: Consult factory for Grayloc end fitting dimensions.

Local Representative:



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