• F-1500 SERIES • INSERTION TURBINE FLOW METER

MADE IN THE USA

Insertion turbine flow meters are ideal for use in larger steam lines where downsizing the line size to improve flow measurement is not desirable. In these applications, the pitch of the turbine rotor is selected to match the expected steam flow velocity range in the pipe. This optimizes the operating range of the flow meter for the application.

DESCRIPTION

The ONICON F-1500 Series Insertion Turbine Flow Meter is a flexible design that delivers accurate, reliable flow measurement in a wide variety of applications. The integral temperature sensor and optional integral pressure sensor allow for direct mass flow measurement in steam and compensated flow measurement in compressed air and gases. A volumetric flow version of the meter is also available for liquid flow applications.

ONICON insertion style turbine meters for steam and gas flow are provided with rotors that are optimized for the expected flow range in the pipe. This makes them ideal for retrofit applications where low flow rates are often the norm. They can also be installed without disrupting flow, and they are priced independent of the pipe size. This makes them very cost effective option.

A version of the F-1500 with temperature and optional pressure compensation is available as a DC loop powered (2-wire) device with analog and pulse outputs. Optional external DC and AC powered versions of the meter are also available. These versions offer additional options for serial communications and additional analog, pulse, frequency and alarm outputs.

APPLICATIONS

- Saturated steam
- Hot water to 450° F (232° C) standard
- 850° F (454° C) optional

Applications with optional pressure sensor

- Superheated steam to 450° F (232° C) standard 850° F (454° C) optional
- Compressed air
- Industrial gases

CALIBRATION

Every ONICON flow meter is wet calibrated in a flow laboratory against standards that are directly traceable to N.I.S.T. A certificate of calibration accompanies every meter.

FEATURES

- Mass flow measurement from a single instrument
- Improved flow operating range when compared to insertion vortex meters
- Interchangable rotors optimize meter performance for the expected flow range
- Integral 1,000 Ω platinum RTD for precise temperature measurement
- Optional integral pressure transducer for accurate pressure readings at the meter location
- DC loop powered operation
- Advanced signal processing algorithms ensure stable flow readings and reject noise
- Easy-to-install meter arrives fully programmed and ready to use
- Optional multi-analog output versions available
- HART® serial communication
- Optional BACnet MS/TP or MODBUS RTU RS485 serial communication

GENERAL SPECIFICATIONS

ACCURACY

Steam and gases (Reynolds Number ≥ 10,000)
Percent of reading accuracy to within:
± 1.5% for steam and gases (volumetric)
± 2.0% for steam and gases (mass)
± 0.1% Volumetric Flow Rate Repeatability
± 0.2% Mass Flow Rate Repeatability

Liquids
± 1.2% for liquids (volumetric)
± 1.5% for liquids (mass)
± 0.1% Volumetric Flow Rate Repeatability
± 0.2% Mass Flow Rate Repeatability

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GENERAL SPECIFICATIONS (cont.)

VELOCITY RANGE
Maximum velocity, liquid: 30 ft/s (9 m/s)
Minimum velocity, liquid: 0.5 ft/s (0.15 m/s)
Maximum velocity, gas or steam: 43 to 205 ft/s (13 to 62 m/s) depending on rotor pitch
Minimum velocity, gas or steam ft/s (m/s): 3.5 to 12 ft/s (1 to 3.7 ms/s) depending on rotor pitch

SENSING METHOD
- Axial mounted rotating turbine utilizing inductive sensing
- Integral 1,000 Ω platinum RTD (optional) provides instantaneous temperature
- Integral pressure transducer (optional) provide instantaneous pressure

OPERATING TEMPERATURE RANGE
Ambient: -40° F (-40° C) to +140° F (+60° C)
Process: -67° F (-55° C) to +450° F (+232° C)
Optional high process temperature range -488° F (-289° C) to +850° F (+454° C)

MAXIMUM OPERATING PRESSURE
≤ Flange rating or 1500 psi (103 bar)

PRESSURE LOSS
Pressure loss varies with meter size and flow rate. Please contact ONICON for detailed information.

CONNECTION TYPE
- NPT threads with packing gland
- 2" ANSI Class 150 Flange with packing gland
- 2" ANSI Class 300 Flange with packing gland

MATERIALS
- Wetted Metal Parts 316L stainless steel
- Electronics Enclosure: Epoxy painted aluminum

INPUT POWER OPTIONS
- Loop Power: 14-36 VDC, 22 mA maximum current
- Optional External DC Power: 18-36 VDC, 300 mA maximum current
- Optional External AC power: 100-240 VAC 50/60 Hz, 5W. maximum power

ENCLOSURE
NEMA 4X (IP66)

DISPLAY
2-line, 16 character alphanumeric LCD with backlighting option. Standard saturated steam display menu provides: Mass Flow Rate, Temperature, Pressure (calculated), Mass Total and Alarms (if active).

Optional remote mount transmitter version available (Standard cable length 50 ft., maximum 150 ft.)

OUTPUT SIGNALS PROVIDED
- DC loop powered version
  Analog Rate: 2-wire, 4-20 mA, 14-36 VDC, maximum loop resistance = RL ≤ ((Vsupply - 12 V) /.020 A)

  Totalization: 2-wire open collector scaled pulse, 50 ms duration, 5-36 VDC and 40 mA / 320 mW maximum

  Frequency: 2-wire open drain FET, 10 kHz maximum frequency, 5-36 VDC and 40 mA / 200 mW maximum

  Digital: HART® serial communications
  Optional backlight connection: Requires external 12-36 VDC power supply, 35 mA maximum current

- Optional DC or AC powered version
  Analog Rate: Up to (3) 2-wire, 4-20 mA, 14-36 VDC, maximum loop resistance = RL ≤ ((Vsupply - 12 V) /.020 A)

  Totalization: (1) 2-wire open collector scaled pulse, 50 ms duration, 5-36 VDC and 40 mA / 320 mW maximum

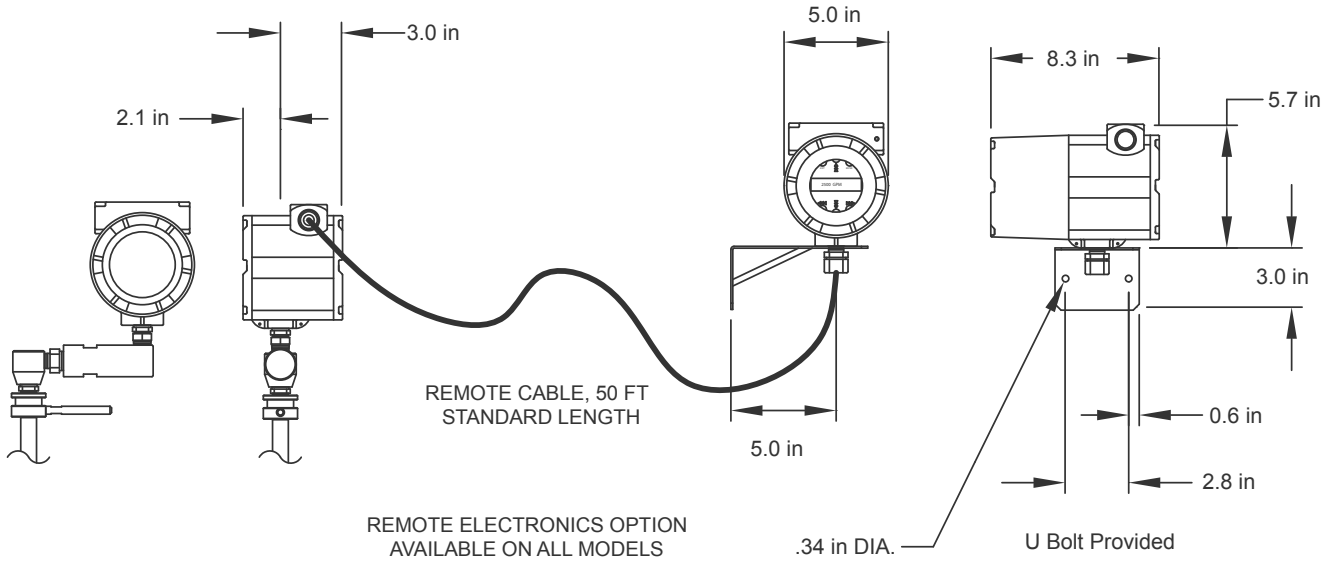
  Frequency: (1) 2-wire open drain FET, 10 kHz maximum frequency, 5-36 VDC and 40 mA / 200 mW maximum

  Alarm: Up to (3) opto-coupled relay alarm outputs
  Digital: HART® serial communications

- Optional on DC or AC powered version BACnet MS/TP or MODBUS RTU RS485 serial communications in place of HART®

Note: Specifications subject to change without notice.

REMOTE MOUNT INSTALLATION DIMENSIONS



FLOW METER OPERATING RANGES

Meter Flow Rates for Saturated Steam

Minimum and Maximum Saturated Steam Flow Rates @ Specific Operating Pressures

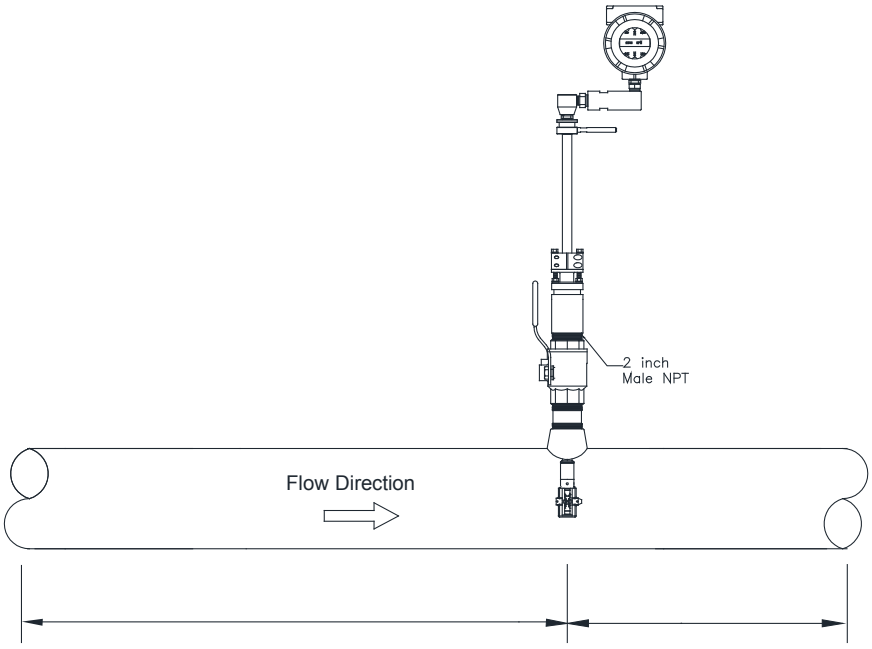
Insertion Meter Flow Rates in lb/hr Nominal Diameter (in), Schedule 40

	Pressure (psig)	5			15			50			75		
Nominal Diameter in inches	Density (lb/ft3)	0.0491			0.0721			0.1496			0.2036		
	Rotor	R10	R25	R40	R10	R25	R40	R10	R25	R40	R10	R25	R40
		lbs/hr											
3"	Minimum	78	32	22	115	47	32	243	99	69	332	136	94
	Maximum	1405	540	287	2073	797	424	4337	1672	890	5922	2284	1217
4"	Minimum	137	56	39	203	83	57	426	174	121	583	239	166
	Maximum	2464	948	504	3635	1399	745	7602	2932	1562	10378	4005	2135
6"	Minimum	323	132	91	478	195	135	1004	411	286	1373	563	391
	Maximum	5790	2230	1187	8539	3291	1753	17847	6891	3673	24355	9410	5018
8"	Minimum	572	233	162	846	346	240	1777	728	506	2429	996	693
	Maximum	10227	3942	2098	15078	5816	3098	31499	12170	6491	42977	16616	8865
10"	Minimum	916	374	260	1354	554	385	2842	1166	810	3885	1595	1109
	Maximum	16342	6302	3357	24089	9298	4955	50305	19447	10375	68622	26546	14169
12"	Minimum	1334	546	378	1971	807	561	4136	1698	1180	5652	2322	1615
	Maximum	23736	9162	4883	34976	13512	7205	72999	28244	15078	99557	38544	20585
14"	Minimum	1640	671	466	2423	993	690	5080	2087	1451	6941	2854	1985
	Maximum	29115	11246	5997	42891	16581	8847	89476	34642	18502	122006	47266	25255
16"	Minimum	2199	901	625	3248	1332	926	6804	2799	1947	9292	3826	2663
	Maximum	38897	15044	8029	57279	22170	11838	119399	46278	24736	162762	63121	33752

	Pressure (psig)	100			150			200			300		
Nominal Diameter in inches	Density (lb/ft3)	0.2569			0.3627			0.4680			0.6791		
	Rotor	R10	R25	R40	R10	R25	R40	R10	R25	R40	R10	R25	R40
		lbs/hr											
3"	Minimum	421	172	119	597	245	170	774	317	220	1129	463	322
	Maximum	7490	2890	1540	10608	4097	2184	13719	5301	2827	19966	7721	4120
4"	Minimum	739	303	210	1049	430	299	1358	557	387	1981	814	566
	Maximum	13123	5068	2702	18583	7181	3830	24028	9290	4957	34961	13528	7222
6"	Minimum	1739	713	496	2468	1013	704	3195	1313	913	4659	1915	1333
	Maximum	30791	11902	6350	43586	16861	8999	56341	21807	11643	81946	31743	16958
8"	Minimum	3075	1262	878	4362	1792	1246	5647	2322	1615	8231	3387	2357
	Maximum	54325	21014	11216	76881	29761	15892	99362	38486	20558	144481	56008	29934
10"	Minimum	4918	2020	1405	6975	2868	1995	9028	3714	2585	13157	5417	3771
	Maximum	86731	33568	17923	122718	47533	25391	158579	61458	32842	230539	89422	47810
12"	Minimum	7153	2941	2046	10141	4173	2904	13123	5403	3761	19119	7878	5486
	Maximum	125807	48732	26034	177963	68985	36871	229926	89178	47681	334180	129717	69392
14"	Minimum	8783	3614	2515	12449	5126	3569	16107	6636	4621	23459	9673	6738
	Maximum	154154	59750	31935	218021	84564	45218	281645	109300	58464	409278	158953	85066
16"	Minimum	11755	4842	3371	16654	6866	4782	21541	8886	6191	31361	12947	9023
	Maximum	205605	79772	42668	290706	112863	60393	375467	145841	78064	545477	212020	113540

STRAIGHT PIPE RUN

Typical Installation



Minimum Upstream Straight Pipe Run Requirements		
Upstream Obstructions	**Straight pipe run without flow straightener**	**Straight pipe run with flow straightener**
Single Bend Preceded by ≥ 9D of Straight Pipe	10D	5D
1 Step Pipe Reduction in Straight Pipe	10D	8D
Two Bends in Plane Separated by ≤ 9D of Straight Pipe	15D	11D
Two Bends Out of Plane	30D	12D
Inflowing Tee	25D	15D
Fully Open Gate/Butterfly Valve	25D	15D
Control Valve	30D	13D

FLOW METER OPERATING RANGES (CONT.)

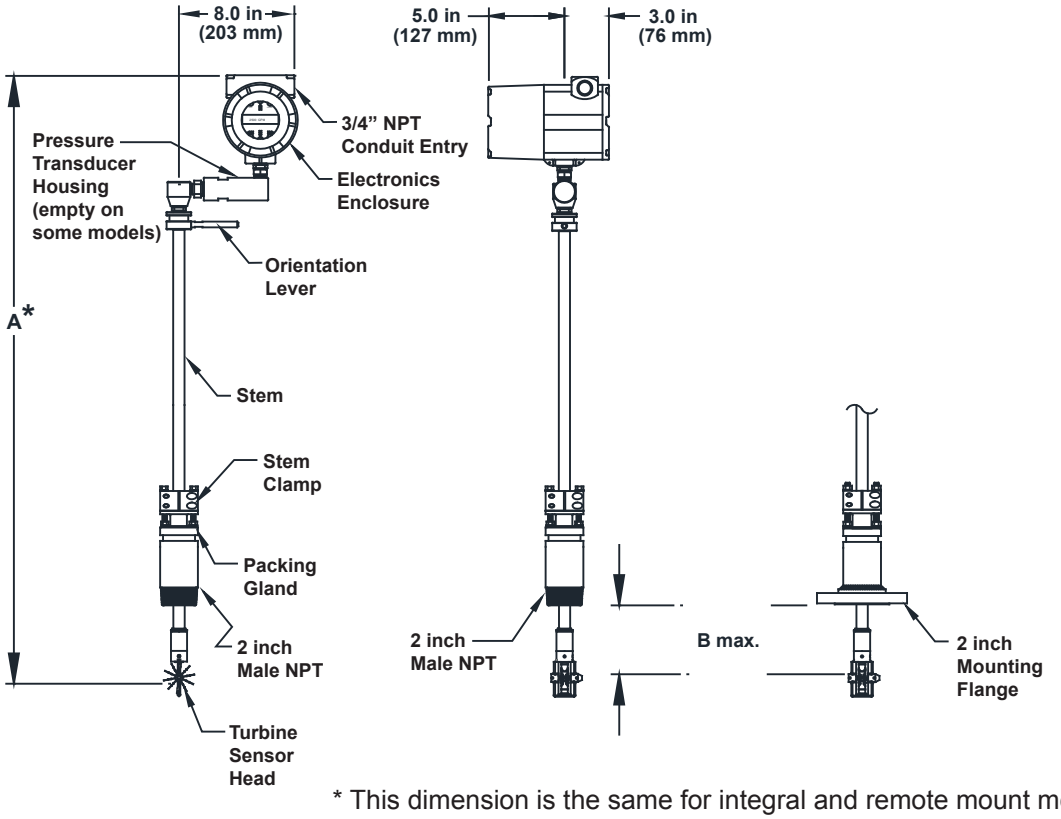
Flow Meter Rates for Water

Water Minimum and Maximum Flow Rates							
Rate	**Nominal Pipe Size**						
	2	3	6	8	12	16	24
GPM Min	5	12	54	109	247	386	877
GPM Max	314	691	2701	4678	10575	16524	37950

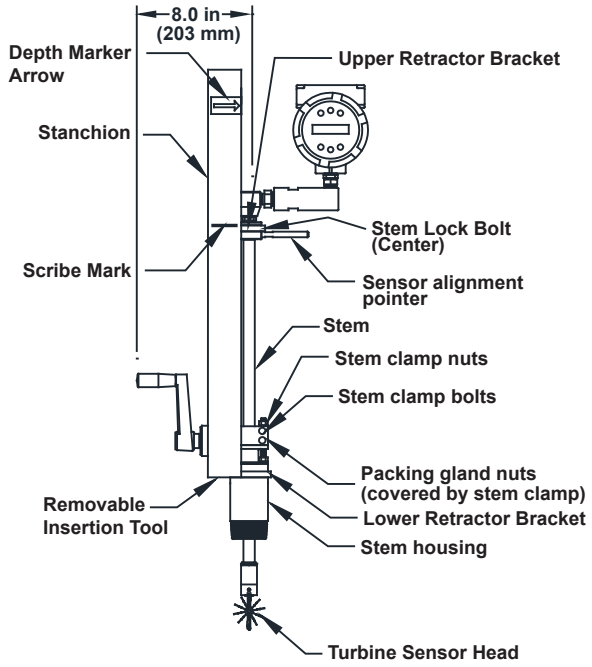
AVAILABLE PRESSURE TRANSDUCERS

Full Scale Operating Pressure	Maximum Overrange Pressure
PSIa	PSIa
30	60
100	200
300	600
500	1000
1500	2500

Retractor Required for Applications Over 50 PSIG



* This dimension is the same for integral and remote mount meters.



Mounting Option in (mm)	Standard Length		Extended Length	
	A	B	A	B
Male NPT	40.0 (1016)	20.7 (526)	52.0 (1321)	32.7 (831)
ANSI Class 150 Flange	40.0 (1016)	20.3 (516)	52.0 (1321)	32.3 (820)
ANSI Class 300 Flange	40.0 (1016)	20.3 (516)	52.0 (1321)	33.1 (841)

APPROXIMATE WEIGHT, LB (KG)

	SL	EL
NPT	16 (7.1)	17 (7.6)
Class 150	21 (9.4)	22 (9.9)
Class 300	25 (11.3)	26 (11.8)

Add 11 LB (5 KG) for remote electronics

Add 9 LB (4.1 KG) for retractor

F-1500 SERIES ORDERING INFORMATION

Insertion Turbine Meter Codification = F-1500-ABCD-EFGH

A = Connection Type
0 = 2" Male NPT threads with retractor
1 = 2" ANSI class 150 flange with retractor
3 = 2" ANSI class 300 flange with retractor
6 = 2" ANSI class 600 flange with retractor
7 = 2" Male NPT threads without retractor (≤50psig maximum pressure)
8 = 2" ANSI class 150 flange without retractor (≤50psig maximum pressure)
9 = 2" ANSI class 300 flange without retractor (≤50psig maximum pressure)

B = Integral or Remote Mount Transmitter
1 = Integral Mount
2 = Remote Mount

C = Temperature / Pressure Compensation
0 = Integral temperature compensation
1 = Integral temperature & pressure sensor, 30 psia maximum
2 = Integral temperature & pressure sensor, 100 psia maximum
3 = Integral temperature & pressure sensor, 300 psia maximum
4 = Integral temperature & pressure sensor, 500 psia maximum
9 = None

D = Rotor Type (nominal range)
0 = Liquid
1 = 3.5 to 43 ft/sec (steam or gas)
2 = 4.0 to 62.5 ft/sec (steam or gas)
3 = 5.0 to 80 ft/sec (steam or gas)
4 = 7.0 to 100 ft/sec (steam or gas)
5 = 8.5 to 134.6 ft/sec (steam or gas)
6 = 12.0 to 205 ft/sec (steam or gas)

E = Input Power
0 = Loop powered (Only available with Output Signals option F=0)
1 = External 12-36 VDC powered
2 = External 85-240 VAC powered

F = Output Signals
0 = 4-20mA output*, pulse output & frequency output
1 = 4-20mA output, pulse output & frequency output, alarm output & MODBUS
2 = 4-20mA output, pulse output & frequency output, alarm output & BACnet
3 = (3) 4-20mA outputs, (3) alarm outputs, (1) pulse output (1) frequency output & MODBUS
4 = (3) 4-20mA outputs, (3) alarm outputs, (1) pulse output (1) frequency output & BACnet
5 = (3) 4-20mA outputs*, (3) alarm outputs, (1) pulse output (1) frequency output
6 = 4-20mA output*, pulse output & frequency output, alarm output

G = Maximum Operating Temperature
0 = 450° F
1 = 850° F

H = Energy Meter
0 = None
1 = Gross energy meter
2 = Net energy meter (requires additional remote temperature sensor.)

* Available with HART® serial communications

REMOTE TEMPERATURE SENSOR AND THERMOWELL INSTALLATION KIT

(Required for Net Energy Meter)

Part Number	Description
20100	Remote Temperature Sensor, 1,000 Ohm 4-wire Class A Platinum RTD
20101	Remote Thermowell Kit for 1½" Welded Steel Pipe
20102	Remote Thermowell Kit for 2 - 5" Welded Steel Pipe
20103	Remote Thermowell Kit for 6 - 14" Welded Steel Pipe

Note: Net energy meter requires 1 temperature sensor and 1 thermowell installation kit sized to pipe.