

# Daniel™ SeniorSonic™ 3414

## Four-Path Gas Ultrasonic Flow Meter





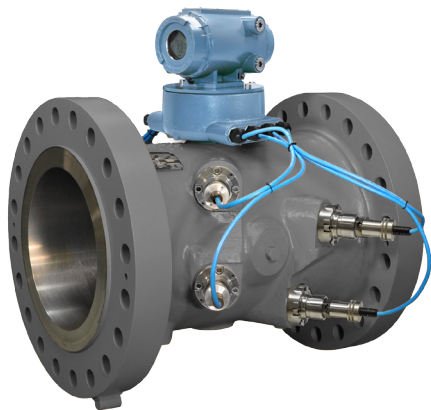
# SeniorSonic 3414 Gas Ultrasonic Flow Meter

## Intelligent Measurement Technology

Engineered for custody transfer applications, the new Daniel SeniorSonic 3414 Four-Path Gas Ultrasonic Flow Meter offers high accuracy and reliable, long-term performance to minimize lost and unaccounted for natural gas. The advanced meter is available in 100 to 1067-mm (4 to 42-in)<sup>(1)</sup> line sizes and offers bi-directional flow capabilities, increased flow capacity and no incremental pressure drop to reduce measurement risk and minimize operating costs.

Powerful next-generation Daniel 3410 Series Electronics work with the SeniorSonic 3414 meter to significantly increase the sampling rate and provide high-volume data capture, including extensive hourly and daily logs. The streamlined electronics feature a plug-in ready, integrated CPU and I/O board assembly and a local LED display (optional) to increase reliability, simplify maintenance and facilitate future expansion. Operators can also easily monitor and troubleshoot the meters in real time from a PC or laptop. Daniel MeterLink™ Diagnostics Software is an intuitive user interface that provides critical information, including expert flow analysis, flow disturbance alerts and suggested corrective actions, to enhance reliability and improve functionality.

The SeniorSonic 3414 meter is also supplied with rugged Daniel T-20 Series Transducers that ensure reliable measurement in harsh environments where wet, rich and/or dirty gas is present. For low pressure conditions, T-32 Transducers are recommended to extend the meter's lower operating pressure limit down to 0 kPag (0 psig). The transducers are engineered to simplify servicing and maximize meter uptime.



**Figure 1: Daniel SeniorSonic 3414 Gas Ultrasonic Flow Meter**

## Typical Application

- Custody transfer for natural gas transmission lines

## Application Sites

- Power plants – inlets
- Gas processing plants – inlets/outlets
- Underground storage sites – inlets/outlets
- Gas production – onshore/offshore
- City gate stations – receipt/delivery points

## Features and Benefits

- Four-path chordal design allows accuracy, stability, redundancy and operational cost savings
- Excellent long-term performance reduces maintenance costs
- High rangeability of >100:1 ensures fewer meter runs, smaller line sizes and lower capital costs
- Cast or forged body construction minimizes measurement uncertainty caused by pressure changes
- Extractable Daniel T-20 Series and T-32 Transducers offer ease of inspection, cleaning and/or replacement; field replaceable transformer module
- 3410 Series Electronics provide fast sampling, an expandable electronics platform and an archive data log containing pressure, temperature and gas composition information which allows the meter to act as a redundant flow computer
- 3410 Series Electronics calculate corrected volume rates, mass rates and energy rates
- 3410 Series Electronics calculate AGA 10 speed of sound from pressure, temperature and gas composition data<sup>(2)</sup>
- Local LED display (optional) with up to nine user-selectable scrolling variables
- Daniel MeterLink Diagnostics Software allows access to expert flow analysis and provides an intuitive view of meter health; calibration cycles can be extended to minimize operating and maintenance costs<sup>(2)</sup>
- Predictive diagnostics allow plant personnel to quickly detect and respond to abnormal situations to avoid process upsets and unscheduled downtime
- The Daniel SeniorSonic 3414 meter is part of Emerson's broad range of intelligent field devices that power the PlantWeb® digital plant architecture

(1) Consult factory on meter sizes above 900 mm (36 in).

(2) Requires a Continuous Flow Analysis software key.

# Standard Specifications

Please consult Daniel if requirements are outside of the listed specifications. Improved performance for other product and material offerings may be available depending on the application.

## Meter Specifications

### Characteristics

- Four-path (eight transducer) chordal design

### Meter Performance

- Flow calibrated accuracy is  $\pm 0.1\%$  of reading relative to lab over entire flow calibration range
- Repeatability is  $\pm 0.05\%$  of reading for 1.5 to 30.5 m/s (5 to 100 ft/s)

### Velocity Range

- Nominal 0 to 30 m/s (0 to 100 fps) with over-range performance exceeding 38 m/s (125 fp/s) on some sizes
- Meter meets or exceeds AGA 9 2007 Edition / ISO 17089 performance specifications

**Table 1A: AGA 9 / ISO 17089 Flow Rate Values  
(Metric Units)**

Meter Size (mm)	100 to 600	750	900
$q_{min}$ (m/s)	0.61	0.61	0.61
$q_t$ (m/s)	3.048	2.591	2.29
$q_{max}$ (m/s)	30.48	25.91	22.86

**Table 1B: AGA 9 / ISO 17089 Flow Rate Values  
(US Customary Units)**

Meter Size (in)	4 to 24	30	36
$q_{min}$ (ft/s)	2	2	2
$q_t$ (ft/s)	10	8.5	7.5
$q_{max}$ (ft/s)	100	85	75

## Electronics Performance

### Power

- 10.4 VDC to 36 VDC
- 8 watts typical; 15 watts maximum

## Mechanical Ratings

### Line Sizes

- 100 to 1050 mm (4 to 42 in)<sup>(1)</sup>
- 100 to 150 mm (4 to 6 in) are 45° dual X orientation
- 200 mm (8 in) and larger are British Gas (BG) orientation

### Operating Gas Temperature (Transducers)

- T-21: -20°C to +100°C (-4°F to +212°F)
- T-22/T-32: -50°C to +100°C (-58°F to +212°F)

### Operating Pressure Range (Transducers)

- T-21/T-22: 689 to 27,579 kPa (100 to 4,000 psig)
- T-32: 0 to 27,579 kPa (0 to 4,000 psig)<sup>(2)</sup>
- T-21/T-22: 345 kPa (50 psig) available with reduced  $Q_{max}$ <sup>(3)</sup>

### Flanges

- Raised Face and Ring Type Joint (RTJ) for PN 50 to 420 (ANSI Classes 300 to 2,500)
- Compact flanges and hub end connectors (optional)

### NACE, NORSOK and PED Compliance

- Designed for NACE compliance<sup>(4)</sup>
- NORSOK available upon request
- PED available upon request

## Electronics Ratings

### Operating Temperature

- 40°C to +60°C (-40°F to +140°F)

### Operating Relative Humidity

- Up to 95% non-condensing

### Storage Temperature

- 40°C to +85°C (-40°F to +185°F) with a low temperature storage limit of -20°C (-4°F) for T-21 transducers and -50°C (-58°F) for T-22/T-32 transducers

### Electronic Housing Options

- Integral mount (standard)
- Remote mount (optional) with 4.6 m (15 ft) cable
  - Required for process temperature above +60°C (+140°F)

(1) Consult factory on meter sizes above 900 mm (36 in).

(2) T-32 Transducers available for 100-mm to 400-mm (4-in to 12-in) meter sizes only.

(3) Refer to page 9 for additional information pertaining to operation limits.

(4) It is the equipment user's responsibility to select the materials suitable for the intended services.

# Materials of Construction

## Material Specifications

### Body and Flange

#### Cast

- ASTM A352 Gr LCC Carbon Steel<sup>(1)</sup>  
-46°C to +150°C (-50°F to +302°F)
- ASTM A351 Gr CF8M 316 Stainless Steel  
-46°C to +150°C (-50°F to +302°F)
- ASTM A351 Gr CF8M 316L Stainless Steel  
-46°C to +150°C (-50°F to +302°F)
- ASTM A995 Gr 4A Duplex Stainless Steel<sup>(2)</sup>  
-50°C to +150°C (-58°F to +302°F)

#### Forgings

- ASTM A350 Gr LF2 Carbon Steel<sup>(1)</sup>  
-46°C to +150°C (-50°F to +302°F)
- ASTM A182 Gr F316 Stainless Steel  
-46°C to +150°C (-50°F to +302°F)
- ASTM A182 Gr F316L Stainless Steel  
-46°C to +150°C (-50°F to +302°F)
- ASTM A182 Gr F51 Duplex Stainless Steel<sup>(2)</sup>  
-50°C to +150°C (-58°F to +302°F)
- ASTM A105 Carbon Steel  
-29°C to +150°C (-20°F to +302°F)

### Enclosure Housing

- ASTM B26 Gr A356.0 T6 Aluminum
- ASTM A351 Gr CF8M Stainless Steel

### Transducer Components

#### Transducer Mounts and Holders O-rings

- Standard: Nitrile Butadiene Rubber (NBR)
- Other materials available

#### Transducer Mounts and Holders

- ASTM A564 Type 630 Stainless Steel Mounts
- ASTM A479 316L Stainless Steel Holders
- INCONEL® ASTM B446 (UNS N06625) Gr 1 Mount (optional)
- INCONEL ASTM B446 (UNS N06625) Gr 1 Holder (optional)

## Paint Specifications

### Body and Flange Exterior

#### Carbon Steel Body Material

- 2 coat paint; inorganic zinc primer and acrylic lacquer topcoat (standard)

#### Stainless Steel or Duplex Body Material

- Paint (optional)

### Enclosure Housing

#### Aluminum Material

- 100% conversion coated and exterior coated with a polyurethane enamel

#### Stainless Steel Material

- Passivated

**Table 2A: Body and Flange Maximum Pressure Ratings by Construction Materials**  
[bar Meter Sizes 100 to 1050 mm]<sup>(3)</sup>

PN	Cast Carbon Steel	Forged Carbon Steel	Cast 316 SS, 316L SS, Forged 316 SS	Forged 316L SS	Duplex SS
50	51.7	51.1	49.6	41.4	51.7
100	103.4	102.1	99.3	82.7	103.4
150	155.1	153.2	148.9	124.1	155.1
200	258.6	255.3	248.2	206.8	258.6
250	430.9	425.5	413.7	344.7	430.9

**Table 2B: Body and Flange Maximum Pressure Ratings by Construction Materials**  
[psi Meter Sizes 4 to 42 in]<sup>(3)</sup>

ANSI Class <sup>(4)</sup>	Cast Carbon Steel	Forged Carbon Steel	Cast 316 SS, 316L SS, Forged 316 SS	Forged 316L SS	Duplex SS
300	750	740	720	600	750
600	1,500	1,480	1,440	1,200	1,500
900	2,250	2,220	2,160	1,800	2,250
1,500	3,750	3,705	3,600	3,000	3,750
2,500	6,250	6,170	6,000	5,000	6,250

(1) Impact tested per specified ASTM standard.

(2) A995 4A material is not yet approved in Canada.

(3) Pressure rating information is for -29°C to +38°C (-20°F to +100°F). Other temperatures may reduce the maximum pressure rating of the materials.

## Meter Sizing: Metric Units

Tables 3A and 3B can be used to determine the flow range at reference conditions for all meter sizes. All calculations are based on Schedule 40 bore, +15°C and typical gas composition (AGA 8 Amarillo). These values are intended to be a guide in sizing.

### Calculating Meter Capacity

To calculate a volume rate for a given velocity, first find the capacity (flow rate) in table 3A for the meter size and operating pressure. Next, multiply the capacity by the ratio of the desired velocity divided by 30.5 m/s to obtain the desired volume rate.

Example: Determine the hourly flow rate at 21 m/s for a 200 mm meter operating at 4,500 kPag.

$$\text{Flow Rate} = 178 \text{ MSCMH} \quad \text{Velocity} = 21 \text{ m/s} \quad \text{Answer} = \frac{178 \text{ MSCMH} \times 21 \text{ m/s}}{30.5 \text{ m/s}} = 122.6 \text{ MSCMH}$$

Table 3A: Flow Rates (MSCMH)												
Based Upon Max Rated Velocity [100 to 600 mm = 30.5 m/s] [750 mm = 25.9 m/s] [900 mm = 22.9 m/s]												
Meter Size (DN)	100	150	200	250	300	400	450	500	600	750	900	
Operating Pressure (kPag)	1,000	10	23	39	62	88	139	175	218	315	432	550
	1,500	15	33	58	91	129	204	258	320	463	635	809
	2,000	19	44	77	121	171	270	342	425	615	843	1,074
	2,500	24	55	96	151	214	339	429	533	770	1,056	1,345
	3,000	29	67	116	182	259	408	517	642	929	1,274	1,622
	3,500	35	78	136	214	304	480	607	754	1,091	1,496	1,905
	4,000	40	90	156	247	350	553	700	869	1,257	1,724	2,195
	4,500	45	103	178	280	397	627	794	987	1,427	1,957	2,491
	5,000	51	115	199	314	446	704	891	1,107	1,600	2,195	2,794
	5,500	56	128	221	349	495	781	989	1,229	1,778	2,438	3,104
	6,000	62	141	244	384	545	861	1,090	1,354	1,959	2,686	3,420
	6,500	68	154	267	420	597	942	1,193	1,482	2,143	2,939	3,742
	7,000	74	168	290	457	649	1,025	1,297	1,612	2,331	3,197	4,071
	7,500	80	181	314	495	702	1,109	1,404	1,744	2,523	3,460	4,405
	8,000	86	195	338	533	757	1,195	1,512	1,879	2,718	3,727	4,745
	8,500	92	209	363	572	812	1,281	1,622	2,015	2,915	3,997	5,090
9,000	99	224	388	611	867	1,369	1,733	2,154	3,115	4,272	5,439	
9,500	105	238	413	651	924	1,458	1,846	2,294	3,318	4,550	5,793	
10,000	112	253	438	691	981	1,548	1,960	2,435	3,522	4,830	6,149	

Table 3B: Flow Rates (MMSCMD)												
Based Upon Max Rated Velocity [100 to 600 mm = 30.5 m/s] [750 mm = 25.9 m/s] [900 mm = 22.9 m/s]												
Meter Size (DN)	100	150	200	250	300	400	450	500	600	750	900	
Operating Pressure (kPag)	1,000	0.240	0.544	0.941	1.484	2.106	3.325	4.208	5.229	7.563	10.372	13.205
	1,500	0.352	0.799	1.384	2.182	3.097	4.889	6.188	7.690	11.122	15.251	19.418
	2,000	0.467	1.061	1.837	2.895	4.110	6.489	8.213	10.206	14.761	20.242	25.773
	2,500	0.585	1.328	2.300	3.626	5.147	8.126	10.285	12.780	18.485	25.348	32.273
	3,000	0.706	1.602	2.774	4.373	6.207	9.800	12.404	15.414	22.293	30.571	38.923
	3,500	0.829	1.882	3.259	5.137	7.292	11.512	14.572	18.107	26.189	35.914	45.725
	4,000	0.956	2.168	3.755	5.919	8.401	13.264	16.789	20.862	30.174	41.378	52.682
	4,500	1.085	2.461	4.262	6.718	9.536	15.055	19.056	23.679	34.248	46.964	59.795
	5,000	1.216	2.760	4.780	7.535	10.695	16.885	21.373	26.558	38.412	52.674	67.065
	5,500	1.351	3.066	5.309	8.369	11.880	18.755	23.740	29.499	42.665	58.508	74.492
	6,000	1.489	3.378	5.850	9.221	13.089	20.664	26.156	32.502	47.009	64.463	82.075
	6,500	1.629	3.697	6.401	10.090	14.322	22.612	28.621	35.565	51.439	70.538	89.810
	7,000	1.772	4.021	6.963	10.975	15.579	24.596	31.133	38.686	55.953	76.729	97.692
	7,500	1.917	4.351	7.535	11.877	16.859	26.616	33.690	41.863	60.549	83.031	105.716
	8,000	2.065	4.687	8.116	12.793	18.160	28.670	36.290	45.094	65.221	89.438	113.873
	8,500	2.215	5.028	8.706	13.723	19.480	30.754	38.928	48.372	69.962	95.940	122.151
9,000	2.368	5.373	9.304	14.666	20.818	32.866	41.601	51.694	74.766	102.528	130.539	
9,500	2.521	5.722	9.909	15.619	22.170	35.002	44.304	55.053	79.625	109.190	139.021	
10,000	2.677	6.075	10.519	16.580	23.535	37.157	47.032	58.442	84.527	115.913	147.581	

## Meter Sizing: US Customary Units

Tables 4A and 4B can be used to determine the flow range at reference conditions for all meter sizes. All calculations are based on Schedule 40 bore, +60°F and typical gas composition (AGA 8 Amarillo). These values are intended to be a guide in sizing.

### Calculating Meter Capacity

To calculate a volume rate for a given velocity, first find the capacity (flow rate) in table 4A for the meter size and operating pressure. Next, multiply the capacity by the ratio of the desired velocity divided by 100 ft/s to obtain the desired volume rate.

Example: Determine the hourly flow rate at 70 ft/s for an 8-inch meter operating at 800 psig.

$$\text{Flow Rate} = 7,842 \text{ MSCFH} \quad \text{Velocity} = 70 \text{ ft/s} \quad \text{Answer} = \frac{7,842 \text{ MSCFH} \times 70 \text{ ft/s}}{100 \text{ ft/s}} = 5,489.4 \text{ MSCFH}$$

**Table 4A: Flow Rates (MSCFH)**  
Based Upon Max Rated Velocity [4 to 24 in = 100 ft/s] [30 in = 85 ft/s] [36 in = 75 ft/s]

Meter Size (in)	4	6	8	10	12	16	18	20	24	30	36
100	252	571	989	1,559	2,213	3,494	4,423	5,495	7,948	10,910	13,862
200	478	1,086	1,880	2,963	4,207	6,641	8,406	10,446	15,108	20,738	26,349
300	712	1,616	2,799	4,412	6,263	9,888	12,515	15,552	22,493	30,875	39,229
400	954	2,164	3,747	5,906	8,384	13,236	16,754	20,819	30,111	41,331	52,515
500	1,202	2,729	4,725	7,448	10,572	16,690	21,126	26,251	37,968	52,117	66,219
600	1,459	3,311	5,733	9,037	12,828	20,252	25,635	31,854	46,071	63,239	80,350
700	1,723	3,911	6,772	10,675	15,153	23,923	30,281	37,627	54,422	74,701	94,914
800	1,996	4,529	7,842	12,362	17,547	27,703	35,065	43,572	63,020	86,504	109,910
900	2,276	5,165	8,943	14,096	20,009	31,590	39,986	49,686	71,863	98,642	125,333
1,000	2,563	5,817	10,073	15,877	22,537	35,581	45,038	55,964	80,943	111,105	141,169
1,100	2,858	6,486	11,231	17,702	25,128	39,671	50,214	62,396	90,246	123,875	157,394
1,200	3,159	7,169	12,414	19,567	27,774	43,850	55,504	68,969	99,752	136,923	173,973
1,300	3,466	7,865	13,619	21,467	30,471	48,107	60,893	75,665	109,437	150,217	190,865
1,400	3,777	8,571	14,842	23,395	33,208	52,428	66,362	82,462	119,267	163,711	208,009
1,500	4,092	9,285	16,079	25,344	35,975	56,797	71,892	89,333	129,205	177,352	225,341
1,600	4,408	10,004	17,323	27,306	38,760	61,193	77,456	96,247	139,205	191,079	242,782
1,700	4,725	10,724	18,570	29,270	41,548	65,595	83,029	103,172	149,221	204,826	260,250
1,800	5,041	11,441	19,811	31,227	44,326	69,981	88,580	110,069	159,197	218,520	277,649
1,900	5,354	12,151	21,041	33,166	47,079	74,327	94,081	116,905	169,083	232,090	294,891
2,000	5,663	12,852	22,255	35,079	49,793	78,612	99,505	123,645	178,832	245,472	311,894

**Table 4B: Flow Rates (MMSCFD)**  
Based Upon Max Rated Velocity [4 to 24 in = 100 ft/s] [30 in = 85 ft/s] [36 in = 75 ft/s]

Meter Size (in)	4	6	8	10	12	16	18	20	24	30	36
100	6.0	13.7	23.7	37.4	53.1	83.9	106.1	131.9	190.8	261.8	332.7
200	11.5	26.1	45.1	71.1	101.0	159.4	201.8	250.7	362.6	497.7	632.4
300	17.1	38.8	67.2	105.9	150.3	237.3	300.4	373.2	539.8	741.0	941.5
400	22.9	51.9	89.9	141.8	201.2	317.7	402.1	499.6	722.7	991.9	1,260.4
500	28.9	65.5	113.4	178.7	253.7	400.6	507.0	630.0	911.2	1,250.8	1,589.3
600	35.0	79.5	137.6	216.9	307.9	486.1	615.2	764.5	1,105.7	1,517.7	1,928.4
700	41.4	93.9	162.5	256.2	363.7	574.2	726.7	903.1	1,306.1	1,792.8	2,277.9
800	47.9	108.7	188.2	296.7	421.1	664.9	841.6	1,045.7	1,512.5	2,076.1	2,637.8
900	54.6	123.9	214.6	338.3	480.2	758.2	959.7	1,192.5	1,724.7	2,367.4	3,008.0
1,000	61.5	139.6	241.7	381.1	540.9	854.0	1,080.9	1,343.1	1,942.6	2,666.5	3,388.1
1,100	68.6	155.7	269.5	424.8	603.1	952.1	1,205.1	1,497.5	2,165.9	2,973.0	3,777.5
1,200	75.8	172.1	297.9	469.6	666.6	1,052.4	1,332.1	1,655.3	2,394.0	3,286.2	4,175.4
1,300	83.2	188.8	326.9	515.2	731.3	1,154.6	1,461.4	1,816.0	2,626.5	3,605.2	4,580.7
1,400	90.6	205.7	356.2	561.5	797.0	1,258.3	1,592.7	1,979.1	2,862.4	3,929.1	4,992.2
1,500	98.2	222.9	385.9	608.3	863.4	1,363.1	1,725.4	2,144.0	3,100.9	4,256.4	5,408.2
1,600	105.8	240.1	415.8	655.3	930.2	1,468.6	1,858.9	2,309.9	3,340.9	4,585.9	5,826.8
1,700	113.4	257.4	445.7	702.5	997.2	1,574.3	1,992.7	2,476.1	3,581.3	4,915.8	6,246.0
1,800	121.0	274.6	475.5	749.5	1,063.8	1,679.5	2,125.9	2,641.7	3,820.7	5,244.5	6,663.6
1,900	128.5	291.6	505.0	796.0	1,129.9	1,783.8	2,257.9	2,805.7	4,058.0	5,570.2	7,077.4
2,000	135.9	308.4	534.1	841.9	1,195.0	1,886.7	2,388.1	2,967.5	4,292.0	5,891.3	7,485.5

## Local LCD Display

The 3410 Series Electronics offer an optional local LCD display that utilizes three lines to indicate the variable name, variable value and engineering units. The local display configuration is supported via MeterLink software or the handheld Fisher AMS 475 Field Communicator utilizing the HART interface protocol.



Figure 2: Local LCD display.

The local display shows up to 10 items which are user selectable from 26 variables. The display can be configured to scale volume units as actual or 000's, with an adjustable time base of seconds, hours or days. The scroll rate can be adjusted from 1 to 100 seconds (default 5 seconds).

Table 5: User Selectable Display Variables	
Variables	Description
Volumetric Flow Rate	Uncorrected (actual) Corrected (standard or normal)
Average Flow Velocity	(no description necessary)
Average Speed of Sound	(no description necessary)
Pressure	Flowing, if utilized
Temperature	Flowing, if utilized
Frequency Output	1A, 1B, 2A or 2B
Frequency Output K-factor	Channel 1 or 2
Analog Output	1 or 2
Current Day's Volume Totals	Uncorrected or Corrected (forward or reverse)
Previous Day's Volume Totals	Uncorrected or Corrected (forward or reverse)
Total Volume Totals (non-reset)	Uncorrected or Corrected (forward or reverse)

## Input/Output

Table 6: CPU Module I/O Connections			
	I/O Connection Type	Qty	Description
<b>Communication</b>			
<b>Serial Communications</b>	Serial RS232/RS485 Port	1	<ul style="list-style-type: none"> <li>Modbus RTU/ASCII</li> <li>115 kbps baud rate</li> <li>RS232/RS485 Full Duplex</li> <li>RS485 Half Duplex</li> </ul>
	Ethernet Port (TCP/IP) 100BaseT	1	<ul style="list-style-type: none"> <li>Modbus TCP</li> </ul>
<b>Digital and Analog Inputs</b>			
<b>Digital Input<sup>(1)</sup></b>	Contact Closure	1	<ul style="list-style-type: none"> <li>Status</li> <li>Single polarity</li> </ul>
<b>Analog Inputs<sup>(2)</sup></b>	4-20 mA	2	<ul style="list-style-type: none"> <li>AI-1 Temperature<sup>(3)</sup></li> <li>AI-2 Pressure<sup>(3)</sup></li> </ul>
<b>Digital, Analog and Frequency Outputs</b>			
<b>Frequency/Digital Outputs</b>	TTL/Open Collector	3	<ul style="list-style-type: none"> <li>User Configurable</li> </ul>
<b>Analog Outputs<sup>(2, 4)</sup></b>	4-20 mA	2	<ul style="list-style-type: none"> <li>Independently configurable analog outputs</li> <li>HART<sup>®</sup> 7 Compliant, consult factory for HART 5</li> </ul>

Note: Maximum wire gauge is 18 AWG.

(1) The analog-to-digital conversion accuracy is within  $\pm 0.05\%$  of full scale over the operating temperature range.

(2) A 24 volt DC power supply is available to provide power to the sensors.

(3) AI-1 and AI-2 are electronically isolated and operate in sink mode. The input contains a series resistance for HART<sup>®</sup> Communicators to be connected for sensor configuration.

(4) The analog output zero scale offset error is within  $\pm 0.1\%$  of full scale and gain error is within  $\pm 0.2\%$  of full scale. The total output drift is within  $\pm 50$  ppm of full scale per  $^{\circ}\text{C}$ .



# Meter Software

## Daniel MeterLink Overview

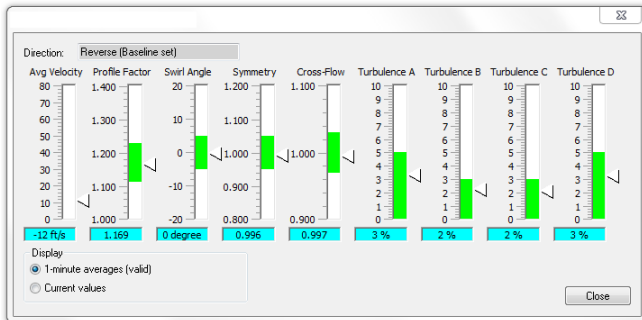


Figure 3A: MeterLink Baseline Viewer

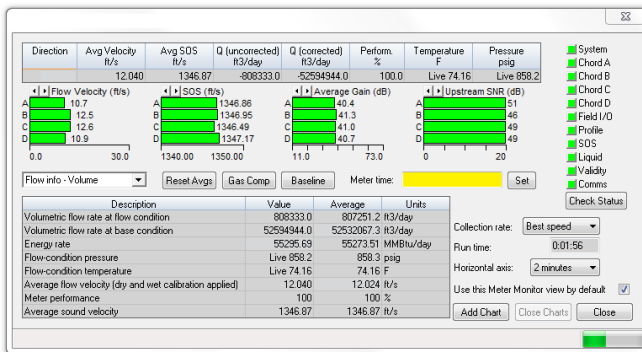


Figure 3B: MeterLink Monitor Screen

Innovative Daniel MeterLink software gives users access to extensive diagnostic information, presented in an intuitive graphical format that takes complexity out of your flow measurement.

This critical information will empower your staff to work predictively instead of reactively.

- MeterLink software is supplied with meter at no charge
- MeterLink is required for transmitter configuration
- MeterLink software requires RS-232, RS-485 full duplex or Ethernet (recommended)
- Supports Microsoft® Windows XP, 7 and 8 as well as Microsoft® Excel® 2000 or later

### PlantWeb

- Meters also configurable with AMS™ Device Manager or 375 / 475 Field Communicator if HART is used

		Table 7: MeterLink Features <sup>(1)</sup>	
		With Continuous Flow Analysis Feature	Without Continuous Flow Analysis Feature
Operation	Monitor Screen	●	●
	Chart Diagnostic Data	●	●
	Multiple Charts	●	●
	Charts with Green Limit Bands	●	●
	View Waveforms	●	●
	AGA 10 Calculator	●	●
	Display SNR in dB	●	●
	Improved Help Topics / Links	●	●
	Baseline Viewer™	●	●
	Maintenance Logs	●	●
History	Trend Maintenance Logs	●	●
	Hourly / Daily Log Graphing	●	●
Configuration	Field Setup Wizard	●	●
	Meter Directory Support	●	●
	Automatic File Naming	●	●
	Compare Configurations from Logs	●	●
	Analog Input Calibration	●	●
	Flow Calibration Wizard	●	●
	Modbus TCP Server Configuration	●	●
Alarms	Baseline Configuration Wizard	●	●
	Local Display Setup	●	●
	Alarm/Audit Logs	●	●
	Display New Latched Alarms	●	●
	Severity Alarm Display	●	●
	Bore Build-up Alert	●	●
	Blockage Alert	●	●
	Abnormal Profile Alert	●	●
	Liquid Detection Alert	●	●
	SOS Deviation Alert	●	●
Reverse Flow Detection Alert	●	●	

(1) MeterLink does not support Mark II Gas Ultrasonic Meters.

## Safety and Compliance


The Daniel SeniorSonic 3414 gas ultrasonic flow meter meets worldwide industry standards for electrical and intrinsic safety certifications and approvals. Consult Daniel for a complete list of agencies and certifications.

### Safety Classifications

#### Underwriters Laboratories (UL / cUL)

- Hazardous Locations — Class I, Division 1, Groups C and D

#### CE Marked to Directives

- Explosive Atmospheres (ATEX)
- Certificate — Demko II ATEX 1006133X
- Marking —  II 2G Ex d ia IIB T4 Gb  
(-40°C ≤ T ≤ +60°C)
- Pressure Equipment Directive (PED)
- Electromagnetic Compatibility (EMC)

#### INMETRO

- Certificate — NCC 11.0163 X
- Marking — Ex d [ia] IIB T4 Gb IP66W

#### International Electrotechnical Commission (IECEx)

- Marking — Ex d ia IIB T4



Figure 4: Aluminum enclosure for 3410 Series Electronics with optional display.

### Environmental Ratings

#### Aluminum

- NEMA 4
- IP66 to EN60529

#### Stainless Steel

- NEMA 4X
- IP66 to EN60529

### Metrology Approval

#### NMI/MID

- OIML R137-1&2 Edition 2012(E)
- MID Class 1.0 <sup>(1)</sup>

#### China Pattern Approval (CPA)

(1) T-32 Low Pressure Transducer approval pending.

## Operation Limits

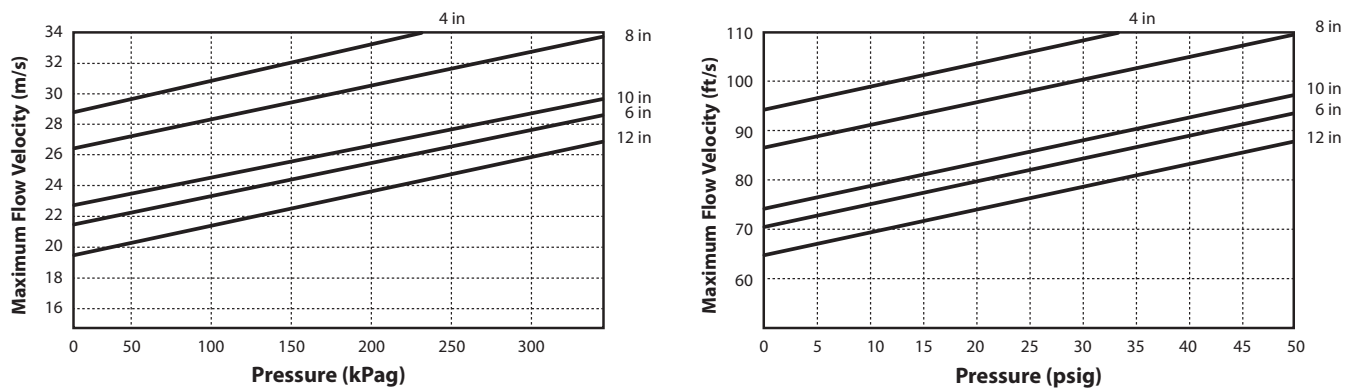
Smaller diameter meters are less affected by lower minimum pressures than larger diameter meters. For example, under certain conditions, a 4-inch diameter meter may be able to operate at a velocity higher than 50 ft/s at 50 psig. Consult Daniel if requirements are outside of the operation limits shown below for T-21 / T-22 transducers.

Table 8A: Recommended Maximum Velocity (Metric Units)				
Nominal Meter Size (DN)	Maximum Velocity Rating at 345 kPa (m/s) <sup>(1)</sup>	Capacity between 345 and 689 kPa (ACMH) <sup>(2)</sup>	Maximum Velocity Rating at 689 kPa (m/s) <sup>(1)</sup>	Capacity at Max Rated Velocity (ACMH) <sup>(2)</sup>
100	15.2	450	30.5	901
150	15.2	1,022	30.5	2,045
200	15.2	1,770	30.5	3,541
250	15.2	2,791	30.5	5,582
300	15.2	4,003	30.5	8,006
400	15.2	6,465	30.5	12,930
450	15.2	8,272	30.5	16,544
500	15.2	10,301	30.5	20,603
600	15.2	15,027	30.5	30,055
750	13.7	21,406	26	40,433
900	12.2	27,634	23	51,814

Table 8B: Recommended Maximum Velocity (US Customary Units)				
Nominal Meter Size (in)	Maximum Velocity Rating at 50 psig (ft/s) <sup>(1)</sup>	Capacity between 50 and 100 psig (ACFH) <sup>(2)</sup>	Maximum Velocity Rating at 100 psig (ft/s) <sup>(1)</sup>	Capacity at Max Rated Velocity (ACFH) <sup>(2)</sup>
4	50	15,913	100	31,826
6	50	36,113	100	72,226
8	50	62,534	100	125,068
10	50	98,568	100	197,136
12	50	141,372	100	282,743
16	50	228,318	100	456,635
18	50	292,131	100	584,263
20	50	363,799	100	727,598
24	50	530,696	100	1,061,392
30	45	755,952	85	1,427,909
36	40	975,906	75	1,829,824

### Low Pressure Applications

For 12 inch and smaller meters, T-32 transducers may be utilized for low pressure applications. See chart below for operational limits of size vs. operating pressure for T-32 transducers.



T-32 Transducer Minimum Operating Pressure

(1) Q<sub>max</sub> maximum velocity generally increases linearly with increase in minimum pressure (ie: 50 psig = 50 fps, 75 psig = 75 fps, 100 psig = 100 fps) for 100 to 600 mm (4 to 24 in) meters.

(2) Capacities are for meter ID equivalent to Schedule 40 (or STD).

# Weights and Dimensions

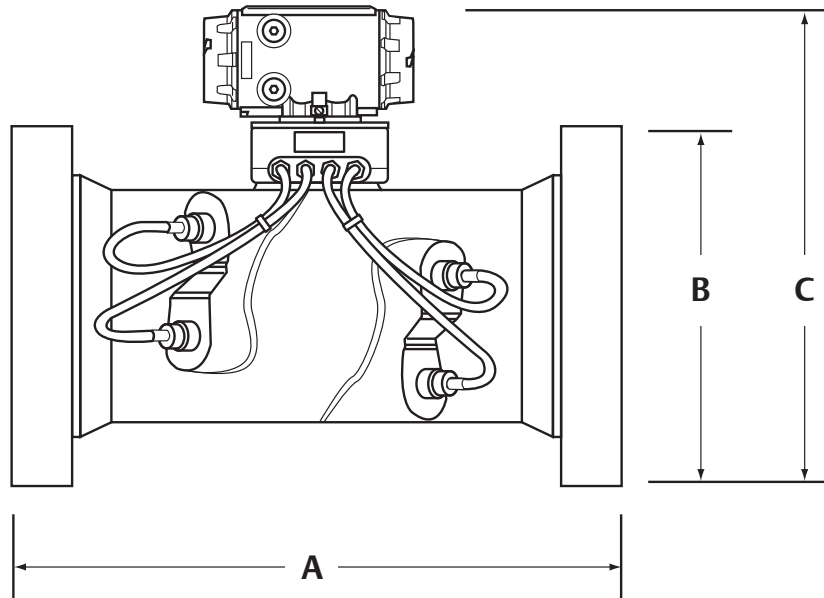


Figure 5A: Meter Dimension Key (See tables 9A and 9B)

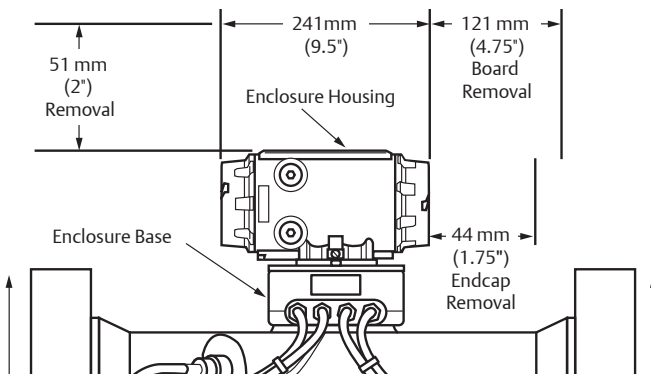


Figure 5B: Position of Enclosure Housing

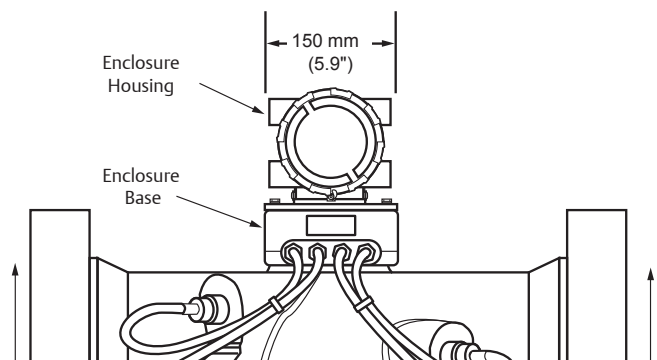


Figure 5C: Optional Position of Enclosure Housing<sup>(1)</sup>

(1) Enclosure housing may be rotated 360 degrees in 90 degree increments.

# Weights and Dimensions

The Meter Dimension Key diagram (Figure 5A) on page 10 illustrates the meter component measurements that correspond to A, B and C in the chart below. The certified approval drawing will include the actual weights and dimensions.

Table 9A: Weights and Dimensional Data (Metric Units)														
[Line Sizes 100 to 150 mm Port Angle = 45°] [Line Sizes 200 to 900 mm Port Angle = 60°]														
Nominal Line Size (DN)	100	150	200	250	300	350	400	450	500	600	650	750	900	
PN 50	Weight (kg)	178	196	200	273	341	CF	589	848	919	1425	1485	1916	2414
	A (mm)	736.6	749.3	546.1	622.3	660.4	CF	762	800.1	901.7	990.6	1029	1137	1302
	B (mm)	254	318	381	444.5	520.7	CF	647.7	711.2	774.7	914.4	973	1092	1270
	C (mm)	472	526	582.7	645	709	CF	814.3	869	930	1057	1141	1255	1405
PN 100	Weight (kg)	185	196	237	351	419	CF	782	925	1190	1802	2006	2483	3753
	A (mm)	737	749	546	622	660	CF	762	800	902	991	1194	1227	1397
	B (mm)	273	356	419	508	559	CF	686	743	812.8	939.8	1016	1130	1314.5
	C (mm)	481.3	544.6	601.7	677.9	727.2	CF	833.4	884.5	947.7	1068.6	1157.5	1275	1428
PN 150	Weight (kg)	193	278	460	903	1212	CF	1507	1440	1666	3460	CF	3743	5433
	A (mm)	787.4	940	698.5	774.7	876.3	CF	1054	914.4	939.8	1498.6	CF	1473.2	1543.1
	B (mm)	292.1	381	469.9	546.1	609.6	CF	705	787.4	857.3	1041.4	CF	1231.9	1460.5
	C (mm)	490	566	640	703.3	773.2	CF	866	922.3	1002	1150.9	CF	1332	1524
PN 250	Weight (kg)	202	310	478	1072	1485	CF	2388	CF	3639	4705	CF	CF	CF
	A (mm)	787	940	699	775	876	CF	1054	CF	1524	1727	CF	CF	CF
	B (mm)	292	381	470	546	610	CF	706	CF	984.3	1168	CF	CF	CF
	C (mm)	500	569	645	721	805	CF	925	CF	1066	1213	CF	CF	CF

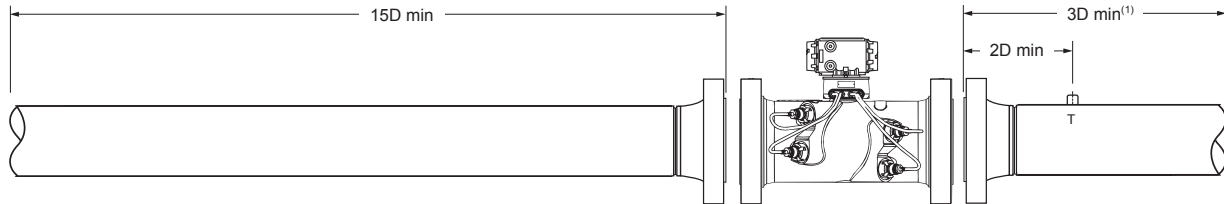
Table 9B: Weights and Dimensional Data (US Customary Units)														
[Line Sizes 4 to 6 in Port Angle = 45°] [Line Sizes 8 to 36 in Port Angle = 60°]														
Nominal Line Size (in)	4	6	8	10	12	14	16	18	20	24	26	30	36	
300 ANSI	Weight (lb)	393	433	441	601	751	CF	1299	1870	2027	3141	3273	4223	5323
	A (in)	29	29.5	21.5	24.5	26	CF	30	31.5	35.5	39	40.5	44.8	51.3
	B (in)	10	12.5	15	17.5	20.5	CF	25.5	28	30.5	36	38.3	43	50
	C (in)	18.6	20.7	22.9	25.4	27.9	CF	32.1	34.2	36.6	41.6	44.9	49.4	55.3
600 ANSI	Weight (lb)	408	433	523	773	923	CF	1723	2040	2623	3973	4423	5473	8273
	A (in)	29	29.5	21.5	24.5	26	CF	30	31.5	35.5	39	47	48.3	55
	B (in)	10.8	14	16.5	20	22	CF	27	29.3	32	37	40	44.5	51.8
	C (in)	19	21.4	23.7	26.7	28.6	CF	32.8	34.8	37.3	42.1	45.6	50.2	56.2
900 ANSI	Weight (lb)	426	613	1013	1991	2673	CF	3323	3174	3673	7629	CF	8251	11978
	A (in)	31	37	27.5	30.5	34.5	CF	41.5	36	37	59	CF	58	60.8
	B (in)	11.5	15	18.5	21.5	24	CF	27.8	31	33.8	41	CF	48.5	57.5
	C (in)	19.3	22.3	25.2	27.7	30.4	CF	34.1	36.3	39.5	45.3	CF	52.4	60
1500 ANSI	Weight (lb)	446	683	1053	2363	3273	CF	5265	CF	8023	10373	CF	CF	CF
	A (in)	31	37	27.5	30.5	34.5	CF	41.5	CF	60	68	CF	CF	CF
	B (in)	12.3	15.5	19	23	26.5	CF	32.5	CF	38.8	46	CF	CF	CF
	C (in)	19.7	22.4	25.4	28.4	31.7	CF	36.4	CF	42	47.8	CF	CF	CF

CF: Consult factory

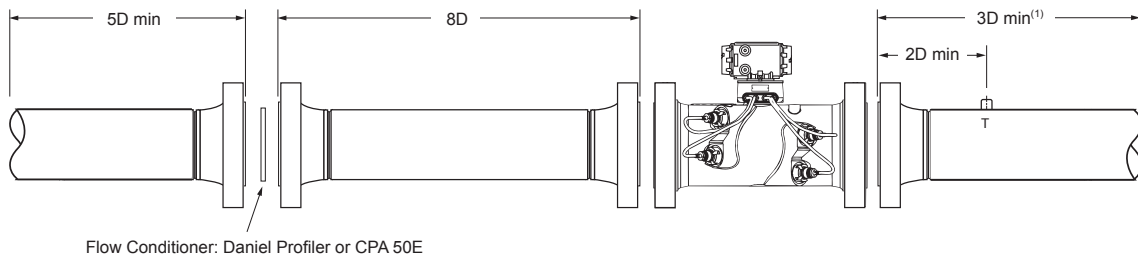
# Recommended Installation

## Recommended Pipe Lengths

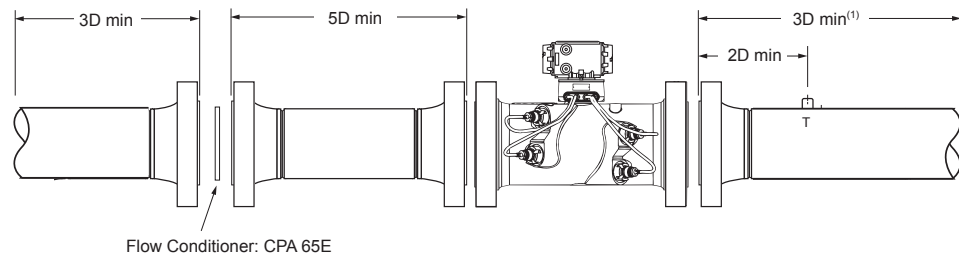
The drawings below represent recommended minimum pipe lengths for the installation of the Daniel SeniorSonic 3414 Gas Ultrasonic Flow Meter. Please consult Daniel for installation recommendations for the specific application. Other lengths or flow conditioners can be accommodated.



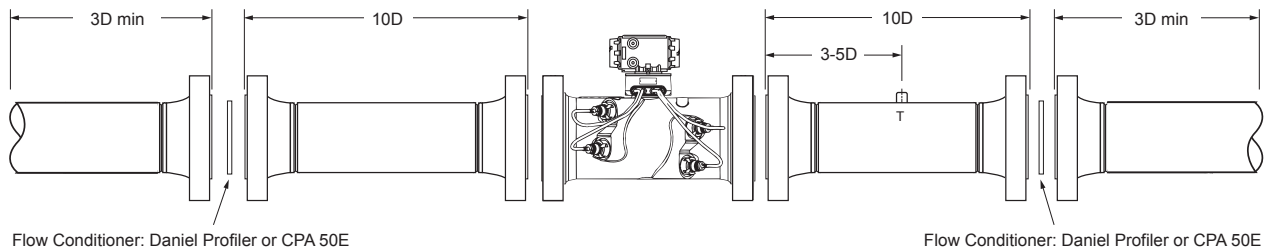
**Figure 6A: Daniel Piping Recommendation for Gas Ultrasonic Meter (No Flow Conditioner)**



**Figure 6B: Daniel Piping Recommendation for Gas Ultrasonic Meter with a Flow Conditioner**



**Figure 6C: Daniel Piping Recommendation for Gas Ultrasonic Meter with a Flow Conditioner (Compact Installation)<sup>(2)</sup>**



**Figure 6D: Daniel Piping Recommendation for Bi-directional Gas Ultrasonic Meter with Flow Conditioners**

**Notes:**

1. For best results, flow conditioning is recommended
2. D = Nominal pipe size in inches (i.e., 6 in pipe size; 10D = 60 in)
3. T = Temperature measurement location
4. Pressure measurement location provided on meter body

(1) Additional pipe length may be required for additional taps (i.e. sample probe, test well, etc.).

(2) Longer upstream lengths can increase long term baseline diagnostics stability.

# SeniorSonic 3414 Gas Ultrasonic Flow Meter

**Product Datasheet**

34XX XX XX XXX XX XXX - X X X X X X X X X X X X X X X X

<p><b>Device</b> 3414 Four-Path.....14</p> <p><b>Line Size</b> DN 100 (4 in).....04 DN 150 (6 in).....06 DN 200 (8 in).....08 DN 250 (10 in).....10 DN 300 (12 in).....12 DN 350 (14 in).....14 DN 400 (16 in).....16 DN 450 (18 in).....18 DN 500 (20 in).....20 DN 600 (24 in).....24 DN 650 (26 in).....26 DN 750 (30 in).....30 DN 900 (36 in)<sup>(1)</sup>.....36</p> <p><b>Pressure Rating</b> PN 50 / ANSI 300.....03 PN 100 / ANSI 600.....05 PN 150 / ANSI 900.....06 PN 250 / ANSI 1500.....07 PN 420 / ANSI 2500.....08</p> <p><b>Flange Type</b> RF / RF.....S01 RTJ / RTJ.....S02 FEFA / FEFA.....S03 Compact Flange (Special).....S04</p> <p><b>Body and Flange Material</b> Cast: LCC / Carbon Steel / SS / Duplex.....M<sup>(2)</sup> Forged: Carbon Steel / 316 SS / Duplex SS.....F<sup>(2)</sup></p> <p><b>Schedule (Pipe Bore)</b> Schedule LW.....LW0 Schedule 20.....020 Schedule 30.....030 Schedule 40.....040 Schedule 60.....060 Schedule 80.....080 Schedule 100.....100 Schedule 120.....120 Schedule 140.....140 Schedule 160.....160 Schedule STD.....STD Schedule XS.....XS0</p> <p><b>Transducer Assembly</b> T-21 (-20°C to +100°C) - Standard Mounts / Holders, NBR O-ring.....G T-22 (-50°C to +100°C) - Standard Mounts / Holders, NBR O-ring.....H T-21 (-20°C to +100°C) - Inconel Mounts / 316L Holders, NBR O-ring.....J T-22 (-50°C to +100°C) - Inconel Mounts / 316L Holders, NBR O-ring.....K T-21 (-20°C to +100°C) - Inconel Mounts / Inconel Holders, FKM O-ring.....L T-22 (-50°C to +100°C) - Inconel Mounts / Inconel Holders, FKM O-ring.....M T-32 (-50°C to +100°C) - Standard Mounts / Holders, NBR O-ring.....P T-32 (-50°C to +100°C) - Inconel Mounts / 316L Holders, NBR O-ring.....R T-32 (-50°C to +100°C) - Inconel Mounts / Inconel Holders, FKM O-ring.....T</p>	<p><b>Metrology Approval</b> A.....None B.....OIML C.....China (CPA)</p> <p><b>Electrical Approvals</b> 1.....UL / c-UL 2.....ATEX/IECEX 3.....JNMETRO</p> <p><b>Pressure Directive Certification</b> 1.....None 2.....PED (must select electrical approval 2) 3.....CRN (Canadian Boiler Branch)</p> <p><b>Tagging Language</b> 1.....English 2.....French 3.....Russian 4.....Chinese</p> <p><b>Tagging Format (Line Size / Pressure Rating / Flow Parameters)</b> 1.....Inch / ANSI / US Customary 2.....Inch / ANSI / Metric 3.....DN / PN / US Customary 4.....DN / PN Metric</p> <p><b>Wireless</b> A.....None B.....THUM</p> <p><b>Expansion Module</b> A.....None B.....Serial RS232</p> <p><b>CPU/Display/Keys</b> C.....Full I/O, no Display D.....Full I/O, with Display G.....Full I/O, no Display, with CFA Key H.....Full I/O, with Display, with CFA Key</p> <p><b>Electronics Mounting</b> A.....Integral Mount (up to +60°C) B.....Remote Mount w/15ft Cables E.....Integral Mount (up to +60°C) w/Armored Cables</p> <p><b>Conduit Type</b> 1.....3/4" NPT 2.....M20 (reducers required)</p> <p><b>Pressure Taps</b> 1.....1/2" NPT 3.....Pipette</p> <p><b>Enclosure Type</b> 1.....Aluminum 2.....Stainless Steel</p>
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This is for informational purposes only. Not every option is listed and some options are contingent on others. Please consult factory for assistance designing your optimal meter.

(1) Consult factory on meter sizes above 900 mm (36 in).  
(2) Consult factory for specific model code for desired material.

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