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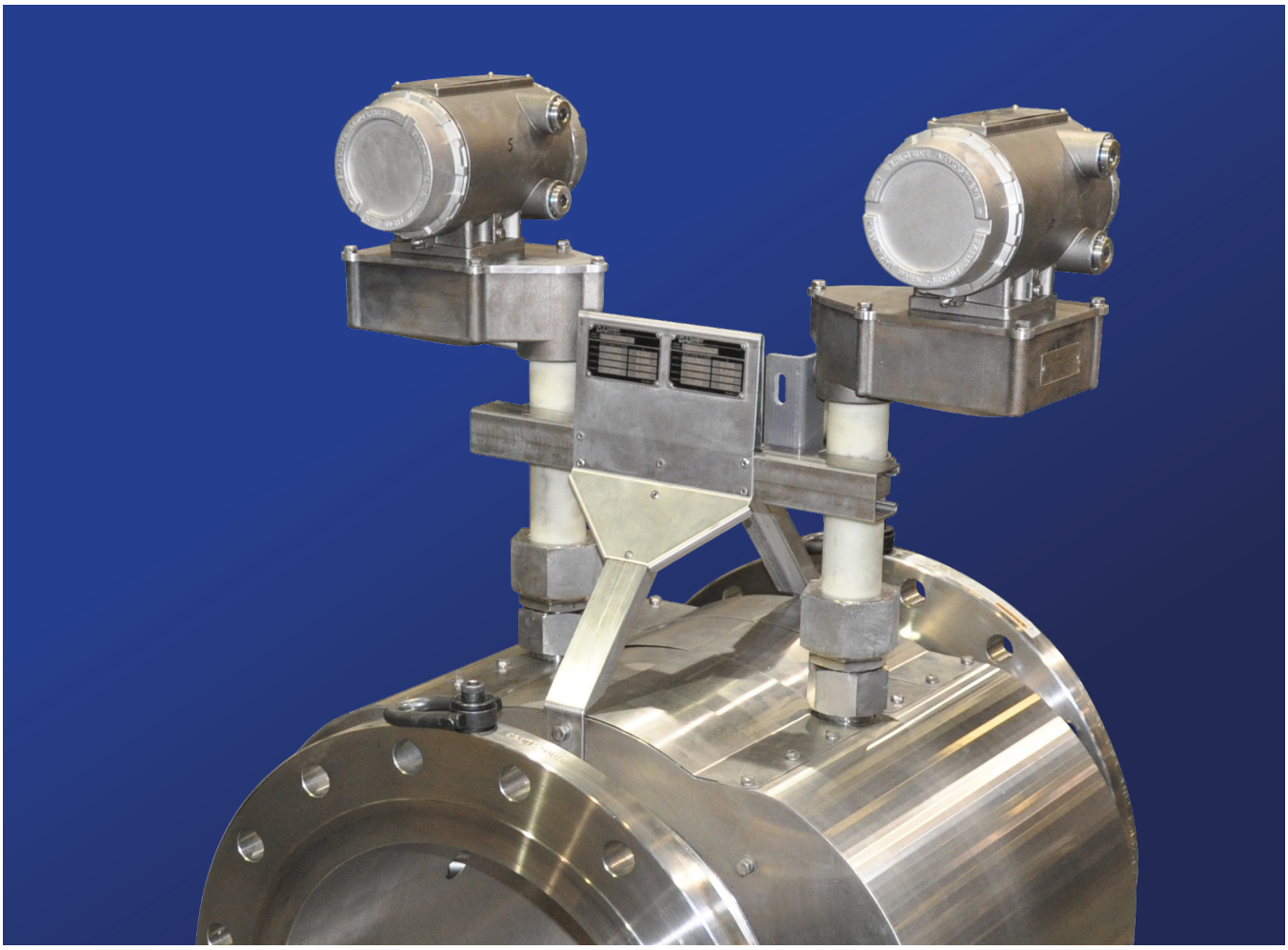
Datasheet
October 2015

Daniel™ 3818 for Liquified Natural Gas (LNG)

Liquid Ultrasonic Flow Meter



DANIEL™

EMERSON™
Process Management

Model 3818 Liquid Ultrasonic Flow Meter for LNG

Redundancy for Long-Term Stability

The Daniel 3818 Liquid Ultrasonic Flow Meter is designed for high accuracy and long-term, reliable performance in LNG applications. The 3818 meter features a unique multi-plane interlocked eight-path British Gas design.

The equivalent of two four-path meters in a single body, the completely redundant design utilizes two independent transmitters—one for each set of four (4) chordal paths and offers the ability to poll each four-path meter separately. Acoustic processing is performed by specialized electronics designed to achieve high sampling rates and provide stable ultrasonic signals and optimal low flow response for accurate, stable and reliable measurement.

Ideal for meeting strict safety and environmental regulations, the 3818 LNG meter is engineered and manufactured to ISO certifications (9001, 14001). Additionally, the meter comes equipped with advanced diagnostics software, allowing operators to learn more about system performance and monitor the meter's health. Meters are calibrated using both a static zero flow test on liquid nitrogen and a full dynamic test on water in our ISO 17025 certified flow calibration facility.

Available in nominal line sizes DN200 to DN900 (8-in to 36-in), the 3818 LNG meter offers increased flow capacity and no incremental pressure drop to minimize operating costs and improve measurement integrity and safety.

Figure 1: Daniel 3818 Liquid Ultrasonic Flow Meter for Liquefied Natural Gas Applications

LNG Applications

- Custody Transfer
- Tanker Loading and Off-Loading
- Liquefaction Trains (Rundown Lines)
- Storage Allocation
- Check Metering
- Line Balance

Features and Benefits

- Redundant 4-path chordal design ensures accuracy, stability and operational cost savings
- Ease of installation and operation reduces start-up time and lowers capital costs
- Full bore design eliminates incremental pressure drop, improving measurement and reducing energy costs
- Geometric correction calculations account for meter body expansion/contraction due to changes in pressure and temperature
- Meter factory insulation minimizes heat sinks and hot spots and reduces startup time
- Equipped with Daniel MeterLink™ advanced diagnostics software for monitoring meter and system performance
- 3810 Series Electronics provide fast sampling rates, enabling quick response to process upsets
- Communicates predictive diagnostics and processes variable information via the HART® protocol which allows plant personnel to quickly detect and respond to abnormal situations, avoiding process upsets and unscheduled downtime
- The 3818 meter is part of Emerson's broad range of intelligent field devices that power the PlantWeb® digital plant architecture

Standard Specifications[1]

Meter Specifications

Characteristics

- Eight-path (sixteen transducer) chordal design
- British Gas (BG) configuration
- Two paths are paired at each of the four horizontal chords in the pipe cross section. The paired paths are angled with respect to the pipe axis such that four horizontal chords lie in each of the angled planes, forming an X when viewed from above. This allows a true 3-D representation of the flow profile.

Meter Performance

- Linearity is ± 0.15% of measured value over a 1.2 to 12.2 m/s (4 to 40 ft/s) range
- Factory proven linearity is ± 0.20% of measured value over a 0.6 to 12.2 m/s (2 to 40 ft/s) range (option)

Uncertainty of Meter Factor

- < ± 0.027% (API MPMS, chapter 5, section 8, table B-1)

Velocity Range

- 0.6 to 12.2 m/s (2 to 40 ft/s) with an over-range of 0.3 to 14.6 m/s (1 to 48 ft/s)

Calibration

- ISO 17025 certified flow laboratory available for all meters

Electronics Performance

Power (Each set of electronics)

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

Meter Mechanical Ratings

Line sizes

- DN200 to DN900 (8-in to 36-in)[2]

Operating Product Temperature

- -196°C to +60°C (-321°F to +140°F)

Operating Pressure Range

- 0 to 250 Bar (0 to 3600 psig)

Specific Gravity Range

- 0.35 and higher (nominal 0.45)

Flanges

- Raised Face for ANSI Classes 150 to 1500

Electronics Ratings

Direct Mounted Electronics

- Ambient Temperature
  - -40°C to +60°C (-40°F to +140°F)
- Relative Humidity
  - Up to 95% non-condensing

Storage Temperature

- -50°C to +60°C (-40°F to +140°F)

(1) Please consult Daniel if your requirements are outside the list specifications. Improved performance, other product and material offerings may be available depending on the application.

(2) Consult factory on sizes above 900 mm (36").

Materials of Construction[1]

Material Specifications

Body and Flange

Forgings

- ASTM A182 dual grade F316/F316L SST
  -196°C to +60°C (-385°F to +140°F)

Electronic Enclosures

- ASTM A351 Gr CF8M stainless steel

Transducer Components

Transducer Housing

- Full penetration weld for pressure containment

Transducer Housing Materials

- ASTM A479 316L stainless steel with proprietary matching layer material

Insulation Package

Shroud Material

- ASTM A240 316 stainless steel

Factory Insulation

- Insulation is positioned around all transducers and meter body reducing likelihood of hot spots
- Reduces installation and start-up time in the field

Paint Specifications

Body and Flange

Stainless Steel

- Unpainted
- Consult factory for painted stainless steel specification

Enclosure Enclosures

Stainless Steel

- Unpainted
- Consult factory for painted stainless steel specification

Table 1A: Body and Flange Maximum Pressure Ratings by Construction Materials - bar[2]
[Meter Sizes 200 to 900 mm]

PN	F316/F316L SST
20	19.0
50	49.6
100	99.3
150	148.9
250	248.2

Table 1B: Body and Flange Maximum Pressure Ratings by Construction Materials - psi[2]
[Meter Sizes 8” to 36”]

ANSI	F316/F316L SST
150	275
300	720
600	1440
900	2160
1500	3600

(1) Please consult Daniel if your requirements are outside the list specifications. Improved performance and other product and material offerings may be available.

(2) Pressure rating information is for -385°F (-196°C) to 140°F (60°C).

Standard Flow Ranges

Table 2A: Daniel 3818 Flow Ranges Metric Units								
Nominal Meter Size (DN)	Meter I.D. (mm)	Pipe Schedule	Fluid Velocity (m/s)			Flow Rate (m^3/hr)		
			Min	Max	Over-Range	Min	Max	Over-Range
200	202.7	Sch 40	0.61	12.2	14.6	71	1,417	1,700
250	254.5	Sch 40	0.61	12.2	14.6	112	2,233	2,679
300	303.2	Sch 40	0.61	12.2	14.6	158	3,170	3,803
350	333.4	SCh 40	0.61	12.2	14.6	192	3,831	4,597
400	381.0	Sch 40	0.61	12.2	14.6	250	5,004	6,005
450	428.65	Sch 40	0.61	12.2	14.6	317	6,334	7,601
500	477.82	Sch 40	0.61	12.2	14.6	394	7,871	9,445
600	574.65	Sch 40	0.61	12.2	14.6	569	11,383	13,660
750	742.95	STD	0.61	12.2	14.6	951	19,028	22,833
900	895.35	STD	0.61	12.2	14.6	1,382	27,635	33,162

Table 2B: Daniel 3818 Flow Ranges US Customary Units											
Nominal Meter Size (in)	Meter I.D. (in)	Pipe Schedule	Fluid Velocity (ft/s)			Flow Rate (BPH)			Flow Rate (GPM)		
			Min	Max	Over-Range	Min	Max	Over-Range	Min	Max	Over-Range
8	7.981	Sch 40	2	40	48	446	8,910	10,692	312	6,237	7,485
10	10.020	Sch 40	2	40	48	702	14,045	16,853	492	9,831	11,797
12	11.938	Sch 40	2	40	48	997	19,936	23,923	698	13,955	16,746
14	13.124	Sch 40	2	40	48	1,205	24,094	28,913	843	16,866	20,239
16	15.000	Sch 40	2	40	48	1,574	31,474	37,769	1,102	22,032	26,438
18	16.876	Sch 40	2	40	48	1,992	39,839	47,807	1,394	27,887	33,465
20	18.812	Sch 40	2	40	48	2,475	49,504	59,405	1,733	34,653	41,583
24	22.624	Sch 40	2	40	48	3,580	71,599	85,920	2,506	50,120	60,144
30	29.25	STD	2	40	48	5984	119,680	143,617	4189	83,776	100,531
36	35.25	STD	2	40	48	8691	173,816	208,580	6084	121,671	146,005

Input/Output

The Daniel 3818 LNG Ultrasonic Flow Meters provide the following I/O connections on the CPU Module. Each meter has two sets of electronics with independent transmitters—one for each set of four (4) chordal paths.

Table 3: CPU Module I/O Connections

	I/O Connection Type	Qty	Description
Communication			
Serial Communications	Serial RS232/RS485 Port	1	▪ Modbus RTU/ASCII ▪ 115 kbps baud rate ▪ RS232/RS485 Full Duplex ▪ RS485 Half Duplex
	Ethernet Port (TCP/IP) 100BaseT	1	▪ Modbus TCP
Digital and Analog Inputs			
Digital Input(1)	Contact Closure	1	▪ Status ▪ Single polarity
Analog Inputs(2)	4-20 mA	2	▪ AI-1 Temperature(3) ▪ AI-2 Pressure (3)
Digital, Analog and Frequency Outputs			
Frequency/Digital Outputs	TTL/Open Collector	3	▪ User Configurable
Analog Outputs(2, 4)	4-20 mA	2	▪ Independently configurable analog outputs ▪ HART® 7 Compliant, consult factory for HART 5

Note: Maximum wire gauge is 18 AWG.

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

(2) AI-1 and AI-2 are electronically isolated and operate in sink mode. The input contains a series resistance so HART® Communicators can be connected to configure sensors.

(3) A 24 Volt DC power supply is available to provide power to the sensors.

(4) The analog output zero scale offset error is within ±0.1% of full scale and gain error is within ±0.2% of full scale. The total output drift is within ±50 ppm of full scale per °C.

Meter Software

Daniel MeterLink Overview

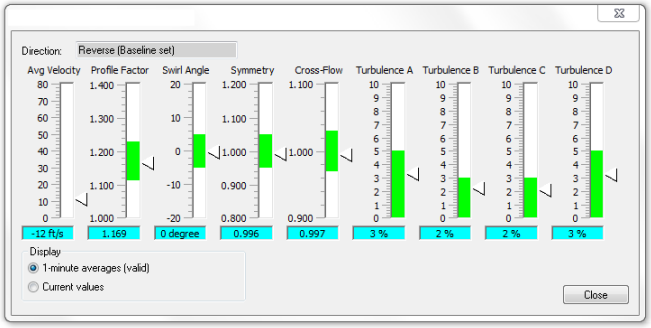


Figure 3A: MeterLink Baseline Viewer

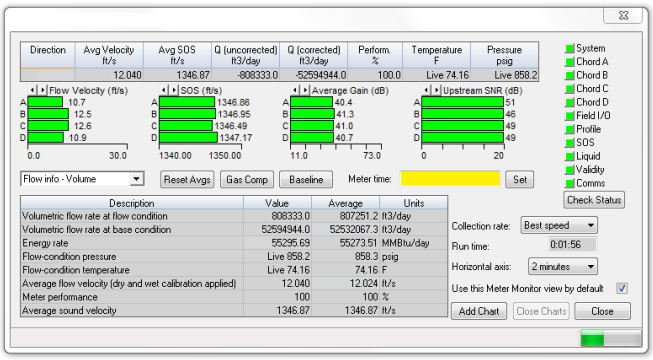


Figure 3B: MeterLink Monitor Screen

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 Vista, 7 and 8 as well as Microsoft® Office® 2003-2013

PlantWeb

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

Table 7: MeterLink Features(1)

		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	●	●
	Baseline Configuration Wizard	●	●
	Local Display Setup	●	●
Alarms	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 3818 LNG Ultrasonic Flow Meter meets the following worldwide standards for hazardous area and intrinsic safety certifications and approvals.

Safety Classifications

(UL / cUL) — Underwriters Laboratories

- 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)
- International Electrotechnical Commission (IECEx)
  - Certificate — IECEx UL 11.0004X
  - Marking — Ex d ia IIB T4

IMPORTANT: Please consult Daniel for a complete list of agencies and certifications.

Dimensional Drawings[1]

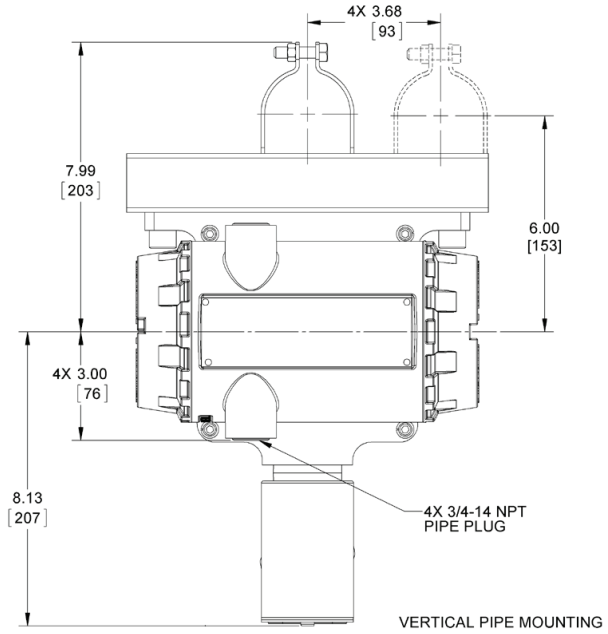


Figure 2A: Electronics Enclosure (Top)

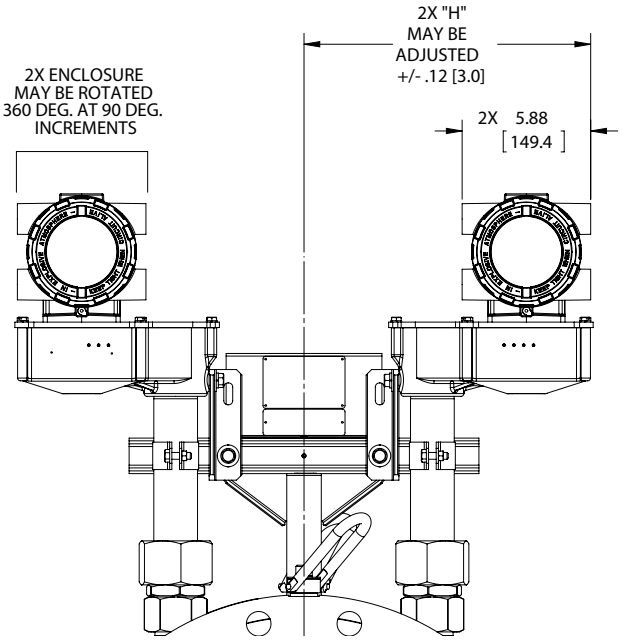


Figure 2B: Electronics Enclosure (Front)

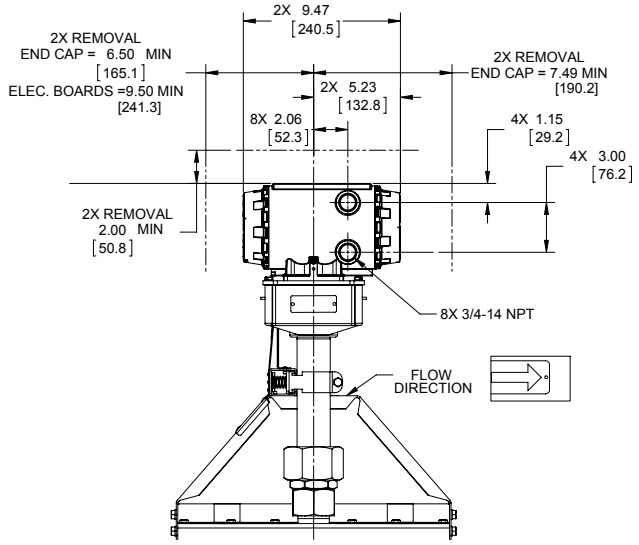


Figure 2C: Electronics Enclosure (Side)

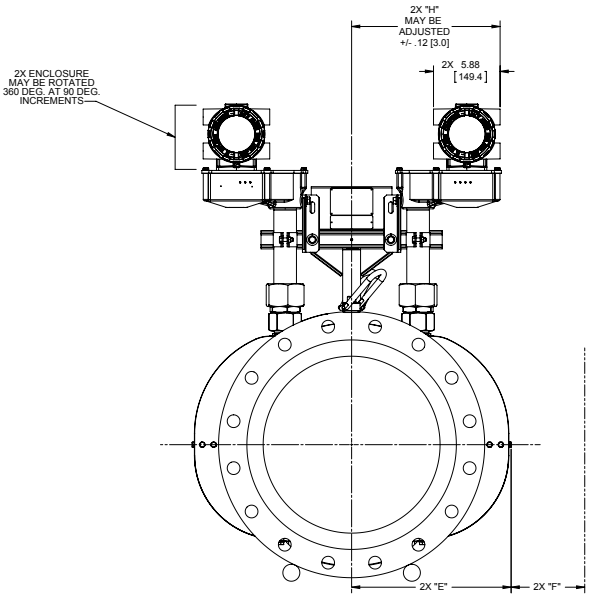


Figure 2D: Direct Mounted Electronics

(1) Consult factory for weight and dimensional data on all line sizes.

Recommended Installation for LNG Applications

Recommended Pipe Lengths

The drawings below represent recommended pipe lengths for the installation of the Daniel 3818 Liquid Ultrasonic Flow Meter. Please consult Daniel for installation recommendations of your specific application.

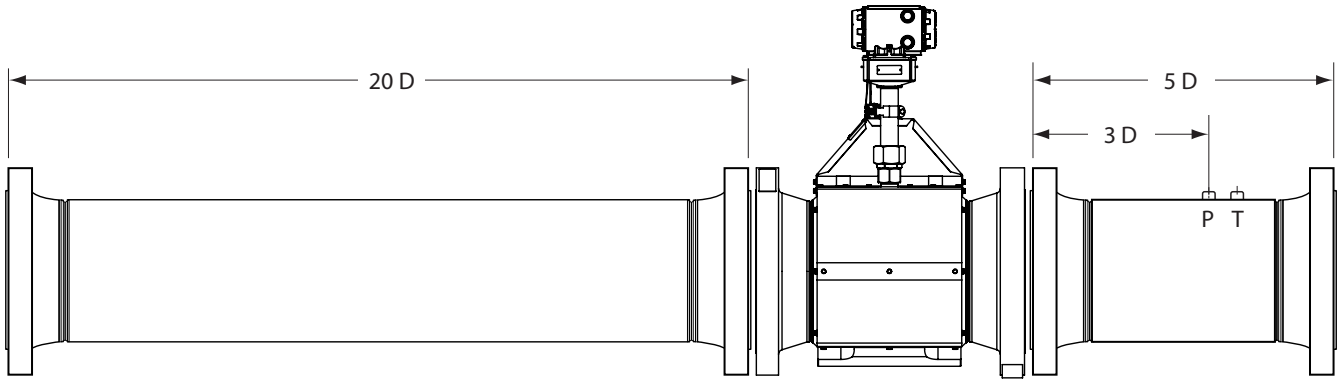


Figure 3A: Daniel Piping Recommendation for Straight Pipe (No Flow Conditioner)

Notes:

1. Flow conditioning is not recommended as it creates additional pressure drop and potential gas breakout
2. D = Nominal pipe size in inches (i.e. 8 inch pipe size; 20 D = 160 inches)
3. P = Pressure measurement location
4. T = Temperature measurement location

3818 LNG Ultrasonic Flow Meters

Product Datasheet 38 18 XX XX XXX XX XXX - X X X X X X X X X X X X

Line Size
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 750 (30 in) 30
DN 900 (36 in) 36

Pressure Rating
PN 20 / 150 ANSI 01
PN 50 / 300 ANSI 03
PN 100 / 600 ANSI 05
PN 150 / 900 ANSI 06
PN 250 / 1500 ANSI 07

Flange Type
RF/RF S01

Body and Flange Material
F316/F316L F6

Schedule (Pipe Bore)
Schedule 20 020
Schedule 40 040
Schedule 60 060
Schedule 80 080
Schedule STD ..... STD

Transducer Assembly
LT-06 (-196°C to +60°C) 8 to 10 inches Sizes ..... Y
LT-07 (-196°C to +60°C) 12 to 36 inches Sizes ..... Z

Metrology Approval
A ..... None
B ..... MID (OIML)
E ..... OIML[2]

Electrical Approvals
1 ..... U.L. / cU.L.
2 ..... CE (ATEX, MID, and PED)
3 ..... INMETRO

Pressure Directive Certification
1 ..... None
2 ..... PED (must select electrical approval code 2)

Tagging Language
1 ..... English
2 ..... French
3 ..... Russian
4 ..... Chinese

Tagging Format (Line Size / Pressure Rating / Flow Parameters)
(Line Size / Pressure Rating / Flow Parameters)
1 ..... Inch / ANSI / US Customary
2 ..... Inch / ANSI / Metric
3 ..... DN / PN / US Customary
4 ..... DN / PN / Metric

Wireless
A ..... None
B ..... THUM

Expansion Module
A ..... None

CPU/Display
C ..... Full I/O, no Display
G ..... Full I/O, with Display

Electronics Mounting
A ..... Direct Mounted

Conduit Type
1 ..... 3/4" NPT
2 ..... M20 (uses reducers)

Future
1 ..... None

Enclosure Type/Input Power
2 ..... Stainless steel; 10.4-36 VDC

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 greater than 900mm (36")

(2) R117-1 : 2007E

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