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Datasheet
December 2016

Daniel™ Models 3415 and 3416

Dual-Configuration Gas Ultrasonic Flow Meters

DANIEL™

EMERSON™

Models 3415 and 3416 Gas Ultrasonic Flow Meters

Advanced Check Metering

The new dual-configuration Daniel Models 3415 and 3416 Gas Ultrasonic Flow Meters deliver exceptional custody transfer accuracy and reliability by combining the power and performance of a field-proven Daniel four-path chordal, British Gas-design meter with a second reflective check meter in one body. These self-verification meters provide advanced detection and validation of process disturbances to help operators identify critical issues before measurement is adversely affected.

The Model 3415 meter offers a four-path custody transfer meter with a single-path reflective check meter, providing continuous real-time measurement verification and an early warning of process and/or meter deviations. With immediate alerts for blockages, contamination and other flow disturbances, operators can reduce maintenance time and costs as well as implement predictive maintenance practices and eliminate unnecessary trips into the field. In addition, the integrated check meter ensures cost-effective, continuous backup measurement is available. The ultra-reliable Model 3416 meter offers the same Model 3415 configuration along with an additional reflective path positioned vertically. This diagnostic path detects even a thin layer of liquid or buildup on the bottom of the pipe that can cause significant measurement error and higher LAUF product.

Available in DN200 to DN600 (8-in to 24-in) line sizes, each standard Model 3415 or 3416 meter is equipped with modular Daniel 3410 Series Electronics and rugged Daniel T-20 Series Transducers that offer greater tolerance to wet, rich and/or dirty gas. A new patented transducer synchronization method ensures 3410 Series Electronics provide the highest sampling rates possible, resulting in more stable ultrasonic signals for better flow resolution.

The latest version of Daniel MeterLink Software gives operators advanced insight and allows real-time meter monitoring from a PC or laptop to help eliminate unplanned shutdowns.

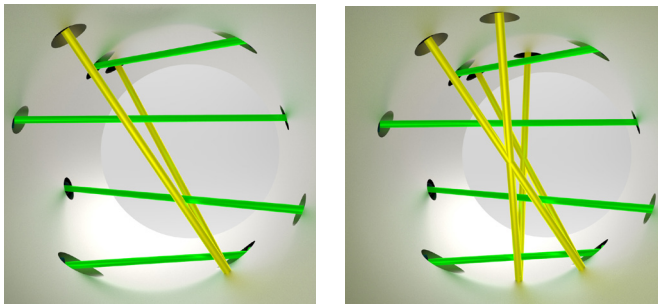

Figure 1: In addition to the 4-path, British Gas-design custody meter, the Model 3415 meter (left) offers a single reflective path for integrated check metering while the Model 3416 meter (right) features a second, vertical path for advanced liquid detection.

Typical Application

- Custody transfer for natural gas transmission lines

Application Sites

- Transmission pipelines
- Gas plant inlets/outlets
- Production and gathering
- Underground storage
- Industrial interconnects

Features and Benefits

- Redundant models with a field-proven Daniel 4-path chordal, British Gas-design meter (OIML Accuracy Class 0.5) and a 1-path or 2-path reflective check meter in one body offering:
  - Direct inputs for pressure, temperature and gas composition that allow calculations of AGA 8 Compressibility and optional AGA 10 speed of sound
  - Automatic calculations and totalization of corrected volume rates, mass rates and energy rates
  - Ethernet connectivity for expedited data transfer
- Immediate detection of process disturbances via integration of chordal and reflective methodologies
  - Provides early warning of process or gas quality issues to minimize LAUF and/or prevent equipment damage
  - Offers a backup measurement, if needed
  - Allows for predictive maintenance to minimize trips to the field and reduce maintenance related costs
- Patented transducer synchronization method increases sampling speed, resulting in faster detection of flow disturbances to expedite alerts and troubleshooting
- Daniel 3410 Series Electronics provide an expandable platform and an expansive archive data log to simplify accounting and dispute resolution
- New Type 4 CPU Module offers additional I/O with five frequency or digital outputs and one digital input that can be configured as the sixth output if needed
- Local LED displays (optional) on each transmitter offer up to ten user-selectable scrolling variables
- High rangeability (>100:1) eliminates an additional meter run
- 5D upstream piping requirement (with flow conditioner) for offshore rigs and other sites with limited straight run
- Simplifies installation with no intermediate flanges

Standard Specifications

Please consult a Daniel product specialist if requirements are outside of the listed specifications. Other product and material offerings may be available depending on the application.

Meter Specifications:

Four-Path Custody Transfer Meter

Characteristics

- 4-path (eight transducers) chordal design

Meter Performance

- Flow calibrated accuracy is ±0.1% of reading over entire flow calibration range
- Repeatability is ±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 (DN)	200 to 600
q_{min} (m/s)	0.5
q_t (m/s)	3.048
q_{max} (m/s)	30.48

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

Meter Size (in)	8 to 24
q_{min} (ft/s)	1.7
q_t (ft/s)	10
q_{max} (ft/s)	100

Meter Specifications:

Check Meter

Characteristics

- One-path (two transducer) and two-path (four transducer) reflective designs

Meter Performance

- Flow calibrated accuracy is ±0.2% of reading
- Accuracy is typically ±1.5% of actual volume flow (without flow calibration)
- Repeatability is ±0.1% of reading for 1.5 to 30.5 m/s (5 to 100 ft/s)

Velocity Range

- Nominal up to 30 m/s (100 fps)
- Extended range up to 35 m/s (115 fps) on some sizes

Electronics Performance

Power per Transmitter

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

Total Meter Consumption

- 16 watts typical; 30 watts maximum

Mechanical Ratings

Line Sizes

- DN200 to DN600 (8-in to 24-in) with British Gas (BG) orientation

Operating Gas Temperature (Transducers)(1)

- T-21: -20°C to +100°C (-4°F to +212°F)
- T-41: -50°C to +100°C (-58°F to +212°F)
- T-22: -50°C to +100°C (-58°F to +212°F)

Operating Pressure Range (Transducers)(1)

- T-21/T-41/T-22: 1,034 to 27,579 kPa (150 to 4,000 psig)

Flanges

- Raised Face (RF) and Ring Type Joint (RTJ) for PN 50 to 250 (ANSI Classes 300 to 1,500)
- Compact flanges/hub end connectors (optional)

NACE, NORSOK and PED Compliance

- Designed for NACE compliance(3)
- 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-41/T-22 transducers

Electronic Housing

- Integral mount

(1) T-21 and T-41 transducers are the only transducers available for the check meter.

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

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

Materials of Construction

The materials of construction are dependent upon application requirements that must be specified by the customer. If needed, a Daniel product specialist can provide material guidance.

Material Specifications

Body and Flange

Forgings

- ASTM A350 Gr LF2 Carbon Steel[(1)]
  -46°C to +150°C (-50°F to +302°F)
- ASTM A350 Gr LF2 Carbon Steel[(1)]
  -50°C to +150°C (-58°F to +302°F)
- ASTM A182 Gr F316/F316L Stainless Steel (Dual Certified)
  -46°C to +150°C (-50°F to +302°F)
- ASTM A182 Gr F51 Duplex Stainless Steel[(2)]
  -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

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

Electronics Bracket

Stainless Steel Material

- 316SS

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)

Transducer Shroud

Aluminum Material

- Powder coated

Enclosure Housing

Aluminum Material

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

Stainless Steel Material

- Passivated (optional)

Table 2A: Body and Flange Maximum Pressure Ratings by Construction Materials
[bar Meter Sizes DN200 to DN600][(3)]

PN	Forged Carbon Steel	Forged 316/316L SS	Duplex SS
50	51.1	49.6	51.7
100	102.1	99.3	103.4
150	153.2	148.9	155.1
200	255.3	248.2	258.6

Table 2B: Body and Flange Maximum Pressure Ratings by Construction Materials
[psi Meter Sizes 8-in to 24-in][(3)]

ANSI Class[(4)]	Forged Carbon Steel	Forged 316/ 316L SS	Duplex SS
300	740	720	750
600	1,480	1,440	1,500
900	2,220	2,160	2,250
1,500	3,705	3,600	3,750

(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. Please confirm meter sizing with a Daniel product specialist prior to order placement.

Calculating Meter Capacity

To calculate a volume rate for a given velocity, first find the capacity (flow rate) in tables 3A or 3B 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.

The example below illustrates how to determine the hourly flow rate at 21 m/s for a DN200 meter operating at 4,500 kPag:

If Flow Rate = 178 MSCMH and Velocity = 21 m/s, the calculation is: $\frac{178 \text{ MSCMH} \times 21 \text{ m/s}}{30.5 \text{ m/s}} = 122.6 \text{ MSCMH}$

Table 3A: Flow Rates (MSCMH)
Based Upon Max Rated Velocity [DN200 to DN600 = 30.5 m/s]

	Meter Size (DN)	200	250	300	400	500	600
Operating Pressure (kPag)	1,000	39	62	88	139	218	315
	1,500	58	91	129	204	320	463
	2,000	77	121	171	270	425	615
	2,500	96	151	214	339	533	770
	3,000	116	182	259	408	642	929
	3,500	136	214	304	480	754	1,091
	4,000	156	247	350	553	869	1,257
	4,500	178	280	397	627	987	1,427
	5,000	199	314	446	704	1,107	1,600
	5,500	221	349	495	781	1,229	1,778
	6,000	244	384	545	861	1,354	1,959
	6,500	267	420	597	942	1,482	2,143
	7,000	290	457	649	1,025	1,612	2,331
	7,500	314	495	702	1,109	1,744	2,523
	8,000	338	533	757	1,195	1,879	2,718
	8,500	363	572	812	1,281	2,015	2,915
	9,000	388	611	867	1,369	2,154	3,115
	9,500	413	651	924	1,458	2,294	3,318
	10,000	438	691	981	1,548	2,435	3,522

Table 3B: Flow Rates (MMSCMD)
Based Upon Max Rated Velocity [DN200 to DN600 = 30.5 m/s]

	Meter Size (DN)	200	250	300	400	500	600
Operating Pressure (kPag)	1,000	0.941	1.484	2.106	3.325	5.229	7.563
	1,500	1.384	2.182	3.097	4.889	7.690	11.122
	2,000	1.837	2.895	4.110	6.489	10.206	14.761
	2,500	2.300	3.626	5.147	8.126	12.780	18.485
	3,000	2.774	4.373	6.207	9.800	15.414	22.293
	3,500	3.259	5.137	7.292	11.512	18.107	26.189
	4,000	3.755	5.919	8.401	13.264	20.862	30.174
	4,500	4.262	6.718	9.536	15.055	23.679	34.248
	5,000	4.780	7.535	10.695	16.885	26.558	38.412
	5,500	5.309	8.369	11.880	18.755	29.499	42.665
	6,000	5.850	9.221	13.089	20.664	32.502	47.009
	6,500	6.401	10.090	14.322	22.612	35.565	51.439
	7,000	6.963	10.975	15.579	24.596	38.686	55.953
	7,500	7.535	11.877	16.859	26.616	41.863	60.549
	8,000	8.116	12.793	18.160	28.670	45.094	65.221
	8,500	8.706	13.723	19.480	30.754	48.372	69.962
	9,000	9.304	14.666	20.818	32.866	51.694	74.766
	9,500	9.909	15.619	22.170	35.002	55.053	79.625
	10,000	10.519	16.580	23.535	37.157	58.442	84.527

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. Please confirm meter sizing with a Daniel product specialist prior to order placement.

Calculating Meter Capacity

To calculate a volume rate for a given velocity, first find the capacity (flow rate) in tables 4A or 4B 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.

The example below illustrates how to determine the hourly flow rate at 70 ft/s for an 8-inch meter operating at 800 psig:

If Flow Rate = 7,842 MSCFH and Velocity = 70 ft/s, the calculation is: $\frac{7{,}842 \text{ MSCFH} \times 70 \text{ ft/s}}{100 \text{ ft/s}} = 5{,}489.4 \text{ MSCFH}$

Table 4A: Flow Rates (MSCFH)
Based Upon Max Rated Velocity [8-in to 24-in = 100 ft/s]

	Meter Size (in)	8	10	12	16	20	24
Operating Pressure (psig)	100	989	1,559	2,213	3,494	5,495	7,948
	200	1,880	2,963	4,207	6,641	10,446	15,108
	300	2,799	4,412	6,263	9,888	15,552	22,493
	400	3,747	5,906	8,384	13,236	20,819	30,111
	500	4,725	7,448	10,572	16,690	26,251	37,968
	600	5,733	9,037	12,828	20,252	31,854	46,071
	700	6,772	10,675	15,153	23,923	37,627	54,422
	800	7,842	12,362	17,547	27,703	43,572	63,020
	900	8,943	14,096	20,009	31,590	49,686	71,863
	1,000	10,073	15,877	22,537	35,581	55,964	80,943
	1,100	11,231	17,702	25,128	39,671	62,396	90,246
	1,200	12,414	19,567	27,774	43,850	68,969	99,752
	1,300	13,619	21,467	30,471	48,107	75,665	109,437
	1,400	14,842	23,395	33,208	52,428	82,462	119,267
	1,500	16,079	25,344	35,975	56,797	89,333	129,205
	1,600	17,323	27,306	38,760	61,193	96,247	139,205
	1,700	18,570	29,270	41,548	65,595	103,172	149,221
	1,800	19,811	31,227	44,326	69,981	110,069	159,197
	1,900	21,041	33,166	47,079	74,327	116,905	169,083
	2,000	22,255	35,079	49,793	78,612	123,645	178,832

Table 4B: Flow Rates (MMSCFD)
Based Upon Max Rated Velocity [8-in to 24-in = 100 ft/s]

	Meter Size (in)	8	10	12	16	20	24
Operating Pressure (psig)	100	23.7	37.4	53.1	83.9	131.9	190.8
	200	45.1	71.1	101.0	159.4	250.7	362.6
	300	67.2	105.9	150.3	237.3	373.2	539.8
	400	89.9	141.8	201.2	317.7	499.6	722.7
	500	113.4	178.7	253.7	400.6	630.0	911.2
	600	137.6	216.9	307.9	486.1	764.5	1,105.7
	700	162.5	256.2	363.7	574.2	903.1	1,306.1
	800	188.2	296.7	421.1	664.9	1,045.7	1,512.5
	900	214.6	338.3	480.2	758.2	1,192.5	1,724.7
	1,000	241.7	381.1	540.9	854.0	1,343.1	1,942.6
	1,100	269.5	424.8	603.1	952.1	1,497.5	2,165.9
	1,200	297.9	469.6	666.6	1,052.4	1,655.3	2,394.0
	1,300	326.9	515.2	731.3	1,154.6	1,816.0	2,626.5
	1,400	356.2	561.5	797.0	1,258.3	1,979.1	2,862.4
	1,500	385.9	608.3	863.4	1,363.1	2,144.0	3,100.9
	1,600	415.8	655.3	930.2	1,468.6	2,309.9	3,340.9
	1,700	445.7	702.5	997.2	1,574.3	2,476.1	3,581.3
	1,800	475.5	749.5	1,063.8	1,679.5	2,641.7	3,820.7
	1,900	505.0	796.0	1,129.9	1,783.8	2,805.7	4,058.0
	2,000	534.1	841.9	1,195.0	1,886.7	2,967.5	4,292.0

Local LCD Display

Each Daniel 3410 Series transmitter offers an optional LCD display with a three-line readout that indicates variable name, variable value and engineering unit. The displays can easily be configurated via Daniel MeterLink software or Emerson's AMS™ 475 Field Communicator with HART® protocol.

Figure 2: Optional LCD displays scroll the user-selected variables noted in Table 5.

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)

Table 6: I/O Connections Per Transmitter

	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	5	▪ User Configurable (can configure Digital Input as 6th Frequency/Digital Output)
Analog Output(2, 4)	4-20 mA	1	▪ Independently configurable analog output ▪ HART® 7 Compliant

Optional I/O Expansion Slot: 1 RS232 or 1 RS485 Half Duplex, 2-Wire available per transmitter

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; can configure as sixth Frequency/Digital Output.

(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 resistor for HART® Communicators to be connected for sensor configuration.

(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.

Diagnostics and Software

Expedite delivery of more in-depth diagnostics by activating the optional Continuous Flow Analysis (CFA)(1) feature in the meter's firmware. CFA helps minimize flow measurement uncertainty by determining the root cause of the diagnostic parameter indication. Using these intelligent gas flow diagnostics, operators can more easily maintain meter health and ensure the highest measurement integrity.

Every Daniel ultrasonic flow meter is provided with advanced MeterLink™ Software to simplify monitoring and troubleshooting. This advanced software displays a number of performance-based diagnostics that indicate meter health. In addition, dynamic flow-based diagnostics help operators identify flow disturbances that may affect measurement uncertainty.

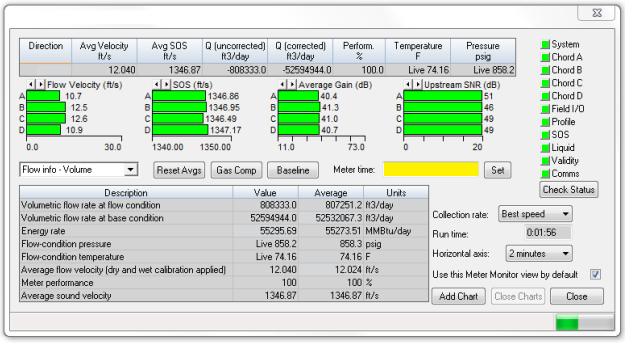

Figure 3A: Daniel MeterLink Monitor Screen

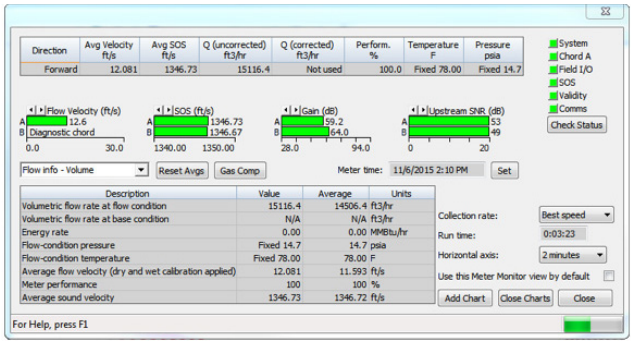

Figure 3B: Two-Path Meter Monitor Screen

- MeterLink software is supplied with meter at no charge
- MeterLink is required for transmitter configuration
  - Meters also configurable with AMS Device Manager or 475 Field Communicator if HART is used
- MeterLink software requires RS232, RS485 full duplex or Ethernet (recommended)
- Supports Microsoft® Vista™, 7, 8.1 and 10
- Microsoft Office 2003-2016

Table 7: Features of Meter and MeterLink(2)

		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	•	•
	Configurable Modbus GC Component Data Table*	•	•
	AGA 10/Meter SOS Comparison*	•	
	SOS Deviation Alert: Check vs. Diagnostic Path (3416 meter only)*	•	•
	Transducer Health Monitoring*	•	•
	AGA 10 Calculator (offline)	•	•
	SNR displayed in dB	•	•
	Improved Help Topics/Links	•	•
	Baseline Viewer™ (4-path only)	•	
	Maintenance Logs	•	•
History	Trend Maintenance Logs	•	•
	Merge Event Logs	•	•
	Hourly Logs (100 days)*	•	•
	Daily Logs (365 days)*	•	•
	Hourly/Daily Log Graphing	•	•
Configuration	Field Setup Wizard	•	•
	Meter Directory Support	•	•
	Automatic File Naming	•	•
	Compare Configurations from Logs	•	•
	Analog Input Calibration	•	•
	Local Display Configurator	•	•
	Modbus GC Component Data Table Configurator	•	•
	Flow Calibration Wizard	•	•
	Modbus TCP Server Configuration	•	•
	Baseline Configuration Wizard	•	
Alarms	Alarm/Audit/System Logs*	•	•
	Display New Latched Alarms	•	•
	Severity Alarm Display	•	•
	Bore Buildup Alert	•	
	Blockage Alert	•	
	Abnormal Profile Alert	•	
	Liquid Detection Alert	•	
	SOS Deviation Alert: Check vs. Diagnostic Path (3416 meter only)*	•	•
	Reverse Flow Alert	•	•

***Features highlighted in blue represent functions of the meter.**

(1) Requires a Continuous Flow Analysis software key.

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

Safety and Compliance

The Daniel Models 3415 and 3416 gas ultrasonic flow meters meet worldwide industry standards for electrical and intrinsic safety certifications and approvals. Consult a Daniel technical specialist 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 — Ex 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

Canadian Registration Number

- Certificate — 0F14855

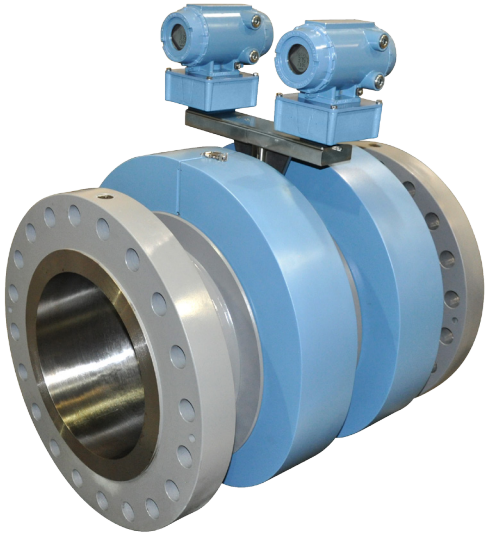

Figure 4A: Dual transducer shrouds are standard on DN400 (16-in) and larger Model 3415 and 3416 meters.

Environmental Ratings

Aluminum

- NEMA 4
- IP66 to EN60529

Stainless Steel

- NEMA 4X
- IP66 to EN60529

Figure 4B: A single transducer shroud is standard on DN200 to DN300 (8-in to 12-in) Model 3415 and 3416 meters.

Metrology Approval

OIML(1)

- OIML R137-1&2 Edition 2012(E)
- Class 0.5

MID(1)

- Directive 2014/32/EU (MID MI-002)
- Class 1.0

DNV GL for Field Robustness(1)

- Certificate — OGNL.123682
- Class 0.5 (Level I-AA)

Measurement Canada(1)

- Approval — AG-0623

(1) Metrology approval only applies to four-path meter.

Operation Limits

Smaller diameter meters are less affected by lower minimum pressures than larger diameter meters. For example, under certain conditions, a DN200 (8-in) diameter meter may be able to operate at a velocity higher than 50 ft/s at 50 psig. Consult a Daniel product specialist if requirements are outside of the operation limits shown below for T-21/T-41/T-22 transducers.

Table 8A: Recommended Maximum Velocity (Metric Units)

Nominal Meter Size (DN)	Maximum Velocity Rating at 345 kPa (m/s)(1)	Capacity between 345 and 689 kPa (ACMH)	Maximum Velocity Rating at 689 kPa (m/s)(1)	Capacity at Max Rated Velocity (ACMH)	Schedule STD Bore (mm)
200	15.2	1,770	30.5	3,541	202.7
250	15.2	2,791	30.5	5,582	254.5
300	15.2	4,003	30.5	8,006	303.2
400	15.2	6,465	30.5	12,930	381
500	15.2	10,301	30.5	20,603	477.9
600	15.2	15,027	30.5	30,055	574.7

Table 8B: Recommended Maximum Velocity (US Customary Units)

Nominal Meter Size (in)	Maximum Velocity Rating at 50 psig (ft/s)(1)	Capacity between 50 and 100 psig (ACFH)	Maximum Velocity Rating at 100 psig (ft/s)(1)	Capacity at Max Rated Velocity (ACFH)	Schedule STD Bore (in)
8	50	62,534	100	125,068	7.981
10	50	98,568	100	197,136	10.020
12	50	141,372	100	282,743	12.000
16	50	228,318	100	456,635	15.250
20	50	363,799	100	727,598	19.250
24	50	530,696	100	1,061,392	23.250

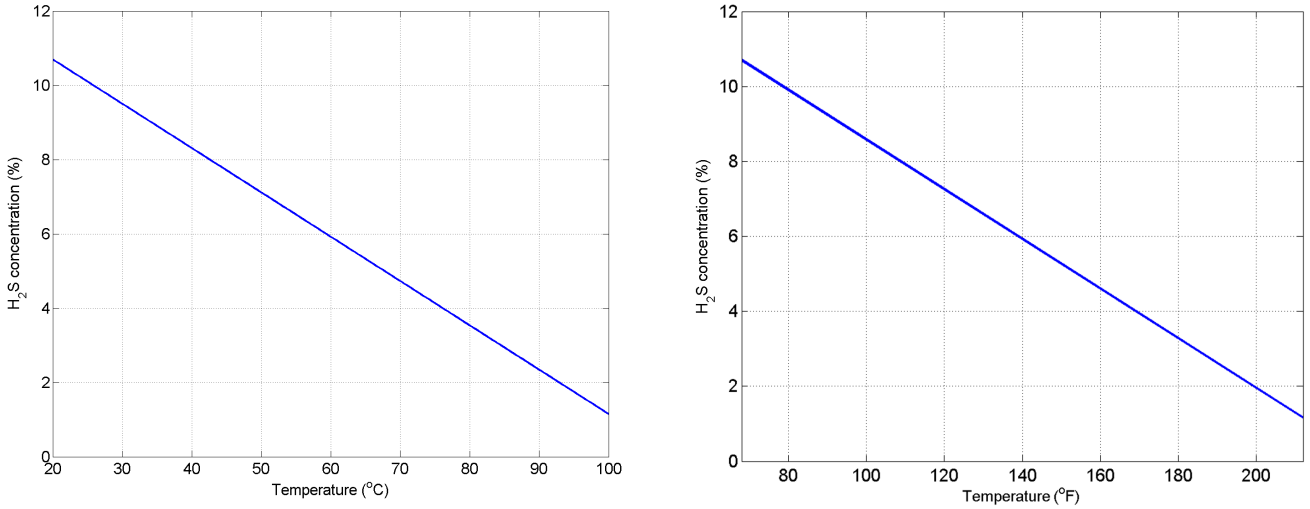

Figure 5: H_2S Limits by Temperature and Pressure for Daniel T-20 Series Transducers

(1) Qmax maximum velocity generally increases linearly with increase in minimum pressure (ie: 50 psig = 50 fps, 75 psig = 75 fps, 100 psig = 100 fps) for DN200 to DN600 (8-in to 24-in) meters.

Weights and Dimensions

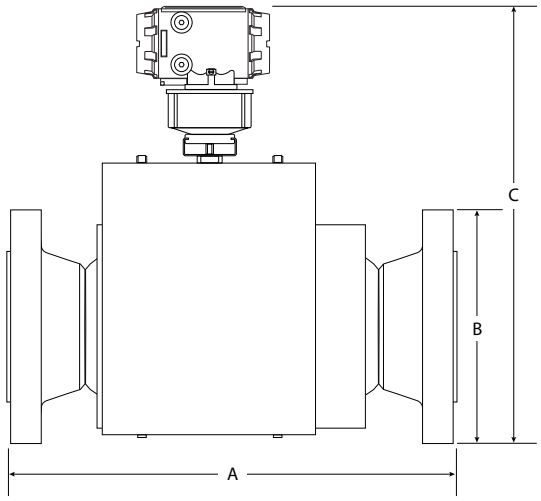

Figure 6A: Dimension Key for DN200 to DN300 (8-in to 12-in) Meters with Single Transducer Shroud (See tables 9A and 9B)

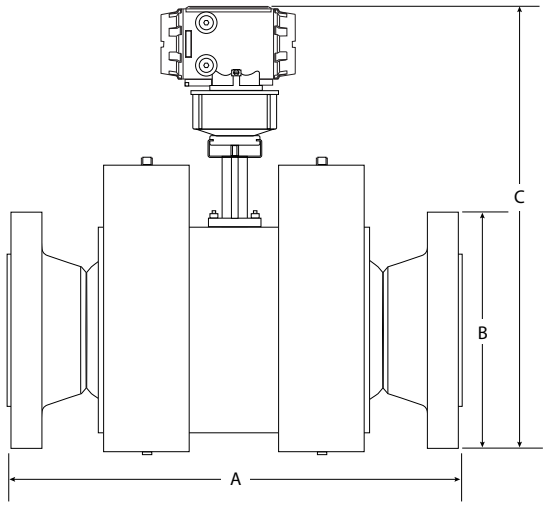

Figure 6B: Dimension Key for DN400 and larger (16-in and larger) Meters with Dual Transducer Shrouds (See tables 9A and 9B)

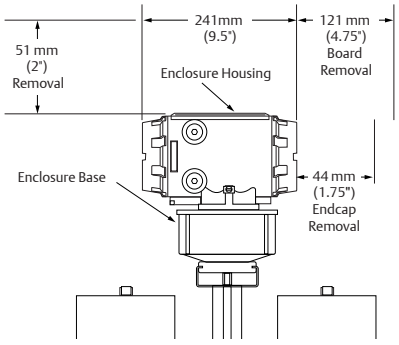

Figure 6C: Dimensions of Enclosure Housing

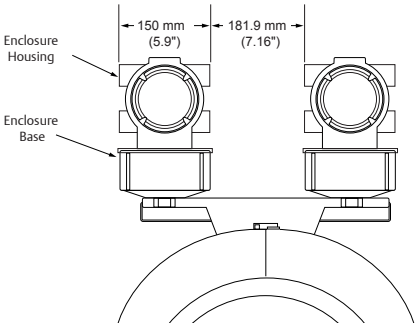

Figure 6D: Additional Dimensions of Enclosure Housing

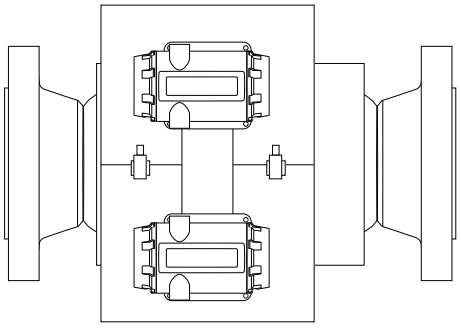

Figure 6E: Overhead View of Meter

Weights and Dimensions

The Meter Dimension Key diagram (Figures 6A and 6B) on page 10 illustrates the meter component measurements that correspond to A, B and C in the chart below. All weights and dimensions are based on the standard electronics enclosure. The certified approval drawing will include the actual weights and dimensions.

Table 9A: Weights and Dimensional Data (Metric Units)

	Nominal Line Size (DN)	200	250	300	400	500	600
PN 50	Weight (kg)	567	771	771	998	1452	2177
	A (mm)	897	1011	927	953	1087	1207
	B (mm)	381	445	521	648	775	914
	C (mm)	790	841	902	1004	1125	1252
PN 100	Weight (kg)	612	839	862	1089	1678	2404
	A (mm)	953	1093	991	1029	1156	1290
	B (mm)	419	508	559	686	813	940
	C (mm)	800	867	922	1023	1143	1265
PN 150	Weight (kg)	CF	CF	CF	CF	CF	CF
	A (mm)	CF	CF	CF	CF	CF	CF
	B (mm)	CF	CF	CF	CF	CF	CF
	C (mm)	CF	CF	CF	CF	CF	CF
PN 250	Weight (kg)	CF	CF	CF	CF	CF	CF
	A (mm)	CF	CF	CF	CF	CF	CF
	B (mm)	CF	CF	CF	CF	CF	CF
	C (mm)	CF	CF	CF	CF	CF	CF

Table 9B: Weights and Dimensional Data (US Customary Units)

	Nominal Line Size (in)	8	10	12	16	20	24
300 ANSI	Weight (lb)	1250	1700	1700	2200	3200	4800
	A (in)	35.3	39.8	36.5	37.5	42.8	47.5
	B (in)	15	17.5	20.5	25.5	30.5	36
	C (in)	31.1	33.1	35.5	39.5	44.3	49.3
600 ANSI	Weight (lb)	1350	1850	1900	2400	3700	5300
	A (in)	37.5	43	39	40.5	45.5	50.8
	B (in)	16.5	20	22	27	32	37
	C (in)	31.5	34.2	36.3	40.3	45	49.8
900 ANSI	Weight (lb)	CF	CF	CF	CF	CF	CF
	A (in)	CF	CF	CF	CF	CF	CF
	B (in)	CF	CF	CF	CF	CF	CF
	C (in)	CF	CF	CF	CF	CF	CF
1500 ANSI	Weight (lb)	CF	CF	CF	CF	CF	CF
	A (in)	CF	CF	CF	CF	CF	CF
	B (in)	CF	CF	CF	CF	CF	CF
	C (in)	CF	CF	CF	CF	CF	CF

CF: Consult factory

Recommended Installation

Recommended Pipe Lengths

The drawings below represent the manufacturer's recommended minimum pipe lengths for installation of Daniel Model 3415 and 3416 Meters. The final recommendations are dependent upon application requirements that must be specified by the customer. Other lengths and flow conditioners can be accommodated.

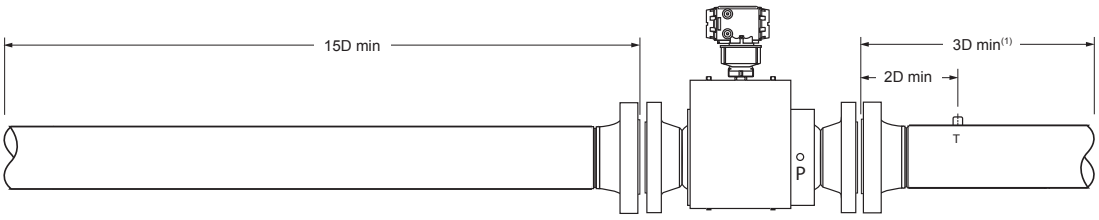

Figure 7A: Piping Recommendation for Gas Ultrasonic Meter (No Flow Conditioner)

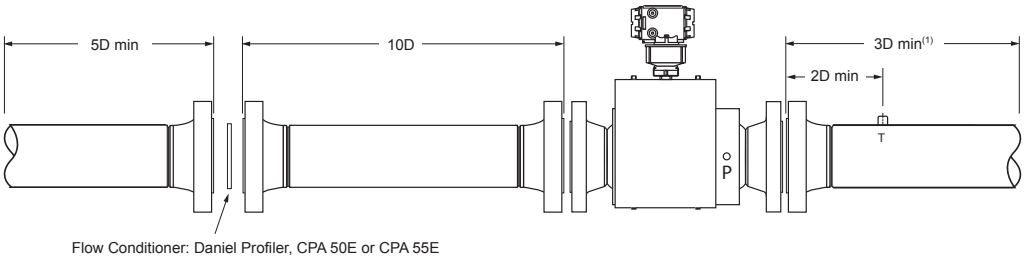

Figure 7B: Piping Recommendation for Gas Ultrasonic Meter with a Flow Conditioner

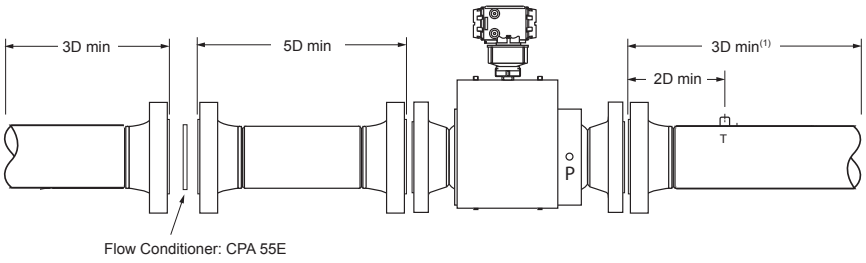

Figure 7C: Piping Recommendation for Gas Ultrasonic Meter with a Flow Conditioner (Compact Installation)(2)

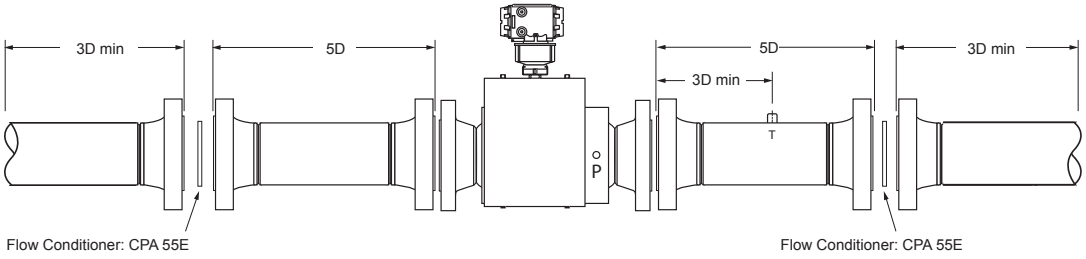

Figure 7D: Piping Recommendation for Bi-directional Gas Ultrasonic Meter with Flow Conditioners (Compact Installation)(2)

Notes:
1. *For best results, flow conditioning is recommended*
2. *D = Nominal pipe size in inches (i.e., 8-in pipe size; 10D = 80-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. This configuration is not applicable to OIML installations.

Daniel Models 3415 and 3416 Gas Ultrasonic Flow Meters

Product Datasheet 34 XX XX XX XXX XX XXX - X X X X X X X X X X X X

Device
- 3415 Custody/Check Meter 15
- 3416 Custody/Check Meter + Diagnostic 16

Line Size
- DN200 (8-in) 08
- DN250 (10-in) 10
- DN300 (12-in) 12
- DN400 (16-in) 16
- DN500 (20-in) 20
- DN600 (24-in) 24

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

Flange Type
- RF / RF S01
- RTJ / RTJ S02
- FEFA / FEFA S03

Body and Flange Material
- Forged: Carbon Steel / 316 SS / Duplex SS ..... F(1)

Schedule (Pipe Bore)
- 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
- Schedule XXS ..... XXS

Transducer Assembly(2)
- T-21 (-20°C to +100°C) - Standard Mounts / Holders, NBR O-ring ..... G
- T-22/T-41 (-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/T-41 (-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/T-41 (-40°C to +100°C) - Inconel Mounts / Inconel Holders, FKM O-ring ..... M
- T-41 (-50°C to +100°C) - Standard Mounts / Holders, NBR O-ring ..... N
- T-41 (-50°C to +100°C) - Inconel Mounts / 316L Holders, NBR O-ring ..... Q
- T-41 (-40°C to +100°C) - Inconel Mounts / Inconel Holders, FKM O-ring ..... S
- T-21/T-22 (-20°C to +100°C) - Standard Mounts / Holders, NBR O-ring ..... U
- T-21/T-22 (-20°C to +100°C) - Inconel Mounts / 316L Holders, NBR O-ring V
- T-21/T-22 (-20°C to +100°C) - Inconel Mounts / Inconel Holders, FKM O-ring ..... W

Pressure Taps
- 1 ..... 1/2-in NPT
- 3 ..... Pipette

Conduit Type
- 1 ..... 3/4-in NPT
- 2 ..... M20 (reducers required)

Electronics Mounting
- A ..... Integral Mount

CPU/Displays/Keys
- C ..... I/O Type 2 (3 Frequency/Digital Outputs, 2 Analog Outputs)
- D ..... I/O Type 2 (3 Frequency/Digital Outputs, 2 Analog Outputs)/Displays
- G ..... I/O Type 2 (3 Frequency/Digital Outputs, 2 Analog Outputs)/CFA Key
- H ..... I/O Type 2 (3 Frequency/Digital Outputs, 2 Analog Outputs)/Displays/CFA Key
- J ..... I/O Type 4 (6 Frequency/Digital Outputs, 1 Analog Output)
- K ..... I/O Type 4 (6 Frequency/Digital Outputs, 1 Analog Output)/Displays
- M ..... /O Type 4 (6 Frequency/Digital Outputs, 1 Analog Output)/CFA Key
- N ..... I/O Type 4 (6 Frequency/Digital Outputs, 1 Analog Output)/Displays/CFA Key

Transmitter Head 1 Expansion Module
- A ..... None
- B ..... Serial RS232
- C ..... Serial RS485

Transmitter Head 2 Expansion Module
- A ..... None
- B ..... Serial RS232
- C ..... Serial RS485

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

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

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

Pressure Directive Certification
- 1 ..... None
- 2 ..... PED (must select electrical approval 2)
- 3 ..... Canadian Boiler Branch (CRN)
- 4 ..... EAC-Russia

Electrical Approvals
- 1 ..... UL / c-UL
- 2 ..... ATEX/IECEx
- 3 ..... INMETRO
- 4 ..... EAC-Russia

Metrology Approval
- A ..... None
- B ..... OIML
- C ..... China

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 for specific model code for desired material.

(2) T-21 and T-41 transducers are the only transducers available for the single-path check meter.

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