Daniel™ Model 3804
Liquid Ultrasonic Flow Meter
Daniel® 3804 Liquid Ultrasonic Flow Meter

Digital Intelligence at Work
Daniel 3804 Liquid Ultrasonic Flow Meter is designed to accurately measure liquid products in accordance with API Chapter 5.8 and OIML R117. With an exceptional rangeability and linearity throughout the flow range, Daniel 3804 Liquid Ultrasonic meter reduces lost and unmeasured liquid products and features HART equipped electronics. Not only does the meter deliver precise process variable data through the PlantWeb® digital plant architecture, it also transmits meter health information to the operator and maximizes uptime.

Daniel 3804 is a four-path, in-line ultrasonic meter that measures transit times of ultrasonic pulses passing through the liquid in four parallel planes. Each of the four paths has two integrally mounted ultrasonic transducers. Each pair of transducers acts alternately as transmitter and receiver. The difference in transit times of the downstream-directed pulses and the upstream-directed pulses is directly proportional to the measured fluid velocity. With no moving parts, the meter is ideal for bi-directional measurement as it provides accurate measurement of both upstream and downstream transit times.

Metrology Approvals
- OIML R117 Draft Edition April 2004(E), Accuracy Class 0.3
- NMi Certificate Test Number CPC-607284
- MID Certificate Number TC7227

Typical Applications
This technology can be applied to custody transfer, allocation measurement, check metering, leak detection and inventory control applications such as:

- Offshore
  - Floating Production Storage and Off-loading (FPSO)
- Offshore platforms
- Barges
- Pipelines
- Crude oil pipelines
- Refined product pipelines
  - Ethane
  - LPG
  - Gasoline
  - Diesel
  - Aviation fuel
- Terminals
  - Loading and off-loading (such as ships, barges, and railcars)
- Tank Farms
- Cavern Storage

Features and Benefits
- Reduce unaccounted fluid loss
- Increase energy savings
- Intrinsically safe / explosion proof
- Lower capital costs
- Reduce maintenance costs
- Reduce inventory costs
- Reduce start-up time
- Improve uptime
- Reduce field technician costs
- Optimize meter operation
SPECIFICATIONS

Please consult Daniel if your requirements are outside the specifications noted below. Other product and material offerings may be available depending on the application.

Meter Type
• Number of paths:
  • Four-path (eight transducer) chordal design
• Ultrasonic type:
  • Transit-time based measurement
  • Spool piece with integral mount transducers

Meter Performance
• Linearity:
  • ± 0.15% of measured value over a 40 to 4 ft/s (12.2 to 1.2 m/s) range
  • ± 0.20% of measured value over a 40 to 2 ft/s (12.2 to 0.6 m/s) range
• Uncertainty of meter factor:
  • < ± 0.027% (API MPMS, Chapter 5, Section 8, Table B-1)
• Repeatability:
  • ± 0.02% of measured value
• Velocity range:
  • Nominal 40 to 2 ft/s (12.2 to 0.6 m/s) with over-range of up to 48 ft/s (14.6 m/s)

Process Parameters
• Process product temperature:
  • -50°F to +212°F (-45°C to +100°C) (Standard)
  • -58°F to +302°F (-50°C to +150°C) (Optional)
• Specific gravity range:
  • 0.35 to 1.50 units

Process Parameters
• Operating pressure range:
  • 0 to 2250 psig (0 to 155 Bar)
• Flanges:
  • Raised face and Ring Type Joint (RTJ) for ANSI Classes 150, 300, 600, 900 (PN 20, 50, 100, 150)
  • Higher ANSI ratings available upon request
• NACE compliant:
  • Designed for NACE compliance*
• Humidity:
  • Up to 95%, non-condensing

* It is the equipment user’s responsibility to select the materials suitable for the intended services.

Figure 1: Typical 8 Inch Meter Performance Curve
Materials of Construction

- **Body and flange material:**
  - ASTM A352 Gr. LCC Carbon Steel (standard)
  - ASTM A351 Gr. CF8M 316 SS (optional)
  - ASTM A351 Gr. CF3M 316L SS (optional)
  - ASTM A995 Gr. 4A Duplex SS (optional)

- **Transducer housing material:**
  - ASTM A479 316L SS with proprietary matching layer material
  - INCONEL ASTM B446 (UNS N06625) Gr. 1 (optional)

- **Transducer cable material:** (for local and remote mounting)
  - TPE Jacket, Tinned Copper Braided Armor, Aluminum Foil Shield, 20 Gauge Twisted Pair (standard) (up to 100°C)
  - Conductor Insulation Material ETFE, Tinned Copper Braid Shield, 20 gauge Tin Coated Copper Wire, Extended Modified Silicone Rubber Jacket (optional) (up to 150°C)

- **Transducer cable gland material:**
  - Chloroprene/Nitrile Rubber

- **Electronic housing material:**
  - ASTM B26 grade A356.0 T6 Aluminum

- **Meter body paint specification:**
  - Carbon steel body material:
    - 2 Coat Paint – Inorganic Zinc primer and Acrylic Lacquer Top Coat (standard: 100°C)
    - 3 Coat Epoxy – Inorganic Zinc primer, Epoxy Midcoat, and Polyurethane Top Coat (optional: 100°C)
    - 2 Coat Paint - Inorganic Zinc primer and Modified silicon top coat (optional: 150°C)

- **Stainless steel or duplex body material:**
  - Unpainted
  - **Electronic housing:**
    - Powder coat

### Table 1A: Daniel 3804 Body and Flange Pressure Ratings - English Units

<table>
<thead>
<tr>
<th>Meter Size (in)</th>
<th>ANSI</th>
<th>Carbon Steel</th>
<th>316 SS</th>
<th>316L SS</th>
<th>Duplex Stainless Steel</th>
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<tr>
<td>4 to 24</td>
<td>150</td>
<td>290</td>
<td>275</td>
<td>275</td>
<td>290</td>
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<tr>
<td></td>
<td>300</td>
<td>750</td>
<td>720</td>
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<td></td>
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<td>2,250</td>
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Note: Pressure rating information is for -20°F to 100°F. Other temperatures may reduce the maximum pressure rating of the materials.

### Table 1B: Daniel 3804 Body and Flange Pressure Ratings - Metric Units

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<th>Meter Size (DN)</th>
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<th>Carbon Steel</th>
<th>316 SS</th>
<th>316L SS</th>
<th>Duplex Stainless Steel</th>
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<tr>
<td>100 to 600</td>
<td>20</td>
<td>20.0</td>
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<td>19.0</td>
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<td>100</td>
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<td>99.3</td>
<td>99.3</td>
<td>103.4</td>
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<td></td>
<td>150</td>
<td>155.1</td>
<td>148.9</td>
<td>148.9</td>
<td>155.1</td>
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Note: Pressure rating information is for -29°C to 38°C. Other temperatures may reduce the maximum pressure rating of the materials.
### Standard Flow Ranges

#### Table 2A: Daniel 3804 Flow Range Table - English Units

<table>
<thead>
<tr>
<th>Nominal Meter Size (in)</th>
<th>Meter I.D. (in)</th>
<th>Pipe Schedule</th>
<th>Fluid Velocity (ft/s)</th>
<th>Flow rate (BPH)</th>
<th>Flow Rate (GPM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Over-Range</td>
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<tr>
<td>4</td>
<td>4.026</td>
<td>Sch 40</td>
<td>2</td>
<td>40</td>
<td>48</td>
</tr>
<tr>
<td>6</td>
<td>6.065</td>
<td>Sch 40</td>
<td>2</td>
<td>40</td>
<td>48</td>
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<tr>
<td>8</td>
<td>7.981</td>
<td>Sch 40</td>
<td>2</td>
<td>40</td>
<td>48</td>
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<tr>
<td>10</td>
<td>10.020</td>
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<td>2</td>
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<td>48</td>
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<tr>
<td>12</td>
<td>11.938</td>
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<tr>
<td>16</td>
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<td>2</td>
<td>40</td>
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<td>18</td>
<td>16.876</td>
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<td>20</td>
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<td>40</td>
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<td>24</td>
<td>22.624</td>
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<td>2</td>
<td>40</td>
<td>48</td>
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#### Table 2B: Daniel 3804 Flow Range Table - Metric Units

<table>
<thead>
<tr>
<th>Nominal Meter Size (DN)</th>
<th>Meter I.D. (mm)</th>
<th>Pipe Schedule</th>
<th>Fluid Velocity (m/s)</th>
<th>Flow Rate (m/hr)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>100</td>
<td>102.3</td>
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<td>12.2</td>
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<tr>
<td>150</td>
<td>154.1</td>
<td>Sch 40</td>
<td>0.61</td>
<td>12.2</td>
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<tr>
<td>200</td>
<td>202.7</td>
<td>Sch 40</td>
<td>0.61</td>
<td>12.2</td>
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<td>250</td>
<td>254.5</td>
<td>Sch 40</td>
<td>0.61</td>
<td>12.2</td>
</tr>
<tr>
<td>300</td>
<td>303.2</td>
<td>Sch 40</td>
<td>0.61</td>
<td>12.2</td>
</tr>
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<td>400</td>
<td>381.0</td>
<td>Sch 40</td>
<td>0.61</td>
<td>12.2</td>
</tr>
<tr>
<td>450</td>
<td>428.65</td>
<td>Sch 40</td>
<td>0.61</td>
<td>12.2</td>
</tr>
<tr>
<td>500</td>
<td>477.82</td>
<td>Sch 40</td>
<td>0.61</td>
<td>12.2</td>
</tr>
<tr>
<td>600</td>
<td>574.65</td>
<td>Sch 40</td>
<td>0.61</td>
<td>12.2</td>
</tr>
</tbody>
</table>
Electronics Platform

- **Power**: 10.4 VDC – 36 VDC
  - 8 watts typical
  - 15 watts maximum
- **Ambient temperature range**: -40°F to +149°F (-40°C to +65°C)
- **Storage temperature range**: -58°F to +185°F (-50°C to +85°C)
- **Operating relative humidity**: up to 95% non-condensing
- Six conduit ports (3/4” NPT or M20)
  - Plugs provided
- **Electronic housing options**:
  - Integral (standard)
  - Remote mount - (optional)
    - required when process temperature exceeds 150°F (+65.5°C)
  - 15ft (4.6 m) transducer cables
- **Weather proof to NEMA 4X, IP66 to EN60529**

Safety Classifications

- **UL / c-UL Class I, Division 1, Group C,D UL file – E152246**
- **CE Marked to Directives**:
  - 94/9/EC – Explosive Atmospheres (ATEX)
    - Certificate Baseefa 04ATEX0129
    - Marking – II 2G Ex d ia IIB T4 (-40°C ≤ T_a ≤ +65°C)
  - 97/23/EC – Pressure Equipment Directive (PED)
  - 92004/108/EC – Electromagnetic Compatibility (EMC)
- **IECEEx**
  - Certificate BAS 08.0005
  - Marking – Ex d ia IIB T4

Electronics Functionality

- **Meter body expansion correction**
- **Configuration write protection**
- **Hardware security switch**
- **Wire seal security available**
- **Archive logging (Historical Record Retention)**
  - Hourly and daily logs
  - Audit log (for configuration changes)
  - Alarm log
- **Field-upgradeable firmware**
  - Via serial or Ethernet port

Transducer Assembly

- **Transducer capsule**
  - Field replaceable
  - Intrinsically safe
- **Transducer cable glands**
  - Comply with BS 6121 and EN 50262 standards
- **IP 66 rated for water ingress**
- **Approved by UL and ATEX**
- **Eight conduit ports for transducer cables**
- **Transducer housing locking ring**
- **Wire seal security available**
- **Transducer housing O-ring material: NBR(Nitrile butadiene rubber) (Standard) other materials available**

Figure 2: Transducer Assembly
Input / Output

- One Ethernet port (TCP/IP) (Up to 10 Mbps) Half-Duplex
  - Modbus TCP
- Three serial ports *

<table>
<thead>
<tr>
<th>Port</th>
<th>Supports</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>RS-232 and RS-485 full and half duplex</td>
</tr>
<tr>
<td>B</td>
<td>RS-232 and RS-485 full and half duplex</td>
</tr>
<tr>
<td>C</td>
<td>RS-232 and RS-485 half duplex</td>
</tr>
</tbody>
</table>

- 1.2 to 115 kbps baud rate
- Modbus RTU/ASCII
- Maximum cable length (with Beldon wire No. 9940 or equivalent)
  - RS-232 communications: 250 ft. (88.3 m) at 9600 bps
  - RS-485 communications: 1970 ft. (600 m) at 57600 bps
- Two isolated frequency pair outputs for volumetric flow rate *
  - Individually configurable frequency range as 0-1000 Hz or 0-5000 Hz frequency range (frequency over-range 150% of full scale)
  - Individually configurable as forward, reverse, absolute, or bi-directional flow
  - Individually configurable for Open Collector or TTL
  - Each pair capable of level B security
- Two 4-20 mA outputs for volumetric flow rate *
  - One conventional 4-20 mA
  - One 4-20 mA output with HART
  - Internally powered and magnetically isolated to 500V
- Two 4-20 mA analog inputs (16 bit) for pressure and temperature
- One digital input for flow calibration gating (contact closure)
  - Single input for starting and stopping gate
  - Four pulse configurations available
- Four digital outputs
  - Individually configurable for data validity or flow direction
  - Individually configurable for Open Collector or TTL

*Frequency, analog and serial outputs are electronically isolated from each other.

Operation / Configuration Software

- Windows®-based MeterLink™ software is supplied with meter at no charge
- It is recommended to upgrade to MeterLink™ if you are still using Daniel CUI 5 Edition
- MeterLink™ allows for transmitter configuration
- MeterLink™ requires RS-232, RS-485 full duplex, or Ethernet (recommended)
- Configurable with AMS™ Device Manager or 375 / 475 Field Communicator if HART® is used

<table>
<thead>
<tr>
<th>Table 3: MeterLink™ Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehensive monitor screen shows meter performance information</td>
</tr>
<tr>
<td>Create maintenance logs and reports</td>
</tr>
<tr>
<td>Audit / alarm / history retrieval in Excel® or CSV files</td>
</tr>
<tr>
<td>Field set up wizard</td>
</tr>
<tr>
<td>Meter directory support</td>
</tr>
<tr>
<td>View and chart advanced diagnostic data</td>
</tr>
<tr>
<td>View and save waveforms</td>
</tr>
<tr>
<td>Automatic file naming and organized saving</td>
</tr>
<tr>
<td>Supports hundreds of meters</td>
</tr>
<tr>
<td>Trend maintenance logs</td>
</tr>
<tr>
<td>View multiple graphs simultaneously</td>
</tr>
<tr>
<td>Compare meter configurations stored in Excel logs</td>
</tr>
<tr>
<td>Calibrate analog inputs</td>
</tr>
<tr>
<td>Meter factor wizard for flow calibration</td>
</tr>
<tr>
<td>Hourly and daily log graphing</td>
</tr>
<tr>
<td>SNR displayed in dB</td>
</tr>
<tr>
<td>Alarms displayed by severity</td>
</tr>
<tr>
<td>Separate latched alarm display</td>
</tr>
<tr>
<td>Modbus TCP server configuration</td>
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<tr>
<td>Reverse flow alert display</td>
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</table>
WEIGHTS AND DIMENSIONS

Figure 3A: Factory installed position of enclosure housing for 4" and 6" meters*

Figure 3B: Optional field installed position of enclosure housing*

*Enclosure Housing may be rotated 360 degrees in 90 degree increments

Figure 3C
Table 4A: Daniel 3804 Weight and Dimension Data - English Units

<table>
<thead>
<tr>
<th>Nominal Line Size (in)</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>12</th>
<th>16</th>
<th>18</th>
<th>20</th>
<th>24</th>
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<tbody>
<tr>
<td>A (in)</td>
<td>16.00</td>
<td>18.00</td>
<td>21.50</td>
<td>24.50</td>
<td>26.00</td>
<td>30.00</td>
<td>31.50</td>
<td>35.50</td>
<td>39.00</td>
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<tr>
<td>B (in)</td>
<td>9.00</td>
<td>11.00</td>
<td>13.50</td>
<td>16.00</td>
<td>19.00</td>
<td>23.50</td>
<td>25.00</td>
<td>27.50</td>
<td>32.00</td>
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<tr>
<td>C (in)</td>
<td>15.69</td>
<td>16.94</td>
<td>17.94</td>
<td>19.19</td>
<td>20.13</td>
<td>21.81</td>
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<td>Weight (lb)</td>
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<td>649</td>
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<th>500</th>
<th>600</th>
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<tr>
<td>PN20</td>
<td>A (mm)</td>
<td>406</td>
<td>457</td>
<td>546</td>
<td>622</td>
<td>660</td>
<td>762</td>
<td>800</td>
<td>902</td>
<td>991</td>
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<tr>
<td></td>
<td>B (mm)</td>
<td>229</td>
<td>279</td>
<td>343</td>
<td>406</td>
<td>483</td>
<td>597</td>
<td>635</td>
<td>699</td>
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<tr>
<td></td>
<td>C (mm)</td>
<td>399</td>
<td>430</td>
<td>456</td>
<td>487</td>
<td>511</td>
<td>554</td>
<td>576</td>
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<td></td>
<td>Weight (kg)</td>
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<td>380</td>
<td>572</td>
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<td>546</td>
<td>622</td>
<td>660</td>
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<tbody>
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<td>PN100</td>
<td>A (mm)</td>
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<td>800</td>
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<td>991</td>
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<tr>
<td></td>
<td>B (mm)</td>
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<td>C (mm)</td>
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<td>456</td>
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<td>Weight (kg)</td>
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<table>
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<tr>
<th>900 ANSI</th>
<th>Nominal Line Size (DN)</th>
<th>100</th>
<th>150</th>
<th>200</th>
<th>250</th>
<th>300</th>
<th>400</th>
<th>450</th>
<th>500</th>
<th>600</th>
</tr>
</thead>
<tbody>
<tr>
<td>PN150</td>
<td>A (mm)</td>
<td>419</td>
<td>470</td>
<td>699</td>
<td>775</td>
<td>876</td>
<td>1,054</td>
<td>914</td>
<td>940</td>
<td>1,219</td>
</tr>
<tr>
<td></td>
<td>B (mm)</td>
<td>292</td>
<td>381</td>
<td>470</td>
<td>546</td>
<td>610</td>
<td>705</td>
<td>785</td>
<td>857</td>
<td>1,040</td>
</tr>
<tr>
<td></td>
<td>C (mm)</td>
<td>399</td>
<td>430</td>
<td>463</td>
<td>494</td>
<td>532</td>
<td>576</td>
<td>760</td>
<td>637</td>
<td>665</td>
</tr>
<tr>
<td></td>
<td>Weight (kg)</td>
<td>135</td>
<td>215</td>
<td>384</td>
<td>471</td>
<td>827</td>
<td>1,190</td>
<td>1,435</td>
<td>1,676</td>
<td>2,791</td>
</tr>
</tbody>
</table>

Note: This information is not intended for construction. Certified dimensional drawings are available. Please consult the factory.
Figure 4A: Pressure Drop Chart - U.S. Customary Units
Meter Only

Figure 4B: Pressure Drop Chart - Metric Units
Meter Only
RECOMMENDED INSTALLATION

The drawings below represent minimum recommended pipe lengths for the installation of the Daniel 3804 Liquid Ultrasonic Flow Meter. If shorter lengths are used, there may be an increase in flow measurement uncertainty. Please consult Daniel for best installation recommendations for your application.

Figure 5: Daniel Piping Recommendation for Liquid Ultrasonic Meter with a Flow Conditioner

Figure 6: Daniel Piping Recommendation for Bi-Directional Liquid Ultrasonic Meter with Flow Conditioners

Notes:
1. For best results flow conditioning is recommended
2. All pipe lengths are minimum.
3. D = Nominal pipe size in inches (i.e. 6" pipe size; 10 D = 60 in)
4. P = Pressure measurement location
5. T = Temperature measurement location
**Daniel 3804 LiquiD UltraSonic Flow Meter Selector**

### Line Size
- 4" inches (DN 100).................04
- 6" inches (DN 150).................06
- 8" inches (DN 200).................08
- 10" inches (DN 250)................10
- 12" inches (DN 300)...............12
- 16" inches (DN 400)...............16
- 20" inches (DN 500)...............20
- 24" inches (DN 600)...............24

### Pressure Rating
- 150 ANSI / PN 20 .................01
- 300 ANSI / PN 50 .................03
- 600 ANSI / PN 100 ...............05
- 900 ANSI / PN 150 ...............06

### Flange Type
- RF / RF ..................................S01
- RTJ / RTJ ..................................S02

### Body and Flange Material
- Carbon steel body and flanges: (-45°C to 150°C) ..............M1
- 316 Stainless steel body and flanges: (-50°C to 150°C) ........M2
- 316L Stainless steel body and flanges: (-50°C to 150°C) ......M3
- Duplex stainless steel: (-50°C to 150°C) ..................M4
- Carbon steel body and flanges: (-50°C to 150°C) ..............M5

### Schedule (Pipe Bore)
- Light Wall ................................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
- Standard (only for use in 12" line sizes) ..............STD
- Extra Strong (only for use in 12" line sizes) ..XS0
- Extra, Extra Strong (only for use in 4", 6", and 8" line sizes) XXS

### Transducer Assembly
- LT-01 transducer (-50°C to 100°C) with NBR o-rings
- LT-03 transducer (-50°C to 100°C) with NBR o-rings
- LT-01 transducer (-40°C to 100°C) with FKM o-rings
- LT-03 transducer (-40°C to 100°C) with FKM o-rings
- LT-08 transducer (-50°C to 135°C) with NBR o-rings
- LT-09 transducer (-50°C to 135°C) with NBR o-rings
- LT-04 transducer (-50°C to 135°C) with NBR o-rings
- LT-05 transducer (-50°C to 135°C) with NBR o-rings
- LT-08 transducer (-40°C to 150°C) with FKM o-rings
- LT-09 transducer (-40°C to 150°C) with FKM o-rings
- LT-04 transducer (-40°C to 150°C) with FKM o-rings
- LT-05 transducer (-40°C to 150°C) with FKM o-rings

### Metrology Approvals
- None
- European Union (TC 7227), OIML
- China (CPA-2008-C160)
- Brazil (INMETRO ML 249/2008)

### Electrical Approvals
- UL / C-UL Approval
- CE (ATEX and PED), IECEx
- Must select pressure directive cert code 2

### Pressure Directive Cert
- None
- PED (must select electrical approval code 2)
- CRN (Canadian Boiler Branch)

### Tagging Language (for all tags)
- English
- French
- Russian

### Tagging Format
- (Line Size / Pressure Rating / Flow Parameters)
  - Inch / ANSI / US Customary
  - Inch / ANSI / Metric
  - DN / PN / US Customary
  - DN / PN / Metric

### Future
- None

### Expansion Board
- Output Card with HART Functionality

### Flow Direction
- Uni-directional
- Bi-directional

### Electronics Mounting
- Integral Mounted (Up to 65°C)
- Remote Mounted w/ 15" Transducer cables (Up to 100°C)
- Remote Mounted 15" (Up to 150°C)

### Conduit Type
- 3/4" NPT
- M20 Reducer

### Input Power
- 10.4 VDC to 36 VDC input supply

### Enclosure Type
- Aluminum Powder Coated Housing, Indoor/Outdoor,
- Explosion Proof - Meets Requirement of NEMA 7 & 4X