

CALDON®

LEFM 380Ci Gas Ultrasonic Flow Meters



When accuracy and reliability are critical, the Caldon family of LEFM Ultrasonic Meters provides the petroleum industry with a durable, stable and low cost-of-ownership measurement option. LEFM models cover a broad range of measurement demands and allow users to choose just the right meter for applications ranging from heavy crude oil, LNG, NGL's and now, natural gas.

The **LEFM 380Ci ultrasonic meter** is designed specifically for measurement of natural gas where accuracy and reliability are critical.

Transducers are isolated from the process, located behind a pressure boundary, eliminating transducer failures due to erosion, chemical attack; or, sudden pressure or temperature changes.

The LEFM 380Ci is **inherently immune to swirl within the flow stream**, eliminating the need for flow conditioning elements and long upstream piping configurations, reducing the footprint and installation costs.

The meter combines **exceptional signal processing technology** with **advanced transducer design** that results in a measurement solution that is unmatched in performance, reliability and safety.

Ideally suited for custody transfer measurement

Transducer elements isolated from the process, allowing safe removal for examination or replacement without de-pressurizing the line or special extraction tools

Immune to swirl errors – flow conditioning element is not required

Flow tests in liquid fractions up to 5% by volume validate the meter remains operational in wet gas flowing conditions

No obstructions
No pressure drop

Superior flow stream and performance diagnostics

Meter Construction

The Caldon LEFM 380Ci meter body is designed and manufactured in accordance with ASME B31.3 Process Piping Code, making it suitable for handling pressurized natural gas.

The 380Ci has sixteen piezoelectric ultrasonic transducer modules that are arranged in pairs to form eight measurement paths. Two paths are paired at each of 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.

Meter Sizes, Flow Rates, and Velocities

| Meter Size | | Schedule | Flow Rate – mcf/day (actual) | | | Flow Rate – m ³ /day (actual) | | |
|------------|-----|----------|------------------------------|--------|------------|--|---------|------------|
| Inches | DN | | Min | Max | Over-range | Min | Max | Over-range |
| 8 | 200 | 40 | 60 | 3,000 | 3,600 | 1,700 | 85,000 | 102,000 |
| 10 | 250 | 40 | 90 | 4,700 | 5,700 | 2,700 | 134,000 | 161,000 |
| 12 | 300 | 40 | 130 | 6,700 | 8,100 | 3,800 | 190,000 | 229,000 |
| 16 | 400 | 40 | 210 | 10,600 | 12,700 | 6,000 | 301,000 | 360,000 |
| 20 | 500 | 40 | 330 | 16,700 | 20,000 | 9,500 | 473,000 | 567,000 |
| 24 | 600 | 40 | 480 | 24,100 | 29,000 | 13,600 | 687,000 | 823,000 |
| 8 | 200 | 80 | 50 | 2,700 | 3,300 | 1,500 | 77,500 | 93,000 |
| 10 | 250 | 80 | 90 | 4,300 | 5,200 | 2,500 | 122,000 | 147,000 |
| 12 | 300 | 80 | 120 | 6,100 | 7,300 | 3,500 | 173,000 | 208,000 |
| 16 | 400 | 80 | 190 | 9,700 | 11,600 | 5,500 | 273,000 | 328,000 |
| 20 | 500 | 80 | 300 | 15,200 | 18,200 | 8,500 | 430,000 | 515,000 |
| 24 | 600 | 80 | 440 | 21,900 | 24,200 | 12,400 | 621,000 | 687,000 |

*Over-range flow rates are at 120 fps. Refer to Cameron support for applications outside these ranges. Consult factory for other sizes and pipe schedules.

Standard Material of Construction

| Component | Material |
|---------------------|--|
| Meter Body | Carbon Steel (Stainless and Duplex Optional) |
| Flanges | Carbon Steel (Stainless and Duplex Optional) |
| Transducer Housings | Titanium |
| Junction Boxes | Copper-free Aluminum or Stainless Steel |
| Compact Transmitter | Copper-free Aluminum 316 Stainless Steel – Optional |

Standard End Connections & Maximum Working Pressure

Maximum Working Pressure -20° to 100°F (-29° to 38°C)

| | ANSI B16.5 Raised Face Carbon Steel | | ANSI B16.5 Raised Face Stainless Steel | |
|------------|--|--------|---|-------|
| | psi | bar | psi | bar |
| Class 300 | 740 | 51.02 | 720 | 49.6 |
| Class 600 | 1,480 | 102.04 | 1,440 | 99.3 |
| Class 900 | 2,220 | 153.06 | 2,160 | 148.9 |
| Class 1500 | 3,705 | 255.38 | 3,600 | 248.2 |

General Specifications

| | Remote Compact Electronics | Meter Body |
|----------------------------|---|-----------------------------------|
| Voltage | 18 to 30 VDC | |
| Power | <15 W | |
| Relative Humidity | 0-95% | 0-95% |
| Operating Temperature | -40° to 140°F (-40° to 60°C) | -40°F to 212°F (-40° to 100°C) |
| Local Display | 2-line 16 characters/ line 0.22 inch high (6.0 mm) | |
| Remote Mounting from Meter | 328 feet (100 meters) | |
| Analog Input | 4-20 mA DC. Configured for pressure. | |
| RTD Input | Gas temperature | |
| Analog Output | One; 4-20 mA DC. Any process variable measured by the meter is available as an analog output. | |
| Digital Outputs Flow | Two pulse output channels selectable as 0-5 VDC or 0-12VDC; A and B continuous 50/50 duty cycle. Programmable K Factor | |
| Flow Direction | B channel can be programmed as 90° out of phase with A or as a direction-indicating voltage level (High = Forward Flow) | |
| Alarm Status | 0-5 VDC or 0-12VDC selectable (0 = alarm) | |
| Serial Communication | ModBus RTU: (2) RS-485 – Up to 3,900 feet (1,200 meters) | |
| Ethernet | Modbus TCP | |

General Performance

Meets or Exceeds the Requirements of AGA 9 Second Edition (April 2007)

| flowrate | fps |
|------------------|-----|
| q _{min} | 2 |
| q _i | 10 |
| q _{max} | 100 |

Where:

q_{min} = minimum flow rate

q_i = stated accuracy minimum flow rate

q_{max} = stated accuracy maximum flow rate

Uncertainty of Measurement ± 0.1% flow rate relative to calibration facility

Repeatability ± 0.1% for q_t ≤ q_i ≤ q_{max}; where q_i is the measured flow rate

Velocity Sampling Interval ≤ 0.06 seconds

Electrical Safety Approvals

Compact Transmitter

II 2 G, Ex d IIB Gb T6
 US Class I, Div. 1, Groups C&D T6
 Temp: -40° to 140°F (-40° to 60°C) Temp: -40° to 140°F (-40° to 60°C)
 PENDING

Meter Body

II 2 G, Ex d IIB Gb T6
 US Class I, Div. 1, Groups C&D T6
 Temp: -40° to 140°F (-40° to 60°C) Temp: -40° to 140°F (-40° to 60°C)
 PENDING

Dimensions for the LEFM 380Ci

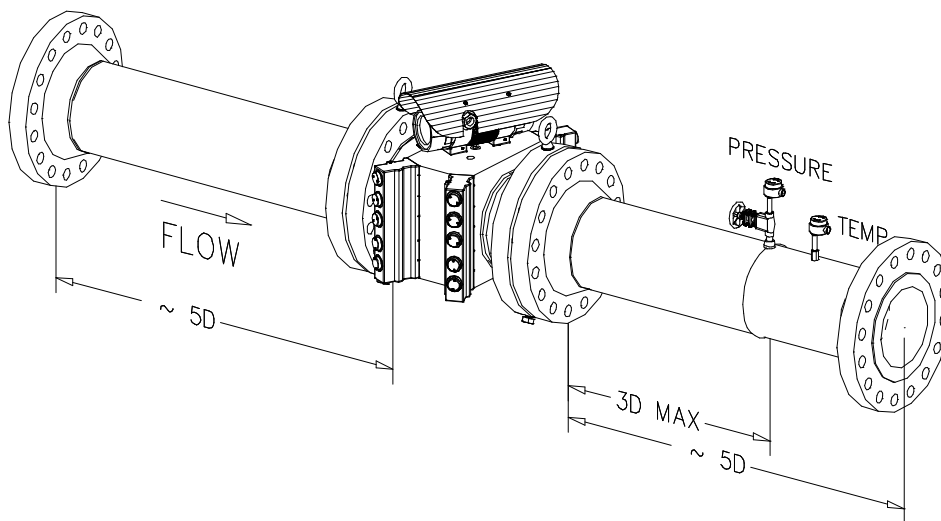
| Meter Size | | Face-to-Face | | | |
|------------|-----|--------------|-------------|-------------|-------------|
| | | Class 300 | Class 600 | Class 900 | Class 1500 |
| Inches | DN | Inches (mm) | Inches (mm) | Inches (mm) | Inches (mm) |
| 8 | 200 | 21.5 (546) | 21.5 (546) | 23.8 (604) | 27.8 (705) |
| 10 | 250 | 24.5 (622) | 24.5 (622) | 27.0 (686) | 32.5 (826) |
| 12 | 300 | 26.0 (660) | 26.0 (660) | 29.5 (750) | 36.0 (914) |
| 16 | 400 | 30.0 (762) | 30.0 (762) | 33.0 (838) | 40.5 (1029) |
| 20 | 500 | 35.5 (902) | 35.5 (902) | 40.0 (1016) | 48.5 (1232) |
| 24 | 600 | 39.0 (991) | 39.0 (991) | 46.0 (1168) | 55.0 (1397) |

Installation

To obtain the best possible performance from the LEFM 380Ci, follow these basic minimum installation requirements:

- The upstream and downstream piping must have the same inside diameter (schedule) as that of the meter.
- 5 diameters of upstream straight pipe is sufficient flow conditioning for elements such as full-port valves, elbows, and concentric reducers upstream of the meter.
- When the meter must be installed downstream of reduced port valves, partially open valves, eccentric reducers, etc., 15 diameters of straight pipe are recommended.
- Process temperature and pressure should be measured within 3 diameters downstream of the meter.
- Where installation guidelines cannot be met, or for recommendations for specific applications, consult Cameron to determine acceptable options.

The LEFM 380Ci does not require a flow conditioning element.



For more information contact: Caldon Ultrasonics Technology Center
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