



# CALDON LEFM Ultrasonic Flowmeters for Liquids

Integrating experience, proven technology,  
and innovation



*CALDON LEFM 280Ci ultrasonic flowmeter.*

# Contents

## **CALDON LEFM Ultrasonic Flowmeters for Liquids**

Count on Cameron .....	3
Advantages .....	4
CALDON LEFM* ultrasonic flowmeter models for liquids .....	5
CALDON LEFM SystemLink* user interface software technology .....	7
Specifications .....	8
Dimensions and weights .....	10
Installation .....	13
Hydrocarbon calibration laboratory .....	14
Notes .....	15



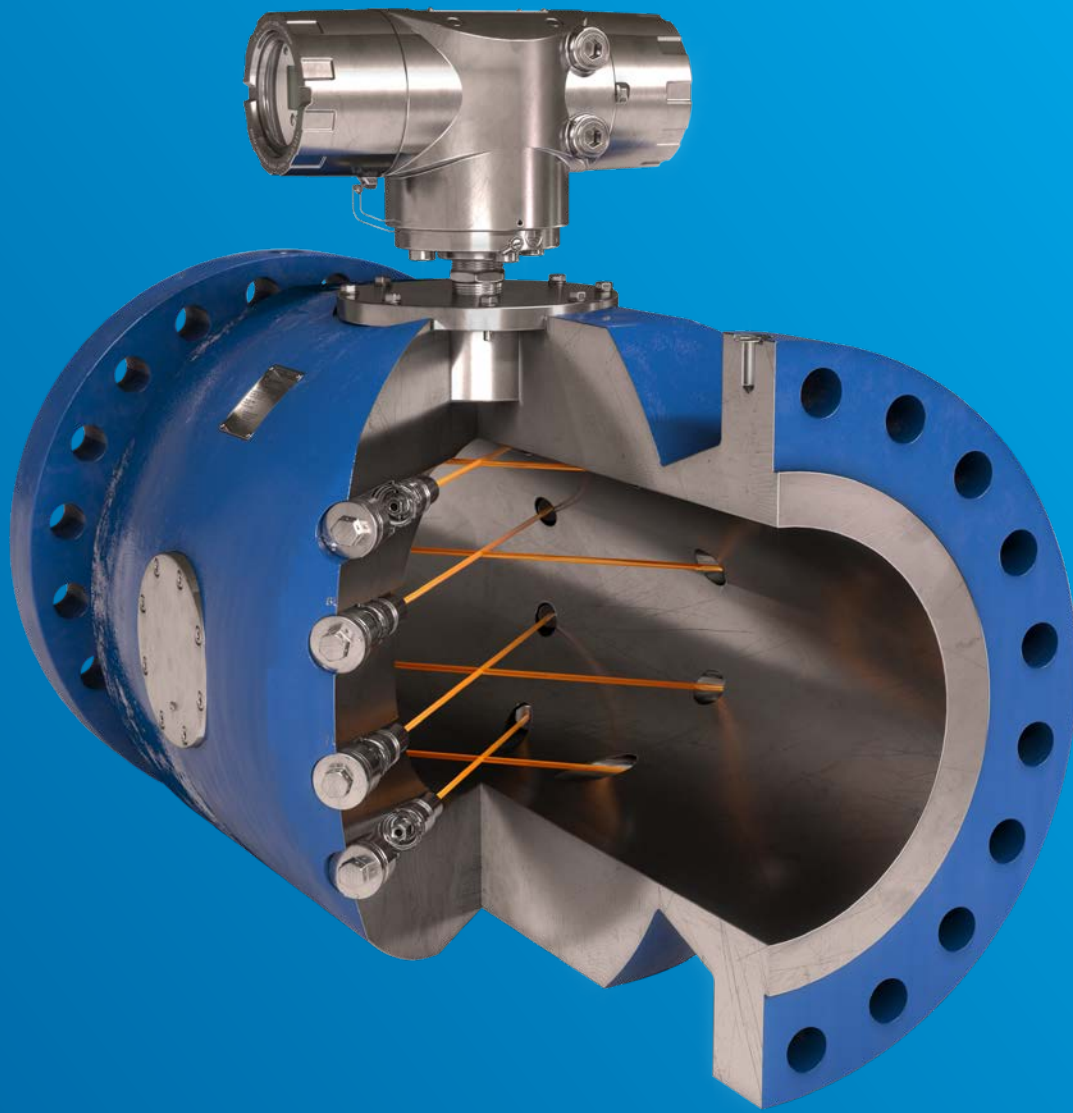
## Count on Cameron

Backed by more than 50 years of experience and a history of technological firsts, the Cameron portfolio of CALDON LEFM\* ultrasonic flowmeters combines experience, innovation, and proven technology into the broadest offering of custody transfer, fiscal, check metering, and leak detection innovations for the liquid hydrocarbon industry. The CALDON LEFM flowmeter series accommodates the largest range of applications, including high-viscosity crude oils and LNG.

CALDON LEFM flowmeters for liquids have become the benchmark around the world. Leveraging expertise from one of the most advanced liquid hydrocarbon calibration laboratories, Cameron offers the most complete capabilities to fit all customer application and service needs.

### **CALDON LEFM Flowmeter Technology Firsts**

- |                |  |
|----------------|--|
| <b>1965–70</b> | First chordal multipath flowmeters   |
| <b>1970–75</b> | First nuclear reactor coolant application  |
| <b>1974–75</b> | First flowmeter for crude oil applications   |
| <b>1994–99</b> | First measurement uncertainty recapture uprate at nuclear facilities                               |
| <b>1995</b>    | First military-specification flowmeter   |
| <b>2003</b>    | First application for custody transfer of liquid hydrocarbons                                      |
| <b>2005</b>    | First application for custody transfer of LNG  |
| <b>2008</b>    | First application for custody transfer of heavy, viscous crude oils up to 3,000 mm <sup>2</sup> /s |



*CALDON LEFM 280Ci ultrasonic flowmeter.*

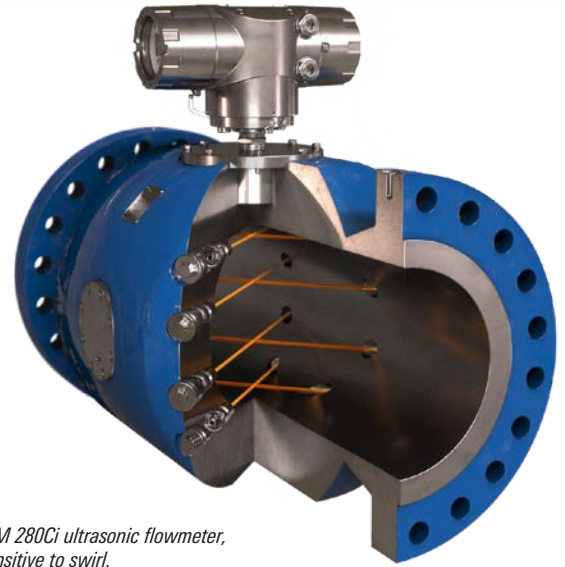
### **Advantages**

- Compliance with API MPMS Chapter 5.8, International Organization of Legal Metrology (OIML) Recommendation R 117-1 Class 0.3, Measuring Instruments Directive (MID) 2004/22/EC, and NACE MR0175
- Four- and eight-path chordal designs for optimal linearity and repeatability
- Industry-leading eight-path chordal design with immunity to swirl and asymmetry effects at 5D upstream and no requirement for flow conditioner, which reduces total cost of ownership
- Advanced signal processing with real-time diagnostic analysis, including best-in-class update rate
- Reduced nozzle design that delivers unparalleled accuracy and flow profile stability for high-viscosity, low-Reynolds number applications
- Four- and eight-path designs for cryogenic applications that require custody transfer and allocation performance
- Transducers that are isolated from the process, providing a safety barrier if service is required
- No recalibration or zeroing required if transducer is replaced
- Superior transducer quality with no drift
- Internal resistance temperature detector (RTD) for thermal expansion compensation
- Continuous logging capabilities
- Optional corrosion- and contamination-resistant internal coating

# CALDON LEFM Flowmeter Models for Liquids

## 280Ci

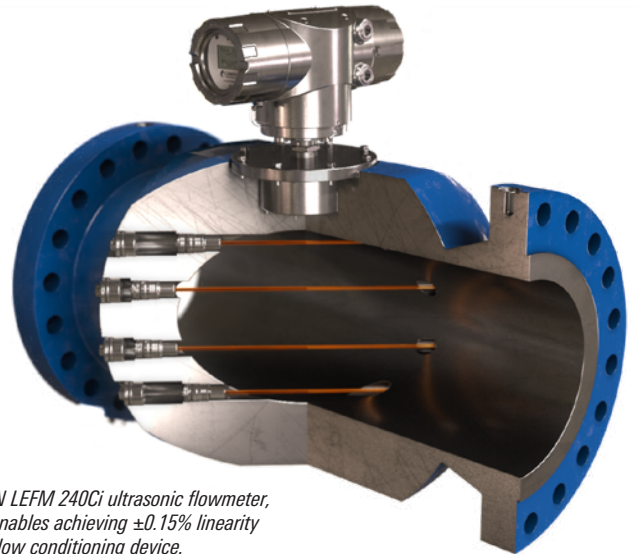
The eight-path CALDON LEFM 280Ci ultrasonic flowmeter is a compact, high-performance unit designed to meet the most stringent requirements of custody-transfer and fiscal metering applications. The design of the 280Ci model makes it insensitive to swirl and flow profile effects and capable of  $\pm 0.1\%$  linearity without requiring a flow conditioner. The flowmeter can be installed with only 5 pipe diameters straight run upstream to achieve premium performance.



*CALDON LEFM 280Ci ultrasonic flowmeter, which is insensitive to swirl.*

## 240Ci

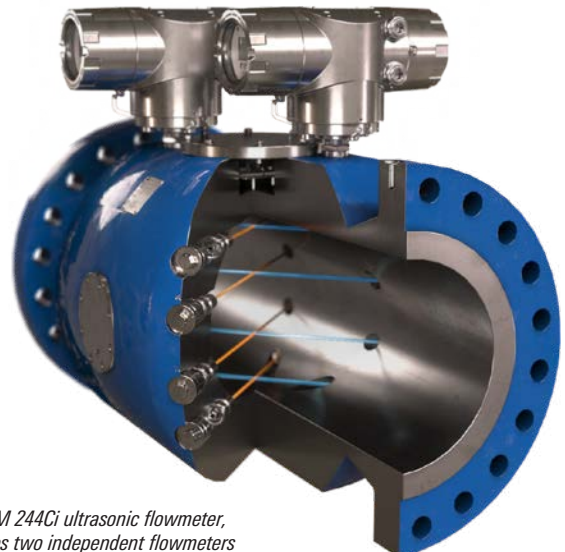
The CALDON LEFM 240Ci ultrasonic flowmeter for liquids is designed to achieve  $\pm 0.15\%$  linearity in combination with a flow conditioning device, meeting or exceeding the industry standards for performance and reliability.



*CALDON LEFM 240Ci ultrasonic flowmeter, which enables achieving  $\pm 0.15\%$  linearity with a flow conditioning device.*

## 244Ci

The CALDON LEFM 244Ci ultrasonic flowmeter is a high-performance unit designed for custody-transfer or fiscal metering applications that features two independent four-path flowmeters in one compact meter body. The four-path-plus-four-path dual-meter design meets all custody-transfer requirements while offering full redundancy and meter-to-meter comparison for in situ validation.



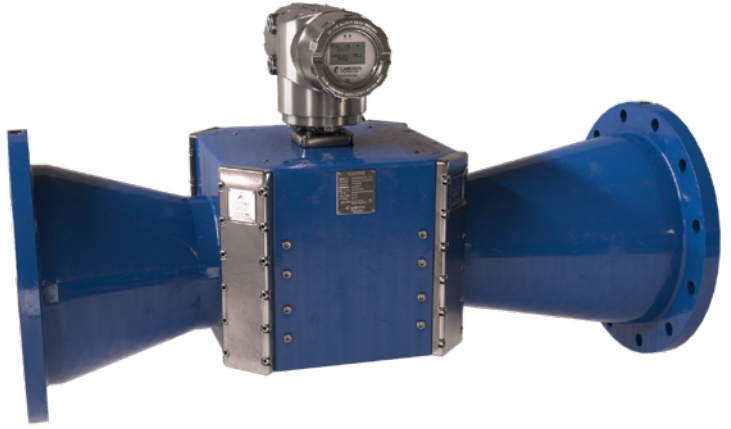
*CALDON LEFM 244Ci ultrasonic flowmeter, which features two independent flowmeters in one compact body.*

## 280CiRN

The eight-path CALDON LEFM 280CiRN ultrasonic flowmeter is designed with a reduced bore and a special nozzle-shaped entry in which the liquid velocity profile is stabilized to overcome velocity-profile-related problems at Reynolds numbers below 10,000. High-viscosity fluids are measured without compromising performance or repeatability and enabling enhanced meter proving capabilities, ideal for replacement of turbine and positive-displacement flowmeters.



*High-viscosity fluid flow rates stabilized by patented reduced-bore inlet design.*



*CALDON LEFM 280CiRN ultrasonic flowmeter, which overcomes velocity-profile-related challenges.*

## 240CiLT-R and 280CiLT-R

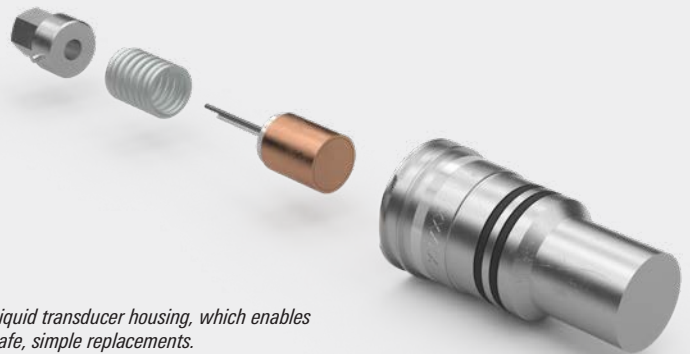
The CALDON LEFM 240CiLT-R and 280CiLT-R ultrasonic flowmeters are designed for measurement of LNG at cryogenic temperatures, providing the performance required for custody transfer, allocation, and check metering. The design of the eight-path 280CiLT-R model makes it less sensitive to swirl and profile effects, thereby eliminating the need for flow conditioning elements and their associated pressure drop while maintaining accuracy suitable for custody transfer.



*CALDON LEFM 280CiLT-R ultrasonic flowmeter, which is less sensitive to swirl and profile effects.*

## Sealed transducer housing design

Our ultrasonic flowmeters for liquids have transducers that are installed into stainless steel transducer housings. The transducer housing is a pressure boundary between the transducer assembly and the process. The operator does not have to block and depressurize the meter if a CALDON LEFM flowmeter transducer should ever need to be replaced. A transducer can be replaced safely with fluid flowing in the meter. The design does not require any special tools or extraction devices for transducer replacement.



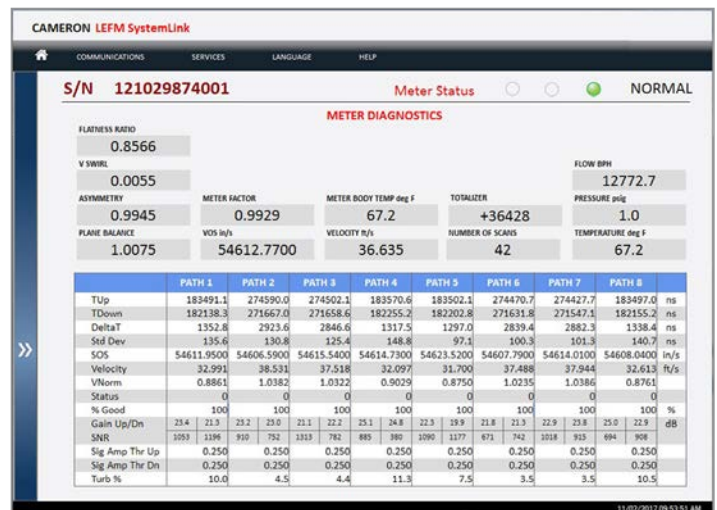
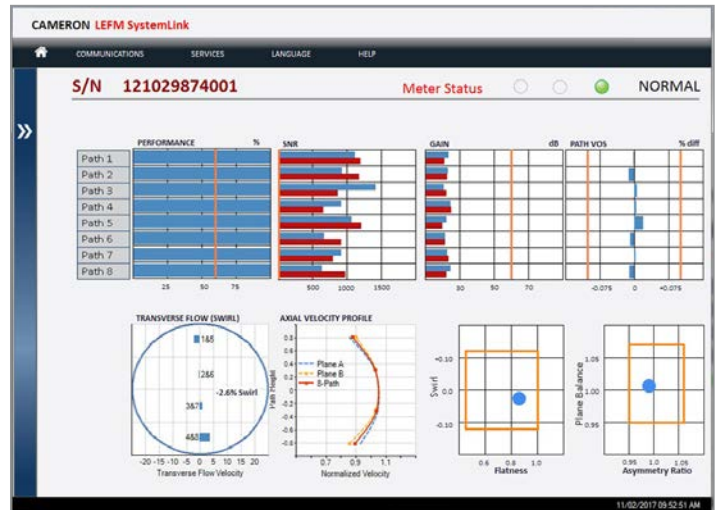
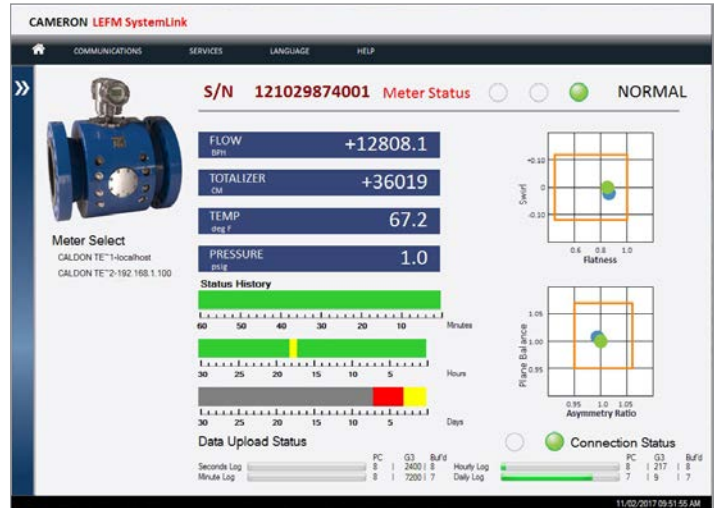
*Liquid transducer housing, which enables safe, simple replacements.*

# CALDON LEFM SystemLink Technology









Our CALDON LEFM SystemLink\* user interface software technology enables access to real-time diagnostic data, historical data, and event logs from the ultrasonic flowmeter transmitter by using an Ethernet or fiber-optic modem or a serial connection. Historical data and event logs are stored within the transmitter for later retrieval, enabling operators to monitor and analyze critical diagnostics and mitigate unplanned downtime.

## Features

- Health overview report showing the current meter status and meter process measurements, including flow rate, temperature, and pressure
- Detailed charts and graphs that present the meter diagnostic information in an easy-to-understand format with alarm limits that help identify issues
- User-defined reference points built using the meter's stored data that enable the user to graphically compare current meter performance against user-defined reference points (e.g., current performance against calibration or commissioning data)
- Data exporting as predefined PDF reports or to customer-defined spreadsheets



# Specifications

	Meter Body with Integral Transmitter		Meter Body with Remote Transmitter	
	 	 	 	 
Class	II 2 G, Ex d IIC Gb T6	Class I, Div. 1, Groups B,C, & D T6	II 2 G, Ex d IIC Gb T3	Class I, Div. 1, Groups B,C, & D T3C
Temperature, degF [degC]				
2XXCi models	-58 to 158 [-50 to 70]	-58 to 158 [-50 to 70]	-58 to 257 [-50 to 125]	-58 to 257 [-50 to 125]
240CiLT-R and 280CiLT-R models	-58 to 158 [-50 to 70]	-58 to 158 [-50 to 70]	-274 to 266 [-170 to 130]	-274 to 266 [-170 to 130]

## Standard Materials of Construction (Compliance with Pressure Equipment Directive (PED))

Meter body and flanges	
2XXCi models	Carbon steel (stainless and duplex optional)
240CiLT-R and 280CiLT-R models	Stainless steel
Transducer housings	Stainless steel (INCONEL® material optional)
Junction boxes and transmitter enclosure	Copper-free aluminum (stainless steel optional)

Consult Cameron for other material options.

## Sizes and Flow Rates

Nominal Size, in [mm]	Flow Rate, bbl/h [m³/h]	
	Q <sub>min</sub>	Q <sub>max</sub>
4 [100]	223 [35]	2,232 [355]
6 [150]	506 [81]	5,064 [805]
8 [200]	877 [139]	8,770 [1,394]
10 [250]	922 [147]	13,823 [2,198]
12 [300]	1,322 [210]	19,826 [3,152]
14 [350]	1,611 [256]	24,171 [3,843]
16 [400]	2,135 [339]	32,019 [5,091]
18 [450]	2,731 [434]	40,968 [6,514]

## Standard End Connections and Maximum Working Pressure

ANSI B16.5 Raised Face	Stainless Steel, psi [bar]	Carbon Steel, psi [bar]
Class 150	275 [19.0]	285 [19.6]
Class 300	720 [49.6]	740 [51.1]
Class 600	1,440 [99.3]	1,480 [102.1]
Class 900	2,160 [148.2]	2,220 [153.2]
Class 1500	3,600 [248.2]	3,705 [255.3]

Consult Cameron for other material options.

## Sizes and Flow Rates

Nominal Size, in [mm]	Flow Rate, bbl/h [m³/h]	
	Q <sub>min</sub>	Q <sub>max</sub>
20 [500]	3,401 [541]	51,019 [8,112]
22 [550]	4,145 [659]	62,171 [9,885]
24 [600]	4,962 [789]	74,425 [11,833]
26 [650]	5,852 [930]	87,780 [13,956]
28 [700]	6,816 [1,084]	102,236 [16,255]
30 [750]	7,853 [1,249]	117,794 [18,728]
32 [800]	8,964 [1,425]	134,453 [21,377]

Operation and Performance	240Ci, 244Ci, and 240CiLT-R	280Ci and 280CiLT-R	280CiRN			
Linearity	±0.15% over nominal flow range <sup>§</sup>	±0.10% over nominal flow range	±0.10% over nominal flow range <sup>‡</sup>			
Repeatability	In accordance with the requirements of API Manual of Petroleum Measurement Standards Chapter 5.8, Table B.1 or OIML R 117-1 Accuracy Class 0.3					
Flow range relative to nominal maximum <sup>†</sup>	10:1 for sizes 4 to 8 in [DN 100 to DN 200] ≥ 15:1 for sizes 10 in and larger [≥DN 250]		15:1			
Recommended minimum Reynolds number	10,000	10,000	No limitation			
Custody transfer certification	OIML R 117-1 Edition 2007 (E), "Dynamic measuring systems for liquids other than water" WELMEC Guide 8.8, "General and Administrative Aspects of the Voluntary System of Modular Evaluation of Measuring Instruments Under the MID"					
Water in oil	CALDON LEFM flowmeters can operate reliably with high water contents provided that the water and oil are well mixed. Typically, the oil and water will be sufficiently well mixed for good ultrasonic meter performance at velocities above 6.5 ft/s [2 m/s]. Meter operation and performance can be affected if the water and oil are not well mixed. Please contact Cameron for further advice on high-water-cut applications.					
Nominal pipe sizes, <sup>††</sup> in [mm]	<b>240Ci</b> 4 to 48 [100 to 1,200]	<b>244Ci</b> 8 to 48 [100 to 1,200]	<b>240CiLT-R</b> 6 to 36 [150 to 900]	<b>280Ci</b> 4 to 48 [150 to 1200]	<b>280CiLT-R</b> 6 to 36 [150 to 900]	<b>280CiRN</b> 6 to 24 [150 to 600]

<sup>†</sup> From nominal maximum flow, range can be extended when linearity requirements are relaxed.

<sup>‡</sup> Extrapolated on LNG volumes from calibration on water or light oil as documented in NMI Report No. CPC10200743.

<sup>§</sup> Extrapolated on LNG volumes from calibration on water or light oil when installed as per recommendations. CALDON 240CiLT-R flowmeter uncertainty can be improved by use of a flow conditioner.

However, for LNG duties where lower uncertainty is required, the CALDON 280CiLT-R flowmeter is recommended.

<sup>††</sup> Standard pipe sizes to 24 in. For larger pipe sizes and sizes not listed, contact Cameron.

For nominal sizes larger than 48 in [1,200 mm], contact Cameron.

For sizes 4 and 6 in and flange ratings Cl 900 and 1500, the previous-generation body shape can be used.



**General Specifications****Electronics**

## Power requirements—DC power

Voltage required, V DC	24 (18 to 30)
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Current draw at 24 V DC, A	0.25
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Power consumption, W	6
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## Power requirements—AC power

Voltage, V AC	120 (60 Hz); 230 (50 Hz)
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Voltage range, V AC	108–253
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Frequency range, Hz	47–63
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Current draw, A	0.14
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Power consumption, W	7.3
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Protection	Ingress Protection (IP) 66; Association of Electrical Equipment and Medical Imaging Manufacturers (NEMA) Type 4 and 4X
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Relative humidity, %	0–95
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Operating temperature, degF [degC]	–58 to 158 [–50 to 70]
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Local display, px	400 × 240 LCD showing flow, diagnostics data, and alarms
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Remote mounting electronics from meter, ft [m]	328 [100]
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Analog inputs (three), mA	4–20 configurable
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RTD input	Meter body temperature
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Analog outputs (two), mA	4–20 (configurable 650-ohm maximum load)
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## Digital outputs

Flow	Four pulse output channels
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	Programmable K-factor
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	Programmable configuration
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	1. Dual frequency set-up, 50/50 duty cycle
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	Channel B lags channel A by 90° for forward flow
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	Channel B leads channel A by 90° for reverse flow
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	2. Frequency and direction, 0 duty cycle
--	--

	Channel B indicates flow direction
--	------------------------------------

	Forward flow = 0
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	Reverse flow = high (5 or 12 V DC)
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	3. Alternating, forward-flow frequency on
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	Channel A only reverse-flow frequency
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	On channel B only 50/50 duty cycle
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Alarm status	Four outputs, 0–5 or 0–12 V DC selectable (0 V = alarm)
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Communication	Three serial
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	Ethernet (copper)
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**Meter Body**

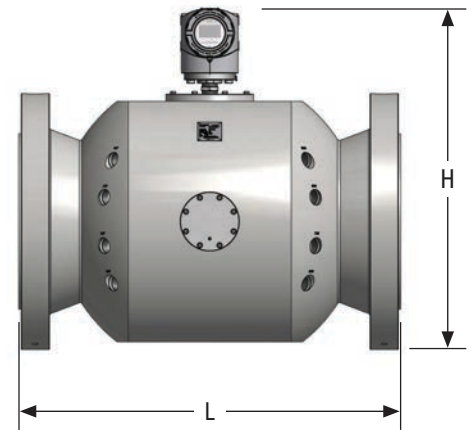
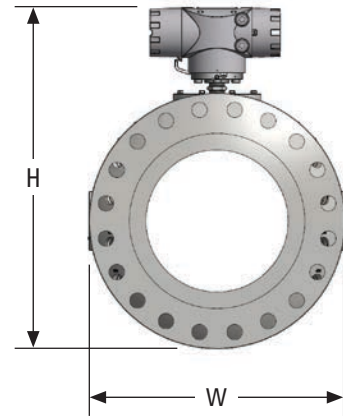
Relative humidity, %	0–95
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Operating temperature, degF [degC]	–58 to 257 [–50 to 125]
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# Dimensions and Weights

Dimensions and Weights for CALDON LEFM 240Ci, 280Ci, and 244Ci Ultrasonic Flowmeters

Nominal Pipe Size, in [mm]	Flange ANSI Class	Width (W), in [mm]	Height (H), in [mm]	Overall Length (L), in [mm]	Meter Weight, lbm [kg]
4 [100]	150	17.7 [450]	19.2 [487]	21.0 [533]	333 [151]
	300	17.7 [450]	19.7 [500.0]	21.7 [552]	353 [160]
	600	17.7 [450]	20.1 [510.0]	23.5 [597]	384 [174]
	900	17.7 [450]	20.4 [519]	24.5 [622]	419 [190]
	1500	17.7 [450]	20.8 [529]	25.2 [641]	465 [211]
6 [150]	150	17.7 [450]	21.1 [535]	24.0 [610]	494 [224]
	300	17.7 [450]	21.8 [554.0]	24.8 [629]	536 [243]
	600	17.7 [450]	22.6 [573.0]	26.7 [679]	624 [283]
	900	17.7 [450]	23.1 [586]	28.5 [724]	705 [320]
	1500	17.7 [450]	23.3 [592]	31.0 [787]	840 [381]
8 [200]	150	17.0 [432]	23.9 [606]	26.8 [679]	769 [349]
	300	17.0 [432]	24.4 [619]	27.5 [699]	824 [374]
	600	17.0 [432]	25.1 [638]	29.8 [756]	919 [417]
	900	18.5 [470]	26.1 [662]	32.0 [813]	1,111 [504]
	1500	19.0 [483]	26.3 [668]	36.0 [914]	1,334 [605]
10 [250]	150	20.0 [508]	27.4 [695]	28.8 [730]	1,193 [541]
	300	20.0 [508]	27.4 [695]	30.0 [762]	1,279 [580]
	600	20.0 [508]	28.6 [727]	33.3 [845]	1,462 [663]
	900	21.5 [546]	28.4 [722]	35.7 [908]	1,596 [724]
	1500	23.0 [584]	29.2 [741]	41.3 [1,048]	2,090 [948]
12 [300]	150	22.0 [559]	30.4 [773]	31.8 [806]	1,641 [744]
	300	22.0 [559]	30.4 [773]	33.0 [838]	1,754 [795]
	600	22.0 [559]	30.9 [785]	35.5 [902]	1,927 [874]
	900	24.0 [610]	30.9 [786]	39.0 [991]	1,812 [822]
	1500	26.5 [673]	30.9 [786]	45.5 [1,156]	3,067 [1,391]
14 [350]	150	23.8 [603]	32.3 [820]	34.0 [864]	2,011 [912]
	300	23.8 [603]	32.4 [822]	35.3 [895]	2,182 [990]
	600	23.8 [603]	32.7 [831]	37.5 [953]	2,328 [1,056]
	900	25.2 [641]	34.4 [875]	41.3 [1,048]	2,619 [1,188]
	1500	29.5 [749]	34.4 [875]	48.0 [1,219]	3,889 [1,764]
16 [400]	150	27.0 [686]	35.2 [895]	35.8 [908]	2,778 [1,260]
	300	27.0 [686]	35.3 [896]	37.3 [946]	2,992 [1,357]
	600	27.0 [686]	36.0 [916]	40.3 [1,022]	3,262 [1,480]
	900	27.8 [705]	34.8 [884]	43.3 [1,099]	3,373 [1,530]
	1500	27.8 [705]	37.2 [945]	50.7 [1,289]	5,104 [2,315]
18 [450]	150	29.3 [743]	37.2 [946]	38.8 [984]	3,309 [1,501]
	300	29.3 [743]	37.5 [954]	40.3 [1,022]	3,602 [1,634]
	600	29.3 [743]	38.2 [970]	43.3 [1,099]	3,913 [1,775]
	900	31.0 [787]	37.4 [949]	46.3 [1,175]	4,405 [1,998]
	1500	36.0 [914]	39.9 [1,013]	54.0 [1,372]	6,592 [2,990]
20 [500]	150	32.0 [813]	39.6 [1,006]	41.1 [1,045]	4,118 [1,868]
	300	32.0 [813]	40.0 [1,016]	42.5 [1,080]	4,462 [2,024]
	600	32.0 [813]	40.7 [1,035]	46.3 [1,175]	4,886 [2,216]
	900	33.7 [857]	39.8 [1,010]	49.8 [1,264]	5,478 [2,485]
	1500	38.7 [984]	42.2 [1,073]	58.3 [1,480]	8,208 [3,723]
24 [600]	150	37.0 [940]	41.9 [1,063]	45.8 [1,162]	5,555 [2,520]
	300	37.0 [940]	43.9 [1,114]	48.5 [1,232]	6,123 [2,777]
	600	37.0 [940]	44.4 [1,127]	52.3 [1,327]	6,681 [3,030]
	900	41.0 [1,041]	45.3 [1,151]	57.2 [1,454]	8,878 [4,027]
	1500	46.0 [1,168]	47.8 [1,214.0]	66.3 [1,683]	12,694 [5,758.0]



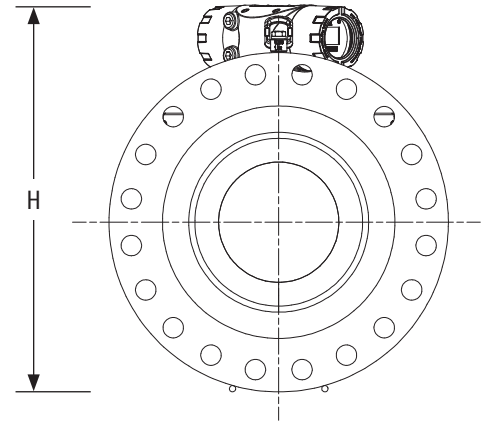
Consult Cameron for sizes larger than 24 in.

**Dimensions and Weights for CALDON LEFM 280CiRN Flowmeter (Integral Manifold) with Compact Transmitter**

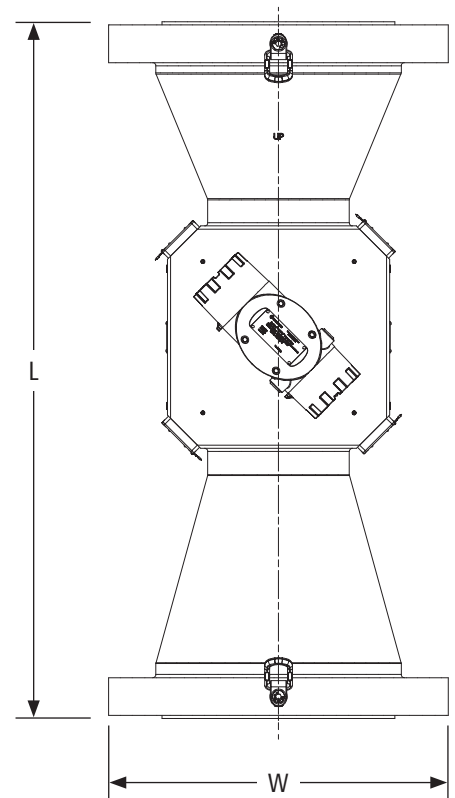
Nominal Pipe Size, in [mm]	Flange ANSI Class	Height (H), in [mm]	Max. Width (W), <sup>†</sup> in [mm]	Length (L), in [mm]	Weight with Transmitter, <sup>‡</sup> lbm [kg]
6 [150]	150	20.2 [513]	17.7 [450]	29.52 [749.8]	382 [173]
	300	20.9 [532]	17.7 [450]	29.52 [749.8]	433 [196]
	600	21.7 [551]	17.7 [450]	29.52 [749.8]	523 [237]
	900	22.2 [564]	17.7 [450]	30.12 [765.1]	606 [275]
	1500	22.4 [570]	17.7 [450]	29.64 [752.9]	727 [330]
8 [200]	150	22.3 [567]	17.7 [450]	35.92 [912.3]	587 [266]
	300	23.1 [586]	17.7 [450]	35.92 [912.3]	665 [302]
	600	23.8 [605]	17.7 [450]	35.92 [912.3]	813 [369]
	900	24.8 [630]	17.7 [450]	36.40 [924.7]	1,005 [456]
	1500	25.1 [637]	17.7 [450]	34.98 [888.5]	1,193 [541]
10 [250]	150	23.6 [598]	17.7 [450]	40.28 [1,023.1]	659 [299]
	300	24.3 [618]	17.7 [450]	40.28 [1,023.1]	781 [354]
	600	25.6 [649]	17.7 [450]	40.28 [1,023.1]	1,053 [478]
	900	26.3 [668]	18.5 [470]	41.19 [1,046.1]	1,290 [585]
	1500	27.1 [687]	19.0 [483]	39.87 [1,012.6]	1,713 [777]
12 [300]	150	26.3 [668]	17.7 [450]	46.11 [1,171.2]	997 [452]
	300	27.1 [687]	17.7 [450]	46.11 [1,171.2]	1,150 [522]
	600	27.8 [706]	20.0 [508]	46.11 [1,171.2]	1,488 [675]
	900	28.8 [732]	21.5 [546]	47.07 [1,195.7]	1,882 [854]
	1500	30.1 [764]	23.0 [584]	45.21 [1,148.5]	2,687 [1,219]
14 [350]	150	28.2 [716]	19.0 [483]	50.21 [1,275.4]	1,363 [618]
	300	29.2 [741]	20.5 [521]	50.21 [1,275.4]	1,628 [738]
	600	29.6 [751]	22.0 [559]	50.21 [1,275.4]	1,959 [889]
	900	30.3 [770]	24.0 [610]	51.23 [1,301.1]	2,433 [1,104]
	1500	32.4 [824]	26.5 [673]	50.59 [1,285.0]	3,724 [1,689]
16 [400]	150	29.4 [748]	21.0 [533]	55.37 [1,406.5]	1,521 [690]
	300	30.4 [773]	23.0 [584]	55.37 [1,406.5]	1,855 [841]
	600	31.2 [792]	23.8 [603]	55.37 [1,406.5]	2,388 [1,083]
	900	31.6 [802]	25.3 [641]	57.05 [1,449.1]	2,867 [1,300]
	1500	33.9 [862]	29.5 [749]	54.10 [1,374.0]	4,539 [2,059]
18 [450]	150	31.4 [799]	23.5 [597]	61.63 [1,565.4]	1,993 [904]
	300	32.9 [837]	25.5 [648]	61.63 [1,565.4]	2,451 [1,112]
	600	33.6 [852]	27.0 [686]	61.63 [1,564.4]	3,184 [1,444]
	900	34.4 [875]	27.8 [705]	62.98 [1,599.8]	4,034 [1,830]
	1500	36.9 [938]	32.5 [826]	60.12 [1,526.9]	6,145 [2,787]
20 [500]	150	33.4 [849]	25.0 [635]	65.93 [1,674.7]	2,416 [1,096]
	300	34.9 [887]	28.0 [711]	65.93 [1,674.7]	2,953 [1,340]
	600	35.7 [906]	29.3 [743]	65.93 [1,674.7]	4,018 [1,823]
	900	36.6 [929]	31.0 [787]	67.70 [1,719.5]	5,017 [2,276]
	1500	39.1 [992]	36.0 [914]	63.98 [1,625.1]	7,546 [3,423]
24 [600]	150	36.9 [938]	27.5 [699]	77.11 [1,958.6]	3,357 [1,523]
	300	38.9 [989]	30.5 [775]	77.11 [1,958.6]	4,274 [1,939]
	600	36.9 [938]	32.0 [813]	77.11 [1,958.6]	4,986 [2,262]
	900	37.8 [960]	33.8 [857]	78.88 [2,003.6]	6,127 [2,779]
	1500	40.3 [1,024]	38.8 [984]	74.42 [1,890.2]	8,757 [3,972]

<sup>†</sup> On sizes up to 10-in Class 600, the sun shield is widest; on larger sizes, the flange is widest.

<sup>‡</sup> Consult Cameron for weights of cast or other meter construction.



16-in x 10-in CALDON LEFM 280CiRN ultrasonic flowmeter, side view.

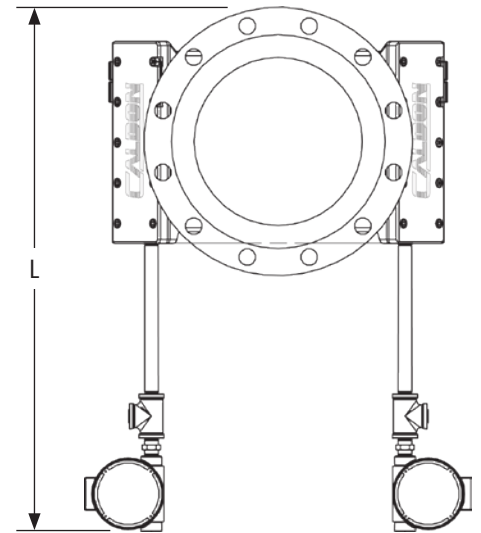
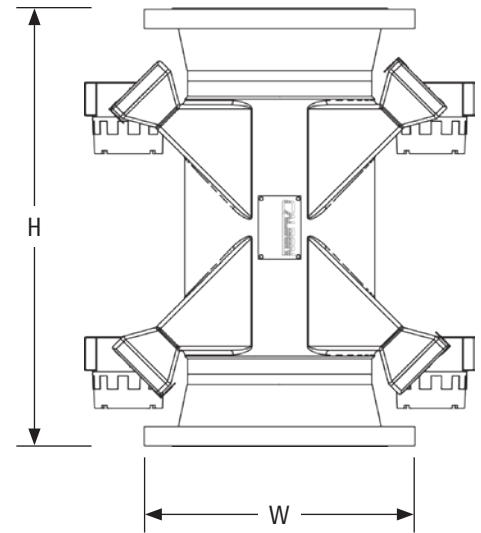


16-in x 10-in CALDON LEFM 280CiRN ultrasonic flowmeter, top view.

## Dimensions and Weights

Dimensions and Weights for CALDON LEFM 240CiLT-R and 280CiLT-R Flowmeters					
Nominal Pipe Size, in [mm]	Flange ANSI Class	Height (H), <sup>†</sup> in [mm]	Width (W), in [mm]	Length (L), in [mm]	Weight, lbm [kg]
8 [200]	150	25.6 [650]	14.8 [375]	24.0 [610]	474 [215]
	300	26.4 [671]	15.0 [381]	24.8 [629]	530 [240]
	600	27.1 [688]	16.5 [419]	27.0 [686]	636 [289]
	900	28.1 [714]	18.5 [470]	29.3 [743]	746 [338]
10 [250]	150	27.9 [709]	17.0 [432]	26.0 [660]	714 [324]
	300	28.7 [729]	17.5 [445]	27.2 [692]	792 [359]
	600	29.9 [759]	20.0 [508]	30.5 [775]	990 [449]
	900	30.7 [780]	21.5 [546]	33.0 [838]	1,130 [513]
12 [300]	150	30.4 [772]	19.0 [483]	29.5 [749]	987 [448]
	300	31.2 [792]	20.5 [521]	30.7 [781]	1,107 [502]
	600	31.9 [810]	22.0 [559]	33.2 [844]	1,277 [579]
	900	32.9 [836]	24.0 [610]	36.8 [934]	1,477 [670]
14 [350]	150	32.0 [813]	21.0 [533]	32.0 [813]	1,265 [574]
	300	33.0 [838]	23.0 [584]	33.2 [844]	1,405 [637]
	600	33.4 [848]	23.8 [603]	35.5 [902]	1,605 [728]
	900	34.2 [869]	25.3 [641]	39.3 [997]	1,845 [837]
16 [400]	150	34.4 [874]	23.5 [597]	33.5 [851]	1,467 [666]
	300	35.4 [899]	25.5 [648]	35.0 [889]	1,687 [765]
	600	36.2 [919]	27.0 [686]	38.0 [965]	1,967 [892]
	900	36.5 [927]	27.8 [705]	41.5 [1,054]	2,177 [988]
18 [450]	150	36.2 [919]	25.0 [635]	37.0 [940]	1,614 [732]
	300	37.7 [958]	28.0 [711]	38.5 [978]	1,954 [887]
	600	38.3 [973]	29.3 [743]	41.0 [1,041]	2,264 [1,027]
	900	39.2 [996]	31.0 [787]	44.5 [1,130]	2,674 [1,213]
20 [500]	150	37.8 [960]	27.5 [699]	39.4 [1,000]	1,640 [744]
	300	39.3 [998]	30.5 [775]	40.8 [1,035]	2,080 [943]
	600	40.0 [1,016]	32.0 [813]	43.5 [1,105]	2,460 [1,116]
	900	40.9 [1,039]	33.8 [857]	48.0 [1,219]	2,940 [1,333]
24 [600]	150	42.0 [1,067]	32.0 [813]	44.0 [1,118]	1,991 [903]
	300	44.0 [1,118]	36.0 [914]	45.2 [1,149]	2,631 [1,194]
	600	44.5 [1,130]	37.0 [940]	48.5 [1,232]	3,131 [1,420]
	900	46.5 [1,181]	41.0 [1,041]	55.5 [1,410]	4,471 [2,028]

<sup>†</sup> Height includes an 8-in nipple extension to penetrate the insulation.  
Consult Cameron for other sizes and pressure classes.

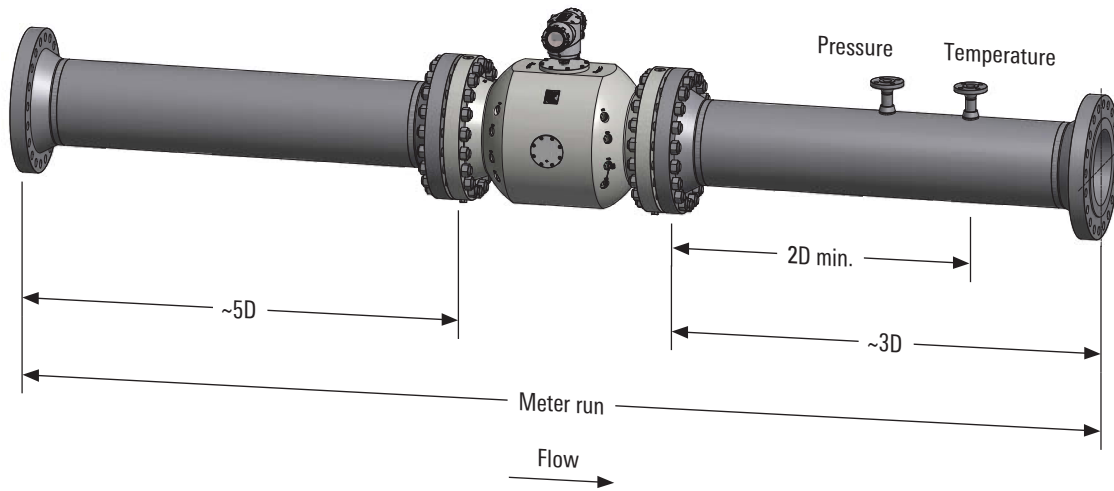


# Installation

## 280Ci, 280CiRN, and 280CiLT-R

To limit uncertainty caused by hydraulic effects, we recommend installing the flowmeter in compliance with the following guidelines. The adjoining straight pipe should be of the same schedule as the meter. Temperature elements and pressure connections should be located downstream of the meter. The CALDON LEFM eight-path flowmeter models do not normally require the use of a flow conditioning element.

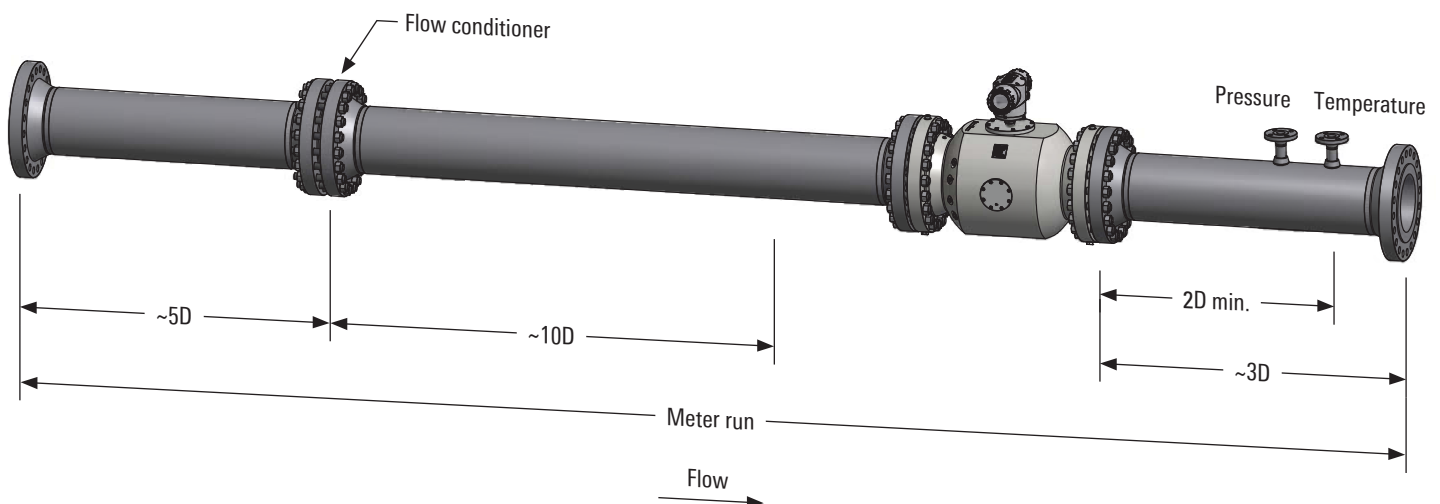
An uninterrupted upstream pipe that is 5 pipe diameters in length is adequate in most applications. In situations where there is a constriction upstream of the meter that is smaller than the diameter of the meter run piping (such as a reduced bore valve), we recommend separating this from the meter by a pipe at least 15 pipe diameters in length. Downstream of the meter, there should be an uninterrupted pipe at least 3 pipe diameters in length.



## 24Xci, 240ciLT-R

To limit uncertainty caused by hydraulic effects, we recommend installing the flowmeter in compliance with the following guidelines. The adjoining straight pipe should be of the same schedule as the meter. Temperature elements and pressure connections should be located downstream of the meter. It is recommended that the meter be installed downstream of a 10 diameter pipe section that includes a flow conditioning element at its inlet.

For effective flow conditioning, we generally recommend an additional straight pipe of approximately 5 diameters in length upstream of the flow conditioner. Downstream of the meter there should be an uninterrupted pipe at least 3 pipe diameters in length. If a flow conditioning element is not used, additional uncertainty can be limited by using a straight pipe upstream at least 20 pipe diameters in length and applying strict rules to avoid the introduction of swirl upstream of that 20-diameter length.



# Hydrocarbon Calibration Laboratory



The Cameron ISO 17025–accredited hydrocarbon calibration laboratory sets us apart from all other ultrasonic flowmeter suppliers.

CALDON LEFM 200 flowmeters are calibrated over a Reynolds number range that corresponds to the actual Reynolds number range the meter encounters in the field. This process ensures that the calibration is appropriate for the range of flow rates and viscosity specified. The ability to calibrate in house virtually eliminates the need for Cameron to use independent facilities, thereby significantly reducing delivery cycles and errors.

## Calibration Laboratory Specifications<sup>†</sup>

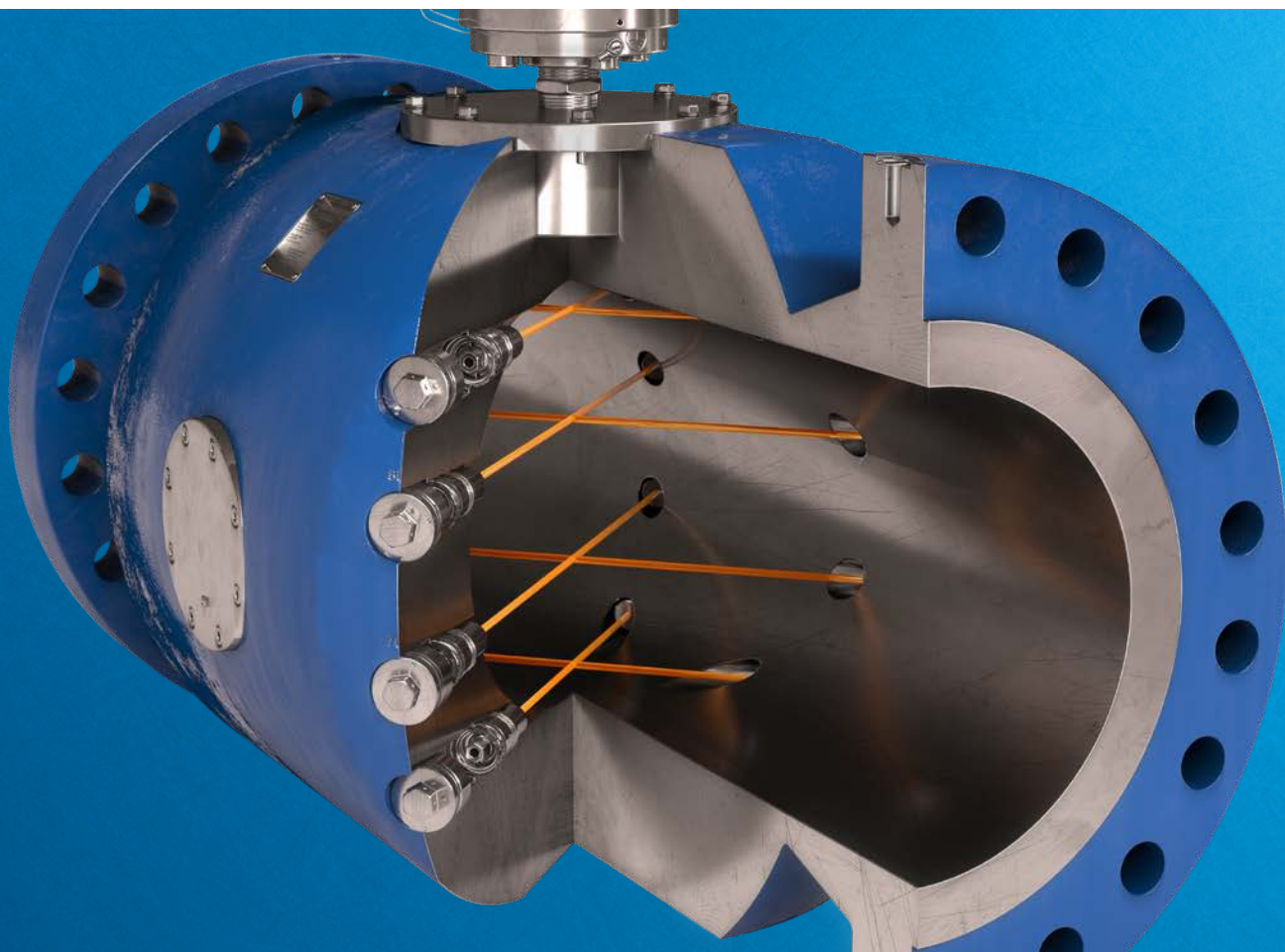
Maximum flow rate	25,000 bbl/h [3,900 m <sup>3</sup> /h]	
Minimum flow rate	63 bbl/h [10 m <sup>3</sup> /h]	
Meter sizes	2- to 24-in [50- to 600-mm] meters can be calibrated using three calibration lines	
Master meters	Two 280Ci models — 10-in meters installed in parallel	
Temperature control	Temperature is controlled within a band of 59–95 degF [15–35 degC] using a 65-tonUS chiller system	
Viscosity	1.5–200 mm <sup>2</sup> /s	
Uncertainty	±0.04% ball prover	0.03% small volume prover (SVP)
	±0.08% master meters	0.04% SVP and turbine meter
	±0.09% single-master meter	

<sup>†</sup> Specifications may change without notice.



# Notes

# CALDON LEFM Ultrasonic Flowmeters for Liquids



[cameron.slb.com/caldon](http://cameron.slb.com/caldon)

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