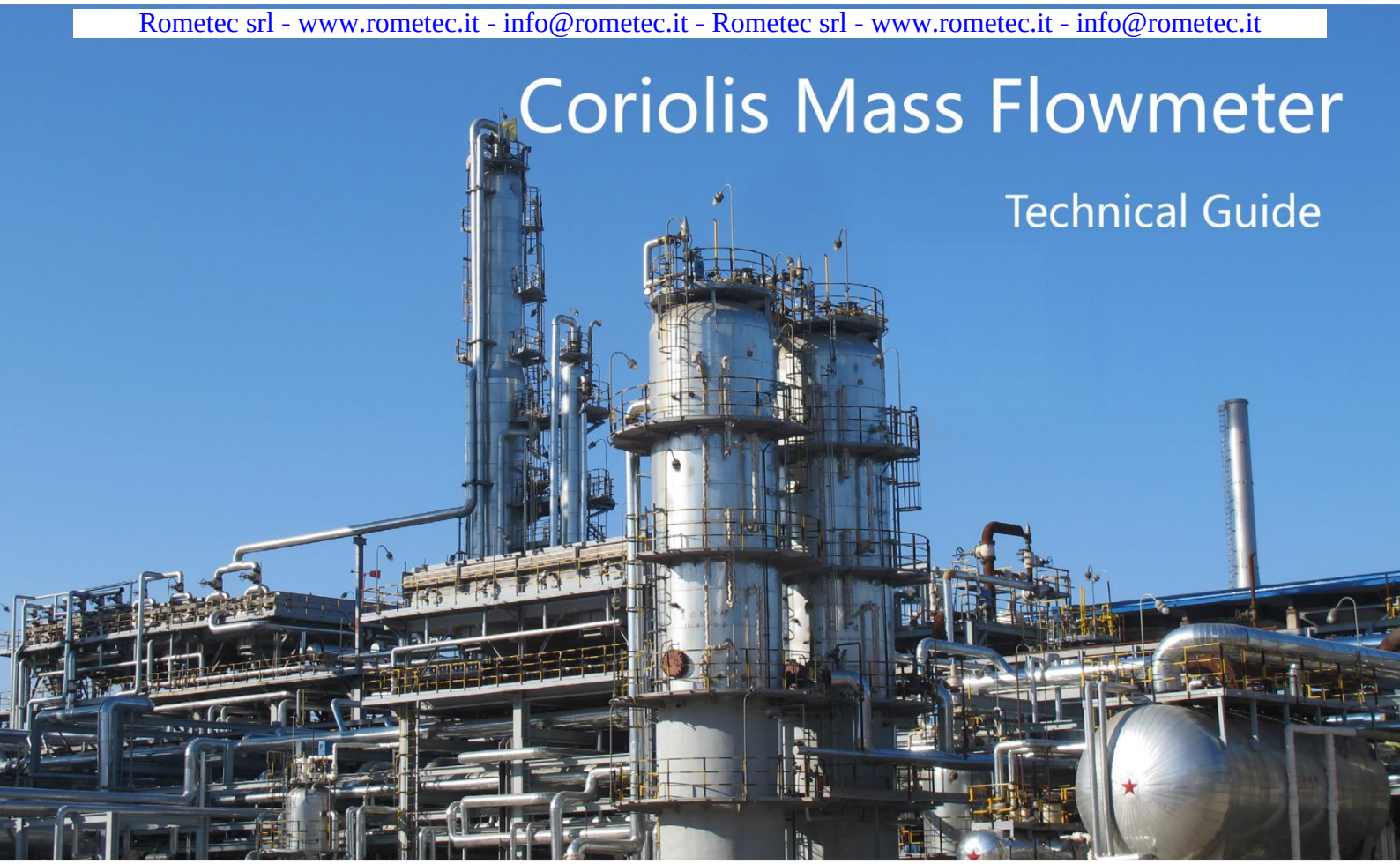
Coriolis Mass Flowmeter

Technical Guide



Walsn

Today's Quality for Tomorrow's World
Walsn Enterprises Ltd.

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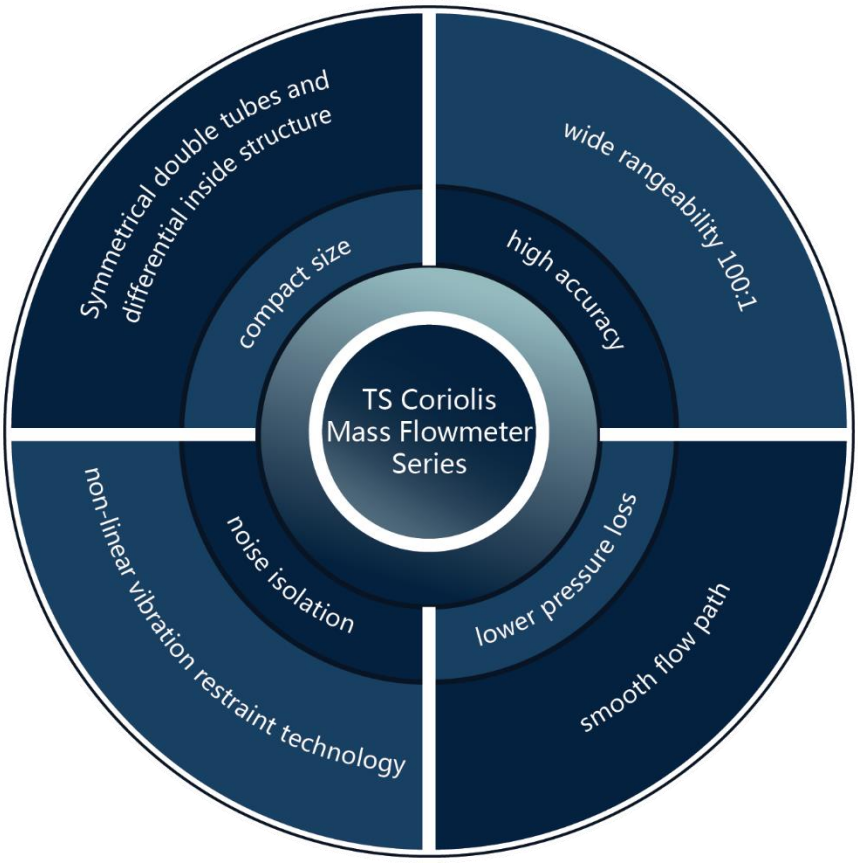
Walsn Mass Flowmeter – **TS Series**

The **TS series** Coriolis mass flowmeter is a new generation of Coriolis meters with paired triangular flow tubes from Walsn. The Walsn mass flow meter is equipped with a transmitter utilizing a digital signal processor (DSP), integrated with digital closed-loop vibration control (DLC), which performs calculations and monitors diagnostic functions of the sensor. This provides high accuracy measurement, wide range ability and excellent reliability for you. Online node-configuration, diagnostics and data recording can be handled directly through a Hart communicator or Modbus.

The **TS Series** flowmeter not only provides mass flow rate, but can also calculate: density, temperature volumetric flow rate, total flow and component fractions online and in real-time.

Rometec srl - www.rometec.it - info@rometec.it - Rometec srl - www.rometec.it - info@rometec.it

Product Features



Unique structure & **Excellent** performance

Coriolis mass flow meters provide sensitive and high-accuracy measurement, with multiple variable outputs, they’re an impressively versatile tool for process flow control.

Features

- Trapezoidal shape amplifies impact of Coriolis force, giving high sensitivity
- Dedicated ASIC with digital closed-loop control (DLC) improves the performance of gas-liquid flow measurement
- Dynamic vibration balance (DVB) technology enhances system stability
- 2-point temperature compensation and process pressure compensation

Applicable Fluids

- Gases
- Liquids
- Slurries

Typical Applications

- Custody transfer
- Density measurement
- Reactor feed ratio
- Batch control

Performance Characteristics

1. Operating Conditions

a) Flow measurement uncertainty includes the combined effects of linearity, repeatability and hysteresis

b) Measurement performance is based on calibration with water as the process fluid at typical process conditions (20℃—30℃ & 200 KPa—400 KPa)

c) Measurement performance is based on collected frequency or pulse outputs by the flow meter

2. Performance

a) Flow Performance

i. Mass flow / volume flow liquid

Uncertainty: ± 0.10%

Repeatability: ≤ 0.05%

ii. Mass flow / volume flow gas

Uncertainty: ± 0.35%

Repeatability: ≤ 0.17%

b) Density Performance

i. Liquid Density:

Error: ± 0.0005 g/cm^3 (0.5 kg/m^3)

Repeatability: ± 0.0002 g/cm^3 (0.2 kg/m^3)

Range: 0.1g/cm^3—3.0 g/cm^3 (100kg/m^3—3,000kg/m^3)

ii. Gas Density: Not Applicable

c) Temperature Performance (Liquid & Gas)

Error: ±1℃ (±1.8℉)

Repeatability: ±0.1℃ (± 0.18℉)

Range: -240℃—400℃ (-400℉—752℉)

d) Zero Stability

Specification	Zero Stability	
	kg/h	lb/min
CMF-TS-005H	0.02	0.00092
CMF-TS-010H	0.04	0.00147
CMF-TS-015N	0.05	0.00184
CMF-TS-025N/015H	0.30	0.011
CMF-TS-040N/025H	1.00	0.037
CMF-TS-050H	3.00	0.11
CMF-TS-080H	9.00	0.33

3. Relationship between Zero Stability, Maximum Error, and Uncertainty

a) When: Zero Stability ≤ Flow × Uncertainty

i. Maximum error (%) = uncertainty

ii. Repeatability = 0.5 × uncertainty

b) When: Zero Stability ≥ Flow × Uncertainty

i. Maximum error (%) = ±(zero stability/flow rate) × 100%

ii. Repeatability = 0.5 × (zero stability/flow rate) × 100%

Environmental Effects

1. Influence of Process Temperature

Due to the temperature difference between the process fluid and the zero point calibration conditions, there can be changes in the flow tube volume, due to thermal expansion, and thermally induced stiffness of the flow tube. These factors can induce some error by causing zero-point drift.

Maximum Deviation:

a) Flow: ±Max. Range × 0.0003%/℃ (±Max Range × 0.000167%/℉)

b) Density: ± 0.015 kg/m^3/℃ (0.014 lb/yd^3/℉)

2. Influence of Process Pressure

Due to the pressure difference between the process fluid and the calibration conditions, there can be changes in the flow tube volume and flow tube stiffness, these factors can induce some error and contribute to zero-point drift.

Correction Formulas:

a) Flow Correction: $Qp = Q \times ((Pi - Pc) \times Kiq + 1)$

Q_p-Real flow

Q-Flow without pressure correction

P_i- Process pressure

P_c- Calibration Pressure

K_{iq}- Pressure correction coefficient for flow

b) Density correction: $\rho_p = \rho \times ((P_i - P_c) \times K_{i\rho} + 1)$

ρ_p- Real density (kg/m^3)

ρ- Density without pressure correction (kg/m^3)

P_i- Process pressure

P_c- Calibration Pressure

$K_{i\rho}$- Pressure correction coefficient for density

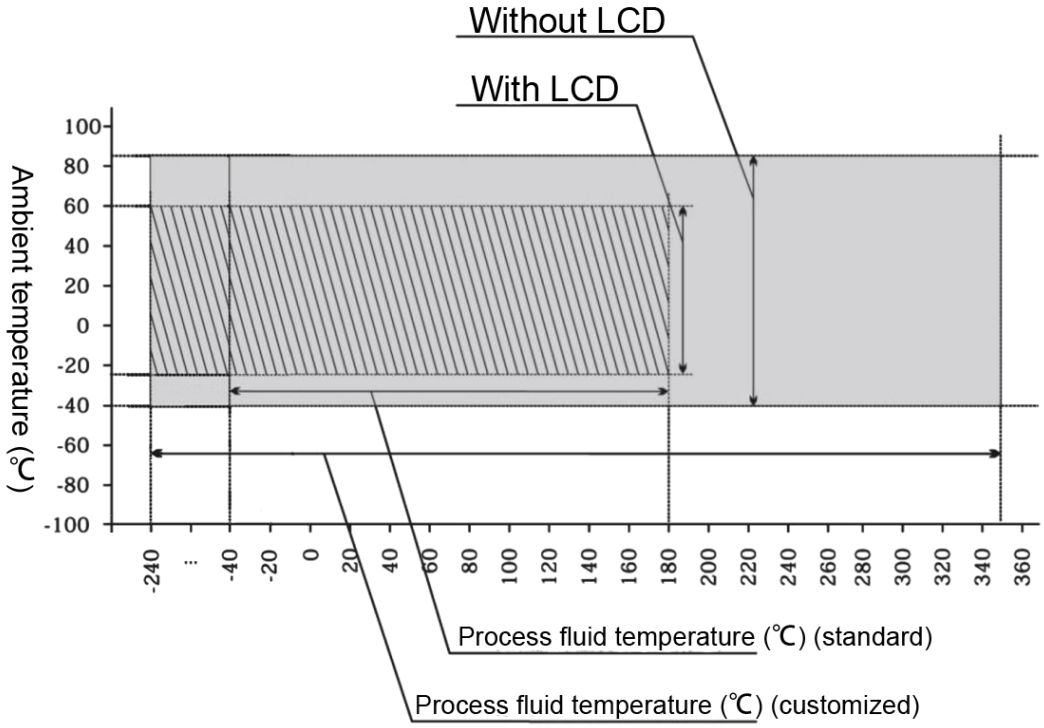
c) Pressure Coefficient (See following table)

Specification	For flow K_{iq}		For density $K_{i\rho}$	
	Pressure unit: psi	Pressure unit: bar	Pressure unit: psi	Pressure unit: bar
CMF-TS-005H	0.00014	0.002	0.00224	0.032
CMF-TS-010H	0.00028	0.004	0.00294	0.042
CMF-TS-015N	0.00042	0.006	0.00315	0.045
CMF-TS-25N/015H	0.00056	0.008	0.00266	0.038
CMF-TS-40N/025H	0.00056	0.008	0.00266	0.038
CMF-TS-050H	0.00028	0.004	0.00182	0.026
CMF-TS-080H	0.0056	0.008	0.00266	0.038

Process Conditions

1. Temperature Range

Process	-240℃—350℃ (-400℉—662℉) (depending on configuration)
Storage	-50℃—70℃ (-58℉—158℉)
Ambient	-25℃—60℃ (-13℉—140℉) (with LCD); -40℃—85℃ (-40℉—185℉) (without LCD)



2. Process Pressure

Maximum process pressure is primarily limited by the type of process connection used. Refer to the list of available **Process Connections** provided in the **Ordering Information** section. Keep in mind that when the process temperature is higher, the flow meter should be operated further below the maximum pressure for a given connection type. Walsn specialists will happily assess a proposed process condition to help ensure the correct choices are made.

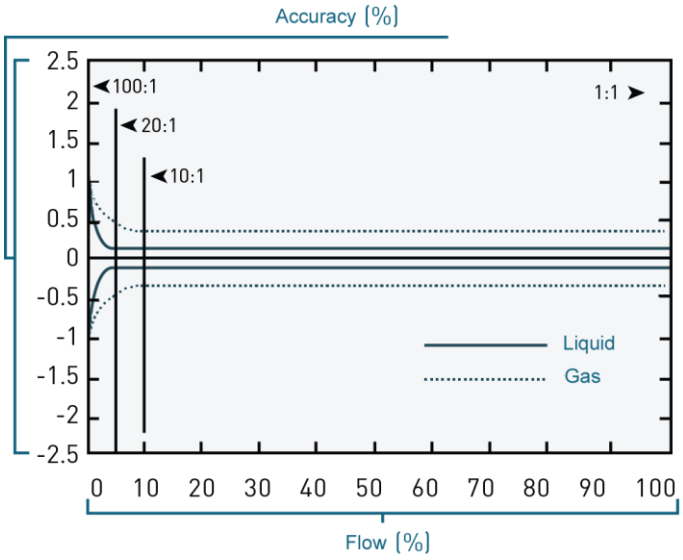
3. Flow Range

Specification	Liquid		K – gas coefficient
	kg/h	lb/min	
CMF-TS-005H	18.4	500	70
CMF-TS-010H	800	30	80
CMF-TS-015N	1000	37	90
CMF-TS-015H/025N	6000	220	140
CMF-TS-025N/040	6000	220	140
CMF-TS-025H	20000	735	140
CMF-TS-040N	20000	735	140
CMF-TS-050H	60000	2200	160
CMF-TS-080H	180000	6600	215

Note: gas flow range = liquid flow range× gas process density / K

4. Pressure Loss

Pressure loss is related to process fluid characteristics and flow rate. The figures below illustrate typical accuracy, range ability and pressure loss for water.



Range ability	500:1	100:1	20:1	10:1	1:1
Accuracy of liquid (± %)	2.5	0.8	0.1	0.1	0.1
Accuracy of gas (± %)	2.5	1.5	0.5	0.35	0.35
Pressure loss					
Liquid (psi)	~0	~0	0.1	0.25	14.5
Liquid (bar)	~0	~0	0.01	0.02	1.0
Gas (psi)	0	0	0.1	0.35	15.0
Gas (bar)	0	0	0.01	0.02	1.03

Environmental Conditions

1. Power consumption: ≤ 20W
2. Enclosure rating: IP65, IP67, IP68 (Remote Style Options only)
3. Vibration limits:
   a) a = 0.5g
   b) Endurance sweep, under the condition of 20Hz ~ 400Hz frequency for 50 sweep cycles
4. Impact limits: If the flow meter is well-packed, its performance will not be affected by the following impacts:
   a) Acceleration: 50m/s^2
   b) Impact frequency: 60 times/min ~100 times/min
   c) Impact: 1000 times
5. Ex approval: Ex d ib IIC T6 Gb
6. Electromagnetic/Electrostatic compatibility
   a) Electrostatic discharge: level 3
   b) Electrical fast transient/burst (EFTB) resistance: level 3

Construction

1. Typical Materials of Components

Wetted Parts	Material	Non-Wetted Parts	Material
Flow tube	316L stainless steel	Sensor housing	304 stainless steel
Separator	316L stainless steel	Transmitter housing	Aluminum Die-Cast
Flange	316L stainless steel	Remote junction box	Aluminum Die-Cast

Note: Non-standard configurations are available. Refer to Ordering Information for details

2. Weight & Packaging

Weights vary depending on configuration, weights for several common configurations are listed below

a) Integral package, T0 transmitter, equipped with ANSI Class 150 RF flanges or standard cable connection

Specification	Net Weight		Material	Packaging Size		Gross Weight	
	lb	kg		in	mm	lb	kg
CMF-TS-005H	10	4.5	Carton	17.72×12.2×9.06	450×310×230	12	5.5
CMF-TS-010H	12	5.5	Carton	17.72×12.2×9.06	450×310×230	14	6.5
CMF-TS-015N	18	8	Carton	22.83×17.32×12.6	580×440×320	24	11
CMF-TS-015H	27	12	Carton	22.83×17.32×12.6	580×440×320	33	15
CMF-TS-025N	29	13	Carton	22.83×17.32×12.6	580×440×320	35	16
CMF-TS-025H	64	29	Wooden box	36.22×28.35×20.47	920×720×520	115	52
CMF-TS-040N	68	31	Wooden box	36.22×28.35×20.47	920×720×520	119	54
CMF-TS-050H	79	36	Wooden box	36.22×28.35×20.47	920×720×520	130	59
CMF-TS-080H	121	55	Wooden box	47.24×36.22×24.41	1200×920×620	220	100

b) Integral type package, T1 transmitter, equipped with ANSI Class 150 RF flanges or standard cable connections

Specification	Net Weight		Material	Packaging Size		Gross Weight	
	lb	kg		in	mm	lb	kg
CMF-TS-005H	12	5.5	Carton	17.72×12.2×9.06	450×310×230	14	6.5
CMF-TS-010H	14	6.5	Carton	17.72×12.2×9.06	450×310×230	17	7.5
CMF-TS-015N	20	9	Carton	24.80×17.32×11.41	630x440x290	27	12
CMF-TS-015H	29	13	Carton	24.80×17.32×11.41	630x440x290	35	16
CMF-TS-025N	31	14	Carton	24.80×17.32×11.41	630x440x290	37	17
CMF-TS-025H	66	30	Wooden box	36.22×28.35×20.47	920×720×520	117	53
CMF-TS-040N	71	32	Wooden box	36.22×28.35×20.47	920×720×520	121	55
CMF-TS-050H	82	37	Wooden box	36.22×28.35×20.47	920×720×520	132	60
CMF-TS-080H	123	56	Wooden box	47.24×36.22×24.41	1200×920×620	223	101

c) Remote type package,T0 transmitter, equipped with ANSI Class 150 RF flanges or standard cable connections, 10 meters cable

Specification	Net Weight of Transmitter		Net Weight of Sensor		Material	Packaging Size		Gross Weight	
	lb	kg	lb	kg		in	mm	lb	kg
CMF-TS-005H	13.5	6.1	4.4	2	Carton	17.72×12.2×9.06	450×310×230	19	8.5
CMF-TS-010H	13.5	6.1	6.6	3	Carton	17.72×12.2×9.06	450×310×230	21	9.5
CMF-TS-015N	13.5	6.1	12	5.6	Carton	26.77×23.23×15.75	680×590×400	33	15
CMF-TS-015H	13.5	6.1	21	9.3	Carton	26.77×23.23×15.75	680×590×400	40	18
CMF-TS-025N	13.5	6.1	22	9.8	Carton	26.77×23.23×15.75	680×590×400	42	19
CMF-TS-025H	13.5	6.1	57	26	Wooden box	36.22×28.35×20.47	920×720×520	121	55
CMF-TS-040N	13.5	6.1	64	29	Wooden box	36.22×28.35×20.47	920×720×520	126	57
CMF-TS-050H	13.5	6.1	75	34	Wooden box	36.22×28.35×20.47	920×720×520	137	62
CMF-TS-080H	13.5	6.1	117	53	Wooden box	47.24×36.22×24.41	1200×920×620	227	103

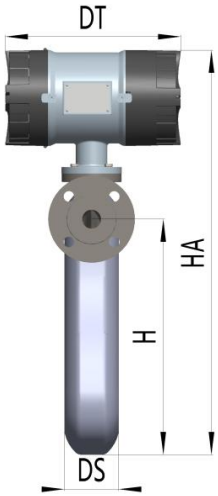
d) Remote type package,T1 transmitter, equipped with ANSI Class 150 RF flanges or standard cable connections, 10 meters cable

Specification	Net Weight of Transmitter		Net Weight of Sensor		Material	Packaging Size		Gross Weight	
	lb	kg	lb	kg		in	mm	lb	kg
CMF-TS-005H	12	5.4	9.9	4.5	Carton	17.72×12.2×9.06	450×310×230	25	11.3
CMF-TS-010H	12	5.4	12	5.5	Carton	17.72×12.2×9.06	450×310×230	27	12.3
CMF-TS-015N	12	5.4	16	7.1	Carton	26.38×23.03×14.37	670×585×365	34	15.3
CMF-TS-015H	12	5.4	26	12	Carton	26.38×23.03×14.37	670×585×365	46	20.3
CMF-TS-025N	12	5.4	26	12	Carton	26.38×23.03×14.37	670×585×365	47	21.3
CMF-TS-025H	12	5.4	64	29	Wooden box	36.22×28.35×20.47	920×720×520	126	57.3
CMF-TS-040N	12	5.4	71	32	Wooden box	36.22×28.35×20.47	920×720×520	133	60.3
CMF-TS-050H	12	5.4	82	37	Wooden box	36.22×28.35×20.47	920×720×520	144	65.3
CMF-TS-080H	12	5.4	121	55	Wooden box	47.24×36.22×24.41	1200×920×620	181	82.3

3. Dimensions

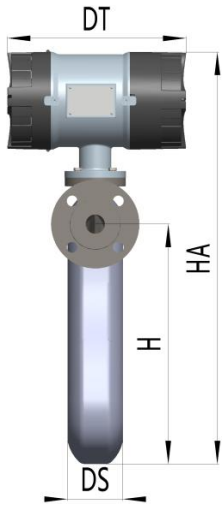
a) Integral type

i. With T0 transmitter Imperial size, inch



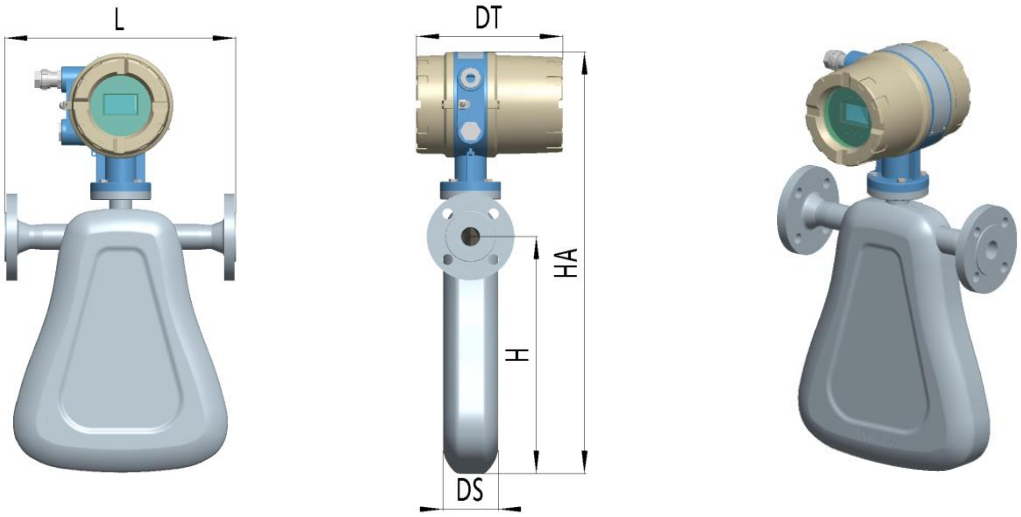
Specification	Line Size	L	H	HA	DS	DT
CMF-TS-005H	3/16	4.53	2.36	7.40	2.36	9.45
CMF-TS-010H	3/8	7.87	3.94	12.72	2.95	9.45
CMF-TS-015N	1/2	10.08	9.06	18.11	2.52	9.45
CMF-TS-015H	1/2	11.97	12.60	21.65	2.83	9.45
CMF-TS-025N	1	11.97	12.60	21.65	2.83	9.45
CMF-TS-025H	1	22.60	20.55	30.55	4.76	9.45
CMF-TS-040N	1-1/2	22.60	19.69	29.69	5.91	9.45
CMF-TS-050H	2	23.82	21.65	32.09	7.28	9.45
CMF-TS-080H	3	29.13	27.36	38.58	9.25	9.45

ii. With T0 transmitter metric size, mm



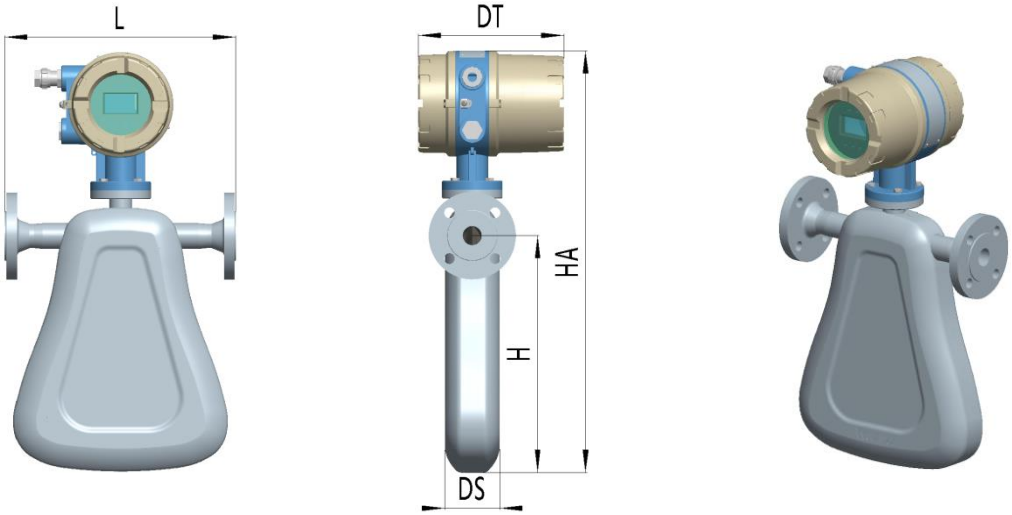
Specification	Line Size	L	H	HA	DS	DT
CMF-TS-005H	5	115	60	188	60	240
CMF-TS-010H	10	200	100	323	75	240
CMF-TS-015N	15	256	230	460	64	240
CMF-TS-015H	15	304	320	550	72	240
CMF-TS-025N	25	304	320	550	72	240
CMF-TS-025H	25	574	622	776	121	240
CMF-TS-040N	40	574	500	754	150	240
CMF-TS-050H	50	605	550	815	185	240
CMF-TS-080H	80	740	695	980	235	240

iii. With T1 transmitter Imperial size, inch



Specification	Line Size	L	H	HA	DS	DT
CMF-TS-005H	3/16	4.53	2.36	7.95	2.36	7.56
CMF-TS-010H	3/8	7.87	3.94	13.50	2.95	7.56
CMF-TS-015N	1/2	10.08	9.06	18.90	2.52	7.56
CMF-TS-015H	1/2	11.97	12.60	22.44	2.83	7.56
CMF-TS-025N	1	11.97	12.60	22.44	2.83	7.56
CMF-TS-025H	1	22.60	24.49	31.30	4.76	7.56
CMF-TS-040N	1-1/2	22.60	19.69	30.39	5.91	7.56
CMF-TS-050H	2	23.82	21.65	32.80	7.28	7.56
CMF-TS-080H	3	29.13	27.36	39.29	9.25	7.56

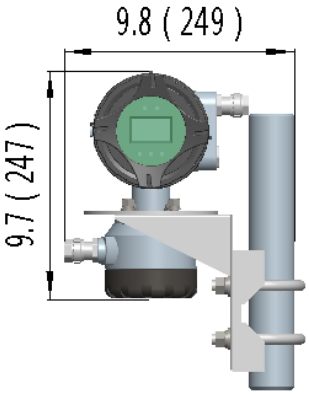
iv. With T1 transmitter metric size, mm

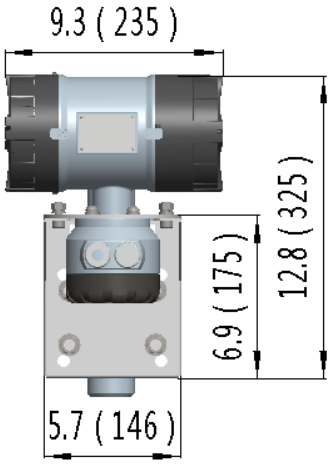


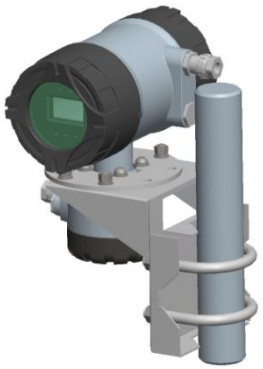
Specification	Line Size	L	H	HA	DS	DT
CMF-TS-005H	5	115	60	202	60	192
CMF-TS-010H	10	200	100	343	75	192
CMF-TS-015N	15	256	230	480	64	192
CMF-TS-015H	15	304	320	570	72	192
CMF-TS-025N	25	304	320	570	72	192
CMF-TS-025H	25	574	622	795	121	192
CMF-TS-040N	40	574	500	772	150	192
CMF-TS-050H	50	605	550	833	185	192
CMF-TS-080H	80	740	695	998	235	192

b) Remote type:

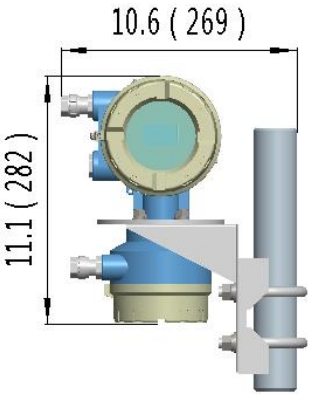
i. T0 transmitter size, inch (mm)

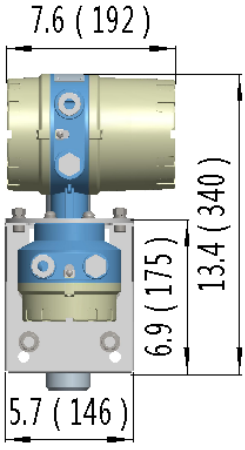


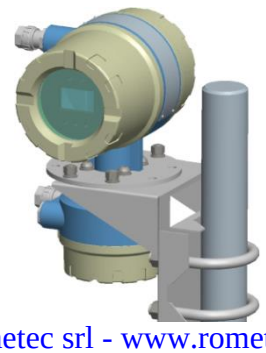




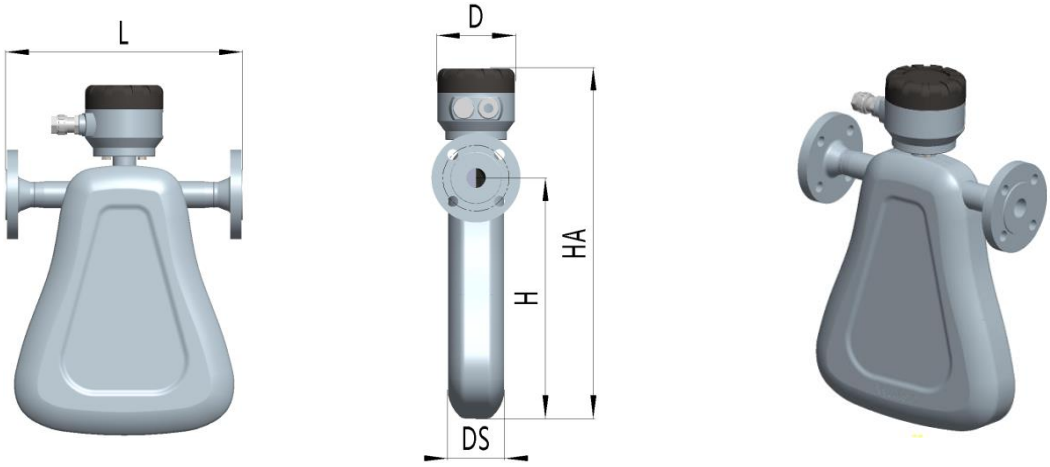
ii. T1 transmitter size, inch (mm)





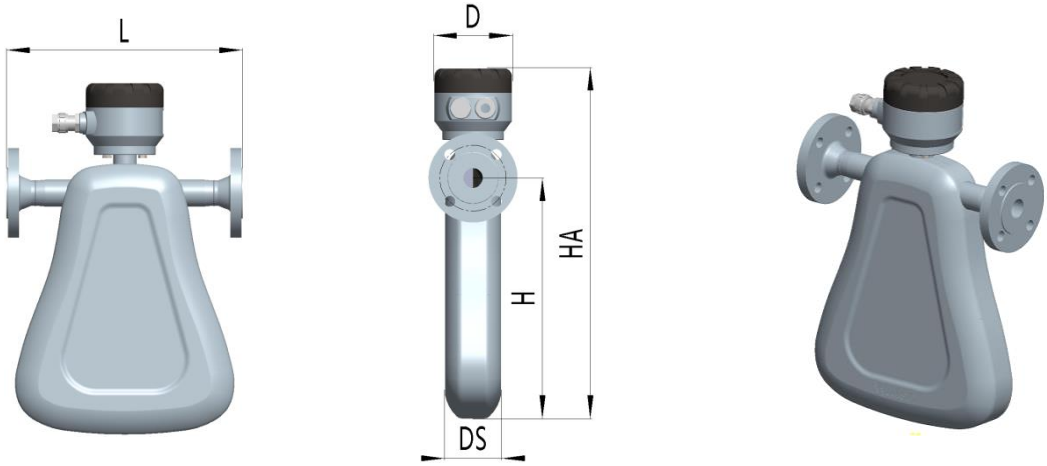


iii. Sensor paired with T0 transmitter Imperial size, inch



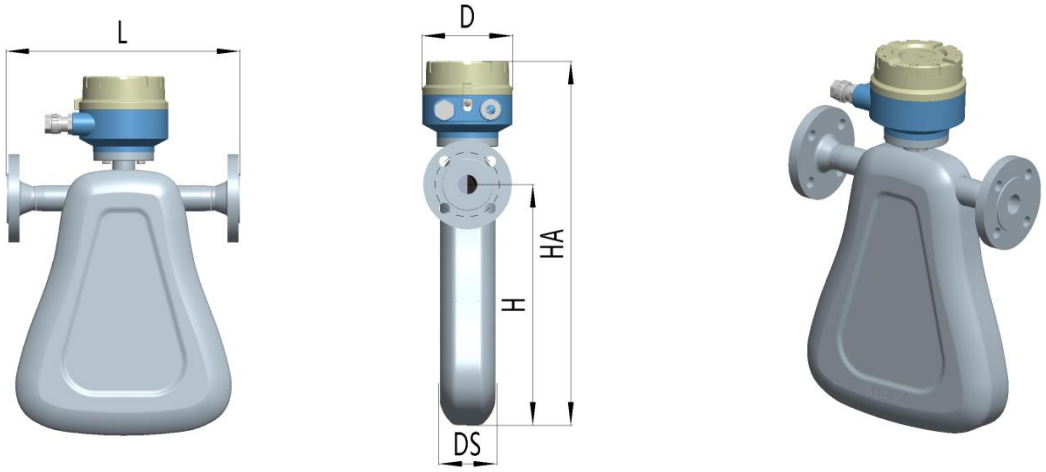
Specification	Line Size	L	H	HA	DS	D
CMF-TS-005H	3/16	4.53	2.36	4.02	2.36	3.94
CMF-TS-010H	3/8	7.87	3.94	9.49	2.95	3.94
CMF-TS-015N	1/2	10.08	9.06	18.90	2.52	3.94
CMF-TS-015H	1/2	11.97	12.60	22.44	2.83	3.94
CMF-TS-025N	1	11.97	12.60	22.44	2.83	3.94
CMF-TS-025H	1	22.60	24.49	31.30	4.76	3.94
CMF-TS-040N	1-1/2	22.60	19.69	26.46	5.91	3.94
CMF-TS-050H	2	23.82	21.65	28.86	7.28	3.94
CMF-TS-080H	3	29.13	27.36	35.35	9.25	3.94

iv. Sensor paired with T0 transmitter metric size, mm



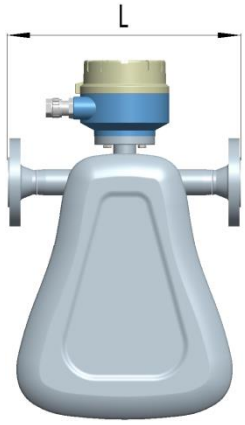
Specification	Line Size	L	H	HA	DS	D
CMF-TS-005H	5	115	60	102	60	100
CMF-TS-010H	10	200	100	241	75	100
CMF-TS-015N	15	256	230	480	64	100
CMF-TS-015H	15	304	320	570	72	100
CMF-TS-025N	25	304	320	570	72	100
CMF-TS-025H	25	574	622	795	121	100
CMF-TS-040N	40	574	500	672	150	100
CMF-TS-050H	50	605	550	733	185	100
CMF-TS-080H	80	740	695	898	235	100

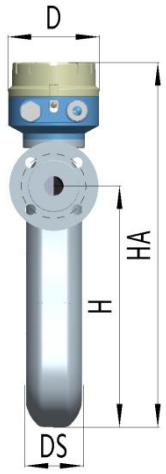
v. Sensor paired with T1 transmitter Imperial size, inch



Specification	Line Size	L	H	HA	DS	D
CMF-TS-005H	3/16	4.53	2.36	4.72	2.36	4.61
CMF-TS-010H	3/8	7.87	3.94	10.28	2.95	4.61
CMF-TS-015N	1/2	10.08	9.06	15.63	2.52	4.61
CMF-TS-015H	1/2	11.97	12.60	19.09	2.83	4.61
CMF-TS-025N	1	11.97	12.60	19.09	2.83	4.61
CMF-TS-025H	1	22.60	20.55	28.03	4.76	4.61
CMF-TS-040N	1-1/2	22.60	19.69	27.17	5.91	4.61
CMF-TS-050H	2	23.82	21.65	29.57	7.28	4.61
CMF-TS-080H	3	29.13	27.36	36.06	9.25	4.61

vi. Sensor paired with T1 transmitter metric size, mm





Specification	Line Size	L	H	HA	DS	D
CMF-TS-005H	5	115	60	120	60	117
CMF-TS-010H	10	200	100	261	75	117
CMF-TS-015N	15	256	230	397	64	117
CMF-TS-015H	15	304	320	485	72	117
CMF-TS-025N	25	304	320	485	72	117
CMF-TS-025H	25	574	522	712	121	117
CMF-TS-040N	40	574	500	690	150	117
CMF-TS-050H	50	605	550	751	185	117
CMF-TS-080H	80	740	695	916	235	117

Walsn Mass Flowmeter – **US Series**

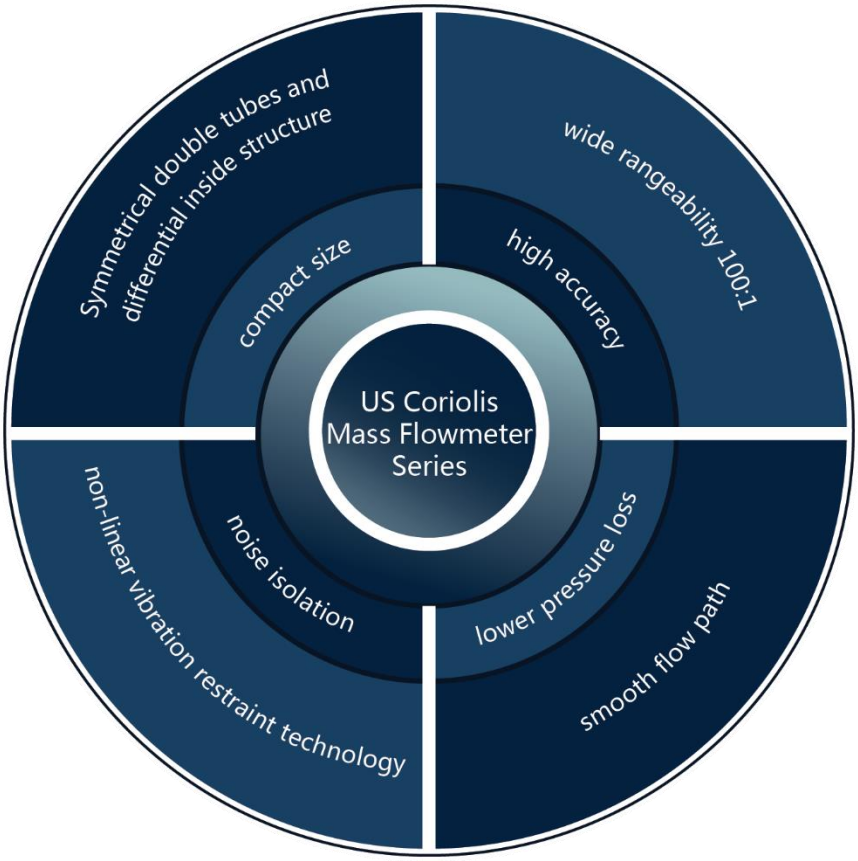
Walsn® **US Series** Coriolis mass flow meters use a classic U-shape for their flow tubes. The Walsn mass flow meter is equipped with a transmitter utilizing a digital signal processor (DSP), integrated with digital closed-loop vibration control (DLC), which performs calculations and monitors diagnostic functions of the sensor. This provides high accuracy measurement, wide range ability and excellent reliability for you. Online node-configuration, diagnostics and data recording can be handled directly through a Hart communicator or Modbus.

DN1 ~ 5

Walsn's **US Series** flowmeter not only provides mass flow rate, but can also calculate: density, temperature volumetric flow rate, total flow and component fractions online and in real-time

DN10 ~ 250

Product Features



Improving on Excellence

Walsn's Coriolis mass flow meter provides high-sensitivity and high-accuracy measurement, with multi-variables outputs and is the optimum measuring solution for flow process control.

Features
◆ U shape design – provides excellent stability and repeatability
◆ Dedicated ASIC with digital closed-loop control (DLC) improves the performance of gas-liquid flow measurement
◆ Dynamic vibration balance (DVB) technology enhances system stability
◆ 2-point temperature compensation and process pressure compensation
◆ Special configurations for difficult applications (e.g. high temperature)

Applicable Fluids

- Gases
- Liquids
- Slurries

Typical Applications

- Custody transfer
- Density measurement
- Reactor feed ratio
- Batch control

Performance Characteristics

1. Operating Conditions

a) Flow measurement uncertainty includes the combined effects of linearity, repeatability and hysteresis

b) Measurement performance is based on calibration with water as the process fluid at typical process conditions (20℃—30℃ & 200 KPa—400 KPa)

c) Measurement performance is based on collected frequency or pulse outputs by the flow meter

2. Performance

a) Flow Performance

i. Liquid

Uncertainty: ±0.10%

Repeatability: ≤0.05%

ii. Gas

Uncertainty: ±0.35%

Repeatability: ≤0.17%

b) Density Performance

i. Liquid Density:

Error: ± 0.0005 g/cm^3 (0.5 kg/m^3)

Repeatability: ± 0.0002 g/cm^3 (0.2 kg/m^3)

Range: 0.1g/cm^3—3.0 g/cm^3 (100kg/m^3—3,000kg/m^3)

ii. Gas Density: Not Applicable

c) Temperature Performance

Error: ±1℃ (±1.8℉)

Repeatability: ±0.1℃ (±0.18℉)

Range: -240℃—400℃ (-400℉—752℉)

d) Zero Stability

Specification	Zero Stability	
	kg/h	lb/min
CMF-US-001N	0.001	0.000037
CMF-US-002N	0.003	0.00011
CMF-US-005N	0.025	0.00092
CMF-US-010N	0.05	0.00185
CMF-US-015N	0.30	0.0111
CMF-US-025h	0.90	0.0333
CMF-US-040N	1.00	0.037
CMF-US-050N/040H	1.50	0.055
CMF-US-080N/050H	3.00	0.111
CMF-US-100N/080H	9.00	0.333
CMF-US-150N/100H	20.00	0.740
CMF-US-200N/150H	40.00	1.480
CMF-US-250N/200H	60.00	2.22
CMF-US-300N/250H	90.00	3.33

3. Relationship between Zero Stability, Maximum Error, and Uncertainty

a) When: Zero Stability ≤ Flow × Uncertainty (e.g. ± 0.1%)

i. Maximum Error (%): Uncertainty

ii. Repeatability: 0.5 × Uncertainty

b) Zero Stability ≥ Flow × Uncertainty (e.g. 0.1%)

i. Maximum Error (%): ±(Zero Stability / Flow Rate) × 100%

ii. Repeatability: 0.5 × (Zero Stability / Flow Rate) × 100%

Environmental Effects

1. Influence of Process Temperature

Due to the temperature difference between the process fluid and the zero point calibration conditions, there can be changes in the flow tube volume, due to thermal expansion, and thermally induced stiffness of the flow tube. These factors can induce some error by causing zero-point drift.

Maximum Deviation:

a) Flow: ±Max. Range × 0.0003%/℃ (±Max Range × 0.000167%/℉)

b) Density: ± 0.015 kg/m3/℃ (0.014 lb/yd3/℉)

2. Influence of Process Pressure

Due to the pressure difference between the process fluid and the calibration conditions, there can be changes in the flow tube volume and flow tube stiffness, these factors can induce some error and contribute to zero-point drift.

Correction Formulas:

a) Flow Correction: $Qp = Q \times ((Pi - Pc) \times Kiq + 1)$

Q_p-Real flow

Q-Flow without pressure correction

P_i- Process pressure

P_c- Calibration Pressure

K_{iq}- Pressure correction coefficient for flow

b) Density correction: $\rho_p = \rho \times ((P_i - P_c) \times K_{i\rho} + 1)$

ρ_p- Real density (kg/m^3)

ρ- Density without pressure correction (kg/m^3)

P_i- Process pressure

P_c- Calibration Pressure

$K_{i\rho}$- Pressure correction coefficient for density

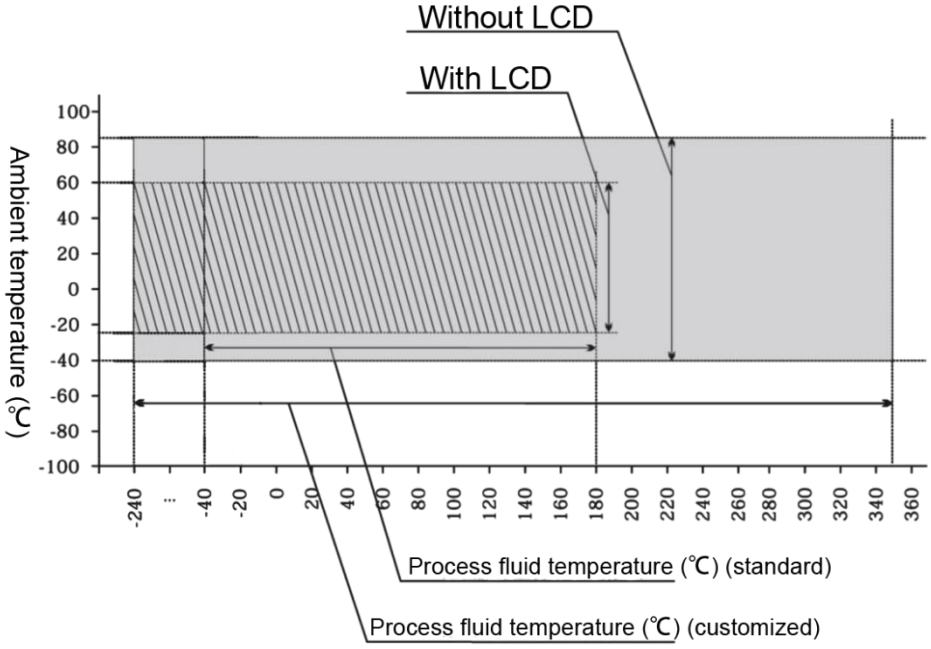
c) Pressure Coefficient (See following table)

Specification	For flow K_{iq}		For density $K_{i\rho}$	
	Pressure unit: psi	Pressure unit: bar	Pressure unit: psi	Pressure unit: bar
CMF-US-001N	0.00014	0.002	0.00196	0.028
CMF-US-002N	0.00014	0.002	0.00196	0.028
CMF-US-005N	0.00014	0.002	0.00224	0.032
CMF-US-010N	0.00028	0.004	0.00294	0.042
CMF-US-015N	0.00042	0.006	0.00315	0.045
CMF-US-025H	0.00056	0.008	0.00266	0.038
CMF-US-040N	0.00056	0.008	0.00266	0.038
CMF-US-050N/040H	0.00028	0.004	0.00182	0.026
CMF-US-080N/050H	0.00056	0.008	0.00266	0.038
CMF-US-100N/080H	0.00084	0.012	0.00266	0.038
CMF-US-150N/100H	0.00098	0.014	0.00224	0.032
CMF-US-200N/150H	0.00126	0.018	0.00224	0.032
CMF-US-250N/200H	0.0014	0.020	0.00245	0.035
CMF-US-300N/250H	0.00175	0.025	0.00266	0.038

Process Conditions

1. Temperature Range

Process	-240℃—350℃ (-400℉—662℉) (depending on configuration
Storage	-50℃—70℃ (-58℉—158℉)
Ambient	-25℃—60℃ (-13℉—140℉) (with LCD); -40℃—85℃ (-40℉—185℉) (without LCD)



2. Process Pressure

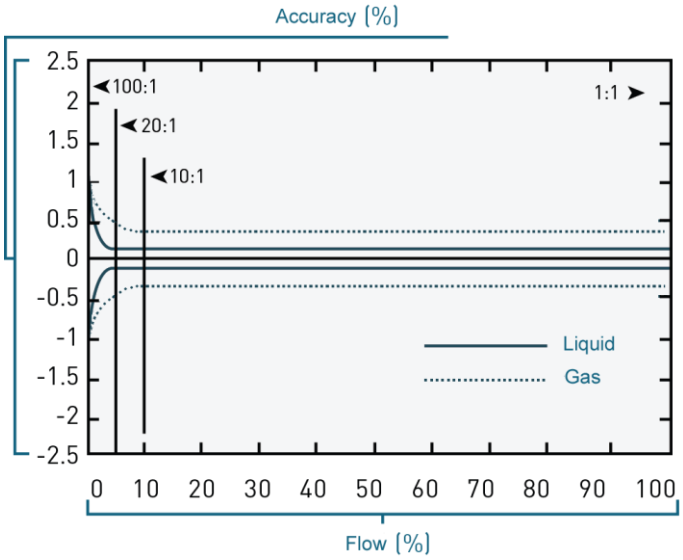
Maximum process pressure is primarily limited by the type of **process connection** used. Refer to the list of available Process Connections provided in the **Ordering Information** section. Keep in mind that when the process temperature is higher, the flow meter should be operated further below the maximum pressure for a given connection type. Walsn specialists will happily assess a proposed process condition to help ensure the correct choices are made.

3. Flow Range

Specification	Liquid		K – gas coefficient
	lb/min	kg/h	
CMF-US-001N	0.75	20	60
CMF-US-002N	2.25	60	60
CMF-US-005N	18.4	500	70
CMF-US-010N	37	1000	80
CMF-US-015N	220	6000	90
CMF-US-025H	661	18000	140
CMF-US-040N	735	20000	140
CMF-US-040H	1100	30000	140
CMF-US-050N	1100	30000	140
CMF-US-050H	2200	60000	160
CMF-US-080N	2200	60000	160
CMF-US-080H	6600	180000	215
CMF-US-100N	6600	180000	215
CMF-US-100H	14697	400000	230
CMF-US-150N	14697	400000	230
CMF-US-150H/200N	29395	800000	240
CMF-US-200H/250N	44092	1200000	250
CMF-US-250H/300N	66000	1800000	300

Note: gas flow range = liquid flow range ×gas process density / K

Pressure loss is related to process fluid characteristics and flow rate. The figures below illustrate typical accuracy, range ability and pressure loss for water.



Range ability	500:1	100:1	20:1	10:1	1:1
Accuracy of liquid (± %)	2.50	0.8	0.1	0.1	0.1
Accuracy of gas (± %)	2.50	1.5	0.5	0.35	0.35
Pressure loss					
Liquid (psi)	~0	~0	0.1	0.25	14.5
Liquid (bar)	~0	~0	0.01	0.02	1.0
Gas (psi)	0	0	0.1	0.35	15.0
Gas (bar)	0	0	0.01	0.02	1.03

Environmental Conditions

1. Power consumption: ≤ 20W
2. Enclosure rating: IP65, IP67, IP68 (Remote Style Options only)
3. Vibration limits:
   a) a = 0.5g
   b) Endurance sweep, under the condition of 20Hz ~ 400Hz frequency for 50 sweep cycles
4. Impact limits: If the flow meter is well-packed, its performance will not be affected by the following impacts:
   a) Acceleration: 50m/s^2
   b) Impact frequency: 60 times/min ~100 times/min
   c) Impact: 1000 times
5. Ex approval: Ex d ib IIC T6 Gb
6. Electromagnetic/Electrostatic compatibility
   a) Electrostatic discharge: level 3
   b) Electrical fast transient/burst (EFTB) resistance: level 3

Construction

1. Typical Materials of Components

Wetted Parts	Material	Non-Wetted Parts	Material
Flow tube	316L stainless steel	Sensor housing	304 stainless steel
Separator	316L stainless steel	Transmitter housing	Aluminum Die-Cast
Flange	316L stainless steel	Remote junction box	Aluminum Die-Cast

Note: Non-standard configurations are available. Refer to Ordering Information for details

2. Weight & Packaging

Weights vary depending on configuration, weights for several common configurations are listed below

a) Integral package, T0 transmitter, equipped with ANSI Class 150 RF flanges or standard cable connections

Specification	Net Weight		Material	Packaging Size		Gross Weight	
	lb	kg		in	mm	lb	kg
CMF-US-010N	12	5.5	Carton	22.83×17.32×12.6	580×440×320	14	6.5
CMF-US-015N	20	9	Carton	26.77×23.23×15.75	680×590×400	26	12
CMF-US-025N	31	14	Carton	26.77×23.23×15.75	680×590×400	37	17
CMF-US-040N	66	30	Wooden box	36.22×28.35×20.47	920×720×520	117	53
CMF-US-040H	71	32	Wooden box	36.22×28.35×20.47	920×720×520	121	55
CMF-US-050N	75	34	Wooden box	36.22×28.35×20.47	920×720×520	126	57
CMF-US-050H	110	50	Wooden box	51.18×29.53×18.50	1300*750*470	209	95
CMF-US-080N	115	52	Wooden box	47.24×36.22×20.47	1200×920×520	214	97
CMF-US-080H	181	82	Wooden box	47.24×36.22×20.47	1200×920×520	280	127
CMF-US-100N	165	75	Wooden box	47.24×36.22×20.47	1200×920×520	265	120
CMF-US-100H	392	178	Wooden box	59.05×52.76×21.26	1500×1340×540	536	243
CMF-US-150N	403	183	Wooden box	59.05×52.76×21.26	1500×1340×540	547	248
CMF-US-150H	483	219	Wooden box	70.87×64.96×22.05	1800×1650×560	659	299
CMF-US-200N	518	235	Wooden box	70.87×64.96×22.05	1800×1650×560	694	315
CMF-US-250N	661	300	Wooden box	78.74×70.87×23.62	2000×1800×600	904	410

b) Integral package, T1 transmitter, equipped with ANSI Class 150 RF flanges or standard cable connections

Specification	Net Weight		Material	Packaging Size		Gross Weight	
	lb	kg		in	mm	lb	kg
CMF-US-010N	13	6	Carton	22.83×17.32×12.6	580×440×320	15	7
CMF-US-015N	21	9.5	Carton	26.77×23.23×15.75	680×590×400	29	13
CMF-US-025N	33	15	Carton	26.77×23.23×15.75	680×590×400	40	18
CMF-US-25H/40N	53	24	Wooden box	38.39×22.99×12.24	975×584×311	117	53
CMF-US-040H	57	26	Wooden box	39.76×24.88×12.52	1010×632×318	123	56
CMF-US-050N	66	30	Wooden box	39.76×24.88×12.52	1010×632×318	132	60
CMF-US-050H	84	38	Wooden box	43.31×28.74×13.90	1100*730*353	165	75
CMF-US-080N	99	45	Wooden box	43.31×28.74×13.90	1100×730×353	181	82
CMF-US-080H	183	90	Wooden box	50.79×33.86×13.11	1290×860×333	287	130
CMF-US-100N	216	98	Wooden box	50.79×33.86×13.11	1290×860×333	304	138
CMF-US-100H	298	135	Wooden box	61.42×43.31×16.54	1560×1100×420	540	245
CMF-US-150N	353	160	Wooden box	61.42×43.31×16.54	1560×1100×420	595	270
CMF-US-150H	661	300	Wooden box	70.87×55.12×22.83	1800×1400×580	944	425
CMF-US-200N	728	330	Wooden box	70.87×55.12×22.83	1800×1400×580	1003	455
CMF-US-200H	664	375	Wooden box	78.74×70.87×23.62	2000×1800×600	1105	501
CMF-US-250N	911	413	Wooden box	78.74×70.87×23.62	2000×1800×600	1186	538
CMF-US-250H	1117	507	Wooden box	86.61×74.80×25.98	2200×1900×660	1385	628
CMF-US-300N	1204	546	Wooden box	86.61×74.80×25.98	2200×1900×660	1470	667

c) Remote package, T0 transmitter, equipped with ANSI Class 150 RF flanges or standard cable connections, 10 meters cable

Specification	Net Weight of transmitter		Net Weight of sensor		Material	Packaging Size		Gross Weight	
	lb	kg	lb	kg		in	mm	lb	kg
CMF-US-001N	13.5	6.1	3	1.5	Carton	17.72×12.2×9.06	450×310×230	20	9
CMF-US-002N	13.5	6.1	4	2	Carton	17.72×12.2×9.06	450×310×230	21	9.5
CMF-US-005N	13.5	6.1	6.6	3	Carton	17.72×12.2×9.06	450×310×230	24	11
CMF-US-010N	13.5	6.1	8.8	4	Carton	17.72×12.2×9.06	450×310×230	26	12
CMF-US-015N	13.5	6.1	15	6.6	Carton	22.83×17.32×12.6	580×440×320	35	16
CMF-US-025N	13.5	6.1	24	11	Carton	22.83×17.32×12.6	580×440×320	44	20
CMF-US-040N	13.5	6.1	60	27	Wooden box	36.22×28.35×20.47	920×720×520	123	56
CMF-US-040H	13.5	6.1	66	30	Wooden box	36.22×28.35×20.47	920×720×520	130	59
CMF-US-050N	13.5	6.1	68	31	Wooden box	36.22×28.35×20.47	920×720×520	132	60
CMF-US-050H	13.5	6.1	104	47	Wooden box	51.18×29.53×18.50	1300*750*470	218	99
CMF-US-080N	13.5	6.1	108	49	Wooden box	47.24×36.22×20.47	1200×920×520	223	101
CMF-US-080H	13.5	6.1	176	80	Wooden box	47.24×36.22×20.47	1200×920×520	287	130
CMF-US-100N	13.5	6.1	159	72	Wooden box	47.24×36.22×20.47	1200×920×520	271	123
CMF-US-100H	13.5	6.1	386	175	Wooden box	59.05×52.76×21.26	1500×1340×540	545	247
CMF-US-150N	13.5	6.1	397	180	Wooden box	59.05×52.76×21.26	1500×1340×540	556	252
CMF-US-150H	13.5	6.1	476	216	Wooden box	70.87×64.96×22.05	1800×1650×560	666	302
CMF-US-200N	13.5	6.1	529	240	Wooden box	70.87×64.96×22.05	1800×1650×560	705	320
CMF-US-250N	13.5	6.1	672	305	Wooden box	78.74×70.87×23.62	2000×1800×600	915	415

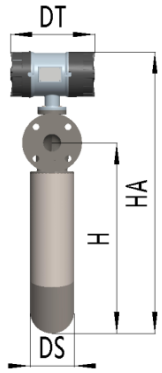
d) Remote type package, T1 transmitter, equipped with ANSI Class 150 RF flanges or standard cable connections, 10 meters cable

Specification	Net Weight of transmitter		Net Weight of sensor		Material	Packaging Size		Gross Weight	
	lb	kg	lb	kg		in	mm	lb	kg
CMF-US-001N	12	5.4	6.6	3	Carton	17.72×12.2×9.06	450×310×230	20	9.3
CMF-US-002N	12	5.4	7.7	3.5	Carton	17.72×12.2×9.06	450×310×230	23	10.3
CMF-US-005N	12	5.4	9.9	4.5	Carton	17.72×12.2×9.06	450×310×230	25	11.3
CMF-US-010N	12	5.4	12	5.5	Carton	17.72×12.2×9.06	450×310×230	27	12.3
CMF-US-015N	12	5.4	18	8.1	Carton	22.83×17.32×12.6	580×440×320	36	16.3
CMF-US-025N	12	5.4	29	13	Carton	22.83×17.32×12.6	580×440×320	47	21.3
CMF-US-25H/40N	12	5.4	48,5	22	Wooden box	38.39×22.99×12.24	975×584×311	124	56.3
CMF-US-040H	12	5.4	52.9	24	Wooden box	39.76×24.88×12.52	1010×632×318	131	59.3
CMF-US-050N	12	5.4	61.7	28	Wooden box	39.76×24.88×12.52	1010×632×318	140	63.3
CMF-US-050H	12	5.4	79.4	36	Wooden box	43.31×28.74×13.90	1100*730*353	173	78.3
CMF-US-080N	12	5.4	94.8	43	Wooden box	43.31×28.74×13.90	1100×730×353	188	85.3
CMF-US-080H	12	5.4	194	88	Wooden box	50.79×33.86×13.11	1290×860×333	294	133.3
CMF-US-100N	12	5.4	212	96	Wooden box	50.79×33.86×13.11	1290×860×333	312	141.3
CMF-US-100H	12	5.4	293	133	Wooden box	61.42×43.31×16.54	1560×1100×420	547	248.3
CMF-US-150N	12	5.4	348	158	Wooden box	61.42×43.31×16.54	1560×1100×420	603	273.3
CMF-US-150H	12	5.4	657	298	Wooden box	70.87×55.12×22.83	1800×1400×580	944	428.3
CMF-US-200N	12	5.4	723	328	Wooden box	70.87×55.12×22.83	1800×1400×580	1006	458.3
CMF-US-200H	12	5.4	822	373	Wooden box	78.74×70.87×23.62	2000×1800×600	1112	504.3
CMF-US-250N	12	5.4	906	411	Wooden box	78.74×70.87×23.62	2000×1800×600	1193	541.3
CMF-US-250H	12	5.4	1113	505	Wooden box	86.61×74.80×25.98	2200×1900×660	1392	631.3
CMF-US-300N	12	5.4	1199	544	Wooden box	86.61×74.80×25.98	2200×1900×660	1478	670.3

3. Dimensions

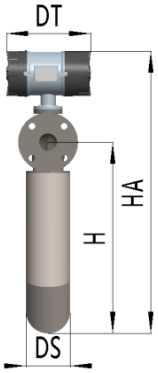
a) Integral type

i. With T0 transmitter Imperial size, inch



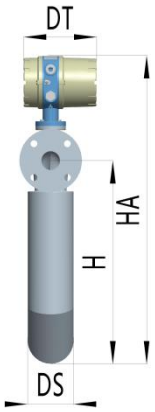
Specification	Line Size	L	H	HA	DS	DT
CMF-US-010N	3/8	7.87	6.69	16.46	3.74	9.45
CMF-US-015N	1/2	10.08	8.66	19.09	4.53	9.45
CMF-US-025N	1	11.97	12.20	21.65	5.31	9.45
CMF-US-040N	1-1/2	22.60	20.55	30.55	4.76	9.45
CMF-US-040H	1-1/2	24.49	21.34	31.46	4.76	9.45
CMF-US-050N	2	24.49	21.34	31.46	4.76	9.45
CMF-US-050H	2	27.64	25.91	36.14	5.91	9.45
CMF-US-080N	3	30.04	26.69	37.44	5.91	9.45
CMF-US-080H	3	33.46	33.90	45.63	7.72	9.45
CMF-US-100N	4	32.36	28.86	40.43	5.91	9.45
CMF-US-100H	4	41.89	45.28	57.95	11.89	9.45
CMF-US-150N	6	45.67	39.13	51.69	9.65	9.45
CMF-US-150H	6	48.82	49.49	63.35	12.83	9.45
CMF-US-200N	8	49.92	49.49	63.35	12.83	9.45
CMF-US-250N	10	69.29	68.94	84.65	17.13	9.45

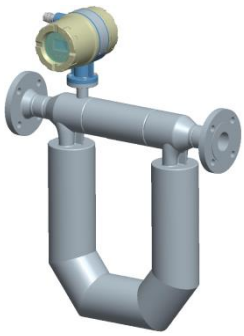
ii. With T0 transmitter metric size, mm



Specification	Line Size	L	H	HA	DS	DT
CMF-US-010N	10	200	170	418	95	240
CMF-US-015N	15	256	220	485	115	240
CMF-US-025N	25	304	310	550	135	240
CMF-US-040N	40	574	522	776	121	240
CMF-US-040H	40	622	542	799	121	240
CMF-US-050N	50	622	542	799	121	240
CMF-US-050H	50	702	658	918	150	240
CMF-US-080N	80	763	678	951	150	240
CMF-US-080H	80	850	861	1159	196	240
CMF-US-100N	100	822	733	1027	150	240
CMF-US-100H	100	1064	1150	1472	302	240
CMF-US-150N	150	1160	994	1313	245	240
CMF-US-150H	150	1240	1257	1609	326	240
CMF-US-200N	200	1268	1257	1609	326	240
CMF-US-250N	250	1760	1751	2150	435	240

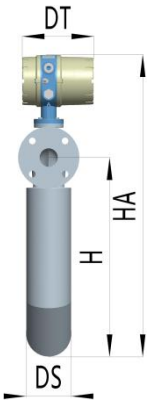
iii. With T1 transmitter Imperial size, inch

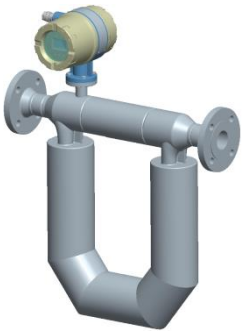




Specification	L	H	HA	DS	DT
CMF-US-010N	7.87	6.69	17.17	3.74	7.56
CMF-US-015N	10.08	8.66	19.80	4.53	7.56
CMF-US-025N	11.97	12.20	22.36	5.31	7.56
CMF-US-25H/040N	22.60	20.55	31.26	4.76	7.56
CMF-US-040H	24.49	21.34	32.17	4.76	7.56
CMF-US-050N	24.49	21.34	32.17	4.76	7.56
CMF-US-050H	27.64	25.91	36.85	5.91	7.56
CMF-US-080N	30.04	26.69	38.15	5.91	7.56
CMF-US-080H	33.46	34.29	46.73	7.72	7.56
CMF-US-100N	33.46	34.29	46.73	7.72	7.56
CMF-US-100H	41.89	45.28	58.66	11.89	7.56
CMF-US-150N	45.83	39.13	52.40	9.65	7.56
CMF-US-150H	48.82	49.49	64.06	12.83	7.56
CMF-US-200N	49.84	49.49	64.06	12.83	7.56
CMF-US-200H	52.76	55.31	69.41	14.17	7.56
CMF-US-250N	53.90	55.31	69.41	14.17	7.56
CMF-US-250H	55.20	67.17	79.09	18.15	7.56
CMF-US-300N	57.13	67.17	79.09	18.15	7.56

iv. With T1 transmitter metric size, mm

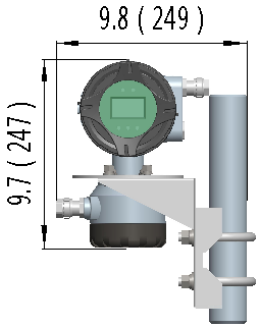


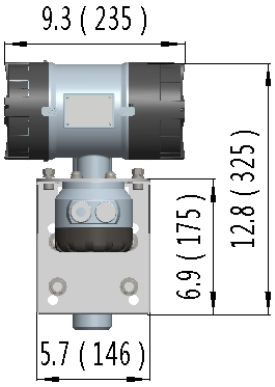


Specification	L	H	HA	DS	DT
CMF-US-010N	200	170	436	95	192
CMF-US-015N	256	220	503	115	192
CMF-US-025N	304	310	568	135	192
CMF-US-25H/040N	574	522	794	121	192
CMF-US-040H	622	542	817	121	192
CMF-US-050N	622	542	817	121	192
CMF-US-050H	702	658	936	150	192
CMF-US-080N	763	678	969	150	192
CMF-US-080H	850	871	1187	196	192
CMF-US-100N	850	871	1187	196	192
CMF-US-100H	1064	1150	1490	302	192
CMF-US-150N	1164	994	1331	245	192
CMF-US-150H	1240	1257	1627	326	192
CMF-US-200N	1266	1257	1627	326	192
CMF-US-200H	1340	1405	1763	360	192
CMF-US-250N	1369	1405	1763	360	192
CMF-US-250H	1402	1706	2009	461	192
CMF-US-300N	1451	1706	2009	461	192

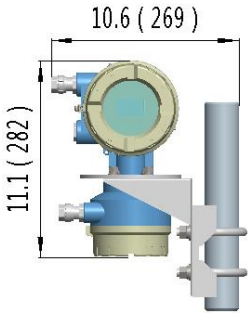
b) Remote type:

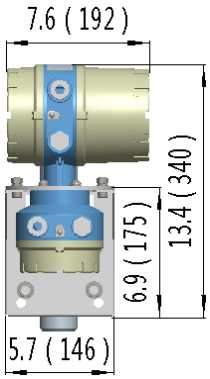
i. T0 transmitter size, inch (mm)

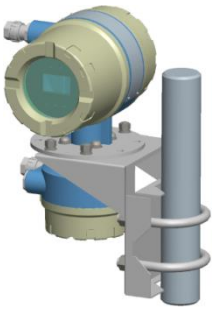




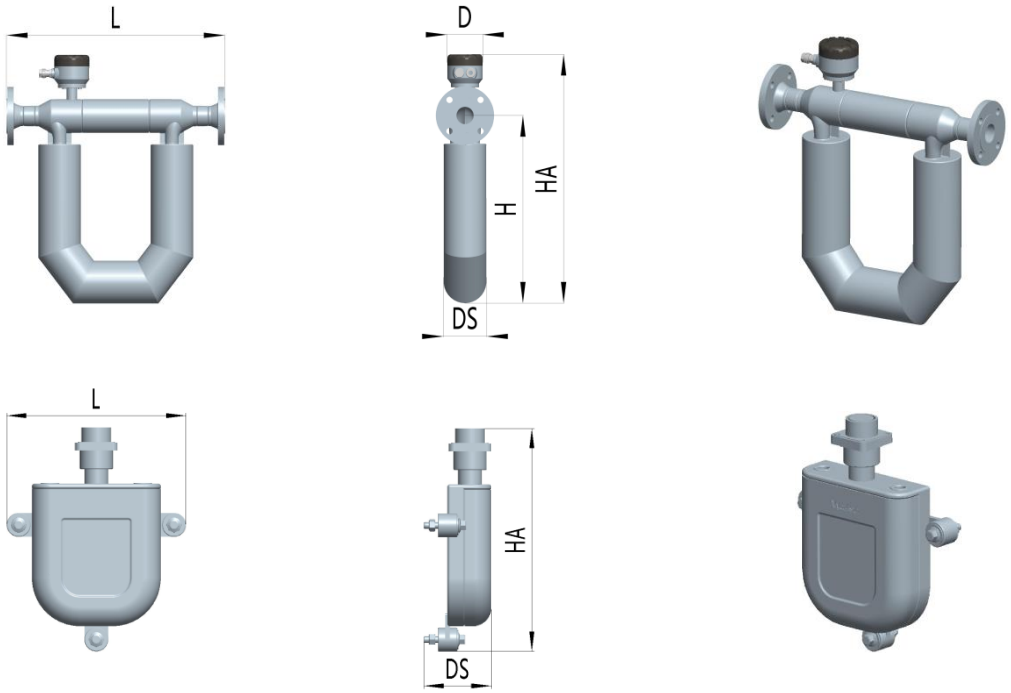
ii. T1 transmitter size, inch (mm)





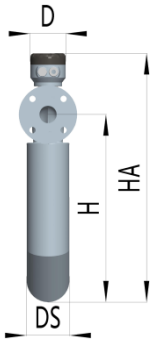


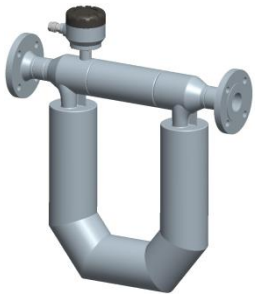
iii. Sensor paired with T0 transmitter Imperial size, inch

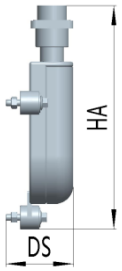


Specification	Line Size	L	H	HA	DS	D
CMF-US-001N	1/24	4.53	\	5.87	1.18	\
CMF-US-002N	1/12	5.31	\	6.65	1.57	\
CMF-US-005N	3/16	6.89	\	8.23	2.56	\
CMF-US-010N	3/8	7.87	6.69	9.49	3.74	3.94
CMF-US-015N	1/2	10.08	8.66	14.65	4.53	3.94
CMF-US-025N	1	11.97	12.20	18.39	5.31	3.94
CMF-US-040N	1-1/2	22.60	20.55	27.32	4.76	3.94
CMF-US-040H	1-1/2	24.49	21.34	28.23	4.76	3.94
CMF-US-050N	2	24.49	21.34	28.23	4.76	3.94
CMF-US-050H	2	27.64	25.91	32.91	5.91	3.94
CMF-US-080N	3	30.04	26.69	34.21	5.91	3.94
CMF-US-080H	3	33.46	33.90	42.40	7.72	3.94
CMF-US-100N	4	32.36	28.86	37.20	5.91	3.94
CMF-US-100H	4	41.89	45.28	54.72	11.89	3.94
CMF-US-150N	6	45.67	39.13	48.46	9.65	3.94
CMF-US-150H	6	48.82	49.49	60.12	12.83	3.94
CMF-US-200N	8	49.92	49.49	60.12	12.83	3.94
CMF-US-250N	10	69.29	68.94	81.42	17.13	3.94

iv. Sensor paired with T0 transmitter metric size, mm

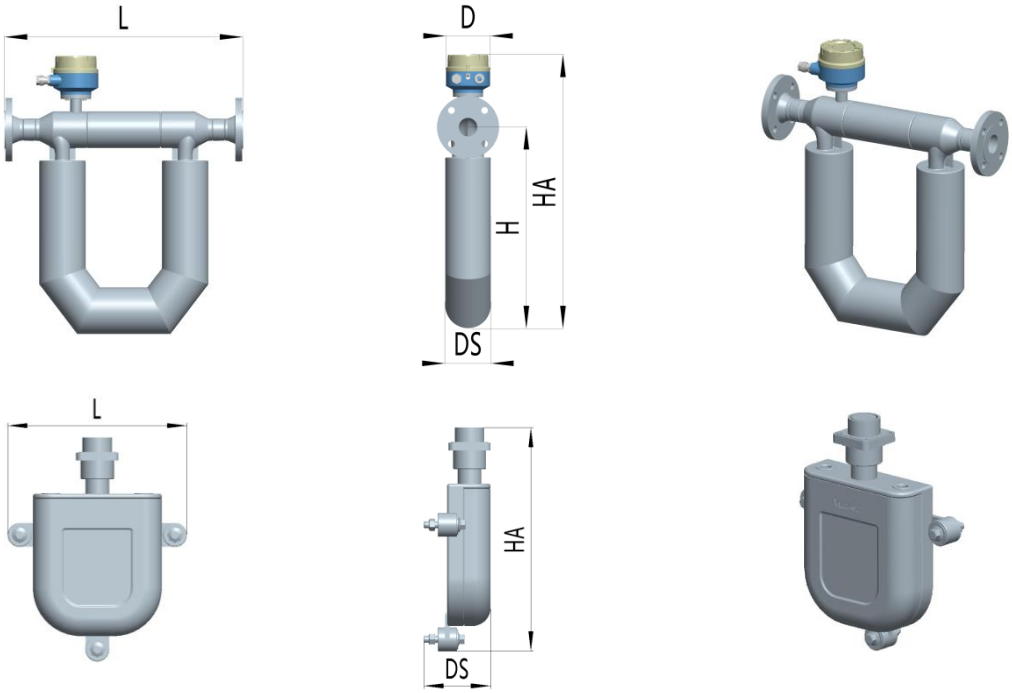






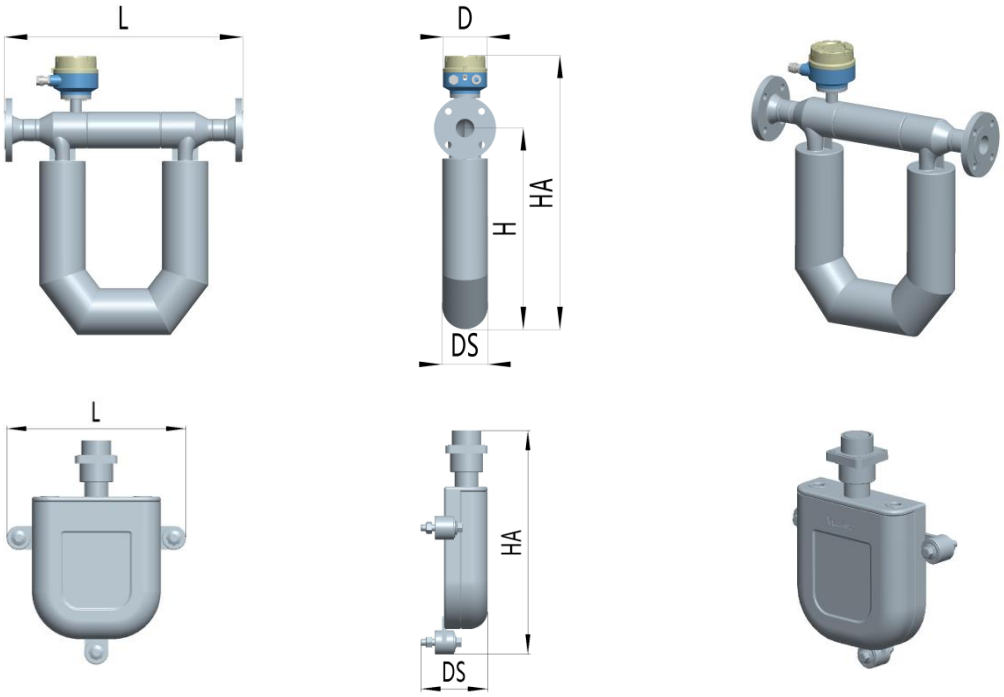
Specification	Line Size	L	H	HA	DS	D
CMF-US-001N	1	115	\	149	30	\
CMF-US-002N	2	135	\	169	40	\
CMF-US-005N	5	175	\	209	65	\
CMF-US-010N	10	200	170	241	95	100
CMF-US-015N	15	256	220	372	115	100
CMF-US-025N	25	304	310	467	135	100
CMF-US-040N	40	574	522	694	121	100
CMF-US-040H	40	622	542	717	121	100
CMF-US-050N	50	622	542	717	121	100
CMF-US-050H	50	702	658	836	150	100
CMF-US-080N	80	763	678	869	150	100
CMF-US-080H	80	850	861	1077	196	100
CMF-US-100N	100	822	733	945	150	100
CMF-US-100H	100	1064	1150	1390	302	100
CMF-US-150N	150	1160	994	1231	245	100
CMF-US-150H	150	1240	1257	1527	326	100
CMF-US-200N	200	1268	1257	1527	326	100
CMF-US-250N	250	1760	1751	2068	435	100

v. Sensor paired with T1/T2/T3 transmitter Imperial size, inch



Specification	L	H	HA	DS	D
CMF-US-001N	4.53	\	5.87	1.18	\
CMF-US-002N	5.31	\	6.65	1.57	\
CMF-US-005N	6.89	\	8.23	2.56	\
CMF-US-010N	7.87	6.69	10.20	3.74	4.61
CMF-US-015N	10.08	8.66	15.35	4.53	4.61
CMF-US-025N	11.97	12.20	19.09	5.31	4.61
CMF-US-025H/040N	22.60	20.55	28.03	4.76	4.61
CMF-US-040H/050N	24.49	21.34	28.94	4.76	4.61
CMF-US-050H/080N	27.64	25.91	33.62	5.91	4.61
CMF-US-080H/100N	33.46	34.29	43.50	7.72	4.61
CMF-US-100H	41.89	45.28	55.20	11.89	4.61
CMF-US-150N	45.83	39.13	58.35	9.65	4.61
CMF-US-150H	48.82	49.49	60.83	12.83	4.61
CMF-US-200N	49.84	49.49	60.83	12.83	4.61
CMF-US-200H	52.76	55.31	66.18	14.17	4.61
CMF-US-250N	53.90	55.31	66.18	14.17	4.61
CMF-US-250H	55.20	67.17	75.87	18.15	4.61
CMF-US-300N	57.13	67.17	75.87	18.15	4.61

vi. Sensor paired with T1 transmitter metric size, mm

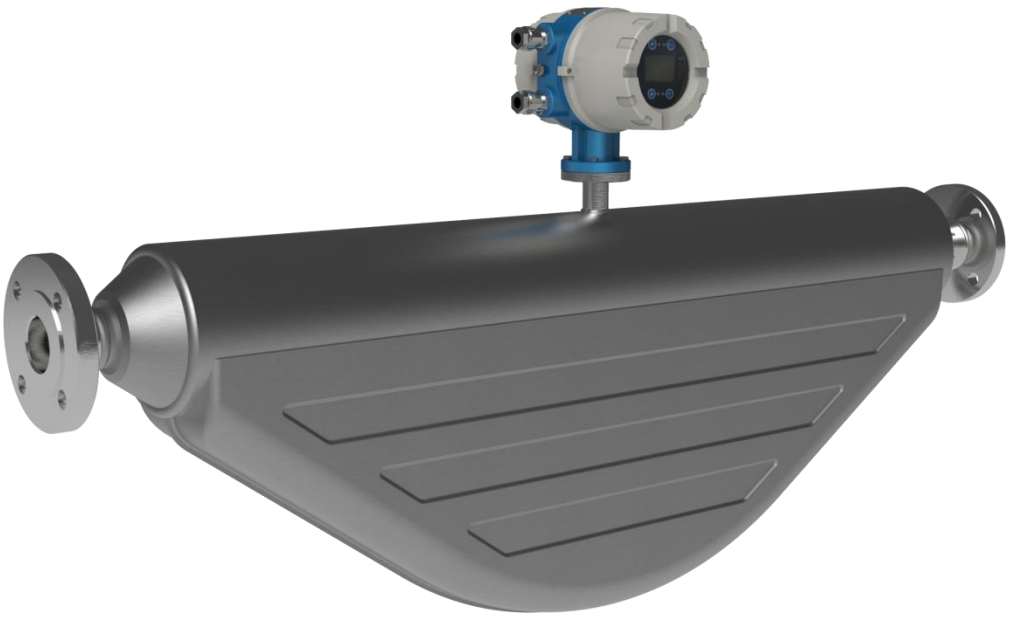


Specification	L	H	HA	DS	D
CMF-US-001N	115	\	149	30	\
CMF-US-002N	135	\	169	40	\
CMF-US-005N	175	\	209	65	\
CMF-US-010N	200	170	259	95	117
CMF-US-015N	256	220	390	115	117
CMF-US-025N	304	310	485	135	117
CMF-US-025H/040N	574	522	712	121	117
CMF-US-040H/050N	622	542	735	121	117
CMF-US-050H/080N	702	658	854	150	117
CMF-US-080H/100N	850	871	1105	196	117
CMF-US-100H	1064	1150	1402	302	117
CMF-US-150N	1164	994	1482	245	117
CMF-US-150H	1240	1257	1545	326	117
CMF-US-200N	1266	1257	1545	326	117
CMF-US-200H	1340	1405	1681	360	117
CMF-US-250N	1369	1405	1681	360	117
CMF-US-250H	1402	1706	1927	461	117
CMF-US-300N	1451	1706	1927	461	117

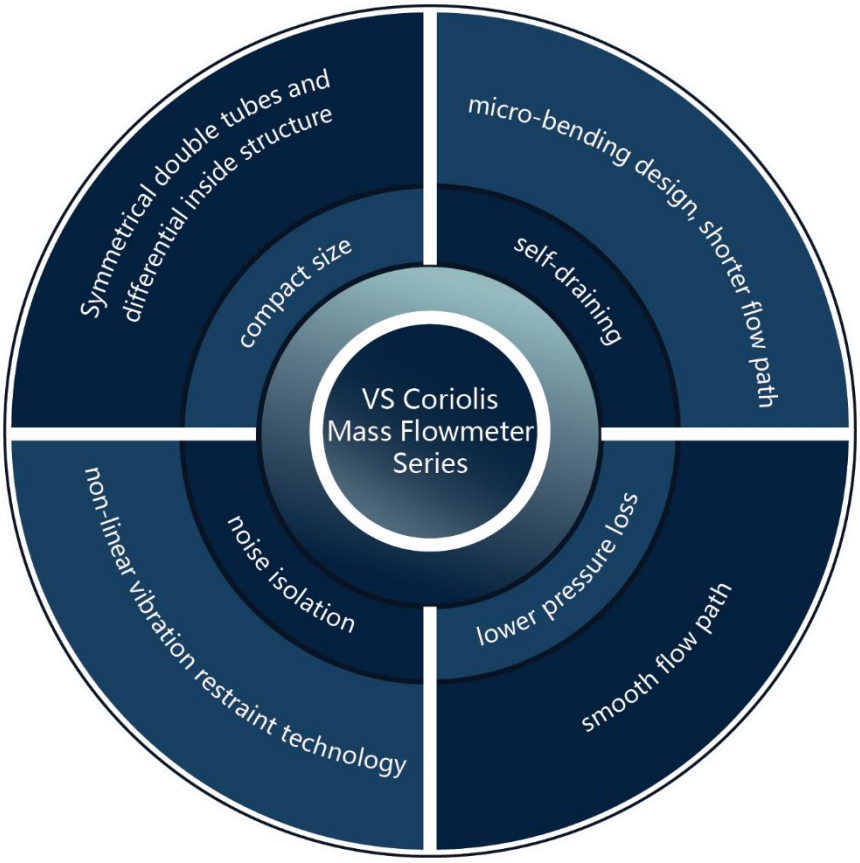
Walsn Mass Flowmeter – **VS Series**

The **VS series** Coriolis mass flowmeter is a new generation of product with twinned micro bend flow tubes from Walsn. The Walsn mass flow meter is equipped with a transmitter utilizing a digital signal processor (DSP), integrated with digital closed-loop vibration control (DLC), which performs calculations and monitors diagnostic functions of the sensor. This provides high accuracy measurement, wide range ability and excellent reliability for you. Online node-configuration, diagnostics and data recording can be handled directly through a Hart communicator or Modbus.

The **VS Series** flowmeter not only provides mass flow rate, but can also calculate: density, temperature volumetric flow rate, total flow and component fractions online and in real-time.



Product Features



Compact structure & **High** stability

These Coriolis mass flow meters provide high-sensitivity and high-accuracy measurement, with multi-variable outputs. They are the ideal measuring solution for flow process control.

Features
◆ Compact structure with micro bend flow tube design
◆ Self-draining flow tube design
◆ Dedicated ASIC with digital closed-loop control (DLC) improves the performance of gas-liquid flow measurement
◆ Dynamic vibration balance (DVB) technology provides system stability
◆ Double-temperature compensation and high-pressure compensation improve installed performance

Applicable Fluids

- Gases
- Liquids
- Slurries

Typical Applications

- Custody transfer
- Density measurement
- Reactor feed ratio
- Batch control

Performance Characteristics

1. Operating Conditions

a) Flow measurement uncertainty includes the combined effects of linearity, repeatability and hysteresis

b) Measurement performance is based on calibration with water as the process fluid at typical process conditions (20℃—30℃ & 200 KPa—400 KPa)

c) Measurement performance is based on collected frequency or pulse outputs by the flow meter

2. Performance

a) Flow Performance

i. Mass flow / volume flow liquid

Uncertainty: ± 0.10%

Repeatability: ≤ 0.05%

ii. Mass flow / volume flow gas

Uncertainty: ± 0.5%

Repeatability: ≤ 0.25%

b) Density Performance

i. Liquid Density:

Error: ± 0.001 g/cm^3 (1.0kg/m^3)

Repeatability: ± 0.0005 g/cm^3 (0.5 kg/m^3)

Range: 0.1g/cm^3—2.5 g/cm^3 (100kg/m^3—2,500kg/m^3)

ii. Gas Density: Not Applicable

c) Temperature Performance (Liquid & Gas)

Error: ±1℃ (±1.8℉)

Repeatability: ±0.1℃ (± 0.18℉)

Range: -240℃—400℃ (-400℉—752℉)

d) Zero Stability

Specification	Zero Stability	
	lb/min	kg/h
CMF-VS-002	0.0004	0.01
CMF-VS-005	0.002	0.05
CMF-VS-010	0.004	0.10
CMF-VS-015H	0.0111	0.30
CMF-VS-025H	0.0333	0.90
CMF-VS-040H	0.0555	1.50
CMF-VS-050H	0.111	3.00
CMF-VS-080H	0.333	9.00

3. Relationship between Zero Stability, Maximum Error, and Uncertainty

a) When: Zero Stability ≤ Flow × Uncertainty

i. Maximum error (%) = uncertainty

ii. Repeatability = 0.5 × uncertainty

b) When: Zero Stability ≥ Flow × Uncertainty

i. Maximum error (%) = ±(zero stability/flow rate) × 100%

ii. Repeatability = 0.5 × (zero stability/flow rate) × 100%

Environmental Effects

1. Influence of Process Temperature

Due to the temperature difference between the process fluid and the zero point calibration conditions, there can be changes in the flow tube volume, due to thermal expansion, and thermally induced stiffness of the flow tube. These factors can induce some error by causing zero-point drift.

Maximum Deviation:

a) Flow: ±Max. Range × 0.0003%/℃ (±Max Range × 0.000167%/℉)

b) Density: ± 0.015 kg/m^3/℃ (0.014 lb/yd^3/℉)

2. Influence of Process Pressure

Due to the pressure difference between the process fluid and the calibration conditions, there can be changes in the flow tube volume and flow tube stiffness, these factors can induce some error and contribute to zero-point drift.

Correction Formulas:

a) Flow Correction: $Qp = Q \times ((Pi - Pc) \times Kiq + 1)$

Q_p-Real flow

Q-Flow without pressure correction

P_i- Process pressure

P_c- Calibration Pressure

K_{iq}- Pressure correction coefficient for flow

b) Density correction: $\rho_p = \rho \times ((P_i - P_c) \times K_{i\rho} + 1)$

ρ_p- Real density (kg/m^3)

ρ- Density without pressure correction (kg/m^3)

P_i- Process pressure

P_c- Calibration Pressure

$K_{i\rho}$- Pressure correction coefficient for density

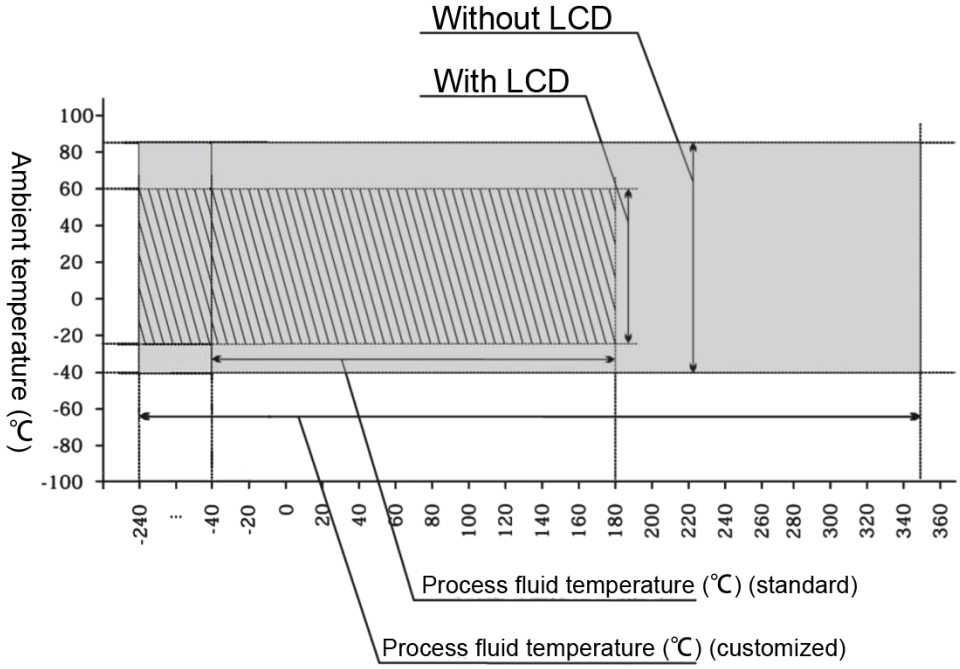
c) Pressure Coefficient (See following table)

Specification	For flow K_{iq}		For density $K_{i\rho}$	
	Pressure unit : psi	Pressure unit : bar	Pressure unit : psi	Pressure unit : bar
CMF-VS-002/5	\	\	\	\
CMF-VS-010	\	\	\	\
CMF-VS-015H	\	\	\	\
CMF-VS-025H	\	\	\	\
CMF-VS-040H	0.00014	0.002	0.014	0.2
CMF-VS-050H	0.00042	0.006	0.014	0.2
CMF-VS-080H	0.00056	0.008	0.014	0.2

Process Conditions

1. Temperature Range

Process	-240℃—350℃ (-400℉—662℉) (depending on configuration)
Storage	-50℃—70℃ (-58℉—158℉)
Ambient	-25℃—60℃ (-13℉—140℉) (with LCD); -40℃—85℃ (-40℉—185℉) (without LCD)



2. Process Pressure

Maximum process pressure is primarily limited by the type of **process connection** used. Refer to the list of available Process Connections provided in the **Ordering Information** section. Keep in mind that when the process temperature is higher, the flow meter should be operated further below the maximum pressure for a given connection type. Walsn specialists will happily assess a proposed process condition to help ensure the correct choices are made.

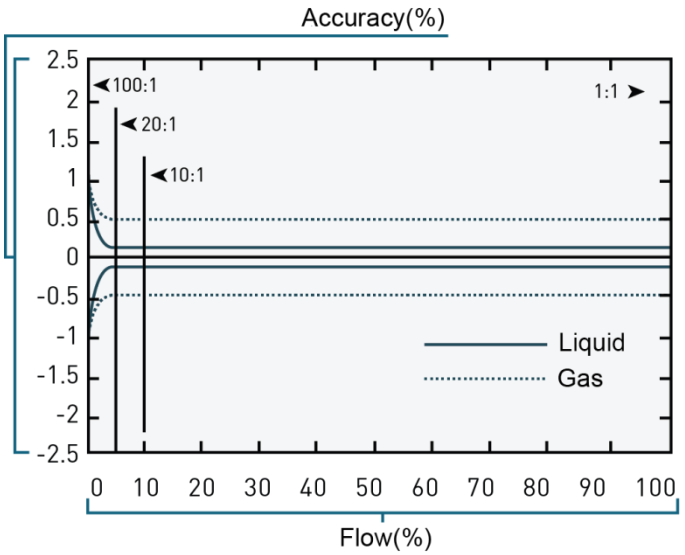
3. Flow Range

Specification	Liquid		K – gas coefficient
	lb/min	kg/h	
CMF-VS-002	3.7	100	40
CMF-VS-005	18.4	500	60
CMF-VS-010	36.7	1000	60
CMF-VS-015H	220	6000	70
CMF-VS-025H	660	18000	70
CMF-VS-040H	1100	30000	80
CMF-VS-050H	2200	60000	80
CMF-VS-080H	6600	1800000	100

Note: gas flow range = liquid flow range ×gas process density / K

4. Pressure Loss

Pressure loss is related to process fluid characteristics and flow rate. The figures below illustrate typical accuracy, range ability and pressure loss for water.



Range ability	500:1	100:1	20:1	10:1	1:1
Accuracy of liquid (± %)	2.5	0.8	0.1	0.1	0.1
Accuracy of gas (± %)	2.5	1.5	0.5	0.5	0.5
Pressure Loss					
Liquid (psi)	~0	~0	0.1	0.25	14.5
Liquid (bar)	~0	~0	0.01	0.02	1.0
Gas (psi)	0	0	0.1	0.35	15.0
Gas (bar)	0	0	0.01	0.02	1.03

Environmental Conditions

1. Power consumption: ≤ 20W
2. Enclosure rating: IP65, IP67, IP68 (Remote Style Options only)
3. Vibration limits:
   a) a = 0.5g
   b) Endurance sweep, under the condition of 20Hz ~ 400Hz frequency for 50 sweep cycles
4. Impact limits: If the flow meter is well-packed, its performance will not be affected by the following impacts:
   a) Acceleration: 50m/s^2
   b) Impact frequency: 60 times/min ~100 times/min
   c) Impact: 1000 times
5. Ex approval: Ex d ib IIC T6 Gb
6. Electromagnetic/Electrostatic compatibility
   a) Electrostatic discharge: level 3
   b) Electrical fast transient/burst (EFTB) resistance: level 3

Construction

1. Typical Materials of Components

Wetted Parts	Material	Non-Wetted Parts	Material
Flow tube	316L stainless steel	Sensor housing	304 stainless steel
Separator	316L stainless steel	Transmitter housing	Aluminum Die-Cast
Flange	316L stainless steel	Remote junction box	Aluminum Die-Cast

Note: Non-standard configurations are available. Refer to Ordering Information for details

2. Weight & Packaging

Weights vary depending on configuration, weights for several common configurations are listed below

a) Integral package, T1 transmitter, equipped with ANSI Class 150 RF flanges or standard cable connection

Specification	Net Weight		Material	Packaging Size		Gross Weight	
	lb	kg		in	mm	lb	kg
CMF-VS-015H	27.12	12.3	Carton	22.83×17.32×12.6	580×440×320	53	24
CMF-VS-025H	27.12	12.3	Carton	22.83×17.32×12.6	580×440×320	53	24
CMF-VS-040H	96.78	43.9	Wooden box	36.22×28.35×20.47	920×720×520	148	67
CMF-VS-050H	96.78	43.9	Wooden box	36.22×28.35×20.47	920×720×520	148	67
CMF-VS-080H	262.13	118.9	Wooden box	59.05×52.76×21.26	1500×1340×540	406	184

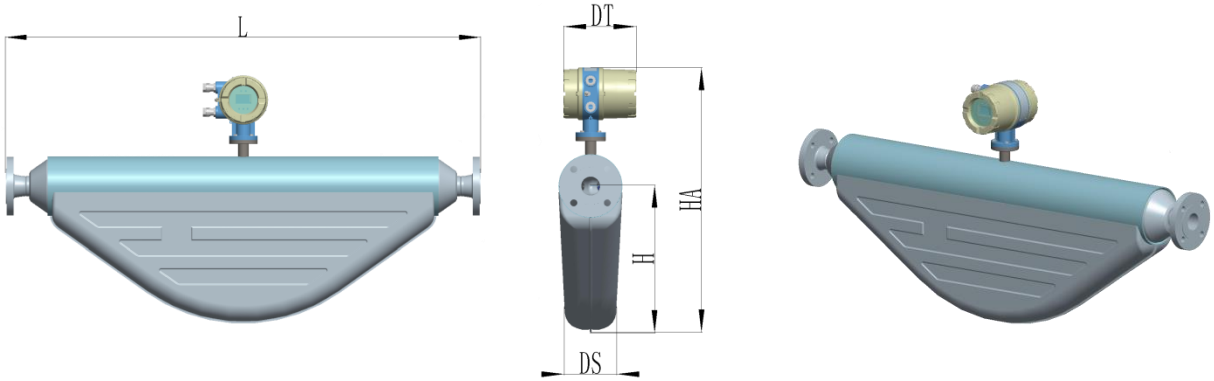
b) Remote type package, T1 transmitter, equipped with ANSI Class 150 RF flanges or standard cable connection

Specification	Net Weight of transmitter		Net Weight of sensor		Material	Packaging Size		Gross Weight	
	lb	kg	lb	kg		in	mm	lb	kg
CMF-VS-002/5	12	5.4	11	5	Carton	22.83×17.32×12.6	580×440×320	49	22.1
CMF-VS-010	12	5.4	14.3	6.5	Carton	22.83×17.32×12.6	580×440×320	52.3	23.6
CMF-VS-015H	12	5.4	21.8	9.9	Carton	22.83×17.32×12.6	580×440×320	59.5	27
CMF-VS-025H	12	5.4	21.8	9.9	Carton	22.83×17.32×12.6	580×440×320	59.5	27
CMF-VS-040H	12	5.4	91.5	41.5	Wooden box	36.22×28.35×20.47	920×720×520	142	64.5
CMF-VS-050H	12	5.4	91.5	41.5	Wooden box	36.22×28.35×20.47	920×720×520	142	64.5
CMF-VS-080H	12	5.4	256.8	116.5	Wooden box	59.05×52.76×21.26	1500×1340×540	412	187

3. Dimensions

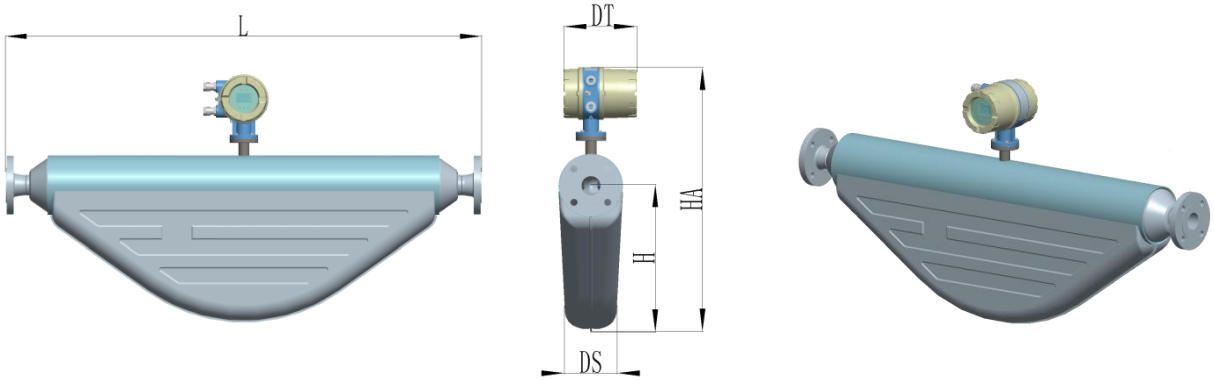
a) Integral type

i. With T1 transmitter Imperial size, inch



Specification	Line Size	L	H	HA	DS	DT
CMF-VS-015H	1/2	17.48	7.48	17.80	3.50	7.56
CMF-VS-025H	1	17.48	7.48	17.80	3.50	7.56
CMF-VS-040H	1-1/2	28.94	11.26	24.29	4.72	7.56
CMF-VS-050H	2	28.94	11.26	24.29	4.72	7.56
CMF-VS-080H	3	52.60	15.20	28.23	6.61	7.56

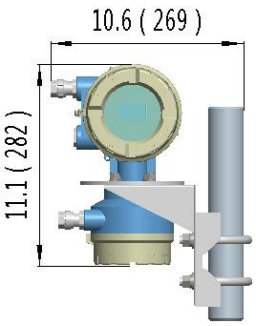
ii. With T1 transmitter metric size, mm

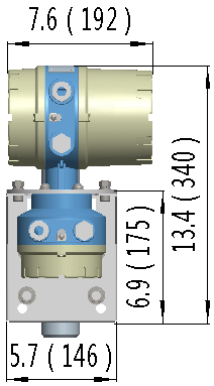


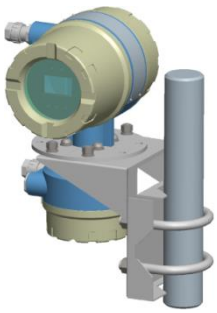
Specification	Line Size	L	H	HA	DS	DT
CMF-VS-015H	15	444	190	452	89	192
CMF-VS-025H	25	444	190	452	89	192
CMF-VS-040H	40	735	286	617	120	192
CMF-VS-050H	50	735	286	617	120	192
CMF-VS-080H	80	1336	386	717	168	192

b) Remote type:

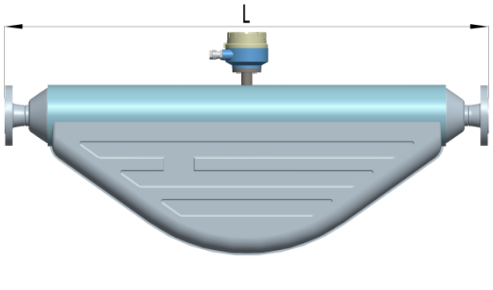
i. T1 transmitter size, inch (mm)

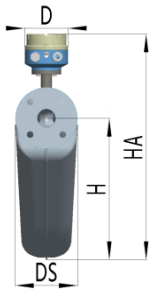


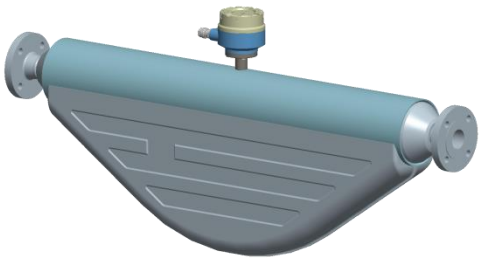




ii. Sensor paired with T1 transmitter Imperial size, inch（Normal Pressure）

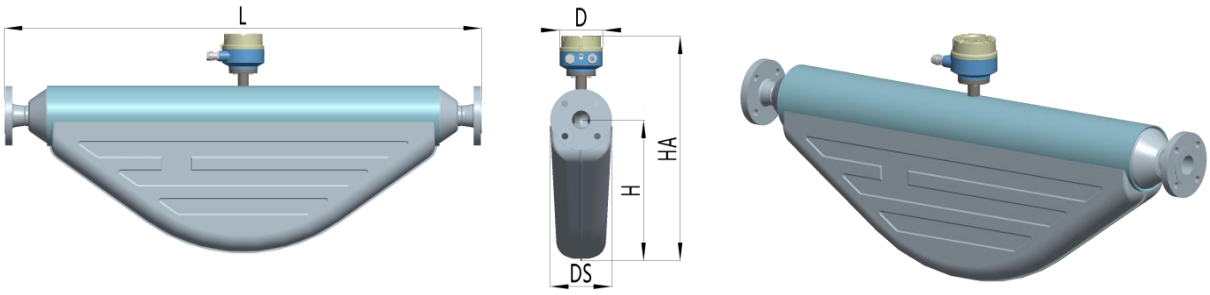






Specification	Line Size	L	H	HA	DS	DT
CMF-VS-002/5	3/16	15.24	4.21	10.75	1.93	4.61
CMF-VS-010	3/8	15.24	5.59	12.13	1.93	4.61
CMF-VS-015H	1/2	17.48	7.48	14.57	3.50	4.61
CMF-VS-025H	1	17.48	7.48	14.57	3.50	4.61
CMF-VS-040H	1-1/2	28.94	11.26	21.06	4.72	4.61
CMF-VS-050H	2	28.94	11.26	21.06	4.72	4.61
CMF-VS-080H	3	52.60	15.20	25.00	6.61	4.61

iii. Sensor paired with T1 transmitter metric size, mm（Normal Pressure）



Specification	Line Size	L	H	HA	DS	DT
CMF-VS-002/5	5	387	107	273	49	117
CMF-VS-010	10	387	142	308	49	117
CMF-VS-015H	15	444	190	370	89	117
CMF-VS-025H	25	444	190	370	89	117
CMF-VS-040H	40	735	286	535	120	117
CMF-VS-050H	50	735	286	535	120	117
CMF-VS-080H	80	1336	386	635	168	117

iv. Imperial size, in （High Pressure）

Specification	Line Size	L	H	HA	DS	D
CMF-VS-002	3/40	17.80	4.21	10.75	1.93	4.61
CMF-VS-005	3/16	17.80	4.21	10.75	1.93	4.61

v. Metric size, mm （High Pressure）

Specification	Line Size	L	H	HA	DS	D
CMF-VS-002	2	452	107	273	49	117
CMF-VS-005	5	452	107	273	49	117

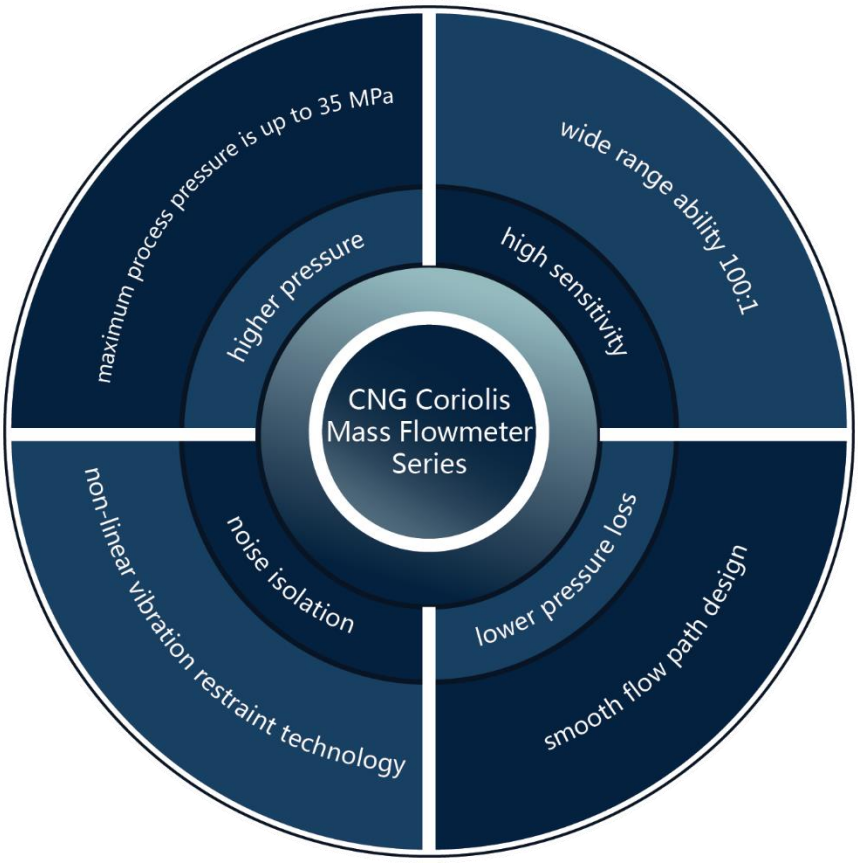
Walsn Mass Flowmeter – **CNG Series**

Walsn's CNG series Coriolis mass flow meters are our latest high pressure product. Harnassing micro bend flow tubes, a digital signal processor (DSP), and integrated digital closed-loop vibration control (DLC) signal processing makes Walsn's CNG series a powerful tool. The transmitter simultaneously calculates outputs and performs diagnostic functions, to provide reliable high accuracy measurement, with wide range ability. Hart communication and Modbus control allow online node-configuration, diagnostics and data recording to be handled remotely, but the transmitter features an easy to use interface for those preferring direct control.

The **CNG Series** flowmeter not only provides mass flow rate, but can also calculate: density, temperature volumetric flow rate, total flow and component fractions online and in real-time.

CNG series is specially designed for the CNG industry, with a focus on natural gas measurement for gas dispensers in applications such as passage cars, light-duty and heavy-duty vehicles.

Product Features



Dedicated solution for CNG measurement

Coriolis mass flow meters provide sensitive and high-accuracy measurement, with multiple variable outputs, they’re an impressively versatile tool for process flow control.

Features
◆ Dual micro bend tube structure for lower pressure loss and high sensitivity, even in high pressure applications
◆ Dedicated ASIC with digital closed-loop control (DLC) improves the performance of gas-liquid flow measurement
◆ Dynamic vibration balance (DVB) technology enhances system stability
◆ 2-point temperature compensation and process pressure compensation

Applicable Fluids

- Compressed natural gas

Typical Applications

- Gas dispensers for CNG

Performance Characteristics

1. Operation Conditions

a) Flow measurement uncertainty includes the combined effects of linearity, repeatability and hysteresis

b) Measurement performance is based on calibration with water as the process fluid at typical process conditions (20℃—30℃ & 200 KPa—400 KPa)

c) Measurement performance is based on collected frequency or pulse outputs by the flow meter

2. Performance

a) Flow Performance

i. Mass flow / volume flow liquid

Uncertainty: ± 0.10%

Repeatability: ≤ 0.05%

ii. Mass flow / volume flow gas

Uncertainty: ± 0.5%

Repeatability: ≤ 0.25%

b) Density Performance

i. Liquid Density:

Error: ± 0.001 g/cm^3 (1.0kg/m^3)

Repeatability: ± 0.0005 g/cm^3 (0.5 kg/m^3)

Range: 0.1g/cm^3—2.5 g/cm^3 (100kg/m^3—2,500kg/m^3)

ii. Gas Density: Not Applicable

c) Temperature Performance (Liquid & Gas)

Error: ±1℃ (±1.8℉)

Repeatability: ±0.1℃ (± 0.18℉)

Range: -240℃—400℃ (-400℉—752℉)

d) Zero Stability

Specification	Zero Stability	
	lb/min	kg/h
CMF-CNG-010	0.00184	0.05
CMF-CNG-015	0.0055	0.30
CMF-CNG-025	0.011	0.60

3. Relationship between Zero Stability, Maximum Error, and Uncertainty

a) When: Zero Stability ≤ Flow × Uncertainty
   i. Maximum error (%) = uncertainty
   ii. Repeatability = 0.5 × uncertainty
b) When: Zero Stability ≥ Flow × Uncertainty
   i. Maximum error (%) = ±(zero stability/flow rate) × 100%
   ii. Repeatability = 0.5 × (zero stability/flow rate) × 100%

Environmental Effects

1. Influence of Process Temperature

Due to the temperature difference between the process fluid and the zero point calibration conditions, there can be changes in the flow tube volume, due to thermal expansion, and thermally induced stiffness of the flow tube. These factors can induce some error by causing zero-point drift.

Maximum Deviation:

a) Flow: ±Max. Range × 0.0003%/℃ (±Max Range × 0.000167%/℉)
b) Density: ± 0.015 kg/m^3/℃ (0.014 lb/yd^3/℉)

2. Influence of Process Pressure

Due to the pressure difference between the process fluid and the calibration conditions, there can be changes in the flow tube volume and flow tube stiffness, these factors can induce some error and contribute to zero-point drift.

Correction Formulas:

a) Flow Correction: $Qp = Q \times ((Pi - Pc) \times Kiq + 1)$

Q_p-Real flow

Q-Flow without pressure correction

P_i- Process pressure

P_c- Calibration Pressure

Kiq- Pressure correction coefficient for flow

b) Density correction: $\rho_p = \rho \times ((P_i - P_c) \times K_{i\rho} + 1)$

ρ_p- Real density (kg/m^3)

ρ- Density without pressure correction (kg/m^3)

P_i- Process pressure

P_c- Calibration Pressure

$K_{i\rho}$- Pressure correction coefficient for density

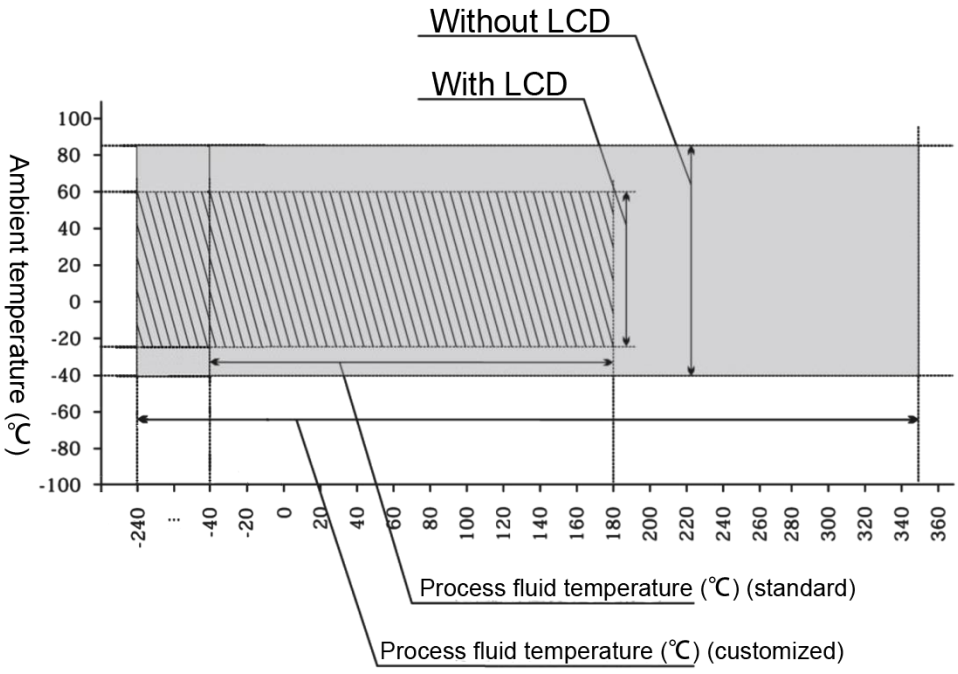
c) Pressure Coefficient (See following table)

Specification	For flow K_{iq}		For density $K_{i\rho}$	
	Pressure unit : psi	Pressure unit : bar	Pressure unit : psi	Pressure unit : bar
CMF-CNG-010	4.2×10^{-5}	6×10^{-4}	2.8×10^{-4}	4×10^{-3}
CMF-CNG-015	4.2×10^{-5}	6×10^{-4}	2.8×10^{-4}	4×10^{-3}
CMF-CNG-025	4.2×10^{-5}	6×10^{-4}	2.8×10^{-4}	4×10^{-3}

Process Conditions

1. Temperature Range

Process	-240℃—350℃ (-400℉—662℉) (depending on configuration)
Storage	-50℃—70℃ (-58℉—158℉)
Ambient	-25℃—60℃ (-13℉—140℉) (with LCD); -40℃—85℃ (-40℉—185℉) (without LCD)



2. Process Pressure

Maximum process pressure is primarily limited by the type of process connection used. Refer to the list of available **Process Connections** provided in the **Ordering Information** section. Keep in mind that when the process temperature is higher, the flow meter should be operated further below the maximum pressure for a given connection type. Walsn specialists will happily assess a proposed process condition to help ensure the correct choices are made.

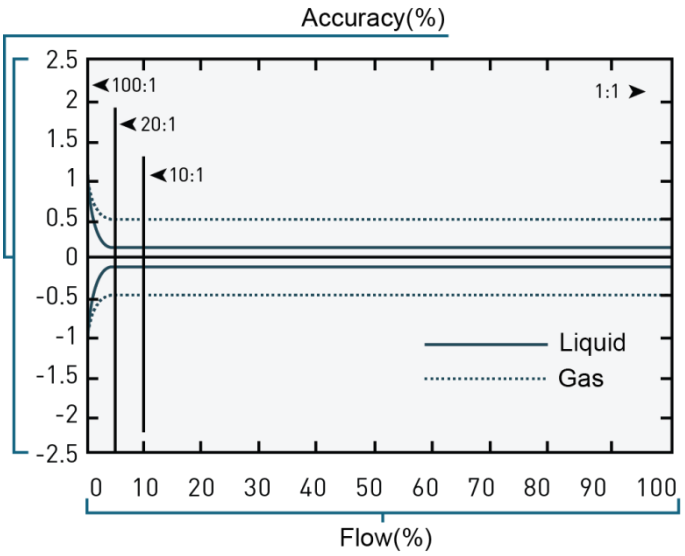
3. Flow Range

Specification	Liquid		K – gas coefficient
	lb/min	kg/h	
CMF-CNG-010	37	1000	20
CMF-CNG-015	220	6000	120
CMF-CNG-025	440	12000	200

Note: gas flow range = liquid flow range x gas process density/K

4. Pressure Loss

Pressure loss is related to process fluid characteristics and flow rate. The figures below illustrate typical accuracy, range ability and pressure loss for water.



Range ability	500:1	100:1	20:1	10:1	1:1
Accuracy of liquid (± %)	2.50	0.8	0.1	0.1	0.1
Accuracy of gas (± %)	2.50	1.5	0.5	0.5	0.5
Pressure loss					
Liquid (psi)	~0	~0	0.1	0.25	14.5
Liquid (bar)	~0	~0	0.01	0.02	1.0
Gas (psi)	0	0	0.1	0.35	15.0
Gas (bar)	0	0	0.01	0.02	1.03

Environmental Conditions

1. Power consumption: ≤ 20W
2. Enclosure rating: IP65, IP67, IP68 (Remote Style Options only)
3. Vibration limits:
   a) a = 0.5g
   b) Endurance sweep, under the condition of 20Hz ~ 400Hz frequency for 50 sweep cycles
4. Impact limits: If the flow meter is well-packed, its performance will not be affected by the following impacts:
   a) Acceleration: 50m/s^2
   b) Impact frequency: 60 times/min ~100 times/min
   c) Impact: 1000 times
5. Ex approval: Ex d ib IIC T6 Gb
6. Electromagnetic/Electrostatic compatibility
   a) Electrostatic discharge: level 3
   b) Electrical fast transient/burst (EFTB) resistance: level 3

Construction

1. Typical Materials of Components

Wetted Parts	Material	Non-Wetted Parts	Material
Flow tube	316L stainless steel	Sensor housing	304 stainless steel
Separator	316L stainless steel	Transmitter housing	Aluminum Die-Cast
Flange	316L stainless steel	Remote junction box	Aluminum Die-Cast

Note: Non-standard configurations are available. Refer to Ordering Information for details

2. Weight & Packaging

a) Integral type package, T0 transmitter, equipped with NPT-female adapter

Specification	Net Weight		Material	Packaging Size		Gross Weight	
	lb	kg		in	mm	lb	kg
CMF-CNG-010	44	20	Carton	22.83×17.32×12.6	580×440×320	51	23
CMF-CNG-015	44	20	Carton	22.83×17.32×12.6	580×440×320	51	23
CMF-CNG-025	55	25	Carton	22.83×17.32×12.6	580×440×320	62	28

b) Integral type package, T1 transmitter, equipped with NPT-female adapter

Specification	Net Weight		Material	Packaging Size		Gross Weight	
	lb	kg		in	mm	lb	kg
CMF-CNG-010	46	21	Carton	22.83×17.32×12.6	580×440×320	53	24
CMF-CNG-015	46	21	Carton	22.83×17.32×12.6	580×440×320	53	24
CMF-CNG-025	57	26	Carton	22.83×17.32×12.6	580×440×320	64	29

c) Remote type package, T0 transmitter, equipped with NPT-female adapter,10 meters cable

Specification	Net Weight of transmitter		Net Weight of sensor		Material	Packaging Size		Gross Weight	
	lb	kg	lb	kg		in	mm	lb	kg
CMF-CNG-010	13.5	6.1	40	18	Carton	22.83×17.32×12.6	580×440×320	60	27
CMF-CNG-015	13.5	6.1	40	18	Carton	22.83×17.32×12.6	580×440×320	60	27
CMF-CNG-025	13.5	6.1	51	23	Carton	22.83×17.32×12.6	580×440×320	71	32

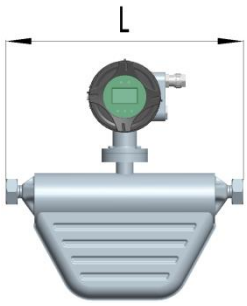
d) Remote type package, T1 transmitter, equipped with NPT-female adapter, 10 meters cable

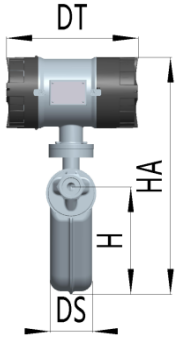
Specification	Net Weight of transmitter		Net Weight of sensor		Material	Packaging Size		Gross Weight	
	lb	kg	lb	kg		in	mm	lb	kg
CMF-CNG-010	12	5.4	42	19	Carton	22.83×17.32×12.6	580×440×320	60	27.3
CMF-CNG-015	12	5.4	42	19	Carton	22.83×17.32×12.6	580×440×320	60	27.3
CMF-CNG-025	12	5.4	53	24	Carton	22.83×17.32×12.6	580×440×320	71	32.3

3. Dimensions

a) Integral type

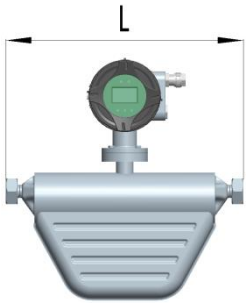
i. With T0 transmitter Imperial size, inch

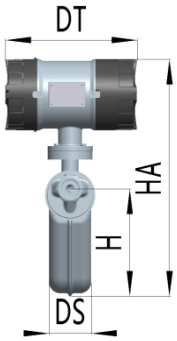




Specification	Line Size	L	H	HA	DS	DT
CMF-CNG-010	3/8	14-9/16	6-1/4	15-11/16	2-3/8	9-7/16
CMF-CNG-015	1/2	16-3/8	7-1/2	17-1/8	2-15/16	9-7/16
CMF-CNG-025	1	18-1/8	8-15/16	18-3/4	3-3/4	9-7/16

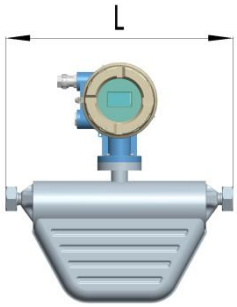
ii. With T0 transmitter metric size, mm

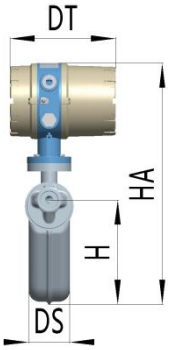




Specification	Line Size	L	H	HA	DS	DT
CMF-CNG-010	10	370	158	398	60	240
CMF-CNG-015	15	416	190	435	75	240
CMF-CNG-025	25	462	227	477	95	240

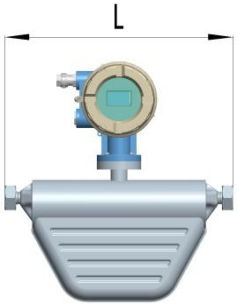
iii. With T1 transmitter Imperial size, inch

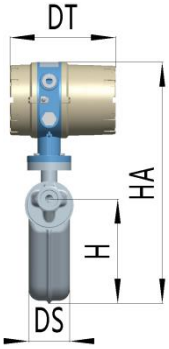




Specification	Line Size	L	H	HA	DS	DT
CMF-CNG-010	3/8	14-9/16	6-1/4	16-3/8	2-3/8	7-9/16
CMF-CNG-015	1/2	16-3/8	7-1/2	17-13/16	2-15/16	7-9/16
CMF-CNG-025	1	18-1/8	8-15/16	19-1/2	3-3/4	7-9/16

iv. With T1 transmitter metric size, mm

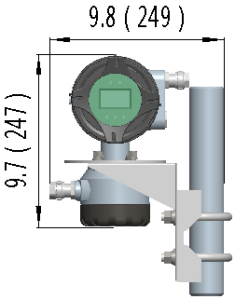


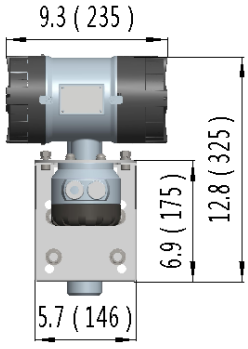


Specification	Line Size	L	H	HA	DS	DT
CMF-CNG-010	10	370	158	416	60	192
CMF-CNG-015	15	416	190	453	75	192
CMF-CNG-025	25	462	227	495	95	192

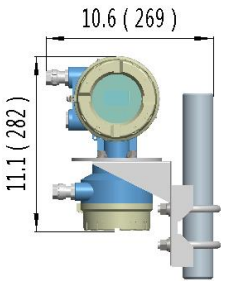
b) Remote type:

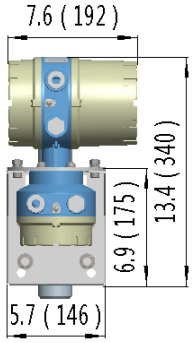
i. T0 transmitter size, inch (mm)

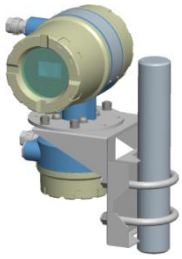




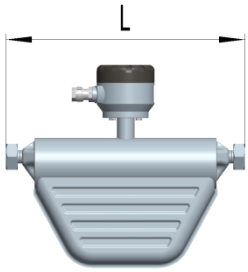
ii. T1 transmitter size, inch (mm)

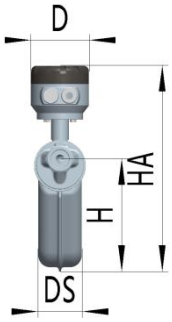






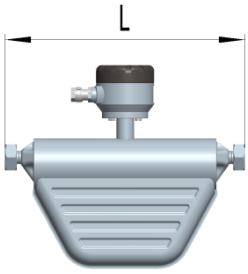
iii. Sensor paired with T0 transmitter Imperial size, inch

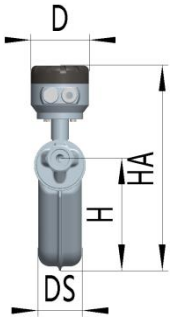




Specification	Line Size	L	H	HA	DS	DT
CMF-CNG-010	3/8	14-9/16	6-1/4	12-7/16	2-3/8	3-15/16
CMF-CNG-015	1/2	16-3/8	7-1/2	13-7/8	2-15/16	3-15/16
CMF-CNG-025	1	18-1/8	8-15/16	15-9/16	3-3/4	3-15/16

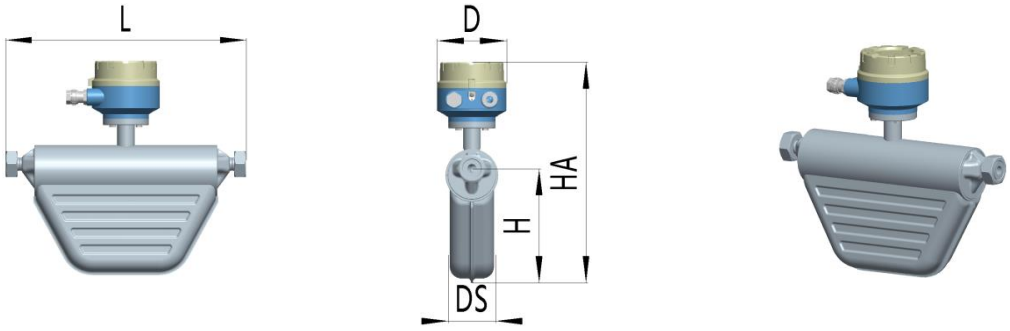
iv. Sensor paired with T0 transmitter metric size, mm





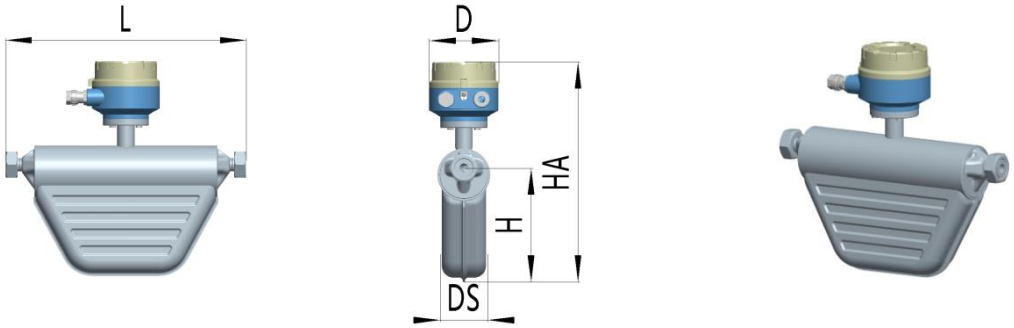
Specification	Line Size	L	H	HA	DS	DT
CMF-CNG-010	10	370	158	316	60	100
CMF-CNG-015	15	416	190	352	75	100
CMF-CNG-025	25	462	227	395	95	100

v. Sensor paired with T1 transmitter Imperial size, inch



Specification	Line Size	L	H	HA	DS	DT
CMF-CNG-010	3/8	14-9/16	6-1/4	13-1/8	2-3/8	4-5/8
CMF-CNG-015	1/2	16-3/8	7-1/2	14-9/16	2-15/16	4-5/8
CMF-CNG-025	1	18-1/8	8-15/16	16-1/4	3-3/4	4-5/8

vi. Sensor paired with T1 transmitter metric size, mm



Specification	Line Size	L	H	HA	DS	DT
CMF-CNG-010	10	370	158	334	60	117
CMF-CNG-015	15	416	190	370	75	117
CMF-CNG-025	25	462	227	413	95	117

Ordering Information (1/6)

Code	Product Description	Notes
CMF	Mass flow meter	
Code	**Tube**	**Notes**
TS	T type tube	According to pressure loss requirements and process
US	U type tube	According to pressure loss requirements and process
VS	V type tube	T2/T3
SS	Straight Tube	
CNG	Dedicated CNG sensor	T2/T3
TK	T tube with jacket	
UK	U tube with jacket	
VK	V tube with jacket	
SK	Straight tube with jacket	
Code	**Certification**	**Notes**
S	No	Choose According to explosion-proof requirements
H	Yes	CSA/PCEC/ATEX/IEC
Code	**Connection Type of Sensor and Converter**	**Notes**
000	Integral type（I）	
005~100	Remote type（D）, Cable with 15ft~300ft (5m~100m)	Default Cable length is10m (30 feet) for remote type
Code	**Line Size**	**Notes**
001~400	1/24、1/12、3/16、3/8、1/2、3/4、1、1-1/2、2、3、4、6、8、10、12、14、16 in DN 1、2、5、10、15、20、25、40、50、80、100、150、200、250、300、350、400 mm	Choose according to flow rate
Code	**Accuracy**	**Notes**
0	±0.2%	
1	±0.15%	
2	±0.1%	T2/T3 only
3	±0.35%G	Gas
4	±0.5%G	Gas
5	±0.25%G	Gas
6	±0.05%	
7	±0.3%	
8	±0.5%	
Code	**Material of Flow Tube**	**Notes**
1	316L	Choose According to process fluid, and user preference
2	Titanium	
3	Hastelloy alloy	

Ordering Information (2/6)

Code	Material of Flow Tube	Notes
4	Duplex stainless steel	Choose According to process fluid, and user preference
5	Tantalum	
6	304 (L)	
7	904(L)	
8	Ziconium	
9	Other materials required by users	
Code	**Pressure Rating of Flow Tube**	**Notes**
L01	CLASS 150# (1.6MPa)	Choose According to process pressure
L02	CLASS 300# (2.5MPa)	
L04	CLASS 300# (4.0MPa)	
M06	CLASS 400# (6.3MPa)	
M10	CLASS 600# (10MPa)	
H16	CLASS 900# (16MPa)	
H25	CLASS 1500# (25MPa)	
H32	CLASS 2500# (32MPa)	
H40	CLASS 2500# (40MPa)	
X	Specific pressure rating required	
Code	**Process Connection Material**	**Notes**
1	304 stainless steel	Choose According to process fluid and end user preference, usually matches electrode material
2	316L stainless steel	
3	Titanium	
4	Hastelloy alloy	
9	Other materials required by users	
Code	**Process Connection Standard**	**Notes**
A0	ASME B16.5 (ANSI) Class 150	Choose according to mating process pipe
A1	ASME B16.5 (ANSI) Class 300	
A2	ASME B16.5 (ANSI) Class 600	
A3	ASME B16.5 (ANSI) Class 900	
A4	ASME B16.5 (ANSI) Class 1500	
B0	JIS B2220 10K	
B1	JIS B2220 20K	
B2	JIS B2220 40K	
B3	JIS B2220 63K	
C0	GB/T 9115 PN 2.5 MPa	
C1	GB/T 9115 PN 4.0 MPa	
C2	GB/T 9115 PN 6.3 MPa	

Ordering Information (3/6)

Code	Process Connection Standard	Notes
C3	GB/T 9115 PN 10 MPa	Choose according to mating process pipe
C4	GB/T 9115 PN 16 MPa	
C5	GB/T 9115 PN 1.6 MPa	
D0	EN 1092-1 (DIN) PN 16	
D1	EN 1092-1 (DIN) PN 25	
D2	EN 1092-1 (DIN) PN 40	
D3	EN 1092-1 (DIN) PN 63	
D4	EN 1092-1 (DIN) PN 100	
D5	EN 1092-1 (DIN) PN 160	
E0	HG/T 20592 PN 2.5 MPa	
E1	HG/T 20592 PN 4.0 MPa	
E2	HG/T 20592 PN 6.3 MPa	
E3	HG/T 20592 PN 10 MPa	
E4	HG/T 20592 PN 16 MPa	
E5	HG/T 20592 PN 1.6 MPa	
H0	HG/T 20615 Class 150	
H1	HG/T 20615 Class 300	
H2	HG/T 20615 Class 600	
H3	HG/T 20615 Class 900	
H4	HG/T 20615 Class 1500	
F1	Sanitary fitting (compatible with Tri-Clamp)	
F2	DIN 11851-SI(mm)	
F3	DIN 11851-US (inch)	
F4	DIN 11864-1 Form A (sanitary) connection	
F5	DIN 11864-2 Form A flange plate with slotted connection	
F6	SMS 1145 (sanitary) connection	
F7	Metal seal	
F8	O-Ring seal	
G0	ZG1/8-F	
G1	ZG1/2-F	
G2	ZG3/4-F	
G3	ZG1-F	
G4	1/2 NPT-F	
G5	3/4 NPT-F	
G6	1/2'' Flange	
G7	VCO Fitting	
G8	Slotted chuck	
X0	Specially customized	

Ordering Information (4/6)

Code	Process Temperature of Sensor	Notes
1	-58℉ ~ 356℉ (-50℃ ~ +180℃)	
2	-58℉ ~ 662℉ (-50℃ ~ +350℃)	T2/T3 only
3	-400℉ ~ 662℉ (-240℃ ~ +350℃)	T2/T3 only
4	-58℉ ~ 266℉ (-50℃~130℃)	
5	-58℉ ~ 482℉ (-50℃~250℃)	
6	-400℉ ~ 266℉ (-240℃~130℃)	
7	-400℉ ~ 356℉ (-240℃~180℃)	
8	-400℉ ~ 482℉ (-240℃~250℃)	
9	Specially customized	
Code	**Enclosure Rating**	**Notes**
1	IP65	Choose according to application environment (indoor, outdoor, buried)
2	IP67	
3	IP68	
4	IP69	
Code	**Power Supply**	**Notes**
0	85VAC ~ 265VAC 50/60Hz	Choose according to availability at installation site and end user preference
1	24VDC	
2	Self-switching (22VDC/AC~245VDC/AC，50/60Hz)	
Code	**Output Display**	**Notes**
0	Without display, without keypad	Choose according to ambient conditions and user preference
1	With display, and keypad	
Code	**Output Signal**	**Notes**
0	Analog + Pulse/Frequency	
1	Analog+ Pulse/Frequency + HART	
2	Analog+ Pulse/Frequency + RS485	
3	Profibus PA/DP	T2/T3 only
4	FF	T2/T3 only
9	Specially customized	T2/T3 only
Code	**Batch Control**	**Notes**
N	Without batch control	Choose according to end user preference
Y	With batch control	
Code	**Conduit Connection**	**Notes**
N	1/2″ NPT	Choose according to end user preference
M	M20×1.5	
P	3/4″ NPT	
X	Specially customized	

Ordering Information (3/6)

Code	QIG Language	Notes
E	English	According to users' requirements and providing corresponding documents
C	Chinese	
R	Russian	
F	French	
J	Japanese	
G	German	
X	Others	
Code	**Dedicated Option**	**Notes**
N	Standard	Can be omitted
H	High capacity	Must be identified
L	Low capacity	Must be identified
Code	**Transmitter Version**	**Notes**
T0	Transmitter, 0 version	High version is compatible with lower version
T1	Transmitter, 1 version	
T2	Transmitter, 2 version	
T3	Transmitter, 3 version	
T4	Transmitter, 4 version	
T5	Transmitter, 5 version	
T6	Transmitter, 6 version	
T7	Transmitter, 7 version	
T8	Transmitter, 8 version	
T9	Transmitter, 9 version	

Special Code-

Special code is optional and multiple codes can selected at the same time.

The selected code is marked at the end of the product model, separated by "-".

Code	Definication	Notes
A	Cast 304LSS transmitter housing and junction box	
B	AI 4~20mA	
C	Statu variables input	
D	Inert gas filling	Sensor housing
E	Secondary containment	Sensor housing
F	FDA cert	
G	Ex seal gland	
H	Long neck juction box	

Ordering Information (6/6)

Code	Definication	Notes
I	EHEDG	
J	3A Cert	
K	Marine approval	
L	Rupture disk	
M	Industry ethernet	
N	Remote wireless communication(GPRS)	
O	Oxygen cleaning	
P	Concerntration output	
Q	Wireless Hart	
S	SIL	
T	Ultra-environment （<-40 ℃ or >85℃）	
U	316L SS sensor housing	
V	304/316L SS tube fitting	
W	Teflon lining	Inner tube
X	Anti-corrosion coating	Housing
Y		
Z		

- **The following codes are options**

Code	Spare Parts	Notes
R	Remote	Spare parts for remove type transmitter
I	Integral	Spare parts for integral type transmitter
SR	Sensor Remote	Spare parts for remove type sensor
SI	Sensor Integral	Spare parts for integral type sensor
Code	**Ancillary Accessories**	**Notes**
0	Without accessories with flow meter	According to users' requirements for TAG
1	CS (carbon steel) accessories with flow meter	
Code	**Matched Flange and Bolts**	**Notes**
0	No	According to piping connection and end user's preference
1	CS (carbon steel)	
2	304	
3	316L SST	