



PROCESSATION

PROCESS + AUTOMATION

Advanced Mass Metering Technology

Coriolis Mass Flow Meter

Typical application

- Custody Transfer
- Reactor Feed Ratio
- Density Measurement
- Batch Control

Industries

- Chemicals
- Food & Beverages
- Machinery
- Minerals & Mining
- Oil & Gas
- Pharmaceuticals
- Power Plant
- Pulp & Paper
- Water
- Waste Water



FLOW MEASUREMENT EXPERT !

INTRODUCTION

PACMF Coriolis mass flowmeter provides best massflow, density and temperature measurement performance, and also calculate volume flow, total flow and fluid composition in real-time. Currently it has three styles available which are M type sensor, U type sensor and S type sensor. Meanwhile each series has its own compact and remote meters.

In general, a typical mass flowmeter is made up of a flow sensor and a signal transmitter. The flow sensor is designed to equip two flow tubes for vibration which resulting in signals for pickoff; The signal transmitter is employed with digital signal processor (DSP), and dynamic vibration balance (DVB) circuit to deliver fast response but accurate measurement performance. In addition, in situ node-configuration, diagnostics and data recording are easily handled via HART or Modbus RTU communication.



Coriolis mass flow meter families

FEATURES

- Robust, no moving parts for long life
- Custom flow connectors & installation lengths
- Excellent repeatability ($\pm 0.05\%$ of flow rate)
- Optional Net Oil functionality
- NIST Traceable NTEP certificates for custody transfer

MATERIALS

- Tubes: SS316L (Hastelloy C for options)
- Flow Splitter: SS304 (SS316L and Hastalloy C for options)
- Flanges: SS304 (SS316L and Hastalloy C for options)
- Housing case (NON WETTED PARTS)
- SS304 (SS316L for options)
- Options: NACE MR 0175/0103 compliant

EX Certificates



BENEFITS

- Increased productivity, less maintenance
- Lower installation cost
- Increased product quality
- Simpler whole solution for Net Oil without PLC/RTU

Coriolis Mass Flow Meter

APPLICATION

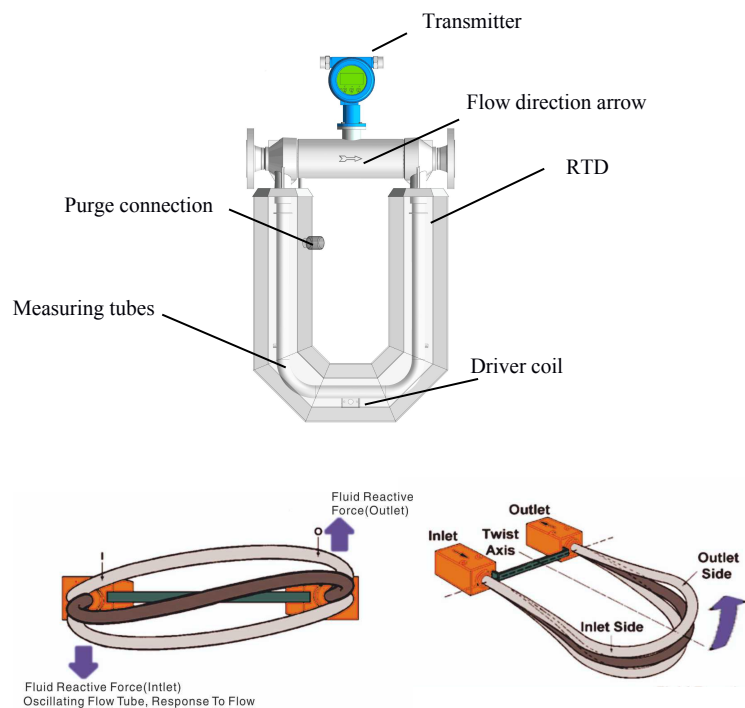
Coriolis mass flow meter is suitable for the most complex and challenging environment for liquid, gas and slurry applications.

Process fluid	Typical application	Industries	
Liquid Gas Slurry	Custody Transfer	Chemicals	Pharmaceuticals
	Reactor Feed	Food & Beverages	Power Plant
	Ratio	Machinery	Pulp & Paper
	Density Measurement	Minerals & Mining	Water
	Batch Control	Oil & Gas	Waste Water



PRINCIPLE

Coriolis Mass Flow Meter uses two parallel arranged pipes which are rotated at their resonant frequency by coils. Any mass flow passing through the tubes will generate coriolis forces which appear whenever a mass moves radially in a rotating system. The forces have opposed effects on the inlet and outlet sides, they slightly deform the pipes. The excursion of the pipes is detected by sensors on the inlet and outlet side. The phase shift between the rotational frequencies of both pipes are proportional to the mass flow rate. The resonant frequency of both pipes changes in accordance with the density of the medium. This effect determines the density. Using one sensor density and temperature can also be measured. The extent of deformation of the pipes depends on temperature. Therefore the temperature is measured for compensation purposes.



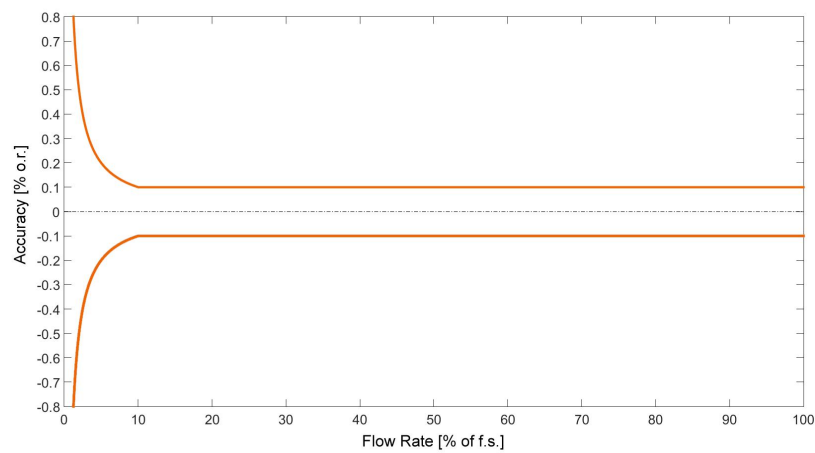
Technical Specification

Flow rate	
Mass flow rate(max.):	3,307,000lb/h (1500,000 kg/h)
Volumetric Flow Rate (max.):	6604GPM or 9434BPD or 1500,000liter/h
PRESSURE	3770 PSI (26 MPa), 5800PSIG (40MPa) available (see pressure range table)

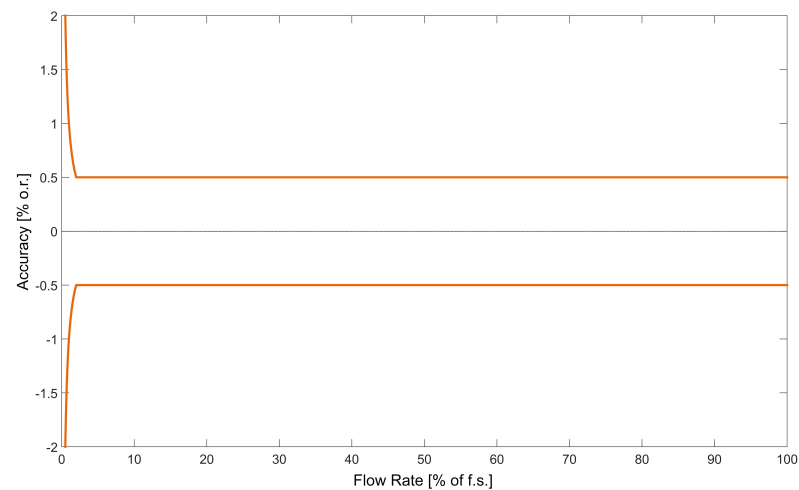
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Coriolis Mass Flow Meter

Accuracy For Liquids:
(Five-Point Calibration, Basic Accuracy: ±0.1 %)



Accuracy For Gases:
(Five-Point Calibration, Basic Accuracy: ±0.5 %)



Flow Rate of full Scale	Accuracy
$\geq \frac{\text{Zero Point}}{\text{Basic Accuracy}} * 100$	$\pm \text{Basic Accuracy}$
$< \frac{\text{Zero Point}}{\text{Basic Accuracy}} * 100$	$\pm \frac{\text{Zero Point}}{\text{Measured Value}} * 100$

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Coriolis Mass Flow Meter

ACCURACY (LIQUIDS)

Basic Accuracy (Mass flow) ² :	±0.1%, ±0.2% or ±0.5%
Mass Flow Repeatability:	± 0.05% (for 0.1% accuracy), ± 0.1% (for 0.2% accuracy) or ±0.25% (for 0.5% accuracy)
Basic Accuracy (Volume flow) ² :	±0.4 % (option: up to ±0.15 %) of flow rate
Repeatability (Volume Flow):	±0.05 % of flow rate
Zero Stability:	±0.01 % of full scale

ACCURACY (GASES)

Basic Accuracy (Mass flow) ² :	±1% (option: up to ±0.5 %) of flow rate
Mass Flow Repeatability:	±0.25 % of flow rate

DENSITY

Density Range:	up to 2500 kg/m ³ , 2.5 g/cm ³
Density Accuracy: ²	±1.0 kg/m ³ , ±0.001 g/cm ³
Density Repeatability:	±0.5 kg/m ³ , ±0.0005 g/cm ³

TEMPERATURE

Process Temperature Range:	-50 °C ... +250 °C (-40 °F ... +212 °F)
Option:	-196 °C ... +55 °C (-320.8...131 °F)
Temperature Accuracy:	±1 °C ±0.5 % of reading (±1.8 °F ± 0.5% of reading)
Temperature Repeatability:	±0.2 °C (±0.36 °F)
Ambient Temperature	-40 to 131 °F (-40 to +55 °C)
Output	4-20 mA and Pulse/Frequency , Optional: HART or Modbus RS485 Pulse Output: 0 to 10 kHz, 0.001%F.S; Current Output: 4 to 20mA, 0.005%F.S
Electronics	Direct Mount or Remote Mount
Graphic Display	OLED
Operating Elements	3 optical keys for operator
Electromagnetic compatibility	Criteria A, complied with IEC 61000-4-2
Power Supply	85 to 265 VAC, 18 to 36 VDC
IP	Standard IP65, IP67 for options

- Stated flow accuracy combines the effects of repeatability, linearity and hysteresis.
- The specifications refer to standard conditions.

Coriolis Mass Flow Meter

Flow range

Flow range for liquid(Metric unit in kg/hr) Table1.1

Model: U type sensor
U size 1 1/2" inch to 8 inch

Size(inch)	Full flow range, kg/h r	Accuracy flow range, kg/h r		Zero stability, kg/h
		+/-0.1%	+/-0.2% and +/-0.5%	
1 1/2"	240– 32,000	2,500 – 32,000	1500 – 32,000	0.9
2"	500 – 50,000	3,500 – 50,000	2,000 – 50,000	1.5
3"	800– 140,000	8,000 – 140,000	6,000 – 140,000	3.5
4"	1,500– 200 000	15,000 – 200,000	10,000 – 200,000	7
6"	5,000 – 500,000	50,000 – 500,000	28,000 – 500,000	17
8"	10,000 – 1,200,000	200,000 – 1 200,000	80,000 – 1200,000	45

Flow range for liquid(US unit in lb/hr) Table 1.2

Model: U type sensor
U: size 1 1/2inch to 8 inch

Size(inch)	Full flow range, lb/hr	Accuracy flow range, lb/hr		Zero stability, lb/hr
		+/-0.1%	+/-0.2% and +/-0.5%	
1 1/2"	530-70,548	5,511-70,548	3,306-70,548	1.98
2"	1,103-110,231	7,716-110,231	4409-110,231	3.31
3"	1763-308,647	17,636-308,647	13,227-308,647	7.72
4"	3370-440,924	33,069-440,924	22,046-440,924	15.43
6"	11,023-1,102,311	110,231-1,102,311	61,729-1,102,311	37.48
8"	22,046-2,645,547	440,924-2,645,547	176,369-2,645,547	99.21

Flow range fo liquid(Metric unit in kg/hr) Table 1.3

Model: M series Micro bend sensor Size 1/8 inch to 10 inch

Size(inch)	Full flow range, kg/hr	Accuracy flow range, kg/hr		Zero stability, kg/hr
		+/-0.1%	+/-0.2% and +/-0.5%	
1/8"	1.2–120	10–120	6–120	0.004
3/8"	10 – 1,000	100– 1,000	50 – 1,000	0.045
1/2"	20 – 3,000	300 – 3,000	150 – 3,000	0.09
1"	80 – 8,000	600– 8,000	300– 8,000	0.25
1 1/2"	240– 32,000	2,400– 32,000	1,000– 32,000	1
2"	500 – 50,000	5,000 – 50,000	2,000– 50,000	2
3"	800– 120,000	10,000– 120,000	6,000– 120,000	3.5
4"	1,500– 200,000	20,000– 200,000	10,000– 200,000	7
6"	5,000 – 500,000	50,000 – 500,000	30,000 – 500,000	23
8"	10,000 – 1,000,000	70,000 – 1,000,000	50,000 – 1,000,000	45
10"	15,000 –1,500,000	150,000–1,500,000	75,000–1,500,000	70

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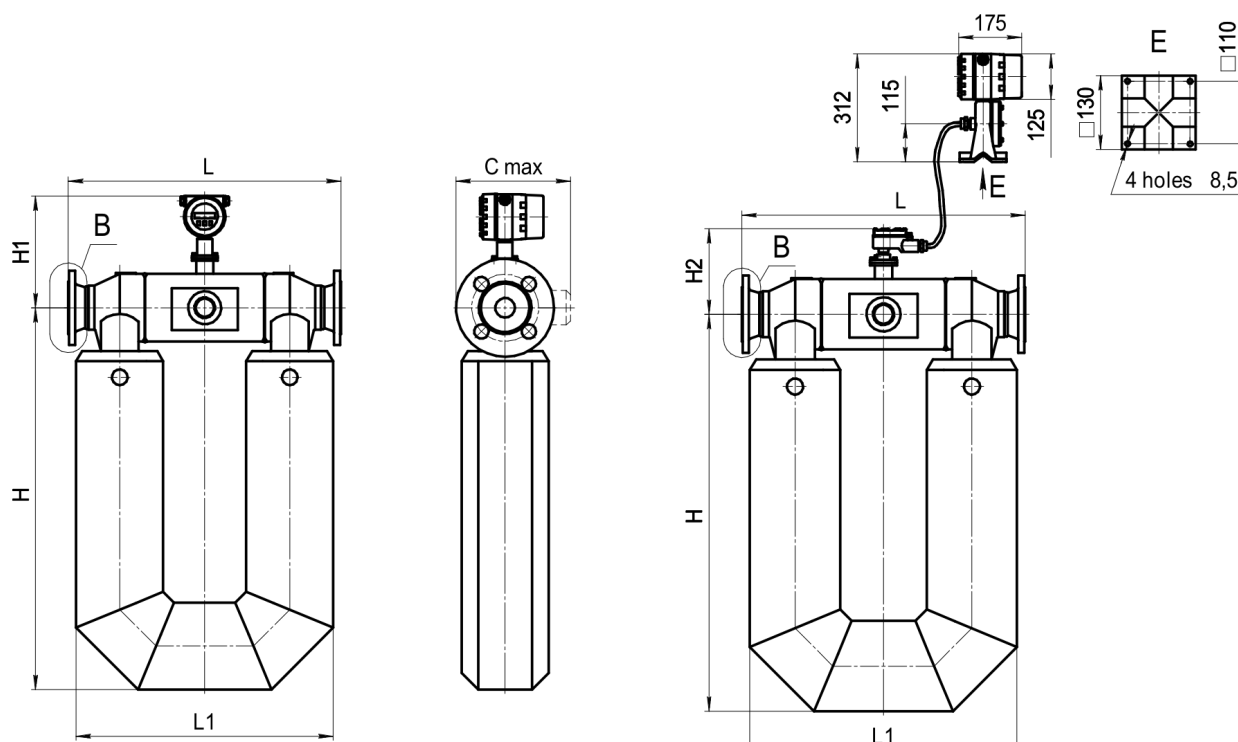
Flow range for liquid(US unit in lb/hr) Table 1.4

Model: M series Micro Bend sensor Size 3/8 inch to 10 inch

Size(inch)	Full flow range, lb/hr	Accuracy flow range, lb/hr		Zero stability, lb/hr
		+/-0.1%	+/-0.2% and +/-0.5%	
1/8"	2—265	22—265	13—265	0.0088
3/8"	22—2,204	220.40—2,204	110—2,204	0.099
1/2"	44—6,613	661.30—6,613	330—6,613	0.2
1"	176—17,636	1322—17,636	661—17,636	0.55
1 1/2"	529—52,910	5,291—52,910	2,204—52,910	2.2
2"	1,102—110,231	11,023—110,231	4,409—110,231	4.41
3"	1,767—264,555	22,046—264,555	13,227—264,555	7.72
4"	3306—440,925	44,092—440,925	22,046—440,925	15.43
6"	11,023— 1,102,311	110,231— 1,102,311	6,6138— 1,102,311	50.71
8"	22,046—2,204,622	220,462—2,204,622	110,231—2,204,622	99.21
10"	33,069—3,307,000	330,693—3,307,000	165,346—3,307,00	154.32

Outline dimensions and weight

U type sensor installation dimension (Fig. A 1.1 and A1.2)



Compact version – Figure A.1.1 (U series)

Remote version – Figure A.1.2 (U series)

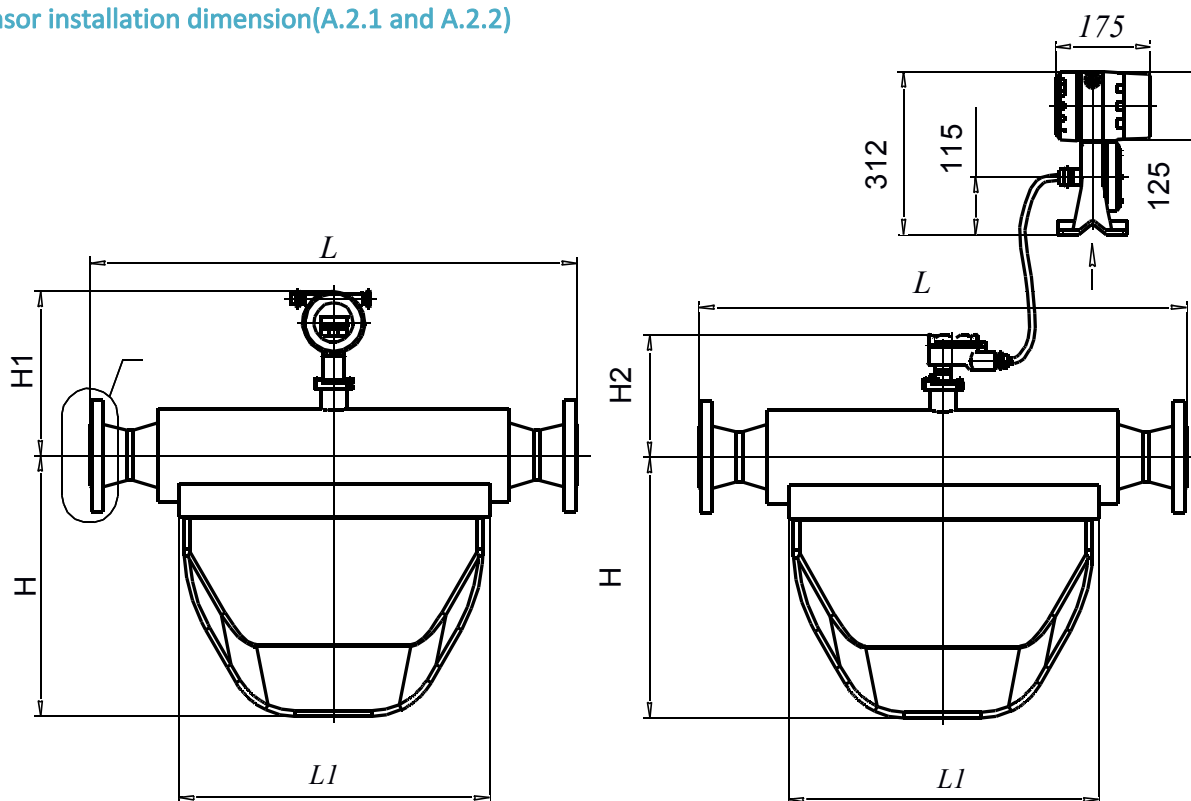
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Table 1.5 U type sensor dimension

Size	L, in mm		L1, in mm	H, in mm	H1, in mm	H2, in mm	Cmax, in MM	Weight,lb kg	
	≤300# (4 MPa)	≥600# (6.3 MPa)						A.2.1	A.2.2
1 1/2" (Dn40mm)	20.47 520	21.54 547	17.72 450	25.98 660	11.02 285	7.56 192	7.87 200	74.96 34	81.57 37
2" (Dn50mm)	21.97 558	23.15 588	20.55 522	29.45 748	11.42 288	7.95 202	7.87 200	97 44	103.62 47
3" (Dn80mm)	30.71 780	31.81 808	27.76 705	40.55 1030	12.6 326	9.53 242	9.06 230	229.28 104	235.89 107
4" (Dn100mm)	36.22 920	37.32 948	33.58 853	44.88 1140	13.78 356	11.02 272	10.71 272	947.99 430	954.6 433
6" (Dn150mm)	43.31 1100	44.88 1140	41.34 1050	59.84 1526	60.08 386	11.89 302	11.89 302	1278.68 580	1285.29 583
8" (Dn200mm)	53.7 1364	55.51 1410	45.67 1160	65.16 1655	17.09 434	13.78 350	13.78 350	2050.3 930	2056.91 933

M type sensor installation dimension(A.2.1 and A.2.2)



Compact version – Figure A.2.1 (M series)

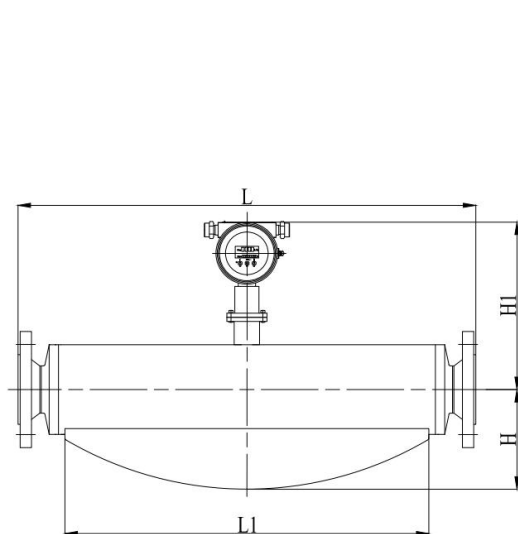
Remote version Figure A.2.2 (M series)

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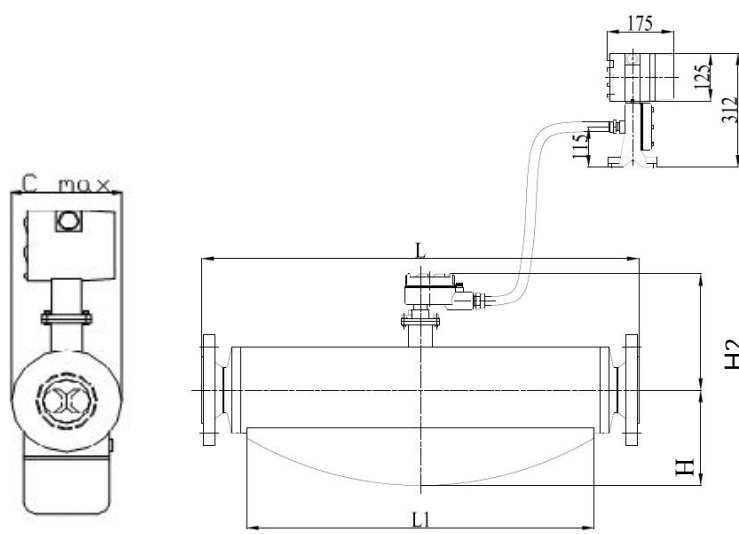
Coriolis Mass Flow Meter

Table 1.6 – Outline dimensions and weight

Process connection size	L, in mm		L1, in mm	H, in mm	H1, in mm	H2, in mm	C max, in mm *	Weight, lb kg	
	≤300# (4 MPa)	≥600# (6.3 MPa)						A.2.1 A.2.2	
1/8" (Dn3mm)	12.64 321	13.58 345	88.98 2260	4.53 115	9.84 250	6.69 170	3.23 82	11.02 5	17.64 8
3/8" (Dn10mm)	16.69 424	19.06 484	11.89 302	6.06 154	10.63 270	7.28 185	4.33 110	22.05 10	28.66 13
1/2" (Dn15mm)	15.75 400	16.30 414	11.02 280	7.52 191	11.73 298	8.39 213	4.53 115	24.25 11	30.86 14
1" (Dn25mm)	19.69 500	21.1 536	14.17 360	10.16 258	11.89 302	8.58 218	5.91 150	33.07 15	39.68 18
1 1/2" (Dn40mm)	23.62 600	24.96 634	18.11 460	12.05 306	12.4 315	9.06 230	6.5 165	61.73 28	68.34 31
2" (Dn50mm)	31.5 800	31.6 828	25.2 640	16.14 410	12.8 325	9.45 240	8.07 205	105.82 48	112.44 51
3" (Dn80mm)	35.43 900	36.54 928	27.56 700	19.49 495	13.78 350	10.43 265	16.38 416	213.85 97	220.46 100
4" (Dn100mm)	44.49 1130	45.51 1156	33.86 860	26.18 665	14.57 370	11.22 285	17.32 440	586.43 266	593.04 269
6" (Dn150mm)	57.09 1450	58.66 1490	47.24 1200	35.63 905	15.75 400	12.44 316	21.06 535	1014.13 460	1020.74 463
8" (Dn200mm)	70.87 1800	72.64 1845	57.09 1450	46.25 1175	16.77 426	13.46 342	22.83 580	1146.4 520	1153.02 523
10" (Dn250)	77.4 1966	78.98 2006	60.24 1530	51.18 1300	18.43 468	15.08 383	23.62 600	1278.68 580	1285.29 583



Compact version – Figure A.3.1 (S series)



Remote version Figure A.3.2 (S series)

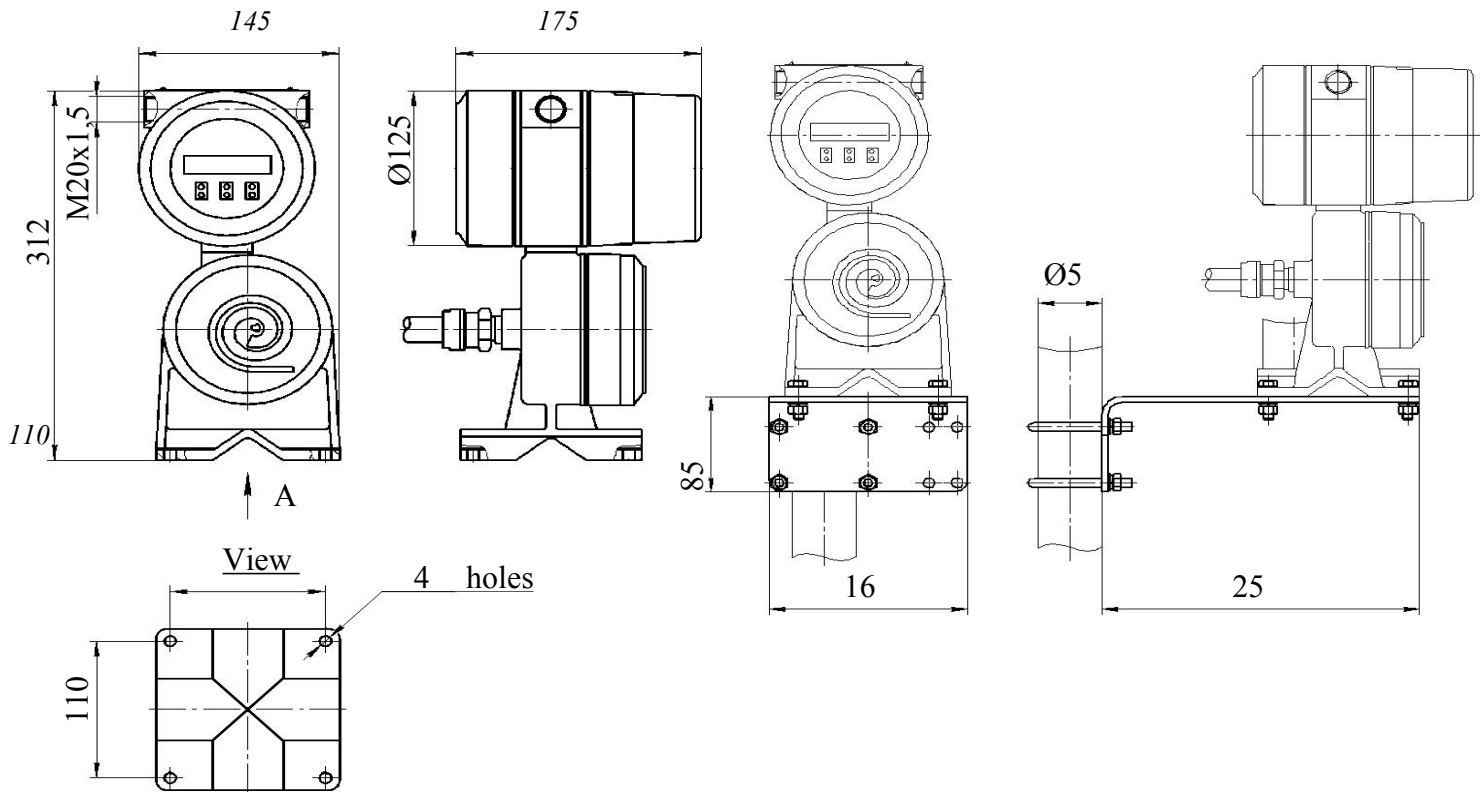
size	L, in mm		L1, in mm	H, in mm	H1, in mm	H2, in mm	C max, in mm *	Weight, lb kg	
	≤300# (4 MPa)	≥600# (6.3 MPa)						A.3.1 A3.2	
2" (Dn50mm)	31.5 800	32.83 834	23.15 588	7.87 200	12.99 330	9.84 250	8.07 205	103.62 47	
3" (Dn80mm)	36.81 935	38.31 973	28.74 730	7.87 200	13.98 355	10.63 270	16.38 416	176.37 80	

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Coriolis Mass Flow Meter

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Remote Transmitter installation dimensions



A.4 remote type electronic units dimension

A.5 Bracket installation dimension

Figure A.4 Overall dimensions and connection size of electronic unit of remote type

Figure A.5 Bracket for fixing remote type electronic unit on the assembly stand

Transmitter and sensor structure



Transmitter

is a high-performing transmitter that uses a micro-processor and offers zero calibration, adjustable pulse outputs, an RS485, and a HART communication protocol. It is highly stable and accurate, as well as easy to install and operate. It requires low maintenance which keeps your process downtime to a minimum and covers the cost of ownership over the long term.

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U type super bend sensor

Size from 1 1/2 ”to 8 ”

These flowmeters are comprised of two tubes that are arranged in the shape of the letter ‘U’, a magnet and coil assembly, and sensors at the inlet and outlet of the tubes. Coriolis forces exerted by the flow medium are used to determine the mass flow rate and density of the medium. U type is the best and most stable sensor for custody transfer measurement.



M type Micro-bend sensor

Size from 1/8 ”to 12 ”

These flowmeters are comprised of two V-Shaped tubes in a casing with a considerably smaller radius than conventional U-Shaped Coriolis flowmeters. The smaller radius ensures a more compact instrument with significantly lower pressure Loss values compared to other flowmeters.



S type super bend sensor

Size from 2 ”to 3 ”

These flowmeters are comprised of two less bend tubes in a casing with a considerably smaller radius than conventional M-Shaped Coriolis flowmeters. less sizing means less installation dimension requirement for smart process

Ordering code

**** Please contact your local GPE application engineer when ordering.**

You also need to provide the following information when ordering :

Ordering Model	Fluid Name	Flange type	Temperature	Process pressure.

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Coriolis Mass Flow Meter

Model Selection

Coriolis mass flow meter											
PACMF		Ordering codes						Description			
1/8"	003							Line Size			
3/8"	010										
1/2"	015										
1"	025										
1½"	040										
2"	050										
2½"	065										
3"	080										
4"	100										
6"	150										
8"	200										
10"	250										
12"	300										
Liquid		L							Medium		
Gas		G									
U-type sensor(1 1/2" to 8")		U							Sensor type		
M- type sesnor(1/8" to 10")		M									
S- type sensor (2" to 3")		S									
ANSI/ASME standard flanges		AN							Process connection		
DIN standard flanges		DI									
JIS standard flanges		JS									
Sanitary fitting connection		SF									
Customized connecton		OF									
230Psi(16bar)		1							Max. Process		
360Psi(25bar)		2									
580Psi(40bar)		3									
915Psi(63bar)		4									
1450Psi(100bar)		5									
2320Psi(160bar)		6									
3625Psi(250bar)		7									
Special pressure		x									
Compact version -58°F to +257 °F(-50℃ to +125℃)		COM							Structures		
Remote Version -58°F to +392°F (-50℃ to +200℃)		REM									
Remote Version -58°F to +572°F (-50℃ to +300℃)		RXM									
Low temperature -320°F to +131°F (-196℃ to -55℃)		LOW									
Without			WT							Explosion proof	
With			W								
DC18 to 36V				1						Power	
AC85 to 265V				2							
4 to 20mA+ Pulse				P						Communication	
Modbus RTU(RS485) 4-20mA+Pulse				R							
HART+4-20mA+Pulse				H							
2*4-20mA+Pulse+Modbus (RS485)				S							
+/-0.05% of RD				0.5						Accuracy	
+/-0.1% of RD				1							
+/-0.2% of RD				2							
+/-0.5% of RD				5							

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