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Datasheet

Coriolis Mass Flow Meter

SUP-FCC300

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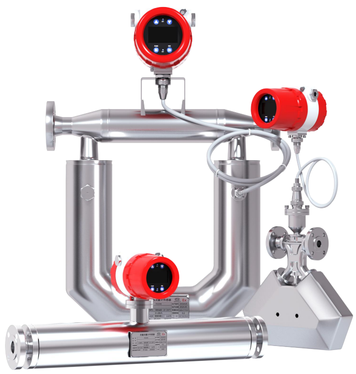
Datasheet

Coriolis Mass Flow Meter
SUP-FCC300

Coriolis Mass Flow Meter is a new type of flow measurement instrument developed according to the principle of Coriolis force, which can directly measure the mass flow rate of the fluid in the closed pipeline, the density and temperature of the medium. It can be widely used in chemical, petroleum, food, pharmaceutical, paper-making and other industries.

Applications

- Chemical industries
- Petroleum industries
- Food industries
- Pharmaceutical industries
- Paper-making industries



Coriolis Mass Flow Meter

Features

- Can directly measure the mass flow of the fluid.
- Wide measuring range and high accuracy.
- Low installation requirements and the front and rear straight pipes are not required.
- Wide applications ranges; can measure not only normal fluid but also industrial media that are difficult to be measured by general fluid measuring instruments, such as high viscosity fluids, various slurries, suspensions, etc.
- The density, temperature and other parameters of the measured medium can be measured online, and derived from this measurement of the solute concentration in the solution.
- Reliable operation, low maintenance rate.

Principle

When a particle is located in a tube rotating with ***P*** as a fixed point (center of rotation)
When you move toward or away from the center of rotation, you create an inertial force, which is shown in Figure 1:

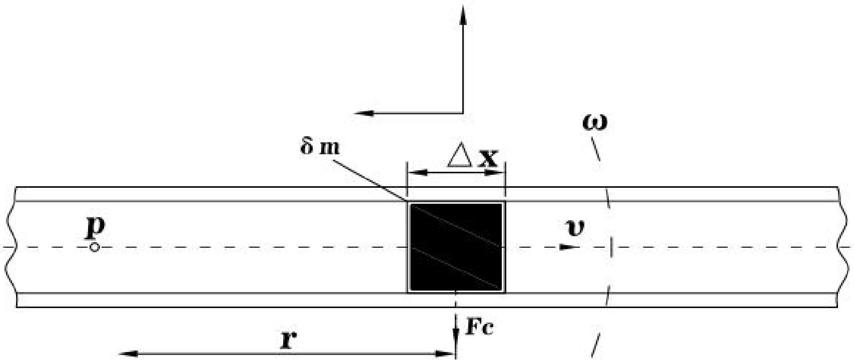


Figure 1 Mass flow measurement principle

In the figure, particles with mass **δm** move to the right inside the pipe at constant speed υ, while the pipe is fixed around point **P** rotates with the angular velocity ω. At this point, the particle will acquire two components of acceleration:

(1) **Normal acceleration α_r (Centripetal acceleration)**, its magnitude is equal to **ω2r**, its direction towards **P** point.

(2) **The tangential acceleration α_t (Coriolis acceleration)** has a magnitude equal to **2ωυ** and a direction perpendicular to α_r.

The force resulting from tangential acceleration is called the Coriolis force and has a magnitude equal to **Fc=2δm,** Fluid in Figure 1:

$\Delta m=\rho A\times\Delta X$, so Coriolis force can be expressed as：

$\Delta Fc=2\omega\upsilon\times\delta m=2\omega\times\upsilon\times\rho\times A\times\Delta X=2\omega\times\delta qm\times\Delta X$ (A is the internal cross-sectional area of the pipeline)

$\Delta qm=\delta dm/dt=\upsilon\rho A$

For a particular rotating pipe, its frequency characteristics are fixed, and ΔFc depends only on δqm.

Therefore, direct or indirect measurement of Coriolis force can measure the mass flow rate.

1 The actual flow meter does not achieve rotational motion, but instead pipe vibration. Its principle is shown in Figure 2, Figure 3 and Figure 4. The two ends of a curved pipe are fixed, and the vibration force (according to the resonance frequency of the pipe) is applied to the pipe in the middle of the two fixed points, so that it vibrates at its natural frequency ω with the fixed point as the axis. When there is no fluid flow in the pipeline, the pipeline is only affected by the external vibration force, and the vibration direction

of the two half sections of the pipeline is the same without phase difference. When there is fluid flow

Under the influence of Coriolis force Fc (Coriolis force F1 and F2 in the two half sections of the pipeline are equal in size and opposite in direction, as shown in Figure 2), the two half sections of the pipeline twist in the opposite direction, resulting in a phase difference (Figure 3, Figure 4), which is proportional to the mass flow. The design of the flow meter is to convert the measurement of Coriolis force into the measurement of the phase difference between the two sides of the vibrating tube.

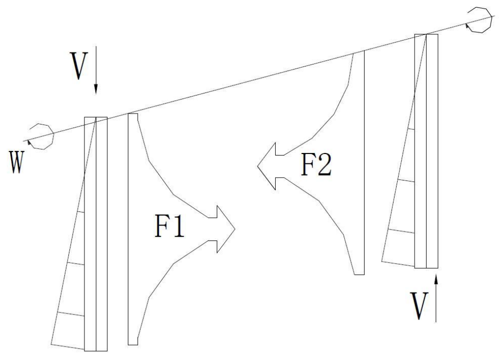


Figure 2

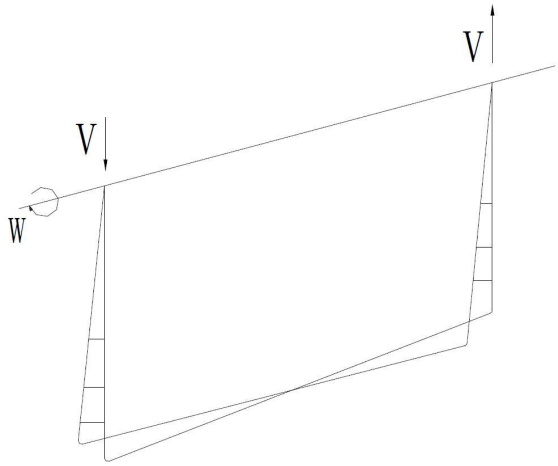


Figure 3

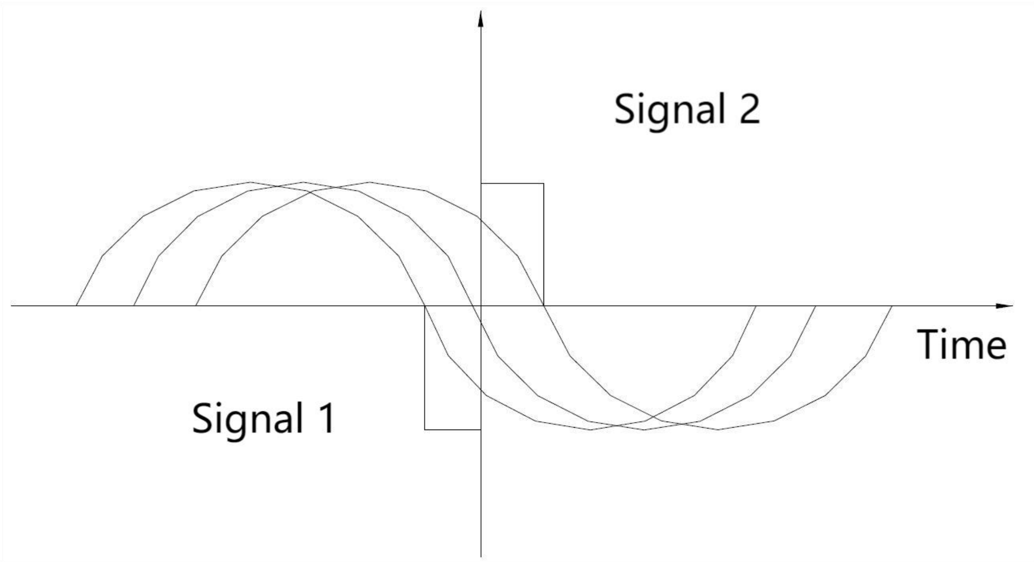


Figure 4

Parameters	
Measured variable	Mass flow, density, temperature
Nominal caliber	Straight pipe type: DN8~DN80 U-type: DN20~DN150 Triangular type: DN3 to DN15
Flow range (L/min)	Refers to Tables 1 and 2
Density measuring range	(0.3～3.000)g/cm3
Temperature measuring range	(-200～300)℃
Converter output	(4 to 20) mA, output load (250 to 600) Ω
Communication output	RS485 interface, MODBUS-RTU communication protocol; Hart
Frequency (pulse) output	Pulse width: 50% Active: Output current 10mA, open circuit voltage 24V
Power supply	24VDC/220VAC
Power consumption	≤15W
Electrical interface	M20*1.5
Accuracy	Flow rate: 0.2, 0.5 Density: ±0.002g/cm3 Temperature: ±1℃
Repeatability	1/2 of the measurement error
Medium temperature	Standard type: (-50 ~ 200) ℃, (-20 ~ 200) ℃ High temperature type: (-50 ~ 350) ℃ Low temperature type: (-200 ~ 200) ℃
Process pressure	The maximum flow rate corresponds to the pressure loss of 100kPa (water as the medium)
Temperature	-40℃～+60℃
Humidity	35%～95%
Ingress protection	IP67

Table 1 Flow range of straight tube mass flow meter

Diameter (mm)	Conventional flow meter flow range (kg/h)	Sanitary flow meter flow range (kg/h)	Zero point stability (kg/h)
8	0～960～1440	/	0.096
10	0～1500～2250	/	0.15
15	0～3000～4500	/	0.3
20	0～6000～9000	0～4500	0.6
15	0～9600～14400	0～9000	0.96
32	0～18000～27000	0～14400	1.8
40	0～30000～45000	0～27000	3
50	0～48000～72000	0～45000	4.8
80	0～120000～180000	/	12

Table 2 Flow range of non-straight tube mass flowmeter

Diameter (mm)	Conventional flow meter flow range (kg/h)	High pressure flow range flow meter Flow range (kg/h)	Zero point stability (kg/h)
3	0～96～144	/	0.0096
6	0～540～810	/	0.054
8	0～960～1440	/	0.096
10	0～1500～2250	/	0.15
15	0～3000～4500	/	0.3
20	0～6000～9000	0～3000～4500	0.6
25	0～9600～14400	0～6000～9000	0.96
32	0～18000～27000	0～9600～14400	1.8
40	0～30000～45000	0～18000～27000	3
50	0～48000～72000	0～30000～45000	4.8
80	0～120000～180000	0～75000～90000	12
100	0～192000～300000	/	19.2
150	0～360000	/	36

Note: Two parameters are given in the flow range, the middle parameter is the standard flow range, the general factory inspection is carried out according to this range, and it is also recommended that users choose instruments within this range; The latter parameter is the upper limit flow range to ensure the stable operation of the flow meter.

Wiring

1 Terminal

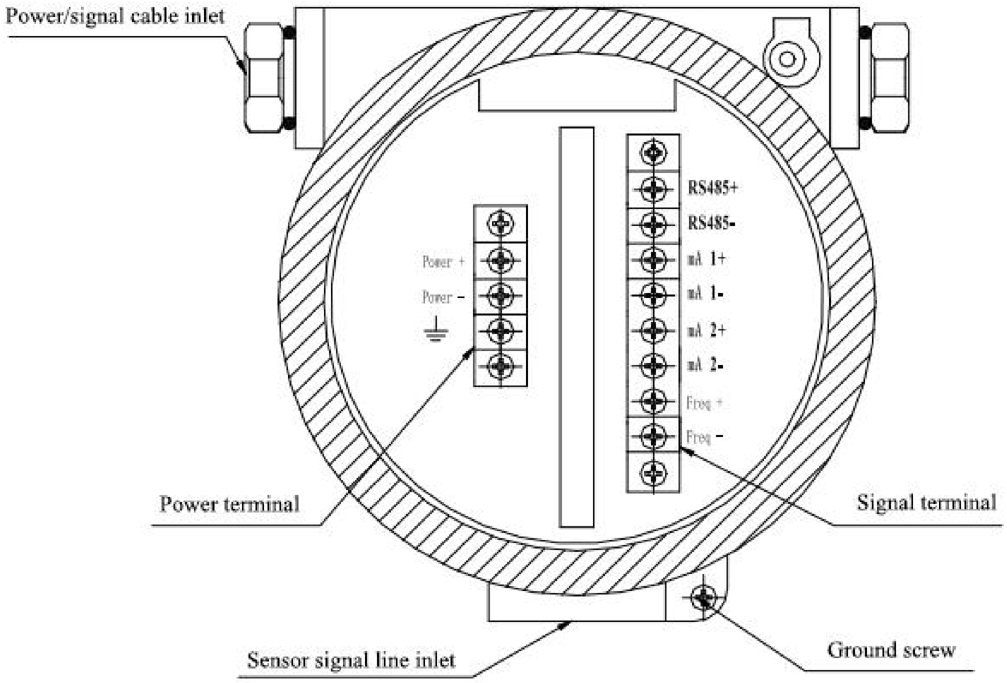
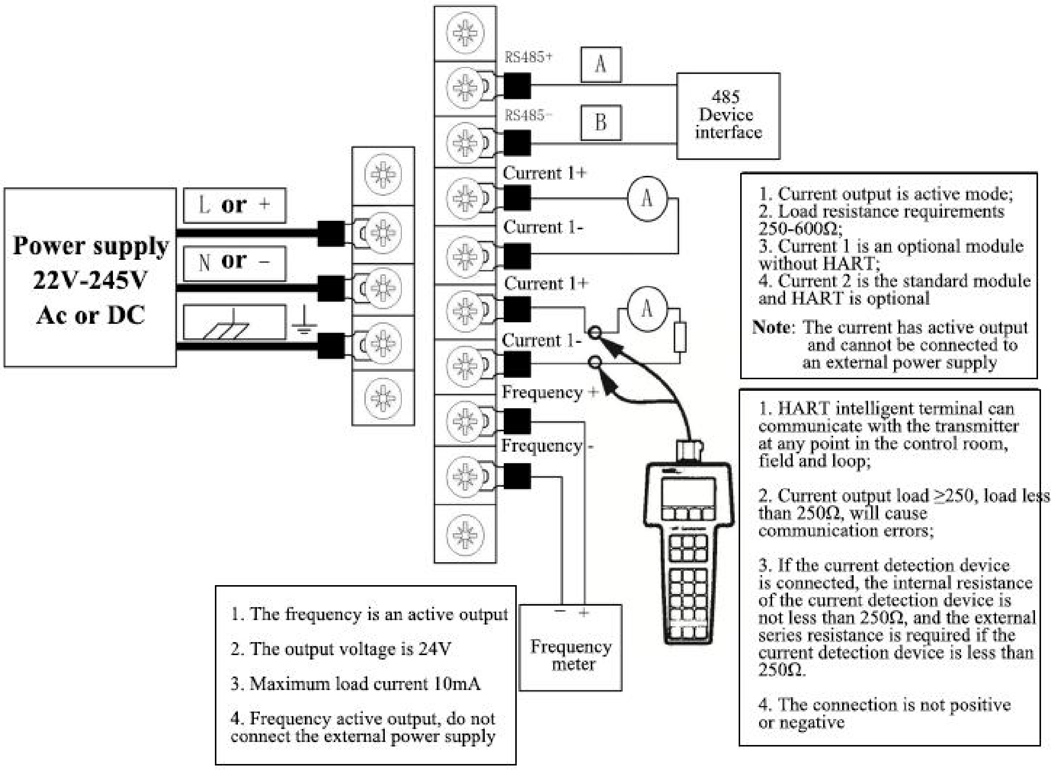


Figure 5 Flow meter terminal

Table 3 Terminal definitions

Symbol	Instructions
RS485+、RS485-	RS485 serial communication interface
mA1+、mA1-	First (4 to 20) mA output port
mA2+、mA2-	Second (4 to 20) mA output port Hart output interface (optional)
Freq+、Freq-	Frequency (pulse) output interface
Power+、Power-	Power interface
⏚	Converter instrument protection ground

Figure 6 Transmitter wiring



2 Specific requirements for electrical wiring

(1) Use special cables

The connection between the terminal box and the converter should be a special cable, can not be used with other cables, so as not to affect the measurement error (separate installation).

(2) Separate cabling

The lead between the sensor and the converter should be routed separately. Do not cover the motor and other power equipment to avoid the impact of electromagnetic field on the measurement. The length of the lead should not exceed the maximum allowable distance of 100 meters (separate installation).

(3) Grounding

- If the sensor terminal is grounded, for example, the pipeline system is connected to the ground, the sensor grounding terminal can be directly connected to the pipeline system.
- The converter ground terminal can be connected directly to the meter protection ground access point through the converter ground, such as the pipe is not conducting or floating. Improper grounding may increase measurement errors. The grounding cable should be as short as possible, and the grounding resistance should be less than 1 Ω.

(4) Drip protection

- All housing screws, housing covers and cable inlet gran heads must be tightened.
- Keep the shell sealing gasket clean and intact when inserting it into the sealing slot. The gasket can be dried, cleaned and replaced if necessary.

- Drip protection should be installed on all cables. That is, the cable inlet of the flowmeter and the cable and conduit should be bent downward to avoid water and short circuit.
- All cable inlet faces must not face upward without protective measures.
- Seal unnecessary cable inlets with plugs.

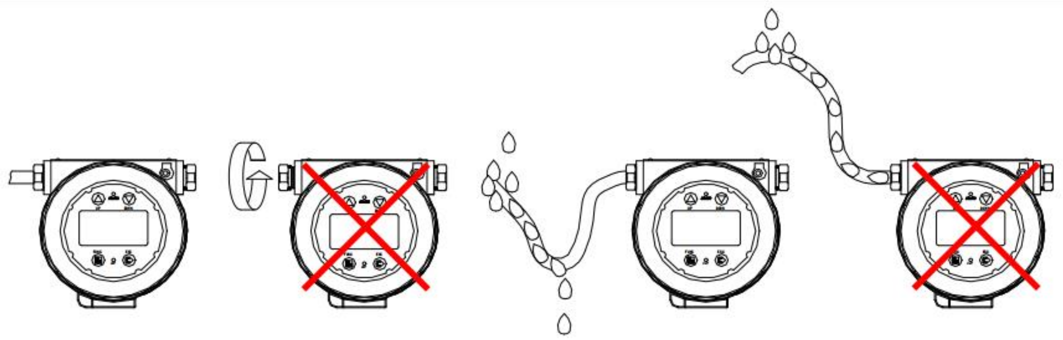


Figure 7 Schematic diagram of drip protection

Dimension

Coriolis mass flow meter is divided into straight tube Coriolis mass flow according to the converter shape Meter and non-straight tube type Coriolis mass flow meter.

1 Straight pipe Coriolis mass flow meter dimensions

1.1 General straight tube mass flow meter integrated dimensions

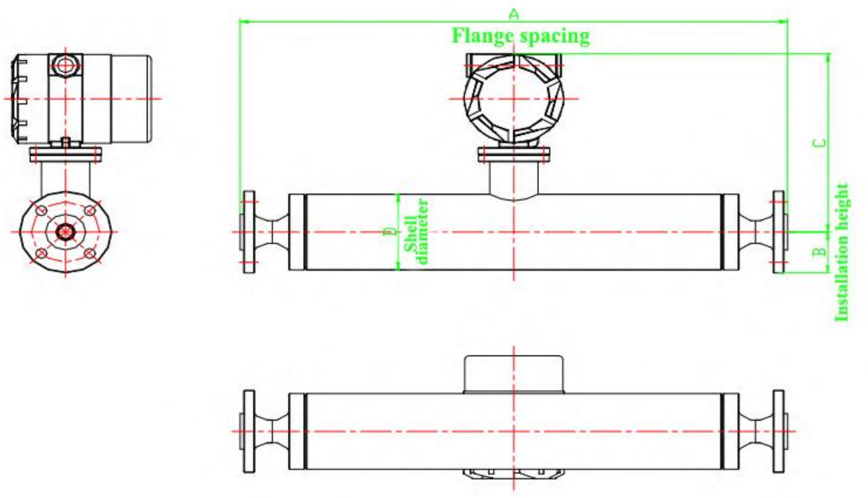


Figure 8 Integrated outline diagram of ordinary straight tube mass flow meter

Table 4 General type General type straight tube mass flow meter integrated dimensions

Diameter (mm)	A mm	B mm	C mm	D mm	Weight kg
DN8	492	45	235	82	10
DN10	542	47.5	238	87	12
DN15	622	52.5	238	87	13
DN20	685	57.5	251	106.5	18
DN25	751	70	257	117	23
DN32	867	70	264	137	31
DN40	963	78.5	279	157	37
DN50	1053	82.5	279	157	42
DN80	1185	115	311.5	219	66

1.2 Sanitary straight tube mass flow meter integrated dimensions

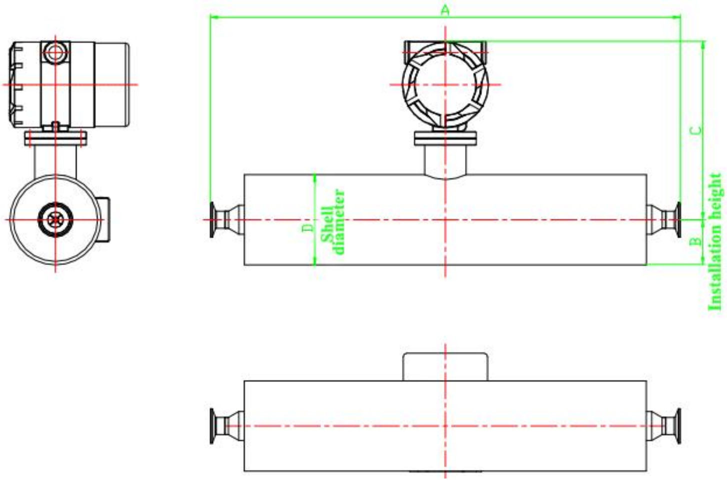


Figure 9 Outline diagram of sanitary straight tube mass flow meter

Table 5 Dimensions of sanitary straight tube mass flow meter

Diameter (mm)	A mm	B mm	C mm	D mm	Weight kg
DN20	598	54	257	108	17
DN25	680	66.5	261	133	23
DN32	680	66.5	261	133	23
DN40	792	70	273	140	28
DN50	864	79.5	283	159	36
DN65	948	79.5	283	159	42

2 Non-straight tube type Coriolis mass flow meter dimensions

2.1 U-type Coriolis mass flow meter dimensions

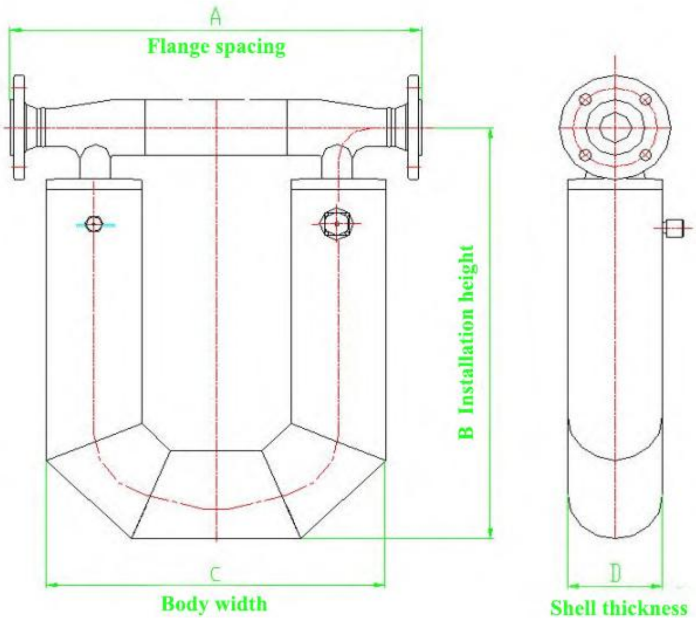


Figure 10 Outline diagram of split U-type Coriolis mass flow meter

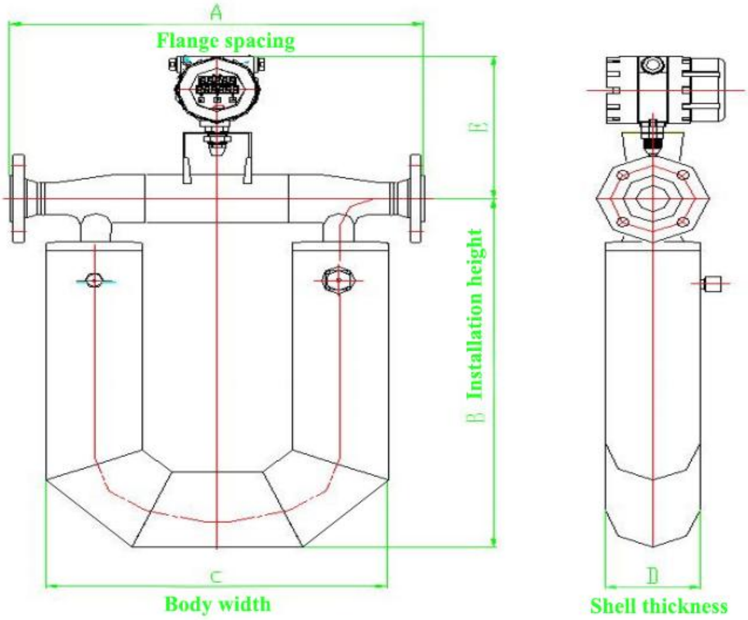


Figure 11 Schematic diagram of the integrated U-type Coriolis mass flow meter

Table 6 Dimensions of U-shaped sensor

Diameter (mm)	A mm	B mm	C mm	D mm	E mm	Weight kg
DN10	450	324	380	60	236	7.2
DN15	456	324	380	60	236	7.5
DN20	540	478	468	108	245	17
DN25	540	492	468	108	245	17.5
DN32	544	517	468	108	245	24
DN40	600	635	500	140	267	32
DN50	606	653	500	140	267	36
DN80	866	857	779	219	316	87.5
DN100	950	977	833	273	340	165
DN150	1300	1223	1144	324	340	252

Note: E indicates the size of the center height increase after the integrated installation of the converter.

2.2 Triangle Coriolis mass flowmeter dimensions

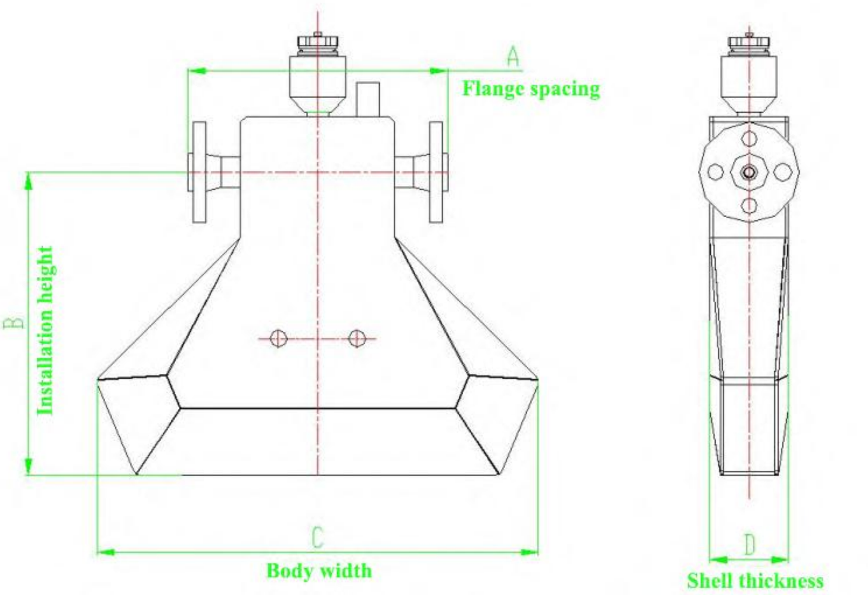


Figure 12 Outline diagram of DN3~DN8 split triangular Coriolis mass flow meter

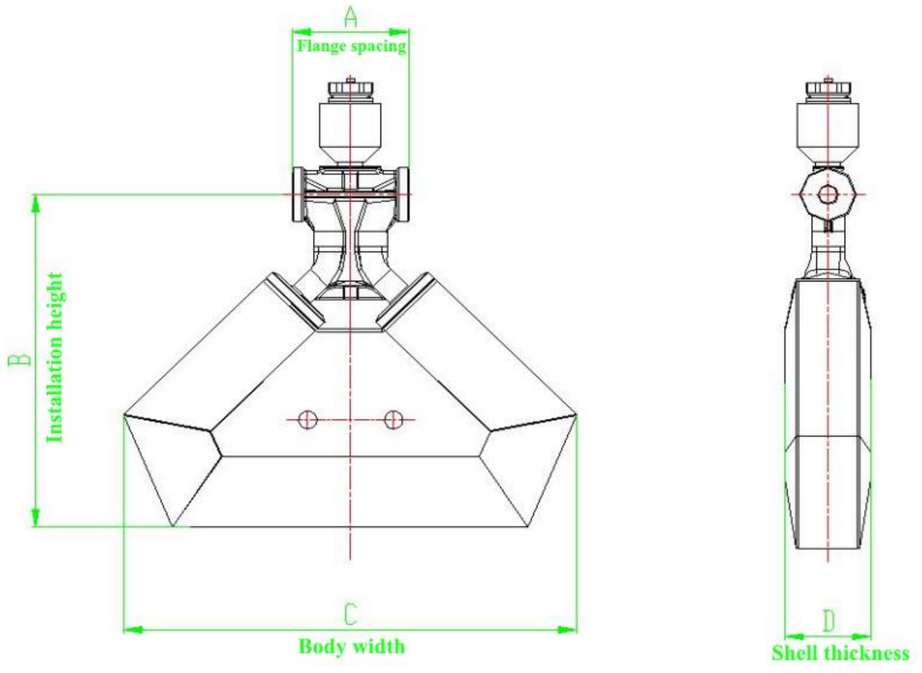


Figure 13 Schematic diagram of DN10~DN15 split triangular Coriolis mass flow meter

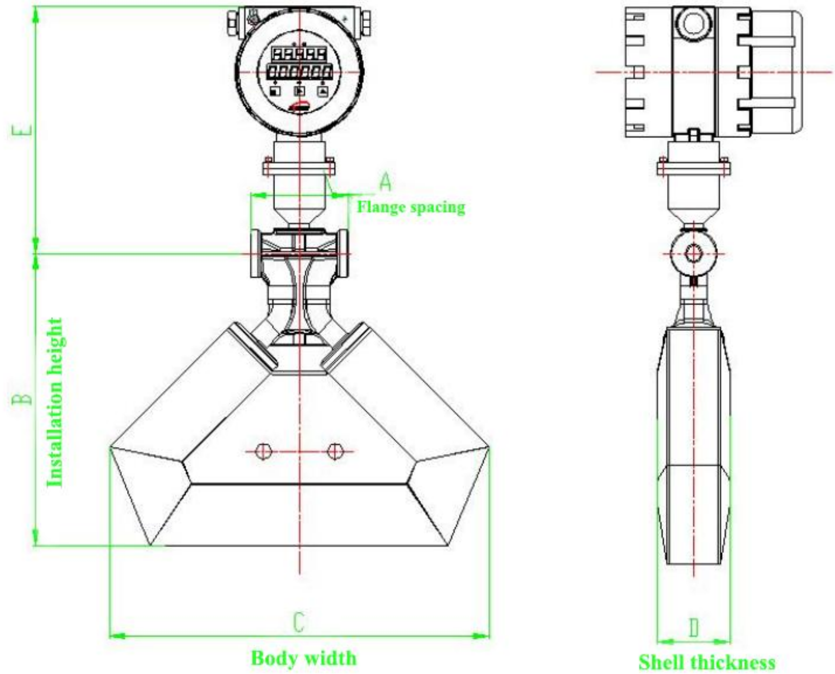


Figure 14 Schematic diagram of the integrated triangular Coriolis mass flow meter

Table 7 Dimensions of the triangle Coriolis mass flow meter

Diameter (mm)	A mm	B mm	C mm	D mm	E mm	Weight kg
DN3	196	176	250	54	270	4.8
DN6	250	263	360	70.5	289	8.1
DN8	250	275	395	70.5	289	8.2
DN10	95	283	370	70.5	264	6.5
DN15	95	302	405	70.5	264	6.5

Note:

(1) The size of A will change according to the change of the connection method, here is only a reference size. For split DN10~DN15 specifications of the flow meter is the clamp section size, the other is the standard configuration flange size.

(2) E indicates the size of the total height increase after the integrated installation of the converter.

3 Process Connection

Flange: Meets HG/T20592 flange standard.

Clamp: According to ISO 2852 clamp standard.

4 Materials

Converter housing material: aluminum alloy

Body material: 304SS

Measuring tube material: 316SS