HIKMICRO

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Coriolis Mass Flow Meter

Features and Benefits

- 30:1 wide range ratio, accurate even at low flow rates
- Fully positive design for high precision – 0.1% for liquid and 0.5% for gas
- 8000 sampling points per second, fast response
- ⩽±0.001 g/cc High density accuracy with precision measurement circuit and advanced temperature compensation algorithm
- Good long-term stability with a large number of tests and failure verification under harsh conditions
- Intelligent self-diagnosis, including noise interference, wiring grounding, coil failure

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Contents

1. Product Introduction

1.1. Application

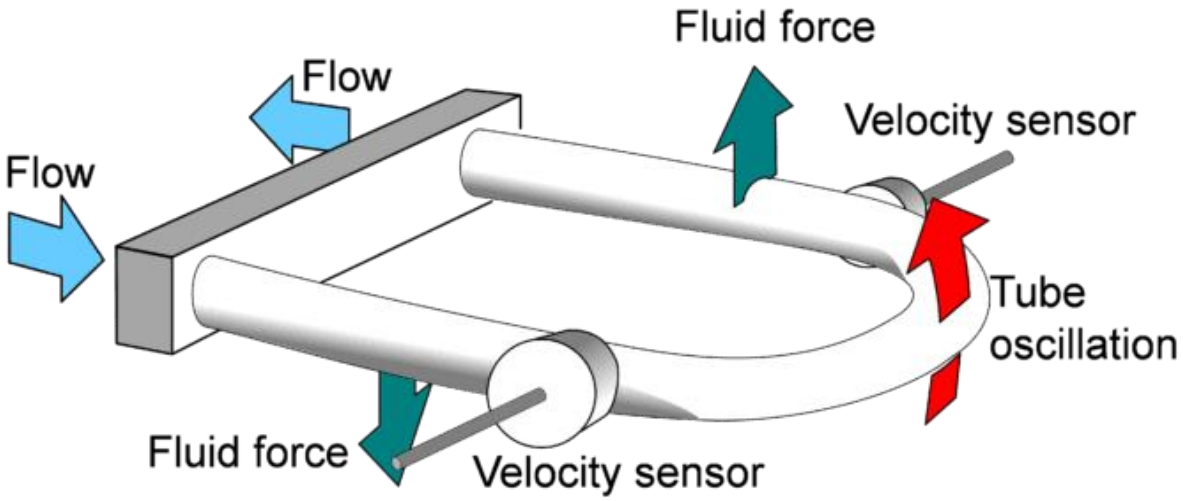
HIKMICRO FC00 series Coriolis mass flow meter consists of two parts: sensor and transmitter. This product can directly measure mass flow, volume flow, density, temperature and infer process parameters online, and is not affected by the physical properties of the measured fluid (such as temperature, pressure, viscosity, density). It has the characteristics of high measurement accuracy, high reliability, good stability and long service life, and is widely used in metallurgy, petrochemical, energy, water management, life sciences, medicine, food and beverage.

1.2. Measuring Principle

FC00 series Coriolis mass flow meter is based on the Coriolis force principle. The fluid flows through the measuring tube, causing the measuring tube to vibrate, thereby inducing the Coriolis Effect. The sensor calculates the mass flow and density of the fluid by measuring the changes in the frequency, phase difference and amplitude of the measuring tube.

The vibration frequency of the mass flow meter measuring tube changes with the change of medium density. By measuring the change of the resonance frequency of the measuring tube, the density of the medium can be obtained.

The mass flow meter sensor has a temperature sensor inside, which can directly measure and output the temperature of the medium. At the same time, the temperature can also be used to compensate for flow and density measurement internally.



2. Performance Characteristics

2.1. Accuracy and Repeatability

2.1.1. Accuracy and Repeatability of Liquid Measurement

Table 1: Accuracy and Repeatability of Liquid Mass Flow

Performance Specifications	Option 1	Option 2
Mass Flow Accuracy	±0.1% (TD* = 10:1)	±0.15% (TD = 15:1)
Maximum Allowable Error	±0.1% (Instantaneous flow/maximum flow>1:10)	±0.15% (Instantaneous flow/maximum flow>1:15)
	±Zero point stability*/ instantaneous flow x 100% (Instantaneous flow/maximum flow≤1:10)	±Zero point stability/ instantaneous flow x 100% (Instantaneous flow/maximum flow≤1:15)
Mass Flow Repeatability	1/2 x the maximum allowable error	
Temperature Accuracy	±1℃±(0.5% x measured value)	
Temperature Repeatability	0.2℃	

Note:

1. *For liquid mass flow measurement, there are two accuracy levels to choose from. Option 1 refers to Accuracy 0.1% while Option 2 refers to Accuracy 0.15%;*
2. *TD (range ratio) = ratio of the maximum measurable flow rate to the minimum measurable flow rate;*
3. *Zero point stability is explained and listed in*

Table 2: Accuracy and Repeatability of Liquid Volume Flow

Performance Specifications	Option 1	Option 2
Volume Flow Accuracy	±0.15%±(zero point stability/instantaneous flow) x 100%	±0.2%±(zero point stability/instantaneous flow) x 100%
Volume Flow Repeatability	0.075%±1/2 (zero point stability/instantaneous flow) x 100%	0.1%±1/2 (zero point stability/instantaneous flow) x 100
Temperature Accuracy	±1℃±0.5% x measured value	
Temperature Repeatability	0.2℃	

Note: When the flow value is lower than zero stability/0.005, accuracy = ± (zero stability/flow value) x 100%, and repeatability = ½ (zero stability/flow value) x 100%

Table 3: Accuracy and Repeatability of Liquid Density

Performance Specifications	All Models	All Models
Liquid Density Accuracy	±0.001 g/cm³	±1 kg/m³
Liquid Density Repeatability	0.0005 g/cm³	0.5 kg/m³
Measuring Range	0.2 g/cm³-3 g/cm³	200 kg/m³ - 3000 kg/m³

Note: The density error of ±2 kg/m 3 is based on water at 20 °C and 0.1~0.2 MPa reference conditions ;

2.1.2. Accuracy and Repeatability of Gas Measurement

Table 4: Accuracy and Repeatability of Gas Volume Flow

Performance Specifications	Option 1*	Option 2
Volume Flow Accuracy	±0.5%	±1%
Repeatability of Volume Flow	0.2%	0.5%
Temperature Accuracy	±1℃±0.5% x measured value	
Temperature Repeatability	0.2 ℃	

Note: For gas mass flow measurement, there are two accuracy levels to choose from. Option 1 refers to Accuracy 0.5% while Option 2 refers to Accuracy 1%;

Standard volume: In most applications, users are still accustomed to using standard volume under certain pressure and temperature. For fluids with fixed components, standard volume is also called "quasi-mass" flow unit. Using the density under standard conditions (obtained from reference materials), the flow meter can be configured to output in standard volume units, that is, the measured fluid mass and the introduced fluid standard density are converted without pressure, temperature or density compensation.

Pressure loss: The geometry of the sensor, the density of the gas and the flow rate determine the pressure loss of the gas after passing through the flow meter. It is recommended that the pressure loss of the flow meter should not exceed 0.127MPa during the selection.

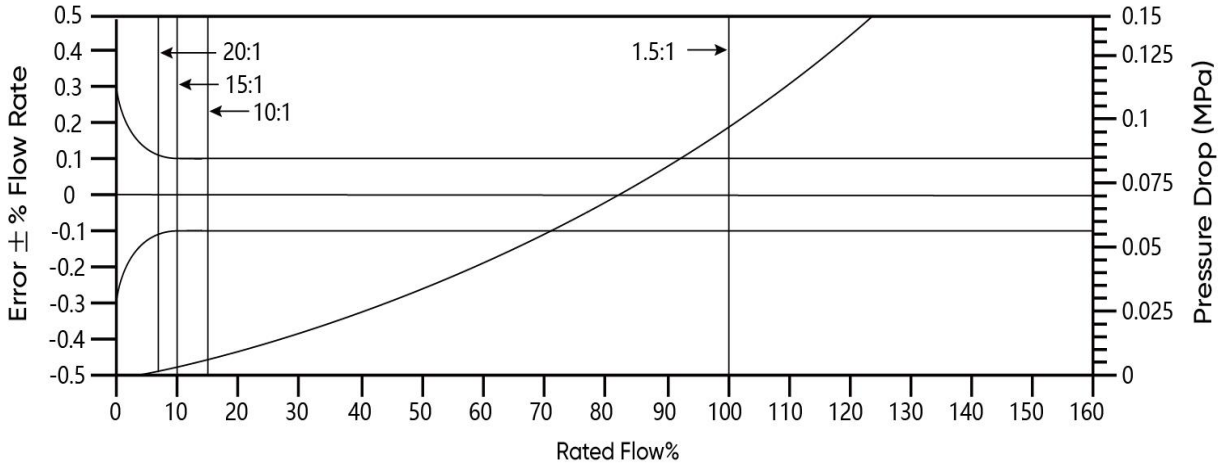
Flow rate: The flow rate when measuring gas is much greater than the flow rate when measuring liquid. The noise generated by high flow rate will affect the signal of the flow meter. When the pressure loss of the flow meter is less than 0.127MPa, the flow rate in the sensor tube should be less than 0.5 times the speed of sound.

2.2. Relationship between Range Ratio, Accuracy and Pressure Drop

Table 5: Relationship between range ratio, accuracy and pressure drop

Maximum Range Ratio	20:1	15:1	10:1	1.5:1	1:1
Accuracy (error)	0.20%	0.15%	0.10%	0.10%	0.10%
Pressure Drop (MPa)	0.001	0.002	0.015	0.1	0.2

Note: Range ratio is the ratio of the maximum measurable flow rate to the minimum measurable flow rate;



2.3. Liquid Flow and Zero Point Stability under Different Calibers

Parameter / Meter Size	Mass Flow Rate (kg/h)		Volume Flow Rate (L/h)		Zero Stability (kg/h)
	Rated Flow	Maximum Flow	Rated Flow	Maximum Flow	
DN2	100	120	100	120	0.005
DN3	300	350	300	350	0.018
DN6	1,000	1,500	1,000	1,500	0.075
DN10	1,800	2,700	1,800	2,700	0.135
DN15	3,000	4,500	3,000	4,500	0.225
DN20	7,000	10,500	7,000	10,500	0.5
DN25	18,000	27,000	18,000	27,000	1.3
DN40	27,000	40,500	27,000	40,500	2.1
DN50	50,000	75,000	50,000	75,000	4.5
DN80	160,000	240,000	160,000	240,000	12
DN100	360,000	540,000	3 60,000	5 40,000	27

2.4. Temperature Indicators and Temperature Influence

2.4.1. Medium and Ambient Temperature

Performance Specifications	Integral Mount	Remote Mount	Storage Temperature	Operating Temperature
Medium Temperature	-50℃~+125℃	-50℃~+350℃		
Ambient Temperature			-50℃~+ 70℃	-50℃~+ 70℃
Temperature Display Range	-50℃~+ 70℃			

2.4.2. Ambient Temperature Influence

The process temperature effect is defined as:

- For mass flow measurement, process temperature effect is the maximum zero deviation caused by the process fluid temperature varying from the zero adjustment temperature.
- For density measurement, process temperature effect refers to the maximum measurement deviation caused by the process fluid temperature varying from the density calibration temperature.

Parameter / Meter Size	Process Temperature Effect	
	%Maximum Flow Rate/℃	Density Error/℃ (kg/m³)
DN2	±0.0002	±0.015
DN3	±0.0002	±0.015
DN6	±0.0001	±0.015
DN10	±0.0001	±0.015
DN15	±0.0001	±0.015
DN20	±0.0001	±0.015
DN25	±0.0001	±0.015
DN40	±0.0001	±0.015
DN50	±0.0001	±0.015
DN80	±0.0001	±0.015
DN100	±0.0001	±0.015

2.5. Pressure Levels and Pressure Influence

Parameter / Meter Size	Pressure Level		Pressure Influence	
	Standard Pressure Resistance (MPa)	Maximum Pressure Resistance (MPa)	Influence of Pressure on Flow Error (% Flow Value/MPa)	Influence of Pressure on Density Error (kg/m³/MPa)
DN2	4	10	/	/
DN3	4	10	/	/
DN6	4	10	/	/
DN10	4	10	/	/
DN15	4	10	/	0.58
DN20	4	10	/	-0.29
DN25	4	10	-0.03	-0.87
DN40	4	10	-0.11	0.145
DN50	4	10	- 0.11	0.145
DN80	4	10	- 0.25	0.029
DN100	4	10	- 0.58	- 1.45

Note:

- *10MPa < Maximum pressure resistance (optional) < 26MPa;*
- *Pressure influence: the change in sensor's flow and density sensitivity caused by the process pressure deviating from the calibration pressure. Pressure influence can be corrected.*
- *The maximum calibration pressure used by HIKMICRO is 0.4 MPa.*

Parameter / Temperature	Measuring Tube Material	
	316L	304
< 148℃	No pressure loss	No pressure loss
204℃	Pressure reduction of 7.2%	Pressure reduction of 5.4%

2.6. Vibration Limitation

At a = 1g (g =9.8 m/s^{-2}) and sweep frequency under (5~2000) Hz, the device can withstand 10 cycles. If vibration exceeds a=0.5g, remote mount installation is recommended.

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3. Specification Overview

Mass Flow Accuracy (Fluid)	0.1%, 0.15%
Mass Flow Repeatability (Fluid)	0.05%, 0.075%
Volume Flow Accuracy (Gas)	0.5%, 1%
Volume Flow Repeatability (Gas)	0.2%, 0.5%
Density Accuracy	0.001 g/cm³
Density Repeatability	0.0005 g/cm³
Temperature Accuracy	±1℃±0.5% x measured value
Temperature Repeatability	0.2 ℃
Meter Size	DN2-DN100 (can be customized above DN100)
Wetted Parts Material	316L, HC, Ta
Process Connection	Flanged
Process Pressure Range	⩽4MPa
Process Medium Temperature Range	-40℃~300℃ (-40℉~572℉)
Temperature Compensation	Yes
Housing of Transmitter	Aluminum alloy
Housing of Sensor	304/316L
Control Button Type	Touch button
Sensor Protection Rating	IP66/67
Communication Type	4~20mA, Pulse, Modbus, Hart
Power Supply	24V DC and 220V AC (Adaptive), Max. 10 W
Working Temperature/Humidity	-40℃~60℃ (-40℉~140℉), ⩽98%

4. Mechanical Construction

4.1. Material

Structural components	Location	Material
Wetted Parts	Sensitive Tube	316L, HC, TA
	Reducer	316L, HC, TA
	Divider	316L, HC, TA
	Flange	316L, HC, TA
Housing	Sensor	304, 316L, Conformal coating
	Transmitter	Cast aluminum alloy (exterior sprayed with epoxy polyurethane)
	Junction Box	Cast aluminum alloy (exterior sprayed with epoxy polyurethane)

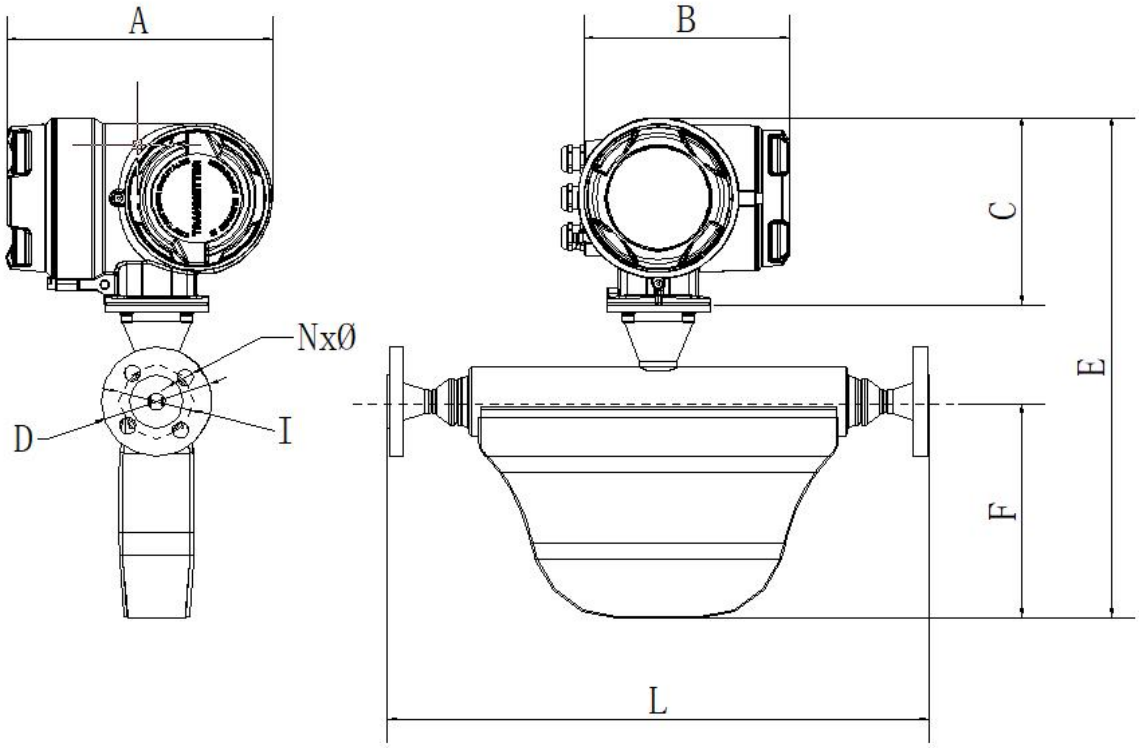
4.2. Weight

Structure / Meter Size	Integral Mount (kg)	Remote Mount (kg)
DN2	8	5
DN3	8	5
DN6	10	7
DN10	10	7
DN15	11	8.5
DN20	15	12
DN25	18.5	15.5
DN40	23.5	20.5
DN50	49	46
DN80	93	92
DN100	203	200

Note: The weight provided is the weight of the flow meter with GB/T 91 24.1-201 9 PN40 raised face welding steel pipe flange.

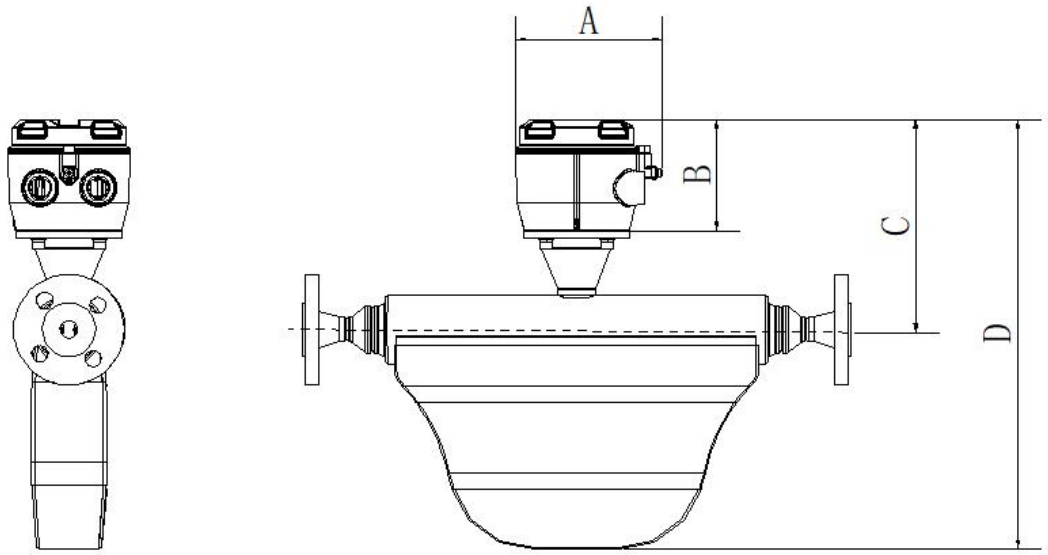
4.3. Dimension

4.3.1. Integral Mount

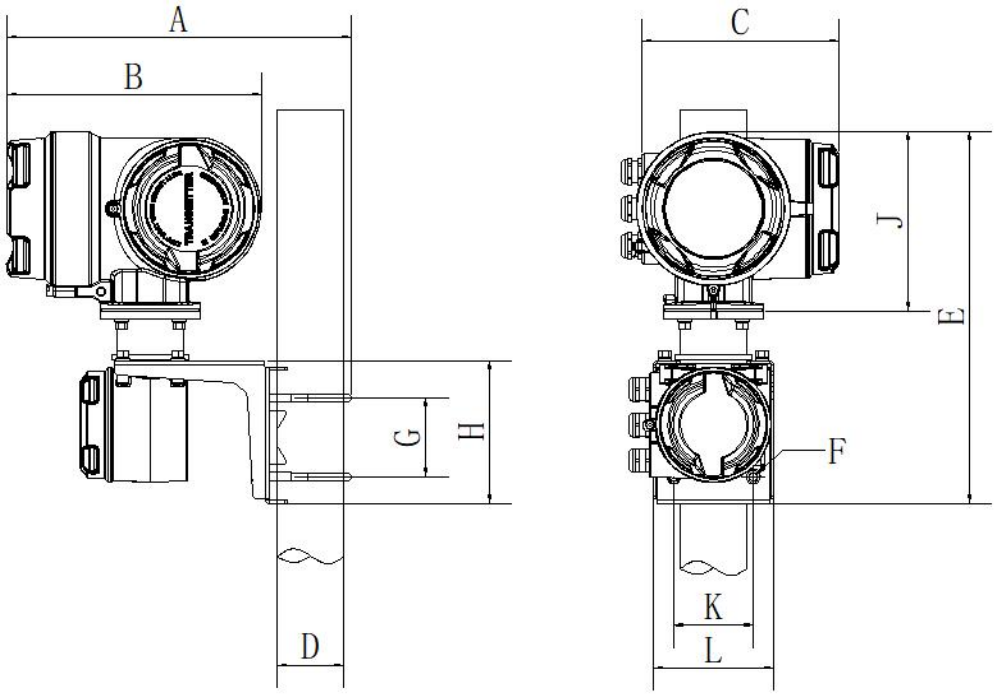


DN	D (mm)	I (mm)	N	Ø	A (mm)	B (mm)	C (mm)	E (mm)	F (mm)	L (mm)
2	95	65	4	14	234	179	163	373	118	308
3	95	65	4	14	234	179	163	373	118	308
6	95	65	4	14	234	179	163	416	164	445
10	95	65	4	14	234	179	163	416	164	445
15	95	65	4	14	234	179	163	437	186	471
20	115	85	4	14	234	179	163	466	214	538
25	150	110	4	18	234	179	163	495	239	574
40	165	125	4	18	234	179	163	522	259	570
50	165	125	4	18	234	179	163	557	282	823
80	200	160	8	18	234	179	163	652	361	1,036
100	235	190	8	22	234	179	163	723	418	1,176

4.3.2. Remote Mount



DN	A (mm)	B (mm)	C (mm)	D (mm)
2	126	95	187	305
3	126	95	187	305
6	126	95	184	348
10	126	95	184	348
15	126	95	183	369
20	126	95	184	398
25	126	95	188	427
40	126	95	195	454
50	126	95	207	489
80	126	95	223	584
100	126	95	237	655



A (mm)	B (mm)	C (mm)	D (mm)	E (mm)	F (mm)	G (mm)	H (mm)	J (mm)	K (mm)	L (mm)
313	231	179	60	339	M8	72	131	163	72	110

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5. Ordering Information

The model code of HIKMICRO Coriolis Mass Flow Meter is explained below. Each item

A. Base Model-Coriolis Mass Flow Meter
B. Series
C. Meter Size
D. Process Connection Standard
E. Process Connection Size
F. Pipeline Pressure Standard
G. Flange Sealing Surface Type
H. Accuracy
I. Temp. Range
J. Structure Type
K. Explosion-proof
L. Sensor Protection Rating
M. Wetted Parts Material
N. Sensor Housing Material
O. Transmitter Housing Material
P. Output Signal
Q. Power Supply
R. Sealing Plug

from A to R must be specified at the time of ordering.

5.1. Model Code Description

Model Code Position	Model Code	Description
Base Model-Coriolis Mass Flow Meter		
A	HM-FC	Product Category
Series		
B	00	Product Series
Meter Size		
C	002	C2 (Equivalent to the flow capacity of DN2)
C	003	C3 (Equivalent to the flow capacity of DN3)
C	006	C6 (Equivalent to the flow capacity of DN6)
C	010	C10 (Equivalent to the flow capacity of DN10)
C	015	C15 (Equivalent to the flow capacity of DN15)
C	020	C20 (Equivalent to the flow capacity of DN20)
C	025	C25 (Equivalent to the flow capacity of DN25)

C	040	C40 (Equivalent to the flow capacity of DN40)
C	050	C50 (Equivalent to the flow capacity of DN50)
C	080	C80 (Equivalent to the flow capacity of DN80)
C	100	C100 (Equivalent to the flow capacity of DN100)
C	150	C150 (Equivalent to the flow capacity of DN150)
C	200	C200 (Equivalent to the flow capacity of DN200)
Process Connection Standard		
D	J	JIS B2220
D	E	EN1092-1
D	A	ASME B16.5
D	T	Clamp connection
Process Connection Size		
E	015	DN15
E	020	DN20
E	025	DN25
E	032	DN32
E	040	DN40
E	050	DN50
E	080	DN80
E	100	DN100
E	150	DN150
Pressure Standard		
F	D1	PN06
F	D2	PN10
F	D3	PN16
F	D4	PN25
F	D5	PN40
F	D6	PN63
F	D9	PN250
F	C1	Class 150

F	C2	Class 300
F	C4	Class 600
F	J1	5K
F	J2	10K
F	J3	16K
F	J4	20K
Flange Sealing Surface Type		
G	B	RF (Raised Face)
G	A	FF (Flat Face)
G	E	Male
G	F	Female
G	C	T-tongue
G	D	G-groove
G	G	OSG-OS O-ring convex surface
G	H	OSG-OG O-ring concave surface
G	J	RJ (Ring joint connection)
Accuracy		
H	B	0.1% (Liquid)
H	C	0.15% (Liquid)
H	F	0.5%(Gas)
H	G	1% (Gas)
Temp. Range		
I	R	-40℃~80℃
I	S	-40℃~125℃
I	T	-40℃~200℃
I	H	200℃~300℃
Structure Type		
J	E00	Integral mount
J	S02	Remote mount with 2m signal line length
J	S05	Remote mount with 5m signal line length

Explosion-proof		
K	N	Non-explosion-proof
Sensor Protection Rating		
L	E	IP66/67
Wetted Parts Material		
M	M	316L
M	H	HC22
M	D	TA
Sensor Housing Material		
N	S	304
N	M	316L
N	E	304+Electric Heat Trace Jacket
Transmitter Housing Material		
O	A	Aluminum
Output Signal		
P	1	4 ~ 20 mA + pulse + MODBUS
P	2	4 ~ 20 mA + pulse + MODBUS + HART
P	3	Dual Current
Power Supply		
Q	S	Adaptive power supply
Sealing Plug		
R	E	1/2NPT nylon cable gland
R	D	1/2NPT explosion-proof cable gland
R	A	M20x1.5 nylon cable gland
R	C	M20x1.5 stainless steel explosion-proof cable gland

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5.2. Selection Table

Coriolis Mass Flow Meter

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Series
00 Series 00

Meter Size

C2 (Equivalent to the flow capacity of DN2)	002
C3 (Equivalent to the flow capacity of DN3)	003
C6 (Equivalent to the flow capacity of DN6)	006
C10 (Equivalent to the flow capacity of DN10)	010
C15 (Equivalent to the flow capacity of DN15)	015
C20 (Equivalent to the flow capacity of DN20)	020
C25 (Equivalent to the flow capacity of DN25)	025
C40 (Equivalent to the flow capacity of DN40)	040
C50 (Equivalent to the flow capacity of DN50)	050
C80 (Equivalent to the flow capacity of DN80)	080
C100 (Equivalent to the flow capacity of DN100)	100
C150 (Equivalent to the flow capacity of DN150)	150
C200 (Equivalent to the flow capacity of DN200)	200

Process Connection Standard

Clamp connection	T
JIS B2220	J
EN1092-1	E
ASME B16.5	A

Process Connection Size

DN15	015
DN20	020
DN25	025
DN32	032
DN40	040
DN50	050
DN80	080
DN100	100
DN150	150

Pressure Standard

PN06	D1
PN10	D2
PN16	D3
PN25	D4
PN40	D5
PN63	D6
PN250	D9
Class 150	C1
Class 300	C2
Class 600	C4
5K	J1
10K	J2
16K	J3
20K	J4

Flange Sealing Surface Type

RF (Raised Face)	B
FF (Flat Face)	A
Male	E
Female	F
T-tongue	C
G-groove	D
OSG-OS O-ring convex surface	G
OSG-OG O-ring concave surface	H
RJ (Ring joint connection)	J

Accuracy
B 0.1% (Liquid)
C 0.15% (Liquid)
F 0.5% (Gas)
G 1% (Gas))

Temp. Range
R -40℃~80℃
S -40℃~125℃
T -40℃~200℃
H 200℃~300℃
(Only for Process Connection Size above DN25)

Structure Type
E00 Integral mount
S02 Remote mount with 2m signal line length
S05 Remote mount with 5m signal line length

Explosion-proof
N Non-explosion-proof

Sensor Protection Rating
E IP66/67

Wetted Parts Material
M 316L
H HC22
D TA

Sensor Housing Material
S 304
M 316L
E 304+ Electric Heat Trace Jacket

Transmitter Housing Material
A Aluminum

Output Signal
1 4~20 mA + pulse + MODBUS
2 4~20 mA + pulse + MODBUS + HART
3 Dual Current

Power Supply
S Adaptive power supply

Sealing Plug
E 1/2NPT cable gland
A M20x1.5 nylon cable gland
D 1/2NPT explosion-proof cable gland
C M20x1.5 stainless steel explosion-proof cable gland

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Coriolis Mass Flow Meter

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