ALPHA SERIES CORIOLIS MASS FLOWMETERS

AI.RCMF

OVERVIEW

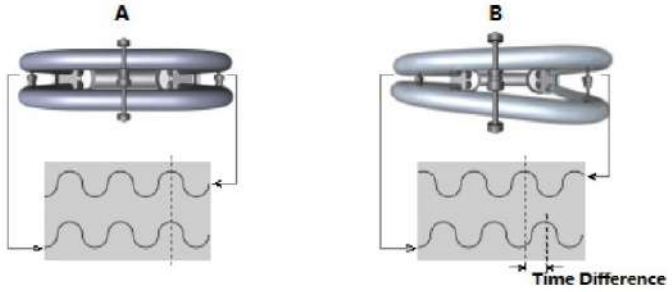
Direct mass flow measurement without the influences of density, viscosity, temperature and pressure
The best flow solutions for high-pressure and cryogenic applications
Wide turndown is up to 50:1
Modular transmitter design with more functional options
Integrated explosion-proof and anti-corrosion sensor design
High precision measurement performance is the best for industrial process control
ATEX certification has been granted

PRINCIPLE

The Alpha series Coriolis mass flowmeter works on the principle of Coriolis effect.
This flowmeter directly measures mass flow, density and temperature; meanwhile it calculates volume flow, total flow and fluid composition in real-time.

MASS FLOW MEASUREMENT

The flow tubes are forced to oscillate to produce sine waves by an external exciter: When no process fluid flows through the two tubes, the vibration of the tubes won't produce a phase shift with each other; However, when the process fluid flows through the tubes, the Coriolis forces cause the tubes to be twisted to produce a phase shift.
The measured time difference between the waves is directly proportional to the mass flow rate. See the diagrams below:



DENSITY MEASUREMENT

The flow tubes can be vibrated at their resonance frequency. Changes of the mass of the process fluid inside the tubes will result in the corresponding changes to the tube resonance frequency.
This frequency changes of the tube are used to calculate the fluid density.

TEMPERATURE MEASUREMENT

Process temperature is directly measured by the temperature sensor which is mounted on one of the two tubes. The process temperature variable can be set as a signal output when necessary; Meanwhile, internal of the flow transmitter, this variable is also used to compensate temperature influences on the material elasticity for improving the measurement performance.

APPLICATION

Alpha series mass flowmeter is competent to the most complex and challenging environment for liquid, gas and slurry applications. This flowmeter is widely used in process measurement and custody transfer with the advantages of short response time, high precision measurement performance and less daily maintenance.

Fluid	Typical Application	Industry	
● Liquid ● Gas ● Slurry	■ Custody Transfer ■ Reactor Feed Ratio ■ Density Measurement ■ Batch Control	◆ Chemicals ◆ Food & Beverages ◆ Machinery ◆ Minerals & Ming ◆ Oil & Gas	◆ Pharmaceuticals ◆ Power Plant ◆ Pulp & Paper ◆ Water ◆ Waste Water

1

Example One: As a key component, the Alpha mass flowmeter is installed in a truck-loading cryogenic system for batch operation.

2

3

Example Two: The Alpha mass flowmeters are installed inside a chemical plant for the raw chemical material process measurement.
Example Three: An Alpha mass flowmeter is installed in a gas station for the fuel measurement.

SPECIFICATION

Sensor Specification, Main Specification

Accuracy	Liquid: ±0.10%, ±0.15% ±0.20%, and ±0.50%
Repeatability	±0.05%
Density	±0.002g/cm^3
Process Temperature	±1℃ (±33.8°F)
Ambient Temperature	-40 to +55℃ (-40 to 131°F)
Relative Humidity	≤95%, non-condensing
Process Fluid	Gas, Liquid
Sensor Body	304
Flow Tube	316L
Transmitter Housing	Cast Aluminum Alloy with Epoxy Polyurethane Coatings

Other Technical Data

Style	Sensor	Applicable Temp	Process Temperature	Working Pressure	Meter Type	Process Connection
	CNG-15 CNG-20	Normal Temp.	-40℃～+80℃	≤25 MPa	Remote	M32*1.5 M42*2
	03TA 06TA 15TA 20TA 25TA 40TA	Low Temp / High Temp	-196 to +300℃ *(-320.8 to +572℉)*	≤4MPa *(≤40Bar)* *Max. 25MPa* *(250Bar)*	Remote	Flange
	50UA 80UA 100UA 150UA 200UA	Low Temp / High Temp	-196 to +300℃ *(-320.8 to +572℉)*	≤4MPa *(≤40Bar)*	Remote	Flange

Note: Customized product is available when working pressure exceeds the specified ranges in this table

Transmitter Specification, Main Specification

Power Supply	85 to 265VAC,50/60Hz or 12 to 24VDC (±5%)
Max. Power Consumption	10 watts
Signal Output	Analog (4 to 20mA), Pulse/Frequency (0 to 10kHz)
Digital Communication	Modbus over RS-485, HART (optional)
Variable	Mass Flow, Volume Flow, Mass Total, Volume Total, Temperature, Density, Standard Flow, and Standard Total
Ambient Temperature	-40 to +55℃ (-40 to 131°F)
Process Connection	M20×1.5; 1/2-inch NPT (optional)

Other Technical Data

Transmitter	Style	Display		Signal Output		
		Without	With	Modbus on RS-485	Pulse/Freq	Analog/HART
F23		■	■	■	■	■

Size and Flow

Sensor	Size		Max Flowrate				
	inch	mm	kg/min	Lb/min	gal/min	kg/h	l/h
CNG15	1/2	DN15	50	110	13	3, 000	3,000
CNG20	3/4	DN20	120	264	30	7, 200	7,200
03TA	1/8	DN03	2	4. 4	0. 5	120	120
06TA	1/4	DN06	20	44	5	1200	1200
15TA	1/2	DN15	50	110	13	3000	3000

20TA	3/4	DN20	120	264	30	7200	7200
25TA	1	DN25	200	440	50	12000	12000
40TA	1-1/2	DN40	500	1100	130	30000	30000
50UA	2	DN50	1000	2200	260	60000	60000
80UA	3	DN80	2500	5500	652	150000	150000
100UA	4	DN100	4000	8800	1043	240000	240000
150UA	6	DN150	13, 000	28, 600	3, 250	780, 000	780, 000
200UA	8	DN200	26, 000	57, 200	6, 500	1, 560, 000	1, 560, 000

Accuracy and Repeatability

Mass Flow Accuracy	<20:1	±0.10%
	>20:1	±0.10% ± [(zero stability/flow rate)×100]%
Volume Flow Accuracy	<20:1	±0.10%
	>20:1	±0.10% ± [(zero stability/flow rate)×100]%
Repeatability	<20:1	±0.075%

Zero Stability

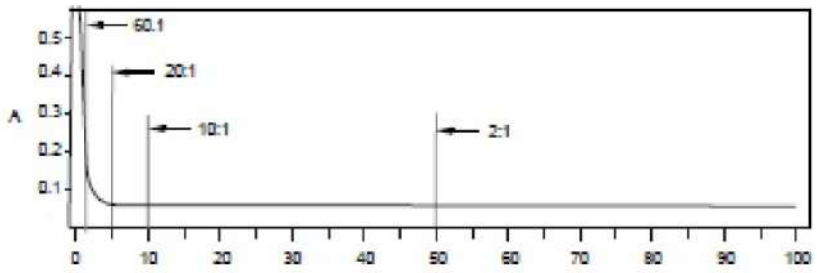
Zero stability is used when the flow rate approaches the low end of flow range where the meter accuracy begins to deviate from the stated accuracy ratings. See the description in the Turndown section below. When the meter operates at the low end of flow range, the accuracy begins to deviate from the stated accuracy rating.
The meter accuracy is calculated by the formula: accuracy - (zero stability/flow rate) x 100%

Zero stability is the value obtained in the laboratory for calculating the expected sensor accuracy.
Under zero flow laboratory conditions, the average flow rate measured by the calibration system should be within the range defined by the sensor's zero stability value (0 ± zero stability). Each sensor has a unique zero stability. By statistics, about 95% of the flow rates should thin the range defined by the zero stability.

Sensor	06TA	15TA	20TA	25TA	40TA	50UA	80UA	100UA
kg/h	0.05	0.10	0.30	0.63	1.7	5	8	15

Turndown

The graph and table below represent an example of the measurement characteristics under various flow conditions. At flow rates requiring large turndowns (greater than 20:1), the zero stability values may begin to govern capability dependent upon flow conditions and meter in use.



A. Accuracy, %
B. Flow rate, % of nominal

The following table shows accuracy and pressure drop across flow rate for a typical sensor of 50UA:

Turndown from nominal flow rate	20:1	15:1	10:1	1.5:1	1:1
Accuracy (±%)	0.14	0.10	0.10	0.10	0.10
Pressure Drop (MPa)	0.00	0.00	0.02	0.10	0.23

Note: When the maximum flowrate exceeds the permissible flow range, the measurement accuracy will be affected by the noise of the pipeline.

Density Performance (Liquid only)

Unit	g/cm^3	kg/m^3
Accuracy	±0.002	±1
Repeatability	±0.0005	±0.5
Measurement Range	0.2 to 3	200 to 3,000

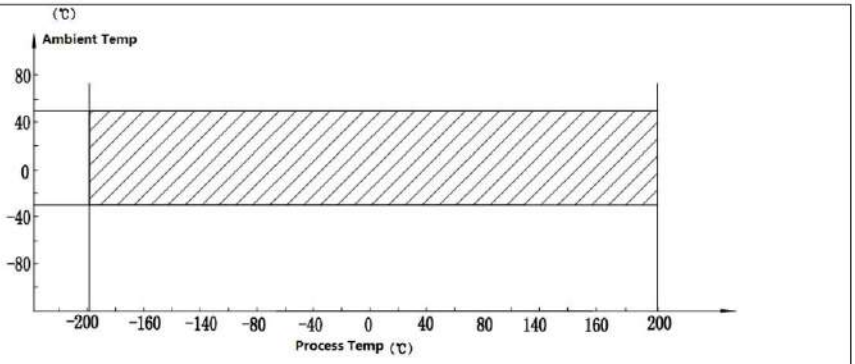
Temperature Performance

Sensors can be used in the process and ambient temperature ranges shown in the temperature limit figures. For the purposes of selecting transmitter options, temperature limit figures should be used only as a general guide. If the process conditions are close to the shaded area, we recommend that customers should consult with our local Reliant
Instruments representatives.

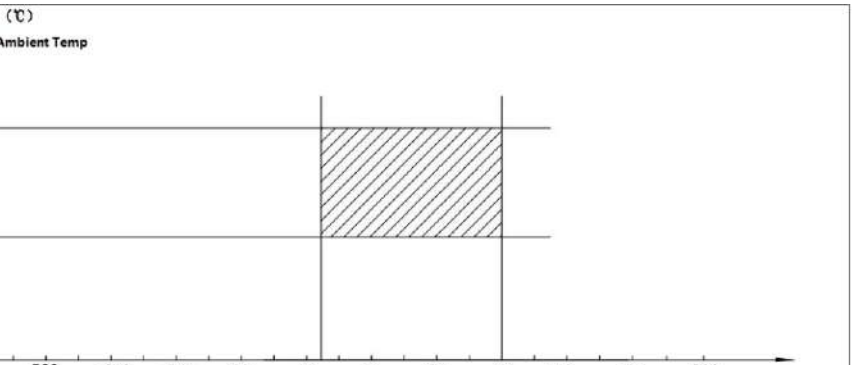
Note:

- In all cases, the transmitter cannot be operated where the ambient temperature is below –40°C (–40°F) or above +60°C (+140°F). If a sensor is to be used where the ambient temperature is outside of the range permissible for the transmitter, the transmitter must be remotely located where the ambient temperature is within the permissible range, as indicated by the shaded areas of the temperature limit figure
- Temperature limits may be further restricted by hazardous area approvals. Refer to the hazardous area approval documentation which is shipped with the sensor.
- The remote-mount transmitter allows the sensor case to be insulated without covering the transmitter, or the junction box, and this insulation should not affect the temperature ratings. When insulating the sensor case at elevated process temperatures (above +60°C or 140°F), please ensure the transmitter is not enclosed in insulation as this may lead to transmitter failure

Temperature Accuracy	All series	±1℃ *(±33.8℉)*
Temperature Limits	All series	See the figures below



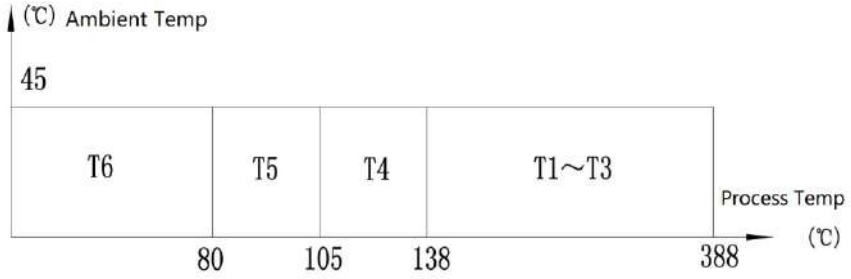
Alpha Series Mass Flowmeter



CNG Series Mass Flowmeter

Process Temperature limits	Alpha Series Mass Flowmeter	-196 to +300℃ *(-320.8 to + 572℉)*
	CNG Series Mass Flowmeter	-30 to +80℃ *(-22 to +176°F)*
Ambient Temperature limits	Storage	-50 to +65℃ *(-58 to +149℉)*
	Operation	-40 to +55℃ *(-40 to +131℉)*

The "T" group refers to the maximum surface temperature at which the sensor operates at an ambient temperature of 45 °C , as shown in the figure below:



Hazardous Area Classification, Approval and Certification

ATEX

Ex-mark	F23	Ⓔx II 2G Ex db [ib] IIC T6…T1 Gb
Ex Certificate No.	TPS 18 ATEX 045116 001X	
Enclosure Rating	IP67	

Ex-mark	CNG15,CNG20,CG06 to CG100	Ⓔx II 2G Ex ib IIC T6…T1 Gb
Ex Certificate No.	TPS 18 ATEX 045116 001X	
Enclosure Rating	IP67	

IEC Ex *(Under Certification)*

Ex-mark	F23	Ex db [ib] IIC T6…T1 Gb
Enclosure Rating	IP67	

Ex-mark	CNG15,CNG20,CG06 to CG100	Ex ib IIC T6…T1 Gb
Enclosure Rating	IP67	

Dimension

Unit in mm **Error: ±2mm**

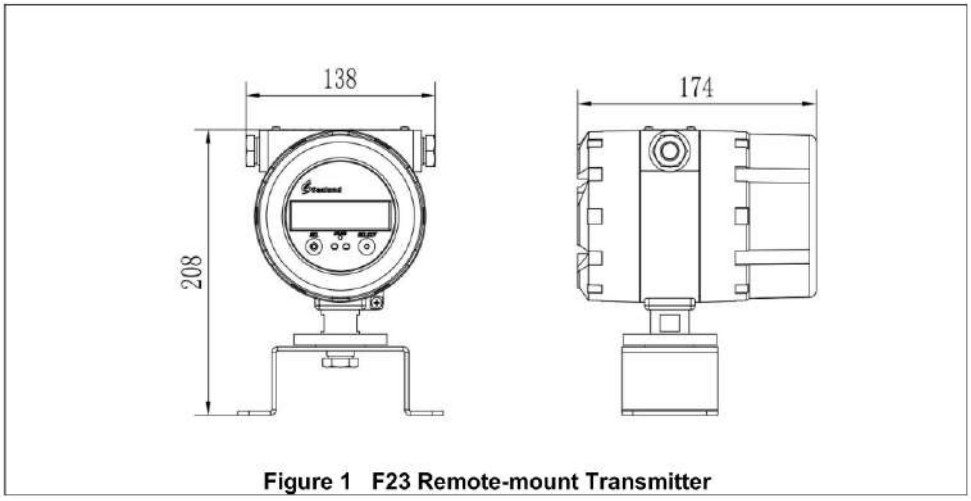


Figure 1 F23 Remote-mount Transmitter

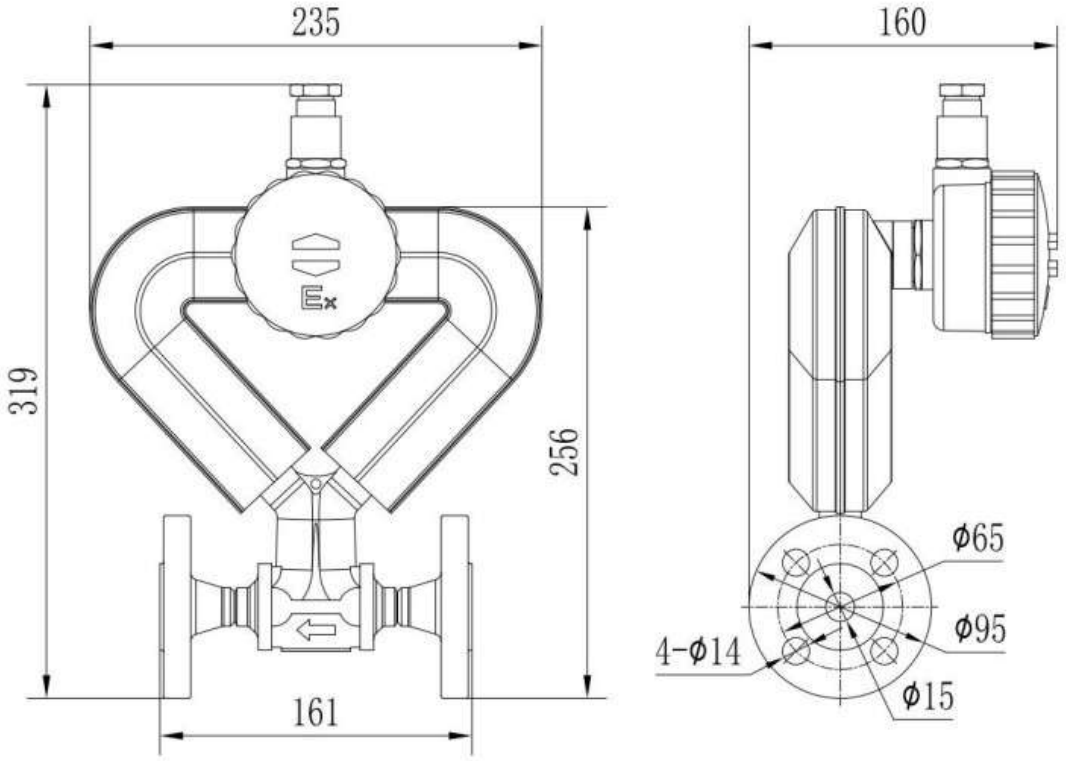


Figure 2 06TA Sensor

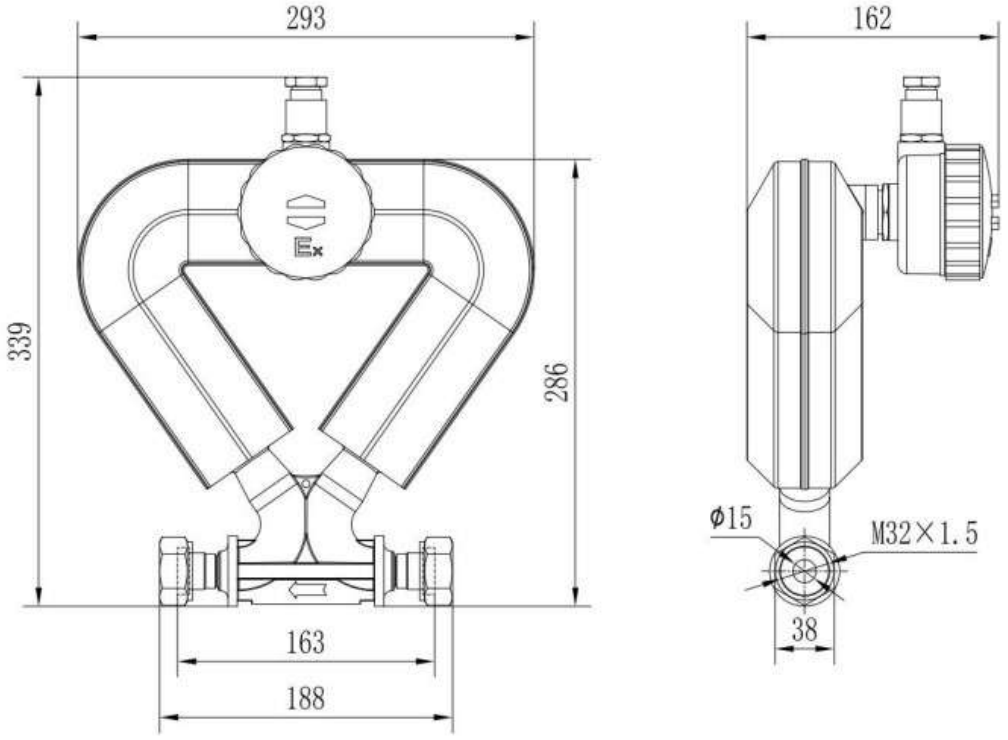


Figure 3 15TA Sensor

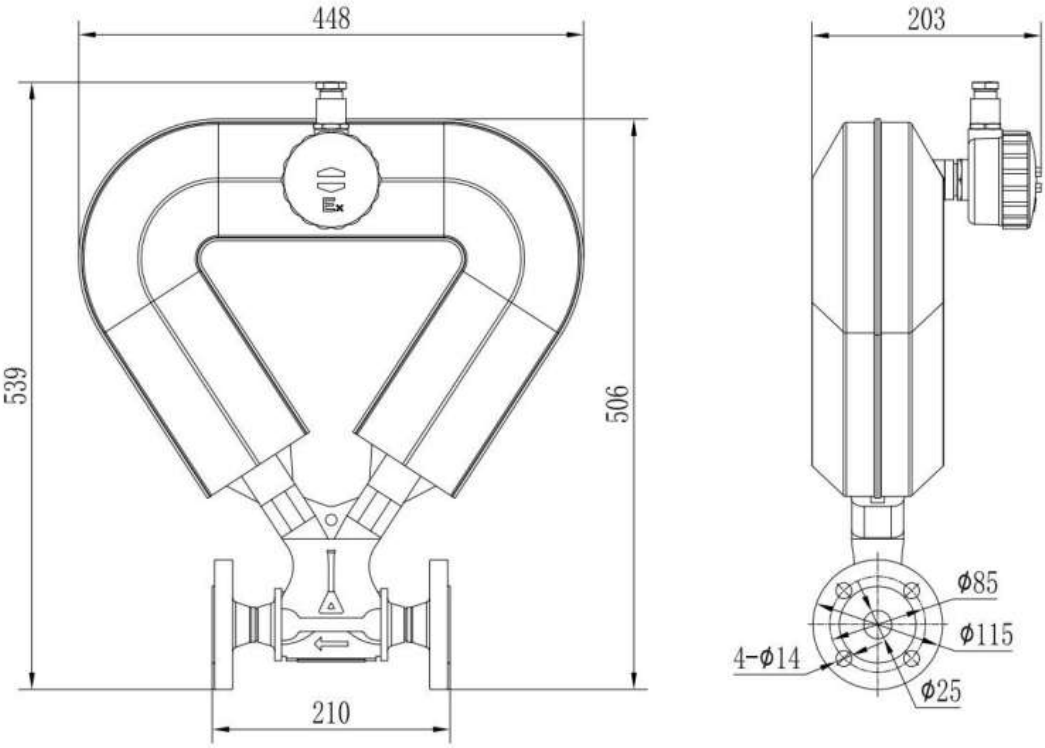


Figure 4 25TASensor

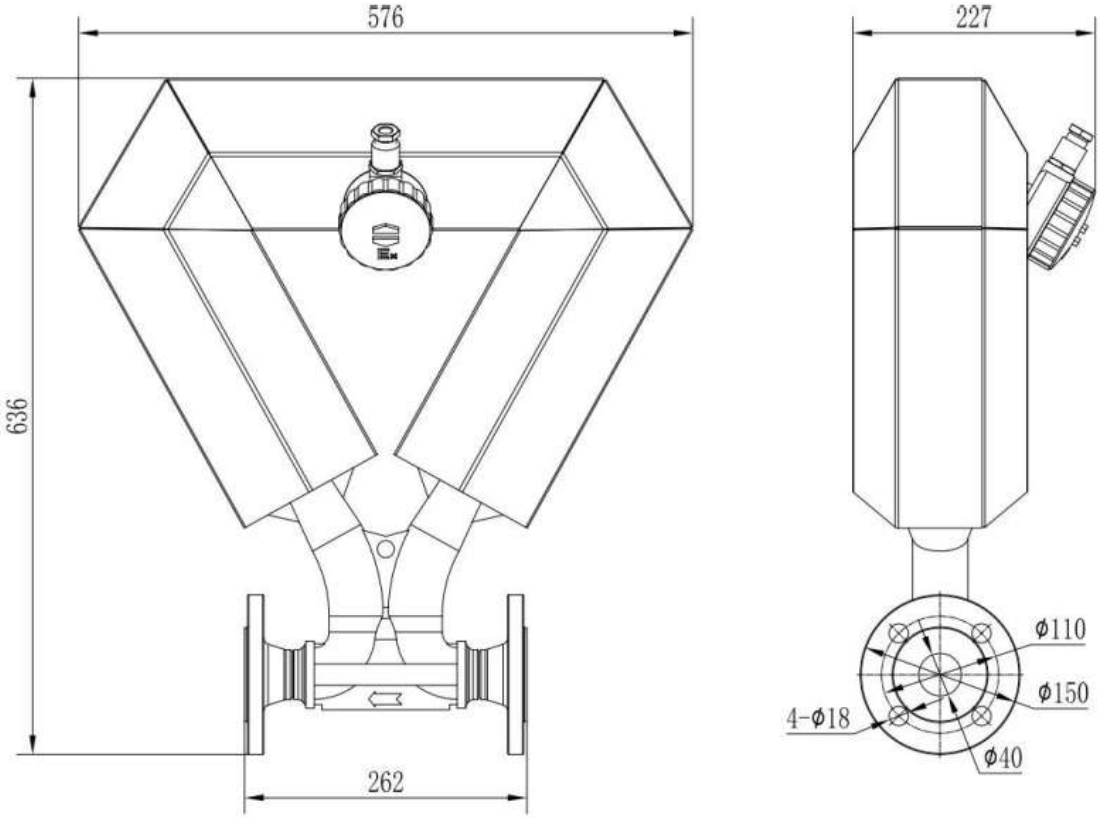


Figure 5 40TA Sensor

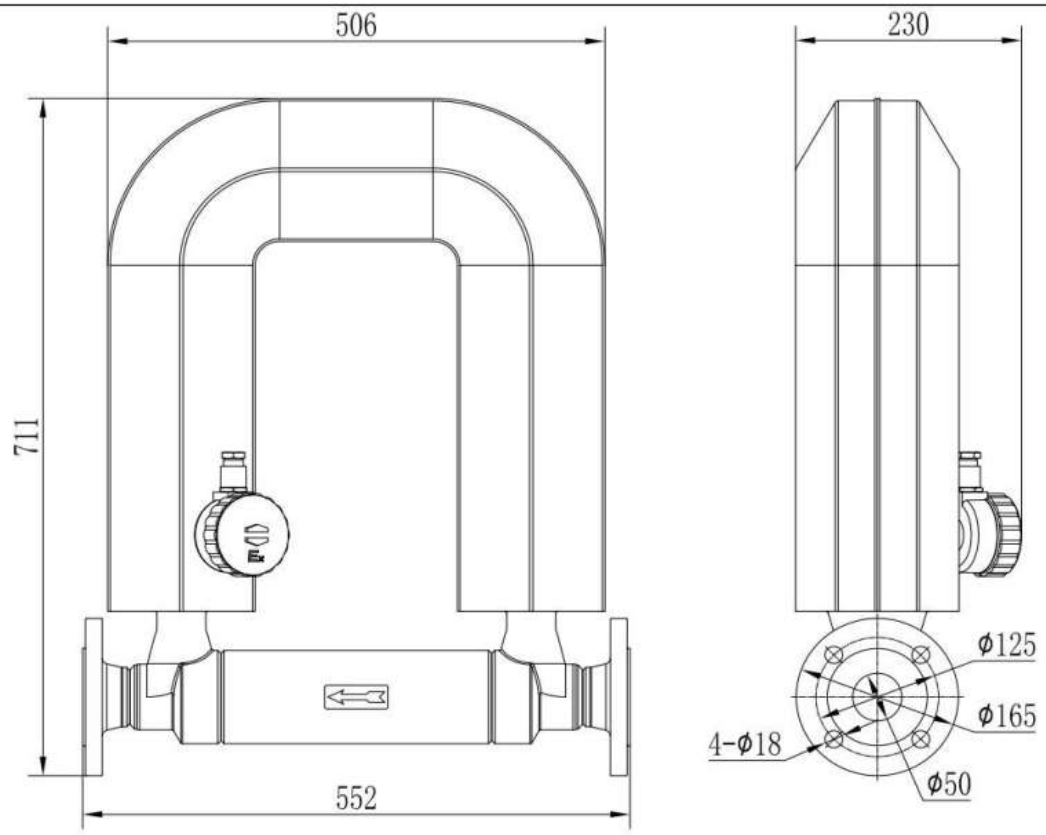


Figure 6 50UA Sensor

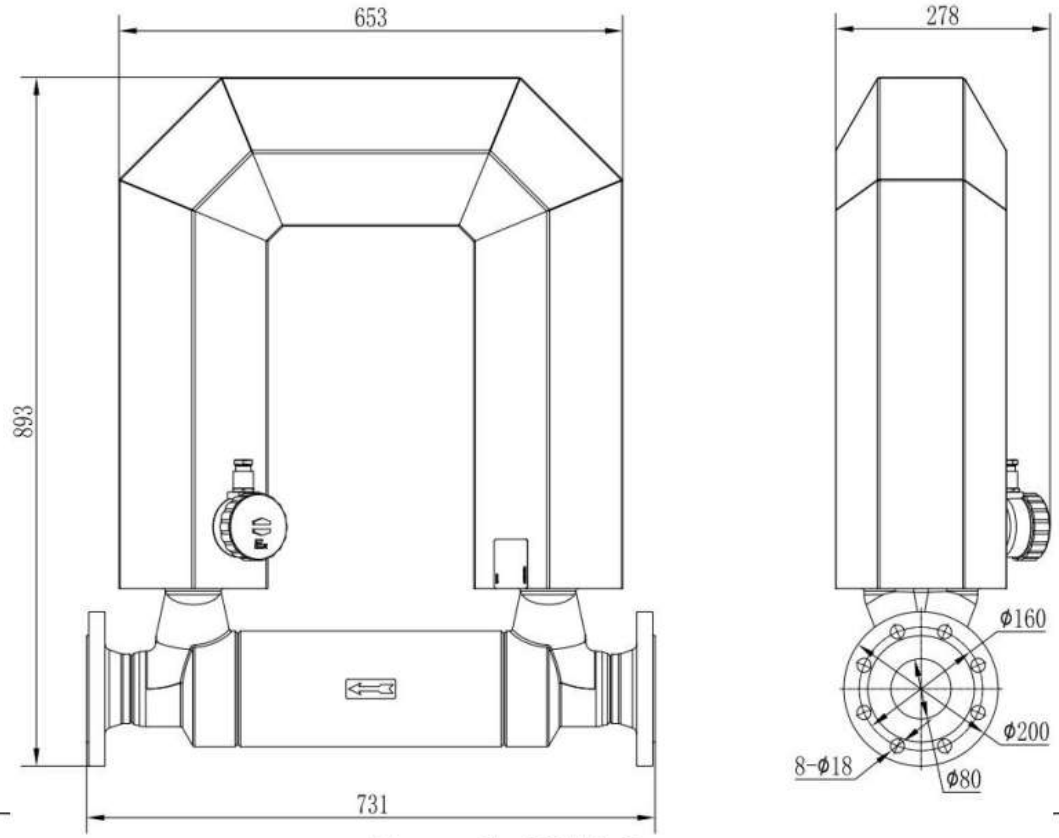


Figure 7 80UA Sensor

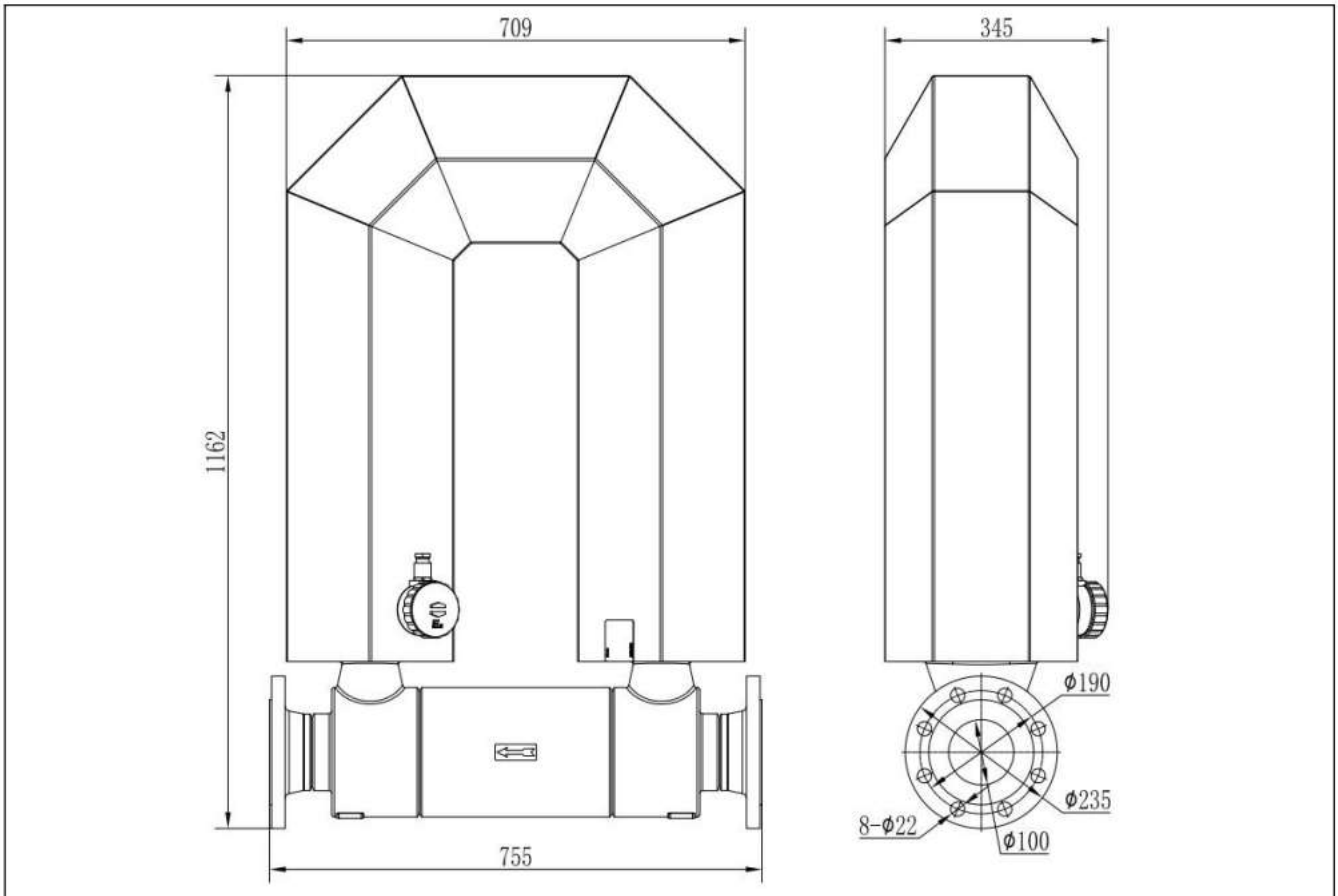
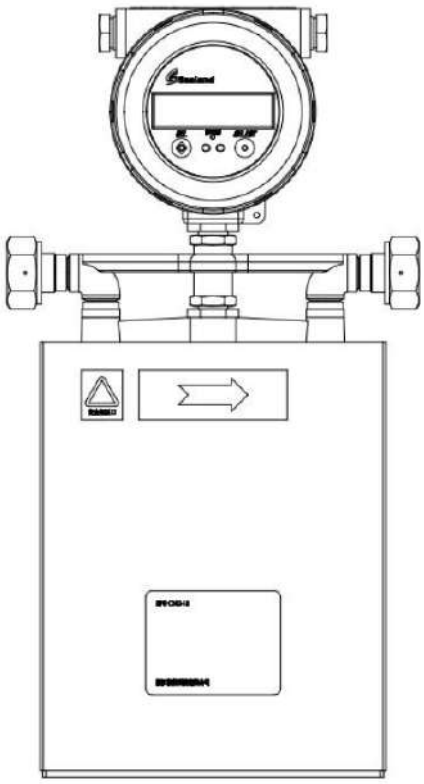


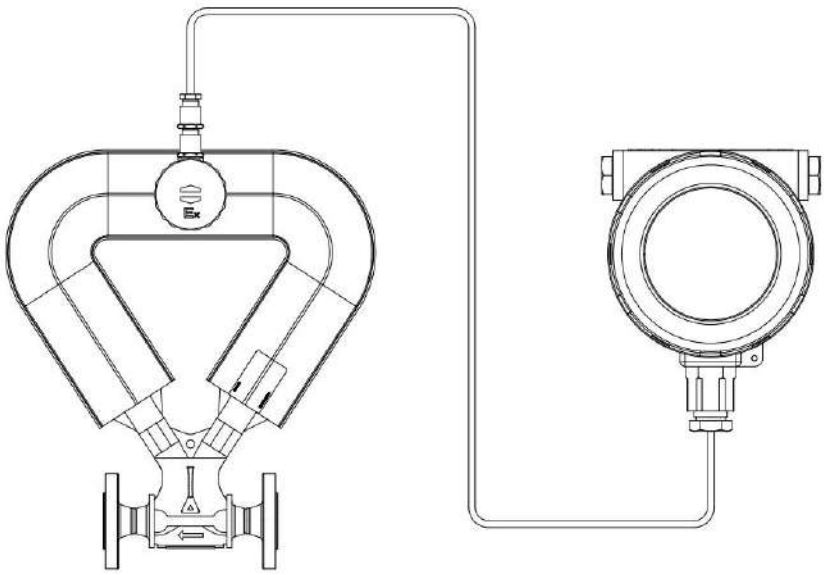
Figure 8 100UASensor

Meter Type



Compact

Remote



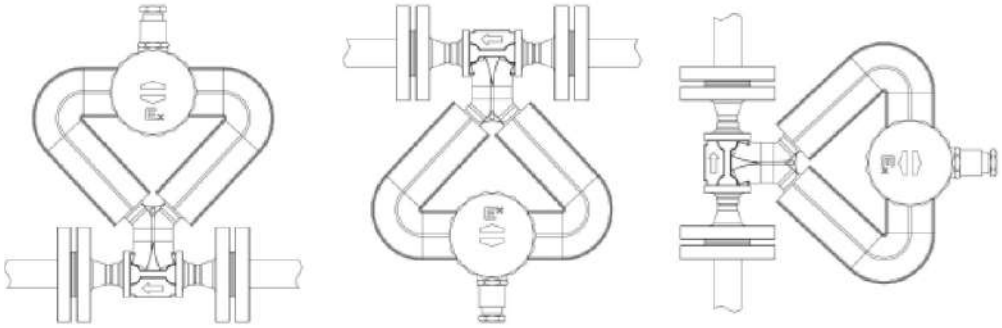
Sensor Installation

Sensor installation has significant effect on the performance of a mass flowmeter. In general the installation should be chosen to ensure the flow tube which is always filled with the process fluid and to prevent accumulation of other medias.

⚠ CAUTION

- Ensure that explosion-proof rating, enclosure rating, and process & ambient temperature limits marked on the nameplate meet or exceed the application requirements
- When a sensor installed horizontally or vertically, flow direction of the process fluid must be consistent with the "Arrow" indicator on the sensor body
- When flagpole installation is adopted , the flow direction of the process fluid must be from bottom to top
- The sensor must be mounted on a firm base plate or with flanges

Typical installations recommended



Upright Installation for Gas	Inverted Installation for Liquid	Flagpole Installation for Slurry

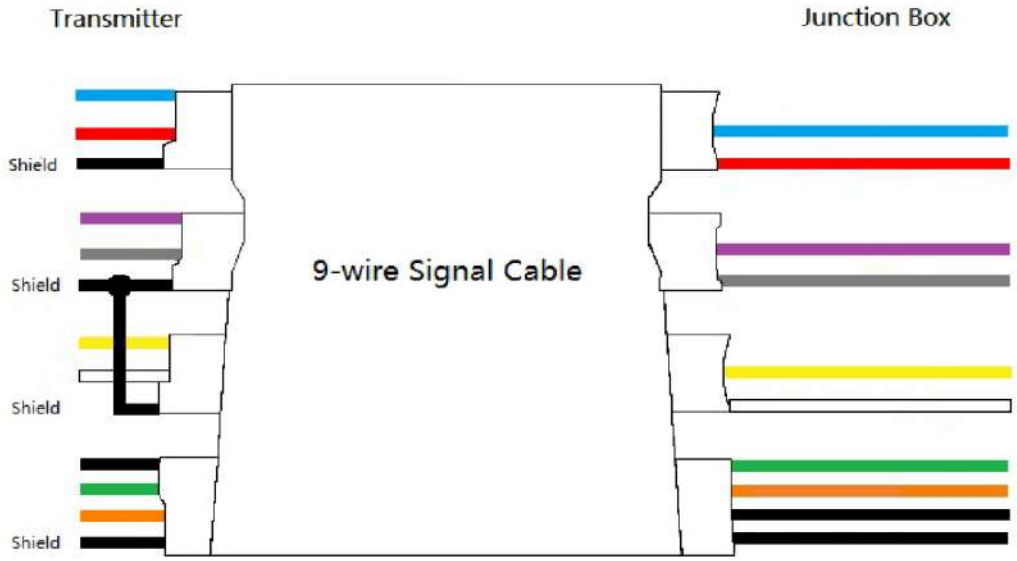
- Upright installation is recommended if the process fluid is a liquid, and the process fluid is easily vaporized. Upright installation prevents the accumulation of vapor or air in the sensor tubes
- Inverted installation is recommended if the process fluid is a liquid with entrained solids, or if the process fluid is a gas which may condense. Inverted installation prevents higher density media from accumulating in the flow tubes
- Flagpole installation is a compromise. It is recommended if the process fluid is a slurry mixture, or if the pipe is to be purged with gas or steam

Wiring, wire shielded signal cable

For the remote mass flowmeter, it's strongly required to use the dedicated 9-wire shielded signal cable to connect the sensor with the transmitter at the installation place. Before conduct the signal cable wiring, please fully understand the wiring terminals in the transmitter and in the Junction Box respectively.

Note:
Must use the dedicated 9-wire shielded cable for the signal wiring. This cable is offered by the manufacturer
Default length of this cable is 3m (10ft), and it can be extended up to 100m (328ft)

DIAGRAM OF THE CABLE WIRING IS SHOWN BELOW



THE TRANSMITTER I/O BOARD WIRING TERMINALS

Code	R+	R-	PE	L+	L-
Color	White	Yellow	Black (Shield)	Gray	Purple
Description	Right Pickoff			Left Pickoff	

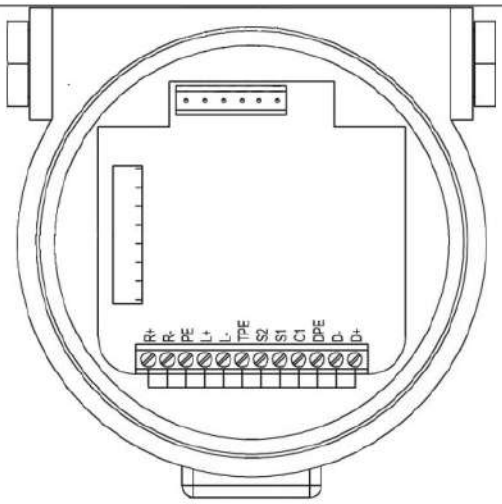
Code	TPE	S2	S1	C1	DPE	D-	D+
Color	Black (Shield)	Black	Green	Orange	Black (Shield)	Red	Blue
Description	Temperature Sensor				Drive Coil		

THE TRANSMITTER I/O BOARD WIRING TERMINALS

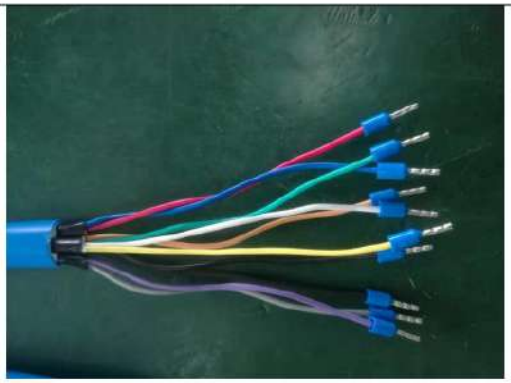
Code	L-	L+	R-	R+
Color	Purple	Gray	Yellow	White
Description	Left Pickoff		Right Pickoff	

Code	D-	D+	TPE	S2	S1	C1
Color	Red	Blue	Black (Shield)	Black	Green	Orange
Description	Drive Coil		Temperature Sensor			

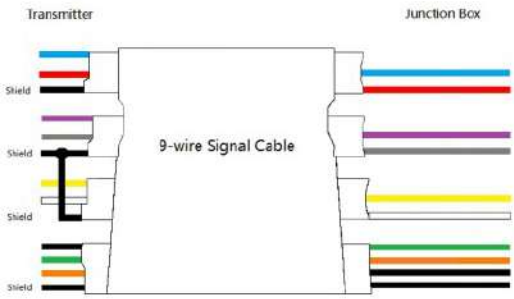
F23 Transmitter



Transmitter I/O Board

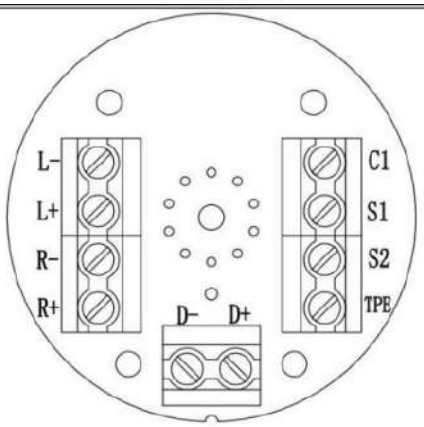


Cable Connecting to Junction Box



9-wire Shielded Signal Cable

Junction Box



Terminal Board

ORDERING INFORMATION

Sensor Model Selection		
Item	**Code**	**Code Description**
Product	RCMF	Reliant Coriolis Mass Flowmeter
Sensor Size □□□□□	06TA	DN06 Max Flow: 20kg/min（water）
	10TA	DN10 Max Flow: 30kg/min（water）
	15TA	DN15 Max Flow: 50kg/min（water） 30 kg/min（CNG）
	20TA	DN20 Max Flow: 120kg/min（water） 70 kg/min（CNG）
	25TA	DN25 Max Flow: 200kg/min（water） 80 kg/min（LNG）
	40TA	DN40 Max Flow: 500kg/min（water）
	50UA	DN50 Max Flow: 1000kg/min（water）
	80UA	DN80 Max Flow: 3000kg/min（water）
	100UA	DN100 Max Flow: 4000kg/min（water）
Flow Tube □	L	316L
	T	Special order
Pressure Rating □□	04	4MPa (40 Bar)
	25	25MPa (250Bar)
	CD	Special order, upon customer's technical requirements
Fluid Temperature □□	1	-196 to +180℃
	2	-50 to +300℃
	3	Special order
Accuracy □	1	±0.10%
	2	±0.15%
	3	±0.20%
	4	±0.50%
Process Connection □	C1	Thread
	C2	Flange
	C3	Special order
Heat Insulation □	0	N/A
	1	Steam heating
	2	Electricity heating
Accessory □	0	N/A
	1	3m (10ft) cable
	2	SST flanges & bolts & nuts + Metal graphite pad + 3m (10ft) cable
	3	Special order

An example of sensor model

RCMF	15TA	L	25	2	1	C1	1	1

Product: RCMF / **Sensor Size:** DN15 mm / **Flow Tube Material:** 316L / **High Pressure**, working pressure ≤25MPa /Fluid Temp.-50 to +300℃ / **Accuracy:** ±0.2% / **Process Connection:** thread, internal thread: G3/4" / **Heat Insulation:** steam heating / **Accessory:** 3m cable

Transmitter Model Selection		
Item	**Code**	**Code Description**
	F23	IP67, Ex d[ib] IIB/IIC T6…T1 Gb（T6 covers of T1…T6）
Display ☐	0	Without display
	1	With display
Power Supply ☐	A	85 to 265VAC, 50/60 Hz
	D	12 to 24VDC（±5%）
Interface & Signal Output ☐	B	RS-485
	N	Pulse/Frequency + RS-485
	I	Analog + RS-485
	H	HART (optional) + Analog +Pulse /Frequency
	T	Special order
Conduit Connection ☐	W	N/A
	M	M20*1.5, or 1/2-inch NPT (optional) - no gland (default)
	T	ATEX / IEC Ex approved conduit connection
Meter Type ☐	0	Remote
	1	Compact

An example of transmitter model

F23	1	A	I	M	0

Transmitter: F23 / Display: with / **Power Supply:** 85 to 265VAC / **Signal Output:** 4-20mA / **Conduit Connection:** M20*1.5 / **Meter Type:** Remote

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