



## **BEST MEASUREMENT PERFORMANCE**

- Best measurement performance on liquid mass flow, and density measurements
- Optimum gas mass flow measurement
- Reliable two-phase flow measurement for the most complicate applications
- Excellent design to reduce installation cost and eliminate daily maintenance

## **BEST FIT- FOR- APPLICATION**

- Wide range of line size from DN1 to DN250
- Wide application of hygienic, cryogenic, high pressure and high temperature
- Wide variety of I/O and expansive communication protocols

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## OVERVIEW

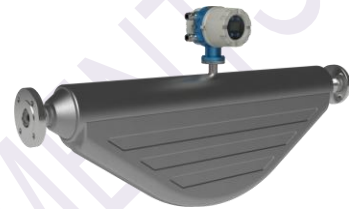
Reliant Coriolis mass flowmeter (**RCMF**) provides best mass flow, density and temperature measurement performance, and also calculate volume flow, total flow and fluid composition in real-time. Currently it has three styles available which are TB, UB, and VB series; meanwhile each series has its own compact and remote meters.



TB



UB



VB

In general, a typical Reliant 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.

## DESIGN & BENEFIT

- Delicate flow tube structure design
- Dedicated ASIC with digital signal processor (DSP)
- Dynamic vibration balance (DVB) technology employed
- 2-point compensation for temperature and process pressure respectively
- ✓ Amplify the impact of Coriolis force and deliver high sensitivity
- ✓ Guarantee the accurate measurement performance both on liquid and gas
- ✓ Enhance the measurement stability
- ✓ Improve the measurement performance

## APPLICATION

Reliant mass flowmeter is suitable for the most complex and challenging environment for liquid, gas and slurry applications.

Process fluid	Typical application	Industries	
<ul style="list-style-type: none"> <li>● Liquid</li> <li>● Gas</li> <li>● Slurry</li> </ul>	<ul style="list-style-type: none"> <li>■ Custody Transfer</li> <li>■ Reactor Feed Ratio</li> <li>■ Density Measurement</li> <li>■ Batch Control</li> </ul>	<ul style="list-style-type: none"> <li>◆ Chemicals</li> <li>◆ Food &amp; Beverages</li> <li>◆ Machinery</li> <li>◆ Minerals &amp; Mining</li> <li>◆ Oil &amp; Gas</li> </ul>	<ul style="list-style-type: none"> <li>◆ Pharmaceuticals</li> <li>◆ Power Plant</li> <li>◆ Pulp &amp; Paper</li> <li>◆ Water</li> <li>◆ Waste Water</li> </ul>

## MEASUREMENT PRINCIPLE

Reliant Coriolis mass flowmeter works on Coriolis effect principle. It can directly measure mass flow, density, temperature online and also calculate volume flow, total flow and fluid composition in real-time.

### Mass flow measurement

The flow tubes are forced to oscillate producing a sine wave. When no flow passing through, the two tubes vibrate without any phase shift generated. When flow is passing, the Coriolis forces cause the tubes to twist resulting in a phase shift. The time difference between the waves is measured and is directly proportional to the mass flow rate.

### Density measurement

The flow tubes are vibrated at their natural frequency. A change in the mass of the fluid contained inside the tubes causes a corresponding change to the tube natural frequency. The frequency change of the tube is used to calculate density.

### Temperature measurement

Temperature is a measured variable that is used as a signal output. The temperature is also used internal to compensate temperature influences on the material elasticity.

## SENSOR MATERIAL

The general selection of wetted parts and of non-wetted parts of a typical Reliant mass flowmeter is as follows:

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

**Note:** For special material selection, please refer to **ORDERING INFORMATION** or contact our sales for the details.

## ACCURACY and REPEATABILITY

### Reference operating conditions

For determining the performance capabilities of Reliant mass flowmeters, the following conditions need to be concerned:

- Flow measurement accuracy includes the combined effects of linearity, repeatability, hysteresis and other non-linearities
- Measurement performance is based on calibration with water as the process fluid at typical process conditions (20 to 30°C and 200 to 400 KPa)
- Measurement performance is based on collected frequency or pulse outputs by the flowmeter

### Accuracy and repeatability on liquids / slurries

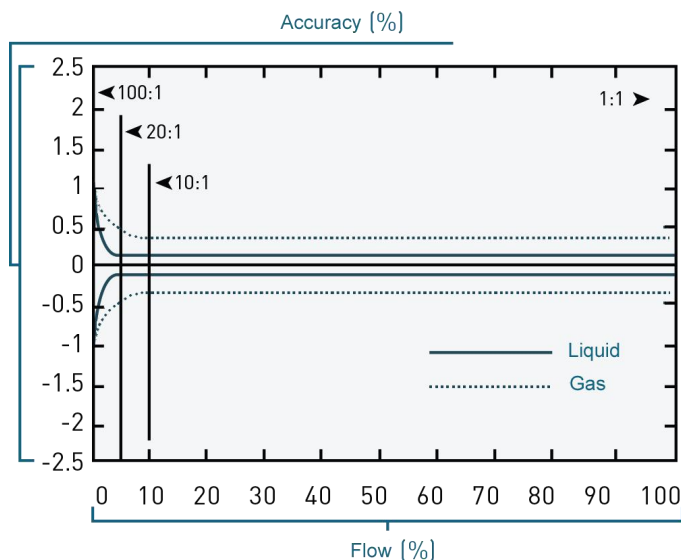
Performance specification	Standard
Mass flow/volume flow accuracy	± 0.10% of rate
Mass flow/volume flow repeatability	≤ 0.05% of rate
Density accuracy	± 0.0005 g/cm <sup>3</sup> (0.5 kg/m <sup>3</sup> ) - TB&UB
	± 0.001 g/cm <sup>3</sup> (1.0 kg/m <sup>3</sup> ) - VB
Density repeatability	± 0.0002 g/cm <sup>3</sup> (0.2 kg/m <sup>3</sup> ) - TB&UB
	± 0.0005 g/cm <sup>3</sup> (0.5 kg/m <sup>3</sup> ) - VB
Density range	0.1 to 3.0 g/cm <sup>3</sup> (100 to 3,000kg/m <sup>3</sup> ) - TB&UB
	0.1 to 2.5 g/cm <sup>3</sup> (100 to 2,500kg/m <sup>3</sup> ) - VB
Temperature accuracy	±1°C (±1.8°F)
Temperature repeatability	±0.1°C (± 0.18°F)
Temperature range	-240 to +400°C (400 to 752°F)

### Accuracy and repeatability on gases

Performance Specification	Standard
Mass flow/volume flow accuracy	± 0.35% of rate - TB&UB
	± 0.50% of rate - VB
Mass flow/volume flow repeatability	≤ 0.17% of rate - TB&UB
	≤ 0.25% of rate - VB
Gas density	N/A
Temperature accuracy	±1°C (±1.8°F)
Temperature repeatability	±0.1°C (± 0.18°F)
Temperature range	-240 to +400°C (400 to 752°F)

### Typical curve

The following figure and curve illustrate accuracy, repeatability and pressure loss for water:



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

### SENSOR SIZE and LIQUID FLOW RANGE

Style	Line Size		Model	Liquid		K-gas coefficient
	inch	mm		lb/min	kg/h	
TB	1/2	15	RCMF-TB-015N	37	1,000	90
			RCMF-TB-015H	220	6,000	140
	1	25	RCMF-TB-025N	220	6,000	140
			RCMF-TB-025H	735	20,000	140
UB	1/25	1	RCMF-US_001N	0.6	16	60
	1-1/2	40	RCMF-UB-040N	735	20,000	140
			RCMF-UB-040H	1,100	30,000	140
	2	50	RCMF-UB-050N	1,100	30,000	140
			RCMF-UB-050H	2,200	60,000	160
	3	80	RCMF-UB-080N	2,200	60,000	160
			RCMF-UB-080H	6,600	180,000	215
	4	100	RCMF-UB-100N	3,700	100,000	200
			RCMF-UB-100H	10,300	280,000	230
	6	150	RCMF-UB-150N	11,000	300,000	230
RCMF-UB-150H			23,515	640,000	240	
8	200	RCMF-UB-200N	40,425	1,100,000	250	
10	250	RCMF-UB-250N	66,000	1,800,000	300	
VB	1/12	2	RCMF-VB-002	3	80	60
	3/16	5	RCMF-VB-005	11	300	70
	38	10	RCMF-VB-010	37	1000	70
	1/2	15	RCMF-VB-015	220	6,000	70
	1	25	RCMF-VB-025	660	18,000	70

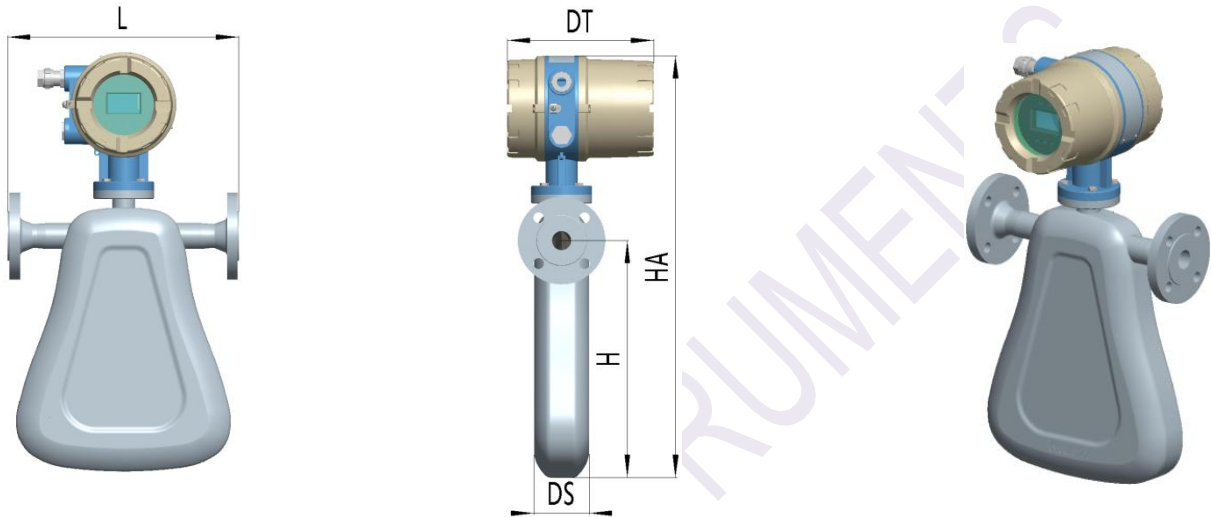
**Gas Flow Range = Liquid flow range × gas process density / K**

## DIMENSION

The following dimensional drawings provide a basic guideline for sizing and planning. The representative of a 316L stainless steel model fitted with ANSI 150 RF flange and T1 transmitter.

### 1. Compact TB

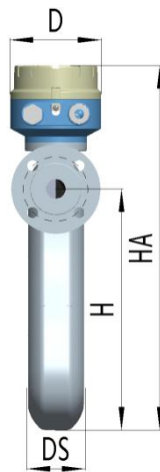
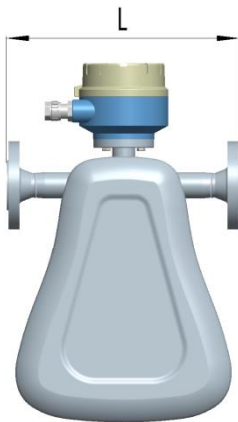
unit: **inch** (mm)



Model	Line size	L	H	HA	DS	DT
RCMF-TB-015N	1/2 (15)	10-1/16 (256)	9-1/16 (230)	18-15/16 (480)	2-1/2 (64)	7-9/16 (192)
RCMF-TB-015H	1/2 (15)	12 (304)	12-5/8 (320)	22-7/16 (570)	2-13/16 (72)	7-9/16 (192)
RCMF-TB-025N	1 (25)	12 (304)	12-5/8 (320)	22-7/16 (570)	2-13/16 (72)	7-9/16 (192)
RCMF-TB-025H	1 (25)	22-5/8 (574)	24-15/16 (622)	49-11/16 (795)	4-3/4 (121)	7-9/16 (192)

2. Remote TB

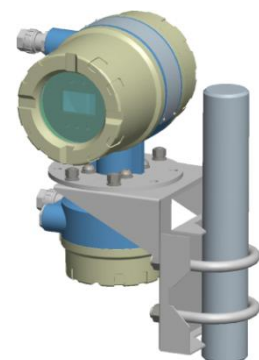
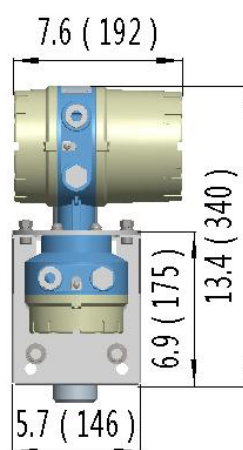
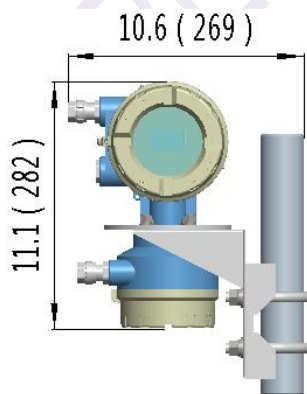
unit: **inch** (mm)



Model	Line size	L	H	HA	DS	D
RCMF-TB-015N	1/2 (15)	10-1/16 (256)	9-1/16 (230)	15-5/8 (397)	2-1/2 (64)	4-5/8 (117)
RCMF-TB-015H	1/2 (15)	12 (304)	12-5/8 (320)	19-1/8 (485)	2-13/16 (72)	4-5/8 (117)
RCMF-TB-025N	1 (25)	12 (304)	12-5/8 (320)	19-1/8 (485)	2-13/16 (72)	4-5/8 (117)
RCMF-TB-025H	1 (25)	22-5/8 (574)	20-9/16 (522)	28-1/32 (712)	4-3/4 (121)	4-5/8 (117)

3. T1 Transmitter

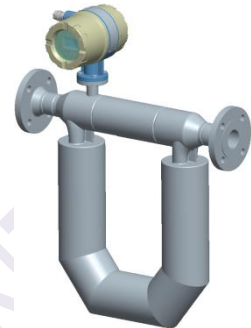
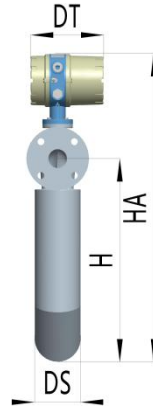
unit: **inch** (mm)





#### 4. Compact UB

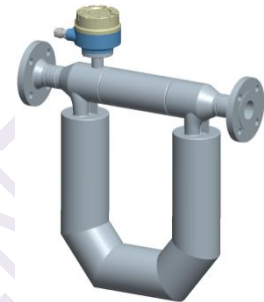
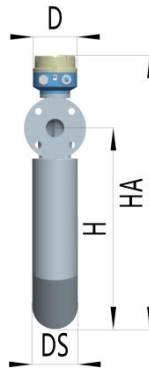
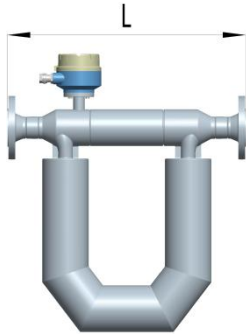
unit: **inch** (mm)



Model	Line size	L	H	HA	DS	DT
RCMF-UB-040N	1-1/2 (40)	22-5/8 (574)	20-9/16 (522)	31-9/32 (794)	4-3/4 (121)	7-9/16 (192)
RCMF-UB-040H	1-1/2 (40)	24-1/2 (622)	21-3/8 (542)	32-7/32 (817)	4-3/4 (121)	7-9/16 (192)
RCMF-UB-050N	2 (50)	24-1/2 (622)	21-3/8 (542)	32-7/32 (817)	4-3/4 (121)	7-9/16 (192)
RCMF-UB-050H	2 (50)	27-21/32 (702)	25-15/16 (658)	36-27/32 (936)	5-29/32 (150)	7-9/16 (192)
RCMF-UB-080N	3 (80)	30-1/16 (763)	26-11/16 (678)	38-5/32 (969)	5-29/32 (150)	7-9/16 (192)
RCMF-UB-080H	3 (80)	33-7/16 (850)	33-7/8 (861)	46-11/32 (1,177)	7-23/32 (196)	7-9/16 (192)
RCMF-UB-100N	4 (100)	32-1/4 (822)	28-29/32 (733)	41-5/32 (1,045)	5-29/32 (150)	7-9/16 (192)
RCMF-UB-100H	4 (100)	41-29/32 (1,064)	45-9/32 (1,150)	58-21/32 (1,490)	11-29/32 (302)	7-9/16 (192)
RCMF-UB-150N	6 (150)	45-11/16 (1,160)	39-1/8 (994)	52-13/32 (1,331)	9-21/32 (245)	7-9/16 (192)
RCMF-UB-150H	6 (150)	40-5/16 (1,240)	49-1/2 (1,257)	64-9/16 (1,627)	12-27/32 (326)	7-9/16 (192)
RCMF-UB-200N	8 (200)	49-15/16 (1,268)	49-1/2 (1,257)	64-9/16 (1,627)	12-27/32 (326)	7-9/16 (192)
RCMF-UB-250N	10 (250)	69-5/16 (1,760)	68-15/16 (1,751)	85-3/8 (2,168)	17-1/8 (435)	7-9/16 (192)

5. Remote UB

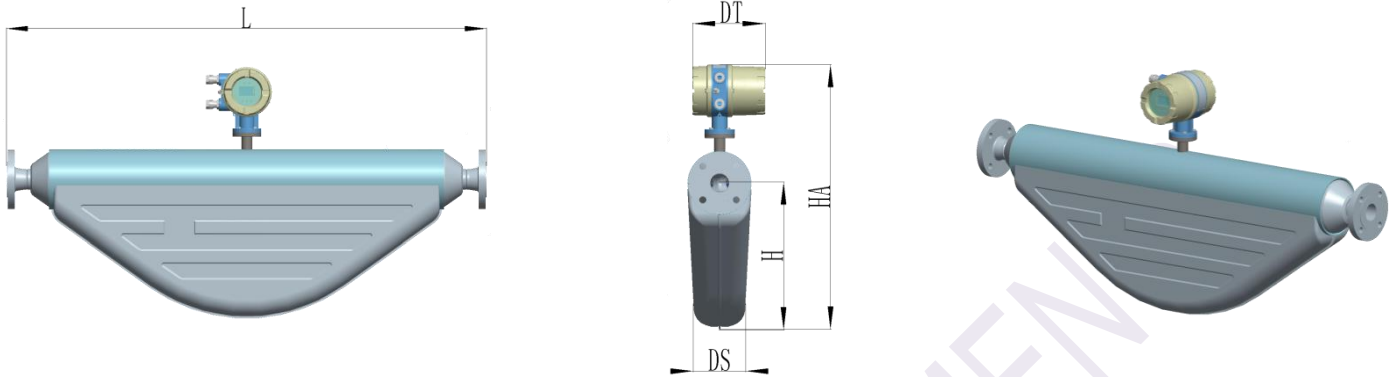
unit: **inch** (mm)



Model	Line size	L	H	HA	DS	D
RCMF-UB-040N	1-1/2 (40)	22-5/8 (574)	20-9/16 (522)	28-1/32 (712)	4-3/4 (121)	4-5/8 (117)
RCMF-UB-040H	1-1/2 (40)	24-1/2 (622)	21-3/8 (542)	28-15/16 (735)	4-3/4 (121)	4-5/8 (117)
RCMF-UB-050N	2 (50)	24-1/2 (642)	21-3/8 (542)	28-15/16 (735)	4-3/4 (121)	4-5/8 (117)
RCMF-UB-050H	2 (50)	27-21/32 (702)	25-15/16 (658)	33-5/8 (854)	5-29/32 (150)	4-5/8 (117)
RCMF-UB-080N	3 (80)	30-1/16 (763)	26-11/16 (678)	34-15/16 (887)	5-29/32 (150)	4-5/8 (117)
RCMF-UB-080H	3 (80)	33-7/16 (850)	33-7/8 (861)	43-1/8 (1,095)	7-23/32 (196)	4-5/8 (117)
RCMF-UB-100N	4 (100)	32-1/4 (822)	28-29/32 (733)	36-27/32 (963)	5-29/32 (150)	4-5/8 (117)
RCMF-UB-100H	4 (100)	41-29/32 (1,064)	45-9/32 (1,150)	55-7/16 (1,408)	11-29/32 (302)	4-5/8 (117)
RCMF-UB-150N	6 (150)	45-11/16 (1,160)	39-1/8 (994)	49-3/16 (1,249)	9-21/32 (245)	4-5/8 (117)
RCMF-UB-150H	6 (150)	40-5/16 (1,240)	49-1/2 (1,257)	60-13/16 (1,545)	12-27/32 (326)	4-5/8 (117)
RCMF-UB-200N	8 (200)	49-15/16 (1,268)	49-1/2 (1,257)	60-13/16 (1,545)	12-27/32 (326)	4-5/8 (117)
RCMF-UB-250N	10 (250)	69-5/16 (1,760)	68-15/16 (1,751)	82-1/8 (2,086)	17-1/8 (435)	4-5/8 (117)

### 6. Compact VB

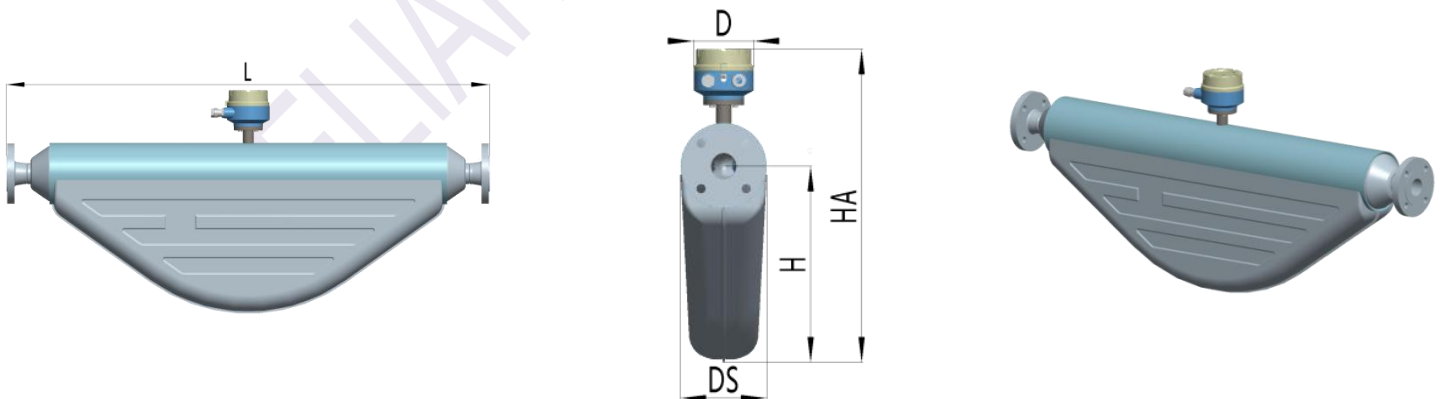
unit: **inch** (mm)



Model	Line size	L	H	HA	DS	DT
RCMF-VB-015	1/2 (15)	17-1/2 (444)	7-1/2 (190)	17-4/5 (452)	3-1/2 (89)	7-9/16 (192)
RCMF-VB-025	1 (25)	17-1/2 (444)	7-1/2 (190)	17-4/5 (452)	3-1/2 (89)	7-9/16 (192)

### 7. Remote VB

unit: **inch** (mm)



Model	Line size	L	H	HA	DS	D
RCMF-VB-015	1/2 (15)	17-1/2 (444)	7-1/2 (190)	14-9/16 (370)	3-1/2 (89)	4-5/8 (117)
RCMF-VB-025	1 (25)	17-1/2 (444)	7-1/2 (190)	14-9/16 (370)	3-1/2 (89)	4-5/8 (117)

## SENSOR INSTALLATION

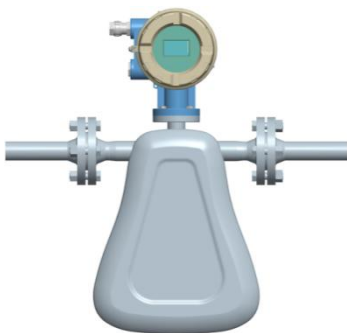
Sensor installation has significant effect on the performance of a mass flowmeter. In general the installation should be chosen to ensure the flow tube which is always filled with the process fluid and to prevent accumulation of other media.



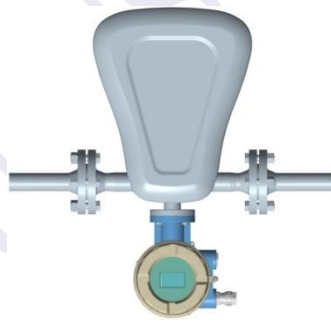
### Warning

- Ensure the explosion-proof class marked on the nameplate to meet or exceed the required rating of the relevant installation environment.
- Ensure that the enclosure rating indicated on the nameplate to meet the requirements of the installation environment.
- Ensure that the ambient and process temperature ranges marked on the nameplates to meet the application requirements.

### Typical installations recommended



**Upright** installation for liquid



**Inverted** installation for gas



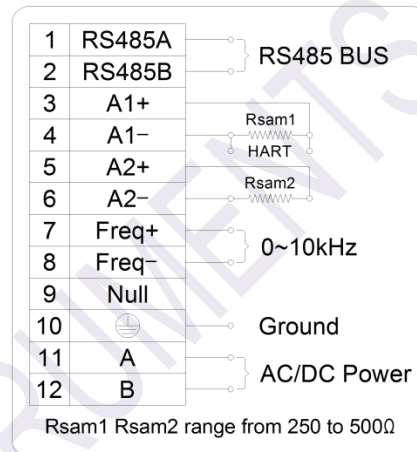
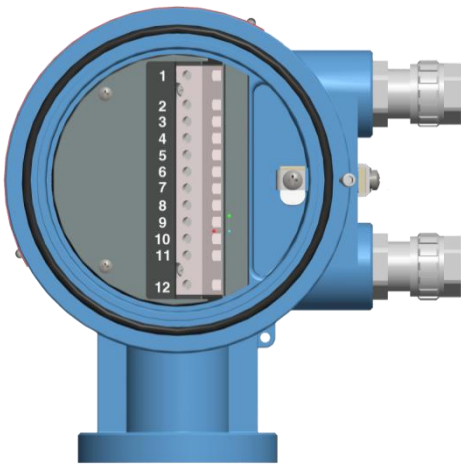
**Flagpole** installation for slurry

1. 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
2. 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
3. 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

### 1. Internal wiring for the Reliant compact mass flow meter

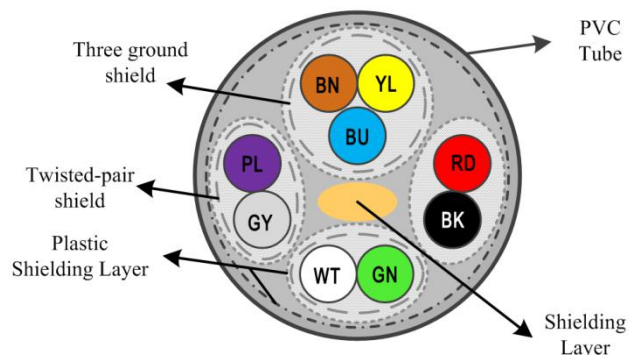
- Wiring between sensor & transmitter is complete before the meter leaves the factory
- Customers do not need to do wiring on site after installation
- T1 transmitter terminals are illustrated below



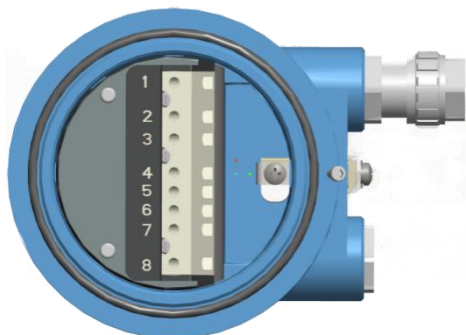
T1 transmitter terminals

### 2. Cable wiring for the Reliant remote mass flowmeter

- Only using Reliant dedicated 9-wire cable to connect the sensor with its transmitter
- Customer needs to do wiring job on site after sensor installation complete
- The cable is connected to the terminals of the remote junction box; After that, it's connected to the transmitter terminals
- Standard cable length is 5m, and the longest cable is less than 100m
- The Reliant dedicated 9-wire cable section is illustrated below



The 9-wire cable section



Label	Definition	Description	Cable color
1	D+	Drive signal+	Red
2	D-	Drive signal-	Black
3	L+	Left pick up signal+	Purple
4	GND	Pick up signal ground	Grey+Green
5	R+	Right pick up signal+	White
6	TI	Temperature current	Brown
7	TEMP	Temperature pick up	Yellow
8	TGND	Temperature ground	Blue
Non	⊕	Shielding ground	Non

Remote junction box terminals

## GROUNDING

### 1. Grounding through sensor terminal

- If the process piping is grounded, the sensor can be grounded directly to the pipe system

### 2. Grounding through transmitter terminal

- If the pipeline is not conductive or otherwise ungrounded, the transmitter grounding terminal can be directly connected with the instrument protection grounding point

## SPECIFICATION

<b>Accuracy</b>	Liquid: $\pm 0.10\%$ , $\pm 0.15\%$ , $\pm 0.20\%$ Gas: $\pm 0.35\%$
<b>Repeatability</b>	0.05%
<b>Line size</b>	DN1 to DN250 (1/25" to 10")
<b>Process pressure</b>	Up to 25MPa (250Bar)
<b>Process connection material</b>	304 stainless steel 316L stainless steel Hastelloy C22
<b>Flow tube</b>	316 stainless steel Hastelloy C22
<b>Enclosure rating</b>	IP65, IP67, IP68 (remote meter only)
<b>Cable length</b>	5-100m (remote meter only)
<b>Process temperature</b>	-40 to +356°F (-40 to +180°C) with LCD display -40 to +662°F (-40 to +350°C) without LCD display
<b>Storage</b>	-58 to +158°F (-50 to +70°C)
<b>Ambient temperature</b>	-13 to +140°F (-25 to +60°C) with LCD display -40 to +185°F (-40 to +85°C) without LCD display
<b>Meter type</b>	Compact Remote
<b>Power supply</b>	85-265VAC 18-36VDC Self-switching
<b>Power consumption</b>	$\leq 20w$
<b>Signal output</b>	Frequency: 0 to 10KHz Analog: 4-20mA, Error: $\leq \pm 0.002mA$ Communication: HART or Modbus RTU over 485
<b>Conduit connection</b>	M20×1.5, 1/2" NPT
<b>Approval and certification</b>	CSA, CE, PCEC
<b>Ex-approval</b>	Ex d ib IIC T6 Gb (under certification)

## ORDERING INFORMATION

Code	Product Description	Notes
RCMF	Reliant Coriolis Mass flowmeter	
Code	Tube	Notes
TB	Triangle sharp tube	
UB	U sharp tube	
VB	V sharp (or called Micro-bend tube)	
Code	Certification	Notes
S	No Ex-proof certified or required	
H	Ex-proof certificate required	CSA/ATEX/IEC Ex (under certification)
Code	Meter Type & Cable Length	Notes
000	Compact meter	
005 - 100	Remote meter	Standard cable: 5m Longest length: less than 100m
Code	Line Size (DN)	Notes
001 - 250	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 (inch)	
	1, 2, 5, 10, 15, 20, 25, 40, 50, 80, 100, 150, 200, 250 (mm)	
Code	Accuracy	Notes
0	±0.10%	
1	±0.15%	
2	±0.20%	
3	±0.35%G	Gas only
4	±0.5%G	
5	±0.25%G	
Code	Flow Tube Material	Notes
1	316L Stainless steel	
3	Hastelloy C22	
9	Customer specify	
Code	Flow Tube Pressure Rating	Notes



L04	CLASS 300# (4.0MPa)	
M10	CLASS 600# (10MPa)	
X	Customer specify	
Code	Process Connection Material	Notes
1	304 stainless steel	
2	316L stainless steel	
4	Hastelloy C22	
9	Customer specify	
Code	Process Connection Standard	Notes
A0	ASME B16.5 (ANSI) Class 150	
A1	ASME B16.5 (ANSI) Class 300	
A2	ASME B16.5 (ANSI) Class 600	
C0	GB/T 9115 PN 2.5 MPa	
C1	GB/T 9115 PN 4.0 MPa	
C2	GB/T 9115 PN 6.3 MPa	
C3	GB/T 9115 PN 10 MPa	
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	
E0	DIN 11851-SI(mm)	
E1	DIN 11851-US (inch)	
E2	DIN 11864-1 Form A (sanitary) connection	
E3	DIN 11864-2 Form A flange plate with slotted connection	
XX	Customer specify	
Code	Process Temperature of Sensor	Notes
4	-58 to +266°F (-50 to +180°C )	
5	-58 to +482°F (-50 to +250°C )	
9	Customer specify	
Code	Enclosure Rating	Notes
1	IP65	
2	IP67	
3	IP68	



Code	Power Supply	Notes
0	24VDC	
1	220VAC 50/60Hz	
2	Self-switching	22VDC/AC to 245VDC/AC, 50/60Hz
Code	Display	Notes
0	No display, no button	
1	With display, with button	
Code	Signal Output	Notes
0	Analog + Pulse/Frequency+Modbus	
1	Analog+ Pulse/Frequency + HART	
2	Analog+ Pulse/Frequency + RS485	
3	Analog+ Pulse/Frequency + Profibus	
4	Analog+ Pulse/Frequency + Fieldbus	
Code	Batch Control	Notes
N	N/A	No batch function on T1 transmitter
Code	Conduit Connection	Notes
N	1/2"NPT	
M	M20×1.5	
X	Customer specify	
Code	Language	Notes
E	English	Currently, only English language is available for the global market
C	Chinese	
Code	Capacity Option	Notes
N	Standard	Default setting
H	High capacity	Must be verified
Code	Transmitter	Notes
T1	Transmitter, version 1.0	

## CONTACT INFORMATION

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