Goldcard TANCY

TVF Vortex Flowmeter

天信仪表集团有限公司

Tancy Instrument Group Co.,Ltd.

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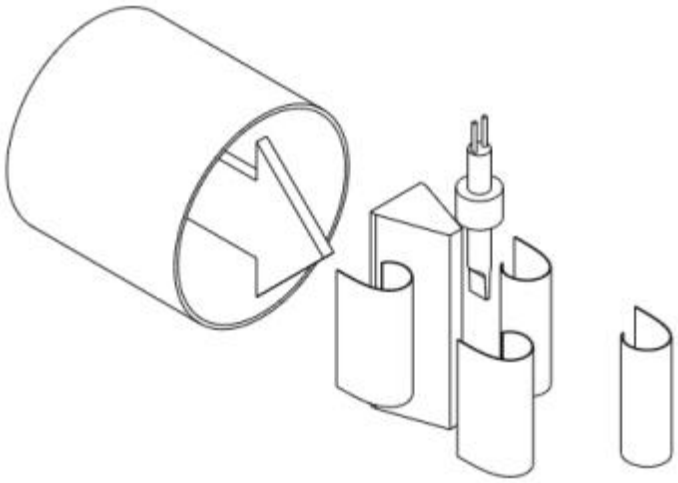
1. Measurement principle

1.1 Product features and application areas

- Measurement is independent of the density and viscosity of the medium within a certain Reynolds number range.
- No moving parts, simple structure, safe and reliable.
- Measures gases, liquids, and vapors in multiple application scenarios.
- Accuracy class 1.0, measuring range ≥ 1 0:1.
- There are various structural forms, including flange pipe section type, clamp-on type, integrated transmitter type, a remote type, etc.
- It has a signal processing technology that is resistant to vibration interference and has excellent anti-vibration performance.
- High-definition LCD display with backlight.
- Supports analog output, multiple digital outputs and RS485 -Modbus and Hart bus communication protocols.
- It can be widely used in used in petroleum, chemical, electric power, metallurgy, food, medicine, and other industrial process flow measurement.

1.2 Measurement principle

According to the Karman vortex principle, the fluid generates vortices alternately on both sides of the Bluff body, and its frequency f is proportional to the flow velocity v within a fairly wide range of Reynolds numbers. The sensor (accelerometer) in the flowmeter senses the pressure fluctuations of the vortex and generates an equivalent voltage corresponding to its frequency, which is then processed by the vortex transmitter to determine the fluid flow rate.



Volumetric instantaneous flow $Q = \frac{f}{K} \times 3600$ formula (1)

f is the vortex frequency

K is the flowmeter coefficient, satisfying the accuracy of the coefficient by calibration.

2. Performance specifications

2.1 Performance parameter table

Performance and features		parameter
Nominal diameter DN (mm)		15/25/50/80/100/150/200/250/300
Maximum operating pressure		10MPa
Measuring medium		The measured medium is a single-phase fluid medium, including liquid, gas and steam. The medium meets the strength and corrosion resistance of the instrument body and sensor materials.
Medium temperature		-40℃~ 250℃
Accuracy level		Level 1.0
Repeatability		≤ 0.33%
Range Ratio		≥ 10:1
Body Material		316L
Sensor Material		316L
Vibration resistance		≥ 1g
Shell material		Stainless steel 304/316
Supply voltage		24V DC
Output method		a. RS485 communication interface, standard MODBUS protocol; b. 1 channel 4mA~20mA standard current signal, accuracy 0.25%FS; HART protocol ; c. Frequency/pulse output.
Self-diagnosis alarm		Flow rate upper limit alarm
Installation type		Flange pipe section type, clamp-on type; transmitter integrated type, separate type
Straight pipe section requirements		Upstream straight pipe length ≥ 15 DN Downstream straight pipe length ≥ 5 DN
Protection level		IP66/IP67
Explosion-proof grade		Ex db IIC T6 Gb; Ex ia IIC T4 Ga
Usage Environment	temperature	Universal integrated type: -40℃~ 60℃; Separate type: base meter -40℃~ 60℃; transmitter -40℃~ 60℃ (LCD displays normally above -20℃)
	Relative humidity	5% ~ 95%
	Atmospheric pressure	86 kPa ~ 106 kPa
Storage environment		The instrument should be stored in an environment with a temperature between -40°C and 60°C. A closed place without significant vibration and shock. The place should be free of corrosive substances.

2.2 Measurement range

DN		liquid		gas		steam	
		flow m3 / h	frequency Hz	flow m3 / h	frequency Hz	Q	Q_{max}
15		0.6 ~ 3.6	74.5~ 447	5 ~ 30	620 ~ 3720	6×ρ	5Q
25		1 ~ 10	22.9 ~ 229	8.5 ~ 85	195-1950	12×ρ	$10Q_{min}$
50		4 ~ 40	11.6 ~ 116	29 ~ 290	83.2 ~ 832	34.5×ρ	
80	A	9 ~ 90	7.2 ~ 72	60 ~ 600	52.5 ~ 525	75×ρ	
	B	10 ~ 100	7.9 ~ 79	70 ~ 700	50.2 ~ 502	90×ρ	
100		16 ~ 160	6.0 ~ 60	110 ~ 1100	41 ~ 410	135×ρ	
150		36 ~ 360	4.6 ~ 46	240 ~ 2400	26.3 ~ 263	315×ρ	
200		64 ~ 640	3.5 ~ 35	420 ~ 4200	19.6 ~ 196	562×ρ	
250		100 ~ 1000	2.7 ~ 27	650 ~ 6500	15.4 ~ 154	900×ρ	
300		140 ~ 1400	2.0 ~ 20	1000 ~ 10000	14.1 ~ 141	1200×ρ	

1) Liquid and gas are water and air under reference conditions (101.325 kPa, 20°C).
2) A: Flange pipe section type; B: Clamp-on type.
3) ρ is the steam density, kg/m^3.

3. Environmental conditions

3.1 Vibration resistance

Sine wave vibration, conform to GB/T2423.10 "test Fc" vibration test severity level requirements.

3.2 Shock resistance:

Half-sine wave, in line with GB/T25480 impact test severity level requirements.

3.3 Electromagnetic compatibility (EMC):

Electrostatic discharge (ESD) immunity level 3.
Radio frequency electromagnetic field immunity level 3.
Electrical transient pulse group immunity level 3.
Surge immunity level 2.

4. Process conditions

4.1 Medium temperature range

-40℃~ 250℃

4.2 Medium pressure range

≤ 10MPa

4.3 Reynolds number range

10^4 ~ 10^6

5. Output

5.1 Output signal:

a. RS485 communication interface, standard MODBUS protocol
b. 1 channel 4mA ~ 20mA standard current signal, accuracy 0.25% FS; HART protocol
c. Frequency/pulse output

5.2 Alarm signal:

Alarm for flow rate exceeding the upper limit, frequency 0 ~ 12000Hz can be set

5.3 Communication specification parameters:

Table 2 RS485 communication configuration

name	type	scope	default value
address	Numeric	0-255	2
Baud rate	Options	1200, 2400 , 4800, 9600 , 1 9200	9600
Parity	Options	No parity, odd parity, even parity	No verification

Table 3 Hart communication configuration

name	type	scope	default value
Polling Address	Numeric	0-255	0
Hart function enable	Options	Disable, Enable	Enable

5.4 Low flow cut-off:

Table 4 Low flow cut-off settings

name	type	scope	default value
Resection function	Options	Disable, Enable	Disable
Cut-off value	Numeric	0~ 10000 m3/ ^{h}	0
Cut-off value	Numeric	0~ 10000 m3/ ^{h}	0

6. power supply

6.1 Supply voltage

24 V DC

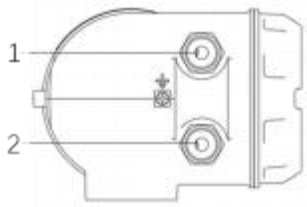
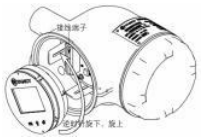
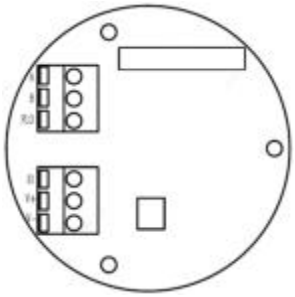
6.2 Power Consumption

﹤ 1W

6.3 Current consumption

Analog output ≤ 22mA, digital output ﹤ 50mA.

6.4 Electrical Connections

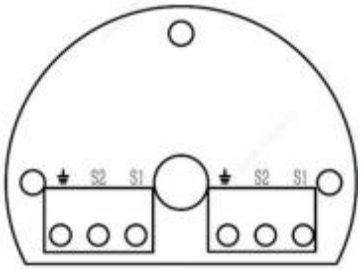
Wiring Instructions	
1. Wires and cables 1) It is recommended to use copper core PVC insulated shielded soft wire, and the cross-sectional area of a single core of the cable should not be greater than 1.5 ^{mm2}. 2) The outer diameter of the cable that can be passed through the M20×1.5 interface is not greater than φ8mm (pre-made cable connector designed for this interface can also be used), and the outer diameter of the cable that can be passed through the NPT1/2 interface is not greater than φ12mm. 3) In high or low temperature environments, use wires or cables that are suitable for the Application temperature 4) In environments containing oils, solvents, corrosive gases or liquids, appropriate wires or cables should be used. **2. Cable laying** 1) Route the wiring as far away from electrical noise sources as possible. 2) Cables should be protected by steel pipes or metal hoses. 3) Signal lines should not be laid in the same steel pipe as power lines; when laying parallel lines, a certain distance should be maintained. **3. Grounding** 1) There are grounding terminals both inside and outside the transmitter. Grounding must meet the level 3 requirements (grounding resistance ﹤ 100Ω).	
Wiring location and requirements	Graphics
Input\output interface: a) Interface size: M20×1.5 (default) or NPT1/2 (specify when ordering). b) Frequency, pulse, RS485 input interface 1. c) 4mA ~ 20mA input line interface 2. d) Power supply input interface 2.	
Transmitter terminal block a) Turn the display module counterclockwise to disconnect the wires b) After wiring, turn the display module counterclockwise again to lock it in place. b) After wiring, the display module will rotate counterclockwise Screw on and lock in place. 	

Remote junction box terminal block

a) The cables of the remote transmitter are configured and connected in accordance with the length required by the user at the factory.

b) After the remote transmitter is mounted, connect the other end of the cable to the remote junction box terminals S1 and S2.

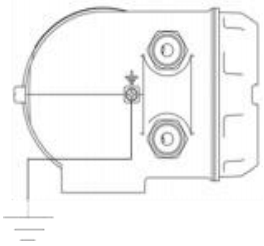
c) Junction box connector size: M20 x 1.5.



Transmitter external grounding:

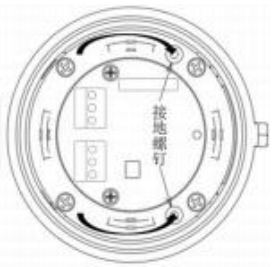
a) The grounding screw and grounding wire should be reliably connected.

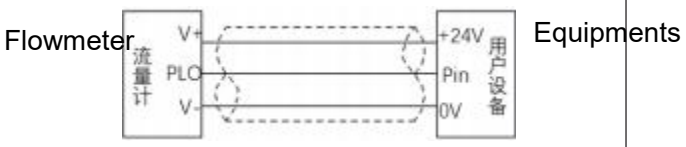
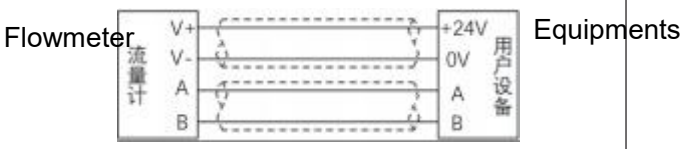
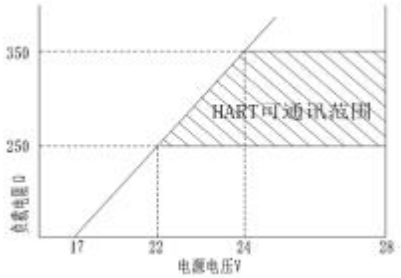
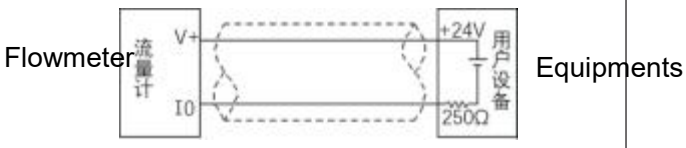
b) It is recommended that the grounding wire be a 500V PVC insulated multi-stranded copper core wire.

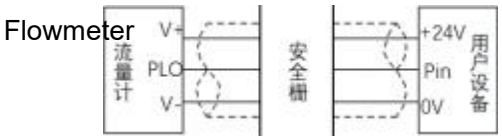
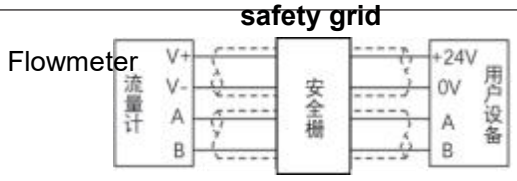
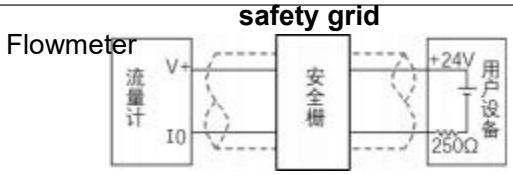


Transmitter internal grounding

The cable shield should be routed along the inner wall of the housing to the grounding screw of the transmitter for reliable connection connection.



Wiring method	Graphics
Pulse/Frequency Output: It is recommended to use 3× $^{0.5mm2}$ Three-core shielded cable.	
RS485 communication: a) It is recommended to use 2×0.5mm2 2-core twisted shielded cable for the signal cable. b) It is recommended to use 2×0.5mm2 two-core shielded cable for power cable.	
Two-wire 4mA ~ 20mA output, with HART Communication: It is recommended to use 2× $^{0.5mm2}$ Two-core shielded cable.  Relationship between 4mA ~ 20mA DC output power supply voltage and load	

Intrinsically safe explosion-proof pulse output It is recommended to use 3× $^{0.5mm2}$ Three-core shielded cable.	
Intrinsically safe explosion-proof 485 communication a) It is recommended that the signal line use 2× $^{0.5mm2}$ Two-core twisted-pair shielded cable. b) It is recommended that the power cable be 2× $^{0.5mm2}$ Two-core shielded cable.	
Intrinsically safe explosion-proof two-wire 4mA ~ 20mA output, with HART communication: a) It is recommended to use 2× $^{0.5mm2}$ Two-core shielded cable. b) The dependence between power supply voltage and load is the same as that of non-intrinsically safe explosion-proof.	

7. Installation

Installation conditions:

1) The flow meter should be installed on a horizontal or vertical fully filled pipe full of medium.

2) When there are flow obstructions in the pipeline, a straight pipe section that meets the requirements should be coaxially configured upstream of the flow meter.

3) The sealing gasket shall not protrude into the pipeline within the straight pipe section.

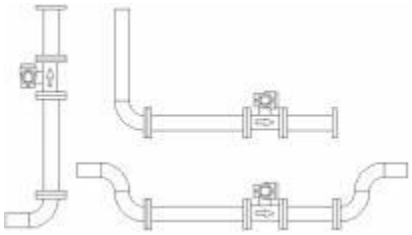
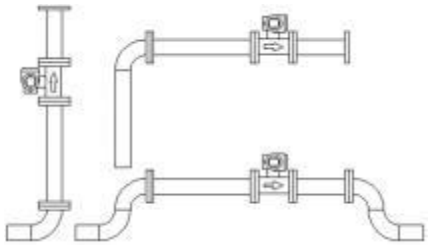
4) Keep away from vibration sources, strong electromagnetic fields, etc. that may interfere with the flow meter's working position.

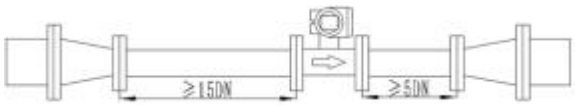
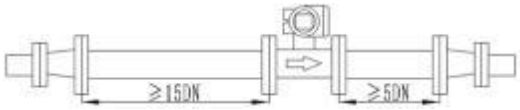
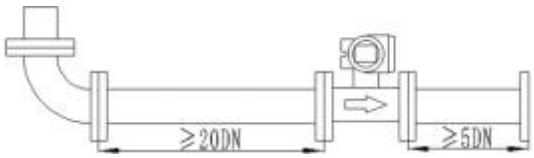
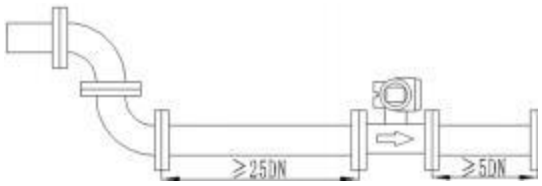
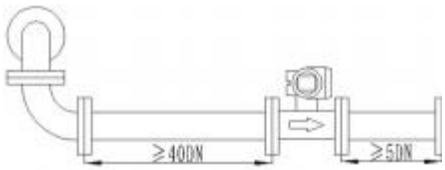
5) When the liquid contains gas or solid, or the gas contains liquid or solid impurities which affect the normal operation of the flow meter, a corresponding equipment for collecting gas, liquid and filtering solid impurities should be installed upstream of the flow meter .

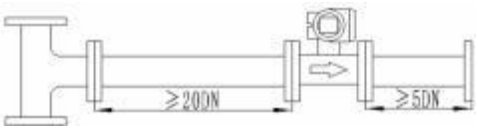
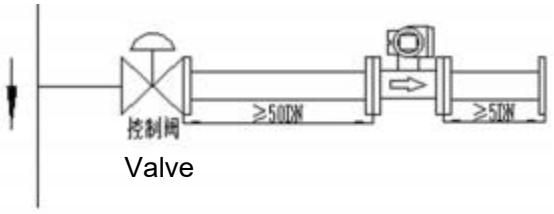
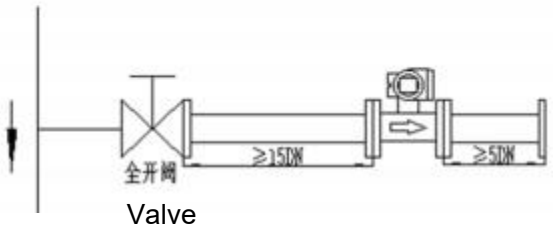
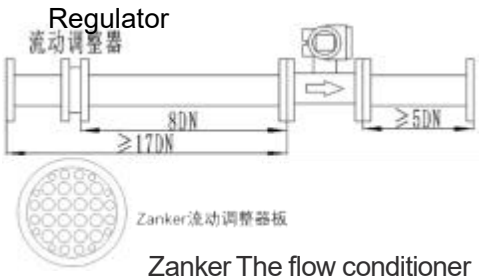
6) Explosion-proof occasions should comply with the requirements of the instrument explosion-proof level.

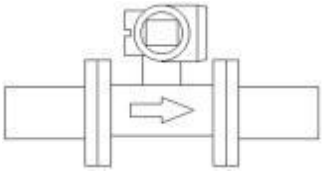
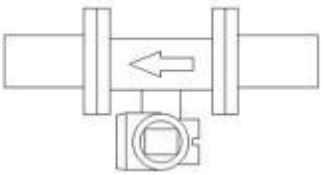
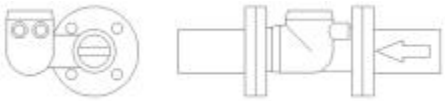
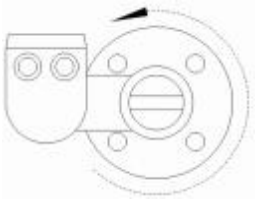
7) The installation location should have the necessary space for easy installation and maintenance.

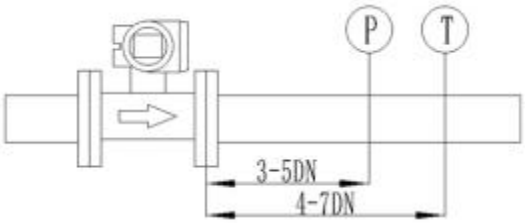
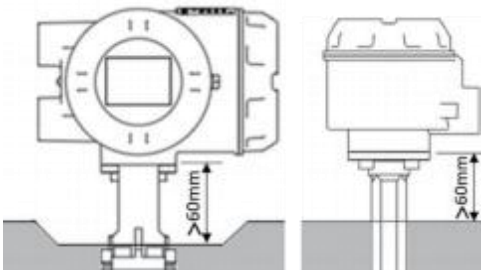
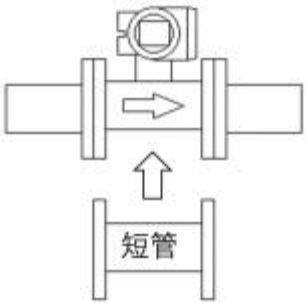
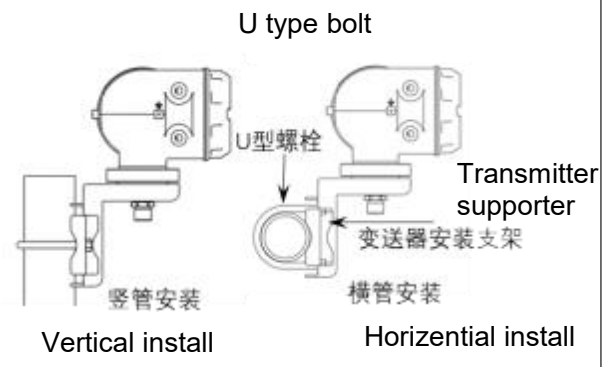
The anti-roll support nails and lifting rings of the base meter housing are not necessary for the operation of the flowmeter and can be removed after installation.

Installation conditions:	Graphics
liquid: a) In horizontal pipelines, to prevent the impact of gas inclusion, the flow meter should be placed at the low point of the pipeline. b) The medium in a vertical pipeline flows from bottom to top.	
gas: a) To prevent the influence of liquid in horizontal pipeline, the flow meter should be placed at the high point of the pipeline. b) For vertical pipelines, it is recommended that the medium flow from bottom to top.	

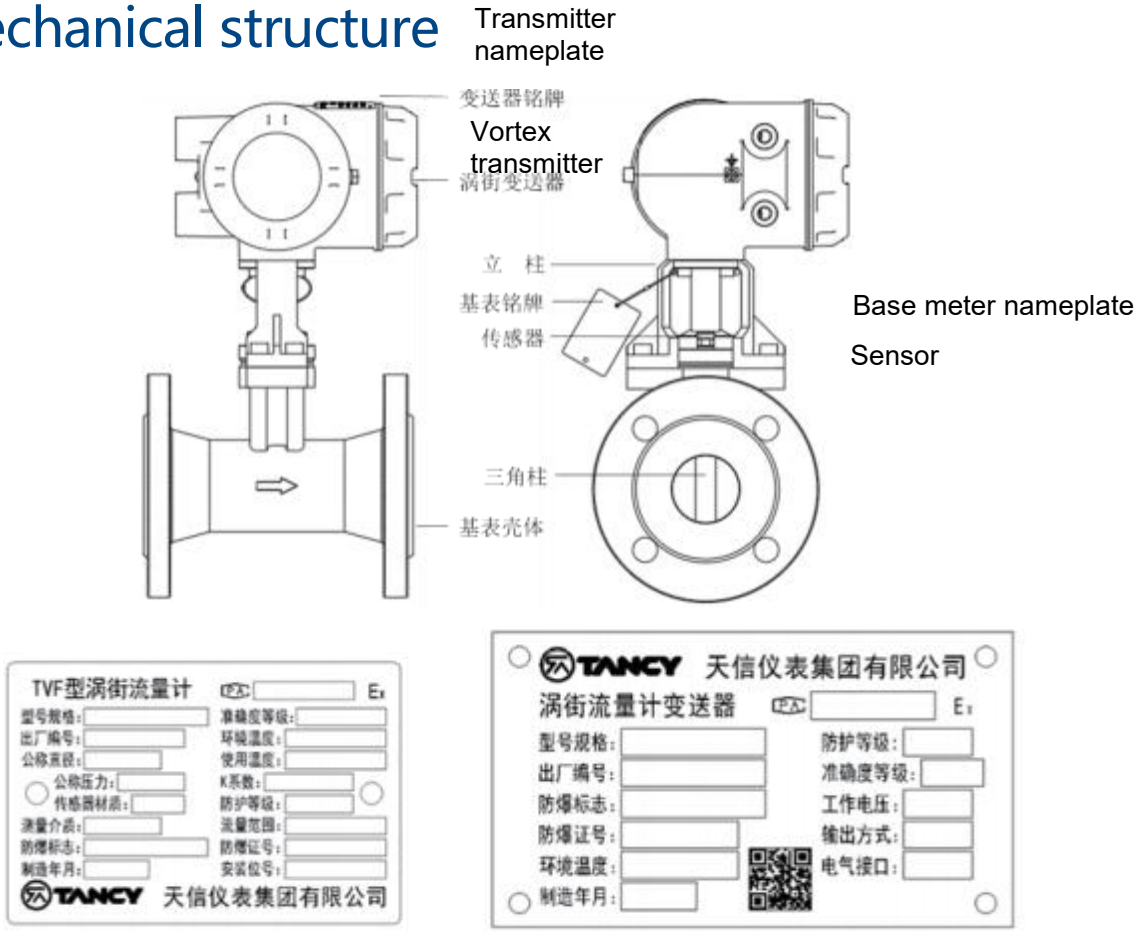
Requirements for straight pipe sections under flow disturbance conditions	Graphics
Reduced diameter: a) A concentric reducer can be used to reduce the diameter to meet the flow range requirements of the flow meter. b) The straight pipe section from the upstream of the flow meter to the reducer is greater than 15DN.	
Diameter expansion: a) Concentric reducing and gradually expanding tubes can be used to expand the diameter to meet the flow range requirements of the flow meter. b) The straight pipe section from the upstream of the flow meter to the reducer is greater than 15DN.	
Fully open straight-through valve: The straight pipe section from the flow meter to the valve is greater than 15DN.	
A 90. Elbow: The straight pipe section from the upstream of the flow meter to the elbow is greater than 20DN.	
Two 90° elbows in the same plane: The straight pipe section from the upstream of the flow meter to the elbow is greater than 25DN.	
Two 90 degrees in different planes. Elbows: The straight pipe section from upstream of the flow meter to the elbow is greater than 40DN.	
Control valve: The straight pipe section from the upstream of the flow meter to the control valve is greater than 50DN.	

Tee: The straight pipe section from the upstream of the flow meter to the tee is greater than 20DN.	
Process piping: A valve should be installed upstream of the flow meter, and the straight pipe section should comply with the valve requirements.	 Valve  Valve
Flow Conditioner: a) A flow conditioner that meets the requirements can effectively reduce the requirements for straight pipe sections and has no Additional uncertainty; b) Recommended using Zanker flow conditioner plate will add a pressure loss of $1.5\rho V^2$. c) The distance between the upstream of the flow meter and the flow blocker is at least 17 DN. d) The straight pipe section from the upstream of the flow meter to the flow conditioner is 8DN.	Regulator  Zanker The flow conditioner

Integral transmitter orientation	Graphics
Horizontal up: Measurement of normal or low temperature medium in horizontal pipelines.	
Horizontal down: a) When the medium temperature is high. b) When the temperature is >120℃, it is recommended to use a remote type transmitter.	
Horizontal sides: a) Measurement of relatively high or low temperature media. b) For high-temperature media, a remote-type transmitter is recommended.	
Vertical pipe: Any direction along the pipe axis.	

Temperature and pressure measurement	Graphics
a) The pressure gauge should be set at 3 to 5D downstream of the meter; b) Temperature gauge should be set at the 4 to 7D downstream of the meter	
Thermal insulation	**Graphics**
a) The distance between the insulation layer and the transmitter or junction box should be greater than 60mm. b) The base meter nameplate should not be covered by insulation.	
Pipe purging	**Graphics**
When purging the pipeline, a short pipe should be used instead of the flow meter to avoid damaging the bluff body and the sensor with contaminants.	
Remote transmitter installation	**Graphics**
a) The transmitter should be placed in a location that is easy to observe and operate. b) If necessary, the instrument should be placed in an insulation or protection box. c) Use 2-inch steel pipe and bracket through M8 U-bolt connection. d) The cable length between the junction box and the transmitter shall not exceed 30 meters and shall be provided by the manufacturer. The user must specify the cable length when ordering. e) Cables should be protected by explosion-proof or protective conduit.	

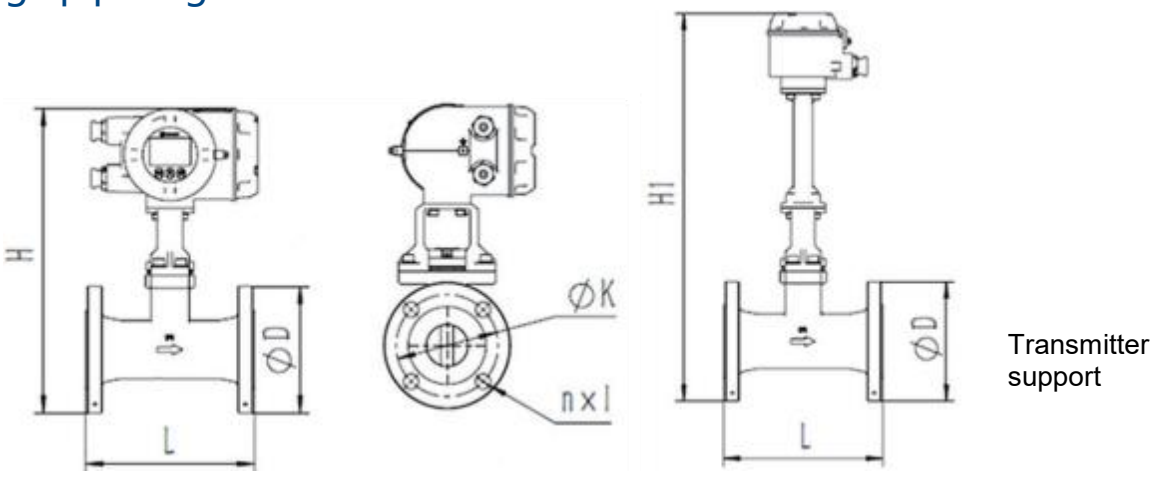
8. Mechanical structure



Base meter nameplate Transmitter nameplate

Figure 1 Structural diagram

8.1 Flange pipe segment



Transmitter integrated

Transmitter remote type

Figure 2 Flange type dimensions

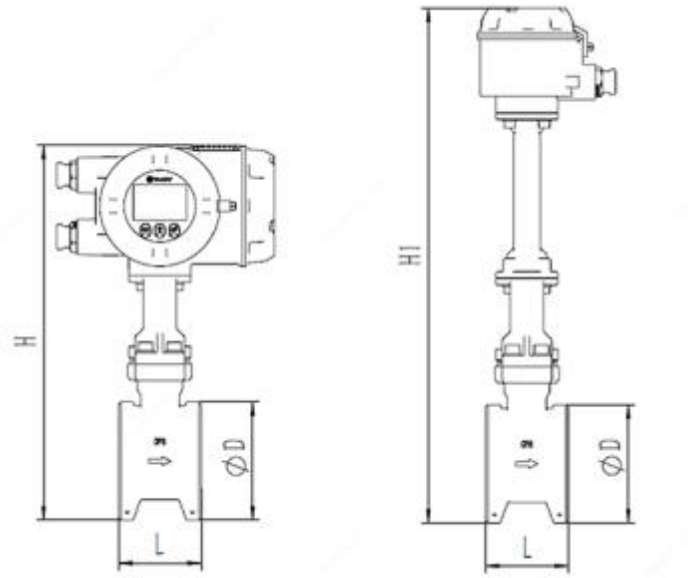
surface 4

Nominal diameter DN(mm)	Nominal pressure	Integrated weight (KG)	Dimensions (mm)			Flange connection size (mm)			
			L	H	H1	Flange outer diameter D	Bolt hole distribution Circle diameter K	Bolt Holes Diameter l	bolt quantity n
15	PN16	7.5	200	325	455	95	65	14	4
	PN25	7.5	200	325	455	95	65	14	4
	PN40	7.5	200	325	455	95	65	14	4
	PN63	8.5	200	330	460	105	75	14	4
	PN100	8.5	200	330	460	105	75	14	4
	Class150	7	200	325	455	90	60.3	16	4
	Class300	7.5	200	325	455	95	66.7	16	4
	Class600	7.5	200	325	455	95	66.7	16	4
25	PN16	10	200	345	475	115	85	14	4
	PN25	10	200	345	475	115	85	14	4
	PN40	10	200	345	475	115	85	14	4
	PN63	12.5	200	355	485	140	100	18	4
	PN100	12.5	200	355	485	140	100	18	4
	Class150	9	200	340	470	110	79.4	16	4
	Class300	10	200	350	480	125	88.9	18	4
	Class600	10.5	200	350	480	125	88.9	18	4
50	PN16	13	200	370	500	165	125	18	4
	PN25	13	200	370	500	165	125	18	4
	PN40	13	200	370	500	165	125	18	4
	PN63	26	230	380	510	180	135	22	4
	PN100	29	230	385	515	195	145	26	4
	Class150	12	200	365	495	150	120.7	18	4
	Class300	15	200	370	500	165	127	18	8
	Class600	25	250	370	500	165	127	18	8
80	PN16	18	200	405	535	200	160	18	8
	PN25	19	200	405	535	200	160	18	8
	PN40	19	200	405	535	200	160	18	8
	PN63	35	250	410	540	215	170	22	8
	PN100	40	260	420	550	230	180	26	8
	Class150	19	200	400	530	190	152.4	18	4
	Class300	23	200	410	540	210	168.3	22	8
	Class600	36	270	410	540	210	168.3	22	8

100	PN16	25	250	420	550	200	180	18	8
	PN25	28	250	435	565	235	190	22	8
	PN40	28	250	435	565	235	190	22	8
	PN63	48	265	445	575	250	200	26	8
	PN100	55	285	450	580	265	210	30	8
	Class150	27	250	435	565	230	190.5	18	8
	Class300	50	250	445	575	255	200	22	8
	Class600	59	310	455	585	275	215.9	26	8
150	PN16	36	300	475	605	285	240	22	8
	PN25	43	300	480	610	300	250	26	8
	PN40	43	300	480	610	300	250	26	8
	PN63	62	316	505	635	345	280	33	8
	PN100	76	356	510	640	355	290	33	12
	Class150	39	300	470	600	280	241.3	22	8
	Class300	57	300	490	620	320	269.9	22	12
	Class600	87	374	510	640	355	292.1	30	12
200	PN16	45	251	525	655	340	295	22	12
	PN25	60	287	535	665	360	310	26	12
	PN40	70	303	540	670	375	320	30	12
	PN63	97	347	560	690	415	345	36	12
	PN100	127	387	570	700	430	360	36	12
	Class150	62	329	525	655	345	298.5	22	8
	Class300	87	350	545	675	380	330.2	26	12
	Class600	133	405	565	695	420	349.2	33	12
250	PN16	71	286	580	710	405	355	26	12
	PN25	88	322	590	720	425	370	30	12
	PN40	110	356	605	735	450	385	33	12
	PN63	140	396	615	745	470	400	36	12
	PN100	202	460	630	760	505	430	39	12
	Class150	88	348	580	710	405	362	26	12
	Class300	128	380	600	730	445	387.4	30	16
	Class600	215	462	635	765	510	431.8	36	16
300	PN16	107	348	630	760	460	410	26	12
	PN25	128	376	645	775	485	430	30	16
	PN40	164	422	660	790	515	450	33	16
	PN63	203	472	665	795	530	460	36	16
	PN100	300	532	695	825	585	500	42	16
	Class150	140	418	645	775	485	431.8	26	12
	Class300	192	450	660	790	520	450.8	33	16
	Class600	276	514	680	810	560	489	36	20

Note: Flanges refer to standards GB/T 9124.1-2019 and GB/T 9124.2-2019.

8.2. Cllamp-on



Transmitter integrated transmitter remote

Figure 3 Clamp-on Dimensions

Nominal diameter DN (mm)	Nominal pressure	Integrated weight (KG)	Dimensions (mm)			Sealing surface size D (mm)	
			L	H	H1	RF Raised Face	M Convex
15	PN16	6	70	305	430	45	39
	PN25		70	305	430	45	39
	PN40		70	305	430	45	39
	Class150		70	302	427	34.9	34.9
25	PN16	7	70	325	455	68	57
	PN25		70	325	455	68	57
	PN40		70	325	455	68	57
	Class150		70	320	450	50.8	50.8
50	PN16	7.5	75	345	470	102	87
	PN25		75	345	470	102	87
	PN40		75	345	470	102	87
	Class150		75	345	470	92.1	92.1
80	PN16	11	100	375	505	138	120
	PN25		100	375	505	138	120
	PN40		100	375	505	138	120
	Class150		100	370	500	127	127
100	PN16	14	120	400	530	158	149
	PN25		120	400	530	162	149
	PN40		120	400	530	162	149
	Class150		120	405	530	157.2	157.2

Note: Flanges refer to standards GB/T 9124.1-2019 and GB/T 9124.2-2019.

8.3 Transmitter

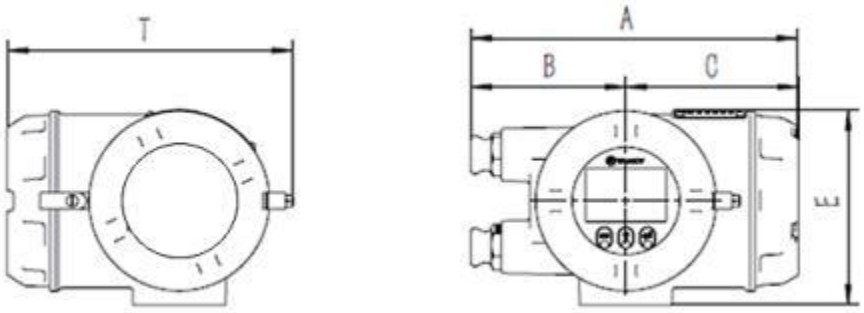


Figure 4 Integrated transmitter

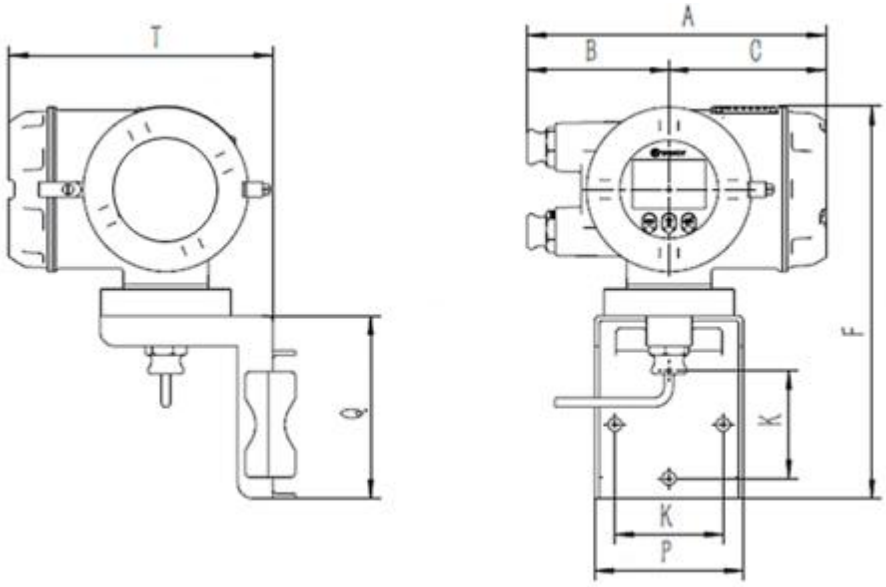


Figure 5 Remote transmitter

Remote transmitter dimensions							
A	B	C	F	K	P	Q	T
198	94	104	260	71.4	98	121	174

9. Ordering Information

9.1. Selection Guide

1) Operating flow rate

The flowmeter measures volumetric flow under operating conditions. When selecting a meter, the volumetric flow for liquids can be treated directly as the operating-condition flow. For gases, the standard volumetric flow must be converted to operating-condition volumetric flow. For steam, the mass flow must be converted to operating-condition volumetric flow.

To convert standard volumetric flow to operating-condition volumetric flow (the compressibility factor can be neglected during meter selection):

$$Q = Q_n \times \frac{T}{T_n} \times \frac{P_n}{P}$$ Equation (2)

Where: Q: Volumetric flow under operating conditions , m 3 /h.

Q n : Volumetric flow under standard conditions , Nm 3 /h.

T: operating absolute temperature, K.

Tn : Absolute temperature under standard conditions (293.15 K) .

P: operating pressure, kPa.

Pn: Standard pressure, 101.325kPa .

For converting a mass flow into operating-condition volumetric flow:

$$Q = \frac{M}{\rho}$$ Formula (3)

Where: M is mass flow rate, kg/h; ρ is Density under operating conditions, kg/m ^{3}.

2) Reynolds number

R = 0 . 354 x Q /(D V) or Re = 354 x Q X P /(D - u) or Re = P -D · V/U formula (4)

Where: D: The flowmeter inner diameter, mm.

υ: kinematic viscosity, m ^{2}/s.

μ: dynamic viscosity, mPa ·s.

V: Flow velocity under operating conditions $V = 354 \times \frac{Q}{D^2}$, m/s.

3) Pressure loss

$$\Delta P = 1.2PV2$$ Formula (5)

Where: ΔP is pressure loss, Pa.

4) Minimum working pressure of liquid medium

$$p\ min \geq 2.7\Delta p + 1.3\ po$$ Formula (6)

Where: P_0 is the saturated vapor pressure of the liquid at its operating temperature. ΔP is calculated based on the pressure loss at the highest flow rate.

5) Maximum working pressure

TVF vortex flowmeter design parameters are as follows: Maximum working pressure P=10Mpa, maximum operating emperature 250℃, pipe meter ture in the housing is designed according to tube number SCH80, material is stainless steel (cast, forged, pipe, or bar).

Calculation formula:

$$\frac{P}{\sigma_{[t]}} \times 1000 < 80$$ Formula (7)

Where: P is the maximum working pressure, MPa; $\sigma_{[t]}$ is the allowable stress (MPa) for 304 material at its highest operating temperature. , MPa.

Applicable caliber	Allowable stress ... (MPa) for 304 stainless steel at various temperatures.				
	≤ 20℃	100℃	150℃	200℃	250℃
DN ≤ 100	137	137	137	134	125
DN > 100	116	116	116	111	104

Users can refer to GB/T 9124.1-2019 (Tables 93–100) and GB/T 9124.2-2019 (Table C.16). Based on the flange's temperature and pressure rating and the maximum allowable working pressure requirements, they can select the appropriate nominal pressure rating for the flowmeter model.

6) Determination of flow range

Vortex flowmeters measure flow velocity, i.e., the measured value is volumetric flow. Before leaving the factory, each flowmeter is calibrated on a standard test rig according to the flow ranges in Table 2. During this process, the meter coefficient (K-factor) and related configurations are determined.

For accurate measurement, the flowmeter's diameter should be selected according to the medium's volumetric flow under operating conditions, using Table 1 as a reference.

If the process flow exceeds the range shown in Table 1, the flow range may be expanded by calculation, or a different flowmeter diameter may be selected that meets the required flow range. Any flow range expansion must be confirmed by our company.

Minimum flow requirements:

a) Reynolds number ≥ 8000, calculated according to formula (4)

b) The frequency must not be less than 1 Hz, according to formula (1) $f = KX\ Q/3600$ calculation, theoretical K refer to Table 1.

c) The minimum flow rate should exceed the flow value (in m^3/h) required by the sensor's minimum signal amplitude to ensure accurate measurement.

$$Q = B/\sqrt{\rho} \qquad \text{Formula (8)}$$

Table 5 β value

DN	15	25	50	80A	80B	100	150	200	250	300
Normal temperature sensor β	4.4	8.8	25.2	54.8	65.7	98.6	230	411	657	876
High temperature sensor β	6.6	13.1	37.8	82.2	98.6	148	345	616	986	1315

Maximum flow requirements:

a) Typically, the maximum flow is set to $10Q_{min}$, Under permissible operating parameters, the flow range can be extended beyond this ratio.

b) The frequency f should be less than 4000 Hz, calculated using formula (1).

c) The common Reynolds number range is $Re < 10^6$.

d) The usual upper velocity limit for liquids is ≤ 7m/s.

e) The usual upper velocity limit for gases is ≤ 50m/s.

f) The usual upper velocity limit for steam is ≤ 70m/s.

9.2 Precautions for use

1) Select a flow meter that meets the medium's operating temperature and pressure requirements.

2) If the medium temperature is above 20℃ or or if the installation location is difficult to observe or operate, a remote transmitter design should be used.

3) Vortex flowmeters are not suitable for high-viscosity, low-Reynolds-number fluids. Typically, the Reynolds number should be > ... and frequency f>1 Hz.

4) For liquid media, the operating pressure must be sufficient so that at maximum flow, the backpressure remains above the medium' s saturated vapor pressure.

5) Vortex flowmeters are not suitable for accurate measurement of two-phase or multiphase fluids. Steam, in particular, must be dry.

6) The fluid flowing through the meter should be free of viscous or sticky solid particles, fibers, or other contaminants that could affect measurement accuracy.

7) The flow meter should be installed away from vibration sources, strong electromagnetic fields, etc. that may interfere with its operation.

9.3. Selection table

model	Code	illustrate
TVF		Vortex flowmeter
Size	015	DN15
	025	DN25
	050	DN50
	080	DN80
	100	DN100
	150	DN150
	200	DN200
	250	DN250
	300	DN300
Measuring medium	L	liquid
	G	gas
	S	steam
Accuracy level	1	/
	2	Level 1.0
Medium temperature	U	-40℃ ~150℃
	M	-20℃ ~250℃
Housing material	A	304 Stainless Steel
	B	316 Stainless Steel
	X	other
Input	0	none
Output	1	4mA~20mA +HART, pulse/frequency, RS485

Process connection	P1	PN16 RF Raised Face Flange Clamp Mount
	P2	PN25 RF Raised Face Flange Clamp Mount
	P3	PN40 RF Raised Face Flange Clamp Mount
	PA	Class150 RF Raised Face Flange Clamp Mount
	F1	PN16M Raised face flange clamp
	F2	PN25M Raised face flange clamp
	F3	PN40M Raised face flange clamp
	FA	Class150 M raised face flange clamp
	R1	PN16 RF Raised Face Flange Connection
	R2	PN25 RF Raised Face Flange Connection
	R3	PN40 RF Raised Face Flange Connection
	R4	PN63 RF Raised Face Flange Connection
	R5	PN100 RF Raised Face Flange Connection
	RA	Class150 RF Raised Face Flange Connection
	RB	Class300 RF Raised Face Flange Connection
	RC	Class600 RF Raised Face Flange Connection
Electrical interface	M	IS0 M20*1.5
	N	ANSI 1/2 NPT
Explosion-proof and protection level	d	Ex db IIC T6 Gb IP66/IP67
	i	Ex ia IIC T4 Ga IP66/IP67
Transmitter	1	Integrated, aluminum alloy
	2	Remote type, made of aluminum alloy
Nameplate	0	According to factory standard nameplate
	1	Custom Tag
	2	Stainless steel number plate
SIL2	Null Value	none
	S	have
Stress Testing	Null Value	none
	P	have
Degreasing	Null Value	none
	D	have
Material certificate	Null Value	none
	M	have
Cable length	L	Split cable length (unit: meter) 05/10/15/20

Version number: V01-20250401

Tancy Instrument Group Co., Ltd.

A: No. 198, Hualian Road, Cangnan County Industrial Park, Wenzhou City, Zhejiang Province
T: 0577-6885 6655
W: www.tancy.com
E : tancy@tancy.com