

S-VTX **Vortex Flowmeter**

Operation Manual

2012.10



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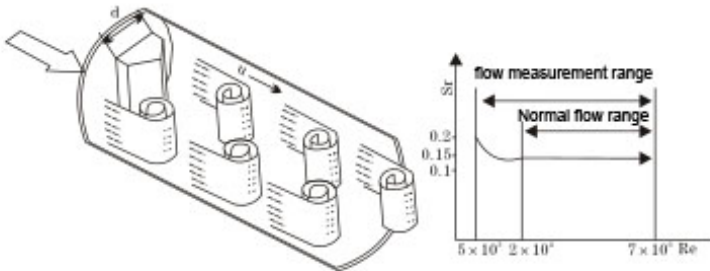
1. Summary

1.1 Working Principle and Application Scope

Vortex Flowmeter is one kind of main flowmeters in the international for detection and metering the liquid, gas and steam. It is widely used in Petroleum, chemical, metallurgy, heat supply industry, etc.

Setting a triangular prism vortex generator in the flowmeter, regular vortex will be generated at both the sides of triangular prism, which is called Karman swirl. As showed on the drawing 1.1, vortex are arranged regularly at the downstream of vortex generator. Suppose the vortex generation frequency is f , the average flow velocity of medium is V , d is the width of the surface of triangular prism incident flow, and D for the nominal diameter of flowmeter. Then we get the computation formula:

$$f = Sr \frac{\bar{V}}{(1 \sim 1.25d/D) d}$$



In the formula Sr = Strouhal number

Fitting the detection probe and related electrocircuit, then they make up the vortex flow sensor, the detection probe of S-VTX flow sensor, adopting special structure and material, which is the improved vortex flow sensor.

1.2 Features

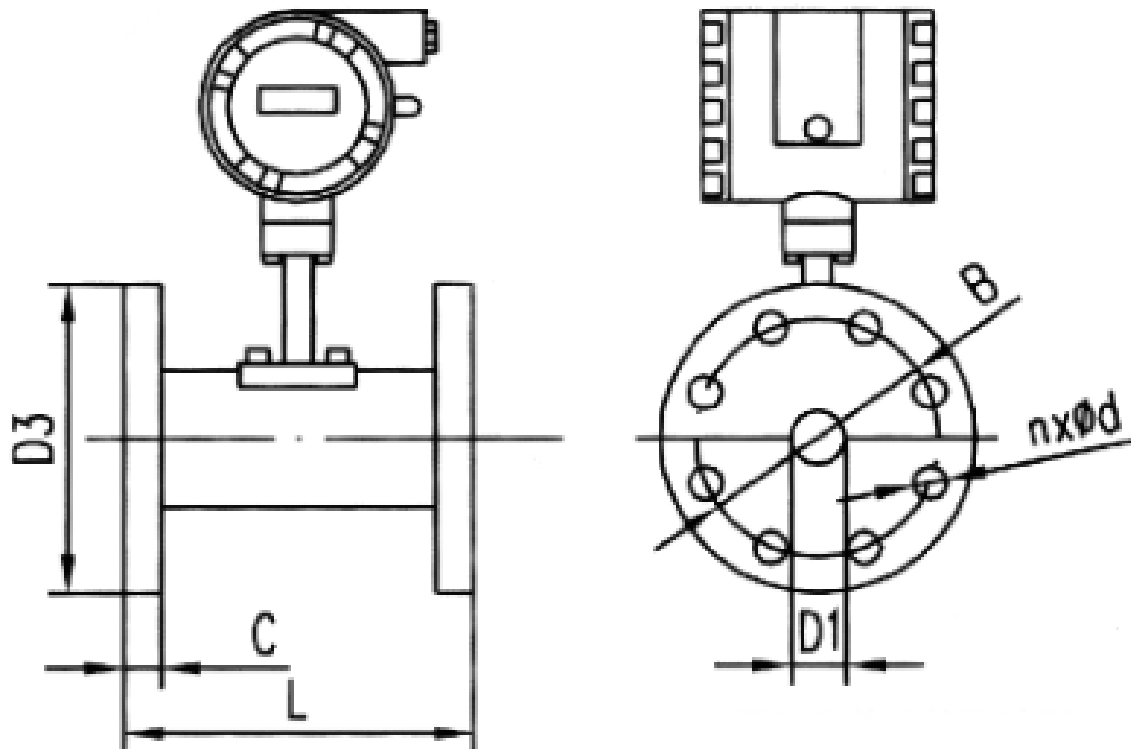
- Detecting element does not touch with flow medium, with high reliability, and strong flexibility for medium
- No moving parts, wear resistance, structure is simple and fastness
- Good earthquake resistance
- The allowed working temperature is wide from -40°C to $+350^{\circ}\text{C}$
- Wide range, High accuracy
- Pulse signal output or two-wire system 4-20mA current signal output

2. Basic Parameter

Measured Medium	Liquid, Gas, Steam (Single-phase medium or the one can be regarded as single-phase medium)		
	-40°C~+350°C		
Medium Temp.	1.6Mpa, 2.5Mpa, 4.0Mpa (pressure above 4.0Mpa, Special Customized)		
Accuracy	± 1.0%, ± 1.5%		
Measuring range ratio	1:8-1:30 (Standard air condition as reference), 1:8-1:40 (Normal Temperature as reference)		
Flow range	Liquid: 0.4-7.0m/s; Gas: 4.0-60.0m/s; Steam: 5.0-70.0m/s		
Specifications	DN25 DN40 DN50 DN65 DN80 DN100 DN125 DN150 DN200 DN250 DN300		
Material	1Cr18Ni9Ti		
Reynolds number	Normal $2 \times 10^4 - 7 \times 10^6$		
Resistance coefficient	$C_d \leq 2.6$		
Vibration acceleration	$\leq 0.2g$		
Ex-proof class	IP65		
Ambient condition	Ambient Temp.	-40°C-55°C (Non Ex-Proof); -20°C-55°C (Ex-proof)	
	Relative humidity	$\leq 85\%$	
	Pressure	86-106kPa	
Power Supply	Non Ex-proof type	Pulse type	+12VDC 20mA
		Current type	+24VDC 20mA
Signal Output	Pulse frequency signal 2-3000Hz, Low level $\leq 1V$, high level $\geq 6V$		
	Two-wire system 4-20 signal (isolated output), Load ≤ 500		

3. Flow Sensor Model Selection:

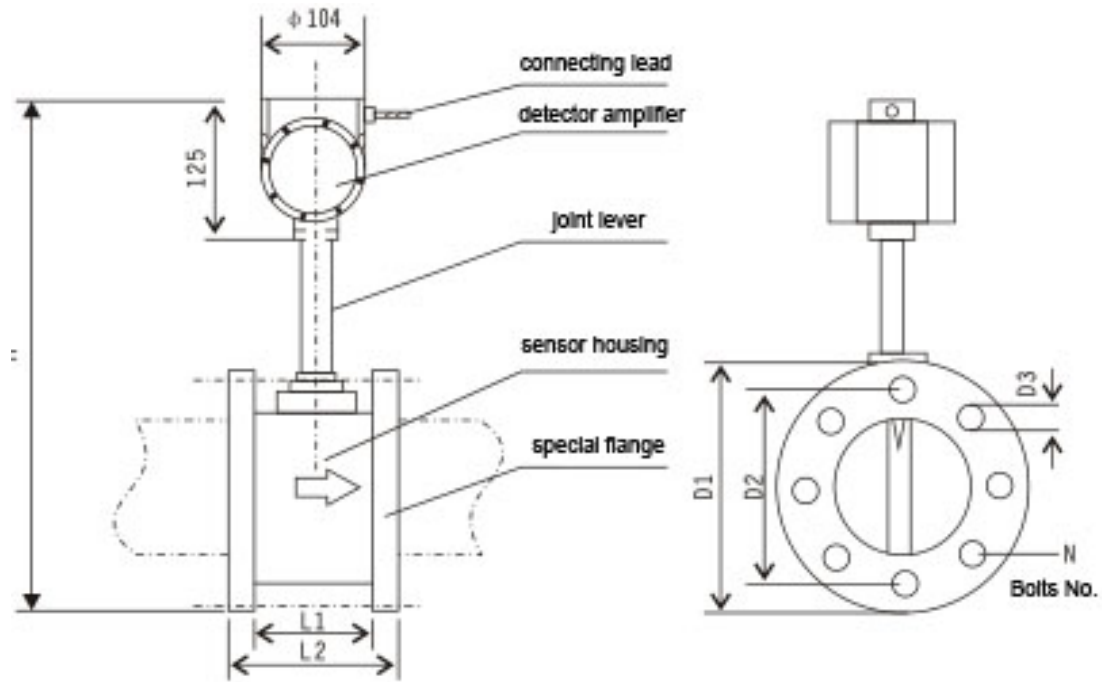
3.1 Flow Sensor is made up by detector, detector amplifier and connection rod. The sensor frame, frame accessories and connecting rod is made from 1Cr18Ni9Ti, with the advantage of anti-corrosion and durable, vortex generator and sensor frame is welded by gas shielded welding, sturdy and durable. The detection probe and vortex generator is separated, which can solve the problem that pressure tube blocking caused the flowmeter can not work normally. Structure and size as the below drawing:



Drawing 1 Flange Connection Vortex Flowmeter Outline Dimension

Flange Connection Vortex Flowmeter Outline Size:

Nominal diameter (mm)	Shell Inside Diameter D1(mm)	Shell Length L(mm)	Flange Outer Diameter D3(mm)	Bolt Hole Center distance B (mm)	Flange Thickness C (mm)	Bolt Hole Diameter d(mm)	Bolt Quantity n
25	25	170	150	110	18	18	4
32	32	170	155	115	18	18	4
40	40	190	160	120	18	18	4
50	50	190	165	125	20	18	4
65	65	220	185	145	20	18	4
80	80	220	200	160	20	18	8
100	100	240	220	180	22	18	8
125	125	260	250	210	22	18	8
150	150	280	285	240	24	22	8
200	200	300	340	295	26	22	12
250	250	360	405	355	28	26	12
300	300	400	460	410	32	26	12

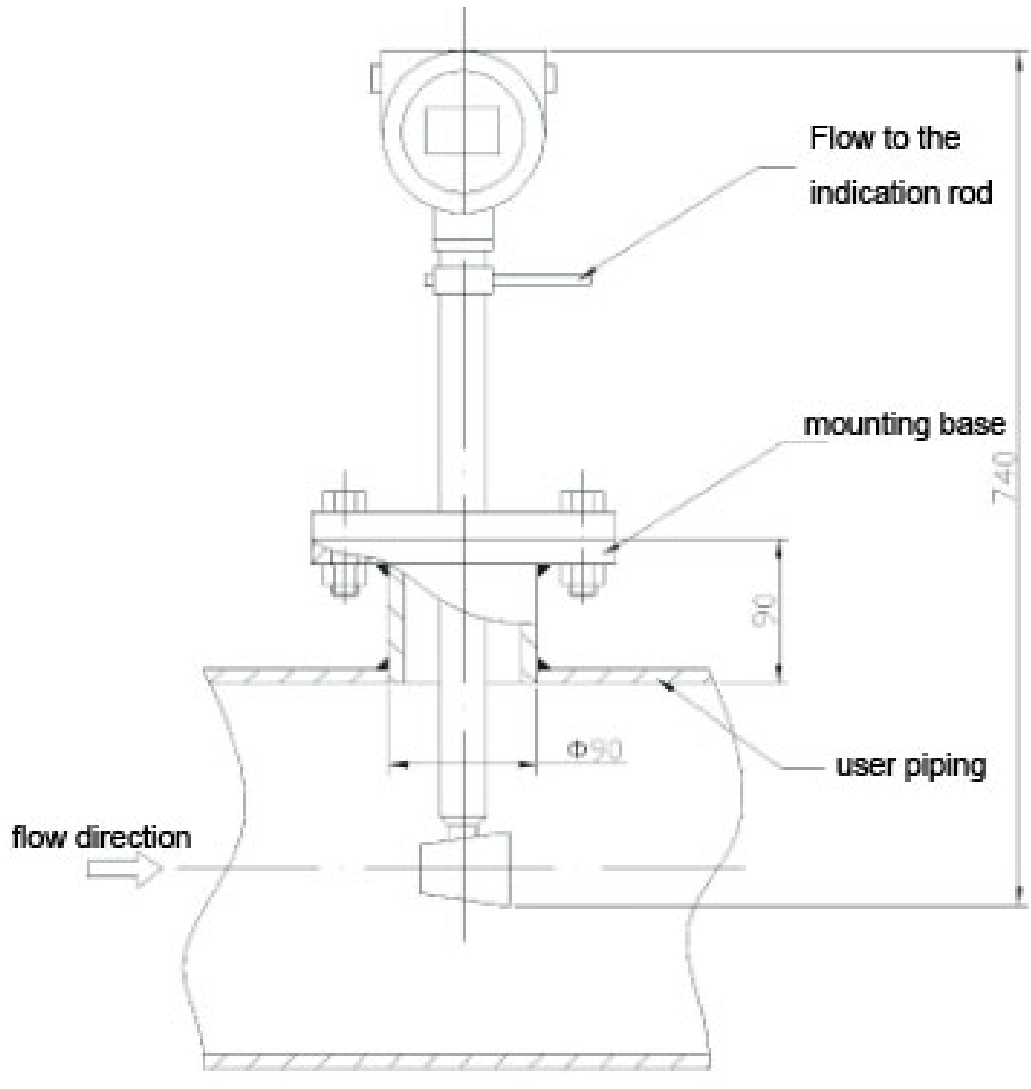


Drawing 2 Flange Clamped on Vortex Flowmeter Outline Dimension

Flange Clamped on Vortex Flowmeter Outline Size:

Caliber (mm)	L1 (mm)	L2 (mm)	D1 (mm)	D2 (mm)	H (mm)	D3 (mm)	N (pcs)
20	65	95	125	100	460	13	4
25	65	95	125	100	460	13	4
40	75	109	145	110	470	13	4
50	75	109	160	125	481	17	4
65	75	117	180	145	497	17	6
80	80	122	195	160	510	17	6

Caliber (mm)	L1 (mm)	L2 (mm)	D1 (mm)	D2 (mm)	H (mm)	D3 (mm)	N (pcs)
100	90	132	230	190	544	17	8
125	100	146	245	210	564	17	8
150	120	170	280	240	594	21	8
200	150	200	335	295	646	21	12
250	160	214	405	355	708	21	12
300	170	224	460	410	760	21	12



Drawing 3 Insertion Vortex Flowmeter Outline Size and Installation Diagram

Insertion Vortex Flowmeter is mainly used in big diameter pipeline of various industries for measuring the gas, liquid and steam. The characteristics are simple structure, no moving parts, low pressure loss, wide measuring ratio can reach to 10-15, high cost performance.

■ Attention for installation:

1. Mounting base inserted into pipeline can not exceed the pipeline in wall.
2. The base in the pipeline should be upright, not declined.
3. Removing burr and welding slag.
4. The flange surface of base is paralleled to the axis of pipeline.
5. Make sure that the flow direction is same as the flow indication rod, strictly forbidden to wrench the flow rod.

The model selection of Flow Sensor

Stress type Vortex Flow sensor, the model can be marked as:

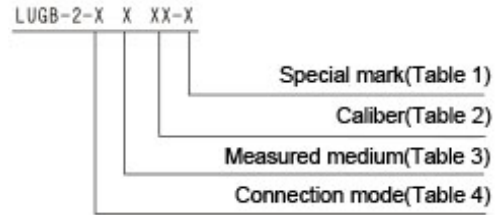


Table one:Special mark.

Form	Normal	Standard Signal Output	Intrinsic safety	Local Display	High Temp. (350)	Temp. Compensation	Pressure Compensation	Temp.and pressure Compensation
Mark	No Mark	M	B	X	G	W	Y	Z

Table two:Nominal Diameter

Flange connection 、 Flange clamp on

Caliber	15	20	25	32	40	50	65
Mark	150	200	250	320	400	500	650
Caliber	80	100	125	150	200	250	300
Mark	800	101	125	151	201	251	301

Insertion Type

Caliber	100	125	150	200	250	300	350	400	500	600
Mark	10	125	151	201	251	301	351	401	501	601
Caliber	700	800	900	1000	1200	1400	1600	1800	2000	
Mark	701	801	901	102	122	142	162	182	202	

Table Three

Medium to be measured

Medium	Liquid	Normal Gas	Saturated steam	Superheated steam	Others
Mark	1	2	3	4	5

Table Four

Connection Type

Connection Type	Flange connection	Flange Clamped	Insertion	Others
Mark	1	2	3	4

Table Five

Flow Range table(for reference)

Nominal Diameter	Liquid($t=20^{\circ}\text{C}$, $\rho_0 = 1000\text{kg} / \text{m}^3$)	Gas($t=20^{\circ}\text{C}$ 101325Pa air)

DN(mm)	Standard range	Flow range Measurable	Standard range	Flow range Measurable
20	1-8	0.6-12	5-50	5-60
25	1.5-12	0.8-16	8-80	8-120
40	2.5-30	1.5-40	20-200	18-300
50	3-50	2-60	30-300	30-500
80	8-120	5-150	80-1000	60-1200
100	12-200	6-240	100-1000	100-2000
125	20-300	13-390	150-1600	150-3000
150	30-400	15-600	250-2500	200-4000
200	40-800	30-1200	400-4000	350-8000
250	80-1200	40-1600	600-6000	500-12000
300	100-1800	50-2000	1000-10000	600-18000

3.2 The choice of flow range at working condition

Different caliber,different medium,the vortex flow sensor and flow transmitter's flow range is different too.The model selection for special medium needs to calculate for settlement.

3.2.1 The choice for Gas flow range

The upper limit of vortex flowmeter does not influenced by the temperature and pressure of medium.Flow range is depended on the medium's density and viscosity at working condition.Thus,the confirmation of flow range is calculation the available lower limit flow.

Calculation 1:First of all,using Q_v formula to calculate the working condition lower limit flow,which is determined by viscosity

$$Q_p = Q_{ox} \sqrt{\rho_o / \rho} \quad (m^3/h)$$

In the formula:

Q_v :The medium's lower limit flow at working condition density

Q_o :The lower limit flow of flowmeter at reference condition

ρ_o :Reference the air density, $\rho_o=1.205kg/m^3$

P:Working condition density of medium to be measured

Calculation 2 Q_v formula for calculation the lower flow limit by kinematic viscosity

$$Q_v = Q_o \times v/v_o \quad (\text{m}^3/\text{h})$$

In the formula:

Q_v :Lower limit flow of the medium

Q_o :Low flow limit at reference condition

V_o :Reference viscosity,15kgm/S²

V :The working condition viscosity of medium(kgm/S²)

Compare Q_o and Q_v ,the larger flow as the real low flow limit of gas.

3.2.2 The choice for liquid flow range

As shown on flow range table five

3.2.3 The choice of steam flow range

Saturated steam:Reference to table six to choose

Superheated steam: Through table seven to get the pressure, temperature and corresponding density,taking the similar density's flow range from table six to confirm the flow range of superheated steam.

Table six: Saturated steam mass flow range table(kg/h)

Abs Pre.P(Mpa)	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.2	1.4	1.6	1.8	2.0
Temp.T(°C)	120.2	133.5	143.62	151.84	158.94	158.94	170.41	175.36	179.68	187.96	195.04	201.37	207.11	212.37
Density kg/m ³	1.129	1.651	2.163	2.669	3.170	2.669	4.162	4.665	5.147	6.127	7.106	8.085	9.065	10.05
DN20 Qmin	9	11	12	13	15	16	17	18	19	20	22	24	25	26
QMax	60	83	108	134	158	183	208	233	257	306	355	404	453	503
Measurable Up Limit	80	102	130	160	190	220	250	279	309	368	426	485	544	603
Measurable Low Limit	9	11	12	13	15	16	17	18	19	20	22	24	25	26
DN25 Qmin	14	17	19	21	23	25	27	28	30	33	35	37	39	42
QMax	93	133	173	215	254	293	333	372	412	490	568	647	725	804
Measurable Up Limit	136	198	260	320	380	440	499	559	618	735	853	970	1088	1206
Measurable Low Limit	14	17	19	21	23	25	27	28	30	33	35	37	39	42
DN40 Qmin	35	42	48	54	59	63	67	71	75	82	88	94	99	104
QMax	233	332	433	534	634	733	832	931	1029	1225	1421	1617	1813	2010
Measurable Up Limit	400	498	649	801	951	1100	1249	1397	1544	1838	2132	2426	2720	3015
Measurable Low Limit	32	38	44	48	53	57	60	64	67	73	79	84	89	94

DN50 Qmin	52	64	73	81	88	95	100	107	112	122	132	140	149	157
QMax	400	498	649	801	951	1100	1249	1397	1544	1838	2132	2426	2720	3015
Measurable Up Limit	667	826	1080	1335	1585	1834	2081	2328	2574	3054	3553	4043	4533	5025
Measurable Low Limit	52	64	73	81	88	95	100	107	112	122	132	140	149	157
DN65 Qmin	88	106	121	135	147	158	168	178	187	204	220	234	248	261
QMax	667	826	1080	1335	1585	1834	2081	2328	2574	3054	3553	4043	4533	5025
Measurable Up Limit	933	1320	1730	2135	2536	2934	3330	3724	4118	4902	5685	6468	7252	8040
Measurable Low Limit	88	106	121	135	147	158	168	178	187	204	220	234	248	261
DN80 Qmin	140	170	194	215	235	252	269	284	299	326	350	375	397	418
QMax	1166	1650	2160	2700	3170	3660	4160	4655	5150	6130	7100	9080	9060	10000
Measurable Up Limit	1400	1980	2596	3240	4015	4644	5270	5896	6520	7760	9000	10240	11480	12730
Measurable Low Limit	105	127	145	161	176	189	201	213	224	345	263	280	298	313
DN100 Qmin	175	212	242	269	293	315	336	355	374	408	439	468	496	522
QMax	1166	1650	2160	2700	3170	3660	4160	4655	5150	6130	7100	8080	9060	10050
Measurable Up Limit	2332	3300	4320	5400	6430	7320	8320	9310	10300	12260	14200	16160	19120	20100
Measurable Low Limit	175	212	242	269	293	315	336	355	374	408	439	468	496	522
DN125 Qmin	262	317	363	404	440	473	504	533	560	611	658	702	744	783
QMax	1866	2640	3460	4270	5070	5870	6660	7450	8240	9800	11370	12940	14500	16080
Measurable Up Limit	3500	4950	6490	8000	9510	11000	12500	14000	15440	18400	21300	24260	27200	30200
Measurable Low Limit	262	317	363	404	440	473	504	533	560	611	658	702	744	783
DN150 Qmin	437	529	605	673	733	788	840	888	934	1091	1097	1171	1239	1305
QMax	292	4130	5408	6670	7930	9170	10400	11640	12870	15320	17770	20210	66000	25120
Measurable Up Limit	4666	6600	8650	10680	1268	14670	16650	18620	20590	24500	28420	32340	36260	40200
Measurable Low Limit	350	423	484	538	586	631	672	711	747	815	878	936	990	1044
DN200 Qmin	700	847	969	1076	1173	1261	1344	1421	1494	1630	1756	1873	1983	2088
QMax	4666	6600	8650	10680	12680	14670	16650	18620	20590	24500	28420	32240	36260	40200
Measurable Up Limit	9330	13200	17300	21360	25360	29340	33300	37240	41180	47000	56850	64680	72520	80400
Measurable Low Limit	610	740	848	942	1026	1104	1176	1243	1308	1427	1536	1638	1735	1827
DN250 Qmin	1050	1270	1614	1759	1892	2016	2132	2241	1446	2634	2808	1453	2975	3132
QMax	6998	9906	12980	16010	19020	22000	24970	27930	30880	36760	42640	48500	54390	60300
Measurable Up Limit	13997	19810	25960	32030	38040	44000	49940	55860	61760	73520	85270	97000	108780	120600
Measurable Low Limit	875	1056	1210	1345	1466	1577	1680	1776	1868	2038	2195	2340	2480	2610
DN300 Qmin	1750	2116	2422	2690	2932	3153	3359	3550	3736	4076	4389	4682	4958	5220
QMax	11664	16510	21630	26690	31700	36670	41620	46550	51470	61270	71010	80850	90650	10050
Measurable Up Limit	20995	29720	38930	48040	57050	66000	74900	83800	92650	110300	127900	145530	16320	180900
Measurable Low Limit	1050	1270	1453	1614	1759	1892	2016	2132	2241	2446	2634	2808	2975	3132

[10] Vortex Flowmeter Installation and Operation Manual

Table Seven: Superheated steam's Pressure, Temperature and corresponding density(kg/m³)

Absolute pressure Mpa	Temperature(°C)					
	150	200	250	300	350	400
0.1	0.52	0.46	0.42	0.38		
0.15	0.78	0.70	0.62	0.57	0.52	0.49
0.2	1.04	0.93	0.83	0.76	0.69	0.65
0.25	1.31	1.16	1.04	0.95	0.87	0.81
0.33	1.58	1.39	1.25	1.14	1.05	0.97
0.35	1.85	1.63	1.46	1.33	1.22	1.13
0.4	2.12	1.87	1.68	1.52	1.40	1.29
0.5		2.35	2.11	1.91	1.75	1.62
0.6		2.84	2.54	2.30	2.11	1.95

0.7		3.33	2.97	2.69	2.46	2.27
0.8		3.83	3.41	3.08	2.82	2.60
1.0		4.86	4.30	3.88	3.54	3.26
1.2		5.91	5.20	4.67	4.26	3.92
1.5		7.55	6.58	5.89	5.36	4.93
2.0			8.968	7.97	7.21	6.62
2.5			11.5	10.1	9.11	8.33
3.0			14.2	12.3	11.1	10.1
3.5			17.0	14.6	13.0	11.8
4.0				17.0	15.1	13.6

4. Installation Condition

4.1 Flow sensor should be horizontal or vertical installed (the liquid flow direction should be from bottom to top) on the pipeline, which is corresponding to the flow sensor nominal diameter.

4.2 The definite straight pipeline length at upstream and down stream of flow sensor is required.

The length should meet below table's requirements:

Straight Pipeline Configuration

Upstream Straight pipe form	The Straight length of upstream	The Straight length of downstream
Concentric tube fully open valve	$\geq 12DN$	$\geq 5DN$
Concentric contraction fully open valve	$\geq 15DN$	
Single quarter bend	$\geq 20DN$	
Two quarter bends on the same surface	$\geq 25DN$	
Two quarter bends on the different surface	$\geq 40DN$	
Regulating valve、Half-open gate valve	$\geq 50DN$	

4.3 At the upstream of flow sensor should not install a flow regulating valve.

4.4 If the length of upstream can not meet the requirement, we suggest that customer install a flow regulator at the side pipeline of upstream.

4.5 In order to avoid the accuracy, Flow sensor should be not installed on a strong vibration pipeline. If installation the flow sensor on a vibration pipeline, there are following methods to decrease the disturbing of vibration:

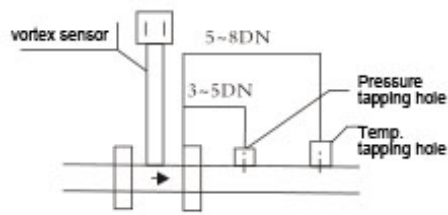
A. Installing a fixed support on pipeline at 2D upstream of flow sensor.

B. At the condition of meeting the straight length, install a hosepipe as a transmission.

4.6 Installation flow sensor on high temperature pipeline, if the heat preservation not good, the flow sensor should be installed downward vertical.

4.7 No collision by hard subject, when the flow sensor is installing, otherwise, the accuracy will be influenced, even flowmeter damaged.

4.8 When the amendment is needed for temperature and pressure, it should install pressure tapping points at 3-5D downstream of flow sensor and temperature taking point at 5-8D downstream of flow sensor. (As the drawing 4)



Drawing 4

5. Flow Sensor Electricity Wiring Diagram

5.1 Connecting terminal diagram and definitions

V+	Fout	GND	12-24V(DC)
1	2	3	Pulse output
			Shield, earth(OV)

5.2 Wiring

5.2.1 Wire should be 3*0.5mm² or 2*0.5mm² (I_{out} 4-20mA current output) shield conductor.

5.2.2 Wire and wire terminal should be connected tight.

5.2.3 Power load(OV) should ground connecting well; If the system do not permit OV end to ground, it can connect a 47μF/50V electrolytic capacitor between the OV terminal and earth.

6. The installation of insertion vortex flowmeter

1. Installing a insertion vortex flowmeter on the pipeline should insure the upstream $\geq 15D$, downstream $\geq 5D$.

2. Opening a $\Phi 90$ mm circular hole on the pipe line by gas cutting, the hole without rag to insure that the probe passes smoothly.

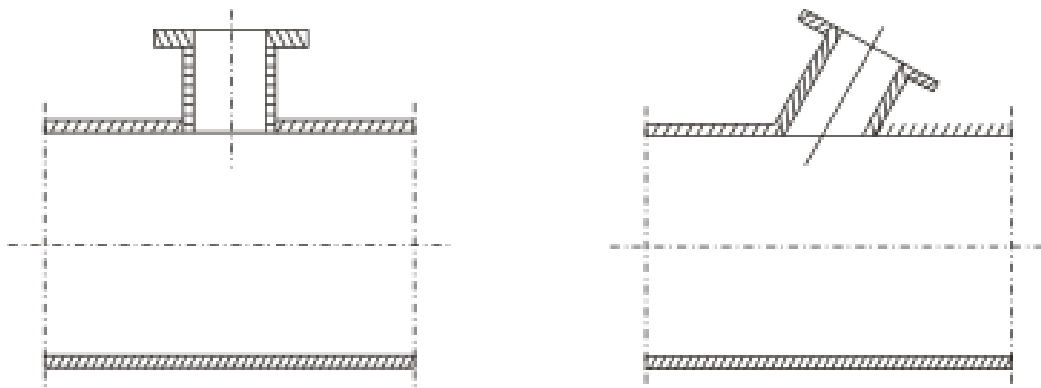
3. Welding flange short tube on the pipeline hole, pay attention to the vertical direction when welding, the effect after welding requires the axis and pipeline axis orthogonality and the extended line of flange short tube passing the cross-section circle center.

4. The Y length of Insertion rod below vortex flowmeter down connection flange, should be prevail to the real external workshop. The users do not need to adjust it. In the special condition, computing the insertion depth should consider the length of straight pipeline and working condition medium, then making proper adjustment. When the straight pipeline length is enough and pipeline diameter above 400mm, can adopting average flow spot measurement, this method does not influence by the Reynolds number changing, probe insertion depth is $1/4D-1/3D$ (D for the diameter of pipeline). When the pipeline straight length is short and pipeline diameter less than or equal to 400mm, adopting center velocity flow spot measurement, the insertion depth

$Y=0.5D$ (Reference drawing 6).After the measurement depth confirmed,adjusting insertion rod length,settling erosion point direction mark to make sure that the direction of vortex generator and flow direction in the pipeline is same,then connecting the flowmeter and bolts fixed joint on the flange short pipe.

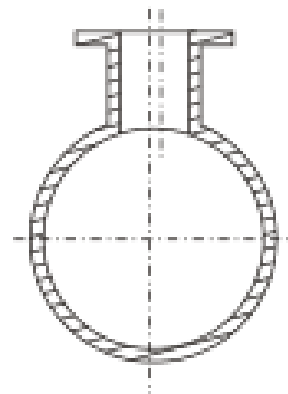
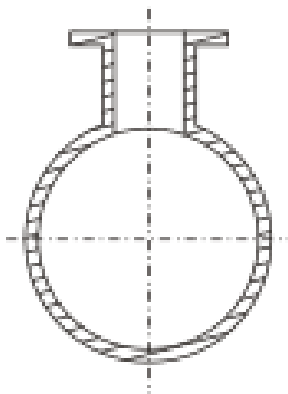
5.Should install sealing gasket between flanges,rubber plate for normal temperature,high temperature can adopt the asbestos pad etc. heat-resisting material.

6.Assembling and disassembling method at the condition of non flow cutoff(with ball valve),when disassembling,first unscrewing stopper screw,then loosening the lock nut,pushing insertion rod upward until the probe is located the limiting position of ball valve top,now ball valve is closed.Then disassembling the top connecting flange,bolt and nut,finally taking the flowmeter away.The process of assembling is opposite to disassembling.



Right

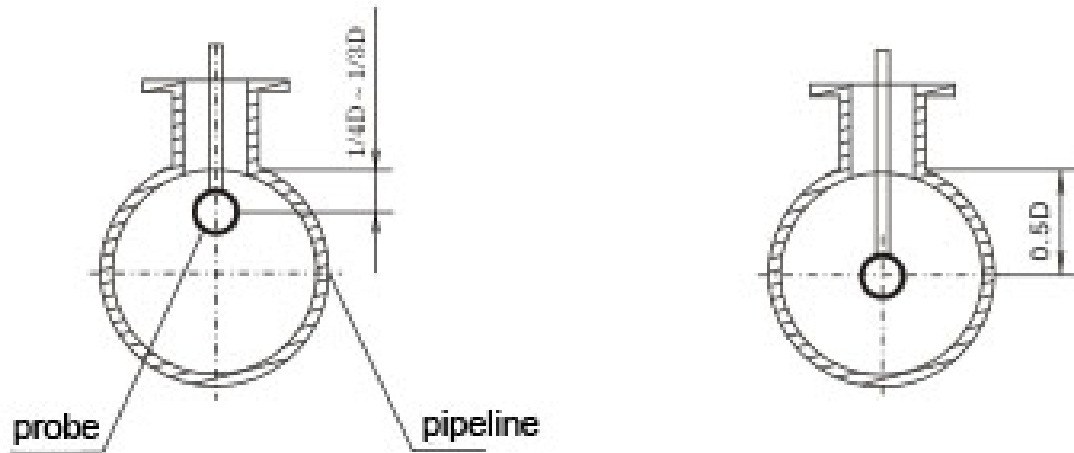
Wrong



Right

Wrong

Drawing 5 The flange position of Insertion Vortex Flowmeter installed on pipeline.



Drawing 6 Insertion Position
(Insertion Depth is according to reservation real calibration)

7. Local Display Vortex Flowmeter Usage instruction

Basic summarize

VT3W/2WE Three wire/Two wire system E series display circuit is the new simplify circuit for vortex flowmeter, the amplifier circuit is analog. In the normal flow range, it can measure the flow of Gas, Liquid and steam and away from the influence of flow physical property. The flowmeter can be suitable to various caliber and medium by manual setting.

Data post-processing and Signal remote transmission circuit can be divided into three-wire system and two-wire system. Three-wire system can include RS485 communication and can adopt battery powered. Two-wire system adopts 4-20mA current output and providing isolated original pulse output. Its' design and usage has below outstanding features:

1. When measuring the liquid, gas and steam can set the density, temperature and pressure, can converting the working condition flow to mass flow or standard status volume flow. 7 compensation algorithm can satisfy normal flow calculation of compensation.

2. 128*64 field-array LCD can display the instantaneous flow, total flow, measuring frequency and current output.

3. Data presentation is rich and intuitive. Universal operating system menu adopts english point out, distinct and intuitive, simple operation.

4. Electric circuit adopts surface mount technology, setting the caliber and medium by switch. The structure is compact with high reliability.

5. Probe and electric elements are generic and interchangeable. VT3WE three-wire system can adopt battery powered, which has working time more than 2 years.

6. VT2WE with 4-20mA analog current signal output, and includes three-wire pulse signal.

7. VT3WE with RS485 communication can satisfy customer's various needs.

RS485 adopts 8-16 bytes short message addressing PYMC communication protocol. Flowmeter series number 01-99. Which can upload the instantaneous flow, total flow, frequency according to the communication protocol address.

Flowmeter Wiring

Warning: Before wiring, cut off the external power. Wiring with electric is strongly prohibit!

[15] Vortex Flowmeter Installation and Operation Manual

VT2WE Two-Wire System Electric Wiring

1. Main power supply and output signal terminals (2-digit under-hang spinning terminals in the left).

+24V	-24V	V+	F	OV
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“+24V” is the “+” terminal of 15V~24VDC power source.

“-24V” is the terminal of current output.

“+” is the “+” terminal of the external 12V~24VDC, the current output flows from the “-” terminal to the computer or the sample resistance of the gauge, and then flows back to the “-” terminal after the load of sample resistance.

Pulse Output Wiring

V+	F	0
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V+ is connected to the “+” terminal of the pulse output power supply(+12V).

F is the terminal of pulse output signal

OV is connected to the “-” terminal of the pulse output power supply.

The pulse output must be applied when the main current circuit has electricity and the output is non-correction with 50Hz removal, The output signal of optical isolator original pulse is open-collector output with 1K5 pull-up resistance.

Intrinsic safety Vortex Flowmeter Ex-proof mark is **Exia II CT2-T6**, it should install Explosion-proof security gate between the flowmeter and computer.

Ex-proof Vortex Flowmeter installed at the hazardous area, Safety fence, Display Flowmeter, Power Supply, Computer and other associated apparatus must install at safety place. The details of wiring can consult the instruction and drawing of ex-proof fence, which is provided by safety fence manufacturer.

User Menu operation

(I)Working Menu

After power-on,meter will be self-checking first,after then it will enter into LCD(figure 1)working display status.

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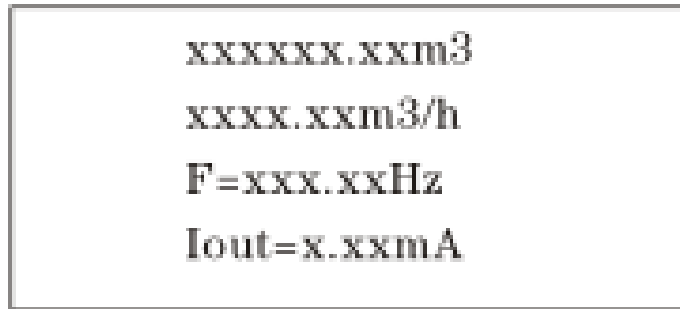


Chart 1 VT2WE Two-wire System working screen (Figure One)

The first line:Cumulant 2 decimal display and automatic carry of decimal points. The unit comes in line with the non-time-part of instantaneous flow rate unit;

The second line: instantaneous flow; reserve 2 decimals and the flow unit is presented in Menu Setup;

The third line: Flow frequency signal,which shows" F=XXXX.XX.Hz" Hz,reserving 2 decimals.

The fourth line: output current value display,which shows" I= XX.XX mA",reserving 2 decimals.(Only VT2WE Type).

Switching working screen 2 and working screen one by pressing "<" or "+"key.

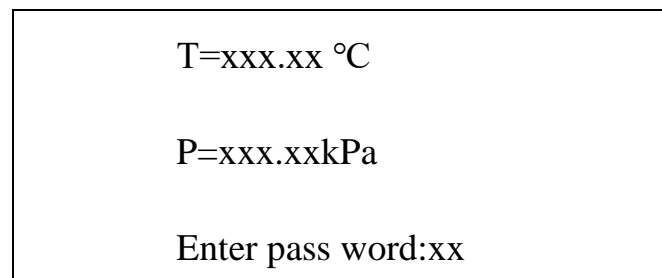


Chart 2 VT2WE Two-wire System working screen (Figure Two,Sub Screen)

From Up to Down:

The first line:Temperature value setting for temperature compensation calculation,shows" T=999.9°C",reserving 1 decimal.

The second line:Pressure value setting for pressure compensation calculation,,shows" P=99999.99kPa",reserving 2 decimals.

The third line:password entering set state.

Press the enter key of "E" to enter password initial input state.

Press the key of "S" to cancel entering state and return to figure two Subsidiary LCD.

Press “+”key in the input state to change the value of cursor circularly.

Press the shift key“<” to change the position of input cursor.

Press “E”key at the input state to submit the password.If right,enter to menu.if incorrect,return to initial input state.

T=xxx.xx °C
P=xxx.xxkPa
Enter password:xx

Chart 3 Password Initial Input State

Password:User menu password 22 or 2010

(II)User’s Data Setting

1.Input operation

In the input state:

Press “S”key to exit the input state.

Press “E”key to confirm and save the input.

Press “+”key in the input state to change the value or symbol of cursor circularly.

Press “<”key to move the current cursor one position towards the right.

Max.8 digits inputting is allowed.(including the symbol,decimal).

(II) Menu Operation

In the menu browse:

Press “+” key for page down;

Press“<”key for page up;

Press“E” key to enter sub-menu;

Press the“S”key to return working screen figure 2.Switching working screen 2 and working screen one by pressing “<” or “+”key;

In the sub-menu,press “S” key to quit out;press “E”key to enter into modified state;press “+” key for downward selecting;press “<”for upward selecting;press “E”key to enter into suba-menu amendments status.If input type modification,should be processed according to input operation.

In the sub-menu browsing,if the amendments is through optional pause instruction,press “+” key for page down,Press“<”key for page up,after selection,press “E” key for confirmation.

In the sub-menu amendments status,if amendment through inputting,should amend according to input operation.

In the sub-menu amendments status,Press the“S”key to return sub-menu.

3.Setting Method

After the password confirmed, it can enter into the data setting status, different requirements for measurement, choosing the different working model, setting the related flowmeter parameters at the same time. User menu password is 22.

Open the front cover of flowmeter, choosing the needed parameters menu, entering into the amendment status.

Attentions: When the parameters setting, the contents displayed need to press “E” key for reservation, otherwise, the setting is invalid.

User Parameter Setting Menu

Sub-menu Series#	Display of menu	Definition	Alternative options or range of value
1	Flow Unit select	Flow Unit select (default 0)	0: m ³ /h 1: m ³ /m 2: l/h 3: l/m 4: t/h 5: t/m 6: kg/h 7: kg/m
2	Algorithm Selection	Algorithm Selection (default 0)	00: Conventional Volume flow 01: Conventional mass flow 02: Volume flow of conventional gases 03: Mass flow of conventional gases 04: Temperature compensation of saturated steam 05: Pressure compensation of saturated steam 06: Temperature and pressure compensation of overheated steam
3	Flow Coefficient	Flow Coefficient (default 3600)	Set the meter coefficient with the unit of P/m ³
4	Maximum Output Flow	Max. Flow (default 1000)	When the meter outputs 4~20mA analog signal, must set the value and the value cannot be zero, the unit should be accordance with the flow unit.
5	Density setting	Density setting (default 1.0)	When Algorithm Selection is setting to mass flow (01, 03), it must set this item, the unit is kg/m ³
6	Temperature Setting	Temperature Setting (default 0.0)	Setting the temperature calculated value, when choose 02, 03, 04, 06 algorithm, it must set this item, the unit is Celsius degree.
7	Absolute pressure setting	Gas Absolute pressure set (default 101.325)	Setting the absolute pressure of gas, when choose 02, 03, 05, 06 algorithm, it must set this item, the unit is Kpa. (when vacuum is 0.0, it will cause the flow is 0)
8	Flow Lower limit cut off	Set percentage of resection pulse input (Default 1%)	The value is between 0~100
9	485 Address	Set RS485 communication No. (Default 0)	For three-wire system only. The meter uses RS485 communication should set this item, and should not equal to other equipment in the same system, the range is 0~31.

10	Damping time	Set current output damping time (Default 4s)	Only VT2WE two-wire system needs to set damp time, it is for avoiding the current's fluctuation too big along with the flow rate. The range is 2~32.
11	Reset Cumulant	Reset cumulant	If need to Reset cumulant, choose YES and press "E" key.

8. Common symptoms and Solution

Common Symptoms	Reasons	Solutions
Big measure error	1) The straight pipeline is not enough; 2) Strong variation for voltage; 3) Flowmeter pass the calibration interval; 4) Diameter of flowmeter and pipe are contrasting; 5) Not concentric installed or sealing gasket into pipe; 6) Flowmeter stained or damaged; 7) Two-phase flow or pulsatile flow; 8) Pipeline leakage;	1) lengthen straight length or add a regulator; 2) Check the power; 3) Inspect in time; 4) Check pipe inner Dia., correct flowmeter factor; 5) Adjust installation, reorganized sealing gasket; 6) Clean or replace the flow sensor; 7) Remove the two-phase flow or pulsatile flow; 8) Remove the leakage;
Signal Output Unstable and irregular	1) Strong electrical interference signal; 2) Flowmeter stained/damped, sensitivity become lower; 3) Flow sensor damaged or lead wire bad connection; 4) Two-phase flow or pulsatile flow; 5) Influenced by pipeline vibration; 6) Technological process unstable; 7) Not concentric installed or sealing gasket into pipe; 8) Upstream and downstream valves disturbance; 9) Liquid does not fill full of pipeline; 10) Vortex generator with entanglement; 11) Existing cavitation	1) Strengthen shield and grounding; 2) Clean or replace the flow sensor 3) Check the Flow sensor and lead wire; 4) Remove Two-phase flow or pulsatile flow; 5) Taking the method of reducing vibration; 6) Adjust the installation position; 7) Check the installation and modify seal gasket; 8) lengthen straight length or add a regulator; 9) Change flow sensor installed place & method; 10) Remove entanglement; 11) Lower flow velocity, increase pipe pressure.
Measuring Tube Leakage	1) Inner pipeline pressure too high; 2) Wrong choice of flow sensor nominal pressure; 3) Damaged for sealing gasket; 4) Corrosion for flow sensor	1) Adjust pipe pressure, change installation place; 2) Using one more higher level nominal pressure; 3) Changing sealing gasket; 4) Adopting corrosion prevention and protection.
Flow Sensor Abnormal Sound	1) Flow velocity too high, cause strong vibration; 2) Cavitation	1) Adjust flow or change bigger caliber flowmeter; 2) Adjust flow and add liquid pressure.