

Rotorflow



# VF28 Series Vortex Flowmeter

Technical Datasheet



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# 1. Overview

RV58 series intelligent vortex flowmeters are divided into 3 basic types according to the application situation of the board.

- Two line 24V DC; 4 ~ 20mA superposition Hart communication; pulse output;
- Temperature and pressure compensation, two line 24V D, 4 ~ 20mA superposition Hart communication, pulse output;
- 24V DC/3.6V Double power supply, display instantaneous and cumulative flow.

# 2. Features

- Simple structure, no moving part, reliable, durable with one echelon vortex generator;
- Output is proportional with flow rate;
- The two pieces piezoelectric components are used to tests the vortex being not contact with the medium;
- Liquid, gas and vapor could be measured by transmitters with same structure;
- The mediums under all temp. and pres. could be measured;
- The three lines show the instantaneous flow rate, the cumulative total amount, the third line frequency, the pressure, the temperature, the density, the current and the percentage.
- 4 ~ 20mA stack Hart output, pulse output;
- Support two temperature calibration and two pressure calibration, temperature and pressure can be set as manual input or automatic acquisition

# 3. Principle of operation

Set a echelon barrier (vortex generator) in the object to be measured and vortex will be produced alternately on the 2 sides of the barrier. The vortex frequency relates to flow velocity. To get the vortex frequency by piezoelectric transmitter or differential capacitance transmitter first, after adjusting the frequency, MCU will calculate the flow rate and accum. total. At the same times, proportional pulse signal, 4~20mA current signal will output. Fig.1

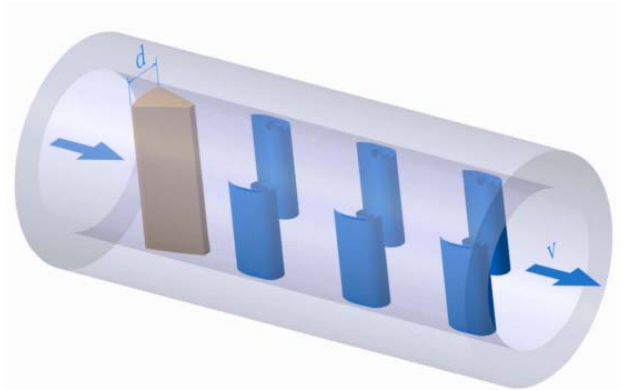


Figure 1 working principle diagram of vortex flowmeter

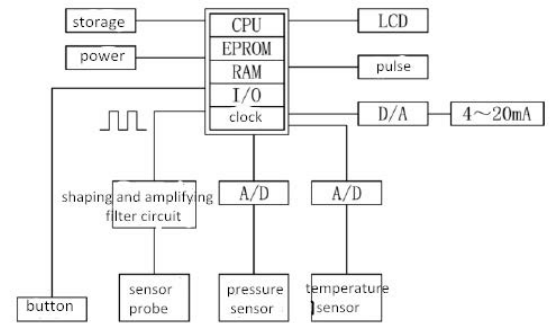


Figure 2 Schematic diagram of the circuit of vortex flowmeter

When a non streamlined cylinder (vortex generator) perpendicular to the flow direction is inserted into the fluid, there will be regular vortex on the downstream side, which is called "Kaman vortex street". In the range of Reynolds number, the frequency of the vortex release is related to the flow velocity of the fluid and the width of the vortices.

$$f = S_t \times v/d \dots \dots \dots (1)$$

In the equation :  $S_t$ — Strouhal number *Strouhal*

It can be seen from the above , As long as the frequency of the vortex is detected  $f$ ,

then the flow velocity of the fluid  $v$ ,

$$v = f * d/S_t \dots \dots \dots (2)$$

In the equation:

$d$ —inner diameter of the measuring tube

Thus the flow of fluid in the pipe is measured.

$$Q = v * A = f * d/S_t * A \dots \dots \dots (3)$$

In the equation:

$A$ — The cross section of the pipe ;

$v$ — Average velocity of medium

$d/S_t * A$  is constant, if  $1/k = d/S_t$

\*  $A$  and

$$Q = f/k \dots \dots \dots (4)$$

In the equation:  $k$ — meter coefficient of flowmeter  $1/m^3$ , it is usually calculated by actual flow test.

Because of the bluff body vortex on both sides alternately, the vortex force acting on the test object, the alternating stress, the stress of the piezoelectric element, and has the same vortex frequency alternating electric charge signal converter, through processing, output and vortex of the same frequency pulse signal or proportional to the flow rate 4 ~ 20mA DC signal.

## 4 Technical Parameter

medium type	Liquid, gas, steam
measuring range	See the flow chart for details
caliber	DN15, DN20, DN25, DN32, DN40, DN50, DN65, DN80, DN100, DN125, DN150, DN200, DN250, DN300
medium temperature	Standard: -40~+160°C; High temperature: 280°C
ambient temperature	-20~+60°C
relative humidity	5%~90%RH
medium pressure maximum	Max.10MPa
medium viscosity	DN15(1/2") ≤ 4cP; DN25(1") ≤ 5cP; DN40(1 1/2") ≤ 7.5 cP
speed	Liquid 0.3~7m/s; Gas 3~70m/s
maximum measurement error	Liquid volume flow : $Re \geq 20000$ 时, error ± 0.75% Volume flow of gas and steam: $Re \geq 20000$ $v < 75m/s$ , error ± 1% Volume flow of liquid, gas and steam: $10000 < Re < 20000$ , error ± 2% Volume flow of liquid, gas and steam: $Re \geq 20000$ , error ± 1.5% Volume flow of liquid, gas and steam: $10000 < Re < 20000$ , error ± 2.5%
repeatability	±0.5%
display	instantaneous flow, accumulative flow, pulse frequency, medium temperature, medium pressure
power supply	D ~ C 1232V or 3.6V lithium battery
load resistance	250~750 Ω (wire resistance included)
output signal	4~20mA
anti-hazard classification	Ex ia IIC T2~T6 Gb
electrical interface	M20×1.5 internal thread
housing protection	IP67
flange connection	DIN EN 1092—1 HG/T 20592~20635 GB/T 9112~9124 DN15~DN300—PN16~100; ASME 1/2"~12"—150~600lb JIS B 2220 DN15~DN300—10K~40K
clamp connection	DIN EN 1092—1 HG/T 20592~20635 GB/T 9112~9124 DN15~DN150—PN16~100; ASME 1/2"~6"—150~600lb JIS B 2220 DN15~DN150—10K~40K
installation type	One type of installation;Somatotype installation
installation conditions	Usually without turbulence: u p 15DN, d o w n 5DN; Pipe contraction and expansion, or with one 90°, up 25 DN, down 5 DN; 2 bent pipes in the plane, up30DN, down 5DN; 2 bent pipes in different planes, up40DN, down 5DN; Full open valve, up 15DN,down 5DN; half open valve, up 50DN, down 5DN.
pressure loss $\Delta P$	Gas and liquid $\Delta P = 118.5 \times Q^2 \times \rho / D^4$ steam: $\Delta P = 118.5 \times Q_m^2 / \rho / D^4$ $\Delta P$ : pressure loss, <i>kPa</i> $\rho$ : Density in operating state, <i>kg/m<sup>3</sup></i> $Q$ : Volume flow in operating state, <i>m<sup>3</sup>/h</i> $Q_m$ : mass flow, <i>kg/h</i> $D$ : Inner diameter of flowmeter, <i>mm</i>
material	main part: 304, 316, 316L, Ti, Hastelloy alloy transmitter: 304, 316L, Ti, Hastelloy alloy converter housing : die-casting aluminum alloy

## 5. Measurement Range and Selection

### 5.1 Range of gas measurement (Reference to standard air)

$t = 20^{\circ}\text{C}$   $\rho = 1.204 \text{ kg/m}^3$   $P = 101.3 \text{ kPa}$   $\eta = 0.0181 \text{ mPa} \cdot \text{s}$   $V_{max}$ :  $V_{min}$ :  $Q_{max}$ :  $Q_{min}$ :

caliber DN/NPS	internal diameter (mm)	Vmin (m/s)	Vmax (m/s)	Qmin (m <sup>3</sup> /h)	Qmax (m <sup>3</sup> /h)
15/0.5	16	8.5	45	6.2	32.5
20/0.75	20	7.5	55	8.5	62
25/1.0	25	6.0	70	10	110
32/1.25	32	6.0	73	17.5	210
40/1.5	40	6.0	76	27.5	340
50/2.0	50	6.0	80	42.5	560
65/2.5	65	6.0	80	72	950
80/3.0	80	6.0	80	110	1400
100/4.0	100	6.0	80	170	2200
125/5.0	125	6.0	80	265	3500
150/6.0	150	6.0	80	385	5000
200/8.0	200	6.0	80	680	9000
250/10.0	250	6.0	80	1100	14000
300/12.0	300	6.0	80	1530	20000
350/14.0	350	6.0	80	2100	27500
400/16.0	400	6.0	80	2750	36000

### 5.2 Measurement range of liquid (Reference to standard water)

$t = 20^{\circ}\text{C}$   $\rho = 998.2 \text{ kg/m}^3$   $P = 101.3 \text{ kPa}$   $\eta = 1 \text{ mPa} \cdot \text{s}$   $V_{max}$ :  $V_{min}$ :  $Q_{max}$ :  $Q_{min}$ :

caliber DN/NPS	internal diameter (mm)	Vmin (m/s)	Vmax (m/s)	Qmin (m <sup>3</sup> /h)	Qmax (m <sup>3</sup> /h)
15/0.5	16	0.6	7	0.45	5
20/0.75	20	0.6	7	0.7	8
25/1.0	25	0.5	7	0.9	12
32/1.25	32	0.5	7	1.5	20
40/1.5	40	0.5	7	2.5	30
50/2.0	50	0.5	7	3.5	50
65/2.5	65	0.5	7	6.0	80
80/3.0	80	0.5	7	9.0	125
100/4.0	100	0.5	7	15	195
125/5.0	125	0.5	7	22	300
150/6.0	150	0.5	7	32	440
200/8.0	200	0.5	7	57	790
250/10.0	250	0.5	7	90	1200
300/12.0	300	0.5	7	130	1750
350/14.0	350	0.5	7	180	2450
400/16.0	400	0.5	7	230	3150

### 5.3 Measurement range of saturated steam (kg/h)

P(MPa,abs)	0.1	0.15	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.5	2.0	2.5
T(°C)	99.6	111.3	120.2	133.5	143.6	151.8	158.8	164.9	170.4	175.3	179.9	198.3	212.4	223.9
$\rho(kg/m^3)$	0.5903	0.8625	1.129	1.651	2.163	2.668	3.169	3.666	4.161	4.654	5.145	7.593	10.04	12.51
DN15 $Q_{min}$	7	8	9	11	12	14	15	16	17	18	19	23	26	29
$Q_{max}$	38	46	52	63	73	80	88	95	100	106	112	136	157	175
DN20 $Q_{min}$	8	9	11	13	15	16	18	19	20	21	23	27	31	35
$Q_{max}$	60	70	84	100	116	130	140	150	160	170	180	218	250	280
DN25 $Q_{min}$	10	12	14	17	20	22	24	25	27	28	30	36	42	47
$Q_{max}$	80	95	110	130	155	170	185	200	210	225	235	285	330	370
DN32 $Q_{min}$	18	22	25	30	34	38	41	44	47	50	52	64	73	82
$Q_{max}$	140	170	195	230	270	300	328	350	375	395	415	505	585	650
DN40 $Q_{min}$	20	25	30	35	40	44	47	51	55	58	61	74	85	95
$Q_{max}$	200	250	300	350	390	440	470	510	550	580	610	740	850	950
DN50 $Q_{min}$	38	45	55	65	73	80	88	95	100	107	112	136	157	175
$Q_{max}$	380	450	550	650	730	800	880	950	1000	1070	1120	1360	1570	1750
DN65 $Q_{min}$	63	80	90	110	120	135	145	155	170	178	186	227	260	290
$Q_{max}$	630	760	900	1100	1200	1350	1450	1550	1700	1780	1860	2270	2600	2900
DN80 $Q_{min}$	90	110	125	150	170	190	205	220	235	250	262	318	365	410
$Q_{max}$	900	1100	1250	1500	1700	1900	2050	2200	2350	2500	2620	3180	3650	4100
DN100 $Q_{min}$	125	155	175	220	245	270	295	315	335	355	375	455	525	580
$Q_{max}$	1250	1500	1750	2200	2450	2700	2950	3150	3350	3550	3750	4550	5250	5800
DN125 $Q_{min}$	190	230	265	320	365	400	440	470	500	535	560	680	785	875
$Q_{max}$	1900	2300	2650	3200	3650	4000	4400	4700	5000	5350	5600	6800	7850	8750
DN150 $Q_{min}$	250	305	350	425	485	540	585	630	670	710	750	910	1045	1165
$Q_{max}$	2500	3050	3500	4250	4850	5400	5850	6300	6700	7100	7500	9100	10450	11650
DN200 $Q_{min}$	500	615	700	850	970	1050	1170	1250	1340	1420	1500	1820	2090	2330
$Q_{max}$	5000	6150	7000	8500	9700	10500	11700	12500	13400	14200	15000	18200	20900	23300
DN250 $Q_{min}$	760	920	1050	1300	1450	1600	1750	1900	2020	2130	2240	2720	3130	3500
$Q_{max}$	7600	9200	10500	13000	14500	16000	17500	19000	20200	21300	22400	27200	31300	35000
DN300 $Q_{min}$	1260	1500	1750	2100	2450	2700	2900	3150	3360	3550	3740	4540	5220	5830
$Q_{max}$	12600	15000	17500	21000	24500	27000	29000	31500	33600	35500	37400	45400	52200	58300
DN350 $Q_{min}$	1900	2300	2650	3200	3650	4000	4400	4730	5040	5330	5600	6800	7830	8740
$Q_{max}$	19000	23000	26000	32000	36500	40000	44000	47300	50400	53300	56000	68000	78300	87400
DN400 $Q_{min}$	2250	2750	3150	3800	4350	4800	5280	5680	6050	6400	6730	8170	9400	10500
$Q_{max}$	22500	27500	31500	38000	43500	48000	52800	56800	60500	64000	67300	81700	94000	105000

### 5.4 Model selection:

The calibre of the flowmeter should be determined according to the maximum flow Q that needs to be measured. The best linear section flow measurement should be chosen, and the maximum flow rate should be measured not less than the 1/2 of the maximum flow rate ( $Q_{max}$ ) of the flowmeter. Linear flow range flowmeter corresponding Reynolds number range is  $2 \times 10^4 = DN150 \times 4 \times 10^7 \times 10$ . Gas should convert the flow rate of standard state (101.3kPa, 0 C) into the flow under working condition, and then select the proper diameter flowmeter from the flow range table. The conversion formula is as follows:

5.4.1. standard density  $\rho_N$  convert to working density  $\rho$

$$\rho = \rho_N \times \frac{0.1013 + P}{0.1013} \times \frac{273.15}{273.15 + T}$$

5.4.2.1 standard volume flow  $Q_N$  for working volume flow Q

$$Q = Q_N \times \frac{\rho_N}{\rho} = Q_N \times \frac{0.1013}{0.1013 + P} \times \frac{273.15 + T}{273.15}$$

5.4.2. Find out the flow in the working state Q

5.4.2.2 Mass flow  $Q_m$  calculate the working condition of volume flow Q

$$Q = \frac{Q_m}{\rho}$$

5.4.3 The pressure loss of the flowmeter is calculated as follows:

$$\text{gas and liquid } \Delta P = 118.5 \times Q^2 \times \rho / D^4$$

$$\text{steam: } \Delta P = 118.5 \times Q_m^2 / \rho / D^4$$

5.4.4 Avoid cavitation

When measuring liquid (especially volatile liquid) flow rate, when the flow rate is high and the pipeline pressure is low, it is likely to produce cavitation phenomenon, so that the flowmeter can not work properly, or even damage the flowmeter and equipment. To avoid cavitation, it is necessary to estimate the minimum working pressure of the cavitation phenomenon when the maximum flow rate is not occurred.

$$P_L = 2.7\Delta P + 1.3P_0$$

If the working pressure in the pipe is lower than the estimated pressure value, the working pressure must be increased or reduce the flow.

The meaning of each parameter:

$P$ : Pressure of working state,  $MPa$

$T$ : Temperature in working state ,  $K$

$\rho$ : Density in working state ,  $kg/m^3$

$\rho_N$ : Density in standard state ,  $kg/Nm^3$

$Q$ : Volume flow in working state ,  $m^3/h$   $Q_m$ : mass flow ,  $kg/h$

$\Delta P$ : pressure loss ,  $kPa$

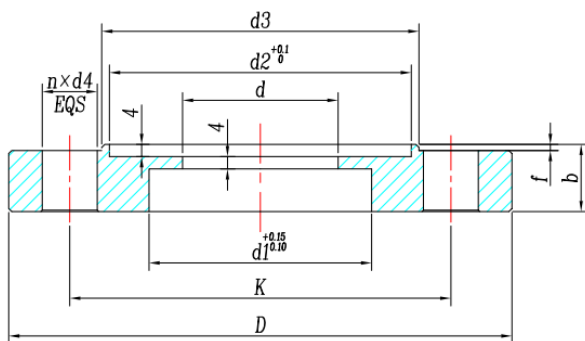
$D$ : Inner diameter of flowmeter ,  $mm$

$P_0$ : Saturated vapor pressure of liquid under working condition ,  $kPa$

## 6 .Dimension,size and weight

### 6.1、Clamp type

Pair positioning flange size identification diagram

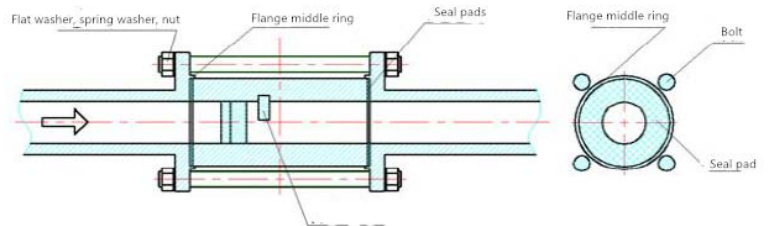


Schematic diagram of vortex process connection

Installation: Clamp

Caliber: DN15~DN150

Accessories: Pinch flanges, seal pads, flat washer, spring washer, nut



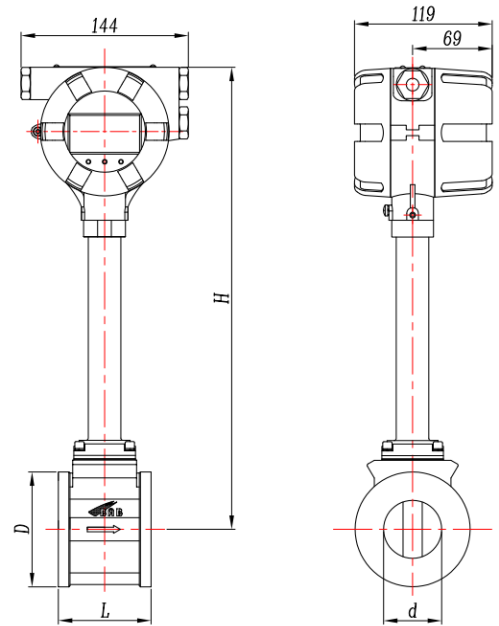
In order to ensure the concentricity of the instrument and the process pipeline, please refer to the table below and order the RV58C series clip type vortex street flowmeter positioning flanges produced by our company :

### Metric Flanges Dimensions

Caliber/DN	Pressure/MPa	D /mm	K /mm	d1 /mm	d /mm	d2 /mm	d3 /mm	b /mm	n x d4	Seal pads
15	4.0	95	65	18	16	45	49	16	4 x 14	Ø44.5 x Ø16.5
20	4.0	105	75	25	20	55	59	18	4 x 14	Ø54.5 x Ø20.5
25	4.0	115	85	32	25	65	69	18	4 x 14	Ø64.5 x Ø25.5
32	4.0	140	100	38	32	75	79	18	4 x 18	Ø74.5 x Ø32.5
40	4.0	150	110	45	40	85	89	18	4 x 18	Ø84.5 x Ø40.5
50	4.0	165	125	57	50	100	104	20	4 x 18	Ø99.5 x Ø50.5
65	1.6	185	145	76	65	120	124	20	4 x 18	Ø119.5 x Ø65.5
80	1.6	200	160	89	80	135	139	20	8 x 18	Ø134.5 x Ø80.5
100	1.6	220	180	108	100	155	159	20	8 x 18	Ø154.5 x Ø100.5
125	1.6	250	210	133	125	185	189	22	8 x 18	Ø184.5 x Ø125.5
150	1.6	285	240	159	150	210	216	22	8 x 22	Ø209.5 x Ø150.5

### Metric Clamp Size

Caliber/DN	Pressure/MPa	D/mm	d/mm	L/mm	H/mm	Weight/kg
15	4.0	45	16	65	393	3.5
20	4.0	55	20	65	399	4.0
25	4.0	65	25	65	401	4.5
32	4.0	75	32	65	396	5.0
40	4.0	85	40	80	397	6.1
50	4.0	100	50	80	399	7.0
65	1.6	120	65	80	406	7.4
80	1.6	135	80	100	431	10
100	1.6	155	100	120	438	15
125	1.6	185	125	140	464	20
150	1.6	210	150	160	476	28



### British System Positioning Flange

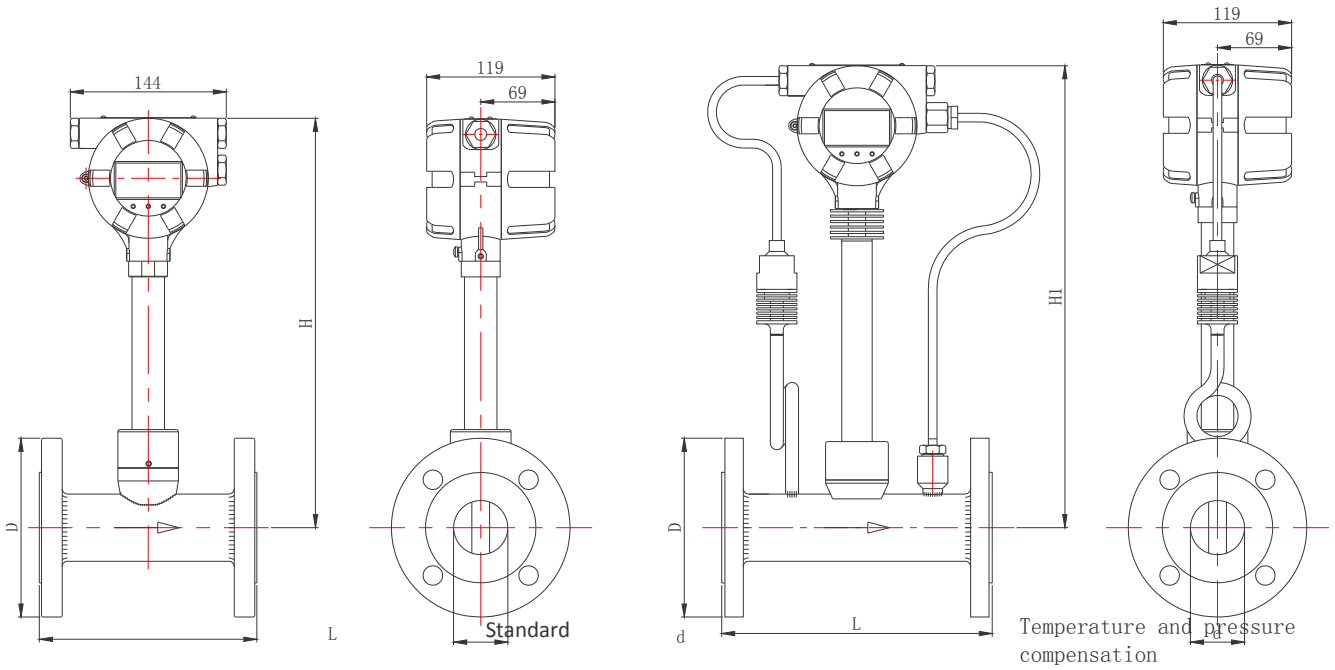
Caliber/NPS	Pressure/ CLASS	D /inch	K /inch	d1 /inch	d /inch	d2 /inch	d3 /inch	b /inch	nxd4	Seal pad
1/2	150	3.50	2.38	0.84	0.62	1.38	1.54	0.46	4x5/8	Ø1.38 × Ø0.62
3/4	150	3.88	2.75	1.05	0.82	1.69	1.85	0.52	4x5/8	Ø1.69 × Ø0.82
1	150	4.25	3.12	1.32	1.05	2.00	2.25	0.58	4x5/8	Ø2.00 × Ø1.05
1 1/4	150	4.62	3.50	1.66	1.38	2.50	2.75	0.64	4x5/8	Ø2.50 × Ø1.38
1 1/2	150	5.00	3.88	1.90	1.61	2.88	3.15	0.70	4x5/8	Ø2.88 × Ø1.61
2	150	6.00	4.75	2.38	2.07	3.62	3.80	0.77	4x3/4	Ø3.62 × Ø2.07
2 1/2	150	7.00	5.50	2.88	2.47	4.12	4.50	0.89	4x3/4	Ø4.12 × Ø2.47
3	150	7.50	6.00	3.50	3.07	5.00	5.20	0.96	4x3/4	Ø5.00 × Ø3.07
4	150	9.00	7.50	4.50	4.03	6.19	6.55	0.96	8x3/4	Ø6.19 × Ø4.03
5	150	10.00	8.50	5.56	5.05	7.31	7.50	0.96	8x7/8	Ø7.31 × Ø5.05
6	150	11.00	9.50	6.63	6.07	8.50	8.60	1.02	8x7/8	Ø8.50 × Ø6.07

### British System Clamp Size

Caliber/NPS	Pressure/ Class	D/inch	d/inch	L/inch	H/inch	Approximate weight lb
1/2	150/300/600	1.38	0.63	2.56	15.47	7.04
3/4	150/300/600	1.69	0.79	2.56	15.71	8.14
1	150/300/600	2.00	0.98	2.56	15.79	9.24
1 1/4	150/300/600	2.50	1.26	2.56	15.59	10.34
1 1/2	150/300/600	2.88	1.57	3.15	15.63	12.54
2	150/300/600	3.62	1.97	3.15	15.71	14.74
2 1/2	150/300/600	4.12	2.56	3.15	15.98	15.62
3	150/300/600	5.00	3.15	3.94	16.97	21.34
4	150/300/600	6.19	3.94	4.72	17.24	31.90
5	150/300/600	7.31	4.92	5.51	18.27	42.90
6	150/300/600	8.50	5.91	6.30	18.74	60.06



## 6.2. Flange Connection



### Metric Flange Connection (DIN、EN1092-1、HG/T20592)

Caliber /DN	Pressure/MPa	D/mm	d/mm	L/mm	H/mm	Standard type approximate weight /kg	L1/mm	H1/mm	Temperature and pressure compensation approximate weight/kg
15	4.0	95	16	200	368	4.7	250	418	5.6
20	4.0	105	20	200	367	4.9	250	417	5.7
25	4.0	115	25	200	366	4.9	250	416	5.7
32	4.0	140	32	200	357	5.5	250	407	6.3
40	4.0	150	40	200	364	5.9	250	414	6.5
50	4.0	165	50	200	369	6.9	250	419	7.8
65	1.6	185	65	200	378	8.2	250	428	9.3
80	1.6	200	80	200	386	9.2	250	436	10.5
100	1.6	220	100	250	396	11.8	300	446	13.2
125	1.6	250	125	250	409	14.8	300	459	16.5
150	1.6	285	150	300	423	21.7	350	473	24.0
200	1.6	340	200	350	448	33.3	400	498	36.2
250	1.6	405	250	400	475	54.3	450	525	58.6
300	1.6	460	300	450	500	78.4	500	550	83.7

### British System Flange Connection (ASME B16.5、HG/T20615、SH/T3406)

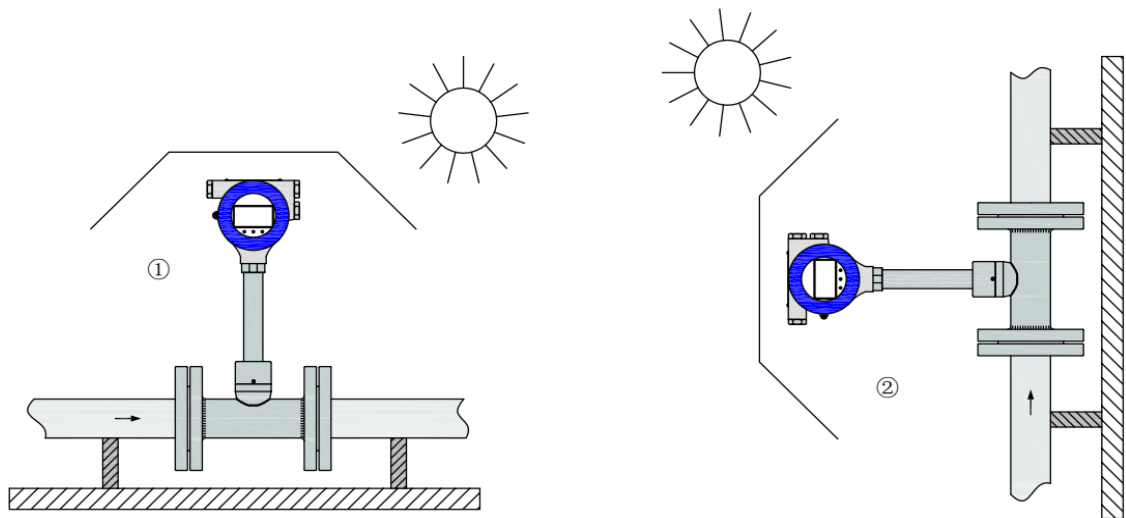
Caliber /NPS	Class150 D/inch	Class300 D/inch	Class600 D/inch	d/inch	L/inch	H/inch	Standard Weight/lb	L1/inch	H1/inch	Temperature and pressure compensation weight/lb
1/2	3.50	3.75	3.75	0.63	7.87	14.49	10.36	9.84	16.46	12.34
3/4	3.88	4.62	4.62	0.79	7.87	14.45	10.72	9.84	16.42	12.59
1	4.25	4.88	4.88	0.98	7.87	14.41	10.89	9.84	16.38	12.61
1 1/4	4.62	5.25	5.25	1.26	7.87	14.06	12.15	9.84	16.02	13.89
1 1/2	5.00	6.12	6.12	1.57	7.87	14.33	13.06	9.84	16.30	14.28
2	6.00	6.50	6.50	1.97	7.87	14.53	15.14	9.84	16.50	17.20

2 1/2	7.00	7.50	7.50	2.56	7.87	14.88	17.99	9.84	16.85	20.54
3	7.50	8.25	8.25	3.15	7.87	15.20	20.23	9.84	17.17	23.09
4	8.50	10.00	10.75	3.94	9.84	15.59	25.93	11.81	17.56	29.04
5	10.00	11.00	13.00	4.92	9.84	16.10	32.51	11.81	18.07	36.29
6	11.00	12.50	14.00	5.91	11.81	16.65	47.72	13.78	18.62	52.70
8	13.50	15.00	16.50	7.87	13.78	17.64	73.21	15.75	19.61	79.72
10	16.00	17.50	20.00	9.84	15.75	18.70	119.53	17.72	20.67	128.83
12	19.00	20.50	22.00	11.81	17.72	19.69	172.41	19.69	21.65	184.17

## 7. Installation Requirements

### 7.1. Installation environment and precautions

7.1.1. Avoid temperature changes in large degrees. If above condition can not be avoided, it is necessary to have heat insulation ventilation. It is necessary to avoid direct sunlight, if you can't avoid adding a sunshade as shown in the following figure.



7.1.2. Avoid strong power equipment, high frequency equipment, high power switching power supply equipment, and try not to share power with these equipment as far as possible.

7.1.3. Avoid corrosive gas environment, or ensure ventilation.

7.1.4. Avoid the mechanical produced by the pipe, or install anti-vibration seat plus suction pad or hose isolation, 2DN from UP and Down.

7.1.5. The inner diameter of the flowmeter sensor and the pipe must be equal, and the former should be the latter(0.98~1.05)D.

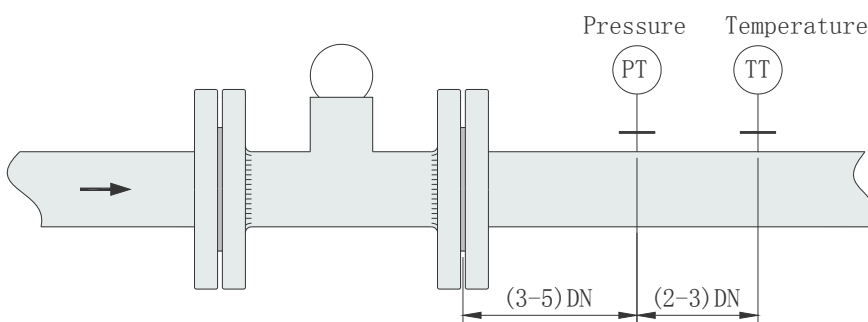
7.1.6. The upper and lower pipe should be installed with the flowmeter in a coaxial line, and its coaxiality should be less than 0.05D.

7.1.7. If the temperature of medium > 150 C (302 F), when the sensor is installed, the transmitter must be facing to the side or below.

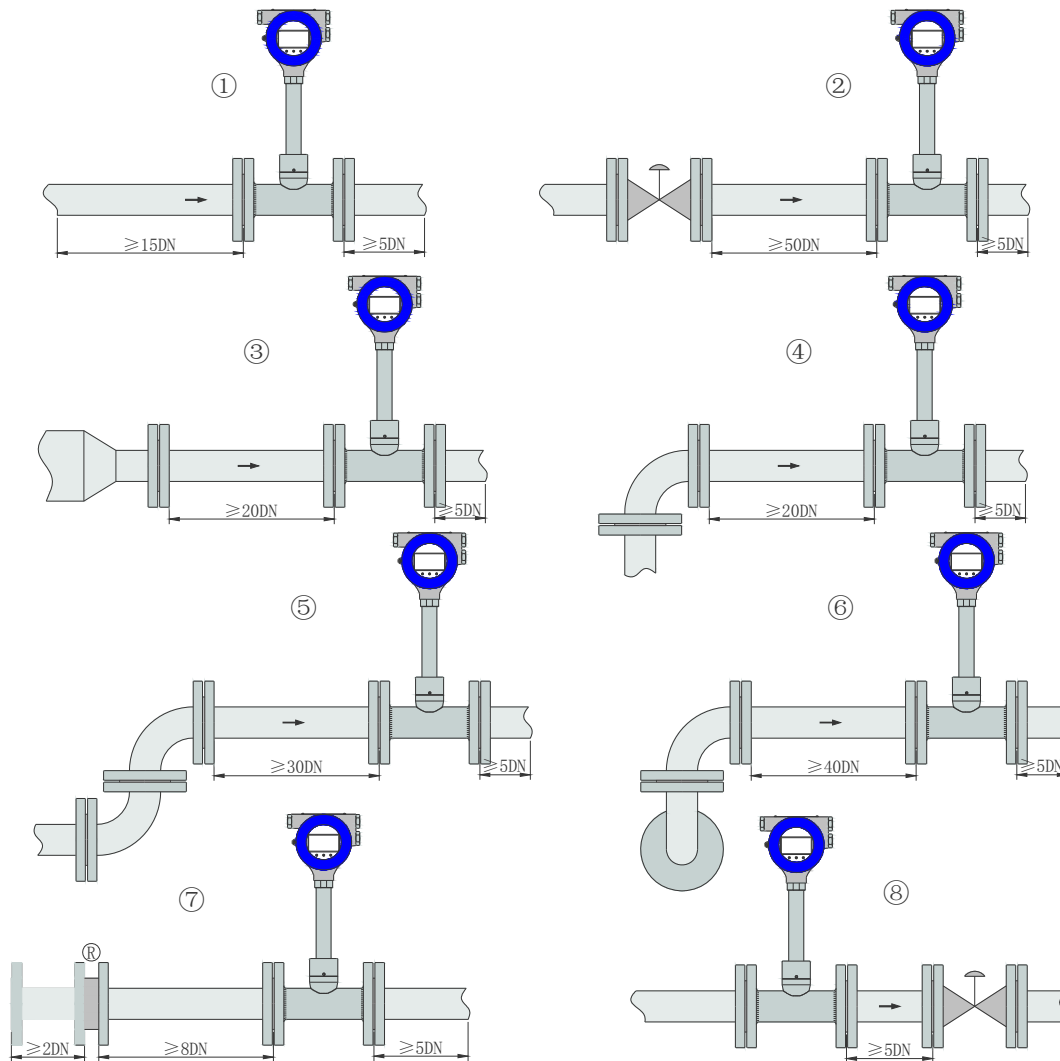
7.1.8. If medium flows vertically down, it is necessary to ensure that the liquid is full of pipes to ensure the accuracy of the measurement.

7.1.9. In order to facilitate the installation, the pipe needs to be more than 0.5m of the wall.

7.1.10. While connecting external pressure or temperature compensation, install as the picture below.

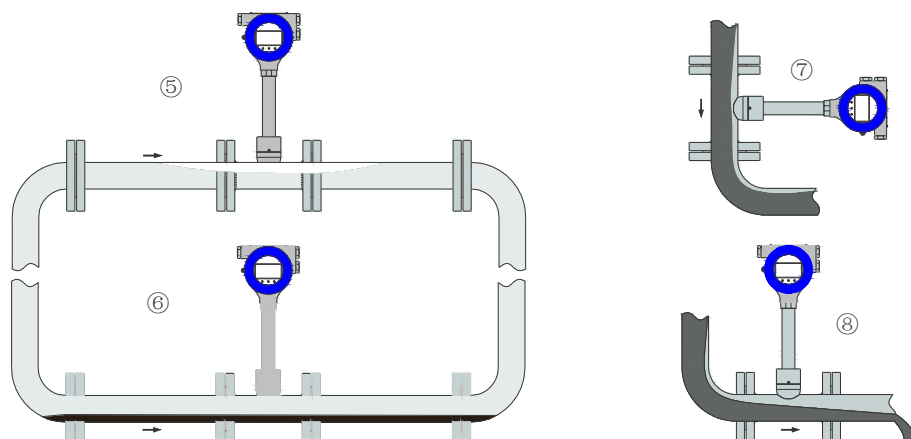


## 7.2. Upper and lower straight pipe



Usually without turbulence: up $15DN$ , down $5DN$ ; 2.if installed to the upstream flow, ensure the pipe length is $\geq 50DN$ ; 3. For neck tube, upstream straight pipe length is  $\geq 20DN$ , downstream straight pipe length is  $\geq 5DN$ ; 4. one-way elbow upstream straight pipe is  $\geq 20DN$ , downstream straight pipe length is  $\geq 5DN$ ; 5. two-way elbow upstream straight pipe is  $\geq 30DN$ , downstream straight pipe length is  $\geq 5DN$ ; 6. 3D bidirectional elbow upstream straight pipe is  $\geq 40DN$ , downstream straight pipe length is  $\geq 5DN$ ; 7. If the installation conditions can not meet the requirements of the length of the upstream straight pipe section, it is suggested to use the rectifier between two flanges; 8. If the medium is transmitted through a piston pump / plunger pump or compressor (liquid pressure  $>10$  bar (145 psi)), the pipe may be subjected to hydraulic vibration when the valve is closed. If above condition happens, the valve should be installed downstream and a proper absorber may be required.

## 7.3. Medium Flow Direction and Instrument Installation Direction and Precautions



The instrument can be installed in any direction on the pipe. When measuring liquid on a vertical pipe, the flow direction should be down to avoid the non-full-tube(see 3); While measuring high temperature medium (such as steam or medium temperature  $\geq 150^{\circ}\text{C}$  ), select the installation direction 2 or 4; While measuring low temperature medium (such as liquid nitrogen), 2 and 4 are recommended; For horizontal installation, 1,2 and 4 are recommended, and the direction of the flow of the medium must be in accordance with the arrow direction of the flowmeter. Whiling measing liquid, never install the instrument above the the pipe like 5, or there will risk of bubble aggregation in the instrument leading to pressure fluctuation and inaccurate measurement; Never install the instrument in a vertical downward flow pipe like 7 nor 8, this leads to pressure fluctuation and inaccurate measurement; Never install the instrument at a position below the pipe elbow when measuring steam like 6, otherwise, condensate is easily aggregated, and condensing will result in cavitation and inaccurate measurement. Under specific conditions, the instrument will be damaged and the medium will leak.

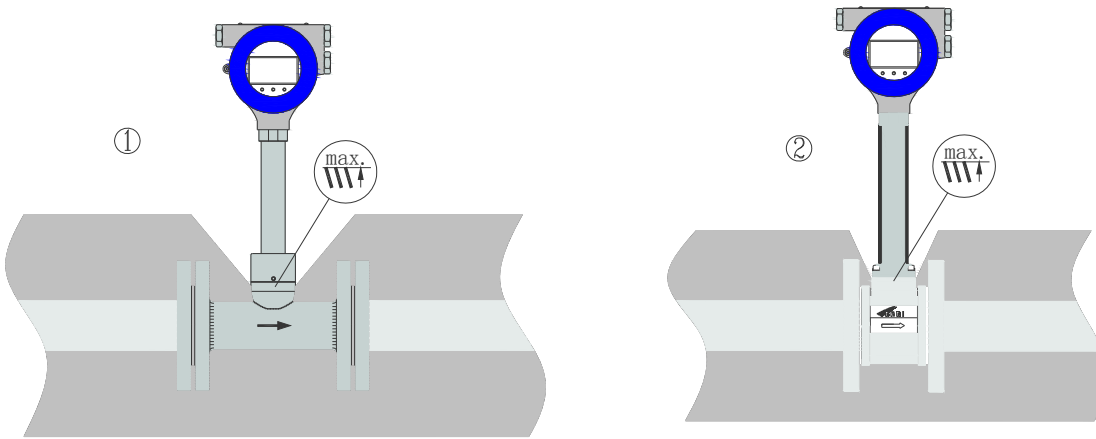
**NOTE: When using the instrument, open the valve slowly to avoid the hydraulic impact!**

### 7.4. Medium Condition

- 7.4.1. Ensure that the medium is a one-way flow, and the droplets, bubbles and solid particles are not allowed in the gas, liquid and steam.
- 7.4.2. While measuring gas and steam, make sure the drying degree is  $\geq 95\%$ , otherwise install a separator 50D up stream the instrument.
- 7.4.3. If there are solid particles in the medium and some filtering equipment is installed , it should be checked regularly.
- 7.4.4. For the medium which is easy to scale and precipitate, it is necessary to clean the scale of the measuring tube part of the instrument regularly.

### 7.5. Heat insulation layer

When measuring some fluid, avoid the heat conduction of the sensor. Thus by choosing different materials to avoid heat conduction and heat insulation. It is ensured that the flowmeter shell is exposed to the outside, so that the heat radiates outward, to prevent that the temperature of the electronic parts of the instrument is too high or too low. The height of the insulation layer is not allowed to exceed the 1/3 of the bracket.



## 8. Electric Connection

The inner loop circuit breaker in the instrument. Therefore, it is necessary to install the switch or the circuit breaker of the power supply circuit to ensure that the connection of the power line can be disconnected conveniently.

Electrical connection must be carried out when POWER OFF. Please pay attention to the voltage data on the nameplate!

The transmitter must be reliably grounded. Connect directly to the earthing end inside the terminal box or outside the outer shell by minimum impedance ( $R < 100\Omega$ ) .

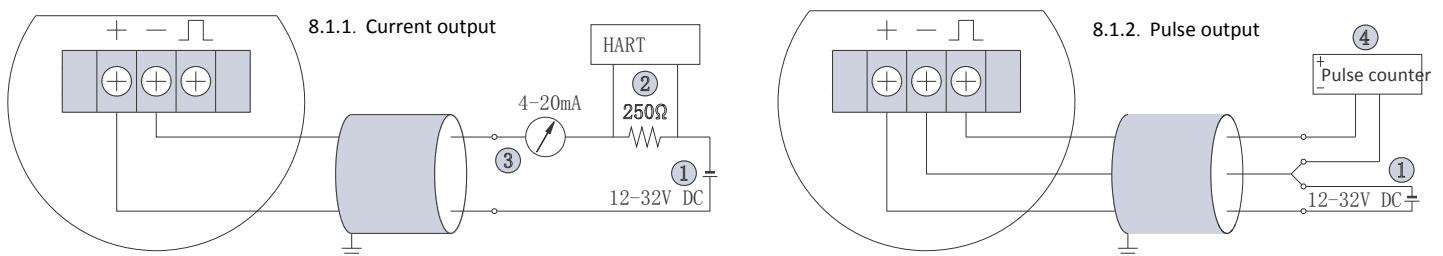
The safety grid must be installed as required.

For 4~20 mA, standard cable is feasible.

When 4~20 mA & HART or pulse output is used, in order to reduce the influence of electromagnetic and noise interference, shielded cables are required. The cable shield must be grounded in a safe place.

While connecting the cable, bent down the cable to ensure that the moisture is not penetrated into the cable entrance.

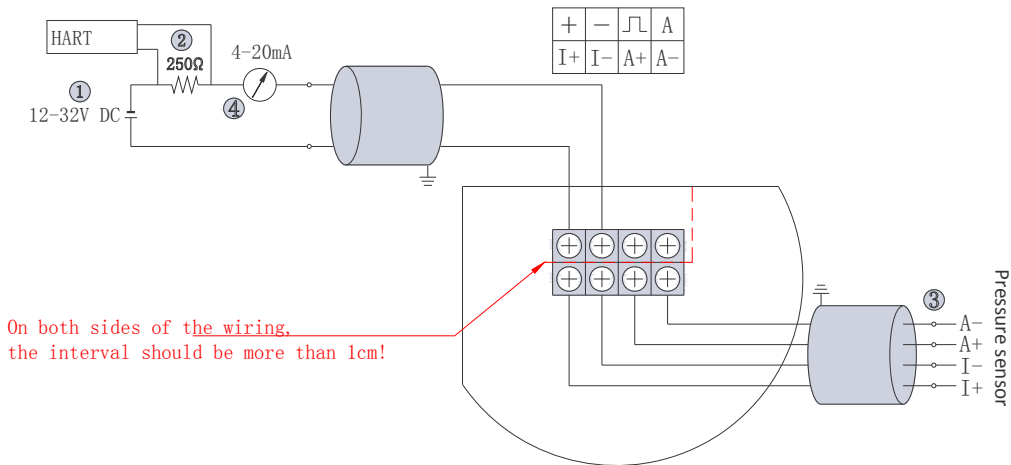
### 8.1. Standard



- 1. Power :12~32V DC ; 2. Hart Minimum load required 250Ω ;3 .Analog current output 4~20mA ;
- 4 Pulse counter ;5. Maximum loop resistance  $R_{max} = 45(\text{UB-12})$

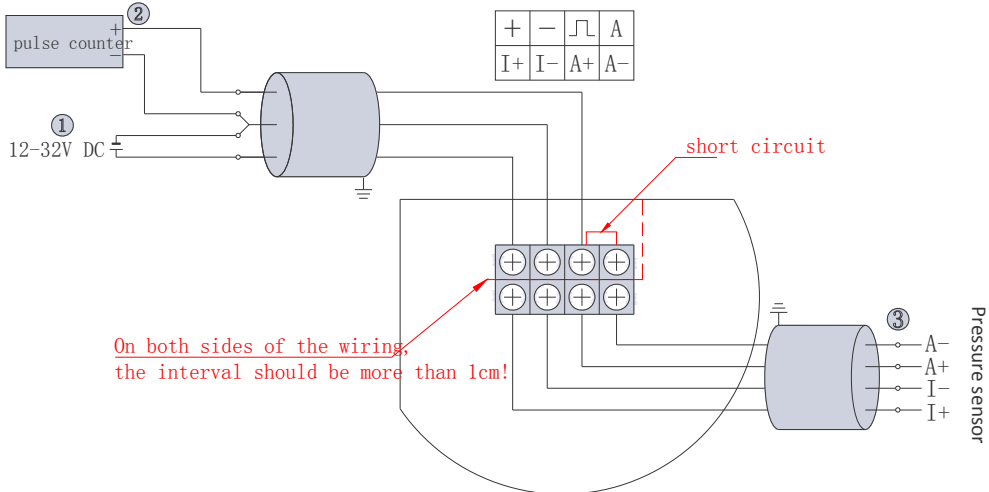
## 8.2. Temperature and pressure compensation

### 8.2.1. 4-20mA output+Hart+Pressure sensor



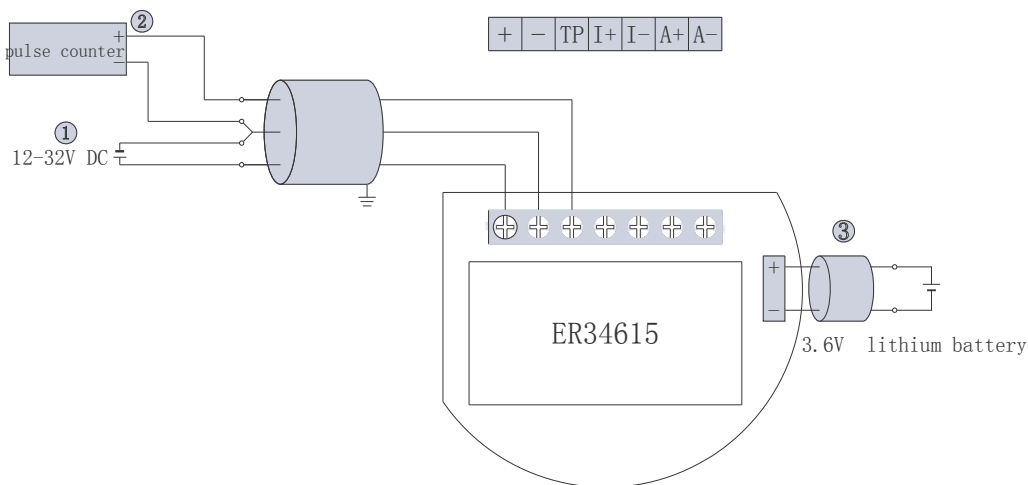
1.power supply : 12~32V DC; 2. Hart minimum load required 250Ω ; 3. pressure sensor ; 4.analog current output4~20mA

### 8.2.2.pulse output + pressure sensor



1.power supply; 2.pulse counter; 3. pressure sensor

### 8.3. Battery type (with 24V DC power supply and pulse output)

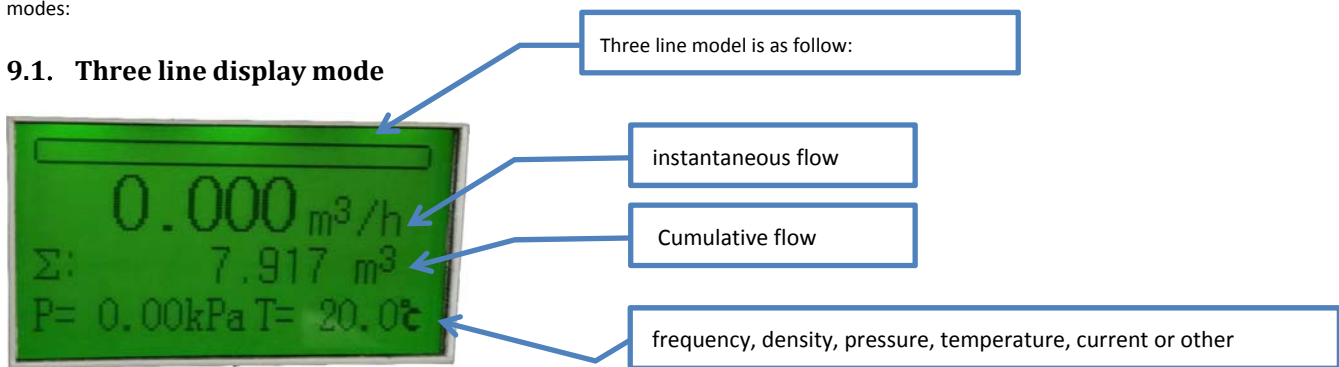


①power supply: 12~32V DC ②pulse counter ③3.6V lithium battery

## 9. Display

LCD displays can be set by the key. It uses 128\*64 dot matrix display to support multivariable display This instrument supports two display modes:

### 9.1. Three line display mode



Notes:

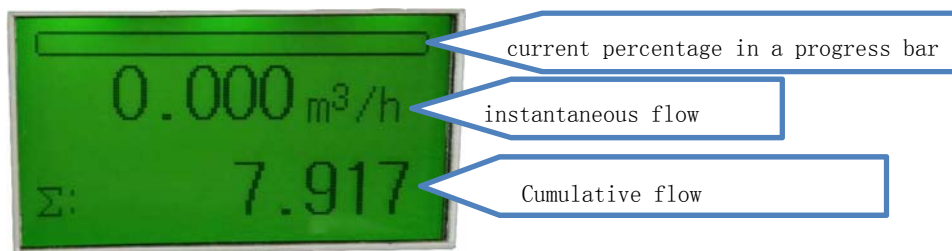
- In the normal state, long press M to set the frequency, pressure, temperature, density, current and percentage.

Code of third line

Letter	F:	Den:	P:	T:	Curr:	Per:	P=	T=
Full Name	frequency	density	pressure	temprature	current	percentage	Pressure and temperature	

### 9.2. Two line mode

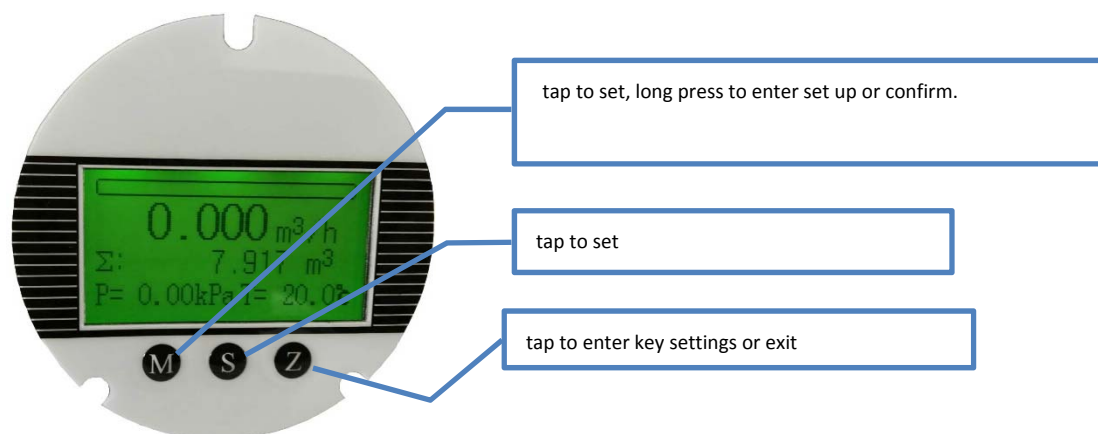
2 line mode is as follow:



## 10. Key debugging instructions

### 10.1. Key function description

There are 3 button on this product,whose functions as below:



## 10.2. Field configuration entry and exit

In normal state, tap button Z to enter Field Configuration. The parameter of Field Configuration can be set by number and Menu Selection; in the state of Field Configuration, press Z to exit and enter normal state.

Note: This instrument records the state of the last exit button setting, and press "Z" to return to the last exit.

### 10.2.1 Digital input setting method

No need to enter the password, it can modify contrast, write protection, alarm lower limit, alarm upper limit, traffic mode, traffic unit, upper limit of range, density, small flow resection, damping, decimal place, display mode, cumulative zero clearing and other options.

- Long press M key, the underline is moved to the second line, indicating that the number, symbol, or switch option on the underline can be changed.
- If the first bit is a symbol bit and the M key is pressed short, the symbol can be switched on.
- When press S and underline moves to right, the number on the underline can be changed from 1 to 9 and decimal point by pressing M.
- If the number on the underline is decimal point, tap M and the decimal point will be removed.
- Press S and set the numbers.
- while setting the data, long press the M key to save, or press the Z key to exit the setting

## 11. Quality and After-sales Service Commitment

Our company guarantees that the equipment and materials provided are completely new, unused, and fully meet the specifications and performance requirements specified by the buyer. For parts of failure or defect, which was caused by designing or manufacturing reasons, our company will repair or replace it for free with new parts. We provide after-sale technical service, instructions on how to use and the maintenance technical consultation. It is guaranteed that when the department of technology and maintenance receive questions from customers(E-mail fax ,telephone ), they will reply in 24 hours with solution till the problem is solved.

## 12. Type Code

Code Instruction	Product Code			Series Code		Installation type				Caliber	Pressure	main part material					probe material				pressure	temperature	Explosion proof type		output		communication		power
	vortex	liquid	gas	whole	split	flange	clamp	Thread	cutting sleeve	spec	1.6	304	316	316L	Ti	C4	304	316L	Ti	C4			PC	TC	Exi	Exd	4-20mA	pulse	
	VF	L	G	580	581	F	H	W	C	mm	Mpa	S4	S6	SL	Ti	C4	S4	SL	Ti	C4			i	d	4	P	S	H	
	VFL= liquid			580		F				100	1.6	S4					S4							d	4			H	B
Caliber Instruction	code	15	20	25	32	40	50	65	80	100	125	150	200	250	300	350	400	450	500	Used for:									
	metric	15 mm	20 mm	25 mm	32 mm	40 mm	50 mm	65 mm	80 mm	100 mm	125 mm	150 mm	200 mm	250 mm	300 mm	350 mm	400 mm	450 mm	500 mm	DIN、ISO、HG/T20592、GB( Chinese standard )									
	Code	0.5	0.75	1.0	1.2	1.5	2.0	2.5	3.0	4.0	5.0	6.0	8.0	10	12					Used for:									
	BS	1/2"	3/4"	1"	1-1/4"	1-1/2"	2"	2-1/2"	3"	4"	5"	6"	8"	10"	12"					flange: ANSI、ASME、HG/T20615 thread: BSP、NPT、R、G、M、cutting sleeve(M thread)									
Pressure Code	clamp conn	25.4	25.4	50.5	50.5	50.5	64.0	77.5	91.0	119										3A、ASME BPE、ISO/IDF、BS4825						sanitary			
	scale	34.0	50.5	50.5	64.0	64.0	77.5	91.0	106	130										ISO1127、ANSI									
	ex dia size code	50.5	50.5	50.5	50.5	50.5	64.0	91.0	106	119										DIN32676						Tri-Clampa			
	code	34.0	34.0																										
Pressure Code	code	1.0	1.6	2.0	2.5	4.0	5.0	6.3	10.0	11.0	15.0	16.0	20.0	25.0	26.0	32.0	42.0			Used for: GB, Chinese standard									
	Mpa	1.0	1.6	2.0	2.5	4.0	5.0	6.3	10.0	11.0	15.0	16.0	20.0	25.0	26.0	32.0	42.0												
	code	10	16		25	40		63	100			160	200	250			320			Used for: DIN、ISO									
	bar	10	16		25	40		63	100			160	200	250			320												
Pressure Code	code			150			300			600		900			1500		2500			Used for: ANSI、ASME、HG/T20615									
	Class			150			300			600		900			1500		2500												

Instruction: The type code VFL/580/F/100/1.6/S4/S4/d/4/H, suggest as follows: the medium is liquid, whole body structure, DN100 flange connection, pressure 1.6MPa, main body material 304, probe material 304, flameproof indicator, 4~20mA output, Hart communication.

Note: The function of HART works only under 4 - 20mA output mode. When powered by Li-battery, there will be no following functions: 4 - 20mA/ pulse /485/HART.



# 13. Datasheet

MAI SHIH Instruments Co.,Ltd

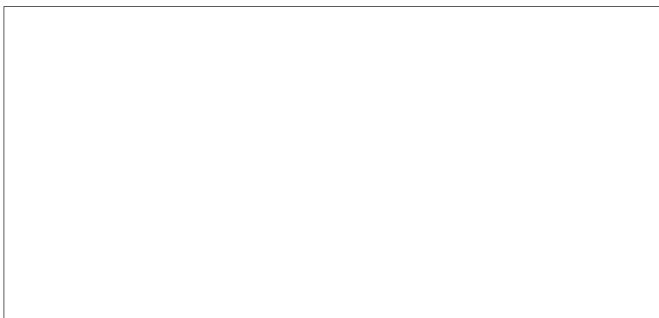
Address:Rm. 607, 6F., No. 7, Wuquan 1st Rd., Xinzhuang Dist., New Taipei City 248021 , Taiwan (R.O.C.)		Signature:
Tel: 02-22997112	Fax: 02-22993732	
Contract No.:	Delivery date:	Production Date:

## Vortex Flowmeter Specification

Pro.No.									
Tag No.									
MFG.No.									
Quantity									
Nominal Diameter									
Flange Standard									
Pressure Rating									
Body Materials									
Probe Materials									
Overall Height									
Accuracy Class									
Fluid Conditions	liquid	gas	steam	liquid	gas	steam	liquid	gas	steam
Fluid Name									
Operating Conditions	Min	Normal	Max	Min	Normal	Max	Min	Normal	Max
Flow Rate									
Temperature	°C								
Pressure	MPa								
Density	kg/m <sup>3</sup>								
SPGR	kgf/m <sup>3</sup>								
Viscosity	mPa.s(cp)								
G.mol.Wt.									
Piping Size									
Measuring Range									
Electrical Signal Output									
Power Supply									
Cable Connection									
Protection Class									
Explosion Type									

### Accessory

Name	Model	Serial NO.	Specification	Pipe Size	Material.	Flange. Standard.	Quantity



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 Email: wei@mixgauge.com