FERTRON

USER MANUAL

VORTEX FLOWMETER

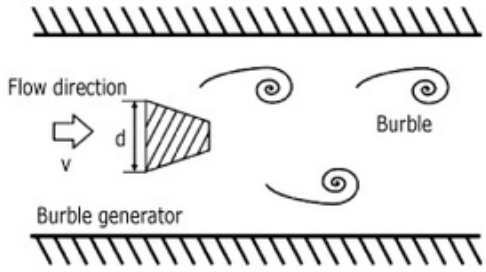
CONTENTS

1. Description

LUGB Vortex flow meter is one kind of velocity type flow meter, it's based on Karman vortex theory and adopts piezoelectric crystal to detect the burble frequency of the fluid caused by flowing through the triangular prism in the pipeline and then measure the flow of fluid. It is widely used in petrol, chemical industry, light industry and power heat supply and so on.

2. Working Principle

When the fluid in the pipeline passes the burble generator(triangular prism),burble will generate due to the acceleration of partial flow rate. The burble will arise alternatively in two burble lines, which is called Karman vortex. The releasing frequency of Karman vortex depends on the size of triangle prim and flow rate of fluid, while independent of the medium feature parameter, such as the temperature, pressure, it can be indicated by the following formulas:



$F=sR*v\ (1-1.27*d/D)\ Q=3600*F/K\ M=Q*P$

- F.....The releasing frequency of Karman vortex (Hz)
- Sr.....Strouhal number (unit: dimensionless)
- V.....Medium flow rate (m/s)
- d.....The width of triangle prim
- D.....Vortex meter inner diameter (m)
- Q.....Instantaneous volume flow rate (m^3/h)
- K.....Vortex meter coefficient (unit pulse number/m^3)
- M.....Instantaneous quality flow rate (kg/h)
- P.....Fluid density (kg/m^3)

3. Features

- Integrated pressure and temperature compensation.
- 4-20mA, pulse with HART; Optional pulse with RS485
- Wide temperature range up to highest temperature 350°C
- Adopt Japan OVAL technology and design
- Embedded sensor, 4 piezo-electric crystal encapsulated inside the sensor.
- No moving parts, no abrasion, non-wearing parts inside, fully welded SS304 body (Optional SS316)

Medium	Max flow rate (m/s)	Standard flow rate (m/s)
Gas	2~65	3~50
Liquid	0.3~8	0.5~5
Steam	2~70	3~50

4. Technical Data

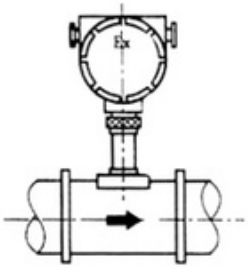
- Size : DN15-DN300mm
- Accuracy : ± 1.5%(standard),± 1.0%(optional)
- Power Supply : 24VDC, battery 3.6v
- Communication : RS485/Modbus, Hart
- Flange Standard : EN1092-1
  PN10,PN16,PN25,PN40
  ANSI BS16.5 Class 150,300,600
  JIS2220 10K,20K,40K
- Straight Pipe : Inlet Path ≥ 10D,Outlet Path ≥ 5D
- Signal Output : 4~20 mA,pulse
- Frequency Output : 2~3000 Hz
- Relative Humidity : ≤85%
- Explosion-proof : Exia IIC T1~T6 Ga
- Ambient Temperature : -40°C~55°C (Non Ex-proof Place)
  -20°C~55°C (Non Ex-proof Place)

- Nominal Pressure : 1.6 MPa, 2.5 MPa, 4.0 MPa
- Protection Grade : IP65
- Velocity : 0.4~7.0 m/s liquid
  4.0~60 m/s gas
  5.0~70 m/s steam
- Body Material : SS304(Standard),SS316(Optional)
- Resistance Coefficient : Cd ≤2.6
- Oscillatory Acceleration: ≤0.2g
- Reynolds Number : $2x10^4$~$7x10^6$

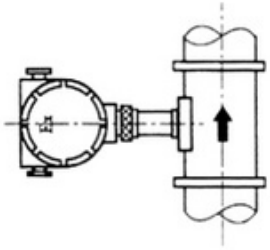
Size (mm)	Gas flow range (m^3/h)	Liquid flow range (m^3/h)
15	2-30	0.2-2
20	3.5-45	0.3-3
25	6-80	0.5-5
32	12-120	0.9-9
40	20-200	1.4-14
50	30-300	2.1-21
65	50-500	3.6-36
80	70-700	5.5-55
100	100-1000	8.5-85
125	150-1500	13-130
150	250-2500	19-190
200	400-4000	34-340
250	600-6000	53-530
300	1000-10000	76-760

5. Installation

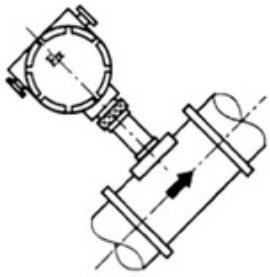
5.1 Flow meter installation form



Horizontal installation



Vertical installation



Inclined installation

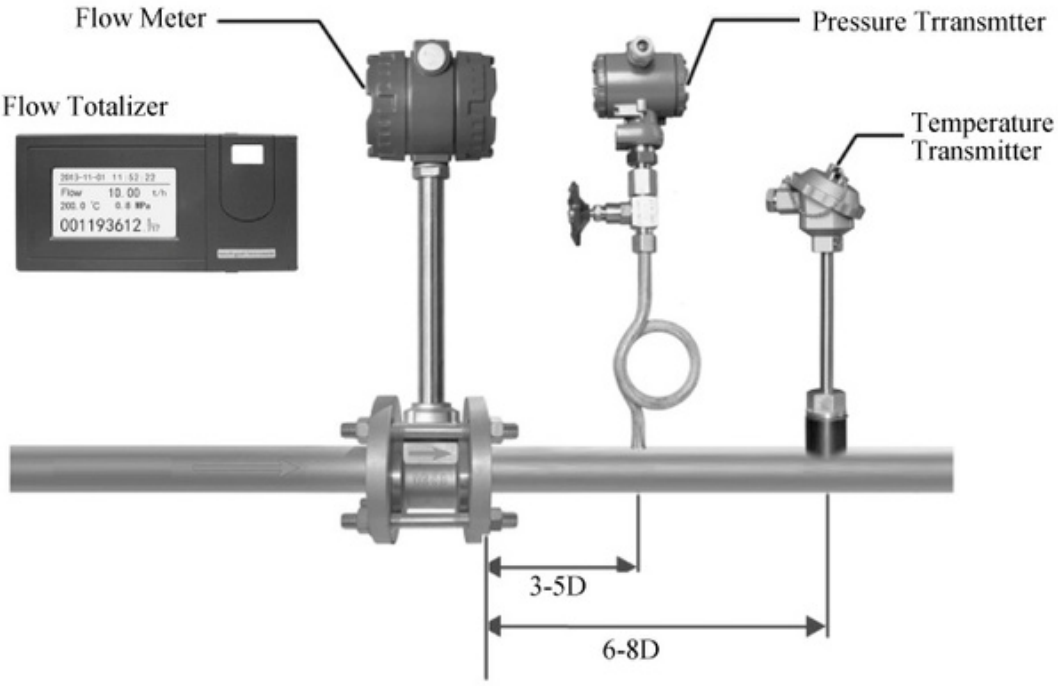
5.2 Installation steps

- Making hole on pipes according to hole dimensions, and the hole position should meet the requirement of strait pipeline.
- Input the whole set of flow meter which connecting the top flange to the pipeline hole.
- Weld and fix the position on flange and pipeline.
- Remove the flow meter, welding the flange according to requirement, and clean the protruding part inside of pipeline.
- Install the sealing gasket which has the same size of pipe on inner flange, input the flow meter to flange, the flow direction of flow meter should be the same as fluid, then fasten the bolts.

5.3 Installation of platinum resistance and pressure transmitter

- If the medium needs split temperature and pressure compensation(like steam, compressed air), then it should install temperature sensor and press transmitter.
- The temperature should be installed below the flow meter 6-8D, making a 25mm hole on fixed position,welding the platinum resistance base vertically or inclined on the hole, mount the platinum resistance to the base, and make sure no leakage.
- Pressure transmitter should be installed below flow meter 3-5D, the hole

position should at the position where the end of elbow welding vertically on the hole, mount the valve on the other end of the elbow, install pressure transmitter on the top of valve, the both sides of valve should make sure no leakage. If measuring high temperature medium, the elbow should be filled with water in advance, in order not to damage the pressure transmitter because of high temperature.

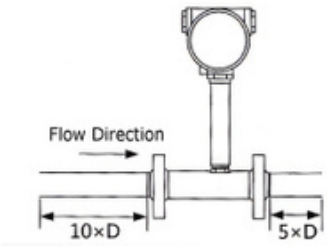
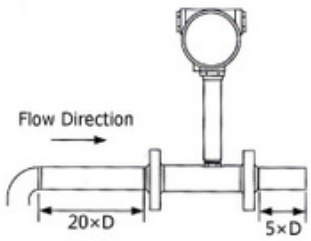
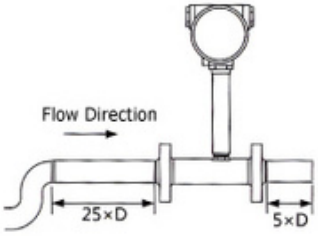
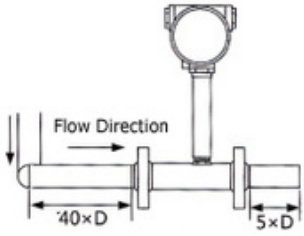
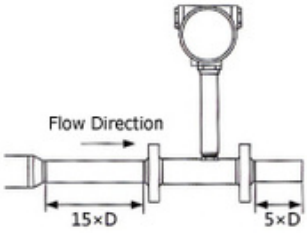
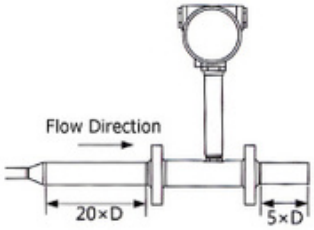
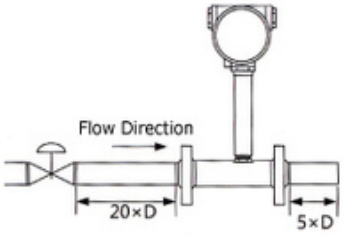
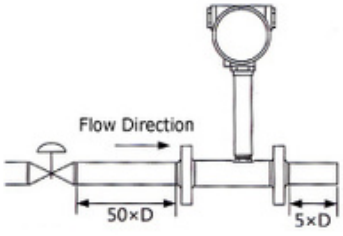


5.4 Installation Considerations

- Flow meter is best installed in the room, if required to be installed outdoors, avoid direct sunlight and rain should be measures to prevent.
  Flow meter should be avoided in magnetic interference, small space and maintenance inconvenient occasions.
- Flow meter should be avoided at higher temperatures by thermal radiation or equipment containing corrosive gas applications, if required to install, there must be insulated ventilation.
- Flow meter should be avoided in the mechanical vibration of the pipe, If to be installed, damping measures must be taken, Hose can be installed transition, or on the 2D of flow meter upstream or downstream Installation. of pipes fixed anchor and add shock pad.

- After positioning spot welding flange and pipe, Can not be welded with flow meter.
- Vortex flow meter can measure liquid, gas and steam, But it is not universal among different media; The same kind of media is divided into low, high and special high temperature in three sizes, it is not universal among different temperatures.
- When measuring liquids must ensure that the pipe is filled with liquid, So the medium should be a bottom-up flow.
- Flow meter should avoid longer installed on overhead pipes, Due to sagging pipeline. Easy to cause the seal leakage between the flow meter and the flange. If the required installation, on the 2D of flow meter upstream or downstream. Pipe support points were set.
- Measuring steam pipe, To prevent overheating converter, Do at least half meter connecting rod insulation.
- Shielded cable that connect flow meter direction, Keep away from strong electromagnetic interference occasions, And definitely not with the high voltage cable laying. Shielding line should be as short as possible, And not coil, In order to reduce the inductance, The maximum length is not more than 500 meters.
- First unscrew the case back cover when wiring, The signal lines from waterproof connector access. Correct wiring in accordance with wiring diagram. The waterproof joints tightening, And to ensure that the cable must bend down before entering the waterproof connector, To ensure that water does not enter the housing along the cable.

5.5 Straight pipe requirements

Entrance type	Installation conditions Entrance Exit	Entrance Baffles type	Installation conditions Entrance Exit
General		90°Elbow	
On the same plane Two 90°Elbow		On different planes Two 90°Elbow	
Reduced Pipeline		Expansion Pipeline	
Fully open valve		Half open valve	

Installation Precautions

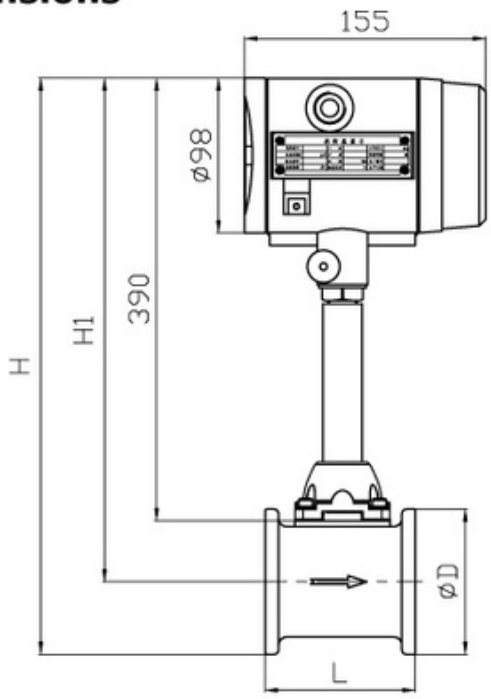
Note: Requirements for piping: Upstream downstream pipe inner diameter flow meter installation point should be the same as the inner diameter of the flow meter, Should meet the requirements of the following formulas:

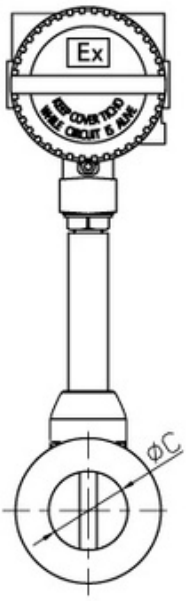
0.98D ≤ DN ≤ 1.05D

Formula: D :The inner diameter of the flow meter DN :Pipe inner diameter

Piping and flow meter must be concentric, Coaxial deviation should be less than0.05D.

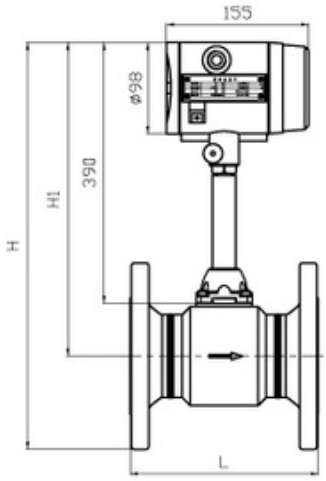
6. Dimensions

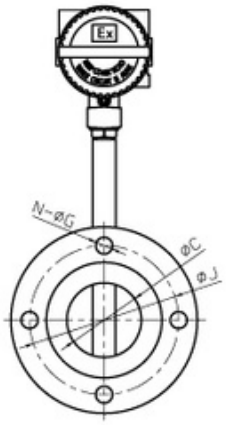




Wafer Type

Size	H1	H	L	D	C
15	431	448	70	35.1	15
20	431	452	70	43	20
25	431	456	70	50.8	25
32	431	463	70	64	32
40	428	464	70	73	40
50	431	477	75	92	50
65	440	492	75	105	65
80	448	511	100	127	80
100	459	537	120	157.2	100
125	471	564	103	186	125
150	484	592	120	216	150
200	504	624	98	240	200
250	535	684	114	298	250
300	560	734	130	348	300





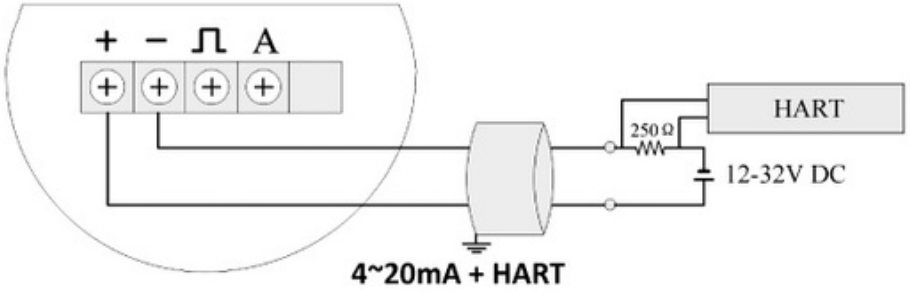
Pressure and Temperature Compensation Type

SIZE	L	H1	DIN 1.6Mpa			DIN 2.5Mpa			DIN 4.0Mpa			ANSI 150RF			ANSI 300RF			C
			H	J	N-ΦG	H	J	N-ΦG	H	J	N-ΦG	H	J	N-ΦG	H	J	N-ΦG	
15	220	431	478	65	4-Φ14	478	65	4-Φ14	478	65	4-Φ14	/			/			15
20	220	431	483	75	4-Φ14	483	75	4-Φ14	483	75	4-Φ14	480	70	4-Φ15	489	82.5	4-Φ19	20
25	220	431	488	85	4-Φ14	488	85	4-Φ14	488	85	4-Φ14	485	79.5	4-Φ15	493	89	4-Φ19	25
32	220	431	501	100	4-Φ18	501	100	4-Φ18	501	100	4-Φ18	490	89	4-Φ15	497	98.4	4-Φ19	32
40	170	428	503	110	4-Φ18	503	110	4-Φ18	503	110	4-Φ18	491	98.5	4-Φ15	506	114.5	4-Φ23	40
50	170	431	513	125	4-Φ18	513	125	4-Φ18	513	125	4-Φ18	507	120.5	4-Φ19	513	127	8-Φ19	50
65	170	440	532	145	4-Φ18	532	145	8-Φ18	532	145	8-Φ18	529	139.5	4-Φ19	535	149	8-Φ23	65
80	200	448	548	160	8-Φ18	548	160	8-Φ18	548	160	8-Φ18	543	152.5	4-Φ19	553	168	8-Φ23	80
100	220	459	569	180	8-Φ18	574	190	8-Φ22	574	190	8-Φ22	573	190.5	8-Φ19	586	200	8-Φ23	100
125	220	471	596	210	8-Φ18	606	220	8-Φ26	H	220	8-Φ26	598	216	8-Φ23	610	235	8-Φ23	125
150	270	484	626	240	8-Φ22	634	250	8-Φ26	478	250	8-Φ26	623	241.5	8-Φ23	643	270	12-Φ23	150
200	310	504	674	295	12-Φ22	684	310	12-Φ26	483	320	12-Φ30	675	298.5	8-Φ23	694	330	12-Φ25	200
250	370	535	737	355	12-Φ26	747	370	12-Φ30	488	385	12-Φ33	738	362	12-Φ25	757	387.5	16-Φ30	250
300	400	560	790	410	12-Φ26	802	430	16-Φ30	501	450	16-Φ33	801	432	12-Φ25	820	451	16-Φ33	300

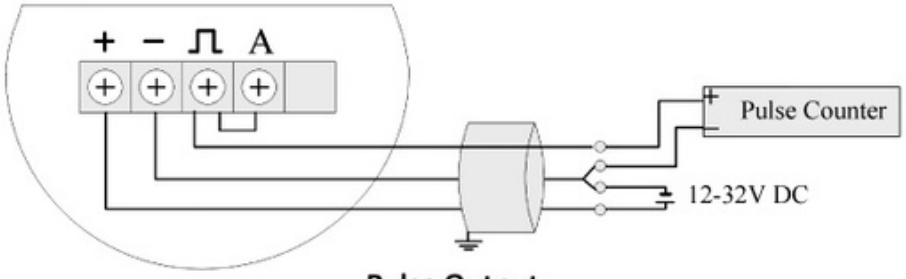
Flange Type

SIZE	L	H1	DIN 1.6MPa			DIN 2.5MPa			DIN 4.0MPa			ANSI 150RF			ANSI 300RF			C
			H	J	N-ΦG	H	J	N-ΦG	H	J	N-ΦG	H	J	N-ΦG	H	J	N-ΦG	
15	170	431	478	65	4-Φ14	478	65	4-Φ14	478	65	4-Φ14	/			/			15
20	170	431	483	75	4-Φ14	483	75	4-Φ14	483	75	4-Φ14	480	70	4-Φ15	489	82.5	4-Φ19	20
25	170	431	488	85	4-Φ14	488	85	4-Φ14	488	85	4-Φ14	485	79.5	4-Φ15	493	89	4-Φ19	25
32	170	431	501	100	4-Φ18	501	100	4-Φ18	501	100	4-Φ18	490	89	4-Φ15	497	98.4	4-Φ19	32
40	170	428	503	110	4-Φ18	503	110	4-Φ18	503	110	4-Φ18	491	98.5	4-Φ15	506	114.5	4-Φ23	40
50	170	431	513	125	4-Φ18	513	125	4-Φ18	513	125	4-Φ18	507	120.5	4-Φ19	513	127	8-Φ19	50
65	170	440	532	145	4-Φ18	532	145	8-Φ18	532	145	8-Φ18	529	139.5	4-Φ19	535	149	8-Φ23	65
80	200	448	548	160	8-Φ18	548	160	8-Φ18	548	160	8-Φ18	543	152.5	4-Φ19	553	168	8-Φ23	80
100	220	459	569	180	8-Φ18	574	190	8-Φ22	574	190	8-Φ22	573	190.5	8-Φ19	586	200	8-Φ23	100
125	220	471	596	210	8-Φ18	606	220	8-Φ26	H	220	8-Φ26	598	216	8-Φ23	610	235	8-Φ23	125
150	270	484	626	240	8-Φ22	634	250	8-Φ26	478	250	8-Φ26	623	241.5	8-Φ23	643	270	12-Φ23	150
200	310	504	674	295	12-Φ22	684	310	12-Φ26	483	320	12-Φ30	675	298.5	8-Φ23	694	330	12-Φ25	200
250	370	535	737	355	12-Φ26	747	370	12-Φ30	488	385	12-Φ33	738	362	12-Φ25	757	387.5	16-Φ30	250
300	400	560	790	410	12-Φ26	802	430	16-Φ30	501	450	16-Φ33	801	432	12-Φ25	820	451	16-Φ33	300

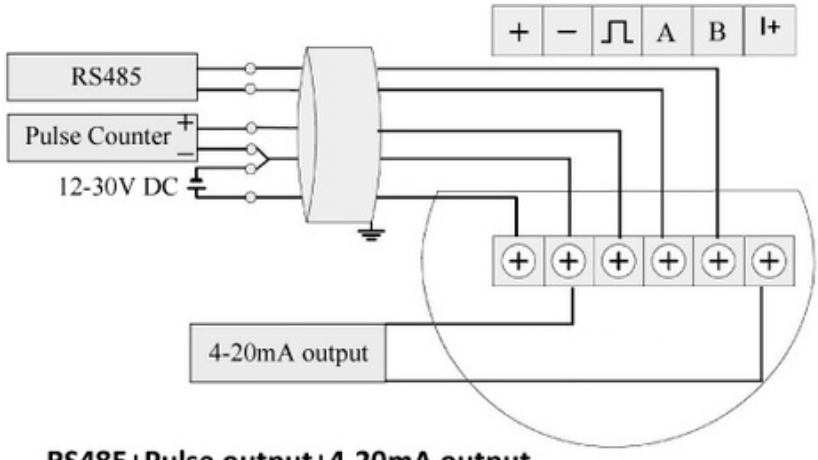
7. Wiring



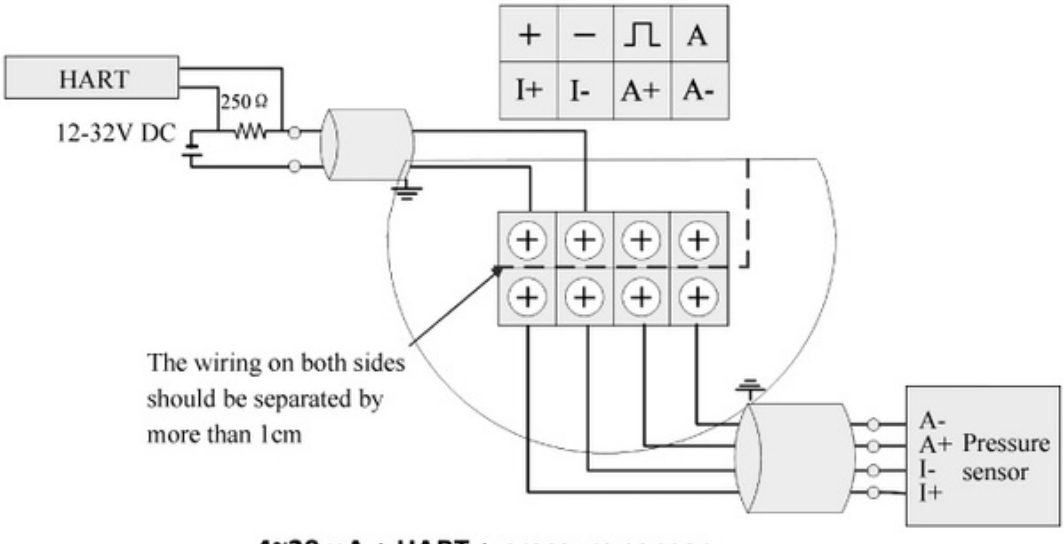
4~20mA + HART



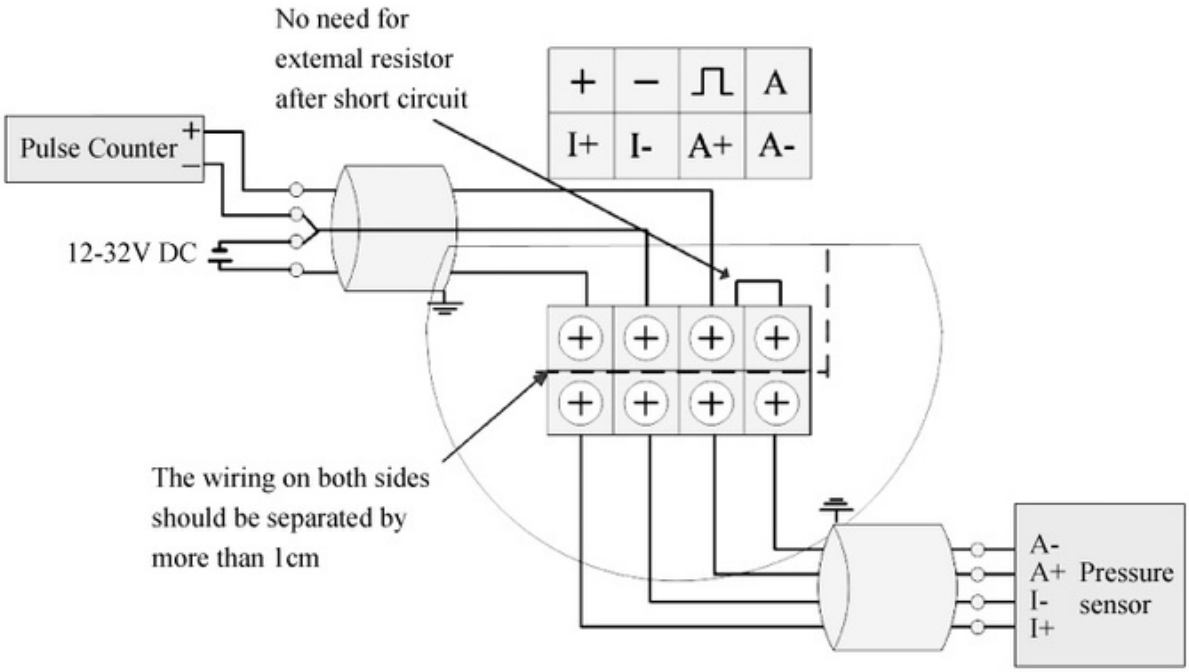
Pulse Output



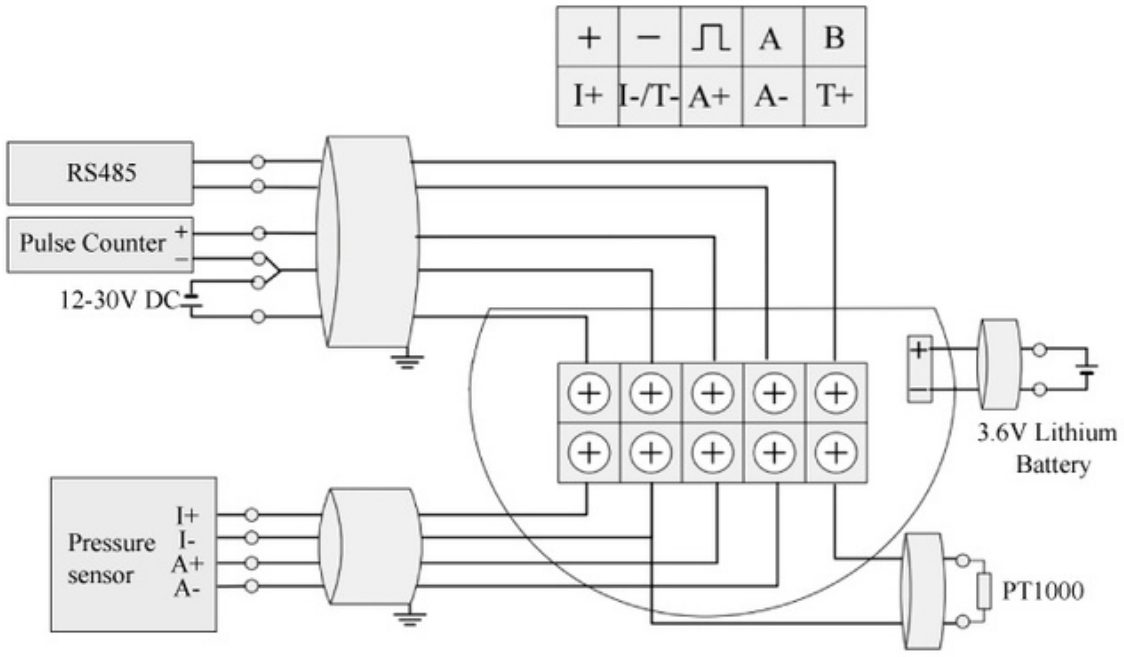
RS485+Pulse output+4-20mA output



4~20mA + HART + pressure sensor



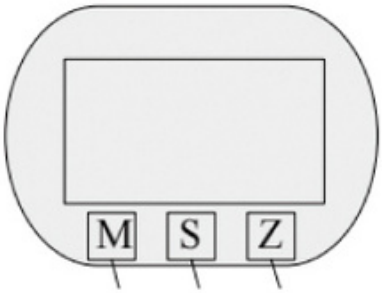
pulse + pressure sensor



RS485+Pulse Output + External Pressure and Temperature sensors

8. Parameter setting and debugging

8.1 Data is entered using the 3 keys M, S and Z on the display.



The Z -Key is used to toggle between the operating mode and the menu mode.

The S-Key is used to scroll forward through the menu, or to shift the setting number.

Short press the M-Key is used to scroll backwards through the menu, or to increase the setting number.

Long press (over 3 seconds) the M-Key is used to enter setting, or access the parameter to be changed and to accept the new selected or entered value.

8.2 LCD Full display as Figure 7.2-1:

8.3 Two-line LCD display. Instant flow rate and totalized flow value can be displayed simultaneously with high-brightness backlight, as Figure 7.3-2.

Figure 7..3-2 Instant flow rate and totalized flow value

8.4 Short press M to set the second line shows the frequency, pressure, temperature, density, current, or percentages.

Use indicator to distinguish between different display variables shows in the second line

Indicator	Σ	F	d	P	t	C	ſ
variable	totalized flow	frequency	density	pressure	temperature	current	percentage

Notes:

- In write protection mode, display
- Measured value is lower than the lower limit alarm, flashing the "down arrow".
- Measured value is higher than the upper limit alarm, flashing the "up arrow".
- If enable automatic measure pressure, and the pressure signal abnormality (sensor fault), flashing the "left arrow"
- If enable automatic measure temperature, and the temperature signal abnormality (sensor fault), flashing the "right arrow"

Enter or Exit Menu Mode

Enter Menu Mode

In the operating mode, press the "Z" key to enter the menu mode (data entry).

Exit Menu Mode

In the menu mode, press the "Z" key to enter the operating mode.

Data Entry Method

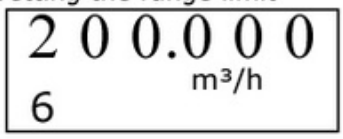
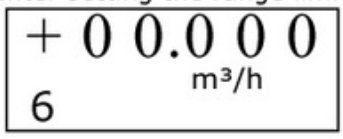
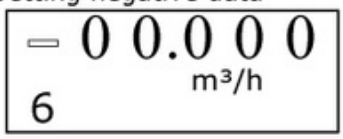
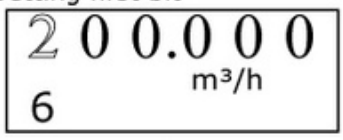
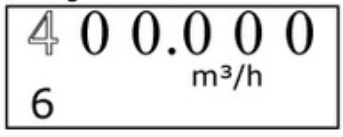
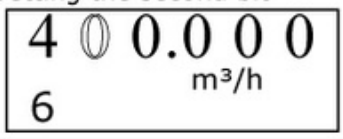
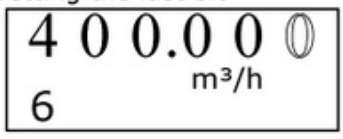
There are two ways to set parameters, one is numeric, and the other is from table .

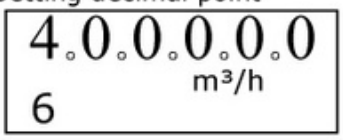
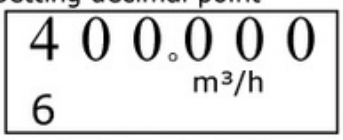
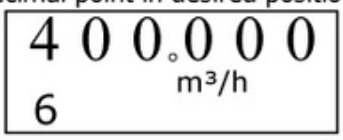
'Numeric' Method

- Long press the M-Key to enter setting, and the sign flag will start flashing.
- Short press the M-Key to select the sign.
- Press the S-Key to shift the setting number. The number bit will start flashing, which means that you can set. Press M-Key to increase the setting number.

- Press the S-Key to shift the setting number again. All bits can be set according to the same operation.
- After setting all 6-bits, press S-Key to set decimal point position. And five decimal points will flash simultaneously, which means that you can set. Short press M-Key to change the decimal point position.
- After completion of data entry, you can long press M-Key to save (access) the parameter. Or Press Z-Key to give up.

For example, the original range limit is 200, the new input range limit is 400.

Press the Z-key to enter the menu mode. Press M-Key or S-Key to scroll backwards or forwards the menu until display 6 in the bottom-left. Then you can set the range limit.	Setting the range limit 
Long press M-Key to enter setting, and the sign flag will start flashing.	Enter setting the range limit 
Short press the M-Key to select the sign between "+" and "-". "-"means input is negative (less than 0, vortex flowmeter range limit must be a positive number).	Setting negative data 
Press the S-Key, the first bit "2" will start flashing, which means you can change this bit.	Setting first bit 
Press the M-Key until display "4".	Setting first bit 
Press S-Key, the second bit "0" will start flashing, which means you can change this bit. Press M-Key to set new data.	Setting the second bit 
Press the S-Key to shift the setting number again. All bits can be set according to the same operation.	Setting the last bit 

After setting all 6-bits, press S-Key to set decimal point position. And five decimal points will start flashing simultaneously, which means that you can set.	Setting decimal point 
Short press M-Key to change the decimal point position.	Setting decimal point  decimal point in desired position 
After completion of data entry, you can long press M-Key to save (access) the parameter. Or Press Z-Key to give up.	

From Table Method

- Long press M-Key to enter setting, and the menu options will start flashing.
- Short press M-Key or S-Key to scroll backwards or forwards the menu.
- Long press M-Key to save (access) the parameter.

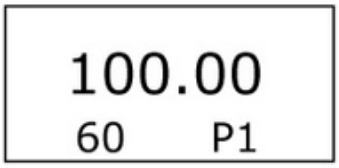
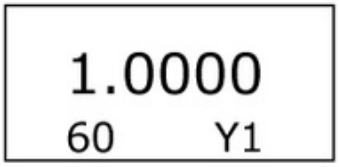
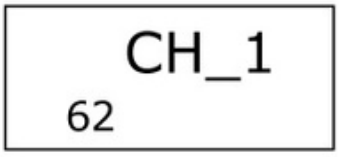
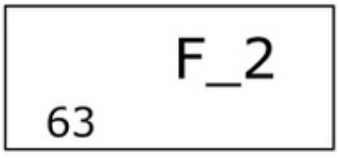
Local Configuration Function

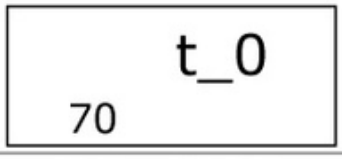
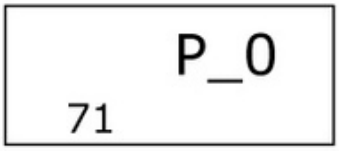
The character "88" on the bottom-left of LCD corresponding menu item:

character	Menu	Setting method	Notes
01	Write Protect	from table	ON / OFF
02	Low Alarm Limit	numeric	Unit: %
03	High Alarm Limit	numeric	Unit: %
04	Flow mode	from table	LIq_0: Liquid volume LIq_1: Liquid mass GAS_0: Gas volume GAS_1: Gas mass ST_0: Steam volume ST_1: Steam mass ST_2 : Saturated steam mass (temperature compensation) ST_3 : Saturated steam mass (pressure compensation)

05	Flow unit	from table	$Nm^3/h, Nm^3/m, Nm^3/s, m^3/d, m^3/h, m^3/m, m^3/s$, l/h, l/m, l/s, t/d, t/h, t/m, kg/d, kg/h, kg/m, kg/s, g/h, g/m, g/s, Note: Totalizer flow's unit based on the flow unit.
06	Range (Qmax)	numeric	Qmax value for selected flow mode (= 20 mA)
07	Density	numeric	Gas density (unit: Kg/m^3) Liquid density (unit: g/cm^3)
08	Gas pressure(Gauge)	numeric	Unit:kpa.
09	Gas temperature (Degrees C)	numeric	Unit: °C.
10	Low flow cutoff value	numeric	Range: 0% ~ 20%
11	Damping	numeric	Range: 0 ~ 64S
14	Totalizer reset	from table	When Lcd display ACC_y, press M-Key to reset the totalizer and overflow counter.
15	Number of totalizer overflows	read only	Display of the number of totalizer overflows; max. 99,999 1 overflow = 10,000,000
40	Trim 4mA		Steps: 1.Long press M-Key, enter trim; 2.Short press M-key to decrease current. Press S-Key to increase current. Stepping is 12 microamperes. 3.Long press M-Key to save new trim value. Or press Z-Key to exit without saving.
41	Trim 20mA		
50	Opcode	numeric	Input ****50, set 51~57 menu. Input ****40, set 40~ 41 menu. Input ****60, set 60 menu. Input ****62, set 62 menu. Input ****63, set 63 menu. Input ****70, set 70~77 menu.

51	Signal status	read only	LCD display：450.00 51 2 - 10 status：450.00 is the gain, 51 is indicator, 2 is channel,10 is signal amplitude, it must be greater than 9.
52	Meter size and media type	from table	Options：15mm, 20mm, 25mm, 32mm, 40mm, 50mm, 5mm, 80mm, 100mm, 125mm, 150mm, 200mm, 250mm, 300mm, 350mm, 400mm, 450mm, 500mm, 600mm; Note: Maximum frequency, minimum frequency, maximum gain and average calibration K-Factor should be reset, if meter size or media type changed. Media type is gas, setting interface:  Media type is liquid, setting interface:  If you change the meter size and media type, you must re-set from 53 to 56.
53	Maximum frequency	numeric	According to the meter size and measuring media,set the corresponding maximum frequency.
54	Minimum frequency	numeric	According to the meter size and measuring media, set the corresponding minimum frequency.
55	Maximum gain	numeric	Between 200 and 1000 suggested. Typically about 500.
56	k-Factor	numeric	Set average calibration k-Factor
57	Pulse factor	numeric	Set the output pulse number corresponding 1m3.

60	Five-point linearity correction	numeric	Where P is the reference frequency, Y is the correction coefficient K. When input frequency value, the lower right corner shows Pi, i=1,2,3,4,5. When i=1, LCD show as follows:  When input coefficient value, the lower right corner shows Yi,i=1,2,3,4,5. When i = 1,LCD show as follows: 
62	Channel settings	from table	There are CH_1, CH_2, CH_3 three options。 CH_3 gain maximum CH_1 gain minimum Set CH_1 show as follows:  Note: CH1 generally used for liquid easurement,which corresponds to the configuration software, select X0 and X1. CH_3 generally used for gas measurement,which corresponds to the configuration software, select X1, X2 and X3.
63	Work mode settings	from table	There are F_1, F_2, F_3, F_4 four options. F_2 setting show as follows:  Note: Generally choose F_2.

70	Temperature acquisition mode setting	from table	There are t_0 and t_1 two options. t_0: Temperature uses the input reference value. See Section 9: gas temperature. t_1: Temperature is automatic acquisition, should be use external pt1000. t_0 setting show as follows: 
71	Pressure acquisition mode setting	from table	There are P_0 and P _1 two options. P_0: Pressure uses the input reference value. See Section 8: gas pressure. P_1: Pressure is automatic acquisition, should be use external silicon pressure sensor. P_0 setting show as follows: 
72	Temperature low trim	numeric	Enter the calibration resistor value, unit: ohm.
73	Temperature high trim	numeric	Enter the calibration resistor value, unit: ohm.
74	Pressure low trim	numeric	Enter the calibration reference pressure value, unit kpa
75	Pressure high trim	numeric	Enter the calibration reference pressure value, unit kpa
76	Low pressure cutoff value	numeric	If the measured pressure value is less than"Low pressure cutoff value", set to 0kpa. Unit kpa.
77	Pressure bias settings	numeric	Enter the current actual pressure value, to achieve bias. Unit kpa.

Special Note:

Maximum frequency, minimum frequency, maximum gain and average calibration K- Factor should be reset, if meter size or media type changed. These parameters are very important for vortex flowmeter good working, please carefully set according to the actual application.

9. Model selection

Model	Code								Specification
LUGB									Vortex Flow Meter
Diameter									DN15-DN300
Connection	Pipeline	FL							Flange Connection
		JZ							Wafer Clamp
		Z							Customized
Accuracy			Pipeline	10					1.0%R
				15					1.5%R
Temperature and Pressure Compensation					S				With
					Z				Without
Communication Protocol						N			No Communication Interface
						H			HART Protocol
						M			MODBUS Protocol
Output							1		No Output
							2		Two-wire 4-20mA Output
							3		Pulse Output
Power Supply								DD	24VDC
								B	Battery 3.6V
Body Material								S	Stainless Steel
Measuring Medium									1 Gas
									2 Liquid
									3 Saturated Steam
									4 Superheated Steam

10. Schedule

Schedule 1 Saturated steam density

T:°C P:MPa D:kg/m^3

P	0.1	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
T	120	134	144	152	159	165	170	175	175	179	187	195	201	207	212
D	1.12	1.67	2.17	2.67	3.17	3.71	4.11	4.66	4.66	5.14	6.12	7.1	8.08	9.06	10.05

Schedule 2 Superheated steam density

T:°C P:MPa D:kg/m^3

T / P	130	140	150	160	170	180	190	210	220	250	300	360	420
0.10	1.10	1.07	1.04	1.02	0.99	0.97	0.95	0.91	0.89	0.83	0.76	0.69	0.63
0.15	1.38	1.34	1.34	1.28	1.24	1.21	1.19	1.13	1.11	1.04	0.95	0.86	0.78
0.26		1.96	1.90	1.85	1.81	1.76	1.72	1.64	1.61	1.51	1.37	1.24	1.13
0.30			2.12	2.01	2.01	1.96	1.92	1.37	1.79	1.68	1.53	1.38	1.26
0.36			2.46	2.39	2.33	2.27	2.21	2.11	2.06	1.94	1.76	1.59	1.45
0.40				2.61	2.54	2.47	2.41	2.30	2.25	2.11	1.91	1.73	1.57
0.50				3.16	3.07	2.99	2.91	2.77	2.71	2.54	2.30	2.07	1.89
0.60					3.61	3.51	3.42	3.25	3.18	2.97	2.69	2.42	2.21
0.70						4.05	3.94	3.74	3.65	3.41	3.09	2.78	2.53
0.80						4.59	4.46	4.23	4.13	3.85	3.48	3.13	2.84
0.90						5.15	4.99	4.73	4.61	4.30	3.88	3.48	3.16
1.00							5.54	5.23	5.09	4.75	4.28	3.84	3.48
1.15							6.37	6.00	5.84	5.43	4.88	4.37	3.97
1.50								7.87	7.64	7.05	6.30	5.63	5.10
1.65								8.70	8.43	7.76	6.92	6.17	5.59
1.80								9.55	9.24	8.48	7.55	6.72	6.08
2.00									10.36	9.47	8.39	7.45	6.74
2.20									11.51	10.47	9.24	8.20	7.40
2.50										12.02	10.55	9.32	8.39