VORTEX-STREET FLOWMETER

OPERATING MANUAL

Contents

1. Overview

Stress type vortex street flow meter is one kind of speed type flow meter. It bases on Karman vortex street 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. Vortex street flow meter is widely used in petrol, chemical industry, light industry and power heat supply and so on.

Vortex street flow meter has the following characteristics:

- High measuring accuracy, wide range;
- Extensive measured mediums, can measure liquid, gas and steam;
- High working temperature, medium temperature can be up to 350℃;
- No moving parts, no abrasion, with high reliability;
- Meter body adopts stainless steel material, corrosion-proof.

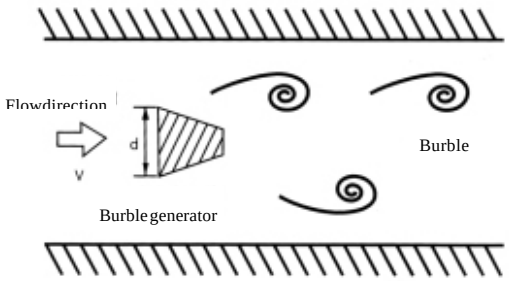


Figure 1

2. Measuring principle

When the fluid in the pipeline passes the burble generator (triangular prism), burble will generate due to the acceleration of partial flow rate (as Fig.1). This burble will arise alternatively in two burble lines, which is called Karman vortex street.

The releasing frequency of Karman vortex street 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 formula:

$$f=S_tV/d \quad \cdots\cdots\cdots\cdots\cdots\cdots \quad (1)$$

Here: f—the releasing frequency of Karman vortex street

S_t—Strouhal number

V—medium flow rate

d—the width of triangle prim

Strouhal number is an important parameter of vortex street flow meter, which only relates to the medium Reynolds number Re. Strouhal number St should be a constant As long as the Reynolds number of medium in the pipeline kept in the range of 2×10^4 to 7×10^6. Thus, we can detect the flow rate of fluid medium by measuring burble frequency signal and then calculate the medium flow by medium flow rate.

3. Technical parameters

◆ Nominal aperture: DN15, DN20, DN25, DN32, DN40, DN50, DN65, DN80, DN100, DN125, DN150, DN200, DN250, DN300, DN350, DN400, DN450, DN500;

◆ Applicability: gas (air, oxygen, nitrogen, coal gas, natural gas, chemical gas and so on), liquid (water, high

temperature water, oil, food liquid, chemical liquid and so on), steam (saturated steam, overheated steam);

- ◆ Measurable medium temperature: -40℃～280℃, -40℃～350℃;
- ◆ Nominal pressure: ≤1.6MPa ≤2.5MPa ≤4Mpa;
- ◆ Accuracy grade: liquid 0.5 grade, gas, steam 1.0 grade;
- ◆ Range of flow rate: liquid: 0.6-6 m/s, gas: 5-60m/s, Steam: 5-70m/s;
- ◆ Measuring range: see table 1, table 2;
- ◆ Output signal:

Voltage impulse: lower electrical level≤1V, higher electrical level ≥6V, width of impulse 0.4ms, load resistance ＞150O;

Standard current: 4-20mA, conversion accuracy ±0.5% full-scale value, load resistance 24V-500O, field LCD display: instantaneous delivery 5 bit display (m^3/h, kg/h, t/h), conversion accuracy ± 0.1%; integrated flux 9 bit display (m^3, kg, t), conversion accuracy ± 0.1%;

- ◆ Power supply:

When voltage impulse output: +12VDC; when 4-20mA output: +24VDC;

Field LCD display: 3.6V No.1 1 lithium cell power supply, working life more than 2 years;

- ◆ Ambient temperature: When voltage impulse output: -30℃—+65℃; when 4-20mA output: -10℃—+55℃; Field LCD display: -25℃—+55℃;
- ◆ Material of meter body: 1Cr18Ni9Ti (other materials supplied by agreement).

4. Guide for lectotype

4.1 Determine the aperture

Primaries of different apertures have different measuring range. The measuring range of every aperture will change along with the variation of measured medium types, work condition temperature and pressure.

For gas and liquid, firstly make sure the rough flow range of medium, fixing the primary aperture by looking up table (table 1); for saturated steam, after making sure the work condition temperature or pressure and rough flow range, the primary aperture can be fixed by looking up table (table 2); for overheated steam, make sure the work condition temperature and pressure, and then ascertain its density by look up table 3, finally fix the primary aperture by looking up table 2 through the density and rough flow range. (Note: In the table 2, the pressure is absolute pressure, absolute pressure = pipeline pressure + atmospheric pressure.)

Calculation of mass flow:

$$Q_G=3.6Fr\rho/K \cdots\cdots (2)$$

Here: Q_G——mass flow (When K is the value indicated on the nameplate, unit is t/h; When K value reduced by 1000 times, unit is kg/h)

Fr——Impulse frequency (Hz)

ρ——Density (kg/m^3)

K——Instrument coefficient (Impulse number／m^3)

Frequently-used reduction formula:

A: Volume flow under work condition state converts to the one under standard state:

$$Q_N = 2695\ (P + 0.1013)\ Q_V / (273 + t) \quad \cdots\cdots (3)$$

B: Density under work condition state converts to the one under standard state:

$$\rho_N = (273 + t)\ \rho_0 / 2695(P + 0.1013) \quad \cdots\cdots (4)$$

C: Mass flow converts to volume flow:

$$Q_V = Q_G / \rho \quad \cdots\cdots (5)$$

Here: Q_V——Volume flow under work condition state (m^3/h)

Q_N——Volume flow under standard state (m^3/h)

ρ_0——Density under work condition state (kg/m^3)

ρ_N——Density under Standard state (kg/m^3)

t—— Temperature under work condition state (℃)

P——Pressure under work condition state (MPa)

Q_G——Mass flow (kg/h)

Table 1: Measuring range of liquid and gas

Unit: m^3/h

Aperture mm	Liquid (water of normal temperature)		Gas (work condition)		Aperture mm	Liquid (water of normal temperature)		Gas (work condition)	
	Measurable range	Examine range	Measurable range	Examine range		Measurable range	Examine range	Measurable range	Examine range
15	0.4～5	0.5～4	4～35	5～25	125	24～350	30～240	150～2200	200～1600
20	0.75～8	0.8～6.5	5～60	8～40	150	38～450	45～360	250～3800	300～2400
25	1～11	1.2～10	6～90	10～60	200	75～850	90～720	400～6000	500～4000
32	1.5～20	1.8～14.5	12～180	16～100	250	130～1300	140～1100	600～9000	700～5600
40	2.5～30	3～24	16～240	20～160	300	180～2000	200～1600	800～12000	1000～8000
50	3.5～50	4.5～36	30～450	35～280	350	250～2800	280～2300	1200～18000	1500～12000
65	6～70	7.5～60	40～700	50～400	400	320～3300	350～2800	1500～22000	2000～16000
80	10～140	12～100	70～1000	80～640	450	360～4000	400～3200	2000～30000	2500～20000
100	16～220	20～160	120～1800	150～1200	500	420～5000	500～4000	2500～38000	3100～25000

4.2 Determine appropriate configuration:

A. Determine to use remote transmission type or field display type;

B. When choosing remote transmission type, for saturated steam, should select temperature automatic compensatory density or pressure automatic compensatory density; for overheated steam, should select temperature and pressure simultaneous compensatory density; for other mediums, should ascertain whether they need compensation according to actual conditions.

C. When choosing intelligent flow integrating instrument, if only need to display parameters, such as flow, pressure and temperature, LED display or LCD display intelligent flow integrating instrument can be selected; if need to review its historical data and with memory function, intelligent flow integrating paperless recorder should be selected.

D. No matter which kind of intelligent flow integrating instrument is selected, if need RS485 or RS232 communication interface should be taken into consideration.

E. No matter which kind of intelligent flow integrating instrument is selected, if need backup power supply should be taken into consideration so as to measure normally when power failure suddenly. (With different configuration, the working time is different, generally more than 24-48 hours.)

F. When selecting intelligent flow integrating instrument, if need instrument box should be taken into consideration so as to put intelligent flow integrating instrument in it, hanging on the wall and prevent the arbitrary modification of setting parameters.

G. When selecting remote transmission type, should consider if need wireless, no-range flow monitoring system to realize the real-time supervision and management of flow for every pipeline.

H. If the measured medium is flammable and explosive substance or measuring flammable and explosive gas exited in the measuring environment, explosion-proof primary and measuring system should be selected.

4．3 Calculation of primary pressure loss:

After ascertaining the aperture of primary, primary pressure loss can be calculated to make sure if the primary will influence the process pipeline.

Computational formula is:

$$\triangle P \leq 1.2 \rho V^2 \cdots\cdots (6)$$

Here: $\triangle P$——Primary pressure loss（Pa）

ρ——Fluid density（kg/m^3）

V—— Average flow rate of the fluid in pipeline（m/s）

Flow rate of max. flow can be calculated by the following formula:

$$V_{max}=353.7Q_{max}/D^2 \cdots\cdots (7)$$

Here: V_{max}——Flow rate when max. flow（m/s）

Q——Max. flow（m^3/h）

D——Aperture of primary（mm）

4．4 Examples for lectotype

Example1: The inner diameter of process pipeline is DN100. Medium is saturated steam. Gas consumption is 0.5t/h-3t/h. Gauge pressure is 0.4Mpa. Please select the aperture of instrument.

Solution: By the gauge pressure 0.4Mpa know the absolute pressure is 0.5Mpa, and get temperature is 152℃ by looking up table 2. The flow range of DN100 is 0.4-3.5t/h and it can complete meet the requirements. So DN100 vortex street flow primary can be selected. If the gas consumption is about 0.3t/h-2t/h, DN80 vortex street flow primary can be selected. And at this time, process pipeline should be reduced to DN80 from DN100.

Example 2: The inner diameter of process pipeline is DN100. Medium is overheated steam. Gas consumption is 0.5t/h-2.8t/h. Gauge pressure is 0.5Mpa. Temperature is 220℃. Please select the aperture of instrument.

Solution: According to the pressure and temperature, it is known from table 3: the density is 2.66 when gauge pressure is 0.5Mpa, temperature is 220℃. It can be learned from table 2: when density is 2.66, the flow range of DN100 is 0.40-3.50t/h, which can meet the use requirement. So select DN100 vortex street flow primary. If the gas consumption is about 0.3t/h-2.0t/h, DN80 vortex street flow primary can be selected. At this time, process pipeline needs shrinkage pipe.

5. Installation methods and steps:

5.1 The selection of installing position:

When selecting the installing position, need to pay attention to the following points:

A. The installing position should not have pipeline vibration or have slight vibration, of which vibration acceleration not more than 2g. If the vibration is very fierce, shock absorption measures should be taken.

B. There should be enough straight pipelines in the upstream and downstream of primary (see Fig.2)

C. Service valve should be installed in the upstream of senor, while flow regulating valve in the downstream.

D. To choose position easy to install, examine and repair as can as possible.

E. Should select dry position.

F. Primary can be installed on horizontal pipeline and vertical pipeline. When installing on the vertical pipeline, medium should be flow from the bottom to up.

G. Primary should better be installed indoors. If it must be installed outdoors, should pay attention to water proofing. The cable outside magnifier box should be bent to U type.

H. Primary should be kept away from electrical noise, such as high power frequency converter, high power transformer, electromotor and high power wireless transmitter-receiver and so on.

5.2 Installing requirements:

A. When welding, should ensure the flange end face vertical to the centerline of pipeline.

B. The bigger pitch position of mounting hole is meter pole mounting position, and the direction of two flange mounting holes should keep accord.

C. After welding the flanges, should clean up the pipeline and must not have weld slag.

5.3 Installation steps:

Method 1: (shown as Fig.3):

A. Fix the installing position, cut off front/back straight pipelines of appropriate length according to Fig.2 and one pipe of L1 length (shown as Fig.5 and table 5).

B. Respectively weld a flange on the front/back straight pipelines. After adding glands on the two ends of primary connect primary and flange by bolt stud (Note: The arrowhead direction on the meter body should keep accord with fluid flowing direction.)

C. Weld the front/back straight pipeline of primary on the original pipeline.

Method 2: (shown as Fig.4):

A. Select the installing position and fix the front/back straight pipelines according to Fig.3. Cut off a pipe of length L1 (shown as Fig.5 and table 5) between front and back straight pipeline.

B. Respectively weld a flange on the front/back straight pipelines. When welding, all the mounting holes of the two flanges should keep concentric.

C. After adding glands on the two ends of primary connect primary and flange by bolt stud.

Table 2 Measuring range of saturated steam mass flow

Absolute pressure (Mpa)	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	Flow unit
Temperature (℃)	120	134	144	152	158	165	170	175	
Density (kg/m^3)	1.13	1.65	2.17	2.67	3.17	3.71	4.06	4.66	
Aperture DN (mm)	Flow range								Kg/h
15	6.5~42	7.2~54	8.3~66	9~79	9.7~92	10.1-105	10.85115	11.3~129	
20	11.5~74	12.8~96	14.7~118	16~141	17.3~163	17.9-186	19.2-206	20.1~230	
25	18~115	20~150	23~185	25~220	27~255	28-290	30-320	32~360	
32	30~190	34~245	37~300	41~360	44~415	47-470	49-530	52~585	
40	46~295	52~385	58~475	64~560	68~650	73-740	77~830	81~910	
50	72~460	82~600	91~740	100~880	110~1020	110~1160	120~1290	130~1430	
65	121~775	138~1010	154~1250	170~1480	180~1720	190~51950	200~52180	210~2410	
80	0.18~1.17	0.21~1.55	0.23~1.90	0.26~2.20	0.27~2.60	0.29~52.96	0.31~53.30	0.32~3.65	t/h
100	0.29~1.85	0.33~2.40	0.36~2.96	0.40~3.50	0.43~4.10	0.46~54.62	0.48~55.16	0.51~5.71	
125	0.45~2.86	0.51~3.75	0.57~4.65	0.63~5.47	0.67~6.36	0.71~57.22	0.75~8.06	0.79~8.92	
150	0.65~4.12	0.74~5.40	0.82~6.66	0.90~7.88	0.96~9.16	1.02~10.4	1.08~11.6	1.14~12.8	
200	1.15~7.13	1.31~9.60	1.46~11.8	1.60~14.0	1.71~16.3	1.82~18.5	1.92~20.6	2.02~22.8	
250	1.79~11.4	2.05~15.0	2.28~18.5	2.50~21.9	2.67~25.4	2.84~28.9	3.01~32.3	3.16~35.7	
300	2.58~16.5	2.95~21.6	3.28~26.6	3.60~31.5	3.84~36.6	4.10~41.6	4.33~46.4	4.55~51.4	
350	3.51~22.4	4.02~29.4	4.46~36.3	4.90~42.9	5.23~50.0	5.67~56.6	5.90~63.2	6.20~70.0	
400	4.58~29.3	5.25~38.4	5.83~47.4	6.40~56.0	6.83~65.1	7.28~74.0	7.70~82.6	8.10~91.4	
450	5.80~37.1	6.64~48.6	7.37~60.0	8.10~70.9	8.65~82.4	9.21~93.6	9.74~105	10.2~116	
500	7.16~45.8	8.2~60.0	9.10~74.0	10.0~87.5	10.7~102	11.4~116	12.0~129	12.7~143	

5.4 Primary installing outline dimension is shown as Fig.5 and table 5. For reference when installation.

5.5 When primary and pressure transmitter/temperature transmitter forms a measuring system, the position of pressure and temperature measuring points can be selected according to Fig. 6.

5.5.1 The installation of pressure transmitter:

A. Open the leading-pressure holes on the pipeline according to the given position on Fig.6 (about Φ12);

B. Weld the leading-pressure base on the position of leading-pressure holes. Note that leakage is forbidden;

C. Install needle type valve;

D. Install leading-pressure pipe;

E. Close the needle type valve and pour cold water into the leading-pressure pipe;

F. Install pressure transmitter;

G. Open the needle type valve when running.

Table 2 Measuring range of saturated steam mass flow

Absolute pressure (Mpa)	1	1.2	1.4	1.6	1.8	2.0	2.5	3	Flow unit
Temperature (℃)	179	187	195	201	206	212	223	235	
Density (kg/m3)	5.15	6.13	7.10	8.08	9.06	10.1	12.5	15	
Aperture DN (mm)	Flow range								Kg/h
15	11.9~141	12.9~165	13.7~191	14.7~213	16.5~239	18.4~266	22.8~329	27.4~395	
20	21.1~250	23~294	24.3~339	26.2~378	29.4~424	32.8~473	40.6~585	48.7~702	
25	33~390	36~460	38~530	41~590	46~662	51~738	64~913	76~1096	
32	54~640	59~750	63~860	67~970	75~1088	84~1213	104~1501	124~1801	
40	85~1000	92~1170	98~1350	110~1520	123~1704	137~1900	170~2352	204~2822	
50	130~1560	140~1840	150~2110	160~2380	179~2669	200~2975	248~3682	298～4418	
65	220~2640	240~3100	260~3560	280~4010	314~4496	350~5012	433~6203	520~7444	
80	0.34~4.00	0.37~4.70	0.39~5.39	0.42~6.08	0.47~6.82	0.53~7.60	0.65~9.41	0.78~1.13	t/h
100	0.53~6.25	0.57~7.34	0.61~8.42	0.65~9.50	0.73~10.7	0.81~11.8	1.00~14.7	1.20~17.6	
125	0.83~9.77	0.90~11.5	0.96~13.2	1.02~14.8	1.14~16.6	1.27~18.5	1.57~22.9	1.88~27.5	
150	1.19~14.1	1.29~16.5	1.38~18.9	1.47~21.4	1.65~24.0	1.84~26.8	2.28~33.1	2.74~39.7	
200	2.12~25.0	2.29~29.4	2.46~33.7	2.61~38.0	2.93~42.6	3.27~47.5	4.05~58.8	4.86~70.5	
250	3.31~39.1	3.58~45.9	3.84~52.6	4.08~59.4	4.57~66.6	5.09~74.3	6.30~91.9	7.56~110	
300	4.77~56.3	5.16~66.1	5.53~75.8	5.88~85.5	6.59~95.9	7.35~107	9.10~132	10.9~159	
350	6.49~76.6	7.02~89.9	7.52~103	8.00~116	8.97~131	10.0~146	12.4~180	14.9~216	
400	8.48~100	9.17~117	9.82~135	10.4~152	11.7~170	13.0~190	16.0~235	19.2~282	
450	10.7~127	11.6~149	12.4~171	13.2~192	14.8~216	16.5~241	20.4~298	24.5~357	
500	13.3~156	14.3~184	15.4~211	16.3~238	18.3~266	20.4~297	25.2~367	30.3~441	

Table 3 The density of overheated steam relative to pressure and temperature

Temperature(℃) / Absolute pressure (MPa)	140	180	220	260	300	340	380	420	460
0.15	0.78	0.71	0.65	0.60	0.56	0.52	0.49	0.46	0.44
0.2	1.05	0.95	0.87	0.80	0.75	0.70	0.65	0.62	0.58
0.25	1.32	1.19	1.09	1.00	0.93	0.87	0.82	0.77	0.73
0.3	1.59	1.43	1.31	1.21	1.12	1.05	0.98	0.93	0.87
0.36	1.92	1.73	1.58	1.45	1.35	1.26	1.18	1.11	1.05
0.4		1.93	1.75	1.62	1.50	1.40	1.31	1.23	1.16
0.5		2.42	2.20	1.99	1.88	1.72	1.64	1.54	1.46
0.6		2.93	2.66	2.44	2.26	2.10	1.97	1.85	1.75
0.7		3.44	3.11	2.86	2.64	2.46	2.30	2.16	2.04
0.8		3.96	3.58	3.27	3.02	2.82	2.63	2.48	2.34
0.9		4.50	4.04	3.69	3.41	3.17	2.98	2.79	2.63
1		5.04	4.52	4.12	3.80	3.53	3.50	3.10	2.93
1.4			6.46	5.85	5.37	4.98	4.65	4.37	4.05
1.8			8.51	7.64	7.00	6.46	6.02	5.64	5.31
2			9.58	8.56	7.81	7.21	6.71	6.28	5.91
2.4				10.45	9.48	8.72	8.10	7.57	7.12
2.8				12.41	11.19	10.26	9.51	8.88	8.34
3.2				14.46	12.94	11.83	10.94	10.20	9.57
3.6				16.61	14.76	13.43	12.39	11.54	10.91

Note: When density value is between the two values, it can be figured out by interpolation.

Table 4 Gas density under standard state (kg/m^3)

Name of gas	Air	Hydrogen	Oxygen	Nitrogen	Chlorine	Alkaline air	Dawson gas
0℃, 0.1013MPa ρ_N	1.293	0.0889	1.43	1.251	3.214	0.77	0.836
Name of gas	Argon air	Acetylene	Firedamp	Ethane	Propane	Butane	Coal oven gas
0℃, 0.1013MPa ρ_N	1.79	1.017	0.717	1.357	2.005	2.703	0.4849
Name of gas	Ethylene	Propylene	Natural gas	Coal gas	Carbon monoxide	Carbon dioxide	
0℃, 0.1013MPa ρ_N	1.264	1.914	0.828	0.802	1.25	1.977	

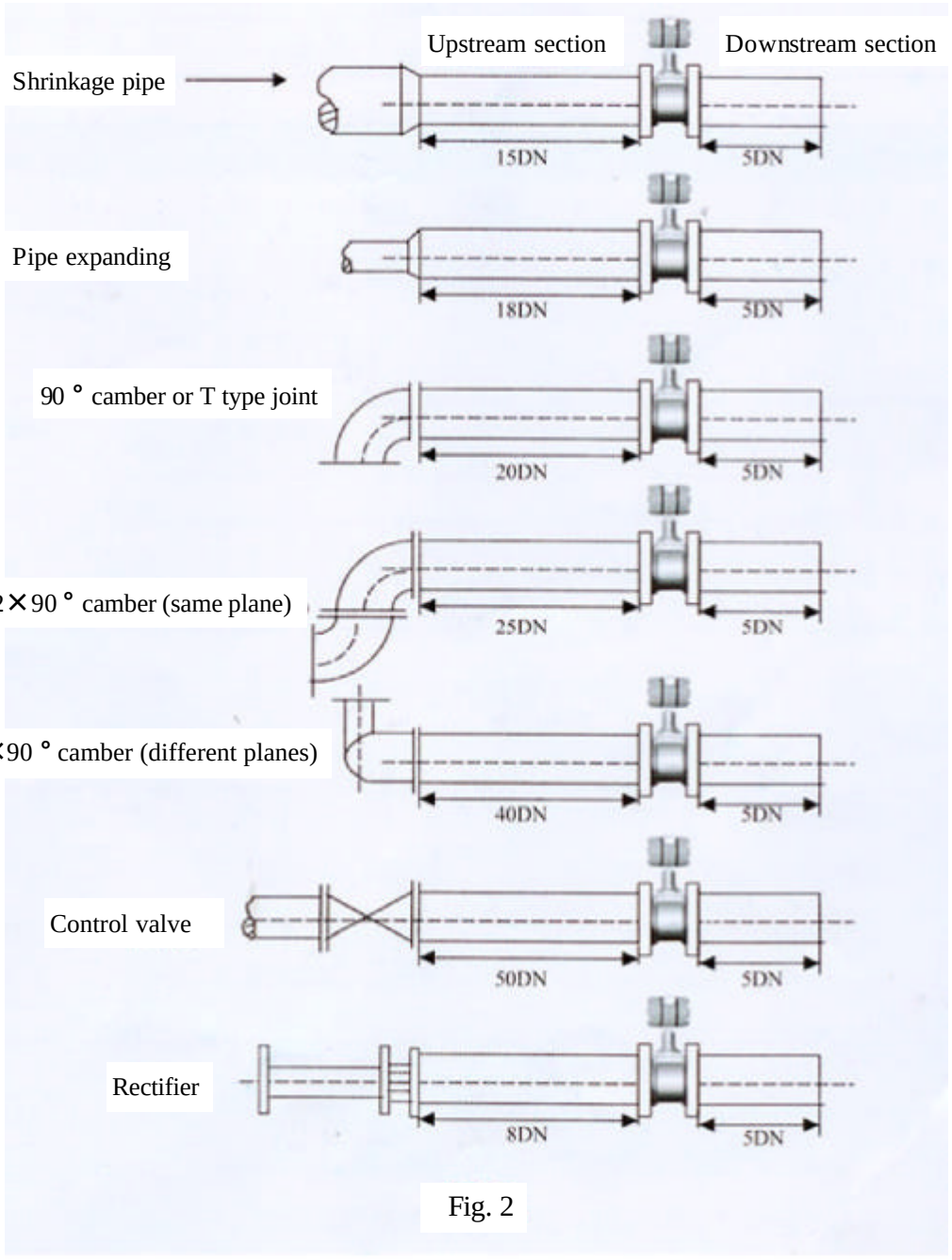
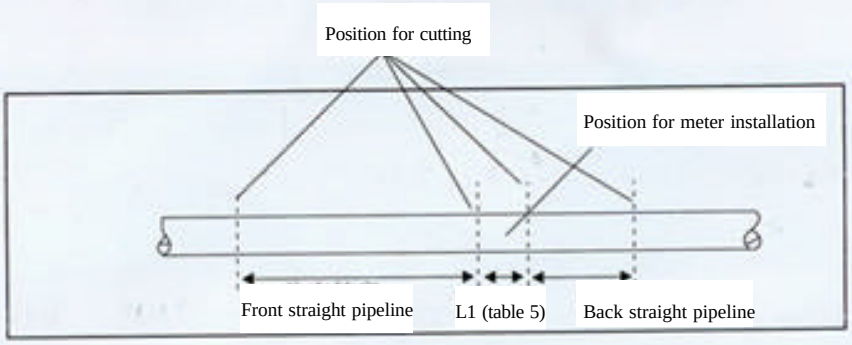
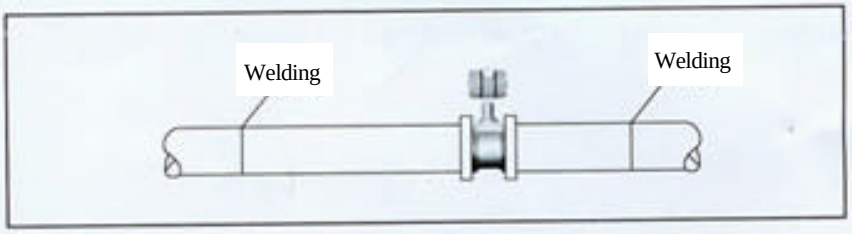


Fig. 2

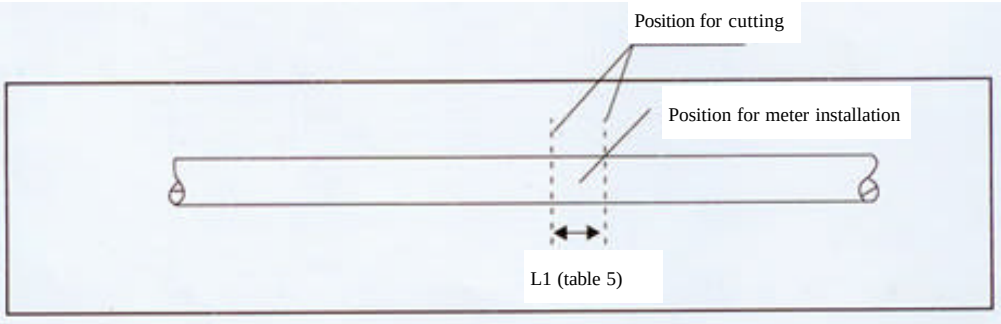


Cutting off the pipeline



Front/back straight pipeline welded on the original pipeline

Fig. 3



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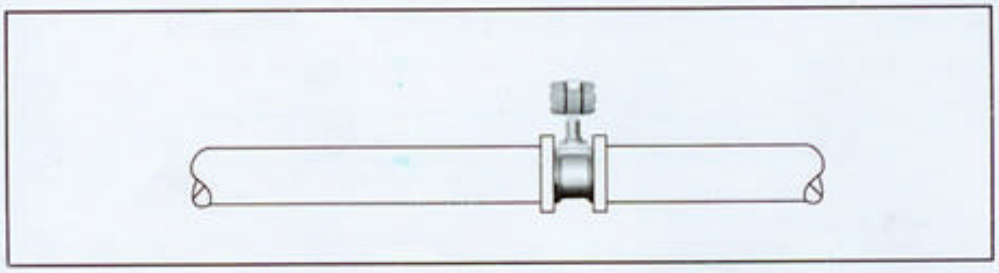


Install the instrument

Fig. 4

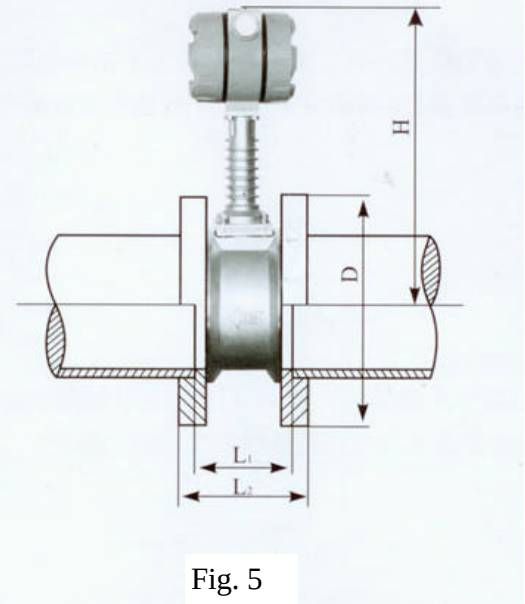


Fig. 5

Table 5 The outline dimension of frequently-used instruments

DN	L_1	L_2	D	H	Match with seamless steel pipe
15	72	90	95	366	Φ18×1.5
20	72	90	105	368	Φ26×3
25	72	90	110	375	Φ32×3.5
32	72	90	114	377	Φ38×4
40	72	90	150	360	Φ45×2.5
50	80	102	165	367	Φ57×35
65	80	102	185	375	Φ73×4
80	84	106	200	384	Φ89×4.5
100	84	110	220	395	Φ108×4
125	94	120	250	408	Φ133×4.5
150	94	124	285	421	Φ159×4.5
200	110	144	340	447	Φ219×9
250	122	164	405	473	Φ273×10
300	140	186	460	498	Φ325×12
350	154	206	520	523	Φ379×14.5

400	168	226	580	548	Φ430×15
450	182	248	640	574	Φ482×16
500	196	270	715	599	Φ534×17

5.5.2 Installation of Platinum thermistor

A. Open appropriate holes on the pipeline according to the given position on Fig. 6. The diameter of holes should be lightly bigger than the external diameter of Platinum themistor base (big diameter Φ40);

B. Weld the Platinum themistor base on the holes position. The upper and lower positions of Platinum themistor base should ensure the lowest end of Platinum themistor lay on the centerline of pipeline;

C. Install Platinum themistor.

6. Connection of signal wire

The primary is matched with 8BVPV3×0.5 signal transmission wire: red wire is power positive, black one is power negative and other colors is frequency signal. The connecting methods of primary, pressure transmitter and Platinum themistor are shown as Fig.7.

7. Primary debugging

Primary is adjusted before out of factory, so normally not needs to set zero. But if the field work condition changes or the operation of instrument is abnormal, need to set zero according to the following methods.

The primary power on, the process pipeline is filled with mediums, close the flow regulating valve on the downstream of primary (When closing the downstream flow regulating valve unconditionally, also can close the upstream service valve), firstly contra-clockwise adjust the potentiometer SF (next to the terminal) to the end, at this time the primary has interfering impulse output signal (4~20mA output type, need to use multimeter to detect if there is impulse output on the first breadboard. If there is no impulse output, adjust R to make its output signal 4mA, R is adjusted full potentiometer.) Then slowly clockwise adjust SF until there is no output, and open the valve, instrument should work properly.

8. Removal of malfunctions

Malfunction: 1. There is flow in the pipeline, but primary has no output or intelligent flow integrating instrument

has no display:

Removing steps:

A. Firstly make sure that there is flow in the pipeline and the flow is larger than the measurable flow lower limit of primary.

B. To judge the amplifier is good or bad: contra-clockwise adjust the potentiometer SF on the amplifying board to the end and see if the primary has output or intelligent flow integrating instrument has display. If not, the amplifying board should be replaced. If has output, the amplifier is regular.

C. To judge if the primary is broken or not: dismount the two lead wires of primary head from the amplifying board. Measure the resistance value between the two lead wires of primary head and the resistance value between the two lead wires of primary head and shell, all of which should be more than 2MΩ, otherwise, primary head should be replaced.

D. If primary is not broken, examine the pressure transmitter and Platinum themistor. If all is OK, can judge the intelligent flow integrating instrument is broken.

Malfunction: 2. There is no flow in the pipeline, but primary has output or intelligent flow integrating instrument has display:

Removing steps:

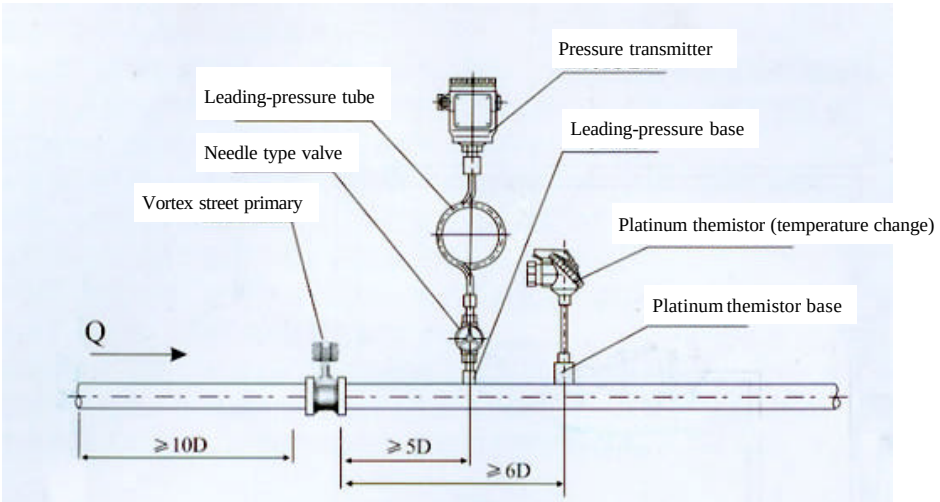
A. Check if the primary installing position has fierce vibration. If the vibration is too fierce, can consider mounting shock absorption bracket.

B. Slowly clockwise adjust SF until the amplifier just has no output or intelligent flow integrating instrument just has no display.

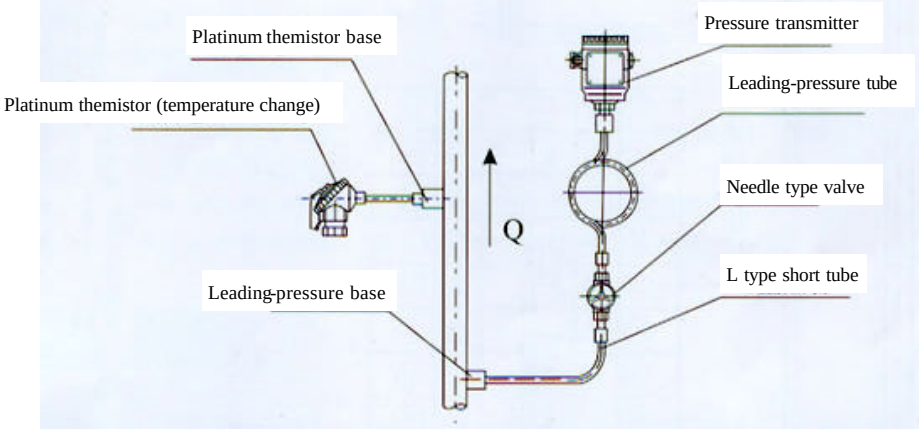
C. For other malfunctions, can contact our Technology Department.

9. Intelligent flow integrating instrument

According to the needs of user, we can provide various forms of flow integrating instrument mating with primaries, including LEC display intelligent flow integrating instrument, LCD Chinese character display intelligent flow integrating instrument, intelligent flow integrating paperless recorder. We also can mate with backup power supply and wall-mounted type instrument box, its main performance and characteristics are as follows:



The methods for pressure transmitter and Platinum themistor installing on horizontal pipeline



The methods for pressure transmitter and Platinum themistor installing on vertical pipeline

Fig.6 The installation of pressure transmitter and Platinum themistor

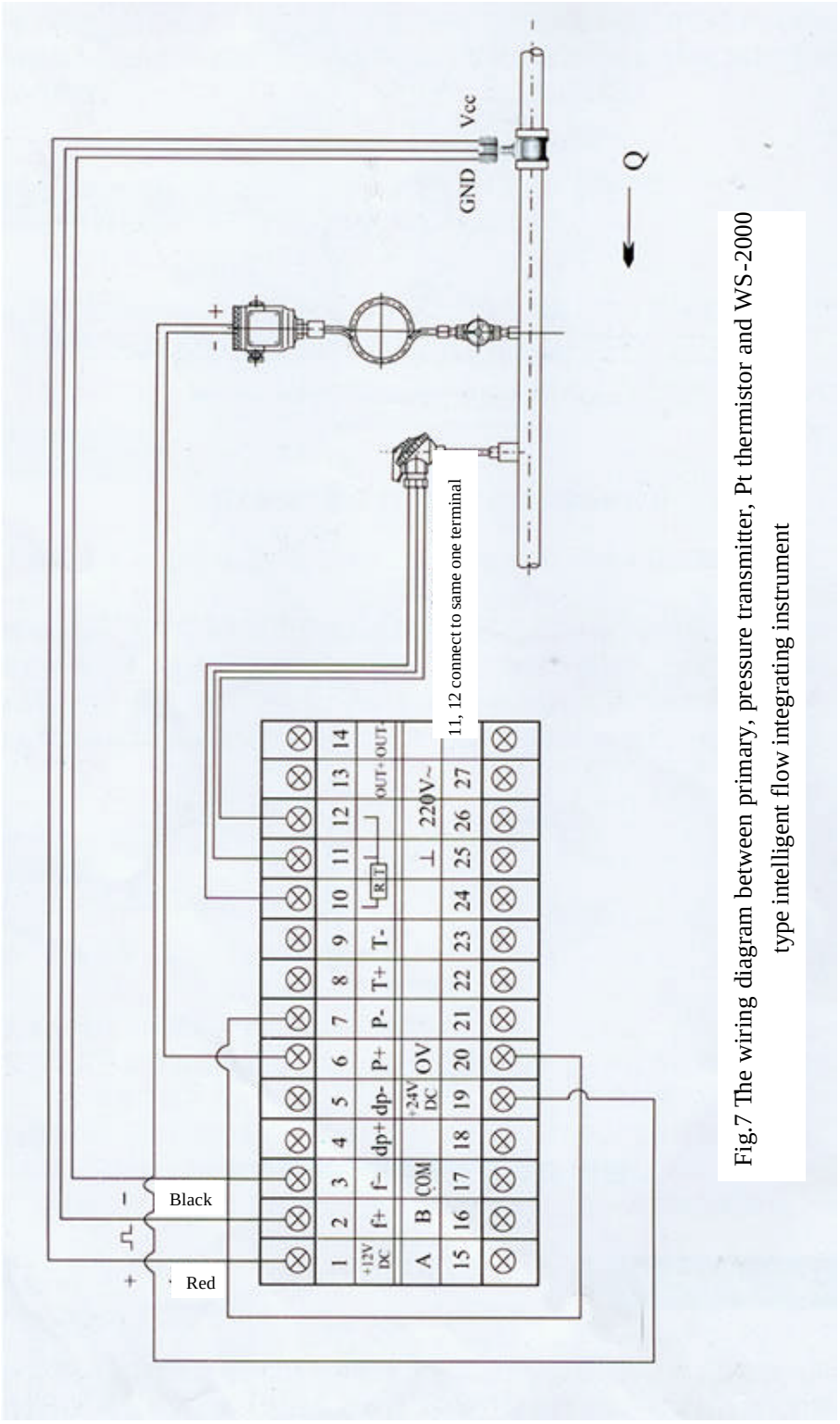


Fig.7 The wiring diagram between primary, pressure transmitter, Pt thermistor and WS-2000 type intelligent flow integrating instrument

- Measuring accuracy: analog quantity better than 0.2%, frequency quantity better than 0.1%
- Flow signal can be frequency and standard current.
- Can display integrated flux, instantaneous delivery, differential pressure, frequency, density, pressure, temperature, current time and power on/off inquiry.
- Realize pressure auto compensation density, temperature auto compensation density and temperature, pressure simultaneous compensation density.
- Can configure RS485 or RS232 communication interface, and has lightening protection.
- Can configure micro stylus printer, arbitrarily and timing print integrated flux, instantaneous delivery, differential pressure, frequency, density, pressure, temperature, current time and the start and end time of power off; intelligent flow integrating paperless recorder can print historical data and curves at appointed time quantum.
- Can conduct heat quantity calculation through simple programming and can measure thermal difference of measured medium.
- Have auto restoring function: besides software watchdog, hardware system also is configured with watchdog. Power on, power off resetting system, once system fails or accidental system halted, it can ensure instrument to recover to operation forcibly.
- Have power-failure protection function: the calculation result inside instrument and data set by user will not lose when power off and saving time is more than ten years.
- Can configure backup power supply. When power cut, it will automatically convert to backup power supply, so the instrument can continue working.
- Can configure wall-mounted instrument box, which can make the field neat and protect the instrument from theft.

10. Wireless remote flow monitoring system:

Based on wireless private network and adopting multiple advanced technologies, wireless remote flow monitoring system conducts remote and real-time data collection on instantaneous delivery, integrated flux, temperature and pressure at the user terminal of heat supply network pipeline and transmits to supervising and managing center and record by wireless communication mode so as to complete routine management. At the same time, it can timely find leakage or gas using embezzlement phenomenon and realize the historical retrospect of measured data so as to avoid the arising of disputes between the two parties.

The wireless remote flow monitoring system has the following functions:

- Electronic map of heat supply network pipeline system;
- Monitor all users' parameters, such as real-time instantaneous delivery, integrated flux, temperature, pressure, gas-using time and instrument power-on time and so on;
- Provide real-time parameter curve of single user;
- Provide all users' and single user's integrated flux curve of different periods of time, such as year, month and day.
- Provide all users' and single user's all reports of year, month, day and any period of time.

11. Backup power supply

Backup power supply overcomes the shortcomings that user cannot measure normally when suddenly power off. Under normal operation, backup power is on charging or standby state (after charging, it will enter into standby state automatically); when power off, backup power automatically enter into power supply state, which can make the instrument continuously work more than 48 hours. After power on, backup power will automatically enter into charging state and then standby state after charging.

12. Wall-mounted instrument box

Wall-mounted instrument box is divided into general type and with backup power supply type. It has the following advantages:

Solve the problem that there is no putting space in field.

Make the field neat and it is convenient to check and copy the data.

Dustproof and anti-collision protect the intelligent flow integrating instrument and prolong its service life.

For the wall-mounted instrument box has locks, the setting parameter of intelligent flow integrating instrument can not be adjusted arbitrarily and have anti-theft function; with air switch, it will protect the intelligent flow integrating instrument.

Appendix

Option

MODEL						DISCRIPTION
WIDEPLUS-EMFUB	?	?	?	?	?	
Connection method	1					Flanged connection
	2					Flanged cassette mounting
Measured medium		2				Liquid (water, high-temperature water, oil, food liquid, chemical liquid etc.)
		3				Gas (air, O2, H2, coal gas, natural gas, chemical gas etc.)
		4				Steam (saturated steam, overheat steam)
Caliber			015			DN15
			020			DN20
			02			DN25
			03			DN32
			04			DN40
			05			DN50
			06			DN65
			08			DN80
			10			DN100
			12			DN125
			15			DN150
			20			DN200
			25			DN250
			30			DN300
Category				0		General type
				B		Frameproof type
				C		On-site display type

Operation manual for integrated type on-spot display vortex street flow meter

1. Characteristics

WP-EMFUB type integrated type on-spot display instrument is one kind of special circuits for vortex street flow meter designed by our company. It adopts MSP430 series chip and double-row segmentation LCD chip, which can fixedly set medium density to accurately measure the flow in field. A whole set on-spot display instrument is composed of micro-power loss amplifying board (applies to vortex of any aperture) and display board. The function of amplifying board is universal; viz. can match with gas and liquid of various apertures through dial-up switch. The function of display board is to complete the setting, calculation and display functions.

2. Technical index:

1. Instantaneous delivery: measuring accuracy better than 0.5%
2. Frequency measurement: measuring accuracy better than 0.2%
3. Working temperature: 0~50℃ (make it clear for special environment)
4. Working battery voltage: 3.0~3.6V
5. Outer power supply: 12V or 24V
6. Checkout range of impulse output and accumulated impulse output:

   V low ≤Vcc/3, V high ≥2Vcc/3
7. Range of instantaneous impulse output: 0~2500Hz
8. Permissible load current of impulse output: less than 15mA

3. Use

1. Computational formula

a) Instantaneous delivery: F=3.6 x Fr (frequency) x dE (density) /U (instrument coefficient)

b) Integrated flux: instantaneous delivery vs time integral

2. LCD display screen shows each parameter according to the flowing pictures:

a) First row displays five-bit instantaneous flow, second row display 8-bit cumulant

Q 1.2345
12345678

b) First row display marking, second row display frequency value

Fr——
120.45

c) Display set density

dEn——
2.125000

d) Upper limit of flow

FH——
1000.000

e) Small-signal elimination

FL——
10.00000

f) Flow coefficient

U—— 3.600000

g) Cumulant clear, when enter into setting state and set this item 4321.000, can clear cumulant

Un—— 4321.000

3. Range bar:

In order to judge if the flow is in the permissible range, on the right side of LCD screen will display a bar which changes following the change of instantaneous flow. The upper limit in the bar represents setting upper limit and lower limit stands for 0.

4. Keyboard:

The display instrument has three thin-film keystrokes, detailed explanation is as following:

Position:	Left key	Middle key	Right key
Functions when operating:	Accumulation (instantaneous)	Frequency	Content
Functions when setting:	Shift	Characters turn over	Confirm and paging

a) Under operating state:

Press accumulation key (left key) one time to display instantaneous flow and integrated flow;

Press frequency key (middle key) one time to display vortex street frequency;

Press content key (right key) one time to in order display frequency (Fr), temperature (℃), compensation density (dE), density compensation mode (Ur), set density (dEn), flow coefficient (U), damp coefficient (Lr), flow upper limit (FH) and flow lower limit (FL) and so on.

b) Under setting state:

Pressing accumulation key (left key) one time can shift the set character (flash character);

Pressing frequency key (middle key) one time can modify the set character (flash character);

Pressing content key (right key) one time can confirm this page and turn over the page.

c) Setting methods:

Firstly press right key and then press the middle key simultaneously to enter into setting state. At this time, the display screen will display flash characters "Ur". The user can complete the setting of all items by the shift function of left key, modifying function of middle key and confirming and paging function of right key. For example, set density is 3.240, measure saturated steam, firstly enter into setting state, set "Ur" 1.000000, dEn 3.240, then press right key to confirm, simultaneously display entering into the next parameter setting. After setting all the parameters, can exit setting state and enter into display state by simultaneously pressing right key and middle key.

4. Remarks:

1. When flow is less than the set "flow lower limit", it will be eliminated as small-signal and not displayed.

2. There is impulse output only when the power supply is 12V or 24V.

3. The working environment temperature of LCD screen is 0~50℃ (It needs to customize when exceeding this temperature.).

4. Outline dimension: Φ77mm.

5. If the LCD screen flashes, it indicates that battery voltage is too low and need to replace the battery.