Vortex Flow Meters

Manual

SHM Meters - The Meters You Can Trust

CONTENTS

Part I：Manul

1.Series

(SHMV)series is suitable for oil,chemical industry,metallurgy,heating power,spinning,papermaking ,etc. Be use of control: over-heating vapor, saturation vapor, compressed air, ordinary air(oxygen, nitrogen, hydrogen, natural gas, coal gas ,etc),water and liquid (water, petrol , alcohol, benzene ,etc.)

2.Working Principle

Non-streamline vortex-maker be set in fluid（anti-flow part）,then two regular vortex would be come out ,from two sides of the vortex-maker in turn，so this kind of vortex be called as Karman vortex street，Chart I as follow。

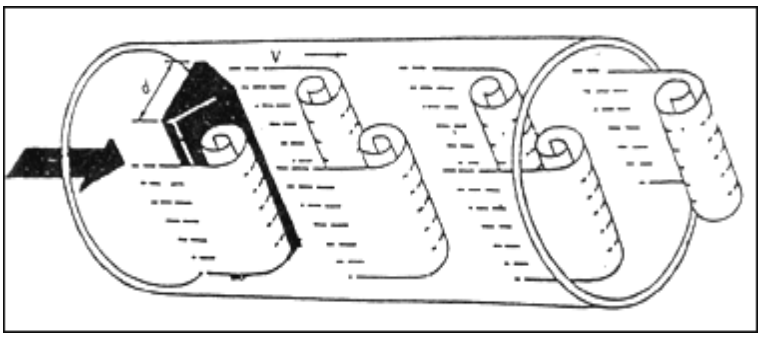


Chart I

Vortex is not flowing symmetrically under vortex-maker set .As if, set frequency of vortex is f,the speed of test medium is V,inlet face width of vortex-maker is d,Past part diameter is D，as the principle of Karman vortex street ,as follow:

$$f=StV/d \qquad (1)$$

Factor：

f—The Karman vortex street frequency which one side of vortex-maker

St—Strouhal number（dimensionless number）

V—mean flow rate

d—the width of vortex-maker

So, check the separate frequency of Karman vortex street to know the instant capacity(flow) .among, Strouhal number（St）is dimensionless number，

Chart II　Show the relation of, Strouhal number（St） & Reynolds number (Re)

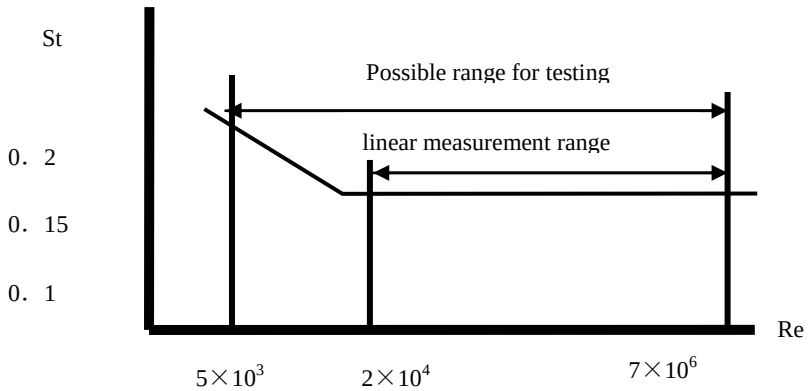


Chart II

Straightness part in curve(St=0.17),free frequency & flow rate of vortex is direct ratio, it means flow sensor range. so just check out frequency (f),we can get the flow rate inside pipe， then as the flow rate(V) to take volume flow, the ratio record of impulse & volume, called as（K），as follow（2）

$$K=N/Q\ (1/m^3) \qquad (2)$$

Model：K＝instrument constant（1/m³）.

N＝impulse number

Q＝volume flow（m³）

3. The key technical indexes

Inside nominal diameter (mm)	25，40，50，65，80，100，125，150，200，250，300，(300～1000 plug-in)
Nominal pressure (MPa)	DN25-DN200 4.0(>4.0 order by agreement)， DN250-DN300 1.6(>1.6 order by agreement)
Medium temperature (℃)	Piezoelectric type：-40～250，-40～320；Capacitance： -40～300, -40～400，-40～450（Order by agreement）
Noumenon	1Cr18Ni9Ti,(Order by agreement if need other material)
Vibrating acceleration	Piezoelectric type:0.2g Capacitance:1.0～2.0g
Range	±1%R，±1.5%R，±1FS；Plug-in：±2.5%R，±2.5%FS
Range degree	1：6～1：30
Service voltage	Sensor：+12V DC,+24V DC；Transmitter：+12V DC ,+24V DC；Battery supply feed：3.6V battery
Output signal	Square wave pulse (non- battery supply feed)：high level≥5V，low level≤1V；urrent：4～20mA
Loss coefficient	JB/T9249 Cd≤2.4
Anti-explosion sign	Ben-an type：Exd Ⅱ ia CT2-T5 anti-explosion type：Exd Ⅱ CT2-T5
Protection grade	Ordinary type IP65 Dive type IP68
Environment condition	Tem-20℃～55℃,Relative humidity 5%～90%,Atm press 86～106kPa
Medium	Gas、Liquid、Vapor
Transmission range	Three-wire system flow sensor：≤300m，electric sign of two-wire system transmitter (4～20mA)：load resistance≤750Ω

Part II : Model selecting & Installing for meter

It is important for selecting model, the key to use, so client must read this chapter carefully, and if find question, you can contact us.

I. Ensure the diameter of meter

According to the flow range to choose diameter. Different diameter hold different test range. Even if the same diameter, the test range is different if medium is not same. Practical test range must be confirmed by figure.

1.1 Flow range of air and water under reference condition，as chart II，reference condition as follow:

1)．Air：Normal Temp & press，t=20℃，P=0.1MPa（absolute pressure）,ρ=1.205 kg/m3，υ=15×10-6 m2/s.

2).Liquid： Normal temperature water,t=20℃，ρ=998.2kg/m3，υ=1.006×10-6m2/s.

1.2 Basic step to ensure diameter of meter and flow range：

1)．Working parameter clearly.

(a) Name & component of testing medium

(b) Min, Nor and Max capacity under working condition

(c) Min, Nor & Max Press & Temp of medium

(d) Viscosity of medium under working condition

2)．Meter test the flow capacity of medium under working condition, so as the technological parameter to know the flow capacity of medium under working condition, as follows：

(a) If know air capacity under standard condition, we can get the capacity which under working condition, as follow;

$$Q_v = Q_O \times \frac{0.101325}{0.101325 + P} \times \frac{273.15 + t}{293.15}$$ formula（3）

(b) If know air density under standard condition ρ，as follow;

$$\rho = \rho_o \times \frac{0.101325 + P}{0.101325} \times \frac{293.15}{273.15 + t}$$ formula（4）

(c) Mass flow rate Qm charge to volume flow Qv

$$Q\nu = Q_m \times 10^3 / \rho$$ formula（5）

Among formula(5)：

Qv: Volume flow of medium under working condition (m3/h)

（Qv=3600f/K K: Coefficient of meter ）

Qo : Volume flow under standard condition(Nm3/h)

Qm: Mass flow rate (t/h)

ρ: Density of medium under working condition(kg/m3)

ρo: Density of medium under normal state(kg/m3)，common air medium density under normal state，as chart III

P: Gage pressure under working state (MPa)

t: Temp under working state(℃)

3). To ensure lower limit capacity. For the upper limit capacity of flow meter may be not counted under ordinary condition，so that just count its lower limit for choosing caliber. Shall meet two conditions：Minimum Reynolds number shall be not less than limited（Re=2×104）；for vortex street flow meter with stress type set, it take vortex intensity from lower limit capacity shall be more than limited sensor intensity（vortex intensity and lift force, as scaling relation as ρv2）. Relation as follow:

For density to test measurable lower limit flow：

$$Q_\rho = Q_O \times \sqrt{\rho_O / \rho}$$ formula (6)

For kinematic viscosity to test linear lower limit flow：

$$Q_\upsilon = Q_O \times \upsilon / \upsilon_O$$ formula(7)

medium：

Qρ: Meet request of vortex intensity, the minimum volume flow (m^3/h)

ρ0: Medium density under reference condition

Qu: Meet request of Min-Reynolds number, the minimum linear volume flow (m^3/h)

ρ: The density of tested medium under working condition（kg/m^3）

Q_0: Minimum volume flow of meter under working condition (m^2/s)

u_o: Kinematic viscosity of medium under reference condition (m^2/s)

by means of formula（6）&（7）to come out Qρ& Qv: Compare with Qρ& Qv，to ensure measurable range of lower limit flow & linear lower limit flow :

Qu≥Qρ：measurable range= Qρ～Qmax , linear flow range= Qu～Qmax

Qu<Qρ：measurable range & linear flow range Qρ～Qmax

Qmax：upper limit volume flow (m^3/h)

4). The standard of upper limit flow ,See(II). gaseous upper limit flow velocity shall be less than 70m/s, liquid shall be less than 7m/s.

5). When tested gas is vapor，often use quality flow as unit of measurement quality flow，as ： t/h or Kg/h. because of vapor （overheating & saturated）,density would be changed under different temp & press，so to ensure the flow range, see (8)

$$Q_s = 1.5Qa \times \rho \times 10^3 \times \sqrt{\rho_o / \rho}$$ formula（8）

TIPS：

ρ: Density of vapor（kg/m^3）

ρ_0: 1.205kg/m^3

Q_s : Quality flow of vapor（t/h）

6). For pressure loss， check the effect of reference condition (m^3/h)

u: Kinematic viscosity of medium under

pressure loss to craft pipeline，(Unit：Pa)：

$\Delta p = C d \rho V^2/2$ formula（9）

Tips：

Δ p: Pressure loss（Pa）

Cd: Coefficient of pressure loss

ρ:Density of medium under working condition（kg/m^3）

V：Mean flow rate（m/s）

7). If tested medium is liquid, to avoid 为 gasification and loss, shall make the press of pipeline as follow:

$p \geqslant 2.7\Delta p + 1.3p_0$ formula（10）

Tips：

Δ p: Pressure loss（Pa）

p_0:Saturated vapor pressure of liquid which under working temperature.

（Pa absolute pressure）

Po: Fluidic vapor pressure

(Pa absolute pressure)

8). Vortex street flow meter is not suitable for testing high viscosity liquid. if counted measurable lower limit flow is not suitable for designing, pls select and use other meter type..

9). If as the counted parameter, the two or more kinds of meter can be used, then use less caliber, cheaper. Tips: as far as possible tested range during upper limit of about 1/2～2/3.

Table(I):Extent table of reference condition under working condition

Caliber (mm)	Liquid		Gas	
	Range(m^3/h)	Output frequency range (Hz)	Measurement range (m^3/h)	Output frequency range (Hz)
25	1.6～10	32～214	9～55	190～1178
40	2.5～25	13～130	22～200	115～1011
50	3.5～35	9～93	36～320	96～854
80	10～100	6～65	70～628	45～402
100	15～150	5～50	130～1100	43～367
150	40～350	4～33	280～2240	27～221
200	80～650	3～26	580～4200	24～167
250	120～950	3～19	970～5500	20～112
300	180～1800	2～22	1460～8000	17～95
(400)	180～3000	5.6～87	2750～27000	85～880
(500)	300～4500	5.6～88	4300～43000	85～880
(600)	450～6500	5.7～89	6100～61000	85～880
(800)	750～10000	5.7～88	11000～110000	85～880
(1000)	1200～17000	5.8～88	17000～170000	85～880
>(1000)	agreement		agreement	

Tips：above table the caliber (300)～(1000) is plug-in

Table(II):The density of common gas under normal state（0℃，absolute pressure P=0.1MPa）

Name	Density (kg/m^3)	Name	Density (kg/m^3)
Air(dry)	1.2928	Acetylene	1.1717
Nitrogen	1.2506	Ethylene	1.2604
Oxygen	1.4289	Propylene	1.9140
Argon	1.7840	Methane	0.7167
Ne	0.9000	Ethane	1.3567
Ammonia	0.7710	Propane	2.0050
Nydrogen	0.08988	Butane	2.7030
Carbon monoxide	1.97704	Natural gas	0.8280
Carbon dioxide	1.3401	Coal gas	0.8020

2. Design & installation

It is important to install meter，if not installed well, then would affect precision, use-life and damage.

2.1 Environmental request for installing:

1). To avoid strong current, high frequency and powerful switch set, power supply of meter shall be avoided to near by these equipments.

2). To avoid high-Temp & radiation source. if have to install it, need heat insulation & ventilated measure.

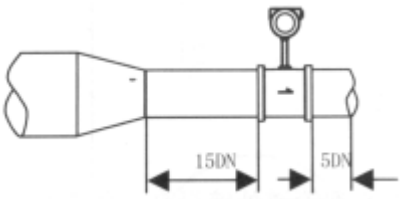
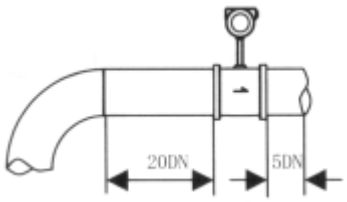
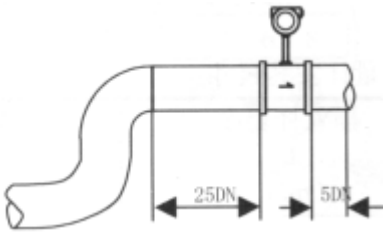
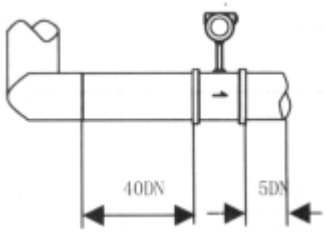
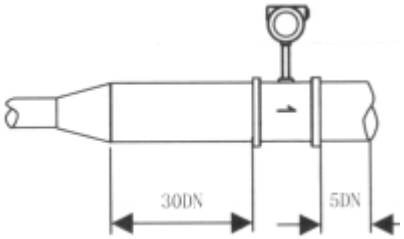
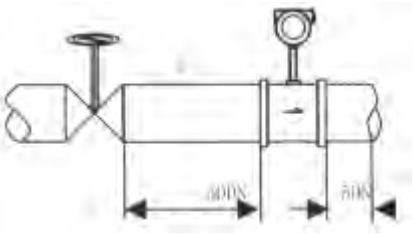
3). To avoid high-Temp & etchant gas, if have to install it, need ventilated measure.

4). Vortex street flow meter shall be avoided to install on shaking part of pipeline. if have to install on it，shall add clamp device and vibration pad which located on 2D to enhance shake proof . meter has better to installed indoors, pay attention to waterproof when installing meter outdoors，special notice the joint, make cable conductor to U shape to avoid water get into the amplifier body Around installing place shall save enough space，so that install connection line and maintenance routine.

2.2 Request for installing of pipeline meter：

1) .Vortex street-flow meter need a request for about installing point up-down stream pipe，if not flow field of medium will be affected in pipeline，refer to measurement accuracy of meter。up-down stream pipe of meter as chart(III)

DN is nominal caliber of meter　　UNIT: mm

Sensor upstream pipe type	Front and back straight pipe length	Sensor upstream pipe type	Front and back straight pipe length
Concentric contract opening-valve		90 degree elbow	
Two 90 degree Elbow which on a same plane		Two 90 degree Elbow which not on a same plane	
Concentric expanded pipe		Control valve half open the vale (not recommend)	

chart(III)

Tips: control valve shall not install on upstream of meter, it better to the downstream 10D.

2). Up-down internal diameter of pipe shall be same. if not，than internal diameter of pipe Dp and vortex street meter inner diameter Db, shall be as follow

$$0.98Db \leq Dp \leq 1.05Db$$

Up-down internal diameter of pipe shall be concentric with inner diameter of flow meter，The non- axiality

shall be less than 0.05Db.

3). Sealing gasket which between meter with flange，can not joint inside pipe when installing，and its inner diameter shall more than meter `s about 1~2mm.

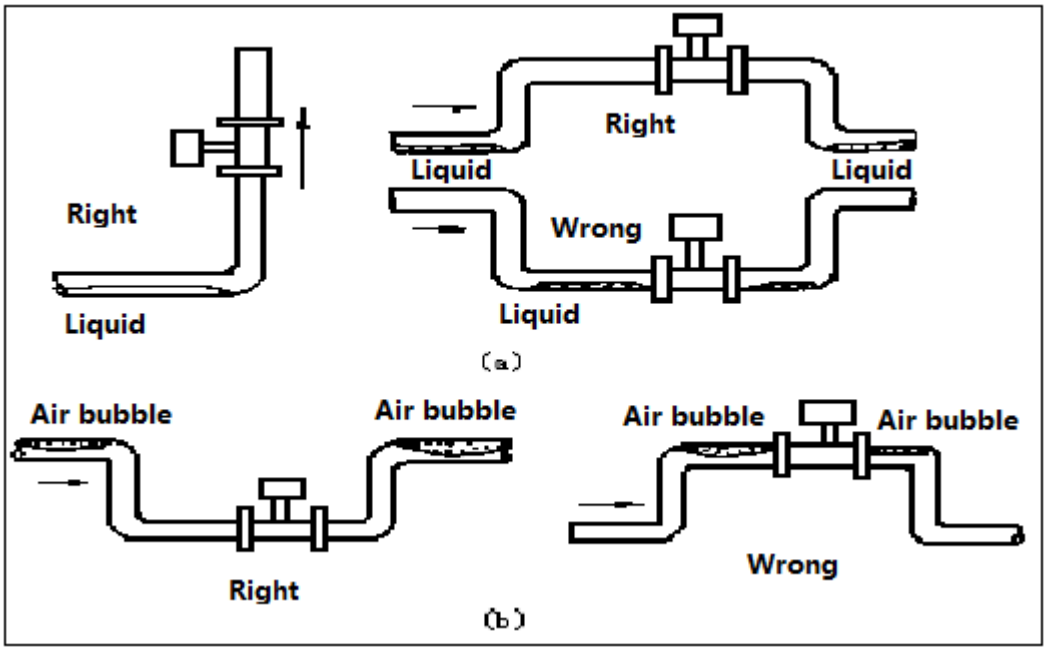
4). Design for temp & press point. When test pipeline need install temp & pressure transmitter，pressure tap may be downstream of 3-5D，thermometer hole may be downstream of 6-8D，see chart（VII）。D is nominal caliber，Unit：mm.

5). Meter can be installed by horizontal, vertical and bias ways on pipeline.

6). When test air, gas can flow anywhere when under uptake pipe to install. if there some air inside pipe ,to prevent liquid into the test pipe，so the air may from below to top, as list（IV）a.

7). When test for liquid，to ensure pipeline filled full，so install meter under vertical or bias working condition，shall ensure liquid flow from below to top。If there are some air inside of pipeline，meter may be installed under pipeline to prevent air into it.

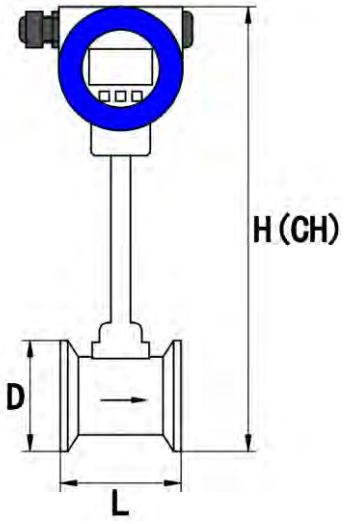
As chart（IV）as follow:



8). when test high& low temp medium，may pay attention to heat preservation. inside changer（inside body of gauge outfit）must be not more than 70℃；if low temp inside will produce water into meter and reducing insulation.

2.3 Overall dimension installing of meter：SEE（V）&（VI）

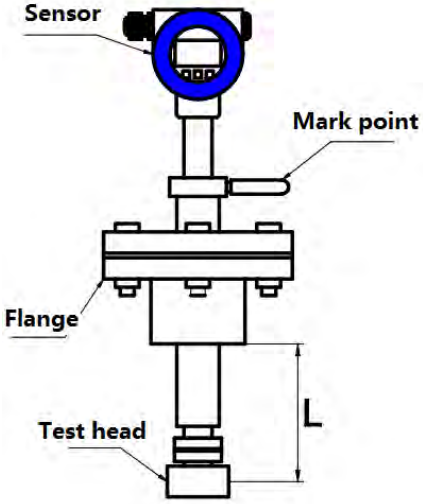
2.3.1 Flange clamp type vortex flowmeter

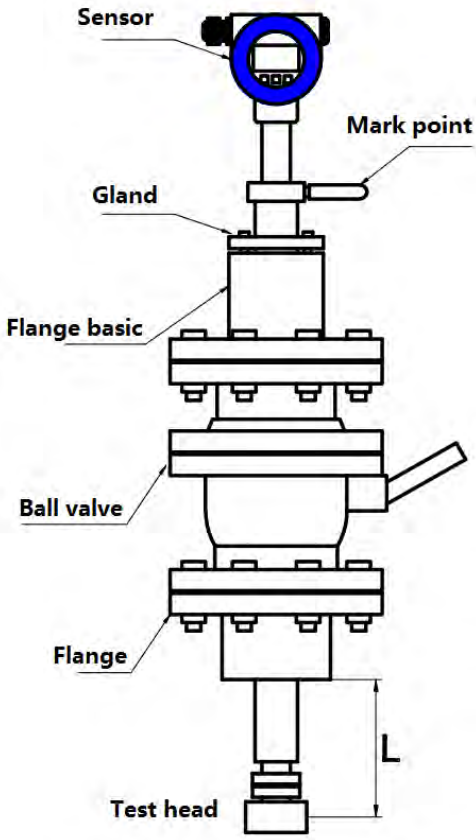


DN（mm）	L	D	H	CH
15~25	70/90	54	325	385
32	85	69	325	385
40	85	79	325	385
50	85	89	330	390
65	85	104	340	400
80	90	119	360	420
100	90	139	380	440
125	95	168	405	465
150	100	194	430	490
200	102	248	485	545
250	115	300	540	600
300	130	350	590	650

Chart（V）

2.3.2 Plug-in vortex flow meter





Chart（VI）

DN (mm)	DN250	DN300	DN400	DN500	DN600	DN800
L（mm）	125	150	200	250	300	400

2.4 The steps of installing plug-in vortex street meter:

1). Use gas welding to get a near φ 100mm circular hole，and clear it so that make the measuring head would be work fine.

2). The flange which from manufacturer would be burned-on round hole of pipeline.

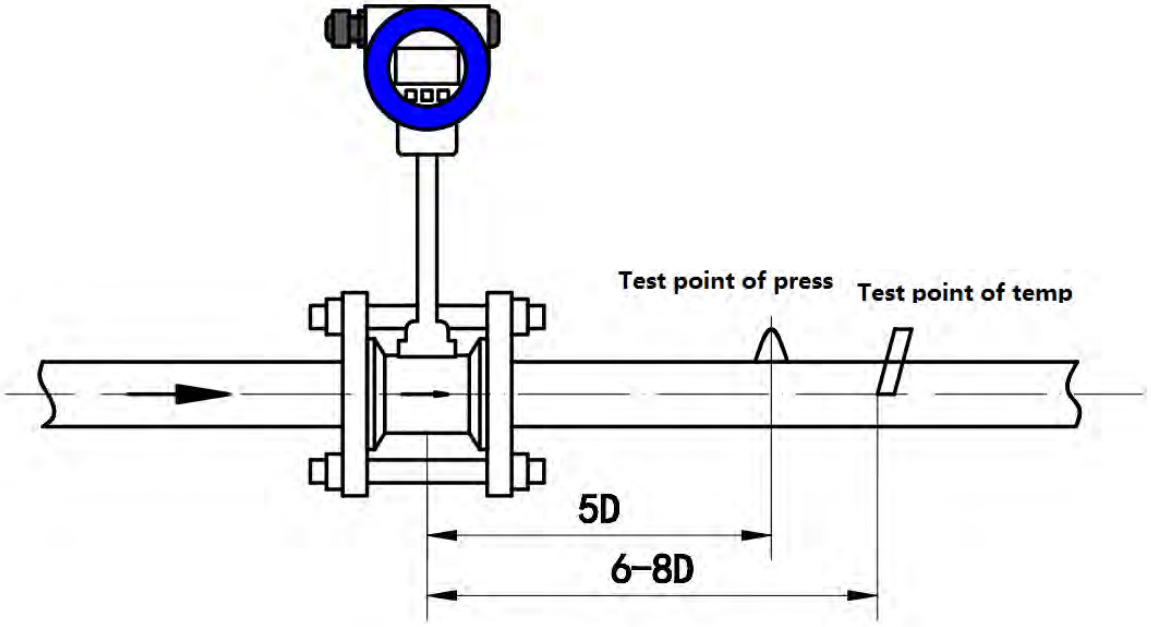
3). Take ball valve and sensor install on the flange.

4). Balance screw, so that insertion depth is pass muster(ensure central axis dead in line between test head with pipeline), fluid flow direction must be stay the same with arrows.

5). Balance gland screw.(Notice: lead screw swirl and seal degree is decided to gland screw elasticity)

6). Check every steps, opening valve slowly to ensure leakage (take care of body), if find leakage, do step 5,6 once more.

2.5 Pt100 installing sketch map of PT100 and pressure transmitter



Part III: Parameter set & pipeline design

1. Electrical Connection

1	2	3	4	5	6	7	8	9	10
S1	GND	S2	V-	P-	P+	V+	B	B	A

Path 1 Path 2

Vortex Sensor Pressure Sensor Temperature Sensor

Path 1 of vortex sensor:

1：+,

2：-

Path 2 of vortex sensor:

3：+

2：-

Pressure Sensor:

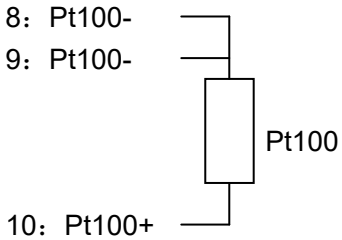
V-: Pressure sensor power supply -;

P-: Pressure sensor signal -;

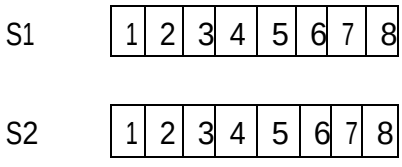
P+: Pressure sensor signal +;

V+: Pressure sensor power supply +.

Temperature Sensor:



S1 and S2 were have 8 dial switch, dial to "ON" for effective. Various caliber, medium corresponding to the amplifier board S1, S2 switch position is as follows, in accordance with the actual situation can be slightly adjusted:



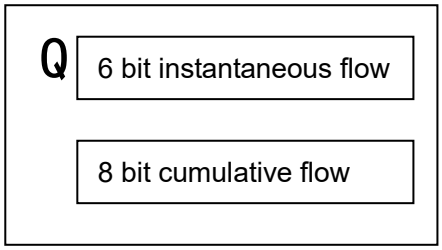
Caliber	Gas		Liquid	
mm	S1	S2	S1	S2
25			1	5
40	1	1	1~2	5
50	1	2	1~3	5
80	1~2	2	1~4	6
100	1~2	3	1~4	6
150	1~3	3	1~5	7
200	1~3	4	1~6	7
250	1~4	4	1~6	8
300	1~4	4	1~7	8

S3 rotary digital potentiometer, a total of 16 files from the 0~F, used to adjust the magnification, 0 files is the minimum, F file is the largest, clockwise rotation for the increase, and vice versa.

The conversion board is configured with three buttons, the left is the shift key F1,the middle for the set / change key F2,the right to add / modify the keyF3.

2.Parameter set

2.1.The main screen is shown as below:



F1——Shift key, used to cycle movement the modify bit。

F2——Parameter setting key,press the key to enter the set state, and then use the option to switch.

F3——Parameter increment key,Used to modify the parameters of the modified bit.

2.2 Setting internal parameters

2.2.1 Setting parameters are as follows:

PASS ——Password input（0001）;

SET d ——Density setting, density compensation (kg/m³) for the measurement of liquid media;

SET qc ——Small signal excision (t/h);

SET F1 ——Vortex flow sensor first segment frequency value (Hz), minimum;

SET C1 ——The first section of the flow coefficient of vortex flow sensor(1/L);

SET F2 ——The second section of vortex flow sensor segment frequency value (Hz);

SET C2 ——The second section of the flow coefficient of vortex flow sensor (1/L);

SET F3 ——The third section of vortex flow sensor segment frequency value (Hz);

SET C3 ——The third section of the flow coefficient of vortex flow sensor (1/L);

SET F4 ——The fourth section of vortex flow sensor segment frequency value (Hz);

SET C4 ——The fourth section of the flow coefficient of vortex flow sensor (1/L);

SET F5 ——The fifth section of vortex flow sensor segment frequency value (Hz);

SET C5 ——The fifth section of the flow coefficient of vortex flow sensor (1/L);

SET dP ——The coefficient of resistance to vibration, 0 is not resistant to vibration, 1-9 to resist vibration intensity;

SET F.S ——Flow range setting;

SET Lb ——Damping time setting (s);

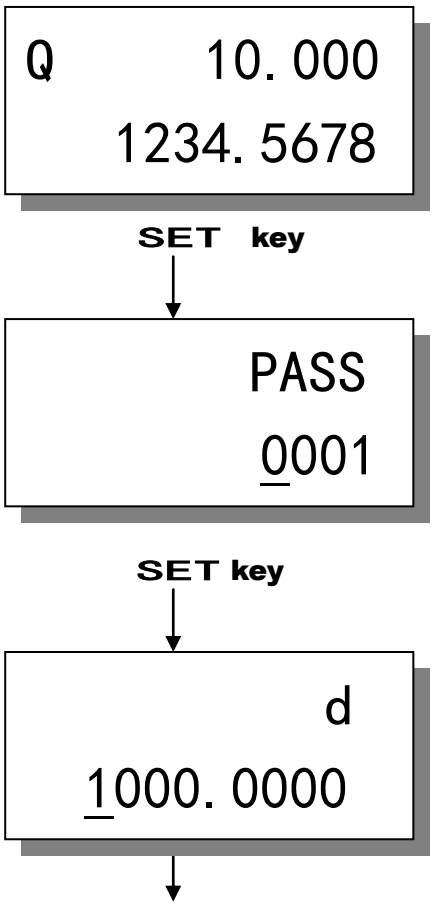
SET bh ——Table number, address identification for 485 communications;

SET bd ——The baud rate (1200, 2400, 4800, 9600, 485) for communication;
SET pc ——Pressure sensor coefficient;
SET p0 ——Zero point of pressure sensor;
SET tc ——Coefficient of temperature sensor;
SET t0 ——Zero point of temperature sensor;
SET p ——Pressure compensated input mode:
Pin：Pressure sensor input pressure compensation;
Sp： Internal setting pressure compensation.
SET SP ——Internal setting compensation pressure value (MPa);
SET t ——Input mode of temperature compensation:
tin：Pt100 temperature compensation;
St： Internal setting temperature compensation.
SET St ——Internal setting temperature compensation value（℃）;
SET pg ——Measurement medium selection:
bh_t：Saturated steam measurement with temperature compensation;
bh_p：Pressure compensated saturated vapor measurements;
gr：Superheated steam measurement;
ys：Compressed gas measurement;
yt：Liquid measurement.

XXXXXXXX
c Lr（Twinkle）——Cumulative traffic cleared;

2.2.2 Parameter setting procedure

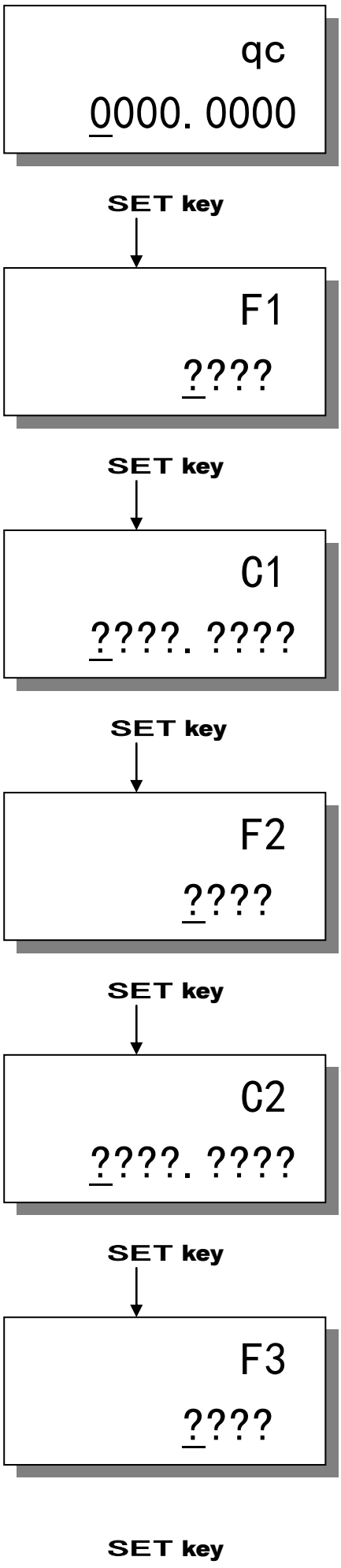
In the normal working state, press the SET key, you can enter the set state.



In the parameter display state, press the "SET" key, you can enter the set state.

Password settings. Password=0001；through the “►” and “▲” button will set the correct password，press “SET” key to confirm。The password is correct, enter the set state; is not correct, exit the set state.

Medium density modification is only effective for liquids.Unit：kg/m3 through the “►” and “▲” key to modify.



Excision of small flow. The unit is the same as the instantaneous flow. After judging the instantaneous flow rate is less than this value, then the instantaneous flow is zero, does not carry on the accumulation.

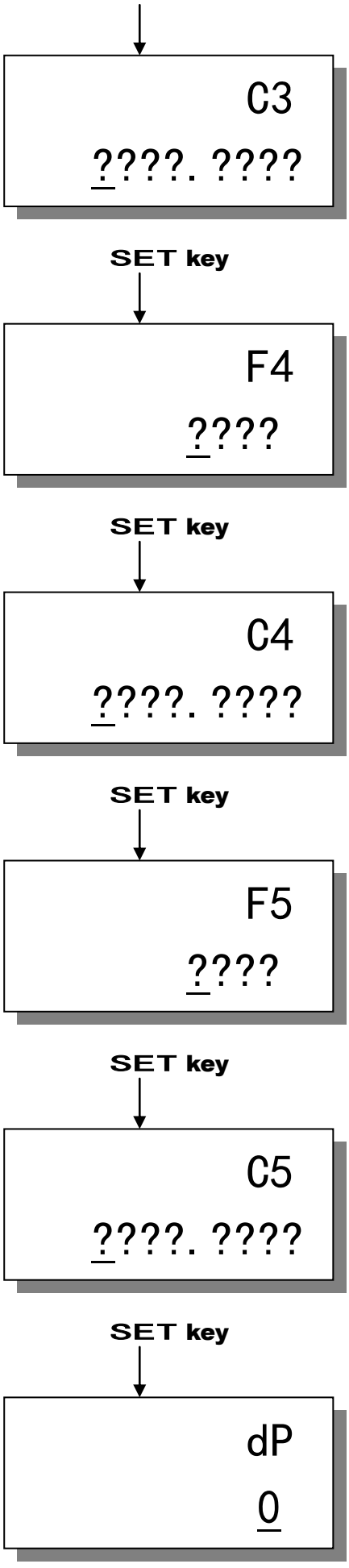
Segment frequency value of the first segment. The piecewise frequency value sorted first segment is the smallest, the fifth section is the largest. Through the "►" and "▲" button to modify. If not, the F1 can be set to a large value (e.g., 5000), Simply set the flow coefficient of C1, other segments, can not care.

Flow coefficient of the first segment, unit: 1/ L. Through the "►" and "▲" button to modify.

Second segment flow segment frequency value.Through the"►"and"▲"button to modify.

Second segment flow coefficient, unit: 1/ L.Through the "►" and "▲" button to modify.

Third segment flow segment frequency value.Through the"►"and"▲"button to modify.



Third segment flow coefficient, unit: 1/ L.Through the “►” and “▲” button to modify.

Fourth segment flow segment frequency value.Through the“►”and“▲”button to modify.

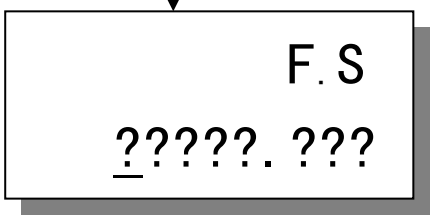
Fourth segment flow coefficient, unit: 1/ L.Through the “►” and “▲” button to modify.

Fifth segment flow segment frequency value.Through the“►”and“▲”button to modify.

Fifth segment flow coefficient, unit: 1/ L.Through the “►” and “▲” button to modify.

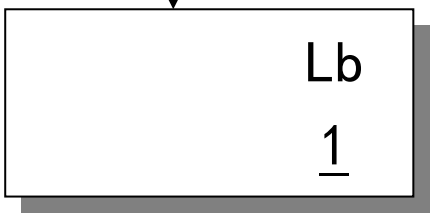
Resistance vibration coefficient. Effective range: 0~9. 0 of them are not resistant to vibration, 1~9 to resist vibration levels in order to enhance.Through the “▲” button to modify.

SET key



Full range of flow. Unit: the same as the instantaneous flow unit. This value corresponds to the current output of 20mA..Through the "►" and "▲" button to modify. This item is very important and must be consistent with the measuring range of the secondary meter.

SET key



Damping time setting, unit: sec.Through the "▲" button to modify. For liquid media, especially large diameter, large number of this set, the instantaneous flow will be relatively stable.

SET key

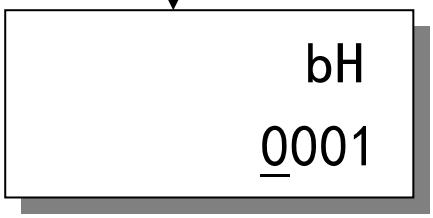
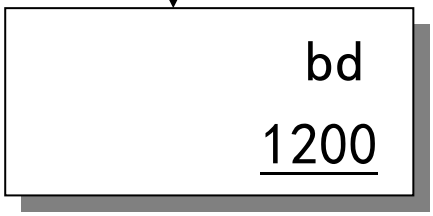


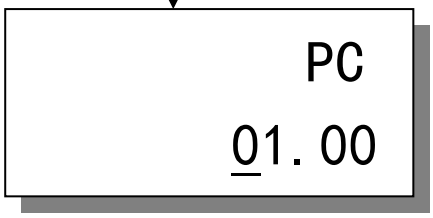
Table setting, address recognition for 485 communication;Through the "►" and "▲" button to modify.
When there is no communication, do not care.

SET key



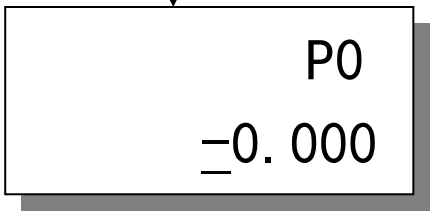
Baud rate（1200、2400、4800、9600）; Through the "▲" button to modify.
When there is no communication, do not care.

SET key



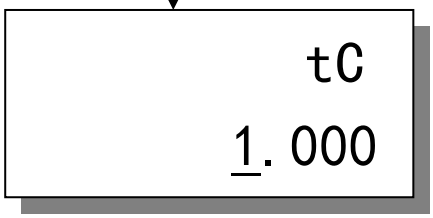
Pressure sensor coefficient. The coefficient is obtained by the calibration of the pressure sensor.Through the"►"and"▲"button to modify.
If there is no external pressure sensor, this item does not care.

SET key



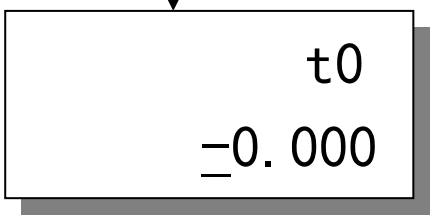
Zero point of the pressure sensor. The coefficient is obtained by the calibration of the pressure sensor.Through the"►"and"▲"button to modify.
If there is no external pressure sensor, this item does not care.

SET key



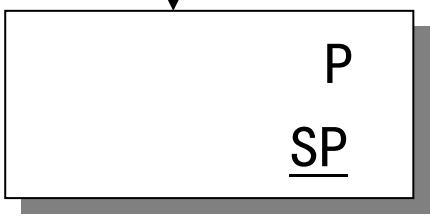
Temperature sensor coefficient. The coefficient is obtained by simulating the Pt100 calibration of the resistance box.Through the "►" and "▲" button to modify.
If there is no external Pt100, this item does not care.

SET key



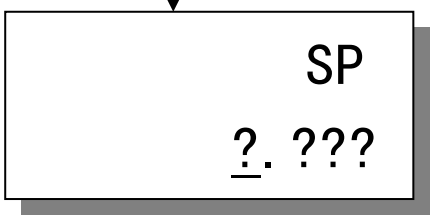
Zero point of temperature sensor. The coefficient is obtained by simulating the Pt100 calibration of the resistance box.Through the "►" and "▲" button to modify.
If there is no external Pt100, this item does not care.

SET key



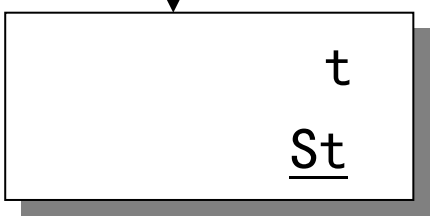
Pressure compensated input mode.SP：Internal setting pressure compensation,Pin： Pressure sensor compensation.Through the "▲"button to modify.
If there is no external pressure sensor, this item must be set to "SP".

SET key



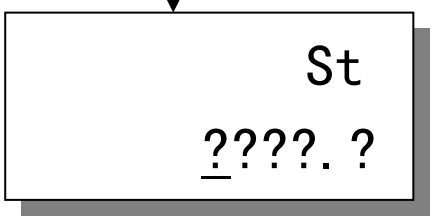
Internal set pressure compensation value, unit: MPa,Through the"►"and"▲"button to modify.
This is very important for steam and compressed gases. For liquid media, this item does not care.

SET key

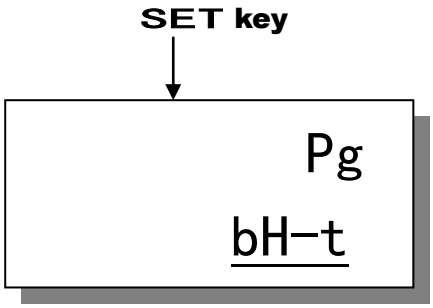


Input mode of temperature compensation.St：Internal setting temperature compensation,tin：Pt100 compensation.Through the "▲"button to modify.
If there is no external Pt100, this item must be set to "St".

SET key



Internal temperature compensation value, unit:℃，Through the"►"and"▲"button to modify.
This is very important for steam and compressed gases. For liquid media, this item does not care.



Measurement medium selection.Through the "▲" button to modify. Among them:

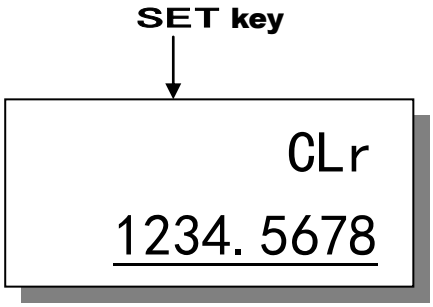
bH_t ： Saturated steam temperature compensation;

bH_p：Saturated steam pressure compensation;

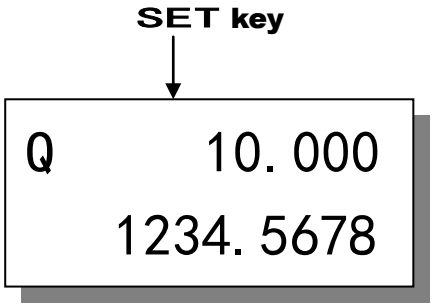
gr：Simultaneous compensation of superheated steam, temperature and pressure;

ys：Simultaneous compensation of compressed gases, temperature and pressure;

yt：Liquid, internal setting density compensation (no temperature pressure compensation).



Cumulative traffic cleared. "►" and "▲" button pressed together,the total flow can be cleared.



Exit setup status.

3. Calculation formula

Calculation formula of flow

（1） Instantaneous flow rate $L=\frac{3.6\times\rho\times F}{1000K}$ (t/h)

Formula:

F：The pulse frequency of vortex flow sensor;

K：The flow coefficient of vortex flow sensor (1/L);

ρ ：Set density of medium（kg/m^3）。

（2） Cumulative flow $\Sigma=\int(L/3600)dt$ （t）

Formula:

L: Instantaneous flow;

4.Calibration of pressure transducer

4.1 Will set the parameters in the PC item, set to 01.00;

pc——Pressure sensor coefficient;

01．00

4.2 Set the P0 item to 00.00;

p0——Zero point of pressure sensor;

00. 00

4.3 Set the P item to Pin;

p——Pressure compensated input mode:

Pin：Pressure sensor input pressure compensation;

4.4 Exit setup status

4.5 Press the right button , switch to the pressure display “P X.XX”;

4.6 Connect the pressure sensor and the meter correctly;

4.7 With the pressure test bench, start calibration, and fill in the form;

Serial number	Full range percentage （%）	Standard pressure Ps (MPa)	Measuring pressure P m (MPa)	Calculation method: Ps = P m÷PC-P0
1	0			Through the 4 and 2 points simultaneous equations, the calculation results are obtained: PC=? P0=?
2	25			
3	50			
4	75			
5	100			

4.8 Set the correct results to the PC and P0 terms of the instrument;

4.9 Through 3 and 5 points to verify the results.

5.Calibration of temperature sensor Pt100

5.1 Sets the tC item in the set parameter to 1.000;

tc——Temperature sensor coefficient;

1．000

5.2 Set the t0 item to 00.000;

t 0——Zero point of temperature sensor;

01. 000

5.3 Set the t item to tin;

t——Input mode of temperature compensation:

tin：Temperature sensor input temperature compensation;

5.4 Exit setup status

5.5 Press the right button, Switch to temperature display “t X.XX”;

5.6 The resistance box is connected with the instrument correctly;

5.7 Start calibration and fill in the form correctly;

Serial number	The resistance of resistance box	Standard temperature Tt(℃)	Measuring temperature Tm(℃)	Calculation method: $T_t = T_m \times T\ C\text{-}T0$
1	100.00	0.00		Through the 4 and 2 points simultaneous equations, the calculation results are obtained: TC=? T0=?
2	138.50	100.00		
3	175.84	200.00		
4	212.02	300.00		
5	247.05	400.00		

5.8 Set the correct results to the TC and T0 terms of the instrument;

5.9 Through 3 and 5 points to verify the results.

6.Troubleshooting

Fault	Cause	Solution
No output signal after power on	1. No fluid flowing or the flow rate is under starting flow. 2. The connections of power supply and output are incorrect. 3. The pre-amplifier is damaged (The calculator can't count, and the flow rate is 0). 4. The circuit of driving amplifier is damaged (The display of calculator is normal).	1. Increase the flow rate or replace a flow meter with smaller nominal diameter to meet the requirement of flow range. 2. Make the connection correct. 3. Replace the pre-amplifier. 4. Replace the damaged components in the circuit of driving amplifier.
The meter outputs signal when no flow	1. The interference of bad grounding of meter, strong electricity and interference of other grounding. 2. The higher sensitivity of amplifier or it may produce self excitation. 3. Unstable power supply, bad filtering or other electrical disturbance.	1. Make the grounding well 2. Replace the pre-amplifier. 3. Repair or replace the power supply.
Unstable display of flow rate	1. Unstable flow in pipe 2. The higher or lower sensitivity of amplifier make the output pulses are more counted or less counted. 3. There is debris in the shell of meter. 4. Bad grounding. 5. The flow rate is under the low limit. 6. The downstream seal ring reaches into pipe,	1. Begin to measure after the flow rate is stable. 2. Replace the pre-amplifier. 3. Remove the debris. 4. Check the grounding, make the grounding well.

	and make disturbance.	
The displayed total flow is inconsistent as actual total flow	1. The flow coefficient of meter is incorrect. 2. The flow rate on site is higher than the maximum flow of meter. 3. The bad quality of the flow meter.	1. Recalibrate the meter and input the new flow coefficient. 2. Reduce the flow rate in pipe or replace the flow meter. 3. Recalibration
Abnormal display	Bad contact of the key or dead lock the key	Replace the display board.
System halts after replacement new battery	The electrify reset circuit is abnormal, or the oscillating circuit can’t afford to boost.	Reinstall the battery (Before reinstall the battery, the meter is needed to discharge more than 5 seconds)