

Precession Vortex Flow Meter User Manual



Kaifeng Qingtianweiye Flow Instrument Co.,Ltd

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I. Summary

Intelligent swirl flow meter is the brand-new gas flow meter design & developed by our company with most advanced technology, this flow meter combine the functions of gathering flow, temperature and pressure testing, and could carry out the temperature, pressure and compression factor compensation automatically, which is the ideal instruments for gases measuring in petrol, chemical, power, metallurgy industry etc.

1.1 Main Characteristics

- Without movable mechanical parts inside, incorruptible, reliable & stable, long service life, long time running no need special maintenance.
- Adopt 16bits computer chip, high integrity, small size, good performance, powerful functions.
- Intelligent flow meter integrate the flow sensor, micro-processor, pressure and temperature sensor together, adopt the embedded type make the structure compact, it can measure the flow, temperature and pressure, and carry out the real-time tracking compensation and compression factor amendment.
- Adopt the double checking technology could enhance the measured signal strength effectively, and restrain the interference caused by pipeline vibration.
- Adopt the advanced intelligent anti-vibration technology, restrain the interference signal caused by vibration and pressure fluctuate.
- Adopt the Chinese character dot matrix display screen, with more display bit, and convenient reading, it can display the volume flow rate under working condition, volume flow rate, total flow and medium pressure, temperature parameters under standard condition.
- Adopt EEPROM technology, convenient parameter setting, can save permanently, it can save the one year historical data.
- The flow converter could output frequency pulse, 4~20mA analogue signal, and has RS485 interface, it could connect computer network, the transmission distance can reach 1.2km.
- Multi physical quantity parameters alarm output, the end user can select any of them.
- Flow meter converter could rotate 360 degree, easy and convenient installation.
- Match with our company FM model data gather, it could carry out the remote data transmission via internet or telephone or internet.
- Pressure, temperature signal is flow sensor input method, strong interchangeability.
- Lower power consumption, could use the battery powered and connect the external power also.

1.2 Main Application

Intelligent swirl flow meter can widely used for various kinds of gases in petrol, chemical,

electricity,metallurgy, city gas supply etc, which is the preferred products in the oil field and city natural gas supply distribution measurement and trade measurement.

II. Structure & Working Principle

2.1 Structure

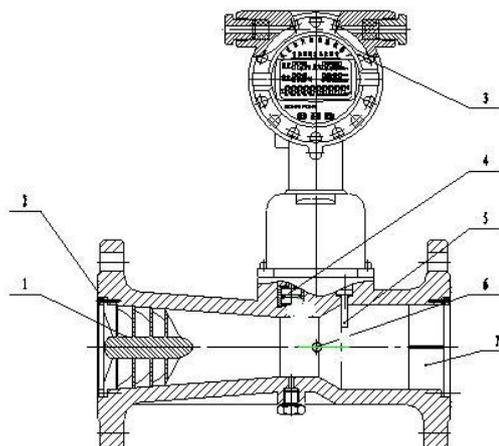
Flow meter is composed by below parts (pic 1):

1. Swirl generation body

Made by aluminium alloy, with certain angle screw blades, it is fixed in front of the housing contraction, then press the fluid and generate strong swirl flow.

2. Housing

It has flange itself, and with certain shape fluid channel, according to different working pressure the housing could adopt cast aluminium alloy or stainless steel (pic 1).



3. Intelligent flow totalizer (principle see pic 3)

It is combined of temperature, pressure testing analogue channel, flow testing no. Channel and micro processing unit, LCD drive circuit and other assistant circuit, with the external output interference.

4. Temperature sensor

Use the PT100 platinum resistance as the temperature sensitive element, under certain temperaure range, the resistance and temperature is correspond with each other.

5. Pressure sensor

Use the diffused silicon piezoresistive type bidge road as the sensitive element, the bridge arm resistance will happen some expected change under pressure effect, under certain excitation current, the two output terminal potential difference in proportion to the outer pressure.

6. Piezocrystal flow sensor

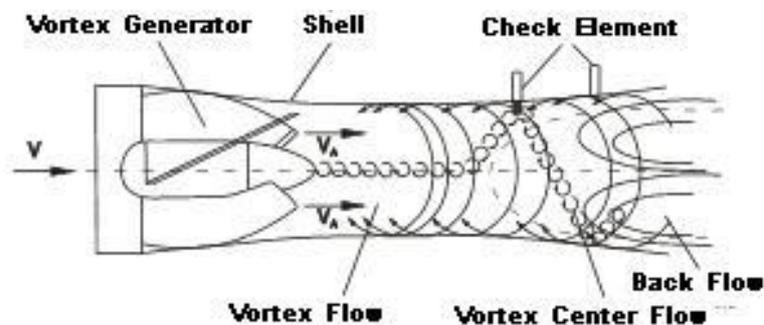
It is installed at the throat near the housing contraction section, it could test the frequency of swirl.

7. Clear swirl part

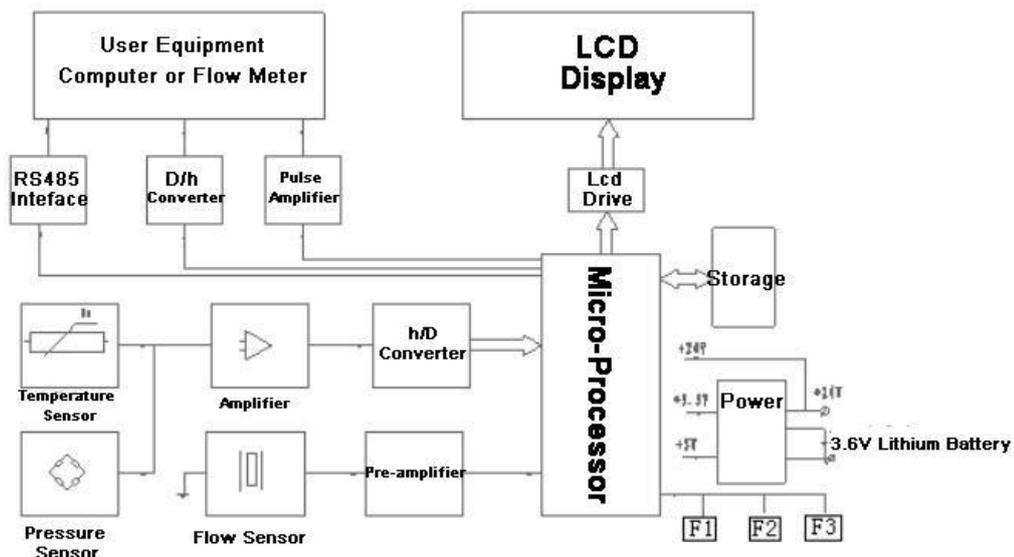
It is fixed at the housing exit section, the function is clear the swirl and decrease the influence to the downstream instruments performance.

2.2 Working Principle

The flow sensor flow profile like the venturi tube shaped wire (pic 2), install one group spirial guide buffle in the side of entrance, while the fluid enter the flow sensor, the guide buffle will press the fluid generate strong swirl flow, when the fluid enter expansion section, the swirl flow will generate second time rotating under the effect of counterflow, and shape the swirl precession phenomenon of gyroscopic shape. The precession frequency in proportion to flow volume, it will not influenced by fluid physical property and density, when get the fluid second time precession, the testing element will get better linearity in the wide flow range. The signal will be magnified via front amplifier, filtering and transform into the pulse signal in proportion to flow rate, then send to the micro processor undertake totalizing process with the temperature, pressure testing signal, fianlly it will display the measured result on the LCD display (instantaneous flow total flow and temperature, pressure data).



2.3 Flow Totalizer Working Principle



Pic 3

Flow totalizer is combined with temperature, pressure testing analogue channel, flow sensor channel and micro processing unit, and with the external output signal interface, with many output signals, the micro processor in the flow meter will carry out the

temperature and pressure compensation according to gas state equation, and carry out the compress factor amendment. The gas state equation as below:

$$Q_N = \frac{P_a + P}{P_N} \cdot \frac{T_N}{T} \cdot \frac{Z_N}{Z} Q_V \dots\dots\dots(2)$$

In the formula:

- QN ——flow volume under standard condition. (m3/h);
- QV ——flow volume under working condition. (m3/h);
- Pa ——local atmospheric pressure (KPa) ;
- P ——flow meter tapping hole measured meter pressure (KPa) ;
- PN ——atmospheric pressure under standard condition. (101.325 KPa) ;
- TN ——absolute temperature under standard conditions. (293.15K) ;
- T ——the absolute temperature of measured fluid. (K) ;
- ZN ——the gas compression factor under standard condition. ;
- Z ——the gas compression factor under working conditions;

Note: when use the bell jar or negative pressure calibrate, use $Z_N/Z=1$, for natural gas $(Z_N/Z)^{1/2}=FZ$ is super compression factor, calculated according to the China National Petroleum Corporation standard SY / T6143—1996 formula.

III. Main Technical Parameters and Functions

3.1 Flow meter specification, basic parameters and performance index (see table 1)

Table 1

DN (mm)	Type	Flow Range (m ³ /h)	Working Pressure (MPa)	Accuracy Level	Repeatability
20		1.2~15	1.6; 2.5; 4.0; 6.3	1.0 1.5	Less than 1/3 of basic error absolute value
25		2.5~30			
32		4.5~60			
50	B	10~150			
80	B	28~400			
100	B	50~800			
150	B	150~2250			
200		360~3600	1.6; 2.5; 4.0		

Note:

Accuracy value: it is system accuracy after temperature and pressure amendment.

3.2 Standard State Condition: P=101.325KPa, T=293.15K.

3.3 Application Condition:

Environment temperature: -30℃~+65℃

Relative humidity: 5%~95%

Medium temperature: -20℃~+80℃

Atmospheric pressure: 86KPa~106KPa

3.4 Electrical Performance Index

3.4.1 Working Power:

A. External power: +24VDC±15%, ripple wave<5%.

Suitable for 4~20mA output, pulse output, alarm output,RS-485 etc.

B: Internal power: 1 group 3.6V lithium battery (ER26500), when the voltage less than 3.0V, it will indicate voltage shortage.

3.4.2 Whole unit power consumption:

A. External power: <2W;

B. Internal power: average power consumption 1mW. It can use more than two year continuously.

3.4.3 Pulse output mode:

A. Working condition pulse signal, it will enlarge and output the working condition pulse signal tested by flow sensor via opto-isolator, high level≥20V, low level≤1V.

B. Scaling the pulse signal, it will match with the IC card valve controller, high level range≥2.8V, low level range≤0.2V, unit pulse standard for volume can set the range: 0.001m³~100m³, select this item need to notice: scaling the pulse signal frequency should ≤1000Hz.

C. Scaling pulse signal, it will enlarge and output via opto-isolator, high level≥20V, low level≤1V.

3.4.4 RS-485 communication(opto-isolate), can realize below functions:

A. Adopt RS-485 interface, it can networking with upper computer or second instrument, display the medium temperature,pressure and the standard volume flow rate and standard volume flow total via temperature and pressure compensation by transmission.

B. RS-485 interface will match with the HW-1 data collector, it can constitute telephone internet communication system, one data collector can connect 15 sets flow meters.

C. RS-485 interface will match with the HW-1 data collector,it can constitute wide band communication system, it can transmit data by internet, one data collector can connect 8 sets flow meters.

3.4.5 4~20mA standard current signal(opto-isolate).

It is in direct proportion to standard volume flow rate, 4mA correspond to 0m³/h, 20mA correspond to biggest standard flow volume rate (this value can set in the first level menu), it has two-wire system and three-wire system, flow meter can recognize automatically according to inserted current module, and output correctly.

3.4.6 Control signal output:

-
- A. Low limit alarm signal (LP); opto-isolate, high and low level alarm, alarm level can set, working voltage: +12V~+24V, the biggest load current 50mA.
 - B. High alarm signal(UP): opto-isolate, high and low level alarm, alarm level can set, working voltage: +12V~+24V, the biggest load current 50mA.
 - C. Close valve alarm output(BC terminal, IC card controller use), logical gate circuit output, normal output low level, range≤0.2V, alarm output high level, range≥2.8V, load resistance≥100kΩ.
 - D. Battery shortage alarm output(BL terminal. IC card controller use), logical gate circuit output, normal output low level, range≤0.2V, alarm output high level, range≥2.8V, load resistance≥100kΩ.

3.5 Real-time Data Storage Function

3.5.1 flow need need to adapt to data management requirements, and add this real-time data storage function, it can select one of them by setting below three:

- A. Day record: latest 5 years data, standard volume flow rate and total flow at zero point.
- B. Month record: each month standard volume flow rate and total flow of latest 5 years.
- C. Fix time interval record: 1200 items fix time interval record data time, temperature, pressure, standard volume flow rate and total flow record.

3.5.2 it can read the above storage data via computer, and form the data report form, graph design for analysis.

3.6 Internet communication software management software functions.

Flow meter match with the data collector, it could communicate via telephone or broad band net, read and set the each flow meter historical data and parameters in the net, at the same the time, the communication management software can realize complete management functions.

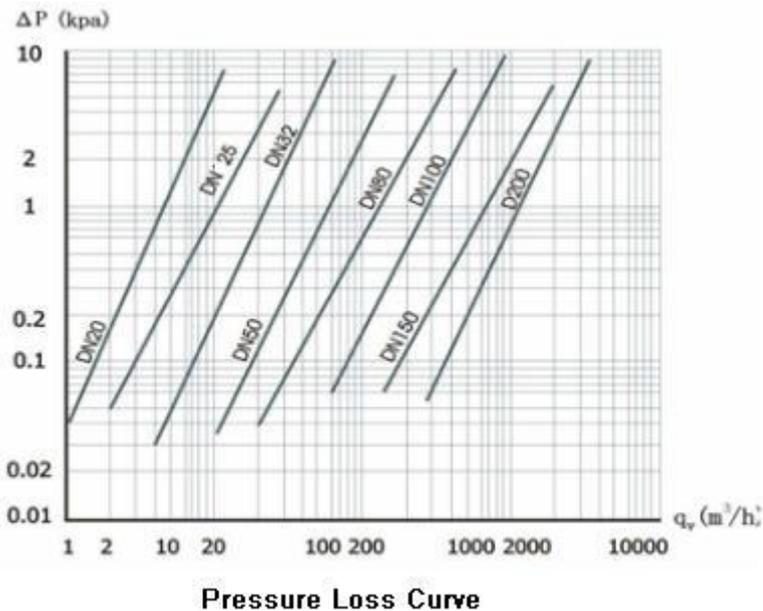
3.7 Explosion proof mark: ExdIIBT4;ExialICT4

3.8 Protection Class: IP65

3.9 Pressure loss.

Flow meter actual pressure loss calculation formula like below:

$$\Delta P_1 = \frac{\rho}{1.205} \Delta P \dots\dots\dots(1)$$



In the formula:

ΔP_1 —flow meter actual pressure loss (KPa) ;

ρ —measured medium density (kg/m³)

ΔP —when the measuring medium is dry air, the flow meter pressure loss medium (KPa),pls check below curve.

3.10 connection port: outlet port is M20×1.5 inner thread.

IV. Model selection & installation

4.1 Flow Meter Model Selection

During the model selection should have two principle, that is: one is to guarantee production safety, one is to keep accuracy, we need to clear three model selection parameters,that is present time and future time biggest,smallest and normal flow(mainly used for select flow meter normal caliber),the design pressure of measured medium(mainly used for decide the flow meter normal pressure degree), actual working pressure(mainly used for decide the flow meter pressure sensor pressure rating).

When the measured flow is working condition flow rate, it can select the suitable normal caliber according to table flow range.

When the measured flow rate is the standard condition volume flow rate, first convert the standard volume flow rate Q_N into working condition flow rate Q_v , then select the corresponding normal caliber according to technical parameters table flow range.

When the two calibers flow meter could cover lowest and highest volume flow rate, under the pressure loss allowance, select the small size.

Pls dont make the actual smallest flow rate Q_{min} lower than select normal caliber flow

meter flow lowest range.

Flow range,normal pressure has special requirements could order by agreement.

Model selection formula as below:

$$Q_V = \frac{Z}{Z_N} \cdot \frac{P_N}{P + P_a} \cdot \frac{T}{T_N} \cdot Q_N = \frac{Z}{Z_N} \cdot \frac{101.325}{P + P_a} \cdot \frac{T}{293.15} \cdot Q_N$$

In the formula: T,P,Pa meaning like above, Q is the volume flow rate, Qn is standard volume flow rate, Z/Zn numerical value pls check table 2, as the calculation step size is big, the table data for reference only, the table data according to natural gas real relative density Gr=0.600,nitrogen and CO2 molar fraction all is 0.00, when the medium pressure less than 0.1Mpa,all can calculated according to Z/Zn=1.

Table 2

Za/Zg AP (Mpa)	Tem °C									
	-20	-15	-10	-5	0	5	10	15	20	25
0.10	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0.20	1.0034	1.0032	1.0030	1.0029	1.0027	1.0025	1.0024	1.0023	1.0021	1.0020
0.30	1.0069	1.0065	1.0061	1.0058	1.0055	1.0051	1.0048	1.0046	1.0043	1.0041
0.40	1.0104	1.0098	1.0093	1.0087	1.0082	1.0078	1.0073	1.0069	1.0065	1.0061
0.50	1.0140	1.0132	1.0124	1.0117	1.0110	1.0104	1.0098	1.0092	1.0087	1.0082
1.00	1.0325	1.0305	1.0286	1.0269	1.0253	1.0238	1.0223	1.0210	1.0198	1.0186
1.50	1.0518	1.0485	1.0455	1.0426	1.0400	1.0375	1.0352	1.0331	1.0311	1.0293
2.00	1.0722	1.0674	1.0630	1.0589	1.0551	1.0516	1.0484	1.0454	1.0426	1.0400
2.50	1.0936	1.0872	1.0812	1.0758	1.0708	1.0661	1.0619	1.0580	1.0543	1.0510
3.00	1.1162	1.1078	1.1002	1.0933	1.0869	1.0810	1.0757	1.0707	1.0662	1.0620
3.50	1.1400	1.1295	1.1200	1.1113	1.1035	1.0963	1.0897	1.0837	1.0782	1.0732
4.00	1.1651	1.1521	1.1405	1.1300	1.1205	1.1119	1.1041	1.0969	1.0904	1.0844
4.50	1.1915	1.1758	1.1618	1.1493	1.1380	1.1278	1.1186	1.1103	1.1027	1.0957
5.00	1.2194	1.2005	1.1839	1.1691	1.1559	1.1441	1.1334	1.1238	1.1150	1.1071
5.50	1.2486	1.2262	1.2067	1.1895	1.1742	1.1606	1.1484	1.1374	1.1274	1.1185
6.00	1.2793	1.2530	1.2302	1.2104	1.1928	1.1773	1.1634	1.1510	1.1399	1.1298
6.50	1.3113	1.2806	1.2544	1.2316	1.2117	1.1942	1.1786	1.1647	1.1522	1.1411
7.00	1.3444	1.3091	1.2790	1.2532	1.2308	1.2111	1.1937	1.1783	1.1645	1.1522
7.50	1.3785	1.3381	1.3040	1.2750	1.2499	1.2280	1.2088	1.1918	1.1767	1.1632
8.00	1.4131	1.3673	1.3291	1.2967	1.2689	1.2448	1.2237	1.2051	1.1886	1.1740

Za/Zg AP (Mpa)	Tem °C									
	30	35	40	45	50	55	60	65	70	75
0.10	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0.20	1.0019	1.0018	1.0017	1.0016	1.0015	1.0014	1.0013	1.0012	1.0012	1.0011
0.30	1.0038	1.0036	1.0034	1.0032	1.0030	1.0029	1.0027	1.0025	1.0024	1.0023
0.40	1.0058	1.0054	1.0051	1.0048	1.0046	1.0043	1.0041	1.0038	1.0036	1.0034
0.50	1.0077	1.0073	1.0069	1.0065	1.0061	1.0058	1.0055	1.0052	1.0049	1.0046
1.00	1.0176	1.0166	1.0156	1.0147	1.0139	1.0131	1.0124	1.0117	1.0110	1.0104
1.50	1.0275	1.0259	1.0244	1.0230	1.0217	1.0204	1.0193	1.0182	1.0171	1.0162
2.00	1.0376	1.0354	1.0333	1.0313	1.0295	1.0277	1.0261	1.0246	1.0232	1.0219
2.50	1.0478	1.0449	1.0422	1.0396	1.0372	1.0350	1.0329	1.0310	1.0292	1.0274
3.00	1.0581	1.0545	1.0511	1.0480	1.0450	1.0423	1.0397	1.0373	1.0351	1.0330
3.50	1.0685	1.0641	1.0600	1.0563	1.0528	1.0495	1.0464	1.0436	1.0409	1.0384
4.00	1.0789	1.0737	1.0690	1.0646	1.0605	1.0567	1.0531	1.0498	1.0467	1.0438
4.50	1.0894	1.0834	1.0779	1.0728	1.0681	1.0638	1.0597	1.0559	1.0523	1.0490
5.00	1.0998	1.0930	1.0868	1.0811	1.0757	1.0708	1.0662	1.0619	1.0579	1.0542
5.50	1.1103	1.1026	1.0956	1.0892	1.0832	1.0777	1.0726	1.0678	1.0633	1.0592
6.00	1.1207	1.1122	1.1044	1.0972	1.0906	1.0845	1.0788	1.0736	1.0687	1.0641
6.50	1.1310	1.1216	1.1130	1.1051	1.0979	1.0912	1.0850	1.0792	1.0738	1.0689
7.00	1.1411	1.1309	1.1215	1.1129	1.1050	1.0977	1.0910	1.0847	1.0789	1.0735
7.50	1.1511	1.1400	1.1298	1.1205	1.1120	1.1041	1.0968	1.0900	1.0838	1.0780
8.00	1.1609	1.1489	1.1380	1.1279	1.1187	1.1103	1.1024	1.0952	1.0885	1.0823

4.2 Model Selection Example

One factory gas supply line actual working pressure range is 0.8MPa—1.2MPa, medium temperature range is $-10^{\circ}\text{C}\sim+40^{\circ}\text{C}$, gas supply peak value is standard volume flow rate 2500, gas supply valley value is standard volume flow rate 5600, natural gas real relative density $Gr=0.591$, Nitrogen gas molar fraction percentage composition is $Mn=1.6\%$, CO_2 molar fraction percentage composition content is $Mc=0.8\%$, local gas pressure is 101.3Kpa, need to confirm the flow meter caliber.

When the medium pressure is 0.8Mpa, temperature is 40°C , natural gas compression factor has smallest influence, when it is reach the gas supply peak value, it will has biggest volume flow rate, when the medium pressure is 1.2MPa, temperature is -10°C , compression factor has biggest influence, when it reach the gas supply peak value, it has the smallest volume flow rate.

When $Gr=0.591, Mn=1.6\%, Mc=0.8\%$, meter pressure $P=0.8\text{MPa}$, temperature $T=40^{\circ}\text{C}$, according to the formula of SY/T16143, can get $Z_n/Z=1.0127$, so the highest volume flow rate is

$$Q_{\max} = \frac{Z}{Z_N} \cdot \frac{P_N}{P + P_a} \cdot \frac{T}{T_N} \cdot Q_N = \frac{1}{1.0127} \times \frac{101.325}{800 + 101.3} \times \frac{40 + 273.15}{293.15} \times 2500 = 2964.6 (\text{m}^3 / \text{h})$$

When meter pressure $P=1.2\text{MPa}$, temperature $T=-10^{\circ}\text{C}$, it can get $Z_n/Z = 1.0355$, so the smallest volume flow rate is:

$$Q_{\min} = \frac{Z}{Z_N} \cdot \frac{P_N}{P + P_a} \cdot \frac{T}{T_N} \cdot Q_N = \frac{1}{1.0355} \times \frac{101.325}{1200 + 101.3} \times \frac{-10 + 273.15}{293.15} \times 5600 = 378 (\text{m}^3 / \text{h})$$

When get the “flow meter size is 200mm, then get HW-2008 model flow meter” via table 1.

4.3 Flow meter overall structure and installation overall structure drawing.

The flow meter overall structure pls check pic 3, if there has no size in the pic pls check table 1, flow meter adopt flange connection method, flange size according to GB/T9112~9113-2000 standard.

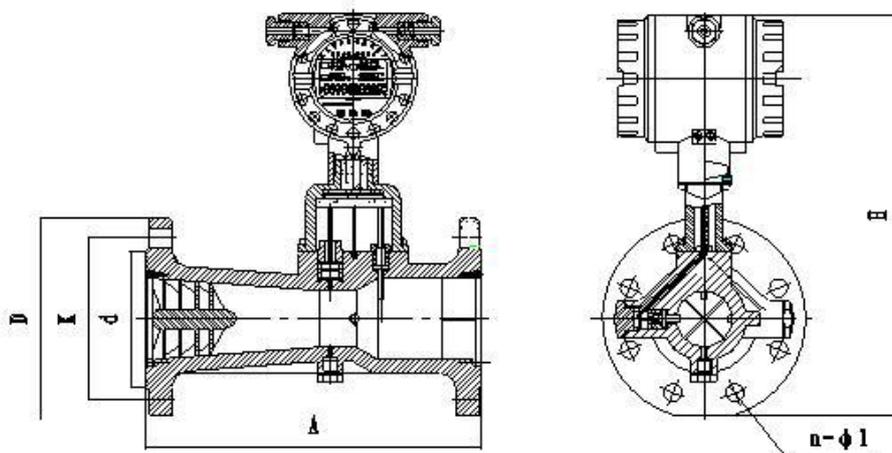


Table 3

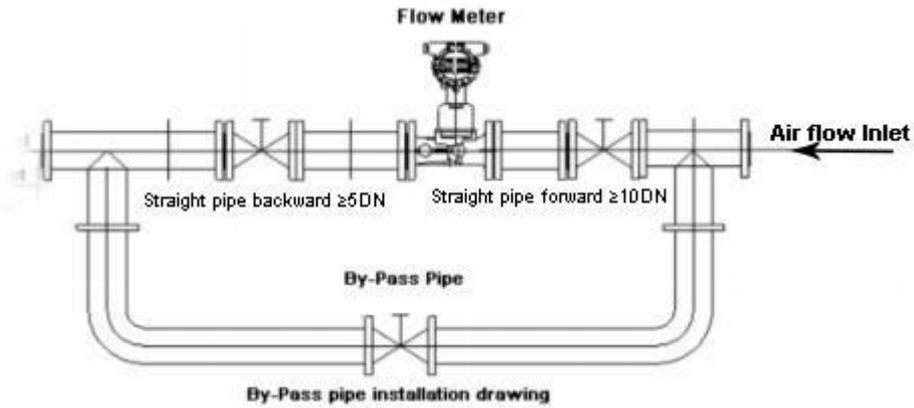
Unit: mm

Model	DN	Meter Length (A)	PN1.6~4.0MPa						PN1.6MPa						※PN2.5~4.0MPa						
			H	D	K	n	L	d	H	D	K	n	L	d	H	D	K	n	L	d	
HW—25	25	200	305	125	85	4	14	65													
HW—32	32	200	320	140	100	4	18	76													
HW—50	50	230	330	165	125	4	18	99													
HW—80	80	330	360	200	160	8	18	132													
			PN1.6MPa						※PN2.5~4.0MPa												
HW—100	100	410	376	220	180	8	18	156	390	235	190	8	22	156							
HW—150	150	570	430	285	240	8	22	211	450	300	250	8	26	211							
			PN1.6MPa						PN2.5MPa						※PN4.0MPa						
HW—200	200	700	470	340	295	12	22	266	490	360	310	12	26	274	510	375	320	12	30	284	

Note:※ is special requirements.

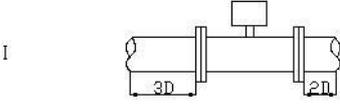
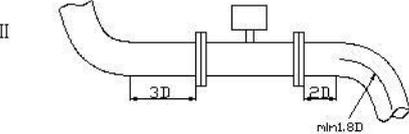
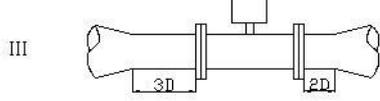
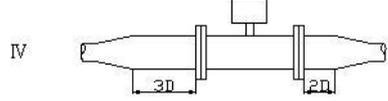
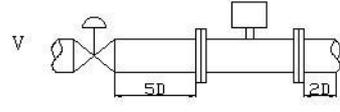
4.4 Flow meter installation

- When install the flow meter, it is forbidden weld near the inlet and outlet flange to avoid the burning of flow meter inner spare parts.
- For the newly installed or maintained pipe must clean it first, to get rid of the sundries inside the pipe then install flow meter.
- Flow meter should install in the area of easily maintenance, without strong electromagnetic field interference, without strong mechanical vibration and thermal radiation influence.
- Flow meter is not suitable in the area of flow break off frequently and with intensive pulsating flow or pressure pulsation..
- When install the flow meter outdoor, the above should have shelter to avoid the rain immerse and strong sunlight will influence the flow meter service life.
- Flow meter can install at any angle, flow direction should same with the flow meter direction arrow.
- During pipe installation, should consider about the extension tube or corrugated tube to avoid the serious stretch or breakage for flow meter.
- Flow meter should install coaxial mounting with the pipe, and avoid sealing fin and grease enter the pipe cavity.
- When adopt the external power supply, the flow meter should have reliable grounding, it should not have common ground with the high voltage system, while the pipe mounting or maintenance, the user should not connect the welding system grounding wire with the flow meter.
- In order not to influence the flow normal transport and convenient for maintenance, pls install the by-pass pipe according to pic 4, and guarantee before $\geq 3DN$ and after $\geq 10DN$ straight pipe line.



4.4.2 Straight pipe line requirement.

According to the flow meter working principle and requirements about the straight pipe line, if there has some resistance parts in the upstream, we suggest the before and after straight pipeline as in below pic, and keep the straight pipe inner wall smooth and flat.

Illustration	See below pic
Guarantee the upstream straight pipeline at least 3D, and the downstream straight pipeline at least 2D, see pic I. (D: Norminal Caliber)	
Bend Pipe: The required upstream straight pipeline at least 3D, the downstream straight pipeline at least 2D, see pic II.	
Contracted Pipe: The required upstream straight pipeline at least 3D, the downstream straight pipeline at least 2D, see pic III.	
Expanding Pipe: The required upstream straight pipeline at least 3D, the downstream straight pipeline at least 2D, see pic IV.	
Valve: The required upstream straight pipeline at least 5D, the downstream straight pipeline at least 2D, see pic V.	 <p style="text-align: center;">Straight Pipeline Requirement</p>

4.4.3 Installation Notice.

- ❖ According to flow direction arrow could install vertically, horizontally or any tilt position.
- ❖ When the pipeline longer or near the vibration, the user should install the support in the upstream and downstream of flow meter to eliminate the pipeline vibration influence.
- ❖ The flow sensor installation area should have enough space to carry out the flow meter checking and maintenance and satisfy the flow meter environment requirements.
- ❖ Avoid the strong electromagnetic field interference.
- ❖ When install the flow meter outdoor, the above should have shelter to avoid the rain immerse and strong sunlight will influence the flow meter service life.
- ❖ While test the pipe pressure, the user should notice the pressure measure range of the flow meter pressure sensor to avoid the damage.
- ❖ Notice the influence of installation stress, the upstream and downstream pipe should be coaxial mounting, or it will has shearing stress, the position should consider sealing pad thickness or install one elastic slip section in the downstream.
- ❖ Clear the welding slag and other sundries in the pipe before install the flow meter.
- ❖ When put into operation, the user should open the upstream and downstream valve slowly to avoid the instant rapid airstream and damage the swirl generator.
- ❖ When the flow meter need signal transmission, it should connect the external power supply (8~24)VDC strictly according to “ electrical performance index”, and forbidden connect the 220VAC or 380VAC power supply directly.
- ❖ The user is forbidden change the anti-explosion system wiring connection method and twist each output cable at will.
- ❖ When flow meter in operation, it is forbidden to open the back cover and change the parameters willingly, or it will influence the normal working of flow meter.
- ❖ Check the flange place leakage or not on time.

4.4.4 Embedded battery use and change.

◆ Battery electric quantity display

When battery shows only one cell, the user should change the battery within one month; of battery is run of, need change the battery immediately.

◆ Battery change method

Open the back cover or flow meter, and loose the three bolts on the battery cover plate, and unplug the battery plug, bring out the battery and put in new battery.

4.4.5 Anti-explosion place installation requirement

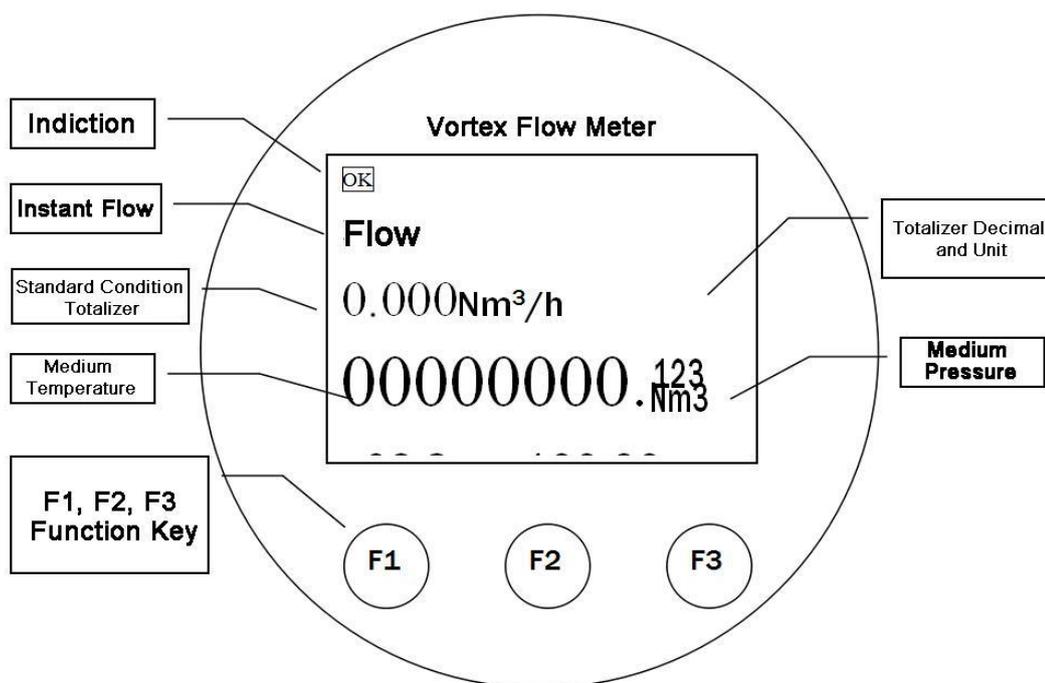
- Flow meter should have reliable grounding, this grounding should not use together with the strong power system protection grounding.
- It is not allowed to use AC power grounding during working site testing power.
- Under any condition, the user is not allowed to change anti-explosion electronic

circuit, component and anti-explosion type.

- First cut off the external power supply then open converter cover.

V. Application method

5.1 Working condition display method(see below pic)



5.1.1 Totalizer (standard volume totalizer) keep three decimals, integer-bit 8, if bigger than 8, it will clear total automatically.

5.1.2 instantaneous flow could switch display standard volume flow rate(Nm³/h) and working condition flow rate(m³/h), it can keep 3 bit numbers at most, the biggest display value is 9999999.

5.1.3 temperature display range is -50~+300℃, if beyond this range, indicator will display **OV** (parameter beyond the range), at the same time, itself could set the temperature and carry out the compensation automatically, and indicate **ST** (set temperature compensation),

5.1.4 Pressure display value keep two decimals, display range is 0~15000KPa, if beyond this range, indicator display **OV** (parameter beyond the range), at the same time, it will carry out the pressure compensation and display **SP** (set pressure compensation).

5.1.5 When the flow meter works normal, it will indicate **OK**, if it has error, then indicate **ERR**, and has error indication symbol.

5.1.6 Display parameters switch.

OK
Flow 0.000Nm³/h
 000000000.123 Nm³
 26.8℃ 100.30KPa

Display standard condition
 instantaneous flow (Nm³/h) , total
 (Nm³), medium temperature(℃)and
 pressure(KPa)。

F3 Key
 ↓

OK
O.F
 0.000m³/h
 000000000.123 Nm³

Display standard condition
 instantaneous flow (m³/h) , total
 (Nm³), medium temperature(℃)and
 pressure(KPa)。

F3 key
 ↓

Frequency 1000 Fz 1.000
O.F 0.000 m³/h
Flow 0.000 Nm³/h
 26.8℃ 100.30KPa

Display working condition
 instantaneous flow (m³/h) , standard
 instantaneous flow (Nm³/h) ,
 Frequency(Hz) , super
 compressibility factor, temperature
 (℃) and pressure(KPa)

5.2 Flow Meter User Parameter Setting

5.2.1 First level menu

OK
Flow 0.000Nm³/h
00000000 ¹²³
 -Nm³

In this normal interface, press “F2”, then enter setting.

F2

Pwd: 000000
Shift Enter Exit

PW=100300;Set the new pw via “Shift” and “Exit”, then press “Enter” for confirmation, it will enter factor change if pw right, or it will indicate “Pw fault!”.

lower cut-off frequency:
000 Hz
Shift Enter Exit

lower cut-off frequency,unit: Hz,HZ,if swirl frequency less than this value, then the flow is zero.

Compressibility Correction Factor :
 YES
Shift Rev

Compression factor correct or not, effective range: Yes/No.

Relative Density :
0.664
Shift Next Rev

Natural gas relative density,dimensionless.this parameter provided by gas analysis report Provide, it can also calculated by gas

Molar Content :
 N2 **00.68**
 CO2 **01.57**
Shift Next Rev

N2 and CO2 molar content of natural gas,this parameter is provided by Gas analysis report.



Current Output : Standard
Co flow range:
001000.00
Shift Next Rev

Current output parameter. Current output: standard condition instantaneous flow/working condition instantaneous flow: flow range accord to 20mA current output.

Damping Factor : 1
Vib coe: 1
Shift Next Rev

Effective range: 0~9

Band: 1 / 7
Filter: 1 / 7
Gain: 12 / 15
Next Rev

Pre-amplifier wave band, filter and gain adjustment factor effective range: 0~7; gain adjustment effective adjustment: 0~15

Device ID: 0001
Baut Rate: 1200
Shift Next Rev

Table no. and baut rate set, used for RS-485, table no. Effective range: 0000~9999; Baut Rate effective range: 1200 / 2400 / 4800 / 9600.

T Input: Setup
T setup: +020.0
Shift Next Rev

Temperature signal gather method and set temperature, temperature input effective range: set/Pt100. Set temperature unit: °C. If temperature signal gather method set as: Set, flow meter carry out temperature compensation according to set temperature.

P Input: Setup
P setup: +0000.00
Atmo P: 101.325
Shift Next Rev

Pressure signal gather method, set pressure and atmospheric pressure set, pressure input effective range: set/flow sensor, set pressure unit: KPa, if pressure signal gather method set as: Set, then flow meter carry out the pressure compensation according to set pressure.

Pulse Equivalent
000.001 Nm³/P
Shift Next Rev

Pulse Equivalent

↓

High Alarm
Param: None
Level: High
Shift Next Rev

Alarm para: no/working condition flow rate/standard condition flow rate /temperature upper limit/pressure upper limit; alarm level:high/low

↓

High alarm value
123456.789
Hyst: 123.456
Shift Next Rev

Upper limit alarm value and return difference set.

↓

Low alarm
Param: None
Level: High
Shift Next Rev

Alarm parameter : no/working condition flow rate /standard condition flow rate/temperature lower limit/ pressure limit ; alarm

↓

Lowalarmvalue
123456.789
Hyst: 123.456
Shift Next Rev

Low alarm value and Hyst set.

↓

OK

Flow 0.000Nm³/h

00000000 ¹²³·Nm³

26.8°C **100.30KPa**

After well set, back to working interface automatically.

5.2.2 Second level Menu

OK
Flow 0.000Nm³/h
00000000 ¹²³·Nm³
 26.8℃ 100.30KPa

In this interface, press“F2”and enter setting

F2

Pwd: 000000
Shift Enter Exit

Pwd=**200400** ; Set the new pw via“Shift” and“Exit” , then press“Enter”for confirmation, it will enter factor change if pw right, or it will indicate“**Pwd fault!**”.

Total Basic: Stanard
00000000.0000
Shift Next Rev

Total value basic set, reverse each bit,can clear initial accumulated flow also.

P zero: +000.00
P coe: 036.270
P gain: 5/7 GP
Shift Next Rev

Connect pressure sensor coefficient,zero,gain, GP/AP. Gain range is 0~7, correspond magnification is :1,2,4,8,16,32,64 and 128 times, gain confirmed with pressure sensor application range, GP/AP confirmed with pressure sensor type.

T zero: -0.00
T coe: 1.000
Shift Next Rev

External Pt1000 coefficient and zero point, calibrated by standard resistance box.

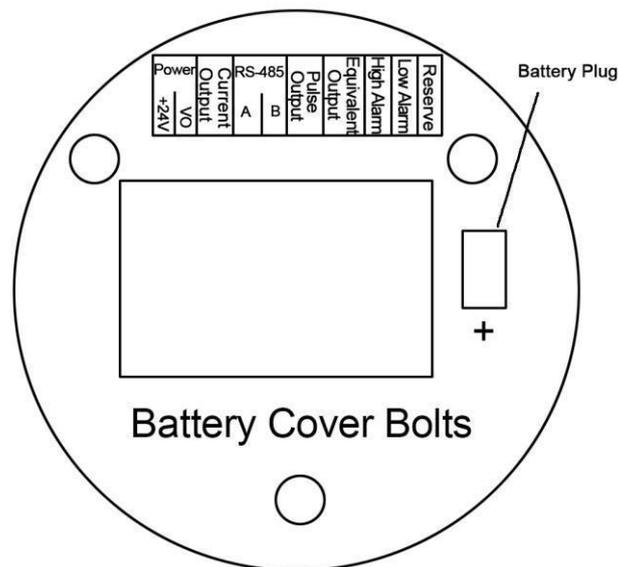
Flow coe: Sect 0
Freq: 0500
Coe: 000200.0000
Shift Next Rev

Flow section coefficient. 10 sections (0~9), after calibrated by flow calibration device, input the section frequency and section coefficient according to small to big sequency(0 is smallest), attention: if 10 sections was not use fully, in the last calibration section next section, set the frequency as 6000, coefficient is the same

B: Pt100 (1);

A: Pt100 (2).

6.2 Output Connection Terminal Illustration



Power: +24V: Power positive; VO: power negative

Current output: 4~20mA

RS485 communication: A and B.

Pulse output: pulse output terminal correspond to working condition volume flow rate, output frequency in direct proportion to flow rate.

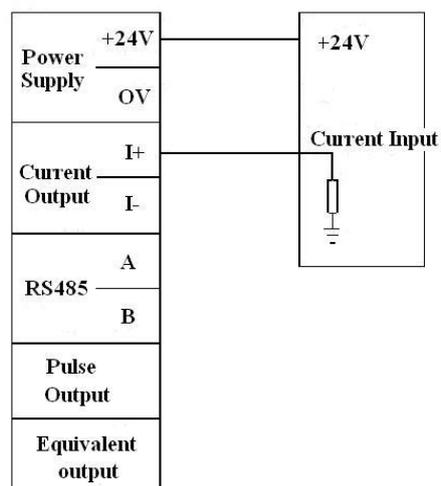
Equivalent output: pulse output terminal correspond to standard condition volume flow rate, output frequency is decided by pulse equivalent factor.

High alarm: Output high alarm level.

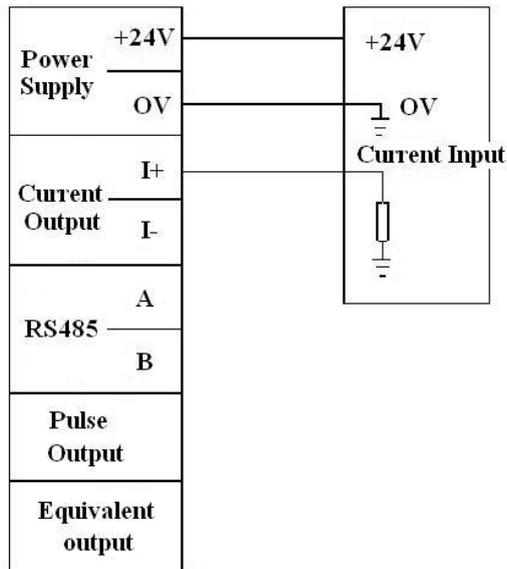
Low alarm: output low alarm level.

6.3 Wiring Connection

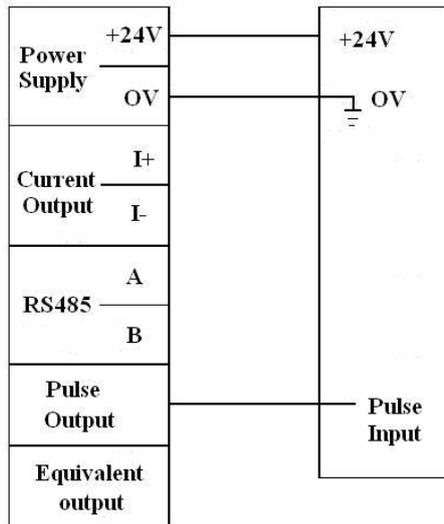
A. Two-wire Current Output Wiring



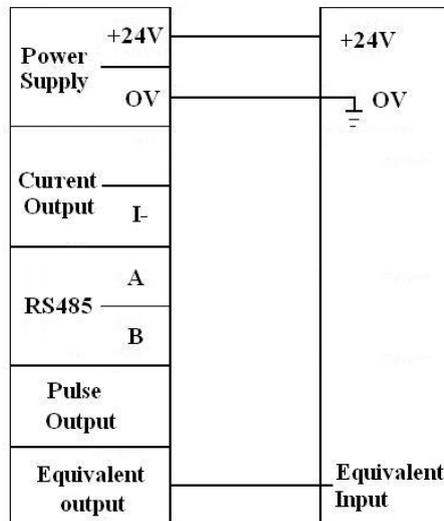
B. Three-wire Current Output Wiring



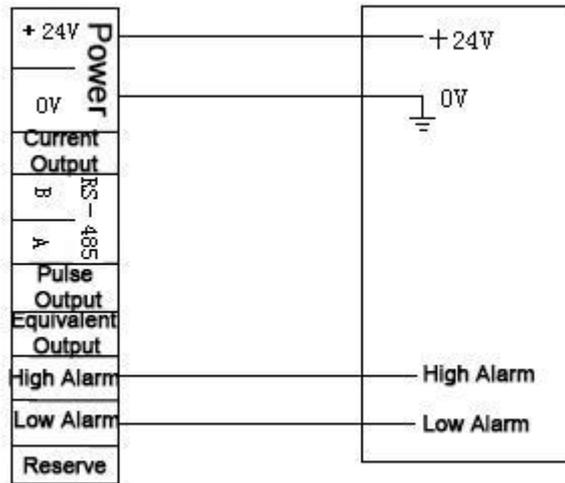
C. Three-wire Pulse Output Wiring (Flow rate)



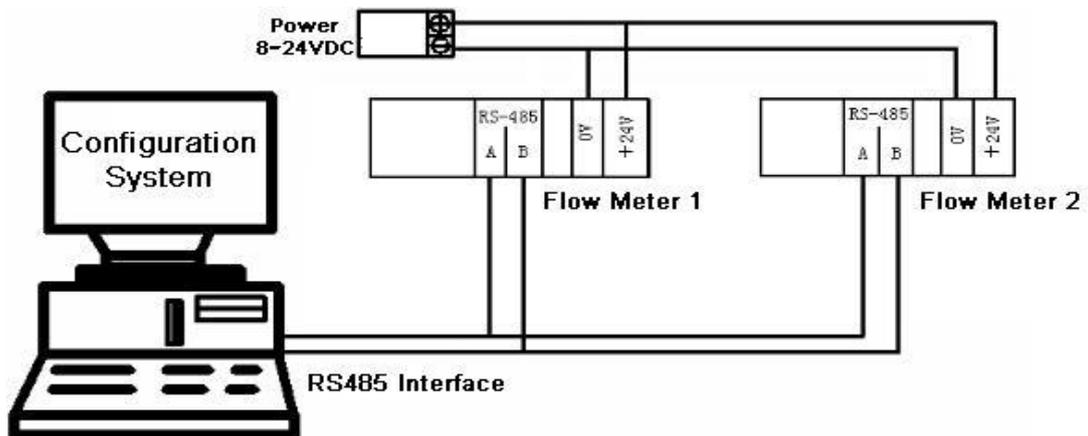
D. Three-wire Equivalent Output Wiring (Total flow)



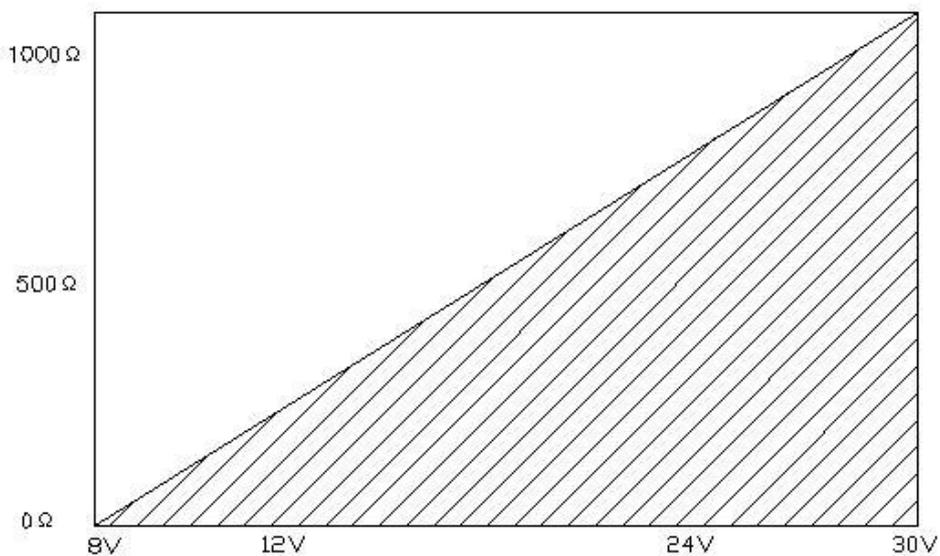
E. Alarm Output Wiring



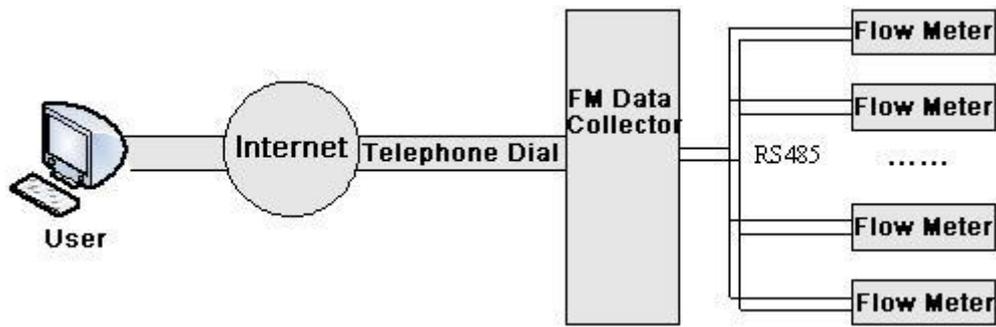
F. Communication Output Wiring



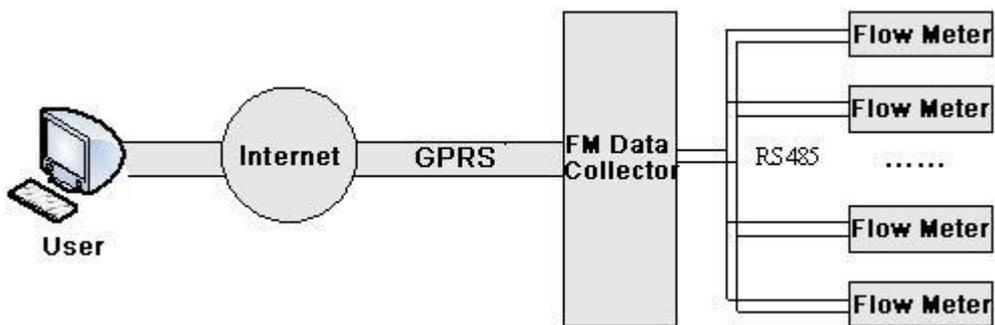
6.4 Current Output Load Characteristics



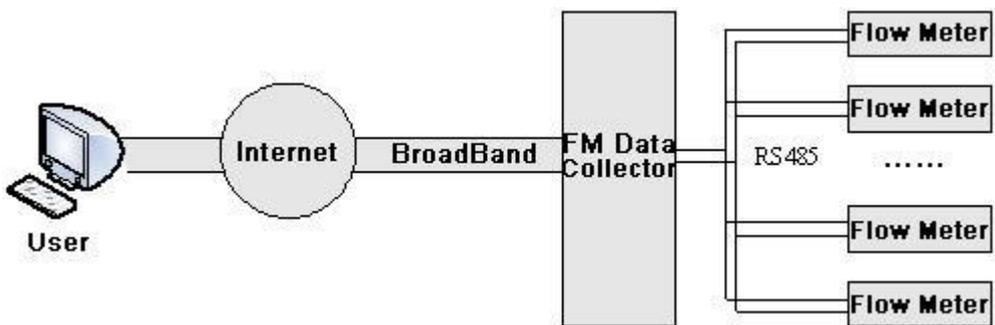
6.5 Flow Meter Networking



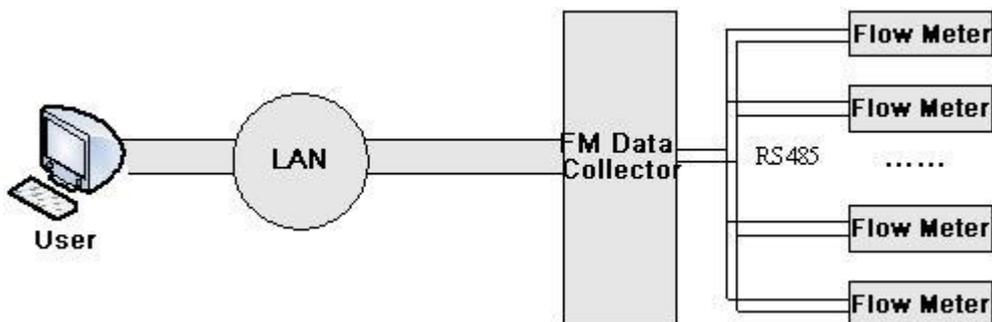
Telephone dial access transmission



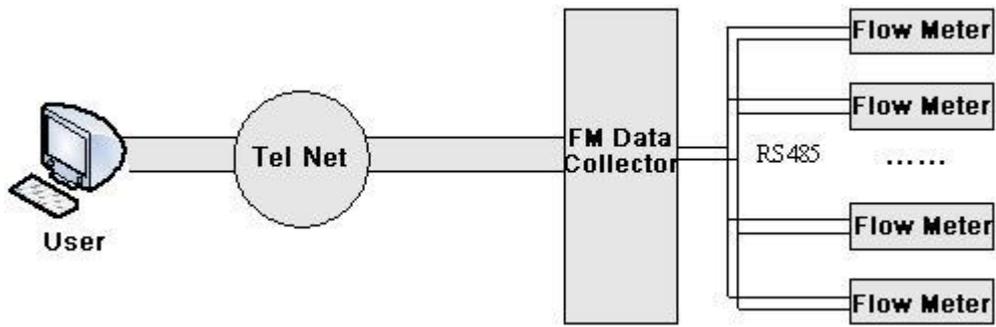
GPRS access transmission



BroadBand access transmission



LAN transmission



Telephone dial transmission

VII Troubleshooting

Fault	Cause	Solution
No output signal after power on	<ol style="list-style-type: none"> 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). 	<ol style="list-style-type: none"> 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	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 1. Make the grounding well 2. Replace the pre-amplifier. 3. Repair or replace the power supply.
Unstable display of flow rate	<ol style="list-style-type: none"> 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, and make disturbance. 	<ol style="list-style-type: none"> 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.
The displayed total flow is inconsistent as actual total flow	<ol style="list-style-type: none"> 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. 	<ol style="list-style-type: none"> 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)

VIII Package, Transportation and Storage

8.1 Flow meter should packed in firm wood carton (medium, small size flow meter can packed in paper carton with foam protection), it should avoid move in package and hand with care in transfer.

8.2 Flow meter transportation and storage conditions should conform to GB/T 9329-1999 《flow instrument transportation, storage basic environment conditions and test method》 requirements.

8.3 Flow meter storage should conform to below conditions:

8.3.1 Water-proof and moisture-proof.

8.3.2 No mechanical vibration or shock.

8.3.3 Temperature Range: 5°C~40°C

8.3.4 Relative Humidity: not bigger than 90%

8.3.5 Environment not has corrosive gas

IX Open Carton and Inspection

9.1 First check the outer package integrity before open the package, then check the products inside according to packing list, and check the documents along with goods are complete or not.

9.2 Custom clearance documents and belongings.

1) Product Verification Certificate

2) User Manual

3) Packing List

4) Manufacturer Certificate