



振安流量

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LUGB型 涡街流量计

Vortex flowmeter

上海振安流量仪表厂

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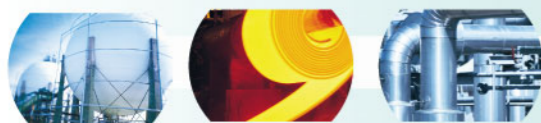
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上海振安流量仪表厂
Shanghai zhenan Flowmeter Co.,Ltd.



上海振安流量仪表厂是一家专业研究和生产流量仪表的企业，通过长时间的摸索和积累，现我公司已初步形成了从研究、开发、生产、测试、销售到售后服务的一套完整的经营体系。

现公司主要生产涡街流量计、智能电磁流量计、可编程演算仪、电脑流量积算仪等产品。我公司设计并生产了目前国际上最先进的涡街流量计、智能电磁流量计，产品一经面世即受到广大客户的欢迎及好评。

振安流量公司将继续以技术为依托，以绝对的产品质量，以及及时的售后技术支持为广大的新老客户服务。同时也将努力为我国流量仪表技术的提升作出应有贡献。

Shanghai Zhen An flow-meters plant is a professional research and production of flow instrumentation business, through a long period of exploration and accumulation, is my company has taken shape from the research, development, production, testing, sales to after-sales service of a complete set of business system.

Present the company mainly produces vortex flowmeters, intelligent electromagnetic flowmeter, programmable calculus, computer Flow Totalizer and other products. Our company designs and manufactures the most advanced of the current vortex flowmeter, intelligent electromagnetic flowmeter, the product that is available upon by the majority of customers welcome and praise.

Zhenan traffic will continue to rely on technology to the absolute product quality, as well as the immediate post-sales technical support for the majority of new and old customer service. China will also strive to enhance the flow meter technology to make their due contributions

涡街流量计工作原理

Working principle of vortex flowmeter

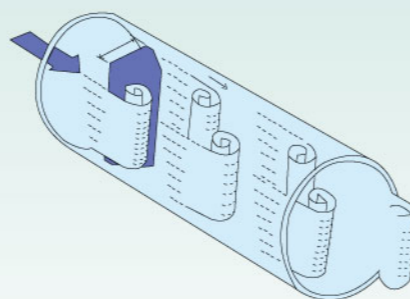
在流体中设置漩涡发生体(阻流体)，从漩涡发生体两侧交替地产生有规则的漩涡，这种漩涡称为卡曼漩涡。漩涡列在漩涡发生体下游非对称地排列。设漩涡的发生频率为f，被测介质来流的平均速度为U，漩涡发生体迎面宽度为d，表体通径为D，根据卡曼漩涡原理，有如下关系式：

To install a vortex generator (bluff body) in the fluid, which can produces regular vortex at both sides of the vortex generator alternatively. Such vortex is called Karman Vortex. Vortex trains are asymmetrically arranged at the downstream of the vortex generator. Suppose the generating frequency of the vortex is f, the average speed of the incoming flow of the tested medium is U, the head-on width of the vortex generator is d, and the diameter of the flowmeter is D, and base on the principles of Karman Vortex, the following relations will be obtained:

$$f = SrU1 / d = SrU / md$$

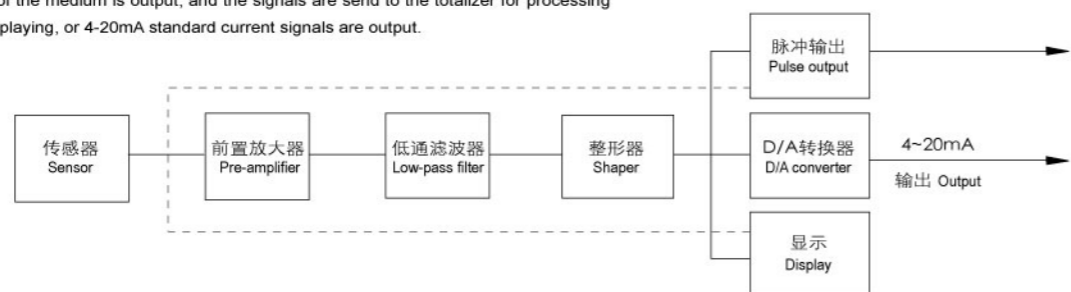
由于漩涡分离在柱体两侧产生压力脉动，探头体产生交变应力，埋在探头体内的压电晶体元件受交变应力作用而产生交变电荷。检测放大器将交变电荷进行变换处理后，输出频率与介质流速成正比脉冲信号，送至积算仪进行处理和显示或输出 4~20mA 标准电流信号。

As the vortex is separated and distributed at the both sides of the column, which generates pressure pulsation, and the probe body generates alternating stress, piezoelectric crystal elements in the probe body generate alternating electric charge under the effect of alternating stress. After the detector amplifier transforms the alternating electric charge, the pulse signals with frequency proportional to the flow speed of the medium is output, and the signals are send to the totalizer for processing and displaying, or 4-20mA standard current signals are output.



注：U1--漩涡发生体两侧平均流速，m/s；
Sr--斯特劳哈尔数；
m--漩涡发生体两侧弓形面积与管道横截面面积之比

Note: U1--average flow velocity at both sides of the vortex generator, m/s;
Sr - Strouhal number
m - ratio of the arch form areas at both sides of the vortex to the cross-section area of the pipelines



(a)转换器原理框图 Functional block diagram of the converter

流量每一处

精确每一度

It can measure the flow at every position at high precision.



LUGB型涡街流量计

vortex flowmeter



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工作特点 Working features

- 检测元件不接触被测介质，因此性能稳定，可靠性高。
- 没有可动部件，构造简单而牢固，长期运行可靠，使用寿命长。
- 测量范围广，量程可达 10:1。
- 准确度等级高。
- 输出脉冲信号或电流信号便于同计算机等数字系统配套使用。
- 安装、维护方便。
- Detecting elements don't touch the tested medium; so it has stable performance with high reliability.
- It is not equipped with movable parts, with simple and firm structure, reliable long-term operation and long service life.
- Wide measuring range, the measurement range can reach 10:1;
- High accuracy class;
- It can output pulse signals and current signals, which makes it easy to use together with computer and other digital system.
- Easy to be installed and maintained.



主要技术参数 Major technical parameters

- **测量介质**
Tested medium
蒸汽（饱和蒸汽和过热蒸汽）、空气、一般气体和液体。
Steam (saturated steam and superheated steam), air, common gas and liquid
- **测量可能范围**
Possible measuring range
雷诺数为 8000~7000000。
Reynolds number: 8000 to 7000000.
- **正常工作范围**
Normal working range
雷诺数为 20000~7000000。
Reynolds number: 20000 to 7000000.
- **准确度等级**
Accuracy class
液体(Liquid): ±1.0%; 气体(Gas): ±1.5%; 蒸汽(steam): ±1.5%。
- **重复性**
Repeatability
液体(Liquid): 0.3%; 气体(Gas): 0.5%; 蒸汽(steam): 0.5%。
- **输出信号**
Output signals
二线制 4~20mA 标准电流信号
三线制电压脉冲
Two-wire system 4-20mA standard current signals
Three-wire system voltage pulse
- **工作电源**
Working power supply
+12VDC、+24VDC、锂电池(Li-ion Battery)3.6V 14Ah
- **介质温度**
Medium temperature
普通型 -40~250℃; 高温型 -40~350℃。(需定做)
Common type: -40~250℃; high-temperature type: -40~350℃ (customized)
- **工作压力**
Working pressure
0~2.5 Mpa。(大于2.5MPa, 按订货要求生产)
0~2.5 Mpa. (if the pressure is higher than 2.5MPa, we will produce the instrument against the order)
- **压力损失**
Pressure loss
 $\Delta P=1.1rxV^2$ (式中 ΔP : 压力损失Pa; V: 流速 m/s; r: 流体重度 kgf/m)。
 $P=1.1rxV^2$ (where ΔP : pressure loss Pa; V: flow velocity m/s; r: fluid gravity kgf/m).
- **传感器材质**
Material of sensor
碳钢: 不锈钢
Carbon steel: stainless steel
- **防护等级**
Protection class
IP65
- **管道口径**
Caliber of pipeline
25~300mm (中间任意口径)
25~300mm (any caliber in the middle)
- **防爆等级**
Anti-Explosion Class
EXible T1-T5
- **电路放大器环境条件**
Ambient condition of circuit amplifier
温度(Temperature): -40~+55℃; 湿度(Humidity): ≤85%RH。

目录 Contents

01 关于技术服务和那些应该引起特别注意	01 Technical service and matters that need special attention
01 如何正确使用仪表	01 How to use the instrument in correct way
02 型号说明	02 Model description
03 流量计的正确选型	03 Correct selection of flowmeter
04 测量过热蒸汽和液体的选型	04 Selection of the instrument for measuring overheated steam and liquid
04 测量气体体积的选型	04 Selection of the instrument for measuring gas volume
05 流量计的外形尺寸	05 Overall dimension of the flowmeter
05 流量计的安装尺寸	05 Installing dimension of the flowmeter
06 安装使用注意事项	06 Precautions for safe operation
06 流量计和显示仪运行前的准备工作	06 Preparation before the operation of flowmeter and display instrument
07 如何正确选择测压力点和测温度点	07 How to choose the points where the pressure and the temperature are measured in correct way
07 就地显示型和二线制4-20mA输出的接线图	07 Wiring diagram of on-site display type instrument and the instrument with two-wire system 4-20mA output
09 就地显示	09 On-site display
11 计算公式	11 Computing formula
11 流量计与智能流量积算仪的接线图	11 Wiring diagram of the flowmeter and the smart flow totalizer
12 流量计带压力温度补偿和智能流量积算仪的接线图	12 Wiring diagram of the flowmeter with pressure and temperature compensation and the smart flow totalizer
14 附录: 常用公式	14 Annex: formulas in common use
15 附表一: 饱和水蒸汽密度及铂电阻-温度对照表	15 Schedule I: Comparison Table of Saturated Steam Density and Pt-Resistance Temperature
16 附表二: 过热蒸汽密度表	16 Schedule II: Table of Overheated Steam Density
17 智能流量积算仪系列仪表简介	24 参数设定表
18 显示功能	25 附录: 常用公式
23 模式设定表	26 仪表准确度检定



关于技术服务和那些应该引起特别注意的

Technical service and matters that need special attention

- 对符合所规定条件的用户上门调试。
- 交付时必须仔细考虑仪表安装的位置。
- 对于指定操作、设置、保养的人员必须阅读全部或相关部分并且理解。特别指出，操作要求一定要符合仪表规定，如果不符合，我们不承担任何责任。
- 技术资料必须安放在档案室里，让使用仪表的人方便查到。如果丢失，从我们或其他任何代理商处索取。
- 在正常使用情况下，保证每一产品无质量问题。保修期一年，始于发货之日。零部件及产品修理和维护的保修期为一年。
- 此保修不适用于因错误选型、错误使用、改装、疏忽、事故或非正常条件下操作和处理而导致损坏之产品。
- 请用户在使用仪表时至少每天定时记录数据，并与相关单位或个人达成仪表出现故障或维修时处理数据的协议，我厂不承担由此造成的任何损失。
- 流量计一经安装使用，即代表您接纳以上条款。
- On-site debugging for users meeting the requirements.
- The installing position of instrument shall be carefully considered when the instrument is delivered.
- The specified operation, setting and maintenance personnel must read and fully understand all or relevant parts of the instructions. It shall be specially pointed out that the operation must be in compliance with the stipulations concerning the instrument; otherwise, we do not assume any responsibilities.
- Technical materials must be put in the file room for reference, and they are available from us or other agencies if lost.
- Under normal operation, we guarantee that every product is free from quality problems. We provide one year warranty for the product from the delivery date, and one-year repair and maintenance warranty for the parts and the product.
- The warranty is not applicable for the damage of the products caused by wrong selection of model, wrong operation, refitting, negligence, accident or the operation and treatment under normal conditions.
- The users shall record the data at least at daily basis when using the instrument, and enter into the agreement with the relevant units and individuals upon the data processing when the instrument goes out of order.
- Installing and using the flowmeter shall be deemed as you accept the above terms.

如何正确使用仪表

How to use the instrument in correctly

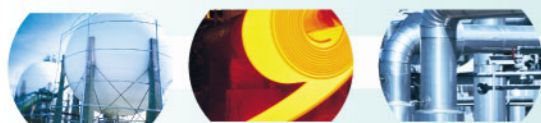
- 流量计是有一定使用范围的，请在安装前确认所购的流量计是否符合您的工作状况(流量、压力、温度)。
- 打开包装后，请尽快安装，以免影响放大器性能和金属部件受到腐蚀等；在储存已经使用过的流量计时，必将流量计完全清洗。
- 流量计避免安装在温度变化很大的场所和受到设备的热辐射，若必须安装时，须有隔热通风的措施。
- 流量计的安装点应避免受到机械振动和碰撞冲击，若流量计安装在振动较大的管道时，须在安装流量计旁边将管道固定。
- 安装流量计的管道要符合本手册规定的前后直管段，否则会影响流量计的测量精度，严重时损坏流量计。
- 安装流量计时，在电焊法兰或管道过程中，流量计须不在管道上，以免损坏流量计的电子放大电路。
- The flowmeter has a certain use range; please make sure the purchased flowmeter meets your working conditions (flow, pressure and temperature) before installation.
- Please install the instrument as soon as possible after unpacking the box so as to avoid impair the property of amplifier and prevent the metal parts from being corroded; used flowmeter must be cleaned thoroughly before storing it.
- Prevent the flowmeter from being installed in the place with great temperature changes or radiation of equipments. If the flowmeter must be installed in the above mentioned places, heat insulation and ventilation shall be ensured.
- The installation place shall be protected against mechanical vibration, collision and impact. If the flowmeter is installed in the pipeline with strong vibration, the pipeline beside the flowmeter shall be fixed.
- The pipeline where the flowmeter is to be installed shall be the front and back straight pipe sections as specified in the Manual, otherwise, it will affect the measuring accuracy of the flowmeter, or even damage the flowmeter.
- While welding flange or pipeline for installing the flowmeter, the flowmeter shall not be placed on the pipeline, so as to avoid damaging the electronic amplifying circuit.

- 每次打开阀门时，要非常缓慢地，打开时间不小于 2min。
- 流量计可以安装在水平或垂直管道上，若安装在垂直管道上，被测介质是液体时须自下往上流动。
- 流量计避免安装在阀门出口较近处，否则阀门的开关会影响流量计寿命，严重时损坏流量计。为方便维修，应安装旁通管道，特别是某些生产过程不能中间停止流体的场合。
- 流量计最好安装在室内，必须安装在室外时，须有防潮和防晒措施。
- 用户必须遵循本使用手册的指令和警告，以保证仪表的正确和安全使用。
- Please open the valves very slowly, and the time to open the valves shall be not less than 2min.
- The flowmeter can be installed on horizontal or vertical pipelines. If it is installed on vertical pipelines and the tested medium is liquid, the liquid shall flow upwardly.
- The flowmeter shall be prevented from being installed near the outlet of valve, otherwise, the opening and closing of the valve will shorten the service life of the flowmeter and even damage the flowmeter. To facilitate the maintenance, bypass line is necessary, especially in the place where the fluid shall not be stopped in the process of production.
- It is preferred that the flowmeter be installed indoors. If it must be installed outdoors, moisture proof and sun proof measures shall be taken.
- Users must obey the instructions and warnings specified in the Manual so as to ensure the correct and safe operation.

型号说明

Model Description

涡街流量计系列 Vortex Flowmeter Series	
代号(Code)	测量介质 Measured medium
-1	气体 Gas
-2	液体 Liquid
-3	蒸汽 Steam
代号(Code)	流量计公称通径 Nominal Diameter of flowmeter
-025	DN25
-032	DN32
-040	DN40
-050	DN50
-065	DN65
-080	DN80
-100	DN100
-125	DN125
-150	DN150
-200	DN200
-250	DN250
-300	DN300
代号(Code)	表体材料 Surface Material
C	碳钢 Carbon steel
F	不锈钢 Stainless steel
代号(Code)	带就地显示表头 With on-site display head
X	智能液晶显示屏 Smart liquid crystal screen
代号(Code)	供电电源 Power source
W	+12V +24V
N	3.6V 电池供电 3.6V Battery feed
代号(Code)	输出信号 Output signals
I	频率输出 Frequency Output
II	二线制4-20mA输出 Two-wire system 4-20mA output



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流量计的正确选型

Correct selection of flowmeter

- 流量计的口径选型很重要, 要遵循一些原则进行选择。口径选择步骤如下: 被测介质的最大流量、常用流量、最小流量; 最高压力、常用压力、最小压力; 最高温度、常用温度、最小温度; 流量测量范围是否处于仪表的最佳工作范围(即上限流量的 $1/2 \sim 2/3$ 处)。见表:
- Caliber selection of the flowmeter is quite important, and some principles shall be followed. The selection procedures of the caliber are as follows: whether the max. flow, common flow and min. flow of the measured medium; max. pressure, common pressure and min. pressure; max. temperature, common temperature and min. temperature; and whether the measuring range of the flow are within the optimal working range of the instrument (i.e. 1/2 to 2/3 of the upper flow limit). See Table:

测量饱和蒸汽质量流量的选型及流量测量范围

Selection of the Instrument for Measuring the Quality and Flow of Saturated Steam and the Flow Measurement Range

单位 (unit): T/h

内径(mm) Inside diameter	0.2MPa	0.3MPa	0.4MPa	0.5MPa	0.6MPa	0.7MPa	0.8MPa
25	11~115kg/h	15~150kg/h	18~185kg/h	22~220kg/h	25~255kg/h	28~290kg/h	30~320kg/h
32	19~190kg/h	24~245kg/h	30~300kg/h	36~360kg/h	41~415kg/h	47~470kg/h	49~530kg/h
40	29~295kg/h	38~385kg/h	47~475kg/h	56~560kg/h	65~650kg/h	73~740kg/h	77~830kg/h
50	46~460kg/h	60~600kg/h	74~740kg/h	0.80~0.800	0.100~1.020	0.110~1.160	0.120~1.290
65	0.700~0.775	0.100~1.010	0.125~1.250	0.140~1.480	0.170~1.720	0.190~1.950	0.200~2.180
80	0.110~1.170	0.150~1.550	0.190~1.895	0.220~2.200	0.260~2.600	0.290~2.960	0.310~3.300
100	0.186~1.850	0.228~2.400	0.264~2.960	0.300~3.500	0.400~4.100	0.460~4.620	0.480~5.160
125	0.280~2.860	0.370~3.750	0.460~4.650	0.530~5.470	0.630~6.360	0.710~7.220	0.750~8.060
150	0.400~4.120	0.538~5.400	0.619~6.660	0.700~7.880	0.900~9.160	1.020~10.10	1.080~11.60
200	0.700~7.130	0.910~9.600	1.160~11.80	1.400~14.00	1.160~16.30	1.820~18.50	1.920~20.60
250	1.100~11.40	1.500~15.00	1.700~18.50	2.000~21.90	2.470~25.40	2.840~28.90	3.010~32.30
300	2.110~16.50	2.150~21.60	2.580~26.60	3.000~31.50	3.640~36.60	4.100~56.60	4.330~46.60
350	3.510~22.40	2.520~29.40	3.460~36.30	4.200~42.90	5.000~50.00	5.570~58.40	5.900~63.20
400	4.580~29.30	5.250~38.40	5.830~47.40	6.400~56.00	6.830~65.10	7.280~74.00	7.700~82.60
450	5.800~37.10	6.640~48.60	7.370~60.00	8.100~70.90	8.650~82.40	9.210~93.60	9.740~104.5
500	7.160~45.80	8.200~60.00	9.100~74.00	10.00~87.50	10.70~101.8	11.40~115.5	12.00~129.0

内径(mm) Inside diameter	0.9MPa	1.0MPa	1.1MPa	1.2MPa	1.3MPa	1.4MPa	1.5MPa
25	32~360kg/h	33~390kg/h	34~425kg/h	36~460kg/h	37~490kg/h	38~530kg/h	40~560kg/h
32	52~585kg/h	54~640kg/h	56~700kg/h	59~750kg/h	61~810kg/h	63~860kg/h	65~920kg/h
40	81~910kg/h	85~1000kg/h	88~1090kg/h	92~1,170kg/h	95~1260kg/h	98~1350kg/h	0.100~1.430
50	0.130~1.430	0.130~1.560	0.140~1.700	0.140~1.840	0.150~1.970	0.150~2.110	0.160~2.240
65	0.210~2.410	0.220~2.640	0.230~2.870	0.240~3.100	0.250~3.560	0.260~3.950	0.270~4.180
80	0.320~3.650	0.340~4.000	0.350~4.350	0.370~4.700	0.380~5.040	0.390~5.390	0.410~5.730
100	0.510~5.710	0.530~6.250	0.550~6.800	0.570~7.340	0.590~7.880	0.610~8.420	0.630~8.960
125	0.790~8.920	0.830~9.770	0.860~10.60	0.900~11.50	0.930~12.30	0.960~13.20	0.990~14.00
150	1.140~12.80	1.190~14.10	1.240~15.30	1.290~16.50	1.340~17.70	1.380~18.90	1.430~20.20
200	2.020~22.80	2.120~25.00	2.200~27.20	2.290~29.40	2.380~31.50	2.460~33.70	2.540~35.80
250	3.160~35.70	3.310~39.10	3.440~42.50	3.580~45.90	3.710~49.30	3.840~52.60	3.960~56.00
300	4.550~51.40	4.770~56.30	4.950~61.20	5.160~66.10	5.350~70.90	5.530~75.80	5.710~80.60
350	6.200~70.00	6.490~76.60	6.740~83.30	7.020~89.90	7.280~96.50	7.520~103.1	7.770~109.8
400	8.100~91.40	8.480~100.00	8.800~108.8	9.170~117.4	9.500~126.1	9.820~134.7	10.10~143.4
450	10.20~115.60	10.70~126.6	11.10~137.7	11.60~148.6	12.00~159.6	12.40~170.5	13.80~181.4
500	12.70~142.8	13.30~156.3	13.80~170.0	14.30~183.50	14.90~197.0	15.40~210.5	15.90~224.0

注: 根据上述原则选择的口径不一定与管道口径一致, 如不同时连接异形管, 再配置一段必要的直管段长度。

Note: The caliber selected according to the above principles is not certainly the same as the diameter of the pipelines. If they are different, special pipes and a section of straight pipe with certain length are necessary.

测量过热蒸汽和液体的选型

Selection of the instrument for measuring overheated steam and liquid

内径(mm) Inside diameter	测量过热蒸汽质量的流量范围(t/h) Flow measurement range of the instrument for measuring overheated steam quality	测量液体体积的流量范围(m³/h) Flow measurement range of the instrument for measuring liquid volume
25	14.063 ρ kg/h~70.684 ρ kg/h	0.9~12m³/h
32	23.043 ρ kg/h~115.80 ρ kg/h	1.5~20m³/h
40	36.005 ρ kg/h~180.94 ρ kg/h	2.5~30m³/h
50	56.257 ρ kg/h~282.73 ρ kg/h	3.5~50m³/h
65	95.075 ρ kg/h~477.81 ρ kg/h	6~80m³/h
80	114.02 ρ kg/h~723.77 ρ kg/h	10~126m³/h
100	225.03 ρ kg/h~1.1309 ρ t/h	15~200m³/h
125	351.61 ρ kg/h~1.7670 ρ t/h	28~310m³/h
150	506.31 ρ kg/h~2.5445 ρ t/h	40~445m³/h
200	900.12 ρ kg/h~4.5236 ρ t/h	75~790m³/h
250	1.4064 ρ t/h~7.0681 ρ t/h	100~1237m³/h
300	2.0253 ρ t/h~10.178 ρ t/h	200~1780m³/h
350	2.7566 ρ t/h~13.854 ρ t/h	270~2430m³/h
400	3.6005 ρ t/h~18.0944 ρ t/h	360~3170m³/h
450	4.5568 ρ t/h~22.901 ρ t/h	450~4100m³/h
500	5.6257 ρ t/h~28.273 ρ t/h	560~4950m³/h

ρ 为工作状态下的过热蒸汽密度 kg/m³
参见附录里面<过热蒸汽密度表>
 ρ is the overheated steam density (kg/m³) under working mode
Refer to Schedule of Overheated Steam Density in Annex

液体: 常温常压下的密度=1000kg/m³
Liquid: density under normal temperature and pressure =1000kg/m³

测量气体体积的选型

Selection of the instrument for measuring gas volume

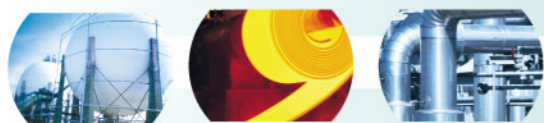
内径(mm) Inside diameter	测量气体(标准状态)体积的流量范围(Nm³/min) Flow range (Nm³/min) of the instrument for measuring gas volume (under normal state)	测量气体(标准状态)体积的流量范围(m³/h) Flow range (Nm³/min) of the instrument for measuring gas volume (under normal state)
25	0.2344k ρ ~1.470k	7~88m³/h
32	0.3841k ρ ~2.41k	10~145m³/h
40	0.6001k ρ ~3.770k	16~220m³/h
50	0.9376k ρ ~5.890k	25~353m³/h
65	1.5846k ρ ~9.950k	42~600m³/h
80	2.4003k ρ ~15.10k	63~900m³/h
100	3.7505k ρ ~23.60k	100~1400m³/h
125	5.8602k ρ ~36.80k	155~2200m³/h
150	8.4385k ρ ~53.00k	222~2800m³/h
200	15.002k ρ ~94.20k	400~5100m³/h
250	23.440k ρ ~147.3k	700~7950m³/h
300	33.755k ρ ~212.0k	1000~10100m³/h
350	45.943k ρ ~288.6k	1700~15000m³/h
400	60.008k ρ ~377k	2260~18000m³/h
450	75.947k ρ ~477.1k	2860~22900m³/h
500	93.762k ρ ~589.0k	3540~28200m³/h

ρ 为工作状态下的气体密度 kg/m³
 ρ is the gas density kg/m³ under operating state
式中: P 为工作压力(表压) MPa; t 为介质工作温度 °C
Where: P is working pressure (gauge pressure) MPa;
t is the working temperature (°C) of the medium

气体: 常温常压空气, t=20°C, $\rho=0.1205$ kg/m³, v=15 $\times 10^{-4}$ m³/s
Gas: gas under normal temperature and pressure, t=20°C, $\rho=0.1205$ kg/m³ (absolute)
P=1.205kg/m³, v=15 $\times 10^{-4}$ m³/s

注: 根据上述原则选择的口径不一定与管道口径一致, 如不同时连接异形管, 再配置一段必要的直管段长度。

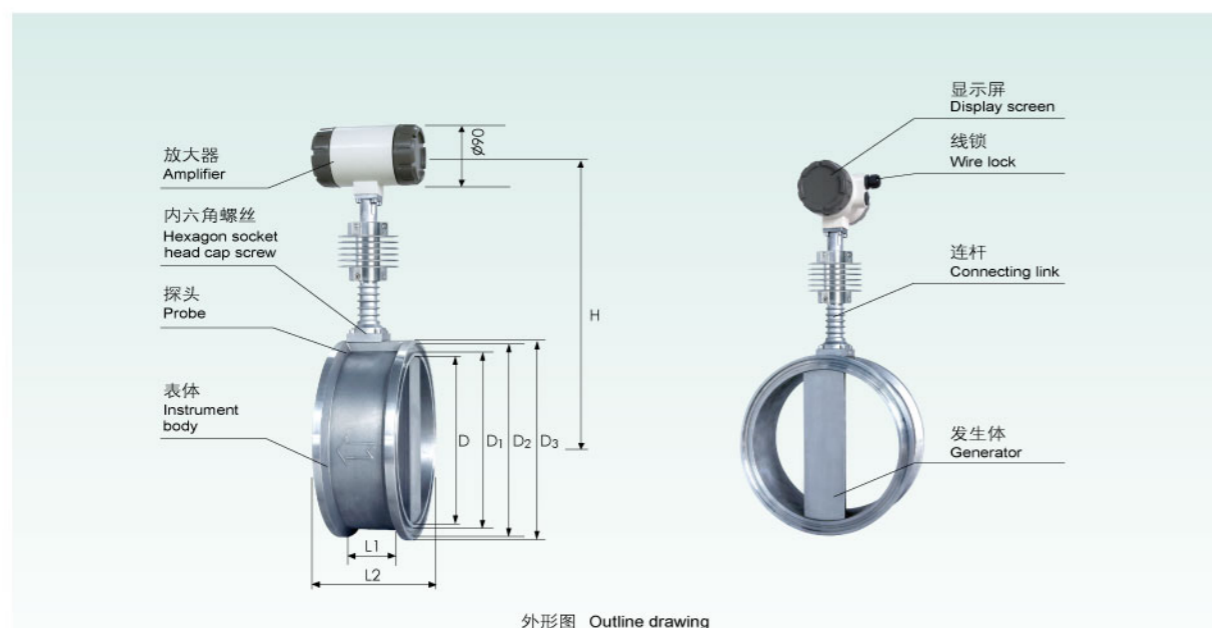
Note: The caliber selected according to the above principles is not certainly the same as the diameter of the pipelines. If they are different, special pipes and a section of straight pipe with certain length are necessary.



流量计的外形尺寸

Overall dimension of the flowmeter

- 流量计外形尺寸如下图所示
Overall dimension of the flowmeter is shown as the following figure



外形图 Outline drawing

流量计的安装尺寸

Installing dimension of the flowmeter

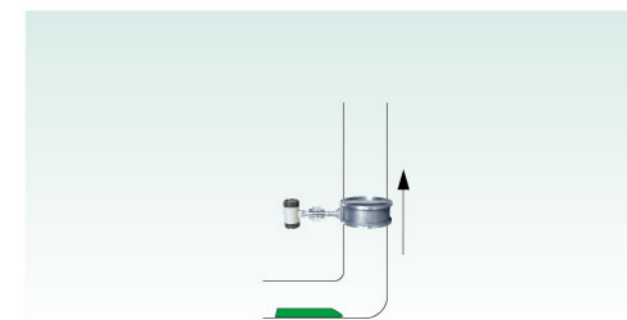
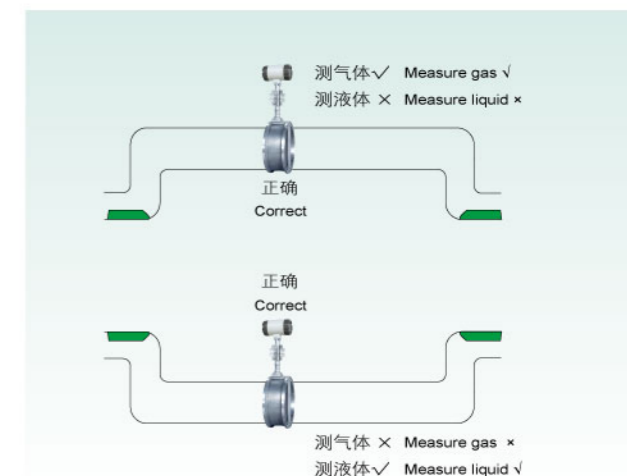
单位 (unit): mm

流量计 Flowmeter	D	D1	D2	D3	L1	L2	H
DN25	25	40	54	88	56	56	365
DN32	32	40	54	88	56	56	368
DN40	40	54	70	88	56	56	372
DN50	50	64	80	98	56	66	377
DN65	65	79	95	113	56	66	385
DN80	80	92	116	128	56	70	392
DN100	100	112	136	148	56	70	402
DN125	125	137	161	173	52	80	415
DN150	150	162	186	198	60	88	427
DN200	200	212	236	248	60	98	452
DN250	250	262	286	298	79	114	477
DN300	300	312	336	348	95	130	502

安装使用注意事项

Precautions for installation and operation

- 流量计在水平管道上的安装**
Installation of flowmeter on horizontal pipelines
 - 在水平管道上安装是流量计最常用的安装方式。
Installation of flowmeter on horizontal pipelines is the most common installation mode.
 - 测量气体流量时,若被测气体中含有少量的液体,流量计应安装在管线的较高处。
When the flowmeter is used to measure gas flow, if there is small amount of liquid in the gas, the flowmeter shall be installed at the higher position of the pipeline.
 - 测量液体流量时,若被测液体中含有少量的气体,流量计应安装在管线的较低处。
When the flowmeter is used to measure liquid flow, if there is small amount of gas in the liquid, the flowmeter shall be installed at the lower position of the pipeline.
- 流量计在垂直管道的安装**
Installation of flowmeter on vertical pipelines
 - 测量气体流量时,流量计可以安装在垂直管道上,流向不限。
When the flowmeter is used to measure gas flow, the flowmeter can be installed on the vertical pipeline and the flow direction is not limited.
 - 若被测气体中含有少量的液体,气体流向应由下向上。
If there is small amount of liquid in the measured gas, the gas shall flow upwardly from the lower position.
 - 测量液体流量时,液体流向应由下向上。
When the flowmeter is used to measure liquid flow, the liquid shall flow upwardly from the lower position.



流量计和显示仪运行前的准备工作

Preparation before the operation of flowmeter and display meter

- 仔细检查流量计的安装,接线等是否正确无误;
- 接通显示仪电源,观察显示仪是否有流量显示;
- 缓慢打开阀门,到一个较小压力时停止,观察传感器周围是否有泄漏现象,并观察显示仪是否有流量显示;
- 若情况正常,开大阀门,稳定一段时间后,观察仪表显示的流量是否正常。
- Check the installation of the flowmeter carefully, and whether the wiring etc. is done in correct way;
- Connect with the power supply of the display meter, and observe whether there is flow display on the display meter.
- Open the valve slowly and stop when the pressure is relatively low. Observe whether there is leakage around the sensor, and observe whether there is flow display on the display meter.
- If they are in normal condition, further open the valve, and after it is stabilized for a while, observe whether the flow displayed on the meter is normal.



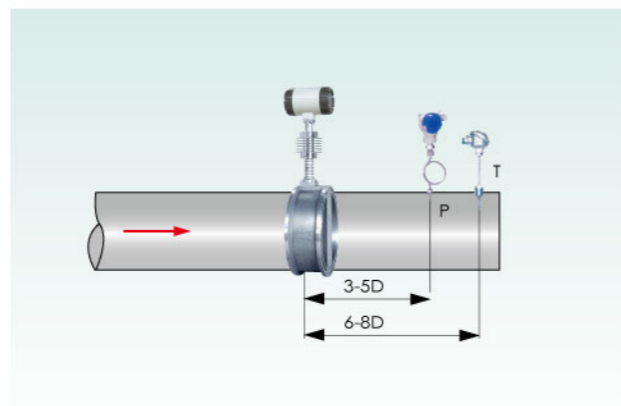
如何正确选择测压力点和测温度点

How to select the measuring points of pressure and temperature correctly

根据测量的需要须在流量计附件测量压力和温度时，
If it is required to measure pressure and temperature near the flowmeter,

- 测压力点应在流量计下游的 3-5D 处，
the pressure shall be measured at the position that is 3-5D downstream from the flowmeter,
- 测温度点应在流量计下游的 6-8D 处。
and the temperature shall be measured at the position that is 6-8D downstream from the flowmeter.

*D 为仪表工称口径
* D is the normal caliber of the instrument



一个90度弯头 A 90 degree elbow		不同平面两个90度弯头 Two 90 degree elbows on different planes	
同心扩管 Concentric expander		调节阀半开阀门 Semi-open adjusting valve	
同心收缩全开阀门 Concentric contracted clearway valve		同一平面两个90度弯头 Two 90 degree elbows on the same plane	

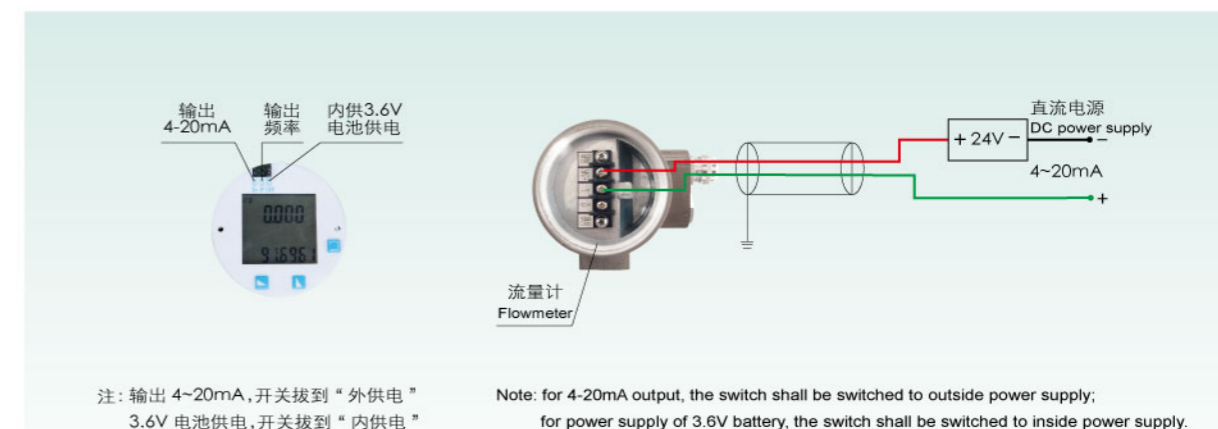
就地显示型和二线制4~20mA输出的接线图

Wiring diagram of on-site display type instrument and the instrument with two-wire system 4~20mA output

- 一般情况下，流量计与智能流量积算仪的连接线采用三芯屏蔽线 (RVVP3x0.5mm) 屏蔽层应可靠地接在放大器盒内的接地螺丝上。
- 连接线不能与电力线平行排放在一起，至少间隔在 20cm 以上，最好单独穿行在金属管子中。连接线要固定好，不能晃动。
- Generally speaking, three-core shielding wire (RVVP3x0.5mm) shall be used to connect the flowmeter and smart flow totalizer, and the shielding layer shall be connected to the earthing screw in the amplifier box reliably.
- Connecting wire and the power line shall not be put together in parallel, and the distance between them shall be at least more than 20cm. It is advisable to put them in the different metal pipes separately. The connecting wire shall be fixed firmly and shall not be shaken.

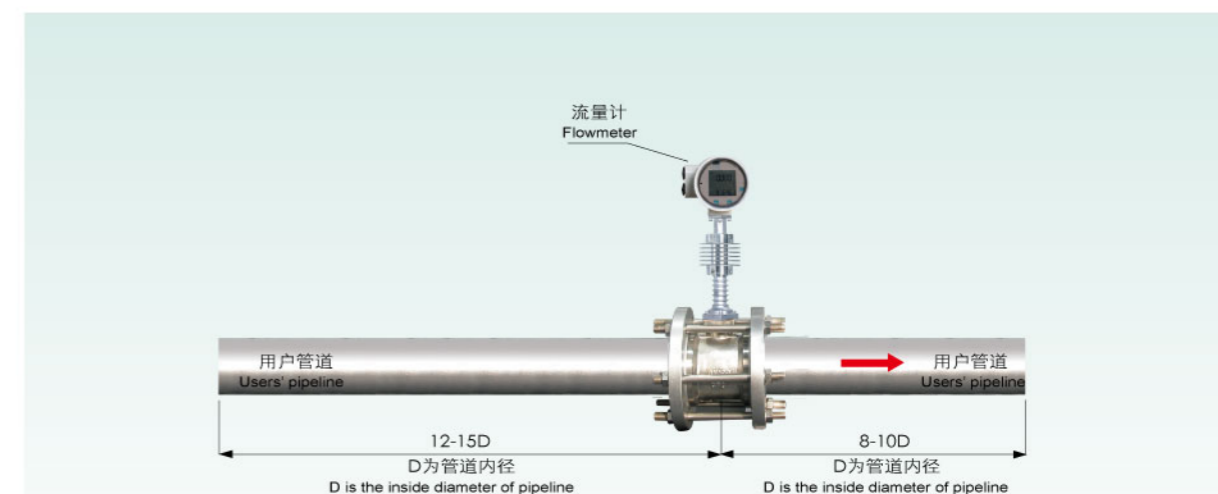
实物接线图

Pictorial Wiring Diagram



实物安装图

Pictorial Installation Diagram





就地显示

On-site display

运行状态下显示画面和按键说明

Display menu and keys instructions under normal mode



Q = 瞬时流量 (instantaneous flow rate)
累积流量 (cumulative flow)

按 (Press) 键 (key),
复位键 reset key
按 (Press) 键 (key),
循环显示瞬时流量和频率信号
Display flow and frequency signals in cycles
按 (Press) 键 (key),
进入设定状态 Enter setting mode



F = 频率信号 (frequency signals)
累积流量 (cumulative flow)

按 (Press) 键 (key),
复位键 reset key
按 (Press) 键 (key),
循环显示瞬时流量和频率信号
Display instantaneous flow and frequency signals in cycles
按 (Press) 键 (key),
进入设定状态 Enter setting state

设定状态下显示画面和按键说明

Display menu and keys instructions under setting mode



图 (Figure) 01

图 01 屏幕显示要求按 键, 进入设定状态

Figure 01 screen display: require pressing key to enter setting mode

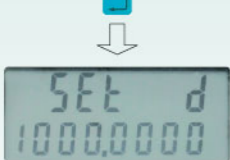


图 (Figure) 02

图 02 屏幕显示要求输入常用压力的介质密度值 (见附表)

Figure 02 screen display: require input the value of medium density under common pressure (see schedule)

按 (Press) 键 (key),
移位键 (用于移动修改数) Shift key (to move and alter number)

按 (Press) 键 (key),
数字增加键 (按下 键 0~9 循环)
Number adding key (press key 0~9 in cycles)

按 (Press) 键 (key),
已确定输入需要介质密度值并进入下项设定状态

Make sure the required value of medium density has been input and then enter next setting mode



图 (Figure) 03

图 03 屏幕显示要求输入需要下限信号切除

Figure 03 screen display: require inputting that the required lower limit signal shall be removed



图 (Figure) 04

图 04 屏幕显示要求输入流量计的仪表系数

Figure 04 screen display: require inputting the coefficient of the flowmeter

(出厂前已设定好或查看铭牌上的系数和设定的系数是否一样)
(which has been set before exiting the factory; or check whether the coefficient on the nameplate is the same as the set coefficient)

按 (Press) 键 (key),
移位键 (用于移动修改数) Shift key (used to move and alter number)

按 (Press) 键 (key),
数字增加键 (按下 键 0~9 循环)
Number adding key (Press key 0~9 in cycles)

按 (Press) 键 (key),
已确定输入需要仪表系数值并进入下项设定状态
Make sure the required value of medium density has been input and then enter next setting mode

图 (Figure) 05

图 05 屏幕显示要求输入需要输出上限 20mA 流量值

Figure 05 screen display: require inputting that it is required to output 20mA (upper limit) flow value

按 (Press) 键 (key),
移位键 (用于移动修改数) Shift key (used to move and alter number)

按 (Press) 键 (key),
数字增加键 (按下 键 0~9 循环)
Number adding key (Press key 0~9 in cycles)

按 (Press) 键 (key),
已确定输入需要输出上限 20mA 流量值并进入下项设定状态
Make sure that the 20mA (upper limit) flow value has been input and then enter setting mode of the next item

图 (Figure) 06

图 06 屏幕显示要求输入阻尼时间, 该项系数值越大, 滤波时间越长,

Figure 06 screen display: require inputting damping time. The bigger the coefficient is, the longer the filtering time is; 滤波时间越长, 瞬时流量越稳, 但显示的滞后时间越长
the longer the filtering time is, the stabler the instantaneous flow rate become, and the longer the displayed lagging time is.

按 (Press) 键 (key),
移位键 (用于移动修改数) Shift key (used to move and alter number)

按 (Press) 键 (key),
数字增加键 (按下 键 0~9 循环)
Number adding key (Press key 0~9 in cycles)

按 (Press) 键 (key),
已确定输入需要阻尼时间并进入下项设定状态
Make sure that the damping time has been input and then enter next setting mode

图 (Figure) 07

图 07 屏幕显示需要清零, 同时按 键和 键累积即可清零

Figure 07 screen display: require resetting, and press the key and the key at the same time to reset

如果不需要清零直接按 键, 已确认完成全部设置并退出设定状态

If clearing is not required, press the key directly, to make sure that all the settings have been completed, and exit the setting mode.

图 (Figure) 08

图 08 屏幕显示已经清零

Figure 08 screen display: it has been reset.

按 键已确认完成全部设置并退出设定状态

Press the key to make sure that all the settings have been completed, and exit the setting mode.



图 09 屏幕显示运行状态
Figure 09 screen display operating mode

- 按 (Press) 键 (key), 复位键 reset key
- 按 (Press) 键 (key), 循环显示瞬时流量和频率信号 Display instantaneous flow and frequency signals in cycles
- 按 (Press) 键 (key), 进入设定状态 Enter setting mode

计算公式

Computing formula

流量的计算公式

Flow-computing formula

瞬时流量

Instantaneous flow

$$L = \frac{3.6 \times \rho \times F}{1000K} \quad (\text{t/h})$$

式中(Where):

- F: 流量计的脉冲频率 pulse frequency of the flowmeter
- K: 流量计的流量系数 (1/升) flow coefficient of the flowmeter (1/liter)
- ρ : 设定的介质密度 (kg/m³) set medium density (kg/m³)

累计流量

Cumulative flow

$$\Sigma = \int (L/3600) dt \quad (\text{t})$$

式中 (Where):

- L: 瞬时流量 instantaneous flow

电流输出

Current output

$$I = \frac{L}{FS} \times 16 + 4 \quad (\text{mA})$$

式中 (Where):

- FS: 设定的流量的量程 range of the set flow

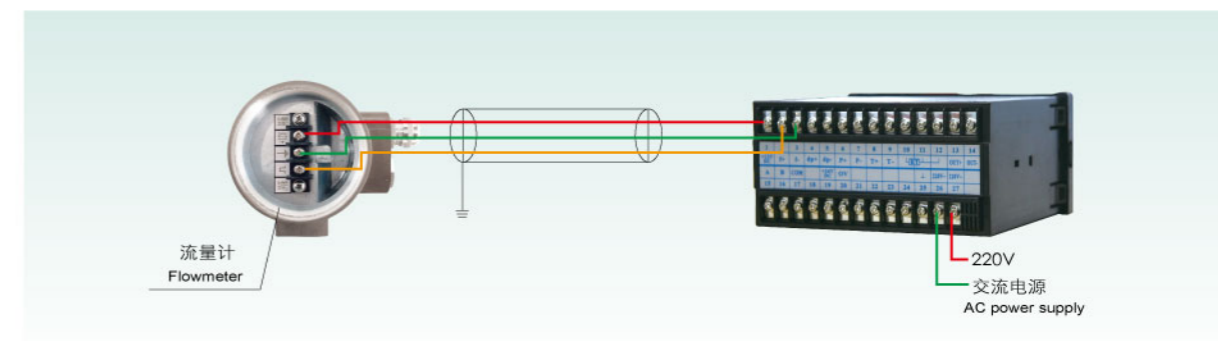
流量计与智能流量积算仪的接线图

Wiring diagram of the flowmeter and the smart flow totalizer

- 一般情况下, 流量计与智能流量积算仪的连接线采用三芯屏蔽线 (RVVP3x0.5mm) 屏蔽层应可靠地接在放大器盒内的接地螺丝上。
- 连接线不能与电力线平行排放在一起, 至少间隔在 20cm 以上, 最好单独穿行在金属管子中。连接线要固定好, 不能晃动。
- Generally speaking, three-core shielding wire (RVVP3x0.5mm) shall be used to connect the flowmeter and smart flow totalizer, and the shielding layer shall be connected to the earthing screw in the amplifier box reliably.
- Connecting wire and the power line shall not be put together in parallel, and the distance between them shall be at least more than 20cm. It is advisable to put them in the different metal pipes separately. The connecting wire shall be fixed firmly and shall not be shaken.

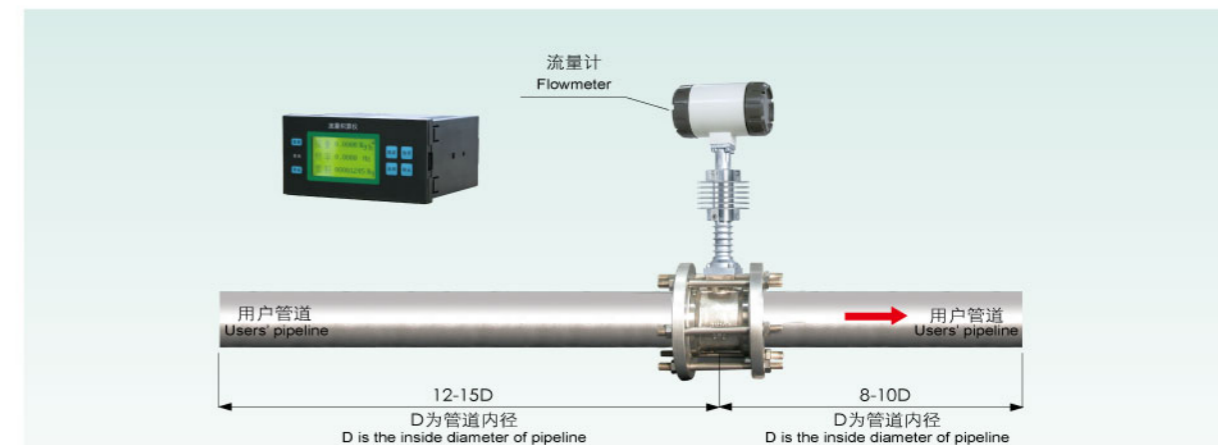
实物接线图

Pictorial Wiring Diagram



实物安装图

Pictorial Installation Diagram

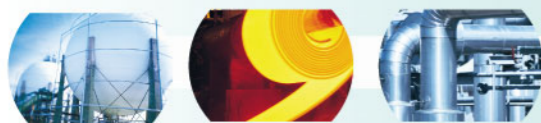


注: 出厂前放大电路板上的电源开关在 +12V 上, 如果输入电源是 +24V 电源供电请把放大电路上的开关拨到 +24V 上 (线路板上有指导)
Note: the power switch of the amplifier circuit board is at +12V before exiting the factory; if the input power supply is +24V, please switch the power switch on the amplifier circuit board to the position of +24V (see instructions on the circuit board)

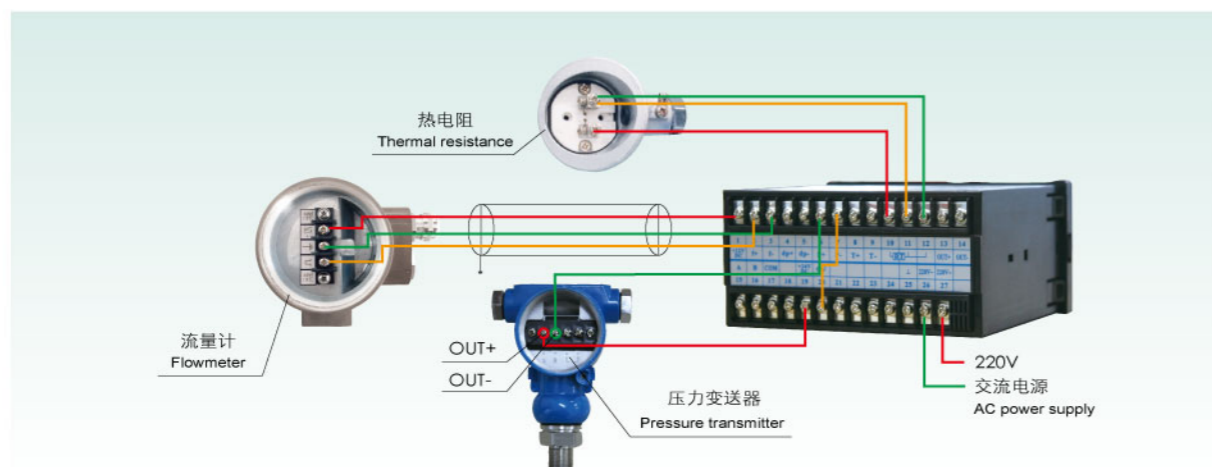
流量计带压力温度补偿和智能流量积算仪的接线图

Wiring diagram of the flowmeter with pressure and temperature compensation and the smart flow totalizer

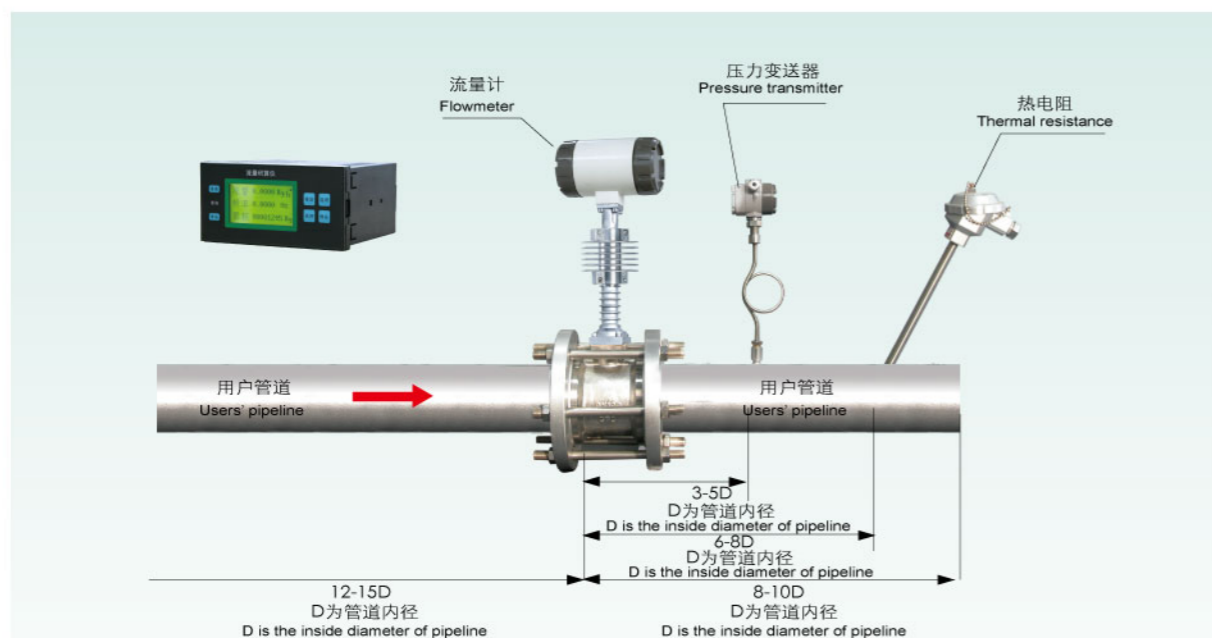
- 一般情况下, 流量计与智能流量积算仪的连接线采用三芯屏蔽线 (RVVP3x0.5mm) 屏蔽层应可靠地接在放大器盒内的接地螺丝上。
- 连接线不能与电力线平行排放在一起, 至少间隔在 20cm 以上, 最好单独穿孔机行在金属子中。连接线要固定好, 能晃动。
- Generally speaking, three-core shielding wire (RVVP3x0.5mm) shall be used to connect the flowmeter and smart flow totalizer, and the shielding layer shall be connected to the earthing screw in the amplifier box reliably.
- Connecting wire and the power line shall not be put together in parallel, and the distance between them shall be at least more than 20cm. It is advisable to put them in the different metal pipes separately. The connecting wire shall be fixed firmly and is allowed to shake.



实物接线图 Pictorial Wiring Diagram



实物安装图 Pictorial Installation Diagram



注：出厂前放大电路板上的电源开关在 +12V 上如果输入电源是 +24V 电源供电请把放大电路上的开关拨到 +24V 上（线路板上有指导）
Note: the power switch of the amplifier circuit board is at +12V before exiting the factory; if the input power supply is +24V, please switch the power switch on the amplifier circuit board to the position of +24V (see instructions on the circuit board)

附录：常用公式

Annex: formulas in common use

● 密度运算公式

Density computing formula

● 压力或温度单独补偿密度

Pressure or temperature compensates the density separately
 $\rho = A + BP$ 或 $\rho = A + BT$ $\rho = A + BP$, or $\rho = A + BT$

注：A、B为系数，通过求解二元一次方程组求得；对于饱和蒸汽，无需计算，仪表自动调用函数

Note: A and B are coefficients, and can be obtained by solving the linear equation with two variables; as for saturated steam, the instrument can invoke functions automatically without computation.

● 压力、温度同时补偿密度

Pressure and temperature compensate the density at the same time
 $\rho = (P \times 10^6 + P_{\text{大气压}}) / (Rz(T + 273.15))$ $\rho = (P \times 10^6 + P_{\text{atm}}) / (Rz(T + 273.15))$

注：p:密度(单位:kg/m³) P:压力(单位:Mpa) P大气压:本地大气压(单位:Pa) T:温度(单位:℃)

Rz值的计算可根据流体在工作温度，工作压力和工作密度已知情况下代入上式求出近似Rz值，也可通过查找流体的压缩系数和气体常数相乘后得出。

本仪表已存有过热蒸汽密度表格。

Note: p density (unit: kg/m³) P: pressure (unit: Mpa) P atmospheric pressure: local atm (unit: Pa) T: temperature (unit: °C)

Approximate value of Rz can be obtained by substituting the known working temperature, working pressure and working density of the fluid in the above formula, or by finding out and multiplying the coefficient of compression and gas constant.

Table of overheated steam density has been stored in the instrument.

● 流量运算公式

Flow computing formula

差压式流量计: $F = K(dp \times \rho)^{1/2}$

K-流量系数 dp-孔板差压 p-介质密度

涡街式流量计: $F = 3.6 \times \rho \times f \div K$

K-流量系数 f-涡街频率 p-介质密度

电磁式流量计(比例): $F = K \times \rho \times dp$

K-流量系数 dp-比例信号 p-介质密度

涡轮式流量计: $F = K \times \rho \times N$

K-脉冲当量数 P-介质密度 N-脉冲数

Differential pressure flowmeter: $F = K(dp \times \rho)^{1/2}$

K- flow coefficient dp- differential pressure of orifice plate p- medium density

Vortex flowmeter: $F = 3.6 \times \rho \times f \div K$

K- flow coefficient f- frequency of vortex p- medium density

Electromagnetic flowmeter (proportion): $F = K \times \rho \times dp$

K- flow coefficient dp- proportional signals p- medium density

Turbine meter: $F = K \times \rho \times N$

K- Equivalent amount of pulse P- medium density N- pulse number

● 标度转换公式

Dial conversion formula

差压 $dp = (dp_{\text{上}} - dp_{\text{下}}) \times X + dp_{\text{下}}$

X: 0~1 (对应0~10mA或4~20mA等)

压力 $P = (P_{\text{上}} - P_{\text{下}}) \times X + P_{\text{下}}$

X: 0~1 (对应0~10mA或4~20mA等)

温度 $T = (T_{\text{上}} - T_{\text{下}}) \times X + T_{\text{下}}$

X: 0~1 (对应0~10mA或4~20mA等)

Differential pressure $dp = (dp_{\text{upper}} - dp_{\text{lower}}) \times X + dp_{\text{lower}}$

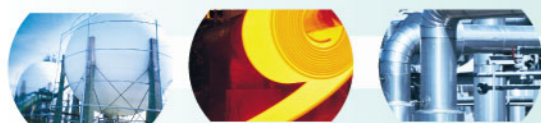
X: 0-1 (corresponding to 0-10mA or 4-20mA etc.)

Pressure $P = (P_{\text{upper}} - P_{\text{lower}}) \times X + P_{\text{lower}}$

X: 0-1 (corresponding to 0-10mA or 4-20mA etc.)

Temperature $T = (T_{\text{upper}} - T_{\text{lower}}) \times X + T_{\text{lower}}$

X: 0-1 (correspond to 0~10mA or 4~20mA etc.)



附表一

Schedule 1

饱和水蒸汽密度及铂电阻-温度对照表

Schedule I: Comparison between Saturated Steam Density and Pt-Resistance Temperature

温度℃ Temperature	压力MPa Pressure	密度kg/m ³ Density	铂电阻Ω Pt-ResistanceΩ	温度℃ Temperature	压力MPa Pressure	密度kg/m ³ Density	铂电阻Ω Pt-ResistanceΩ	温度℃ Temperature	压力MPa Pressure	密度kg/m ³ Density	铂电阻Ω Pt-ResistanceΩ
100	0.1013	0.5997	138.50	140	0.3614	1.967	153.58	180	1.002	15.160	168.46
101	0.1050	0.6108	138.88	141	0.3717	2.019	153.95	181	1.025	5.274	168.83
102	0.1087	0.6388	139.26	142	0.3823	2.073	154.32	182	1.049	5.391	169.20
103	0.1126	0.6601	139.64	143	0.3931	2.129	154.70	183	1.073	5.509	169.57
104	0.1166	0.6821	140.02	144	0.4042	2.185	155.07	184	1.098	5.629	169.94
105	0.1208	0.7046	140.39	145	0.4155	2.242	155.45	185	1.123	5.752	170.31
106	0.1250	0.7277	140.77	146	0.4271	2.301	155.82	186	1.148	5.877	170.68
107	0.1294	0.7515	141.15	147	0.4398	2.361	156.19	187	1.174	6.003	171.05
108	0.1339	0.7758	141.53	148	0.4510	2.422	156.57	188	1.201	6.132	171.42
109	0.1385	0.8008	141.91	149	0.4634	2.484	156.94	189	1.227	6.264	171.79
110	0.1432	0.8265	142.29	150	0.4760	2.548	157.31	190	1.255	6.397	172.16
111	0.1481	0.8528	142.66	151	0.4889	2.613	157.69	191	1.282	6.533	172.53
112	0.1531	0.8798	143.04	152	0.5021	2.679	158.06	192	1.311	6.671	172.90
113	0.1583	0.9075	143.42	153	0.5155	2.747	158.43	193	1.339	6.812	173.26
114	0.1636	0.9359	143.80	154	0.5293	2.816	158.81	194	1.369	6.955	173.63
115	0.1690	0.9650	144.17	155	0.5433	2.886	159.18	195	1.398	7.100	174.00
116	0.1746	0.9948	144.55	156	0.5577	2.958	159.55	196	1.429	7.248	174.37
117	0.1803	1.025	144.93	157	0.5732	3.032	159.93	197	1.459	7.398	174.74
118	0.1862	1.057	145.31	158	0.5872	3.106	160.30	198	1.490	7.551	175.10
119	0.1923	1.089	145.68	159	0.6025	3.182	160.67	199	1.522	7.706	175.47
120	0.1985	1.122	146.06	160	0.6181	3.260	161.04	200	1.554	7.864	175.84
121	0.2049	1.155	146.44	161	0.6339	3.339	161.42	201	1.587	8.025	176.21
122	0.2114	1.190	146.81	162	0.6502	3.420	161.79	202	1.621	8.188	176.57
123	0.2181	1.225	147.19	163	0.6667	3.502	162.16	203	1.654	8.354	176.94
124	0.2250	1.261	147.57	164	0.6836	3.586	162.53	204	1.689	8.522	177.31
125	0.2321	1.298	147.94	165	0.7008	3.671	162.90	205	1.724	8.694	177.68
126	0.2393	1.336	148.32	166	0.7183	3.758	163.27	206	1.759	8.868	178.04
127	0.2467	1.375	148.70	167	0.7362	3.847	163.65	207	1.795	9.045	178.41
128	0.2543	1.415	149.07	168	0.7545	3.937	164.02	208	1.832	9.225	178.78
129	0.2621	1.455	149.45	169	0.7731	4.029	164.39	209	1.869	9.408	179.14
130	0.2701	1.497	149.82	170	0.7920	4.123	164.76	210	1.907	9.593	179.51
131	0.2783	1.539	150.20	171	0.8114	4.218	165.13	211	1.946	9.782	179.88
132	0.2867	1.583	150.57	172	0.8311	4.316	165.50	212	1.985	9.974	180.24
133	0.2952	1.627	150.95	173	0.8511	4.415	165.87	213	2.024	10.17	180.61
134	0.3041	1.672	151.33	174	0.8716	4.515	166.24	214	2.065	10.37	180.97
135	0.3131	1.719	151.70	175	0.8924	4.618	166.61	215	2.106	10.57	181.34
136	0.3223	1.766	152.08	176	0.913	4.732	166.98	216	2.147	10.77	181.71
137	0.3317	1.815	152.45	177	0.935	4.829	167.35	217	2.186	10.98	182.07
138	0.3414	1.864	152.83	178	0.957	4.937	167.72	218	2.232	11.19	182.44
139	0.3513	1.915	153.20	179	0.979	5.048	168.09	219	2.275	11.41	182.80

附表二

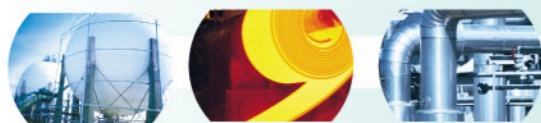
Schedule 2

过热蒸汽密度表

Schedule II: Overheated Steam Density

p MPa	t(°C)							
	150	170	190	210	230	250	270	290
0.10	0.5164	0.4925	0.4707	0.4507	0.4323	0.4156	0.4001	0.3857
0.15	0.7781	0.7412	0.7079	0.6777	0.6500	0.6246	0.6010	0.5795
0.20	1.0423	0.9918	0.9466	0.9056	0.8684	0.8342	0.8027	0.7736
0.25	1.3089	1.2444	1.1869	1.1349	1.0849	1.0445	1.0048	0.9682
0.30	1.5783	1.4990	1.4287	1.3653	1.3079	1.2540	1.2077	1.1634
0.40	2.1237	2.0141	1.9166	1.8297	1.7513	1.6527	1.6152	1.5554
0.50	2.6658	2.5380	2.4121	2.2297	2.1992	2.1081	2.0255	1.9495
0.80	4.3966	4.1676	3.9372	3.7400	3.5655	3.4110	3.2718	3.1453
1.10	6.1313	5.8332	5.5342	5.2356	4.9719	4.7459	4.5445	4.3612
1.40	7.8785	7.5163	7.1540	6.7913	6.4288	6.1147	5.8437	5.6006
1.70	9.8464	9.3688	9.2473	8.4130	7.9352	7.5219	7.1713	6.8607
2.00	11.6295	11.0985	10.5676	10.0366	9.5054	8.9744	8.5350	8.1447
2.50	15.1890	14.4516	13.7250	12.9776	12.2406	11.5036	10.8794	10.3500
3.00	18.4168	17.5709	16.7243	15.8776	15.0367	14.1842	13.3377	12.6359

p MPa	t(°C)							
	310	330	350	370	390	410	430	450
0.10	0.3724	0.3600	0.3484	0.3375	0.3272	0.3176	0.3086	0.2998
0.15	0.5594	0.5404	0.5230	0.5066	0.4912	0.4767	0.4631	0.4502
0.20	0.7465	0.7214	0.6980	0.6759	0.6553	0.6360	0.6178	0.6005
0.25	0.9343	0.9027	0.8732	0.8456	0.8198	0.7955	0.7726	0.7507
0.30	1.1224	1.0844	1.0488	1.0156	0.9845	0.9552	0.9277	0.8989
0.40	1.5000	1.4701	1.4010	1.3563	1.3144	1.2753	1.2377	1.2035
0.50	1.8802	1.8147	1.7545	1.6983	1.6456	1.5961	1.5498	1.5060
0.80	3.0283	2.9215	2.8227	2.7305	2.6440	2.5635	2.4884	2.4171
1.10	4.1943	4.0419	3.9030	3.7722	3.6512	3.5384	3.4335	3.3345
1.40	5.3794	5.1777	4.9945	4.8260	4.6673	4.5220	4.3857	4.2575
1.70	6.5815	6.3309	6.0998	5.7779	5.6936	5.5120	5.3441	5.1863
2.00	7.8061	7.4955	7.2186	6.9619	6.7260	6.5117	6.3090	6.1203
2.50	9.8888	9.4806	9.1136	8.7802	84750	8.1938	7.9332	7.6898
3.00	11.9979	11.5143	11.0497	10.6308	10.2493	9.9000	9.5775	9.2816



智能流量积算仪系列仪表简介

智能流量积算仪系列仪表由 I、II、III 三种型号组成。显示器采用大屏幕全点阵液晶带背光，中文显示。I 型智能流量积算仪通过简单编程可以测量饱和蒸汽、过热蒸汽和液体及气体的体积流量和质量流量，还可以查询停电和来电时间记录；II 型智能流量积算仪有以上功能外，再实现温度自动补偿密度，压力自动补偿密度、温压自动补偿密度等，同时还可以测量热水、饱和蒸汽和过热蒸汽的热量等参数，再实现压力自动补偿热焓，温度自动补偿热焓、温压自动补偿热焓等；III 型智能流量积算仪有以上功能外，再增加 4-20mA DC 标准电流信号输出，方便与 PC 机或记录仪连接，还有 RS485 或 RS232 通讯接口，方便与电脑联网。

主要性能指标

流量输入信号	a. 传感器：差压、比例、频率或脉冲 b. 信号类型：0~10mA、4~20mA 或 0~5000Hz (V 低 < 1V, V 高 > 5V)
压力输入信号 (补偿信号)	a. 传感器：压力变送器 b. 信号类型：0~10mA、4~20mA
温度输入信号 (补偿信号)	a. 传感器：温度变送器、铂电阻 b. 信号类型：0~10mA、4~20mA 或 Pt100 等
输出信号 (选配)	模拟输出 4~20mA 或 开关量输出 50V/30mA 接点
测量精度	模拟量优于 0.2%，频率量优于 0.1%
运算精度	优于 $2 \times 10^{-5}\%$
通讯功能 (选配)	具有 RS485 或 RS232 通讯接口，防雷电保护。
具有多种流量运算模式，可程序设定组合。	
具有密度自动补偿功能，可程序设定组合。	
显示功能	可显示累积流量、瞬时流量、累积热量、瞬时热量、差压、频率、密度、压力、温度、热焓，年，月，日，时，分，秒及查询、停电和来电时间记录。
自动修复功能	除软件看门狗外，硬件系统配置有看门狗，上掉电复位系统，一旦程序出错，或以外死机，可保证仪表强行恢复运行。
断电保护功能	机内的运算结果和用户设定的数据在断电时不会丢失，保存时间在十年以上。
工作电源	AC: 220V ± 15% 功耗：小于 5W
输出电源	DC: 24/2W DC: 12V/1W
工作环境	温度：0~50℃ 湿度：< 85%RH
安装方式	模式和竖式
开孔尺寸	横表：152 ± 0.5 × 76 ± 0.5 (宽 × 高，单位 mm) 竖表：76 ± 0.5 × 152 ± 0.5 (宽 × 高，单位 mm)
外形尺寸	横表：160 × 80 × 140 (宽 × 高 × 深，单位 mm) 竖表：80 × 160 × 140 (宽 × 高 × 深，单位 mm)
重量	约 1.0kg

显示功能

显示画面：

按面板上 **返回** 键和 **确认** 键分别可显示瞬时流量和累积流量，按 **选项** 键可翻页显示所需内容。显示屏右上角有闪烁方块提示仪表处于运行状态。显示信息包括瞬时流量和累积流量，瞬时热量和累积热量，频率、差压、压力、温度、密度、时钟等，可以通过面板键盘随时召唤显示，也可以通过编程自动循环或定格显示，显示画面分别如下：



注：画面九的显示内容是针对校验调试时用，CHO 代表差压通道，CH1 代表压力通道，CH2 代表温度（电流）通道，CH3 代表温度（电阻）通道；



报表查询：

① 进入查询：按面板上 **报表** 键，仪表进入报表查询，按 **选项** 键来选择光标项，按 **确认** 键进入（见图1）

② 查询：画面显示要求输入查询几年几月几日的累积量（见图2）

③ 查询：画面显示要求输入查询几年几月的累积量（见图3）



图4

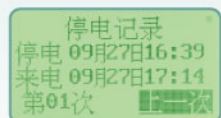


图5

来停电查询:

- ① 进入查询: 按面板上 **停电** 键, 仪表进入来停电查询 (见图4)
- ② 查询: 首先显示最新一次来停电记录, 按 **确认** 键查询上一次来停电记录, 总记录为20次, 最后显示总停电次数和停电累积时间 (见图5)
- ③ 退出查询: 按 **返回** 键即可退出停电查询

编用户程序

由于本仪表是一种多功能可编程智能仪表, 因此在接入使用前, 用户必须对仪表进行简单编程, 用以确定采用何种流量传感器, 所选用传感器输出信号类型等; 确定个测量传感器的量程、流量范围和流量系数等。本仪表采用四键组合完成各种设定。

键盘

仪表键盘由 **设定**、**选项**、**返回**、**确认** 4个功能键组成。在显示状态下, **选项** 键, **返回** 键, **确认** 键用来召唤显示画面; 在设定状态下, **设定** 键用来选择当前设定项内容, “选项”键选择设定项, **确认** 键用来进入当前设定项, **返回** 键退出当前设定项。



图6



图7

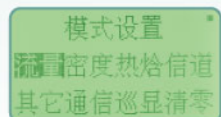


图8

用户编程

编程工作由中文菜单提示完成, 按 **设定** 键进入编程, 首先请输入密码, 出厂密码为0000 (见图6), 密码正确则进入编程主菜单, 画面如图4:

用 **选项** 键选择子菜单, **确认** 键进入光标所在项, 可分别进行设置。

1) 模式设置 (见图8)

按 **确认** 进入模式设置的子菜单, 按 **返回** 键退出当前项, 进入上一级菜单。模式设置清单见表1。

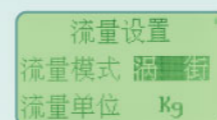


图9

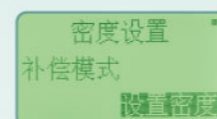


图10



图11



图12



图13

01.流量设置 (见图9)

按 **选项** 键选择设定项目, 按 **设定** 键选择设定内容, 对于流量模式可在: 孔板、电磁、涡街和脉冲之间选择; 对于流量单位可在: L,m³,T,Kg之间选择; 按“返回”键表示对当前内容确认并返回。清单见表1。

02.密度设置 (见图10)

通过 **设定** 键可选择: 设置密度、压力补偿 (饱和汽)、温度补偿 (饱和汽)、温压补偿 (过热汽)、 $p=A+BP$ 、 $p=A+BT$ 、区域补偿和标况换算等模式, 按“返回”键表示对当前补偿模式确认并返回。清单见表1。

03.热焓设置 (见图11)

按 **选项** 键选择设定项目, 按 **设定** 键选择设定内容, 对于热量单位可在: KJ, MJ和GJ之间选择; 对于热焓补偿模式可在: 设置热焓、热水温度补偿、饱和汽压力补偿、饱和汽温度补偿、过热汽温压补偿、 $h=A+BP$ 和 $h=A+BT$ 之间选择; 按 **返回** 键表示对当前内容确认并返回。清单见表1。

04.信道设置 (见图12)

信道设置用来定义输入传感器类型。按 **选项** 键选择设定通道, 按 **设定** 键选择光标所在通道的信号类型, 分别可以在: II、III、电阻关闭之间选择; 按 **返回** 键表示对当前内容确认并返回。清单见表1。

05.阻尼设置 (见图13)

按 **选项** 键用来选择 **测频周期** 和 **背光控制**。**测频周期** 用来选择频率测量周期, 按 **设定** 键可在: 1~9秒之间选择; **背光控制** 用来选择显示屏背光, 可在: 自动、常亮和关闭之间选择; 按 **返回** 键表示对当前内容确认并返回。清单见表1。(在背光控制选择自动, 按任何键背光可延时60秒)



图14

06.通信设置 (见图14)

本机地址和波特率用来定义本仪表和上位机通信时的参数,波特率范围为1200, 2400, 4800, 9600, 本机地址范围为0~125。n表示没有奇偶校验位, e表示有奇偶校验位。按 **确认** 键选择设定项目, 按 **设定** 键选择内容, 按“返回”键表示对当前内容确认并返回。清单见表1。

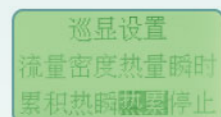


图15

07.巡显设置 (见图15)

巡显设置用于设置自动循环显示的画面, 用户根据需要依次选择自动循环显示的内容及顺序, 按 **设定** 键选择内容, 按 **选项** 键选择设定项。退出设置进入显示状态后, 本仪表大约按3秒间隔自动循环显示 **停止** 项前的所有内容。本仪表共可循环显示八项内容。清单见表1。



图16

08.清零设置 (见图16)

选择 **累积量清零** 按 **确认** 键后出现 **OK**, 表示已清除流量累积量和热量累积量, 选择 **来停电清零** 按 **确认** 后出现 **OK**, 表示已清除来停电记录。清单见表1。



图17

2) 参数设置 (见图17)

参数设置主要用来输入各种模拟量通道进行标度转换和运算时所需的系数、量程和小信号切除范围等, 使仪表能准确地把现场信号转换为各物理量的实读值。按 **设定** 键选择当前位内容, 按 **选项** 键选择设定位, 按 **确认** 键确认当前设定项, 并进入下一项设定。设定完毕按 **返回** 键退回上一级菜单。设定清单见表2。



图18

3) 校验设置 (见图18)

校验设置主要用于完成仪表模拟量测量的校准工作, 必须借助外接标准仪器根据菜单提示来完成, 非专业人员不得任意修改。**差压校零点** 表示当前准备校验差压通道的零点, **请输入** 为外接标准信号, **测量值** 为仪表实际测量值。**测量值** 与 **请输入** 数值相等时, 按 **确认** 则表示零点校完并自动进入满度校验, 方法同上。中间点只需观察, 无须调整。用 **设定** 键可分别选择校验差压, 压力, 温度和电阻通道。校验完毕按 **返回** 键退回上一级菜单。(出厂前已全部校准)



图19

注: 校验电阻 (P1100)通道时, 先按照 **输入** 要求输入电阻值, 按 **确认** 键后, 测量值应显示对应的温度值, 此时零点校完, 进入满度校验, 方法同上。

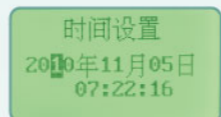


图20

4) 时间设置 (见图20)

时间设置菜单用来设定仪表的当前时间, **确认** 键选择设定项, **设定** 键修改内容。设定完毕按 **返回** 键退回上一级菜单。



图21

5) 密码设置 (见图21)

密码设置用来修改本仪表的设定密码锁, 密码为四位阿拉伯数字, 输入完新密码, 按 **确认** 键就可完成密码修改。按 **设定** 键选择光标所在项数字循环0~9, 按 **选项** 键选择设定位。设定完毕按 **返回** 键退回上一级菜单。

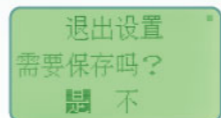


图22

6) 其它设置: 备用

7) 返回设置 (见图22)

在设置主菜单中按 **返回** 键, 进入退回设置。用 **选项** 键选择 **是**, 再按 **确认** 键就可退出设置, 进入显示状态, 同时保存所有的设定数据; 否则本仪表不保存设定的数据。



模式设定表

表1

序号	设定项目	设定子项目	功能码及意义
01	流量设置	流量模式	差压 (如差压变送器)
			频率 (如涡街流量计)
			比例 (如电磁流量计)
			脉冲 (如涡轮流量计)
	流量单位	L、m ³ 、T、Kg	
02	密度设置	补偿模式	设定密度 (不补偿时使用)
			饱和蒸汽压力补偿 (密度)
			饱和蒸汽温度补偿 (密度)
			过热蒸汽温压补偿 (密度)
			$P=A+BP$ (测量气体时用, 压力自动补偿密度)
			$P=A+BT$ (测量气体时用, 温度自动补偿密度)
			气体区域补偿 (测量气体时用, 压力、温度自动补偿密度)
			标况换算 (测量气体采用温压补偿并换算为标准状态体积量)
03	热焓设置	热量单位	KJ、MJ、GJ
		补偿模式	设定热焓 (热焓值为设定值)
			热水温度补偿 (热焓)
			饱和蒸汽压力补偿 (热焓)
			饱和蒸汽温度补偿 (热焓)
			过热蒸汽温压补偿 (热焓)
			$H=A_h+B_hP$ (热焓是压力线性函数, 用于非热水和蒸汽测量)
			$H=A_h+B_hT$ (热焓是温度线性函数, 用于非热水和蒸汽测量)
04	信道设置	差压	II(输出0~10mA信号的变送器) III(输出4~20mA信号的变送器)
		压力	电阻 (温度信号为P1100铂电阻)
		温度	流量信号为频率(如涡街流量计)
			时差压信道无需设定
05	其他设置	测频周期	1~9 (频率采样周期秒)
		背光控制	自动, 常亮, 关闭 (显示屏背光控制选择)
		模出控制	流量、设置
06	通信设置	本机地址	0~127(供仪表联网时使用)
		波特率	1200nl, 1200el, 2400nl, 2400el 4800nl, 4800el, 9600nl, 9600el
07	循显设置	项目1~项目8	每个项目可设为流量、密度、热量、瞬时、累积、热瞬、热累、停止
08	清零设置	累积量清零	光标所在项, 按“确认”键即可清零
		来停电清零	
		报表清零	

参数设定表 (采用十进制浮点数)

表2

序号	设定项目	功能码	说明
001	差压上限 $dp_{上}$	0.000000~9999999	差压单位由用户自定, 涡街流量计无需设定
002	差压下限 $dp_{下}$	0.000000~9999999	
003	压力上限 $P_{上}$	0.000000~9999999	单位: MPa
004	差压下限 $P_{下}$	0.000000~9999999	
005	温度上限 $T1_{上}$	0.000000~9999999	单位: 摄氏度 $^{\circ}C$
006	温度上限 $T1_{下}$	0.000000~9999999	
007	工作密度	0.000000~9999999	补偿时无需设定。
008	流量系数	0.000000~9999999	K值, 根据设计数据或计算得到
009	流量上限	0.000000~9999999	与瞬时流量单位相同, 无模拟输出时无需设定
010	流量下限	0.000000~9999999	
011	补偿系数A	0.000000~9999999	用于测量气体, 密度是压力或温度线性函数用 $P = A + BP$
012	补偿系数B	0.000000~9999999	或 $P = A + BT$ 求得密度
013	标况密度	0.000000~9999999	气体全补偿时使用, 根据附录2中1.(2)公式求得
014	当地大气压	0.000000~9999999	单位采用Pa
015	信号切除	0.000000~9999999	切除小差压或频率
016	工作热焓	0.000000~9999999	自动补偿时无需设定, 单位: KJ/Kg
017	热值系数 K_h	0.000000~9999999	H (瞬时热量) = F (瞬时流量) \times h (热焓值) \times K_h
018	热系数 A_h	0.000000~9999999	测量非热水和蒸汽, 压力或温度自动补偿热焓时用 $h = A_h + B_h \times P$ 或 $h = A_h + B_h \times T$ 求得
019	热系数 B_h	0.000000~9999999	



附录：常用公式

密度运算公式

(1) 压力或温度单独补偿密度

$$\rho = A + BP \text{ 或 } \rho = A + BT$$

A、B为系数，通过求解二元一次方程组求得；对于饱和蒸汽，无需计算，仪表自动调用函数

(2) 压力、温度同时补偿密度

$$\rho = (P \times 10^6 + P_{\text{大气压}}) / (Rz(T + 273.15))$$

注：① ρ : 密度(单位:kg/m³) P: 压力(单位:Mpa) P_{大气压}: 本地大气压(单位:Pa) T: 温度(单位:°C)

② Rz值的计算可根据流体在工作温度，工作压力和工作密度已知情况下代入上式求出近似Rz值，也可通过查找流体的压缩系数和气体常数相乘后得出。

③ 本仪表已存有过热蒸汽密度表格。

流量运算公式

(1) 差压式流量计: $F = K(dp \times \rho)^{1/2}$

K-流量系数 dp-孔板差压 ρ -介质密度

(2) 涡街式流量计: $F = 3.6 \times \rho \times f \div K$

K-流量系数 f-涡街频率 ρ -介质密度

(3) 电磁式流量计(比例): $F = K \times \rho \times dp$

K-流量系数 dp-比例信号 ρ -介质密度

(4) 涡轮式流量计: $F = K \times \rho \times N$

K-脉冲当量数 ρ -介质密度 N-脉冲数

标度转换公式

(1) 差压 $dp = (dp_{\text{上}} - dp_{\text{下}}) \times X + dp_{\text{下}}$

X: 0~1 (对应0~10mA或4~20mA等)

(2) 压力 $P = (P_{\text{上}} - P_{\text{下}}) \times X + P_{\text{下}}$

X: 0~1 (对应0~10mA或4~20mA等)

(3) 温度 $T = (T_{\text{上}} - T_{\text{下}}) \times X + T_{\text{下}}$

X: 0~1 (对应0~10mA或4~20mA等)

仪表准确度检定

本仪表频率测量无需调校，由仪表晶振决定。

模拟量调整采用电调满量程和电调零点，方便快捷，根据校验菜单中的提示进行相应操作即可完成仪表模拟量的校验。