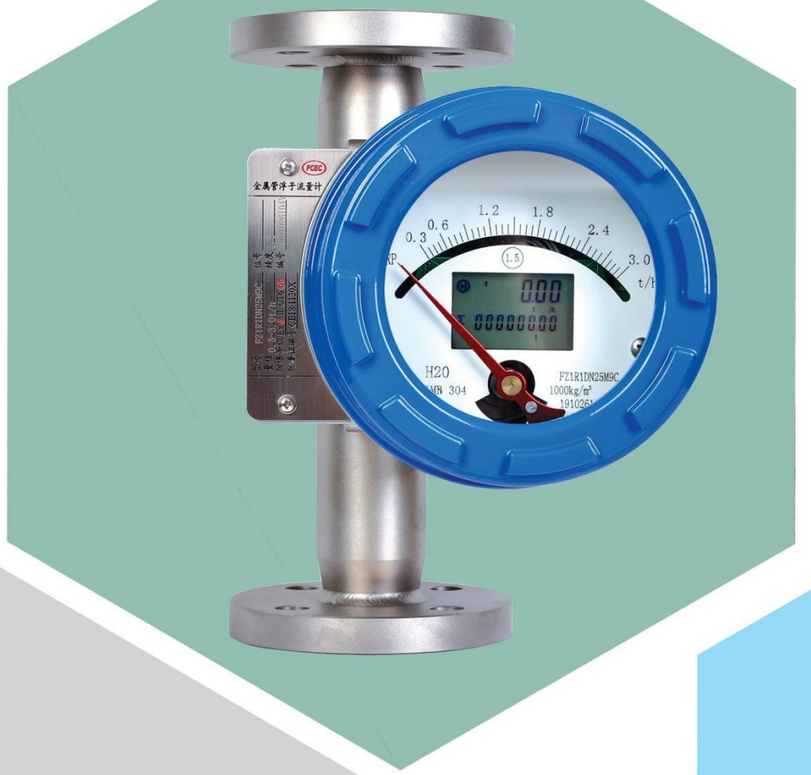
Metal Tube Rotameter Instruction Manual



金属管浮子流量计

VARIABLE AREA FLOWMETER

使用说明书

An instruction manual

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1. Overview

Metal tube rotameter is a variable area flow measurement instrument commonly used in industrial automation process control. It has the characteristics of small size, large detection range and convenient use. It can be used to measure the flow of liquid, gas and steam, and is especially suitable for the measurement of low flow rate and small flow.

Over the years, the metal tube rotameter has been widely used in petrochemical, steel, electric power, metallurgy, light industry, food, pharmaceutical, water treatment and other industries due to its excellent performance and reliability, as well as good cost performance.

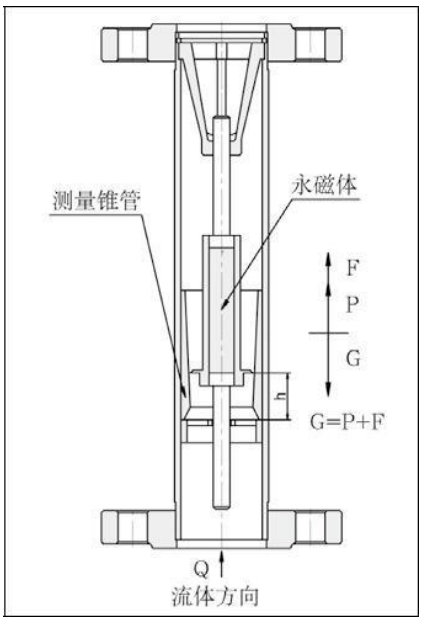
This manual is aimed at professional and technical personnel, suitable for the design and selection of metal tube rotameter, and can also be used as a reference for end users in use.

The manual introduces the working principle, functional characteristics, technical parameters, instrument type and shape, flow calculation, wiring method, installation and maintenance of metal tube rotameter respectively.

This manual is only for the design, selection and use of metal tube rotameter, and the manufacturer reserves the right to improve certain technical parameters without prior notice.

2. Measurement principle

Metal tube rotameter mainly consists of two parts: sensor and indicator. The sensor is mainly composed of connecting flange, measuring cone, float and upper and lower guides; the indicator is mainly composed of shell, magnetic transmission system, dial and electric remote transmission system.



In the vertical conical measuring tube, there is a measuring part that can move up and down - the float (Figure 1), when the fluid passes through the conical tube from bottom to top, the float is forced by the fluid and moves up along the conical tube. When the fluid flow increases, the displacement of the float increases; on the contrary, when the fluid flow decreases, the displacement of the float decreases. That is to say, the size of the fluid flow determines the position of the float in the measuring tube, thereby determining the size of the annular area between the float and the conical tube. When the flow rate of the fluid is maintained at a constant flow rate Q, the float is also in a state of dynamic equilibrium and stays at a position h in the conical tube. At this time, the annular area between the float and the conical tube remains constant. The float is subjected

to three forces:

The gravity G of the float, the buoyant force F on the float, and the force P on the float by the fluid, these three forces are in balance. According to the Bernin equation of fluid dynamics, the force balance principle and the fluid continuity law, the instantaneous fluid flow through the annular area at this time can be calculated, so,

The metal tube rotameter is based on the principle of measuring flow with a variable area.

Inside the float, a high-performance permanent magnet is embedded, and when the float is in the equilibrium position, a uniform and stable magnetic field is formed around the float. A magnetic sensor is installed on the outside of the tapered tube, so that the linear displacement of the float in the measuring tube can be transmitted to the indicator in a non-contact form. After detection and processing, it is finally displayed on the indicator dial or output accordingly. The standard 4 ~ 20mA current signal.

3. Features

- Suitable for small bore and low flow media flow measurement
- Reliable work, low maintenance, long life
- Low requirements for straight pipe sections
- Wide flow span ratio 10:1
- Two-line LCD display, on-site instantaneous/cumulative flow display
- There is a keyboard on the indicator for easy operation and setting
- All-metal structure, suitable for high temperature, high pressure and strong corrosive media
- Non-contact magnetic coupling transmission
- Can be used in flammable and explosive hazardous situations
- Optional DC power supply or battery power supply
- With data recovery, data backup and power failure protection functions
- Multi-parameter calibration function

4.Technical parameter

▲ Flowmeter diameter DN15, DN25, DN50, DN80, DN100, DN150 （For other diameters, please consult with the manufacturer）

▲ Flow range liquid: 1.0～1500001/h gas: 0.05～3000m3/h（For flow ranges, see flow table on page 11）

▲ Flow span ratio 10∶1, 20∶1（special）

▲ Accuracy 1.5 %, 1.0 %（special）

▲ Pressure Level DN15、DN25、DN50: 4.0MPa（Maximum 20MPa） DN80、DN100、DN150: 1.6MPa （Maximum: DN80: 10MPa; DN100: 6.4MPa; DN150: 4.0MPa）

▲	medium temperature	standard: -30℃～+120℃, high temperature: 120℃～350℃
▲	Power supply	24VDC（12～36VDC）, 220VAC
▲	output signal	4～20mADC（two-wire system）, 可附加 HART 协议 HART protocol can be attached
▲	output load	500Ω（ During powered by 24V）
▲	ambient temperature	in situ: -40℃～120℃ remote transmission: -30℃～60℃
▲	Storage conditions	temperature: -40℃～85℃ humidity: ≤ 85%
▲	Connection method	Flange connection, flange standard: GB/T9119-2000, User can specify (other connection methods can be negotiated with the manufacturer)
▲	cable interface	M20×1.5, 1/2 NPT
▲	Shell protection	IP65
▲	Explosion-proof mark	Explosion-proof type: Ex ia IICT6, Explosion-proof type: Ex d IICT6
▲	pressure loss	See flow table for details
▲	medium viscosity	DN15: η＜5mPa.s DN25: η ＜250mPa.s DN50～DN150: η＜300mPa.s
▲	Wetted material	R1: 304, 06Cr19Ni10 R0: 316, 06Cr17Ni12Mo2 RL: 316L, 022Cr17Ni12Mo2 Ti: Titanium alloy RP: Teflon lining

5.Flow meter Type and Dimensions

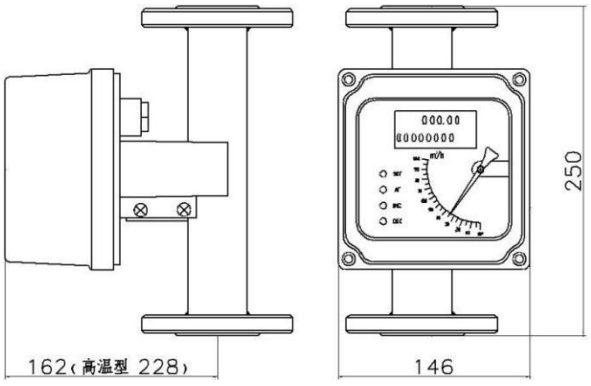
The metal tube rotameter is composed of a measuring tube (sensor) and an indicator (electronic converter). Choose different forms of measuring tube and indicator, and can be

assembled into various forms of complete machines to meet the needs of the site. The outline and dimensions of various types of flow meters, the standard of connecting flanges, and the installation dimensions of magnetic filters are shown below.

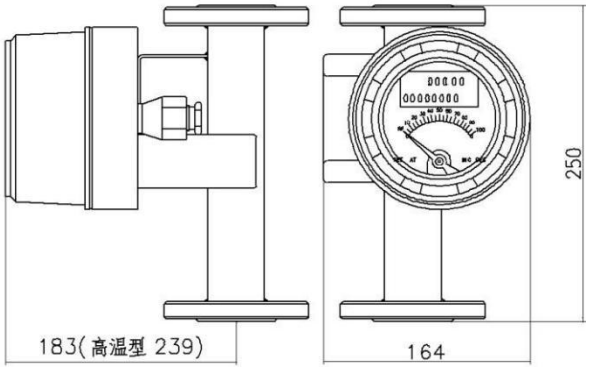
5.1 Product Type

Metal tube rotameters are divided into 5 types according to the direction of fluid inlet and outlet, and each type has standard type, high temperature type, jacket type, etc. They are described below.

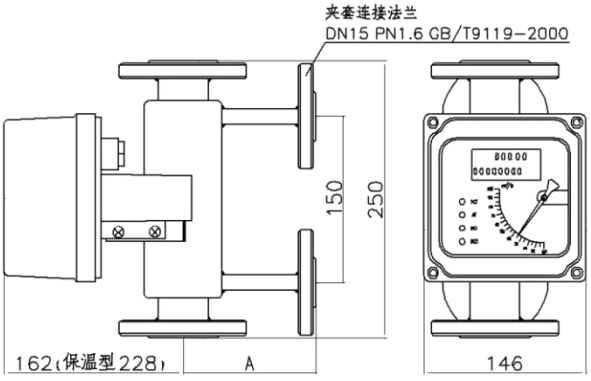
5.1.1 Vertical type



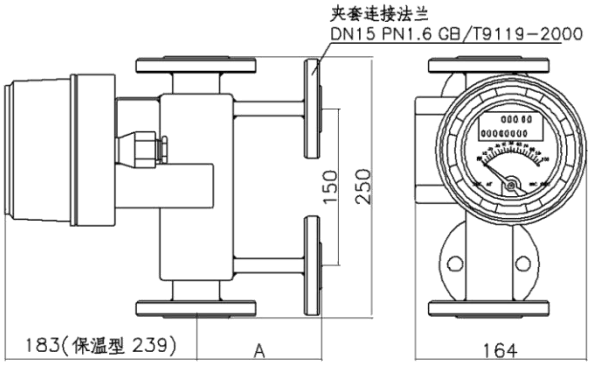
Standard M1 Indicator



Standard M1 Indicator



Cooling Jacket Type M1 Indicator



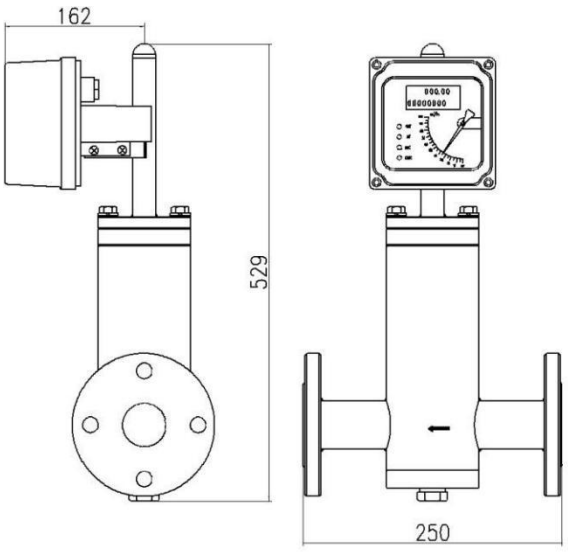
Cooling Jacket Type M2 Indicator

5.1.2 Horizontal type

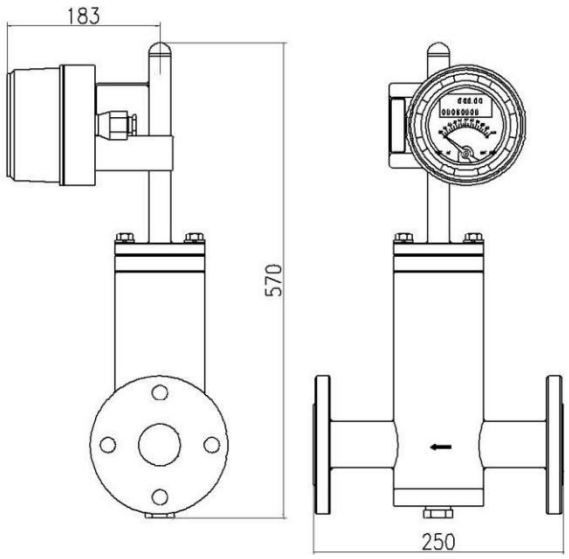
caliber	DN15	DN25	DN50	DN80	DN100	DN150	DN200
A	100	120	135	150	160	40	200
Standard type weight kg	5.0	6.5	10	16	17	35	50
Jacket Type weight kg	7.5	9.5	13	19	20	40	55

When the diameter of the horizontal installation type flow meter is less than DN50 (inclusive), the T-type structure is selected, and when it is larger than DN50, the spring

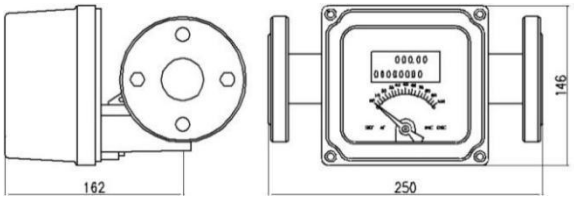
structure is selected.



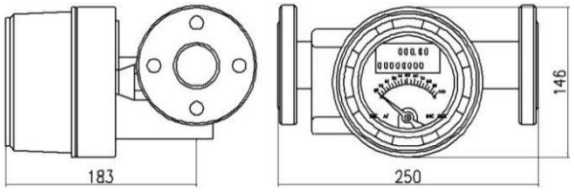
T-Structure M1 Indicator



T-Structure M2 Indicator



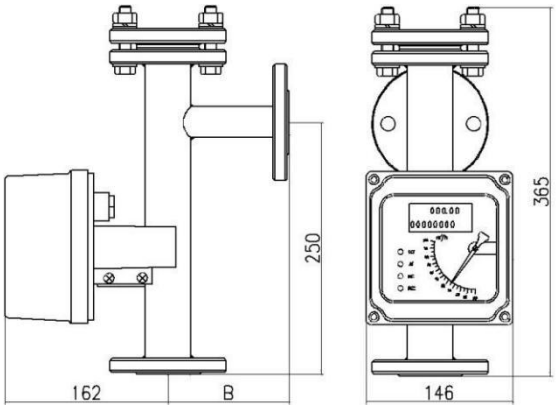
Spring structure M1 indicator



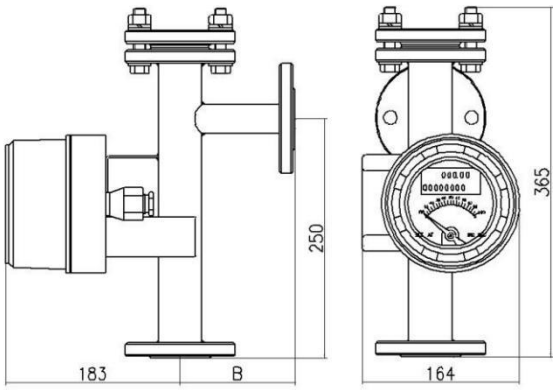
Spring structure M2 indicator

Caliber	DN15	DN25	DN50	DN80	DN100	DN150	DN200
T-Structure kg Weight	6	10	20				
spring kg structure weight				16	17	35	50

5.1.3 Bottom in and side out



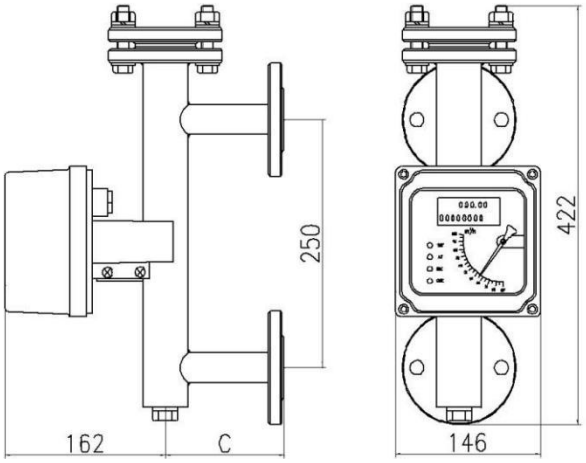
Standard M1 Indicator



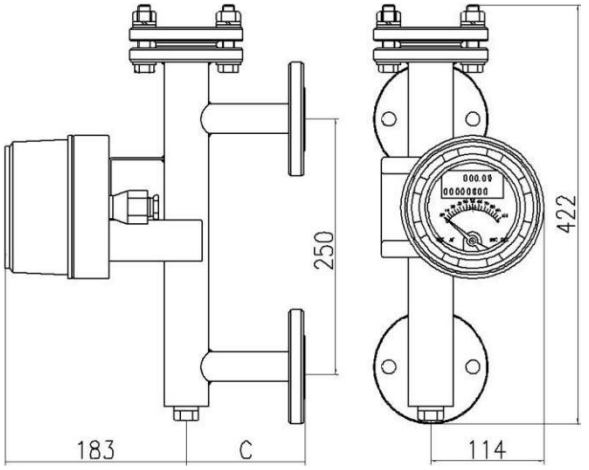
Standard M2 Indicator

caliber	DN15	DN25	DN50	DN80	DN100	DN150	DN200
B	100	120	135	150	160	180	200
weight kg	6	7	14	24	28	52	60

5.1.4 Side in and side out



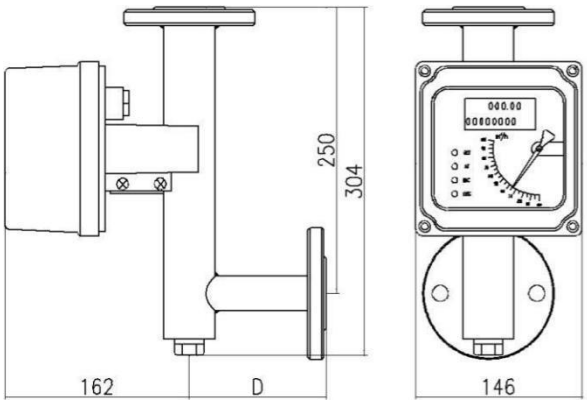
Standard M1 Indicator



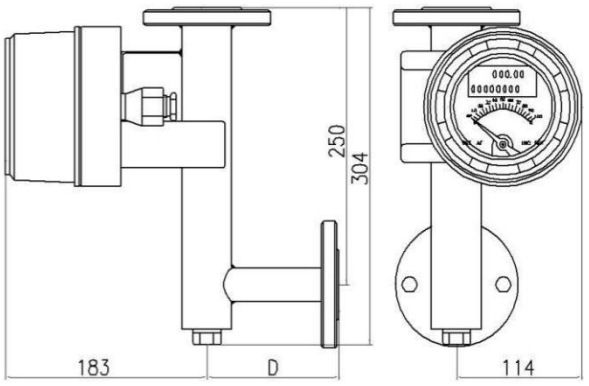
Standard M2 Indicator

caliber	DN15	DN25	DN50	DN80	DN100	DN150	DN200
C	100	120	135	150	160	180	200
weight kg	5.5	6.5	13	22	26	50	57

5.1.5 Side in and top out



Standard M1 Indicator



Standard M2 Indicator

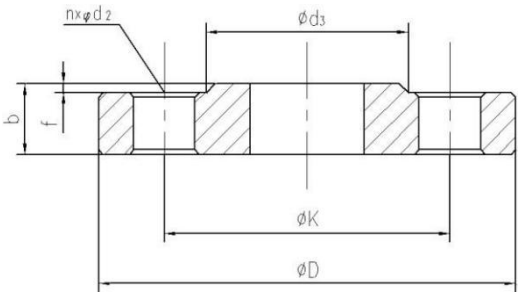
Table 5

caliber	DN15	DN25	DN50	DN80	DN100	DN150	DN200
D	100	120	135	150	160	180	200
weight kg	5.5	6.5	10.5	16	17	36	52

5.2 Flange size

The standard type of metal tube rotameter adopts GB/T9119-2000 flange standard, as shown in Figure 16, and the specific dimensions are shown in Table 6; other flange standards are made according to user requirements.

DN/PN	D	K	d3	b	f	n	d2
15/4.0	95	65	46	14	2	4	14
25/4.0	115	85	65	16	2	4	14
50/4.0	165	125	99	20	2	4	18
80/1.6	200	160	132	20	2	8	18
100/1.6	220	180	156	22	2	8	18
125/1.6	250	210	184	22	2	8	18
150/1.6	285	240	211	24	2	8	22



China National Standard Flange (GB/T9119—2000)　　Flange dimensions

American National Standard Flange (ANSI B16.5 150lb)

DN	D	K	d3	b	f	n	d2
1/2”	88.9	60.5	35.1	11.2	1.6	4	15.7
1”	108.0	79.2	50.8	14.2	1.6	4	15.7
2”	152.4	120.7	91.9	19.1	1.6	4	19.1
3”	190.5	152.4	127.0	23.9	1.6	4	19.1
4”	228.6	190.5	157.2	23.9	1.6	8	19.1
5”	254.0	215.9	185.7	23.9	1.6	8	22.4
6”	279.4	241.3	215.9	25.4	1.6	8	22.4

German national standard flange (DIN2501)

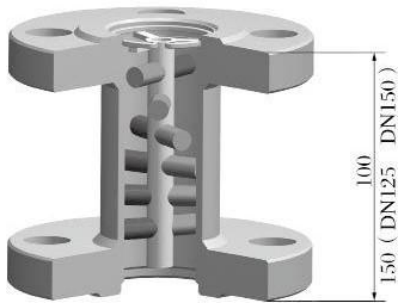
DN/PN	D	K	d3	b	f	n	d2
15/4.0	95	65	46	16	2	4	14
25/4.0	115	85	68	18	2	4	14
50/4.0	165	125	102	20	3	4	18
80/1.6	200	160	138	20	3	8	18
100/1.6	220	180	162	20	3	8	18
125/1.6	250	210	188	22	3	8	18
150/1.6	285	240	218	22	3	8	22

The DIN2501 flange standard is basically equivalent to the following standards and can be used together

Standard Number	standard name	Pressure Level PN MPa					Standard Number	standard name	Pressure Level PN MPa
HG20527-1992	Steel Pipe Flanges	0.6	1.0	1.6	2.5	4.0	DIN2527-1992	flange	0.25～10.0
HG20592-1992	Steel Pipe Flanges	0.6	1.0	1.6	2.5	4.0	DIN2566-1975	Threaded flange	1.0～1.6
HG20592-1997	Steel Pipe Flanges	0.6	1.0	1.6	2.5	4.0	DIN2573-1975	Plate Flat Welding Flange	0.6～1.0
HGJ44～76-1991	Steel Pipe Flanges	0.6	1.0	1.6	2.5	4.0	DIN2655-1975	Flat Weld Ring Plate Loop Flange	0.25～4.0
GB112～9123-2000	Steel Pipe Flanges	0.6	1.0	1.6	2.5	4.0	DIN2673-1962	Butt Weld Ring Plate Loop Flange	1.0

5.3 Magnetic filter

If the medium contains ferromagnetic particles,
a magnetic filter should be installed
in front of the flow meter inlet.
The height below D N100 (inclusive) is 100mm,
and the height above DN100 is 150mm.



6. Indicator and limit alarm device

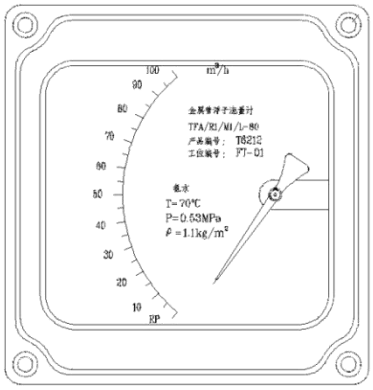
The indicator of the metal tube rotameter is the display and conversion part of the flowmeter. The limit alarm device can realize the flow over-limit alarm and complete the function of the flow switch.

6.1 Indicator selection

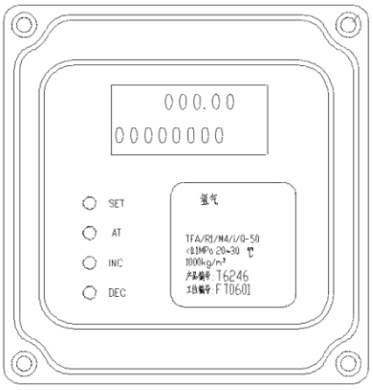
Users can choose the type of indicator according to the actual requirements. See the following table for detailed description of various indicators.

indicator type	Indicator function description
M0	Local indicator, square shell, pointer indicates instantaneous flow, no power supply, no 4~20mA remote transmission, optional flow alarm device, dial can choose instantaneous flow value or percentage scale value.
M1	Square shell, available as local type and electric remote transmission type. In the local type, the pointer indicates the instantaneous flow, no power supply, no 4～20mA remote transmission. Electric remote transmission, intrinsically safe design, explosion-proof mark Ex ia ⅡCT6. 24VDC power supply, on-site pointer indicates instantaneous flow, liquid crystal display instantaneous and cumulative flow, two-wire 4～20mA output, the panel has 4 buttons, which can be viewed and modify internal parameters.
6. M2	Circular housing (white), available as local type and electric remote type. In the local type, the pointer indicates the instantaneous flow, no power supply, no 4~20mA remote transmission. For remote transmission, flameproof design, optional HART protocol function. 24VDC power supply, on-site pointer indicates instantaneous flow, liquid crystal display

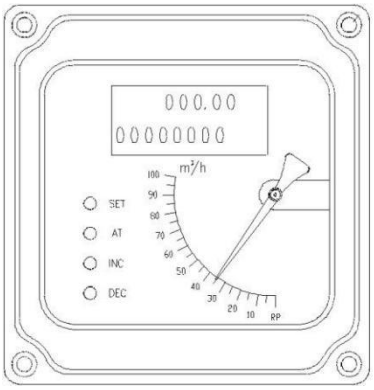
M6	Small round stainless steel shell, the pointer indicates the instantaneous flow, and the liquid crystal can also display the instantaneous and cumulative flow.
M7	Stamped small stainless steel case, pointer indicates instantaneous flow.
M8	Stamped large stainless steel shell, the pointer indicates the instantaneous flow, and the liquid crystal can also display the instantaneous and cumulative flow.
M9	Circular housing (blue), available as local type and electric remote type. In the local type, the pointer indicates the instantaneous flow, no power supply, and no 4-20mA remote transmission. In the case of electric remote transmission, explosion-proof design, explosion-proof mark Ex d ⅡCT6, optional HART protocol function. 24VDC power supply, on-site pointer indicates instantaneous flow, liquid crystal display instantaneous and cumulative flow, two-wire system 4～20mA output, there are 4 buttons on the panel, you can check and modify the internal parameters.



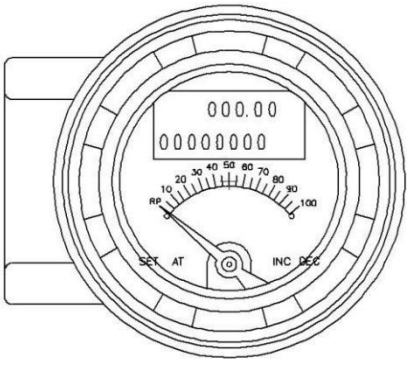
M0 Type



M3 Type



M1 Type



M2 Type

6.2 Alarm device selection

K1, K2 limit alarm switch devices are installed in the M1 type local indicator, K1 is the lower limit, K2 is the upper limit, and the alarm point can be set arbitrarily.

K1, K2 alarm switch consists of two parts, one part is in the indicator, abbreviated as TG22. TG22 is composed of SJ3.5N sensor and cutting plate on the rotating shaft. The alarm point can be set arbitrarily in the whole flow range, and it is indicated on the dial by the positioning pointer; the other part is the external WE77/Ex transistor relay.
The SJ3.5 sensor is used in conjunction with the transistor relays WE77/Ex-1 and WE77/Ex-2 to realize the remote transmission of the upper and lower limit alarm signals, and has intrinsically safe explosion-proof performance. The explosion-proof mark is Ex ia IICT6; among which WE77/Ex -1 can be equipped with one SJ3.5 sensor to realize the control of a single alarm point; WE77/Ex-2 can be equipped with two SJ3.5 sensors to realize the control of the upper and lower limit alarm points.

6.2.1 The technical parameters of WE77 transistor relay and SJ3.5 sensor are shown in the table below

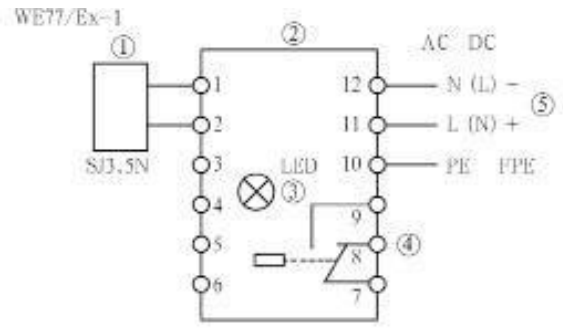
model	WE77/E-1	WE77/E-2	model	SJ3.5-N	SJ3.5-SN
Power supply	220VAC,24VDC		Power supply	8VDC	8VDC
Power consumption	约 3.5VA		effective area open	≥ 3mADC	
Operating temperature	-25℃～ +60℃		effective area close	≤ 1mADC	≤ 1mADC
Open circuit voltage	8(13.5)V	8(13.5)V	Self inductance	250μH	100μH
short circuit current	8(31)mA	8(62)mA	Self capacitance	50nF	60nF
allowable inductance	3(31)mH	1(7.6)mH	Operating temperature	-25℃～ +70℃	-40℃～ +100℃
allowable capacitance	230(609)nF	160(539)nF			

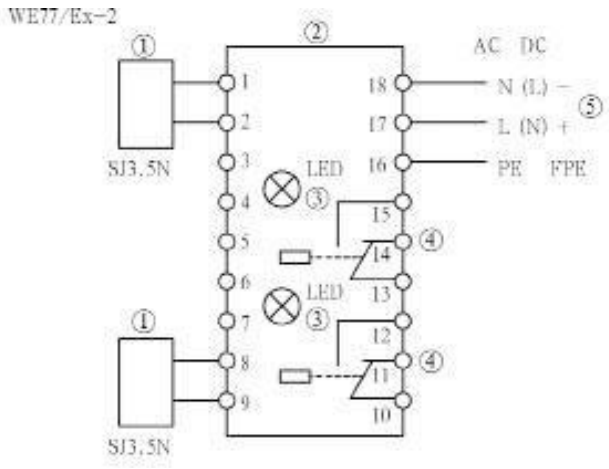
6.1.1 Adjustment and electrical connection of WE77 transistor relay with SJ3.5 sensor:
The transistor relay includes a power supply, a transistor rectifier amplifier and an output intermediate relay. WE77/EX-1 and WE77/EX-2 are generally connected in a normally open working mode, by changing the wiring to make it a normally closed working mode or a normally closed working mode with open circuit monitoring.
Replacing the jumper according to the figure below can obtain various working states. "Relay closed" is indicated by an LED tube.

Model	WE77/E-1	WE77/E-2	model	SJ3.5-N	SJ3.5-SN
Power supply	220VAC、24VDC		Power supply	8VDC	8VDC
Contact melting	3A		effective area open	≥ 3mADC	
Power consumption	about 3.5VA		effective area close	≤ 1mADC	≤ 1mADC
Operating temperature	-25℃～ +60℃		Self inductance	250μH	100μH
Open circuit voltage	8（13.5）V	8（13.5）V	Self capacitance	50nF	60nF
short circuit current	8（31）mA	8（62）mA	Operating temperature	-25℃～ +70℃	-40℃～ +100℃
allowable	3（31）mH	1（7.6）mH			

inductance allowable capacitance	230（609 nF　160（539）nF

6.1.2 WE77/Ex Transistor Relay Mounting and Dimensions (See Figures Below)





① SJ3.5N sensor
③When relay work, the LED light on
⑤Power supply: 220V AC

② Isolation conversion amplifier
④Relay output

7. Caliber calculation and flow meter

The flow meters listed in this manual are calculated with water and air as the standard medium, so the flow rate of the measured medium on site must be converted into the volume flow of water or air first, and then check the caliber in the flow meter. This chapter is used for the selection of flowmeter caliber during design and selection.

7.1. Calculation of liquid flow

7.1.1 Measured liquid volume flow Q_t

According to the density and maximum flow rate of the liquid, substitute formula (1) to calculate the flow rate of water, then go to the flow table to find the corresponding caliber and float number, and substitute the water flow value corresponding to the float number into formula (1) again to calculate The flow value of the liquid to be measured is adjusted to obtain the scale range of the liquid to be measured.

$$Q_S = \qquad \times Q_t \qquad \sqrt{\frac{(}{\rho_f}} \qquad (1)$$

in the formula:

Q_t: The maximum volume flow of the liquid to be measured

Q_m: The maximum mass flow rate of the liquid to be measured

Q_S: Flow rate of calibration medium water

ρ_f: density of float

ρ_t: The density of the liquid to be measured

ρ_s: Density of calibration medium water

7.1.2 Measured liquid mass flow Q_m

The calculation method is the same as above, and the calculation formula is based on the formula (2)

$$Q_S = \sqrt{\frac{\rho_f - \rho_s}{(\rho_f - \rho_t)\rho_t\rho_s}} \times Q_m \qquad (2)$$

7.1.3 Calculation example

For a liquid with an operating density of 720 kg/m3 and a maximum flow of 1800 l/h, calculate the caliber, float number and scale range.

Answer: Take the density of the float as 7850 kg/m3 and the density of water as 1000kg/m3, and substitute 720 (kg/m3) and 1800 (l/h) into formula (1),

Calculated $$Q_S = \sqrt{\frac{(7850-1000)\times 720}{(7850-720)\times 1000}} \times 1800 = 1497.06$$

Check the flow meter and get: caliber DN25, float number: F25.2, Qs=1600, re-substitute Qs into formula (1), calculate Qt=1923.77, after regularization, determine the scale range of the liquid to be measured: 190～1900 l /h.

7.2. Calculation of gas flow

It differs from calculations for liquids as gases are more affected by temperature and

pressure. When converting the flow, not only the influence of density, but also the influence of temperature and pressure should be considered, so when calculating the gas flow, it is necessary to accurately provide the temperature and pressure of the gas to be measured under the working conditions.

7.2.1 If the user gives the gas volume flow rate in the standard state, it is calculated according to formula (3):

$$Q_S = \sqrt{\frac{\rho_{st}}{\rho_s} \times \frac{P_s}{P_t} \times \frac{\overline{T_t}}{T_S}} \times Q_N \qquad \cdots\cdots\cdots\cdots\cdots (3)$$

7.2.2 If the user gives the gas volume flow in the operating state, it is calculated according to formula (4):

$$Q_S = \sqrt{\frac{\rho_{st}}{\rho_s} \times \frac{P_t}{P_s} \times \frac{T_s}{T_t}} \times Q_t \quad \cdots\cdots\cdots\cdots (4)$$

7.2.3 If the gas mass flow rate given by the user is calculated according to formula (5):

$$Q_S = \sqrt{\frac{1}{\rho_t \times \rho_s}} \times Q_m \quad \cdots\cdots\cdots\cdots (5)$$

in the formula:

Q_N: Maximum volume flow of gas in standard state (Nm^3/h)

Q: Maximum volume flow of gas in operating state (m^3/h)

Q_m: Gas maximum mass flow (kg/h)

Q_s: Volume flow of air in calibration state (m^3/h)

ρ_s: Density of the gas in the calibrated state (kg/m^3)

ρ: Density of air in the calibrated state (kg/m^3)

ρ: Density of the gas in the operating state (kg/m^3)

P_s: Absolute pressure of air in calibration state (0.1MPa)

P_t: Absolute pressure of gas in operating state (MPa)

T_s: The absolute temperature of the air in the calibration state (K)

T_t: Absolute temperature of gas in operating state (K)

7.2.4 calculation example

A certain gas, carbon dioxide, the average molecular weight is 44, the process pressure is 0.2MPa, the process temperature is 25℃, and the maximum flow rate is 48Nm3/h. Find the diameter, float number and scale range.

answer:

ρ_{st}=1.803kg/m P_t=0.2+0.1=0.3MPa

ρ_s=1.2041kg/m3 T_t=273.15+25=298.15K

Ps=0.1MPa Ts=293.15K Q_N=48Nm3/h

10.

Bring the above known condition into formula (3)

get $Q_S = \sqrt{\frac{1.803}{1.204} \times \frac{0.1}{0.3} \times \frac{298.15}{293.15}} \times 48 = 34.2$

Check the flow meter and get: caliber DN25, float number F25.1, QS=35 after regularization. Substitute QS into formula (3) again, and get QN=49.123Nm3/h. After adjustment, the scale range of the measured medium is: 4.9 ~ 49Nm3/h.

7.3.Float density table for various materials

Material	CrNi Stainless steel	PTFE Teflon	C4 Hastelloy	Ti Titanium alloy
density (t/m3)	7.85	3.4	8.3	2 .1

Note: Standard status: 0℃ (273.15K), 0.1MPa

Calibration status: 20℃ (293.15K), 0.1MPa

7.4 Flowmeter

◆ Vertical installation flow meter (see table below)

Caliber	Float NO	Water L/h (0.1013MPa abs, 20℃)		Air m3/h (0.1013MPa abs, 20℃)	Pressure loss kPa (Low pressure loss negotiate with the manufacturer)	
	Float material	Stainless steel	PTFE、Ti	Stainless steel	Stainless steel	PTFE、Ti
	F15.0	10	-	-	1.5	-
DN15	F15.1	16	-	0.5	1.5	-
	F15.2	25	-	0.7	1.5	-
	F15.3	40	25	1.2	1.5	1.5
	F15.4	60	40	1.8	1.5	1.5
	F15.5	100	60	2.8	1.5	1.5
	F15.6	160	100	4.5	1.5	1.5
	F15.7	250	160	7.5	3.0	1.5
	F15.8	400	250	12	3.0	3.0
	F15.9	600	400	18	3.5	3.0
DN25	F25.0	1000	600	30	1.5	1.5
	F25.1	1200	800	35	1.5	1.5
	F25.2	1600	1000	45	3.0	1.5
	F25.3	2000	1200	60	3.0	1.5
	F25.4	2500	1600	75	3.5	3.0
	F25.5	3000	2000	90	3.5	3.0
	F25.6	4000	2500	120	8.0	3.5
	F25.7	5000	3000	150	8.0	3.5
	F25.8	6000	-	180	16.0	-
DN50	F50.0	6000	4000	180	3.0	3.0
	F50.1	8000	5000	240	3.0	3.0
	F50.2	10000	6000	300	4.0	3.0
	F50.3	12000	8000	360	4.0	3.0
	F50.4	16000	10000	480	8.0	4.0
	F50.5	20000	12000	600	8.0	4.0
DN80	F80.0	25000	16000	750	14.0	8.0
	F80.1	30000	20000	900	14.0	9.0
	F80.2	40000	25000	1200	20.0	12.0
	F80.3	50000	30000	1500	20.0	15.0
DN100	F100.0	60000	40000	1800	28.0	25.0
	F100.1	80000	50000	2400	28.0	27.0
	F100.2	100000	60000	3000	40.0	38.0
DN125	F125.1	100000	80000	3000	45.0	35.0
	F125.2	125000	100000	-	48.0	40.0
DN150	F150.1	125000	100000	-	48.0	40.0
	F150.2	150000	125000	-	50.0	42.5

◆ Flowmeter for horizontal installation (see table below)

(Low pressure loss need negotiate with the manufacture)

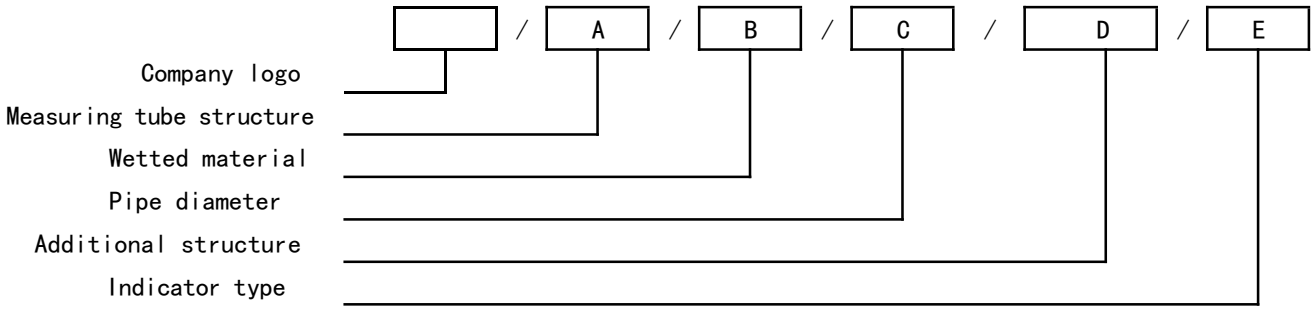
Size	Float	Water L/h (0.1013MPa, 20℃)		Air m3/h (0.1013MPa, 20℃)	Pressure loss kPa	
	Float material	Stainless steel	Ti	Stainless steel	Stainless steel	Ti
DN15	F15.5	160	100	4.5	1.5	1.5
	F15.6	200	120	6.0	1.5	1.5
	F15.7	250	160	7.5	2.0	2.0
	F15.8	400	250	12	2.0	2.0
	F15.9	600	400	18	3.5	3.5
DN25	F25.0	1000	600	30	1.5	1.5
	F25.1	1600	1000	45	1.5	3.0
	F25.2	2000	1200	60	3.0	3.0
	F25.3	2500	1600	75	3.0	3.5
	F25.4	3000	2000	90	3.5	3.5
	F25.5	4000	2500	120	8.0	8.0
DN50	F50.0	6000	4000	180	3.0	3.0
	F50.1	8000	5000	240	3.0	3.0
	F50.2	10000	6000	300	4.0	4.0
	F50.3	12000	8000	360	4.0	4.0
	F50.4	16000	10000	480	8.0	8.0
DN80	F80.1	25000	16000	750	14.0	14.0
	F80.2	30000	20000	900	14.0	14.0
	F80.3	40000	25000	1200	20.0	22.0
DN100	F100.0	60000	40000	1800	30.0	30.0
	F100.1	80000	50000	2400	30.0	30.0
	F100.2	100000	60000	3000	45.0	45.0
DN125	F125.1	100000	80000	3000	45.0	45.5
	F125.2	125000	100000	-	46.0	48.0
DN150	F150.1	125000	100000	-	48.0	46.0
	F150.2	150000	125000	-	50.0	50.0

Note: The data in the flow meter is the standard parameter of the meter. If the user has a special flow range requirement, please negotiate with the supplier.

Sanitary flowmeter reference table (clamp type) generally according to the American standard

DN	Pipeline size	Pipe Outer diameter	Clamp Size
15	1/2”	Φ19	Φ50.5
20	3/4”	Φ22	Φ50.5
25	1”	Φ25.4	Φ50.5
32	1.1/4”	Φ32	Φ50.5
40	1.1/2”	Φ38	Φ50.5
50	2”	Φ51	Φ64.0
65	2.1/2”	Φ63	Φ77.5
80	3”	Φ76	Φ91.0
100	4”	Φ101.6	Φ119.0

8. Selection guide



Measuring tube structure A		Wetted material B		Pipe diameter C		Additional structure D	
1-	bottom in top out	R0-	316	flange type	Sanitary type	NO	
2-	top in bottom out	R1-	304	DN15 DN100	K15 K38	T-	Clip model
3-	bottom in top horizontal out	RP-	PTFE	DN25 DN125	K20 K51	Z-	Damping type
4-	bottom horizontal in and top horizontal out	Ti-	Titanium alloy	DN50 DN150	K25 K63	G-	High temperature type
5-	right in left out	RL-	316L	DN80 DN200	K32 K76	Y-	High pressure type
6-	left in right out	HC-	Hastelloy C		K101		

E Indicator Form Code Combinations	
M0	Local indicator, mechanical pointer indicates instantaneous flow.
M1	Square shell, mechanical pointer indicates instantaneous flow, and liquid crystal display instantaneous/cumulative flow
M2	Round shell (white), mechanical pointer indicates instantaneous flow, and liquid crystal can also display instantaneous/cumulative flow
M3	Square shell (M9), mechanical pointer indicates instantaneous flow, and liquid crystal display instantaneous/cumulative flow
M4	Circular housing (M40), mechanical pointer indicates instantaneous flow, and liquid crystal can also display instantaneous/cumulative flow
M5	Large stainless steel shell, mechanical pointer indicates instantaneous flow, and liquid crystal display instantaneous/cumulative flow
M6	Small round stainless steel shell, mechanical pointer indicates instantaneous flow, and liquid crystal display instantaneous/cumulative flow
M7	Stamped small stainless steel case, mechanical pointer indicates instantaneous flow
M8	Stamped large stainless steel shell, mechanical pointer indicates instantaneous flow, and liquid crystal display instantaneous/cumulative flow
M9	Circular housing (blue), mechanical pointer indicates instantaneous flow, and liquid crystal can also display instantaneous/cumulative flow
M10	Stamped stainless steel shell (diameter 146mm), mechanical pointer indicates

	instantaneous flow				
M11	Circular housing (M30), the mechanical pointer indicates the instantaneous flow, and the liquid crystal can also display the instantaneous/cumulative flow				
M12	Circular housing (double wiring holes), mechanical pointer indicates instantaneous flow, and liquid crystal display instantaneous/cumulative flow				
	Power supply				
	N/A	M0 indicator only			
	A	220VAC 50Hz power supply, 4-20mA signal output, with backlight			
	B	Battery powered, no signal output			
	C	24VDC two-wire power supply, 4-20mA signal output, with backlight			
	D	24VDC three-wire and four-wire power supply, 4-20mA signal output, with backlight			
		Explosion-proof mark			
		N/A	Ordinary not explosion-proof		
		i	Explosion-proof type Ex ia Ⅱ CT6		
		d	Explosion-proof type Ex d Ⅱ CT6		
			Alarm or pulse output		
			N/A	No alarm or pulse output	
			K1	Upper limit alarm or one pulse output	
			K2	Lower limit alarm or one pulse output	
			K3	Upper and lower limit alarm or dual pulse output	

* If the M0 indicator chooses to alarm, the method is that the initiator and the transistor relay are matched to alarm.

9. Flow meter installation and precautions

Different specifications of flow meters can be selected according to the layout of the on-site process pipeline. The vertical installation type is the standard form, and the other forms are the extended type. If the site permits, try to choose the vertical type. The installation methods of flow meters of various installation forms can refer to the following schematic diagrams.

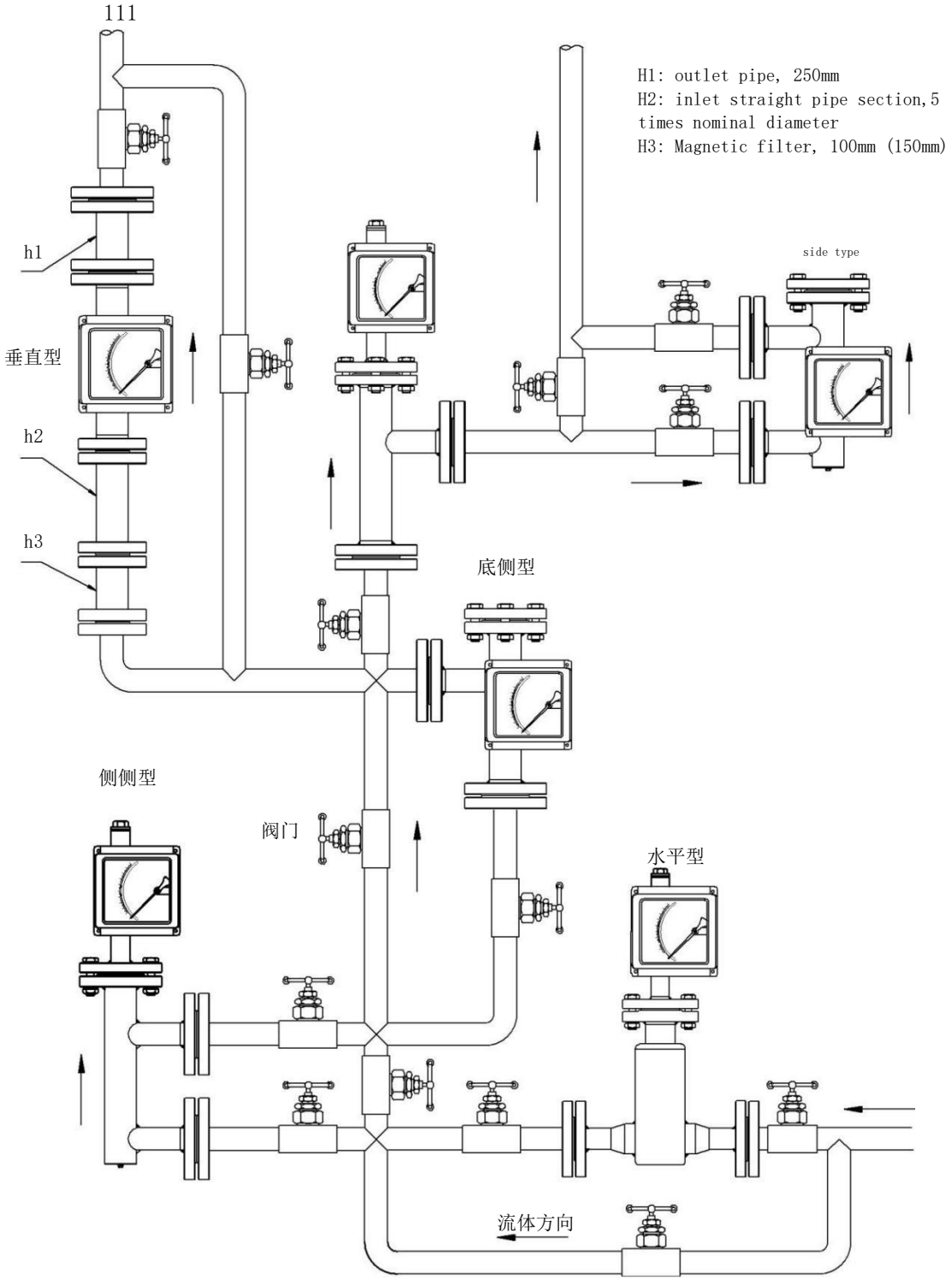


Table 21 Flowmeter installation instructions

9.1 Flow meter Installation Precautions

9.1.1. When the meter arrives on site, all packaging should be unpacked and carefully inspected for shipping damage before installation into the process line.

9.1.2. Before the instrument is installed, the process pipeline should be purged and cleaned to prevent ferromagnetic impurities from remaining in the pipeline and attached to the float of the instrument.It will affect the normal measurement of the instrument, and will cause serious damage to the instrument. If this cannot be avoided, a magnetic filter should be installed at the inlet of the meter (Fig.17).

9.1.3. Since the measuring mechanism of the instrument adopts magnetic transmission and magnetoelectric signal processor, in order to ensure the normal use and performance of the instrument, ferromagnetic substances, strong magnetic fields and strong electromagnetic fields are not allowed to exist within at least 500mm of the installation circumference.

9.1.4. The instrument installed in the pipeline should not be affected by stress. The inlet and outlet of the instrument should be supported by reasonable pipelines, so that the instrument will be subject to the minimum stress on the process pipeline.

9.1.5. The installation of the instrument is divided into horizontal installation and vertical installation. The vertical installation of the instrument should ensure the verticality of the instrument, and the inclination deviation should not exceed 3 degrees; the horizontal installation of the instrument should ensure the horizontal straightness of the instrument, and the inclination deviation should not exceed 3 degrees.

9.1.6. When the instrument is installed, the diameter of the upstream and downstream pipes should be the same as the diameter of the instrument, and the connecting flanges should match each other; to ensure the measurement accuracy and stability of the instrument, the length of the upstream straight pipe section of the instrument is 5 times the nominal diameter of the instrument, and the downstream straight pipe section Minimum length is 250mm

9.1.7. For instruments that measure gas, if the instrument discharges gas directly into the atmosphere, the data of the instrument will be distorted or even the instrument will be damaged. Under such conditions, a throttle valve should be installed at the outlet of the instrument

9.1.8. Use special care when installing PTFE-lined instruments. Under low temperature conditions, PTFE will also deform under the action of pressure, so do not tighten it arbitrarily during installation. The installation torque is shown in the table below.

Diameter mm	Maximum torque kgf.m	Two head bolt
DN15	0.9 ～ 0.95	4×M12
DN25	2.0 ～ 2.2	4×M12
DN50	5.2 ～ 5.6	4×M16
DN80	4.5 ～ 4.8	8×M16
DN100	4.6 ～ 5.0	8×M16
DN125	5.0 ～ 5.3	8×M18
DN150	6.5 ～ 6.8	8×M20

9.2 Maintenance of the instrument

9.2.1. The instrument is a precision device. During transportation, installation, storage and use, it must be handled with care to avoid brutal transportation, overstressed installation and random placement. During all operations, the relative position of the sensor and indicator must remain unchanged, and the change of position will directly affect the measurement accuracy of the instrument

9.2.2. In the long-term use process, ferromagnetic impurities in the pipeline will inevitably be adsorbed on the float, which will block the float or affect the measurement accuracy. It is necessary to clean the float in the sensor from time to time; if a magnetic filter is installed, it is also necessary to carry out Regular cleaning

9.2.3. The instrument indicator is equipped with electronic components. After the instrument is wired or the casing is disassembled, the screws must be tightened. The sealing of the casing must be ensured to prevent impurities, water or other substances from entering. At the same time, the reliable grounding of the instrument casing must be ensured.

9.2.4. After the instrument is installed, when using it for the first time, pay attention to:

When opening the valve, the float must be opened slowly in order to avoid the formation of pressure shocks that can cause damage to the instrument by slamming the float against the limit device! The gas measuring instrument is equipped with a gas damper to minimize the float shock; To ensure the stability of the float, you can install a throttle valve at the outlet of the instrument. To ensure the stability of the float, a throttle valve can be installed at the outlet of the instrument.

9.2.5. For the remote instrument, first of all, ensure that the instrument is wired correctly before it is energized; for dangerous occasions, the explosion-proof type must be selected and installed and used according to the explosion-proof requirements.

10. Electrical connection

This chapter mainly introduces the power wiring of the flow meter, the mating with the safety grid and the technical parameters of the safety grid, etc.。

10.1 Flow meter power wiring

First, unscrew the front cover. If it is a square case, you can see the terminals on the base. The terminal connected to the red lead is connected to the positive pole of the power supply, and the terminal connected to the black lead is connected to the negative pole of the power supply. If it is a round case, you can see the terminals on the circuit board and connect the power cord according to the logo. The explosion-proof type should be connected to the ground wire internally. This flowmeter is two-wire 4～20mA output. See Figure 22

10.2 Equipment related EXi explosion-proof type

When the metal tube rotameter is used in a dangerous place, the EXi explosion-proof type or EXd explosion-proof type must be selected. When the intrinsically safe explosion-proof type is selected, the associated equipment-safety barrier must be configured to form an intrinsically safe explosion-proof system. Safety barriers are divided into zener type and isolation type

10.2.1 Zener safety barrier technical parameters

Explosion-proof mark: [Exia] Ⅱ C

Maximum allowable voltage: 250VAC/DC

EXi explosion-proof circuit rating: U0 ≤ 28V, I0 ≤ 119mA, C0 ≤ 0.083μF, L0 ≤ 2.5mH Installation location: safe area

Environmental conditions: Continuous use temperature: -10℃～ 45℃

Storage temperature: -40℃～ 80℃

Relative humidity: 5-95%RH

10.2.2 Technical parameters of isolated safety barrier

barrierbasic error: ±0.2%F·S

Explosion-proof mark: [Exia] Ⅱ C

EXi explosion-proof circuit rating: U0 ≤ 30VDC, I0 ≤ 30mADC

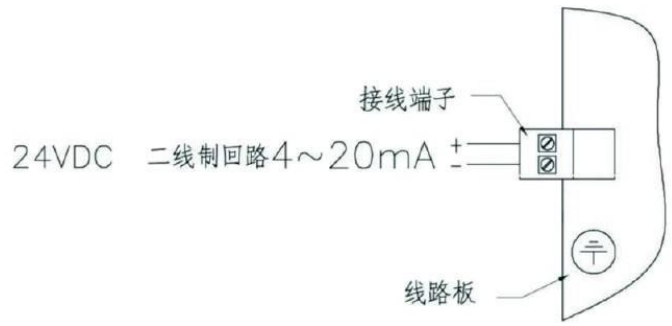
Output load: 0-500Ω

Power supply: 24VDC

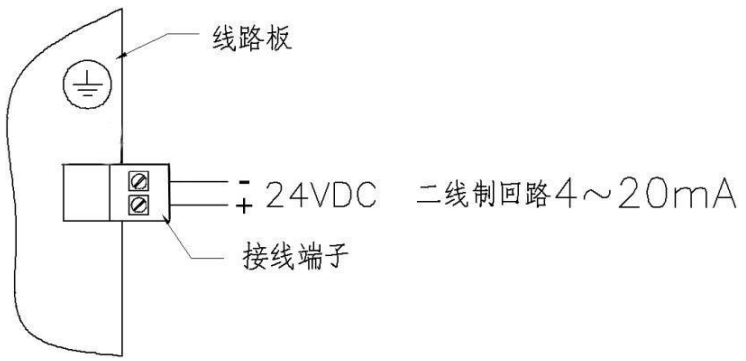
10.2.3 Connection of flow meter to safety barrier

This manual uses TSA528.H type zener barrier and SFA-1100/k type isolation barrier as examples to illustrate the connection method between the safety barrier and the flowmeter.

Other types of safety barriers are subject to the instruction manual. See below:



Square case



Round case

Figure 22 Flowmeter Power Supply Wiring Diagram

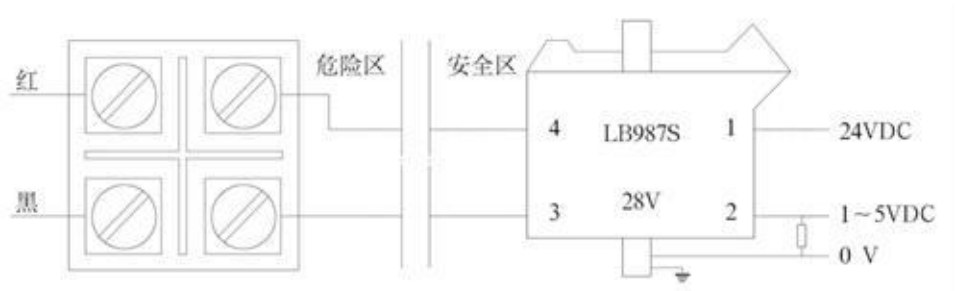


Figure 23 Flowmeter and Zener Barrier Wiring Diagram

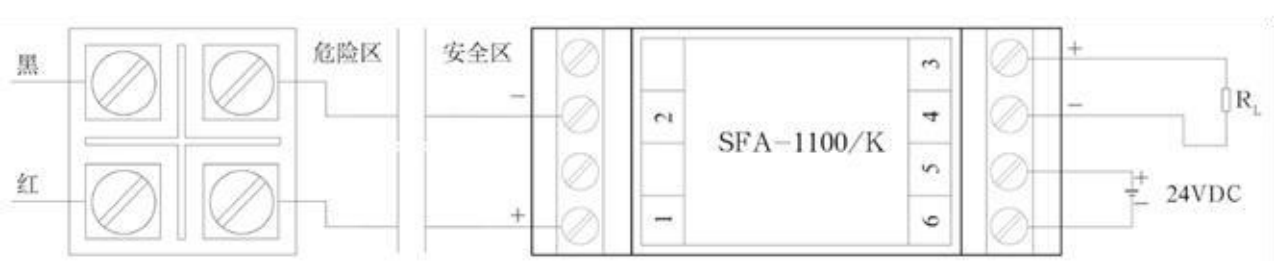


Figure 24 Flowmeter and Isolated Barrier Wiring Diagram

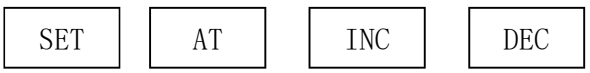
十一 Usage of M1 M2 M5 M6 M8 M9 type indicator

The indicator directly displays the instantaneous and cumulative flow rate of the fluid through the LCD screen. The 4 keys on the panel also allow you to view the internal parameters of the meter and to reset some of them for calibration purposes

The basic parameters of this indicator are open to users, and can be viewed or modified by setting the corresponding password.

11.1 key definition

This product adopts four-keys design as follows



SET key: main key function key, parameter confirmation;

AT key: Left key, move the cursor to the left;

INC key: +1 key, and page backward key;

DEC key: -1 key, and page forward key;

11.2 Basic parameter annotation:

password（CODE）: 00001

parameter	Parameter meaning	set range	explanation
dPI	Decimal point setting value	0～3	Corresponding arithmetic bits
IEL	Cumulative flow rate high 6-digit value	Automatically record cumulative flow high value	read only parameter
dFL	4mA Calibration value	After entering this parameter, use a high-precision ammeter to measure the current current value, and then input the current reading of the multimeter into this parameter to confirm, and the 4mA output can be automatically calibrated	
dFH	20mA Calibration value	The method is the same as above.	
Cod	Meter slope correction value	default 1.0	
SPH	Full scale setpoint		
dLL	Small signal cutoff	Generally set at 10% of full scale	

LPd	The damping value can be freely set according to the site conditions	0～10	Usually set to 4
HFP	final assembly code	This value is not set when there is no HART requirement or when the alarm is not a remote upper or lower limit type.	HART Parameters
HFL	Sensor serial number	This value is not set when there is no HART requirement or when the alarm is not a remote upper or lower limit type.	HART Parameters
HFd	flow unit	Cyclable display：m3/h、l/h、Nm3/h、Nl/h、m3/min、l/min、Nm3/min、Nl/min、kg/h、t/h、kg/min、t/min	0-11
HdL	Flow meter installation form	"0" stands for bottom in and top out, "1" stands for top in and bottom out	The default is 0
HdC	The sensor caliber supports only traffic units:	HdC set to "0" means that the indicator does not calculate the flow rate and displays the instantaneous flow rate HdC set to "1" means the indicator is calculated by DN15 and displays the current flow rate	0-12

	m3/h or l/h	HdC set to "2" means the indicator is calculated in DN20 and displays the current flow rate HdC set to "3" means the indicator is calculated in DN25 and displays the current flow rate HdC set to "4" means the indicator is calculated in DN32 and displays the current flow rate HdC set to "5" means the indicator is calculated in DN40 and displays the current flow rate HdC set to "6" means the indicator is calculated by DN50 and displays the current flow rate HdC set to "7" means the indicator is calculated by DN65 and displays the current flow rate HdC set to "8" means the indicator is calculated according to DN80 and displays the current flow rate HdC set to "9" means the indicator is calculated in DN100 and displays the current flow rate HdC set to "10" means the indicator is calculated according to DN125 and displays the current flow rate HdC set to "11" means the indicator is calculated according to DN150 and displays the current flow rate HdC set to "12" means the indicator is calculated in DN200 and displays the current flow rate	
HdP	devise serial number	This value is not set when there is no HART requirement	HART parameters
SOP	parameter exit interface		

Note for basic parameters: When the indicator is of the remote transmission upper and lower limit alarm type, the functional meanings of the three parameters HFP, HFL and HFD are changed. At this time, the functions of the three parameters are as follows:

Parameter description of remote transmission upper and lower limit alarm type

parameter	Parameter meaning	set range	explanation
HFP	Upper limit alarm value	0-full scale	The user can modify, (the upper limit contact switch will alarm when the instantaneous flow is higher than this value)

HFL	Lower limit alarm value	0-full scale	User can modify, (when the instantaneous flow is lower than this value, the lower limit contact switch pulls in and alarms)
HDC	Alarm point hysteresis setting	0-255	When the flow meter does not set decimals
		0-25.5	When the flow meter is set to 1 decimal place
		0-2.55	When the flow meter is set to 2 decimal places
		0-0.255	When the flow meter is set to 3 decimal places
Note: When setting the alarm value, the principle that the upper limit alarm value is greater than the lower limit alarm value should be followed! Contact switch capacity: 24VDC 0.2A, passive switch output。			

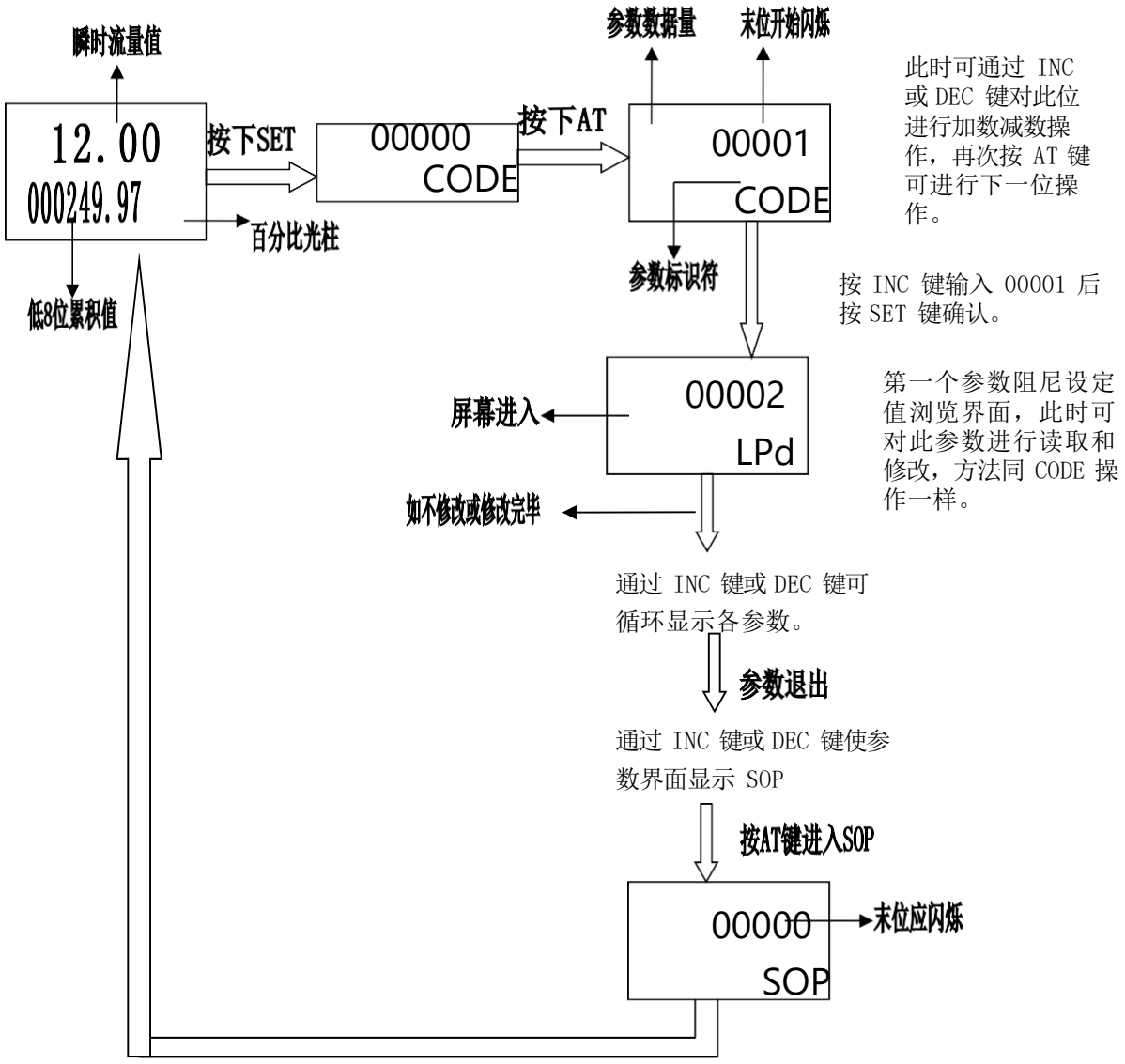
11.3 How to enter the password to enter the function interface of each group:

In the measurement interface state, first press the SET key until the "CODE" character appears, release it, click the "AT" key to select the cursor position, then press the "INC" or "DEC" key to input the corresponding password value, and then click "SET" Press the key to confirm to enter the function interface of this group.

11.4 Modification method of each group of instrument parameters:

The user can modify the basic parameters. After entering the password, use the page key to find the corresponding parameter, click the AT key to enter the parameter, and use the cursor left key (AT) and the plus and minus keys (INC, DEC) to modify the parameters, then Click the "SET" key to confirm and complete the parameter modification.

In the measurement interface, enter the browse parameter example:



Press the SET key to confirm the parameters and return to the measurement state

11.3 The passwords and corresponding functions for Indicators of each group

11.3.1 Basic parameters, password（CODE）：00001

After entering, you can view and modify each basic parameter.

11.3.2 Accumulator manual reset, password（CODE）：00002

After entering this group of parameters to confirm, the cumulant will be cleared to zero, and then automatically return to the measurement state, and the cumulant will start to

accumulate from zero.

11.3.3 Backup factory default password, password (CODE) : 00069

This password is the factory password and does not need to be opened to on-site users.

11.3.4 Factory reset, password (CODE) : 00009

Entering this group of parameters can restore the preset value of the flowmeter when it leaves the factory.

11.3.5 calibration password, password (CODE) : 00188

Default 11-point calibration method

This password is the factory password and does not need to be opened to on-site users.

11.3.6 Calibration password, password (CODE) : 00166

Any point calibration method, but at least zero and span points need to be calibrated

11.6 Detailed introduction of indicator calibration steps

The indicator defaults to 11-point calibration mode

The specific operations are as follows:

11.6.1 Confirm the number of decimal points according to the calibration single range, and input (corresponding to the parameter dPI)

This indicator stipulates: Range≤60, optional 3 decimal places;

Range≤600, optional 2 decimal places;

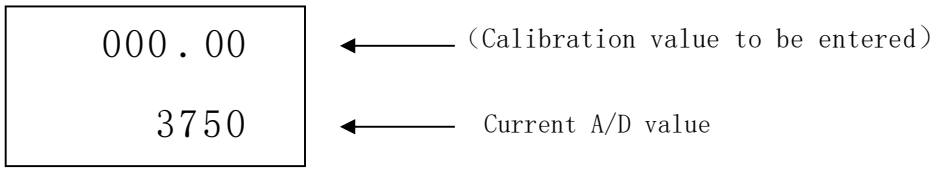
Range≤6000, optional 1 decimal place;

Range＞6000 select no decimal

11.6.2 Input range (corresponding to parameter SPH), calibration zero point 4mA current (corresponding parameter dFL), calibration 20mA current (corresponding parameter dFH) and other parameters

11.6.3 Enter the CODE interface, enter the password 00188, enter the calibration interface

The interface is as follows:



Vertical bottom-in and top-out type metal tube rotameter for example: the upper line of the interface shows the current required input calibration flow rate, the lower line shows the real-time measurement of the current A / D value, note that at this time the first to fix the pointer shaft system on the magnet

(1) Put the whole flowmeter vertically on the operation platform, the float in the sensor is at the bottom end (at the zero position), adjust the position of the disc magnet on the shaft, and observe the change state of the A/D value under the current interface. The A/D value changes from large to small in the entire scale range of the instrument. The effective angle of the indicator corresponding to the universal disc magnet is greater than 90°. After adjusting the position, fix the magnetic steel. Note that the AD value should be adjusted to about 3700 at this time. Move the pointer by hand to observe that the A/D value changes normally in the entire scale range (the AD value continues to change from large to small), can be calibrated.

（2）Calibration:

Note that the calibration process must be from small to large and the zero point must be calibrated. The indicator defaults to 11-point calibration mode (zero, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90% , 100%).

① Zero mark

In the calibration interface, confirm the flowmeter sensor in the zero state and then press the AT key, at this time the instrument enters the first calibration point interface. LCD lower line A/D value is locked, no longer with the magnet change, LCD upper line began to flash and display the current calibration point flow rate value, at this time display zero, directly press SET to confirm, at this time the first zero calibration point is completed, the instrument returns to the initial calibration interface, the upper line of the LCD no longer flashes and displays the next calibration point flow value, the lower line of the LCD A/D value starts real-time measurement for the next calibration point to prepare

②Other point calibration

At this time, a point should be marked in sequence according to the actual situation (the 10% flow point after the zero point is marked, the 20% point after the 10% flow point is marked...), if the 10% point is marked after the zero point, the pointer moves to 10% After the position of the flow point is stable, after pressing the AT key, the A/D value of the liquid crystal downlink will be locked, and will no longer change with the magnet, and the liquid crystal will start to flash upwards and display the flow value of the current calibration point (this time it displays 10% value), Press SET directly to confirm, and the 10% point calibration is completed.

For the calibration of other points, press the AT key to repeat the above calibration process, until the calibration is completed and the full scale point is confirmed, it will automatically return to the measurement interface, and the calibration is completed.

Push the float or pointer by hand to check whether the flow rate just calibrated is accurate.

③ After the final confirmation, use the password (CODE) 00069 to back up all factory parameters.