YSK-Z Straight Tube Coriolis Mass Flow Meter Operating Manual



SIBO.X INDUSTRIAL CO.,LTD.

Add: No. Building 1, No. 1, Jingshi Road, Cicheng Town Industrial Park, Jiangbei District, Ningbo City, Zhejiang, China

https://www.sbxsun.com

Email: info@sbxsun.com

Tel: +86-15958288207

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※Safe use instrument※

Thank you for purchasing the mass flowmeter from our company!
The Koshi Mass Flow Meter user manual records how to use this product correctly and safely. This product is a precision electronic instrument for flow measurement. In order to prevent damage to the instrument and achieve the best performance and stable operation, please read this manual carefully before installation and

- ✧ **After reading this manual, please keep it properly and keep it with this meter.**
- ✧ **Please submit this manual to the end User Technical Department for storage.**
- ✧ **The importance levels of the safety major items in this manual are classified by hazard attention.**



Attentio If you ignore this warning and perform the wrong operation, it may cause personal injury, or cause damage to the instrument and other property.



Danger If you ignore this warning and perform incorrect operations, personal injury or serious security accidents may occur.

The following identifiers may appear in the user manual used:



The picture on the left shows things that could pose a danger;



The picture on the left shows what needs attention;



The picture on the left shows what is prohibited

Explosion-proof instruments are used in explosive environment applications

Verify that there is an explosion-proof certification mark and a temperature group mark on the instrument nameplate. Instruments without this mark cannot be used in explosive environments

The instrument explosion-proof temperature group must meet the environmental requirements of on-site explosion-proof and temperature

When it is used in occasions with explosion-proof requirements, it is necessary to confirm the explosion-proof temperature group of the instrument to meet the requirements of on-site explosion-proof and temperature.

Live operation is prohibited in explosive environment

Before connecting cables, disconnect the power supply

The protection level of the instrument should meet the requirements of the field working conditions

The protection level of the instrument is tested and divided according to the relevant requirements in GB4208-93 (equivalent to IEC529). The protection level required on site should be lower than or equal to the protection level of the instrument to ensure a good working environment for the instrument.

Confirm power supply type

The user can choose between two power supply modes to power the meter, 22V-245V AC or DC. Verify that the power supply type matches the meter before installing power.

Confirm instrument operating environment and medium temperature

The maximum design temperature of the site environment and medium should be lower than the nominal value of the instrument (the nominal value is detailed in the Specification and Technical Parameters in this manual).

When the medium temperature is too high, do not perform online installation and maintenance operations

When the temperature of the measured medium is higher than the temperature borne by the human body or higher than the temperature that may be dangerous, it should be stopped or cooled down, and then operated when the safe temperature is reached. If there is no condition for online operation, it should be stopped to avoid danger.

Verify the ambient pressure and medium pressure of the instrument

The ambient pressure on site and the maximum design pressure of the medium should be lower than the nominal value of the instrument (the nominal value is detailed in the Specification and Technical Parameters in this manual).

Additional requirements when measuring special media

Some media characteristics are more special, the user needs to specify a special type of product according to the actual situation of the site, before the installation of the user to carefully check whether the product type meets the requirements of the site.

Do not operate if you suspect that the instrument is faulty

If the meter is faulty or damaged, please contact our technicians or qualified maintenance personnel for inspection.

1. Straight Tube Mass Flow Meter Overview

Straight Tube Coriolis mass flow meter (YSK-Z) is a new type flow meter which is designed according to Micro Motion and Coriolis principle.This kind of new flow meter can measure the fluid directly in a sealed pipeline. It consists of two sections: Sensor and Signal Transmitter.

1.1 Main Feature

- It can directly measure the mass flow of the fluid (which is of great significance to the measurement and control of the production process, such as energy measurement and chemical reaction)
- High Accuracy（accuracy can be guaranteed in 0.1% ~ 0.5%)
- Wide measure range， generally ensure the basic accuracy of the measurable ratio of 10:1 or 20:1
- wide range of applications, in addition to the normal fluid measurement can also measure the general fluid measuring instrument is difficult to measure the industrial medium, such as high viscosity fluid, all kinds of slurry, suspension, etc
- Measure the density and temperature of medium directly, and convert the concentration of the solute
- There is no requirement for the upstream and downstream straight pipe section of the instrument during installation
- Reliable operation, Low maintenance rate

1.2 Application

The YSK-Z mass flow meter can be used in the following fields to meet the requirements of ingredient, mixing processes and commercial measurement.

- Chemical: containing chemical reaction system
- Petroleum: moisture content analysis
- Lipids: including vegetable oils, animal fats and other oils
- Pharmaceutical
- Painting
- Paper making
- Textile printing and dyeing
- Fuel: crude oil, heavy oil, coal slurry, lubricant and other fuels.
- Food: gas dissolving beverage, health drink and other liquid.
- Transportation: pipeline liquid measurement.
- Low temperature fluid, like liquid oxygen and liquid nitrogen, the low temperature up to -200℃
- High temperature fluid, the maximum temperature up to 300℃
- High pressure fluid, like slurry flow measurement for oil drilling cementing

1.3 Working Principle

If a pipe is rotated around a point (P) while liquid is flowing through it (toward or away from the center of rotation), that fluid will generate an inertial force, with reference to Figure 1.1:

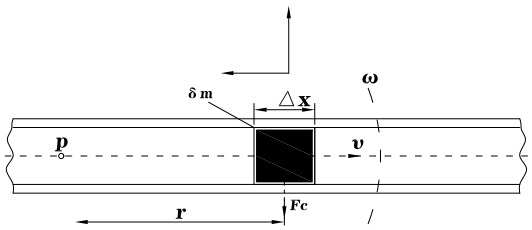


Figure 1.1

A particle (δ_m) travels to the right at a constant velocity (v) inside a tube. The tube is rotating around a fixed point (P) at angular velocity (w), in this case, this particle will get two acceleration components:

1) Normal acceleration (centripetal acceleration), its value is equal to w^2r, its direction is toward the point P

2) Tangential acceleration a_1 (Coriolis acceleration), its value is equal to 2wv, its direction is perpendicular to v

The force generated by tangential acceleration is Coriolis force, its value is equal to Fc =2wvδm. In figure1.1 fluid $\delta_m=\rho A\times\Delta X$, So Coriolis force can be expressed as:

$$\Delta Fc=2\omega\upsilon\times\delta m=2\omega\upsilon\times\rho A\times\Delta X=2\omega\times\delta qm\times\Delta X$$

Wherein A is the duct cross-sectional area.

$$\delta qm=\delta dm/dt=\upsilon\rho A$$

For special rotational pipe, its frequency is constant, ΔFc only depends on δqm. Therefore, directly or indirectly measuring the Coriolis force can be measured mass flow. This is how Coriolis mass flow meter works.

The actual flow sensor can't achieve rotational movement, replace by pipeline vibration. The principle is shown in Figure1.2、Figure1.3、Figure1.4. Both ends of a bend pipe are fixed, and the vibration force is applied to the pipe in an middle of the two fixed points (according to the resonance frequency of pipeline), taking the fixed point as axis, making pipeline vibrate at its natural frequency (w). When no fluid flows through the pipeline, the pipeline is only affected by vibration

force, the vibration direction of two half-section of pipeline is the same, no phase difference. When fluid flows, by the influence of fluid medium dot Coriolis force Fc inside the pipeline (In the two half-section of pipeline, Coriolis F1 and F2 are equal in magnitude and opposite in direction Figure 1.2), two half-section of pipeline occur twist in the opposite direction to generate phase difference which is proportional to mass flow. The design of sensor is converting the measurement of Coriolis force to the measurement of phase difference for both sides of the vibrating tube. This is the working principle of Coriolis mass flow meter.

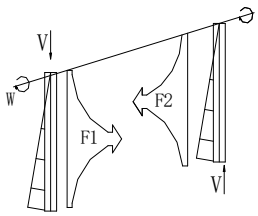


Figure1.2

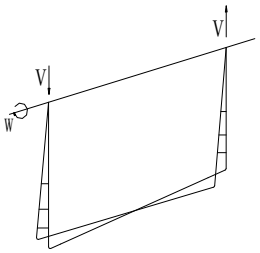


Figure1.3

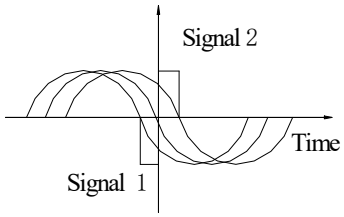


Figure1.4

1.4 Density Measurements

The vibration frequency of the measuring tube is a function of the fluid density.

Based on this principle, the transducer can obtain the density signal by monitoring the vibration frequency of the measuring tube

1.5 Temperature Measurements

The built-in temperature sensor monitors the temperature of the measuring tube and can be used to calculate the compensation factor for the temperature effect, but also as a process temperature output.

2. YSK-Z Straight tube sensor

2.1 YSK-Z Structure and characteristics of straight tube sensor

2.1.1YSK-Z Straight tube sensor shape structure

The structure of the straight tube sensor is shown in the following figure



Figure2.1

2.1.2 YSK-Z Straight tube sensor structure

The sensor is composed of a measuring tube, a measuring tube driving device, a position detector, a supporting structure, a temperature sensor and a shell.

2.1.3 Main Features

- The measurement signal is large, the measurement accuracy is easy to meet the requirements;
- Small installation stress effect;
- The shell structure has the function of secondary pressure protection and easy to achieve heat preservation;
- Loss of pressure;
- No residual medium, easy to clean;
- Strong vibration resistance;
- Small installation size.

2.2 YSK-Z Sensor type and technical parameters

2.2.1YSK-Z Sensor Type Table 2.1

Model Z	1	2	3	4	5	6	7	8	9	10	11	Description
Diameter	008											DN8
	010											DN10
	015											DN15
	020											DN20
	025											DN25
	032											DN32
	040											DN40
	050											DN50
	080											DN80
Structure		C										Compact type
		R										Remote type
Medium temperature			N									-20…+200℃
			H									-50…+300℃
			L									-200…+200℃
Rated pressure				1								1.6MPa
				2								2.0MPa
				4								4.0MPa
				Z								Customized
Power supply					D							DC24V
					A							AC220V
					Z							22-245V
Output signal						R						Pulse/4-20mA/RS485
						H						Pulse/4-20mA/HART
Cable entry							M					M20x1.5
							N					1/2"NPT
							Z					Customized
Accuracy								1				0.1%
								2				0.15%
								3				0.2%
								4				0.5%
Connection									F			Flange
									T			Thread
									C			Tri-clamp
									P			Pipe fittings
									Z			Customized
Explosion										E		ExdbiaIICT6Gb
										N		Safe environment
Others											Z	Customized

2.2.2 Sensor specifications and technical parameters

(1) Sensor specifications, range, zero stability Table 2.2

Model	Diameter	Flow Range	Tri-clamp flow range	Zero Stability
	mm	kg/h	kg/h	kg/h
YSK-Z-008	8	0～960～1440		0.096
YSK-Z-010	10	0～1500～2250		0.15
YSK-Z-015	15	0～3000～4500		0.3
YSK-Z-020	20	0～6000～9000	0～4500	0.6
YSK-Z-025	25	0～9600～14400	0～9000	0.96
YSK-Z-032	32	0～18000～27000	0～14400	1.8
YSK-Z-040	40	0～30000～45000	0～27000	3
YSK-Z-050	50	0～48000～72000	0～45000	4.8
YSK-Z-080	80	0～120000～180000		12

Note: Flow range gives two parameters, the middle parameter is the standard flow range, generally factory inspection according to this range, and it is also suggested that the user choose the instrument within this range; The latter parameter is the upper flow range to ensure the stable operation of the sensor.

(2) Accuracy(Liquid) :

Measurement accuracy: ±0.1% ±（zero stability/measurement value）%

Measurement accuracy: ±0.15% ±（zero stability/measurement value）%

Measurement accuracy: ±0.2% ±（zero stability/measurement value）%

Repeatability: 1/2 measurement accuracy %

(3) Density(Liquid) measuring range and accuracy (With series transmitter)

Range: 0.3～3.000g/cm^3 Accuracy: ±0.002g/cm^3

(4) Temperature measuring range and accuracy (With transmitter):

(5) 3.4 Temperature measuring range: -20～200℃ Accuracy: ±1℃

(6) 3.5Ambient temperature: －40℃～60℃

(7) 3.6 Material : The measuring tube SS316L Housing: SS304

(8) 3.7 Working pressure: 0～4.0MPa

(9) 3.8 Explosion-proof level : Exdbia ⅡC T6G

2.2.3 Dimensions and weight

(1) Compact type flow meter Outline diagram

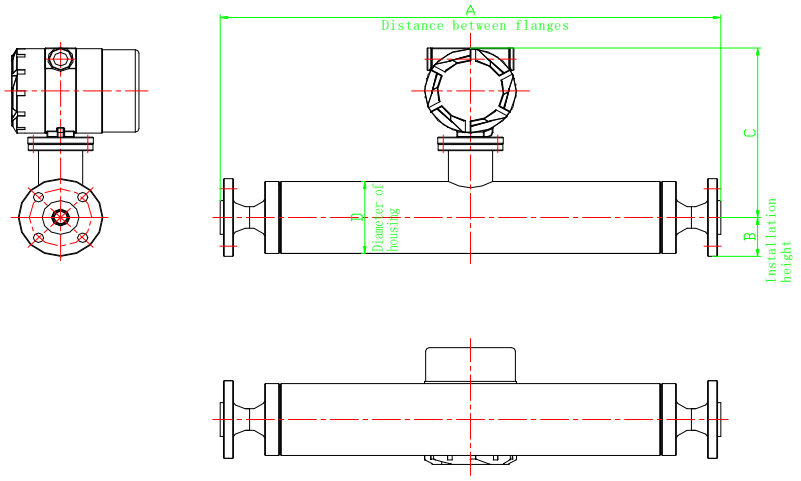


Figure2.2 Straight tube sensor outline diagram
(Sensor transmitter integrated)

(2) Compact type flow meter Installation Dimensions
Table 2.3

Size	A	B	C	D	Weight
	mm	mm	mm	mm	kg
008	492	45	235	82	10
010	542	47.5	238	87	12
015	622	52.5	238	87	13
020	685	57.5	251	106.5	18
025	751	70	257	117	23
032	867	70	264	137	31
040	963	78.5	279	157	37
050	1053	82.5	279	157	42
080	1185	115	311.5	219	66

(3) Sanitary straight tube mass flowmeter integrated outline diagram

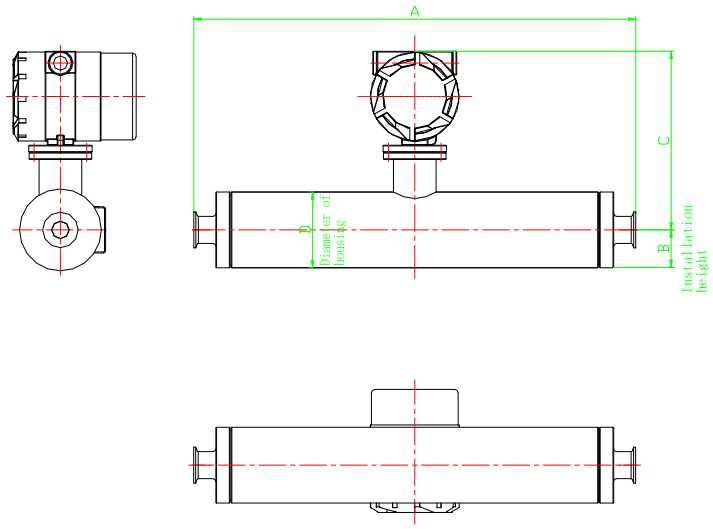


Figure2.3 Sanitary straight tube sensor outline diagram (Sensor transmitter integrated)

(4) Sanitary straight tube mass flowmeter integrated installation dimension table Table 2.4

Size	A	B	C	D	Weight
	mm	mm	mm	mm	kg
YSK-Z-020WS	598	54	257	108	17
YSK-Z-025WS	680	66.5	261	133	23
YSK-Z-032WS	680	66.5	261	133	23
YSK-Z-040WS	792	70	273	140	28
YSK-Z-050WS	864	79.5	283	159	36
YSK-Z-065WS	948	79.5	283	159	42

3. YSK-Z Selection, installation and use of straight tube flowmeter

3.1 Selection

The selection of mass flowmeter should generally consider the following principles:

3.1.1 Media scope and safety

The testability of the medium: Coriolis mass flowmeter can measure a wide range of fluids, but there are some occasions not suitable for direct selection.

For example, the mass flow rate (gas mixed together in a gas mass in a liquid fluid), the pulsating flow rate (fluid transported by a low-speed plunger pump), and so on. In these occasions need to use mass flow timing must take corresponding auxiliary measures.

Corrosion of the medium: the standard mass flow meter sensor tube material is 316L stainless steel, the housing is 304 stainless steel. When selecting, it must be confirmed that the sensor material (especially the vibration tube material) has good anti-corrosion ability for medium measurement. If the above materials are not suitable, anti-corrosion sensors should be selected.

Medium temperature, instrument pressure grade: standard model sensor medium suitable for the temperature range of -20 ~ 200℃, pressure resistance of 4MPa, when the use of conditions beyond this range must be selected special specifications of the sensor.

Environmental conditions of use: The flowmeter technical manual indicates the ambient temperature conditions for the use of sensors and transmitters. When the instrument is used beyond the specified conditions, it may not be displayed normally, and other phenomena must be paid attention to when it is installed outdoors in cold areas and used in high temperature environments, and corresponding measures must be taken.

Explosion-proof and protective performance: The explosion-proof standard of our product transmitter is flameproof type, and the explosion-proof standard of the sensor is safe spark type, and attention should be paid to whether the explosion-proof mark is suitable for the explosion-proof level of the use environment. The protection level of the transmitter is IP67, which can generally be installed and used directly outdoors, and corresponding measures should be taken when it is often wet.

3.1.2 Rationality of flow measurement parameters

Coverage of the meter measurement range: Being able to cover the entire flow measurement range is required for the safe operation of the instrument. It is necessary to avoid blindly pursuing the measurement accuracy and choosing a smaller range, which may cause the measurement to exceed the range.

The use of the best measuring range and the accuracy of the instrument: the normal measuring range of the mass flowmeter is selected in 1/3 to 2/3 of the standard range. At this time, not only can the basic measurement accuracy be guaranteed, but also the pressure loss is relatively small. Use in too small range may cause a decrease in the actual measurement accuracy, and use in the upper range may cause an increase in pressure loss.

3.1.3 Allow for pressure loss consideration

Instrument selection must consider the instrument pressure loss within a reasonable range (especially when reducing the size of the sensor), too large pressure loss will waste energy, blindly pursue to reduce the pressure loss, may increase the measurement error. YSK-Z range parameter table gives the standard range and the upper limit range, we suggest that the user should generally choose the range within the standard range.

3.1.4 Flowmeter maintainability and other related factors

This includes the convenience of installation and maintenance of the instrument; The suitability of the instrument power supply; Signal transmission and monitoring needs.

3.2 Installation

3.2.1 Preparation for flowmeter installation

When unpacking the meter, make sure there is no visible damage during transportation. In case of damage, please contact the carrier for compensation.

Instruments have been thoroughly tested and inspected before shipping. If nothing else is required, the meter should include the following items:

- YSK-Z mass flowmeter;
- Mounting bracket with split-type transmitter wall mount (not equipped with this device for one type);
- Operating instructions;
- Packing list and product certificate;
- Screwdrivers for meter mounting and terminal mounting;
- Factory and material proof as required by the contract.
- If any of these items are missing, please contact your nearest office.
- If your instrument requires a flange connection when ordering, the flange will be provided according to the order requirements. Please check the flange specifications according to your initial order.

3.2.2 Basic requirements for flowmeter installation

1) The sensor installation of YSK-Z mass flow meter should make the sensor flow direction mark consistent with the fluid flow direction, and the installation indicating arrow is on the side of the sensor nameplate bracket;
2) Coriolis mass flowmeter is a flow meter measured according to the principle of measuring pipe vibration, so the sensor installation should consider the relevant pipelines to do solid support, to avoid vibration of the instrument and related pipelines;
3) Allow to support the instrument body, it is recommended to install in the downstream of the pump (to prevent the measurement tube from vacuum-pumping);
4) If strong pipeline vibration is unavoidable, it is recommended to use flexible pipes to isolate the pipeline system from the instrument sensor;
5) The connecting flange faces should be parallel to each other during installation, so that the center of the two flanges is located on the same axis to avoid additional stress;
6) When measuring the liquid flow, ensure that the fluid flows from the bottom up as much as possible. At the same time, avoid installing the instrument at the highest point of the pipeline to prevent gas accumulation in the pipeline from affecting the normal operation of the instrument.

7) The meter can be installed horizontally, in an upward sloping pipe or vertically. For best results, vertical installation is recommended, with the flow direction up but the lateral installation must be avoided (at this time, the vibration tube is not only affected by Coriolis force, but also by the gravity of the vibration tube, so that the measurement can not be carried out properly).

3.2.3 Installation of flow sensors

1) In general, when measuring the flow of liquid medium, small amount of particulate matter medium and gas medium, vertical installation should be adopted, installed at the lowest point of the vertical pipeline, and the medium flows upward to avoid gas or liquid accumulation in the vibration tube, affecting the normal measurement.

Figure 3.1 shows the installation diagram.

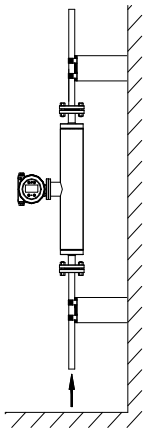


Figure3.1 Vertical installation of the sensor

2) If the measuring medium is pure liquid, you can also install it horizontally. You are advised to install the instrument at the lowest place in the entire system to ensure that the instrument is full to avoid gas accumulation and measurement errors.

The installation diagram is shown in Figure 3.2.

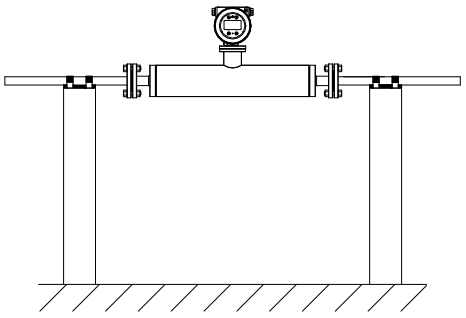


Figure3.2 Sensor horizontal installation diagram

3) When measuring the flow rate of liquid medium, small amount of particulate matter medium and gas medium, it can be installed at an Angle and the medium flows upward to avoid gas or liquid accumulation in the vibration tube and affect the normal measurement.

Figure 3.3 shows the installation diagram.

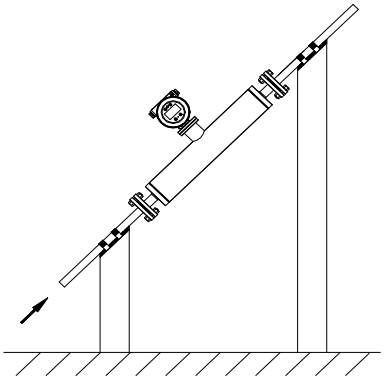


Figure3.3 Sensor Angle installation diagram

4) When using/installing a meter with a hygienic process connection, ensure that the meter is well supported/clamped due to the heavy weight of the meter itself. 3A certification requires the meter to be "self-emptier", so it must be installed vertically and flow from the bottom up. And the main part of the instrument is supported/clamped.

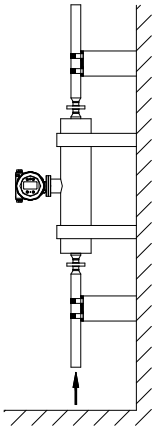


Figure3.4 Sanitary straight tube mass flowmeter installation diagram

5) Thermal insulation and heating installation, if the site needs thermal insulation, a series of materials can be used for thermal insulation treatment, pay attention to the insulation layer should not exceed the position shown.

Electric heating can be used, but be careful that the heating layer does not exceed the shown position. The liquid/steam jacket heat tracing is installed according to the heat tracing interface provided by the meter.

A reinforced flexible hose is recommended to connect the heating jacket to the heat source.

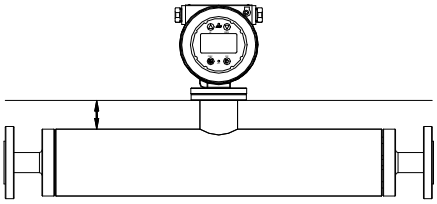


Figure3.5 Insulation and heating type straight tube mass flowmeter diagram

6) Incorrect installation introduction

Horizontal installation, long distance vertical descent after flowing through the instrument, not recommended.

The flow meter is installed at the highest point of the pipe, which can cause air accumulation.

The flow meter is installed directly at the outlet of the downward vent pipe, and this installation is not recommended

Flow regulating valves are not allowed to be installed upstream of the flow meter. If necessary, install them downstream of the flow meter.

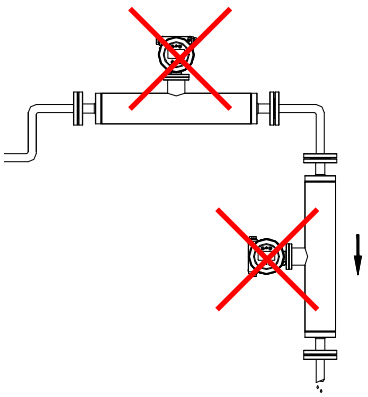


Figure3.6 Installation Introduction 1

Transverse installation, the vibration tube is not only affected by Coriolis force, but also by the vibration tube gravity, so that the measurement can not be carried out normally.

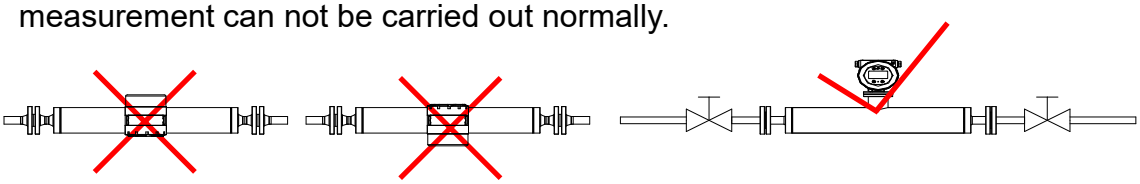


Figure3.7 Installation Introduction 2

3.2.4 Fixation of flow sensor

Coriolis mass flowmeter is a vibrating instrument, and the two vibrating tubes are always in a vibrating state when working. Therefore, external vibration or pipeline vibration may affect its work, and it will not work normally in serious cases. Therefore, when the sensor is installed, the two ends of the sensor should be fixed by brackets, and the main part of the instrument can also be fixed, as shown in the figure above. The fixed support should be installed at a stable and vibration-free interface.

If a fixed support cannot be guaranteed or the pipeline connection cannot be guaranteed to avoid vibration, the sensor can also be installed on the stable interface and connected to the sensor and the pipeline with a hose.

3.2.5 Flowmeter lifting

The following points should be noted during transportation:

- Do not remove the original packaging during transportation.
- Do not remove the protective cover on the process connector. Otherwise, the sealing surface of the process connector may be damaged mechanically during transportation or storage, and foreign matter may not enter the measuring tube.
- Use a mesh soft rope to wrap around the process connection at both ends. Do not wrap the rope around the transmitter shell or the shell of the cable connecting chamber. Do not use a chain to avoid damage to the shell. (Figure 3.8)

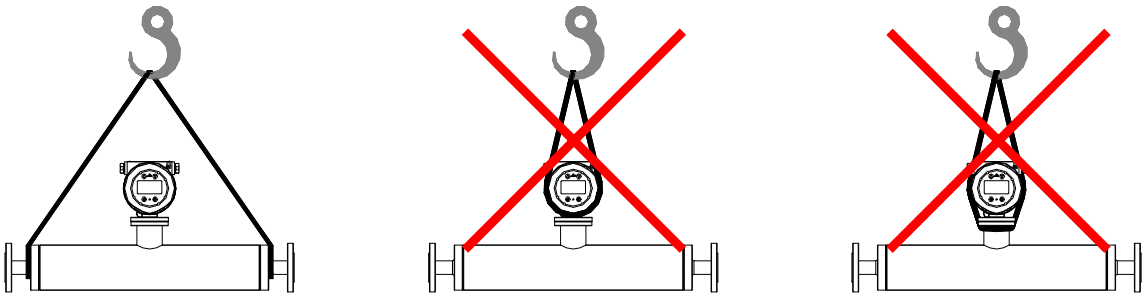


Figure3.8 Flowmeter lifting

3.2.6 Flow meter cleaning

The instrument is sealed with dry protective gas at the factory, so entering any wet gas will damage the instrument. Do not disassemble the sealing structure of the instrument on site without authorization, otherwise the instrument will be damaged. If in doubt, contact the manufacturer for guidance.

Instrument cleaning can refer to the pipeline cleaning method, it is recommended to use CIP, but it must be carried out at the rated temperature and pressure of the instrument nameplate, the use of cleaning media to fully consider the material characteristics of the instrument, do not use hard objects during the cleaning process to dredge the internal pipeline, so as to avoid damage to the internal vibration pipe and affect the measurement accuracy.

In special cases, it must be disassembled and cleaned. Be sure to ensure that the front and back shell and fastening screws of the transmitter instrument are tightened, the explosion-proof plugs on both sides of the instrument are fully sealed, the sensor part can be invaded into the water, the instrument connection and the transmitter can not be invaded into the water, and can only be washed with low pressure water. As shown in the figure

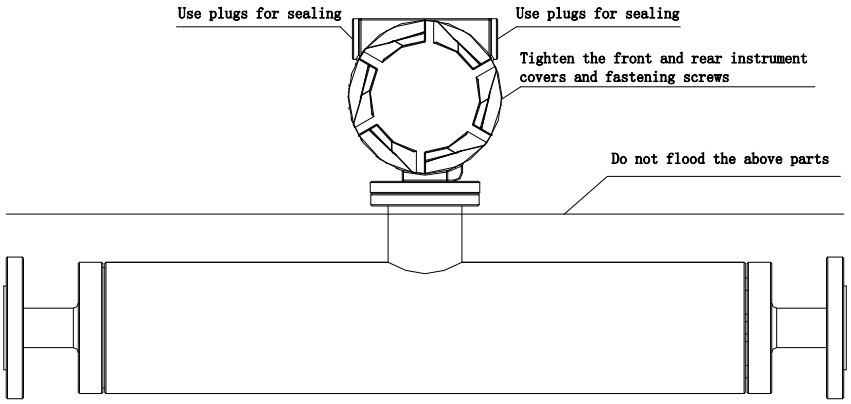


Figure3.9 Flowmeter cleaning

4. Flow meter operation



4.1 Zero point adjustment of flowmeter

The initial installation of the flowmeter may produce installation stress, which may cause the zero point of the flowmeter to change, resulting in measurement errors. Therefore, the zero point of the flowmeter must be checked after the initial installation of the flowmeter. If the zero point changes, the zero point correction operation should be performed

※ Mass flowmeter is a full tube flowmeter, whether in the running or static state need to ensure that the full tube (completely empty is also regarded as full tube), dissatisfied tube will cause the meter measurement abnormal, serious will stop working!!!

4.1.1 Prepare the conditions

(1) After the flow meter is powered on, preheat for 10 minutes;

(2) Make the measured fluid flow through the sensor until the temperature of the sensor is the same as that of the measured fluid;

(3) Close the downstream and upstream valves of the sensor, if present, so that the fluid in the sensor is stationary, and confirm that the fluid has been cut off and the fluid has filled the sensor.

(4) Before calibration, the density parameter of the instrument panel can be used to determine whether the flowmeter is in a full tube state (the density should be consistent with the density value displayed during operation).

(5) Before calibration, be sure to ensure that the medium in the flow meter is full and does not flow, and there is no abnormal phenomenon such as deposition, wall hanging, and gas-liquid mixing during calibration!! Otherwise, it will cause zero deviation, which has a huge impact on the measurement accuracy!!

4.1.2 Calibrate and wait for completion

Select "Basic Settings > Enter Password > Zero Calibration > Yes" from the system menu to perform calibration and wait for the calibration procedure to complete

4.1.3 If zero calibration fails

1) Confirm that the sensor is full of fluid and the fluid is completely stationary;
2) Ensure that the fluid does not contain particles that may precipitate;
3) Repeat zero calibration procedure;
4) If the failure occurs again, contact the manufacturer.

4.2 Flowmeter operation and maintenance

The mass flowmeter is determined by its structural characteristics and generally does not require special maintenance in use. However, in some special use states, appropriate maintenance measures should be taken to ensure the accurate and reliable operation of the flowmeter. For example:

1) If there are particles in the fluid that may accumulate in the vibration tube, it should be checked and excluded regularly to avoid affecting the normal use of the flowmeter;
2) When the measuring medium may adhere to the inner wall of the vibration tube, it should be regularly purged to avoid affecting the normal use of the flowmeter;
3) When there are particles in the measuring medium and it is possible to wear the vibration tube, it should be checked and treated in time.

4.3 Common faults and solutions

During the first installation and use, if the flow meter is found to work abnormally, the cause of the failure should be determined.

Failure causes can be divided into two types: application problems and flowmeter system problems. The application problem is more complex, such as the measurement fluctuation error caused by the change of process and medium state, should be analyzed according to the actual situation.

Common Troubleshooting Table

Table 4.1

Fault phenomenon	Reason	Solution
Large zero drift	1. Whether the medium in the flowmeter is full of tube and does not flow 2. Whether the installation pipeline of the flowmeter is fixed, and whether there is strong source or frequency transmitter interference nearby 3. The sensor is installed with stress	1. Make the flow meter full of liquid , close the valve at both ends of the flow meter 2. Add holder or use flexible pipe connection 3. The connection pipe is coaxial with the flowmeter
Instantaneous flow error	1. Whether the actual flow range exceeds the maximum set range of the flowmeter 2. Whether the installation pipeline of the flowmeter has strong vibration 3. Check whether the zero of the flow meter is normal 4. Check the FO and DP value to see if the flow meter is problem or not	1. Reduce pipe flow or reset meter flow range 2. Add holder or use flexible pipe connection 3. Calibrate zero 4. If the flow meter problem ,contact with factory
Density shows instability	1. Check the FO value in the transmitter or MODBUS,(Normal vavlue ＞200HZ，and stable) 2. Check whether the sensor pin parameters are normal	1. Check if there is bubble in the pipe and find the reason (The installation position of the regulating valve is not correct) 2. If problem please contact with factory
Flow meter no display	1. Check the power supply is normal or not 2. Measure whether the 24V power supply of the junction plate is normal	Check the power supply voltage and wiring terminals to ensure the normal operation of 24V power supply
Communication no signal	Check the communication line for reverse connection or short connection	Check the wiring or AB switch the wiring

5. transmitter wiring and instructions

5.1 Hardware instruction

Normal working condition

- Atmospheric pressure: 86kPa ~ 106kPa
- Ambient temperature: -40℃ to +60℃
- Relative humidity: 35% ~ 95%
- Power supply voltage: 22 ~ 245V AC or DC
- Power consumption: Power ≤15W
- Communication interface: 4 ~ 20mA current ring (error ≤±0.005mA), pulse 0 ~ 10kHz, RS485

5.1.1 Install the transmitter

The compact transmitter requires no additional installation

Diagram of remote installation of the transmitter

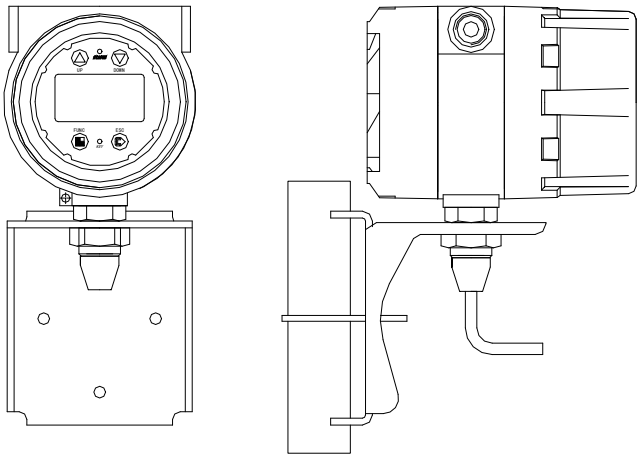


Figure5.1 installation diagram of the remote transmitter

5.1.2 Rotate the transmitter housing and the display

1) transmitter housing rotation

- Remove the fastening screws
- Carefully remove the transmitter cover
- Rotate the transmitter housing into position (90° in any direction)

- Tighten the fastening screws

2) transmitter display rotation

- Unscrew the transmitter panel cover locking block.
- Unscrew the electronic component panel cover.
- Remove the screws fastening the display panel and remove the display panel.
- Rotate display panel to desired position, plug back into socket, and install 4 fastening screws.

  Note: Make sure to align the installation with the socket!

- Replace cover and tighten by hand. Install locking block.

5.1.3 Connect cables to the transmitter terminal

Table show the name of terminals, Figure show the wiring method, **Current 2 have HART （optional）.**

Table 5.1 Definition of wiring terminal

The 1st line signal terminals	Signal Descriptions
1	RS485+
2	RS485-
3	Current output 1+
4	Current output 1-
5	Current output 2+
6	Current output 2-
7	Frequency output +
8	Frequency output -
The 2nd line signal terminals	Signal Descriptions
1	Power +
2	Power -
3	Shielding Grounding

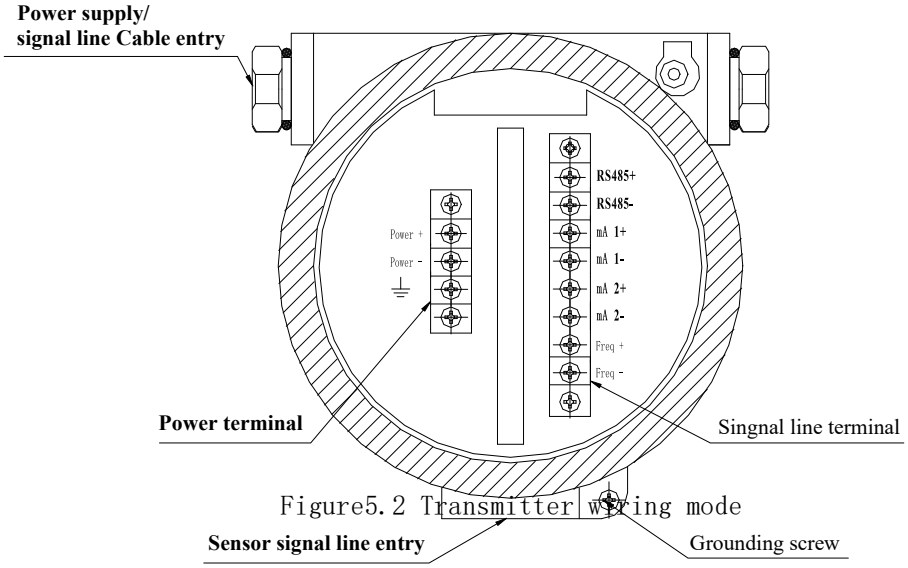


Figure5.2 Transmitter wiring mode

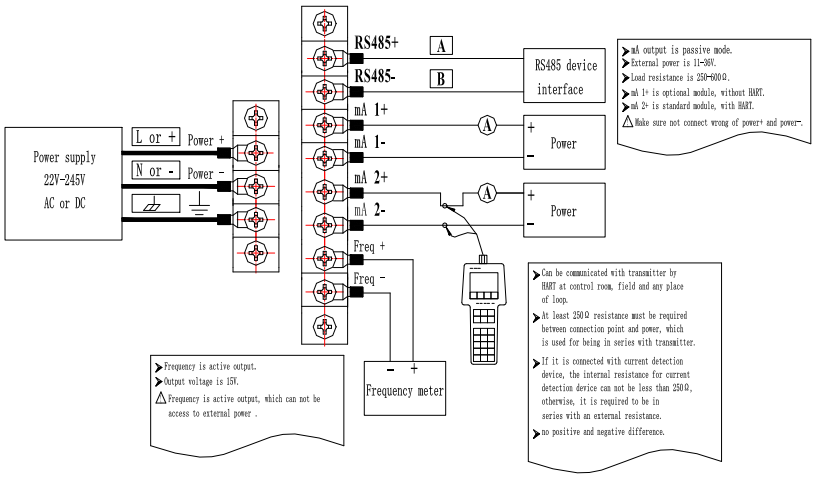


Figure5.3 Transmitter wiring diagram

5.1.4 Specific requirements for electrical wiring

1) Special cables are used

The connection between the terminal box and the transmitter should be a special cable, can not be used with other cables, so as not to affect the measurement error (separate installation).

2) Cabling Cables independently

The lead wire between the sensor and the transmitter should be routed separately. Do not cover the motor and other power equipment to avoid the impact of electromagnetic field on the measurement. The length of the lead wire should not exceed the maximum allowable distance of 100 meters (separate

installation).

3) Grounding

- **Grounding through the sensor terminal**

If the pipeline system is connected to the ground, the sensor ground terminal can be directly connected to the pipeline system.

- **Ground through the transmitter terminal**

If the pipe is not conducting or floating, the transmitter ground terminal can be directly connected to the meter protective ground access point.

Improper grounding may increase measurement errors. The grounding cable should be as short as possible, and the grounding resistance should be less than 1 ohm.

4) 4.4 Drip protection

- **All housing screws, housing covers and cable inlet gran heads must be tightened.**
- **The shell sealing gasket must be kept clean and intact when inserted into the sealing slot. The gasket can be dried, cleaned and replaced if necessary**
- **All wiring should be set up drip protection, that is, the cable inlet of the flow meter, the cable and the threading pipe should be bent downward to avoid water, resulting in short circuit.**
- **In the absence of protective measures, all cable inlet face should not face upward.**
- **The unwanted cable inlet should be sealed with a plug.**

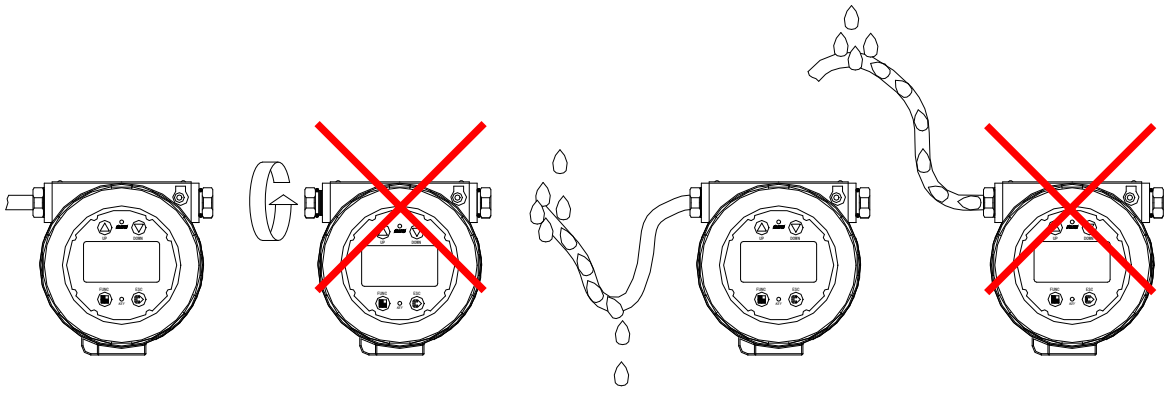


Figure 5.4 Schematic diagram of drip protection

5.2 Software operating procedure

5.2.1 List of software functions

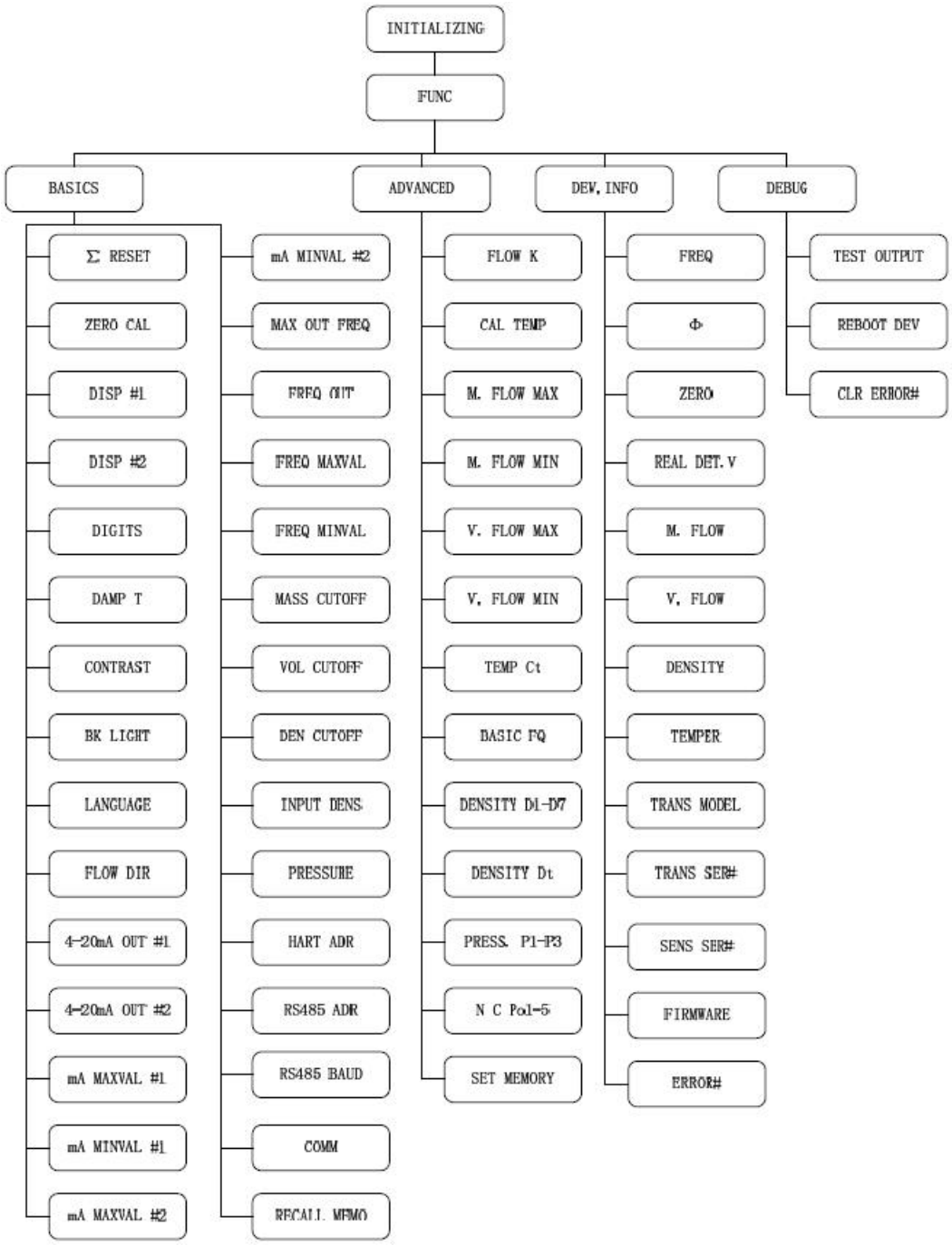


Figure 5.5 List of software functions

5.2.2 Button function

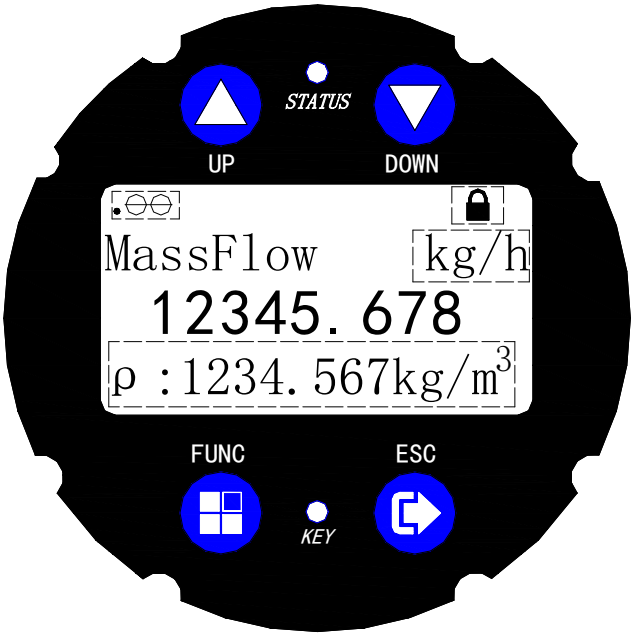


Figure 5.6 diagram of buttons

UP: move up the selection cursor
DOWN: move down the selection cursor
FUNC: function selection (main interface), confirm (setting interface)
ESC: exit the current menu
Note: The button is capacitive touch type, Use finger to touch the button to achieve the corresponding function

5.2.3 Interface description

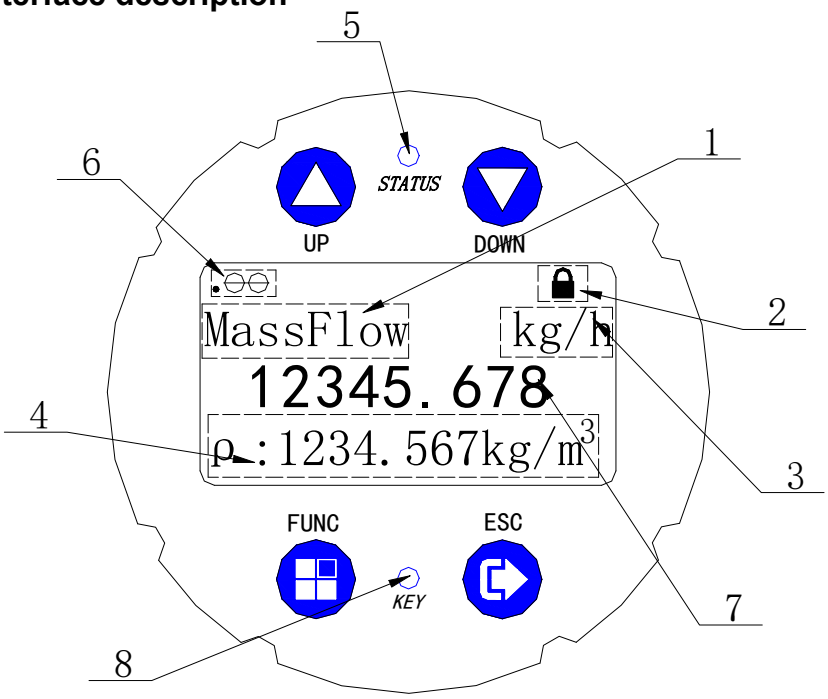


Figure 5.7 Display the interface

1) DISP #1

Any one of the following six variables can be displayed: mass flow, volume flow, total mass, total volume, density, temperature. User can set in “BASICS-＞DISP #1 menu”.

2) Keyboard lock logo

: the keyboard has been unlocked

: the keyboard has been locked

3) DISP #1 unit

User can set in “BASICS -＞DISP #1 menu”.

4) DISP #2

Any one of the following six variables can be displayed: mass flow, volume flow, total mass, total volume, density, temperature. Also measurement value, unit and variable code of DISP #2 can be displayed. At the main interface, the auxiliary display variable can be switched by UP and DOWN keys.

You can set the unit of DISP #2 in “BASICS -＞DISP #2 menu”.

Table 5.2 DISP #2 code

Mass flow	Total mass	Volume flow	Total volume	Density	Temperature
Qm	**∑m**	**Qv**	**∑v**	**ρ**	**t**

5) Keyboard status indicator lights

Green light is for unlocking and pressing keys

Red light is for locking or not pressing keys

6) Decimal cutoff indicate

When the integer length of DISP #1 or DISP #2 is too long, the display digits will be intercepted. You can set display digits in “BASICS -> DIGITS”

7) DISP #1 measurement value

Displayed updating time and damping time set by device is the same, with reference to damping

8) Key indicator

When the button is triggered, the indicator lights.

5.2.4 Lock and unlock

1) Lock

If no operation lasts for 30 seconds, the screen will lock automatically, and lock screen icon will appear.

2) 4.2 Unlock

Press and hold UP and DOWN buttons for 6 seconds, when the indicator light turns green, that means unlocking is successful, then unlocking icon will appear.

5.2.5 System menu setting structure

1) Set the menu access method

In the main interface, press FUNC to enter system setting menu, and press UP or DOWN to select function.

Table 5.3 Main interface menu table

BASICS
ADVANCED
DEV.INFO
DEBUG

2) Selection function

Press the FUNC button to enter the selection function, you need to input password to enter BASICS and ADVANCED.

5.2.6 Set the basic menu structure

Enter the system setting menu and select BASICS, press FUNC to confirm, enter the password by direction button (initial password is 17), press FUNC to confirm and enter menu, press ESC to exit to the main interface.

1) Parameter Modification

Enter BASICS menu, using the UP and DOWN keys to select the submenu. Press the FUNC key to modify and select the parameters by the UP and DOWN keys. Press the FUNC key to confirm or press ESC to cancel.

Table 5.4 Basic Settings menu and parameters

Serial No.	Menu	Setting Method	Parameters Range
1	DISP #1	Option	Mass flow/volume flow/total mass/total volume/density/temperature
2	DISP #2	Option	Mass flow/volume flow/total mass/total volume/density/temperature
3	DIGITS	Set data	0~3
4	DAMP T	Set data	0~60.0s
5	CONTRAST	Set data	25~50
6	BK LIGHT	Option	Open/close
7	LANGUAGE	Option	Chinese/English
8	FLOW DIR	Option	Positive/ reverse/ bidirectional/ absolute value
9	MASS CUTOFF	Set data	0~50%
10	4~20mA OUT #1	Option	Mass flow/volume flow/density/temp.
11	4~20mA OUT #2	Option	Mass flow/volume flow/density/temp.
12	mA MAXVAL #1	Set data	-60000~60000 (unit is the same as range)
13	mA MINVAL #1	Set data	-60000~60000 (unit is the same as range)
14	mA MAXVAL #2	Set data	-60000~60000 (unit is the same as range)
15	mA MINVAL #2	Set data	-60000~60000 (unit is the same as range)
16	MAX OUT FREQ	Set data	0.0000~10.0000kHz
17	FREQ OUT	Option	Mass flow/volume flow
18	FREQ MAXVAL	Set data	-60000~60000 (unit is the same as range)
19	FREQ MINVAL	Set data	-60000~60000 (unit is the same as range)
20	MASS CUTOFF	Set data	0~50%
21	VOL CUTOFF	Set data	0~50%
22	DEN CUTOFF	Set data	0.000~1.000g/cm^3
23	INPUT DENS	Set data	0.0000~3.0000g/L
24	PRESSURE	Set data	0.00~99.00MPa
25	RS485 ADR	Set data	0~31
26	RS485 BAUD	Option	1200/2400/4800/9600
27	COMM	Option	RS485/HART
28	RECALL MEMO	Option	Yes/No
29	RESET	Option	Yes/No

30	ZERO CAL	Option	Yes/No

5.2.7 Advanced Settings menu structure

Enter the main menu and select the ADVANCED setting, press the FUNC key to confirm, enter the password by direction key (User password 987), press FUNC key to confirm and enter the menu, press the ESC key to exit to the main interface.

Table 5.5 Advanced Settings menu and parameters

Serial No.	Menu	Setting Method	Parameters Range
1	FLOW K	Set data	0~9999.99
2	CAL TEMP	Set data	-50.0~100.0
3	M.FLOW MAX	Set data	0~60000 Unit: t/h, kg/h, g/h
4	M.FLOW MIN	Set data	0~60000 Unit: t/h, kg/h, g/h
5	V.FLOW MAX	Set data	0~60000 Unit:m^3/h, L/h, mL/h
6	V.FLOW MIN	Set data	0~60000 Unit:m^3/h, L/h, mL/h
7	TEMP Ct	Set data	-999.999~999.999
8	BASIC FQ	Set data	0~500.00
9	DENSITY D1	Set data	-999.999~999.999
10	DENSITY D2	Set data	-999.999~999.999
11	DENSITY D3	Set data	-999.999~999.999
12	DENSITY D4	Set data	-999.999~999.999
13	DENSITY D5	Set data	-999.999~999.999
14	DENSITY D6	Set data	-999.999~999.999
15	DENSITY D7	Set data	-999.999~999.999
16	DENSITY Dt	Set data	-50~100.0
17	PRESS.P1	Set data	-999.999~999.999
18	PRESS.P2	Set data	-999.999~999.999
19	PRESS.P3	Set data	-999.999~999.999
20	N C Po1	Set data	0~150 -50~50.00
21	N C Po2	Set data	0~150 -50~50.00
22	N C Po3	Set data	0~150 -50~50.00
23	N C Po4	Set data	0~150 -50~50.00
24	N C Po5	Set data	0~150 -50~50.00
25	SET MEMORY	Option	Yes/No

Enter ADVANCED menu and select the submenu by the UP and DOWN keys. Press the FUNC key to modify and select the parameters by the UP and

DOWN keys. Press the FUNC key to confirm and press ESC to cancel. The ADVANCED menu and parameters are shown in Table 5.5.

5.2.8 Display setting

1) DISP #1 setting

DISP #1 can be set separately for mass flow, volume flow, total mass, total volume, density, temperature.

Table 5.6 Display variable type and unit

Display variable	Display variable unit							
Mass flow	g/s	g/min	g/h	kg/s	kg/min	kg/h	kg/day	t/s
	t/min	t/h	t/day	lb/s	lb/min	lb/h	lb/day	
Volume flow	ml/s	ml/min	ml/h	L/s	L/min	L/h	L/day	m^3/s
	m^3/min	m^3/h	m^3/day	Gal/s	Gal/min	Gal/h	Gal/day	
Total mass	g	kg	t	lb	—	—	—	—
Total volume	ml	L	m^3	Gal	—	—	—	—
Density	g/cm^3	g/L	g/ml	kg/L	kg/m^3	lb/Gal	—	—
Temperature	℃	℉	—	—	—	—	—	—

Setting method for DISP #1: BASICS ->Input password -> DISP #1 setting ->Select the type of display variables ->Select the display unit.

2) DISP #2 setting

Same as DISP #1

DIGITS Setting: BASICS ->Input password -> DIGITS -> Set digits

3) DIGITS

DIGITS setting range is 0-3, when DISP #1 or DISP #2 automatically intercepts digits because of too long integer bits, “00” will be displayed at the upper left corner of the screen, which means the current displayed values have decimal digits to be intercepted..

DIGITS Setting: BASICS ->Input password -> DIGITS -> Set digits

4) CONSTRAST

Setting value is 25-50, set the contrast of the current LCD. LCD contrast setting method: BASICS ->Input password -> CONSTRAST ->Set the contrast value

5) BK LIGHT

You can select backlight-off when the transmitter LCD is in a bright place; You can select backlight - on under dark environment.

The setting method for BK LIGHT: BASICS ->Input password -> BK LIGHT

- >Select the backlight state

6) LANGUAGE

Chinese and English are optional

Language setting methods: BASICS -> Input password -> LANGUAGE -> Select the language type

7) 8.5 LCD backlight

The liquid crystal of the transmitter can be clearly displayed in bright places without backlight, and the backlight can be turned off optionally.

If the display is not clear in a dark environment, you can choose to turn on the backlight;

LCD backlight setting method: Basic Settings -> Enter password -> LCD backlight -> Select backlight state.

8) 8.6 Displaying Languages

To switch the display language (Chinese/English).

Display language setting method: Basic Settings -> Enter password -> Display language -> Select language type.

9) Measurement setting

① DAMP TIME

This setting is used to eliminate the small and dramatic fluctuations during measurement process. The damping value sets the reaction time of transmitter response to the change of process variable (Unit is second and setting range is 0-60S). This setting value will affect the response speed of mass flow, volume flow and density andnot affect the totalmass and total volume.

- Higher damping value makes the measurement value change significantly smoother, the change for display, current output and frequency output is slower;
- Lower damping value makes the measurement value change more quickly, the change for display, the current output
- and the frequency output is faster;

- Imposing higher damping value on fast and intense flow changes may result in measurement error;
- As long as the damping value is not zero, the measurement value will lag behind the actual change value, since the measurement value is an average over time; Generally, low damping value is preferred because ofa low probability of data loss and shorter lag time between the actual changed value and the measurement value;
- For gas applications, it is recommended to set the damping to 2.56 or higher.
- Updating damping setting: BASICS ->Input Password ->DAMP T -> Modify damp values

② **Small signal cutoff**

This setting specifies the minimum measurement values, the measurement value which is lower than the cutoff value will be displayed as 0; This setting includes mass flow cutoff, volume flow cutoff and density cutoff.

Mass flow cutoff setting range is 0-50% of range, 2 display digits;

Volumetric flow cutoff setting range is 0-50% of range, 2 display digits;

Density cutoff setting range is 0-1g/cm^3, 3 display digits;

Volume flow cutoff does not affect the measurement value of mass flow and density; Mass flow cutoff and density cutoff will affect the measurement value of volume flow; The measurement value of volume flow is calculated by the density;

Mass flow cutoff setting method: BASICS ->Input password ->MASS CUTOFF -> Modify the mass flow cutoff

Volume flow cutoff setting method: BASICS -> Input password ->VOL CUTOFF -> Modify the volume flow cutoff

Density cutoff setting method: BASICS ->Input password -> DEN CUTOFF -> Modify the density cutoff

Note: The Display of measurement value, frequency output and current output are to undergo the small signal cutoff.

③ INPUT DENS

For the volume flow measurement of the known fluid density, when the input density is not 0, then the volume flow calculation will ignore the actual density measurement value, use the input density as a reference of volume flow. Input the density unit is g/cm^3,input range is 0-3g/cm^3, display digit is 4.

Setting method: BASICS -> Input password -> INPUT DENS -> modify the fluid density

④ FLOW DIR

Flow direction will determine how the fluid forward flow and reverse flow affect the measurement value, the current output value and frequency output value.

- Forward flow: in accordance with flow direction arrow on the sensor;
- Reverse flow: in contrast to the flow direction arrow on the sensor;

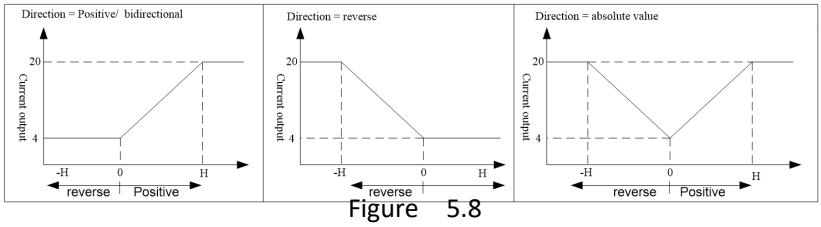
Table 5.7 Flow option table

Flow direction setting	The relation with sensor arrow	The relation with displayed value
Forward	Apply to the same in the direction of the flow arrow and most of the traffic situation	Forward flow displayed value is the measurement value; Direction flow displayed value is 0; Forward flow total mass and total volume increase; Reverse flow total mass and total volume are not changed.
Reverse	Apply to the opposite in the direction of the flow arrow and most of the traffic situation	Direction flow displayed value is 0; Forward flow displayed value is the measurement value（no minus sign）; Forward flow total mass and total volume are not changed; Reverse flow total mass and total volume increase.
Absolute value	Regardless of the direction of arrow	Forward flow displayed value is the measurement value; Direction flow displayed value is the measurement value（no minus sign）; Forward flow total mass and total volume increase; Reverse flow total mass and total volume increase.
Bidirection	Apply to the forward flow and reverse flow, and forward and reverse flow can not be ignored	Forward flow displayed value is the measurement value; Direction flow displayed value is the measurement value（with minus sign）Forward flow total mass and total volume increase; Reverse flow total mass and total volume decrease.

- The effect of flow direction on current output
  Flow direction will affect the current output type only when the current output

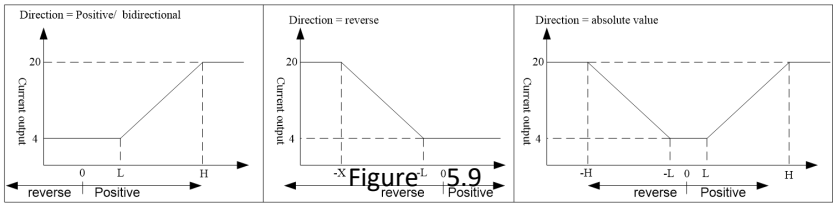
configuration at mass flow or volume flow.

The influence of the flow direction on the current output depends on the current lower limit parameter:



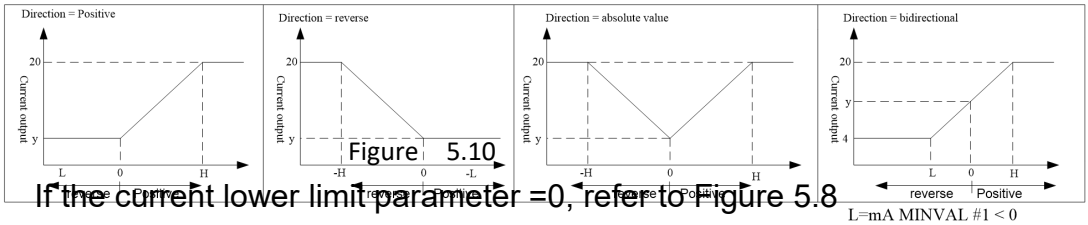
L=mA MINVAL #1 = 0
H=mA MAXVAL #1

Figure 5.8



L=mA MINVAL #1 > 0
H=mA MAXVAL #1

Figure 5.9



L=mA MINVAL #1 < 0
H=mA MAXVAL #1
y= (H/(H-L))*16+4 (mA)

Figure 5.10

If the current lower limit parameter =0, refer to Figure 5.8

If the current lower limit parameter is >0, refer to Figure 5.9

If the current lower limit parameter is negative, refer to Figure 5.10

The effect of flow direction on frequency output

Table 5.8 Flow direction influence on output frequency table

Flow direction setting	Actual flow direction		
	Forward	Zero flow	Reverse
Forward	Output>0	Output=0	Output0
Reverse	Output=0	Output=0	Output>0
Absolute value	Output>0	Output=0	Output>0
Bidirection	Output>0	Output=0	Output>0

- The effect of flow direction on total mass

Table 5.9 Flow direction impact on total volume table

Flow direction setting	Actual flow direction		
	Forward	Zero flow	Reverse
Forward	Total mass increases	Total mass not changed	Total mass not changed
Reverse	Total mass not changed	Total mass not changed	Total mass increases
Absolute value	Total mass increases	Total mass not changed	Total mass increases
Bidirection	Total mass increases	Total mass not changed	Total mass decreases

10) Current output Settings

This setting is used for the configuration scheme of the current output and the range value of the flow rate represented by the output current. (Includes current #1 and current #2)

① **Current configuration Setting**

You can select mass flow, volume flow, density and temperature as the value of current output.

4~20mA OUT setting method: BASICS->Input user password ->4-20mA OUT ->Select value

② **4~20mA MAXVAL and 4~20mA MINVAL**

4~20mA output mass flow: value is -60000~60000, the unit is the same as mass flow range.

4~20mA output volume flow: value is -60000~60000, the unit is the same as volume flow range.

4~20mA output temperature: value is -250~400℃.

4~20mA output density: value is 0~3000, the unit is the same as density.

4mA is corresponding to the mA MIN value.

20mA is corresponding to the mA MAX value.

mA MAX value and mA MIN value setting method:

BASICS->Input user password -> mA MAX value ->Modify value

BASICS ->Input user password -> mA MIN value ->Modify value

Note :

- The current signal output by the current value represents the current measured value. When the actual value is less than the cut value, the measured value output is 0 and the current value output is 4mA.
- The parameter value of the lower current limit cannot be greater than the parameter value of the upper current limit; otherwise, the current will output an incorrect value.

11) Set frequency output

This setting is used for configuration scheme of frequency output, as well as the flow rate of the output frequency represents. Settings include frequency output configuration, frequency maximum value, pulse output equivalent, frequency minimum value.

① **FREQ OUT**

Mass flow and volume flow can be optional;

Setting method: BASICS ->Input user password -> FREQ OUTPUT ->Select mass flow or volume flow.

② **FREQ MAXVAL**

Be used for setting the flow value which high frequency represents, unit is the same as that of device range, modify the scope of value (0-60000).

③ **FREQ MINVAL**

This value is identically equal to zero.

Setting method: BASICS ->Input user password ->FREQ MINVAL->Set value

④ **MAX OUT FREQ**

Be used for setting the frequency value corresponding to max flow.

⑤ **Equivalent pulse calculation**

The equivalent pulse is calculated as follows:

Equivalent pulse = (upper limit flow of pulse signal - lower limit flow of pulse signal)/upper limit frequency

For example, the pulse signal corresponds to the mass flow rate; The upper limit of flow is 36000kg/h, the lower limit of flow is 0kg/h, and the upper frequency is 10kHz.

Pulse equivalent = (36000-0) ÷3600÷10000=0.001 kg/ pulse =1000 pulses /kg

Ps: ÷3600 to convert the flow unit to /s

12) RESET

After reset, the total mass flow and total volume flow will accumulate again.

Setting method: BASICS ->Input password ->RESET-> Select yes.

13) ZERO CAL

After installation, modify the stored zero value to the zero value which is applied to the current application, the setting method is below:

※Mass flowmeter is a full tube flowmeter, whether in the running or static state need to ensure that the full tube (completely empty is also regarded as full tube), dissatisfied tube will cause the meter measurement abnormal, serious will stop working!!!

① **Preparatory condition**

- After the flow meter is energized, preheat for 10 minutes;
- Flow the measured fluid through the sensor until the temperature of the sensor is the same as the temperature of the measured fluid;
- Close the downstream and upstream valves of the sensor, if present, so that the fluid in the sensor is stationary, and confirm that the fluid has been cut off and the fluid has filled the sensor.
- **Before calibration, you can judge whether the flowmeter is in a full tube state by the density parameter of the instrument panel (the density should be consistent with the density value displayed during operation).**

- **l Before calibration, be sure to ensure that the medium in the flow meter is full and does not flow, and there is no abnormal phenomenon such as deposition, wall hanging, and gas-liquid mixing during calibration!!! Otherwise, it will cause zero deviation, which has a huge impact on the measurement accuracy!!**

② **Calibrate and wait for completion**

In the system menu, select "BASICS>Input password>ZERO CAL>Yes"

③ **Troubleshooting for ZERO CAL**

- Make sure the sensor has been filled with fluid and the fluid is completely static;
- Ensure that the fluid does not contain precipitated particles;
- Repeat the procedure of zero adjustment;
- Please contact with the manufacturer.

14) Communication Setting

① **COMM selection**

In system menu select “BASICS-Input password-COMM-Select RS485 or HART”

② **RS485**

If the current communication mode is RS485, the following Settings are valid.

- RS485 ADR: in system menu select “BASICS-input password-RS485 ADS-Input the address for the current device”, the range is 0-31
- RS485 BAUD: in system menu select “BASICS-input password-RS485 BAUD-select value”, 2400/4800/9600 can be optional.

③ **RECALL MEMO**

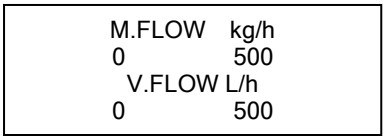
In system menu select” BASICS-input password-RECALL MEMO-select Yes”, restore the current settings to the initial status

15) Device status and output test

① **Instrument information**

Enter the system setting menu and select the DEV.INFO, press the FUNC key to enter and query by the direction key. Press ESC key to exit to the main interface. DEV.INFO is read-only mode and can not be modified.

DEV.INFO includes data info, closed loop data info, range info, series info, model info, firmware info and error code, shown as below:



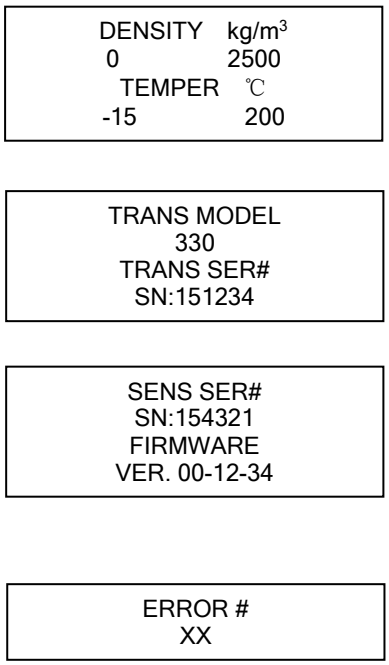


Figure 5.11

② **Debug Menu**

Perform device output test function.

- TEST OUTPUT

Provide test function for frequency and current output. After enter this function, frequency and current output is stable value; After exit this function, return to normal output. This function can be used for adjusting current coefficient and verify the work status of device output part. After enter this function, the output value of frequency and current can be adjusted through adjusting percentage of output by UP or DOWN key.

- REBOOT DEV

Reboot the device.

- CLR ERROR#

Clear the error code of the device.

16) ADVANCED menu

This menu can be only set under the condition of field replacing sensor and calibration. When the device is working in the field, the parameters of this menu can not be adjusted, otherwise it may cause measurement error.

① **Flow coefficient**

When re-calibrating and replacing the sensor, if the error between the measured value and the actual flow value exceeds the error level of the instrument, the instrument can be calibrated by adjusting this coefficient, the adjustment method is as follows:

New flow coefficient = existing meter coefficient × (1- error value)

The representation method in the sensor is the way of scientific counting. First, the value is changed to the calculated new flow coefficient value, the value

range is 0 ~ 9.9999. Then change the power value to change the size of the value, the power value change range is 0 to 4.

Note: The flow value measured by the flowmeter needs to take the average value of multiple measurements (the number of measurements is greater than 3).

② **CAL TEMP**

Calibration temperature is used for recording the fluid temperature when flow coefficient calibrate, which is for temperature compensation.

③ **M.FLOW MAX/MIN**

Mass flow range of the device, which is required to be set according to the connected sensor. Normally, M.FLOW MIN is set according to dynamic range setting. Device range unit: t/h, kg/h, g/h

Table 5.10 Meter range unit table

t/h	kg/h	g/h

④ **V.FLOW MAX/MIN**

Volume flow range of the device, which is required to be set according to the connected sensor. Device range unit: m^3/h, L/h, mL/h

Table 5.11 Volume flow range unit table

m^3/h	L/h	mL/h

⑤ **TEMP Ct**

Temperature coefficient is used for temperature compensation. This is advanced setting and can not be changed. Please contact with the manufacturer for any changes, otherwise, any changes will make the measurement parameters (mass flow etc) inaccuracy when temperature is changed.

⑥ **BASIC FQ**

Basic frequency is the parameter used for density measurement. After sensor installation, record the vibration frequency when the pipe is empty and input the value here, which is sued for the calculation of density. This is advanced setting and can not be changed. Please contact with the manufacturer for any changes, otherwise, any changes will make the measurement parameters (density/volume etc) inaccuracy.

⑦ **DENSITY D1**

This density D1 and basic frequency is used for calculating fluid density, the method of modification and calibration is the same as Flow coefficient.

⑧ **DENSITY D2~D7**

This coefficient can be used only for adopting <JJG_370-2007 Online vibration tube liquid density meter verification procedures>

⑨ **DENSITY Dt**

This coefficient is used for recording fluid temperature when DENSITY D1 calibration, which is used for temperature compensation for density.

⑩ **Storage factory Settings**

The current Settings are stored as factory Settings. If you select Restore factory Settings in the basic Settings, the storage status of the value is restored

⑪ **ADVANCED SETTING**

Pressure coefficient P1-P3, N C Po1~5 is advanced setting, which can not be changed. Please contact with the manufacturer for any changes, otherwise, it will lead to inaccuracy in measurement.

5.3 Explosion protection of transmitter

When the instrument is used in explosion-proof occasions, explosion-proof instruments must be used to ensure safety.

The main explosion-proof form of the FT-52X series transmitter is flameproof type, and the connection part of the sensor is installed with intrinsic safety measures to ensure the explosion-proof performance of the sensor.

The transmitter housing is aluminum alloy housing. The connection between the outer cover of the terminal and the body, the connection between the outer cover of the transmitter display operation part and the body, and the sealing ring of silicone rubber between the transmitter display window and the housing are all sealed.

The transmitter external wiring cables (power and signal output cables) should be cables with an outer diameter of 8mm. Cables are connected to the table through M20x1.5 compression nuts, gaskets, and cable sealing rubber rings. After cables are connected, lock the nuts to ensure cable sealing.

A safety gate is installed at the wiring outlet of the transducer and the sensor to ensure the explosion-proof performance of the sensor.

In order to explosion-proof safety, the sealing structure of the flowmeter must not be damaged during use.

When the transmitter needs to open the cover, the instrument power supply must be disconnected first. The transmitter is forbidden to open the cover in the energized state. Reclosing the cover must ensure that the transmitter is sealed, check and confirm before power.

The sensor housing should be grounded nearby, and the cross-sectional area of the wire should not be less than 1 square millimeter.

YSK-Z transmitter ModBus communication protocol description

Hardware Version ： V11， File Version ： 201609V11

ModBus communication protocol（RTU Format）

1. Read N variables

Host request information frame:

Meter address +0x03+ Register start address (2 bytes, high byte first) + register read/write number 2*N (2 bytes, high byte first) + CRC check code (2 bytes, low byte first)

Slave response message frame:

Meter address +0x03+ bytes of data 4*N (1 byte) + register data (4*N bytes, the high byte before) + CRC check

Code check (2 bytes, low byte first)

2. Write N variables

Host request information frame:

Meter address + Function code 0x10+ Register start address (2 bytes, high byte first) + register read/write number 2 x N (2 bytes, high byte first) + data bytes 4 x N (1 byte) + data to be written (4 x N bytes, 4 x N bytes) High byte in front) + CRC check code (2 bytes, low byte in front) ·

Slave response message frame:

Meter address + Function code 0x10+ Register start address (2 bytes, high byte first) Register read/write quantity 2 x N (2 bytes, high byte first) + CRC check code (2 bytes, low byte first)

Read and write variable addresses are shown in Table 1:

Table 1 YSK-Z transmitter ModBus communication variable address

No	Name	Access Type	Address (DEC)	Default

1	Mass Flow	Read	2000	floating-point number
2	Volume Flow	Read	2002	floating-point number
3	Medium Temperature	Read	2004	floating-point number
4	Medium Density	Read	2006	floating-point number
5	Total Mass L	Read	2008	floating-point number
6	Total mass H	Read	2010	Length shaping, the unit changes as the setting unit changes. Total amount =H* 1,000,000 +L
7	Total Volume L	Read	2012	floating-point number
8	Total Volume H	Read	2014	Length shaping, the unit changes as the setting unit changes. Total amount =H* 1,000,000 +L
9	Mass Flow Unit	Read-write	2030	0~14 , 5 g/s，g/min，g/h，kg/s，kg/min，kg/h，kg/day，t/s，t/min，t/h，t/day，lb/s，lb/min，lb/h，lb/day
10	Total Mass Unit	Read-write	2032	0~3，1 g，kg，t，lb
11	Volume Flow	Read-write	2034	0~14，5 ml/s，ml/min，ml/h，L/s，L/min，L/h，L/day，m^3/s，m^3/min，m^3/h，m^3/day， Gal/s，Gal/min，Gal/h，Gal/day
12	Total Volume Unit	Read-write	2036	0~3，2 ml，L，m^3，Gal
13	Medium Temperature Unit	Read-write	2038	0~1 , 0 ℃，℉
14	Medium Density Unit	Read-write	2040	0~5，0 g/cm^3，g/L，g/ml，kg/L，kg/m^3，lb/Gal
15	Clear aggregate command	Read-write	2052	Write 0，Total clearing volume; Read back 1
16	Calibration zero command	Read-write	2054	Write 0，Total clearing volume; Read back 1
17	Refresh Time	Read-write	2056	0.0~60.0s，0.5s
18	Decimal Digits	Read-write	2058	0~3，3
19	Mass flow excision ratio	Read-write	2060	0.00~50.00%，1%
20	Volume flow excision ratio	Read-write	2062	0.00~50.00%，1%
21	Density-cut value	Read-write	2064	0.0000~1.0000g/cm^3，0.0050g/cm^3
22	Input fluid density	Read-write	2066	0.0000~3000.0000g/L
23	Liquid Pressure	Read-write	2068	0.00~99.99MPa
24	Liquid Direction	Read-write	2070	0~3，1(Forward, reverse, bidirectional, absolute value)
25	Language	Read-write	2072	0~1，0 Chinese、English

26	Upper limit of mass range	Read-write	2074	0~99999 ， 6000
27	Lower limit of mass range	Read-write	2076	0~99999，0
28	Mass Range Unit	Read-write	2078	0~2，1 t/h，kg/h，g/h
29	Upper limit of volume range	Read-write	2080	0~99999，6000
30	Lower limit of volume range	Read-write	2082	0~99999，0
31	Volume range unit	Read-write	2084	0~2，1 m^3/h，L/h，ml/h
32	Upper limit of density range	Read-write	2086	0~3000，3000
33	Lower limit of density range	Read-write	2088	0~3000，0
34	Density Range Unit	Read-write	2090	0 kg/m^3
35	Upper limit of temperature range	Read-write	2092	-200~400，180
36	Lower limit of temperature range	Read-write	2094	-200~400，-50
37	Temperature range Unit	Read-write	2096	0 ℃
38	Current output 1 configuration	Read-write	2098	0~3，0 Mass flow rate, volume flow rate, medium density, medium temperature
39	Current output 2 configuration	Read-write	2100	0~3 ， 1 Mass flow rate, volume flow rate, medium density, medium temperature
40	Current 1 Upper limit parameter	Read-write	2102	Mass flow：-99999~99999 Volume flow：-99999~99999 Medium density：0.0~3000.0 Medium Temperature：-250~400
41	Current 1 lower limit parameter	Read-write	2104	Mass flow：：-99999~99999 Mass flow：：-99999~99999 Medium density ：0.0~3000.0 Medium Temperature：-250~400
42	Current 2 Upper limit parameter	Read-write	2106	Mass flow：：-99999~99999 Mass flow：：-99999~99999 Medium density：0.0~3000.0 Medium Temperature：-250~400
43	Current 2 lower limit parameter	Read-write	2108	Mass flow：：-99999~99999 Mass flow：：-99999~99999 Medium density ：0.0~3000.0 Medium Temperature：-250~400
44	Frequency output configuration	Read-write	2114	0~1，0 Mass Flow，Volume Flow

45	Upper frequency parameter	Read-write	2116	Mass Flow：-99999~99999 Volume Flow：-99999~99999
46	Lower frequency parameter	Read-write	2118	Mass Flow：-99999~99999 Volume Flow：-99999~99999
47	Upper output frequency limit	Read-write	2122	0~10kHz，10
48	flow coefficient	Read-write	2124	0~10000.000，8.1234
49	Nominal flow temperature	Read-write	2126	-50.0~100.0℃，25.0
50	Flow temperature coefficient	Read-write	2128	-999.999~999.999，-51.08
51	Foundation vibration frequency	Read-write	2130	50.000~500.000Hz，140.000
52	communication password	Write	2216	
53	Set communication password	Write	2218	

Note: Read-only data does not have password protection. Write data only after entering the correct password.

In the user Settings menu, if you select Restore factory Settings, the communication password will be restored to the factory default value, which is used to restore the communication password that the user forgot to set.

When setting the communication password, the original password must be written to the setting register before the password can be changed. For example, the communication password, the old password is 0124, the new password is 2018, then the setting, first write 0124 to address 2216, then write 2018 to address 2218, after receiving the data, the transmitter automatically checks whether the original password is correct, if correct, the 2018 password is set. Otherwise it is invalid.

*Note：

Each register is 4 bytes, occupies two addresses (low address addressing), data transmission using 32-bit single-precision floating-point number (high before);

Address 2052 corresponds to the total clear register, write 0 to the address to perform total clear operation; Return 1 when reading this register;

Address 2054 corresponds to the zero calibration register, write 0 to the address to carry out the total zero clearing operation; Return 1 when reading this register;

Table 2:Setting instructions

Date	0	1	2	3	4	5	6	7
Mass Flow Unit	g/s	g/min	g/h	kg/s	kg/min	kg/h	kg/day	t/s
Date	8	9	10	11	12	13	14	
Mass Flow Unit	t/min	t/h	t/day	lb/s	lb/min	lb/h	lb/day	

Date	0	1	2	3	4	5	6	7
Volume Flow Unit	ml/s	ml/min	ml/h	L/s	L/min	L/h	L/day	m^3/s
Date	8	9	10	11	12	13	14	
Volume Flow Unit	m^3/min	m^3/h	m^3/day	Gal/s	Gal/min	Gal/h	Gal/day	

Date	0	1	2	3
Total Mass Unit	g	kg	t	lb

Date	0	1	2	3
Total Volume Unit	ml	L	m^3	Gal

Date	0	1	2	3	4	5
Medium Density Unit	g/cm^3	g/L	g/ml	kg/L	kg/m^3	lb/Gal

Date	0	1
Medium temperature Unit	℃	℉

Date	0	1	2
Instrument range unit	t/h	kg/h	g/h
Date	0	1	2
Flow range unit	m^3/h	L/h	ml/h
Date	0	1	2
Current configuration	Mass Flow	Volume Flow	Density
Date	0	1	
Frequency configuration	Mass Flow	Volume Flow	
Date	0	1	
Language	Chinese	English	

Date	0	1	2	3
Liquid Direction	Forward direction	Reverse direction	bidirection	Absolute Value