

Turbine flow sensor

Turbine flow transmitter

Intelligent Turbine Flowmeter

Intelligent Turbine Flow Transmitter



user ' s manual

- High quality turbine, extensive range ability
- Multi-kinds of transducer, be used widely
- Intelligent information processing, unique meter factor , three nonlinear correction

I. Overview

QFM404 Turbine Flow Sensor (Hereinafter referred to as sensor). Based on the principle of torque balance, It belongs to speed flow meter. The sensor has the characteristics of simple structure, light weight, high precision, good repeatability, responsiveness, easy installation and maintenance, etc. It is widely used in petroleum, chemical, metallurgy, water supply, papermaking and other industries. It is an ideal instrument for flow measurement and energy saving.

The sensor is used in conjunction with the display instrument. It is suitable for measuring liquids in closed pipes that do not corrode stainless steel 1Cr18Ni9Ti, 2Cr13 and corundum Al_2O_3 , cemented carbide, and have no impurities such as fibers and particles. If it is matched with a display instrument with special functions, it can also perform quantitative control and over-alarm alarm. The explosion-proof type (ExmIIT6) of this product is selected, and it can be used in an explosive environment.

The sensor is suitable for media with a viscosity of less than $5 \times 10^{-6} m^2/s$ at operating temperature. For liquids with a viscosity of greater than $5 \times 10^{-6} m^2/s$, the sensor must be calibrated with real liquid before use.

If the user needs to use a special form of sensor, the order can be negotiated. When an explosion-proof sensor is required, it should be explained in the order.

II. QFM404 Basic turbine flow sensor

1. Structural characteristics and working principle

(1) Structure

The sensor is a hard alloy bearing thrust type, which not only guarantees accuracy and improves wear resistance, but also has the characteristics of simple structure, firmness and convenient disassembly.

(2) Working principle

The fluid flows through the sensor housing. Because the blades of the impeller have a certain angle with the flow direction, the impulsive force of the fluid makes the blades have a rotating torque. After the friction torque and fluid resistance are overcome, the blades rotate. The rotation speed is proportional to the flow rate. Because the blade is magnetically conductive, it is in the magnetic field of the signal detector (consisting of permanent magnetic steel and coil). The rotating blade cuts the magnetic line of force and periodically changes the magnetic flux of the coil, so that the coil ends. An electrical pulse signal is induced. This signal is amplified and shaped by an amplifier to form a continuous rectangular pulse wave with a certain amplitude, which can be transmitted to a display instrument to show the instantaneous flow or total amount of fluid. Within a certain flow range, the pulse frequency f is proportional to the instantaneous flow Q of the fluid flowing through the sensor, and the flow equation is:

$$Q = 3600 \times \frac{f}{k}$$

In the formula:

F--Pulse frequency [Hz]

k--Instrumentation factor of the sensor [1/m³], Given by checklist.

Q-- Instantaneous flow of fluid (Under working condition) [m³/h]

3600-- Conversion factor in seconds

The instrument coefficient of each sensor is filled in the verification certificate by the manufacturer, and the k value is set in the matching display instrument, which can display the instantaneous flow and the cumulative total.

2. Basic parameters and technical performance

(1) Basic parameters:

DN4—DN40 The caliber sensor is screw connection, the maximum working pressure is 6.3Mpa;

DN50—DN200 The caliber sensor is screw connection, the maximum working pressure is 6.3Mpa

DN4—DN10 Caliber sensor with straight pipe sections.

Sensors with diameters above DN15 can be equipped with straight pipe sections.

(2) **Medium temperature:** -20~+120℃.

(3) **Ambient temperature:** -20~+65℃.

(4) **Power supply:** Voltage:+6-24V DC, Current: ≤10mA.

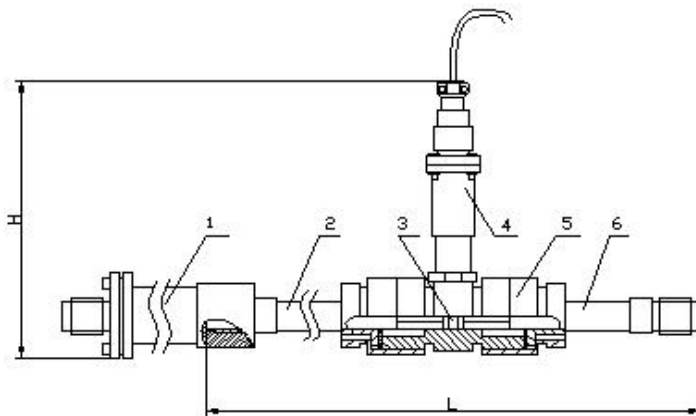
3.6V / 0.3mA when powered by battery. RS485 communication current increased by 0.6mA.

(5) **Transmission distance:** The distance from the sensor to the display instrument can reach 1000m.

3. Installation, use and adjustment

(1) Installation

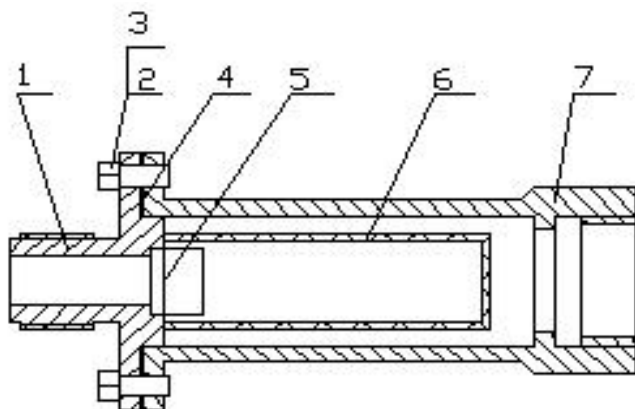
The installation method of the sensor is based on different specifications, and it is connected by thread or flange. The installation method is shown in Figure 1, Figure 2, and Figure 3, and the installation dimensions are shown in Table 2.。



1. Filter 2. Front straight section 3. Impeller 4. Preamplifier

5. Case 6. Rear straight section

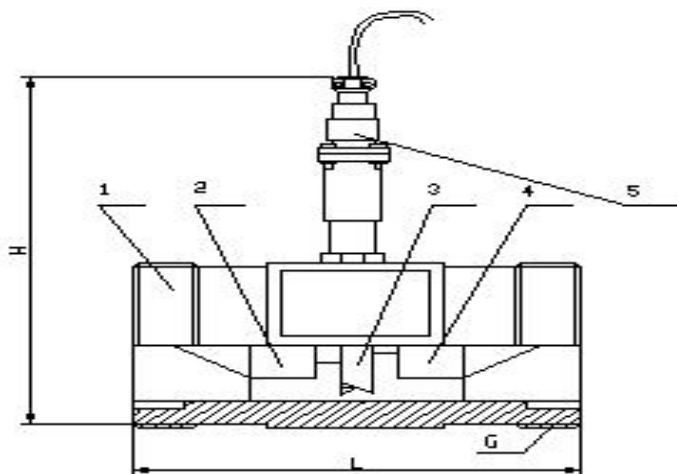
Overall structure diagram



1. Compression ring 2. Bolt 4×14 3. washer 4. Sealing washer
5. Steel wire 1Cr18Ni9Ti-0.8×2.5 6. Filter 7. Seat

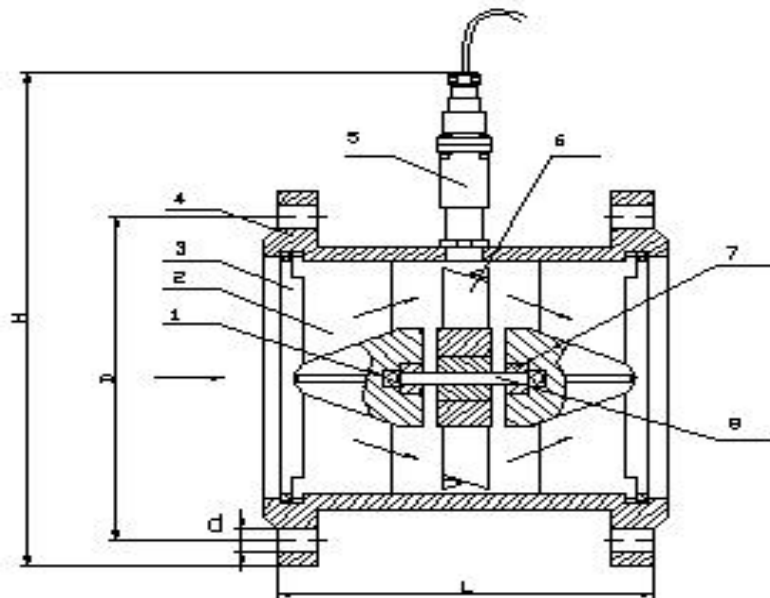
Filter structure diagram

Figure 1: QFM404-4~10 Schematic diagram of sensor structure and installation dimensions



1. Case 2. Front guide 3. Impeller 4. Rear guide 5. Preamplifier

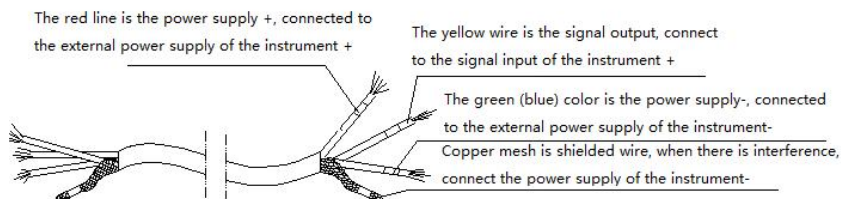
Figure 2:QFM404—15 ~ 40 Schematic diagram of sensor structure and installation dimensions



1. Jack joint 2. Front guide 3. Rising circle 4. Case
5. Preamplifier 6. Impeller 7. Bearing 8. Axis

Figure 3 :QFM404—50~200 Schematic diagram of sensor structure and installation dimensions

(2) QFM404 Turbine flow sensor wiring instructions: as shown



(3) Wiring instructions for explosion-proof turbine flow sensor:

Open the back cover, as shown:

I+	I-	F+	Fout	F-	3.6+	3.6-	A	B
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Frequency wiring: 24 power supply is connected to F + and F-, frequency line is connected

Fout, connect 3.6+ and 3.6- when the battery is powered,

485 wiring: 24V power is connected to F + and F-485 lines to A and B.

Current wiring: If the customer's field system is a two-wire system 24V + connected to I +, the current line is connected to I-.

Three-wire system, connect 24V + to I + and current line to I-, then short-circuit the current line and the GND of 24V power supply in the system.

Four-wire system, 24V + connects to I +, current line connects to I-, then short-circuit 24V GND and current GND of the system together.

(4) Sensor structure size chart: Table 2

Table 2

Metric diameter (mm)	L(mm)	H(mm)	G	L' (mm)	D(mm)	d(mm)	Hole
4	275	145	G1/2	215			
6	275	145	G1/2	215			
10	455	165	G1/2	350			
12	75	173	G1				
15	75	173	G1				
20	85	173	G1				
25	100	173	G5/4				
32	140	175	G1 1/2				
40	140	178	G2		Φ110	Φ18	4
50	150	252			Φ125	Φ18	4
65	180	278			Φ145	Φ18	4
80	200	287			Φ160	Φ18	8
100	220	322			Φ180	Φ18	8
125	250	347			Φ210	Φ18	8
150	300	367			Φ250	Φ22	8
200	360	415			Φ295	Φ22	12

The sensor can be installed horizontally and vertically, and the fluid direction must be upward when installed vertically. The liquid should fill the pipe without bubbles. During installation, the liquid flow direction should be consistent with the direction of the arrow on the sensor housing indicating the flow direction. The upstream end of the sensor should have a straight pipe section of at least 20 times the nominal diameter length,

and the downstream end should be no less than 5 times the straight pipe length of the nominal diameter, and its inner wall should be smooth and clean without defects such as dents, scale and peeling. The axis of the pipeline of the sensor should be aligned with the axis of the adjacent pipeline, and the gasket used for connecting and sealing should not go deep into the internal cavity of the pipeline.

The sensor should be far away from the external electric field and magnetic field, and if necessary, effective shielding measures should be taken to avoid external interference.

In order not to affect the normal delivery of liquid during maintenance, it is recommended to install a bypass pipe at the installation location of the sensor.

When the sensor is installed in the open air, please waterproof the amplifier and plug. The wiring of the sensor and the display instrument is shown in Figure 4.

When the fluid contains impurities, a filter should be installed. The mesh of the filter is determined according to the impurities of the flow rate, generally 20 to 60 mesh. When free gas is mixed in the fluid, a degasser should be installed. The entire piping system should be well sealed.

The user should fully understand the corrosion of the measured medium to prevent the sensor from being corroded.

(5) Use and adjust

◆ When using, the liquid to be tested should be kept clean and free of impurities such as fibers and particles。

◆ When the sensor starts to be used, the sensor should be slowly filled with liquid, and then the outlet valve should be opened. It is strictly forbidden that the sensor is impacted by high-speed fluid when there is no liquid.

◆ The maintenance period of the sensor is generally half a year. When overhauling and cleaning, please pay attention not to damage the parts in the measuring chamber, especially the impeller. Pay attention to the positional relationship between the guide and the impeller during assembly.

◆ When the sensor is not in use, the internal liquid should be cleaned, and protective covers should be added at both ends of the sensor to prevent dust and dirt from entering, and then stored in a dry place.

◆ When used, the filter should be cleaned regularly. When not in use, the internal liquid should be cleaned. Just like the sensor, add a dust cover and store it in a dry place.

◆ The transmission cable of the sensor can be laid overhead or buried (iron pipes should be covered when buried.)

◆ Before installing the sensor, first connect the display instrument or oscilloscope, connect the power supply, use a mouth blower or

hand-push the impeller, make it rotate quickly to observe whether there is display, and install the sensor when there is display. If there is no display, check the relevant parts to eliminate the fault.

III. QFM404 type turbine flow transmitter

The QFM404 type turbine flow sensor is based on the QFM404 basic turbine flow sensor. It adds 24VDC power supply and 4-20mA two-wire current transmission function. It is especially suitable for use with computer control systems such as display instruments, industrial computers, and DCS.

Please refer to the second part of the manual "QFM404 basic turbine flow sensor" for the flow measurement range, sensor structure size, installation method and maintenance of each caliber of this transmitter.

$$\text{Flow calculation formula: } Q = \frac{I - 4}{16} Q_F$$

In the formula: Q ——Actual flow, m³/h

Q_F——Flow measurement upper limit, m³/h, See table 1

I ——Current output, mA

Transmitter power supply voltage: 24V, (12V-30V)

Relationship between supply voltage and load resistance:

$$R_{LMAX} = \frac{U - 12}{0.02} - 100$$

In the formula :R_{LMAX}——Maximum load resistance, Ω

U——Supply voltage, V

IV. Intelligent turbine flowmeter

User menu operation

After the power is turned on, the meter first self-tests, and after completion, it enters the work main display state of screen 1

OK	SAVE
Instant	0 . 000 m ³ /h
0 0 0 0 0 0 0 0 .	<u>0001</u> Nm ³
Flow V	0. 0000 m ³ /s

The first line: self-test normal sign, LCD backlight is turned on, before SAVE shows IOUT is current output, FOUT is frequency output, 485OUT is 485 output.

Second line: instantaneous flow.

The third line: cumulative flow.

The fourth line: flow rate display, only after setting the caliber.

Press SHIFT to switch between work screen 2 and work screen 1.

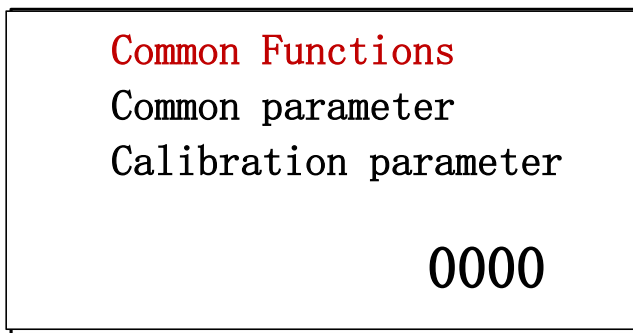


Chart 1 Menu 1

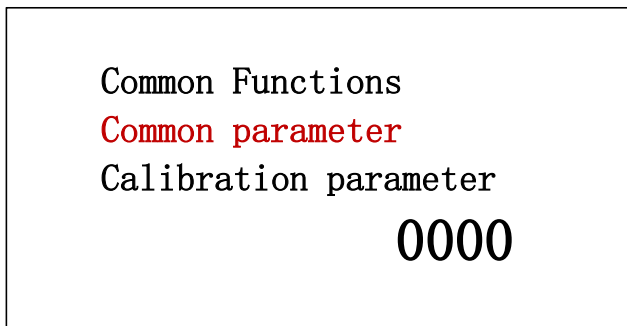


Chart 2 Menu 2

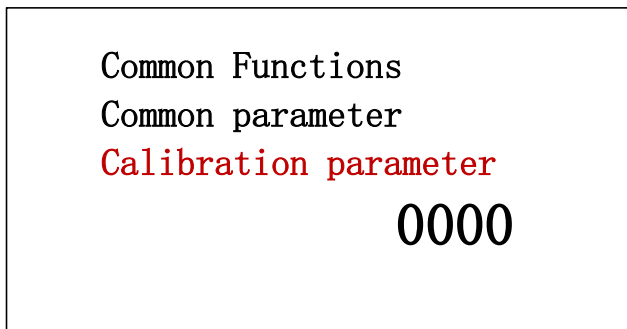


Chart 3 Menu 3

The circuit board can be found through the appearance of three buttons, their functions are:

- SHIFT:** a. Switch the screen. You can switch to the menu screen by pressing this on the main interface.
- b. To switch menu items, press this key on the menu screen to switch between different menus.
- c. Shift key. In parameter setting, you can use this key to shift.
- d. Exit. In the parameter setting, if there is no displacement item, press this button to exit the menu item.
- △:** Digital item plus function, press this item to adjust the size of the digital item, the digital size can be displayed cyclically. For example, if the current display is 6, you can display it as 8 by pressing twice, or display it as 1 by pressing 3 more times.
- SET:** a. Confirm function, mainly after modifying the parameter, press this button to confirm the parameter
- b. Switch the menu. In the parameter setting, press this key directly to switch to other parameters. The parameter list is displayed cyclically. When the last list is pressed, press again to return to the main menu.

The first menu is the user menu. The password is 0000 by default. It is used for basic settings. The second menu is for parameter query. The frequency value can be queried. There is also an overflow sign. When the flow is greater than 100 million, the main interface cumulative flow is cleared. The overflow flag here counts as 1. It is cleared when the overflow flag is greater than 9. The calibration parameters are mainly used for current calibration and restoring factory settings.

Cumulative clearing function: Long press the middle button on the main interface for more than 5 seconds to clear the cumulative flow.

Table 1 User parameter setting menu The default password of the user menu is 0000.

Submenu serial number	Menu display	meaning	Selection or value range
1	Language	Chinese and English switch	Switch between Chinese and English display
2	Algorithm	Algorithm selection (Default 0)	00: Conventional volume flow 01: Conventional mass flow
3	Unit	Flow unit selection (Default 0)	0: m ³ /h 1: l/m 2: kg/h 3: l/h 4: t/h 5: kg/m 6: m ³ /m
4	F min HZ	Lower limit for segment calibration	The default is 0. Note that the segment value here is set to frequency.
5	F min HZ	Upper limit value for segmented calibration	The default is 0, the upper limit calibration has 3 values, For example, the lower calibration limit is 0, the upper calibration limit 0 is set to 50, and the upper calibration limit 1 is set to 100. If the flow coefficient 0 is set to 3600 and the upper flow limit 1 is set to 1800, the frequency is 0-50HZ and the 3600 coefficient is used for calculation, and 50-100HZ is calculated using the 1800 coefficient.。
6	Flow Coefficient	Flow coefficient (default 3600)	Set the meter coefficient, the unit is P / m ³ , and the meter coefficient can be set to 4 corresponding segment calibrations.

7	Full Flow	Full-scale output flow (Default 1000)	When the instrument outputs a 4 ~ 20mA analog signal, this value must be set and must not be 0
8	Density	Density settings (Default 1000)	When the algorithm selection is set to mass flow, this item must be set, the unit is kg / m ³
9	Lower cut	Cut-off frequency	When the lower limit cutoff 0 is set, cut off the frequency value less than this value, and when the lower limit frequency 1 and 2 are set, cut off the value between the two values.
10	password	set password	The default is 0. The user can set a four-digit password arbitrarily. When forgetting the password, enter 1111 as the universal password.
11	Backlight	Backlight switch	This item is a backlight switch, set to 0 is off, when set to 1, the backlight is turned on, the default is on, when opened, the LCD logo will appear in the upper left corner of the main interface, customers can switch according to demand.
12	Caliber	Caliber setting	The setting here is based on the actual caliber. If it is 0, the flow rate on the main interface is displayed as 0. If the flow rate is required, the corresponding caliber must be set here.

V. Production verification

The production adjustment of the instrument should be carried out by a professional who has a deep understanding of the instrument under the condition of calibration equipment with corresponding accuracy. In the two-wire system adjustment, at least a current meter with a range > 20mA and an accuracy better than 0.1% should be available.

Production adjustment and some advanced settings are carried out in the production setting state. If there is no corresponding equipment and sufficient professional knowledge, improper adjustment will cause the instrument to not work properly. After the password is confirmed, you can enter the production setting state, and set the corresponding instrument parameters according to different instrument models.

Open the front cover of the watch, according to the definition of Table 2, press the parameter menu to select the required settings in turn, and enter the production verification menu

Table 2 Corresponding menu of the production verification menu table 3 The verification menu password is 4321.

Submenu serial number	Menu display	meaning	remark
1	4mA Calibration	4mA Current calibration	All calibrations must ensure that the value is 4.000 calibrations. For example, the current meter displays 3.9956, enter 3.9956 here, it is recommended not to change the settings here and 20mA, because the instrument is equipped with a 16-bit high-precision DA conversion chip compared to other instruments , Higher than the general multimeter accuracy, can guarantee the accuracy within 1.5 thousandths.
2	20mA Calibration	20mA Current calibration	Same as above, except that the menu must be

			calibrated when the value is 20.000.
3	RESET	Here is the factory calibration setting	It is forbidden to reset the parameters, which will affect the operation and measurement accuracy of the instrument

VI. Repairs and common faults

The general faults and elimination methods of the sensors may be shown in Table 3. The maintenance period should not exceed half a year.

Table 3

NO.	Fault phenomenon	The reason	Elimination method
1	The display instrument has no display on the flow signal and the inspection signal.	1. The power is not turned on and the given voltage is incorrect. 2. The display is faulty.	1. Turn on the power and set the voltage as required. 2. Overhaul the display instrument.
2	The display instrument shows the "check" signal but not the flow signal.	1. The wiring between the sensor and the display is wrong, or there is an open circuit, short circuit, poor contact, etc. 2. The amplifier is defective or damaged. 3. The converter (coil) is open or short-circuited. 4. The impeller is stuck. 5. No fluid flow or blockage in the pipeline.	1. Check the correctness and quality of the wiring, referring to Figure 4. 2. Repair or replace the amplifier. 3. Repair or replace the coil. 4. Clean the sensor and pipeline. 5. Open the valve or pump and clean the pipeline.

3	The display instrument is unstable; the measurement is incorrect.	1. The actual flow rate is beyond the measuring range of the instrument or unstable. 2. The meter factor K is set incorrectly. 3. Fibers and other impurities are hung inside the sensor. 4. There are bubbles in the liquid. 5. There is strong electromagnetic interference next to the sensor. 6. The sensor bearing and shaft are severely worn. 7. The shielding layer of the sensor cable or other grounding conductor is disconnected from the line ground wire or has poor contact. 8. Display instrument failure.	1. Adapt the measured flow rate to the measuring range of the sensor and stabilize the flow rate. 2. Make the coefficient K set correctly. 3. Clean the sensor. 4. Take degassing measures to eliminate bubbles. 5. Try to stay away from interference sources or take shielding measures. 6. Replace the "guide" or "impeller shaft". 7. Refer to Figure 4 and connect the wires. 8. Overhaul the display instrument.
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When the user observes the provisions of the manual for storage and use, within one year from the date of shipment from the manufacturer, if the sensor fails to work due to poor manufacturing, the manufacturer can repair it for free.

VII. Transportation and storage

The sensor should be packed in a sturdy wooden box or carton. It is not allowed to move freely in the box. Care should be taken when handling it.

The storage location should meet the following conditions:

- a. Protect from rain and moisture.
- b. Not subject to mechanical vibration or impact.
- c. Temperature range $-20\text{ }^{\circ}\text{C} \sim +65\text{ }^{\circ}\text{C}$.
- d. The relative humidity is not more than 80%.
- e. No corrosive gas in the environment.

VIII. Notes on unpacking

1. After unpacking, check whether the documents and accessories are complete according to the packing list.

The packing documents are: a manual

a product certificate

2. Observe whether the sensor is damaged due to transportation for proper disposal.

3. Don't lose the "qualified certificate" properly, otherwise the meter coefficient cannot be set!

IX. Ordering instructions

When ordering the turbine flow sensor, the user should pay attention to select the appropriate specifications according to the nominal diameter of the fluid, working pressure, working temperature, flow range, fluid type and environmental conditions. When there is an explosion-proof requirement, an explosion-proof sensor must be selected, and strict attention must be paid to the explosion-proof level.

When you need our company's display instrument matching, please refer

to the corresponding manual, select the appropriate model, or our company's technical staff will design and select for you based on the information you provide. When the cable for signal transmission is required, specify the specification length.