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LEFOO

INTELLIGENT TURBINE FLOWMETER

User Manual

CONTENTS

I. OVERVIEW

The turbine flow sensor (hereinafter referred to as the sensor) operates on the principle of torque balance and belongs to the category of velocity-type flow meters. The sensor is characterized by its simple structure, lightweight design, high accuracy, good repeatability, responsive measurement, and ease of installation, maintenance, and use. It is widely used in industries such as petroleum, chemical, metallurgy, water supply, and paper manufacturing, making it an ideal instrument for flow measurement and energy conservation.

The sensor, when paired with a display instrument, is suitable for measuring liquids in closed pipelines that do not corrode stainless steel (1Cr18Ni9Ti, 2Cr13), sapphire (Al_2O_3), or hard alloys, and that are free of fibers, particles, and other impurities. When used with specialized display instruments, it can also perform functions such as quantitative control and over-limit alarms. The explosion-proof version of this product (Exdib mb IIB T6 Gb) can be used in environments with explosion hazards.

The sensor is suitable for measuring media with a viscosity of less than $5x10^{-6}$ m²/s at operating temperature. For liquids with a viscosity greater than $5x10^{-6}$ m²/s, the sensor must be calibrated with the actual liquid before use.

If the user requires a sensor in a special form, they may negotiate the order. For explosion-proof sensors, please specify this requirement when placing the order.

II. BASIC TYPE TURBINE FLOW SENSOR

1. Structural Features and Working Principle

(1) Structural Features

The sensor uses a thrust-type hard alloy bearing, which not only ensures accuracy and enhances durability but also features a simple, robust structure that is easy to assemble and disassemble.

(2) Working Principle

When fluid flows through the sensor housing, the impeller blades, which are set at an angle to the flow direction, are subjected to the fluid's force, generating a torque that causes the blades to rotate. This rotation overcomes friction and fluid resistance, leading to a stable rotation speed once torque balance is achieved. Under certain conditions, the rotational speed is proportional to the fluid velocity. The blades are made of magnetically conductive material and are located within the magnetic field of a signal detector (comprising a permanent magnet and a coil). As the blades rotate, they cut through the magnetic field lines, periodically changing the magnetic flux through the coil, inducing an electrical pulse signal at the coil terminals. This signal is amplified and shaped by an amplifier into a continuous rectangular pulse wave of a certain amplitude, which can be transmitted to a display instrument to show the instantaneous or total fluid flow.Within a certain flow range, the pulse frequency is proportional to the instantaneous flow rate Q of the fluid passing through the sensor. The flow equation is:

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

In the equation:

f- Pulse frequency [Hz]

K - Meter factor of the sensor [1/m], provided by the calibration certificate.

Q- Instantaneous fluid flow rate (under working conditions) [m³/h]

3600 - Conversion factor from seconds to hours

The meter factor k for each sensor is documented by the manufacturer in the calibration certificate. By entering the k value into the corresponding display instrument, the instantaneous flow rate and cumulative total can be accurately displayed.

2. Basic Parameters and Technical Performance

(1) Basic Parameters: See Table 1

Table 1

		□□□	□	□	□	Description
Type	1					Basic type, 24V DC power supply
	2					4–20mA two-wire current output, remote transmission type
	3					Battery-powered on-site display type
	4					On-site display / 4–20mA two-wire current output
	5					RS485 communication output
Nominal diameter		4				4mm, standard turbine flow range 0.04–0.25 m³/h
		6				6mm, standard turbine flow range 0.1–0.6 m³/h
		10				10mm, standard turbine flow range 0.2–1.2 m³/h
		15				15mm, standard turbine flow range 0.4–6 m³/h
		20				20mm, standard turbine flow range 0.6–8 m³/h
		25				25mm, standard turbine flow range 1.2–12 m³/h
		32				32mm, standard turbine flow range 1.5–15 m³/h
		40				40mm, standard turbine flow range 3–30 m³/h
		50				50mm, standard turbine flow range 5–50 m³/h
		65				65mm, standard turbine flow range 5–70 m³/h
		80				80mm, standard turbine flow range 12–120 m³/h
		100				100mm, standard turbine flow range 20–200 m³/h
		125				125mm, standard turbine flow range 25–280 m³/h
		150				150mm, standard turbine flow range 10–400 m³/h
		200				200mm, standard turbine flow range 80–800 m³/h
Explosion-proof						No mark indicates non-explosion-proof type.
			B			Explosion-proof type
				A		Accuracy level 1
					A	Standard turbine

DN4-DN40 sensors are standardly equipped with threaded connections.
DN50-DN200 sensors are standardly equipped with flange connections.
DN4-DN10 sensors come with upstream and downstream straight pipe sections.

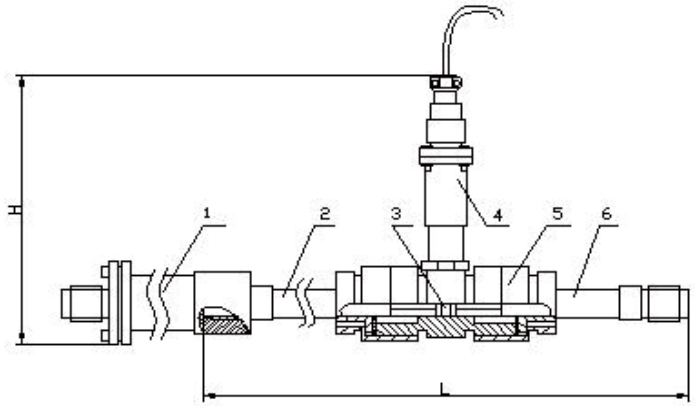
(2) Medium temperature: -20 to +80°C. For temperatures higher than this range, special customization is required, with a maximum temperature resistance of 120°C.

(3) Ambient temperature: -20 to +65°C.

(4) Power supply: Voltage: 24V DC
For battery-powered operation: 3.6V/0.3mA. RS485 communication increases current by 0.6mA.
(5) Transmission distance: The distance between the sensor and the display instrument can reach up to 100 meters.

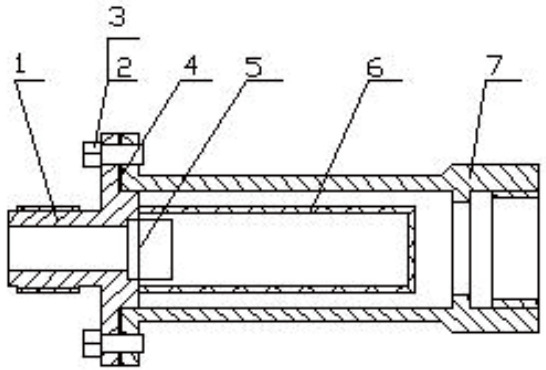
3. Installation, Usage, and Adjustment

(1) Installation Types
The installation method of the sensor varies depending on the specifications, utilizing either threaded or flange connections. Installation methods are shown in Figures 1, 2, and 3, with installation dimensions provided in Table 2.



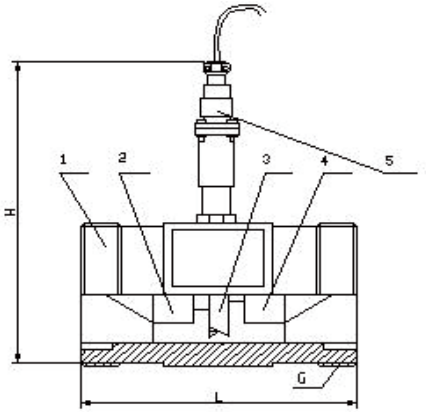
1. Filter 2. Upstream straight pipe section 3. Impeller
4. Pre-amplifier 5. Housing 6. Downstream straight pipe

Section Complete Structure Diagram Of The Meter



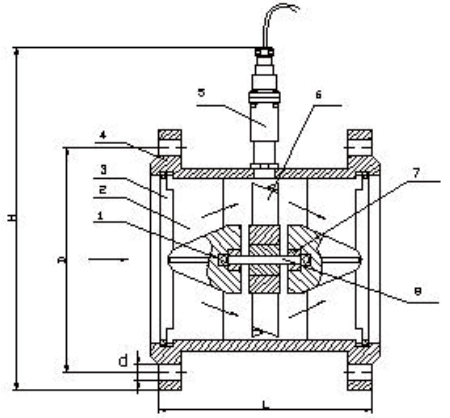
1. Retaining ring 2. Bolt 4x14 3. Washer 4. Sealing gasket
5. Wire 1Cr18Ni9Ti-0.8x2.5 6. Filter screen 7. Base Filter structure diagram

Figure 1: Structural and installation dimension diagram of 4~10 sensors



1. Housing
2. Front guide
3. Impeller
4. Rear guide
5. Pre-amplifier

Figure 2: Structural and installation dimension diagram of 15~40 sensors

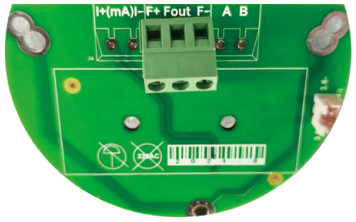


1. Ball bearing
2. Front guide
3. Expanding ring
4. Housing
5. Pre-amplifier
6. Impeller
7. Bearing
8. Shaft

Figure 3: Structural and installation dimension diagram of 50~200 sensors

4. Wiring Instructions for the Turbine Flowmeter

(1) 24V Power Supply with Pulse Output Type

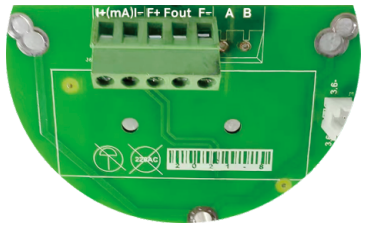


Terminal labels

Display screen

Wiring instructions for the circuit board are as follows:
F+: Connect to the positive 24V power supply “+”
F-: Connect to the negative 24V power supply “-”
Fout: Connect to the pulse output

(2) 24V power supply with pulse and 4-20mA output type:

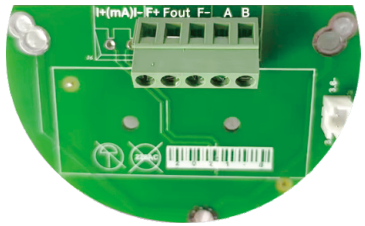


Terminal labels

Display screen

Wiring instructions for the circuit board are as follows:
For two-wire configuration: I+: Connect to the positive 24V power supply (+) I-: Connect to the 4-20mA signal
For pulse signal collection: F+: Connect to the positive 24V power supply (+) F-: Connect to the negative 24V power supply (-) Fout: Connect to the pulse output

(3) 24V Power Supply with Pulse and RS485 Communication Type:

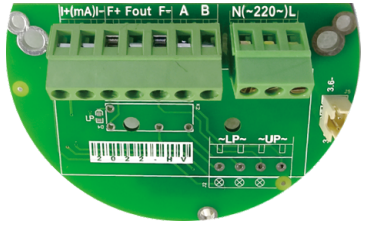


Terminal labels

Display screen

Wiring instructions for the circuit board are as follows:
F+: Connect to the positive 24V power supply (+) F-: Connect to the negative 24V power supply (-)
Fout: Connect to the pulse output A: Connect to the positive 485 (+) B: Connect to the negative 485 (-)

(4) 220V Power Supply with Pulse, 4-20mA, and RS485 Communication Type：



Terminal labels

Display screen

Wiring instructions for the circuit board are as follows:
For 4-20mA signal collection:
L: Connect to the positive 220V power supply N: Connect to the negative 220V power supply
I+: Connect to the positive 4-20mA signal I-: Connect to the negative 4-20mA signal

For pulse signal collection:
F+: Connect to the positive 220V power supply (+)
F-: Connect to the negative 220V power supply (-) Fout: Connect to the pulse output
For RS485 signal collection:
L: Connect to the positive 220V power supply N: Connect to the negative 220V power supply
A: Connect to the positive RS485 (+) B: Connect to the negative RS485 (-)

5. Sensor Structural Dimension Diagram

Table 2

	Nominal Diameter (mm)	L (mm)	H (mm)	G	L₁ (mm)	No. of Holes
DN4	4	275	145	G1/2	215	
DN6	6	229	145	G1/2	215	
DN10	10	345	165	G1/2	350	
DN15	15	75	173	G1		
DN20	20	85	173	G1		
DN25	25	100	173	G5/4		
DN32	32	140	175	G11/2		
DN40	40	140	178	G2		4
DN50	50	150	252			4
DN65	65	180	278			4
DN80	80	200	287			8
DN100	100	220	322			8
DN125	125	250	347			8
DN150	150	300	367			8
DN200	200	360	415			12

The sensor can be installed horizontally or vertically, but when installed vertically, the fluid must flow upwards. The liquid should completely fill the pipeline, with no air bubbles present. During installation, the fluid flow direction must align with the arrow on the sensor housing indicating the flow direction. The upstream end of the sensor should have a straight pipe section at least 20 times the nominal diameter, and the downstream end should have a straight pipe section at least 5 times the nominal diameter. The inner walls of these pipe sections should be smooth, clean, and free from defects such as dents, scale, or peeling.
The axis of the sensor's pipeline must align with the axis of the adjacent pipeline, and the sealing gasket used in the connection should not protrude into the internal chamber of the pipeline.
The sensor should be kept away from external electric and magnetic fields. If necessary, effective shielding measures should be taken to avoid external interference.
To ensure that the normal flow of liquid is not affected during maintenance, it is recommended to install a bypass pipeline at the sensor installation location. If the sensor is installed outdoors, waterproofing measures should be taken for the amplifier and connectors.
The wiring between the sensor and the display instrument should follow the configuration shown in Figure 4.

When the fluid contains impurities, a filter should be installed. The mesh size of the filter depends on the impurity content and flow conditions, generally ranging from 20 to 60 mesh. If the fluid contains free gases, a degasser should be installed. The entire pipeline system should be well-sealed. Users must fully understand the corrosive properties of the measured medium to prevent sensor corrosion.

(5) Usage and Adjustment

◆During use, ensure that the measured liquid is clean and free of impurities such as fibers and particles.

◆When the sensor is first used, it should be slowly filled with liquid before opening the outlet valve. It is strictly prohibited to expose the sensor to high-speed fluid impacts when there is no liquid present.

◆The maintenance cycle for the sensor is generally six months. During inspection and cleaning, be careful not to damage the parts inside the measuring chamber, especially the impeller. Pay attention to the positional relationship between the guide components and the impeller during reassembly.

◆When the sensor is not in use, the internal liquid should be drained, and protective caps should be placed on both ends of the sensor to prevent dust from entering. The sensor should then be stored in a dry place.

◆The filter used with the sensor should be cleaned regularly. When not in use, the internal liquid should be drained, and, like the sensor, a dust cover should be applied before storing it in a dry place.

◆The sensor's transmission cable can be installed either overhead or buried (if buried, it should be enclosed in an iron pipe).

◆Before installing the sensor, first connect it to the display instrument or oscilloscope, power it on, and manually spin the impeller or blow on it to make it rotate quickly. Check for a display reading. If there is a display, the sensor can be installed. If there is no display, inspect all relevant parts and troubleshoot the issue.

III. TURBINE FLOW TRANSMITTER

The LWGB turbine flow sensor is an enhanced version of the basic LWGY turbine flow sensor, featuring the addition of a 24VDC power supply and a 4-20mA two-wire current transmission function. It is particularly well-suited for use in conjunction with display instruments, industrial control computers, DCS systems, and other computer control systems.

For details on the flow measurement range, sensor structure dimensions, installation methods, and maintenance procedures for various diameters of this transmitter, please refer to the second section of this manual, “LWGY Basic Type Turbine Flow Sensor.”

Flow Calculation Formula:

$$Q = \frac{I - 4}{16} Q_F$$

In the formula:

Q - Actual flow rate, in m³/h

QF - Maximum flow rate, in m³/h (refer to Table 1)

I - Current output, in mA

Transmitter Power Supply Voltage: 24V (range: 12V-30V)

Relationship Between Supply Voltage and Load Resistance:

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

In the formula:

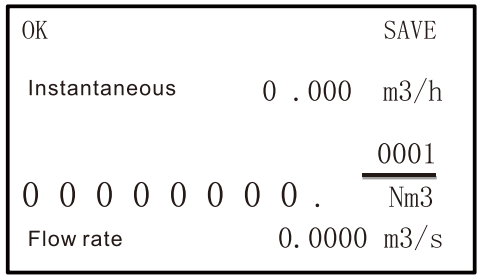
RLMAX - Maximum load resistance, in ohms (Ω)

U - Supply voltage, in volts (V)

IV. INTELLIGENT TURBINE FLOWMETER (Current Output Type and Communication Output Type)

1. User Menu Operation

After powering on, the instrument will first perform a self-check. Once the self-check is completed, it will enter the main display state of Screen 1.



First line: Indicates that the self-check is normal. The LCD backlight is on, and before “SAVE,” the display shows IOUT for current output, FOUT for frequency output, 485OUT for RS485 output.

Second line: Displays the instantaneous flow rate.

Third line: Displays the cumulative flow.

Fourth line: Displays the flow velocity, which will only appear after the diameter is set.

Press the SHIFT key to toggle between Work Screen 2 and Work Screen 1.

1. Common Function Settings 2. Common Parameter Queries 3. Calibration Parameter Settings 0000	1. Common Function Settings 2. Common Parameter Queries 3. Calibration Parameter Settings 0000	1. Common Function Settings 2. Common Parameter Queries 3. Calibration Parameter Settings 0000
Table 1: Menu 1	Table 2: Menu 2	Table 3: Menu 3

This circuit board has three visible buttons, and their functions are as follows:

SHIFT:

a. Switching screens: In the main interface, press this button to switch to the menu screen.

b. Switching menu items: In the menu screen, press this button to switch between different menu items.

c. Shift key: In parameter settings, this button can be used to shift positions.

d. Exit: In the parameter settings, when not within a shiftable item, pressing this button will exit the menu item.

△: Number adjustment function. In items where numbers can be entered, pressing this button adjusts the number. The numbers will cycle through the options. For example, if the current display shows 6, pressing the button twice will change it to 8, and pressing it three more times will change it to 1.

SET:

a.Confirmation function: After modifying a parameter, press this button to confirm the changes.

b.Menu switching: In the parameter settings, pressing this button directly will switch to other parameters. The parameter list will cycle through, and pressing it again after the last item will return to the main menu.

The first menu is the user menu password, which allows users to make basic settings. The second menu is for parameter queries, where users can check frequency values and the overflow indicator. When the flow exceeds 100 million, the cumulative flow on the main interface resets to zero, and the overflow indicator increments to 1. When the overflow indicator exceeds 9, it resets to zero. The calibration parameters menu is primarily used for current calibration and restoring factory settings.

Cumulative Reset Function: In the main interface, press and hold the middle button for more than 5 seconds to reset the cumulative flow to zero.

Table 1: User Parameter Setting Menu

Submenu number	Menu display	Meaning	Selection or Value Range
1	Language	Switch between Chinese and English	Switch between Chinese and English display
2	Algorithm selection	Algorithm selection (default is 0)	00: Standard volume flow 01: Standard mass flow
3	Flow unit selection	Flow unit selection (default is 0)	0:m^3/h 1:1/m 2:kg/h 3:1/h 4:t/h 5:kg/m 6:m^3/m
4	Calibration lower limit	Lower limit value for segmented calibration	Default is 0, note that this is the frequency setting for segmented values.
5	Calibration upper limit	Upper limit value for segmented calibration	Default is 0. The upper calibration has three values. For example, if the calibration lower limit is set to 0, upper limit 0 is set to 50, and upper limit 1 is set to 100, with flow coefficient 0 set to 3600 and flow coefficient 1 set to 1800, then the system will use the 3600 coefficient for calculations at frequencies between 0-50Hz, and the 1800 coefficient for frequencies between 50-100Hz.
6	Flow coefficient	Flow coefficient (default is 3600)	Set the meter factor, with the unit as P/m^3. The meter factor can be configured for four corresponding segmented calibrations.
7	Full-scale output flow	Full-scale output flow (default is 1000)	When the instrument outputs a 4-20mA analog signal, this value must be set and cannot be zero.
8	Density setting	Density setting (default is 1000)	When the algorithm selection is set to mass flow, this parameter must be set, with the unit as kg/m^3.
9	Lower limit cut-off flow	Cut-off lower limit frequency	When the lower limit cut-off is set to 0, it eliminates frequency values smaller than this setting. When lower limit frequencies 1 and 2 are set, it eliminates values between these two settings.
10	Password	Password setting	The default is 0. Users can set a four-digit password. If the password is forgotten, entering 1111 will serve as a universal password.
11	Backlight	Backlight switch	This setting controls the backlight switch. Setting it to 0 turns the backlight off, and setting it to 1 turns it on. The default is on, and when the backlight is on, an LCD symbol will appear in the upper left corner of the main interface. Customers can turn it on or off according to their needs.
12	Diameter	Diameter setting	This setting corresponds to the actual diameter. If this value is set to 0, the flow velocity display on the main interface will show 0. To display the flow velocity, you must set this to the corresponding diameter.

V. PRODUCTION CALIBRATION

The production calibration of the instrument should be conducted by professionals who have a deep understanding of the instrument and under conditions with appropriate precision calibration equipment. During two-wire calibration, a current meter with a range >20mA and accuracy better than 0.1% should be used. Production calibration and some advanced settings are conducted in the production setting mode. If you do not have the necessary equipment and sufficient expertise, improper calibration may result in the instrument not functioning properly.

After password confirmation, you can enter the production setting mode and set the relevant parameters according to the specific model of the instrument. To enter the production calibration menu, open the front cover of the instrument, and according to the definition in Table 2, select the desired parameter menu.

Table 2: Production Calibration Menu Corresponding to Menu 3

Submenu No.	Menu Display	Meaning	Remarks
1	4mA Calibration	4mA current calibration	All calibrations must ensure that the value is calibrated to exactly 4.0000. For example, if the current meter displays 3.9956, you should enter 3.9956 at this point. It is recommended not to arbitrarily change this setting or the 20mA setting because the instrument is equipped with a 16-bit high-precision DA conversion chip, which is more accurate than most standard multimeters and can ensure accuracy within 0.15%.
2	20mA Calibration	20mA current calibration	Same as above, but with the difference that in this menu, calibration must be performed when the value is exactly 20.000.
3	Reset	This is for factory calibration settings.	Resetting parameters is prohibited, as it can affect the instrument's operation and measurement accuracy.

VI. MAINTENANCE AND COMMON FAULTS

Possible common faults of the sensor and their troubleshooting methods are listed in Table 3. The maintenance cycle should not exceed six months.

Table 3

S/N	Fault	Cause	Solution
1	No display of flow signal and test signal on the display instrument	1. The power is not connected, or the supplied voltage is incorrect. 2. The display device is malfunctioning.	1. Connect the power supply and provide the specified voltage as required. 2. Inspect and repair the display instrument.
2	Display instrument shows a "test" signal but no flow signal	1. Incorrect wiring between the sensor and the display device, or issues such as open circuit, short circuit, or poor contact. 2. The amplifier is faulty or damaged. 3. The converter (coil) has an open circuit or short circuit. 4. The impeller is stuck. There is no fluid flow in the pipeline, or it is blocked.	1. Refer to Figure 4 to check the wiring correctness and quality. 2. Repair or replace the amplifier. Repair or replace the coil. 3. Clean the sensor and pipeline. Open the valve or pump, and clean the pipeline.
3	Display instrument is unstable or shows incorrect measurements	1. The actual flow rate exceeds the measurement range of the instrument or is unstable. 2. The instrument's calibration factor (K factor) is set incorrectly. 3. Foreign substances, such as fibers, are caught inside the sensor. 4. Air bubbles are present in the liquid. 5. There is strong electromagnetic interference near the sensor. 6. The sensor's bearings and shaft are severely worn. 7. The sensor cable shielding layer or other grounding wires are disconnected or have poor contact with the circuit ground. 8. The display instrument is malfunctioning.	1. Adjust the measured flow rate to match the sensor's measurement range and stabilize the flow. 2. Ensure the K factor is set correctly. 3. Clean the sensor. 4. Implement degassing measures to eliminate air bubbles. 5. Keep the sensor as far away from interference sources as possible or apply shielding measures. 6. Replace the "guide component" or the "impeller shaft." 7. Refer to Figure 4 and reconnect the wires properly. 8. Inspect and repair the display instrument.

If the user stores and uses the product in accordance with the instructions, and within one year from the date of shipment from the manufacturer, the product cannot function properly due to quality issues, the manufacturer will provide free repairs.

VII. TRANSPORTATION AND STORAGE

The sensor should be packed in a sturdy wooden or cardboard box, ensuring that it does not move freely inside the box. Handle with care during transportation, and avoid rough handling or unloading.
The storage location should meet the following conditions:
a. Protection from rain and moisture.
b. Free from mechanical vibrations or impacts.
c. Temperature range of -20°C to +65°C.
d. Relative humidity not exceeding 80%.
e. The environment should be free from corrosive gases.

VIII. UNPACKING INSTRUCTIONS

1. After unpacking, check the packing list to ensure that all documents and accessories are complete.
   The packing documents include:
   - One user manual
   - One product quality certificate
2. Inspect the sensor for any damage that may have occurred during transportation, so that appropriate measures can be taken if necessary.
3. Users should properly store the “Quality Certificate” and avoid losing it, as it is necessary for setting the instrument's calibration factor!

IX. ORDERING INFORMATION

When ordering a turbine flow sensor, users should select the appropriate specifications based on the nominal diameter, working pressure, operating temperature, flow range, fluid type, and environmental conditions. If explosion-proof requirements are necessary, an explosion-proof sensor must be selected, and the explosion-proof rating must be strictly adhered to.
If a display instrument from our company is needed to match the sensor, please refer to the relevant manual to select the appropriate model, or our technical staff can assist in selecting the model based on the information you provide. If a signal transmission cable is required, please specify it in the order.