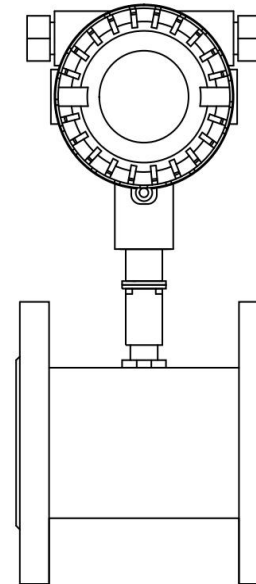


Liquid Turbine Flowmeter



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1. Overview

The LWGY series turbine flow sensor (hereinafter referred to as the sensor) is based on the principle of torque balance and is a speed flow meter. The sensor has the characteristics of simple structure, light weight, high precision, good repeatability, sensitive response, and easy installation, maintenance and use. It is widely used in petroleum, chemical industry, 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 and is suitable for measuring liquids in closed pipes that do not corrode with stainless steel 1Cr₁₈Ni₉Ti, 2Cr13, corundum Al₂O₃ and cemented carbide, and are free of fibers, particles and other impurities. If matched with a display instrument with special functions, it can also perform quantitative control, over-quantity alarm, etc. By selecting the explosion-proof type (ExmIIT6) of this product, it can be used in environments with explosive hazards.

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

If the user needs a special form of sensor, the order can be negotiated. If an explosion-proof sensor is required, please specify it in the order.

2. LWGY basic turbine flow sensor

2.1 Structural features and working principles

2.1.1 Structural characteristics

The sensor is a carbide bearing thrust type, which not only ensures accuracy and improves wear resistance, but also has the characteristics of simple, solid structure and easy disassembly and assembly.

2.1.2 Working principle

The fluid flows through the sensor housing. Since the blades of the impeller are at a certain angle to the flow direction, the impulse of the fluid causes the blades to have a rotational torque. After overcoming the friction moment and fluid resistance, the blades rotate. After the torque is balanced, the rotational speed becomes stable. Under certain conditions, The rotational speed is proportional to the flow rate. Since the blade has magnetic permeability, it is in the magnetic field of the signal detector (composed of permanent magnet steel and coil). The rotating blade cuts the magnetic lines of force and periodically changes the magnetic flux of the coil, thereby causing both ends of the coil to The electrical pulse signal is induced, and this signal is amplified and shaped by the amplifier to form a continuous rectangular pulse wave with a certain amplitude, which can be remotely transmitted to the display instrument to display the instantaneous flow rate or total volume of the fluid. Within a certain flow range, the pulse frequency f is proportional to the instantaneous flow rate Q of the fluid

flowing through the sensor. The flow equation is:

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

In the formula:

f—Pulse frequency (Hz)

k—the instrument coefficient of the sensor (1/m³), given by the calibration sheet.

Q—instantaneous flow rate under fluid working condition (m³/h)

3600—conversion factor in seconds

The instrument coefficient of each sensor is filled in the calibration certificate by the manufacturer, and the k value is set into the matching display instrument to display the instantaneous flow rate and cumulative total.

3. LWGB type turbine flow transmitter

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

LWGB type turbine flow sensor flow calculation formula is:

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

In the formula:

Q —Actual flow rate, m³/h

Q_F—the upper limit of flow measurement, m³/h, see Table 1

I —Current output, mA

Transmitter supply voltage:24V, (12V~30V)

The 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)

4. Technical performance indicators of liquid turbine flowmeter

carried standard	《JJG 1032-2007》 liquid turbine flowmeter 《GB/T 19583-2016》 liquid turbine flowmeter
DN(mm)	Flange connection type: DN15~DN300 Clamping connection type: DN10~DN100 Threaded connection type: DN4~DN100 (Other options can be customized specially.)
nominal pressure (MPa)	routine: 1.6MPa~25MPa (Other options can be customized specially.)
medium temperature	common design: -20~100 (°C) High-temperature customized version: -20~150 (°C)
Operating conditions	environment temperature: -20°C~55°C, relative humidity: 5%~90%
Main material	304、316
Impeller material	Stainless iron, duplex steel
accuracy	Accuracy within the measurement range: 1.0 class (0.2 class/0.5 class customizable)
placement	Flange connection, threaded connection, clamp connection.
Range ratio	Regular model: 1:6 to 1:20
supply voltage	Flowmeter: DC (12~32V), 3.6V lithium battery, dual power supply
outcoming signal	Pulse output, 4~20mA current output, RS485 (modbus-RTU protocol), Hart protocol, IoT GPRS remote transmission, etc.
anti-hazard classification	EX db IIC T6 Gb
level of protection	IP66
electrical interface	Standard: Internal thread M20*1.5 or 1/2NPT (can be specially customized)
suitable medium	A liquid without fibers, particles of impurities or corrosive substances
transmission distance	Three-wire pulse output type: $\leq 300\text{m}$, Two-wire standard current output type (4~20mA) $\leq 1500\text{m}$, load resistance $\leq 500\Omega$, RS485、Hart $\leq 1200\text{m}$.

	type	caliber	□	□	□	illustrate
Flow meter type	LWGY					Pulse output, 12 - 30VDC power supply
	LWGB					4~20mA two-wire current output, remote transmission type
	LWY					Battery powered on-site display type
	LWYC					On-site display, 4~20mA two-wire and four-wire current output
	LWYD					RS485 communication output
Nominal diameter		DN4				Ordinary turbine flow range: 0.04~0.25 (m ³ /h)
		DN6				Ordinary turbine flow range: 0.1~0.6 (m ³ /h)
		DN10				Ordinary turbine flow range: 0.2~1.2 (m ³ /h)
		DN12				Ordinary turbine flow range: 0.2~2 (m ³ /h)
		DN15				Ordinary turbine flow range: 0.6~6 (m ³ /h)
		DN20				Ordinary turbine flow range: 0.7~7 (m ³ /h)
		DN25				Ordinary turbine flow range: 1~10 (m ³ /h)
		DN32				Ordinary turbine flow range: 1.5~15 (m ³ /h)
		DN40				Ordinary turbine flow range: 2~20 (m ³ /h)
		DN50				Ordinary turbine flow range: 4~40 (m ³ /h)
		DN65				Ordinary turbine flow range: 7~70 (m ³ /h)
		DN80				Ordinary turbine flow range: 10~100 (m ³ /h)
		DN100				Ordinary turbine flow range: 20~200 (m ³ /h)
		DN125				Ordinary turbine flow range: 25~250 (m ³ /h)
		DN150				Ordinary turbine flow range: 30~300 (m ³ /h)
		DN200				Ordinary turbine flow range: 80~800 (m ³ /h)
Explosion proof						No mark, non-explosion-proof
		B				Explosion-proof type
Accuracy level			A			Accuracy 0.5 level
			B			Accuracy Level 1
turbine type				A		Wide range turbine
				B		Ordinary turbine

Conditions of use	Medium temperature: -20~120 (°C), ambient temperature: -20~65 (°C)
power supply	LWGY type basic type: 5~24VDC power supply LWGB, LWY, LWYC, LWYD type: 24VDC power supply, current: $\leq 10\text{mA}$ When powered by battery, it is 3.6V/0.3mA, and the current increases by 0.6mA during 485 communication.
Transmission distance	Three-wire pulse output type: $\leq 300\text{m}$, two-wire standard current output type (4~20mA) $\leq 1500\text{m}$, load resistance $\leq 500\Omega$, RS485 $\leq 1200\text{m}$.

5. Product classification and installation

5.1 Product classification

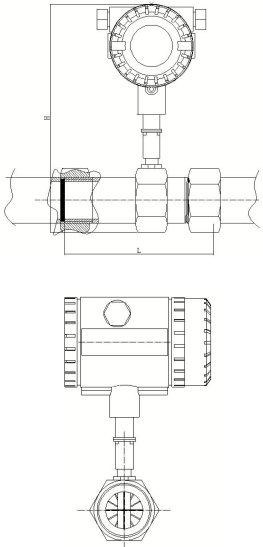
5.1.1 Classification by display

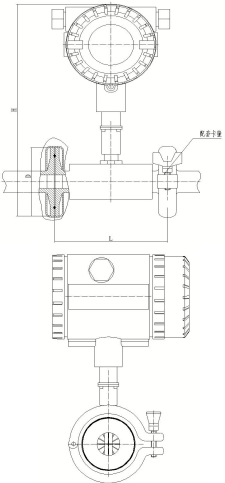
1. Without display type (LWGY basic type).
2. Type with display (LWGB type, LWY type, LWYC type, LWYD type).

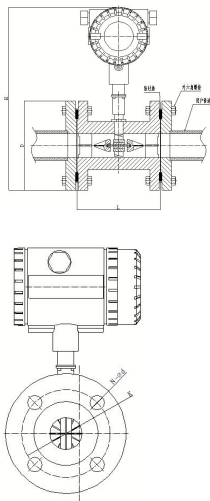
5.1.2 Classification by installation method

1. Liquid turbine threaded flow meter
2. Liquid turbine clamp connection flow meter
3. Liquid turbine flange connection flow meter
4. Other special structures can be customized through negotiation with the supplier.

5.2 Product installation dimensions

	caliber (mm)	L	Thread specifications/ G	H
	DN4	50±1	G1/2	200±10
	DN6	50±1	G1/2	200±10
	DN10	50±1	G1/2	200±10
	DN15	75±1	G1	200±10
	DN20	85±1	G1	210±10
	DN25	100±1	G1 1/4	210±10
	DN32	120±1	G1 1/2	210±10
	DN40	140±1	G2	215±10
	DN50	150±1	G2 1/2	220±10
	DN65	175±1	G3	240±10
	DN80	200±1	G3 1/2	240±10
	DN100	220±1	G4 1/2	245±10
Liquid turbine threaded flow meter				

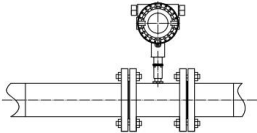
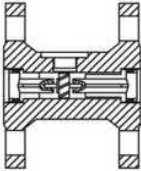
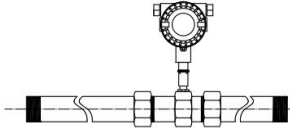
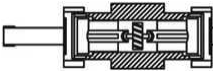
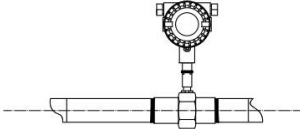
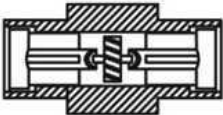
	caliber (mm)	L	Clamp outer diameter D	H
	DN10	50±1	Φ34	200±10
	DN15	75±1	Φ50.5	200±10
	DN20	85±1	Φ50.5	210±10
	DN25	100±1	Φ50.5	210±10
	DN32	120±1	Φ50.5	220±10
	DN40	140±1	Φ64	220±10
	DN50	150±1	Φ77.5	230±10
	DN65	175±1	Φ91	240±10
	DN80	200±1	Φ106	240±10
	DN100	220±1	Φ119	245±10
Liquid turbine clamp connection flow meter				

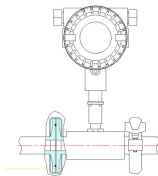
	caliber (mm)	L	D	N	d	K	External hexagon bolt		H
							Spec ificat ion	quan tity	
	DN15	75±1	Φ95±1.2	4	14	65	M12	8	280±10
	DN20	85±1	Φ105±1.2	4	14	75	M12	8	285±10
	DN25	100±1	Φ115±1.2	4	14	85	M12	8	290±10
	DN32	120±1	Φ140±1.2	4	18	100	M16	8	303±10
	DN40	140±1	Φ150±1.2	4	18	110	M16	8	308±10
	DN50	150±1	Φ165±1.2	4	18	125	M16	8	316±10
	DN65	175±1	Φ185±1.2	8	18	145	M16	16	326±10
	DN80	200±1	Φ200±1.2	8	18	160	M16	16	334±10
	DN100	220±1	Φ220±1.2	8	18	180	M16	16	344±10
	DN125	250±1	Φ250±1.2	8	18	210	M16	16	359±10
	DN150	300±2	Φ285±1.2	8	22	240	M20	16	377±10
	DN200	360±2	Φ340±1.2	12	22	295	M20	24	405±10
	DN250	400±2	Φ405±2	12	26	355	M24	24	438±10
	DN300	500±2	Φ460±2	12	26	410	M24	24	466±10
Liquid turbine flange connection flow meter									

6. Product installation and use

6.1 Product installation

The installation method of the sensor adopts flange, thread and clamp connection according to different specifications. The installation method is as shown below.

type	Assembly diagram	Structural diagram
Flange connection type		
Threaded connection type		
		

Clamp connection type		
-----------------------------	---	---

6.2 Installation environment requirements

1. The sensor can be installed horizontally or vertically. When installed vertically, the fluid direction must be upward. The liquid should fill the pipe and there should be no air bubbles. During installation, the direction of liquid flow should be consistent with the direction of the arrow indicating the flow direction on the sensor housing. The upstream end of the sensor should have a straight pipe section of at least 20 times the nominal diameter, and the downstream end should have a straight pipe section of no less than 5 times the nominal diameter. The inner wall should be smooth and clean, without defects such as dents, scale, and peeling. The axis of the sensor pipe should be aligned with the axis of the adjacent pipe, and the gasket used for connection sealing must not extend into the inner cavity of the pipe.

2. The sensor should be kept away from external electric fields and magnetic fields, and effective shielding measures should be taken when necessary to avoid external interference.

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

location of the sensor.

4. When the sensor is installed in the open air, please waterproof the amplifier and plug.

5. When the fluid contains impurities, a filter should be installed. The mesh size of the filter depends on the flow rate of impurities, generally 20 to 60 mesh. When free gas is mixed in the fluid, an air eliminator should be installed. The entire duct system should be well sealed.

6. Users should fully understand the corrosion situation of the measured medium and strictly prevent the sensor from being corroded.

6.3 Precautions for use

1. When using, the liquid to be measured should be kept clean and free of impurities such as fibers and particles.

2. When starting to use the sensor, the sensor should be slowly filled with liquid before opening the outlet valve. It is strictly forbidden for the sensor to be impacted by high-speed fluid when there is no liquid.

3. The maintenance cycle of the sensor is generally half a year. During maintenance and cleaning, please be careful not to damage the parts in the measuring chamber, especially the impeller. When assembling, pay attention to the positional relationship between the guide parts and the

impeller.

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

5. The filter should be cleaned regularly when used. When not in use, the liquid inside should be cleaned. Like the sensor, it should be covered with a dust cover and stored in a dry place.

6. The sensor transmission cable can be laid overhead or buried (it should be covered with iron pipes when buried underground.)

7. Before installing the sensor, first connect it to the display instrument or oscilloscope, turn on the power, blow the impeller with your mouth or turn it by hand, and make it rotate quickly to see if there is a display. When there is a display, install the sensor. If there is no display, check the relevant parts and eliminate the fault.

7. Wiring methods and operations

7.1 Intelligent turbine flow meter display interface

OK		SAVE	
Instantaneous		0 . 000	m3/h
		0001	
0 0 0 0 0 0 0 0 .		Nm3	
Flow velocity		0. 0000	m3/s

Main interface

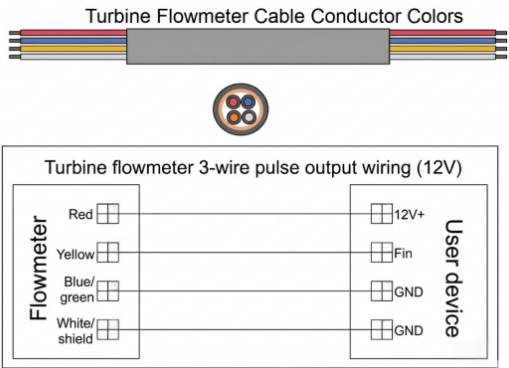
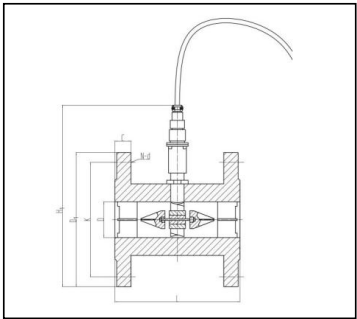
After the power is turned on, the instrument first performs a self-check, and then enters the main work interface display state.

The first line: Self-test normal sign, with LCD backlight turned on. Before SAVE, it shows that IOUT is the current output, FOUT is the frequency output, and 485OUT is the 485 output.

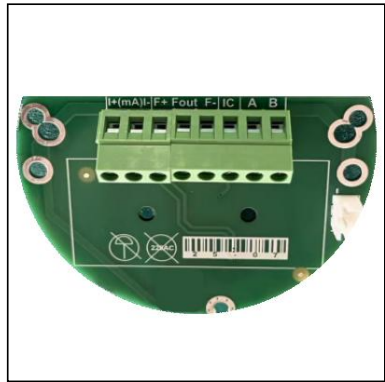
Second row: instantaneous traffic.
The third row: accumulated traffic.
The fourth line: flow rate display, which is displayed after setting the

caliber.

7.2 Wiring diagram



Note: Conventional pulse wiring is a 3-wire wiring method. When the instrument is installed in a pipe and there is interference during use, the white wire/shielded wire power supply GND, which can effectively reduce the interference during use.



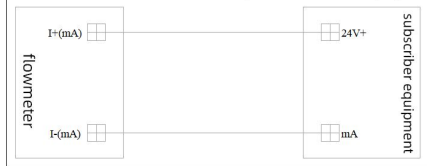
Three wire pulse output cable with display (24V supply)



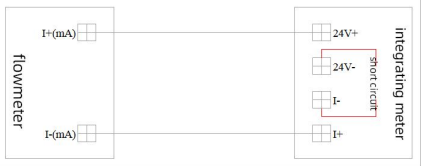
Three wire pulse output integration device with display



Two-wire 4-20mA current output cable with display



Two-wire system 4-20mA current output integrator with display (two-wire to four-wire)

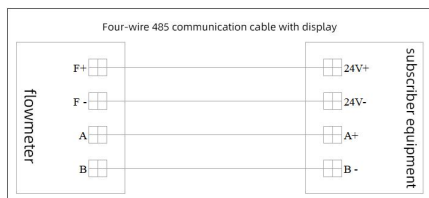


Four-wire 4-20mA current output cable with display



With display four-wire system 4-20mA current output connected integrator





7.3 Operating Instructions

7.3.1 Button introduction

Relevant introduction of SHIFT button, Δ button and SET button:

SHIFT: a. Switch screens; you can press this key on the main interface to switch to the menu screen.

b. Switch menu items; press this key on the menu screen to switch between different menus.

c. Displacement key; in parameter settings, you can use this key to shift.

d. Exit; in parameter settings, if there is no displacement item, press this button to exit the menu item.

Δ : Numeric items have a function. In items where numbers can be input, press this to adjust the size of the numbers, and the size of the numbers can be displayed in a loop. For example, if 6 is currently displayed, you can press it twice to display it as 8, or press it three more times to display it as 1.

SET:

a. Confirmation function, mainly press this button to confirm the parameters after modifying them.

b. Switch menu. In parameter setting, press this key directly to switch to other parameters, and the parameter list will be displayed in a loop. Go to the last list and press again to return to the main menu.

The first menu is the user menu. The default password is 2010, which is used for users to make basic settings. The second menu is parameter query, where you can query the frequency value and overflow flag. When the flow rate is greater than 100 million, the accumulated flow rate on the main interface is cleared. The overflow flag here counts as 1 and is cleared

when the overflow mark is greater than 9. The calibration parameters are mainly used for current calibration and restoring factory settings.

Clear cumulative flow function: Press and hold the middle button on the main interface for more than 5 seconds to clear the cumulative flow.

7.3.2 Introduction to common function settings

Note: The default password for the user menu is 2010

Menu Name	Parameter Value	meaning
language	0: Chinese 1: English	Set the instrument language
algorithm	0: Normal volume flow 1: Conventional mass flow	Algorithm selection (default 0) Different algorithms are used according to different media and selected units.
Flow Unit	0: m ³ /h 1: L/m 2: kg/h 3: L/h 4: T/h 5: kg/m 6: m ³ /m	Flow unit selection (default 0) The unit in which the fluid is to be displayed. The unit must match the algorithm.
Calibration lower limit	The default is 0, note that the frequency of segmented value is set here	Used to make the lower limit of segmented calibration
Calibration upper limit	The default is 0, and the upper limit has 3 values. For example, the lower limit of the calibration is 0, the calibration upper limit 0 is set to 50, and the calibration upper limit 1 is set to 100, and the calibration upper limit 2 is set to 150. The flow coefficient 0 is set to 3600, and the upper limit of the flow is set to 1800. The frequency of 0-50Hz is performed with 3600	Used to do the upper limit of segmented calibration

	coefficients, and 50-100Hz is calculated with 1800 coefficients.	
Flow coefficient	Set the instrument coefficient, the unit is P/m^3 , and the instrument coefficient can set 4 corresponding segments calibration.	Flow coefficient (default 3600)
Full output flow	When the instrument outputs 4 ~ 20mA analog signal, the value must be set, and it must not be 0.	Fullness output traffic (default 1000)
Density settings	When the algorithm is selected as a quality flow, this item must be set, and the unit is kg/m^3	Dental settings (default 1000)
Lower cut-off flow	The lower limit is removed when setting the frequency value of less than that value, and the lower limit frequency 1 and 2 set the value in the middle of the 2 value.	Remove the lower limit frequency
password	The default is 0. The user can set a four -digit -to -digital password. When you forget the password, enter 1111 to be a universal password.	Set a password
Backlight	This item is the switch of the backlight, which is set to 0 as the level, and the backlight is opened when it is set. The default is opened. The LCD logo will appear in the upper left corner of the main interface when opening, and the customer can switch according to the requirements.	Backlight switch
caliber	According to the actual caliber, if it is 0 here, the main interface flow speed is displayed as 0. If the flow rate is required, the corresponding caliber must be set here.	Setting of the caliber

8. Common faults and maintenance

Possible sensor faults and their elimination methods are as follows. The maintenance cycle should not exceed half a year.

Serial number	Fault phenomenon	reason	Elimination method
1	The displayer has no display to the flow signal and the inspection signal	1. The power supply is not connected, and the given voltage is wrong. 2. There is a fault in the displayer.	1. Connect the power and give the voltage as required. 2. Make a display instrument.
2	The display instrument has displayed the "verification" signal but did not display the flow signal.	1. There are errors in the wiring between the sensor and the display instrument, or there are open roads, short circuit, poor contact and other faults. 2. The amplifier is faulty or damaged. 3. Converter (coil) open or short circuit. 4. The leaf wheel is stuck. The pipeline has no fluid flowing or blocking.	1. In contrast to Figure 4, check the correctness and wiring quality of the wiring. 2. Maintenance or replacement amplifier. 3. Maintenance or replacement coil. 4. Clean sensor and pipeline. Open valves or pumps to clean the pipeline.

3	The display instrument is unstable; the measurement is incorrect.	1. The actual traffic beyond the measuring range or unstable of the instrument. 2. The instrument coefficient K is wrong. 3. Hanging fiber and other impurities in the sensor. 4. Bubbles in the liquid. 5. There are strong electromagnetic field interference next to the sensor. 6. Sensor bearing and bearing severe wear. 7. Sensor cable shielding layer or other grounding wires are disconnected or exposed to the line ground line. 8. Display instrument failure.	1. Make the measured traffic and the measurement range of the sensor and stabilize the flow. 2. Make the coefficient K set correctly. 3. Clean the sensor. 4. Take anti -gas measures to eliminate bubbles. 5. Try to stay away from the source of interference or take shielding measures. 6. Replace the "guidelines" or "leaf wheel shaft". 7. In contrast to Figure 4, connect the line. 8. Make a display instrument.
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Provided that the user abides by the instructions for storage and use, if the sensor fails to work properly due to poor manufacturing within one year from the date of shipment from the manufacturer, the manufacturer can repair it free of charge.

9. Transportation and storage

The sensor should be packed into a strong wooden box or carton. It is not allowed to move freely in the box. It should be handled with care during transportation and rough handling is not allowed.

The storage location should meet the following conditions:

- a. Rainproof and moisture-proof.
- b. Not subject to mechanical vibration or impact.

- c. Temperature range -20°C~65°C.
- d. Relative humidity should not be greater than 80%.
- e. The environment does not contain corrosive gases.

10. Precautions when unpacking

1. Check the packing list; check whether the accessories are complete.

Packing documents include: one instruction manual

A product certificate

2. Appearance inspection; check whether the instrument is complete and whether it has been damaged due to transportation.

3. Keep the "Qualification Certificate" properly and do not lose it, otherwise the instrument coefficient cannot be set!

11. Ordering Instructions

When ordering a turbine flow sensor, users should pay attention to selecting appropriate specifications based on the fluid's nominal diameter, working pressure, working temperature, flow range, fluid type and environmental conditions. When there are explosion-proof requirements, explosion-proof sensors must be selected and strict attention must be paid to the explosion-proof level.

When you need our company's display instruments, please refer to the

corresponding instructions and select the appropriate model, or our company's technical staff will design and select the model for you based on the information you provide. When you need a cable for signal transmission, please indicate the specification length.

Appendix A. Communication protocol

A.1 Protocol Overview

The liquid turbine circuit adopts MODBUS-RTU protocol.

Mod bus Poll software RTU connection:

Display Option—Floating Pt (All data display formats - floating point).

Command 03: Read HOLDING REGISTER (read holding register 4X)

Device id: Internal address of the instrument

Address: The starting address of the instrument parameters, from 1 to 14.

Length: Data length; $\text{Length} + \text{Address} \leq 14$

A.2 Protocol Overview

Parameter address: 40001-2: Temperature (for liquid turbine meters, this value is always 0)

40003-4: Instantaneous value

40005-6: Flow velocity

40007-8: Frequency

40009-10: Integer part of the totalized flow (hundreds and above, e.g. 1234)

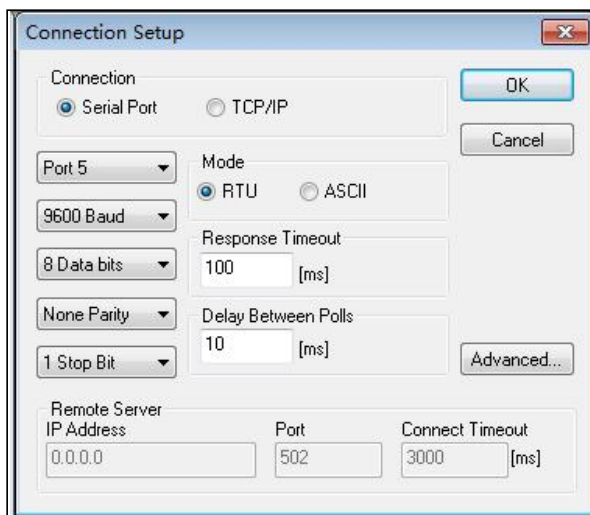
40011-12: Fractional part of the totalized flow (below hundreds, e.g. 87.89),

Cumulative flow = $1234 \times 100 + 87.89 = 123487.89$.

40013-14: Unit of the current instantaneous flow. 0: m³/h, 1: L/min, 2: kg/h

3: L/h, 4: t/h, 5: kg/min, 6: m³/min

The register addresses include a default offset. The actual physical address is the register address minus 1.



A.3 Communication Example

Master request: 01 03 00 00 00 0E C4 0E (command in hexadecimal)

01: Device address

03: Function code

00 00: Starting register address

00 0E: Number of registers

C4 0E: CRC check code

Slave response frame:

01 03 1C 00 2A A7 3F 60 00 00 00 00 8D 0F

01: Device address, 03: Function code, 1C: Byte count

(A total of 0E, i.e. 14 registers, are read. Each register is 2 bytes, for a total of 28 bytes.)

2A A7 3F 60: Data from the 11th and 12th registers, representing the fractional part of the totalized flow.

The bytes must be reordered before parsing (byte order 3412).

That is, 3F 60 2A A7, which parses to 0.87565, consistent with the value read by the software.

All data are parsed using the same method, with the same data type (floating point) and byte order (3412).