WM9100 Series
Residential Ultrasonic Water Meter
(For DN15/DN20/DN25)

Lanry Instruments (Shanghai) Co.,Ltd

(V1.0/2022)

Notice

Dear users,

In order to your quick understanding of our product features and use of the product correctly, please read the manual carefully before installing and operating.

- Please check the packing list and confirm whether your received goods are the same as your ordered goods.
- Please read the manual carefully before installing and operating.
- Please observe all the warnings and requirements before installing, operating and maintaining.
- Please operate the products according to the manual strictly, otherwise our company will not be responsible for any consequence.
- All the figures are only for reference. Please refer to the actual products when operating or consult our company.
- When connecting the water meter output interface with output cable, lock threaded joints after connection and do not pull the cable after locking.
- When the products show/indicate A , please consult our company.
- Please check the products carefully before installing, please consult with our company if any obvious transporting damage.
- Please keep the brochure properly for your reference anytime.
- Please contact our company if the products cannot work or need repair.
- All products are tested strictly before delivering. It is forbidden to open the seal once sold the water meter. If user open the seal privately, our company will not be responsible for the loss.

Warning

To avoid any financial loss and personal injury, please observe following safety items and operate the products properly.

① **The products are precision measurement instruments, to avoid any damage please handle with care.**

② **About Battery**

- Please do not charge, short out or modify the battery
- Please keep the battery far away from the fire, high temperature objects, water or welding
- Please do not make the battery be seriously crashed.
- Please do not replace the battery with other same model battery, as our battery is treated

specially and professionally

- Please change the battery when it is low power, to avoid data loss. When changing the battery, it must be operated by professionals, or return the product to our company.
- Please do insulation treatments to the replaced battery. To avoid fire or explosion, user should keep the replaced battery far from other mental objects or batteries.
- Please do environmental treatments to the replaced battery. Otherwise return the replaced battery to our company.
- Please take the battery out immediately if it leaks, color changes, shape changes, smokes or spreads odor. Please avoid burning during operating.
- Please keep the leakage far away from eyes, skin and clothes. If touches, please wash the touched parts with the mass water (do not rub) and go to hospital immediately.

③ **Please do not operate the product under the acid and alkali environment.**

Otherwise will reduce the working life and the product will not conform to the sanitary standard.

CONTENT

1. Summary

Ultrasonic water meter is a new type of water meter which can measure and display the flow rate according to the time difference between upstream and downstream when the ultrasonic wave propagates in the water. Water meter can be equipped with wired or wireless data communication interface to communicate with the collector, concentrator or network server to form a remote meter reading management system. The management department can copy the data in the table as needed and convenient to the user's water consumption statistics and management.

2. Features

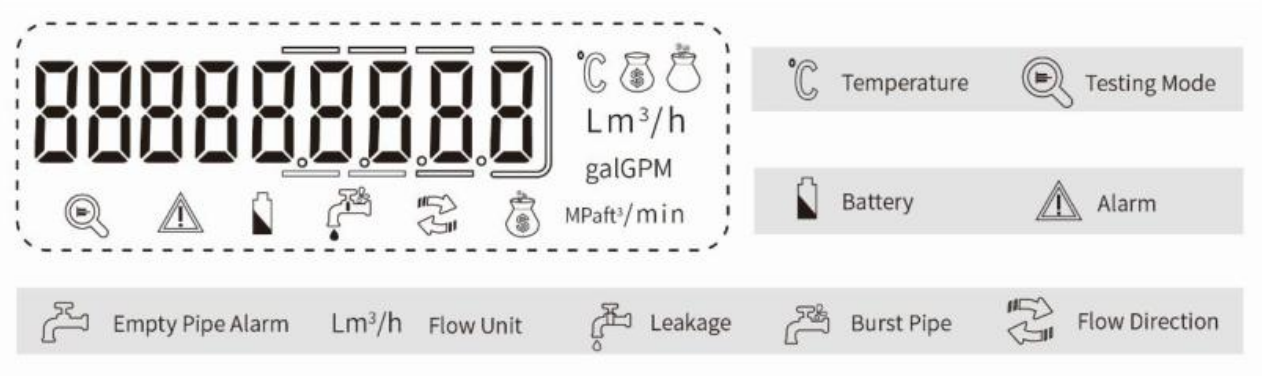
- Full Stainless Steel Body
- Wide Range
- Measuring Low Starting Flow
- No Moving Parts, Accuracy Will Not Change After Long Term Working
- With Functions of Self-diagnosis, Flow Sensor Alarm, Temperature Sensor Alarm, Over Range Alarm and Battery Undervoltage Alarm
- Low Consumption Design, Battery Can Continuously Work For Over 6 Years
- With Optic Electric Interface, Hand-held Infrared Meter Reading Tool Can Read Directly
- Stainless Steel 316L Is Optional, Meet The Measurement Of Direct Drinking Water
- Bi-directional Measuring Forward And Reverse Flow
- Users Can Set Specified Time To Upload Data, Integrated Multiple Intelligent Alarm Functions For Abnormal Water Consumption, Open Protocols Are Better Suited To Compatible Extensions
- According To Sanitary Standard For Drinking Water

3. Specifications

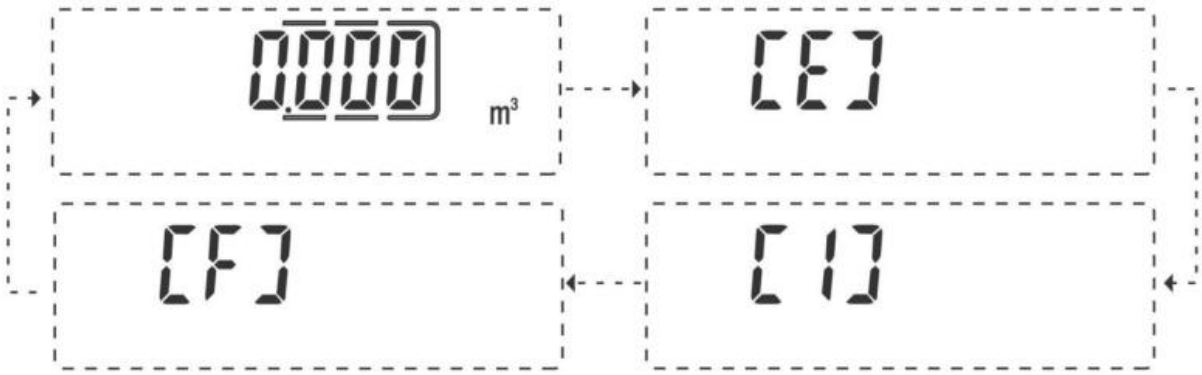
Max. Working Pressure	1.6Mpa
Temperature Class	T30
Accuracy Class	ISO4064, Accuracy Class 2, Optional Class 1
Body Material	Stainless SS304 (opt. SS316L)
Battery Life	6 Years (Consumption<0.3mW)
Protection Class	IP68
Environmental Temperature	-40~70℃，≤100%RH
Pressure Loss	AP25, AP40 (Based on different dynamic flow)
Climatic And Mechanical Environment	Class O
Electromagnetic Class	E2
Communication	M-bus, RS485 modbus, LoRaWAN
Display	9 digits LCD display volume Cumulative flow (m^3, L, GAL), Instantaneous flow(m^3/h, L/min, GPM) Power alarm, flow direction, output etc.
Connection	Thread
Flow Profile Sensitivity Class	U5/D3
Data Storage	Can store frozen data for 24 months, and the data will be permanently saved after power failure
Frequency	1-4 times/second
Diameter	DN15~DN25
Range Q3/Q1	125,160, 200, 250, 400, 500 (Default 250)
Q3	DN15: 2.5m3/h, DN20: 4.0m3/h, DN25: 6.3m3/h

4. **Operation**

This water meter adopts LCD screen combined with digital and graphic to present measurement parameters and working status information to users, as shown below:



User can use magnetic bar to touch the magnetic induction area on the water meter shell to switch different function menu. Operation and display consists of 4 groups of menus.



■ **Arrow Indicates**

- - - - → Touch the induction area with the magnetic bar for more than 2 seconds and hold (same as Press & Hold in the below)

——→ Touch the induction area with the magnetic bar in 1 second and leave (same as Press & leave in the below)

The complete menu screen loop is in below order

1) Main Menu: Display screen for daily use

2) Error Menu【E】:Record and display the corresponding fault, occurrence time and duration

3) Information Menu【I】:Display water meter address, communication parameter and historical data

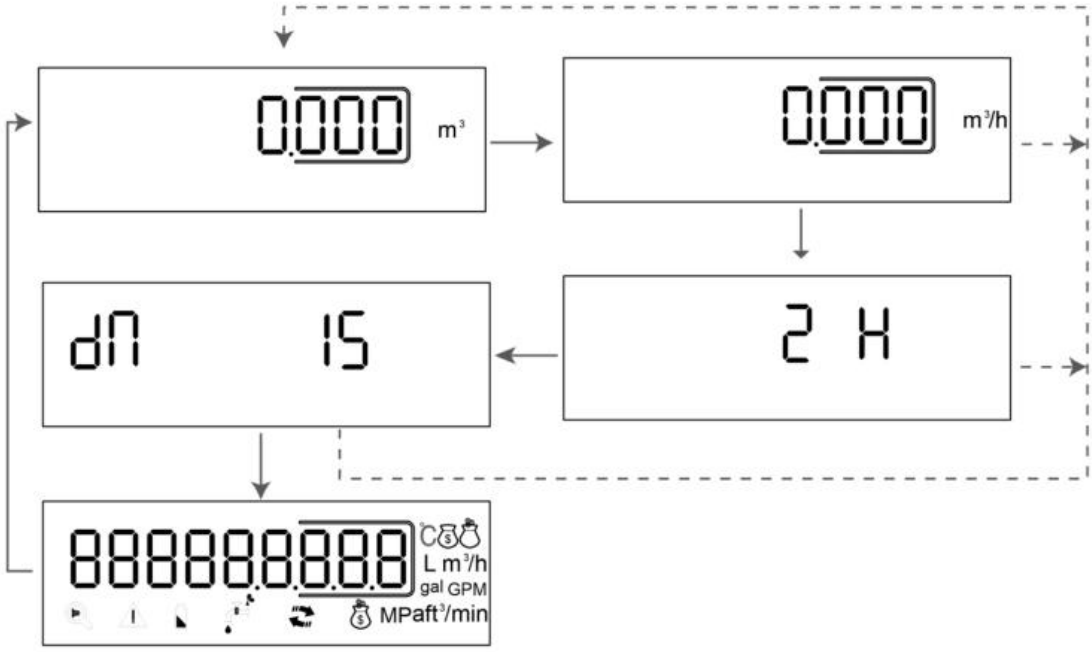
4) Testing Menu【F】:Use this menu when testing

This water meter is usually displayed by default LCD, the main menu is fixed to show cumulative flow. Use Press and Hold can loop through 4 menus. Use Press and Leave can shift in this level menu. User can use Press and Hold to shift into【E】【I】【F】menu and check relevant data by Press and Leave to shift into submenu. Screen will automatically return to the main menu page if no any operating over 3 minutes (except in menu【F】).

Please pay attention, no matter in which menu (except in menu【F】),as long as there is water flowing through the water meter, the flow value will be automatically accumulated in the water meter and there will be no missing or undercounting of the measurement data due to viewing the menu content or keystroking.

The following diagrams show the cyclic operation of each menu

1) Main Menu



Remarks: In the figure above, the parameters of each menu in order of arrows are shown below:

a. Accumulated flow

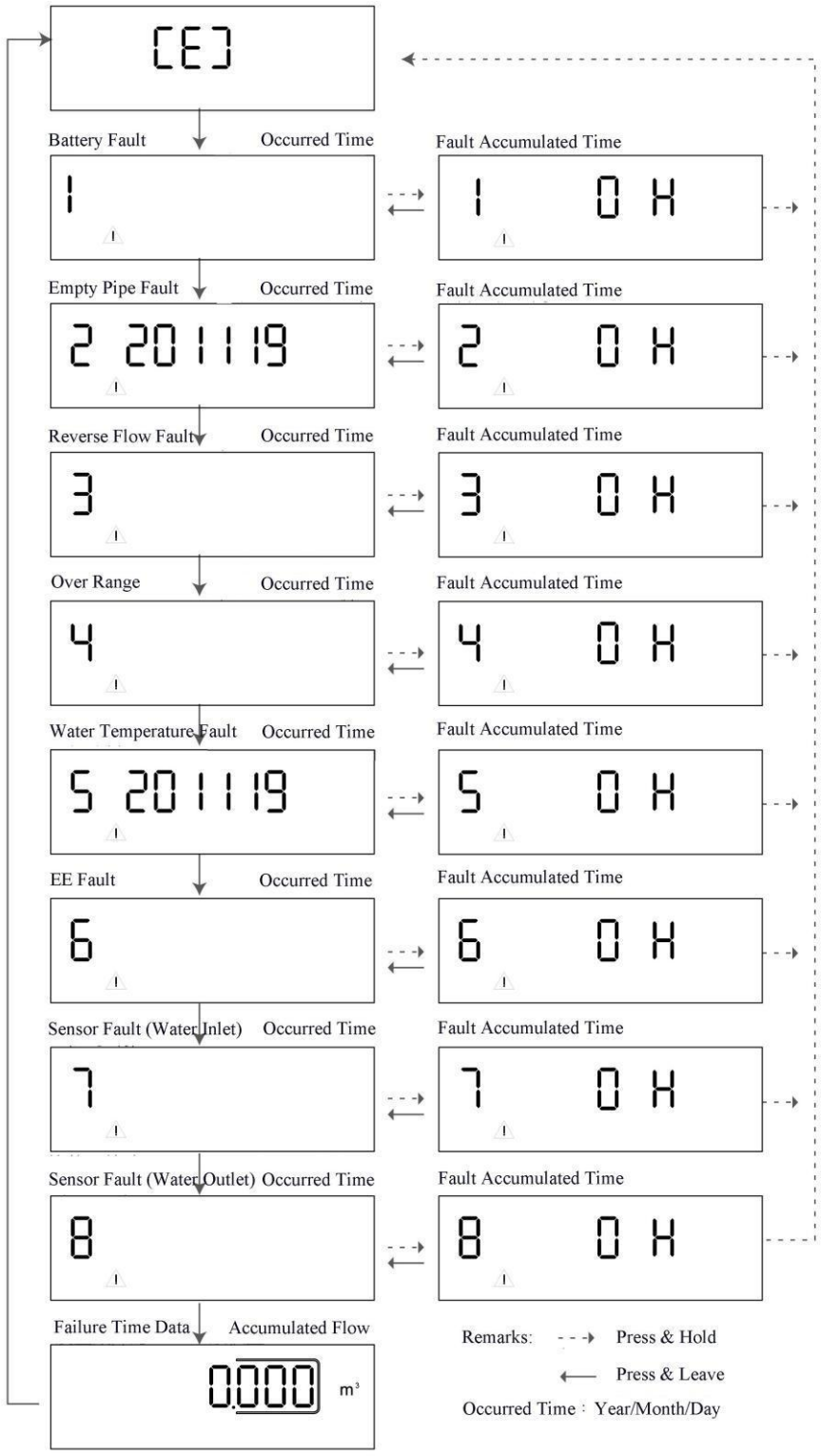
b. Instantaneous flow

c. Accumulated working time (hour)

d. Pipe diameter

e. Full screen

Error Menu【E 】

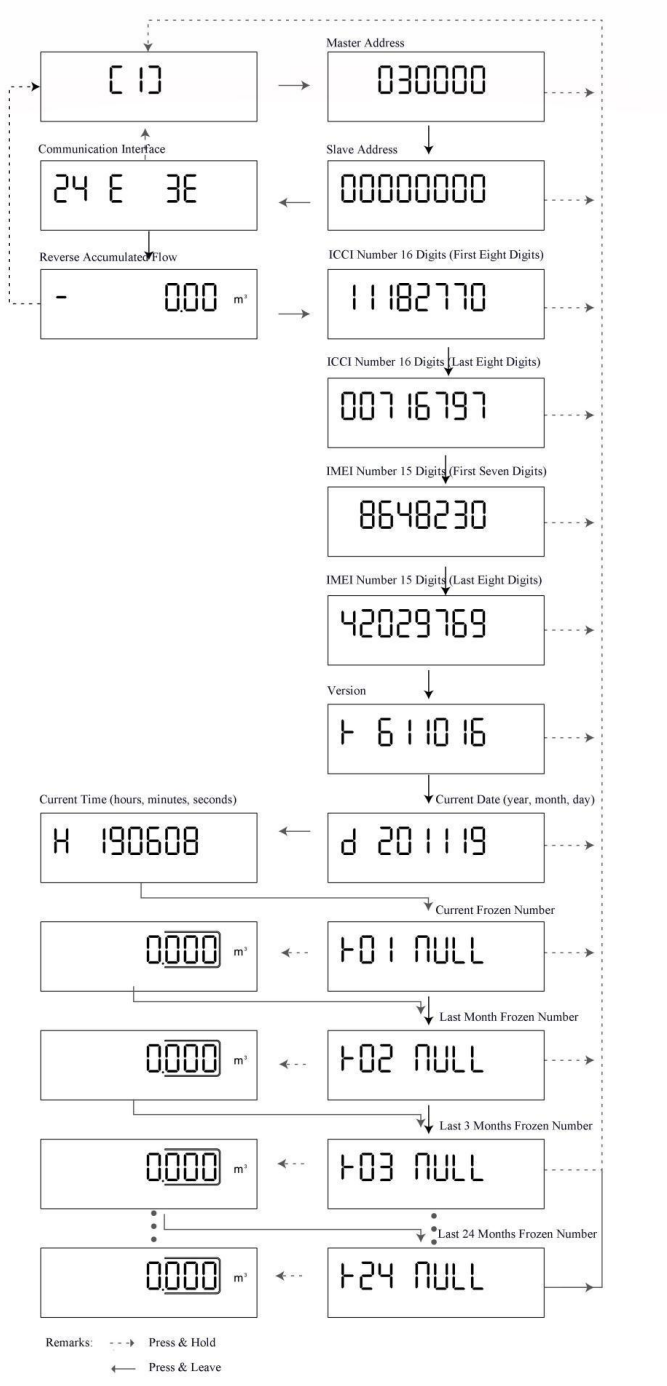


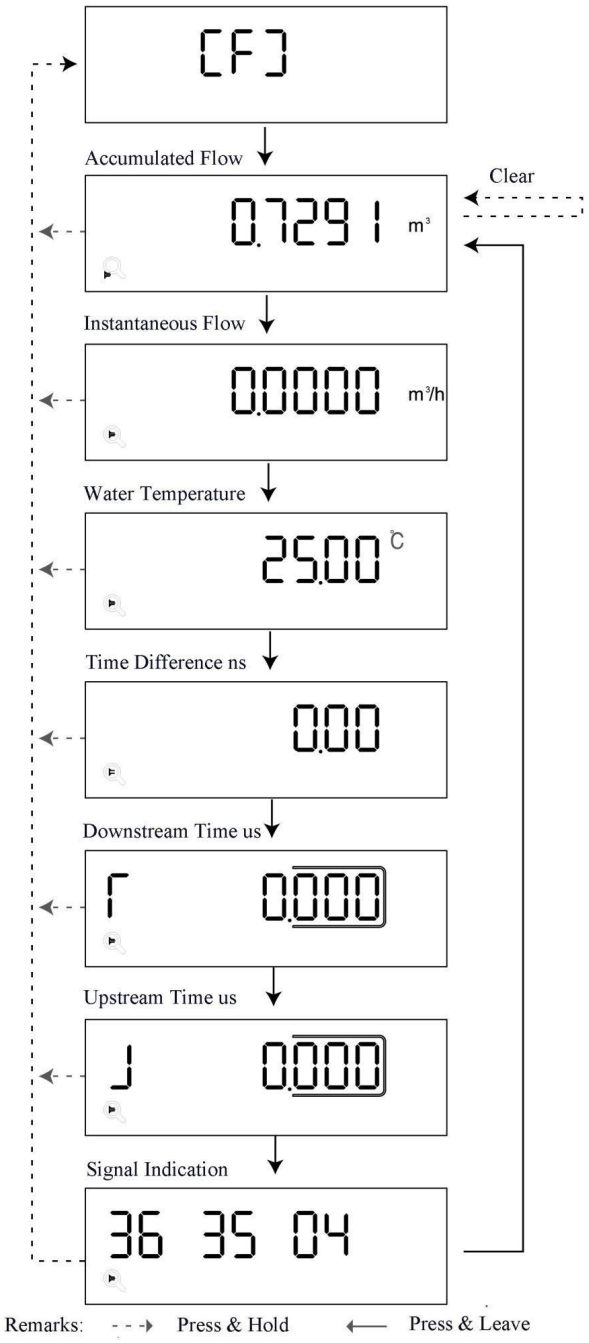
Remarks: Number 1-8 is fault code.

1Battery fault	Occurred time (year/month/day)
2 Empty pipe fault	Occurred time (year/month/day)
3 Reverse flow fault	Occurred time (year/month/day)
4 Over range fault	Occurred time (year/month/day)
5 Water temperature fault	Occurred time (year/month/day)
6 EE fault	Occurred time (year/month/day)
7 Sensor fault(water inlet)	Occurred time (year/month/day)
8 Sensor fault(water outlet)	Occurred time (year/month/day)

Use Press & Hold on the corresponding fault menu can view the duration of fault time.

2) Information Menu【I】





is displayed as "NULL", it
hat date.

3) Testing Menu [F]

5. **Infrared Meter Reading**
6. Users can be equipped with a hand-held meter reading machine to record the accumulated flow, running time and other information of the water meter. The meter reading method can refer to the operation instructions of the handheld machine.

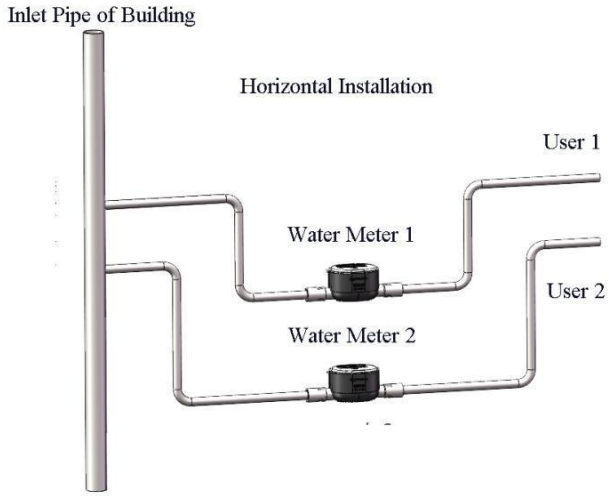
7. **Installation**

1) Installation Dimension

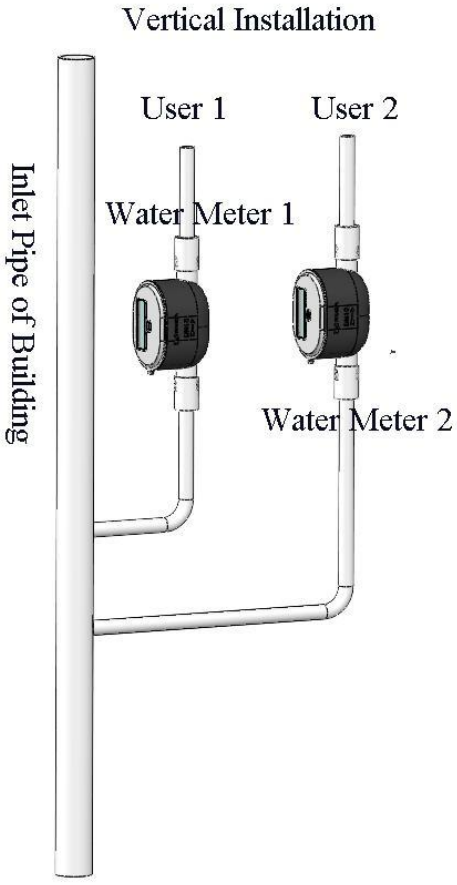
Norminal Size DN(mm)		15	20	25
Dimension	Length L (mm)	165	195	225
	Width W(mm)	83.5	89.5	89.5
	Height H(mm)	69.5	73	73
	Weight(kg)	0.7	0.95	1.15
Interface Size of Flow Pipe Segment	Thread Specification	G3/4B	G1B	G1 1/4B
	Thread Length(mm)	12	12	12
Pipe Joint Size	Pipe Joint Length(mm)	53.8	60	70
	Thread Specification	R1/2	R3/4	R1
	Thread Length(mm)	15	16	18

2) Ultrasonic Water Meter Installation Requirements (A check valve must be installed before the water meter)

Because the measuring principle of ultrasonic water meter is different from the mechanical water meter, the pipe can't be empty or accumulate much air bubbles, otherwise the ultrasonic signal can't be transmitted and resulting in not counting or inaccurate measurement. Based on the above reasons, the recommend installation method is as follows:



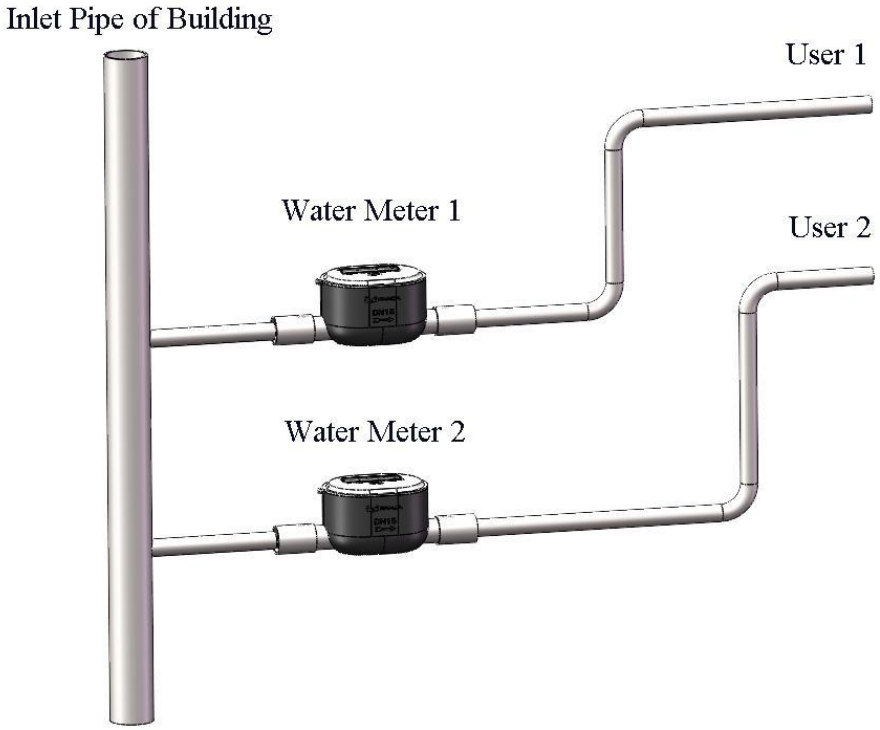
For horizontal installation, it is recommended to install as above and make the pipe line into "U".



In vertical installation, as shown in the figure above, the water flow direction is inflow at the water meter at the lower end and outflow at the upper end.
In this case, when water flows through, bubbles can be avoided to gather in the meter measuring pipe.

Compromised installation (horizontal)

If it is difficult to implement the recommended horizontal installation conditions due to the objective conditions on site, at least install as shown below.



In the figure, the pipe section in front of the water meter can be parallel to the water meter body (the right-angle bending structure is eliminated compared to the recommended method), but the pipe at the back of the water meter must be arranged as shown in the figure, so as to avoid bubbles forming in the pipe.

3) Precautions before installation

(1) The pipeline must be thoroughly cleaned before installing the ultrasonic water meter to avoid debris damage the water meter;

(2) Ultrasonic water meter is a relatively expensive precision instrument, you must be careful when picking up and putting down, do not directly lift the meter head or sensor line; It is strictly prohibited to be close to high temperature heat sources (such as electric welding, to prevent battery explosion, injury people and damage to the instrument);

(3) Special attention should be paid to the installation location of the ultrasonic water meter. It should be avoided to install the water meter on the upper end of the pipe (there will be bubbles in the pipe section), avoid installing it near the elbow (it will generate vortex flow), and keep it away from the pump and other equipment (it will cause pulsating flow).

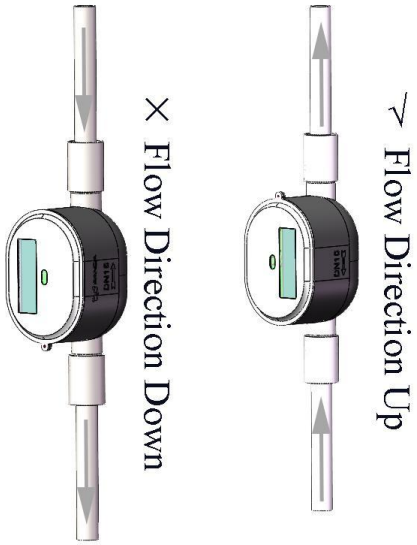
(4) The connecting pipes upstream and downstream of the ultrasonic water meter should be consistent with the diameter of the water meter and should not be reduced;

(5) The direction indicated by the arrow on the surface body of the ultrasonic water meter is the direction of water flow, and reverse installation is not allowed.

(6) It is suggested that the ultrasonic water meter is equipped with a filter of corresponding caliber in front of the meter; front and back of the meter is equipped with the corresponding diameter of the valve and it can be separated from the meter body, which is convenient for future maintenance and overhaul.

4) Common Error Installation Examples

(1) When the meter is installed vertically, it must be installed in a straight pipe with water flowing upwards, because the downward pipe with water flowing downwards will be affected by the gravity of the earth, which will cause the the pipe can't be filled up. In this case, the meter measurement will be inaccurate or even not measured (as shown in Figure C).



(2) When installing at the "U"-shaped pipe, please install the meter at the lowest point, because the pipe may gather air at a high place, causing the meter measurement to be inaccurate or not measured (as shown in Figure D)

Figure(D)

(3) When the meter is installed at the elbow, it must be ensured that the distance between the front straight pipe ≥5 times the pipe diameter and the rear straight pipe ≥ 3 times the pipe diameter, otherwise the meter may be inaccurate (as shown in Figure E).

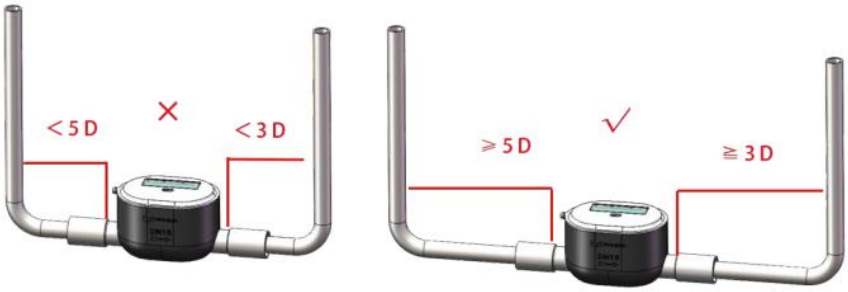
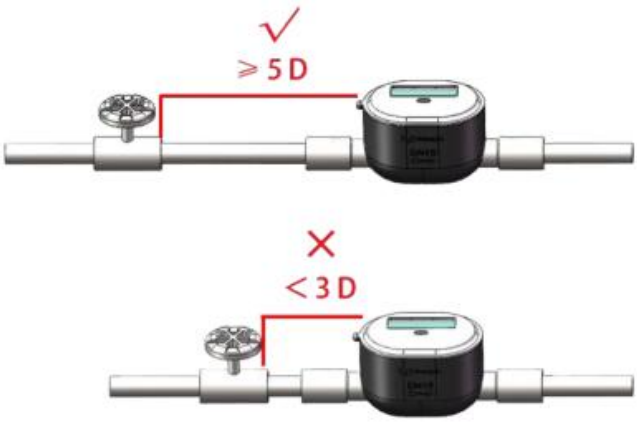


Figure (E)

(4) When the valve or other objects are installed in front of the meter, the distance between the meter and this object must be ≥5 diameters, otherwise the meter may be inaccurate; (as shown in Figure F)



Figure（F）

4) Wire Connection

●Power Wire

Default is built-in lithium battery power supply, extra power line is not needed.

External power supply mode (optional), red wire connects positive pole, black wire connects negative pole, voltage is DC (7.5-24)V

● Communication Wire

M-BUS communication mode: connect two communication wires with M-BUS directly, without positive and negative pole.

RS485 communication mode: there are 4 pieces of wires: A(Yellow), B(Green), Ground(Black),

Power(Red), DC（7.5～24V), connect correspondingly (pay attention to the pole, the meter will be burned down if connect incorrectly)

5) Daily Maintenance

(1)Please check the meter condition before using.

(2)Please don't damage the seal on water meter, otherwise we can't guarantee the quality and accuracy.

(3)The water meter is powered by built-in lithium battery, working life is up to 6 years. When battery is going not to work any more or LCD displays the symbol D (indicating low power), please inform after-sale service workers in time to avoid the meter can't work normally.

6) Common Fault and Troubleshooting

No.	Error Type	Symbol	Cause	Solution
1	Battery	Be on	Battery under voltage or poor connection	Check attachment plug and change battery.
2	Empty Pipe	Blink	Have no water in pipe or partially filled pipe	Make the pipe full of water and eliminate air bubbles.
3	Reverse Flow	Be on	Pipe inlet and outlet are reversed	Change the inlet and outlet.
4	Over range	Be on	Flow rate is too high	Reduce flow or change higher range meter
5	Water Temperature	Be on	Water temperature fault	Reduce water temperature or change higher temperature meter
6	EE	Be on	EE memory failure	Change circuit board
7	Sensor	Be on	Inlet sensor fault	Change or re-install inlet sensor
8	Sensor	Be on	Outlet sensor fault	Change or re-install outlet sensor

8. RS485 Modbus Protocol

1) Protocol Instruction

1. RS485 meter reading — Using RS485 communication hardware for 4-wire system long-distance serial communication.

2. 2.Totally 4 wires — A, B, Ground and Power 9-24V, the default 12V.

3.There are 4 wires on the water meter A(yellow), B(green), Ground(black), Power(red,

9-24V), correspondingly connected(different polarity, wrong connection may be burned).

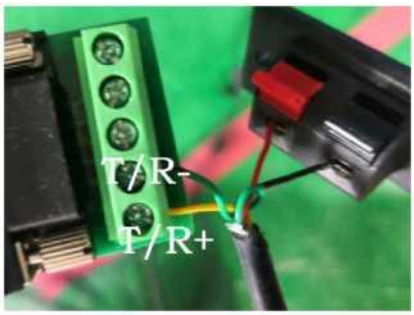
4.Communicate within 800 meters, up to 64 terminals.

5.Baud rate (default) is 2400bps, even parity, one start bit, one stop bit.

6.When the water meter responds to data, the pause time between bytes is about 4ms.

7.All plaintext transmission, no encryption.

8.Parity mode: CRC-16/ModBus, x16+x15+x2+1.



2) Modbus Protocol Format

① **Frame Format**

Item	Code	Length
Frame start character	68H	1
Meter type	T	1
Address field	A0	7
	A1	
	A2	
	A3	
	A4	
	A5	
	A6	
Control code	C	1
Data length	L	1
Data identification	DI0, DI1	2
Serial number	SER	1
Data	DATA	N
Check code	CS	1
End character	16H	1

② **Instrument type and its code**

Meter Type	Code
Water meter	10H
Heat meter	20H

③ **Address field**

AO∽A6 consists of seven bytes, each byte is in 2-bit BCD code format. The address length is 14 decimal digits, the low address is first, and the high address is last.

④ **Control code**

D0	D1	D2	D3	D4	D5	D6	D7

D7:

0 ⟶ Communication frame sent by the platform

1 ⟶ Communication frame sent by water meter

D6 - DO: Refer to specific protocol analysis

⑤ **Data length**

Data length = data identification bytes + sequence number bytes + data field bytes. Hexadecimal representation.

⑥ **Data**

Actual information of the table

⑦ **Check code**

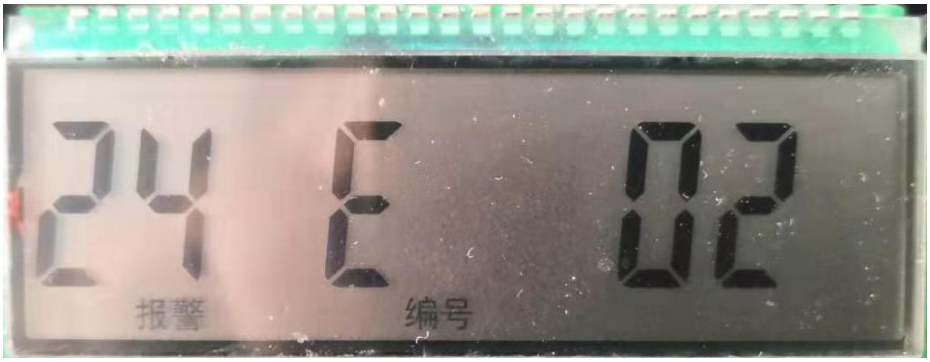
One byte, the cumulative sum of all bytes before the frame start character to the check code, excluding the overflow value exceeding FFH.

3) **Modbus Baud rate Setup**

To prevent modification, Modbus command cannot change the address directly; it needs to be modified by CJ188 protocol. Details as follows:

e.g.: Firstly check the baud rate in the third interface through [I] menu of water meter.

e.g.: 24 E 02 means communication baud rate is 2400, E,81, means Modbus address is 0x02.



e.g.: Baud rate switch to 9600,N,81. Data analysis format is integer data.

FE FE FE 68 20 AA AA AA AA AA AA AA 04 05 39 A0 03 44 16 6D 16

FE FE FE	68	20	AAAAAAAAAAAAAA	04	05	39	A0	03	44	16	6D	16

e.g.: Baud rate switch to 9600,N,81. Data analysis format is floating type data.

FE FE FE 68 20 AA AA AA AA AA AA AA 04 05 39 A0 03 24 16 4D 16

FE FE FE	68	20	AAAAAAAAAAAAAA	04	05	39	A0	03	24	16	4D	16

e.g.: Baud rate switch to 2400,E,81. Data analysis format is integer data.

FE FE FE 68 20 AA AA AA AA AA AA AA 04 05 39 A0 03 44 24 7B 16

FE FE FE	68	20	AAAAAAAAAAAAAA	04	05	39	A0	03	44	24	7B	16

e.g.: Baud rate switch to 2400,E,81. Data analysis format is floating type data.

FE FE FE 68 20 AA AA AA AA AA AA AA 04 05 39 A0 03 24 25 5B 16

FE FE FE	68	20	AAAAAAAAAAAAAA	04	05	39	A0	03	24	24	5B	16

4) Modbus Address Setup

To prevent modification, Modbus command cannot change the address directly, it needs to

be modified by Cj188 protocol. Details as follows:

e.g.:

Set Modbus address is 01, send data as follows:

FE FE FE 68 20 FF FF FF FF 04 74 68 15 0A A0 18 AA FF FF FF FF 01 11 11 04 16

Set modbus address is 02, send data as follows:

FE FE FE 68 20 FF FF FF FF 04 74 68 15 0A A0 18 AA FF FF FF FF 02 11 11

05 16

Therein 04 74 68 is factory code, provided by manufacturer, also can be checked in the first interface through [I] menu.

01，02 are the address of Modbus.

5) ModBus Application Protocol

① **1. ModBus Integer Command Read**

An example of the command sequence sent by the host:

ModBus address: 0x01 (integer format register address must start with 01)

Command code: 0x03

Register start address high byte: 0x00

Register start address low byte: 0x01

Register address number high byte: 0x00

Register address number low byte: 0x26

CRC check high byte: 0x95

CRC check low byte: 0xD0

Frame format:

01H	03H	00H	01H	00H	26H	95H	D0H

Frame format:

Slave response command sequence description:

ModBus address: 0x01

Command code: 0x03

Return register data bytes: 0x4C

CRC high byte: 0xxxxx

CRC low byte: 0xxxxx (check method CRC-16/ModBus, x16+x15+x2+1)

01H	03H	4CH	DATA	CRC high byte	CRC low byte

Register Address	Data Format	Number Of Bytes	Data Content
register address 0	HEX	2	Instantaneous flow rate
register address 1	HEX	2	
register address 2	HEX	2	Positive cumulative flow
register address 3	HEX	2	
register address 4	HEX	2	Cumulative daily traffic in the last month
register address 5	HEX	2	
register address 6	HEX	2	Cumulative working time
register address 7	HEX	2	
register address 8	HEX	2	Meter status
register address 9	HEX	2	
register address 10	HEX	2	Reverse cumulative flow
register address 11	HEX	2	
register address 12	HEX	2	Current pressure
register address 13	HEX	2	
register address 14	HEX	2	Current Temperature
register address 15	HEX	2	
register address 16	HEX	2	Undefined
register address 17	HEX	2	Undefined
register address 18	HEX	2	Undefined
register address 19	HEX	2	Undefined
register address 20	HEX	2	Undefined
register address 21	HEX	2	Undefined
register address 22	HEX	2	Undefined
register address 23	HEX	2	Time of the meter
register address 24	HEX	2	
register address 25	HEX	2	

Specific analysis examples

The host sends the command sequence:

01 03 00 00 00 1A C4 01

The slave responds to the command sequence:

01 03 34 3F 7D 40 D9 0F C5 42 0F 85 1F 41 45 B4 38 49 96 00 00 40 00 85 1F 41 45 FE F4 3E 94 E1 48 41 E4 00 00 00 00 00 00 00 00 00 000 28 24 09 19 01 4C 2B

ModBus address: 0x01

Command code: 0x03

Return register data bytes: 0x34

Register Address 0: 0x3F7D

Register address 1: 0x40D9 Instantaneous flow rate (floating point number 6.789m3/h)

Register Address 2: 0x0FC5

Register address 3: 0x420F positive cumulative flow (floating point number 35.7654m3)

Register Address 4: 0x851F

Register address 5: 0x4145 Cumulative daily flow in the last month (floating point number 12.345m3)

Register Address 6: 0xB438

Register address 7: 0x4996 cumulative operation (float 1234567 hours)

Register Address 8: 0x0000

Register Address 9: 0x4000 Error Alarm (0x0002)

Register address 10: 0x851F

Register address 11: 0x4145 Inverse cumulative daily flow (floating point number 12.345m3)

Register Address 12: 0xFEF4

Register address 13: 0x3E94 pressure (0.291MPa)

Register Address 14: 0xE148

Register address 15: 0x41E4 Water temperature (28.61℃)

Register address 16~22: 0x0000 undefined

Register address 23: 0x4128 minutes, seconds

Register address 24: 0x2409 day, hour

Register address 25: 0x1901 year, month //time in the meter January 24, 2019, 09:41:28

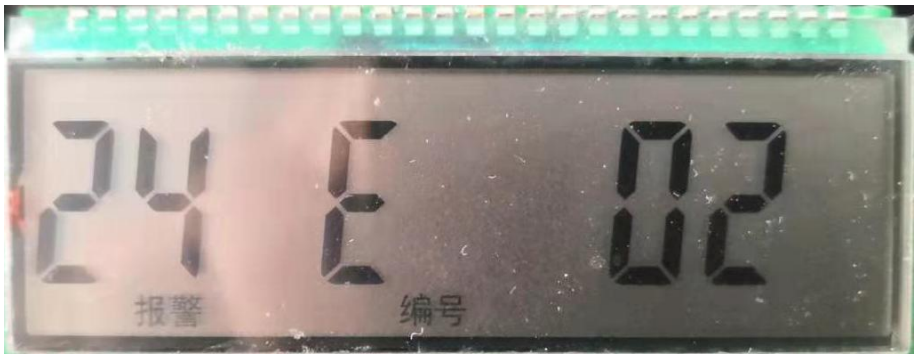
CRC high byte: 0x4C

CRC low byte: 0x2B

6) Third-party software ModScan32 debugging

1. Set ModScan32 software: menu "Connection/Connect", select Connect as the corresponding port number, baud baud rate (fill in according to the baud rate in the actual table), word (data bit) is 8, Parit check bit (fill in according to the baud rate in the actual table), Stop (stop bit) is 1, "Rotocal "Selection\Transmission Mode" select "STANDARD RTU". Then click "OK" to confirm.

As shown in the table above, the third screen of the [I] menu displays the following content, 2400 even parity, modbus address 02,The software settings are as follows:



(1) **Integer data read**: Device Id (meter address LocalAdress) is set to 2, MODBUS Point Type (command word) is set to 03, Address (data address) is set to 0002 (it should be address 1, but this software will automatically

The address is reduced by one, so it is changed to 2), and the Length (data length) is set to 38.

It can be seen that the return data below is normal, the 40004 register data is 0B3B, the meaning is L/h.

- On-off Valve Instruction

Open the valve:

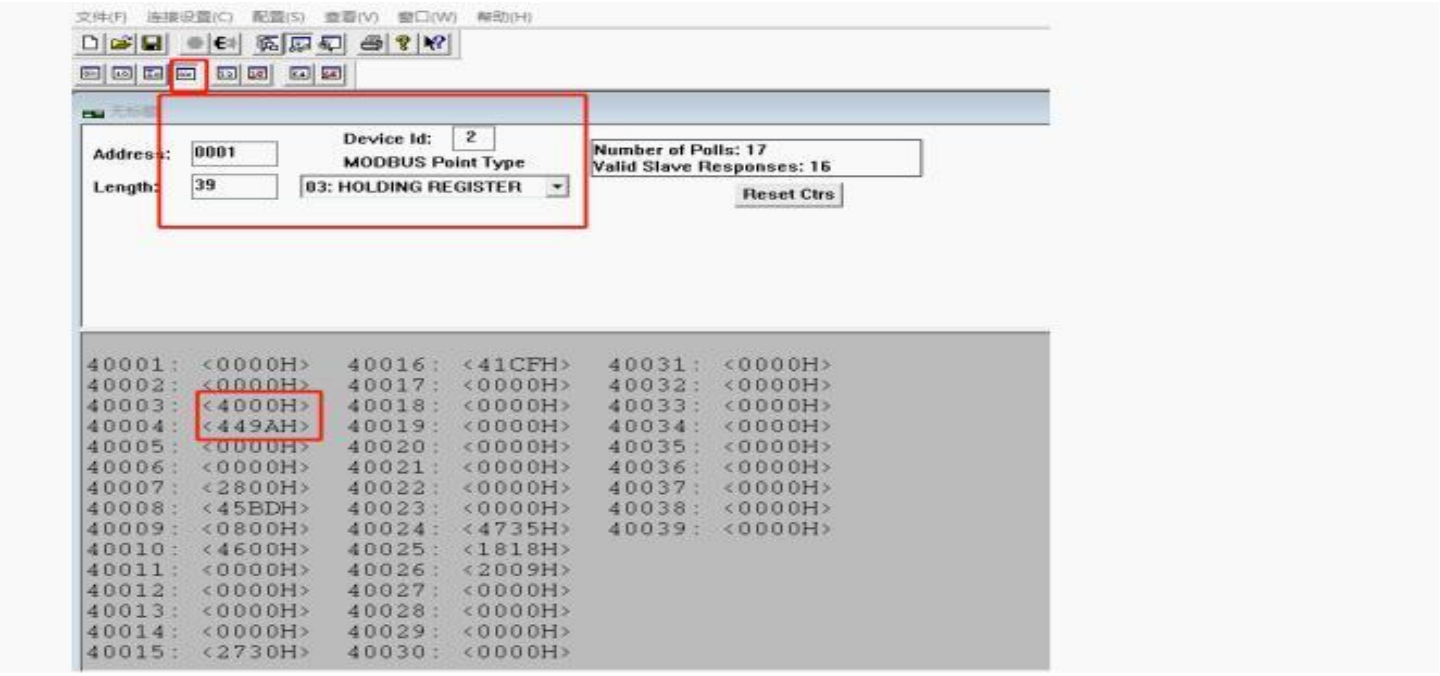
Hex 6810AAAAAAAAAAAA0404A01700553216

Base64 aBCqqqqqqqqBASgFwBVMhY=

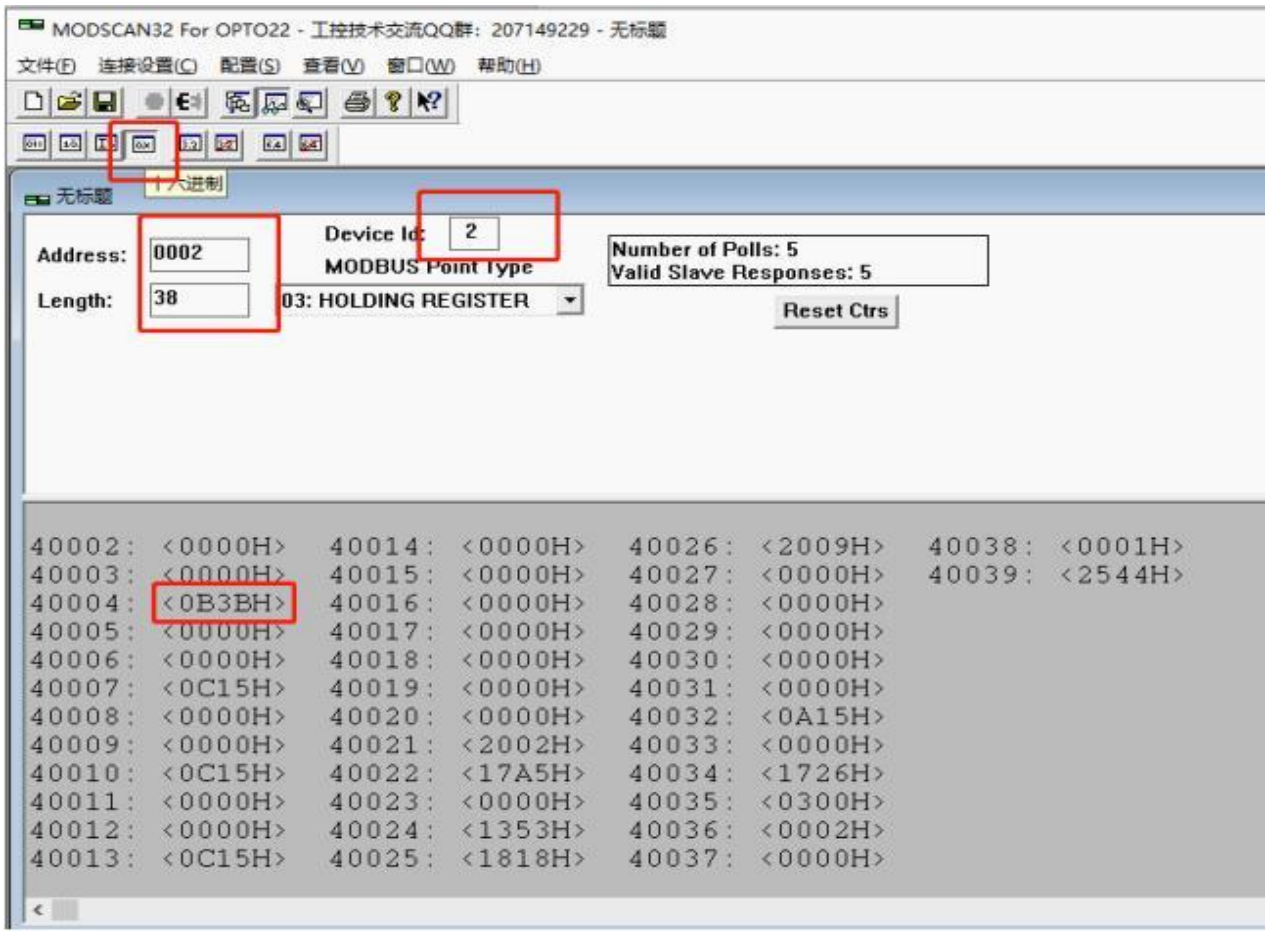
Close the valve:

Hex 6810AAAAAAAAAAAA0404A01700997616

Base64 aBCqqqqqqqqBASgFwCZdhY=



(2) **Integer data read**: The floating-point address can start from 0, and the 449A4000 corresponds to a single-precision floating-point decimal accumulation of 1234 cubic meters.



2. **Communication Test Software**

How to use: 1234 steps as shown below

1. Set the communication parameters (COM5, 2400, even parity, data bit 8, stop bit 1) and open the serial port

2. MBUS read address, get manufacturer address 687508

3. Set the Modbus address. Fill in 687508 for the manufacturer's address, and 02 for the table address (here 02 is in decimal, and it is displayed in hexadecimal on the table)

4. Modbus table reading (integer type), device address 02, starting address 01, and the number of addresses is 38.

9. Transport and Storage

1) Please handle with care during transport and avoid violently crashing.

2) Storage temperature is (-10∽+50) °C, relative humidity is lower than 80%, avoid strong electromagnetic field and direct sunlight.

3) The stored product shall be at least 30cm from the ground, at least 1m from the walls, and at least 2m from the heating equipment.

4) The warehouse shall be kept dry and free from corrosive substances, gas and dangerous goods.

10. Warranty

The ultrasonic water meter defaults to a free warranty within one year from the date of shipment.(Customers can pay extra to extend the free warranty period, maximum is 6 years), lifetime maintenance. However, damage caused by the following conditions is not covered by the warranty：

1) The seal signs of each part of the ultrasonic water meter are opened or destroyed.
2) The components of the ultrasonic water meter are artificially destroyed.
3) The components of the ultrasonic water meter are exposed to sun exposure, flooding, freezing and chemical pollution.
4) The pipeline is not cleaned before installation or there are too many impurities in the pipeline, which results in damage to the flow sensor.
5) Failure and damage caused by not selecting a suitable product model.

Warranty Card

User Name		Contact Number	
User Address		Purchasing Date	
Product Model		Product SN	
Fault			

Notice：

Please read the user manual carefully before using meter.

Hope you can contact with us regularly to get the latest information, cause our product is constantly updated and improved.

11. Recycling Instructions for Waste Products

1) Purpose

When the product can't be maintained or used and need to be recycled, please follow the requirements of local environmental department to minimize the possible damage to the environment.

2) Range

Suitable for products of Lanry instruments（Shanghai） Co.,Ltd

3) Details

(1) Regulations on waste products and emissions.

(2) Dispose of all waste products properly.

(3) When handling and disposing of the treated liquid, comply with applicable environmental regulations.

Clean up all spilled liquids according to safety and environmental protection regulations, and report all environmental emissions to relevant departments.

4) Electrical Parts

(1) For electrical equipment recycling requirements, please consult local power company.

(2) Recycling Guidelines

(3) Please strictly abide by local laws and regulations when recycling.

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