Product Instruction Manual

Ultrasonic Water Meter

WM9100 Series

Lanry Instruments (Shanghai) Co.,Ltd

Dear users，

Thank you for choosing our water meter products. In order to use the meter correctly, please read this instruction manual carefully before use. And please keep it properly for reference when needed.

Notice

- 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  , due to water meter pipe section filled with water, 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.

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

②About 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.

③Please 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.

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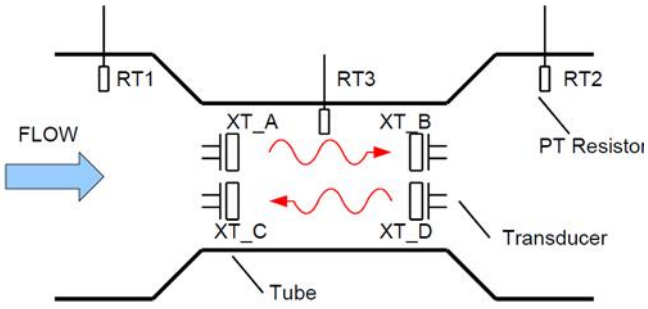
Summary

1. Introduction

At present, the flow meter industry has problems such as high initial flow, inconvenient measurement of small flow, inaccurate measurement due to scaling, unstable and inconvenient connection of flow and pressure remote transmission. In response to the above water meter stubborn problems, our company has developed the latest generation product -Company intelligent ultrasonic water meter, which can be accessed through remote one-key scanning of flow and pressure; the high turndown ratio can take into account the flow measurement of two types of ultrasonic water meters on the market, full bore and reduced bore. 304 stainless steel is used for one-time stretching, colorless electrophoresis to prevent scaling. The water meter is approved by National Health Inspection and Quarantine department and meets the sanitary standard for drinking water. Protection class is IP68. Reading the manual carefully will be more helpful to understand and operate the water meter.

2. Measuring Principle

The ultrasonic water meter utilizes the transducers to transmit and receive the signal. The transducer signal travels faster downstream than upstream. By measuring transit time, the average flow velocity can be detained. The volume flow can be calculated out of the flow velocity and pipe sectional area.



Ultrasonic water meter is precious instrument with built-in battery power supply for measuring the flow.

3. Industrial Standard

- ISO 780:1997, MOD Packaging-Pictorial marking for handling of goods
- ISO 4064-1:2014 Water Meters for Cold Potable Water and Hot Water
- ISO 228-1-2000 Non-sealed thread pipe, Part 1, Dimensions, tolerances and designation

Features

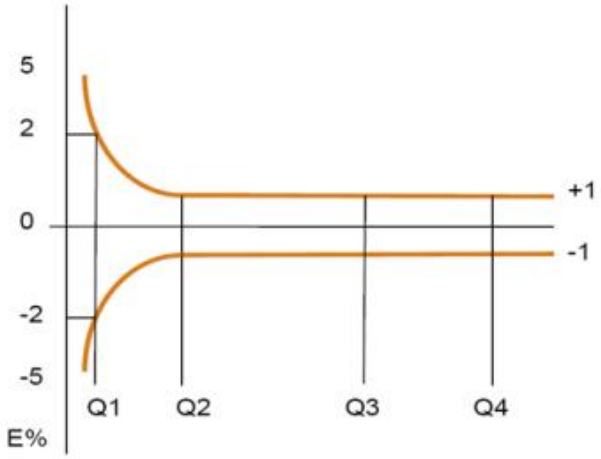
1. Technical Specification

Max.Working Pressure	1.6Mpa
Temperature Class	T30, T50, T70, T90（default T30）
Accuracy Class	ISO 4064, Accuracy Class 2
Body Material	Stainless SS304（opt. SS316 or SS316L)
Battery Life	Up to 10 years (consumption ≤0.5mW)
Protection Class	IP68
Environmental Temp.	-40～70℃，≤100%RH
Pressure Loss	ΔP10, ΔP16（based on different dynamic flow）
Climatic And Mechanical Environment	Class O
Electromagnetic Class	E2
Communication Output	RS485 (baud rate adjustable) Pulse Opt. NB-IOT, GPRS
Display	9 digit LCD display volume, flow rate, pressure, error alarm, flow direction, low battery power alarm, output
RS485	Baud rate 2400bps,4800bps,9600bps,(default 9600bps,Modbus-RTU)
Connection	Flange or Clip
Flow Profile Sensitivity Class	U5/D3 or U3/D0
Data Logger	Store the latest 10 years' data including Day, Month and Year The data can be permanently saved even after the loss of power.
Frequency	1-4 times/second

2. Flow Parameter

Model		WM9100								
Nominal Size	(mm)	50	65	80	100	125	150	200	250	300
	(inch)	2	2.5	3	4	5	6	8	10	12
Overload Flow Q4		78.75	125	200	312.5	312.5	500	787.5	1250	2000
Permanent Flow Q3		63	100	160	250	250	400	630	1000	1600
Transitional Flow Q2		0.202	0.320	0.512	0.800	0.800	1.280	2.016	3.200	5.120
Minimum Flow Q1		0.126	0.200	0.320	0.500	0.500	0.800	1.260	2.000	3.200
R=Q3/Q1		500								
Q2/Q1		1.6								

3. Error Curve



Installation

1. Dimension and Weight

n :bolt hole numbers

k: Bolt hole diameter

Model		WM9100								
Nominal Size	（mm）	50	65	80	100	125	150	200	250	300
	(inch)	2	2.5	3	4	5	6	8	10	12
L-Length（mm）		200	200	225	250	250	300	350	450	500
L-custom length (mm)		280	/	370	370	/	500	500	/	/
B-Width（mm）		165	185	200	220	255	285	340	406	489
H-Height（mm）		258	277	293	307	334	364	409	458	512
h-Height（mm）		74	89	96	106	120	138	169	189	216
D×n		18×4	18×4	18×8	18×8	18×8	22*8	22*8	22*12	22*12
K (mm)		125	145	160	180	210	240	295	350	400
Pressure(MPa)		1.6	1.6	1.6	1.6	1.6	1.6	1.0	1.0	1.0

2. Installation location selection

- The direction of the arrow on the body of the ultrasonic water meter is the direction of the water flow, and it must not be installed backwards;
- Installed in the vertical pipeline or the lowest horizontal pipeline where the liquid flows upward (or obliquely upward), try to avoid the pipeline where the liquid flows downward (or obliquely downward), so as to prevent the liquid from filling the pipe.
- The installation position should not be selected at the highest point of the pipeline to prevent the accumulation of air bubbles in the pipeline and cause abnormal measurement.
- Because the installation position of the ultrasonic water meter and the state of the measured pipeline have a certain degree of influence on the measurement accuracy, under any field conditions, the longer the straight pipe section before and after the installation point is better, and the A-type straight diameter installation point is recommended to meet at least Upstream side 5D, downstream side 3D straight pipe requirements.
- (B-type micro-reduced diameter U3/D0, C-type reduced-diameter straight pipe section U0/D0 are for the front and rear valves are gate valves), if the front end is a butterfly valve or a straight pipe section at the pump outlet, the installation point is recommended to meet at least 10D on the upstream side and on the downstream side 5D straight pipe requirements.
- If there are valves installed on the pipelines before and after the water meter, it is recommended to select gate valves.
- Special attention should be paid to the installation position of the ultrasonic water meter. It should be avoided to install the water meter at the upper end of the pipe (there will be air bubbles in the pipe section), avoid installation near the elbow (the vortex flow will be generated), and should be kept away from the pump and other equipment (will cause pulsating flow);
- In locations with large pressure fluctuations, it is recommended that a check valve must be installed at the water inlet end when the water meter is installed to reduce the water meter rotation caused by passive water pressure in the pipeline.

3. Meter Installation

1) Flange Connection

A. Cut the pipe and measure the installed position according to the dimension chart

B. Weld the flange on the pipe.

C. Both of The central points of flange and pipe should be aligned and place sealing gasket between them.

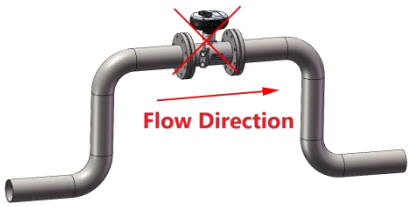
Fasten together with bolts after all central points aligned.

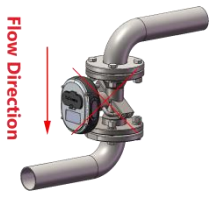
Caution

- The water meter must be recovered originally after disassembling and seal completely in case of leakage.
- Take notice of the mar ➡ , it must be in the same direction with the flow.
- Each of The central points of flange, pipe and sealing gasket should be aligned.

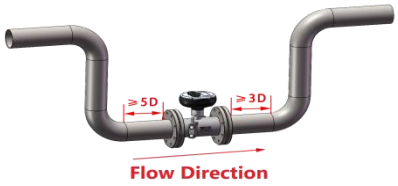
2) Schematic diagram of installation location

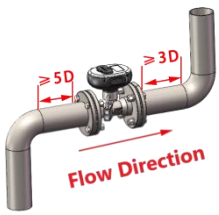
A. Avoid installing at the highest point of the pipeline or where the water flow direction is from top to bottom



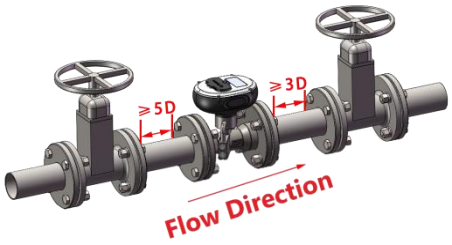


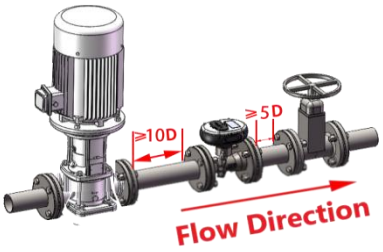
B. For accurate and accurate measurement, it is recommended to install according to the following diagram



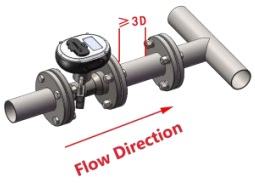


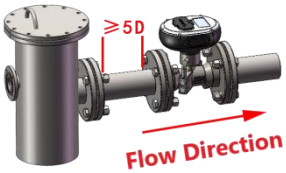
C. At the lowest level, the front installation needs ≥5DN straight pipe section, and after installation, it needs ≥3DN straight pipe section, 90o elbow needs ≥5DN long straight pipe section before, and ≥3DN long straight pipe section after

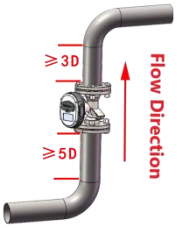




D. The gate valve requires ≥5DN long straight pipe section in front of the valve, and ≥3DN long straight pipe section after;



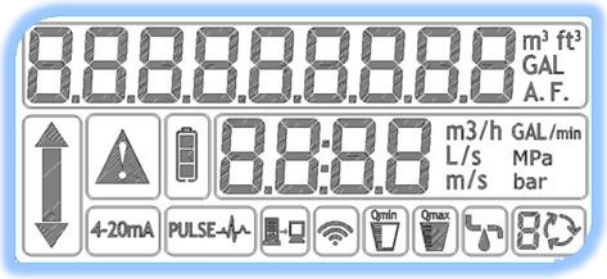




E. ≥3DN straight pipe section is required for the front installation of the tee joint, ≥5DN long straight pipe section is installed after the filter, and ≥5DN long straight pipe section is required for vertical installation before the elbow, and ≥3DN long straight pipe section is required after the installation.

Display and Output

1. LCD Display



2. Display Description

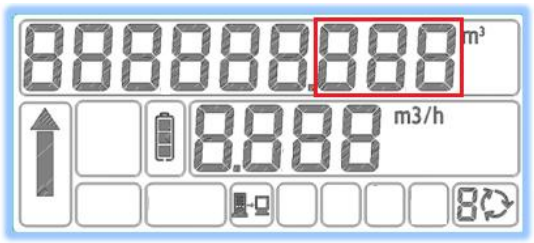
Ultrasonic water meter adopts multi-lines*9 digital LCD, as below

-  Flow Direction
-  Battery Voltage Detection, the figure lose one bar while the battery power reduce 30%
-  Communication output, RS485 output
-  Pulse output is open
-  GPRS/NB is open
-  Maximum flow alarms
-  Minimum flow alarms
-  Empty pipe / error
-  Dripping in the pipe
-  Communication baud rate selection

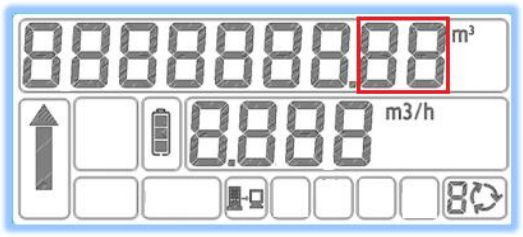
- Volume unit, Gal, ft³, m³, A.F
- Velocity unit, Gal/min, L/s, m³/h, m³/s
- When choosing different output, the corresponding logo will be lit.
- When the set flow reaches the minimum or maximum flow, the corresponding logo will be lit.
- Empty pipe or error, the corresponding logo will be lit.

Notice: Ultrasonic water meter is highly precise measuring instrument. It is double path, no moving parts and operating buttons. All parameters are set by Modbus. Specific setting refers to RS485 communication introduction.

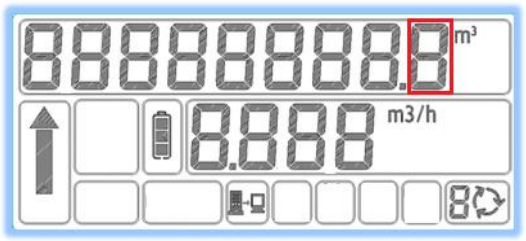
3. Display Resolution



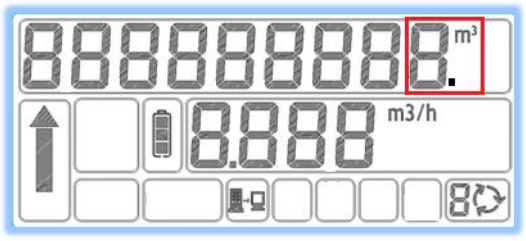
Default display-(Minimum Resolution=0.001/unit)



Optional display-(Minimum Resolution=0.01/unit)



Optional display-(Minimum Resolution=0.1/unit)



Optional display-(Minimum Resolution=1/unit)

4. Flow Display Option

- The display resolution of volume can be changed by RS485. Default display resolution is 0.001/unit.

- Volume is divided into positive flow, negative flow and net flow. Default display is net flow.
- Display resolution will be automatically adjusted. The maximum value is 999999999.
- The volume unit can be set by RS485.

5. Communication Output

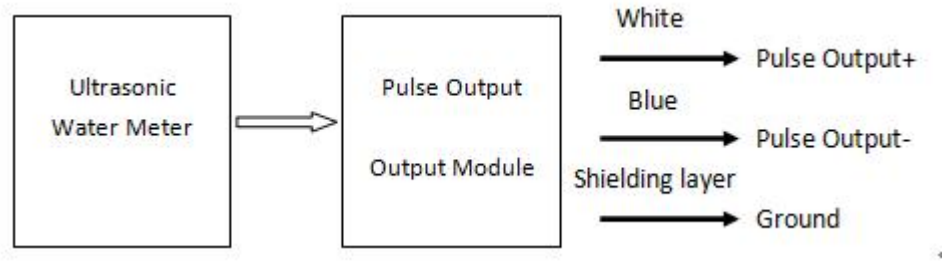
The ultrasonic water meter has two output, pulse output and RS485 output, which are integrated in a communication module. Both outputs are passive output through connecting wires. For RS485 output, an external 3.3V power supply is required. The two outputs can be used at the same time or separately, and the output mode can be selected through the RS485 setting.

- Pulse output (refer to chapter 6)
- RS485 output (Modbus Protocol) (refer to chapter 7)

When choosing different output model, the corresponding icon will be lit.

6. Pulse Output

Open collector that allows current loading of 200mA and up to 5V (Please pay attention no more than 5 VDC).



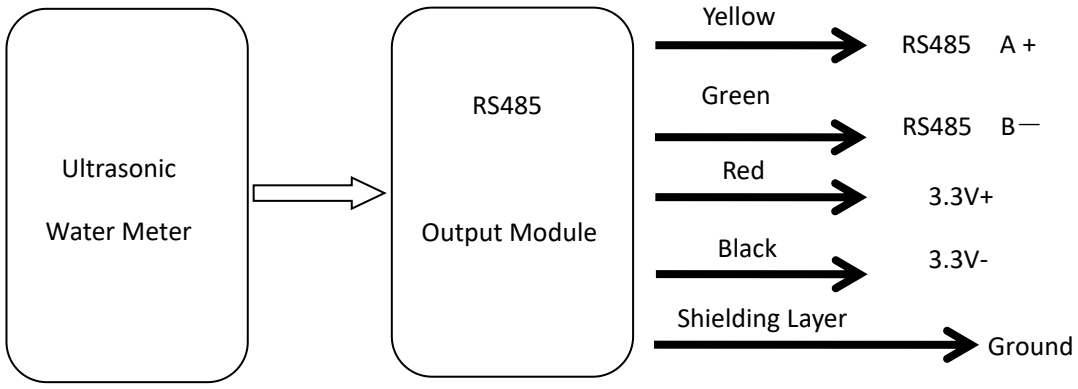
Output	Cable color	Function
Cable	White	Pulse Output+
	Blue	Pulse Output-
	Shielding layer	Ground

Warning: Signal connection polarity is compulsive

Output	Dry contact
Cable length	1 m
Max. power voltage	5VDC

7. RS485 Output

The default baud rate of RS485 is 9600, non-inspection, 8 digit, 1 stop button.



RS485	Cable color	Function
Cable	Yellow	RS485 A+
	Green	RS485 B-
	Red	3.3V+
	Black	3.3V-
	Shielding layer	Ground

Warning Signal connection polarity is compulsive

8. Modbus-RTU Protocol

a. Modbus-RTU Protocol

Ultrasonic water meter supports Modbus-RTU Protocol, it usually communicates with other devices by RS232/RS485. It observes and realizes standard read/write information structure. Notice that Modbus doesn't provide suitable structure for document transfer. It consists of address code, function code, payload data and calibration.

Master format

Address code	Function code	Data	CRC Verification

Address code 1 byte, range from 1 to 255

Function code 1 byte, can read 3 times and write 16 times.

Payload data 0 to N bytes, determine by user setting

CRC Verification 2 bytes, according to address code, function code, data

Slave format

Address code	Function code	Data	CRC Verification

Address code 1 byte, master device transfer address

Function code 1 byte, master device transfer function code

Payload data 0 to N bytes, response data come from water meter.

CRC Verification 2 bytes, according to address code, function code, data

b. Standard format

Read the logger for searching measuring value

Information		
Address	1 byte	1 to 255
Function code	1 byte	3
Address code	2 byte	0 to 62
Logger count	2 byte	2 to 64
CRC Verification	2 byte	

Response		
Address	1 byte	1 to 255
Function code	1 byte	3
Byte count	1 byte	4 to 128
Payload data	N byte	
CRC Verification	2 byte	

Byte character= 2*Logger count

Separately write logger is used for setting water meter.

Information		
Address	1 byte	0 to 255
Function code	1 byte	16
Address code	2 byte	0 to 62
Logger count	2 byte	2 to 64
Payload data	N byte	
CRC Verification	2 byte	

Response		
Address	1 byte	1 to 255
Function code	1 byte	16
Byte count	2 byte	0 to 62
Payload data	2 byte	2 to 64
CRC Verification	2 byte	

c. Modbus RTU Setting

Baud rate 2400/4800/9600/

Data bit 8 digits

Parity bit Even, Odd, None

Stop bit 1 byte

Default setting is 9600, no parity bit

The device address 0 is the broadcast address, the device can accept the write command but does not reply.

d. Modbus Logger

Address	Capacity	Model/Connect	Data Type	Description
00	4	Read only	float	Instantaneous velocity (m/s)
02	4	Read only	float	Instantaneous flow (m^3 /h)
04	8	Read only	double	Net volume (m^3 /h)
08	8	Read only	double	Positive volume (m^3 /h)
12	8	Read only	double	Negative volume (m^3 /h)
16	4	Read only	hhmmss	BCD format time
18	4	Read only	yymmdd	BCD format date
20	4	Read only	uint	Device status
22	4	Read only	uint	Device number
24	8	Read only	double	Appointed day net volume
28	8	Read only	double	Appointed day positive volume
32	8	Read only	double	Appointed day negative volume
36	4	Read/write	yymmdd	Set specific date by BCD format
38	4	Read/write	uint	Display control
40	4	Read/write	uint	RS485 control
42	4	Read/write	uint	User control
44	4	Read/write	float	Current circuit range 4mA
46	4	Read/write	float	Current circuit range 20mA
48	4	Read/write	uint	RS485 retention time
50	4	Read only	float	Battery power
52	4	Read only	float	Software version
54	4	Read only	float	Pipe pressure
56	4	Read only	int	Positive integral part (m^3 /h)
58	4	Read only	int	Positive accumulative decimal, three decimal places (m^3 /h)
60	4	Read only	float	Current Temperature
62	4	Read/write	float	Pipe loss factor

Remarks
Device address 20
Bit 0 Current flow exceeds measuring range
Bit 1 Low battery
Bit 2 Signal error, generally empty pipe or transducer error
Bit 3 No pressure sensor signal
Bit 4 The cumulative amount exceeds the screen display range
Device address 38
Bit [2-0] Decimal part displays 0-5 digits
Bit [4-3] Volume Type
00 Net volume
01 Positive volume
10 Negative volume
Bit [7-5]: The second line content option on display
000 Velocity
001 Flow rate
100 Pressure, flow, velocity circled in every 5 seconds
101 Current pressure
Bit 8: Display test, automatically recover 1s after display light on
Bit [10-9]: Volume unit option
00 m^3
01 ft^3
10 gal
11 A.F
Bit [12-11]: Velocity unit option
00 m^3/h
01 l/s
10 Gal/min
Bit 13: Pressure unit option
0 Mpa
1 bar//1bar=100Kpa=0.1Mpa
RS485 address 40
Bit [7-0]: Modbus communication address
Bit [10-8]: Serial port baud rate option (bps)
000:2400
001:4800
010:9600
011:19200
110:115200
Bit [12-11]: Parity bit type option
00 None
01 Odd
10 Even

Device address 42

Bit [1-0]: Pulse output option

00 Net volume

01 Positive volume

10 Nagative volume

Bit [4-2]: Pulse output resolution option

000 2ml

001 100ml

010 1L

011 10L

100 100L

101 1m³

110 10m³

111 100 m³

Bit 5: Pulse output support

Bit 13: Positive support

Bit 14: Negative support

Bit 15: Zero calibration support

Bit 16: Pressure measurement enable

Common Fault

If a fault occurs, please read the following common faults and solve method first. If the fault still cannot be solved, please contact our company for repair

Fault	Content	Solution
Constantly display 	1.Empty pipe 2.Transducer severe scaling 3.A fault has occurred	1.Full fill water in pipe 2.Remove transducer scaling 3.Contact us for help
Frequent display 	Liquid with too much air bubbles or solids	Eliminate solids and air bubbles in pipe
Display 	Low battery	Replace battery ASAP
Constantly display “888888888”	Internal program chaos, a fault has occurred	Contact us

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