FC-702C Ultrasonic Water Meter User Manual（05）

LoRaWAN Terminal Series

Version 1.1

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About This Document

Scope

Scope of this document is to present features and application of Friendcom FC-702C Ultrasonic Water Meter

Audience

This document is intended for
system engineers (SEs),
application engineers,
and test engineers.

Related Documents

Friendcom FC-702C Ultrasonic Water Meter Datasheet
Friendcom FC-702C Ultrasonic Water Meter Configuration Guide

Conventions

Symbol	Indication
	This warning symbol means danger. You are in a situation that could cause fatal device damage or even bodily damage.
	Means reader be careful. In this situation, you might perform an action that could result in module or product damages.
	Means note or tips for readers to use the module.

History

Issue	Date	Change
1.0	2020-12	Initial draft
1.1	2021-01	● Upgrade the Magnet activation position ● Upgrade the server platform information.

Content

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1 Introduction

This document describes the technical parameters and key functions which are connected with customers' applications, and it can help customers quickly understand the data format, as well as other related information of Ultrasonic Water Meter.

1.1 Safety Recommendations

Ensure that this product is used in compliant with the requirements of the country and the environment, the following safety precautions must be observed during all phases of the operation, such as usage, service or repair of wireless pulse acquisition products. If not so, Friendcom assumes no liability for customers' failure to comply with these precautions.

Full attention must be given to driving at all times in order to reduce the risk of an accident. Using the terminal while driving causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.

Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.

The wireless terminal contains a transmitter and receiver. RF interference can occur if it is used close to other electric equipment.

Do not use this product at any places with a risk of fire or potentially explosive atmospheres such as gasoline stations, oil refineries, etc.

2 Product Concept

2.1 General Description

Ultrasonic water meter is a kind of high precision water meter. Using LoRaWAN technology,

it can support the flow reporting, remote on-off valve control, fault warning and other functions, which greatly facilitates the statistics and management of users' water consumption by the management department.

The product implements the standards of "GB/T 778 for Measuring Water Flow in Closed Full Pipe for Drinking Cold Water Meter and Hot Water Meter" and the verification regulations of "JJG 162-2009 Cold Water Meter".

2.2 Key Features

The following shows the key features of FC-702C Ultrasonic Water Meter.

- Valve integrated on the meter, fully wrapped structure, anti-damage
- With self-diagnosis function: battery power alarm, empty pipe alarm, reverse flow alarm, over range alarm, water temperature alarm etc.
- Advanced flow measurement method and intelligent data error correction technology, high measurement accuracy and stability
- Large capacity lithium battery, can meet the current demand of valve action.The whole machine can meet the service life of 10 yearsLong range wireless data transmission.
- Communication range up to 15km (In visibility conditions)
- MAC Layer: LoRaWAN ®
- Multi-band support EU433, CN470, EU868, US915, AU915, IN865, AU923-2.
- Configurable reporting interval.
- Air wireless configuration.
- IP Rating: IP68

Lifetime depends from the device location and reporting interval.

2.3 Specifications

The following table describes the specifications of FC-702C Ultrasonic Water Meter.

Table 2-1 Specifications of FC-702C Ultrasonic Water Meter

Specifications	Description
Operating conditions	Operating temperature: -40 °C to +70 °C
	Operating humidity: 5%RH to 95%RH
Cumulative volume resolution	0.001M (at use) 0.00001M (at verification)
Current flow resolution	0.001 m3/h (when in use) 0.001 m3/h (when verification)
Static operating current	< 6uA
Battery life	10 years
Number of LCD display	eight
Temperature rating	T30
Pressure rating	MAP16
Pressure loss rating	△p40
Environmental Hardness Rating	Class C
IP Rating	IP68
Accuracy grade	Class 2
Electromagnetic environment level	E1
Installation	Horizontal or vertical
Sensitivity level of upper/downstream flow field	U5/D3
the ratio of measurement range Q3 / Q1	125, 160 (default), 200

Diameter range	DN15 ~ DN25
Commonly used traffic Q3	DN15: 2.5 m^3 / h DN20: 4.0 m^3 / h DN25: 6.3 m^3 / h
Radio characteristics	Tx Power: Max. 20dBm
	Rx Sensitivity: < -138dBm
Communication range	Up to 15km (In visibility conditions)
Frequency bands	EU433, CN470, EU868, US915, AU915, IN865, AU923-2
MAC Layer	LoRaWAN ®
Antenna option	Build-in Antenna
Configuration	Over-the-air
Upgrade	FOTA
Communication module certificate approval	CE, FCC, LoRa Alliance*, ANATEL

"*" Means for features and certifications in planning

3 Data Format and Setting Command

3.1 Data Format of Reporting

Ultrasonic Water Meter actively reports data according to the set period. The format of reported data frame can be set to three types: meter reading 1, meter reading 2, meter reading 3 . The information reported in the there formats is different, as follows:

'Meter reading 1' data frame example:

FEFE 68 10 75700200357568 81 16 901F 00 2C 01020000 2C 05010000 38341331122020 0102 13 16	
Bytes	**Remarks**
FEFE	Leading code (two bytes)
68	Frame start character
10	Instrument type
75700200357568	Address (7 bytes)(table address).
81	Control code
16	Data length
901F	Data id
00	SER
2C	Unit (refer to CJ-T188-2004 standard 8.3.1) (xxxxxx.xxm3)
01020000	Current cumulative flow (refer to CJ-T188-2004 standard 8.3)(2.01m3)
2C	Unit (xxxxxx.xxm3)
05010000	Settlement day cumulative traffic (indicating that the last record was 1.05m3)
38341331122020	Real time (YYYYMMDDHHMMSS) : 2020-12-31 13:34:38
0102	state (see CJ - T188-2004 standard 8.3.2)ST1, ST2 : Current Valve is closed ; WARNING: Empty Pipe ST1 : BIT1,BIT0, 00: on, 01: off, 11: abnormal BIT2,1: Battery power alarm,0: Normal ST2 : BIT0,1: Battery power alarm,0: Normal BIT1,1: Empty Pipe alarm,0: Normal BIT2,1: reverse flow alarm,0: normal BIT3,1: overrange alarm,0: normal BIT4,1: water temperature alarm, 0: normal BIT5,1:EE fault,0: Normal

	BIT6,1: Water inlet flow sensor alarm,0: Normal BIT7,1: Backwater flow sensor alarm,0: Normal
13	Check byte
16	The terminator

'Meter reading 2' data frame example:

FEFE 68 10 75700200357568 81 08 D121 00 2C 05010000 18 16	
Bytes	**Remarks**
FEFE	Leading code (two bytes)
68	Frame start character
10	Instrument type
75700200357568	Address (7 bytes) (table address)
81	Control code
8	Data length
D121	Data id (20~79)
0	SER
2C	Unit (refer to CJ-T188-2004 standard 8.3.1) (XXXXXX.XXM3)
05010000	Cumulative flow for the last X settlement day(1.05 m3)
18	Check byte
16	The terminator

'Meter reading 3' data frame example:

FEFE 68 10 75700200357568 B1 1C 0100 00 2C 29040000 35 73650000 2C 29040000 2C 00000000 502300 0000 9D 16	
Bytes	**Remarks**
FEFE	Leading code (two bytes)
68	Frame start character
10	Instrument type
75700200357568	Address (7 bytes) : (table address).
B1	Control code
1C	Data length
100	Data id
00	SER
2C	Unit (refer to CJ-T188-2004 standard 8.3.1): (XXXXXX.XXM3)
29040000	Current cumulative flow (refer to CJ-T188-2004 standard 8.3) : (4.29 m3)
35	Unit (refer to CJ-T188-2004 standard 8.3.1): (XXXX.XXXXM3 /h)

73650000	Current instantaneous flow (refer to CJ-T188-2004 standard 8.3) : (0.6573 m3/h)
2C	Unit (refer to CJ-T188-2004 standard 8.3.1): (XXXXXX.XXM3)
29040000	Current forward cumulative flow (refer to CJ-T188-2004 standard 8.3) : (representing 4.29 m3)
2C	Unit (refer to CJ-T188-2004 standard 8.3.1): (XXXXXX.XXM3)
0000	Current reverse cumulative flow (refer to CJ-T188-2004 standard 8.3) : (for 0.00 m3)
502300	Water supply temperature (refer to CJ-T188-2004 standard 8.3) :(23.50 ℃)
0000	Status (refer to CJ-T188-2004 standard 8.3.2): Status normal ST1 : BIT1,BIT0, 00: on, 01: off, 11: abnormal BIT2,1: Battery power alarm,0: Normal ST2 : BIT0,1: Battery power alarm,0: Normal BIT1,1: Empty Pipe alarm,0: Normal BIT2,1: reverse flow alarm,0: normal BIT3,1: overrange alarm,0: normal BIT4,1: water temperature alarm, 0: normal BIT5,1:EE fault,0: Normal BIT6,1: Water inlet flow sensor alarm,0: Normal BIT7,1: Backwater flow sensor alarm,0: Normal
9D	Check byte
16	The terminator

3.2 Setting Command

Parameters of Ultrasonic Water Meter can be set and read by AT command, the format of commands is shown in the following table.

Table 3- 1 Format of commands

Command	Note	Ack (Success)	Ack (Failure)
AT+I	Query the current electronic index, the unit is m³	InitValue = xxx.xx	Error
AT+T	RTC real-time clock query	RTC real-time = year.month.day_week_hour	Error

		:minute:second	
AT+T=xx.xx.xx x xx:xx:xx	RTC real-time clock setting, the format is xx.xx.xx_x_xx:xx:xx (year.month.day_week_hour:minute:second) Note that Saturday and Sunday, correspond to number 6 and 7. For example, to set the time On January 21, 2018, Sunday at 14:00, the input command is as follows: AT+T=18.01.21 7 14:00:00	Set RTC Success	Error
AT+DA	Check the product address	Address = ********	
AT+DA=“Device address”	Set the product's mailing address, 4 bytes of hexadecimal digits. Example: AT+DA =ABCDEF01	Set Address = ABCDEF01	
AT+VP	Read pull-up resistor configuration of external Vcc and two pulse sampling ports	Vcc = **(ON), Pull Up = **(OFF)	
AT+VP=”vcc state”,”Pull up state”	Set pull-up resistor of external Vcc and two pulse sampling ports. ON is open OFF is close Example: AT+VP=ON, OFF	Set Vcc = ON, Pull Up = OFF	
AT+RC	Read reporting period	Report Cycle = ****	
AT+RC=“Report cycle”	Set the reporting period in minutes. Valid range: 1-99999 Example: AT+RC=1440	Set Report Cycle = ****	
AT+RST	Reset the device	Reset now	
AT+V	Query the current software version	version:0.3	Error

AT+DR=band	Set the frequency band. For example, set the band to AU915. The command is: AT+DR=AU915.	+DR: XXXXXX	
AT+CH=NUM, chm-chn	Set channel. The transmit channel of the module must be consistent with the receive channel of the gateway. For example, set the channel to 0-7. The command is: AT+CH=NUM, 0-7	+CH: NUM, 0-7	
AT+POWER=xx	Set the transmit power , For example, set the transmit power to 20dBm, the command is AT+POWER=20	+POWER: 20	
AT+ID=DevAddr, "xxxxxxxx"	Set DevAddr, "xxxxxxxx" to an 8-digit hexadecimal number. For example, set the DevAddr ID to 01234567, the command is: AT+ID=DevAddr, "01234567"	+ID: DevAddr, 01:23:45:67	
AT+ID	Query LoRaWAN module ID information: DevAddr, DevEui, AppEui	+ID:DevAddr, 00:F3:50:02 +ID:DevEui, 47:A7:CA:DD:00:2B:00:49 +ID:AppEui, 52:69:73:69:6E:67:48:46	
AT+MODE=LWOTAA	Set the module to LWOTAA mode	+MODE:LWOTAA	
AT+MODE=LWABP	Set the module to LWABP mode	+MODE:LWABP	

4 Parameters Configuration

4.1 Parameters Configuration

Before using the Ultrasonic Water Meter, we need to configure some parameters, such as initial index, RTC real-time clock, reporting period, reporting frame type and other information. The configuration mode supports wireless. For detailed operation steps, users can refer to 'Friendcom FC-702C Ultrasonic Water Meter Configuration Guide'.

4.1.1 Wireless Configuration Mode

Plug the wireless USB adapter FC-714-USB into your computer and install the correct driver to configure the product wirelessly.

4.1.2 Entering Configuration Mode

Ultrasonic Water Meter can be activated by magnet to enter configuration mode. Both the wired configuration mode and wireless configuration mode need to be activated before parameters configured.

The sensor inside the product is triggered by the magnet to put the product into the configuration mode, and then the configuration command must be sent within 30 seconds. If the product does not detect the configuration command in 30 seconds, the configuration mode will be exited. Once the command is received, the product will keep in configuration mode for another 30 seconds.

The trigger position is shown in the figure below.

Figure 4-1 Magnet activation position

The time that magnet triggers the sensor to connect (the duration from connect to the break) and the corresponding functions are shown in the following table:

Magnet hold time	Features	Remarks
2s-4s	Report data once	Typically 3s
4s-9s	Configuration mode	Typically 5s
9s-15s	Reset	Typically 12s
>15s	No response	Close magnet detecting function 60s

Note

- When the product exits the configuration mode, basing on whether the user has sent a network access command (AT + JOIN) and whether the current mode is OTAA, it will automatically join the network if both are satisfied. The network access result can be verified by triggering whether the data report is successful.
- The parameters can be set through AT command, for detailed command information, please refer to section 3.2.

5 Dimensions and Installation

5.1 Dimensions

Nominal diameter DN (mm)		15	20	25
size	Length L (mm)	165	195	225
	Width W (mm)	96	96	96
	H (mm)	198	198	198
	Weight (kg)	0.94	1.01	1.28
Interface dimensions of flow pipe segments	Thread specification	G 3/4B	G1B	G1 1/4B
	Thread length (mm)	12	12	12
Pipe joint size	Length of pipe joint (mm)	43	50	58
	Thread specification	R1/2	R3/4	R1
	Thread length (mm)	15	16	18

5.2 Installation Requirements

Precautions Before Installation:

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

(2) Ultrasonic water meter belongs to the more precious precision instrument, pick up and put down must be careful, prohibit directly pull the meter head or sensor line;Do not close to a high temperature heat source (such as electric welding, to prevent battery explosion injury and damage to the instrument);

(3) Special attention should be paid to the installation position of 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), to avoid installation near the elbow (will produce vortex flow), and to stay away from pumps and other equipment (will cause pulsating flow);

(4) The upstream and downstream connecting pipes of the ultrasonic water meter should be

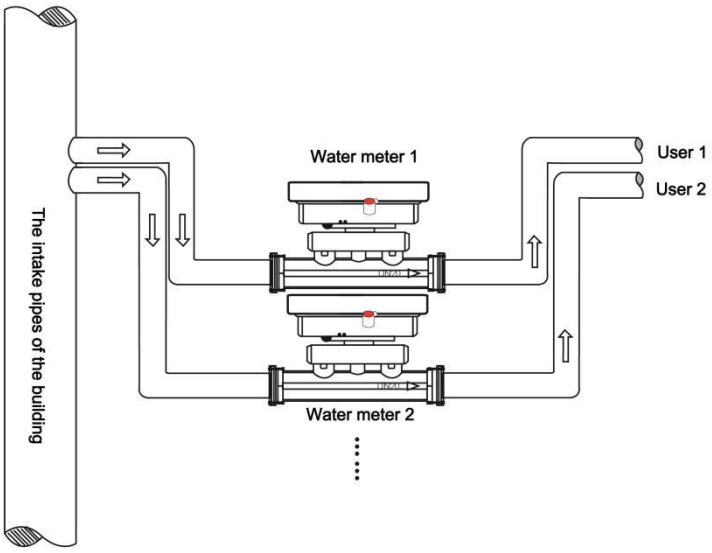
the same size as the caliber of the water meter, and can not be reduced;

(5) The direction indicated by the arrow on the surface of the ultrasonic water meter is the direction of the water flow and shall not be reversed;

(6) It is recommended that the filter of corresponding caliber be installed in front of the ultrasonic water meter;The front and back of the meter are equipped with the corresponding caliber valve and it can be separated from the body, easy to maintenance and repair in the future.

Because the measuring principle of ultrasonic water meter is different from that of mechanical water meter, the pipe can not be empty pipe or accumulate more bubbles, otherwise it will lead to the transmission of ultrasonic signal, resulting in the table does not count or measurement is inaccurate. For the above reasons, the recommended installation methods are as follows:

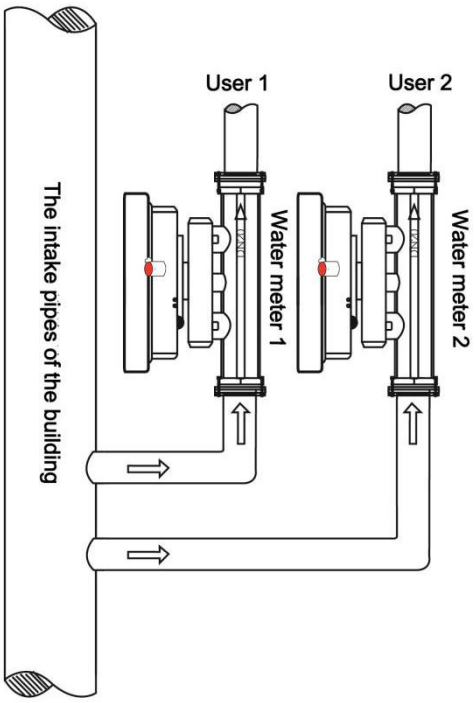
5.2.1 Horizontal Installation



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

In this case, the low ultrasonic water meter pipe can keep full pipe.

5.2.2 Vertical Installation

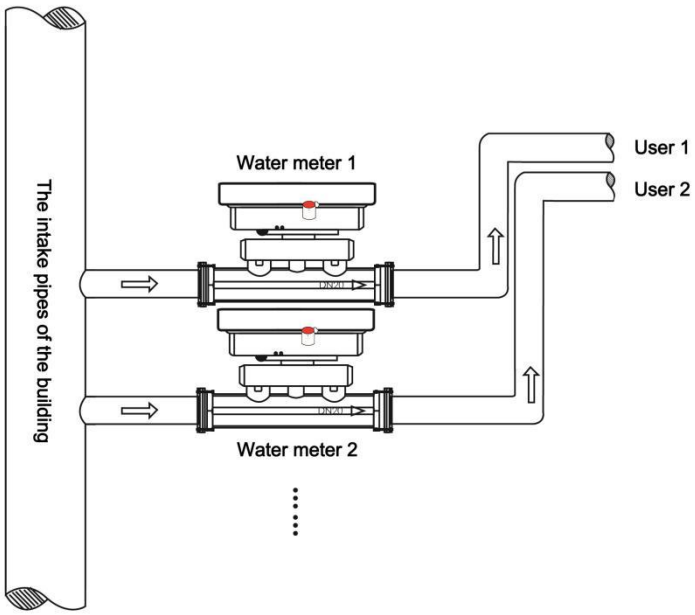


For vertical installation, as shown in the figure above, the water flow direction at the water meter is water at the lower end and water at the upper end.

In this case, the air bubbles can be avoided to accumulate in the water meter measuring pipe when there is water flowing through.

5.2.3 Poor Installation (Horizontal)

If it is really difficult to implement the recommended horizontal installation conditions due to the limitation of objective conditions on site, the installation should be at least as shown in the following figure:



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

5.3 Common Examples of Incorrect Installations

1), when the table is installed vertically, it must be installed on the straight pipe with upward flow, because the water flow down the pipe under the gravity of the earth will cause the phenomenon that the water in the pipe can not be filled, which will lead to meter measurement is not allowed or even caused by measurement (as shown in Figure C).

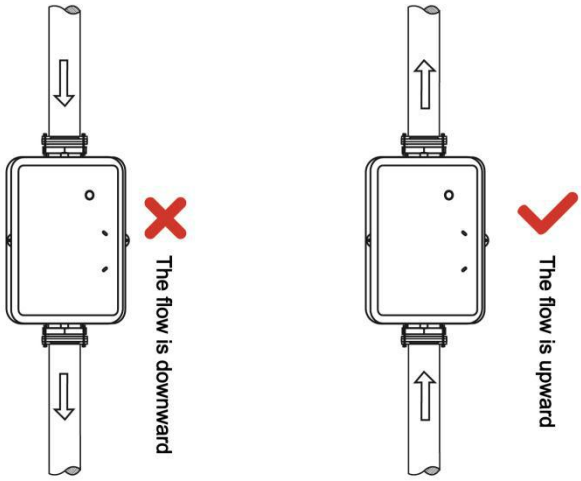


Figure (C)

2) When installed in the "U" pipe, please install the meter in the lowest place, because the pipe in the height of the place may collect air, resulting in meter measurement is not allowed or not measured (as shown in Figure D).

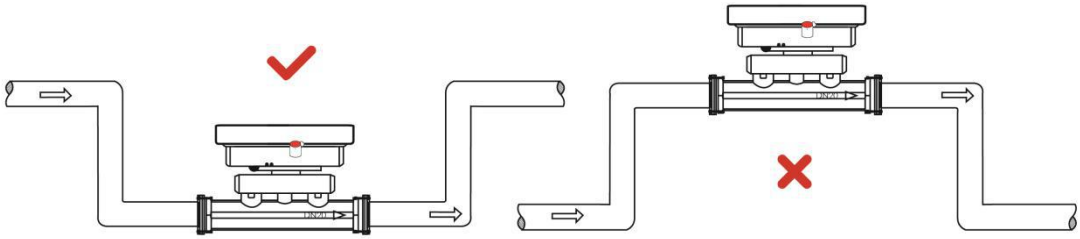


Figure (D)

5) When the meter is installed in the elbow, it must ensure that the distance of the front straight pipe is more than 5 times the pipe diameter, and the back straight pipe is more than 3 times the pipe diameter, otherwise it may cause inaccurate meter measurement (as shown in Figure E).

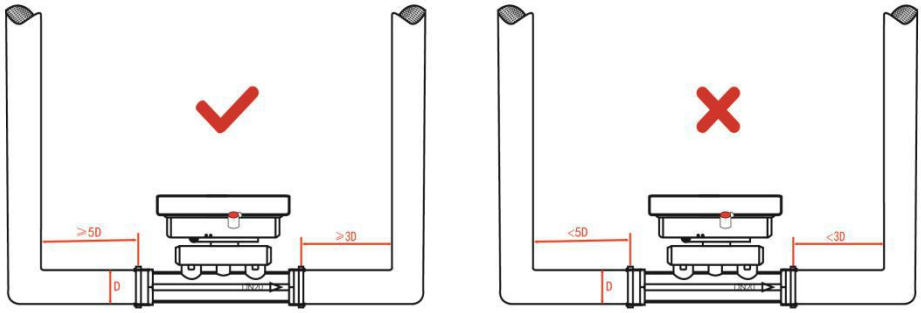


Figure (E)

6) When the valve or other objects are installed in front of the table, the distance between the table and the object must be ⩾5 times the diameter, otherwise it may cause inaccurate meter measurement. As shown in Figure F.

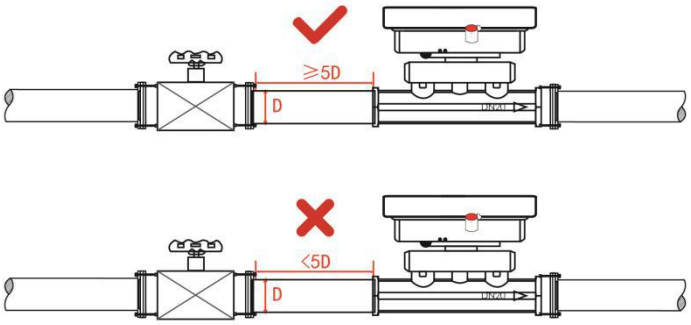


Figure (F)

5.4 Daily Maintenance

(1) The current state of the ultrasonic water meter must be checked before use;

(2) The lead seal on the ultrasonic water meter shall not be damaged. If damaged, the manufacturer will no longer guarantee the quality and accuracy;

(3) The ultrasonic water meter is powered by a built-in lithium battery and can run for up to 10 years. When the battery life will end or less than 10 years but the LCD display symbol (indicating insufficient voltage), that is, timely notify the after-sales staff, so as not to affect its normal work;

6 Transportantion and Storage

Storage: -5°C to 55°C, non-corrosive gases.

Less than 4 layers stacked and pay attention to shockproof during transportation.