Ultrasonic Heat Meter

Operation Manual

Shanghai Mingwan Intelligent Instrument Co., Ltd.

Contents

1. Overview

The ultrasonic heat meter is a measuring instrument based on the principle of time difference of ultrasonic propagation for flow measurement and heat accumulation calculation. It mainly consists of ultrasonic transducers, measuring pipe sections, paired temperature sensors, and an accumulator (circuit board). By driving the ultrasonic transducers with the CPU on the circuit board, it measures the time difference of ultrasonic waves traveling upstream and downstream to determine the flow rate. Then, it measures the temperatures of the inlet and return pipes with temperature sensors and finally calculates the heat released over a period of time.

This product integrates a data transmission interface, supporting data upload through the Internet of Things (IoT) to form a remote meter reading management system. Management personnel can read the data from the meter at any time, facilitating the statistics and management of users' heat consumption. The product complies with the national standard "GBT 32224-2020 Heat Meter" and the verification regulation "JJG225-2001 Heat Energy Meter". Its measurement units are kWh or GJ.

2. Product Features

(1) Suitable for both hot and cold water.
(2) Self-diagnosis function: alarms for flow sensor faults, temperature sensor open or short circuits, measurement out of range, battery low voltage, etc.
(3) Utilizes our company's patented flow measurement method and intelligent data error correction technology, ensuring high measurement accuracy and stability.
(4) Powered by an internal lithium battery, with ultra-low power consumption, it can be used for (6+1) years or more.
(5) Equipped with an optical interface, supporting handheld infrared meter reading tools for on-site reading.
(6) High-definition wide-temperature LCD display.
(7) Optional M-BUS, 485, or wireless communication interfaces.
(8) Optional built-in IoT communication module (4G or NB-IoT) to form an IoT meter.
(9) Selectable power supply methods:
1) Internal battery power supply (default)
2) M-BUS power supply
3) External power supply (DC 7.5～24V)

3. Technical Specifications

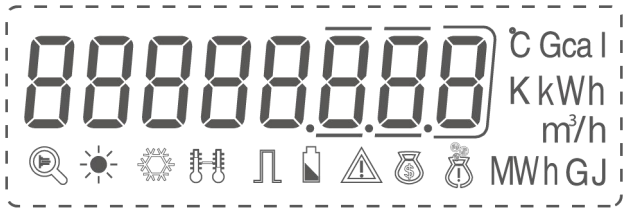
Main Technical Specifications

Accuracy Class	Class 2
Temperature Range	（4～95）℃
Temperature Difference Range	（2～75）K
Maximum Allowable Working Pressure	1.6MPa
Allowable Pressure Loss	≤25kPa
Ambient Class	Class A, B
Diameter Range	DN15～DN600

Common Flow Rates q_p	DN15: 1.5 m^3/h DN20: 2.5 m^3/h DN25: 3.5 m^3/h DN32: 6.0 m^3/h DN40: 10 m^3/h DN50: 15 m^3/h DN65: 25 m^3/h DN80: 40 m^3/h DN100:60 m^3/h DN125:100 m^3/h DN150:150 m^3/h DN200:250 m^3/h DN250:400 m^3/h DN300:600 m^3/h DN350:800 m^3/h DN400:1000 m^3/h DN450:1200 m^3/h DN500:1500 m^3/h DN600:2000 m^3/h
q_p/ q_{min}	DN15～DN40：50 or 100 DN50～DN600：25 or 50
q_{max}/ q_p	2

4. Usage Method

This meter uses a combination of digital and graphical LCD display to present measurement parameters and operational status information to the user, as shown below:



℃	Temperature Unit	K	Temperature Difference Unit
kWh	Heat Unit	m³/h	Flow Unit

	Verification Mode		Heat Indication		Cooling Indication		Battery Low Alarm		Other Alarm Indications
	Inlet Water Temperature		Return Water Temperature	MWh	Heat Unit	GJ	Heat Unit		Pulse Indication

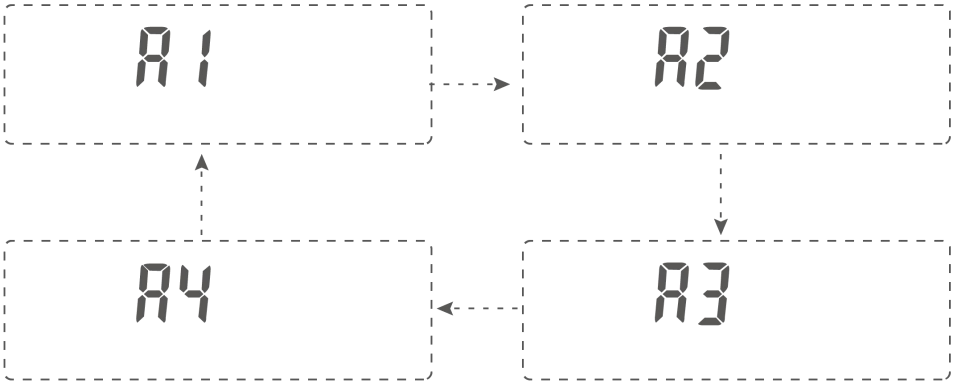
You can switch between different function menus by pressing buttons. There are a total of 4 sets of menus composed as follows:

■ **Arrow Example**

- - - - → Indicates that the button is pressed for more than 2 seconds and held (referred to as "long press" in the following text).

——→ Indicates that the button is pressed for about 1 second and then released (referred to as "short press" in the following text).

The complete menu screen cycle is as follows:

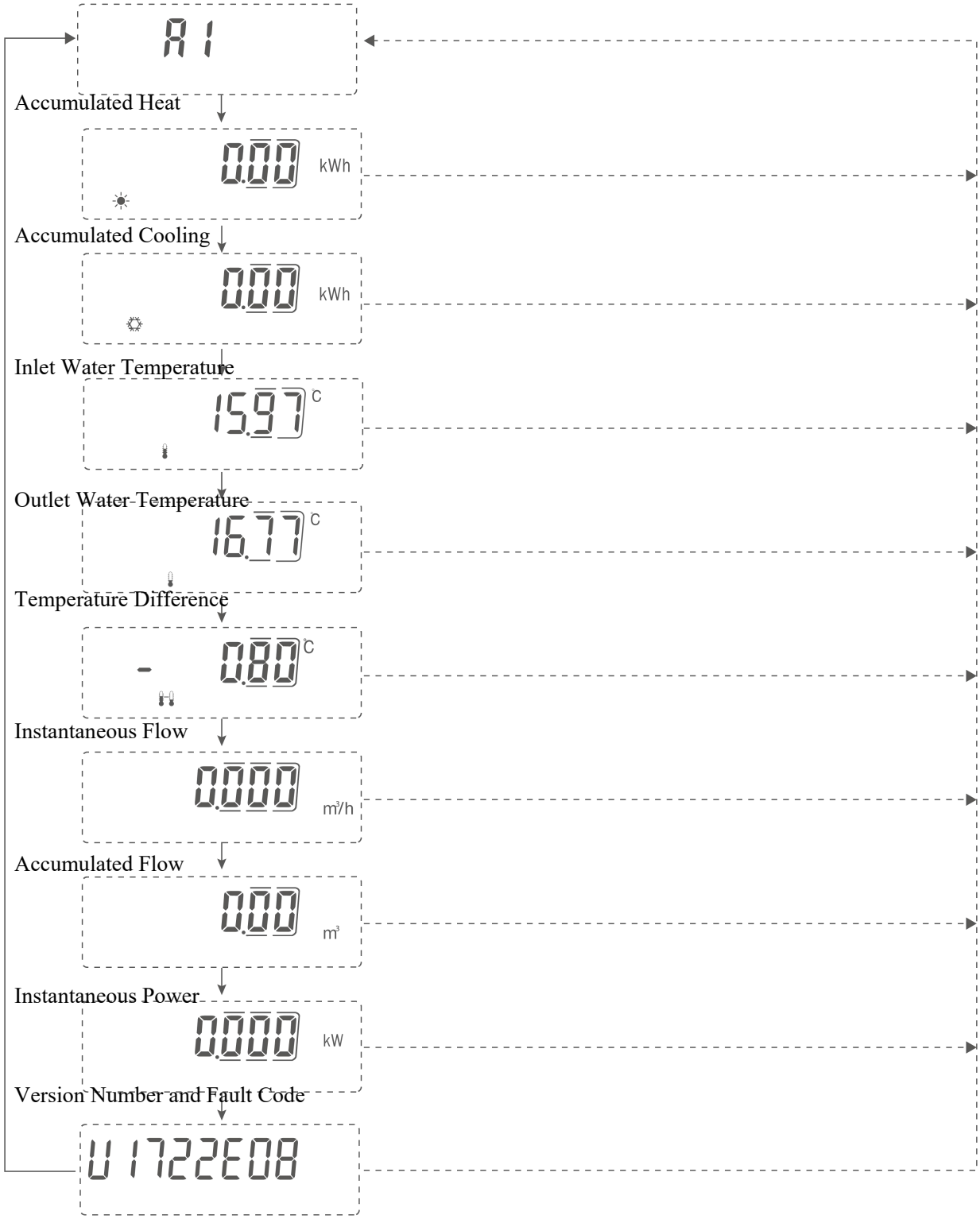


1) 【A1】: Main Menu, which is the display interface used during daily operation.
2) 【A2】:Information Menu: Displays information such as date and time, meter address, diameter, version, etc.
3) 【A3】:Historical Data Menu: Records and views historical data (stored monthly for up to 36 months).
4) 【A4】:Test Menu: Used during verification.

In the standby state, the display screen is off. A "short press" can wake the meter from standby, lighting up the display and entering the main menu. A "long press" can switch between menu directories to find the desired menu, and then follow the operation diagrams for each menu to view the relevant content. After 3 minutes of inactivity, the display automatically returns to the main menu page (except for items under the Test Menu【A4】), and the screen turns off. It is important to note that regardless of the menu display state, as long as heat (cooling) is being used, the meter will accumulate the relevant heat (cooling) and flow data into the corresponding parameters of the main menu. Manual button operations will not cause data to be missed.

Here is the cycle operation diagram for each menu:

(1) Main Menu [A1]

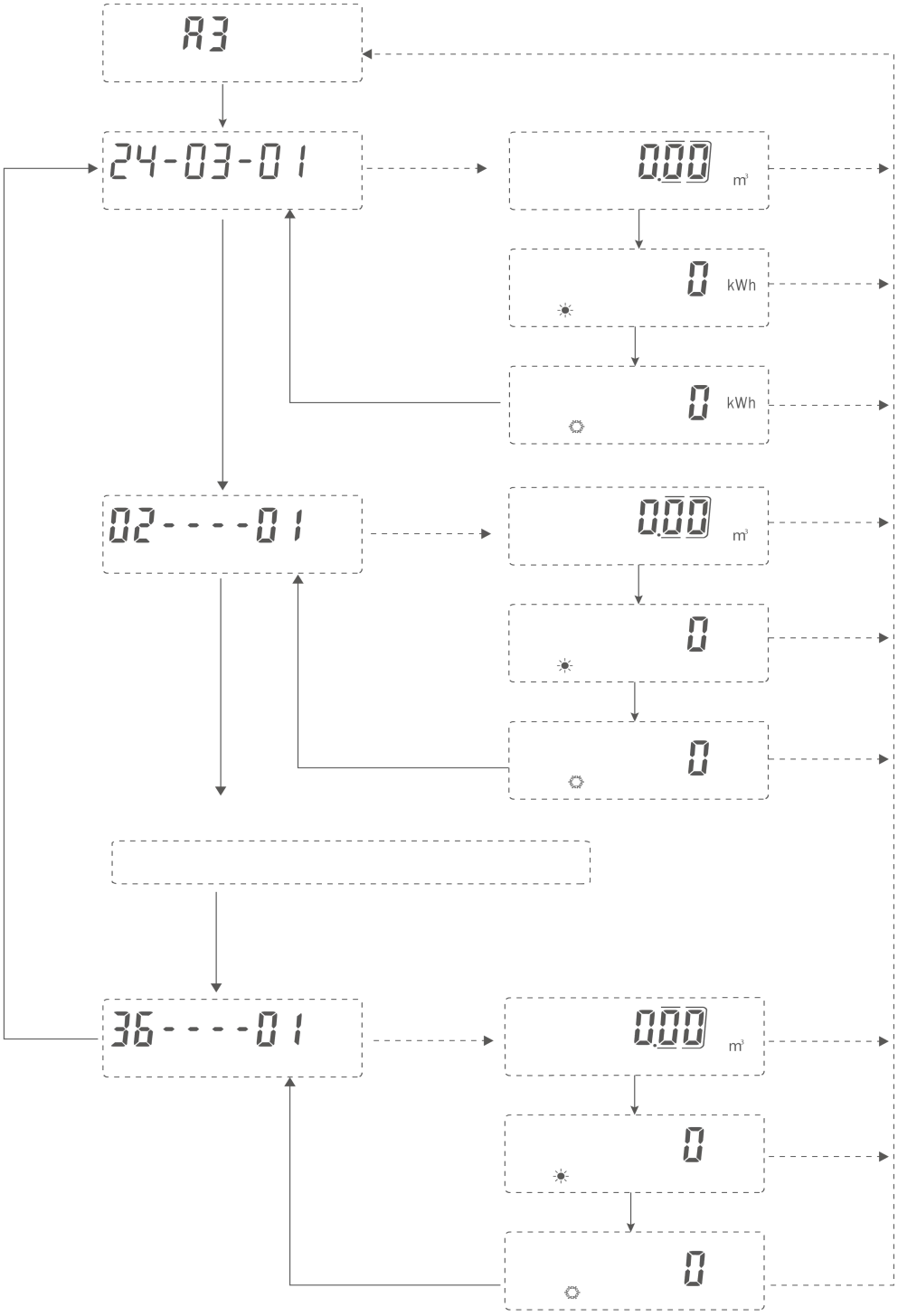


Note: 1) When the meter detects a fault, ⚠ will be displayed on the interface to provide a prompt.An additional prompt will appear when the battery is low.

2)The numerical code after "E" represents the fault code: It uses 1 byte (Bit0～Bit7) to indicate 8 fault sources, representing: low voltage, short circuit of temperature sensor, open circuit of temperature sensor, flow sensor fault or empty pipe, low voltage fault, memory fault, water temperature below 3℃, water temperature above 95℃. A fault code of 00 indicates no faults.

(2) Information Menu [A2]

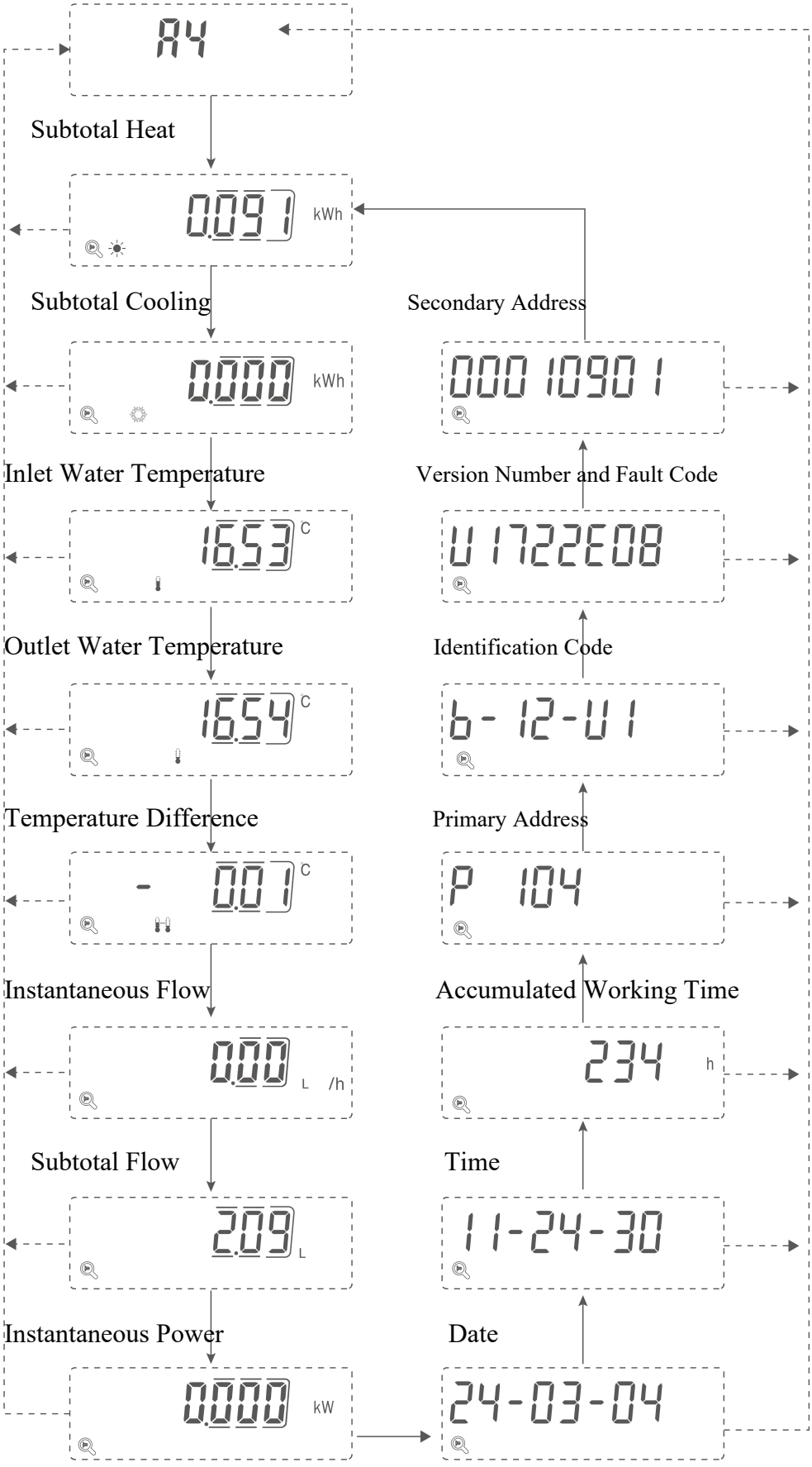
(3) Historical Data Menu [A3]



Note:1) This menu records historical data for the last 36 months (maximum number is 36), including data such as date, monthly accumulated flow, monthly accumulated heat, and monthly accumulated cooling.

2) If the date is displayed as "----", it means there is no historical data for that month on that date.

(4)Test Menu [A4]



Note:This menu is dedicated for meter calibration. It is not necessary to enter this state under normal circumstances, and it can be exited by a long press operation.

5. Infrared Reading

Users can be equipped with a handheld device to realize handheld meter reading, which is used to record the accumulated heat ,the accumulated flow and other information of the heant meter. The meter reading method is as follows:

Press the standby interface briefly, point the handheld meter to the infrared receiving and sending interface of the water meter, and select the meter reading command. After the communication is successful, the handheld will display related information. For details, refer to the infrared handheld meter reading manual.

6. Installation Instructions

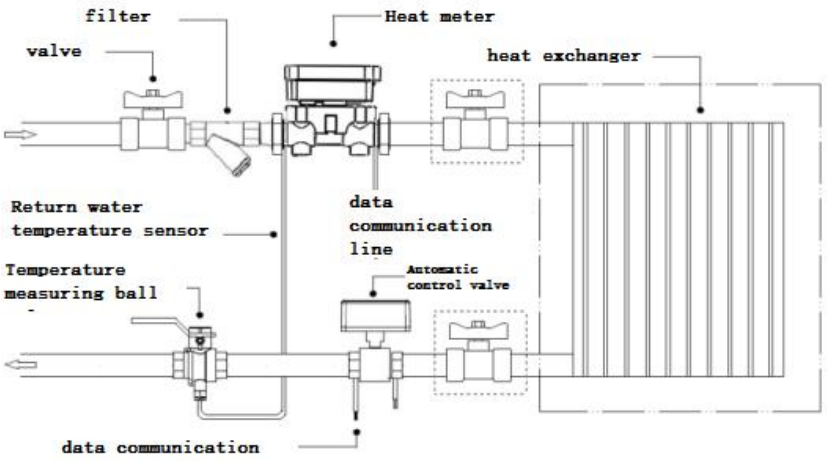
6.1. Installation

（1）DN15～DN40

● Installation dimensions

Nominal Diameter DN		15	20	25	32	40
Size	L（mm）	110	130	160	180	200
	W(mm)	75	75	75	75	75
	H(mm)	100	120	135	155	170
	Weight(kg)	0.5	0.7	0.86	1.1	1.3
Size of interface	Screw thread: M	G 3/4B	G1B	G1 1/4B	G1 1/2B	G2B
	Thread length(mm)	12	14	16	18	18
Size of connecting pipe	Connecting pipe length: L1（mm）	43	50	58	58	59
	Connecting pipe thread: M	R1/2	R3/4	R1	R1 1/4	R1 1/2
	Thread length(mm): L(mm)	15	16	18	20	22
Temperature measuring accessories	Installation	Temperature measuring three-way valve (ball valve)				
	Length(mm)	60	60	60	65	65

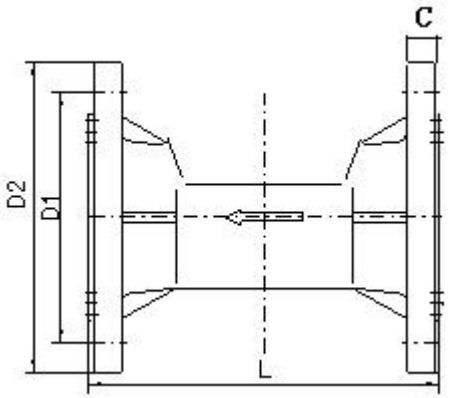
● Installation diagram（Household type,default water inlet installation）



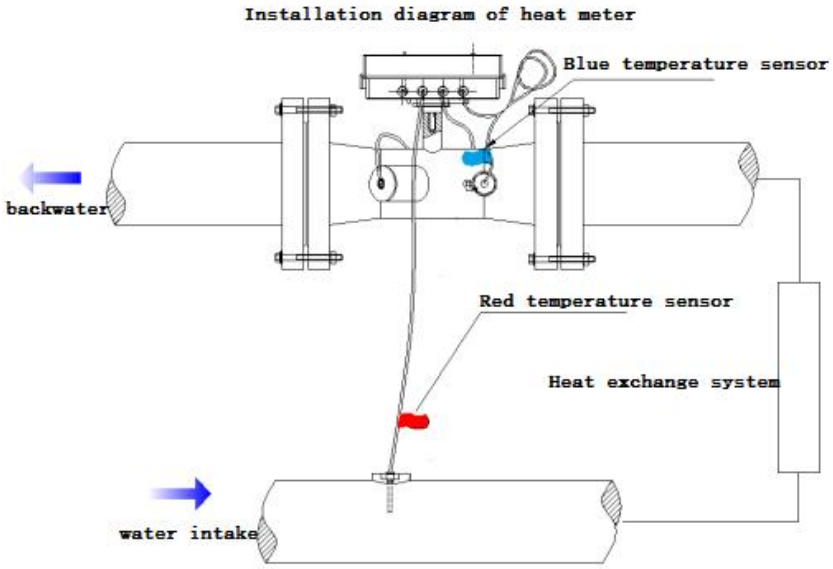
（2）DN50～DN600

● **Installation dimensions**

Nominal Diameter DN (mm)	Body Length L (mm)	Connecting Flange			Flange Thickness C(mm)
		Flange Outer Diameter D2（mm）	Thread Hole Center Diameter D1 (mm)	Connecting Bolts	
50	200	165	125	4*M16	20
65	200	185	145	4*M16	20
80	225	200	160	8*M16	20
100	250	220	180	8*M16	22
125	250	250	210	8*M16	22
150	300	280	240	8*M20	24
200	345	335	295	12*M20	24
250	445	405	355	12*M24	26
300	500	460	410	12*M24	28
350	500	520	470	16*M24	30
400	500	580	525	16*M27	31
450	500	640	585	20*M27	37
500	500	715	650	20*M30	37
600	600	840	770	20*M33	41



● **Installation Diagram (Default Outlet Installation)**



6.2. Wiring Method

● **Power Line**

In external power supply mode, connect the red wire to the positive power terminal and the black wire to the negative terminal, with a voltage range of DC (7.5～24)V.

● **Communication Line**

For M-BUS communication mode, directly connect the two communication lines to the MBUS bus without distinguishing positive or negative; For 485 communication mode, there are 4 wires coming out of the meter: A (yellow), B (green), ground (black), and power (red, DC 7.5～24V), connect them accordingly (pay attention to polarity, wrong connection may damage the meter).

● **Temperature Sensors**

For inlet installation mode：Install the temperature sensor with the red label on the meter body and the temperature sensor with the blue label on the return pipe;

For return installation mode：Install the temperature sensor with the blue label on the meter body and the temperature sensor with the red label on the inlet pipe.

●**Special Note :** When communication lines (M-BUS or RS485) are not in use, please protect them properly and **do not throw them into water carelessly**（(water can penetrate the wires into the meter, causing short circuits or failure).

6.3. Heat Meter Installation Precautions

(1) Before installing the ultrasonic heat meter, the pipes must be cleaned thoroughly;
(2) The ultrasonic heat meters are relatively expensive precision instruments. Be careful when picking up and lowering. Do not directly pull the meter head or the sensor wire.Do not squeeze the temperature probe.Do not approach high temperature heat sources (such as electric welding to prevent battery explosion from hurting people and damaging the meter);
(3) Special attention should be paid to the installation position of the ultrasonic heat meter. Avoid installing the heat meter on the upper end of the pipe (there will be air bubbles in the pipe section), avoid installing it near the elbow (which will generate vortex), and keep it away from pumps and other equipment (which will cause Pulsating flow);
(4) The direction of the arrow on the surface of the ultrasonic heat meter is the direction of the water flow, and it must not be reversed;
(5) For large diameter heat meters, the default installation is on the return pipe. If installation on the inlet pipe is required, specify it when ordering;
(6) The front end of the heat meter must be equipped with a filter of the corresponding caliber;
(7) Both ends of the heat meter must be equipped with valves of corresponding calibera ,and it can be separated from the body of the meter to facilitate future maintenance and repair during use;
(8) The installation of heat meters should reserve necessary straight pipe sections, with a 5DN straight pipe section in front of the meter and a 3DN straight pipe section behind the meter;
(9) There are two temperature sensors for the heat meter (inlet and outlet). When installing, the temperature sensor with the red label should be installed on the inlet pipe, and the temperature sensor with the blue label should be installed in the outlet pipe. The temperature probe should be installed in the center of the pipeline section;
(10) The standard wire length for temperature sensors is 1.5 meters. If there are special circumstances during installation, it can be extended according to the actual length. However, the manufacturer must be notified before ordering, and the lead wires of the temperature sensor must not be increased or decreased arbitrarily;
(11) After installation, lead seals should be applied between the inlet connecting nut of the heat meter and the heat meter, as well as between the temperature measuring ball valve and the platinum resistor;
(12) Special Note:

a) The heat meter should be installed in a suitable position for easy operation, reading and maintenance;
b) The lead seal on the heat meter cannot be damaged. If it is damaged, the manufacturer will no longer be responsible for quality and accuracy;
c) Damage to the heat meter caused by abnormal use (such as human factors and harsh usage environments) is not covered by the free warranty. When installing, it is necessary to carefully read this regulation and operate with caution.

6.4. Daily Maintenance

(1) The current state of the ultrasonic heat meter must be checked before use;
(2) The current heat data must be recorded before the use of the heat meter (as detection, flushing of pipelines, and pressure testing may cause the initial heat value to be non-zero);
(3) After the installation and use of the heat meter, it should be regularly toured to check the running condition of the heat meter and whether the battery voltage is normal;
(4) When the flow rate is significantly reduced to affect the heating, the filter should be discharged and cleaned;
(5) The ultrasonic heat meter is powered by a built-in lithium battery,so it should be kept away from high-temperature heat sources during use to prevent battery explosions;
(6) The ultrasonic heat meter can run for up to 6 years (2 verification cycles). When the battery life is near or less than 6 years but the data displayed on the LCD screen is not clear or the battery symbol is displayed (indicating that the voltage is insufficient), the battery should be replaced by a specialized technician to avoid affecting its normal work;
(7) For pipelines with installed heat meters, if heating is not provided, the water in the pipeline should be drained to avoid damage to the heat meter due to freezing.

6.5. Analysis and troubleshooting of common faults

No.	Error Type	Error cause	Solution
1	The instantaneous flow rate is displayed as zero	The inlet valve may be closed	Adjust the valve to the appropriate opening
		The front-end filter may be blocked	Clean the filter
		The inlet direction of the pipe section is reversed	Adjust the pipe section to the current direction
		Excessive bubble	Exhaust the pipeline
2	The measurement error of heat and flow is not accurate	The installation position of the inlet and outlet water is incorrect	Install in the correct installation position
		Incorrect installation of temperature probe	Adjust the inlet and return water temperature probe
		Excessive bubble	Exhaust the pipeline
		Display the undervoltage symbol	Replace battery
3	The joint is leaking	Damaged joint gasket	Replace the pipe joint gasket
4	The temperature probe is leaking	Damaged sealing gasket of the temperature probe	Replace the sealing gasket of the temperature probe
5	Temperature error	Temperature sensor failure	Return to the manufacturer to replace the temperature sensor
		The signal cable of the temperature sensor is damaged or short-circuited	Return to the manufacturer to repair or replace the signal cable

6	The LCD does not display	The internal battery is dead	Replace the battery
		Water ingress into the circuit board and corrodes the circuit	Replace the heat meter

7. Packing List

NO.	PRODUCT NAME	UNIT	QTY
1	HEAT METER	PCS	1
2	ACCESSORIES（OPTIONAL）	SET	
3			
4			

8. Transportation & Storage

1. Handle the instrument carefully during transportation to avoid severe impact.
2. Storage environment temperature (-10 ～ 50) ℃, relative humidity is less than 80%, prevent strong electromagnetic field and direct sunlight.
3. The product stored at least 30cm away from the ground, at least 1m away from the four walls, and no less than 2m away from the heating equipment.
4. Keep the warehouse dry and free of corrosive materials, gases and dangerous goods.

9. Warranty

The ultrasonic heat meter is warranted for one year from the date of shipment (as per contract agreement if specified), with lifetime maintenance. However, the following situations are not covered by the warranty:

1) The seal mark (lead seal) of the ultrasonic heat meter is opened and destroyed;
2) Any part of the ultrasonic heat meter is artificially damaged;
3) The components of the heat meter are exposed to exposure, flooding, freezing and chemical contamination;
4) The pipeline is not cleaned before installation or there are too many impurities in the pipeline, which cause damage to the flow sensor;
5) The lead of the temperature sensor is torn off, or the flow sensor lead is torn off due to excessive rotation of the display;
6) Failure and damage caused by not selecting the appropriate product model specifications.