CRL-H Residential Ultrasonic Heat Meter

Technical Manual

汇中® HUIZHONG

汇中仪表股份有限公司
HUIZHONG INSTRUMENTATION CO., LTD.

⚠Safety Warning/

Please follow the following safety precautions and use this product correctly to avoid economic losses and personal casualties!

1. This product is a precision measuring instrument. Please operate it by professional staff.

2. About batteries:

- Do not charge, short circuit or modify the battery without permission.
- Do not overheat or weld the battery.
- Keep the battery away from flame or water.
- Do not subject the battery to severe physical impact.
- The battery of this product has been professionally treated. Do not replace it with other batteries of the same model.
- Please replace the battery in time when the battery is low, otherwise it will cause the loss of measurement data. When replacing the battery, the operation must be performed by a professional who has been instructed by the manufacturer, or the product should be sent back to the manufacturer to replace the battery.
- Please use tape to insulate the electrical contacts of the battery under replacement to avoid contact with other metal objects or batteries to avoid fire or explosion.
- The replaced waste batteries shall be subject to environmental treatment and must be sent to the dustbin, garbage station, recycling station, etc which specialize in recycling used batteries.
- If the battery leaks, changes color, deforms, smokes or emits peculiar smell, please remove it immediately. Avoid burns during operation.
- Do not let the leakage of the battery come into contact with eyes, skin or clothing, otherwise it will cause blindness or skin damage.
- If the battery leaks and comes into contact with eyes, skin or clothing, wash the contact area with plenty of water immediately (do not rub), and seek medical attention immediately.

3. Do not change any cable length, otherwise the product performance will be affected.

4. Do not make any cables of this product close to the heat source to avoid fire or

electric shock due to thermal deformation of the cables or damage to the insulation layer caused by the battery.

5. Any exposed thread part of the product may cause skin scratch. Please operate with care.

6. The wireless remote meter reading system of our company adopts GPRS or NB communication mode. Please abide by relevant local laws and regulations.

7. Try to avoid using in acidic environment and environment with heavy salt spray, otherwise it will accelerate the aging of product materials and cause the product to fail to meet the hygienic standards.

8. This product is a precision measuring instrument, please do not drop it or subject it to impact.

9. The storage temperature of the product is between - 25 ℃~55 ℃, avoid corrosive gas or liquid, and avoid direct sunlight to the display panel of the instrument for a long time.

Content

1 Application Field

CRL-H residential heat meter integrates measurement, calculation and display. It adopts micro-power consumption technology, and one battery can work for more than 12 years. It can accurately measure the minimum flow of 0.01m^3/h, which is not affected by poor water quality. At the same time, the instrument has the characteristics of small volume, good stability and strong anti-interference ability.

The structure design is optimized to realize LCD multi angle display, which is convenient for users to read meters. Due to the ultrasonic flow measurement technology, multi-angle installation can be realized, the instrument measurement is not affected, and the pipeline pressure loss is minimized.

It supports NB-IoT, optical interface, RS-485, M-Bus output interface to achieve remote meter reading for easier centralized management of users.

It is widely used in unit residence, building, district heating station, central air conditioning and other systems.

It can be customized according to different needs of users: heat meter, cooling meter, cooling and heating meter.

Table 1-1

Performance		Parameters					
Accuracy		Class 2					
Flow Sensor	Nominal diameter（mm）	DN15		DN20		DN25	
	Range ratio	100		100		100	
	Common flow q_p（m^3/h）	1.0	1.5	1.5	2.5	2.5	3.5
	Minimum flow q_i（m^3/h）	0.010	0.015	0.015	0.025	0.025	0.035
	Maximum flow q_s（m^3/h）	3.0	3.0	5.0	5.0	7.0	7.0
Temperature Sensor	Type	Pt1000，DIN/IEC751B					
	Temperature range（℃）	2～105					
	Temperature difference range（K）	2～95					
	Starting temperature difference（℃）	0.2K					
Maximum permissible working		1.6					

pressure（MPa）		
Protection level		IP66 / IP68, the default is IP66 (IP68 is proposed when ordering)
Power supply		Powered by 3.6V lithium battery, one battery can work continuously for more than 12 years
Mechanical installation level		M1
Environmental class		Environmental class A / B
Display and main display contents		LCD, 10 digits + prompt
		Heat quantity (kW ħ or MJ),thermal power(kW), instantaneous flow(m^3/h), cumulative flow (m^3), water supply temperature(℃), return water temperature(℃), temperature difference (K), cumulative effective running time(h), date (year/month/day), time (hour / minute / second)
Display resolution		Heat quantity 0.1kW ħ or 1MJ, cumulative flow 0.001m^3; temperature 0.01℃; temperature difference 0.01K
Data communication	Optical interface	Baud rate 2400bps, even parity, EN13757 protocol
	Wireless interface	Narrowband IoT（NB-IoT network）
	M-Bus/RS-485	Baud rate: 2400bps, 4800bps, 9600bps optional，the default is 2400bps, transmission distance≤1200m；EN13757(GB/T26831)protocol, CJ-T188 protocol、Modbus protocol are optional, the default is EN13757protocol
Data storage（EEPROM）		It can store the heat quantity, cumulative flow, corresponding time and maximum thermal power by month, and can store the data of the last 24 months.
Storage temperature（℃）		-25～+55
Pressure loss（kPa）		<25
Cable length of temperature sensor (m)		⩾1.3
Installation position		Water supply and return pipeline(optional)

Note：The service life of the battery is related to the application ambient temperature. The service life marked here is the test value within the range of 25 ± 5 ℃; Beyond this temperature range, the service life will be reduced. The wired communication interval has a great impact on the service life of the battery. This standard life is the calculated life when the communication interval is greater than 1 minute.

2 Technical Data

2.1 Heat Measurement

2.1.1 Accuracy Class：Class 2

Calculation formula of maximum permissible error of integral heat meter：

$$E_h = \pm\left(3 + 4\frac{\Delta\theta_{min}}{\Delta\theta} + 0.02\frac{q_p}{q}\right)\%$$

Where:

E_h is the maximum permissible error of heat meter

$\Delta\theta_{min}$ is the lower limit of temperature difference, in Kelvin (k)

$\Delta\theta$ is the temperature difference within the range of use, in Kelvin (k)

q_p is the common flow, in m^3/h

q is the flow within the range of use, in m^3/h

2.1.2 Heat Quantity Calculation

The enthalpy difference method is used to calculate the heat quantity. When the medium flows through the heat meter in the heat exchange system, the calculator calculates the heat released or absorbed by the heat exchange system according to the flow measured by the flow sensor, the inlet and outlet temperatures measured by the temperature sensor, as well as the time when the medium flows through. The calculation formula of heat released or absorbed by heat exchange system is：

$$Q = \int_{t_0}^{t_1} q_m \times \Delta h \times dt$$

$$q_m = \rho \times q_v$$

Where:

Q is the heat released or absorbed by heat exchange system, in KJ.

q_m is the mass flow of the medium through heat meter, in kg/h

Δh is the mass enthalpy difference of the medium at the inlet and outlet temperatures of the heat exchange system, in kJ/kg

t is the working hours, in h

ρ is the density of the medium flowing through the heat meter, in kg/m^3

q_v is the volume flow of medium through the heat meter, in m^3/h

2.2 Temperature Measurement

The data of temperature sensor of heat meter is shown in table 2-1:

Table 2-1

Number of temperature sensors	2
Temperature sensor type	Pt1000，DIN/IEC751B
Temperature measurement range	(2～105)℃
Temperature difference range	(2～95) ℃
Starting temperature difference	0.2K

2.3 Flow Measurement

The data of heat meter flow sensor is shown in table 2-2:

Table 2-2

Flow sensor	Nominal diameter（mm）	DN15		DN20		DN25	
	Range ratio	100		100		100	
	Common flow q_p（m^3/h）	1.0	1.5	1.5	2.5	2.5	3.5
	Minimum flow q_i（m^3/h）	0.010	0.015	0.015	0.025	0.025	0.035
	Maximum flow q_s（m^3/h）	3.0	3.0	5.0	5.0	7.0	7.0

2.4 Display LCD Description

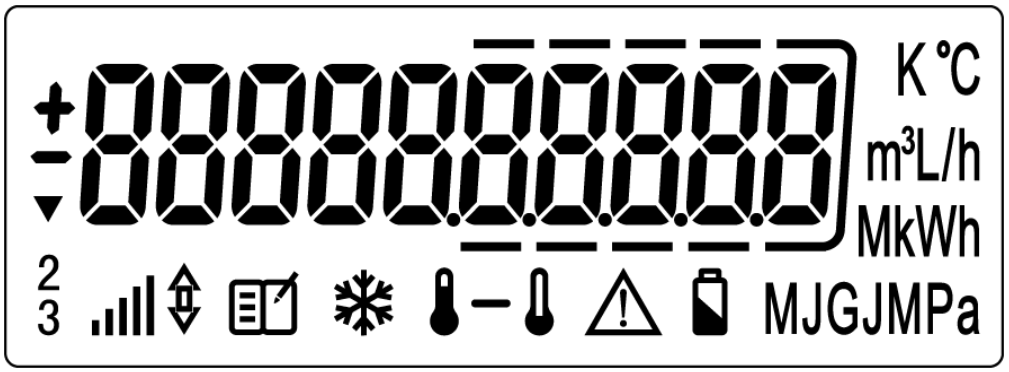


Figure 2-1 Schematic diagram of LCD

The LCD adopts a 10-digit digital display, which can meet the needs of different users for the resolution and range. In order to facilitate users to read, the decimal part

adopts a frame display prompt; at the same time, the instrument LCD can display a variety of information prompt symbols to ensure the stable and reliable operation of the system. The meanings of various prompt symbols are as follows:

Table 2-3

Symbols	Meanings	Symbols	Meanings
±	Negative value displays "-"; Positive values are not displayed	▼	Key operation is effective
2 3	Screen cycle number； main cycle is not displayed		NB-IoT network online
❄	Displayed when the cold and heat meter is in use mode		Water supply temperature
	Return temperature		Temperature difference between water supply and return
⚠	Anomaly identification of flow measurement		Low power prompt
℃	Temperature unit	m^3L/h	Flow unit
MkWh	Heat unit	MJGJ	Heat unit
MPa	Pressure unit		Numerical display

2.5 Data Storage

Independent external permanent memory storage (EEPROM) is adopted for data storage to ensure long-term reliable storage of instrument data. Even after power failure, the data can still be stored for 100 years. See the table below for storage information:

Table 2-4

Storage content	Storage description
Daily historical data	The daily historical data of the last 24 months can be stored.
Monthly historical data	The monthly historical data of the last 24 months can be stored.

Table 2-5

Storage information	Daily historical data	Monthly historical data
Date	●	●
Cumulative running time	●	●
Cumulative flow	●	●

Cumulative heat quantity	●	●
Maximum thermal power	●	●
Temperature of supply and return water	●	●
Diagnostic information codes	●	—

Note：If you need more storage information, please specify when ordering. It will be designed according to customized products.

2.6 Communication Interface Description

The product supports optical interface (standard), NB-IoT interface, M-Bus interface, optional RS-485 interface (please specify when ordering).

Data and various alarm information can be read through optical interface and M-Bus/RS-485 communication interface.

Table 2-6 Connection method with RS-485/M-Bus data communication equipment

RS-485/M-Bus output cable color	Connect with communication equipment	
	RS-485	M-Bus
Red	A+	M（Positive/negative）
White	B-	M（Positive/negative）

2.6.1 Optical Interface

Optical interface adopts infrared receiving and transmitting tube for near field communication；

Application tools: Infrared reading head, intelligent reading terminal equipment or App (contact our company to order or register);

Optical interface conforming to EN 13757 standard, baud rate 2400bps, check bit: even parity;

In addition to reading the instrument parameters, it can also control the instrument to enter the verification and debugging state.

2.6.2 NB-IoT

The wireless interface communicates with the IoT platform through the narrow band Internet of Things (NB-IoT network) for data upload and download services, and can support the frequency band: band1/ band3/ band5/ band8/ band20/ band28.

2.6.3 M-Bus

M-Bus (Meter Bus) conforms to the 2-wire bus standard. It is a data bus standard specially designed for consuming measuring instruments and counters to transmit

information. It is a communication line, a high-reliability and high-speed remote meter reading system bus dedicated to remote meter reading.

It supports CJ-T188 protocol，Huizhong protocol, Modbus, EN13757 protocol，the default is EN 13757 protocol；Baud rate 2400bps, 4800bps, 9600bps are optional, the default is 2400bps；even parity；

Transmission distance≤1200m；

Two wires on the heat meter are connected with the two wires on the bus, regardless of polarity.

2.6.4 RS-485

RS-485 is a 2-wire long-distance serial communication using RS-485 communication hardware.

It supports CJ-T188 protocol, Huizhong protocol, Modbus, EN13757 protocol, the default is EN13757 protocol; Baud rate 2400bps, 4800bps, 9600bps are optional, the default is 2400bps；even parity；

Transmission distance≤1200m；

Two wires on the heat meter are connected with the two wires on the bus, and they are connected according to the polarity; Wrong connection may cause communication failure or burning.

2.7 Alarm Description

The alarm information of the equipment is shown in the following table:

Table 2-7 Alarm information table

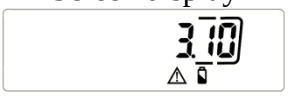
Alarm information	NB-IoT	M-bus	Rs485
Low power alarm	√	√	√
Very low battery is about to run out	√	√	√
High water temperature alarm	√	√	√
Low water temperature alarm	√	√	√
Empty pipe or transducer failure alarm	√	√	√
Storage failure alarm	√	√	√
Water temperature sensor failure alarm	√	√	√
PSM alarm	√	×	×

The equipment can read out alarm information through infrared communication

during use; wired equipment will upload alarm information during meter reading; wireless equipment will upload alarm information during periodic reporting or immediate alarm reporting.

If the product has a fault alarm, the LCD can display the corresponding fault alarm symbol. Common fault alarm symbols are shown in the table below:

Table 2-8 Common fault alarm list

Alarm symbol	Content	Solutions
Long term display“⚠”	1.Empty pipe. 2.Serious scaling on transducer surface. 3.Instrument failure.	1. Fill the pipe with water. 2. Remove the scaling on the transducer surface. 3. Please contact the manufacturer for maintenance.
Frequently display“⚠”	There are too many bubbles or impurities in the measured liquid.	Remove bubbles or impurities from the liquid.
Display “🔋”	The battery is low.	The battery should be replaced as soon as possible.
Screen display 	The battery power is severely low. At this time, the number on the screen indicates the battery voltage value. The meter stop measuring, but the stored data can be viewed.	The battery must be replaced.
Non-temperature screen display “🌡”、“🌡”、“🌡—🌡”	The water supply, return, water supply and return temperature sensors are faulty.	Please contact the manufacturer for maintenance immediately.
Screen display “88888888”	The internal memory "EEPROM" is malfunctioning.	Please contact the manufacturer for maintenance immediately.

2.8 Power Supply Mode

This product uses a 3.6V lithium battery with a service life of more than 12 years at an ambient temperature of 20° C to 30° C. When the meter displays the “🔋” symbol, it means that the battery is insufficient and needs to be replaced, otherwise it will cause the loss of measurement data. When replacing the battery, the operation must be performed by professionals who have been instructed by the manufacturer, or

the product should be sent back to the manufacturer for replacement by the manufacturer. After replacing the battery, the "cumulative flow", "cumulative effective running time" and "cumulative heat (cold) value" stored in the meter will not be lost.

2.9 Mechanical Parameters

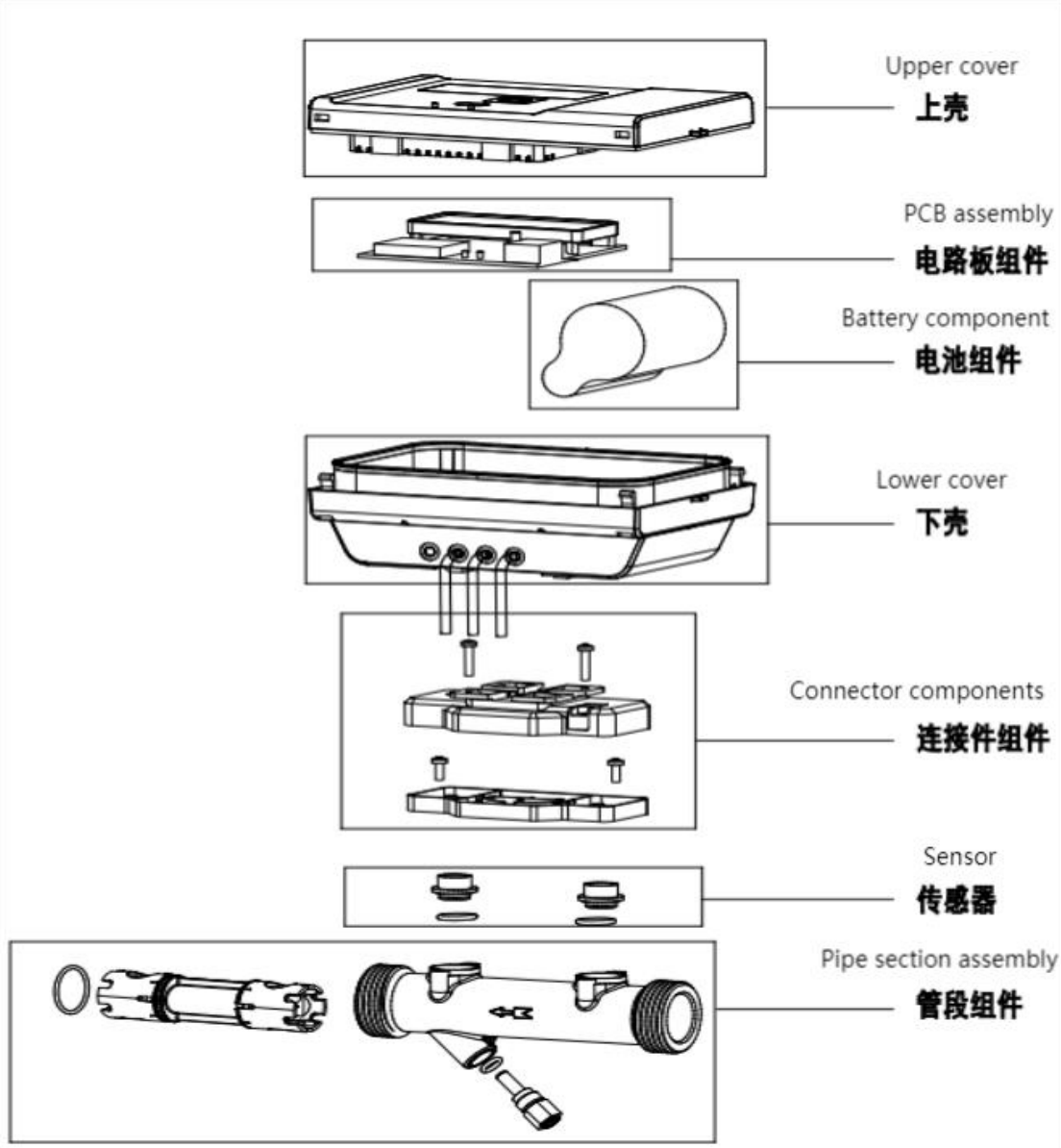


Figure 2-2 CRL-H assembly drawing of residential ultrasonic heat meter

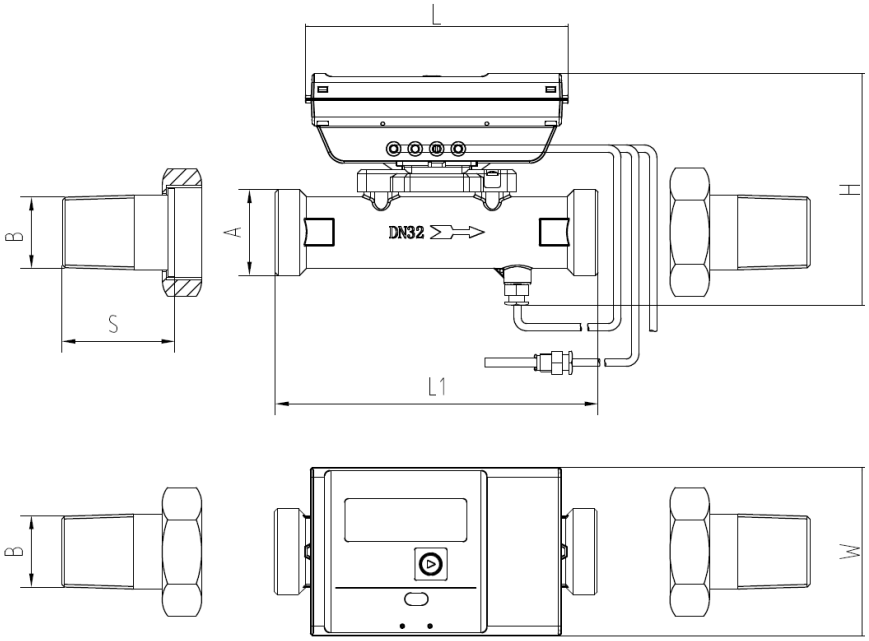


Figure 2-3 Outline dimension drawing

Table 2-9 Outline dimension table

Nominal diameter（mm）	DN15	DN20	DN25
A Installation without connecting accessories	G$\frac{3}{4}$B	G1B	G1 $\frac{1}{4}$B
B Installation with connecting accessories	R$\frac{1}{2}$B	R$\frac{3}{4}$B	R1B
L（mm）	147	147	147
L1（mm）	110	130	160
H（mm）	110	115	120
W（mm）	94	94	94
Length of connecting accessories S（mm）	45	51	59

3 Product Parts and Components

The parts list is as follows:

Parts	Supplier name / trademark	Model	Technical specification/ Main parameter	Number
Measuring pipe section	Huizhong	CRL-H	Maximum permissible working pressure: 1.6MPa	1
Ultrasonic transducer	Huizhong	CRL-H	Emission frequency：1MHz	2
Temperature sensor	JUMO AUTOMATION	PT1000	Temperature range:（0~105）℃	2

	DALIAN CO., LTD		Temperature range:（0~95）℃	
Circuit board	Huizhong	CRL-H-BC95-Z3（NB-IoT interface） CRL-H-RS485-Z3（wired interface）	Time measurement accuracy: 12.5ps	1
Battery	EVE Energy Co., Ltd.	ER34615+SPC1550（NB-IoT interface）ER17505（wired interface）	Voltage：3.6V Capacity：3.6Ah/19 Ah	1

The component list is shown below：

Components	Supplier name / trademark	Model	Technical specification/ Main parameter	Number
Connector	Huizhong	CRL-H	Maximum permissible working pressure: 1.6MPa	2

4 Description of Working Principle

CRL-H residential heat meter is an instrument that uses ultrasonic flow sensor and paired temperature sensor to measure water supply flow, temperature difference between water supply and return and time of water flow, and then measure and display the heat released or absorbed by the water flowing through the heat exchange system.

And the enthalpy difference method is used for heat measurement, and the calculation formula is:

$$Q = \int_{\tau_0}^{\tau_1} q_m \times \Delta h \times d_\tau = \int_{\tau_0}^{\tau_1} \rho \times q_v \times \Delta h \times d_\tau$$

Where，

Q is the heat quantity released or absorbed by the system, in J;

q_m is the mass flow of water flowing through the heat meter, in kg/h;

q_v is the volume flow of water flowing through the heat meter, in m^3/h;

Δh is the enthalpy difference of water at the temperature of the water supply and return in the heat exchange system, in J/kg;

τ is the time, in h.

The heat meter consists of the following three parts:

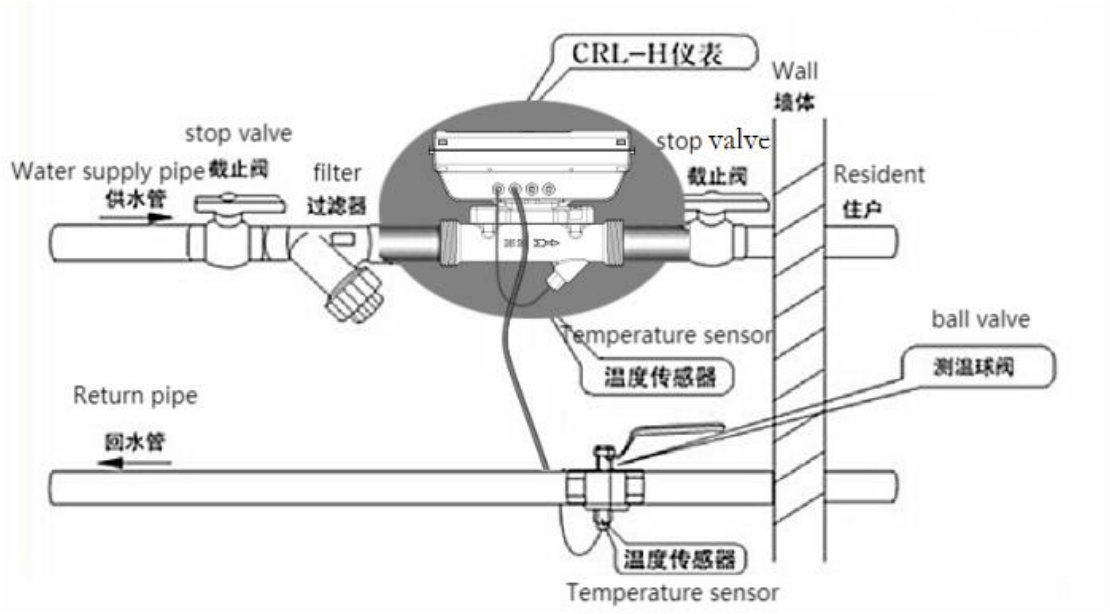


Figure 4-1 Installation diagram

Calculator: used to receive the signals from the flow sensor and the paired temperature sensor, and to calculate, accumulate, store and display the heat value in the heat exchange system;

Flow sensor: installed in the heat exchange system to collect the water flow and send out a flow signal;

Temperature sensor: a pair of temperature sensors with the same or similar measurement characteristics used to simultaneously measure the temperature signals of the heat-carrying liquid in the water supply and return pipelines in the heat exchange circuit.

5 Nameplate

5.1 Panel Notes

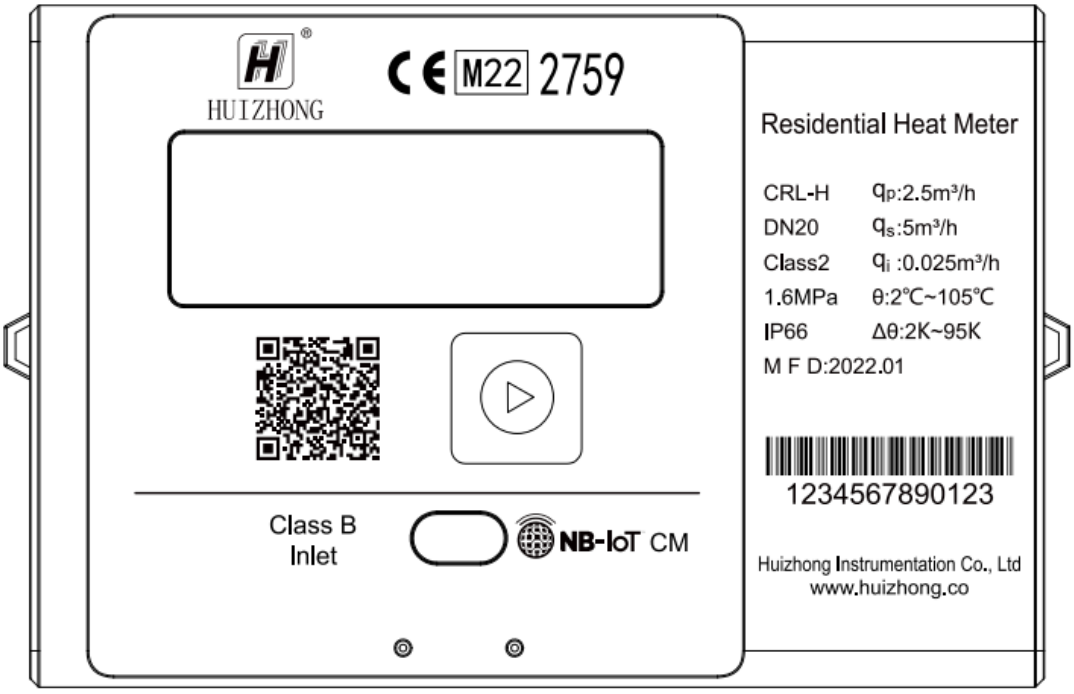


Figure 5-1

Note：The actual panel information shall be subject to the delivered products.

- Manufacturer；
- Model and specification, production date and number;
- Limit of temperature (θ_{min} and θ_{max})；
- Limit of temperature difference ($\Delta\theta_{min}$ and $\Delta\theta_{max}$）；
- Limits of flow rate (q_i, q_p and q_s). Different sets of q_i and q_s may be given depending on mounting orientation and type of liquid;
- Installation position (inlet or outlet);
- Medium flow direction；
- Maximum admissible working pressure，in MPa；
- Accuracy class；
- Environmental classification；
- Enclosure protection class；

5.2 Sealing Drawing

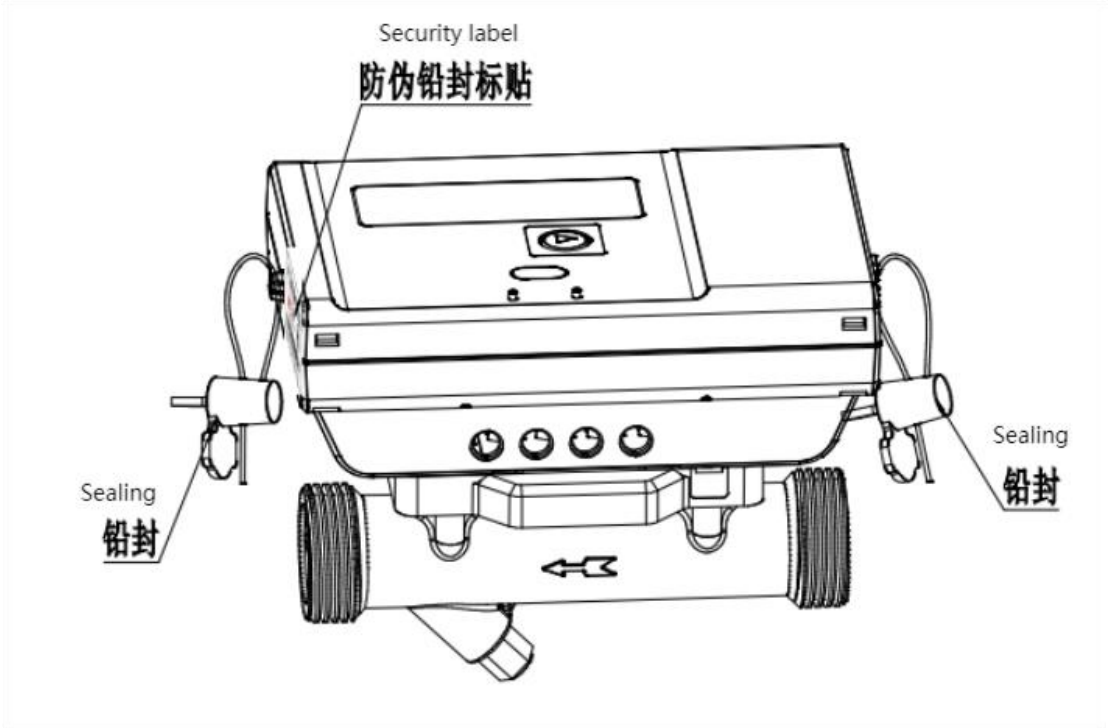


Figure 5-2

6 Safety Requirements

- Do not charge, short circuit or modify the battery without permission.
- Do not overheat or weld the battery.
- Keep the battery away from flame or water.
- Do not subject the battery to severe physical impact.
- The battery of this product has been professionally treated. Do not replace it with other batteries of the same model.
- Please replace the battery in time when the battery is low, otherwise it will cause the loss of measurement data. When replacing the battery, the operation must be performed by a professional who has been instructed by the manufacturer, or the product should be sent back to the manufacturer to replace the battery.
- Please use tape to insulate the electrical contacts of the battery under replacement to avoid contact with other metal objects or batteries to avoid fire or explosion.
- The replaced waste batteries shall be subject to environmental treatment and must be sent to the dustbin, garbage station, recycling station, etc which specialize in recycling used batteries.
- If the battery leaks, changes color, deforms, smokes or emits peculiar smell, please remove it immediately. Avoid burns during operation.
- Do not let the leakage of the battery come into contact with eyes, skin or clothing, otherwise it will cause blindness or skin damage.
- If the battery leaks and comes into contact with eyes, skin or clothing, wash the contact area with plenty of water immediately (do not rub), and seek medical attention immediately.
- Do not change any cable length, otherwise the product performance will be affected.
- Do not make any cables of this product close to the heat source to avoid fire or electric shock due to thermal deformation of the cables or damage to the insulation layer caused by the battery.

7 Installation Instructions

7.1 General Requirements

1) The installation position of the instrument shall be protected from rain and sunlight.
2) It shall be installed in strict accordance with the professional design position, and it is strictly prohibited to move without permission.
3) In order to ensure the accuracy of the instrument, the cable length of the temperature sensor shall not be changed.
4) The battery replacement must be operated by professionals.
5) The heat meter can be installed in the water supply pipe or the return water pipe, and the default is the water supply installation.

7.2 Installation of Flow Sensor

The flow sensor is suitable for water supply pipes with a maximum working pressure of 1.6MPa.

7.2.1 Installation Position

Ⅰ. Integrated installation, and the calculator is directly installed on the flow sensor.

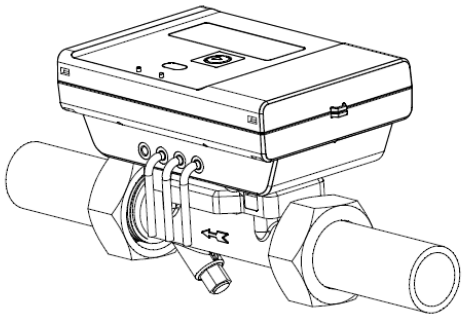


Figure 7-1

Ⅱ. Split installation, the calculator is installed on the wall.

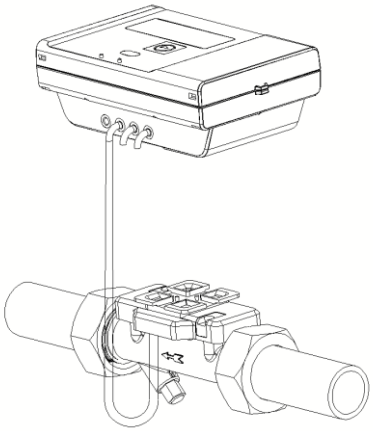
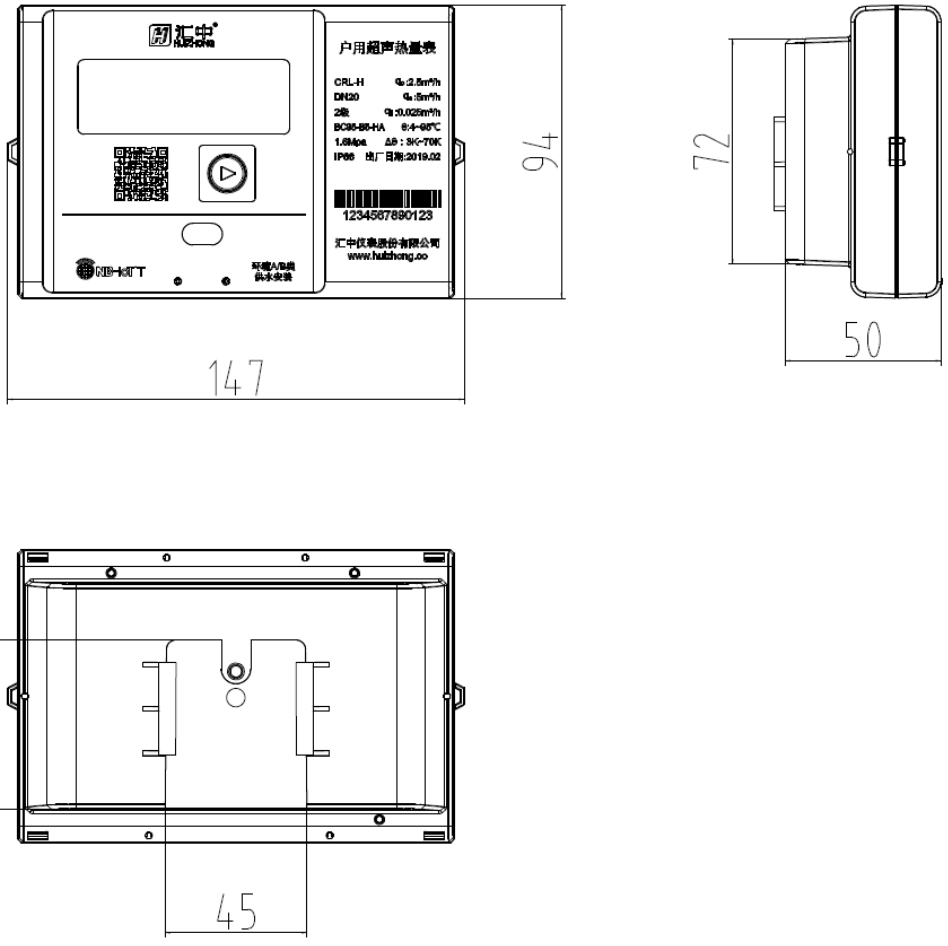


Figure 7-2

Ⅲ. Installation dimension of calculator fixed on the wall.



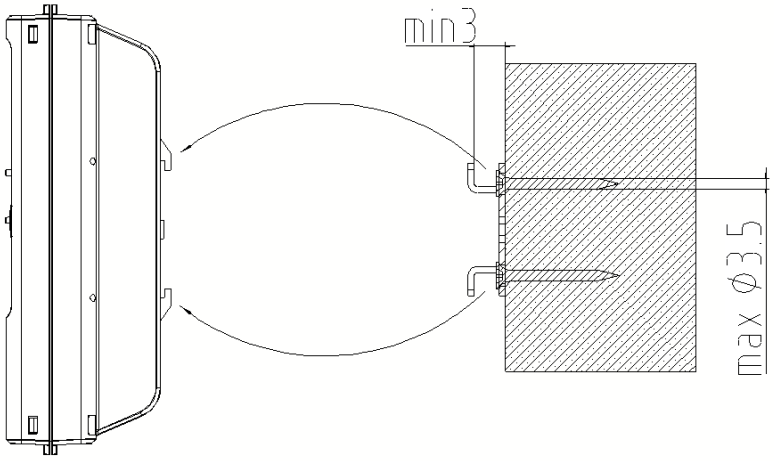


Figure 7-3

7.2.2 Installation Position

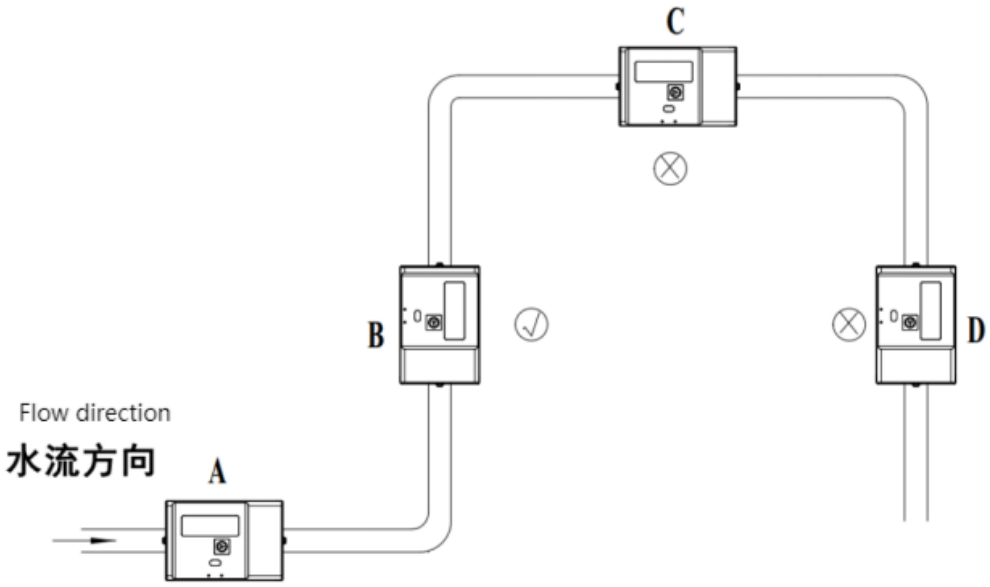


Figure 7-4 Schematic diagram of Installation position

1) Point A is the recommended installation point. The heat meter is installed below the pipeline. There is back pressure at the rear end of the meter, which will not produce bubbles to affect the measurement accuracy.
2) Point B is the recommended installation point. The meter is installed on a pipeline where the liquid flows upward (or obliquely upward), and there will be no air bubbles. The principle is the same as that of point A;
3) Point C is not recommended. The meter is installed at the highest point of the pipeline route. It is easy to produce bubbles in the pipeline and cause abnormal

measurement;

4) Point D is not recommended. The meter is installed on the pipeline where the liquid flows downward (or obliquely downward). There is no back pressure at the rear end of the instrument, which may cause the liquid in the pipeline to not be fully filled and affect the measurement accuracy.

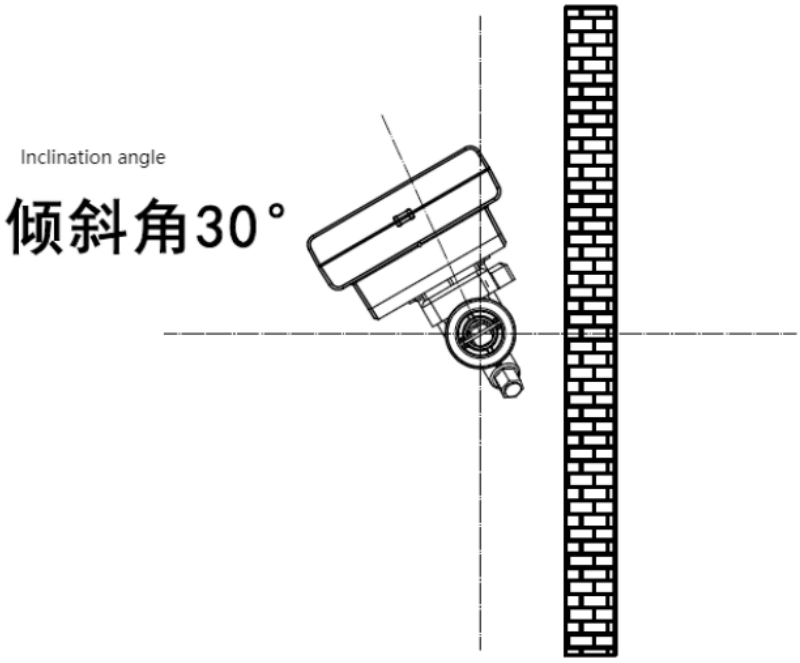


Figure 7-5 Schematic diagram of panel position

5) As shown in the above figure, the best installation method is to install the heat meter on the pipeline and keep the panel of the meter installed horizontally. When it needs to be tilted under special circumstances, the maximum angle of inclination shall not exceed 30 °. The purpose is to ensure the transducer is not above the pipeline during measurement and avoid the accumulation of bubbles above the pipeline and affect the measurement accuracy.

7.2.3 Installation Method

Attention： a. Pay attention to sealing during installation to prevent water leakage!

b. Note that the direction of " ➡ " on the side of the instrument pipe section must be consistent with the direction of water flow！

1) Installation without connecting accessories

Cut off the water supply pipe where the instrument is installed, and leave the position for installing the instrument, as shown in the figure:

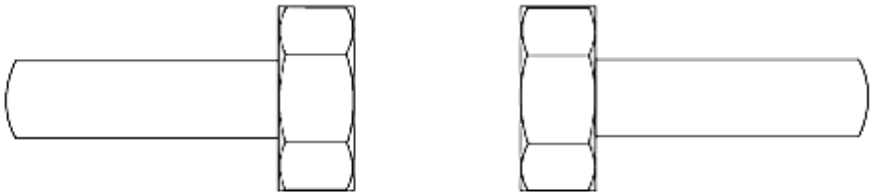


Figure 7-6 Installation diagram 1

Align the meter with the pipe concentrically, and use a wrench to connect the pipe union with the meter thread together and then tighten it, as shown in the figure:

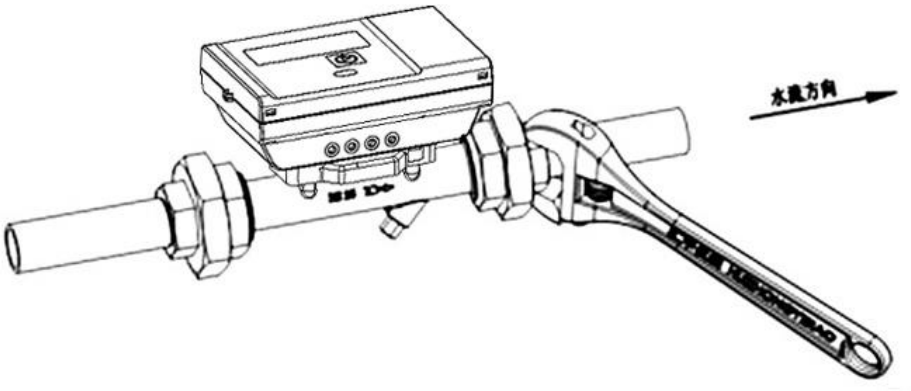


Figure 7-7 Installation diagram 2

2) Installation with connecting accessories

Cut off the water supply pipe section where the instrument is installed, and leave the installation position of the instrument and connecting accessories, as shown in the figure:

Figure 7-8 Installation diagram 3

Tighten the connecting accessories at the cut-off point of the water supply pipe, as shown in the figure:

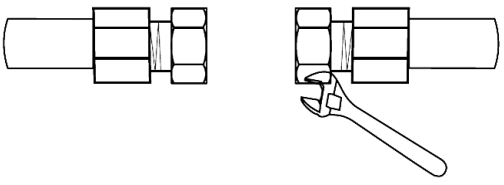


Figure 7-9 Installation diagram 4

Align the meter with the connecting accessories and install it:

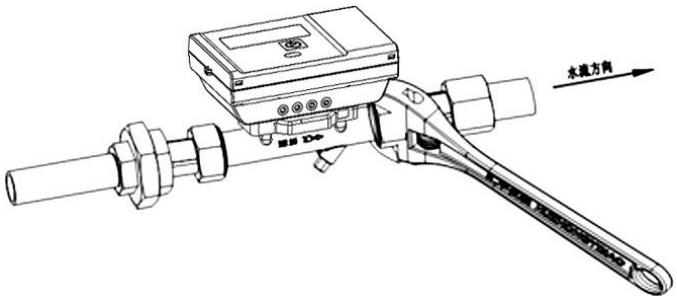


Figure 7-10 Installation diagram 5

7.3 Installation of Calculator

When the medium temperature reaches 90℃ or higher (or the ambient temperature is greater than the medium temperature), you can choose to remove the calculator from the flow sensor and install it in a place far away from the heat source.

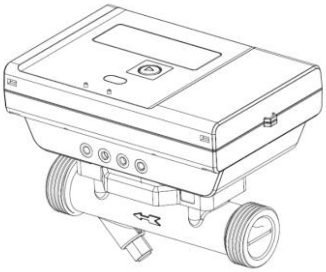


Figure 7-11 Overall installation diagram of flow calculator

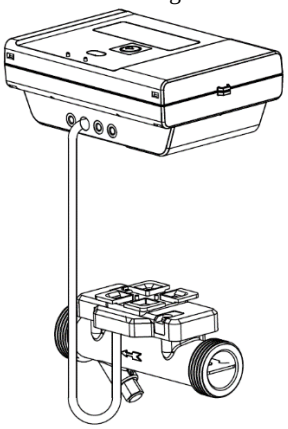


Figure 7-12 Split installation diagram of flow calculator

When leaving the factory, the cable length between the calculator and the flow meter is 0.5 meters, and the customer cannot change it at will.

In order to facilitate meter reading, the calculator can be fixed in four directions perpendicular and parallel to the pipe section body, as shown in the figure:

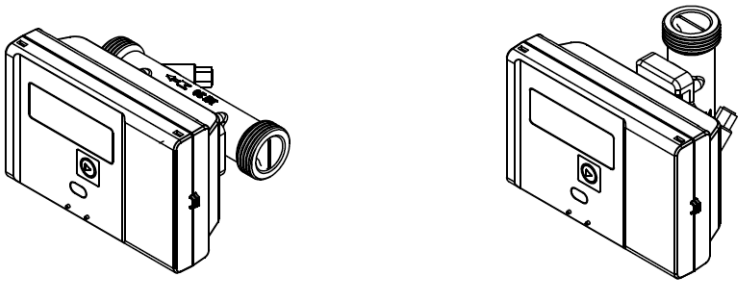


Figure 7-13 Rotary installation diagram 1

Meanwhile folding can be added to increase the rotation of 90°, as shown in the figure:

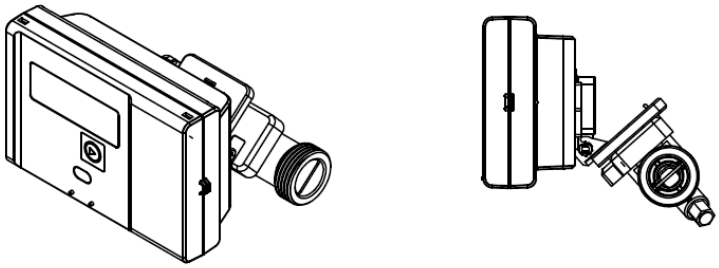


Figure 7-14 Rotary installation diagram 2

7.4 Installation of Temperature Sensor

1) The temperature sensor is used to measure the temperature of the medium at the inlet (water supply) and outlet (water return) of the pipeline. The temperature sensor is two PT1000 platinum resistance temperature sensors that are matched accurately and cannot be used separately;
2) When leaving the factory, the temperature sensor with a red label has been installed in the body. The specific installation method is shown in the table below:

Type	Label color	Installation position
Heat meter/water supply installation	Red	In the meter body
	Blue	Pipe outlet (return pipe)
Heat meter/return installation	Red	In the meter body
	Blue	Pipe inlet (water supply pipe)

3) The cable length of temperature sensor outside the meter is 1.3m, and cannot be changed at will.
4) The temperature sensor outside the meter shall be installed in the temperature measuring ball valve.

Cut off the pipe section where the thermometer outside the meter needs to be installed, and reserve a position where the temperature measuring ball valve is installed, as shown in the figure:

Figure 7-15 Installation diagram of temperature sensor 1

Align the valve with the pipe, and tighten it on the return pipe with a wrench, as shown in the figure:

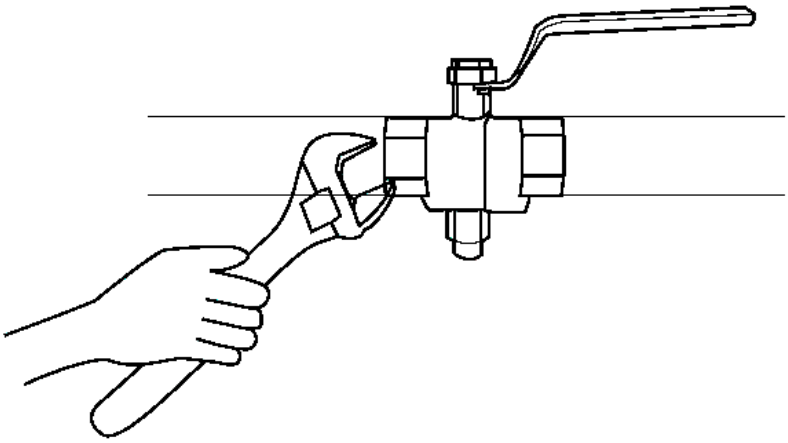


Figure 7-16 Installation diagram of temperature sensor 2

Install the thermometer outside the meter at the corresponding position at the bottom of the valve and seal it, as shown in the figure:

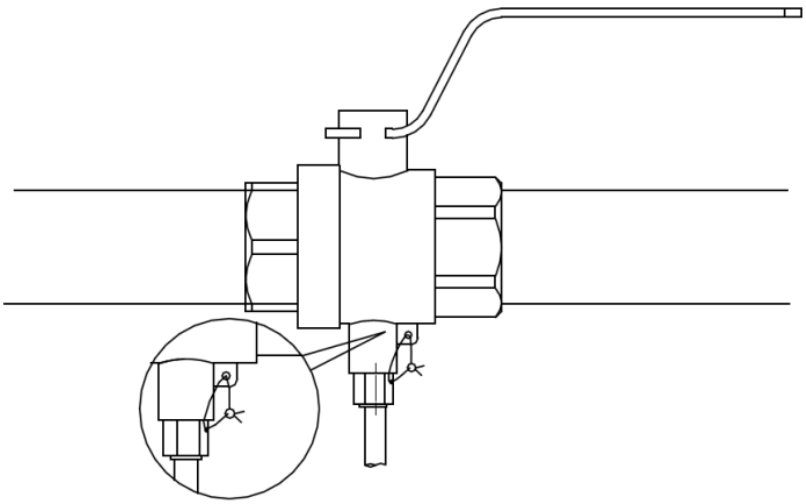


Figure 7-17 Installation diagram of temperature sensor 3

Then the thermometer outside the meter body has been installed.

8 Operation Instructions

8.1 Key Operations of NB-IoT Interface

●When the meter is cooling meter, cooling and heating meter, the main screen displays the cooling capacity in kW•h.

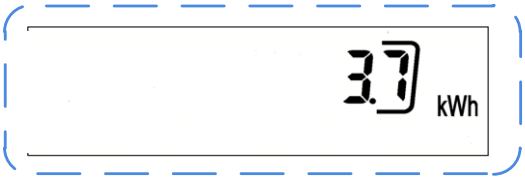
●When the symbol " ⚠ " is displayed, no key operation on any screen of the instrument, it will continue to display for 2 minutes, and then automatically return to the main screen for display.

●When no symbol " ⚠ " is displayed, no key operation on any screen of the instrument will be displayed for 2 minutes, and then automatically shut down.

●The user of meter can press this  key to switch between the display screens to view the related measurement data and cycle display.

8.1.1 Description of Cycle Display

Energy window



The energy window in the main cycle is the basic window.

The energy calculation formula is:

Energy= instantaneous flow × density×（enthalpy of water supply-enthalpy of return）×running time/（3.6×10^6）

To facilitate meter reading, the energy unit of the instrument is defined as kW•h（1kW•h=1 degree）. The energy unit has been set at the factory and cannot be changed by the user.

Energy can also be displayed in GJ units：E（GJ）=E（kW•h）×3.6

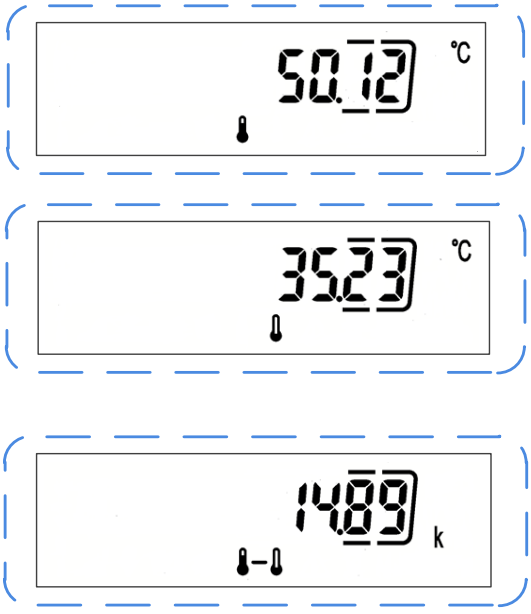
In the case of no operation, the update frequency of the energy window is: 2 seconds/time.

- Flow calculation

Cumulative flow (m^3) and instantaneous flow (m^3/h)

In the case of no operation, the update frequency of the display is: 2 seconds/time.

- Temperature calculation

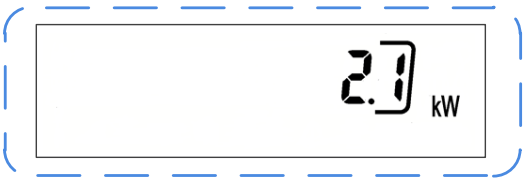


The temperature of the water supply and return water is measured by a precisely matched Pt1000 temperature sensor, and the measurement range is 2℃~105℃.

Temperature difference=Water supply temperature-Return water temperature

In the case of no operation, the update frequency of the temperature display is: 30 seconds/time.

- Instantaneous thermal power calculation



The meter calculates the current power based on the current water flow rate and the temperature difference measured during the last integration.

Power calculation formula：

Thermal power calculation=Instantaneous flow × density×

（Water supply enthalpy-water return enthalpy）/（3.6×10^6）

In the case of no operation, the update frequency of power display is: 2 seconds/time.

- Cumulative effective running time

Unit：h

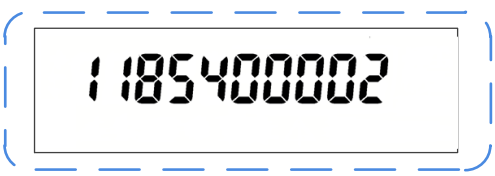
- Date display

Unit：Year/Month/Day

- Clock display

Unit：hour / minute / second

- ID number

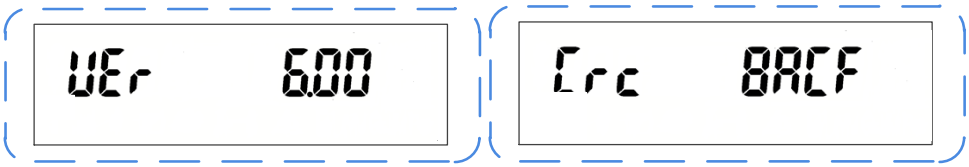


The factory code is different for each meter.

- Display inspection

All display/all off display alternately, displaying all field, used to check whether the fields are in bad contact.

- Software version and CRC check



Software version refers to the software version number used internally by the meter;

Check and (Cyclic Redundancy Check): a data transmission error detection function.

CRC and version number are alternately displayed.

8.2 Key Operations of M-Bus/RS-485 Interfaces

The user of M-Bus/RS-485 instrument can press this  key to switch between display screens as required to view the relevant data measured by the meter. The display cycle is also different with the length of key press time. The key press time is less than 5 seconds to display each content in a cycle. If the key press time on any screen is longer than 5 seconds, it will switch to the next cycle.

There are three cycles: main cycle, information cycle and monthly historical data cycle.

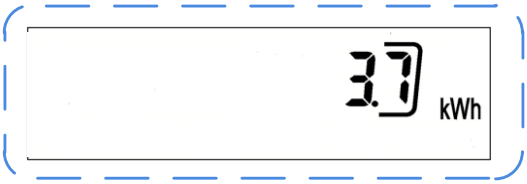
When no key operation on any screen of the instrument, and no symbol " ⚠ " is displayed, the instrument will automatically enter the power-saving mode and shut down. Press the key again to display the energy screen.

8.2.1 Description of Main Cycle Display

- Energy window

The energy unit of the meter is defined as kW•h（1kW•h=1 degree）, The energy

unit has been set at the factory and cannot be changed by the user.



The energy window in the main cycle is the basic window.

The energy calculation formula is:

Energy= instantaneous flow × density×（enthalpy of water supply-enthalpy of return）×running time/（3.6×10^6）

To facilitate meter reading, the energy unit of the instrument is defined as kW•h（1kW•h=1 degree）. The energy unit has been set at the factory and cannot be changed by the user.

Energy can also be displayed in GJ units：E（GJ）=E（kW•h）×3.6

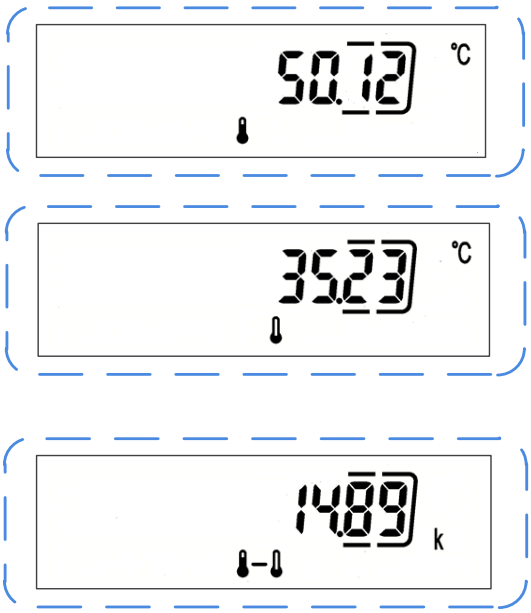
In the case of no operation, the update frequency of the energy window is: 2 seconds/time.

- Flow calculation

Cumulative flow（m^3）and instantaneous flow（m^3/h）

In the case of no operation, the update frequency of the display is: 2 seconds/time.

- Temperature calculation

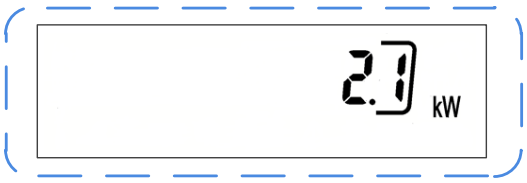


The temperature of the water supply and return water is measured by a precisely matched Pt1000 temperature sensor, and the measurement range is 2℃~105℃.

Temperature difference=Water supply temperature-Return water temperature

In the case of no operation, the update frequency of the temperature display is: 30 seconds/time.

- Instantaneous thermal power calculation



The meter calculates the current power based on the current water flow rate and the temperature difference measured during the last integration.

Power calculation formula:

Thermal power=instantaneous flow × density×

（Enthalpy of water supply-Enthalpy of water return）/（3.6×10^6）

In the case of no operation, the update frequency of the power display is: 2 seconds/time.

- Cumulative effective running time

Unit：h

- Date display

Unit：Year/Month/Day

- Clock display

Unit: hour / minute / second

- Display inspection

All display/all off display alternately, displaying all field, used to check whether the fields are in bad contact.

- Software version and CRC check

Software version refers to the software version number used internally by the meter;

Check and (Cyclic Redundancy Check): a data transmission error detection function.

CRC and version number are alternately displayed.

8.2.2 Description of Information Cycle Display

- Factory code

The factory code is different for each meter.

- Battery Power

Battery Power, its unit is V, normal range:3.00~3.65.

- Primary Address

Primary address refers to the local address when using M-Bus/RS-485 interface for multi-machine serial communication. The effective address range is 001 ~ 199.

- Secondary address

M-Bus/RS-485 auxiliary address (secondary address). If there are multiple slaves with the same primary address on the bus, a conflict will occur. When there is a conflict, the current and voltage of the M-Bus/RS-485 bus will change abnormally. The host can use this abnormality to assist messages such as "select secondary address" and automatically resolve the conflict.

- Baud rate and check method

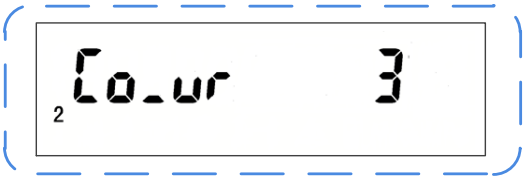
Select the communication rate of 2400 baud, check bit: Even Parity;

The baud rate is the number of bytes transmitted per second in RS-485/M-Bus interface communication.

2400bps, 4800bps, 9600bps are optional, the default is 2400bps;

Optional (order proposal): N-none, O-odd;

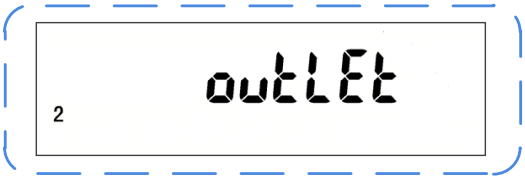
- Communication Version



The current communication protocol (Communication version) is displayed. It is set at the factory and cannot be changed by the user. The figure above shows the 3-EN13757 protocol;

Optional (order proposal): 0-CJ/188, 1-Huizhong protocol, 2-ModBus.

- Installation position



It is set at the factory and cannot be changed by the user. The figure above shows the return water installation (OUTLET);

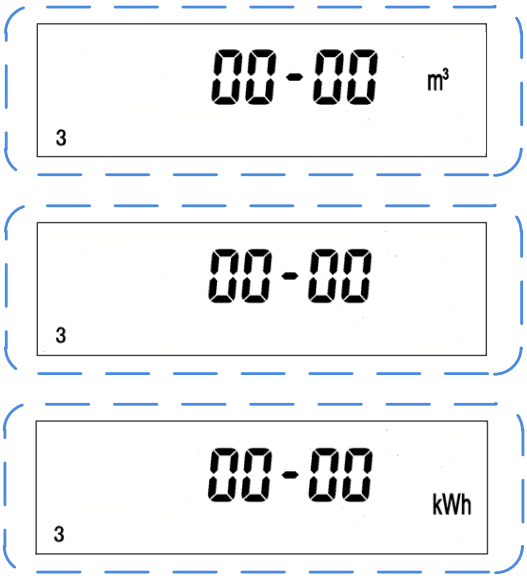
Optional (order proposal): it can be changed to water supply installation through optical interface (INLET).

- Instrument type

It is set at the factory and cannot be changed by the user. The figure above shows the heat meter (HEAT);

Optional (order proposal): cooling meter (COLD), heating/cooling meter (H And C).

8.2.3 Description of Monthly Historical Cycle Display



The screen automatically circulates between the three menus at an interval of 2 / s, and the user does not need to perform any operation;

The screen displays the total cumulative flow at the end of the previous month, the settlement date (set at the factory), and the total cumulative energy at the end of the previous month;

Press the key for a short time to enter the historical data information of the last two months;

A total of historical data for the previous 24 months can be displayed;

Press the key for more than 5s to enter the energy screen of the main cycle.

9 Applied Standard

The design of the CRL-H ultrasonic heat meter meets the standard requirements of EN1434-5.

10 Transportation and Storage Requirements

1. The packaged equipment can be used for any type of truck transportation, and the equipment packaging shall be reliable and stable to avoid the possibility of impact and displacement in the vehicle.

2. This product is a precision measuring instrument. Please do not drop it or subject it to impact during transportation.

3. Do not charge, short circuit or modify the battery without permission.

4. Do not make any cables of this product close to the heat source to avoid fire or

electric shock due to thermal deformation of the cables or damage to the insulation layer caused by the battery.

5. Any exposed thread part of the product may cause skin scratch. Please operate with care.

6. Try to avoid using in acidic environment and environment with heavy salt spray, otherwise it will accelerate the aging of product materials and cause the product to fail to meet the hygienic standards.

7. The storage temperature of the product is between - 25 ℃ ~ 55 ℃, avoid corrosive gas or liquid, and avoid direct sunlight to the display panel of the instrument for a long time.

Company Address：No.126 West Gaoxin Road, High Tech Industrial Zone, Tangshan, Hebei

Sales Hotline：0315-3296878　3296898

After sales service line：0315-3208508

Fax：0315-3208503　3190081

Zip code：063020

E-mail:info@hzyb.com

http://www.huizhong.co

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