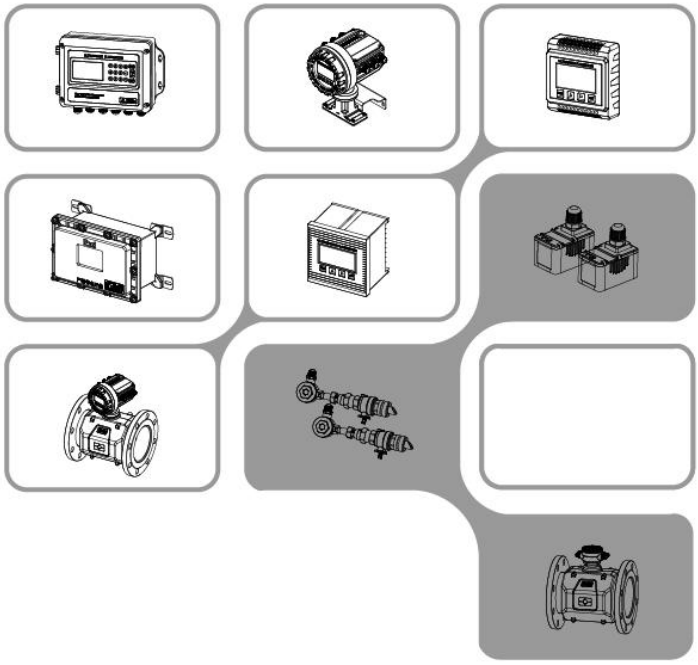
Ultrasonic Flow/Heat Meter

User Mannual



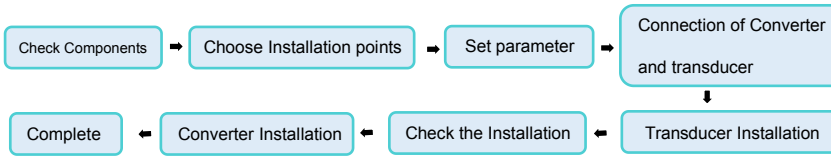
ISO9001

Contents

You are welcome to use our multi-channel ultrasonic flow meter / heat meter.

Understanding product assortments helps you understand when to use the ordered product and helps you check the configuration of the ordered product. The multi-channel ultrasonic flow meter is composed of a multi-channel sensor and a host. It is divided into integrated ultrasonic flow meter and split ultrasonic flow meter.

Installation Procedure



Chapter 1 Products Categories

1.1 Composition of Ultrasonic flow /Heat meter

Ultrasonic Flow meter = Converter + transducer

Ultrasonic Heat meter = Converter + transducer + temperature transducer

1.2 Types of Converters

Model	Separated				Fix mount
	Wall mount	Module	Panel mount	Explosion proof	
Picture					

1.3 Types of Flow transducers

Classification		Picture	Model	Measuring range	Temperature
Clamp on	Normal temperature		S1 (small)	DN15-100	-30~90℃
			M1 (medium)	DN50-700	
			L1 (large)	DN300-6000	
	High temperature		S1-HT (small)	DN15-100	-30~160℃
			M1-HT (medium)	DN50-700	
			L1-HT (large)	DN300-6000	
Bracket	Normal temperature		HS1 (small)	DN15-100	-30~90℃
			HM1 (medium)	DN50-300	
	High temperature		HS1-HT (small)	DN15-100	-30~160℃
			HM1-HT (medium)	DN50-300	
Insertion type			ATC-1 (standard)	DN50-6000	-30~160℃
			ATC-2 (extended)		
			ATP-1 (parallel)	DN200-6000	
Inline type	Tiny caliber		Thread / flange / quick connection	DN6-10	-30~160℃
	Minor-caliber			DN15-40	
	Heavy caliber		Thread / flange connection	DN50-2000	

1.4 Types of Temperature transducers

Classification	Picture	Model	Measuring range	Temperature range	Cutoff water
Clamp on		CT-1	≥DN50	-40~160℃	No need
Insertion		TCT-1	≥DN50	-40~160℃	Need
Insertion under pressure		PCT-1	≥DN50	-40~160℃	No need
Insertion small sizes		SCT-1	≤DN40	-40~160℃	Need

Chapter 2 Measuring Diagrams

2.1 Separated Mounting

		
Clamp on	Insertion	Inline

2.2 Fix mounting

		
Clamp on	Insertion	Inline

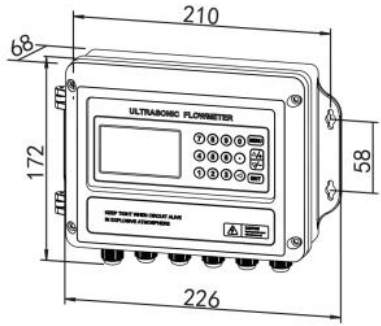
✧ Temperature and heat can be measured by connecting PT 100 temperature sensors on both water supply and return pipes.

Chapter 3 Converter Installation and Wiring Diagram

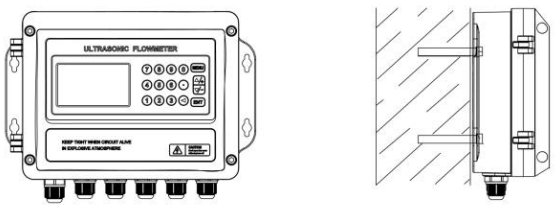
3.1 Separated Mounting

3.1.1 Wall-mounted

- Size



- Installation diagram

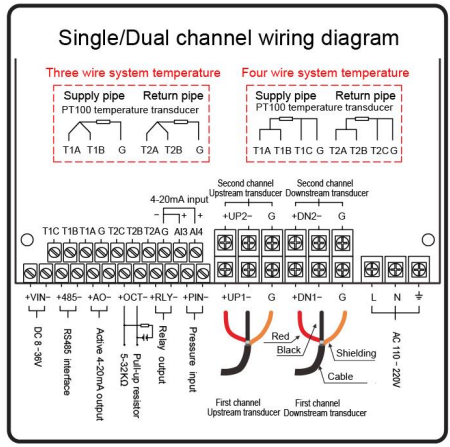


✧ Wall mounting

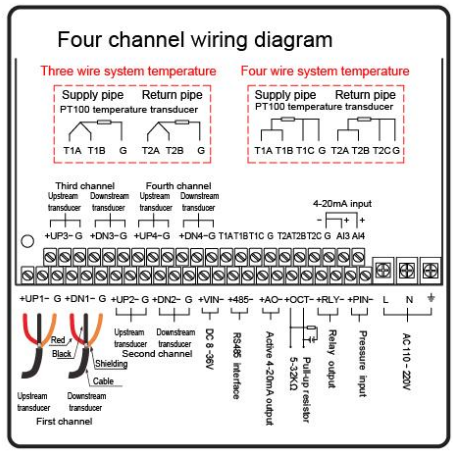
✧ Fix the converter with four Φ6 expansion bolts or normal nails.

➢ Wiring Diagram (Wall mount / Explosion proof)

✧ Single track /dual track wiring diagram

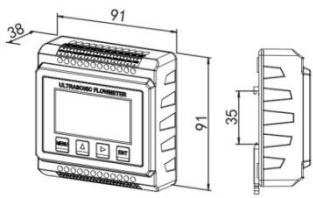


✧ Four tracks wiring diagram

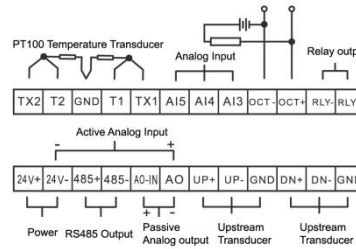


3.1.2 Module type

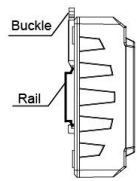
- Size



- Wiring Diagram



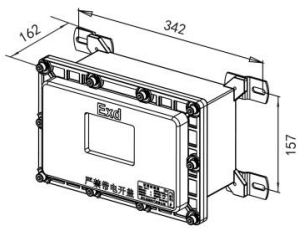
- Installation diagram



- ✧ The applicable guide rail width is 35mm
- ✧ Adjustable snap fastener, which needs to be lifted, fixed or removed before pressing down during installation or disassembly.

3.1.3 Explosion proof

- Size



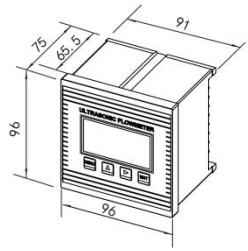
- ✧ Explosion-proof type is suitable for explosion-proof occasions
- ✧ Explosion-proof grade：DIIBT5
- ✧ Fix the converter with 4 Φ8mm expansion bolts.

- Wiring Diagram

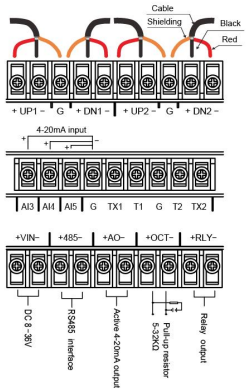
Wiring diagram of the same-wall-mounted main engine

3.1.4 Panel mount

➢ Size

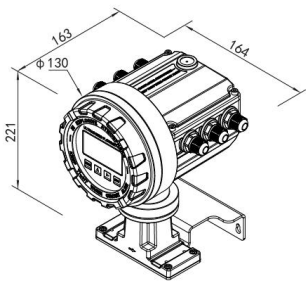


➢ Wiring Diagram



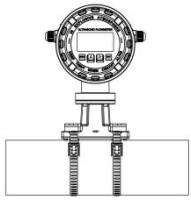
3.2 Installation and wiring diagram of the fix mounting

➢ Size

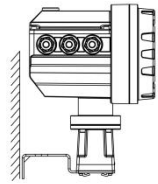


➢ Installation diagram

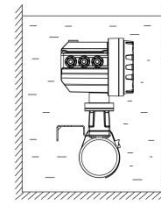
The host machine is usually installed on the pipe. The host protection level is IP68, which can be submerged for 2 meters.



Install the fixing on the piping



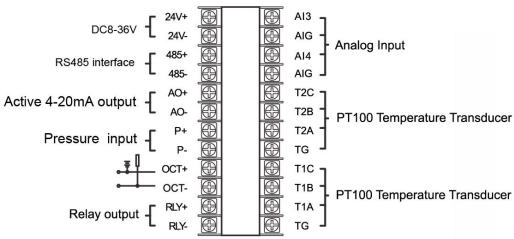
The wall fixed

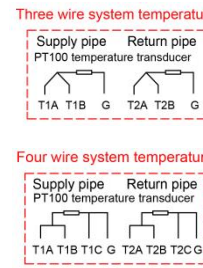


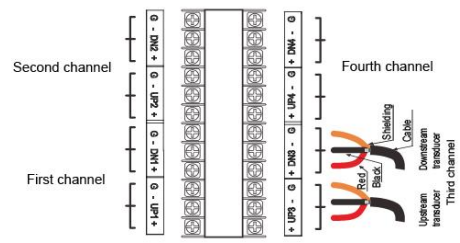
underwater installing

Power supply: the integrated power supply is DC24V, which can be connected with AC85-264V waterproof power supply adapter.

➢ Wiring Diagram





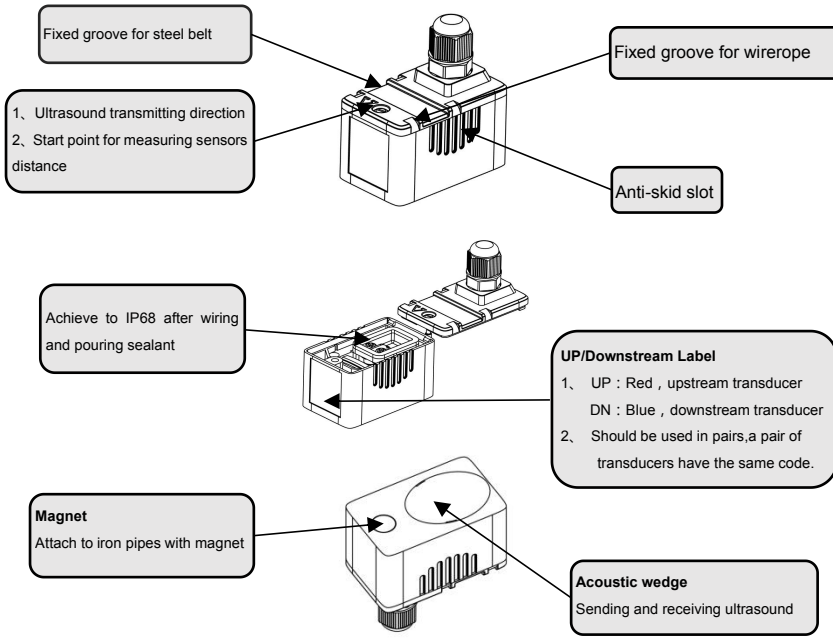


Open the flip cover and complete the wiring. To avoid leaking, please tighten the water joint and screws of the back cover after wiring, then pot gel inside to reach IP68 protection class.

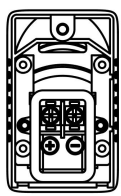
Chapter 4 Transducer Introduction and Wiring Diagram

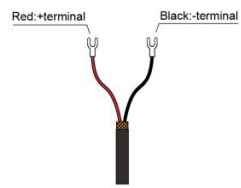
4.1 Clamp on type transducer

- **Introduction**



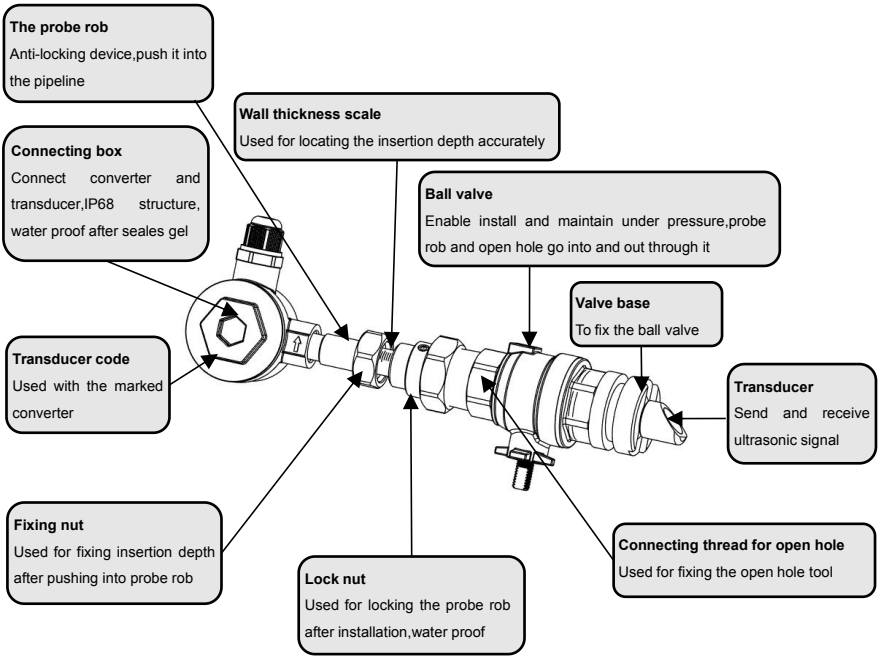
- wiring diagram



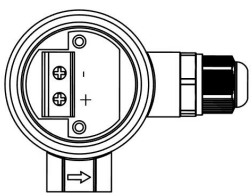


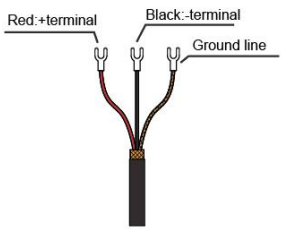
4.2 Insertion type transducer

- Introduction



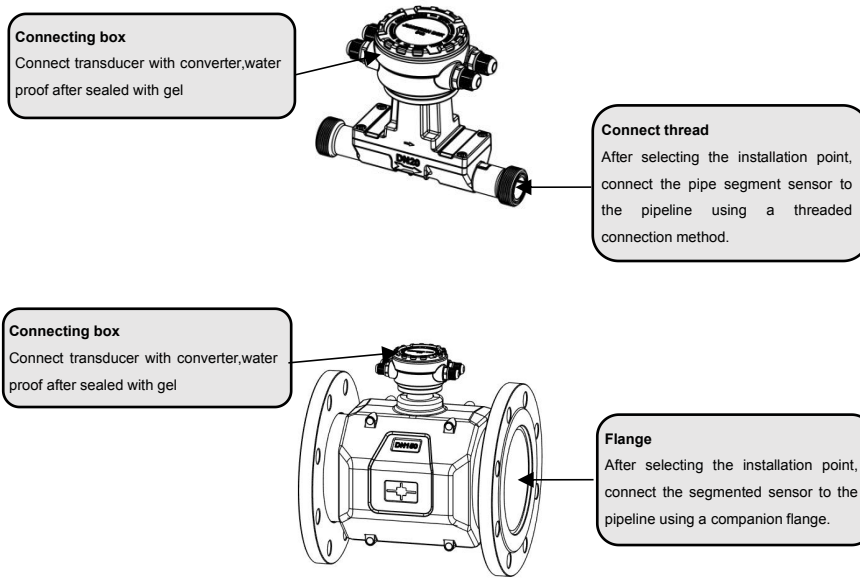
- Wiring Diagram



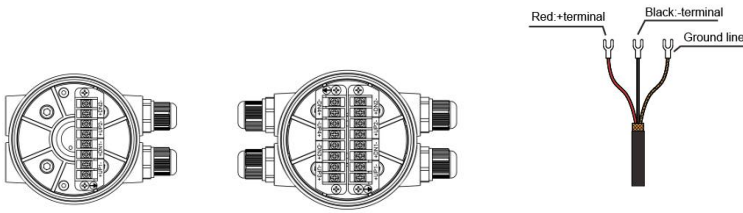


4.3 Inline type transducer

- Introduction



- Wiring Diagram



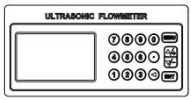
Dual track

Four track

Chapter 5 Display and Operation

5.1 Display and keyboard

- 16-key Keyboard



0-9 and"**.**"are used for inputting numbers or menu number ;

◀is used for back left or delete the left character ;

▲/+and**▼/-**are used for entering into the last and next menu.Also can be used as±sign when inputting numbers.

MENU is used for accessing the menu.Press this key first,then type the number keys to enter into the matched menu.

ENT is the ENTER key,used for confirming the contents you input or choose

> > For details, see "Quick Set measurement parameters" on page 17.

- 4-key Keyboar

MENU : Used for entering into menus.

▲ : Used for menu up or choosing 0~9、+、-、•

▼ : Used for menu down or moving the cursor to next

ENT : Used for finishing menu inputting or entering into submenu.

Operation :

The user interface of this flow meter comprises about 100 different menu windows that are numbered by M00, M01... M+9.

Method to enter Menu: Press **MENU** first, and follow the two-digit number keys. Take M35 as an example, the correct key sequence is **MENU35**

To move between the adjacent menus, press **▲/+** and **▼/-** for 16-key keyboard; press ▲ and ▼ for 4-key keyboard.

5.2 Menu Details

Window arrangement according to the following rules, keep in mind these window arrangements, can effectively improve the operation speed, but also facilitate the use of shortcut keys.

- MENU "**..**" is the navigation menu window ;
- MENU ".0 ~ .9" is the basic information and Settings window ;
- MENU "00 ~ 09" is the flow / heat measurement display window ;
- MENU "10 ~ 19" is the measurement initial parameter setting window ;
- MENU "20 ~ 29" is the initial parameter setting window for heat measurement ;
- MENU "30 ~ 39" is the flow unit and cumulator setting window ;
- MENU "40 ~ 46" is the flow setting and correction window ;
- MENU "50 ~ 55" is the communication and data transmission setting window ;
- MENU "60 ~ 69" is the signal input and output setting window ;
- MENU "70 ~ 74" is the measurement status and quantitative control window ;
- MENU "90 ~ 95" is the hardware adjustment setting window ;
- MENU "+0 ~ +9" is the additional common function window.

5.3 Menu window

Navigation menu		Basic information and settings	
M	Select the Menu ribbon	M.0	Language setting
0	Basic information and settings	M.1	Displays backlight settings
1	Measurement value display	M.2	LCD Contrast setting
2	Measurement initial settings	M.3	Date time setting
3	Flow unit and cumulative settings	M.4	Set parameter password
4	Flow rate setting and correction	M.5	Set the keyboard password
5	Heat setting and corrections	M.6	
6	Communication and data storage	M.7	Factory data reset
7	Input/output signal	M.8	Set simulation run
8	History query		
9	Measuring condition		
Flow / heat measurements display		Measurement initial settings	
M00	Display the instantaneous flow rate / flow rate / status bar	M10	Enter the pipe size
M01	Display the instantaneous flow / net cumulative flow / status bar	M11	Pipe material type
M02	Display the instantaneous flow / positive cumulative flow / status bar	M12	Select lining material
M03	Display the instantaneous flow / negative cumulative flow / status bar	M13	Select the fluid type
M04	Display the instantaneous flow rate / 4-20 mA histogram	M14	Select probe type
M05	Display instantaneous traffic/Pressure/temperature	M15	Probe installation distance
M06	Display the heat flow rate / total heat	M16	Read storage parameters
M07	Display heat flow rate/4-20mA bar chart	M17	Data handling
M08	Display temperature T1, T2 and corresponding resistance values	M18	Signal excision
M09	Display the current value corresponding to the analog input AI3/AI4	M19	Set flow range
Flow units and accumulator settings		Flow rate setting and correction	
M20	Flow Unit Settings	M30	Camping coefficient
M21	Instantaneous flow unit	M31	Low flow rate excision values
M22	Cumulative flow unit	M32	Set static zero

M23	Traffic multiplier factor	M33	Clear the static zero
M24	Cumulator switch	M34	Manual zero point setting
M25	Accumulator reset	M35	Instrument correction factor
M26	Manual Accumulator	M36	Correction of line coefficient
M27	Power outage flow compensation		
M28	Pressuer Unit		
Heat setting and corrections		Communication and data storage	
M40	Heat flow unit setting	M50	Address code
M41	Cumulative heat unit	M51	RS485 serial port settings
M42	Heat multiplicative factor	M52	Communication protocol selection
M43	Heat Accumulator Switch	M53	Timer set
M44	Select temperature source	M54	Data timing output
M45	Heat accumulation method	M55	Data output flow
M46	Installation method of heat meter		
M47	Temperature difference and sensitivity		
M48	Zero temperature difference setting		
M49	Temperature correction		
M4+	Manual temperature correction		
Input / output signal settings		History query	
M60	Analog input range	M80	Current traffic query
M61	Analog Input Calibration	M81	Historical traffic query
M62	Analog input mode	M82	Current heat query
M63	Output value of Current loop	M83	Historical heat query
M64	Current value of Current loop	M84	Timing of working hours
M65	OCT output options	M85	Working time query
M66	OCT pulse width setting	M86	Power outage query
M67	RLY relay output	M87	Flow and heat query at power on time
M68	Frequency output settings		
M69	Beeper setup		
M70	#1 Alarm settings		
M71	#2 Alarm settings		
M72	Quantitative control start source		
M73	Quantitative controller		
M74	FlowBatch Controller		

Measurements status is shown			
M90	Signal strength/quality		
M91	Transmission time ratio		
M92	Total propagation time difference		
M93	Fluid sound velocity		

5.4 Quick setup of measured parameters

Accurate measured parameters can have a great influence on measuring precision and reliability. It is suggested to measure the practical perimeter and wall thickness of the pipeline. Ultrasonic thickness gauge can be used to measure the pipe thickness.

Measured parameters setup is from Menu10 to Menu15,Please complete one by one

- Following parameters need to be inputted before measurement :

①Outer diameter unit: mm

②Pipe thickness unit: mm

③Pipe material

④Lining parameters: thickness and sound velocity (If have lining)

⑤Liquid type

⑥Sensor type (because the host can support many different sensors)

⑦Sensor installation method

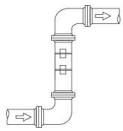
Chapter 6 Installation and Debugging of Transducers

6.1 Choose installation points

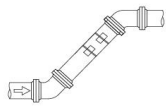
Proper installation point is a key for transducer installation. Following factors must be considered: Full filled pipeline, shaking, steady flow, scaling, temperature, pressure, EMI, instrument well.

- Full filled pipeline

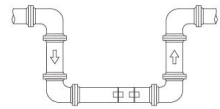
Following situations can be full filled of liquid



Vertical upward



Obliquely upward



Lowest point

- Shaking

There cannot be obvious shaking on the installation point, otherwise it needs to be tightened.

- Steady flow

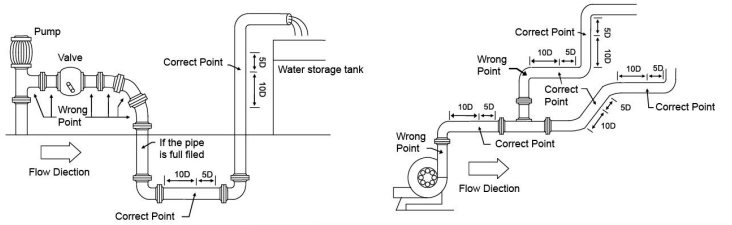
A stable flowing fluid helps to ensure measurement stability and accuracy. A fluid with chaotic flow state can make measurement data unstable or impossible to measure.

Standard requests for steady flow are:

①The pipe should be far away from pump outlet and half-open valve.

10D to upstream and 5D to downstream (D means outer diameter)

②30D to pump outlet and half-open valve.



- Scaling

The inside scaling would have bad effect on ultrasonic signal transmission ,and would decrease the inner diameter as well.As a result,the measurement accuracy can not be guaranteed.Plaese try to avoid choosing the installation point with inside scaling.

- Temperature

The fluid temperature at the installation point must be within the range of use of the sensor. Try to choose installation points with lower temperatures. Therefore, the same pipeline should be avoided as much as possible from the boiler water outlet and the heat exchanger outlet, and should be installed on the return water pipeline as much as possible.

- Pressure

The maximum pressure that the DN15-40 pipe segment sensor can withstand is 2.5MPa.The maximum pressure that the DN50-2000 standard pipe segment sensor can withstand is 1.6MPa.Out this range need customized.

- EMI (electromagnetic interference)

The ultrasonic flow meter, transducer and signal cable can be easily interfered by interference sources such as frequency changer, radio station, microwave station, GSM base station and high-tension cable. Please try to avoid these interference sources when choosing installation points.

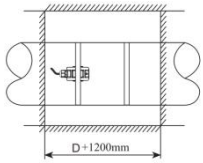
The shield layer of flow meter, transducer and signal cable should be connected to earth.

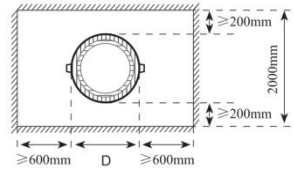
Better to use isolated power supply. Do not use the same power supply with the frequency converter.

- Instrument well

When measuring underground pipes or need to protect the measuring points, an instrument

well is required. To ensure the enough installation space, the sizes of instrument well should meet the following requirements.



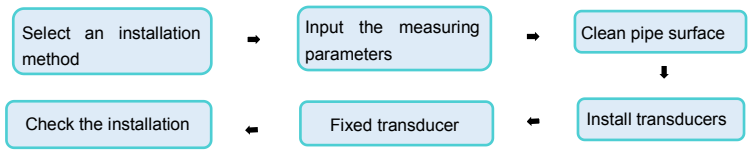


D means the pipe diameter

6.2 Clamp on transducer Installation

Before installation, please verify the parameters of pipeline and liquid. To ensure the installation accuracy.

6.2.1 Installation process

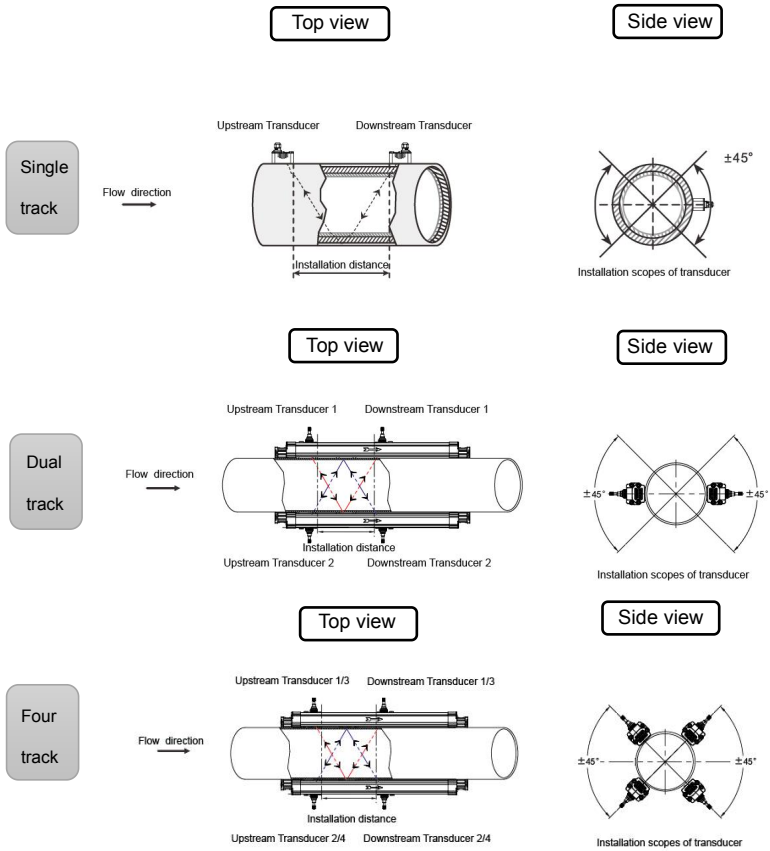


6.2.2 Select an installation method

There are two different methods for clamp on transducers: V method and Z method.

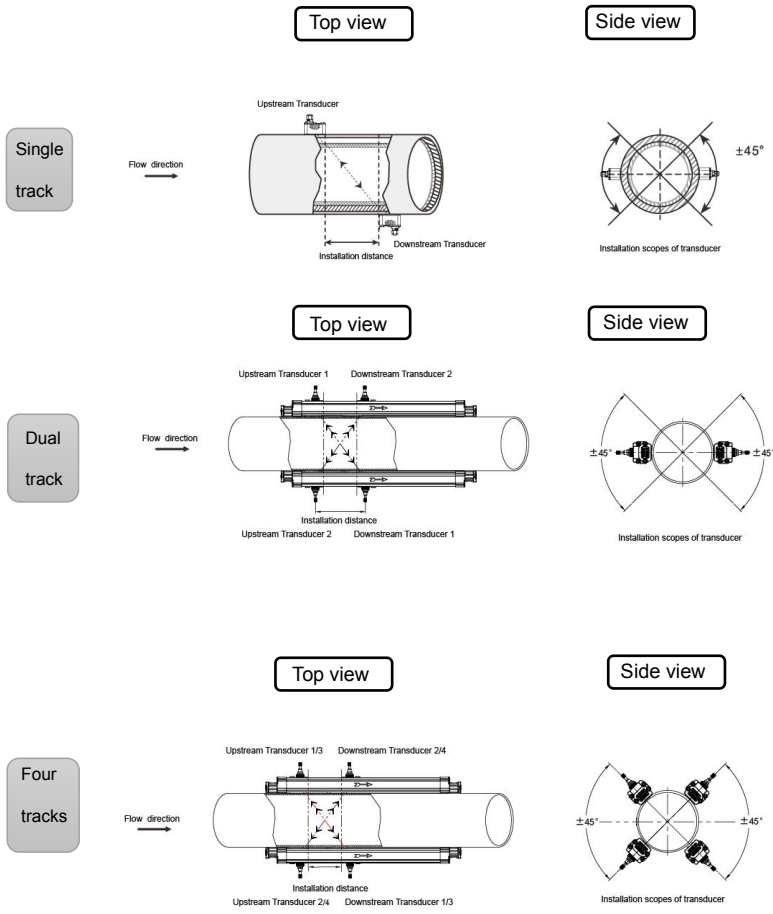
> > V method

The V method is preferred for DN15mm 200mm pipelines, and the two sensors are horizontally aligned during installation. The centerline should be parallel to the pipeline axis, and the emission direction should be relative.



>> Z method

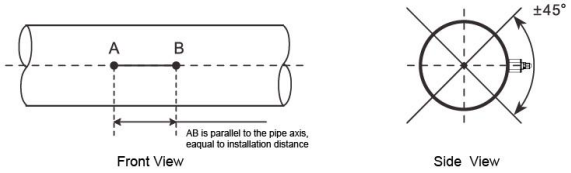
Z method should be priority selected for pipe sizes DN200 - DN6000. Also can be used when V method doesn't work well. Make sure the vertical distance of two transducers equals to the installation distance, and the two transducers are on the same axis surface.



6.2.3 Positioning installation points

>> V method

The line between two transducers is parallel to pipe axis, and equal to the distance shown in the converter. As shown, A, B are the two installation points.



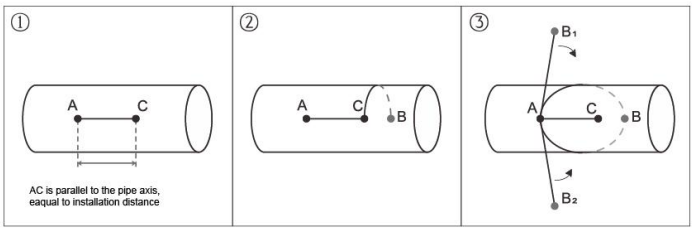
>> Z method

①Firstly according to the installation distance shown in converter, positioning two points A, C on the same side of pipeline. AC is parallel to pipe axis.

②Perpendicular to the pipe axis, opposite to point C, get Point B.

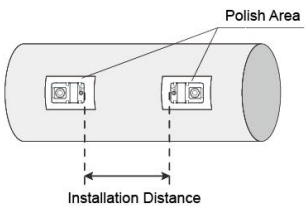
③Check. Measure the length between A and B from both sides of the pipe, get AB1 and AB2. If AB1 = AB2, then B is the correct point. If not, need to positioning point B and C again.

As shown, A, B are the two installation points.



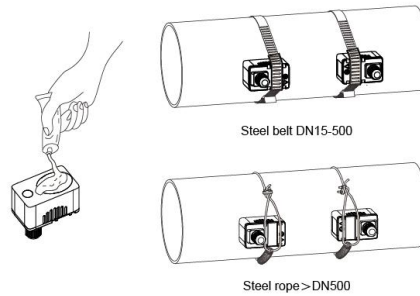
6.2.4 Clean the surface of installation points

Paint, rust and anti-corrosive coating on installation points need to be cleaned. It's good to use a polishing machine to get the metal luster.



6.2.5 Install transducers

After transducer wiring and sealing, please evenly smear 2-3mm couplant on the transducer emitting surface. Then put the transducers on the installation points, fixed with steel belt or steel rope.



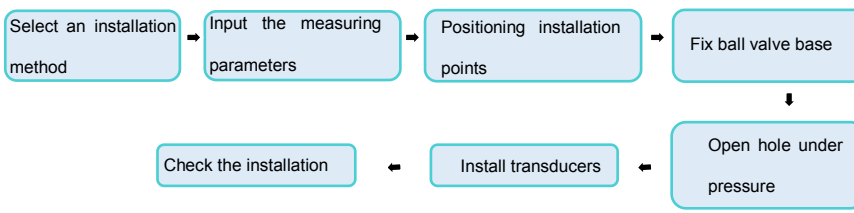
6.2.6 Check Installation

See page "Check for installation" for details

6.3 Insertion type transducer installation

Before installation, please verify the parameters of pipeline and liquid.To ensure the installation accuracy.

6.3.1 Installation procedure



6.3.2 Select installation method and positioning installation points

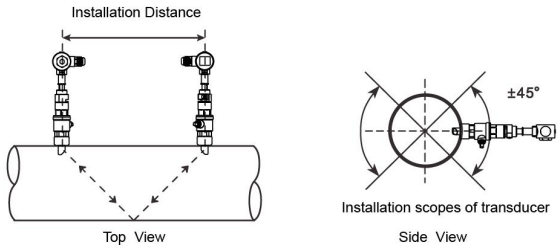
(1) Installation method

Insertion type transducers are suitable for pipe sizes > 50mm

Two different installation methods: V method and Z method. Generally use Z method, only use V method for lack of space.

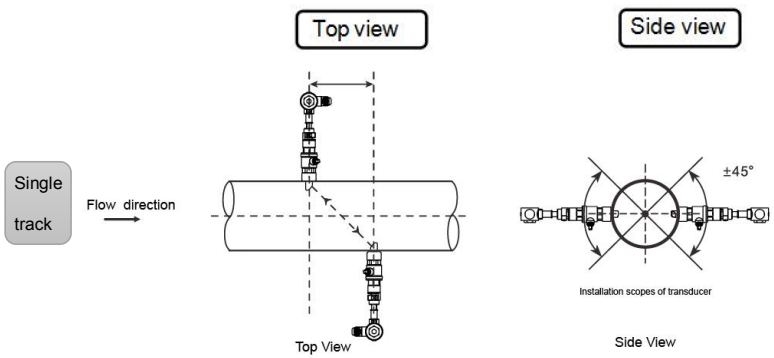
> > V method

V method can be used for DN50mm - 300mm. Let the pair of transducers horizontal alignment,the central line in parallel with the pipeline axis, and the transmit direction mush be opposite.



>> Z method

Z method can be used for all pipes > DN50mm. Make sure the vertical distance of two transducers equals to the installation distance, and the two transducers are on the same axis surface. The transmit direction mush be opposite.

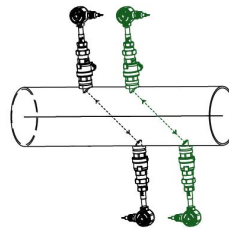


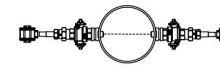
Top view

Side view

Dual track

Flow direction



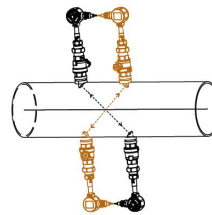


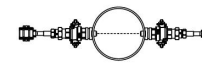
Top view

Side view

Dual track

Flow direction



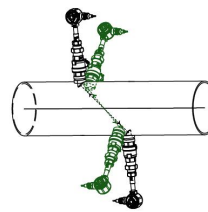


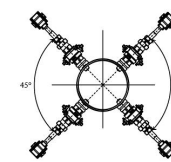
Top view

Side view

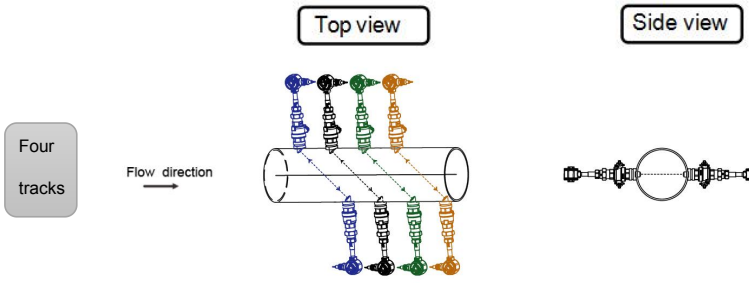
Dual track

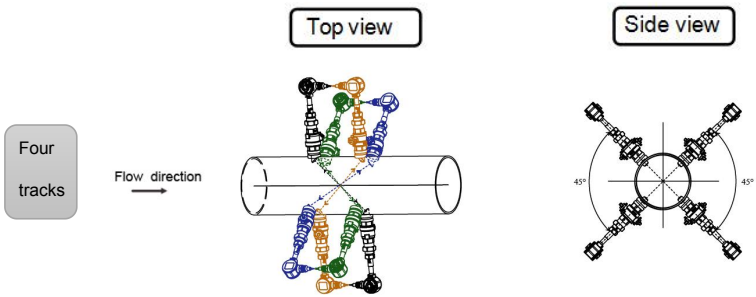
Flow direction





* The installation distance of any one sensor of the multi-channel flowmeter should refer to the installation sketch of the single-channel sensor.





* The installation distance of any one sensor of the multi-channel flowmeter should refer to the installation sketch of the single-channel sensor.

>>Parallel insertion

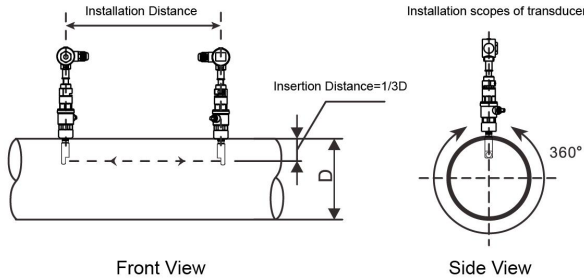
If there is insufficient installation space or the transducers can be only installed on the top of pipeline, parallel insertion transducer will be a good choice. (Pipe size ≥200)

Positioning of parallel insertion transducer need to meet the 3 factors as follow :

①Installation distance = Vertical distance of two transducers along the pipe axis direction. Flow direction

②Make sure two transducers are in the same horizontal line,Insertion depth = 1/3 inner diameter.

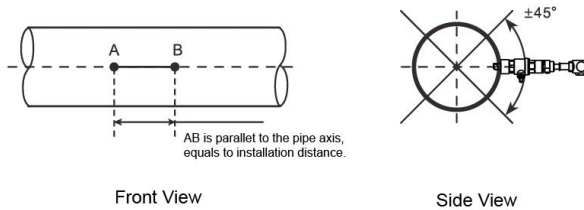
③Users can set the distance between transducers by themselves. Recommend 300~500mm.



（2）Positioning installation points

>> V method

The line between two transducers is parallel to pipe axis, and equal to the distance shown in the converter. As shown, A, B are the two installation points.



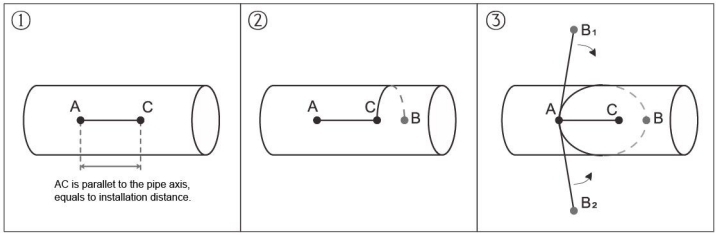
>> Z method

①Firstly according to the installation distance shown in converter, positioning two points A, C on the same side of pipeline. AC is parallel to pipe axis.

②Perpendicular to the pipe axis, opposite to point C, get Point B.

③Check. Measure the length between A and B from both sides of the pipe, get AB 1 and AB2. If AB1 = AB2, then B is the correct point. If not, need to positioning point B and C again.

As shown, A, B are the two installation points.



6.3.3 Fix ball valve base

>> Welding Fix

For carbon steel pipes, the ball valve base can be welded directly. Make sure that the central point of ball valve base is overlapped with the transducer installation point.

Matters need attention:

①Please take the PTFE sealing gasket out from the base before welding.

②Please clean the pipe surface around welding point before welding. Pay attention that there should not be any air hole during welding, which can avoid leaking. Welding strength must be ensured.

③Do not sputter welding slag on the base thread.

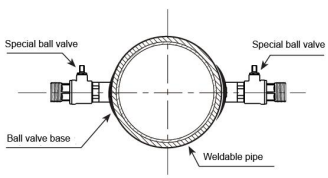
④Non-deformation ofbase during welding.

After welding, tighten ball valve into the base.

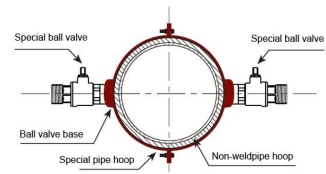
>> Pipe hoop Fix

For pipes can't be welded directly like cast iron pipe, cement pipe, copper pipe and composite pipe, customized pipe hoop is recommended.

The hoop center should be overlapped with the transducer installation point. Please compress the sealing gasket tightly to avoid leaking.



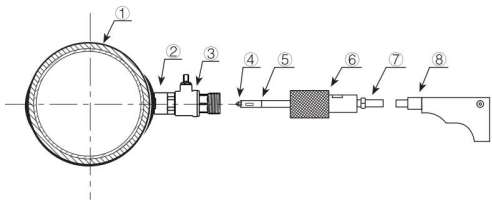
Welding Fix



Pipe Hoop Fix

6.3.4 Open hole

After the installation of the base and ball valve is completed, connect the sealing sleeve of the opening device to the external thread of the ball valve. After tightening, open the ball valve, push the drill pipe until it comes into contact with the outer wall of the pipeline, connect the electric hand drill and the drill pipe tightly, connect the power supply, and start drilling. During the drilling process, the electric drill should be kept at a low speed and the rotational speed should not be too fast to avoid getting stuck or even breaking the drill bit. After drilling through, pull out the drill pipe until the front end of the drill bit of the hole opener retracts to the ball valve core, close the ball valve, and remove the hole opener.



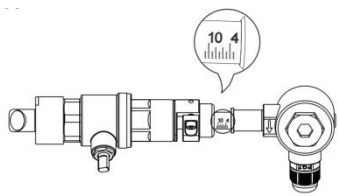
1. Pipeline
2. Ball valve base
3. Special ball valve
4. Drill
5. Supper hole cutter
6. Seal cover
7. Drill rod
8. Electric hand drill

6.3.5 Install transducer and adjustment

Adjust the proper insertion depth and transmit direction to get good ultrasound signal.

>> Insertion depth adjustment

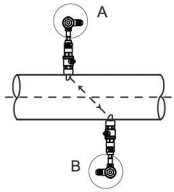
Adjust the depth scale according to pipe wall thickness, and completely push in the transducer rod.



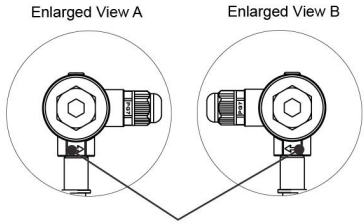
>> Transmit direction

After adjusting the insertion depth, locate the launch direction

There is a indicating arrow on the transducer junction box, the arrow direction on two transducers should be opposite"→←"and parallel to the pipe axis.



Top View



Two direction arrows are opposite

>> Operation steps

①Tighten the locknut into ball valve, adjust the insertion depth scale.

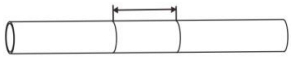
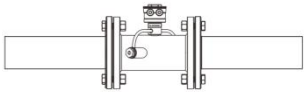
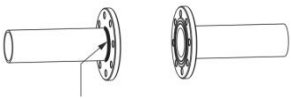
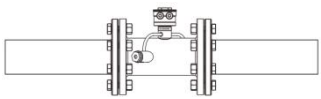
②Open ball valve, completely push in the upstream transducer rod. Adjust the transmit direction parallel with pipe axis, and point to the installation point of downstream transducer. Lock it after adjustment.

③Install downstream transducer in the same way. Adjust the transmit direction to get the best signal strength and watching M91, if the value is between 97% ~ 103%, the installation is correct. If not, need to re-adjust the insertion depth and transmit direction until meet the requirement.

6.4 In-line type transducer installation

After choosing the installation point, install the transducer in the pipeline with companion flanges. Then connect the transducer to converter with special signal cable. Installation is complete.

6.4.1 Installation method

<table>
<tr>
<td>1. Confirm installation size
Length L + 2 gasket thickness + 10mm
  </td>
<td>2. Cutting pipeline
  </td>
</tr>
<tr>
<td>3. Equip companion flanges
  </td>
<td>4. Positioning the flanges
 
Install 3 screws, evenly position the flange, and fix it by spot welding</td>
</tr>
<tr>
<td>5. Welding the flanges
 
Remove the segmented sensor and fully weld the flange</td>
<td>6. After cooling, clamp the gasket, tighten the screws, and connect to the main machine with an ultrasonic cable
  </td>
</tr>
</table>

Please refer to Appendix 2 on page 42 for installation dimensions

6.4.2 Check installation

Please refer to page 30 for details on “Inspection and Installation”.

6.5 Check installation

This machine has a check function, and the menu M90 is used to check the signal strength and quality, as well as the measured and theoretical transmission time ratio

①Check signal intensity：

The signal strength is represented by numbers ranging from 00.0 to 99.9. 00.0 indicates no signal received, and 99.9 indicates maximum signal. The flow meter can only measure when the signal strength is ≥ 60.0.

②Check signal quality：

The signal quality Q value is represented by numbers ranging from 00 to 99, with 00 indicating the worst and 99 indicating the best. The general normal working conditions are signal quality Q value>60.

When installing, please pay attention to adjusting the sensor to ensure that the signal strength and quality are as high as possible, in order to ensure the long-term stable operation of the flow meter and make the measurement results more accurate.

Signal strength and signal quality installation reference table

Signal strength	Q value
< 60	Can not work
60~75	general
75~80	good
> 80	excellent

③Check transmission time ratio：The transmission time ratio is the percentage ratio of the theoretical transmission time of ultrasound calculated based on the parameters set by the flowmeter to the actual measured transmission time. It represents the relationship between the set measurement parameters and the actual installation distance of the sensor. This value should be between 97% and 103%.

If the transmission time ratio is not between 97% and 103%, it indicates that the set measurement parameters are inconsistent with the sensor installation distance. If the set measurement parameters or sensor installation distance are incorrect, please check them separately.

6.6 Finish

1、Setting of common parameters.

Place the display window at M00 or M01 according to the meter reading needs；

Choose the appropriate flow unit for M20-M22；

Selection damping coefficient for M30；

Calibration Date Time for M.3；

2、To avoid signal reduction and improve anti-jamming ability, it is better to use the customized signal cable from flow meter manufacturer.

3、The length of cables between converter and transducer should be as short as possible, cannot exceed 200m.

4、 The temperature and humidity of working environment should be in the range of technical specifications. Avoid direct sunlight on LCD.

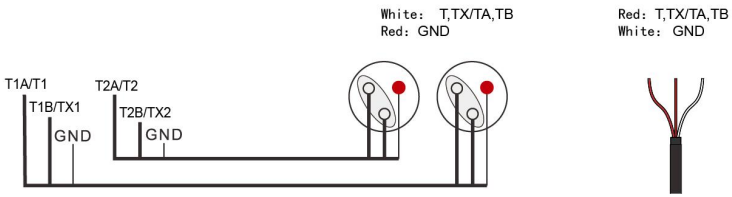
Chapter 7 Heat measurement

The ultrasonic flow meter can be connected to a temperature resistor to achieve heat measurement. This product provides three wire PT100, three wire PT1000, and four wire PT100 for temperature measurement. Users can choose any one to use.

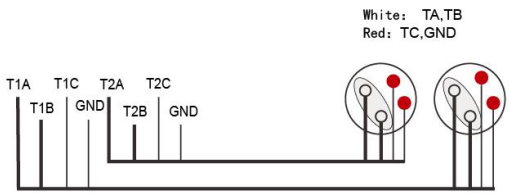
Weld the base onto the pipeline, and after the pipeline is cut off, use an electric drill to drill holes through the base with a diameter of Φ10 , Put on the sealing ring, screw the protective sleeve into the base, and finally insert the temperature resistor into the protective sleeve to complete the installation.

Our company also provides a kit for installation with water and pressure, which needs to be ordered separately.

Three wire PT100/PT1000 wiring method：



Four wire PT100 wiring method：



Chapter 8 Communication interface and protocol

The ultrasonic flow/Heat meter itself has an isolated RS485 interface, and supports a variety of commonly used communication protocols, including MODBUS protocol, M-BUS, FUJI expansion protocol and other domestic manufacturers' protocols.

The MODBUS protocol supports MODBUS ASCII by default, and MODBUS-RTU requires selecting 'MODBUS-RTU Only' from the M52 menu. The following is a commonly used address table in the MODBUS protocol：

Register	Length	Register name	Data type	Instruction
0001-0002	2	Instantaneous flow rate	REAL4	Unit: cubic meter/hour
0003-0004	2	Instantaneous heat flow rate	REAL4	Unit: GJ/hour
0005-0006	2	Fluid velocity	REAL4	Unit: meters/second
0007-0008	2	Measuring fluid sound velocity	REAL4	Unit: meters/second
0009-0010	2	Positive cumulative flow	LONG	Unit by M32
0011-0012	2	Fractional part of positive cumulative flow	REAL4	Also known as FLOAT format
0013-0014	2	Negative cumulative flow	LONG	
0015-0016	2	Negative cumulative flow fraction	REAL4	
0017-0018	2	Positive cumulative heat	LONG	
0019-0020	2	Fractional part of positive cumulative heat	REAL4	
0021-0022	2	Negative cumulative heat	LONG	
0023-0024	2	Negative cumulative heat fraction	REAL4	
0025-0026	2	Net cumulative flow	LONG	
0027-0028	2	Fractional portion of net cumulative flow	REAL4	
0029-0030	2	Net accumulated heat	LONG	
0031-0032	2	Fractional portion of net accumulated heat	REAL4	
0033-0034	2	Temperature 1/water supply temperature	REAL4	Unit: ℃
0035-0036	2	Temperature 2/Return water temperature	REAL4	Unit: ℃

Chapter 9 Frequently Asked Questions and Answers

1、How to distinguish the flow direction of fluid in pipelines

After correctly installing the sensor and wiring, if the instantaneous flow rate display value is positive, it indicates that the direction of the fluid is positive, that is, flowing from the upstream probe to the downstream probe. If the instantaneous flow rate is displayed as a negative value, it indicates that the flow rate is reversed and the upstream and downstream sensors need to be swapped and reinstalled.

2、How to Use Zero Cut to Avoid Invalid Accumulation

The data in window M31 is called the low flow rate cutoff value, and the system treats the flow rate below this value as "0". This parameter can be set to avoid false accumulation of measurement errors generated by the flow meter when the actual flow rate is "0". In general, set this parameter to 0.03m/s. When the flow rate is greater than the low flow rate cutoff value, the low flow rate cutoff value is independent of the measurement results and will never affect the measurement results.

3、How to set zero

When the pipeline is filled with static water and the instantaneous flow rate displayed by the flowmeter is not zero, use the M32 menu to zero, and do not perform any operations during the zeroing process.

4、How to modify the instrument coefficient (scale factor) for calibration and correction

When the flow meter runs for too long, it may cause errors in the flow meter. In this case, we can correct it by modifying the coefficient (scale factor), which is the ratio of the actual value to the measured value in the M35 window. The instrument coefficient must be

input based on the actual calibration results.

5、How to use 4-20mA Current loop output

Ultrasonic flowmeter/heat meter with one Current loop output, accuracy better than 0.1%, and can be set to 4~20mA and 0~20mA and other output modes, which can be selected using window M62.

Enter the flow value represented by 4mA in window M63, and the flow value represented by 20mA in window M63.

If the flow direction is considered, the 0~4~20mA output mode can be selected. When the flow direction is negative, the output current is within the range of 0~4MA. When the flow direction is positive, the output current is within the range of 4-20mA. The output mode can be selected in window M62. Use window M61 to verify whether the Current loop itself has been "calibrated". Please refer to the page "Installation and Wiring Diagram of the Host" for the wiring diagram。

6、How to output cumulative pulses

Ultrasonic flowmeter/Heat meter can generate a cumulative pulse every unit flow.

Accumulated pulses can only be output through hardware OCT or relays. Therefore, it is also necessary to implement corresponding settings for the hardware OCT or relay (see windows M65, M67) ,

For example, to use a relay to output forward cumulative pulses, each pulse represents a flow rate of 0.1m3, the following settings can be made :

1. Select the cumulative flow unit in window M22: "cubic meter (m3)";
2. Select the multiplication factor in window M23: "2 × 0.1 ";
3. Select "9. Positive accumulation pulse output" in window M67.

Note: The cumulative pulse size should be selected appropriately. If it is too large, the output cycle will be too long; If it is too small, the relay will operate too

frequently, affecting its service life, and if it is too fast, it will cause an error of losing pulses. Suggest using a rate of 1-60 pulses/minute。

7、How to use OCT output

OCT output of ultrasonic flowmeter/Heat meter is Galvanic isolation Open collector output. It can work at DC60V and 100mA. By setting M65, the conditions for its activation can be set. Please refer to the page "Installation and Wiring Diagram of the Host" for the wiring diagram.

8、How to use relay output

The relay output of ultrasonic flow/Heat meter can work at AC125V/DC28V, 1A. By setting M67, the conditions for its activation can be set. Please refer to the page "Installation and Wiring Diagram of the Host" for the wiring diagram.

9、How to use a quantitative (batch) controller

The ultrasonic flowmeter/Heat meter has built-in batch controller, which can control the flow quantitatively. Use the keyboard or the rising or falling edge of the analog input signal as the input for control, and the output can be controlled using OCT or relays. When using analog input as control signal, input current signal greater than 2 mA at the analog input terminal to indicate "1" status, and 0 mA current indicates "0" status。

Using window M72 to select the control input signal, using window M65 (OCT output) or M67 (relay output), selecting item 8 "as quantizer output" will generate an output signal on the OCT or relay output.

The quantitative value is entered in window M73. After inputting the quantitative value, start the batch controller.

10、How to Input Linearity Line Input Data

Ultrasonic flow/Heat meter can realize non-linear multi-point linearization

correction of flow, and can realize more than 11 segments of broken line correction. When leaving the factory, this function is turned off and can be used by entering menu M36 with password: 12345。

In order to correct the flow beyond the flow range without causing sudden changes in the correction coefficient, we have added two flow points, 0m3/h and 100000m3/h, based on the measured flow points. The coefficient of 0m3/h is the coefficient of the minimum flow point we measured, and the coefficient of the maximum flow point we measured is used for 100000m3/h. Then, we input it into M36 in order of flow points from small to large。

If you need to cancel the line correction function, simply enter "0" in the number of line points in menu M36.

The following table provides an example of 5-point line correction：

Standard device flow rate (m^3/h)	Instrument indication flow rate (m^3/h)	Correction coefficient (standard/indication)
0	0	1
1.02	0.998	1.02
5.11	5.505	0.93
10.34	10.85	0.95
20.45	19.78	1.03
50.56	51.23	0.99
100000	100000	1

Appendix 1: Common Parameters

1. Sound velocity of commonly used materials Unit of sound velocity：m/s

Pipe material	sound velocity(m/s)
steel	3206
iron	3230
iron casting	2460
lead	2170
ABS	2286
aluminium	3048
brass	2270
iron casting	2460
bronze	2270
glass fiber reinforced plastics	3430
glass	3276
polyethylene	1950
propenyl	2644
PVC	2540
mortar	2500

Lining material	sound velocity(m/s)
Teflon	1225
nodular cast iron	3000
stainless steel	3206
vinyl chloride	2640
titanium	3150
cement	4190
asphalt	2540
enamel	2540
glass	5970
plastics	2280
polyethylene	1600
teflon	1450
FRP	2505
rubber	1600
Asphalt epoxy	2505

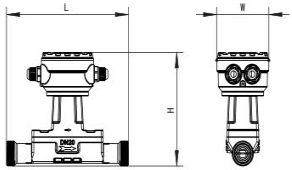
2. Common liquid sound velocity and viscosity

Liquid	Sound velocity (m/s)	Viscosity	Liquid	Sound velocity (m/s)	Viscosity
water 20℃	1482	1.0	glycerol	1923	1180
water 50℃	1543	0.55	gasoline	1250	0.80
water 75℃	1554	0.39	66#gasoline	1171	
water 100℃	1543	0.29	80#gasoline	1139	
water 125℃	1511	0.25	0#gasoline	1385	
water 150℃	1466	0.21	benzene	1330	
water 175℃	1401	0.18	ethylbenzene	1340	
water 200℃	1333	0.15	toluene	1170	0.69
water 225℃	1249	0.14	carbon tetrachloride	938	
water 250℃	1156	0.12	kerosene	1420	2.3
acetone	1190		petroleum	1290	
methanol	1121		pine oil	1280	
ethanol	1168		tce	1050	0.82
alcohol	1440	1.5	Dagang Aviation Coal	1298	
Ethanone	1310		Daqing 0 # Aviation Coal	1290	
acetaldehyde	1180		peanut oil	1472	
ethylene glycol	1620		castor-oil	1502	
aniline	1659	1.762	ether	1006	0.336
n-octane	1192		O-Xylene	1360	
chloroform	1001	0.383	Chlorobenzene	1289	
Glycerol	1923	1188.5	acetic acid	1159	1.162
methyl acetate	1181	0.411	ethyl acetate	1164	
Dicarboxylic acid	1389		heavy water	1388	1.129
carbon disulfide	1158	0.290	Bromoform	931	
n-Propanol	1225		n-pentane	1032	0.366
n-ethane	1083	0.489	light oil	1324	
transformer	1425		Spindle lubricating oil	1342	15.7
petroleum	1295		gasoline	1250	0.4-0.5

For other liquids and materials, please contact the company for sound speed inquiries

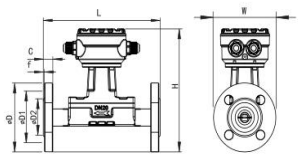
Appendix 2: Table of Installation Dimensions for Inline type

- **Threaded**

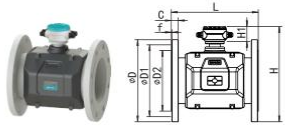


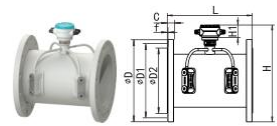
Nominal diameter	pressure Grade P	length L	width W	height H	Connecting thread	Effective length of thread	Connection thread standard
DN15	2.5	165	82	146	G3/4B	12	GB/T7307-2001
DN20	2.5	190	82	152	G1B	18	
DN25	2.5	180	82	159	G1 1/4B	18	
DN32	2.5	180	82	166	G1 1/2B	15	
DN40	2.5	200	82	175	G2B	18	

- **Flange connection**



Nominal diameter	pressure Grade P	length L	width W	height H	Flange size							Flange specifications
					outside diameter D	Bolt hole center circle diameter D1	Bolt hole diameter × quantity Φ×n	Sealing surface diameter D2	flange thickness C	flange thickness f	Bolt specification	
DN15	2.5	165	95	181	95	65	14×4	46	14	2	M12×50	GB/T 9119-2000
DN20	2.5	190	105	188	105	75	14×4	56	16	2	M12×50	
DN25	2.5	180	115	196	115	85	14×4	65	16	2	M12×60	
DN32	2.5	180	140	212	140	100	18×4	76	18	2	M16×60	
DN40	2.5	200	150	220	150	110	18×4	84	18	2	M16×60	





Nominal diameter	pressure Grade P	length L	width W	height H	Flange size							Flange specifications
					outside diameter D	Bolt hole center circle diameter D1	Bolt hole diameter × quantity Φ×n	Sealing surface diameter D2	flange thickness		Bolt specification	
									C	f		
DN50	1.6	200	165	218	165	125	18×4	102	19	2	M16×65	GB/T 9119-2000
DN65	1.6	200	185	238	185	145	18×4	122	20	2	M16×65	
DN80	1.6	225	200	253	200	160	18×8	138	20	2	M16×65	
DN100	1.6	250	220	273	220	180	18×8	158	22	2	M16×70	
DN125	1.6	275	250	300	250	210	18×8	188	22	2	M16×70	
DN150	1.6	300	285	331	285	240	22×8	212	24	2	M20×80	
DN200	1.6	350	340	389	340	295	22×12	268	26	2	M20×80	
DN250	1.6	450	405	460	405	355	26×12	320	29	2	M24×95	
DN300	1.6	500	460	515	460	410	26×12	378	32	2	M24×100	
DN350	1.6	550	520	570	520	470	26×16	438	35	4	M24×105	JB/T81-94
DN400	1.6	600	580	625	580	525	30×16	490	38	4	M27×115	
DN450	1.6	700	640	682	640	585	30×20	550	42	4	M27×120	
DN500	1.6	800	715	745	715	650	33×20	610	46	4	M30×135	
DN600	1.6	1000	840	857	840	770	36×20	725	55	5	M30×145	
DN700	1.6	1100	910	937	910	840	36×24	795	63	5	M33×180	
DN800	1.6	1200	1025	1043	1025	950	39×24	900	74	5	M36×200	
DN900	1.6	1300	1125	1142	1125	1050	39×28	1000	82	5	M36×220	
DN1000	1.6	1400	1255	1259	1255	1170	42×28	1115	90	5	M39×240	