FXUF-W Series Ultrasonic Flow Meter

Single/Multiple Channel(s)

User Manual

2023.03

1. Overview

§ 1.1 Introduction

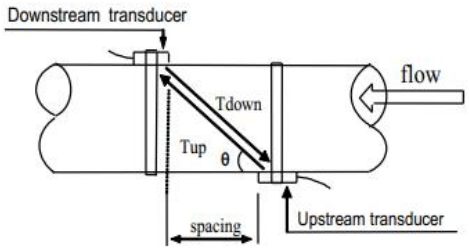
Welcome to use the FXUF-W series ultrasonic flow meter/ultrasonic calorimeter/flow transmitter developed and produced by our company.

The FXUF-W series ultrasonic flow meter/ultrasonic calorimeter/flow transmitter is a new series of products with high performance, low price, good reliability, and powerful functions, based on the seventh edition of FXUF-W, integrating 11 years of professional production technology and experience in the production of ultrasonic flow meters, using TI's MFP430FG4618 low-power micro-controller. The new product has greatly improved compared to the original 7th edition ultrasonic flow meter in terms of measurement accuracy, measurement stability, communication protocol, and ease of use. At the same time, it realizes the non adjustment of component parameters during the production process, making the production process simpler and more reliable, and achieving good product consistency, thereby ensuring that each factory product achieves the best performance.

§ 1.2 Working Principle

When an ultrasonic beam propagates in a liquid, the flow of the liquid will cause a slight change in the propagation time, which is proportional to the flow rate of the liquid. At zero flow, the time required for the two sensors to transmit and receive sound waves is exactly the same (the only technology that can actually measure zero flow). When the liquid flows, the propagation time of the sound waves in the countercurrent direction is greater than the propagation time of the sound waves in the downstream direction. Its relationship conforms to the following expression:

$$V = \frac{MD}{\sin 2\theta} \times \frac{\Delta T}{T_{up} \bullet T_{down}}$$



Where

θ is the include angle to the flow direction

M is the travel times of the ultrasonic beam

D is the pipe diameter

Tup is the time for the beam from upstream transducer to the downstream one

Tdown is the time for the beam from downstream transducer to the upstream one

ΔT=Tup –Tdown

§ 1.3 Features

The FXUF-W series ultrasonic flow meter/calorimeter inherits the advantages of the original product, but also has the following features:

(1) The number of samples per cycle has been increased to 1280, and the measurement results are more stable, which can meet the flow measurement requirements of the vast majority of clean water, sewage, and various chemical liquids. Even pulp containing large amounts of suspended solids can be measured.

(2) The use of an electrically isolated DC power supply greatly improves the reliability and anti-interference of the host. It can work more stably under variable frequency and high voltage conditions. For applications where the host operates alone and does not have a 24V power supply, users can choose a 24V power adapter with a commercially available power of around 2W to power the host. For on-site situations where there is no power supply, users can choose a 15W solar panel coupled with a 12V/30AH lead acid battery pack to achieve continuous power supply on cloudy days for a week.

(3) The measurement motherboard is equipped with a standard RS-485 port.

(4) The measurement motherboard is equipped with a serial expansion bus interface, allowing users to select various function expansion modules for function expansion. Extensible functions include 4~20mA current loop output, frequency signal output, large capacity data recording, thermal printer, and other functions.

(5) The measurement motherboard can be operated and set using a variety of keyboard displays with different interfaces. One is a parallel keyboard display plugged into the parallel port of the main board, and the other is a serial keyboard display hooked onto an RS485. When using a keyboard display attached to the RS485 interface, the measurement host (see Chapter 4, Parallel and Serial Port Keyboard Display and Operation) can be installed or placed on the measurement site. The keyboard display with RS485 interface can be installed in the instrument control room as far as 1 km away. It has the characteristics of strong anti-interference, reliable operation, and saving sensor signal cables.

(6) With two three-wire PT100 platinum resistor input circuits, connecting the platinum resistor becomes a complete ultrasonic calorimeter. At the same time, a temperature difference sensitivity function is added to prevent the ineffective accumulation of heat during long-term low flow rates or low temperature differentials.

(7) Physical quantities such as pressure and liquid level can be input.

(8) 8 languages are available (default Chinese+English).

§ 1.4 Parameters

Item	Specification
Accuracy	±1%
Repeatability	0.2%
Velocity	±32m/s
Pipe Diameter	DN20~DN6000mm
Signal Output	4~20mA, OCT
Communication	RS485
Signal Input	4-20mA by temperature / pressure sensor
Pipe Material	Carbon Steel, Stainless Steel, Cast Iron, Cement, Copper, PVC, Aluminum, FRP, and others. Liner can be set.
Liquid Types	Water, Sea Water, Sewage, Acid & Alkali, Alcohol, oil, and other media (single uniform liquid) which can transmit ultrasonic
Operating Temperature	-30~90C; -30~160C
Liquid Turbidity	Less than 10000 ppm, a little bubble is acceptable.
Environment Temperature	-30~80C (Main Device), -40~110C (Transducer)
Humidity	85%RH
Transducer Protection Class	IP65 (standard), IP68 (optional)
Power Supply	Both of AC220V and DC24V
Power Consumption	＜1.5W

§ 1.5 Use

It can be widely used in online measurement and system monitoring of almost all liquids, such as petrochemical, metallurgy, electric power, water conservancy, water supply companies, energy monitoring, etc., to achieve the measurement and detection of flow rate, flow rate, cumulative amount of various fluids, as well as flow switch, fluid identification, and other functions.

2. Product Introduction

The FXUF-W ultrasonic flowmeter/calorimeter consists of a measurement board, a function expansion module, and a remote display operation terminal. Users can choose appropriate configurations based on their own needs. The simplest configuration requires only a measurement board and a pair of sensors to complete the flow metering function.

FXUF-W type ultrasonic flowmeter/calorimeter is a complete on-site host that is packaged in a sealed immersion cast aluminum housing, with a working power supply of 8~36VDC and a standard isolated RS485 output. The on-site measurement host (primary meter) can be welded to the pipeline under test or hung on the test well wall. It is also possible to set parameters on a keyboard operated display (secondary meter) with an RS485 interface or connect it to an instrument control room 1 km away. At the same time, the secondary meter (220VAC or 24VDC) can also provide working power for the on-site host at the same time. It has the characteristics of low cost, good anti-interference, and reliable operation.

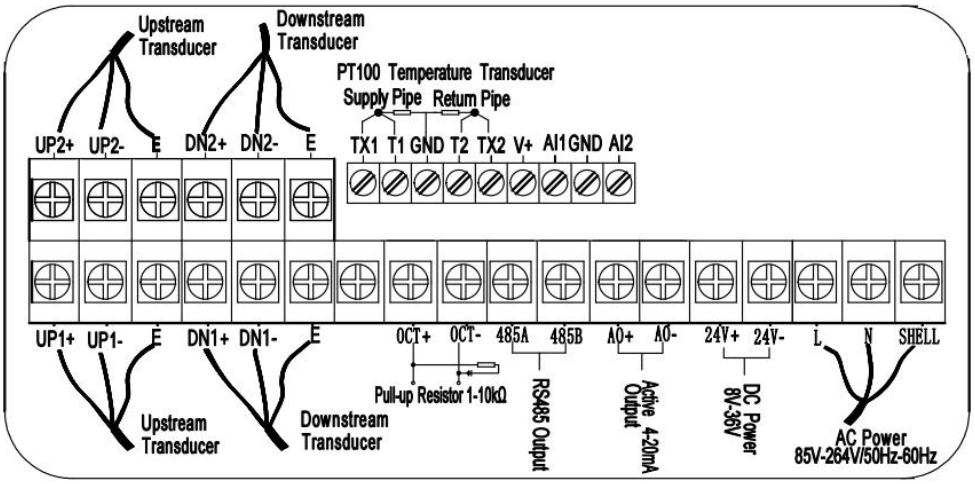
§ 2.1.1 Packing List

1	Wall Mounted Device	1 set	2	Transducers	1 pair
3	Clamp	1 pair	4	Cable	5m×2
5	Couplant	1box	6	Calibration Report	1 piece

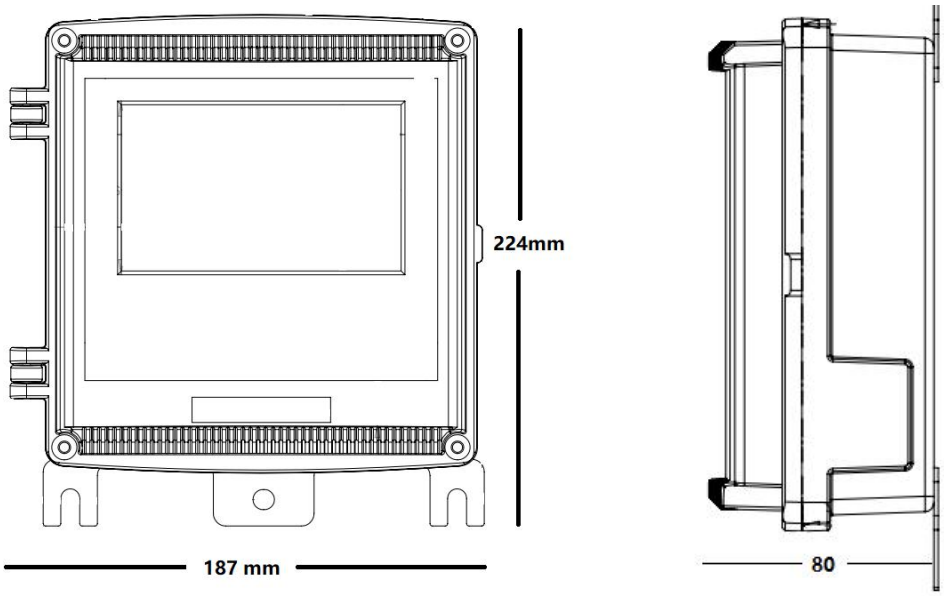
§ 2.1.2 Optional Accessories

（1）Other transducers
（2）Plug-in sensor
（3）Pipe section sensor (π type pipe section type, standard pipe section type)
（4）Remote secondary operation instrument
（5）PT100 three-wire platinum resistor
（6）Pipe clamp
（7）FEYV75-2 Special Twisted Pair Shielded Cable
（8）Power supply and RS485 four-core cable

§ 2.1.3 Wiring:



Dimension



3. Display & Operation

3.1 Buttons

The operation panel consists of a 4-key keyboard with the following functions and icons:

▼ Scroll, number change

Digital shift

◄ Menu

↵ Enter, Confirm (After Enter, if display ">", can input number via ▼, then Enter again, the ">" disappear, the number was input.

3.2 Menu Contents

Operation: Press Menu for choosing different menu, press ↵ for entering different menu, there has 5 main menus, choosing the menu you need through ▼, press ↵ for entering, refer below picture:

Monitor	Description	Sensor Cfg	Description	Output	Description	Calibration	Check Result	
Flow:	Flow Rate	Sensor Set	Choose Sensor Model	Start Flow	Low Flow Cutoff	Scale Factor	Signal S&Q&T	Check Signal Quality
NET:	Net Total Flow	Mount Set	Install Method	Damping Time	Damping Time	Ch1 Set Zero	Zero Calibration	Clean Totalizer
Velocity:	Flow Velocity	Pipe Inner Dia	Pipe Inner Diameter	Modbus Addr	Modbus Address			
POS:	Positive Total Flow	Fluid Type	Fluid Type	RS485 Setting	9600 8n1			
Neg:	Negitive Total Flow	Mount Spacing	Transducer Distance	CL 20mA Output	Flow Rate @ 20mA			
EFR	Heat Rate	Signal S&Q&T	Transducer's Signal Quality	OCT Pulse	Pulse Setting			
E.T	Total Heat	Backlight Tm	Time of Clossing Backlight	Energy Unit	Choose An Unit			
POS E.T	Positive Total Heat	Reset Setting	Recovery to Factory Setting	Measurement Unit	Choose An Unit			
NEG E.T	Negitive Total Heat			Flow Rate Unit	Choose An Unit			
Hot Temp	Hot Side Temperature			Total Flow Unit	Choose An Unit			
Cold Temp	Cold Side Temperature			Tm/s SoundSpd	Set Sound Speed			
AI 1	Analog Output 1			Meter Setting	Choose Heat/Flow			
AI 2	Analog Output 2			BkLight	Backlight Luminance			
YY-MM-DD	Year-Month-Day			Set Password	Set Password			
HH-MM-SS	Hour-Minute-Seconds			Reset Device	Reset Devicec			
Serial ID:	Product Series Number							
RS485:	Modbus Protocol							
Addr:	Modbus Address							
Parameter:	9600 8n1							

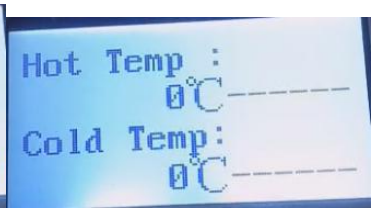
3.3 Menu resolution

3.3.1 Monitoring

The monitoring screen displays several main measurement results of the flow (heat) meter. Select a specific screen through the mouse button. The first screen displays the instantaneous flow and total accumulated heat as shown in Figure 3-3-1, the second screen displays the measured instantaneous heat and accumulated heat as shown in Figure 3-3-2 when used as a calorimeter, and the third screen displays the measured water supply temperature and return water temperature as shown in Figure 3-3-3 when used as a calorimeter.

3-3-1

3-3-2



3-3-3

3.3.2 Measurement Configuration

Measurement configuration is mainly used to set the most basic information necessary for measurement. If the information entered is not accurate, it is likely to cause the flow (heat) meter to be unable to measure. As a tubular flow (heat) meter, the above parameters have been set before leaving the factory, and there is no need for the customer to set them again. Unauthorized changes to the parameters will cause various incalculable consequences. However, when used as plug-in and external clip flow (heat) meters, each parameter needs to be set according to the actual situation.

Inner Diameter: The measured inner diameter of the pipe, in millimeters (mm).

Wall Thickness: The measured wall thickness of the pipe, in millimeters (mm).

Pipe Material: The material of the measured pipeline can be directly selected from common materials such as stainless steel, carbon steel, PVC, and cast iron. For other materials, please contact the manufacturer to determine the propagation speed of sound waves in the material.

Installation Method: mainly sets the layout method of the sensor. The actual installation method of the sensor needs to be consistent with this parameter.

Installation Distance: Based on the above settings, the final installation distance of the sensor will be obtained, in millimeters (mm). The actual installation distance between sensors should be consistent with this parameter.

LCD Backlight: Set the LCD backlight time. When the setting is greater than or equal to 9999 seconds, it indicates that the LCD is always on.

Recovery Parameters: This function can be used when the user forgets the set parameters or sets them incorrectly.

3.3.3 Output

The "Output" menu contains settings for outputting various parameter as follows:

Damping Time: Set the response speed of the instantaneous flow, with a maximum value of 200.

The larger the value, the more stable the instantaneous flow, the slower the response.

The smaller the value, the greater the instantaneous flow, but the faster the response at the same time.

Low Flow cutoff: Set the minimum flow rate that the flow (heat) meter can measure, which is generally 0.03m/s from the factory. If the measured value is lower than this value, it will be treated as zero flow.

Communication ID: Set the address number of the flow (heat) meter for Modbus RTU communication. The factory default is 1.

Communication Set: Set flow (heat) meter RS485 communication rate, check bit, stop bit, etc.

20mA Flow: Set 20mA's flow in the 4~20mA output.

OCT: The flow rate represented by a pulse. The flowmeter can output up to 10000 pulses per second, and the flowmeter will automatically calculate the OCT output frequency based on the device.

The corresponding relationship between OCT pulse equivalent and instantaneous flow calculation is: instantaneous flow=xx L/pulse * 10000 * 3600/1000, and the maximum output frequency of 0CT is 10K. Assuming that the OCT equivalent is 0.1L/pulse, the instantaneous flow range is 0-3600m3/h, and the OCT is 0-10KHz.

3.3.4 View

Flow Rate: The flow (heat) meter measurement result shows that it is the result of comprehensive calculation of dual channel flow.

Total Flow (Net): The cumulative flow rate in both positive and negative directions.

Total Flow (+): The cumulative flow rate in the positive direction of the flow (heat) meter.

Total Flow (-): The cumulative flow rate in the negative direction of the flow (heat) meter During installation, the arrow direction on the flow (heat) meter should be consistent with the actual liquid flow direction. The flow direction opposite the arrow is negative flow, and the accumulation of negative flow is negative accumulation. When leaving the factory, the default setting is negative flow off.

Other Channel: Other channels' signal and quality

3.4 Quickly set pipe parameters

1> Sensor Cfg ->Sensor set ->Select a Suitable Sensor
2> Sensor Cfg ->Mount Set ->Select a Suitable Install Method
3> Sensor Cfg ->Pipe Inner Dia ->Input Inner Diameter
4> Sensor Cfg ->Pipe Thickness->Input Pipe Thickness (Inserted & flange type no this option)
5> Sensor Cfg ->Pipe Material->Input Pipe Material (Inserted & flange type no this option)
6> Sensor Cfg ->Mount Spacing-> Check Transducers' distance
7> Sensor Cfg ->Signal S&Q&T->Check Signal Quality

4. Transducer Installation

§4.1 Open Package and Inspection

Please check whether the spare parts comply with the packing list? Is the casing damaged during transportation? Are any screws coming off? Is the wiring loose? If you have any questions, please contact the manufacturer as soon as possible.

§ 4.2 Power Supply and Cable

When ordering, the user should pay attention to the power supply before wiring. Generally, the working power supply for the flow meter is divided into two types:

Class I: AC110~264V (collectively referred to as AC power supply)

Class II: DC24V or DC8-30V (collectively referred to as DC power supply)

Special reminder to operators： If a flow meter powered by DC(DC8-30V) is connected to an AC220V power supply, the flow meter will be broken.

The sensor signal cable of the FXUF-W series ultrasonic flowmeter/calorimeter uses high-frequency twisted pair cables, which is due to the principle of balanced transmission and balanced reception in the transceiver circuit. Using high-frequency twisted pair cables can greatly improve the anti-interference performance of the machine, reduce signal loss, and ensure the long-term reliable operation of the instrument. Generally, the special signal cables provided by the manufacturer must be used for construction.

§4.3 Clamp On Transducer Installation

The installation of the new generation FXUF-W series ultrasonic flowmeter/calorimeter is the simplest and most convenient of all flowmeter installations. Simply select a suitable measurement point, input the pipeline parameters at the measurement point into the flowmeter, and then fix the sensor on the pipeline.

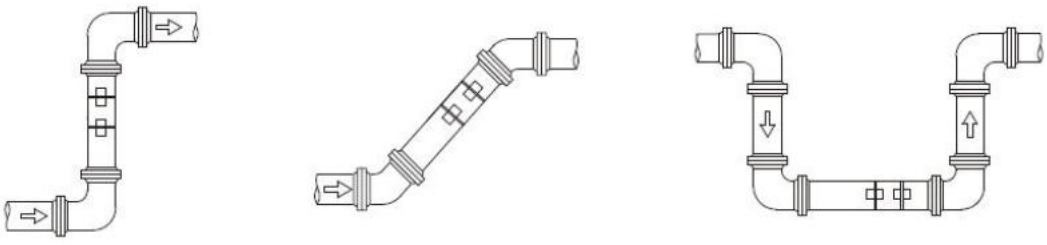
§ 4.3.1 Choose Transducer Installation Area

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

>> Vibration

There cannot be strong vibration on the installation area, otherwise it needs to be tightened.

>>Stable flow

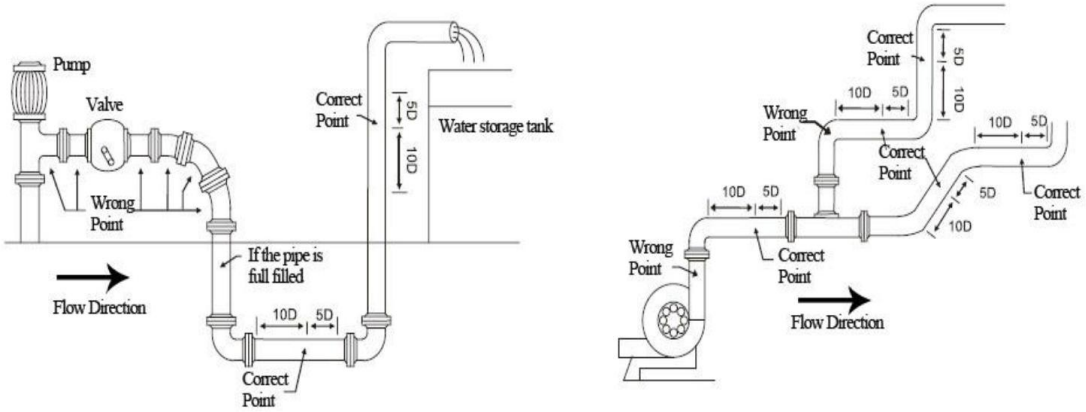
Stable flow is helpful for ensuring measurement accuracy.

Standard requests for steady flow are:

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

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

2. 30D 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.

Please try to avoid choosing the installation point with inside scaling.

>>Temperature

The liquid temperature on installation point should be in the working range of transducers.

Please try to choose the point with lower temperature. Avoid to choose points like the outlet of boiler water and heat exchanger. Return water pipe would be better.

Temperature range of standard clamp on and insertion transducers: -30 ~ 90℃

Temperature range of high temperature clamp on and insertion transducers: -30 ~ 160℃

>>Pressure

The maximum pressure for standard insertion and inline transducer is **1.6MPa**

Out of this range need customized.

>>EMI (electromagnetic interference)

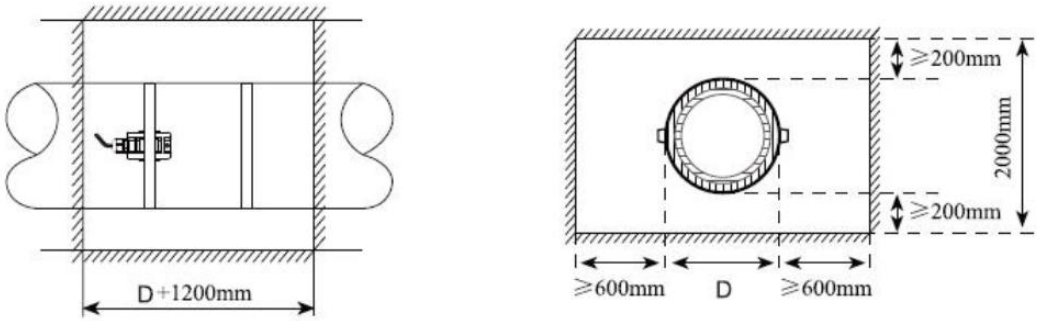
The ultrasonic flow meter, transducer and signal cable can be easily interfered by interference sources such as frequency changer, radio station, microwave station, GSM base station and high-tension cable. Please try to avoid these interference sources when choosing installation points.

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

1) Installation procedure

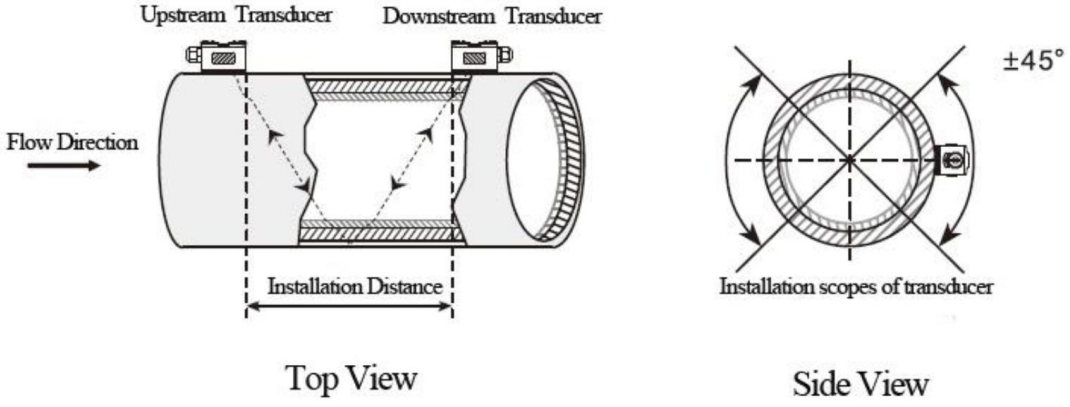
Select an installation method → Input the measuring parameters → Clean pipe surface → Install transducers → Check the installation

2) Select an installation method

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

>> V method

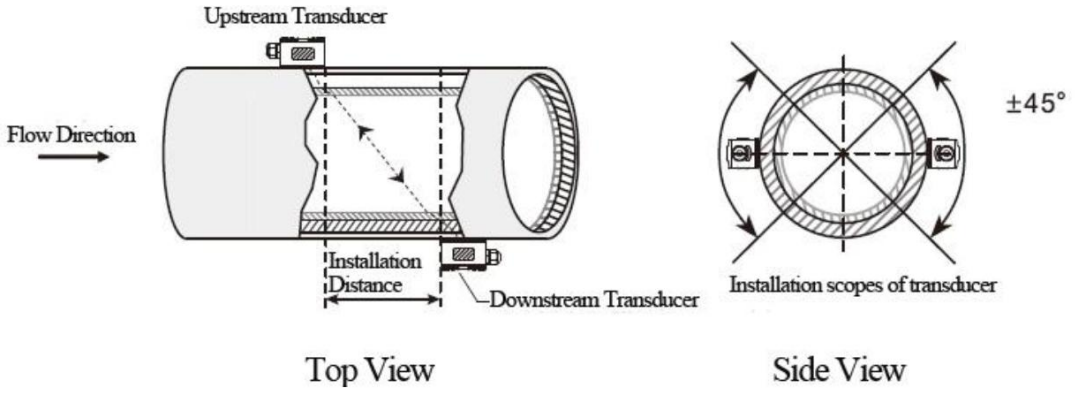
V method should be priority selected for pipe sizes DN25 - DN200. Let the pair of transducers horizontal alignment, the central line in parallel with the pipeline axis.



Top View　　Side View

>> Z method

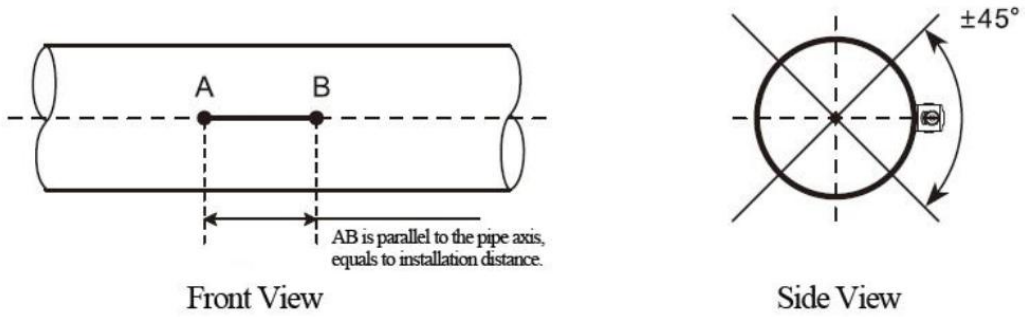
Z method should be priority selected for pipe sizes DN200 - DN6000. Also can be used when V method doesn't work well. Make sure the vertical distance of two transducers equals to the installation distance, and the two transducers are on the same axis surface.



3) Positioning Transducers

>> 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.

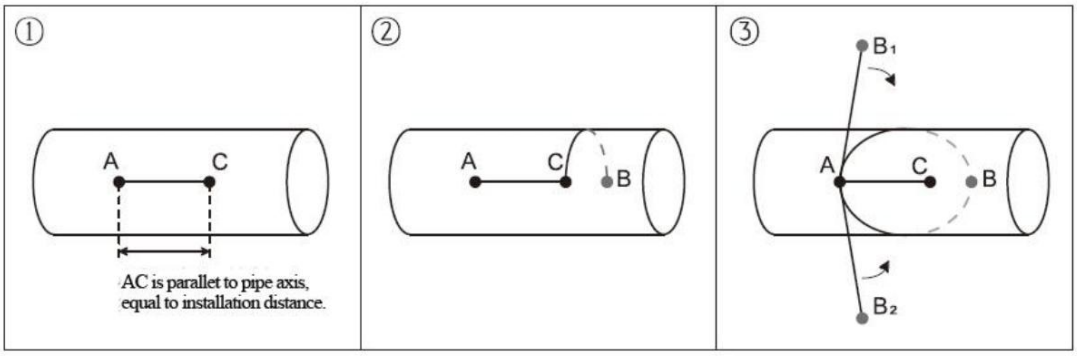


>> Z method

① Firstly 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.

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

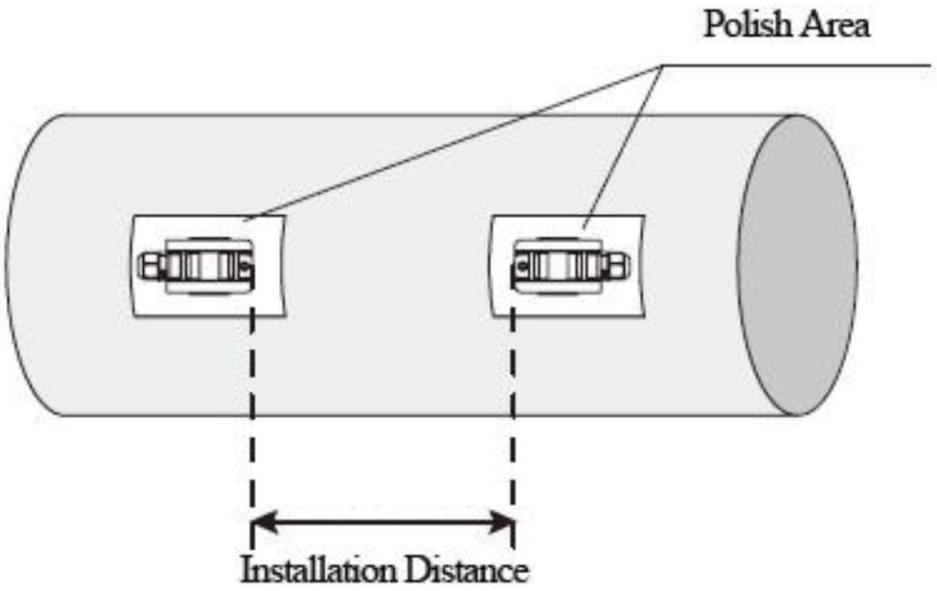
③ Check. Measure the length between A and B from both sides of the pipe, get AB_1 and AB_2. If $AB_1 = AB_2$, then B is the correct point. If not, need to positioning point B and C again. As shown, A, B are the two installation points.



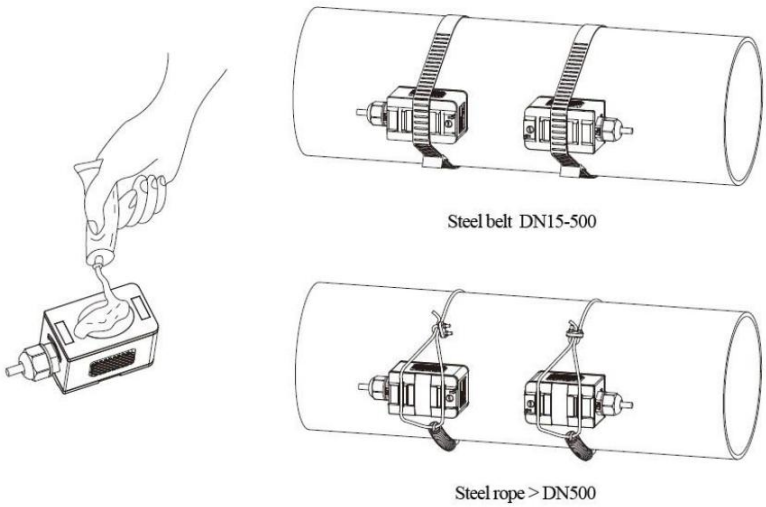
4) Clean the Surface of Installation Area

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.

As shown below:



5) Install Transducers



6) Check Installation

Please refer to Chapter 3.4

§4.4 Inserted Transducer Installation

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

1） **Installation procedure**

Select an installation method → Input the measuring parameters → Positioning installation points→ Fix ball valve base →Open hole under pressure →Install transducers → Check the installation

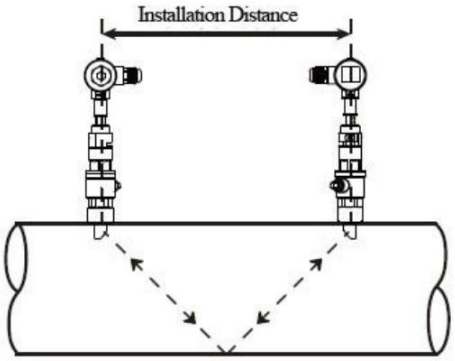
2) **Select installation method and positioning installation points**

Insertion type transducers are suitable for pipe sizes > 50mm.

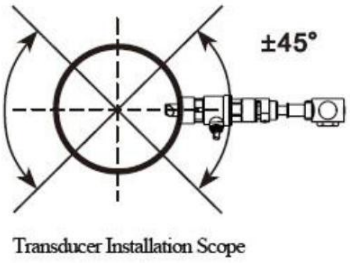
Two different installation methods: V method and Z method. Generally use Z method, only use V method for lack of space.

>> 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.



Top View

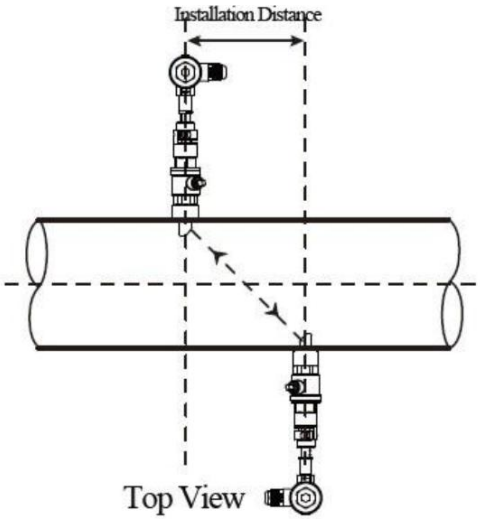


Side View

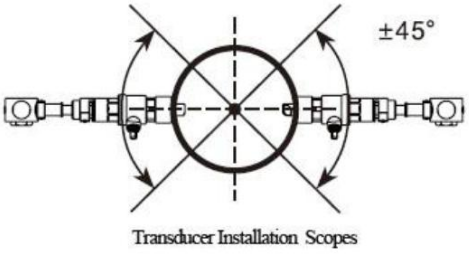
>> Z method

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

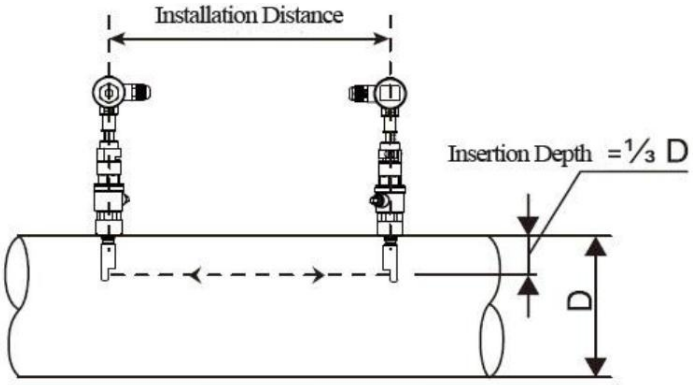
>> Parallel insertion

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 ≥300)

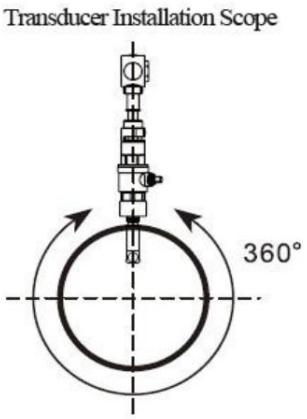
Positioning of parallel insertion transducer need to meet the 3 factors as follow:

• Installation distance = Vertical distance of two transducers along the pipe axis direction

- Make sure two transducers are in the same horizontal line,
  Insertion depth = 1/3 inner diameter
- Users can set the distance between transducers by themselves. Recommend 300~500mm



Front View

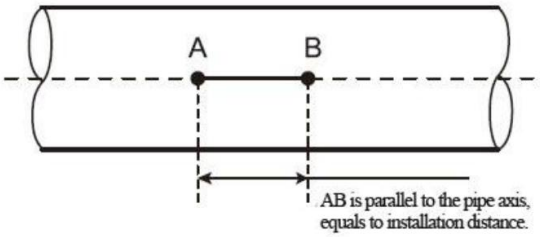


Side View

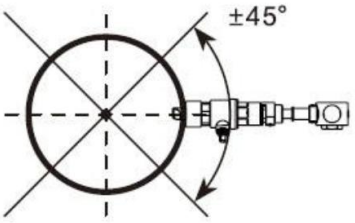
2) Positioning Installation Area

>> 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.



Front View



Side View

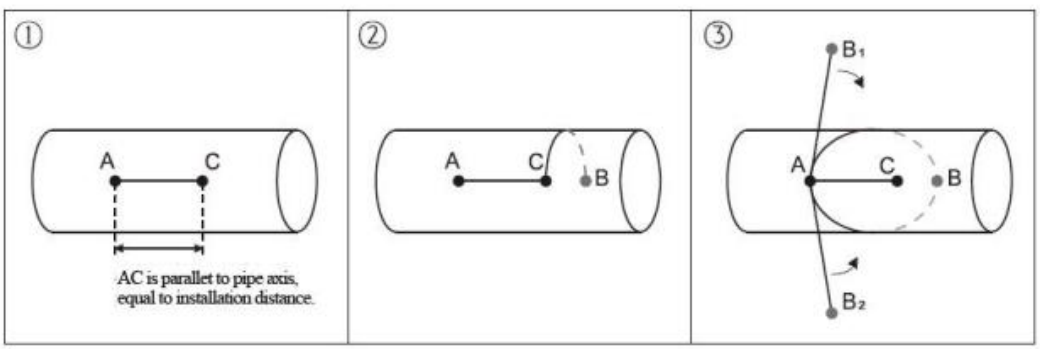
>> Z method

① Firstly 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.

② Perpendicular 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 AB_2. If $AB_1 = AB_2$, 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.



4） **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:

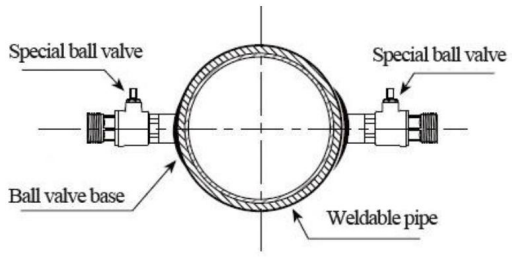
- Please take the PTFE sealing gasket out from the base before welding.
- Please clean the pipe surface around welding point before welding. Pay attention that there should not be any air hole during welding, which can avoid leaking. Welding strength must be ensured.
- Do not sputter welding slag on the base thread.
- Non-deformation of base during welding.

After welding, tighten ball valve into the base.

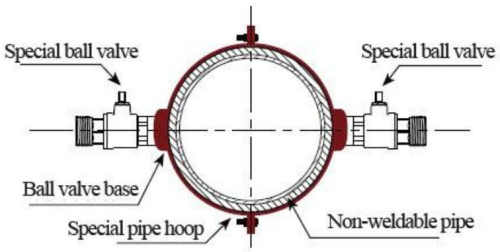
>> Pipe hoop Fix

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

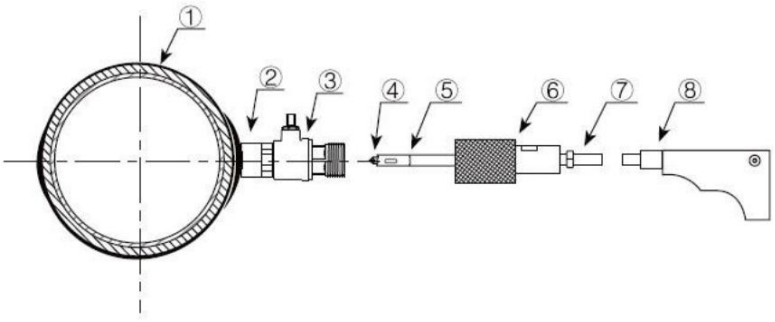


Pipe hoop Fix

5) Drilling

After finishing the installation of ball valve and base, insert the open-hole tool into ball valve and lock it. Then open the ball valve, start drilling, from slow to fast. Close ball valve after drilling.

See more details in the video of insertion transducer installation.



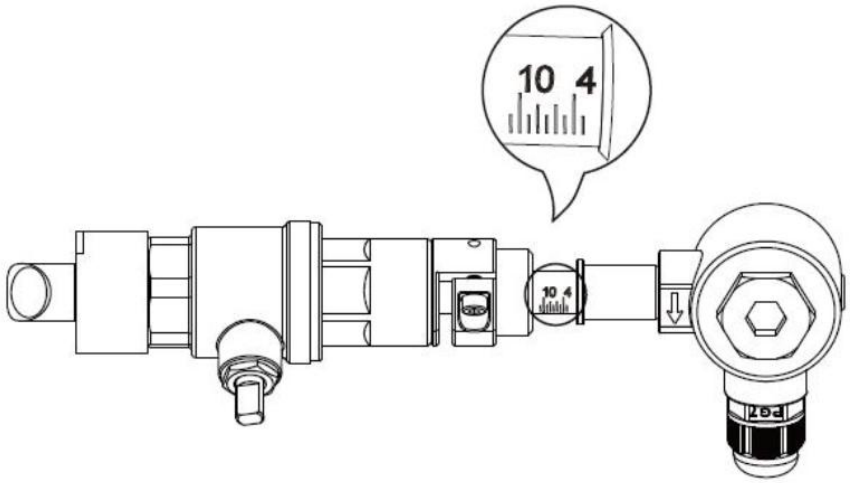
① Pipeline
② Ball valve base
③ Special ball valve
④ Drill
⑤ Super hole cutter
⑥ Seal cover
⑦ Drill rod
⑧ Electric hand drill

6) **Install transducer and adjustment**

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

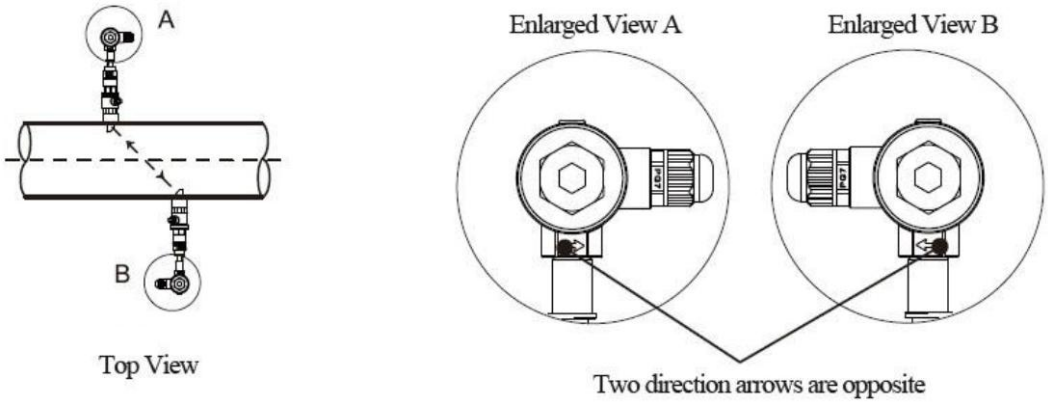
>> Insertion depth adjustment

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



>> Transmit direction

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.



>>Operation steps

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

• Open 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.

• Install downstream transducer in the same way. Adjust the transmit direction to get the best signal strength and watching Menu91, 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.

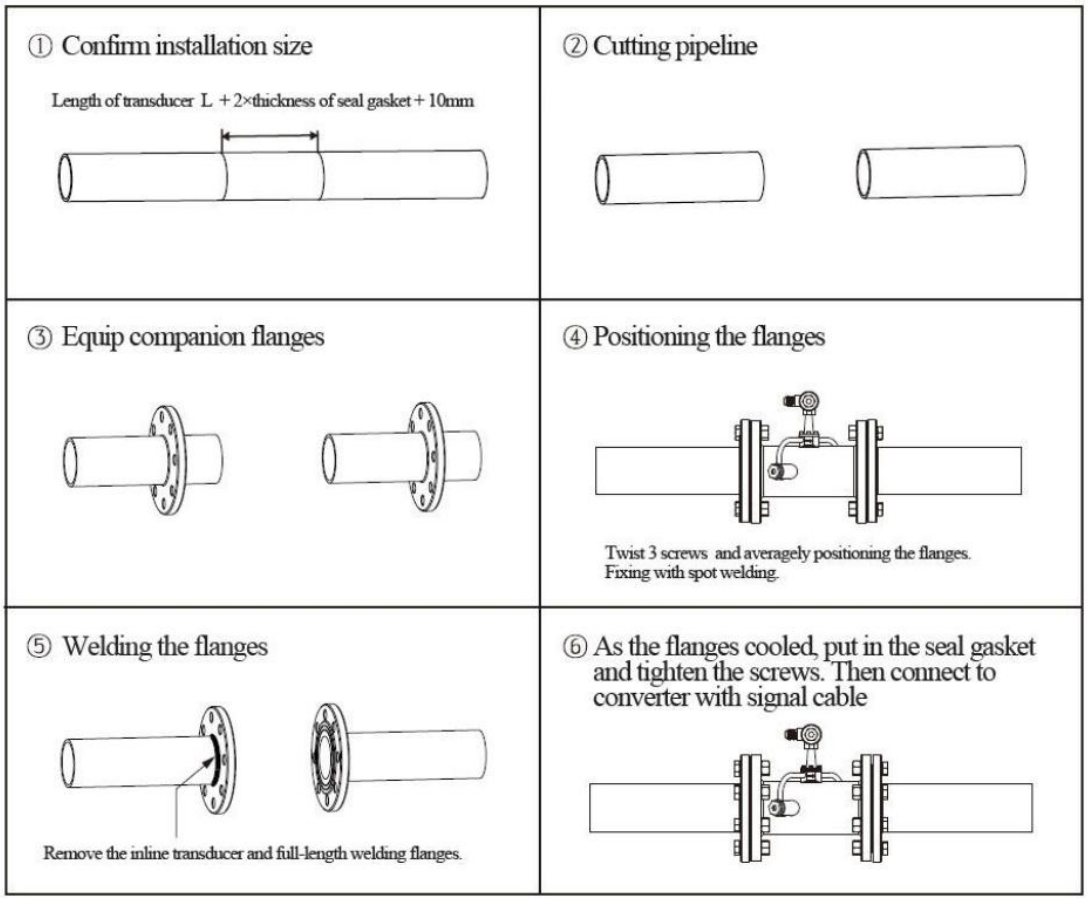
7) Check installation

Please refer to Chapter 4.6

§4.5 Flange Type Installation

After choosing the installation area, install transducers in the pipeline with matching flanges. Then connect the transducers to converter with special signal cable.

1) Installation Method



2) Check Installation

Please refer to Chapter 3.4

5.Communication

This flow meter has standard Modbus RTU protocol. Use the 0x04 command to read (standard Modbus RTU read input register). The register address is as follows:

Main Add (04)	Content	Type	Unit	Note
0	Flow Rate	float	M3/h	IEE754 float CDAB
1				
2	Heat Rate	float	GJ/h	IEE754 float CDAB
3				
4	Net total flow Integer part	Unsigned 32-bit integer	M3	CDAB
5				
6	Total flow (+) Integer part	Unsigned 32-bit integer	M3	CDAB
7				
8	Total flow (-) Integer part	Unsigned 32-bit integer	M3	CDAB
9				
10	Net total heat Integer part	Unsigned 32-bit integer	GJ	CDAB
11				
12	Total heat (+) Integer part	Unsigned 32-bit integer	GJ	CDAB
13				
14	Total heat (-) Integer part	Unsigned 32-bit integer	GJ	CDAB
15				
16	Net total flow Fractional part	Unsigned 16-bit integer	0.001m3	
17	Total flow (+) Fractional part	Unsigned 16-bit integer	0.001m3	
18	Total flow (-) Fractional part	Unsigned 16-bit integer	0.001m3	
19	Net total heat Fractional part	Unsigned 16-bit integer	0.001GJ	
20	Total heat (+) Fractional part	Unsigned 16-bit integer	0.001GJ	
21	Total heat (-) Fractional part	Unsigned 16-bit integer	0.001GJ	
22				
23				
24	Flow Velocity	float	M/s	IEE754 float CDAB
25				
26	Liquid Level	Unsigned 16-bit integer	mm	
27	Battery Voltage	Unsigned 16-bit integer	mV	
28	Temperature of hotter side	Unsigned 16-bit integer	0.01C	
29	Temperature of colder side	Unsigned 16-bit integer	0.01C	
30	Resistance of hotter side	Unsigned 16-bit integer	0.1 Ω	
31	Resistance of colder side	Unsigned 16-bit integer	0.1 Ω	
32	Analog input 1	Unsigned 16-bit integer	uA	
33	Analog input 2	Unsigned 16-bit integer	uA	
34	Physical value-analog input 1	float		IEE754 float CDAB
35				
36	Physical value-analog input 2	float		IEE754 float CDAB
37				
65400	Series Number	Uint32 Unsigned 32-bit integer		CDAB
65401				

5.1 When using C, what is the storage order of floating point：

For example, the four bytes of 3F 9E 06 51 are IEEE754 format single precision floating-point form of 12345678. The order in the MODBUS data stream is 06513F 9E, and the address 1 data stream should be 01 03 04 06 513F 9E 3B 32 (-hexadecimal digits). When using the C language in an X86 computer, the memory is stored in the order from low to high 51 06 9E 3F

5.2 How to Read

You can use a Modbus RTU pointer to read the required data. Here, assuming the flowmeter address is 1, the command sent by the Modbus master station is as follows: 01 04 00 00 28 F0 14, and its communication data is as follows:

>The instantaneous flow data is: 82 D0 44 FE, and the actual data in memory is arranged as 44FED082. The floating point number (EE754) represented by: 2036.087890625, so the instantaneous flow is: 2036.087890625m3/h; Other data is extrapolated based on this.

>The net cumulative integer part is: 00 C9 00 00 00 The actual data is 000000C9, which is 201m3>The net cumulative fractional part is: 01 1E, and the actual data is 011E-481, with a unit of 0.001, indicating 0.481m3>Net cumulative=Net cumulative integer+Net cumulative decimal=201+0.481=201.481m3

6. FAQ

6.1 How to use 4-20mA current loop output

The current loop output accuracy of the flow (heat) meter is better than 0.1%. The flow value corresponding to 4mA is 0m3/h, and the flow value corresponding to 20mA is adjusted to "output ->20mA corresponding flow value". For example, if it is set to 80m3/h, the flow meter corresponding to the output of 4~20mA is 0~80m3/h.

6.2 How to use OCT

The OCT of this device has an intelligent output, which can automatically complete the correspondence between the cumulative flow instantaneous flow and the OCT pulse equivalent, as well as the pulse frequency, just by inputting the OCT equivalent. The default maximum frequency for OCT output is 10K. The maximum OCT pulse width is 32ms. The pulse width decreases as the frequency increases, and is automatically calculated.

The relationship between OCT equivalent and instantaneous flow is: instantaneous flow - xx L/pulse * 10000 * 3600/1000, and the maximum output frequency of OCT is 10K.

Assuming that the OCT equivalent is 0.1L/pulse, the maximum instantaneous flow=0.1 * 10000 * 3600/1000m3/h=3600m3/h, the instantaneous flow range is 0~3600m3/h, and the OCT frequency is 0~10KHz.

6.3 How to use RS485

The ultrasonic flowmeter uses a standard Modbus RTU communication protocol, with a device address between 1 and 254 that can be set by software, and a baud rate between 1200 and 57600 that can be selected.

>Output ->Communication ID: Used to set the Modbus RTU address Output ->Communication parameters: used to set serial communication baud rate, parity bit, etc

6.4 How to Use Zero Cut to Avoid Ineffective Accumulation

The data of "Output ->Low Flow Cutoff" is called the low flow rate cutoff value. 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 flowmeter when the actual

flow rate is "0". Generally, this parameter is set to 0.03m/s.
When the flow rate is greater than the flow rate represented by the low flow rate cutoff value, the low flow rate cutoff value has nothing to do with the measurement result and never affects the measurement result.

6.5 How to judge whether the flow meter works well

>Check the measurement configuration ->Channel 1 signal strength and quality: it is recommended that Q>85%, 97%<T<103%, upstream and downstream are greater than 10mV, and the difference between upstream and downstream is not more than 5%
>The viewing method for channel 2 is similar to that for channel 1

6.6 Flow meter has signal but no flow

If the sensor signal is normal in the flowmeter measurement configuration, Q>85%, 97%<T<103%, and the flowmeter displays no flow, there are two possibilities: 1. The flow rate is too low, and it is considered 0 if it is cut off. 2. The upstream and downstream connections of the sensor are reversed. By default, the negative accumulation is turned off, and no negative flow occurs.
Debugging method: On the "Output>Low Flow Rate Cutoff" page, set the low flow rate cutoff to 0. At this time, the flow rate is in debugging mode. When the upstream and downstream of the sensor are reversed, a negative flow rate will appear; If the flow rate is too low, small flow rates may also occur (low flow rate cutoff is not performed at this time).

6. 7 How to clear cumulative quantity

Enter: Press  for reset total flow, pls ask us about the password.

7. Sound speed in water at atmosphere pressure

Unit: t (Deg C) v (m/s)

t	v	t	v	t	v	t	v
0	1402.3	25	1496.6	50	1542.5	75	1555.1
1	1407.3	26	1499.2	51	1543.5	76	1555.0
2	1412.2	27	1501.8	52	1544.6	77	1554.9
3	1416.9	28	1504.3	53	1545.5	78	1554.8
4	1421.6	29	1506.7	54	1546.4	79	1554.6
5	1426.1	30	1509.0	55	1547.3	80	1554.4
6	1430.5	31	1511.3	56	1548.1	81	1554.2
7	1434.8	32	1513.5	57	1548.9	82	1553.9
8	1439.1	33	1515.7	58	1549.6	83	1553.6
9	1443.2	34	1517.7	59	1550.3	84	1553.2
10	1447.2	35	1519.7	60	1550.9	85	1552.8
11	1451.1	36	1521.7	61	1551.5	86	1552.4
12	1454.9	37	1523.5	62	1552.0	87	1552.0
13	1458.7	38	1525.3	63	1552.5	88	1551.5
14	1462.3	39	1527.1	64	1553.0	89	1551.0
15	1465.8	40	1528.8	65	1553.4	90	1550.4
16	1469.3	41	1530.4	66	1553.7	91	1549.8
17	1472.7	42	1532.0	67	1554.0	92	1549.2
18	1476.0	43	1533.5	68	1554.3	93	1548.5
19	1479.1	44	1534.9	69	1554.5	94	1547.5
20	1482.3	45	1536.3	70	1554.7	95	1547.1
21	1485.3	46	1537.7	71	1554.9	96	1546.3
22	1488.2	47	1538.9	72	1555.0	97	1545.6
23	1491.1	48	1540.2	73	1555.0	98	1544.7
24	1493.9	49	1541.3	74	1555.1	99	1543.9