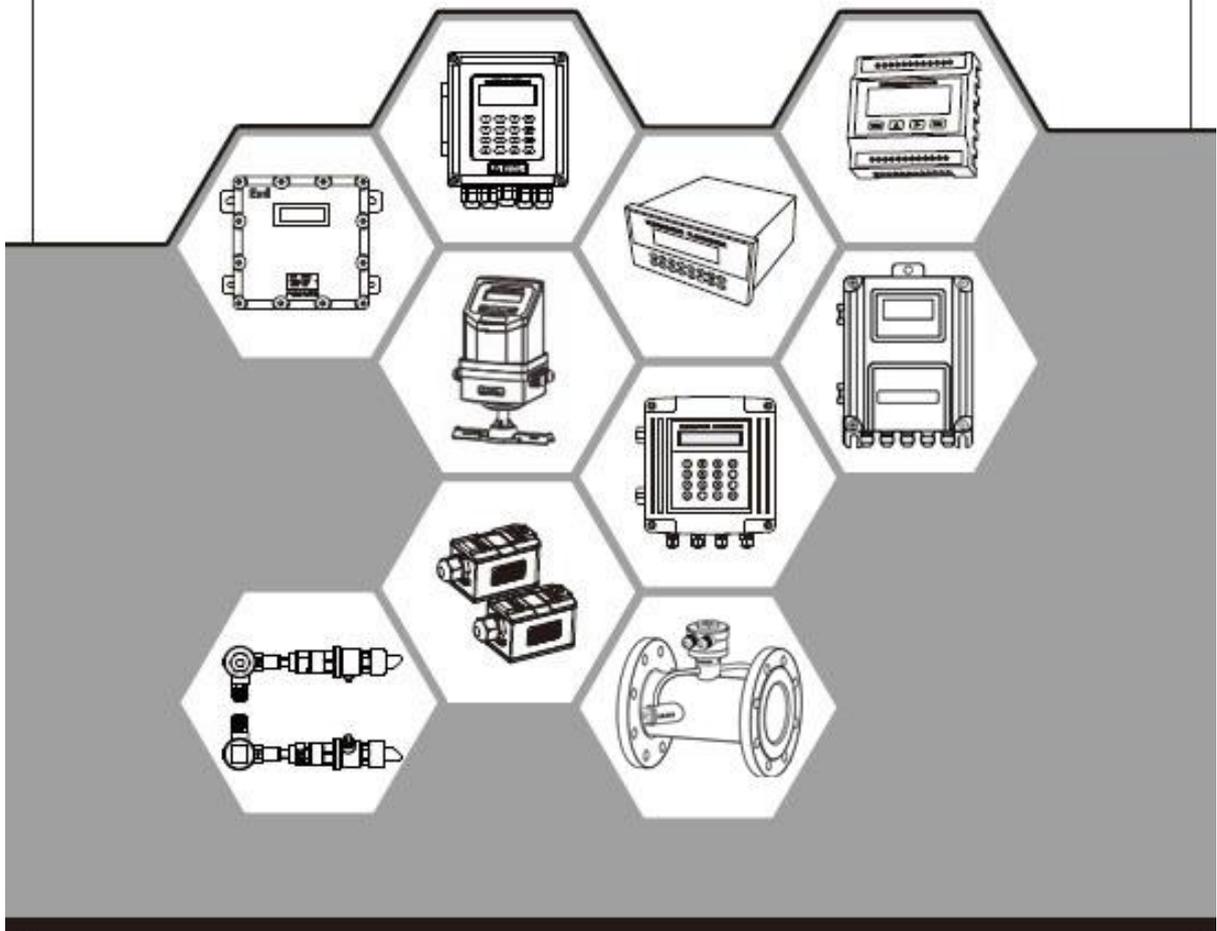


Ultrasonic Flow/Heat Meter User Manual



MC CE ISO9001

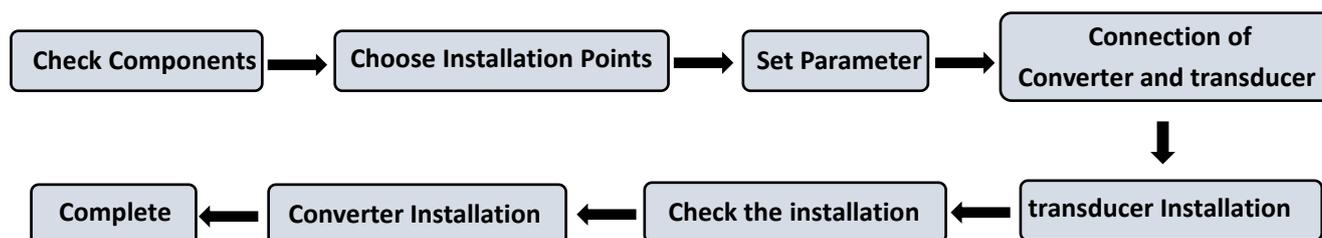
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Welcome to use the new generation ultrasonic flow meter made of our patented technology. TUF-2000 Series Ultrasonic Flow/Heat Meters utilize the transit-time principle to measure the velocity of relatively clean liquids in full pipes.

The purpose of this guide is to provide installation procedures and basic operating instructions for TUF-2000 Series Ultrasonic Flow/Heat Meters.

Installation Procedure



1. Products Categories

1.1 Composition of Ultrasonic flow meter

Ultrasonic Flow meter = Converter + transducer

Ultrasonic Heat meter = Converter + transducer + Temperature transducer

1.2 Types of Converters

Model	Wall Mount TUF-2000B	Wall Mount TUF-2000S	Wall Mount TUF-2000S(Grey)	Explosion proof TUF-2000D
Picture				
Model	Panel mount TUF-2000U	Module TUF-2000M	Fix Mount TUF-2000F2	
Picture				

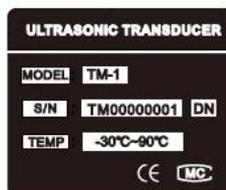
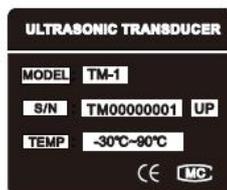
1.3 Types of Flow/Temperature transducers

Flow transducer	Picture	Model	Measuring range	Temperature
Clamp on		TS-2 (small)	DN25-100	-30 ~ 90°C
		TM-1 (medium)	DN50-700	
		TL-1 (large)	DN300-6000	
High temp. Clamp on		TS-2-HT (small)	DN25-100	-30 ~ 160°C
		TM-1-HT (medium)	DN50-700	
		TL-1-HT (large)	DN300-6000	
Insertion		TC-1 (standard)	DN50-6000	-30 ~ 160°C
		TC-2 (extended)		
		TP-1 (parallel)	DN80-6000	
Inline		Standard	DN15-1000	-30 ~ 160°C

Temperature transducer	Picture	Model	Measuring range	Temperature	Cutoff water
Clamp on		CT-1	DN50-6000	-40 ~ 160°C	No need
Insertion		TCT-1	DN50-6000	-40 ~ 160°C	Need
Insertion under pressure		PCT-1	DN50-6000	-40 ~ 160°C	No need
Insertion small sizes		SCT-1	< DN50	-40 ~ 160°C	Need

2. Check Components

1. Please check you have all the components in the order.
2. All codes on the converter and transducers should be matched. They are used in sets.



3. Measuring Diagrams

3.1 Separated Mounting

		
Clamp on	Insertion	Inline

3.2 Separated Mounting

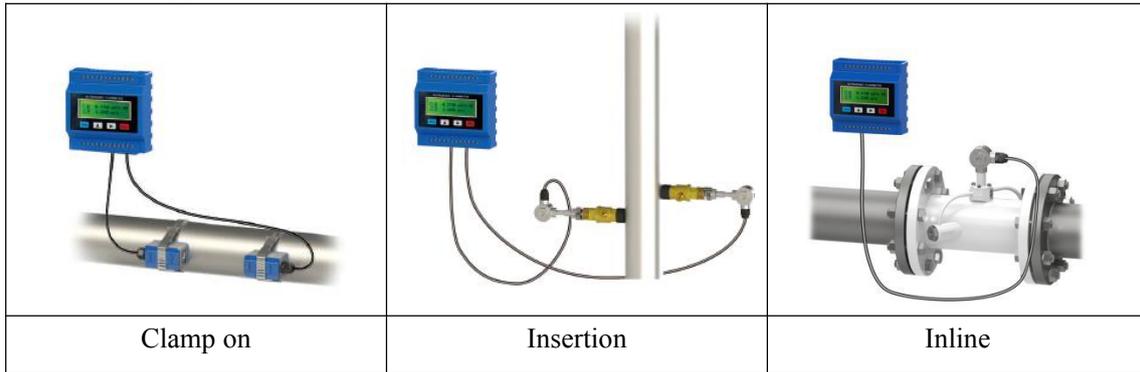
		
Clamp on	Insertion	Inline

Note: Mounting of TUF-2000S(Grey), TUF-2000U and TUF-2000D are in the same way.

3.3 Fixed Mounting

		
Clamp on	Insertion	Inline

3.4 Module type

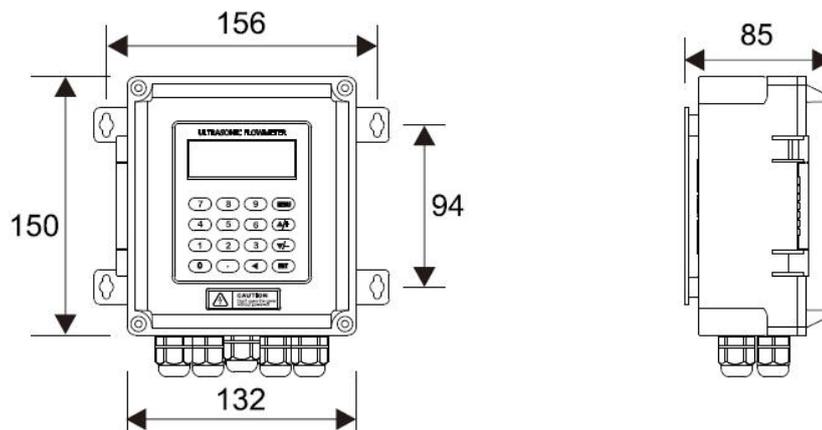


★ Temperature and heat can be measured by connecting PT100 temperature sensors on both water supply and return pipes.

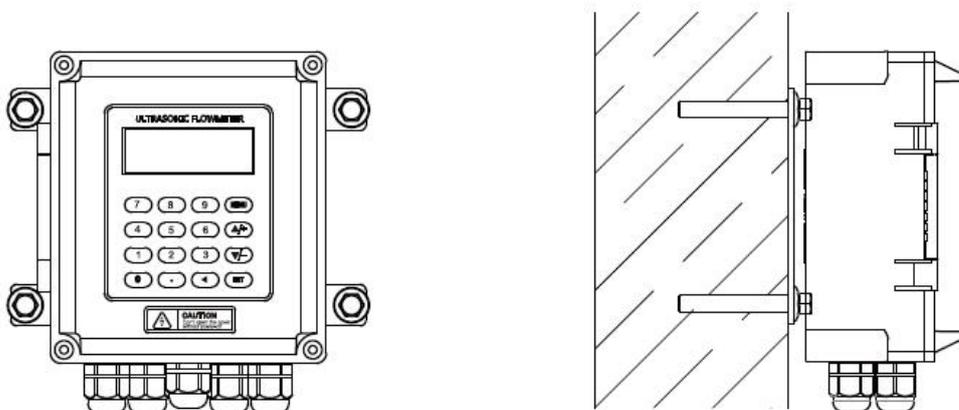
4. Converter Installation and Wiring Diagram

4.1 Separated Mounting

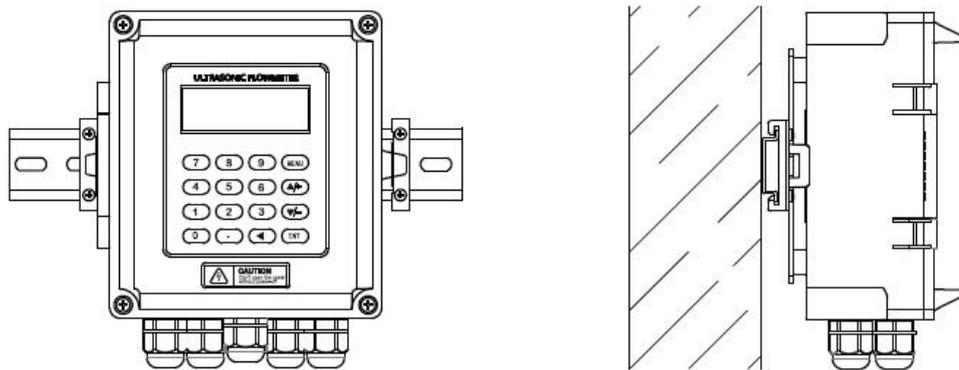
- TUF-2000B Installation Instruction



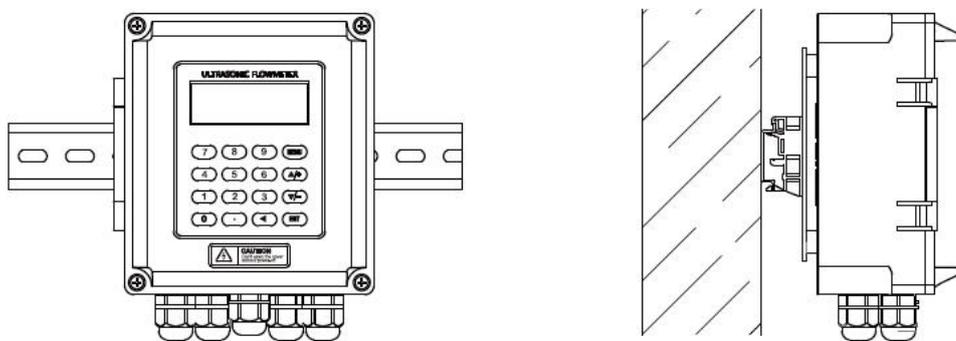
- Wall mounting: Fix the converter with 4 $\Phi 6$ expansion bolts or normal nails.



- DIN-rail mounting by using rail fixing clamps.

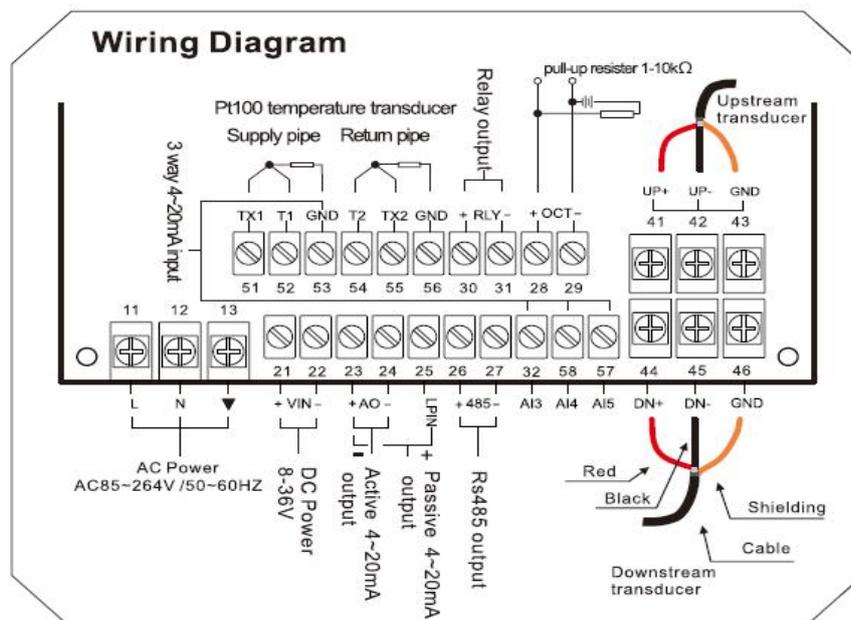


- DIN-rail mounting by using PCB bracket

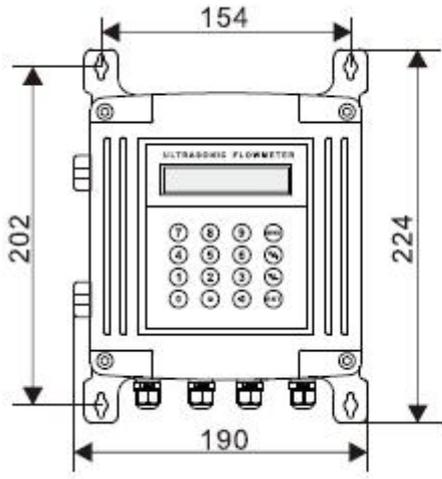


★ Converter of TUF-2000B can be installed on the wall or in distribution box and explosion-proof box

- TUF-2000B Wiring Diagram

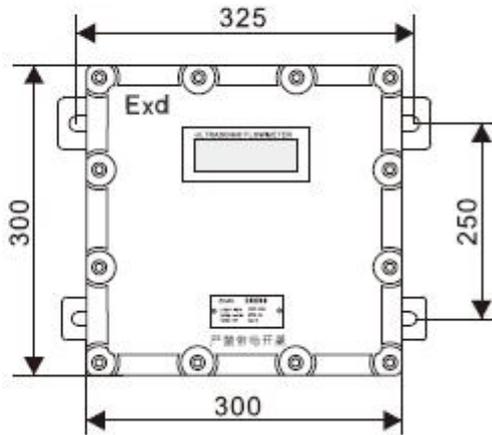


- TUF-2000S and TUF-2000D Installation Instruction(TUF-2000S(Grey) is the same way)



Thickness: 75mm

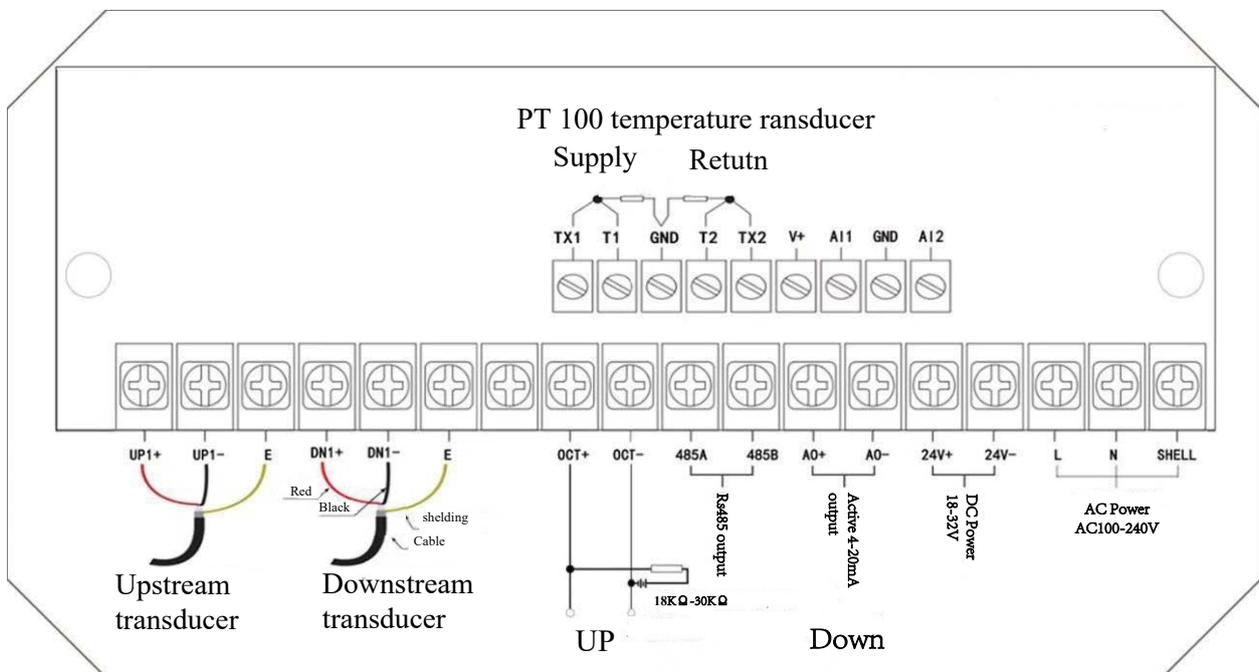
Wall mounting: Fix the converter with 4 $\Phi 6$ expansion bolts.



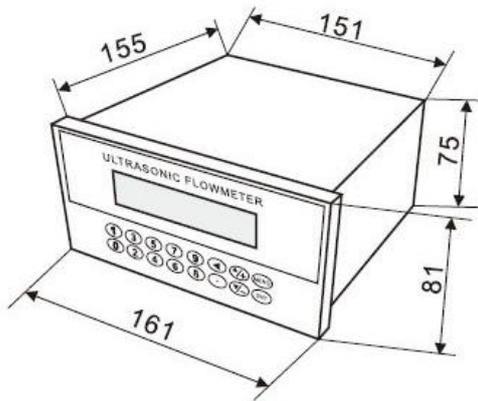
Thickness: 165mm

Explosion-proof grade: D II BT5
Fix the converter with 4 $\Phi 8$ expansion bolts.

- TUF-2000S and TUF-2000D Wiring Diagram



● **TUF-2000U Installation and Wiring Diagram**



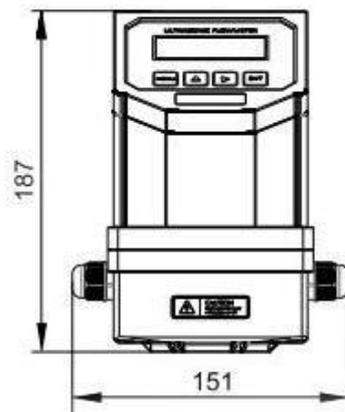
RS485		4-20mA		Upstream sensor			Downstream sensor		
+	-	+	-	UP+	UP-	GND	DN+	DN-	GND
L	N	⊥	TX2	T2	GND	T1	TX1	+	-
AC Power 220V			Supply water		Return water		OCT		

PT100 temperature sensor

- Used for Panel Mounting
Hole size : 152 × 76mm

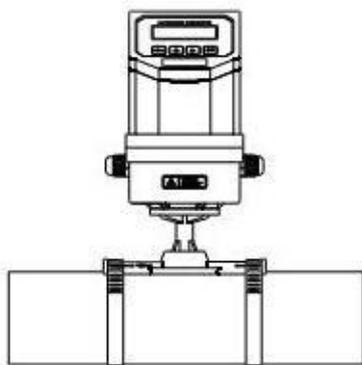
4.2 Fix mounting

● **TUF-2000F2 Installation and Wiring Diagram**

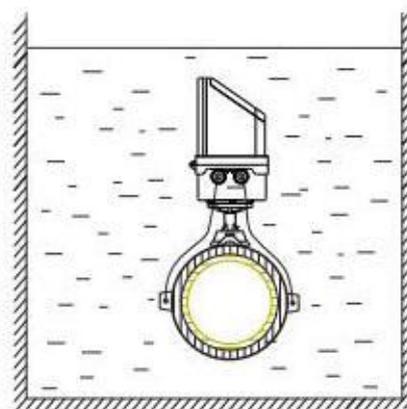


Thickness: 117mm

The converter is generally installed on the pipeline, sometimes installed in the water.

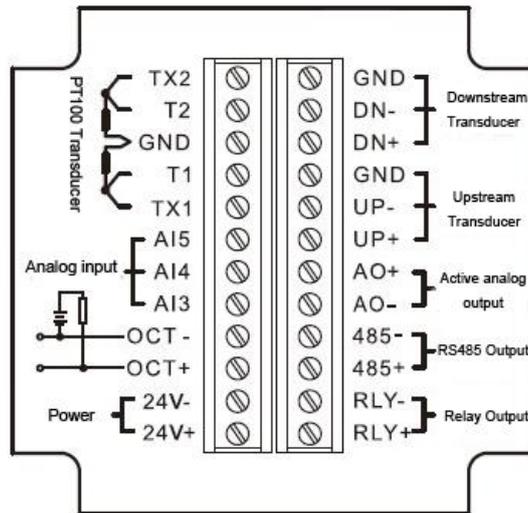


Install on the pipeline



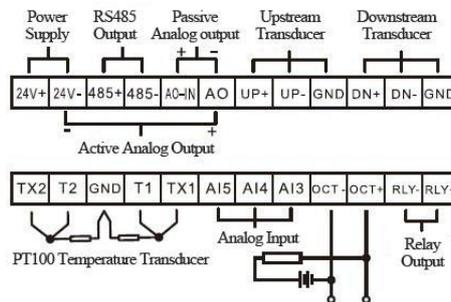
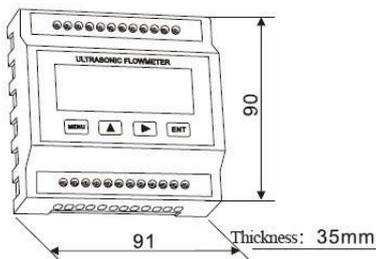
Install in the water

● TUF-2000F2 Wiring Diagram

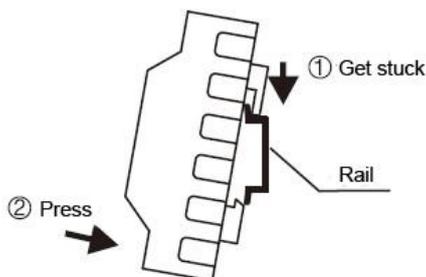


Open the flip cover and complete the wiring. To avoid leaking, please tighten the water joint and screws of the back cover after wiring, then pot gel inside to reach IP68 protection class.

4.3 Module type

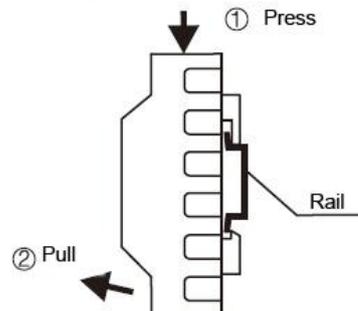


Installation



- ① Get the above slot stuck in the rail.
- ② Press the bottom of converter to make it totally stuck in the rail.

Remove



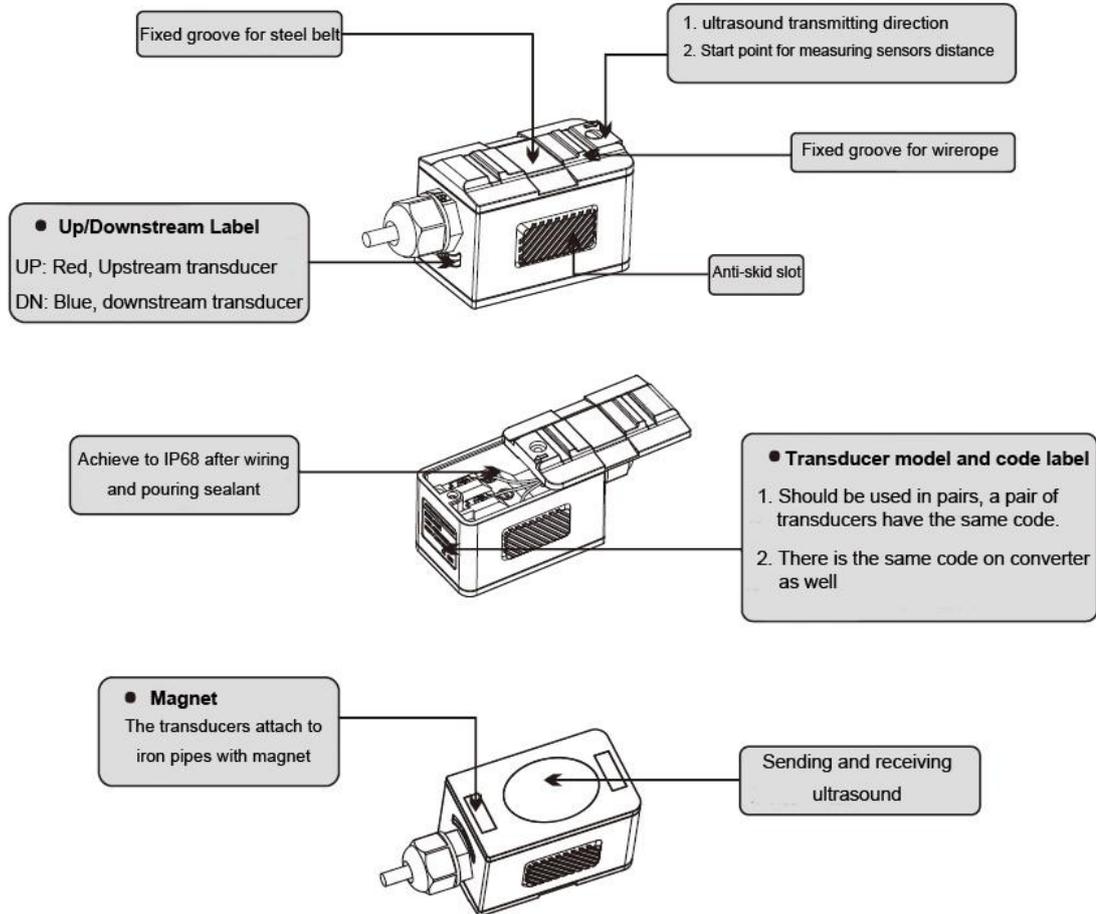
- ① Press the converter top hard

- ② Outward pull the bottom part

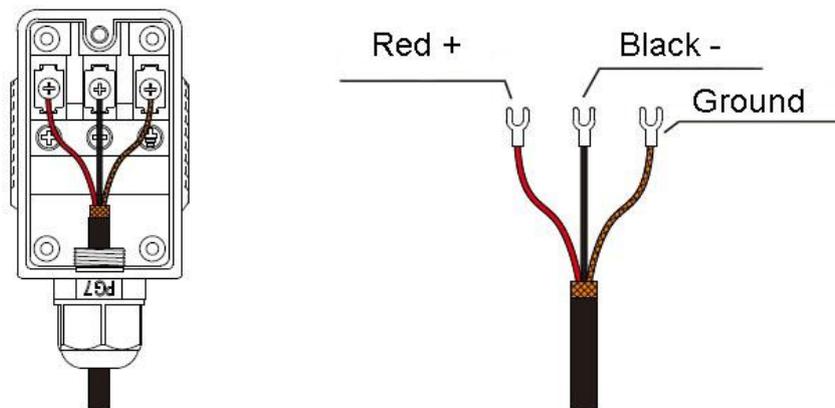
5. Transducer Introduction and Wiring Diagram

5.1 Clamp on type transducer

- Introduction

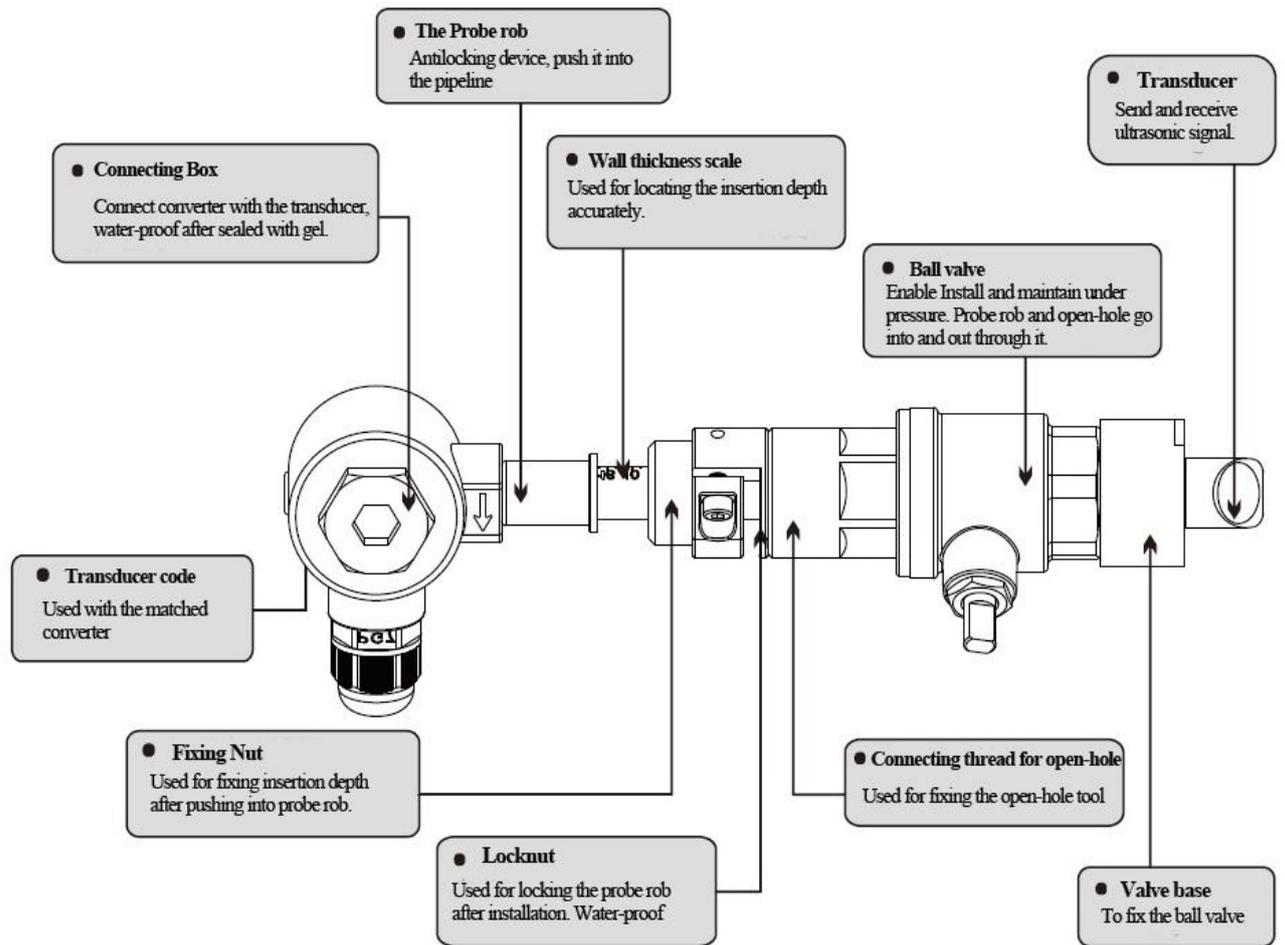


- Wiring Diagram

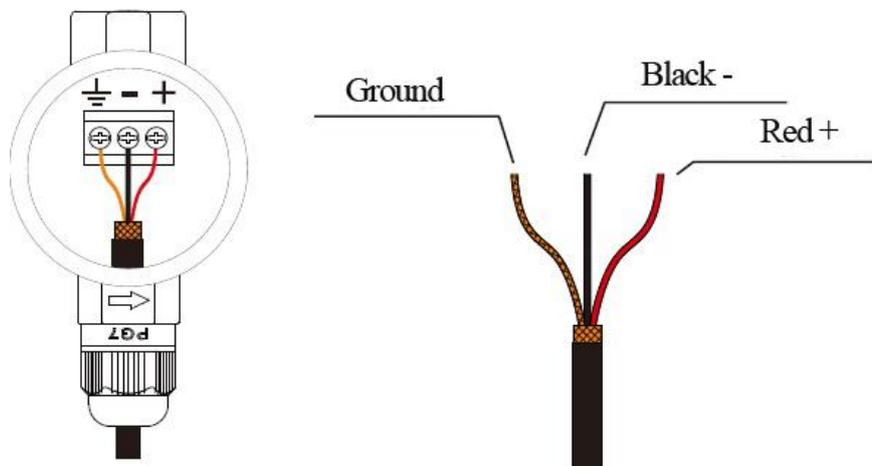


5.2 Insertion type transducer

- Introduction

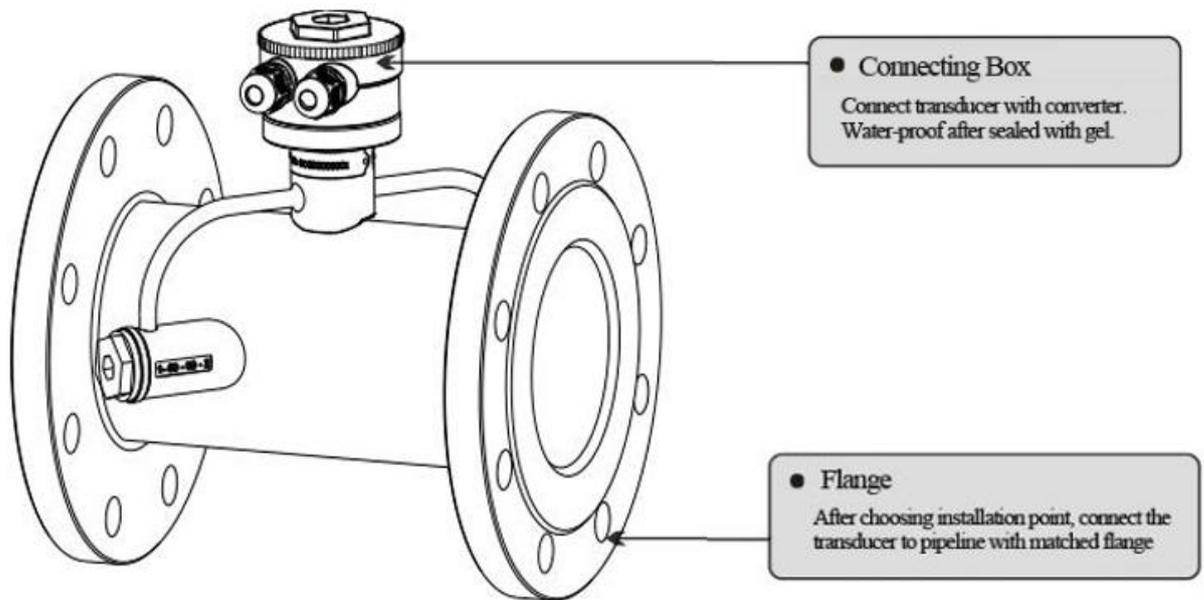


- Wiring Diagram

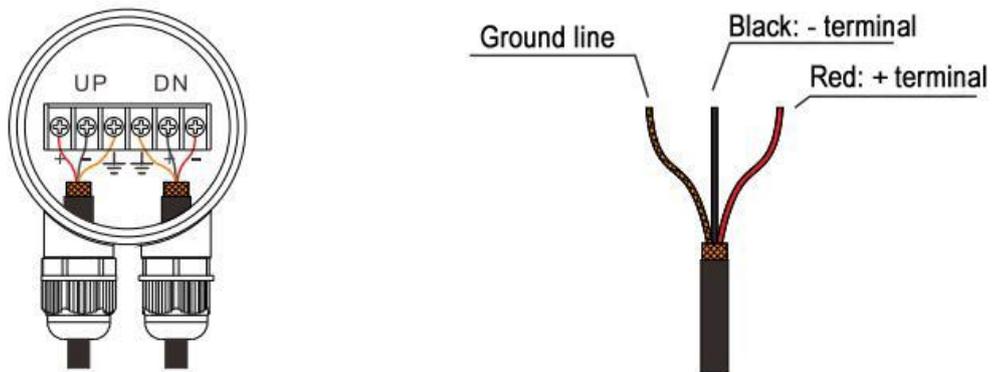


5.3 Inline type transducer

- Introduction



- Wiring Diagram

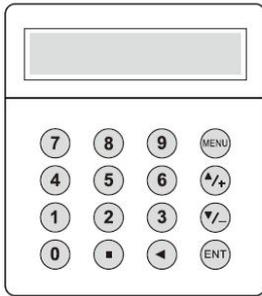


6. Display and Operation

6.1 Display and keyboard

Display is 2×20 characters LCD with backlight, available to set backlight time and contrast.

- 16-key Keyboard



Separated Mounting

0 - 9 and are used for inputting numbers or menu numbers.

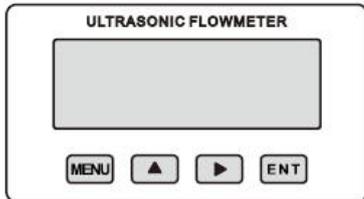
is used for back left or delete the left character.

and are used for entering into the last and next menu. Also can be used as ± sign when inputting numbers.

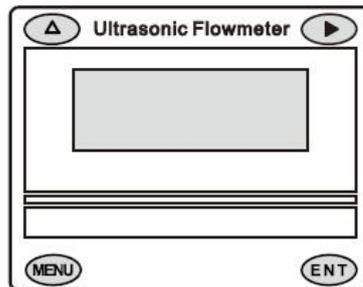
is used for accessing the menu. Press this key first, then type the number keys to enter into the matched menu.

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

- 4-key Keyboard



TUF-2000M



TUF-2000F

: used for entering into menus.

: used for menuup or choosing 0-9, +, -

: used for menudown or moving the cursor to next.

: used for finishing menu inputting or entering into submenu.

6.2 Operation

The user interface of this flow meter comprises about 100 different menu windows that are numbered by M00, M01, M02 ... M99.

Method to enter Menu: Press first, and follow the two-digit number keys. Take M35 as an example, the correct key sequence is 35

To move between the adjacent menus, press and for 16-key keyboard; press and for 4-key keyboard.

6.3 Menu Details

Menu No.	Function
M00	<p>Display flow rate and NET totalizer. If the net totalizer is turned off(refer to M34), the net totalizer value shown on the screen is the value prior to its turn off. Select all totalizer unit in menu M31.</p>
M01	<p>Display flow rate, velocity.</p>
M02	<p>Display flow rate and POS(positive) totalizer. If the positive totalizer is turned off, the positive totalizer value shown on the screen is the value prior to its turn off.</p>
M03	<p>Display flow rate and NEG(negative) totalizer. If the negative totalizer is turned off, the negative totalizer value shown on the screen is the value prior to its turn off.</p>
M04	<p>Display date and time, flow rate. The date and time setting method is found in MENU60.</p>
M05	<p>Display energy rate(instantaneous Caloric)and total energy (Caloric).</p>
M06	<p>Display temperatures, inlet T 1, outlet T2.</p>
M07	<p>Display analog inputs, AI3/AI4, current value and its corresponding temperature or pressure or liquid level value.</p>
M08	<p>Display all the detailed error codes. Display working condition and system error codes. 'R' stands for normal; others refer to Chapter 5 for details.</p>
M09	<p>Display today's total NET flow.</p>
M 10	<p>Window for entering the outer perimeter of the pipe. If pipe outer diameter is known, skip this menu and go to Menu 11 to enter the outer diameter.</p>
M 11	<p>Window for entering the outer diameter of the pipe. Valid range:0 to 18000mm. Note: you just need to enter either the outer diameter in M11 or the perimeter in M 10.</p>
M 12	<p>Window for entering pipe wall thickness You may skip the menu and enter inner diameter in M 13 instead.</p>
M 13	<p>Window for entering the inner diameter of the pipe If pipe outer diameter and wall thickness are enter correctly, the inner diameter will be calculated automatically, thus no need to change anything in the window</p>

M 14	<p>Window for selecting pipe material</p> <p>Standard pipe materials (No need to enter material sound speed) include: (0) carbon steel (1) stainless steel (2) cast iron (3) ductile iron (4) copper (5) PVC (6) aluminum (7) asbestos (8) fiberglass (9) other(need to enter material sound speed in M15)</p>
M 15	<p>Window for entering the pipe material speed, only for non-standard pipe materials</p>
M 16	<p>Window for selecting the liner material, select none for pipes without any liner.</p> <p>Standard liner materials(no need to enter the liner sound speed) include: (0) None, No liner (1) Tar Epoxy (2) Rubber (3) Mortar (4) Polypropylene (5)</p>
M 17	<p>Window for entering the non-standard liner material speed.</p>
M 18	<p>Window for entering the liner thickness, if there is a liner</p>
M 19	<p>Window for entering the ABS thickness ofthe inside wall of the pipe</p>
M20	<p>Window for selecting fluid type</p> <p>For standard liquids(no need to enter fluid sound speed) include: (0) Water (1) Sea Water (2) Kerosene (3) Gasoline (4) Fuel oil (5) Crude Oil (6) Propane at -45C (7) Butane at 0C (8)Other liquids(need to enter sound speed in M21 and viscosity in M22) (9) Diesel Oil (10)Caster Oil (11)Peanut Oil (12) #90 Gasoline (13) #93 Gasoline (14) Alcohol (15) Hot water at 125C</p>
M21	<p>Window for entering the sound speed of non- standard liquid, used only when option item 8 'Other' is selected in M20</p>
M22	<p>Window for entering the viscosity of the non-standard liquids, used only when option item 8 'Other' is selected in M20</p>
M23	<p>Window for selecting transducer type,</p>
M24	<p>Window for selecting the transducer mounting methods</p> <p>Four methods can be selected: (0) V-method (1) Z-method (2) N-method (3) W-method</p>
M25	<p>Display the transducer mounting spacing or distance</p>
M26	<p>Liquid Temp</p>

M27	Reserved (Unused)
M28	Reserved (Unused)
M29	<p>Entry to setup empty signal threshold. When the signal is less than this threshold, the pipe is regarded as empty pipe, and the flow meter will not totalize flow.</p> <p>This is based on the fact that, for most occasions, when pipe is empty, the transducer would still receive signal, just smaller than normal, As a result, The flow meter would show normal operation, which is not correct.</p> <p>Make sure that the entered value must be less than the normal signal strength.</p> <p>When much noisy signals are received, to make sure the flow meter will not incorrectly totalize flow, there is also a 'Q' threshold should be entered in M.5</p>
M30	Measurement Unit
M31	<p>Window for selecting flow rate unit system.</p> <p>Flow rate can be in 0. Cubic meter short for (m³)</p>
M32	Window for selecting the totalizers unit. Available units are the same as those in M31
M33	Reserved (Unused)
M34	Reserved (Unused)
M35	Reserved (Unused)
M36	Turn on or turn off the NEG(negative) totalizer
M37	<p>(1) Totalizer reset</p> <p>(2) Restore the factory default settings parameters. Press the dot key followed by the backspace key. Attention, It is recommended to make note on the parameters before doing the restoration</p>
M38	Manual totalizer used for easier calibration. Press a key to start and press a key to stop the manual totalizer.
M39	<p>Language selection.</p> <p>The selection could also be changed automatically by the system, if English LCD display is used as the display device.</p>

M40	Flow rate damper for a stable value. The damping parameter ranges from 0 to 999 seconds. 0 means there is no damping. Factory default is 10 seconds
M41	Low flow rate (or zero flow rate) cut-off to avoid invalid accumulation.
M42	Zero calibration/Zero point setup. Make sure the liquid in the pipe is not running while doing the setup.
M43	Clear the zero point value, and restore the solidified zero point value.
M44	Set up a flow bias. Generally this value should be 0.
M45	Scale Factor
M46	Networks address identification number. Any integer can be entered except 13(ODH, carriage return), 10 (0AH, line feeding), 42 (2AH), 38, 65535. Every set of the instrument in a network environment should have a unique IDN. Please refer to the chapter for communication.
M47	System locker to avoid modification of the system parameters. If password is forgotten, you could send a command 'LOCK0' to the serial input to unlock. Or you can write 0 to REGISTER49-50 under MODBUS protocol.
M48	Entry to linearity correcting data inputs. By using of this function, the non-linearity of flow meter will be corrected. Correcting data shall be obtained by careful calibration.
M49	RS485
M50	Switches for the built-in data logger. There are as many as 22 different items can be chosen. To turn this function, select 'YES' the system will ask for selecting the items. There are 22 items available. Turn on all those items you want to output
M51	Reserved (Unused)
M52	Reserved (Unused)
M53	Flow Meter Mode: Normal Mode / Virtual Operation
M54	Virtual Flow when Setting Virtual Operation

M55	Select analog output (4-20mA current loop, or CL) mode. Available options: (0) 4-20mA output mode (setup the output range from 4-20mA) (1) 0-20mA output mode (setup the output range from 0-20mA, This mode can only be used with Version-15 flow meter) (2) RS232 Serial port controls 0-20mA (3) 4-20mA corresponding fluid sound speed (4) 20-4-20mA mode (5) 0-4-20mA mode (can only be used with Version-15 flow meter) (6)20-0-20mA mode(can only be used with Version-15 flow meter) (7) 4-20mA corresponding flow velocity (8)4-20mA corresponding heat flow rate
M56	4mA or 0mA output value, Set the value which corresponds to 4mA or 0mA output current (4mA or 0mA is determined by the setting in M55)
M57	20mA output value, Set the value which corresponds to 20mA output current
M58	Reserved (Unused)
M59	Reserved (Unused)
M60	Setup system date and time. Press ENT for modification. Use the dot key to skip the digits that need no modification.
M61	Display Version information and Electronic Serial Number (ESN) that is unique for each flow meter. The users may employ the ESN for instrumentation management
M62	RS-232/RS485 setup. All the devices connected with flow meter should have matched serial configuration. The following parameters can be configured: Baud rate (300 to 19200 bps), parity, data bits (always is 8), stop bits (1).
M63	Select communication protocol. Factory default is 'MODBUS ASCII. this is a mode for MODBUS-ASCII, Meter-BUS, Fuji Extended Protocol, Huizhong's various protocols. If you are going using MODBUS-RTU you have to select 'MODBUS_RTU' .
M64	AI1value range. Used to enter temperature/pressure values that are corresponding to 4mA and 20mA input current. The display values have no unit, so that they can present any physical parameter.
M65	AI2value range. Used to enter temperature/pressure values that are corresponding to 4mA and 20mA input current.

M66	OCT Output Selection
M67	The relationship between OCT equivalent and instantaneous flow rate is: Instantaneous Flow (m ³ /h) = xx L/Pulse × 10000 × 3600 / 1000 Maximum OCT output frequency: 10 kHz.
M68	Window to setup the minimum flow rate value which corresponds to the lower frequency limit of the frequency output.
M69	Windows to setup the maximum flow Rate value that corresponds to the upper frequency limit of the frequency output.
M70	LCD display backlight control. The entered value indicates how many seconds the backlight will be on with every key pressing. If the enter value is great than 50000 seconds, It means that the backlight will always keeping on.
M71	LCD contrast control. The LCD will become darker or brighter when a value is entered.
M72	LCD Contrast
M73	Relay Setup
M74	Relay Total Flow/Pulse
M75	Window to setup the lower limit offlow rate for Alarm#2.
M76	Window to setup the upper limit offlow rate for Alarm#2.
M77	Buzzer setup. If a proper input source is selected, the buzzer will beep when the trigger event occurs. The available trigger sources are: 0. No Signal 1. Poor Signal 2. Not Ready (No*R) 3. Reverse Flow 4. AO Over 100% 5. FO Over 120% 6. Alarm #1 7. Reverse Alarm #2 8. Batch Controller 9. POS Int Pulse 10.NEG Int Pulse 11.NET Int Pulse 12.Energy POS Pulse 13.Energy NEG Pulse 14.Energy NET Pulse 15.MediaVel=>Thresh 16.MediaVelo<Thresh 17.ON/OFF viaRS485 18.Daily Timer (M51) 19.Timed alarm #1 20. Timed alarm #2 21.Batch Total Full 22. Timer by M51 23. Batch 90% Full 24. Key Stroking ON 24.Disable BEEPER

M78	Reserved (Unused)
M79	Reserved (Unused)
M80	Reserved (Unused)
M81	Reserved (Unused)
M82	View the daily, monthly and yearly flow totalizer and thermal energy totalizer value. The totalizer values and errors for the last 64 days, 32 last 32 months and last 2 years are stored in the RAM memory, To view them, use the 'ENT ' and 'UP ' 'Down' keys.
M83	Reserved (Unused)
M84	Set the thermal energy unit: 0. GJ 1. KC 2.KWh 3. BTU
M85	Specific Heat Select
M86	Temp Diff/Cutoff
M87	Ch1:Sig Strength
M88	Fire Pulse Num
M89	1.Noise threshold 2.Signal noise threshold
M90	Display signal strengths S (one for upstream and one for downstream), and signal quality Q value. Signal strength is presented by 00.0 to 99.9, the bigger the value, the bigger the signal strength will be, and more reliable readings will be made. Q value is presented by 00 to 99, the bigger the better. It should at least be great than 50 for normal operations.
M91	Displays the Time Ratio between the Measured Total Transit Time and the Calculated time. If the pipe parameters are entered correctly and the transducers are properly installed, the ratio value should be in the range of 100±3%. Otherwise the entered parameters and the transducer installation should be checked.

M92	Displays the estimated fluid sound velocity. If this value has an obvious difference with the actual fluid sound speed, pipe parameters entered and the transducer installation should be checked again.
M93	Displays total transit time and delta time(transit time difference)
M94	Max Vel Limit
M99	Reset Meter
M.1	T1,T2 CaliOffset
M.2	Factory Scale
M.6	Modify Accumulator, Password Required. Please Contact Manufacturer.

6.4 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 Menu29. Please complete one by one.

>>> Following parameters need to be inputted before measurement:

1. Outer diameter unit: mm
2. Pipe thickness unit: mm
3. Pipe material
4. Lining parameters: thickness and sound velocity (If have lining)
5. Liquid type
6. transducer type
7. transducer mounting type

>> Above parameters setup generally follow the steps below:

1. Press keys **MENU 1 1** to enter M11 window to input the pipe outer diameter, and then press **ENT** key.
2. Press key **▼/-** to enter M12 window to input the pipe outer diameter and then press **ENT** key.
3. Press key **▼/-** to enter M14 window, and press **ENT** key to enter the option selection mode.
Use keys **▲/+** and **▼/-** to select the pipe material, and then press **ENT** key.
4. Press key **▼/-** to enter M16 window, press **ENT** key to enter the option selection mode. Use keys **▲/+** and **▼/-** to select the liner material, and then press ENT key. Select “No Liner”, if there is no liner.
5. Press key **▼/-** to enter M20 window, press **ENT** key to enter the option selection mode. Use keys **▲/+** and **▼/-** to select the proper liquid, and then press **ENT** key.
6. Press key **▼/-** to enter M23 window, press **ENT** key to enter the option selection mode. Use keys **▲/+** and **▼/-** to select the proper transducer type, and then press **ENT** key.
7. Press key **▼/-** to enter M24 window, press **ENT** key to enter the option selection mode. Use keys **▲/+** and **▼/-** to select the proper transducer mounting method, and then press **ENT** key.
8. Press key **▼/-** to enter M25 window and get the transducer installation distance.
9. Press **MENU 2 6** to store the parameters setup.

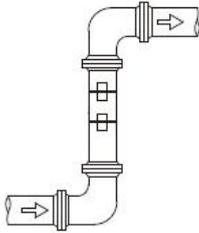
7. Transducers Installation

7.1 Choose installation points

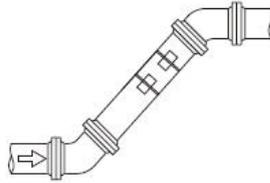
Proper installation point is a key for transducer installation. Following factors must be considered: Full filled pipeline, shaking, steady flow, scaling, temperature, pressure, EMI, instrument well.

>> Full filled pipeline

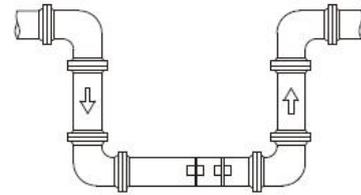
Following situations can be full filled of liquid:



Vertical upward



Obliquely upward



Lowest point

>> Shaking

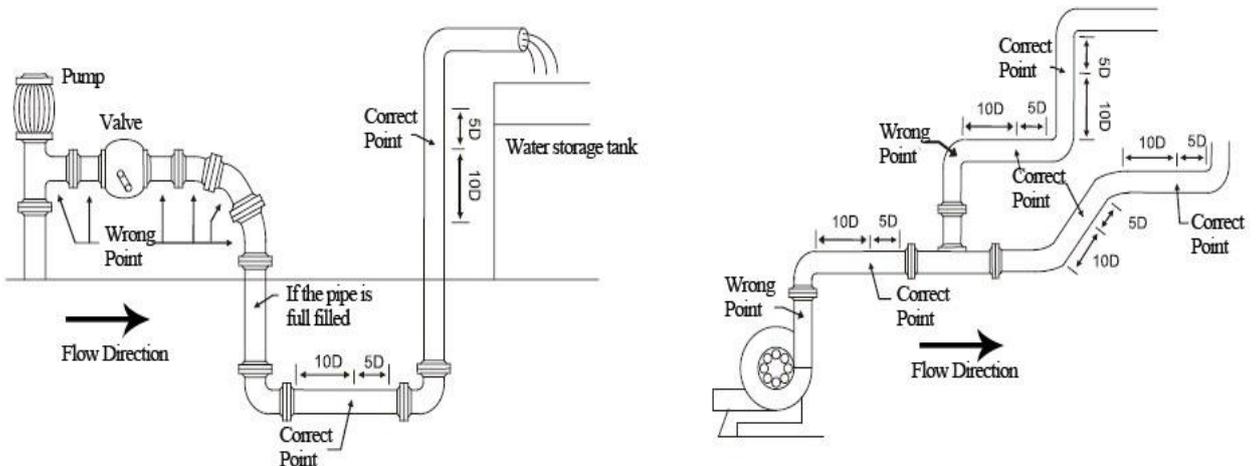
There cannot be obvious shaking on the installation point, otherwise it needs to be tightened.

>> Steady flow

Steady 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°C

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

>> **Pressure**

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

Out of this range need customized.

>> **EMI (electromagnetic interference)**

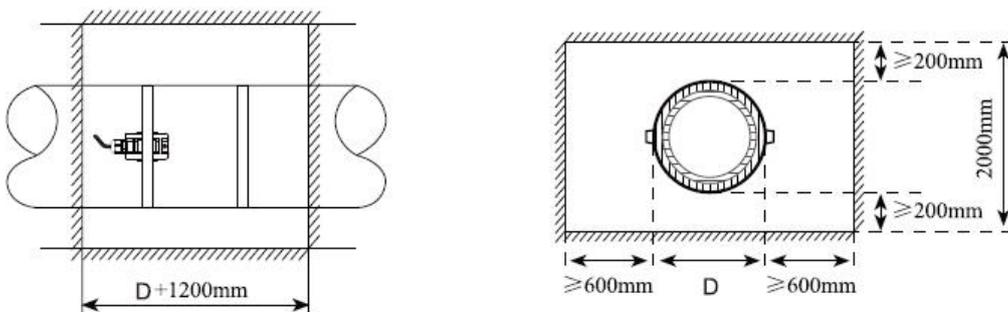
The ultrasonic flow meter, transducer and signal cable can be easily interfered by interference sources such as frequency changer, radio station, microwave station, GSM base station and high-tension cable. Please try to avoid these interference sources when choosing installation points.

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

7.2 Clamp on transducer Installation

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

1) Installation procedure

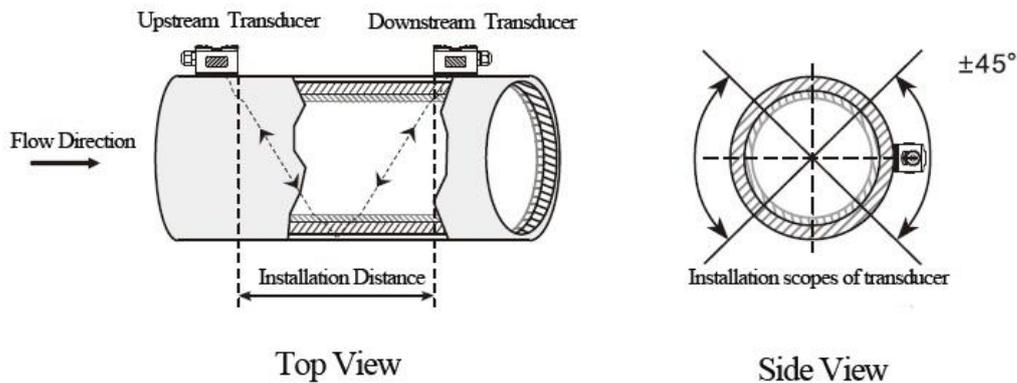
Select an installation method → Input the measuring parameters → Clean pipe surface → Install transducers → Check the installation

2) Select an installation method

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

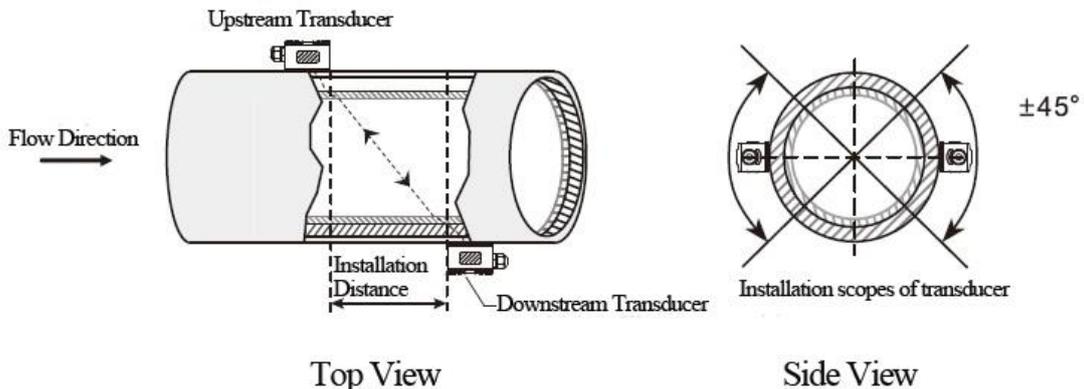
>> V method

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.



>> Z method

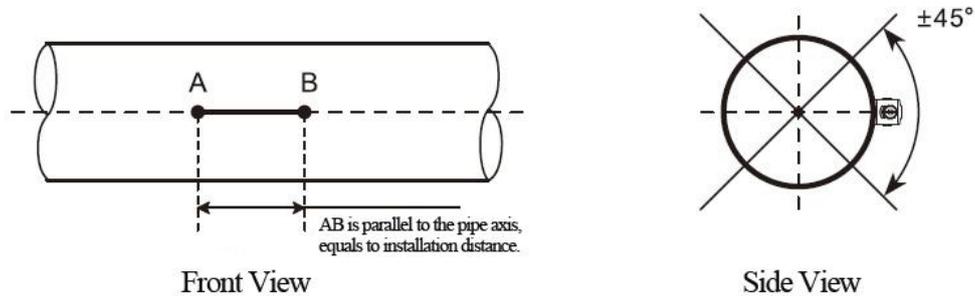
Z method should be priority selected for pipe sizes DN200 - DN6000. Also can be used when V method doesn't work well. Make sure the vertical distance of two transducers equals to the installation distance, and the two transducers are on the same axis surface.



3) Positioning installation points

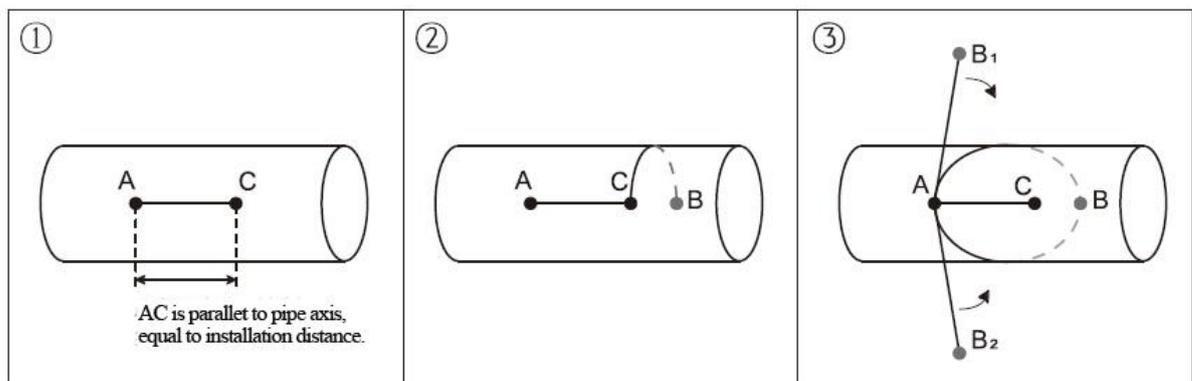
>> V method

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

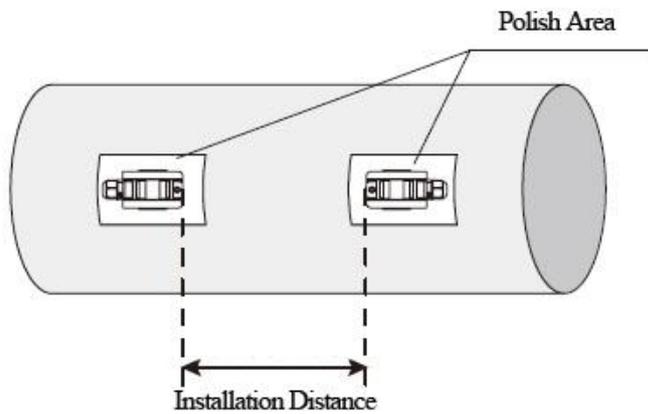
- ① Firstly according to the installation distance shown in converter, positioning two points A, C on the same side of pipeline. AC is parallel to pipe axis.
- ② Perpendicular to the pipe axis, opposite to point C, get Point B.
- ③ Check. Measure the length between A and B from both sides of the pipe, 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 points

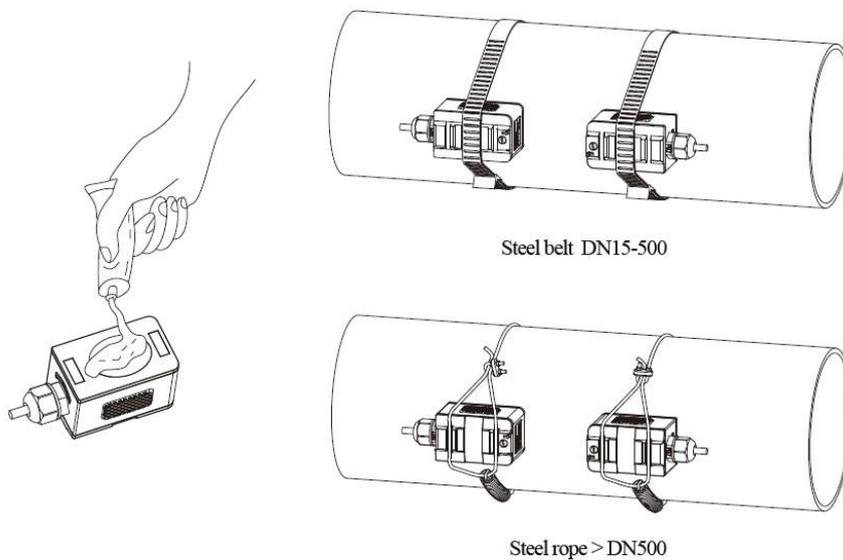
Paint, rust and anti-corrosive coating on installation points need to be cleaned. It's good to use a polishing machine to get the metal luster.

As shown below:



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) Check Installation

Please see details in Chapter 7.5

7.3 Insertion type 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

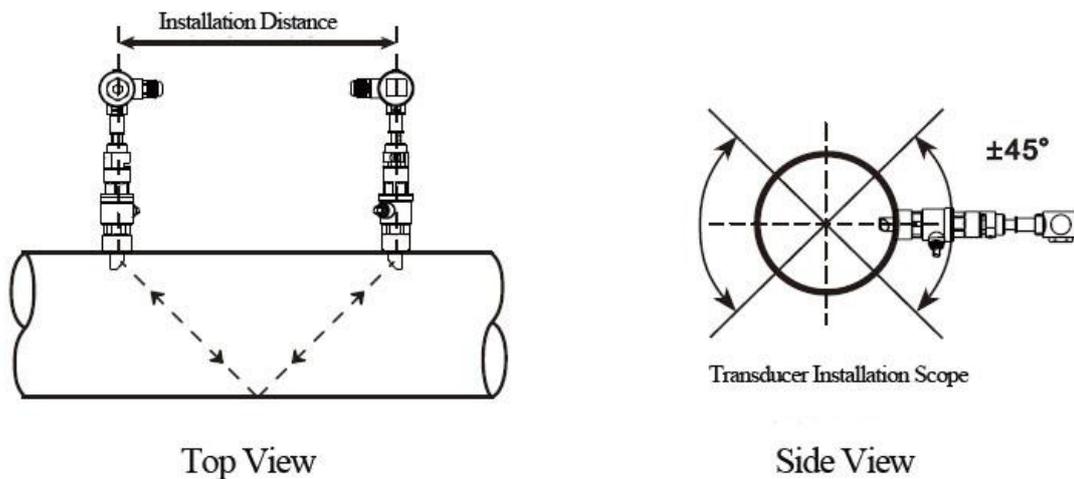
2) Select installation method and positioning installation points

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.

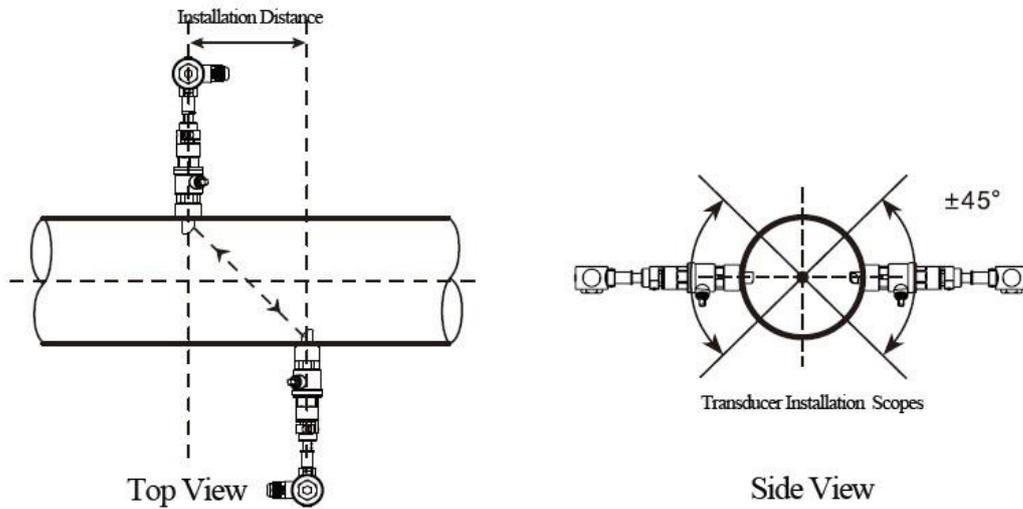
>> V method

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 must 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 must be opposite.

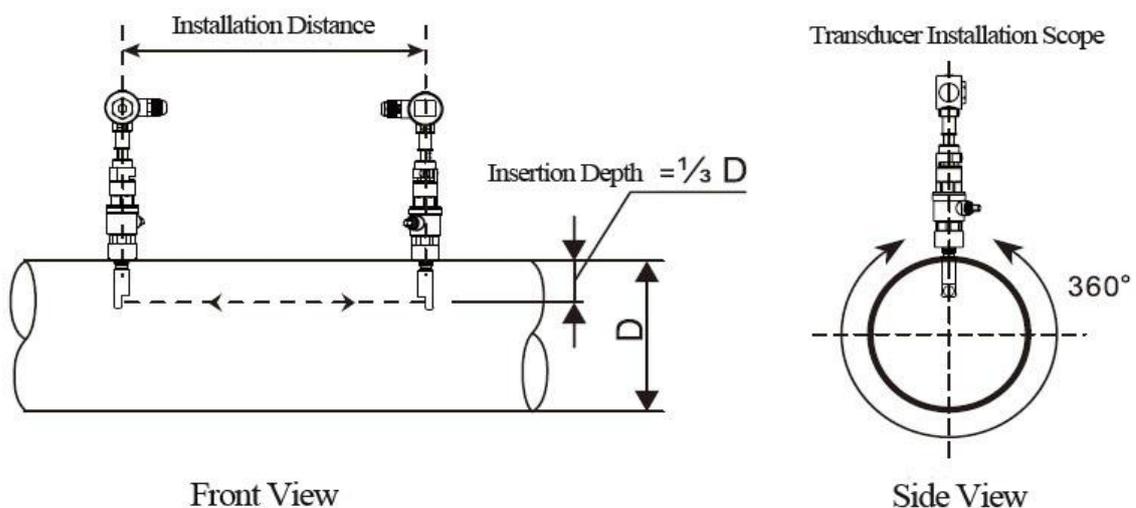


>> Parallel insertion

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:

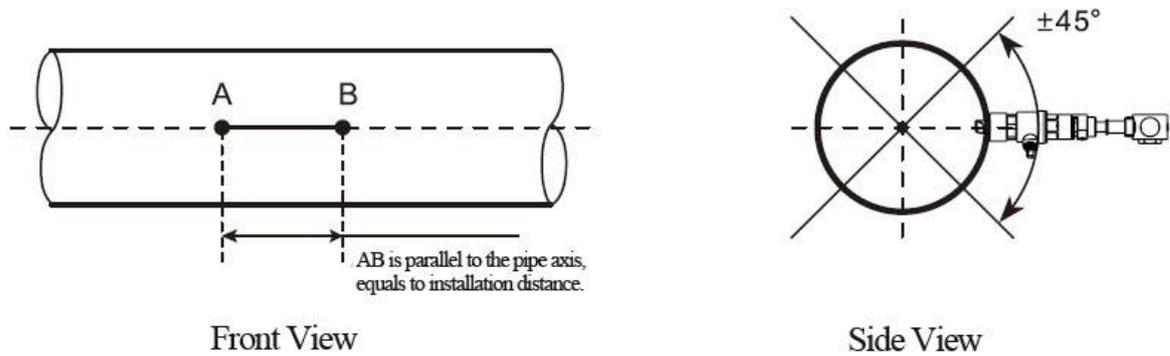
- Installation distance = Vertical distance of two transducers along the pipe axis direction
- Make sure two transducers are in the same horizontal line,
Insertion depth = $\frac{1}{3}$ inner diameter
- Users can set the distance between transducers by themselves. Recommend 300~500mm



3) Positioning installation points

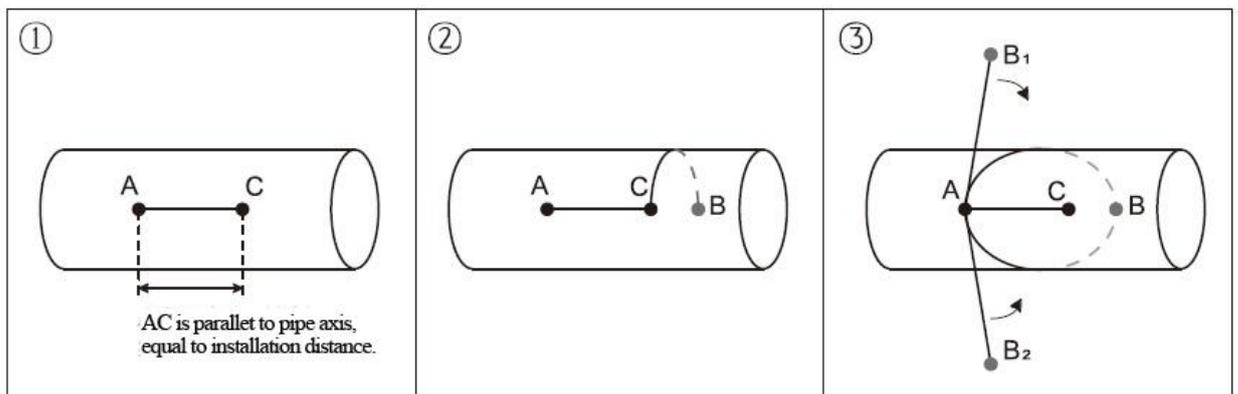
>> V method

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

- 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 pipeline.
- 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) 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:

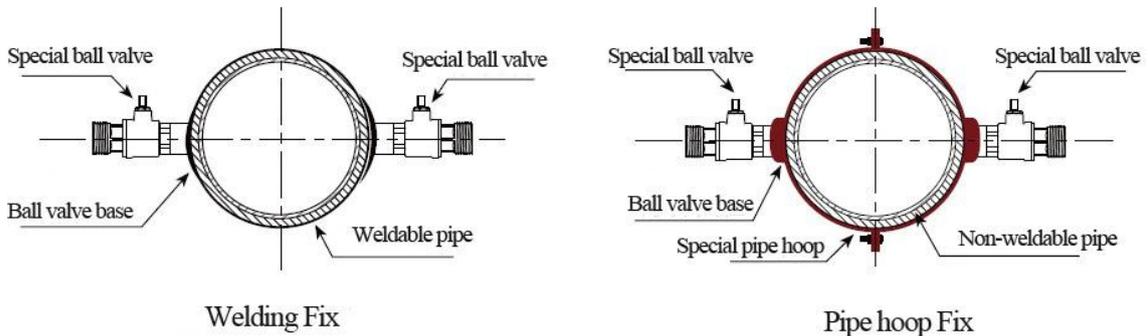
- Please take the PTFE sealing gasket out from the base before welding.
- Please clean the pipe surface around welding point before welding. Pay attention that there should not be any air hole during welding, which can avoid leaking. Welding strength must be ensured.
- Do not sputter welding slag on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

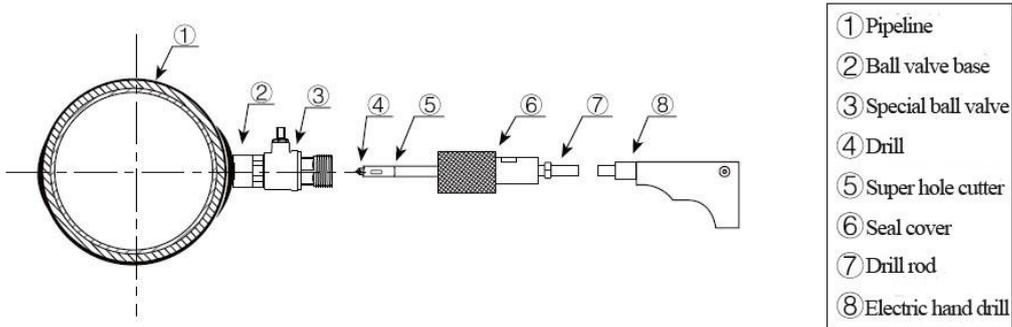
The hoop center should be overlapped with the transducer installation point. Please compress the sealing gasket tightly to avoid leaking.



5) Open hole

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.

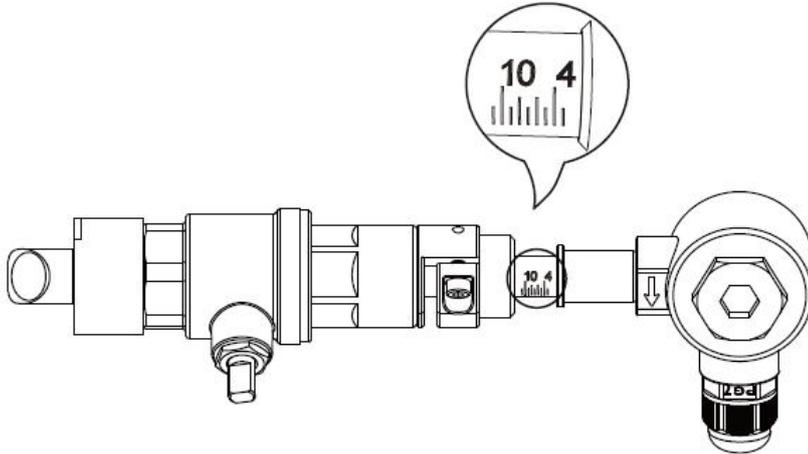


6) Install transducer and adjustment

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

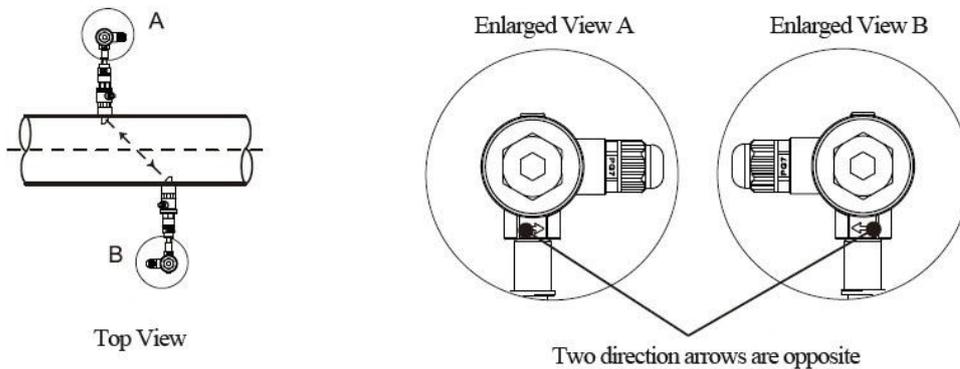
>> Insertion depth adjustment

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 “ $\rightarrow \leftarrow$ ” 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.

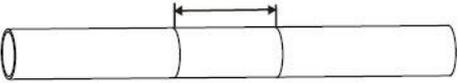
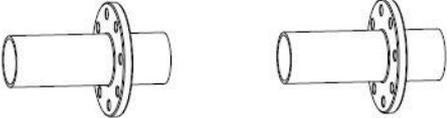
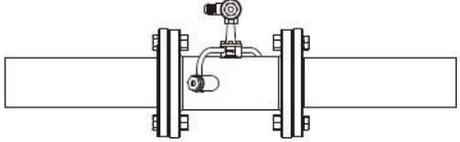
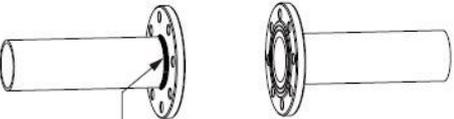
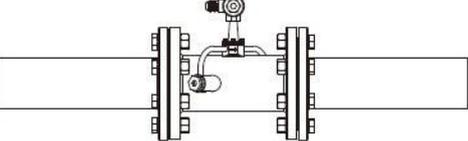
7) Check installation

Please see details in Chapter 7.5

7.4 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.

1) Installation method

<p>① Confirm installation size</p> <p>Length of transducer L + 2×thickness of seal gasket + 10mm</p> 	<p>② Cutting pipeline</p> 
<p>③ Equip companion flanges</p> 	<p>④ Positioning the flanges</p>  <p>Twist 3 screws and averagely positioning the flanges. Fixing with spot welding.</p>
<p>⑤ Welding the flanges</p>  <p>Remove the inline transducer and full-length welding flanges.</p>	<p>⑥ As the flanges cooled, put in the seal gasket and tighten the screws. Then connect to converter with signal cable</p> 

2) Check installation

Please see details in Chapter 7.5

7.5 Check Installation

The flow meter includes the detection ability. M90 is used for checking signal strength and quality. M91 is used for checking the ratio of measured and theoretical transmission time (transmission time ratio).

1) Check signal strength and quality

M90 is used for checking the signal strength and signal quality(Q value) of upstream and downstream transducers.

Signal strength is represented by numbers 00.0 ~ 99.9, 00.0 means no signal and 99.0 means maximum signal. Generally, the flow meter can work properly when signal strength is > 60.0

Signal quality (Q value) is represented by numbers 00 ~ 99. 00 means signal is worst and 99 means signal is best. The flow meter can work properly when Q > 60.

During the installation, please adjust the transducer to make the signal strength and signal quality the larger the better. This will ensure the flow meter long term stable operation and lead to accurate measurement.

Signal strength and Q value	Installation Judgement
< 60	Can not work
60~75	Bad
75~80	Good
>80	Excellent

2) Check transmission time ratio

M91 is used for displaying transmission time ratio. It is a percentage ratio between theoretical transmission time and measured transmission time. It shows the relation between setting parameters and actual transducer installation distance. This ratio should be between 97% ~ 103%. If not in the range of 97%~103%, it means that the parameters and transducer installation distance are inconsistent. Please check separately.

8. Finish Installation

- 1) Commonly used menus. M00 or M02 is for meter reading. M30~M33 is for unit selection. M40 is for selecting damping factor, generally 5~10 sec. M60 is for correcting time and date. M26 is for curing parameters.
- 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.