



SCL-76 Ultrasonic Flowmeter
Installation & User Guide

Huizhong Instrumentation Co., Ltd.

Dear Users and Friends,

Thank you for your choice of our company's ultrasonic flow measuring meters. Huizhong Instrumentation Co., Ltd. is currently China's R & D and manufacture base of series ultrasonic heat meters, water meters and flowmeters and related systems. It is also a new and high-tech and software enterprise of Hebei Province.

Huizhong owns all the proprietary intellectual property of all the products and it has always been in the leading edge of ultrasonic flow measuring field. Huizhong has also participated in industry/national standards, such as "Ultrasonic Flowmeter for Water Supply and Drainage Application (operating on the principle of propagation velocity difference)", "Regulations on Calibration of Ultrasonic Flowmeter", "Heat Meter" and "Drinking Cold Water and Hot Water Meter".

In 2008, Huizhong participated in the research of "Flow Sensor and System for Industrial Process Control"—the 863 Program assigned by the Ministry of Science and Technology, which has contributed to the independent R & D and industrialization of advanced sensors in China.

Incessant technical innovation lays a solid foundation which enables the company's products to maintain all along technologically a leading position and win the acclaim of numerous users both at home and abroad for their leading technology and superior quality. Among them, the series ultrasonic flowmeters and water meters have been sold in batch quantities to European, African, Australian, North American and South Asian countries and regions, and the products are well accepted by users.

Huizhong will innovate the ultrasonic flow measuring technology, to satisfy needs of users with world-class products and services, and make contributions to the development of global water and energy conservation course.

Quality Assurance:

The following are product's Standards and Certificates:

- China Metrology Certification Hebei Province No.: 02000127
- Designed and manufactured in conformity to the Professional Standard of P.R.C. for Urban Construction CJ/T 3063-1997, 《Ultrasonic Flow Meter for Water Supply & Drainage》
- The ex-factory calibration is made in conformity to the National Metrological Calibration
- Regulation of PRC JJG1030-2007, 《Ultrasonic flow meter》
- If the heat integrating function is available, then the meter should be designed and manufactured in conformity to the Professional Standard of P.R.C. for Urban Construction CJ128-2007, 《Heat meter》
- If the heat integrating function is available, then the ex-factory calibration is made to conform with the National Metrological Calibration Regulation of PRC JJG225-2001 《Verification Regulation of Heat energy meter》

Enterprise's certificates:

- Quality Standard System GB/T 19001-2008/ISO9001:2008
- Environment Management System GB/T 24001-2004/ISO14001:2004
- Measurement Management System GB/T 19022-2003/ISO10012:2003

Important Tips:

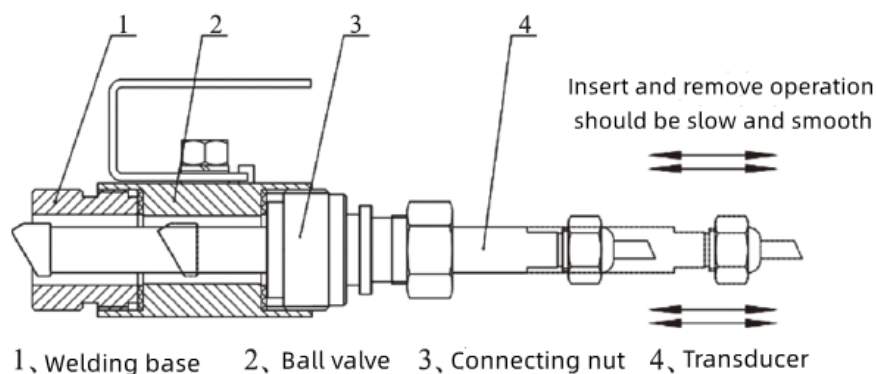
- Please do read the *Installation & User Guide* carefully prior to the use of the meter.
- Please keep this instruction manual for reference whenever necessary.
- Please operate the meter strictly in accordance with the instructions. Huizhong bears no responsibility for any consequence resulted from user's failure to follow the directives.
- All the diagrams shown in this instruction manual are illustrated instructions for operation, and do not serve as a basis for meter inspection. If there exists in the instruction manual any data that is inconsistent with that of the meter for use, take the meter actually used as the criterion, or consult with our company.
- The meter has been subjected to fine calibration before delivery. Huizhong bears no responsibility for any damage resulted from arbitrary disassemble of the meter by user.
- If the meter doesn't work and need to be repaired or maintained, please contact us or our authorized agencies.

Shockproof requirements:

Warning:

In the process of disassembly and installation of the insertion transducer, the collision and vibration caused by pipeline pressure or other external forces are easy to cause damage to the transducer.

The transducer should be inserted into or taken out of the pipeline slow and smooth.



Indicative icons

Before using, please know the meaning of icons in the Instruction.



Warning—situation that users or others may get hurt.



Caution—situation that will damage the meter or other equipment.



Please note—Annotation, Usage Tips and Additional Information.



Caution!

Please proceed with your meter installation and operation strictly in accordance with the instructions for a avoiding the loss of your interest.

Version No.: Ver 1.21

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Safety Warning

Please proceed with following precautions and use the meter correctly for avoiding economic loss, personal injury and death.

1. The meter is a precise measuring instrument which should be operated by specialized personnel.
2. About batter:
 - The battery is non-rechargeable. Never short circuit or retrofit it without permission.
 - Never allow battery to get overheated or soldered up.
 - Keep battery away from flame.
 - Protect battery against strong physical impact.
 - The battery has undergone special treatment. Never use any battery of the same type of replacement.
 - When battery power is low, replace it in time. Otherwise, meter-measured data may get lost. The battery must be replaced by trained personnel or by Huizhong, or sent the battery back to Huizhong.
 - The replaced battery should have its electronic contracts insulated using adhesive tape for avoiding fire or explosion hazard caused by their contact with other metallic objects or battery.
 - The used battery should be treated by environmental protection, and sent to the special recycling waste battery rubbish bins, garbage stations, recycling stations, etc.
 - If the battery leaks, changes color, distorts, smokes, or gives off an odor, take it out immediately. Pay attention to avoid burning during operation.
 - If the battery leakage contacts your eyes, skin or clothes, lose no time to wash them with plenty of fresh water (Do not try to rub your affected part) and immediately seek medical advice.
3. Never change the length of transducer cable. Otherwise, the performance of the meter would be affected.

4. Keep any wires or cable of the meter away from heat source to avoid fire hazard or electric shock arising from deterioration of insulation layers due to deformation of cable under high temperature.
5. Be careful not to let your skin get scratched by any exposed threaded parts.
6. Do not use the meter under acidic, heavy salt or fog environment to avoid accelerated aging of meter's materials.
7. The meter is a precise unit. Take care and don't let it fall off or be subjected to knocking force.
8. Product storage temperature is between -25°C - 55°C , avoid corrosive gas or liquid, and avoid long-term direct sunlight on the display panel of the meter.

1. Description

- SCL-76 Ultrasonic flow meter is working on “Propagation velocity difference” principle and specially designed for urban water supply and industrial sites. It will promote the refined management of water distribution pipe network and meet the demands of reducing the pipeline’s leakage rate.
- Ultrasonic flow measurement technology with multi-channel design, suitable for complex water flow regime, small installation space without break the pipes or water cut-off, greatly reduce the cost of comprehensive management cost.
- Battery powered with lifetime over 10 years, suitable for all kinds of metering requirements without power supply.
- Lower starting flow rate, high accuracy class (class 0.5), bidirectional metering is possible.
- Multiple outputs transmission methods with GPRS/GSM, can form a monitoring system, with flow alarm function.
- Designed and manufactured in conformity to the Professional Standard of P.R.C. for Urban Construction CJ/T 3063-1997, 《Ultrasonic Flow Meter for Water Supply & Drainage》
- The ex-factory calibration is made in conformity to the National Metrological Calibration Regulation of PRC JJG1030-2007 《Ultrasonic flow meter》

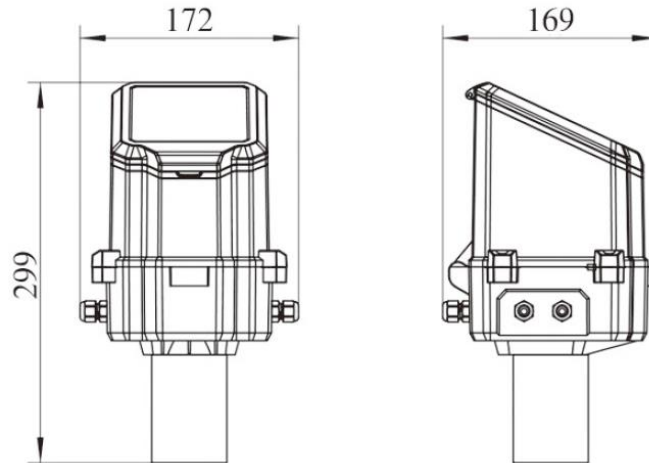
2. Main Unit Installation and Operating Instruction

2.1 Technical Parameters of Main Unit

Table 2-1 Technical Parameters

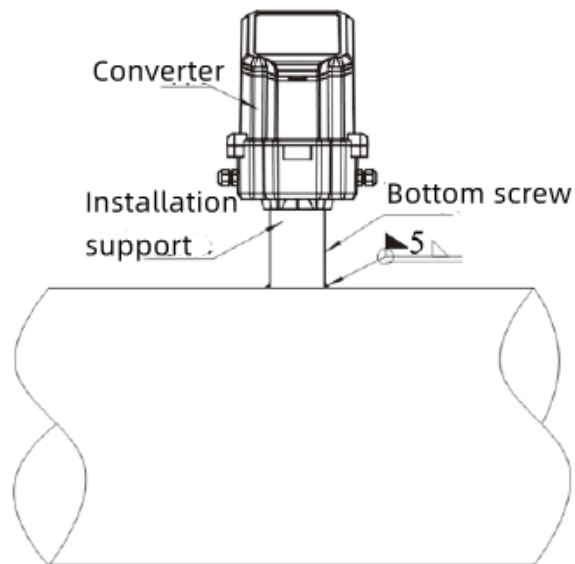
Item	Parameter	
Number of Sonic Channels	2/4 channels	
Accuracy Class	0.5	
Material of measured pipes	Pipe size: DN100~DN2000 Material: steel, cast iron, cement , plastic, etc.	
Measured fluid	Full pipe flow of water and other homogeneous fluid	
Range of flow velocity	0.25 m/s ~12.00m/s	
Installation type	Insertion-type	
Working environment	-10°C~+45°C, RH≤85% (If the range is exceeded, please specify on ordering)	
Protection Class	IP68	
Push button	Magnetic induction key	
Display	LCD, 10-digit +prompting characters , word height: 12mm	
Content of display	Instantaneous flowrate(m ³ /h); Cumulative flowrate(m ³); Cumulative effective running time(h); Date(y/m/d); Time : h/m/s; Signal strength; Battery quantity; The liquid flowing direction, ect.	
Display Range	Cumulative flowrate: -199999999 m ³ +199999999 m ³ Instantaneous flowrate: -9999999.9 m ³ /h~+9999999.9 m ³ /h	
Data Communication	Photoelectric Interface	Baud rate: 2400bps, protocol: EN 13757
	RS-485	Baud rate: 2400bps, 4800bps, 9600bps (Selectable), Default: 2400bps Transmission distance: ≤1200m Protocol: Huizhong , Modbus, EN13757(selectable), Default: Huizhong
	(4-20)mA + HART	Output: passive output, supply voltage: DC (18~30)V, electrical load: (250-500)Ω
	Notes: RS-485 and (4-20) mA + HART cannot be used at the same time	
Data Storage	Storage by EEPROM of cumulative flowrate and effective running time; Data can be saved for a period of 100 years after power failure; Automatic storage of historic monthly accumulated flowrate and effective running pf past 24 months.	
Measuring Cycle	1s	
Power Supply	3.6V lithium battery-powered (One battery can continuously work for over 10 years)	
Power consumption	<0.8 mW	

2.2 Main Unit Dimensions



Picture 2-1 Main unit dimensions (mm)

2.3 Main Unit Installation method



Picture 2-2 Installation diagram

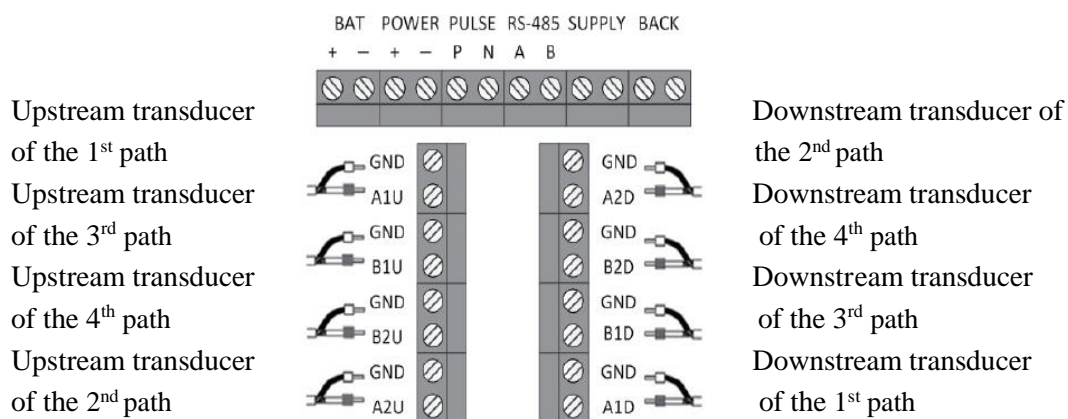
- **Installation Instructions**

1. Determine the exact location of the converter installation. (According to the pipe size and actual situation of installation sites)
2. Weld the “Installation support” on the pipe wall, and the “Installation support” should be firm and reliable.
3. Put the lower branch-pipe into the hole of base and tighten the screw on the top of base.
4. Install Transducer on the pipes.
5. Rotationally opening the upper cover of converter, you can see the circuit board in the wiring house.

6. Connect the cables of transducer to the right position in the circuit board through cable connectors.
 7. After connecting transducers' cables, tighten the cable connectors.
 8. After checking all the connections, seal the converter's internal wiring housing with 316 glue solution. The filling height shall be subject to the full coverage of all components on the circuit board.
 9. Rotate to close the upper cover of converter and tighten the bolts on both sides.
 10. The installation of main unit is finished.
- Note: If all the cables were connected to the wiring board and filled glue before delivery, please skip over the steps 4, 5, 6, 7, 8, 9.

2.4 Electrical Connection of the Main Unit Wiring Terminal

2.4.1 Electrical Connection of the Main Unit Wiring Terminal



Picture 2-3 Diagram of the main unit wiring terminal

- **Introduction of main unit wiring terminal:**

Terminal 1U should be connected to the upstream transducer of the 1st path;
 Terminal 1D should be connected to the downstream transducer of the 1st path ;
 Terminal 2U should be connected to the upstream transducer of the 2nd path;
 Terminal 2D should be connected to the downstream transducer of the 2nd path;
 Terminal 3U should be connected to the upstream transducer of the 3rd path;
 Terminal 3D should be connected to the downstream transducer of the 3rd path;
 Terminal 4U should be connected to the upstream transducer of the 4th path;
 Terminal 4D should be connected to the downstream transducer of the 4th path;
 Terminal BAT should be connected to battery, terminal+ to positive pole of battery, terminal – to negative pole of battery.
 Terminal RS-485 should be connected to data communication cables, If RS-485 port

is used, terminal A should be connected to RS-485 cable A, and terminal B should be connected to RS-485 cable B. If the 4-20mA+HART port is used, terminal A should be connected to the + of the 4-20mA cable, and terminal B should be connected to the - of the 4-20mA cable.

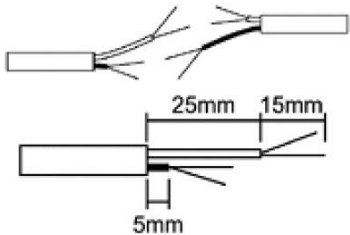
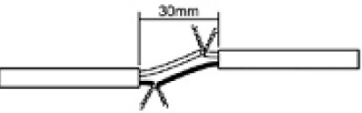


Note: Shielded wire (white line cap) connects to the terminal “GND”.

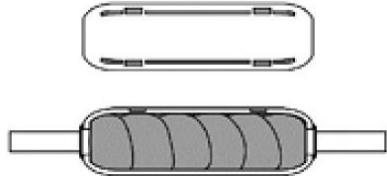
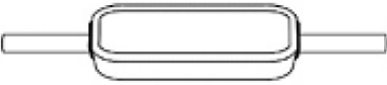
2.4.2 Communication Connection

2.4.2.1 Waterproof mastic connection

- The A+ and B- of the RS-485 data communication equipment are respectively connected to the white and green lines of the instrument communication lines, wrapped with waterproof mastic and compacted into the protective box, and covered with the protective box cover to complete the wiring.
- The “+” and “-” of the (4-20)mA + HART data communication equipment are respectively connected to the red and black lines of the instrument communication lines, wrapped with waterproof mastic and compacted into the protective box, and covered with the protective box cover to complete the wiring.
- For details, see Table 2-2.

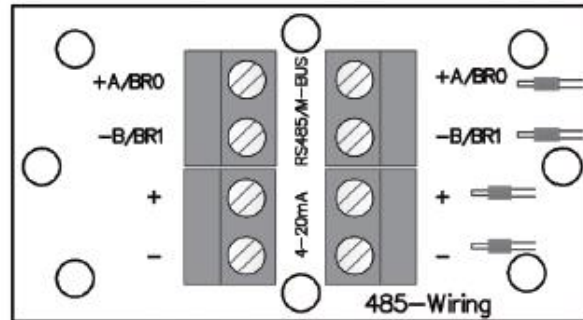
Table 2-2 Waterproof mastic connection

Step	Diagram	Introduction
1		Strip the wire as shown in the left figure. The long side is 25mm, the short side is 5mm, and the bare part is 15mm
2		Connect a long and short core wires and tighten them respectively. After tightening, the distance between the two jackets is about 30mm
3		Tighten the core wire again and bend the core as shown on the left figure
4		Use mastic to wrap the cable connector, make the mastic angle 45 ° from the cable axis, and semi-overlapping and continuous winding. The winding stretch is about 100%, and the winding length is about equal to the length of the protective box

5		Press the wrapped cable connector into the protective box
6		Close the protective cover, and the wiring is complete

2.4.2.2 Junction box connection

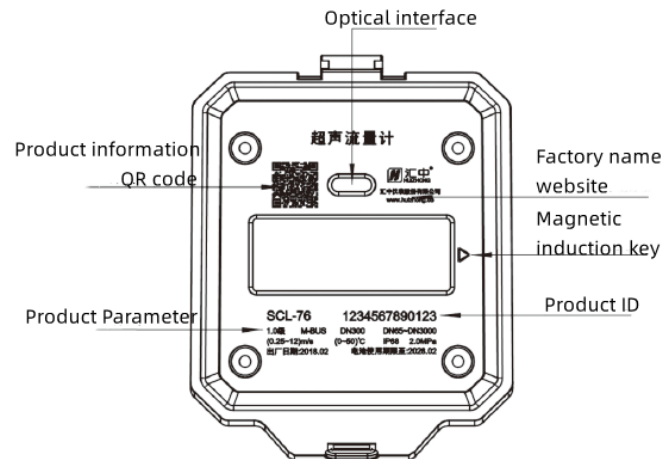
- A+ of the RS-485 interface of data communication device should be connected to terminal +A/BRO of connecting box, B- should be connected to terminal -B/BR1.
- +/- of the (4-20) mA + HART data communications device should be connected to terminal +/- of connecting box.
- For details, see Picture 2-4.



Picture 2-4 Diagram of junction box connection

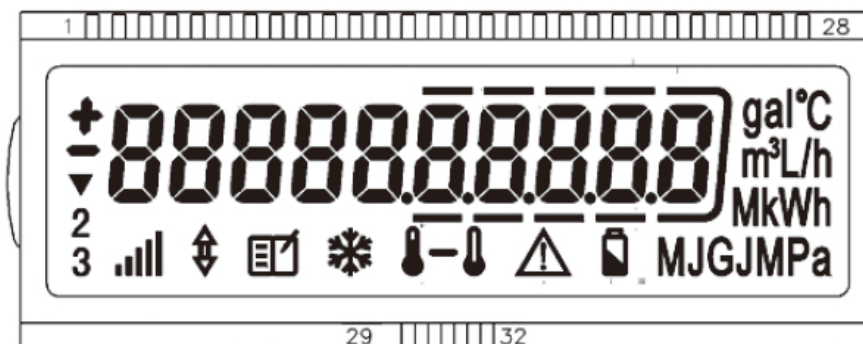
3. Operating instruction

3.1 Panel annotation



Picture 3-1 Panel annotation

3.2 Screen Display



Picture 3-2 LCD screen display

LCD displays by 10 digits, which will satisfy the demands of resolution and range for different clients. In order to facilitate the user to read, the decimal part adopts the frame explicit prompt; at the same time, the meter LCD can display a variety of information prompt symbols to ensure the stable and reliable operation of the system. The meanings of symbols are as followed:

Table 3-1 Symbol Meanings

Symbol	Meaning	Symbol	Meaning
	+/- volume (for dual direction only)		Valid button operation
	Water Temperature		Working status of wireless communication
	Unusual flow		Low Battery
MPa	Pressure unit (for pressure measurement only)	m³L/h	Flowrate unit
°C	Temperature unit		Value display
	Wireless communication receiving and sending mark		

Note:

1.It requires Infrared portable device (the device needs separately purchase) to have access to meter with optical interface.









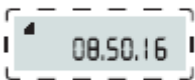





2.The meter applies magnetic induction button operations by vertically place magnetic bar near the button, and “▼” on LCD display indicates the operation is valid.

3. “⚠” on LCD display indicates that there is no water in pipe, or large on bubble content, the cumulative effective operating time would not be accumulated.

When the cumulative flowrate exceeds 199999999m³, the display value would start from 0 again.

3.3 Operation & Display content

The default main screen of one-way measuring meter is positive cumulative flowrate. The default screens of bidirectional measuring meter are positive cumulative flowrate and negative cumulative flowrate, two kind of screen are displayed alternately. When operating, get the magnetic bar vertically close to the Magnetic induction key and the measuring data of meter will be circularly displayed. According to the types of meters, the cyclic display contents are different, as shown in the picture 3-3:

One-way measuring meter		Bidirectional measuring meter	
Main display screen		Main display screen	
Cumulative flowrate		Positive cumulative flowrate	
Instantaneous flowrate		Negative cumulative flowrate	
Cumulative effective running time		Instantaneous flowrate	
Date (Y/M/D)		Positive cumulative effective running time	
Time (H/M/S)		Negative cumulative effective running time	
Software Version		Date (Y/M/D)	
		Time (H/M/S)	
		Software Version	

Picture 3-3 Cyclic display content



Attention:

When enter into other display screens without any operation beyond 10 minutes, automatically go back to the main display screen of meter. The main display screen can be set with special tools.

3.4 HART Communication

The meter supports HART communication protocol version 7.5.

The contents and units of dynamic variables and device variables see Table 3-2 and Table 3-3.

Table 3-2

Dynamic variable	The corresponding device variable code	content	unit
PV	0	Instantaneous flowrate	m ³ /h or L/s
SV	1	Positive cumulative flowrate	m ³
TV	2	Negative cumulative flowrate	m ³
QV	3	Positive cumulative effective running time	hour

Table 3-3

Device variable code	content	unit
0	Instantaneous flowrate	m ³ /h or L/s
1	Positive cumulative flowrate	m ³
2	Negative cumulative flowrate	m ³
3	Positive cumulative effective running time	hour
4	Negative cumulative effective running time	hour
5	Reserve	
6	Reserve	

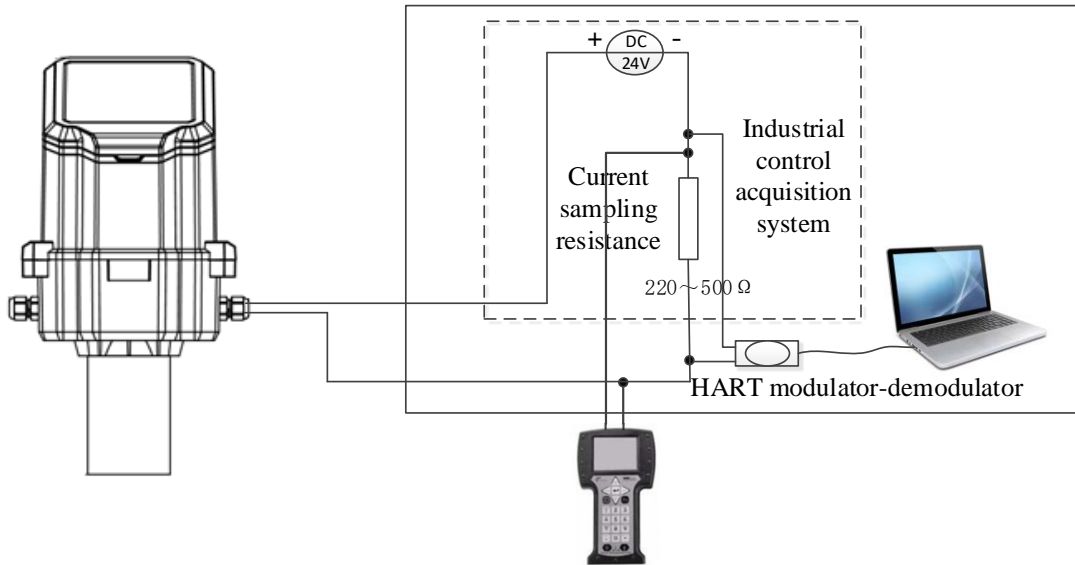
The default parameters of the instrument before delivery see Table 3-4.

Table 3-4

Manufacturer name	Huizhong Instrumentation Co., Ltd.
Device version	1
Manufacturer ID	24728(6098 Hex)
Device type code	58067(E2D3 Hex)

HART version	7.5
Signal type	4~20mA
Number of device variables	5
Number of dynamic variables	4
short address	0
Device ID	The first digit is fixed as 0, and the last five digits are the same as the last five digits of instrument factory number
Is dynamic variable mapping supported?	No
Is working mode conversion supported?	No
Is burst mode supported?	No
Is write protection supported?	No

HART communication wiring see Figure 3-4.



Picture 3-4 HART communication wiring

4. Transducer Installation and Operation Instruction

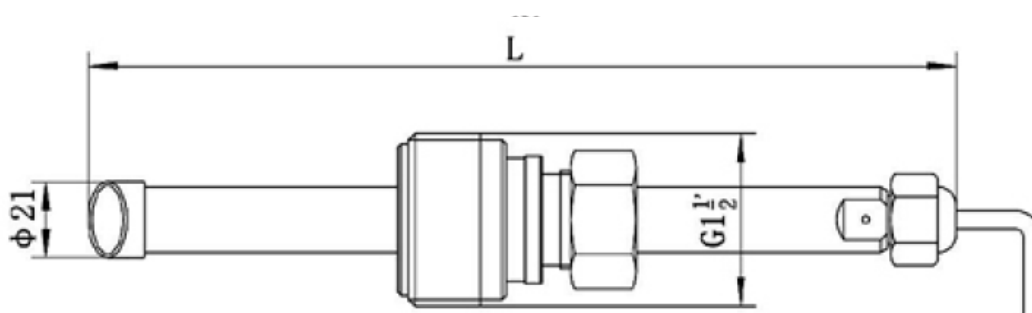
4.1 Technical Parameters of Transducer

Table 4-1 Technical Parameters of Transducer

Item	Parameter
Material	304(Stainless steel)

Range of working pressure		$\leq 2\text{MPa}$
Measured liquid temperature		Normal temperature: $0^{\circ}\text{C}\sim 50^{\circ}\text{C}$ High temperature: $0^{\circ}\text{C}\sim 130^{\circ}\text{C}$
Working environment temperature		$-40^{\circ}\text{C}\sim +70^{\circ}\text{C}$
Weight (Pair)	Suitable for the transducer with pipe size from DN100 to DN300	1.50kg (include standard cables)
	Suitable for the transducer with pipe size larger than DN300	2.28kg (include standard cables)
Protection class		IP68

4.2 Transducer Dimensions



Picture 4-1 Insertion-type transducer

Table 4-2 Thickness range of pipe wall for insertion-type transducer

Type	L	Pipe wall thickness (mm)
Standard	240	≤ 30
Extended I	280	< 70
Extended II	320	< 110
Extended III	360	< 150

Note: The thickness of pipe wall includes the thickness of liner and scale.

4.3 Installation of Transducer

4.3.1 Installation position of Transducer

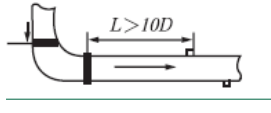
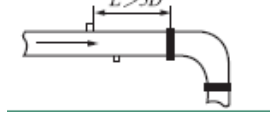
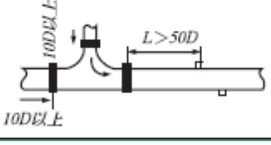
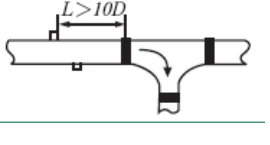
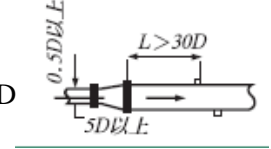
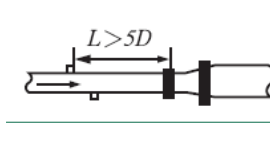
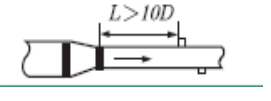
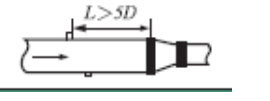
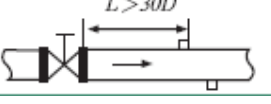
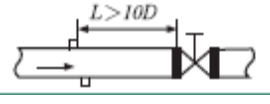
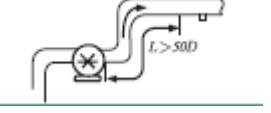
➤ Straight pipe section requirements

The installation position of transducer and condition of measured pipe has great effect on the measuring accuracy. Therefore, for the transducer installation position, the following conditions should be met:

(1) Straight pipe section is larger than 10D on the upstream side, 5D on the downstream side. In case of the presence of any pipe fittings, such as reducer, expansion joint or bend, a proper transducer installation position should be determined based on Table 4-3.

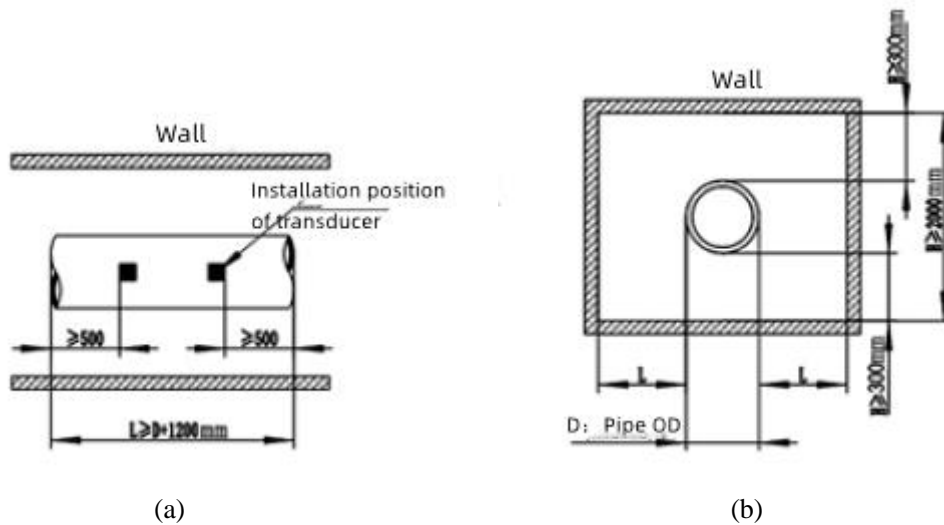
(2) Within the range of 30D on the upstream side, make sure there is no pipe flow disturbing objects like pump, valve, restriction orifice. (See Table 4-3)

Table 4-3 Length of shortest straight pipe section

Resistance part	Upstream side	Downstream side
90°C bend	Above 10D 	
T-shaped bend	Above 10D 	
Expansion joint	Above 0.5D 	
Reducer		
Valve		
Pump		

Note: D is the "Pipe inner Diameter".

(3) Enough space is required for the installation of transducer, shown as Picture 4-2. The size of cement pipe $L > 1500\text{mm}$, other pipes $L > 800\text{mm}$.

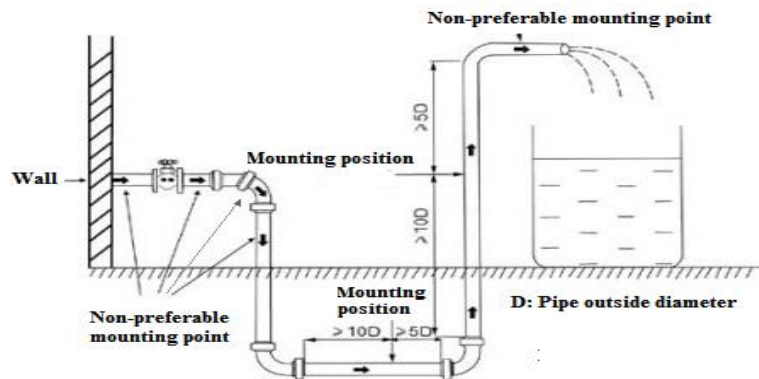


Picture 4-2 Installation space of transducer

➤ Recommended installation position (Shown as Picture 4-3)

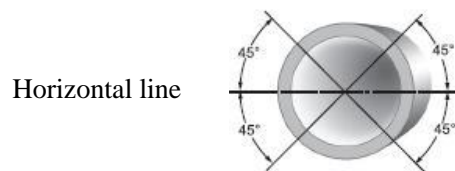
(1) The measuring point should be preferably selected on an upright pipe with upward or inclined flow, followed by horizontal pipe. Avoid liquid downward (or oblique downward) flow pipe, to prevent the pipe not fully filled with fluid.

(2) Never install any transducers at the highest flowing point of pipes to avoid abnormally measuring due to air bubbles accumulation in pipe.



Picture 4-3 Transducer Installation Position

(3) On a horizontal pipe, the transducer installation position should be within $\pm 45^\circ$ from the horizontal line, shown as Picture 4-4



Picture 4-4

(4) Never install transducer at the places where the pipe surface is uneven or near welded point. Moreover, the installed point needs to be ground for removal of dust, dirt and coating.









Attention:

- ① For the installation of the insertion-type transducer, the pipeline pressure should be less than 1MPa, otherwise the pressure needs to be reduced.
 - ② If the material of measured pipe can not be welded, a special tightening device is required for the installation of transducer. In addition, material of pipe and outer diameter should be indicated.
-

4.3.2 Installation of transducers

4.3.2.1 Installation tools


Table 4-4 Installation Tools

Tape	Marking Pen (Separate order)	Paper Tape	Teflon Tape	Thickness Meter (Separate order)	Handheld meter reading device
					

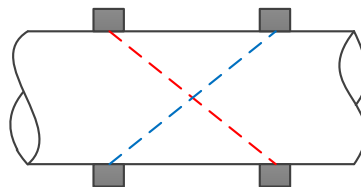
Note: Above object photos are for reference only.

4.3.2.2 Determination of parameters and Installation mode

(1) Outside diameter of pipe (Use a tape to measure)

 Attention: For a pipe with a protective coating on its outer wall, the pipe's actual OD should be measured with the coating removed.

- (2) Pipe wall thickness (Measure with a thickness meter)
- (3) Pipe wall material
- (4) Pipe liner thickness (Thickness of scale deposit included)
- (5) Pipe liner material
- (6) Installed mode: Z mode



Picture.4-5 Z Mode

In Z mode, the attenuation of signal is smaller because the signal propagates directly between a pair of transducers without reflection.

Tablet 4-5 Pipe diameters under different channels

Pipe size		Double-channel	Four-channel
Weldable pipe	DN100≤DN≤DN2000	√	√
Plastic pipe	DN100≤DN<DN500	√	x
Cast iron pipe	DN500≤DN≤DN2000		√
Cement pipe	DN100≤DN<DN200	x	x
	DN200≤DN<DN500	√	x
	DN500≤DN≤DN1300	√	√
	DN1300<DN≤DN2000	x	x

Note: √- ok, x- impossible

(7) Mounting distance

- With the help of matched handheld meter reading device, select options of pipe inside diameter (ID) by keys in the main menu, shown as Picture 4-6:

Block coefficient	Overall coefficient
Clear operation	Pipe diameter
Data reading reading	Meter's parameter
Inside diameter	Calibration status

Picture 4-6

- Press key **【5】** to confirm and handheld device reads the current inside diameter of measured pipe. If reads successfully, display the inside diameter size, otherwise, the meter shows reading data failed, shown as Picture 4-7, 4-8:

Inside diameter (mm): **150.00**

Picture 4-7 Read successfully

Failed to read!
Infrared communication error!
Confirm

Picture 4-8 Failed to read

- If reads successfully, press key **【5】** and enter into interface of parameters modify, shown as Picture 4-9. In this interface, you can modify the inside diameter of pipe. Use number keys **【4】** and **【6】** to switch the position of cursor. Use **【2】** or **【8】** to adjust the value.

Inside diameter (mm):
+00150.00

Picture 4-9

- After modification, pressing key【5】, installation distance of ultrasonic transducer will be displayed, shown as picture 4-10. Users can install the ultrasonic transducer based on the distance. Press key 【5】 again to confirm, then the handheld device will write the installation distance into meter.



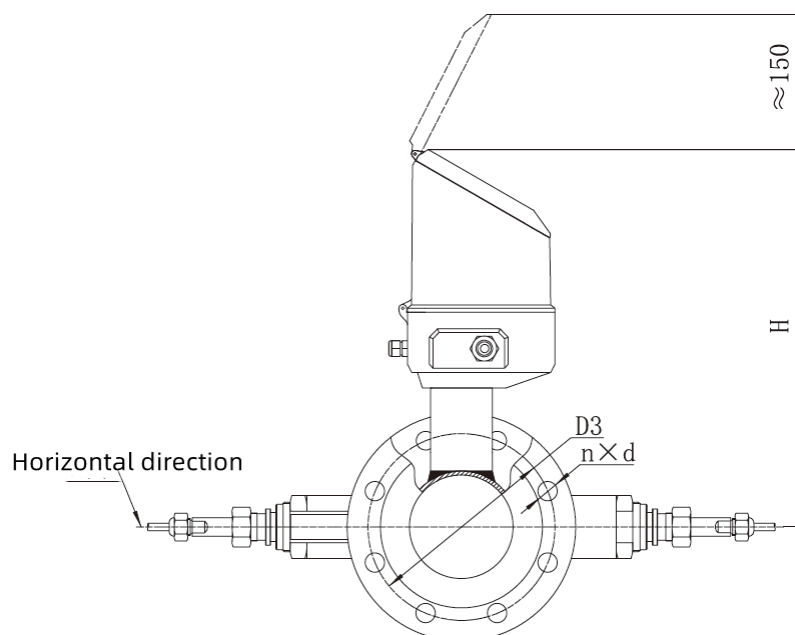
Picture 4-10

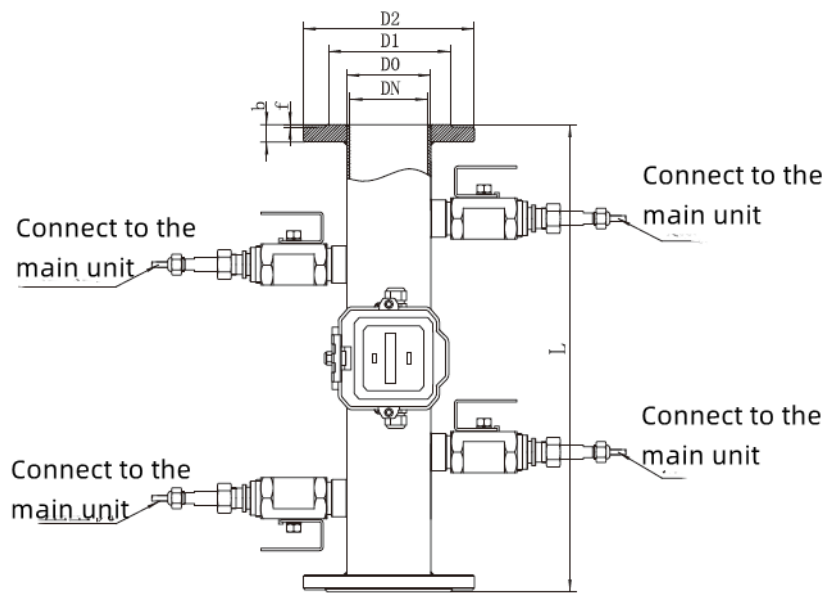


Attention:

In order to make communication steady, should aim the infrared head of handheld device to the photoelectric interface of meter.

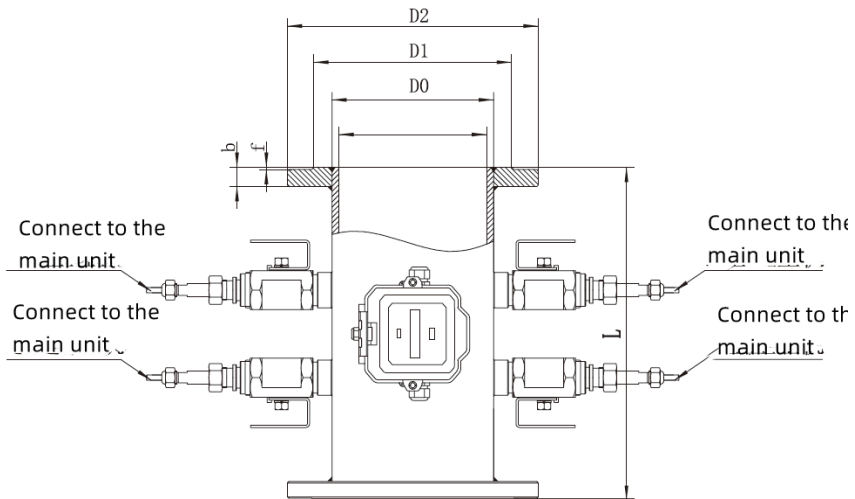
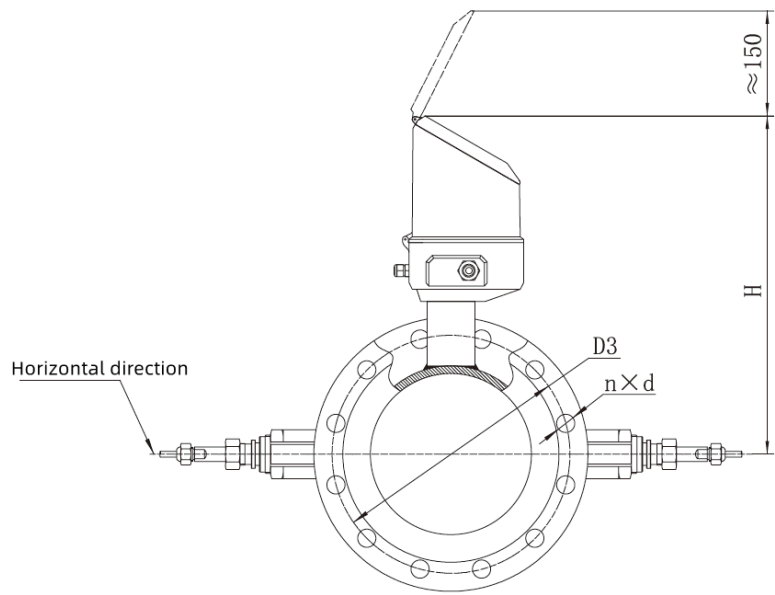
(8) The insertion-type transducer can be mounted directly on the pipe or can be fitted with a dedicated section for installation, suitable for pipe sizes DN100-DN1000. (See Figure (a) for the installation mode and size of the special pipe section of 2-channel DN100-DN150. See Figure (b) for the installation mode and size of the DN200-DN1000 special pipe section. See Figure (c) for the installation mode and size of the special pipe section of 4-channel DN100-DN150. See Figure (d) for the installation mode and size of the special pipe section of 4-channel DN200-DN300. See Figure (e) for the installation mode and size of the special pipe section of 4-channel DN350-DN1000.)





Nominal Diameter	D2	D0	L	L1	Pressure MPa
DN100	$\Phi 220+0.5$	$\Phi 108$	650	≈ 566	1.0, 1.6
	$\Phi 235+0.5$				2.5
DN125	$\Phi 250+0.5$	$\Phi 133$	700	≈ 591	1.0, 1.6
	$\Phi 270+0.5$				2.5
DN150	$\Phi 285+0.5$	$\Phi 159$	700	≈ 677	1.0, 1.6
	$\Phi 300+0.5$				2.5

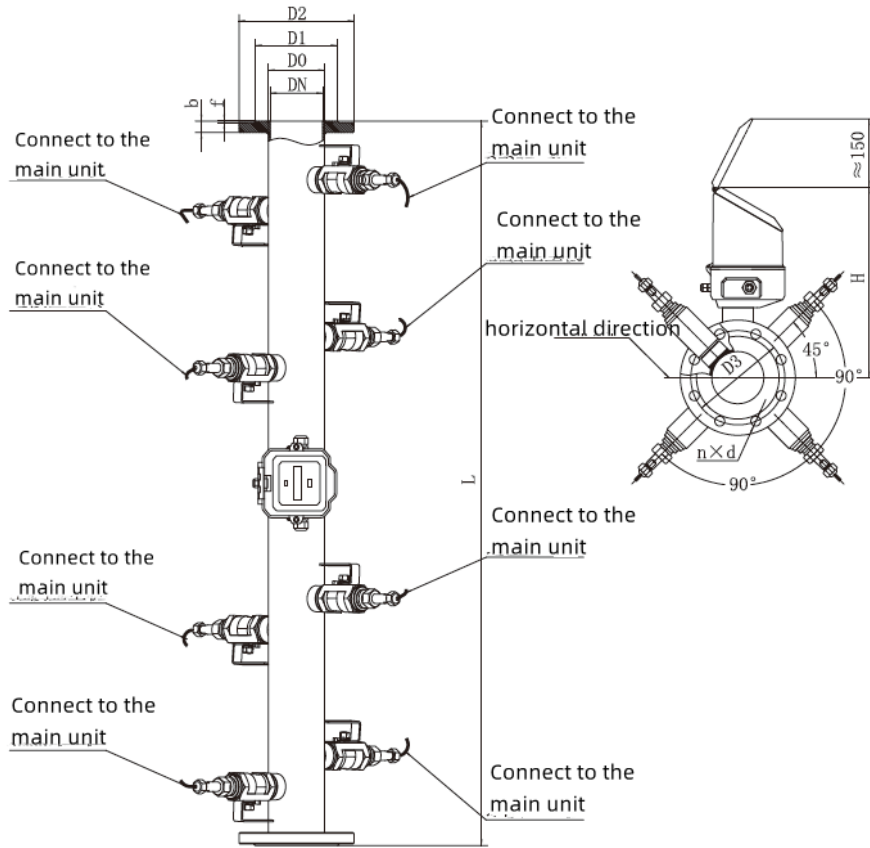
Figure (a) 2-channel DN100-DN150



Nominal Diameter	D2	D0	L	L1	L2	Pressure MPa
DN200	Φ340	Φ219	350	≈677	35	1.0, 1.6
	Φ360					2.5
DN250	Φ395	Φ273	400	≈731	50	1.0
	Φ405					1.6
	Φ425					2.5
DN300	Φ445	Φ325	450	≈783	50	1.0
	Φ460					1.6
	Φ485					2.5

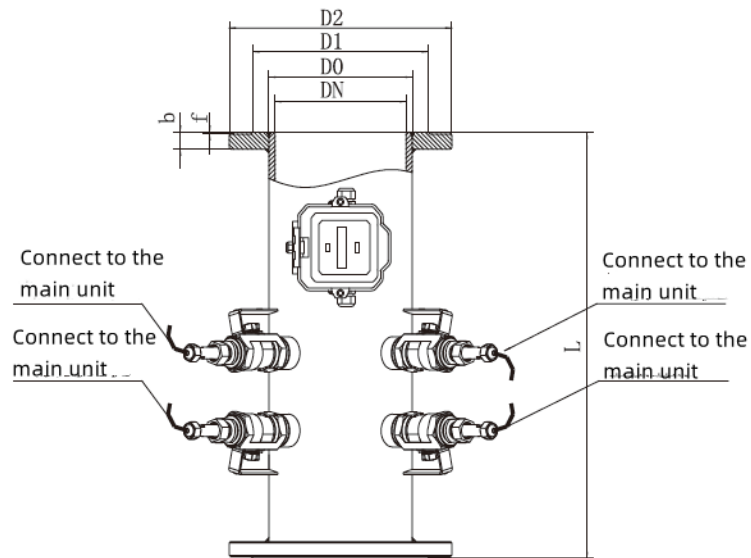
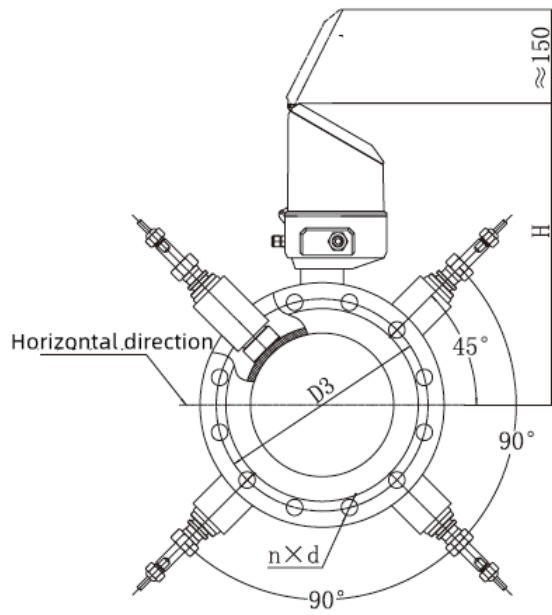
DN350	Φ505	Φ377	550	≈834	65	1.0
	Φ520					1.6
	Φ555					2.5
DN400	Φ565	Φ426	550	≈884	70	1.0
	Φ580					1.6
	Φ620					2.5
DN450	Φ615	Φ480	600	≈938	85	1.0
	Φ640					1.6
	Φ670					2.5
DN500	Φ670	Φ516	650	≈988	95	1.0
	Φ715					1.6
	Φ730	Φ520				2.5
DN600	Φ780	Φ716	700	≈1088	115	1.0
	Φ840					1.6
	Φ845	Φ720				2.5
DN700	Φ895	Φ716	800	≈1188	135	1.0
	Φ910					1.6
	Φ960	Φ720				2.5
DN800	Φ1015	Φ816	850	≈1288	140	1.0
	Φ1025					1.6
	Φ1085	Φ820				2.5
DN900	Φ1115	Φ916	950	≈1388	140	1.0
	Φ1125	Φ920				1.6
	Φ1185	Φ924				2.5
DN1000	Φ1230	Φ1016	1000	≈1498	140	1.0
	Φ1255	Φ1020				1.6
	Φ1320	Φ1028				2.5

Figure (b) 2-channel DN200-DN1000



DN	D0	D1	D2	D3	L	n	d	b	f	H	Pressure MPa
DN100	Φ108	Φ158	Φ220+0.5	Φ180+0.5	1450±0.5	8	Φ18	22±1	3	730	1.0
			Φ162	Φ235+0.5				Φ190+0.5			Φ22
		Φ188	Φ250+0.5	Φ210+0.5	Φ22		28±1	2.5			
DN125	Φ133	Φ188	Φ250+0.5	Φ210+0.5	1500±0.5	8	Φ18	22±1	3	380	1.0
			Φ270+0.5	Φ220+0.5				Φ22			28±1
		Φ212	Φ285+0.5	Φ240+0.5	Φ22		24±1	2.5			
DN150	Φ159	Φ212	Φ285+0.5	Φ240+0.5	1500±0.5	8	Φ22	24±1	3	395	1.0
			Φ218	Φ300+0.5				Φ250+0.5			Φ26
		Φ218	Φ300+0.5	Φ250+0.5	Φ26		30±1	2.5			

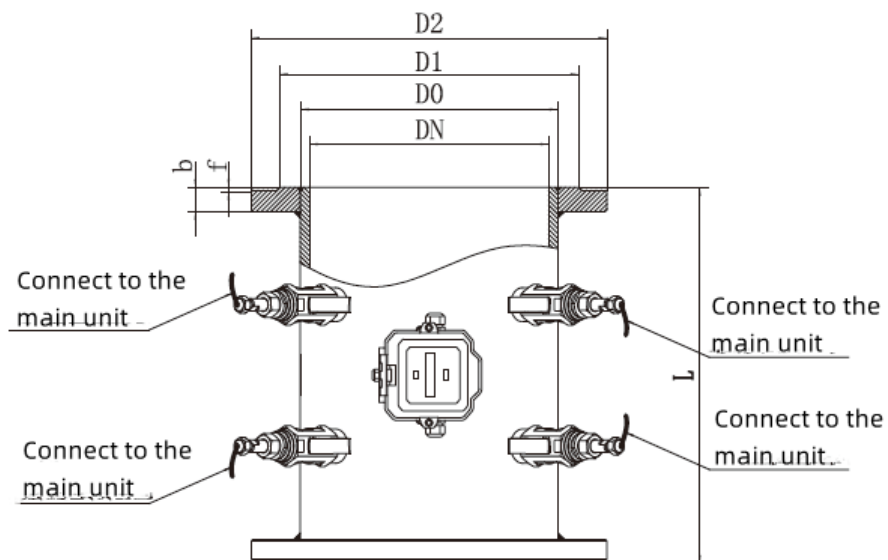
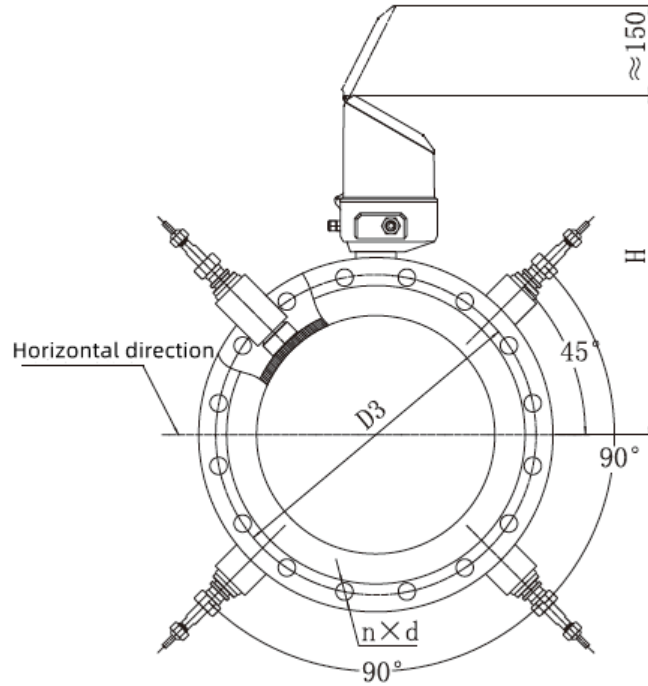
Figure (c) 4-channel DN100-DN150



DN	D0	D1	D2	D3	L	n	d	b	f	H	Pressure MPa
DN200	Φ219	Φ268	Φ340+0.5	Φ295+0.5	650±0.5	8	Φ22	22±1	3	420	1.0
			Φ278	Φ360+0.5	Φ310+0.5	12		26±1			1.6
		Φ320	Φ395+0.5	Φ350+0.5	700±0.5	12	Φ26	32±1			2.5
DN250	Φ273	Φ320	Φ395+0.5	Φ350+0.5	700±0.5	12	Φ22	26±1	3	450	1.0
			Φ405+0.5	Φ355+0.5				Φ26			29±1
		Φ335	Φ425+0.5	Φ370+0.5	Φ30	35±1	2.5				

DN300	Φ1325	Φ370	Φ445+0.8	Φ400+0.5	750±0.5	12	Φ22	26±1	4	480	1.0
		Φ378	Φ460+0.8	Φ410+0.5			Φ26	32±1			1.6
		Φ395	Φ485+0.8	Φ430+0.5	16	Φ30	38±1	2.5			

Figure (d) 4-channel DN200-DN300



DN	D0	D1	D2	D3	L	n	d	b	f	H	Pressure MPa
----	----	----	----	----	---	---	---	---	---	---	--------------

DN3 50	Φ377	Φ430	Φ505+0.5	Φ460+0.5	550± 0.5	16	Φ22	26±1	4	500	1.0
		Φ438	Φ520+0.5	Φ470+0.5			Φ26	30±1			1.6
		Φ450	Φ555+0.5	Φ490+0.5			Φ33	38±1			2.5
DN4 00	Φ426	Φ482	Φ565+0.5	Φ515+0.5	550± 0.5	16	Φ26	26±1	4	500	1.0
		Φ490	Φ580+0.5	Φ525+0.5			Φ30	32±1			1.6
		Φ505	Φ620+0.5	Φ550+0.5			Φ36	40±1			2.5
DN4 50	Φ480	Φ532	Φ615+0.5	Φ565+0.5	600± 0.5	20	Φ26	28±1	4	500	1.0
		Φ550	Φ640+0.5	Φ585+0.5			Φ30	40±1			1.6
		Φ555	Φ670+0.5	Φ600+0.5			Φ36	46±1			2.5
DN5 00	Φ516	Φ585	Φ670+0.5	Φ620+0.5	650± 0.5	20	Φ26	28±1	4	500	1.0
		Φ610	Φ715+0.5	Φ650+0.5			Φ33	44±1			1.6
	Φ520	Φ615	Φ730+0.5	Φ660+0.5			Φ36	48±1			2.5
DN6 00	Φ616	Φ685	Φ780+0.5	Φ725+0.5	700± 0.5	20	Φ30	34±1	5	500	1.0
		Φ725	Φ840+0.5	Φ770+0.5			Φ36	54±1			1.6
	Φ620	Φ720	Φ845+0.5				Φ39	58±1			2.5
DN7 00	Φ716	Φ800	Φ895+0.5	Φ840+0.5	800± 0.5	24	Φ30	35±1(3 4±1)	5	500	1.0
		Φ795	Φ910+0.5				Φ36	58±1(4 0±1)			1.6
	Φ720	Φ820	Φ960+0.5	Φ875+0.5			Φ42	60±1(5 0±1)			2.5
DN8 00	Φ816	Φ905	Φ1015+0. 5	Φ950+0.5	850± 0.5	24	Φ33	38±1(3 6±1)	5	500	1.0
		Φ900	Φ1025+0. 5				Φ39	62±1(4 2±1)			1.6
	Φ820	Φ930	Φ1085+0. 5	Φ990+0.5			Φ48	66±1(5 4±1)			2.5
DN9 00	Φ916	Φ100 5	Φ1115+0. 5	Φ1050+0. 5	950± 0.5	28	Φ33	38±1(3 8±1)	5	500	1.0

	Φ920	Φ100 0	Φ1125+0. 5				Φ39	64±1(4 4±1)			1.6
	Φ924	Φ103 0	Φ1185+0. 5	Φ1090+0. 5			Φ48	70±1(5 8±1)			2.5
DN1 000	Φ101 6	Φ111 0	Φ1230+0. 5	Φ1160+0. 5	1000 ±0.5	28	Φ33	44±1(3 8±1)	5	500	1.0
	Φ102 0	Φ111 5	Φ1255+0. 5	Φ1170+0. 5			Φ42	68±1(4 6±1)			1.6
	Φ102 8	Φ114 0	Φ1320+0. 5	Φ1210+0. 5			Φ56	74±1(6 2±1)			2.5

Figure (e) 4-channel DN350-DN1000

4.3.2.3 Marking off

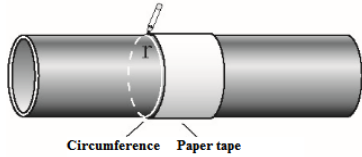
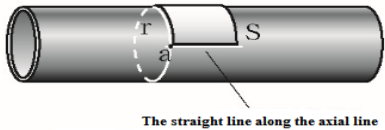
(1) According to the installation distance displayed by handheld device, mark the transducer installed line on pipe.


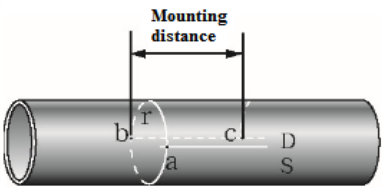
(2) Marking tools

A paper tape with a length longer than pipe perimeter (width about 200mm, printing paper is okay), mark pen and measuring tape (See Table 4-5).

(3) Marking method

Table 4-5 Marking Method

Z mode	
① Wrap the paper tape around the pipe one circuit. Make sure the two ends of the paper's overlapping part completely coincide with each other. Mark a circumferential line "r" of the perimeter from the starting point to edge.	
② Remove the paper tape. Fold the paper tape in two along the perimeter starting line to form a half perimeter. Then draw a line "S" which is perpendicular to and intersects the circumferential line at point "a". The point "a" is the mounting position of a transducer.	

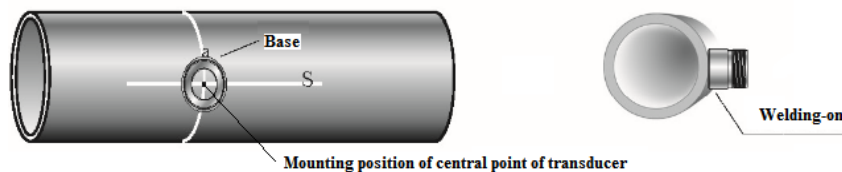
<p>③ Draw along the other edge of the paper tape a straight line “D” on pipe to intersect the circumferential line “r” at point “b”.</p>	
<p>④ Locate on the straight line “D” starting from point “b” the point “c” using a measuring tape according to the mounting distance displayed by conversion unit. The point “c” is the position for the mounting of another transducer (Z mounting mode)</p>	

4.3.2.4 Installation of insertion-type transducer

(1) Installation of base and valve

a. Weldable metal pipe

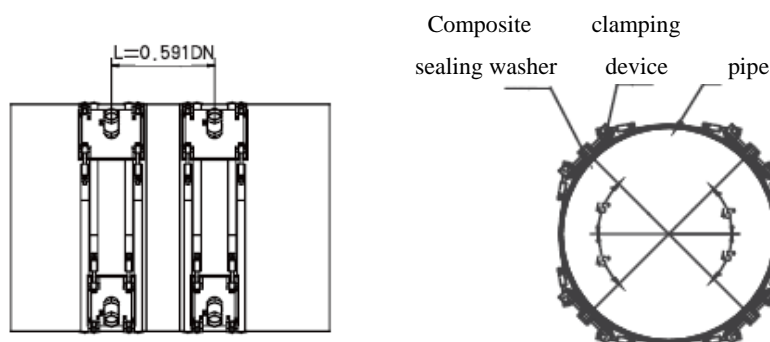
Weld the base provided by manufacturer onto the pipe. Make sure the cross line marked on the base coincides with the drawn one on the outer wall of pipe.



Picture 4-11

b. Non-weldable pipe

In case of the material of pipe is cast-iron (or non-metal material), the base can not be welded on it. Then a stainless-steel clamping device provided by manufacturer should be used for fixing the base onto the outer surface of the pipe. The size of clamping device depends on the pipe outside diameter.



Picture 4-12



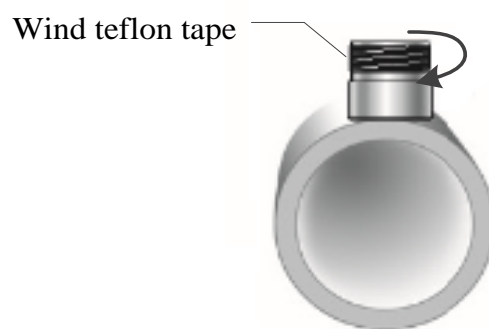
Attention:

① For welded base, make sure it is firmly connected and no weld defects, such as

inclusions and air cavities.

②When install the base with stainless steel clamping device, should put the specified sealing washer provided by Huizhong between base and pipe wall, then tighten the nut!

c. After installation of base, wrap the teflon tape clockwise around the base thread (See Picture. 4-13). Put the sealing lead-pad provided by Huizhong into the inner bottom of ball valve (See Picture. 4-14(b)) and screw ball valve on the base with spanner (See Picture. 4-15).



Picture 4-13

 Attention:

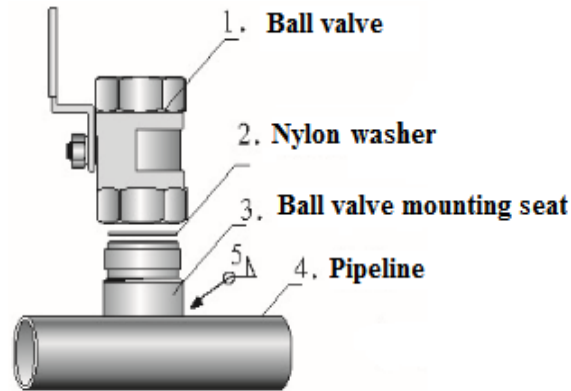
①Remember to wrap the teflon tape clockwise around the base thread, and screw ball valve on the base with spanner to avoid leaking of fluid after drilling.

②The connection threads at both ends of the ball valve are slightly different, shown as Picture 4-14. One end of the ball valve with hexagonal socket nut (see Picture. (b)) should be connected with base.



Picture 4-14 Connection Thread of Ball Valve

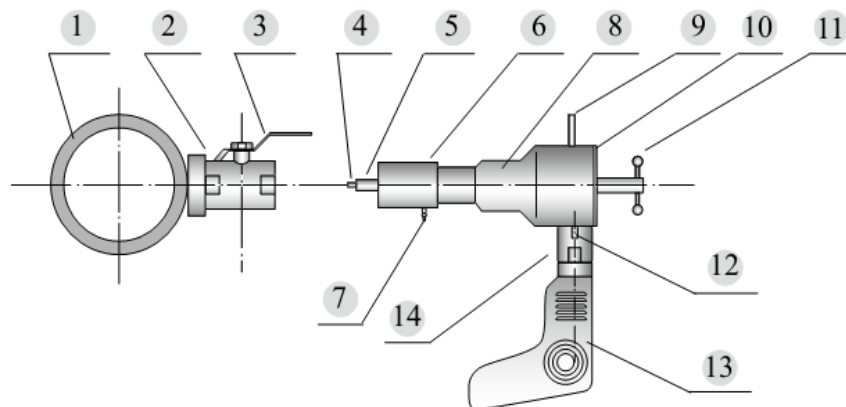
d. After installation, Picture 4-15 is diagram for overall installation.



Picture 4-15 Diagram for overall installation

(2) Drilling

! Caution: The drilling is made under pressure of the pipe system (permissible pressure < 1MPa), so below drilling procedure must be followed to avoid leaking of liquid and accident.



- | | | | |
|---------------------------------|----------------------|---|--------------------|
| ① -Pipe | ② - Valve base | ③ -Ball valve | ④ -Twist bit |
| ⑤ -φ22mm reamer bit | ⑥ -connection piece | ⑦ - Iron-dust discharge and water drainage plug | ⑧ - Casing |
| ⑨ -Handle | ⑩ - Screw-rod nut | ⑪ -Bit travel control handle | ⑫ -Universal joint |
| ⑬ -Handle-held electrical drill | ⑭ -Connection sleeve | | |

Picture.4-16 Schematic Diagram Showing the Structure of Drilling Machine

a. Drilling Procedures:

- ① Open the ball valve ③ in advance and screw the connecting piece ⑥ tightly onto the ball valve ③.
- ② Turn the control handle ⑪ in clockwise direction to make the drill close to pipe

wall.

- ③ Open the iron-dust drain port ⁷.
- ④ Connect hand-held drill ¹³ and drilling rig with connection sleeve ¹⁴. Secure universal joint ¹² with the clamp of the hand-held drill ¹³.
- ⑤ Turn on the power of hand-held drill ¹³.
- ⑥ Press down the power switch of hand-held drill ¹³ and at the same time turn slowly the bit travel control handle ¹¹ in clockwise direction to enable the bit to move toward the pipe wall for drilling operation, shown as Picture.4-17.



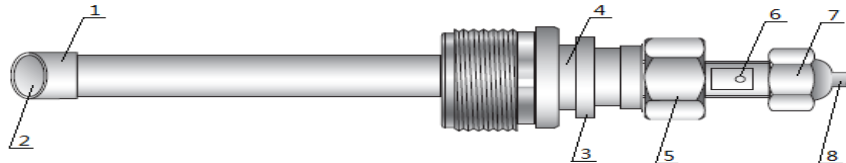
Picture 4-17 Schematic Diagram Showing the Drilling Operation

⚠ Attention: Never push against the bit during drilling with excessive force to avoid jamming of bit. Whenever the bit is found to be sluggish in rotation, quickly release the power switch and turn the bit travel control handle in counter-clockwise direction. (If the flowmeter model DN300 is used as the dividing line, select the reamer bit “5” according to the actual size.)

- ⑦ After completion of drilling on the pipe wall, detach the drill ¹³ and turn the control handle ¹¹ in counter-clockwise direction to retract the drill bit.
- ⑧ Loosen the screw-rod locking nut ¹⁰ and pull backward the bit travel control handle ¹¹ to allow the bit to retract into the threaded bush ⁶ for valve connection.
- ⑨ Close the ball valve, remove drilling machine, and finish the drilling.

⚠ Caution: Check for any fluid leakage in the seal between ball valve and base. In case of fluid leakage, stop immediately installing of transducer and take remedial measures in time.

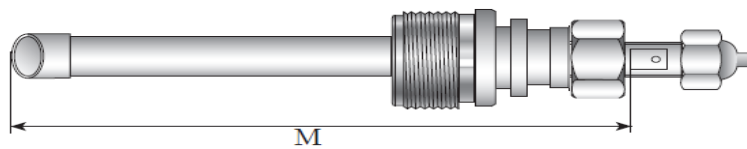
(3) Installation of transducer



Picture 4-18 Schematic Diagram Showing the Structure of Insertion-type Transducer

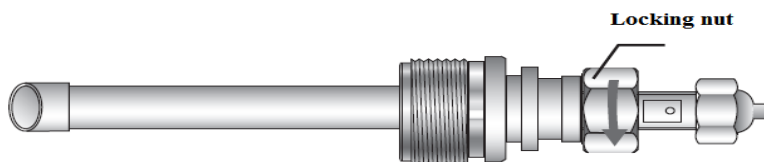
1. Transducer rod	2. Sonic wedge surface	3. Connection nut	4. Location notch
5. Locking nut	6. Marking point (A round point with concave surface and facing the sonic wedge surface)	7. Cable outlet nut	8. Signal cable

① M value of measuring transducer is guide for insertion depth of transducer, shown as Picture.4-19.



Picture 4-19

② Turn the locking nut 5 in counter-clockwise direction to loosen it, shown as Picture.4-20.



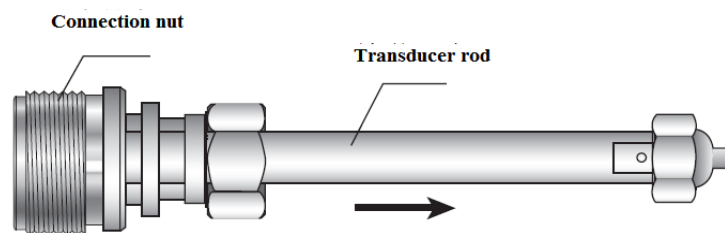
Picture 4-20

⚠ Caution: When installing transducer, the personnel should stand on the vertical side to operate (See Picture.4-21).



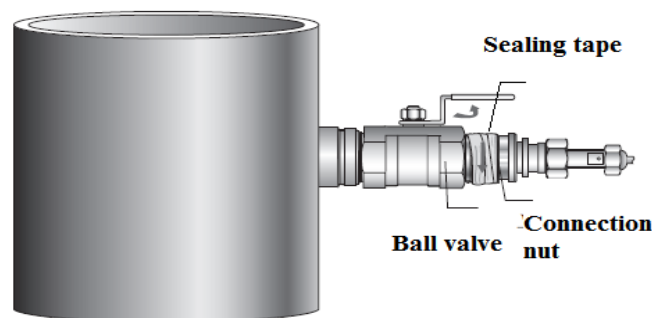
Picture 4-21

③Retract the transducer rod 1 back into the connection nut 3 position, shown as Picture.4-22.



Picture 4-22

④Wrap sealing tape onto the thread of connection nut in counter-clockwise way, screw into ball valve a clockwise way and open valve slowly.



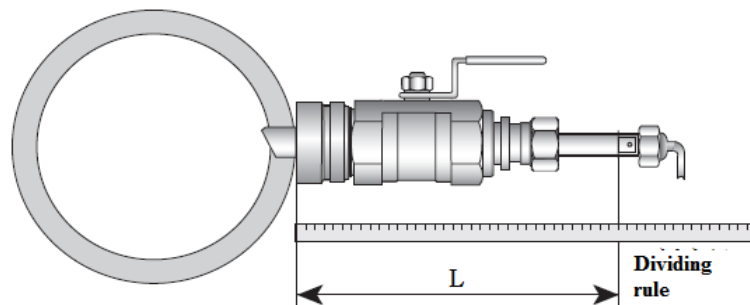
Picture 4 -23



Caution: Check for any fluid leakage from the connection between the ball valve and connection nut. In case of fluid leakage, close the ball valve and

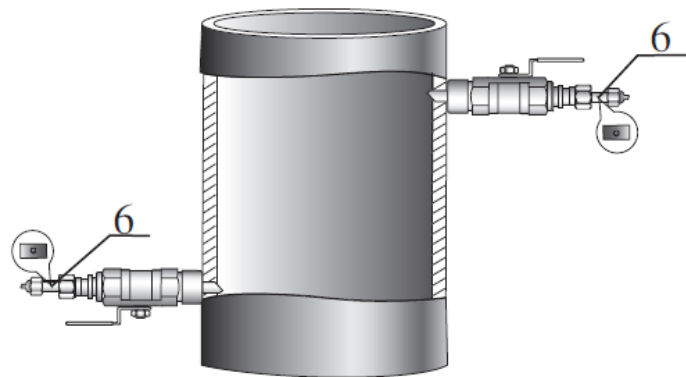
repeat the step ④.

⑤ Push transducer rod 1 into the pipeline and measure the length of transducer outside the pipe to make transducer reach the required installed depth: $L = M - t - b$ (The “t” refers to the pipe wall thickness, liner included; Unit: mm, b consists of two values: pipe size ≤ 300 , 6mm; pipe size $> DN300$, 7.5mm). The measurement method is as shown in Picture.4-24. If it does not meet the requirements, readjust the insertion depth of transducer and lock with locking nut 5 at the end.



Picture 4-24

⑥ Make sure the two sonic wedge surface of transducer face to face (It refers to the two marking point 6 face to face).



Picture 4-25

⑦ In order to make the meter measuring signal to be best, check signal strength with handheld meter reading device and fine-tune the transducer. Specific operation method is as follows:

- Turn on the power of handheld device, choose the “Calibration Status” option in the main menu, shown as Picture.4-26.

Block coefficient	Overall coefficient
Clear operation	Pipe diameter
Data reading	Meter's parameter reading
Inside diameter	Calibration status

Picture 4-26

- Press number key **【5】** and enter into Sub menu “Calibration Status”, shown as Picture.4-27.

Enter into signal testing
Exit signal testing
Enter into channel testing
Exit channel testing

Picture 4-27

- Choose “Enter into signal testing” and press the number key **【5】** . If operate successfully, the handheld device will display as follow:

Operate successfully
Confirm

Picture 4-28

- Press number key **【5】** to confirm and the meter will enter into statue of signal strength. The display screen will alternately display the forward and reverse signal strength of the current debugging sonic path, shown as Picture.4-29. In the Picture.4-29, the first digital “1”of “10(11)” represents for which sonic paths, the second digital “0(1)” represents signal of forward and reverse flow, “2.780(2.790)” means signal strength.




Picture 4-29

- In order to check the signal strength of other sonic paths, please choose “Enter into channel testing” and press the number key **【5】** . Handheld device will show interface as follow:

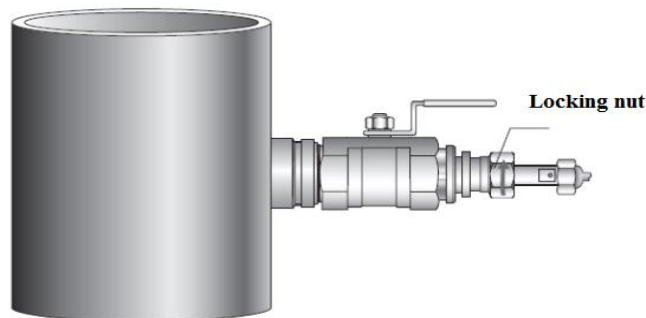
Debug sonic path(1~4): 1

Picture 4-30

- Adjust the data by pressing the number key 【2】 and 【8】 in the handheld device. Choose the installed sonic paths and press number key 【5】 to confirm. If operate successfully, there will be a reminder, shown as Picture.4-28. Then the meter will enter into the states of debugging sonic paths, there is signal strength of forward and reverse flow in the display screen.
- In order to make the measuring signal to the best, observe the signal strength in the LCD screen and fine tuning 2 pieces of transducers, making the signal strength to the maximum and the signal difference of forward and reverse flow to the minimum.
- After adjusting the position of transducers, choose “Exit signal testing” and “Exit channel testing” with handheld device to make the meter measure normally.

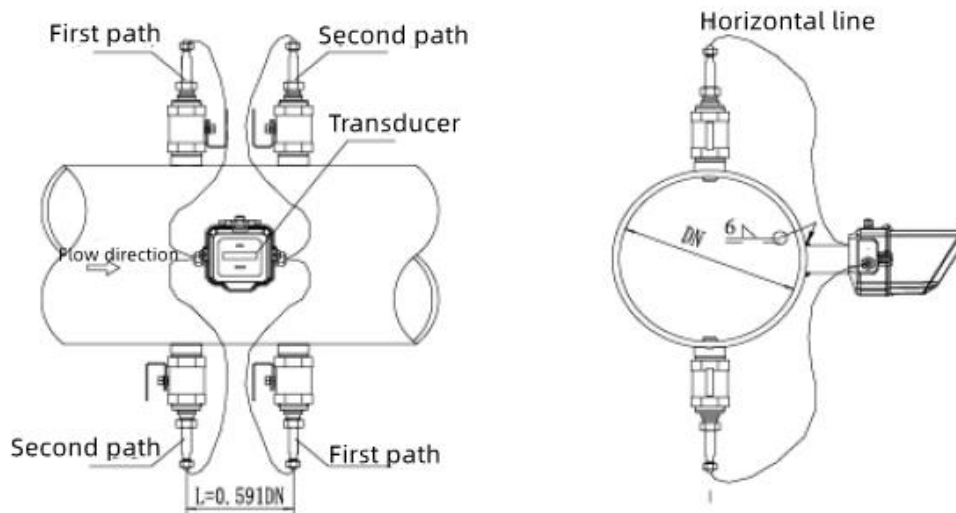
 Caution: In order to ensure the stability of communication, please aim the infrared reading head of handheld device to the photoelectric interface of meter.

⑧ Hold the transducer and clockwise tight the screw nut. Then the installation is finished.

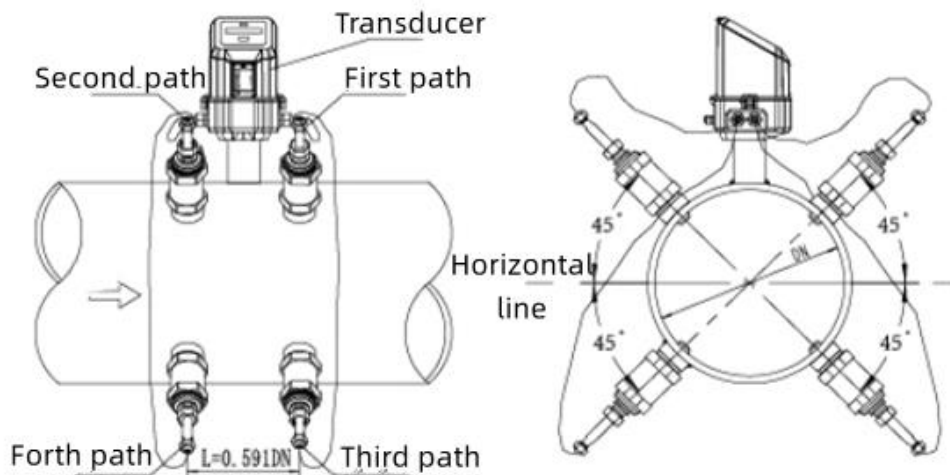


Picture 4-31

⑩ The installation of transducer is finished, shown as Picture 4-32 and 4-33.



Picture 4-32 Installation of dual-channel transducer



Picture 4-33 Installation of four-channel transducer

5. Calibration method

➤ Calibration Basis:


The calibration of Ultrasonic flowmeter is made in conformity to the National Metrological Calibration Regulation of PRC JJG1030-2007 《Ultrasonic flow meter》 .

➤ Calibration Operation:

After the installation of flow meter, start the calibration system, and perform the exhaust operation. When the system runs steady, operate the meter with special tools and make it enter into the calibration states of cumulative flowrate (measuring cycle is 4 times per second). Adjust the flowrate to the point that need to be calibrated. When

flow regime becomes steady, click the induction key, the first click is to “Begin”, the second click is to “Stop” and the third click is to “Clear to zero”, the 3 options runs circularly.

6. Battery Replacement





It is 3.6V lithium battery with a lifetime over 10 years under an ambient temperature of 0°C~35°C. When the symbol  is on display, it indicates that the battery power is low and needs to be replaced to avoid loss of measured data. Replacement of battery must be finished by trained professional personnel or send the meter back to Huizhong for battery replacement. After replaced, the cumulative flowrate and cumulative effective running time remain in storage.

7. Troubleshooting and After-sales Service

7.1 Common Troubleshooting

If there is a fault, read the fault remedy guide in advance. If can not solve it with the guide, please contact Huizhong immediately.

Table 7-1 List of common faults

Faults	Content	Solutions
Display  in long term	1.Empty pipe 2.Thick scale deposit on transducer surface 3. Meter malfunction	1.Keep pipe full of liquid 2.Clean the transducer 3.Contact Huizhong
Frequently display 	Excessive air bubbles or impurities in water or medium	Remove the bubbles or impurities
Display  in long term	Low battery	Replace the battery soon
Display of 	Battery is too low in power with a voltage as low as indicated 3.15. Now, measurements are interrupted, but view of stored data is possible	Battery must be replaced
Display of “88888888”	EEPROM malfunctions	Contact Huizhong immediately for repair

7.2 After-sales service Commitment

Huizhong Instrumentation Co., Ltd. operates by adhering to the principle of “being user’s most trustworthy friend, providing users quality products and timely good after-sales service”. Our Specific commitments are as follows:

1. After receiving user’s call, we promise to make a response within 2 hours..
2. We promise to repair any meter within one year after its date of delivery free of charge without asking for the cost of labor and components.
3. “Free-charged” repair is only limited to the repair of the damaged main measuring unit and key functional components like Transducers and Conversion Unit. Repair of damaged cables is outside the promised scope.
4. Repair of any meter beyond its guaranty period will be made on site, if required, with the travel expenses and cost of components covered by user.
5. The free repair provisions shall not cover any of the following damages:
 - ①Damage of meter due to purely artificial reasons, such as mechanical impact.
 - ②After-sales service rendered for the repair of any meter damage caused not by the failure of the meter itself, but for the shut-down or abnormal operation of system or user’s failure to operate the meter according to the instruction.
 - ③Damage of meter caused by force of majeure, such as thunder strike.

For the repair work done on site for the above mentioned reasons, the travel expenses and costs of components shall be covered by user.

6. If the user sends the meter’s core part or the entire meter back to Huizhong for repair, both parties shall responsive bear the transportation expenses and the costs of replacing components should be borne by user.

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