Preface

// Regarding pipe diameter

People who use different types of pipes have their own customary names for pipe diameters. Engineers who use steel pipes tend to refer to the nominal diameter (DN), while those who use plastic pipes prefer the outer diameter (OD, Φ). Copper pipes also have different outer diameter sizes.

DN: It is neither the inner diameter nor the outer diameter, but a value between the inner and outer diameters. The connection methods of steel pipes include welding, threading... Pipes that can withstand higher pressure will achieve this by reducing their inner diameter and increasing their outer diameter, so as to fit well with the pipe fittings.

OD: It refers to the outer diameter. The pipe fittings of plastic pipes are all standard. Pipes that can withstand different pressures can only achieve this by changing the inner diameter.

The small tube ultrasonic flowmeter is designed for pipes of different materials and needs to meet the installation requirements of different outer diameters. We have summarized the pipe specifications of different countries and standards, and strive to ensure that most pipes can be used during the design process. For details, please refer to the "Appendix: Pipe Specifications" for the correspondence between DN and OD.

Note: There are many ways to represent the inner and outer diameters of pipes and their codes are not listed one by one here.

// Regarding units of measurement

The small tube ultrasonic flowmeter is an instrument for measuring flow velocity and is essentially different from volumetric instruments. Customers who use volumetric instruments are accustomed to talking about volume measurement, while ultrasonic flowmeters need to know the flow velocity range and require conversion when selecting models.

Calculation	Given the flow rate and pipe diameter, calculate the flow velocity $V= (Q\div (3.14\times ID^2 \div 4)) \div 3600$, with the unit of m/s

// Regarding measurement conditions

Since the ultrasonic flowmeter is an instrument for measuring flow velocity, the measurement point must meet certain conditions during measurement:

- Single medium: The measured medium does not contain particles or bubbles. The small tube is more significantly affected by impurities and bubbles, while the large tube has better tolerance.
- Sound-conducting pipe: The pipe has excellent sound-conducting performance and does not have materials such as steel wire or glass fiber in the middle that affect the transmission of sound waves.
- Flow state stability: When the medium is in an unstable state with turbulence, it is prone to cause bubbles and affect signal propagation, leading to the instrument constantly updating and searching for signals, resulting in significant changes in displayed values.
- Certain pressure: Many media may produce bubbles when flowing due to insufficient pressure. This situation can also occur when the flow rate is fast. Our experience is that even when the medium is water, it is necessary to ensure a pressure of 0.1MPa (back pressure).
- Other situations: Refer to the appendix for the selection of installation points.

// Hint

Thank you for choosing the small tube ultrasonic flowmeter.
This manual contains important information about the use of flowmeters. Please read this operation manual carefully before use to ensure that your ultrasonic flowmeter performs at its best.
If operational errors occur, it may affect the normal use of the flowmeter and even lead to malfunctions.

// Appendix: Pipe Specifications

Model		-Φ9.53	-Φ12.7	-Φ15	-Φ20	-Φ25	-Φ32	-Φ40	-Φ50
Outer diameter of the pipe mm		Φ9.53	Φ12.7	Φ15	Φ20	Φ25	Φ32	Φ40	Φ50
Nominal diameter DN		DN6	DN8	DN10	DN15	DN20	DN25	DN32	DN40
Common term NPS		1/8"	1/4"	3/8"	1/2"	3/4"	1"	1.2"	1.5"
Minimum outer diameter mm		9.5	12.4	14.5	16.5	25	32	38	48
Maximum outer diameter mm		10.4	13.1	15.4	23	30	35	45	54
Traffic L/min	Minimum	0.34	0.60	0.86	1.06	1.88	2.94	4.82	7.54
	Maximum	11.02	19.59	27.80	52.99	94.20	147	241	377
Traffic m^3/h	Minimum	0.02	0.04	0.05	0.06	0.11	0.18	0.29	0.45
	Maximum	0.66	1.18	1.67	3.18	5.65	8.83	14.47	22.61

Model		-Φ63	-Φ75	-Φ90	-Φ110	-Φ140	-Φ160	-Φ220	
Outer diameter of the pipe mm		Φ63	Φ75	Φ90	Φ110	Φ140	Φ160	Φ220	
Nominal diameter DN		DN50	DN65	DN80	DN100	DN125	DN150	DN200	
Common term NPS		2"	2.5"	3"	4"	5"	6"	8"	
Minimum outer diameter mm		58	72	86	108	132	158	218	
Maximum outer diameter mm		64	78	92	116	142	168	228	
Traffic L/min	Minimum	11.78	19.90	30.14	47.10	73.59	105.98	188.40	
	Maximum	589	995	1507	2355	3680	5299	9420	
Traffic m^3/h	Minimum	0.71	1.19	1.81	2.83	4.42	6.36	11.30	
	Maximum	35.33	59.70	90.43	141.30	220.78	317.93	565.20	