UCUF-K Series Ultrasonic Flowmeter

DESCRIPTION

The UCUF-K series ultrasonic flowmeter is designed for measuring small flow rates of ultrapure water and chemical liquids. It is comprised of the UCUF-K detector and SFC converter. All wet parts of the detector are made of special-grade PFA molds for the semiconductor industry and have no moving parts or sealing mechanism such as O-rings which would accumulate liquid components. The simple and smooth construction leaves no residues and is ideal for processes such as semiconductor manufacturing which requires ultimate cleanliness. The SFC converter significantly reduces the effect of bubbles in liquid, which cause problems in semiconductor and chemical processes. It has an adjustment function to offset the effect on the kinematic viscosity of liquids, making the converter compatible with various chemicals. The RS485 communication function enables integrated management of the process. For details, see the Technical Guidance of the converter.



KEY FEATURES

- EMC compliance: EN61326-1:2013/EN61326-2-3:2013
- RoHS compatible
- Liquids with kinematic viscosity of as high as 40 mm^2/s can be measured.
- Accuracy: Within ±1% of the reading at flow velocity of 1 m/s or more
- Wide rangeability of 100 : 1 as a typical example
- Detector with highly clean construction
- Corrosion resistant and easy to install

OPERATING PRINCIPLE

The measuring fluid flows into the U-shaped tube, changes direction by 90 degrees twice, and goes out as shown in Figure 1. Two piezoelectric transducers A and B are mounted at both ends of the measuring section. They emit and receive ultrasonic waves alternately and measure the traveling times tA (A to B) and tB (B to A) through the liquid. Without flow, tA is equal to tB. With flow, tA becomes shorter and tB longer in proportion to the flow rate. Thus, calculating tB - tA gives the flow rate of the liquid. tA and tB depend on the size and shape of the tube and liquid viscosity. The actual flow test data are stored in the linearizer in the converter, which enables the UCUF-K to measure flow rates with high accuracy.

APPLICATIONS

- Pure water and ultrapure water in the semiconductor manufacturing process
- Chemical feeding
- Highly corrosive chemicals
- Chemical mechanical polishing (CMP) slurries
- Process liquids of small and medium flow rate
- Ideal for flow measurement and control of cleaning and CMP processes

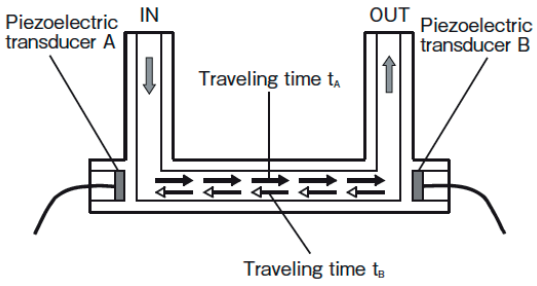


Figure 1 Operating principle

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STANDARD SPECIFICATIONS

- Measuring fluid : Liquids (Without bubbles, and homogeneously mixed)
- Ambient temperature* : 0 to 60°C
- Ambient humidity : 30 to 80%RH
- Enclosure classification : IP65 equivalent, indoor use
- Fluid temperature* : 10 to 60°C
- Fluid pressure : 0 to 0.5 MPa
- Fluid sound speed* : 1000 to 2200 m/s
- Fluid kinematic velocity : 0.3 to 40 mm²/s
- Process connection : PFA tube end (Refer to Table 1.)
- Enclosure classification : IP65
- Flow range : Refer to Table 1.

Table 1. Flow range and connecting tube size

Model	Flow range (L/min)		Connecting tube size
	Min.	Max.	
UCUF-04K	0 to 0.05	0 to 3.0	3/8"
UCUF-06K	0 to 0.4	0 to 8.0	3/8"
UCUF-10K	0 to 1.0	0 to 20.0	1/2"
UCUF-15K	0 to 3.0	0 to 50.0	3/4"
UCUF-20K	0 to 4.0	0 to 80.0	1"

* Coaxial connector is BNC connector.
* Consult us about other models.

- Accuracy : Refer to Table 2.

Table 2. Accuracy and flow range

Model UCUF	Flow velocity < 1m/s		Flow velocity ≥ 1m/s	
	Flow rate (L/min)	Accuracy Flow (L/min)	Flow rate (L/min)	Accuracy (of reading)
-04K	0 to 0.8	± 0.008	0.8 to 3	±1%
-06K	0 to 1.7	± 0.017	1.7 to 8	±1%
-10K	0 to 4.7	± 0.047	4.7 to 20	±1%
-15K	0 to 10.6	± 0.106	10.6 to 50	±1%
-20K	0 to 18.8	± 0.188	18.8 to 80	±1%

* Note: Accuracy statement is based on water calibration

- Pressure loss

Pressure loss for water (kPa) = $C \times Q^2$
where C: Factor (Refer to Table 3.)
Q: Flow rate (L/min)

Table 3. Pressure loss factor

Model	C
-04K	3.04
-06K	0.537
-10K	0.0625
-15K	0.0120
-20K	0.00377

- Materials : Refer to Table 4.

Table 4. Materials of flow detector

Parts		Material
Wetted part	Body	New PFA
	Tube	New PFA
Sensor housing (Not for UCUF-04, 06)		PP
Sensor cup (Only for UCUF-04, 06)		PP
Cable fitting		PP
BNC cable sheath		PVC

- Exclusive cable : Two 5 m coaxial cables, Length: 5 m (Extension cables available up to 30 m)
- Model code : Refer to Table 5.
- Mass : Refer to Table 6.

MODEL CODE

Table 5. Detector

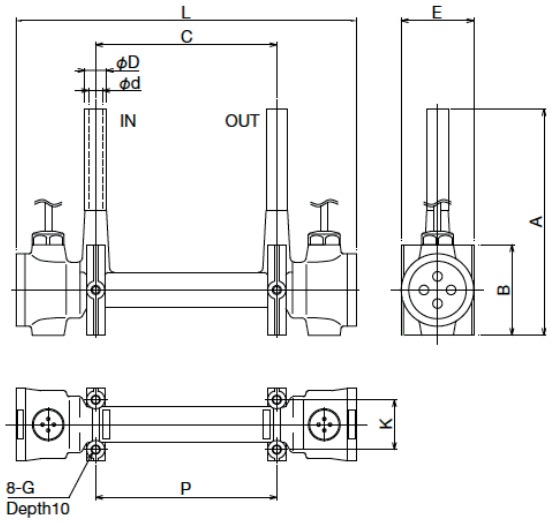
Model code				Description
UCUF	–□□	/□	□	
Meter size	–04K			4 mm
	–06K			6 mm
	–10K			10 mm
	–15K			15 mm
	–20K			20 mm
Connector		(Blank)		BNC
		D		SMB
Shape			(Blank)	Standard (U shaped)
			Z	Z shaped

Note : Specifications of all items with * mark are those of standard types.
See the PRODUCT SPECIFICATION for those other than standard types.

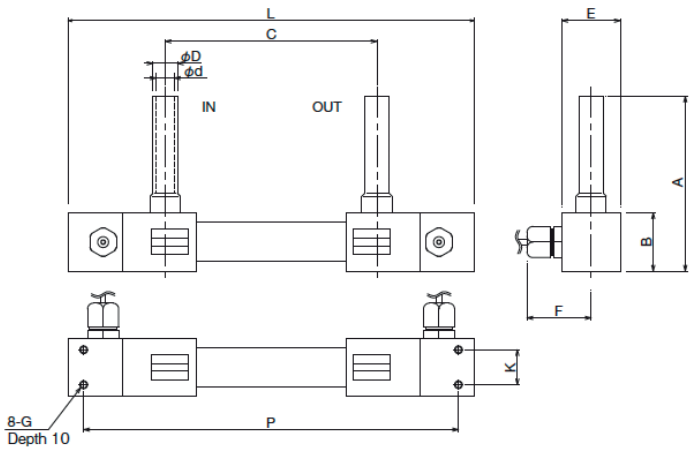
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DIMENSIONS

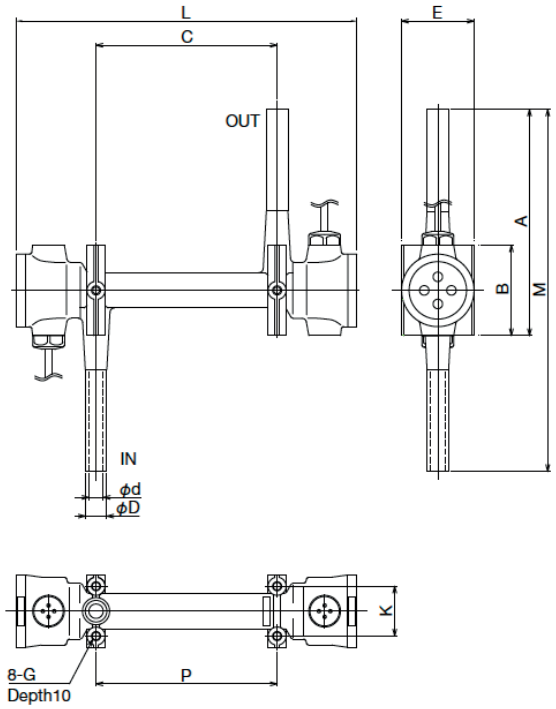
UCUF-04K, 06K U-shape



UCUF-10K, 15K, 20K U-shape



UCUF-04K, 06K Z-shape



UCUF-10K, 15K, 20K Z-shape

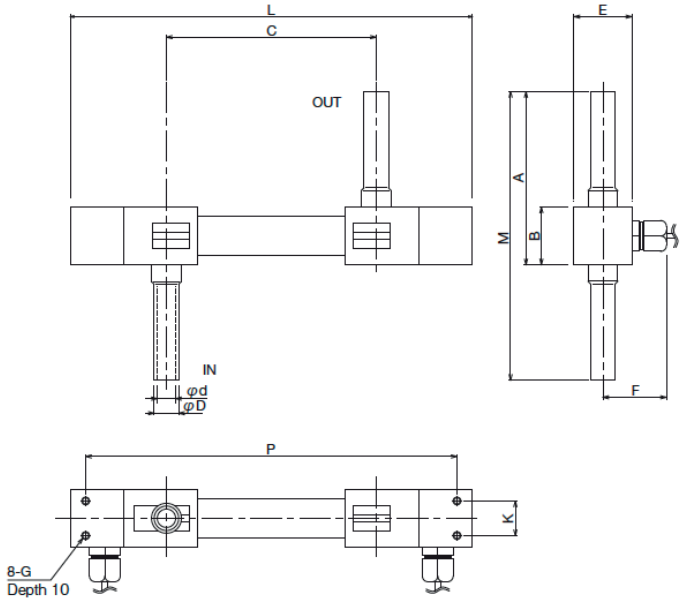


Table 6. Dimensions and mass of detector

UCUF	Connecting tube size	Dimensions (mm)												Mass (g)		
		D	d	C	L	A	B	E	F	G	K	M	P	Detector	Cable (5m)	Total
-04K	3/8"	9.53	6.38	80±1	150±1	100	40	32	—	M4	22	160	80±1	160	140	300
-06K	3/8"	9.53	6.38	100±1	170±1	100	40	32	—	M4	22	160	100±1	200	140	340
-10K	1/2"	12.70	9.55	110±1	209±1	90	30	30	35	M4	18	150	193±1	420	140	560
-15K	3/4"	19.05	15.90	165±2	271±2	100	40	40	40	M5	26	160	253±2	760	140	900
-20K	1"	25.40	22.25	220±2	328±2	120	40	40	40	M5	26	200	310±2	880	140	1020

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COMPATIBLE CONVERTERS

SFC3000, SFC4000

CAUTIONS ON INSTALLATION

- To ensure accurate, stable measurement, do not bend the connecting tube during installation to avoid stress from the piping.
- To ensure accurate, stable measurement, stabilize the liquid temperature within ±5°C.
- Keep the instrument pressurized even when it is not in use to avoid the formation of bubbles.
- Keep the measuring tube filled with liquids. Although the instrument can be installed with horizontal, vertical, or slant tubing, it is recommended to select a position for easy self-draining.
- Install a control valve downstream of the instrument, if necessary.
- Install the flow detector and converter away from noise sources such as power relays and solenoid valves.
- Lay the signal cable away from power cables of high voltage or current.
- For details on how to connect fittings, see the relevant documents of each manufacturer.

*Specification is subject to change without notice.

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