

## OUTLINE

**UCUF** series Ultrasonic Flowmeter is designed for low flow measurement such as ultra pure water and chemical liquid services. It consists of UCUF detector, SFC-720 converter and SFC-780 DSP type converter. UCUF detector whose wet parts are made of molded specific grade NEW PFA has no moving part and no sealing mechanism such as O ring. The simple and smooth construction leaving no residues is best suited for such process as semiconductor manufacturing where cleanliness is required.

The model SFC-720, more compact than SFC-700, has improved significantly on adverse effects of the bubbles contained in liquids of semiconductor and chemical process.

SFC-780 plug-in type converter, narrow in width, is suitable for mounting on DIN rail to save the space. It serves also as process data acquisition and control equipment with RS485 communication protocol.

## FEATURES

- ❑ Cleared EMC test conforming to EN61326.
- ❑ Lead free compatible
- ❑ Improved significantly on harmful effects caused by bubbles.  
The bubbles contained in the liquids interfere with the propagation of the ultrasonic wave and cause failures of flow measurement. TOKYO KEISO CO., LTD., based on the proved field experience and state-of-art technology of DSC signal processing, has succeeded in the stable measurement by determining bubbles' effect from received wave and by eliminating the abnormal output portions from the measured values.
- ❑ Measurement of high viscosity liquids  
The linearizer contained in the converter has the memories of stream data accumulated from actual flow measurement.
- ❑ Measurement of high kinetic viscosity liquids as high as 40mm<sup>2</sup>/s.
- ❑ Zero check : Optimal measurement enabled by zero adjustment before measuring.
- ❑ Accuracy : within  $\pm 1\%$  of the reading at flow velocity 1m/s or more
- ❑ Wide rangeability : 100:1 as central value
- ❑ Ideal detector with clean construction
- ❑ Corrosion resistant and easy installation
- ❑ Easy parameter setting with LCD display (SFC-720)
- ❑ Versatile functions including followings  
Indication of instantaneous and totalizing flow rate (SFC-720)  
High and Low alarm outputs  
Various analog outputs of instantaneous flow rate are selectable.  
Totalization pulse output (SFC-720)  
Frequency output/FAULT output (SFC-780)  
RS485 (MODBUS protocol) communication function (SFC-780)

## MAIN USAGES

- ❑ Pure water and ultra-pure water in semiconductor manufacturing plants
- ❑ Chemical feeds
- ❑ Highly corrosive chemicals
- ❑ Chemical Mechanical Polishing (CMP) slurries
- ❑ Very low flow measurement of liquid



UCUF detector



SFC-720 converter



SFC-780 converter

## OPERATING PRINCIPLE

The fluid to be measured flows through the U-shaped tube. Two piezoelectric transducers, mounted at both ends of the measuring section, emit and receive an ultrasonic wave alternately. The wave propagating in direction with the fluid flow is accelerated and the wave traveling against the fluid flow is slowed. The difference in transit time of wave is proportional to the velocity of the fluid. The converter converts received ultrasonic wave signal into digital data, computes flow rate and transmits output signal. Stable transit time measurements are conducted with new signal processing, regardless fluctuation of wave signal level.

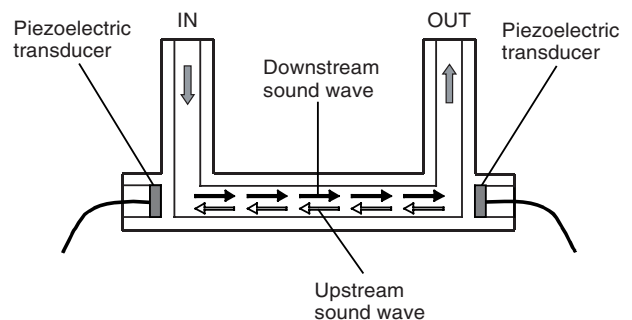


Fig.1 Operating principle

## STANDARD SPECIFICATIONS

### Flow detector

- Measurable fluid Liquids
- Fluid sound speed 1000 to 2200m/s
- Fluid temperature 10 to 60°C
- Fluid pressure 0 to 0.5MPa
- Fluid kinematic viscosity 0.3 to 40mm<sup>2</sup>/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<br>UCUF | Flow velocity < 1m/s   |                            | Flow velocity ≥ 1m/s   |                          |
|---------------|------------------------|----------------------------|------------------------|--------------------------|
|               | Flow rate<br>( L/min ) | Accuracy Flow<br>( L/min ) | Flow rate<br>( L/min ) | Accuracy<br>(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 5m coaxial cables, Length: 5m  
(Extension cables available up to 30m)
- Model code Refer to Table 5 to 7.
- Mass Refer to Table 8.

### Converter

#### 1. SFC-720

- Output

- 1) Current output  
DC4 to 20mA (Load resistance 500Ω or less)
- 2) Totalization pulse output  
Open collector pulse  
Load rating: DC30V, 50mA  
Pulse width: Selectable depending on the setting at full scale  
0.5ms (Max. 1000Hz)  
50ms (Max. 10Hz)  
100ms (Max. 5Hz)  
Pulse rate: 5 to 1000pps (at full scale)
- 3) Flow rate alarm / Preset output  
Open collector (2 points)  
Load rating: DC30V, 50mA  
Relay action: NO/NC (Alternative choice)

- Damping time: 0.2 to 10sec.
- Low cutoff: 0 to 30% FS
- Display: LCD / 2 line 16 figures alphanumeric (with back light)
- Contents of display: Instantaneous and totalizing flow rate, Various parameter preset values

- Alarm output monitor: LED (1 point), Hi, Lo (LCD) indication
- Parameter setup: By 4 key switches on the panel
- Secondary linearizer: 15 line-segment approximation
- Power supply / Power consumption: DC24±10% / 110mA (0.4A starting)
- Temp. and Humidity: 0 to 50°C / 30 to 80%RH
- Installation: Panel mounting
- Enclosure classification: IP20 (Indoor use)
- Materials: Front panel: ABS resin  
Housing: Aluminium alloy  
Back panel: Stainless (Silver)

- Model code: Refer to Table 6.

- Mass: Approx. 400g

#### 2. SFC-780

- Output

- 1) Current output  
DC4 to 20mA (Load resistance 500Ω or less)
- 2) Flow rate alarm  
Open collector (2 points)  
Load rating: DC30V, 50mA  
Relay action: NO/NC (Alternative choice)
- 3) Pulse output  
Frequency output or FAULT output (Selectable)  
Open collector pulse  
Load rating: DC30V, 50mA

- Communication function: RS-485, MODBUS protocol  
Max. 31 of flowmeters can be connected.

- Damping time: 0.2 to 25sec.
- Low cutoff: 0 to 25% FS
- Alarm output monitor: LED (3 points), Error, AGC/ZERO, ALARM
- Parameter setup: PC configurator is used.
- Secondary linearizer: 15 line-segment approximation
- Power supply / Power consumption: DC24±10% / 100mA (1.5A/2ms starting)

- Temp. and Humidity: 0 to 60°C / 30 to 80%RH
- Installation: Plug-in, DIN rail installation
- Enclosure classification: IP20 (Indoor use)
- Materials: Panel and housing: ABS resin (Black)
- Model code: Refer to Table 7.
- Mass: Approx. 200g

## MODEL CODE

**Table 5. Detector**

| Model code |      |              |         | Description         |
|------------|------|--------------|---------|---------------------|
| UCUF       | -□□  | /□           | □       |                     |
| Meter size | -04K |              |         | 4mm                 |
|            | -06K |              |         | 6mm                 |
|            | -10K |              |         | 10mm                |
|            | -15K |              |         | 15mm                |
|            | -20K |              |         | 20mm                |
| Connector  |      | Blank or [B] |         | BNC                 |
| Shape      |      |              | (Blank) | Standard (U shaped) |
|            |      |              | Z       | Z shaped            |

**Table 6. Converter (SFC-720)**

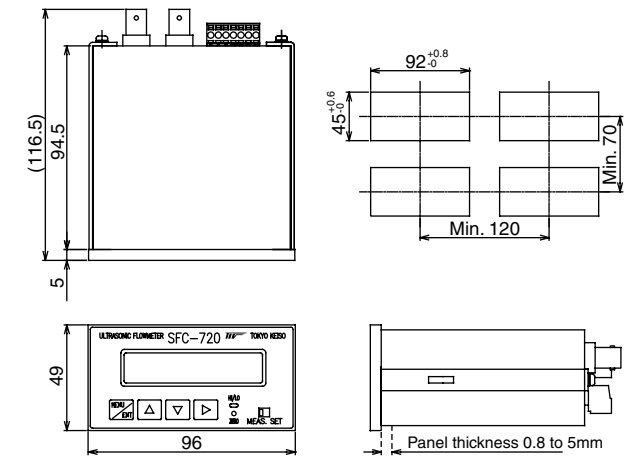
|               |   |         |   |   |                   |
|---------------|---|---------|---|---|-------------------|
| SFC-720       | - | □       | □ | □ | Description       |
| Meter size    | 1 |         |   |   | UCUF-04, 06, 10   |
|               | 2 |         |   |   | UCUF-15, 20       |
| Analog output |   | 0       |   |   | 4 to 20mA         |
|               |   | 1       |   |   | 0 to 10V          |
|               |   | 2       |   |   | 0 to 5V(Optional) |
|               |   | 3       |   |   | 1 to 5V(Optional) |
| Special       |   | (Blank) |   |   | Not provided      |
|               |   | / Z     |   |   | Provided          |

**Table 7. Converter (SFC-780)**

|               |   |         |   |   |                    |
|---------------|---|---------|---|---|--------------------|
| SFC-780       | - | □       | □ | □ | Description        |
| Meter size    | 1 |         |   |   | UCUF-04, 06, 10    |
|               | 2 |         |   |   | UCUF-15, 20        |
| Analog output |   | 0       |   |   | 4 to 20mA          |
|               |   | 1       |   |   | 0 to 10V(Optional) |
|               |   | 2       |   |   | 0 to 5V(Optional)  |
|               |   | 3       |   |   | 1 to 5V(Optional)  |
| Special       |   | (Blank) |   |   | Not provided       |
|               |   | / Z     |   |   | Provided           |

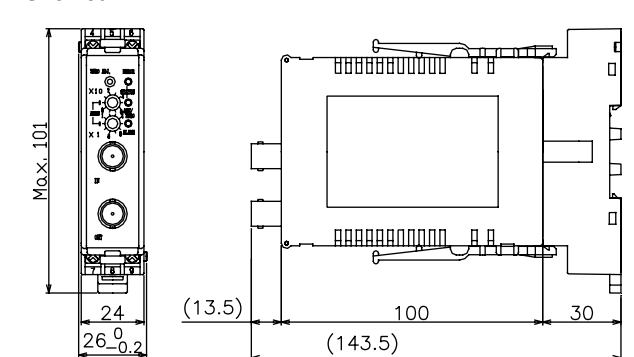
## DIMENSIONS (Converter)

### • SFC-720



**Fig. 2 SFC-720 converter**

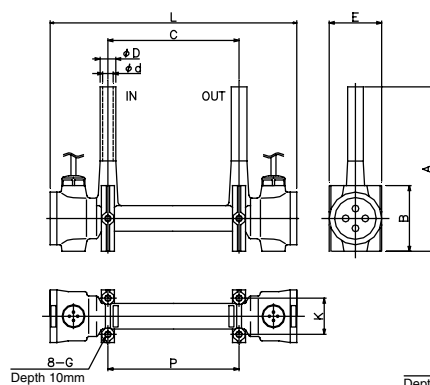
### • SFC-780



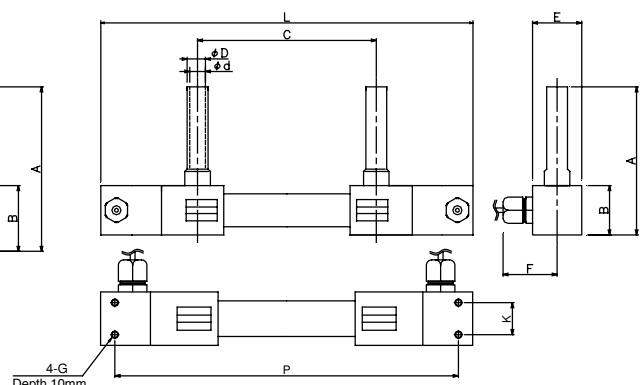
**Fig. 3 SFC-780 converter**

## DIMENSIONS (Detector)

### UCUF-04K, 06K



### UCUF-10K, 15K, 20K



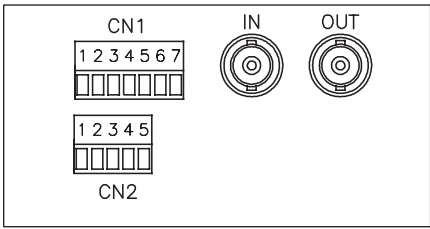
**Fig. 4 Detector**

**Table 8. Dimensions and mass of detector**

| UCUF | Connecting tube size | Dimensions (mm) |       |       |       |     |    |    |    |    |    |       | Mass (g) |            |       |
|------|----------------------|-----------------|-------|-------|-------|-----|----|----|----|----|----|-------|----------|------------|-------|
|      |                      | D               | d     | C     | L     | A   | B  | E  | F  | G  | K  | P     | Detector | Cable (5m) | Total |
| -04K | 3/8"                 | 9.53            | 6.38  | 80±1  | 150±1 | 100 | 40 | 32 | —  | M4 | 22 | 80±1  | 160      | 140        | 300   |
| -06K | 3/8"                 | 9.53            | 6.38  | 100±1 | 170±1 | 100 | 40 | 32 | —  | M4 | 22 | 100±1 | 200      | 140        | 340   |
| -10K | 1/2"                 | 12.70           | 9.55  | 110±1 | 209±1 | 90  | 30 | 40 | 35 | M4 | 18 | 193±1 | 420      | 140        | 560   |
| -15K | 3/4"                 | 19.05           | 15.90 | 165±2 | 271±2 | 100 | 40 | 50 | 40 | M5 | 26 | 253±2 | 760      | 140        | 900   |
| -20K | 1"                   | 25.40           | 22.25 | 220±2 | 328±2 | 120 | 40 | 50 | 40 | M5 | 26 | 310±2 | 880      | 140        | 1020  |

TERMINAL

• SFC-720



BNC connector

| Terminal | Polarity | Description         |
|----------|----------|---------------------|
| IN       | Inlet    | Sensor signal input |
| OUT      | Outlet   |                     |

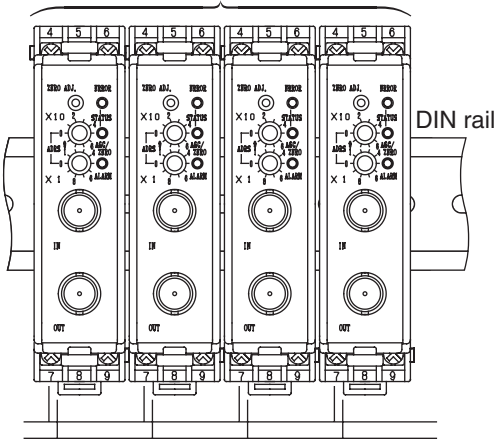
Connector 1

|   |    |                                 |
|---|----|---------------------------------|
| 1 | +  | Power supply (DC24V)            |
| 2 | -  |                                 |
| 3 | FG | Grounding                       |
| 4 | +  | Analog output                   |
| 5 | -  |                                 |
| 6 | +  | Reset pulse input for totalizer |
| 7 | -  |                                 |

Connector 2

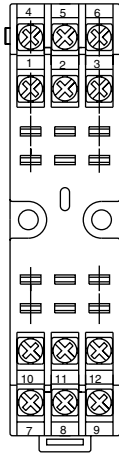
|   |   |  |
|---|---|--|
| 1 | + | Pulse output                                 |
| 2 | - |  |
| 3 | + | Alarm output (Hi) / Total preset output (HH) |
| 4 | - | Alarm common                                 |
| 5 | + | Alarm output (Lo) / Total preset output (H)  |

Max. 31 flowmeters can be connected.



RS-485 MODBUS

• SFC-780



BNC connector

| Terminal | Polarity | Description         |
|----------|----------|---------------------|
| IN       | Inlet    | Sensor signal input |
| OUT      | Outlet   |                     |

| Terminal No | Terminal specification/Terminal name | Description             |
|-------------|--------------------------------------|-------------------------|
| 1           | AL2                                  | Alarm output 2          |
| 2           | AL1                                  | Alarm output 1          |
| 3           | COM                                  | Common (For AL1, AL2)   |
| 4           | FG                                   | Grounding               |
| 5           | 0V                                   | Power supply input      |
| 6           | +24V                                 |                         |
| 7           | RS485(+)                             | RS485 communication (+) |
| 8           | P.OUT(+)                             | Pulse output (+)        |
| 9           | A.OUT(+)                             | Current output (+)      |
| 10          | RS485(-)                             | RS485 communication (-) |
| 11          | P.OUT(-)                             | Pulse output (-)        |
| 12          | A.OUT(-)                             | Current output (-)      |

CAUTIONS ON INSTALLATION

- ❑ Installation area for flow detector: Select the area of pipe where no air or gas bubbles exist in the flow.
- ❑ Mounting of flow detector: Recommend to install detector vertically with upward flow, in order to prevent deposit of slurry or bubbles in low flow rate conditions.
- ❑ Location of control valve: If a flow control valve is installed in the piping, it should be located on the downstream side of the flow detector to keep the fluid pressure high. The high fluid pressure will prevent the formation of bubbles in the flow.
- ❑ Noise suppression: All electrical noise sources near the flowmeter, such as power relays or solenoid valves, should be fitted with a surge suppressor.
- ❑ Signal cable wiring: Keep signal cables away from high voltage or high current power cables to avoid induced electrical noise.

\* Specification is subject to change without notice.

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