

OUTLINE

BIOSONIC ultrasonic flowmeter is designed for measuring liquid flow rates in biopharmaceutical manufacturing processes. It consists of BS detector and SFC converter. The wetted parts of the detector have biocompatibility (USP Class VI, FDA, BSE/TSE free) using gamma-sterilizable material (PSU) for single-use.

Thanks to our unique ultrasonic flow measurement technology developed over the years, **BIOSONIC** can measure instantaneous and integrated flow rates with high accuracy without affecting liquids that contain cells. The construction is simple and smooth with no moving parts in the detector that would cause stress to liquids, and with no sealing mechanism that would cause liquid components to accumulate and leave residues. The detector cable is detachable and easy to install for single-use.

FEATURES

- ❑ Materials of wetted parts of the flow detector: Biocompatible (FDA, USP Class VI, no TSE/BS animal derived components), gamma-sterilizable (up to 50 kGy)
- ❑ Highly clean construction without causing stress to liquids or leaving residues
- ❑ Wide rangeability
 - BS04
Range : 0 to 3000 mL/min
 - BS06
Range : 0 to 8000 mL/min
- ❑ Liquids with kinematic viscosity of as high as 40 mm²/s can be measured.
- ❑ Accuracy: Within $\pm 1\%$ of the reading at flow velocity of 1 m/s or more
- ❑ Adjustment function to offset the effect on the measurement values caused by a change in liquid temperature (optional)
- ❑ CE marking
- ❑ All the detectors are calibrated with the actual flow (water) at the time of shipment.
- ❑ Soundness of the converter can be checked on site by using a simulator (optional).

APPLICATIONS

- ❑ Noninvasive, highly accurate flow measurement of liquids in biopharmaceutical manufacturing processes
- ❑ Flow control by combining pumps, control valves, etc.
- ❑ Installation into single-use kits and systems



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 t_A (A to B) and t_B (B to A) through the liquid. Without flow, t_A is equal to t_B . With flow, t_A becomes shorter and t_B longer in proportion to the flow rate. Thus, calculating $t_B - t_A$ gives the flow rate of the liquid. t_A and t_B 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 BIOSONIC to measure flow rates with high accuracy.

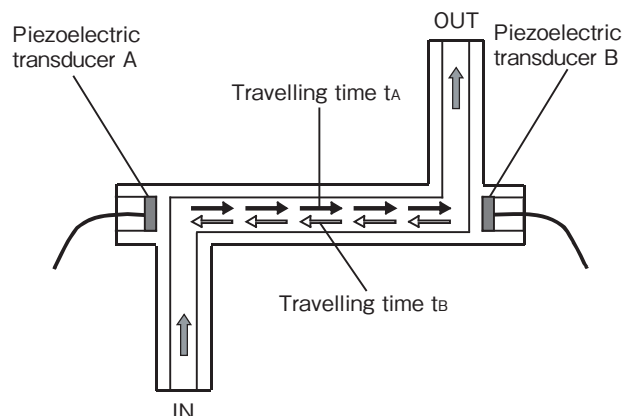


Figure 1 Operating principle

STANDARD SPECIFICATIONS

Detector

- Measuring fluid : Liquids (without bubbles, no permeating or eroding PSU)
- Fluid temperature : 2 to 60°C
- Ambient temperature : 0 to 50°C
- Fluid pressure : 0 to 0.5 MPa
- Fluid sound speed : 400 to 2500 m/s
- Fluid kinematic velocity : 0.3 to 40 mm²/s
- Process connection : 3/8" hose barb fitting
- Wetted part material : PSU (FDA, USP Class VI, no animal derived components, TSE/BS measures), gamma-sterilizable
- Maximum permissible dose : 50 kGy
- Enclosure classification : IP65 (indoor use)
- Mass : Approx. 50 g (sensor body without cable)
- Dedicated cable : Coaxial cable × 2
- Cable length : 5 m (standard)
- Flow range : Refer to Table 1.

Table 1. Flow range and connecting tube size

| Model | Flow range (L/min) | Connecting tube size |
|-------|--------------------|----------------------|
| BS04 | 0 to 3.0 | 3/8" Barb fitting |
| BS06 | 0 to 8.0 | 3/8" Barb fitting |

- Accuracy : Refer to Table 2.

Table 2. Accuracy and flow range

| Model | Flow velocity < 1m/s | | Flow velocity ≥ 1m/s | |
|-------|----------------------|------------------|----------------------|-----------------------|
| | Flow rate (L/min) | Accuracy (L/min) | Flow rate (L/min) | Accuracy (of reading) |
| BS04 | 0 to 0.8 | ±0.008 | 0.8 to 3 | ±1% |
| BS06 | 0 to 1.7 | ±0.017 | 1.7 to 8 | ±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 |
|-------|-------|
| BS04 | 3.04 |
| BS06 | 0.537 |

Model code

| | | | | | | | |
|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--|
| BS | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Description |
| Meter size | 04 | | | | | | 4 mm |
| | 06 | | | | | | 6 mm |
| Process connection | B | | | | | | 3/8" Barb fitting |
| Cable length | 5 | | | | | | 5 m (Standard) |
| Cable leadout direction | A | | | | | | Standard Please consult for other directions. |
| Special specifications | | | | | Blank | | Not provided |
| | | | | | /Z | | Provided |

Converter

- Output
 - 1) Instantaneous flow rate
 - Current output type : 4-20 mA (load resistance: less than 500Ω)
 - Voltage output type : 0-10 V (special specifications: 0-5 V/1-5 V) (load resistance: 1 MΩ or more)
 - 2) Pulse output
 - Open collector output : Load rating: Within 30 V DC, 20 mA
 - Frequency pulse output : Pulse rate up to 1000 Hz at full scale, duty ratio 1 : 1
 - Totalizing pulse output : Output flow rate unit pulse
Can be set per pulse by combining either of the following multipliers and units :
 - Multiplier : ×0.1, ×1, ×10, ×100
 - Unit : mL, L, m³
 - Fault output : Output when converter or detector is in error
NO or NC is selectable, 0 to 1000 Hz
 - 3) Alarm output
 - Open collector (2 points) :
Load rating : Within 30 V DC, 20 mA
Instantaneous flow rate alarm (max. /min.) and integrated flow rate (A/B) can be used in combination, NO or NC is selectable.
- Display : 16-characters, 2-lines LCD with backlight
- Terminal table : Plug-type screw fastening terminal × 3 (detachable plug-in type)
- Setting : Panel switch × 4
- Communication : RS485 communication (Modbus protocol)
- Parameter setting : Panel switch or communication
- Display content : Instantaneous flow rate, integrated flow rate, status
Alarm: Orange LED
- Time constant : 0.5 to 25 seconds
- Low cut-off : 0 to 25% F.S.
- Linearization : Automatic adjustment by kinematic velocity setting. A manual linearizer can be added (up to 20 points, polyline approximation method).
- Power supply/consumption : 24 V DC ±10%
- Current consumption : 110 mA max. (when LCD backlight is on), approx. 200 mA at power-on
- Ambient temperature : 0 to 50°C
- Ambient humidity : 30 to 80% RH (no condensation)
- Installation method : Panel
- Enclosure classification: IP20 (indoor use)
- Material : ABS (black)
- Mass : Approx. 200 g
- Standards : EMC : EN61326-1, EN61326-2-3
RoHS (2011/65/EU)

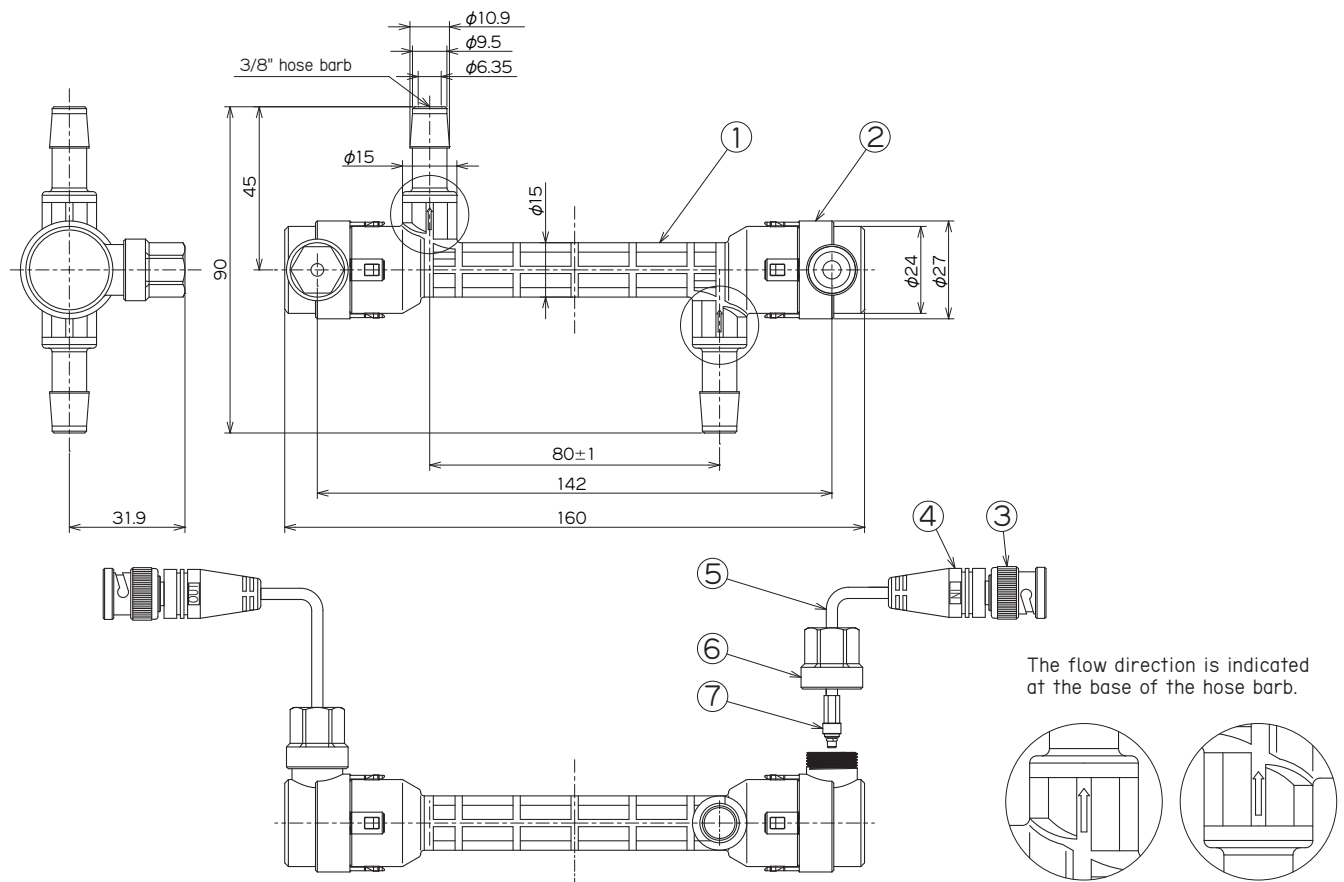
Model code

| | | |
|--------------------------------|--------------------------|-------------|
| SFC4000 – EV – | <input type="checkbox"/> | Description |
| Instantaneous flow rate output | 0 | 4–20 mA |
| | 1 | 0–10 V |
| | 2 | 0–5 V |
| | 3 | 1–5 V |

DIMENSIONS

Detector

BS04, BS06



Materials of flow detector

| No | Parts | Material |
|----|----------------|----------------|
| 1 | Body | PSU |
| 2 | Sensor cap | PSU |
| 3 | BNC connector | Nickel plating |
| 4 | Connector mold | PVC |
| 5 | Cable | PVC coating |
| 6 | Connector cap | PP |
| 7 | MMCX connector | Gold plating |

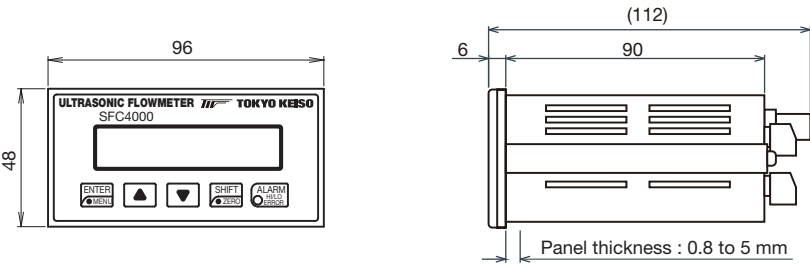
CAUTIONS ON INSTALLATION

- To ensure accurate, stable measurement, do not bend the connecting tube during installation to avoid stress from the piping.
- Install the instrument in a place where no bubbles are contained in the tubing.
- Keep the measuring tube filled with liquid. Although the instrument can be installed with horizontal, vertical, or slanted 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.

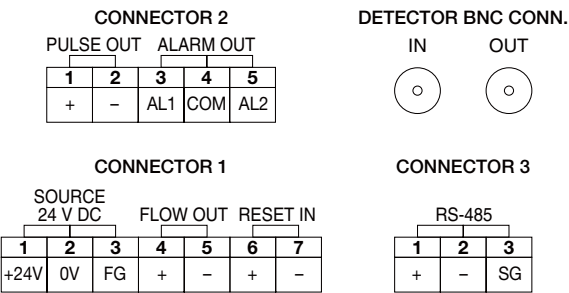
DIMENSIONS

Converter

SFC4000-EV



TERMINAL ARRANGEMENT



Upper left: CONNECTOR 2

| Terminal No. | Terminal name | Description |
|--------------|------------------|--------------|
| 1 | PULSE OUT (+) | Pulse output |
| 2 | PULSE OUT (-) | |
| 3 | ALARM1 OUT (AL1) | Alarm output |
| 4 | ALARM1 OUT (COM) | |
| 5 | ALARM2 OUT (AL2) | |

Upper right: DETECTOR BNC CONN.

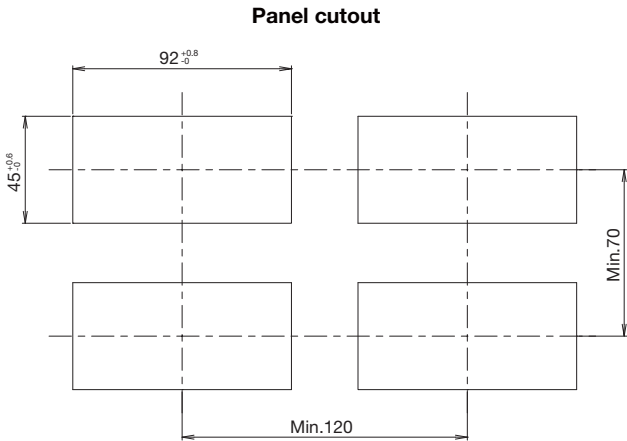
| Terminal | Color | Polarity | Description |
|----------|-------|----------------------|---------------------|
| IN | Red | Inflow (upstream) | Sensor signal input |
| OUT | Black | Outflow (downstream) | |

Lower left: CONNECTOR 1

| Terminal No. | Terminal name | Description |
|--------------|---------------------|------------------------------------|
| 1 | SOURCE DC24V (+24V) | Power supply 24 V DC $\pm 10\%$ |
| 2 | SOURCE DC24V (0V) | |
| 3 | SOURCE DC24V (FG) | Grounding |
| 4 | FLOW OUT (+) | Flow rate output |
| 5 | FLOW OUT (-) | |
| 6 | RESET IN (+) | Totalization reset input |
| 7 | RESET IN (-) | |

Lower right: CONNECTOR 3

| Terminal No. | Terminal name | Description |
|--------------|---------------|----------------------|
| 1 | RS-485 (+) | RS-485 communication |
| 2 | RS-485 (-) | |
| 3 | RS-485 (SG) | |



* Specification is subject to change without notice.

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