



Operating Instructions

863 Valley View Road, Eighty Four, PA 15330
724-941-9701 • skcinc.com

BioSampler® Bioaerosol Collection Device Cat. No. 225 Series

Introduction

Description



Figure 1. SKC BioSampler Components
BioSampler shown with 20-ml vessel (5-ml vessel available)

* Etched nozzle sections and collection vessels are supplied as a matched set. Use the etched identifier to match the two components during sampler reassembly for optimal fit and performance.

Required Equipment/Media

- **BioSampler**
- **Sample pump**, with vacuum gauge or manometer, capable of maintaining sonic flow, such as BioLite[†] (Cat. No. 228-9615), supplied separately or in BioSampler Systems; see *Accessories/Replacement Parts*
- **Collection liquid or coating** (see *Choose a Collection Liquid/Coating*)
- **3/8-inch ID silicone tubing**
- **1/4-inch ID silicone tubing**
- **1/4-inch ID Tygon[®] tubing**
- **3/8 to 1/4-inch reducer/adapters (2)**
- **Liquid trap**
- **Pipette**
- **Aluminum foil or Parafilm**

Tips For optimal operation and convenience, use the BioSampler with the BioSampler case and mounting rod accessories (available in BioSampler Mini Kit Cat. No. 225-9597 and supplied in the Deluxe BioSampler System Cat. No. 228-9615KD).

The BioSampler can be mounted on either side of the BioLite[†] pump using the optional Mounting Bracket Cat. No. 228-9611. See Accessories.

Operation

Set/Calibrate Pump Flow

The BioSampler nozzle section contains three tangential 0.630-mm nozzles that act as sonic orifices. Flow through the nozzles remains constant at approximately 12.5 L/min when used with a pump, such as the BioLite[†], that maintains a pressure drop of 0.5 atmosphere (15 in Hg) or more across the sampler at normal atmospheric conditions (sonic flow).

1. Prepare the pump.
 - a. Plug the pump into the appropriate wall outlet.
 - b. Turn the flow adjuster completely counterclockwise to ensure that it is fully open; turn on the pump using the on/off switch on the back.
 - c. Run the pump for five to ten minutes to stabilize it; turn off the pump.
2. Prepare the calibration train (*Figure 2*): Connect the flowmeter to the BioSampler inlet and the BioSampler outlet to the pump inlet. **Figure 2 illustrates the calibration train using rotameter Cat. No. 320-4A20L, tubing, and reducer/adapters provided in the Deluxe and Basic BioSampler Systems.**

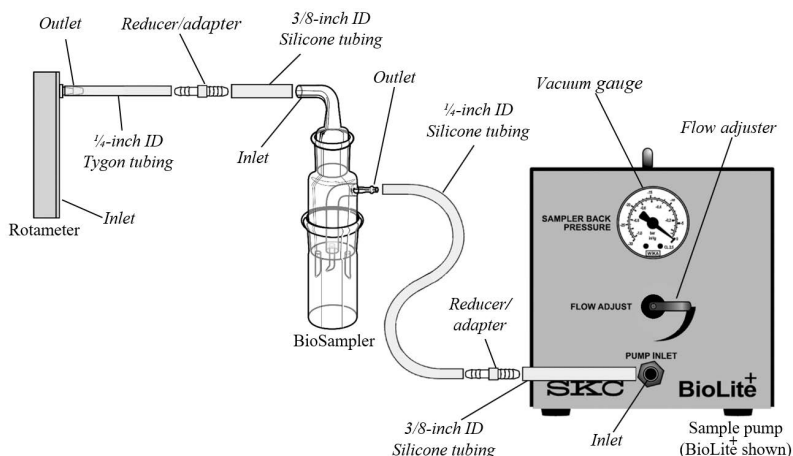


Figure 2. Calibration Train

3. Turn on the pump. Use the flow adjuster on the pump to achieve sonic flow (vacuum gauge or manometer indicates between 15 and 30 in Hg vacuum). **Note:** Turn the flow adjuster **clockwise to reduce** flow rate or **counterclockwise to increase** flow rate.
4. Allow the pump to run for five minutes to stabilize the flow rate before taking any readings.
5. Observe the flow rate indicated on the flowmeter and record as Q_s L/min (to be used to calculate sample volume).

Calibration Note

If pump flow rate changes by $\pm 5\%$ between the baseline calibration (first calibration when sampler is new) and subsequent calibrations, it may indicate a broken or clogged nozzle. Replace the nozzle section of the BioSampler and recalibrate. The new calibrated flow rate (with replacement nozzle section) will likely differ slightly from previous calibrations (each BioSampler has a unique flow rate that is approximately 12.5 L/min). Use this new flow rate as the new baseline flow rate for this sampler.

Prepare the BioSampler Collection Vessel

Before sampling, sterilize the BioSampler, choose a collection liquid or coating, and fill or coat the collection vessel as follows.

Sterilize the BioSampler

Sterilize the inlet, nozzle section, collection vessel, and ground joint cap in an autoclave or oven heated within a range of 320 to 356 F (160 to 180 C) for 180 to 240 minutes **before each use**. This form of sterilization will kill bacteria, fungi, and DNA.



To prevent fritted joints from sticking together during heating, disassemble sampler components (three pieces) before placing them in autoclave or oven.



During reassembly, match the etched identifier on nozzle section with the identifier on collection vessels for optimal fit and performance.

Choose a Collection Liquid/Coating

BioSampler can be used for short-term and long-term sampling. See the following table for recommended collection liquids and coatings based on the desired sample time. **Contact the laboratory for specific requirements, including sterilization.**

Desired Sampling Time	Recommended Liquid/Coating	Notes/Cautions
Shorter than 30 minutes (with liquid)	Sterile distilled water, physiological saline, phosphate buffered saline (PBS), nutrient broth, or peptone water	Do not use water or water-based liquids for sampling periods longer than 30 minutes or for collecting hydrophobic particles such as fungal spores. Contact laboratory for specific requirements.
Shorter than 30 minutes (with coating)	Petroleum jelly/hexane solution coating	Do not use this method for sampling periods longer than 30 minutes.
Longer than 30 minutes	Non-evaporating liquid such as ViaTrap mineral oil or glycerol Note: <i>ViaTrap® mineral oil requires sterilization before use. See Note in Fill or Coat the Collection Vessel.</i>	• Collection efficiency remains virtually constant during 8-hour sampling period. • Glycerol is not recommended for viable microorganism collection; it can cause microorganisms to die from osmotic pressure. • ViaTrap may not be suitable for PCR analysis.

Fill or Coat the Collection Vessel

1. Fill the collection vessel with collection liquid. You will need:

- Sterilized collection vessel(s)
- Pipette
- Sterile collection liquid (can include, but is not limited to, sterile distilled water, physiological saline, PBS, nutrient broth, or peptone water)
- Aluminum foil or Parafilm



If using ViaTrap mineral oil as the collection liquid, sterilize it by filtering it through a 0.4- μ m pore size sterile polycarbonate membrane filter. *Do NOT autoclave ViaTrap; heating the oil will make it cloudy.*

- a. In a sterile environment, aseptically pipet the appropriate amount of sterilized collection liquid into the sterilized collection vessel.



If using a viscous liquid, such as ViaTrap or glycerol, pipet *less than 20 ml* of viscous liquid into the 20-ml collection vessel (< 4 ml inside a 5-ml collection vessel) to prevent overflow of liquid outside the sampler.

- b. In the same sterile environment, assemble the clean, sterilized inlet, nozzle section, and filled collection vessel.
- c. Temporarily seal sampler inlet and outlet with aluminum foil or Parafilm to maintain sterility.

2. Coat the collection vessel. You will need:

- Sterilized collection vessel(s)
- Pipette
- Sterile solution for coating (can include, but is not limited to, petroleum jelly/hexane solution)
- Aluminum foil or Parafilm

- a. In a sterile environment, prepare coating solution. **Note:** SKC recommends using a petroleum jelly/hexane solution (approximately 0.1 gram petroleum jelly per milliliter of hexane).

- b. Aseptically pipet a few drops of solution into the collection vessel and rotate it so that its entire inner surface is wetted. Ensure the coating covers the region where the air jets impact the inner surface of the collection vessel. The hexane will evaporate within five minutes, leaving a uniform sticky layer on the inner surface of the collection vessel.



If using the petroleum jelly/hexane solution, the hexane will evaporate within five minutes, leaving a uniform sticky layer on the inner surface of the collection vessel. Alternative coatings can be used.

- c. In the same sterile environment, assemble the clean, sterilized inlet, nozzle section, and coated collection vessel.
- d. Temporarily seal sampler inlet and outlet with aluminum foil or Parafilm to maintain sterility.

Set Up/Sample

- If sampling using a collection liquid, especially a viscous liquid such as ViaTrap or glycerol, SKC recommends using Liquid Trap Cat. No. 225-22 to protect the sample pump.
 - If using a collection liquid, see *Proper Operation During Sampling*.
 - If sampling biologically inert particles, aseptic procedures are not necessary.
 - If using a water-based collection liquid, **do not** sample at temperatures below 41 F (5 C) to avoid crystallization of the collection liquid.
1. Warm up the vacuum pump sufficiently before connecting it to the sampling train. **Note:** If using the BioLite sample pump, running it for the five minutes required to stabilize the flow rate is sufficient (see *Set/Calibrate Pump Flow*, *Step 3*). Otherwise, see the specific pump operating instructions.
 2. When ready to sample, remove foil or Parafilm from the BioSampler inlet and outlet.
 3. Prepare the sampling train with collection liquid or coated collection vessel.
- a. If using a collection liquid, it is important to use a liquid trap** (Figure 3) to protect the sample pump. Connect the BioSampler outlet (nozzle section) to the inlet of a liquid trap and connect the liquid trap outlet to the sample pump inlet as shown in Figure 3.
- b. If using a coated collection vessel (Figure 4),** connect the BioSampler outlet (nozzle section) to the sample pump inlet as shown in Figure 4.

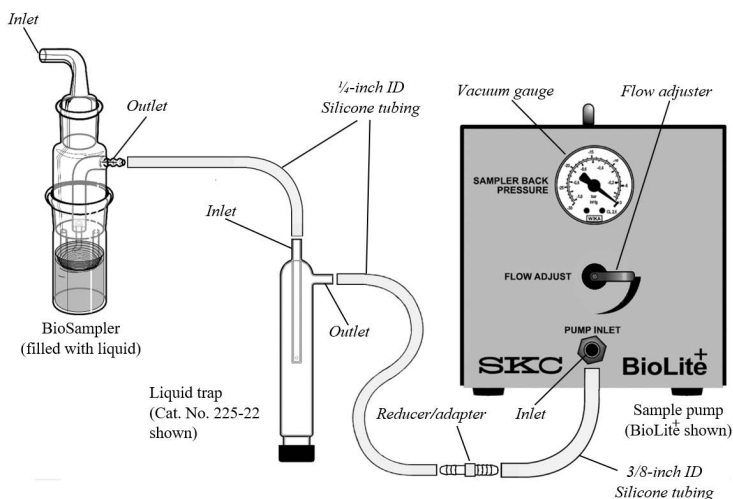


Figure 3. Sampling Train with Liquid Trap

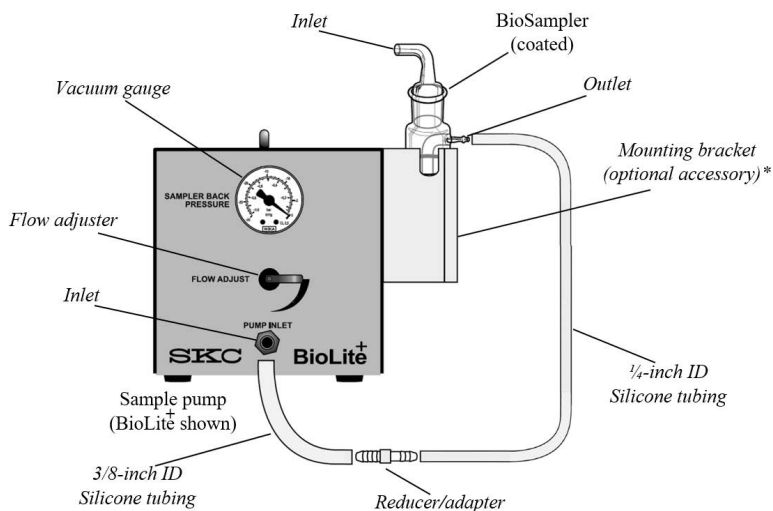


Figure 4. Sampling Train with Coated Collection Vessel

4. Sample for the sampling period appropriate for the collection liquid or coating used. See *Choose a Collection Liquid/Coating*. Also see *Proper Operation During Sampling*.
5. After sampling is complete, record the sampling time.
6. **Calculate volume of air passed through the BioSampler using the following formula:**

$$V \text{ [Liters]} = Q_s \text{ [flow rate in L/min]} \times t \text{ [sampling period in minutes]}$$

* To attach the mounting bracket to the BioLite+ pump, insert the two holes on the back of the mounting bracket over the two mounting screws on the side of the pump and slide the bracket down. Tighten the screws to secure the bracket.

Proper Operation During Sampling



If sampling using collection liquid, observe the sampler frequently during sampling (especially when using viscous collection liquid) for the following.

When operating properly, the collection liquid swirls up the inner wall of the collection vessel, wetting the inner wall where the nozzles output. Visually monitor swirling liquid to determine that:

- There is enough collection liquid to wet the inner wall where nozzles output. If this is not occurring, pause sampling and add more sterilized collection liquid before resuming.

Underfilled



- There is **not** excessive bubbling, which indicates too much collection liquid in the collection vessel. If excessive bubbling occurs, pause sampling and aseptically pipet some of the collection liquid from the vessel before resuming.

Overfilled



Operation with properly filled collection vessel

Prepare Samples for Transport/Shipment and Analysis

1. In a sterile environment, disassemble the BioSampler.
 2. Transfer sample as follows:
 - a. **If collection liquid was used**, accurately measure the final volume of collection liquid and aseptically transfer it into a sterilized container for analysis.
 - b. **If a coated collection vessel was used**, wipe the inner surface of the vessel with a small piece of cloth or paper. Aseptically transfer cloth or paper sample into a sterilized container for transport to a laboratory for analysis.
-  **If sealing a collection vessel with a ground joint cap, apply silicone grease to the ground glass surface on cap to prevent sticking.**
3. Seal individual sample containers to prevent contamination during transport.
 4. Properly label all containers with sample identification.
 5. Transport or ship samples for delivery to a laboratory **as soon as possible after collection, preferably within 24 hours**. Many analyses have very short hold times.

Analyses Information

Samples collected using the BioSampler can be analyzed by the methods described below.

Analysis Method	Used for
Growth culture	Quantification and characterization of airborne bacteria and fungi to the species level
Microscopic	Enumeration and limited identification of total airborne bacteria and fungi
Biochemical assay	Measurement of biological compounds such as endotoxins
Immunoassay	Quantification of airborne allergens. Other methods include fluorescence, enzyme, and radioimmunoassay.
Polymerase Chain Reaction (PCR) Note: <i>If using this analysis method, ViaTrap mineral oil may not be a suitable collection liquid. Contact the laboratory for information on the appropriate collection liquid.</i>	Screening of samples for a specific genus or species based on in-vitro replication of selected nucleic acid sequences

Maintenance

Store components **unassembled** (in three pieces) to prevent future difficulty in separating pieces, and store them in a clean, dry area away from temperature extremes.

References

- Macher, J.M., et al., "Sampling Airborne Microorganisms and Aeroallergens," *Air Sampling Instruments for Evaluation of Atmospheric Contaminants*, 8th ed., ACGIH, 1995, pp. 589-617
- Macher, J.M., "Evaluation of Bioaerosol Sampler Performance," *Applied Occupational Environmental Hygiene*, 12, 1997, pp. 730-736
- Buttner, M.P., et al., "Sampling and Analysis of Airborne Microorganisms," *Manual of Environmental Microbiology*, ASM Press, Washington, DC, 1997, pp. 629-640
- Lin, X., et al., "Effect of Sampling Time on the Collection Efficiency of All-Glass Impingers," *Am. Ind. Hyg. Assoc. Journal*, 58, 1997, pp. 480-488
- Willeke, K., et al., "Improved Aerosol Collection by Combined Impaction and Centrifugal Motion," *Aerosol Science and Technology*, 29 (5), 1998, pp. 439-456
- Lin, X., et al., "Long Term Sampling of Airborne Bacteria and Fungi into a Non-Evaporating Liquid," *Atmospheric Environment*, 1999, pp. 4291-4298
- Lin, X., et al., "Survival of Airborne Microorganisms during Swirling Aerosol Collection," *Aerosol Science and Technology*, 32 (3), 2000, pp. 184-196
- Willeke, K., and Macher, J. M., "Air Sampling," *Bioaerosols: Assessment and Control*, 1999, pp. 11-1 to 11-25
- Reponen, T., et al., *Biological Particle Sampling. Aerosol Measurement, Principles, Techniques, and Applications*, John Wiley & Johns, Inc, 2001, pp. 751-777
- Rule, A. M., et al., "Application of Flow Cytometry for the Assessment of Preservation and Recovery Efficiency of Bioaerosol Samplers Spiked with *Pantoea agglomerans*," *Environmental Science and Technology*, 41 (7), 2007, pp. 2467-2472
- Nevalainen, A., et al., *Bioaerosol Sampling: Aerosol Measurement Principles, Techniques, and Applications*, Van Nostrand Reinhold, New York, 1993, pp. 471-492

Accessories/Replacement Parts

Description	Cat. No.	
BioSampler Collection Vessel (bottom) and ground joint cap, for transporting samples	20 ml	225-9596
	5 ml	225-9596A
ViaTrap Collection Media ,† special mineral oil for bioaerosol sampling	120 ml	225-9598A
	500 ml	225-9598
	950 ml	225-9599
Sonic Flow Pump includes protective housing with vacuum gauge and valve, supplied without orifices or rotameter, AC operation only	115 V	228-9615
	230 V	228-9620
Glass Trap , prevents collection liquid from entering the pump, can be used with or without sorbent		225-22
Trap Sorbent , 200 grams, silica gel/activated charcoal sorbent mix to remove vapors		225-22-02
Rotameter , 2 to 20 L/min, 1/4-in ID Tygon tubing installed on outlet		320-4A20L
Mounting Bracket , for mounting BioSampler on BioLit [®] pump		228-9611

† ViaTrap mineral oil may not be suitable for PCR analysis.

SKC Limited Warranty and Return Policy

SKC products are subject to the SKC Limited Warranty and Return Policy, which provides SKC's sole liability and the buyer's exclusive remedy. To view the complete SKC Limited Warranty and Return Policy, go to skcinc.com/warranty.

Appendix

Performance Profile

Flow Rate	Approximately 12.5 L/min
Medium	Water or more viscous liquids such as ViaTrap mineral oil [†] or coating. Contact the laboratory for specific medium.
Method of Operation	Air passes through three 0.630-mm tangential sonic nozzles that output into a swirling flow of collection liquid, thereby entraining bioaerosols in the liquid for analysis.
Collection Efficiency	Nearly 100% over a wide range of particle sizes; decreases to approximately 90% at 0.5 µm
Pump	High-volume vacuum pump capable of achieving sonic flow; SKC recommends the BioLite [†] Sample Pump (115 V)

[†] May not be suitable for PCR analysis. Contact the laboratory for information on the appropriate collection liquid.

skcinc.com

Form 37084 Rev 230202