

BioHawk® Plus

High-Volume Air Sampler + 8-Channel Biodetection System

Introduction

The BioHawk Plus combines a highly efficient, high-volume aerosol concentrator (SASS 4000) with an 8-channel collector/bioidentifier system (BioHawk). This system concentrates particulates from ambient air then passes it on to a wetted-wall air sampler that extracts the particulates from the air stream into a liquid phase. The liquid sample is then automatically analyzed by fluoroimmunoassay.

The system can be used for many applications including:

- Counter-terrorism
- Epidemiology
- Agriculture
- Food processing air quality
- Medical facility air quality

Principles of Operation

The SASS 4000 continuously samples over 3500 liters/minute of ambient air. Air flows radially inward into the concentrator through a coarse square-mesh screen. This inward radial flow provides 360 degree sampling of the surrounding aerosol environment. The primary fan and a curved air shroud are mounted above the sampler inlet section, channeling exhaust air into a vertical stream away from the inlet area.

Particulates in this air stream are transferred to a much smaller secondary air stream using patent-pending centrifugal and virtual impaction principles. Particles are routed into the secondary flow by forcing primary circuit air to circulate through specially shaped channels where centrifugal force and particle momentum isolate and concentrate the particles.

The secondary flow can reach aerosol concentrations that are 4X to 15X higher than present in the incoming air, yet the velocity of this secondary aerosol concentrate flow is much lower than peak velocities in the primary circuit. The two-stage sampler therefore amplifies and slows down the captured ambient aerosol particles prior to their collection. Due to advantageous pressure differentials within the device, one fan drives both the primary and secondary flows.

This secondary airflow is then routed, via a hose connection, into the integrated wetted-wall aerosol collector of the BioHawk® 8-channel bioassay system. Particulates are captured and concentrated in the collector operating fluid. Next, the concentrated sample is automatically transferred to the biodetector portion. It is suitable for high-sensitivity monitoring of biological agents, toxins, explosives, and chemical contaminants. Assay results are typically available in 20 minutes.. Alternatively, a Sample Port may be used to introduce liquid samples for analysis from external sources, either manually or under software control. A built-in microcomputer provides unparalleled operating flexibility and sophistication.

Bioassays are performed within a small disposable credit card-sized plastic assay coupon using a 'sandwich format' fluoroimmunoassay protocol. Unlike other assay technologies that are based on a "use once and discard" philosophy, this coupon and the reagents stored within it may be used for 10 or more assay procedures before being discarded. Since a single assay coupon can handle up to eight different analytes simultaneously, this means that up to 80 individual assays may be performed before discarding or removing the coupon. This capability simplifies field use and substantially reduces life cycle cost.

Although sophisticated and versatile, the unit is still very easy to use. Most global functions such as air sampling and bioidentification are performed using multi-step recipes developed by Research International and stored in the system's computer memory. Users need only the most fundamental level of training since the internal processes and steps are preset through the built-in computerized recipes. For more professional users, bundled Windows-based software allows the user to develop their own customized sample collection and detection protocols.



Figure 1: BioHawk Plus - High-Volume Air Sampler plus 8-Channel Biodetection System.

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BioHawk Plus Dry/Wet Air Sampling and Bioidentification System Specifications

Concentrator (SASS 4000)

| <u>Characteristic</u> | <u>Description</u> |
|--------------------------------------|--|
| Primary airflow: | 3,600+ liters/min is sampled uniformly from around the concentrator's circumference. |
| Secondary airflow: | 325 LPM at +0.4 cm of water static head. |
| Secondary airflow connection: | Hose barb fitting on base surface for nominal 3.8 cm ID hose. |
| Concentration enhancement: | 4 - 15 times, typical, depending on primary/secondary airflow ratio. |
| Overall size: | 38 cm high x 25.4 cm diameter max. |
| Weight: | 6.32 kg (13.9 lbs.) |
| Operating temperature range: | -40°C to 60°C |
| Power consumption: | <ul style="list-style-type: none"> • 90 watts for 28 V ECM drive motor. If operated from DC, please specify DC source voltage of 12, 24 or 28 VDC. • 100 to 230 VAC lump-in cord AD/DC converter supplied. Please specify AC voltage range required. |
| Sound level: | 72 db-A @ 1 meter radius on inlet equatorial plane. |
| Mounting: | Quick-detach tripod legs; 0.53m to 1.46m adjustable height. |
| Accessories: | <ul style="list-style-type: none"> • Hard shell carrying case. • Electret sample filter assembly (for stand-alone operation). |

8-Channel Collector/Bioidentifier (BioHawk)

| | |
|------------------------------|--|
| Use profile | Indoor/outdoor sample collection, transfer, and assay; storage of 255 assay recipes; user in full MOPP gear either walking or in moving vehicle. |
| Collection principle | Multi-stage wetted-wall cyclone with enhanced particulate collection. |
| Assay method | Disposable wet assay coupon-reuseable more than 10 times. Eight simultaneous software-based assays. Antibody or nucleic acid. Coupon reseals on removal for archival storage. |
| Fluid Handling | Fluids manipulated under microprocessor control using peristaltic and syringe pumps; sample may be oscillated to lower assay time; reagent is recovered for reuse. |
| Fluids storage | Snap on 3-section fluid pack. Clean water: 1 liter; Buffer: 250 ml. Waste: 500ml. Assay samples may be optionally stored in a detachable 8cc vial for later analysis. |
| Human interface | Day/night Touchscreen LCD display. Usable in MOPP gear. |
| Digital communication | RS-232 bi-directional serial link |
| Physical size | 35.6 cm W x 36.5 cm H x 17.1 cm D |
| Weight | 21.7 lbs. dry; 26.7 lbs. with battery and fluids (9.8/12.1 kg). |
| Operating/storage | 1 to 66°C and -29 to 66°C. Reagent deterioration can reduce upper limit significantly |
| Humidity | 10% and above. May be operated in rain. |
| Survivability | MILSPEC 810F; MTBF of about 30,000 hours is determined by air sampler fan |
| Data storage | Flash memory retains raw/processed data for over 6000 assays. |
| Power Consumption | 6.2 W at idle; 17.8W with fan operating and one assay performed each 30 minutes |
| Power source | Primary battery BA-5390A/U, 1.05 kg (2.3 lb); lifetime 14 to 45 hours. Rechargeable battery UBI-2590; lifetime is approximately 56% of the BA5390A/U primary battery. Universal lump-in-cord power supply, 82-265 Volt (47-63 Hz). |
| Alarm | Visual LED and 103 dB @0.6m waterproof horn; adjustable. RS-232 data link. |
| Decontamination | Auto-flush protocols using onboard water, or manual flush with detergent and/or disinfectant. High-performance pull-through fan easily remove if contaminated. |
| Sound level | 60 dB (A). |
| Ancillary equipment | Heavy-duty hard-shell transport case with wheels. |
| Analyte range | Toxins, viruses, bacteria, spores, fungi, multicellular pathogens |
| Sensitivity | Analyte dependent, 1 to 10 ppb typical for toxins, 100 to 100,000 CFU/ml for bacteria. |
| Assay time | Dependent on assay; 10 to 20 minutes typical. |
| Reagent storage | Reagent stored onboard assay coupon; may be reused up to 15 times depending on assay protocol. |
| Confirmatory sample | Confirmatory sample may be stored in assay coupon or 8cc sample vial. |



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