Thank you for purchasing this Esco Biological Safety Cabinet. Please read this manual thoroughly to familiarize yourself with the many unique features and exciting innovations we have built into your new equipment. Esco provides many other resources at our website, www.escoglobal.com, to complement this manual and help you enjoy many years of productive and safe use of your Esco products.

User Manual

For Technical Service, contact
North America
Esco Technologies, Inc.
2940 Turnpike Drive, Units 15-16 •Hatboro, PA 19040, USA
Toll-Free USA and Canada 1-877-479-3726
Tel 215-441-9661 • Fax 215-441-9660
us.escoglobal.com • usa@escoglobal.com

Rest of the World
Esco Micro Pte. Ltd.
21 Changi South Street 1 • Singapore 486777
Tel +65 6542 0833 • Fax +65 6542 6920
www.escoglobal.com • mail@escoglobal.com

Airstream®
Class II
Biological Safety Cabinet

Esco Airstream Class II BSC (AC2 - TU) User Manual
Version A - Released August 2014

Copyright Information

"Material in this manual is provided for informational purposes only. The contents and the product described in this manual (including any appendix, addendum, attachment or inclusion), are subject to change without notice. Esco makes no representations or warranties as to the accuracy of the information contained in this manual. In no event shall Esco be held liable for any damages, direct or consequential, arising out of or related to the use of this manual."

Table of Contents

Warranty Terms and Conditions

Esco products come with a limited warranty. The warranty period will vary depending on the product purchased, beginning on the date of shipment from any Esco international warehousing location. To determine which warranty applies to your product, refer to the appendix below.

Esco's limited warranty covers defects in materials and workmanship. Esco's liability under this limited warranty shall be, at our option, to repair or replace any defective parts of the equipment, provided that these parts, if proven to the satisfaction of Esco, were defective at the time of being sold and that all defective parts shall be returned, properly identified with a Return Authorization.

This limited warranty covers parts only, and not transportation/insurance charges.

This limited warranty does not cover:

- Freight or installation (inside delivery handling) damage. If your product was damaged in transit, you must file a claim directly with the freight carrier.
- Products with missing or defaced serial numbers.
- Products for which Esco has not received payment.
- Problems that result from:
  - External causes such as accident, abuse, misuse, problems with electrical power, improper operating environmental conditions.
  - Servicing not authorized by Esco.
  - Usage that is not in accordance with product instructions.
  - Failure to follow the product instructions.
  - Failure to perform preventive maintenance.
  - Using accessories, parts, or components not supplied by Esco.
  - Damage by fire, floods, or acts of God.
  - Customer modifications to the product.
- Consumables such as filters (HEPA, ULPA, carbon, pre-filters) and fluorescent / UV bulbs.

Factory installed, customer specified equipment or accessories are warranted only to the extent guaranteed by the original manufacturer. The customer agrees that in relation to these products purchased through Esco, our limited warranty shall not apply and the original manufacturer's warranty shall be the sole warranty in respect of these products. The customer shall utilize that warranty for the support of such products and in any event not look to Esco for such warranty support.

Esco encourages all users to register their equipment online at www.escoglobal.com/warranty_registrations.php or complete the warranty registration form included with each product.

ALL EXPRESS AND IMPLIED WARRANTIES FOR THE PRODUCT, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES AND CONDITIONS OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE LIMITED IN TIME TO THE TERM OF THIS LIMITED WARRANTY. NO WARRANTIES, WHETHER EXPRESS OR IMPLIED, WILL APPLY AFTER THE LIMITED WARRANTY PERIOD HAS EXPIRED. ESCO DOES NOT ACCEPT LIABILITY BEYOND THE REMEDIES PROVIDED FOR IN THIS LIMITED WARRANTY OR FOR SPECIAL, INDIRECT, CONSEQUENTIAL OR INCIDENTAL DAMAGES, INCLUDING, WITHOUT LIMITATION, ANY LIABILITY FOR THIRD-PARTY CLAIMS AGAINST YOU FOR DAMAGES, FOR PRODUCTS NOT BEING AVAILABLE FOR USE, OR FOR LOST WORK. ESCO'S LIABILITY WILL BE NO

MORE THAN THE AMOUNT YOU PAID FOR THE PRODUCT THAT IS THE SUBJECT OF A CLAIM. THIS IS THE MAXIMUM AMOUNT FOR WHICH ESCO IS RESPONSIBLE.

These Terms and Conditions shall be governed by and construed in accordance with the laws of Singapore and shall be subject to the exclusive jurisdiction of the courts of Singapore.

Technical Support, Warranty Service Contacts
USA: 1-888-479-ESCO
Singapore: +65 6542 0833
Global Email Helpdesk: support@escoglobal.com
Visit http://escoglobal.com to talk to a Live Support Representative
Distributors are encouraged to visit the Distributor Intranet for self-help materials.

Product Appendix, Warranty Listings

Biological Safety Cabinets, Laminar Flow Cabinets, HEPA-Filtered Cabinets (except Streamline brand)	4 years limited
Laboratory Fume Hoods	2 years limited
Ductless Fume Hoods	4 years limited for Ascent Opti 6 years for Ascent Max
Cleanroom Equipment	1 year limited
Laboratory Ovens and Incubators	1 year limited
CO_2 Incubators	2 years limited
Containment/Pharma Products	2 years limited
Ultra-low Temperature Freezer	5 years limited 5 years on compressor
Benchtop Incubator	2 years limited
Thermal Cyclers	3 years limited for MiniPro, MaxPro, Provocell 2 years limited for Spectrum 2 years on blocks and Peltier units 2 years on all electronic components 3 years on the housing and fans

Policy updated on 1st January 2012

Applies to all units ordered on and after 1st January 2012

Introduction

1. Products Covered

Esco Class II Biological Safety Cabinet				
Model	Electrical Rating	1.2 meters 4 feet	1.5 meters 5 feet	1.8 meters 6 feet
Airstream	230 VAC, 50/60Hz, 1Φ	AC2-4E8-TU	AC2-5E8-TU	AC2-6E8-TU

2. Safety Warning

- Anyone working with, on or around this equipment should read this manual. Failure to read, understand and comply with the instructions given in this manual may result in damage to the unit, injury to operating personnel, and / or poor equipment performance.
- Any internal adjustment, modification or maintenance to this equipment must be undertaken by qualified service personnel.
- The use of any hazardous materials in this equipment must be monitored by an industrial hygienist, safety officer or some other suitably qualified individuals.
- Explosive or inflammable substances should never be used in the cabinet unless adequate risk assessment has been carried out.
- If chemical, radiological or other non-microbiological hazards are being used in the cabinet, additional protective measures should be taken based an adequate risk assessment.
- This cabinet should not be used with cytotoxic substances unless it has been determined that the filter can be safely changed. Please note that cytotoxic substances cannot be inactivated by conventional gaseous decontamination method (e.g. formaldehyde) used to inactivate biological agents.
- The biological hazard symbol on the front panel of the cabinet indicates the presence of biological substances that pose a threat to human health.
- Before you process, you should thoroughly understand the installation procedures and take note of the environmental / electrical requirements.
- In this manual, important safety related points will be marked with the symbol. 
- If the equipment is used in a manner not specified by this manual, the protection provided by this equipment may be impaired.

3. Document Management

We recommend that you keep this manual, along with the factory test report close to the cabinet for easy reference by the cabinet operator and qualified maintenance personnel.

If you require replacements for any of the provided documentation (including factory test reports) you can request copies from Esco Customer Services*. Please provide the following information when making requests for replacement documents:

- Company (Organization) Name
- Product Brand and Model
- Product Serial Number
- Documents requested

** There may be a nominal charge for this service.*

4. Limitation of Liability

The disposal and / or emission of substances used in connection with this equipment may be governed by various local regulations. Familiarization and compliance with any such regulations are the sole responsibility of the users. Esco's liability is limited with respect to user compliance with such regulations.

5. European Union Directive on WEEE and RoHS

The European Union has issued two directives:

- **Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE)**

This product is required to comply with the European Union's Waste Electrical & Electronic Equipment (WEEE) Directive 2002/96/EC. It is marked with the following symbol:

Esco sells products through distributors throughout Europe. Contact your local Esco distributor for recycling/disposal.

- **Directive 2002/95/EC on Restriction on the use of Hazardous Substances (RoHS)**

With respect to the directive on RoHS, please note that this cabinet falls under category 8 (medical devices) and category 9 (monitoring and control instruments) and is therefore exempted from requirement to comply with the provisions of this directive.

6. Symbols

Information in this manual may be prefaced with the following symbols. They are provided to help you identify important operational, safety, maintenance or conformance issues.

Electrical Hazard: Danger of electric shock

Turn Off and Disconnect From Main Supply Before Proceeding: Do not perform this operation while the unit is operational

The Biohazard Symbol on the front panel of the cabinet indicates the presence of biological substances that pose a threat to human health

Approved Service Engineer Only: Operation to be performed only by approve engineers

Chapter 1 - Product Information

1.1. Quick View AC2-TU

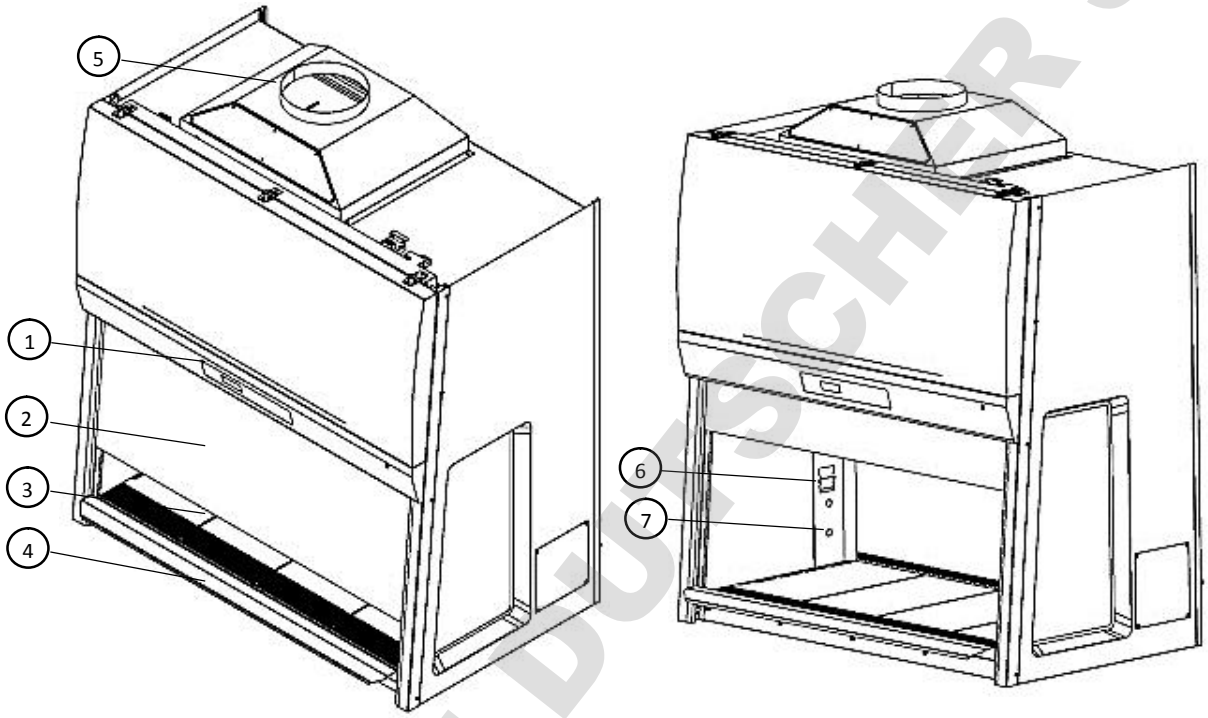


Figure 1.1. EC2 BSC main parts.

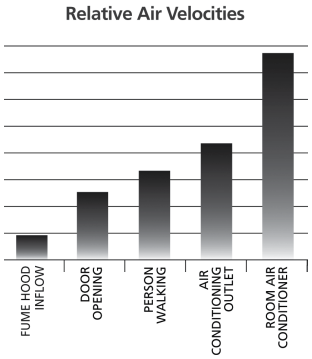
1. Esco Sentinel Gold Control System
2. Sash Window
3. Work Tray (Multi-piece)
4. Armrest
5. Thimble Exhaust Ducting (Optional)
6. Electrical Outlet
7. Service Fixture (Optional)

Chapter 2 - Installation

2.1. General Requirement

2.1.1. Location Requirements

The BSC needs to be sited in a location that does not compromise the performance of the unit.

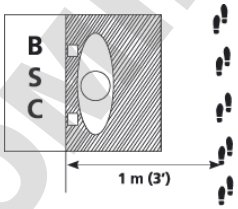


As seen in the chart, your cabinet's internal airflow velocity is relatively low compared to the airflow disturbances potentially caused by opening a door, a person walking by or a direct exposure to an air-conditioning outlet. These external airflow disturbances can affect the containment of the BSC. Therefore, the BSC should be located as far away as possible from sources of airflow disturbance and in an orientation which optimally shields the cabinet's airflow from all external airflow disturbances. There should be adequate SOP in place to minimize events that will affect the performance of the cabinets.

The following requirements should be taken into account:

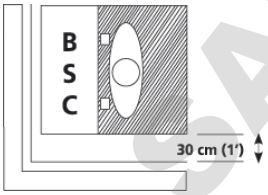
- If necessary, the arm rest and sash cover can be removed to reduce the overall depth of the cabinet. Detailed instructions on how to carry out this step can be obtained from your Esco Service Representative.
- Poor siting of a cabinet can adversely affect performance. A specialist engineer and safety personnel in your facility should be consulted on correct positioning of the cabinet prior to installation.
- Cabinets should never be sited in line with a doorway, a window that can be opened, or adjacent to a thoroughfare. Care should be taken to ensure that potential effect of room air diffusers, fans, extractors, vents, etc. on the BSC are taken into account and any risk of airflow disturbance is appropriately treated (e.g. eliminated, mitigated) before installation.
- Room air supply diffusers should not be within 1.5 meter (5') of the front aperture. If there are large numbers of cabinets in a laboratory this recommendation may be difficult to comply with, but where diffusers have to be placed in close proximity to a safety cabinet, their discharge velocities will need to be low.
- The position of a BSC should satisfy the spatial requirements (e.g. vision, lighting and convenience of access) of the operator and people working nearby. If the cabinet is installed on a bench top, the leading edge should slightly overhang or be flush with the edge of the bench top.
- There should not be an open space between the leading edge of the cabinet and the front of the bench as this may create turbulence in front of the aperture. It also provides an obstacle which could adversely affect airflow across the cabinet face.

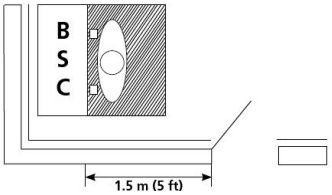
2.1.1.1. Position Requirements



Any pedestrian traffic routes, thoroughfares or walkways should be at least 1.0 metre (3') from the front of the cabinet, so as to preserve zone undisturbed by anyone other than the operator.

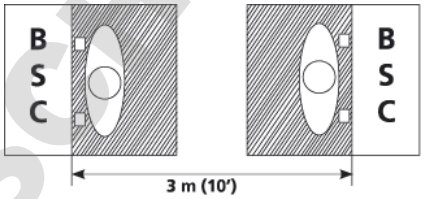
You should not position the cabinet with either side closer than 30 cm (1') to adjacent walls or other similar obstructions. Allow at least 30 cm (1') clearance on both sides of the cabinet. There should be adequate space left for cleaning the sides of the cabinet and for carrying out decontamination procedures. There should be unobstructed access to the main power supply point(s).

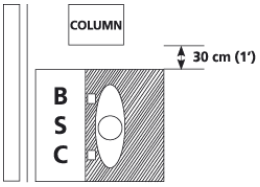




You should not position the cabinet where the distance between the aperture and any doorway is less than 1.5 meters (5') or the distance between the side panel and any doorway is less than 1.0 meter (3'). Door openings cause substantial air turbulence. If the door is fitted with air transfer grills, operator protection factor testing may be carried out to determine suitable reduced clearance.

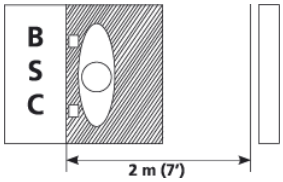
Safety cabinets should not be installed in positions where there is a likelihood of interference from other laboratory equipment. The distance from the aperture to the aperture of an opposing cabinet, fume cupboard, etc. should be in excess of 3 meters (9') for safe operation.

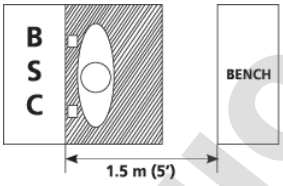




As with walls, any large obstruction such as a pillar or column projecting beyond the plane of the front aperture should not be within 30 cm (3') of the sides of the cabinet.

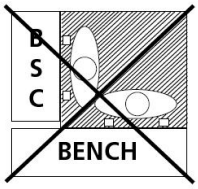
You should not position the cabinet in a location where there is an opposing wall (or other obstruction likely to affect airflow) within 2 meters (7') of the front aperture.

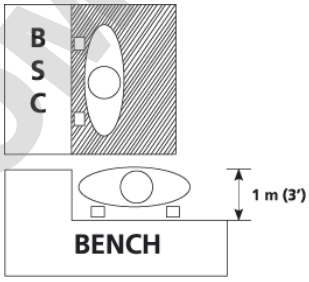




The distance between the aperture of the cabinet and the front of a bench opposite should not be less than 1.5 meters (5'). Containment performance may not be affected if this distance is reduced, to allow the operator to use the bench whilst working in the cabinet for instance. You should measure any such effects using relevant operator protection factor tests to determine safety limits.

Avoid positioning a bench at right angles to the cabinet. While this may reduce traffic in front of the cabinet, any other person working at the bench is likely to disturb airflow close to the cabinet.





A projecting bench will help minimize traffic in front of the cabinet and anyone working at the bench is unlikely to have a significant effect on the airflow as long as the front of the bench is situated at least 1 meter (3') from the side of the cabinet.

2.1.2. Preparing For Installation

2.1.2.1. Support Requirements

Esco provides a number of support stand options, these are summarized below and further details can be found in the table at the end of this section. (Note: Some support stands are not NSF certified)

- Fixed height
- Adjustable height
- Telescoping height
- Infinitely adjustable cradle stand

Esco support stand with leveling feet is recommended for safety. It is recommended that the installation of the support stand be carried out by qualified personnel (contact your Esco Distributor for assistance). After the cabinet is installed on the support stand, use a level placed in the center of the work tray to adjust the legs to achieve a level work surface; first level from left to right and then level from front to back. The NSF approved leg levelers provide a maximum 50 mm (2") adjustment.

When installing the cabinet onto existing work surface, ensure that the structure can safely support the combined weight of the cabinet and any related equipment. Some modifications to the work surface may be necessary. The work surface should be smooth, nonporous and resistant to those disinfectants and chemicals to which the cabinet is regularly exposed to.

2.1.2.2. Relocating the Cabinet

⚠ Normally BSCs are rarely moved once they are in their ideal positions, but should there be a need to relocate or repackage the unit, here are some considerations:

- It is recommended that risk assessment is carried out before the BSC is moved.
- Before moving the BSC, remember to decontaminate the cabinet.
- Before moving the BSC, remember to secure all moving parts (e.g. sash window).
- BSC is heavy so please carry out adequate workplace safety assessment before moving the cabinet. Should only manpower is available (i.e. no suitable equipment), it will usually take 6 or more people to move a BSC manually.

⚠ For repackaging:

- Bolt the BSC to the pallet.
- Strap the BSC body down to the pallet.
- Repackage as necessary. If possible, use original packaging.
- When moving the BSC, use material handling equipment and lift the pallet.

2.1.3. Environmental Requirements

- Indoor use only.
- Altitude of up to 2,000 meter (6,600 feet).
- Relative humidity between 20% – 90%
- Temperature between 18°C – 30°C (65°F – 86°F).
- Main supply voltage fluctuations up to ± of the nominal voltage.
- Transient overvoltages up to levels of Overvoltage Category II.
- Pollution Degree 2.0

  Pollution degree describes the amount of conductive pollutants present in an operating environment. In pollution degree 2.0, it is assumed that only non-conductive pollutants such as dust are present, except when occasional conductivity caused by condensation.

2.1.4. Exhaust Requirements

The exhaust filter area is susceptible to disruptive air currents or air drafts. A clearance of at least 30 cm (1') is recommended between the highest point of the cabinet and the ceiling. If the distance is less than 30 cm (1'),

the airflow alarm system may need re-calibration. For proper exhaust filter leak scanning purposes, a minimum clearance of 50 cm (1' 8'') is recommended.

⚠ Esco does not guarantee that this distance would be sufficient. It would have to be verified by your nearest Esco distributor or your service company.

If you intend to connect your cabinet to an external exhaust system, Esco offers an optional Exhaust Collar for Thimble-Ducting. Installation requirements and instructions are provided with the Exhaust Collar. (Note: External Exhaust System Installation is not NSF certified).

2.1.5. Electrical Requirements

- The cabinet should be connected to its own dedicated power outlet(s).
- The power rating for each model is shown in below. Ensure that the outlet is rated accordingly.

Model	Power rating
AC2-4E8-TU	230 VAC 50/60 Hz, 8.6 A
AC2-5E8-TU	230 VAC 50/60 Hz, 9.5 A
AC2-6E8-TU	230 VAC 50 Hz, 12 A

- The power cable is located on the right hand side of the cabinet and the cord is 2.5 m long. When preparing the installation site, try to ensure the outlet is located to the right of the cabinet for ease of access.
- The cabinet's maximum voltage fluctuation is ±2% of nominal voltage. Therefore, where voltage fluctuation is higher, suitable equipment such power stabilizer or UPS with appropriate feature is recommended.
- Surge protection and UPS are strongly recommended for better protection. Uninterruptible Power Supply (UPS) with power stabilization function could also be used to eliminate or minimize the voltage fluctuation seen by the cabinet. Where UPS is installed, it is recommended that the UPS is sized to enable the BSC to operate for about 20 minutes to provide ample time for the personnel to react to the power failure.
- A reliable protective earth connection is recommended for better operation and safety.

2.1.6. Service Line Requirements

- All service lines should be installed by a suitably qualified and/or certified engineer, in accordance with all applicable local, state and government regulations.
- Service line attachments should be equipped with an emergency shut off valve that can be accessed quickly and with ease, should the need arises.
- Check whether there is a need to install pressure regulators to reduce the line pressure.
- Your BSC can accommodate service fixtures on the left or right hand side of the cabinet. Make allowance for the positioning of service lines when planning the installation site to ensure ease of access to emergency shut off valves.

2.2. Unpacking and Moving your Cabinet

1. Check the packing labels and delivery note before unpacking to ensure the correct consignment has been delivered.
2. Put all packing materials to one side and retain. You may need them to repackage the unit if anything untoward is discovered with the unit during installation.
3. If you have purchased an optional support stand this will be attached to the shipping carton of the cabinet.
4. Cut the retaining straps and remove the stand (if purchased). This will require at least two persons.
5. Remove the shrink wrap from the outside of the main carton and dispose of carefully.
6. If you have not yet done so, remove the retaining straps. Then remove the top of the packing carton.

7. Remove the cardboard outer from the unit by sliding it up and over the unit.
8. Remove the shrink wrap from around the polystyrene panels and dispose of carefully.

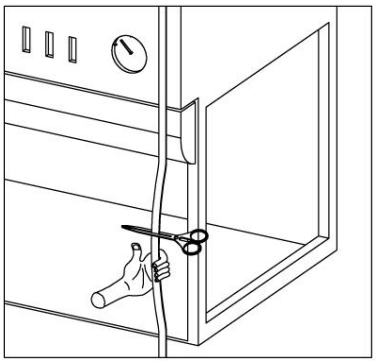


Figure 2.1. Removing the strapping

9. Remove all of the polystyrene, cardboard and Styrofoam packing materials and place with the outer carton.
10. Cut the inner shipping straps and remove the large protective plastic bag.
11. There is a protector on the top of the unit (cardboard sheet), remove this before activating the unit.
12. Take out the carton containing the manuals, toolkit and retrofit kits and place safely to one side.
13. Remove the two retaining screws on the side of the front panel. Use caution when raising the front panel to avoid personal injury or damage to the cabinet.

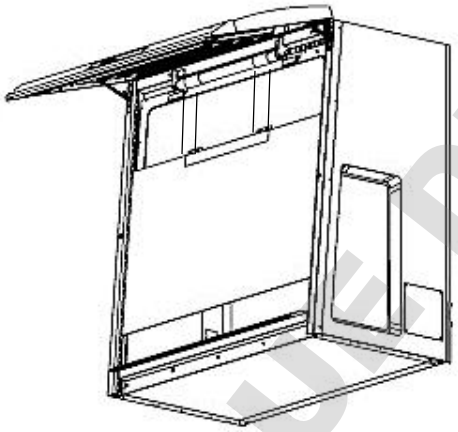


Figure 2.2. Opening the front panel

14. Open up the housing and remove all of the packing materials inside the panel (remember to replace the locking screws when you close the panel).
15. Remove any available sash supports and work area shipping supports.
16. Remove the protective plastic coating on the stainless steel work trays and armrest.
17. The cabinet may be fastened to the skids on the shipping pallet with two braces – one on each side. If so, unbolt the cabinet from the skids and remove the braces.
18. At this point you should assemble the stand as per the instructions provided.
19. Using a mechanical lifting truck, the cabinet should be positioned over the stand, the stand offered up to the cabinet and the bolts fastened. After the stand is fastened to the cabinet, lower the assembly to the ground slowly.
20. Check that all bolts have been fastened adequately and then move the cabinet to its final position. The side panel should not be used to lift the cabinet as it is not a structural component. Please lift by means of the back edge or remove the side panels to lift by means of the side edges. (For information on removing the side panels, please refer to the next chapter).
21. Fasteners securing the armrest – located at the lower side of the frame around the sash window – must be tightly fastened.

2.3. Performance Validation/Certification

After having installed the cabinet but before starting to use it, cabinet performance must be validated and certified to factory standards. It is recommended that this validation and certification be performed only by a qualified personnel who is familiar with the methods and procedures for certifying biological safety cabinets.

The testing methods and equipments needed for carrying out the tests are specified on the test report accompanying your cabinet.

2.3.1. Disclaimer

The performance and safety of all Esco BSC are rigorously evaluated at our factory. Regular field certification is important to ensure factory standards are maintained.

Chapter 3 - Sentinel Control System

3.1. Sentinel Control System

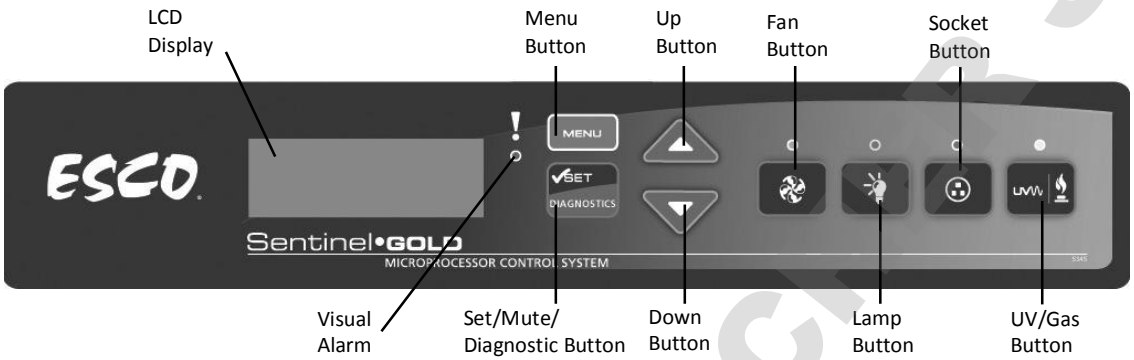


Figure 2.1. Sentinel Gold general parts.

1. Fan Button
   - Turns on and turns off the fan.
   - Activate Standby mode

2. Lamp Button
   - Turns on and turns off the fluorescent lamps.

3. Socket Button
   - Turns on and turns off the electrical socket (retrofit kit).
   - The maximum rating of all the outlets in the cabinet is 5 A. If there is overload, the fuse will blow.

4. UV/Gas Button
   - Turns on and turns off the gas.
   - Turns on and turns off the UV lamp.
   - UV lamp can only be activated when the sash window is fully closed. Since the sash is capable of filtering UV rays, users are protected from the harmful UV radiation.

5. Up (▲) and Down (▼) Arrow Button
   - Moves the menu options upwards and downwards.
   - Increases and decreases corresponding value inside one of the menu options.
   - Moves the sash window upward and downward.

6. Set or Mute or Diagnostic Button
   - To proceed to the next step, level or sequence inside the menu options.
   - Mutes the fully opened sash and airfail alarm sound (during normal and quickstart mode).
   - Enters diagnostic mode.

7. Menu Button

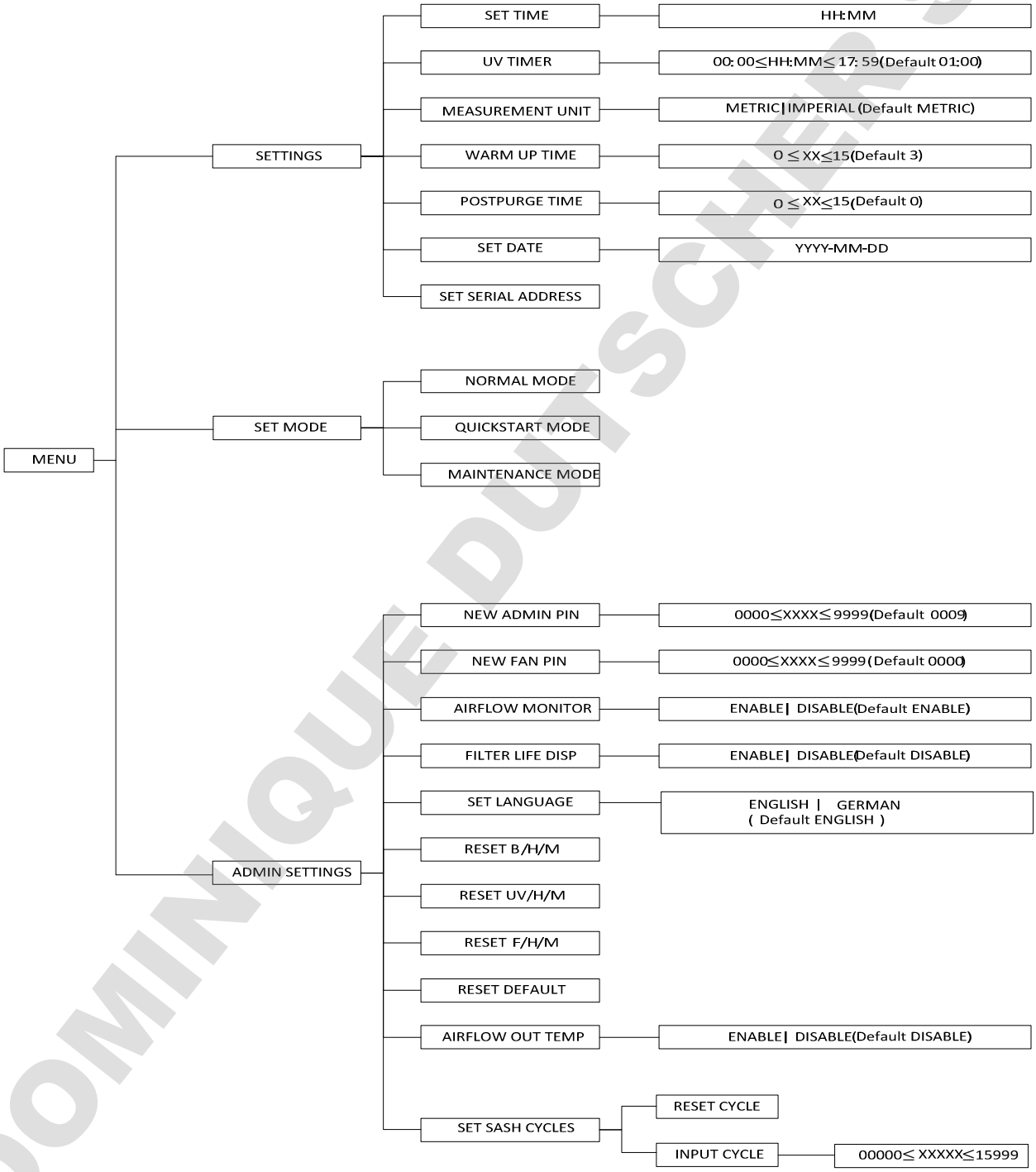
> *When you are entering menu options, the alarm will sound to indicate that the microprocessor is not monitoring the operation of the cabinet. No further warnings will be given.*

   - To enter and exit from the menu options.

- To go back to the previous level of the menu options.

3.2. Menu Options

Please refer to the following diagram for complete reference to all menu options available.



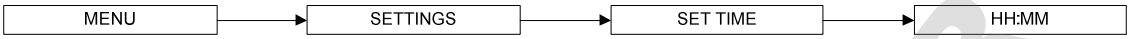
Note: *"Set Sash Cycles" option NOT applicable to non-motorized sash BSC*

3.2.1. Settings

Users may use the settings menu function to customize the operation of the BSC to meet specific application requirements. The settings menu can be entered using either FAN PIN or ADMIN PIN.

3.2.1.1. Set Clock (Time)

Users can set the time by increasing/decreasing the hour and minute values. The correct time will be maintained even after the unit is turned off.

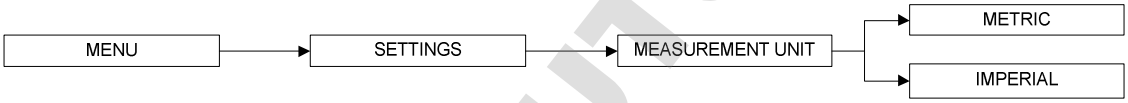


3.2.1.2. UV Timer (If UV present)

UV timer can be used to switch off the UV lamp automatically after a fixed period. The UV timer can be set up to 18 hours. By default, the timer is set to 60 minutes. Esco does not recommend leaving the UV lamp on for more than 60 minutes per decontamination cycle as it shortens the lifespan of the UV lamp. Unless the UV timer is activated, the lamp has to be switched off manually.

3.2.1.3. Measurement Unit

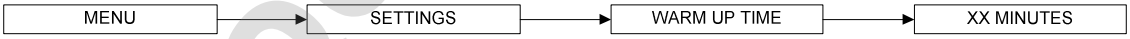
Using this option, the user can select the unit in which air velocity is measured and displayed. The user can choose between metric (m/s) and imperial (fpm) units.



3.2.1.4. Warm Up Time

There will be a warm up period before the BSC is fully functioning upon activation of the unit. This is to ensure that the sensors, the blower, and the control system are stabilized, as well as to ensure the work zone is purged of contaminants. The default setting is 3 minutes and the user can set it between 3 to 15 minutes. *(Note: Please note that WHO Laboratory Biosafety Manual (3rd edition) advocates 5 minutes purging time prior to start of work while US Biosafety in Microbiological and Biomedical Laboratories (5th edition) advocates 4 minutes).*

During the warm up period, the user can use the FAN button to turn off the blower, LIGHT button to turn on and off the fluorescent lamp and MENU button. However, to be able to access the menu, the user needs to input ADMIN PIN and even then, some sections of the menu (WARM UP and all FIELD CALIBRATION) are still not accessible for the user. Entering the menu during this time will put the warm up period on pause.



3.2.1.5. Post Purge Time

After the user switches off the BSC blower, there will be a post-purge period, to ensure that all contaminants are purged from the work zone. The default setting is zero minute (disabled) and user can set from 0 up to 15 minutes. It is recommended that BSC is purged for a minimum of 3 minutes after the work is complete. *(Note: Please note that WHO Laboratory Biosafety Manual (3rd edition) advocates 5 minutes post purging time after work is completed while US Biosafety in Microbiological and Biomedical Laboratories (5th edition) advocates 4 minutes).*

3.2.1.6. Set Date

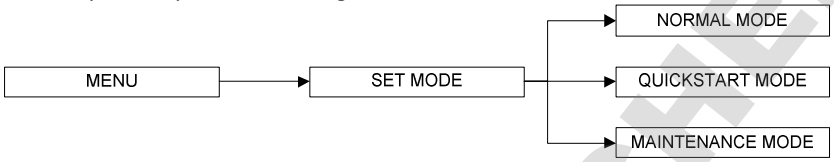
Users can set the date by increasing/decreasing the year, month and minute values. The correct date will be maintained even after the unit is turned off.

3.2.1.7. Set Serial Address

Users can set the address unit for RS485 communication by increasing/decreasing the address value. The default address setting is 1 and the user can set it between address 1 to 253.

3.2.2. Setting Mode

The BSC has three modes and two of which, normal mode and quickstart mode, can be used in daily activity. Both of these modes can be seen and accessed when you enter the FAN PIN. The last mode, maintenance mode is for the use of qualified personnel during maintenance.



3.2.2.1. Normal Mode

The Normal mode is activated by factory default except N series. In this mode, all alarms and interlocks are enabled.

3.2.2.2. Quickstart Mode

Quickstart mode allows the user to activate the blower and light by simply moving the sash window to the operating position. In this mode, all alarms and interlocks are enabled.

3.2.2.3. Maintenance Mode

Maintenance mode should only be accessed by qualified personnel during maintenance. In this mode, all alarms are disabled and all interlocks are defeated.

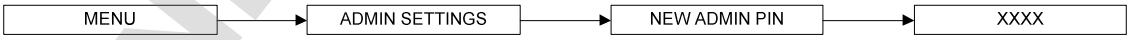
3.2.3. Admin Settings

The admin menu allows you to change both FAN and ADMIN PIN. The reset blower, filter and UV hour meter (if present) functions are usually used after the blower, filter or UV lamp is changed as they can easily serve as an indication to the user on when the BSC needs maintenance. The reset default function will return the options in the settings menu to their factory settings.

3.2.3.1. New ADMIN PIN (Default 0009)

ADMIN PIN restricts access to some of the more delicate menu functions, namely admin and field calibration, which should only be accessed by qualified personnel. User must enter a four-digit ADMIN PIN before accessing these menus.

ADMIN PIN can also be used to switch to maintenance mode from error condition.

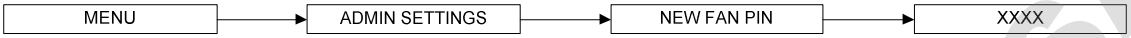


3.2.3.2. New FAN PIN (Default 0000 - DISABLED)

FAN PIN restricts access to fan control and some parts of the menu, settings and set mode. User must enter the four-digit PIN before switching the fan on or off. This feature prevents unauthorized personnel from accessing critical control sections. It will also prevent unauthorized shutdown of the BSC when continuous operation is required. FAN PIN is also needed to disable the alarm when the sash is fully raised and cleaning needs to be performed.

It is recommended that the FAN PIN be issued only to personnel authorized to use the BSC. With FAN PIN, the user can access admin and set mode parts of the menu.

Setting the PIN to 0000 will disable this feature. The FAN PIN is disabled by default. When the FAN PIN is disabled, the BSC can be turned on and off without requiring PIN. However, to access the menu, the user is still required to enter the FAN PIN (0000).

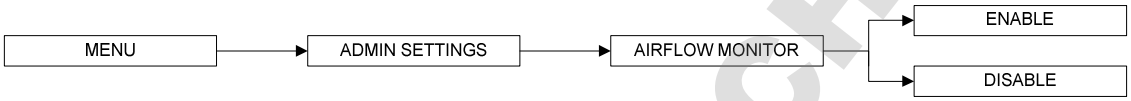


3.2.3.3. Airflow Monitor

Whenever the air velocity falls below the fail point, the air fail alarm will be triggered. This option is used to enable/disable alarm. The alarm is enabled by default.

When the Airflow Monitor is disabled, the warm up period is removed but the airflow will not be displayed for the first three minutes.

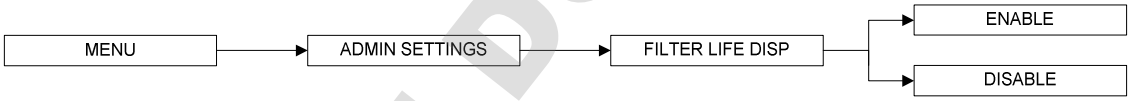
If the ambient temperature is outside of 18-30°C (which is the cabinet working temperature), the Airflow Monitor is automatically disabled.



3.2.3.4. Filter Life Display

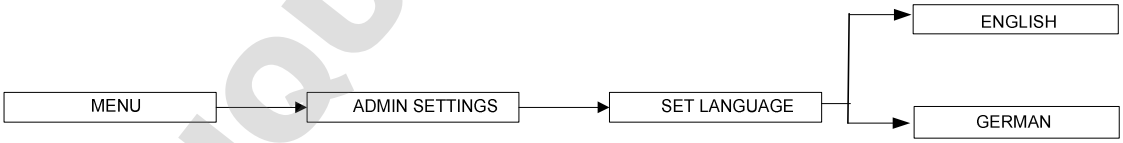
Using this option, the user can select whether the filter life is displayed or not.

Filter life is calculated based on the filter hour meter (F/H/M). The filter life display will count down according to the amount of hours left in the filter hour meter with respect to filter life expectancy of 10,000 hours. When the filter is changed, the F/H/M must be reset *(please see section 3.2.3.8 to reset the F/H/M).* Please note that the life of the filter is dependent on multiple factors which include environmental air cleanliness. A dirty / dusty environment will load the filter fast.



3.2.3.5. Set Language

Using this option, the user can select the language of messages displayed on the LCD.



3.2.3.6. Reset B/H/M

This option is used to reset the blower hour meter. The blower hour meter indicates how long the blower has been in operation. There is no maximum value in blower hour meter. The counter value can be checked in the diagnostic mode. The value can also provide some help in setting up maintenance schedule.

3.2.3.7. Reset UV/H/M (If UV is present)

This option is used to reset the UV lamp hour meter. The UV lamp hour meter indicates how long the UV lamp has been in operation. Maximum counter is set at 2,000 hours (100%). The counter value can be checked while in the diagnostic mode. Please reset the UV lamp hour meter after each UV lamp replacement.

3.2.3.8. Reset F/H/M

This option is used to reset the filter hour meter. The filter hour meter indicates how long the filter has been in operation. Maximum counter is set at 10,000 hours (100%). The counter value can be checked while in the diagnostic mode. Please reset the filter hour meter after each filter replacement.

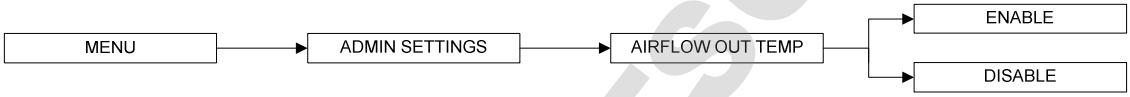
3.2.3.9. Reset Default

User can reset default settings by choosing this option. The features being reset are warm up period (3 minutes), post-purge period (0 minute), UV timer (60 minutes) if present, measurement unit (metric), airflow monitor (enabled), ADMIN PIN (0009), filter life display (disabled) and FAN PIN (0000).

Note that the calibration settings cannot be reset as it may cause the BSC to operate in an unsafe manner. The hour meters cannot be reset using this function either.

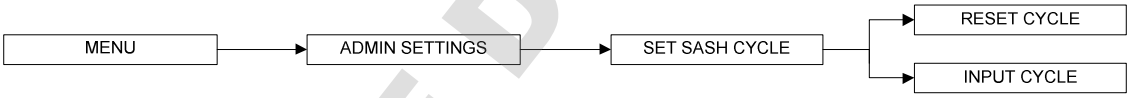
3.2.3.10. Airflow Out Temp

Using this option, the user can select whether or not to display the airflow when the ambient temperature is out of the optimum temperature range, below 18°C (65°F) or above 30°C (86°F).



3.2.3.11. Set Sash Cycle (Not applicable to non-motorized sash BSC)

To reset the sash cycles count to zero or to input the sash cycle count manually. The maximum value of sash cycles is 16,000 and after which the motor needs to be replaced (e.g. as part of the preventive maintenance program). The cycles will raise every sash move to up and down.



Warning message will be shown after the cycle value reaches 15,000.

- 1st warning: “Replace Sash Motor” – after sash reached 15,000 cycles.
- 2nd warning: “Stop Using Sash” - after sash reached 15,500 cycles.
- 3rd warning: “Sash Motor Locked” (sash motor cannot operate) - after sash reached 16,000 cycles.

3.3. Alarms and Warnings

A BSC uses alarms to indicate that the condition inside the BSC is not safe for the operator, so check the LCD display to understand the cause of these alarms. The most common alarm is the SASH ALARM, which indicates that the sash is neither at the normal operating height nor at fully closed position (UV mode) – this condition can easily be corrected by putting the sash at the appropriate operation position.

Other alarms that indicate a failure or an error in the BSC system:

- **AirFlow: NO!** will be displayed if there is an airflow failure.
- **SASH: ERROR POSITION** indicates a failure in the sash detection system.
- **SENSOR UNCALIBRATED** will be displayed if the airflow velocity sensor is not yet calibrated
- **Warning: Low Inflow** will be displayed if inflow velocity is less than minimum inflow.
- **Warning: Low Downflow** will be displayed if downflow velocity is less than minimum downflow.
- **Warning: High Downflow** will be displayed if downflow velocity is higher than the maximum downflow.
- **Watchdog failure** will be displayed if there is communication failure between the mainboard and watchdog board.
- **DAC failure** will be displayed if there is communication failure between the mainboard and DAC.

Note: If the message "Call Service for re-certification" is displayed, it means the BSC certification has expired. Call service or Esco's local distributor for re-certification.

3.4. Diagnostic Mode

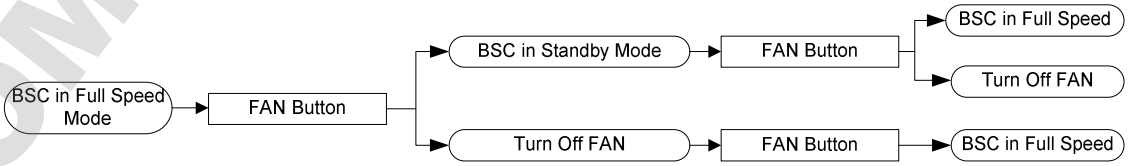
Diagnostic mode can be accessed by pressing the SET button. The diagnostic mode allows the user to know the condition of the BSC or help the service engineer during maintenance and troubleshooting.

On Screen	Explanation
MODE	Shows which mode is active: NORMAL MODE, QUICKSTART MODE or MAINTENANCE MODE
VERSION	Shows the version of the software; eg: CP104D V 1.0
TEMPERATURE	Shows the temperature inside the cabinet.
B/H/M	Blower Hour Meter – increase by the hour.
SASH CYCLE	Shows the cycle of sash moving. Maximum cycle is 16000.
FILTER LIFE	Shows percentage of filter life (based on Filter Hour Meter) and expected filter life of 10000 hours.
AF OUT TEMP	Velocity display status when temperature out of range
UV LIFE	Shows percentage of UV lamp life (based on UV Lamp Hour Meter).
UV TIMER	Shows the UV timer value – default is 60 minutes. Maximum value is 00 minutes (infinite on).
ADC IF0	ADC at Zero Inflow Point Calibration
ADC IFN	ADC at Nominal Inflow Point Calibration.
ADC IFA	ADC for Actual Inflow – showing real time sensor reading.
ADC DF0	ADC at Zero Downflow Point Calibration
ADC DFN	ADC at Nominal Downflow Point Calibration.
ADC DFA	ADC for Actual Downflow – showing real time sensor reading.
ADC TEMP	ADC value for TEMPERATURE.
M_SWITCH1	Shows the condition of magnetic switch 1 – fully open position.
M_SWITCH2	Shows the condition of magnetic switch 2 – safe position.
M_SWITCH3	Shows the condition of magnetic switch 3 – fully closed position.

3.5. Standby Mode

In Standby Mode, the blower speed is greatly reduced resulting in less power consumption. This mode is typically used during the night to maintain basic level of containment where the cabinet is not used by the operator.

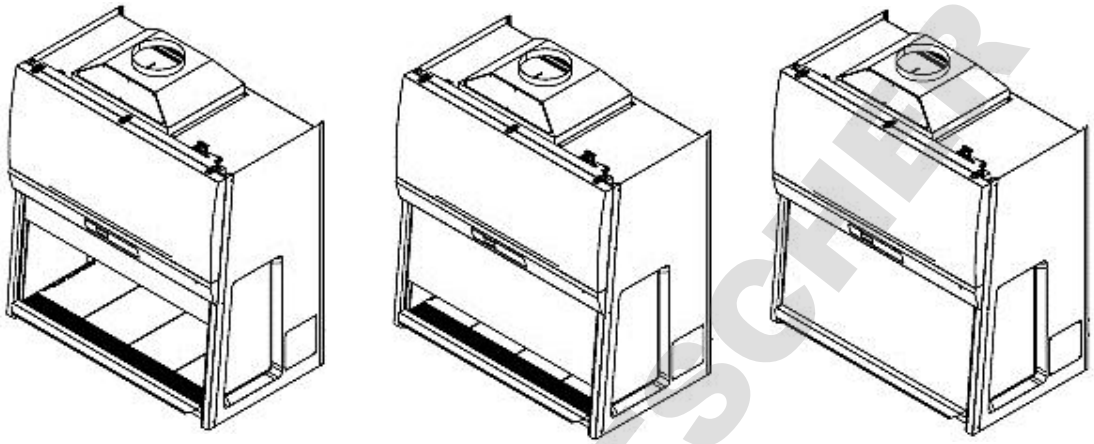
The mode can be accessed by pressing the FAN button when the cabinet is in operation. In half speed mode, the airflow monitor is disabled and only the FAN button is operational, while other buttons are interlocked.



Chapter 4 - Basic Cabinet Operation

4.1. Sash Window Operation

4.1.1. Sash Window State



Sash is fully open

- ✓ Blower can be active
- ✓ Fluorescent lights can be used
- × Unsafe working condition

Sash is in safe position

- ✓ Blower can be activated
- ✓ Fluorescent lights can be used
- ✓ Safe working condition

Sash is fully closed

- × Blower can't be activated
- × Fluorescent lights unusable

Figure 3.1. Sash window positions.

4.1.2. Operating Motorized Sash Window (Only for BSC with motorized sash window)

The motorized sash uses a "push and hold" mechanism, so if you remove your finger from the button the sash will stop immediately – this is a safety feature to control the closure and prevent anything getting trapped in the aperture as the sash descends.

Lower Sash from Fully Open Position

When the sash is fully open, pressing the down button and holding it will cause the sash to move to the Safe Height setting and stop. If the fluorescent lights are on as the sash descends, they will stay on as long as the sash stops in the Safe Position. If you release the button before the sash has reached Safe Position the lights will switch off automatically.

Lower Sash from Safe Height Position

When the sash is at safe operating height, pressing the down button and holding it will cause the sash to move down to the fully closed position and stop. If the fluorescent lights are on as the sash descends, they will switch off automatically as soon as the sash is fully closed. If you release the button before the sash has reached the fully closed position, the lights will switch off automatically.

Raise Sash from Fully Closed Position

When the sash is fully closed, pressing the up button and holding the sash will move up to the Safe Height setting and stop.

Raise Sash from Safe Height Position

When the sash is in safe operation position, pressing the up button and holding it will cause the sash to move up to the fully open position and stop. If the fluorescent lights are on as the sash rises, they will stay on as long as the sash is allowed to fully open. Stopping the sash midway will cause the lights to switch off automatically.

4.1.3. Using Sash Window

- The sash window should be fully closed when the cabinet is not in use. This helps to keep the work zone interior clean.
- The sash window should always be at the normal operating height at all times when the cabinet is in use. Even if the cabinet is left unattended, while the blower is on, the sash window should never be moved from the normal operating height, unless during loading or unloading of materials/apparatus into the cabinet.
- The alarm will be activated whenever the sash window is moved from the normal operating height.
- Whenever the sash window is moved to the correct height from a higher or lower position, the light will automatically be turned on as a signal to the user.
- The sash window may be opened to its maximum position for the purpose of loading/unloading of materials/apparatus into/from the cabinet. When the sash window is fully opened, the alarm sound may be muted by pressing MUTE button but the alarm will automatically sound again after 30 seconds (default is 30 seconds but can be set up to 5 minutes) to remind the user that it is not safe to work in the cabinet and the light will be turned on to facilitate cleaning.

4.2. Starting and Shutting Down the BSC

4.2.1. Turning on the BSC

1. Raise the sash to the indicated normal operational height (READY state). The lamp will turn on when this height is reached.
   Note: *When Quickstart mode is selected, fan will turn on as well, without pressing the fan button.*
2. Turn on the fan by pressing the FAN button. Input the Fan PIN if asked (if PIN ≠ 0000). This will start the warm up procedure (default: 3 minutes). All buttons are disabled during warm up period.
3. The BSC is ready for work.

4.2.2. Turning off the BSC

1. Turn off the fan by pressing the FAN button. Input the Fan PIN if asked (if PIN ≠ 0000). This will start the post purge procedure (default: 0 minute). All buttons are disabled during post purge period.
2. Lower the sash to the fully closed position (the display will show Sash: Fully Closed). The sash can be lowered immediately after turning off the fan as it will not interrupt the post purge procedure.
3. Turn on the UV lamp (when present) to decontaminate the work area by pressing the UV button. Leave the UV lamp on to make sure the decontamination is done effectively. The UV lamp can only be turned on after the post purge procedure is finished.

4.3. Working in the BSC

- Allow the BSC to purge any contaminant by allowing the blower to operate for at least 3 minutes before and after using the BSC *(see Section 3.2.1.4 and 3.2.1.5 of this manual for more information)*.
- Wear appropriate personal protective equipment (PPE) determined by your risk assessment prior to working in a BSC.
- Adjust stool height to achieve a comfortable working position.
- Perform surface decontamination on the work area (work surface, back and side walls, UV lamp, electrical outlets, service fixtures and the inner surface of the sash window) before and after using the BSC. Filter diffuser should not be wiped to prevent filter damage. Where bleach is used, a second wiping with sterile water should be carried out to remove any residual chlorine that may corrode stainless steel surfaces.

- Perform surface decontamination on the surfaces of any materials, containers or apparatus with appropriate disinfectant before entering or exiting the work area.
- Place the waste container (biohazard bag, pipette discard pans, etc.) inside the BSC work area.
- Place all items and apparatus in the safe working area.

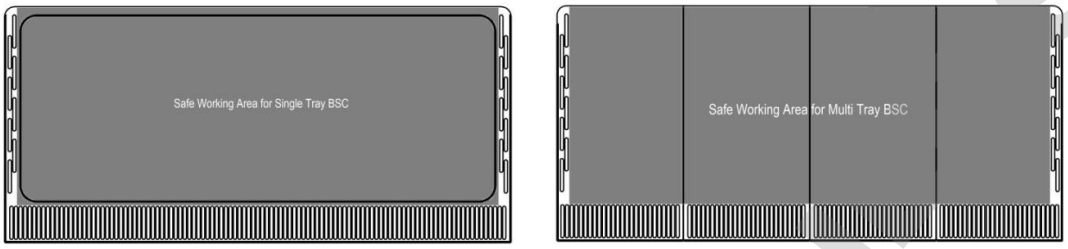


Figure 3.2. Safe Working Area

- Minimize room activities (personnel movements, closing and opening of doors, etc.) since these external airflow disturbances may adversely affect the BSC's internal airflow, thereby possibly impairing the containment capabilities of the BSC.
- Ensure that the sash is at normal operating height (READY state) before starting any experiment.
- Ensure the front and back air grilles are not obstructed by your arms or any other objects.
- Work as far back in the BSC as possible - at least 150 mm (6 inches) behind the front air intake grille.
- Wait for around one minute after placing the hands into the cabinet prior to any manipulation.
- While working in the BSC, move your hands slowly and in a controlled manner. Rapid movements may disrupt the air barrier, allowing contaminants to escape or enter the BSC.
- The use of bunsen burner inside the work zone is not recommended. However, if the use of bunsen burner is unavoidable, a burner that is capable of being used on demand or an enclosed electric micro incinerator may be used but they must be placed towards the back of the work surface in the BSC.
- Place aerosol-generating instruments as far back in the BSC as possible and at least 150 mm (6 inches) from clean items/materials.
- Place air turbulence generating equipment such as centrifuges, blenders or sonicators towards the back of the BSC. Stop other work while any of these equipment is in operation.
- As much as possible, it is recommended that the BSC be operated continuously in order to achieve optimal containment and cleanliness. Airflow studies have shown that once the fan has been switched off, air from the BSC may escape due to the thermal currents from inside the BSC. Therefore, it is recommended that post purge time is set to clear the work zone of contaminants after work in the BSC is completed. Air balance is an important consideration when determining the operation mode of the BSC since the air discharged through ducted BSC must be considered in the overall air balance of the laboratory.

4.4. Working Ergonomics

On most occasions, you would most likely be operating the BSC in a sitting rather than a standing position. There are some obvious advantages of the sitting position:

- The physiological energy cost and fatigue involved in sitting are relatively less.
- Sitting position provides the body with a stable support.

However, sitting position has some drawbacks too:

- The working area available is fairly limited.
- There is a potential risk of being constrained in the same posture for a long time.
- Sitting position is one of the most stressful postures for one's back.

Therefore, you should pay careful attention to the following guidelines in order to achieve comfortable and healthy working conditions:

- Always ensure that your legs have enough legroom.
- Keep your lower back comfortably supported by your chair. Adjust the chair or use an appropriate support (e.g. pillow) behind your back whenever necessary.
- You should place your feet flat on the floor or on a footrest. Don't dangle your feet and compress your thighs.
- You should vary your sitting position throughout the day at regular intervals so that you are never in the same posture for too long.
- Observe the following precautions with respect to your eyes:
    - Give your eyes frequent breaks. Periodically look away from the work area and focus at a distant point.
    - Keep your glasses clean.
- Arrange the items/apparatus frequently used in your work in such a way that you can minimize the physical strain involved in handling them.
- Exercise regularly.

The BSC's noise emission has been tested and found to be in compliance with EN 12469, ISO 4871 and NSF/ANSI 49 which is important to ensure health and comfort for the operator.

Ergonomics accessories available from Esco include:

- Armrest padding
- Lab chair
- Footrest

Please contact your local distributor or Esco for more information.

4.5. UV Lamps (If Present)

Shortwave UV (UVC) is considered as germicidal and virucidal. The UV lamp that Esco provides has a large portion of the spectrum in the UVC range. Unlike many other types of decontamination agent, UV light does not leave any residue. The decontamination action stops upon de-energizing of the lamp. However, the UVC spectrum does not penetrate well.

- UV light decontamination method may be used before and after working with susceptible organisms. However, it should not be the sole decontamination agent. Chemical decontamination agent should still be used.
- There should be minimal amount of material inside the BSC's work area during the process of UV light decontamination. A direct interaction with UV light can degenerate plastic or rubber-based material and can cause other hazards (e.g. Generation of hazardous vapors).
- Before activating the UV lamp, the BSC sash should be in fully closed position and the user should ensure that interlock is working properly. Avoid direct contact with skin and eyes as UV light is classified as a probable human carcinogen.
- The UV timer feature should be used to easily control the decontamination period (**Note:** *UV timer is 60 minutes by default)*. Leaving the UV lamp on for over 60 minutes or even overnight is not recommended because it shortens the lifespan of the lamp. The UV lamps used in Esco BSCs have a lifespan of 2,000 hours.
- The UV lamp should be cleaned of any dust and dirt weekly and changed annually to ensure its effectiveness. Ensure that the lamp is turned off when lamp cleaning and maintenance is carried out.
- *Please note that the use of UV lamp in a BSC has been explicitly discouraged in all major international standards and recommendations.*

4.6. Decontamination and Disinfecting Agents

- For stainless steel surfaces, all common disinfectant agents, except chlorine-based ones, are suitable. Where chlorine-based agents are used, sterile water should be used to wipe down the surfaces following the application of the disinfectant agents.
- For powder coated surfaces, all common disinfectant agents are suitable. However, the BSC has been specifically evaluated for use with the following:

- 1N Hydrochloric Acid
- 1N Sodium Hydroxide
- 1% Quaternary Ammonium Compound
- 5% Formaldehyde
- 5,000 ppm Hypochlorite
- 2% Iodophor
- 5% Phenol
- 70% Ethyl Alcohol

- Adequate contact time should be observed for effective decontamination and the time required depends on the disinfectant agents, the concentration and the object of disinfection.
- There is no one disinfectant agent that works with all organisms. Therefore, users and safety professionals should carry out risk assessment to ensure that appropriate disinfectant agents and validated decontamination procedures are used in decontaminating the BSC.

4.7. Gaseous Decontamination

Decontamination may frequently be carried out by means of formaldehyde fumigation or using other decontamination agents, such as chlorine dioxide or hydrogen peroxide. Decontamination process should only be carried out by qualified personnel.

In any of the following eventualities, the user should ensure that the BSC has been properly decontaminated, keeping in mind the nature of the pathogens used:

- At the time of moving/relocating the BSC
- At the time of changing the type of work being carried out in the BSC
- Before accessing contaminated areas for servicing (e.g. when filter needs replacement)
- Periodically and as mandated by your risk assessment

4.8. Further Information

- A Guide to Biosafety and Biological Safety Cabinets can be downloaded from http://escoglobal.com/resource.php?id=13
- An educational video on “Working Safely in your Biological Safety Cabinet” is available for viewing at http://www.youtube.com/watch?v=ZnUW1N-JJz8

Chapter 5 - Maintenance

5.1. Scheduled Maintenance

Proper and timely maintenance is crucial for trouble-free functioning of any device and your Esco BSC is no exception to this rule. We strongly recommend that you follow the maintenance schedule suggested hereunder in order to obtain optimal performance from your Esco BSC.

No.	Description of Task to Perform	Maintenance to be carried out every					
		Day	Week	Month	Quarter	1 Year	2 Years
1	Surface decontaminate the work zone	√					
2	BSC power-up alarm verification	√					
3	Perform thorough surface decontamination on the drain pan		√				
4	Check the paper catch for retained materials		√				
5	Clean UV lamp (where present) of any dust and dirt		√				
6	Clean the exterior surfaces of the BSC			√			
7	Clean the sash window			√			
8	Check all service fixtures (where present) for proper operation			√			
9	Inspect the BSC for any physical abnormalities or malfunction				√		
10	Clean stubborn stains on stainless steel surfaces with MEK				√		
11	Recertification					√	
12	Check the cabinet's functionality					√	
13	Change UV Lamp (where present)					√	
14	Change the fluorescent lamps						√

Cleaning the BSC

- Clean the work surface and walls with appropriate disinfectant and soap water afterward.
- Clean the sash window with appropriate disinfectant and glass cleaner afterward.
- Use a damp cloth to clean the exterior surface of the BSC, particularly on the front and top in order to remove dust that has accumulated there.
- Use sterile water to finish the cleaning and wash away any residue of disinfectant, soap, water and glass cleaner.
- For removing stubborn stains or spots on the stainless steel surface, make use of MEK (Methyl-Ethyl-Ketone). In such cases, make sure that you wash the steel surface immediately afterwards with sterile water and some liquid detergent. Use a polyurethane cloth or sponge for washing. Regular cleaning of the stainless steel surface helps retain the attractive factory finish.
- Ensure that the chemicals used are compatible with one another.
- Use appropriate personal protective equipment (PPE) when carrying out the activity.

Test the audible and visual alarm

The simplest method by far would be to move the sash until the glass window is no longer in the sash ready or UV mode position.

Check the cabinet's functionality

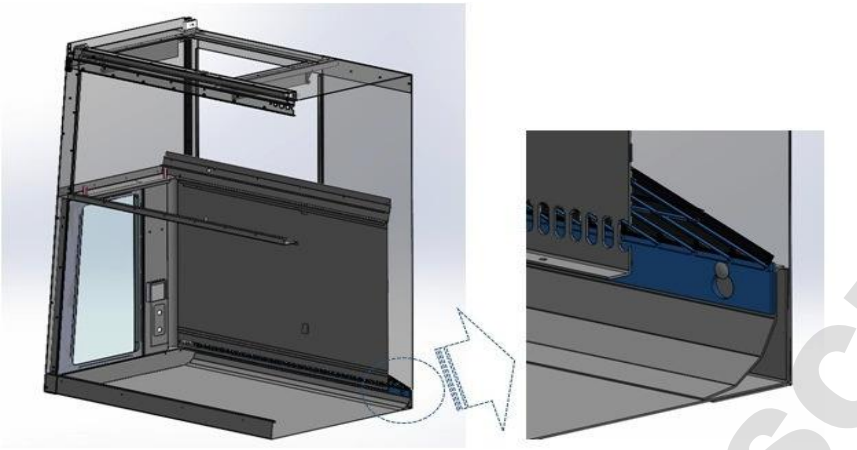
- Check the BSC's mechanical functionality (e.g. sash window – lubricate if necessary).
- Check the BSC's electrical functionality (e.g. fluorescent lamp – replace if necessary).
- Check the BSC for any defect and if any, repair immediately.

Recertification

All BSCs must be re-certified annually by a certified engineer. See certification procedures attached to the factory test report.

Accessing the paper catch

The purpose of accessing the paper catch is to remove any retained materials that might cause obstructions to airflow. Care must be taken as the area is contaminated.



Accessing the paper catch:

1. Turn off the blower then raise the sash to fully open position for easy access.
2. Remove the tray(s) to access the paper catch.
3. As detailed, the paper catch is being hooked into two hooking objects at the back.
   two hooking objects at the lower portion of the carcass. Raise the paper catch initially up to 10mm until it feels like it disengages from those hooking objects, pull a bit to the front then do steps 1 to 3 below. Be carefull of any sharp objects that might be present. You might want to use a mirror to help you asses the presence of hazardous materials prior to accessing the paper catch. Removed any materials that have been trapped.

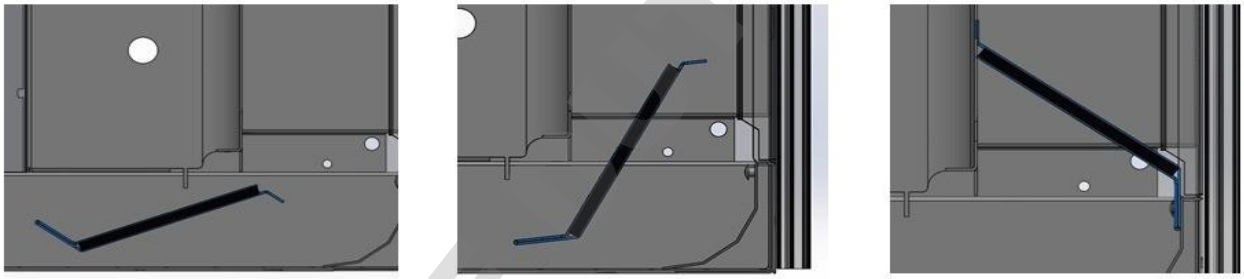
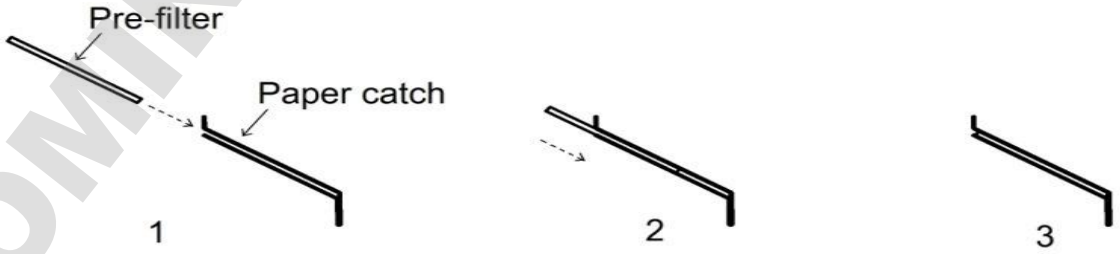


Figure 4.1. Paper catch access.

Pre-filter Installation:

1. Insert the pre-filter to the opening of the paper catch as shown in image 1 above.
2. Push the pre-filter accordingly until it fits into the paper catch as shown in image 2 to 3.

Figure 4.2. Installation of pre-filter.



5.2. Maintenance/Service Log

It is good practice (and in some cases regulatory requirement) to maintain a log of all maintenance work carried out on your cabinet.

APPENDIX

APPENDIX A: LOG RECORD

Cabinet : _____
Serial Number : _____
Person in Charge : _____

1. This log record should be used by the operator to record any new agent/virus/bacteria/germs that has been introduced to the cabinet during its operation, problems encountered, etc.
2. Any decontamination procedure performed by either the user or the technician should be recorded down as well.
3. Please also record any major maintenance procedure performed by the service technician, for example: parts replacement, recertification, etc.

Date	Event	User Signature	Supervisor Signature

In case of emergencies, please call:
Name : _____
Cell Phone Number : _____
E-mail : _____