

*Thank you for purchasing this Esco Microbiological 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](http://www.escoglobal.com), to complement this manual and help you enjoy many years of productive and safe use of your Esco products.*



# User and Service Manual

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**NORDICSAFE**  
Low Noise, Class II  
Microbiological Safety Cabinet

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# Table of Contents

## INTRODUCTORY PAGES

i	Table of Contents
iii	Manual Revision History
iv	Warranty Terms and Conditions
v	Introduction
v	1. Products Covered
v	2. Safety Warning
v	3. Limitation of Liability
v	4. European Union Directives on WEEE and RoHS
vii	Declaration of Conformity

## USER SECTION

### **1 Chapter 1 – Product Information**

1	1.1 About NordicSafe Class II Microbiological Safety Cabinet
1	1.2 Labels
2	1.3 Quick View
3	1.4 Airflow Pattern

### **5 Chapter 2 – Sentinel Control System**

5	2.1 Sentinel Control System
6	2.2 Menu Options
7	2.2.1 Settings
9	2.2.2 Setting Mode
9	2.2.3 Field Calibration
10	2.2.4 Admin Settings
14	2.3 Half Speed Mode
14	2.4 Alarm and Warnings
15	2.5 Diagnostic Mode

### **17 Chapter 3 - Basic Cabinet Operation**

17	3.1 Sash Window Operation
17	3.1.1 Sash Window State
17	3.1.2 Operating Motorized Sash Window
18	3.1.3 Using Sash Window
18	3.2 Starting and Shutting Down the MSC
18	3.2.1 Turning on the MSC
18	3.2.2 Turning off the MSC
18	3.3 Working in the MSC
19	3.4 Working Ergonomics
20	3.5 UV Lamps
20	3.6 Decontamination and Disinfecting Agents

## SERVICE SECTION

### **23 Chapter 4 - Installation**

23	4.1 General Requirements
23	4.1.1 Location Requirements
25	4.1.2 Environmental Requirements
25	4.1.3 Support Requirements
25	4.1.4 Exhaust Requirements
25	4.1.5 Electrical Requirements
26	4.1.6 Service Line Requirements
26	4.2 Installation
26	4.2.1 Connecting the Electrical Supply

26	4.2.2 Connecting to a PC (using RS232)
27	4.2.3 Safety and Warning Labels on the Cabinet
27	4.2.4 Preliminary Cleaning
27	4.3 Performance Validation/Certification
27	4.3.1 Disclaimer
27	4.3.2 References for Qualified Certifiers

## **29 Chapter 5 – Service and Maintenance**

29	5.1 Scheduled Maintenance
30	5.2 Parts Replacement
31	5.2.1 Filter Replacement Procedure
32	5.2.2 Blower Replacement Procedure
32	5.2.3 Fluorescent Lamp(s) Replacement Procedure
32	5.2.4 UV Lamp Replacement Procedure
33	5.2.5 Airflow Sensor Replacement Procedure
33	5.3 Maintenance/Service Log

## **35 Chapter 6 – Recertification & Calibration**

35	6.1 Certification Flowchart
35	6.2 Certification and Calibration
36	6.3 Airflow Adjustment

## **37 Chapter 7 - Decontamination**

37	7.1 Decontamination Agents
37	7.1.1 Formalin/Paraformaldehyde Decontamination
38	7.1.2 Chlorine Dioxide Decontamination
38	7.1.3 Hydrogen Peroxide Decontamination
39	7.1.4 Comparison Table
39	7.2 Recommended Decontamination Sealing Method

## **41 Chapter 8– Troubleshooting**

## **58 Chapter 9 – Engineering Details**

58	9.1 Engineering Drawing
59	9.2 General Specification

## **APPENDIX**



## Warranty Terms and Conditions

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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 if proven to the satisfaction of Esco that these parts 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.
  - Problems caused by 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.
- Esco is not liable for any damage incurred on the objects used on or stored in Esco equipment. If the objects are highly valuable, user is advised to have in place independent external preventive measures such as connection to a centralized alarm system.

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](http://www.escoglobal.com/warranty) 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.

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Visit <http://www.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)	The warranty periods for BSC may vary by country. Contact your local distributor for specific warranty details.
Laboratory Fume Hoods	2 year limited.
Ductless Fume Hoods	4 years limited for Ascent Opti's, 6 years for Ascent Max's.
Cleanroom Equipment	1 year limited.
Laboratory Ovens and Incubators	1 year limited.
CO <sub>2</sub> Incubators	2 years limited.
Containment/Pharma Products	2 years limited.
Ultralow Temperature Freezer	5 years limited. 60 months on Compressor.

The warranty period starts two months from the date your equipment is shipped from Esco facility for international distributors. This allows shipping time so the warranty will go into effect at approximately the same time the equipment is delivered to the user. The warranty protection extends to any subsequent owner during the warranty period. Distributors who stock Esco equipment are allowed an additional four months for delivery and installation, providing the product is registered with Esco. User can register product online at [www.escoglobal.com/warranty](http://www.escoglobal.com/warranty) or complete the warranty registration form included with each product.

Policy updated on 1<sup>st</sup> January 2012 (This limited warranty policy applies to products purchased on and after 1<sup>st</sup> January 2012)

## Introduction

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### 1. Products Covered

Esco Class II Microbiological Safety Cabinet – NordicSafe		
Electrical Rating	1.2 meters (4 feet)	1.8 meters (6 feet)
220-240 V AC, 50/60Hz, 1Φ	NC2-4L8	NC2-6L8

### 2. Safety Warning

- Anyone working with, on or around this equipment should read this manual. Failure to read, understand and follow the instructions given in this documentation 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 individual.
- 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. 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.

### 4. 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)**

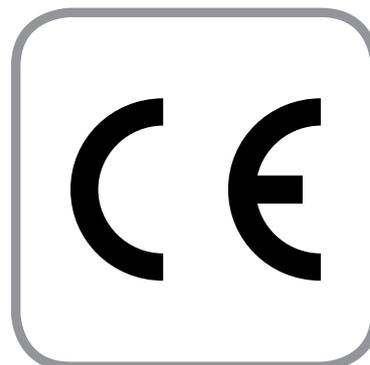
With respect to the directive on RoHS, please note that this hood falls under category 8 (medical devices) and category 9 (monitoring and control instruments) and is therefore exempted from requirement to comply with the provisions of this directive.



## Declaration of Conformation

In accordance to EN ISO/IEC 17050-1:2010

We, Esco Micro Pte. Ltd.  
of 21 Changi South Street 1  
Singapore, 486777  
Tel: +65 6542 0833  
Fax: +65 6542 6920



declare on our sole responsibility that the product:

**Category** : Class II Microbiological Safety Cabinet  
**Brand** : NordicSafe  
**Model** : NC2-4L8, NC2-6L8

in accordance with the following directives:

**2006/95/EEC** : The Low Voltage Directive and its amending directives  
**92/31/EEC** : The Electromagnetic Compatibility Directive and its amending directives

has been designed to comply with the requirement of the following Harmonized Standard:

**Low Voltage** : EN 61010-1:2010  
**EMC** : EN 61326-1:2006 Class B  
**Design/Performance Criteria** : EN 12469 (2000) Class II Microbiological Safety Cabinet

More information may be obtained from Esco's authorized distributors located within the European Union. A list of these parties and their contact information is available on request from Esco.

A handwritten signature in black ink, appearing to read 'XQ Lin', is positioned above a horizontal line.

**XQ Lin**  
Group CEO. Esco

This Declaration of Conformity is only applicable for 230V AC 50Hz units

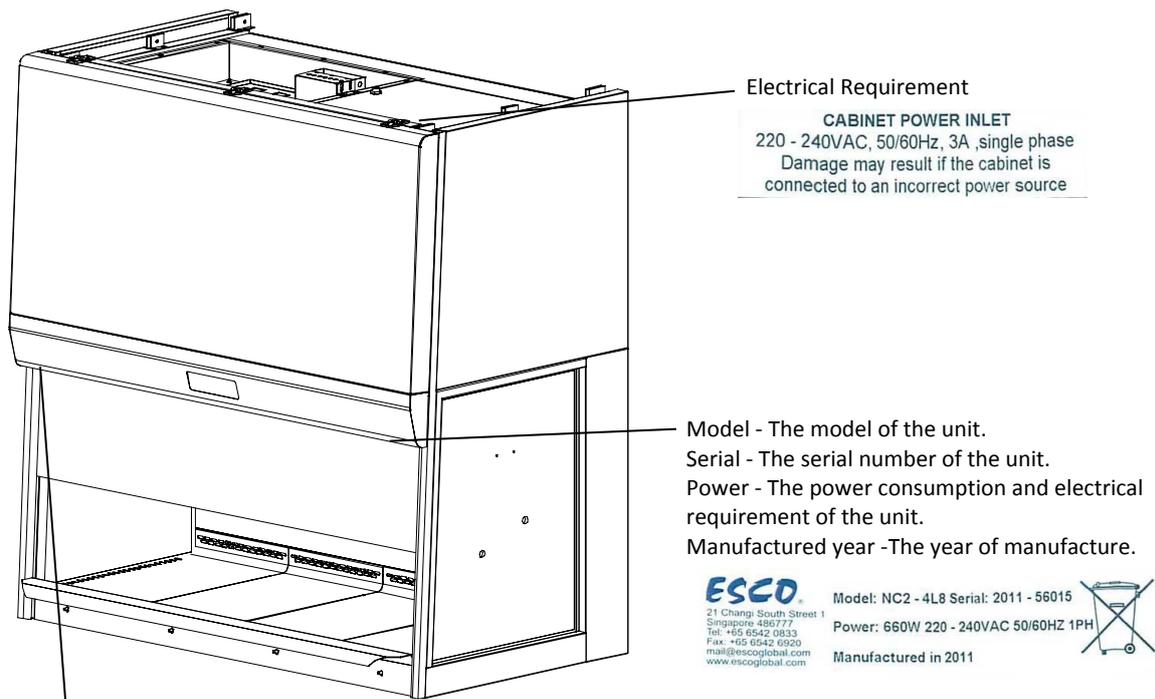
## Chapter 1 - Product Information

### 1.1 About NordicSafe Class II Microbiological Safety Cabinets (MSCs)

The Esco NordicSafe Class II Microbiological Safety Cabinet is a cost effective solution to providing operator, product and environmental protection within laboratories and industrial facilities. The MSC features the use of 2 ULPA filters to deliver ISO Class 3 air cleanliness to the work zone.

The Esco NordicSafe Class II Microbiological Safety Cabinet has been independently certified and type-tested by Health Protection Agency (HPA, formerly CAMR, the Centre for Applied Microbiological Research, Porton Down, Salisbury, UK) for compliance with the Class II requirements of the EN12469:2000 (European standard for microbiological safety cabinets). The type-testing performed included stringent evaluations of cabinet airflows, containment, and operator comfort factors.

### 1.2 Labels



#### Electrical Requirement

**CABINET POWER INLET**  
220 - 240VAC, 50/60Hz, 3A ,single phase  
Damage may result if the cabinet is  
connected to an incorrect power source

Model - The model of the unit.  
Serial - The serial number of the unit.  
Power - The power consumption and electrical  
requirement of the unit.  
Manufactured year -The year of manufacture.

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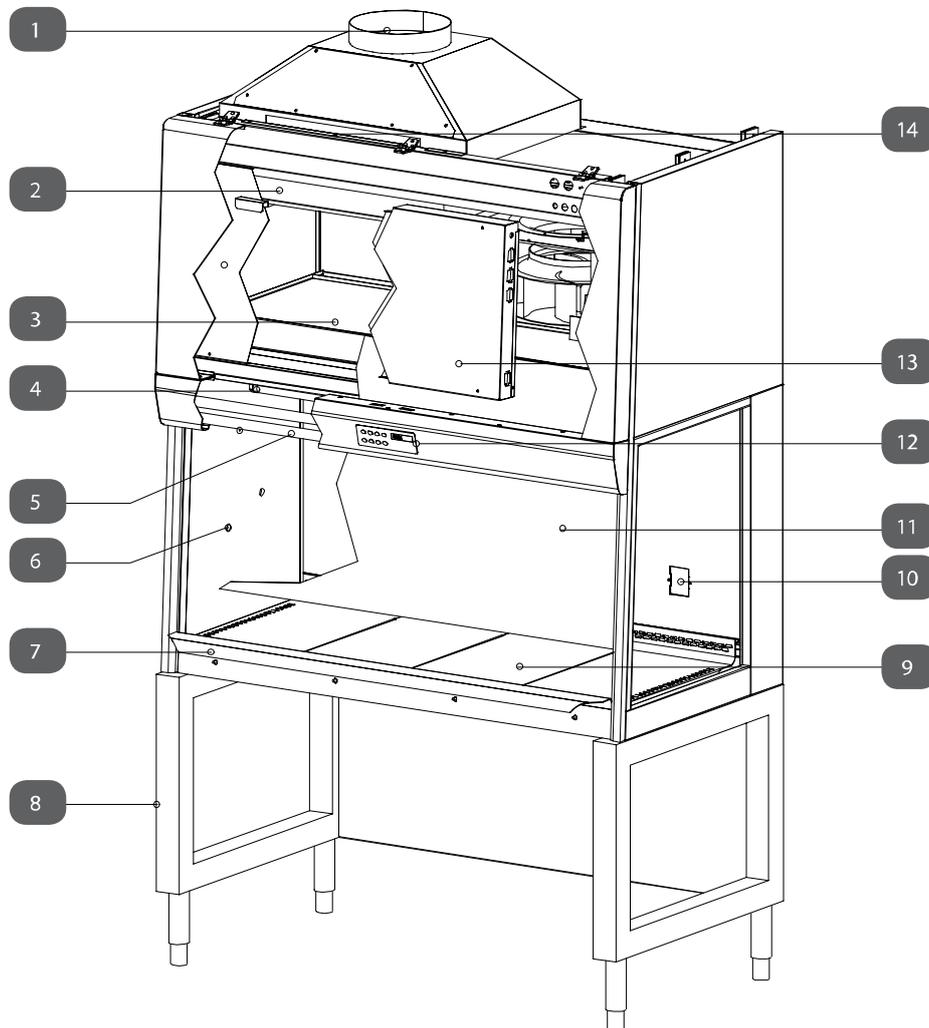
Model: NC2 - 4L8 Serial: 2011 - 56015  
Power: 660W 220 - 240VAC 50/60HZ 1PH  
Manufactured in 2011



#### Airflow Information

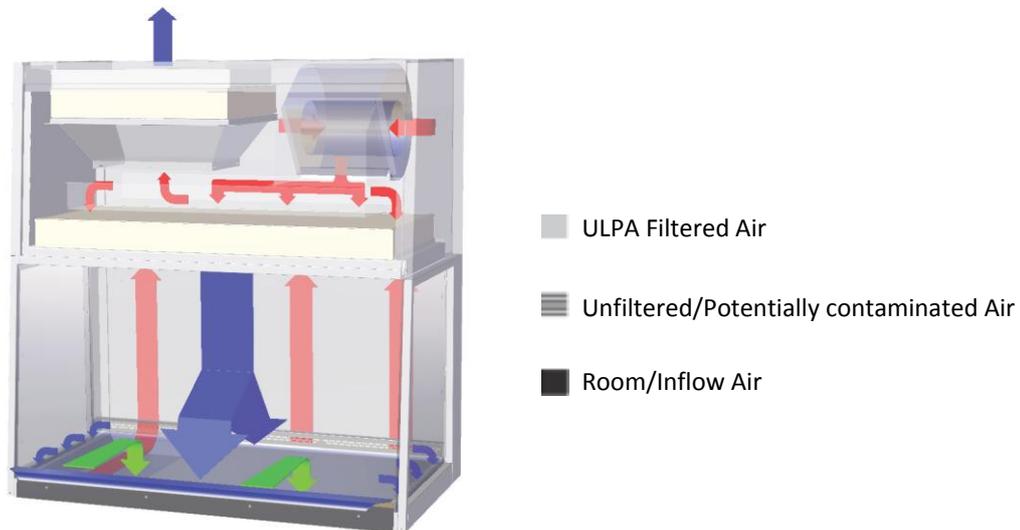
Cabinet Airflow Setpoints NC2 - 4L8 Class II MSC per EN 12469:2000  
INFLOW: 0.45 +/- 0.025 m/s or 88 +/- 7 l/s for DIM and Secondary Methods (SM)  
SM grid: mid of 76mm opening, 9pts, 113mm from L/R wall & 113mm apart  
Use Esco NC2 Probe Holder & Thermoanemeter. Inflow=SM avg x 0.435  
DOWNFLOW: 0.32 +/- 0.025 m/s, 2 rows x 4 columns (8 points total), with grid:  
L-R: 141mm from wall & 282mm, F-B: 144mm from wall & 587mm apart

### 1.3 Quick View



- |                              |   |
|------------------------------|---|
| 1. Exhaust collar (optional) | 9. Multi-piece work surface                                   |
| 2. Exhaust ULPA filter       | 10. Electrical outlet Retrofit Kit provision                  |
| 3. Downflow ULPA filter      | 11. Sash glass window   |
| 4. Downflow sensor           | 12. Esco Sentinel Gold microprocessor.                        |
| 5. Fluorescent lamps         | 13. Electrical panel  |
| 6. Side glass wall           | 14. Exhaust inflow sensor – above the exhaust filter (hidden) |
| 7. Stainless steel arm rest  |   |
| 8. Support stand (optional)  |   |

## 1.4 Airflow Pattern

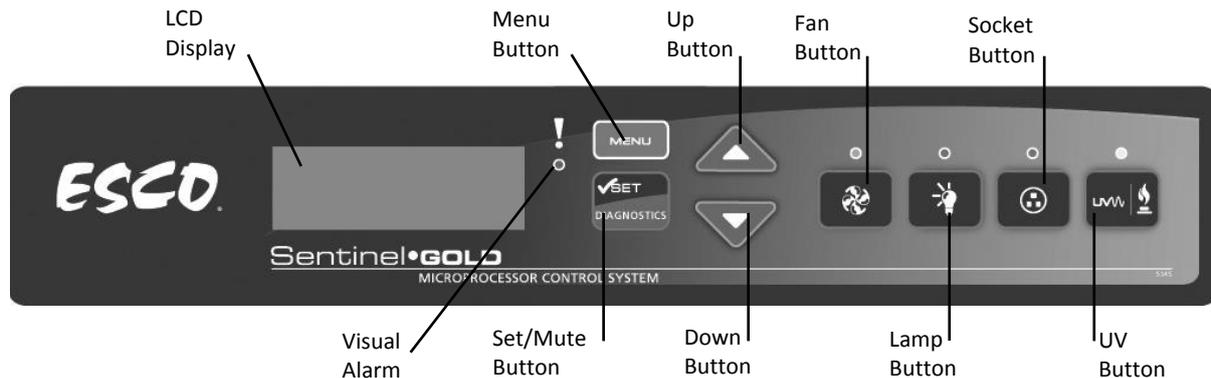


- Ambient air is pulled through the perforations located towards the work zone front to prevent contamination of the work surface and work product. The inflow does not mix with the clean air within the cabinet work zone. Inflow air travels through a return path toward the common air plenum (blower plenum) at the top of the cabinet.
- The uniform, non-turbulent air stream protects against cross contamination within and throughout the work area.
- Near the work surface, the downflow air stream splits with a portion moving toward the front air grille, and the remainder moving to the rear air grille. A small portion of the ULPA filtered downflow enters the intake perforations at the side capture zones at a higher velocity (small blue arrows).
- A combination of inflow and downflow air streams forms an air barrier that prevents contaminated room air from entering the work zone, and prevents work surface emissions from escaping the work zone.
- Air returns to the common air plenum where the 33% exhaust and 67% recirculation process is continued.



## Chapter 2–Sentinel Control System

### 2.1 Sentinel Control System



1. Fan Button
  - Turns on and turn off the fan.
  - To access the half speed mode.
    - Choose between turning fan off or half speed when the fan is on normal speed
    - Choose between turning fan off or normal speed when the fan is on half speed
2. Lamp Button
  - Turns on and turn off the fluorescent lamps.
3. Socket Button
  - Turns on and turn off the electrical socket (retrofit kit).
  - The maximum rating of all the outlets in the cabinet is 5 A. If overload, the fuse will blow.
4. UV Button
  - Turns on and turn 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
  - Move the menu options upwards and downwards.
  - Increase and decrease corresponding value inside one of the menu options.
  - Move the sash window upward and downward
6. Set / Mute / Diagnostic Button
  - Choose the menu or sub-menu currently displayed on the LCD screen.
  - Proceed to the next step or sequence inside one of the menu options.
  - To mute the airfail alarm sound (only in normal or quickstart mode)
  - To enter diagnostic mode.

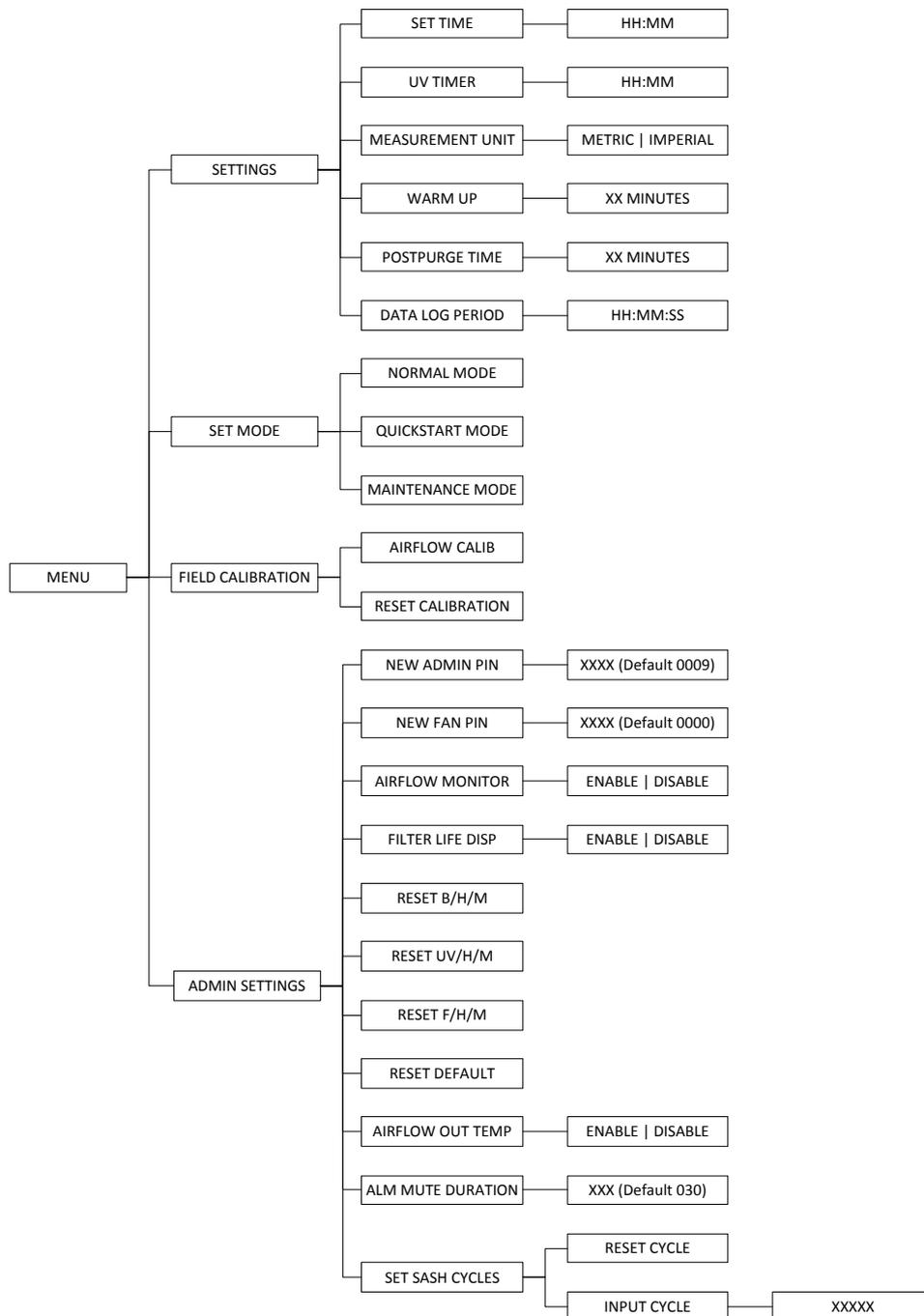
7. Menu Button

*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.
- To access maintenance mode from ERR.MSWITCH and AIRFAIL! error condition.

**2.2 Menu Options**

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



## 2.2.1 Settings

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

### 2.2.1.1 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.



To Set Time:

1. Press MENU button to enter the menu display – if the MSC is secured by a FAN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the FAN PIN or ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose SET TIME. Press SET button to confirm.
6. The time is set in 24 hour HH:MM format. Use UP / DOWN buttons to choose the hour (HH). Press SET button to confirm.
7. Use UP / DOWN buttons to choose the minute (MM). Press SET button to confirm.
8. The display will show TIME SET for a few second and then return to SETTINGS.
9. Press MENU button twice to return to the main display.

### 2.2.1.2 UV Timer

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, which is considered the most effective UV decontamination time. Esco does not recommend leaving the UV lamp on for more than 60 minutes as it shortens the lifespan of the UV lamp. Without the UV timer, the lamp has to be switched off manually.

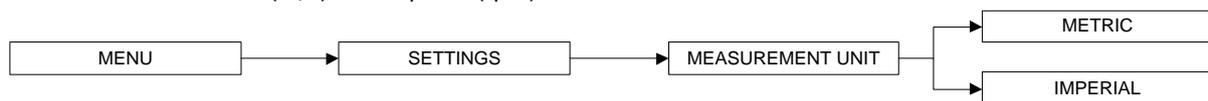


To Set UV Timer:

1. Press MENU button to enter the menu display – if the MSC is secured by a FAN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the FAN PIN or ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose UV TIMER. Press SET button to confirm.
6. Use UP / DOWN buttons to choose the hour (HH). Press SET button to confirm.
7. Use UP / DOWN buttons to choose the minute (MM). Press SET button to confirm.
8. The display will show UV TIMER SET for a few second and then return to SETTING
9. Press MENU button twice to return to the main display.

### 2.2.1.3 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).



To Set Measurement Unit:

1. Press MENU button to enter the menu display – if the MSC is secured by a FAN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the FAN PIN or ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose MEASUREMENT UNIT. Press SET button to confirm.

6. Use UP / DOWN buttons to choose between METRIC and IMPERIAL. Press SET button to confirm.
7. The display will return to SETTING
8. Press MENU button twice to return to the main display.

#### 2.2.1.4 Warm Up

There will be a period of warm-up, before the fan is fully functioning. This is to ensure that the sensors, the blower, and the control system are stabilized, as well as purging the work zone of contaminants. The default setting is 3 minutes and the user can set it between 3 to 15 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 need to input ADMIN PIN and even then, some portions of the menu (WARM UP and all FIELD CALIBRATION) is still not accessible for the user. Entering the menu during this time will pause the warm up period.



To Set Warm Up:

1. Press MENU button to enter the menu display – if the MSC is secured by a FAN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the FAN PIN or ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose WARM UP. Press SET button to confirm.
6. Use UP / DOWN buttons to choose the amount of time (MM) the MSC will be in the warm-up period. Press SET button to confirm.
7. The display will show WARM UP SET for a few second and then return to SETTING
8. Press MENU button twice to return to the main display.

#### 2.2.1.5 Post Purge

After the user switches off the MSC blower, there will be a post-purge period. This feature is to ensure that all residual contaminants are purged from the work zone. The default setting is zero minute and user can set it between 0 to 15 minutes. Setting it to zero minute will disable this feature. However, it is recommended to purge the MSC by leaving the fan on for around 3 minutes after the work is complete.



To Set Post Purge:

1. Press MENU button to enter the menu display – if the MSC is secured by a FAN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the FAN PIN or ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose POSTPURGE TIME. Press SET button to confirm.
6. Use UP / DOWN buttons to choose the amount of time (MM) the MSC will be in the post purge period. Press SET button to confirm.
7. The display will show POSTPURGE SET for a few second and then return to SETTING
8. Press MENU button twice to return to the main display.

#### 2.2.1.6 Data Log Period

Using RS232 communication port, the MSC can send data on the condition of the MSC to a PC. Data Log Period option allows the user to control the amount of time in between the MSC data sending procedure.



To Set Data Log Period:

1. Press MENU button to enter the menu display – if the MSC is secured by a FAN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the FAN PIN or ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose SETTINGS. Press SET button to confirm.

5. Use UP / DOWN buttons to choose DATA LOG PERIOD. Press SET button to confirm.
6. Use UP / DOWN buttons to choose the hour (HH). Press SET button to confirm. Repeat this step to choose and confirm the minute (MM) and second (SS).
7. The display will show DATA LOG PERIOD SET for a few second and then return to SETTING
8. Press MENU button twice to return to the main display.

### 2.2.2 Setting Mode

LA2 MSC has three working mode; 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.



To Set the Mode:

1. Press MENU button to enter the menu display – if the MSC is secured by a FAN and ADMIN PIN, then it will ask for the appropriate PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the FAN PIN or ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose SET MODE. Press SET button to confirm.
5. Use UP / DOWN buttons to choose between NORMAL MODE, QUICKSTART MODE and MAINTENANCE MODE Press SET button to confirm.
6. The display will return to SET MODE
7. Press MENU button twice to return to the main display.

#### 2.2.2.1 Normal Mode

The normal mode is activated by factory default. In this mode, all alarms and interlocks are enabled.

#### 2.2.2.2 Quickstart Mode

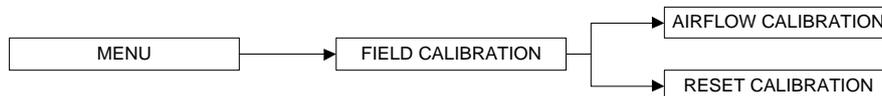
Quickstart mode allows the user to activate the blower and the light simply by opening the sash window to the operating position. In this mode, all alarms and interlocks are enabled.

#### 2.2.2.3 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.

### 2.2.3 Field Calibration

The purpose of calibration is to ensure the accuracy of the airflow display and alarm (if present). This involves measuring airflow with reference instrumentation and establishing reference between airflow sensor(s) on the MSC to the standard reference. Calibration should only be carried out by trained personnel. This section presents a brief overview of the calibration menu function. For more information, refer to test report.



#### 2.2.3.1 Airflow Calibration

This option allows proper calibration and operation of the airflow sensor alarm. There will be three points to be calibrated, namely inflow fail point, inflow nominal point, and downflow nominal point.

#### 2.2.3.2 Reset Calibration

This option allows the user to reset all value calibrated in the field and return it to the values gathered in factory calibration.

## 2.2.4 Admin Settings

The admin menu allows you to change both FAN and ADMIN PIN. The reset blower, filter and UV hour meter functions are usually used after you change the blower, filter or UV lamp as they can easily give you the indication on when to do MSC maintenance. While the reset default function will return the options in the settings menu to their factory settings.

### 2.2.4.1 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 a qualified personnel. User must enter four digits ADMIN PIN before accessing these menus.

ADMIN PIN can also be used to switch to maintenance mode from ERR.MSWITCH and AIR FAIL! error condition.



To Set New ADMIN PIN:

1. Press MENU button to enter the menu display – if the MSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose ADMIN SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose NEW ADMIN PIN. Press SET button to confirm.
6. Use UP / DOWN buttons to choose the first digit (X). Press SET button to confirm. Repeat this step until all four digit is filled and confirmed.
7. The display will show CONFIRM PIN? Press SET button to confirm.
8. The display will return to ADMIN SETTINGS.
9. Press MENU button twice to return to the main display.

### 2.2.4.2 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 four-digit PIN before switching fan on or off. As such, it can restrict access to operating the MSC by unauthorized personnel. It will also prevent unauthorized shutdown of the MSC when continuous operation is required. Note that continuous operation is recommended for better safety. 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 MSC. 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 MSC 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).



To Set New FAN PIN:

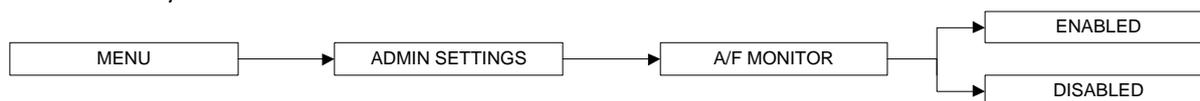
1. Press MENU button to enter the menu display – if the MSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose ADMIN SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose NEW FAN PIN. Press SET button to confirm.
6. Use UP / DOWN buttons to choose the first digit (X). Press SET button to confirm. Repeat this step until all four digit is filled and confirmed.
7. The display will show CONFIRM PIN? Press SET button to confirm.
8. The display will return to ADMIN SETTINGS.
9. Press MENU button twice to return to the main display.

### 2.2.4.3 A/F 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 A/F 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 A/F Monitor is automatically disabled



To Set A/F Monitor:

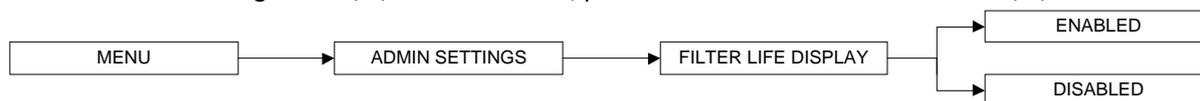
1. Press MENU button to enter the menu display – if the MSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose ADMIN SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose A/F MONITOR. Press SET button to confirm.
6. Use UP / DOWN buttons to choose between ENABLED and DISABLED. Press SET button to confirm.
7. The display will return to ADMIN SETTINGS.
8. Press MENU button twice to return to the main display.

### 2.2.4.4 Filter Life Display

Using this option, the user can select the 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 10000 hours.

When the filter is changed the F/H/M must be reset, please see section 2.2.4.7 to reset the F/H/M.



To Set Filter Life Display:

1. Press MENU button to enter the menu display – if the MSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose ADMIN SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose FILTER LIFE DISPLAY. Press SET button to confirm.
6. Use UP / DOWN buttons to choose between ENABLED and DISABLED. Press SET button to confirm.
7. The display will return to ADMIN SETTINGS.
8. Press MENU button twice to return to the main display.

### 2.2.4.5 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's no maximum value in blower hour meter. The counter value can be checked while in the diagnostic mode. The value can also provide some help in setting up maintenance schedule.



To Reset B/H/M:

1. Press MENU button to enter the menu display – if the MSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.

4. Use UP / DOWN buttons to choose ADMIN SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose RESET B/H/M. Press SET button to confirm.
6. The display will show READ MANUAL and PRESS SET. Press SET button to confirm.
7. The display will show CONFIRM?. Press SET button to confirm.
8. The display will return to ADMIN SETTINGS.
9. Press MENU button twice to return to the main display.

#### 2.2.4.6 Reset UV/H/M

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 2000 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.



To Reset UV/H/M:

1. Press MENU button to enter the menu display – if the MSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose ADMIN SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose RESET UV/H/M. Press SET button to confirm.
6. The display will show READ MANUAL and PRESS SET. Press SET button to confirm.
7. The display will show CONFIRM?. Press SET button to confirm.
8. The display will return to ADMIN SETTINGS.
9. Press MENU button twice to return to the main display.

#### 2.2.4.7 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 10000 hours (100%). The counter value can be checked while in the diagnostic mode. Please reset the filter hour meter after each filter replacement.



To Reset F/H/M:

1. Press MENU button to enter the menu display – if the MSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose ADMIN SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose RESET F/H/M. Press SET button to confirm.
6. The display will show READ MANUAL and PRESS SET. Press SET button to confirm.
7. The display will show CONFIRM?. Press SET button to confirm.
8. The display will return to ADMIN SETTINGS.
9. Press MENU button twice to return to the main display.

#### 2.2.4.8 Reset Default

User can reset the default setting by choosing this option. The features being reset are warm-up period (3 minutes), post-purge period (0 minute), UV timer (60 minute), measurement unit (Metric), A/F monitor (enabled), ADMIN PIN (0009), Filter Life Display (disabled) and FAN PIN (0000). The calibration settings cannot be reset as it may cause the MSC to operate in an unsafe manner. The hour meters cannot be reset either.



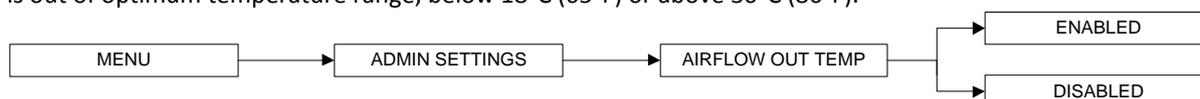
To Reset Default

1. Press MENU button to enter the menu display – if the MSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose ADMIN SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose RESET DEFAULT. Press SET button to confirm.

6. The display will show READ MANUAL and PRESS SET. Press SET button to confirm.
7. The display will show CONFIRM?. Press SET button to confirm.
8. The display will return to ADMIN SETTINGS.
9. Press MENU button twice to return to the main display.

#### 2.2.4.9 Airflow Out Temp

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



To Set Airflow Out Temp:

1. Press MENU button to enter the menu display – if the MSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose ADMIN SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose AIRFLOW OUT TEMP. Press SET button to confirm.
6. Use UP / DOWN buttons to choose between ENABLED and DISABLED. Press SET button to confirm.
7. The display will return to ADMIN SETTINGS.
8. Press MENU button twice to return to the main display.

#### 2.2.4.10 Alarm Mute Duration

To mute airfail alarm for a certain period. The mute period can be set between 0 to 299 seconds, the default value is 30 seconds.

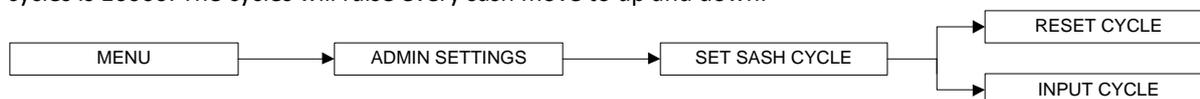


To Set Alarm Mute Duration:

1. Press MENU button to enter the menu display – if the MSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose ADMIN SETTINGS. Press SET button to confirm.
5. Use UP / DOWN buttons to choose ALM MUTE DURATION. Press SET button to confirm.
6. Use UP / DOWN buttons to choose the mute period. Press SET button to confirm.
7. The display will show MUTE DURATION SET for 2 seconds and return to ADMIN SETTINGS.
8. Press MENU button twice to return to the main display.

#### 2.2.4.11 Set Sash Cycle

To reset the sash cycles count to zero or to input the sash cycle count manually. The maximum of value of sash cycles is 16000. The cycles will raise every sash move to up and down.



Warning message will be showed after the cycle value reach 15000.

- 1st warning: “Replace Sash Motor” – after sash reached 15000 cycles.
- 2nd warning: “Stop Using Sash” - after sash reached 15500 cycles.
- 3rd warning: “Sash Motor Locked” (sash motor cannot operate) - after sash reached 16000 cycles.

To Set Sash Cycle Display:

1. Press MENU button to enter the menu display – if the BSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose ADMIN. Press SET button to confirm.

5. Use UP / DOWN buttons to choose SET SASH CYCLE. Press SET button to confirm.
6. Use UP / DOWN buttons to choose INPUT CYCLE. Press SET button to confirm.
7. Use UP / DOWN buttons to input the first sash cycle number. Press SET button to confirm. Do the same for the following 4 digits.
8. The display will return to SET SASH CYCLE.
9. Press MENU button thrice to return to the main display.

To Reset Sash Cycle:

1. Press MENU button to enter the menu display – if the BSC is secured by an ADMIN PIN, then it will ask for the PIN, otherwise go to step 3.
2. Use UP / DOWN button to enter the ADMIN PIN digit by digit. Press SET button to confirm.
3. The alarm buzzer will sound.
4. Use UP / DOWN buttons to choose ADMIN. Press SET button to confirm.
5. Use UP / DOWN buttons to choose SET SASH CYCLE. Press SET button to confirm.
6. Use UP / DOWN buttons to choose RESET CYCLE. Press SET button to confirm.
7. The display will return to SET SASH CYCLE.
8. Press MENU button thrice to return to the main display.

### 2.3 Half Speed Mode

NC2-L supports half speed mode, where the blower speed is reduced so that power consumption becomes less than half of normal mode. 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.



### 2.4 Alarms and Warnings

MSC uses alarms to indicate that the condition inside the MSC 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 that 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.

Another warning that should be acted upon is AIR FAIL! which indicates that there is airflow failure. The operator should check if there is any obstruction to the airflow, and correct it if possible. However, if the problem continues, the operator should stop working as the MSC's protection may have been compromised. Call service or Esco's local distributor.

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

- AIRFLOW: NO! will be displayed if the blower is turned off while there is an airflow failure.
- SASH:ERROR POSITION will be displayed if the microprocessor (controller) detects more than one micro-switch activated at the same time, which is impossible, as the sash can only be at one position at one time. This indicates a failure in the sash detection system.
- SENSOR UNCALIBRATED will be displayed if the airflow velocity sensor is not yet calibrated.

## 2.5 Diagnostic Mode

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

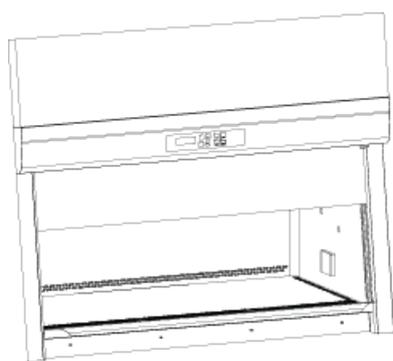
On Screen	Explanation
MODE	Shows which mode is active: NORMAL MODE, QUICKSTART MODE or MAINTENANCE MODE
VERSION	Shows the version of the software; eg: CP107 V 1.0
TEMPERATURE	Shows the temperature inside the cabinet.
B/H/M	Blower Hour Meter – increase by the hour.
SASH CYCLE	Shows the cycle of sash moving. 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	Airflow velocity display status when temperature is 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).
MUTE TIMER	Shows the mute timer value–default is 30 seconds. Maximum value is 299 seconds.
ADC IFF	ADC for Fail Point Inflow – calculated using offset based on Inflow Nominal Point.
ADC IFN	ADC for Nominal Point Inflow – based on field calibration.
ADC IFA	ADC for Actual Inflow – showing real time sensor reading.
ADC IF0	ADC for factory calibrated Zero Point Inflow (no inflow).
ADC IF1	ADC for factory calibrated Fail Point Inflow.
ADC IF2	ADC for factory calibrated Nominal Point Inflow.
ADC DFA	ADC for downflow velocity actual reading from the sensor
ADC DF0	ADC for factory calibrated zero point downflow (no inflow).
ADC DFN	ADC for downflow velocity nominal point – based on field calibration.
ADC DF2	ADC for factory calibrated nominal point downflow.
CONSTANT1	Inflow sensor constant. This value is needed when ordering a new sensor.
CONSTANT2	Downflow sensor constant. This value is needed when ordering a new sensor.
CALIB TEMP	Temperature when the factory calibration was performed.
ADC TEMP	ADC value for temperature.
M_SWITCH1	Shows the condition of magnetic switch 1 – safe position.
M_SWITCH2	Shows the condition of magnetic switch 2 – fully closed position.



## Chapter 3 – Basic Cabinet Operation

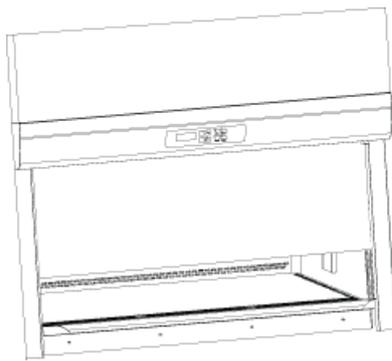
### 3.1 Sash Window Operation

#### 3.1.1 Sash Window State



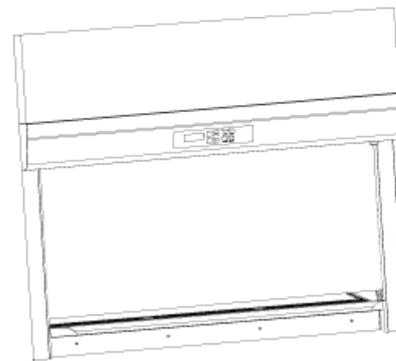
##### Sash is fully open

- ✓ Blower can be activated
- ✓ 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 can't be used

#### 3.1.2 Operating 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 reaches 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 it will prompt the user to input the password to turn on the fan. If the password is correct, if it was on fan will turn on and the sash will move up to the Safe Height setting and stop.

##### Raise Sash from Safe Height Position

When the sash is 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.

### 3.1.3 Using Sash Window

- The sash window should be fully closed when the cabinet is not in use. This helps keep the work zone interior clean.
- The sash window should always be in the normal operating height at all times when the cabinet is in use. Even if the cabinet is left unattended, but 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 the cabinet. When the sash window is fully opened, the alarm sound may be muted by pressing MUTE button but, will be automatically sounded again after 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.

## 3.2 Starting and Shutting Down the MSC

### 3.2.1 Turning on the MSC

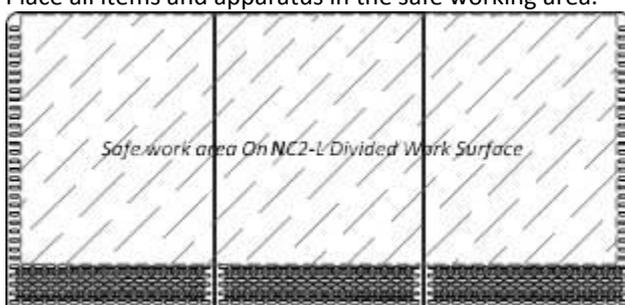
1. Raise the sash to the indicated normal operational height (READY state). The lamp will turned on when this height is reached.
2. Turn on the fan by pressing the FAN button. Input the Fan PIN if asked (default: 0001). This will start the warm up procedure (default: 3 minutes). All buttons are disabled during warm up period.
3. The MSC is ready for work.

### 3.2.2 Turning off the MSC

1. Turn off the fan by pressing the FAN button. Input the Fan PIN if asked (default: 0001). 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 UV MODE). 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.

## 3.3 Working in the MSC

- Surface-decontaminate the work area (work surface, back and side wall, UV lamp, electrical outlet, service fixture and the inner surface of the sash window) before and after using the MSC.
- Allow the MSC to purge any contaminant by allowing the blower to operate at least 3 minutes before and after using the MSC.
- Surface-decontaminate any item (including your arms) or apparatus with appropriate disinfectant before entering or exiting the work area.
- Place the waste container (containment bag, pippete discard pans, etc.) inside the MSC work area.
- Place all items and apparatus in the safe working area.



- Minimize room activity (personnel movements, closing and opening of doors, etc.) since these external airflow disturbances may adversely affect the MSC's internal airflow, thereby possibly impairing the containment capabilities of the MSC.
- 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 inside the MSC as possible - at least 150 mm (6 inches) behind the front air intake grille.
- While working in the MSC, move your hands slowly and in a controlled manner. Rapid movements may disrupt the air barrier, allowing contaminants to escape or enter the MSC.
- The use of Bunsen burner inside the work zone is not recommended. However if the use of Bunsen burner is unavoidable, place the burner in the right side of the work zone.
- Place aerosol-generating instruments as far inside the MSC 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 MSC. Stop other work while any of this equipment is in operation.
- As far as possible, it is recommended that the MSC 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 MSC may escape due to the thermal currents from inside the MSC.

### 3.4 Working Ergonomics

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

- The physiological energy cost and fatigue involved in sitting are relatively less
- Sitting posture 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 posture 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 a 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 keep varying 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 MSC'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 with Esco include:

- Armrest padding
- Lab chair
- Footrest

Please contact your local distributor or Esco for more information.

### 3.5 UV Lamps

The UV light is a very effective germicide and virucide. Even at the minimum acceptable irradiance in a MSC –  $40 \mu\text{W}/\text{cm}^2$  (US Department of Health and Human Services et. al., 2000), it would only take 12.5 minutes to reach  $30,000 \mu\text{W}/\text{cm}^2$  ( $1 \text{ W} = 1 \text{ J}/\text{sec}$ ), which has been listed as germicidal for spore forming organism.

Unlike many other type of decontamination agent, UV light doesn't leave any residue. The decontamination action stops upon de-energizing of the lamp.

However, due to the short wavelength, the UV light does not penetrate well. Thus UV light can only be used to effectively disinfect the work area of an empty MSC. For any container stored inside the MSC's work area, the UV radiation will only disinfect the outer surface of the material, leaving the inner surface and the content inside the material untouched.

- UV light decontamination method may be used before and after working with vegetative organisms and viruses. However, it should not be the sole decontamination agent; the use of chemical decontamination agent is still encouraged.
- Minimize the material inside the MSC'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 hazard.
- Make sure that the MSC sash is in the fully closed position and the interlock is working properly before activating the UV lamp. Avoid direct contact with skin and eyes as UV light is classified as a probable human carcinogen.
- The UV lamp should be activated for around 60 minutes to work effectively. Use the UV timer feature to easily control the period of decontamination (UV timer is disabled 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 MSC have a lifespan of 8,000 hours.
- The UV lamp should be cleaned of any dust and dirt weekly and changed annually to ensure its effectiveness.
- The use of UV lamp in MSC has been explicitly discouraged in all major international standards and recommendations.

### 3.6 Decontamination and Disinfecting Agents

- For stainless steel surfaces, all common disinfecting agents except chlorine-based ones are suitable.
- For powder coated surfaces, all common disinfecting agents are suitable. However, the MSC 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
- Depending on the contaminant involved at the time of operating the MSC, there are various other types of disinfecting agents that may be used. The following table outlines the effectiveness of various disinfecting agents against the different types of contaminants.

Decontaminant	Gluteraldehyde	Peroxide/ Peracetic acid/ Acetic acid	Chlorine Dioxide	Chlorine	Iodophor	Alcohol	Phenolic	Quaternary Ammonium Compounds
Classification	Sterilant	Sterilant	Sterilant	High Level	Interme- diate	Interme- diate	Interme- diate	Low Level
<i>Parameters for use:</i>								
Concentration	2%	1%	1:5:1/100- 1000 ppm	0.01-5%	0.5-2.5%	70-85%	0.2-3%	0.1-2%
Contact time (min.)	10-600	10-720	10-600	10-30	10-30	10-30	10-30	10-30
Stability > 1 week (1)	+		+		+	+	+	+
<i>Agents:</i>								
Bacterial Endospores	+	+	+	+/-				
Naked Viruses	+	+	+	+	+/- (2)	+/- (2)	+/- (2)	
Mycobacterium	+	+	+	+	+	+	+	
Vegetative Bacteria	+	+	+	+	+	+	+	+
Enveloped Viruses	+	+	+	+	+	+	+	+
<i>Characteristics:</i>								
Inactivated by Organics		+		+	+	+	+/-	+
Residual	+	+	+	+/-	+		+	
Corrosive		+		+	+		+	
Flammable						+		
Skin Irritant	+	+	+	+	+		+	
Eye Irritant	+	+	+	+	+	+	+	
Respiratory Irritant	+	+	+	+	+	+	+/-	
Toxic	+	+	+	+	+	+	+	+
<i>Use in MSCs:</i>								
Routine Surface Decon				+/-	+	+		+
Biohazardous Spill		+/-	+	+/-	+		+	+/-

### 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 trained personnel.

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

- At the time of moving/relocating the MSC
- At the time of changing the type of work being carried out in the MSC
- Before accessing contaminated areas for servicing, for example - filter replacement

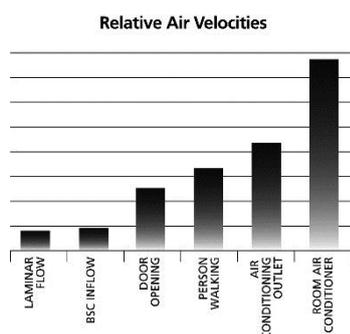


## Chapter 4 – Installation

### 4.1 General Requirement

#### 4.1.1 Location Requirements

Placing the MSC in a proper location is important. Bad location may affect the performance of the cabinet.



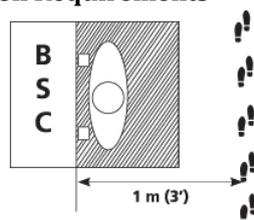
As seen in the chart, your cabinet's internal airflow velocity is relatively low, when compared to the airflow disturbances potentially caused by the opening of a door, a person walking by or a direct exposure to an air-conditioning outlet. These external airflow disturbances can affect the proper laminar flow of the MSC and impaired the protection offered by the cabinet.

When installing the MSC, it 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.

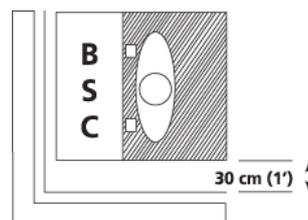
The following requirements should be taken into account:

- Poor siting of a cabinet can adversely affect performance. A specialist engineer should be consulted on correct positioning of the cabinet prior to installation.
- Cabinets should never be sited in line with a doorway, an open-able window, or adjacent to a thoroughfare. Care should be taken to ensure that possible disturbances to airflow such as room air diffusers, fans, extractors, vents, etc. are taken into account and any risk of disturbance noted and 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 and the force air handling rates will need to be low.
- The position of a safety cabinet 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.

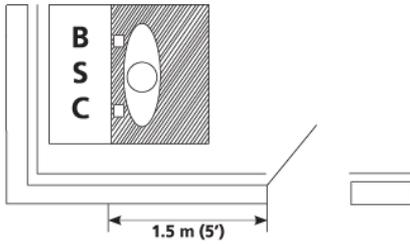
##### 4.1.1.1 Position Requirements



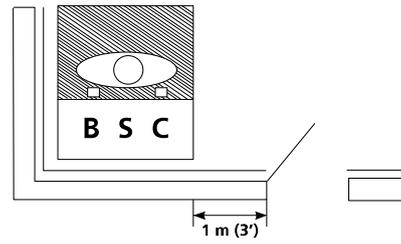
Allow at least 1.0 m (3') between the cabinet and pedestrian traffic routes, thoroughfares or walkways



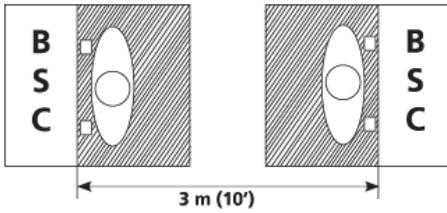
Allow at least 30 cm (1') clearance on both sides of the cabinet



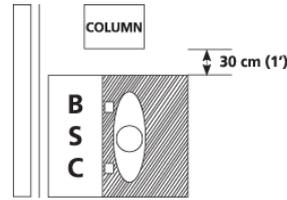
The distance between the cabinet aperture and any doorway is at least 1.5 m (5').



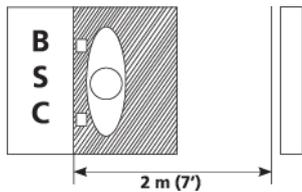
The distance between the side panel and any doorway is at least 1.0 m (3').



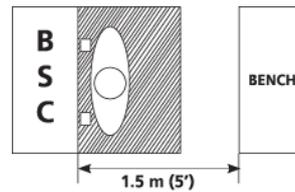
Allow at least 3m (10') between the aperture and the aperture of an opposing cabinet, fume cupboard, etc.



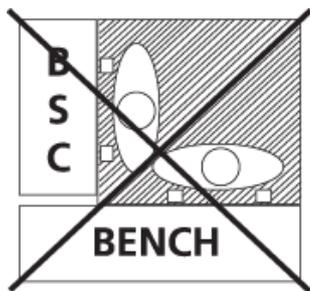
Any large obstruction projecting beyond the plane of the front aperture should not be within 30 cm (1') of the sides of the cabinet.



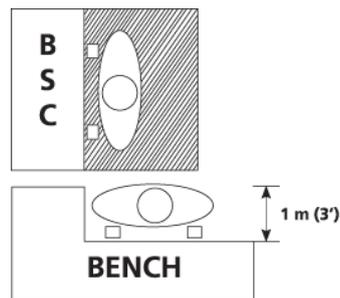
You should not position the cabinet in a location where there is an obstruction that affect airflow within 2 m (7') of the front aperture



The distance between cabinet aperture and the front of a bench opposite should be at least 1.5 m (5').



Avoid positioning a bench at right angles to the cabinet. Any 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 as long as the front of the bench is situated at least 1 m (3') from the side of the cabinet.

#### 4.1.1.2 Relocating the Cabinet

Normally MSCs are rarely moved once they are in their ideal positions, but if the need arise to relocate or even repackage the unit, then here is some considerations:

- Before moving the MSC, remember to decontaminate the cabinet
- Before moving the MSC, remember to secure all moving parts, ex: sash.
- MSC is heavy, be careful with the weight distribution. Usually it will take 6 or more people to move it.

For repackaging:

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

#### 4.1.2 Environmental Requirements

- Indoor use only
- Altitude of up to 2000 meter (6600')
- Relative humidity between 20% – 90%
- Temperature between 18°C – 30°C (65°F – 86°F)
- 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 that occasional conductivity is caused by condensation.*

#### 4.1.3 Support Requirements

- The support/cabinetry should be leveled
- The support/cabinetry must be able to withstand the weight of the cabinet and any apparatus within
- The support/cabinetry must be ergonomics

- *Esco recommends Esco support stand with leveling feet for MSC*
- *Without Esco's support stand, Esco cannot guarantee the cabinet's resistance against tipping and hence the user would be solely responsible for ensuring that the cabinet is securely fastened to third party support/cabinetry.*
- *The use of non-leveling feet Esco support stand will nullify the third party certification (NSF or TÜV) that the cabinet may have, because only Esco leveling feet support stand was used during certification. The maximum NSF approved leg levelers adjustment is 50 mm (2").*

#### 4.1.4 Exhaust Requirements

The exhaust filter area is especially 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. In fact, for proper exhaust filter leak scanning purposes, a minimum clearance of 50 cm (1'8") is recommended.

#### 4.1.5 Electrical Requirements

- Ensure that the outlet is rated accordingly to the model requirement. The cabinet will not work properly or may even be damaged if it is powered by an incorrect source.
- The cabinet's maximum voltage fluctuation is  $\pm 2\%$  of nominal voltage, otherwise install power stabilizer.
- Surge protection and UPS are strongly recommended for better protection.
- The power cable is located on the right hand side of the MSC 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 should be connected to an unobstructed dedicated power outlet(s).

#### 4.1.6 Service Line Requirements

- All service lines should be installed by a suitably qualified and 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 MSC 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.

## 4.2 Installation

### 4.2.1 Connecting the Electrical Supply

- First of all, refer to the serial label on the MSC for the proper electrical rating.
- Review the electrical wiring diagrams in Appendix section prior to installation. All wiring should be done in accordance with the National Electrical Code.
- Connect the supplied power cord to the input on the top of the MSC. Make sure the cable connector is seated firmly in the socket.

### 4.2.2 Connecting to a PC (using RS232)

1. Connect the RS232 female connector of the MSC to the RS232 male connector of the PC using DB9 RS232 serial cable.
2. Use these port settings for your RS232 connection:
  - Baud Rate : 2400
  - Data Bits : 8
  - Stop Bits : 1
  - Parity : None
  - Flow Control : None

If you are using Windows XP's HyperTerminal, follow these steps:

1. Click **Start**, and select **AllPrograms | Accessories | Communication | HyperTerminal**



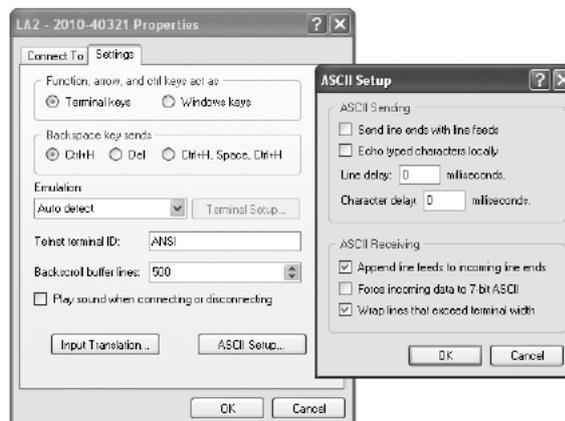
2. In the **Name** box and the **Icon** box, enter an appropriate name and icon.



3. Choose the port in the **Connect Using** drop down box, e.g.: COM1



4. Enter the connection's setting.



5. Enter **File | Properties | Setting | ASCII Setup** and tick **Append line feeds to incoming ends**

6. Click **OK** button twice to return to the HyperTerminal window. The connection is configured successfully
7. The information shown in the HyperTerminal window are current time, inflow velocity, downflow velocity, temperature, sash window position, blower hour meter, and blower condition (or warm up condition).

### 4.2.3 Safety and Warning Labels on the Cabinet

Anyone using the MSC should familiarize themselves with the various labels displayed in and on the cabinet. It is very important that users are familiar with the meanings of the labels before attempting to use the unit.

### 4.2.4 Preliminary Cleaning

Wipe the interior and exterior of the MSC with water or a mild household detergent.

## 4.3 Performance Validation/Certification

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

The test methods and equipment needed for carrying out the tests are specified on the test report.

### 4.3.1 Disclaimer

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

### 4.3.2 References for Qualified Certifiers

#### North America

- NSF (<http://www.nsf.org/Certified/Biosafety-Certifier/>)
- Esco ([www.us.escoglobal.com](http://www.us.escoglobal.com))
- IAFC member certifying company ([www.iafca.com/listview](http://www.iafca.com/listview))

#### UK, China, India, Middle East/North Africa, Malaysia, Singapore

- Esco offers field certification services directly. Contact local Esco office.

#### Other Countries

- Contact Esco or local distributor



## Chapter 5–Service and Maintenance

### 5.1 Scheduled Maintenance

Proper and timely maintenance is crucial for trouble free functioning of any device and your Esco MSC 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 MSC.

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	MSC power-up alarm verification	√					
3	Thoroughly surface decontaminate the drain pan		√				
4	Check the paper catch for retained materials		√				
5	Clean the exterior surfaces of the MSC			√			
6	Clean the sash window			√			
7	Check all service fixtures (where present) for proper operation			√			
8	Inspect the MSC for any physical abnormalities or malfunction				√		
9	Clean up stainless steel surfaces with MEK				√		
10	Re-certification					√	
11	Change UV Lamp (where present)					√	
12	Change the fluorescent lamps						√

#### Cleaning the MSC

- Clean the work surface and walls with appropriate disinfectant agent and soap water afterward
- Clean the sash window using an appropriate disinfectant agent and glass cleaner afterward
- Use a damp cloth to clean the exterior surface of the MSC, particularly on the front and top in order to remove dust that accumulated there
- Use clean water to finish the cleaning and wash away any residue of disinfectant agent, 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 clean water and some liquid detergent. Use a polyurethane cloth or sponge for washing. Regularly cleaning the stainless steel surface can help you retain the attractive factory finish.

#### 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 MSC's mechanical functionality; ex: sash window – lubricate if necessary
- Check the MSC's electrical functionality; ex: fluorescent lamp – replace if necessary
- Check the MSC for any defect, repair immediately

#### Re-certification

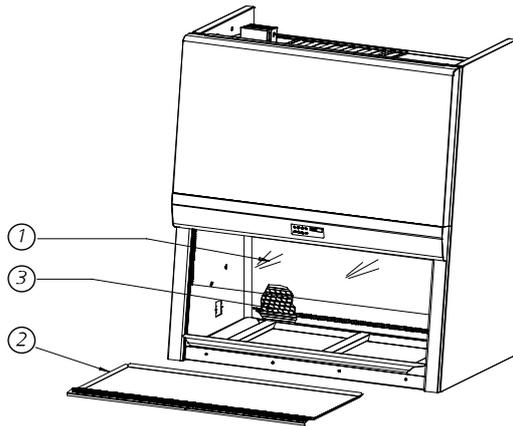
All MSC must be re-certified annually by a certified engineer. See test report for recertification procedure.

### Accessing the paper catch

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

Before opening the paper catch:

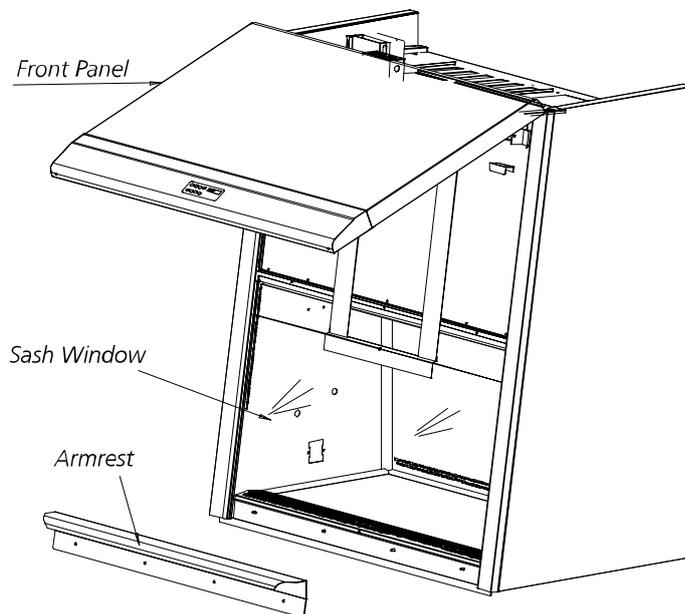
- Use appropriate personal protective equipment (PPE).
- Wipe down the interior of the MSC including the top and bottom surfaces of the work tray(s) while airflow is operating.
- If the interior cannot be wiped down, the MSC should be decontaminated



#### Accessing the paper catch

1. Turn the blower off. Then raise the sash to fully open position for easy access.
2. Remove the tray(s) to access the paper catch.
3. The figure beside, points to the location of the paper catch. Locate and remove any material trapped. Be careful of any sharp objects that might be present. You might want to use a mirror to help you see better.

### Sash cleaning procedure for motorized sash MSC

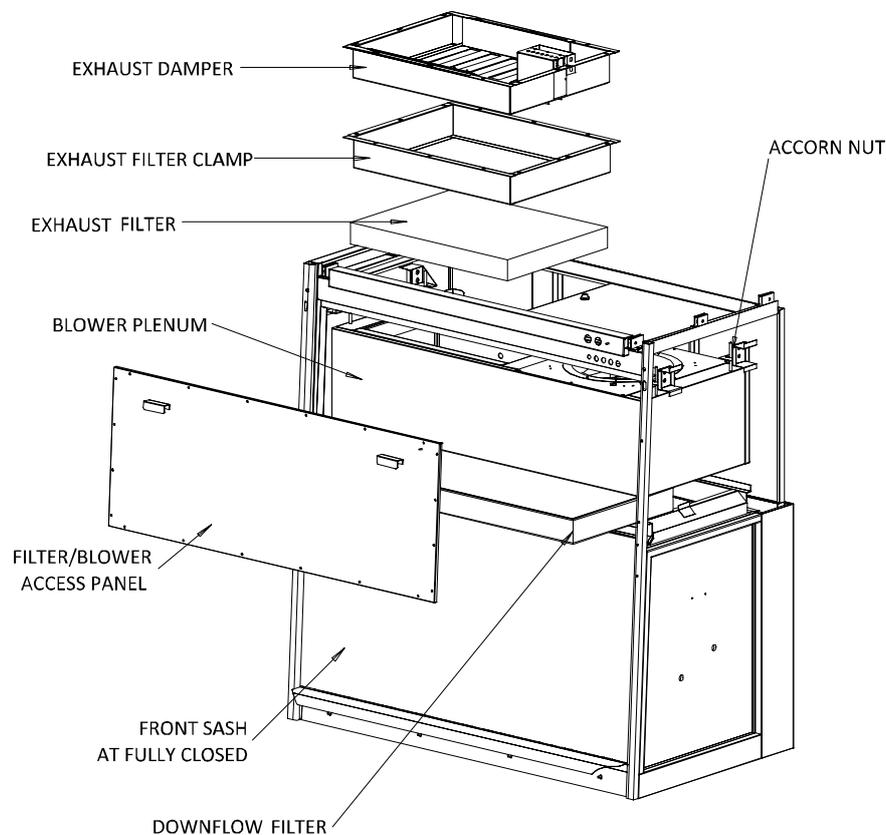


1. Remove armrest
2. Press MENU button, select SET MODE then choose MAINTENANCE MODE - this mode allows you to lower the sash further than usual
3. Lower the sash by pressing the DOWN button continuously until the sash is in the lowest position and create a 10 cm opening between the sash and the diffuser
4. Open the front panel.
5. Slide your hand through the opening and clean the inner side of the sash using cloth and IPA 70%
6. After cleaning, push the UP button continuously until the sash is in the sash ready position
7. Close the front panel.
8. Reattach armrest
9. Set the cabinet back to NORMAL MODE

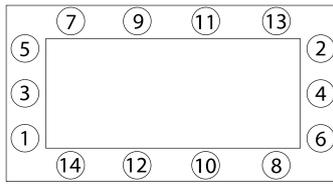
## 5.2 Parts Replacement

The use of non-Esco parts and / or parts not supplied directly by Esco or our authorized distributors, including but not limited to maintenance parts, spare parts, replacement parts, system components and / or system accessories, shall void all expressed or implied warranties.

### 5.2.1 Filter Replacement Procedure



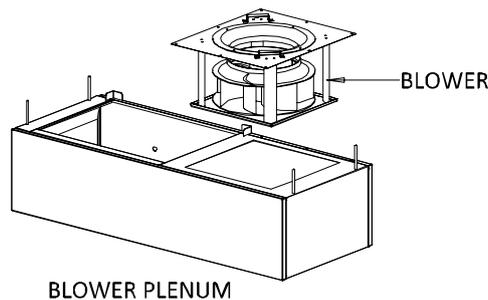
1. Unscrew and remove exhaust damper.
  2. Unscrew and remove the top exhaust filter clamp.
  3. Remove the exhaust filter inside.
  4. Remove the screws located on 2 sides of blue panel.
  5. Open up the hinged front panel which is supported at fixed position by ss hook
  6. Remove filter/blower access panel which is held in position by pan head screws m6.
  7. Turn the accorn nut of the clamping device on left and right side clockwise, until the blower plenum is moved up. Carefully remove the downflow filter from front side.
  8. Replace the filters while reversing the above steps.
- When securing blower housing onto new filter, please ensure gasket compression is equal on both downflow and exhaust filter.
  - When securing the exhaust filter mounting frame, please do not over-tighten the nuts, use the lowest torque if using a power tool.
  - Two persons may be required to facilitate filter changing on 5' and 6' MSC.
  - The two filters under normal usage and barring an accident (a puncture) do not need replacement until the inflow and/or downflow velocity cannot be maintained at the specific rate as mentioned in the test report even though the fan has been set to maximum speed.
  - The filters should not be replaced until the entire MSC has been decontaminated.
  - The cabinet must undergo re-certification after changing filter.



Two steps of tightening are necessary with the first round torque strength of one-third of the final torque required. Over tightening may cause damage to filter and cause leak.

1. Before the filters are removed from the MSC, their contaminated faces should be taped off using plastic film or cardboard or some other suitable material. This will minimize the risk of personnel in the event the decontamination was not thorough.
2. Used filters should be disposed following local regulations. They may have to be incinerated as medical waste. They should be double bagged and appropriately labeled following removal from the MSC.
3. Proper personnel protective attire should be worn when removing used filters (a disposable gown, gloves, facemask, hair and shoe covers are appropriate). These should be disposed after the procedure. Proper hand washing after the procedure is also necessary.
4. Before the new filters are installed, all surfaces should be thoroughly cleaned of silicon and / or adherent gasket material. The new filter should be carefully handled and examined prior to fitting. It is important that the filters and the gaskets be checked for leaks prior to use.

### 5.2.2 Blower Replacement Procedure



To replace the blower, follow the steps mentioned below:

1. Follow step 1-7 from blower replacement procedure, then continue
2. Disconnect the blower wiring.
3. Turn the accorn nut of the clamping device blower plenum set to be removed from front side.
4. Remove forward the full assembly blower plenum.
5. Unbolt the blower set and replace
6. Reverse the above steps.

### 5.2.3 Fluorescent Lamp(s) Replacement Procedure

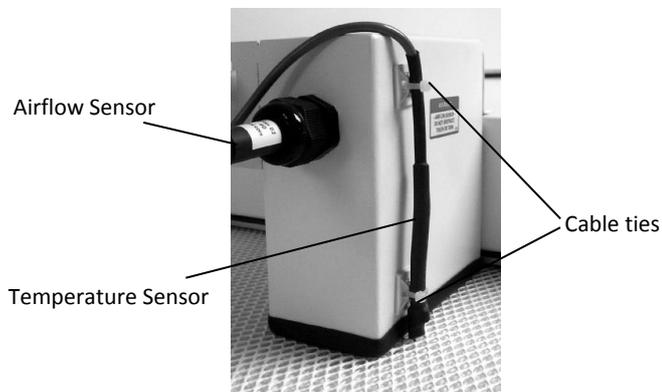
1. Disconnect the electrical connections.
2. Unfasten the two screws from the bottom of the blue panel and then lift up the blue panel.  
**Caution:** *The front panel is equipped with a gas spring which will open the front panel automatically.*
3. The fluorescent lamp(s) is located behind the blue panel. Disconnect the old one(s) and replace with the new one(s).

### 5.2.4 UV Lamp Replacement Procedure

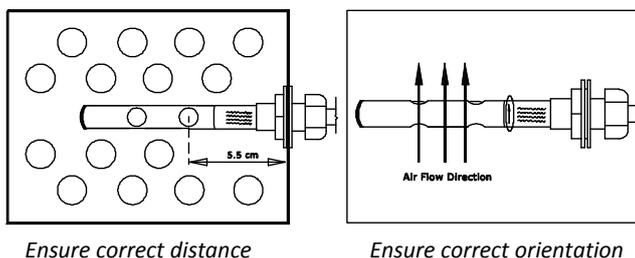
1. Disconnect the electrical connections.
2. Take out the old UV lamp by rotating it 90° counter clockwise and pull downward.
3. Install the new UV lamp by pushing it upward and rotating it 90° clockwise to secure the lamp in its socket.

## 5.2.5 Airflow Sensor Replacement Procedure

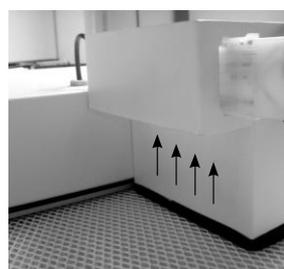
1. Airflow sensor is located on top of the cabinet. Start by disconnecting the airflow sensor cable connector.



2. Cut the cable ties to remove the temperature sensor.
3. Unfasten the nut connecting the airflow sensor to the sensor housing
4. Pull out the old airflow sensor from the sensor housing.
5. Push in the new sensor. Make sure that the arrow sticker on the sensor tube is pointing “up” as shown in the figure below, so that the axes of the sensor holes are parallel to the airflow direction. Also make sure that the distance between the outer sensor hole and wall of the sensor housing is 5.5 cm, as shown in the figure below:



6. Fasten the nut and reconnect the airflow sensor cable connector. Mount back the cable onto the sensor housing. Make sure that there is no gap between the housing and the filter as shown below



*When installing the airflow sensor, please watch the airflow direction*

## 5.3 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.



## Chapter 6–Recertification & Calibration

MSC generally require re-certification, when:

- The cabinet is re-located
- Cabinet’s performance is suspected
- After filter or blower replacement
- At least once a year

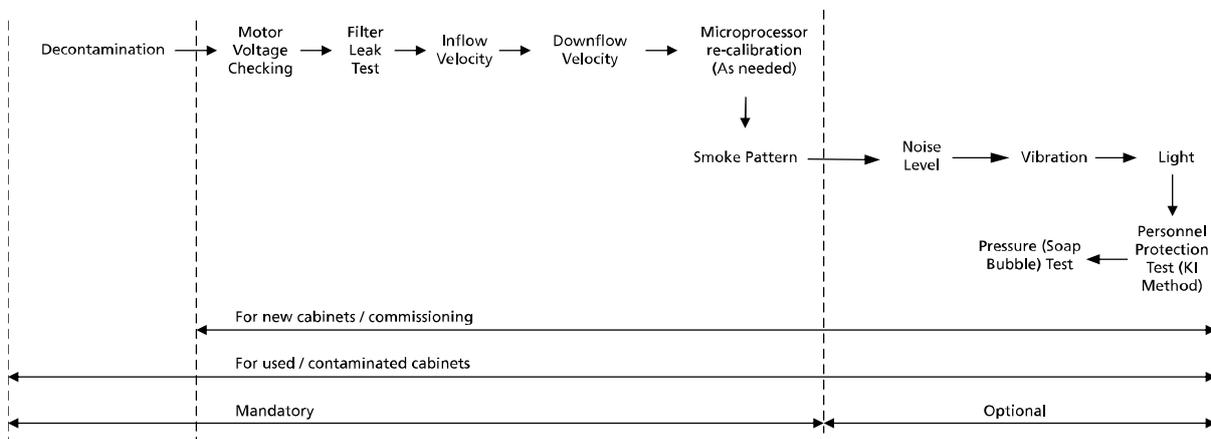
During recertification:

- Cabinet airflow velocities and flow patterns are verified against the manufacturer’s specifications and relevant international standards
- Filters are scan-tested to ensure they do not leak
- Operator comfort tests may be performed
- If airflow velocities are found to be off set point, adjustments are made as part of the certification process before final values are recorded.

Airflow alarm calibration, when:

- The cause of the airflow alarm cannot be determined
- Re-certification indicates the displayed airflow deviates by  $>0.02\text{m/s}$  (4fpm) from actual measured velocities.

### 6.1 Certification Flowchart



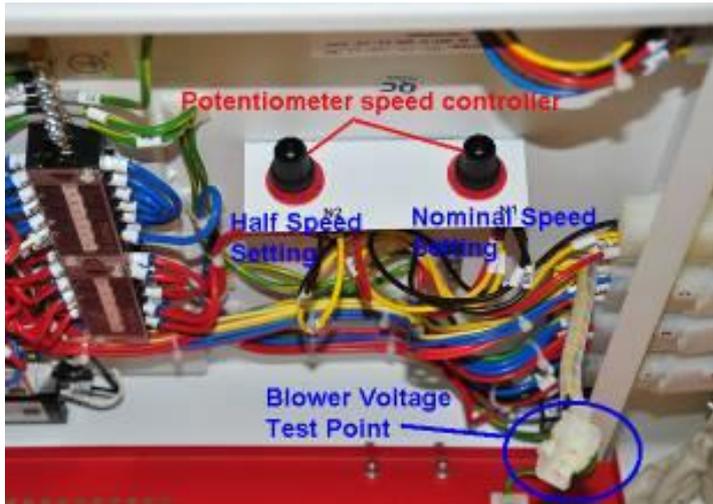
### 6.2 Certification and Calibration

Certification and calibration procedure can be found in the test report.

### 6.3 Airflow Adjustment

The speed controls/potentiometers are located in the electronics panel which is accessed by raising the front engineering access panel at the top of the front of the cabinet and then opening the drop-down cover by removing the two screws on the front left and right sides of the cover.

This cabinet has two potentiometers:  
N1 to control the nominal speed  
N2 to control the half speed



Plug the multimeter probes to the Motor Voltage Sampling Port. Set the multimeter to measure DC voltage. Adjust the airflow by adjusting the potentiometer.

When the cabinet is in normal mode, the blower voltage test point indicate the N1/nominal speed potentiometer DC voltage.

When the cabinet is in half-speed mode, the blower voltage test point indicate the N2/half speed potentiometer DC voltage.

## Chapter 7 - Decontamination

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MSC decontamination should be performed in any of the following eventualities:

- Before replacing the exhaust/downflow filters or blower.
- Before accessing the contaminated negative or positive plenum of the MSC.
- In case of an accidental spillage that might have contaminated any of the inaccessible surfaces.
- Before performance validation and re-certification, especially if the MSC has been used with BSL 3 or 4 agents.
- Before MSC relocation.

Personal protective equipment such as gloves, gown, and respirator with filter suitable for the decontamination gas/vapor must also be used by the certifier performing the decontamination. Esco can provide the formalin vaporizer and decontamination bag needed for the decontamination procedure.

### 7.1 Decontamination Agents

#### 7.1.1 Formalin/Paraformaldehyde Decontamination

Typically the decontamination is performed using formalin gas by either vaporizing 37% formalin solution or by de-polymerization of solid paraformaldehyde.

Despite its widespread usage for decontamination, formalin presents the following health risks:

- External contact can cause irritation to skin, eyes, and mucous membranes.
- Inhalation in small concentrations can cause coughing, nausea, and diarrhea.
- Inhalation in large concentrations can cause convulsions, coma, and death.
- Long term exposure can cause cancer.

Although the Permissible Exposure Level (PEL) for formalin is 0.75 ppm, many scientists believe that there is no safe level of carcinogen exposure to humans. Therefore, typically the room must be evacuated when the decontamination process is performed, which leads to lab down time.

The use of formalin decontamination also has other disadvantages:

- The process is time-consuming.
- The certifier needs to pulse the MSC fan to circulate the formalin vapor. This can dislodge the tape holding the plastic sheet covering the exhaust filter.
- Due to excessive residue extensive cleaning must be done after decontamination and before use.

The formalin decontamination process can require an extended period of time as outlined below:

According to OSHA [Occupational Safety and Health Administration (USA)], formaldehyde Short Term Exposure Level (STEL) is 2 ppm for 15 minutes exposure, 4 times a day, minimum of 60 minutes in between exposures.

Any additional local safety regulations should also be observed. Personnel should be given adequate training.

The following links provide general guidelines on formaldehyde safety:

- Regulations (Standards - 29 CFR) Formaldehyde - 1910.1048, Occupational Safety and Health Standards, OSHA (Occupational Safety and Health Administration), U.S. Department of Labor: <http://www.osha.gov>
- OSHA Formaldehyde Fact sheet (PDF format) [http://www.osha.gov/OshDoc/data\\_General\\_Facts\\_formaldehydefactsheet.pdf](http://www.osha.gov/OshDoc/data_General_Facts_formaldehydefactsheet.pdf)

No.	Process	Time
1	Set-up & sealing the MSC to make it air tight	1 hour
2	Formalin vaporization	½ hour
3	Formalin contact time to obtain target log of 4-6 kill	8 – 10 hours
4	Ammonia vaporization to neutralize formalin	½ hour
5	Ammonia contact time to neutralize formalin	2 hours
6	Exhausting the ammonia residue	1 hour
7	Tear-down & cleaning the (substantial) residue	1 hour
<b>TOTAL without ammonia neutralization</b>		10½ – 12½ hours
<b>TOTAL with ammonia neutralization</b>		14 – 17 hours

Ammonia is used to neutralize formaldehyde. OSHA prescribes the ammonia STEL is 35 ppm for 15 minutes exposure, 4 times a day, minimum of 60 minutes in between exposure.

Due to the adverse health effect of formalin gas, its use has been banned in Germany, Austria, and Switzerland. Other European countries are expected to follow suit. Two primary candidates to replace formalin decontamination are chlorine dioxide gas and hydrogen peroxide vapor.

### 7.1.2 Chlorine Dioxide Decontamination

Chlorine dioxide decontamination is performed by injecting chlorine gas (Cl<sub>2</sub>) into a cylinder filled with solid sodium chlorite (NaClO<sub>2</sub>), which generates the greenish-yellow chloride dioxide gas (ClO<sub>2</sub>). Chlorine dioxide decontamination is much faster than formalin. Being a true gas, it spreads quickly, without the need of pulsing the MSC’s blower. It can rapidly kill the micro-organisms with high efficacy with just 1 hour contact time. There is minimal residue to clean after the decontamination making the entire process much faster than formalin decontamination. The time required for the entire process of chlorine dioxide decontamination is as follows:

No.	Process	Time
1	Set-up & sealing the MSC to make it air tight	1 hour
2	Chlorine dioxide gassing	½ hour
3	Chlorine dioxide contact time	1 hour
4	Chlorine dioxide “scrubbing”	½ hour
5	Tear-down & cleaning the (minimal) residue	½ hour
<b>TOTAL</b>		3½ hours

Chlorine dioxide has the PEL of 0.1 ppm, compared to 0.75 ppm for formalin. In both processes airtight MSC sealing is required to protect personnel from the gas exposure.

### 7.1.3 Hydrogen Peroxide Decontamination

Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) decontamination is performed by flash vaporization of an aqueous peroxide mixture, creating a vapor that is distributed throughout the inside the MSC.

STERIS and BIOQUELL are two major vendors of hydrogen peroxide generators. There are significant differences in operating principles.

- The STERIS principle is to avoid condensation on surfaces to minimize corrosion and optimize vapor distribution. The relative humidity inside the MSC must be lowered to 30% so that the remaining 70% relative humidity can be occupied by the hydrogen peroxide vapor. STERIS product for MSC is VHP M100 Biodecontamination System.
- The BIOQUELL principle is to seek micro-condensation to achieve the kill. The generator releases tiny high-speed droplets inside the MSC. BIOQUELL product for MSC is Clarus L.

Hydrogen peroxide vapor is non-carcinogenic, but highly effective against micro-organisms. Hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) vapor breaks down under catalytic action to become air and water, making it environmentally friendly and it leaves no residues. The decontamination process is as fast as chlorine dioxide if the MSC is ducted.

However, if the MSC is not ducted, the hydrogen peroxide must be aerated, which is time-consuming.

The time needed for the entire process is outlined below:

No.	Process	Time
1	Set-up & sealing the MSC to make it semi-airtight	½ hour
2	Conditioning and decontamination cycle	1 ½ hour
3	Ducting out H <sub>2</sub> O <sub>2</sub>	H <sub>2</sub> O <sub>2</sub> generator doing aeration ½ hour   8 hours
4	Tear-down	½ hour
<b>TOTAL</b>		3 hours   10½ hours

For hydrogen peroxide decontamination, the MSC need to be equipped with two ports:

1. One port located in front opening or side wall, penetrating the work zone area
2. One port located on top of the exhaust filter.

The generator used defines the port function as described below:

	Steris	Bioquell
<b>Hydrogen peroxide source</b>	Injected into the MSC	Generated inside the MSC
<b>Bottom front / side port</b>	Hydrogen peroxide introduction	Hydrogen peroxide re-introduction
<b>Top port</b>	Hydrogen peroxide extraction	Hydrogen peroxide extraction

### 7.1.4 Comparison Table

No.	Aspect	Formalin Vapor	Chlorine Dioxide	Hydrogen Peroxide
1	Is it carcinogenic?	Yes	No	No
2	Is it a genotoxin?	Yes	No	No
3	Permissible Exposure Level (PEL)	0.75 ppm	0.1 ppm	1 ppm
4	Immediately Damaging to Life & Health (IDLH)	2 ppm	5 ppm	75 ppm
5	Sealing of MSC	Must be airtight	Must be airtight	Small gaps are OK
6	Lab evacuated during the process?	Yes, due to leakage danger	Yes, due to leakage danger	No, people can still work in lab
7	Is room humidity control required?	Yes, above 60%	Yes, between 60 to 80 %	No
8	Residue	Substantial, needs extensive cleaning	Minimal, in the form of NaCl	No residue. Needs no cleaning at all.
9	Decontamination time per MSC	11-17 hours	3-4 hours	3-11 hours
10	Equipment cost	US\$ 100 - \$ 2,000 (reusable)	US\$ 1,500 + Cl gas canister (reusable for several times)	US\$ 18,000 - \$ 52,000 (reusable)

### 7.2 Recommended Decontamination Sealing Method



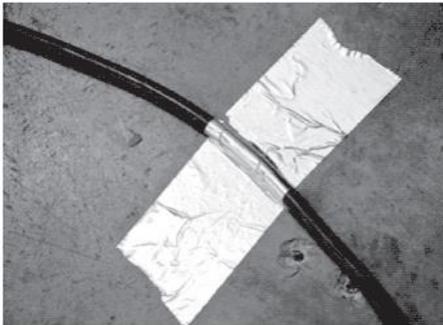
1. Put the decontamination bag to enclose the entire MSC and support stand
2. Use the 50 mm wide aluminum tape to seal the gap between the decontamination bag and the floor. To compensate for areas where the decontamination bag must turn, use multi section tape. Ensure that the two layers of tape overlap at the end points to prevent leakage.



3. Overlap the tape at the joints



4. These 2 cables (for MSC and for vaporizer) should be combined so that only 1 cable should come out from the decontamination bag, to minimize chance of formalin leakage



5. To seal the cable, first make an  $\Omega$ -shape aluminum tape around the cable, and make a 5 cm flat portion going to both directions. Then, paste the aluminum tape to the floor.



6. Put the bottom part of the decontamination bag on top of the aluminum tape, and then seal it with another layer of aluminum tape. Use multiple layer of aluminum tape (*at least 2 layers*) on both directions to ensure leak tightness.



7. The MSC is ready for formalin decontamination.

# Chapter 8 – Troubleshooting

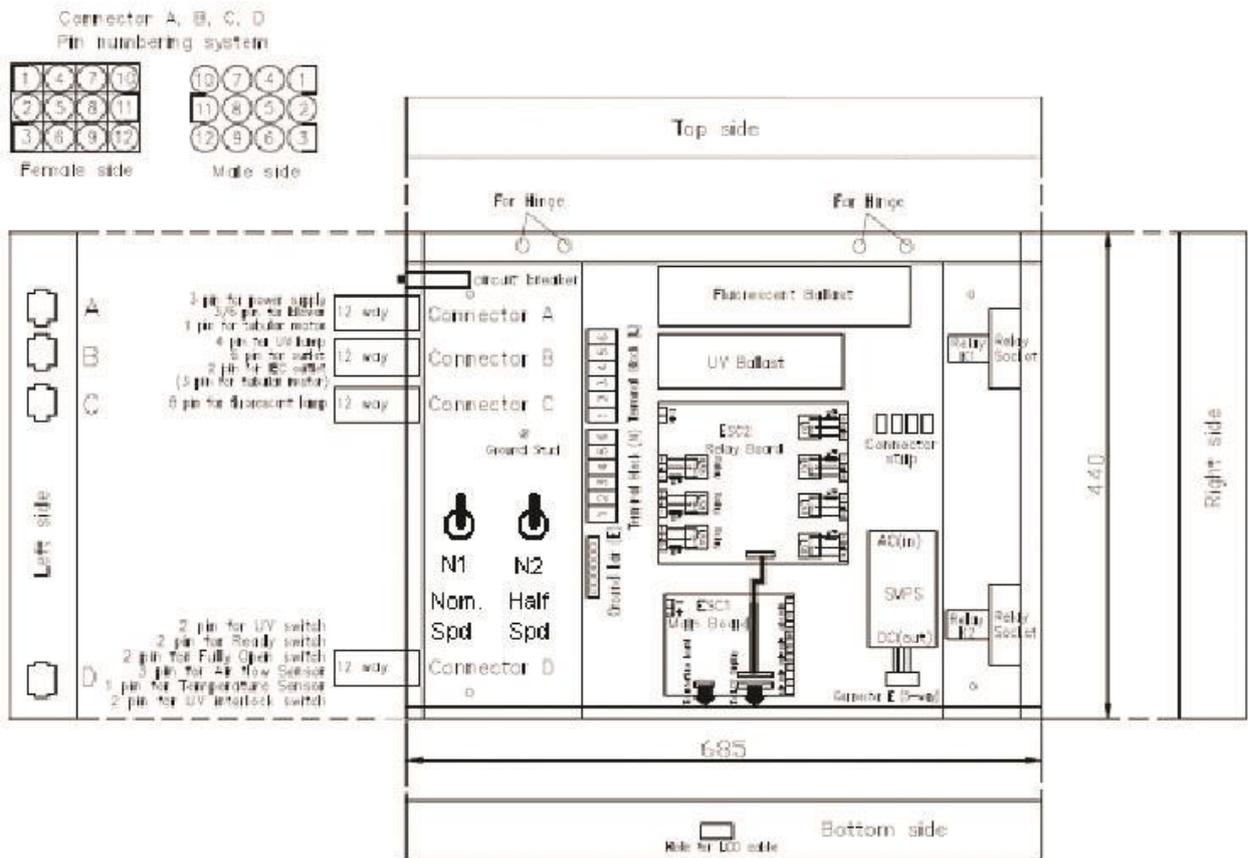
This guide addresses the most common service issues. For more trouble shooting or service information contact your local ESCO Distributor.

### Hardware:

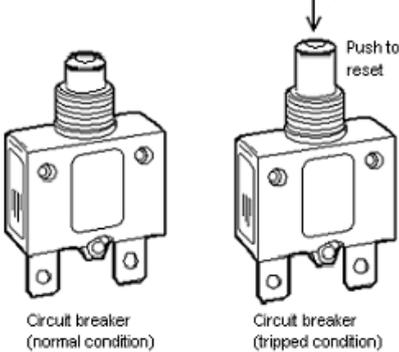
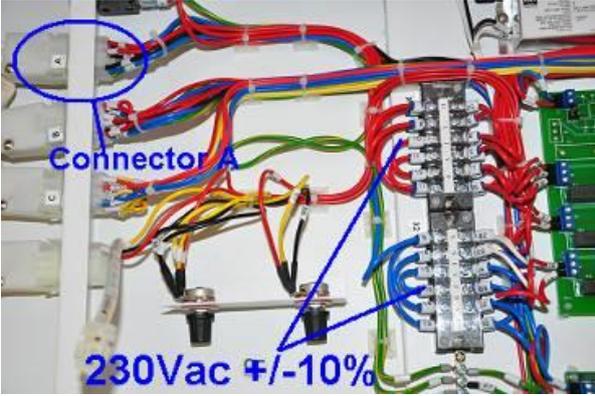
- DVM (Digital Voltage Meter).  
**Note:** An analog meter can be used for troubleshooting, but cannot be used for motor voltage measurement.
- Phillips screwdriver
- Insulated jumper cables

### The Electrical Panel and Component Layout:

Open the front panel, the electrical panel is the red covered box located on the back of the panel. The component layout is as followed:



**Problem 1: Cabinet does not start (LCD, button, fan light, and socket are inoperative)**

Cause	Corrective Action
Power Failure	<ul style="list-style-type: none"> <li>• Check if there is power at the wall/building electrical socket by using DVM.</li> <li>• Ensure the building socket switch is at ON position.</li> </ul>
Power cord is not connected properly or faulty	<ul style="list-style-type: none"> <li>• Check whether power cord has been connected properly into wall/building socket and the unit. Some cabinets have 2 cords.</li> <li>• Measure the AC voltage between the live and the neutral terminal of the cord by using DVM.</li> <li>• If the voltage is not within <math>\pm 2\%</math> of the wall socket voltage, replace cord; otherwise proceed to next step</li> </ul>
Circuit breaker has tripped	<ul style="list-style-type: none"> <li>• See Component Layout to find circuit breaker.</li> <li>• Check the circuit breaker inside the electrical panel.</li> </ul> <p><b>NOTE:</b> If circuit breaker has tripped, do not reset the breaker before checking all electrical components and wiring connections. (See Figure 1-1).</p> <ul style="list-style-type: none"> <li>• Does the cabinet operate correctly after resetting the circuit breaker? If not proceed to next step.</li> </ul>
 <p>Figure 1-1</p>	
Improper connection	<ul style="list-style-type: none"> <li>• Ensure cabinet is plugged in to the main supply.</li> <li>• Carefully measure AC voltage between LIVE and NEUTRAL terminal block inside electrical box (See Figure 1-2).</li> <li>• The voltage should be 230VAC <math>\pm 10\%</math></li> <li>• If the voltage is out of the range, check cable connection at connector A pin 1, 2 and 3 (ground). Confirm that the voltage is present and must be 230VAC <math>\pm 10\%</math></li> <li>• See Component Layout to locate connector A and the pin numbering system.</li> </ul>
 <p>Figure 1-2</p>	
Defective power supply –Switch Mode Power supply (SMPS)	<ul style="list-style-type: none"> <li>• Locate the SMPS (Power Supply) and 5 pin connector.</li> <li>• On the BACK side of the 5 pin connector measure the DC voltage between Red (pin 1) and White (pin 2) Measure on the side away from the SMPS See Figure 1-4.</li> <li>• The voltage should be in range of +7.5VDC <math>\pm 10\%</math>.</li> </ul>

(Only when SMPS item code 1080328 is installed)

- If you do not have voltage measure the other side of the 5 pin connect.
- If out of range or no voltage, check incoming power to the SMPS (Molded cord) – check terminal where the cord is connected. The input of SMPS should be  $\pm 10\%$  of the cabinet incoming voltage.
- If input voltage exists but there is no output voltage, please replace the SMPS.
- If input and output voltage is correct, proceed to the next step.



Figure 1-3

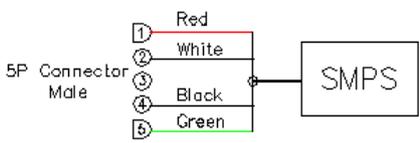


Figure 1-4

Defective power supply – Switch Mode Power supply (SMPS) (Only when SMPS item code 1080945 is installed)

- Locate the SMPS (Power Supply) and Terminal block.
- On the side of terminal block, measure the DC voltage between Red (pin 3) and Black (pin 4) Measure on the side away from the SMPS.
- The voltage should be in range of  $+12\text{ VDC} \pm 10\%$ .
- If you do not have voltage, measures the other side of terminal block.
- If out of range or no voltage, check incoming power to the SMPS – check terminal where the cord is connected. The input of SMPS should be  $\pm 10\%$  of the cabinet incoming voltage.
- If input voltage exists but there is no output voltage, please replace the SMPS.
- If input and output voltage is correct, please proceed to the next step.

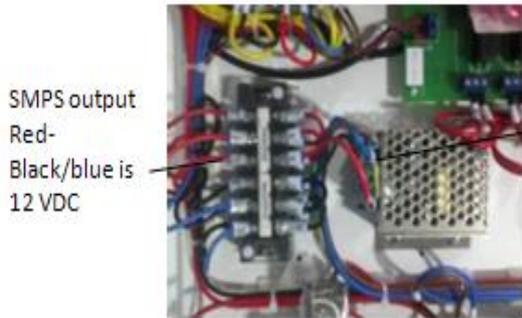
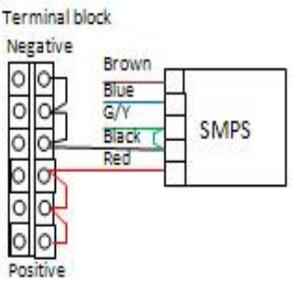


Figure 1-5



Connection problem to main board

- See Component Layout to locate the main board.
- Measure the incoming voltage on the main board at terminal J 13 (Note polarity, blue cable closest to edge is negative -). See Figure 1-5.
- Voltage should be between 6.75 – 8.25VDC, if 7.5 VDC SMPS (item code 1080328) is used.
- Voltage should be between 10.8 – 13.2VDC, if 12 VDC SMPS (item code 1080945) is used.
- If voltage is out of range, check connection between SMPS and main board.
- If voltage is correct, proceed to next step.



Figure 1-6

Defective main board

- Restart the cabinet 2 to 4 times.
- The main board is defective if the main board incoming supply is between 6.75 – 8.25VDC if 7.5 VDC SMPS is installed or between 10.8 – 13.2VDC if 12 VDC SMPS is installed and:
  - All LED's on the control panel are off
  - The LCD is blank
  - No buzzer sound
- If these conditions exist replace the main board, otherwise proceed to next step  
**Note:** when replacing main board, reconnect all wires correctly, any wrong wiring may result in damage

Connection problem to relay board

- See Component Layout to locate the relay board.
- Measure the incoming voltage on the Relay Board at terminal J 1 (Note polarity, BLUE cable closest to edge is negative -). See Figure 1-66.
- Voltage should be between 6.75 – 8.25VDC if 7.5 VDC SMPS is installed or between 10.8 – 13.2VDC if 12 VDC SMPS is installed.
- If voltage is out of range, check connection between SMPS and relay board.
- If voltage is correct, proceed to next step.

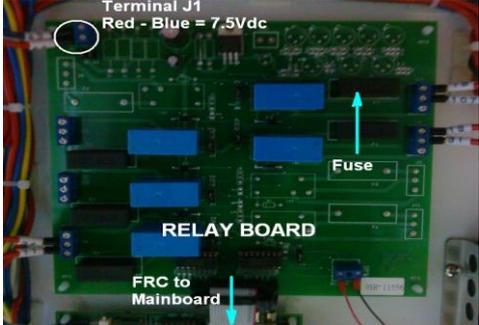
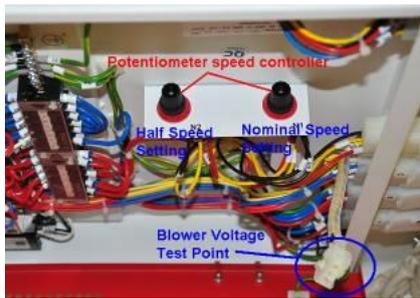


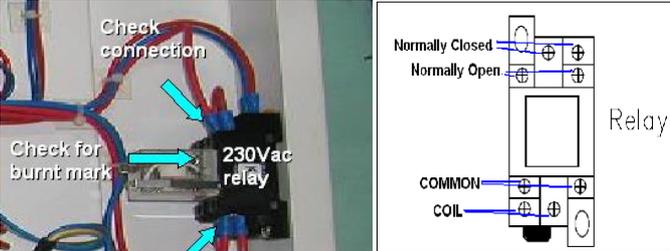
Figure 1-7

Defective relay board

- Ensure the following are correct:
  - Main board is operational
  - Flat Ribbon cable is installed correctly to relay board and main board and shows no physical damage
  - Relay board has the correct incoming voltage (between 6.75 – 8.25VDC if 7.5 VDC SMPS is installed or between 10.8 – 13.2VDC if 12 VDC SMPS is installed)
  - Check all fuses on relay board: Turn off power, remove fuses and physically inspect or check continuity
  - All wiring connections are good
- Turn the cabinet on. If the FAN, LIGHT, SOCKET and cannot be controlled, replace the Relay Board.  
**NOTE:** When replacing relay board, please re-connect all the cables back correctly. Any wrong wiring may result in damage.

**Problem 2: Blower doesn't function**

Cause	Corrective Action
Fan is Off	<ul style="list-style-type: none"> <li>• Switch on the Fan by pressing Fan button on control panel.</li> <li>• Enter the Fan PIN number if required (default is 0001)</li> <li>• The LED for FAN should illuminate and the FAN should start.</li> <li>• If the FAN does not operate, proceed to next step.</li> <li>• If the LED on the membrane does not illuminate, check connection from control panel to main board and LCD, keypad membrane.</li> </ul>
Fuse F1 is blown	<ul style="list-style-type: none"> <li>• Switch off the cabinet.</li> <li>• See Component Layout to locate the relay board.</li> <li>• Check Fuse F1 on relay board. See Figure 2-1 below.</li> <li>• If fuse F1 is blown, replace with 5A, 250V fuse. Otherwise, proceed to next step.</li> </ul>
 <p data-bbox="619 981 721 1003">Figure 2-1</p>	
Faulty potentiometer speed controller	<ul style="list-style-type: none"> <li>• Switch off the blower on the cabinet.</li> <li>• See Component Layout to locate the N1 (nominal speed) and N2 (half speed) potentiometer speed controller</li> <li>• Bypass the speed controllers by adding jumper cable across cables 55(Yellow) and 53(Red) going to N1. For N2 add jumper cable across cables 57(Yellow) and 54(Red). See Figure 2-2.</li> <li>• Switch on the cabinet. The specific potentiometer controller is defective when the fan operates properly. Replace the defective potentiometer.</li> <li>• If the fan does not operate, proceed to next step</li> </ul>
 <p data-bbox="619 1630 715 1653">Figure 2-2</p>	
Faulty relays	<ul style="list-style-type: none"> <li>• Turn off the cabinet.</li> <li>• Check LS1 relay on the Relay Board. See Drawing 2-7 below.</li> <li>• Make sure all wiring and connections are correct.</li> <li>• On terminal J 2, check the NO to C and NC to C circuits by checking continuity.</li> <li>• If the NO to C and NC to C contacts are not correct, replace the Relay Board.</li> <li>• If the NO to C and NC to C contacts are correct, proceed to the next step.</li> <li>• Check K1 relay, see Figure Layout at the end of this section to locate the K1 relay.</li> <li>• With cabinet still switched-off, check if the cables connected to the relay socket are tight. See Figure 2-3 below.</li> <li>• Visually inspect the relay for burnt contacts or flash marks on the inside of the relay</li> </ul>

	<p>case. (Relay is the clear case component)</p> <ul style="list-style-type: none"> <li>• Check NO to Common and NC to common contacts on relay K1, the method is same as for LS1 relay. See Figure 2-4.</li> <li>• If the relay K1 shows signs of arching (burnt marks) or the NO-C and NC-C circuits are not correct, replace the relay.</li> </ul>
 <p>Figure 2-3</p>	 <p>Figure 2-4</p>
<p>Auto-thermal cut-off</p>	<ul style="list-style-type: none"> <li>• Check the Fan for overheating – The motor has a thermal cut out built-in.</li> <li>• Wait 60 minutes with the FAN turned off and then try to restart.</li> <li>• If the FAN restarts determine why there is excessive heat in the cabinet. Proceed to the next step.</li> </ul> <p><b>WARNING:</b> <i>decontamination must be done on the cabinet before accessing the fan.</i></p>
<p>Motor failure</p>	<ul style="list-style-type: none"> <li>• Check whether the motor can rotate properly and not loosened.</li> <li>• Check for physical damage. If present, replace the blower.</li> </ul>

**Problem 3: Airflow Failure (AIRFAIL) – alarm is triggered**

Cause	Corrective Action
<p>External air interference</p>	<ul style="list-style-type: none"> <li>• Ensure that there are no external sources of airflow disturbance like air conditioner vent, window or incidences of door opening or people walking fast near the cabinet.</li> <li>• Locate airflow sensor installed inside the work zone. Ensure there is no air disturbance or obstruction around the sensor.</li> <li>• If there is no external air interference, proceed to next step.</li> </ul>
<p>Blocked cabinet grille</p>	<ul style="list-style-type: none"> <li>• Ensure that the air grilles inside the cabinet are not blocked and that the cabinet is not excessively loaded. If there is no blockage in air grilles, proceed to next step.</li> </ul>
<p>Low building supply voltage (if new cabinet, check this first)</p>	<ul style="list-style-type: none"> <li>• Turn on the cabinet.</li> <li>• Open electrical box and find motor voltage sampling port as shown on Figure 3-1.</li> <li>• For new cabinet, if the motor voltage is lower than the Nominal Voltage value recorded in factory test report, adjust the N1 potentiometer to get output voltage to blower as specified in the Test Report – Test Conditions Documentation Sheet.</li> <li>• For cabinet that has been used for more than 1 year, refer to last motor Nominal Voltage from last certification report or if not available, measure the actual airflow on cabinet and increase motor voltage accordingly to achieve nominal airflow velocity.</li> <li>• If supply voltage is same as Nominal Voltage, proceed to next step.</li> </ul>

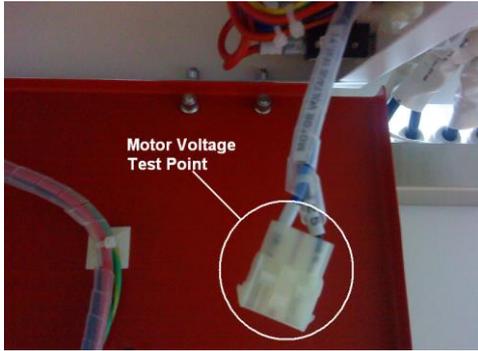


Figure 3-1

<p>Filter loaded or wrong speed controller setting</p>	<ul style="list-style-type: none"> <li>• Plug in the voltmeter to the Motor Voltage Sampling Port.</li> <li>• Measure the actual airflow velocity using anemometer or flow hood. If actual airflow is okay but LCD still shows AIRFAIL, proceed to next step. If actual airflow is not okay, please adjust potentiometer accordingly until alarm is turned off and the LCD shows nominal airflow reading. After this, if LCD still shows AIRFAIL, proceed to next step.</li> <li>• The sensor will take about 2-3 minutes before it can register a new airflow setting. <b>Note:</b> <i>The cabinet must be certified at least annually.</i></li> <li>• If the blower is already operating at maximum voltage and the airflow alarm is still triggered due to filter loaded, it's time to change the filter.</li> <li>• If filter is not loaded, proceed to next step.</li> </ul>
<p>Faulty/ inaccurate calibration</p>	<ul style="list-style-type: none"> <li>• Re-calibrate the microprocessor. Follow the calibration procedure in the test report. <b>Warning:</b> <i>To be carried out only by an authorized person.</i></li> </ul> <p><b>CHECKING CALIBRATION DATA</b></p> <ul style="list-style-type: none"> <li>• After calibration is done, go to MENU, key in PIN if required, choose SET MODE, and choose MAINTENANCE.</li> <li>• LCD will blink in MAINTENANCE MODE.</li> <li>• Go to main display by pressing MENU button twice.</li> <li>• Press SET button, LCD will display software version that is currently being used on the cabinet. Example: <b>CP104E V1</b></li> <li>• Press DOWN button until you find below message:             <ul style="list-style-type: none"> <li>○ <b>ADC IFF:</b> ADC Inflow Fail Point calibration from factory.</li> <li>○ <b>ADC IFN:</b> ADC Inflow nominal point calibration from factory.</li> <li>○ <b>ADC IFA:</b> ADC inflow actual reading from sensor.</li> <li>○ <b>ADC IF0:</b>ADC zero point inflow from factory calibration.</li> <li>○ <b>ADC IF1:</b> ADC Fail point inflow from factory calibration.</li> <li>○ <b>ADC IF2:</b> ADC Nominal inflow from factory calibration.</li> <li>○ <b>ADC DFA:</b> ADC downflow actual reading from sensor.</li> <li>○ <b>ADC DF0:</b> ADC zero point downflow from factory calibration.</li> <li>○ <b>ADC DFN:</b> ADC Nominal point downflow from factory calibration.</li> <li>○ <b>CONSTANT1:</b> Sensor inflow constant from factory calibration.</li> <li>○ <b>CONSTANT2:</b> Sensor downflow constant from factory calibration.</li> <li>○ <b>CALIB TEMP:</b> Record ambient temperature during factory calibration.</li> <li>○ <b>ADC TEMP:</b> ADC actual temperature value.</li> </ul> </li> </ul> <p>In order to prevent any AIRFAIL or unstable velocity displayed on LCD problem, please ensure the following is done after the calibration:</p> <ol style="list-style-type: none"> <li>1. CONSTANT value is correct. Check it with constant written on sensor body or inside Replaceable Component Record List which come with test report.</li> <li>2. CALIB TEMP shows room temperature. If not, refer to next possible cause part B.</li> <li>3. ADC IF0 &lt; ADCIF1 &lt; ADC IF2. If not please re-do calibration in correct sequence: SET CONSTANT → SET ZERO → CALIB. If CALIBRATION ERROR is encountered,</li> </ol>

	<p>please refer to next possible cause part A.</p> <p>4. ADC DFO &lt; ADC DFN. If not please re-do calibration in correct sequence: SET CONSTANT → SET ZERO → CALIB. If CALIBRATION ERROR is encountered, please refer to next possible cause part A.</p>
<p>Sensor Failure / Sensor Misalignment</p>	<p><b><u>A. Air Flow Sensor failure / misalignment</u></b></p> <ul style="list-style-type: none"> <li>• There are 2 units of airflow sensor, exhaust and downflow.</li> <li>• Exhaust airflow sensor is located on top of the unit, above exhaust filter and installed inside white metal box. See Figure 3-2 below. It is a stainless steel tube with 2 round holes facing up.</li> <li>• Downflow airflow sensor is located below the downflow filter, inside cabinet work zone</li> </ul> <p><b>Important to check:</b></p> <ul style="list-style-type: none"> <li>• Ensure that the sensor area is not blocked at all and that its through-holes are perpendicular to the filter's surface.</li> <li>• Exhaust sensor is attached tightly to the box.</li> <li>• There is no gap between sensor box and filter surface.</li> <li>• Sensor box is installed tightly to the cabinet.</li> <li>• Turn off the cabinet.</li> <li>• See Component Layout to locate the main board.</li> <li>• Using DVM, check the exhaust sensor's output voltage (DC) at channel AIN1(+) and J1(-) on main board (See drawing 3-4 below). Also check the downflow sensor's output voltage (DC) at channel AIN2(-) and J2(+) on main board.</li> <li>• The exhaust sensor voltage should increase if exhaust airflow is increased and decrease if exhaust airflow is decreased.</li> <li>• The downflow sensor voltage should increase if downflow motor voltage (N1/N2) is increased and decrease if downflow motor voltage is decreased.</li> <li>• If your observation is different, check sensor connection on the unit.</li> <li>• If connection is okay but sensor is still not working properly, replace it.</li> <li>• If airflow sensor is working properly, proceed to next step.</li> </ul> <p><b><u>B. Temperature Sensor Failure</u></b></p> <ul style="list-style-type: none"> <li>• Temperature sensor is located close to airflow sensor See figure 3-3.</li> <li>• Using DVM, check the temperature sensor's output voltage (DC) at channel AIN4(-) and J4(+) on main board (See figure 3-4 below).</li> <li>• 0.01VDC should represent 1°C. For example, if output is 0.25VDC, it indicates temperature of 25°C. Tolerance of ±1°C is acceptable.</li> <li>• Replace temperature sensor if the reading is wrong.</li> <li>• If temperature sensor is working properly, proceed to next step.</li> </ul>

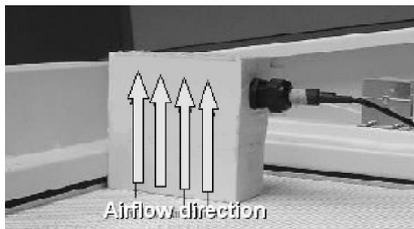


Figure 3-2



Figure 3-3

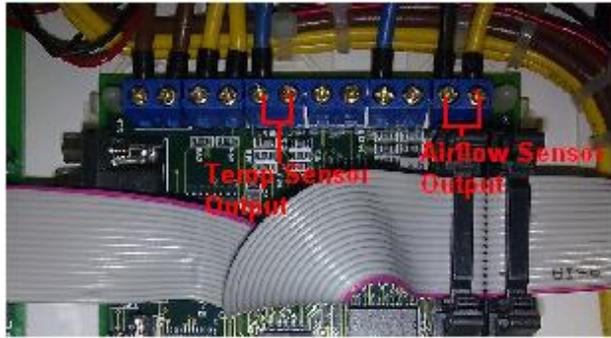


Figure 3-4

Motor failure	<ul style="list-style-type: none"> <li>• Check the motor. If motor is not running, refer to 'Blower doesn't function' problem.</li> <li>• If motor is working properly, proceed to next step.</li> </ul>
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**Problem 4: Contaminated Sample**

Cause	Corrective Action
Blocked air grille	<ul style="list-style-type: none"> <li>• Make sure that the front and back air grilles are not blocked.</li> </ul>
Low airflow	<ul style="list-style-type: none"> <li>• Adjust the potentiometer and / or damper to get the optimum airflow as stated in the test report.</li> </ul>
Leaking downflow filter	<ul style="list-style-type: none"> <li>• Decontaminate the cabinet and change the downflow filter.</li> <li>• Re-certify the cabinet after the new filter has been installed.</li> </ul>
Environmental air disturbance	<ul style="list-style-type: none"> <li>• Ensure that there are no external sources of airflow disturbance like air conditioner vent, window or incidences of door opening or people walking fast near the cabinet.</li> </ul>

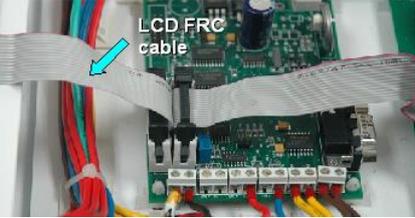
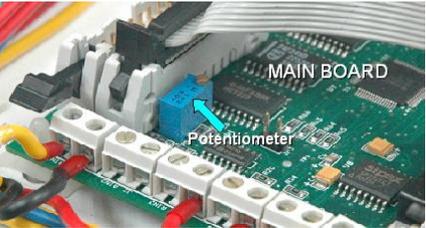
**Problem 5: Contaminated Lab**

Cause	Corrective Action
Leaking exhaust filter	<ul style="list-style-type: none"> <li>• Exhaust filter is located on top of the unit.</li> <li>• Patch the leak (the patched area should not exceed 4% of the total filter area).</li> <li>• Then check the filter for leakage again.</li> <li>• If the filter is still leaking, decontaminate the cabinet and change the exhaust filter.</li> <li>• Re-certify the cabinet after the new filter has been installed.</li> </ul>

**Problem 6: Excessive Blower Noise**

Cause	Corrective Action
Resonance	<ul style="list-style-type: none"> <li>• See Component Layout to locate the motor speed controller.</li> <li>• Increase the motor speed by 1-2 VDC. Check whether the noise disappears. If the noise is already gone, measure the actual airflow velocity.                             <ul style="list-style-type: none"> <li>○ If the velocity is still in the acceptable range, maintain it.</li> <li>○ If velocity is out of acceptable range, or if noise persists, go to next step.</li> </ul> </li> </ul>
Loosed motor or impeller wheel mounting	<p><b>Note:</b> decontaminate unit first before accessing the blower</p> <ul style="list-style-type: none"> <li>• Open the blower access panel and check if the mounting bolts are fully tightened.</li> <li>• Also check whether the motor can rotate properly and not loosed</li> <li>• If motor is physically damaged, replace it.</li> </ul>

**Problem 7: Blank LCD**

Cause	Corrective Action
<p>Connection problem</p>	<ul style="list-style-type: none"> <li>• Turn off the cabinet.</li> <li>• See Component Layout to locate the main board.</li> <li>• Check whether LCD FRC (Flat Ribbon Cable) has been inserted properly into its socket on the main board. See Figure 7-1 below.</li> </ul>
<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Figure 7-1</p> </div> </div>	
<p>Contrast problem</p>	<ul style="list-style-type: none"> <li>• Turn off the cabinet.</li> <li>• Adjust the potentiometer on main board by rotating the top metal part using flat screw driver to achieve the best LCD contrast. Counter clock-wise direction will increase the contrast. See Figure 7-2.</li> <li>• If the LCD remains blank, replace it.</li> </ul>
<div style="display: flex; align-items: center;">  <div style="margin-left: 20px;"> <p>Figure 7-2</p> </div> </div>	
<p>Defective LCD</p>	<ul style="list-style-type: none"> <li>• Connect a new LCD to the LCD port on main board (See Component Layout).</li> <li>• If the new LCD functions properly, means the old one is Defective. Replace it.</li> <li>• If the new LCD is not working, check its cable and connector interface to the main board. If all connections okay but LCD doesn't function, replace the main board.</li> </ul>

**Problem 8: Inoperative buttons**

Cause	Corrective Action
<p>Connection problem</p>	<ul style="list-style-type: none"> <li>• Turn off the cabinet.</li> <li>• See Component Layout to locate the main board.</li> <li>• See figure 8-1 and ensure FRC cable going to interface board is connected properly. The triangle sign on the female connector indicates PIN number 1.</li> <li>• Interface board and membrane/keypad are located behind the blue panel, underneath the light metal deflector.</li> <li>• With the cabinet still turned-off, uninstall the fluorescent light and metal deflector to access the interface board.</li> <li>• See Figure 8-2 for the proper connection between main board, interface board, and membrane/keypad.</li> <li>• Check if the green plastic cable from the membrane has been inserted properly into the interface board. Follow Figure 8-3 for the correct orientation of connector.</li> </ul>

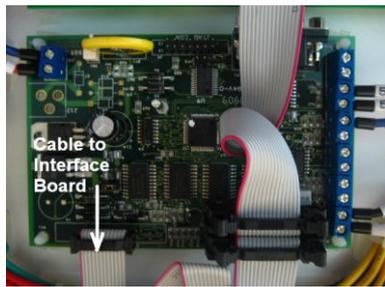


Figure 8-1

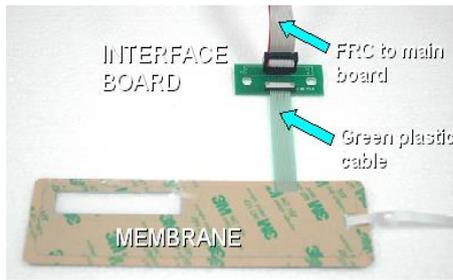


Figure 8-2

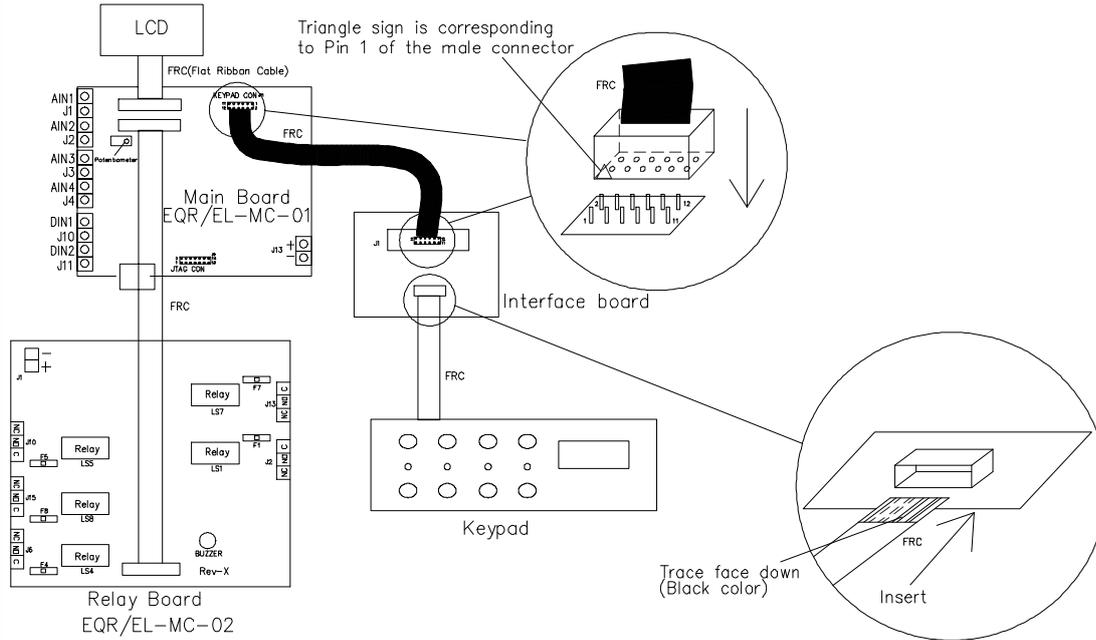


Figure 8-4

<p>Defective Cable and / or Interface Board and / or keypad</p>	<ul style="list-style-type: none"> <li>• Replace them one by one, to check which one(s) among them is/are Defective.</li> <li>• Replace the Defective part(s).</li> </ul>
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**Problem 9: Light always OFF**

Cause	Corrective Action
<p>Sash in SASH ALARM state</p>	<ul style="list-style-type: none"> <li>• Move the sash to Ready position (normal operating height).</li> <li>• Switch on the light by pressing LIGHT button on the membrane.</li> <li>• Light can only be ON at Ready sash position.</li> <li>• If light cannot be ON when sash at Ready position, proceed to next step.</li> </ul>
<p>Ready magnetic switch is not connected properly, faulty or misaligned</p>	<ul style="list-style-type: none"> <li>• Move sash to Ready position. The LCD should show either "FAN OFF" or showing velocity.</li> <li>• If the LCD showing "SASH ALARM" instead, please check the magnetic switches.</li> <li>• There are 2 magnetic switches inside the right profile. See Figure 9-1 below. The one above is for Ready/Nominal position.</li> <li>• You will find a magnetic strip attached on the glass just beside the switch.</li> <li>• Shift the switch or magnet position so the distance between them is between 10-13mm. If the distance is too far, the switch may not be able to detect the magnet.</li> <li>• If the LCD still showing "SASH ALARM", the wiring connection may have problem.</li> </ul>

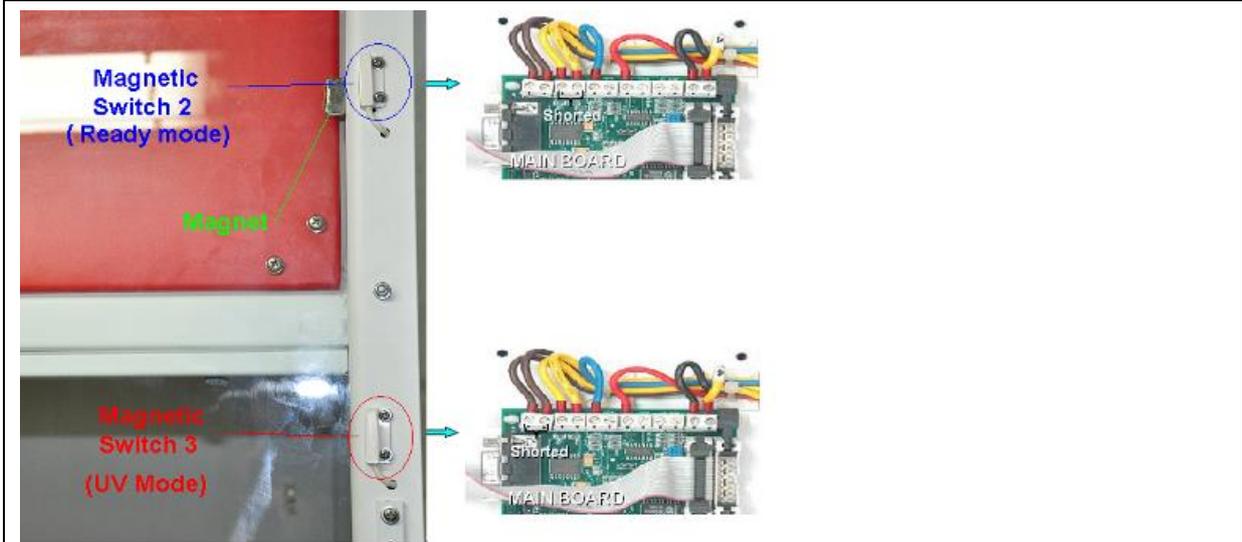


Figure 9-1

<p>Faulty fluorescent tube</p>	<ul style="list-style-type: none"> <li>• Replace the faulty fluorescent tube.</li> <li>• Fluorescent tube is located inside the blue panel.</li> </ul>
<p>Faulty Fluorescent ballast</p>	<ul style="list-style-type: none"> <li>• See Component Layout to locate the fluorescent ballast, connector C, and relay board.</li> <li>• Turn on the cabinet then the light by pressing LIGHT button on membrane.</li> <li>• Check AC voltage at ballast input (between pin NO on J13 terminal on relay board to neutral), see figure 9-2.</li> <li>• It should be 230VAC ±10%.</li> <li>• If not, check the LS7 relay and F7 fuse (refer to possible cause faulty relay below).</li> <li>• Turn off the unit.</li> <li>• Disconnect male connector C on electrical box.</li> <li>• Turn on the unit.</li> <li>• Turn on the light, then check AC voltage at ballast output (between female connector C pin 1 and 2), it should be around 450-600VAC.</li> <li>• Replace ballast if output voltage is much lower than this range.</li> </ul>



Figure 9-2

<p>Connection Problem</p>	<ul style="list-style-type: none"> <li>• Turn off the cabinet.</li> <li>• See Component Layout to locate the relay board, fluorescent ballast, and connector C inside electrical box.</li> <li>• Check for any loose or bad connection between relay board, fluorescent lamp ballast, and female connector C.</li> <li>• See figure 9-1 to locate terminal J 13 on relay board, check tightness of 2 cables connected to J 13.</li> <li>• For connector C, disconnect the male side from electrical box, and then check male</li> </ul>
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	<p>and female side for any bad connection.</p> <ul style="list-style-type: none"> <li>• Check also connection of the lamp holder.</li> </ul>
Faulty relay or fuse	<ul style="list-style-type: none"> <li>• Turn off the cabinet.</li> <li>• See Component Layout to locate the relay board.</li> <li>• Check relay LS7 and fuse F7 on the relay board. See figure 9-2.</li> <li>• If fuse F7 is blown, replace with F5 (spare).</li> <li>• On terminal J13, check the NO to C and NC to C circuits by checking continuity.</li> <li>• If the NO to C and NC to C contacts are not correct, replace the Relay Board.</li> <li>• If the NO to C and NC to C contacts are correct, proceed to the next step.</li> </ul>

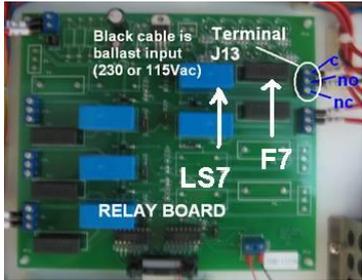


Figure 9-3

**Problem 10: UV Light always OFF**

Cause	Corrective Action
Sash not in UV state	<ul style="list-style-type: none"> <li>• Lower the sash to UV mode position</li> <li>• If UV MODE is not displayed on the LCD, check Magnetic switch 3(UV mode) on the right side profile and magnetic switch 4(UV interlock) on the left side profile. See Figure 10-1 below.</li> <li>• Switch on the UV lamp by pressing the UV button.</li> <li>• If UV MODE is displayed on LCD but UV is not on after pressing UV button, please check on Magnetic switch 4(UV interlock).</li> <li>• Turn off the unit and locate male connector D pin 3 and 6 in electrical panel. Probe using a continuity tester on these two pins when the sash is fully closed. If magnetic switch 4 and magnet are not activated when fully closed, adjust either magnet or switch to activate.</li> <li>• If with adjustment on the distance between magnet and switch doesn't activate the switch, replace the magnetic switch.</li> <li>• Proceed to next step if switch 4 is activated and still UV lamp cannot be turned on.</li> </ul>

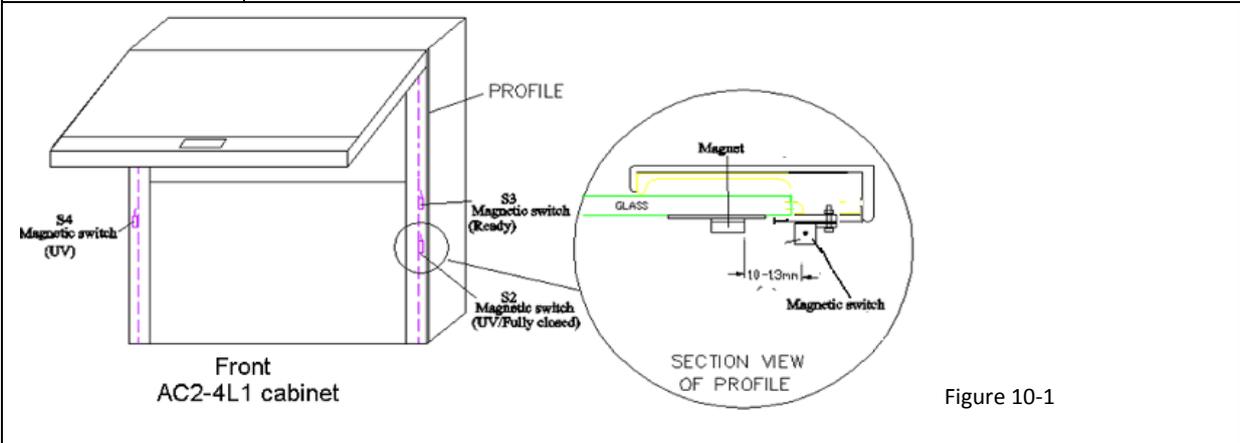
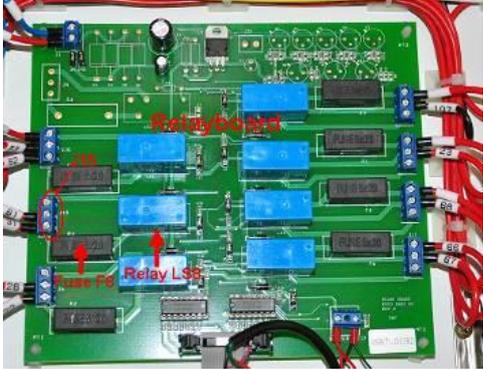


Figure 10-1

Faulty UV tube	<ul style="list-style-type: none"> <li>• Replace the faulty UV tube.</li> </ul>
Faulty UV ballast	<ul style="list-style-type: none"> <li>• Open the front panel and locate electrical box behind it.</li> <li>• Open electrical box and see Component Layout at the end of this section to locate the UV ballast, relay board, and connector B inside electrical box.</li> </ul>

	<ul style="list-style-type: none"> <li>• Turn on the cabinet, fully close the sash. Then switch on the UV by pressing UV button on membrane/keypad.</li> <li>• Check AC voltage at UV ballast input (between pin NO on J15 terminal on relay board to neutral), see Figure 10-2.</li> <li>• It should be 230VAC +/- 10%.</li> <li>• If not, check the LS8 relay and F8 fuse (refer to next possible cause).</li> <li>• Turn off the unit, disconnect male connector C on electrical box.</li> <li>• Turn on the unit, turn on the UV, then check AC voltage at ballast output (between female connector C pin 6 and 12). It should be around 10-25VAC.</li> <li>• Replace ballast if output voltage is out this range.</li> </ul>
<p>Faulty relay or fuse</p>	<ul style="list-style-type: none"> <li>• Turn off the cabinet.</li> <li>• See Component Layout to locate the relay board.</li> <li>• Check LS8 relay and fuse F8 on the relay board. See Figure 10-2 below.</li> <li>• If fuse F8 is blown, as temporary solution, use F5 (spare) to replace F8.</li> <li>• On terminal J 15, check the NO to C and NC to C circuits by checking continuity.</li> <li>• If the NO to C and NC to C contacts are not correct, replace the Relay Board.</li> <li>• If the NO to C and NC to C contacts are correct, proceed to the next step.</li> </ul>
 <p style="text-align: right;">Figure 10-2</p>	
<p>Connection Problem</p>	<ul style="list-style-type: none"> <li>• Turn off the cabinet.</li> <li>• See Component Layout to locate the relay board, UV ballast, and connector C.</li> <li>• Check for any loose or bad connection between relay board, UV lamp ballast and female connector B .</li> <li>• See Figure 10-2 to locate terminal J 15 on relay board, check tightness of 2 cables connected to J 15.</li> <li>• For connector B, disconnect the male side from electrical box, then check male and female side for any bad connection.</li> <li>• Check also connection of the UV lamp holder</li> </ul>

**Problem 11: Electrical socket always OFF**

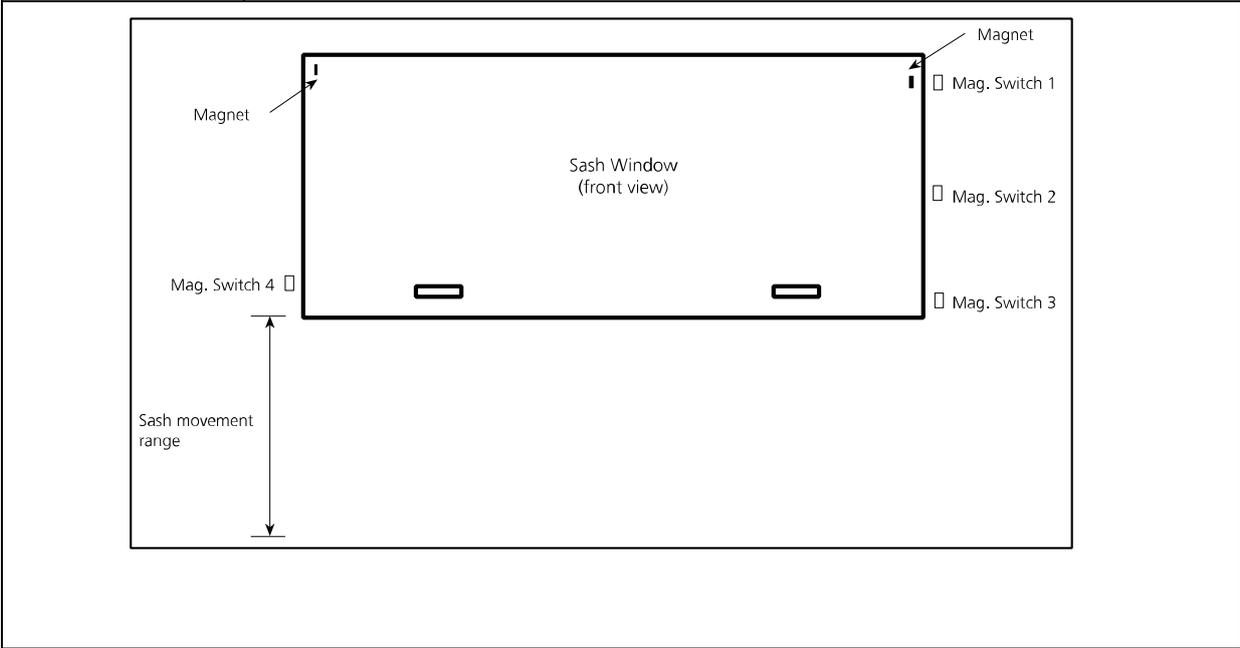
Cause	Corrective Action
<p>Connection Problem</p>	<ul style="list-style-type: none"> <li>• Turn off the cabinet.</li> <li>• See Component Layout to locate the relay board and connector B.</li> <li>• Check any loose or bad connection between relay board and female connector B.</li> <li>• See Figure 11-1 to locate terminal J 6 on relay board, check tightness of 2 cables connected to J 6.</li> <li>• For connector B, disconnect the male side from electrical box, and then check male and female side for any loose or wrong connection.</li> <li>• Check also connection on electrical socket. It is located inside the work zone.</li> </ul>
<p>Faulty relay or fuse</p>	<ul style="list-style-type: none"> <li>• Turn off the cabinet.</li> <li>• See Component Layout to locate the relay board.</li> <li>• Check LS4 relay and fuse F4 on the relay board. See Figure 11-1 below.</li> </ul>

	<ul style="list-style-type: none"> <li>• If fuse F4 is blown, replace with F5 (spare).</li> <li>• On terminal J 6, check the NO to C and NC to C circuits by checking continuity.</li> <li>• If the NO to C and NC to C contacts are not correct, replace the Relay Board.</li> <li>• If the NO to C and NC to C contacts are correct, proceed to the next step.</li> </ul>
<p>Faulty electrical socket</p>	<ul style="list-style-type: none"> <li>• Socket is located inside the work zone.</li> <li>• Check electrical socket connection.</li> <li>• If connection is correct but socket has no output, replace electrical socket.</li> </ul>

Figure 11-1

**Software Troubleshooting**

Error Code	Corrective Action
ERR.MSWITCH	<ul style="list-style-type: none"> <li>• Press MENU button and key in ADMIN password (if any). Pressing SET button to read diagnostic message.</li> <li>• Interpreting the stages of the three Magnetic Switches</li> <li>• Switch_1 (J10) ON when sash is at nominal height, the DIN1 and J10 are shorted.</li> <li>• Switch_2 (J11) ON when sash is fully closed, the DIN2 and J11 are shorted.</li> <li>• If all Switches are off, the sash is at SASH ALARM position.</li> <li>• Check the position of switch and signal at main board respectively (magnetic switches can be found after removing sash profile).</li> <li>• Remove any magnetic devices near the MSC. Check for faulty main board</li> <li>• Switch off the system</li> <li>• Remove the connection from J3, DIN1, J10, DIN2, and J11.</li> <li>• Switch on the system</li> <li>• If the LCD does not show "SASH ALARM", the main board is faulty.</li> </ul>



Magnetic Switch 1	Magnetic Switch 2	Magnetic Switch 3	Description
Close	Open	Close	Sash is Fully closed, UV can be operated.
Open	Close	Open	Cabinet sash is at nominal height, ready to use.
Open	Open	Open	Sash is at unsafe state, alarm is given. ALARM cannot be muted.
Rest Conditions			"Sash: Error Position" detected.

Table 1

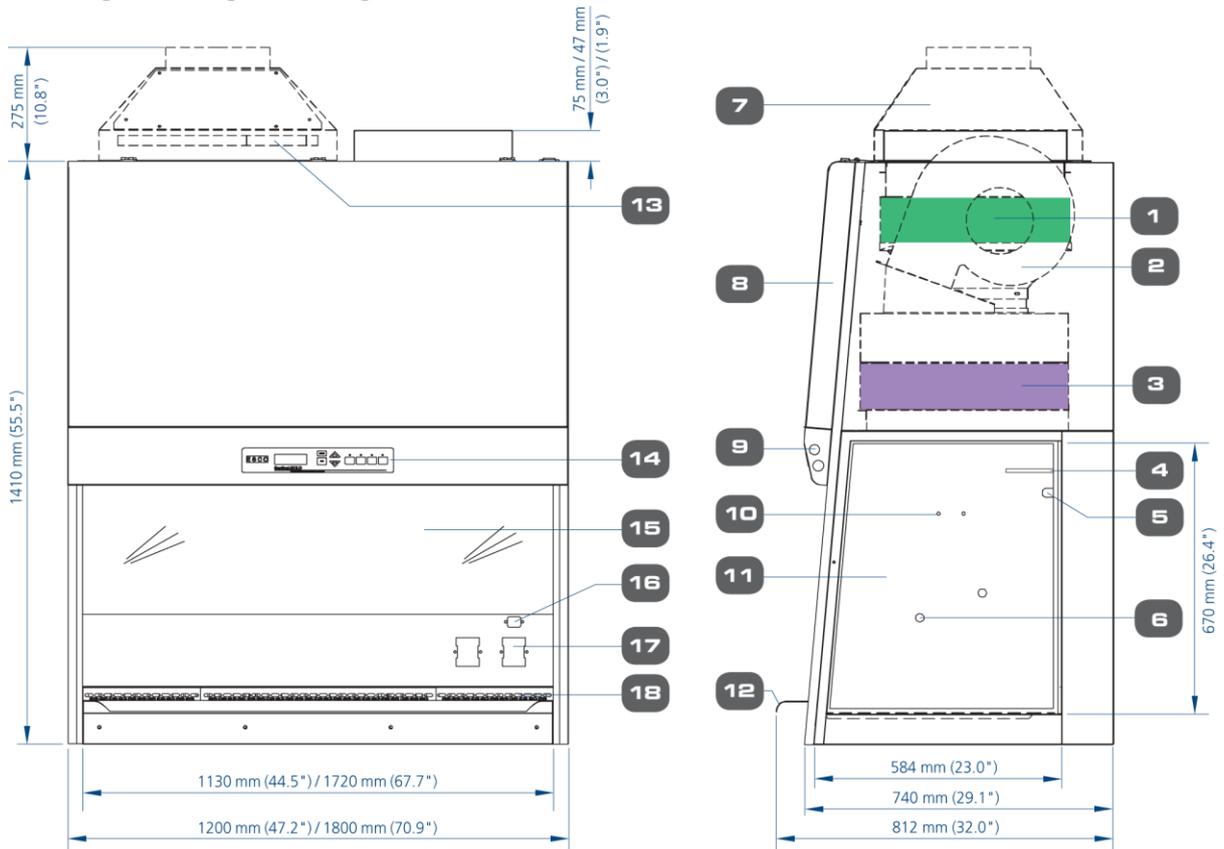
AIRFAIL	<ul style="list-style-type: none"> <li>• Check for inflow velocity using anemometer.</li> <li>• If the inflow actually drops below the fail point, adjust the speed control to achieve nominal inflow. Otherwise, proceed to next step</li> <li>• Press SET button to read diagnostic message.</li> <li>• Check if Temperature is correct. If temperature is incorrect, please check the connection &amp; temperature sensor. Call your distributor to replace any defective parts.</li> </ul> <p><b>Warning:</b> <i>this step should be carried by an authorized person.</i></p>
SENSOR UNCALIBRATED	<ul style="list-style-type: none"> <li>• Calibrate the controller. Refer to test report to calibrate.</li> </ul>

Sash Position	Function Available	Normal/Quickstart Mode Airfail Alarm On	Normal/Quickstart Mode Airfail Alarm Off	Maintenance Mode	Half Speed Condition	
Ready	Sash Position Detection	Yes	Yes	Yes	No	
	Fan Control	Yes, with WARM UP & PURGING time, FAN PIN required	Yes, with WARM UP & PURGING time, FAN PIN required	Yes, without WARM UP & PURGING time, no PIN required	To select turn off Fan or back to normal speed	
	Light Control	Yes	Yes	Yes	Not Applicable	
	Socket Control	Yes	Yes	Yes	Not Applicable	
	UV Control	Interlocked	Interlocked	Not Applicable	Not Applicable	
	Sash UP Motor Control	Yes	Yes	Yes	Not Applicable	
	Sash DOWN Motor Control	Yes	Yes	Yes	Not Applicable	
	MENU Access	Yes, USER or ADMIN PIN required	Yes, USER or ADMIN PIN required	Yes, no PIN required	Yes, USER or ADMIN PIN required	
	Pressing Set button	Complete Diagnostic Message	Complete Diagnostic Message	Complete Diagnostic Message	Complete Diagnostic Message	
	Current Time Display	Yes	Yes	Yes	Yes	
	Air Velocity Display	Yes	Yes	Yes	Not Applicable	
	If not calibrated, displaying "Sensor Uncalibrated"					Not Applicable
	Air Velocity Display Status	Yes	Yes	No	Not Applicable	
Air Fail checking	Yes, Alarm and display alert if air fails	No	No	Not Applicable		

Sash Position	Function Available	Normal/Quickstart Mode Airfail Alarm On	Normal/Quickstart Mode Airfail Alarm Off	Maintenance Mode	Half Speed Condition
Sash Alarm	Sash Position Detection	Yes	Yes	Yes	Not Applicable
	Current Time Display	Yes	Yes	Yes	Not Applicable
	Sash Alarm	Yes, not mutable	Yes, not mutable	Not Applicable	Not Applicable
	Fan Control	Yes, without WARM UP & PURGING time, no PIN required	Yes, without WARM UP & PURGING time, no PIN required	Yes, without WARM UP & PURGING time, no PIN required	Not Applicable
	Light Control	No	No	Yes	Not Applicable
	Socket Control	Yes	Yes	Yes	Not Applicable
	UV Control	Interlocked	Interlocked	Not Applicable	Not Applicable
	Sash UP Motor Control	Yes	Yes	Yes	Not Applicable
	Sash DOWN Motor Control	Yes	Yes	Yes	Not Applicable
	Current Time Display	Yes	Yes	Yes	Not Applicable
	Air Velocity Display Status	Yes	Yes	No	Not Applicable
	Air Velocity Display	Yes	Yes	Yes	Not Applicable
	Air Fail checking	Yes, display alert if air fails	No	No	Not Applicable
Fully Closed	Sash Position Detection	Yes	Yes	Yes	Not Applicable
	SWITCH OFF Fan requested	Yes	Yes	No	Not Applicable
	Fan Control	Interlocked	Interlocked	Yes	Not Applicable
	Light Control	Interlocked	Interlocked	Yes	Not Applicable
	Socket Control	Yes	Yes	Yes	Not Applicable
	UV Control	Yes	Yes	Not Applicable	Not Applicable
	Sash UP Motor Control	Yes	Yes	Yes	Not Applicable
	Sash DOWN Motor Control	Interlocked	Interlocked	Yes (Cleaning condition)	Not Applicable

## Chapter 9 – Engineering Details

### 9.1 Engineering Drawing



1. Exhaust ULPA filter
2. Blower
3. Downflow ULPA filter
4. Downflow sensor
5. Standard UV light Retrofit Kit provision
6. Plugged service fixtures provisions (2 on each side)
7. Exhaust collar (optional)
8. Electrical / electronic panel
9. Fluorescent lamps
10. Standard IV bar Retrofit Kit™ provision
11. Tempered side glass
12. Stainless steel arm rest
13. Exhaust sensor
14. Esco Sentinel™ Gold microprocessor control system
15. Safety glass motorized sash window
16. Female IEC inlet for UV provision
17. Standard electrical outlet Retrofit Kit provision
18. Stainless steel multi-piece work tray

## 9.2 General Specification

		NC2-4L8		NC2-6L8	
Nominal Size		1.2 meters (4')		1.8 meters (6')	
External Dimensions (W x D x H)		1200 x 812 x 1410 mm 47.5" x 32.0" x 55.5"		1800 x 812 x 1410 mm 70.9" x 32.0" x 55.5"	
Internal Work Area, Dimensions (W x D x H)		1130 x 584 x 670 mm 44.5" x 23.0" x 26.4"		1720 x 584 x 670 mm 67.7" x 23.0" x 26.4"	
Internal Work Area, Space		0.44m <sup>2</sup> (5.6 sq.ft)		0.81 m <sup>2</sup> (8.7 sq. ft)	
Tested/Working Opening		173 mm (6.8") / 200 mm (7.9")			
Average Airflow Velocity	Inflow	0.45 m/s (90 fpm) at initial set point			
	Downflow	0.32 m/s (65 fpm) at initial set point with uniformity of better than +/- 20%			
Airflow Volume	Inflow	317 cmh (187 cfm)		485 cmh (286 cfm)	
	Downflow	703 cmh (414 cfm)		1165 cmh (686 cfm)	
	Exhaust	317 cmh (187 cfm)		485 cmh (286 cfm)	
ULPA Filter Typical Efficiency	Downflow	>99.999% at 0.1 to 0.3 microns and MPPS as per IEST-RP-CC001.3 USA with H14 rating as Exhaust per EN 1822, Europe			
	Exhaust				
Typical Sound Emission per EN 12469		51dBA		53 dBA	
Fluorescent Light Intensity At Zero Ambient		1100 lux(102 foot-candle)		1250 lux (116 foot-candles)	
Cabinet Construction	Main Body	1.2 mm (0.05") 18 gauge electro-galvanized steel with white oven-baked epoxy Isocide antimicrobial powder coated finish			
	Work Zone	1.5 mm (0.06") 16 gauge stainless steel, type 304, with 4B finish			
	Side Walls	UV absorbing tempered glass, 5 mm (0.2"), colorless and transparent			
Electrical 220-240 V AC, 50/60 Hz, 1Φ		<b>Full Speed</b>	<b>Half Speed</b>	<b>Full Speed</b>	<b>Half Speed</b>
	Cabinet Power/ Amp	180 W / 1 A	80 W / 0.4 A	260 W / 1.3 A	126 W / 0.6 A
	Outlet Amp Fuse	5 A			
	Total Amp	8 A			
	BTU/ Hr	615	273	888	430
Net Weight		208 kg (459 lbs.)		287 (633 lbs.)	

\* Sound emission test is conducted in an open field condition/anechoic chamber

# **APPENDIX**

