

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



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User Manual

Horizontal & Vertical
Laminar Flow Clean Benches

Copyright Information

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Esco reserves the right to make periodic minor design changes without obligation to notify any person or entity of such change.

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

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USER SECTION

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APPENDIX

Warranty Terms and Conditions

Esco products come with either a 1, 2 or 3 year limited warranty, 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 or complete the warranty registration form included with each product.

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

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

Technical Support, Warranty Service Contacts

USA: 1-877-479-3726

Singapore: +65 65420833

Global Email Helpdesk: support@escoglobal.com

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	1 year limited.
Ductless Fume Hoods	3 years limited for Ascent Opti's, 5 years for Ascent Max's.
Cleanroom Equipment	1 year limited.
Laboratory Ovens and Incubators	1 year limited.
CO ₂ Incubators	2 years limited.
Containment/Pharma Products	2 years limited.
Ultralow Temperature Freezer	3 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 or complete the warranty registration form included with each product.

Policy updated on 12th Apr 2011 (This limited warranty policy does not apply to products purchased before 12th Apr 2011)

Introduction


1. Products Covered

Esco Vertical Laminar Flow Clean Benches							
Model	Electrical Rating	0.6 m (2 ft)	0.9 m (3 ft)	1.2 m (4 ft)	1.5 m (5 ft)	1.8 m (6 ft)	2.4 m (8 ft)
Airstream	220-240 V AC, 50Hz, 1Φ	AVC – 2D1	AVC – 3D1	AVC – 4D1	AVC – 5D1	AVC – 6D1	
	110-130 V AC, 60Hz, 1Φ	AVC – 2D2	AVC – 3D2	AVC – 4D2	AVC – 5D2	AVC – 6D2	
	220-240 V AC, 60Hz, 1Φ	AVC – 2D3	AVC – 3D3	AVC – 4D3	AVC – 5D3	AVC – 6D3	
Optimair	220-240 V AC, 50Hz, 1Φ			ACB – 4A1		ACB – 6A1	
	110-130 V AC, 60Hz, 1Φ			ACB – 4A2		ACB – 6A2	
	220-240 V AC, 60Hz, 1Φ			ACB – 4A3		ACB – 6A3	
Labculture	220-240 V AC, 50Hz, 1Φ		LVC – 3A1	LVC – 4A1	LVC – 5A1	LVC – 6A1	
	110-130 V AC, 60Hz, 1Φ		LVC – 3A2	LVC – 4A2	LVC – 5A2	LVC – 6A2	
	220-240 V AC, 60Hz, 1Φ		LVC – 3A3	LVC – 4A3	LVC – 5A3	LVC – 6A3	

Esco Horizontal Laminar Flow Clean Benches							
Model	Electrical Rating	0.6 m (2 ft)	0.9 m (3 ft)	1.2 m (4 ft)	1.5 m (5 ft)	1.8 m (6 ft)	2.4 m (8 ft)
Airstream	220-240 V AC, 50Hz, 1Φ	AHC – 2B1	AHC – 3B1	AHC – 4B1	AHC – 5B1	AHC – 6B1	
		AHC – 2D1	AHC – 3D1	AHC – 4D1	AHC – 5D1	AHC – 6D1	
	110-130 V AC, 60Hz, 1Φ	AHS – 6C1	AHS – 8C1				
Airstream	110-130 V AC, 60Hz, 1Φ	AHC – 2B2	AHC – 3B2	AHC – 4B2	AHC – 5B2	AHC – 6B2	
		AHC – 2D2	AHC – 3D2	AHC – 4D2	AHC – 5D2	AHC – 6D2	
	220-240 V AC, 60Hz, 1Φ	AHS – 3B2	AHS – 4B2	AHS – 5B2	AHS – 6B2	AHS – 8C2	
Airstream	220-240 V AC, 60Hz, 1Φ	AHC – 2B3	AHC – 3B3	AHC – 4B3	AHC – 5B3	AHC – 6B3	
		AHC – 2D3	AHC – 3D3	AHC – 4D3	AHC – 5D3	AHC – 6D3	
	110-130 V AC, 60Hz, 1Φ	AHS – 4C3	AHS – 6C3	AHS – 8C3			
Labculture	220-240 V AC, 50Hz, 1Φ	LHC – 3A1	LHC – 3B1	LHC – 4A1	LHC – 4B1	LHC – 5A1	LHC – 6A1
		LHC – 3C1	LHC – 4C1	LHC – 5C1	LHC – 6C1		
	110-130 V AC, 60Hz, 1Φ	LHC – 3A2	LHC – 3B2	LHC – 4A2	LHC – 4B2	LHC – 5A2	LHC – 6A2
Labculture	220-240 V AC, 60Hz, 1Φ	LHC – 3B2	LHC – 3C2	LHC – 4B2	LHC – 4C2	LHC – 5B2	LHC – 6B2
		LHC – 3C2	LHC – 4C2	LHC – 5C2	LHC – 6C2		
	110-130 V AC, 60Hz, 1Φ	LHC – 3A3	LHC – 3B3	LHC – 4A3	LHC – 4B3	LHC – 5A3	LHC – 6A3
Labculture	220-240 V AC, 60Hz, 1Φ	LHC – 3B3	LHC – 3C3	LHC – 4B3	LHC – 4C3	LHC – 5B3	LHC – 6B3
		LHC – 3C3	LHC – 4C3	LHC – 5C3	LHC – 6C3		

Esco Reverse Horizontal Flow Cabinets							
Model	Electrical Rating	0.6 m (2 ft)	0.9 m (3 ft)	1.2 m (4 ft)	1.5 m (5 ft)	1.8 m (6 ft)	2.4 m (8 ft)
Labculture	220-240 V AC, 50Hz, 1Φ		RHL – 3A1	RHL – 4A1	RHL – 5A1	RHL – 6A1	
	110-130 V AC, 60Hz, 1Φ		RHL – 3A2	RHL – 4A2	RHL – 5A2	RHL – 6A2	
	220-240 V AC, 60Hz, 1Φ		RHL – 3A3	RHL – 4A3	RHL – 5A3	RHL – 6A3	

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)**

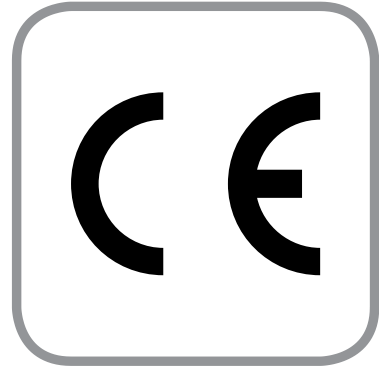
With respect to the directive on RoHS, please note that this hood falls under category 8 (medical devices) and category 9 (monitoring and control instruments) and is therefore exempted from requirement to comply with the provisions of this directive.



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 : Vertical Laminar Flow Clean Benches
Brand : Airstream
Model : AVC-2D1, AVC-3D1, AVC-4D1, AVC-5D1, AVC-6D1

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

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.

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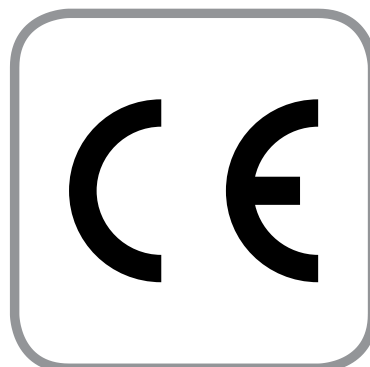
XQ Lin
Group CEO, Esco

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

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 : Horizontal Laminar Flow Clean Benches
Brand : Airstream
Model : AHC-2B1, AHC-3B1, AHC-4B1, AHC-5B1, AHC-6B1
AHC-2D1, AHC-3D1, AHC-4D1, AHC-5D1, AHC-6D1
AHS-4C1 , AHS-6C1, AHS-8C1

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

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Low Voltage : EN 61010-1:2010
EMC : EN 61326-1:2006 Class B

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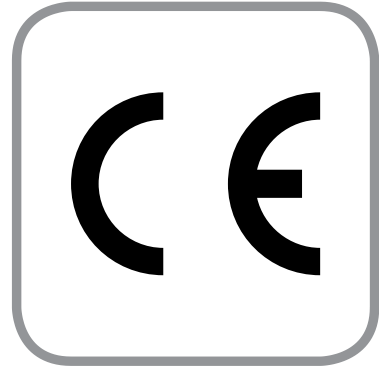
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XQ Lin
Group CEO, Esco

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

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 : Vertical Laminar Flow Clean Benches
Brand : Optimair
Model : ACB-4A1, ACB-6A1

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

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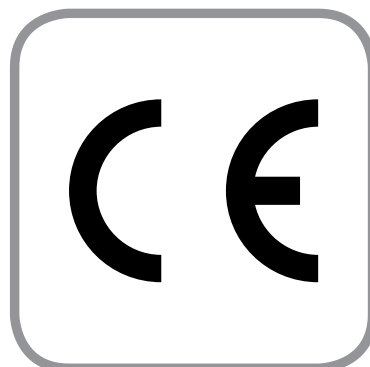
XQ Lin
Group CEO, Esco

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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 : Vertical Laminar Flow Clean Benches
Brand : Labculture
Model : LVC-3A1, LVC-4A1, LVC-5A1, LVC-6A1

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

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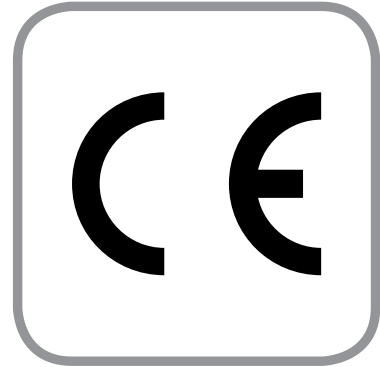
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Group CEO, Esco

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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 : Horizontal Laminar Flow Clean Benches
Brand : Labculture
Model : LHC-3A1, LHC-4A1, LHC-5A1, LHC-6A1
LHC-3B1, LHC-4B1, LHC-5B1, LHC-6B1
LHC-3C1, LHC-4C1, LHC-5C1, LHC-6C1

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
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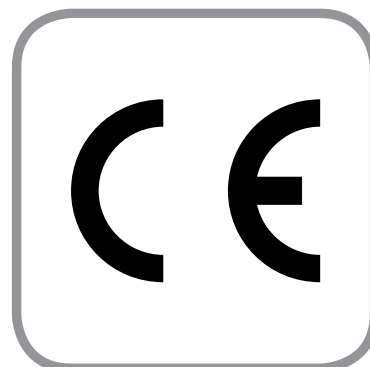
XQ Lin
Group CEO, Esco

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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 : Reverse Horizontal Flow Cabinets
Brand : Labculture
Model : RHL-3A1, RHL-4A1, RHL-5A1, RHL-6A1

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

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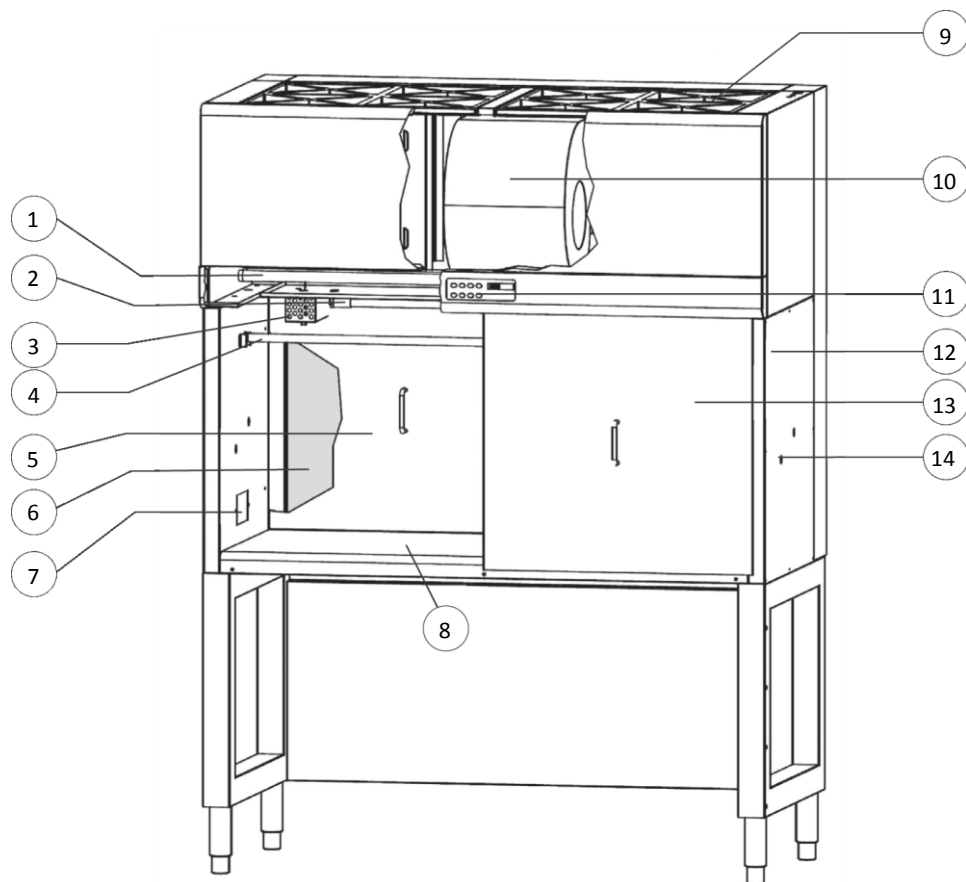
XQ Lin
Group CEO, Esco

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Chapter 1 - Product Information

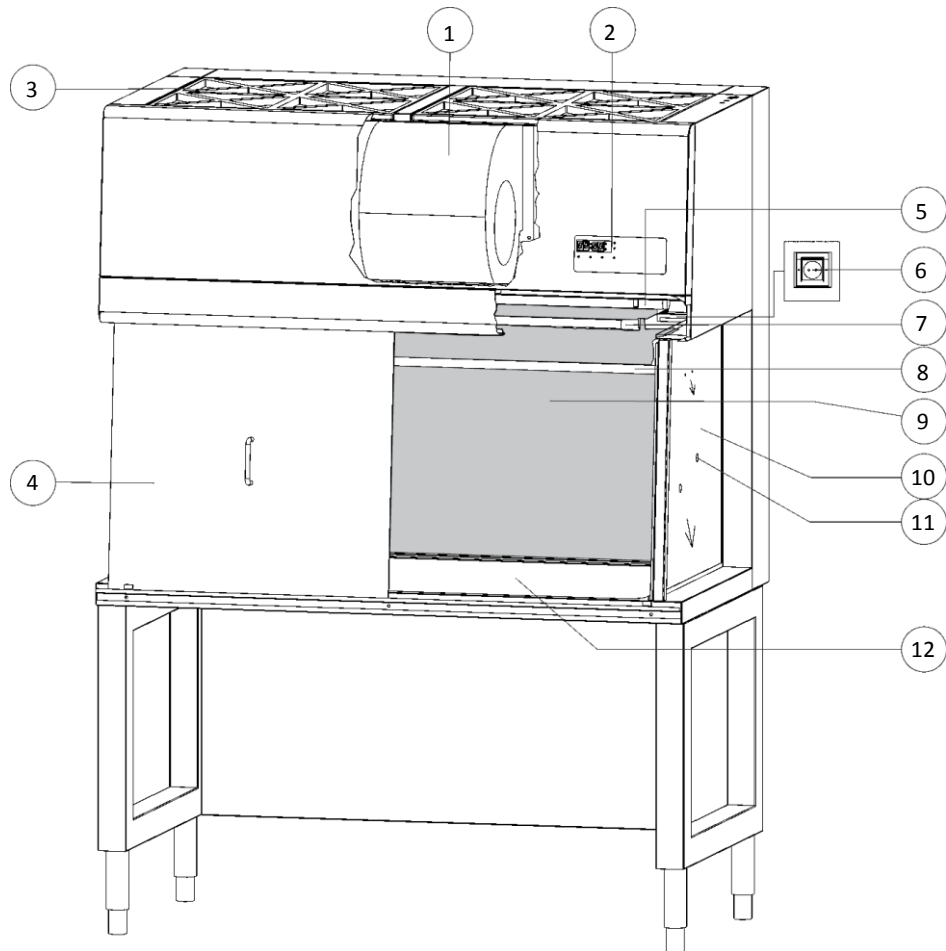
1.1 Quick View

1.1.1 Horizontal Laminar Flow Clean Bench with Stainless Steel Side Wall



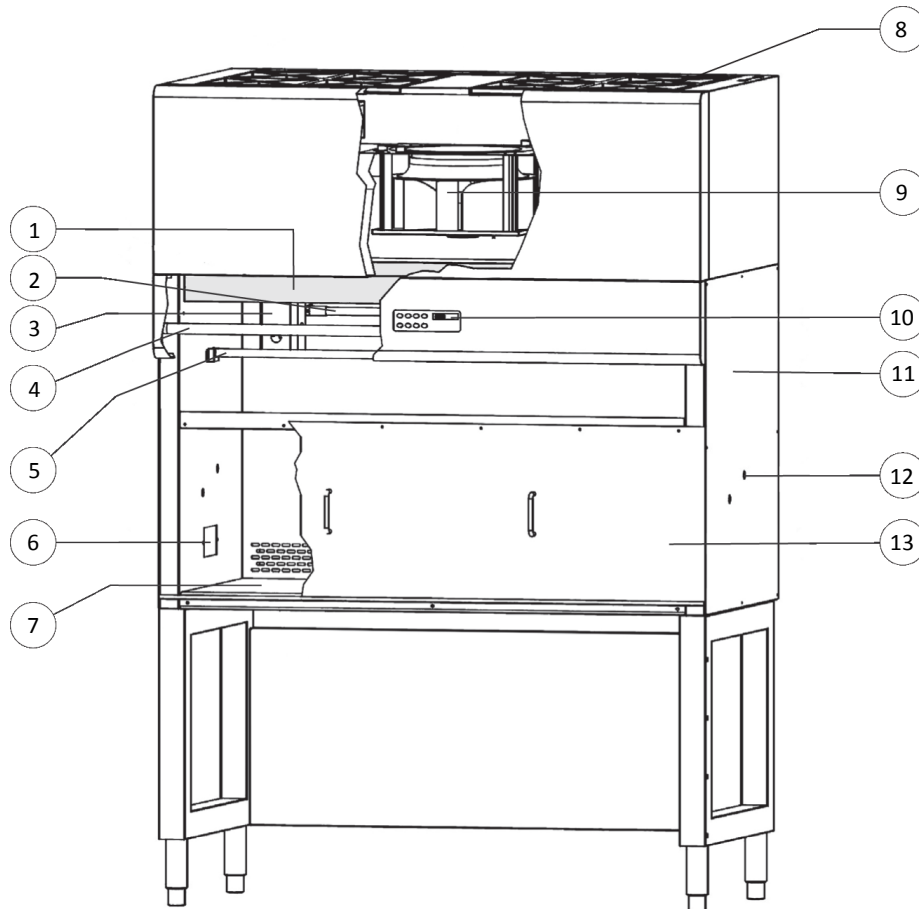
1. Fluorescent lamp
2. Optional UV light
3. Airflow sensor
4. Optional IV bar
5. Removable perforated filter diffuser
6. ULPA Filter
7. Optional Electrical Outlet
8. Stainless steel work top
9. Pre-filter
10. Blower
11. Control System
12. Internal stainless steel side panel
13. Optional front cover for UV protection
14. Service Fixture Retrofit Kit provision

1.1.2 Horizontal Laminar Flow Clean Bench with Glass Side Wall



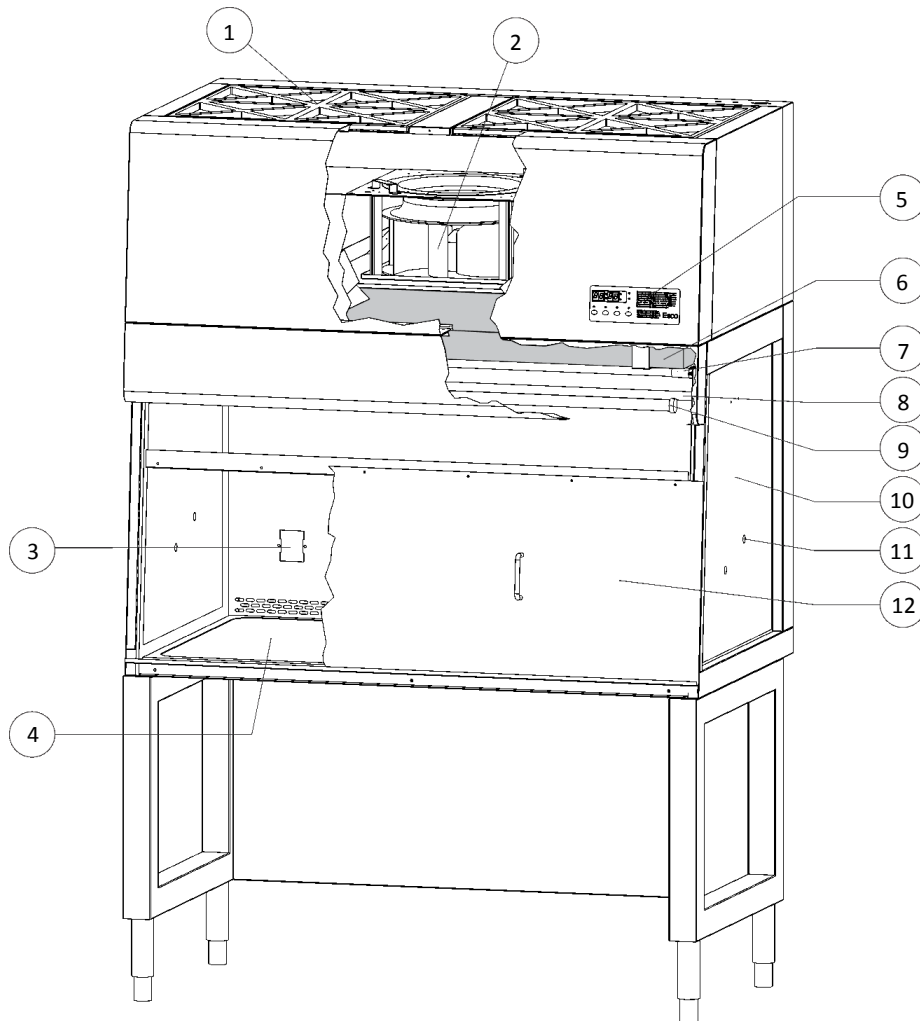
1. Blower
2. Control system
3. Pre-filter
4. Optional front cover for UV protection
5. Fluorescent lamp
6. Optional electrical outlet
7. Optional UV light
8. Optional IV bar
9. ULPA Filter
10. Transparent tempered glass side panel
11. Service fixture Retrofit Kit provision
12. Stainless steel work top

1.1.3 Vertical Laminar Flow Clean Bench with Stainless Steel Side Wall



1. ULPA Filter
2. Optional UV Light
3. Airflow sensor
4. Fluorescent lamp
5. Optional IV bar
6. Optional Electrical Outlet
7. Stainless steel work top
8. Pre-filter
9. Blower
10. Control System
11. Internal stainless steel side panel
12. Service Fixture Retrofit Kit provision
13. Optional front cover for UV protection

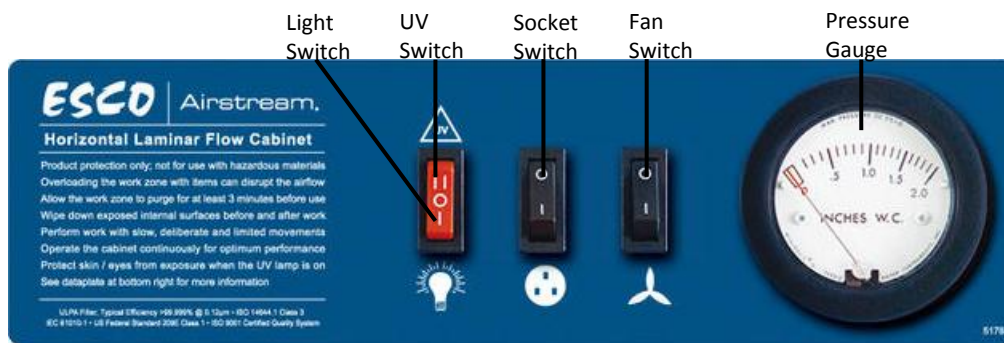
1.1.4 Vertical Laminar Flow Clean Bench with Glass Side Wall



1. Pre-filter
2. Blower
3. Electrical outlet Retrofit Kit provision
4. Stainless steel work top
5. Control System
6. ULPA Filter
7. Fluorescent lamp
8. Optional IV bar
9. Optional UV light
10. Transparent tempered glass side panel
11. Service fixture Retrofit Kit provision
12. Optional front cover for UV protection

Chapter 2 – Switch Control System

2.1 Switch Control System



Fan Switch

- Turns the fan on or off.

Light Switch

- Turns the fluorescent light on or off.

Socket Switch

- Turns the power outlets in the clean bench on or off (retrofit kit)

UV Light Switch

- Turns the UV Lamp in the clean bench on or off (retrofit kit)
- The UV lamp can only be activated when both the fan and light are off.
Please install front cover (retrofit kit) if you want to use this feature. Since the front cover is capable of filtering UV rays, users are protected from the harmful UV rays.

- *Eyes and skin should not be exposed to direct UV light.*
- *UV light should not be relied upon as the sole decontaminating agent.*
- *Check the UV interlock regularly for correct operation.*

Note: The use of UV lamp voids cULus listing.

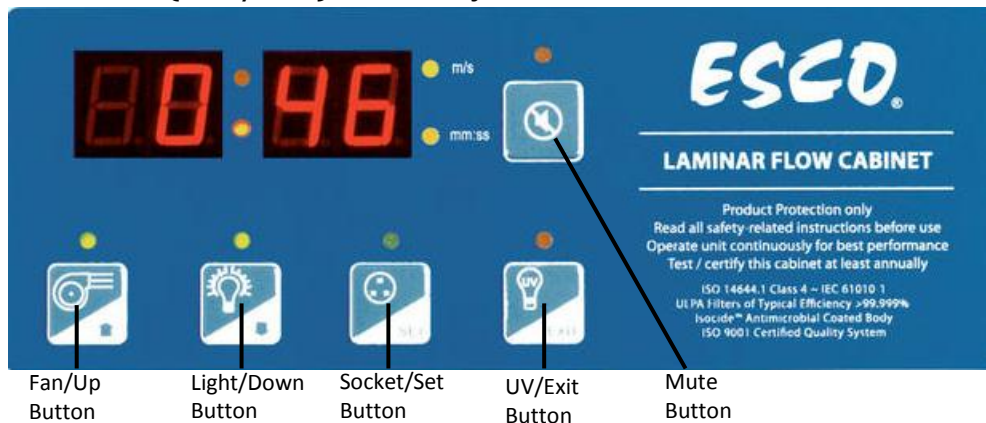
Pressure Gauge

- Indicates the pressure drop across filter, to maintain nominal airflow velocity as specified inside the test report. The gauge is calibrated in “inches of water column” pressure. The initial pressure reading will be approximately 0.50” (13 mm) W.C ± 0.05” (2 mm) W.C depending on altitude from sea level. The clean bench should be checked for proper airflow at each 0.1-inch (2 mm) increase in static pressure.

AHS-8C_ unit has two control panels that work independently of each other. To use the unit, the operator must activate both control panels' switches. Activating only one control panel's switch will compromise air flow and the unit will not be able to provide adequate protection to the products.

Chapter 3 – AHC/AVC-D Series Control System

3.1 Sentinel Delta (AHC/AVC) Control System



Fan/Up Button

- Turns on and off the fan in normal condition.
- Serves as UP button in MENU mode or DIAGNOSTIC MESSAGE mode.

Light/Down Button

- Turns on the lamp in normal condition.
- Serves as DOWN button in MENU mode or DIAGNOSTIC MESSAGE mode.

Socket/Set Button

- Turns on/off the electrical socket (retrofit kit) in normal condition.
- Serves as SET button in MENU mode or DIAGNOSTIC MESSAGE mode.

UV/Exit Button

- Turns on/off the UV lamp in normal condition.
- UV can only be turned on when both fan and light are off.
Please install front cover (retrofit kit) if you want to use this feature. Since the front cover is capable of filtering UV rays, users are protected from the harmful UV rays.

- *Eyes and skin should not be exposed to direct UV light.*
- *UV light should not be relied upon as the sole decontaminating agent.*
- *Check the UV interlock regularly for correct operation.*

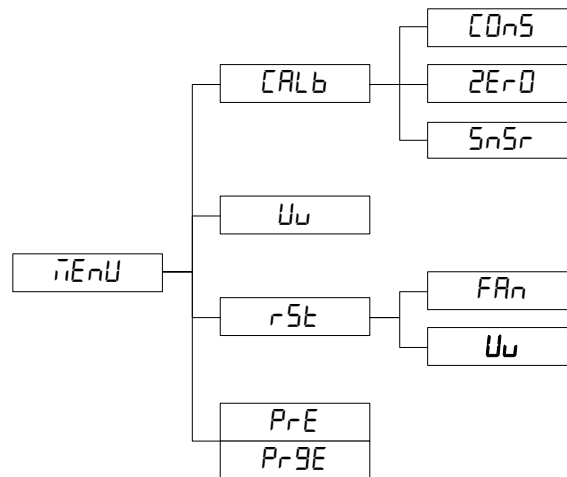
Note: The use of UV lamp voids cULus listing.

- Serve as EXIT button in MENU mode or DIAGNOSTIC MESSAGE mode.

Mute Button

- Turns on/off audible alarm.
- **Mute + Light/Down** - to access MENU mode from normal condition, or exit MENU mode to normal condition. MUTE and LIGHT/DOWN buttons need to be pressed concurrently.
- **Mute + Socket/Set** - to access DIAGNOSTIC MESSAGE mode from normal condition, or exit DIAGNOSTIC MESSAGE mode to normal condition. MUTE and SOCKET/SET buttons need to be pressed concurrently.

3.2 Menu Options



3.2.1 CALb (CALB)

Press SOCKET/SET button to enter the CALIBRATION (CALB) menu. Use FAN/UP or LIGHT/DOWN button to move through the available options: SET TEMPERATURE CONSTANT (CONS), ZERO AIRFLOW SENSOR (ZERO), and CALIBRATE AIRFLOW SENSOR (SNSR).

Once calibration is properly performed, airflow velocity will be displayed when fan is on, and airflow alarm will be triggered if it drops below pre-defined fail point. If calibration has not been performed or done wrongly, airflow velocity won't be displayed; instead "FAN ON" message will be displayed.

3.2.2 UV (UV)

Press SOCKET/SET button to enter the UV TIMER (UV) menu. UV timer allows control system to switch off the UV light automatically after a fixed period. By default UV timer is set to 0, and UV must be manually switched off after switching on. UV timer can be set between 0 to 99 minutes.

3.2.3 PrE (RST)

Press SOCKET/SET button to enter RESET HOUR METER (RST) menu. Fan hour meter or UV hour meter is reset back to 0 by choosing FAN HOUR METER (FAN) or UV HOUR METER (UV) respectively.

3.2.4 PrE PrGE (PRE PRGE)

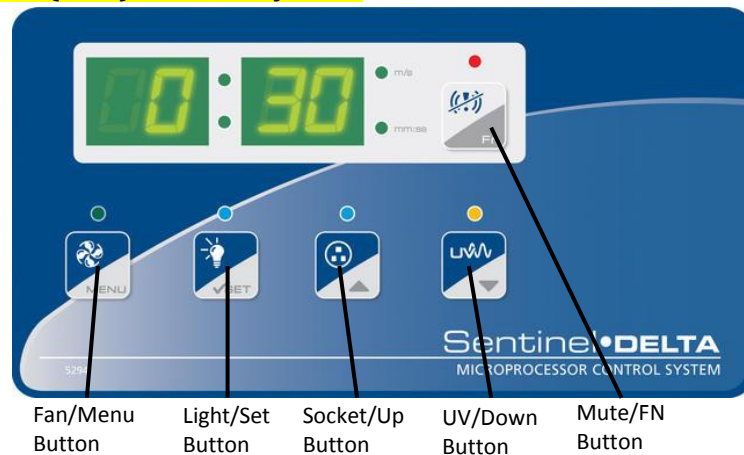
Press SOCKET/SET button to enter PRE PURGE TIMER (PRE PRGE) menu. Pre purge time allows system (fan and airflow sensor) to be stabilized before user has full access to the clean bench. By default, pre purge timer is set to 3 minutes, and can be set between 0 to 15 minutes.

3.3 Diagnostic Mode

- VER: the software version of the product.
- FAN HR: the working hours of fan.
- UV ON HR: the working hours of UV.
- ADC FAN: the ADC value of current airflow sensor output.
- ADC ZERO: the ADC ZERO point, which corresponds to zero airflow.
- ADC FAIL: the ADC FAIL point, which corresponds to airflow fail point.
- ADC OPT: the ADC OPTIMUM point, which corresponds to airflow optimum point.
- ADC TPTR: the ADC value of temperature sensor output.
- DEGC TPTR: the temperature in Celsius Degree.

Chapter 4 – ACB Control System

4.1 Sentinel Delta (ACB) Control System



Fan/Menu Button

- Turns on and off the fan in normal condition.
- Serves as MENU (cancel) button in MENU mode.

Light/Set Button

- Turns on the lamp in normal condition.
- Serves as SET button in MENU mode.

Socket/Up Button

- Turns on/off the electrical socket (retrofit kit) in normal condition.
- Serves as UP button in MENU mode.

UV/Down Button

- Turns on/off the UV lamp in normal condition.
- UV can only be turned on when both fan and light are off.
Please install front cover (retrofit kit) if you want to use this feature. Since the front cover is capable of filtering UV rays, users are protected from the harmful UV rays.

- *Eyes and skin should not be exposed to direct UV light.*
- *UV light should not be relied upon as the sole decontaminating agent.*
- *Check the UV interlock regularly for correct operation.*

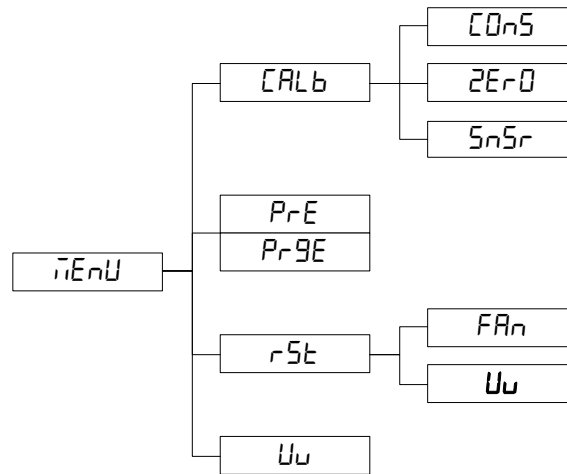
Note: The use of UV lamp voids cULus listing.

- Serves as DOWN button in MENU mode.

Mute/FN (Function) Button

- Turns on/off audible alarm.
- **Mute/FN + Fan/Menu** - to access MENU mode from normal condition, or exit MENU mode to normal condition. MUTE/FN and FAN/MENU buttons need to be pressed concurrently.

4.2 Menu Options



4.2.1 CALb (CALB)

Press LIGHT/SET button to enter the CALIBRATION (CALB) menu. Use FAN/UP or LIGHT/DOWN button to move through the available options: SET TEMPERATURE CONSTANT (CONS), ZERO AIRFLOW SENSOR (ZERO), and CALIBRATE AIRFLOW SENSOR (SNSR).

Once calibration is properly performed, airflow velocity will be displayed when fan is on, and airflow alarm will be triggered if it drops below pre-defined fail point. If calibration has not been performed or done wrongly, airflow velocity won't be displayed; instead "FAN ON" message will be displayed.

4.2.2. PrE PrGE (PRE PRGE)

Press LIGHT/SET button to enter PRE PURGE TIMER (PRE PRGE) menu. Pre purge time allows system (fan and airflow sensor) to be stabilized before user has full access to the clean bench. By default, pre purge timer is set to 3 minutes, and can be set between 0 to 15 minutes.

4.2.3 rSt (RST)

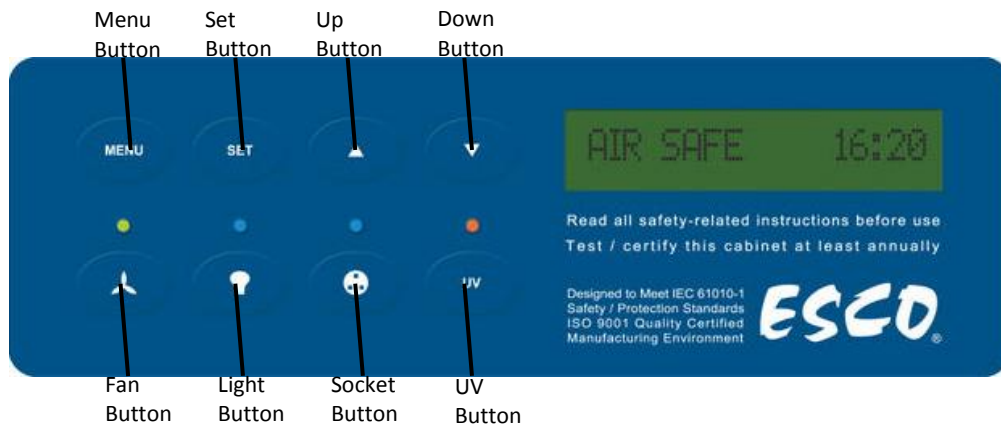
Press LIGHT/SET button to enter RESET HOUR METER (RST) menu. Fan hour meter or UV hour meter is reset back to 0 by choosing FAN HOUR METER (FAN) or UV HOUR METER (UV) respectively.

4.2.4 UV (UV)

Press LIGHT/SET button to enter the UV TIMER (UV) menu. UV timer allows control system to switch off the UV light automatically after a fixed period. By default UV timer is set to 0, and UV must be manually switched off after switching on. UV timer can be set between 0 to 99 minutes.

Chapter 5 – LHC/LVC & RHL Control System

5.1 Sentinel Silver (LHC/LVC & RHL) Control System



Fan Button

- Turns on and off the fan.

Light Button

- Turns on and off the light.

Socket Button

- Turns on and off the electrical socket (retrofit kit).

UV Button

- Turns on and off the UV lamp (optional retrofit kit). Please install front cover (retrofit kit) if you want to use this feature. Since the front cover is capable of filtering UV rays, users are protected from the harmful UV rays.

- *Eyes and skin should not be exposed to direct UV light.*
- *UV light should not be relied upon as the sole decontaminating agent.*
- *Check the UV interlock regularly for correct operation.*

Note: The use of UV lamp voids cULus listing.

Up and Down Arrow Button

- Moves upwards and downwards the menu options.
- Increases and decreases corresponding value inside one of the menu options.
- Starts, stops and resets timer.

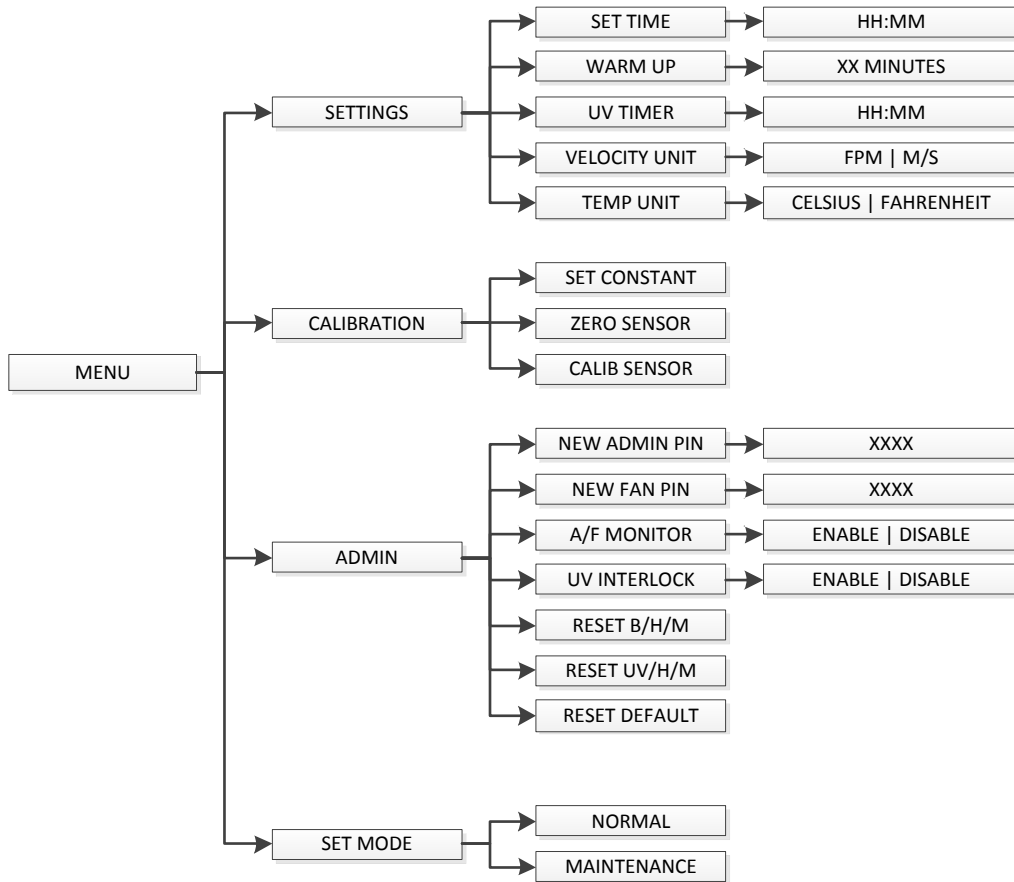
Set or Mute Button

- Chooses the menu or sub-menu currently displayed on the LCD screen.
- Proceeds to the next step or sequence inside one of the menu options.

Menu Button

- Enters and exits from the menu options.
- Goes back to the previous level of the menu options.
- Accesses maintenance mode from ERR.MSWITCH and AIRFAIL! error condition.

5.2 Menu Options

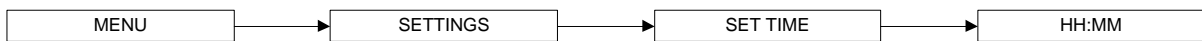


5.2.1 Settings

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

5.2.1.1 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.



5.2.1.2 Warm Up Time

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.



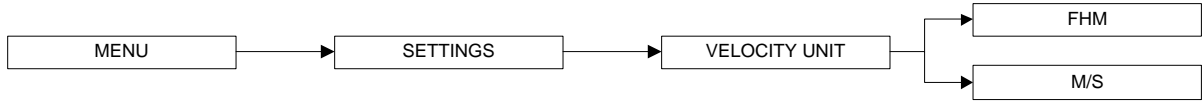
5.2.1.3 UV Timer

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.



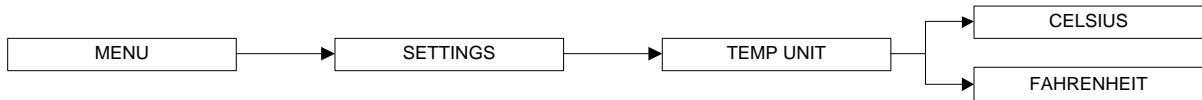
5.2.1.4 Velocity Unit

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).



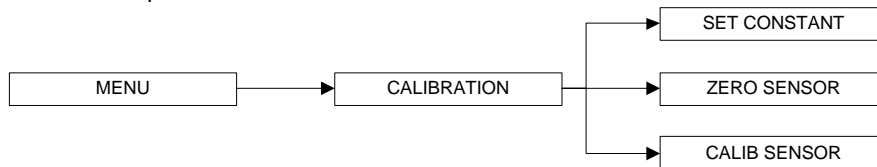
5.2.1.5 Temp Unit

Using this option, the user can select the unit in which temperature is measured and displayed. The user can choose between Celsius and Fahrenheit



5.2.2 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 cabinet to the standard reference. Calibration should only be carried out by trained personnel. For more information, refer to test report.



5.2.3 Admin

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

5.2.3.1 New ADMIN PIN (default 0009)

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

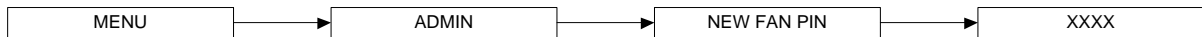
ADMIN PIN can also be used to switch to maintenance mode from error condition.



5.2.3.2 New FAN PIN (default 0001)

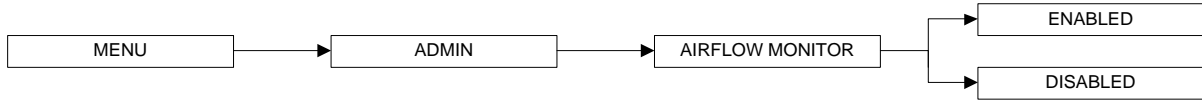
FAN PIN restricts access to fan control and some parts of the menu, settings and set mode. User must enter four-digit PIN before switching fan on or off. As such, it can restrict access to operating the cabinet by unauthorized personnel. It will also prevent unauthorized shutdown of the cabinet when 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 cabinet.

Setting the PIN to 0000 will disable this feature.



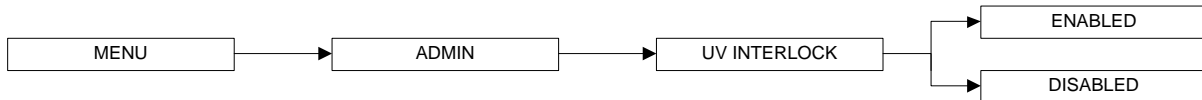
5.2.3.3 Airflow Monitor

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



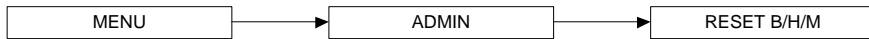
5.2.3.4 UV Interlock

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.



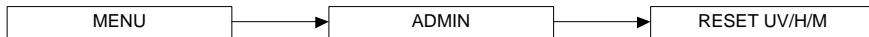
5.2.3.5 Reset B/H/M

This option is used to reset the blower hour meter. The blower hour meter indicates how long the blower has been in operation. The value can also provide some help in setting up maintenance schedule.



5.2.3.6 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. Please reset the UV lamp hour meter after each UV lamp replacement.



5.2.3.7 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), Airflow monitor (enabled), ADMIN PIN (0009), and FAN PIN (0001).

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



5.2.4 Setting Mode

The cabinet has two working mode which is normal mode and maintenance mode.



5.2.4.1 Normal Mode

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

5.2.4.2 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.

5.3 Stopwatch Function

The stopwatch function can be started by pressing the UP button while the sash is in the safe/ready position. Pressing the UP button again while the stopwatch function is active will pause and resume the timer. Pressing the DOWN button will leave the stopwatch function and reset the timer. The timer in the stopwatch function is counting up and shown using the HH:MM:SS format.

5.4 Alarms and Warnings

The cabinet uses alarms to indicate that the condition inside the cabinet 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.

Chapter 6 – Basic Cabinet Operation

6.1 Working in the Clean Bench

1. Thoroughly surface-decontaminate the work surface, side walls and back wall using 70% ethanol (or some other disinfectant depending on materials used in the clean bench). Surface-decontaminate the UV lamp and electrical outlets as well. Do not use any disinfectant containing chlorine-based substances as this may cause corrosion of the stainless steel surfaces.
2. Minimize room activity (personnel movements, closing and opening of doors, etc.) since these external airflow disturbances may adversely affect the clean bench's internal airflow, thereby possibly impairing the containment capabilities of the clean bench.
3. Allow only essential items in the work zone. Items/instruments should not be placed between the filter and any area where the clean environment is needed. New items introduced into the work zone should be placed downstream of items already in the work zone for several minutes to allow contaminants to flush off.
4. Work in the clean bench in a slow and controlled manner. While putting items inside / removing items from the work zone, move your hands in and out of the work zone opening slowly and in a direction perpendicular to the plane of the work zone opening. Rapid movement of arms in a sweeping motion may disrupt the air barrier, thereby allowing contaminants to enter the clean bench.
5. Exercise particular care when placing equipment within the work space. Where possible, instruments should be placed on perforated platforms to allow air movement under as well as around the object.
6. Perform all work with the operator's hand or head downstream of the critical process points. Keep unnecessary movement within the work zone to a minimum.
7. Do not use Bunsen burner and aerosol-generating instruments whenever possible as they interfere with airflow.
8. Wipe surfaces clean by applying appropriate disinfecting solution to clean bench surface. Most surface disinfectants require a specific contact time, depending on the microbiological agents used within the clean bench. After the specified contact time, wipe the excess disinfectant.
9. Leave the unit running for 5-30 minutes before continuing work to allow the system to purge itself.

6.2 Working Ergonomics

On most occasions, you would most likely be operating the clean bench 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 clean bench'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.

6.3 UV Lamps

The UV light is a germicide and virucide. Even at the minimum acceptable irradiance in a clean bench – 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 W = 1 J/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 clean bench. For any container stored inside the clean bench'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 clean bench'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 clean bench is fully closed 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 clean bench have a lifespan of 2,000 hours.
- The UV lamp should be cleaned of any dust and dirt weekly and changed annually to ensure its effectiveness.
- The use of UV lamp in clean bench has been explicitly discouraged in all major international standards and recommendations.

Chapter 7 – Maintenance

7.1 Scheduled Maintenance

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

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	Clean the exterior surfaces of the BSC			√			
3	Check all service fixtures (where present) for proper operation			√			
4	Replace Pre-Filter				√		
5	Inspect the work bench for any abnormalities or malfunction				√		
6	Clean up stainless steel surfaces with MEK				√		
7	Re-certification					√	
8	Change UV Lamp (where present)					√	
9	Change the fluorescent lamps						√

Cleaning the Clean Bench

- Clean the work surface and walls with appropriate disinfectant agent and soap water afterward
- Use a damp cloth to clean the exterior surface of the clean bench, 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.

Check the cabinet's functionality

- Check the clean bench's mechanical functionality; ex: front panel – lubricate if necessary
- Check the clean bench's electrical functionality; ex: fluorescent lamp – replace if necessary
- Check the clean bench for any defect, repair immediately

Re-certification

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

7.2 Maintenance/Service Log

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

APPENDIX

