SIMCO ION™
An ITW Company

IONIZATION SOLUTIONS

AeroBar® MP

Model 5635

User's Manual

About Simco-Ion

Simco-Ion develops, manufactures, and markets system solutions to manage electrostatic charge. As the world's largest provider of electrostatics management products and services, Simco-Ion improves its customers' business results by providing a total solution to their electrostatic discharge and electromagnetic interference challenges. Simco-Ion is a division of Illinois Tool Works (ITW), with its Technology Group located in Alameda, California. For more information about Simco-Ion visit www.simco-ion.com or call 800-367-2452. Simco-Ion is ISO 9001 and ANSI ESD S20.20 certified.

Important Safety Information

Carefully read the following safety information before installing or operating the equipment. Failure to follow these safety warnings could result in damage to your ionization system and/or voiding the product warranty.

- ☑ To avoid ionizer degradation, keep grounded objects away from the emitter nozzles and a directed flow of ions.
- ☑ To avoid injury to self or the product, make sure all mounting clips and brackets are connected to a low-impedance earth ground.
- ☑ Do not clean emitter points while the unit is powered. Doing so may result in additional contamination and possible shock.
- ☑ To avoid personal injury or damage to the equipment, perform only the maintenance described in this manual.

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Description

1.1 Overview

The Model 5635 AeroBar MP is a modulated pulse ionizer specifically designed for semiconductor wafer processing and the stringent cleanliness and performance requirements at smaller geometries.

- The Aerobar MP has the following unique features:
- Patent-pending, modulated pulse (MP) technology with high efficiency ion emitters
- Low swing voltage
- Unparalleled cleanliness
- Long maintenance cycles
- Self-contained, established algorithms in the onboard microprocessor with a range of performance settings including ion generating frequency, power, and pusher frequency.

This manual covers the installation, operation, and maintenance of the AeroBar MP.

1.2 AeroBar Identification

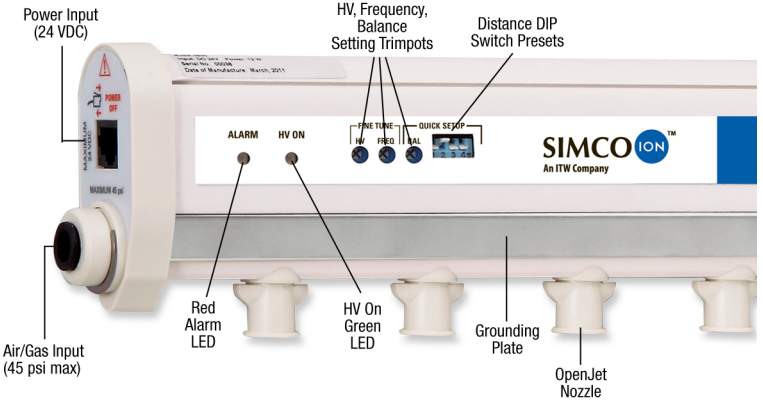

Figure 1. Model 5635 AeroBar MP with Open Jet Nozzles

AeroBar MP Lengths

The AeroBar MP is available in multiple lengths to fit any wafer tool environment. Note that the AeroBar's active length should be equal or greater than the area to be ionized.

Lengths (mm/in)	Active Length (mm/in)	No. of Emitters with 50 mm Spacing	No. of Emitters with 75 mm Spacing
450 (18)	350	8	N/A
600 (24)	500	11	N/A
850 (34)	750 (30)	N/A	11
1000 (39)	900 (35)	N/A	13
1150 (45)	1050 (41)	N/A	15
1300 (51)	1200 (47)	N/A	17
1450 (57)	1350 (53)	N/A	19
1600 (63)	1500 (59)	N/A	21
1750 (69)	1650 (65)	N/A	23
1900 (75)	1800 (71)	N/A	25
2050 (81)	1950 (77)	N/A	27
2200 (87)	2100 (83)	N/A	29
2350 (93)	2250 (89)	N/A	31

Table 1. AeroBar MP Bar Lengths

- **Length**: Overall AeroBar length from endcap-to-endcap.
- **Active Length**: The length of the active ionizing area, from first emitter nozzle to last.

1.3 Nozzle Configurations

A Single Crystal Silicon emitter in an open jet nozzle is standard on the AeroBar MP5635.

Insertion/Removal

The emitter nozzles utilize a unique quarter-turn design, which makes for easy and fast removal and replacement.

Interchangeability

The discharge time performances are similar for both pitches. The 50 mm pitch is recommended for applications where the ionizing bar is located in close proximity (<150 mm) to the wafer.

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Installation & Operation

2.1 Safety Information

Before installing or operating any component of the ionization system, carefully read the following safety information:

Before installing or operating any component of the ionization system, carefully read the following safety information--Never plug or unplug an AeroBar MP to the power while the power is on.

To avoid injury to self or the product, do not place any conductive labels on the AeroBar chassis! The electrostatic fields are sensitive.

To avoid ionizer degradation, keep grounded objects away from the emitter nozzles and a directed flow of ions.

To avoid injury to self or the product, make sure all mounting clips and brackets are connected to a low-impedance earth ground.

Do not clean emitter points while the unit is powered. Doing so may result in additional contamination and possible shock.

To avoid personal injury or damage to the equipment, perform only the maintenance described in this manual.

2.2 Installation Guidelines

Keep in mind the following considerations when determining locations for the units:

- Site requirements/restrictions are observed.
- A location with adequate ventilation and constant temperature and humidity that do not exceed specifications will result in the best performance.
- Applicable mounting brackets and screws are used per building codes at specified distances.
- AeroBars are installed away from all moving components or surfaces.
- AeroBars are installed away from flammable solvents or particles and water and oil that could spray into the air.
- AeroBars are placed at least 150 mm away from grounded surfaces.
- Allow for 60 mm (2.4 in) minimum at the end of the Aerobar for power cable and air (if needed).

To avoid injury to self or the product, do not place any conductive labels on the AeroBar chassis! The electrostatic fields are sensitive.

To avoid degraded ionizer performance, keep grounded objects away from the emitter nozzles and direct flow of ions.

2.3 Mounting

Mount the AeroBar MP using clips. Three mounting clips are available from Simco-Ion that are specifically designed to securely hold AeroBars in different positions.

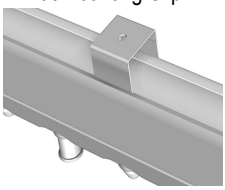
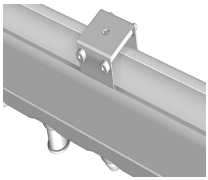
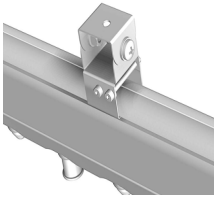
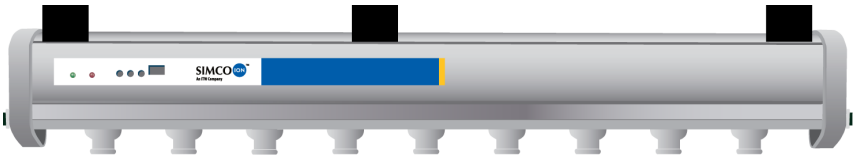
Part No.	Description	Application	Number Clips/Bar
28-6370	Flat Mounting Clip 	Horizontal or Vertical	400-1150 mm: 2 Clips 1300-2050 mm: 3 Clips 2200-2350 mm: 4 Clips
33-5353	Flat Clip with Active/ Screw Fastener 	Horizontal or Vertical	400-1150 mm: 2 Clips 1300-2050 mm: 3 Clips 2200-2350 mm: 4 Clips
32-22210	Adjustable Horizontal Mounting Bracket 	Horizontal	400-1150 mm: 2 Clips 1300-2050 mm: 3 Clips 2200-2350 mm: 4 Clips
32-22220	Vertical Mounting Bracket 	Vertical	2 Clips Per Any Length

Table 2. Mounting Clip Part Numbers and Descriptions

Mounting Clip Placement

Lengths up to 1150 mm 2 Clips/Bar



Lengths 1300-2050 mm 3 Clips/Bar

Lengths 2200 and above 4 Clips/Bar

Figure 2. Recommended Mounting Clips Per Bar

To attach clips to a mounting surface or rod, use a screw (not supplied). Snap the clip into the grooves of the AeroBar. Mounting clips should be attached at the ends of the bar, with additional clips in the mid-area of the AeroBar for added support with longer bars. Note that mounting clips should be grounded, specifically clips placed near the power supply.

Mounting clips must be grounded

Mounting Clip Guidelines

- Position clips between nozzles
- Make sure all mounting brackets are connected to a low-impedance earth ground.

2.4 Power Connection Options

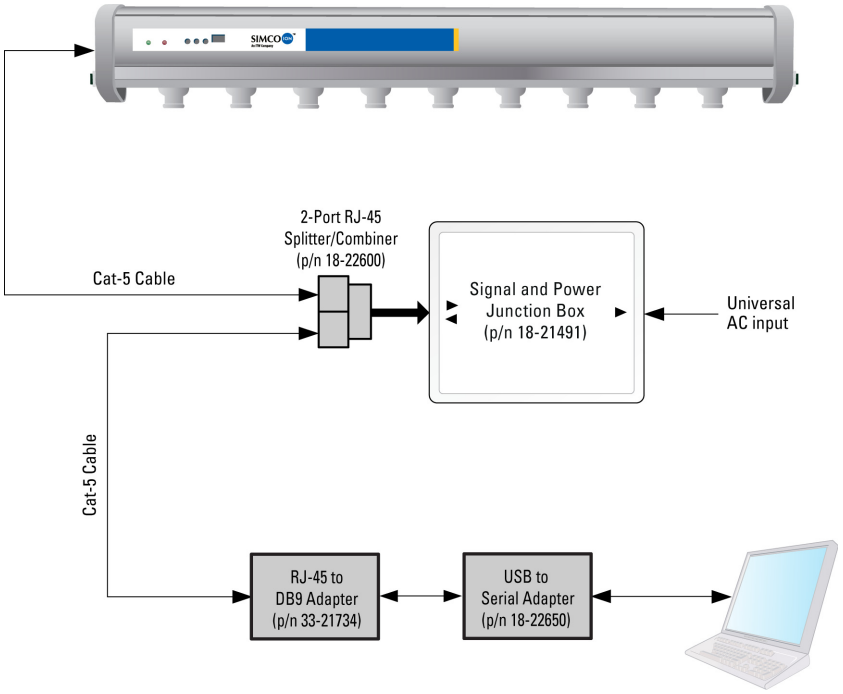


Figure 3. Hard Wire to Junction Box and +24 VDC Tool Power

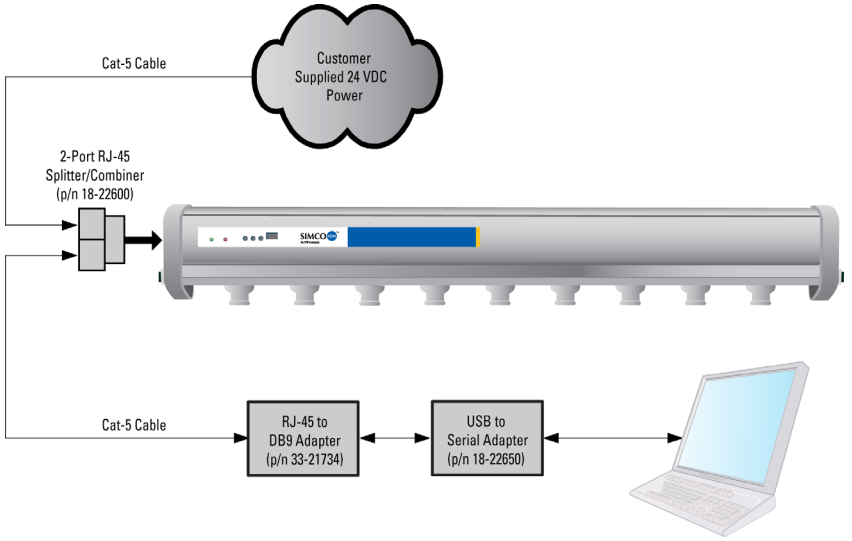


Figure 4. Hard Wire to Junction Box and Power Adapter

Wiring Information

Pin Out	Junction Box Color Code	Power/ Signal	Descriptions
1	Blue	RXD	RS-232 Receive data Input
2	Orange	Signal ground	Signal ground
3	Black	+24 VDC	+24 VDC supply to the ionizer
4	Red	TXD	RS-232 Transmit data Output
5	Green	Signal ground	Signal ground
6	yellow	24V ground	24V common, power ground
7	Brown	Remote HV	Input, when low will put the AeroBar in standby
8	White	Alarm (FMS)	Open collector output, no alarm = short (100-110 phm), alarm = open (5 Kohm)

Table 3. RJ-45 Wiring

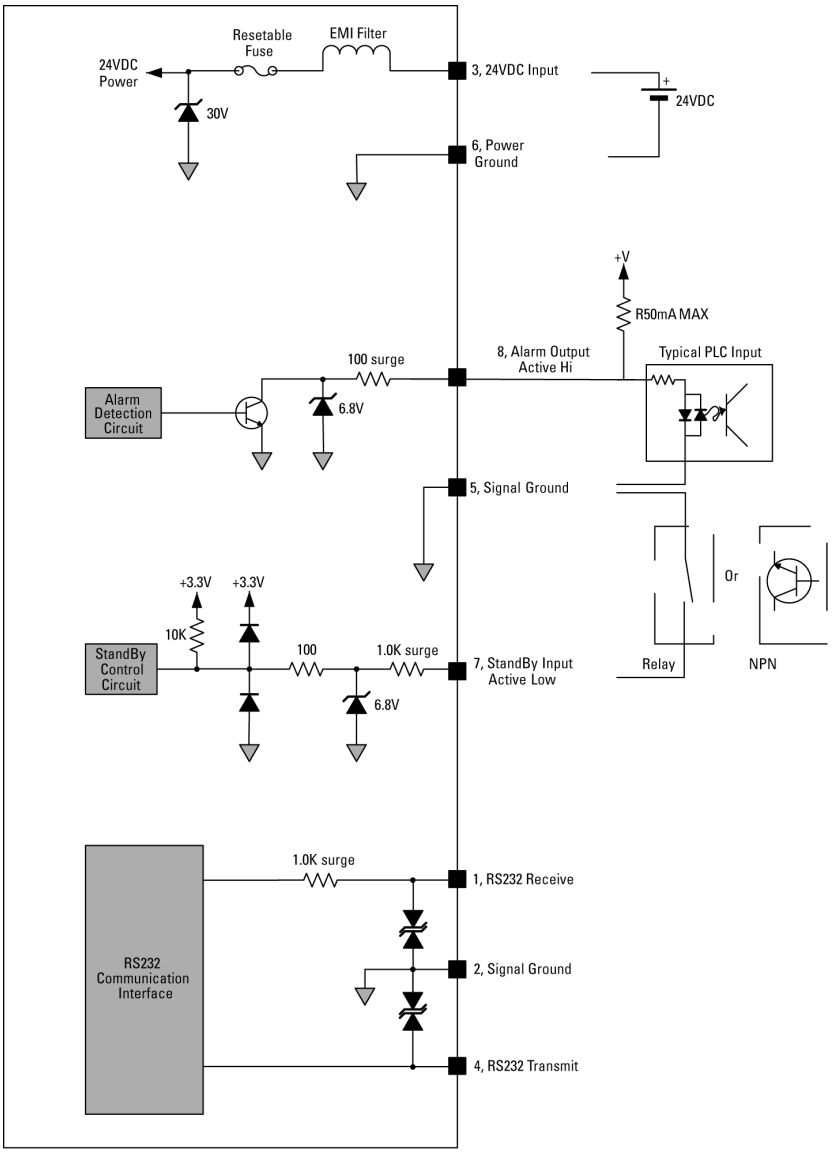


Figure 5. Model 5635 Wiring Diagram

The following parts and accessories for power connection are available from Simco-Ion:

Part No.	Description
33-21491	Signal and Power Junction Box for FMS connection
33-25625	24 VDC Power Converter Box with Signal and Power Junction Box Kit
25-0540	CAT-5 with RJ-45 Ethernet Cable
92-5635-001	MP AeroBar Remote Serial Adapter Kit
91-5635-SW-VX.X	MP AeroBar Software

Table 4. Parts and Accessories for Power Connection

Figure 6. CAT-5 Cable Connection

2.5 FMS Connection

The AeroBar MP may be connected to a Facility Monitoring System (FMS), which can monitor system status along with the rest of the facility.

To connect the AeroBar MP to an FMS, use Simco-Ion Signal and Power Junction Box (p/n 33-21491). Alternatively, the CAT-5 cable may be hardwired to an FMS system.

Figure 7. Signal and Power Junction Box

2.6 Gas and Air

Even though the AeroBar MP 5635 can be used with purging air, the AeroBar's cleanliness rating does not apply when purging air is in use.

The information presented here is to guide the user when faster discharge time performance is required and purging air is used.

A flowmeter is recommended for use in conjunction with gas input to the AeroBar MP. A flowmeter helps establish control and maintain the total gas input flow to nozzles.

Gas and Air Requirements

Simco-Ion recommends using clean dry air (CDA) to improve performance of ion delivery to the target. A CDA supply should be appropriately filtered to remove moisture, oil and particles. Filtration to the desired cleanliness level is recommended (not supplied by Simco-Ion).

The input gas volume requirement is at least one liter per minute per nozzle. The maximum input pressure is 45 PSI (0.31 MPa).

Gas and Air Connections

A one-touch fitting, 8 mm (OD) tubing bulkhead is at either end of the bar. Both ends are single-point use only. It is not possible to daisy chain gas connections without degrading nozzle airflow distribution. To connect the air supply to the AeroBar MP:

1. Insert the tubing into the one-touch fitting at either end. Be sure the tubing is fully inserted by gently tugging on the tubing to lock the tube into place.

2. Ensure the gas fitting at the other end of the AeroBar MP is plugged, using the supplied red plug. To remove the plug, push in the black fitting collar to release the plug.

Figure 8. Gas Line Plug

2.7 Operation

Recommended Setup

The AeroBar MP is designed for easy setup and calibration. In order to obtain the correct setting for your environment, perform an initial setup with a charged plate monitor (CPM). Simco-Ion Model 280A is recommended. See figure below for a setup picture.

Take measurements over the entire area of emitter points only. Obtaining measurements outside the range, including at endcaps, will provide an incorrect and incomplete picture of discharge time.

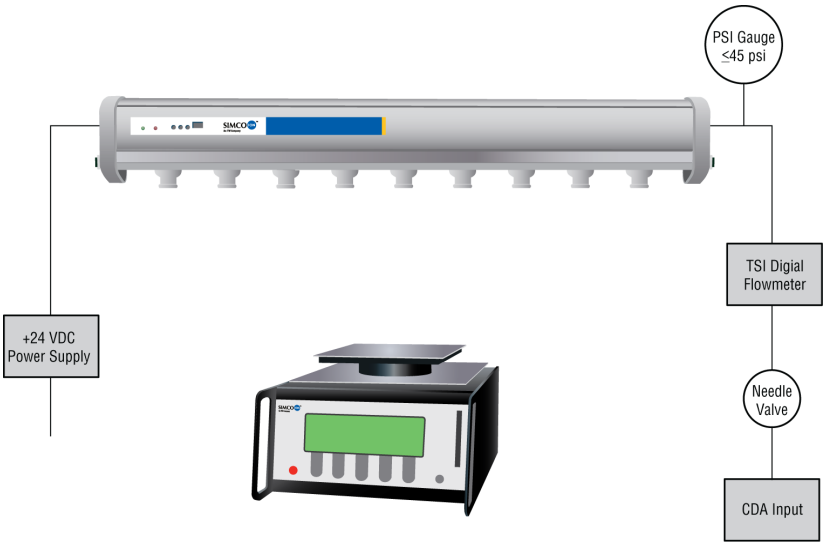


Figure 9. Recommended Setup for Calibration

Distance Selection Setup

The four DIP switches on the bar allow three pre-set distance selections. Settings depend on the application, environment, and operation conditions. After setting the switches for the desired distance, adjust the Balance setting.

Distances	For the following distance from bar to target	...use this setting	...with this HV level
Short	150-200 mm	 (LL)	10 kVp-p
		 (LH)	11 kVp-p
Medium	200-300 mm	 (HL)	12 kVp-p
Long	≥300 mm	 (HH)	13 kVp-p

Table 5. DIP Switch Settings for Distance

Manual/Remote Mode Setup

Manual Mode: To operate the AeroBar MP in Manual Mode, power down the AeroBar for about 10 seconds to make sure the bar is fully powered off. Then set the mode switch (#4) on the front-panel to the OFF position before powering up.

AeroBar MP settings are controlled by the remaining switches and pots.

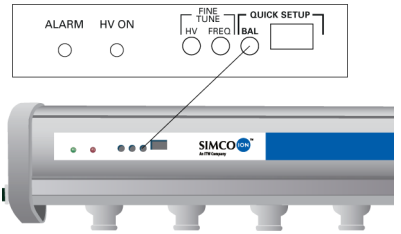
Remote Mode: To operate the AeroBar MP in Remote Mode, power down the AeroBar for about 10 seconds to make sure the bar is fully powered off. Then set the mode switch (#4) on the frontpanel to the ON position before powering up. AeroBar MP settings are controlled through the serial communication.

The remaining switches and pots have no effect in this mode.

A remote setup kit is available from Simco-Ion, order part number 92-5635-001. The kit includes a Setup Guide and all the necessary hardware and software to control the bar remotely.

Balance Setting

- Possible range is from -50% to 50%.
- The typical balance setting at 200-300 mm distance is in the range of -10% to +10%.



Balance %	Trimpot Position
0	Center (C)
-50%	Counter-Clockwise (CCW)
+50%	Clockwise (CW)

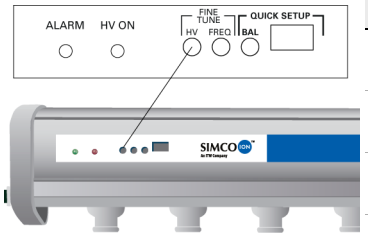
Table 6. Balance Settings and Trimpot Position

High Voltage (HV) Setting

- The HV trimpot provides +/-0.5 kV p-p adjustment at each HV setting level at the DIP switches.
- The typical HV output 10-13.5 kV p-p where the Extended ISO Class 1 default setting output is approximately 11.5 kV p-p.

The AeroBar MP 5635 is shipped with a High Voltage setting that achieves the best long-term cleanliness and meets Extended ISO class 1. Using a higher voltage setting will degrade the AeroBar's ability to maintain the Extended ISO class 1 rating.

For exceptional site situations, and where Extended ISO Class 1 cleanliness is not necessary, using a higher voltage setting will improve discharge time performance.



Typical Setting		Approximate HV Output Range (kVp-p)
	(LL)	10-10.8
	(LH)	10.8-11.7
	(HL)	11.7-12.6
	(HH)	12.6-13.5

Table 7. High Voltage Settings

Frequency

Possible range is from 0.3 to 33 Hz in two ranges:

- **For short distance applications,** adjust the frequency higher (clockwise) to achieve the desired performance level.
- **For long distance applications,** adjust the frequency lower (counter-clockwise) to achieve the desired performance level.

Desired High Range Frequency (Hz) (Sw# 3 ON)	Trimpot Position	Desired Low Range Frequency (Hz) (Sw# 3 OFF)	Trimpot Position
1		0.3	
5		0.4	
16		0.8	
25		1.2	
33		1.5	

Table 8. Frequency and Trimpot Position

AeroBar MP Settings in Specific Environments

To effectively ionize a target, the ions must be released as fast as possible with the least amount of recombination. **Settings must be optimized for the environment** -- size of the target, distance from the ionizer, and airflow.

The AeroBar MP 5635 is shipped with a High Voltage setting that achieves the best long-term cleanliness and meets Extended ISO class 1. Using a higher voltage setting will degrade the AeroBar's ability to maintain the Extended ISO class 1 rating.

For exceptional site situations, and where Extended ISO Class 1 cleanliness is not necessary, using a higher voltage setting will improve discharge time performance.

- Lower the frequency and increase the voltage levels to reduce ion recombination prior to the ions reaching the target.
- For long distance applications, a setup with lower frequencies is appropriate. For short distances, the frequency is typically set at a higher frequency.
- Adjust the balance in all environments to ensure that equal numbers of positive and negative ions reach the target area.
- Lower the voltage levels to reduce the ion emission and increase the frequency setting to decrease the swing voltage for target areas that are smaller and positioned closer to the emitter points (typically 150-200 mm).

2.8 Alarms

An alarm condition is indicated by red LED's on both sides of the chassis.

Alarms are caused by one or more of the following possible conditions:

- HV feedback (high and low) threshold
- Over voltage supply
- Over current supply limit
- Oscillator frequency (high and low) threshold

Possible Solutions

- Check for grounded objects near the bar, shorted emitter points (corroded points or any obstructions to the points).
- If the red alarm LED is lit, unplug the power cable to turn off the AeroBar, wait 30 seconds and then plug the power cable back in to restart the AeroBar. If the red alarm LED continues to stay lit, contact Simco-Ion Technical Support (techsupport@simco-ion.com or 510.217.0460).

Alarm Test (for wiring testing, etc.)

(Aerobar Firmware Version 3.0 and above)

- Set all the dip switches to the off position
- The Red LED on the AeroBar's will illuminate and the alarm output will be activated
- To the restore the previous AeroBar's operating point, set the dip switches to there previous configuration

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In Local Mode, the AeroBar's emitter voltage will increase to near maximum and the pusher frequency will change to1.5Hz or less.

In Remote the AeroBar's emitter voltage and pusher frequency will be unaffected.

2.9 Standby

The Model 5635 AeroBar MP can be placed in standby mode by pulling pin 7 to ground. Standby mode is where the AeroBar is still powered and able to send and receive data from it's serial port but the voltage applied to the emitters is off.

When the Standby input is active, the green panel LED will blink approximately once per second until the pin 7 is again released.

The input can be used in conjunction with the remote feature, however, the standby input will override and reset the remote control standby command. If the standby input is released (from ground) it will place the bar in active state regardless of remote control state.

The standby function can be used to temporarily stop the ionization during a period of inactivity in the work environment.

The standby function will work in conjunction with the Demand Flow Controller (DFC). Contact Simco-Ion sales for more information on the DFC. When the AeroBar is connected with a DFC, the Standby input will also turn off the air to the bar.

3

Maintenance

3.1 Maintenance Considerations

As maintenance schedules will vary depending on conditions, develop a schedule that meets the requirements for your application. In general, equipment should be checked on a monthly basis to ensure it is operating as originally set.

There are no user-serviceable parts inside the AeroBar MP. Any unauthorized service will void the warranty and may result in additional repair charges.

3.2 Emitter/Nozzle Inspection & Cleaning

Cleaning Frequency

- Nozzle and emitter point cleaning is recommended every 6 months or longer depending on the application and/or environment.

Replacement is recommended every 2 to 3 years depending on the application and/or environment surrounding the emitter nozzle. The Open Jet nozzle with emitter point is replaced together as an assembly.

Inspection

Before performing any maintenance, the AeroBar must be powered down.

Dirty or eroded emitter points and nozzles may cause diminished ionization output and failure. Dirt or erosion can be caused by a number of environmental factors, including non-visible airborne molecular contaminates (AMC). Emitter points and nozzles should be checked regularly for erosion or dirt on the tips of the points, and dirt on the inside walls of nozzles.

Evidence of dirty emitter points may include:

- Discoloration
- White dirt formed on the tips (fuzz balls)
- Worn points

Evidence of dirty nozzles may include:

- Buildup on the nozzle
- Deterioration of the surface of the nozzle cleaning

Cleaning Materials

A solution of 50% deionized water and 50% isopropyl alcohol (IPA) with cleanroom-compatible cloth, wipe or swabs less than 5 mm diameter or Simco-Ion Emitter Point Cleaner swab (p/n 22-1000).

Do not clean emitter points while the unit is powered with HV on. Doing so may result in additional contamination and possible shock. After removing power from the AeroBar, allow a minute for the high voltage power supplies to discharge.

To clean the Aerobar chassis and areas around the emitter points, refer to section 3.3 Cleaning the Chassis.

To clean the emitter points use cleanroom-compatible swabs with less than 5 mm diameter or Simco-Ion Emitter Point Cleaner swab (p/n 22-1000). Gently rotate the swab around the emitter point and nozzle until dirt or debris is removed.

Emitter points break easily if too much force is applied to them from the side

Nozzle and Emitter Point Replacement

- Replacement Open Jet nozzle assemblies can be ordered from Simco-Ion
- All nozzles feature an easy quarter turn screw design

To remove nozzles: Turn the nozzle counter-clockwise and then pull.

To reinstall nozzles: A small amount of cleanroom-approved lubricant on a Kleen Wipe or other appropriate cleanroom wipe may be applied to make insertion smoother. If this is not allowed for the application, the nozzle may be inserted firmly and turned into position without the lubricant.

The use of a lubricant, and the type of lubricant used is dependent upon the individual application and customer requirements. Some cleanroom-approved lubricants to consider are Krytox LVP, PFPE grease, and Christo-Lube MCG 109 perfluoropolyether.

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1. Rub the sides of the wipe together to spread the lubricant. Gently and lightly coat the o-ring.
2. Place the nozzle to fit in the notch and then turn clockwise to lock it in.

3.3 Cleaning the Chassis

Do not clean the chassis while the unit is powered with HV on. Doing so may result in additional contamination and possible shock. After removing power from the AeroBar, allow a minute for the high voltage power supplies to discharge.

The AeroBar MP can be externally cleaned if dirt has accumulated on the chassis. Use a cleanroom-compatible cloth moistened with 50% de-ionized water and 50% IPA to clean the chassis from end to end. Change the cloth frequently to ensure that the dirt is completely removed from the chassis. Do not use any other cleaners or solvents.

4

Specifications

4.1 Specifications

Input Voltage	24 VDC, ±10% power input RJ-45
Input Current	0.7A (max)
Balance Drift	<20V from initial offset for 60 days; measured at 24 in. below an emitter center group of points (note balance measurement is an average of all samples collection in 60 sec at a sample rate is 100 sample/sec; note any one measurements could be outside of spec)
Balance Distribution	Within ±50V from initial setting
Emitter Material	Single Crystal Silicon
Input Control Signals	Standby (HV Off) active low pin 7 (this pin is internally pulled up to 3.3 VDC and diode clamped at 3.3 VDC, input resistance equal to 1 kw @ 0.25W max)
Output Control Signals	FMS alarm output (open collector output), pin 8 (max 24 VDC @ 200 mA); standby input (active low pin 7 - open normal mode)
Ionization Performance	15 sec (typ) with no air-assist and a Vp-p Swing of 80 Vp-p; measured at 24 in. below an emitter center group of points.
Emitter Voltages	9.5-13.5 kV, peak-to-peak
Emitter Emissions	Meets Extended ISO 14644-1 Class 1 at 10 nm $\leq$34 particles/ft^3 using the ~45 to 50% output voltage setting and Open Jet nozzles with Si emitters; not guaranteed to meet cleanliness spec when purging air is used
Emitter Frequency	0.3-1.5 Hz, Low; 1-33 Hz, High
Input Pressure	45 psi (0.3 kPa) max pressure
Air Supply	Clean dry air (CDA) or nitrogen (N2) when used with purging air, the AeroBar's Extended ISO Class 1 cleanliness rating does not apply
Air Connection	8 mm tubing (OD) bulkhead, one-touch fitting; no daisy-chain capacity
Purging Air Filtration	To meet customer cleanliness requirements (not supplied)
Temperature	15-35°C (59-95°F); storage temperature 2-45°C (35-113°F)
Humidity	30-60% RH non-condensing
Ozone	<0.05 ppm (24-hour accumulation)
Indicators	One pair of red and green LEDs on both sides of the bar: • Green LED lights when AeroBar operation is normal • Red LED on when in alarm
Material	ABS chassis; stainless steel bottom plates
Mounting	Flat clips, active clips, & brackets for horizontal and vertical available from Simco-Ion

Dimensions	78H x 34W x 450/600/850/1000/1150/1300/1450/1600/1750/1900/2050/2200/2350L mm (3.07H x 1.34W x 18/24/34/39/45/51/57/63/69/75/81/87/93L in.)
Weights	450 mm bar: 0.6 kg (1.3 lb) 600 mm bar: 0.7 kg (1.6 lb) 850 mm bar: 1.0 kg (2.3 lb) 1000 mm bar: 1.1 kg (2.5 lb) 1150 mm bar: 1.2 kg (2.7 lb) 1300 mm bar: 1.3 kg (3.0 lb) 1450 mm bar: 1.5 kg (3.3 lb) 1600 mm bar: 1.6 kg (3.5 lb) 1750 mm bar: 1.7 kg (3.8 lb) 1900 mm bar: 1.8 kg (4.1 lb) 2050 mm bar: 1.9 kg (4.3 lb) 2200 mm bar: 2.0 kg (4.5 lb) 2350 mm bar: 2.1 kg (4.7 lb)
Certifications	CE, RoHS compliant

4.2 Dimensional Drawings

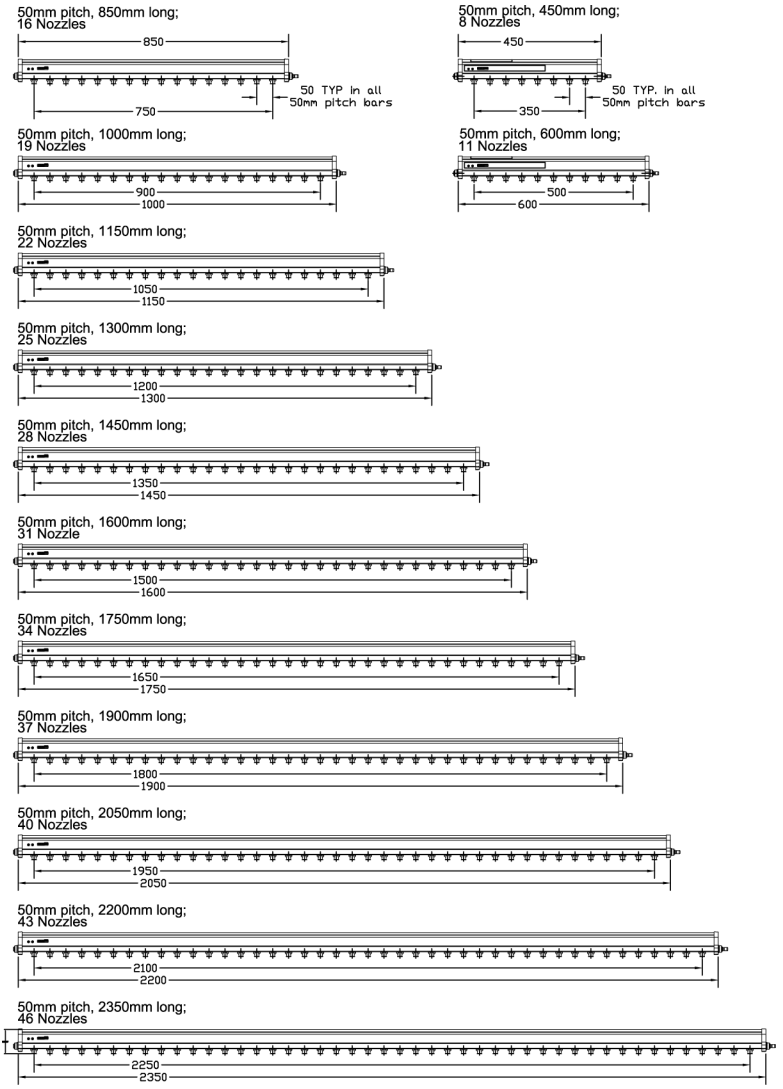
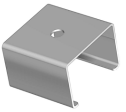
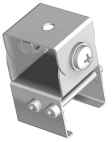


Figure 10. Model 5635 Lengths with 50 mm and 75 mm Emitter Pitch Spacing

Contact Simco-Ion for CAD drawings.

4.3 Parts & Accessories

Power		
33-21491		Signal and Power Junction Box for FMS connection
33-25625		24 VDC Power Converter Box with Signal and Power Junction Box Kit
25-0540-6 (6') 25-0540-10 (10') 25-0540-15 (15')		CAT-5 with RJ-45 Ethernet Cable, White
92-5635-001		MP AeroBar Serial Adapter Kit
Mounting		
28-6370		Flat mounting clip
33-5353		Flat clip with active/screw fastener
32-22210		Adjustable horizontal mounting bracket

32-22220		Vertical mounting bracket
Replacement Emitter Nozzles		
33-25383		OpenJet emitter nozzle
Software		
91-5635-SW-VX.X	MP AeroBar Software	

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Warranty & Service

Simco-Ion provides a limited warranty for the AeroBar MP Model 5635. New products manufactured or sold by Simco-Ion are guaranteed to be free from defects in material or workmanship for a period of two (2) years from date of initial shipment. Simco-Ion liability under its new product warranty is limited to servicing (evaluating, repairing, or replacing) any unit returned to Simco-Ion that has not been subjected to misuse, neglect, lack of routine maintenance, repair, alteration, or accident. In no event is Simco-Ion be liable for collateral or consequential damages. Consumable items such as, but not exclusive to, emitter points, emitter wires, batteries, filters, fuses or light bulbs are only covered under this warranty if found defective as received with the new product.

To obtain service under this warranty, please contact Simco-Ion Technical Support at techsupport@simco-ion.com or (510) 217-0470.

Notes

Notes

SIMCO ION™

An ITW Company

ISO 9001 CERTIFIED

Technology Group
1750 North Loop Rd., Ste 100
Alameda, CA USA 94502
Tel: 510-217-0600
Fax: 510-217-0484
Toll free: 800-367-2452
Sales services: 510-217-0460
Tech support: 510-217-0470

ioninfo@simco-ion.com
salesservices@simco-ion.com
techsupport@simco-ion.com
service@simco-ion.com
www.simco-ion.com

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