

BIOCLIMATIC

**REMOTE MONITOR
Model RM-102D**

for use with

AEROTRON[®] 500 THROUGH 1200

INSTALLATION, OPERATION

&

MAINTENANCE

MANUAL

Bioclimatic Air Systems
600 Delran Parkway
Delran, NJ 08075 USA
Tel. (856) 764 4300
Fax (856) 764 4301

BIOCLIMATIC AIR SYSTEMS

REMOTE MONITOR

Model RM-102D

for use with

AEROTRON[®] 500 THROUGH 1200

TABLE OF CONTENTS

1	INTRODUCTION	3
	1.1 <i>Disclaimer</i>	3
	1.2 <i>Receiving</i>	3
	1.3 <i>Storage</i>	4
	1.4 <i>Warranty</i>	4
2	INSTALLATION.....	5
	2.1 <i>Initial Setup</i>	6
	2.2 <i>Electrical Connections</i>	6
3	PHYSICAL DESCRIPTION	7
	3.1 <i>Principle of Operation</i>	7
	3. <i>Front Panel Controls and Indicators</i>	8
4	SYSTEM STARTUP	11
5	OPERATION & MAINTENANCE OF UNIT	12
	5.1 <i>General</i>	12
	5.2 <i>Calibration Procedure</i>	12
	5.3 <i>Ionization Tubes</i>	14
	5.4 <i>Troubleshooting Guide</i>	15
	5.5 <i>Troubleshooting Table</i>	17
6	SPECIFICATIONS	17
	6.1 <i>Electrical</i>	17
	6.2 <i>Mechanical</i>	18

1 INTRODUCTION

1.1 Disclaimer

These instructions are submitted with the implicit understanding that:

- 1.1.1 This manual is to guide the user of Bioclimatic equipment in the proper installation, operation and maintenance procedures to insure maximum equipment life with efficient operation.
- 1.1.2 The customer has assigned competent maintenance and operating personnel to the system described herein and will assume operational and maintenance responsibility upon start-up of the system.
- 1.1.3 The customer will read and thoroughly examine the foregoing instructions and will notify the seller of any points not fully understood, points of conflict or error.
- 1.1.4 The customer, in lieu of any notification to the contrary, has read and fully understands the operation of the System and is aware of the hazards of corrosion, abrasion and fire or explosion and shall take the necessary steps in the operation of equipment to control such hazards to the maximum extent possible.
- 1.1.5 Start-up assistance or field engineering service provided by Bioclimatic shall in no way relieve the customer of responsibility for the proper operation of the System.

IMPORTANT: Any modifications to the unit by unauthorized personnel will void ETL listing and factory warranty. The unit must be installed in accordance with the manufacturer instructions to preserve warranty and ETL label.

1.2 Receiving

Products leaving the Bioclimatic factory are inspected and in satisfactory operating condition. All equipment should be thoroughly inspected when received. Although all units are properly packaged, rough handling in transit can cause breakage. Any shortage or damage should be reported at once to the transportation company. Note the damage on the bill of lading before signing for the shipment. **No equipment may be returned to Bioclimatic without written authorization. Returned equipment sent without authorization will be refused and returned to sender.**

All products are shipped F.O.B. Bioclimatic warehouse. Responsibility for all equipment passes to the Buyer at the time equipment is loaded onto the carrier's truck.

1.3 Storage

If the RM-102D is not installed upon delivery, it should be stored in a cool, dry location. Do not stack any other equipment on top of the unit.

1.4 Warranty

THE SELLER WARRANTS THE EQUIPMENT AGAINST DEFECTIVE WORKMANSHIP AND MATERIAL FOR ONE (1) YEAR FROM DATE OF FACTORY SHIPMENT OR 15 MONTHS FROM COMMISSIONING, WHICHEVER OCCURS FIRST. IN THE FULFILLMENT OF ITS WARRANTY, THE SOLE OBLIGATION OF SELLER SHALL BE TO REPAIR OR REPLACE, AT ITS OPTION, F.O.B. ITS FACTORY, ANY PART OR PARTS WHICH ARE RETURNED F.O.B. ITS FACTORY, SHIPPING CHARGES PREPAID, AND WHICH AFTER INSPECTION BY SELLER ARE FOUND TO BE DEFECTIVE. BUYER SHALL NOTIFY SELLER OF DEFECT IN WRITING, PROMPTLY UPON DISCOVERY AND WITHIN THE WARRANTY PERIOD. THIS WARRANTY DOES NOT COVER DEFECTS CAUSED BY CORROSION OR NORMAL DETERIORATION; IT DOES NOT EXTEND TO CONSEQUENTIAL DAMAGE, LOSS OR DELAY ASSOCIATED WITH A WARRANTY DEFECT; AND IT DOES NOT COVER ANY COST OF LABOR, TRAVEL, OR OTHER EXPENSE ASSOCIATED WITH THE REPAIR OR REPLACEMENT OF DEFECTIVE PARTS. SELLER ASSUMES NO LIABILITY FOR PRODUCT LOSS OR OTHER CLAIMS WHATSOEVER ARISING OUT OF THE USE OR APPLICATION OF THE EQUIPMENT IN ANY OPERATIONS, WHETHER THE MACHINE IS USED ALONE OR IN CONJOINT USE WITH OTHER EQUIPMENT OR PROCESSES. NOTWITHSTANDING THE FOREGOING, SELLER'S WARRANTY OBLIGATIONS WITH RESPECT TO ANY ITEMS NOT MANUFACTURED BY SELLER SHALL NOT EXCEED THE OBLIGATIONS UNDERTAKEN BY THE MANUFACTURER THEREOF UNDER EXPRESS WARRANTY TO THE SELLER. THIS EXPRESS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES OF FITNESS OF THE MACHINE FOR ANY PARTICULAR PURPOSE.

THERE ARE NO OTHER REPRESENTATIONS, WARRANTY OF CONDITION IN ANY RESPECTS EITHER EXPRESS OR IMPLIED, STATUTORY OR OTHERWISE IN CONTRACT OR TORT, OTHER THAN WHAT IS STATED ABOVE.

THE SELLER SHALL NOT BE HELD LIABLE IN ANY WAY FOR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED.

THIS WARRANTY WILL NOT APPLY IF THE SELLER'S EQUIPMENT HAS BEEN DAMAGED DUE TO IMPROPER INSTALLATION, ALTERATION, ABUSE OR MISUSE, ACCIDENT, FIRE, FLOOD OR ACT OF GOD. FURTHER, THIS WARRANTY WILL NOT APPLY IF REPAIRS, REPLACEMENTS, OR ALTERATIONS ARE MADE BY OTHERS WITHOUT THE SELLER'S PRIOR WRITTEN AUTHORIZATION.

IN THE EVENT THE STATE IN WHICH THE EQUIPMENT IS INSTALLED DOES NOT PERMIT THE LIMITATION OR EXCLUSION OF IMPLIED WARRANTIES OR CONDITIONS UNDER GIVEN CIRCUMSTANCES, THE PROVISIONS OF THIS WRITTEN WARRANTY ARE IN ADDITION TO AND NOT A MODIFICATION OF THE STATUTORY WARRANTIES AND OTHER RIGHTS AND REMEDIES PROVIDED BY SUCH LAWS.

NOTE:

“ANY MODIFICATION TO ORIGINAL EQUIPMENT BY ANY COMPANY OR PERSON OTHER THAN THE MANUFACTURER WILL SERVE TO CANCEL AND VOID ALL OF THE SELLER'S

LIABILITY UNDER THE MANUFACTURER'S WARRANTY. ENCLOSURES CONTAINING ELECTRONIC COMPONENTS ARE NORMALLY SEALED BY THE MANUFACTURER TO PREVENT UNAUTHORIZED TAMPERING OR ADJUSTMENTS. ONLY AUTHORIZED SERVICE PROVIDES MAY BREAK SEALS TO COMPLETE CALIBRATION OR TO TROUBLE SHOOT THE UNIT. UNAUTHORIZED TAMPERING OR BREAKING SEALS WILL RELEASE THE SELLER FROM ANY FUTURE LIABILITY UNDER THE WARRANTY".

A comprehensive discussion of these and other features of the RM-102D will be given under Section 2 (INSTALLATION) and under Section 5 (OPERATION & MAINTENANCE OF UNIT).

2.1 Initial Setup

2.1.1 Aerotron[®] Bi-Polar Ionization Units

Unregulated Aerotron[®] units are designed for installation totally within the plenum of an air handling unit.

Install ionization tubes as follows:

- 2.1.1.1 Screw tubes into socket by holding the leaf spring clear of tube surface.
- 2.1.1.2 Turn tube into socket by the plastic base.
- 2.1.1.3 After tube contacts base, tighten an additional 1/8 to 1/4 turn. Do not use hand tools to tighten tubes, as they will damage the glass tubes.
- 2.1.1.4 Ensure leaf spring is in contact with outer mesh.
- 2.1.1.5 Close access door.

NOTE: The ionization tubes are fragile - Handle With Care.

2.1.2 RM-102D Unit

The RM-102D is designed for interior surface wall mounting only. **Never** install the RM-102D outside or in any location not covered by the environmental specification in Section 6. Choose a suitable location not more than 50 feet from the operating generators. Greater distances will require special interconnect wiring. Mount the unit on a wall or other vertical structure and install conduit as required.

2.2 Electrical Connections

NOTE: All primary electrical power connections to this unit must be made on the terminal block at the main 4x4 junction box (JB1) supplied on the equipment. Refer to the electrical diagram for specific connection points.

Remove the access cover from lower part of RM-102D exposing the main termination blocks TB1, TB2 & TB3. All electrical connections to the RM-102D are made at TB1, TB2, TB3 & TB4 (if necessary). Drawing 14506 is an illustration of the RM-102D including an exploded view showing the terminal identification.

WARNING!! Do not attempt to connect the RM-102D to electrical service unless you are qualified to do so. Electrical connections must be performed by a licensed electrician or other qualified personnel.

Multiple Bi-Polar ionization generators (up to 4) may be connected to a single RM-102D. Drawing 14010 is a block diagram of a typical RM-102D controlling four separate Bi-Polar ionization generators. The regulated power fed to the generators must conform to applicable codes specified by NFPA/NEC, (wiring in ducts, plenums and other air handling spaces) when the generator units are installed inside a Side Access Housing or other enclosed air handling unit plenum.

RM-102D TB1, TB2 & TB3 Connections

TB1 is designed to accommodate up to 14-gauge stranded electrical wire. Connections to electric service are made at TB1, terminals L, N & G. These terminals correspond respectively to Line (L), Neutral (N) and Ground (G) in Standard 125v, 2 ϕ , 3w grounding systems and Line 1 (L1), Line 2 (L2) and Ground (G) in 240v, 2 ϕ , 3w ground systems.

Caution: DO NOT attempt to connect the RM-102D across multi-phase 3 or 4 wire circuits or across any electrical service in which pole to pole voltage exceeds 240 volts rms.

Carefully strip insulation 3/8-inch from ends. Twist strands evenly and insert wire into access hole on TB2. Tighten clamp screw securely for each wire. On TB2, terminals marked L, N & G adjacent to the primary group are the system "load" terminals and follow the same configuration with respect to Line/Neutral/Ground assignments, as do the RM-102D TB1 terminals. Terminals marked "G" are common ground and should be externally tied to common system ground. Ground faults must not exist between these two ground terminals.

DO NOT integrate connections of dissimilar generators on TB2. It is important for proper system operation that load currents be equally distributed between the generators and no more than four generators be connected to the output terminal TB2.

Run a separate line (20 AWG stranded wire) from each Aerotron[®] generator, terminal to the corresponding terminal of TB3; e.g. generator #1 connected to TB3-1, generator #2 to TB3-2, etc. The numbered terminals 1-4 on TB3 are for fault sensing only. **DO NOT connect AC power wiring to TB3-1 through 4.**

3 PHYSICAL DESCRIPTION

3.1 Principle of Operation

3.1.1 RM-102D Remote Monitor

The RM-102D Remote Monitor is an electronically controlled power regulator and visual status indicator designed to operate in conjunction with single or multiple Bi-polar ionization generators. The RM-102D is used to simultaneously regulate the output and individually monitor the operating status of up to four power generators in a system.

The RM-102D Remote Monitor is an entirely self-contained unit designed for wall or surface mounting. Electronic circuitry and power regulation devices together with associated ionization level control and visual status indicators are all housed within an impact-resistant polystyrene enclosure. A transparent acrylic hinged door covers front panel controls and indicators. This cover affords protection against accidental or unauthorized adjustment of the power control while affording unobstructed visual access to the status indicator lights.

The RM-102D has three operating ranges, "Low" (under), "Normal" and "High" (overload). Each range is calibrated within specific limits of ionization as set by

the level control on the front panel. As the ionization control is advanced (turned up), ionization increases and the status indicators will switch in sequence from Low (Amber), to Normal (Green), to High (Red) thus providing a visual indication of level. Since the level control is continuously variable, system operators are free to make level changes within each operating range depending upon environmental or other operating considerations.

3.1.2 Aerotron[®] Bi-Polar Ionization Unit

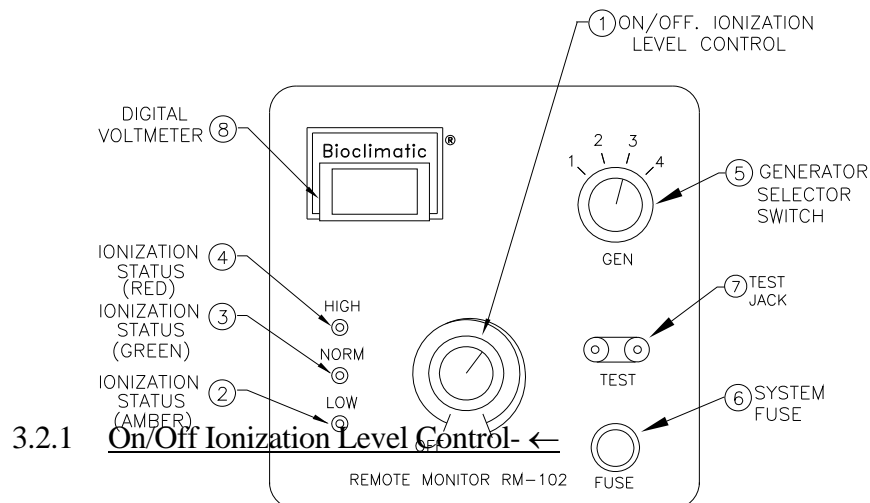
The Bi-polar ionization unit consists of a power generator and ionization tubes.

The power generator produces line synchronized bi-polar ionization of an air stream whose flow is perpendicular to the axis of the tubes. Thus, depending upon the volume of air, its velocity, chemical and biological content, ionization is adjusted by means of local control to affect particle discharge density sufficient to produce the desired volumetric air purification. Externally, the power generator includes ionization tube sockets, spring contacts, fuse, fuse holder, indicator lamp, test jacks, and mounting plate.

The ionization tube consists of two electrodes, a glass tube and a plastic base with a male threaded connector. The external electrode is crimped around the glass tube by the manufacturer, and under no circumstances should it be removed from the tube. The glass tubing material is fragile and should be handled with care. Cracked or damaged glass will cause a system malfunction and require tube replacement.

NOTE: Ozone is a by-product of any ionization process. When installed and operated in accordance with manufacturer instructions, the Bioclimatic System will not generate ozone in excess of the safety standards specified by OSHA and FDA. In most cases, there will not be chemically detectable levels of ozone generated.

3.2 Front Panel Controls and Indicators (Figure 1)



Turns system power ON, rotating (c/w max) this control sets system ionization level to the desired range as indicated by the ionization status indicators, ↑, → & ↓.

3.2.2 Ionization Status Lamps ↑, → & ↓

The three ionization status indicator lamps (LED's) provide a visual reference of how system generators are operating at the time of observation. These LED indicators must be observed in conjunction with the 4-position generator selector switch, °. The three status lamps convey information on the status of only one generator at a time as selected by °. This individual selective monitoring in the RM-102D differs from the multi-channel, non-switched operation inherent in the RM-600, where up to six individual generators are monitored simultaneously with a bank of three status lamps available for each generator.

The three LED lamps marked Low (Amber), Norm (Green), and High (Red) indicate three operating conditions. All generators in the system operate in response to the position set by the ionization level control. Each setting is **calibrated at the factory** within specified limits as shown in Table 1. Note the values shown for "Ionization Density" are based on average emission from a single F- type (IRF) tube.

Total ionization density can be **approximated** by multiplying the value shown by the total number of tubes in the system.

The Normal (Green) range is recommended for all standard ionization applications. Both the Low (Amber) and High (Red) indices represent abnormal operating conditions, hence they are referred to as "faults".

TABLE 1

<u>Range</u> <u>Indication</u>	<u>Indicator</u> <u>Light Color</u>	<u>Ionization Tube Potential</u> <u>VAC (rms.) 60 Hz</u>	<u>Operating Condition</u>
Low (fault)	Amber	1250 to 1500	Negligible ionization
Norm	Green	1500 to 2400	Normal ionization
High (fault)	Red	2400 to 2500	High voltage, O ₃ potential

. Data IM 5005 Ionometer IRF Tube @ 100 CFM

Note: Specific values may be estimated by extrapolating data from TABLE 1 and using the relative position of the indicator knob for the range involved.

3.2.3 Generator Status Selector Switch ° (Fault and Status Indication)

As noted above, the generator selector switch ° may be rotated to select individual inputs from four separate generators. The data from each is internally processed by

the RM-102D and activates the appropriate status lamp for the generator when selected. Hence by setting the switch to position No. 4, for example, the operating status of generator No. 4 is observed by the illumination of the appropriate status LED. If the switch is rotated starting at position No. 1 through position No. 4 (assuming a 4 - generator system), each time the switch is advanced numerically, the corresponding generator is monitored.

3.2.4 Fault Indicator

In a multi-generator system in which the gain control has been set to the "Green" or "Normal" range, all generators will display "Green" when selected, provided all generators are operating normally. If, during the process of switching the status selector, one or more of the status lamps shows Red or Amber, one can assume these generators are defective. Faults can be assumed to exist in generators which do not conform to the Green operating range set by the front panel gain control.

Therefore, the Red and Amber LED's when used in conjunction with the selector switch provide local visual fault detection for the system, provided the operating range is first set to the Normal (Green) range.

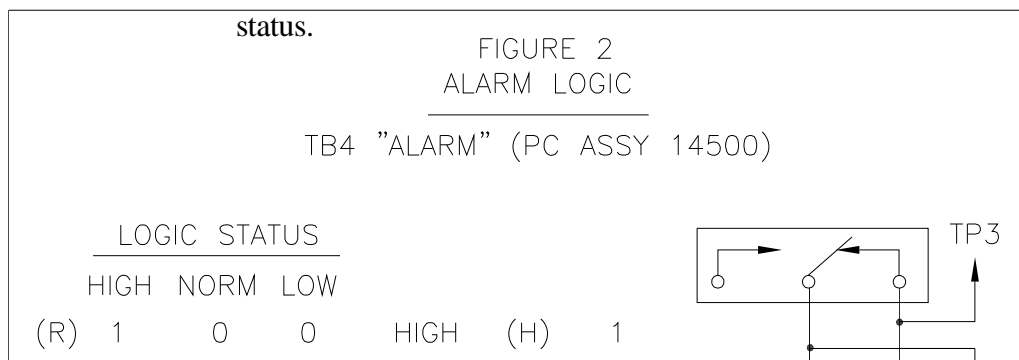
3.2.4.1 Fault Reporting Subsystem

All RM-102D Remote Monitors are equipped with an on board fault reporting subsystem.

The system is designed to monitor the operating status of the generator, detect a component or operational failure within the generator, and provide both local visual alarm indication and external buss interface for interconnection with building management systems or other remote monitoring systems.

3.2.4.2 Fault Alarm Logic (Figure 2)

The method employed to communicate fault information from that of the RM-102D Remote Monitor to the outside world is through "dry contact" indicated internally. When the unit is operating in the Normal range, alarm contacts remain open and circuit continuity remains open to terminals TP3 and TP4 (TB4). When either a high (red) or low (amber) fault occurs, the corresponding LED will illuminate and circuit continuity is terminated between terminals TP3 and TP4. Thus, a "fault" condition produces a contact connection between TP3 and TP4 while a "no fault" condition breaks the connection and returns the visual indicator to the normal (green) status.



3.2.4.3 TB4 Alarm Connections

Connections to building management system (BMS) are made at TB4, terminals TP3 and TP4 (ground if necessary).

3.2.5 Front Panel Fuse ©

This is the main system fuse. It protects the RM-102D power control circuitry **and** the electric service feeding **all** generators in the system. **DO NOT** substitute or jump this fuse. Replace only with the **exact** type provided by Bioclimatic.

3.2.6 Test Jack

The test jack provides a convenient way to measure the presence of ionization high voltage for each generator. Risk of shock and personal injury is eliminated during measurement because the test jack carries a proportionally derived but greatly reduced potential (less than 3.0 Volts) compared to the actual ionization potential shown in Figure 5 (Range & Status Calibration).

Figure 5 (Range & Status Calibration) also shows the relationship between ionization voltage and corresponding test jack voltage and the status of the tree range indicator status lamps.

3.2.7 Digital Voltmeter®

An important feature of the RM-102D with the digital voltmeter is direct reading test voltage value. The digital voltmeter is required to perform measurement to the fully specified accuracy decreasing the setting time. (Figure 4)

4 SYSTEM STARTUP

CAUTION!!! DO NOT energize the system without installing ionization tubes.

After the power connections and generator sense lines have been secured at TB1 and all generators in the system have been connected as illustrated in Drawing 14010, the system may be turned on.

Be sure that the generator status selector switch is set to position 1. Slowly, advance the gain control clockwise until the **Green** ionization status lamp illuminates. Check the range of this control and observe the point on the circular scale where the light switches to Amber (Low) and Red (High). These two switch points should correspond to dial settings of approximately 9 o'clock and 3 o'clock respectively.

Next, verify that all other generators in the system operate similarly. Switch generator selector to #2 then #3, etc..., and verify operation as explained above for generator 1.

Finally, the gain control can be set to any position, within any of the "Green" ranges consistent with environmental requirements. The power regulator circuit in the RM-102D will maintain correct operating conditions for all system generators. It is suggested that periodic inspection be made of each generator to determine that it is functioning normally within the established Green operating range. This is accomplished by simply rotating the generator selector switch and observing the LED status indicators. **All generators, when functioning normally, will display identical range indication regardless of the power control setting.**

5 OPERATION & MAINTENANCE OF UNIT

5.1 General

Should it become necessary to repair or replace the printed circuit board or component within the RM-102D enclosure, recalibration of the unit is required. Erratic operation of the status indicator lights for **all** generators throughout the three ranges is an indication of failure of the ionization unit. If this condition exists for only one generator and the remaining generators operate normally, it is highly probable that one generator is defective and the RM-102D needs no recalibration.

Figure 3 is an outline drawing of the RM-102D printed circuit board. There are four miniature trim pots located on the lower left hand portion of the circuit board. These are:

R7	-	Amber/Green Key
R9	-	Green/Red Key
R28	-	Low Limit Reg
R26	-	High Limit Reg

Note: R7 and R9 adjust the keying relays that switch the indicator LED's. R28 and R26 set the high and low voltage limits for the power regulator. The two functions while separate in their operation, are interactive in their initial adjustments. R-28 & R-26 must be adjusted before R7 and R9.

5.2 Calibration Procedure

CAUTION !!! Hazardous voltages are exposed during this procedure. Extreme caution must be exercised. Work should be performed by or under supervision of a licensed electrician or other qualified personnel.

- 5.2.1 Complete the installation of all equipment and secure all external wiring connections between all Aerotron[®] units and the RM-102D as shown in Drawing 14010. **DO NOT energize the system at this time.**
- 5.2.2 Remove any one tube from its socket and insert the **positive** end of a high voltage insulated test probe directly into the threaded center jack on the tube socket. Connect the **negative** lead to the associated stainless steel ground spring. The opposite end of the test probe should be connected to an AC voltmeter with a rating of 5.0 KV peak. Alternatively, a high-voltage multiplier probe, similar to Fluke, Model #80K-6 may be used in conjunction with a normal range AC voltmeter. In either case, observe proper safety precautions.
- 5.2.3 Open the front cover on the RM-102D and remove the four screws that secure the face plate and front panel assembly. The electronic component circuit board is now exposed.
- 5.2.4 Using a small blade screwdriver, position R-28 and R-26 to mid-range.
- 5.2.5 **Energize the system now** by clicking on the ionization level control knob. Do not advance control, leave it turned fully counter-clockwise.
- 5.2.6 With the system energized and the ionization level control set to minimum, carefully adjust R-28 until a reading of 1250 volts AC is obtained on the meter. This is the minimum operating voltage for all system generators.
- 5.2.7 Now, turn the ionization level control wide open to its maximum clockwise position and observe the reading on the AC voltmeter.
- 5.2.8 Adjust R-26 until a reading of 2500 volts AC is obtained. This is the maximum operating voltage for all system generators.
- 5.2.9 Check the low limit (1250 VAC) by returning the ionization level control to its minimum setting. Some additional adjustment may now be necessary. Re-adjust R-28 if necessary and repeat steps 7, 8, & 9 until the desired results are obtained. **R-28 and R-26 are properly set when the full excursion of the ionization level control from minimum to maximum produces a range of 1250 to 2500 ± 25 VAC.**
- 5.2.10 Using a small blade screwdriver, next, set the position of both R7 and R9 to mid-range. Note R7 and R9 are 10-turn trim pots, so count off 5 turns when making this initial adjustment.
- 5.2.11 Set the ionization level control to indicate a reading of 1500 VAC on the meter. This voltage corresponds to the fault threshold between "Low" and "Normal" ionization ranges as indicated by the respective front panel LED's. Adjust R7 until the LED switch point is found between Amber (Low) and Green (Normal). This

switch point will occur alternately within a 1 or 2 turn range of R7. The proper setting for R7 is midway within this 1 or 2 turn range.

- 5.2.12 Set the ionization level control to indicate a reading of 2400 VAC on the meter. This voltage corresponds to the fault threshold between "Normal" and "High" ionization as indicated by the respective front panel LED's. Adjust R9 until the LED switch point is found between Green (Normal) and Red (High). This switch point will occur alternately between a 1 or 2 turn range of R9. The proper setting for R9 is midway between this 1 or 2 turn range.
- 5.2.13 Now go back and recheck the switch point between Amber and Green, making sure that it occurs when the meter indicates 1500 ± 50 VAC. It may be necessary to read just as described in steps 10 through 13. **R7 and R9 are correctly adjusted when switching occurs at the voltages given above and in Table 1, Column 3.**
- 5.2.14 This completes all adjustments required to calibrate the RM-102D. Turn the system off. Re-position the front panel and fasten all hardware. Close the cover, re-install unit, and connect all wiring to appropriate terminals on TB1, TB2 & TB3. Re-attach the lower access cover.

The calibration procedure, steps 1 - 14 outlined above are summarized in Figure 5, Range & Status Calibration.

5.3 Ionization Tubes

The ionization tubes must be washed on a periodic basis to ensure operating efficiency. At minimum, they should be washed any time that the primary filter is serviced, but in no case, longer than one year. The tubes can be washed using the following procedure:

WARNING: All power to the ionization unit must be disconnected prior to undertaking any maintenance procedure!

- 5.3.1 Remove the tubes from the unit by lifting the leaf spring from the surface of the tube and unscrew each tube.
- 5.3.2 A solution of warm water and non-abrasive detergent can be used to clean the tubes.

NOTE: DO NOT wet the polycarbonate tube base under any circumstances. DO NOT submerge ionization tube in water.

!!! WARNING: SHORT CIRCUITING MAY OCCUR !!!

- 5.3.3 A soft nylon brush may be used to remove embedded material within the external electrode.

NOTE: Do not attempt to remove the tube's outer electrode.

- 5.3.4 Rinse with clean water after washing.
- 5.3.5 Replace ionization tubes only after they are completely dry. Pay special attention to removing moisture from the polycarbonate base.
- 5.3.6 Screw tube into socket by holding the leaf spring clear of tube surface. Turn tube into socket by the plastic base. After tube contacts base, tighten an additional 1/8 to 1/4 turn.

NOTE: Do not use hand tools to tighten tubes, as they will damage the glass tubes.

- 5.3.7 Make sure that the leaf spring is in contact with tube surface.

REMEMBER: The tubes are fragile - Handle With Care.

5.4 Troubleshooting Guide

Under normal operating conditions, assuming the adjustments described in Section 5.2 (Calibration Procedure) have been made, all generators will respond uniformly to changes in position or setting of the power control located on the front panel of the RM-102D. If the power control is set fully counter-clockwise, the Amber (Low) LED will light for each generator as selected by the channel selector switch.

As the power control is advanced (clockwise direction) the Green (Normal) Led will illuminate and the Amber light will extinguish. Additional advancement of the control will eventually cause the Red (High) LED to illuminate and Green (Normal) to extinguish.

Periodic inspection of the system generators is recommended to determine proper operation. The following procedure is suggested.

- 5.4.1 Open the lucite cover on RM-102D and reduce the power control to minimum (fully CCW).
- 5.4.2 Rotate generator selector switch (starting on channel #1) clockwise in numerical order, stopping on each channel number assigned to a functioning ionization generator. For example, if your system uses four ionization generators, you select channels 1, 2, 3 & 4.
- 5.4.3 Pause on each channel long enough to check the operation of the LED indicators, as the power control is rotated through its 270 degree rotation from minimum setting to maximum setting.

5.4.4 Selected channels should respond in a similar manner with LED's switching at approximately the same voltage for each channel as indicated in the following Table:

TABLE 2

Test (Feed Back) Voltage (V)

<u>LED</u>	<u>Actual Range</u>	<u>Recommended Working Range</u>	<u>FAULT</u>
Amber	1.41 – 1.70		0.05
Green	1.71 – 2.78	2.53 – 2.70	
Red	2.79 – 2.89		

Note the above table provides a qualitative check for determining uniform operation (relative performance) of each ionization generator in the system.

Quantitative data may be obtained by following the procedure authorized in Section 5.2, Calibration Procedure.

If all generators, as selected by the RM-102D channel selector switch on the front panel respond uniformly according to the above procedure, then all generators are assumed to be operating normally.

The RM-102D will detect and respond to a faulty ionization generator by showing a non-uniform LED indication for the faulty generator when that generator is chosen by the selector switch. For example, in a four-generator system, assuming a fuse is blown in generator No. 4, the Amber (Low) LED and voltmeter reading will illuminate throughout the entire range of the ionization gain control with the channel selector in position #4. Whereas, channels 1, 2 & 3 will **all** respond uniformly as described in Section 5.4.4. Thus, the "non-uniform" or non-conforming channel #4 generator is assumed to be defective.

The RM-102D can be useful in establishing preliminary fault conditions, as described above; however, it can not be relied upon to determine the exact nature of the fault; only that a fault exists and in a particular generator. This information however is sufficient to indicate the need for further troubleshooting. To help provide a more detailed guide for troubleshooting system problems, refer to the following table, listing fault conditions, probable cause and corrective action. Do not hesitate to contact the factory for assistance.

5.5 Troubleshooting Table

<u>Fault Condition</u>	<u>Probable Cause</u>	<u>Corrective Action</u>
1. LED's Amber All Channels	Gain control set too low All generator fuses blown	Raise Level Replace
2. LED's Red All Channels	Gain control set too high	Lower Level
3. Single Channel LED Amber	Shorted ionization tube Problem with electronic circuit board	Replace Contact Factory
4. Single Channel LED Red	Shorted ionization tube Problem with electronic circuit board	Replace Contact Factory
5. Flickering LED's Red, Green, Amber One or More Channels	Defective ionization tube in system Power line interruptions	Replace Check power line voltage 120 VAC
6. System Operating Normally, All Front Panel LED's Out	Defective PC Board	Contact Factory

Notice: Corrective action must be performed by qualified personnel only. Refer to manufacturer's recommended replacement procedures for ionization tubes.

WARNING: DO NOT ATTEMPT TO REPLACE ANYTHING WHILE POWER TO THE SYSTEM IS ON. DISCONNECT ALL POWER BEFORE SERVICING ANY UNIT.

6 SPECIFICATIONS

6.1 Electrical

Power Requirement:	115/230 volts AC, 1 phase 50/60 Hz
Power Consumption:	no load - 5.0 watts max. full load - 280 watts max.
Max Number Generators:	Four (4) 600-F4, Four (4) 1000-F6 or Four (4) 1200-F8
Voltage Regulator Range:	75 to 115/160 to 230 volts AC
High Voltage Range:	1100 VAC to 2700 VAC
Ionization Tube Range Voltages:	Low 1250 to 1500 VAC Fault Norm 1500 to 2400 VAC High 2400 to 2500 VAC Fault
Max Operating Temperature:	+80° C
Sensing Voltage:	1.3 to 3.3 volts AC

Indicators:
Power Regulator:

Hi-intensity LED's
Gate controlled triac

6.2 Mechanical

Height:	7.0 inches, 135 mm
Width:	4.5 inches, 114 mm
Depth:	4.0 inches, 102 mm
Weight:	2.0 lbs., 0.9 Kg
Mounting:	3 pt. (flat surface or walls)
Environment:	Indoor only