



Ionmaster[®]

Model 1000 User Manual

Patent Protected: US 10,794,863 B1



Ionmaster[®] Model 1000

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1.0 Safety

1.1 Safety Precautions

The following safety precautions should be observed before using this product and any associated instrumentation. There are situations where hazardous conditions may be present. This product is intended for use by qualified personnel who recognize shock hazards and are familiar with the safety precautions required to avoid possible injury. Read and follow all installation, operation, and maintenance information carefully before using the product. Refer to the manual as well as the data sheet for complete product specifications. If the product is used in a manner not specified, the protection provided by the product may be impaired.

Operators must use a grounding wrist strap when operating the device. One end of the cable should be grounded to your work surface and the other end should be strapped to your wrist to ensure proper usage. Before operating the instrument, make sure the Ionmaster Model 1000 is properly grounded as well. Inspect the connecting cables for possible wear, cracks, or breaks before each use.

1.2 Warning Notices

Warning notices alert you of potential damage that can occur when handling the device. There are four levels, each identifiable by the signal word used.

Signal word	Meaning
DANGER	Indicates a high level of risk which could result in death or serious injury.
WARNING	Indicates a medium level of risk which could result in death or serious injury.
CAUTION	Indicates a danger with a low level of risk which could result in minor or medium-severity injury.
IMPORTANT	Indicates a condition that could result in damage to property.



General warning



Shock



General caution



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1.3 Faults During Operation

⚠ WARNING: Operation with known damage may cause Ionmaster to fail, void warranty, or result in injury to operator.

- Regularly check device for visible damage such as broken or worn cables, broken mesh, housing damage, or power supply integrity.
- If faults occur, disconnect the sensor from the tablet.
- Do not continue to use devices that are damaged.

1.4 Modifications

Any unauthorized modifications to any component of the Ionmaster may impair safety, make the device inoperative, and will void manufacturer's warranty.

2.0 Introduction

NRD's Ionmaster Model 1000 is a sensor that offers continuous monitoring of ion balance and decay measurement and provides storage of real-time ionization data. The data allows the user to optimize an ionizer's location and direction, as well as providing crucial measurement data for insight on the effectiveness and maintenance of the ionizer. This manual will go into detail regarding the proper use of the sensor and the navigation of the user interface.

2.1 Features

The Ionmaster Model 1000 measures the ion density of an identified environment and then converts the data into a useable format. The resulting data is displayed, in an easy to read format on a tablet via the Ionmaster User Interface.

Features include:

- Ionizer balance measurement (Offset voltage) measured in Volts
- Real-time (+) positive and (-) negative decay time measured in seconds
- User Interface system
- Data graphical and chart display
- Data Storage



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2.2 Ionmaster Theory of Operation

The Ionmaster sensor's electronics and core are surrounded by a stainless steel grounded enclosure which serves as a faraday cage cancelling all fringe electric fields. The openings in the housing allow ionized gas to pass into the core region where ions can be measured.

This is accomplished by attracting ions to the core where charge is transferred to the sensor and recorded as volumetric charge density (Coulomb/m³). The volumetric charge density reading is used to calculate positive and negative decay times as well as balance voltage similar to what would be typically displayed on a charged plate monitor.

The Ionmaster Model 1000 decay times are calculated from ion density, as opposed to waiting for a decay cycle to complete. Decay times can be displayed very quickly (once per second); this higher resolution allows for subtle changes in decay times (ion density) that would otherwise go unnoticed during a charged plate monitor measurement.

2.3 General information

Unpacking and Inspection

After unpacking all items from the shipping package, check for any obvious signs of physical damage that may have occurred during shipping. Immediately, report any damage to NRD. Before removing the system from the package, observe the handling precautions discussed below.

⚠ Warning – Use the grounded wrist strap for ESD protection and follow all of the precautions to ensure reliable use.

- Always grasp the sensor by the handle.
- Do not disassemble any part of the sensor.
- Do not place any objects on the tablet touch screen and take caution to not impact the screen.
- When the device is not in used, store it in the original shipping package.



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3.0 Components

3.1 Package content

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The following items are included with every order:

- Sensor
- Interface box
- Tablet
- Banana lead to banana lead grounding cable
- Cat5e cable
- USB cable
- Certificate of Calibration
- User Manual

Optional Items/Accessories

- Carry Case
- Mounting Brackets

3.2 System Assembly (*will implement changes made from the committee*)

- To complete the setup, install all of the cables in manner described and shown. (Figure 3.2)
 - Connect the USB cable to the interface box and tablet.
 - Connect the ground cable to the interface box and ground referenced to the measurement area.
 - Connect the Cat5e cable to the interface box and the port on the sensor.



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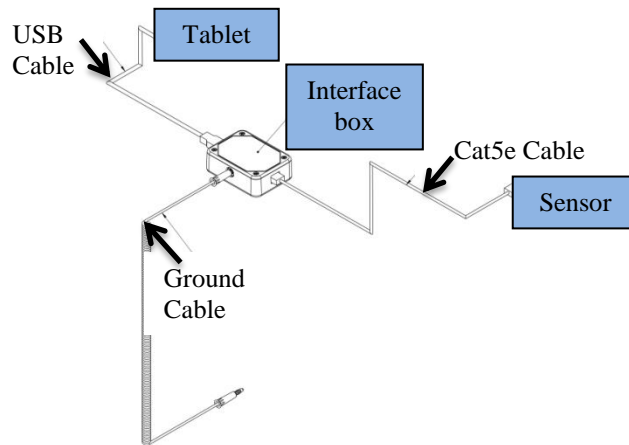


Figure 3.2 System Assembly

4.0 Navigating User Interface (UI)

4.1 Launching the User Interface

Once the Ionmaster Model 1000 is set up, the system is now ready to launch the user interface system. Double click the `ionmaster.exe` in file explorer to launch the program or click shortcut on the desktop's taskbar. (Figure 4.2) If the program was successfully launched, it will take you to the main screen (Figure 4.1). If there are issues getting to the screen, refer to Section 6 for troubleshooting.

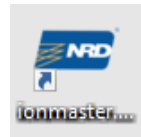


Figure 4.2 NRD Ionmaster shortcuts



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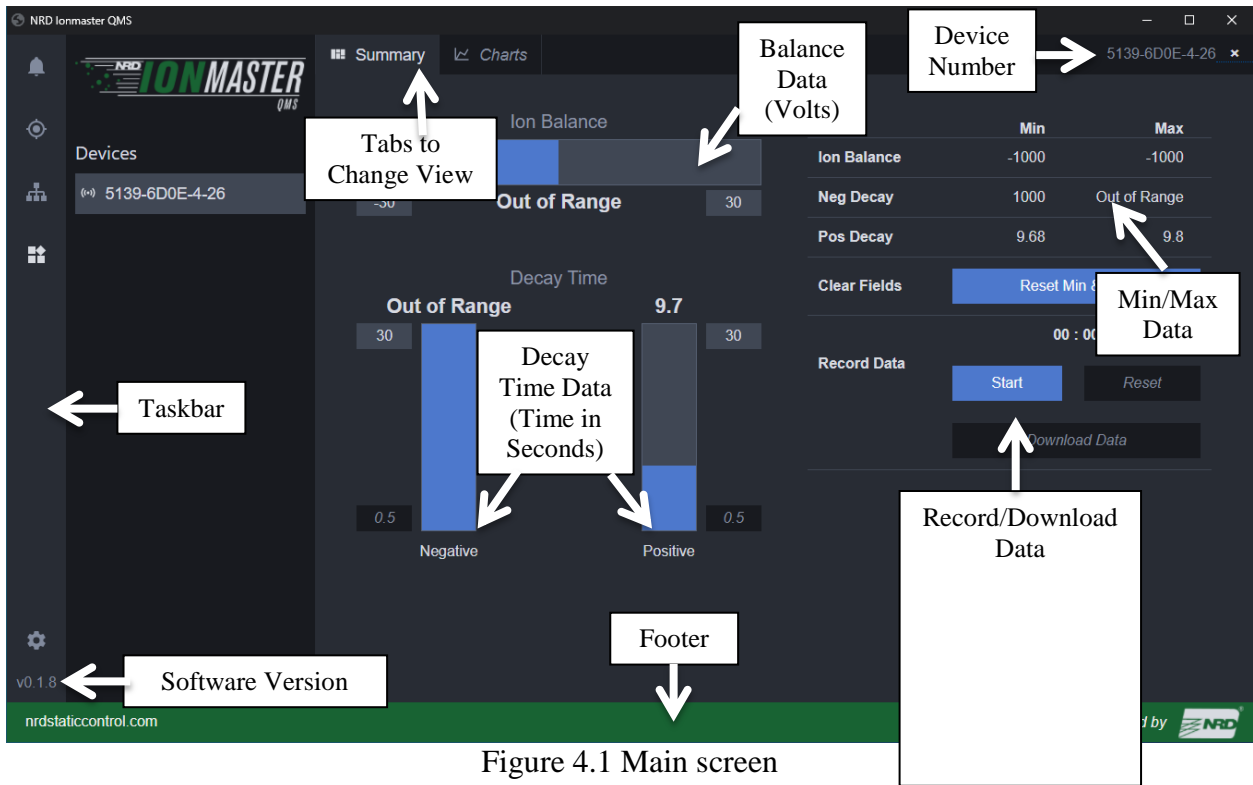







Figure 4.1 Main screen

4.2 Taskbar

The taskbar is aligned to the left side of the screen; it displays the user interface version of software and various icons that provide the user with additional information. Many of the taskbar features are to be used for future QMS system expansion and may not be used for standalone sensor use.

-  Notification Icon – Allows the user to receive notifications and updates for the system
-  Location Icon – Allows the user to view devices based on location
-  Controller Icon – Allows the user to view controller
-  Device Icon – Allows the user to view the quantity of device's connected and the tag number associated with it.
-  Settings Icon – Allows the user to hide/unhide the green NRD footer (Figure 4.3)



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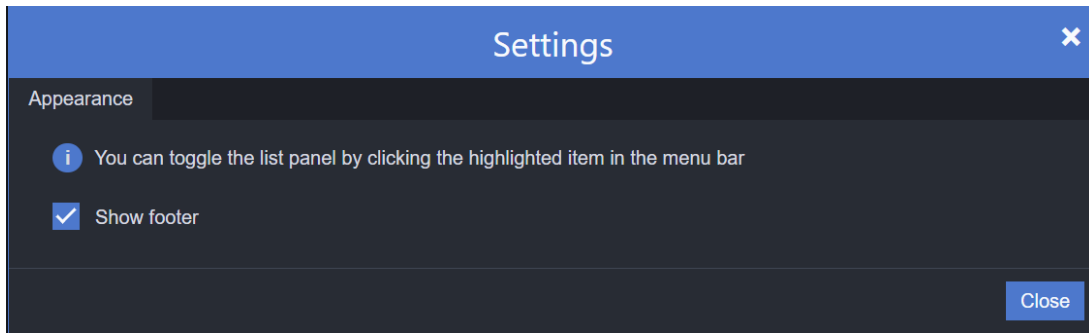


Figure 4.3

4.3 Toggle Summary/Chart View

The tabs that are shown in the red box (Figure 4.3) enables the user to easily transition between the default summary view (Figure 4.4) and the chart view (Figure 4.4). The summary view allows the user to visualize data in a bar graph format; it also allows the user to view & reset minimum and maximum data as well as record the data (Figure 4.4). Refer to sections 4.4 and 5.0 to learn more about the editing boxes and recording data functions.

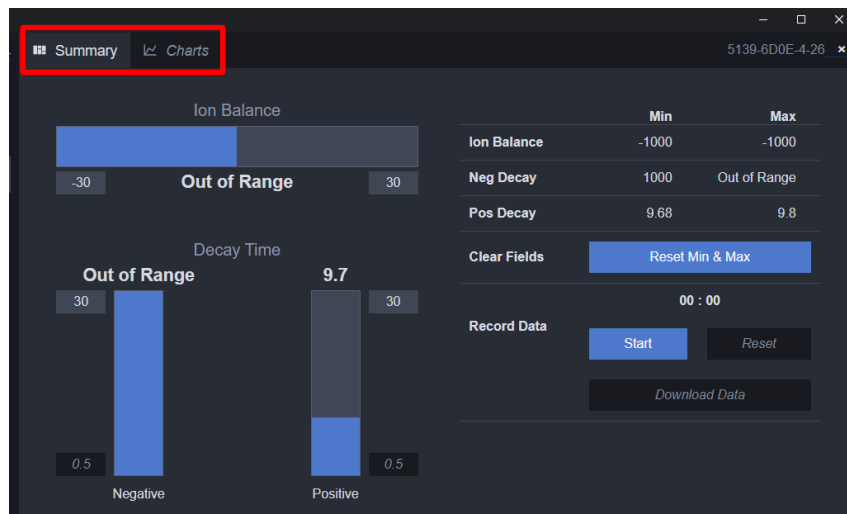


Figure 4.4 Summary View



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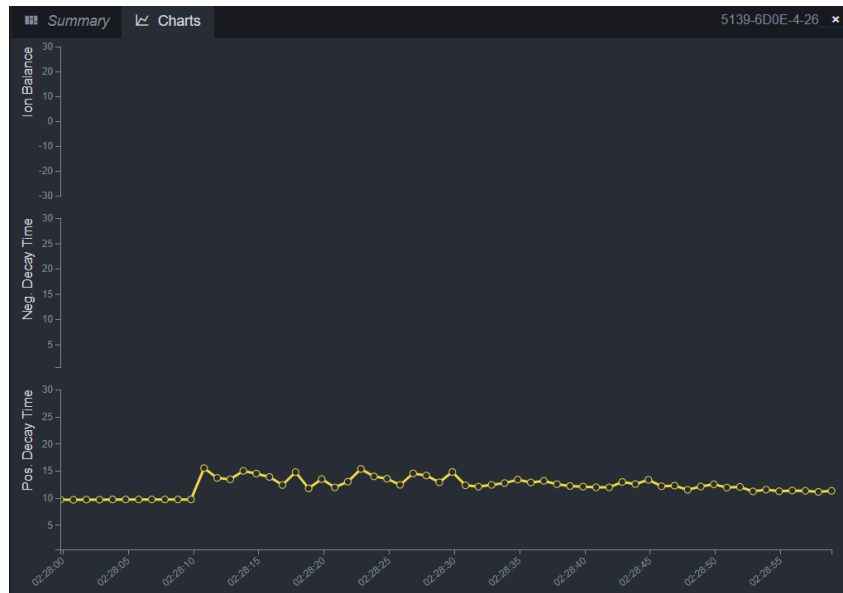


Figure 4.5 Chart view

*Tip – To view the value (y-axis) at a stamped time (x-axis), simply select the data using your finger (Figure 4.6).

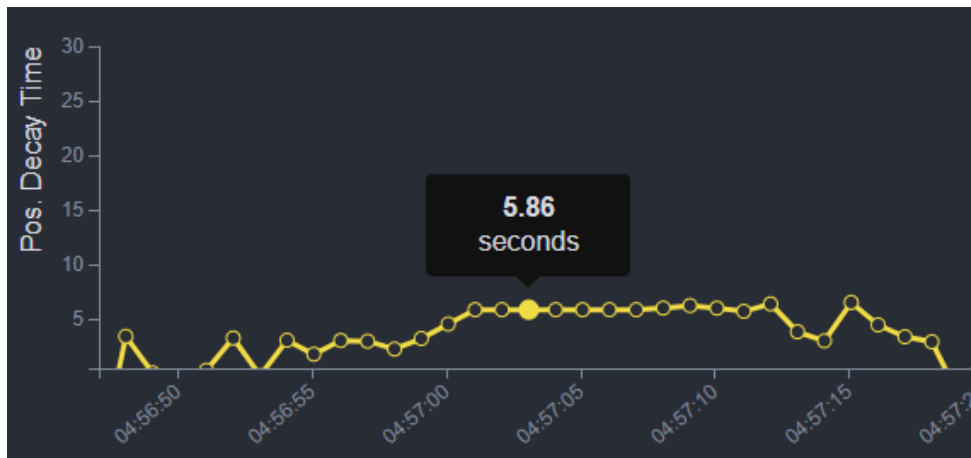


Figure 4.6 View chart's data points



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4.4 Editing Limits

Both the Ion Balance and Decay Time have min, max boxes that can be edited to meet your desired range (Figure 4.7). If data from the Ionmaster Model 1000 is out of the range from the set limits, then “Out of Range” will be reported. (Figure 4.7) The fields are not capable of exceeding the sensor’s specifications. The ion balance range is ± 30 V and decay times’ limit is 0.5 – 30 seconds.



Figure 4.7 Max/Min section

5.0 Monitoring and Recording Data

5.1 Ionmaster Initial Setup and Operation

NOTE: NRD recommends viewing the Ionmaster model 1000 demonstration video available at <https://nrdstaticcontrol.com/products/1000-ionmaster-ionization-monitor> .

Sensor setup steps:

- Power up the sensor, and then allow the electronics to run and warm up for a minimum of 10 minutes before monitoring or recording data.
- Place the Ionmaster 1000 in an identified environment for analyzing ionization. 18 inches is the recommended distance from the ionizer, this may vary. The Ionmaster 1000 requires a half foot of clearance away from the surface it is placed.
- Position the arrow on top of the sensor in the direction of the ionizing source, perpendicular to the ion stream. (Figure 5.1)



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Figure 5.1 Illustrates the arrow on the sensor. In this instance, the ionizing source is directly above the Ionmaster therefore the arrow is faced upward

- To ensure accurate readings, the Ionmaster model 1000 needs to remain close to motionless; do not have a shaky hand. This is easily achieved using brackets.
- The data needs to stabilize for approximately 5-10 seconds before recording. If ion balance, and decay times are not giving you steady numbers, the reading is invalid. If you view the data in the form of a chart, you should start to see the data form a flat line.

5.2 Recording data

To start recording data, touch the Start Button. (Figure 5.2)

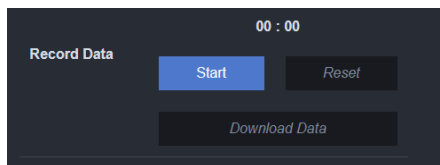


Figure 5.2 Start recording data

The start button will change into the Stop Button. (Figure 5.3) Press stop to end recording.

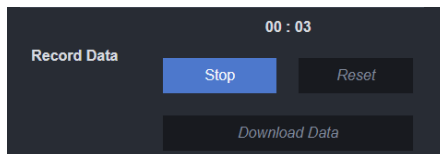


Figure 5.3 Stop recording data

Once the stop button is selected, the sample time is reported, and the “Download Data” and “Reset” button will turn blue allowing the user to save the data to an excel (.csv) file or clear the data stored and rerun measurement. (Figure 5.4)



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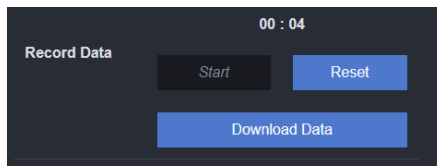


Figure 5.4 Download and reset data

Once you select “Download Data”, open up the file. It will show the recorded data showing the time stamped data points for ion balance, negative decay, and positive decay.

6.0 Troubleshooting

6.1 User Interface fails to launch

If the message “Finding devices” appears on the screen, that means there is a problem with the sensor communicating with the tablet (Figure 6.1). The first thing to check for is proper connections with the device as outlined below.

1. Ensure the Cat5e Cable is connected to the Ionmaster 1000 and the interface box. Go back to section 3.2 and reference the diagram. (Figure 3.2)
2. Ensure the Cable is connected to the tablet and the interface box. (Figure 3.2)
3. If this was the issue, the message will go away.
4. If the connections are correct and the message still appears; unplug and plug connections back, then exit and reboot the user interface.
5. If the message is still there, check to ensure the Ionmaster Model 1000 is receiving power.

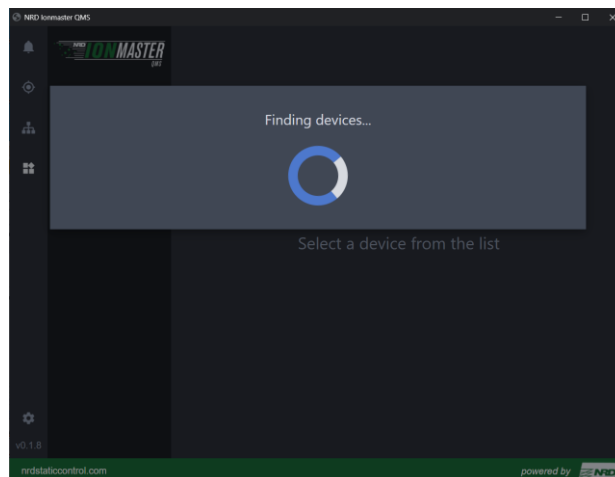


Figure 6.1 Finding device



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6.2 Checking power to the Ionmaster

- Ensure the Ionmaster Model 1000 has a solid green LED lit on the bottom side.
- A solid green LED ensures it is powered up correctly (Figure 6.2 A).

6.3 Checking communication to the Ionmaster

- There is an unlikely condition where the Ionmaster Model 1000 can be connected to the user interface but fail to produce data.
- To ensure the sensor is producing data, check that the yellow LED flashes while the program is running properly (Figure 5.2 B).

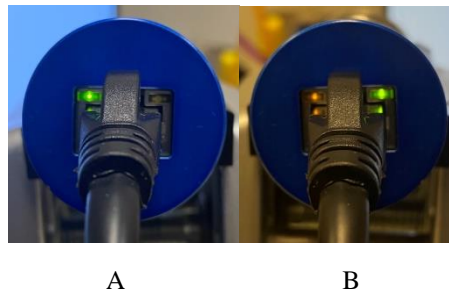


Figure 6.2 Check for Power/RS communication (sensor) Can you use a better photo that does not have crooked cable connections?

- If the problem persists with powering up the Ionmaster Model 1000 or communicating with the tablet contact NRD's support team for help.

6.4 Interface Box

Similar to the RS connection on the bottom of the Ionmaster Model 1000, the interface box has a solid-state green LED and a flashing yellow LED to indicate power and communication to the sensor (Figure 6.3). If green LED is failing to turn on, check proper connection to the tablet COM ports. Follow the steps below. (I numbered the steps here because it has to follow this order.

1. Open device manager
2. Click on view in the menu bar and select "show hidden"
3. Locate ports (COM & LPT)
4. Check if the COM port is recognizing the interface box by unplugging the cable and plugging it back in.
5. If the computer doesn't recognize it, the usb cable needs to be replaced.



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If you are able to see the green LED (Figure 6.3 A), but fail to communicate, check for the flashing yellow LED on the Interface box (Figure 6.3 B). If it doesn't light up, then the USB cable may need to be replaced.

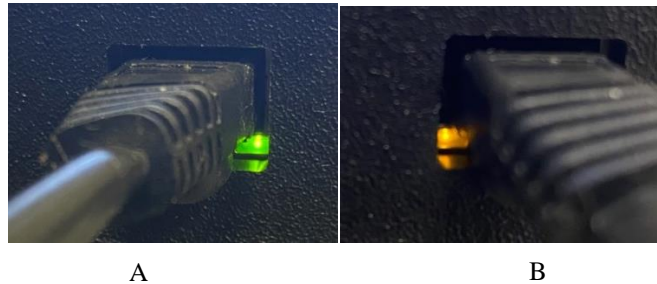


Figure 6.3 Check for Power/RS communication (Portable Interface Box)

6.5 Sensor Outside of Ion Stream

If you are seeing “Out of range” on the User Interface, it is possible the sensor is not perpendicular to the ionizer or air-stream from an air assisted ionizer. You will need to adjust the placement of the sensor. Check the direction the arrow is facing the ionizer, and check the direction of the ionizing source.

7.0 Maintenance

To maintain a properly functioning Ionmaster Model 1000, some basic maintenance is required:

- The sensor must be stored in a clean environment when not in use.
- The core of the sensor must be kept free of debris, dust, and films therefore it must be cleaned periodically with oil and contaminant free compressed air only.
- The Ionmaster Model 1000 needs to be calibrated by a qualified technician once a year to ensure specified performance. Calibration should only be conducted by NRD LLC.
- Firmware updates for the sensor will be available on the NRD secured web portal. An email will be sent to the registered user of the sensor when updates occur.



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8.0 LIMITED WARRANTY

Limited Warranty:

Seller warrants that the Goods manufactured by Seller will be free from defects in workmanship and will conform to the specifications under which such Goods are sold at the time of shipment under normal use and regular service and maintenance for one year from the date of manufacture by Seller.

The warranties set forth are the only warranties given by Seller with respect to the Goods and are made in lieu of and exclude all other warranties, express or implied, arising by operation of law or otherwise, including without limitation, merchantability and fitness for a particular purpose whether or not the purpose or use has been disclosed to Seller in specifications, drawings or otherwise, and whether or not Seller's Products are specifically designed and/or manufactured by Seller for Buyer's use or purpose. The warranties given herein do not extend to any losses or damages due to misuse, accident, abuse, neglect, negligence (other than Seller's), unauthorized modification or alteration, use beyond rated capacity, environmental conditions, improper installation, repair, handling, maintenance or application or any other cause not the fault of Seller. To the extent that Buyer or its agents have supplied specifications, information, representation of operating conditions or other data to Seller in the selection or design of the Goods and the preparation of Seller's quotation, and in the event that actual operating conditions or other conditions differ from those represented by Buyer and determined detrimental to the Goods by Seller, all warranties contained herein shall be null and void.

The physical property values given in Seller's product technical data sheets are typical values only and such values do not represent, and are not construed as product specifications. If within 30 days after Buyer's discovery of any warranty defects within the warranty period, Buyer shall notify Seller thereof in writing Seller shall, at its option and as Buyer's exclusive remedy, repair, correct or replace per its return policy, or refund the purchase price for, that portion of the Goods found by Seller to be defective. Failure by Buyer to give such written notice within the applicable time period shall be deemed an absolute and unconditional waiver of Buyer's claim for such defects. Advance written permission to return Goods must be obtained from Seller. Such Goods must be shipped transportation pre-paid to Seller. Returns made without proper written permission will not be accepted by Seller. Seller reserves the right to inspect Goods prior to authorizing return. Goods repaired or replaced during the warranty period shall be covered by the foregoing warranties for the remainder of the original warranty period or 90 days from the date of shipment, whichever is longer. Buyer assumes all other responsibility for any loss, damage, or injury to persons or property arising out of, connected with, or resulting from the use of Goods, either alone or in combination with other products/components. Pre-Production (prototype, engineering verification test, or design verification test) units are sold "where is, as is, with all faults" without warranty of any kind, express or implied, including, without limitation, implied warranties of merchantability or fitness for intended purpose.



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Limitation of Liability:

The sole and exclusive remedy for breach of any warranty hereunder (other than the warranty provided under "Limited Warranty") shall be limited to repair, correction or replacement, or refund of the purchase price. Seller shall not be liable for any damages caused by delay in Seller's timely performance to supply the Goods to Buyer. In no event, regardless of the form of the claim or cause of action (whether based in contract, infringement, negligence, strict liability, other tort or otherwise), shall Seller's liability to Buyer or to Buyer's customers and end users, exceed the price paid by Buyer for the specific Goods provided by Seller giving rise to the claim or cause of action. Buyer agrees that in no event shall Seller's liability to Buyer or its customers and end users, include any special, incidental, consequential or punitive damages. The term "consequential damages" shall include, but is not limited to, loss of anticipated profits, business interruption, loss of use, revenue, reputation and data, costs incurred, including without limitation, for capital, fuel, power and loss or damage to property or equipment. It is expressly understood that any technical advice furnished by Seller with respect to the use of the Goods is given without charge, and Seller assumes no obligation or liability for the advice given, or results obtained, all such advice being given and accepted at Buyer's risk. Seller's aggregate liability for any and all claims, liabilities, expenses, and all other damages or remedies arising under these terms, whether such claims are in contract, negligence (which for avoidance of doubt will include willful misconduct and gross negligence), or other tort, strict liability, warranty, indemnity, or other type of liability, shall in no event exceed ten percent (10%) of the trailing twelve (12) month revenue with Buyer.

Patents and Copyrights:

Seller warrants that the Goods sold, expressly excepting any Goods made for Buyer according to Buyer's specifications, do not infringe any valid patent or copyright in existence in the region in which Seller does business, as of the date of shipment. The Ionmaster Sensor is protected under Patent Number US 10,794,863 B1. All rights are reserved. This warranty is given on the condition that Buyer promptly notifies Seller of any claim or suit involving Buyer in which such infringement is alleged and cooperates fully with Seller and permits Seller to control completely the defense, settlement or compromise of any such allegation of infringement. Seller's warranty as to utility patents only applies to infringement arising solely out of the inherent operation according to Seller's specifications and instructions of such Goods. In the event such Goods are held to infringe such a patent or copyright in such suit, and the use of such Goods is enjoined, or in the case of a compromise or settlement by Seller, Seller shall have the right at its option and expense, to procure for Buyer, the right to continue using such Goods, or replace them with non-infringing Goods, or modify same to become non-infringing, or grant Buyer a credit for the depreciated value of such Goods and accept return of them. In the event of the foregoing, Seller may also, at its option, cancel the agreement as to future deliveries of such Goods, without liability. In no event shall Seller be liable for any incidental, consequential or punitive damages.



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