



9000-Z1 DustCount® IS

User Manual (ISEx)

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For DustCount IS Firmware 7.1.x, User Interface 1.4.x.

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1 Introduction

1.1 Device Overview

The DustCount 9000-Z1 (“DustCount IS” throughout this document) measures the ambient level of dust particles in real-time. The DustCount IS has intrinsic safety protection, designed for specific hazardous, explosive environments. The DustCount IS can be easily identified by its yellow bezel label, which distinguishes it from the DustCount 9000-Z2, which has a black bezel and is only certified for non-hazardous environments. This User manual is for the DustCount IS only.

The DustCount IS unit detects and counts particles and displays their mass concentration in mg/m³ (factory default). It also provides real-time information on the mass concentration distribution over the PM_{2.5}, respirable, PM_{10.0} fractions of the particle size range.

The DustCount IS unit also has a sample collecting filter, enabling post-measurement dust content analysis and total dust mass determination for each test period.

The DustCount IS unit also provides user the ability to enter gravimetric and density information into the device via the DustCount User Interface (UI).

The DustCount User Interface (UI) runs on a PC which has Windows 7 Service Pack 1 (SP1) or on a MAC which has OSX 10.11 or newer operating system. It connects to the DustCount IS Unit via USB or Bluetooth. The UI allows the user to easily configure the DustCount IS and download test results for post-processing and display.

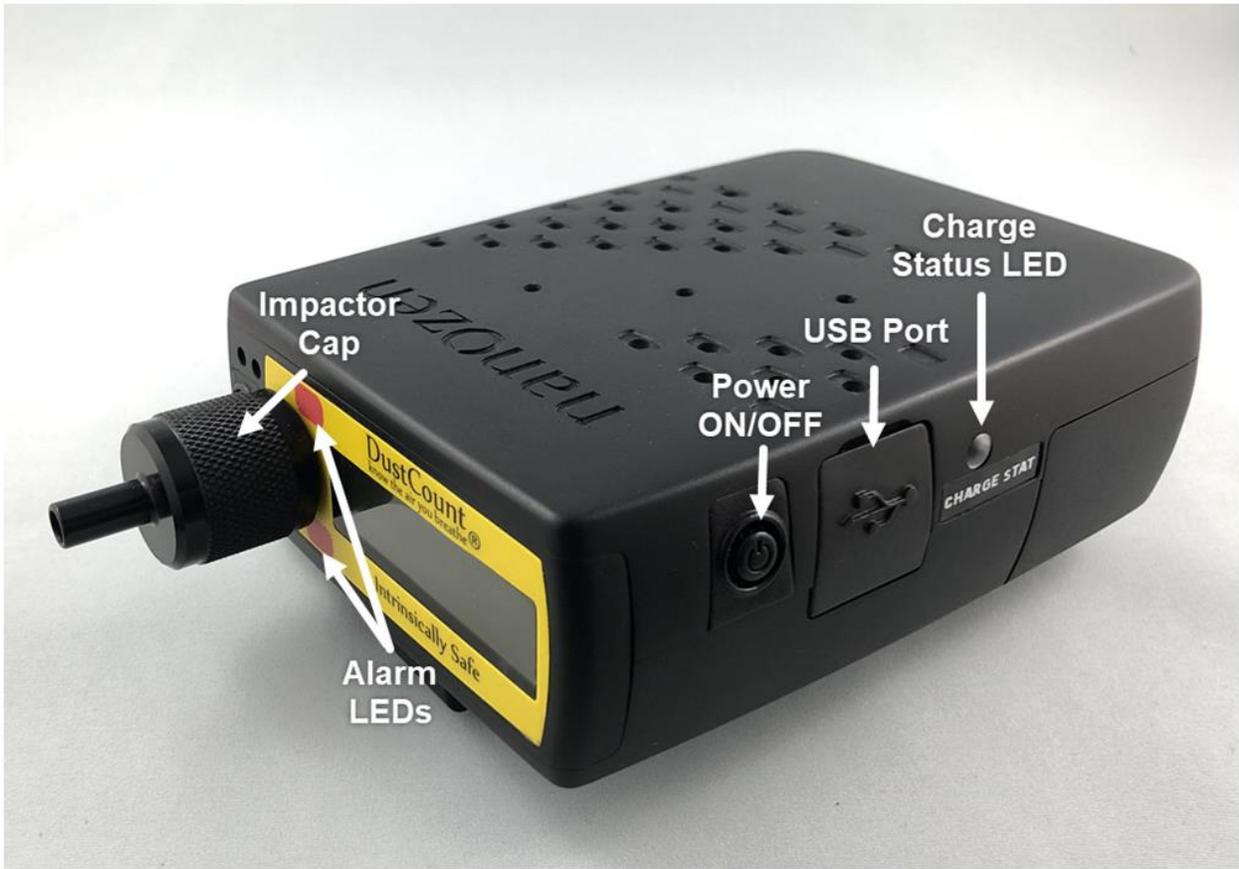
The DustCount IS is certified as Intrinsically Safe hazardous environments where the air contains the following substances all of the time:

- Carbonaceous Dust (such as coal dust)
- Coal Mine Firedamp (methane and other explosive vapors from coal mines)
- Other explosive carbon-based dust. (flour, wood, plastic, etc.)

Caution: The DustCount IS is not certified to be Intrinsically Safe where the air contains combustible quantities of the following substances at any time:

- Combustible metal dust
- Acetylene, hydrogen, ethylene
- Methane and propane unless they appear as part of mine firedamp.

See the label on the back of the DustCount IS, indicating its safety certification. It is incumbent on the user to ensure that the unit’s certification is accepted by the jurisdiction or organization in which it is used.



1.2 Contents of the Box

The DustCount IS unit come in various kits, from 1 to 5 units per kit. Each kit is equipped with the required ancillary components. Please refer to the packing slip of your kit for a list of the components included.

2 Getting Started

2.1 Out of the Box

- The DustCount IS unit is shipped with the battery installed and connected. If the battery is disconnected (due to shipping regulations), re-connect the battery as shown in **Section 4.1**.
- Turn on the DustCount IS by pressing the power push-button switch on the side of the unit. The screen should illuminate, and the air pump should start within a few seconds.
- Batteries are shipped with less than 100% state-of-charge. Charging to 100% is recommended prior to further use.

2.2 Charging

- To charge the battery, remove the battery charger from the box, and plug it into the mains. Connect the charger to the DustCount IS using the USB cable provided. The DustCount IS USB port is on the side of the unit. The charger accepts 100-240 V_{ac} at 50/60 Hz.
- To ensure that the batteries are charging, turn off the DustCount IS, and wait for the red light on the side of the unit to turn green, indicating that full charge has been reached. *Note: charging from 70% to 100% should take about 2 hours if the DustCount IS is off.*

2.3 Cleaning the Inlet

If the DustCount IS has been exposed to high dust concentrations for prolonged periods, its inlet channel should be cleaned. A small percentage of dust can accumulate on the walls of the inlet channel over time. To ensure accuracy, these deposits should be removed by the following cleaning procedure. It is recommended to clean the inlet when performing impactor plate maintenance. For this procedure, you will need a can of compressed-gas duster with a flexible tube less than 3mm in diameter. A keyboard duster from an office supply store works well.

1. Ensure that there is a filter in the cassette.
2. Remove the impactor cap and the impactor plate assembly.
3. Turn the unit on.
4. Insert the tube about 2cm into the inlet of the impactor base and spray a half second burst of compressed air.
5. Observe a burst in dust concentration reported on the LCD. This is an indication that lodged dust has been released.
6. Repeat steps 4 and 5 several times or until the concentration bursts seen on the LCD subside.



2.4 Prepping the Impactor

The DustCount IS unit comes equipped with a particle impactor installed inline at the inlet. This allows the DustCount IS unit to measure dust mass concentrations according to the standard that the impactor was designed for (NIOSH 4 um respirable exposure guidelines, or EPA PM 2.5, PM 10). The impactor plate comes oiled from the factory, but to operate properly, the impactor plate must be cleaned and have its oil replenished on a regular basis. Please refer to **Section 5** for the details on the Impactor kits available for the DustCount IS unit.

2.4.1 Cleaning the impactor

1. To access the impactor plate, the impactor cap must be removed. Rotate the cap counter-clockwise until it is fully unscrewed and pull it away from the DustCount IS unit to remove it, see **Figure 1**.
2. Separate the impactor plate from the plate holder by pulling the two pieces directly apart, see **Figure 1**.
3. Clean the impactor plate by using an alcohol wipe or similar fiber free cloth to brush away any accumulated particulate. See **Figure 2**. Alcohol wipes are included in the kits for cleaning the impactor parts.

2.4.2 Oiling the Impactor

1. Use the Impactor Oil Applicator to apply one drop of oil to the impactor plate, see **Figure 4**. Let sit for 30 seconds allowing the oil to disperse into the impactor plate. **DO NOT PUT MORE THAN ONE DROP AT A TIME.**
2. If there is no obvious excess oil pooled on the collection plate repeat step 1 until there is. This ensures that the plate is fully impregnated with oil.
3. Use a clean fiber free cloth to dab/wipe off excess pooled oil on the plate or any surrounding plastic **Figure 4**.
4. Insert the impactor plate back into the holder by pressing the two pieces together using the orientation seen in **Figure 5**. Twisting while pushing the two pieces together can help get a good seat between the pieces. **ENSURE THE PIECES ARE PRESSED FULLY TOGETHER AS DEMONSTRATED IN Figure 5.**
5. While keeping the DustCount IS in an upright position, place the plate holder/ impactor plate combo into the impactor base, **Figure 6**. Screw the impactor cap onto the base ensuring the cap screws all the way down. **DO NOT OVER-TIGHTEN.**



Figure 1 Impactor Assembly: Impactor Cap, Impactor Plate Holder and Impactor Plate.

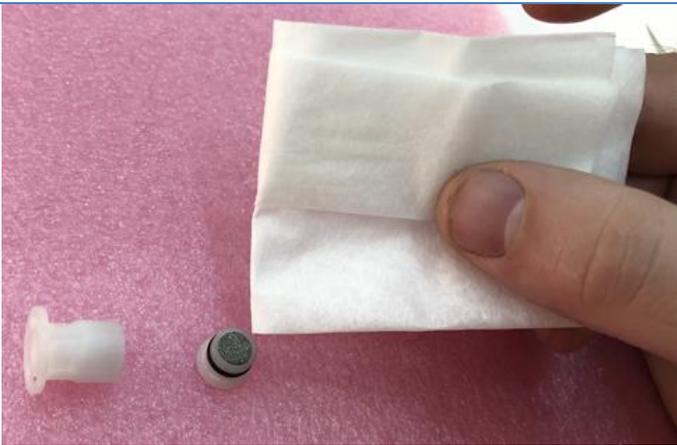


Figure 2 Cleaning Impactor Plate



Figure 3 Impactor Oil.

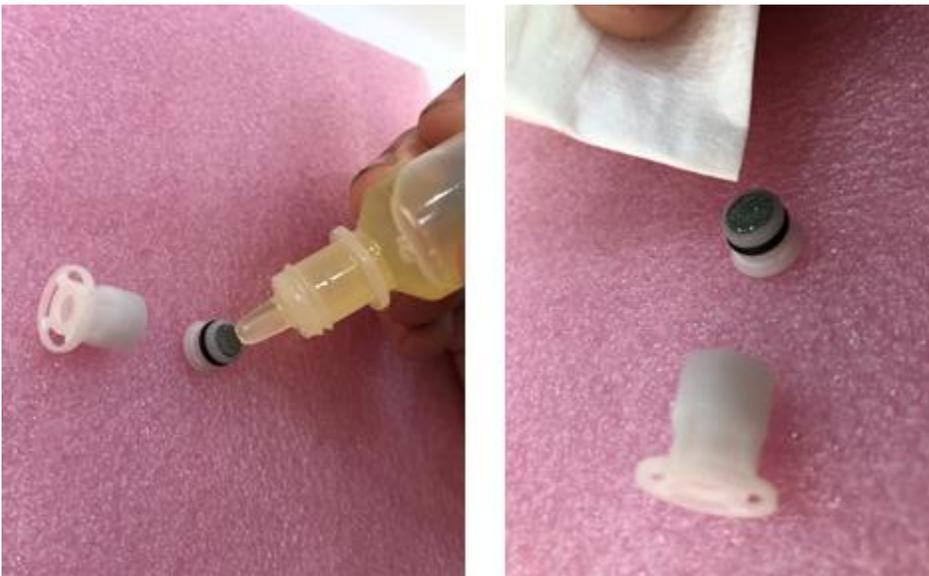


Figure 4 Use the Impactor Oil to apply one drop of oil to the Impactor plate. Wipe away excess oil.

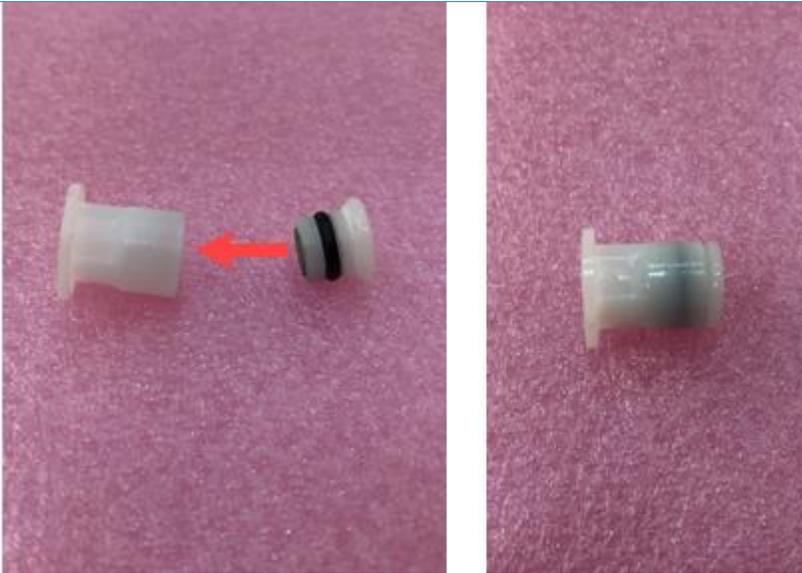


Figure 5 Insert Impactor Plate into Impactor Plate Holder.



Figure 6 Insert Impactor Plate holder assembly into Impactor base and screw Impactor Cap onto the base.

2.5 Validating DustCount IS Unit Prior to sampling.

Prior to sampling, it is common procedure to validate that a particle detector is reading zero under clean-air conditions. A HEPA filter is used to create these conditions. To ensure that the HEPA filter can provide clean air, it is best to perform the following test in a relatively clean environment, such as an office with $<0.01 \text{ mg/m}^3$ dust concentration.

1. Use a piece of the supplied anti-static tubing to connect HEPA filter to the DustCount IS unit's input.
2. Put one end of the tube on the outlet-barb of the HEPA filter, and the other end on the input of the impactor. Double check that the HEPA filter flow direction is correct. See **Figure 7**.

3. Turn on the unit and let it go through its calibration procedure. With the logging period set to the one-minute default value, the unit's Average mass concentration (AvMC) readings on the LCD should settle to less than 0.001 mg/m³ within 2 minutes. The per-second mass concentration (MC) readings on the LCD should be 0.0 mg/m³, but sporadically higher readings are normal.
4. Further validation can be done by ensuring that the average particle count-per-minute is less than 300 within 2 minutes of starting the HEPA test. Particle count information can be read from the UI. See **Section 3.3** for using the User Interface.
5. The DustCount IS's function with clean air has now been validated.
6. If the concentration and counts are not below the above-specified range, clean the impactor and try the above procedure again. If they are still not low enough, return the unit for maintenance.



Figure 7 HEPA filter connected to the DustCount IS input

2.6 Performing a Gravimetric or Sample Test

- The Cassette comes with a fiber support backing, and a PVC filter with 5-micron pore size to protect down-stream channels from dust. This filter may need to be changed periodically. The unit will raise a filter alert when the filter should be replaced. If the protection filter becomes clogged to the point that it needs replacing, a low flow alarm (FLOW) will appear on the unit's LCD.
- To perform a gravimetric or sample test, remove the protection filter and install a 25mm Teflon® (PTFE) filter with 2 µm pore size, or a Poly Vinyl Chloride (PVC) filter with 5 µm pore size (see **Section 2.9**).

2.7 Using with Default Settings

- To use the DustCount IS unit with the default settings, simply turn it on and commence testing. The default settings are for Arizona Road Dust, 1-minute logging period, and a concentration alarm threshold of 0.05 mg/m³.

2.8 Configuring for Other Test Settings

- The user can reconfigure the device with other settings via the User Interface. See **Section 3.3** for using the UI to re-configure the DustCount IS unit with other test settings.

2.9 Installing and Removing the Filter

- The DustCount IS unit has a Cassette for a 25mm filter disc. Any air that is drawn into the instrument passes through this filter. Installing a 25mm filter disc will allow dust to be collected for post analysis and weighing.

2.9.1 Removing the Filter

1. Before removing the filter, turn on the DustCount IS unit. Use the 'System Air Purge' function under User Settings tab of the UI software this will pull any loose dust onto the filter.
2. Turn the unit off.
3. Turn the button cover on the side of the unit 90° counterclockwise. This cover holds the filter Cassette in place, see **Figure 8**.
4. Pull the cover out of the housing to expose the filter Cassette, see **Figure 9**.
5. Slide the filter Cassette out of the cover. See **Figure 10**.
6. Pull the two halves of the filter Cassette apart to open. See **Figure 11**.
7. Slide the filter out of the cavity. See **Figure 12**. Remove the filter with tweezers, being careful not to cause any collected dust to come off the filter.
8. Slide the fiber filter support out of the cavity. See **Figure 13**.
9. Follow steps in **Section 2.9.2** below to reinstall a new filter.
(If lab analysis is to be performed, cassette sleeves are available for cassette transport.)



Figure 8 Turn filter Cassette cover 90° with flat screwdriver or coin.

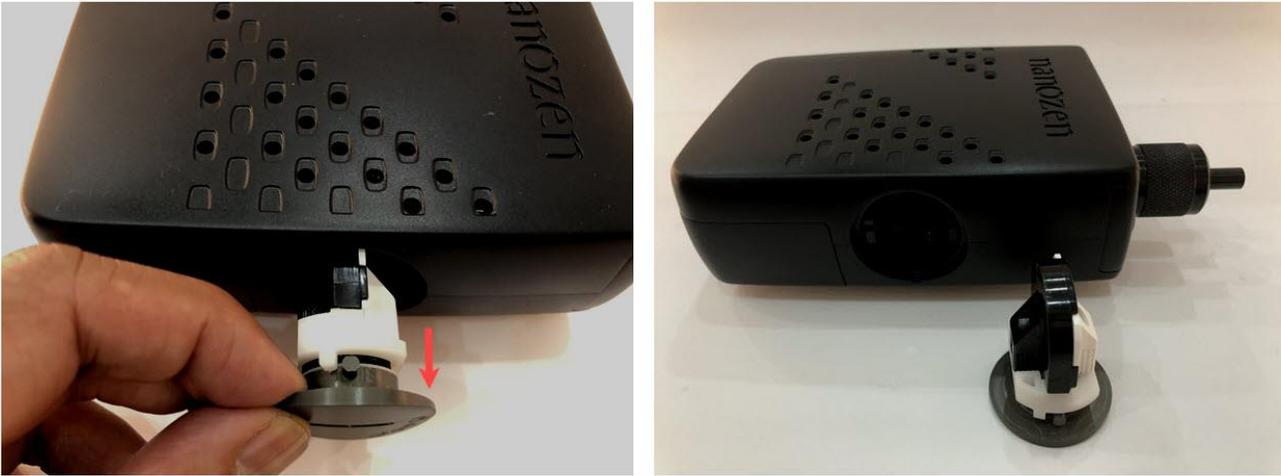


Figure 9 Extract filter Cassette by pulling on Cover

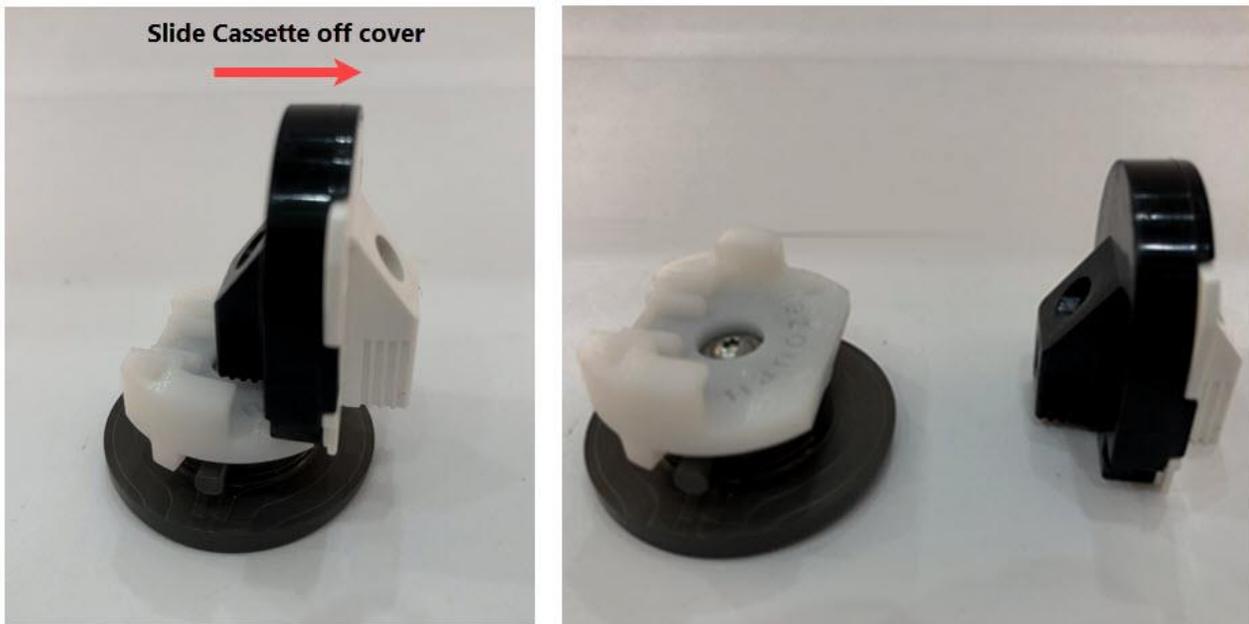


Figure 10 Slide filter Cassette off filter Cassette cover

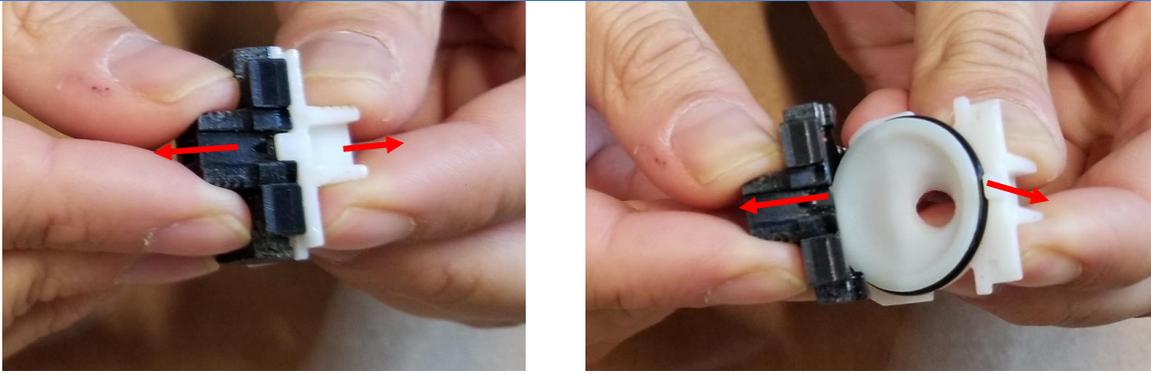


Figure 11 Pull the Filter Cassette Halves Apart to Access Filter



Figure 12 Filter Exposed for Removal. Slide Filter Out of Cavity with Tweezers

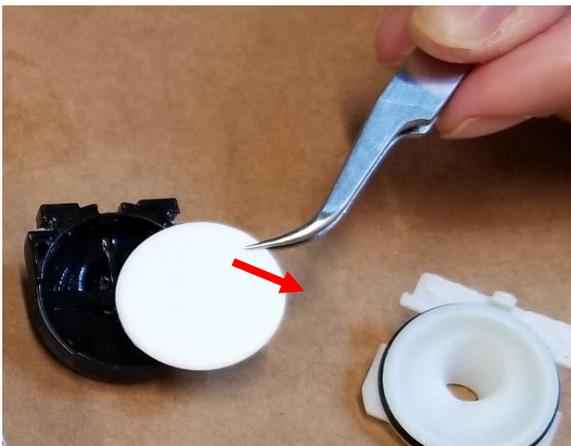


Figure 13 Remove Filter Support with Tweezers

2.9.2 Installing a New Filter

1. Remove the old filter as described in **Section 2.9.1** above.
2. Clean the inside of the cassette with isopropyl alcohol on a fiber-free applicator, then spray with clean compressed air.
3. Install a fiber filter support into the empty black half of the cassette. A Zefon FSP25 25mm Cellulose Support Pad is shown here, but any pad with the same thickness and diameter will work. See **Figure 14**.

4. Use tweezers to place the 25 mm sampling filter in the cavity. Even if sampling is not needed, install a 25 mm PTFE or PVC filter with 5-micron pore size. This filter will keep downstream channels clean. If this filter eventually becomes clogged, the DustCount IS unit will give a low-flow alarm (FLOW ALM), and the filter will need to be replaced. See **Figure 15**.
5. Reassemble the filter Cassette as shown in **Figure 16**.
6. Press the two halves together at several points around the Cassette to ensure everything is in its correct place. See **Figure 17**. The two halves do not need to be perfectly tight together. They will tighten further when the cartridge is installed in the DustCount IS.
7. Slide the filter Cassette into the Cassette cover. Please note that the cassette can only be slid on one way. See **Figure 18**.
8. Reinstall the Cassette and button cover assembly and turn the button cover on the side of the unit 90° clockwise. Please note that the filter Cassette cover can only fit in the housing one-way. This is the reverse of the process shown in **Figure 8** and **Figure 9**.



Figure 14 Installing Fiber Support Backing with Tweezers



Figure 15 Installing Filter with Tweezers on top of Backing

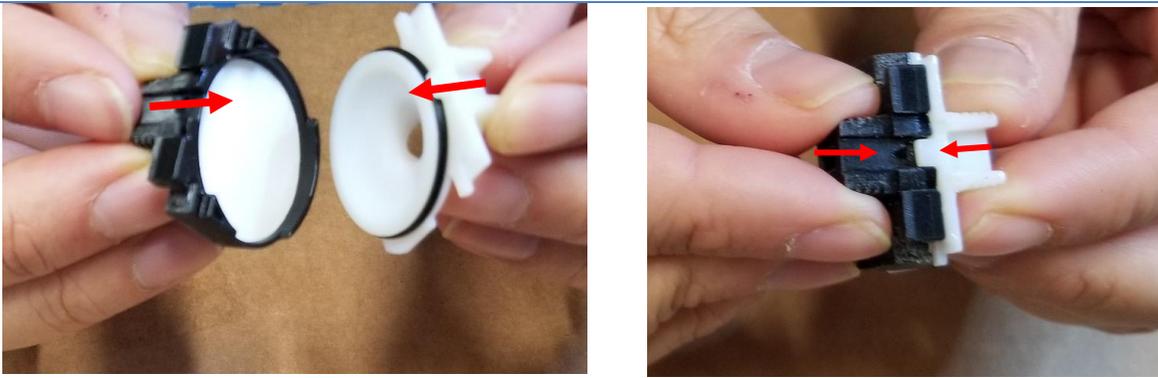


Figure 16 Fit the Two Halves of the Cassette Back Together

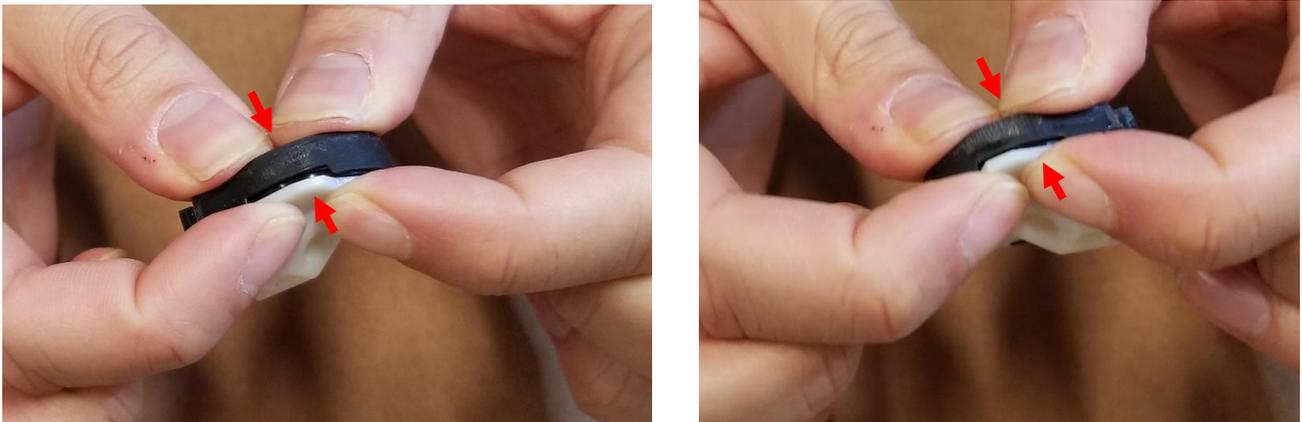


Figure 17 Press the Cassette Halves Together in Several Places.

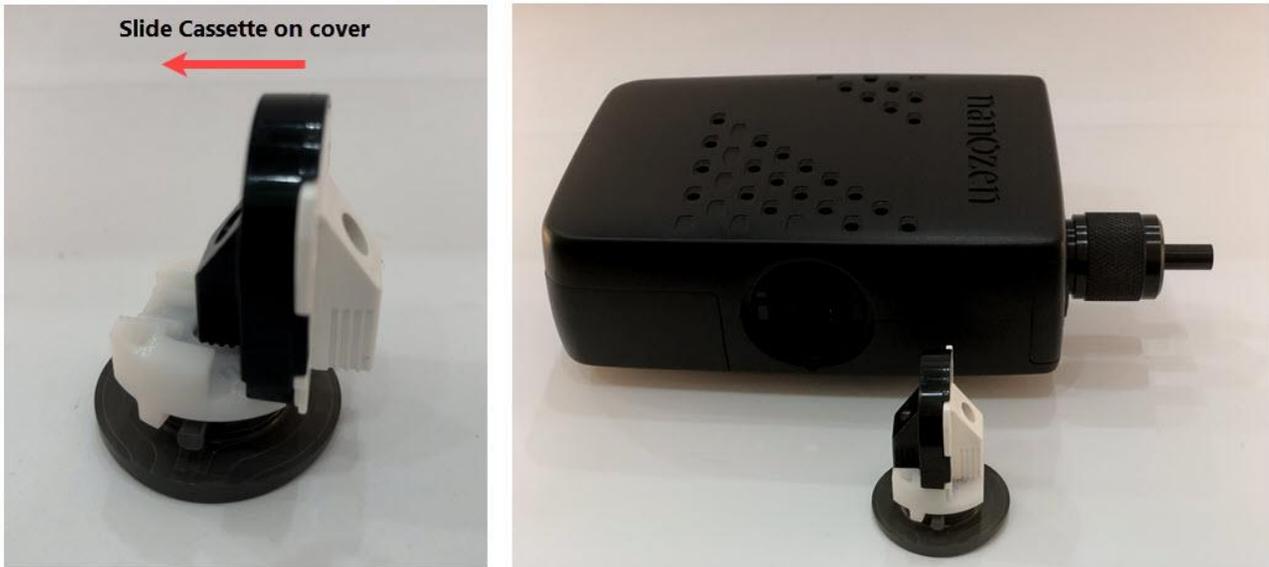


Figure 18 Slide the Cassette onto the Cover.

3 Device Operation

After pressing the power button, the unit will begin an *initialization and calibration* sequence. This will last for up to 30 seconds. In the last phase of this sequence, the pump is calibrated to achieve a 1.0 liters/minute flow rate.

Once the *self-test and calibration* sequence is complete, the DustCount IS unit starts logging the particle count, dust mass concentration and other operational data. It also starts displaying mass concentration and important operational data in real-time on its LCD. *Note: Pump calibration may continue for a few seconds in this operating mode.*

3.1 LCD

3.1.1 LCD bezel components

LCD bezel has the following key physical components:

- LCD display
- 2 LEDs for visual alarms
- LCD page change button

3.1.2 Start-up screen

Upon power-up, information identifying the unit, such as its hardware and firmware information, will be displayed on the screen for 2 seconds. See **Figure 19**.

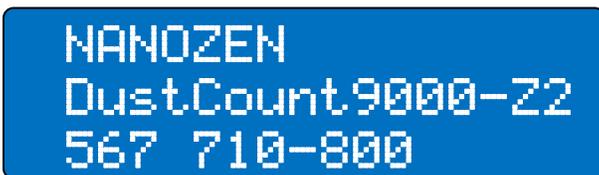


Figure 19 Start-up LCD - information

The first screen also indicates that the DustCount IS unit is running through its initialization sequence. See **Figure 20**.



Figure 20 Start-up LCD - initializations

The pump calibration sequence can persist for up to 30 seconds, depending on how long it takes for the pump speed to reach its flow-rate set-point. See **Figure 21**.



Figure 21 Start-up LCD - pump calibration

3.1.3 Normal operation

The LCD provides real-time feedback to the user and is refreshed once per second. Pressing the LCD page change button will scroll through 4 different pages, each with different set of data.

3.1.3.1 Information displayed on all pages

For all pages, the top row of LCD always displays the following information:

- Current time (hh:mm:ss).
- Battery state-of-charge in percentage.
- Any active alarms or alerts will cycle along with the battery percentage.
- Audible alarm sound and LED flash indicator,  if enabled (default), and  if disabled.
- Bluetooth connection status , which appears if there is a Bluetooth connection.

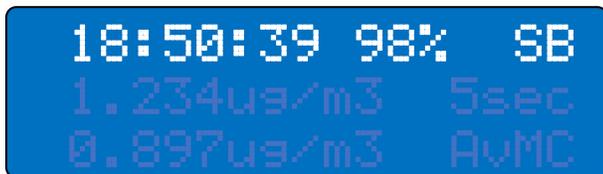


Figure 22 Information displayed on top row of all LCD pages

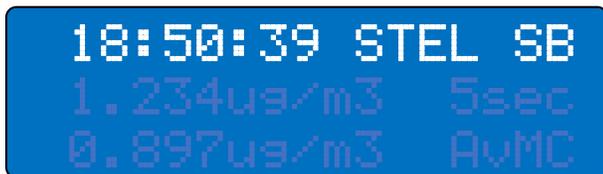


Figure 23 Information displayed on top row of all LCD pages (showing alarm)

3.1.3.2 Page 1 – Mass Concentration information

Page 1 displays mass concentration values on second and third row.

Mass concentration measured over the previous second is displayed on the second row.

Average mass concentration (AvMC) measured over the previous logging period is displayed on the third row.

By default, mass concentration units are displayed in mg/m³. The units are configurable between mg/m³ or µg/m³ via the User Interface.

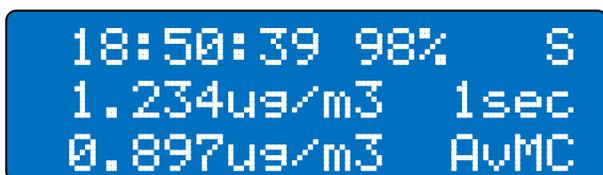


Figure 24 LCD page 1 with mass concentration information

3.1.3.3 Page 2 – Moving Window and TWA information

Moving Window Average Mass Concentration is displayed on second row.

TWA Concentration, and TWA percentage with respect to configured TWA percentage threshold is displayed on third row.

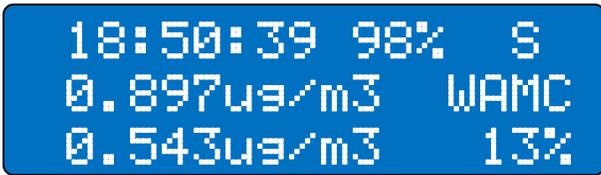


Figure 25 LCD page 2 with Moving Window and TWA information

3.1.3.4 Page 3 – User Settings

WAMC&AVMC confis is displayed on second row.

STEL Moving Window x Logging Period, STEL Alarm Threshold and Logging Period Alarm Threshold configuration is displayed on the third row.



Figure 26 LCD page 3 with user settings

3.1.3.5 Page 4 – Additional User Settings

TWA&CEIL confis is displayed on second row.

TWA Alarm Threshold, TWA Percentage Alarm Threshold, and Ceiling Alarm Threshold configuration is displayed on the third row.



Figure 27 LCD page 4 with user settings

3.1.3.6 Page 5 – DustCount IS Information

Page 4 displays information identifying the unit, such as model type on the second row, and its hardware and firmware identifiers on the third row.

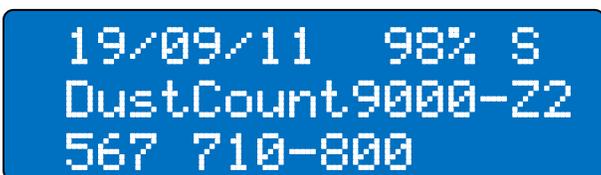


Figure 28 LCD page 5 with user settings

3.2 Visual and audible alarms and alerts

The DustCount IS has a buzzer for an audible alarm and has two LEDs for a visual alarm.

Textual alarms are displayed in the top row and occupy the same space on the display as the battery state-of-charge. See **Figure 29**



Figure 29 Concentration Alarm (CONC), with audible and visual alarms enabled as displayed on the LCD in Classic Mode

Multiple alarms may occur at the same time. Concurrent alarms will appear on the display successively with each alarm message appearing on the screen for one second, followed by the battery state-of-charge.

Both the audible buzzer and visual LED alarms can be enabled/disabled together by pressing the LCD page button momentarily when an alarm is present, or by holding the button down for more than 2 seconds at any other time. When alarms are disabled the screen will display an **X**. See **Figure 30**



Figure 30 Concentration alarm (CONC) with audible and visual alarms disabled as displayed on the LCD

3.2.1 Unit Alarms

3.2.1.1 Battery Alarm (BAT)

When the battery's state of charge drops below 5%, 'BAT' will appear on the display, see **Figure 31**. The DustCount IS unit will continue to operate normally, but it is recommended that the charger be plugged into the unit. Equivalent alarms can be seen via the User Interface. The unit will beep, and the LEDs will flash 3 times every minute for as long as the battery alarm persists.

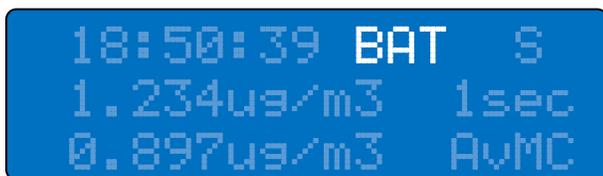


Figure 31 Battery alarm (BAT) displayed when battery State-of-Charge is 1% - 14%

Note 1 User action for low battery state-of-charge is to charge the unit.

When the battery state of charge drops to 1%, the display will prompt the user to plug in the charger. After saving the most recent incomplete or complete log, logging is disabled, and the pump is stopped. The display will remain running on reserve power, but the DustCount IS is not operating as a dust monitor. See **Figure 32**.

As soon as charger is plugged in and battery state-of-charge rises to 2% or higher, the unit will re-enable the pump, then start gathering and logging data in a new logging period.



Figure 32 Shutdown (0 - 1%) Battery State-of-Charge as displayed on the LCD

Note 2 User action for shutdown battery state-of-charge.
The DustCount IS unit MUST be charged for it to operate normally.

3.2.1.2 System alarm (SYS)

If there is any system failure in the DustCount IS unit, the display will show 'SYS', as seen in **Figure 33**

Note 3 User action for system alarm (SYS).
Restart the unit. If alarm persists, contact Nanozen technical support.

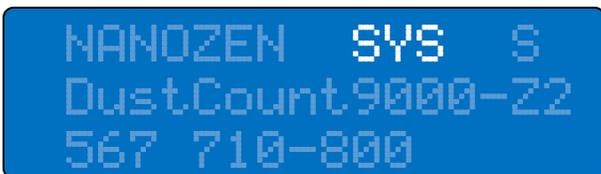


Figure 33 System alarm as displayed on the LCD

3.2.1.3 Flow Rate alarm (FLOW)

If the flow rate is not within 5% of the factory-defined 1.0 L/min flow rate the LCD will display 'FLOW' as shown in **Figure 34***Error! Reference source not found.*

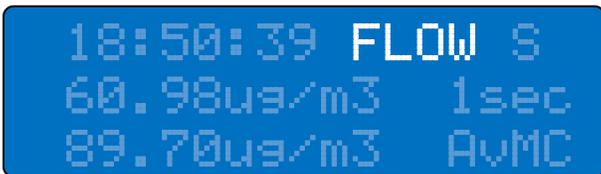


Figure 34 Flow Rate Alarm (FLOW) displayed on the LCD

Note 4 User actions for flow-rate alarm (FLOW):

- **Ensure air inlet is not blocked. Ensure breathing tube (if used) is not kinked.**
- **Power cycle unit.**
- **Clean the impactor and replace the filter and support pad.**
- **If the alarm persists, contact Nanozen Technical support.**

3.2.1.4 Leak detection alarm (LEAK)

If there is a leak in the DustCount IS unit filter Cassette, the filter Cassette cover has not been tightened properly. The LCD will display 'LEAK' as shown in **Figure 35***Error! Reference source not found.*



Figure 35 Leak detection alarm (LEAK) displayed on the LCD

Note 5 User actions for leak detection alarm (LEAK).

- Remove and inspect the cassette and ensure both sides are pressed tightly against each other and there are no cracks.
- Install a new cassette with filters, if available.
- If this alarm persists, contact Nanozen Technical support.

3.2.1.5 Laser alarm (LSR)

The Laser Alarm will occur if the output power of the laser exceeds 1.5 times the level at which it was set in the factory. The LCD will display 'LSR' as shown in **Figure 36***Error! Reference source not found.*

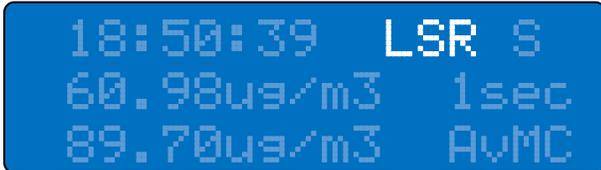


Figure 36 Laser alarm (LSR) displayed on the LCD

Note 6 User actions for laser alarm (LSR).

- If the alarm occurs while in an explosive environment, turn the unit off. Similarly, do not take the unit into an explosive environment while it is powered on.
- Return the unit to Nanozen for repair.

3.2.2 Mass concentration alarms

3.2.2.1 Logging period concentration alarm (CONC)

When the average mass concentration of the previous logging period (AvMC) is above the configured alarm threshold, the display indicates 'CONC', as shown in **Figure 37***Error! Reference source not found.*

The DustCount IS unit will continue to operate normally. The unit will LCD screen and LEDs will flash, and the unit will beep every second for as long as the concentration alarm condition persists.

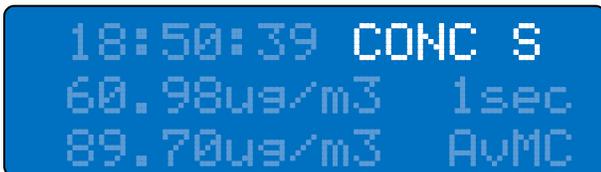


Figure 37 Concentration Alarm (CONC) displayed on the LCD

3.2.2.2 Short Term Exposure Limit alarm (STEL)

The STEL alarm triggers when the STEL moving window mass concentration exceeds the configured STEL threshold, and matches the configured number of required consecutive exposure events, within the configured exposure interval. The display indicates 'STEL', as shown in **Figure 38**.

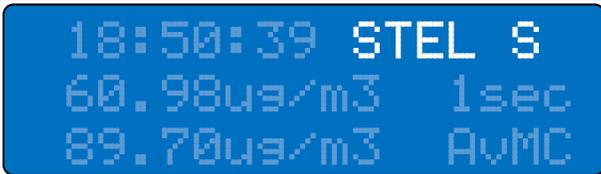


Figure 38 Short Term Exposure Limit Alarm (STEL) displayed on the LCD

3.2.2.3 Time-Weighted Average alarm (TWA)

TWA alarm triggers when the configurable TWA mass concentration with respect to the TWA percentage alarm threshold value has been met. The display indicates 'TWA', as shown in **Figure 39**.



Figure 39 Time-Weighted Average Alarm (TWA) displayed on the LCD

3.2.2.4 Ceiling alarm (CEIL)

The Ceiling Alarm triggers when the 1sec mass concentration exceeds the configured Ceiling alarm threshold. The display indicates 'CEIL', as shown in **Figure 40**.

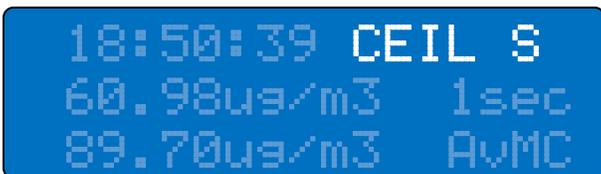


Figure 40 Ceiling Alarm (CEIL) displayed on the LCD

3.2.3 Maintenance Alerts

3.2.3.1 Impactor Maintenance Alert (IMP)

The Impactor Maintenance Alert is triggered then the impactor mass counter exceeds the factory set mass threshold. as shown in **Figure 41**.

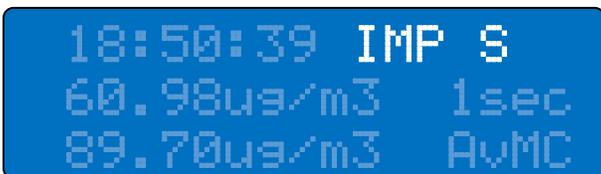


Figure 41 Impactor Maintenance Alert (IMP) displayed on the LCD

Note 7 User actions for Impactor Maintenance Alert (IMP).

- Cleaning and oiling of the Impactor plate is required.
- Clear and Acknowledge Impactor alert in DustCount User Interface (UI) software.

3.2.3.2 Filter Maintenance Alert (FILT)

The Filter Maintenance Alert is triggered then the filter mass counter exceeds the factory set mass threshold. as shown in **Figure 42**.

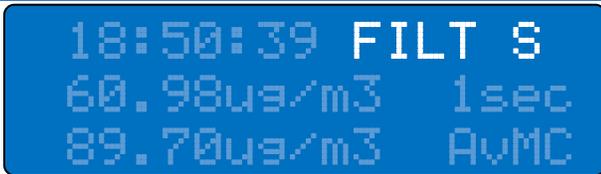


Figure 42 Filter Maintenance Alert (FILT) displayed on the LCD

Note 8 User actions for Filter Maintenance Alert (FILT).

- **Filter and support pad replacement is required**
- **Clear and acknowledge Filter alert in DustCount IS UI software.**

3.2.4 Power Button

Holding down the power button turns the unit off. If the power button is held down, the buzzer will beep once followed by a message on LCD alerting the user to release power button to leave unit powered ON. See **Figure 43**. If the power button isn't released, the unit will prepare to power down. See **Figure 44**.

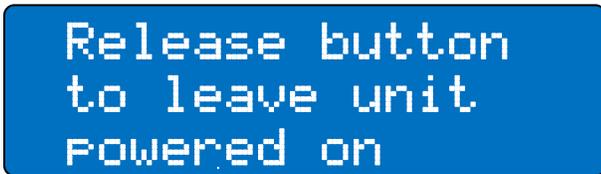


Figure 43 Message on LCD when power button is pressed

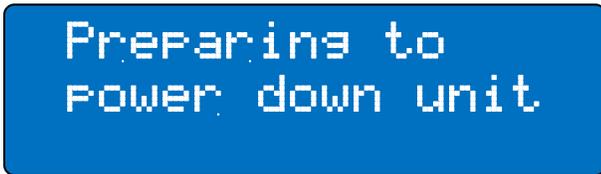


Figure 44 Message on LCD when unit is powering down

Note 9 Press and hold the Power button for 5 seconds to turn the unit off.

3.2.5 Bluetooth Connection Buzzer Feedback

The buzzer will beep anytime a Bluetooth host connects to or disconnects from the DustCount IS unit. The LCD will display a "B" in the upper right corner of the LCD when a Bluetooth host is connected as shown in **Figure 45**.



Figure 45 Bluetooth Connected displays B at the top right corner on the LCD

3.3 DustCount User Interface (UI) Application for PC or Mac

All the necessary user interface functions can be performed over the UI.

Install the DustCount IS UI application on the host PC. Note: the PC must have one of the following operating systems. Windows 7 Service Pack 1 or later. Mac OSX 10.11 or later. Please install the .exe file for windows and .dmg for MACs. To install the UI application, double-click on the .exe or .dmg file provided on the USB-drive that comes with the DustCount IS unit kit. Follow the instructions on the pop-up windows.

Once installed, the software version of the UI can be viewed by clicking on *Help* in the upper left corner of the UI screen, then clicking on *About DustCount IS* in the menu. The following description is for UI version 1.4.x, which is released in conjunction with DustCount IS firmware 7.1.x.

3.3.1 Connect DustCount IS unit via USB

Connect the DustCount IS units USB port to a USB port on the host PC and ensure that the User Interface application is installed on the PC.

Note 10 Connecting DustCount IS unit via USB.

An action button labelled  appears in the “Select a Device” window, where <xxx> is the serial number of the DustCount IS unit. Click on the button to connect the UI application to the DustCount IS.

3.3.2 Connect DustCount IS unit via Bluetooth

To connect to the DustCount IS unit via Bluetooth, you must pair your PC with it. Note: Choose “Yes” if prompted with a code during the pairing process. The Serial number of the DustCount IS unit that the UI has discovered, followed by “Bluetooth” will appear in the “Select a Device” window. All other connection procedures are as described above.

Note 11 Pairing and connecting DustCount IS unit via Bluetooth.

Turn the PC’s Bluetooth on and pair it with ‘DUSTCOUNT ISxxx’, where <xxx> is the serial number of the DustCount IS unit. When the PC has paired with the DustCount IS, an action button labelled  appears in the “Select a Device” window of the UI. Click on the button to connect the UI application to the DustCount IS.

3.3.3 UI Page Layout

The DustCount IS UI software application is divided into the following sections:

3.3.3.1 Connection

The UI software automatically searches for DustCount IS units connected to the host PC. DustCount IS units that have been found connected to the host computer are listed as blue action buttons in the “Select a device” box. Each DustCount IS is identified by its serial number. If the connection is via Bluetooth, “(Bluetooth)” will also be shown.

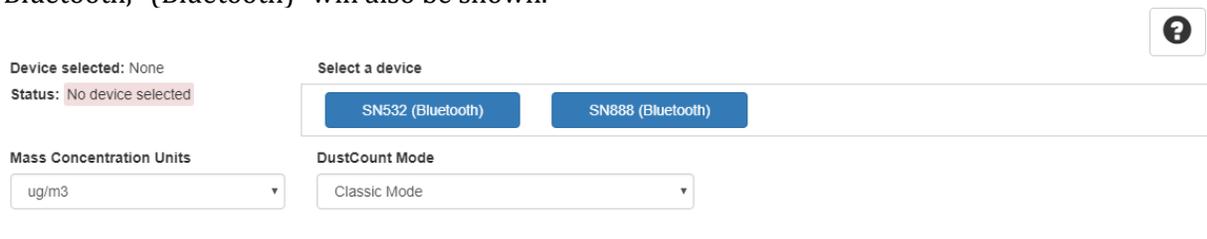


Figure 46 UI Connection Section when DustCount IS Found but Not Connected

Clicking on a blue action button will commence communication between the UI application and the selected DustCount IS. The selected action button will turn Yellow. The **Device Selected** line will show the serial number of the selected DustCount IS. The **Status:** line will change to “Connected to SNXXX”.



Figure 47 UI Connection Section when Connected to a DustCount IS

3.3.3.2 Tooltips

Tooltips can be turned on/off by clicking on the “?” at top right corner of the UI window as shown below. When enabled, additional details for action buttons and action text boxes are displayed when the mouse is hovered over them. Tooltips are disabled when icon is White/Black (see **Figure 47**) and enabled when the icon is Orange/White (see **Figure 48**).



Figure 48 Tooltips ON (? in the top right corner of UI window)

3.3.3.3 Mass Concentration Units

The Mass Concentration Units drop-down menu allows the user to choose between mg/m³ and µg/m³ for the units of mass concentration values displayed on the LCD, User Interface and data logs.

Note 12 Firmware releases prior to 5.0.31 only partially support mass concentration units. For firmware releases prior to 5.0.31, changing mass concentration units from the drop-down only changes the units in the UI software screen for Previous Average Concentration and Alarm Threshold. Mass concentration units in the data logs and on the LCD will remain in mg/m³ for high concentrations.

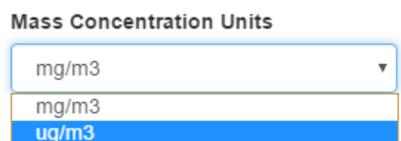


Figure 49 Mass Concentration Units drop-down selection

3.3.3.4 DustCount IS Mode

The DustCount IS Mode drop-down menu allows the user to choose between Classic Mode and Display Moving Window Average Mode.

In Classic Mode, average mass concentration for the previous logging period is displayed on the LCD, User Interface, and data logs. The concentration alarm will be triggered off this average mass concentration for the previous logging period.

In Display Moving Window Average Mode, moving window average of the mass concentration for the previous factory-defined or user-defined number of logging periods is displayed on the LCD, User Interface, and data logs. The concentration alarm will be triggered off this moving window average.

Note 13 Firmware releases prior to 5.0.31 do not support Moving Window Average. Changes made in the drop-down menu will have no effect on the LCD, data logs or the User interface.

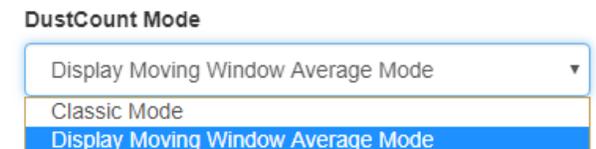


Figure 50 DustCount IS Mode drop-down selection

3.3.3.5 Maintenance Alerts

The maintenance section provides the current status of accumulated mass for the filter and impactor, along with providing a visual alert if either of them requires maintenance. A green button indicates the status of the filter or impactor is OK, a red button box indicates maintenance is required. The maintenance should be performed prior to clicking on the button to clear the alert. A confirmation warning dialog box will appear, click OK to confirm clearing the alert. Clearing the alert will reset the mass counter and clear the active alert on the unit and log.

Maintenance Alerts

<p>Ensure filter has been replaced before clearing alert.</p> <p>Clear filter alert</p> <p>Accumulated Mass (ug): 5340.344</p>	<p>Ensure impactor has been cleaned before clearing alert.</p> <p>Clear impactor alert</p> <p>Accumulated Mass (ng): 92248</p>
---	---

Figure 51 Maintenance Alerts

3.3.3.6 Real-time Display

The Real-time Display section displays data seen on the LCD of the DustCount IS unit plus other operational status, and configuration information.

Date: 19/09/12	Time: 08:57:08	Counts/sec: 53	Avg. conc. for last logging period (mg/m3): 0.0027
Flow-rate status: OK	Battery status: OK	Concentration status: OK	Moving window average conc. (mg/m3): 0.0019
System Status: OK	Battery: 73%	Free log memory: 100%	Logging period (seconds): 60
Leak Status: OK	STEL Status: OK	TWA Status: OK	TWA mass conc. (mg/m3): 0.0001
TWA mass conc. percentage: 0.00%	Ceiling Status: OK	Laser Status: OK	

Figure 52 Real-time display section.

The following real-time data is refreshed once per second.

1. Current date is displayed in the **Date** box.
2. Current time is displayed in the **Time** box.
3. Particle count for the previous second is displayed in the **Counts/sec** box.
4. Concentration for the previous logging period is displayed in the **Avg. conc. for last logging period (mg/m³ or ug/m³ - depending on the Mass Concentration Units value that is chosen)** box.
5. If the flow rate alarm is active, 'ALM' is displayed in the **Flow-Rate Status** box. Otherwise 'OK' is displayed.
6. If a battery alarm is active, 'ALM' is displayed in the **Battery Status** box. Otherwise 'OK' is displayed.
7. If a concentration alarm is active, 'ALM' will be displayed in the **Concentration Status** box. Otherwise 'OK' is displayed.
8. Concentration for the STEL Moving Window Average is displayed in the **Moving window average conc. (mg/m³ or ug/m³ - depending on the Mass Concentration Units value that is chosen)** box.
9. If a system alarm is active, 'ALM' is displayed in the **System Status** box. Otherwise 'OK' is displayed.
10. Battery State-of-Charge % is displayed in the **Battery** box.
11. Available memory space percentage is displayed in the **Free log memory** box.
12. Logging period is displayed in the **Logging period (in seconds)** box.
13. If a leak detection alarm is active, 'ALM' is displayed in the **Leak Status** box. Otherwise, 'OK' is displayed.
14. If a STEL alarm is active, 'ALM' will be displayed in the **STEL Status** box. Otherwise 'OK' is displayed.
15. If a TWA alarm is active, 'ALM' will be displayed in the **TWA Status** box. Otherwise 'OK' is displayed.
16. Concentration for the TWA is displayed in the **TWA mass conc. (mg/m³ or ug/m³ - depending on the Mass Concentration Units value that is chosen)** box.
17. TWA concentration percentage with respect to the configured alarm threshold value is displayed in the **TWA mass conc. percentage** box.
18. If a Ceiling alarm is active, 'ALM' will be displayed in the **Ceiling Status** box. Otherwise 'OK' is displayed.
19. If a Laser alarm is active, 'ALM' will be displayed in the **Laser Status** box. Otherwise 'OK' is displayed.

3.3.3.7 Logging Mode

This section displays the currently selected mode of logging and allows the user to change this mode. *Continuous Logging* is the default mode.

Logging Mode: Logging Continuously



Figure 53. UI Action Buttons when Continuous Logging is enabled

To disable logging select the *Disable Logging* action button. The Logging Mode title will indicate "Logging Disabled" when the mode has successfully been changed.

Logging Mode: Logging Disabled



Figure 54. UI Action Buttons when Logging is disabled

To collect a single log event, select the *One-shot Logging* action button. The Logging Mode title will indicate “One-shot Logging”.

If logging was disabled prior to pressing “One-shot Logging”, the DustCount IS will collect data for one logging period, then disable logging.

If “Continuous Logging” was enabled prior to pressing “One-shot Logging”, the DustCount IS will truncate and record the log it is working on, collect data for one more log period, then disable logging.

Logging mode title will display ‘Logging Disabled’ once one-shot logging is complete.

Logging Mode: One-shot Logging



Figure 55 UI Action Buttons when One-shot Logging is enabled

3.3.3.8 Read Logs

The Read Logs section allows the user to download and display data entries in the *Log Read Out* section. Use the Display Mode drop-down menu to select an option.

Depending on the option selected, the following additional checkbox options will be displayed:

- **With distribution:** Enable checkbox to download and display the data with distribution.
- **Include extended data:** Enable checkbox to download and display data with extended information (configuration information, user tag, etc.)
- **Include inhalable data:** Enable checkbox to download and display inhalable concentration data. This feature is supported for DustCount IS Firmware 7.1.10 and higher.

Note 14 The Read Logs button will change to orange while data downloading is in progress. The greater the number of logs requested to be downloaded from the unit, the longer the time it will take to retrieve them. During this time the log readout window will be empty.

Read Logs

Display Mode

All logs ▾

- Select an option...
- Time and date
- Since power-on
- All logs
- Last log
- Last N logs
- Real-time update

Read Logs

Figure 56 Read logs Display Mode drop-down menu

Read Logs

Display Mode

All logs ▾

- With distribution
- Include extended data
- Include inhalable data

Read Logs

Figure 57 Read logs with optional data selection once a display mode is chosen

The menu options available from the Display mode drop-down are outlined below:

Time and date: To download data using a specific date and time range. Enter a start date and time, and an end date and time.

Read Logs

Display Mode

Time and date ▼

Start Date

yyyy-mm-dd

End Date

yyyy-mm-dd

Start Time

--:--

End Time

--:--

With distribution

Include extended data

Include inhalable data

Read Logs

Figure 58 Read data filtered by Time and date

Since power-on: To download data since the most recent power-on.

Read Logs

Display Mode

Since power-on ▼

Include extended data

Include inhalable data

Read Logs

Figure 59 Read data since power-on

All logs: To download all data stored on the DustCount IS.

Read Logs

Display Mode

All logs ▾

With distribution

Include extended data

Include inhalable data

Read Logs

Figure 60 Read all data stored on the unit

Last Log: User can select this option to display the most recent data log.

Read Logs

Display Mode

Last log ▾

Include extended data

Include inhalable data

Read Logs

Figure 61 Read the most recent data

Last N logs: Download a specific number of the most recent data logs by selecting Last N logs from the drop-down menu and entering a number into the Number of Logs box.

Read Logs

Display Mode

Last N logs ▾

Number of logs

With distribution

Include extended data

Include inhalable data

Read Logs

Figure 62 Read the most recent N number of logs

Real-time update: Real-time update Display Mode option allows the user to view or graph data logs in real-time. The UI continuously displays data logs into the Log read out text box at the end of a logging period. The Start Date and Start Time can be entered as any date and time earlier than current date and time. Real-time update will always read data logs from the unit with distribution.

Read Logs

Display Mode

Real-time update ▼

Enter earlier date and time if required

Start Date **Start Time**

2019-09-12 09:34 AM

With distribution

Include extended data

Include inhalable data

Read Logs

Figure 63 Real-time update selection for Display Mode under Read Logs

The *Read Logs* green button will be orange when clicked and the *Display Mode*, *Logging Period*, and *Mass Concentration Units* selections are greyed out and cannot be changed during real-time updates. Data can be saved or graphed at any point as described in the next two sections: **Save data logs** and **Graph data logs**.

To stop the real-time updates, user can click *Stop Reading Logs* green button at any time.

Read Logs

Display Mode

Real-time update ▼

Start Date **Start Time**

2019-09-12 09:34 AM

With distribution

Include extended data

Include inhalable data

Read Logs Stop Reading Logs

Figure 64 Stop Real-time update by clicking Stop Reading Logs

3.3.3.9 Clear Logs

The clear section allows the user to clear log entries from the memory in the DustCount IS. The color of the selected button will change to orange while logs are being cleared.

The unit can hold up to a million logs, which can result in a large amount of data if logs are not cleared on a regular basis. Unused logs should be cleared regularly. To clear the logs via the UI, user has the following options:

1. Click **Clear All Logs** to clear all logs on the unit.
2. Click **Clear Last Log** to clear data for the most recent logging period.
3. Click **Clear Last N Logs** to clear data for N of the most recent logging periods.

Note 15 Data logs are permanently deleted after a clear operation.

Data logs are permanently deleted from the DustCount IS once they have been cleared using any of the above-mentioned clear log operations.

Clear Logs



Figure 65 UI Clear Logs Action Buttons

3.3.3.10 Log Read Out

The Log Read Out window is a text box which is populated with data downloaded from the unit once Read Logs is clicked. Data will on be displayed after all the requested logs have been downloaded from the DustCount IS unit.

Log Read Out

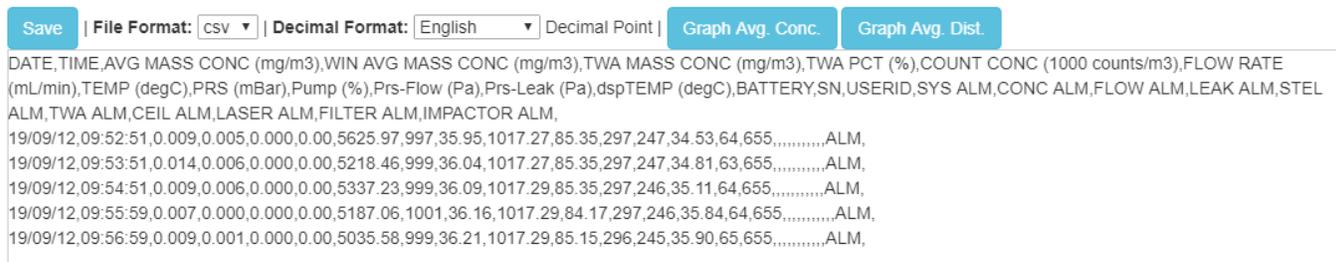


Figure 66 UI Log Read Out without any checkbox options enabled.

Log Read Out

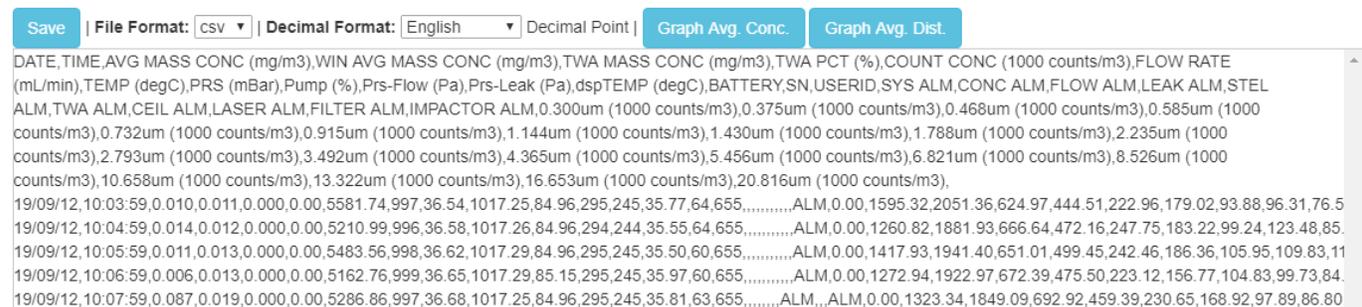


Figure 67 UI Log Read Out with the With distribution checkbox enabled.

Log Read Out

Save | File Format: csv | Decimal Format: English | Decimal Point | Graph Avg. Conc. | Graph Avg. Dist.

```
DATE,TIME,AVG MASS CONC (mg/m3),WIN AVG MASS CONC (mg/m3),TWA MASS CONC (mg/m3),TWA PCT (%),COUNT CONC (1000 counts/m3),FLOW RATE (mL/min),TEMP (degC),PRS (mBar),Pump (%),Prs-Flow (Pa),Prs-Leak (Pa),dspTEMP (degC),BATTERY,SN,USERID,SYS ALM,CONC ALM,FLOW ALM,LEAK ALM,STEL ALM,TWA ALM,CEIL ALM,LASER ALM,FILTER ALM,IMPACTOR ALM,0.300um (1000 counts/m3),0.375um (1000 counts/m3),0.468um (1000 counts/m3),0.585um (1000 counts/m3),0.732um (1000 counts/m3),0.915um (1000 counts/m3),1.144um (1000 counts/m3),1.430um (1000 counts/m3),1.788um (1000 counts/m3),2.235um (1000 counts/m3),2.793um (1000 counts/m3),3.492um (1000 counts/m3),4.365um (1000 counts/m3),5.456um (1000 counts/m3),6.821um (1000 counts/m3),8.526um (1000 counts/m3),10.658um (1000 counts/m3),13.322um (1000 counts/m3),16.653um (1000 counts/m3),20.816um (1000 counts/m3),
19/09/12,10:03:59,0.010,0.011,0.000,0.00,5581.74,997,36.54,1017.25,84.96,295,245,35.77,64,655,,,,,,,,,ALM,0.00,1595.32,2051.36,624.97,444.51,222.96,179.02,93.88,96.31,76.5
19/09/12,10:04:59,0.014,0.012,0.000,0.00,5210.99,996,36.58,1017.26,84.96,294,244,35.55,64,655,,,,,,,,,ALM,0.00,1260.82,1881.93,666.64,472.16,247.75,183.22,99.24,123.48,85.
19/09/12,10:05:59,0.011,0.013,0.000,0.00,5483.56,998,36.62,1017.29,84.96,295,245,35.50,60,655,,,,,,,,,ALM,0.00,1417.93,1941.40,651.01,499.45,242.46,186.36,105.95,109.83,11
19/09/12,10:06:59,0.006,0.013,0.000,0.00,5162.76,999,36.65,1017.29,85.15,295,245,35.97,60,655,,,,,,,,,ALM,0.00,1272.94,1922.97,672.39,475.50,223.12,156.77,104.83,99.73,84.
19/09/12,10:07:59,0.087,0.019,0.000,0.00,5286.86,997,36.68,1017.25,84.96,295,245,35.81,63,655,,,,,,,,,ALM,,ALM,0.00,1323.34,1849.09,692.92,459.39,230.65,168.92,97.89,86.80
```

Figure 68 UI Log Read Out with: With distribution and Include extended data checkbox options enabled.

3.3.4 User, DustCount IS Information, Factory, and Server Settings Tabs.

3.3.4.1 User Settings Tab

The *User Settings* Tab allows a user to view and change various configuration parameters in the DustCount IS unit. The displayed configuration settings are updated from the DustCount IS every 10 seconds. To change these settings, enter the desired value in the appropriate field, and press the return key on your keyboard. A green information box will temporarily appear, indicating that the change was successful.

User Settings | DustCount Information | Factory Settings | Server Settings

Press enter after changing a value for it to take effect.

Year <input type="text" value="19"/>	Month <input type="text" value="9"/>	Day <input type="text" value="12"/>
Hour <input type="text" value="10"/>	Minute <input type="text" value="28"/>	Second <input type="text" value="10"/>
Logging Period (seconds) <input type="text" value="60"/>	Logging Period Alarm Threshold (mg/m3) <input type="text" value="0.05"/>	Gravimetric Mass Calibration Coefficient (%) <input type="text" value="100"/>
Dust Type <input type="text" value="Arizona Road Dust"/>	Impactor Calibration Coefficient (%) <input type="text" value="105"/>	LCD Backlight Adjustment (%) <input type="text" value="52"/>
STEL Moving Window (no. of logging periods) <input type="text" value="15"/>	STEL Alarm Threshold (mg/m3) <input type="text" value="0.025"/>	STEL Exposure Frequency <input type="text" value="4"/>
STEL Exposure interval (minutes) <input type="text" value="60"/>	TWA Threshold (mg/m3) <input type="text" value="25"/>	TWA Percentage Alarm Threshold (%) <input type="text" value="100"/>
TWA Duration (hours) <input type="text" value="12"/>	Ceiling Alarm Threshold (mg/m3) <input type="text" value="4"/>	High priority alarm volume <input type="text" value="5"/>
Medium priority alarm volume <input type="text" value="3"/>	Informational alerts volume <input type="text" value="1"/>	User Tag <input type="text"/>
Turn Pump OFF/ON <input checked="" type="checkbox"/>	<input type="button" value="System Air Purge"/>	<input type="button" value="Sync DustCount Time to Computer Time"/>
Flow-rate adjustment <input type="range"/>	<input type="button" value="Shift Status OFF"/>	

Figure 69 User Settings with Shift status disabled.

User Settings
DustCount Information
Factory Settings
Server Settings

Press enter after changing a value for it to take effect.

Year <input type="text" value="19"/>	Month <input type="text" value="9"/>	Day <input type="text" value="12"/>
Hour <input type="text" value="10"/>	Minute <input type="text" value="29"/>	Second <input type="text" value="56"/>
Logging Period (seconds) <input type="text" value="60"/>	Logging Period Alarm Threshold (mg/m ³) <input type="text" value="0.05"/>	Gravimetric Mass Calibration Coefficient (%) <input type="text" value="100"/>
Dust Type <input type="text" value="Arizona Road Dust"/>	Impactor Calibration Coefficient (%) <input type="text" value="105"/>	LCD Backlight Adjustment (%) <input type="text" value="52"/>
STEL Moving Window (no. of logging periods) <input type="text" value="15"/>	STEL Alarm Threshold (mg/m ³) <input type="text" value="0.025"/>	STEL Exposure Frequency <input type="text" value="4"/>
STEL Exposure interval (minutes) <input type="text" value="60"/>	TWA Threshold (mg/m ³) <input type="text" value="25"/>	TWA Percentage Alarm Threshold (%) <input type="text" value="100"/>
TWA Duration (hours) <input type="text" value="12"/>	Ceiling Alarm Threshold (mg/m ³) <input type="text" value="4"/>	High priority alarm volume <input type="text" value="5"/>
Medium priority alarm volume <input type="text" value="3"/>	Informational alerts volume <input type="text" value="1"/>	User Tag <input type="text"/>
<input type="button" value="System Air Purge"/> <input type="button" value="Sync DustCount Time to Computer Time"/>		
Flow-rate adjustment <input type="range" value="50"/>	<div style="border: 2px solid red; padding: 2px; display: inline-block;">Shift Status <input checked="" type="checkbox"/></div>	Shift start hour <input type="text" value="6"/>
Shift start minute <input type="text" value="0"/>	Shift end hour <input type="text" value="18"/>	Shift end minute <input type="text" value="0"/>

Figure 70 User Settings with Shift Status enabled.

The following section describes the various User setting options available and their use. Valid values ranges and defaults are outlined in **Table 1**.

- a) *Year, Month Day, Hour, Minute and Second.*
To adjust the DustCount IS unit date and time settings. Press the enter key after setting each value.
- b) *Logging period (seconds)*
Logging period is the frequency at which a data log is saved on the unit. Valid values are between 5 seconds and 65535 seconds.
- c) *Logging period Alarm Threshold (mg/m³ or ug/m³)*
Enter the concentration threshold to trigger a CONC alarm based on the average concentration value of the previous logging period.
- d) *Gravimetric Mass Calibration Coefficient (%)*
Allows the user to re-calibrate the DustCount IS to the concentration measured by gravimetric analysis. This allows the DustCount IS unit to account for varying material properties of different dust types.
- e) *Dust Type*
Select from available dust types in the “Dust Type” field. By default, Arizona Road Dust is enabled.
- i) *Impactor Calibration Coefficient (%)*
This coefficient allows the user to scale up count and concentration to account for particle loss through the impactor.

Note 16 Impactor Calibration Coefficient

The Impactor Calibration Coefficient is set to 105% for the Nanozen Impactors and should not be changed.

- f) *LCD Backlight Adjustment (%)*
Enter a percentage value to decrease or increase LCD brightness.
- g) *STEL Moving Window (no. of log periods)*
Moving window size is the size of the moving window for the STEL average mass concentration. For instance, if the logging period is set to 60 seconds and moving window size is 15, each STEL average mass concentration will be an average of the previous 15 mass concentrations readings at 60 second intervals (in other words the average mass concentration is over a 15 minute moving window).
- h) *STEL Alarm Threshold (mg/m³ or ug/m³)*
Enter the concentration threshold to trigger the STEL alarm.
- i) *STEL Exposure Frequency (number)*
Enter the number of concentration threshold exposure events required to trigger the STEL alarm.
- j) *STEL Exposure Interval (minutes)*
Enter the time interval for consecutive instances of STEL exposure events required to trigger the STEL alarm.
- k) *TWA Threshold (mg/m³ or ug/m³)*
Enter the concentration threshold to trigger the TWA alarm.
- l) *TWA Percentage Alarm Threshold (%)*
Enter the percentage of the TWA mass concentration required to trigger the TWA alarm.
- m) *TWA Duration (hours)*
Enter the time in hours that will be used to determine the TWA concentration exposure.
- n) *Ceiling Alarm Threshold (mg/m³ or ug/m³)*
Enter the concentration threshold to trigger the Ceiling alarm.
- o) *High priority alarm volume (number)*
Enter a value to increase or decrease volume of a High priority alarm. High priority alarms are CONC (logging period concentration), TWA, STEL or CEIL.
- p) *Medium priority alarm volume (number)*
Enter a value to increase or decrease volume of a Medium priority alarm. Medium alarms are SYS, LSR, FLOW, LEAK, BATT, FILT, IMP
- q) *Informational alerts (number)*
Enter a value to increase or decrease volume of an Informational alert. Information alerts include when Bluetooth is connected/disconnected.
- r) *User Tag (alpha-numeric)*
Used to provide additional contextual information that will be included in the data logs (user ID, test site, etc.).
- s) *System Air Purge*
Click on System Air Purge button to run the pump at maximum speed for 10 seconds, followed by re-calibration of the pump. Should be used after a sampling session if filter is to be send for lab analysis.
- t) *Turn Pump OFF/ON*
Click on the toggle switch to turn pump OFF/ON. When the pump is turned off, logging will be disabled until the pump is turned back on. This feature can be used where downloading of logs, or

configuration of the unit is required but the pump doesn't need to be running to avoid added noise in an office environment.

u) *Sync DustCount IS Time to Computer Time*

The sync button can be used to update DustCount IS date and time with the Computer date and time. Recommended to be used over the manual entry of each value for month, day, year, hour, minute, and second.

v) *Flow-rate adjustment.*

Move the slider to adjust the flow rate of the unit.

Note 17 Flow-rate adjustment.

The DustCount IS unit adjusts flow rate to be within +/-5% of the factory setting of 1.0L/min. In most environments manual flow adjustment is not required. In environments where the altitude is outside of the auto-adjust ranges (+10000m above sea level, and -2000m below sea level) the flow can be adjusted while measuring the unit flow rate using a primary standard flow meter.

w) *Shift Status.*

Used to enable or disable Shift mode. When outside of configured shift hours the unit is in power saving mode. Logging, pump and LCD are disabled outside of shift hours.

Note 18 Shift Mode.

Once Shift mode is configured the units pump, logging and LCD backlighting will be disabled. Do not power off the unit. Powering off the unit will cause it to fail to start at the scheduled shift start time.

x) *Shift Start hour, Shift start minute.*

Enter the start hour (24-hour format) and minutes for the start of shift.

y) *Shift end hour, Shift end minute.*

Enter the end hour (24-hour format) and minutes for the end of shift.

Table 1 User Settings values and default settings List

Command	Valid Values	Factory Default
Year	0-99	00
Month	1-12	01
Day	1-31	01
Hour	0-23	00
Minute	0-59	00
Second	0-59	00
Logging Period (seconds)	5-3600	60
Logging Period Alarm Threshold (mg/m ³ or ug/m ³)	0.0 - 0-65.535 mg/m ³ or 0.0 - 0-65535.999 ug/m ³	0.05 mg/m ³ or 50 ug/m ³
Gravimetric Mass Calibration Coefficient (%)	0-65535.999	100
Dust Type	Selectable drop-down menu	Arizona Road Dust
Impactor Calibration Coefficient (%)	100-65535.999	105
LCD Backlight Adjustment (%)	0-100	50
STEL Moving Window (no. of logging periods)	1 - 200	15
STEL Alarm Threshold (mg/m ³ or ug/m ³)	0.0 - 0-65.535 mg/m ³ or 0.0 - 0-65535.999 ug/m ³	0.025 mg/m ³ or 25 ug/m ³
STEL Exposure Frequency	1-255	4
STEL Exposure Interval (minutes)	1-255	60
TWA Threshold (mg/m ³ or ug/m ³)	0.0 - 0-65.535 mg/m ³ or 0.0 - 0-65535.999 ug/m ³	25 mg/m ³ or 25000 ug/m ³
TWA Percentage Alarm Threshold (%)	0 - 100	100
TWA Duration (hours)	1 - 255	12
Ceiling Alarm Threshold (mg/m ³ or ug/m ³)	0.0 - 0-65.535 mg/m ³ or 0.0 - 0-65535.999 ug/m ³	4 mg/m ³ or 4000 ug/m ³
High Priority alarm volume	0 - 5	5
Medium Priority alarm volume	0 - 5	3
Informational alerts volume	0 - 5	1
User Tag	32 characters excluding comma and semi colon	Null
Shift start hour	0-23	00
Shift start minute	0-59	00
Shift end hour	0-23	00
Shift end minute	0-59	00

3.3.4.2 DustCount IS Information Tab

The DustCount IS Information tab outlines the DustCount IS model, serial number, firmware, calibration and runtime information of the unit that is connected to the UI software. This tab also allows the user to create a diagnostic file to send to Nanozen technical support when reporting an issue by clicking on the Create Diagnostic File button.

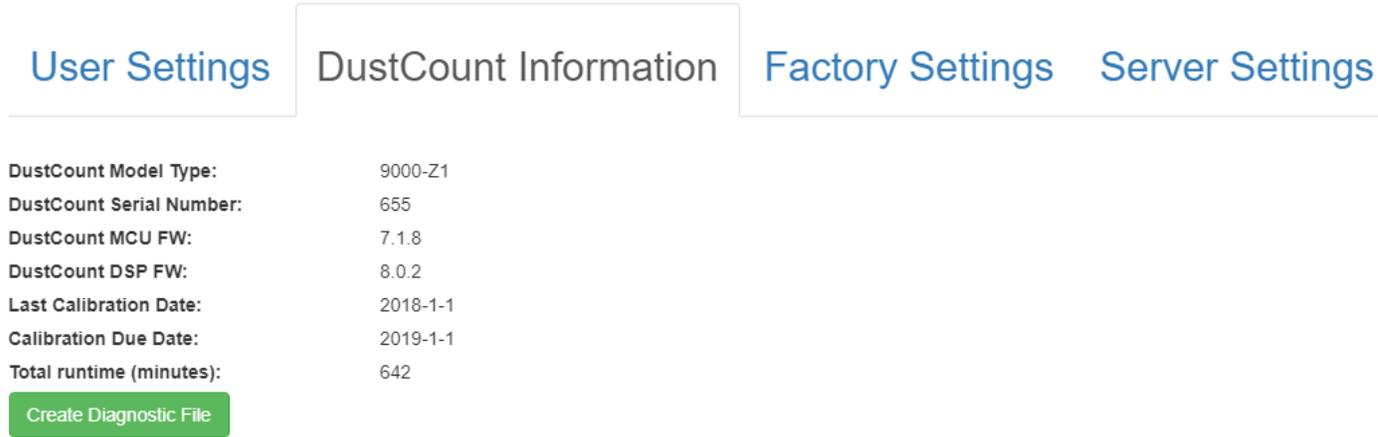


Figure 71 User Settings with Shift Status enabled

3.3.4.3 Factory Settings

Factory settings are not available to the end user.

3.3.4.4 Server Settings Tab

The server settings tab can be used to connect to a remote UI over a network using a web browser. If the DustCount IS is connected to a PC that is running the UI software application then the default IP address and port numbers are used.

Settings shown in this tab should only be changed by an IT systems administrator who has the correct IP address and port numbers to connect over the internet to a remote UI application.

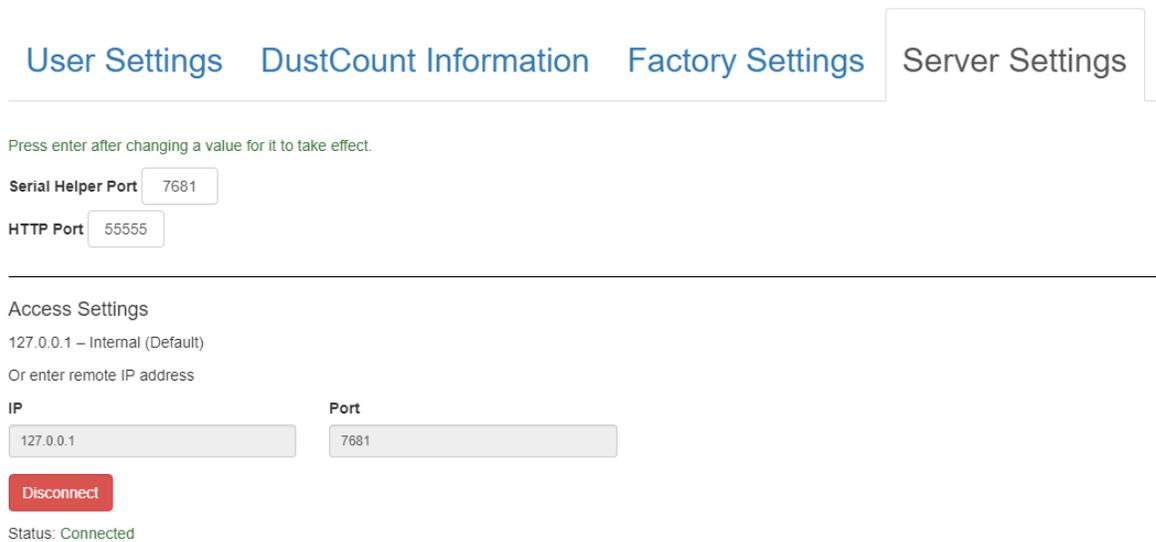


Figure 72 UI Server Settings Tab

3.3.5 Save data logs

The Log read window displays the downloaded data logs based on the selected options listed in the *Display Mode* drop-down under the *Read Logs* sections.

The user interface software buffers the incoming data from the DustCount IS unit. During download the Read Logs action button will be orange, and the log read-out window will be grey until all the requested data has been received. Older data is overwritten in the log read out field, as new logs are received.

Click on 'Save' button to save log read out field data in .csv see **Figure 73** or .xlsx format see **Figure 74**.

Default format is .csv. Default filename is logs.csv. Default decimal format selection is English where period is a decimal point. Example: 5.123.

CSV format can be set to International where comma is a decimal point. Example: 5,123.

Note: This change is reflected in the saved .csv only, and not the log read out area.

Log Read Out



Figure 73 Save logs.csv with CSV decimal format set to English (i.e. Decimal Point)

Log Read Out



Figure 74 Save logs.xlsx (i.e. Excel format)

Note 19 Save the data in .csv format. (Default File Name: logs.csv).

Select csv in the File format drop down, select decimal format as English for a point (E.g. 5.123) or International for a comma (E.g. 5,123) via the Decimal Format drop-down.

Note 20 Save the data in .xlsx format. (Default File Name: logs.xlsx).

Select xlsx in the File Format drop down, the file will be saved using the decimal format that is used by the host computer.

3.3.6 Graph data logs

After data logs have been downloaded and are available in the log read out window, two types of graphs are available for the user to visualize this data: a 2-line graph and a histogram.

Note 21 Graphs are plotted for data in the log read out window.

Data content must be made in the log read out window before it can be graphed.

3.3.6.1 Average Concentration 2-line graph via Graph Avg. Conc. button

A 2-line graph of average mass concentration of the last logging period and moving window average of the mass concentration with respect to time can be seen when Graph Avg. Conc. is clicked. See **Figure 75**.

The Series 1 and Series 2 drop-down menus at the end of graph window can be set to any of the following parameters:

1. Average mass concentration for the last logging period (AVG MASS CONC.)
2. Moving window average mass concentration (WIN AVG MASS CONC)
3. Time Weighted average mass concentration (TWA MASS CONC)
4. Tie Weighted average percentage (TWA PCT)
5. Average count concentration for the last logging period (COUNT CONC)
6. Average flow rate for the last logging period (FLOW RATE)
7. Average temperature for the last logging period (TEMP)
8. Average pressure for the last logging period (PRS)
9. Average pump PWM percentage for the logging period (Pump)
10. Average pressure for the logging period that helps regulate flow (Prs-Flow)
11. Average pressure for the logging period that helps detect leaks (Prs-Leak)
12. Average temperature of the DSP for the logging period (dspTEMP)
13. Battery state of charge in percentage at the end of last logging period (BATTERY)

Series 1 and Series 2 have separate vertical axes as there could be several orders of magnitude difference between the two series.

Vertical axes and horizontal axis titles correspond to the data log column headers, with units (or format) in parenthesis. The sliders along each of these axes allow user to zoom in or out by modifying range on the axes. A legend for the graph is displayed the top right corner of the graph window.

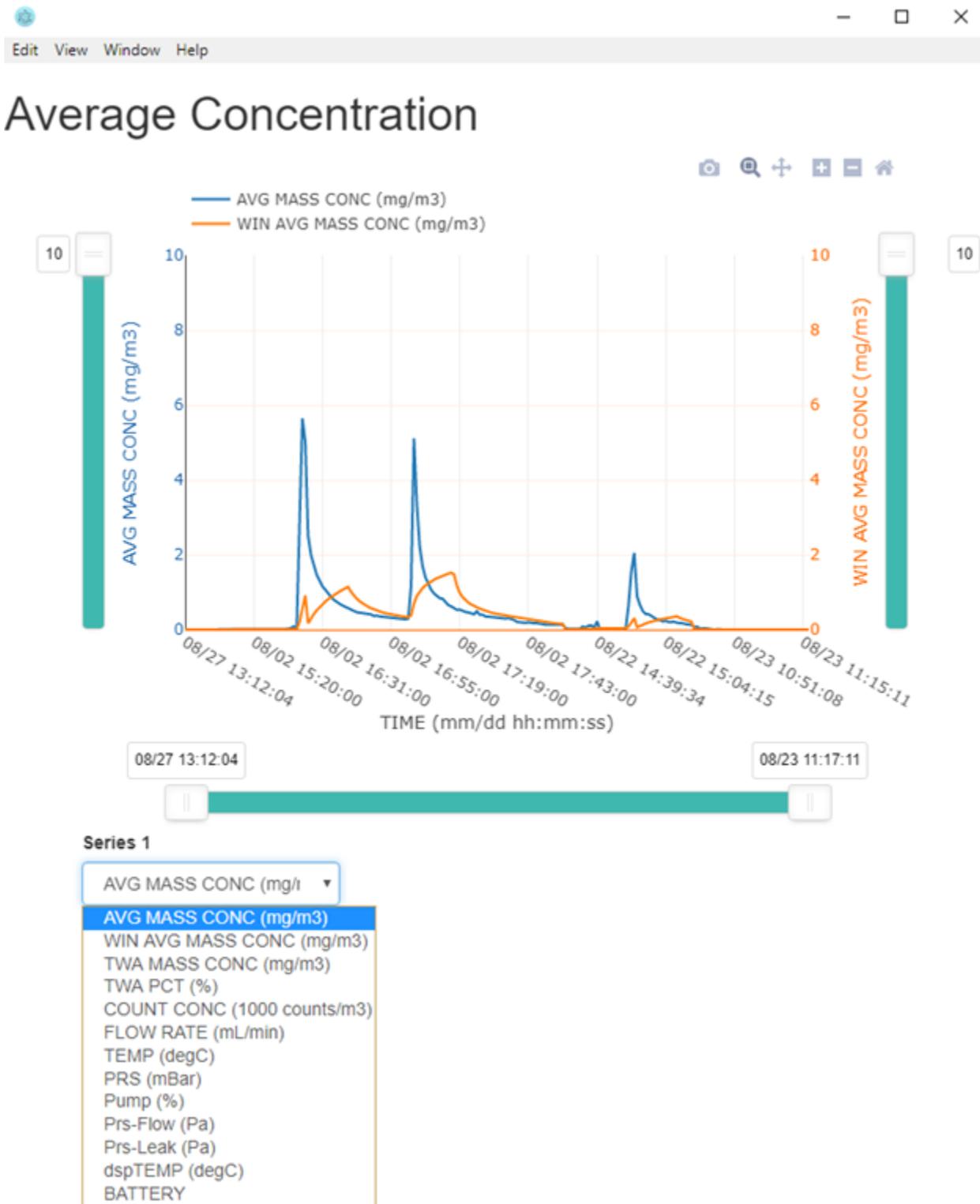


Figure 75 Average Concentration graph window when Graph Avg. Conc. is clicked

3.3.6.2 Average Distribution histogram via Graph Avg. Dist. button

A bar graph of average count concentration with respect to the particle diameter can be seen when Graph Avg. Dist. is clicked. See **Figure 76**. Note that data must be downloaded using the with distribution option enabled. If data was read without distribution, the graph window when opened will display a warning as there is no distribution data available to plot a histogram.

The start and end time, at the bottom of the graph window, can be changed to modify the number of logging periods' count concentration averaged in this graph.

Vertical axes and horizontal axis titles correspond to the data log column headers, with units (or format) in parenthesis. The slider along the vertical axis allows user to zoom in or out by modifying range on the axis.

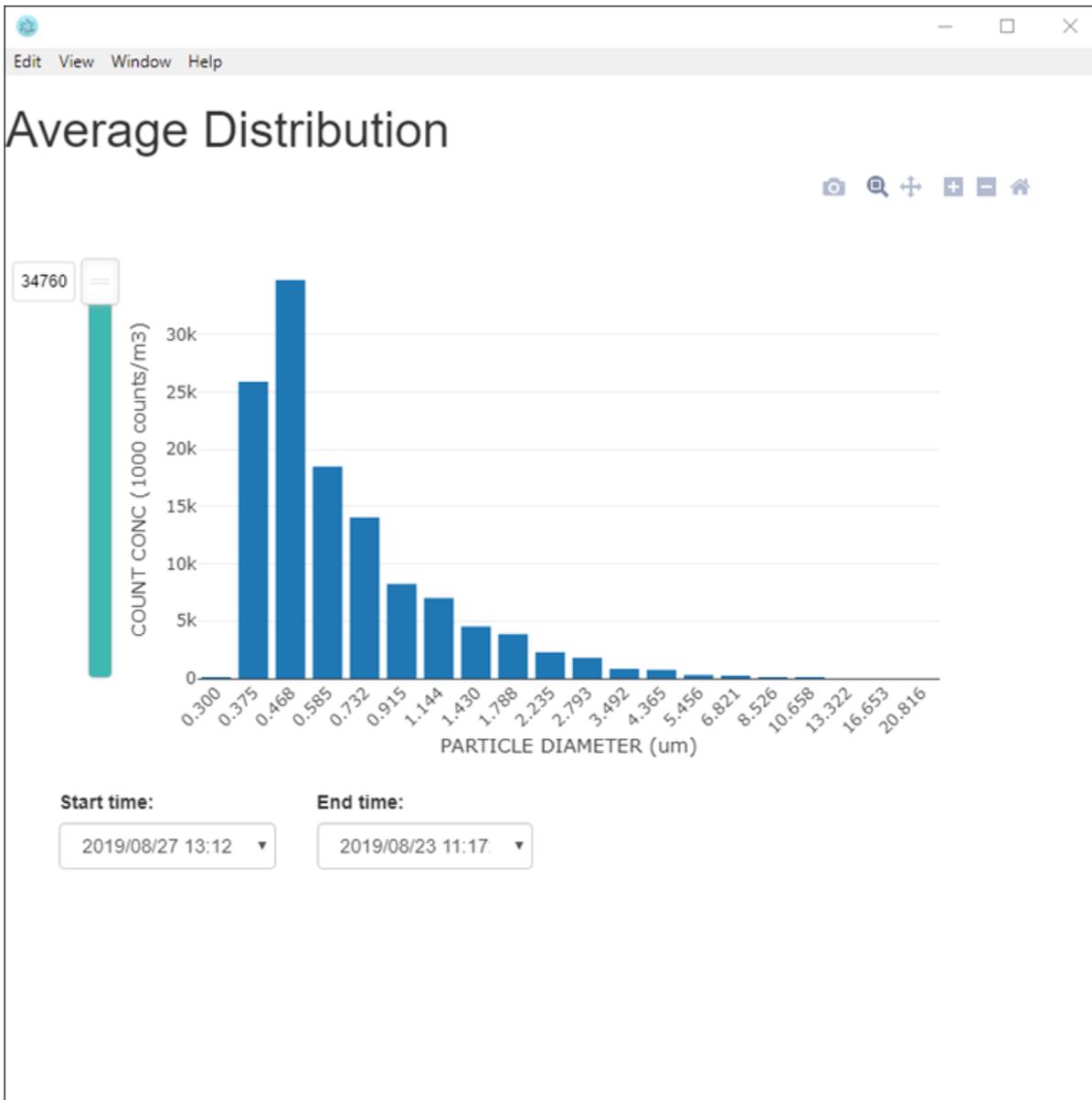


Figure 76 Average Distribution histogram when Graph Avg. Dist. is clicked

Real-time update graphing

The graphing features for real-time update are the same as the non-real-time option, except for one feature. While in real-time update graphing mode, a user can zoom in and out of any section of the graph.

When the user zooms into a section of the graph, the lock symbol shown in **Figure 77** below next to the sliders on the Y-axis and X-axis will be replaced by the Y-axis and X-axis coordinates for the zoomed in graph, as illustrated in **Figure 78**. Same behavior applies to the real-time update Average Distribution graph.

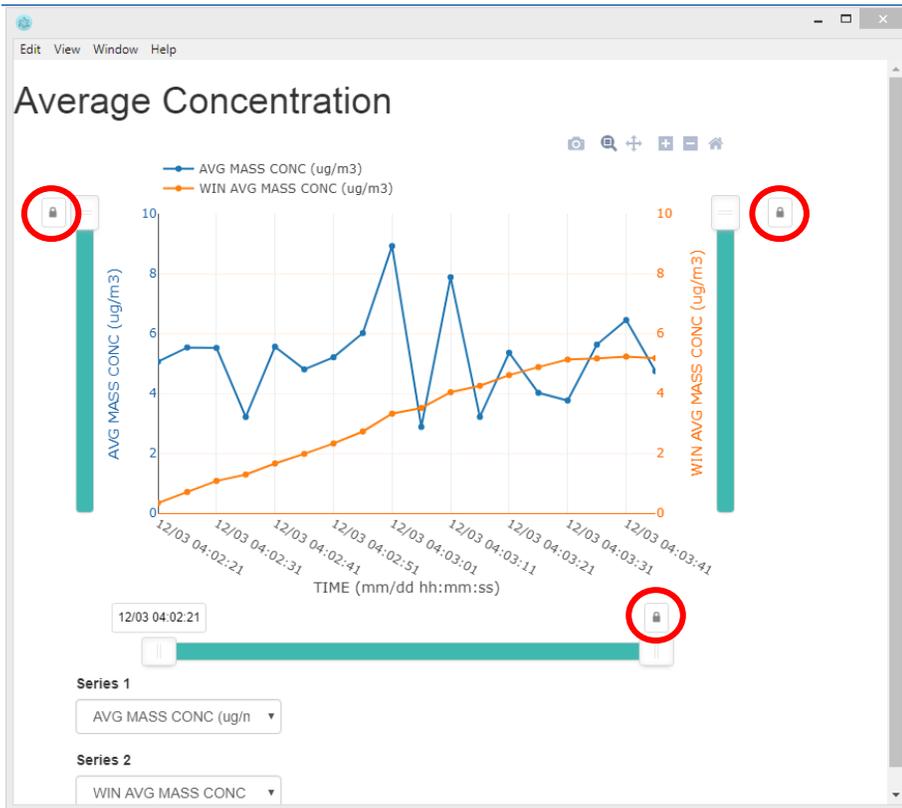


Figure 77 Real-time update Avg. Conc. Graph while zoomed out (Default)

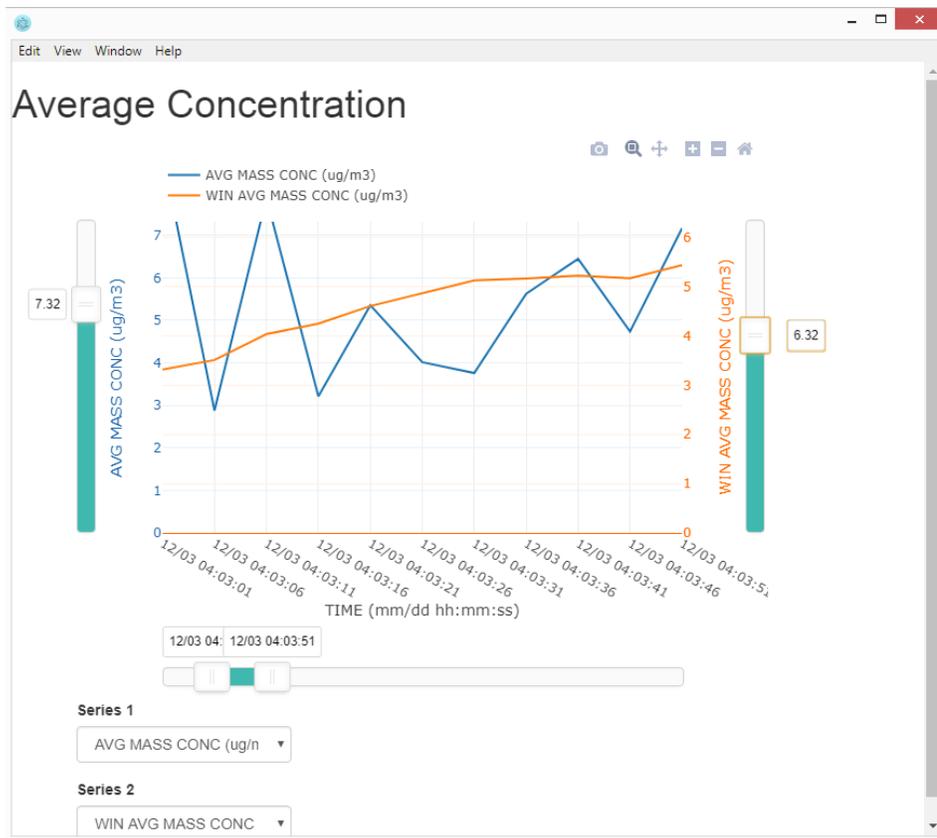


Figure 78 Real-time update Avg. Conc. Graph while zoomed in

3.3.6.3 Graphing tools

The Average Concentration and Average Distribution graph windows have tools located on the top right corner that allow the user to save the graph as a png, zoom, pan or reset axes back to default. See **Figure 79**.

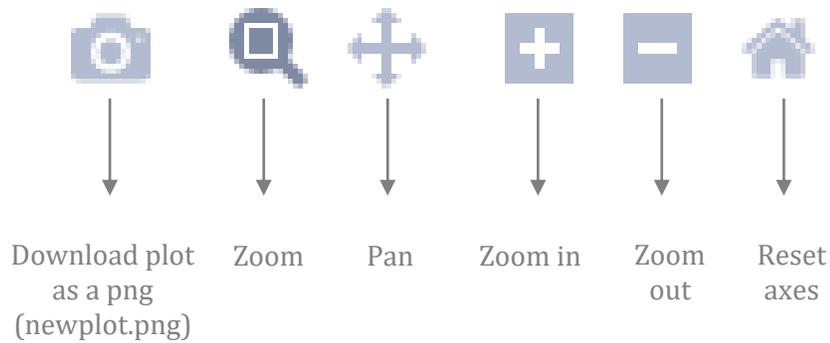


Figure 79 Graphing tools available at the top right corner of the graph window

If new data logs are read using any of the buttons in the Read Logs section, while the graph windows are open, the graphs will automatically update to show the latest data logs read.

3.3.7 Interpretation of Data

For every logging period, the data listed below is saved on the DustCount IS units' non-volatile memory in comma separated format. Data can be downloaded with or without Particle Distribution or Extended data columns.

Table 2 Data Log Columns for DustCount IS unit (factory default)

Column headers	Description	Format
DATE	Date at the end of the logging period	yy/mm/dd
TIME	Time at the end of logging period	hh:mm:ss (24h format)
AVG MASS CONC (mg/m3 or ug/m3)	Average mass concentration for the logging period.	Number with 3 decimal places
WIN AVG MASS CONC (mg/m3 or ug/m3)	Moving window average of the mass concentrations of previous logging periods	Number with 3 decimal places
TWA MASS CONC (mg/m3 or ug/m3)	Time weighted average of mass concentration.	Number with 3 decimal places
TWA PCT (%)		
COUNT CONC (1000 counts/m3)	Count concentration for the logging period	Number with 2 decimal places
FLOW RATE (mL/min)	Average flowrate for the logging period	Whole number
TEMP (degC)	Average ambient temperature inside DustCount IS unit for the logging period	Number with 2 decimal places
PRS (mBar)	Average ambient pressure for the logging period	Number with 2 decimal places
Pump (%)	Average pump PWM percentage for the logging period	Number with 2 decimal places
Prs-Flow (Pa)	Average pressure measured for the logging period, that is used to regulate flow	Whole number
Prs-Leak (Pa)	Average pressure measured for the logging period, that is used to help detect leaks	Whole number
dspTEMP (degC)	Average temperature of the digital signal processor for the logging period	Number with 2 decimal places
BATTERY	Battery state-of-charge at the end of the logging period	Whole number [1 - 100]. "ALM" displayed when battery charge falls below 1%
SN (numeric)	Unit serial number	Whole number
USERID	Optional 32 Character text string to provide additional context to log data	32 characters excluding commas and semi-colons.
SYS ALM	Alarm raised if there was any system error during the previous logging period	ALM if an alarm was raised, otherwise blank.

CONC ALM	Alarm triggered when configured logging period alarm threshold concentration is exceeded.	ALM if an alarm was raised, otherwise blank.
FLOW ALM	Alarm raised if the flow rate was not within +/- 5% of 1.0 L/min for the previous logging period	ALM if an alarm was raised, otherwise blank.
LEAK ALM	Alarm raised if excess air is leaking in from a loose filter cassette.	ALM if an alarm was raised, otherwise blank.
STEL ALM	Alarm triggered when moving window mass concentration is greater than the STEL threshold, consecutively, at least STEL frequency times, with STEL intervals	ALM if an alarm was raised, otherwise blank.
TWA ALM	Alarm triggered when TWA mass concentration with respect to the TWA threshold percentage is greater than the TWA alarm percentage.	ALM if an alarm was raised, otherwise blank.
CEIL ALM	Alarm triggered when the 1sec mass concentration is greater than configured ceiling alarm threshold	ALM if an alarm was raised, otherwise blank.
LASER ALM	Alarm is triggered when the output power of the laser exceeds 1.5 times the level at which it was set in the factory.	ALM if an alarm was raised, otherwise blank.
FILTER ALM	Alarm is triggered when an internal running filter mass counter is greater than the factory-defined filter mass threshold.	ALM if an alarm was raised, otherwise blank.
IMPACTOR ALM	Alarm is triggered when an internal running impactor mass counter is greater than the factory-defined impactor mass threshold.	ALM if an alarm was raised, otherwise blank.

Extended Data Column Information.

Column headers	Description	Format
GRAV_COEFF(%)	Configured Gravimetric calibration coefficient.	Number with 3 decimal places
LOGPER_THR(ug/m3)	Configured Logging period alarm threshold.	Number with 3 decimal places
LOGPER(sec)	Configured Logging Period.	Whole Number.
STEL_THR(ug/m3)	Configured STEL Alarm Threshold.	Number with 3 decimal places
STEL_WIN(n/a)	Configured STEL window size.	Whole Number.
STEL_INT(mins)	Configured STEL alarm interval.	Whole Number.
STEL_FRQ(n/a)	Configured STEL alarm frequency.	Whole Number.
TWA_THR(ug/m3)	Configured TWA concentration alarm threshold.	Number with 3 decimal places
TWA_PCT(%)	Configured TWA Alarm Percentage.	Number with 3 decimal places
TWA_LEN(hrs)	Configured TWA Duration.	Whole Number.
CEIL_THR(ug/m3)	Configured Ceiling Alarm Threshold.	Number with 3 decimal places
ALM_MUTED	Flag that records if the alarm was muted during a logging period at least once.	

Table 3 Additional Log Columns for particle distribution data for DustCount IS unit

Column Headers	Description	Format
0.300um (1000 counts/m3)	Bin diameters closest to 0.300um	Number with up to 2 decimal places
0.375um (1000 counts/m3)	Bin diameters closest to 0.375um	Number with up to 2 decimal places
0.468um (1000 counts/m3)	Bin diameters closest to 0.468um	Number with up to 2 decimal places
0.585um (1000 counts/m3)	Bin diameters closest to 0.585um	Number with up to 2 decimal places
0.732um (1000 counts/m3)	Bin diameters closest to 0.732um	Number with up to 2 decimal places
0.915um (1000 counts/m3)	Bin diameters closest to 0.915um	Number with up to 2 decimal places
1.144um (1000 counts/m3)	Bin diameters closest to 1.144um	Number with up to 2 decimal places
1.430um (1000 counts/m3)	Bin diameters closest to 1.430um	Number with up to 2 decimal places
1.788um (1000 counts/m3)	Bin diameters closest to 1.788um	Number with up to 2 decimal places
2.235um (1000 counts/m3)	Bin diameters closest to 2.235um	Number with up to 2 decimal places
2.793um (1000 counts/m3)	Bin diameters closest to 2.793um	Number with up to 2 decimal places
3.492um (1000 counts/m3)	Bin diameters closest to 3.492um	Number with up to 2 decimal places
4.365um (1000 counts/m3)	Bin diameters closest to 4.365um	Number with up to 2 decimal places
5.456um (1000 counts/m3)	Bin diameters closest to 5.456um	Number with up to 2 decimal places
6.821um (1000 counts/m3)	Bin diameters closest to 6.821um	Number with up to 2 decimal places
8.526um (1000 counts/m3)	Bin diameters closest to 8.526um	Number with up to 2 decimal places
10.658um (1000 counts/m3)	Bin diameters closest to 10.658um	Number with up to 2 decimal places
13.322um (1000 counts/m3)	Bin diameters closest to 13.322um	Number with up to 2 decimal places
16.653um (1000 counts/m3)	Bin diameters closest to 16.653um	Number with up to 2 decimal places
20.816um (1000 counts/m3)	Bin diameters closest to 20.816um	Number with up to 2 decimal places

4 Maintenance

4.1 Battery

The DustCount IS unit comes with the battery preinstalled. It should not need to be replaced, however if it does, follow the instructions below.

4.1.1 Battery replacement procedure

- 1) Remove the rear battery cover using a small Phillips screwdriver. See
- 2) **Figure 80**.
- 3) Slide off the battery cover and take the old battery out of the housing. See **Figure 81**.
- 4) Unscrew the battery cable clamp from the case and unplug the battery from its receptacle. See **Figure 82** and
- 5) **Figure 83**.
- 6) For the DustCount IS 9000-Z1 Ensure that the new battery is marked

Nanozen Industries Inc.
Assembled in Canada
P/N 10-00144-0*
Rechargeable Lithium Ion Battery Assembly
Voltage 3.6V, Capacity 9Ah, 32.4 Wh

Notes:

- 1) *the * can be any letter from C through Z.*
- 7) Plug the new battery cable into the mating receptacle inside the DustCount IS unit, paying attention to the keyed orientation.
- 8) Reattach the battery cable clamp, reinstall the battery and the battery cover.
- 9) Restart the DustCount IS unit.
- 10) Set the date and time using the User Interface. *Note: date and time are lost when the battery is disconnected.*



Figure 80 Loosening and removing Screw for Rear Battery Cover



Figure 81 Sliding off Rear Battery Cover



Figure 82 Removing Screw to Release Battery Cable Tie



Figure 83 Press Down on Tab to Disconnect Battery

Note: ALWAYS CONNECT THE BATTERY CHARGER (USB CABLE) AFTER REINSTALLING THE BATTERY. This connects the battery electrically and resets the battery protection.

4.2 DustCount IS Maintenance Schedule

The following table outlines the recommended schedule for performing maintenance on the DustCount IS unit.

Table 4 Recommended DustCount IS Maintenance Schedule.

Item	Frequency
Perform Zero Check	Before each use.
Clean and Oil Impactor	Before each sampling session (recommended), OR when IMP alert is raised.
Clean Air Inlet	Before each sampling session (recommended), OR when performing Impactor maintenance.
Replace Protective Filter	When FILT alert is raised.
Replace Support Filter	When replacing filter.
Return to Factory for Cleaning & Calibration	Annually.

5 Impactor Selection

The table below outlines the Impactor kits available for the DustCount IS unit. The combination of the Impactor Cap and Impactor Plate Holder determine the specific sampling convention cut size at a flow rate of 1.0L/min.

Note: The Impactor plate is identical in all kits.

Sampling Convention	Impactor Cap	Impactor Plate Holder	Impactor Plate
<p>PM 2.5</p> <p>Part Number: DAI-9000-02</p>			
<p>Respirable</p> <p>Part Number: DAI-9000-04</p>			
<p>PM 10</p> <p>Part Number: DAI-9000-10</p>			



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