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9000-Z1 DustCount® IS User Guide (ExIS)

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For DustCount IS Firmware 7.1.2x, User Interface 1.5.x.

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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 is an Optical Particle Counter (OPC) that provides real-time particle count, particle size distribution and mass concentration data. It also provides real-time information on the mass concentration distribution over the PM2.5, respirable (PM4.0), and PM10.0 fractions of the particle size range.

The DustCount IS unit includes 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 the ability to enter gravimetric information into the device via its User Interface (UI) application.

The User Interface for the DustCount runs on a PC which has Windows 7 Service Pack 1 (SP1) 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 data logs for post-processing and display.

The DustCount IS is certified as Intrinsically Safe for hazardous environments where the air contains the following substances all 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.)
- *Methane
- *Propane
- *Ethylene fumes

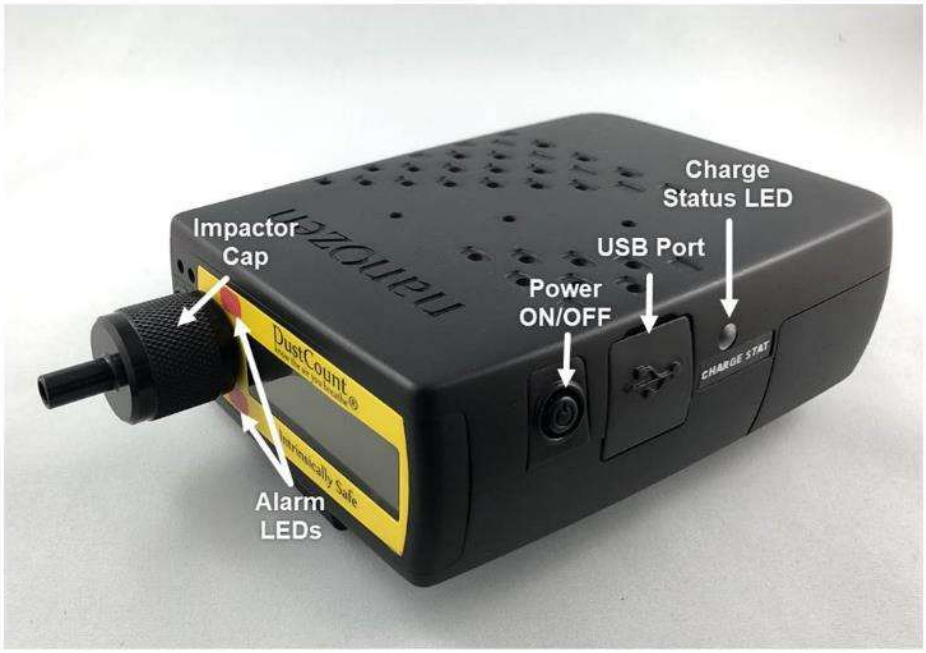
Caution: The DustCount IS unit is not certified to be Intrinsically Safe where the air contains combustible quantities of the following substances at any time:

- Combustible metal dust
- Acetylene, hydrogen

*Refer to the label on the back of the DustCount IS, indicating its safety certification, as earlier versions were not marked as certified for IEC**Ex ia IIB Ga**, and North America **Class1, Division 1, Groups C&D,** which cover methane, propane, and ethylene outside of mine firedamp.

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.

Caution: Charging the battery, connecting a USB cable to the USB port on the DustCount IS unit or opening the battery compartment should not be performed in an explosive environment.



The DustCount IS unit comes 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 8***

2.2 Charging

Batteries are shipped with less than 100% state-of-charge. The present state of charge is displayed on the LCD screen when the unit is on. Charging to 100% is recommended prior to further use. To charge the battery, connect the supplied battery charger to the mains and to the DustCount IS unit's USB port located 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. Expected charging time for % state of charge from an initial 0% charge state are outlined below.

0 to 30% state of charge in 1.5 hours
0 to 60% state of charge in 3 hours
0 to 75% state of charge in 4 hours
0 to 100% state of charge in 7 hours

To calculate the time to full charge from a known partial charge time use the formula Full Charge Time – Partial Charge Time = Time to Full Charge. For Example: Charging to 100% from a partial charge from 30% state of charge would take 5.5 hours (i.e., 7.0hrs -1.5hrs = 5.5hrs).

⚠ **Caution: The DustCount IS unit should not be charged in explosive environments**

2.3 Cleaning the Inlet

If the DustCount IS has been exposed to high dust concentrations for prolonged periods, 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 the cassette with filter is installed in the unit.
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 Preparing 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, and PM 10). Please refer to ***Section 10*** for the impactor kits available for the DustCount IS unit.

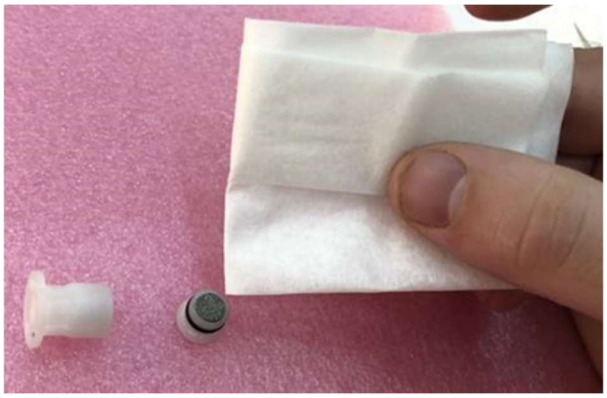
The impactor plate comes pre-oiled from the factory, but to operate properly, the impactor plate must be cleaned and have its oil replenished on a regular basis. It is recommended that the Impactor plate is cleaned and oiled before each sampling session or at a minimum when the unit raises an IMP maintenance required alert notification.

2.4.1 Accessing the impactor

To access the impactor plate, unscrew the impactor cap counterclockwise and slide the plastic impactor plate assembly out from the air inlet.

Separate the impactor plate from the impactor plate holder by pulling the two pieces directly apart.

2.4.2 Cleaning the impactor plate.



Clean the impactor plate by using a supplied alcohol wipe or a fiber free cloth and isopropyl alcohol to wipe away any accumulated particulate.

2.4.3 Oiling the Impactor

Use the Impactor Oil Applicator to apply one drop of oil to the impactor plate. Let sit for 5 seconds allowing the oil to disperse into the impactor plate.

Do not put apply more than one drop at a time.

If there is no excess oil pooled on the collection plate repeat the above step until there is.

This ensures that the plate is fully impregnated with oil

Insert the impactor plate into the plate holder and press the two pieces together**.**

Twisting while pressing the two pieces together will allow a good seal between the pieces.

Ensure the pieces are pressed together fully.

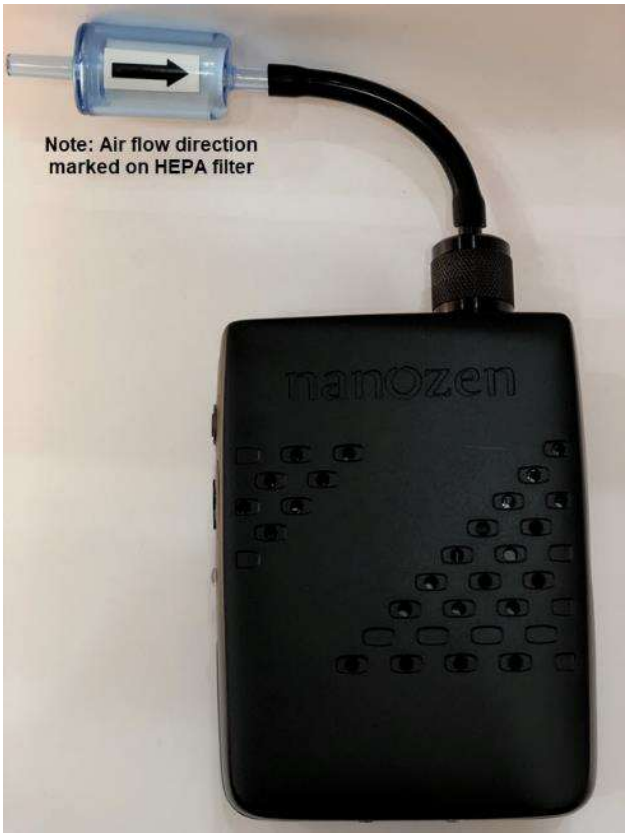
With the DustCount IS in an upright position, place the plastic impactor plate assembly into the impactor base.

Screw the impactor cap onto the base ensuring the cap screws all the way down.

Do not over-tighten.

2.5 Validating DustCount IS Unit Prior to sampling.

Prior to sampling, it is common 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 environment.



1. Use a piece of the supplied anti-static tubing to connect the HEPA filter to the DustCount IS.
2. Put one end of the tube on the outlet of the HEPA filter, and the other end on the air inlet of the impactor cap. Double check that the HEPA filter air flow direction is correct.
3. Turn on the unit and let it go through its pump 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/m^3 within 2 minutes. The per-second mass concentration (MC) readings on the LCD should be 0.0 mg/m^3, sporadically higher readings are normal.
4. 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.

2.6 Installing and Removing the Filter

The built-in Cassette comes with a 25mm filter support pad and 25mm 5um PVC filter to protect down-stream channels from dust.

The filter will 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 flow alarm (FLOW) will appear on the unit's LCD.

When performing a gravimetric or composition analysis sample, remove the protection filter and install a pre-weighed 25mm Teflon® (PTFE) filter with 2 µm pore size, or a Poly Vinyl Chloride (PVC) filter with 5 µm pore size.

Caution: Even if gravimetric analysis sampling is not required, a filter, and filter support pad should always be installed to keep downstream channels clean and protect the unit's pump.

2.6.1 Accessing the Filter Cassette

1. Before removing the filter, turn on the DustCount IS unit. Use the 'System Air Purge' function under the User Settings tab of the UI software. This will pull any loose dust onto the filter.
2. Turn the unit off.
3. Follow steps in ***Section 2.6.3*** to install a new filter and support pad.

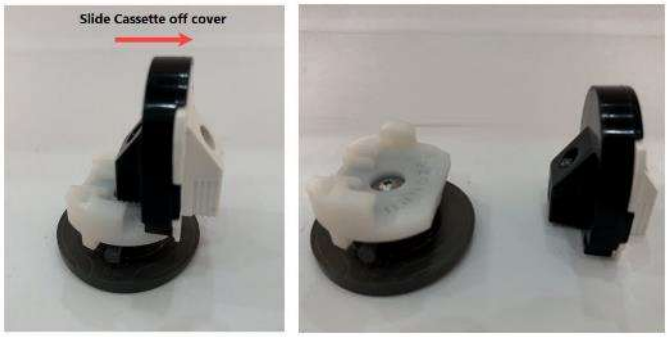
Turn the button cover on the side of the unit 90° counterclockwise to unlock the cover from the housing.

This cover holds the filter Cassette in place.

⚠ **To avoid damaging the cassette housing, do not turn the cover beyond 90° counterclockwise.**

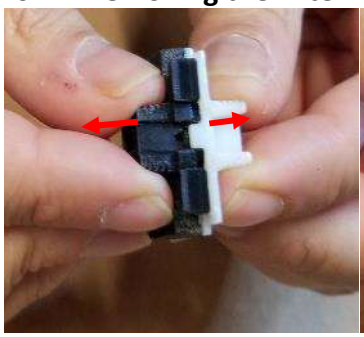
With the cassette cover in the unlocked position.

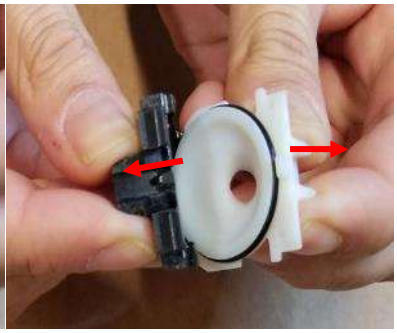
Pull the cover out of the housing to expose the filter Cassette.



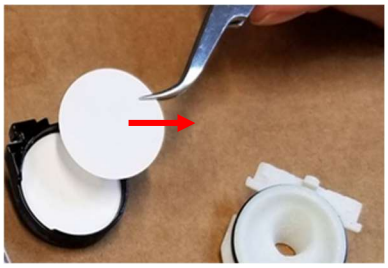
Slide the filter Cassette off the cover.

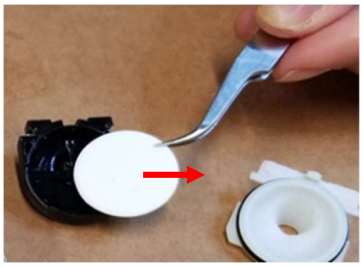
2.6.2 Removing the Filter





Pull the two halves of the filter Cassette apart to open.





Remove the filter with tweezers, being careful not to cause any collected dust to come off the filter.

Remove the support pad with tweezers.

2.6.3 Installing a New Filter

Prior to installing a new filter and support pad, clean the inside of the cassette with isopropyl alcohol using a fiber-free applicator, then spray with clean compressed air.

Install a support pad into the empty black half of the cassette.

DustCount units ship with a Zefon FSP25 – 25mm Cellulose support pad installed in the cassette, but any pad with the same thickness and diameter will work.

Use tweezers to place a 25 mm filter in the cavity.

The DustCount units ship with a Zefon FPVC525 – 25 mm 5um PVC filter, installed in the cassette. 25mm PTFE 2um filters may also be used if available.

Reassemble the filter Cassette.


Press the two halves at several points around the Cassette to ensure a secure seal.

Slide the filter Cassette into the Cassette cover. The cassette can only be slid on one way.

Reinstall the button cover assembly and turn the button cover on the side of the unit 90° clockwise to lock the cover in place. Please note that the filter Cassette cover can only fit in the housing one-way. This is the reverse of the process shown in ***Section 2.6.1.***

⚠ **To avoid damaging the cassette housing do not attempt to turn the cover beyond 90° clockwise.**

2.7 Working with Labs for filter analysis

When analysis of a filter sample from a credited lab is required, it is not recommended to install and remove filters from cassettes as this may lead to contamination of sample/filter or loss of collected sample deposited on the filter. For sample analysis, it is recommended to utilize replacement cassettes and sleeves to mitigate the handling of exposed filters prior to and after the sampling exercise.

High-level process outline:

1. Customers order cassettes with sleeves and have them shipped to their lab.
2. The lab is equipped to handle Nanozen cassettes (generally providing this guide on cassette handling is enough)
3. When the customer requires a lab analysis the lab pre-weighs a filter and prepares the cassette and sleeve and ships the assembly to the customer.
4. The customer installs the cassette that has the pre-weighed filter and performs the sample collection.
5. After sampling is completed the customer removes the cassette, installs the sleeve and ships to the lab for analysis and results.

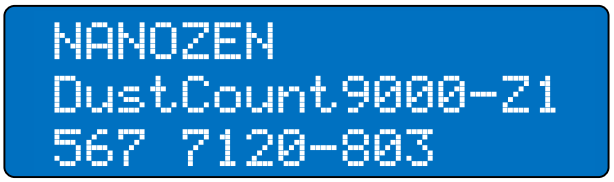
3 Device Operation

After pressing the power button, the unit will begin an *initialization and pump 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.

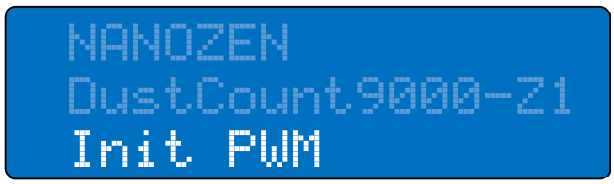
Once the sequence is complete, the DustCount IS unit starts logging the particle count, mass concentration and other operational data. It also starts displaying mass concentration and important operational data in real-time on its LCD. *Note: Pump calibration may continue for a few seconds in this operating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

3.1 LCD

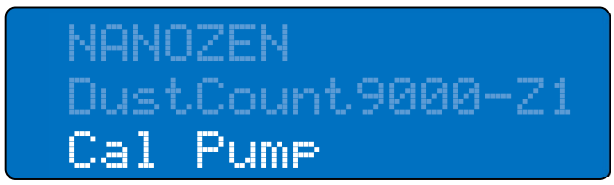
3.1.1 Start-up screen



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



The first screen also indicates that the DustCount IS unit its running through its initialization sequence.



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.

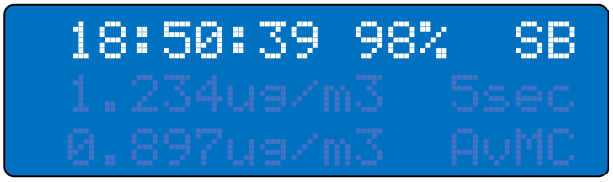
3.1.2 Normal operation

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

3.1.3 Information displayed on all pages

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

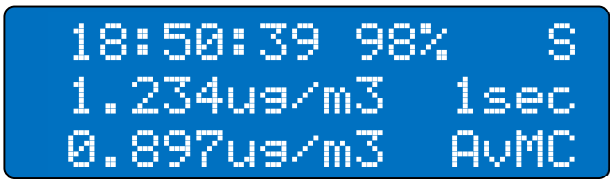
- Current time (hh:mm:ss).
- Battery state-of-charge in percentage. *Note: This will take up to 25 seconds to stabilize after start-up.*
- Any active alarms or alerts will cycle along with the battery percentage.
- Audible alarm sound and LED flash indicator, S if enabled (default), and X if disabled.
- Bluetooth connection status B, which appears when there is a Bluetooth connection and the User Interface software running on the host has detected the DustCount IS unit.



Information displayed on top row of all LCD pages

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

3.1.4 LCD Page 1 – Mass Concentration information

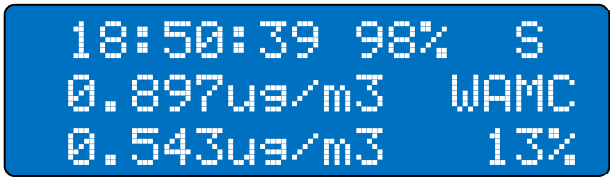


Mass concentration measured over the previous second is displayed on the second row.

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/m^3. The units can be changed to $\mu g/m^3$ via the User Interface.

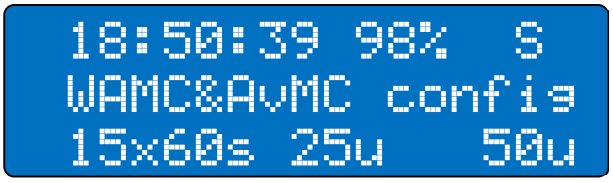
3.1.5 LCD Page 2 – Moving Window and TWA information



STEL Moving Window Average Mass Concentration is displayed on the second row.

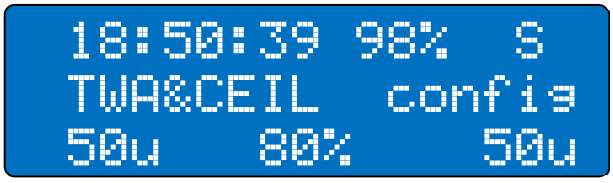
TWA Concentration, and TWA percentage with respect to configured TWA percentage threshold is displayed on the third row.

3.1.6 LCD Page 3 – STEL and Logging Period User Settings



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

3.1.7 LCD Page 4 – TWA and CEIL User Settings



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

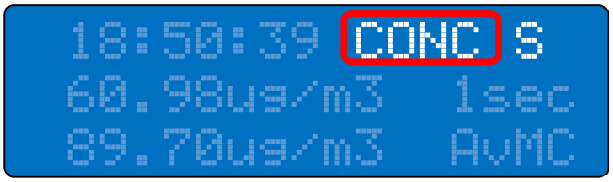
3.1.8 LCD Page 5 – DustCount IS Information

Displays the model type on the second row, and serial number and firmware versions on the third row.

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.

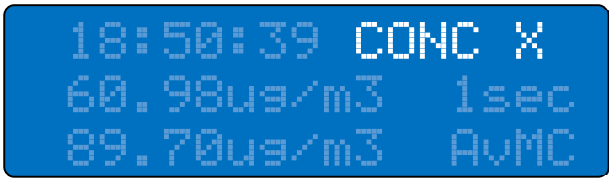
Textual alarms are displayed in the top row and occupy the same space on the display as the battery state-of-charge.



Concentration Alarm (CONC), with audible and visual alarms enabled

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 the audible indications for alarms are disabled the screen will display an X.



Concentration alarm (CONC) with audible and visual alarms disabled

The following sections outline the alarms, and alerts that can be triggered. Refer to ***Table 1*** for recommended user actions for troubleshooting.

3.2.1 Battery Alarms (BAT, LOW BATTERY! PLUG ME IN)

When the battery's charge is at 5% and below, the BAT alarm will appear in the alarm section of the LCD, and LOW BATTERY! PLUG ME IN will appear on the display. The units LEDs will initially flash 3 times and then stop. The unit will continue to beep 3 times each minute for as long as the battery state of charge is below 5%.

While the battery state of charge is between 5% and 2%, the DustCount IS unit will continue to take measurements and log data normally.

When the battery state of charge reaches 1%, logging will stop, the LCD backlight will go dark and the pump will turn off.

When the battery state of charge reaches 0%, the unit will briefly display Preparing to power down unit. and then proceed to power itself down.

3.2.2 System alarm (SYS)

If there is any system failure in the DustCount IS unit, the display will show SYS.

3.2.3 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.

3.2.4 Leak detection alarm (LEAK)

If there is a leak in the DustCount IS units filter Cassette the LCD will display LEAK.

3.2.5 Laser alarm (LSR)

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. Protection circuitry automatically reduces the laser power to safe limits, but the particle concentration readings will be inaccurate.

3.2.6 Logging period concentration alarm (CONC)

When the average mass concentration of the previous logging period (AvMC) is above the configured alarm threshold, the LCD will display CONC.

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

3.2.7 Short Term Exposure Limit alarm (STEL)

The STEL alarm triggers when the STEL moving window mass concentration exceeds the configured STEL threshold. The LCD will display STEL.

3.2.8 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 LCD will display TWA. The alarm can be cleared by turning off the DustCount.

3.2.9 Ceiling alarm (CEIL)

The Ceiling Alarm triggers when the 1sec mass concentration exceeds the configured Ceiling alarm threshold. The LCD will display CEIL.

3.2.10 Excess Exposure alarm (EXEX)

The Excess Exposure alarm triggers when either of the following conditions are met:

1) When the mass concentration value averaged over the moving window of the past n logs (default n=15 logs and 60-second log period) exceeds the TWA threshold the DustCount considers this an Excess Exposure event. Note, this is not yet an Excess Exposure alarm. If there are 2 or more consecutive Excess Exposure Events within 60 minutes of each other, the Excess Exposure alarm is triggered.
2) The Excess Exposure Alarm is raised if there are more than 4 Excess Exposure events in an 8-hour period, prorated based on the TWA duration hours. (i.e., >2 events in a 4-hour period if the TWA Duration is set to 4 hours, >6 events in a 12-hour period if the TWA Duration is set to 12 hours). This alarm is raised Even if the Excess Exposure events occur more than 60 minutes apart

The LCD will display EXEX. The alarm can be cleared by turning off the DustCount.

NOTE: The Excess Exposure Alarm is supported in DustCount firmware releases 7.1.21 and above.

3.2.11 Impactor Maintenance Alert (IMP)

The Impactor Maintenance Alert is triggered when the impactor mass counter exceeds the factory set mass threshold. The LCD will display IMP.

3.2.12 Filter Maintenance Alert (FILT)

The Filter Maintenance Alert is triggered when the filter mass counter exceeds the factory set mass threshold. The LCD will display FILT.

3.2.13 Pump disabled Alert (PUMP)

When the DustCount IS unit's pump is turned off using the Turn Pump OFF/ON toggle via the User Interface application software, the LCD will display PUMP.

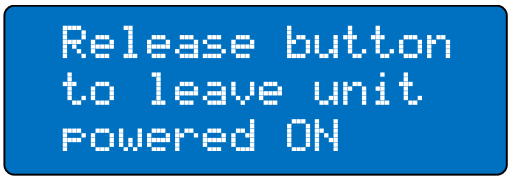
Table 1 User actions for Alarms & Alerts

Alarm/Alerts	Trigger	User Action
BAT	Charge drops below 5%	Charge the unit.
SYS	A system hardware failure has occurred	Restart the unit. If the alarm persists, contact Nanozen Technical support.
FLOW	Flow rate is not within 5% of the factory set point	• Ensure air inlet is not blocked. Ensure breathing tube (if applicable) is not kinked. • Power cycle unit if the flow alarm persists. • Clean the impactor and replace the filter and support pad. If the alarm still persists, contact Nanozen Technical support.
LEAK	A leak has been detected	• Inspect the filter 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.
LSR	The output power of the laser exceeds 1.5 times the factory set level	• Protection circuitry automatically reduces the laser power to safe limits. Data readings will be inaccurate. Power the unit off and remove it from an explosive environment. • Return the unit to Nanozen for repair.
CONC	Concentration threshold exceeded	• Defined by local Industrial Hygiene (IH) /Occupational Health Safety (OHS) processes.
STEL	STEL threshold exceeded	Defined by local IH/OHS processes.
TWA	TWA threshold exceeded	Defined by local IH/OHS processes.
CEIL	Ceiling threshold exceeded	Defined by local IH/OHS processes.

EXEX	1) If there are 2 or more consecutive Excess Exposure Events within 60 minutes of each other the alarm is triggered. 2) If there are more than 4 Excess Exposure events in an 8-hour period, prorated based on the TWA duration hours. (i.e., >2 events in a 4-hour period, >6 events in a 12-hour period). This alarm is raised Even if the Excess Exposure events occur more than 60 minutes apart.	Defined by local IH/OHS processes.
IMP	Alert: Impactor plate maintenance is required.	• Cleaning and oiling of the Impactor plate is required. • After cleaning, clear and Acknowledge Impactor alert in User Interface (UI) application.
FILT	Alert: Filter & support pad replacement required.	• Filter and support pad replacement is required • After replacing, clear and acknowledge Filter alert in UI application.
PUMP	Alert: Pump is turned off via the User Interface software.	Enable Pump via the UI software application.
LOW BATTERY PLUG ME IN	Charge drops below 5% alert	Charge the unit

3.3 Power Button

To power the unit off, press and hold the power button until you hear the pump stop or see the LCD backlight extinguish. While the power button is held down, the buzzer will beep once followed by a message on the LCD alerting the user to “Release button to leave unit powered ON”. If the button is not released, a message "Preparing to power down unit" will be displayed. Release the button at this point to allow the unit to power itself down.



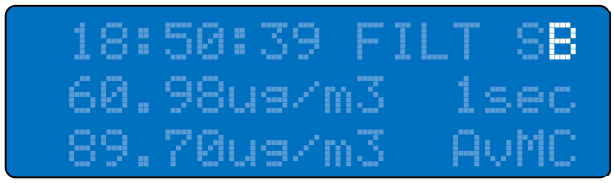
When the power button is pressed the buzzer will beep once followed by a message to release the power button to leave unit powered on.

Message displayed on the LCD when the unit is powering down. Release the power button when this message is displayed.

Caution: If you hold the button too long the red LEDs will flash, indicating that you should release the power button. Do not continue to hold the button past this point, as prolonged operation in this mode may reduce the long-term reliability of the unit.

3.4 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 running the User Interface software is connected.



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

4 User Interface (UI) software for PC

The User Interface software allows management and configuration of DustCount units. The software also allows the download, saving and graphing of data logs from DustCount units. The software communicates with DustCount units either via USB or Bluetooth interfaces.

Install the UI application for the DustCount IS on the host PC. Note: the PC must have one of the following operating systems. Windows 7 Service Pack 1 or later. To install the UI application, double-click on the .exe 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 menu bar, then clicking on *About DustCount UI Software.* The following description is for UI version 1.5.x, which is released in conjunction with DustCount IS firmware 7.1.2x.

4.1 Connect DustCount IS unit via USB

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

⚠ **Caution: Do not connect the DustCount IS unit via USB when the unit is in an explosive environment.**

A button labelled **SNxxx** 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.

4.2 Connect DustCount IS unit via Bluetooth

To connect to the DustCount IS unit via Bluetooth, you must pair your PC with it. Select the DUSTCOUNT<XXX> where <XXX> is the serial number of the unit in the available devices list. Enter the factory default PIN code "1234" if prompted 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.

A button labelled **SNxxx (Bluetooth)** 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.

DustCount units with firmware releases 7.1.20 and higher support Bluetooth Secure Authentication Mode, which requires a 4-digit PIN code that matches the PIN code configured on the unit to complete the pairing process. Enter the factory default PIN code "1234" when prompted during the pairing process. The default PIN code can be changed using the User Interface software application via the Connections Settings tab.

4.3 UI Page Layout

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

4.3.1 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.

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".

4.3.2 Tooltips

Tooltips can be turned on/off by clicking on the '?' at top right corner of the UI window. When enabled, additional details for action buttons and action text boxes are displayed when the mouse is hovered over them.

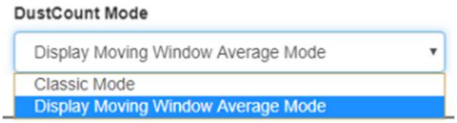
Tooltips are enabled when the icon is Orange/White

Tooltips are disabled when icon is White/Black

4.3.3 DustCount Mode

The DustCount Mode drop-down menu is a legacy feature supported on DustCount 8899 and 8866 models.

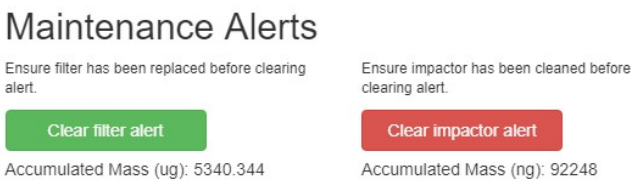
DustCount IS units inherently support both Logging Period Average(Classic Mode) and STEL Moving Window Average (Display Moving Window Average Mode) measurements. Changes made to this setting will have no effect to DustCount IS units.



4.3.4 Maintenance Alerts

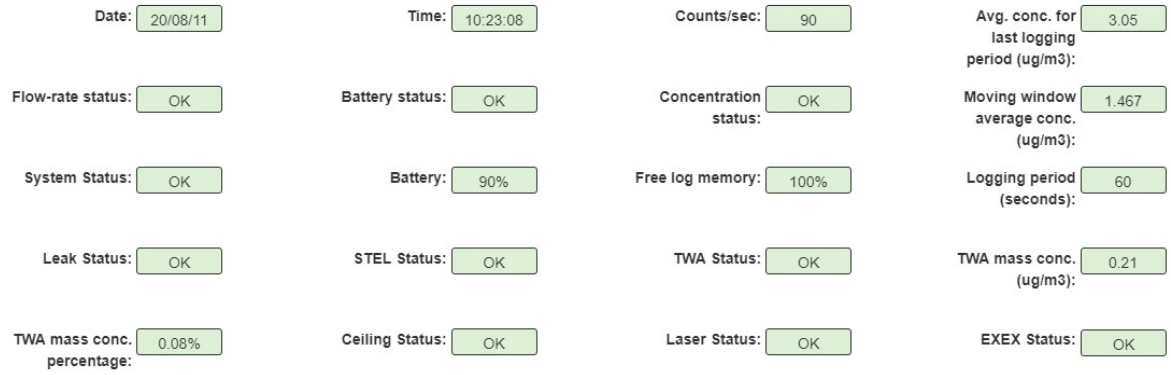
The Maintenance Alerts section provides the status of accumulated mass on the filter and impactor, along with providing a visual alert if either of them requires maintenance. A green button indicates the status of the filter or impactor is OK, a red button box indicates maintenance is required.

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.



4.3.5 Real-time Display

The Real-time Display section displays data polled from the DustCount IS unit once every 2 seconds. Any boxes that are grey mean the DustCount unit's firmware does not support the feature or alarm.



The following real-time data is polled.

- Current date is displayed in the **Date** box.
- Current time is displayed in the **Time** box.
- Particle count for the previous second is displayed in the **Counts/sec** box.
- Concentration for the previous logging period is displayed in the **Avg. conc. for last logging period** box **(**units are **mg/m³ or ug/m³**, depending on the Mass Concentration Units value that is chosen**)**.
- Concentration for the STEL Moving Window Average is displayed in the **Moving window average conc** box**. (**Units are **mg/m³ or ug/m³**, depending on the Mass Concentration Units value that is chosen**)**.
- Battery State-of-Charge % is displayed in the **Battery** box.
- Available memory space percentage is displayed in the **Free log memory** box.
- Logging period is displayed in the **Logging period (in seconds)** box.
- Concentration for the TWA is displayed in the **TWA mass conc** box**. (**Units are **mg/m³ or ug/m³**, depending on the Mass Concentration Units value that is chosen**)**.
- TWA concentration percentage with respect to the configured alarm threshold value is displayed in the **TWA mass conc. percentage** box.
- Alarm Status for: **Flow-Rate, Battery, Concentration, System, Leak, STEL, TWA, Ceiling, Laser, and EXEX**. If an alarm is active, 'ALM' is displayed in the **Status** box. Otherwise 'OK' is displayed.

4.3.6 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.

To disable logging select the *Disable Logging* action button. The Logging Mode title will indicate "Logging Disabled".

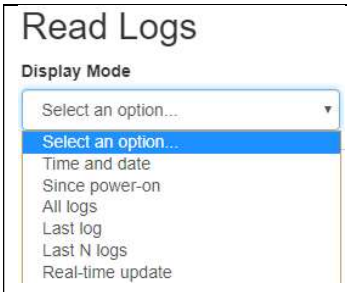
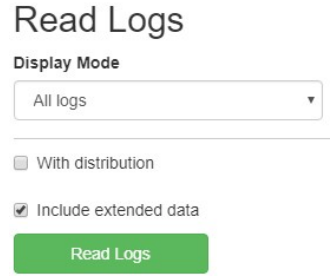
To collect a single log event, select the *One-shot Logging* action button. The Logging Mode title will indicate "One-shot Logging".

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. The Logging mode title will display 'Logging Disabled' once one-shot logging is complete.

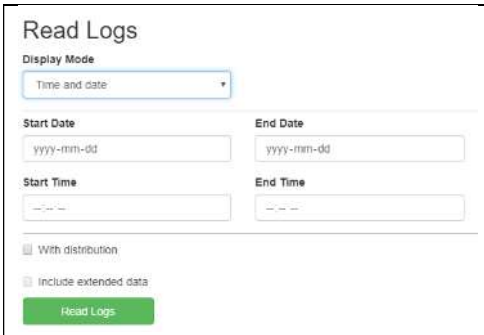
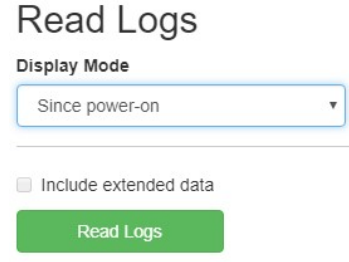
4.3.7 Read Logs

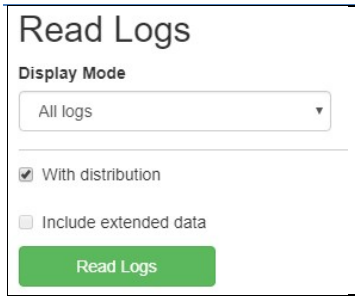
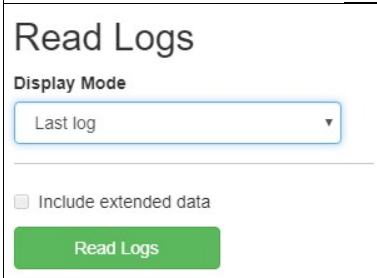
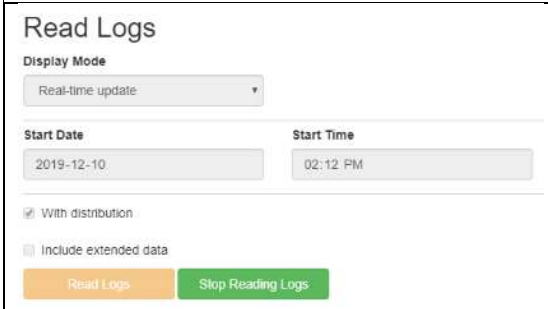
The Read Logs section allows the user to download and display data entries in the *Log Read Out* section. Use the Display Mode drop-down menu to select an option.

Note: The Read Logs button will change to orange while data download 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. While logs are downloading the log readout window will be empty.

	Read logs Display Mode drop-down menu options. Certain options will result in context sensitive data field requests.
	Depending on the option selected, the following additional checkbox options will be displayed. **With distribution**: When enabled, log data will include particle distribution information. **Include extended data**: When enabled, log data will include User Settings Tab configuration information.

Display mode drop-down options are detailed below:

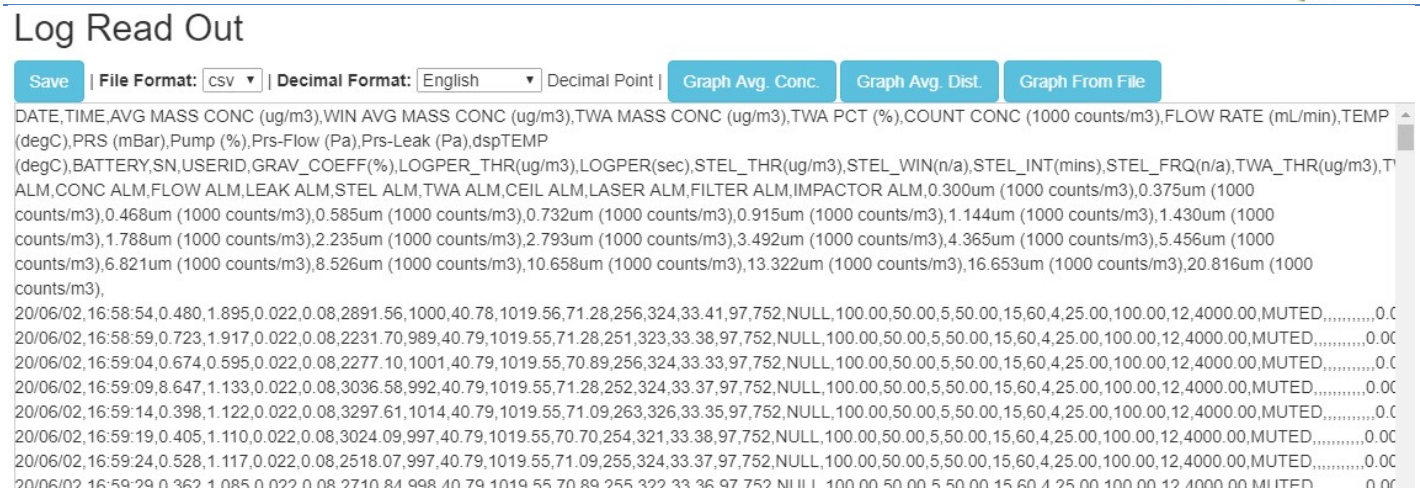
	**Time and date:** Used to download data within a specific date and time range. Enter a start and end date and time values. **Note: This Read Logs operation will take approximately 1 minute to start while selected data range is being prepared for download.**
	**Since power-on:** Used to download data since the most recent power-on.

	**All logs:** Used to download all data stored on the unit
	**Last Log:** Used to download the most recent data log.
	**Last N logs:** Used to download a specific number of the most recent data logs. Enter a number into the Number of Logs box.
	**Real-time update:** Used to download and view or graph data logs in real-time. The UI will display data logs in the Log read out text box at the end of each 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 always reads data logs with particle distribution. **Note: This Read Logs operation will take approximately 1 minute to start while data is being prepared for download** 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. To stop the real-time updates, click the *Stop Reading Logs* button

4.3.8 Log Read Out

The Log Read Out window is populated with data downloaded from the unit once a Read Logs mode is selected. Data is only displayed in the Log Read Out window once the download is completed. During download the Read Logs button remain orange, and the log read-out window will be grey until all requested logs have been received. Older data is overwritten in the log read out window when new logs are requested.

Section 5 provides details on saving logs downloaded from the DustCount unit.
Section 6 provides details on graphing logs downloaded from the DustCount unit.



4.3.9 Clear Logs

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

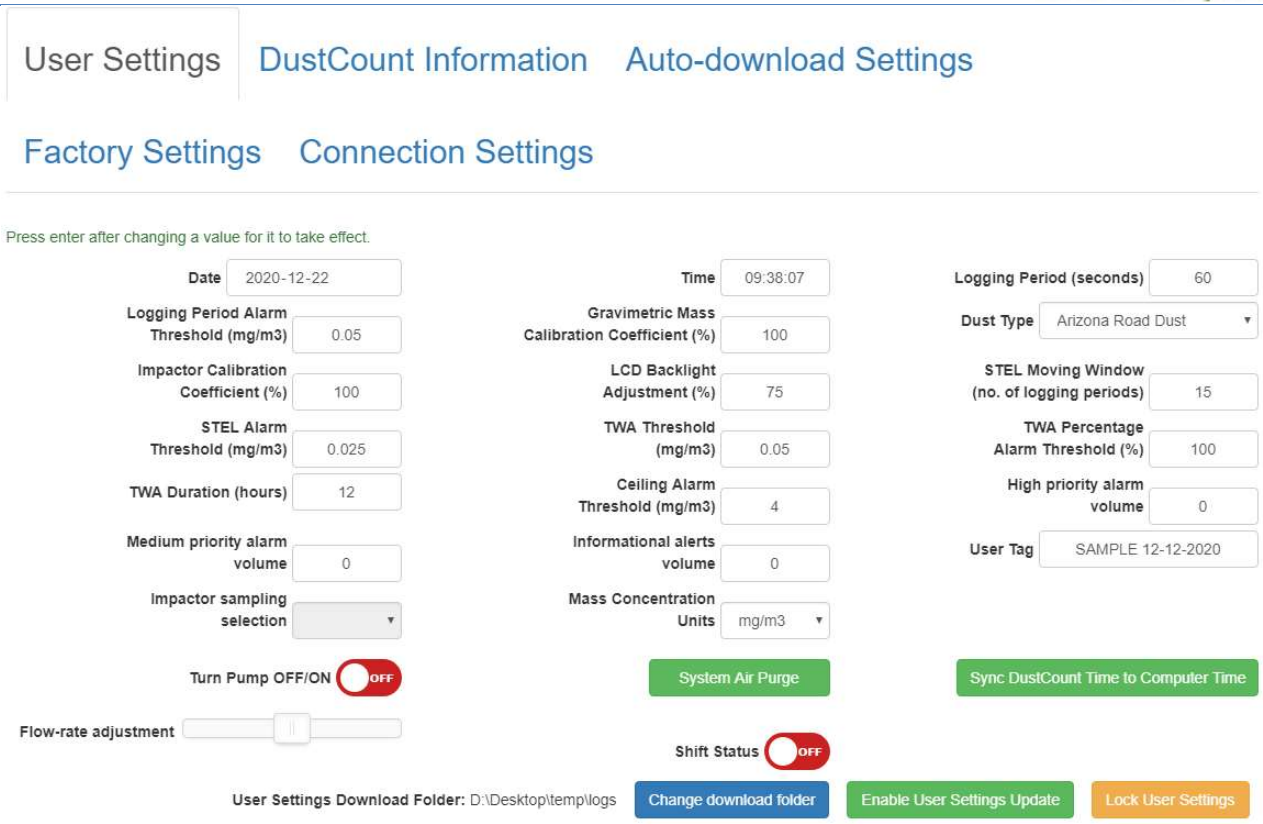
The unit can hold up to a million logs, which can result in a large amount of data if logs are not cleared on a regular basis. Unused logs should be cleared regularly. To clear the logs via the UI, the following options are available:

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

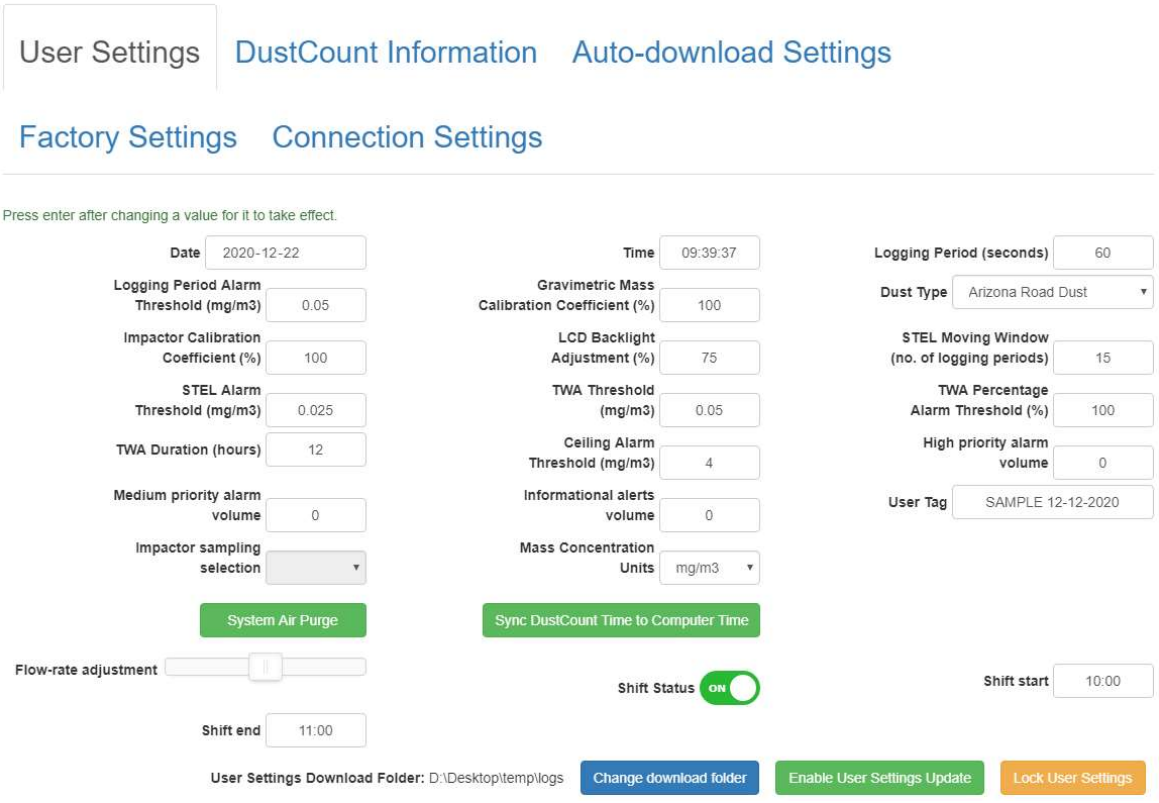
Note: Data logs are permanently deleted from the DustCount IS when using any of the above clear log operations.

4.3.10 User Settings Tab

The User Settings Tab allows a user to view and change 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 with Shift status disabled.



User Settings with Shift Status enabled.

The following section describes the various User setting options. Valid value ranges and defaults are outlined in ***Table 2***.

Date, Time
To adjust the DustCount IS unit date and time settings. You can also use the Sync DustCount Time to Computer time button.

Logging period (seconds)
Logging period is the frequency at which a data log is saved on the unit. A log event will be generated based on the configured value. For example, if set to 60, a new log event will be written every 60 seconds.

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.

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.

Dust Type
Select from available dust types in the "Dust Type" field. By default, Arizona Road Dust is enabled.

Impactor Calibration Coefficient (%)
This coefficient allows the user to scale count and concentration to account for particle loss through the impactor.

⚠ **Caution: The Impactor Calibration Coefficient is set to 100% for Nanozen Impactors and should not be changed.**

LCD Backlight Adjustment (%)
Enter a percentage value to adjust LCD brightness.

STEL Moving Window (no. of log periods)
Moving window size is the size of the moving window for the STEL average mass concentration. For example, if the logging period is set to 60 seconds and the STEL Moving Window is set to 15, the calculated STEL average mass concentration will be averaged over a 15-minute moving window (15 * 60s = 15-minute moving window).

STEL Alarm Threshold (mg/m³ or ug/m³)
Enter the concentration threshold to trigger the STEL alarm.

TWA Threshold (mg/m³ or ug/m³)
Enter the concentration threshold to trigger the TWA alarm.

TWA Percentage Alarm Threshold (%)
Enter the percentage of the TWA mass concentration required to trigger the TWA alarm.

TWA Duration (hours)
Enter the time in hours. This value will be used to calculate the time weighted average concentration.

Ceiling Alarm Threshold (mg/m³ or ug/m³)
Enter the concentration threshold to trigger the Ceiling alarm.

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.

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

Informational alerts (number)

Enter a value to increase or decrease volume of an Informational alert. Information alerts include when Bluetooth is connected/disconnected.

User Tag (alpha-numeric)
Used to provide additional contextual information that will be included in the data logs (user ID, test site, etc.).

Impactor sampling selection

Reserved for future use.

Mass Concentration Units
Used to choose between mg/m^3 and $\mu g/m^3$ for the units of mass concentration values displayed on the LCD, User Interface, and data logs.

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 flow rate. Should be used after a sampling session if filter is to be send for lab analysis.

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 to avoid added noise in an office environment where downloading of logs, or configuration of the unit is required but the pump does not need to be running. While the pump is off, the DustCount unit's LCD will display PUMP.

Sync DustCount IS Time to Computer Time
Click to update DustCount IS date and time with the Computer date and time.

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).

⚠ **Caution: The flow should only be adjusted while measuring the unit flow rate using a primary standard flow meter. Move the slider to adjust the flow rate of the unit.**

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 backlight are disabled outside of shift hours.

Once Shift mode is configured the unit's pump, logging and LCD backlighting will be disabled.

Note: Do not power off the unit. Powering off the unit will cause it to fail to start at the scheduled shift start time.

Shift Start, Shift End
Enter the shift start time and shift end time (24-hour format) using either the quick select scrolling drop down list or enter the time manually.

Note: For DustCount units with firmware releases 7.1.20 and below the software will generate a warning if the end time is set to a value earlier then the start time.

For DustCount units with firmware releases 7.1.21 and above the software will not generate a warning. DustCount firmware releases 7.1.21 and above will allow the ability to configure a shift start and end time that spans over midnight.

Table 2 User Settings values and default settings List

Command	Valid Values	Factory Default
Date	YYYY-MM-DD	Read from unit
Time	HH:MM:SS	Read from unit
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	100
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	0.05 mg/m^3 or 50 ug/m^3
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	30 characters excluding commas, semi-colons, and the word invalid	Null
Impactor Sampling selection	Reserved for future use	N/A
Mass Concentration Units	mg/m3 or ug/m3	mg/m3
Shift Start	0-23	00
Shift End	0-23	00

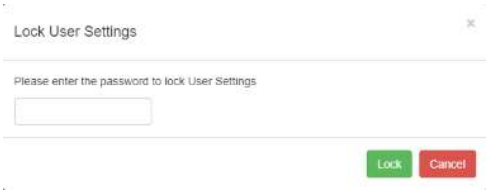
4.3.10.1 Locking and unlocking user settings configuration

By default, the configurable parameters in the User settings tab can be changed by any user with access to the UI software application connected to a DustCount unit. User Interface software releases 1.5.4 and greater include the ability to lock certain configurable parameters.

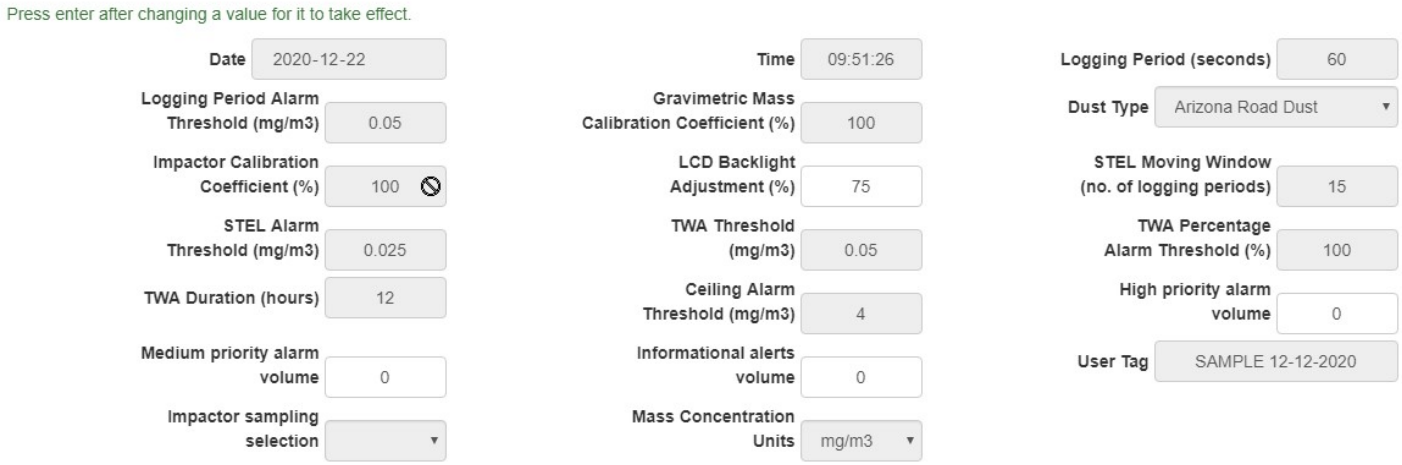
To lock most of the configurable parameters, click on the Lock User Settings button at the bottom of the UI screen.

A password dialog box will be displayed. Enter the factory set password ***Zad#1*** and click on the green Lock button. The lock status is maintained until explicitly unlocked.

The password is set at the factory and is not user configurable.



When the User Settings Tab is in the locked state, configurable values that are locked will be in greyed-out boxes. The mouse cursor will change to ⊘ when hovered over a locked setting or function.

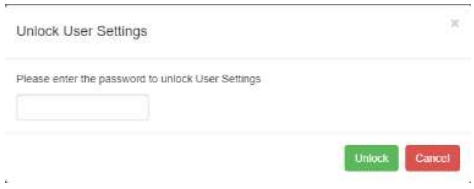


Settings, and functionality which are not locked while User Settings lock is enabled are outlined below.

- LCD Backlight Adjustment.
- High, Medium, Informational Alarm/Alert volume.
- Shift Status including Shift Start and End times.
- System Air Purge, Sync DustCount Time to Computer Time, Enable User Settings Update, and Unlock User Settings buttons.

To unlock the user settings tab configurable parameters, click on the Unlock User Settings button at the bottom of the UI screen.

A password dialog box will be displayed. Enter the factory set password ***Zad#1*** and click on the green Unlock button.



4.3.10.2 Configuring the DustCount from .csv file

User Interface software releases 1.5.4 and greater include the ability to configure a DustCount unit via a .csv file. When enabled, the software application will:

1. Search for a .csv configuration file in a configurable folder location for a .csv filename containing the string SNxxx (where xxx = the serial number of a DustCount unit e.g., SN752) ***and***,
2. If a DustCount unit with a matching serial number is connected to the software via USB or Bluetooth
3. The UI software will configure the DustCount unit with the values contained in the .csv file and save a configuration summary status file in the same folder in which the .csv configuration file is located.

Notes:

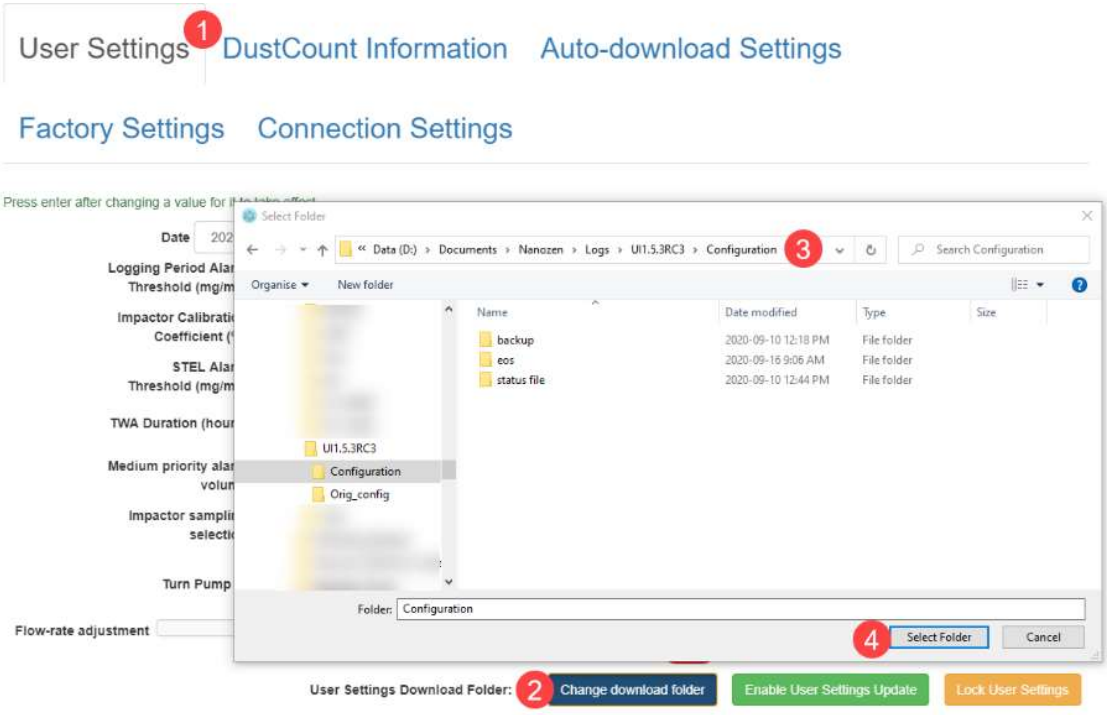
The header row values in the .csv file must contain specific names. Refer to the CSV file header value column in *Table 5 CSV file header and Configuration value*.

The configuration value row entries in the .csv file must contain valid ranges. Refer to the Configuration Value column in *Table 5 CSV file header and Configuration value*.

There should only be one .csv file per DustCount unit in the configured download folder. The folder should not contain multiple configuration files with the same serial number in the filename.

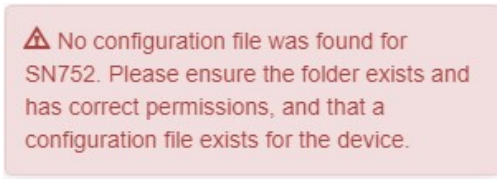
To perform a manual configuration update to a DustCount unit select the DustCount unit to be configured in the Select a device window.

1. At the bottom of the UI page select the User Settings TAB.
2. Click on the Change download folder button.
3. Choose the location where the .csv configuration file for the connected DustCount is saved.
4. Click on the Select Folder button.

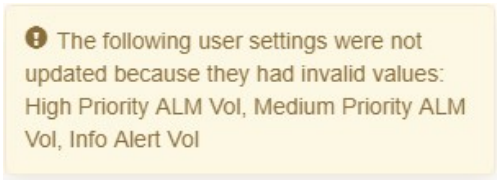


5. Click on the Enable User Settings Update button.

The software application will search for the matching serial number string in a .csv filename in the selected User settings Download Folder and upload the configuration values contained in the file to the DustCount unit. The software will also save a configuration summary status file in the selected User Settings Download folder. Details of the configuration status file are outlined in ***Section 7.2***.



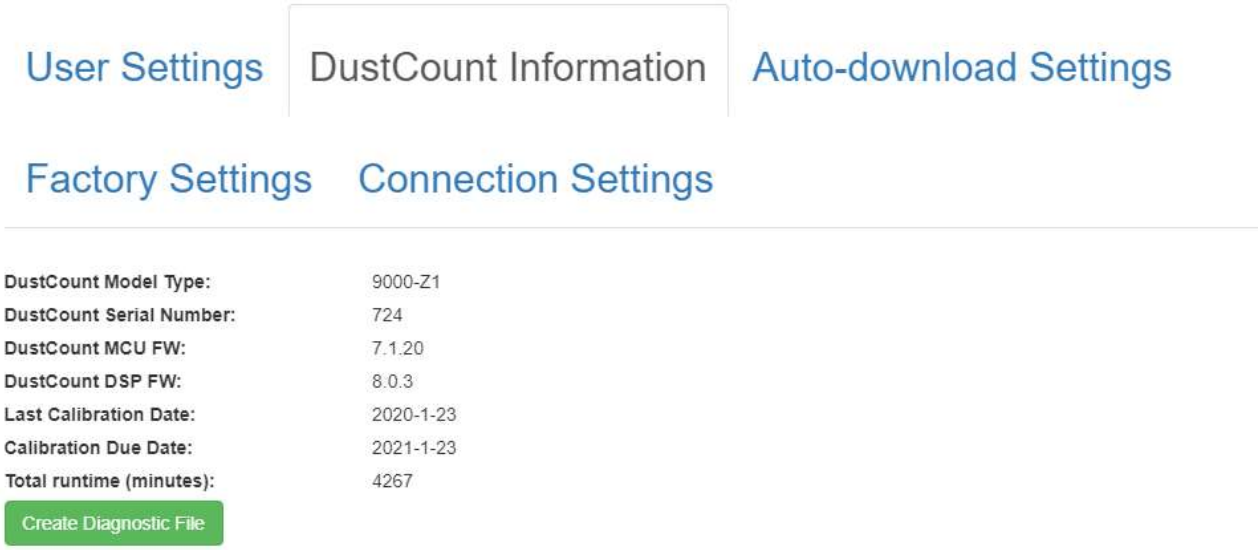
If the software is unable to either find a matching file or cannot access the folder an error dialog box will be displayed.



If the software detects invalid values in the second row a warning dialog box will be displayed outlining the invalid values detected.

4.3.11 DustCount Information Tab

The DustCount Information tab outlines the DustCount 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.



4.3.12 Auto-Download Settings

The Auto-Download Settings tab is used to change the mode of the software application to either End of Shift Download Mode or Real-time Download Mode. The functionality of each mode is outlined in the following sections.

4.3.12.1 End of Shift Download Mode.

When the **End of Shift download mode** is configured and enabled, the User Interface software will:

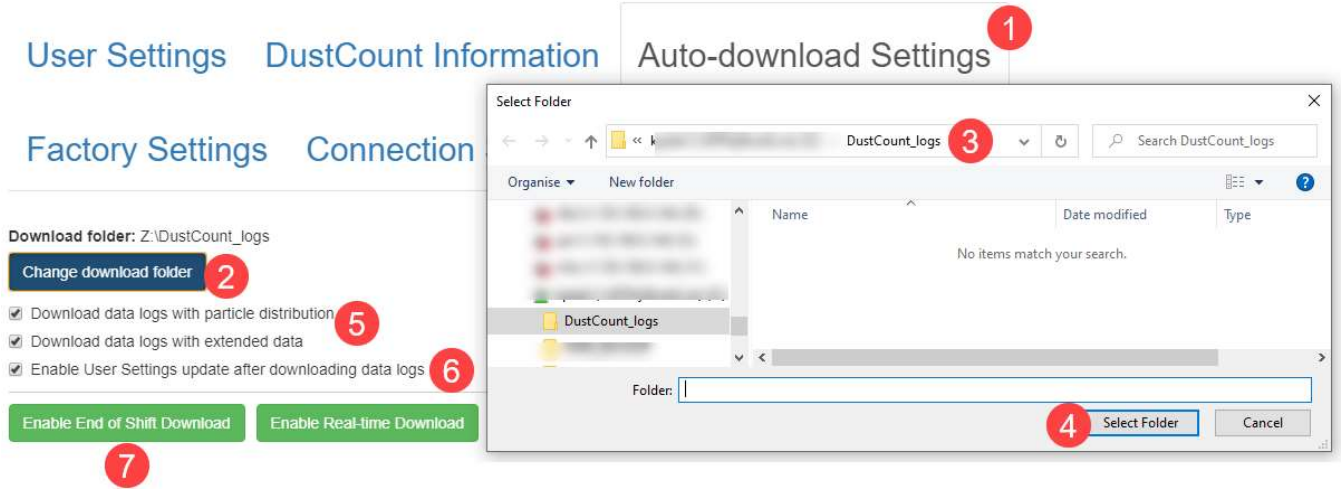
1. Connect to any DustCount that is connected either via USB or Bluetooth to the computer the UI is running on.
2. Download all logs from each DustCount unit the UI is connected to.
3. Save the downloaded logs for each unit in separate CSV files to the configured download folder the computer on which the UI is running has write access to.
4. Delete all logs from the DustCount units(s) once the download and saving of log files is successful.

4.3.12.1.1 Configuring and Enabling End of Shift Download Mode

1. At the bottom of the UI page select the Auto-Download Settings TAB.
2. Click on the Change download folder button.
3. Choose the location where you wish the log files to be saved in the Select Folder window.
4. Click on the Select Folder button to save.
5. Enable/Disable the download data logs options as required:
    - Download data logs with particle distribution (optional)
    - Download data logs with extended data (optional)
6. Select Enable User Settings update after downloading data logs (optional)
7. Click on the Enable End of Shift Download button.

If the option to Enable User Settings update after downloading data logs is selected, the UI will download, save and clear the logs from the DustCount units, then the UI will search the configured User Settings download folder for .csv filenames that match the serial numbers of the connected DustCount units. The UI will update

the configuration for each unit. A configuration summary status file for each updated unit will be saved to the User Settings download folder.



In End of Shift mode, the UI does not display any errors or warnings for accessing configuration files failures or if invalid values are detected. The UI will log these events in the ui.log file located in the \Users\<USER ACCOUNT NAME>\AppData\Roaming\DustCount UI Software, where <USER ACCOUNT NAME> is the user profile the software was installed against.

4.3.12.1.2 End of Shift Download Screen

When enabled, the End of Shift Download feature will replace the normal user interface with an End of Shift Download page. The screen has two major sections, a) Device Status, and b) Download Progress, which will populate with various information once DustCount units paired to the computer are within range.

4.3.12.1.3 Device Status

The status of each DustCount unit the software is connected to will be displayed in the Device Status Window section of the screen. This section shows the serial number, last update date and time, availability status, and alarm and alert states. A "Not supported" status appears if a unit's firmware version does not support an alarm.

End of Shift Download

Device Status

Device	Last update	Available	Battery status	System status	Concentration status	Flow-rate status	Leak status	STEL status	TWA status	Ceiling status	Laser status	Filter alert	Impactor alert	EXEX status
SN752 (Bluetooth)	2020-Aug-13 10:03:56	Yes	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	Not supported

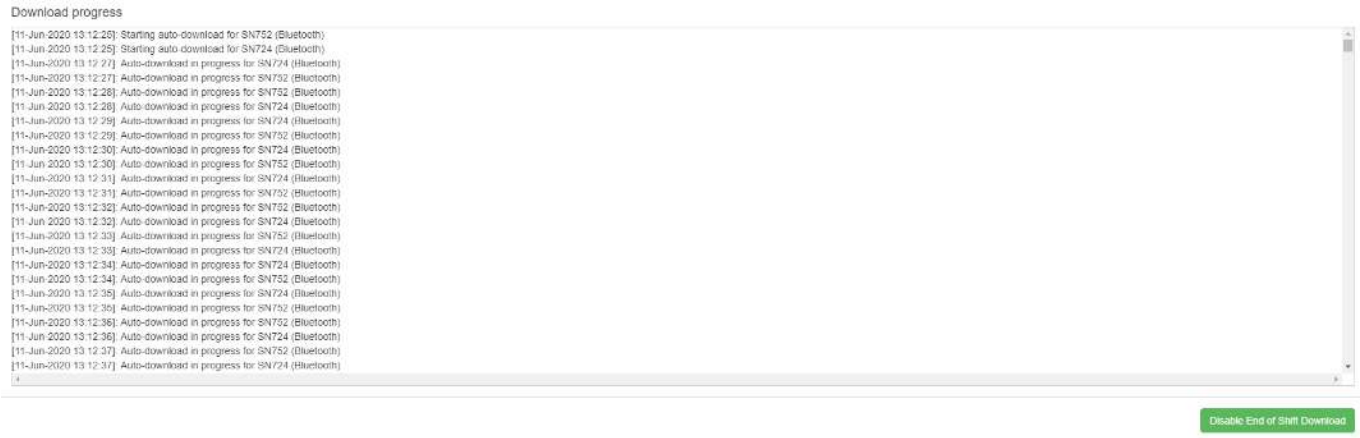
If a unit goes out of Bluetooth range or its USB connection is removed after initially connecting with the software, the device status for that unit will update with a red background and the Availability status will change to No.

Device Status

Device	Last update	Available	Battery status	System status	Concentration status	Flow-rate status	Leak status	STEL status	TWA status	Ceiling status	Laser status	Filter alert	Impactor alert	EXEX status
SN752 (Bluetooth)	2020-Aug-13 10:32:51	No	86	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	Not supported

4.3.12.1.4 Download Progress

The Download progress window will display the download status events for each connected unit. Each status event will have a date and time stamp and the serial of the unit included.



For normal operation, the UI will establish the connection to each DustCount, display its status and initiate the auto-download. If successful, it will output a complete event message outlining the number of logs downloaded, finally the UI will delete the logs from the unit. An example of a download status process is shown below:

```
[11-Jun-2020 13:12:25]: Starting auto-download for SN724 (Bluetooth)
[11-Jun-2020 13:12:27]: Auto-download in progress for SN724 (Bluetooth)
[11-Jun-2020 13:12:28]: Auto-download in progress for SN724 (Bluetooth)
[11-Jun-2020 13:12:29]: Auto-download in progress for SN724 (Bluetooth)
[11-Jun-2020 13:52:55]: Auto-download complete for SN724 (Bluetooth); 342 logs were downloaded
[11-Jun-2020 13:52:55]: All logs deleted for SN724 (Bluetooth)
```

If the number of logs on the DustCount unit is large, the software will periodically output progress status events as shown below.

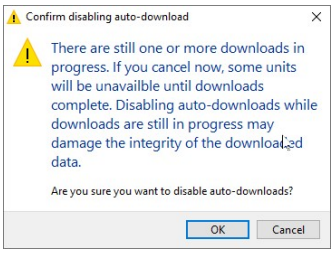
```
[11-Jun-2020 13:12:27]: Auto-download in progress for SN724 (Bluetooth)
[11-Jun-2020 13:12:28]: Auto-download in progress for SN724 (Bluetooth)
[11-Jun-2020 13:12:29]: Auto-download in progress for SN724 (Bluetooth)
```

If the unit goes out of Bluetooth range during the download process, the software will attempt to reconnect 2 times before declaring a failure event as shown below.

```
[11-Jun-2020 13:52:31]: Auto-download in progress for SN724 (Bluetooth)
[11-Jun-2020 13:52:31]: Retrying auto-download for SN724 (Bluetooth) (retry #1)
[11-Jun-2020 13:52:31]: Retrying auto-download for SN724 (Bluetooth) (retry #2)
[11-Jun-2020 13:52:31]: Auto-download failed for SN724 (Bluetooth)
```

4.3.12.1.5 Disabling End of Shift

To disable the auto-download feature click on the Disable End of Shift Download button at the bottom of the Disable End of Shift Download window.



A warning confirmation dialog box will pop up if the End of Shift Download button is clicked while downloads are in progress.

4.3.12.1.6 Log File Types

There are 3 files that are saved by the UI in the selected download folder.

1. Log data downloaded for each unit saved as a .csv file. The filename will include the Serial # of the unit, with a date and time stamp in the filename. Ex: **SN724 (Bluetooth)_20200611_132400.csv**
2. Device status log file for each unit saved as a .csv file. The filename will include the Serial # of the unit, with a data and time stamp and will have the word status included in the filename. Ex. **SN724 (Bluetooth)_status_20200611_132400.csv**
3. A logs.csv file which includes the status events displayed on the UI Download Progress window. Ex: **log.csv**

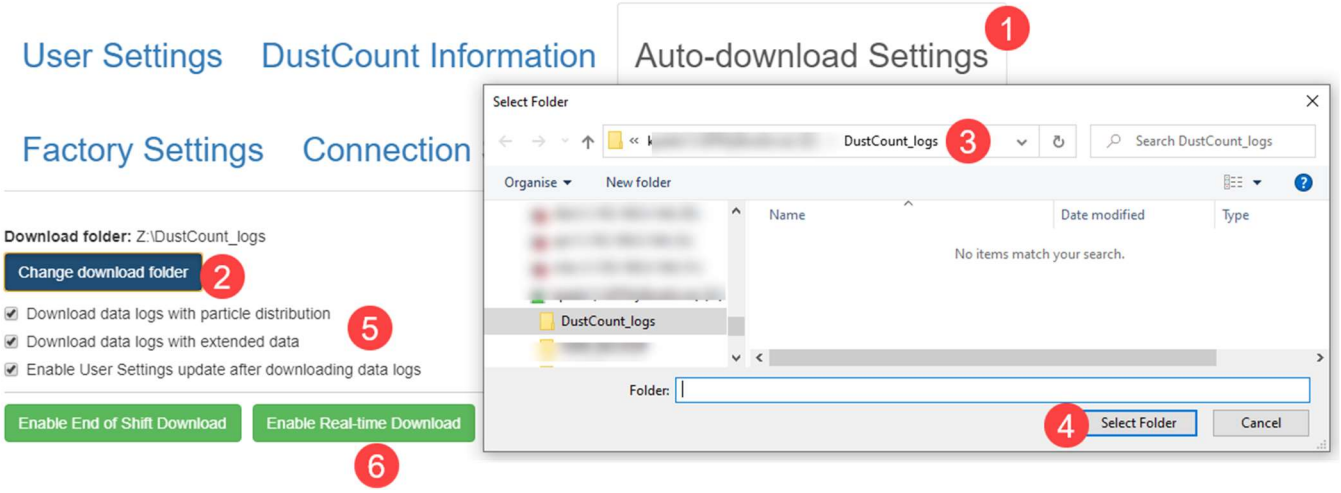
4.3.12.2 Real-time Download Mode.

When the real-time download feature is configured and enabled. The User Interface software (UI application) for the DustCount will:

1. Connect to any DustCount that is connected either via USB or Bluetooth to the computer the UI is running on.
2. Download the most recent log from each DustCount unit that the UI is connected to.
3. Generate a CSV file containing the header row and data row downloaded from each DustCount.
4. Save the CSV file to a configured download folder that the computer on which the UI is running has write access to.
5. Repeat the above three steps at each DustCount unit's configured logging period rate, while ensuring that no logs are missed.

4.3.12.2.1 Configuring and Enabling Real-time download mode.

1. At the bottom of the UI page, select the Auto-Download Settings TAB.
2. Click on the Change download folder button.
3. Choose the location where you wish the files to be saved in the Select Folder window.
4. Click on the Select Folder button to save.
5. Enable/Disable download data logs options:
    a. Download data logs with particle distribution (optional)
    b. Download data logs with extended data (optional)
6. Click on the Enable Real-Time Download button.



Note: Enable User Settings update after downloading data function is not available in Real-time Download Mode.

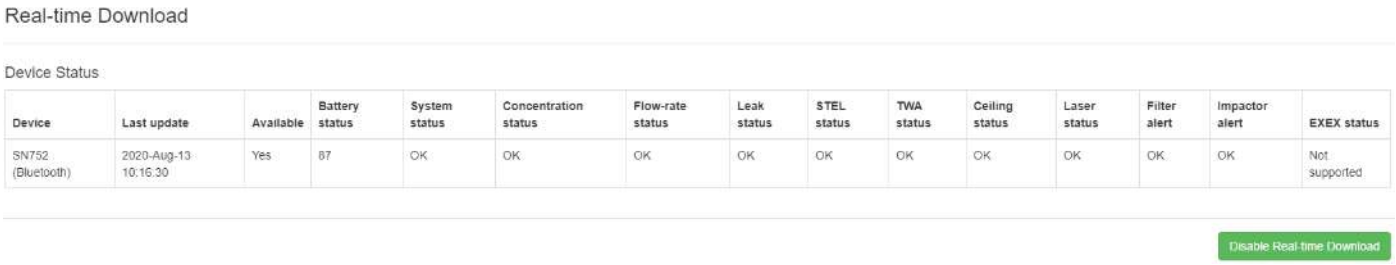
4.3.12.2.2 Real-time Download screen

When enabled, the Real-time Download feature will replace the normal user interface with a Real-time Download page.

The Real-time Download page will display a Device Status at the top of the page.

4.3.12.2.3 Device Status

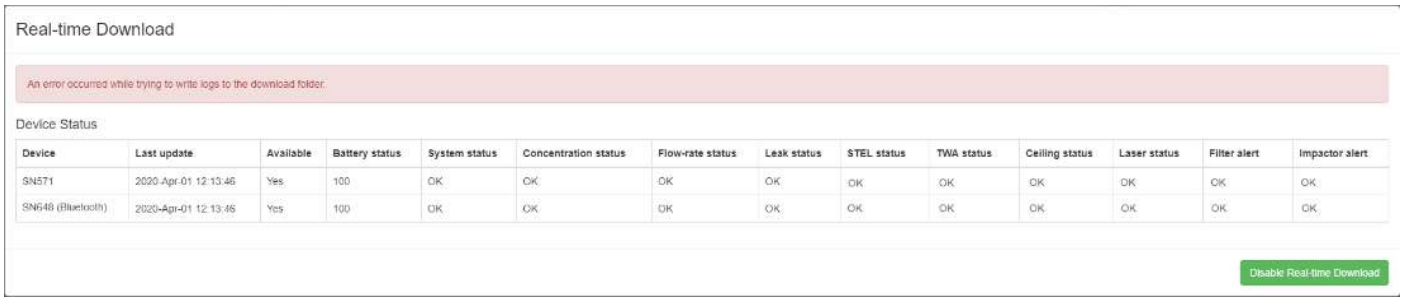
Each DustCount unit the software has connected to will be displayed in the Device Status Window section of the screen, providing the serial number, last update date and time, availability status, and all alarm and alert states. A "Not supported" status appears if a unit's firmware version does not support an alarm.



4.3.12.2.4 Error messages

An error message will be raised after clicking the Enable Real-time Download button for a download folder that either no longer exists or the computer does not have permissions to access (see figure below). Select a folder that does exist, or verify the computer has permissions to access the folder.

If connectivity is lost between the software and Download folder CSV file destination, the real-time download feature will display a message indicating a failure to write (see figure below). At the end of each next log period, it will try to write a CSV file containing the missing logs while the network disconnection persists. Once connection is re-established and the CSV log file containing all outstanding logs is successfully written to the Destination folder, it will clear the error message and return to writing CSV files containing only one log.

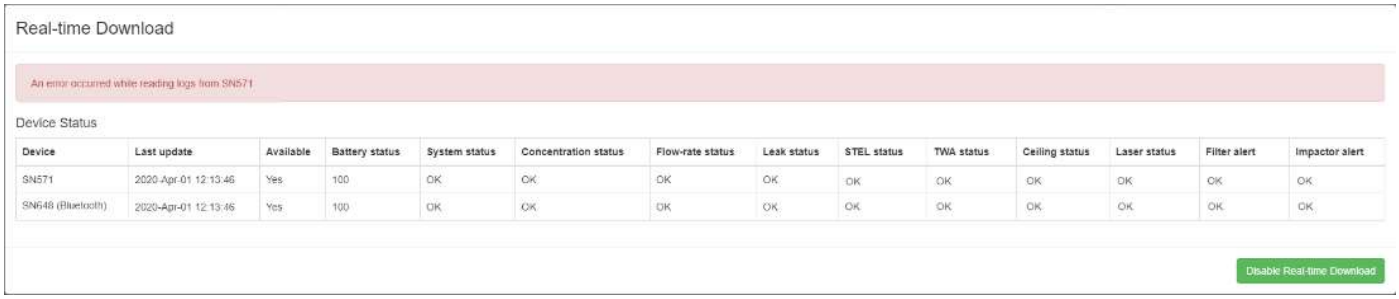


If a previously connected unit goes out of Bluetooth range or the USB connection is disconnected the device status for that unit will update with a red background and the Availability status will change to No (see figure below). A status CSV file will be generated.

Device Status

Device	Last update	Available	Battery status	System status	Concentration status	Flow-rate status	Leak status	STEL status	TWA status	Ceiling status	Laser status	Filter alert	Impactor alert	EXEX status
SN752 (Bluetooth)	2020-Aug-13 10:32:51	No	86	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	Not supported

When the UI does not receive a response from a DustCount for 180 seconds or receives a read error while trying to read logs from a DustCount an error message will be raised (see figure below).



4.3.12.2.5 DISABLING Real-time download

To disable the Real-time download feature, click on the Disable Real-time Download button at the bottom of the Real-time Download window.

4.3.12.2.6 Log File types

There are 2 files that are saved by the UI in the selected download folder.

1. Log data downloaded for each unit saved as a .csv file. The filename will include the Serial # of the unit, with a date and time stamp of the oldest log in the filename. **Ex: SN571 (Bluetooth)_20200402_130034.csv**
2. Status log file for each unit is saved as a .csv file when a device initially connected to the UI connection status changes. The filename will include the date and time stamp when the connection changed. **Ex. STATUS_20200402_130036.csv**

Notes:

The Real-time download feature does not delete any logs from the unit. It is up to the user to manage the deleting of logs from the unit.

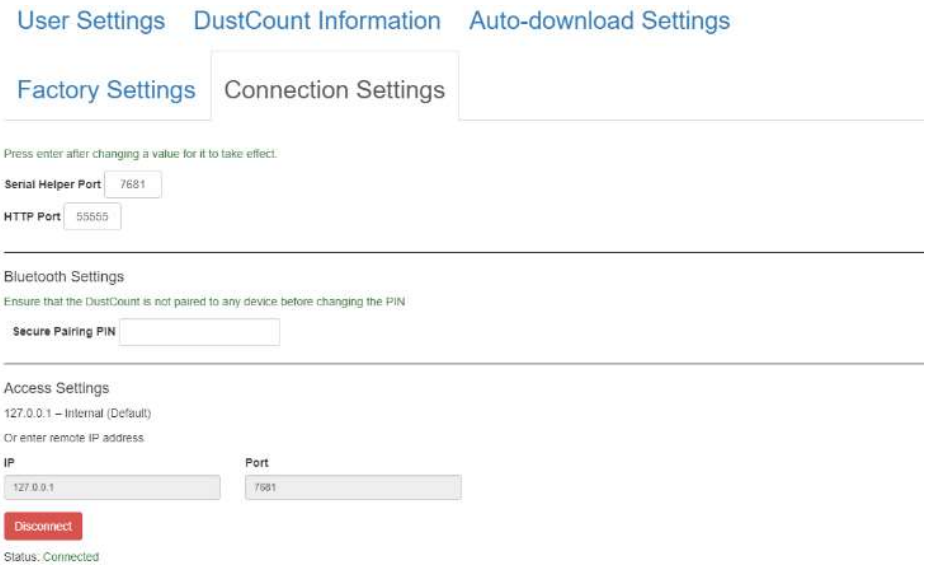
Although rare, there may be cases where CSV log files may be written out of order due to network conditions not within the software applications control. Backend systems/services responsible for pulling data into the historian should use the date and time stamp in the FILENAME to correctly sort data in chronological order.

4.3.13 Factory Settings

Factory settings are not available to the end user.

4.3.14 Connection Settings Tab

The Connection Settings tab allows for a network or systems administrator to change the default TCP / HTTP ports used by the User Interface software application. Generally, the Serial Helper Port and HTTP port settings should be left with the default values.



4.3.14.1 Bluetooth Settings

For DustCount units with firmware releases 7.1.20 and above, the Connection Settings tab allows the ability to change a DustCount unit's Secure Pairing PIN code. Secure Authentication ensures that users who provide the Secure PIN CODE during the pairing process between the UI's host computer and the DustCount will be able to connect the UI to that DustCount. If the user does not enter the correct PIN CODE, the pairing process will fail.

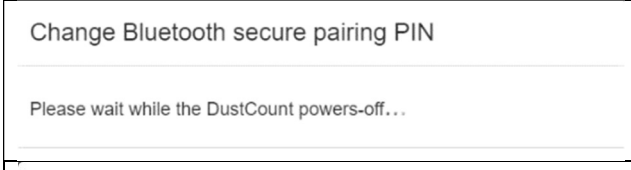
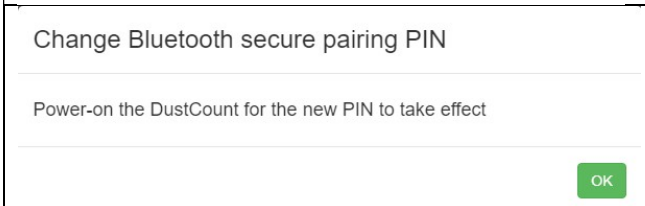
Note: The factory default Secure Pairing PIN Code is 1234.

Note: The Secure Pairing PIN field will be grey for units with firmware releases that do not support this feature.

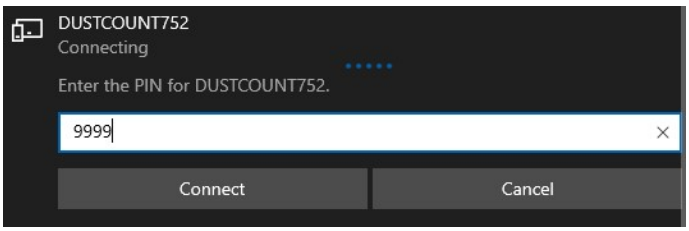
4.3.14.2 Changing the Secure Pairing PIN.

Changing the Secure Pairing PIN requires a DustCount unit connected to the User Interface application via USB connection only. The DustCount should not be paired via Bluetooth to any computer or other device when changing the PIN. Verify the "B" is not present on the DustCount's LCD display before attempting the procedure below.

	With the DustCount unit connected to the software enter a 4-digit PIN code in the Secure Paring PIN box and press the <ENTER> key.
	A confirmation dialog box will appear, click on OK to proceed.

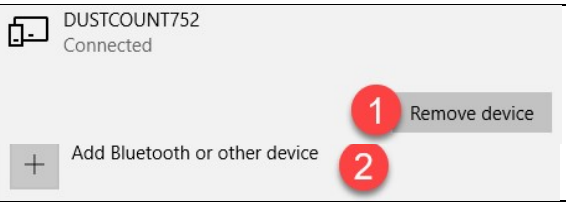
	The UI software application will initiate a power down sequence on the DustCount unit, this will take a few seconds
	Once the power down has been completed click OK. **NOTE: It is recommended to disconnect the USB cable from the DustCount and exit the User Interface software application**

Power on the DustCount unit and pair the unit to the computer, during the pairing process enter the newly configured PIN and click connect to complete the pairing process.



After pairing is completed, start the User Interface software, and verify the device is detected within 1 minute.

If the DustCount does not show up in the device list exit the User Interface software and either:

1	Disable/Enable Bluetooth on the host computer using Bluetooth Settings	
2	Remove and then Add the device once again	

Start the User Interface software application, the unit should now show up in the Device list.

5 Saving Logs

The Log read out window displays the downloaded data logs requested using the *Display Mode* drop-down under the *Read Logs* sections.

Once displayed in the Log Read Out windows these logs can be saved to a file by selecting either .csv (default) or .xlsx file format and clicking on the Save button.

For .csv files formats the decimal format can be set to either English where a dot "."is the decimal delimiter (e.g., 5.123) or International where a comma "," is the decimal delimiter (e.g., 5,123). This change is reflected in the saved .csv only, and not the log read out area.

6 Graphing 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.

Notes:

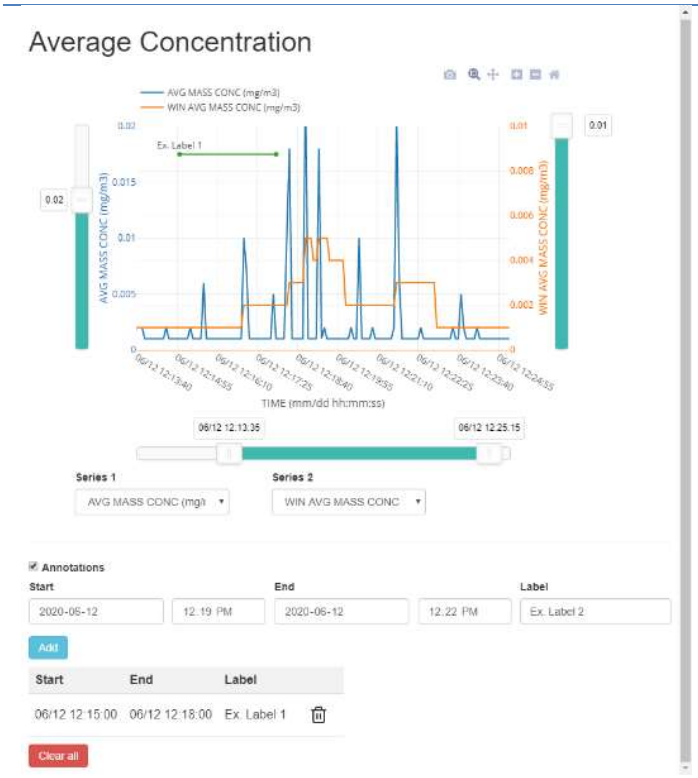
The log read out window must contain data before it can be graphed.

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 log read.

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

By default, a 2-line graph of logging period average vs. moving windows average mass concentration with respect to time is graphed when Graph Avg. Conc. is clicked.

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



The Series 1 & Series 2 vertical axes can be set to any of the following:

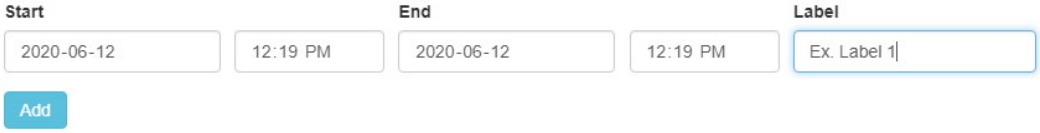
- Average mass concentration for the last logging period (AVG MASS CONC.)
- Moving window average mass concentration (WIN AVG MASS CONC)
- Time Weighted average mass concentration (TWA MASS CONC)
- Time Weighted average percentage (TWA PCT)
- Average count concentration for the last logging period (COUNT CONC)
- Average flow rate for the last logging period (FLOW RATE)
- Average temperature for the last logging period (TEMP)
- Average pressure for the last logging period (PRS)
- Average pump PWM percentage for the logging period (Pump)
- Average pressure for the logging period that helps regulate flow (Prs-Flow)
- Average pressure for the logging period that helps detect leaks (Prs-Leak)
- Average temperature of the DSP for the logging period (dspTEMP)
- Battery state of charge in percentage at the end of the last logging period (BATTERY)

6.2 Adding Annotations

Annotations can be added to the Concentration graph for additional context.

To add annotation labels, enable the Annotations radio button.

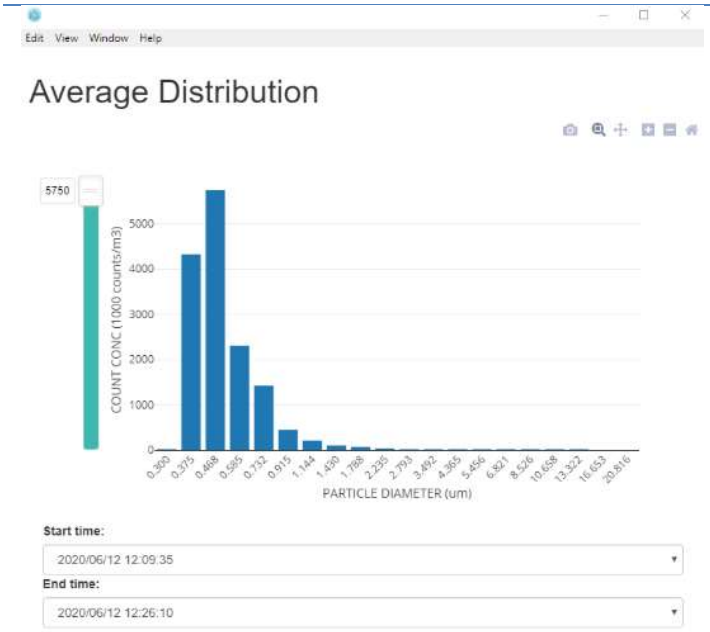
Enter a start / end date and time and a text label to be displayed on the graph and click on the Add button. Additional annotations can be added by repeating this step.



Selective annotations can be removed by clicking on the trash can icon beside each label entry, or all label can be removed by clicking on the Clear all button.

6.3 Average Distribution histogram via Graph Avg. Dist. button

A bar graph of average count concentration with respect to the particle diameter is generated when Graph Avg. Dist. is clicked.

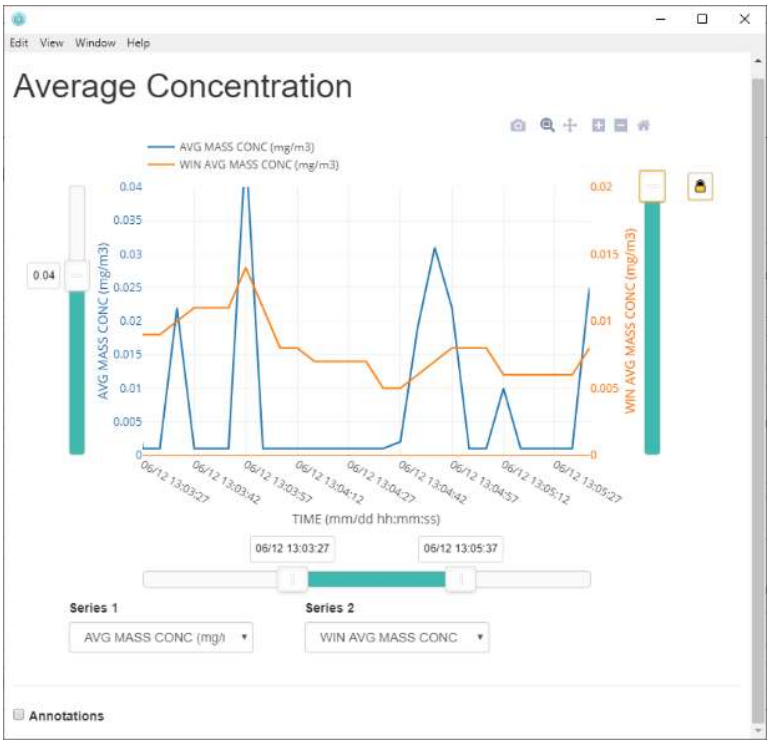


Note data must be downloaded using the **With Distribution** option enabled. If data was read without distribution, the graph window when opened will display a "***No Distribution data found. Please make sure "With Distribution" is checked." Warning.***

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

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

6.4 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 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.

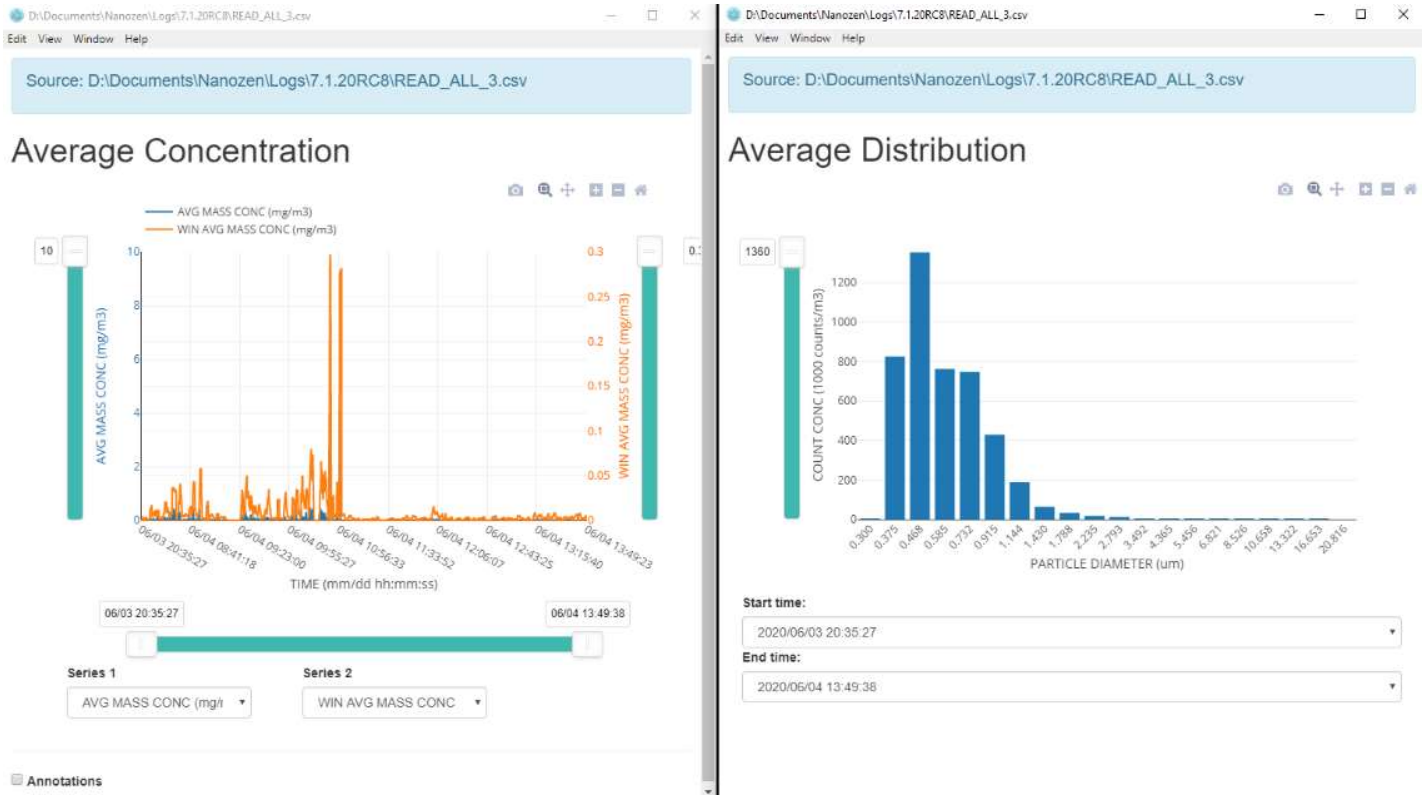
Same behavior applies to the real-time update Average Distribution graph.

6.5 Graph from File

The User Interface software supports the ability to import and graph a previously saved DustCount data log file that was saved as a .csv file. To graph a previously saved .csv file click the Graph from File button.

1. Click on Choose File to select the .csv file to import.
2. Select the Graph types
3. Click on the Graph Button.

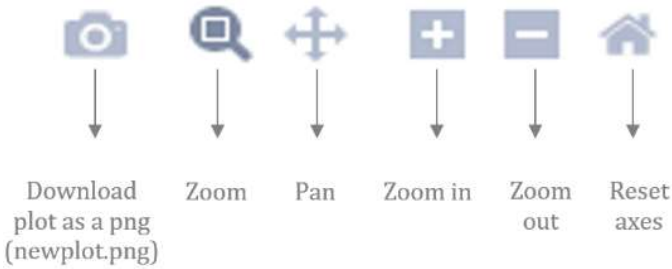
The selected Graph type windows will open, the top of each window will identify the .csv file path and name used to generate the graph. Multiple files can be graphed by repeating the above steps.



6.6 Graphing tools

The 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.

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.



6.7 Log 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 3 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 the 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 (%)	TWA concentration percentage with respect to the configured alarm threshold value	Whole number [1 - 100]
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)	Differential pressure used to control flow, averaged over the logging period.	Whole number
Prs-Leak (Pa)	Supplemental differential pressure averaged over the logging period. Unused.	Whole number
dspTEMP (degC)	Air temperature inside the sensor, averaged over 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	ALx (where x= 1-5, or any combination of the numbers 1 - 5) if an alarm was raised, otherwise OK.
CONC ALM	Alarm triggered when configured logging period alarm threshold concentration is exceeded.	ALM if an alarm was raised, otherwise OK.
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 OK.
LEAK ALM	Alarm raised if excess air is leaking in from a loose filter cassette.	ALM if an alarm was raised, otherwise OK.

Column headers	Description	Format
STEL ALM	Alarm triggered when moving window mass concentration is greater than the STEL threshold.	ALM if an alarm was raised, otherwise OK.
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 OK.
CEIL ALM	Alarm triggered when the 1sec mass concentration is greater than the configured ceiling alarm threshold	ALM if an alarm was raised, otherwise OK.
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 OK.
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 OK.
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 OK.
EXEX ALM	Alarm is triggered when the either 2 or more Excess Exposure events occur within a 60-minute period, or if there are more than 4 Excess Exposure events in an 8-hour period, prorated based on the TWA duration hours.	Available if unit's firmware supports the EXEX alarm (7.1.21 and later). ALM if an alarm was raised, otherwise OK.

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.
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.	MUTED if alarms are muted, otherwise OK.

Table 4 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

7 CSV Configuration File

7.1 CSV file header and value row

The table below outlines the values to be used for both the header and configuration value rows in the .csv file. Refer to the sample configuration file DustCount_SNxxx_Default_Configuration_Sample_v1.csv for an example of content and format.

Notes:

1. Use the header names outlined in the column **CSV file header value** for the header row of the csv configuration file.
2. Use the **Configuration Value** column for the values in the configuration value row in the configuration file.
3. Some or all the column headers can be included in the .csv file.
4. The column order of the headers and values in the .csv file does not matter.
5. For any missing columns or configuration row values that are empty, the UI software will ignore updating the respective User Settings parameter.
6. Additional customer specific headers and values can be added to the .csv file for context and reference, these columns with header names that do not match those outlined below will be ignored by the UI software.
7. If multiple configuration value rows are included in the .csv file only the last value row will be read by the UI software.

Table 5 CSV file header and Configuration value.

CSV file header value	User Settings Tab parameter	Configuration Value	Notes
Ceiling Threshold ug per m3	Ceiling Alarm Threshold	0.0 - 0-65535.999	Value **must** be in ug/m^3
Dust Type	Dust Type	0 – 10	0 is the first dust in the named list, 1 is the next dust . etc.
Gravimetric Coefficient	Gravimetric Mass Calibration Coefficient	0-65535.999	Value in %
Impactor Coefficient	Impactor Calibration Coefficient	0-65535.999 (%)	Value in %. Default value of 100 **should not** be changed
Impactor Sampling Selection	Impactor sampling selection	N/A	Reserved for future use.
Logging Period	Logging Period	5-65535	Value in seconds
Logging Period Threshold ug per m3	Logging Period Alarm Threshold	0.0 - 0-65535.999	Value **must** be in ug/m^3
Mass Conc Units	Mass Concentration Units	ug or mg	Use ug for micrograms, mg for milligrams
STEL Threshold ug per m3	STEL Alarm Threshold	0.0 - 0-65535.999	Value **must** be in ug/m^3
STEL Window	STEL Moving Window	1 - 200	Value as a whole number
TWA Duration	TWA Duration	1 – 255	Value in hours as a whole number
TWA Percentage	TWA Percentage Alarm Threshold	0.0 – 100	Value in %
TWA Threshold ug per m3	TWA Threshold	0.0 - 0-65535.999	Value **must** be in ug/m^3

User ID	User Tag	30 characters	Alpha-numeric string. Excluding **commas, semicolons**, and the string **invalid**
LCD Backlight	LCD Backlight Adjustment	0 – 100 %	Value in %
High Priority ALM Vol	High priority alarm volume	0 – 5	Value as a whole number
Medium Priority ALM Vol	Medium priority alarm volume	0 – 5	Value as a whole number
Info Alert Vol	Informational alerts volume	0 – 5	Value as a whole number
Shift Status	Shift Status	0 or 1	0 for disabled, 1 for enabled
Shift Start Time	Shift start	00:00 – 23:59	Time value in hh:mm format
Shift End Time	Shift end	00:00 – 23:59	Time value in hh:mm format

Note: The software does not allow the configuration of the Date, Time, Turn Pump OFF/ON, Flow-rate adjustment or Change Download folder via the configuration file.

7.2 Configuration status file

For a successful configuration update of a DustCount unit a summary status file will be saved in the selected User Settings Download folder. The file is saved in .csv format and includes the serial number of the updated DustCount, and the date and time the update was completed in the file name.

E.g., SN752_20200916_110012_updated_user_settings.csv

The configuration status file contains 3 rows:

Row 1 – Header row containing all the configurable parameters outlined in ***Table 5 CSV file header and Configuration value***. **Error! Reference source not found.**Row 2 – Action row containing:

- **Updated** = the update was successful
- **Not Updated** = either the value is not supported in the DustCount firmware version, or the value was empty, or the configuration parameter column was not included.
- **Update Failed** = the configuration parameter value was invalid.

Row 3 – Value row will contain either:

- **The updated value** If the update was successful. (Row 2 status = Updated)
- **Not Supported** if the value is not supported by the DustCount firmware. (Row 2 status = Not Updated)
- **The current value *from* the unit** if the value for the configuration parameter was invalid, empty, or the configuration parameter column was not included in the file. (Row 2 status = Not Updated or Update Failed)

8 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.

Remove the rear battery cover using a small Phillips screwdriver.

Do not open battery compartment in an explosive environment.

Slide off the battery cover.

Unscrew the battery cable clamp from the case.

Unplug the battery cable from its mating receptacle inside the DustCount IS unit.

Note: For the DustCount IS 9000-Z1 ensure the new replacement battery is marked as shown below. The * can be any letter from C through Z.

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

Reverse the above steps to install the replacement battery. Pay attention to the keyed orientation for battery cable into the mating receptacle inside the DustCount IS unit.

Restart the DustCount IS unit and set the date and time using the User Interface as they are lost when the battery is disconnected

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

9 DustCount IS Maintenance Schedule

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

Table 6 Recommended DustCount IS Maintenance Schedule.

Item	Frequency
Perform Zero Check	Before each sampling session (recommended).
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.

10 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.

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