USER'S GUIDE

SM-4000™

REAL-TIME PERSONAL DIESEL PARTICULATE MONITOR

MODEL SM-4000
DOC# SM40000217

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New technology for monitoring air quality

EDC

SM-4000™

User's Guide

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Environmental Devices Corporation (EDC) warrants only non-expendable products, parts and labor, for a period of one year from date of shipment to the original purchaser. The warranty covers only product parts and labor that failed due to normal operation of the instrument and not due to abuse or negligence. The product will be delivered in accordance to its published specifications and free from defects in materials or workmanship.

Expendable products (battery, o-rings, tubing, disposable filter cassette, etc.) are warranted for a period of 90 days from receipt of shipment.

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Chapter 1 - Introduction to the SM-4000

Chapter 1 Introduction to the SM-4000

Chapter Overview

The SM-4000 Real-Time Silica Personal Monitor is a modified version of the HazDust model HD-1004. The SM-4000 comes complete with respirable cyclone and calibrated to correlate readings to ISO 12103-1 A2 Fine Test Dust in ug/m³ (micro grams per cubic meter). The SM-4000 combines traditional filter techniques with real-time monitoring methods. These techniques are combined to overcome limitations found with other manufacturers' real-time particulate monitoring products. The SM-4000 can be cross calibrated to OSHA's new ruling using the 37mm filter cassette, mounted in the OSHA defined breathing zone and the unique scaling and correction factor features found in the SM-4000 software can be used.

Introduction

This chapter gives a complete overview of the SM-4000 which is modified version of the model Haz-Dust HD-1004 for Diesel Particulate Matter.

This chapter:

- Introduces and describes the Haz-Dust SM-4000.
- Explains operating principles of the Haz-Dust SM-4000.
- Identifies features, specifications and components of Haz-Dust SM-4000.

In this chapter

This chapter contains the following topics.

Figure 1-1. Picture of the Haz-Dust SM-4000.

Introduction

The SM-4000 is the world's first Real-Time personal Particulate Matter monitor to combine traditional filter techniques with real-time monitoring methods for silica. These techniques are combined to overcome limitations found in other manufacturers' real-time particulate monitoring products. The SM-4000 can be cross-calibrated to using a gravimetric filter cassette 37mm filter cassette.

The SM-4000 can utilize a 37mm filter cassette in addition to offering real-time results. The SM-4000 is designed for sampling in atmospheres where it is necessary to determine the silica content from other respirable dust.

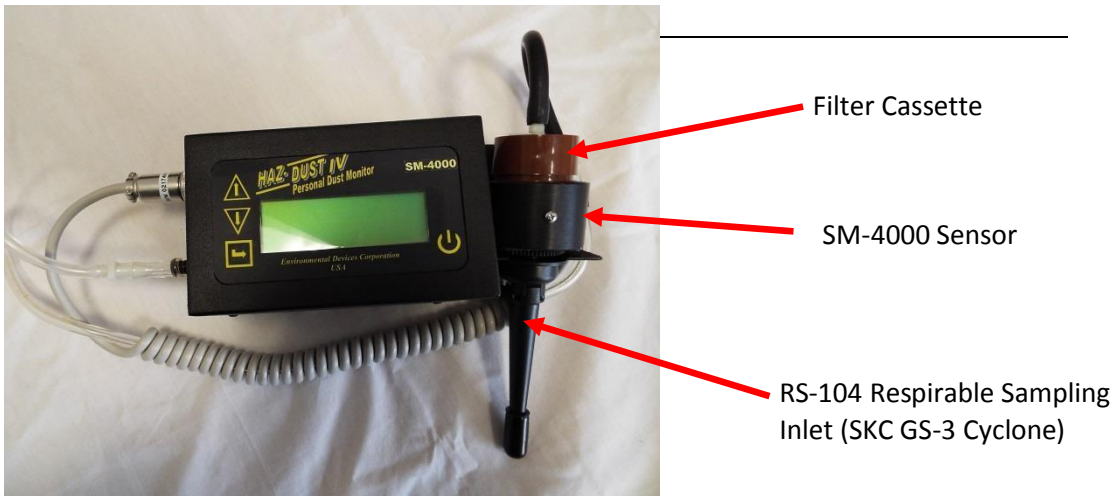

Figure 1-2. Diagram of the Haz-Dust SM-4000.

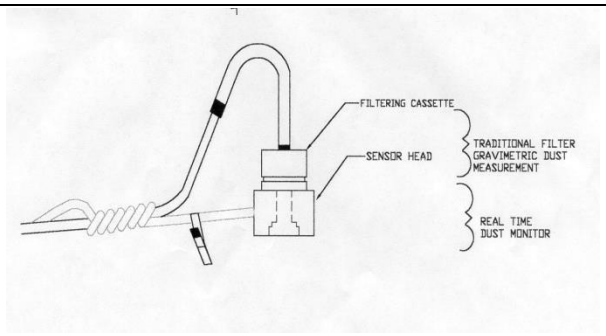

Figure 1-3. Diagram showing components used for both the traditional and real-time dust monitoring methods.

Comparison of methods

The traditional and real-time dust monitoring methods are described below.

Description of traditional method

Air is drawn by a vacuum pump through a 25mm or 37mm diameter membrane filter. The fibers and particles collected on the membrane filter must be counted or weighed in a laboratory for further analysis.

Advantages of traditional method[1]

- OSHA/ACGIH compliance reference method.
- Collection of dust particles, which are available for further chemical analysis.
- Instant Real-Time Readings

Description of real-time method

Dust particles are drawn into the sensor head and are detected once every second. Dust concentrations are instantaneously calculated and displayed on the Haz-Dust SM-4000 LCD. All data points are stored in memory for later analysis.

Advantages of real-time method[1]

- Immediate real-time estimations of particulate concentration of a contaminant, permitting on-site evaluations.
- Provision of permanent 8-hour graphical records of contaminant concentrations using continuous monitors.
- Internal audible alarm to warn workers of approaching hazardous situations.
- Reduction of number of manual tests.
- Reduction of number of laboratory analyses.
- Provision of more convincing evidence for presentation at hearings and litigation proceedings.
- Reduced cost of obtaining individual results.

Overview of the Haz-Dust SM-4000

[1] "The Industrial Environment - It's Evaluation & Control", U.S. Department of Health & Human Services, DCD, NIOSH, 1973.

Ease of use □ The user controls all functionality and programming using menus displayed on a high contrast LCD.

- The compact unit clips to the workers belt or pocket allowing for flexibility during on-site monitoring.
- A detached sensor head easily attaches to the worker for true breathing zone measurements.
- A user adjustable alarm can be preset to alert the worker of approaching threshold limits.

General Information

- The LCD displays real-time concentration in micrograms per cubic meter (ug/m^3) in accordance with OSHA Reference Methods.
- Statistical information of TWA, STEL, Max and Min levels can be viewed instantly.
- The Haz-Dust SM-4000 is calibrated using ISO 12103-1 A2 test dust containing 70% silica against NIOSH method 0600 for Respirable dust with a $\pm$ 10% accuracy.

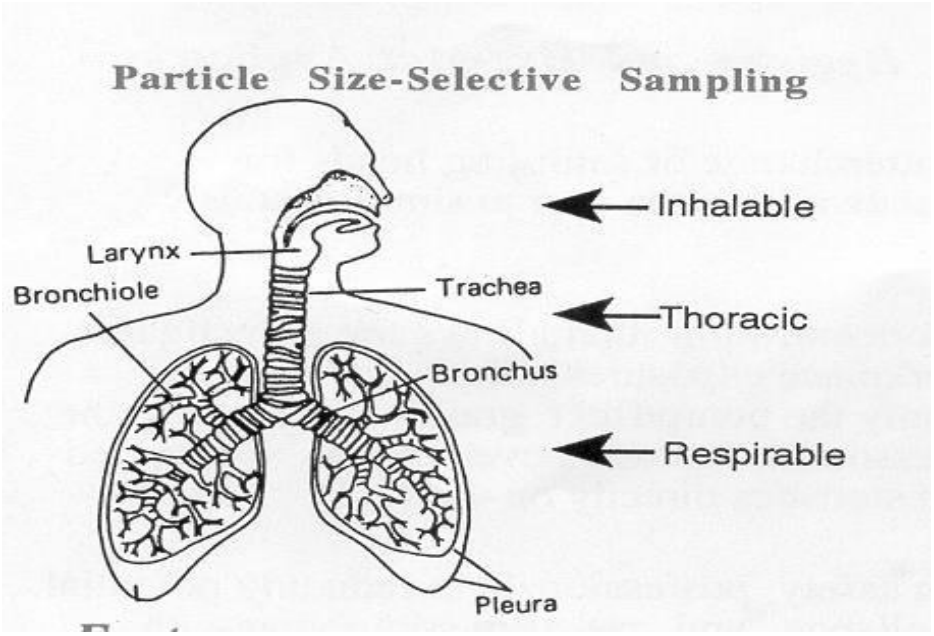

Figure 1-4. Diagram showing breathing zones of Inhalable, Thoracic, and Respirable dust particles.

Continued on next page

DustComm Pro Software

The Haz-Dust SM-4000 comes equipped with DustComm Pro software, which allows internally stored data to be downloaded to a PC for further analysis.

DustComm Pro software is designed for more detailed analysis of sampled data. Pull down menus provides a user-friendly environment to store and analyze data and print management ready reports.

Data can easily be exported in comma-delimited ASCII Text Files importable into spreadsheet programs such as Microsoft Excel.

The data plots provided with DustComm Pro enable:

- Detailed statistical analysis.
- Creation of graphics and charts.
- Mathematical correction of particle characteristics when aerosol significantly differs from calibration dust.

Features

Introduction

The Haz-Dust SM-4000 provides a unique combination of features to provide superior data quality, ease of use, and flexibility to the user. Below is a partial list of distinctive features.

Real-time display of

- Particulate exposure levels.
- TWA, STEL, Min, and Max levels.
- Thoracic, Respirable or Inhalable Particulate Mass.
- True breathing zone measurements.
- Stored data by location code.

Functional features	• Calibration to NIOSH methods for lung damaging particles. • In-line concurrent filter samples for gravimetric analysis. • High sensitivity of 1 to 20000 ug/$m^{3.}$ • Interchangeable size-selective sampling inlets. • Internal air sampling pump. • Simple cleaning of sensor hardware. • Easy user access to rechargeable battery and internal filter.
Operational features	• On-screen programming of sampling and data storage parameters. • Real-time clock. • User selectable audible alarm. • In-field zero and span check of instrument calibration.
Data management	• Choice of 1 second, 1 minute, or 10 minute averaging/storage intervals. • Up to 21 weeks of sample/record time. • Memory storage of up to 21,500 data points that can be distributed into a maximum of 999 location files. • DustComm Pro Software supplied with RS-232 cable for downloading data to a PC. • Data translation to ASCII text files, importable into Excel or Lotus 1-2-3.

Specifications

Introduction The Haz-Dust SM-4000 meets the following specifications.

SPECIFICATION	RANGE
Calibration	ISO 12103-1 A2 test dust containing 70% silica against NIOSH method 0600 for Respirable
Accuracy	± 10%
Precision	5 ug/m^3
Sensing range	1 to 20000 ug/m^3
Particle size range	0.1 to 10 □m Respirable 0.1 to 50 □m Thoracic 0.1 to 100 □m Inhalable (IOM)
Recording time	1 second, 2 seconds, 10 seconds, and 1 minute (15 days max)
Flow rate	1.0 to 3.3 LPM
Memory	21,500 data points
Locations	Up to 999 storage locations
Output	RS-232
Operating temperature	32 to 120□ F (0□ -50□C)
Humidity range	95% non-condensing
Battery	Rechargeable NiMH
Battery life	8 hours
Charging time	16 hours
Size	5.5 x 3.25 x 2.75 in
Weight	2 lbs.

Components

Components The following components ship with the Haz-Dust SM-4000.

SM-4000	**Serial Number**
RS-104	**Respirable Sampling Inlet**

BC-104-110-220	**Universal Battery Charger US, Euro, AUS,& UK plugs**
CC-USB-102	**USB to Serial Cable**
CC-102	**Computer Interface Cable**
ZF-102	**Zeroing Filter**
18-1	**Pump Adjustment Stick**
HD-1004 Media CD	**Instruction Manual and Dust Comm Pro Software**
23-1	**Filter Cassette 37mm opaque**
22-13	**Black Pouch**
Warranty Label	**Warranty Label**
Cert.NIST	**Certificate of Calibration**

Chapter 2 - Operating Parameters of the Haz-Dust SM-4000

Chapter 2

Operating Parameters of the Haz-Dust SM-4000
Chapter Overview

Introduction

This chapter describes the steps involved in starting the Haz-Dust SM-4000 and configuring its operating parameters.

In this chapter

This chapter contains the following topics.

Turning the SM-4000 On and Off

Introduction

Note: **THE BATTERY MUST BE FULLY CHARGED** before each use. See page 5-8 for information on battery maintenance.

Power-On

Press the **ON/OFF** key to turn the Haz-Dust SM-4000 monitor on.

Result: The unit will turn on and the Title Screen will appear.

Note: Before taking a sample fully charge battery for 16 hour and allow monitor to run for at least two minutes for the Haz-DustSM-4000 to equilibrate and stabilize. Then perform an auto zero to set baseline. See section 3-6 for detailed procedure.

Power-Off

Press the **ON/OFF** key a second time to turn the Haz-Dust SM-4000 off.

Using the Menu

Introduction The Haz-Dust SM-4000 menu appears on the 4x20-character liquid crystal display (LCD).

Note: See Appendix A for menu option flow charts.

Accessing the main menu Press **ENTER** from the Title Screen to access the Main Menu.

Using the menu The Haz-Dust SM-4000 is operated using the following menu selections.

Selection	Function
<⏻>	Turns the Haz-Dust on and off.
<↵> **(ENTER)**	Activates the selected option.
< □ >	Selection Arrow. Indicates the selected menu option. Located on the LCD Display.
<△>	Scrolls the Selection Arrow up one line in a menu list.
<▽>	Scrolls the Selection Arrow down one line in a menu list.

```
** Haz-Dust SM-4000 **
  Personal Real-Time
 Particulate Monitor
 E.D.C. Ver 1.1 6/07
```

Figure 2-2. The Title Screen of the Haz-Dust SM-4000.

```
□    Run
     Review Data
     Special Functions
     Auto-Zero
```

Figure 2-3. The Main Menu of the Haz-Dust SM-4000.

Setting the Alarm

Introduction An audible alarm can be set to alert the worker of approaching threshold limits.

Alarm settings The concentration level must be set to the defined agency standard for the particulate type being sampled.

Note: See Appendix B for a listing of the most common dust particulates and their corresponding concentration levels.

Using the alarm Follow the steps in the table below to set the alarm level.

Step	Action
1	Select **Special Functions** from the Main Menu**.**
2	Select **Set Alarm.**
3	Enter the appropriate concentration level using the table below.
	To... / **Press...** Increase the value of the selected digit. / < □ > Decrease the value of the selected digit. / < □ > Select the next digit. / **ENTER**
4	Press **ENTER** after the last digit is entered. **Result:** The alarm has been set and the Main Menu appears.

Setting the Date and Time

Introduction The date and time are pre-set by the factory to Eastern Standard Time and are maintained by an internal clock. It may be necessary to change the date and time due to local time zones or daylight savings time.

Note: It is important that the system date and time are correct for accurate record keeping.

Date and Time settings

Time is entered and displayed in military time format.
Date is entered and displayed in European format (i.e., MON. 15-JAN-07).

View settings

Follow the steps in the table below to check the units date and time.

Step	Action
1	Select **Special Functions** from the Main Menu**.**
2	Select **Date/Time.**
3	Select **View Date/Time.** **Result:** The unit's current date and time will display.
4	Press **ENTER** to return to the Date/Time Screen.

Change settings

Follow the steps in the table below to change the units date and time.

Step	Action		
1	Select **Special Functions** from the Main Menu**.**		
2	Select **Date/Time.**		
3	Select **Set Date/Time.**		
4	Enter the correct date and time using the steps in the table below.		
		To...	**Press...**
		Increase the value of the selected digit.	< □ >
		Decrease the value of the selected digit.	< □ >
		Select the next digit or field.	**ENTER**
5	Press **ENTER** when the correct information has entered.		
		To...	**Select...**
		Update the selected date and time.	**Set Date/Time**
		Return to the Date/Time screen without saving changes.	**Cancel**

Clearing the Memory

Introduction

The memory of the Haz-Dust SM-4000 can be cleared at any time.

Note: All data points in all locations will be deleted from memory.

Clearing memory

Follow the steps in the table below to clear the memory of the Haz-Dust SM4000.

Step	Action
1	Select **Special Functions** from the Main Menu.
2	Select **System Options**.
3	Select **Erase Memory**.
4	Select **Yes** to clear memory. **Note:** Selecting **No** will cancel the process without clearing memory.

Chapter 3 - Operating the Haz-Dust SM-4000

Chapter 3 Operating the Haz-Dust SM-4000

Chapter Overview

Introduction This chapter describes and diagrams operation procedures of the Haz-Dust SM-4000.

In this chapter This chapter contains the following topics.

Selecting The Particle Size

Introduction The inlet system of the Haz-Dust SM-4000 is configured for Respirable dust fractions.

Respirable Dust Particulates

Respirable GS Cyclone Respirable Sampling Inlet requires cyclone adapter part number GSA-204. Pull existing inlet to remove and push GSA-204 adapter into bottom of sensor.

Follow the steps in the table below to select Respirable dust particulates.

Step	Action
1	Select **Special Functions** from the Main Menu**.**
2	Select **System Options.**
3	Select **Extended Options.**
4	Select **Size Select, then Select.**
5	Select **Respirable.** **Result:** The Main Menu is displayed.
6	Push in GS cyclone adapter p/n GSA-204 into bottom of sensor. Push the GS-Cyclone into the GSA-204. **NOTE:** For a tighter more secure fit; remove the two thumbscrews from back of the lapel bracket. Follow step above to insert GSA204 and GS-Cyclone onto bottom of sensor. Then, put lapel bracket around GS-Cyclone, make sure to push lapel bracket tight against lip on GS-Cyclone. Finally, replace the two thumbscrews on back of lapel bracket. **Note:** If also collecting concurrent 37mm filter samples place a clean gravimetric filter in the filter cassette. The Flow Rate should be checked each time a new gravimetric filter is used. See page 55 for information on checking the flow rate for 2.75 lpm.
7	Attach the filter cassette to the sensor of the Haz-Dust SM-4000.
8	Attach the air intake tubing to the filter cassette.
9	Turn to page 3-7 and follow the instructions to Auto-Zero the SM4000.

Figure 3.3. Component identifications from left to right: SKC GS-Cyclone for Respirable sampling, GSA-204 adapter, sensor head, filter cassette, and air intake tubing. ***Requires the GSA-204 Cyclone adapter to fit.**

Auto-Zero

Introduction

Auto-Zero sets the measurement baseline of the Haz-Dust SM-4000 to zero mg/m^3. The Auto-Zero check should take place prior to beginning a new set of measurements.

Auto-Zero

Follow the steps in the table below to Auto-Zero the Haz-Dust SM-4000.

Note: The battery should be fully charged before beginning the Auto-Zero process.

Step	Action
1	Be sure the appropriate sampling inlet is attached to the sensor head of the Haz-Dust SM-4000 using the table below.

If sampling...	Then insert the...
Thoracic Particulates	Thoracic sampling inlet
Inhalable Particulate	SKC IOM and IA-204 sampling inlet
Respirable Particulates	SKC GS Cyclone and GSA204 sampling inlet

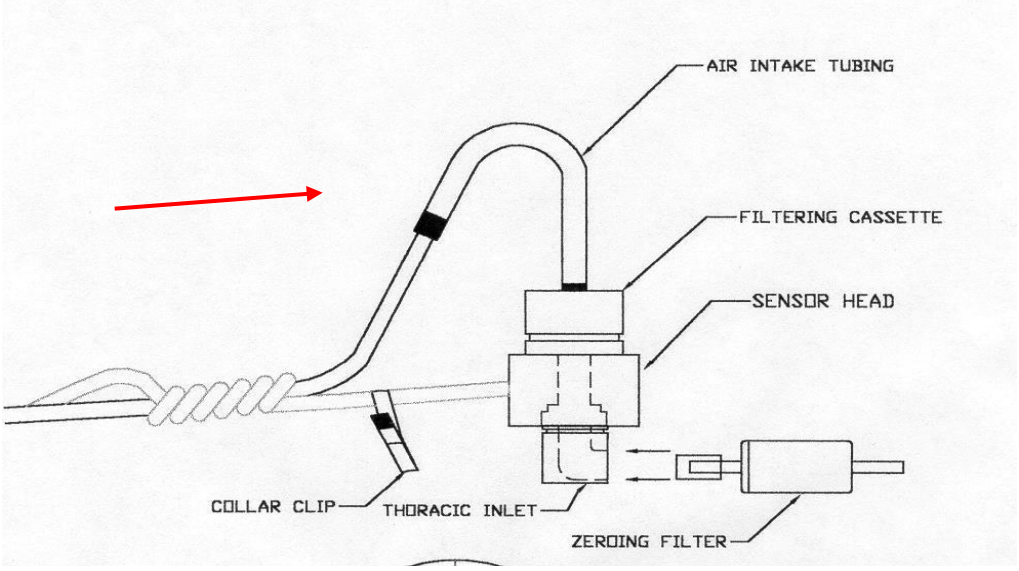

Figure 3-6. Diagram of zeroing filter being inserted into the Thoracic sampling inlet.

Continued on next page

2	Insert the Zeroing Filter using the table below.	
	If Sampling...	**Then...**
	Thoracic Particulates (Figure 3.7a)	Insert the zeroing filter into the Thoracic sampling inlet.
	Inhalable Particulates (Figure 3.7b)	Insert the zeroing filter (p/n ZA202A) into the front of the IOM front plate refers to figure 3.7b.
	Respirable Particulates (Figure 3.7c)	Insert the zeroing filter into the bottom of the GSA-204. GS-Cyclone adapter.

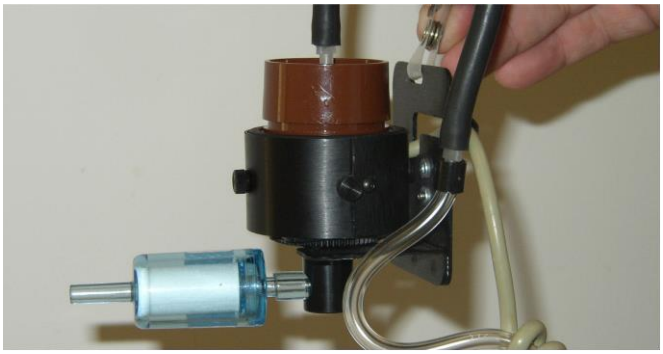

Figure 3.7a Zeroing filter (p/n ZF-102) being attached to the Thoracic sampling inlet.

Figure 3.7b. Zeroing filter (p/n ZA-202A) being attached to the Inhalable sampling inlet.

Continued on next page

Figure 3.7c. Zeroing filter (p/n ZF-102) being attached to GSA-204 GS-Cyclone adapter.

3	Select **Auto Zero** from the Main Menu.
4	Select **Auto-Zero.** **Result:** The Auto-Zeroing screen appears briefly. **Note:** Wait 50 Seconds. The unit automatically executes the steps necessary to reestablish the baseline. **Result:** The Main Menu is displayed when the auto-zero process is complete.
5	Remove the zeroing filter and begin the sampling process described on page 3-10.

Sampling

Introduction Once you have selected a Particle Size and completed the Auto-Zero process the Haz-Dust SM-4000 is ready to begin sampling.

Conditions The following conditions must be met before starting the sampling process.

Condition...	For further Information See Page...
The correct particle size must be selected.	3-2
The correct sampling inlet must be attached.	3-2
The correct date and time must be set.	2-5
The Auto-Zero process must be complete.	3-7
The alarm level must be set if sampling with the alarm feature.	2-4

Sampling Follow the steps in the table below to begin dust sampling.

Step	Action
1	From the main menu select **Special Functions**, then select **System Options**, then select **Sample Rate**
2	Select a sample interval using the table below.

Select...	For maximum sampling time of...
1 Second	6 Hours
10 Seconds	60 Hours
1 Minute	15 Days
30 Minutes	15 Months

Note: A sample is taken each second and averaged by the sample interval time selected.

Step	Action
3	From the main Menu Select **Run**. Use the chart below to choose the memory storage type and alarm feature.

To...	Select...
Sample and erase all previously recorded data points in all locations.	**Run - Overwrite,** *then* Select **Yes** to confirm, **Note:** Selecting **No** will cancel sampling process without effecting memory.

Continued on next page

Sampling, Continued

	Sample using alarm feature and erase all previously recorded data points in all locations.	**Alm - Overwrite,** *then* Select **Yes** to confirm, **Note:** Selecting **No** will cancel sampling process without effecting memory.
	Sample adding data points to the next consecutive location.	**Run – Continue**
	Sample using alarm feature and adding data points to the next consecutive location.	**Alm – Continue**

Note: See page 3-14 for explanation of tag codes.

Results:

The internal pump is activated and the sampling process begins.

The Data Record Screen is displayed (figure 3.10).

Note: Maximum sampling time is based on the sampling interval selected in step number two.

4	Attach SM-4000 to belt of the worker using belt clip.
5	Clip the sensor onto the worker's collar within the OSHA defined breathing zone (figure 3.9).

Figure 3.9. Detachable sensor head attached to worker's collar.

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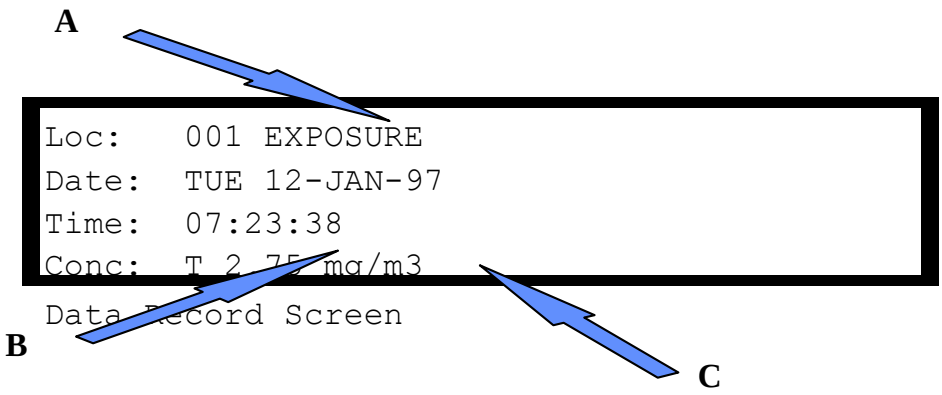


Figure 3.10. The Data Record Screen. The table below describes the diagram details.

Detail	Explanation
A	Indicates Location Code of data being sampled. A record should be kept of the site that corresponds to each location code. **Note:** See page 3-14 for explanation of location codes.
B	Particulate type being sampled. T = Thoracic R = Respirable I = Inhalable
C	Concentration. A negative number may indicate the baseline of the unit is not set to zero and the Auto-Zero process should be performed (page 3-7).

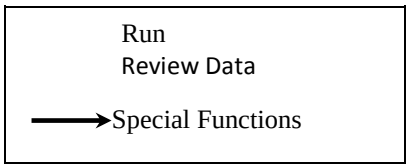
Ending the Sampling process

Press **ENTER** to stop data collection and return to the Main Menu.

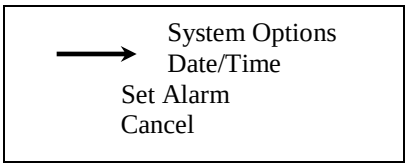
Custom Correction Factor on SM-4000

Before a SCALE factor can be entered, a gravimetric result must be obtained from the filter contained behind the sensing head. The filter must be pre-weighed.

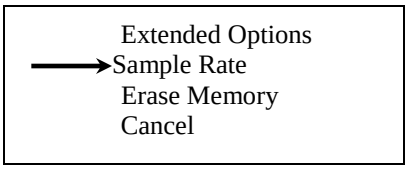
Step 1:
Go to Special Functions option by pressing either the down button or the up button until the arrow is opposite Special Functions. Press **ENTER** button.



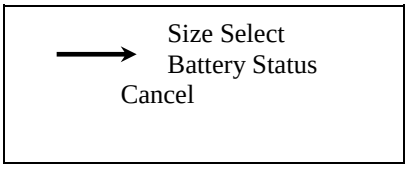
Step 2:
Scroll arrow to System Options option and press the **ENTER** button.



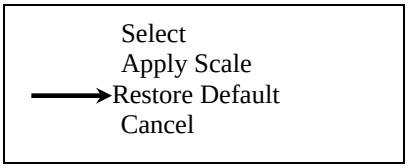
Step 3:
Scroll arrow to Extended Options and press **ENTER** button.



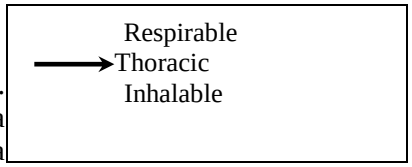
Step 4:
Scroll arrow to Size Select Option and press **ENTER** button.



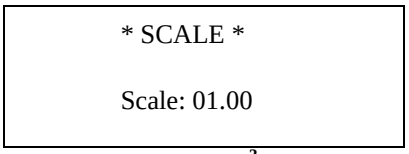
Step 5:
Scroll arrow to Apply Scale Option and press **ENTER** button.



Step 6:
Scroll arrow to Respirable, Thoracic, or Inhalable Option and press **ENTER**. The fraction selected depends on the fraction you have sampled and obtained a gravimetric result for. **NOTE:** To do this for respirable you must have a gravimetric result, obtained by using the IOM with foam and filter.



Step 7:
Default scale of 01.00 will be seen. Enter the SCALE factor required by using the **UP, DOWN** and **ENTER** buttons. The screen will now return to the APPLY SCALE screen.



How to Calculate the SCALE Factor:

The TWA result obtained from the filter used during a monitoring exercise is compared against the TWA displayed by the SM-4000 LCD in the REVIEW DATA option.

From the two results a simple calculation is used to obtain the SCALE factor for that sample and atmosphere type.

Filter TWA result
SM-4000 TWA result = SCALE

EXAMPLE:

Filter TWA was 5 mg/m^3
HD-1004 TWA was 2.5 mg/m^3

$$\frac{5}{2.5} = 2$$

Scale factor to be entered for the next sample in the same atmosphere is 02.00

Tag Codes

Introduction

The Haz-Dust SM-4000 assigns a tag code to each sampling sequence. The active location is indicated in the Data Record Screen (figure 3.10).

Maximum tag codes

The Haz-Dust SM-4000 can store a total of 21,500 data points, which can be distributed into a maximum of 999 locations.

Assigning tag codes

The tag code assigned to the site is determined by the memory storage type selected in step number three of the sampling process (page 3-10).

Use the table below to identify the tag code being used.

Data storage type selected...	The Haz-Dust SM-4000 Assigns...
Continuation	The N**ext Consecutive Value** as the Tag Code. **Example:** If data was previously stored in tags #001 and #002 the data being collected will be stored in tag #003.
Overwrite	**001** as the Tag Code and all previously stored data points in all tags are erased.

Reviewing Stored Data

Introduction

The Haz-Dust SM-4000 provides extensive capabilities for reviewing internally stored data and statistics on the LCD.

LCD display

The following information is displayed on the LCD.

Display	Description
Date	Date of sampling.
Start	Time sampling began.
Stop	Time sampling was terminated.
Time	Time of occurrence of reported statistic.
MAXIMUM Sample	Highest concentration of dust particles.
MINIMUM Sample	Lowest concentration of dust particles.
T.W.A.	Time weighted average concentration of dust particles.

Elapsed	Elapsed time of the time weighted average.
S.T.E.L.	Short-term exposure limit.

Viewing data on the LCD

Follow the steps in the table below to review stored information and statistics.

Step	Action
1	Select **Review Data.**
2	Select **Statistics.**
3	Determine your next step using the table below.

If...	Then the...
Memory holds data points in other locations.	Review Tag Select appears.
Memory has been cleared of all data points.	The Scanning Memory Screen displays. Go to step 7.

4	Select the Location using the table below.

To review...	Select...
The Location displayed in the Review tag field.	**Review Tag XXX** and go to step 7.
A different Location	**New Tag** and continue to step 5.

Continued on next page

5	Enter the desired Location in the Tag Select Screen using the table below (figure 3-11).

To...	Press...
Increase the value of the selected digit.	< □ >
Decrease the value of the selected digit.	< □ >
Select the next digit or field.	**ENTER**

6	Press **ENTER** when the desired location code has been entered. **Result:** The Scanning Memory Screen displays. If the location is being reviewed for the first time scrolling dots will appear indicating the microprocessor is computing data.

7	The first of five statistics screen appears when data is computed. Scroll through the statistics screens using the table below.

Press...	To Scroll...
< □ >	Forward through the statistic screens.
< □ >	Backward through the statistic screens.

```
** Tag Select  **
Range:   001 thru 002
Loc:     002
```

Figure 3-11. Tag Select Screen. Range: indicates number of location files stored in memory. Tag: indicates location code being reviewed.

Chapter 4 – DustComm Pro V2.3.1

Introduction to the DustComm Software

Introduction

DustComm is a powerful and flexible Windows application software package designed for use with the Haz-Dust Particulate Monitoring Equipment.

DustComm is both communications software that enables stored project data to be downloaded to a PC, and a data manipulation tool, enabling detailed analysis and reporting of sampled data.

Spreadsheet applications

DustComm easily translates data into spreadsheet ASCII text files. These files can be opened in spreadsheet programs such as Microsoft Excel

Data plots

The data plots provided with DustComm enable:

- Detailed statistical analysis.
- The creation of graphics and charts.
- The mathematical correction of particle characteristics when aerosol significantly differs from calibration dust.

Installing DustComm

Introduction

DustComm installation is easy and quick, the entire process should take less than 5 minutes.

Minimum system requirements

Windows ME or Higher.
4 MB available disk space.
8 MB RAM.

Software installation

Follow the steps in the table below to install DustComm.

Note: It is assumed that the CD-Rom Drive is the "D" Drive. Substitute D with the appropriate drive letter if necessary.

Step	Action

1	Start Windows.

2	Close all open applications.
3	Insert *Installation Disk* into the D drive.
4	Open My Computer
5	Select the folder named “DustComm V2.3.1” and double click to enter.
6	Select the icon named “Setup” and double click. See Figure 1.
7	Follow the installation wizard steps.

Figure 1: DustComm Software Folder with “Setup” Selected in Windows XP.

Loading the DustComm Software

Windows ME Follow the steps in the table below to load the DustComm software if using Windows ME.

Step	Action
1	Select the Start Menu.
2	Select Programs.
3	Select the folder EDC DustComm Pro 1.2
4	Select DustComm Pro 1.2

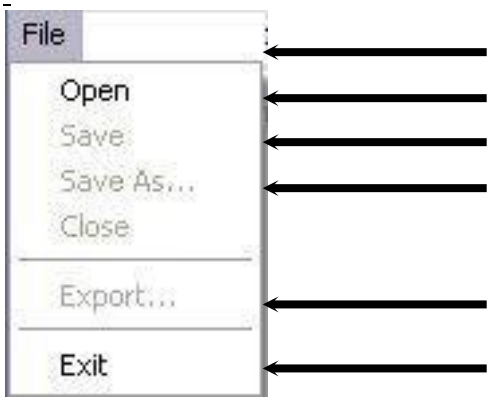
Windows NT, 2000 & XP Follow the steps in the table below to load the DustComm Software if using Windows NT, 2000 & XP.

Step	Action
1	Double Click on the icon on your desktop. NOTE: If shortcut icon does not appear on desktop follow the steps for Windows ME.

Figure 2. DustComm Screen immediately after loading software.

Menu Selections

Introduction Figures 3 through 5 shows each of the DustComm menu options.



Note: If a menu option is displayed in light type it is not available during the current task.

Opens Saved Files

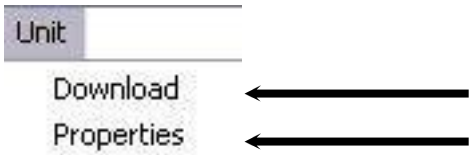
Saves Current Open Files if changed

Saves Current Open Files, that have not yet been saved

Closes Open Files

Saves Current Open Files as a text file, so that you can open the data up in a spreadsheet Exits the entire Program

Figure 3. File Menu Options.



Downloads Instrument

Selects Instrument and Com Port that you want to download

Figure 4. Unit Menu Options.

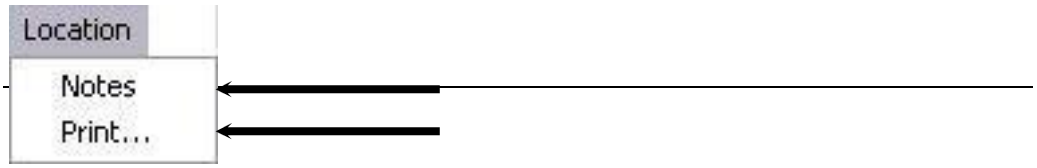
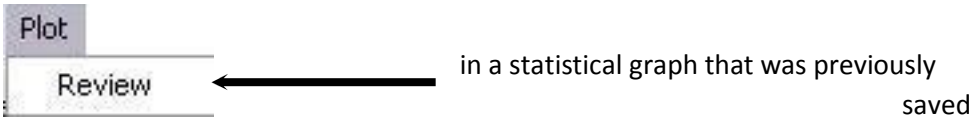
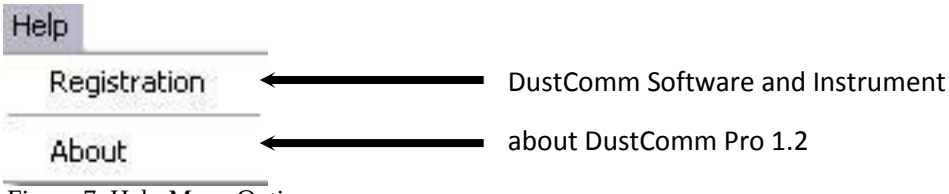


Figure 5. Location Menu Options.



Review the data in a statistical graph that was previously saved

Figure 6. Plot Menu Options.



Register the DustComm Software and Instrument

Information about DustComm Pro 1.2

Figure 7. Help Menu Options.

File Menu Commands

Introduction Use the File Menu option to open, save, print, close and export sampled data. You can also use the File Menu to Exit the DustComm Pro Software

Notes:

- Data is sorted by time collected.
- Data points are reported in mg/m^3.

Opening an existing project folder Follow the steps in the table below to retrieve stored project data. NOTE: A sample .dcm file is preloaded for review of software options.

Step	Action
1	Select **File**.
2	Select **Open**.
3	Double click on the desired Project Folder. **Note:** DustComm will save all files in My Documents, or user selected folder.

Saving a project folder Follow the steps in the table below to store project data.

Step	Action

1	Select **File.**

2	**If...** / **Then Select...** • Saving the data in the project folder for the first time, or, • Saving an existing folder to a new name or location. / **1. Save As,** then, **2.** Type a file name for the project file. **3.** Select **OK**. Saving an updated version of an existing project folder to the same file name and location. / **Save** **Result:** The data is saved in the new project folder and the new file name is displayed in the title bar. Only with **Save As** with the data have a new file name and location if selected.

Continued on next page

File Menu Commands, Continued

Exit software Exit Communication Software in one of two ways.

Option number	Action
1	1. Select **File.** 2. Select **Exit**.
	Or
2	Single click on the "X" in the upper right hand corner of the screen.

Downloading Data

Introduction

Internally stored data can be downloaded to DustComm for detailed analysis.

Downloading data

The three major steps used to download data from the EDC dust-monitoring unit to a PC are listed below and detailed in the next few pages.

1. Connect the cable.
2. Prepare the PC for data transmission.
3. Prepare the EDC dust-monitoring unit for data transmission.

Connect the cable

Follow the steps in the table below to connect the cable for data transmission.

Step	Action
1	Connect one end of the supplied RS232 cable to the EDC dustmonitoring unit. **Note:** If USB compatibility needed you will need to purchase a serial to USB adapter.
2	Connect the other end of the RS232 cable to the appropriate COMM port on the PC. **Note:** Check that both connections are secure. An intermittent connection can disrupt data transmission.

Preparing the PC

Follow the steps in the table below to prepare the PC for data transmission.

Note: Multiple locations will be separated by tabs at the bottom of the program.

Step	Action
1	Open DustComm.
2	Select **Unit** and Select **Properties**.
3	Under the **Properties** selection choose SM-4000 option and the Com Port that you want to connect. Press Ok when you are finished
4	Select **Unit** and Select **Download**.
5	When the items above are finished you should see the download box appear.

Continued on next page

Preparing the unit. Follow the steps in the table below to prepare the EDC unit for data transmission.

Step	Action
1	Select **Review Data** from the Main Menu on the unit.
2	Select **Download**.
3	Select **To Dust Data Collector.**
4	Press **ENTER**. **Result:** The Transmitting window appears. **Note:** Bars on the PC screen should increase as the unit downloads.
5	When the transmission is complete... • The **To Dust Data Collector** selection screen is displayed on the units display. The unit may be shut off at this time. • The downloaded data is displayed in the Project Folder on the PC. (Figure 8).

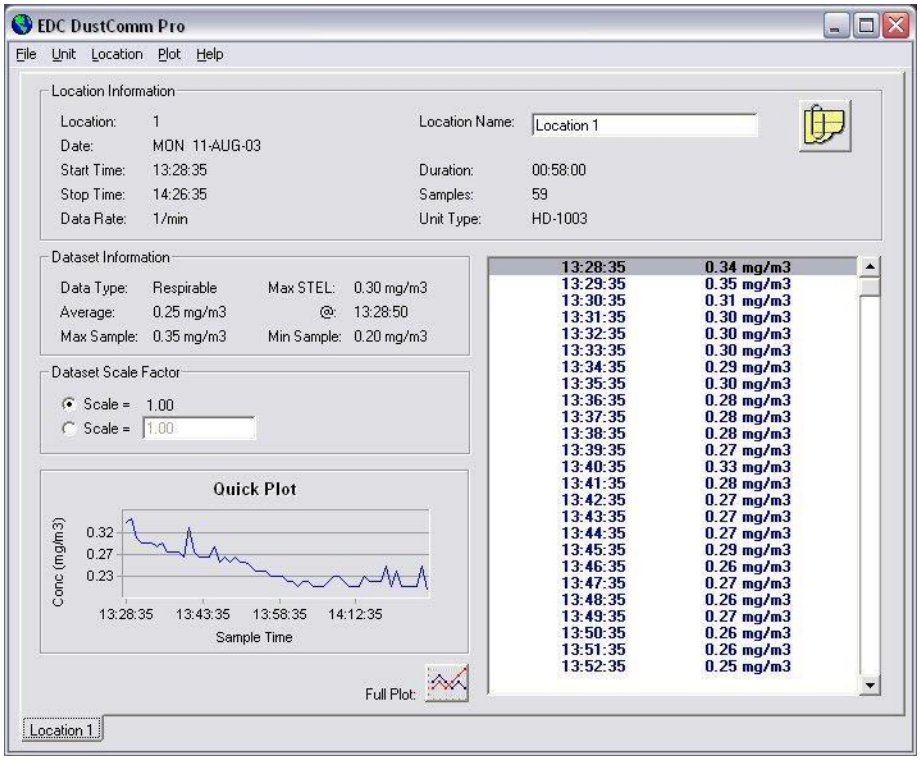


Figure 8. Project File after data has been transmitted.

DustComm Pro Window

Introduction Each section of the DustComm Pro Window will explain a different part of the statistics.

Location Information	The Location information will give you general details about the downloading statistics. Such as date, time, start/stop time, data rate, duration, how many samples where downloaded and the unit. There is also box so that you can name the location and a shortcut to type in any notes you would like to add.

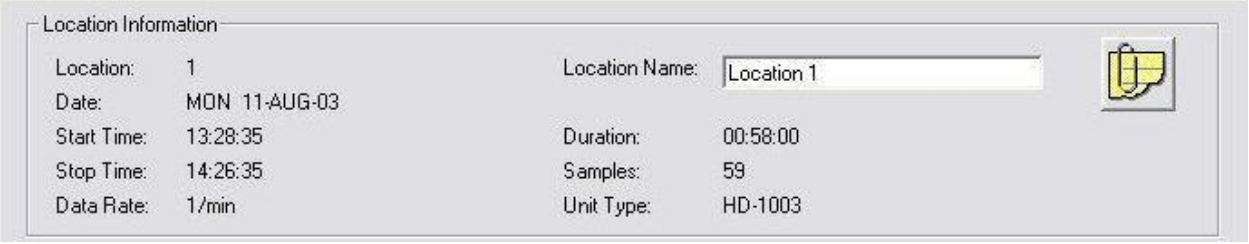
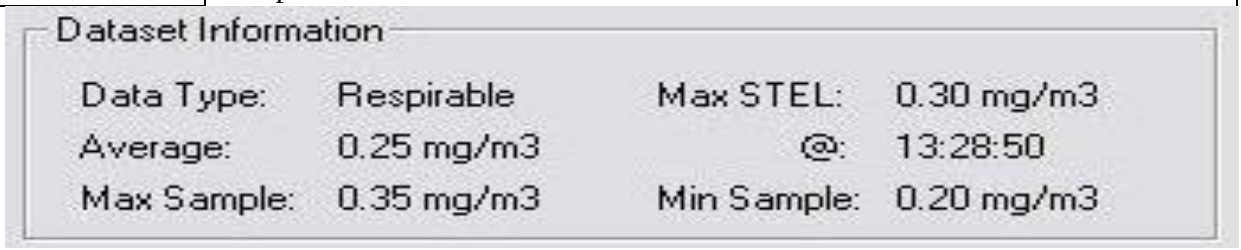


Figure 9. Location Information section of the DustComm Pro Window.

Dataset Information	The Dataset Information will tell you more specific information about the downloaded statistics. Such as type of data, the average, the Max/Min Sample and the Max STEL.



Continued on the next page

Figure 10. Dataset Information section of the DustComm Pro Window.

DustComm Pro Window, Continued

Dataset Scale Factor	The dataset scale factor section of the DustComm Pro Window, is so that you can adjust the scale to be equal to your specific type of dust. You can read more about adjusting the scale factor on page 4-18.

Note: Choose scale factor of scale = 0.1 when using SM-4000.

Figure 11. Dataset scale factor section of the DustComm Pro Window.

Quick Plot	The Quick Plot graph shows you a miniature version of the Full Plot. The Full Plot button is located directly below Quick Plot can you can read more about Full Plot on pages 11-14.

Figure 12. Quick Plot & Full Plot Button on the DustComm Pro Window.

DustComm Pro Window, Continued

Location Data	The location data section shows you the milligrams per cubic meter you sampled for and the times that they were sampled at.

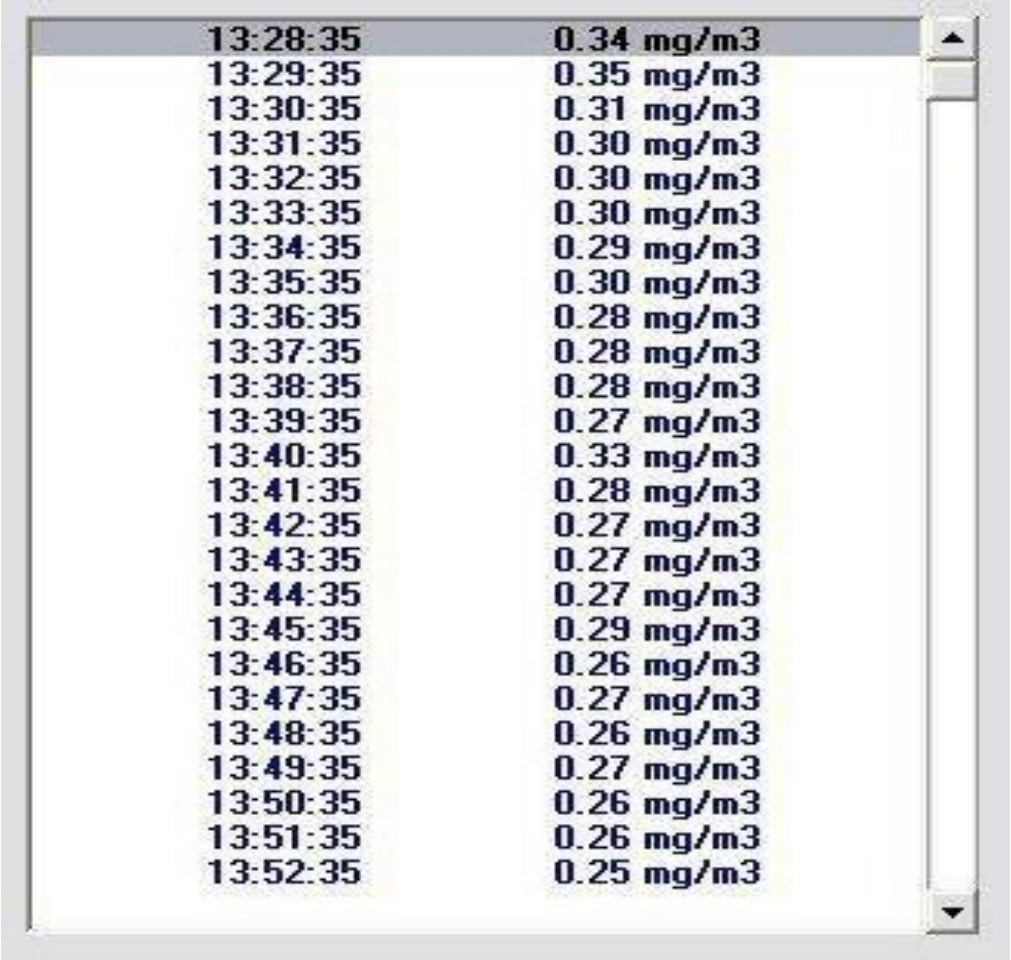


Figure 13. Location Data on the DustComm Pro Window.

Translating Data to an ASCII Text File

Introduction

Project Data must be translated into ASCII text format before it can be read by a spreadsheet application.

Translating data

Follow the steps in the table below to Translate Project Data into ASCII Text format.

Note: A Project Folder must be open to access the translate feature.

Step	Action
1	Select **File** from the Main Menu.
2	Select Export.
3	An "Export Locations" Window will appear. Select either All for all locations or select the range of locations you would like to export. Click **OK** when you have selected your locations.
4	An "Export To…" Window will appear. Type in the name that you would like to call your exported data and click **Save.**
6	When you are ready to open the data in a spreadsheet application. Open the spreadsheet program go to the **Open** menu, select all files under type of file name and double click on the file you want to review. This will result in your saved data opening in your spreadsheet program.

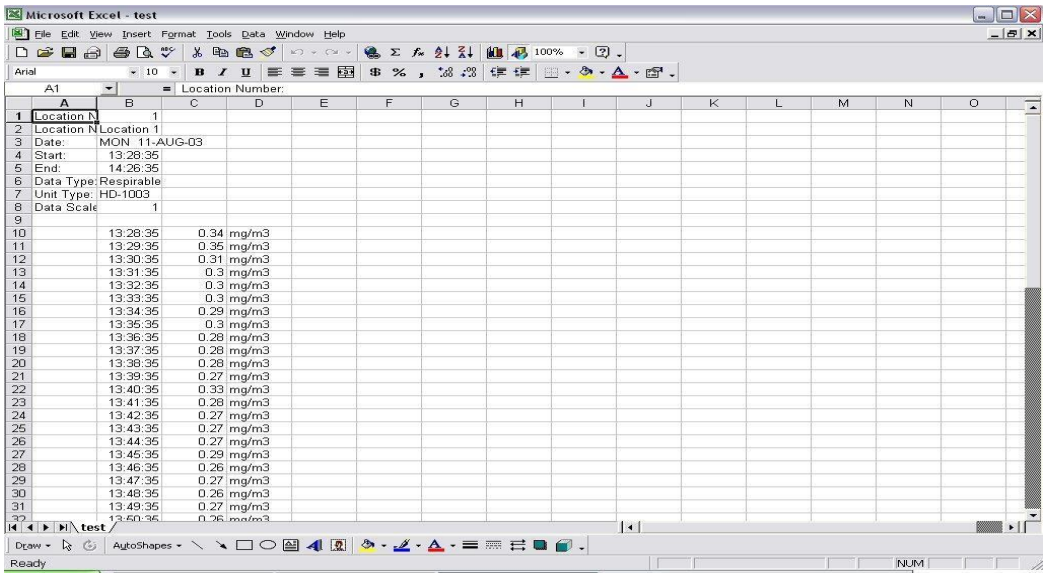


Figure 14. Exported Excel information.

Generating a Plot

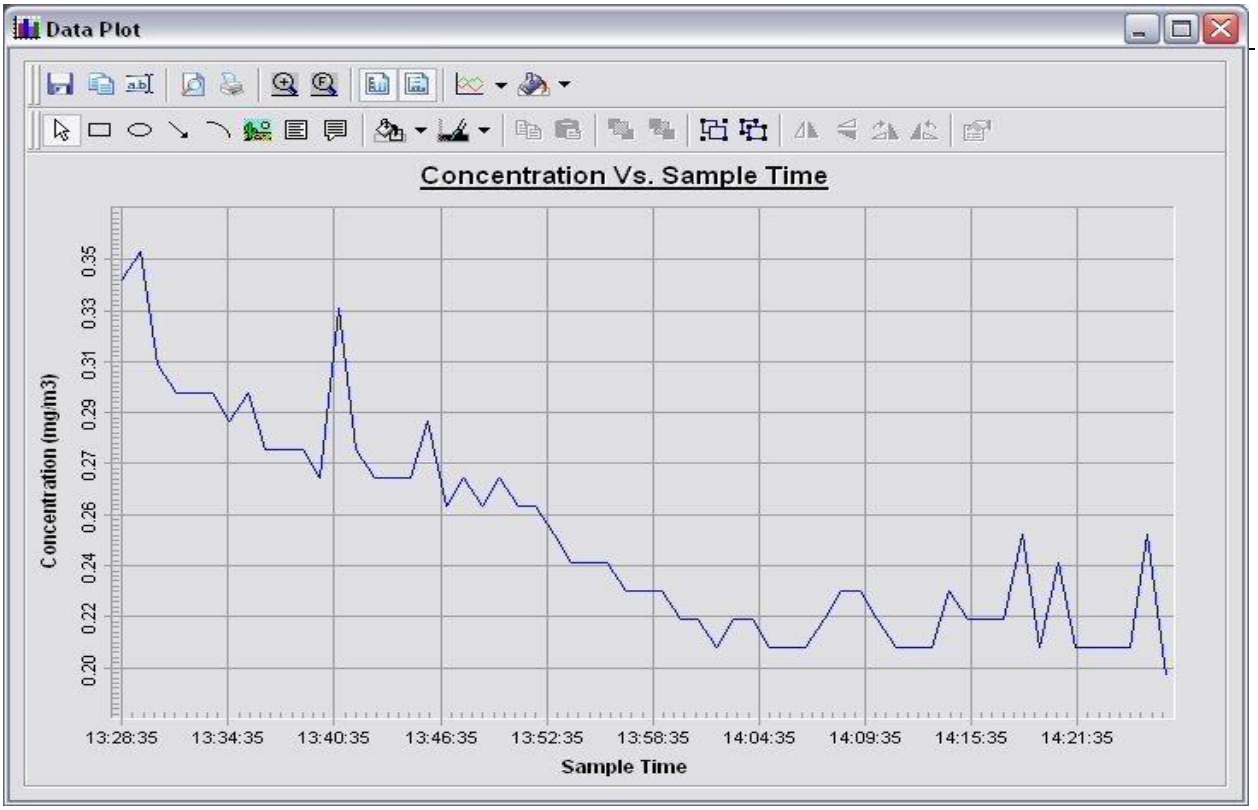
Introduction

A graph can be plotted with full plot located at the bottom of the DustComm Pro Window.

Generating a graph

Follow the steps in the table below to generate a graph using the DustComm Plot menu selections.

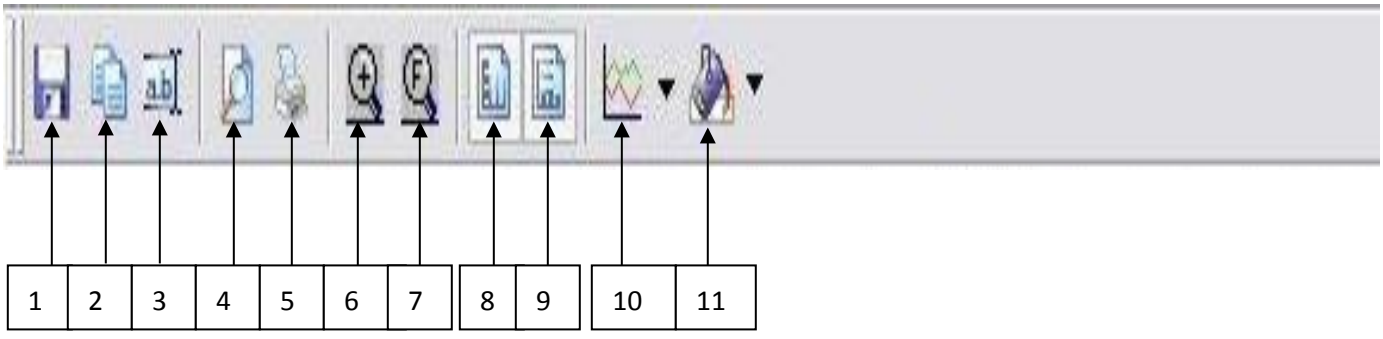
Step	Action
1	Select **Plot.**
2	Select **Review.** This option is for graphs that have already been saved. **Note:** For new statistics click on the "Full Plot" Icon on the DustComm Pro Window.
3	The result is graph will be plotted to the screen (see figure 15 below).



Continued on next page

Data Plot Menu Selections

Introduction At the top of the data plot will be a button bar. Below is an explanation of what each button does.

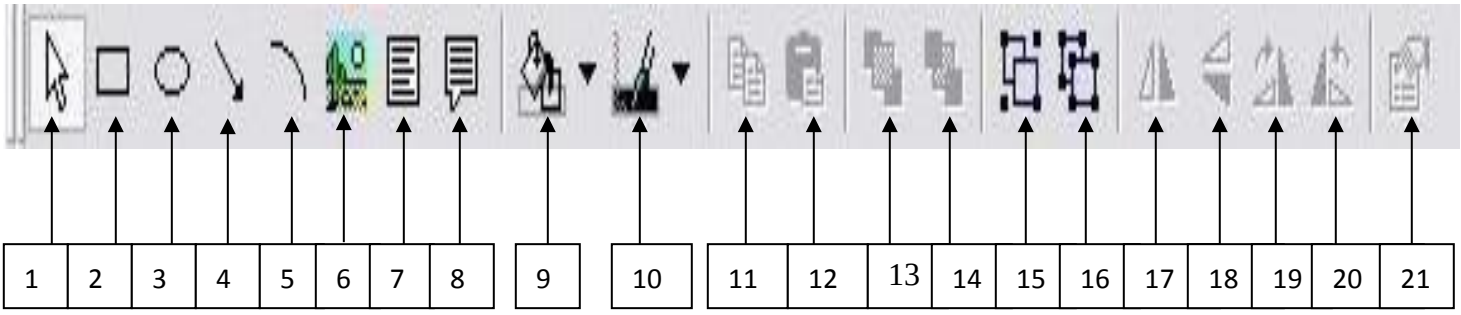


Number	Function
1	Saves plotted information as a DustComm Pro Chart (*.dcc).

2	Copies plot to a bitmap file.

3	Edits the title of the plot.
4	Page Setup Properties.
5	Prints the current plot.
6	Zooms into plot. By Highlighting from point to point that you want zoomed in on.
7	Returns to full screen of plot.
8	Adds or removes vertical lines.
9	Adds or removes horizontal lines.
10	Select the specific type of graph, i.e. bar or line graphs.
11	Changes color of the graph.

Data Plot Menu Selections, Continued



Number	*Function*
1	Pointer tool.
2	Insert Squares.
3	Insert Ovals.
4	Insert arrows.
5	Insert arched lines.
6	Insert a picture. Choose the size of your picture and then right click on the box and select properties. Select the picture tab and select picture. The picture you chose will appear in the box.
7	Insert a text box.
8	Insert a callouts with text.
9	Change the color of your squares, ovals, text boxes and callouts.
10	Change the color of the text in your text boxes and callouts.
11	Copy squares, ovals, text boxes and callouts.
12	Paste squares, ovals, text boxes and callouts.
13	Bring squares, ovals, text boxes and callouts to front.
14	Send squares, ovals, text boxes and callouts to the back.
15	Group squares, ovals, text boxes and callouts.
16	Ungroup squares, ovals, text boxes and callouts.
17	Flip over left to right squares, ovals, text boxes and callouts**.**
18	Flip over up and down squares, ovals, text boxes and callouts.
19	Rotate squares, ovals, text boxes and callouts clockwise.
20	Rotate squares, ovals, text boxes and callouts counterclockwise.
21	Properties of selected squares, ovals, text boxes and callouts.

Editing Title

Introduction A customized title can be added to a graph before printing.

Editing the title Follow the steps in the table below to add a title to the graph.

Step	Action
1	Have location plotted already.
2	Select the **Edit Title** button on the menu bar.
3	A Window will appear where you can edit the title for what you would like its name to be.
4	Select **OK** when the correct title is in the box**.** **Result:** The graph will be created with the new caption.

Figure 16. Edit Title Window.

Applying a Correction Factor

Introduction

A correction factor can be applied to the data collected with the EDC unit to account for variances in gravimetric readings.

Calculating a correction factor

The correction factor is calculated by dividing the Gravimetric reading by the EDC unit reading.

Applying a correction factor

Follow the steps in the table below to apply a correction factor to all data points in the current project folder.

Step	Action
1	Select the 2nd **Scale=** with a box where you can type in your scale factor.

2	Type in the Scale factor.
3	After the scale factor is entered press enter. **Result:** All data points in the project folder have been multiplied by the correction factor. **Note: Choose scale factor of scale = 0.1 when using SM-4000**.

Removing the correction factor

Follow the steps in the table below to remove the correction factor from the data points in the project folder.

Step	Action
1	Select the 1st **Scale=** under the **Dataset Scale Factor.** **Result:** Data points should return to original state.

Inability to Download Data to PC

Introduction If DustComm Software installs properly but downloading instrument to computer is unsuccessful try the following:

- **Ensure that the RS232 cable connectors from the PC are *tightly screwed* into place.**

- **Ensure that the communications settings are set appropriately in the Download Properties screen of the DustComm program. Select Unit, Properties to access this dialog box. The communications port must be set to the appropriate Com Port used on the PC.**

- **If you are experiencing problems downloading your unit's results to your PC, and the RS232 cable connectors are secured tightly, your cable may be connected to the wrong 9-pin port on your PC. If your PC has more than one 9-pin connection port, attach the cable to another 9-pin port and try to download the dust monitor's results at that port. You may need to try all of your PC's 9-pin ports before finding the correct connection.**

- **If the previous steps check out, try using the Windows supplied HyperTerminal or other appropriately configured communications software to receive data when downloading from the Haz-Dust Monitor.**

- **If using a USB port, make sure you are using the proper USB to serial adapter.**

For service or Technical Questions please call 800-234-2589 or e-mail techsupport@hazdust.com

Chapter 5 - Maintenance

Chapter 5 Maintenance

Chapter Overview

Introduction This chapter covers the maintenance procedures for the Haz-Dust SM-4000.

In this chapter This chapter contains the following topics.

Checking the Calibration Span

Introduction

The Calibration Reference is a light scattering device that provides a constant value (termed a "k" factor).

The Calibration Reference should be used as a reference to check factory calibration span of the SM-4000.

When to check the calibration span

The calibration span should be checked under the following conditions:

- Once a month with normal usage.
- If the SM-4000 is dropped or otherwise damaged.
- The first time you use the unit to double check the factory calibration.

Note: The SM-4000 should be sent into EDC annually for recalibration.

Conditions

The following conditions must be met before checking the calibration span.

Condition...	For further information see page...
The Sensor Optics must be clean.	5-11
The Environment must be clean.	---
The Battery must be fully charged.	5-7

Figure 5-1. Figure of the SM-4000 sensor showing the calibration reference being inserted.

Continued on next page

Checking the Calibration Span, Continued

Checking Calibration Span

Follow the steps in the table below to check the Calibration Span of the HazDust SM-4000.

Note: Failure to follow this procedure in its entirety may cause an incorrect "k" value reading.

Step	Action
1	Insert the Thoracic sampling inlet into the sensor head of the SM4000.
2	Attach the filter cassette to the sensor of the SM-4000.
3	Attach the air intake hose to the filter cassette.
4	Put the SM-4000 into Respirable mode using the steps below.

Step	Action
4-1	Select **Special Functions** from the Main Menu**.**
4-2	Select **System Options.**
4-3	Select **Extended Options.**
4-4	Select **Size Select,** then **Select.**
4-5	Select **Respirable.** **Result:** The Main Menu is displayed and the SM4000 is in Respirable mode.

Step	Action
5	Activate the internal pump using the steps in the table below.

Step	Action
5-1	Select **Run** from the Main Menu.
5-2	Select **Run – Continue.**
5-3	Allow the SM-4000 to run for at least 2 minutes to stabilize. **Result:** The internal sampling pump is activated.
5-4	Press **ENTER** after at least two minutes to stop the sampling process.

Continued on next page

Checking the Calibration Span, Continued

6 Perform the Auto-Zero process using the steps in the table below.

Step	Action
6-1	Insert the zeroing filter into the Thoracic sampling inlet.
6-2	Select **Auto-Zero.** **Result:** The Auto-Zeroing screen appears briefly.
6-3	Select **Auto-Zero.** **Results:** • The Auto-Zeroing screen appears during the autozero process. • The Main Menu is displayed when the Auto-Zero process is complete.
7	Remove the Thoracic sampling inlet from the sensor head.
8	Disconnect the air intake tubing.
9	Push the calibration reference CS-104 into the sensor head (see figure 5-1 on page 5-2).
10	Activate the internal sampling pump again by repeating the process described in step number five on page 5-3. Skip step number 5-4 and leave the sampling pump running.
11	Observe the printed "k" value on the calibration reference. **Note:** The printed "k" value should match the concentration value shown on the SM-4000 LCD to within ± 10%. Note: If the CS-104 is purchased as an after market accessory or from SKC, Inc., then the user must assign a "k" value.
IF	**THEN**
The numbers agree within ± 10%	The SM-4000 has passed the span check test.
The numbers do not agree within ± 10%.	1. Repeat the process to rule out error, then 2. Call EDC technical support or return the SM-4000 for recalibration.

Checking the Flow Rate

Introduction It is good technique to check the flow rate every time a new gravimetric filter is used for sampling.

Checking the flow rate Use the steps in the table below to check the flow rate.

Notes:

- If sampling Thoracic or Inhalable particulates make sure the Thoracic sampling inlet is attached to the sensor head.
- If sampling Respirable particulates make sure the Respirable sampling inlet is attached to the sensor head.

Step	Action	
1	Attach your airflow calibrator to the SM-4000 using the table below.	
	If sampling...	**Then...**
	Thoracic or Inhalable Particulates	1. Attach one end of the calibration airflow tubing to the Thoracic sampling inlet. 2. Connect the other end of the calibration airflow tubing to your airflow calibrator.
	Respirable Particulates	1. Insert GS-Cyclone into cover of calibration chamber. Screw cover on tight. 2. Attach airflow calibrator to 90° nylon fitting. Attach SM-4000 sensor to tygon tubing. See figure 5.3. Consult calibration chamber instructions, p/n CH-103, for further detail.

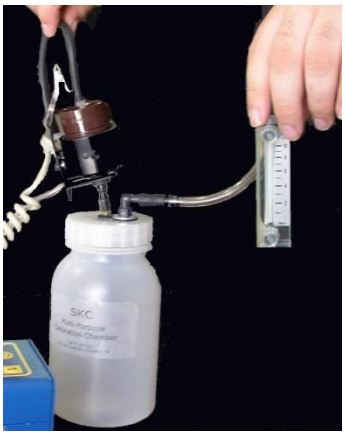


Figure 5-3. SM-4000 sensor connected to CH-103 calibration chamber.

Continued on next page

Checking the Flow Rate, Continued

2 Activate the internal sampling pump using the steps below.

Step	Action
1	Select **Sample/Record** from the Main Menu
2	Select **1 Second.**
3	Select **Overwrite.**
4	Select **Yes.**
5	Select **No.**
6	Select **Sample/Rec** and allow the SM-4000 to run for at least two minutes to stabilize.

3 Observe the flow rate on your air flow calibrator.

If...	Then...
The flow rate is 2.75 LPM.	The flow rate is properly calibrated. Detach the airflow calibrator tubing and continue with the "Selecting the Particle Size" process.
The flow rate is not 2.75 LPM.	The flow rate must be adjusted. See page 5-7 for instructions.

NOTE: The GS-3 Cyclone is an optional accessory for the SM4000. Its optimal flow rate is 2.75 LPM. The GS-1 Cyclone may be used, however, its optimal flow rate of 2.0 LPM to a 4µm respirable cut point.

Using the Thoracic inlet and the flow rate is 2.0 LPM.	The flow rate is properly calibrated. Detach the airflow calibrator tubing and continue with the "Selecting the Particle Size" process.
The flow rate is not 2.0 LPM.	The flow rate must be adjusted. See page 5-7 for instructions.

Using the Inhalable inlet the flow rate is 2.0 LPM.	The flow rate is properly calibrated. Detach the airflow calibrator tubing and continue with the "Selecting the Particle Size" process.
The Flow rate is not 2.0 LPM.	The rate must be adjusted. See page 5-7 for instructions.

Adjusting the Flow Rate

Introduction

The flow rate must be adjusted when it does not equal:

- 2.75 LPM for 25-mm cyclone Respirable Inlet
- 2.0 LPM for Thoracic Inlet
- 2.0 LPM for Inhalable Inlet

Adjusting the flow rate

Follow the steps in the table below to adjust the flow rate.

1	Locate the adjustment screw on the side of the SM-4000 next to the air intake nozzle.
2	Use the flow adjustment screw to adjust the flow rate.
	To... / **Turn the adjustment screw...** Decrease the flow rate / Counterclockwise Increase the flow rate / Clockwise
3	Record the Flow Rate.
4	Detach the airflow calibrator and calibration airflow tubing.
5	Continue with the "Selecting the Particle Size" process.

Battery Maintenance

Introduction

The battery pack is a 6.0 V NiMH rechargeable battery that can hold a charge for up to 8 hours. It is important to check the battery periodically and recharge when necessary.

Checking the Battery

The battery status can be checked using the menu options on the Haz-Dust SM-4000. Use the following menu options to check the battery.

Step	Action
1	Select **Special Functions** from the Main Menu.
2	Select **Systems Options**.

3	Select **Extended Options.**

4	Select **Battery Status.** **Result:** The Battery Level Screen displays the charging level of the unit's battery in VDC.
5	

If the charge level is...	Then...
7.0 VDC or higher	The battery is fully charged.
6.2 VDC or lower	The battery must be recharged. See instructions on page 5-9.

Continued on next page

Battery Maintenance, Continued

Recharging the supplied **battery**

Follow the steps in the table below to recharge the battery using the charger.

Note: If the battery is low the sampling process will terminate and the low battery screen will display.

Step	Action
1	Plug the battery charger into an electrical outlet.
2	Plug the battery charger into the battery charge jack on the back of the battery plate. **Results:** • The battery charge begins. • If the unit is off there will be no visible indication of the charge. **Note:** Recharging time is approximately 16 hours, and unit must be powered off when charging. If battery does not hold a charge for 8 hours, charge time can be increased to 24 hours. Typical lifetime of battery is 18 to 24 months. Batteries are warranty for 90 days upon receipt of shipment.

CAUTION: Do not charge in a hazardous environment. Use *only* the EDC approved charger designed for the Haz-Dust SM-4000.

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Battery Maintenance, Continued

Removing and replacing the battery pack

The battery pack can be removed and replaced whenever necessary.

Note: The battery of the SM-4000 can be recharged while either inside or outside of the instrument.

Removing the battery

Follow the steps in the table below to remove the battery pack.

Step	Action
1	Remove the two thumbscrews from the side plate of the Haz-Dust ISM-4000.
2	Slide the battery plate out of the unit.
3	Unplug the nylon connector from its mating plug.
	Note: The battery pack is attached to the battery plate with a retaining bracket. The battery is not removable from the plate. Replacement batteries will come mounted on battery plates for easy replacement.

Thumbscrews

Remove thumbscrews from battery pack and till monitor so battery slides out.

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Reinstalling the battery

Follow the steps in the table below to reinstall the battery pack.

Step	Action
1	Slide battery pack assembly into unit.
2	Plug the nylon connector into it’s matting connectors
3	Insert the two thumbscrews to secure the battery pack in place.

Cleaning the Sensor Optics

Introduction

It is important to keep the sensor optics of the Haz-Dust SM-4000 clean to ensure the integrity of the optical sensor.

The sensor optics need to be checked every 48 hours when used in a 2 to 3 mg/m^3 T.W.A. environment, or on a weekly or monthly basis in less contaminated locations.

Cleaning the Sensor Optics

Follow the steps in the table below to clean the sensor optics.

Figure 5-2. Picture of the cleaning kit.

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Cleaning the Sensor Optics, Continued

Step	Action
1	Remove the three thumbscrews from the sensor cover.
2	Remove the sensor cover.
3	Remove the sampling head from the bottom of the sensor.
4	Inspect the sensor cover for residual dust. **Note:** Use one of the following methods to clean the surface. □ Blow the dust away with low pressure air, or, □ Wipe with a soft lint-free cloth.
5	Inspect the glass lens covers for dust. **Note:** Use one of the following methods to clean the glass lens. □ Blow the dust away with low pressure air, or, □ Use a small amount of isopropyl alcohol and wipe with foam tip swabs. **CAUTION:** Do not spill any alcohol into the internals of the Haz-Dust SM-4000.
6	Replace the sampling head.
7	Replace the sensor cover.
8	Tighten the three thumbscrews snugly into place.

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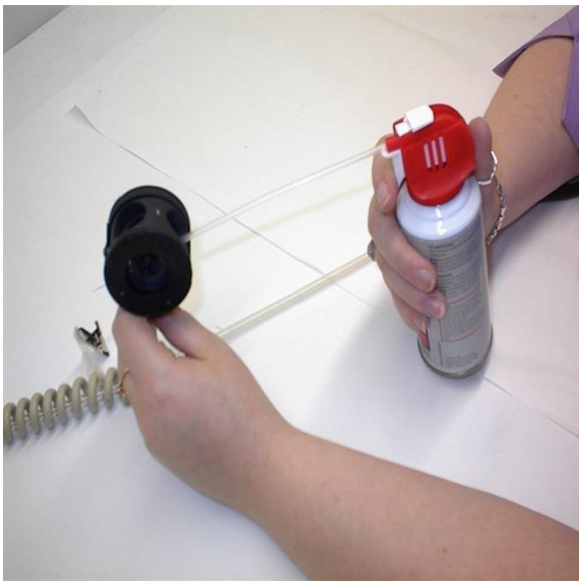

Cleaning the Sensor Optics, Continued Figure 5-3. Removing the sensor cover.

Figure 5-4. Dust being removed with low pressure air.

Appendix

Appendix A NIOSH/OSHA Particulate Air Monitoring Reference

Dust/Hazard	Agency	Reference	TWA	STEL
alpha-Alumina (Respirable fraction)	OSHA	CIM	5 mg/m^3	
alpha-Alumina (Total dust)	OSHA	CIM	15 mg/m^3	
Aluminum, Pyro powders	OSHA	CIM	*	
Aluminum (Respirable fraction)			5 mg/m^3	
Ammonium nitrate	OSHA	CIM	*	
Ammonium sulfamate (Respirable dust)	OSHA	CIM	5 mg/m^3	
Ammonium sulfamate (Total dust)	OSHA	CIM	15 mg/m^3	
Ammonium sulfamate (Total dust)	OSHA	ID 188	15 mg/m^3	
Bismuth telluride, Se-Doped	OSHA	ID 121	5 mg/m^3	
Bismuth telluride, Undoped (Respirable dust)	OSHA	ID 121	5 mg/m^3	
Bismuth telluride, Undoped (Total dust)	OSHA	CIM	15 mg/m^3	
Boron oxide (Total dust)	OSHA	ID 125G	15 mg/m^3	
Boron oxide (Total dust) (Particulates, Total)	NIOSH	0500	10 mg/m^3	
Carbon black	NIOSH	5000	3.5 mg/m^3	
Carbon black	OSHA	ID 196	3.5 mg/m^3	
Chromium, Metal & Insol cpds	OSHA	ID 121	1 mg/m^3	
Chromium, Metal & Insol cpds	OSHA	ID 125	1 mg/m^3	
Chrysene	OSHA	58	0.2 mg/m^3	
Coal dust (<than 5% SiO2)	OSHA	CIM	2.4 mg/m^3	
Coal dust (>than 5% SiO2)	OSHA	ID 142	10 mg/m^3	
Coal tar pitch volatiles	OSHA	58	0.2 mg/m^3	
Copper dust	NIOSH	7029	1 mg/m^3	
Copper, Dusts & Mists	OSHA	ID 125G	1 mg/m^3	
Copper, Dusts & Mists	OSHA	ID 121	1 mg/m^3	
Copper (Elements)	NIOSH	7300	1 mg/m^3	
Copper fume	NIOSH	7029	0.1 mg/m^3	
Copper fume	OSHA	ID 121	0.1 mg/m^3	
Copper fume	OSHA	ID 125G	0.1 mg/m^3	
Cotton dust (Raw)	OSHA	CIM	1 mg/m^3	

* Refer to Agency Method

Continued on next page

NIOSH/OSHA Particulate Air Monitoring Reference, Continued

Dust/Hazard	Agency	Reference	TWA	STEL
Crag herbicide (Respirable dust)	OSHA	CIM	5 mg/m^3	
Crag herbicide (Total dust)	NIOSH	5(S356)	10 mg/m^3	
Crag herbicide (Total dust)	OSHA	CIM	15 mg/m^3	
Cresol, All isomers	NIOSH	2546	10 mg/m^3	
Cresol, All isomers	OSHA	32	15 mg/m^3	
Cyanide (as Cn)	OSHA	ID 120	5 mg/m^3	
Fluorides (Aerosol & Gas)	NIOSH	7902	2.5 mg/m^3	5.0 (HF)
Glass, Fibrous dust	OSHA	CIM	*	
Glycerin mist (Particulates)	NIOSH	0600	*	
Glycerin mist (Respirable)	OSHA	CIM	5 mg/m^3	
Glycerin mist (Total dust)	OSHA	CIM	15 mg/m^3	
Grain dust (Oats, Wheat & Barely)	OSHA	CIM	10 mg/m^3	
Graphite, Synthetic (Respirable dust)	OSHA	CIM	5 mg/m^3	
Graphite, Synthetic (Total dust)	OSHA	CIM	15 mg/m^3	
Iodine (Particulates)	OSHA	ID 212	*	0.1
Kaolin (Respirable dust)	OSHA	CIM	5 mg/m^3	
Kaolin (Total dust)	OSHA	CIM	15 mg/m^3	
Lead	NIOSH	7082	<0.1 mg/m^3	
Lead	NIOSH	7105	<0.1 mg/m^3	
Lead	NIOSH	7700	<0.1 mg/m^3	
Lead (Elements)	NIOSH	7300	<0.1 mg/m^3	
Lead, Inorganic fumes & dusts (as Pb)	OSHA	ID 121	0.05 mg/m^3	
Lithium (Elements)	NIOSH	7300	*	
Lithium hydride	OSHA	CIM	25 □g/m^3	
Magnesium oxide fume (Total dust)	OSHA	ID 121	15 mg/m^3	
Manganese (Elements)	NIOSH	7300	1 mg/m^3	3 mg/m^3
Manganese fume (as Mn)	OSHA	ID 121	*	5 mg/m^3
Methoxychlor (Total Dust)	OSHA	CIM	15 mg/m^3	
Oil mist (Mineral)	OSHA	ID 128	5 mg/m^3	
Oil mist (Mineral)	OSHA	ID 178SG	5 mg/m^3	
Oil mist (Vegetable) (see Dust, Total and Respirable nuisance)				
Pentaerythritol (Total dust)	OSHA	CIM	15 mg/m^3	

Pentaerytritol (Respirable dust)	OSHA	CIM	5 mg/m^3	

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NIOSH/OSHA Particulate Air Monitoring Reference, Continued

Dust/Hazard	Agency	Reference	TWA	STEL
Picloram (Tordon), Respirable dust	OSHA	CIM	5 mg/m^3	
Picloram (Tordon), Total dust	OSHA	CIM	15 mg/m^3	
Plaster of Paris (see Dust, Respirable nuisance)	OSHA	CIM		
Portland cement (Respirable dust)	OSHA	ID 142	5 mg/m^3	
Portland cement (Total dust)	OSHA	ID 142	15 mg/m^3	
Respirable nuisance	OSHA	CIM	5.0 mg/m^3	
Respirable nuisance (Particulates)	NIOSH	0600	*	
Total nuisance	OSHA	CIM	15 mg/m^3	
Total nuisance (Particulates)	NIOSH	0500	10 mg/m^3	
Rouge (Respirable dust)	OSHA	CIM	5 mg/m^3	
Rouge (Total dust)	OSHA	CIM	15 mg/m^3	
Silica, Amorphous	OSHA	CIM	20 mppcf	
Silica, Crystalline tripoli, Respirable dust	OSHA	ID 142	0.05 mg/m^3	
Soapstone (Respirable dust)	OSHA	CIM	20 mppcf	
Soapstone (Total dust)	OSHA	CIM	6 mg/m^3	
Wood dust (except Western red cedar)	OSHA	CIM	*	
Wood dust (Western red cedar)	OSHA	CIM	2.5 mg/m^3	
Zinc bromide (see Dust, Total and Nuisance)			*	
Zinc oxide dust (see Dust, Total & Respirable)	OSHA	CIM		
Zinc oxide fume	OSHA	ID 121	5 mg/m^3	
Zinc oxide fume	OSHA	ID 125	5 mg/m^3	
Zinc oxide fume	OSHA	ID 143	5 mg/m^3	
Zinc stearate (Respirable dust)	OSHA	CIM	5 mg/m^3	
Zinc stearate (Total dust)	OSHA	ID 121	15 mg/m^3	
Zinc stearate (Total dust)	OSHA	ID 125	15 mg/m^3	
Zirconium cpds (as Zr)	OSHA	ID 121	5 mg/m^3	

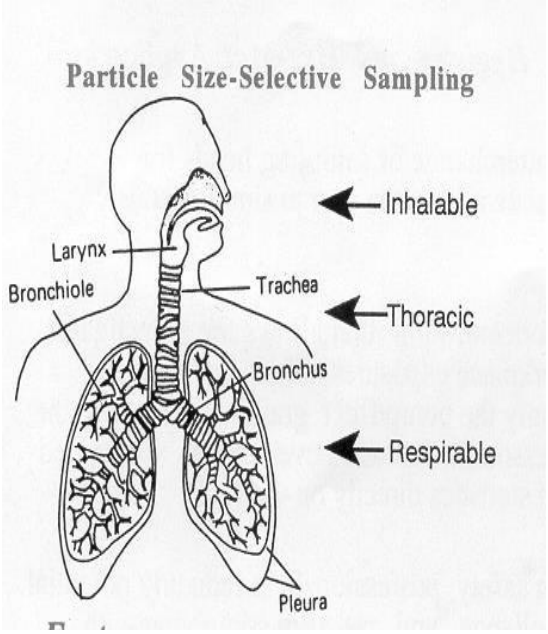
Appendix B
Particle Size Selections

Introduction The tables below show the particle size cut point for Thoracic, Inhalable, and Respirable dust particles.

Inhalable	
Particle Aerodynamic Diameter (□m)	Inhalable Particulate Mass (IPM) (%)
0	100
1	97
2	94
5	87
10	77
20	65
30	58
40	54.5
50	52.5
100	50

Particle Aerodynamic Diameter (□m)	**Respirable Particulate Mass (RPM) (%)**
0	100
1	97
2	91
3	74
4	50
5	30
6	17
7	9
8	5
10	1

Appendix E



Thoracic	
Particle Aerodynamic Diameter (□m)	Thoracic Particulate Mass (TPM) (%)
0	100
2	94
4	89
6	80.5
8	67
10	50*
12	35
14	23
16	15
18	9.5
20	6
25	2

* Same cut point as EPA PM-10.

Respirable

B 1

Appendix D

Glossary of Terms

Term	Definition/Standard
μm	Micron, 1/1000 of a meter.
ARD	Arizona Road Dust
Inhalable Dust Particulates	Particulates having a 50% cut point at 100μm.
LPM	Liters per minute.
mg/m^3	Milligrams per cubic meter.
NIOSH	National Institute of Occupational Safety & Health
OSHA	Occupational Safety & Health Administration.
Respirable Dust Particulates	Particulates having a 50% cut point at 3.5μm.
STEL	Short-term exposure level. Maximum dust concentration over a 15 minute period.
Thoracic Particulates	Particulates having a 50% cut point at 10μm.
TWA	Time Weighted Average. Average particulate concentration over a period of time.

Appendix E

Haz-Dust SM-4000 Accessories

Overview

Introduction

Accessories may be purchased separately for the Haz-Dust SM-4000.

Accessory and part number

Use the part number from the table below to order Haz-Dust SM-4000 accessories.

Accessory	Part Number
110 V Battery Charger	BC-104-110
220 V Battery Charger	BC-104-220
37 mm Opaque Filter Cassette Blanks	CAS-102
5.0 µm PVC 37 mm Filter	225-806
Battery Pack	BP-104
Calibration Reference	CS-104
Calibration Chamber	CH-103
Cleaning Kit	KK-101
Computer Interface Cable	CC-102
Carrying Case	CC-104
Flow Meter	FM-103
SM-4000 Media CD-Rom Includes: Computer Software and Instructions Manual	CD-104
Respirable Dust Cyclone Inlet	RS-104
Tripod Stand	TP-104
Zeroing Filter	ZF-102

Appendix D

OSHA's Final Ruling on Silica

HAZ-DUST Model:
SM-4000 Personal Silica Monitor

Application Note: New Product DOC1216

Background

Earlier this year, OSHA published the final rule to protect workers from exposure to crystalline silica. Crystalline silica can be found in Quartz and is a basic component in soil, sand, granite and other minerals.

The new rule is to protect more than 2 million workers in the United States that are at risk to silica exposure. The health effects of crystalline silica exposure has been linked to disabling illnesses, fatalities and has been classified as lung carcinogen. Exposure to silica can cause silicosis which is disabling if not fatal by causing scar tissue in the lung and reduces the lungs ability to take in oxygen. High risk workers would include foundry work, stonecutting, rock drilling, quarry work, tunneling and any occupation, which can chip, cut drill or grind off crystalline silica in to respirable size fractions.

In order to minimize the health effects of silica OSHA has established new Permissible Exposure Limit (PEL) over an 8 hour work shift. The new rule reduced the PEL by 50%. The new PEL is 50 ug/m3. Additionally, OSHA also adopted an action level of 25 ug/m3 which is the same level as the ACGIH TLV for quartz and cristobalite.

SM-4000: Personal Real-Time Silica Monitor

Cross Calibration

Real Time Nephelometer are calibrated with a standardized Test Dust. Test dust varies, however a commonly used test dust is the ISO12103-01A2 Fine Test Dust, or *"Arizona Road Dust."* The particle characteristics and properties of silica vary from the test dust, causing a variance in the instrumentation response. To compensate for this variance Cross Calibration is required.

$$\textbf{Calibration Factor} = \frac{Gravimetric\ Filter\ TWA}{SM1004\ \ TWA}$$

Traditional Cross Calibration requires two devices; a Reference Sampler and a Real-Time Nephelometers. The Reference Sampler is a pump attached to gravimetric filter. The filter is sent to the lab and compared with the post ex facto real- time readings. The SM-4000 changes the way sampling is performed and reduces the need for two instruments. The SM-4000 has a far superior design compared with other Real-Time Personal Samplers.

The SM-4000 offers a miniature optical sensor mounted in the OSHA defined breathing zone. The sensor is situated between the gravimetric filter and Respirable Cyclone. The SM-4000 is ***THE ONLY*** device on the market with this unique feature.

Appendix E

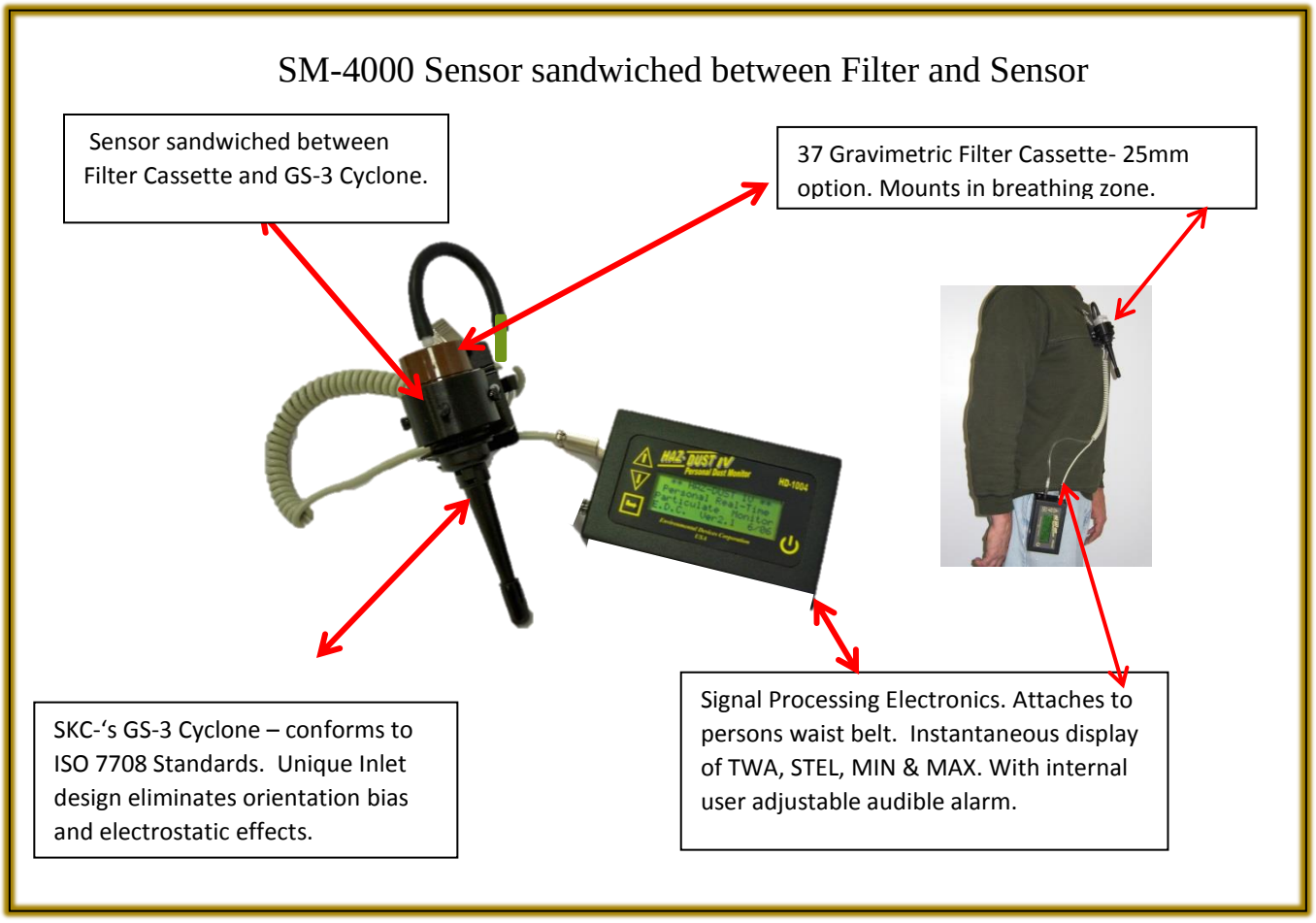
Design of the SM-4000

Unique Design – Patent Pending

Having the air sampler mounted in the breathing zone allows for a more accurate representation of workers exposure. In addition, having a Real-Time Optical Sensor placed in the breathing zone, reduces inner wall dust deposition, experienced by other Real-Time optical devices on the market.

Also having a gravimetric filter cassette directly behind the optical sensor allows for maximum particle deposition and thus a more accurate representation of worker exposure.

In addition to the Real-Time Concentration Readings, the DustComm Software allows for graphical analysis and comprehensive time history reporting.



Appendix D

Specifications of the SM-4000

DISPLAY : Alpha-numeric LCD-4line, 20 character mg/m3 concentration reading

OPERATIONS : Four key splash proof membrane switch – menu driven

CALIBRATION : Gravimetric reference NIST Traceable – SAE fine test dust-ISO12103-1

ACCURACY : +/- 10% to filter gravimetric SAE fine test dust

SENSING RANGE : 1-20,000 ug/m3 (0.001 – 20 mg/m3)

PARTICULATE SIZE RANGE : 0.1 to 10um using SKC GS-3 Cyclone

PRECISION: +/- 3 ug/m3 (0.003-mg/m3)

REAL-TIME CLOCK and DATA DISPLAY : Hours, min., sec., day, month, year

DATA DISPLAY : concentration in mg/ m3 & TWA, MAX, MIN, STEL, date, time

SAMPLING FLOW RATE : 2.75 Lpm User adjustable

SAMPLING RATE : 1 sec., 1 min. and 10 min. intervals

FILTER CASSETTE : 37mm (optional 25mm) mounted directly behind sensor

ALARM OUTPUT: 90db at 3ft.

RECORDING TIME: 1 second to 21 weeks

DATA STORAGE: 21,500 data points

MEMORY & TIME STORAGE: > 5 years

DIGITAL OUTPUT: RS-232

OPERATING TEMPERATURE: 0 to 50 C

STORAGE TEMPERATURE: -20 to 70 C

DustComm Pro Software: Windows driven

POWER: NiMH rechargeable battery

OPERATING TIME : >/= 8 hours

CHARGING TIME : 10 – 12 hours

HUMIDITY: 95% non-condensing

DIMENSIONS & WEIGHT (case): 5.4” x 3.3” x 2.7” & 1.5lbs

SENSOR DIMENSIONS: 1.75” x 1.5”