



NEPHELOMETER OPERATION MANUAL

DELUXE MODEL WITH PARTICLE SIZE SELECTION

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Sensidyne Nephelometer Operation Manual

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Technical Support

Should you require support, please consult your printed documentation to resolve your problem. If you are still experiencing difficulty, you may contact a Technical Service representative during normal business hours—7:30 a.m. to 4:00 p.m. Eastern Standard Time, Monday through Friday.

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Safety Notice

The contents of this manual have been checked against the hardware and software described herein. Since deviations cannot be prevented entirely, we cannot guarantee full agreement. However, the data in this manual is reviewed regularly and any necessary corrections included in subsequent editions.

Faultless and safe operation of the product presupposes proper transportation, storage, erection and installation as well as careful operation and maintenance. The seller of this equipment cannot foresee all possible modes of operation in which the user may attempt to utilize this instrumentation.

The user assumes all liability associated with the use of this instrumentation. The seller further disclaims any responsibility for consequential damages.

NOTICE



CAUTION—Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.



WARNING—This product, when properly installed and operated, is considered a Class I laser product. Class I products are not considered to be hazardous.

There are no user serviceable parts located inside the cover of this device.

Do not attempt to remove the cover of this product. Failure to comply with this instruction could cause accidental exposure to laser radiation.

This system contains a laser operating at 655 nm. This wavelength is visible to the naked eye and can cause damage to the eye if directly exposed. A protective housing protects the unit. To avoid the possibility of accidental exposure, always power down the system any time service or repair work is being performed.

Repair of instrumentation should only be attempted by manufacturer trained service personnel.

Electrical & Safety Conformity

The manufacturer certifies that this product operates in compliance with the following standards and regulations:

- FDA / CDRH This product is tested and complies with 21 CFR, Subchapter J, of the health and Safety Act of 1968.
- European Community (CE) Directive 89/336/EEC
EN 55011 Group 1, Class B (Emissions) and EN 55082-1 (Immunity)
- IEC 60825-1 Ed.1.1 (1998-01)
- EN 60825-1 W/A11 (1996)
- US 21 CFR 1040.10

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1. Safety

1.1. Safety Indicators

This manual uses a **CAUTION** and a **WARNING** indication.

Familiarize yourself with the following definitions for the meanings of these indicators.

A **CAUTION** indicates a hazard and calls attention to a procedure that if not correctly followed could result in damage to the instrument. Do not proceed beyond a caution indicator without understanding the hazard.

A **WARNING** indicates a hazard to you and calls attention to a procedure that if not correctly followed could result in injury or even death. Do not proceed beyond a warning without understanding the hazard.

2. Setting Up

2.1. Unpacking

When you unpack the Nephelometer and accessories, inspect the carton for obvious damage. If the carton is damaged notify the carrier. Unpack everything and make a visual inspection.

You should have the following:

1. Nephelometer
2. 100-240 VAC to 8.4 VDC Lithium Ion Smart Charger w/ power cord
3. USB Communications Cable
4. Zero Cap with storage bag
5. CD Containing Companion Software & Operation Manual
6. Nephelometer Calibration Certificate
7. Sheath-Air Filter with storage bag
8. PM 2.5 Impactor kit
9. PM 4.0 Impactor Kit
10. PM 10 Impactor kit

If any of the above components are missing contact your supplier.

Keep the carton and packing material for reuse.



PM 10 Impactor Kit



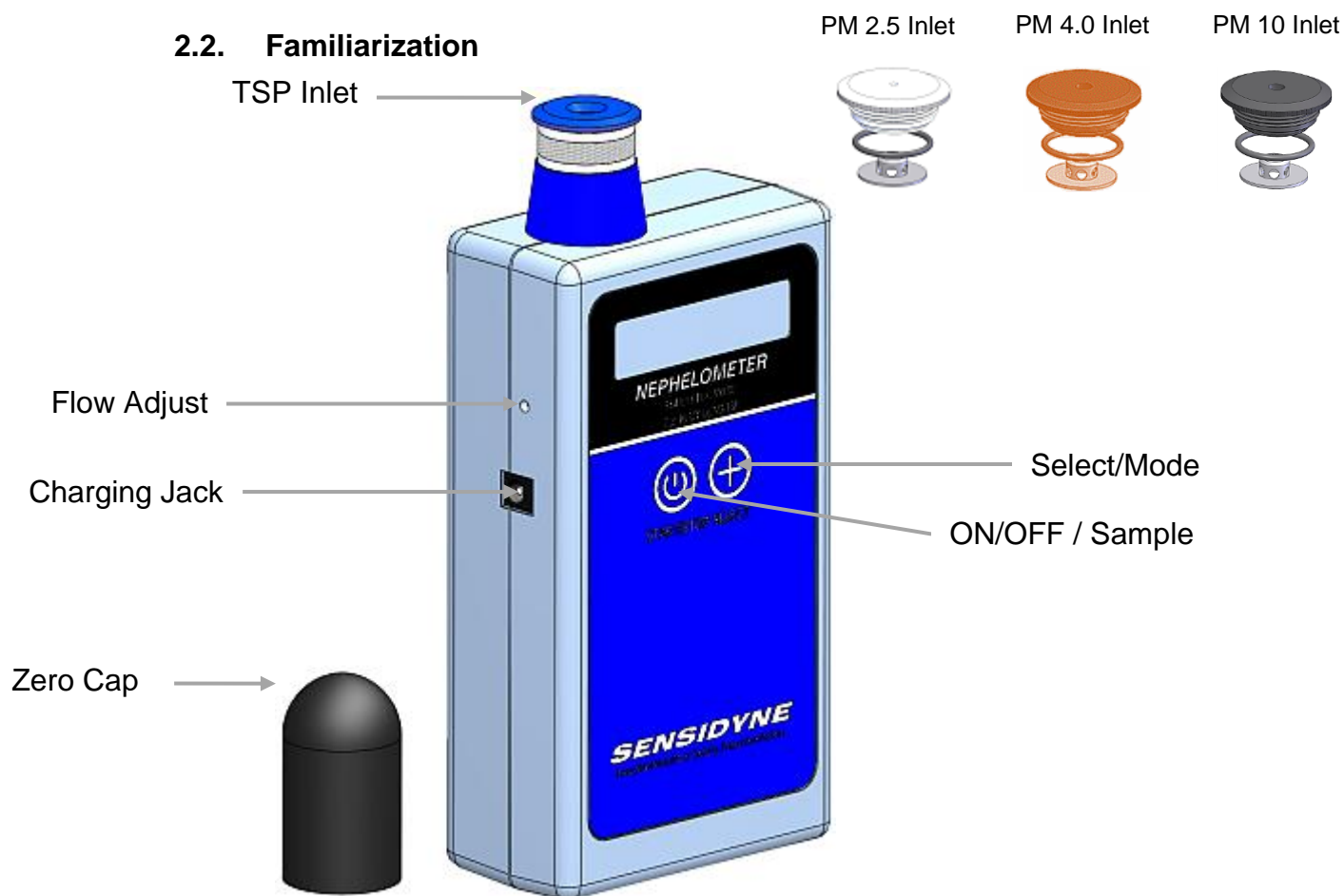
PM 2.5 Impactor Kit



811-1004-02 (PM 10), 811-1004-01 (PM 2.5) and 811-1004-04 (PM 4.0) Impactor Kits are included with the 811-1003-US-R (US Kit), 811-1003-EU-R (Eu Kit), 811-1003-UK-R (Uk Kit) or available separately.

(Although PM 4.0 Impactor is not pictured above it is the same as shown with the one difference is of orange color.)

2.2. Familiarization



Item	Description
Charging Jack	Plug Lithium Ion charger module into the jack to charge the batteries.
TSP Impactor Ready Inlet	Inlet for sampling Total Suspended Particulate
PM 2.5 Impactor	Sample PM 2.5
PM 4.0 Impactor	Sample PM 4.0
PM 10 Impactor	Sample PM 10
Flow Adjust	Adjusts the flow rate of the unit. Factory Set.
USB Port (not shown, on reverse side)	For downloading of data and unit set up.
ON/OFF Sample	Button to turn unit ON and Off and to start new sample.
Select / Mode	Button to select Environment and operation mode .
Zero Cap	Rubber cap used for zeroing instrument.

2.3. General Information

2.3.1. General Information

The Nephelometer measures particulate in the air using a laser engine. Laser light is scattered by the particles in the view volume and detected by a photo detector. This information is then multiplied by a K factor and displayed on the screen and logged as a sample event.

The Nephelometer logs each sample event into memory; data is transferred to a computer using the companion software. A cable is supplied for connection to the USB port on the user's computer. Each sample event records a time, date, serial number, environmental setting and an average concentration.

Several special features have been included in the Nephelometer that make it easy to use.

2.3.2. PM Fraction Impactors

The Nephelometer is supplied with a TSP inlet assembly for sampling Total Suspended Particulate. This TSP inlet assembly can easily be modified with the factory included PM 2.5, PM 4.0 or PM 10 Impactors.

2.3.3. Environmental Factors

Environmental Factors allow the user to match the Nephelometer to specific conditions of the area to be monitored. Each Environmental Factor has a name and a correction factor (K factor) for the specific environment. These Environmental Factors provide the best accuracy, and are particularly valuable when diverse environments are measured.

Ten Environmental Factors may be stored in the Nephelometer; the ten factors are selected by using the companion software and selecting from the 99 user created factors in the software, each with name, description, and correction factor.

2.3.4. Sheath Air

Air is drawn in through the top mounted inlet and then the sample air is surrounded by a sheath of clean filter air. This sheath protects the sensor from contamination. The rubber Zero cap may be installed to keep particulate out of the sensor during periods when the unit is not in operation.

2.3.5. Automatic Power Saving

The unit will power down when the unit is not sampling and no key press or communication activity for 5 minutes.

2.3.6. Selectable Sample Modes

In MANUAL (M) mode a timed one minute measurement cycle begins and upon completion of the measurement cycle, the collected data is stored. During the measurement cycle the real time data is displayed, at the end of the measurement cycle the average concentration is displayed until the operator either pushes **Start/Stop** again or the **Select** button is depressed.

In CONTINUOUS (C) mode samples are taken as above, however, the unit will continue to make 60 second measurement cycles until the **Start/Stop** sample key is depressed.

In STEL (S) mode 60 second samples are taken for a 15 minute period and upon completion the unit will stop sampling.

2.3.7. Utility Software

The supplied software is designed to simplify set-up operations and to download data records from the Nephelometer into a standard data file.

Refer to Operation Manual 360-0139-01 for software operation.

2.4. Operation

The battery pack inside the Nephelometer should be charged for 2.5 hours prior to use (**WARNING:** see section 3.2 – Battery Pack for instructions and safety).

Press the **Start/Stop** button to turn the unit on. The startup screen will appear for 3 seconds followed by the main screen.

SENSIDYNE
NEPHELOMETER

Startup Screen

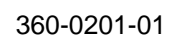
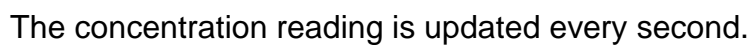
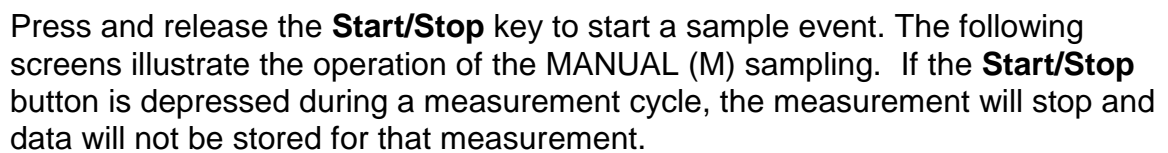
1,234 ug/m³ (M)
ENVIRONMENT 1

Main Screen

The first line on the display shows the sample concentration in micrograms-per-cubic-meter (ug/m³). The letter in parenthesis (M) at the right hand side of the first line indicates the Sample Mode. This value will be M, C, or S for Manual, Continuous or STEL modes respectively.

The second line on the display shows the ENVIRONMENTAL FACTOR NAME and during operation will show status/progress. An operational progress bar is displayed while the unit is sampling.

Before sampling, remove the zero cap (store cap in storage bag).



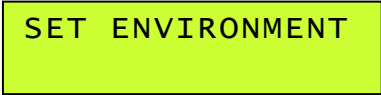
2.6. Select Key

There are two parameters which can be set using the **Select** Key. One allows the user to select the Environment factor and the other allows the user to select the Sample Mode.

The Select Key can only be used when the unit is not sampling.

Pressing the **Select** key will display the Select screen. This screen allows the user to choose which setting to change. The preference is given to the Set Environment screen as this is the parameter likely to be changed the most.

The select screen is shown below.



SET ENVIRONMENT

Select Screen

Releasing the **Select** Key within 3 seconds will bring up the Set Environment Screen

Holding the **Select** Key down for 3 seconds will change the display to Set Sample Mode as shown below.



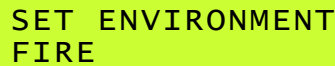
SET SAMPLE MODE

Sample Screen

Releasing the **Select** Key will bring up the Set Sample Mode screen

2.7. Set Environment Screen

Here the `ENVIRONMENT` setting can be changed.



SET ENVIRONMENT
FIRE

Pressing the **Select** key will cycle the Environment setting through the available selections.

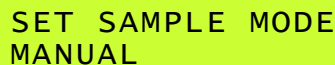
The Main screen will be displayed after 3-seconds of no key presses.

Pressing the **Start/Stop** key at anytime will display the Main screen and start the sample event.

Releasing the **Select** key will bring up the Set Sample Mode screen

2.8. Set Sample Mode Screen

Here the `SAMPLE MODE` setting can be changed.



SET SAMPLE MODE
MANUAL

There are three choices for Sample Mode.

Pressing the **Select** key will cycle the Sample Mode setting through the available selections, Manual, Continuous and STEL.

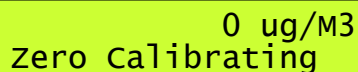
The Main screen will be displayed after 3-seconds of no key presses.

Pressing the **Start/Stop** key at any time will display the Main screen and start the sample event.

2.9. Zero Calibration

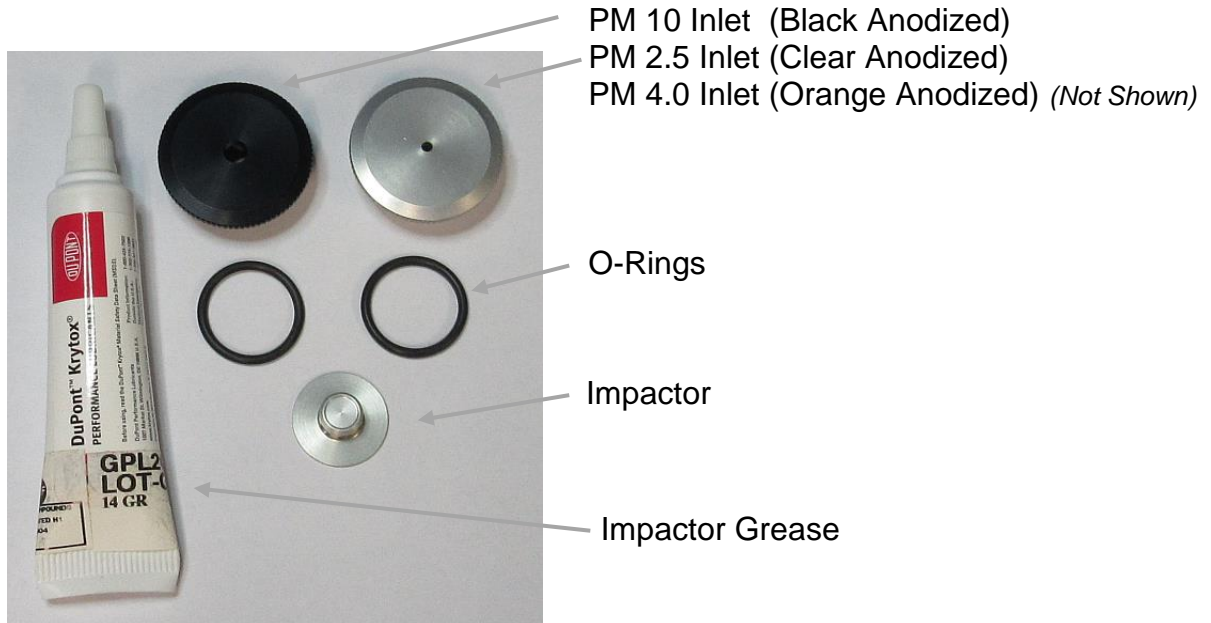
The Nephelometer software will place the unit into a zero calibration mode.

The display indicates the following when zero calibrating. This process is completely automated and only requires the user to install the zero cap over the inlet.



0 ug/M3
Zero Calibrating

2.10. PM 2.5, PM 4.0 and PM 10 Impactor Installation



Each Impactor kit comes with the thread-in size-selective Inlet, O-ring (installed), Impactor and Impactor Grease. The Impactor is identical for both the PM 2.5 and PM 10 inlets.



Stop sampling and turn off the Nephelometer.

To replace the standard TSP inlet, un-screw and remove the TSP inlet assembly.



Apply Impactor Grease here

Apply a thin film of grease to the cup in the Impactor and place the impactor in the Nephelometer inlet housing.



Ensure O-Ring is installed in O-Ring Groove in Inlet. Thread Inlet into Nephelometer inlet housing.

Ready for size selective sampling!

Aerosol Sampling fraction is easily identified by color code:

BLUE	TSP
SILVER	PM 2.5
BLACK	PM 10
ORANGE	PM 4.0

3. Trouble Shooting and Maintenance

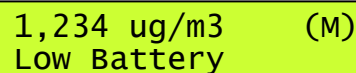
There are no user serviceable parts inside of the unit beyond the Sheath-Air Filter.
(See 3.3).

3.1. Errors and Alarms

Certain operational failures are displayed and recorded in the Alarm Log. In the event of one of the following errors, the error is shown on the second line of the display. Typical display with error is shown below.

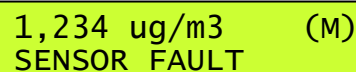
3.1.1. Battery Alarm

A low battery condition is checked for when the unit is sampling. When the battery voltage goes below 6.0 volts the Sample will be stopped and Low Battery will be displayed. This alarm is logged in the Alarm Log.

A yellow rectangular box representing a digital display. The top line shows '1,234 ug/m3' followed by '(M)' on the right. The bottom line shows 'Low Battery'.

3.1.2. Laser Current Error

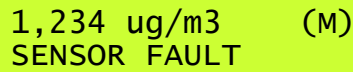
Laser current is measured (IOP) and if the current exceeds a preset value the alarm is triggered. As the laser degrades, it takes more and more current to maintain the same output level. When it fails altogether, the current will go to maximum.

A yellow rectangular box representing a digital display. The top line shows '1,234 ug/m3' followed by '(M)' on the right. The bottom line shows 'SENSOR FAULT'.

The unit will display SENSOR FAULT and operation will be suspended. Only the Power button will be active to turn off the unit. This is due to the nature of the fault. The unit is not capable of taking valid measurements if this occurs. This alarm is logged in the Alarm Log.

3.1.3. Counter Error

The output of the optical engine is a frequency. There is always frequency of >1000 pulses per second regardless of actual concentration measured. If the output falls below this value the sensor is no longer functioning correctly.

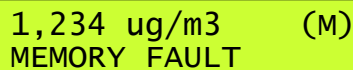


1,234 ug/m3 (M)
SENSOR FAULT

The unit will display SENSOR FAULT and operation will be suspended. Only the Power button will be active to turn off the unit. This alarm is logged in the Alarm Log.

3.1.4. Memory Error

Each time a record is written to memory the memory is validated for proper function. If this process fails the unit will no longer be able to record new data records.



1,234 ug/m3 (M)
MEMORY FAULT

The unit will display MEMORY FAULT and operation will be suspended. Only the Power button will be active to turn off the unit.

3.2. Battery Pack

WARNING: There are no user serviceable components inside the Nephelometer. Do not attempt to change the internal battery pack. The wrong battery pack could cause serious damage, a fire, or explosion. The Nephelometer should be sent to a service center where a factory qualified person would change and properly dispose of the battery pack.

This device contains Lithium Ion battery technology and should only be charged with the supplied 8.4 VDC Lithium Ion Smart Charger unit. Never connect a power source greater than 8.4 VDC to this device.

When the battery is low enough to need charging, a “Battery Low” message is displayed on the display and the pump will not turn on when the **Start/Stop** key is pushed.

To charge the battery pack, plug the 8.4 VDC Lithium Ion Smart Charger unit into an AC power outlet. The module is universal and will work with power line voltages of 100 to 240 volts, 50 to 60 Hz. Take the barrel connector on the end of the cord coming from the Charger module and plug it into the charger input socket on the side of the Nephelometer (See section 2.2 Familiarization). To fully charge a discharged battery pack should take around 2.5 hours.

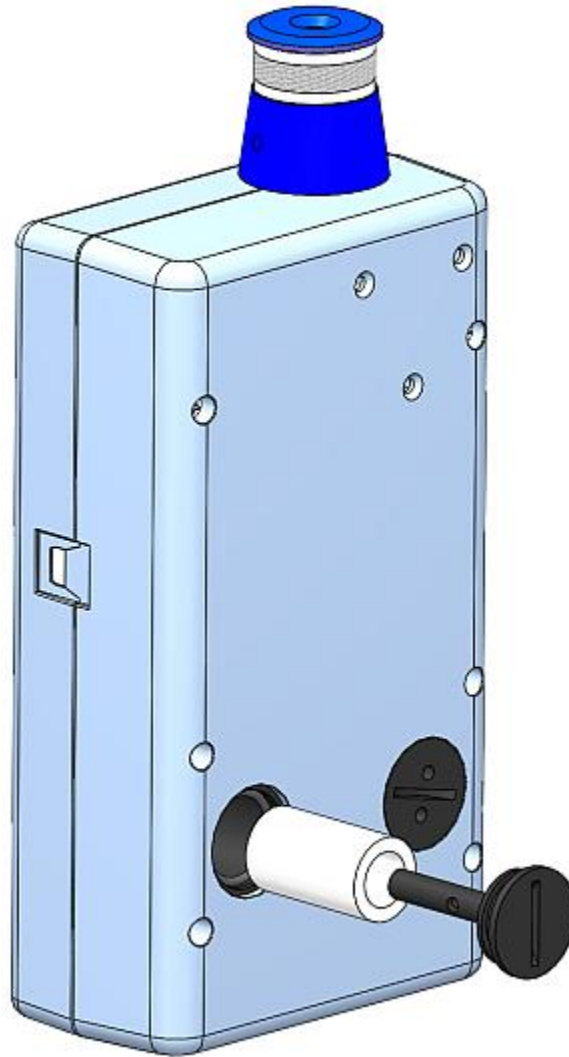
NOTE: After the batteries are completely charged, the smart charger will stop charging. The next time it is used, it must be disconnected from AC power, and then reconnected to the AC outlet to restart the charge cycle.

The battery pack inside the Nephelometer when fully charged will power the Nephelometer for about 10 hours of continuous use. Under normal intermittent or manual operation however, there is considerably less battery drain and up to 25 hours of use is possible.

If the Nephelometer is to be used powered by its battery pack on a daily basis, connect the charger after every few days of usage, or as needed.

3.3. Filter

The Nephelometer has a 0.2 micron filter to produce the clean air for the sheath system. This filter will normally need to be changed on an annual basis but may require a more frequent change if used in extremely dirty environments.



Remove the filter element by unscrewing the filter holder cap. Replace filter and install filter holder cap.

3.4. TSP, PM 2.5, PM 4.0 and PM 10 Inlet

The TSP, PM 2.5, PM 4.0 and PM 10 inlets should be removed and cleaned on a periodic basis. Typically, blowing off with compressed air or “Dust Off” is sufficient. This will normally need to be done on a monthly basis but may require a more frequent cleaning if used in extremely dirty environments.

3.5. Impactor

The Impactor should be removed and cleaned on a periodic basis. Remove grease from the cup with isopropyl alcohol and a lint free tissue. Clean the entire impactor with isopropyl alcohol and a lint free tissue. This will normally need to be done on a monthly basis but may require a more frequent cleaning if used in extremely dirty environments.

3.6. Service Schedule

WARNING: There are no user serviceable components inside this instrument. The covers on this instrument should not be removed or opened for servicing, calibration or any other purpose except by a factory-authorized person. To do so may result in exposure to visible laser radiation that can cause blindness.

Sensor and vacuum pump require access to the inside of the Nephelometer and a factory-authorized person must do this. Contact Sensidyne, LP for service information, including a Return Material Authorization (RMA) Number.

Calibrating the Nephelometer requires specialized equipment and a skilled technician. Sensidyne, LP maintains a calibration facility for calibrating particle counters according to industry-accepted methods like ASTM and traceable standards. The sensor in the Nephelometer should be calibrated on a yearly basis.

3.7. Service Schedule Table

Item To Service	Frequency	Done By
Clean TSP, PM 2.5 PM 4.0 & PM 10 Inlet	Monthly	Customer
Clean and re-grease Impactor	Monthly	Customer
Filter	Yearly *	Customer or Factory Service
Inspect pump	Yearly	Factory service only
Test battery pack	Yearly	Factory service only
Calibrate Sensor	Yearly	Factory service only

* In heavy use the filter should be changed more frequently. The filter should be changed if noticeably discolored.

3.8. Troubleshooting

WARNING: There are no user serviceable components inside this instrument. The covers on this instrument should not be removed or opened for servicing, calibration or any other purpose except by a factory-authorized person. To do so may result in exposure to visible laser radiation that can cause blindness.

A factory-authorized person should perform replacement of the sensor, vacuum pump, filter or any component inside the Nephelometer.

Symptom	Possible Cause	Correction
Does not turn on, no display	1. Low battery 2. Defective Battery	1. Charge battery 2.5 hrs 2. Send to service center
Display turns on but pump does not	1. Low Battery 2. Defective pump	1. Charge battery 2.5 hrs 2. Send to service center
Keypad functions do not Work	Loose connector or defective component inside	Send to service center
Sample result remains at zero after sampling	1. Pump stopped 2. Laser diode bad	1. Send to service center 2. Send to service center
Sample result is lower than normal	1. Something may be stuck in the inlet nozzle and blocking the beam 2. Contaminated optics in sensor	1. Blow into nozzle with a can of 'Aero Duster'. 2. Send to service center
Sample result is higher than normal	1. Air leak in sensor 2. Noisy laser	1. Send to service center 2. Send to service center
Battery pack does not hold a charge	1. Defective or worn out battery pack 2. Defective power cords 3. Defective charger module or cords	1. Send to service center 2. Check with an Ohm-meter 3. Contact your distributor to get another charger

4. Specification

Measurement Method	Scattered laser light
<u>Performance</u>	
Concentration Range	1 – 10,000 $\mu\text{g}/\text{m}^3$ (0.001 to 10 mg/m^3)
Resolution	1 $\mu\text{g}/\text{m}^3$ (0.001 mg/m^3)
Sensitivity	1 $\mu\text{g}/\text{m}^3$ (0.001 mg/m^3)
Accuracy	$\pm 5\%$ traceable standard with 0.6 μm (0.0006 mg) PSL
Sample Mode	Selectable: Manual: 60 seconds Continuous: runs in 60 sec cycles until stop key is depressed STEL: 15 minutes
Flow	1 lpm, with sheath air inlet
Size Selective Inlets	TSP, PM 2.5, PM 10
<u>Electrical</u>	
Light Source	Laser Diode
Power	7.2V Lithium ion 2200 mAh Self-contained battery pack – Provides for 25 hours of typical intermittent operation, up to 10 hours continuous use.
AC Adapter/Charger	AC to DC module, 100 – 240 VAC to 8.4 VDC @ 1500 mA
Charging Time	2.5 Hours
Communications	USB Mini B Type
Logging	4000 Records
Real Time Clock	Battery backed set through the PC program
<u>Interface</u>	
Display	2 line x 16 character LCD
Keyboard	2 key pushbutton type
<u>Physical</u>	
Size	Height = 6.25" (15.9 cm) Width = 3.63" (9.22 cm) Thickness= 2.00" (5.08 cm)
Weight	1.74 lbs – 28 ounces – (0.79 kg)
<u>Environmental</u>	
Operating Temperature	0° C to +50° C, (32° F to +122° F)
Storage Temperature	-20° C to +60° C, (-4° F to +140° F)
<u>Accessories</u>	
Supplied	Operation Manual USB Cable AC to DC Converter Module with IEC AC Power Cord Zero Cap Software Spare Filter



DECLARATION OF CONFORMITY

Manufacturer: Met One Instruments, Inc.
1600 Washington Blvd.
Grants Pass, OR 97526

Model Number: 80570
Type of Equipment Handheld Dust Monitor


We declare under our sole responsibility that the equipment referenced above is in conformity with the following Directives and Standards.

Applicable Directives:
EMC 2004/108/EC Electromagnetic Compatibility

Standards of Conformity:
EMC Emissions EN 61326-1:2006 Class B
EMC Immunity EN 61326-1:2006

Tests Methods:
Radiated Emissions CISPR 11:2009 (Amended by A1:2010)
Conducted Emissions CISPR 11:2009 (Amended by A1:2010)
ESD IEC 61000-4-2:2008
Radiated Immunity IEC 61000-4-3:2010
EFT IEC 61000-4-4:2012
Surge IEC 61000-4-5:2005
Conducted Immunity IEC 61000-4-6:2008
Magnetic Field Immunity IEC 61000-4-8:2009
Voltage Interrupts / Dips IEC 61000-4-11:2004

Date of Issue: November 30, 2012

Signed: 
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President

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